

TEST REPORT NO: RU1017/5883

1

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REPORT ON THE CERTIFICATION TESTING OF A PALMER ENVIRONMENTAL Ltd MICROCORR DIGITAL BASE STATION 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:		J CHARTERS
APPROVED BY:		P GREEN PRODUCT MANAGER
DATE:	18 th November 2004	
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:	MJCMCD			
PURPOSE OF TEST:	CERTIFICATION			
TEST SPECIFICATION:	FCC RULES CFR 47, Part 90			
TEST RESULT:	Compliant to Specification			
EQUIPMENT UNDER TEST:	MICROCORR DIGITAL BASE STATION			
EQUIPMENT SERIAL No:	Engineering Sample			
ITU: EMISSION CODE:	16k2F2D			
EQUIPMENT TYPE:	BASE STATION			
PRODUCT USE:	Water Leak Detection			
CARRIER EMISSION:	High Power 24.5dBm Low Power 5.2dBm			
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):	12.0Vdc Battery			
TEST DATE(s):	25 th – 30 th November 2002			
ORDER No(s):	29217			
APPLICANT:	PALMER ENVIRONMENTAL Ltd			
ADDRESS:	TY-COCH HOUSE LLANTARNAM PARK WAY CWMBRAN NP44 3AW UNITED KINGDOM			
TESTED BY:		J CHARTERS		
APPROVED BY:		P GREEN PRODUCT MANAGER		
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APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	MICROCORR DIGITAL BASE STATION		
EQUIPMENT TYPE:	BASE STATION		
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)	25 th – 30 th November 2002		
TEST REPORT No:	RU1017/5883		

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

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

2.	Product Use:	Leak detection	
3.	Emission Designator:	16k2F2D	
4.	Duty Cycle:		<100%
5.	Temperatures:	Ambient (Tnom)	19°C
6.	Supply Voltages:	Vnom	12.0Vdc
	Note: Vnom voltages are as stated above unless other	rwise shown on the test	report page

7.	Equipment Category:	Single channel Two channel Multi-channel	[X] [] []
8.	Channel spacing:	Narrowband Wideband	[X] [] 25kHz

TRANSMITTER OUTPUT POWER - CONDUCTED - PART 2.1046

Ambient temperature	= 18°C	Supply voltage	= 12Vdc
Relative humidity	= 70%	Channel number	= 464.5MHz
EUT		TRLUH120	

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 in both power modes.

RESULTS

Microcore Digital Base Station was found to comply with the limits.

FREQ. (MHz)	MEASURED VALUE (dBm)	CABLE LOSS (dB)	ATENUATOR (dBm)	LEVEL (dBm)	LEVEL (WATTS)
464.5	-5.7	0.2	30	24.5	0.281
464.5	5.0	0.2	0	5.2	0.003

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 OCCUPIED BANDWIDTH – CONDUCTED – PART 2.1049(1)

Ambient temperature	
Relative humidity	
ITU emission code	

= 18°C = 70% = 16k6F2D

Supply voltage	=	12Vdc
Channel number	=	464.5MHz
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

Limits Emission Mask C	Frequency	Applicable level	Frequency (MHz)	Frequency (MHz)	Level dBc High power	Level dBc Low power	Result
	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 BASE STATION was found to comply with the limits.

See next page for plots of compliance

Analyser plot showing compliance with mask



TRANSMITTER SPURIOUS EMISSION - CONDUCTED - Part 2.1051 - High Power

= 18°C, = 70%, = 12Vdc = 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

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

RESULTS

Microcore Digital Base Station was found to comply with the limits.

FREQ. (MHz)	MEASUREMENT Rx. READING (dBm)	CABLE LOSS (dB)	ATTENUATION (dB)	LEVEL (dBm)	LIMIT (dBm)
929.0	-52.5	0.5	30	-22.0	-13.0
1393.5	-44.0	0.6	30	-13.4	-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 1-2GHz



Spurious Emission 2-3GHz



Spurious Emissions 3-4012

TRANSMITTER SPURIOUS EMISSION - CONDUCTED - Part 2.1051 - Low Power

Ambient temperature
Relative humidity
Supply voltage
Channel number

= 18°C, = 70%, = 12.0Vdc = 464.5MHz Level Fc = 5.2dBm



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

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

RESULTS

Microcore Digital Base Station 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.					

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







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TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 2.1053 - High Power

1 metre

Ambient temperature=Relative humidity=Conditions=Supply voltage=Channel number=		10ºC(<1GHz) 70% (<1GHz), Open Area Test Site (OATS) 12Vdc 464.5MHz	3m measurements <1GHz 1m measurements >1GHz 3m extrapolated from 1m	[X] [X] [X]
EUT] ←		Spectrum Analyser	

Antenna

Horn

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° 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

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

RESULTS

Microcore Digital Base Station 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 (-13dBm)
	No significan	it emission	s within 10dB's	s of limit.		-13dBm

See notes over page

Notes:	 Results quoted are extrapolated as indicated Emissions were searched to: (x) 1000MHz 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 New batteries used for battery powered products. Only emissions within 20dB of limit are recorded. Emissions Checked up to 10 times Fc
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. Horizontal and vertical polarisations, of the receive antenna. EUT orientation in three orthagonal planes.

Maximum results recorded.

TRANSMITTER SPURIOUS EMISSIONS - RADIATED - PART 2.1053 - Low Power

1 metre

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

Antenna

Horn

Analyser

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 low power and with a modulating signal. The unit was mounted on a turntable and rotated through 360° 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

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

RESULTS

Microcore Digital Base Station 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 (-13dBm)
	No significant emissions within 10dB's of limit.					

See notes over page

Notes:	1 2 3 4 5 6 7 8 9	Results quoted are extrapolated as indicated Emissions were searched to: (x) 1000MHz 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 New batteries used for battery powered products. Only emissions within 20dB of limit are recorded. Emissions Checked up to 10 times Fc
Test Method:	1 2 3 4	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. Horizontal and vertical polarisations, of the receive antenna. EUT orientation in three orthagonal planes. Maximum results recorded.

FREQUENCY STABILITY - CONDUCTED - TEMPERATURE - PART 90.213

Ambient temperature	
Relative humidity	
Supply voltage	

= 28°C = 49% = +12 Vdc Radio Laboratory



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

RESULTS

TEMP ⁰C	Frequency (MHz)	Limit (kHz)	Result
+50	464.501580	±2.3	Compliant
+40	464.502280	±2.3	Compliant
+30	464.499650	±2.3	Compliant
+20	464.500228	±2.3	Compliant
+10	464.501580	±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 BASE STATION was found to comply with the limits.



Frequency Stability Temperature

FREQUENCY STABILITY – CONDUCTED – VOLTAGE – PART 90.213

Ambient temperature	=
Relative humidity	=
Supply voltage	=

= 28°C = 49% = +12 Vdc Radio Laboratory



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 BASE STATION was found to comply with the limits.



TRANSMITTER TRANSIENTS – CONDUCTED – PART 90.214

Ambient temperature	
Relative humidity	
Supply voltage	

= 28°C = 49% = +12.0Vdc Radio Laboratory



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 BASE STATION was found to comply with the limits.

	Deviation	Time allowed for deviation	Result
T1	±25kHz	10mS	Compliant
T2	±12.5kHz	20mS	Compliant
Т3	±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



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ANNEX A PHOTOGRAPHS

TRANSMITTER FRONT VIEW



TRANSMITTER REAR VIEW



PCB TRACK SIDE











PCB COMPONENT SIDE

PHOTOGRAPH No. 8



EQUIPMENT UNDER TEST



ANNEX B

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

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