

**An Engineering Document**

**FOR**

**Buddi Limited**

**ON**

**Buddi Colorado System - RF Beacon**

**Document No. TRA-021068-02-47-00A**

**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-021068-02-47-00A

**Applicant** : Buddi Limited

**Apparatus** : Buddi Colorado System - RF Beacon

**Specification(s)** : FCC CFR47 Part 15(c) & RSS-210 Issue 8

**Purpose of Test** : Certification

**FCC ID** : ZDLRF1

**Authorised by** :



: Radio Product Manager

**Issue Date** : 30<sup>th</sup> June 2014

**Authorised Copy Number** : PDF

**Contents**

Section 1:	Introduction	4
1.1	General	4
1.2	Tests Requested By	5
1.3	Manufacturer	5
1.4	Apparatus Assessed	5
1.5	Test Result Summary	6
1.6	Notes relating to the assessment	7
1.7	Deviations from Test Standards	7
Section 2:	Measurement Uncertainty	8
2.1	Measurement Uncertainty Values	8
Section 3:	Modifications	10
3.1	Modifications Performed During Assessment	10
Appendix A:	Formal Emission Test Results	11
A1	Transmitter Intentional Emission Radiated	12
A2	Transmitter Bandwidth	13
A3	Radiated Electric Field Emissions	14
A4	Unintentional Radiated Emissions	17
A5	Power Line Conducted Emissions	19
Appendix B:	Supporting Graphical Data	21
Appendix C:	Additional Test and Sample Details	31
C1	Test samples	32
C2	EUT operating mode during testing	33
C3	EUT Configuration Information	34
C4	List of EUT Ports	35
C5	Details of Equipment Used	36
Appendix D:	Additional Information	37
Appendix E:	Calculation of the duty cycle correction factor	38
Appendix F:	Photographs and Figures	39
Appendix G:	MPE Calculation	41

**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](mailto:test@tracglobal.com)  
Web site: <http://www.tracglobal.com>

Tests performed by: A Tosif

Report author: A Tosif

**This report must not be reproduced except in full without prior written permission from TRaC Global Ltd.**

## **1.2 Tests Requested By**

This testing in this report was requested by:

Buddi Limited

Talbot House  
17 Church Street  
Rickmansworth  
Herts  
WD3 1DE

## **1.3 Manufacturer**

As above

## **1.4 Apparatus Assessed**

The following apparatus was assessed between: 2<sup>nd</sup> – 5<sup>th</sup> June 2014

Buddi Colorado System - RF Beacon.

The above device is a plug top SRD unit and operates in 902 – 928MHz band.

## 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	FCC Regulation	IC Regulation	Measurement standard	Result
Spurious Emissions Radiated	Title 47 of the CFR: Part 15 Subpart (c) 15.249(a)(d)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart (b) 15.109	RSS-Gen Issue 3 December 2010 Section 4.10	ANSI C63.10	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart (c) 15.207	RSS-Gen Issue 3 December 2010 Section 7.2.4	ANSI C63.10	Pass
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Intentional Emission Field Strength	Title 47 of the CFR: Part 15 Subpart (c) 15.249 (a)	RSS-210 Issue 8 December 2010 Annex 2 A2.9	ANSI C63.10	Pass
Intentional Emission Band Occupancy	Title 47 of the CFR: Part 15 Subpart (c) 15.215 (c)	RSS-Gen Issue 3 December 2010 Section 4.6.1	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	: 20 to 22 °C
Humidity	: 45 to 75 %

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	ALSR	: Absorber Lined Screened Room
Mod	: Modification	OATS	: Open Area Test Site
EUT	: Equipment Under Test	ATS	: Alternative Test Site
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) 15.249 (a) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
EUT sample number	S19
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	20.4°C
Photographs	Refer to Appendix F

FREQ. (MHz)	MEASUREMENT Rx. READING (dB $\mu$ V)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	DUTY CYCLE CORRECTION (dB)	FIELD STRENGTH (dB $\mu$ V/m)	FIELD STRENGTH (mV/m)
914.5	67.1	4.5	23.4	N/A	94.9	55.59pk
914.5	67.1	4.5	23.4	24.8	70.1	3.20av
917.5	67.3	4.5	23.6	N/A	95.3	58.48pk
917.5	67.3	4.5	23.6	24.8	70.5	3.37av
921	67.5	4.5	23.6	N/A	95.5	59.77pk
921	67.5	4.5	23.6	24.8	70.7	3.44av
Limit av			50mV/m @ 3m			

- Notes:**
- 1 Results quoted are extrapolated as indicated
  - 2 Receiver detector @  $f_c$  = Peak / 120kHz bandwidth
  - 3 When battery powered the EUT was powered with new batteries

- Test Method:**
- 1 As per Radio – Noise Emissions, ANSI C63.10
  - 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 orthogonal planes.  
Maximum results recorded

**A2 Transmitter Bandwidth**

<b>Test Details:</b>	
Regulation	Part 15.215 (c) / RSS-Gen Issue 3 Section 4.6.1
Measurement standard	ANSI C63.10:2009
EUT sample number	S20
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	24°C

<b>Band occupancy @ -20 dBc</b>			
<b>FREQ. (MHz)</b>	<b>f lower (MHz)</b>	<b>f higher (MHz)</b>	<b>Occ BW (kHz)</b>
914.5	914.467000	914.529808	62.808
917.5	917.464231	917.526538	62.308
921	920.960269	921.023117	62.848

The 20dB Bandwidth of the carrier must be contained within the frequency band 902-928 MHz.

<b>99% Band occupancy</b>			
<b>FREQ. (MHz)</b>	<b>f lower (MHz)</b>	<b>f higher (MHz)</b>	<b>Occ BW (kHz)</b>
914.5	914.467951	914.528528	60.577
917.5	917.465072	917.525649	60.577
921	920.952818	921.039356	86.538

### A3 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 Part 15 Subpart (c) Clause 15.209 (a) / RSS-Gen Issue 3 Section 7.2.5. 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	Part 15 Subpart (c) Clause 15.249 (a)(d) / RSS-210 Issue 8 Annex 2 A2.9
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz-10GHz
EUT sample number	S19
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22.2°C

The worst case emissions are listed below:

#### Bottom Channel

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	1829.06	45.6	3.0	27.1	36.3	-	-	39.4	92.79Av	500Av
2.	2743.43	40.7	3.2	29.1	36.0	-	-	37.0	70.63Av	500Av
3.	3658.03	63.5	3.1	31.5	35.7	-	-	62.4	1316.74pk	5011pk
4.	3658.03	63.5	3.1	31.5	35.7	-	24.8	37.6	75.77Av	500Av
5.	4572.51	53.9	3.6	32.3	35.6	-	-	54.2	509.92pk	5011pk
6.	4572.51	49.7	3.6	32.3	35.6	-	-	50.0	316.59Av	500Av
7.	5487.00	54.1	3.9	33.9	35.7	-	-	56.2	645.65pk	5011pk
8.	5487.00	50.5	3.9	33.9	35.7	-	-	52.6	424.13Av	500Av
9.	7316.00	50.0	4.4	36.5	36.1	-	-	54.8	546.39pk	5011pk
10.	7316.00	41.8	4.4	36.5	36.1	-	-	46.6	213.55Av	500Av

**Middle Channel**

Ref No.	FREQ. (MHz)	MEAS Rx (dB $\mu$ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dB $\mu$ V/m)	FIELD ST'GH ( $\mu$ V/m)	LIMIT ( $\mu$ V/m)
11.	1834.89	45.1	3.0	27.2	36.3	-	-	39.0	89.33Av	500Av
12.	2752.41	41.9	3.1	29.1	36.0	-	-	38.1	80.08Av	500Av
13.	3670.01	64.6	3.1	31.6	35.7	-	-	63.6	1517.05pk	5011pk
14.	3670.01	64.6	3.1	31.6	35.7	-	24.8	38.8	87.30Av	500Av
15.	4587.48	54.6	3.6	32.3	35.6	-	-	54.9	557.83pk	5011pk
16.	4587.48	51.0	3.6	32.3	35.6	-	-	51.3	368.98Av	500Av
17.	5504.99	54.1	3.9	33.9	35.7	-	-	56.2	641.95pk	5011pk
18.	5504.99	50.0	3.9	33.9	35.7	-	-	52.1	404.11Av	500Av
19.	7339.97	49.8	4.3	36.6	36.1	-	-	54.6	535.18pk	5011pk
20.	7339.97	41.6	4.3	36.6	36.1	-	-	46.4	209.41Av	500Av

**Top Channel**

Ref No.	FREQ. (MHz)	MEAS Rx (dB $\mu$ V)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	HPF Loss (dB)	Duty Cycle correction (dB)	Field ST'GH (dB $\mu$ V/m)	FIELD ST'GH ( $\mu$ V/m)	LIMIT ( $\mu$ V/m)
21.	1842.02	45.0	2.9	27.2	36.3	-	-	38.8	86.70Av	500Av
22.	2762.95	40.2	3.2	29.1	36.0	-	-	36.5	66.60Av	500Av
23.	3683.95	61.1	3.1	31.7	35.7	-	-	60.2	1018.59pk	5011pk
24.	3683.95	61.1	3.1	31.7	35.7	-	24.8	35.4	58.61Av	500Av
25.	4605.02	54.1	3.6	32.3	35.6	-	-	54.4	526.02pk	5011pk
26.	4605.02	49.9	3.6	32.3	35.6	-	-	50.2	321.74Av	500Av
27.	5525.94	55.0	3.9	33.9	35.7	-	-	57.1	712.03pk	5011pk
28.	5525.94	51.1	3.9	33.9	35.7	-	-	53.2	457.09Av	500Av
29.	7367.97	50.0	4.4	36.7	36.2	-	-	54.9	553.35pk	5011pk
30.	7367.97	42.0	4.4	36.7	36.2	-	-	46.9	220.80Av	500Av

**Notes:**

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: 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=VBW= 1MHz  
Average                RBW=VBW= 1MHz

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 / RSS-Gen Issue 3 Section 7.2.5 for all emissions.

Frequency of emission (MHz)	Field strength (□V/m)	Measurement Distance (m)	Field strength (dB) □
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				



**A4 Unintentional Radiated Emissions**

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109 and in RSS- GEN Section 7.2.3. The EUT was set to receive mode only on its lowest, centre and highest carrier frequency in turn.

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.

<b>Test Details</b>	
Regulation	Part 15 Subpart (c) Clause 15.109 / RSS-Gen Issue 3 Section 4.10
Measurement standard	ANSI C63.10:2003
Frequency range	30MHz – 10GHz
EUT sample number	S19
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22.2°C

No emissions were detected within 20dB of the limit.

**Notes:**

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: 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 (pk)                      RBW=VBW= 1MHz  
Average (Av)                  RBW=VBW= 1MHz

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 15.109 / RSS-Gen Issue 3 section 6.1 for all emissions:

Frequency of emission (MHz)	Field strength (□V/m)	Measurement Distance (m)	Field strength (dB) □
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**

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.

<b>Test Details:</b>	
Regulation	Part 15 Subpart (c) Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S19
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C

No emissions detected within 20dB of the limit.

**Specification limits :**

Conducted emission limits (47 CFR Part 15:Clause 15.207 / RSS-Gen Issue 3 Section 7.2.4):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB $\mu$ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 <sup>2</sup>	56 to 46 <sup>2</sup>
0.5 to 5	56	46
5 to 30	60	50

Notes:

- The lower limit shall apply at the transition frequency.
- 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

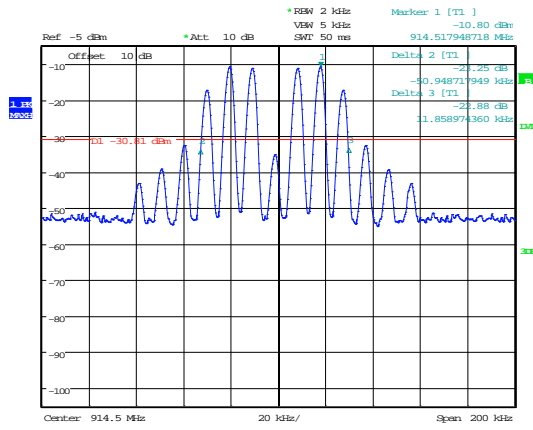
**Appendix B:****Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

Notes:

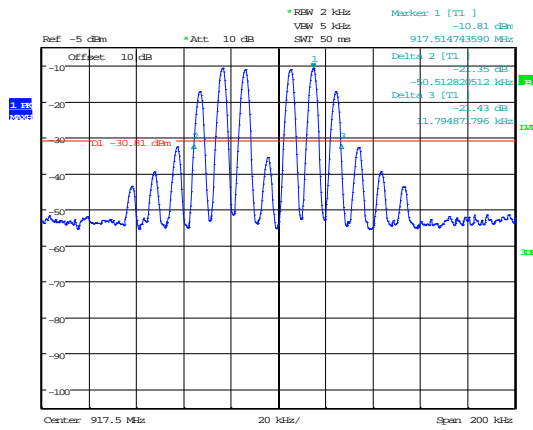
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power 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



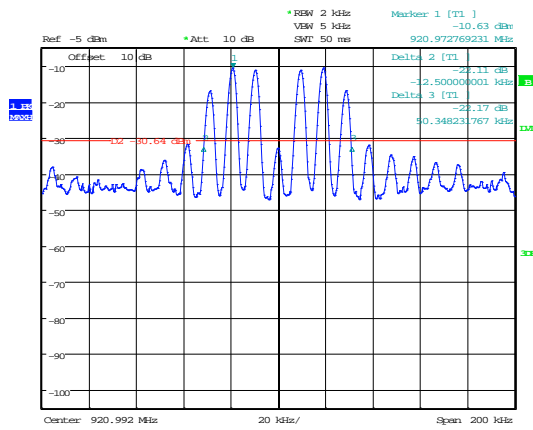
Date: 5 JUN 2014 11:26:53

### 20dB Bandwidth 914.5MHz



Date: 5 JUN 2014 11:28:52

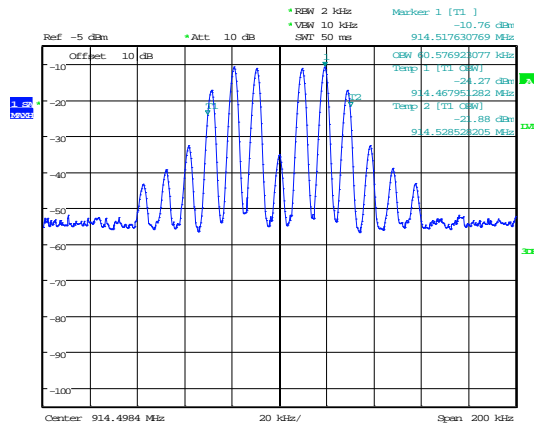
### 20dB Bandwidth 917.5MHz



Date: 5 JUN 2014 11:56:04

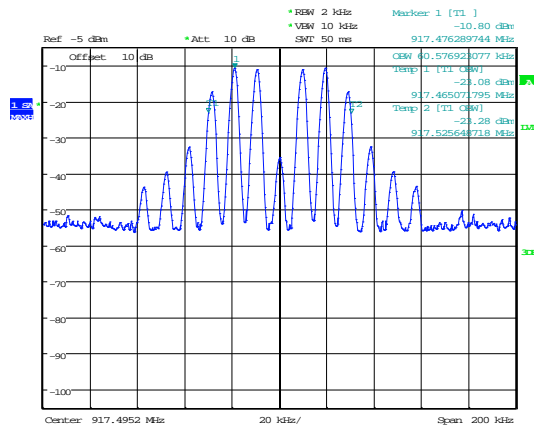
### 20dB Bandwidth 921MHz

### 99% Bandwidth



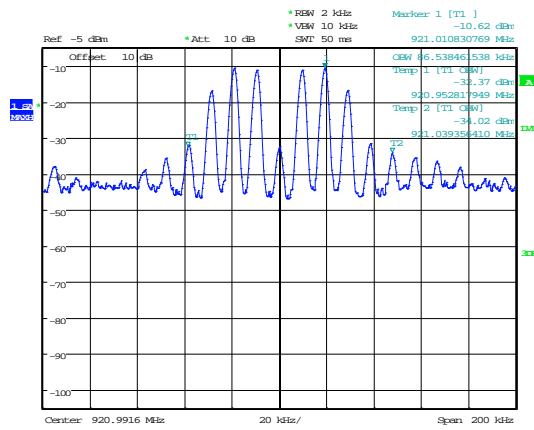
Date: 5 JUN 2014 12:28:49

### 99% Bandwidth 914.5MHz



Date: 5 JUN 2014 12:31:01

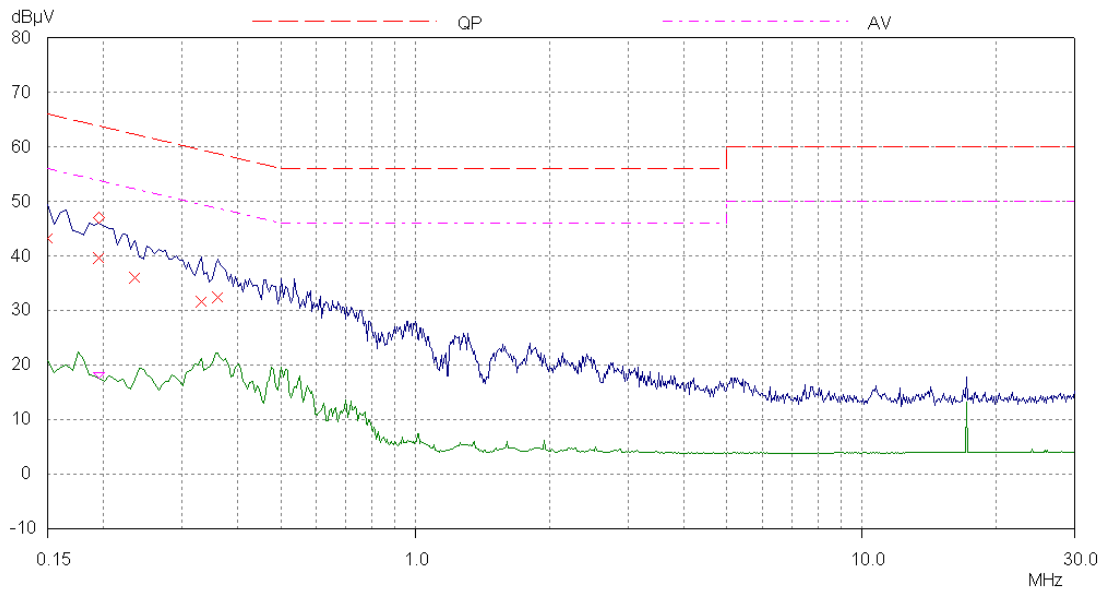
### 99% Bandwidth 917.5MHz



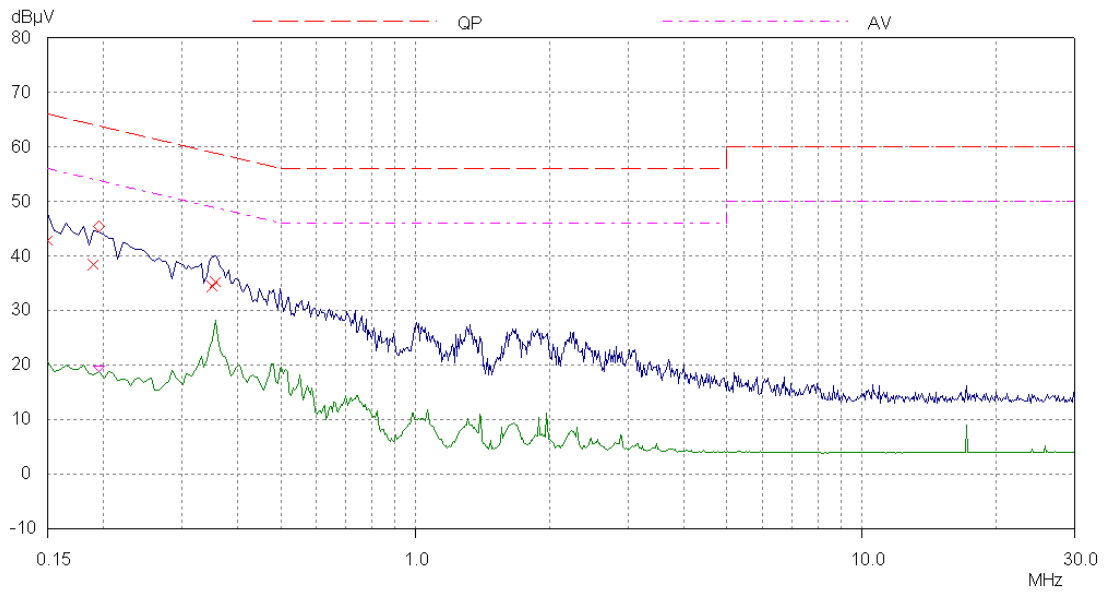
Date: 5 JUN 2014 12:26:19

### 99% Bandwidth 921MHz

Powerline Conducted Emissions



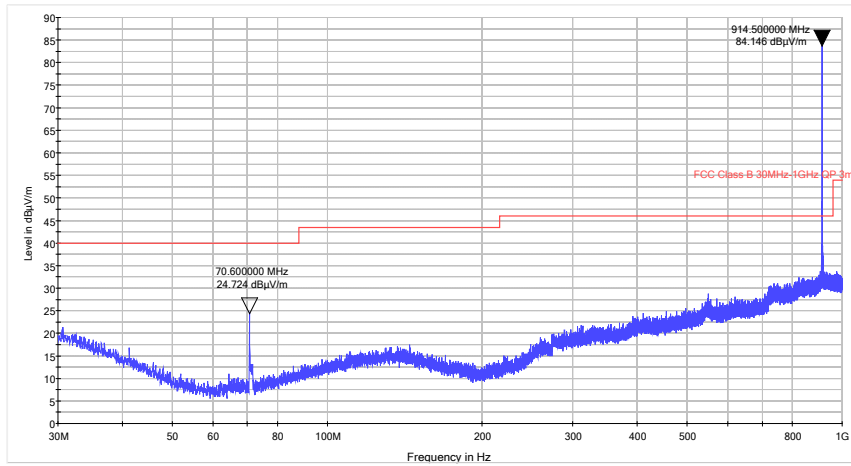
Live Line



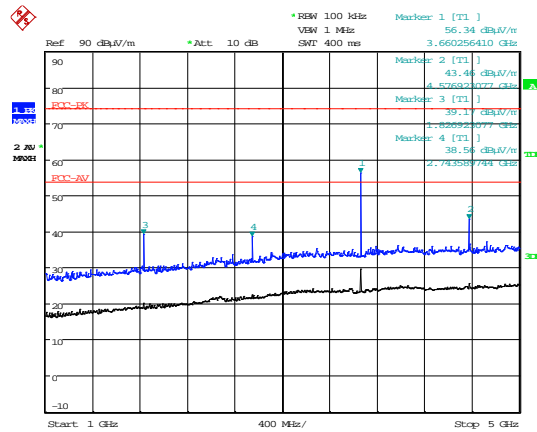
Neutral Line



Radiated Transmitter Emissions – 914.5MHz

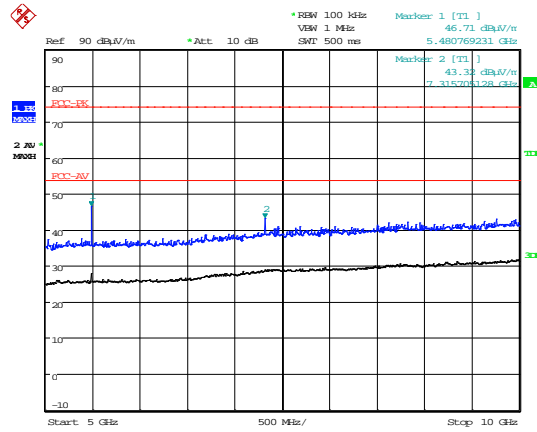


30MHz – 1GHz



Date: 4.JUN.2014 09:52:37

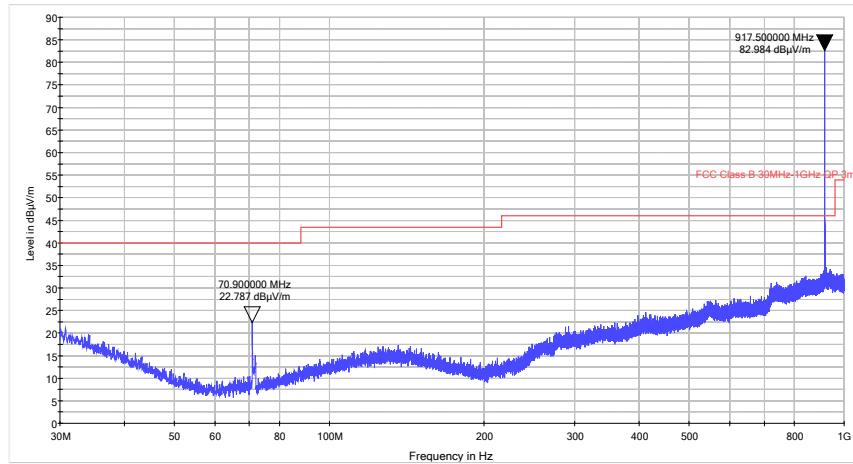
1GHz – 5GHz



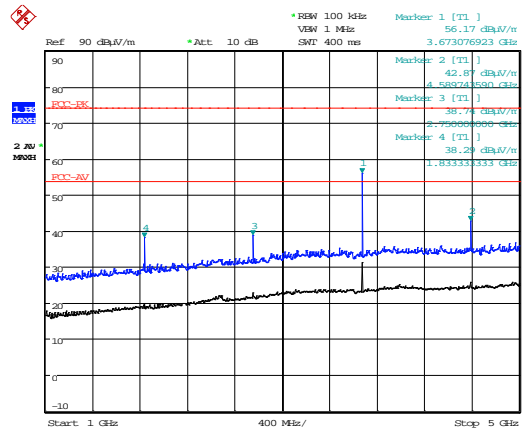
Date: 4.JUN.2014 09:56:20

5GHz – 10GHz

Radiated Transmitter Emissions – 917.5MHz

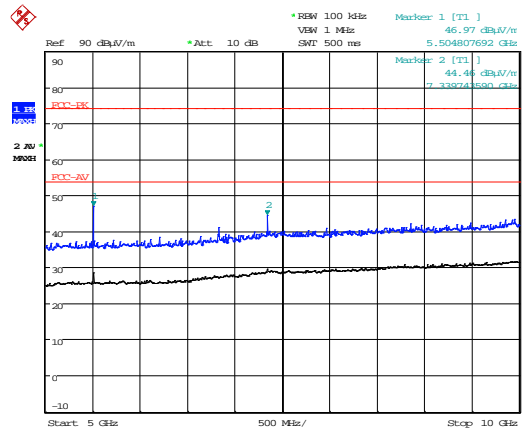


30MHz – 1GHz



Date: 4.JUN.2014 09:58:20

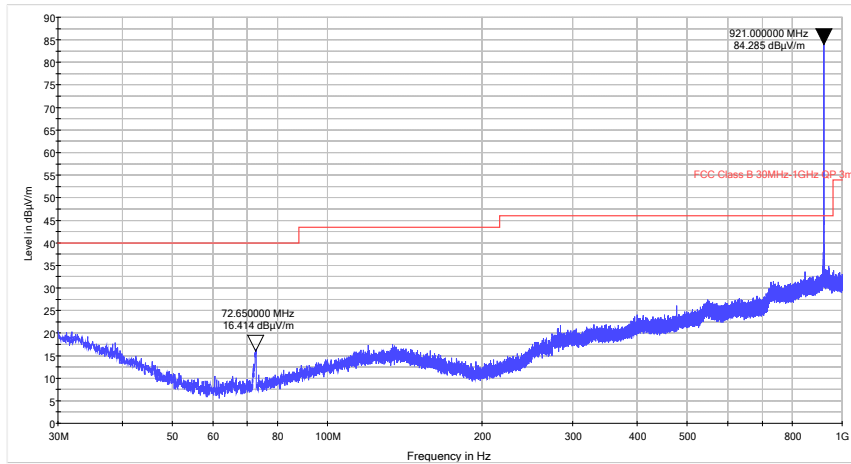
1GHz – 5GHz



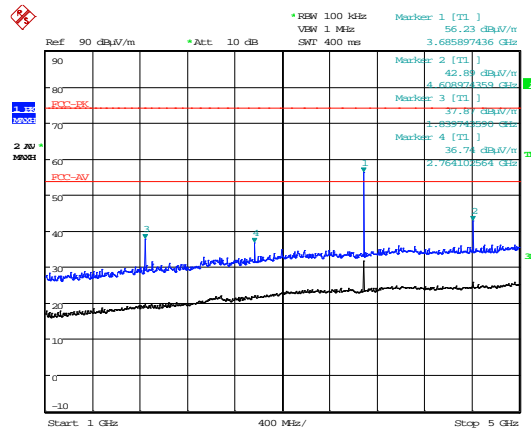
Date: 4.JUN.2014 09:59:33

5GHz – 10GHz

Radiated Transmitter Emissions – 921MHz

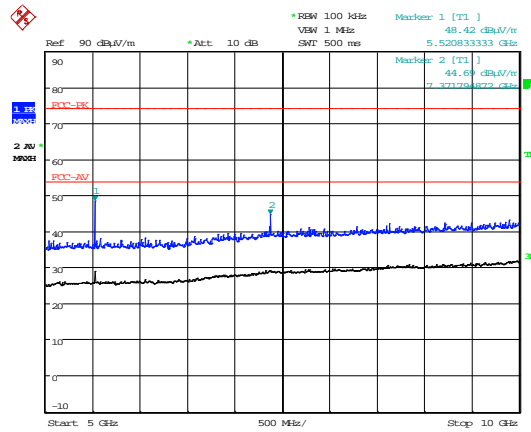


30MHz – 1GHz



Date: 4.JUN.2014 10:08:17

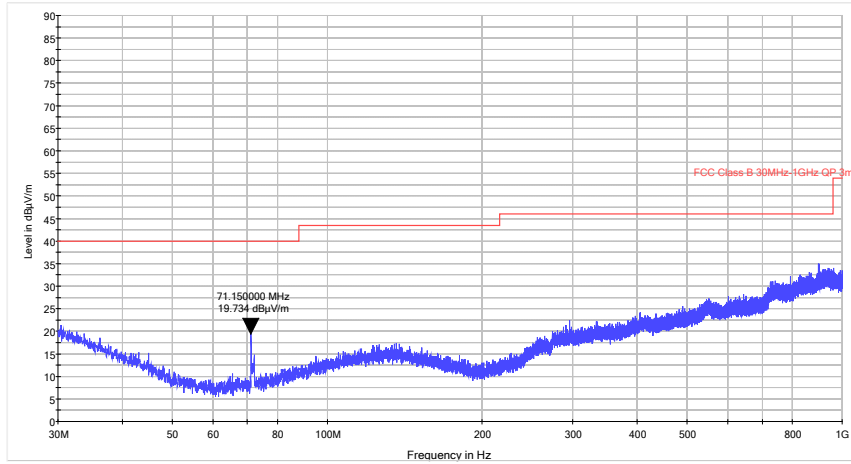
1GHz – 5GHz



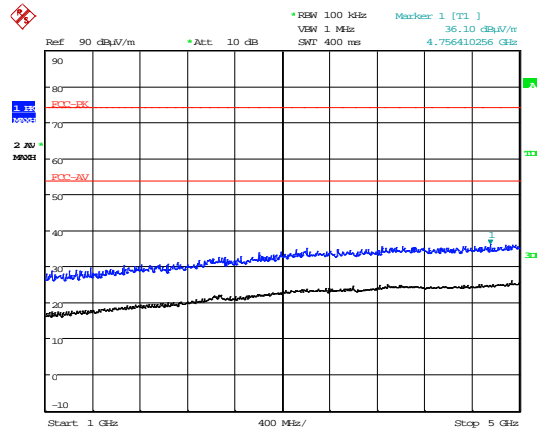
Date: 4.JUN.2014 10:07:13

5GHz – 10GHz

Unintentional Radiated Emissions – 914.5MHz

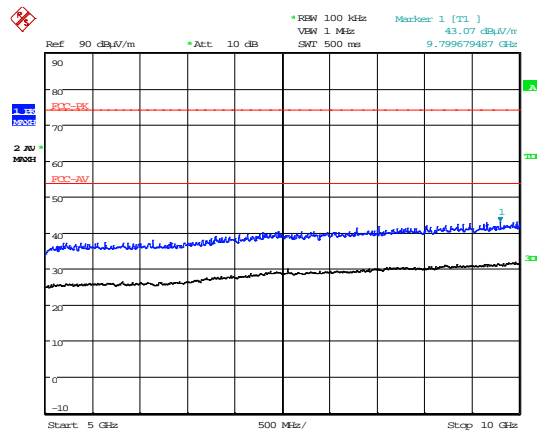


30MHz – 1GHz



Date: 4 JUN 2014 10:10:07

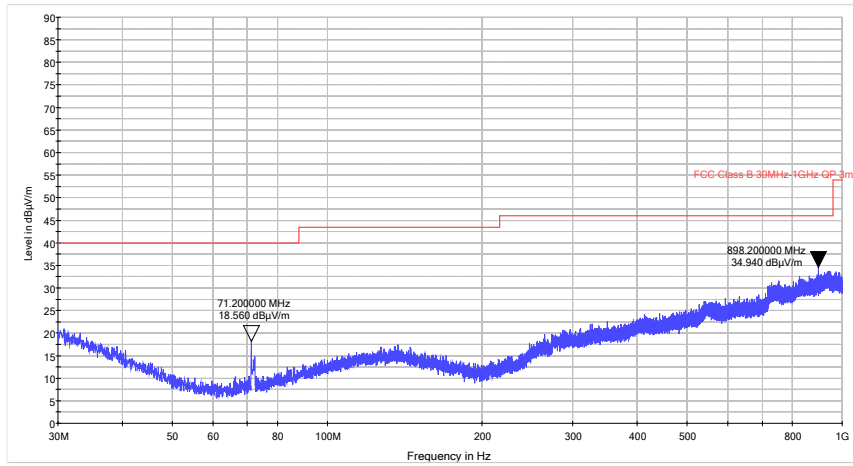
1GHz – 5GHz



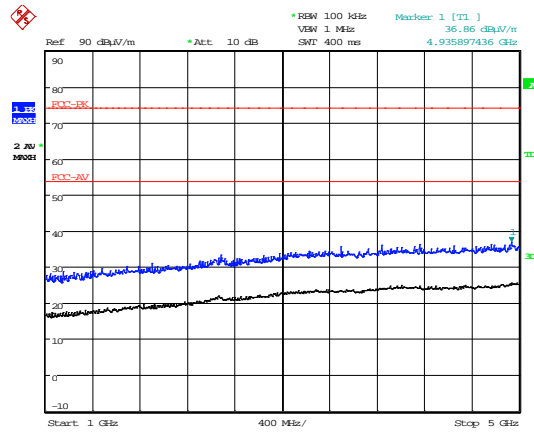
Date: 4 JUN 2014 10:11:18

5GHz – 10GHz

Unintentional Radiated Emissions – 917.5MHz

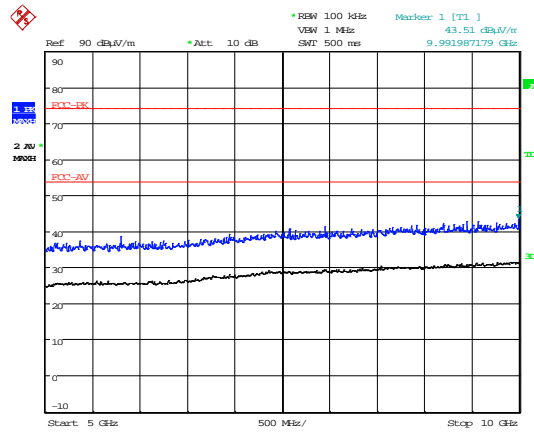


30MHz – 1GHz



Date: 4.JUN.2014 10:19:30

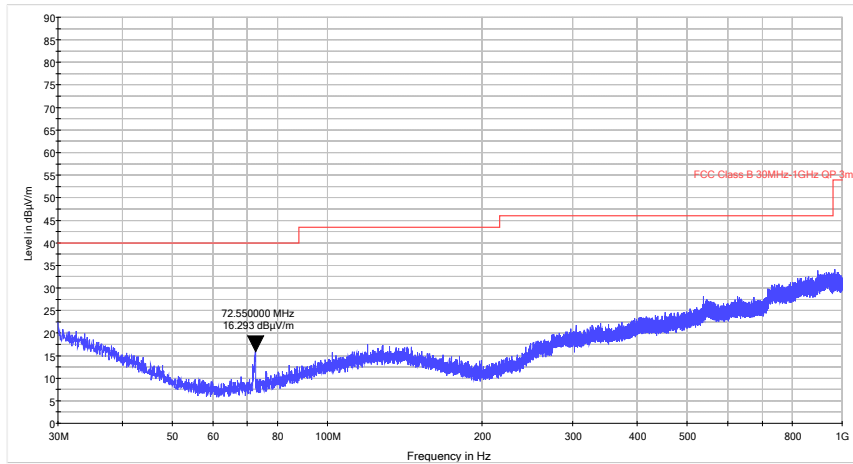
1GHz – 5GHz



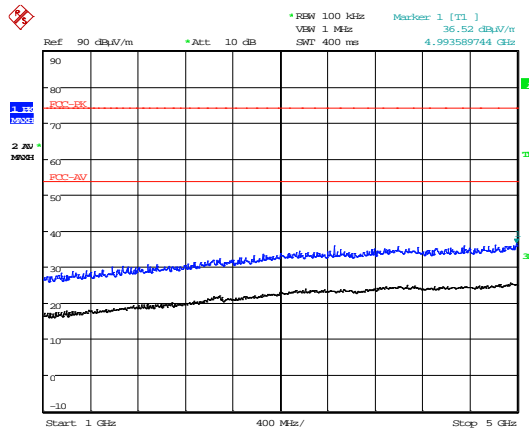
Date: 4.JUN.2014 15:36:46

5GHz – 10GHz

Unintentional Radiated Emissions – 921MHz

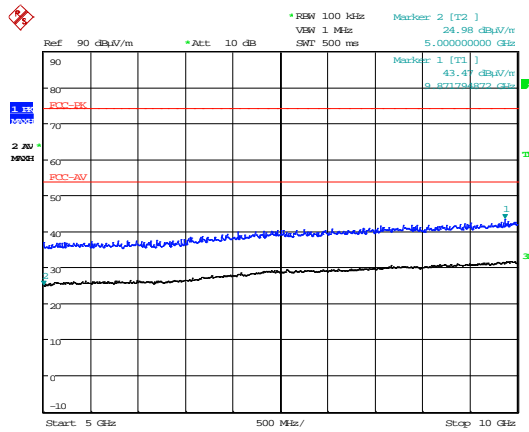


30MHz – 1GHz



Date: 4.JUN.2014 10:20:54

1GHz – 5GHz



Date: 4.JUN.2014 15:33:25

5GHz – 10GHz

**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
S19	Buddi Colorado System - RF Beacon	DAC47427
S20	Buddi Colorado System - RF Beacon	DAC47728

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

Sample No.	Description	Identification
None		

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 Transmitter Tests	EUT actively transmitting

Test	Description of Operating Mode:
Receiver radiated spurious emissions	EUT in receive mode

Test	Description of Operating Mode:
PLCE	EUT in transmit and receive modes

### **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 : S19  
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
EUT has got no external ports			

**C5 Details of Equipment Used**

<b>TRaC No</b>	<b>Equipment Type</b>	<b>Equipment Description</b>	<b>Manufacturer</b>	<b>Last Cal Calibration</b>	<b>Calibration Period</b>	<b>Due For Calibration</b>
UH191	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
UH405	FSU26	Spectrum Analyser	R&S	16/04/2014	12	16/04/2015
UH281	FSU46	Spectrum Analyser	R&S	26/03/2014	12	26/03/2015
L138	3115	1-18GHz Horn	EMCO	17/10/2013	24	17/10/2015
L317	ESVS10	Receiver	R&S	12/02/2014	12	12/02/2015
REF940	ATS	Radio Chamber - PP	Rainford EMC	09/07/2013	12	09/07/2014
L572	8449B	Pre Amp	Agilent	11/02/2014	12	11/02/2015
UH187	ESHS10	Receiver	R&S	19/02/2014	12	19/02/2015
UH396	ENV216	Lisn	R&S	22/05/2014	12	22/05/2015

**Appendix D:**

**Additional Information**

This report contains no additional information.

**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 pulsewidths and period was measured

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

Therefore the calculated duty cycle was determined:

Duty cycle =  $\frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}}$

e.g

$$= \frac{5.769\text{ms}}{100\text{ms}} = 0.05769$$

Correction factor (dB) =  $20 \times (\text{Log}_{10} 0.05769) = 24.8\text{dB}$

Duty cycle correction factor to be used is:

Txon period 5.769ms in 100ms

Worse case 5.769ms in 100ms

Therefore  $20\log (5.769 \div 100) = 24.8\text{dB}$ .

**Appendix F:**

**Photographs and Figures**

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: Overview
2. Radiated electric field emissions arrangement: Close up
3. AC Powerline Conducted Emissions: Overview

Photograph 1



Photograph 2



Photograph 3





**Appendix G:**

**MPE Calculation**

1

**47 CFR §§1.1307, 2.1091 and RSS-102**

Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC and Industry Canada 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 centimeters 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 and Industry Canada 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 0.6mW/cm<sup>2</sup> (60W/m<sup>2</sup> for Industry Canada) power density limit, as required under FCC and IC rules

**Prediction of MPE limit at a given distance**

Using KDB 447498 for guidance

$$S = \frac{1.64ERP}{4\pi R^2} \text{ re - arranged } R = \sqrt{\frac{1.64ERP}{S4\pi}}$$

where:

S = power density

R = distance to the centre of radiation of the antenna

ERP = EUT Maximum power

Result:

Prediction Frequency (MHz)	Maximum ERP (mW)	Power density limit (S) (mW/cm <sup>2</sup> )	Distance (R) cm required to be less than 0.6mW/cm <sup>2</sup>
914.5	0.65	0.61	0.38

