A RADIO TEST REPORT

FOR

MICROWAVE SOLUTIONS Ltd

ON

X-BAND DOPPLER MOTION DETECTOR UNITS
MODEL NUMBER MDU1720

DOCUMENT NO. TRA-012363-W-NA-1

HULL
Unit E, South Orbital Trading Park, Hedon Road, Hull, HU9 1NJ, UK.
T +44 (0)1482 801801 **F** +44 (0)1482 801806 **E** test@tracglobal.com
www.tracglobal.com

TRaC Wireless Test Report	**:** TRA-012363-W-NA-1
Applicant	**:** Microwave Solutions Ltd
Apparatus	**:** MDU1720
Specification(s)	**:** CFR47 Part 15 & RSS-210
Purpose of Test	**:** Limited Modular Approval
FCCID	**:** ROO-MDU1720
Certification Number	**:** 10829A-MDU1720
Authorised by	**:** 
	: Radio Product Manager
Issue Date	**:** 18th January 2013
Authorised Copy Number	**:** *PDF*

Total number of pages: 40

0026

Contents

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.

Test performed by:

TRaC Global [ ]
Unit E
South Orbital Trading Park
Hedon Road
Hull, HU9 1NJ.
United Kingdom.

Telephone: +44 (0) 1482 801801
Fax: +44 (0) 1482 801806

TRaC Global [X]
Unit 1
Pendle Place
Skelmersdale
West Lancashire, WN8 9PN
United Kingdom

Telephone: +44 (0) 1695 556666
Fax: +44 (0) 1695 577077

Email: test@tracglobal.com
Web site: http://www.tracglobal.com

Tests performed by: D. Winstanley

Report author: D. Winstanley

1.2 Tests Requested By

This testing in this report was requested by :

Microwave Solutions Ltd
Hamilton House
111 Marlowes
Hemel Hempstead
Herts
HP1 1BB
UNITED KINGDOM

1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between the dates 4th – 19th December 2012:

X-Band Doppler Motion Detector Unit
Model Number MDU1720

The unit is able to operate at 100% transmitter on mode or in a pulsed mode with a duty cycle down to 1%

The MDU1720 is a module.

This assessment of the MDU1720 covers use in both indoor and outdoor applications.

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	Regulation		Measurement standard	Result
	Title 47 of the CFR: Part 15 Subpart (c)	RSS-210 Section		
Spurious Emissions Radiated <1000MHz	15.209	RSS-Gen 4.9 RSS-210 Annex 7	ANSI C63.10:2009	Pass
Spurious Emissions Radiated >1000MHz	15.209 & 15.245	RSS-Gen 4.9 RSS-210 Annex 7	ANSI C63.10:2009	Pass
AC Power conducted emissions	15.107 & 15.207	RSS-Gen Issue 3 7.2.4	ANSI C63.10:2009	Pass
Intentional Emission Frequency	15.245	RSS-210 Annex 7	ANSI C63.10:2009	Pass
Intentional Emission Field Strength	15.245	RSS-210 Annex 7	ANSI C63.10:2009	Pass
Intentional Emission Band Occupancy	15.215	RSS-Gen Issue 3 4.6	ANSI C63.10:2009	Pass
Intentional Emission ERP (mW)	-	-	ANSI C63.10:2009	-
Unintentional Radiated Spurious Emissions	15.109	RSS-Gen Issue 3 4.10	ANSI C63.10:2009	Pass
Antenna Arrangements Integral:	15.203	RSS-Gen Issue 3 7.1.2	-	Pass
Antenna Arrangements External Connector	15.204	RSS-Gen Issue 3 7.1.2	-	-
Restricted Bands	15.205	RSS-Gen Issue 3 7.2.2	-	-
Maximum Frequency of Search	15.33	RSS-Gen Issue 3 4.9	-	-
Extrapolation Factor	15.35(f)	RSS-Gen Issue 3 7.2.7	-	-

Abbreviations used in the above table:

ANSI C 63.10:2009 is outside the scope of the laboratories UKAS accreditation.

CFR : Code of Federal Regulations
ANSI : American National Standards Institution
RSS : Radio Standards Specification
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 (Power Meter) = **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

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
Mod	: Modification
EUT	: Equipment Under Test
SE	: Support Equipment
L	: Live Power Line
N	: Neutral Power Line
E	: Earth Power Line
Pk	: Peak Detector
QP	: Quasi-Peak Detector
Av	: Average Detector
CDN	: Coupling & decoupling network

ALSR	: Absorber Lined Screened Room
OATS	: Open Area Test Site
ATS	: Alternative Test Site
Ref	: Reference
Freq	: Frequency
MD	: Measurement Distance
SD	: Spec Distance
Pol	: Polarisation
H	: Horizontal Polarisation
V	: Vertical Polarisation

A1 Transmitter Intentional Emission Radiated

Test Details:	
Regulation	Part15 Subpart (c) 15.245 & RSS-210 Annex 7
Measurement standard	ANSI C63.10:2009
EUT sample number	S01 & S04
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25
Photographs (Appendix F)	1&2

FREQ. (MHz)	DUTY CYCLE (%)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	PRE AMP (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
10523.79	100 %	104.45	6.1	38.2	36.0	112.75	434.01026
10523.79	50 %	104.39	6.1	38.2	36.0	112.69	431.02256
10523.79	1%	104.41	6.1	38.2	36.0	112.71	432.01617
Limit value @ fc				2500 mV/m @ 3m			

Band occupancy @ -20 dBc			
DUTY CYCLE (%)	f lower (MHz)	f higher (MHz)	Occupied Bandwidth (kHz)
100 %	10524.806766	10524.872869	64.102
50 %	10523.430288	10524.266826	836.538
1%	10521.814904	10523.981571	2166.666

Band occupancy @ 99%			
DUTY CYCLE (%)	f lower (MHz)	f higher (MHz)	Occupied Bandwidth (kHz)
100 %	10524.776715	10524.840827	64.524
50 %	10523.141827	10524.327724	1185.897
1%	10519.103365	10524.971314	4967.948

Notes:

1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Peak 1MHz bandwidth
3 When battery powered the EUT was powered with new batteries

Test Method:

1 As per Radio – Noise Emissions, ANSI C63.10:2009
2 Measuring distances 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 orthagonal planes.
Maximum results recorded

A2 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric filed emission test applies to all spurious emissions and harmonics emissions . The maximum permitted field strength is listed in Section 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:	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.209
Measurement standard	ANSI C63.10:2009
Frequency range	30MHz – 52750 MHz
EUT sample number	S01 & S04
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	25
Photographs (Appendix F)	1&2

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below:

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	FIELD ST'GH (dBµV/m)	EXTRAP FACT (dB)	FIELD ST'GH (mV/m)	LIMIT (mV/m)
1.	21050.34	72.07	9.5	37.4	35.3	83.67	-	15.26	25.0*
2.	31578.71	47.97	10.16	40.7	-	98.83	-29.54	2.91	25.0*

Notes:
Measurements below 26.5 GHz @ 3meters
Measurements above 26.5 GHz @ 0.1meters
*For the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors

The worst case results recorded in the table above are based on a CW signal. Based on the levels measured above a duty cycle correction factor of 7.76 dB is required to allow the device to meet the general 7.5mV/m limit for any other devices.

An on time of 40.9ms in a 100ms period will give a duty cycle correction of 7.77dB
See appendix E for duty cycle information.

Based on the information above the MDU1720 will meet the requirements of CFR 47 Part 15.245(b) (1) (i) under all operating conditions and Part 15.245 (b) (1) (ii) when operated with a maximum duty cycle of 40.9% averaged over a period of 100ms.

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 ≥ RBW
Average	RBW= 1MHz, VBW ≥ 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 μV/m	Measurement Distance m
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3
Un-restricted Bands & Harmonics		
Frequency of emission (MHz)	Field strength mV/m	Measurement Distance m
Harmonics <17.7 GHz Un-restricted Bands	25.0	3
Harmonics in restricted bands >17.7 GHz	25.0*	3
Harmonics in restricted bands >17.7 GHz	7.5#	3
All other Emissions	-50dBc	3

* For the second and third harmonics of field disturbance sensors operating in the 24075–24175 MHz band and for other field disturbance sensors designed for use only within a building or to open building doors

\# For all other field disturbance sensors

(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:

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

(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

A3 Power Line Conducted Emissions

Preview 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	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	3

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
1	No Significant Emissions Within 20 dB of the limit					Pass

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
1	No Significant Emissions Within 20 dB of the limit					Pass

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dBμV	
	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:

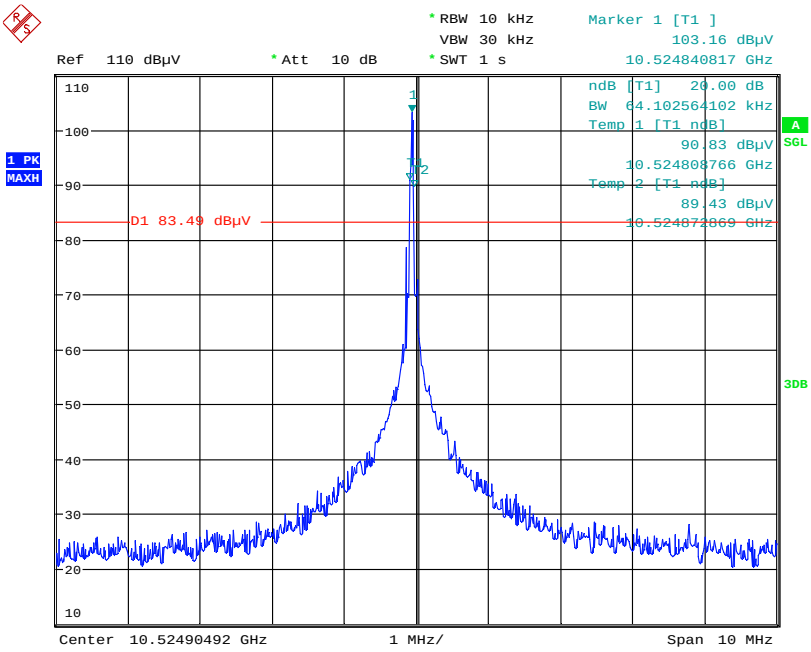
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

(b) The time and date on the plots do not necessarily equate to the time of the test.

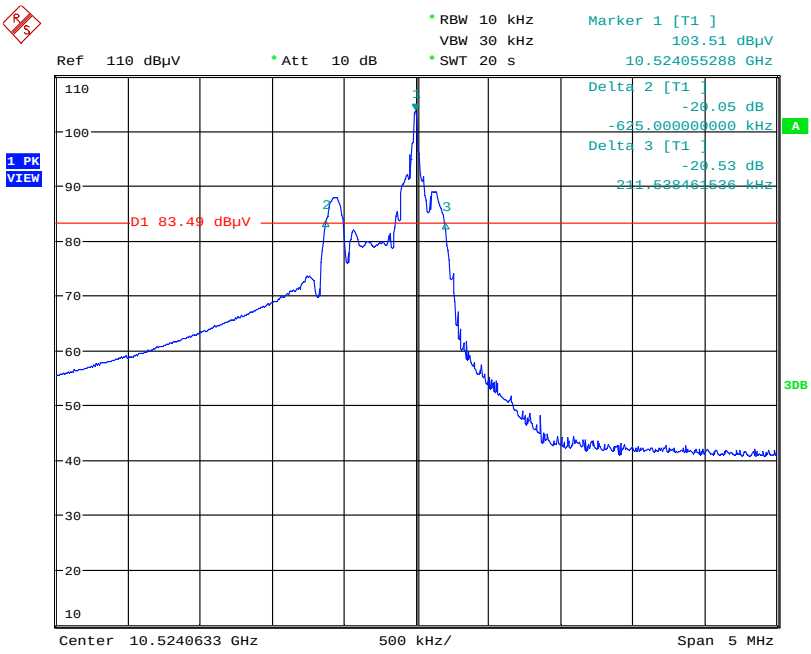
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

(d) Appendix C details the numbering system used to identify the sample and its modification state.

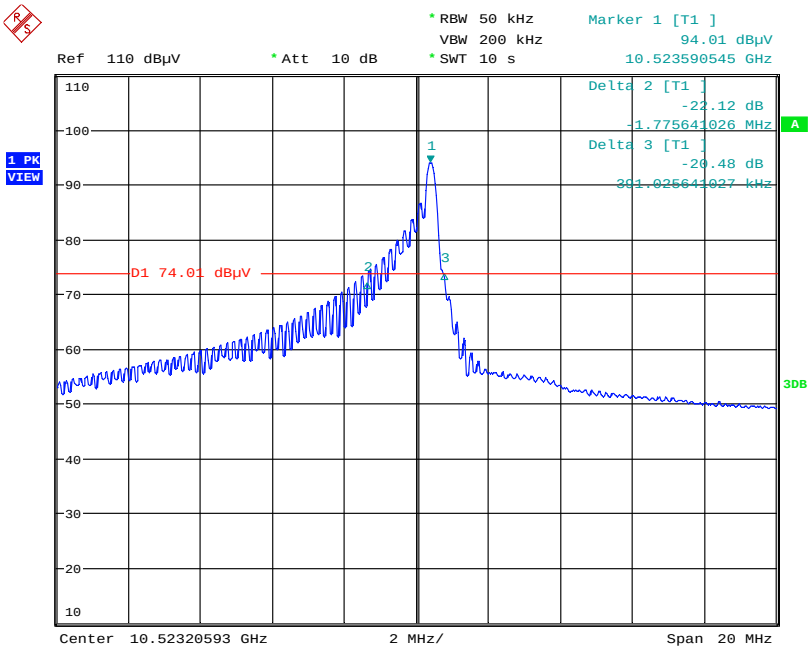
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



20dB Bandwidth - 100% Duty Cycle

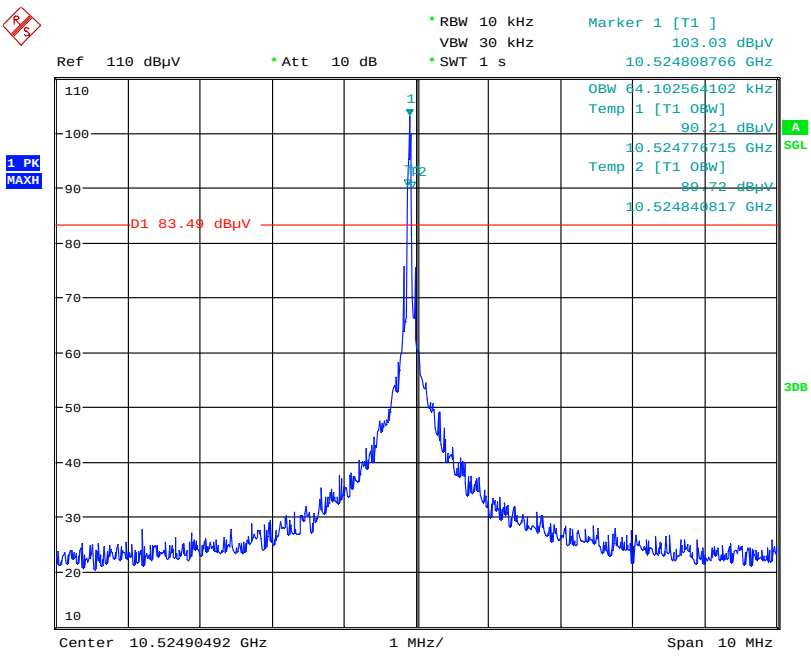


20dB Bandwidth - 50% Duty Cycle



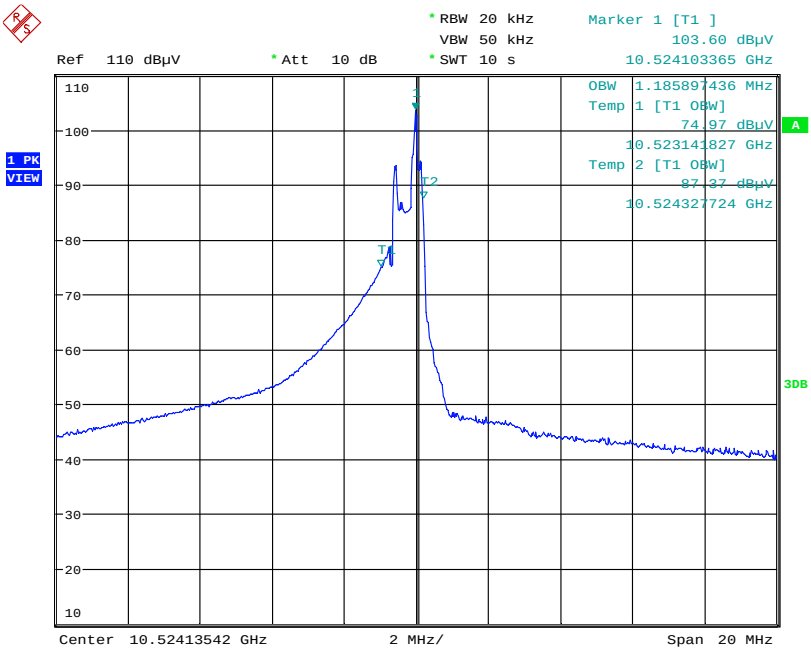
Date: 5.DEC.2012 12:04:54

20dB Bandwidth - 1% Duty Cycle



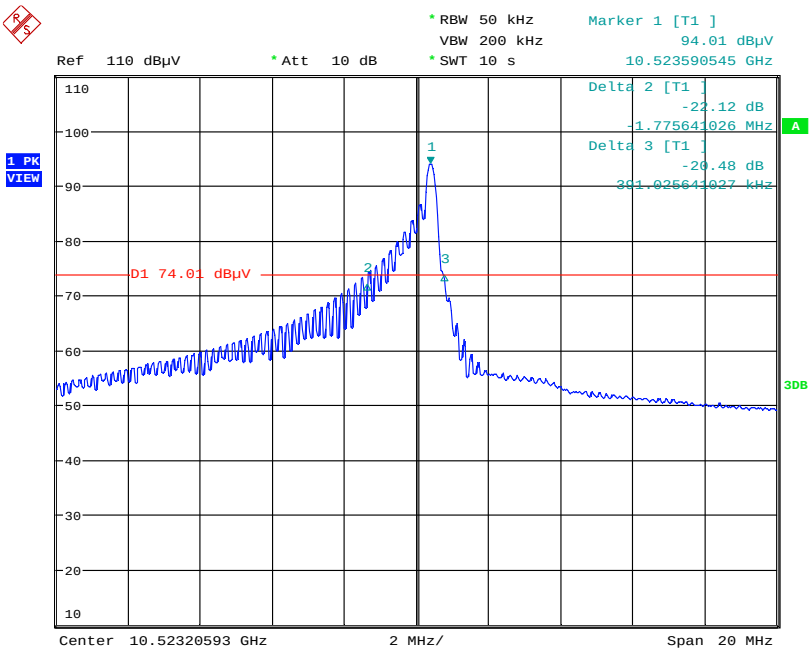
Date: 5.DEC.2012 12:27:25

99% Bandwidth - 100% Duty Cycle



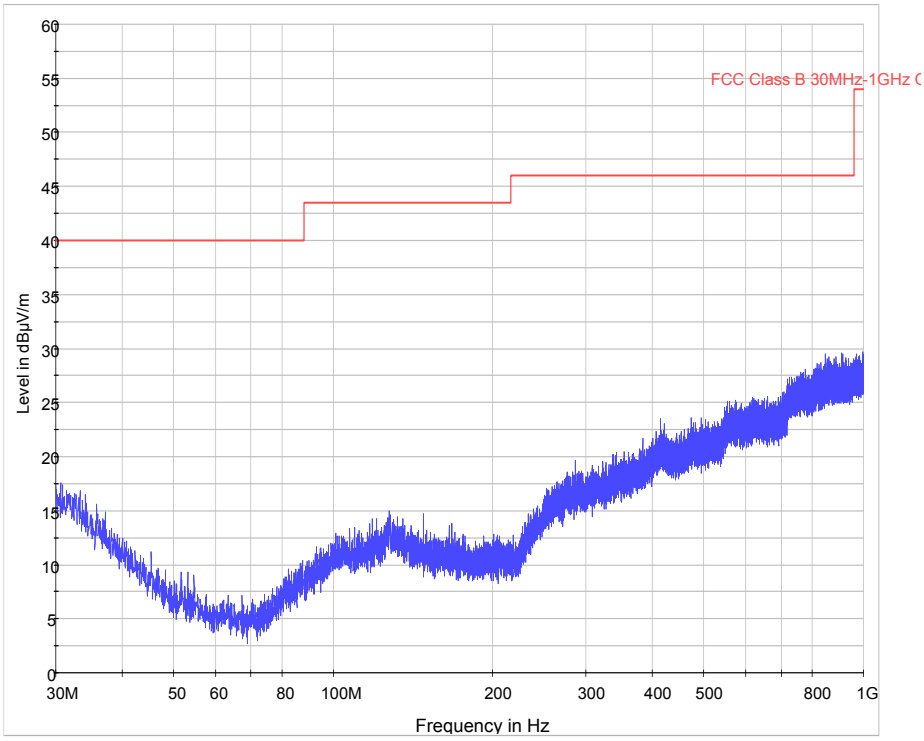
Date: 5.DEC.2012 12:07:38

99% Bandwidth - 50% Duty Cycle

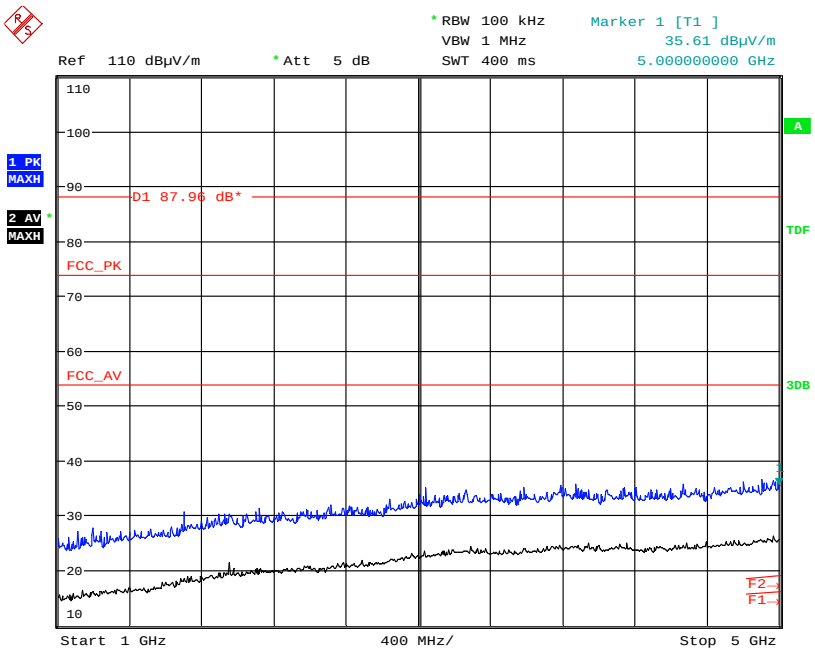


Date: 5.DEC.2012 12:04:54

99% Bandwidth - 1% Duty Cycle

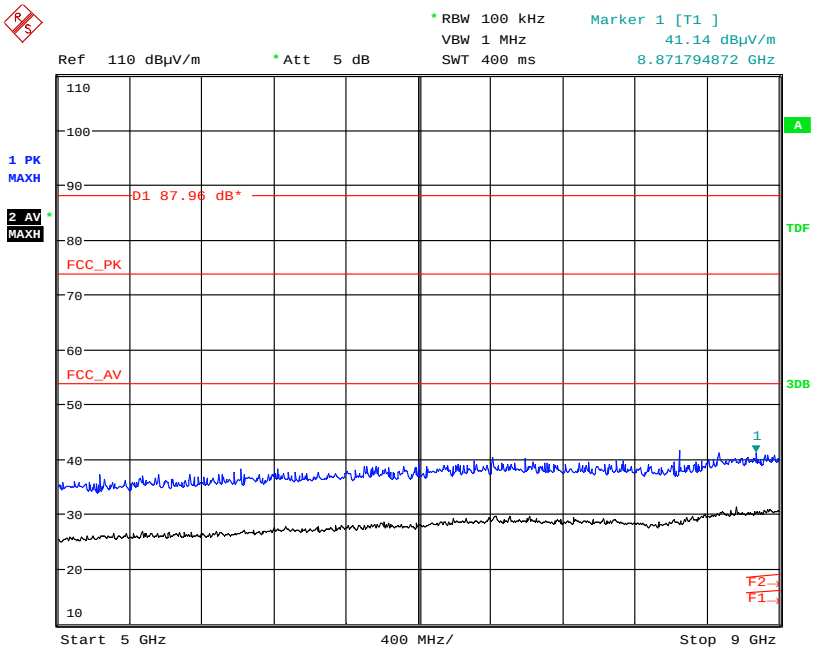


Radiated spurious emissions 30 MHz to 1 GHz



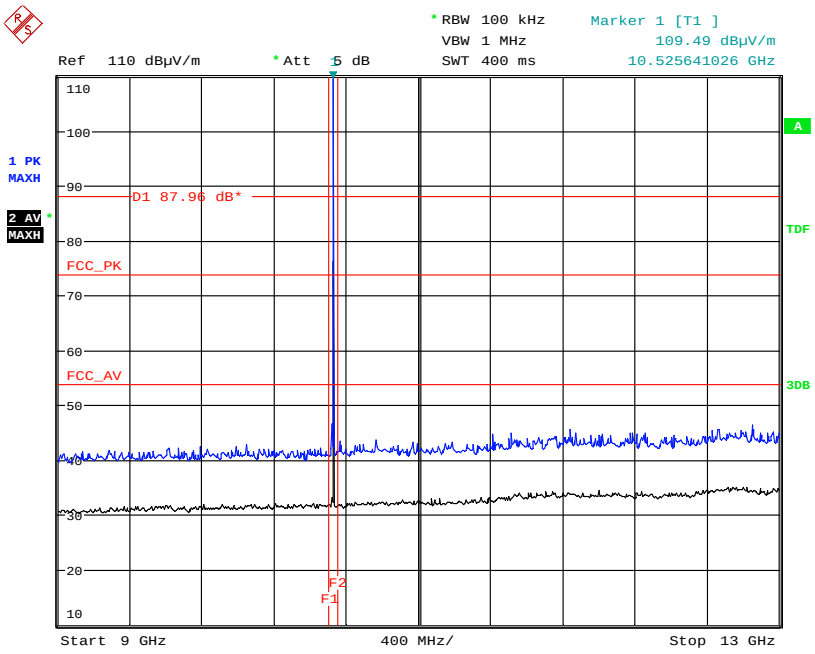
Date: 4.DEC.2012 16:28:27

Radiated spurious emissions 1 GHz to 5 GHz



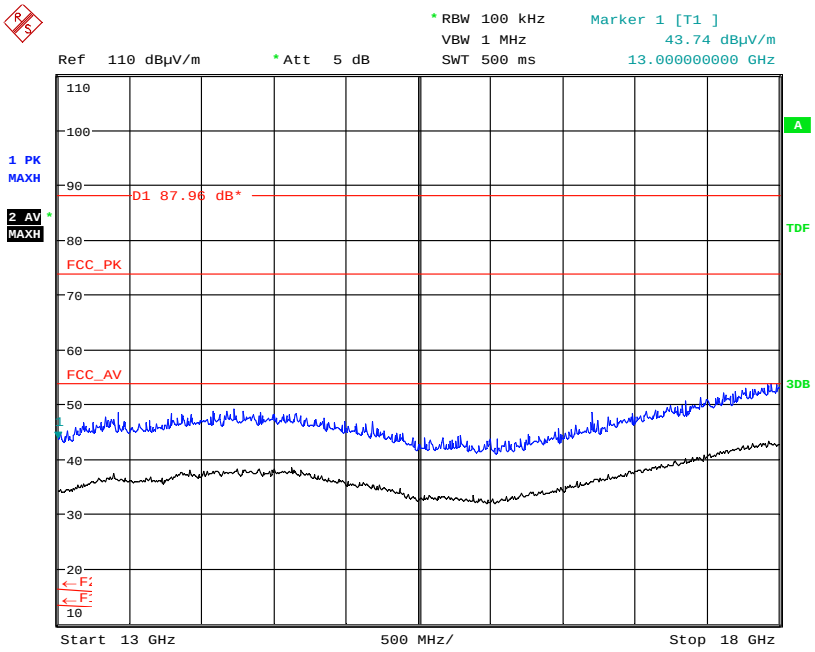
Date: 4.DEC.2012 16:30:10

Radiated spurious emissions 5 GHz to 9 GHz

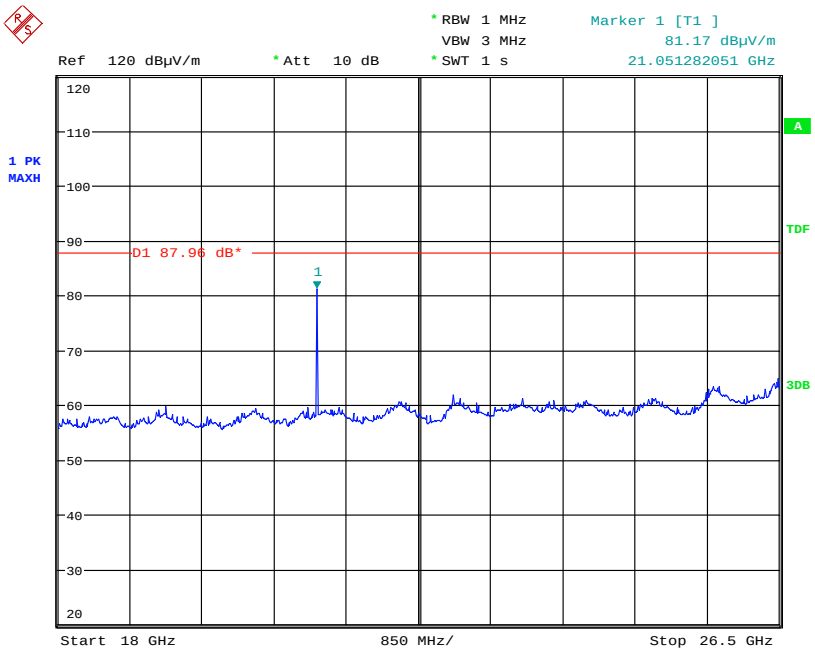


Date: 4.DEC.2012 16:29:54

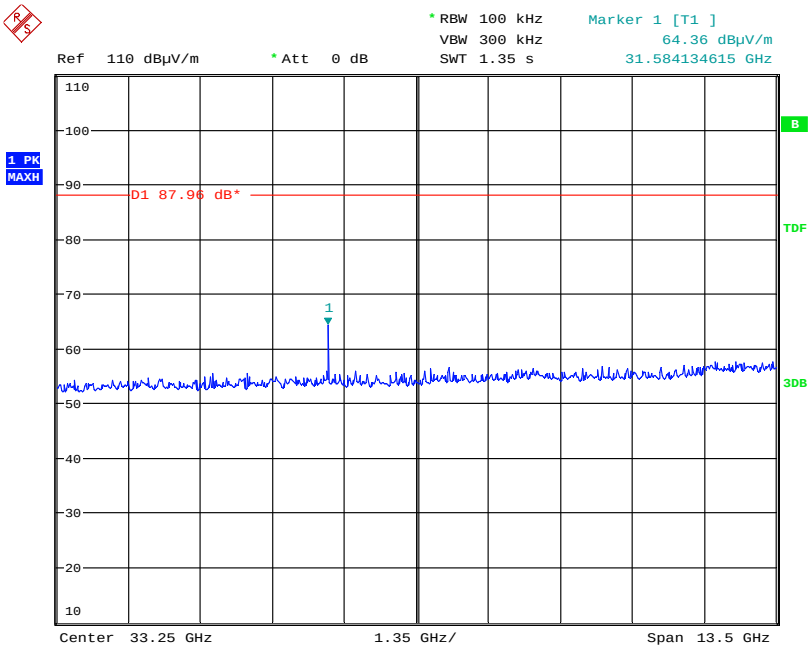
Radiated spurious emissions 9 GHz to 13 GHz



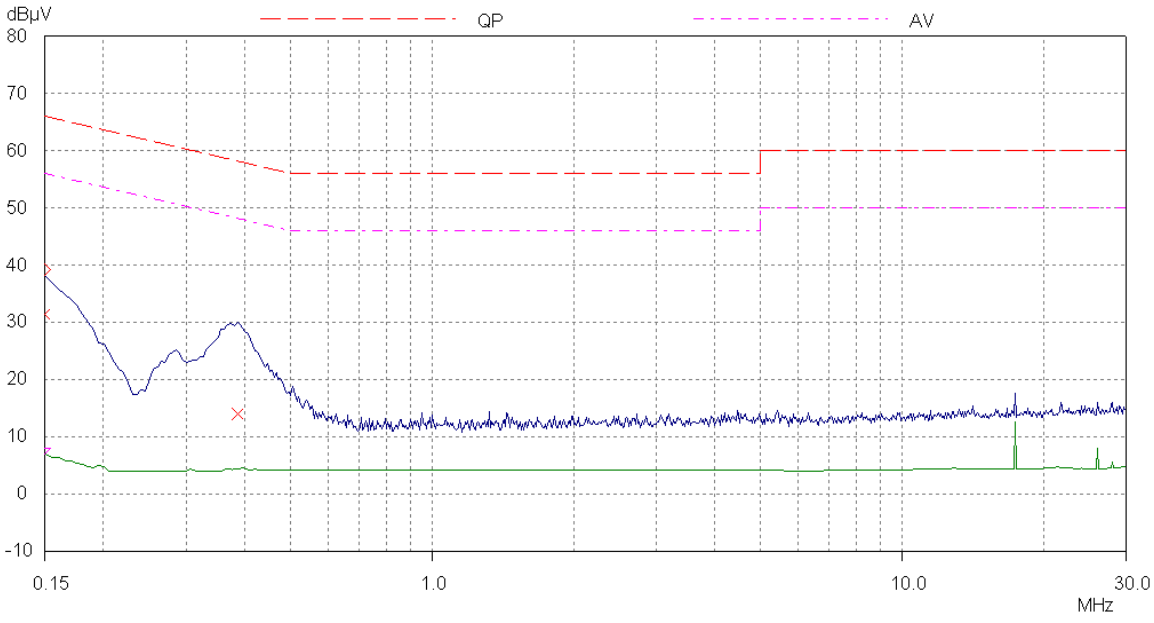
Radiated spurious emissions 13 GHz to 18GHz



Radiated spurious emissions 18 GHz to 26.5 GHz



Radiated spurious emissions 26.5 GHz to 40 GHz



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 it's 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	MDU1720	None
S04	CW / Pulse control Interface Module	None

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

Sample No.	Description	Identification

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

Identification	Description

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 transmitting at the required duty cycle.

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

Port	Description of Cable Attached	Cable length	Equipment Connected
Power	Twisted Pair	1m	S04

* Only connected during setup.

C5 Details of Equipment Used

TRaC No	Equipment Type	Equipment Description	Manufacturer	Last Cal	Cal Period	Cal Due
UH004	ESVS10	Receiver	R&S	12/01/2012	12	12/01/2013
UH093	CBL6112B	Bilog	Chase	20/06/2011	24	20/06/2013
UH096	6960B	Power meter	Marconi	04/11/2012	12	04/11/2013
UH191	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
UH195	ESH3-Z5.831.5	Lisn	R&S	01/06/2012	12	01/06/2013
UH281	FSU46	Spectrum Analyser	R&S	09/02/2012	12	09/02/2013
UH372	6201-69	PreAmp	Wat-John	20/10/2010	24	20/10/2012
UH396	ENV216	Lisn	R&S	12/04/2012	12	12/04/2013
UH403	ESCI 7	Recevier	R&S	27/06/2012	12	27/06/2013
UH405	FSU26	Spectrum Analyser	R&S	06/04/2011	12	06/04/2012
L138	3115	1-18GHz Horn	EMCO	08/11/2011	24	08/11/2013
L139	3115	1-18GHz Horn	EMCO	14/09/2011	24	14/09/2013
L263/A	20240-20	Horn 18-26GHz	Flann	17/11/2011	24	17/11/2013
L290	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
L300	20240-20	Horn 18-26GHz	Flann	17/11/2011	24	17/11/2013
L317	ESVS10	Receiver	R&S	21/12/2011	12	21/12/2012
L572	8449B	Pre Amp	Agilent	12/12/2012	24	12/12/2014
L654	8563A	Spectrum Analyser	HP	18/10/2012	12	18/10/2013
REF940	ATS	Radio Chamber - PP	Rainford EMC	26/06/2012	12	26/06/2013
UH330	N/A	K type transition	Maury M'wave	Connected & Calibrated with TRL300		
UH365	11970Q	Harmonic Mixer (33-50)	Agilent	16/07/2008	24	16/07/2010
UH366	11970V	Harmonic Mixer (50-75)	Agilent	21/07/2008	24	21/07/2010
UH367	11970W	Harmonic Mixer (75-110)	Agilent	02/07/2008	24	02/07/2010
UH368	25240-20	Standard Gain Horn (50-75)	Flann	See Note Below		
UH369	27240-20	Standard Gain Horn (75-110)	Flann			
L264/A	2324-20	Standard Gain Horn 33-50	Flann			
L301	22240-20	Standard Gain Horn 26-40	Flann			

Note: ANSI C63.10 - 4.6.2 Antenna calibration
Standard gain horn antennas have gain characteristics that are established by the physical dimensions and dimensional tolerances. Consequently, standard-gain horn antennas need not be calibrated beyond the dimensional characteristics that are provided by the manufacturer, unless damage or deterioration is suspected, or if used at distances closer than 2D2/λ.

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. If applicable the transmit pulsewidths and period was measured and a plot of the pulse train is contained in Appendix B of this test report.

As per CFR47 Part 15.35(c) if the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths 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 x (Log_{10} 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 = $\frac{\text{the sum of the highest average value pulsewidths over 100ms}}{\text{100ms}}$

e.g

$$= \frac{40.9ms}{100ms} = 0.0409$$

0.0409 or 40.9%

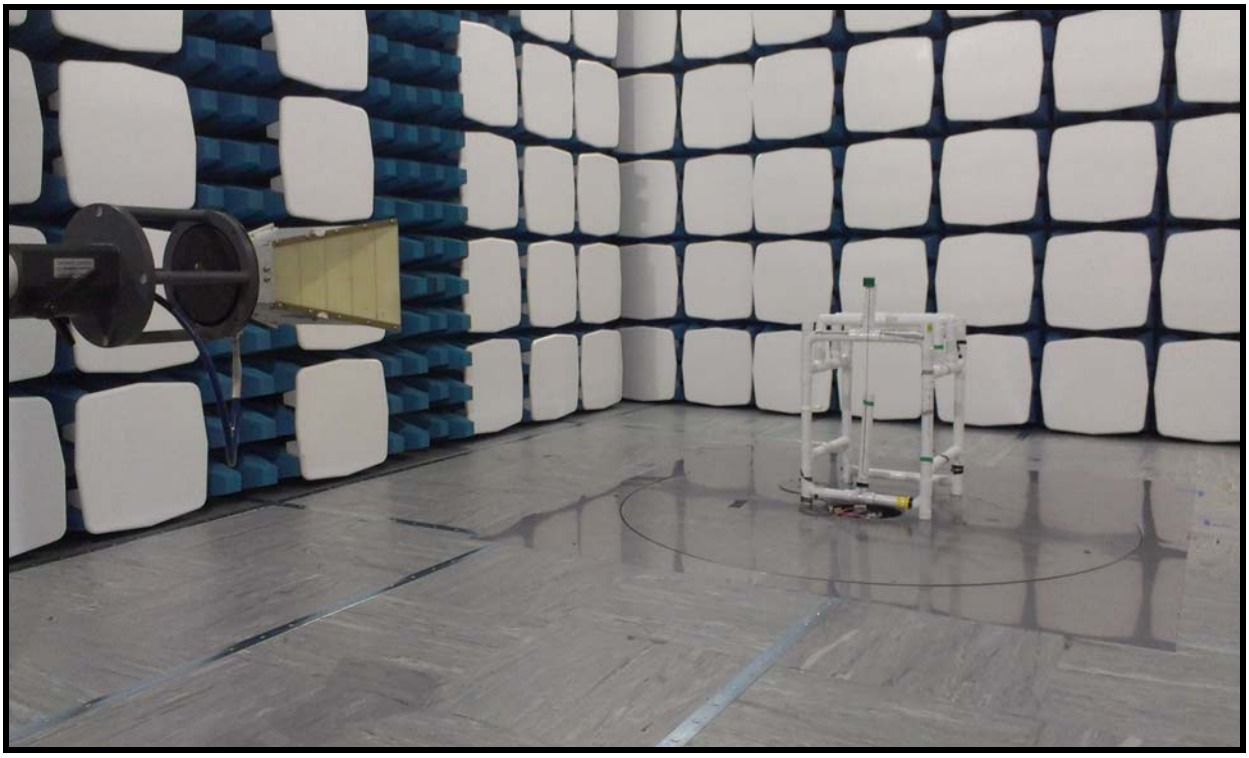
Correction factor (dB) = 20 x (Log_{10} 0.07459) = -7.77dB

The above correction factor is determined to determine the correction required to allow the unit to meet the 7.5 mV/m requirements for general operation, see Appendix A2

Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Over view.
2. Radiated electric field emissions arrangement: Close up.
3. AC powerline conducted emissions arrangement: Over view.



Photograph 1

Photograph 2

Photograph 3

Appendix G: MPE Calculation

OET Bulletin No. 65, Supplement C 01-01

47 CFR §§1.1307 and 2.1091 & RSS-102

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 1mW/cm^2 power density limit, as required under FCC rules.

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$$S = \frac{EIRP}{4\pi R^2} \quad \text{re - arranged} \quad R = \sqrt{\frac{EIRP}{S\ 4\pi}}$$

where:

S = power density
R = distance to the centre of radiation of the antenna
EIRP = EUT Maximum power

Note:

The EIRP measurement was performed using a signal substitution method.

Result

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm^2)	Distance (R) cm required to be less than 1mW/cm^2
10523.79	56.5	1	2.2 cm

The FCC limit of 1mW/cm^2 ≡ 10 W/m^2 the limit as defined in RSS-102

TRAC
testing regulatory and compliance