A RADIO TEST REPORT

FOR

G4S Monitoring Technologies LTD

ON

OM247 Home Station 915MHz 10-0166-4

DOCUMENT NO.TRA-016455WUS5A

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TRaC Wireless Test Report : TRA-016455WUS5A

Applicant : G4S Monitoring Technologies Ltd.

Apparatus : OM247 Home Station 915MHz 10-0166-4

Specification(s) : CFR47 Part 15.249

Purpose of Test : **Certification**

FCCID : **2ACGBHST915**

Authorised by : 

: Radio Product Manager

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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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As Above

1.4 Apparatus Assessed

The following apparatus was assessed between 07th July 2014 – 11th July 2014:

OM247 Home Station 915MHz 10-0166-4

The above device is a Monitoring 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:

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 **General Test Procedures**

2.1 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.

2.2 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.

2.3 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.

2.4 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.

2.5 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.

2.6 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).

Section 3: Measurement Uncertainty

3.1 Measurement Uncertainty Values

For the test data recorded the following measurement uncertainty was calculated:

Test type	Quantity	Quantity frequency range	Uncertainty
Radiated electric field emissions 3m alternative test site Effective Radiated Power 3m alternative test site	Amplitude	30MHz to 300MHz Horizontal	±4.6dB
		30MHz to 300MHz Vertical	±5.1dB
		300MHz to 1000MHz Horizontal	±5.2dB
		300MHz to 1000MHz Vertical	±5.5dB
		1GHz to 26.5GHz Horizontal and Vertical	±4.1dB
Conducted emissions		N/A	±0.9 dB
Absolute RF power (via antenna connector)		N/A	±0.9 dB
PSD		N/A	±0.9 dB
Frequency Range	Frequency	dc to 26.5GHz	3.611kHz

Section 4: Modifications

4.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A: Formal Emission Test Results

Abbreviations used in the tables in this appendix:

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

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

A1 Transmitter Intentional Emission Radiated

Test Details:	
Regulation	Part 15.249 (a)
Measurement standard	ANSI C63.10:2009
EUT sample number	S37
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	23˚C
Photographs	Appendix F

FREQ. (MHz)	MEASUREMENT Rx. READING (dBµV)	CABLE LOSS (dB)	ANT FACTOR (dB/m)	PRE AMP (dB)	DUTY CYCLE ADJUSTMENT (dB)	FIELD STRENGTH (dBµV/m)	FIELD STRENGTH (mV/m)
915.25	76.5	4.2	22.2	N/A	N/A	102.9	139.6
915.25	76.5	4.2	22.2	N/A	-18.6	84.3	16.4
927.6	76.5	4.3	22.6	N/A	N/A	103.4	147.9
927.6	76.5	4.3	22.6	N/A	-18.6	84.8	17.4
Limit value @ fc			Peak			501.2 mV/m @ 3m	
			Corrected			50mV/m @ 3m	

Notes:
1 Results quoted are extrapolated as indicated
2 Receiver detector @ fc 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 orthagonal planes.
Maximum results recorded

A2 Transmitter Bandwidth

Test Details:	
Regulation	Part 15.215 (c)
Measurement standard	ANSI C63.10:2009
EUT sample number	S38
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	20˚C

Band occupancy @ -20 dBc			
FREQ. (MHz)	**f lower (MHz)**	**f higher (MHz)**	**Occ BW (kHz)**
915.25	915.201442308	915.289903846	88.461538462
927.6	927.536538462	927.657211538	120.673076923

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 filed emission test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit as required.

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

3m open area test site : [ ] 3m alternative test site : [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	S37
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22˚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 (dBµV)**	**CABLE LOSS (dB)**	**ANT FACT. (dB/m)**	**PRE AMP (dB)**	**DUTY CYCLE (dB)**	**1m - 3m EXTRAP. (dB)**	**FIELD ST'GH (dBµV/m)**	**FIELD ST'GH (µV/m)**	**LIMIT (µV/m)**
QP	32.000	49.8	0.7	12.5	31.6	N/A	N/A	31.4	37.2	100
Pk	1830.467	63.1	5.1	27.3	34.6	N/A	N/A	60.9	1109.17	5000
Av	1830.467	63.1	5.1	27.3	34.6	-18.6	N/A	42.3	130.32	500
Pk	2745.712	56.0	4.7	30.9	34.7	N/A	N/A	56.9	699.84	5000
Av	2745.712	56.0	4.7	30.9	34.7	-18.6	N/A	38.3	82.22	500
Pk	3660.966	57.3	6.7	34.0	34.7	N/A	N/A	63.3	1462.18	5000
Av	3660.966	57.3	6.7	34.0	34.7	-18.6	N/A	44.7	171.79	500

Test Details: EUT Transmitting @ 927.6 MHz										
DET	**FREQ. (MHz)**	**MEAS Rx (dBµV)**	**CABLE LOSS (dB)**	**ANT FACT. (dB/m)**	**PRE AMP (dB)**	**DUTY CYCLE (dB)**	**1m - 3m EXTRAP. (dB)**	**FIELD ST'GH (dBµV/m)**	**FIELD ST'GH (µV/m)**	**LIMIT (µV/m)**
QP	32.000	49.5	0.7	12.5	31.6	N/A	N/A	31.1	35.9	100
Pk	1855.163	60.5	5	27.4	34.6	N/A	N/A	58.3	822.24	5000
Av	1855.163	60.5	5	27.4	34.6	-18.6	N/A	39.7	96.61	500
Pk	2782.793	59.1	4.9	31	34.8	N/A	N/A	60.2	1023.29	5000
Av	2782.796	59.1	4.9	31	34.8	-18.6	N/A	41.6	120.23	500
Pk	3710.351	57.6	6.5	34	34.7	N/A	N/A	63.4	1479.11	5000
Av	3710.351	57.6	6.5	34	34.7	-18.6	N/A	44.8	173.78	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 ≥ RBW
Average	RBW= 1MHz, VBW ≥ RBW

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

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

Frequency of emission (MHz)	Field strength μV/m	Measurement Distance m	Field strength dBμV/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 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	S37
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22˚C
Photographs	Appendix F

Test Details: EUT Idle										
DET	**FREQ. (MHz)**	**MEAS Rx (dBµV)**	**CABLE LOSS (dB)**	**ANT FACT. (dB/m)**	**PRE AMP (dB)**	**DUTY CYCLE (dB)**	**1m - 3m EXTRAP. (dB)**	**FIELD ST'GH (dBµV/m)**	**FIELD ST'GH (µV/m)**	**LIMIT (µV/m)**
Pk	32.000	56.9	0.7	12.5	31.6	N/A	N/A	38.5	84.1	1000
QP	32.000	49.2	0.7	12.5	31.6	N/A	N/A	30.8	34.7	100

No further 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 ≥ RBW
Average	RBW= 1MHz, VBW ≥ RBW

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

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

Frequency of emission (MHz)	Field strength μV/m	Measurement Distance m	Field strength dBμV/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 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 : ☒

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	S37
Modification state	0
SE in test environment	None
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 @ 915.25 MHz					
FREQ. (MHz)	**DET**	**LINE**	**MEASURED RESULT (dBµV)**	**MARGIN (dB)**	**LIMIT (dBµV)**
0.150	QP	N	51.7	-14.3	66.0
0.150	Av	N	34.6	-21.4	56.0
0.185	QP	L	47.3	-17.0	64.3
0.185	Av	L	29.3	-25.0	54.3
0.245	QP	N	41.1	-20.8	61.9
0.245	Av	N	37.5	-14.5	51.9
0.295	QP	N	40.1	-20.3	60.4
0.295	Av	N	30.1	-20.2	50.4
0.380	QP	L	41.3	-17.0	58.3
0.380	Av	L	34.1	-14.1	48.3
2.565	QP	N	36.9	-19.1	56.0
2.565	Av	N	25.0	-21.0	46.0
3.960	QP	L	34.0	-22.0	56.0
3.960	Av	L	24.4	-21.6	46.0
7.950	QP	N	26.3	-33.7	60.0
7.950	Av	N	18.6	-31.4	50.0

Test Details: EUT Transmit Standby					
FREQ. (MHz)	**DET**	**LINE**	**MEASURED RESULT (dBµV)**	**MARGIN (dB)**	**LIMIT (dBµV)**
0.155	QP	L	53.5	-12.2	65.7
0.155	Av	L	21.0	-34.7	55.7
0.160	QP	N	37.9	-27.6	65.5
0.160	Av	N	14.2	-41.3	55.5
0.185	QP	L	48.5	-15.8	64.3
0.185	Av	L	30.7	-23.5	54.3
0.250	QP	N	43.6	-18.2	61.8
0.250	Av	N	40.4	-11.3	51.8
0.380	QP	L	41.5	-16.8	58.3
0.380	Av	L	30.6	-17.7	48.3
0.495	QP	L	35.1	-21.0	56.1
0.495	Av	L	28.1	-17.9	46.1
2.550	QP	N	35.2	-20.8	56.0
2.550	Av	N	25.0	-21.0	46.0
4.160	QP	N	33.7	-22.3	56.0
4.160	Av	N	24.3	-21.7	46.0
10.095	QP	L	24.0	-36.0	60.0
10.095	Av	L	17.5	-32.5	50.0

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 (dBµV)	
	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:

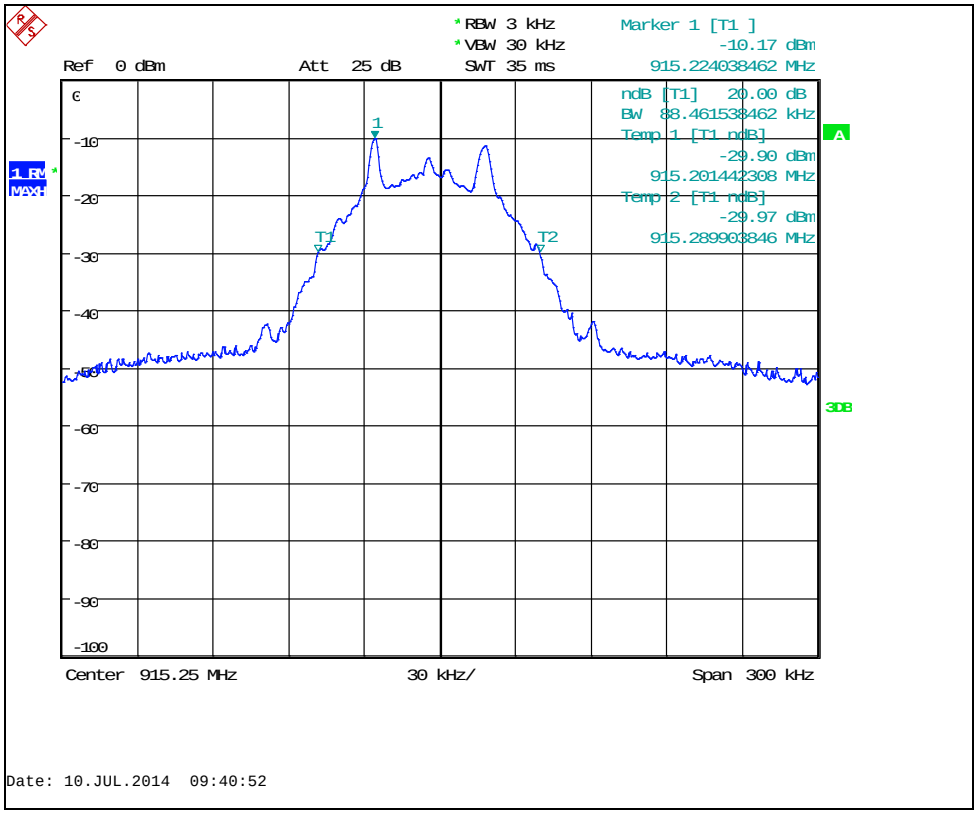
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A.

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

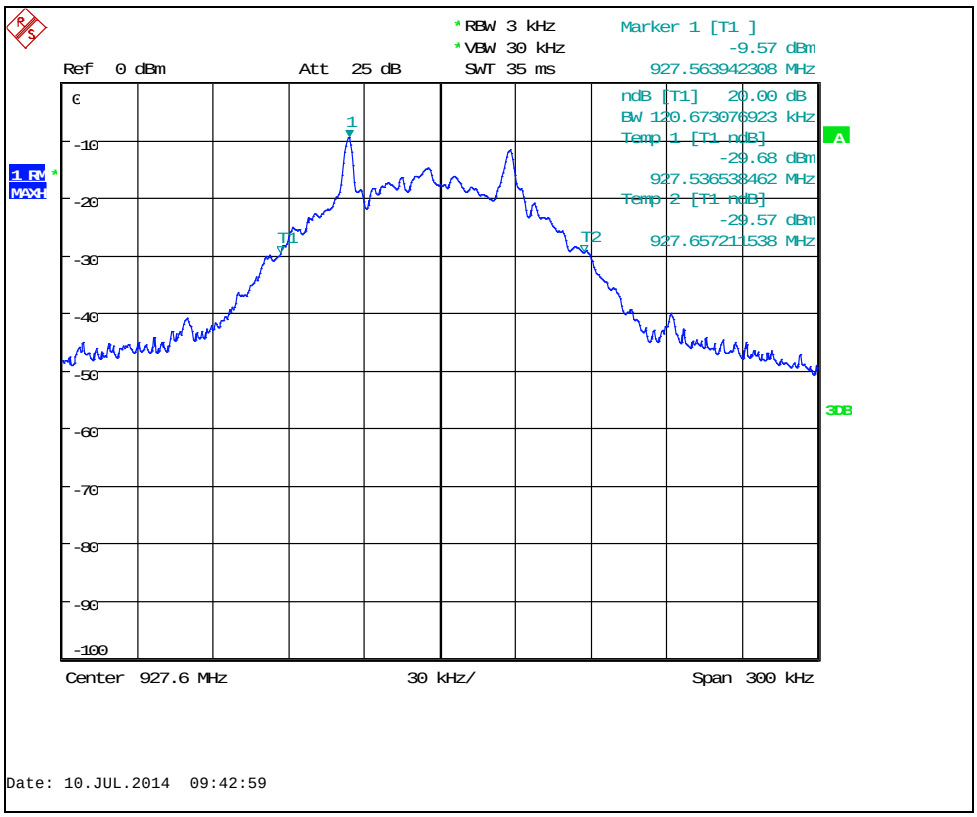
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

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

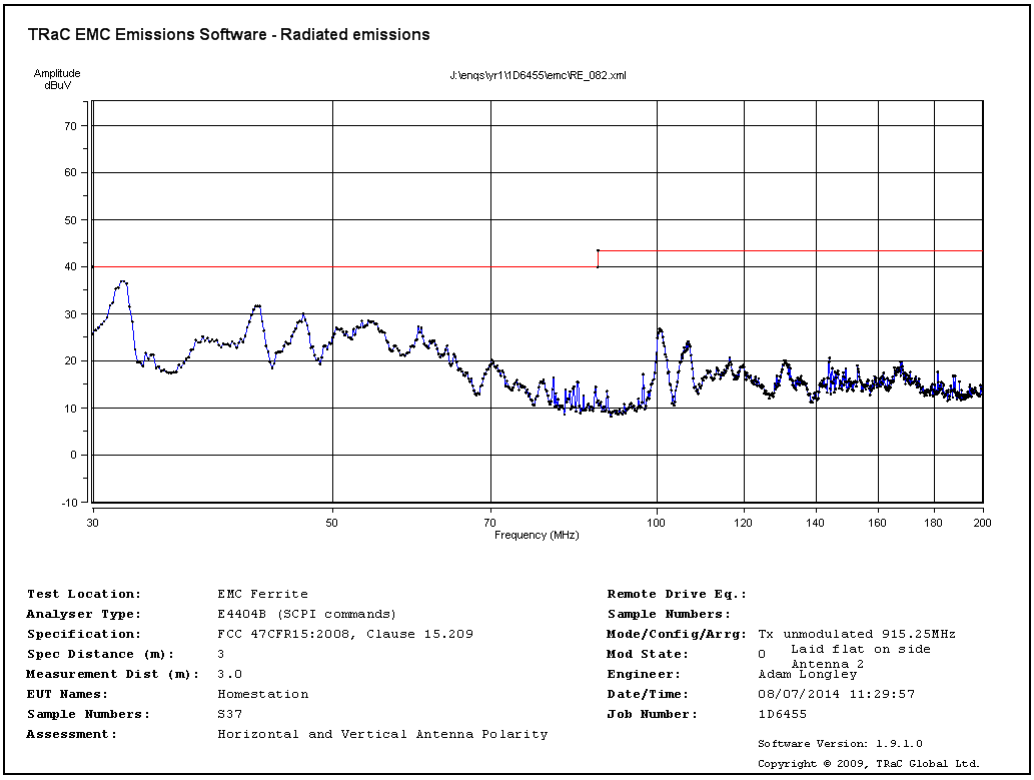
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



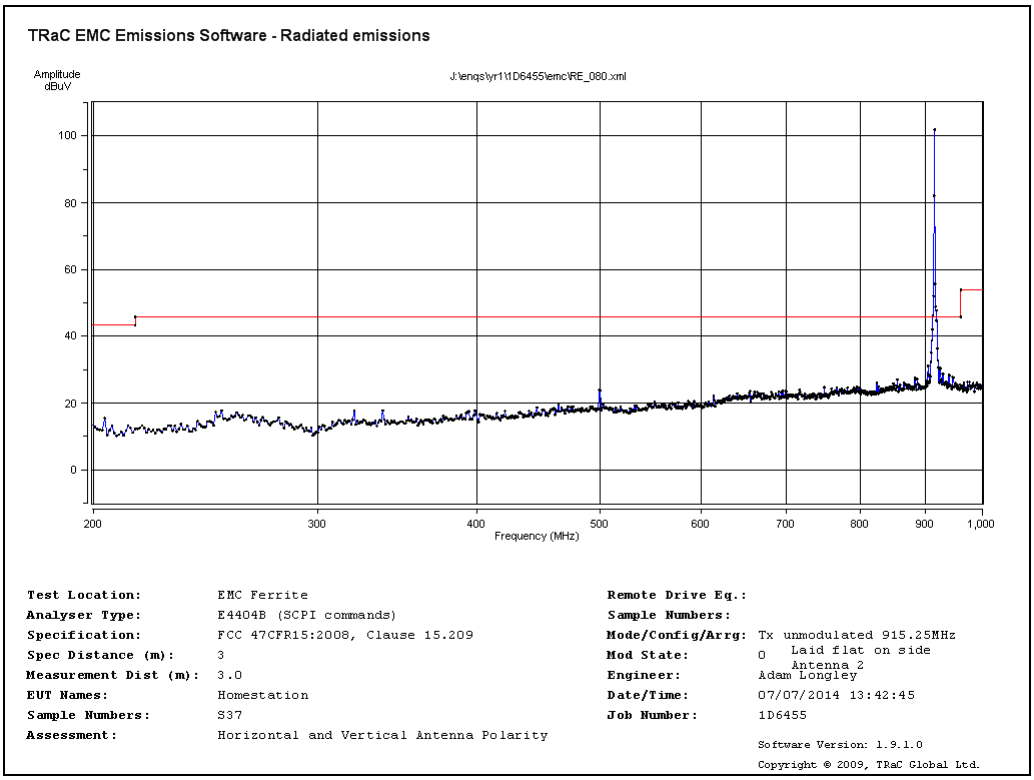
Fc = 915.25 MHz - 20dB Bandwidth



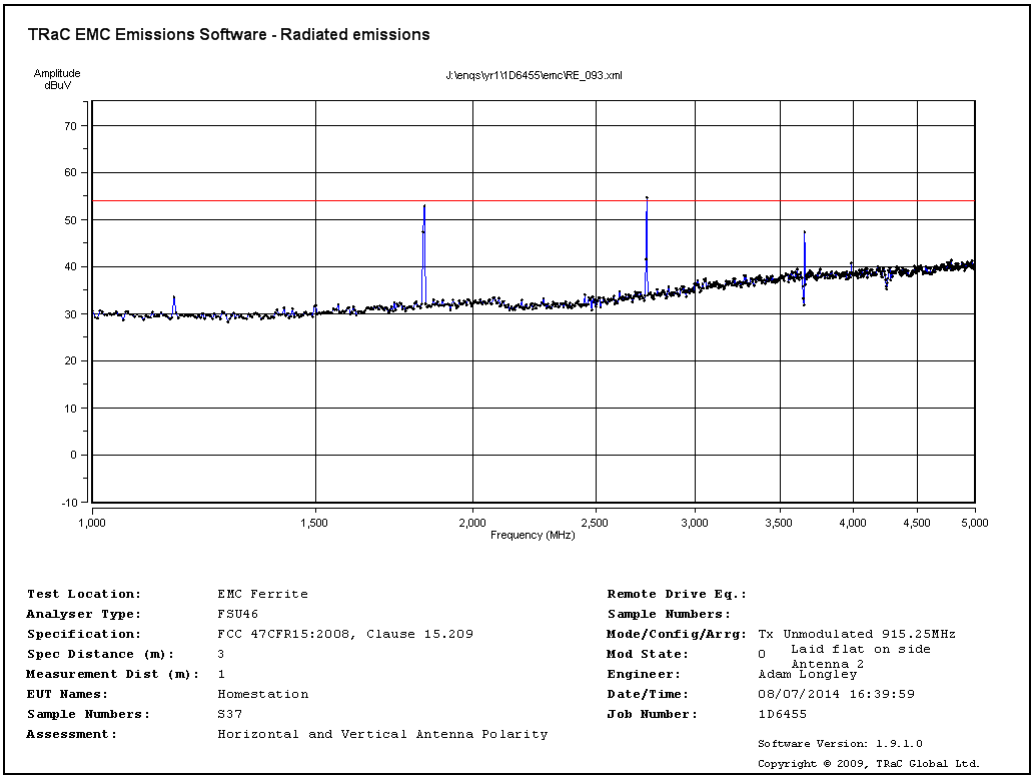
Fc = 927.6 MHz - 20dB Bandwidth



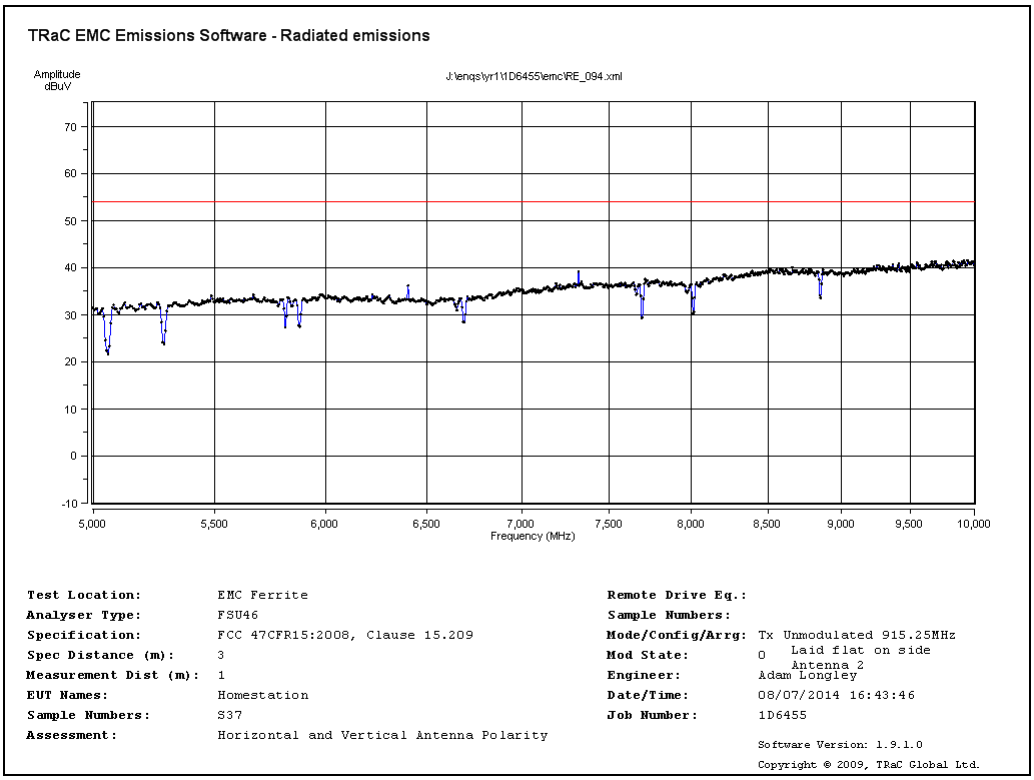
Fc = 915.25 MHz Radiated spurious emissions 30 MHz to 200 MHz



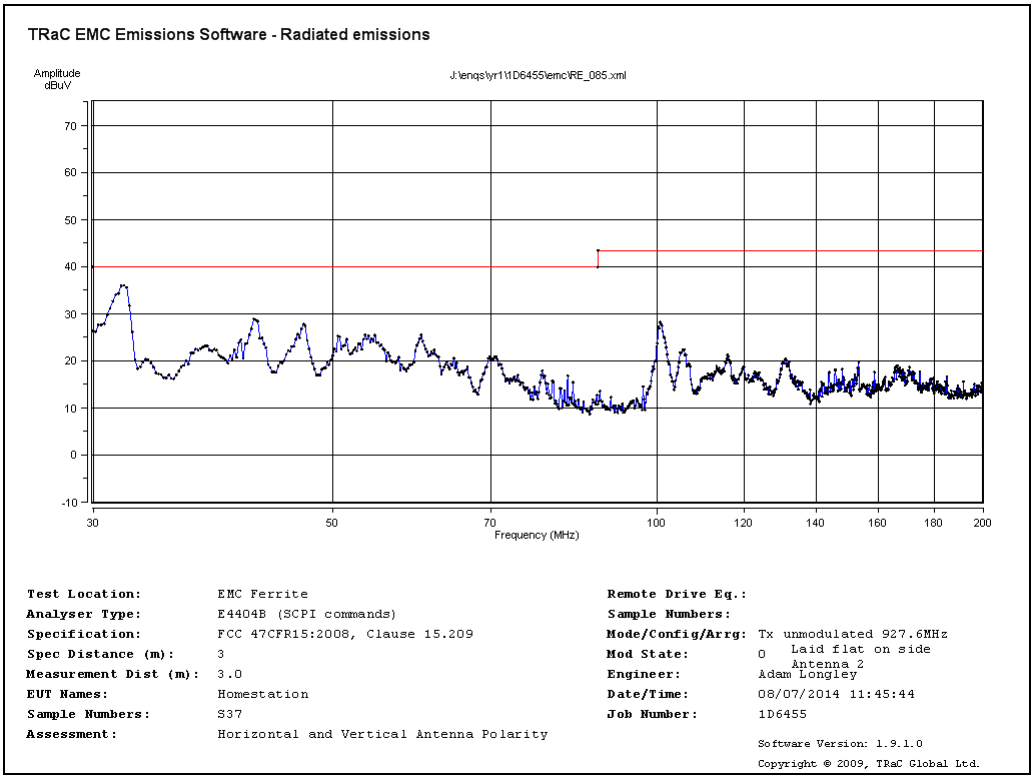
Fc = 915.25 MHz Radiated spurious emissions 200 MHz to 1 GHz



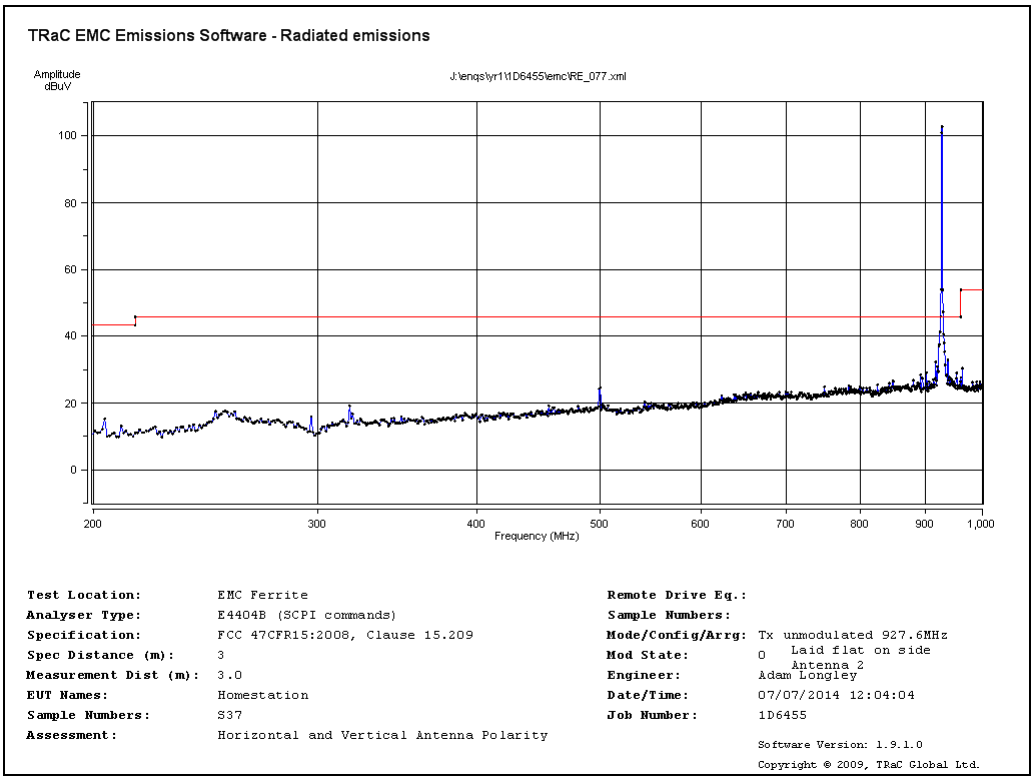
Fc = 915.25 MHz Radiated spurious emissions 1 GHz to 5 GHz



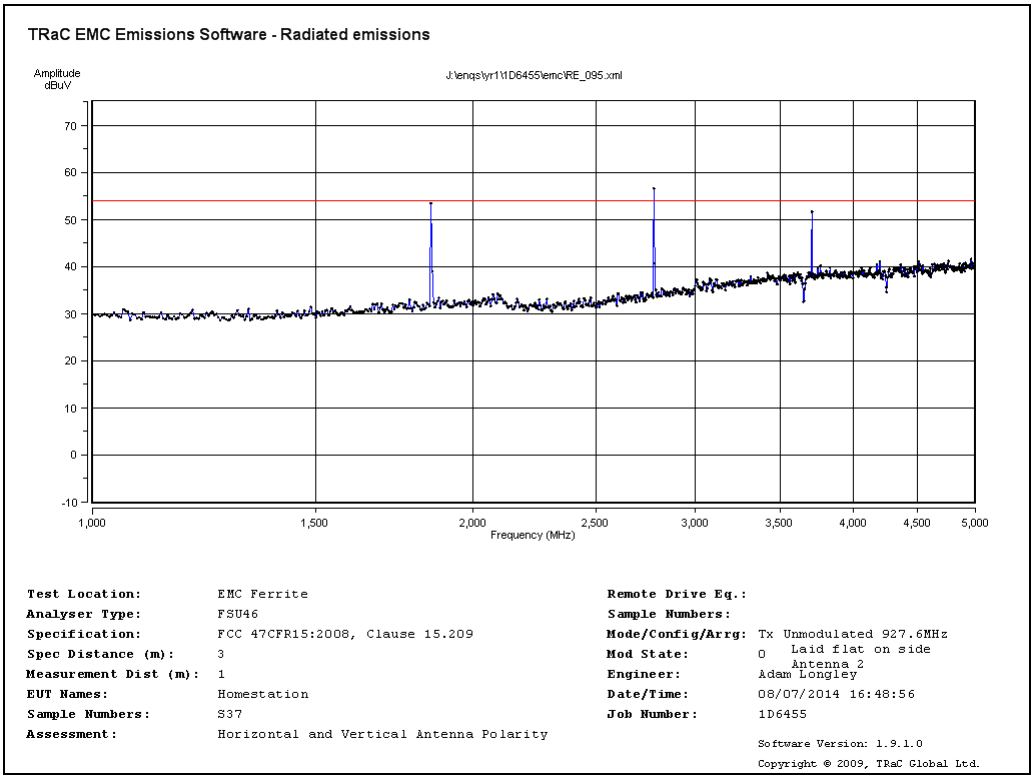
Fc = 915.25 MHz Radiated spurious emissions 5 GHz to 10 GHz



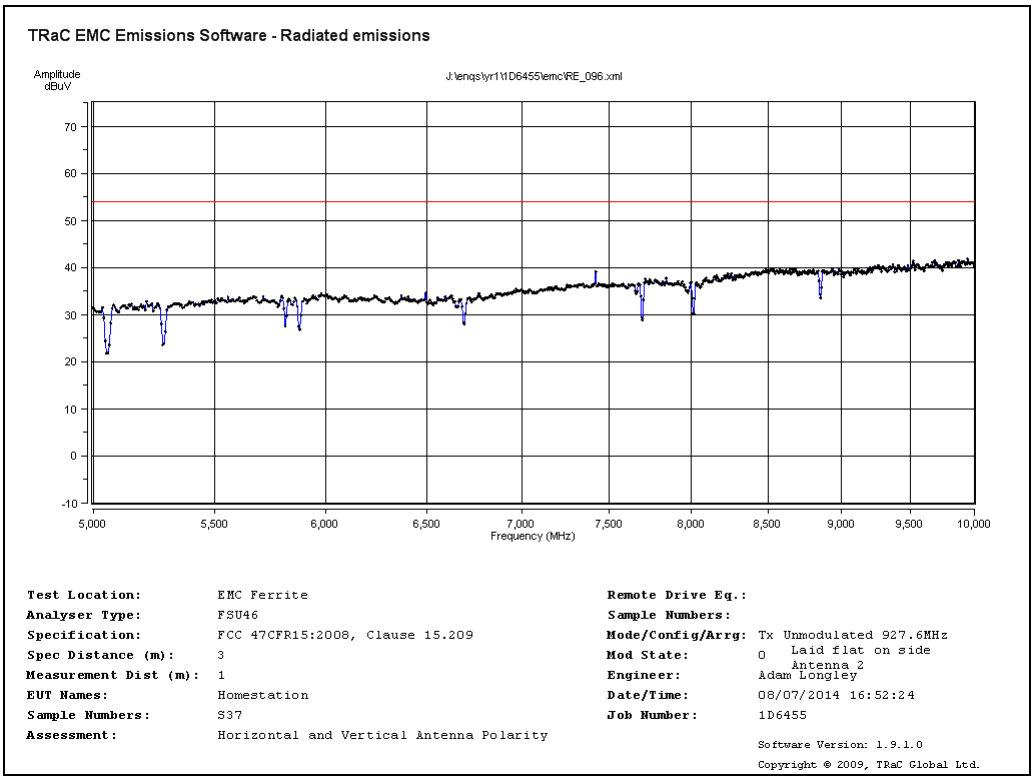
Fc = 927.6 MHz Radiated spurious emissions 30 MHz to 200 MHz



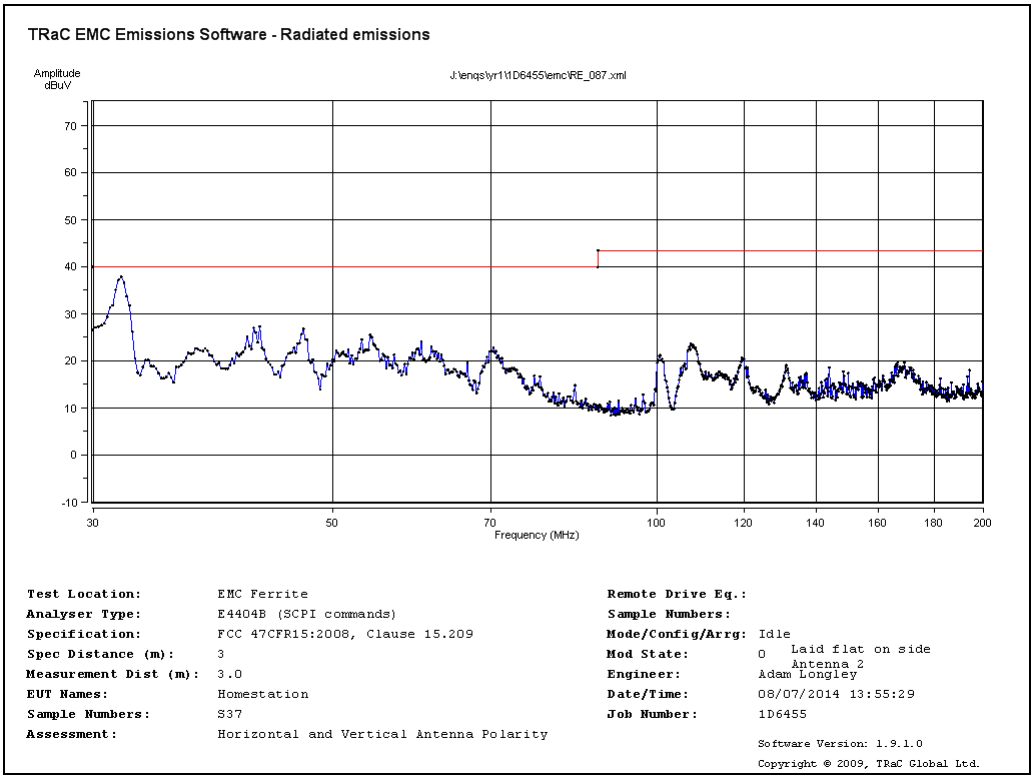
Fc = 927.6 MHz Radiated spurious emissions 200 MHz to 1 GHz



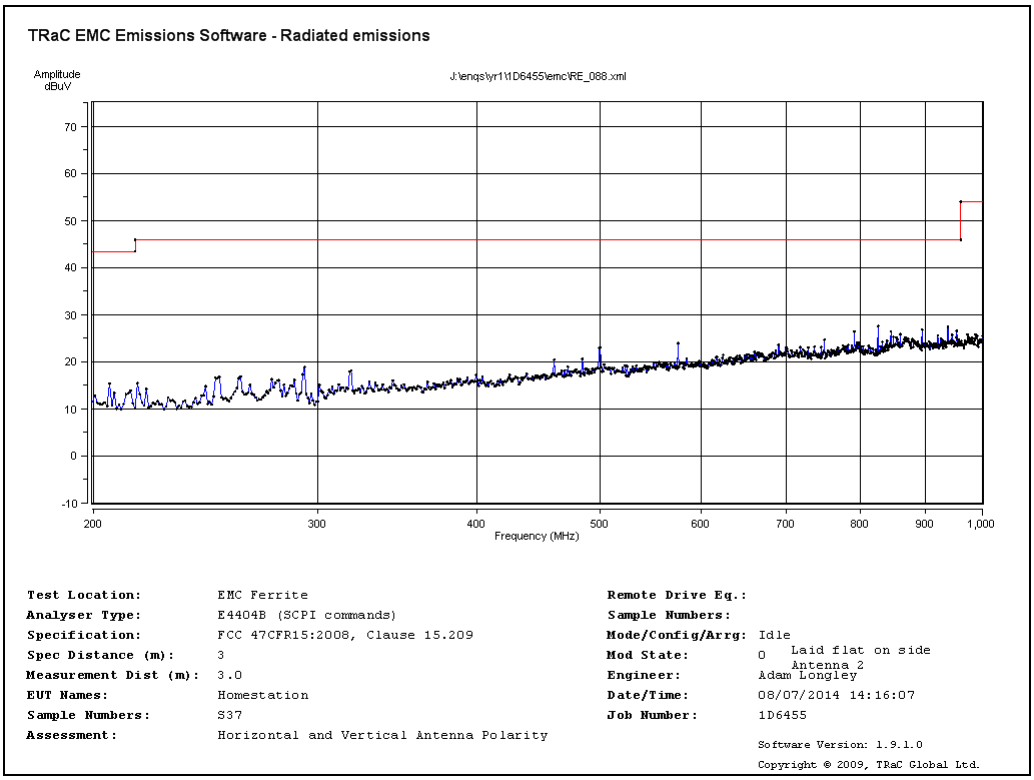
Fc = 927.6 MHz Radiated spurious emissions 1 GHz to 5 GHz



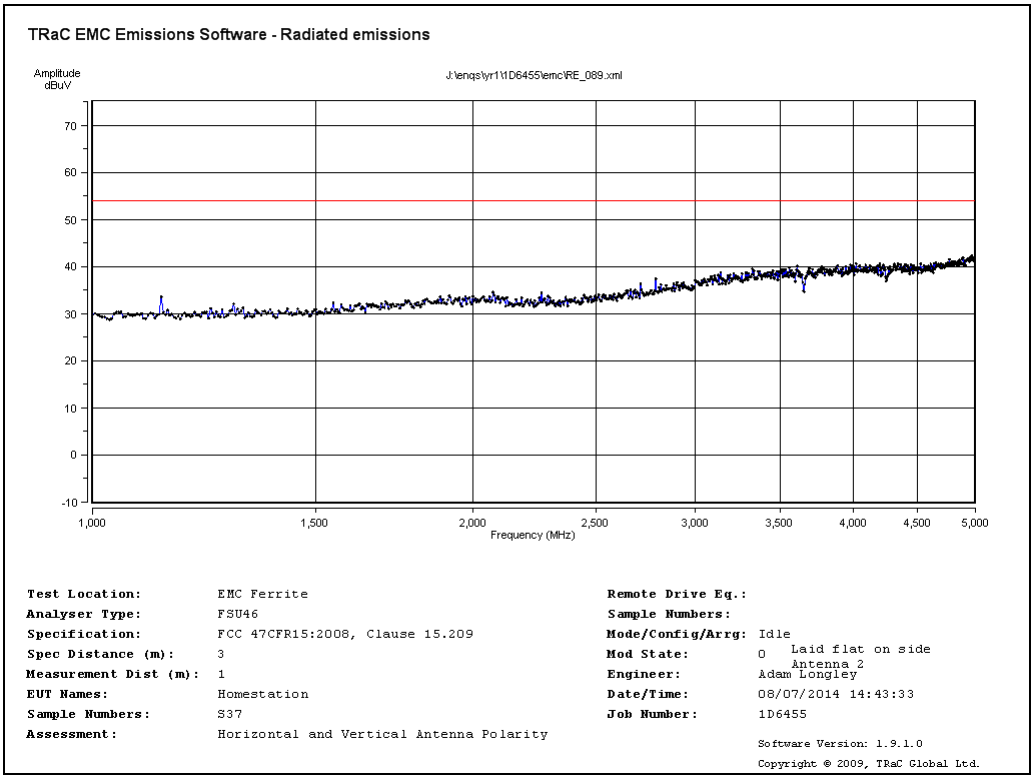
Fc = 927.6 MHz Radiated spurious emissions 5 GHz to 10 GHz



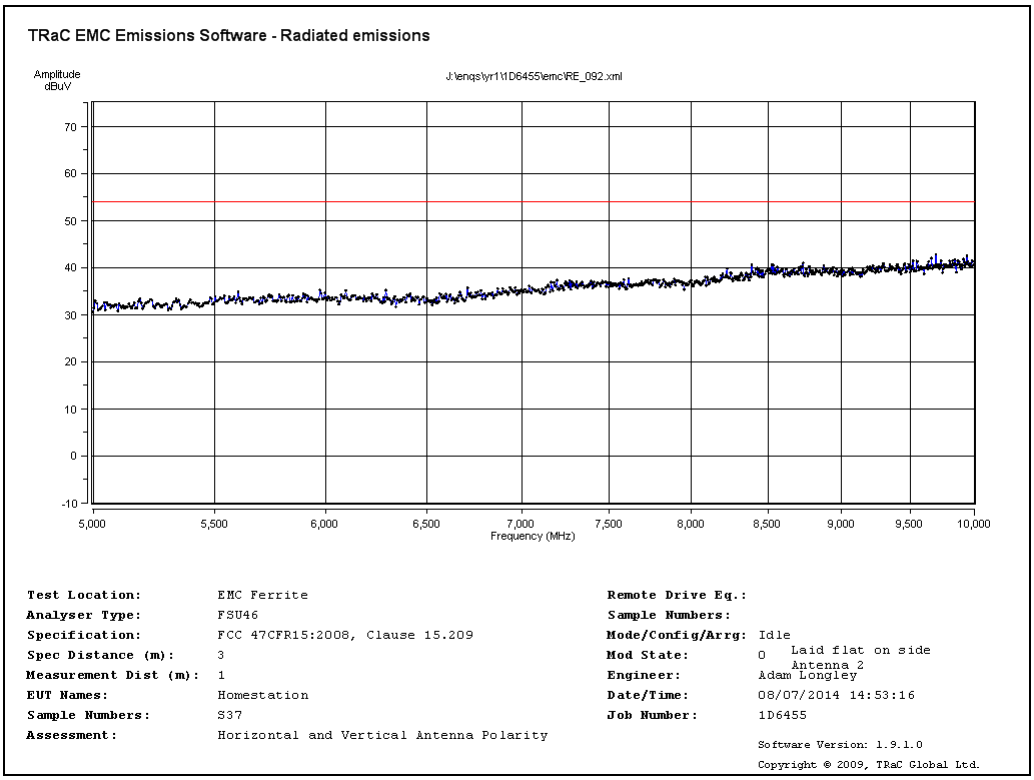
Unintentional Radiated spurious emissions 30 MHz to 200 MHz



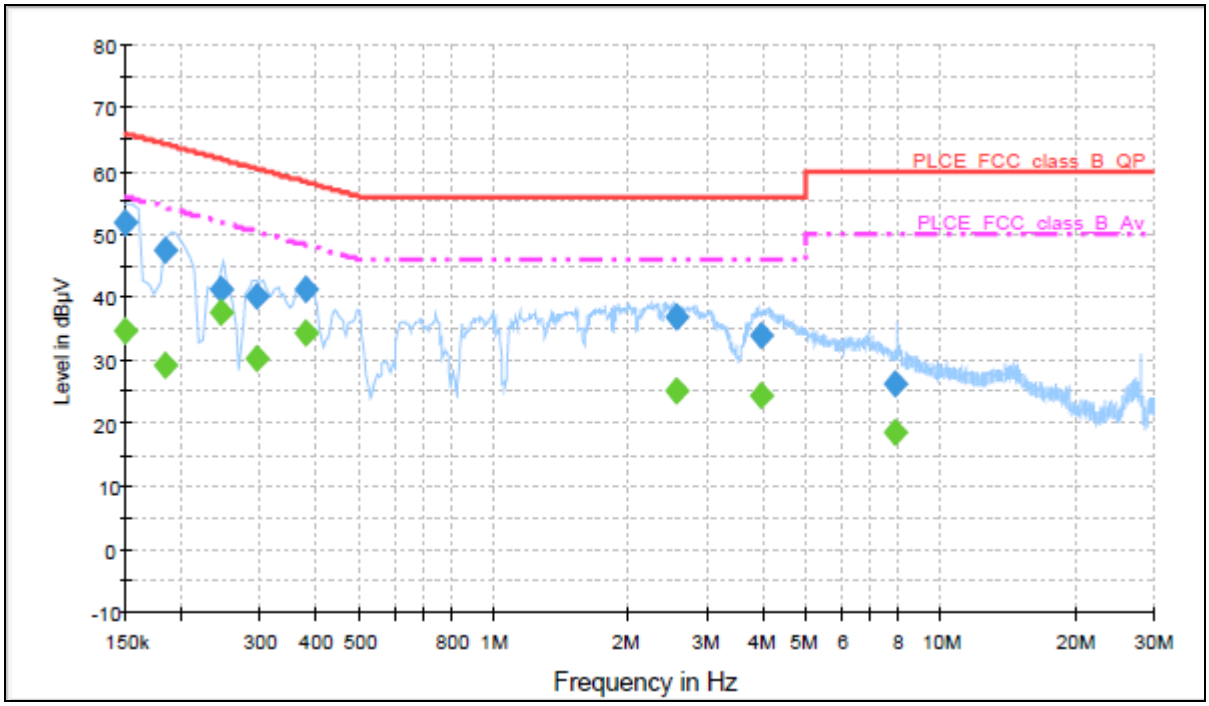
Unintentional Radiated spurious emissions 200 MHz to 1 GHz



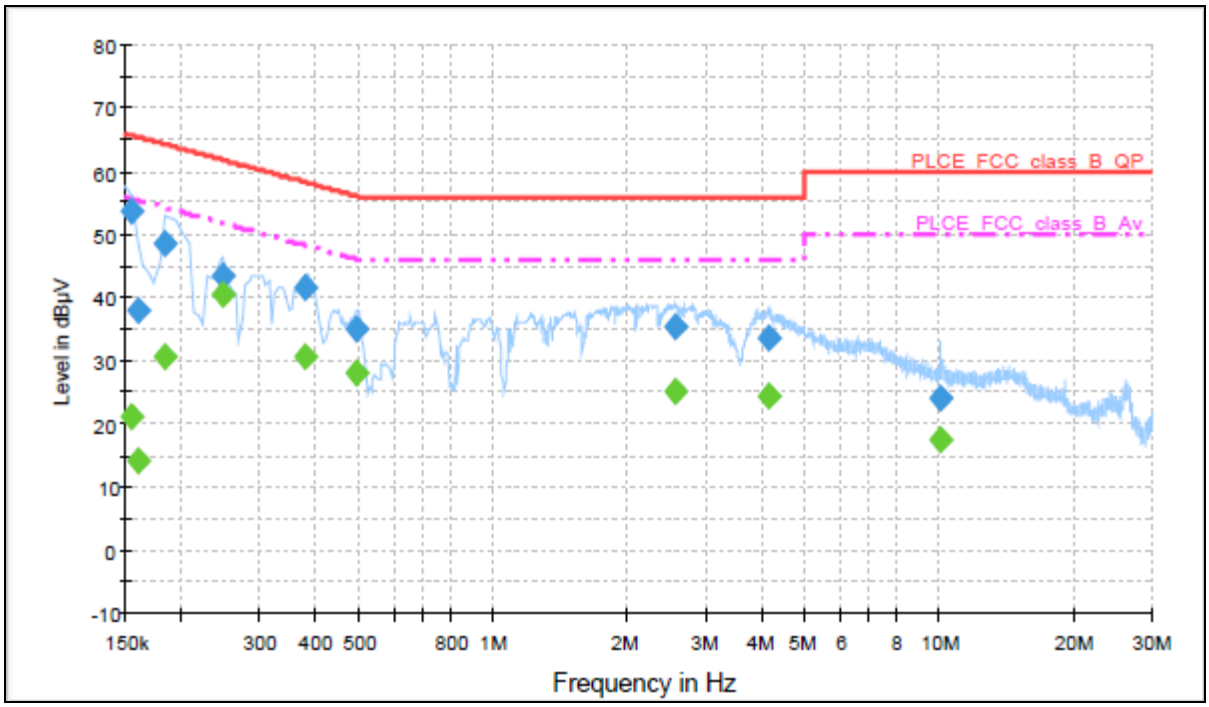
Unintentional Radiated spurious emissions 1 GHz to 5 GHz



Unintentional Radiated spurious emissions 5 GHz to 10 GHz



Transmitting – Power Line Conducted Spurious Emissions



Transmit Standby – Power Line Conducted Spurious Emissions

Appendix C: Additional Test and Sample Details

This appendix contains details of:

1. The samples submitted for testing.
2. Details of EUT operating mode(s)
3. Details of EUT configuration(s) (see below).
4. EUT arrangement (see below).

Throughout testing, the following numbering system is used to identify the sample and it's modification state:

Sample No: Sxx Mod w

where:

xx = sample number eg. S01
w = modification number eg. Mod 2

The following terminology is used throughout the test report:

Support Equipment (SE) is any additional equipment required to exercise the EUT in the applicable operating mode. Where relevant SE is divided into two categories:

SE in test environment: The SE is positioned in the test environment and is not isolated from the EUT (e.g. on the table top during REFE testing).

SE isolated from the EUT: The SE is isolated via filtering from the EUT. (e.g. equipment placed externally to the ALSR during REFE testing).

EUT configuration refers to the internal set-up of the EUT. It may include for example:

Positioning of cards in a chassis.
Setting of any internal switches.
Circuit board jumper settings.
Alternative internal power supplies.

Where no change in EUT configuration is **possible**, the configuration is described as “single possible configuration”.

EUT arrangement refers to the termination of EUT ports / connection of support equipment, and where relevant, the relative positioning of samples (EUT and SE) in the test environment.

For further details of the test procedures and general test set ups used during testing please refer to the related document "EMC Test Methods - An Overview", which can be supplied by TRaC Global upon request.

C1) Test samples

The following samples of the apparatus were submitted by the client for testing:

Sample No.	Description	Identification
S37	OM247 Home Station 915MHz 10-0166-4	HSTGMT750030
S38	OM247 Home Station 915MHz 10-0166-4 (fitted with rf cable in place of integral antenna)	HSTGMT750031

Hardware build level: Rev. 6

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

Sample No.	Description	Identification
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 : 1.06

C3) EUT Configuration Information.

The EUT was submitted for testing in one single possible configuration.

C4) List of EUT Ports

The table below describes the termination of EUT ports:

Sample : S37
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
Mains	DC cable to Plug-Top PSU	1.4m	AC Mains supply

Sample : S38
Tests : Occupied Band Width

Port	Description of Cable Attached	Cable length	Equipment Connected
Mains	DC cable to Plug-Top PSU	1.4m	AC Mains supply (via Variac)
RF (SMA connector)	Coaxial RF cable	1.5m	Measurement Instrument

C5) Details of Equipment Used

For Radiated Measurements:

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.	Calibration Due
REF886	ATS	Ferrite Lined Chamber	TRaC	21/07/14	21/07/15
095		Biconical Antenna	EMCO	09/05/13	09/05/16
191		Log Periodic Antenna	EMCO	09/05/13	09/05/16
RFG682	HL050	GHz Log Periodic Antenna	Rhode & Schwarz	16/07/13	16/07/14
RFG629		Horn Antenna	Q-Par	19/09/13	19/07/14
REF927	310	Pre-Amp (9kHz – 1GHz)	Sonoma	01/07/14	01/07/16
REF913	8449B	Pre-Amp (1 – 26.5GHz)	Agilent	05/02/14	05/02/15
RFG452		SMA RF coaxial cable		03/07/13	03/07/15
REF881		N-Type RF coaxial cable		01/07/13	01/07/15
REF882		N-Type RF coaxial cable		01/07/13	01/07/15
REF884		N-Type RF coaxial cable		01/07/13	01/07/15
REF885		N-Type RF coaxial cable		01/07/13	01/07/15
RFG832		K-Type RF coaxial cable	Teleydyne	17/07/14	17/07/15
RFG919		K-Type RF coaxial cable	Teleydyne	17/07/14	17/07/15
REF910	FSU	Spectrum Analyser	Rhode & Schwarz	31/03/14	31/03/15
REF837	E4440A	Spectrum Analyser	Agilent	19/05/14	19/05/15

For Conducted RF Measurements

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.	
REF910	FSU	Spectrum Analyser	Rhode & Schwarz	31/03/14	31/03/15
REF837	E4440A	Spectrum Analyser	Agilent	19/05/14	19/05/15

For Power Line Conducted Measurements

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.	
RFG674	ESH3-Z2	Pulse Limiter	R & S	14/04/14	14/04/15
RFG295	-	BNC coaxial cable	-	24/12/13	24/12/14
RFG299	-	BNC coaxial cable	-	24/12/13	24/12/14
RFG189	ESH3-Z5	LISN	R & S	17/06/13	04/09/14
RFG125	ESHS10	Measuring Receiver	R & S	24/04/14	24/04/15

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) = 20log(Max. Pulse Length / 100ms)

Maximum Pulse Length at 915.25MHz : 11.7ms

Maximum Pulse Length at 927.6MHz : 8ms

Worst case adjustment = 20log(11.7/100) = -18.6dB

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: General SAR test reduction and exclusion guidance

KDB 447498

Section 4.3 General SAR test reduction and exclusion guidance

For Standalone SAR exclusion consideration, when 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 to 6 GHz and test separation distance of 50mm, the SAR Test Exclusion Threshold for operation at 915.25 and 927.6 MHz will be determined as follows

SAR Exclusion Threshold

$NT = [(MP/TSD) * \sqrt{f_{GHz}}] + \{(TSD - 50mm) * f_{(MHz)}/150]\}$

Where:

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	=	Min Test separation Distance (mm) = 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.

$MP = [(NT \times TSD) / \sqrt{f_{GHz}}] + \{(TSD - 50) * [f_{(MHz)}/150]\}$

Operating Frequency 915.25 MHz

MP= [(3.0 x 50) / √0.91525] + {(50 – 50) * [915.25/150]
MP= [150 / 0.9566] + (0 * 6.10)
MP= 156.8mW

The calculated output power 3.56mw (Peak) is less than the SAR Exclusion Threshold of 156.8mW.

Operating Frequency 927.60 MHz

MP= [(3.0 x 50) / √0.92760] + {(50 – 50) * [927.60/150]}
MP= [150 / 0.9631] + (0 * 6.18)
MP= 155.7mW

The calculated output power 3.99mW (Peak) is less than the SAR Exclusion Threshold of 155.7mW.

Base on a separation distance of 50mm and the numeric threshold for 1-g SAR, standalone SAR evaluation for general population exposure conditions by measurement or numerical simulation is not required.

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