

AN RADIO TEST REPORT

FOR

Paxton Access Ltd

ON

Net10 Dual Mode RFID Desktop Reader

DOCUMENT NO.TRA-024435-00-47-00B

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-024435-00-47-00B

Applicant : Paxton Access Ltd

Apparatus : Net10 Dual Mode RFID Desk Top Reader

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

Purpose of Test : Certification

FCCID : USE010387

Certification Number : 10217A-010387

Authorised by :

: Radio Product Manager

Issue Date : 23rd April 2015

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
Section 4	General Test Procedures	11
4.1	Radiated Test Setup and Procedures	11
4.2	AC Powerline Conducted Emissions Test Setup and Procedures	12
4.3	Antenna Port Conducted Emissions	12
4.4	Power Supply Variation	13
4.5	Thermal Variation	13
4.6	Time Domain Measurements	13
Appendix A:	Formal Emission Test Results	14
A1	Transmitter Intentional Emission Radiated – 125.0 kHz	15
A2	Transmitter Intentional Emission Radiated – 13.56MHz	16
A3	Radiated Electric Field Emissions	18
A4	Power Line Conducted Emissions	23
A5	Frequency Tolerance 13.56MHz	28
Appendix B:	Supporting Graphical Data	29
Appendix C:	Additional Test and Sample Details	37
Appendix D:	Additional Information	43
Appendix E:	Calculation of the duty cycle correction factor	44
Appendix F:	Photographs and Figures	45
Appendix G:	General SAR test reduction and exclusion guidance	49

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: S Hodgkinson

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

1.2 Tests Requested By

This testing in this report was requested by :

Paxton Access Ltd
Paxton House
Home Farm Road
Brighton
BN1 9HU
Great Britain

1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 22nd – 28th January 2015

The Net10 Dual mode Desktop RFID reader which operates on 125kHz and 13.56MHz.

Model: 010-387

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	Title 47 of the CFR: Part 15 Subpart (c)	RSS-210	Measurement standard	Result
Spurious Emissions Radiated <1000MHz	15.209	RSS-Gen Issue 4 6.13	ANSI C63.10:2009	Pass
Spurious Emissions Radiated >1000MHz	15.209	RSS-Gen Issue 4 6.13	ANSI C63.10:2009	N/A
Emissions Below 30MHz	15.209	RSS-Gen Issue 4 6.13	ANSI C63.10:2009	Pass
AC Power conducted emissions	15.207	RSS-Gen Issue 4 8.8	ANSI C63.10:2009	Pass
Intentional Emission Frequency	15.209 & 15.225(a)	A2.6 & RSS-Gen Issue 4 6.13	ANSI C63.10:2009	Pass
Intentional Emission Field Strength	15.209 & 15.225(a)	A2.6 & RSS-Gen Issue 4 6.12	ANSI C63.10:2009	Pass
Intentional Emission Band Occupancy	15.215 (c)	RSS-Gen Issue 4 6.6	ANSI C63.10:2009	Pass
Frequency Stability	15.225	RSS-Gen 4.7	ANSI C63.10:2009	Pass
Unintentional Radiated Spurious Emissions	Subpart (b) 15.109	RSS-Gen Issue 4 6.11	ANSI C63.10:2009	Pass
Antenna Arrangements Integral:	15.203	RSS-Gen Issue 4 6.7	-	Pass
Antenna Arrangements External Connector	15.204	RSS-Gen Issue 4 6.7	-	N/A
Restricted Bands	15.205	RSS-Gen Issue 4 8.10	-	Pass
Maximum Frequency of Search	15.33	RSS-Gen Issue 4 6.13	-	Pass
Extrapolation Factor	15.31(f)	RSS-Gen Issue 4 6.5	-	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

All test result at 3 meters are recorded at IC Site 39030-B4 additional measurements were performed on an open sites with no ground plane.

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

For the test data recorded 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

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Section 4

General Test Procedures

4.1 Radiated Test Setup and Procedures

Radiated electromagnetic emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked, using a peak detector and where applicable worst case determined for function, operation, orientation etc for both vertical and horizontal polarisations

If the EUT connects to auxiliary equipment and is table or floor standing, the configurations prescribed in ANSI C63.10:2009 are followed. Alternatively, a layout closest to normal use (as declared by the provider) is employed, (see EUT setup photographs for more detail).

For devices with intentional emissions below 30 MHz, a shielded loop antenna is used as the test antenna. It is placed at a 1 meter receive height and appropriate low frequency magnetic field extrapolation to the regulatory limit distance is employed. The EUT is rotated through 360° in the azimuth.

Emissions between 30 MHz and 1 GHz are measured using calibrated broadband antennas. Emissions above 1 GHz are characterized using standard gain horn antennas. Pre-amplifiers and filters are used where required. Care is taken to ensure that test receiver resolution bandwidth, video bandwidth and detector type(s) meet the regulatory requirements.

For both horizontal and vertical polarizations, the EUT is then rotated through 360° in azimuth until the highest emission is detected. At the previously determined azimuth the test antenna is raised and lowered from 1 to 4 m in height until a maximum emission level is detected, this maximum value is recorded.

Where regulations allow for direct measurement of field strength, power values measured on the test receiver / analyzer are converted to dBuV/m at the regulatory distance, using:

$$FS = PR + AF + CL - PA + KG + DC - CF \text{ (dBuV/m)}$$

Where:

PR is the power recorded on receiver / spectrum analyzer (dBuV),

AF is the test antenna factor in dB/m,

CL is the cable loss in dB,

PA is the pre-amplifier gain dB (when applicable),

DC is duty correction factor (when applicable) in dB, and

CF is a distance correction (employed only for measurements at alternate distance to limit) in dB.

This field strength value is then compared with the regulatory limit.

If effective radiated power (ERP) or effective isotropic radiated power (EIRP) is required, it is computed as per ANSI C63.10:2009

$$P = \frac{(Ed)^2}{30G}$$

Where

P is the power, in W

E is the measured peak field strength, in V/m

d is the distance at which the measurement was made, in m

G is the numeric gain of the radiating element

If the gain of the radiating element is not known, then either the effective radiated power (ERP) or the effective isotropic radiated power (EIRP) may be calculated from the measured peak field strength, by using either $G = 1.64$ or $G = 1$, respectively.

4.2 AC Powerline Conducted Emissions Test Setup and Procedures

AC Powerline Conducted Emissions from the EUT are checked first by preview scans with Peak and average detectors covering both live and neutral lines. A spectrum analyser is used to determine if any periodic emissions are present. Preview scans are performed in standby or receive mode if the device is subject to these requirements. For transmit mode of operation the device is set to one of the following modes.

- Transmitting operating at full power (single mode device)
- Transmitting at freq / modulation that gives highest output power (multi mode device)
- Transmitter operating in normal TX mode (e.g. FHSS, TDMA etc)

Formal measurements using the correct detector(s) and bandwidth are made on frequencies identified from the preview scans.

Battery Power devices are not subject to power line conducted emissions measurements when it is powered solely by its internal battery.

4.3 Antenna Port Conducted Emissions

Antenna port conducted emissions can include, but are not limited to, Carrier power, Power Spectral Density, Occupied bandwidth and spurious emission.

Spurious Emissions from the EUT are checked first by preview scans. Preview scans for all spectrum and modulation characteristics are checked to identify frequencies to perform formal measurements on.

Formal measurements are made on frequencies identified from the preview scans and fundamental emission(s). Measurements are made using the correct instrumentation (inc. power meter, receiver, spectrum analyser) that operate with the required detector(s) and bandwidth.

Care is taken to ensure the measurement instrument is not overloaded by the presence of the transmitted signal by use of external attenuation and filtering where required.

Measured levels are corrected for cables, attenuators, and filters. If applicable, for the specific measurement, antenna gain is also taken into account.

4.4 Power Supply Variation

Tests at extreme supply voltages are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

In the case the EUT is designed for operation from a lead-acid battery power source, the extreme test voltages are evaluated between 90% and 130% of the nominal battery voltage declared by the manufacturer.

For float charge applications using gel-cell type batteries, extreme test voltages are evaluated between 85% and 115% of the nominal battery voltage declared.

For all battery operated equipment, worst case intentional and spurious emissions are re-checked employing a new (fully charged) battery.

4.5 Thermal Variation

Tests at extreme temperatures are made if required by the procedures specified in the test standard, and results of this testing are detailed in this report.

Tests are performed at the upper and lower extremes as required and typically at 10° steps between.

Before any temperature measurements are made, the equipment is allowed to reach a thermal balance in the test chamber.

4.6 Time Domain Measurements

Time domain measurements are made for (but not limited to) use in duty cycle correction, to ensure compliance with time restrictions on certain types of devices.

If measurements of a transmitter's on time are required these are performed with a spectrum analyser in the time domain or with an oscilloscope and RF detector. If time on a specific frequency is required (e.g. FHSS timing) the measurement can only be made with a spectrum analyser.

The triggering, timescale and amplitude settings are adjusted according to the signal to be measured on a case by case basis.

For devices with sharp rise/fall times measurements are made between RF reaching full power (T_{on}) and RF dropping to the measurement instrument noise floor (T_{off}). For longer rise times measurements are made for T_{on} and T_{off} at the RF level required by the occupied bandwidth measurement (e.g. 6 dB, 20 dB etc).

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
		Freq	: Frequency
L	: Live Power Line		
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 – 125.0 kHz

Carrier power was verified with the EUT transmitting Test Details:	
Regulation	Part15 Subpart (c) 15.209 & RSS-Gen 6.13
Measurement standard	ANSI C63.10:2009
EUT sample number	S02,S38, S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19°C
Photographs (Appendix F)	1

FREQ. (kHz)	MEASUREMENT DISTANCE Meters	MEASUREMENT Rx. READING (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)
125.00	3	76.10	86.28	0.310
125.00	10	48.90	59.08	0.310
Limit value @ fc		19.20µV/m@ 300meters		
Band occupancy @ -20 dBc		f lower	f higher	
13.14kHz		118.429487kHz	131.570512kHz	
Band occupancy @ 99%		f lower	f higher	
33.49kHz		114.583333kHz	148.076923kHz	

- Notes:**
- 1 Results quoted are extrapolated as indicated
 - 2 Receiver detector @ fc = Average 200Hz bandwidth
 - 3 When battery powered the EUT was powered with new batteries
 - 4 Extrapolation <30 MHz 40dB/decade as per 15.31(f)(2) & RSS Gen 6.4
 - 5 3 – 300 metre extrapolation 80 dB
 - 6 1 – 3 metre extrapolation measured
 - 7 1 – 300 metre extrapolation = measured 1m-3m + calculated 3m - 300m

- 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 Transmitter Intentional Emission Radiated – 13.56MHz

Carrier power was verified with the EUT transmitting Test Details:	
Regulation	Part15 Subpart (c) 15.225(a), RSS-210 A2.6
Measurement standard	ANSI C63.10:2009
EUT sample number	S01,S37,S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19°C
Photographs (Appendix F)	1

FREQ. (MHz)	MEASUREMENT DISTANCE Metres	MEASUREMENT Rx. READING (dBµV/m)	EXTRAP. FACTOR (dB)	FIELD STRENGTH (µV/m)
13.56	3	73.00	35.98	70.918
13.56	10	56.10	19.08	70.918
Limit value @ fc		15848 µV/m @ 30metres		
Band occupancy @ -20 dBc		f lower	f higher	
350kHz		13.432115MHz	13.782115MHz	
Band occupancy @ 99%		f lower	f higher	
1.738MHz		12.686602MHz	14.425384MHz	

FREQ. (MHz)	Limit @30m (µV/m)	Result
13.410-13553 13.567-13710	334	Compliant Note 8
13.110-13.410 13.710-14.010	106	Compliant Note 8

Notes:

- 1 Results quoted are extrapolated as indicated
- 2 Receiver detector @ fc = Quasi Peak 10
- 4 Extrapolation <30 MHz 40dB/decade as per 15.31(f)(2) & RSS Gen 6.4
- 5 3 – 300 metre extrapolation 80 dB (40dB/decade) as per 15.31(f)(2)
- 6 1 – 3 metre extrapolation as measured
- 7 1 – 300 metre extrapolation 104.7 dB (80dB + 24.7dB)
- 8 For compliance with emission mask rule part 15.225(b) and (c) see graphical data

- 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

A3 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions and harmonics emissions. 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 :

☒

Test Details 125.0kHz	
Regulation	Part 15 Subpart (c) Clause 15.209, RSS-Gen 6.13
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S02,S38, S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19° C
Photographs (Appendix F)	1

The worst case radiated emission measurements for spurious emissions and harmonics are listed overleaf.

Note only emission within 20 dB of limit are recorded. See scan data in appendix B.

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 (μV/m)	LIMIT (μV/m)
1.	30.10	4.0	0.8	17.8	-	22.6	-	13.41	100
2.	33.40	8.0	0.8	16.0	-	24.8	-	17.38	100
3.	33.90	8.7	0.8	15.8	-	25.3	-	18.30	100
4.	34.55	6.9	0.8	15.4	-	23.1	-	14.24	100
5.	36.00	13.7	0.8	14.6	-	29.1	-	28.64	100
6.	45.15	9.4	1.0	9.8	-	20.2	-	10.27	100
7.	46.05	12.8	1.0	9.4	-	23.2	-	14.42	100
8.	46.25	15.6	1.0	9.3	-	25.9	-	19.68	100
9.	156.00	13.3	1.8	9.6	-	24.7	-	17.18	150
10.	164.00	21.4	1.9	9.3	-	32.6	-	42.66	150
11.	196.00	13.4	2.0	8.7	-	24.1	-	16.00	150
12.	204.00	22.4	1.9	8.8		33.1		45.19	150
13.	212.00	25.7	2.0	8.4	-	36.1	-	63.68	150
14.	220.00	21.5	2.1	8.5	-	32.1	-	40.04	200
15.	715.00	13.1	3.8	19.4	-	36.3	-	65.09	200
16.	780.00	10.9	4.0	20.0	-	34.9	-	55.27	200

Test Details 13.56MHz	
Regulation	Part 15 Subpart (c) Clause 15.209, RSS-Gen 6.13
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S01,S37, S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19°C
Photographs (Appendix F)	1

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

Note only emission within 20 dB of limit are recorded. See scan data in appendix B.

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 (µV/m)	LIMIT (µV/m)
1.	30.50	3.8	0.8	17.6	-	22.2	-	12.81	100
2.	36.15	15.7	0.9	14.5	-	31.1	-	35.81	100
3.	39.60	11.0	0.9	12.6	-	24.5	-	16.87	100
4.	40.35	13.3	1.0	12.2	-	26.5	-	21.16	100
5.	43.85	16.6	1.0	10.5	-	28.1	-	25.35	100
6.	51.85	15.3	1.0	7.1	-	23.4	-	14.71	100
7.	60.15	14.9	1.1	5.2	-	21.2	-	11.48	100
8.	75.90	12.8	1.3	6.0	-	20.1	-	10.08	100
9.	83.85	13.4	1.3	7.5	-	22.2	-	12.84	100
10.	123.85	11.8	1.6	11.6	-	25.0	-	17.78	150
11.	139.90	16.1	1.6	11.0	-	28.7	-	27.23	150
12.	148.15	19.1	1.7	10.2	-	31.0	-	35.40	150
13.	156.15	22.8	1.8	9.6	-	34.2	-	51.29	150
14.	163.85	28.0	1.9	9.3	-	39.2	-	91.20	150
15.	179.85	13.8	2.0	8.3	-	24.1	-	15.96	150
16.	195.85	28.5	2.0	8.7	-	39.2	-	90.99	150
17.	203.90	28.9	1.9	8.8	-	39.6	-	95.50	150
18.	212.00	29.2	2.0	8.4	-	39.6	-	95.28	150
19.	220.00	21.8	2.1	8.5	-	32.4	-	41.45	200
20.	715.00	8.8	3.8	19.4	-	32.0		39.67	200

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 (μV/m)	LIMIT (μV/m)
21.	780.00	4.6	4.0	20.0	-	28.6	-	26.76	200
22.	845.00	5.8	4.0	20.3	-	30.1	-	32.10	200

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10:2009. For emissions below 30MHz the cable losses are assumed to be negligible.
- 2 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.
- 3 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:

Frequency of emission (MHz)	Field strength $\mu\text{V/m}$	Measurement Distance m	Field strength $\text{dB}\mu\text{V/m}$
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				

A4 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 8.8
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S01,S02,S03, S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	2

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

Results measured using the Quasi Peak detector compared to the Quasi Peak limit 13.56MHz

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.167910	41.8	2000.0	9.000	GND	N	0.1	23.4	65.2
2.663370	28.3	2000.0	9.000	GND	N	0.3	27.7	56
2.812620	32.0	2000.0	9.000	GND	N	0.3	24	56
13.558620	53.2	2000.0	9.000	GND	N	1.0	2.8	56
20.000250	37.4	2000.0	9.000	GND	L1	1.3	22.6	60
26.480685	33.6	2000.0	9.000	GND	L1	1.5	26.4	60
26.844855	26.7	2000.0	9.000	GND	L1	1.6	33.3	60
26.895600	31.0	2000.0	9.000	GND	N	1.5	29	60
26.907540	43.3	2000.0	9.000	GND	N	1.5	16.7	60
26.922465	29.7	2000.0	9.000	GND	L1	1.6	30.3	60
26.973210	31.9	2000.0	9.000	GND	L1	1.6	28.1	60
27.068730	32.4	2000.0	9.000	GND	N	1.5	27.6	60
27.107535	37.4	2000.0	9.000	GND	N	1.5	22.6	60
27.125445	45.6	2000.0	9.000	GND	L1	1.6	14.4	60
27.143355	33.4	2000.0	9.000	GND	N	1.5	26.6	60
27.170220	31.4	2000.0	9.000	GND	L1	1.6	28.6	60
27.265740	31.3	2000.0	9.000	GND	N	1.5	28.7	60
27.313500	30.5	2000.0	9.000	GND	N	1.5	29.5	60
27.334395	39.3	2000.0	9.000	GND	L1	1.6	20.7	60
28.119450	40.8	2000.0	9.000	GND	N	1.5	19.2	60

Results measured using the Average detector compared to the Average limit**13.56MHz**

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.164925	38.4	2000.0	9.000	GND	N	0.1	16.7	55.1
2.803665	29.5	2000.0	9.000	GND	N	0.3	16.5	46
2.848440	28.5	2000.0	9.000	GND	L1	0.3	17.5	46
3.018585	29.6	2000.0	9.000	GND	N	0.3	20.4	50
13.558620	53.5	2000.0	9.000	GND	N	1.0	-3.5	50
20.003235	33.8	2000.0	9.000	GND	L1	1.3	16.2	50
26.895600	26.2	2000.0	9.000	GND	N	1.5	23.8	50
26.907540	34.7	2000.0	9.000	GND	N	1.5	15.3	50
27.068730	27.1	2000.0	9.000	GND	N	1.5	22.9	50
27.095595	28.3	2000.0	9.000	GND	L1	1.6	21.7	50
27.101565	30.5	2000.0	9.000	GND	N	1.5	19.5	50
27.119475	46.5	2000.0	9.000	GND	L1	1.6	3.5	50
27.128430	36.5	2000.0	9.000	GND	N	1.5	13.5	50
27.334395	32.4	2000.0	9.000	GND	L1	1.6	17.6	50
27.835875	40.3	2000.0	9.000	GND	N	1.5	9.7	50
27.907515	38.9	2000.0	9.000	GND	N	1.5	11.1	50
28.000050	38.1	2000.0	9.000	GND	N	1.5	11.9	50
28.047810	36.1	2000.0	9.000	GND	N	1.5	13.9	50
28.119450	40.9	2000.0	9.000	GND	N	1.5	9.1	50
28.191090	38.9	2000.0	9.000	GND	N	1.5	11.1	50

13.56MHz Dummy Load fitted**Results measured using the Quasi Peak detector compared to the Quasi Peak limit**

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.158000	37.0	2000.0	10.000	GND	L1	0.1	28.6	65.6
2.178000	34.3	2000.0	10.000	GND	N	0.3	21.7	56.0
2.258000	34.3	2000.0	10.000	GND	L1	0.3	21.7	56.0
2.314000	34.3	2000.0	10.000	GND	L1	0.3	21.7	56.0
2.810000	34.3	2000.0	10.000	GND	N	0.3	21.7	56.0
17.938000	35.2	2000.0	10.000	GND	N	1.2	24.8	60.0
18.098000	35.2	2000.0	10.000	GND	N	1.2	24.8	60.0
18.650000	35.3	2000.0	10.000	GND	N	1.3	24.7	60.0
19.998000	42.2	2000.0	10.000	GND	L1	1.3	17.8	60.0
20.446000	35.4	2000.0	10.000	GND	L1	1.4	24.6	60.0
20.746000	35.4	2000.0	10.000	GND	L1	1.4	24.6	60.0
23.998000	35.9	2000.0	10.000	GND	N	1.4	24.1	60.0
24.010000	35.5	2000.0	10.000	GND	L1	1.5	24.5	60.0
27.118000	35.5	2000.0	10.000	GND	N	1.5	24.5	60.0
27.330000	35.5	2000.0	10.000	GND	N	1.5	24.5	60.0
27.834000	35.9	2000.0	10.000	GND	L1	1.6	24.1	60.0
27.906000	35.6	2000.0	10.000	GND	N	1.5	24.4	60.0
27.998000	44.6	2000.0	10.000	GND	L1	1.6	15.4	60.0
28.118000	36.2	2000.0	10.000	GND	N	1.5	23.8	60.0
28.190000	35.7	2000.0	10.000	GND	N	1.5	24.3	60.0

13.56MHz Results measured using the Average detector compared to the Average limit

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.158000	36.2	2000.0	10.000	GN	L1	0.1	19.4	55.6
0.482000	34.1	2000.0	10.000	GN	L1	0.1	12.2	46.3
0.758000	34.2	2000.0	10.000	GN	N	0.2	11.8	46.0
2.986000	34.3	2000.0	10.000	GN	L1	0.3	11.7	46.0
19.998000	42.6	2000.0	10.000	GN	N	1.3	7.4	50.0
23.998000	35.7	2000.0	10.000	GN	N	1.4	14.3	50.0
27.762000	35.5	2000.0	10.000	GN	N	1.5	14.5	50.0
27.830000	35.5	2000.0	10.000	GN	N	1.5	14.5	50.0
27.906000	35.6	2000.0	10.000	GN	N	1.5	14.4	50.0
27.998000	44.7	2000.0	10.000	GN	N	1.5	5.3	50.0
28.046000	35.5	2000.0	10.000	GN	N	1.5	14.5	50.0
28.118000	35.8	2000.0	10.000	GN	L1	1.6	14.2	50.0
28.190000	35.6	2000.0	10.000	GN	N	1.5	14.4	50.0
28.686000	35.5	2000.0	10.000	GN	N	1.5	14.5	50.0
29.610000	35.6	2000.0	10.000	GN	L1	1.6	14.4	50.0
29.678000	35.5	2000.0	10.000	GN	N	1.5	14.5	50.0

Test Details:	
Regulation	Part 15 Subpart (c) Clause 15.207, RSS-Gen 8.8
Measurement standard	ANSI C63.10:2009
Frequency range	150kHz to 30MHz
EUT sample number	S02,S38, S07,S08,S09
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Photographs (Appendix F)	2

Results measured using the Quasi Peak detector compared to the Quasi Peak limit 125.0kHz

Frequency (MHz)	QuasiPeak (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.161940	44.0	2000.0	9.000	GN	N	0.1	21.4	65.4
2.176815	20.3	2000.0	9.000	GN	N	0.3	35.7	56.0
2.260395	21.0	2000.0	9.000	GN	N	0.3	35.0	56.0
2.430540	24.6	2000.0	9.000	GN	L1	0.3	31.4	56.0
2.624565	26.8	2000.0	9.000	GN	N	0.3	29.2	56.0
2.905155	32.0	2000.0	9.000	GN	L1	0.3	24.0	56.0
19.755480	30.9	2000.0	9.000	GN	L1	1.3	29.1	60.0
20.003235	33.8	2000.0	9.000	GN	L1	1.3	26.2	60.0
20.068905	31.4	2000.0	9.000	GN	L1	1.3	28.6	60.0
20.125620	31.5	2000.0	9.000	GN	L1	1.3	28.5	60.0
20.224125	31.3	2000.0	9.000	GN	L1	1.4	28.7	60.0
20.268900	31.1	2000.0	9.000	GN	L1	1.4	28.9	60.0
20.355465	30.8	2000.0	9.000	GN	L1	1.4	29.2	60.0
20.373375	30.7	2000.0	9.000	GN	L1	1.4	29.3	60.0
20.424120	30.3	2000.0	9.000	GN	L1	1.4	29.7	60.0
20.471880	30.3	2000.0	9.000	GN	L1	1.4	29.7	60.0
20.534565	29.8	2000.0	9.000	GN	L1	1.4	30.2	60.0
20.647995	29.6	2000.0	9.000	GN	L1	1.4	30.4	60.0
23.498670	34.4	2000.0	9.000	GN	N	1.4	25.6	60.0
28.000050	40.4	2000.0	9.000	GN	N	1.5	19.6	60.0

Results measured using the Average detector compared to the Average limit 125.0kHz

Frequency (MHz)	Average (dBμV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.150000	39.1	2000.0	9.000	GN	N	0.1	16.9	56.0
0.194775	31.3	2000.0	9.000	GN	N	0.1	22.5	53.8
0.239550	29.5	2000.0	9.000	GN	L1	0.1	22.6	52.1
2.633520	24.7	2000.0	9.000	GN	N	0.3	21.3	46.0
2.905155	29.2	2000.0	9.000	GN	L1	0.3	16.8	46.0
19.621155	27.4	2000.0	9.000	GN	L1	1.3	22.6	50.0
19.770405	27.6	2000.0	9.000	GN	L1	1.3	22.4	50.0
19.868910	27.2	2000.0	9.000	GN	L1	1.3	22.8	50.0
19.919655	27.4	2000.0	9.000	GN	L1	1.3	22.6	50.0
20.000250	35.8	2000.0	9.000	GN	N	1.3	14.2	50.0
20.137560	28.0	2000.0	9.000	GN	L1	1.3	22.0	50.0
20.170395	26.9	2000.0	9.000	GN	L1	1.3	23.1	50.0
20.331585	26.9	2000.0	9.000	GN	L1	1.4	23.1	50.0
20.370390	27.0	2000.0	9.000	GN	L1	1.4	23.0	50.0
20.406210	27.2	2000.0	9.000	GN	L1	1.4	22.8	50.0
20.421135	27.3	2000.0	9.000	GN	L1	1.4	22.7	50.0
20.471880	27.1	2000.0	9.000	GN	L1	1.4	22.9	50.0
20.645010	26.2	2000.0	9.000	GN	L1	1.4	23.8	50.0
24.000150	33.5	2000.0	9.000	GN	N	1.4	16.5	50.0
28.000050	40.6	2000.0	9.000	GN	N	1.5	9.4	50.0

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207 & RSS-Gen 8.8):

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

A5 Frequency Tolerance 13.56MHz

Test Details	
Regulation	Part 15.225(e) / RSS – 210 Issue 8 (A2.6)
Measurement standard	ANSI C63.10:2009:2009
EUT sample number	S15
Modification state	0
SE in test environment	S39,S16,S17,S37
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	19°C

Test Conditions		Measured Frequency (MHz)	Drift (kHz)
T_{nom} (+20°C)	V_{nom}	13.5600000	N/A
T_{nom} (+20°C)	V_{min}	13.5600000	0.0000
T_{nom} (+20°C)	V_{max}	13.5600000	0.0000
T_{max} (+50°C)	V_{nom}	13.5600000	0.0000
T_{min} (-20°C)	V_{nom}	13.5600000	0.0000
Limit		± 1.356 kHz ($\pm 0.01\%$ of the operating frequency)	
Verdict		Pass	

Appendix B:**Supporting Graphical Data**

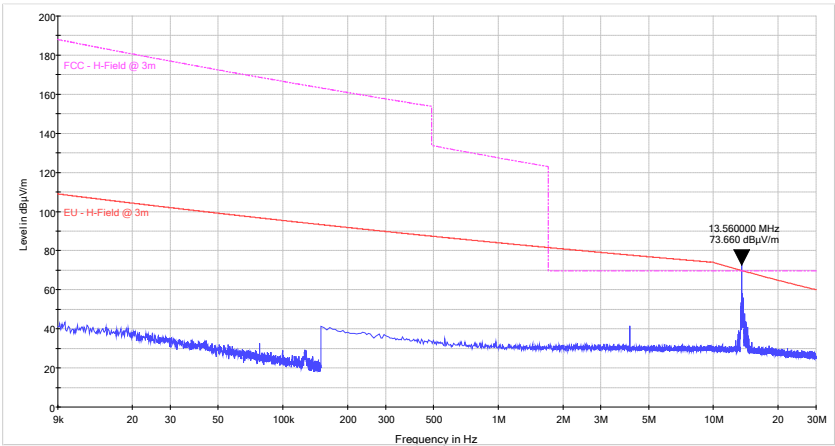
This appendix contains graphical data obtained during testing.

Notes:

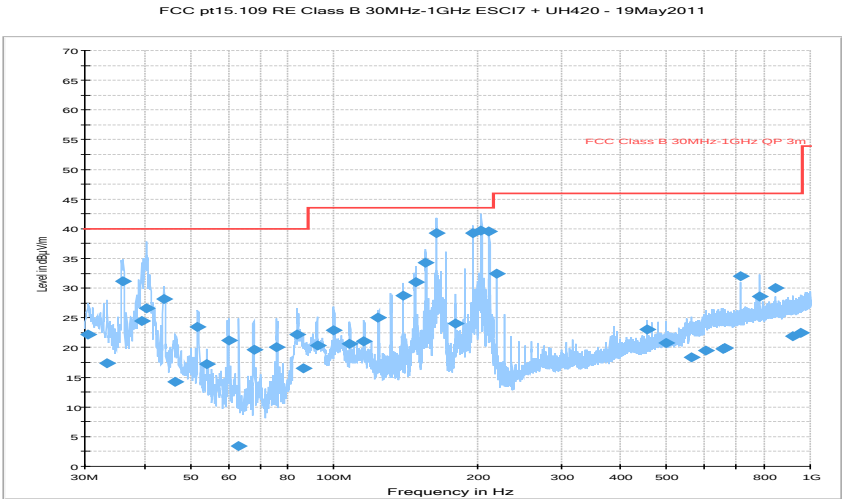
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power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

Radiated spurious emissions

13.56MHz 9 kHz to 30 MHz

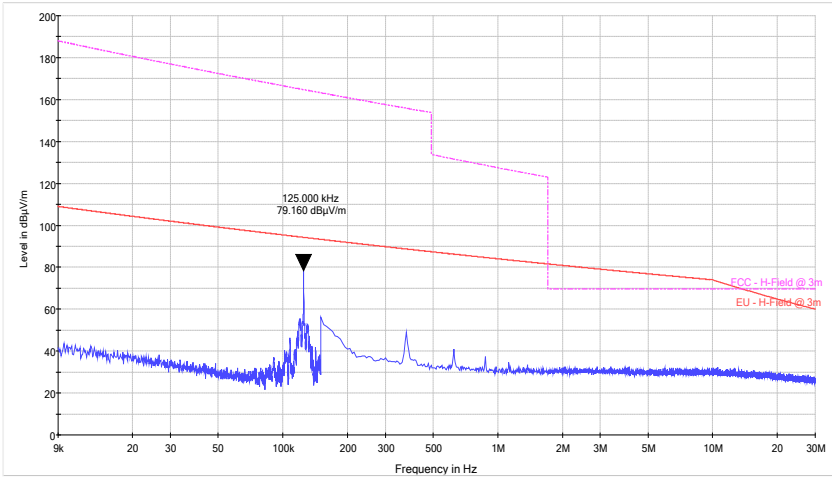


13.56MHz 30 MHz to 1 GHz

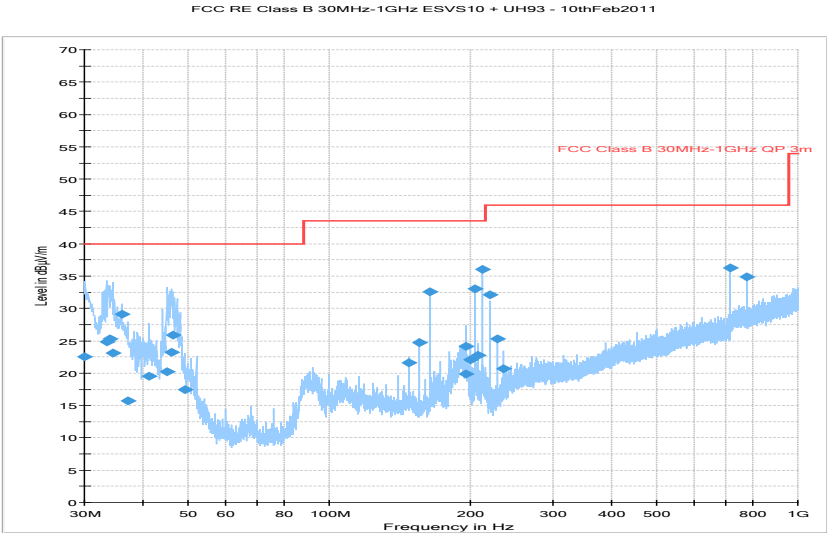


Radiated spurious emissions

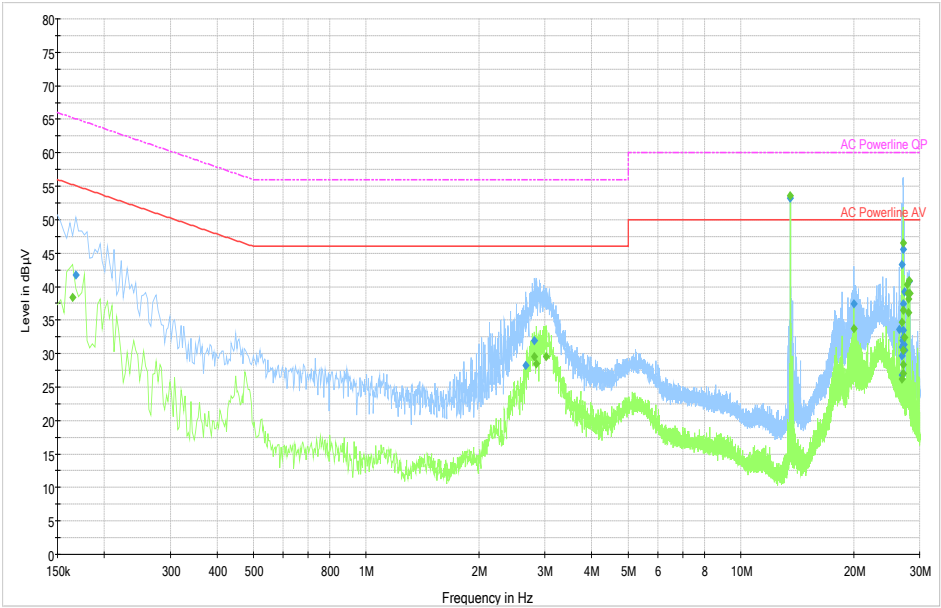
125.0kHz 9 kHz to 30 MHz



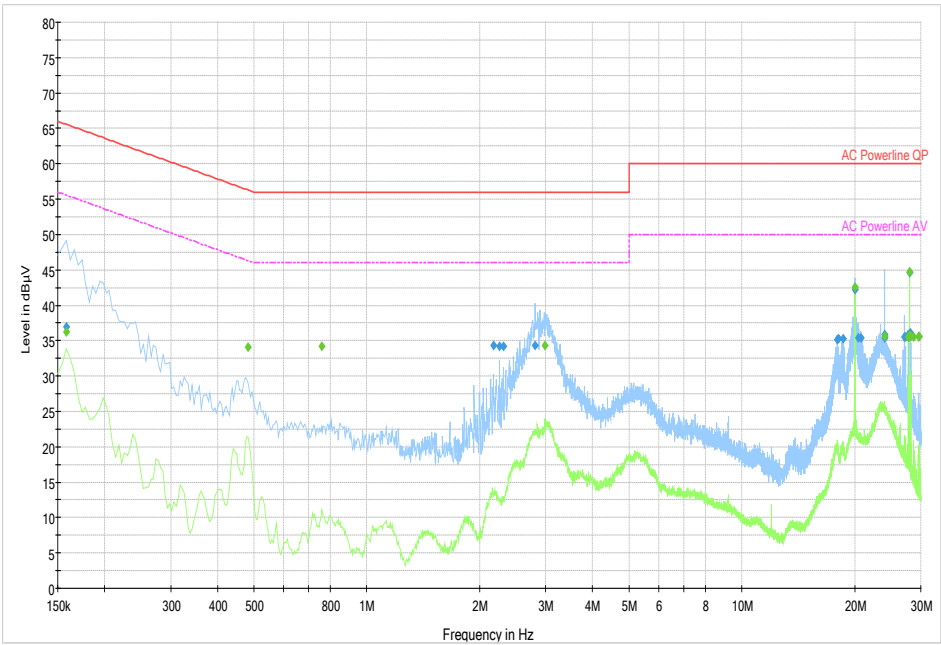
125.0kHz 30 MHz to 1 GHz



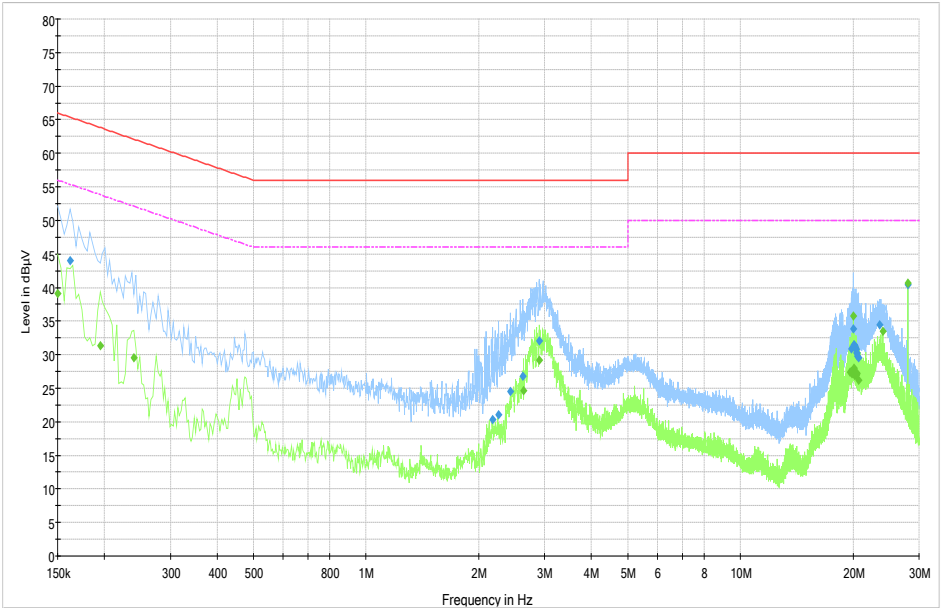
AC Powerline Conducted Emissions
13.56MHz

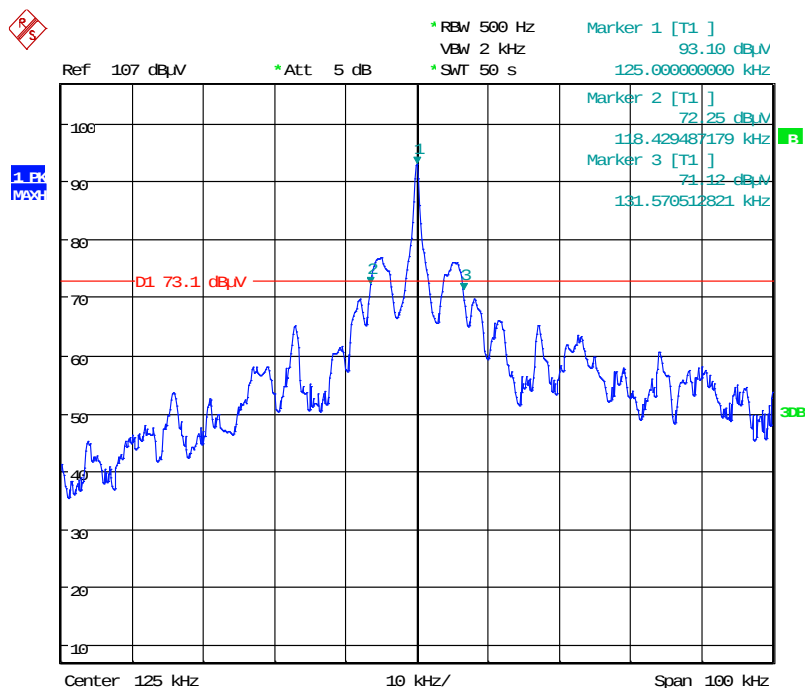


13.56MHz Dummy load



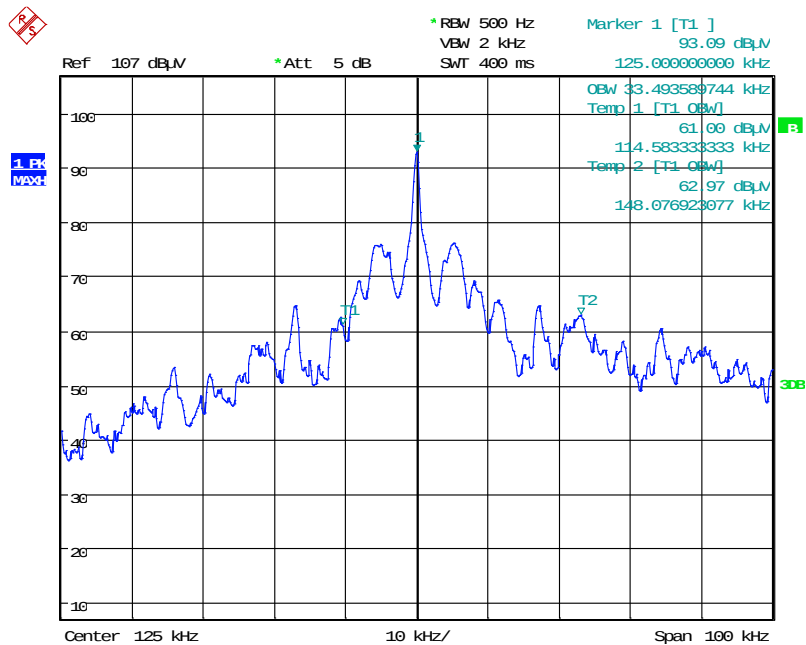
AC Powerline Conducted Emissions
125.0kHz





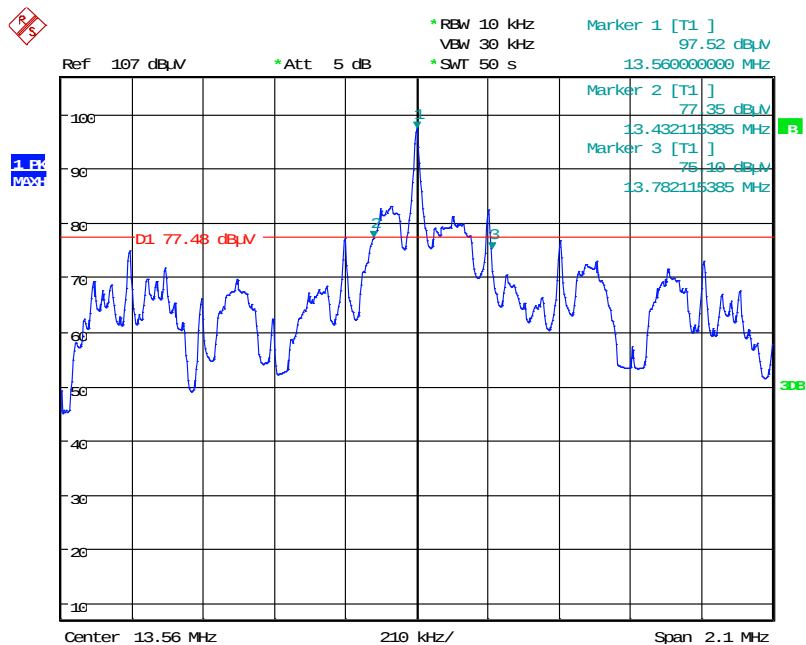
Date: 28.JAN.2015 16:03:55

125.0kHz 20dB bandwidth



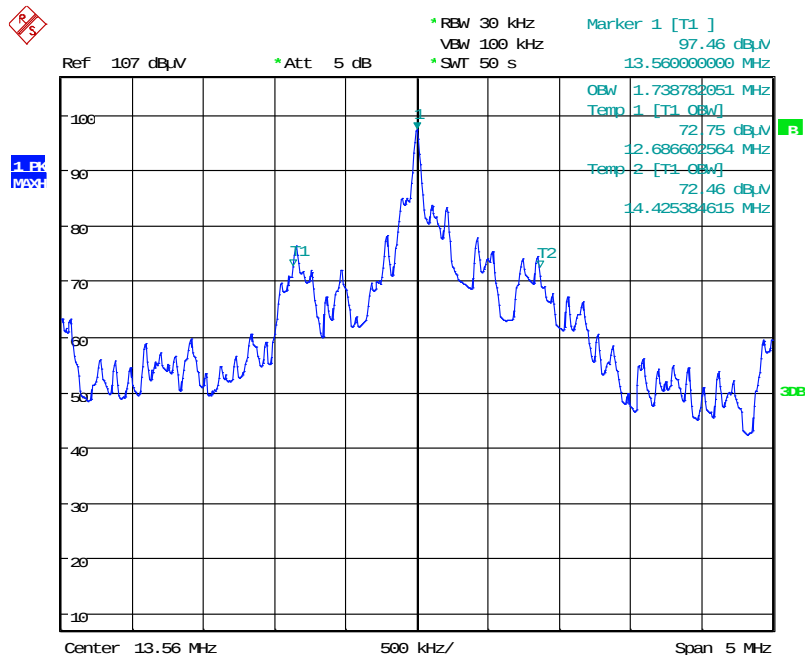
Date: 28.JAN.2015 16:02:01

125.0kHz 99% bandwidth



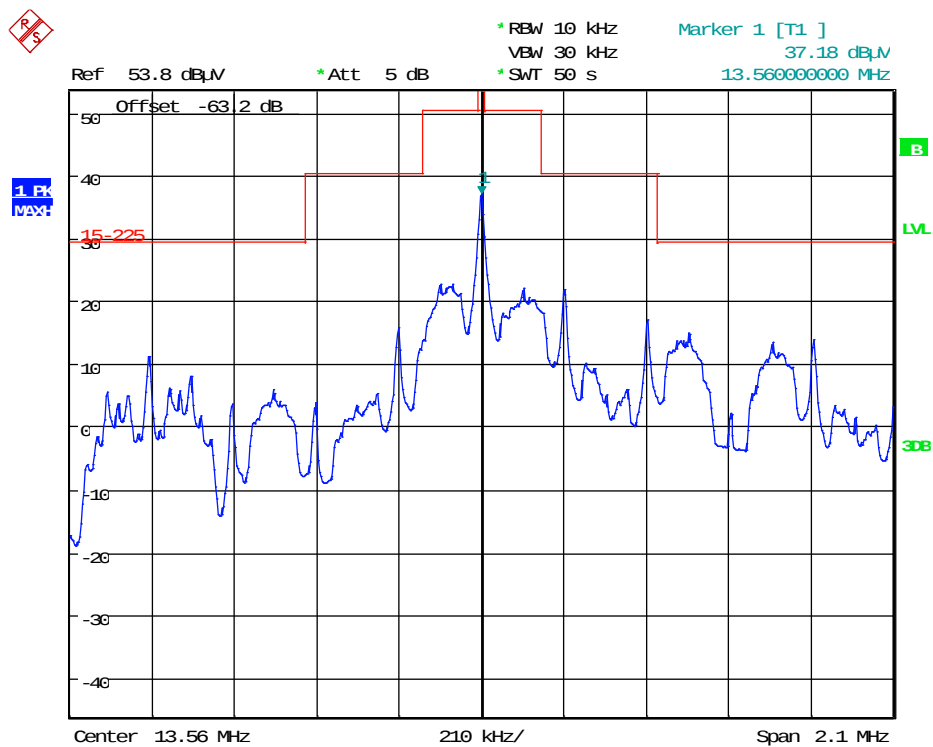
Date: 28.JAN.2015 15:54:42

13.56MHz 20dB bandwidth



Date: 28.JAN.2015 15:59:48

13.56MHz 99% bandwidth



Date: 27.JAN.2015 11:12:48

13.56MHz Mask

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	13.56MHz unit	2839144
S02	125.0kHz unit	2839142
S03	13.56MHz unit (Dummy Antenna)	2988553

Description	
Software version	V1.00.5470.31123
Hardware version	Final production

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

Sample No.	Description	Identification
S07	1.8mtr USB cable	None
S08	USB power Source third party device	None
S09	Dc Power supply for the above equipment	P/NA0652101

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,S02, S03
Tests : All Tests

Port	Description of Cable Attached	Cable length	Equipment Connected
Power	USB cable	1.8mtr	USB power source

C5 Details of Equipment Used

TRaC No	Type	Description	Manufacturer	Last Cal	Period	Cal Due
UH403	ESCI 7	Recevier	R&S	20/08/2014	12	20/08/2015
UH93	CBL6112B	Bilog	Chase	08/07/2013	24	08/07/2015
L007	hfh2	Loop Antenna	R&S	17/10/2013	24	17/10/2015
UH187	ESHS10	Receiver	R&S	19/02/2014	12	19/02/2015
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
UH396	ENV216	Lisn	R&S	22/05/2014	12	22/05/2015
UH909	FSU26	Spectrum Analyser	R&S	12/02/2014	12	12/02/2015

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 pulsewidths 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 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:

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

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

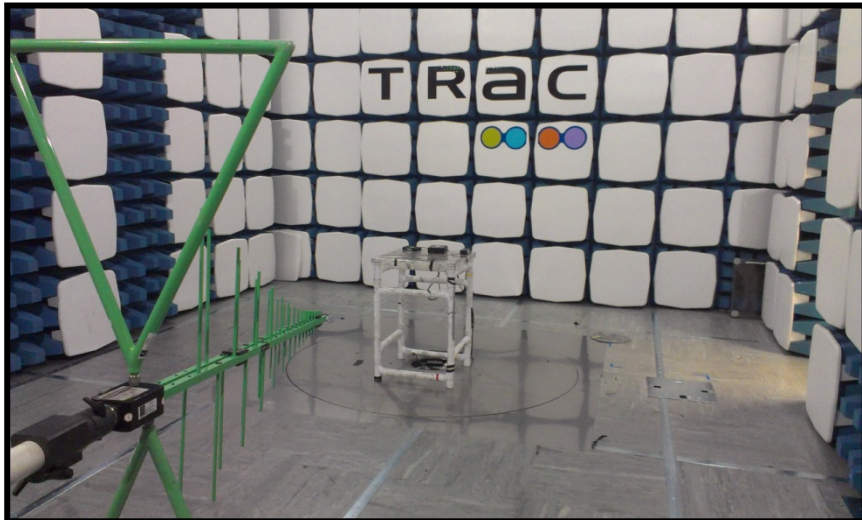
Appendix F:

Photographs and Figures

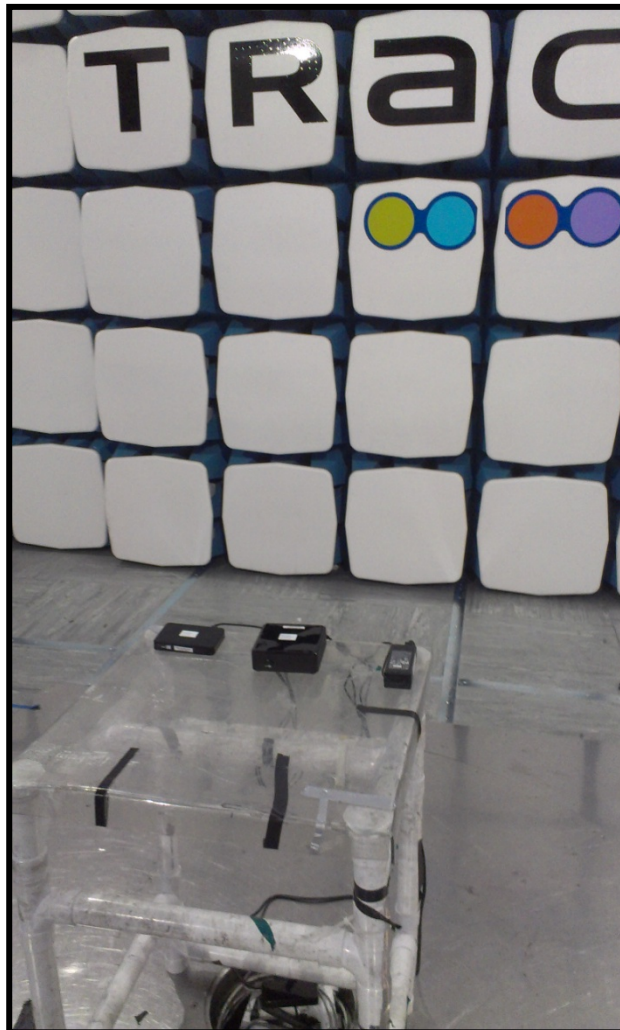
The following photographs were taken of the test samples:

1. Radiated emissions arrangement
2. Radiated emissions arrangement
3. AC Powerline emissions arrangement

Photograph 1



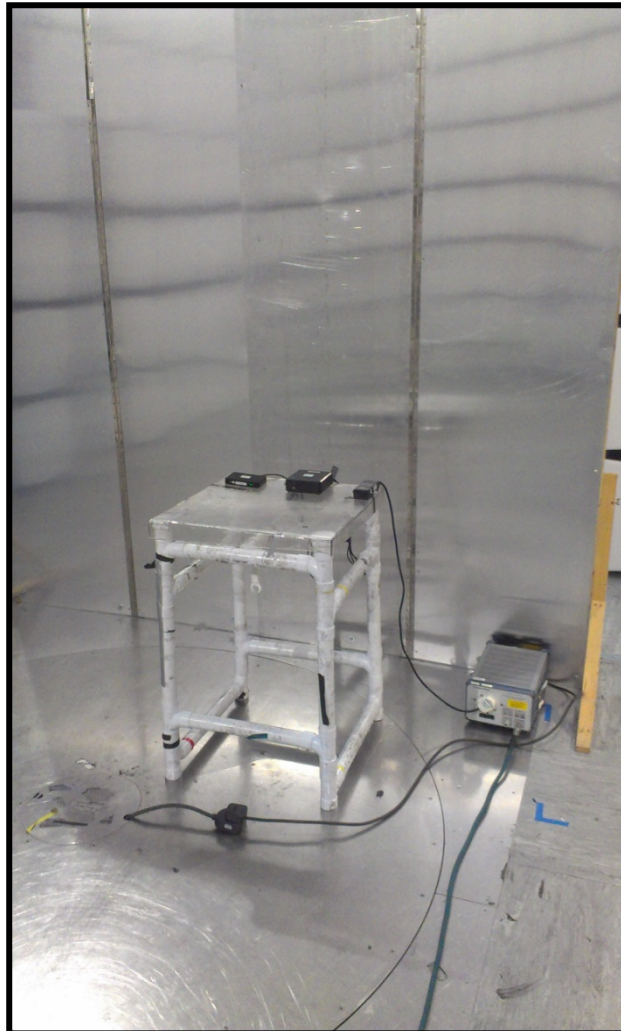
Photograph 2



Photograph 3



Photograph 4



Appendix G:**General SAR test reduction and exclusion guidance****KDB 447498 & RSS-102**

Section 4.3 General SAR test reduction and exclusion guidance

For Standalone SAR exclusion consideration, when the considering SAR exclusion Threshold requirement in KDB 447498 is satisfied standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

In the frequency range below 100 MHz and test separation distance ≤ 50 mm, the SAR Test Exclusion Threshold will be determined as follows

SAR Exclusion Threshold (SARET)

$$\text{SAR Exclusion Threshold} = ([\text{Step 1} + \text{Step 2}] * \text{Step 3a}) * \text{Step 3b}$$

Step 1

$$\text{NT} = [(\text{MP}/\text{TSD}^A) * \sqrt{f_{\text{GHz}}}]$$

NT	=	Numeric Threshold (3.0 for 1-g SAR and 7.5 for 10-g SAR)
MP	=	Max Power of channel (mW) (inc tune up)
TSD ^A	=	Min Test separation Distance or 50mm (whichever is lower) = 50
f _{GHz}	=	Transmit frequency (or 100MHz if lower)

We can transpose this formula to allow us to find the maximum power of a channel allowed and compare this to the measured maximum power.

$$\text{MP} = [(\text{NT} * \text{TSD}^A) / \sqrt{f_{\text{GHz}}}]$$

For Distances Greater than 50 mm Step 2 applies

Step 2

$$(\text{TSD}^B - 50\text{mm}) * f_{(\text{MHz})}/150$$

Where:

f _{MHz} ^B	=	Transmit frequency
TSD ^B	=	Min Test separation Distance (mm) = 50

Step 3

3a) The power threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by $[1 + \log(100/f_{(\text{MHz})})]$ for *test separation distances* > 50 mm and < 200 mm

3b) The power threshold determined by the equation in steps 1 and 2 for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$ for *test separation distances* ≤ 50 mm

$$\begin{aligned} \text{SARET} &= (\{ [(\text{NT} * \text{TSD}^A) / \sqrt{f_{\text{GHz}}}] + (\text{TSD}^B - 50) * [100/150] \} * (1 + \text{Log} [100 / F_{\text{MHz}}])) * \frac{1}{2} \\ \text{SARET} &= (\{ [(3.0 * 50) / \sqrt{0.1}] + (50 - 50) * [100/150] \} * (1 + \text{Log} [100 / F_{\text{MHz}}])) * \frac{1}{2} \\ \text{SARET} &= (474 * (1 + \text{Log} [100 / 13.56])) * \frac{1}{2} \\ \text{SARET} &= 442.65 \text{ mW} \end{aligned}$$

The calculated output power is 0.00364 mW (eirp) which is less than the SAR Exclusion Threshold of 468mW, at 5mm test separation distance, for general population and uncontrolled exposure.

Therefore standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

Prediction of MPE limit at a given distance

For purposes of these requirements mobile devices are defined by the 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 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 1.67W/m² power density limit, as required under Industry Canada rules.

Equation from IEEE C95.1

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

Where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Note:

The EIRP value was calculated using the peak E Field measurement.

Result

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm ²)	Distance (R) cm required to be less than 0.98 mW/cm ²
13.56	0.00364	0.9789	0.0173

