

**A RADIO TEST REPORT
FOR
G4S Monitoring Technologies LTD
ON
OM247 FIT3 10-0142-4
DOCUMENT NO.TRA-016455WUS2**

HULL

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TRaC Wireless Test Report : TRA-016455WUS2

Applicant : G4S Monitoring Technologies Ltd.

Apparatus : OM247 FIT3 10-0142-4

Specification(s) : CFR47 Part 15.249

Purpose of Test : Certification

FCCID : 2ACGBFIT915



Authorised by : John Charters
: Radio Product Manager

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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 | 16 |
| A5 | Power Line Conducted Spurious Emissions | 18 |
| Appendix B: | Supporting Graphical Data | 20 |
| Appendix C: | Additional Test and Sample Details | 28 |
| Appendix D: | Additional Information | 34 |
| Appendix E: | Calculation of the duty cycle correction factor | 35 |
| Appendix F: | Photographs and Figures | 36 |
| Appendix G: | MPE Calculation | 40 |

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 [X]

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1.2 Tests Requested By

This testing in this report was requested by:

G4S Monitoring Technologies Ltd.

3 Centurion Court
Meridian Business Park
Leicester
LE19 1TP
United Kingdom

1.3 Manufacturer

As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 25th March 2014 – 19th May 2014:

OM247 FIT3 10-0142-4

The above device is a Programming Unit for an ankle monitor containing a Radio Transceiver operating on 2 fixed frequencies (915.25 & 927.6 MHz) in the 902 – 928 MHz 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 | Regulation | Measurement standard | Result |
|--|---|----------------------|--------|
| | Title 47 of the CFR: Part 15 Subpart (c) | | |
| Intentional Emission Field Strength | 15.249 (a) | ANSI C63.10:2009 | Pass |
| Intentional Emission Band Occupancy | 15.215 (c) | ANSI C63.10:2009 | Pass |
| Spurious Emissions Radiated <1000MHz | 15.209 & 15.249 (a) (d) | ANSI C63.10:2009 | Pass |
| Unintentional Radiated Spurious Emissions | 15.109 | ANSI C63.10:2009 | Pass |
| Power Line Conducted Spurious Emissions | 15.207 | ANSI C63.10:2009 | Pass |

Abbreviations used in the above table:

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

CFR : Code of Federal Regulations
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 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 CFR47 Part 2 & RSS-Gen.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

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

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

Radio Testing – General Uncertainty Schedule

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

[1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

[2] Carrier Power

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

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

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

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

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

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

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

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

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

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

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

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

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

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

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

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

[12] Power Line Conduction

Uncertainty in test result = **3.4dB**

[13] Spectrum Mask Measurements

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

[14] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[15] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[16] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[17] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[18] Receiver Threshold

Uncertainty in test result = **3.23dB**

[19] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:**Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

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

A1 Transmitter Intentional Emission Radiated

| Test Details: | |
|------------------------|---------------------|
| Regulation | Part 15.249 (a) |
| Measurement standard | ANSI C63.10:2009 |
| EUT sample number | S11 |
| Modification state | 0 |
| SE in test environment | S12 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23°C |
| Photographs | Appendix F |

| FREQ. (MHz) | MEASUREMENT Rx. READING (dB μ V) | CABLE LOSS (dB) | ANT FACTOR (dB/m) | PRE AMP (dB) | DUTY CYCLE ADJUSTMENT (dB) | FIELD STRENGTH (dB μ V/m) | FIELD STRENGTH (mV/m) |
|------------------|--|-----------------------|-------------------------|--------------------|----------------------------------|-------------------------------------|-----------------------------|
| 915.25 | 58.1 | 4.5 | 22.2 | 30.6 | -18.6 | 35.6 | 0.06 |
| 927.6 | 58.3 | 4.6 | 22.6 | 30.5 | -18.6 | 36.4 | 0.07 |
| Limit value @ fc | | | 50mV/m @ 3m | | | | |

Notes:

- 1 Results quoted are extrapolated as indicated
- 2 Receiver detector @ fc Quasi Peak 120kHz bandwidth
- 3 When battery powered the EUT was powered with new batteries

Test Method:

- 1 As per Radio – Noise Emissions, ANSI C63.10:2009
- 2 Measuring distances 3m
- 3 EUT 0.8 metre above ground plane
- 4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthogonal planes.
Maximum results recorded

A2 Transmitter Bandwidth

| Test Details: | |
|------------------------|---------------------|
| Regulation | Part 15.215 (c) |
| Measurement standard | ANSI C63.10:2009 |
| EUT sample number | S11 |
| Modification state | 0 |
| SE in test environment | S12 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 21°C |

| Band occupancy @ -20 dBc | | | |
|---------------------------------|--------------------------|---------------------------|-------------------------|
| FREQ. (MHz) | f lower (MHz) | f higher (MHz) | Occ BW (kHz) |
| 915.25 | 915.211865385 | 915.291673077 | 79.8077 |
| 927.6 | 927.561461538 | 927.640307692 | 78.8462 |

Notes:

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

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 maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit as required.

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

3m open area test site :

3m alternative test site : X

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

| Test Details: | |
|------------------------|--|
| Regulation | Part 15.209, 15.249 (a) & (d), Annex 2 A2.9(a) |
| Measurement standard | ANSI C63.10:2009 |
| Frequency range | 30MHz -10GHz |
| EUT sample number | S11 |
| Modification state | 0 |
| SE in test environment | S12 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23°C |
| Photographs | Appendix F |

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

| Test Details: EUT Transmitting @ 915.25 MHz | | | | | | | | | | |
|---|----------------|----------------------------|-----------------------|------------------------|--------------------|-----------------------|----------------------------|----------------------------------|--------------------------------|-----------------------|
| DET | FREQ. (MHz) | MEAS Rx (dB μ V) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | DUTY CYCLE (dB) | 1m - 3m EXTRAP. (dB) | FIELD ST'GH (dB μ V/m) | FIELD ST'GH (μ V/m) | LIMIT (μ V/m) |
| Pk | 6406.776 | 49.8 | 9.0 | 34.6 | 34.8 | -18.6 | -9.5 | 30.5 | 33.5 | 5000 |
| Av | 6406.776 | 43.7 | 9.0 | 34.6 | 34.8 | -18.6 | -9.5 | 24.4 | 16.6 | 500 |

| Test Details: EUT Transmitting @ 927.6 MHz | | | | | | | | | | |
|--|----------------|----------------------------|-----------------------|------------------------|--------------------|-----------------------|----------------------------|----------------------------------|--------------------------------|-----------------------|
| DET | FREQ. (MHz) | MEAS Rx (dB μ V) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | DUTY CYCLE (dB) | 1m - 3m EXTRAP. (dB) | FIELD ST'GH (dB μ V/m) | FIELD ST'GH (μ V/m) | LIMIT (μ V/m) |
| Pk | 6495.238 | 48.5 | 9.7 | 34.5 | 34.8 | -18.6 | -9.5 | 29.8 | 30.9 | 5000 |
| Av | 6495.238 | 40.5 | 9.7 | 34.5 | 34.8 | -18.6 | -9.5 | 21.8 | 12.3 | 500 |

Notes:

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

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

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

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

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

A4 Unintentional Radiated Emissions

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to all spurious emissions not directly related to the transmitter. The maximum permitted field strength is listed in Section 15.109. The EUT was set to operate in a transmit standby / receive mode.

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 : X

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 (b) Clause 15.109 |
| Measurement standard | ANSI C63.10:2009 |
| EUT sample number | S11 |
| Modification state | 0 |
| SE in test environment | S12 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23 |
| Photographs | Appendix F |

No emissions were detected within 10dB of the limits.

Notes:

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

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

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

Radiated emission limits 47 CFR Part 15: Clause 15.109 for all emissions:

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

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

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

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

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

| | See (i) | See (ii) | See (iii) | See (iv) |
|--|---------|----------|-----------|----------|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | | ✓ | | |
| Effect of Position of EUT cables & samples on emission levels | ✓ | | | |
| (i) Parameter defined by standard and / or single possible, refer to Appendix 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 Power Line Conducted Spurious Emissions

Preliminary scans were performed using a peak detector with the RBW = 10kHz. The power line conducted emission test applies to all spurious emissions not. The maximum permitted voltage level is listed in Section 15.207. 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 : X

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 15.207 |
| Measurement standard | ANSI C63.10:2009 |
| EUT sample number | S11 |
| Modification state | 0 |
| SE in test environment | S12 |
| SE isolated from EUT | None |
| EUT set up | Refer to Appendix C |
| Temperature | 23 |
| Photographs | Appendix F |

The worst case conducted emission measurements are listed below.

| Test Details: EUT Transmitting @ 927.6 MHz | | | | | |
|--|-----|------|------------------------------------|----------------|-----------------------|
| FREQ. (MHz) | DET | LINE | MEASURED RESULT (dB μ V) | MARGIN (dB) | LIMIT (dB μ V) |
| 0.161 | QP | N | 44.5 | 20.9 | 65.4 |
| 0.161 | Av | N | 35.0 | 20.4 | 55.4 |
| 0.201 | QP | N | 40.1 | 23.5 | 63.6 |
| 0.201 | Av | N | 30.9 | 22.7 | 53.6 |
| 0.241 | QP | N | 36.9 | 25.2 | 62.1 |
| 0.241 | Av | N | 27.4 | 24.7 | 52.1 |
| 0.403 | QP | L | 35.3 | 22.5 | 57.8 |
| 0.403 | Av | L | 32.7 | 15.1 | 47.8 |
| 0.444 | QP | L | 38.6 | 18.4 | 57.0 |
| 0.444 | Av | L | 37.5 | 9.5 | 47.0 |
| 0.483 | QP | L | 33.4 | 22.9 | 56.3 |
| 0.483 | Av | L | 31.2 | 15.1 | 46.3 |

Notes:

- 1 RBW= 10 kHz, testing was performed with CISPR16 compliant test receiver with QP detector and with an average detector.
- 2 Measurements were performed between 150kHz and 30MHz.

Conducted emission limits 47 CFR Part 15: Clause 15.207 for all emissions:

| Frequency of emission (MHz) | Conducted Limit (dB μ V) | |
|-----------------------------|------------------------------|-----------|
| | Quasi-peak | Average |
| 0.15 – 0.5 | 66 to 56* | 56 to 46* |
| 0.5 – 5 | 56 | 46 |
| 5 – 30 | 60 | 50 |

*Decreases with the logarithm of the frequency.

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

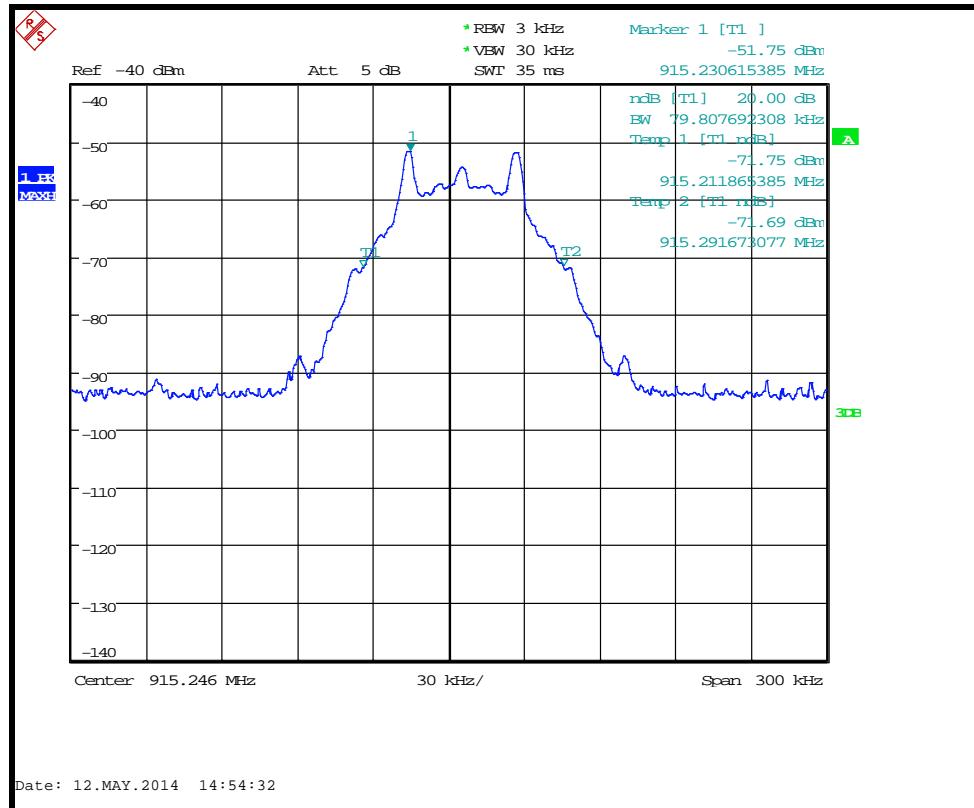
| | See (i) | See (ii) | See (iii) | See (iv) |
|--|---------|----------|-----------|----------|
| Effect of EUT operating mode on emission levels | ✓ | | | |
| Effect of EUT internal configuration on emission levels | | ✓ | | |
| Effect of Position of EUT cables & samples on emission levels | ✓ | |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

Appendix B:**Supporting Graphical Data**

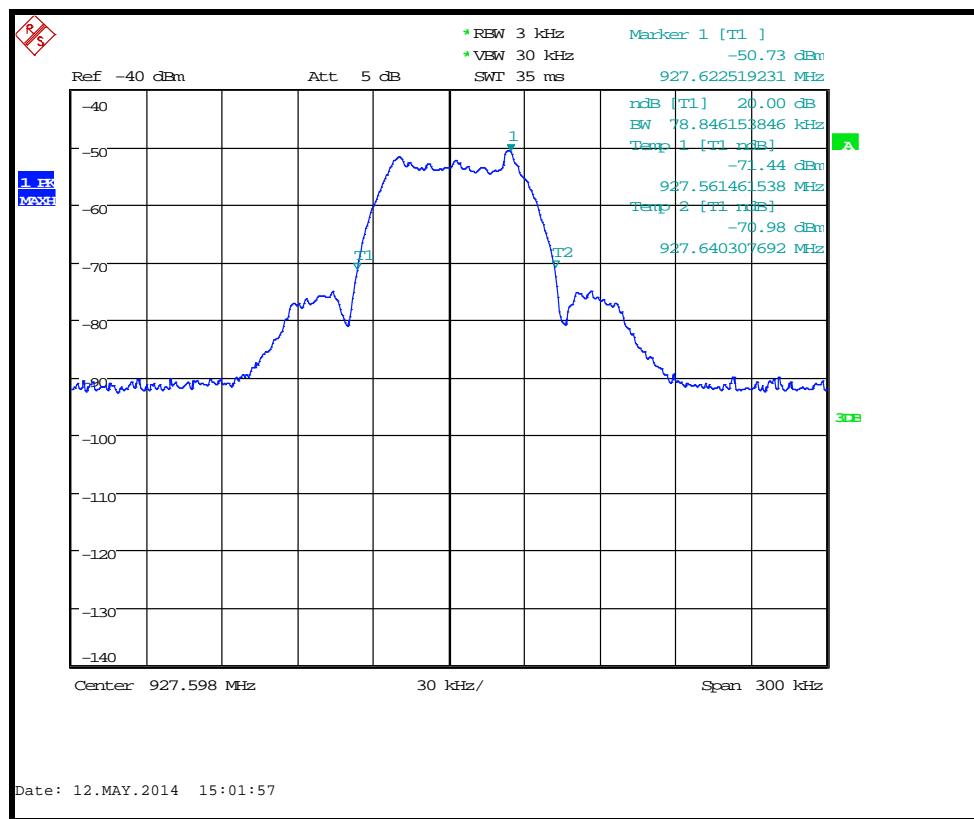
This appendix contains graphical data obtained during testing.

Notes:

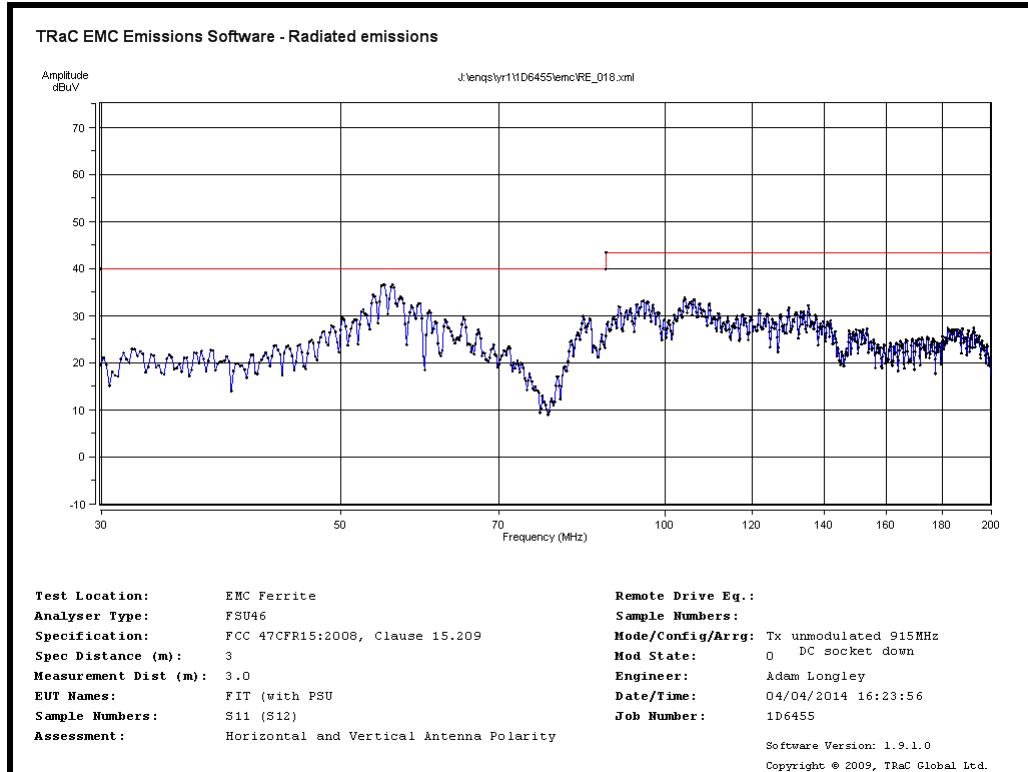
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power line conducted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



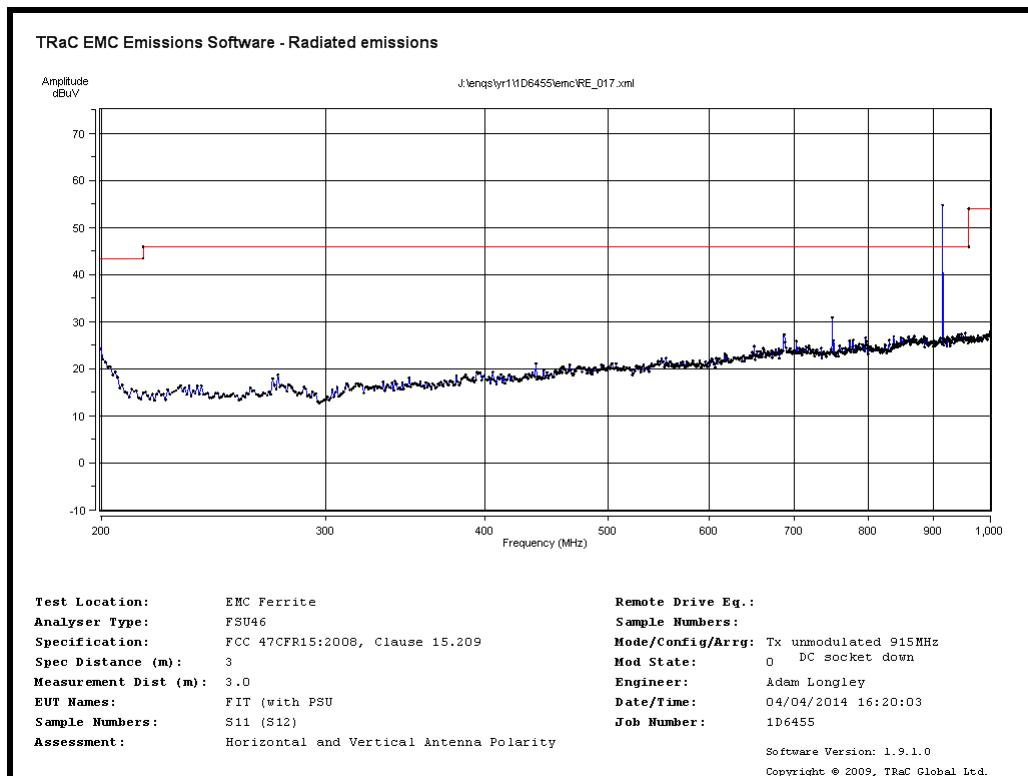
F_c = 915.25 MHz - 20dB Bandwidth



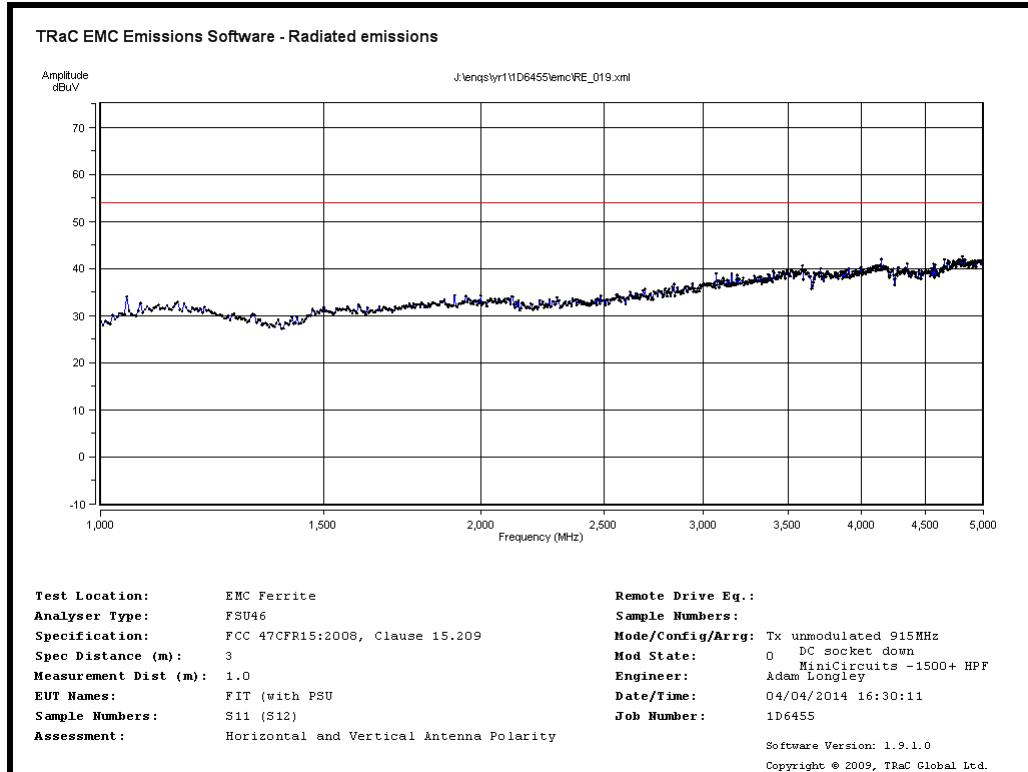
F_c = 927.6 MHz - 20dB Bandwidth



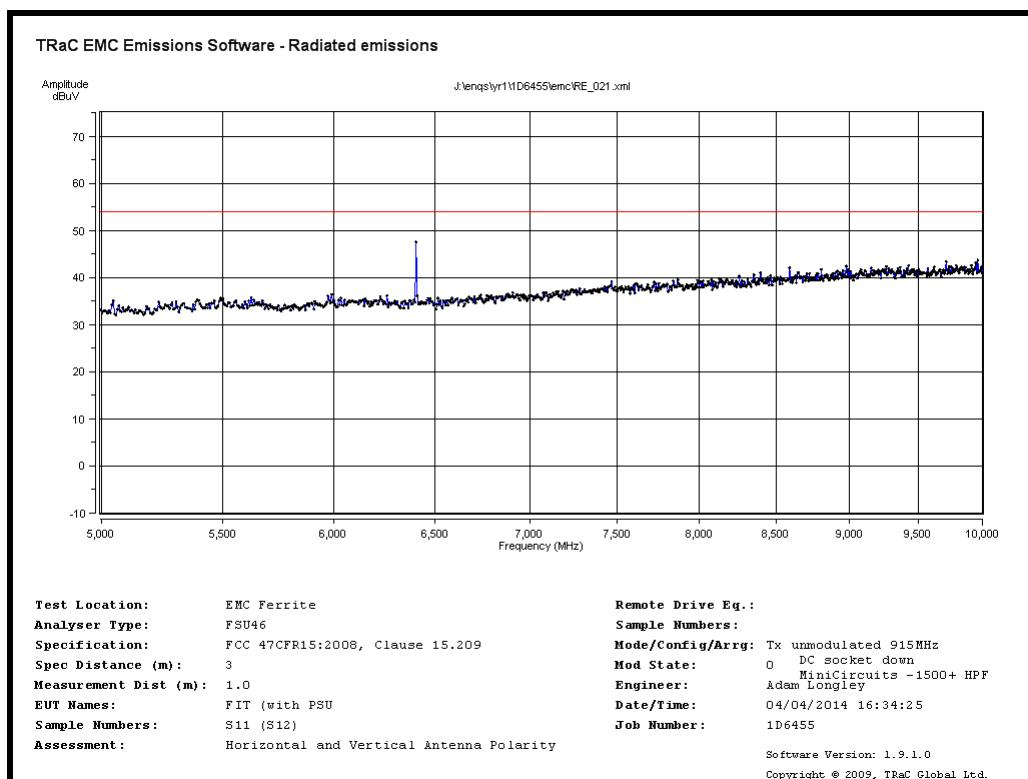
F_c = 915.25 MHz Radiated spurious emissions 30 MHz to 200 MHz



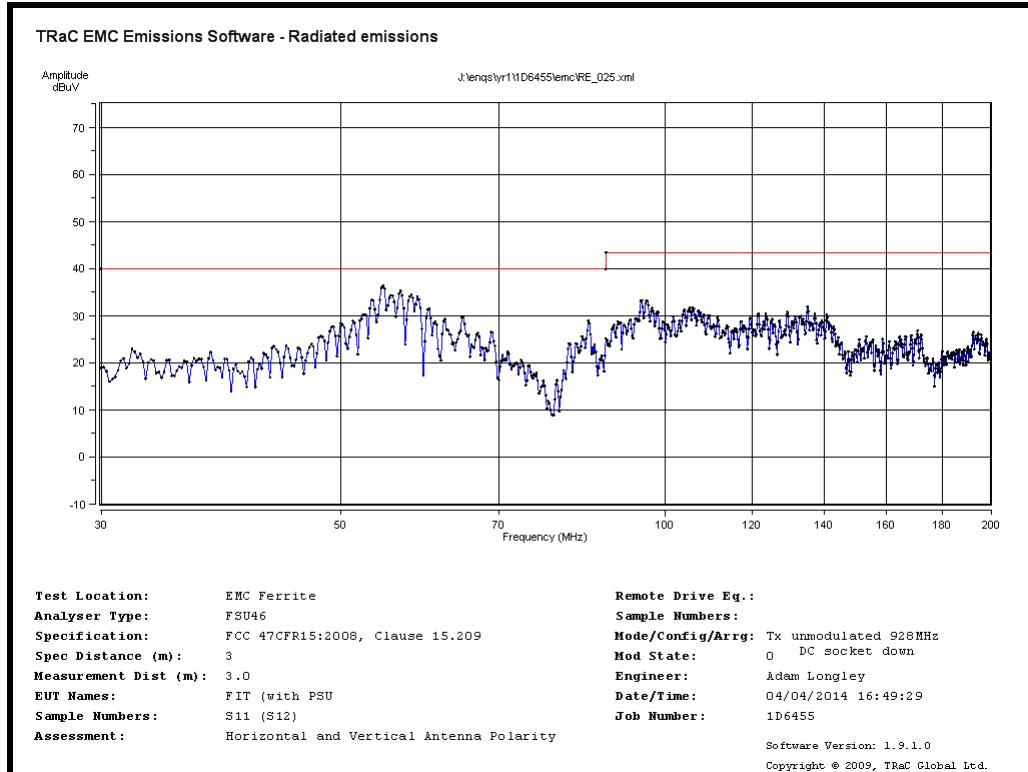
F_c = 915.25 MHz Radiated spurious emissions 200 MHz to 1 GHz



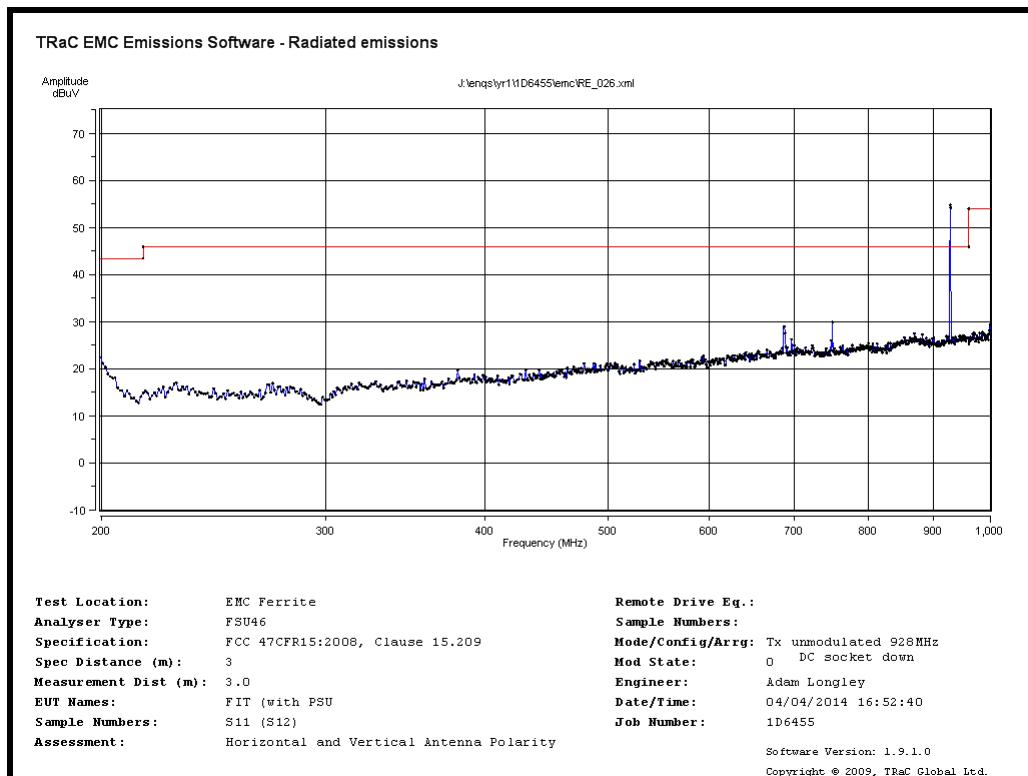
F_c = 915.25 MHz Radiated spurious emissions 1 GHz to 5 GHz



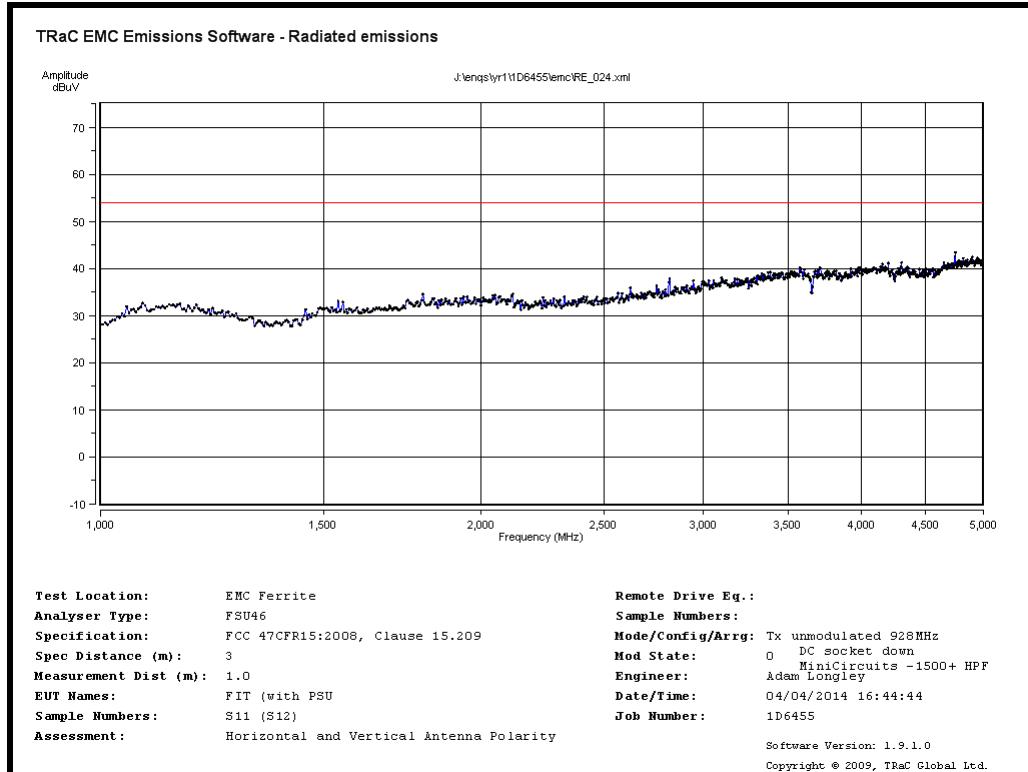
F_c = 902.5 MHz Radiated spurious emissions 5 GHz to 10 GHz



F_c = 927.6 MHz Radiated spurious emissions 30 MHz to 200 MHz

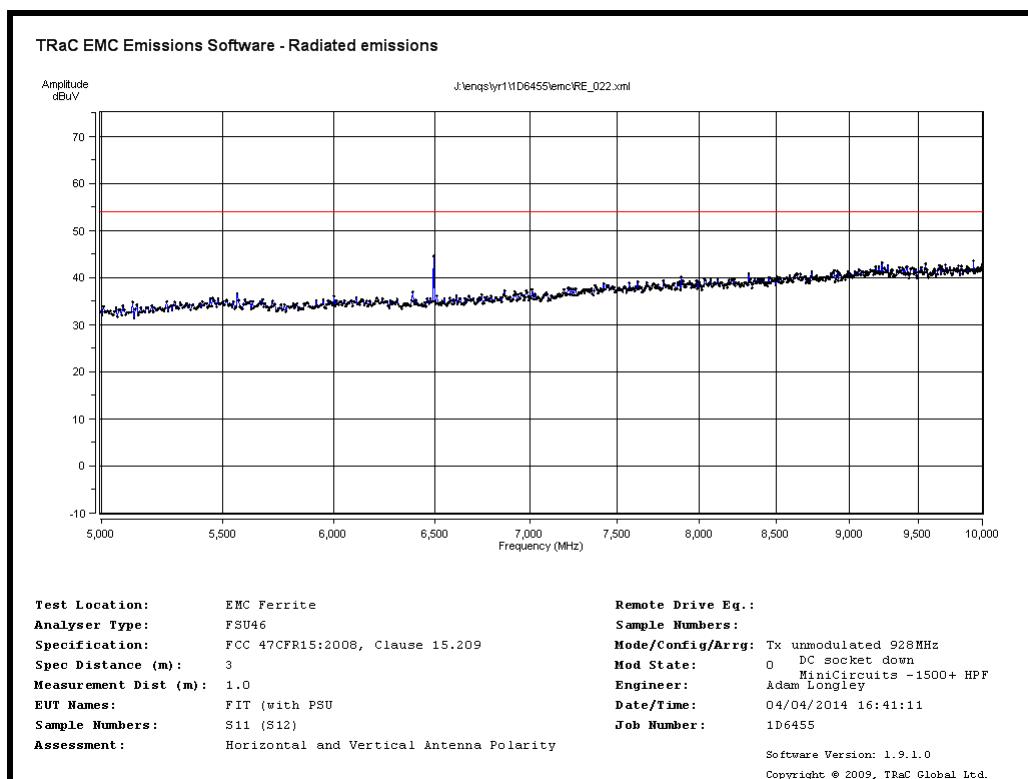


F_c = 927.6 MHz Radiated spurious emissions 200 MHz to 1 GHz



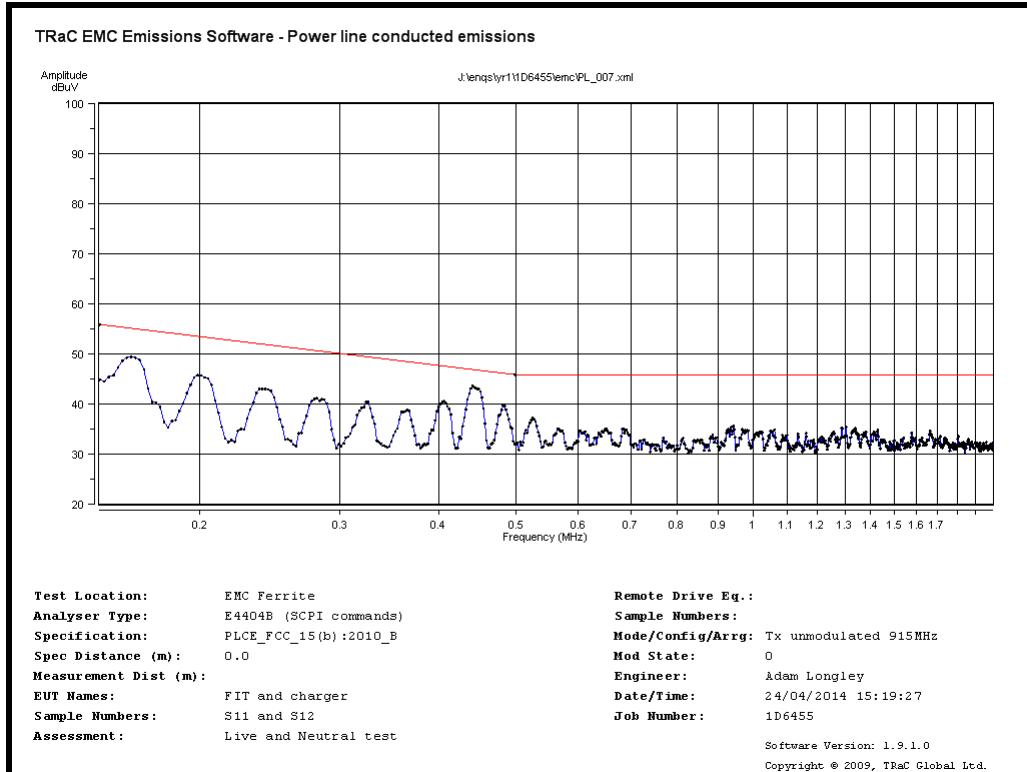
Fc = 927.6 MHz

Radiated spurious emissions 1 GHz to 5 GHz

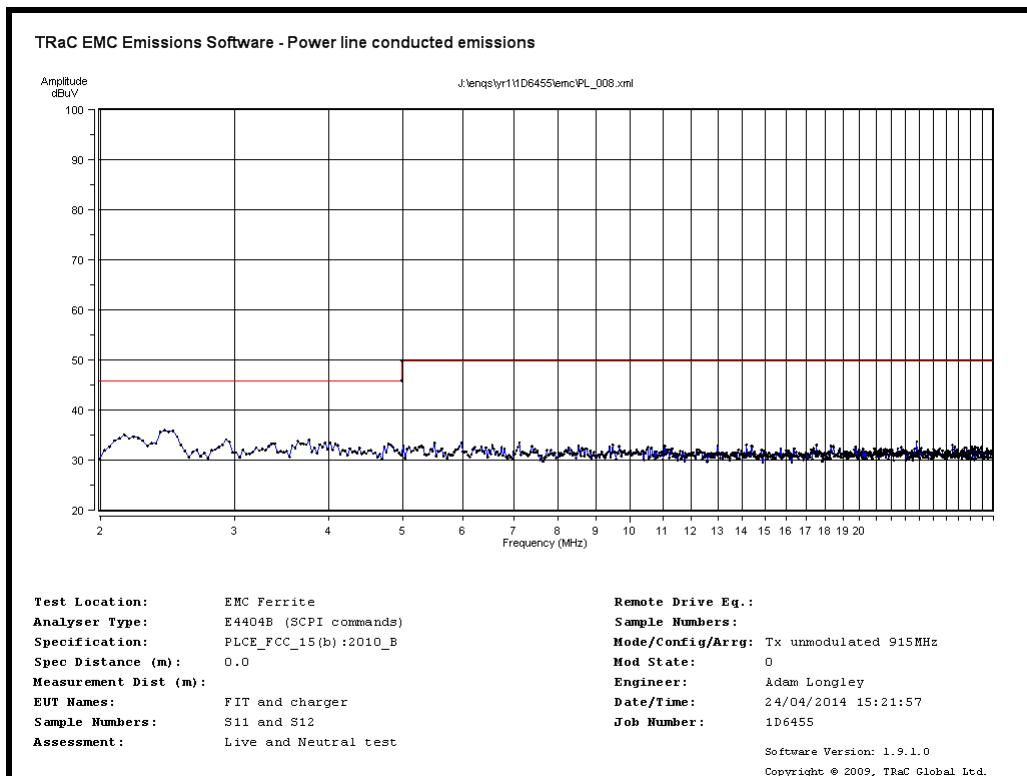


Fc = 927.6 MHz

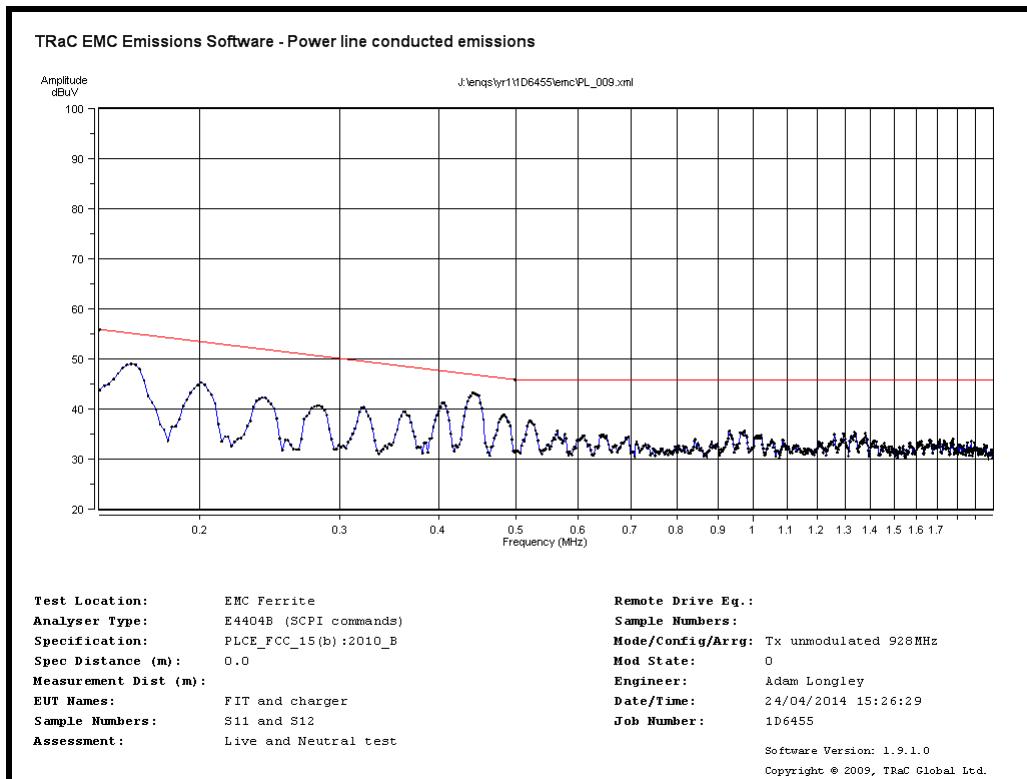
Radiated spurious emissions 5 GHz to 10 GHz



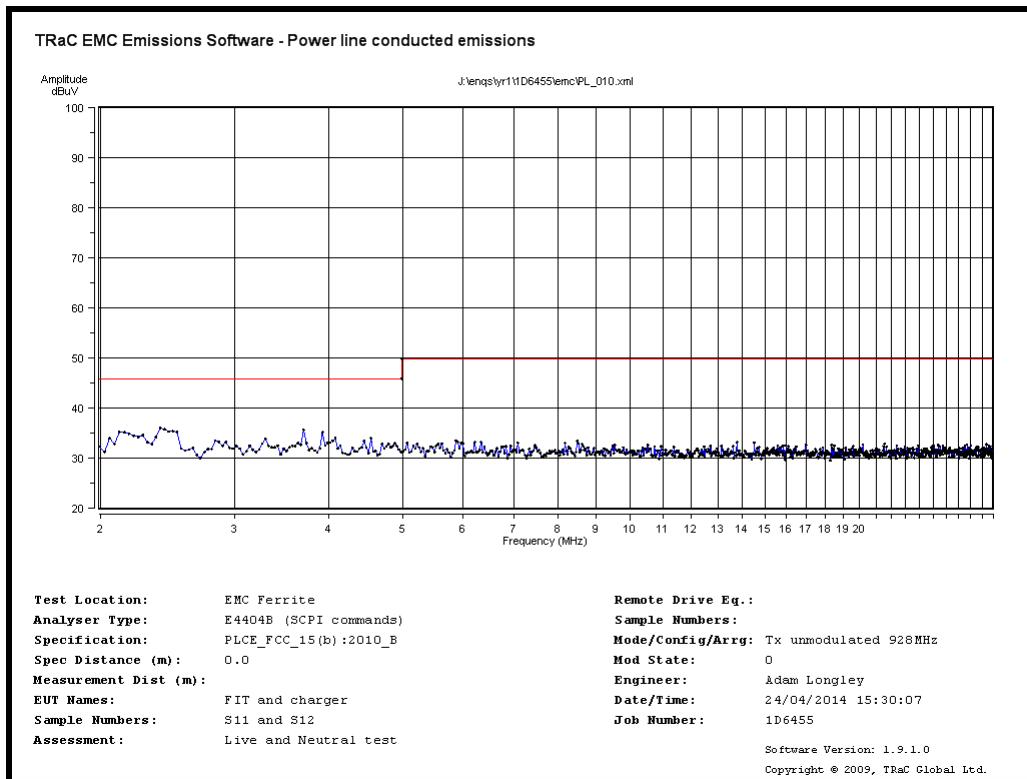
Transmitting at 915.25MHz – Power Line Conducted Spurious Emissions 150kHz to 2MHz



Transmitting at 915.25MHz – Power Line Conducted Spurious Emissions 2MHz to 30MHz



Transmitting at 927.6MHz – Power Line Conducted Spurious Emissions 150kHz to 2MHz



Transmitting at 927.6MHz – Power Line Conducted Spurious Emissions 2MHz to 30MHz

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 |
|------------|----------------------|----------------|
| S11 | OM247 FIT3 10-0142-4 | FITGMT014679 |

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

| Sample No. | Description | Identification |
|------------|--|----------------|
| S12 | FIT Charger | None |
| S17 | ACT-IR224UN-L+ Infra-red Computer Link | 003036 |
| S19 | Dell Latitude ATG D630 Laptop | G4S-L0045 |

C2) EUT Operating Mode During Testing.

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

| Test | Description of Operating Mode: |
|---|---|
| Carrier power Radiated Spurious Emissions Bandwidth Conducted Spurious Emissions | EUT actively transmitting on 915.25MHz or 927.6MHz as required. |

| Test | Description of Operating Mode: |
|---|--|
| Unintentional radiated spurious emissions | EUT active but non-transmitting on 915.25MHz or 927.6MHz as required |

The EUT firmware version number was : FIT_Application 915.25MHz based on 3.5.1

Note: This is a special test firmware to allow the use of continuous transmission, there is not enough spare memory on the chip to allow this in a full official release of the firmware.

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 : S11
Tests : Radiated Emissions

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|----------|-------------------------------|--------------|---------------------|
| DC power | 2 core DC power cable | 1.8m | Plug-top PSU S12 |

Sample : S11
Tests : Occupied Band Width

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|----------|-------------------------------|--------------|---------------------|
| DC power | 2 core DC power cable | 1.8m | Plug-top PSU S12 |

Occupied Band Width measurements were taken using a test fixture as there was no sample supplied with an RF connection.

C5 Details of Equipment Used

For Radiated Measurements:

| TRAC REF/RFG No. | Type | Description | Manufacturer | Date Calibrated. |
|------------------------|--------|--------------------------|-----------------|------------------|
| REF886 | ATS | Ferrite Lined Chamber | TRaC | 10/05/13 |
| 095 | | Biconical Antenna | EMCO | 09/05/13 |
| 191 | | Log Periodic Antenna | EMCO | 09/05/13 |
| RFG682 | HL050 | GHz Log Periodic Antenna | Rhode & Schwarz | 16/07/13 |
| RFG629 | | Horn Antenna | Q-Par | 19/09/13 |
| REF927 | 310 | Pre-Amp (9kHz – 1GHz) | Sonoma | 15/09/11 |
| REF913 | 8449B | Pre-Amp (1 – 26.5GHz) | Agilent | 05/02/14 |
| RFG452 | | SMA RF coaxial cable | | 03/07/13 |
| REF881 | | N-Type RF coaxial cable | | 01/07/13 |
| REF882 | | N-Type RF coaxial cable | | 01/07/13 |
| REF884 | | N-Type RF coaxial cable | | 01/07/13 |
| REF885 | | N-Type RF coaxial cable | | 01/07/13 |
| RFG832 | | K-Type RF coaxial cable | Teledyne | 04/07/13 |
| RFG919 | | K-Type RF coaxial cable | Teledyne | 04/07/13 |
| REF910 | FSU | Spectrum Analyser | Rhode & Schwarz | 31/03/14 |
| REF837 | E4440A | Spectrum Analyser | Agilent | 10/05/13 |

For Conducted RF Measurements

| TRAC REF/RFG No. | Type | Description | Manufacturer | Date Calibrated. |
|------------------------|--------|-------------------|-----------------|------------------|
| REF910 | FSU | Spectrum Analyser | Rhode & Schwarz | 31/03/14 |
| REF837 | E4440A | Spectrum Analyser | Agilent | 10/05/13 |

For Power Line Conducted Measurements

| TRAC REF/RFG No. | Type | Description | Manufacturer | Date Calibrated. |
|------------------------|---------|--------------------|--------------|------------------|
| RFG674 | ESH3-Z2 | Pulse Limiter | R & S | 14/04/14 |
| RFG295 | - | BNC coaxial cable | - | 24/12/13 |
| RFG299 | - | BNC coaxial cable | - | 24/12/13 |
| RFG189 | ESH3-Z5 | LISN | R & S | 17/06/13 |
| RFG125 | ESHS10 | Measuring Receiver | R & S | 24/04/14 |

Appendix D:

Additional Information

No Additional Information was provided by the client to support the assessment.

Appendix E:

Calculation of the duty cycle correction factor

Adjustment due to short duty cycle :

Adjustment (dB) = $20\log(\text{Max. Pulse Length} / 100\text{ms})$

Maximum Pulse Length at 915.25MHz : 11.7ms

Maximum Pulse Length at 927.6MHz : 8ms

Worst case adjustment = $20\log(11.7/100) = -18.6\text{dB}$

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. Power line conducted emissions arrangement.



Photograph 1



Photograph 2



Photograph 3

Appendix G:**MPE Calculation****KDB 447498 D01****47 CFR §§1.1307 and 2.1091**

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 0.6mW/cm^2 power density limit, as required under FCC rules

Prediction of MPE limit at a given distance

Equation from KDB 447498 D01

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

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^2) | Distance (R) cm required to be less than 0.6mW/cm^2 |
|----------------------------|------------------|--|--|
| 927.6 | 0.00003 | 0.6 | 0.003 |

