AN ENGINEERING DOCUMENT

FOR

ELCOMETER LIMITED

ON

J480T-268 - GLOSSMETER

DOCUMENT NO. TRA-020471-00-47-01C

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TRaC Wireless Test Report	**:** TRA-020471-00-47-01C
Applicant	**:** Elcometer Limited
Apparatus	**:** J480T-268 - Glossmeter
Specification(s)	**:** CFR47 Part 15.225 & RSS-210
Purpose of Test	**: Certification**
FCCID	: 2AB66480
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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.

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1.2 Tests Requested By

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1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 25/03/14 and 31/03/14

J480T-268 - Glossmeter

The above equipment is a battery powered hand held glossmeter gauge and has a 13.56MHz RFID and a Bluetooth device

1.5 Test Result Summary

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

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

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

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

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 %

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

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 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

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

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
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	Title 47 of the CFR: Part 15 Subpart (c) 15.225 (a) / RSS – 210 Issue 8 (A2.6)
Measurement standard	ANSI C63.10:2009
EUT sample number	S05
Modification state	0
SE in test environment	S01, S04
SE isolated from EUT	N/A
EUT set up	Refer to Appendix C
Temperature	20°C

Frequency (MHz)	Measurement Distance (m)	Measurement Rx. Reading (dBµV/m)	Extrapolation Factor (dB)	Field Strength at 30m (µV/m)
13.56	1	69.80	60.80	2.818
13.56	3	49.00	40.00	2.818
Limit at 30m		15848 µV/m		

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc = Average / Quasi Peak with 10kHz / 120kHz bandwidth appropriately
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: 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 orthagonal planes.
Maximum results recorded

A2 Frequency Tolerance

Test Details	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.225(e) / RSS – 210 Issue 8 (A2.6)
Measurement standard	ANSI C63.10:2009
EUT sample number	S05
Modification state	0
SE in test environment	S04
SE isolated from EUT	S01
EUT set up	Refer to Appendix C
Temperature	20°C
Humidity	32%

Test Conditions		Measured Frequency (MHz)	Drift (kHz)
$T_{nom\ (+20^{\circ}C)}$	V_{nom}	13.56002644	0.0000
$T_{nom\ (+20^{\circ}C)}$	V_{min}	13.56002644	0.0000
$T_{nom\ (+20^{\circ}C)}$	V_{max}	13.56002644	0.0000
$T_{max\ (+50^{\circ}C)}$	V_{nom}	13.56001282	-0.0136
$T_{min\ (-20^{\circ}C)}$	V_{nom}	13.56004327	0.0168
Limit		± 1.3560 kHz (± 0.01% of the operating frequency)	
Verdict		Pass	

A3 Occupied Bandwidth

Test Details	
Regulation	Title 47 of the CFR:Part 15 Subpart (c) 15.215(c) / RSS – Gen Issue 3 4.6.1
Measurement standard	ANSI C63.10:2009
EUT sample number	S05
Modification state	0
SE in test environment	None
SE isolated from EUT	S01, S04
EUT set up	Refer to Appendix C
Temperature	20°C
Humidity	32%

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Band occupancy at -20 dBc	f_L	f_H
	13.559804MHz	13.560221MHz
	BW = 416.67Hz	
99% Band occupancy	f_L	f_H
	13.558538MHz	13.561327 MHz
	BW = 2.79kHz	

A4 Radiated Spurious Emissions

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

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

3m open area test site : ☐ 3m alternative test site : ☒

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

Test Details	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.225 (a)(b)(c)(d) & 15.209/ RSS – 210 Issue 8 (A2.6)
Measurement standard	ANSI C63.10:2009
Frequency range	9kHz – 1GHz
EUT sample number	S05
Modification state	0
SE in test environment	S01, S04
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22.5°C

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

Frequency (MHz)	Meas Rx (dBuV)	Cable Loss (dB)	Antenna Fact (dB/m)	Pre-amp (dB)	Field Strength (dBuV/m)	Extrap Fact	Field Strength (uV/m)	Limit (uV/m)
31.55	4.4	0.92	16.97	-	22.29	-	13.02	100
40.65	9	1	12.08	-	22.08	-	12.71	100
42.9	11.6	1	10.95	-	23.55	-	15.05	100
43.25	11.7	1	10.78	-	23.48	-	14.93	100
82.85	11.9	1.23	7.27	-	20.4	-	10.47	100
105.75	19.7	1.3	11.08	-	32.08	-	40.18	150
107	20.5	1.3	11.2	-	33	-	44.67	150
120	12.6	1.44	11.5	-	25.54	-	18.92	150
128.6	20.6	1.59	11.58	-	33.77	-	48.81	150
132.2	20.7	1.6	11.4	-	33.7	-	48.42	150
144	22.7	1.6	10.6	-	34.9	-	55.59	150
192	24.9	1.8	8.5	-	35.2	-	57.54	150
207.7	17	1.8	8.73	-	27.53	-	23.80	150
228.8	18.5	1.9	9.58	-	29.98	-	31.55	200
240	21.1	1.9	10.9	-	33.9	-	49.55	200
244.1	20.4	1.9	11.42	-	33.72	-	48.53	200
246.75	13.4	1.9	11.78	-	27.08	-	22.59	200
265.5	14.6	1.96	13.3	-	29.86	-	31.12	200

Frequency (MHz)	Meas Rx (dBuV)	Cable Loss (dB)	Antenna Fact (dB/m)	Pre-amp (dB)	Field Strength (dBuV/m)	Extrap Fact	Field Strength (uV/m)	Limit (uV/m)
288	21.2	2.04	12.8	-	36.04	-	63.39	200
311.9	15.7	2.12	13.5	-	31.32	-	36.81	200
336	22	2.21	14	-	38.21	-	81.38	200
345.7	11.2	2.26	14.19	-	27.65	-	24.13	200
359	10.4	2.34	14.6	-	27.34	-	23.28	200
379.7	17.2	2.4	15.07	-	34.67	-	54.14	200
384	25.3	2.4	15.2	-	42.9	-	139.64	200
393.25	17.1	2.4	15.56	-	35.06	-	56.62	200
400	9.5	2.4	15.9	-	27.8	-	24.55	200
406.8	18.5	2.4	16.24	-	37.14	-	71.94	200
415.3	8.6	2.42	16.67	-	27.69	-	24.24	200
433.9	16.1	2.47	16.4	-	34.97	-	56.04	200
447.5	13.3	2.5	16.33	-	32.13	-	40.41	200
461.05	17.9	2.53	16.65	-	37.08	-	71.45	200
480	14.5	2.58	17.1	-	34.18	-	51.17	200
488.15	17.7	2.6	17.2	-	37.5	-	74.99	200
501.75	12.5	2.6	17.4	-	32.5	-	42.17	200
515.3	17.5	2.6	17.6	-	37.7	-	76.74	200
528.85	11.8	2.6	17.7	-	32.1	-	40.27	200
542.4	15.9	2.62	18.52	-	37.04	-	71.12	200
542.45	12.1	2.62	18.52	-	33.24	-	45.92	200
583.1	12.2	2.84	18.8	-	33.84	-	49.20	200
623.75	9.3	3	19.01	-	31.31	-	36.77	200
650.9	11.9	3.09	19.06	-	34.05	-	50.41	200
678	12.8	3.18	19	-	34.98	-	56.10	200
705.15	12.5	3.26	19.36	-	35.12	-	57.02	200
732.25	13.7	3.32	19.5	-	36.52	-	66.99	200
759.35	17.7	3.36	20	-	41.06	-	112.98	200
786.5	16.4	3.4	20.03	-	39.83	-	98.06	200
813.6	15.5	3.4	20.5	-	39.4	-	93.33	200
840.7	12.6	3.4	20.24	-	36.24	-	64.86	200
867.85	12	3.4	20.52	-	35.92	-	62.52	200
899.75	10.5	3.51	20.9	-	34.91	-	55.65	200

There were no further emissions within 20dB of the limit.

Note: Additional testing was performed due to the co-location of transmitter. Spectrum was investigated from 9kHz to 25GHz with both RFID and Bluetooth actively transmitting simultaneously. No intermodulation products were detected.

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 15.209 Clause 15.33(a) and 15.33(a)(1).

Radiated emission limits for all emissions:

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848µV/m at 30m. Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 µV/m at 30m. Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz the field strength of any emissions shall not exceed 106 µV/m at 30m. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in § 15.209 given overleaf.

Frequency of emission (MHz)	Field strength (dBµ/V/m)	Measurement Distance (m)	Field strength (dBµ/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:

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

(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

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.

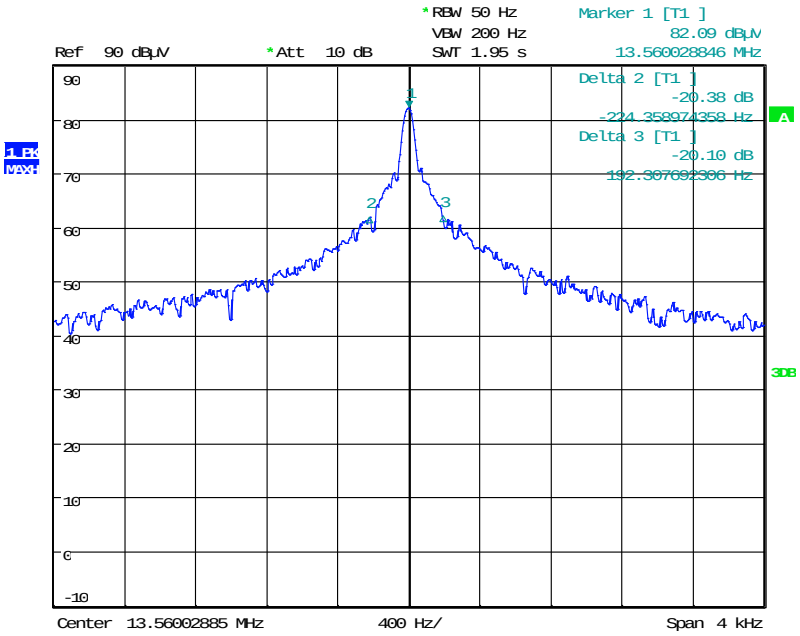
(b) The time and date on the plots do not necessarily equate to the time of the test.

(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.

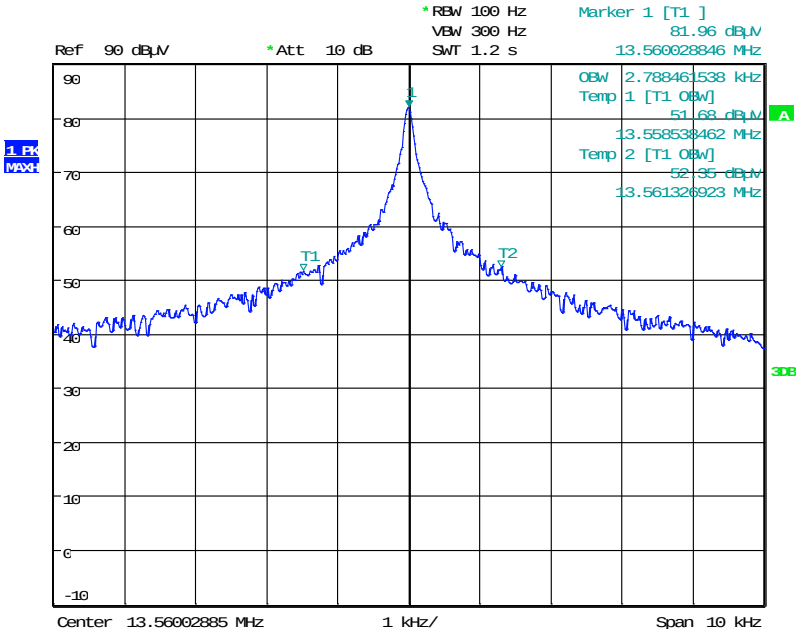
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.

20dB Bandwidth



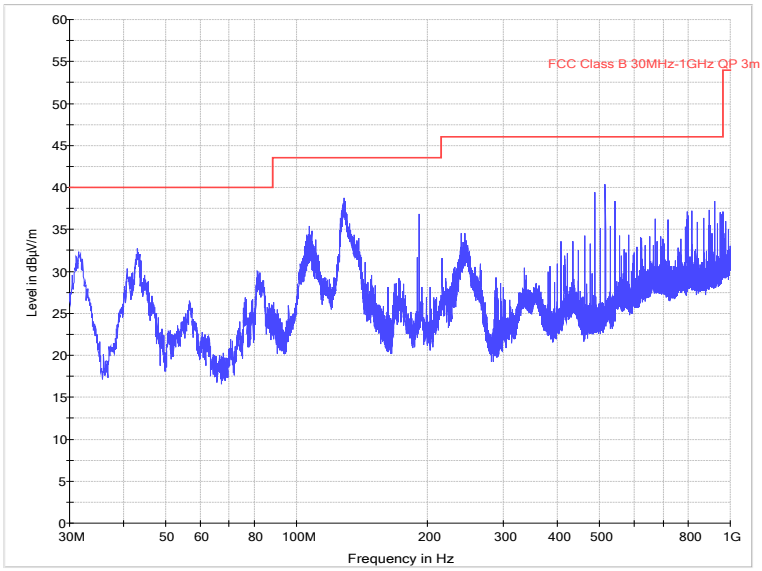
Date: 31.MAR.2014 11:18:05

99% Bandwidth

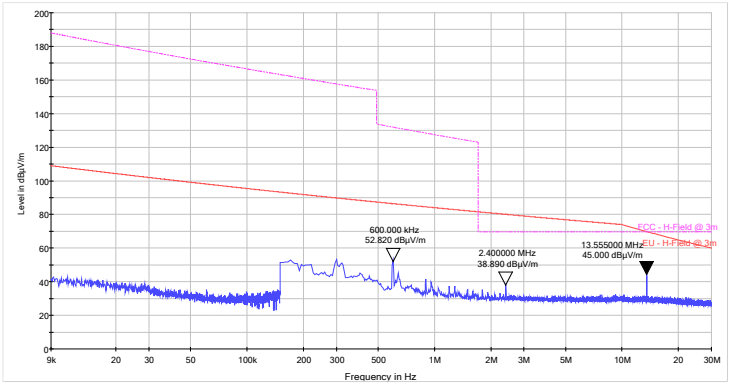


Date: 31.MAR.2014 12:37:30

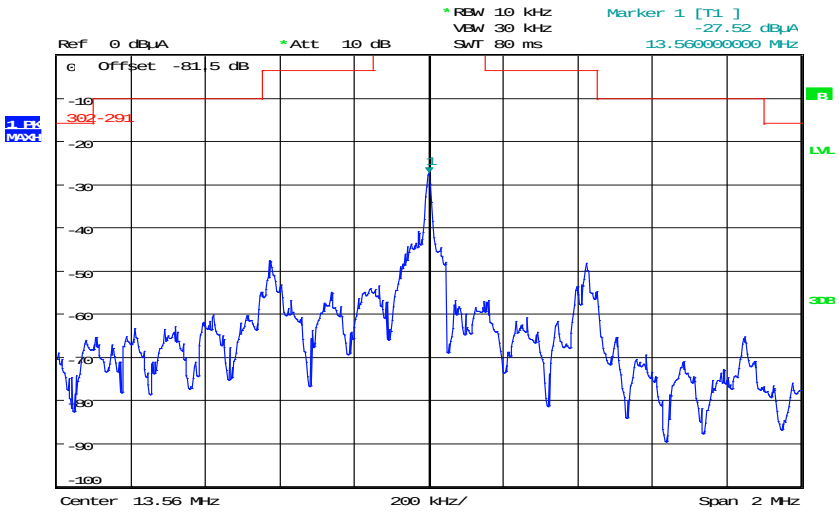
Radiated spurious emissions 30 MHz to 1 GHz



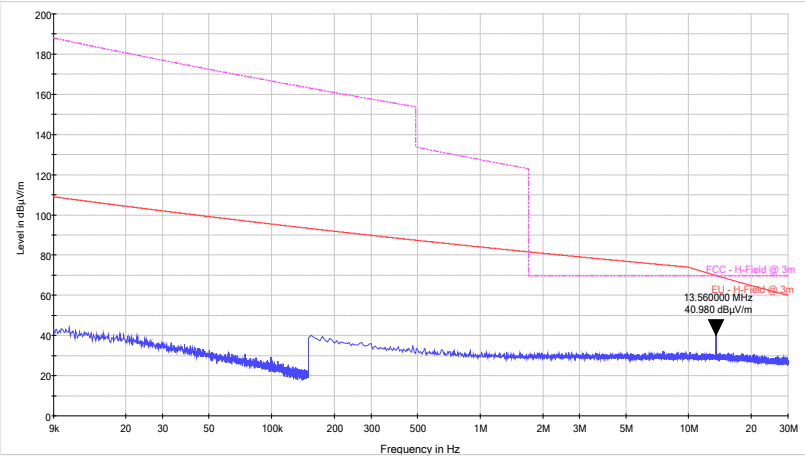
Radiated spurious emissions 9KHz to 30MHz



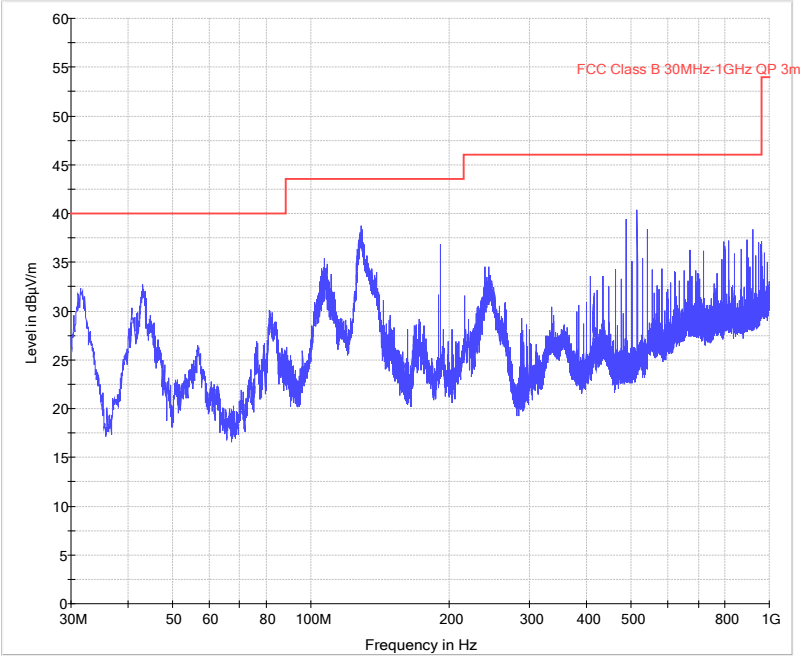
In-Band Emissions



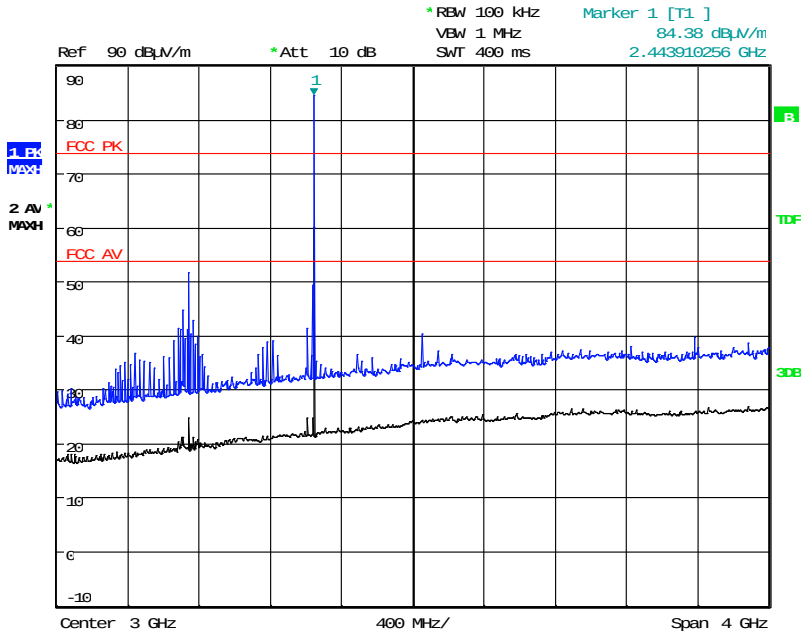
Intermodulation 9kHz- 30MHz



Intermodulation 30MHz- 1GHz

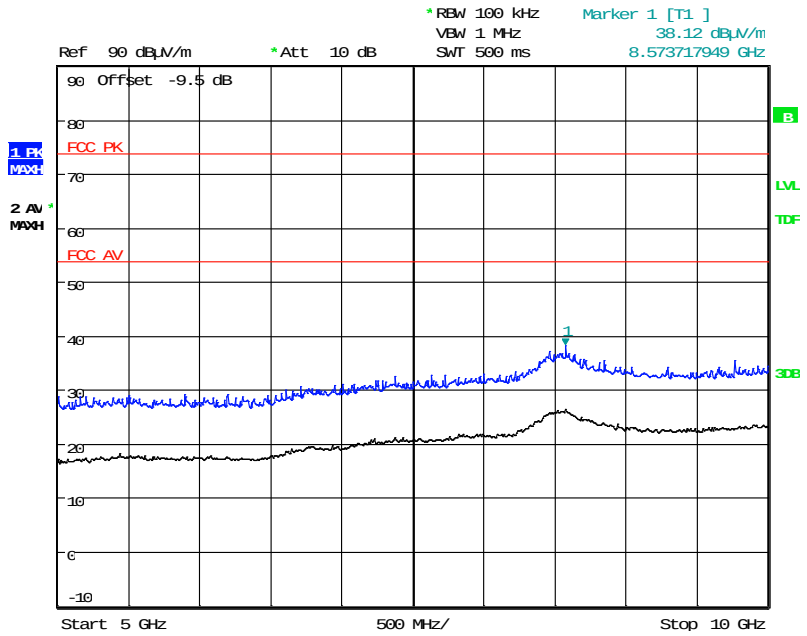


Intermodulation 1GHz- 5GHz



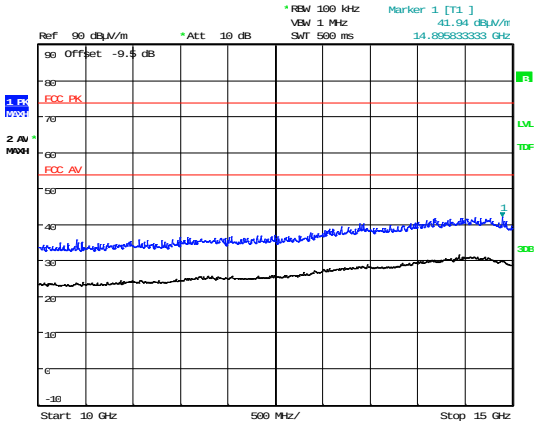
Date: 31.MAR.2014 09:55:31

Intermodulation 5GHz- 10GHz



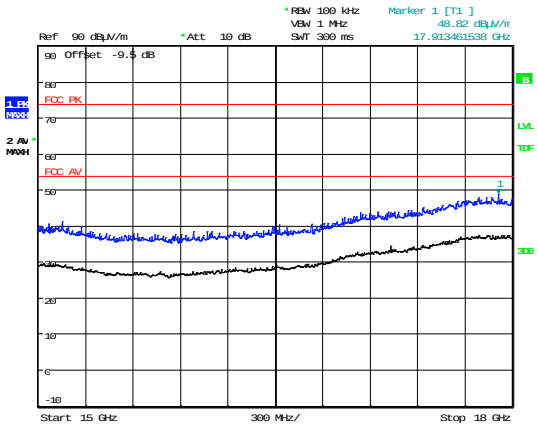
Date: 31.MAR.2014 10:04:28

Intermodulation 10GHz- 15GHz



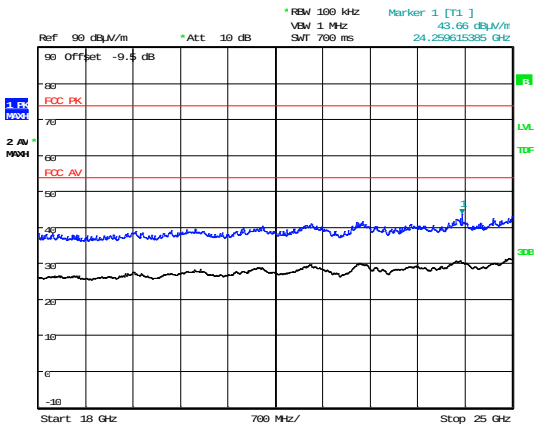
Date: 31.MAR.2014 10:05:17

Intermodulation 15GHz- 18GHz



Date: 31.MAR.2014 10:06:11

Intermodulation 18GHz- 25GHz



Date: 31.MAR.2014 10:21:37

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
S05	J480T-268 - Glossmeter	None

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

Sample No.	Description	Identification
S01	Hp Laptop	None
S04	USB to mini USB cable	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 actively transmitting

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 : S05

Port	Description of Cable Attached	Cable length	Equipment Connected
Mini USB	USB to mini USB Cable	1m	Laptop

C5 Details of Equipment Used

RFG No	Type	Description	Manufacturer	Date Calibrated.	Period	Calibrated Due
UH191	CBL611/A	Bilog	Chase	13/12/2012	24	13/12/2014
UH387	ATS	Chamber 1	Rainford EMC	04/07/2013	24	04/07/2015
L007	HFH2	Loop Antenna	R&S	17/10/2013	24	17/10/2015
L176	2042	Signal Generator	Marconi	29/11/2013	12	29/11/2014
L203	UPA6108	Log Periodic Ant	Chase	25/06/2014	24	25/06/2016
REF940	ATS	Radio Chamber - PP	Rainford EMC	08/09/2014	24	08/09/2016
UH405	FSU26	Spectrum Analyser	R&S	16/04/2014	12	16/04/2015
REF916	SMBV100A	Signal Generator	R&S	19/02/2014	12	19/02/2015

Appendix D: Additional Information

No additional information is included within this test report.

Appendix E: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement

Photograph 1

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 ≤ 50mm, the SAR Test Exclusion Threshold will be determined as follows

SAR Exclusion Threshold (SARET)

SAR Exclusion Threshold = ([Step 1 + Step2] * Step 3a) * Step 3b

Step 1

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

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.

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

For Distances Greater than 50 mm Step 2 applies

Step 2

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

Where:

f_{MHz}	=	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 $[1 + \log(100/f_{(MHz)})]$ 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 ½ for *test separation distances* ≤ 50 mm

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

The calculated output power is 1.09×10^{-10}mW (eirp) 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 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 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/m^2 power density limit, as required under Industry Canada rules.

Equation from IEEE C95.1

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

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	2.4×10^{-7}	0.98	0.00014

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