

**AN RADIO TEST REPORT
FOR
CONTROLLED ELECTRONIC MANAGEMENT SYSTEMS
LIMITED
ON
EMERALD TSR V9
DOCUMENT NO.TRA-021653-00-47-00A**

HULL

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TRaC Wireless Test Report : TRA-021653-00-47-00A

Applicant : Controlled Electronic Management Systems Limited

Apparatus : Emerald TSR V9

Specification(s) : CFR47 Part 15 (c) & RSS-210

Purpose of Test : Certification

FCCID : QABTSR105V910

Certification Number : 12009A-TSR105V910

Authorised by :



: Radio Product Manager

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Section 1:**Introduction****1.1 General**

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests Requested By

This testing in this report was requested by:

Controlled Electronic Management
Systems Limited
t/a Tyco Security Products
195 Airport Road
Belfast
Northern Ireland
BT3 9ED

1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 01 July 2014 and 07 July 2014:

- Emerald TSR V9

The above device is a door access RFID reader. It has got two variants given below.

- Emerald TSR V9 powered by POE
- Emerald TSR V9 powered by 12V battery

Radiated spurious emission is done on both variants.

1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

Test Type	Regulations		Measurement standard	Result
	Title 47 of the CFR: Part 15 Subpart (c)	RSS – 210 Issue 8 & RSS-Gen Issue 3		
In-Band Emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.225 (a)(b)(c)	RSS – 210 Issue 8 (A2.6)	ANSI C63.10	Pass
Out-of-Band Emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.225(d)	RSS – 210 Issue 8 (A2.6)	ANSI C63.10	Pass
Frequency Tolerance	Title 47 of the CFR: Part 15 Subpart (c) 15.225(e)	RSS – 210 Issue 8 (A2.6)	ANSI C63.10	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215(c)	RSS – Gen Issue 3 4.6.1	ANSI C63.10	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c); 15.207	RSS-GEN Issue 3 7.2.4	ANSI C63.10	Pass

Abbreviations used in the above table:

CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions

ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

1.6 Notes Relating To the Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, "Pass" indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2:**Measurement Uncertainty****2.1 Measurement Uncertainty Values**

For the test data recorded in accordance with note (iii) of Section 2.1 the following measurement uncertainty was calculated:

Radio Testing – General Uncertainty Schedule

All statements of uncertainty are expanded standard uncertainty using a coverage factor of 1.96 to give a 95% confidence where no required test level exists.

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

Uncertainty in test result (Power Meter) = **1.08dB**

Uncertainty in test result (Spectrum Analyser) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Frequency Counter) = **0.113ppm**

Uncertainty in test result (Spectrum Analyser) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz – 30MHz) = **4.8dB**,

Uncertainty in test result (30MHz – 1GHz) = **4.6dB**,

Uncertainty in test result (1GHz – 18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result – Up to 8.1GHz = **3.31dB**

Uncertainty in test result – 8.1GHz – 15.3GHz = **4.43dB**

Uncertainty in test result – 15.3GHz – 21GHz = **5.34dB**

Uncertainty in test result – Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**,
Uncertainty in time measurement = **0.59%**,
Uncertainty in Amplitude measurement = **0.82%**

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3:	Modifications
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3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

Spec	: Specification	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
		ATS	: Alternative Test Site
EUT	: Equipment Under Test		
SE	: Support Equipment	Ref	: Reference
L	: Live Power Line	Freq	: Frequency
N	: Neutral Power Line	MD	: Measurement Distance
E	: Earth Power Line	SD	: Spec Distance
Pk	: Peak Detector	Pol	: Polarisation
QP	: Quasi-Peak Detector	H	: Horizontal Polarisation
Av	: Average Detector	V	: Vertical Polarisation
CDN	: Coupling & decoupling network		

A1 Transmitter Intentional Emission Radiated

Test Details:	
Regulation	Part15 Subpart (c) 15.225(a), RSS-210 A2.6
Measurement standard	ANSI C63.10:2009
EUT sample number	S01
Modification state	0
SE in test environment	S07, S09
SE isolated from EUT	S03, S04
EUT set up	Refer to Appendix C
Temperature	24.2°C
Photographs (Appendix F)	1

FREQ. (MHz)	MEASUREMENT DISTANCE (Metres)	MEASUREMENT Rx. READING (dB μ V/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (μ V/m)
13.56	1	97.10	60.80	65.31
13.56	3	76.30	40.00	65.31
Limit value @ fc		15848 μ V/m @ 30metres		

Notes:

- 1 Results quoted are extrapolated as indicated
- 2 Receiver detector @ fc = Quasi Peak with 120kHz bandwidth
- 3 Extrapolation <30 MHz 40dB/decade as per 15.31(f)(2) & RSS Gen 7.2.7
- 4 3 – 30 metre extrapolation 40 dB (40dB/decade) as per 15.31(f)(2)
- 5 1 – 3 metre extrapolation as measured (20.8dB)
- 6 1 – 30 metre extrapolation 60.8dB (40dB + 20.8dB)
- 7 All measurement below 30MHz made with loop antenna

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.10:2009
- 2 Measuring distances 1m & 3m
- 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 orthogonal planes.
Maximum results recorded

A2 Frequency Tolerance

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.225(e) / RSS – 210 Issue 8 (A2.6)
Measurement standard	ANSI C63.10:2009
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	20°C
Humidity	32%

Test Conditions		Measured Frequency (MHz)	Drift (kHz)
T_{nom} (+20°C)	V_{nom}	13.559356	0.000
T_{nom} (+20°C)	V_{min}	13.559356	0.000
T_{nom} (+20°C)	V_{max}	13.559356	0.000
T_{max} (+50°C)	V_{nom}	13.559361	0.005
T_{min} (-20°C)	V_{nom}	13.559399	0.043
Limit		$\pm 1.356 \text{ kHz}$ ($\pm 0.01\%$ of the operating frequency)	
Verdict		Pass	

A3 Occupied Bandwidth

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.215(c) / RSS – Gen Issue 3 4.6.1
Measurement standard	ANSI C63.10:2009
EUT sample number	S01
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	20°C
Humidity	32%

Band occupancy at -20 dBc	f_L	f_H
	13.391074 MHz	13.730817 MHz
BW = 339.744 kHz		
99% Band occupancy	f_L	f_H
	13.558641 MHz	13.560019 MHz
BW = 1.378 kHz		

A4 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100 kHz. The radiated electric field emission test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Section 15.225 and 15.209. The EUT was set to transmit as required.

The following test site was used for final measurements as specified by the standard tested to:

3m open area test site :

3m alternative test site :

The effect of the EUT set-up on the measurements is summarised in note (c) below.

Test Details: Powered by 12v Battery	
Regulation	Part 15 Subpart (c) Clause 15.209, RSS-Gen 7.2.5
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S01
Modification state	0
SE in test environment	S07, S09
SE isolated from EUT	S03, S11, S12
EUT set up	Refer to Appendix C
Temperature	25°C
Photographs (Appendix F)	1,2

The worst case radiated emission measurements for spurious emissions and harmonics are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dB μ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dB μ V/m)	FIELD ST'GH (μ V/m)	LIMIT (μ V/m)
1.	43.8	10.3	0.9	11.9	-	23.1	14.3	100
2.	54.0	17.1	1.0	7.1	-	25.2	18.2	100
3.	58.8	20.7	1.0	6.2	-	27.9	24.7	100
4.	60.3	23	1.0	6.0	-	30.0	31.6	100
5.	64.8	22.7	1.1	6.0	-	29.8	30.8	100
6.	67.9	19.4	1.2	6.4	-	27.0	22.4	100
7.	101.9	14.2	1.3	10.9	-	26.4	20.9	150
8.	106.7	18.2	1.4	11.3	-	30.9	35.1	150
9.	148.2	12.2	1.7	11.5	-	25.4	18.6	150
10.	151.6	11.4	1.7	11.4	-	24.5	16.8	150
11.	153.0	12.9	1.7	11.3	-	25.9	19.7	150
12.	189.8	25.4	2.0	8.7	-	36.1	63.6	150
13.	191.7	13.1	2.0	8.5	-	23.6	15.2	150
14.	217.0	19.8	2.0	9.3	-	31.1	36.0	200
15.	225.0	15.2	2.1	9.8	-	27.1	22.6	200

Ref No.	FREQ. (MHz)	MEAS Rx (dB μ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dB μ V/m)	FIELD ST'GH (μ V/m)	LIMIT (μ V/m)
16.	243.0	16.3	2.2	11.1	-	29.6	30.3	200
17.	252.0	12.2	2.3	12.5	-	27.0	22.4	200
18.	387.0	9.3	2.7	15.2	-	27.2	22.8	200
19.	405.0	9.2	2.9	16.1	-	28.2	25.6	200
20.	510.0	6.9	3.3	17.6	-	27.8	24.5	200
21.	515.3	7.6	3.3	17.8	-	28.7	27.4	200
22.	549.0	6.6	3.4	20.2	-	30.1	32.1	200
23.	567.0	8.3	3.3	19.4	-	31.0	35.3	200
24.	585.0	11.2	3.5	18.9	-	33.6	47.8	200
25.	603.0	8.5	3.6	19.4	-	31.5	37.5	200
26.	621.0	6.3	3.7	19.8	-	29.8	30.8	200
27.	639.0	7.2	3.7	19.8	-	30.7	34.1	200
28.	657.1	5.2	3.7	19.8	-	28.7	27.2	200
29.	675.0	6.7	3.8	20.1	-	30.5	33.5	200
30.	693.0	9.5	3.8	20.3	-	33.6	47.6	200
31.	705.1	8.4	3.8	20.6	-	32.8	43.7	200
32.	711.0	9	3.9	20.8	-	33.6	47.9	200
33.	801.0	3.8	4.1	21.8	-	29.7	30.4	200
34.	837.1	5.4	4.2	22.7	-	32.3	41.2	200
35.	850.1	1.1	4.2	22.6	-	27.9	24.9	200
36.	855.0	7.9	4.2	22.5	-	34.6	54.0	200
37.	867.8	4.8	4.3	22.4	-	31.5	37.4	200
38.	873.0	7.9	4.3	22.4	-	34.5	53.3	200
39.	889.2	1	4.3	22.3	-	27.6	24.0	200
40.	891.0	7	4.3	22.5	-	33.8	48.9	200
41.	909.0	6.5	4.4	23.2	-	34.1	50.8	200
42.	917.4	0.3	4.5	23.6	-	28.3	26.1	200
43.	918.5	0.3	4.5	23.6	-	28.4	26.2	200
44.	921.4	0.2	4.5	23.6	-	28.3	25.9	200
45.	927.1	4.7	4.5	23.8	-	33.0	44.4	200
46.	935.2	0.1	4.5	24.2	-	28.8	27.6	200
47.	945.0	5.6	4.5	24.3	-	34.4	52.4	200
48.	955.3	-0.1	4.6	23.7	-	28.2	25.7	200

Test Details: Powered by PoE	
Regulation	Part 15 Subpart (c) Clause 15.209, RSS-Gen 7.2.5
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S01
Modification state	0
SE in test environment	S07, S09, S14
SE isolated from EUT	S03, S04
EUT set up	Refer to Appendix C
Temperature	19°C
Photographs (Appendix F)	1,2

The worst case radiated emission measurements for spurious emissions and harmonics are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dB μ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dB μ V/m)	FIELD ST'GH (μ V/m)	LIMIT (μ V/m)
1.	30.1	19.2	0.7	19.5	-	39.4	92.8	100
2.	31.1	12.8	0.7	18.9	-	32.4	41.9	100
3.	34.1	15.9	0.7	17.3	-	33.9	49.7	100
4.	40.4	13.6	0.8	13.7	-	28.1	25.4	100
5.	42.4	15.9	0.9	12.6	-	29.4	29.4	100
6.	45.4	16.4	0.9	11.0	-	28.3	26.0	100
7.	49.2	18.5	0.9	9.0	-	28.4	26.4	100
8.	53.4	21.2	1.0	7.3	-	29.5	29.8	100
9.	59.5	21.4	1.0	6.1	-	28.5	26.5	100
10.	60.7	20.0	1.0	5.9	-	26.9	22.2	100
11.	62.5	22.8	1.0	6.0	-	29.8	30.9	100
12.	66.7	19.8	1.2	6.2	-	27.2	23.0	100
13.	81.3	18.2	1.2	8.1	-	27.5	23.6	100
14.	85.5	12.4	1.2	8.8	-	22.4	13.2	100
15.	106.7	11.7	1.4	11.3	-	24.4	16.6	150
16.	108.8	14.8	1.7	12.2	-	28.7	27.1	150
17.	141.2	11.3	1.7	12.2	-	25.2	18.1	150
18.	153.0	13.8	1.7	11.3	-	26.8	21.9	150
19.	162.8	17.3	1.8	10.7	-	29.8	31.0	150
20.	171.0	15.5	1.8	9.8	-	27.1	22.6	150
21.	189.9	24.8	2.0	8.7	-	35.5	59.4	150
22.	216.0	13.9	2.0	9.3	-	25.2	18.2	150

Ref No.	FREQ. (MHz)	MEAS Rx (dB μ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dB μ V/m)	FIELD ST'GH (μ V/m)	LIMIT (μ V/m)
23.	225.0	14.6	2.1	9.8	-	26.5	21.1	200
24.	243.0	13.4	2.2	11.1	-	26.7	21.7	200
25.	284.9	11.8	2.7	14.1	-	28.6	26.8	200
26.	333.0	11.5	2.7	14.1	-	28.3	25.9	200
27.	351.0	11.2	2.6	14.2	-	28.0	25.1	200
28.	515.3	7.3	3.3	17.8	-	28.4	26.4	200
29.	531.0	4.7	3.4	18.4	-	26.4	20.9	200
30.	549.0	7.1	3.4	20.2	-	30.6	34.0	200
31.	567.0	6.8	3.3	19.4	-	29.5	29.7	200
32.	585.0	12.0	3.5	18.9	-	34.4	52.4	200
33.	603.0	9.4	3.6	19.4	-	32.4	41.5	200
34.	621.0	8.5	3.7	19.8	-	32.0	39.7	200
35.	639.0	6.9	3.7	19.8	-	30.4	32.9	200
36.	657.0	5.1	3.7	19.8	-	28.6	26.9	200
37.	675.0	8.0	3.8	20.1	-	31.8	38.9	200
38.	693.0	9.5	3.8	20.3	-	33.6	47.6	200
39.	705.1	4.9	3.8	20.6	-	29.3	29.2	200
40.	711.0	10.1	3.9	20.8	-	34.7	54.4	200
41.	729.0	4.5	3.9	21.9	-	30.3	32.5	200
42.	819.0	3.8	4.2	22.3	-	30.2	32.4	200
43.	837.0	6.2	4.2	22.7	-	33.1	45.1	200
44.	849.9	1.1	4.2	22.6	-	27.9	24.9	200
45.	855.1	6.4	4.2	22.5	-	33.1	45.4	200
46.	873.0	5.4	4.3	22.4	-	32.0	39.9	200
47.	882.0	2.9	4.3	22.1	-	29.3	29.2	200
48.	891.0	6.8	4.3	22.5	-	33.6	47.8	200
49.	902.8	0.6	4.4	23.0	-	28.0	25.1	200
50.	909.0	6.4	4.4	23.2	-	34.0	50.2	200
51.	927.0	6.6	4.5	23.8	-	34.9	55.3	200
52.	945.0	6.8	4.5	24.3	-	35.6	60.2	200
53.	963.0	7.1	4.6	23.9	-	35.5	59.8	501
54.	981.0	6.3	4.6	24.0	-	34.9	55.4	501

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10:2009: section 4.5, Table 1 For emissions below 30MHz the cable losses are assumed to be negligible.
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 4 For Frequencies below 1 GHz, RBW= 120 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW= 1MHz, VBW \geq RBW
Average	RBW= 1MHz, VBW \geq RBW

The upper and lower frequency of the measurement range was decided according to 47 CFR Part 15 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits 47 CFR Part 15: Clause 15.209 for all emissions:

Frequency of emission (MHz)	Field strength μ V/m	Measurement Distance m	Field strength $\text{dB}\mu$ V/m
0.009-0.490	2400/F(kHz)	300	67.6/F (kHz)
0.490-1.705	24000/F(kHz)	30	87.6/F (kHz)
1.705-30	30	30	29.5
30-88	100	3	40.0
88-216	150	3	43.5
216-960	200	3	46.0
Above 960	500	3	54.0

(a) Where results have been measured at one distance, and a signal level displayed at another, the results have been extrapolated using the following formula:

$$\text{Extrapolation (dB)} = 20 \log_{10} \left(\frac{\text{measurement distance}}{\text{specification distance}} \right)$$

(b) The levels may have been rounded for display purposes.

(c) The following table summarises the effect of the EUT operating mode, internal configuration and arrangement of cables / samples on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels	✓			
Effect of EUT internal configuration on emission levels	✓			
Effect of Position of EUT cables & samples on emission levels	✓			
(i) Parameter defined by standard and / or single possible, refer to Appendix D (ii) Parameter defined by client and / or single possible, refer to Appendix D (iii) Parameter had a negligible effect on emission levels, refer to Appendix D (iv) Worst case determined by initial measurement, refer to Appendix D				

A5 Power Line Conducted Emissions

Previous power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector.

Test Details:	
Regulation	Part 15 Subpart (c) Clause 15.207, RSS-Gen 7.2.4
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S01
Modification state	0
SE in test environment	S03, S04, S07, S09, S14
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	4

The worst-case power line conducted emission measurements are listed below:

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
No emissions were detected within 20dB of the limit						

Results measured using the quasi-peak detector compared to the quasi-peak limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
No emissions were detected within 20dB of the limit						

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207 & RSS-Gen 7.2.4):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB μ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 ²	56 to 46 ²
0.5 to 5	56	46
5 to 30	60	50

Notes:

1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

- (a) The levels may have been rounded for display purposes.
- (b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels		✓		
Effect of EUT internal configuration on emission levels		✓		
(i) Parameter defined by standard and / or single possible, refer to Appendix C (ii) Parameter defined by client and / or single possible, refer to Appendix C (iii) Parameter had a negligible effect on emission levels, refer to Appendix C (iv) Worst case determined by initial measurement, refer to Appendix C				

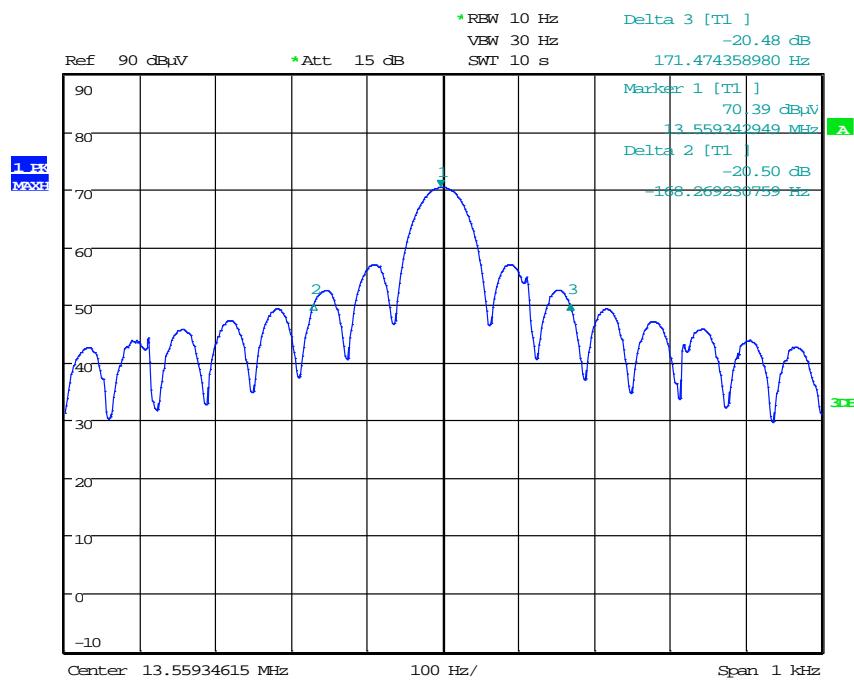
Appendix B:**Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

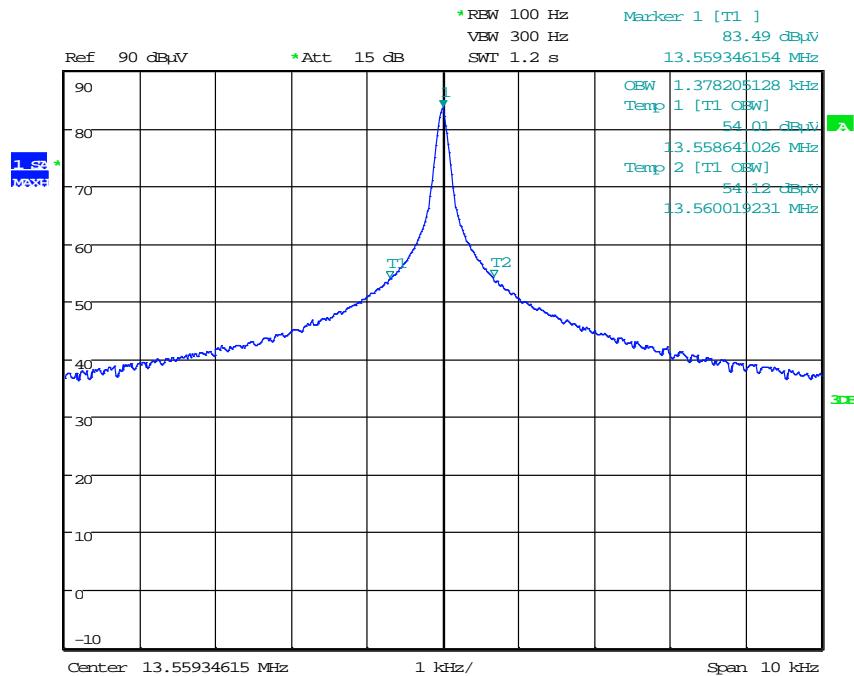
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.
- (d) Appendix C details the numbering system used to identify the sample and its modification state.
- (e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

20dB Bandwidth



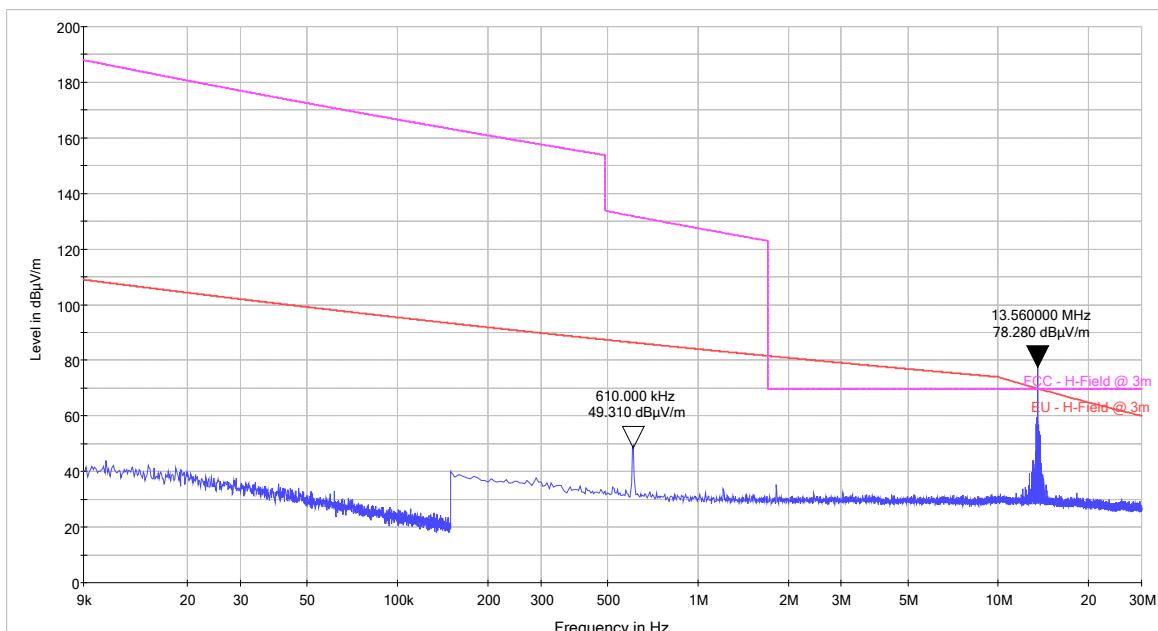
Date: 4.JUL.2014 17:52:57

99% Bandwidth

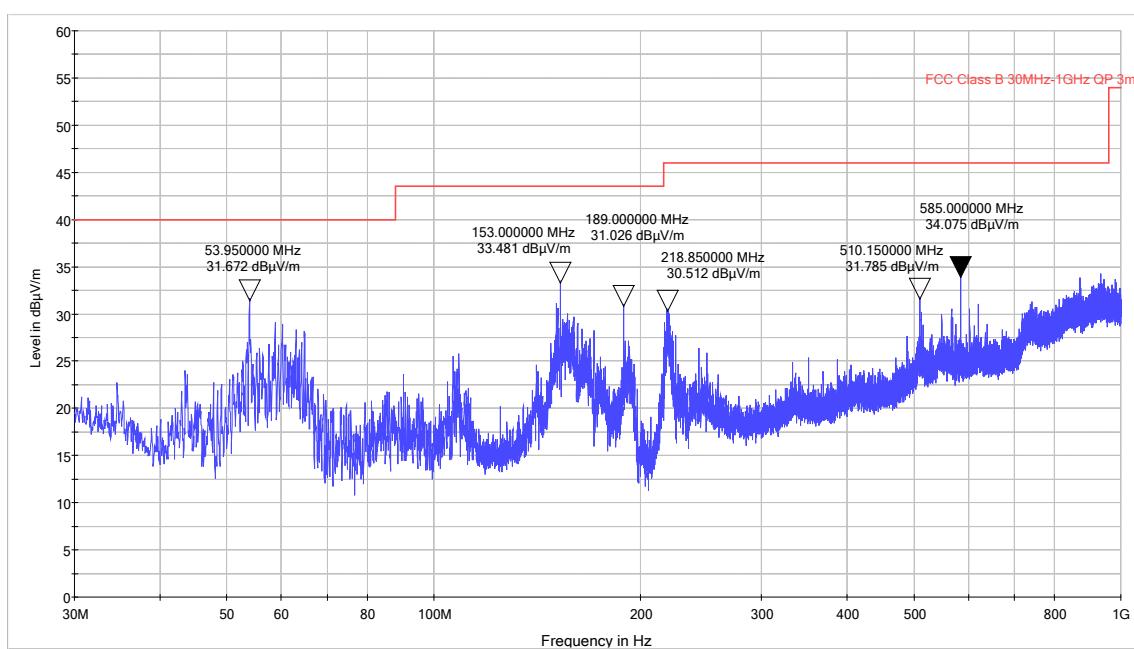


Date: 4.JUL.2014 17:29:05

Radiated spurious emissions – powered by 12v battery

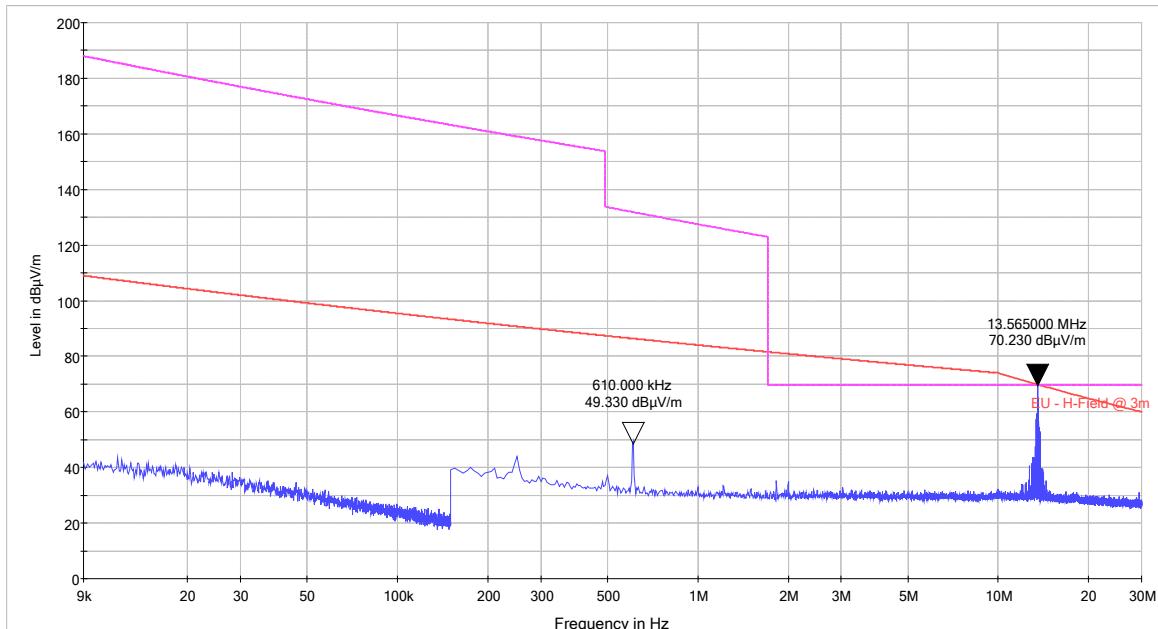


9 kHz to 30 MHz

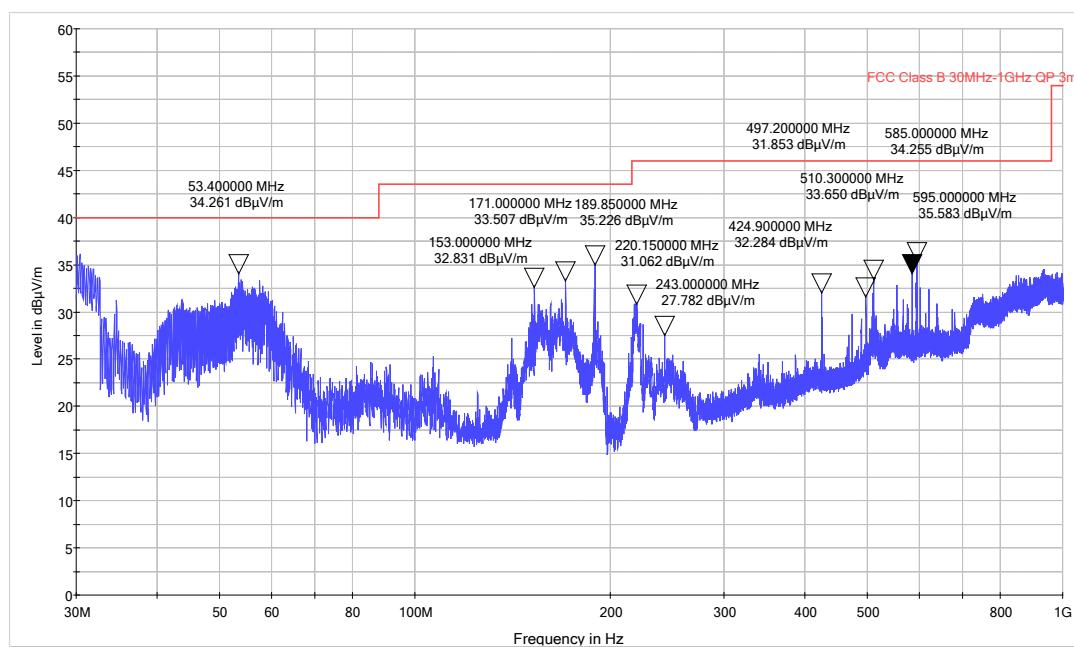


30 MHz to 1 GHz

Radiated spurious emissions – powered by PoE

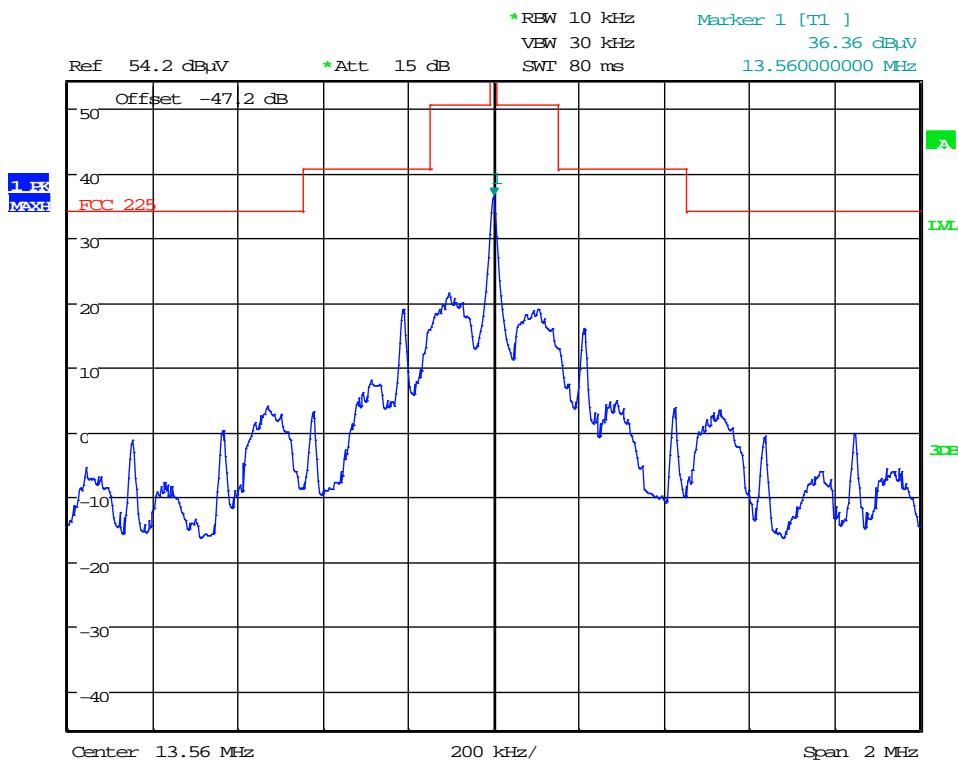


9 kHz to 30 MHz



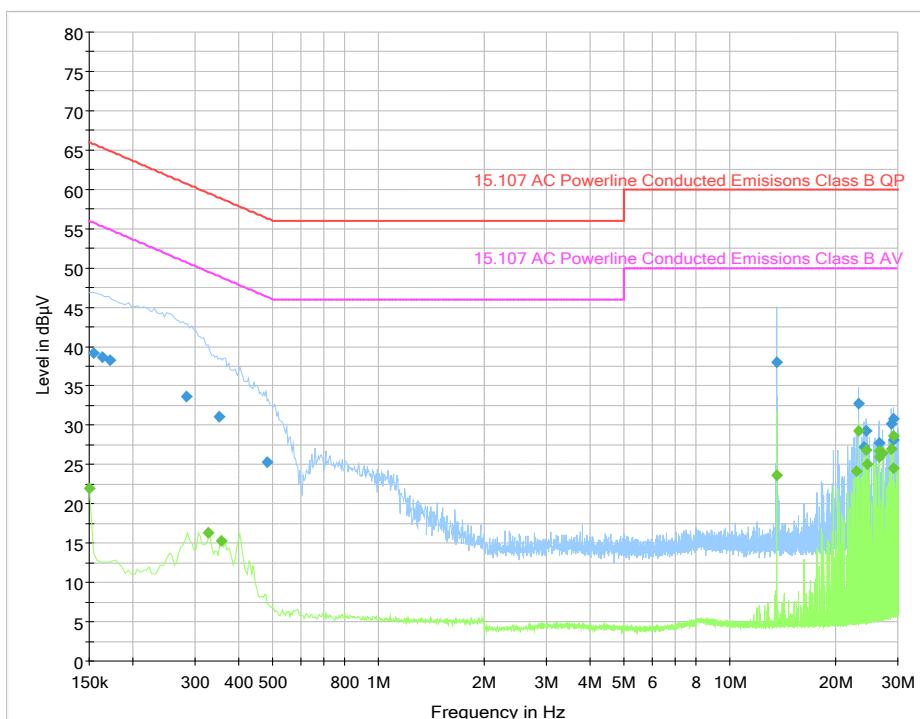
30 MHz to 1 GHz

In-Band Emissions



Date: 4.JUL.2014 16:34:12

AC Powerline Conducted Emissions



Appendix C:**Additional Test and Sample Details**

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and its modification state:

Sample No: Sxx Mod w

where:

xx	= sample number	eg. S01
w	= modification number	eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

- Positioning of cards in a chassis.
- Setting of any internal switches.
- Circuit board jumper settings.
- Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing:

Sample No.	Description	Identification
S01	Emerald TSR V9	None

The following samples of apparatus were submitted by the client as host, support or drive equipment (auxiliary equipment):

Sample No.	Description	Identification
S03	Dell Laptop	None
S04	PoE	None
S07	Magnetic Lock	None
S09	Door Simulator	None
S11	Ethernet Hub	None
S12	12V Power Supply	None
S14	WURTH ELEKTRONIK Ferrite	74271722

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Identification	Description
	None

C2) EUT Operating Mode During Testing.

During testing, the EUT was exercised as described in the following tables :

Test	Description of Operating Mode:
All tests detailed in this report	EUT is actively transmitting either waiting for a tag to be presented or reading a tag as required.

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The tables below describe the termination of EUT ports:

Sample : S01
Tests : Radiated emissions / Powerline conducted emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
Maglock	Multiple wires Cable	20cm	S07
Door simulator	Multiple wires Cable	20cm	S09
Power	2 wires	1m	S12
Ethernet	Ethernet cable with 2 turns on ferrite S14	1m	S04/S11

C5 Details of Equipment Used

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal Calibration	Calibration Period	Due For Calibration	
UH191	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014	
L317	ESVS10	Receiver	R&S	12/02/2014	12	12/02/2015	
REF940	ATS	Radio Chamber - PP	Rainford EMC	09/07/2013	24	09/07/2015	
REF976	34405a	Multimeter	Agilent	19/02/2014	12	19/02/2015	
L426	52 Series II	Temperature Indicator	Fluke	22/05/2014	12	22/05/2015	
UH396	ENV216	Lisn	R&S	22/05/2014	12	22/05/2015	
L007	hfh2	Loop Antenna	R&S	17/10/2013	24	17/10/2015	
UH403	ESCI 7	Recevier	R&S	12/08/2013	12	12/08/2014	
UH100	-	PSU	Thandar	Cal in use			
L011	-	Temp Chamber	Sharetree	Cal in use			

Appendix D:

Additional Information

No additional information is included within this test report.

Appendix E:**Calculation of the duty cycle correction factor**

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsedwidths and period was measured. A plots of the pulse train is contained in Appendix B of this test report.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsedwidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsedwidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = $20 \times (\text{Log}_{10} \text{Calculated Duty Cycle})$

Therefore the calculated duty cycle was determined:

The pulse train period was greater than >100ms and in as shown from the plots in contained in appendix B of this test report.

Duty cycle = the sum of the highest average value pulsedwidths over 100ms
100ms

e.g

$$= \frac{7.459\text{ms}}{100\text{ms}} = 0.07459$$

0.07459 or 7.459%

Correction factor (dB) = $20 \times (\text{Log}_{10} 0.07459) = -22.54\text{dB}$

Duty cycle correction may not be applicable.

Unless duty cycle correction is utilised in the results section of this report this section is included for information only

Appendix F:

Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated transmitter intentional emission arrangement: Overview
2. Radiated emissions arrangement: Overview
3. Radiated emissions arrangement: Close up showing the ferrite
4. Powerline conducted emissions arrangement: Overview

Photograph 1



Photograph 2



Photograph 3



Photograph 4



