TEST REPORT NO: RU1017/4145

COPY NO: 2

ISSUE NO: 1

FCC ID: MJCMD

REPORT ON THE CERTIFICATION TESTING OF A
PALMER ENVIRONMENTAL Ltd
MICROCORR DIGITAL OUTSTATION
WITH RESPECT TO
THE FCC RULES CFR 47, PART 90
INTENTIONAL RADIATOR SPECIFICATION
ON BEHALF OF
PALMER ENVIRONMENTAL Ltd

TEST DATE: 25th – 30th November 2002

TESTED BY: JOHN CHARTERS (Signature Not Verified) Digitally signed by JOHN CHARTERS DN: cn=JOHN CHARTERS, o=TRL COMPLIANCE SERVICES, c=US Date: 2004.11.24 11:34:37 Z J CHARTERS

APPROVED BY: Peter Green (Signature Not Verified) Digitally signed by Peter Green DN: cn=Peter Green, o=TRL Compliance Services, c=GB Date: 2004.11.24 P GREEN
PRODUCT MANAGER

DATE: 28th November 2004

Distribution:

Copy Nos:
1. PALMER ENVIRONMENTAL Ltd
2. FCC EVALUATION LABORATORIES
3. TRL EMC

TRL COMPLIANCE SERVICES LTD EMC DIVISION
LONG GREEN FORTHAMPTON GLOUCESTER GL19 4QH UNITED KINGDOM
TELEPHONE +44 (0)1684 833818 FAX +44 (0)1684 833858
E-MAIL test@trlcompliance.com www.trlcompliance.com

CONTENTS

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:	MJCMD					
PURPOSE OF TEST:	CERTIFICATION					
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90					
TEST RESULT:	Compliant to Specification					
EQUIPMENT UNDER TEST:	MICROCORR DIGITAL OUTSTATION					
EQUIPMENT SERIAL No:	Engineering Sample					
ITU: EMISSION CODE:	16k2F2D					
EQUIPMENT TYPE:	OUTSTATION					
PRODUCT USE:	Water Leak Detection					
CARRIER EMISSION:	High Power 24.3dBm Low Power 5.0dBm					
ANTENNA TYPE:	Whip					
ALTERNATIVE ANTENNA:	Not applicable					
FREQUENCY OF OPERATION:	464.5MHz					
CHANNEL SPACING:	25kHz					
NUMBER OF CHANNELS:	1					
FREQUENCY GENERATION:	SAW Resonator	[ ]	Crystal	[ ]	Synthesiser	[X]
MODULATION METHOD:	Amplitude	[ ]	Digital	[X]	Angle	[ ]
POWER SOURCE(s):	12Vdc Battery					
TEST DATE(s):	25th – 30th November 2002					
ORDER No(s):	29217					
APPLICANT:	PALMER ENVIRONMENTAL Ltd					
ADDRESS:	TY-COCH HOUSE LLANTARNAM PARK WAY CWMBRAN NP44 3AW UNITED KINGDOM					

TESTED BY: JOHN CHARTERS — Digitally signed by JOHN CHARTERS DN: cn=JOHN CHARTERS, o=TRL COMPLIANCE SERVICES, c=US Date: 2004.11.24 11:34:53 Z — Signature Not Verified — J CHARTERS

APPROVED BY: Peter Green — Digitally signed by Peter Green DN: cn=Peter Green, o=TRL Compliance Services, c=GB Date: 2004.11.24 11:44:18 Z — Signature Not Verified — P GREEN PRODUCT MANAGER

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	MICROCORR DIGITAL OUTSTATION
EQUIPMENT TYPE:	OUTSTATION
SERIAL NUMBER OF EUT:	Engineering Sample
PURPOSE OF TEST:	CERTIFICATION
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 90
TEST RESULT:	COMPLIANT Yes [X] No [ ]
APPLICANT'S CATEGORY:	MANUFACTURER [X] IMPORTER [ ] DISTRIBUTOR [ ] TEST HOUSE [ ] AGENT [ ]
APPLICANT'S ORDER No(s):	29217
APPLICANT'S CONTACT PERSON(s):	Mr S Harris
E-mail address:	Sharris@palmer.co.uk
APPLICANT:	PALMER ENVIRONMENTAL Ltd
ADDRESS:	TY-COCH HOUSE LLANTARNAM PARK WAY CWMBRAN NP44 3AW UNITED KINGDOM
TEL:	+44 (0)1633 489479
FAX:	+44 (0)1633 877857
MANUFACTURER:	PALMER ENVIRONMENTAL Ltd
EUT(s) COUNTRY OF ORIGIN:	UNITED KINGDOM
TEST LABORATORY:	TRL EMC
UKAS ACCREDITATION No:	0728
TEST DATE(s)	25th – 30th November 2004
TEST REPORT No:	RU1017/4145

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

TEST/EXAMINATION	RULE PART	DETECTOR	APPLICABILITY
RF Power Output:	90.2052	Peak	Yes
Modulation Limits:	90.212	Peak	Yes
Occupied Bandwidth:	90.209	Peak	Yes
Spurious Emissions at Antenna Terminal:	2.991	Quasi Peak Average	Yes
Field Strength of Spurious Radiation:	90.210	Quasi Peak Average	Yes
Frequency Stability:	90.213	Peak	Yes
Transient Frequency Behaviour:	90.214	N/A	Yes
Maximum Frequency of Search:		-	Yes

2. Product Use: Leak detection

3. Emission Designator: 16k2F2D

4. Duty Cycle: <100%

5. Temperatures: Ambient (Tnom) 19^{o}C

6. Supply Voltages: Vnom 7.5Vdc

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

7. Equipment Category:

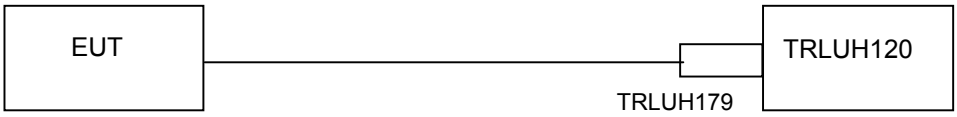
Single channel	[X]
Two channel	[ ]
Multi-channel	[ ]

8. Channel spacing:

Narrowband	[X]
Wideband	[ ]
	25kHz

TRANSMITTER OUTPUT POWER – CONDUCTED – PART 2.1046

Ambient temperature	=	18°C	Supply voltage	=	12Vdc
Relative humidity	=	70%	Channel number	=	464.5MHz



See Annex C for full list of test equipment

The test setup was as per the above diagram .The unit was put into test mode and set to operate at both power modes.

RESULTS

Microcore Digital Outstation was found to comply with the limits.

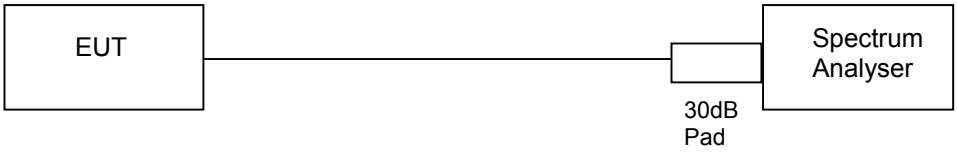
FREQ. (MHz)	MEASURED VALUE (dBm)	CABLE LOSS (dB)	ATENUATOR (dBm)	LEVEL (dBm)	LEVEL (WATTS)
464.5	-5.9	0.2	30	24.3	0.269
464.5	5.0	0.2	0	5.2	0.004

Notes:
1 Results quoted are extrapolated as indicated
2 Test at both high and low power
3 New batteries used for battery powered products

TRANSMITTER TESTS

TRANSMITTER OCCUPIED BANDWIDTH – CONDUCTED – PART 2.1049(1)

Ambient temperature	=	18°C	Supply voltage	=	12Vdc
Relative humidity	=	70%	Channel number	=	464.5MHz
ITU emission code	=	16k6F2D	Authorised Bandwidth	=	20kHz



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was put into test mode and set to operate at maximum power.

.

On any frequency removed from the assigned frequency by the following percentage of the authorised bandwidth

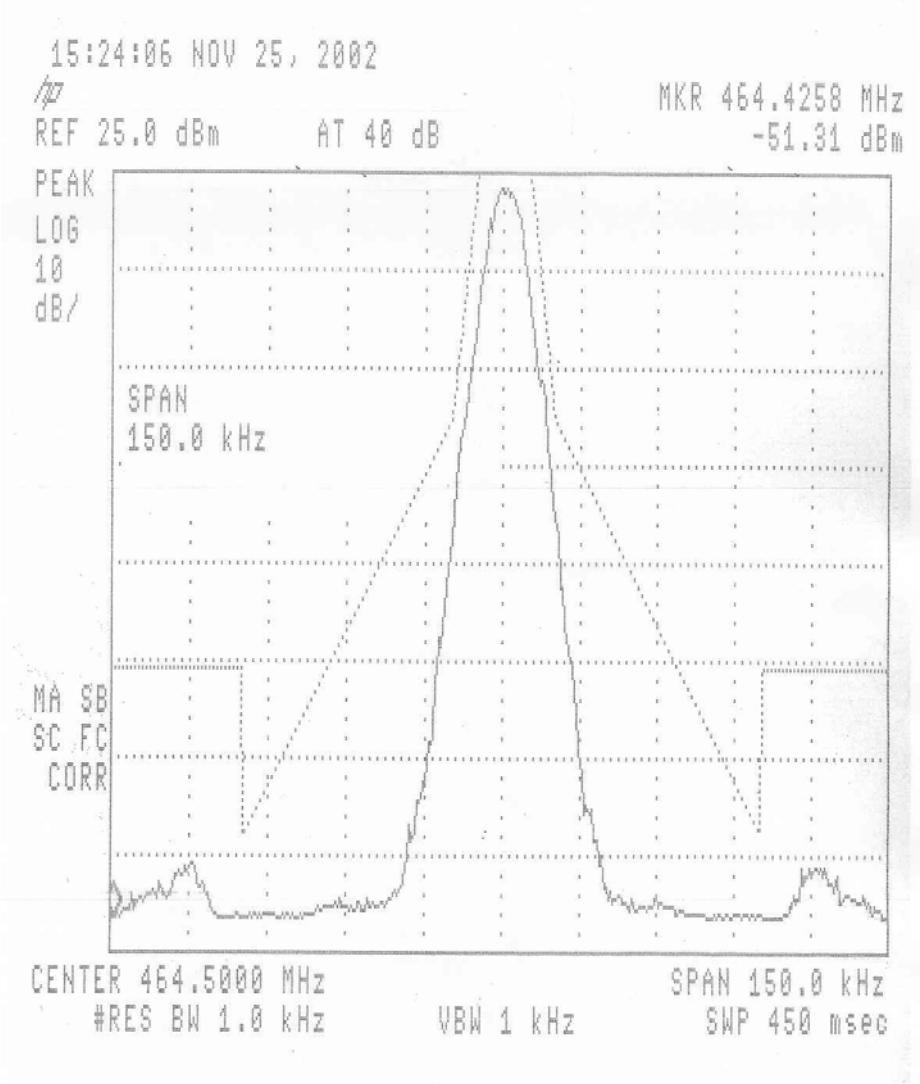
	Frequency	Applicable level	Frequency (MHz)	Frequency (MHz)	Level dBc High power	Level dBc Low power	Result
Limits Emission Mask C	ABW ±5kHz	0	464.495	464.505	0	0	Compliant
	>5kHz<10kHz f_d	83log(f_d/5)	464.49	464.51	-24.9	-24.9	Compliant
	f_d>10kHz <250%	29log (f_d^2/11)dB or 50dB	464.45	464.55	-50.0	-50.0	Compliant
	>250%	43+10log(P)dB	464.45<	464.55>	-56.9	-50.1	Compliant

Notes:
1 ABW =Authorized bandwidth
P = Carrier output power
f_d = Displacement frequency
2 See over for Emission plots
3 Analyser plots corrected for attenuator if applicable

Microcore Digital Outstation was found to comply with the limits.

See next page for plots of compliance

Analyser plot showing compliance with mask



TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSION – CONDUCTED – Part 2.1051 – High Power

Ambient temperature = 18°C,
Relative humidity = 70%,
Supply voltage = 12Vdc
Channel number = 464.5MHz

Level Fc = 24.3dBm

See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was put into test mode and set to operate at maximum power.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log (P)dB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

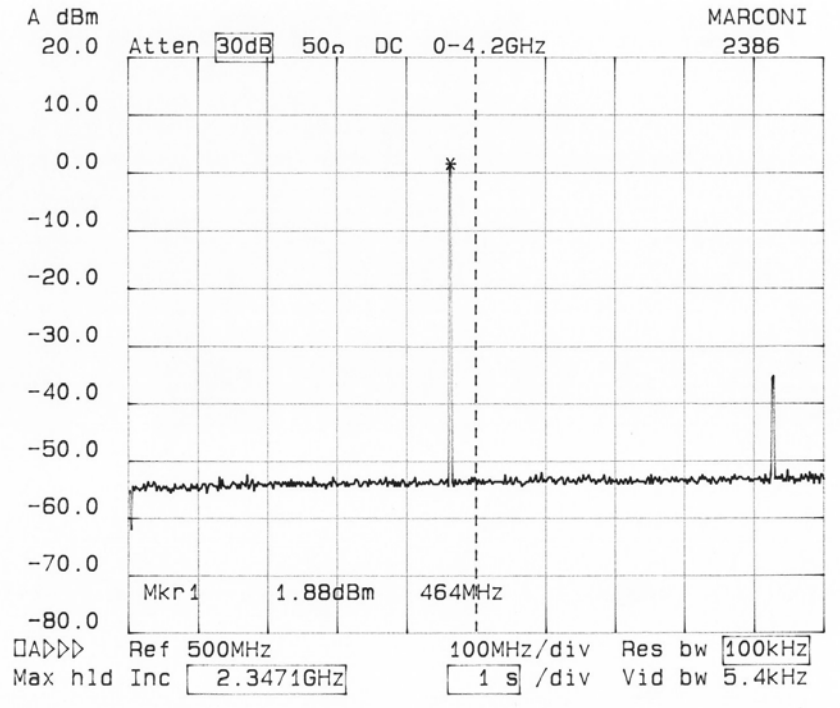
RESULTS

Microcore Digital Outstation was found to comply with the limits.

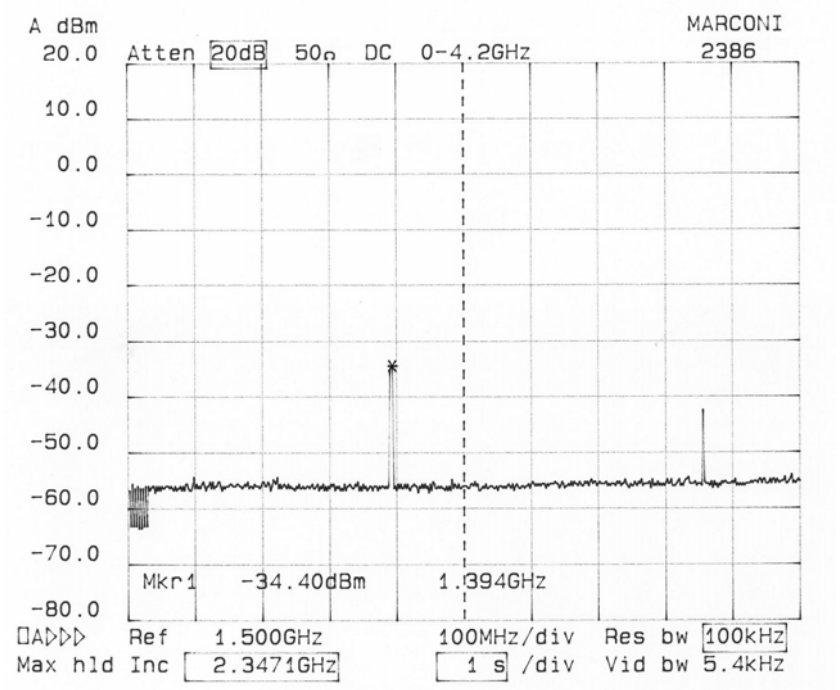
FREQ. (MHz)	MEASUREMENT Rx. READING (dBm)	CABLE LOSS (dB)	ATTENUATION (dB)	LEVEL	LIMIT (dBm)
929.0	-50.65	0.5	30	-20.6	-13.0
1393.5	-43.8	0.6	30	-13.2	-13.0
2322.5	-63.1	0.8	30	-32.7	-13.0

Notes:
1 Emission 20dB away from the limit were not recorded.
2 Emissions Checked up to 10 times Fc
3 When battery powered the EUT was powered with new batteries

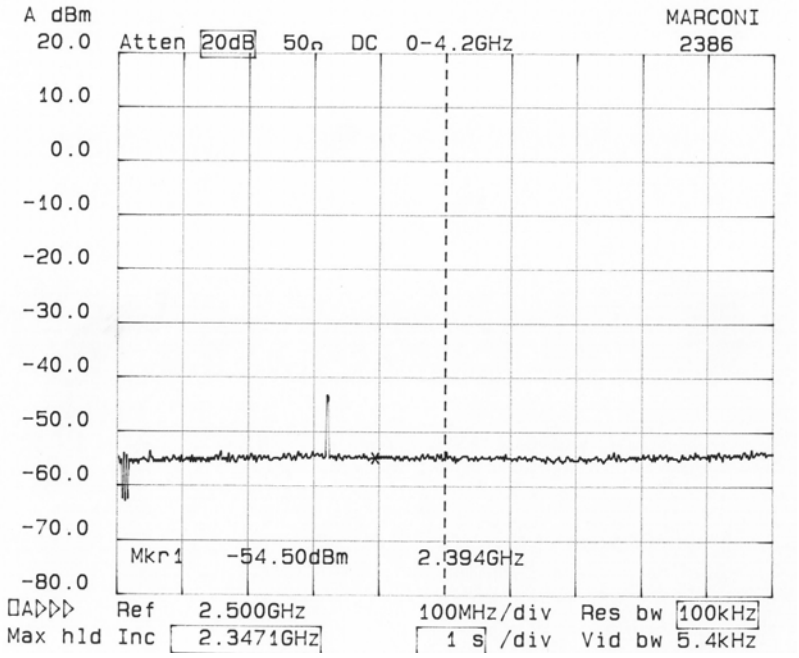
Test Method:
1 The EUT was connected to the analyzer via the attenuator
2 Emission were recorded



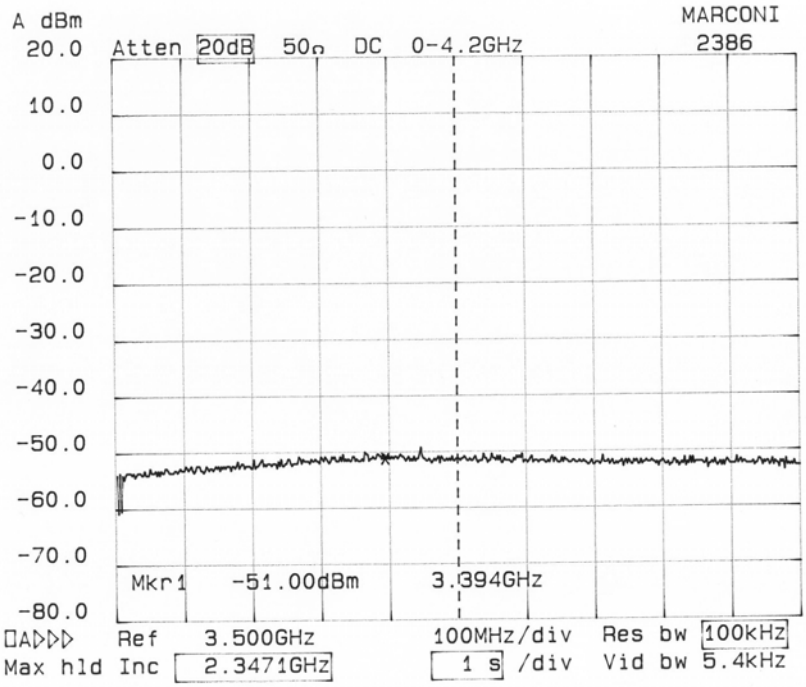
Spurious Emissions 0-1GHz



Spurious Emissions 1-2GHz



Spurious Emission 2-3GHz



Spurious Emissions 3-4GHz

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSION – CONDUCTED – Part 2.1051 – Low Power

Ambient temperature = 18°C, Level Fc = 5.2dBm
Relative humidity = 70%,
Supply voltage = 12.0Vdc
Channel number = 464.5MHz

See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was put into test mode and set to operate at maximum power.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log (P)dB

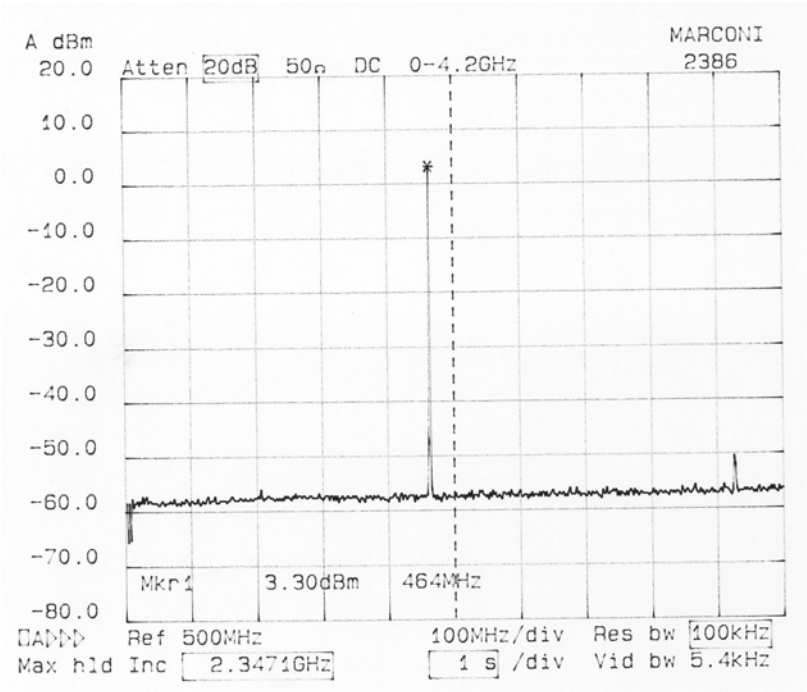
$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

RESULTS

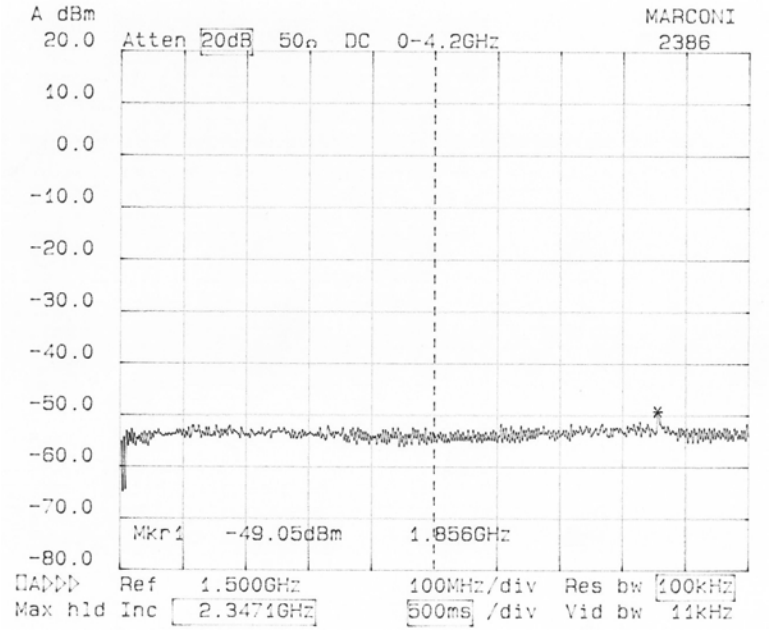
Microcore Digital Outstation was found to comply with the limits.

FREQ. (MHz)	MEASUREMENT Rx. READING (dBm)	CABLE LOSS (dB)	ATTENUATION (dB)	LEVEL	LIMIT= 43+10log(P) (dBm)
No significant emissions within 10dB 's of the limit.					-13

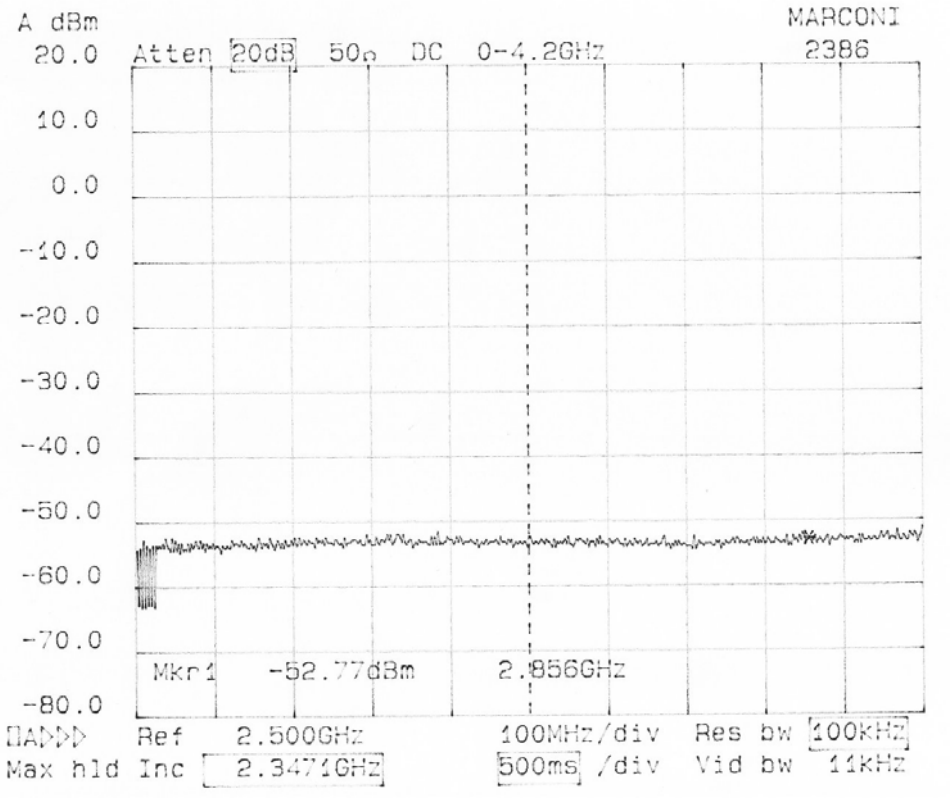
Notes:
1 Results quoted are extrapolated as indicated
2 Emissions Checked up to 10 times Fc
3 When battery powered the EUT was powered with new batteries



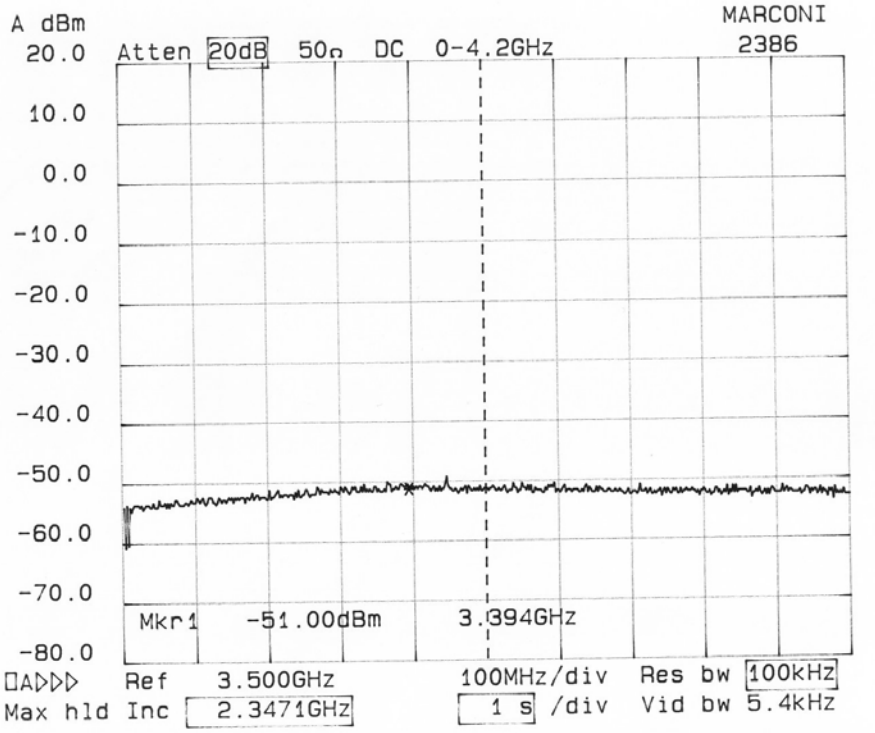
Spurious Emissions 0-1GHz



Spurious Emissions 1-2GHz



Spurious Emissions 2-3GHz

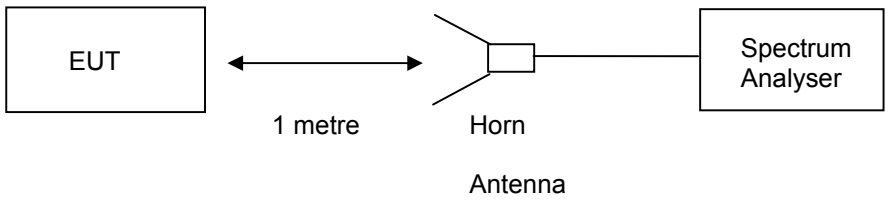


Spurious Emissions 3-4GHz

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 2.1053 – High Power

Ambient temperature	=	10^{o}C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	70% (<1GHz),	1m measurements >1GHz	[X]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[X]
Supply voltage	=	12Vdc		
Channel number	=	464.5MHz		



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was put into test mode and set to operate at maximum power and with a modulating signal. The unit was mounted on a turntable and rotated through 360^{0} to find the worst case emission.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

RESULTS

Microcore Digital Outstation was found to comply with the limits.

FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	RESULT EIRP (dBm)	LIMIT EIRP (dBm)
No significant emissions within 10dB's of limit.						-13dBm

See notes over page

Notes:

1 Results quoted are extrapolated as indicated
2 Emissions were searched to: (**x**) 1000MHz inclusive, as per Part 15.33a
3 Extrapolation factor 9.5dB from 1m to 3m, as per Part 15.31f
4 Measurements >1GHz @ 1m as per Part 15.31f(1)
5 Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
6 Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
7 New batteries used for battery powered products.
8 Only emissions within 20dB of limit are recorded.
9 Emissions Checked up to 10 times Fc

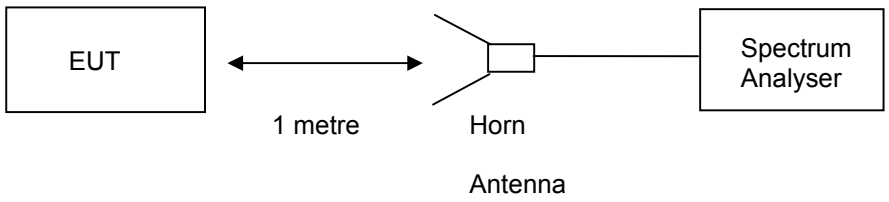
Test Method:

1 As per Radio – Noise Emissions, ANSI C63.4: 1992
2 Measuring distances as Notes 1 to 4 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

TRANSMITTER TESTS

TRANSMITTER SPURIOUS EMISSIONS – RADIATED – PART 2.1053 – Low Power

Ambient temperature	=	10^{o}C(<1GHz)	3m measurements <1GHz	[X]
Relative humidity	=	70% (<1GHz),	1m measurements >1GHz	[X]
Conditions	=	Open Area Test Site (OATS)	3m extrapolated from 1m	[X]
Supply voltage	=	12Vdc		
Channel number	=	464.5MHz		



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was put into test mode and set to operate at maximum power and with a modulating signal. The unit was mounted on a turntable and rotated through 360^{0} to find the worst case emission.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

RESULTS

Microcore Digital Outstation was found to comply with the limits.

FREQ. (MHz)	MEAS. Rx. (dBµV)	CABLE LOSS (dB)	ANT FACTOR	FIELD STRENGTH (dBµV/m)	RESULT EIRP (dBm)	LIMIT EIRP (dBm)
No significant emissions within 10dB's of limit.						-13dBm

See notes over page

Notes:

1 Results quoted are extrapolated as indicated
2 Emissions were searched to: (**x**) 1000MHz inclusive, as per Part 15.33a
3 Extrapolation factor 9.5dB from 1m to 3m, as per Part 15.31f
4 Measurements >1GHz @ 1m as per Part 15.31f(1)
5 Receiver detector >1GHz = CISPR, Quasi-Peak, 120kHz bandwidth
6 Receiver detector >1GHz = Peak Hold, 1MHz resolution bandwidth
7 New batteries used for battery powered products.
8 Only emissions within 20dB of limit are recorded.
9 Emissions Checked up to 10 times Fc

Test Method:

1 As per Radio – Noise Emissions, ANSI C63.4: 1992
2 Measuring distances as Notes 1 to 4 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.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes.
Maximum results recorded.

TRANSMITTER TESTS

FREQUENCY STABILITY – CONDUCTED – TEMPERATURE – PART 90.213

Ambient temperature	=	28°C	Radio Laboratory
Relative humidity	=	49%	
Supply voltage	=	+12 Vdc	

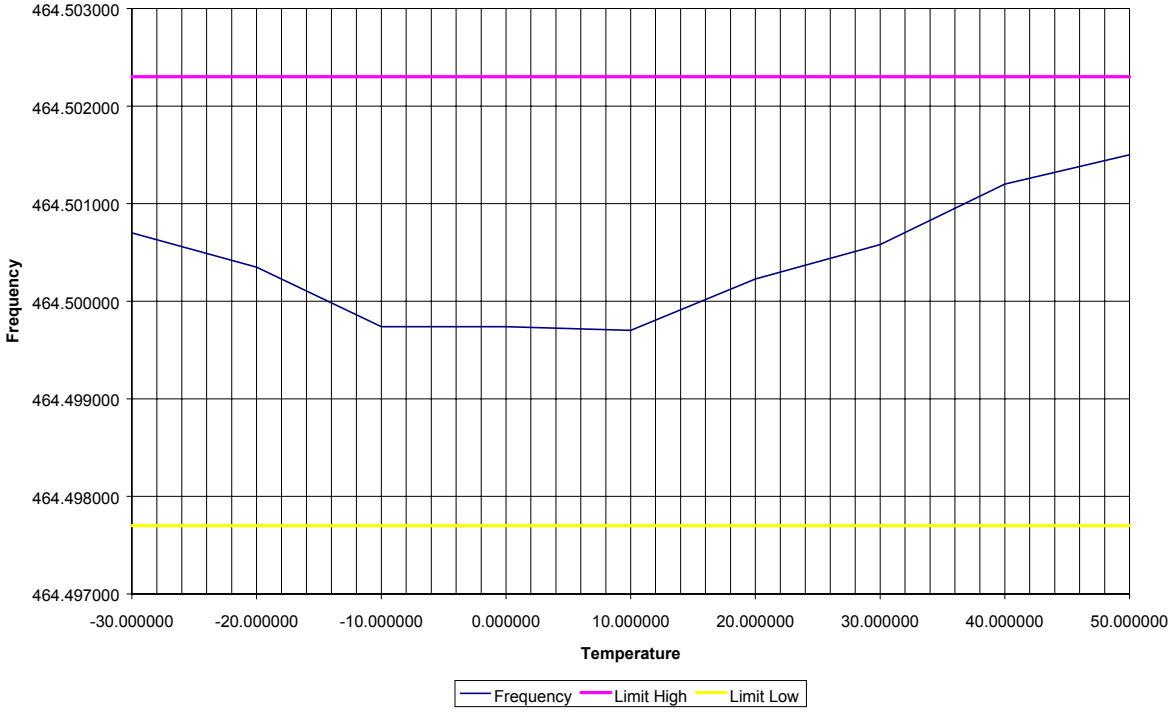
The test setup was as per the above diagram. The unit was tested at high power on one channels .The unit was put into test mode and set to operate at maximum power. The Analyser was set to max hold

RESULTS

TEMP ^{0}C	Frequency (MHz)	Limit (kHz)	Result
+50	464.50150	±2.3	Compliant
+40	464.50120	±2.3	Compliant
+30	464.50058	±2.3	Compliant
+20	464.500228	±2.3	Compliant
+10	464.499700	±2.3	Compliant
0	464.499740	±2.3	Compliant
-10	464.499740	±2.3	Compliant
-20	464.500350	±2.3	Compliant
-30	464.500700	±2.3	Compliant

Microcore Digital Outstation was found to comply with the limits.

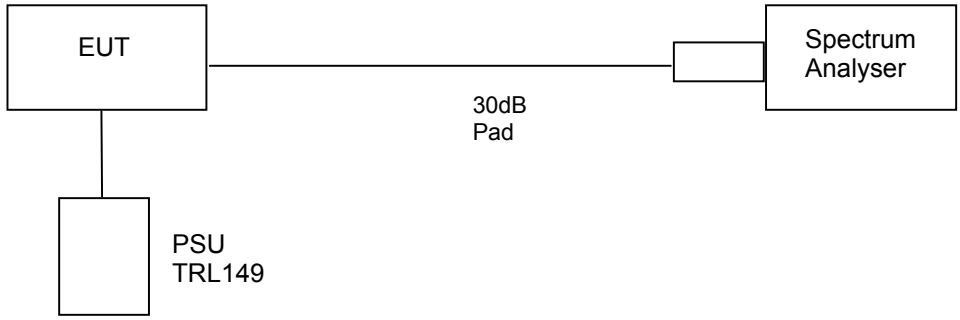
Frequency Stability Temperature



TRANSMITTER TESTS

FREQUENCY STABILITY – CONDUCTED – VOLTAGE – PART 90.213

Ambient temperature	=	28°C	Radio Laboratory
Relative humidity	=	49%	
Supply voltage	=	+12 Vdc	



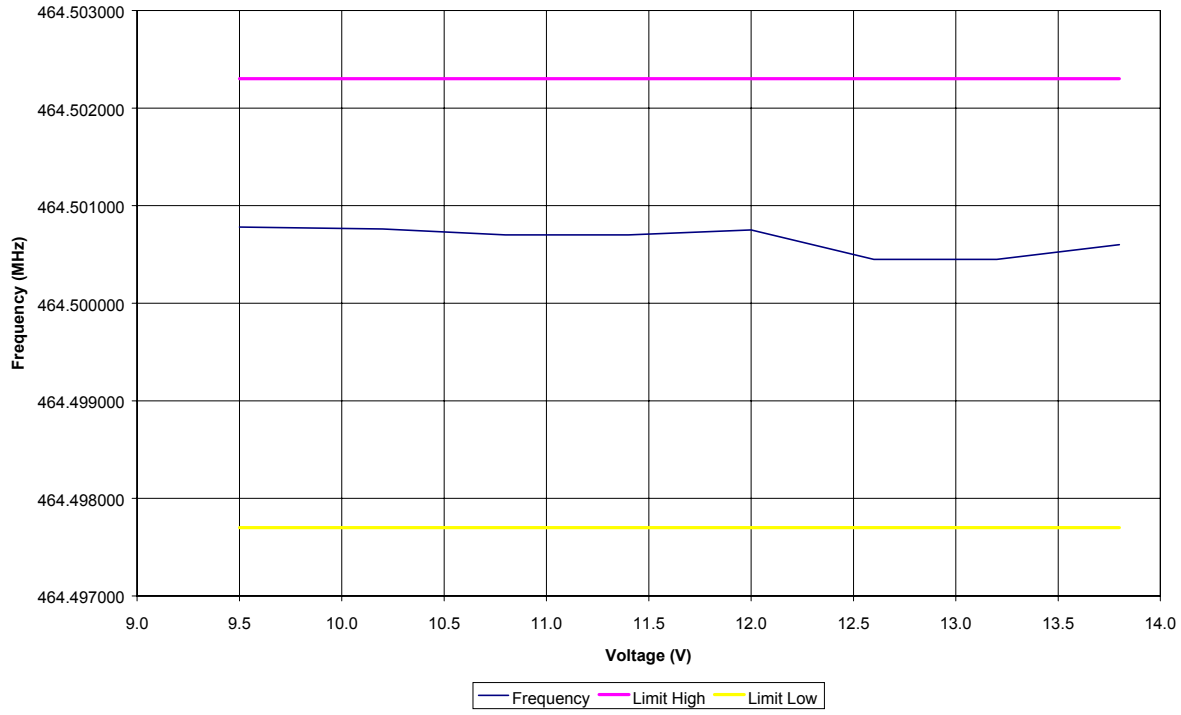
See Annex C for full list of test equipment

The test setup was as per the above diagram .With the battery being replaced by a variable bench power supply. The unit was put into test mode and set to operate at maximum power. The supply voltage was altered and the frequency change recorded.

RESULTS

VOLTAGE (%)	Frequency (MHz)	Limit (kHz)	Result
80	464.500780	±2.3	Compliant
85	464.500760	±2.3	Compliant
90	464.500700	±2.3	Compliant
95	464.500700	±2.3	Compliant
100	464.500750	±2.3	Compliant
105	464.500450	±2.3	Compliant
110	464.500450	±2.3	Compliant
115	464.500600	±2.3	Compliant

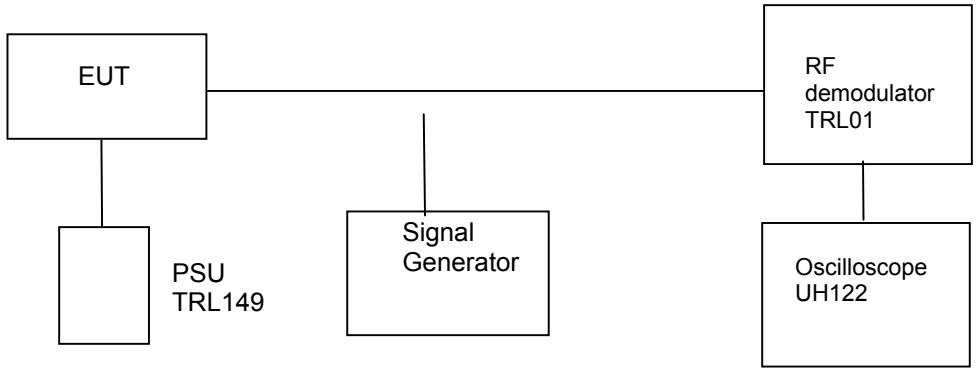
Microcore Digital Outstation was found to comply with the limits.


464.503000
464.502000
464.501000
464.500000
464.499000
464.498000
464.497000
Frequency (MHz)
9.0
9.5
10.0
10.5
11.0
11.5
12.0
12.5
13.0
13.5
14.0
Voltage (V)
Frequency
Limit High
Limit Low

TRANSMITTER TESTS

TRANSMITTER TRANSIENTS – CONDUCTED – PART 90.214

Ambient temperature	=	28°C	Radio Laboratory
Relative humidity	=	49%	
Supply voltage	=	+12.0Vdc	



See Annex C for full list of test equipment

The test setup was as per the above diagram. The signal generator was connected to the RF demodulator and was used to calibrate the 25kHz and 12.5kHz deviation on the oscilloscope. The unit was put into test mode and set to operate at maximum power. The carrier was turned on. The level of deviation was recorded on the storage oscilloscope.

RESULTS

Microcore Digital Outstation was found to comply with the limits.

	Deviation	Time allowed for deviation	Result
T1	±25kHz	10mS	Compliant
T2	±12.5kHz	20mS	Compliant
T3	±25kHz	10mS	Compliant

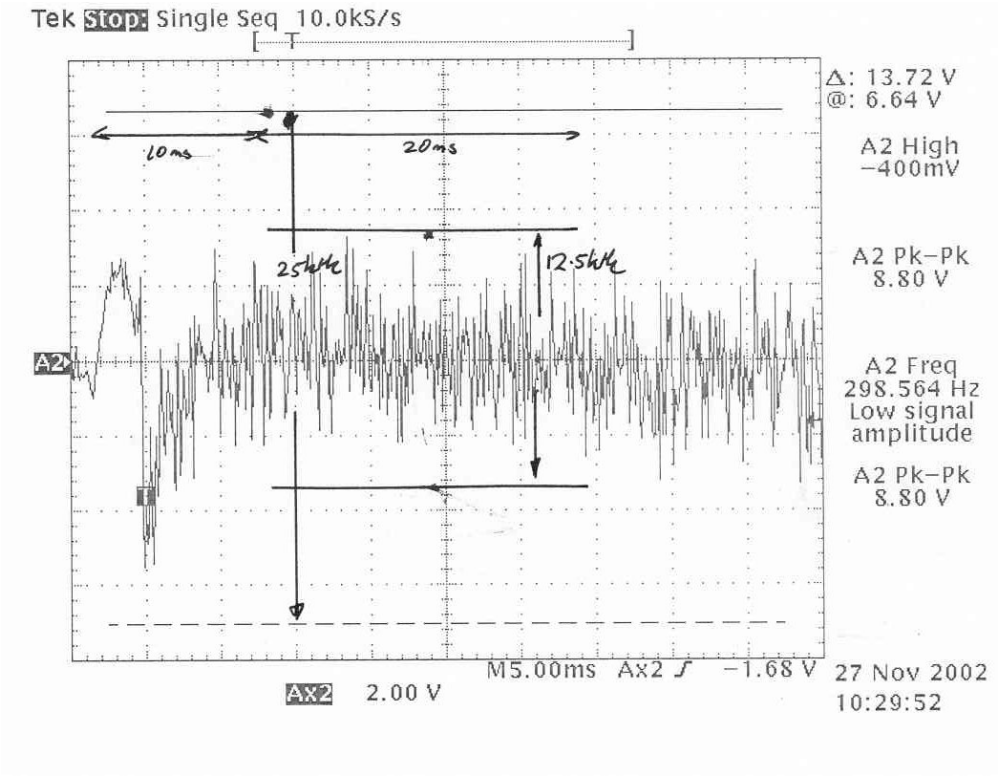
T1 = time immediately after Ton

T2 = time after T1

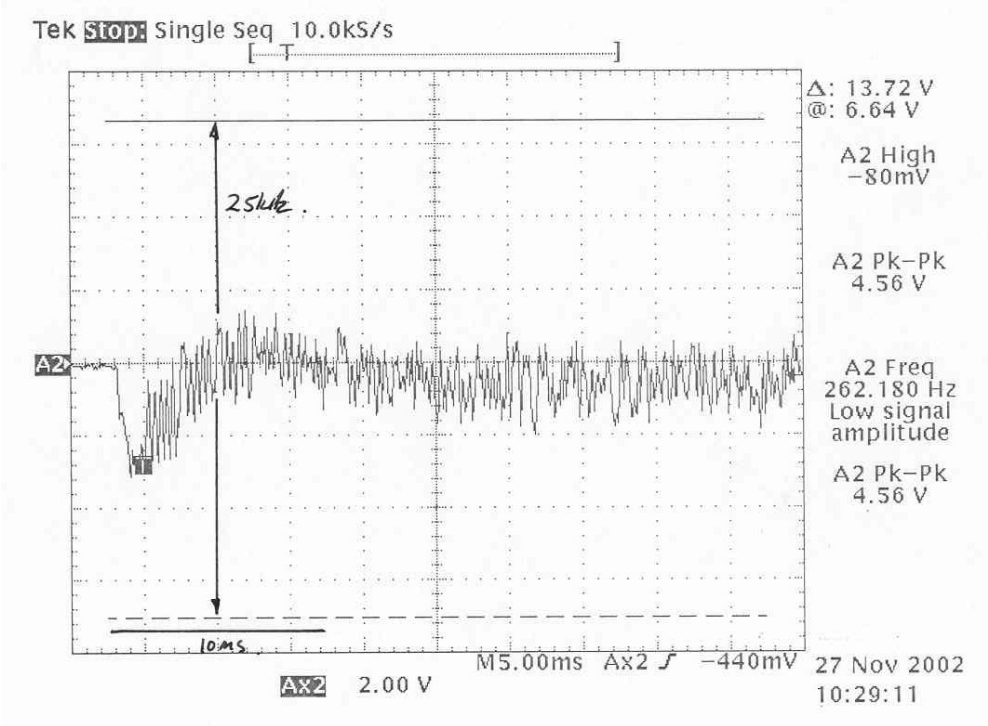
T3 = time immediately after Toff

See over for analyser plots

Transmitter on



Transmitter off



ANNEX A

PHOTOGRAPHS

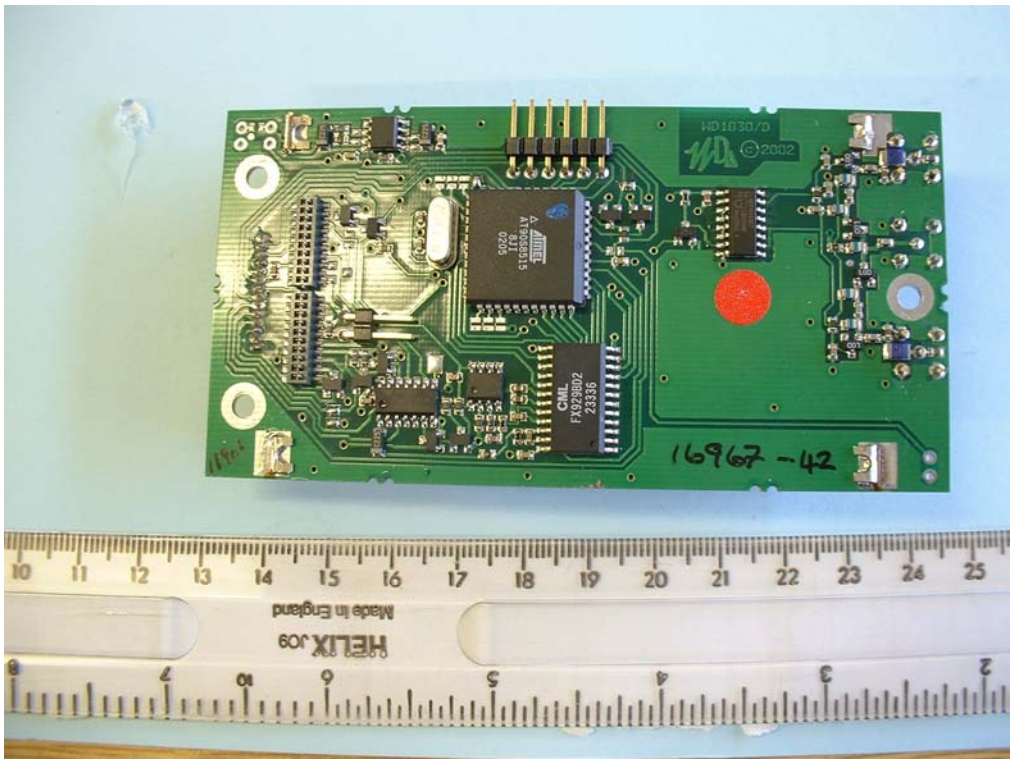
PHOTOGRAPH No. 1 **TRANSMITTER FRONT VIEW**

PHOTOGRAPH No. 2 **TRANSMITTER REAR VIEW**

PHOTOGRAPH No. 3 **TRANSMITTER PCB TRACK SIDE**

PHOTOGRAPH No. 4 **TRANSMITTER PCB COMPONENT SIDE**

PHOTOGRAPH No. 5 **TRANSMITTER PCB COMPONENT SIDE**



PHOTOGRAPH No. 6 **EQUIPMENT UNDER TEST**

ANNEX B

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

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

ANNEX C

TEST EQUIPMENT

TEST EQUIPMENT LIST

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No
SPECTRUM ANALYSER	R & S	ESIB 26	100202	N/A
SPECTRUM ANALYSER	R & S	ESIB 7	100182	630
SPECTRUM ANALYSER	MARCONI	2386/2380	152076/004	UH120
HIGH PASS FILTER	AFL	N/A	N/A	N/A
PSU	MANSON	EP-603	60316619	149
RF DIODE	SUHNER	H7	1001.17.A	248
HORN	EMCO	3115	9010-3581	139
BIDIRECTIONAL COUPLER	NARDA	3022	72622	UH226
CABLE	ROSENBERGER	MICRO COAX	N/A	280
ENVIRONMENTAL CHAMBER(TEMP)	SHARTREE	TCC125-815P	CS 203	11
POWER METER	MARCONI	6960B	237034019	UH132
POWER SENSOR	MARCONI	6924	951206/006	129
30 dB ATTENUATOR	N/A	N/A	N/A	UH179
30 dB ATTENUATOR	NARDA	776C-30	577	N/A
LOOP ANTENNA 9kHz - 30MHz	R & S	HFH2	881058 - 53	07