A RADIO TEST REPORT

FOR

G4S Monitoring Technologies LTD

ON

OM247 MU3 Multicomm 915MHz 10-0173-4

DOCUMENT NO.TRA-016455WUS1

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UKAS TESTING
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TRaC Wireless Test Report	**:** TRA-016455WUS1
Applicant	**:** G4S Monitoring Technologies Ltd.
Apparatus	**:** OM247 MU3 Multicomm 915MHz 10-0173-4
Specification(s)	**:** CFR47 Part 15.249
Purpose of Test	**: Certification**
FCCID	**: 2ACGBMCM3915**
Authorised by	**:** 
	: Radio Product Manager
Issue Date	**:** 30th May 2014
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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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1.2 Tests Requested By

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1.3 Manufacturer

As Above

1.4 Apparatus Assessed

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

OM247 MU3 Multicomm 915MHz 10-0173-4

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:

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
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	S20
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	76.4	4.2	22.2	N/A	-18.6	84.2	16.2
927.6	75.6	4.3	22.6	N/A	-18.6	83.9	15.7
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 orthagonal planes.
Maximum results recorded

A2 Transmitter Bandwidth

Test Details:	
Regulation	Part 15.215 (c)
Measurement standard	ANSI C63.10:2009
EUT sample number	S30
Modification state	0
SE in test environment	None
SE isolated from EUT	None
EUT set up	Refer to Appendix C
Temperature	22˚C

Band occupancy @ -20 dBc			
FREQ. (MHz)	**f lower (MHz)**	**f higher (MHz)**	**Occ BW (kHz)**
915.25	915.196647436	915.285589744	88.9423
927.6	927.532269231	927.647173077	114.9038

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	S20
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

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)**
Pk	1830.463	66.0	5.1	27.5	34.6	-18.6	-9.5	35.9	62.4	5000
Av	1830.463	65.1	5.1	27.5	34.6	-18.6	-9.5	35.0	56.2	500
Pk	2745.692	60.1	4.7	29.1	34.7	-18.6	-9.5	31.1	35.9	5000
Av	2745.692	58.4	4.7	29.1	34.7	-18.6	-9.5	29.4	29.5	500
Pk	3660.966	69.2	6.7	31.7	34.7	-18.6	-9.5	44.8	173.8	5000
Av	3660.966	68.6	6.7	31.7	34.7	-18.6	-9.5	44.2	162.2	500
Pk	5491.462	54.3	8.3	34.2	34.5	-18.6	-9.5	34.2	51.3	5000
Av	5491.462	50.9	8.3	34.2	34.5	-18.6	-9.5	30.8	34.7	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)**
Pk	1855.163	64.8	5.0	27.6	34.6	-18.6	-9.5	34.7	54.3	5000
Av	1855.163	64.0	5.0	27.6	34.6	-18.6	-9.5	33.9	49.5	500
Pk	2782.731	58.6	4.9	29.1	34.8	-18.6	-9.5	29.7	30.5	5000
Av	2782.731	56.8	4.9	29.1	34.8	-18.6	-9.5	27.9	24.8	500
Pk	3710.341	67.2	6.5	32.0	34.7	-18.6	-9.5	42.9	139.6	5000
Av	3710.341	66.5	6.5	32.0	34.7	-18.6	-9.5	42.2	128.8	500
Pk	5565.541	53.8	8.3	34.2	34.5	-18.6	-9.5	33.7	48.4	5000
Av	5565.541	50.2	8.3	34.2	34.5	-18.6	-9.5	30.1	32.0	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	S20
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

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 ≥ 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	S20
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:

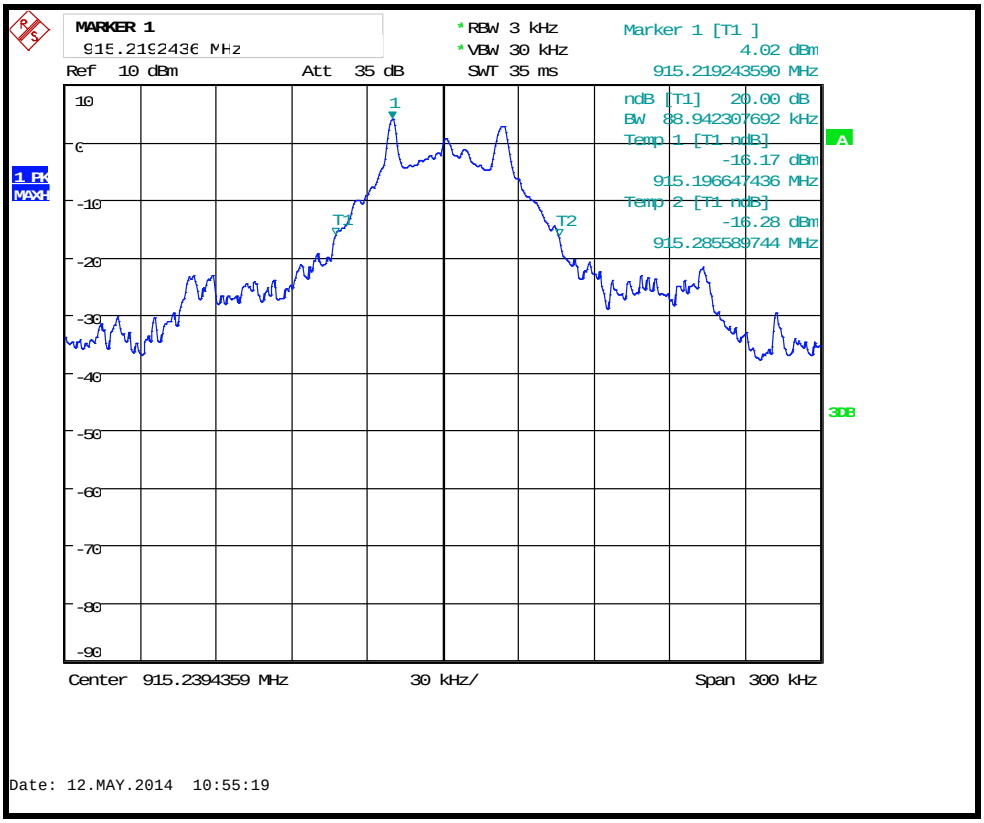
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A.

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

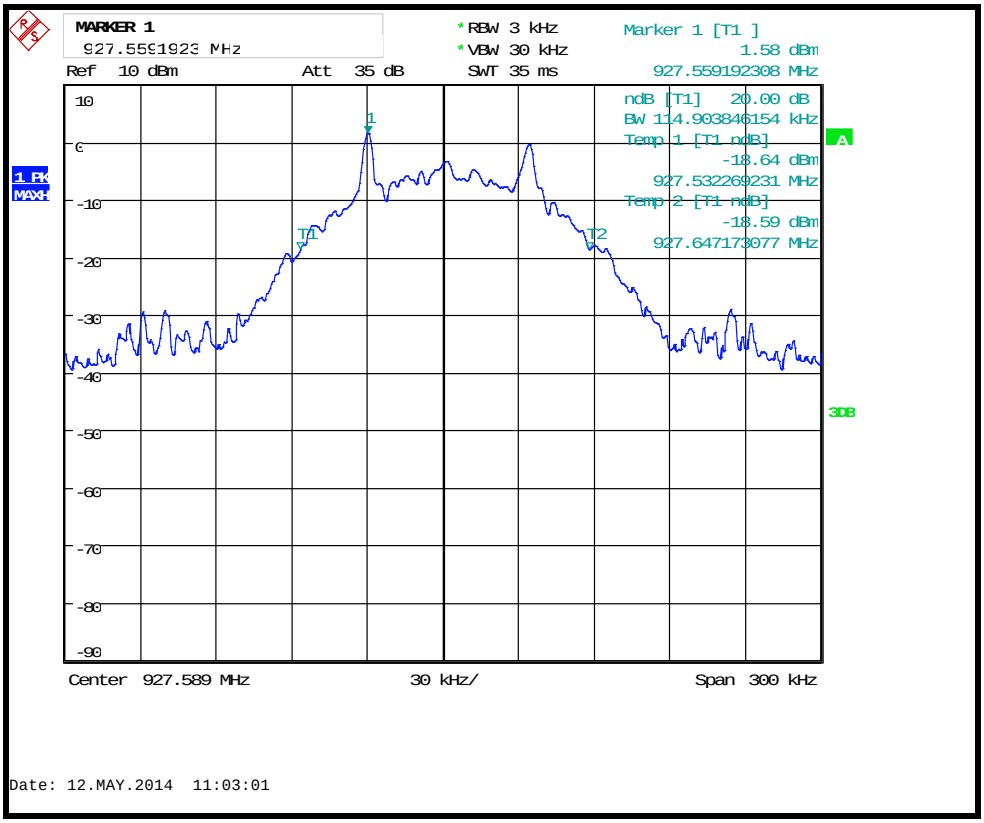
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

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

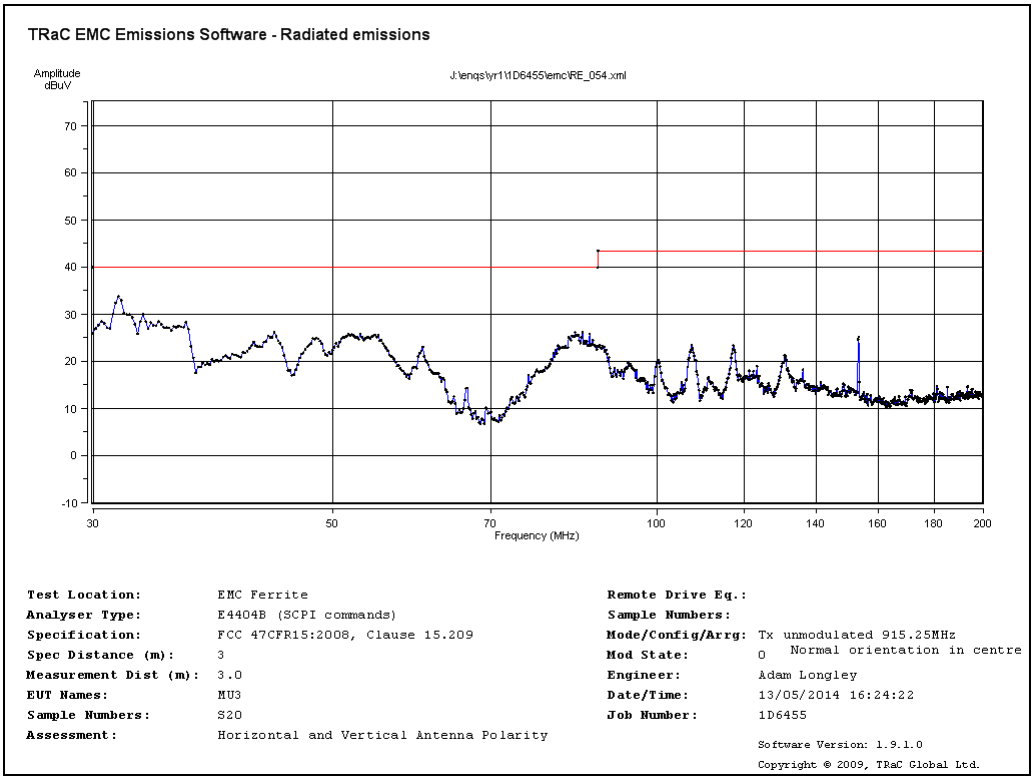
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



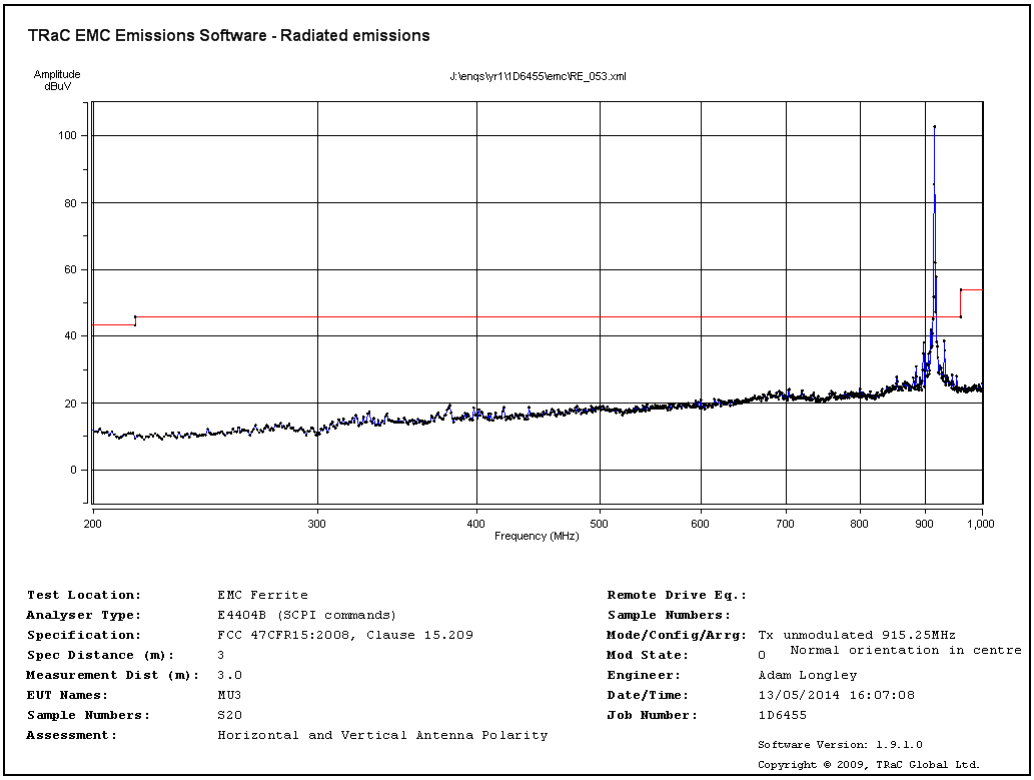
Fc = 915.25 MHz - 20dB Bandwidth



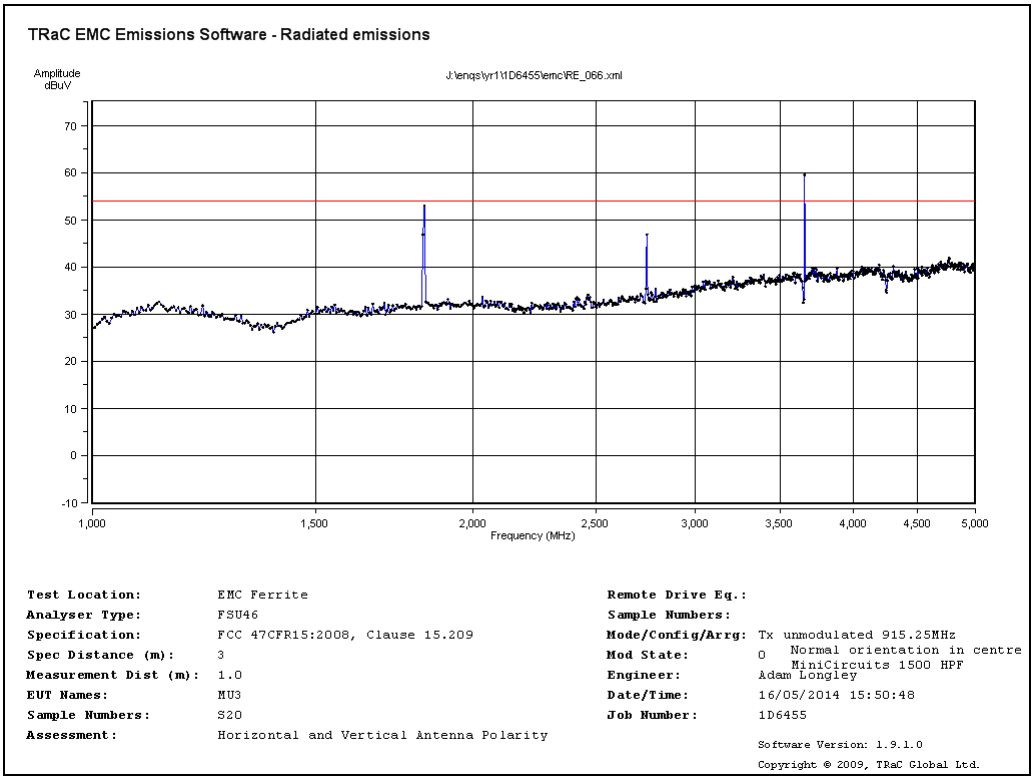
Fc = 927.6 MHz - 20dB Bandwidth



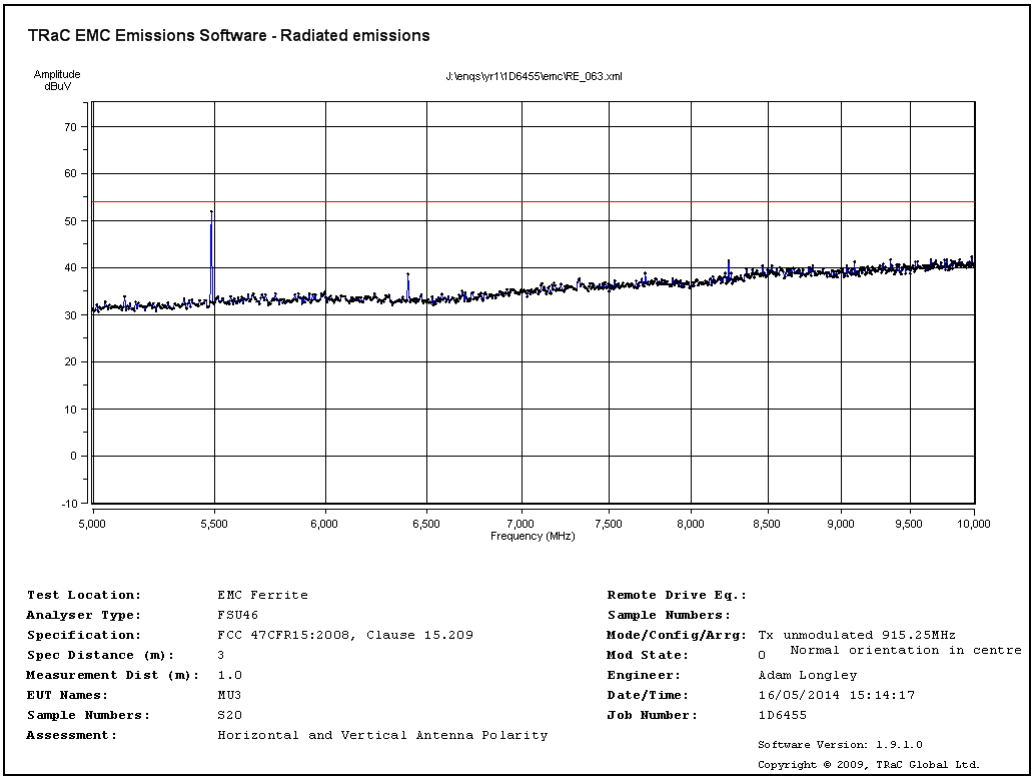
Fc = 915.25 MHz Radiated spurious emissions 30 MHz to 200 MHz



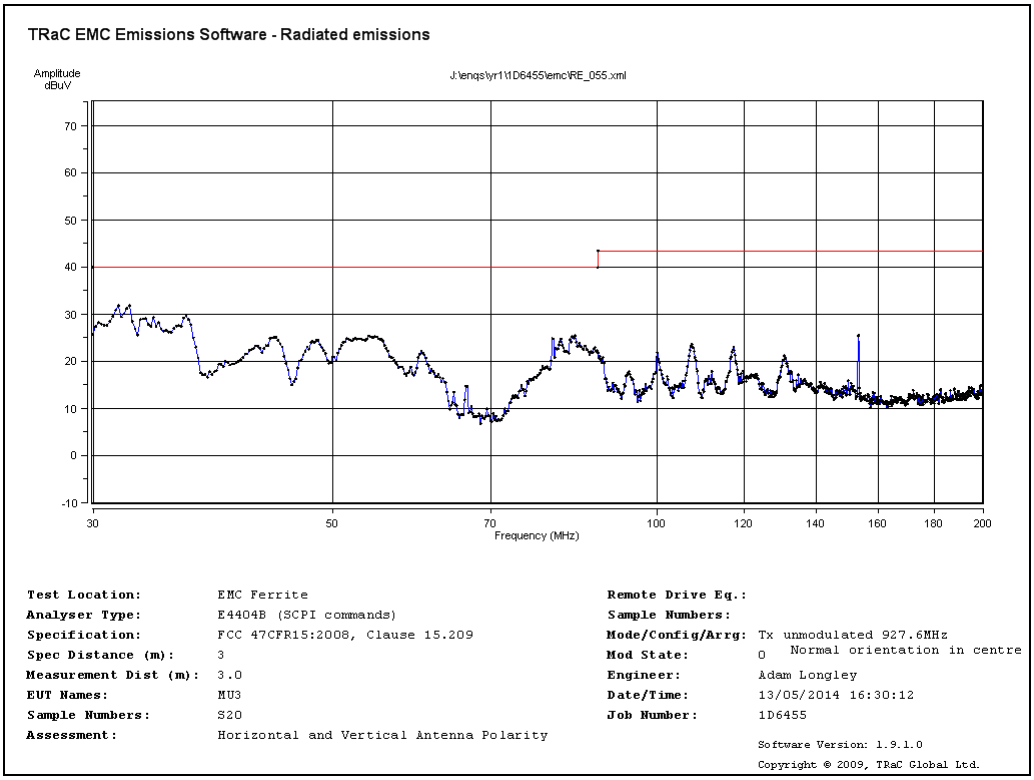
Fc = 915.25 MHz Radiated spurious emissions 200 MHz to 1 GHz



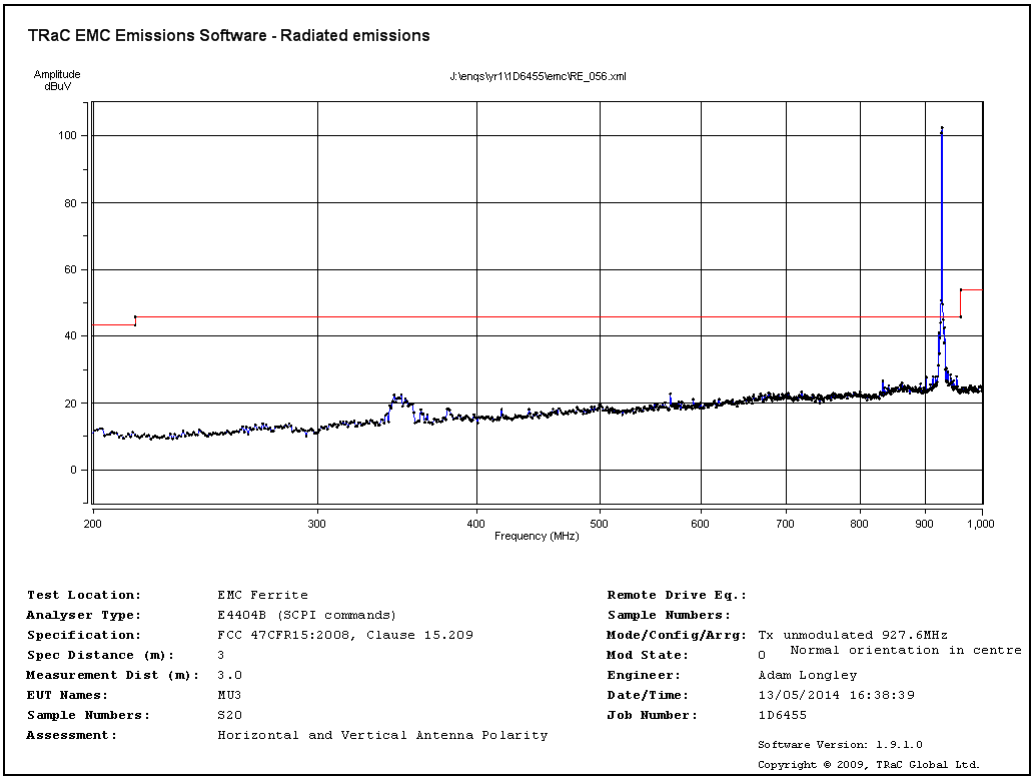
Fc = 915.25 MHz Radiated spurious emissions 1 GHz to 5 GHz



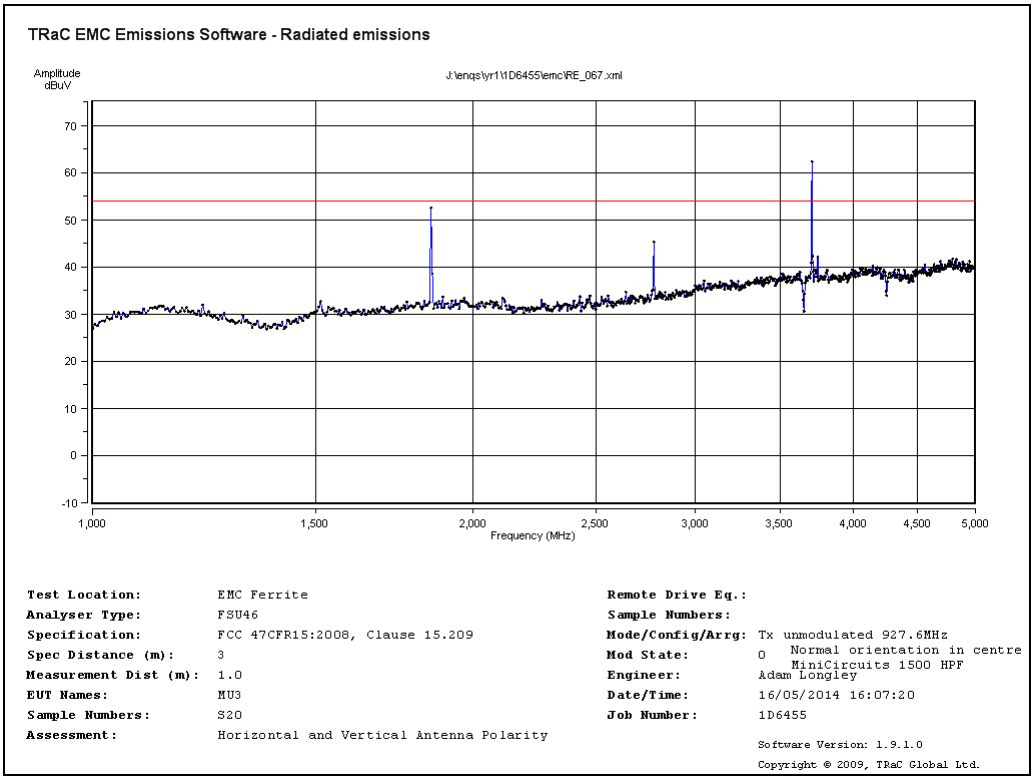
Fc = 902.5 MHz Radiated spurious emissions 5 GHz to 10 GHz



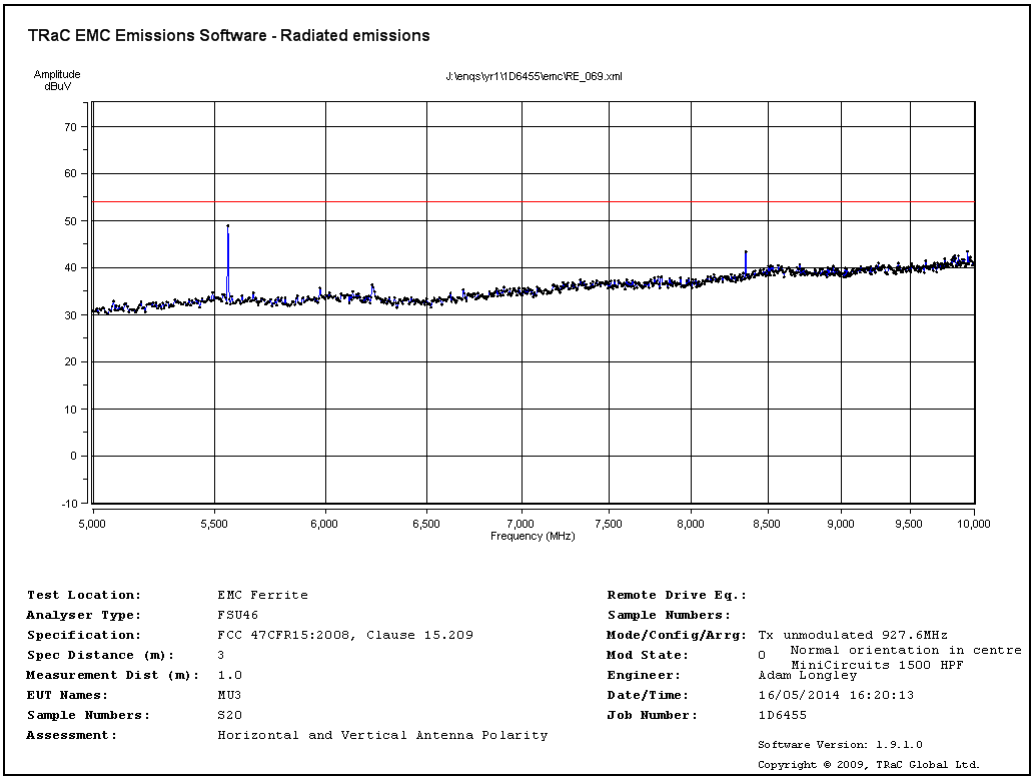
Fc = 927.6 MHz Radiated spurious emissions 30 MHz to 200 MHz



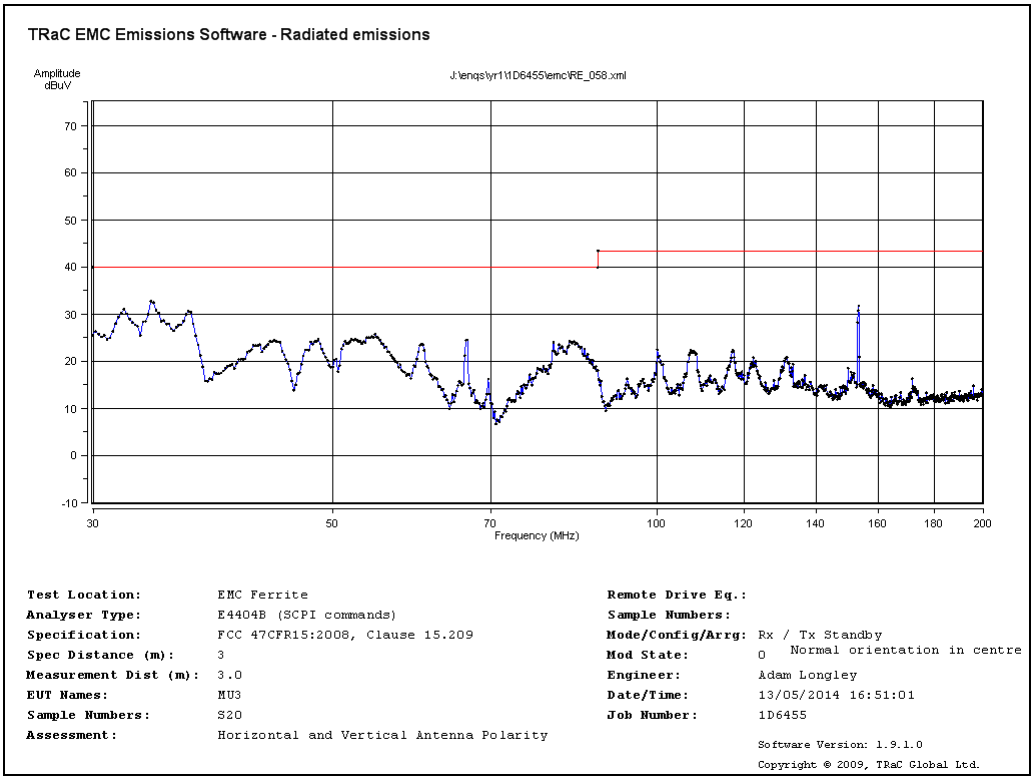
Fc = 927.6 MHz Radiated spurious emissions 200 MHz to 1 GHz



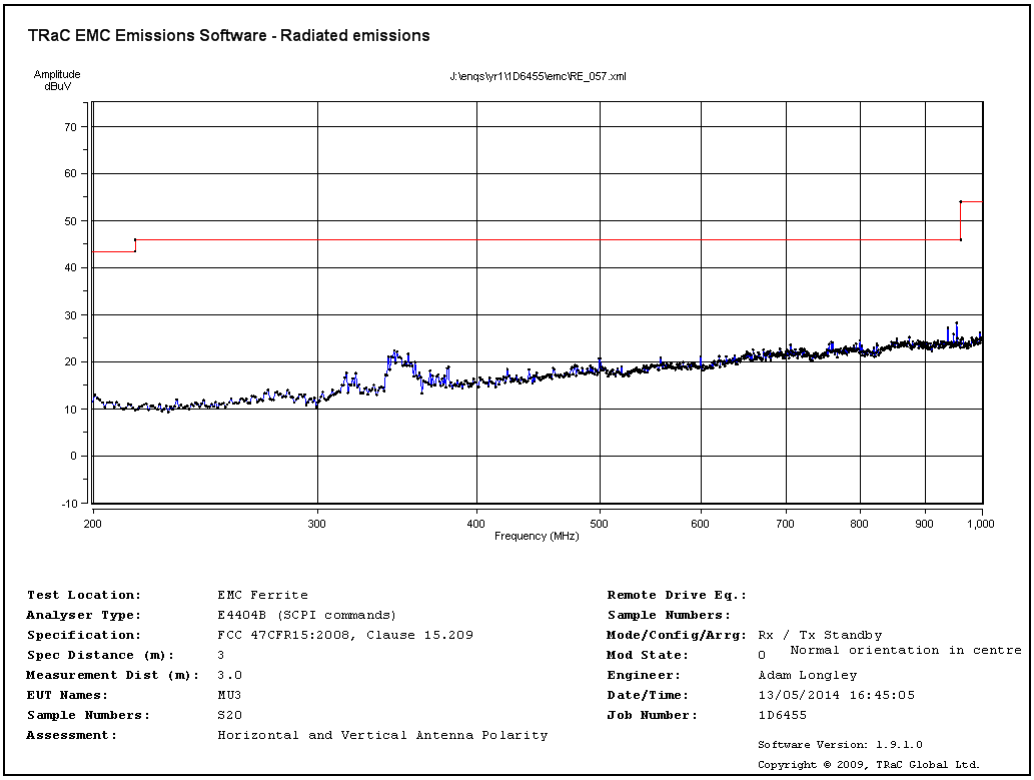
Fc = 927.6 MHz Radiated spurious emissions 1 GHz to 5 GHz



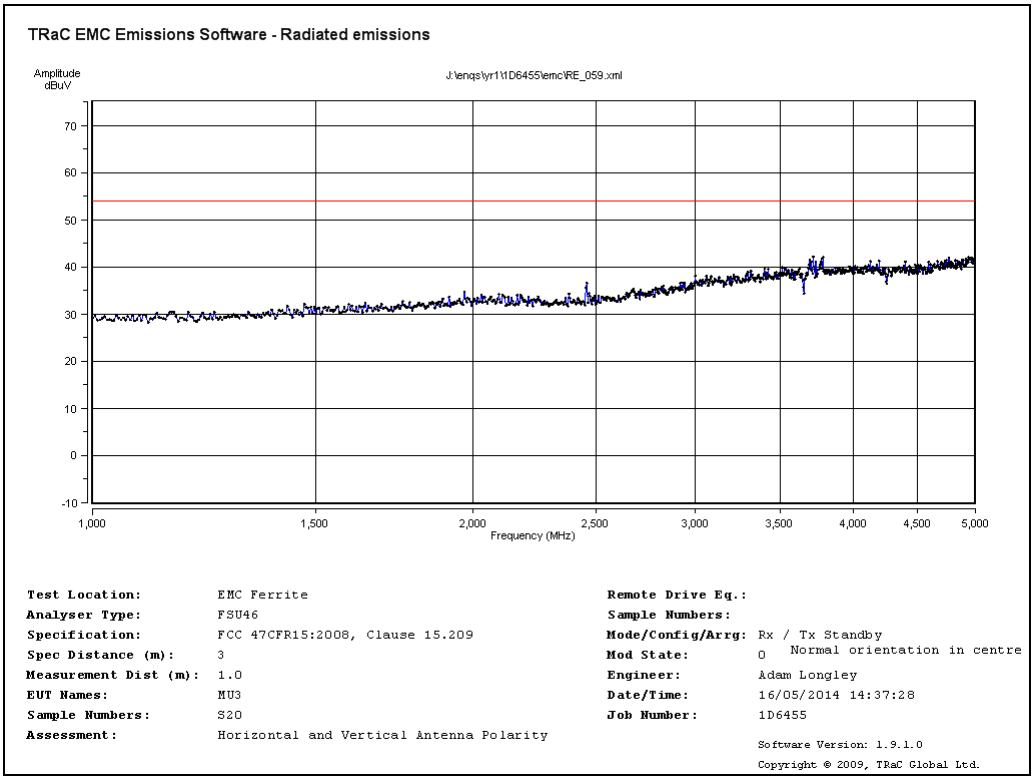
Fc = 927.6 MHz Radiated spurious emissions 5 GHz to 10 GHz



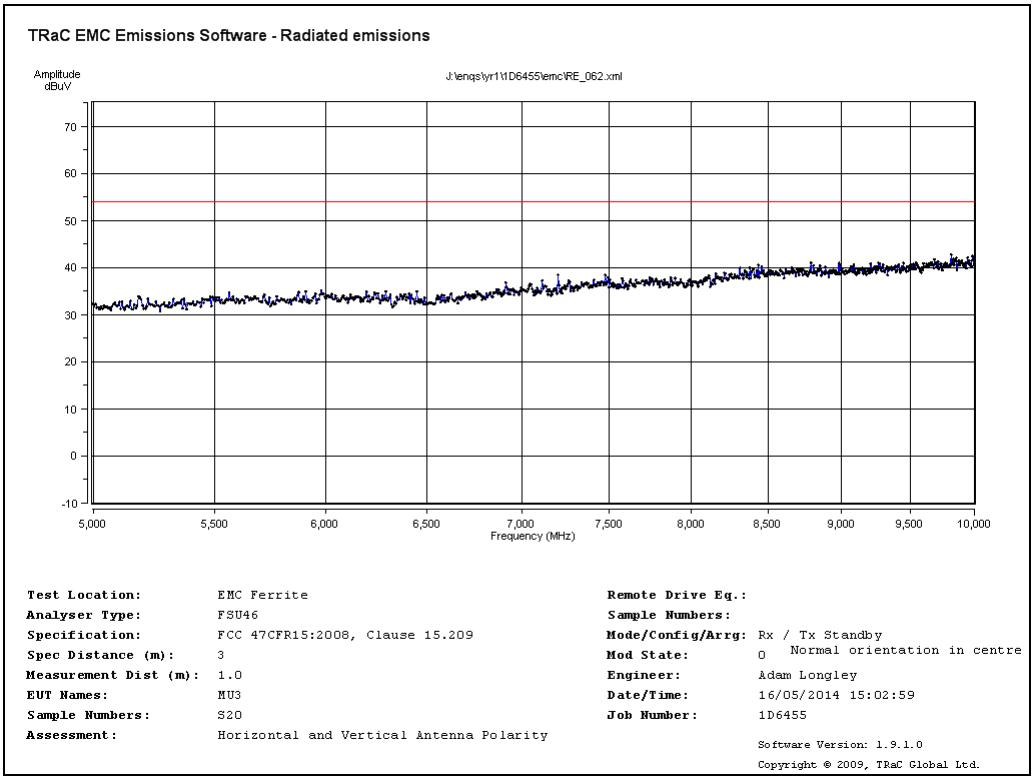
Unintentional Radiated spurious emissions 30 MHz to 200 MHz



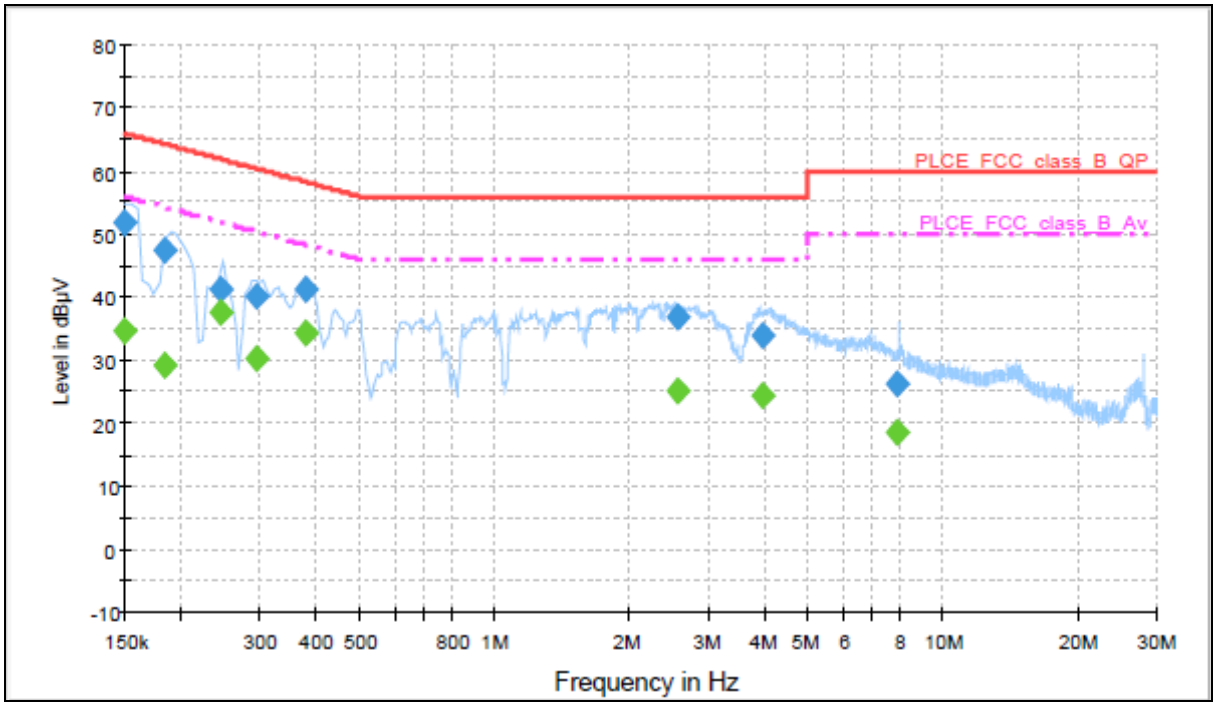
Unintentional Radiated spurious emissions 200 MHz to 1 GHz



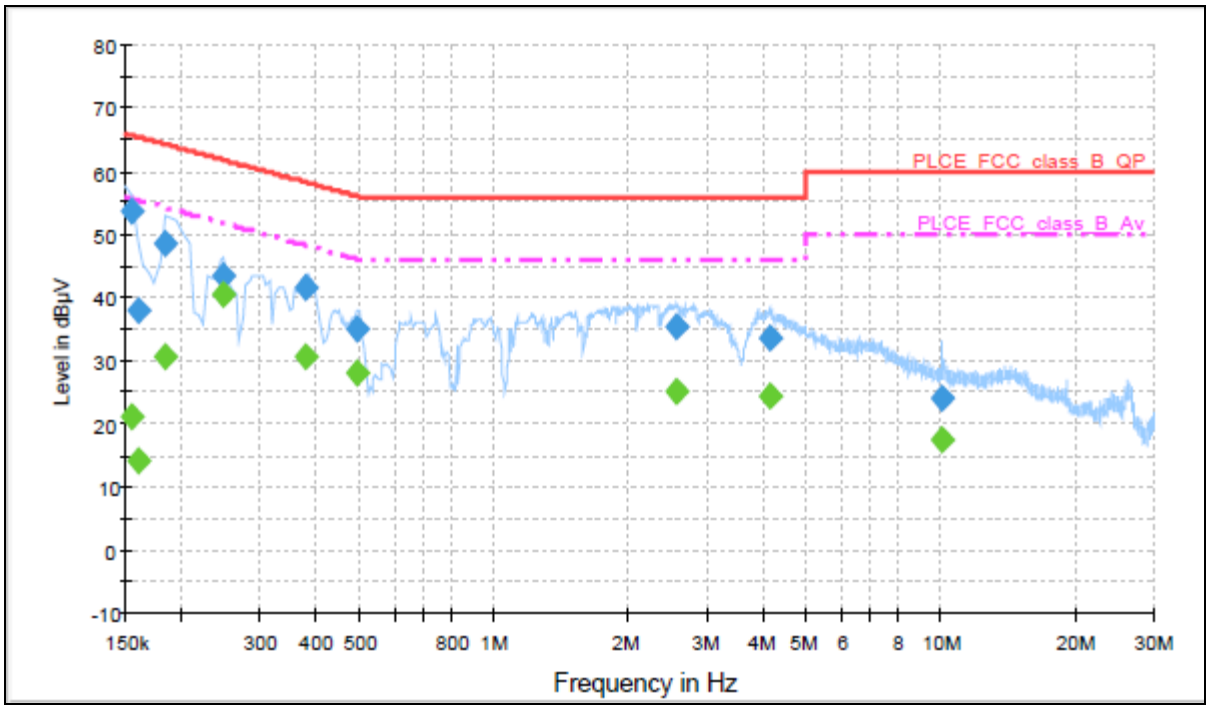
Unintentional Radiated spurious emissions 1 GHz to 5 GHz



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
S20	OM247 MU3 Multicomm 915MHz 10-0173-4	MUMGMT821549
S30	OM247 MU3 Multicomm 915MHz 10-0173-4 (fitted with rf cable in place of integral antenna)	MUMGMT800816

The following samples of 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 : 2.6.1

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 : S20
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
Mains	DC cable to hardwired Plug-Top PSU	1.8m	AC Mains supply

Sample : S30
Tests : Occupied Band Width

Port	Description of Cable Attached	Cable length	Equipment Connected
Mains	DC cable to hardwired Plug-Top PSU	1.8m	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.
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	Teleydyne	04/07/13
RFG919		K-Type RF coaxial cable	Teleydyne	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) = 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: MPE Calculation

OET Bulletin No. 65, Supplement C 01-01

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

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

where:

S = power density
R = distance to the centre of radiation of the antenna
ERP = EUT Maximum power

Result:

Prediction Frequency (MHz)	Maximum ERP (mW)	Power density limit (S) (mW/cm^2)	Distance (R) cm required to be less than 0.6mW/cm^2
915.25	1.9	0.6	0.6

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