A Radio Test Report

FOR

Airtame ApS

ON

HDMI Dongle

DOCUMENT NO. TRA-021973WUS1

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UKAS TESTING
0026

TRaC Wireless Test Report	**:** TRA-021973WUS1
Applicant	**:** Airtame ApS
Apparatus	**:** HDMI Dongle
Specification(s)	**:** CFR47 Part 15.247
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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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1.4 Apparatus Assessed

The following apparatus was assessed between 28/10/2014 and 29/01/2015:

HDMI Dongle

The apparatus was an HDMI Dongle intended for wireless screen duplication between screen and smartphone/tablet or PC using IEEE 802.11 WiFi.

The apparatus consisted of a mini PC running Linux connected to any screen using an HDMI Male connector and powered by an external USB AC Adapter connected with a Micro USB cable. The device included a Micro SD card which the OS booted from and which ran the AIRTAME test application. Two WiFi IC's with individual MAC addresses were integrated at the PCB for 2.4GHz and 5GHz WiFi connection.

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
Radiated spurious emissions (Restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10	Pass
Conducted spurious emissions (Non-restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart C; 15.207	ANSI C63.10	Pass
Occupied Bandwidth	Title 47 of the CFR : Part 15 Subpart C; 15.247(a)(2)	ANSI C63.10	Pass
Conducted Carrier Power	Title 47 of the CFR : Part 15 Subpart C; 15.247(b)	ANSI C63.10	Pass
Power Spectral Density	Title 47 of the CFR : Part 15 Subpart C; 15.247(d)	ANSI C63.10	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart B; 15.109	ANSI C63.10	Pass
Digital Modulation	Title 47 of the CFR: Part 15 Subpart C; 15.403	-	Pass
RF Safety	Title 47 of the CFR : Part 15 Subpart C; 15.247(b)(5)	-	Pass

Abbreviations used in the above table:

ANSI C63.10 is outside the scope of the laboratories UKAS accreditation.

Mod : Modification
CFR : Code of Federal Regulations
REFE : Radiated Electric Field Emissions
ANSI : American National Standards Institution
PLCE : Power Line Conducted Emissions

1.6 Notes Relating To The Assessment

With regard to this assessment, the following points should be noted:

The results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

The apparatus was set up and exercised using the configurations, modes of operation and arrangements defined in this report only.

Particular operating modes, apparatus monitoring methods and performance criteria required by the standards tested to have been performed except where identified in Section 1.7 of this test report (Deviations from Test Standards).

For emissions testing, throughout this test report, “Pass” indicates that the results for the sample as tested were below the specified limit (refer also to Section 2, Measurement Uncertainty).

Where relevant, the apparatus was only assessed using the monitoring methods and susceptibility criteria defined in this report.

All testing with the exception of testing at the Open Area Test Site was performed under the following environmental conditions:

Temperature	: 17 to 23 °C
Humidity	: 45 to 75 %
Barometric Pressure	: 86 to 106 kPa

All dates used in this report are in the format dd/mm/yy.

This assessment has been performed in accordance with the requirements of ISO/IEC 17025.

1.7 Deviations from Test Standards

There were no deviations from the standards tested to.

Section 2: Measurement Uncertainty

2.1 Measurement Uncertainty Values

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

Parameter	Uncertainty
Radio frequency	± 1 x 10^{-7}
RF power, conducted	± 1.5 dB
Maximum frequency deviation: - within 300 Hz and 6 kHz of audio frequency - within 6 kHz and 25 kHz of audio frequency	 ±5 % ±3 dB
Adjacent channel power	±3 dB
Conducted spurious emission of transmitter, valid up to 6 GHz	±3 dB
Conducted emission of receivers	±3 dB
Radiated emission of transmitter, valid up to 6 GHz	±6 dB
Radiated emission of receiver, valid up to 6 GHz	±6 dB
RF level uncertainty for a given BER	±1.5 dB
Temperature	±1^{o}C
Humidity	±10 %

Section 3: Modifications

3.1 Modifications Performed During Assessment

1. The HDMI port shield was connected to the PCB ground as a result of EMC measurements for Radiated Electric Field Emissions. Measurements showed that this modification had no effect on the emissions measured on the rf port due to the transmitters.

Section 4 General Test Procedures

4.1 Radiated Test Setup and Procedures

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

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

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

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

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

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

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

Where:

PR is the power recorded on receiver / spectrum analyzer (dBuV),
AF is the test antenna factor in dB/m,
CL is the cable loss in dB,
PA is the pre-amplifier gain dB (when applicable),
DC is duty correction factor (when applicable) in dB, and
CF is a distance correction (employed only for measurements at alternate distance to limit) in dB.

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

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

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

Where

P is the power, in W
E is the measured peak field strength, in V/m
d is the distance at which the measurement was made, in m
G is the numeric gain of the radiating element

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

4.2 AC Powerline Conducted Emissions Test Setup and Procedures

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

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

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

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

4.3 Antenna Port Conducted Emissions

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

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

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

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

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

4.4 Power Supply Variation

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

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

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

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

4.5 Thermal Variation

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

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

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

4.6 Time Domain Measurements

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

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

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

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

Appendix A: Formal Emission Test Results

Abbreviations used in the tables in this appendix:

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

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

A1 6 dB Bandwidth

Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2) requires the measurement of the bandwidth of the transmission between the -6 dB points on the transmitted spectrum.

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2)
EUT sample number	S03, S07
Modification state	0
SE in test environment	None
SE isolated from EUT	TRaC Laptop
Temperature	22
EUT set up	Refer to Appendix C

Mode: HT20 MCS6

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2403.153846	2420.910256	17756.41026	>500kHz	Pass
2442	2433.089744	2450.782052	17692.30769	>500kHz	Pass
2472	2463.153846	2480.910256	17756.41026	>500kHz	Pass

Mode: HT20 MCS0

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2404.115385	2420.782051	16666.66667	>500kHz	Pass
2442	2433.153846	2450.397436	17243.58974	>500kHz	Pass
2472	2463.474359	2480.846154	17371.79487	>500kHz	Pass

Mode: 54Mb/s

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2403.730769	2420.269231	16538.46154	>500kHz	Pass
2442	2433.666667	2450.269231	16602.56400	>500kHz	Pass
2472	2463.730769	2480.333333	16602.56410	>500kHz	Pass

Mode: 6Mb/s

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2404.243590	2420.205128	15961.53846	>500kHz	Pass
2442	2433.794872	2449.884616	16089.74359	>500kHz	Pass
2472	2464.051282	2480.269231	16217.94872	>500kHz	Pass

Mode: 11Mb/s

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2406.551642	2416.872155	10320.51282	>500kHz	Pass
2442	2436.48718	2447.000000	10512.82051	>500kHz	Pass
2472	2466.935898	2477.705128	10.76923077	>500kHz	Pass

Mode: 1Mb/s

Channel Frequency (MHz)	F_{lower}	F_{Higher}	Measured 6 dB Bandwidth (kHz)	Limit	Result
2412	2406.935897	2417.128205	10192.30769	>500kHz	Pass
2442	2436.871794	2447.128205	10256.41026	>500kHz	Pass
2472	2466.871795	2477.128205	10256.41026	>500kHz	Pass

Plots of the 6 dB bandwidth are contained in Appendix B of this test report.

A2 Transmitter Peak Output Power

Carrier power was verified with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10
EUT sample number	S03, S07
Modification state	0
SE in test environment	None
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22

Mode: MCS6

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	11.6	0.014	1	Pass
2442	8.4	0.007	1	Pass
2472	11.1	0.013	1	Pass

Mode: MCS0

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	14.4	0.028	1	Pass
2442	11.3	0.013	1	Pass
2472	12.0	0.016	1	Pass

Mode: 54Mb/s

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	11.7	0.015	1	Pass
2442	9.6	0.009	1	Pass
2472	10.2	0.010	1	Pass

Mode: 6Mb/s

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	13.8	0.024	1	Pass
2442	12.6	0.018	1	Pass
2472	12.2	0.017	1	Pass

Mode: 11Mb/s

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	16.4	0.044	1	Pass
2442	12.5	0.018	1	Pass
2472	12.3	0.017	1	Pass

Mode: 1Mb/s

Channel Frequency (MHz)	Conducted Peak Carrier Power (dBm)	Conducted Peak Carrier Power (W)	Limit (W)	Result
2412	16.2	0.041	1	Pass
2442	12.6	0.018	1	Pass
2472	12.3	0.017	1	Pass

Notes:

Conducted Measurement

Measured Conducted Peak Carrier power does not require adjustment due to antenna gain for antennas with a gain less than 6dBi.
Highest Gain of any antenna to be used = 2dBi
Conducted measurements were performed with a temporary antenna connector provided by the client.

A3 Transmitter Power Spectral Density

Transmitter Power Spectral Density was verified with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

Test Details:	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(e)
Measurement standard	ANSI C63.10
EUT sample number	S03, S07
Modification state	0
SE in test environment	None
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22

Mode: MCS6

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-15.09	8	Pass
2442	-15.00	8	Pass
2472	-15.43	8	Pass

Mode: MCS0

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-13.83	8	Pass
2442	-12.96	8	Pass
2472	-16.26	8	Pass

Mode: 54Mb/s

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-16.46	8	Pass
2442	-15.63	8	Pass
2472	-17.03	8	Pass

Mode: 6Mb/s

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-15.11	8	Pass
2442	-13.20	8	Pass
2472	-15.49	8	Pass

Mode: 11Mb/s

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-8.23	8	Pass
2442	-10.73	8	Pass
2472	-12.84	8	Pass

Mode: 1Mb/s

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm)	Limit (dBm)	Result
2412	-9.93	8	Pass
2442	-12.81	8	Pass
2472	-14.07	8	Pass

Notes:

Conducted Measurement

Measured Conducted Peak Carrier power does not require adjustment due to antenna gain for antennas with a gain less than 6dBi, as the same method is specified this also applies to the measured Power Spectral Density.
Highest Gain of any antenna to be used = 2 dBi
Conducted measurements were performed with a temporary antenna connector provided by the client.
The resolution bandwidth on the analyser was set to 3kHz and trace set to max hold.
The span is set as appropriate to ensure the capture of the peak Power Spectral Density.

A4 Radiated Electric Field Emissions outside of the Restricted Band

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency.

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: 2412 MHz	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz – 25GHz
EUT sample number	S06, S09
Modification state	1
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

There were no significant radiated spurious emissions that fell outside of the restricted bands specified in section 15.205. Lower Band Edge measurements have been performed using conducted test methods, please see Appendix A5.

Radiated Electric Field Emissions outside of the Restricted Band continued:

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

Test Details: 2442 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S06, S09
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

There were no significant radiated spurious emissions that fell outside of the restricted bands specified in section 15.205.

Radiated Electric Field Emissions outside of the Restricted Band continued:

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

Test Details: 2462 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S06, S09
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

There were no significant radiated spurious emissions that fell outside of the restricted bands specified in section 15.205.

Notes:

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
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 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
4 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.
5 For Frequencies below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak	RBW=VBW= 1MHz
Average	RBW=VBW= 1MHz

These settings as per ANSI C63.10

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 15.247(d)) for emissions falling outside the restricted bands defined in 15.205(a):

The radio frequency power of the emission (measured in 100kHz bandwidth) shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, in accordance with 15.247(d) when measured using a peak detector.

Notes:

(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:

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

The results displayed take into account applicable antenna factors and cable losses.

(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 RF Antenna Conducted Spurious Emissions

Measurement of conducted spurious emissions at the antenna port was performed using a peak detector with the RBW set to 100kHz and the VBW>RBW. Only the Lower Band Edge has been assessed using this test method, the emissions up through to the 10th harmonic with the EUT transmitting on its lowest, centre and highest carrier frequency in turn were covered by radiated scans and were not repeated using the conducted method.

Test Details: 2412 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	2400 GHz
EUT sample number	S03, S07
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22

The worst case conducted emission measurements at the antenna port are listed below:

Ref No.	Operating Mode	Measured Frequency (MHz)	Measured Peak Conducted Power at the Measurement Frequency (dBm)	Measured Peak Conducted Power at the Highest Desired Power (dBm)	Highest Desired Power -20dB (Limit) (dBm)	Result
1.	MCS6	2400.000	-36.15	-2.25	-22.25	Pass
2.	MCS0	2400.000	-35.45	-1.07	-21.07	Pass
3.	54Mb/s	2400.000	-36.43	-1.01	-21.01	Pass
4.	6Mb/s	2399.604	-31.50	0.81	-19.19	Pass
5.	11Mb/s	2398.486	-30.31	5.81	-14.19	Pass
6.	1Mb/s	2398.486	-30.76	4.18	-15.82	Pass

All power measurements in the above table were in 100kHz RBW.

Notes:

1. For emissions outside the restricted bands, defined in 47CFR15.205(a) the radio frequency power of the emission (measured in 100kHz bandwidth) shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, in accordance with 15.247(d) when measured using a peak detector, with the EUT transmitting on its lowest, centre and highest carrier frequencies in turn.
2. The RBW = 100 kHz, Video bandwidth (VBW) > RBW.
3. Measurements were made at 2400 MHz to ensure band edge compliance.

The limit outside the restricted band in 100 kHz RBW is defined using the following formula in accordance with 15.247(d):

The limit in 100 kHz RBW = (Maximum Peak Conducted Power in 100kHz)-20dB

A6 Radiated Electric Field Emissions within the Restricted Bands of 15.205

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The radiated electric field emission test applies to spurious emissions and harmonics that fall within the restricted bands listed in Section 15.205. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit on its lowest, centre and highest carrier frequency.

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: 2412 MHz	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz – 25GHz
EUT sample number	S06, S09
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below (2412MHz MCS0 was selected from the preview measurements as the worst case, band edge measurements were repeated in all operating modes):

Mode: MCS6

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	74.02	5.2	28.4	34.62	-9.5	63.5	1496.24	5000
2.	2390	52.28	5.2	28.4	34.62	-9.5	41.8	123.03	500

Mode: MCS0

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	1039.503	71.34	3.5	25.4	35.51	-9.5	55.2	575.44	5000
2.	1039.503	69.16	3.5	25.4	35.51	-9.5	53.1	451.86	500
3.	1187.995	69.47	3.6	25.5	35.25	-9.5	53.8	489.78	5000
4.	1187.995	66.73	3.6	25.5	35.25	-9.5	51.1	358.92	500
5.	1300.163	78.10	3.6	25.6	35.06	-9.5	67.7	2426.61	5000
6.	1300.163	52.58	3.6	25.6	35.06	-9.5	37.2	72.44	500
7.	1336.513	63.07	3.6	25.7	34.99	-9.5	47.9	248.31	5000
8.	1336.513	56.82	3.6	25.7	34.99	-9.5	41.6	120.23	500
9.	2227.362	63.32	3.9	27.9	34.59	-9.5	51.0	354.81	5000
10.	2227.362	57.60	3.9	27.9	34.59	-9.5	45.3	184.08	500
11.	2277.037	65.44	4.1	28.1	34.60	-9.5	53.5	473.15	5000
12.	2277.037	45.34	4.1	28.1	34.60	-9.5	33.4	46.77	500
13.	2375.976	67.33	5.1	28.3	34.62	-9.5	56.6	676.08	5000
14.	2375.976	57.80	5.1	28.3	34.62	-9.5	47.1	226.46	500
15.	3860.918	56.81	6.9	32.6	34.65	-9.5	52.2	407.38	5000
16.	3860.918	44.63	6.9	32.6	34.65	-9.5	40.0	100.00	500
17.	4824.000	48.00	8.1	33.0	34.7	-9.5	44.9	175.79	5000
18.	4824.000	33.86	8.1	33.0	34.7	-9.5	30.8	34.67	500
19.	5048.968	57.1	8.0	33.7	34.67	-9.5	54.6	537.03	5000
20.	5048.968	46.13	8.0	33.7	34.67	-9.5	43.7	153.11	500

Mode: MCS0 (txpwr setting = 8)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	82.86	5.2	28.4	34.62	-9.5	72.3	4120.98	5000
2.	2390	58.72	5.2	28.4	34.62	-9.5	48.2	257.04	500

Mode: 54Mb/s

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	76.73	5.2	28.4	34.62	-9.5	66.2	2041.74	5000
2.	2390	53.86	5.2	28.4	34.62	-9.5	43.3	146.22	500

Mode: 6Mb/s (txpwr setting = 10)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	84.27	5.2	28.4	34.62	-9.5	73.8	4897.79	5000
2.	2390	60.46	5.2	28.4	34.62	-9.5	49.9	312.61	500

Mode: 11Mb/s

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	64.64	5.2	28.4	34.62	-9.5	54.1	506.99	5000
2.	2390	51.06	5.2	28.4	34.62	-9.5	40.5	105.93	500

Mode: 1Mb/s

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2390	63.07	5.2	28.4	34.62	-9.5	52.6	426.58	5000
2.	2390	50.51	5.2	28.4	34.62	-9.5	40.0	100.00	500

Radiated Electric Field Emissions within the Restricted Band 15.205 continued:

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

Test Details: 2442 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S06, S09
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

Measurements were made at 2412MHz (MCS0 mode) as worst case as indicated by preview measurements.

Radiated Electric Field Emissions within the Restricted Band 15.205 continued:

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

Test Details: 2462 MHz	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S06, S09
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

The worst case radiated emission measurements for spurious emissions and harmonics that fall within the restricted bands are listed below (2412MHz MCS0 was selected from the preview measurements as the worst case, band edge measurements were repeated in all operating modes):

Mode: MCS6 (txpwr setting = 10)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	80.71	4.9	28.5	34.64	-9.5	70.0	3162.28	5000
2.	2483.5	59.76	4.9	28.5	34.64	-9.5	49.0	281.84	500

Mode: MCS0 (txpwr setting = 10)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	81.96	4.9	28.5	34.64	-9.5	71.2	3630.78	5000
2.	2483.5	61.46	4.9	28.5	34.64	-9.5	50.7	342.77	500

Mode: 54Mb/s (txpwr setting = 10)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	84.52	4.9	28.5	34.64	-9.5	73.8	4897.79	5000
2.	2483.5	57.45	4.9	28.5	34.64	-9.5	46.7	216.27	500

Mode: 6Mb/s (txpwr setting = 10)

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	81.66	4.9	28.5	34.64	-9.5	70.9	3507.52	5000
2.	2483.5	59.1	4.9	28.5	34.64	-9.5	48.4	263.03	500

Mode: 11Mb/s

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	62.5	4.9	28.5	34.64	-9.5	51.8	389.05	5000
2.	2483.5	49.16	4.9	28.5	34.64	-9.5	38.4	83.18	500

Mode: 1Mb/s

Ref No.	FREQ. (MHz)	MEAS Rx (dBµV)	CABLE LOSS (dB)	ANT FACT. (dB/m)	PRE AMP (dB)	EXTRAP FACT (dB)	FIELD ST'GH (dBµV/m)	FIELD ST'GH (µV/m)	LIMIT (µV/m)
1.	2483.5	62.04	4.9	28.5	34.64	-9.5	51.3	367.28	5000
2.	2483.5	49.09	4.9	28.5	34.64	-9.5	38.4	83.18	500

Notes:

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
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 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
4 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.
5 For Frequencies below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak RBW=VBW= 1MHz
Average RBW=VBW= 1MHz

These settings as per ANSI C63.10

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 emissions falling within the restricted bands defined in 15.205(a):

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

Notes:

(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:

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

The results displayed take into account applicable antenna factors and cable losses.

(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

A7 Power Line Conducted Emissions

Preview power line conducted emission measurements were performed with a peak detector in a screened room. The effect of the EUT set-up on the measurements is summarised in note (b). Where applicable formal measurements of the emissions were performed with a peak, average and/or quasi peak detector. The EUT was set to transmit on its lowest, centre and highest carrier frequency in turn. The formal measurements are detailed below:

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10
Frequency range	150kHz to 30MHz
EUT sample number	S01, S08
Modification state	0
SE in test environment	TRaC Monitor
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C

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

Results measured using the average detector compared to the average limit

Frequency (MHz)	Average (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.415000	29.9	15000.0	10.000	GND	N	10.1	17.6	47.5
0.425000	28.3	15000.0	10.000	GND	N	10.1	19.0	47.3
0.535000	31.4	15000.0	10.000	GND	L1	10.1	14.6	46.0
0.945000	22.4	15000.0	10.000	GND	L1	10.1	23.6	46.0
3.845000	21.5	15000.0	10.000	GND	L1	10.1	24.5	46.0
7.085000	27.8	15000.0	10.000	GND	L1	10.4	22.2	50.0
7.345000	24.8	15000.0	10.000	GND	N	10.5	25.2	50.0
7.520000	23.5	15000.0	10.000	GND	N	10.5	26.5	50.0
7.690000	28.1	15000.0	10.000	GND	N	10.5	21.9	50.0
13.560000	13.4	15000.0	10.000	GND	N	10.8	36.6	50.0
13.640000	12.8	15000.0	10.000	GND	N	10.8	37.2	50.0
13.780000	12.3	15000.0	10.000	GND	L1	10.8	37.7	50.0

Results measured using the quasi-peak detector compared to the quasi–peak limit

Frequency (MHz)	QuasiPeak (dBµV)	Meas. Time (ms)	Bandwidth (kHz)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.415000	42.0	15000.0	10.000	GND	N	10.1	15.6	57.5
0.425000	41.4	15000.0	10.000	GND	N	10.1	15.9	57.3
0.535000	45.9	15000.0	10.000	GND	L1	10.1	10.1	56.0
0.945000	35.7	15000.0	10.000	GND	L1	10.1	20.3	56.0
3.845000	34.7	15000.0	10.000	GND	L1	10.1	21.3	56.0
7.085000	45.4	15000.0	10.000	GND	L1	10.4	14.6	60.0
7.345000	43.5	15000.0	10.000	GND	N	10.5	16.5	60.0
7.520000	44.3	15000.0	10.000	GND	N	10.5	15.7	60.0
7.690000	46.1	15000.0	10.000	GND	N	10.5	13.9	60.0
13.560000	21.0	15000.0	10.000	GND	N	10.8	39.0	60.0
13.640000	30.1	15000.0	10.000	GND	N	10.8	29.9	60.0
13.780000	21.0	15000.0	10.000	GND	L1	10.8	39.0	60.0

Specification limits :

Conducted emission limits (47 CFR Part 15: Clause 15.207):

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dBμV	
	Quasi-peak	Average
0.15 to 0.5	66 to 56[2]	56 to 46[2]
0.5 to 5	56	46
5 to 30	60	50

Notes:
1. The lower limit shall apply at the transition frequency.
2. The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz.

Notes:

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

(b) The following table summarises the effect of the EUT operating mode and internal configuration on the measured emission levels :

	See (i)	See (ii)	See (iii)	See (iv)
Effect of EUT operating mode on emission levels				✓
Effect of EUT internal configuration on emission levels		✓		

(i) Parameter defined by standard and / or single possible, refer to Appendix C
(ii) Parameter defined by client and / or single possible, refer to Appendix C
(iii) Parameter had a negligible effect on emission levels, refer to Appendix C
(iv) Worst case determined by initial measurement, refer to Appendix C

A8 Antenna Gain

The maximum antenna gain for the antenna types to be used with the EUT, as declared by the client, is 2 dBi.

A9 Unintentional Radiated Electric Field Emissions - 15.109

Preliminary scans were performed using a peak detector with the RBW = 100kHz. The maximum permitted field strength is listed in Section 15.109. The EUT was set to receive mode only on its lowest, centre and highest carrier frequency in turn.

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]

Test Details: Tx Standby mode	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109(g)
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S01, S08
Modification state	1
SE in test environment	None
SE isolated from EUT	TRaC Laptop
EUT set up	Refer to Appendix C
Temperature	22
Photographs (Appendix F)	Photographs 1, 2 & 3

The worst case radiated emission measurements for spurious emissions:

Radiated Spurious Emissions 30MHz to 1GHz (Quasi-Peak detector)

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Limit (dBµV/m)	Margin (dB)
58.508760	27.2	15000.0	120.000	118.0	V	170.0	-21.5	40.0	12.8
142.059320	37.0	15000.0	120.000	101.0	V	210.0	-14.8	40.0	3.0
148.532453	38.2	15000.0	120.000	101.0	V	178.0	-15.0	40.0	1.8
151.726827	34.7	15000.0	120.000	101.0	V	220.0	-15.1	40.0	5.3
445.495813	31.6	15000.0	120.000	114.0	V	264.0	-10.1	47.0	15.4
742.495653	34.9	15000.0	120.000	101.0	V	253.0	-4.5	47.0	12.1
890.980573	42.9	15000.0	120.000	101.0	V	192.0	-4.1	47.0	4.1
974.992893	40.9	15000.0	120.000	106.0	H	176.0	-1.8	47.0	6.1

No Radiated Spurious Emissions >1GHz were measured within 10dB of the limit line.

Notes:

1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
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= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

Peak RBW=VBW= 1MHz
Average RBW=VBW= 1MHz

These settings as per ANSI C63.10

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 emissions above 1GHz:

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

Radiated emission limits (47 CFR Part 15: Clause 15.109(g)) for emissions below 1GHz:

Frequency of emission (MHz)	Field strength dBμV/m @ 10m	Measurement Distance Used (m)	Field strength dBμV/m @ 3m
30 – 230	30	3	40
230 - 1000	37	3	47

Notes:

(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:

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

The results displayed take into account applicable antenna factors and cable losses.

(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

Appendix B: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

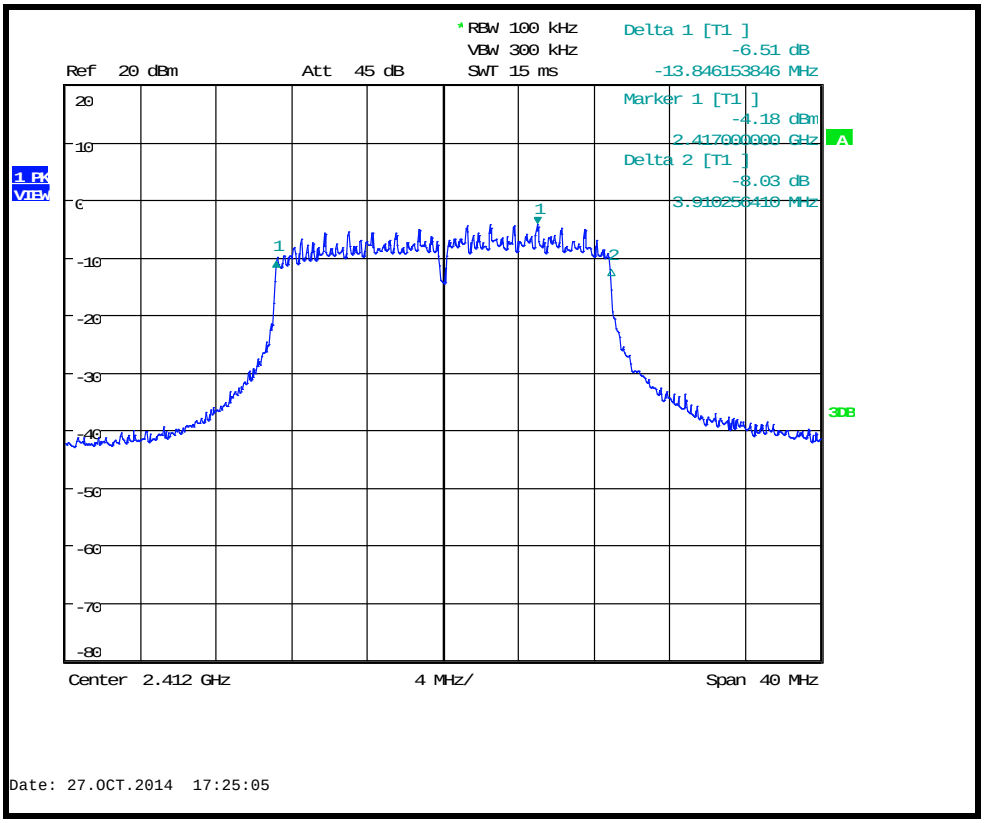
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A.

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

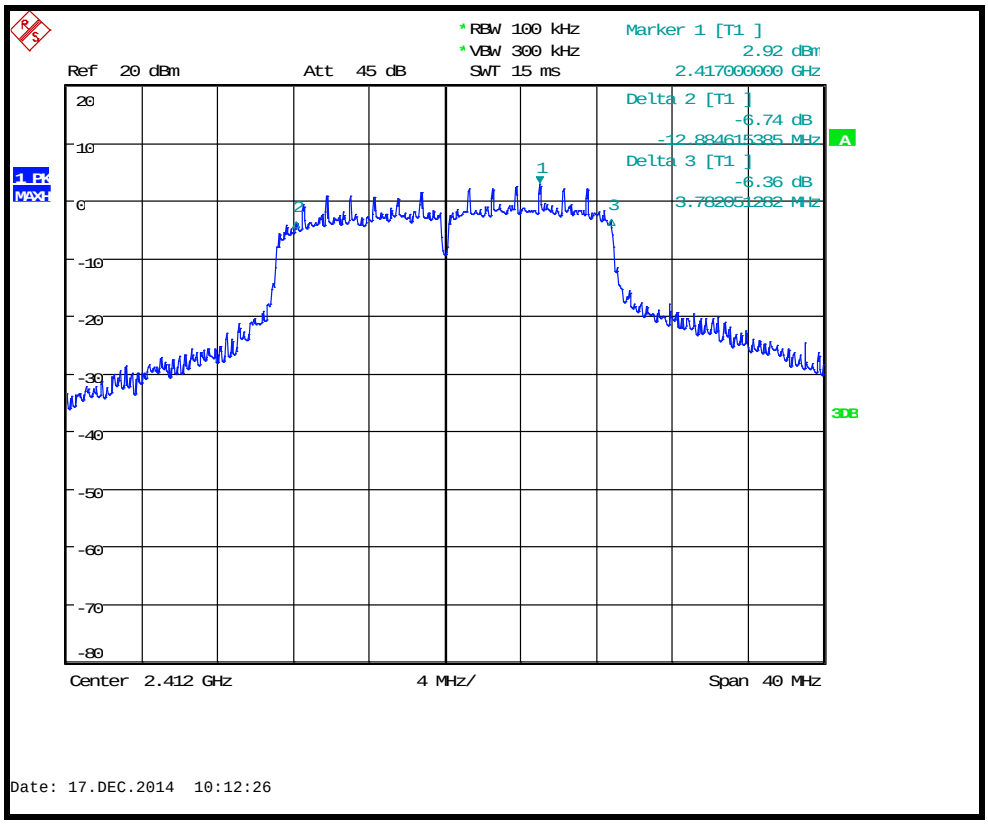
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

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

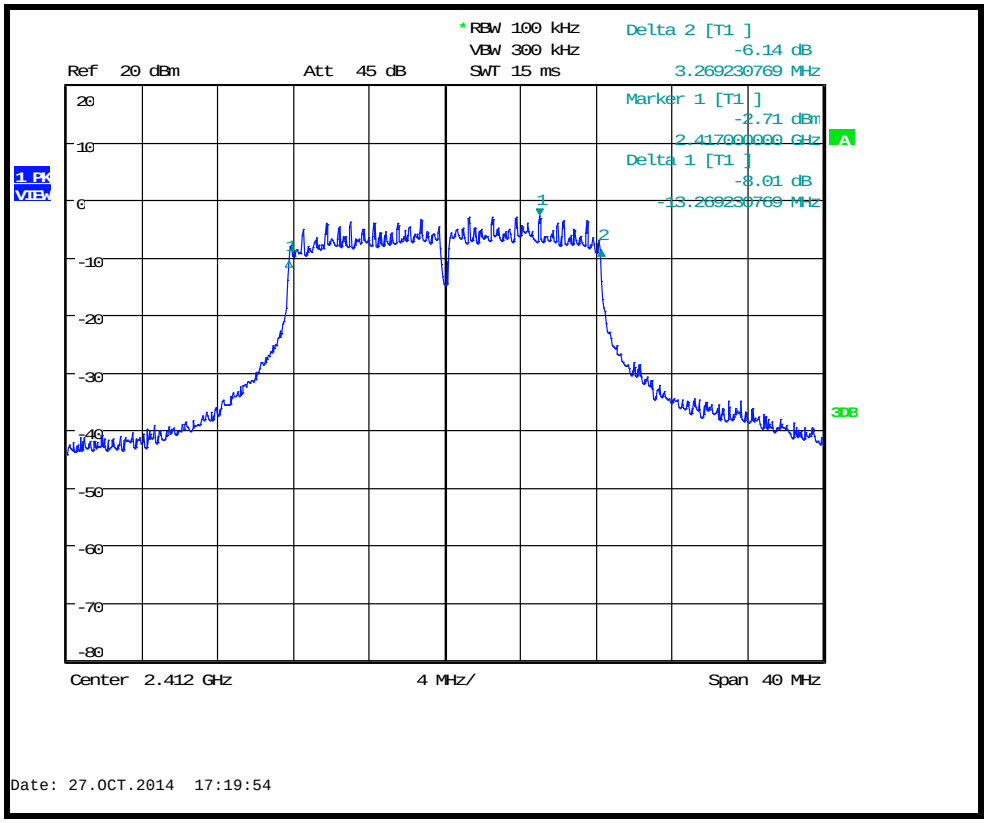
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



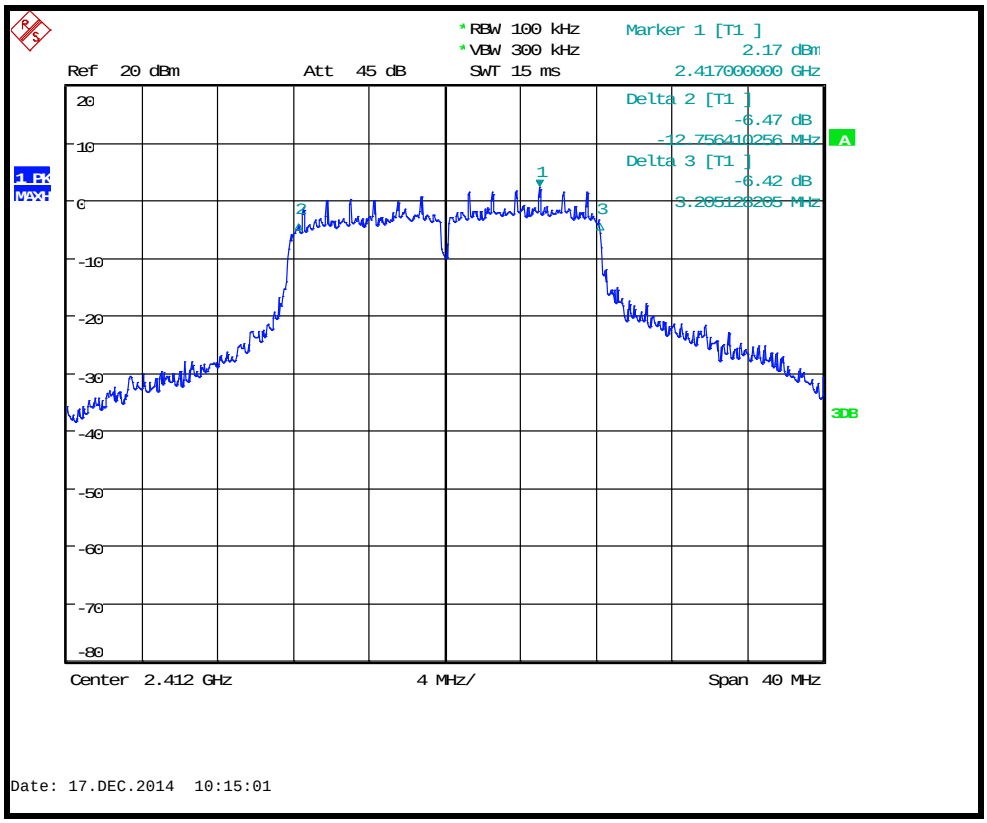
6dB Bandwidth 2412MHz MCS6



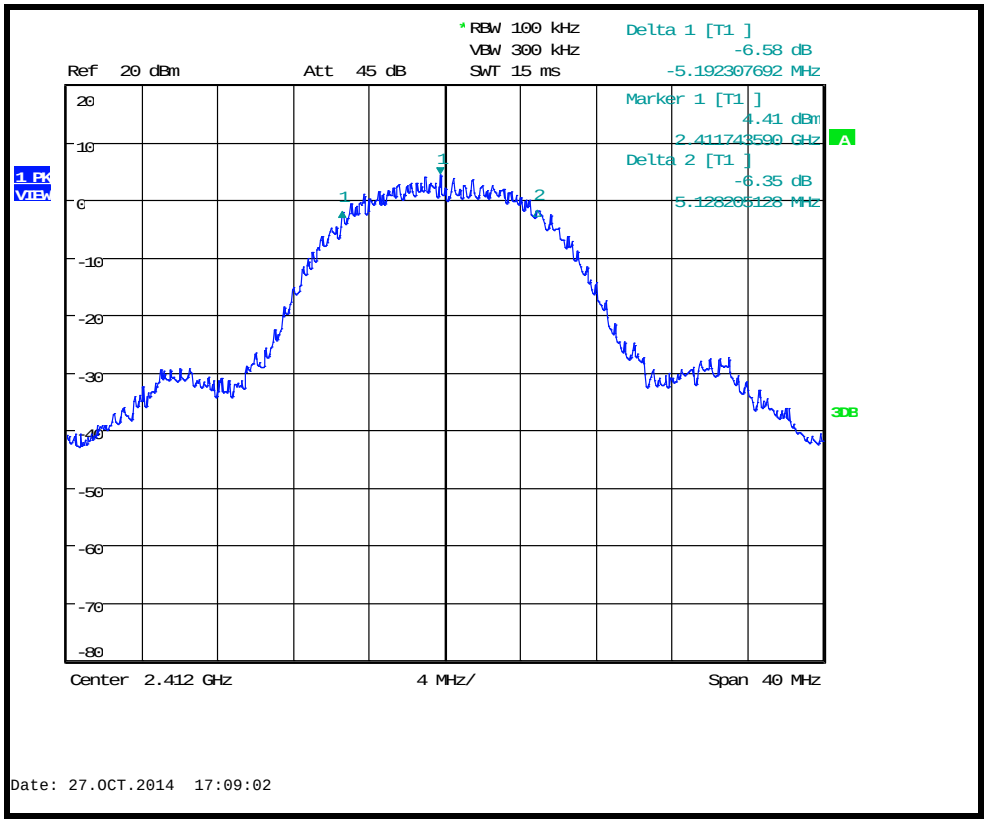
6dB Bandwidth 2412MHz MCS0



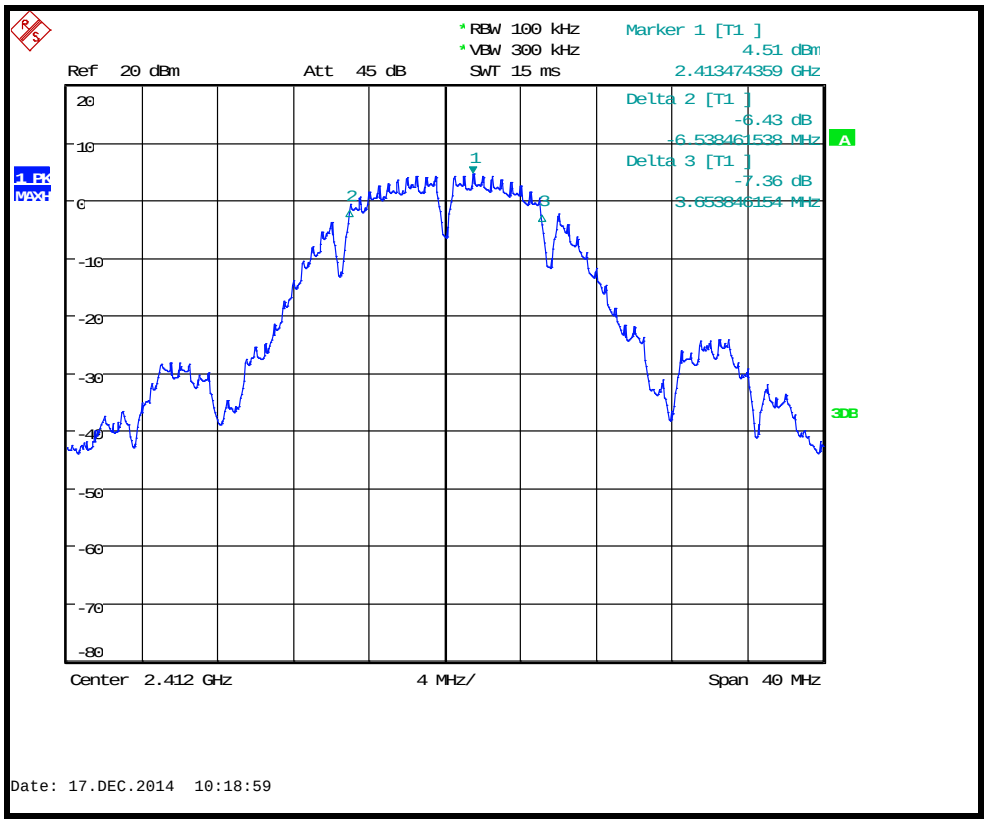
6dB Bandwidth 2412MHz 54Mb/s



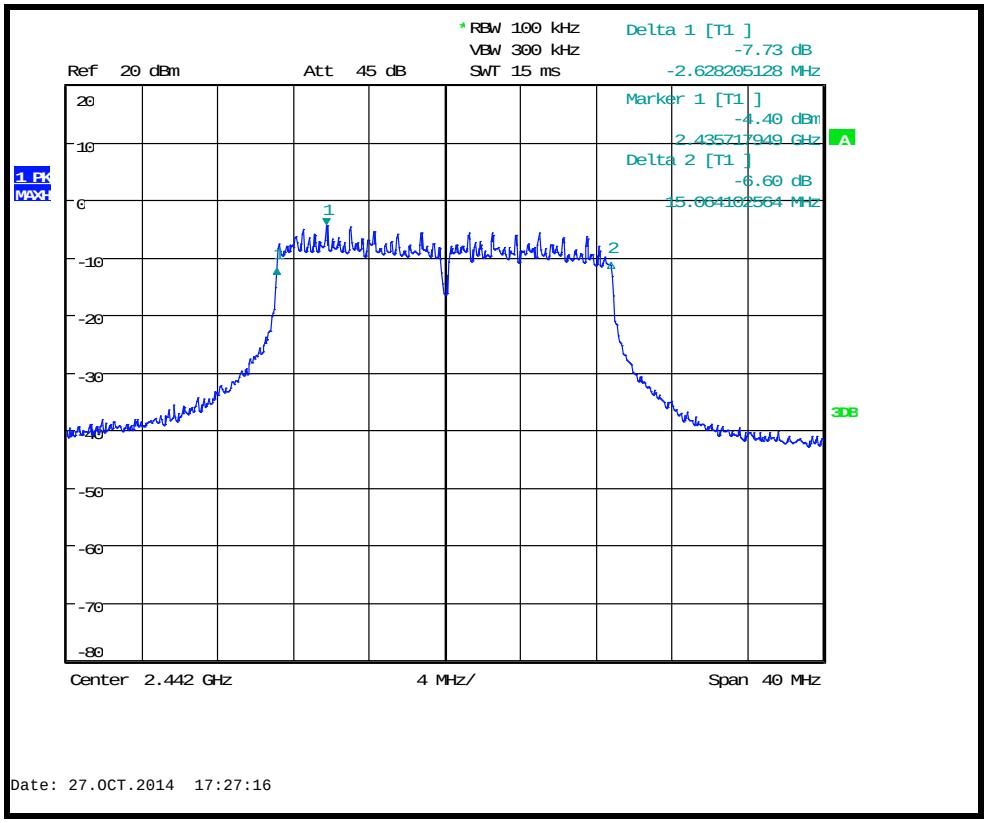
6dB Bandwidth 2412MHz 6Mb/s



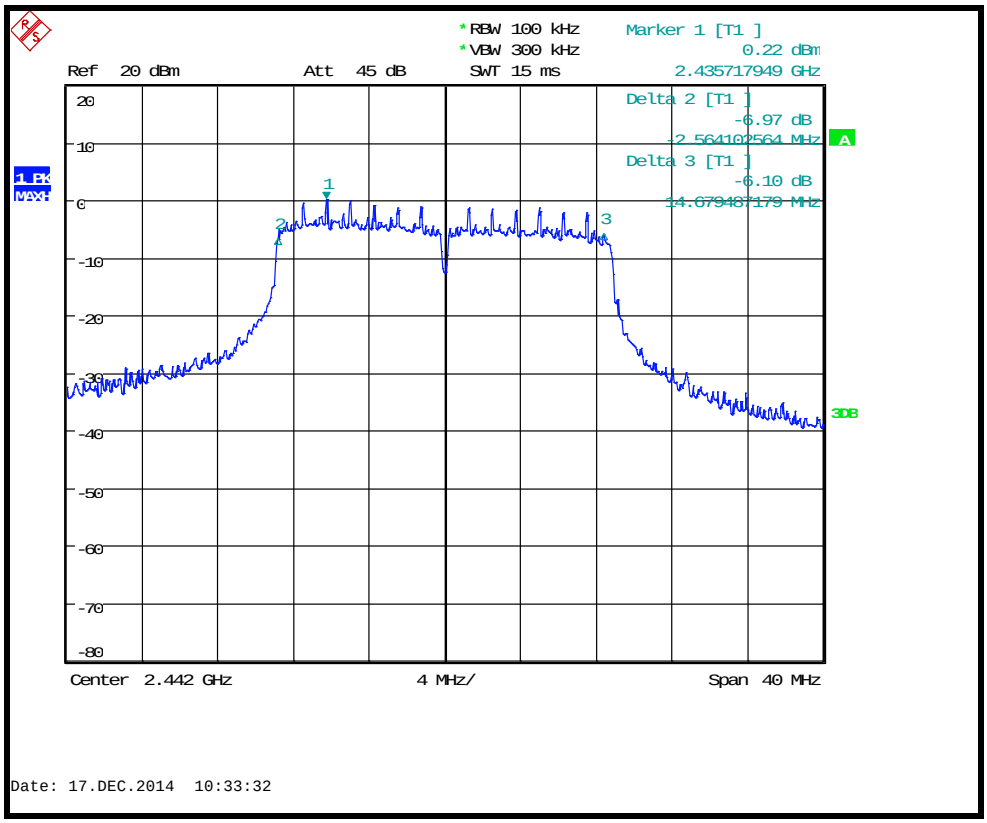
6dB Bandwidth 2412MHz 11Mb/s



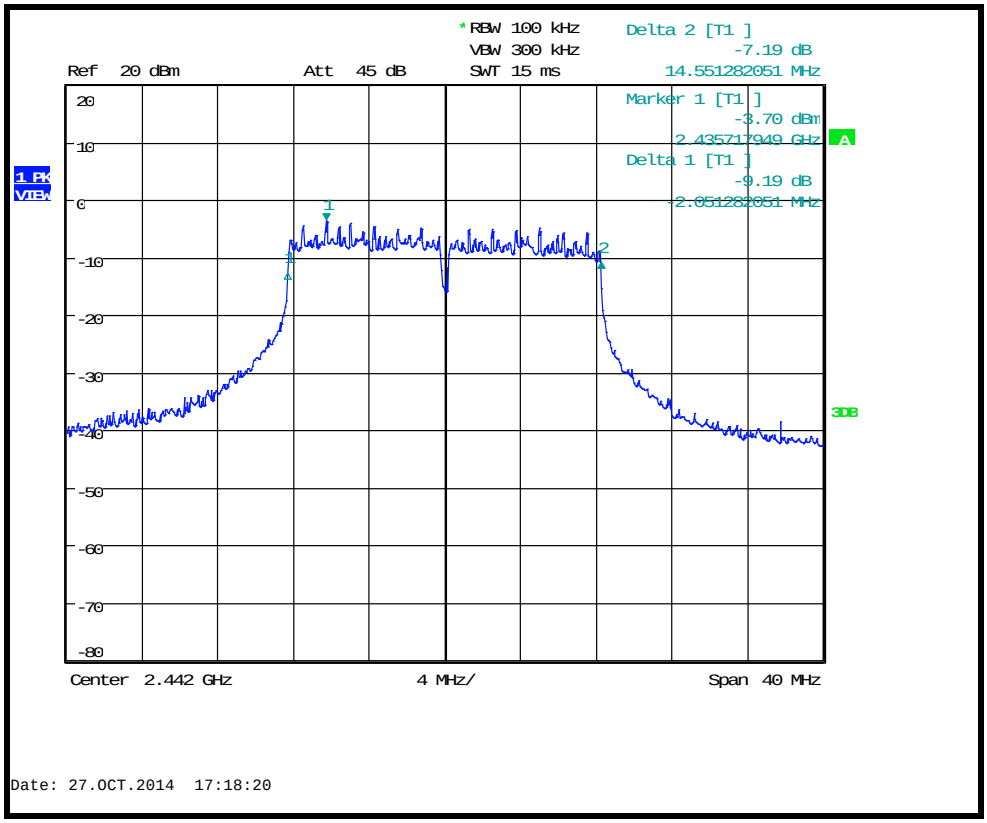
6dB Bandwidth 2412MHz 1Mb/s



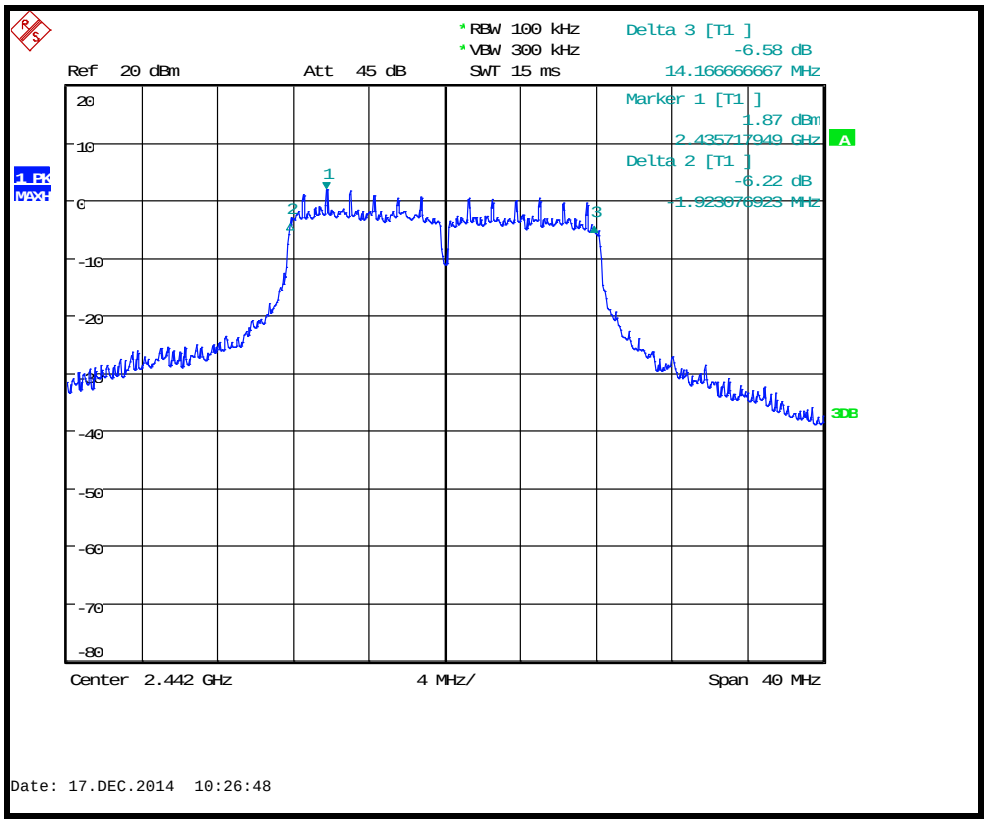
6dB Bandwidth 2442MHz MCS6



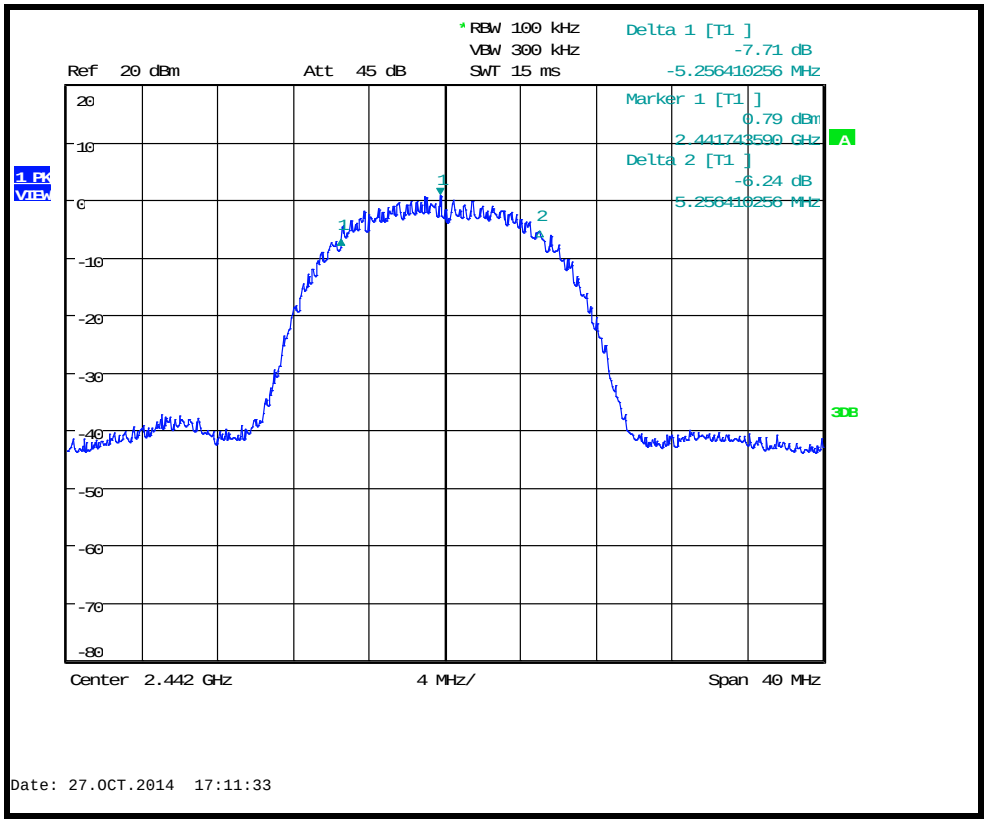
6dB Bandwidth 2442MHz MCS0



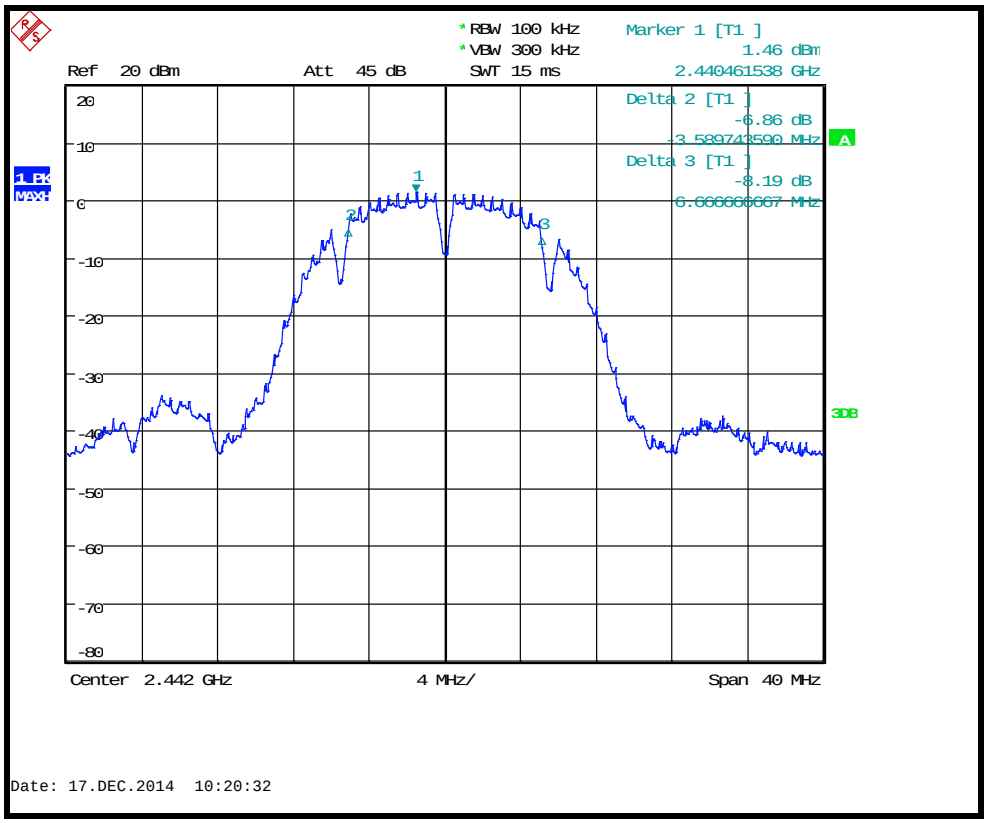
6dB Bandwidth 2442MHz 54Mb/s



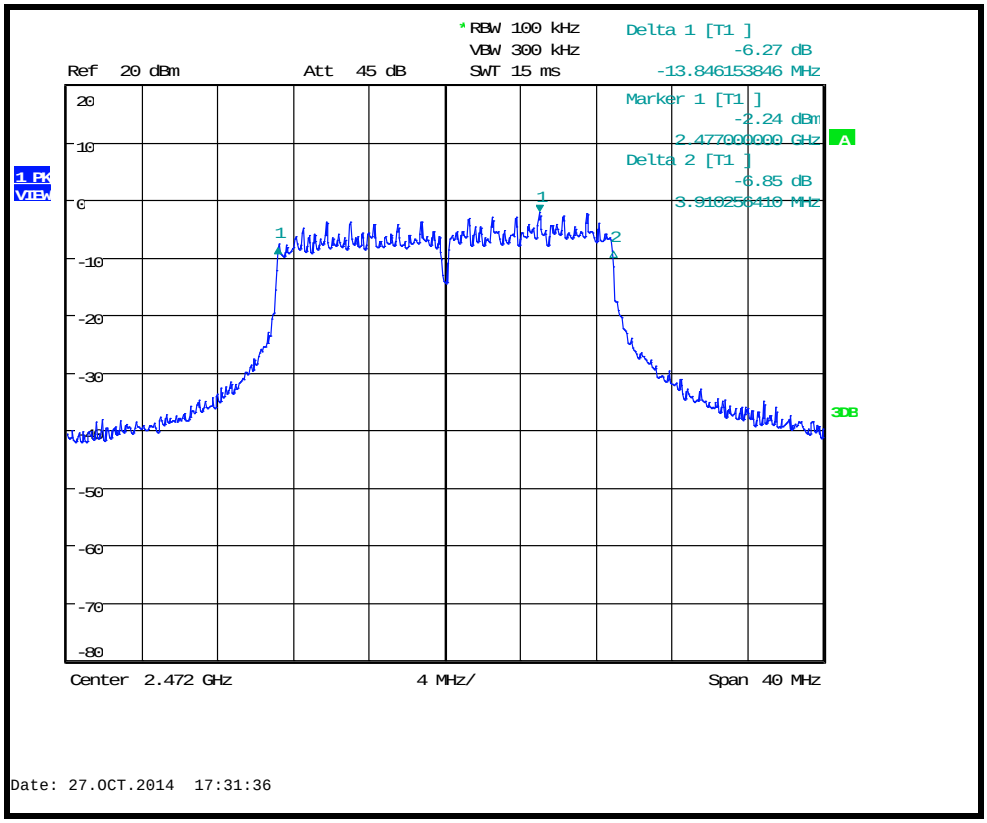
6dB Bandwidth 2442MHz 6Mb/s



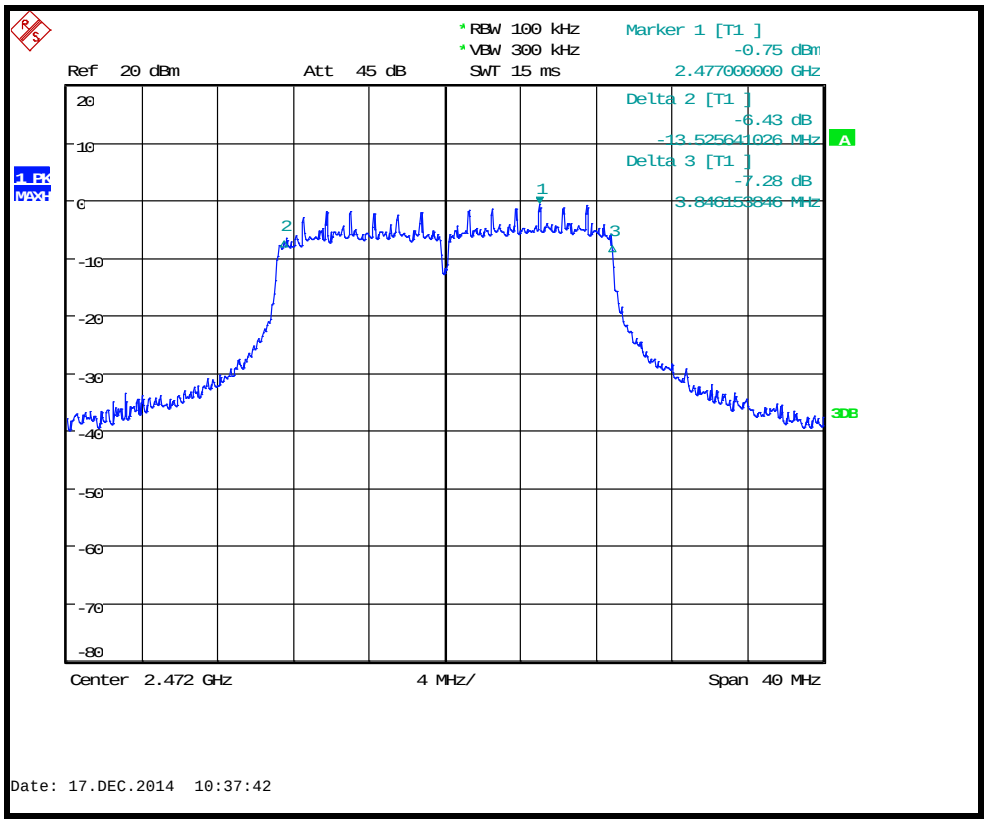
6dB Bandwidth 2442MHz 11Mb/s



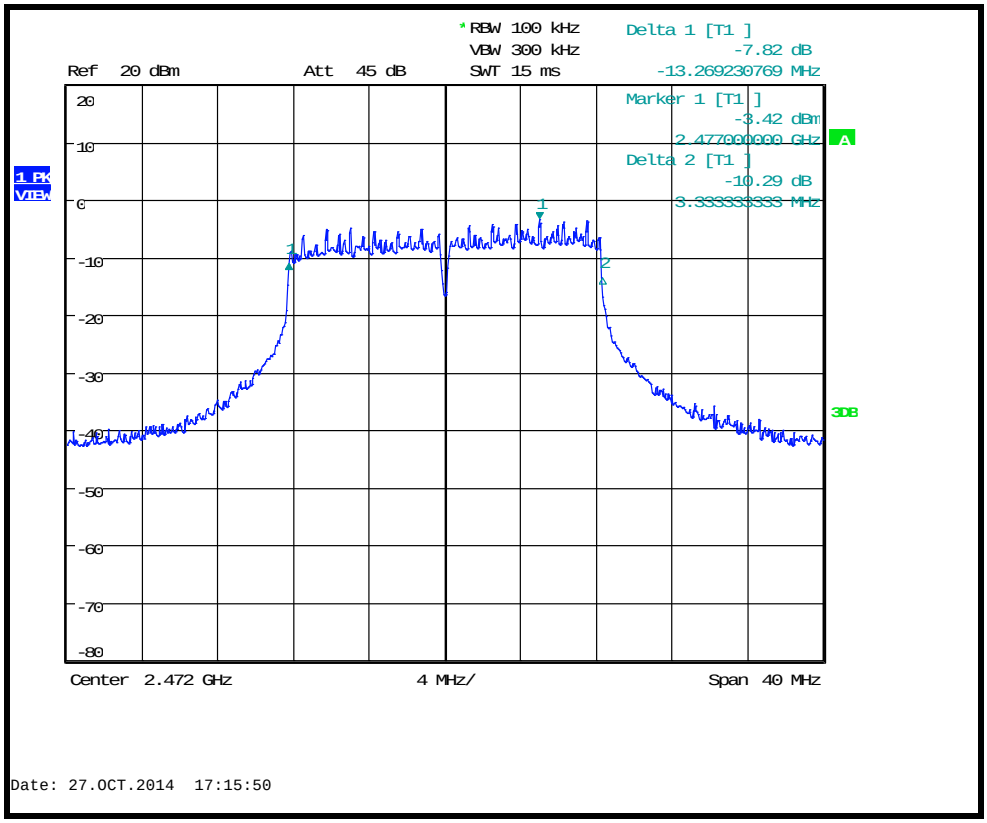
6dB Bandwidth 2442MHz 1Mb/s



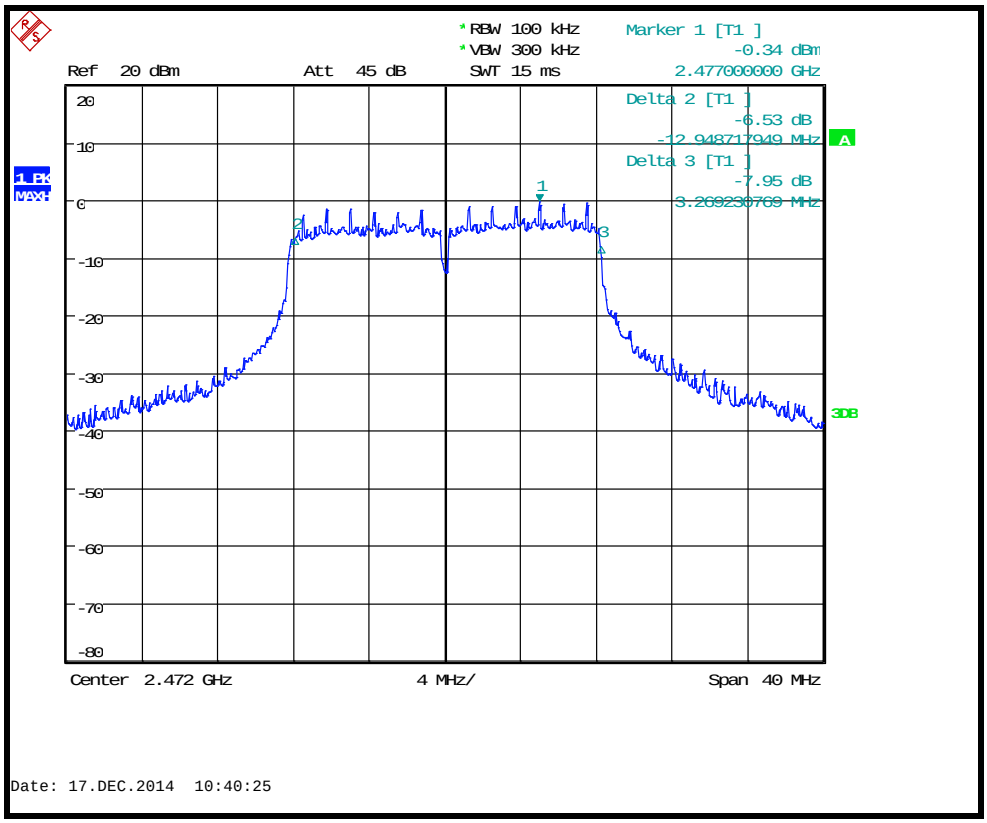
6dB Bandwidth 2472MHz MCS6



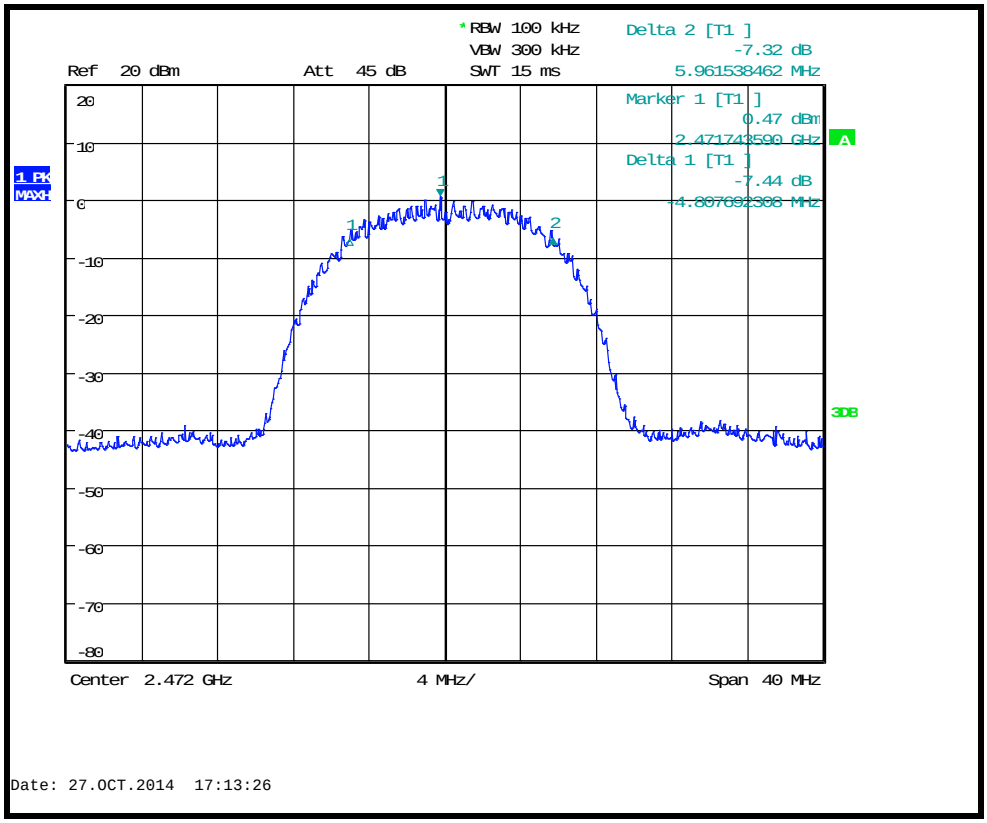
6dB Bandwidth 2472MHz MCS0



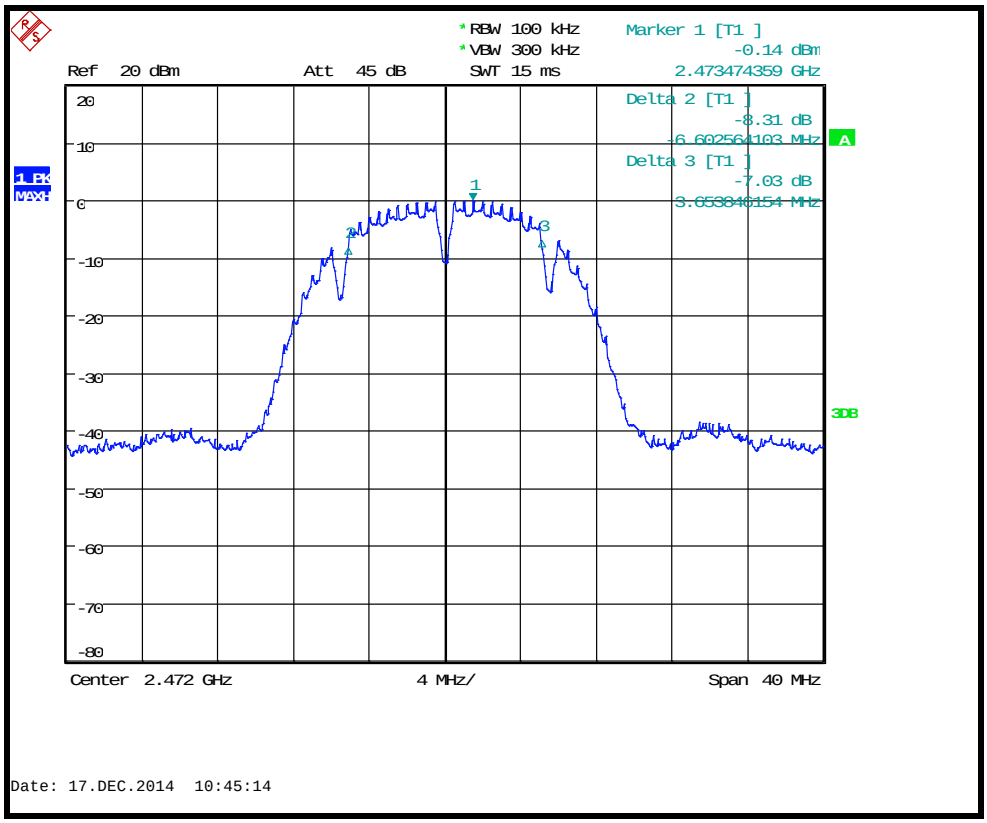
6dB Bandwidth 2472MHz 54Mb/s



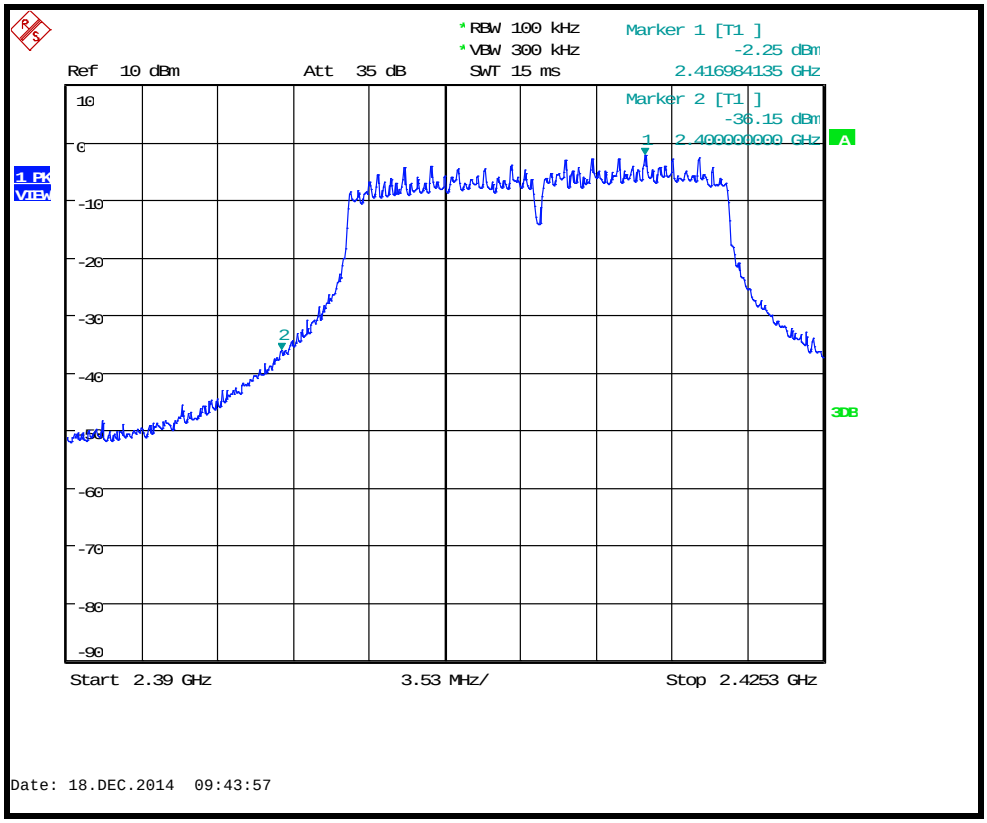
6dB Bandwidth 2472MHz 6Mb/s



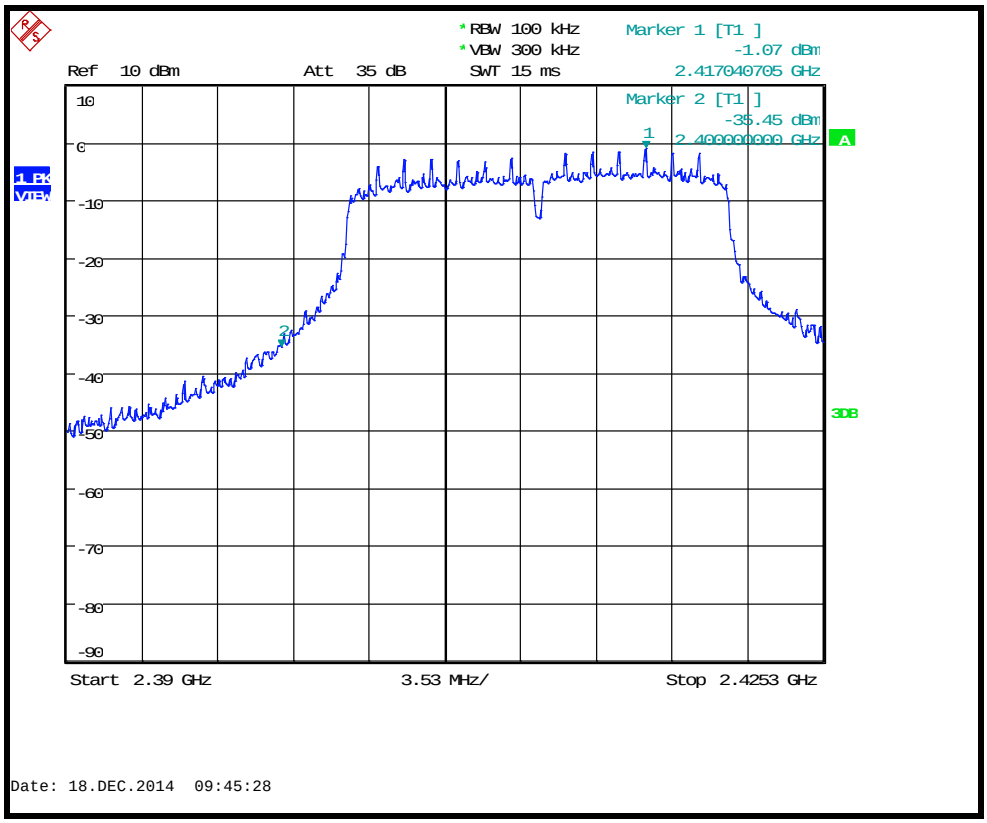
6dB Bandwidth 2472MHz 11Mb/s



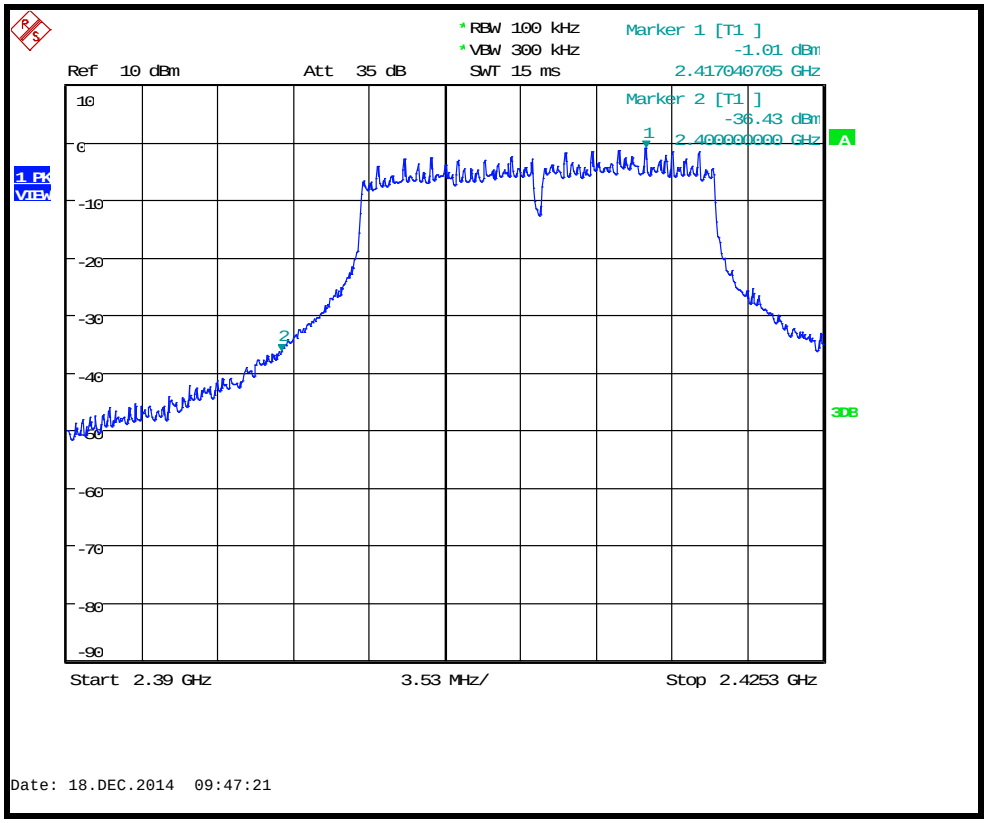
6dB Bandwidth 2472MHz 1Mb/s



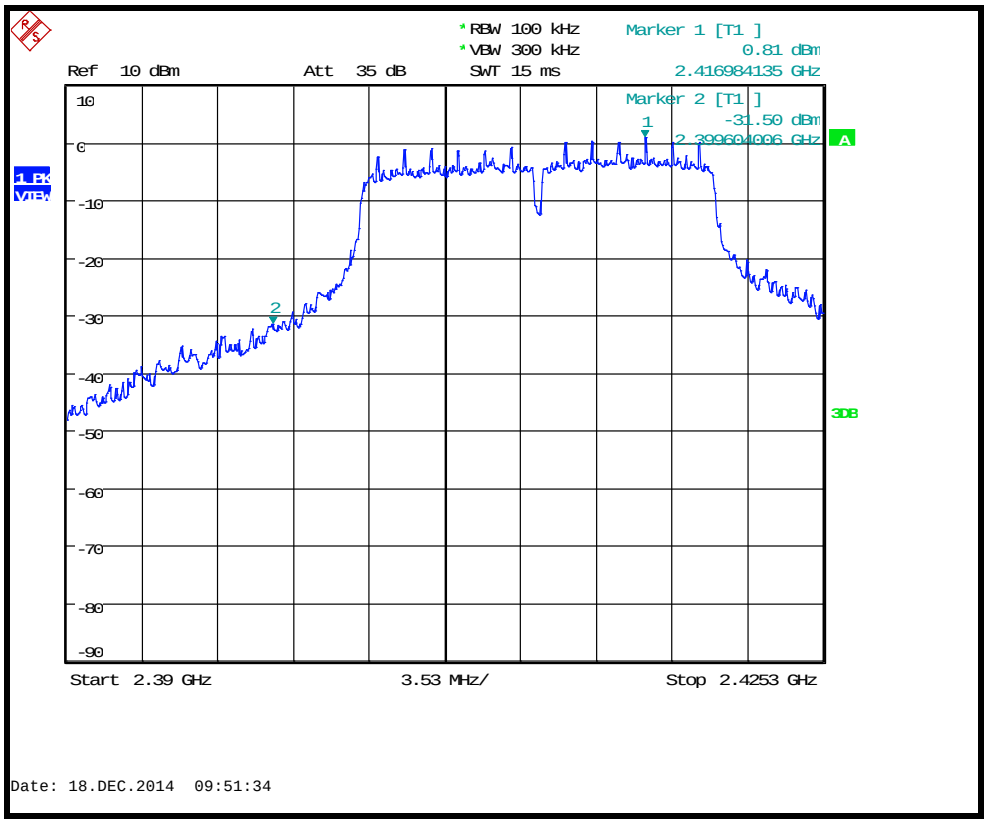
Conducted Lower Band Edge 2412MHz MCS6



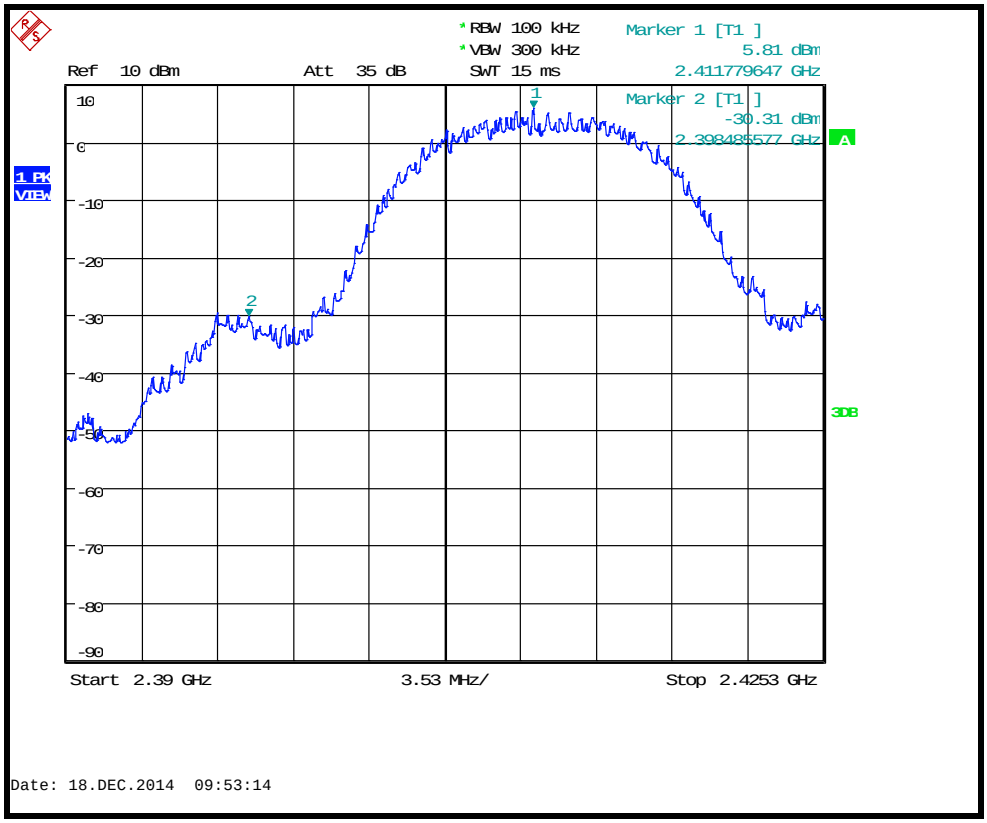
Conducted Lower Band Edge 2412MHz MCS0



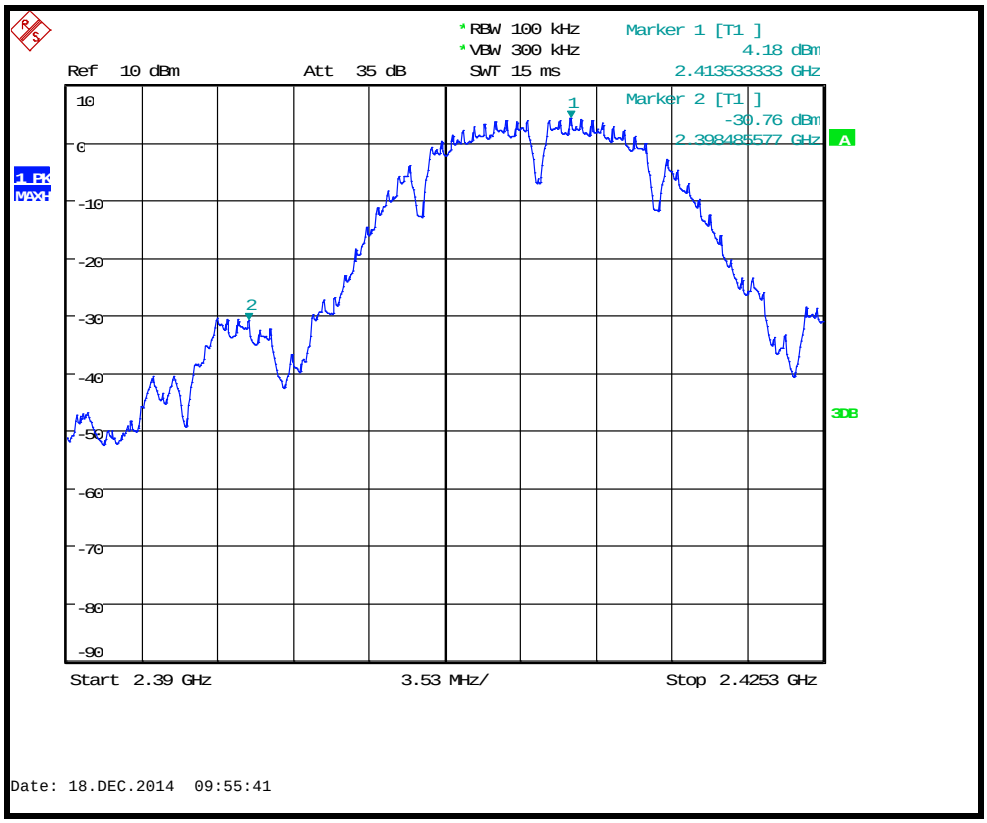
Conducted Lower Band Edge 2412MHz 54Mb/s



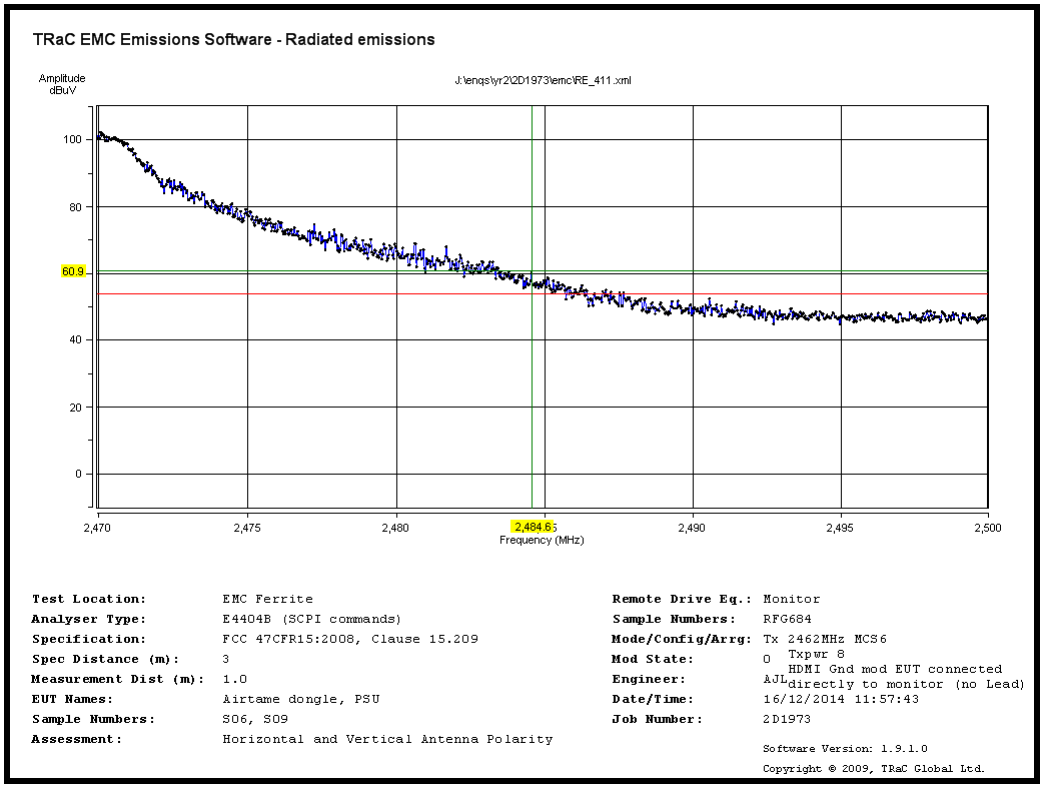
Conducted Lower Band Edge 2412MHz 6Mb/s



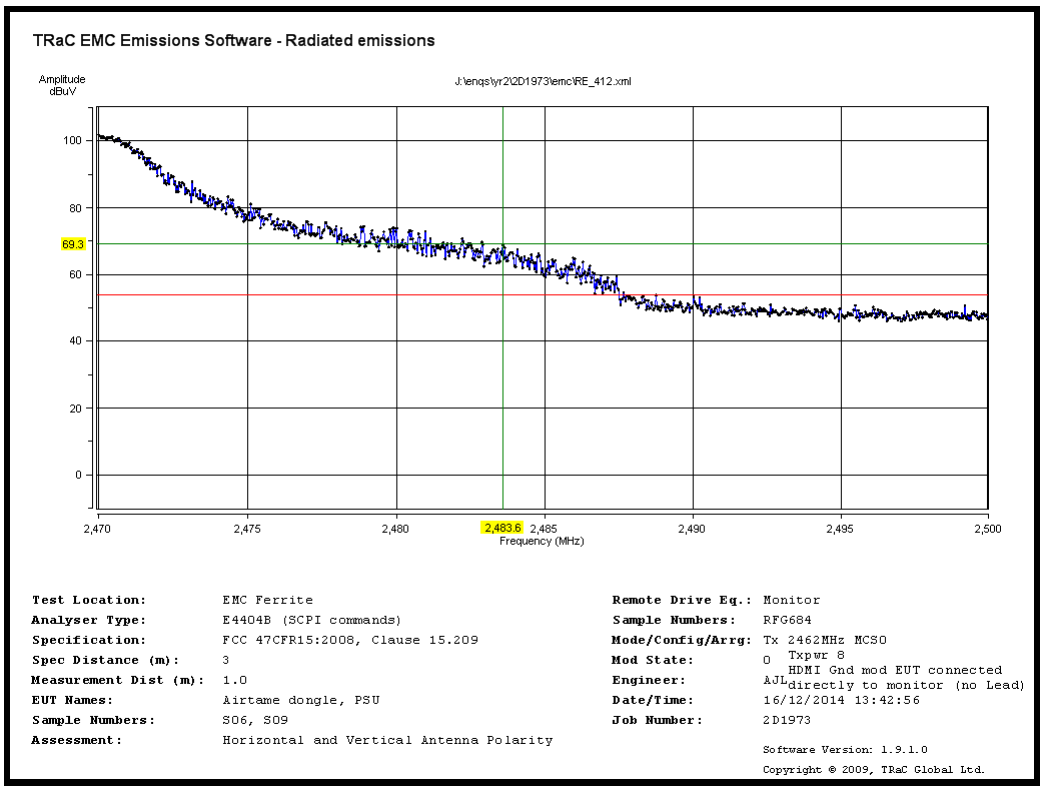
Conducted Lower Band Edge 2412MHz 11Mb/s



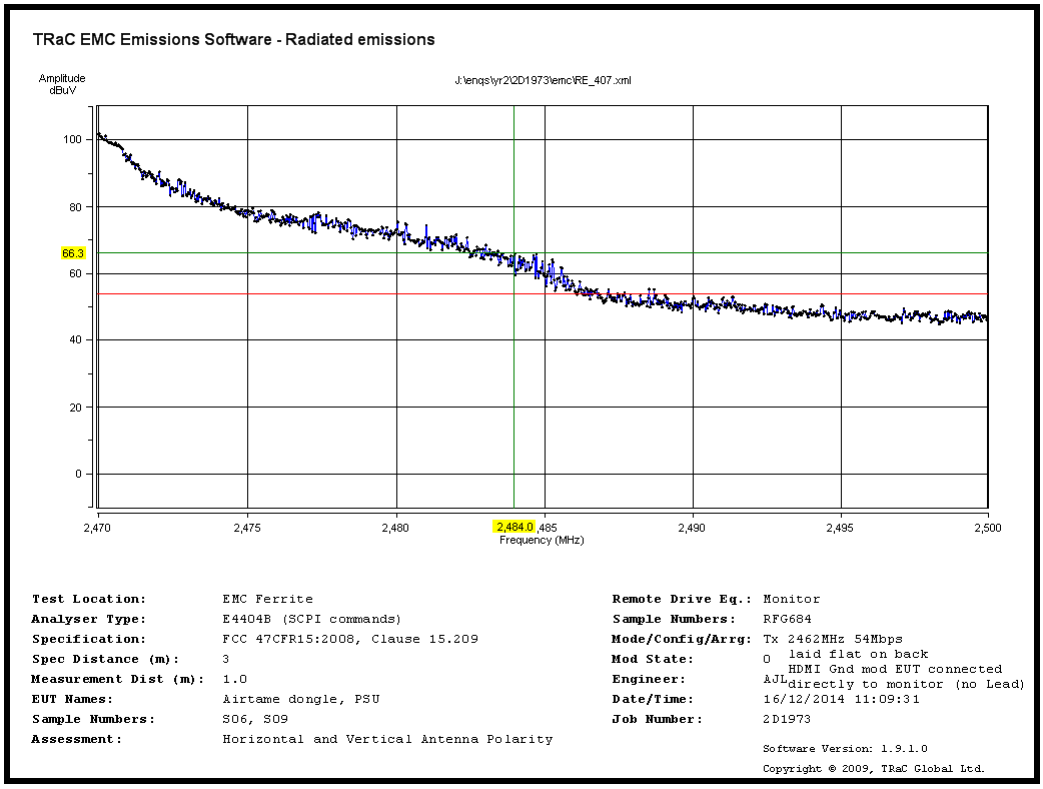
Conducted Lower Band Edge 2412MHz 1Mb/s



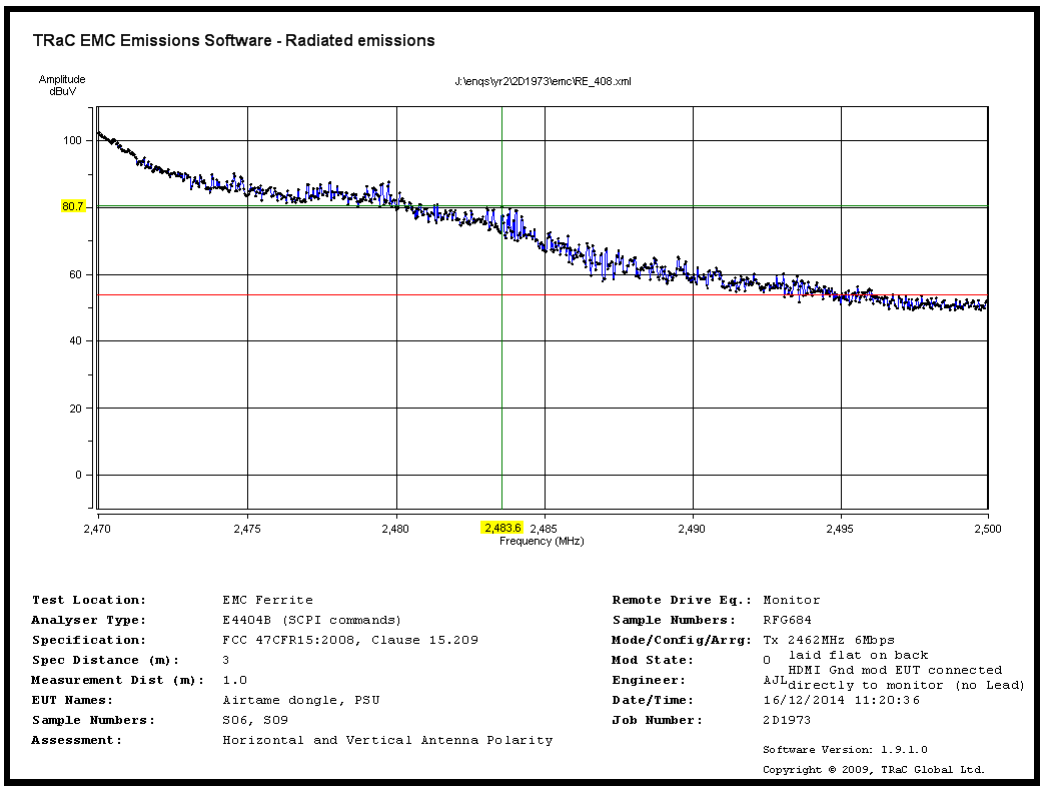
Radiated Upper Band Edge 2462MHz MCS6



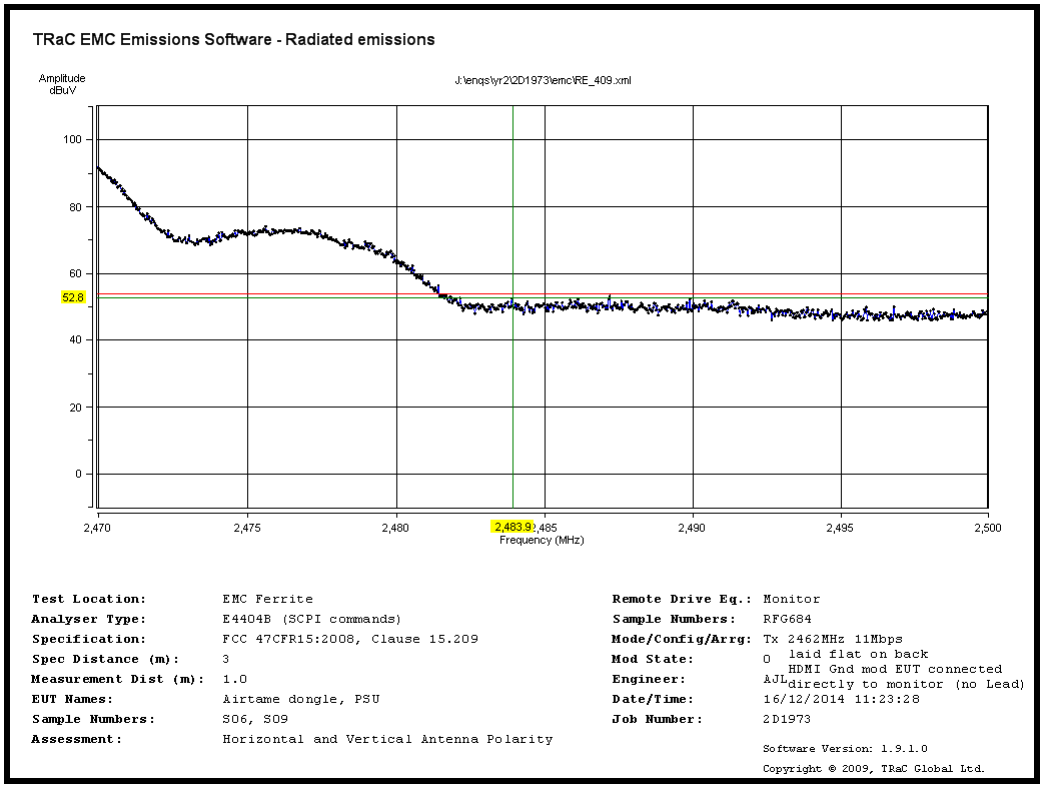
Radiated Upper Band Edge 2462MHz MCS0



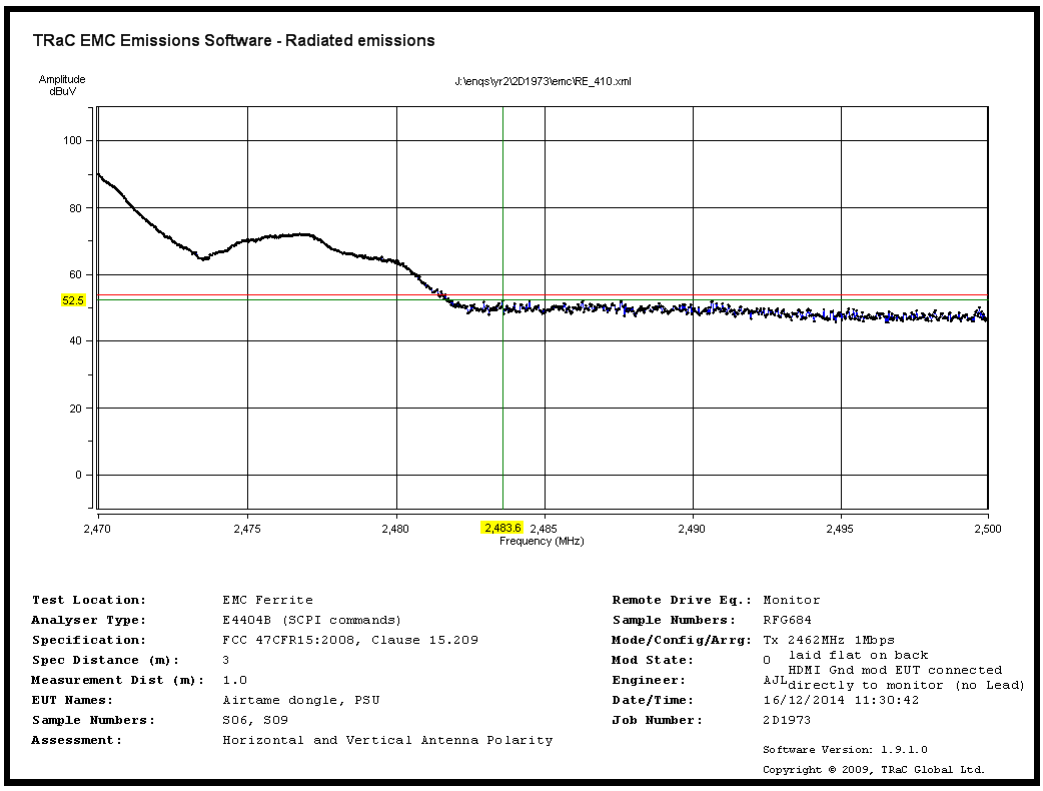
Radiated Upper Band Edge 2462MHz 54Mb/s



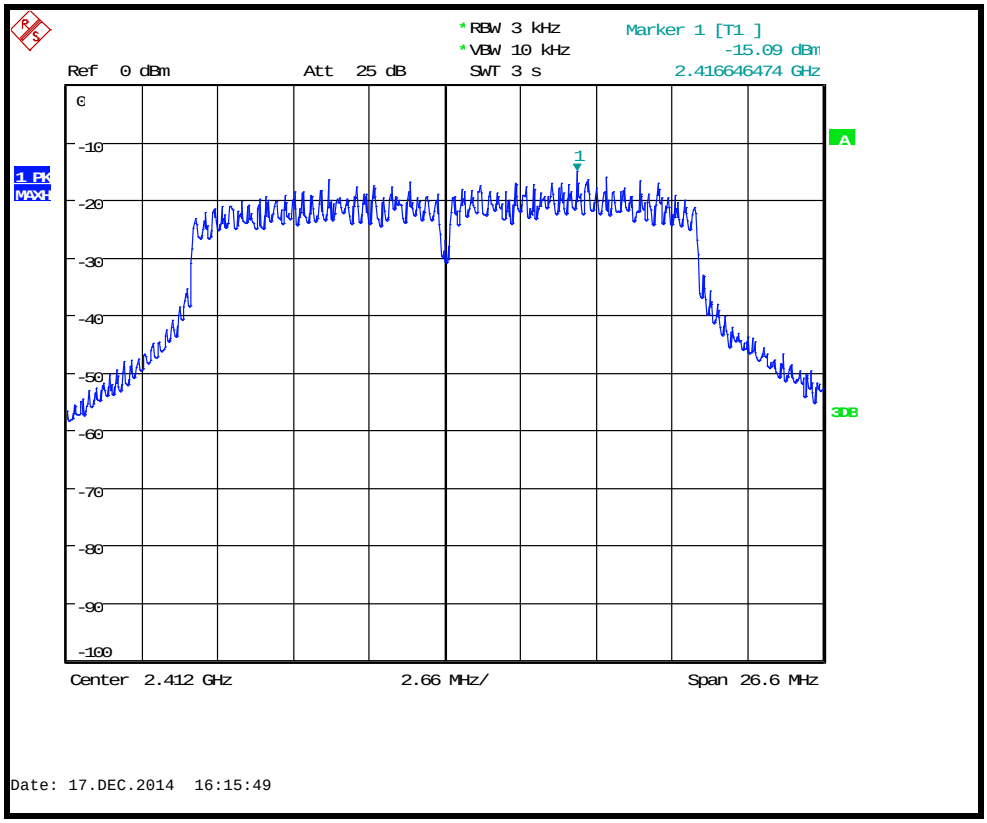
Radiated Upper Band Edge 2462MHz 6Mb/s



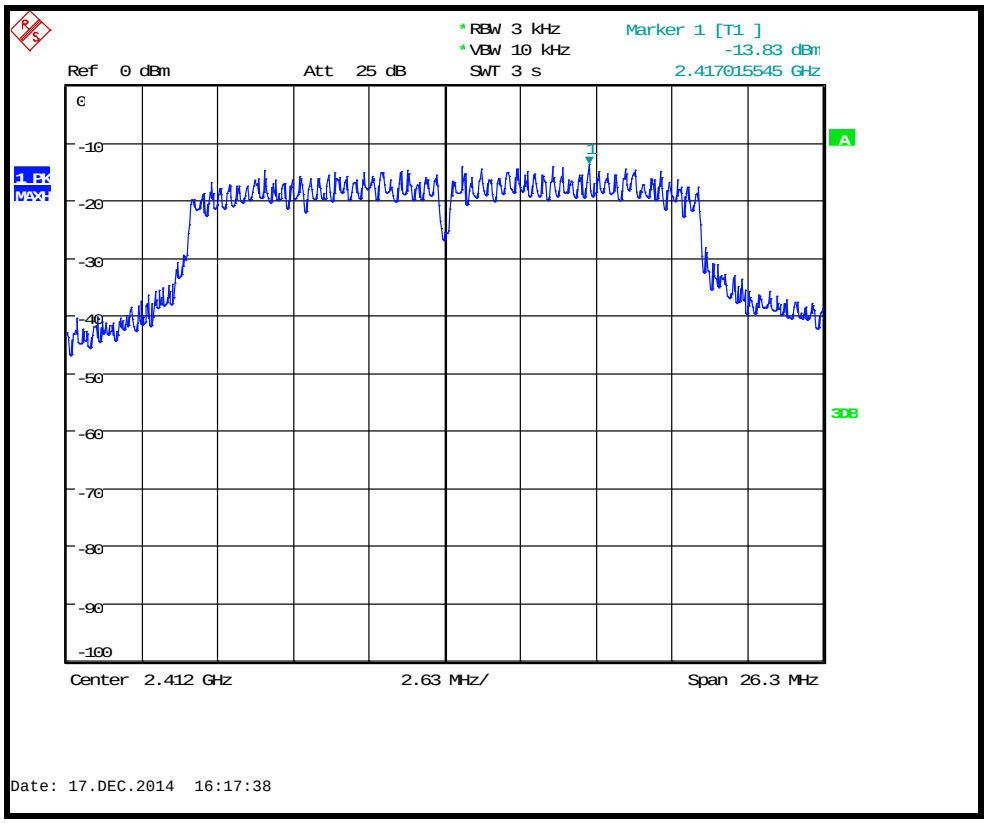
Radiated Upper Band Edge 2462MHz 11Mb/s



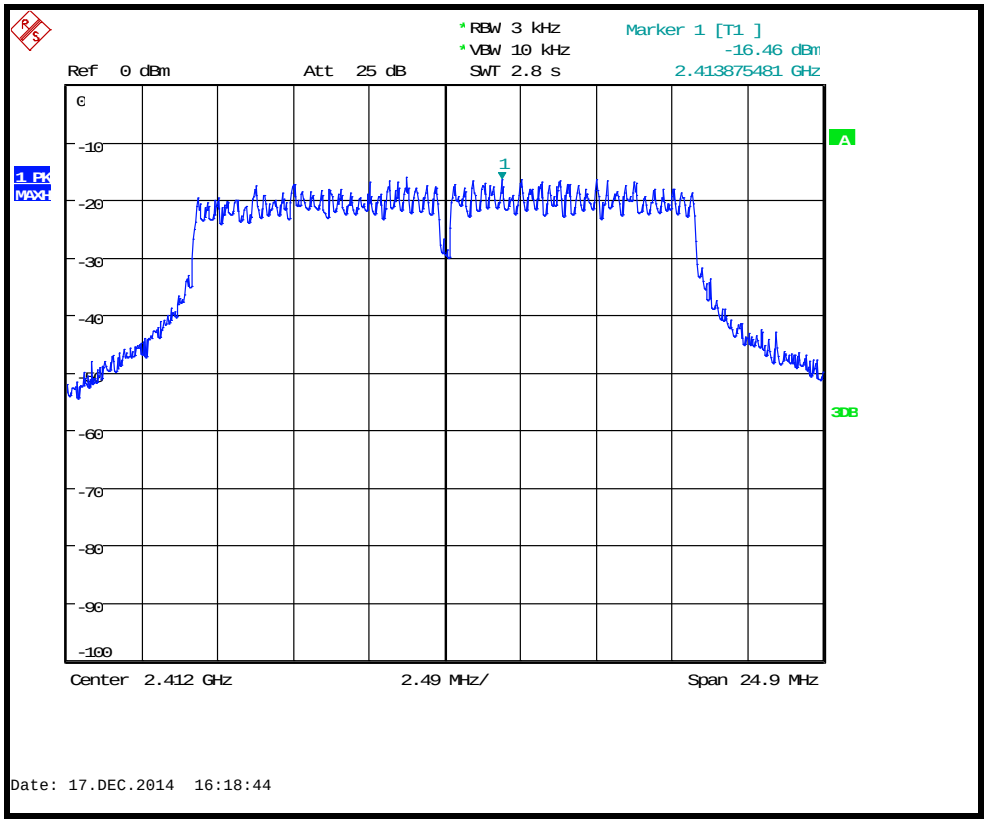
Radiated Upper Band Edge 2462MHz 1Mb/s



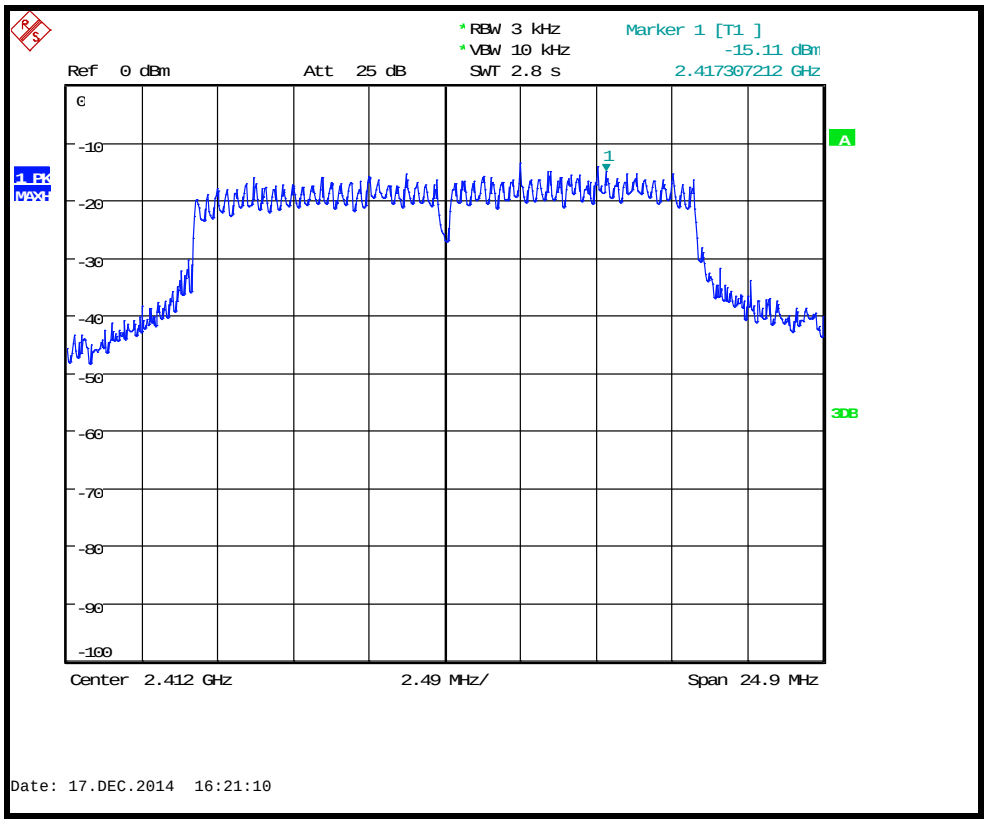
Conducted power spectral density 2412MHz MCS6



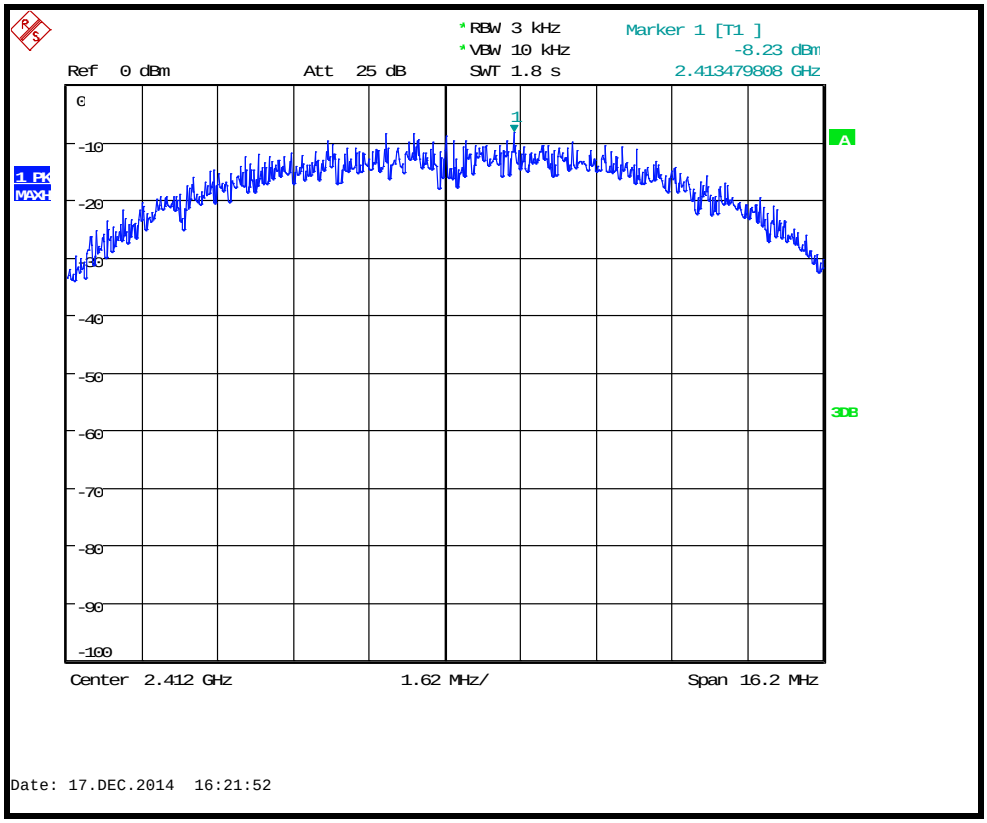
Conducted power spectral density 2412MHz MCS0



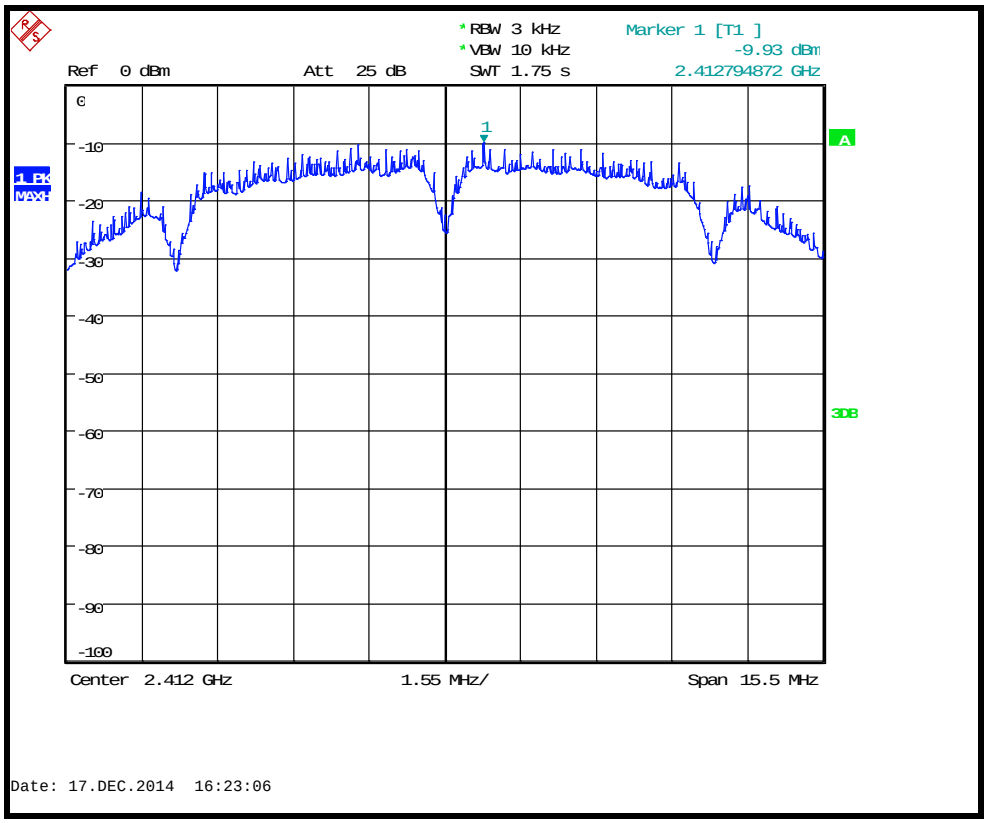
Conducted power spectral density 2412MHz 54Mb/s



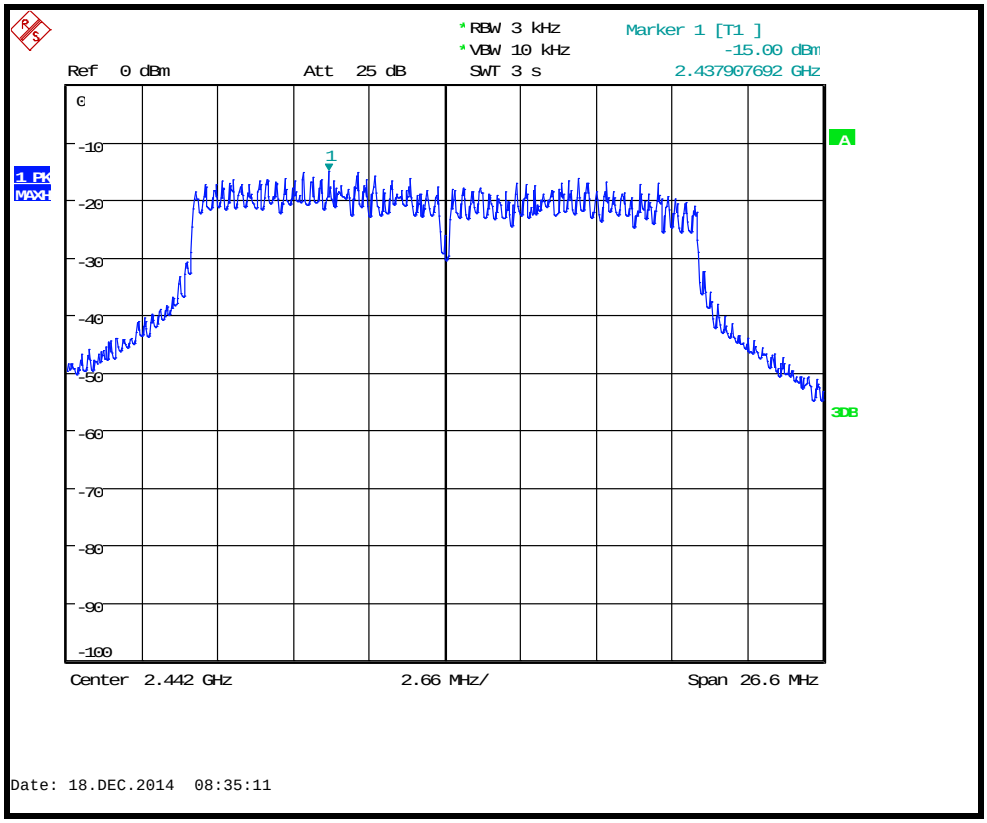
Conducted power spectral density 2412MHz 6Mb/s



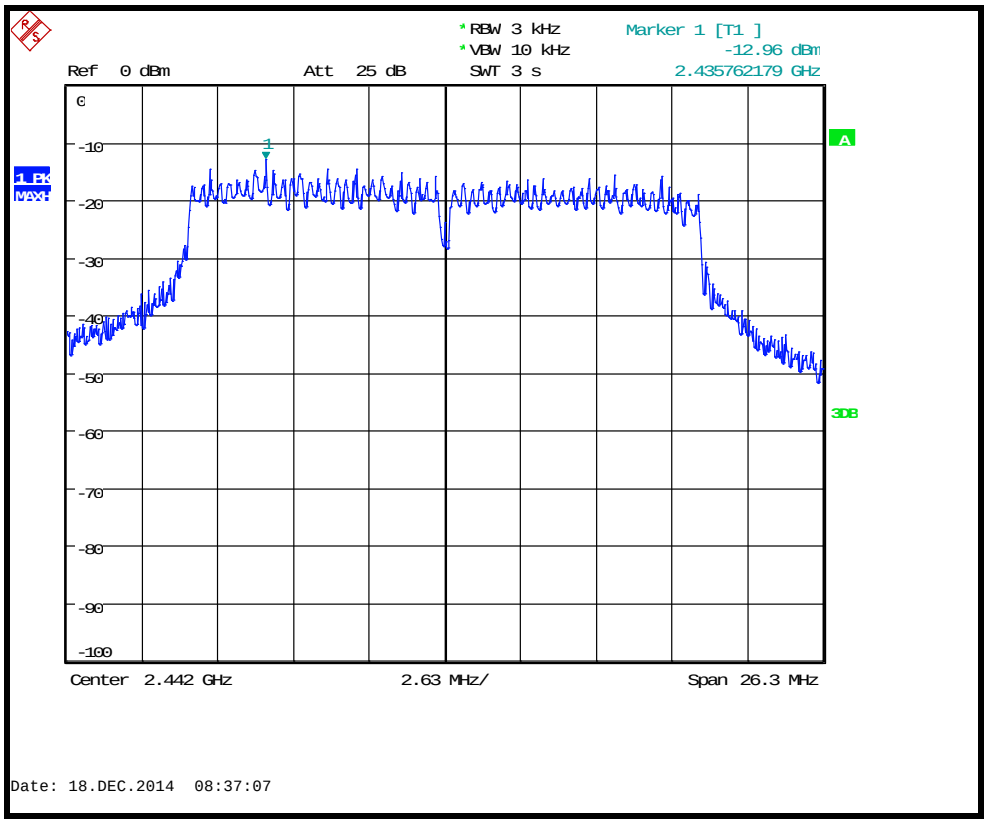
Conducted power spectral density 2412MHz 11Mb/s



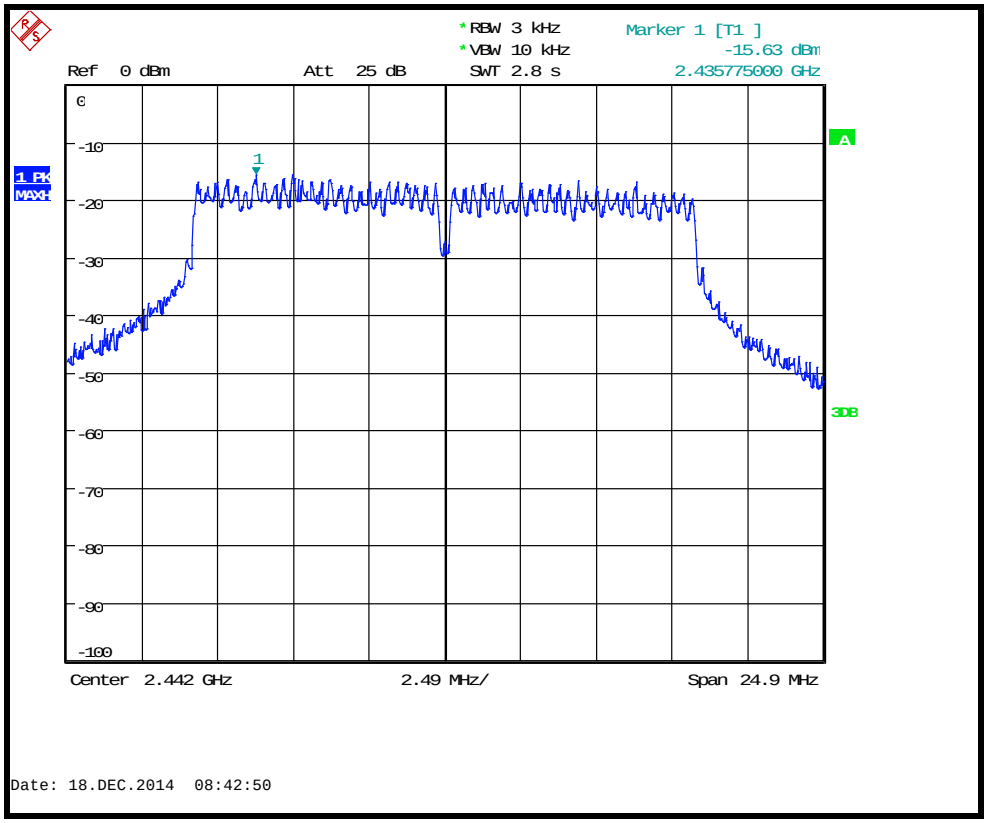
Conducted power spectral density 2412MHz 1Mb/s



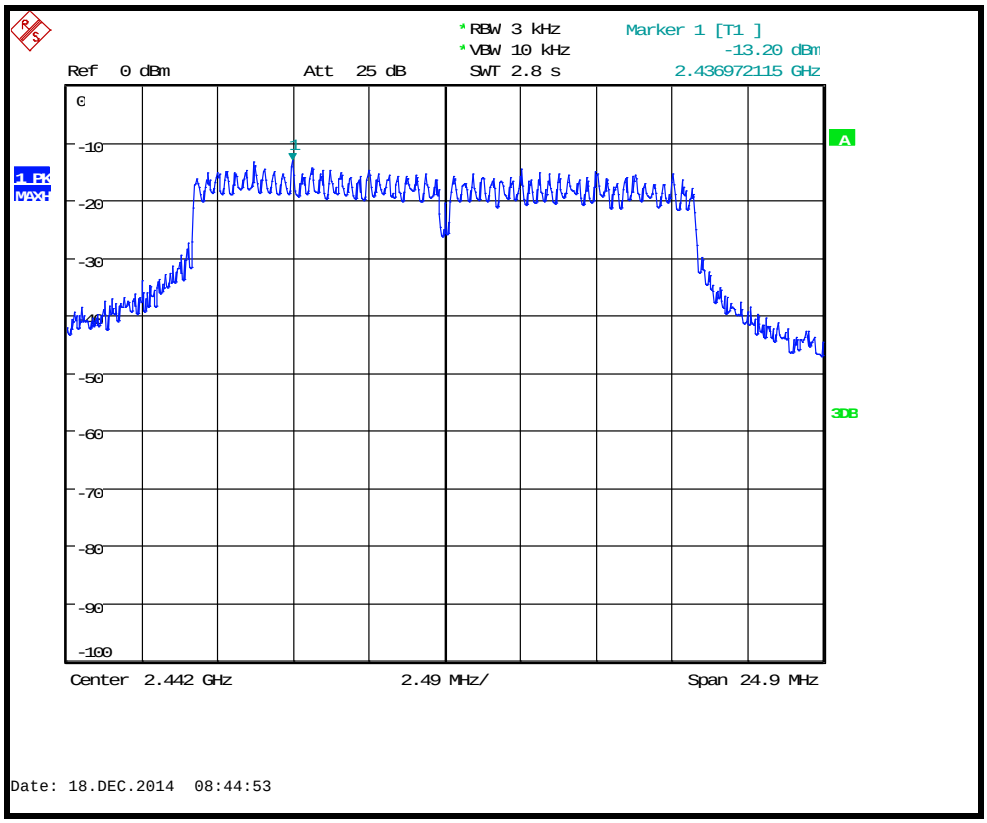
Conducted power spectral density 2442MHz MCS6



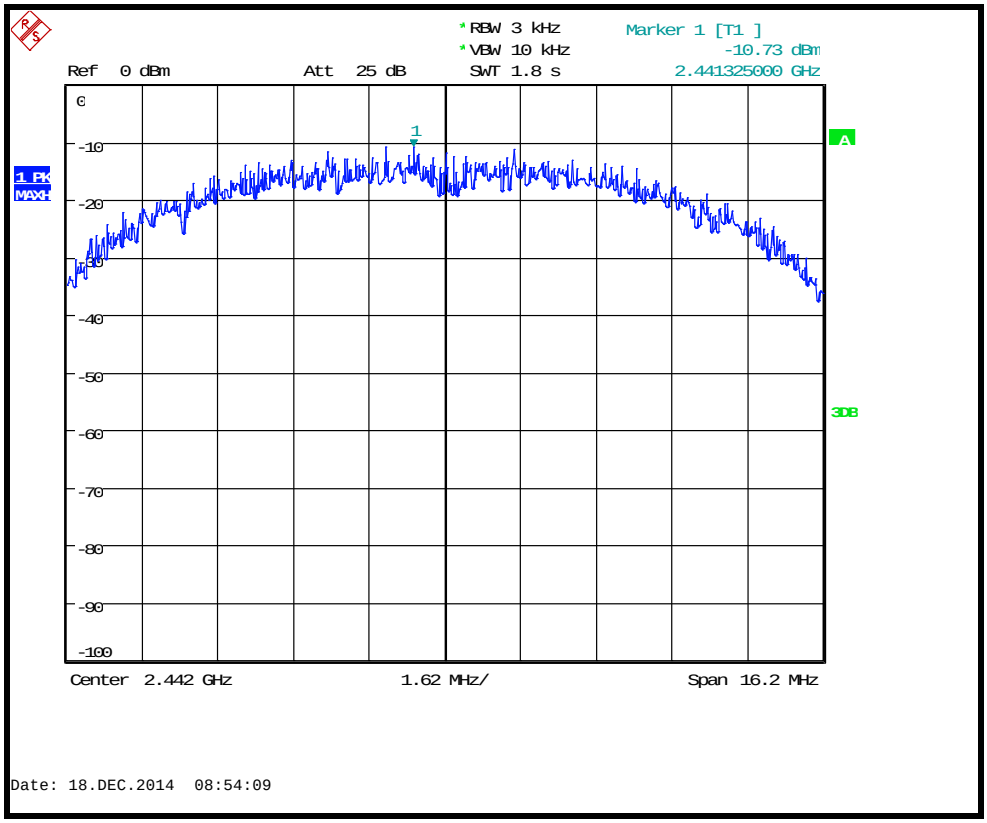
Conducted power spectral density 2442MHz MCS0



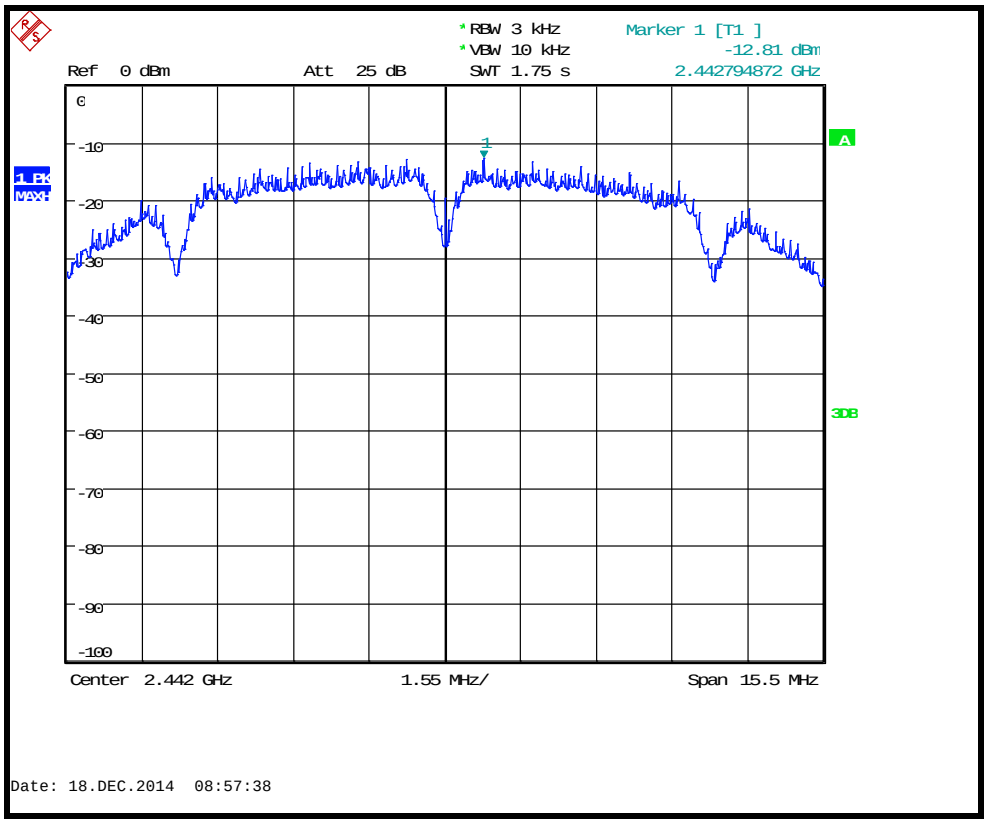
Conducted power spectral density 2442MHz 54Mb/s



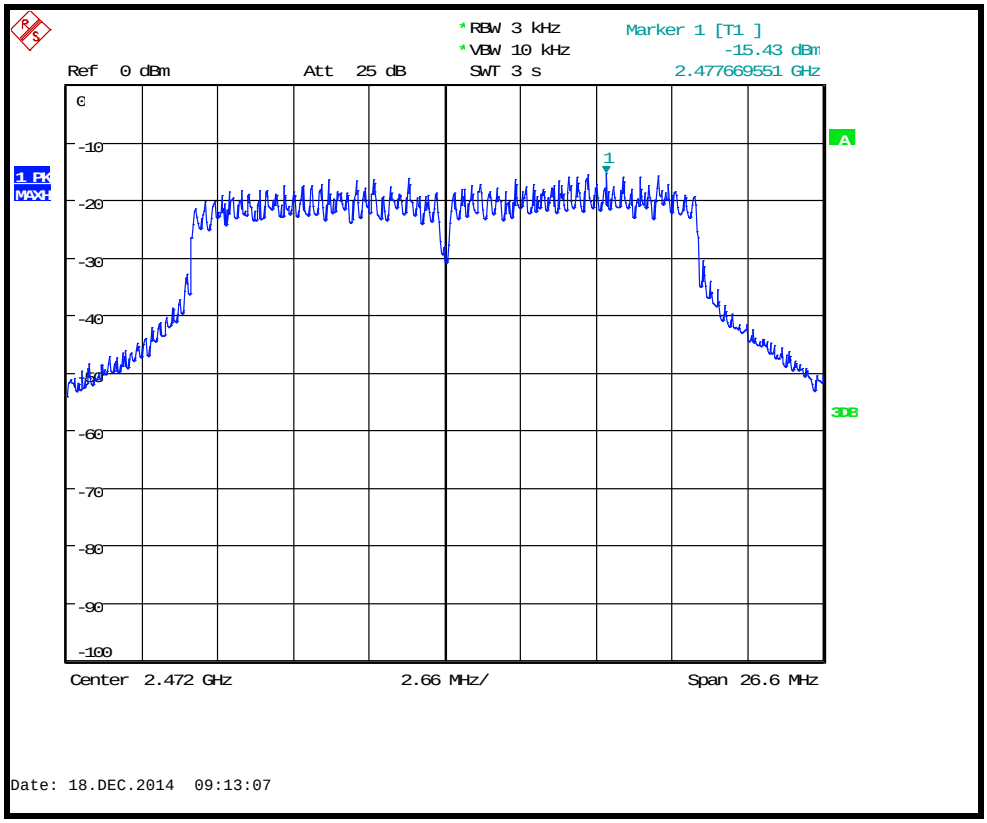
Conducted power spectral density 2442MHz 6Mb/s



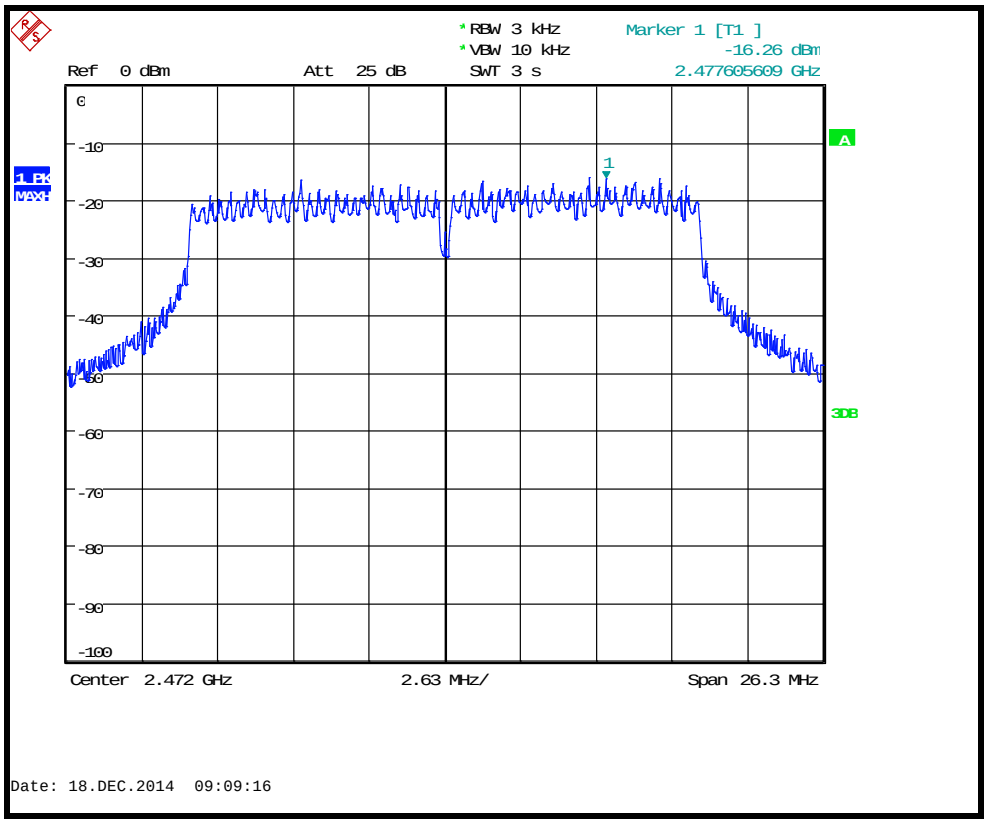
Conducted power spectral density 2442MHz 11Mb/s



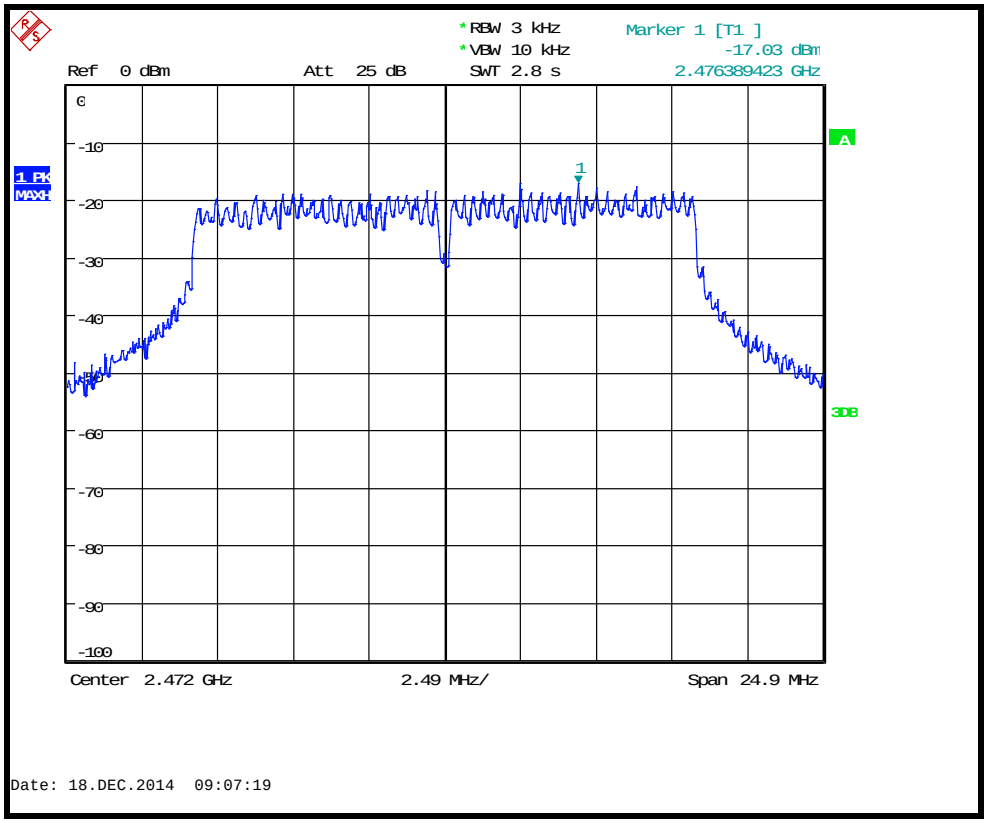
Conducted power spectral density 2442MHz 1Mb/s



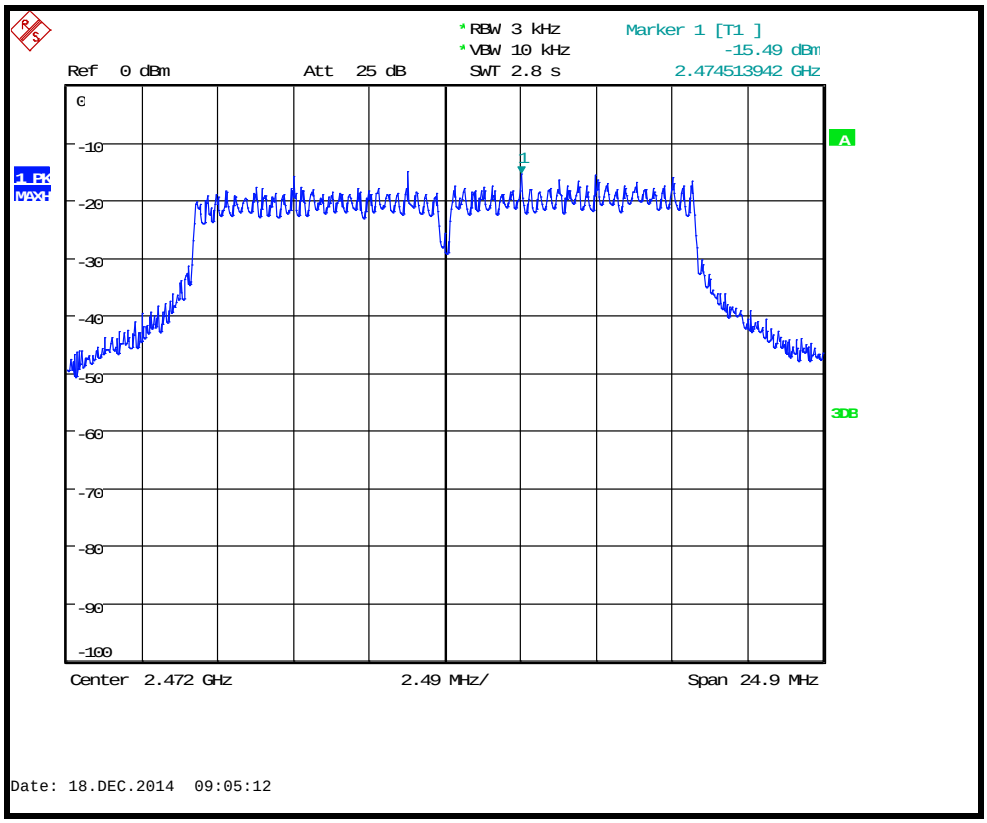
Conducted power spectral density 2472MHz MCS6



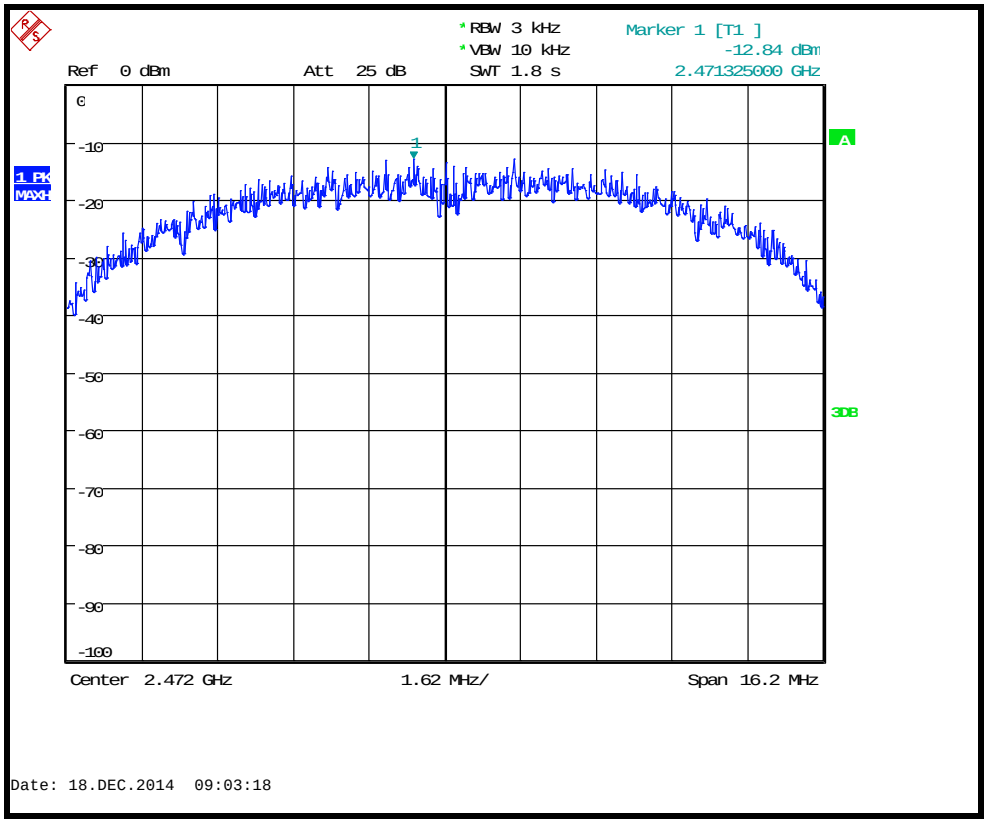
Conducted power spectral density 2472MHz MCS0



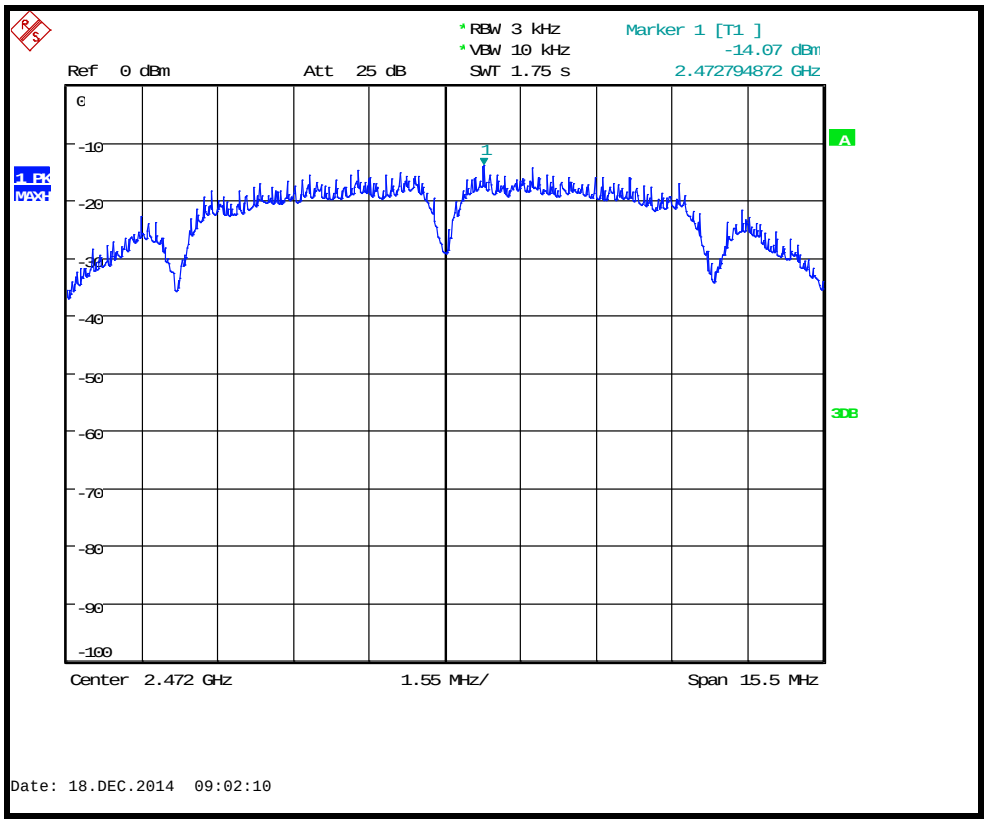
Conducted power spectral density 2472MHz 54Mb/s



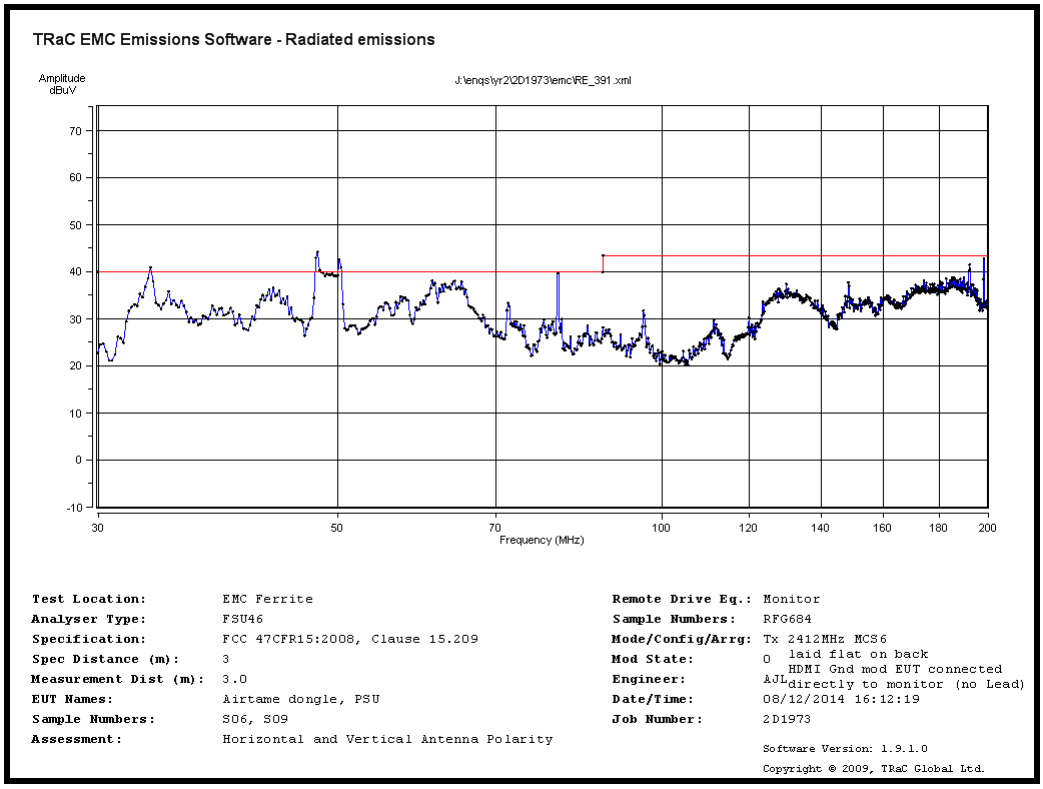
Conducted power spectral density 2472MHz 6Mb/s



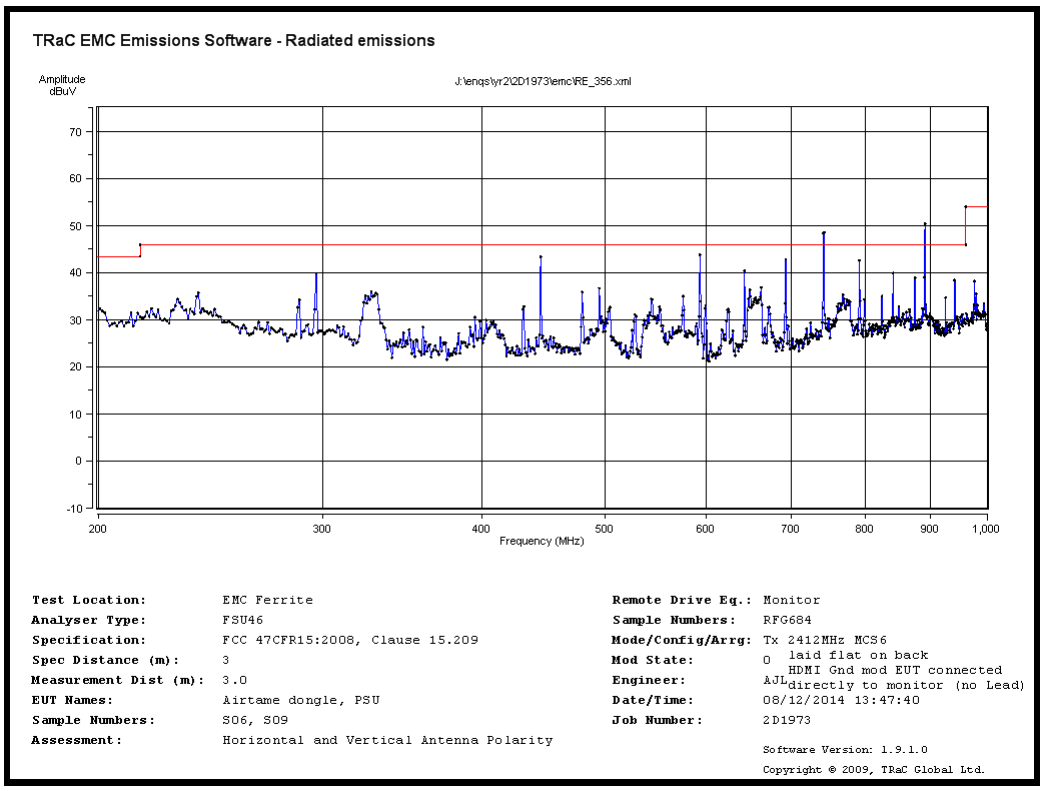
Conducted power spectral density 2472MHz 11Mb/s



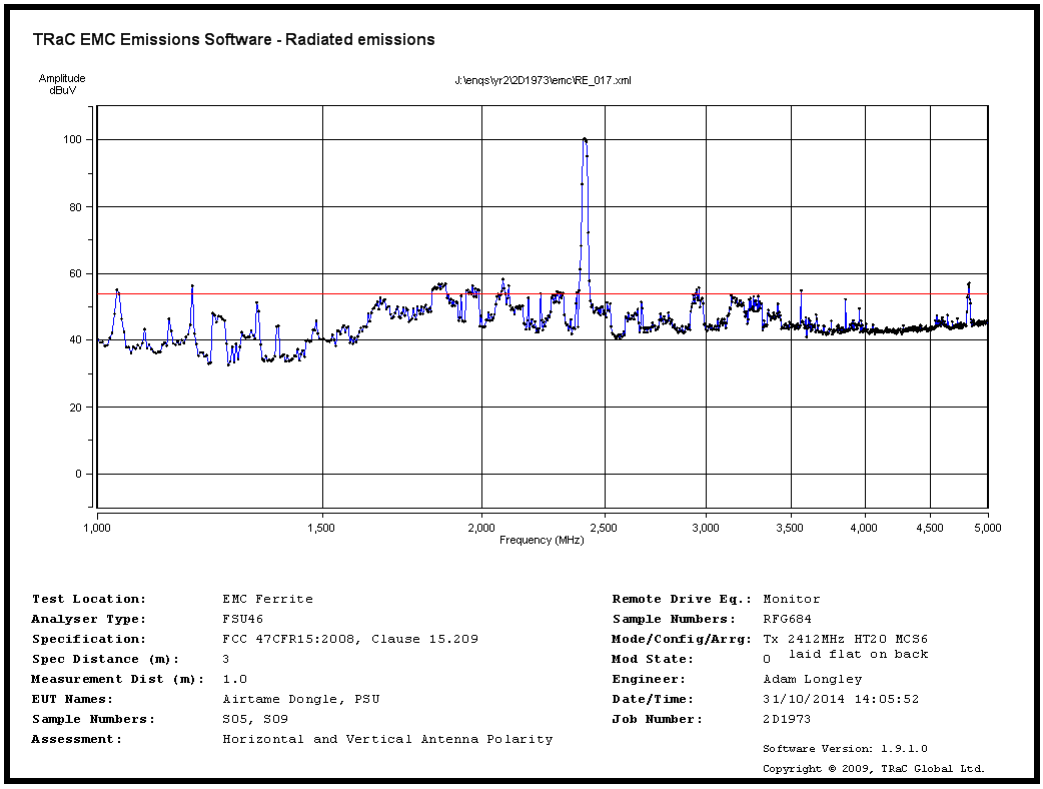
Conducted power spectral density 2472MHz 1Mb/s



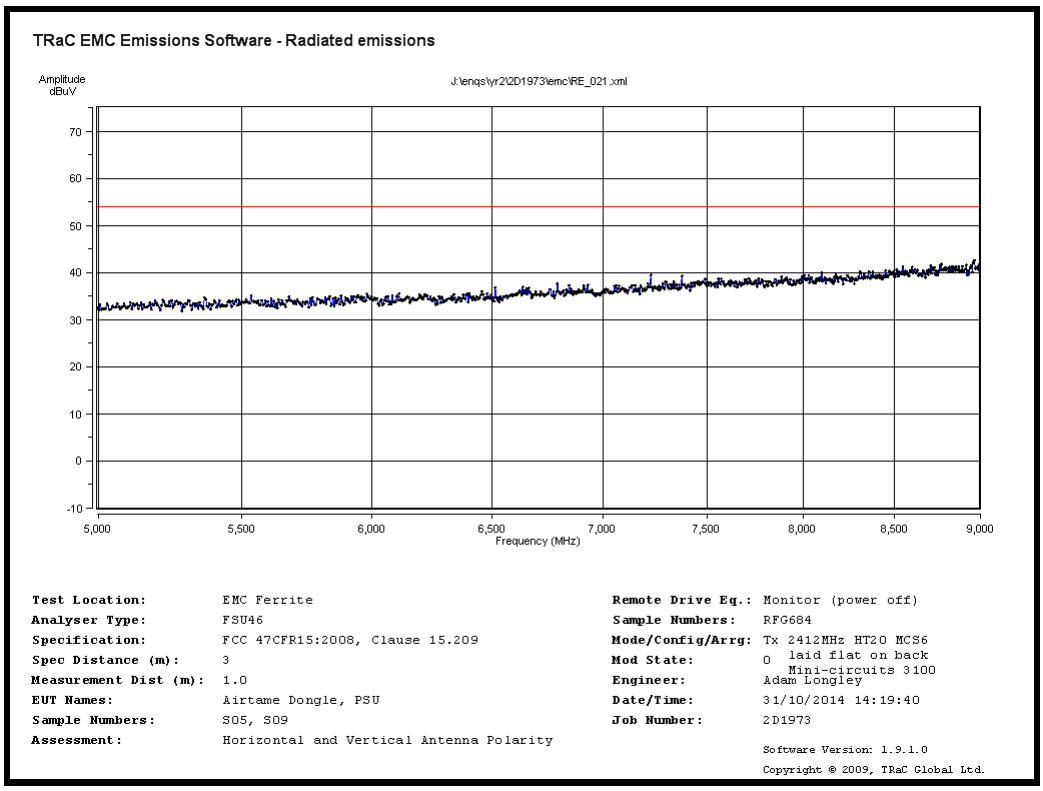
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz MCS6



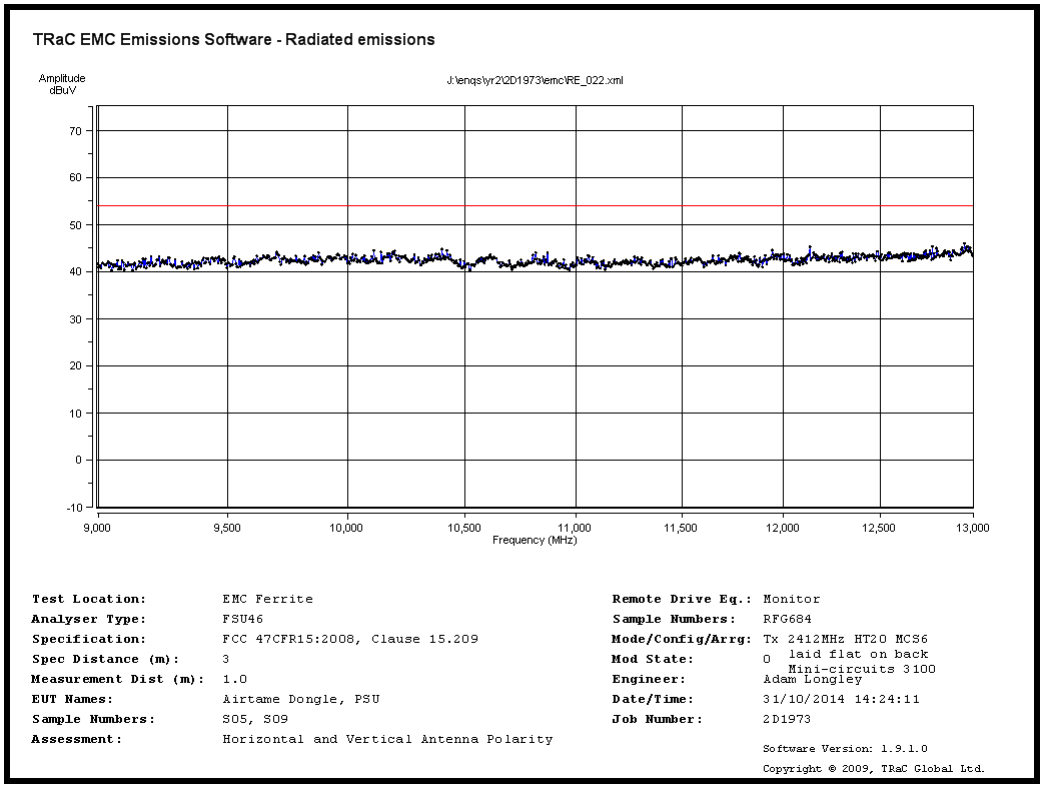
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz MCS6



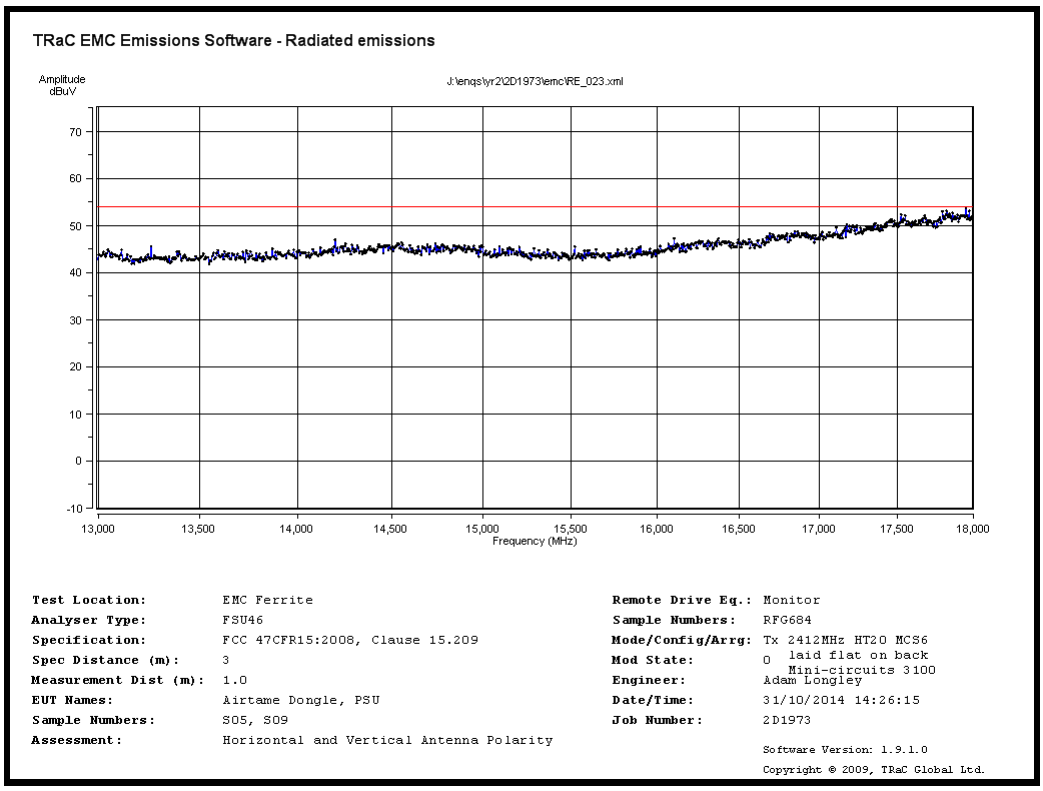
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz MCS6



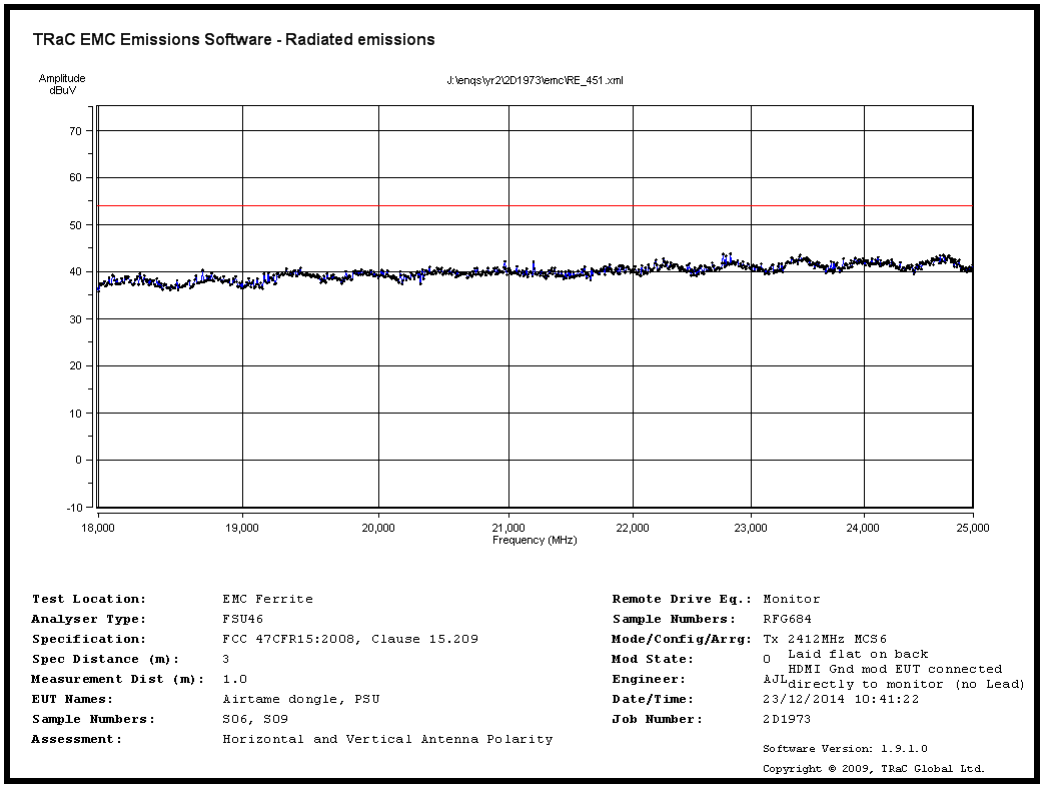
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz MCS6



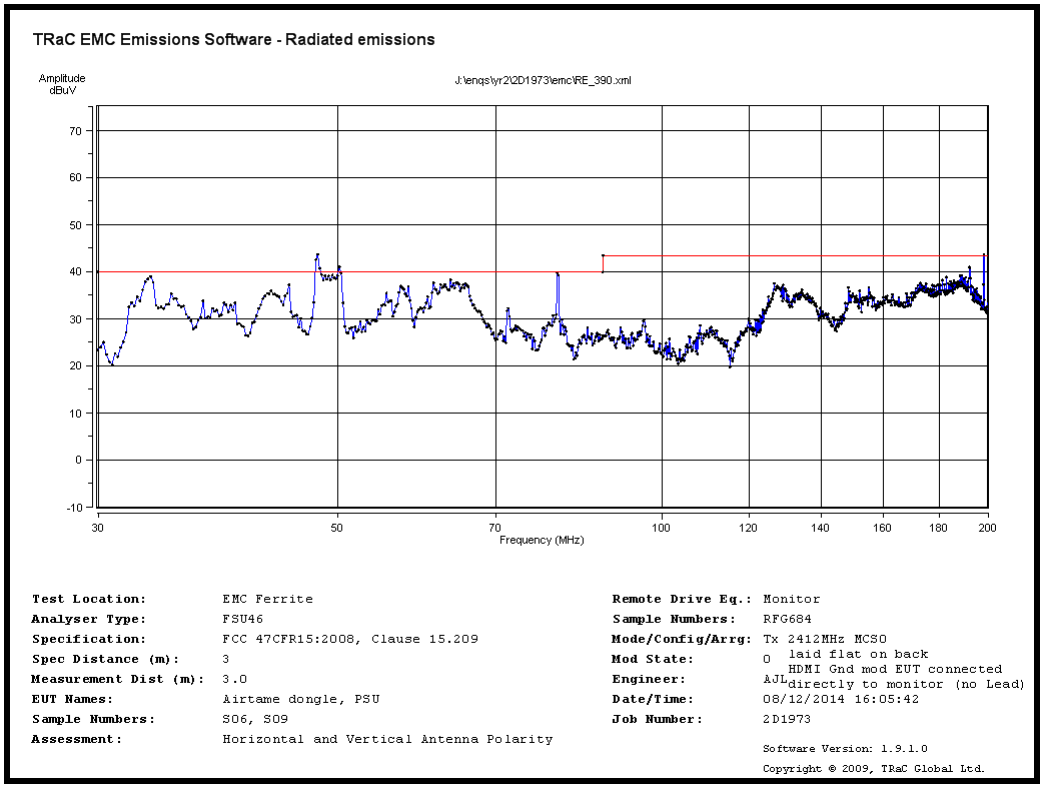
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz MCS6



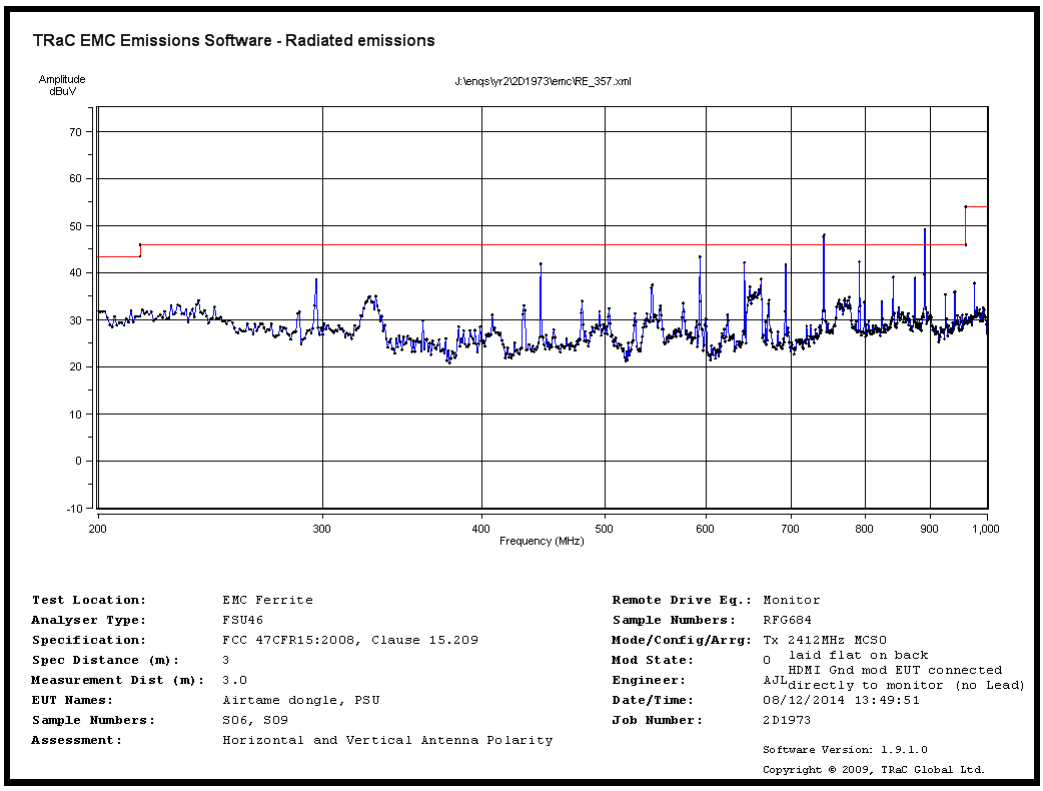
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz MCS6



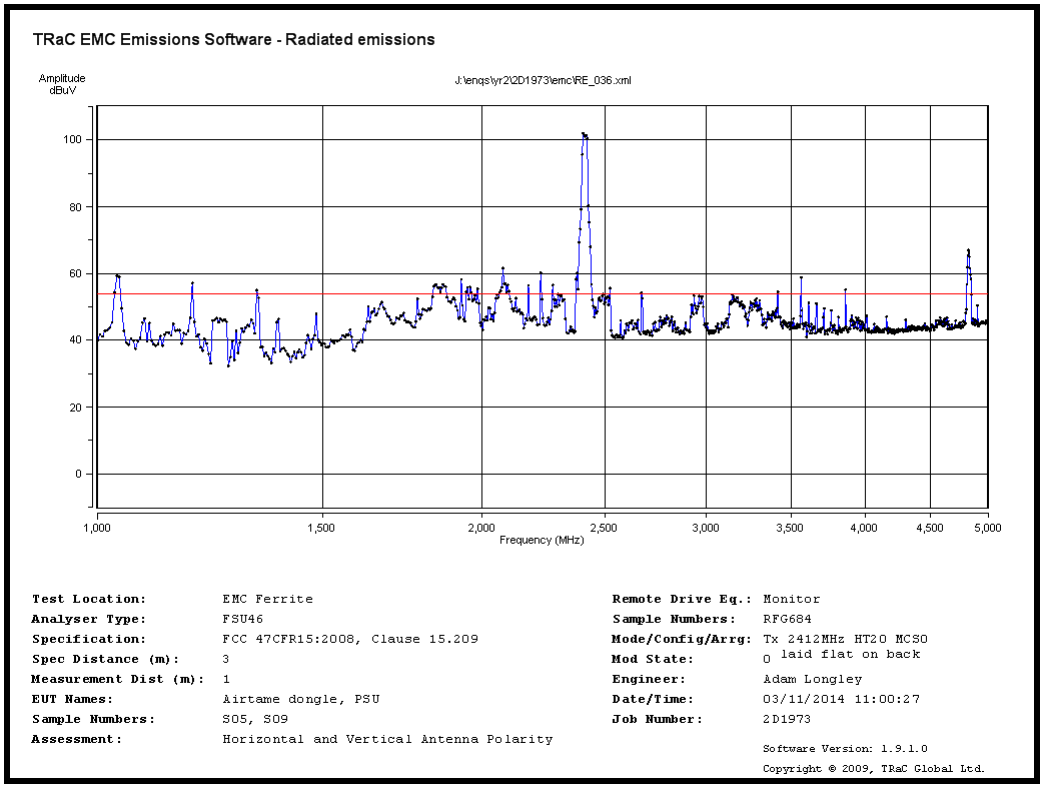
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz MCS6



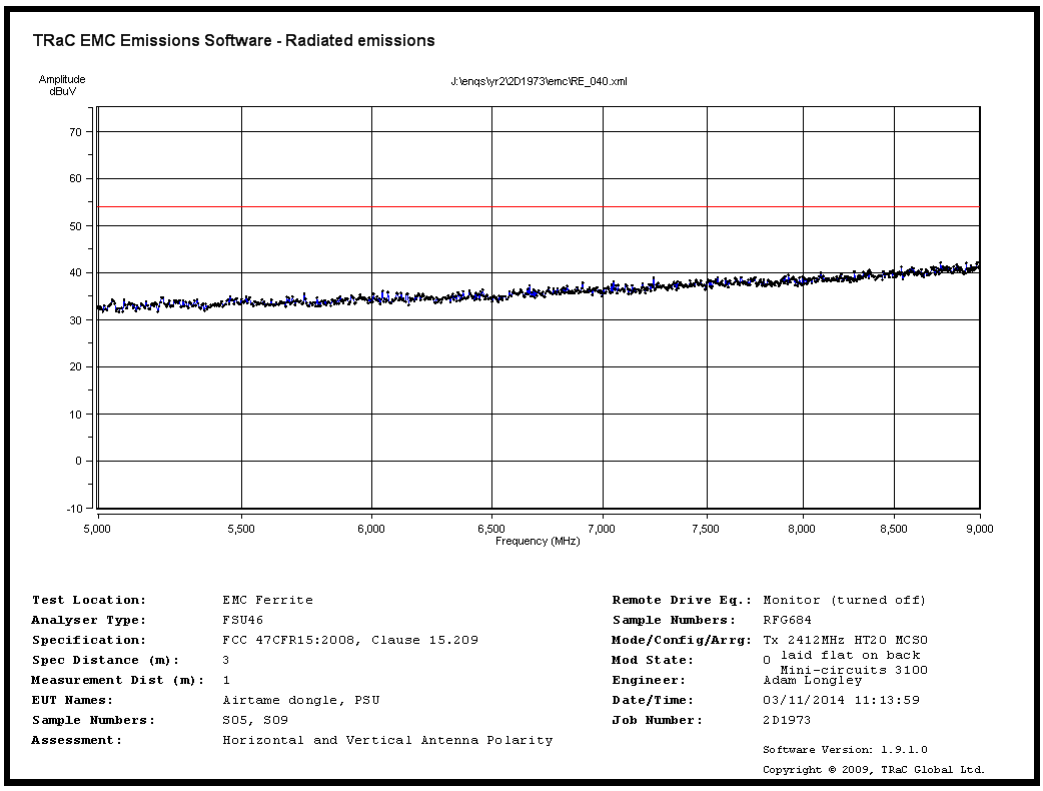
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz MCS0



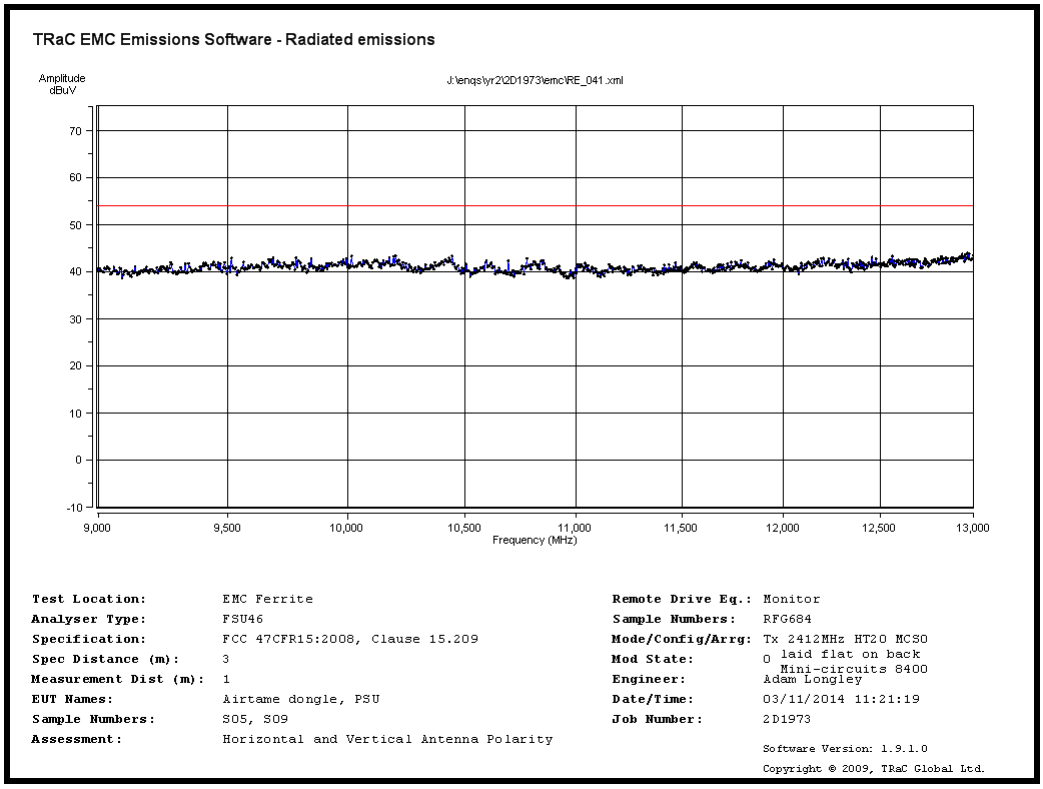
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz MCS0



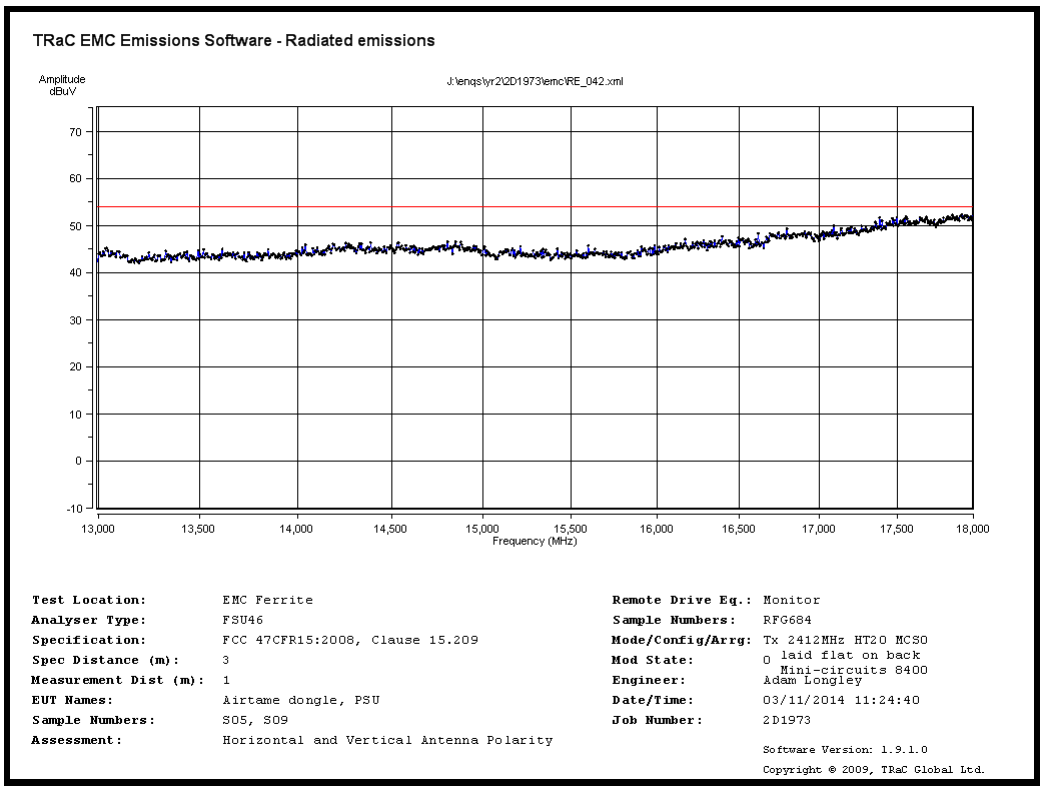
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz MCS0



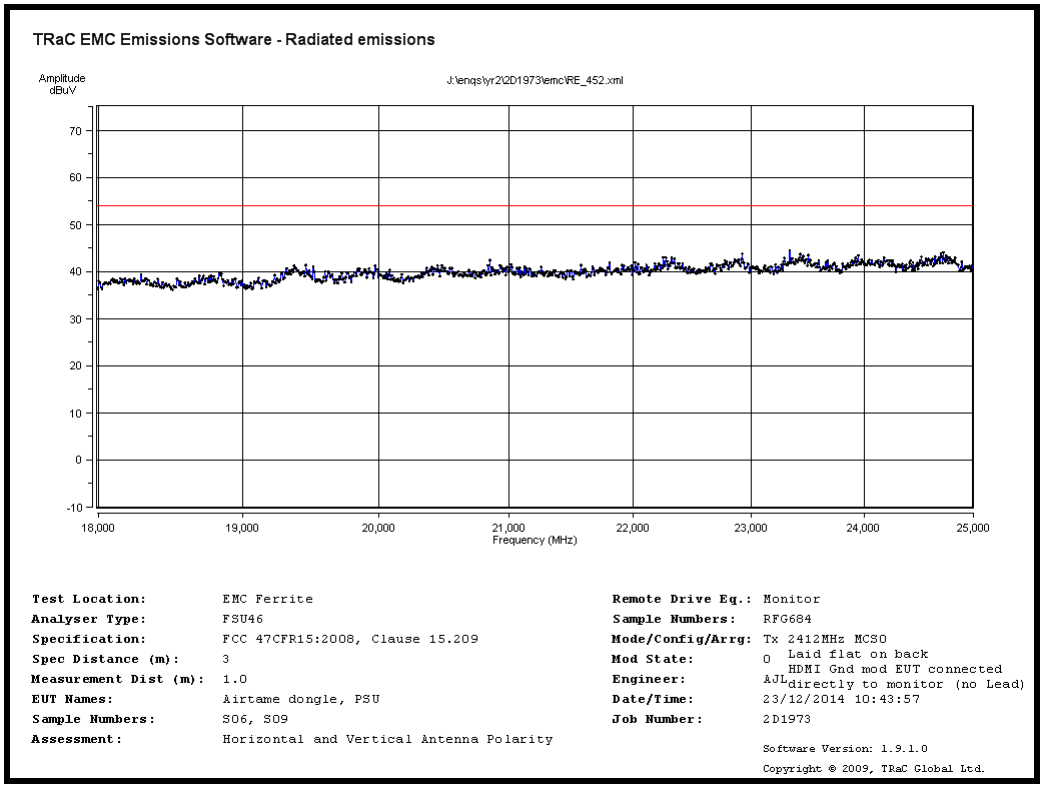
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz MCS0



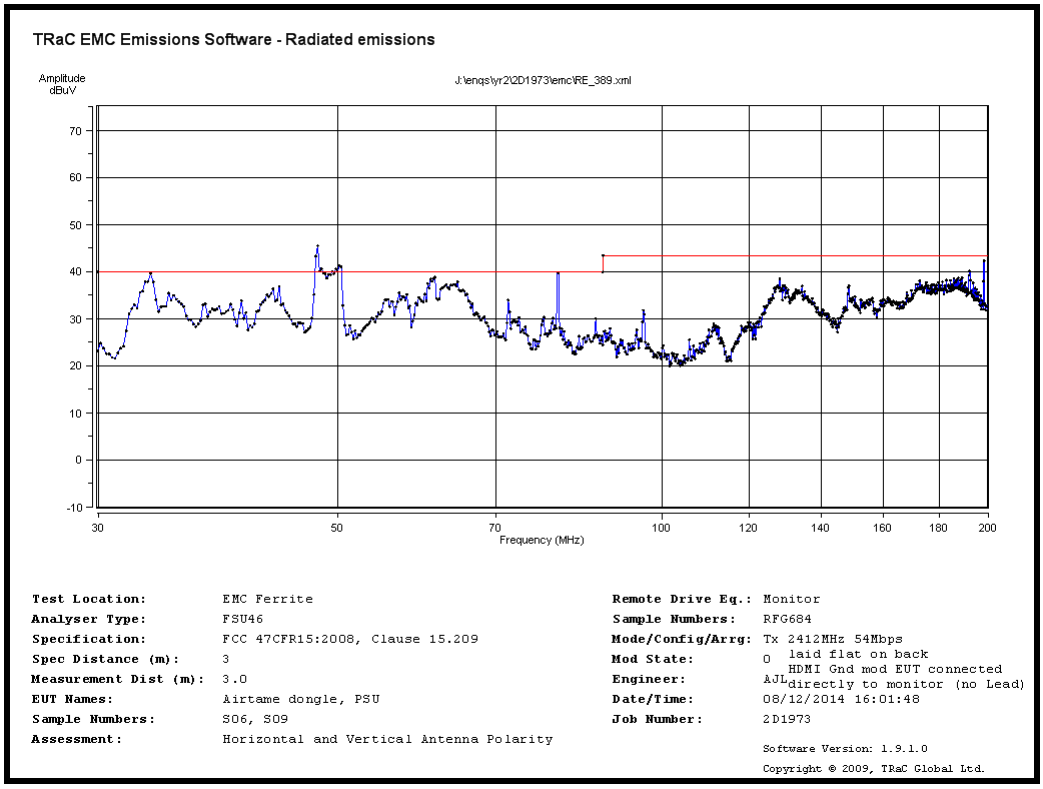
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz MCS0



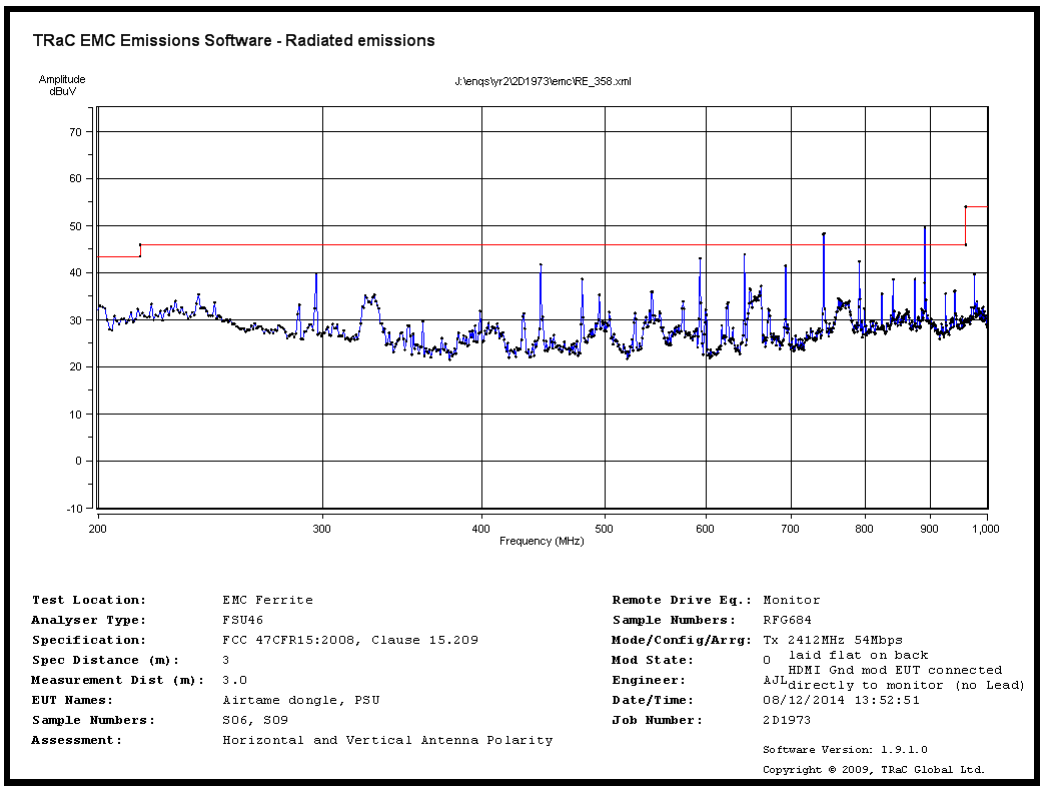
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz MCS0



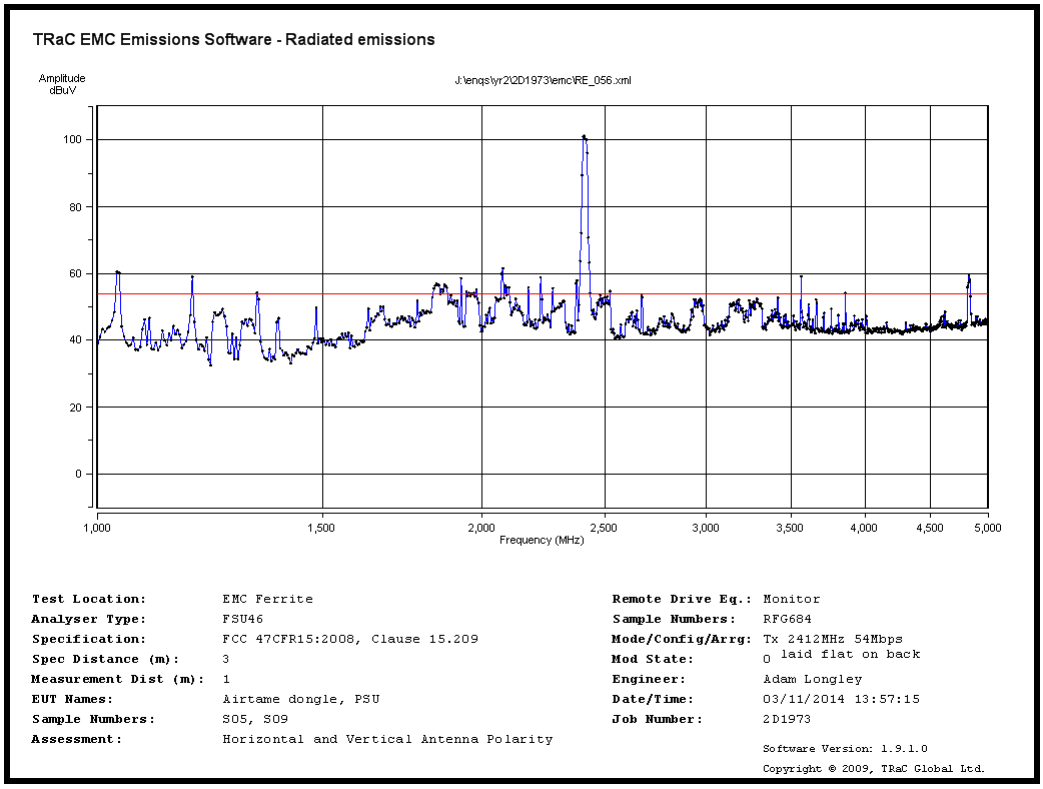
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz MCS0



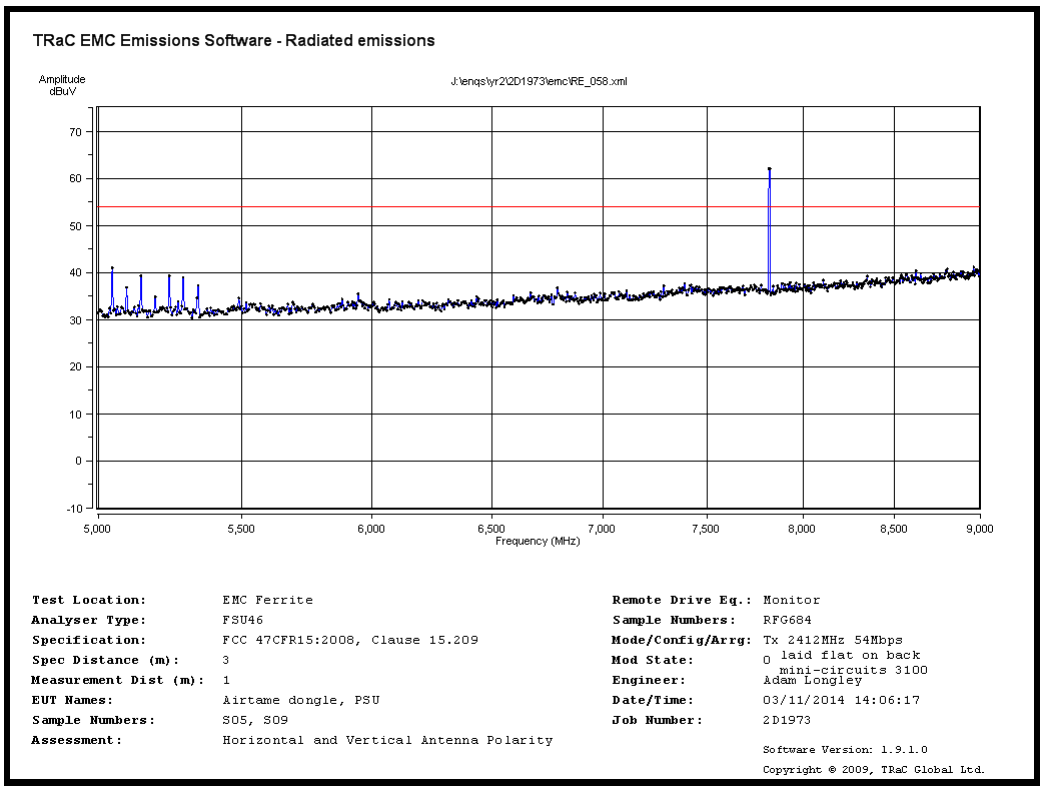
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz 54Mb/s



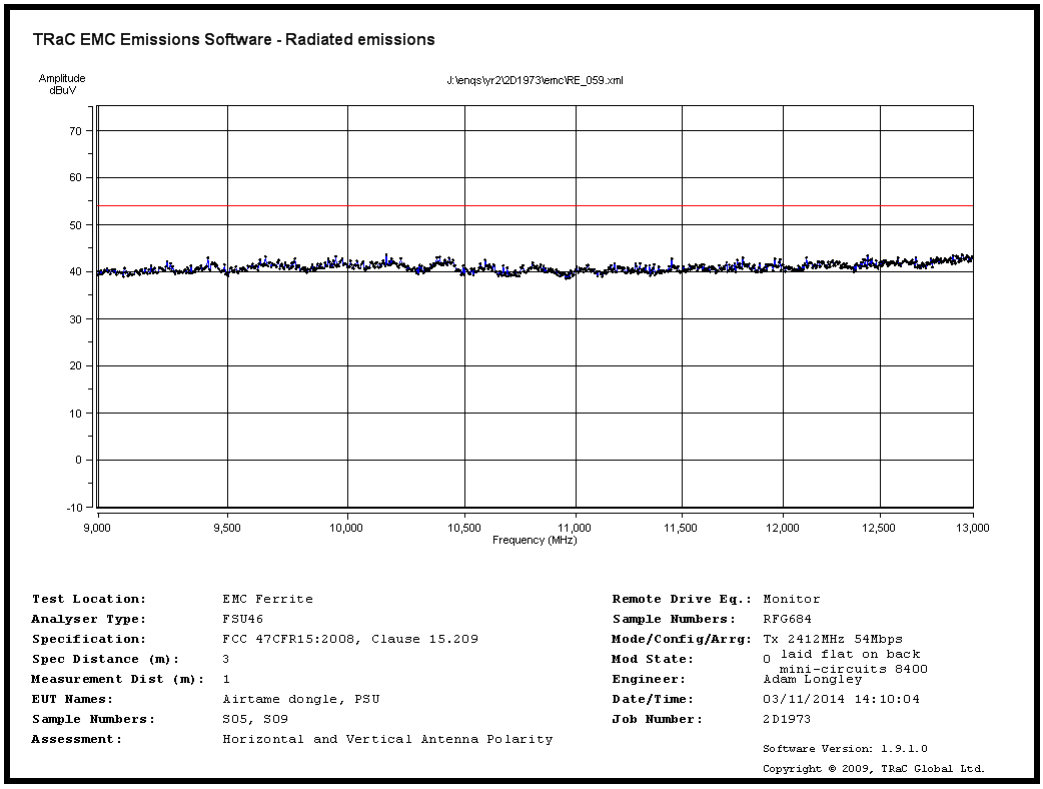
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz 54Mb/s



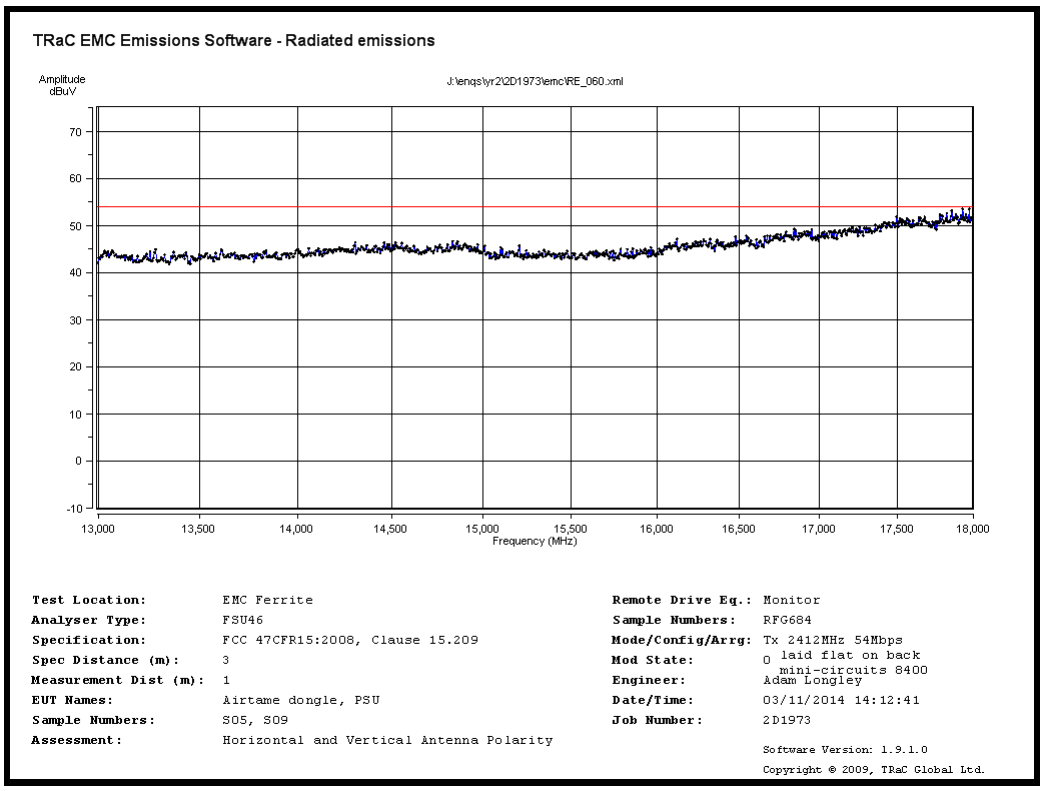
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz 54Mb/s



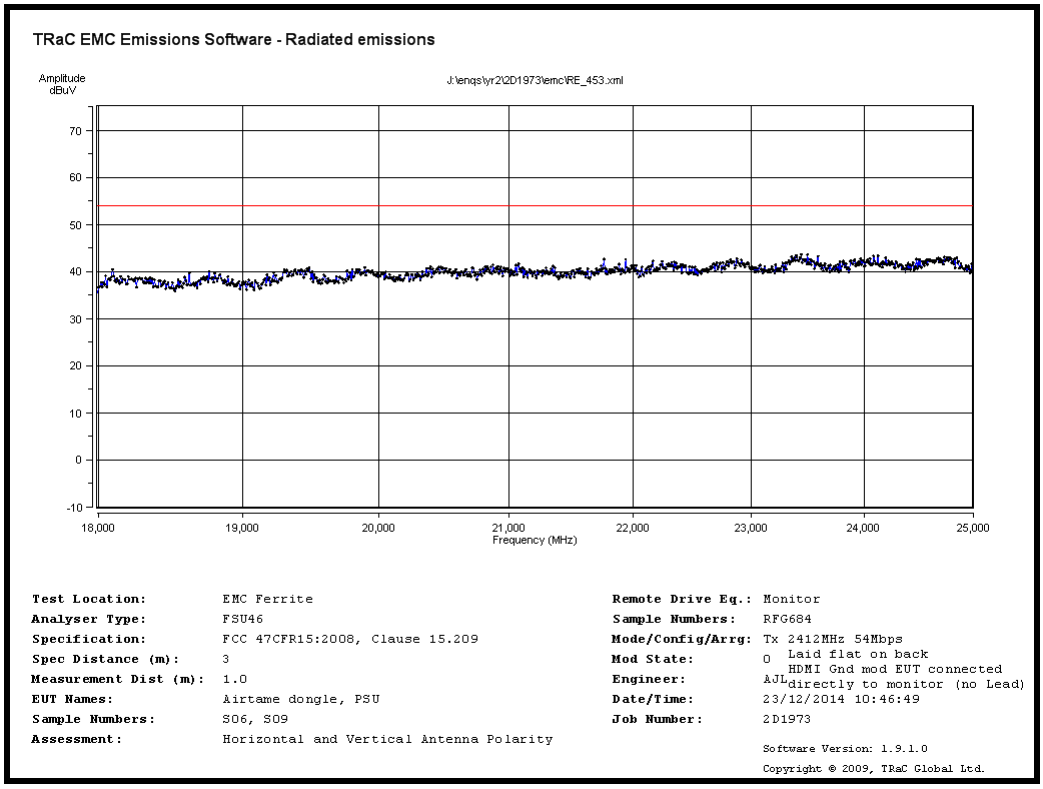
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz 54Mb/s



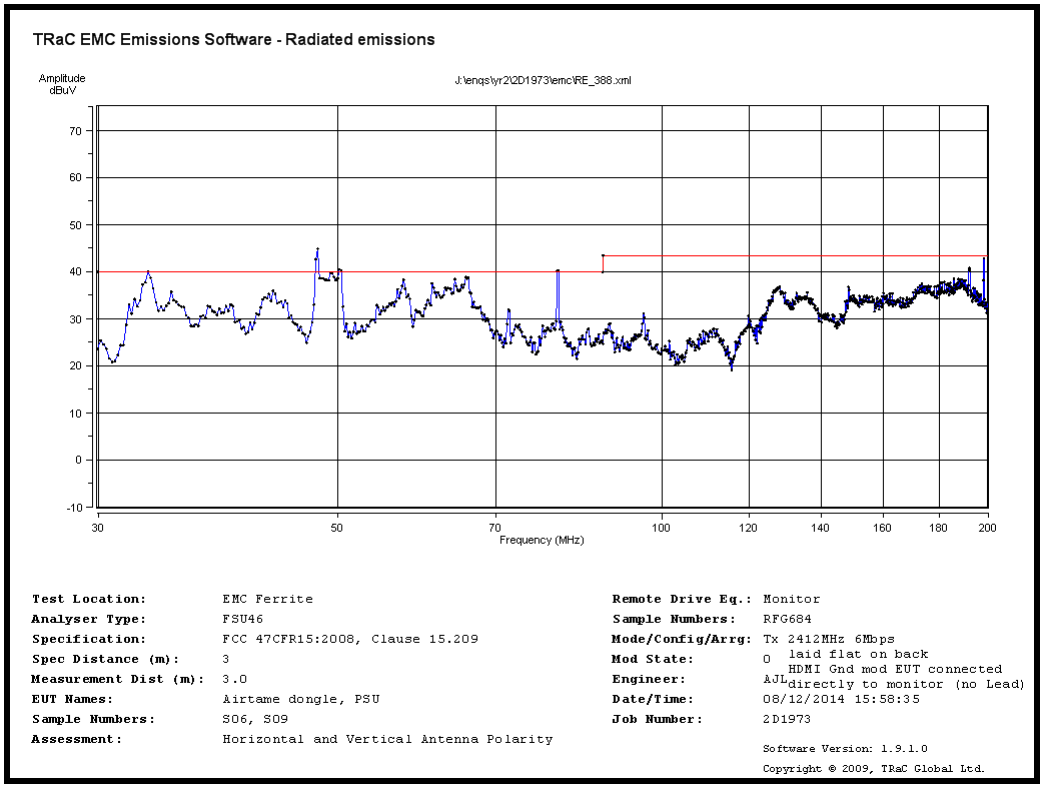
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz 54Mb/s



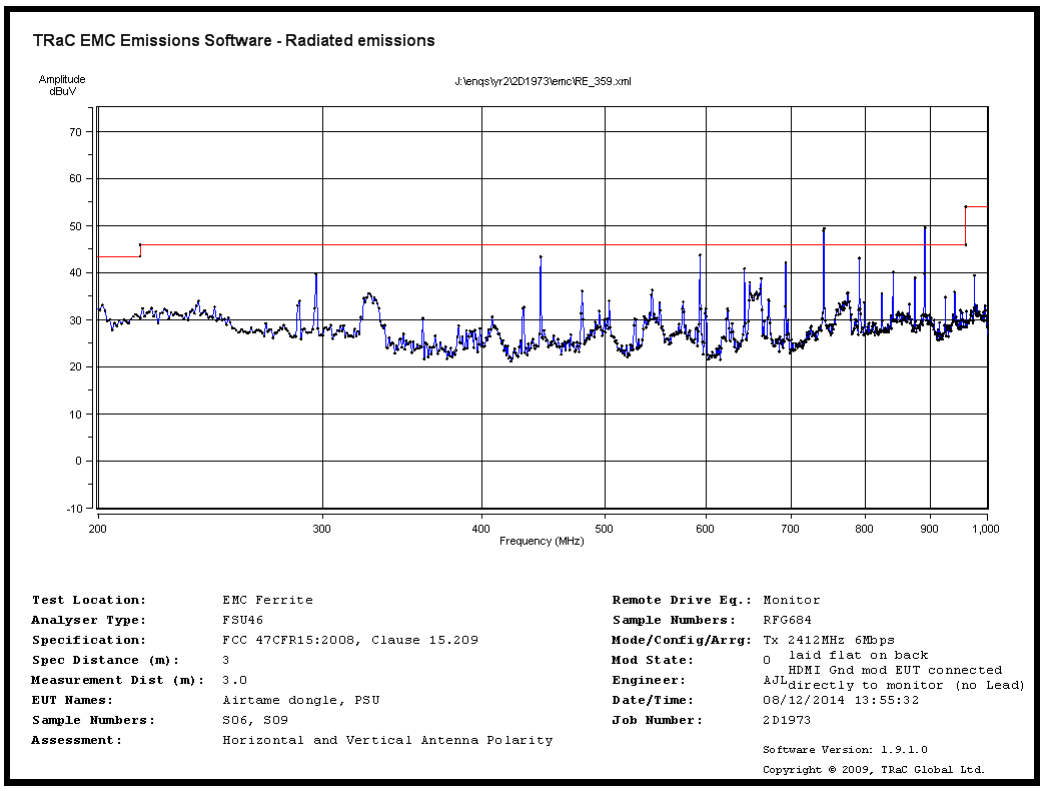
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz 54Mb/s



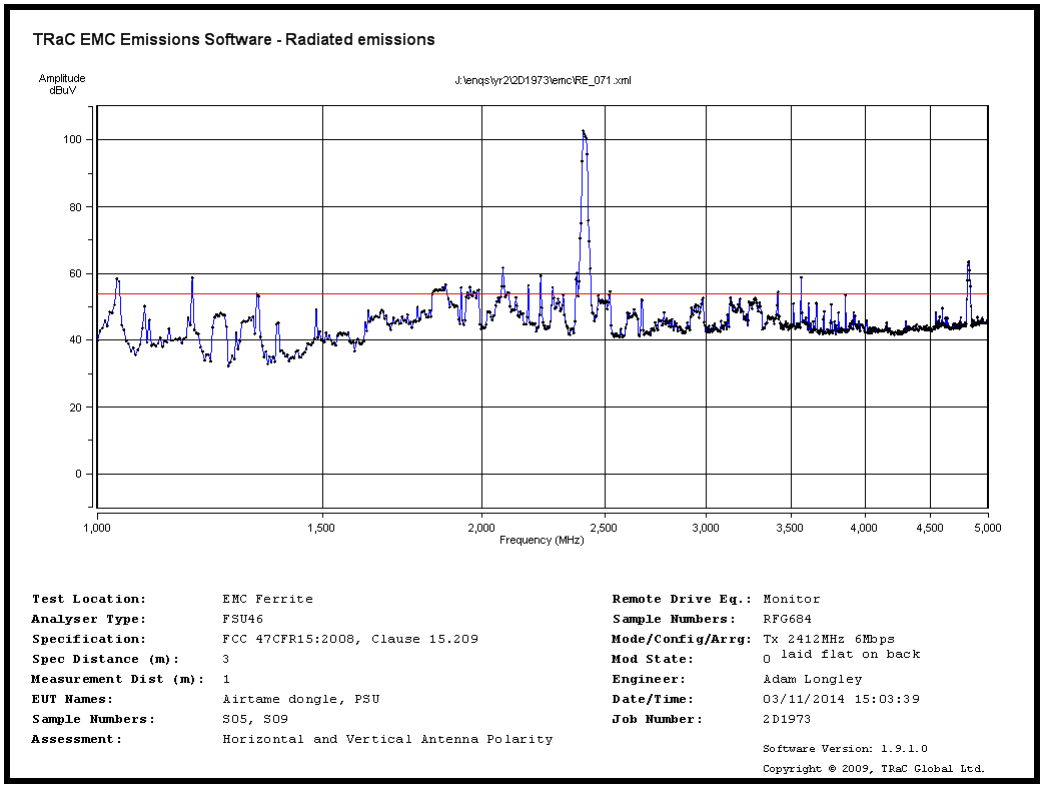
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz 54Mb/s



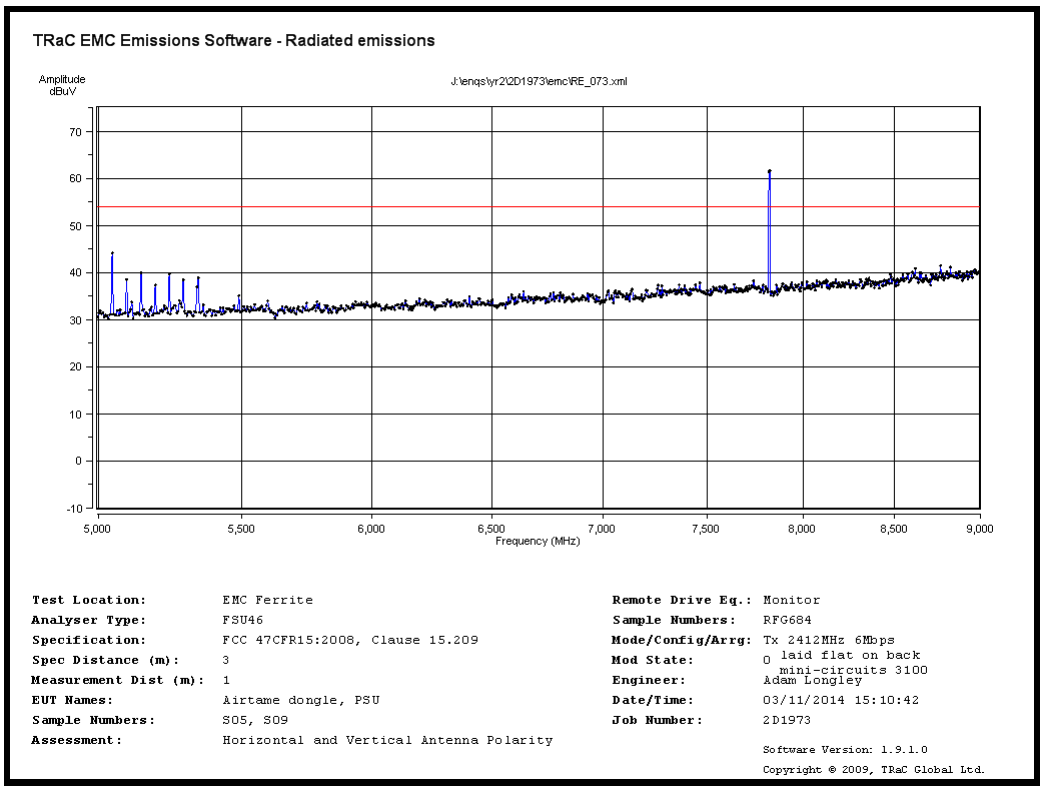
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz 6Mb/s



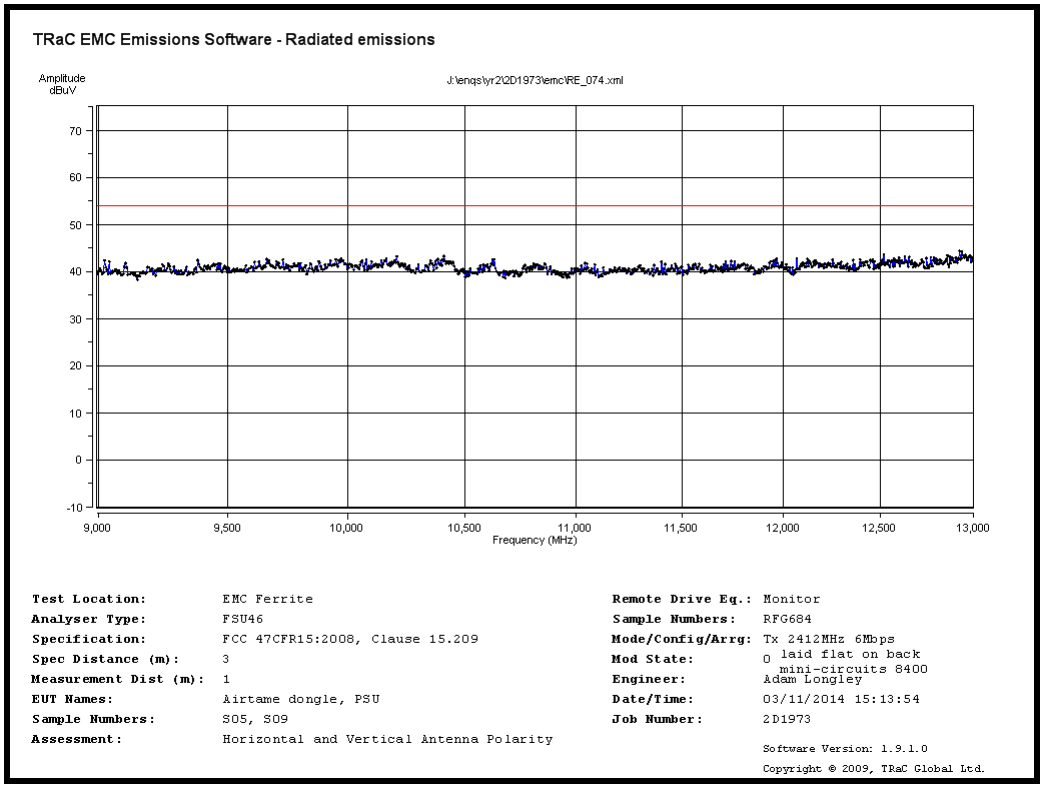
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz 6Mb/s



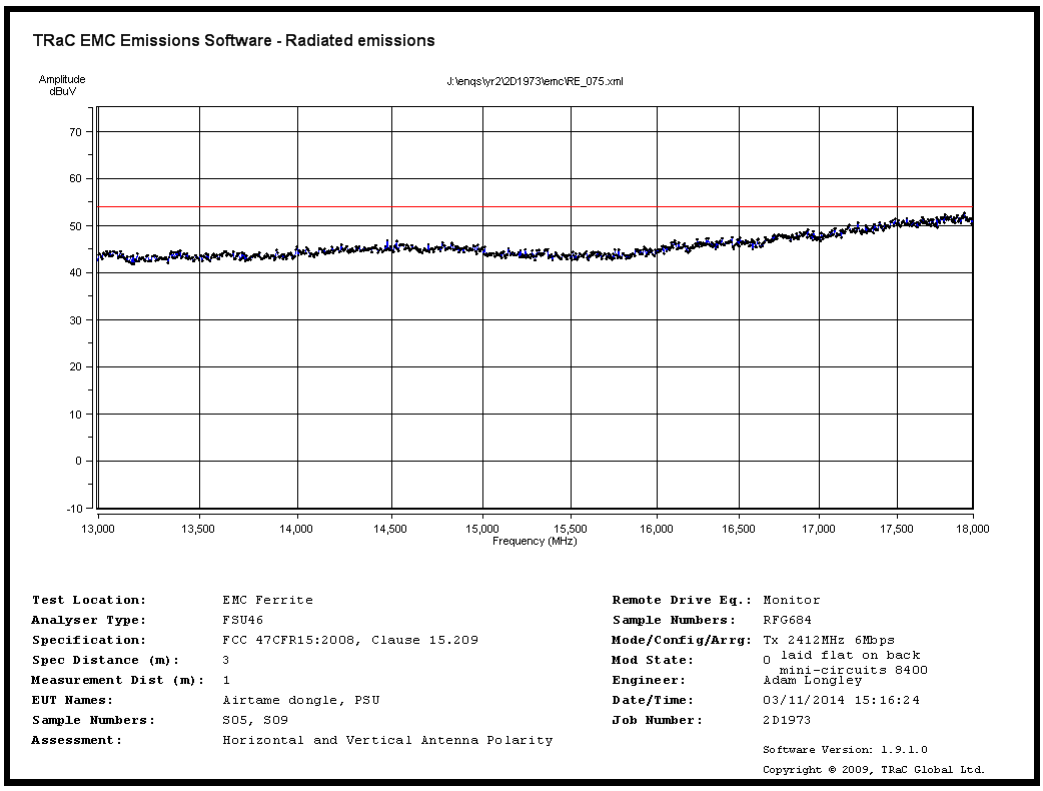
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz 6Mb/s



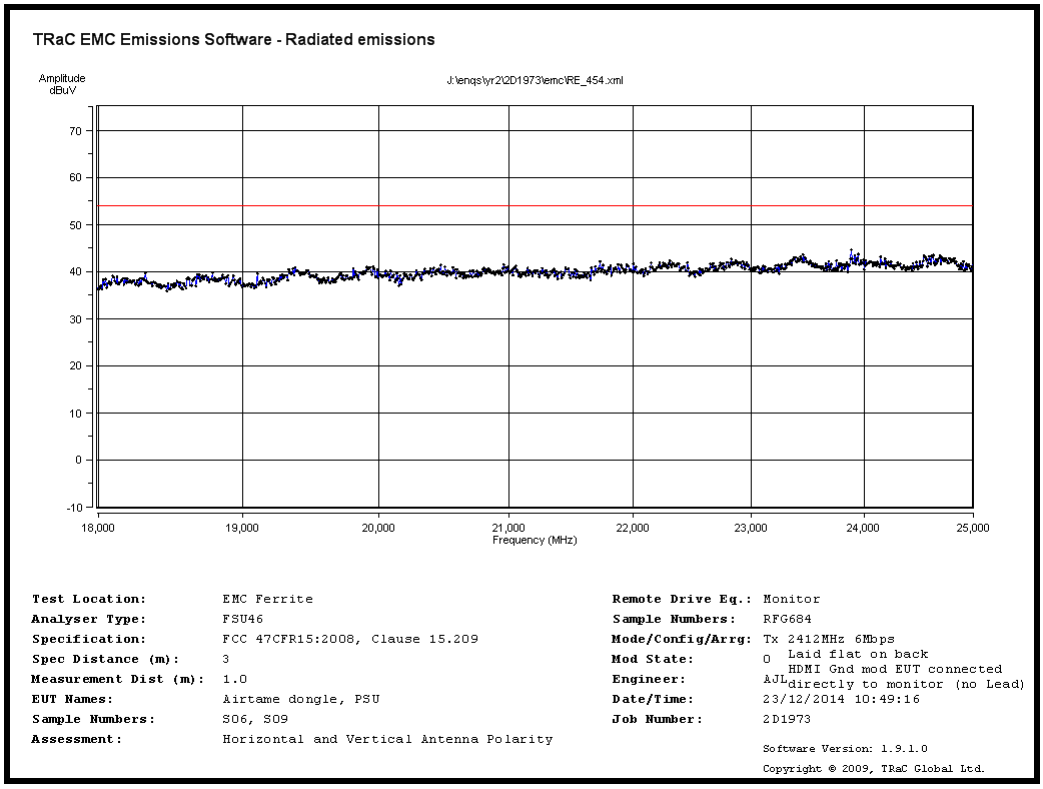
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz 6Mb/s



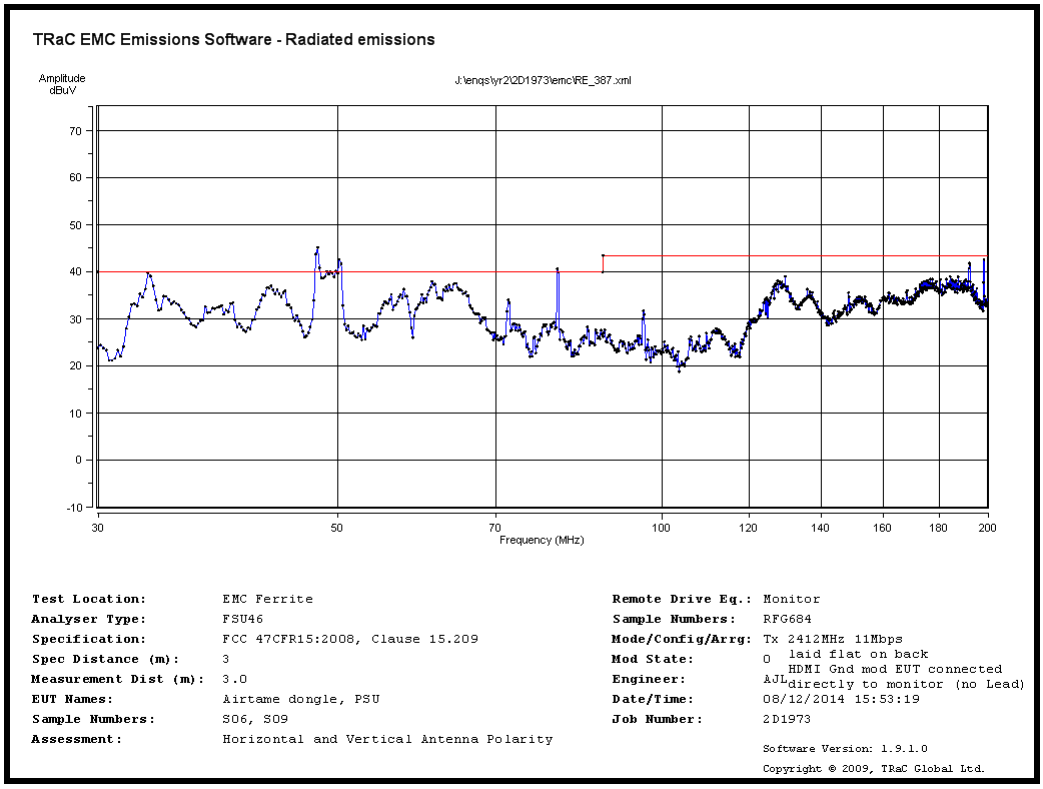
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz 6Mb/s



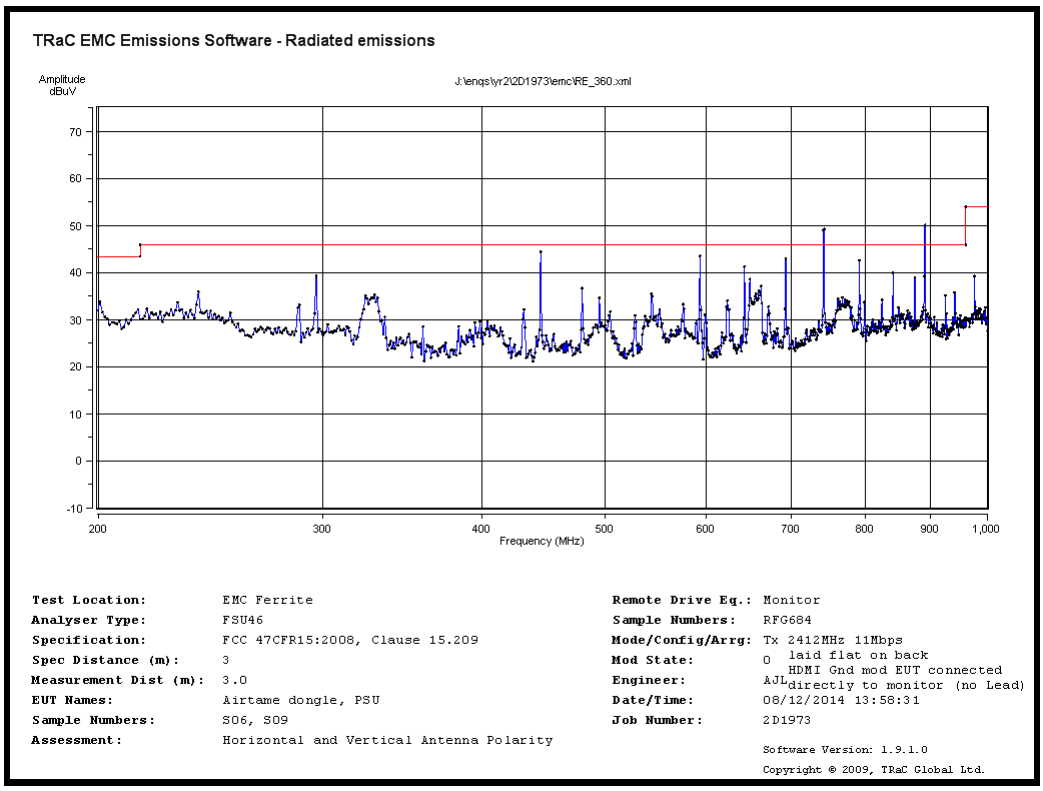
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz 6Mb/s



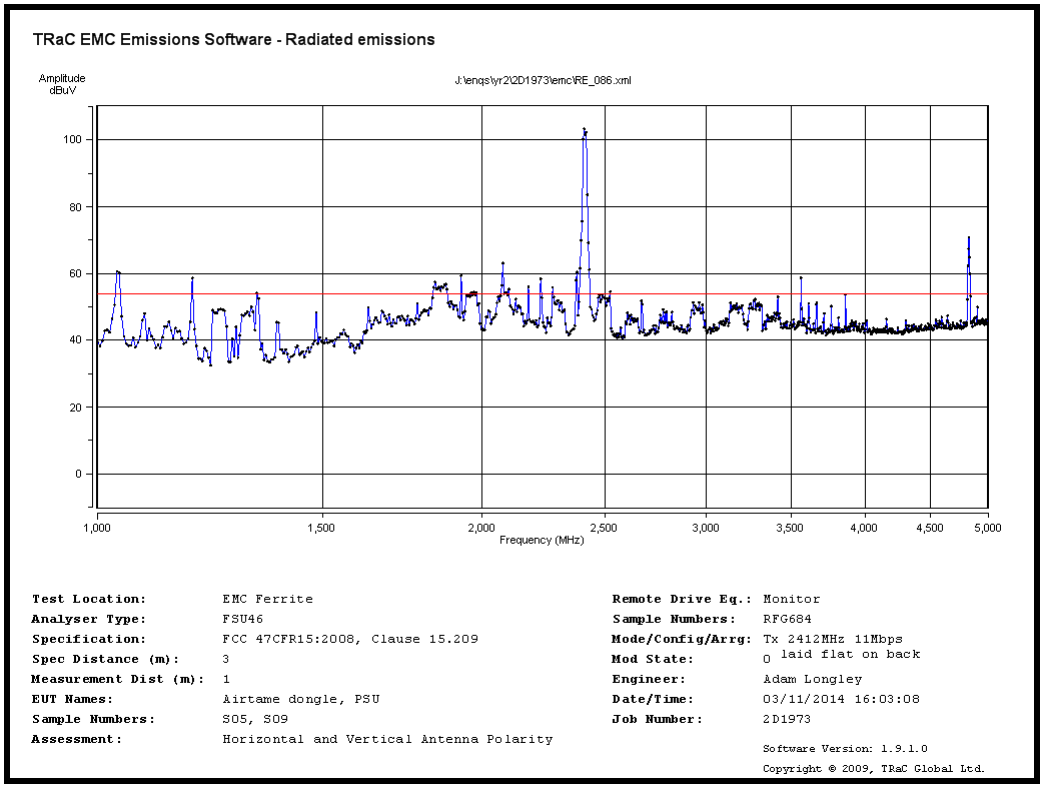
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz 6Mb/s



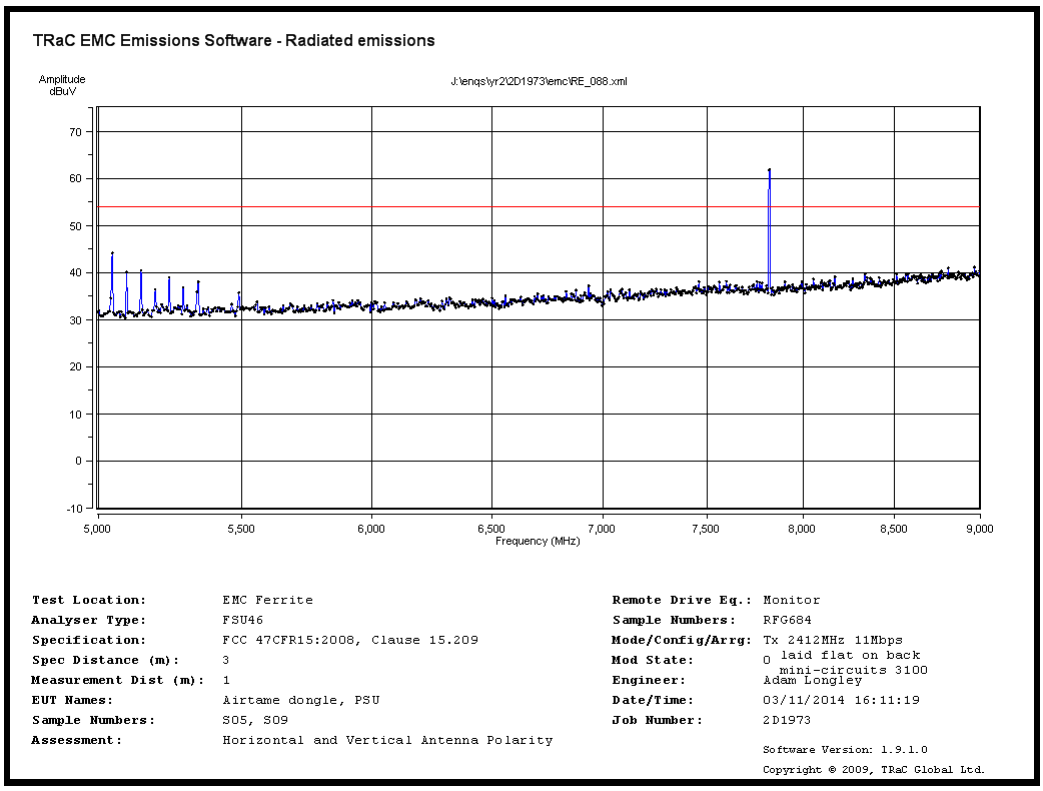
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz 11Mb/s



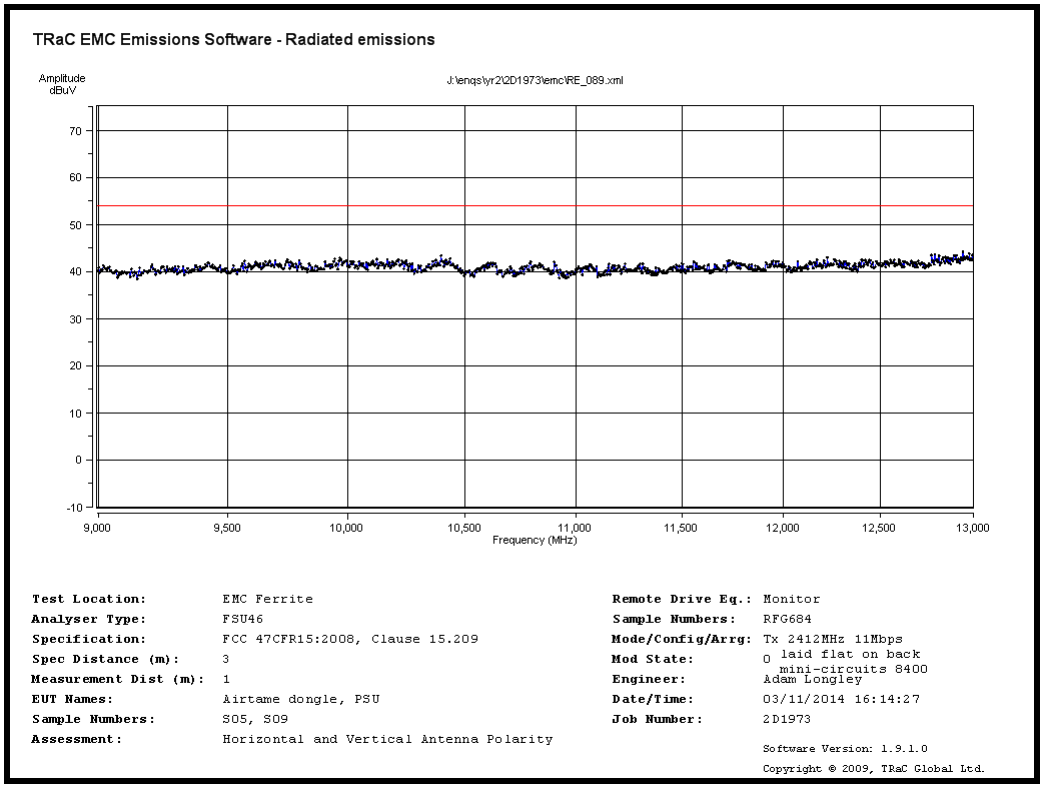
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz 11Mb/s



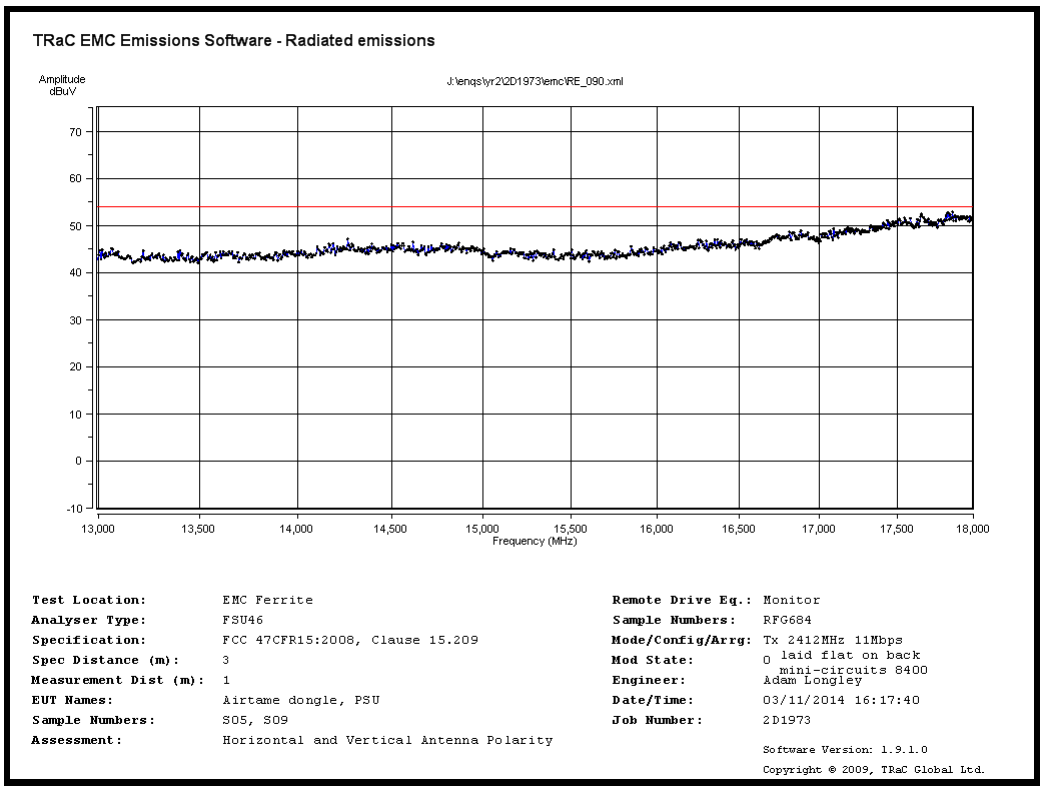
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz 11Mb/s



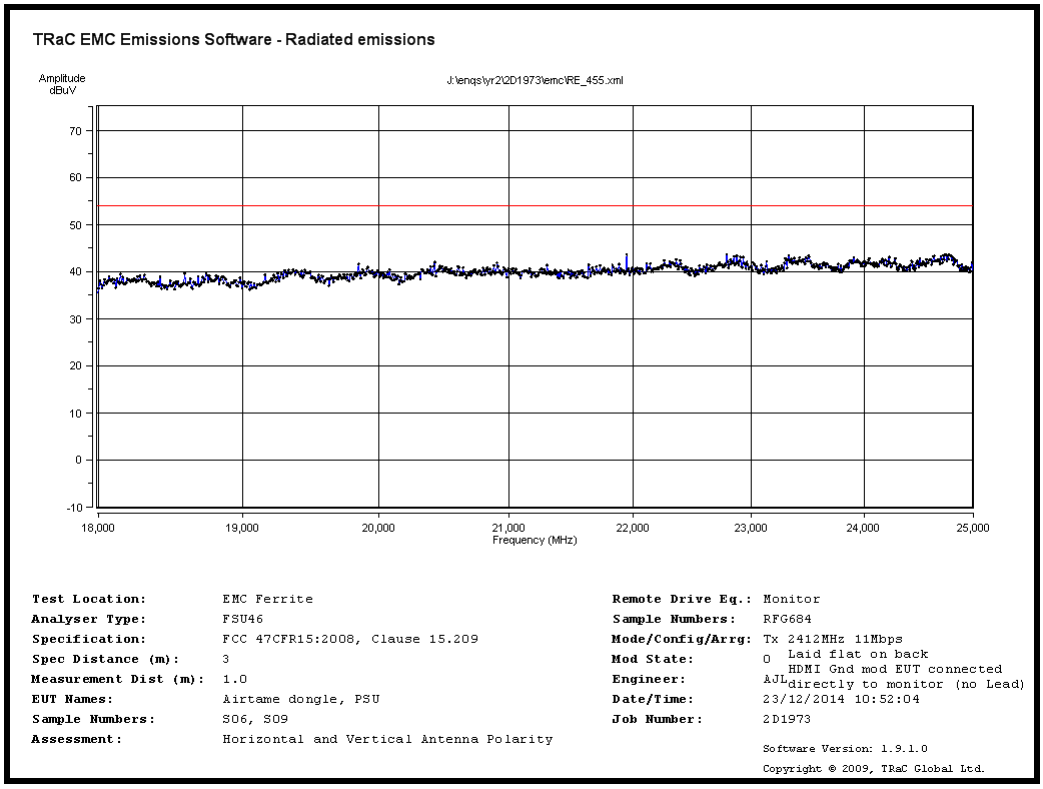
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz 11Mb/s



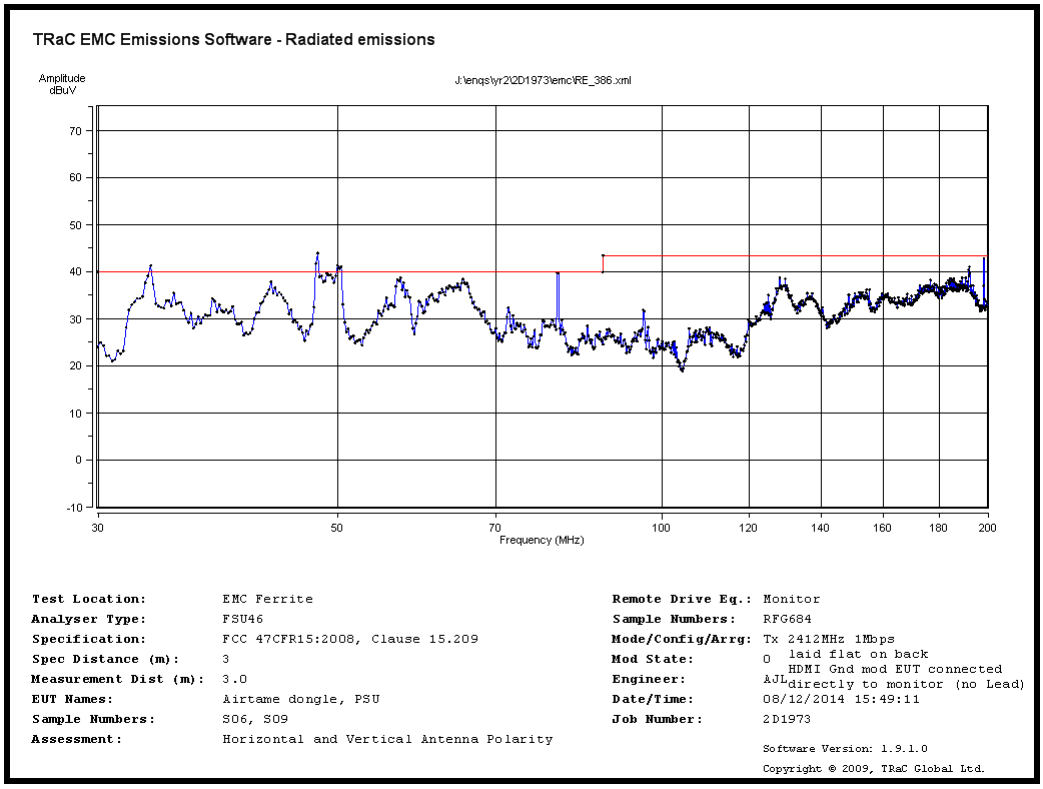
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz 11Mb/s



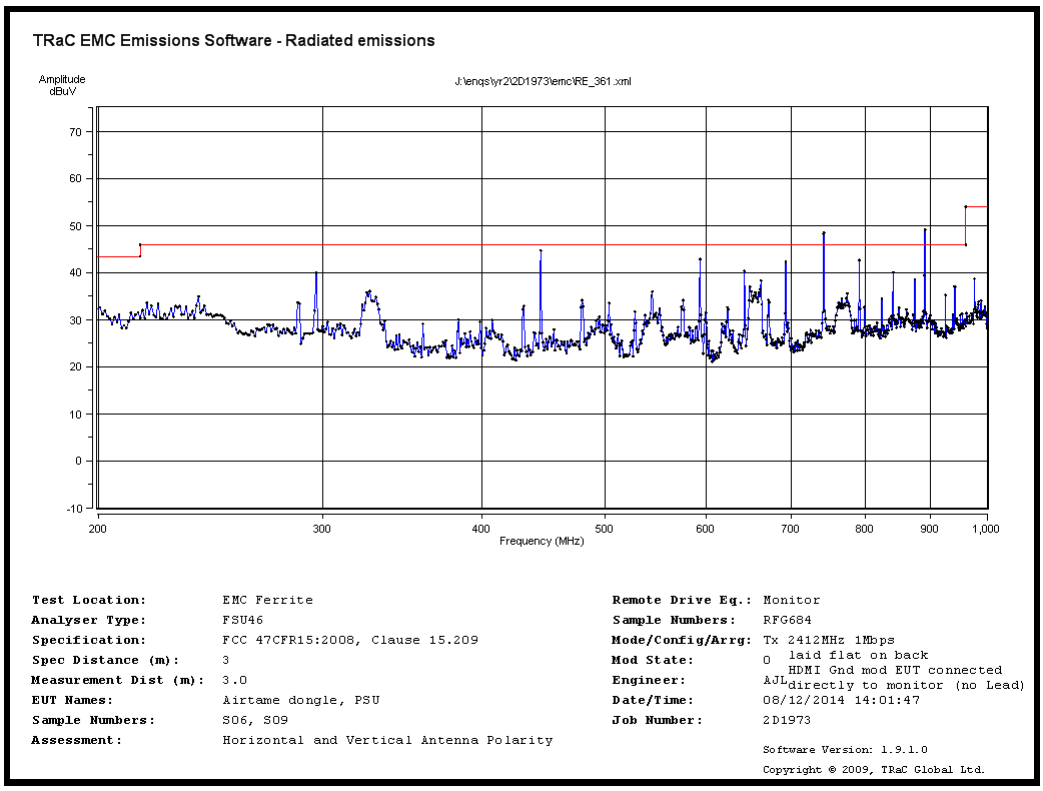
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz 11Mb/s



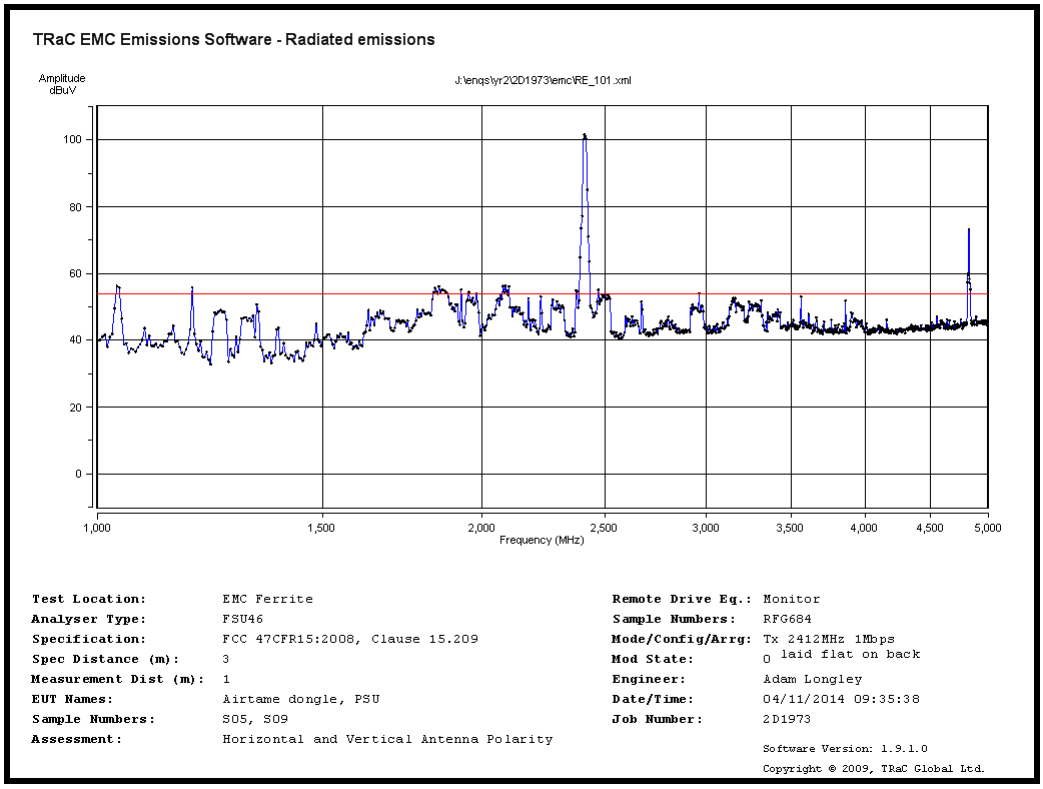
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz 11Mb/s



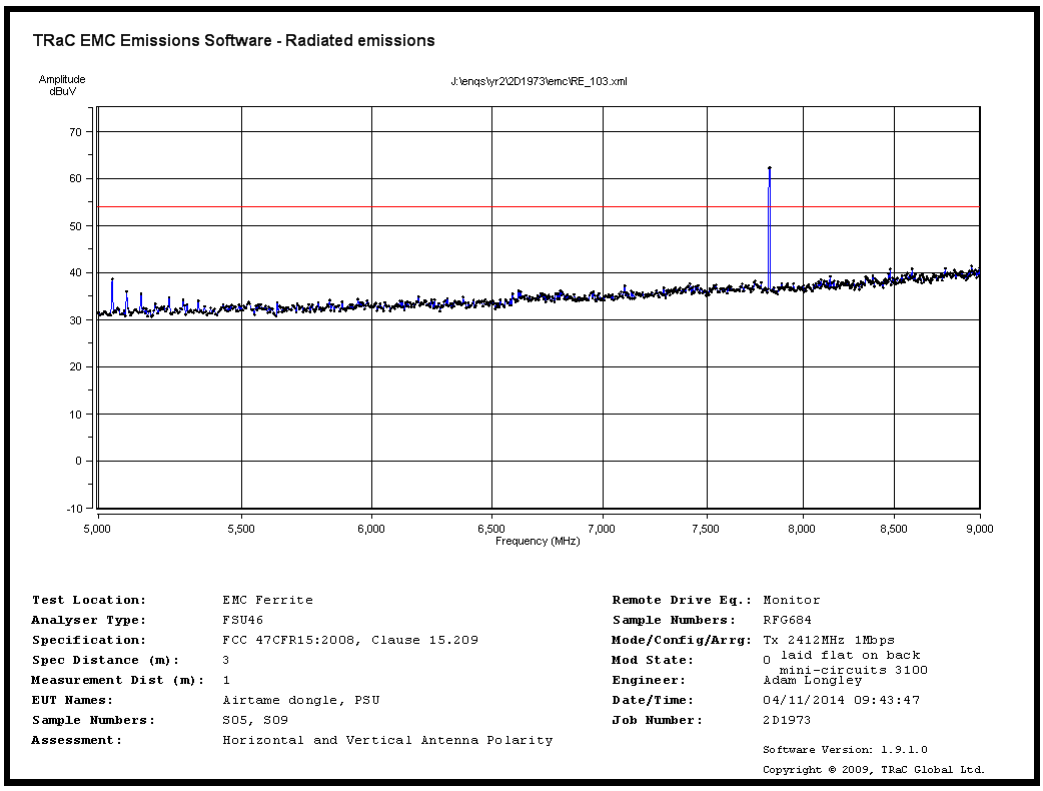
Radiated Spurious emissions 30MHz to 200MHz – 2412MHz 1Mb/s



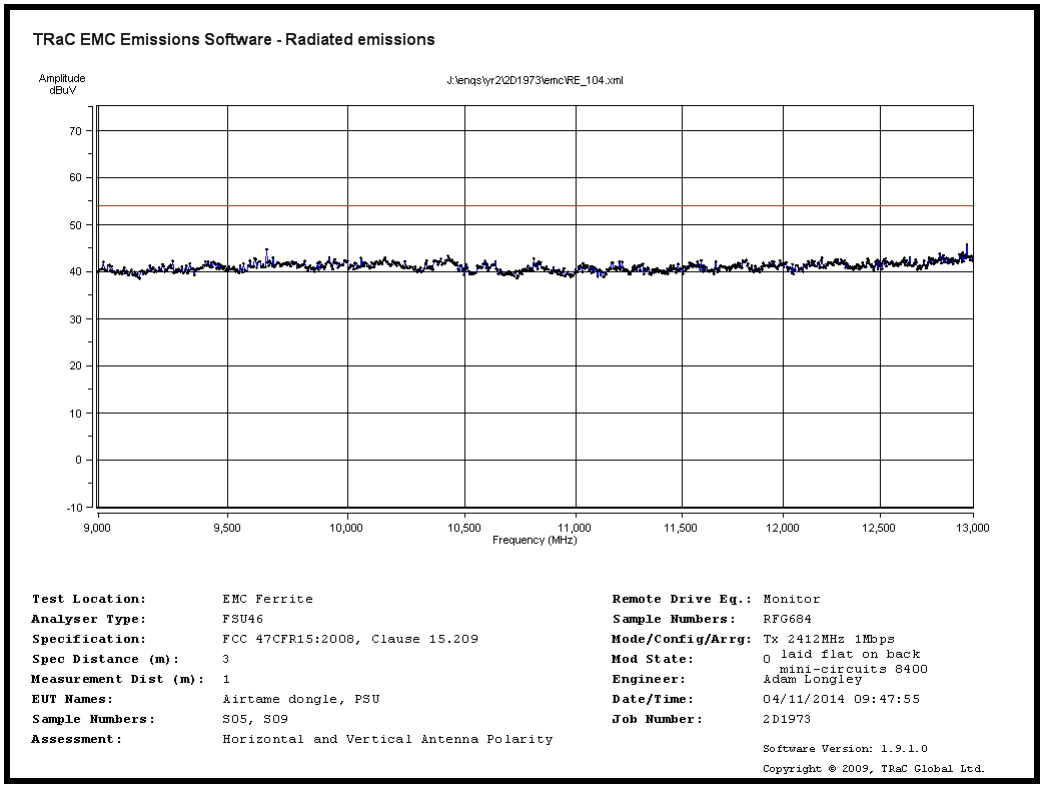
Radiated Spurious emissions 200MHz to 1GHz – 2412MHz 1Mb/s



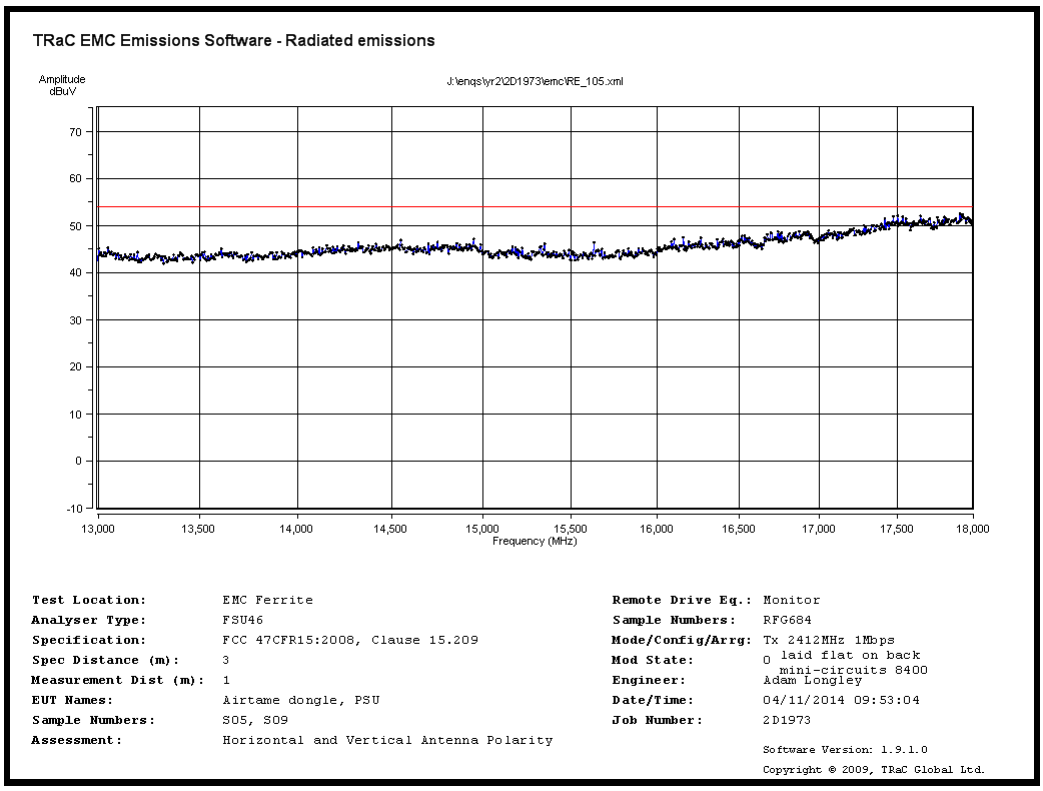
Radiated Spurious emissions 1GHz to 5GHz – 2412MHz 1Mb/s



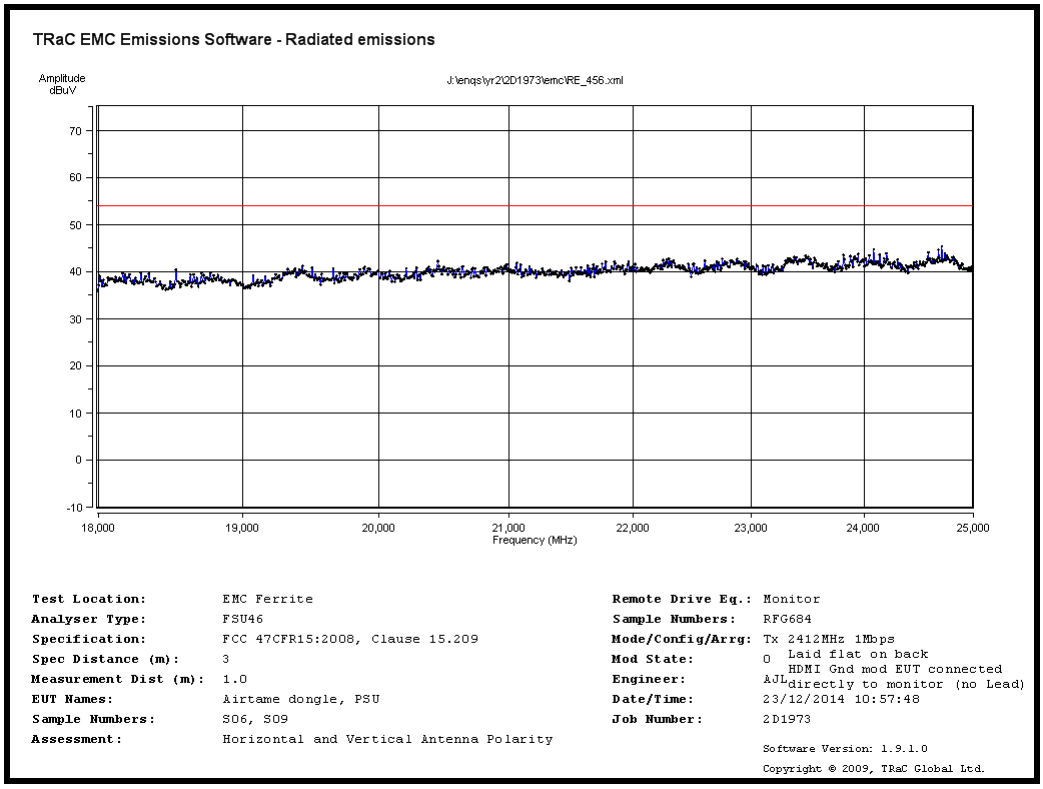
Radiated Spurious emissions 5GHz to 9GHz – 2412MHz 1Mb/s



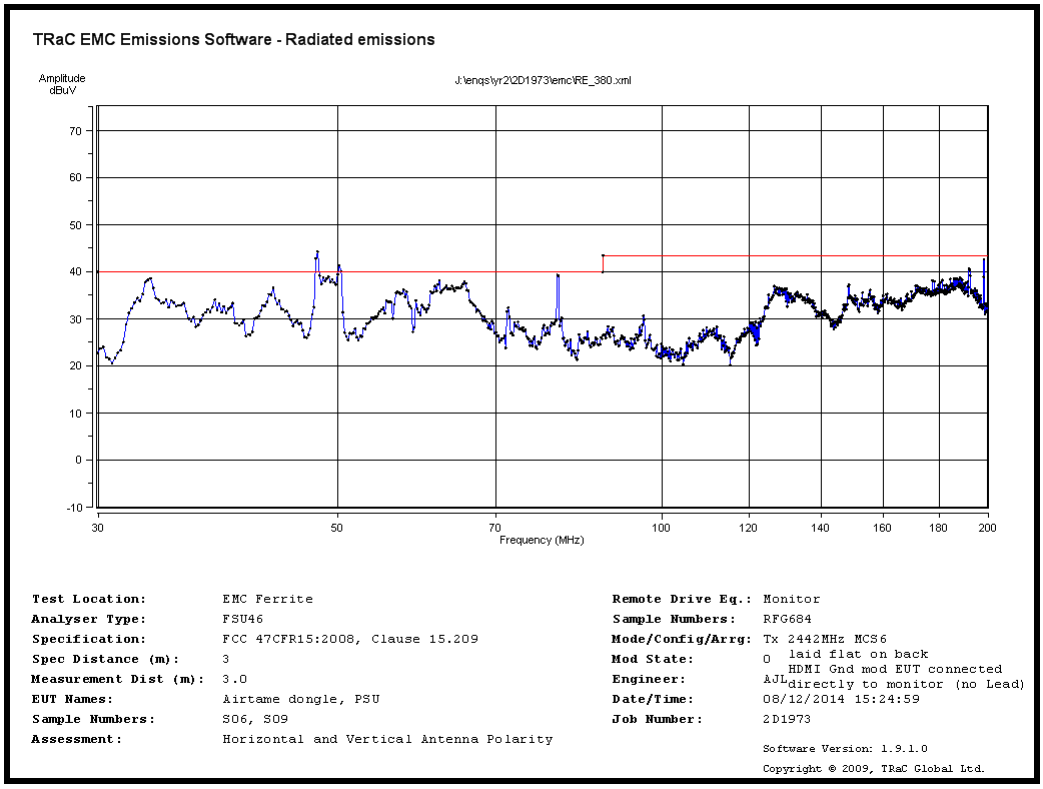
Radiated Spurious emissions 9GHz to 13GHz – 2412MHz 1Mb/s



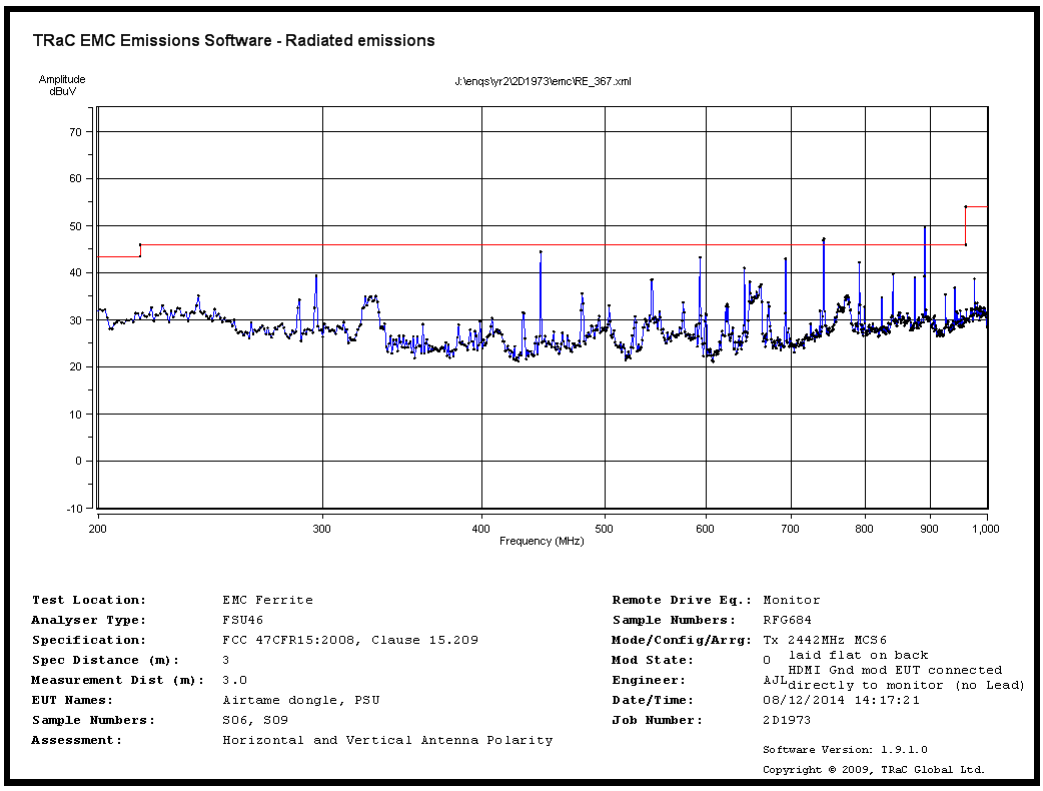
Radiated Spurious emissions 13GHz to 18GHz – 2412MHz 1Mb/s



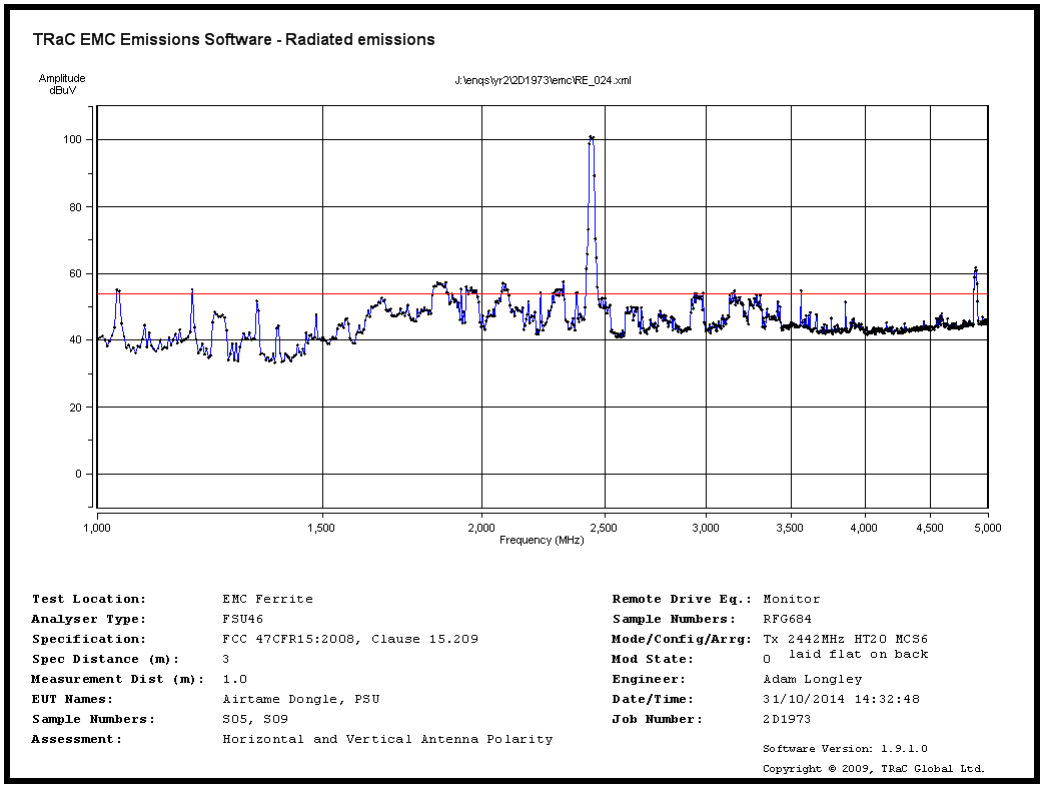
Radiated Spurious emissions 18GHz to 25GHz – 2412MHz 1Mb/s



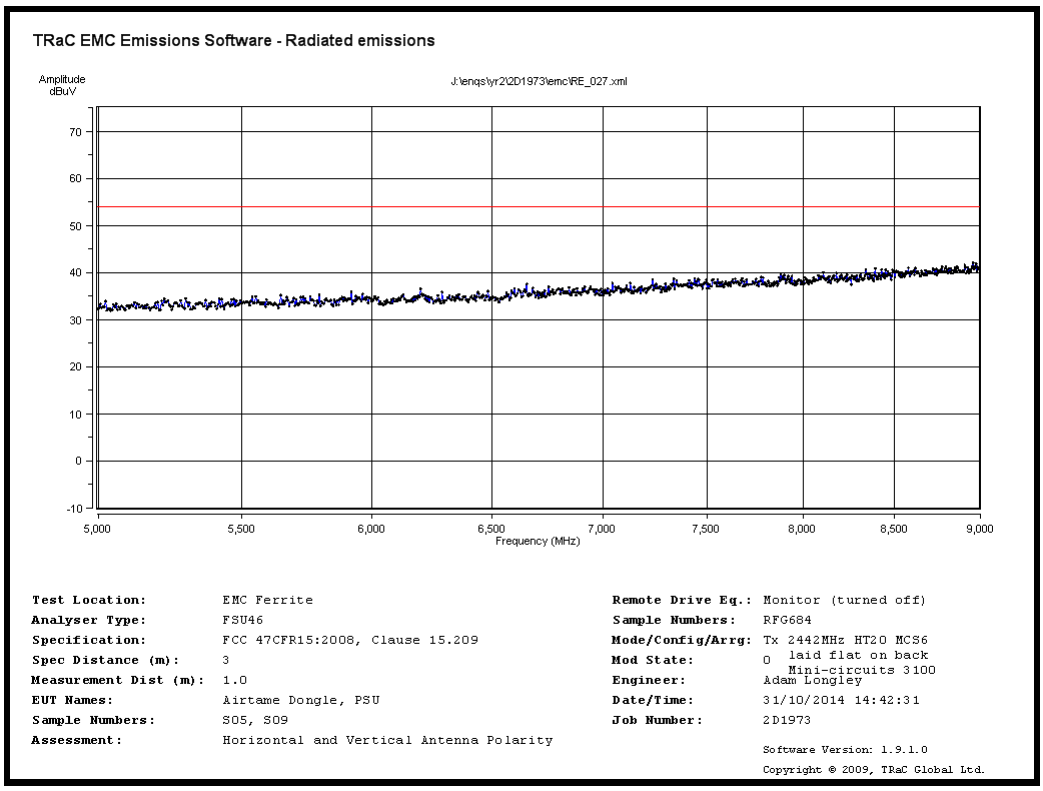
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz MCS6



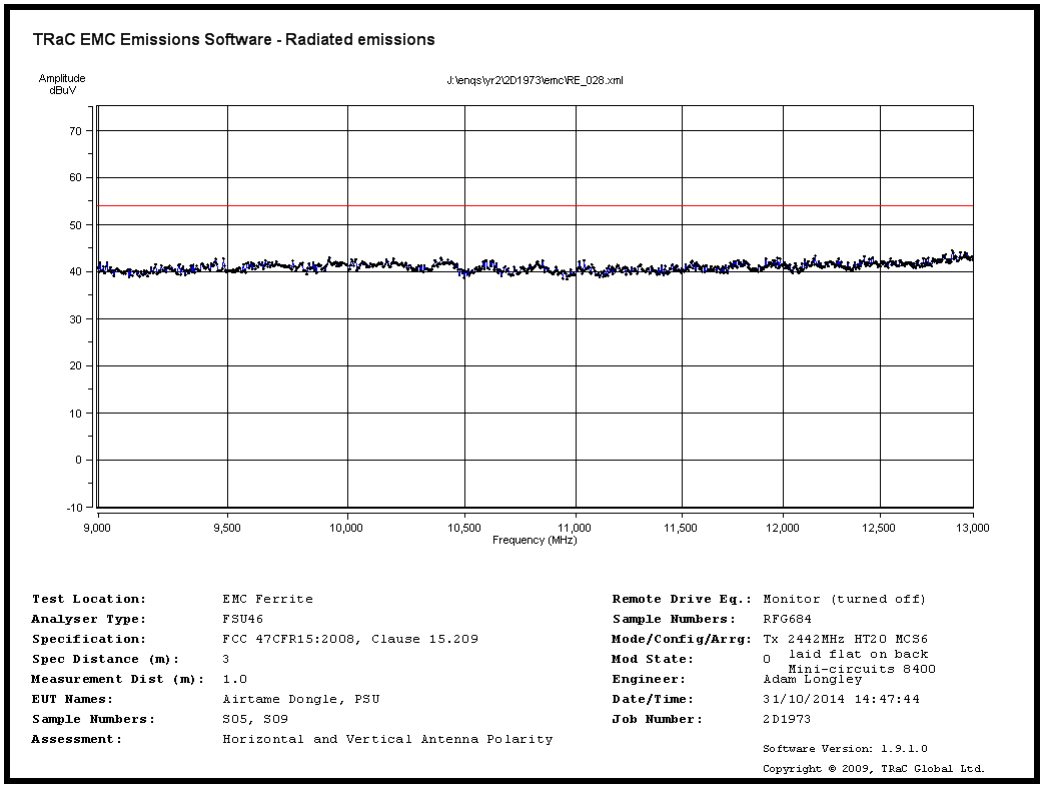
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz MCS6



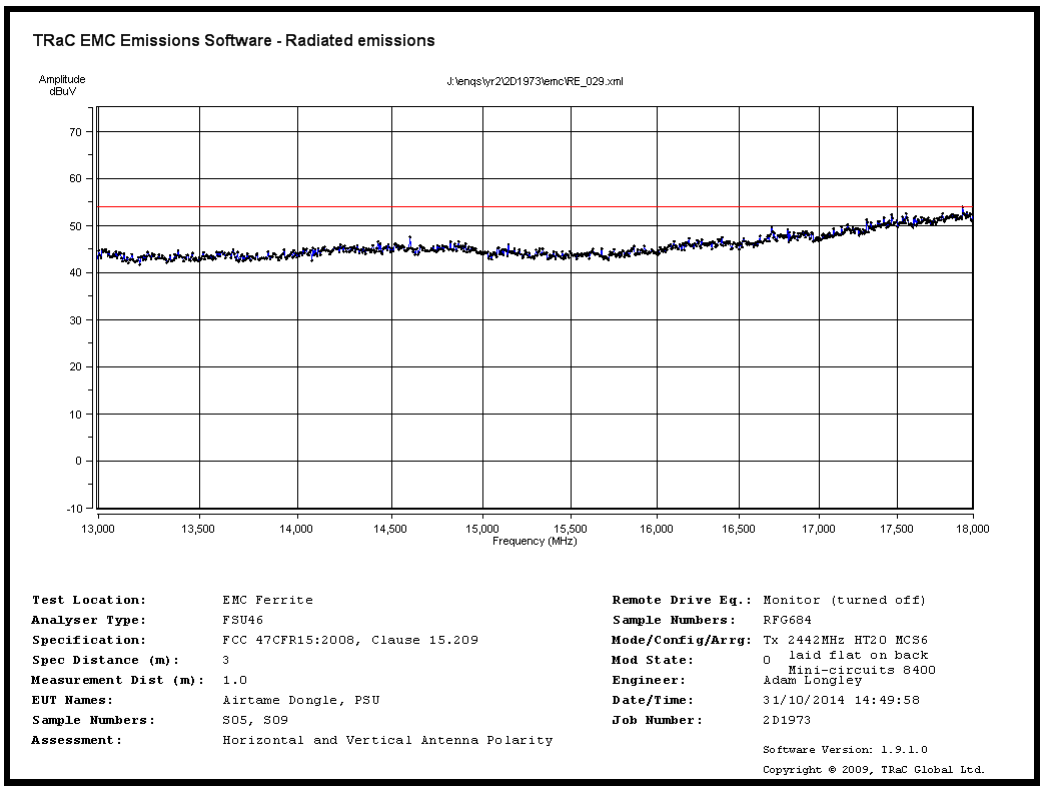
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz MCS6



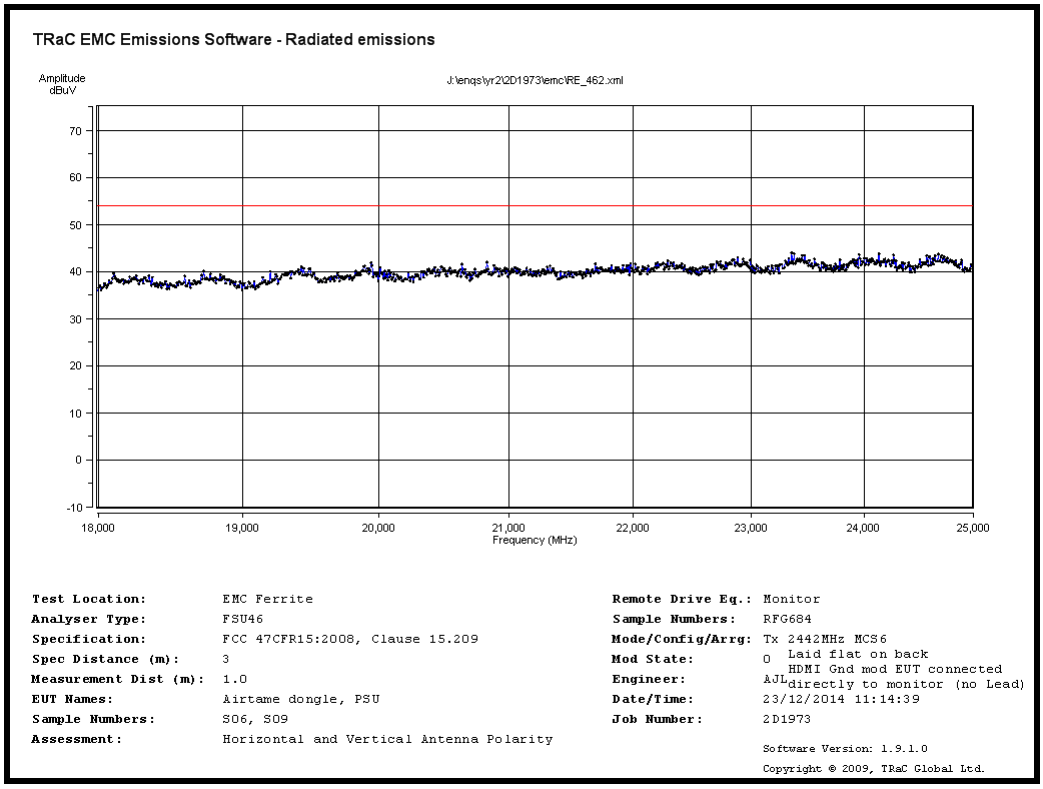
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz MCS6



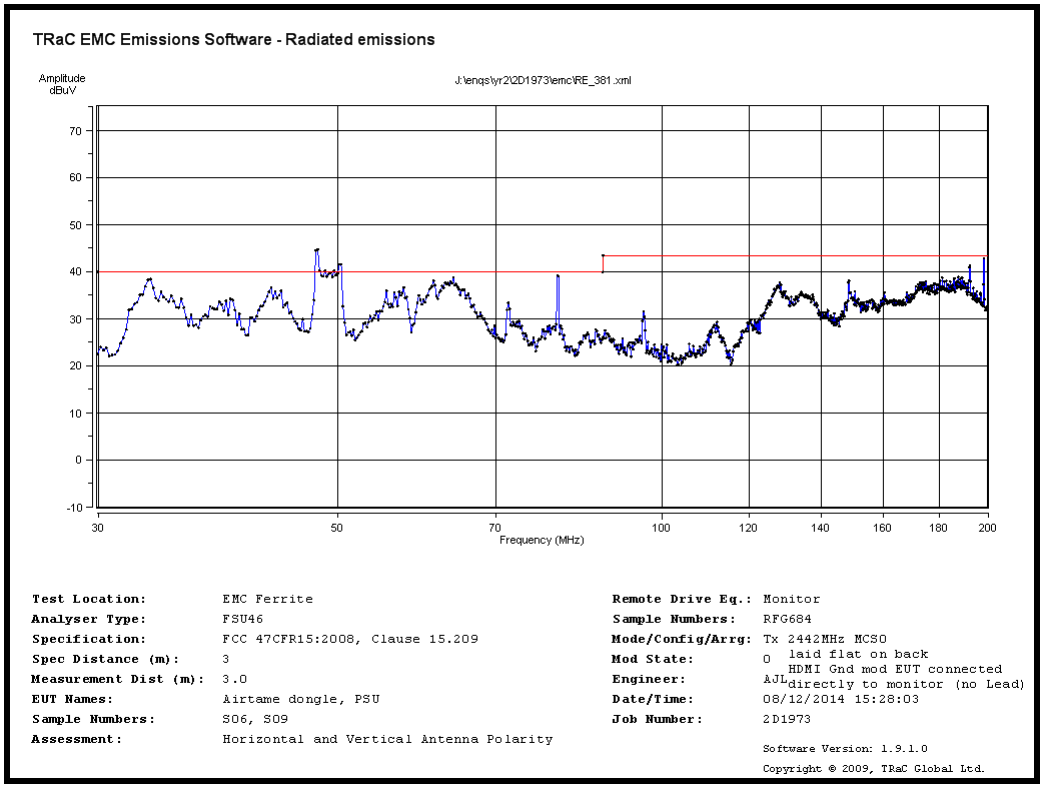
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz MCS6



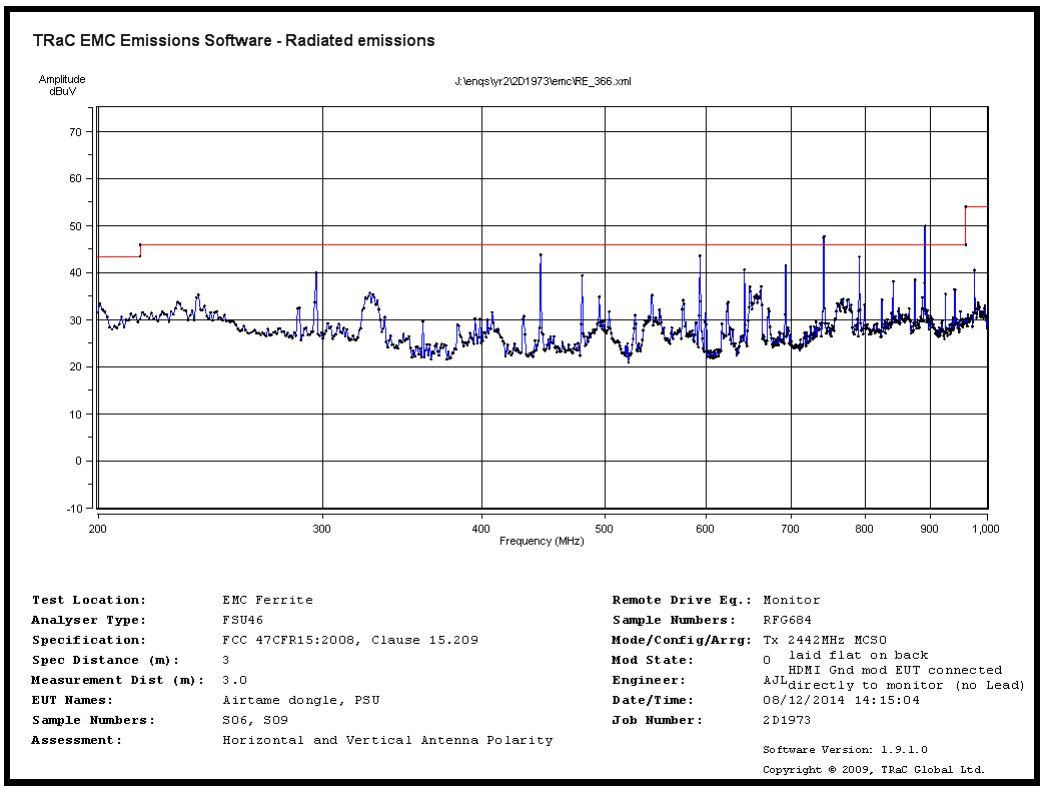
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz MCS6



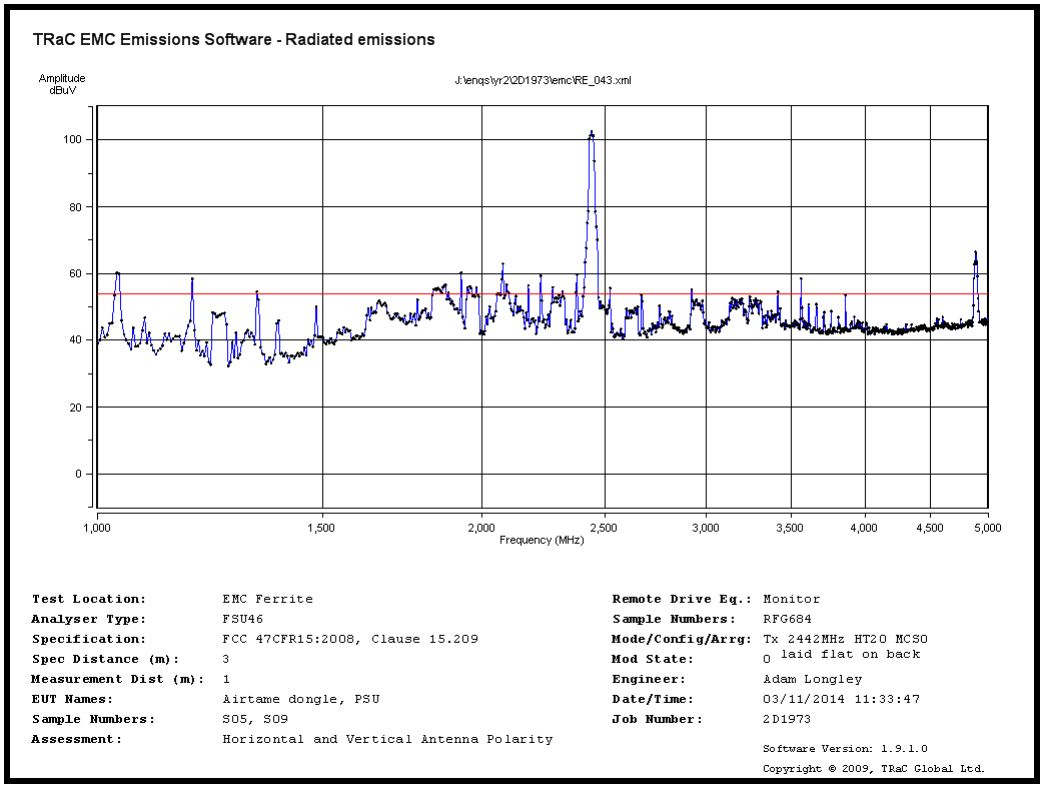
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz MCS6



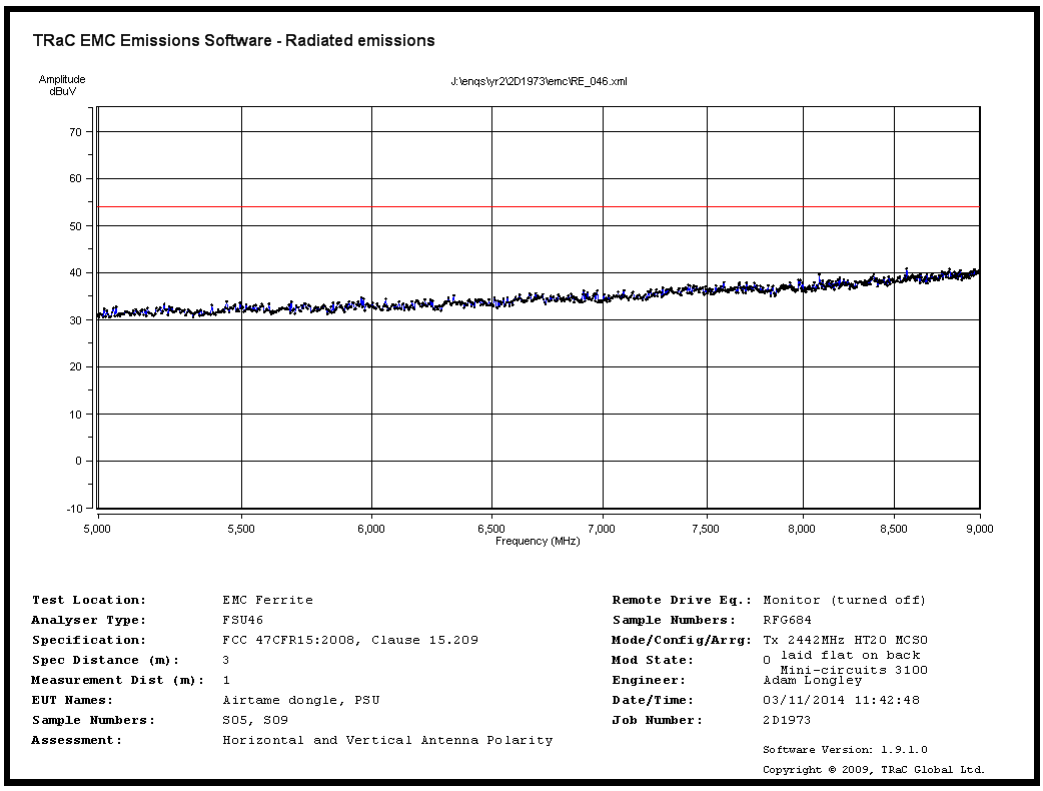
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz MCS0



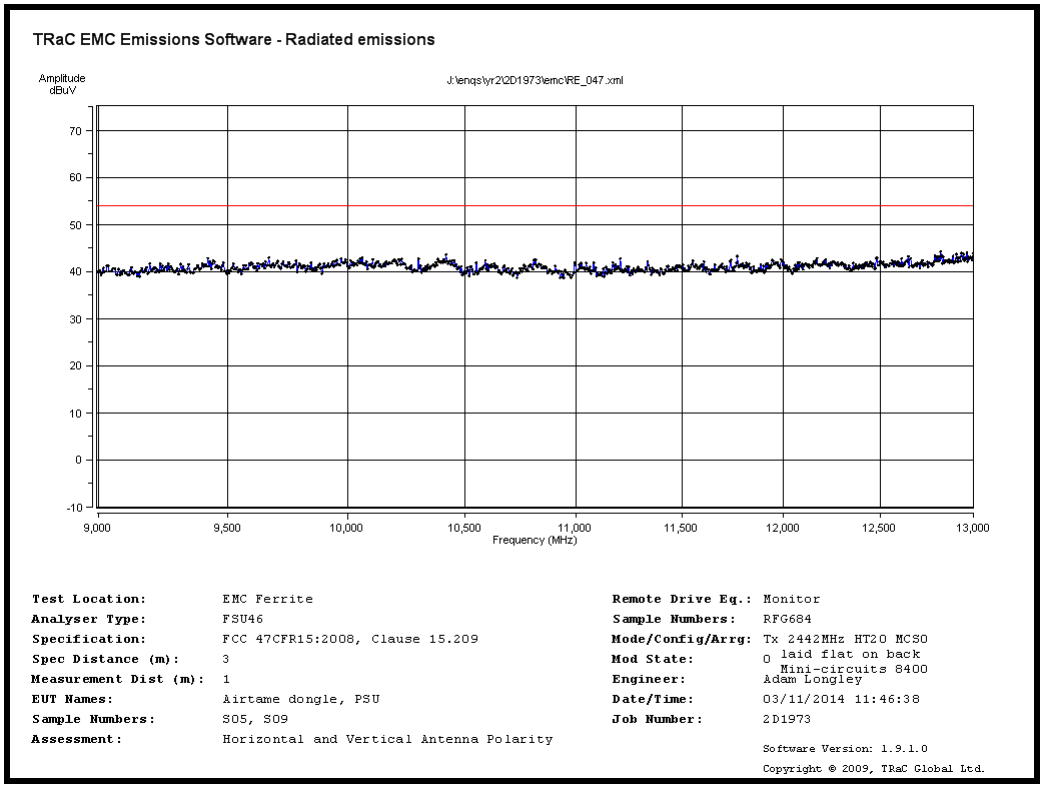
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz MCS0



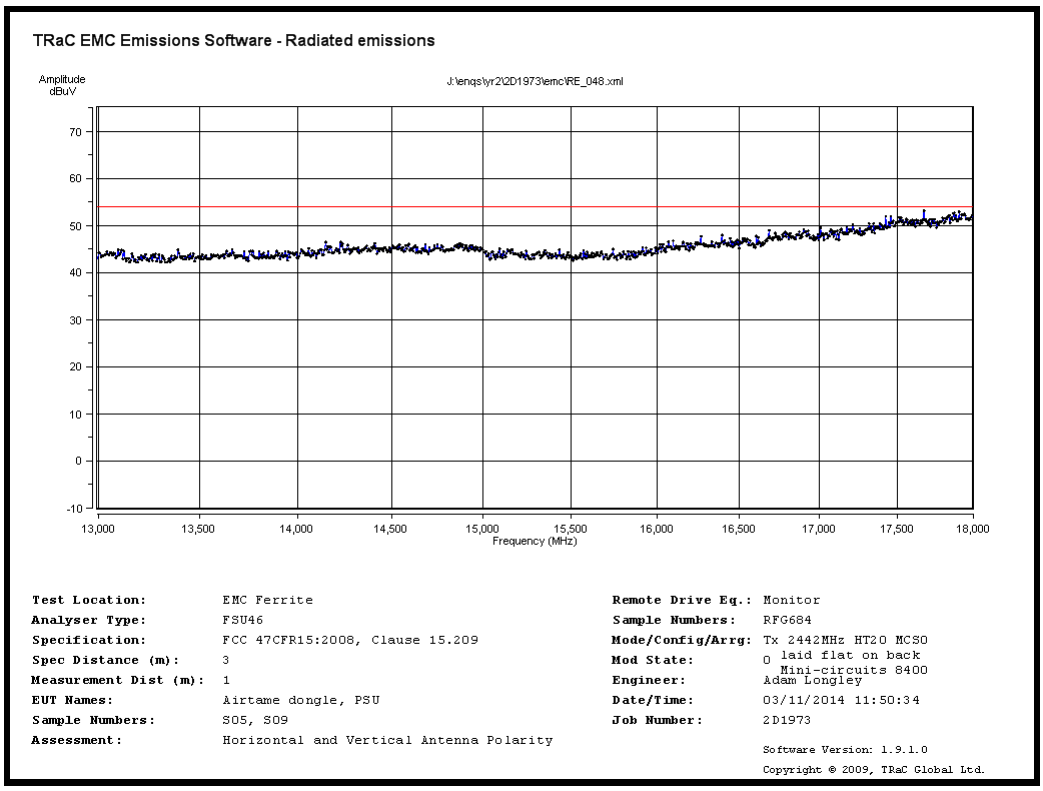
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz MCS0



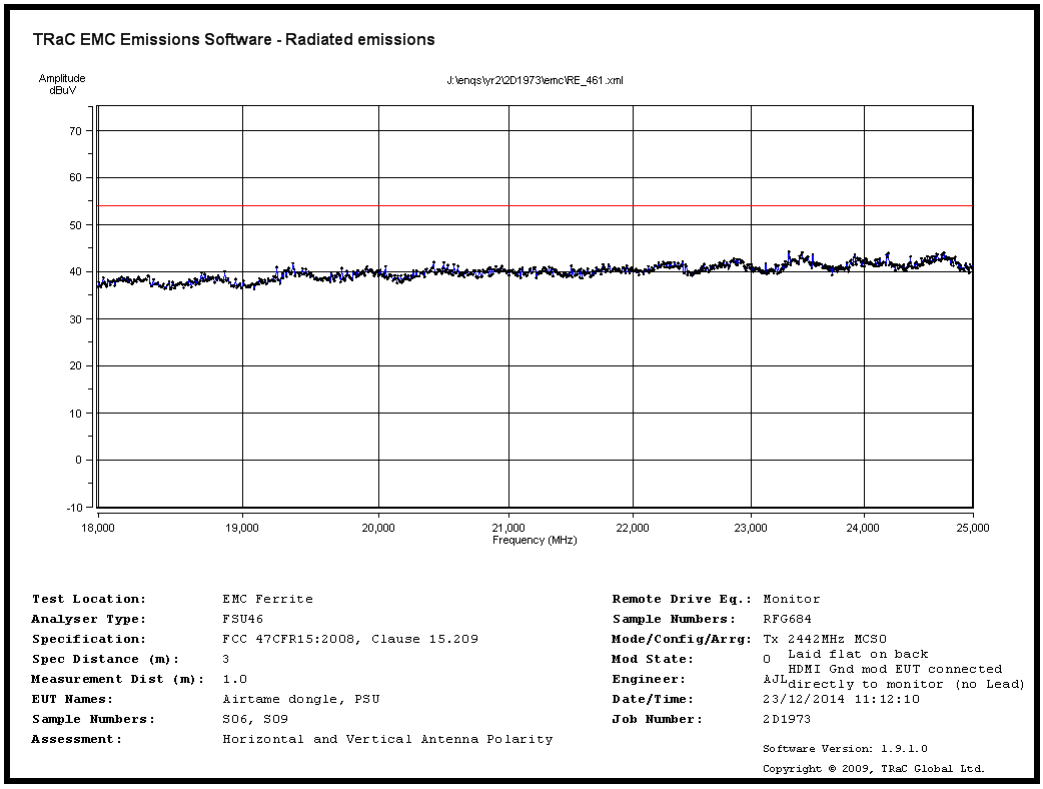
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz MCS0



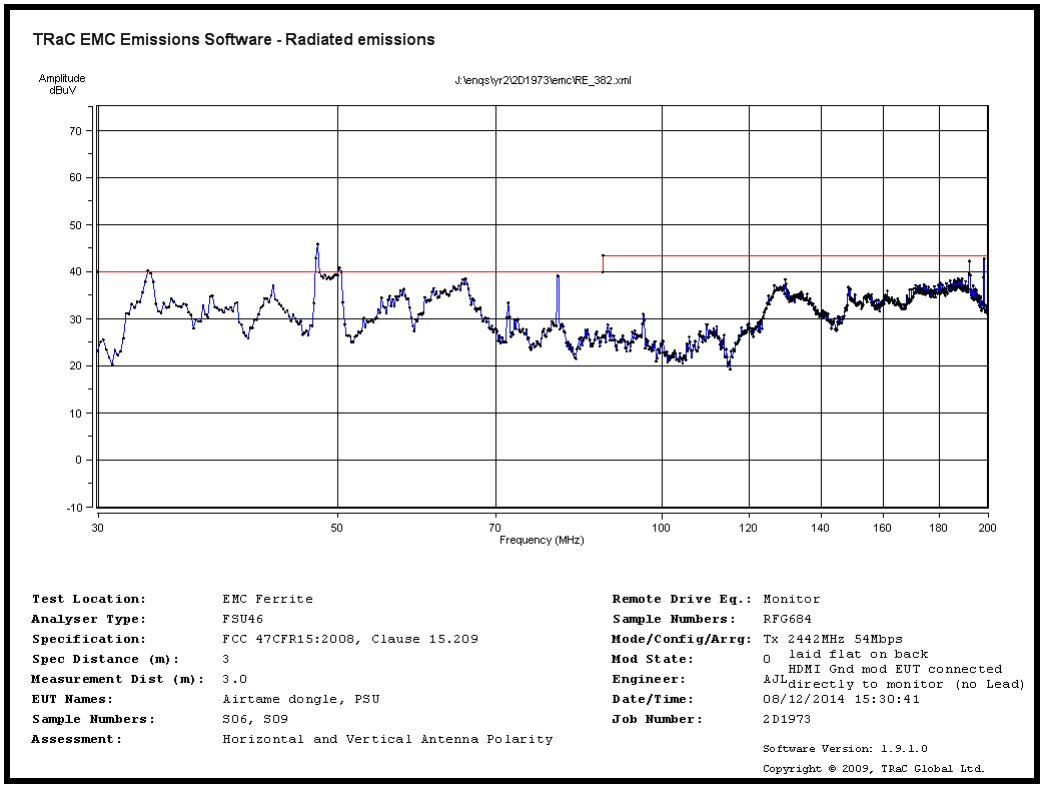
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz MCS0



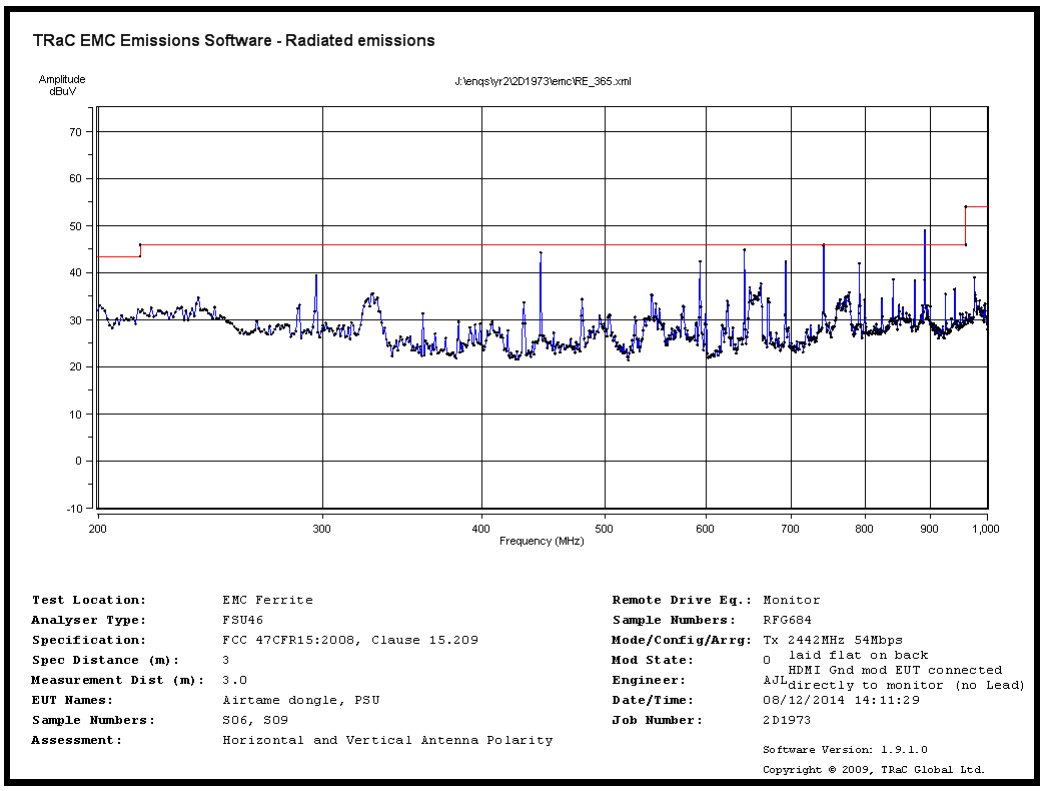
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz MCS0



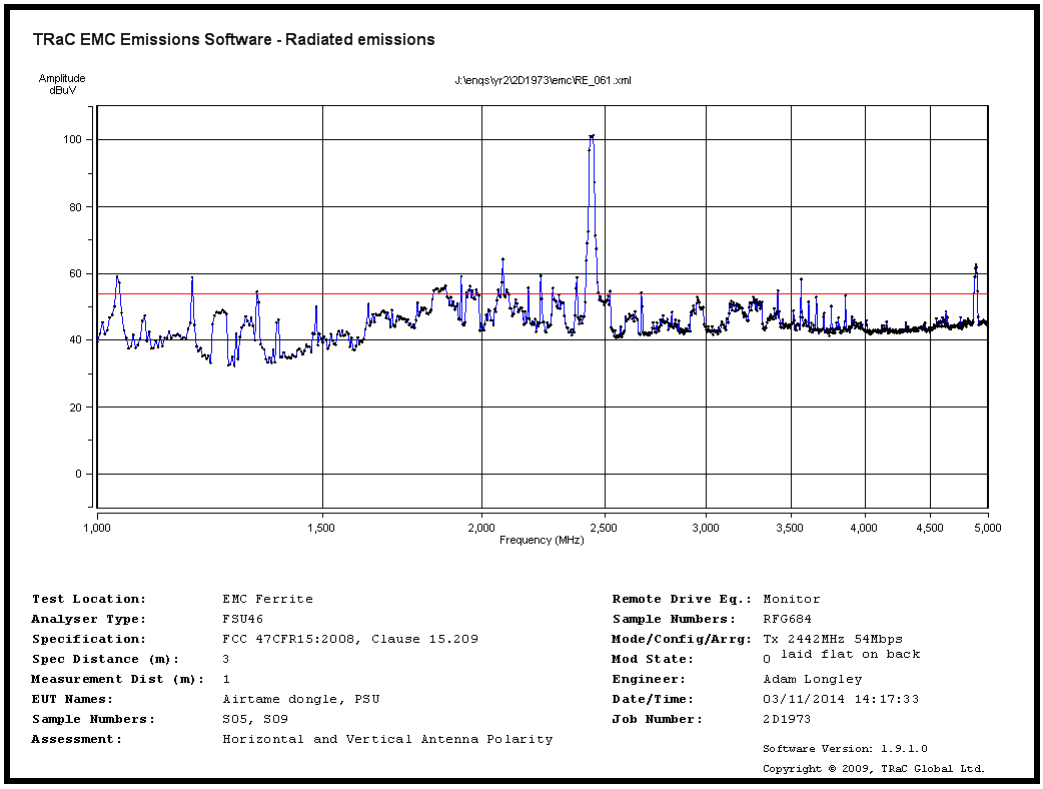
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz MCS0



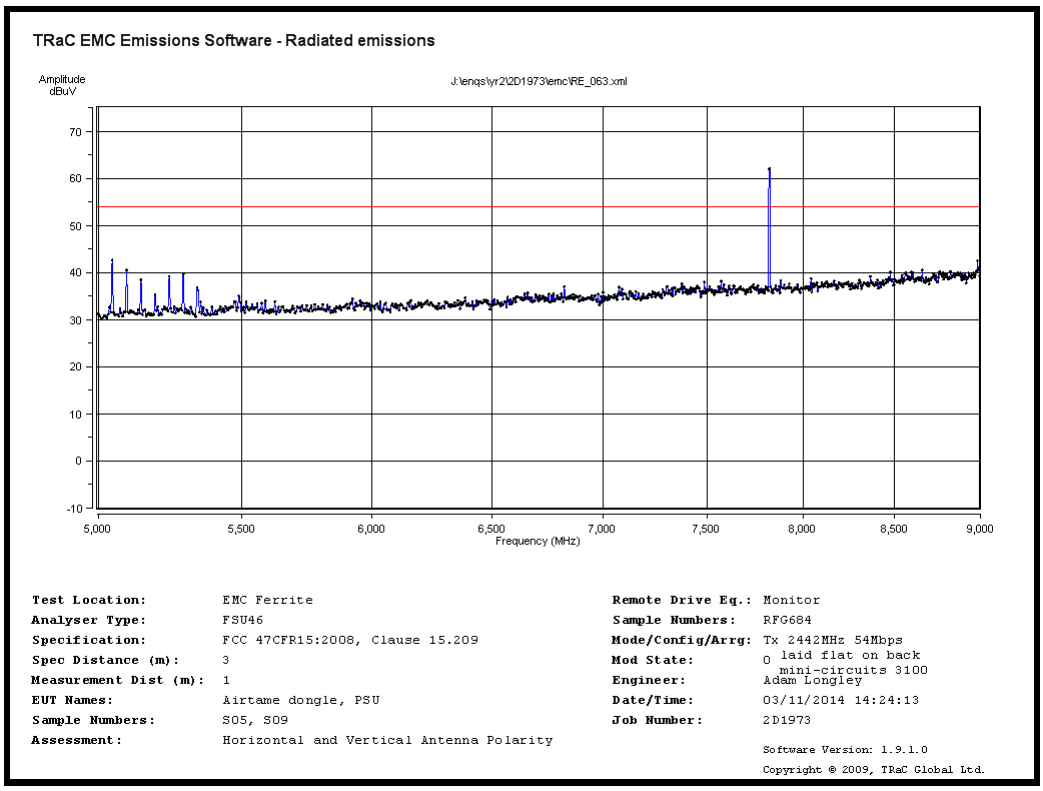
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz 54Mb/s



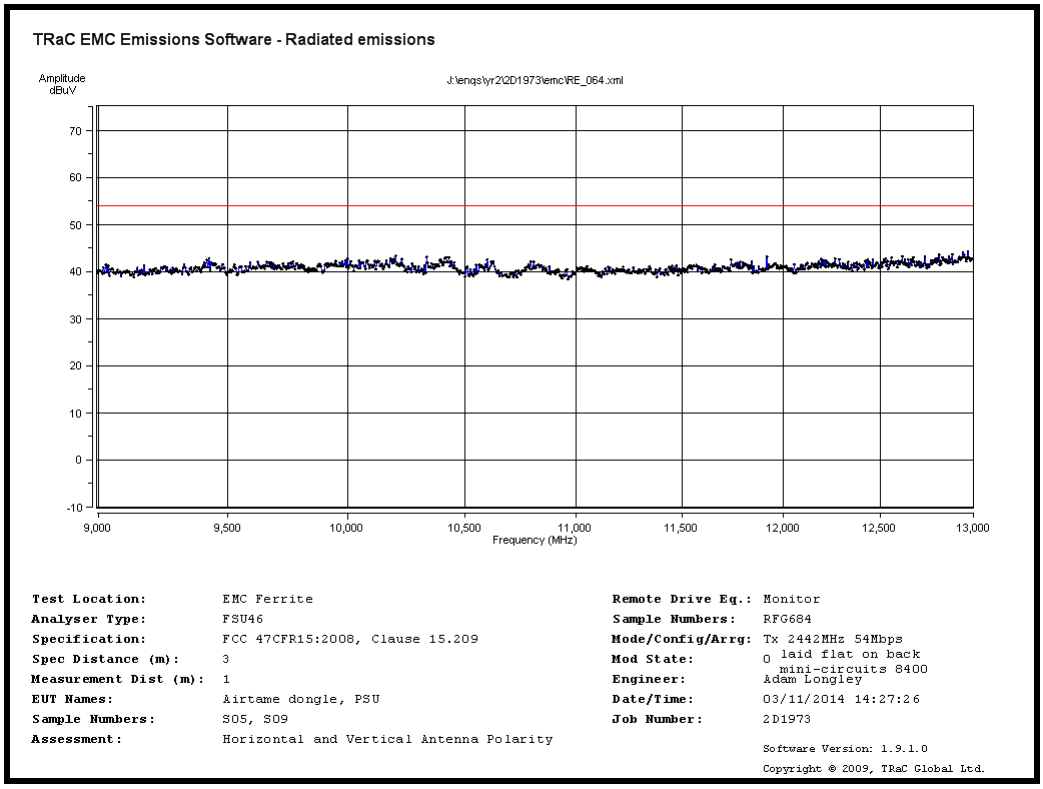
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz 54Mb/s



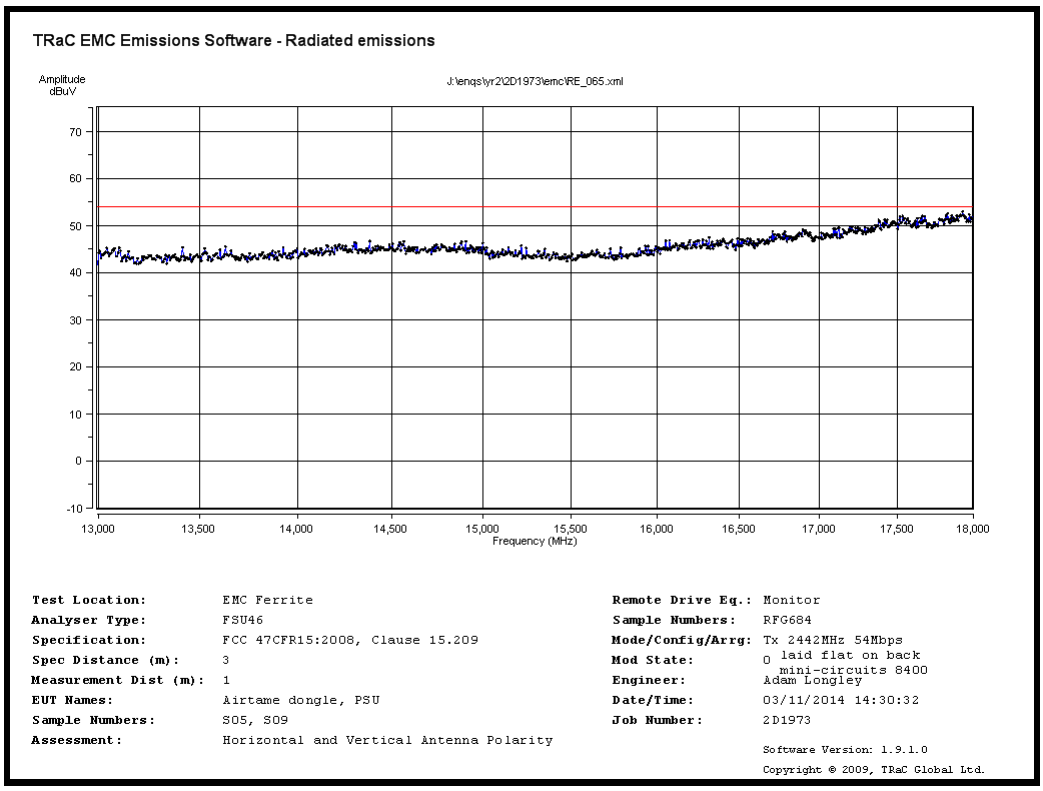
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz 54Mb/s



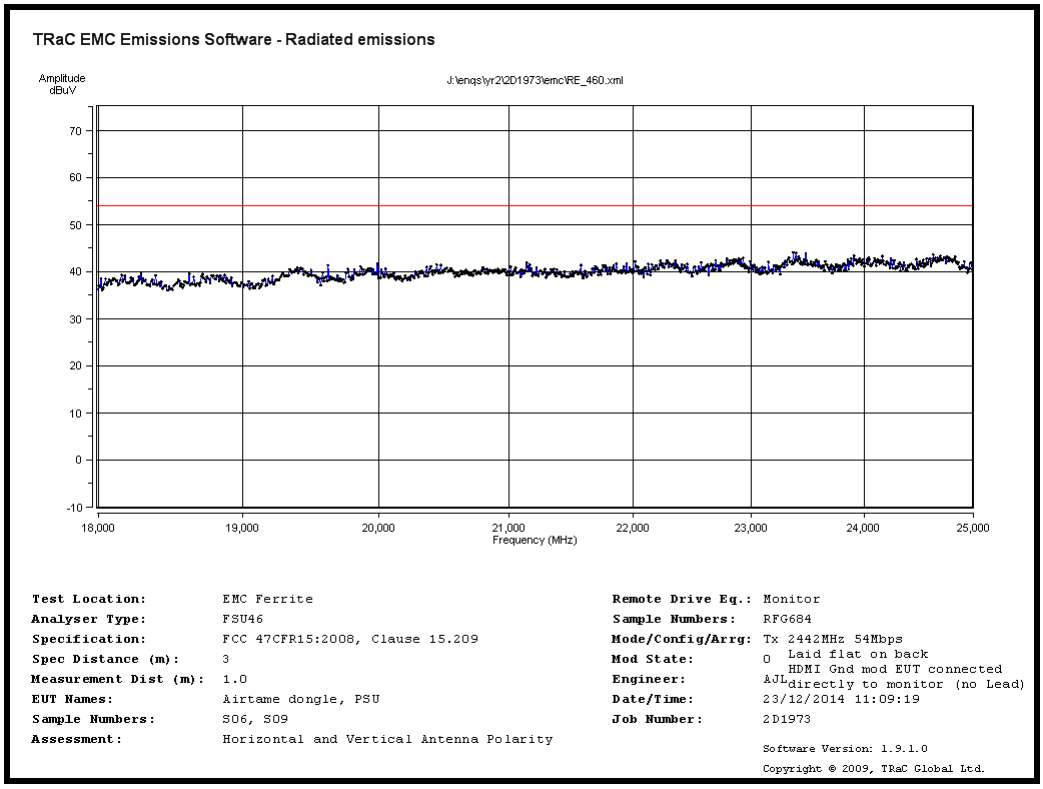
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz 54Mb/s



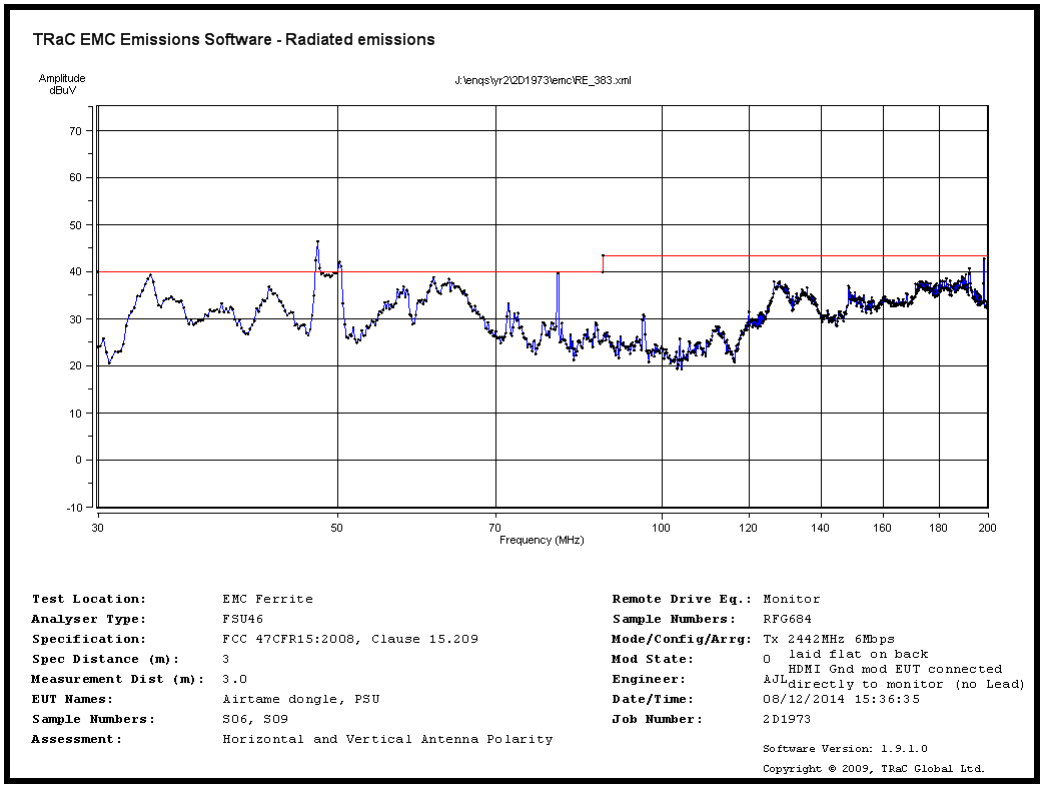
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz 54Mb/s



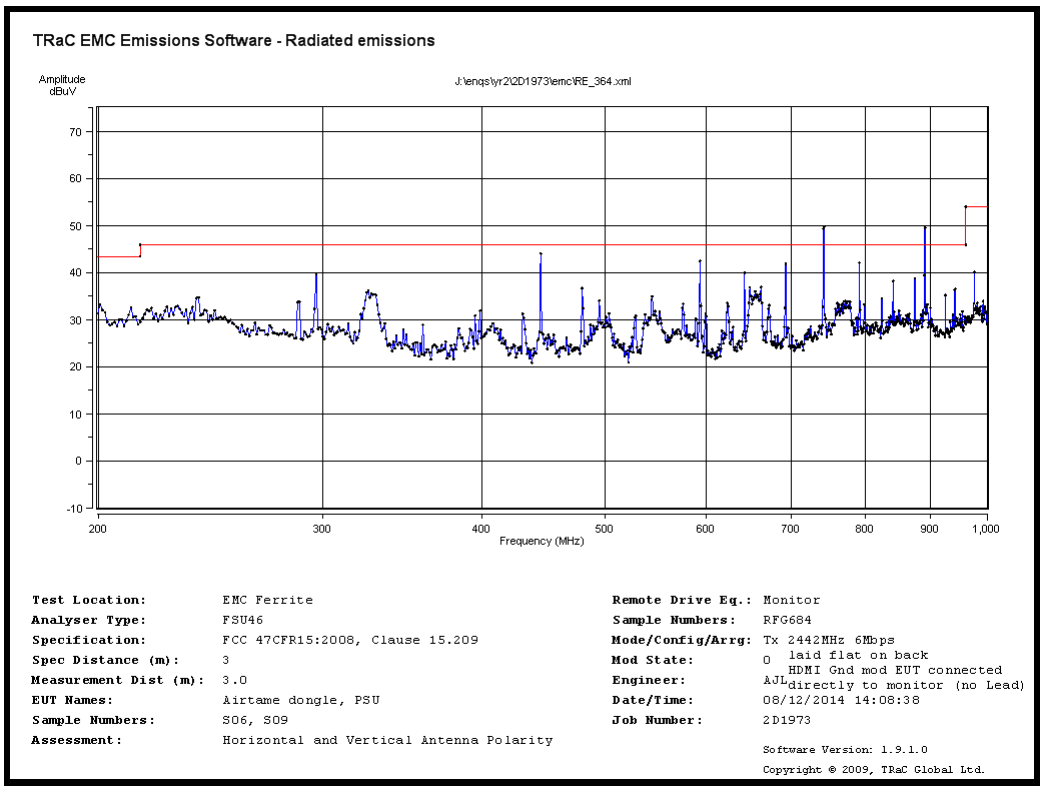
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz 54Mb/s



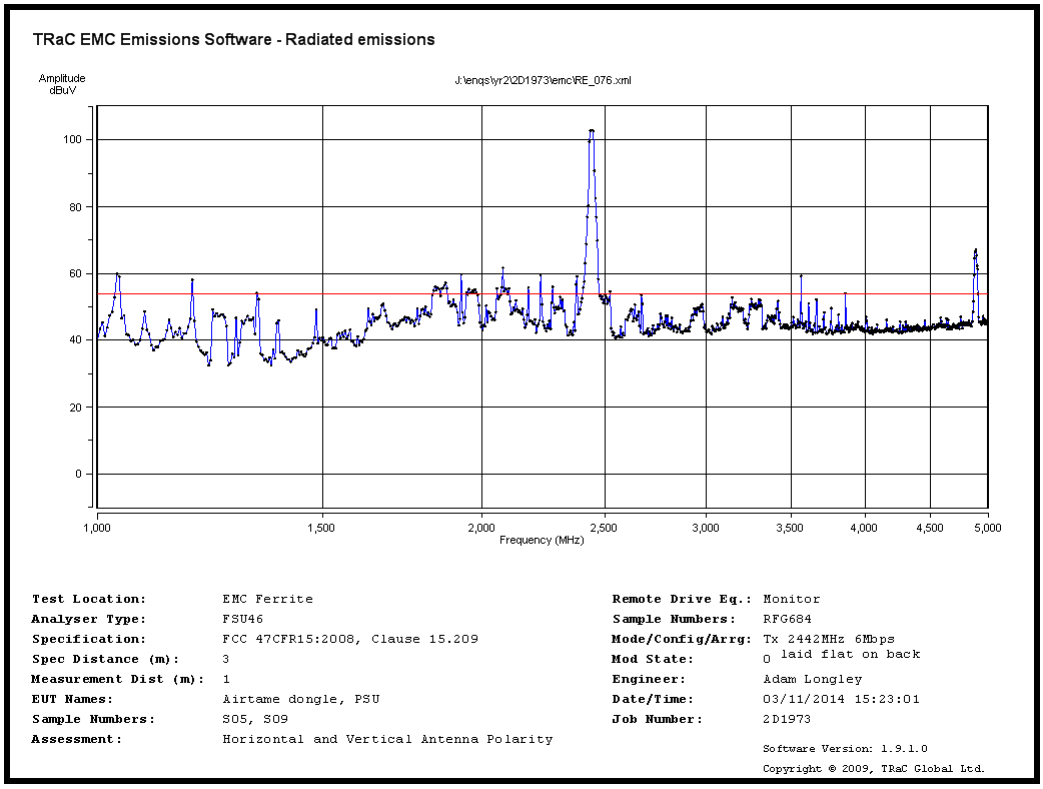
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz 54Mb/s



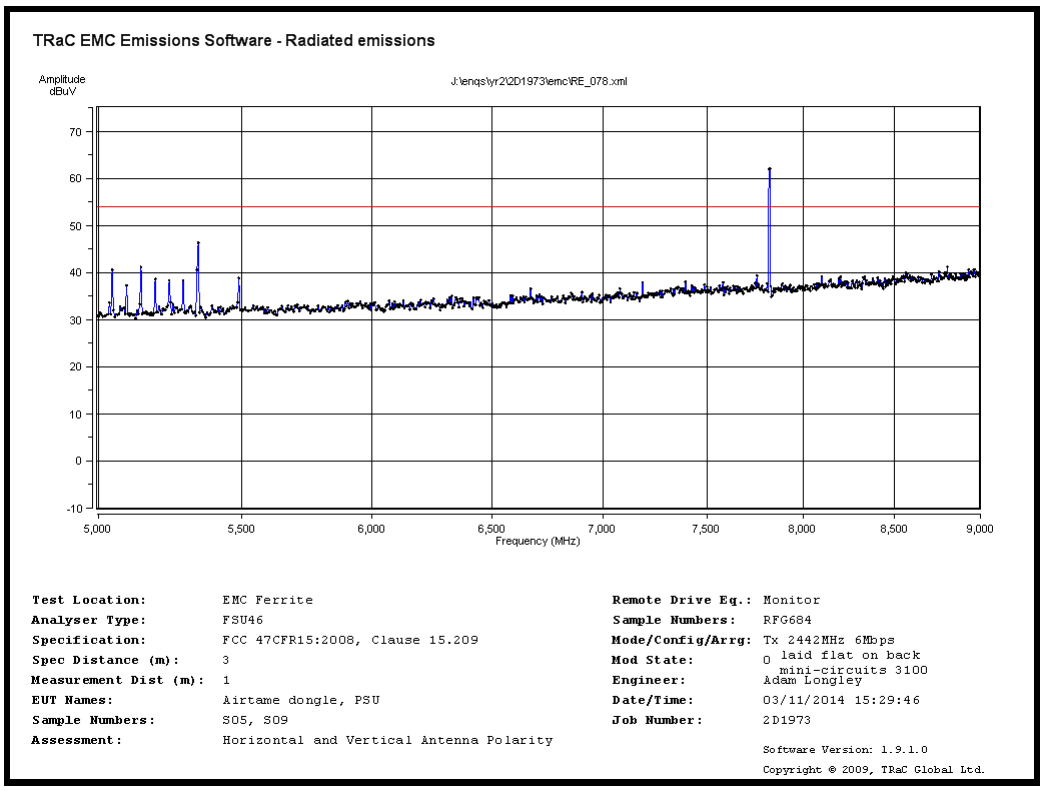
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz 6Mb/s



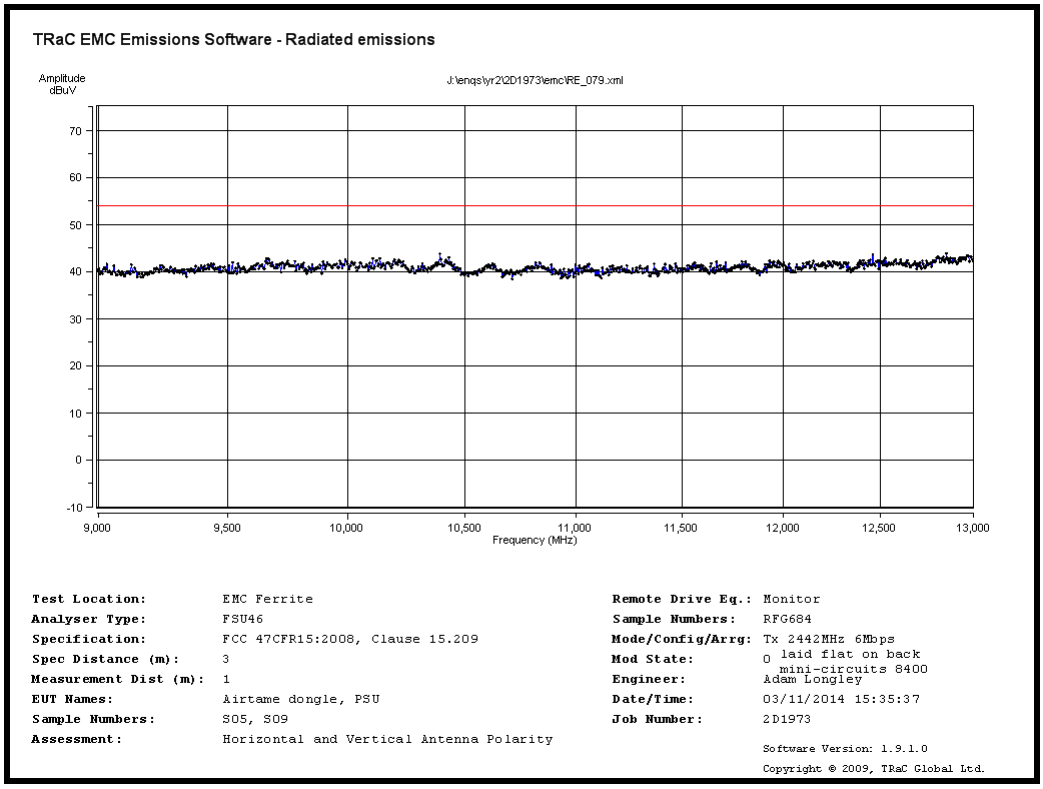
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz 6Mb/s



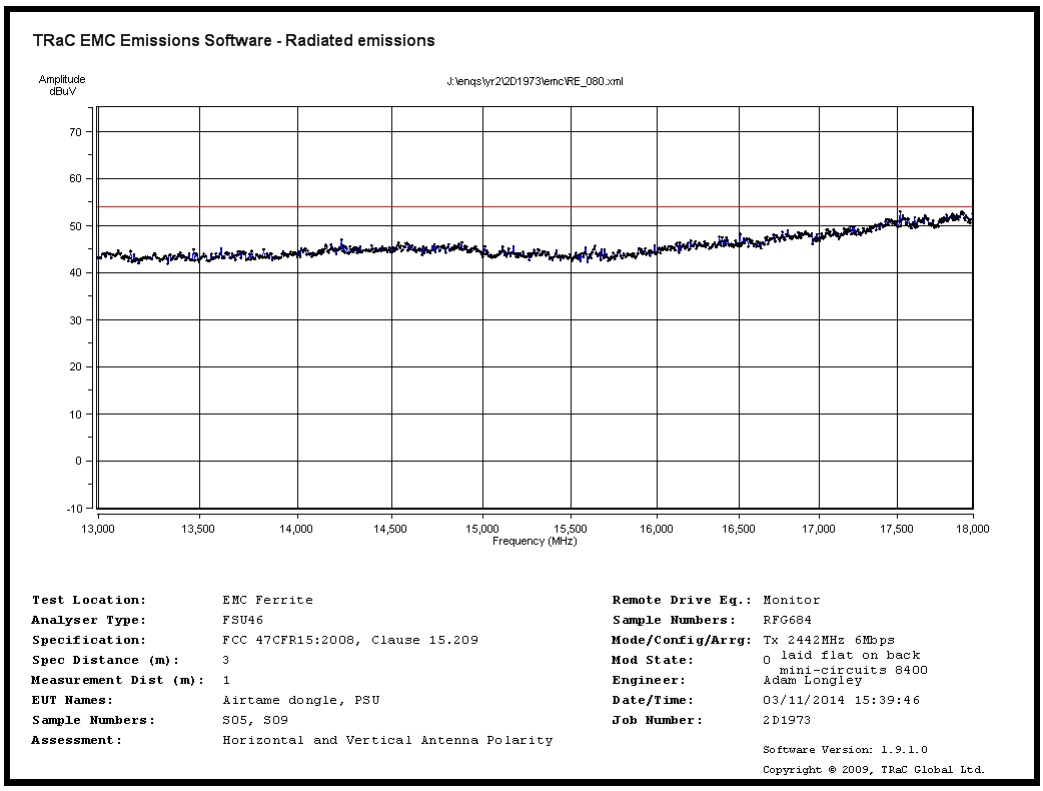
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz 6Mb/s



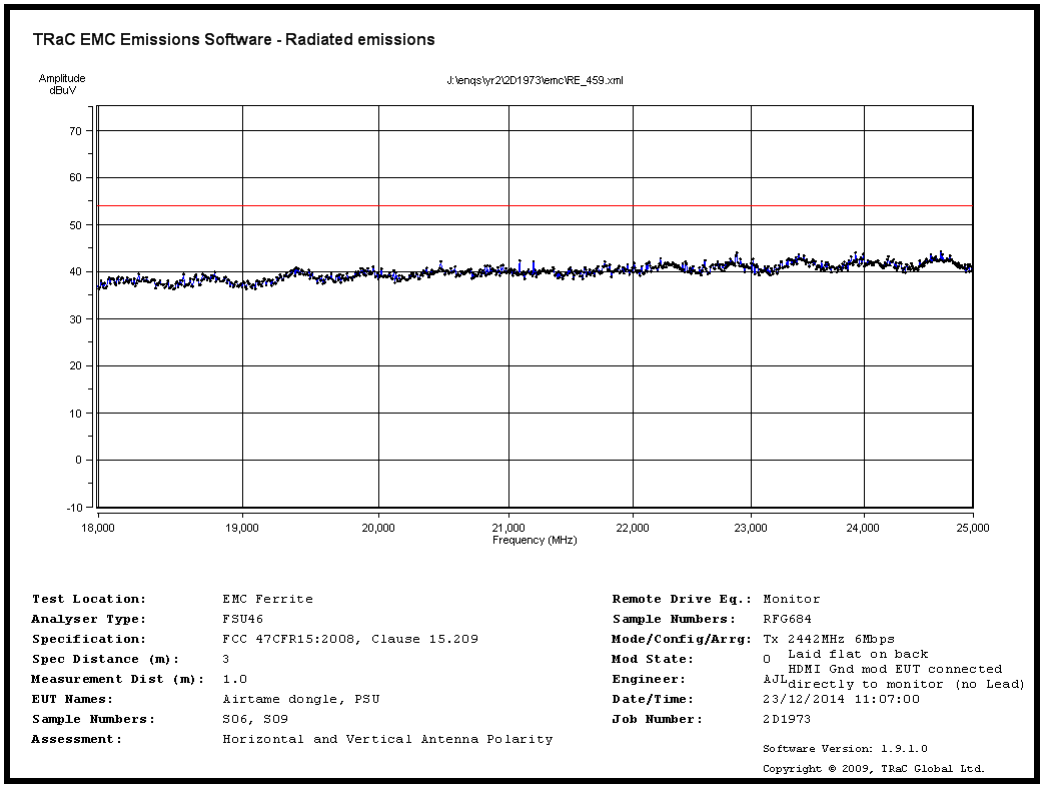
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz 6Mb/s



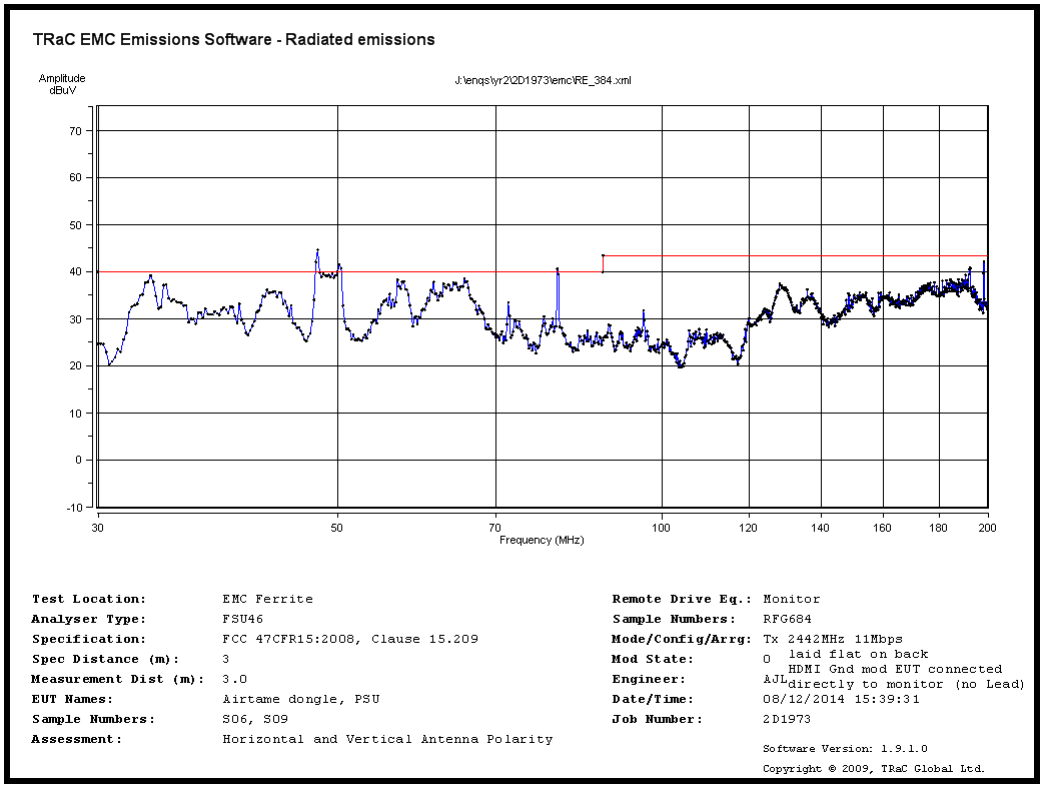
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz 6Mb/s



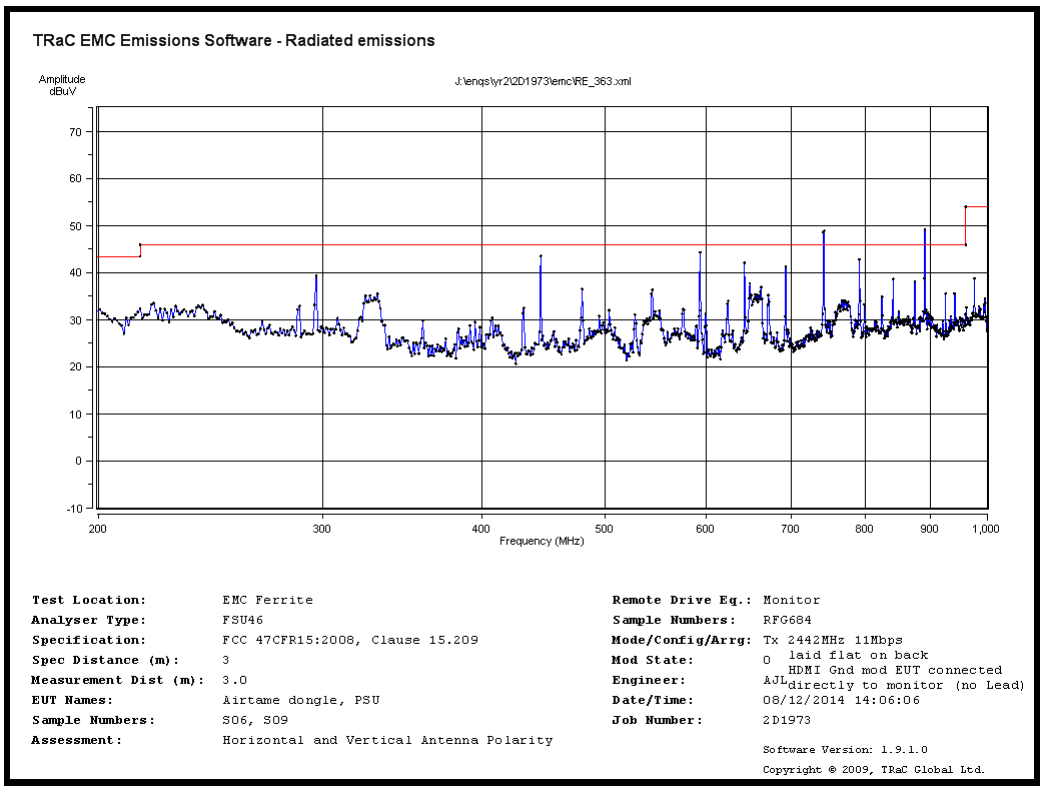
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz 6Mb/s



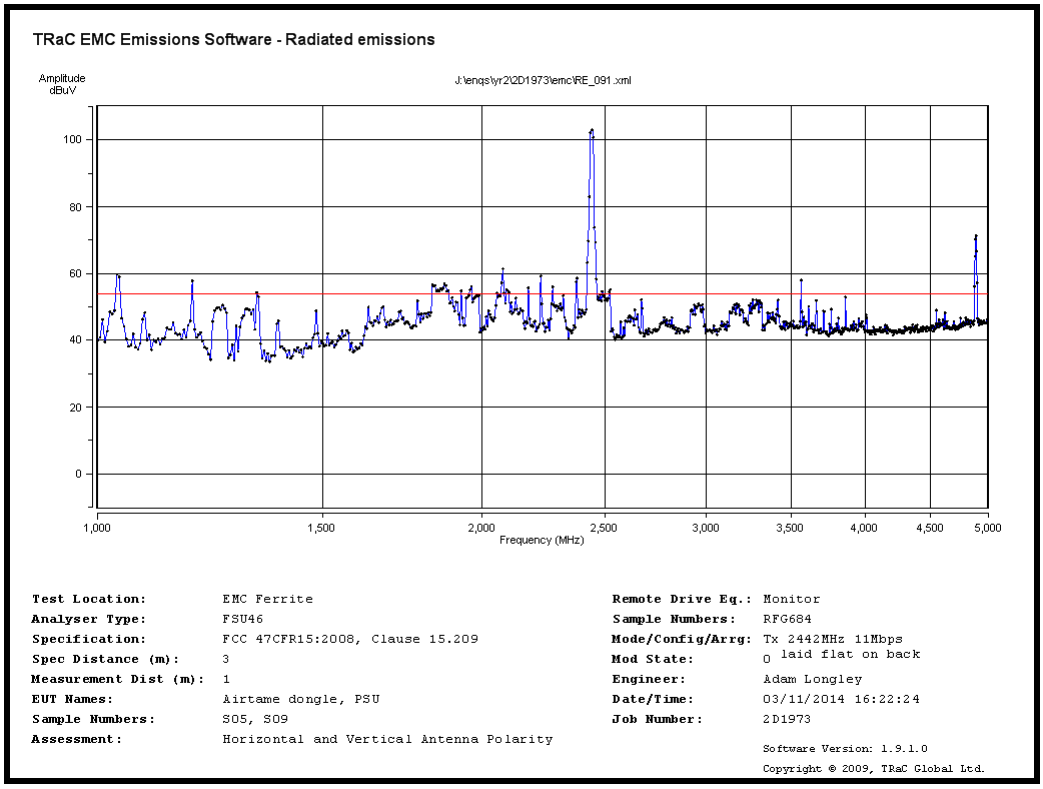
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz 6Mb/s



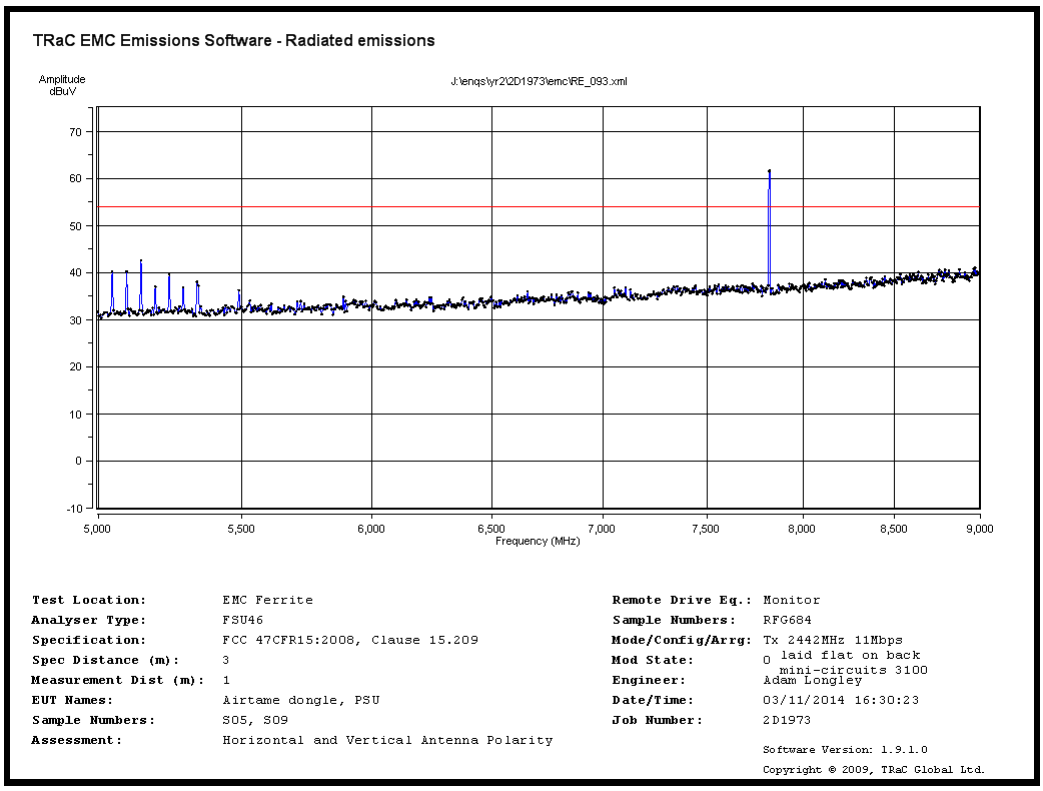
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz 11Mb/s



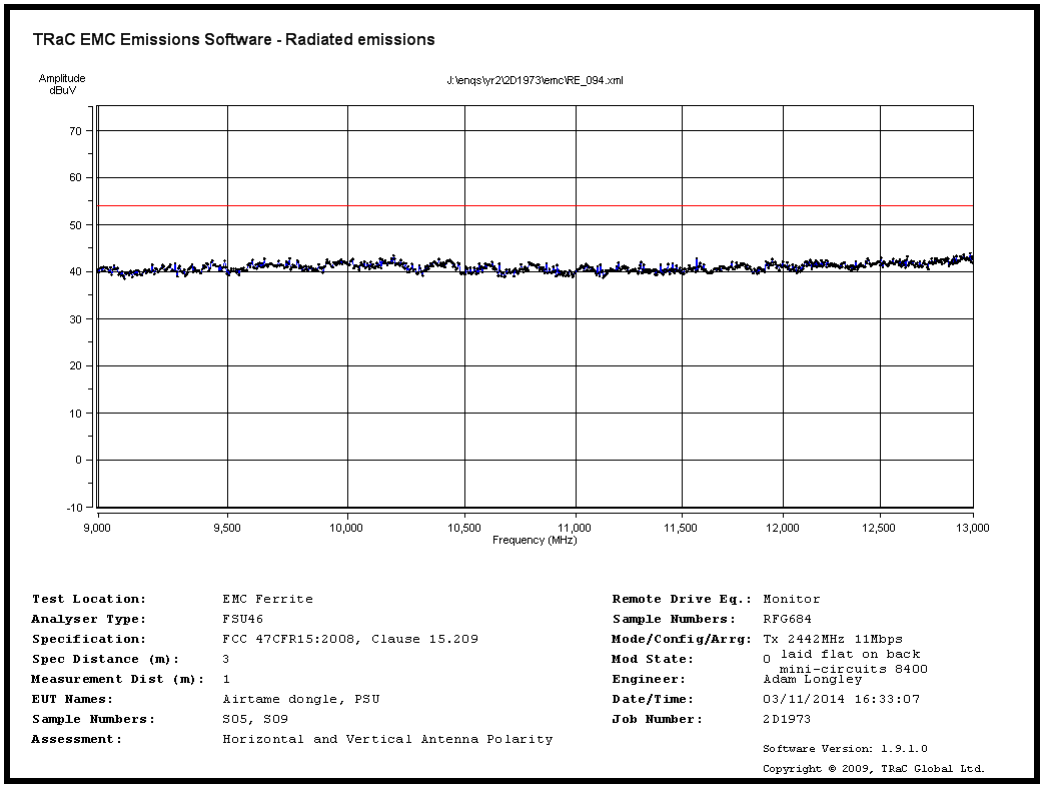
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz 11Mb/s



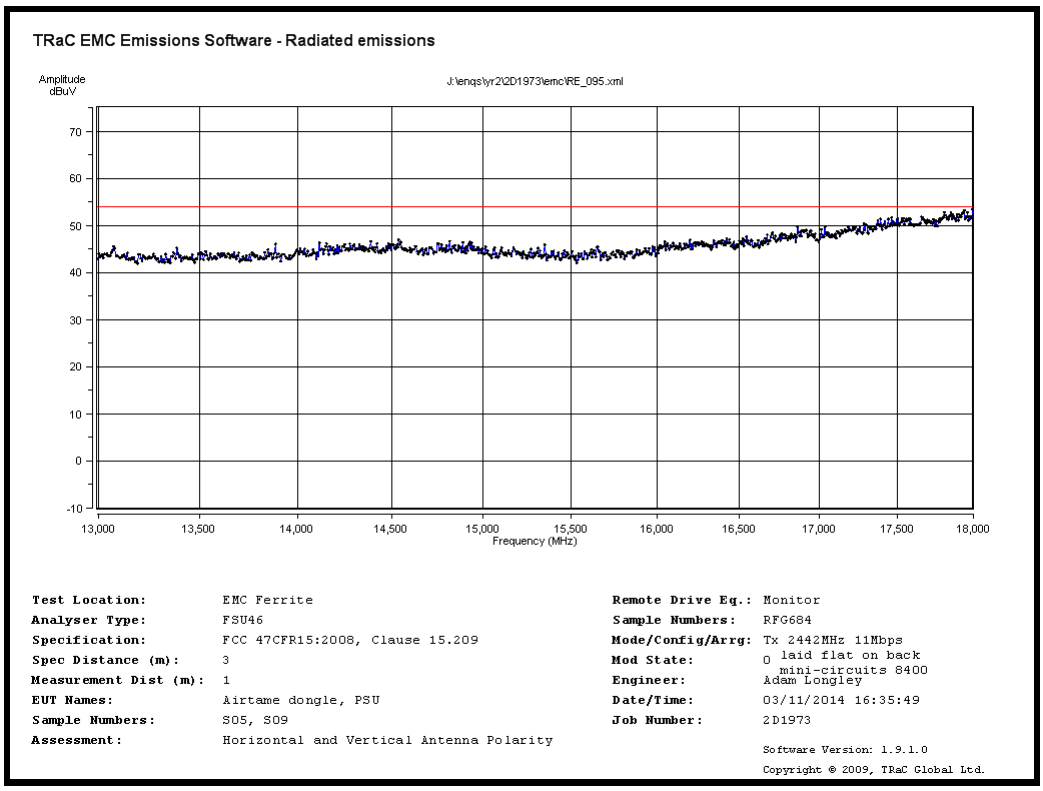
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz 11Mb/s



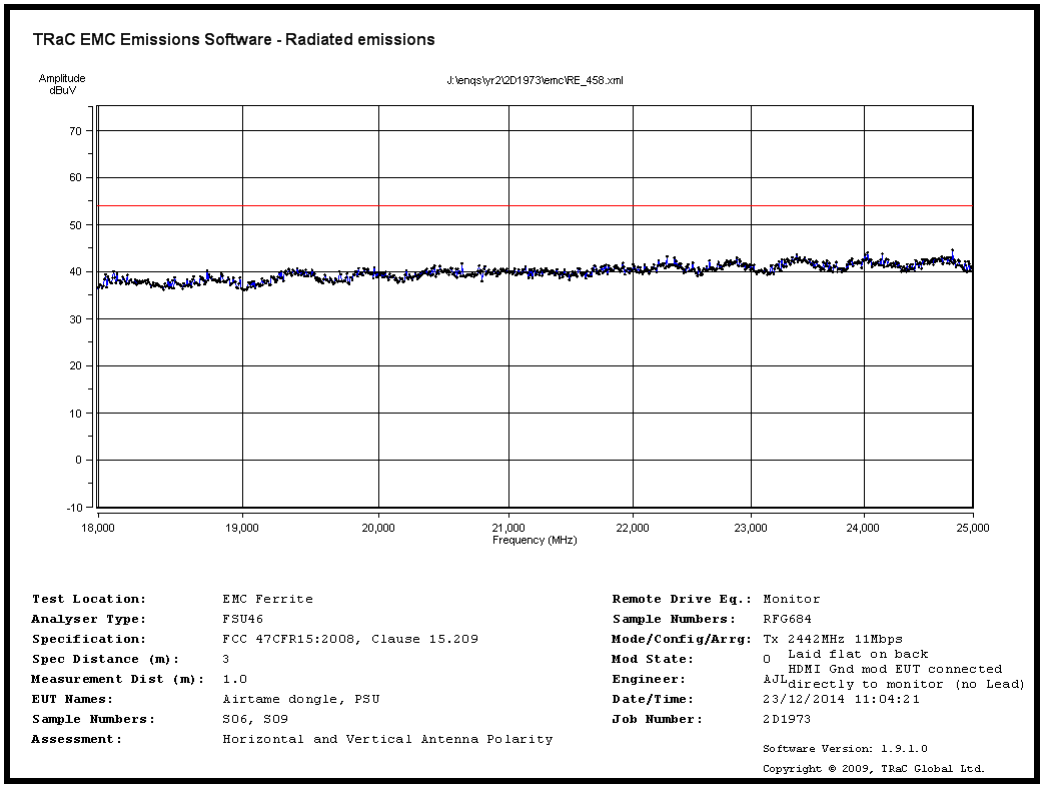
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz 11Mb/s



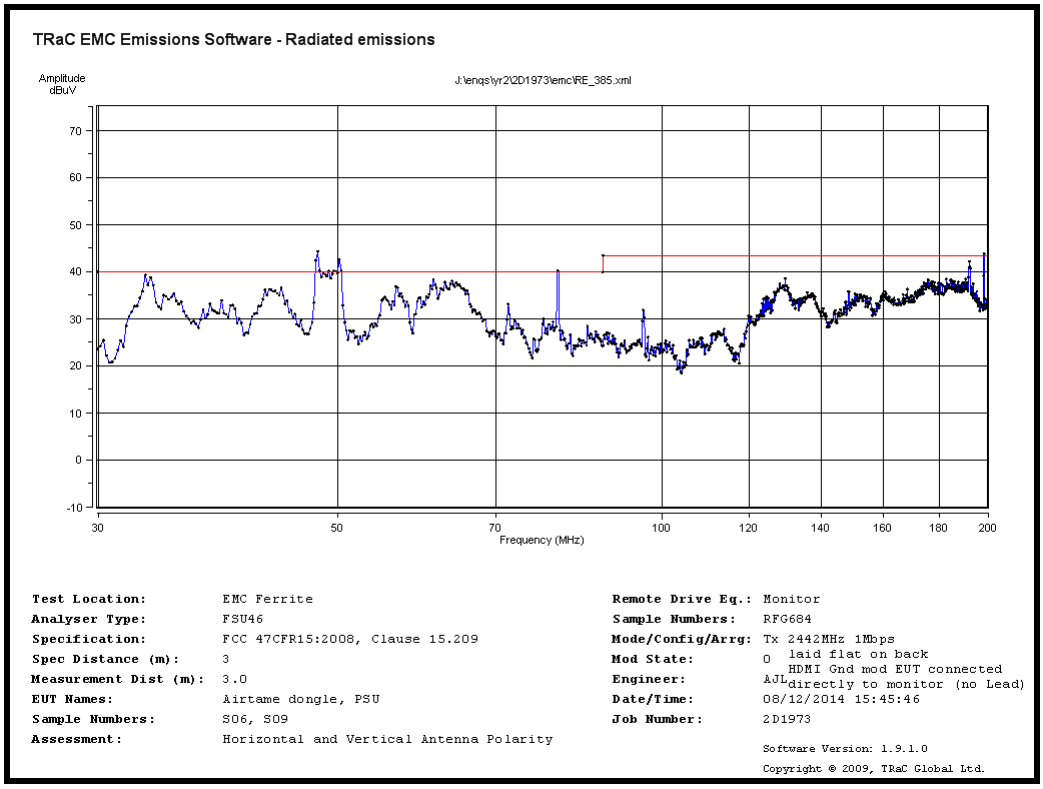
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz 11Mb/s



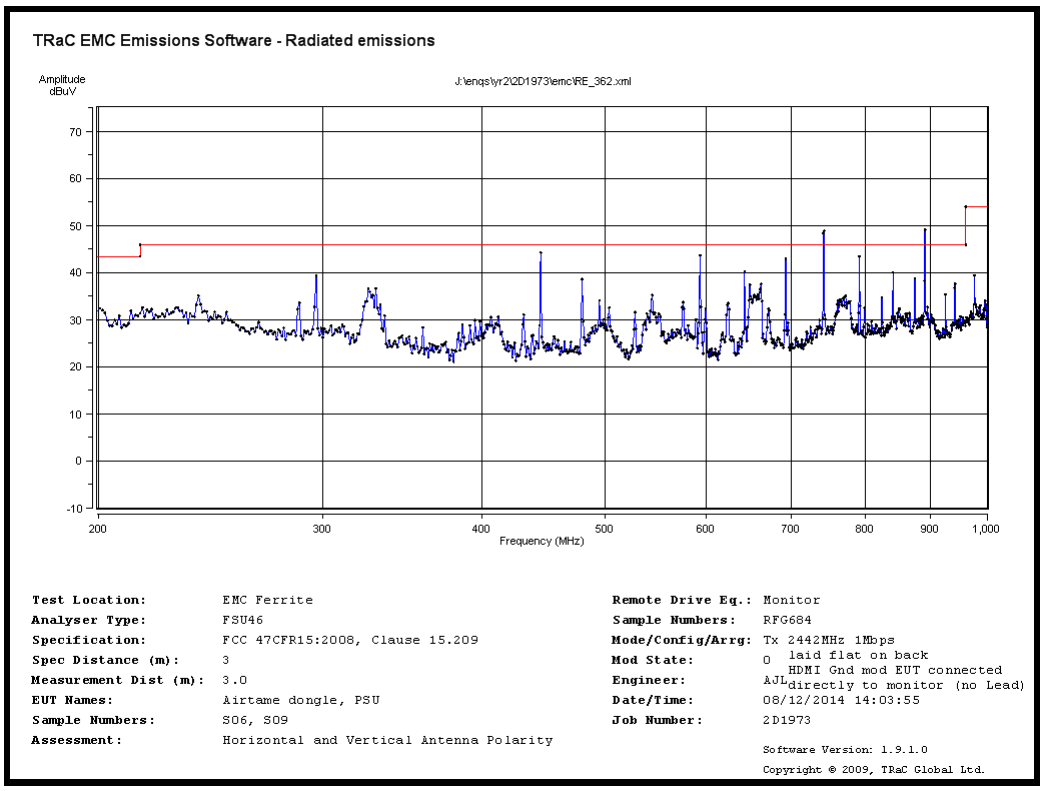
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz 11Mb/s



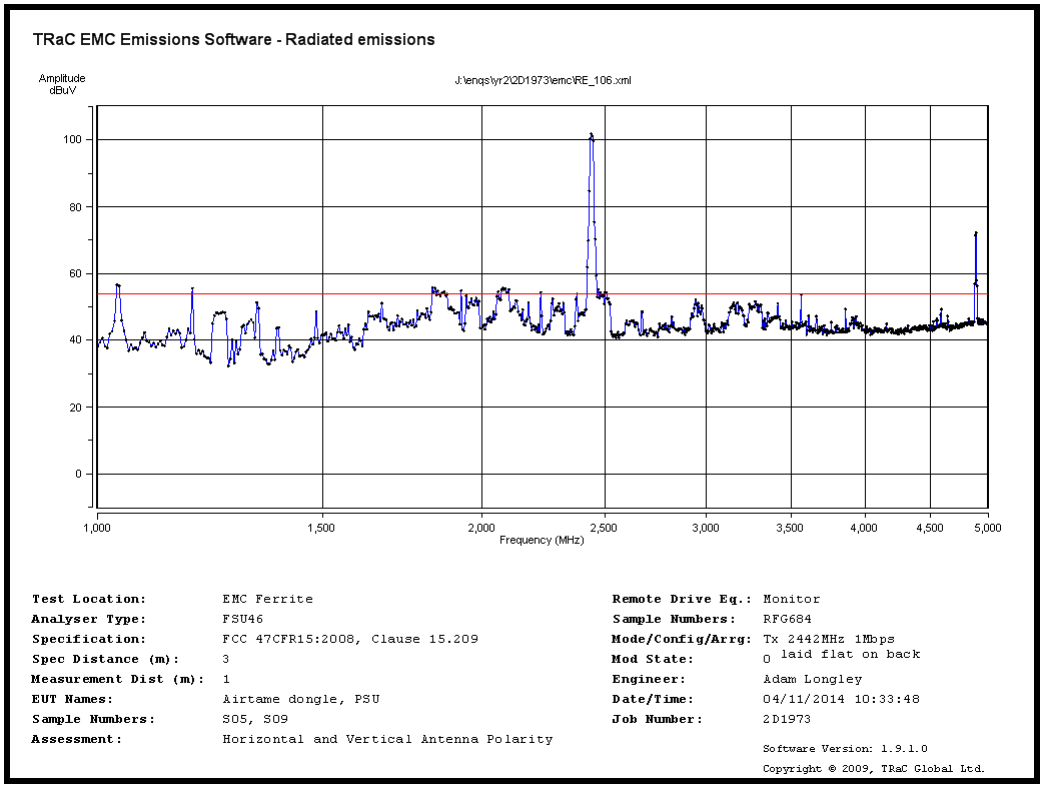
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz 11Mb/s



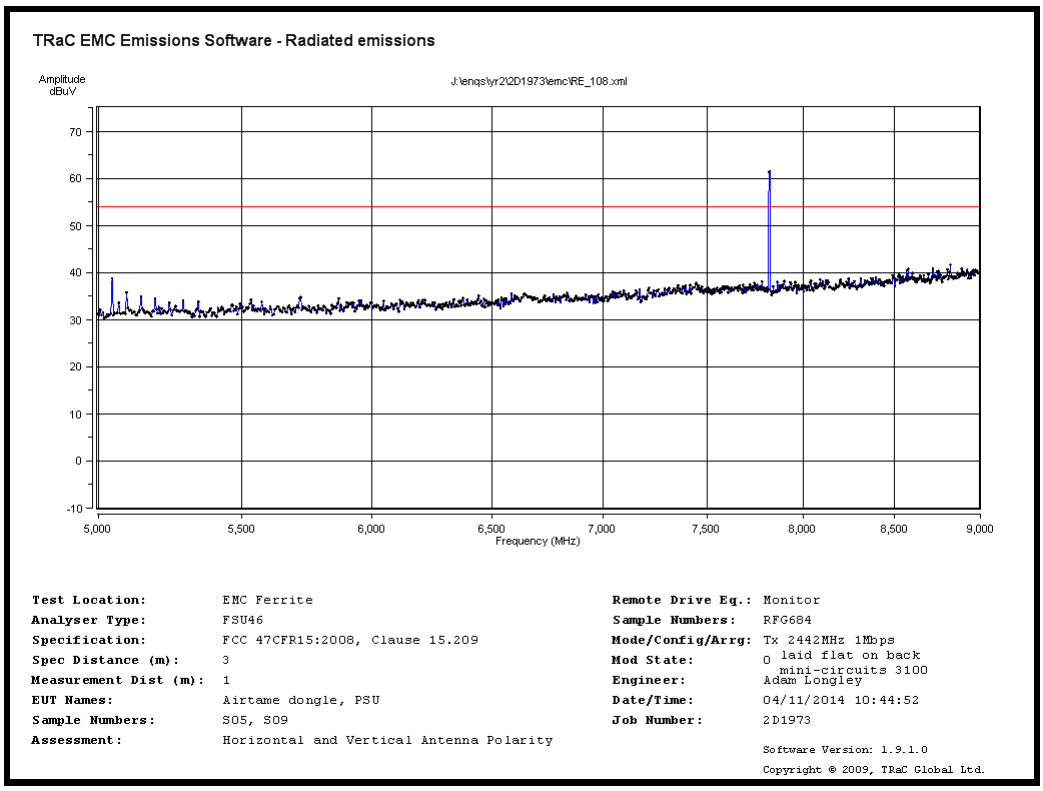
Radiated Spurious emissions 30MHz to 200MHz – 2442MHz 1Mb/s



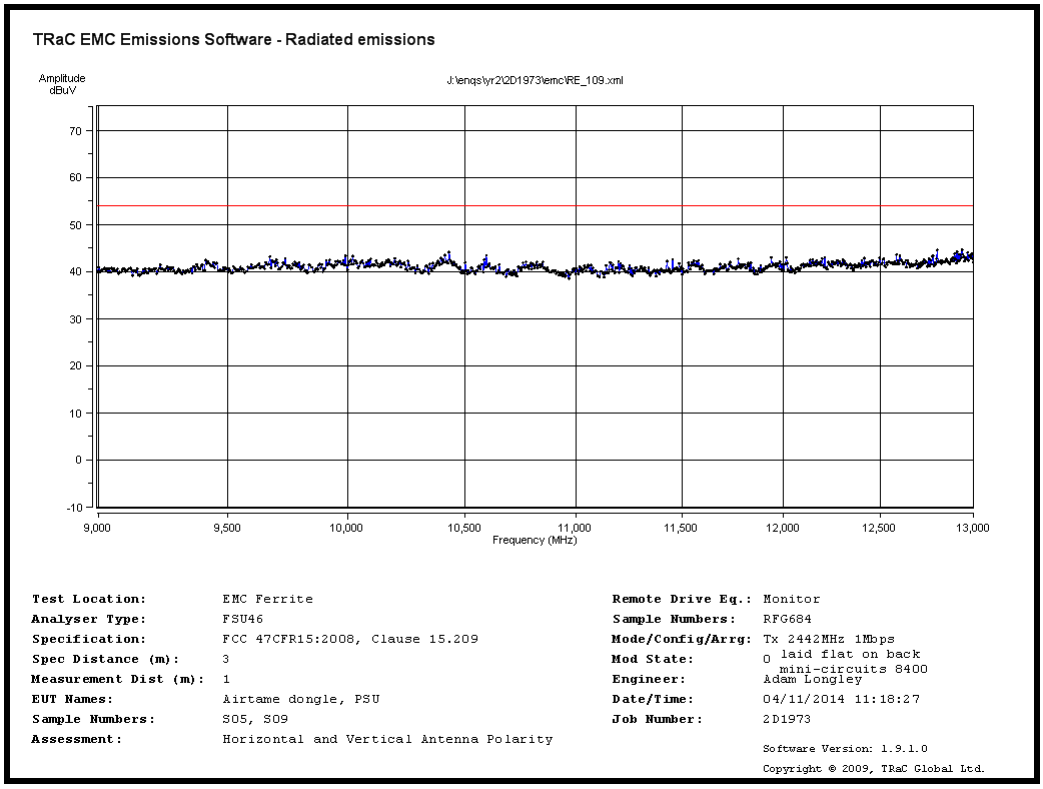
Radiated Spurious emissions 200MHz to 1GHz – 2442MHz 1Mb/s



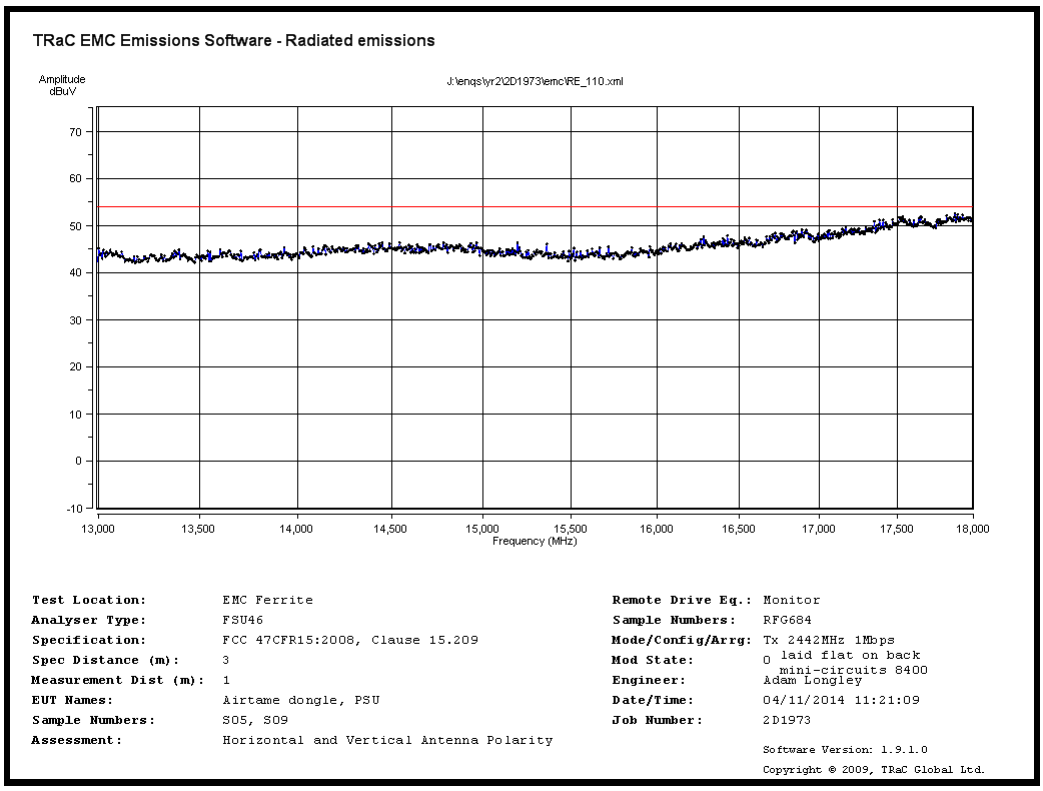
Radiated Spurious emissions 1GHz to 5GHz – 2442MHz 1Mb/s



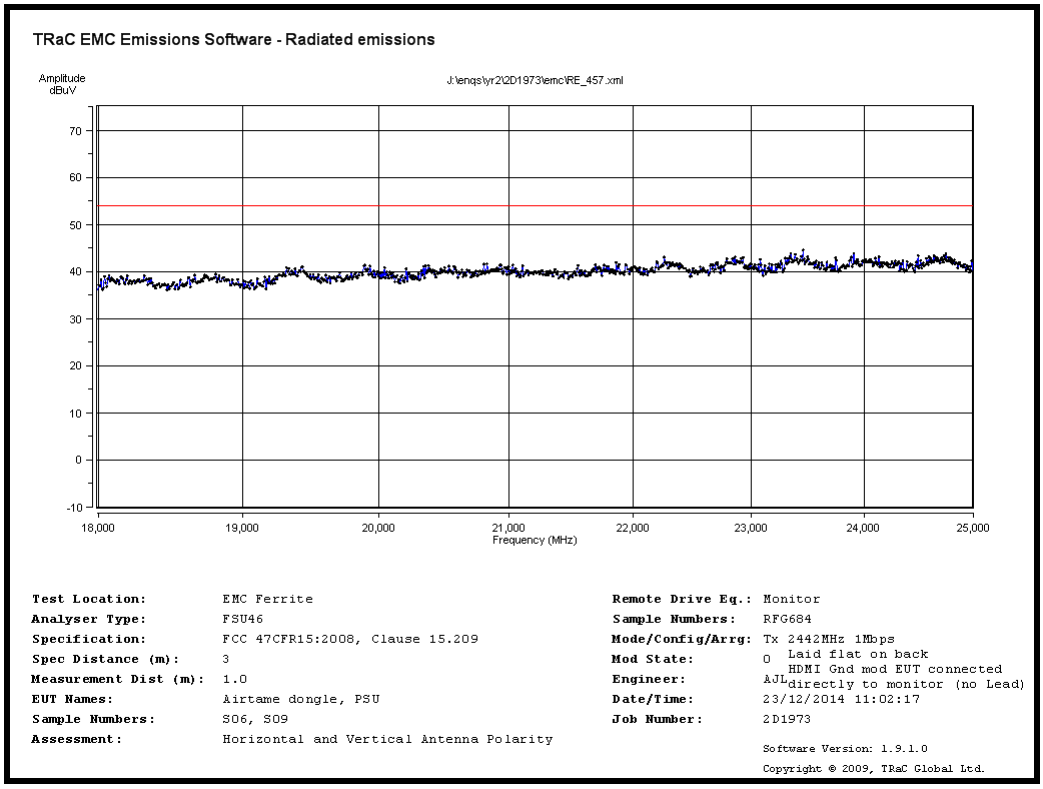
Radiated Spurious emissions 5GHz to 9GHz – 2442MHz 1Mb/s



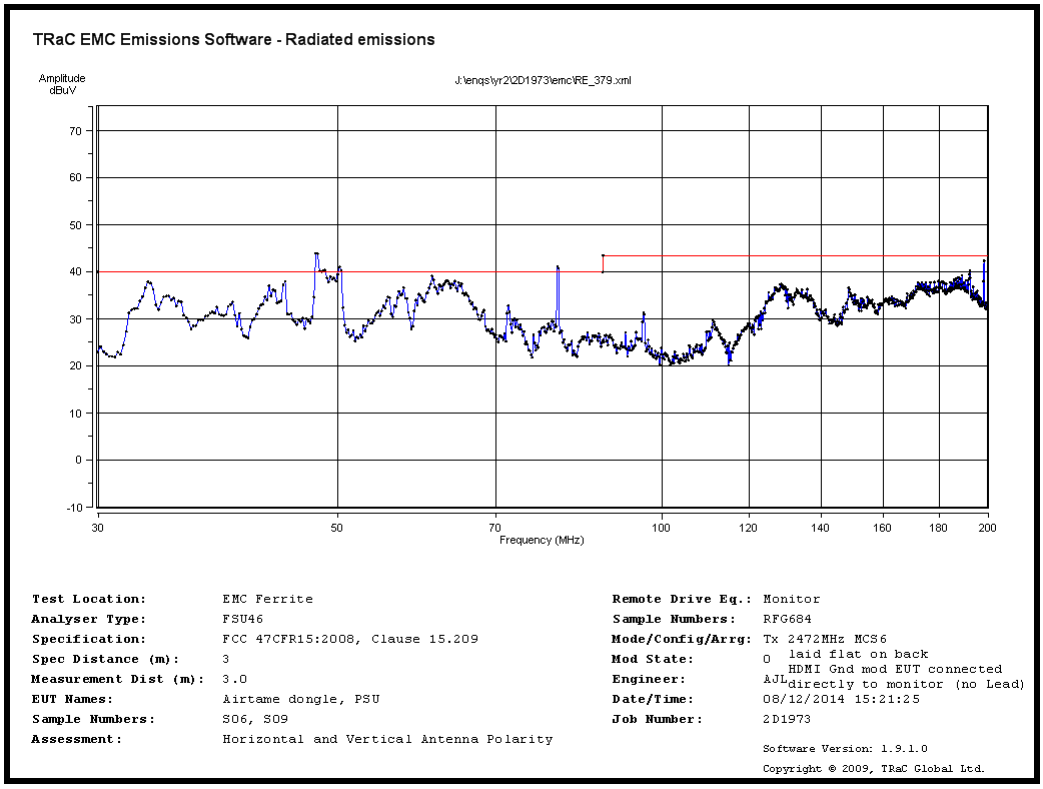
Radiated Spurious emissions 9GHz to 13GHz – 2442MHz 1Mb/s



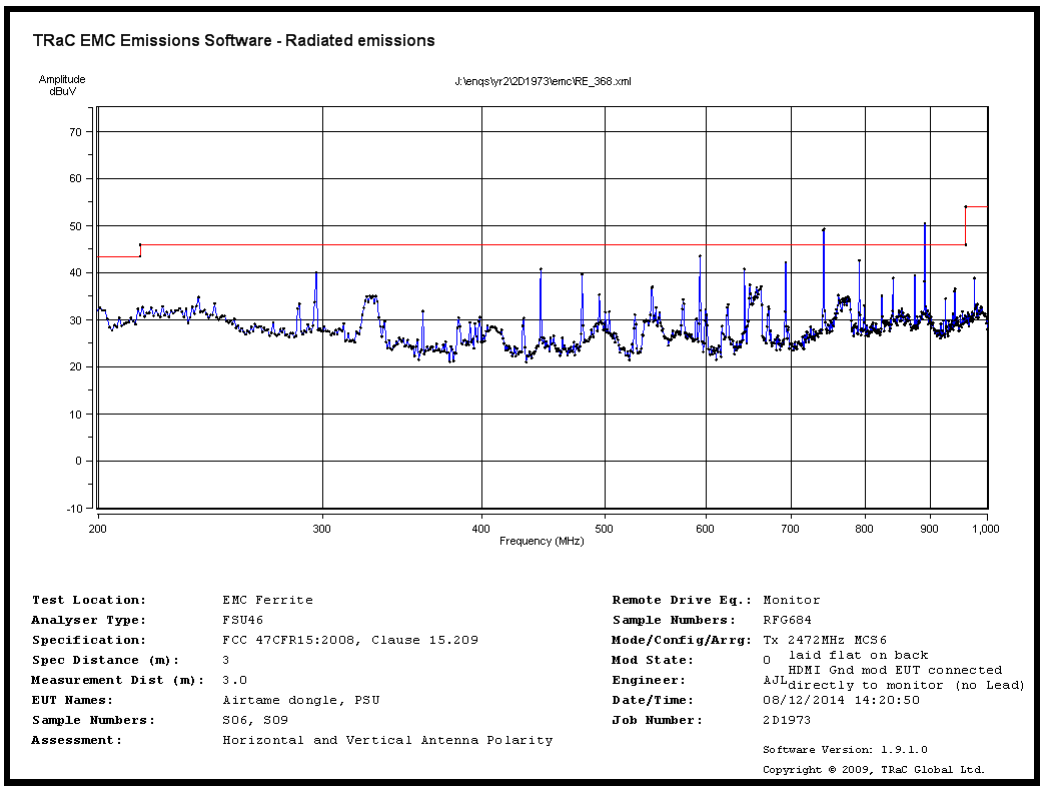
Radiated Spurious emissions 13GHz to 18GHz – 2442MHz 1Mb/s



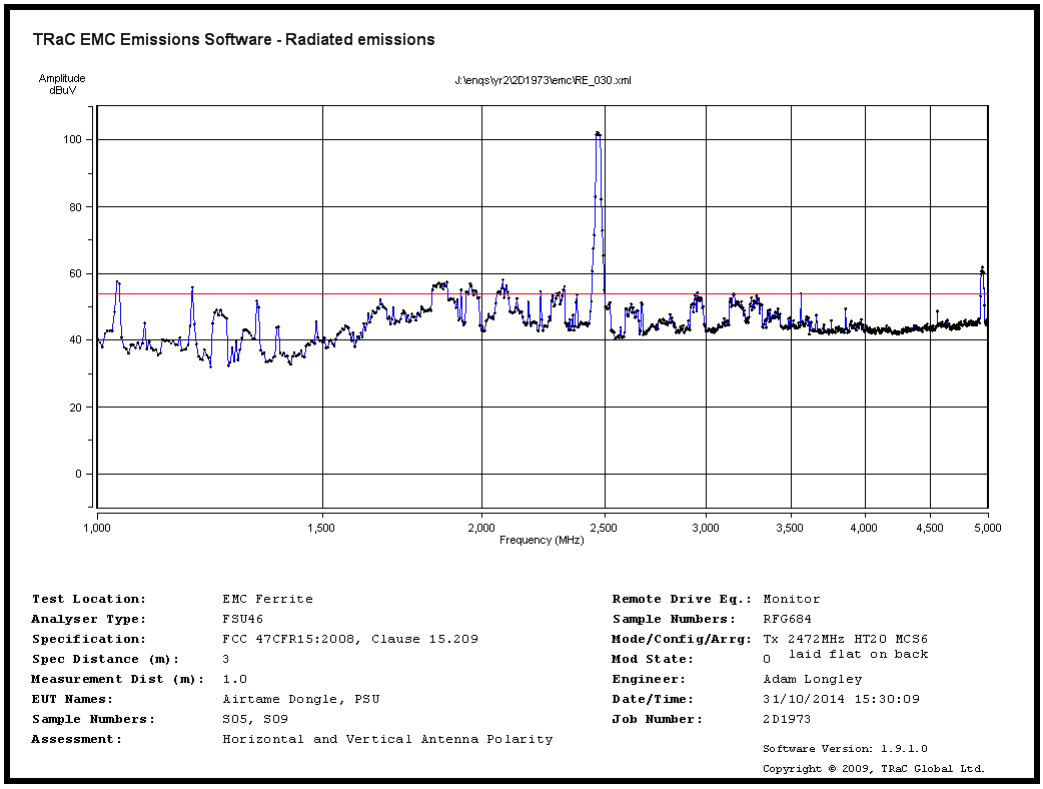
Radiated Spurious emissions 18GHz to 25GHz – 2442MHz 1Mb/s



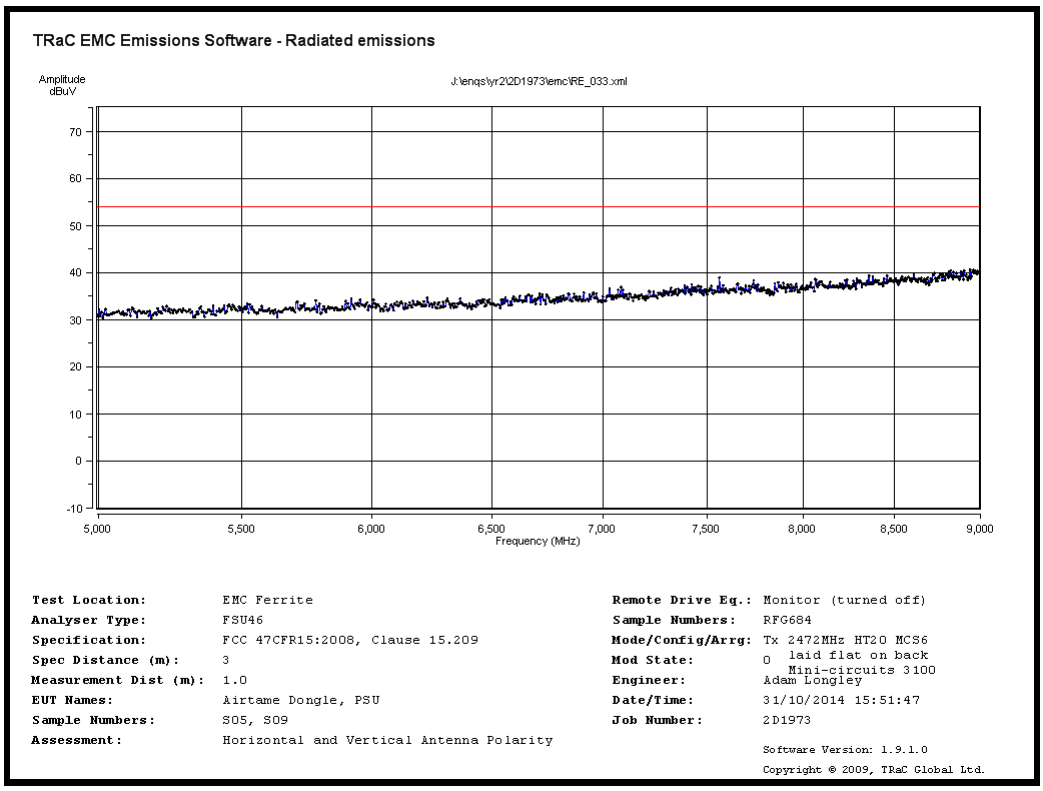
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz MCS6



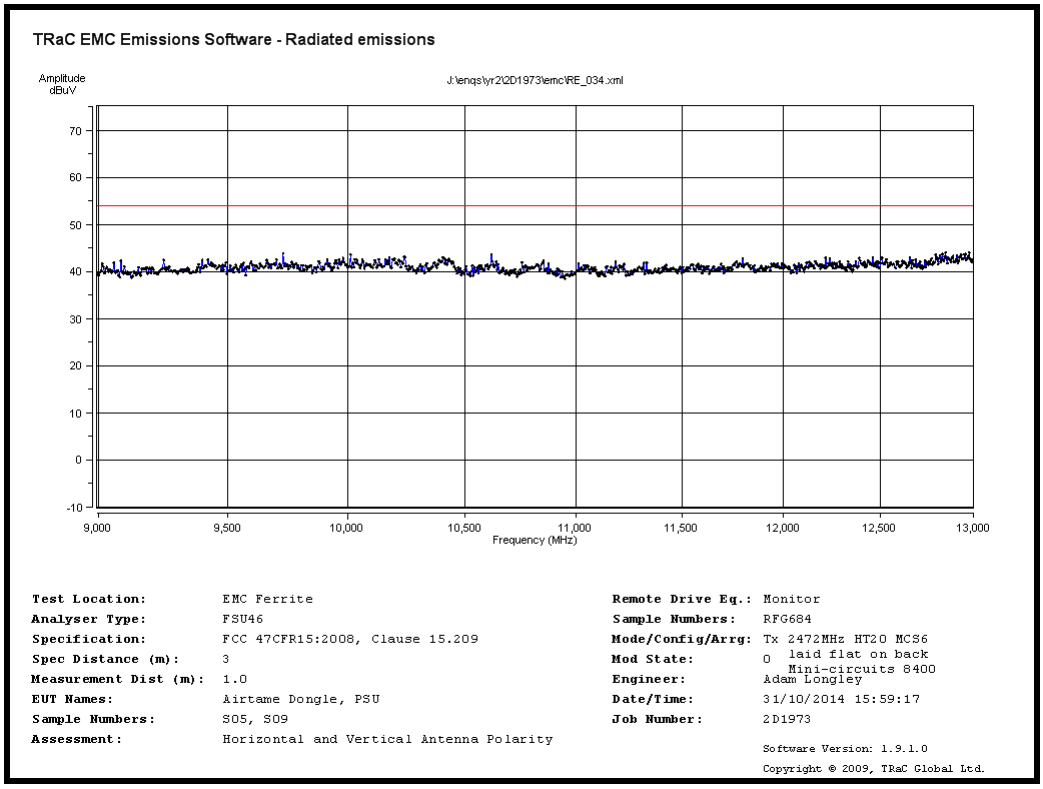
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz MCS6



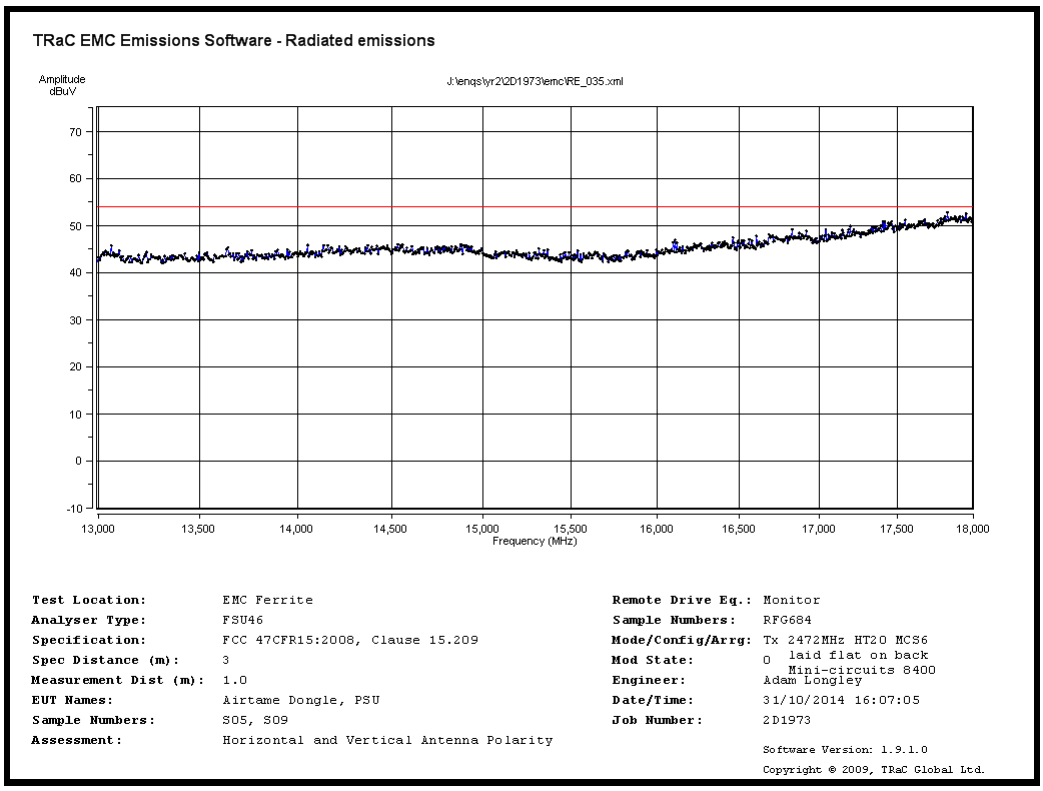
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz MCS6



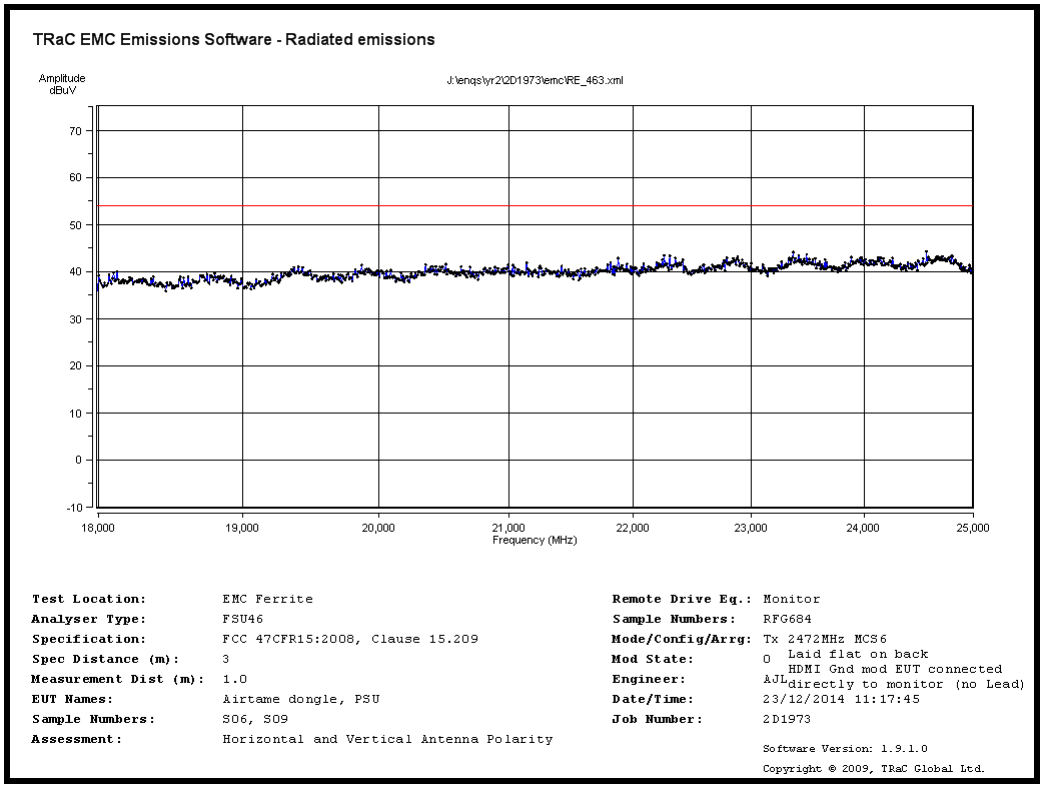
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz MCS6



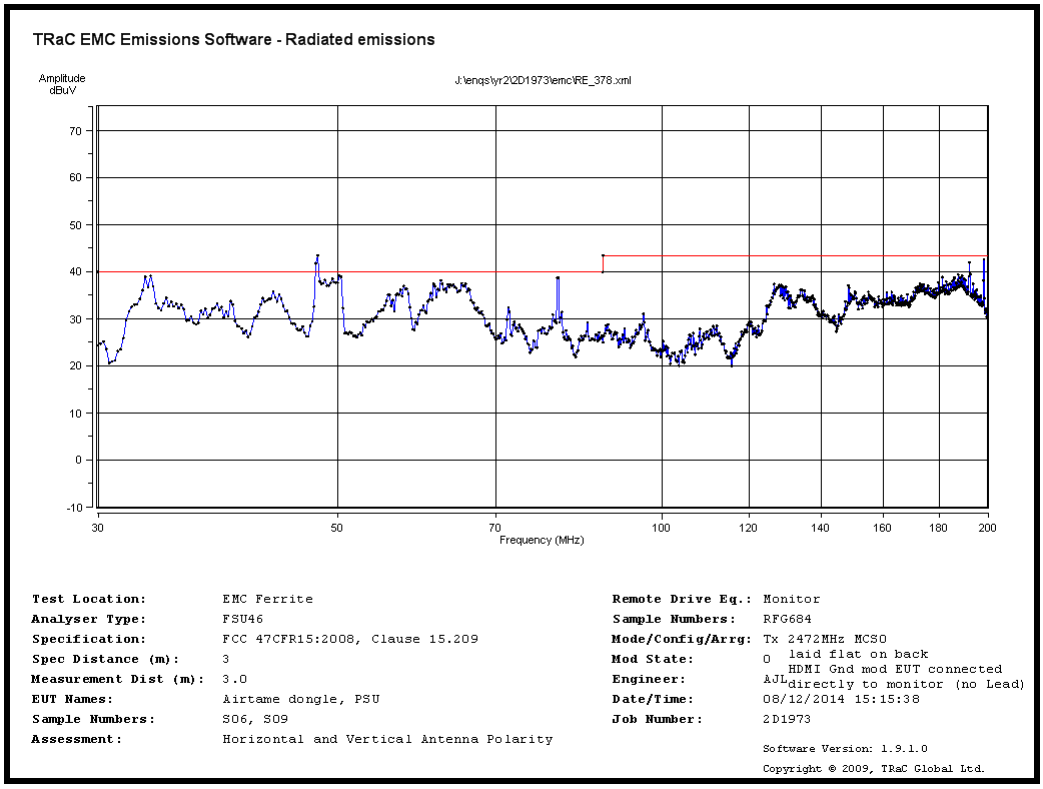
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz MCS6



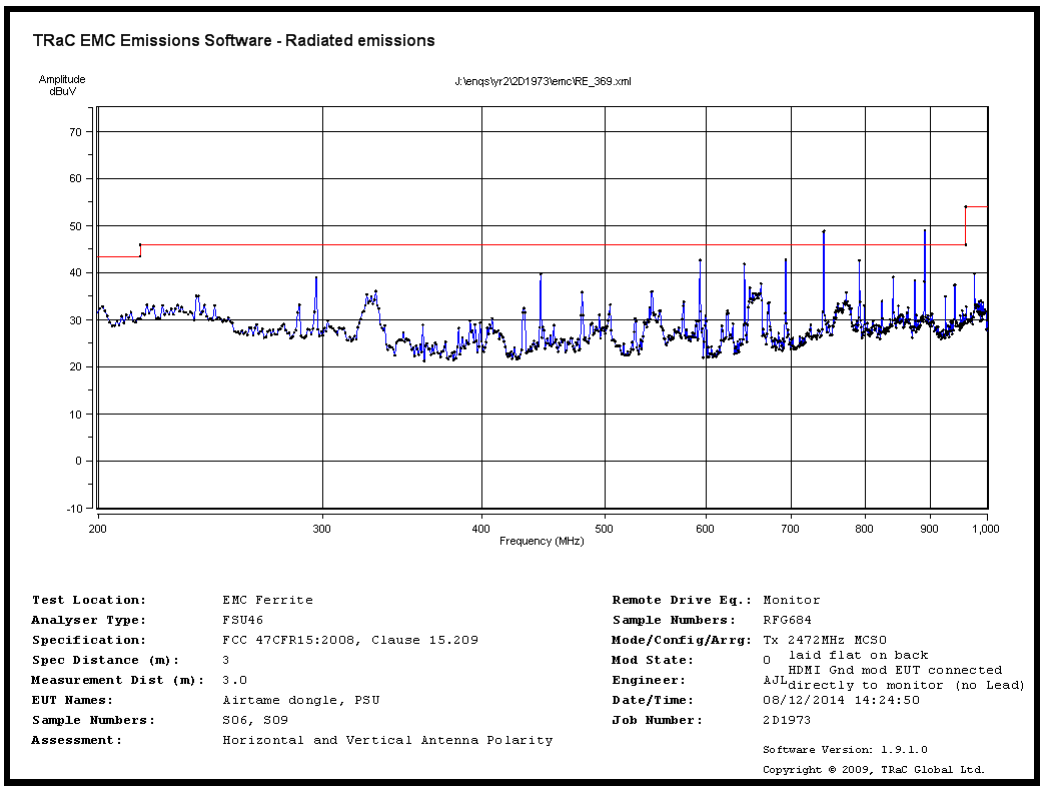
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz MCS6



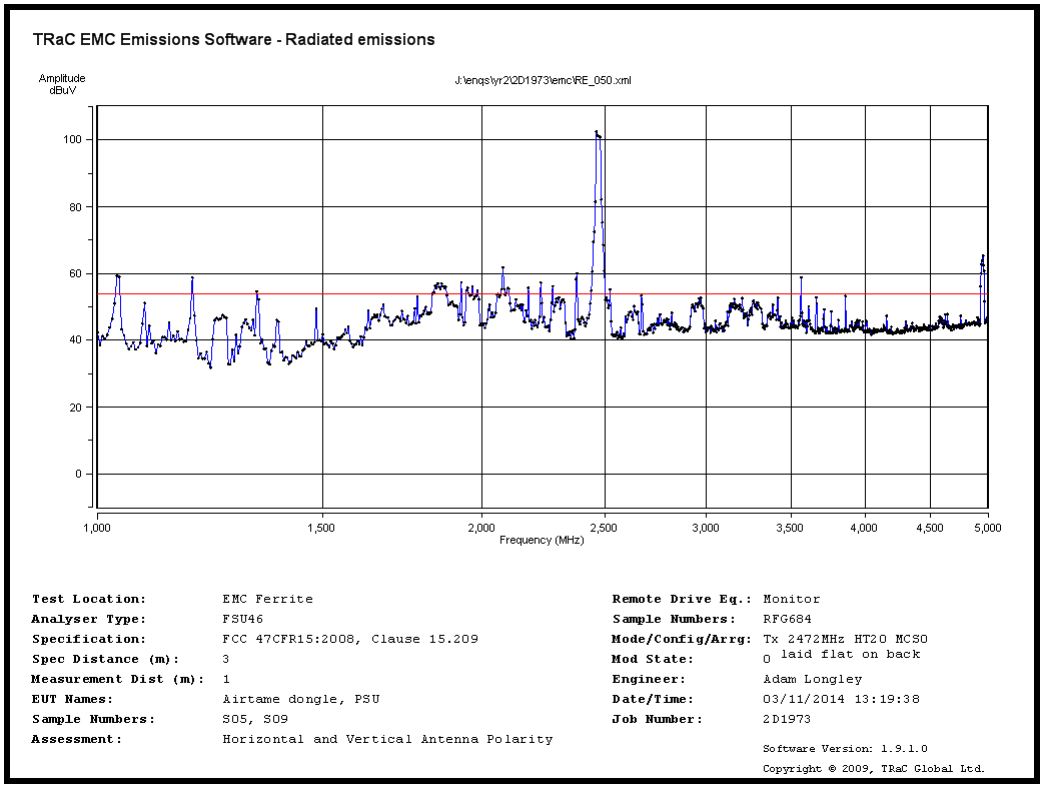
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz MCS6



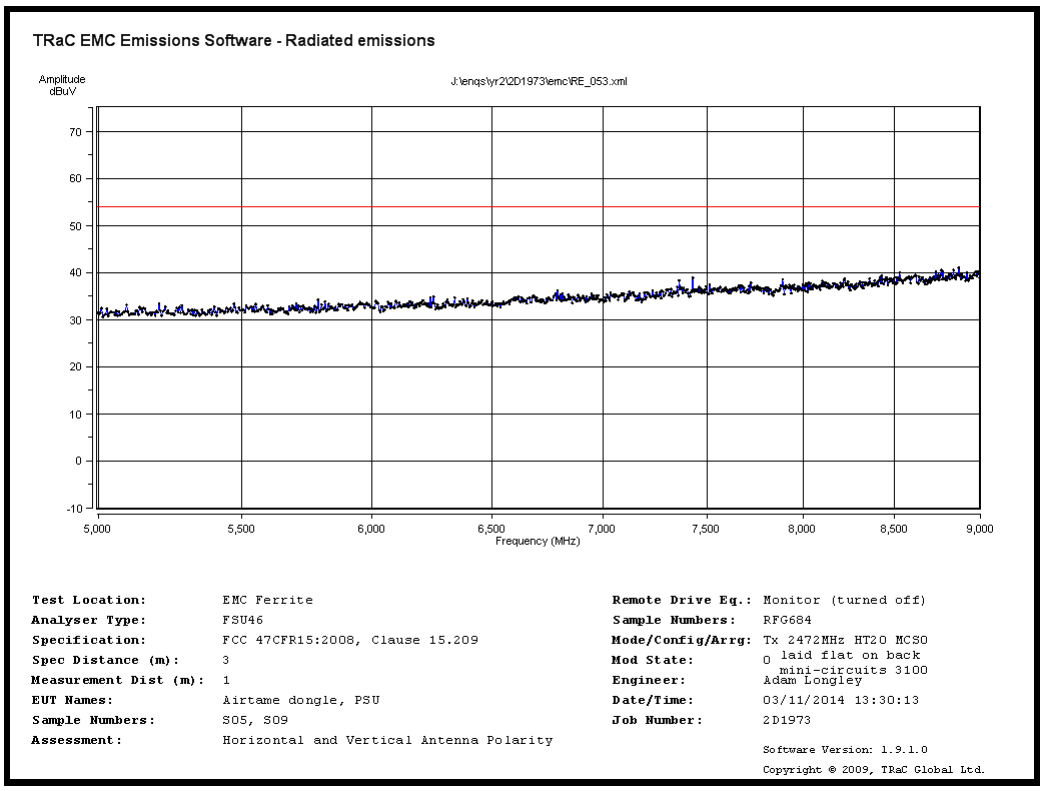
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz MCS0



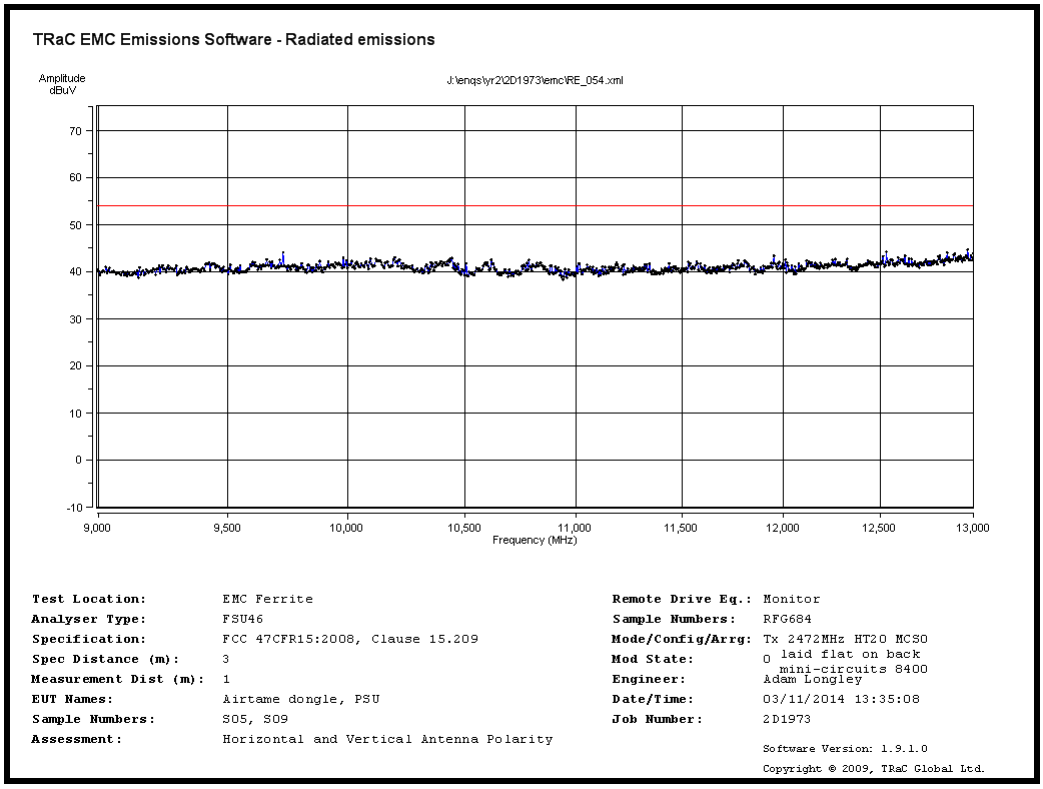
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz MCS0



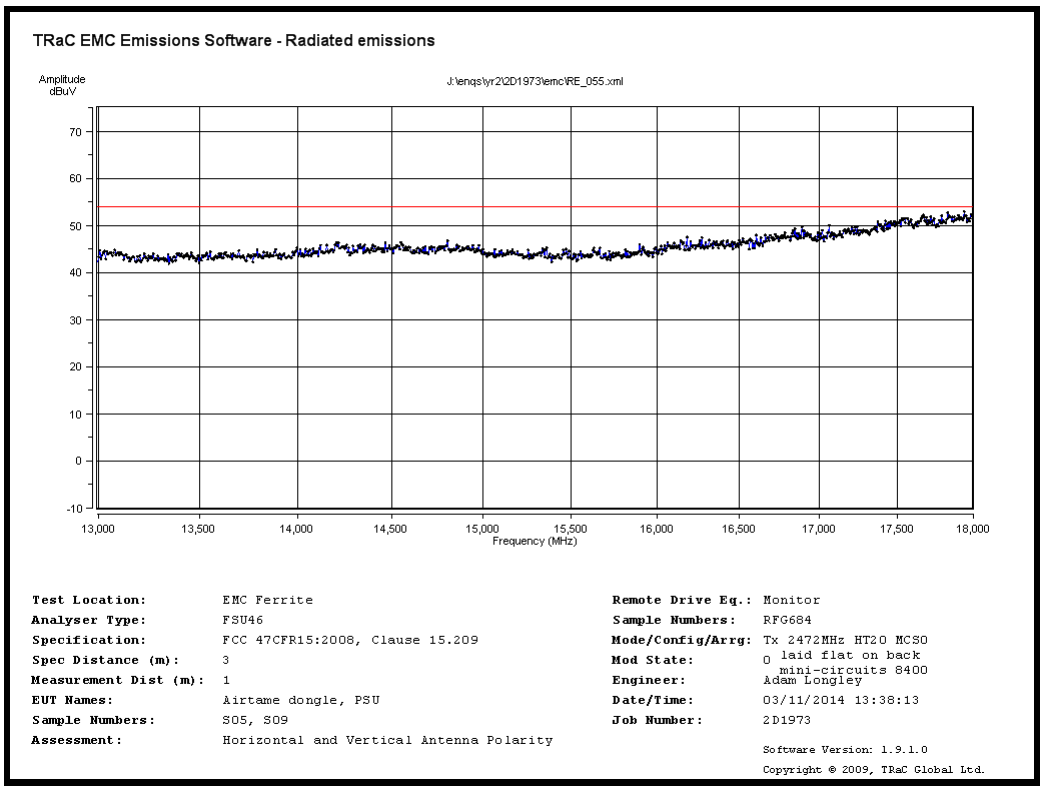
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz MCS0



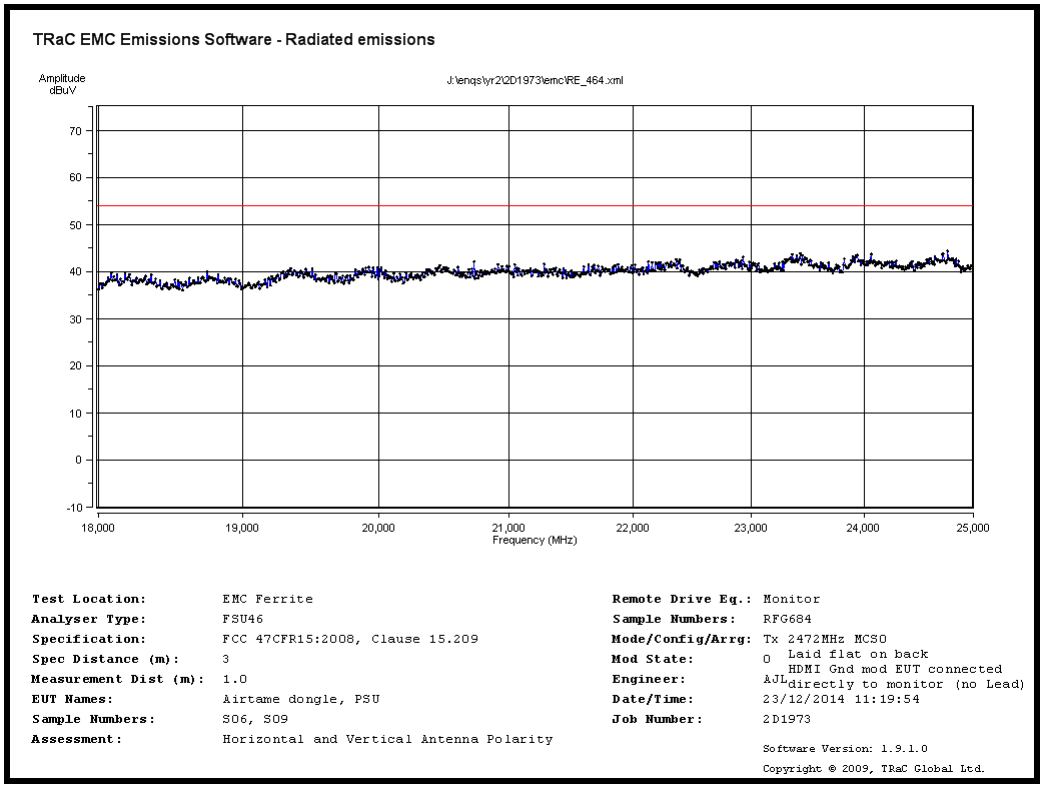
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz MCS0



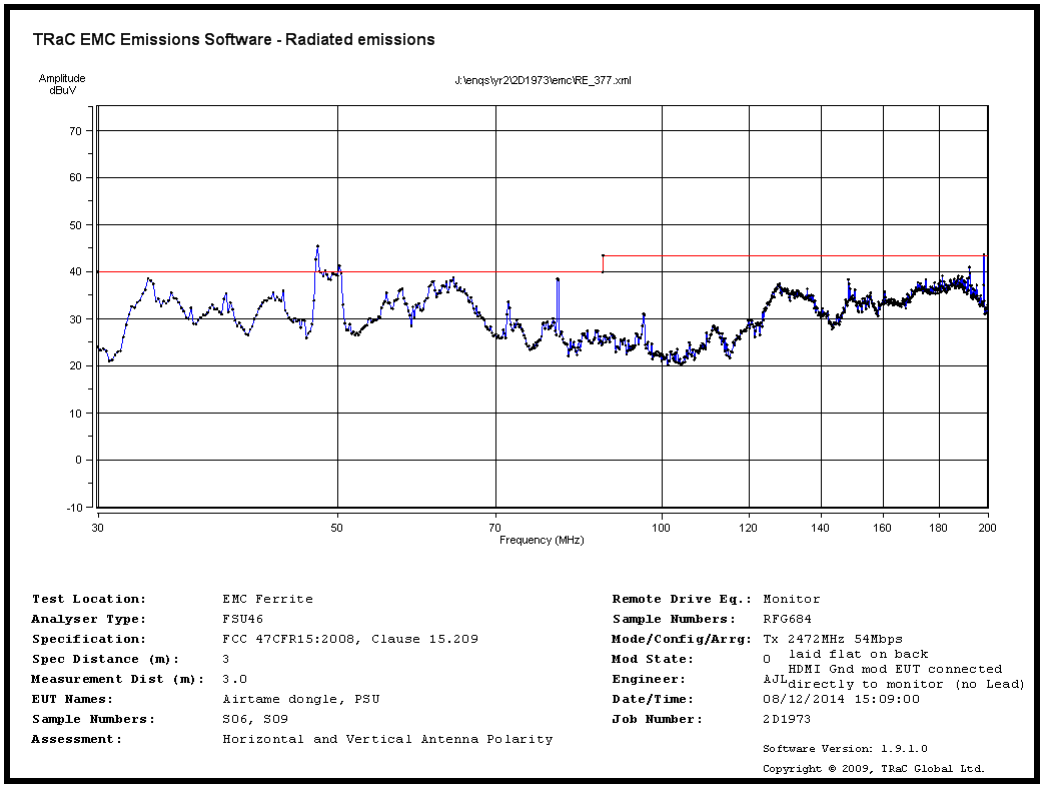
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz MCS0



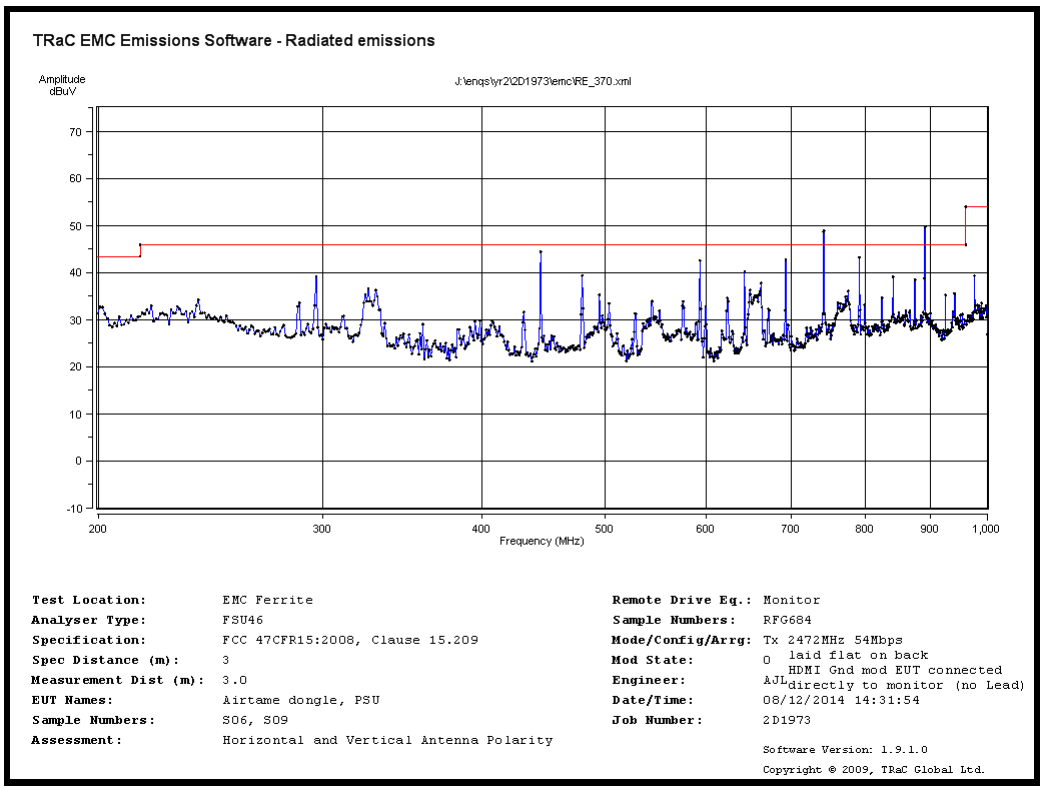
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz MCS0



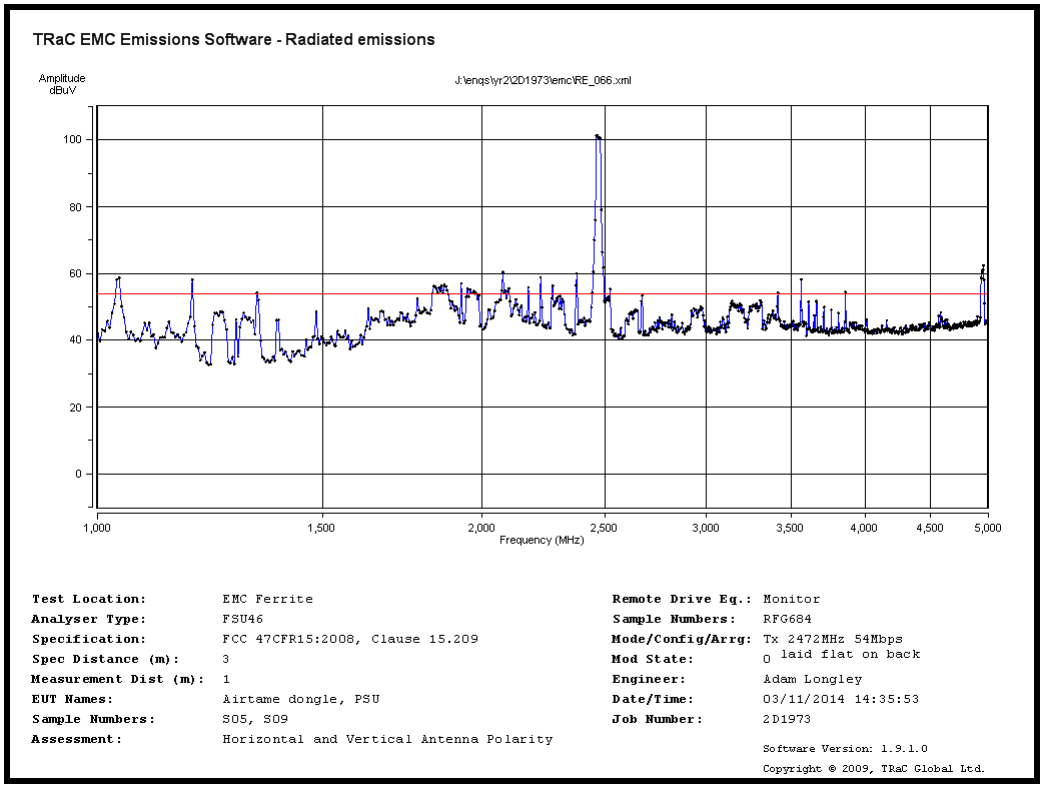
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz MCS0



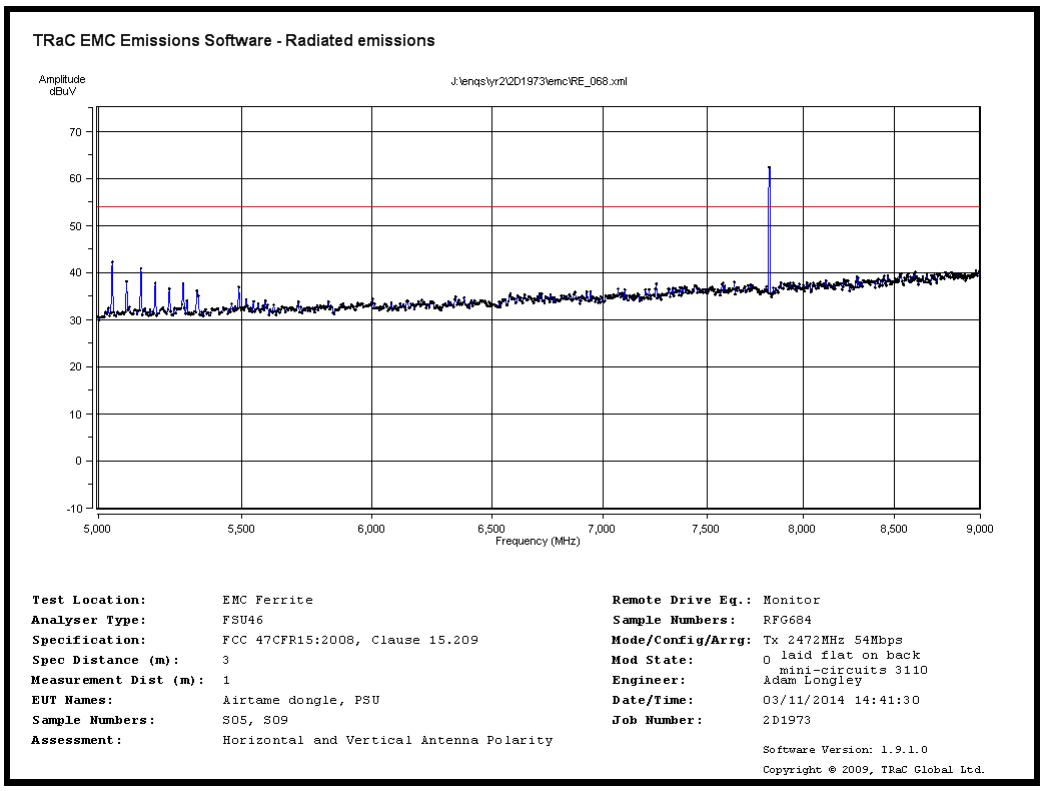
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz 54Mb/s



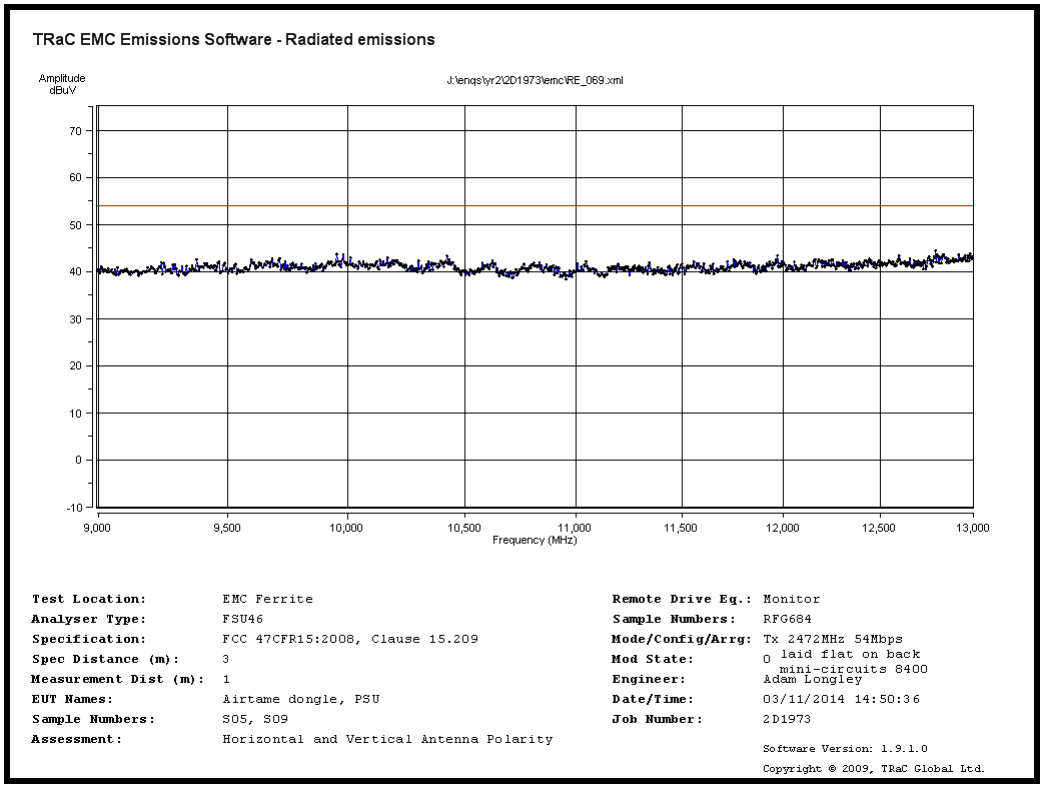
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz 54Mb/s



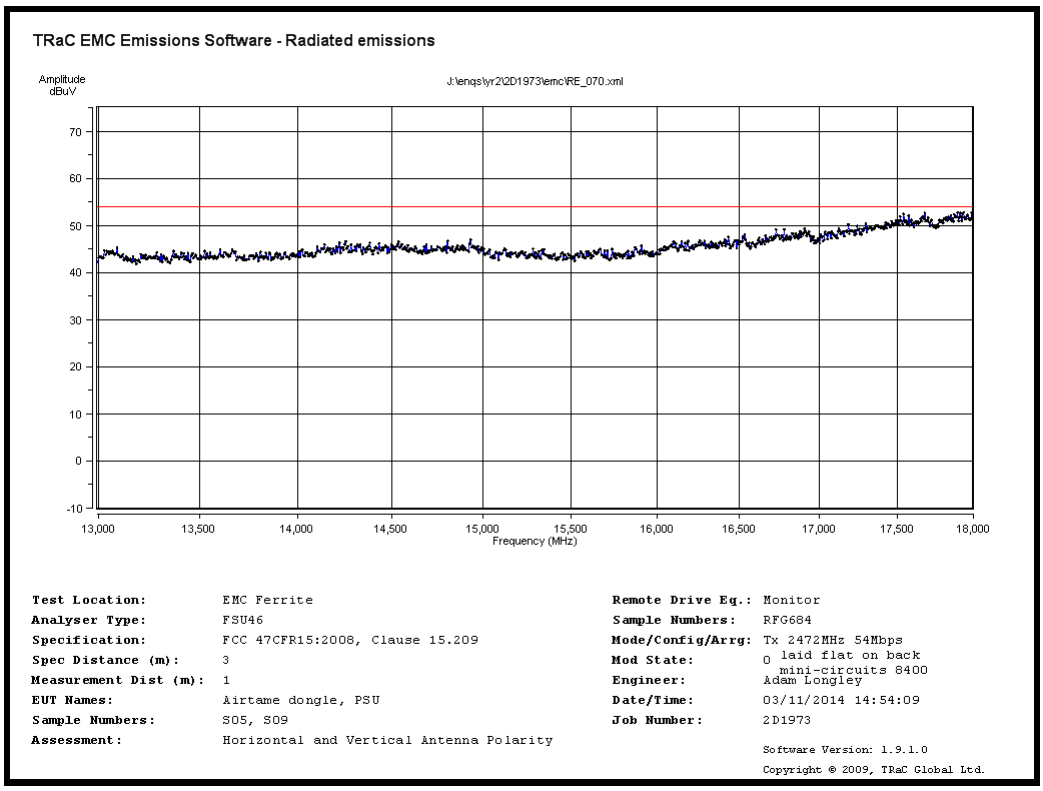
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz 54Mb/s



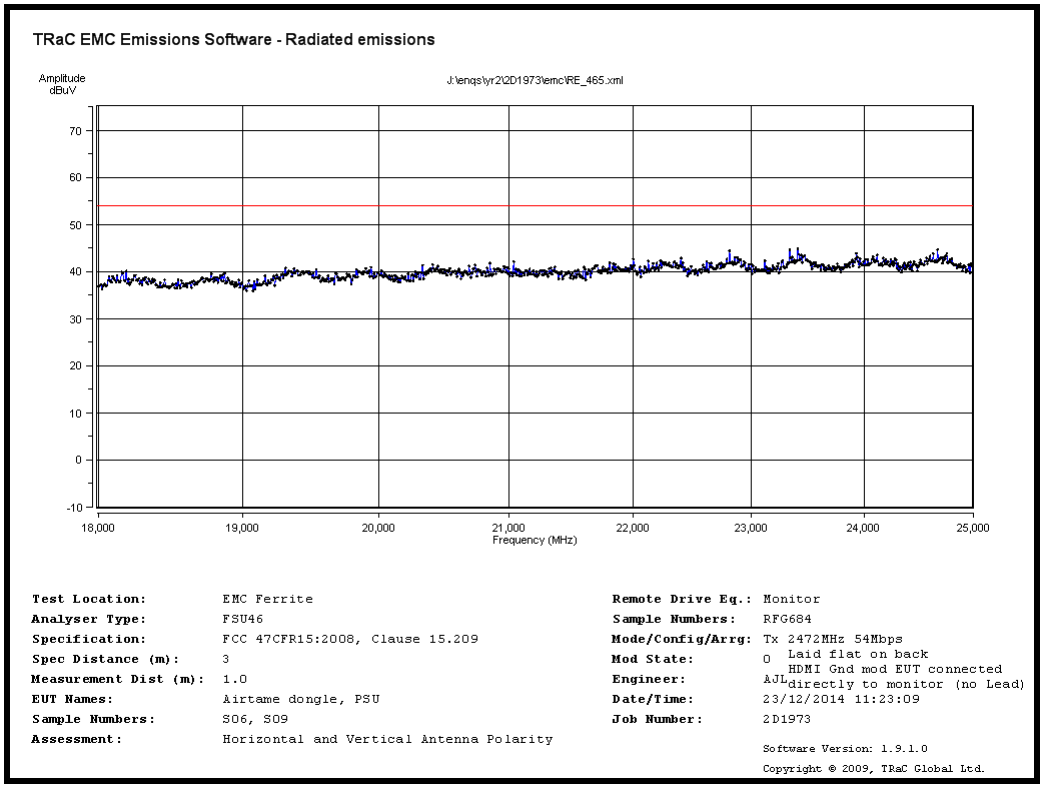
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz 54Mb/s



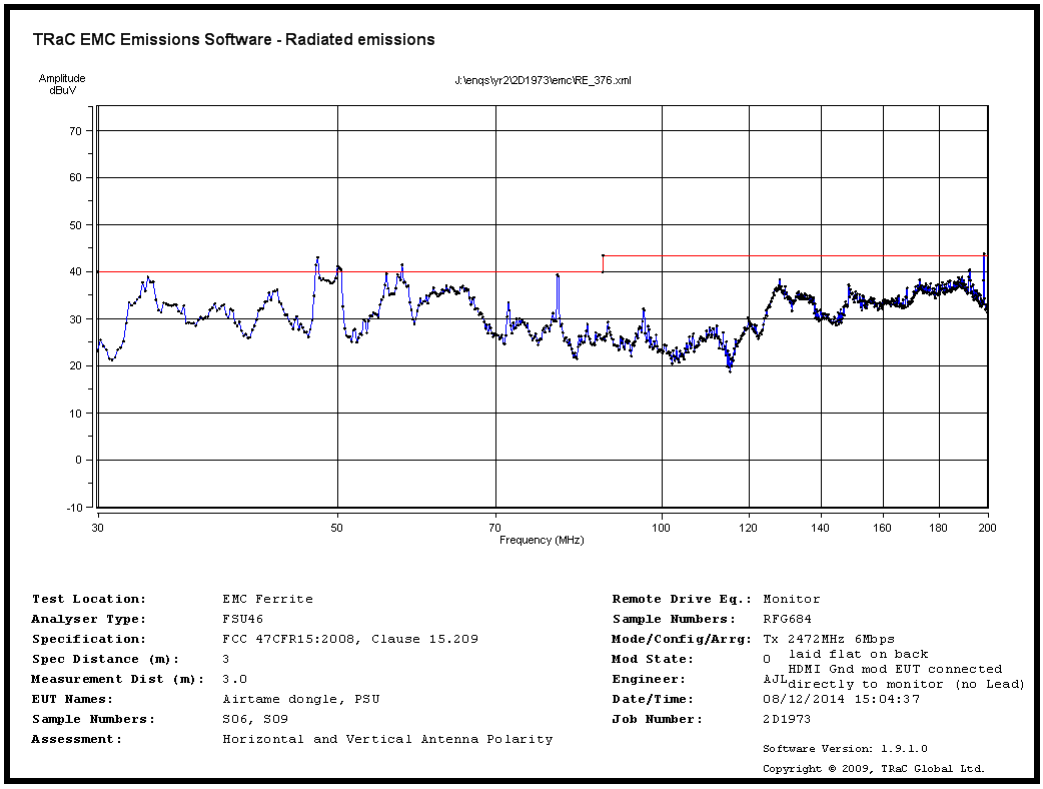
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz 54Mb/s



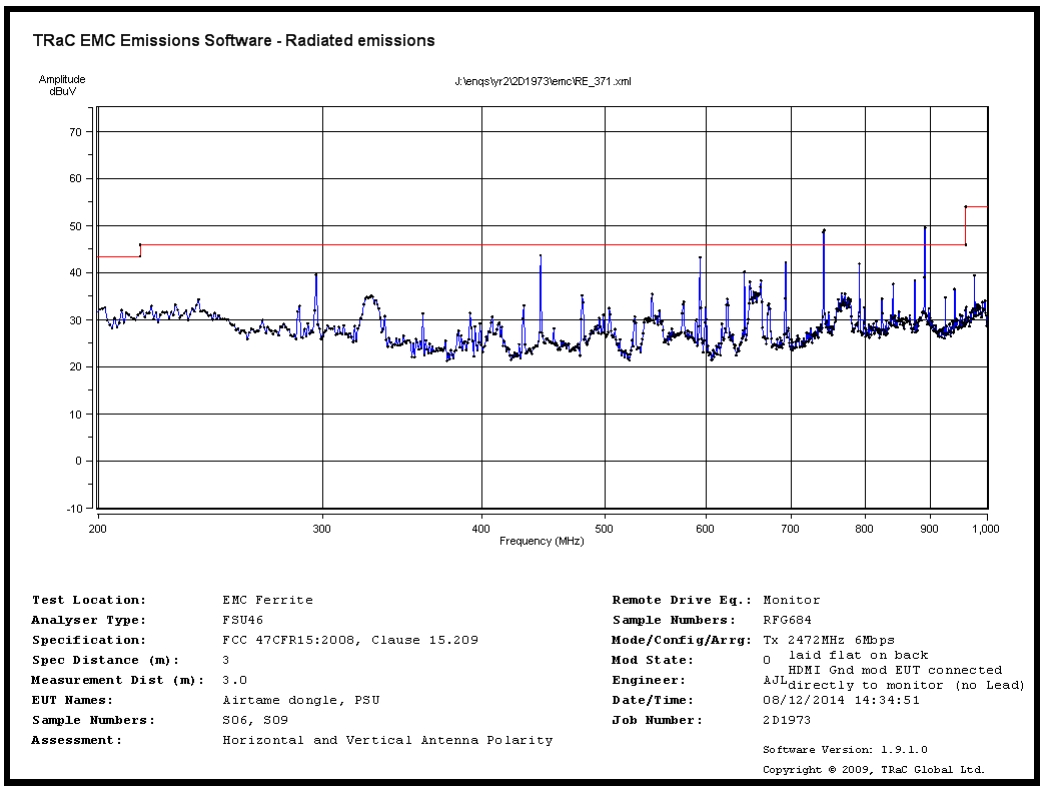
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz 54Mb/s



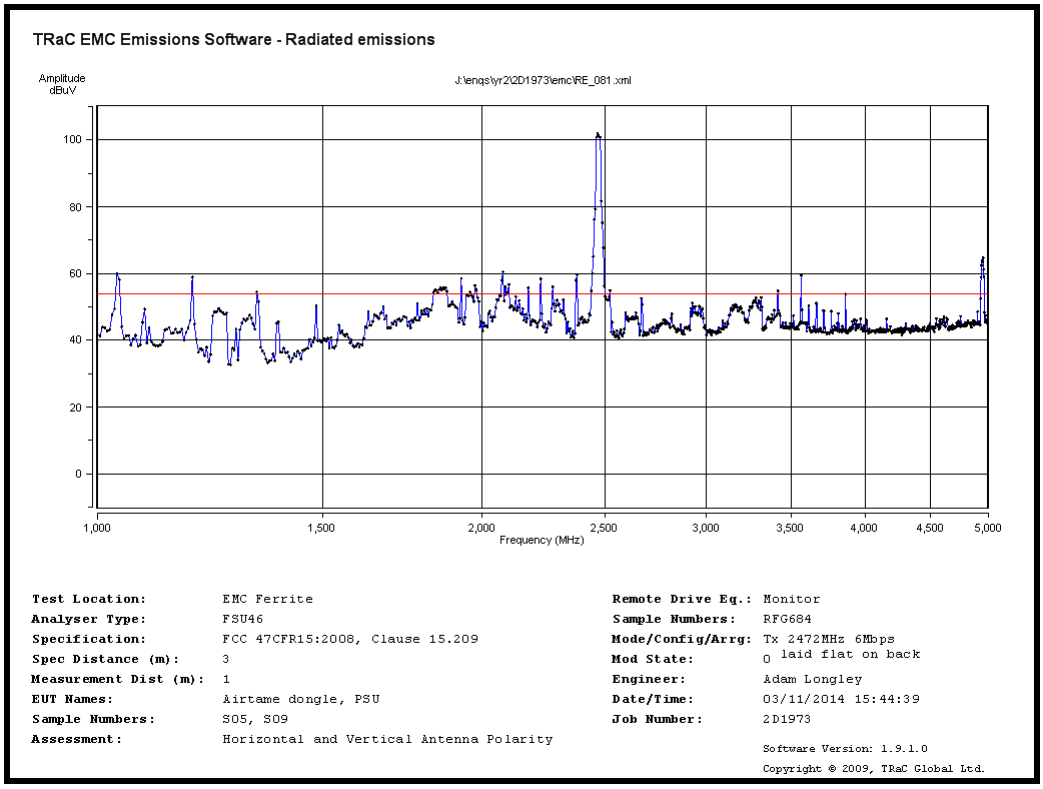
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz 54Mb/s



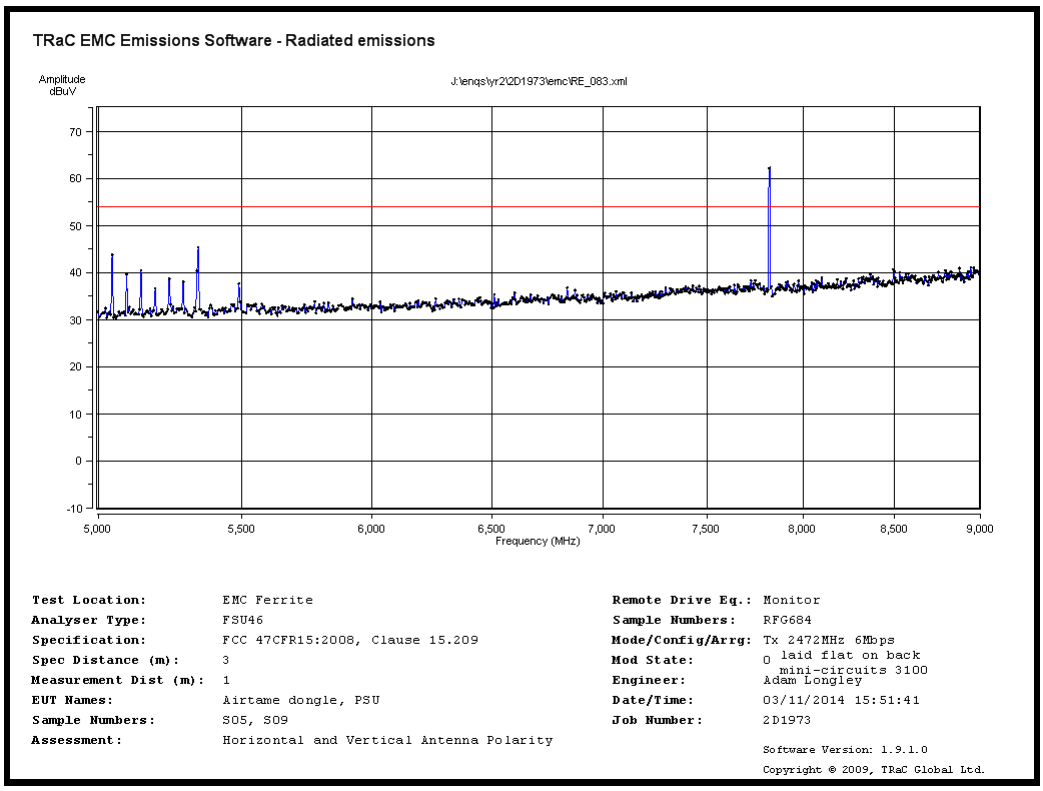
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz 6Mb/s



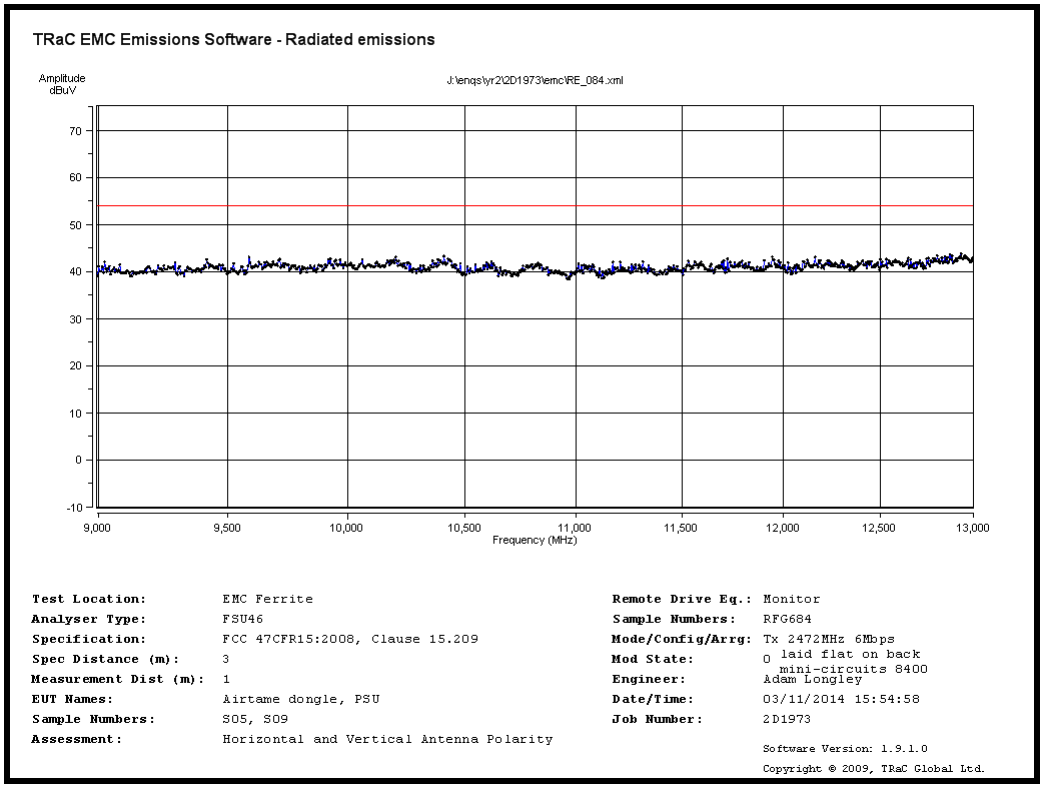
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz 6Mb/s



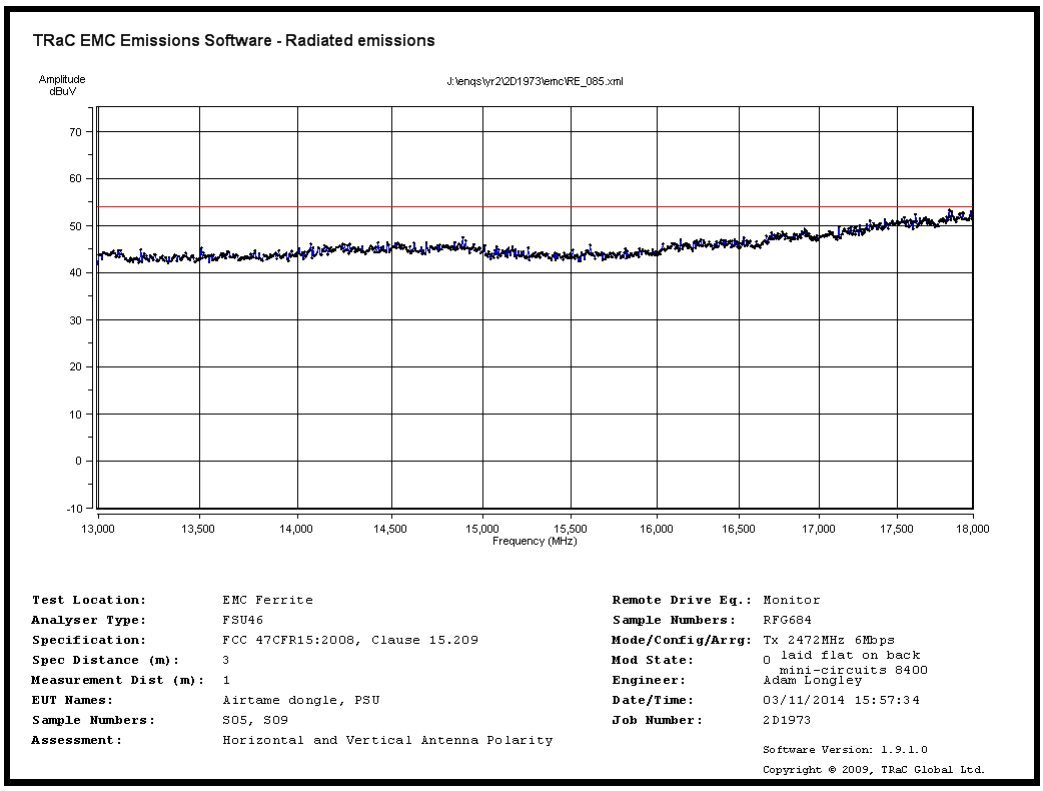
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz 6Mb/s



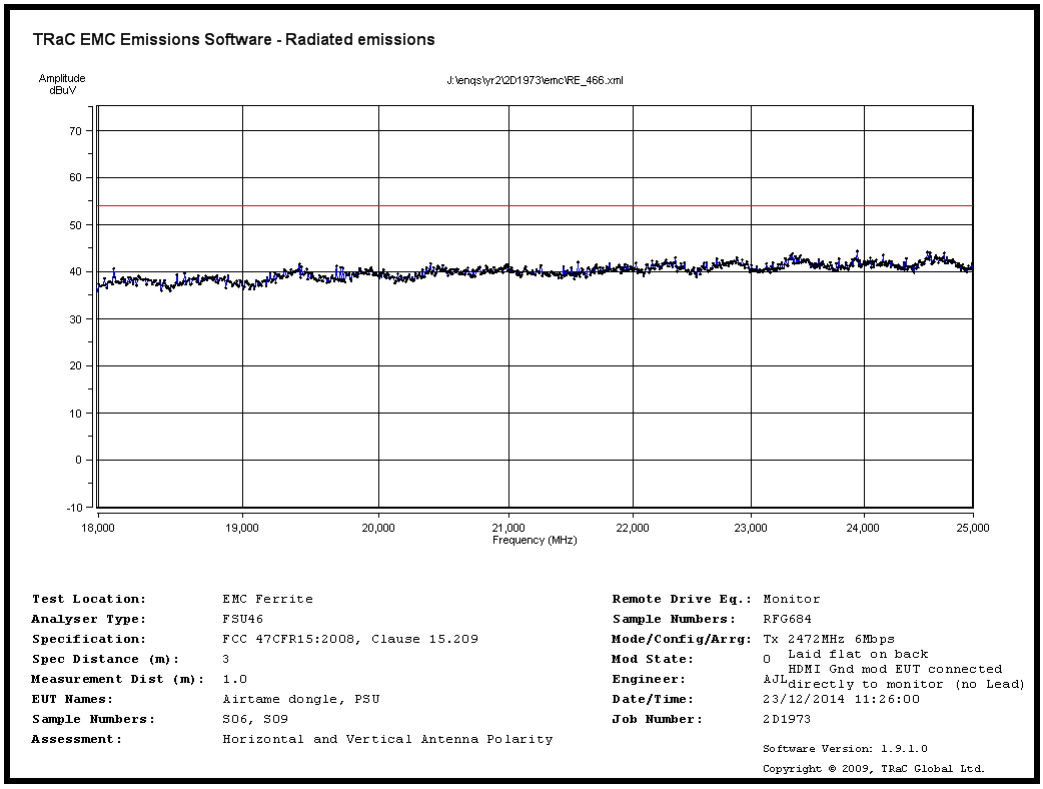
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz 6Mb/s



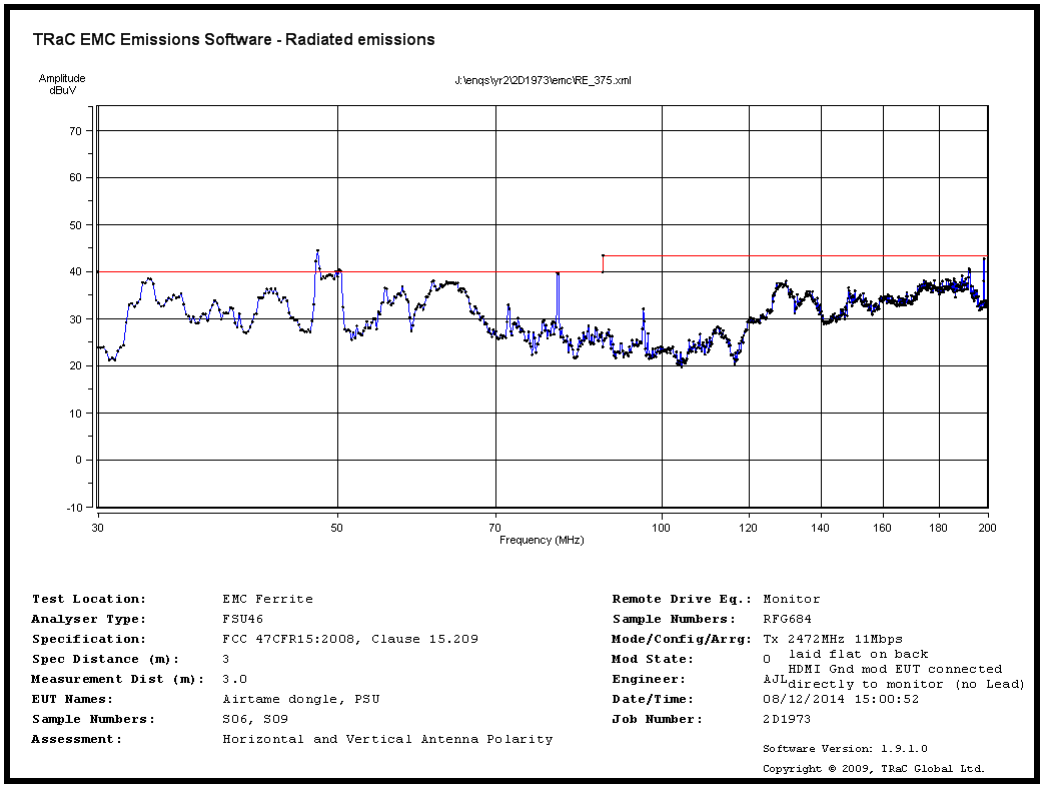
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz 6Mb/s



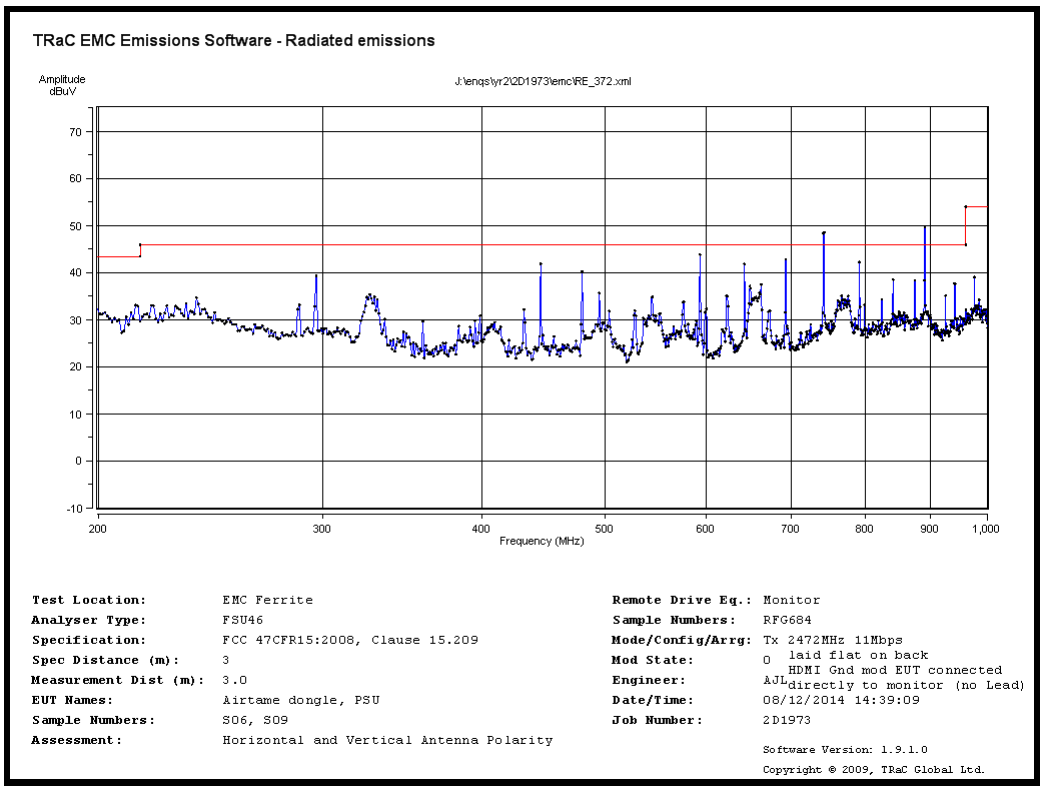
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz 6Mb/s



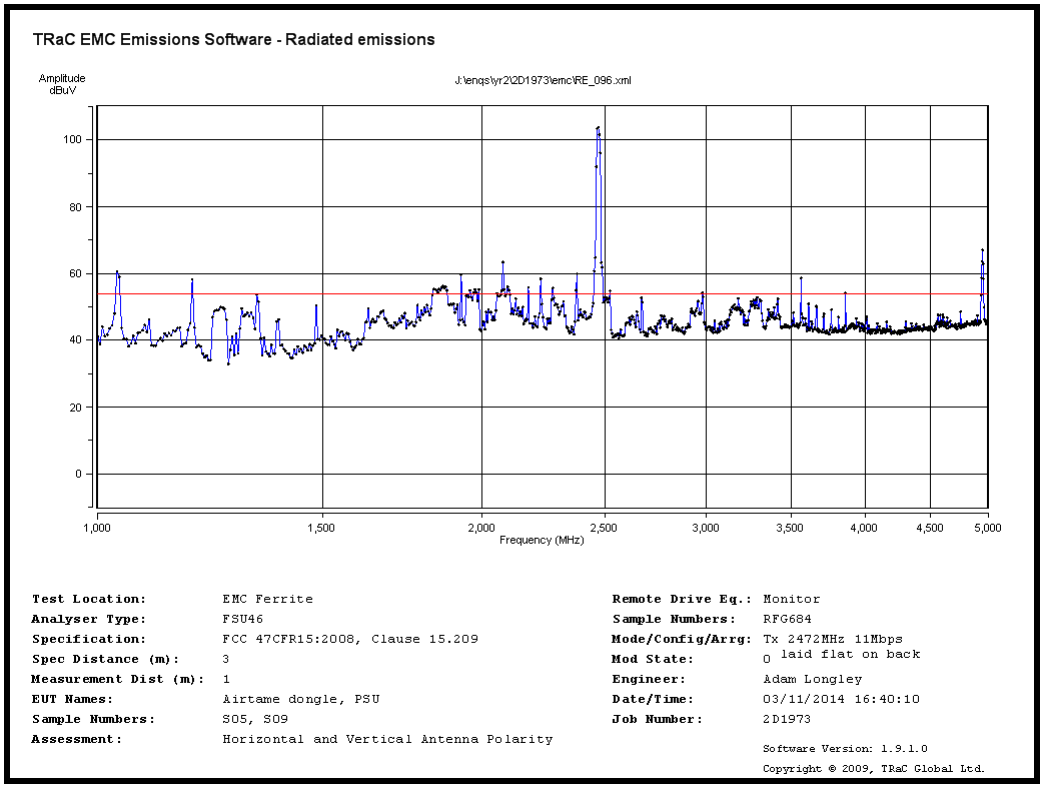
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz 6Mb/s



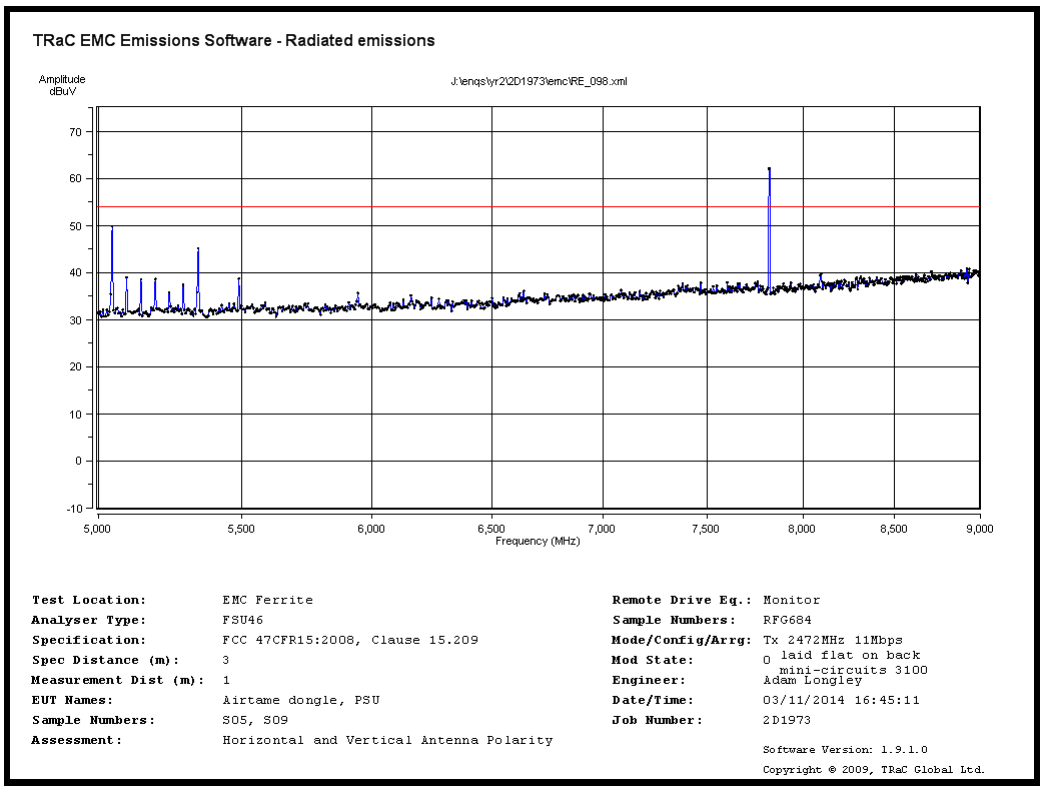
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz 11Mb/s



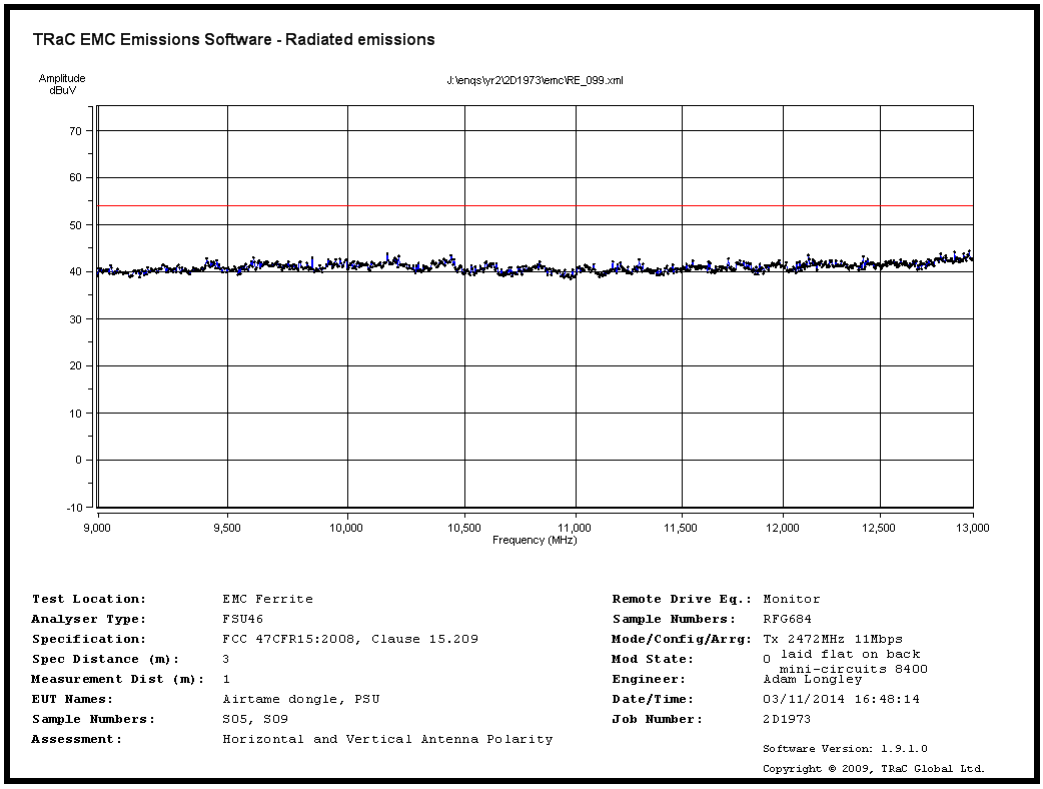
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz 11Mb/s



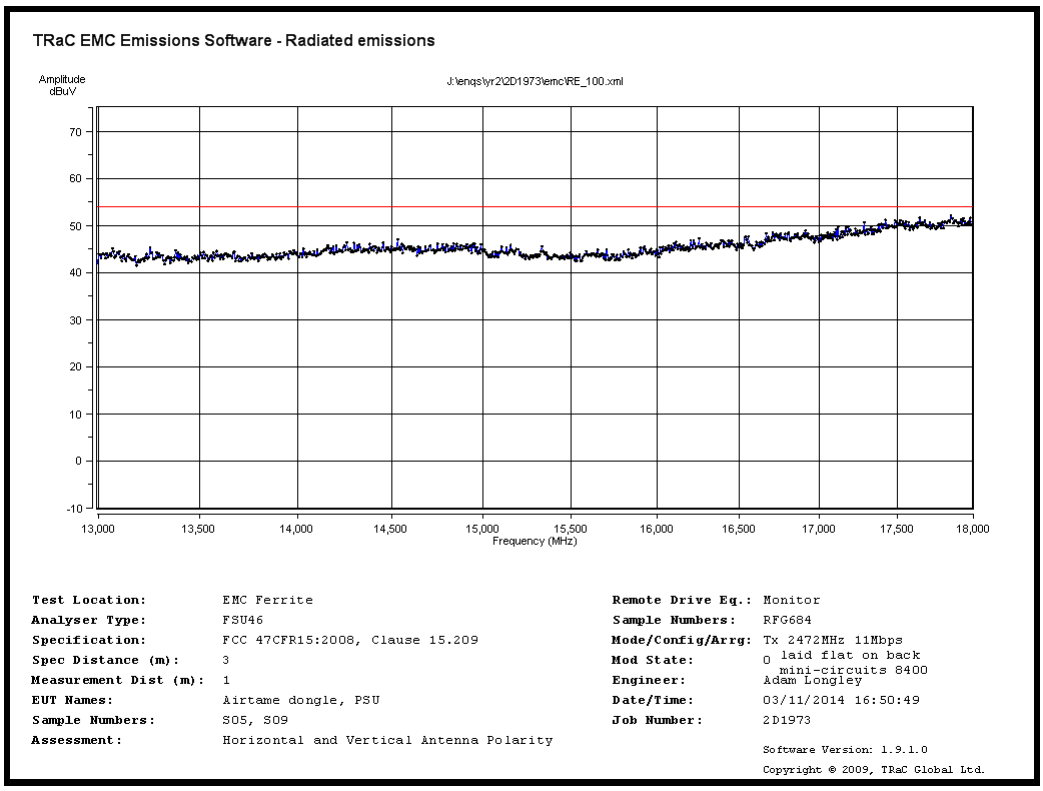
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz 11Mb/s



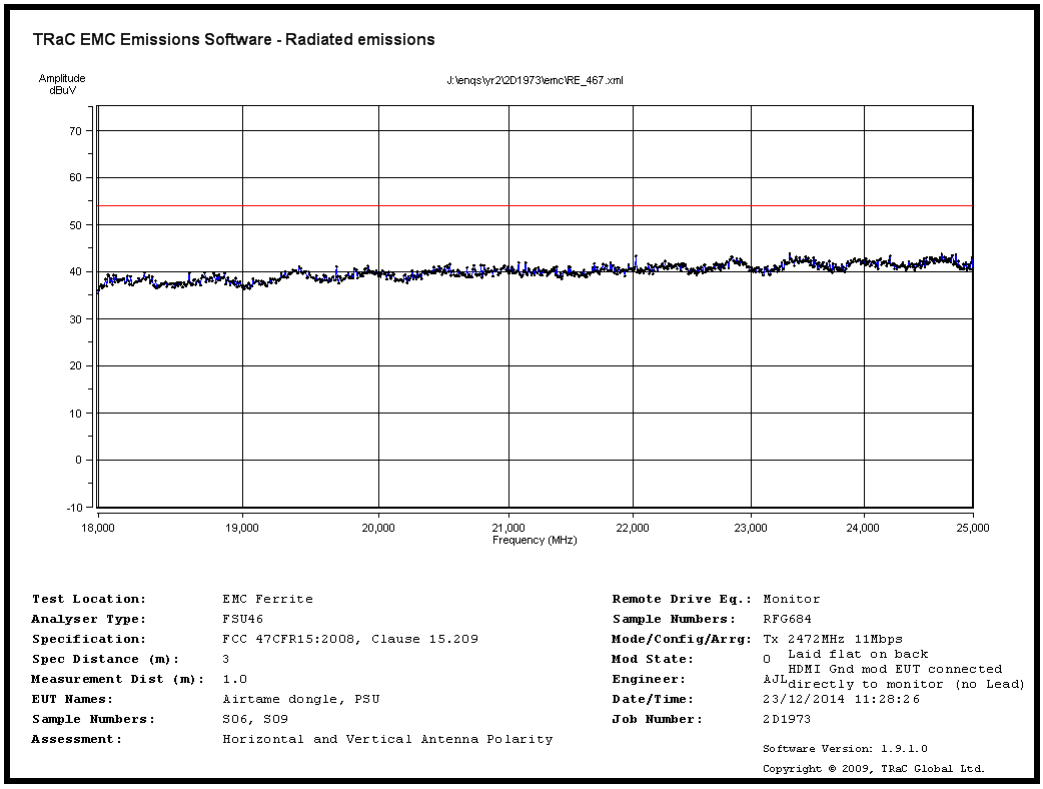
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz 11Mb/s



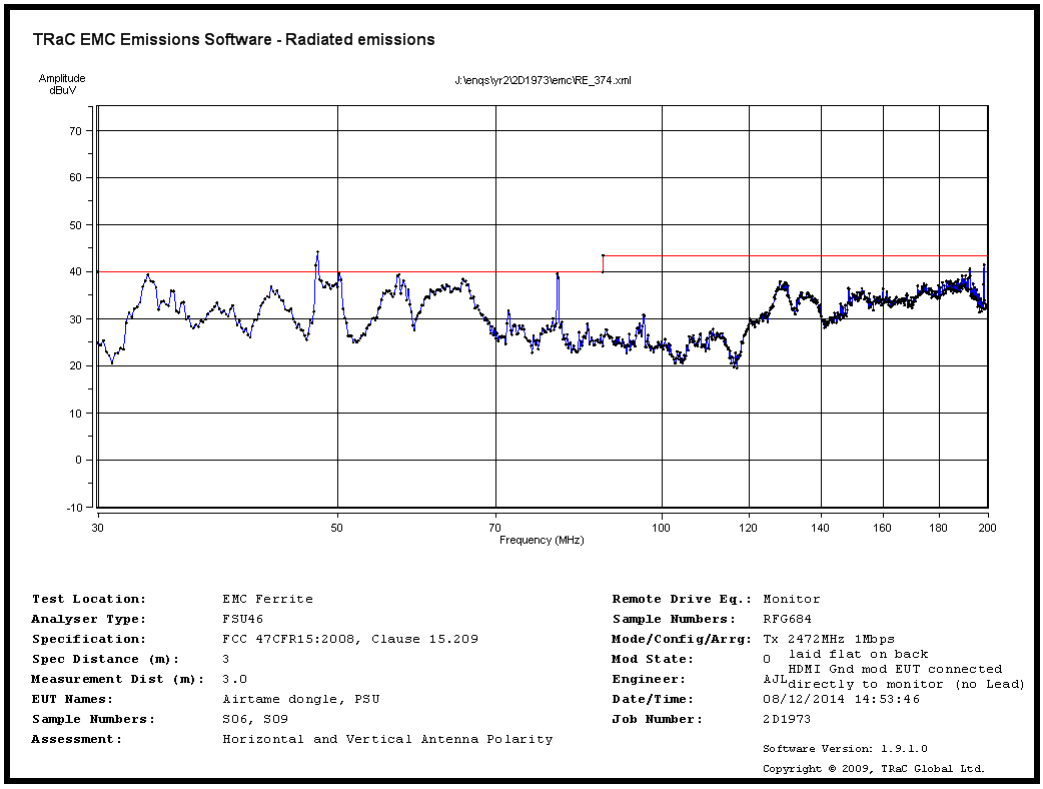
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz 11Mb/s



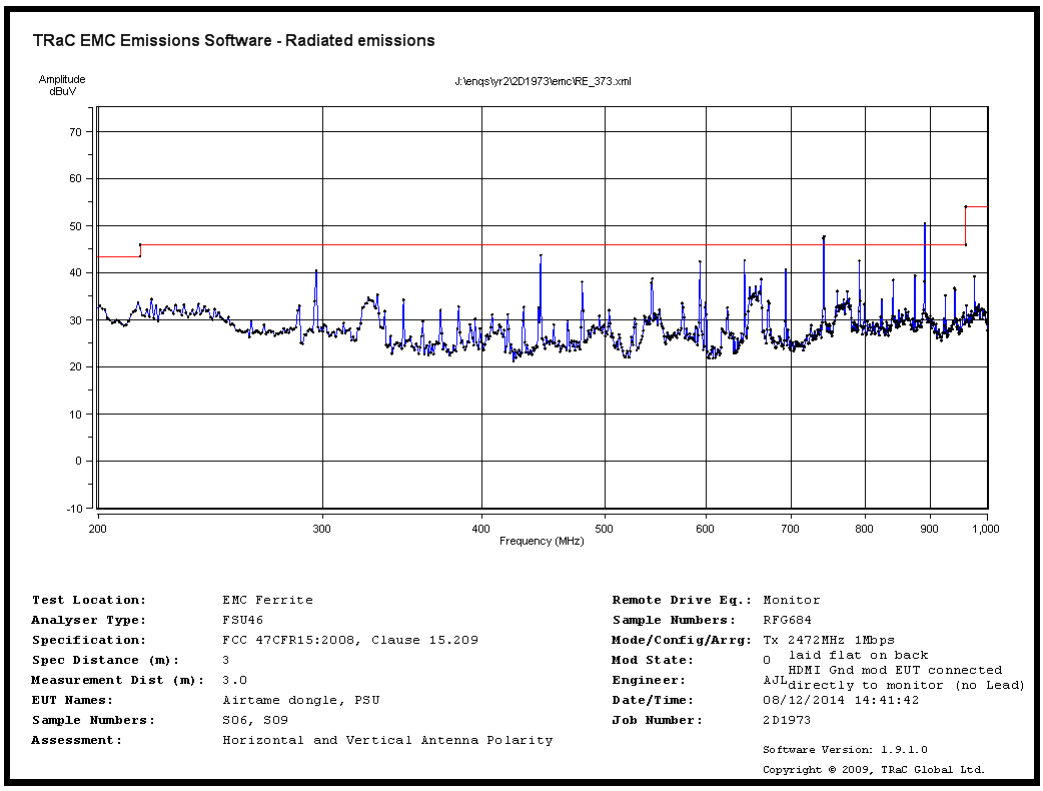
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz 11Mb/s



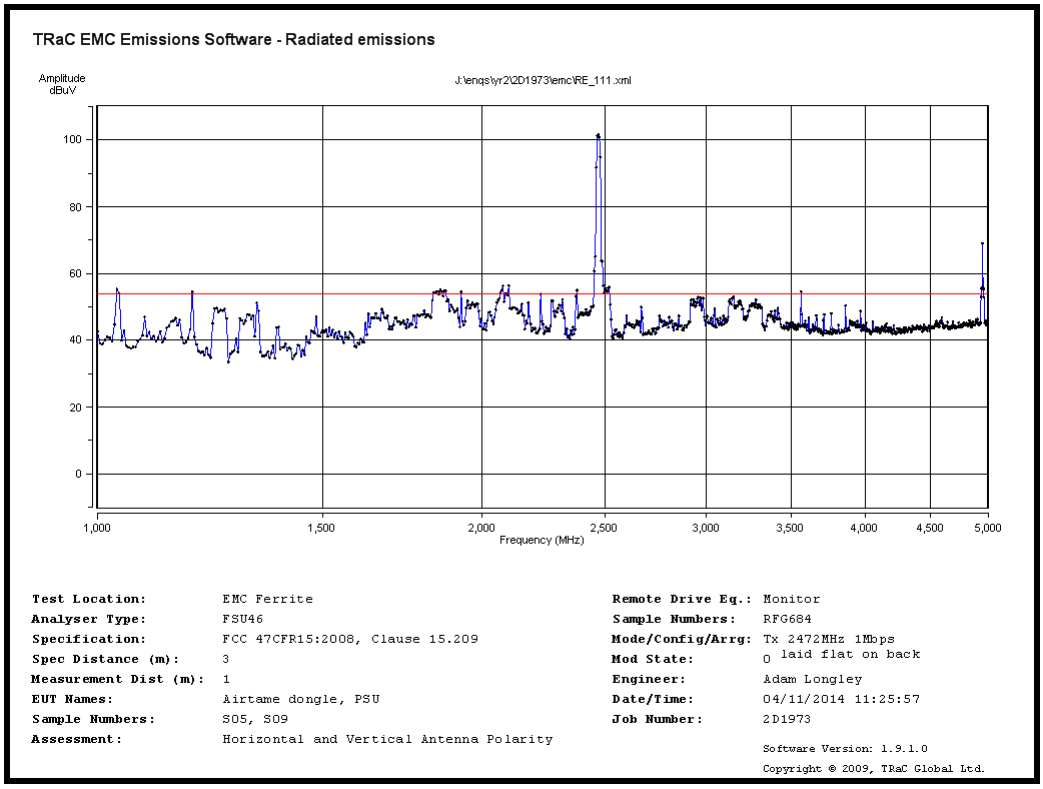
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz 11Mb/s



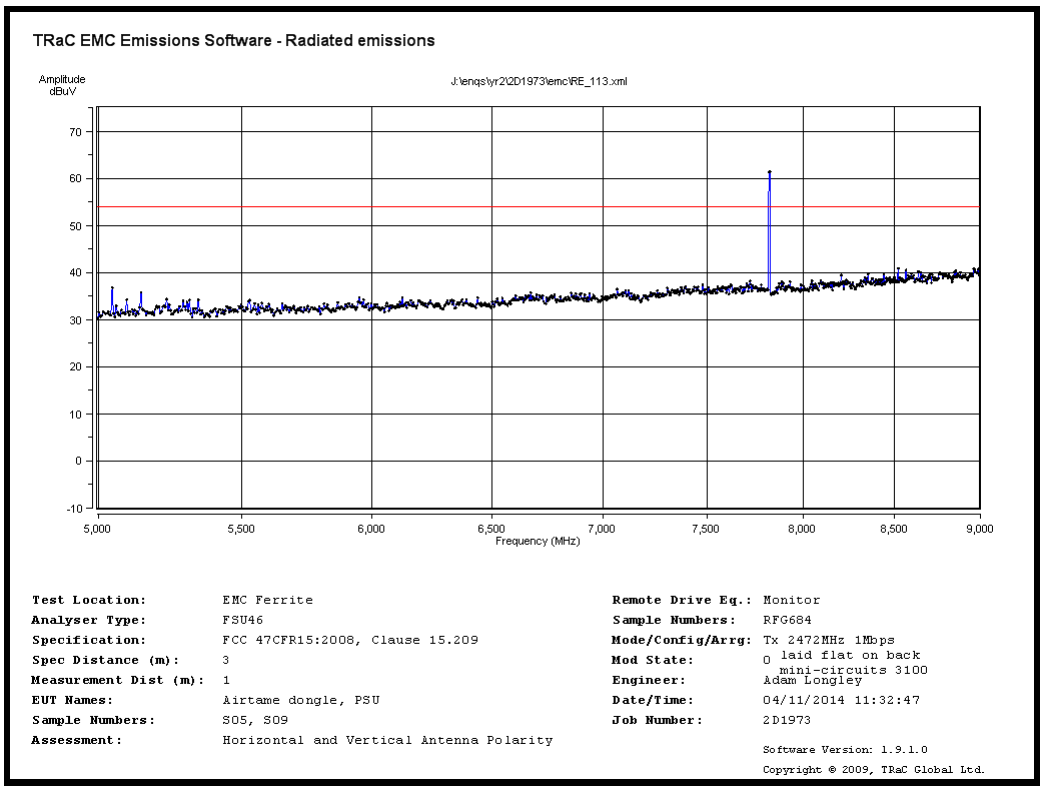
Radiated Spurious emissions 30MHz to 200MHz – 2472MHz 1Mb/s



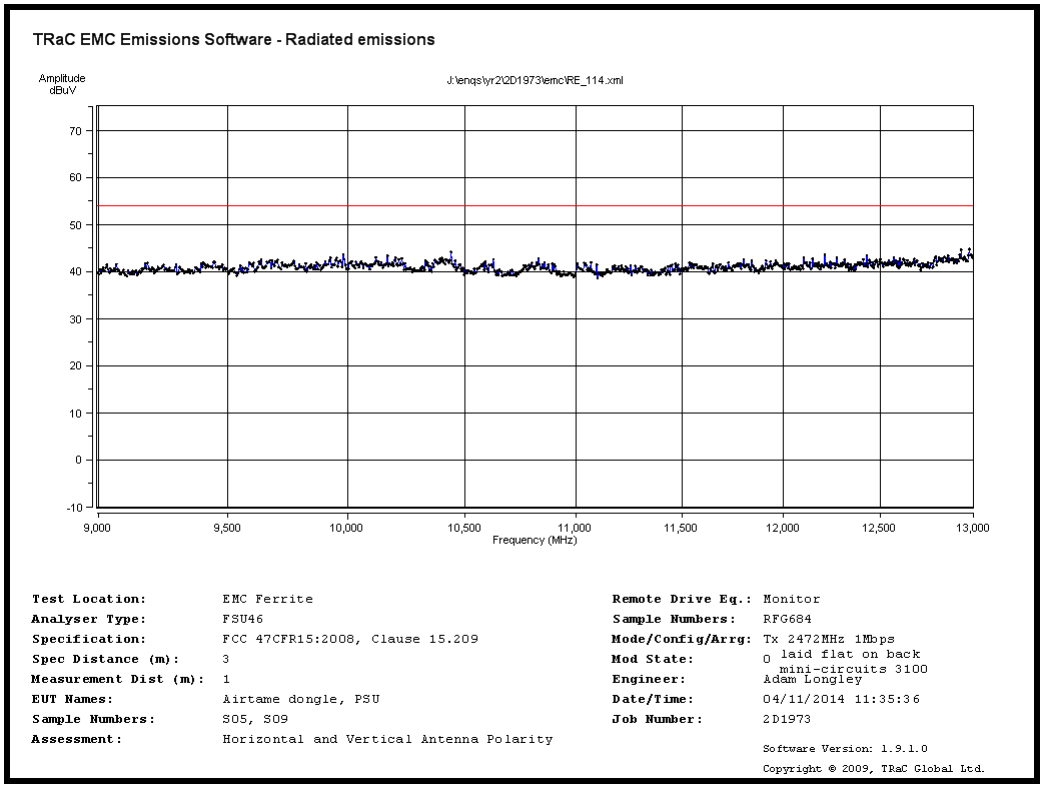
Radiated Spurious emissions 200MHz to 1GHz – 2472MHz 1Mb/s



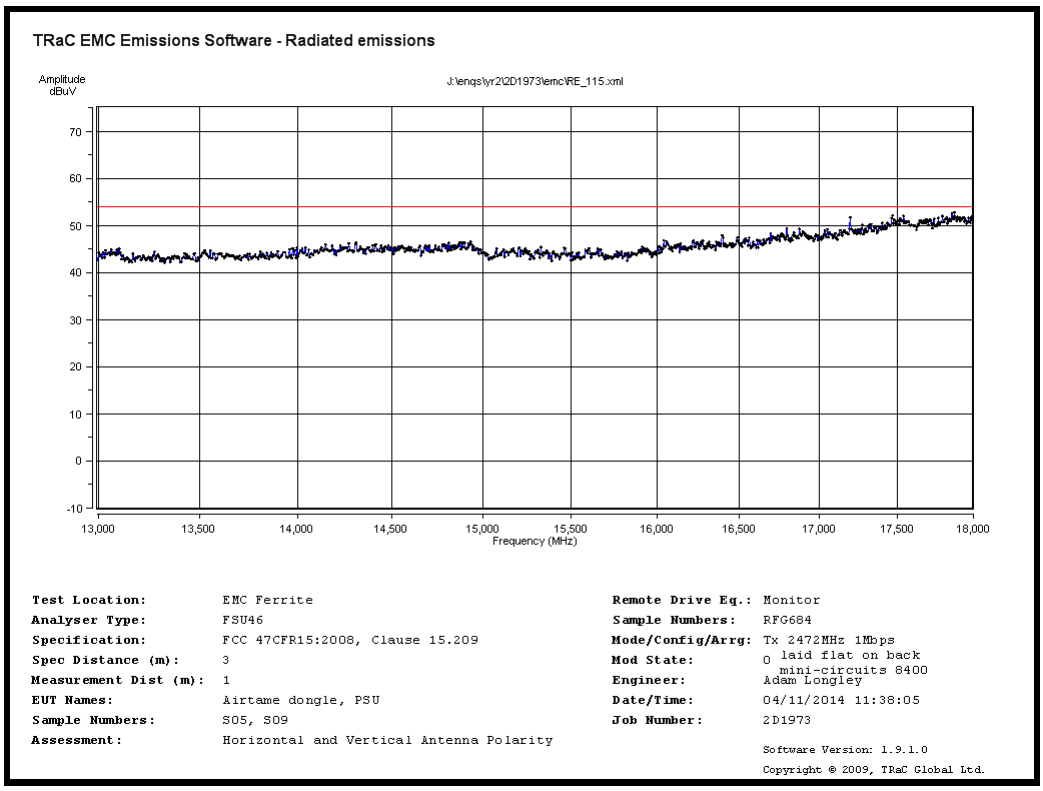
Radiated Spurious emissions 1GHz to 5GHz – 2472MHz 1Mb/s



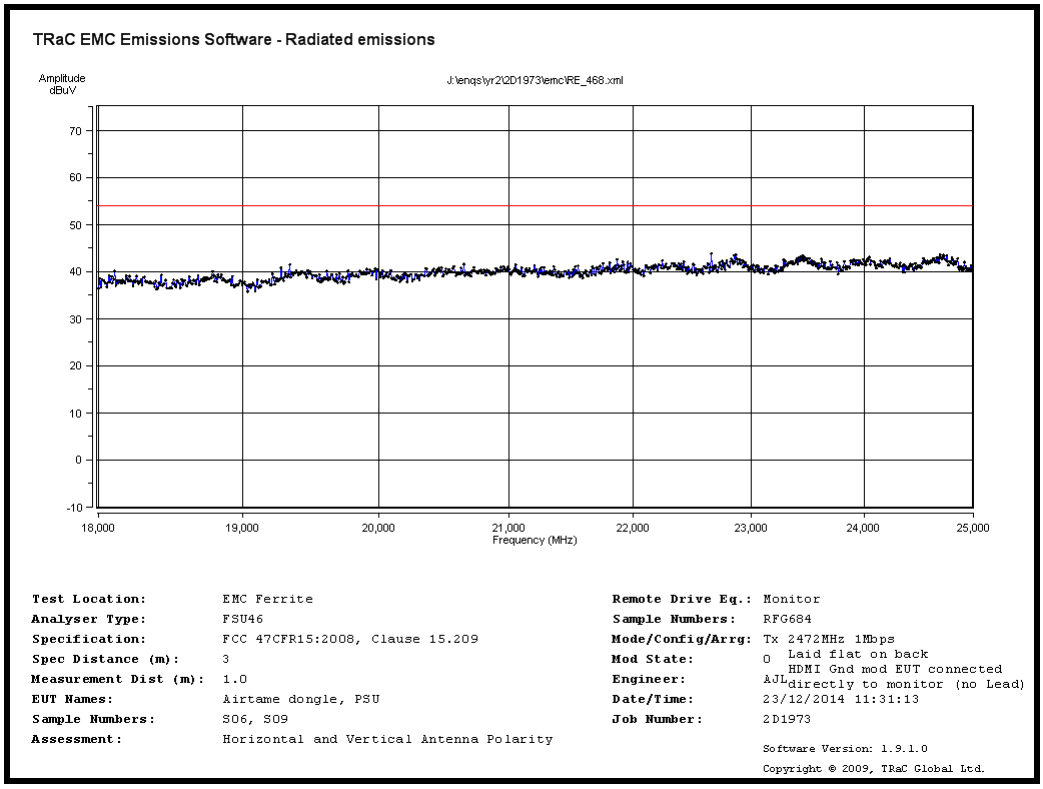
Radiated Spurious emissions 5GHz to 9GHz – 2472MHz 1Mb/s



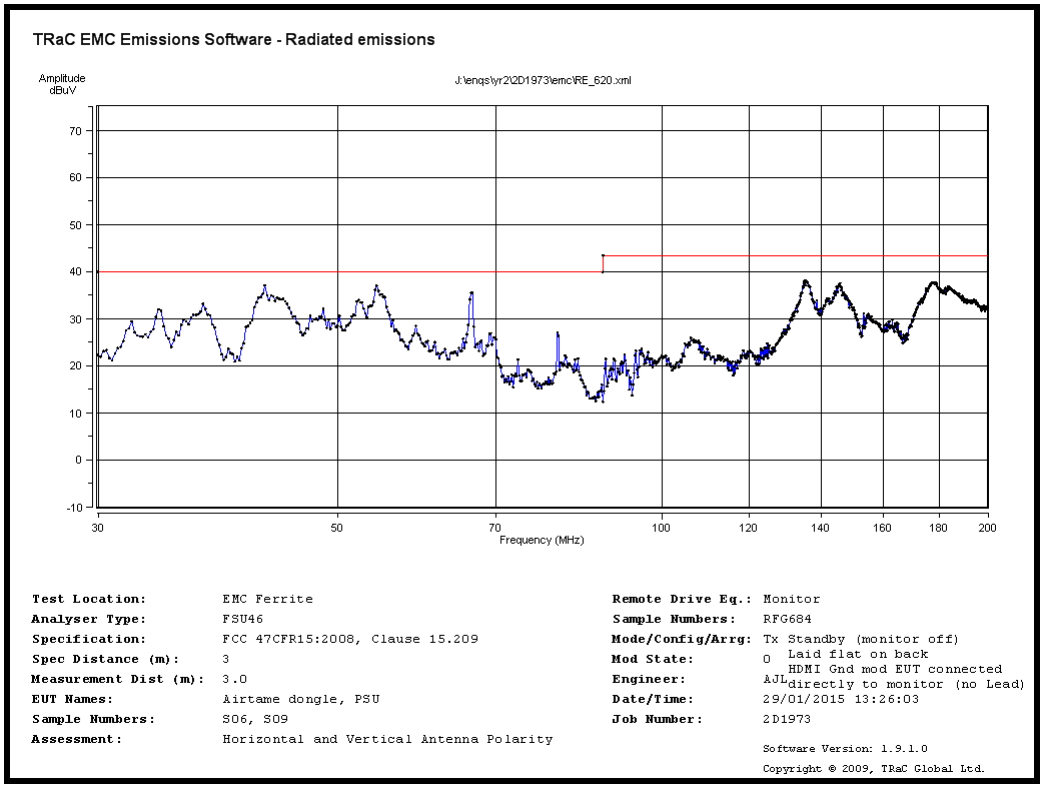
Radiated Spurious emissions 9GHz to 13GHz – 2472MHz 1Mb/s



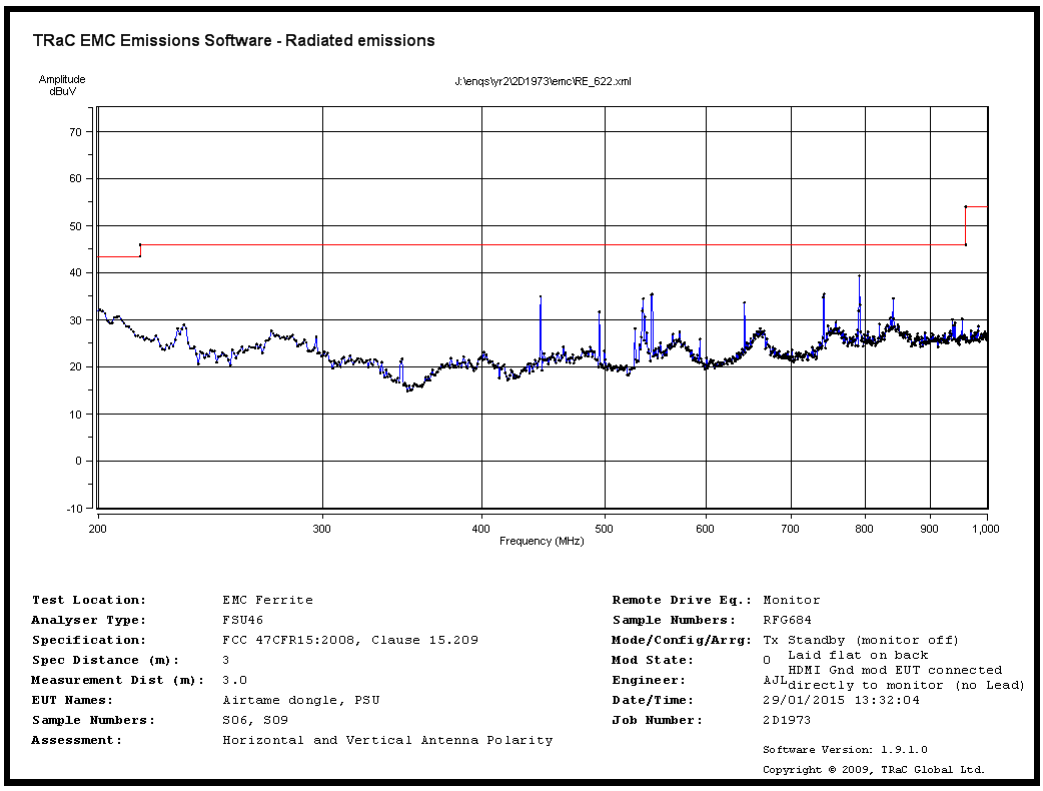
Radiated Spurious emissions 13GHz to 18GHz – 2472MHz 1Mb/s



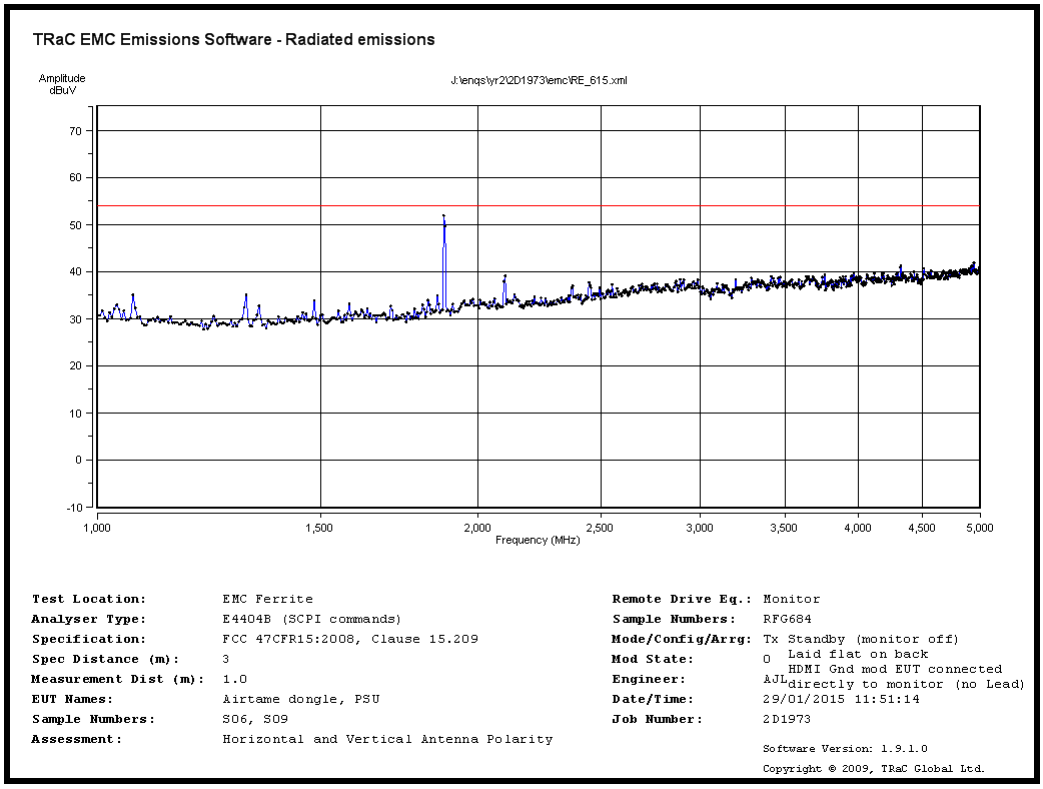
Radiated Spurious emissions 18GHz to 25GHz – 2472MHz 1Mb/s



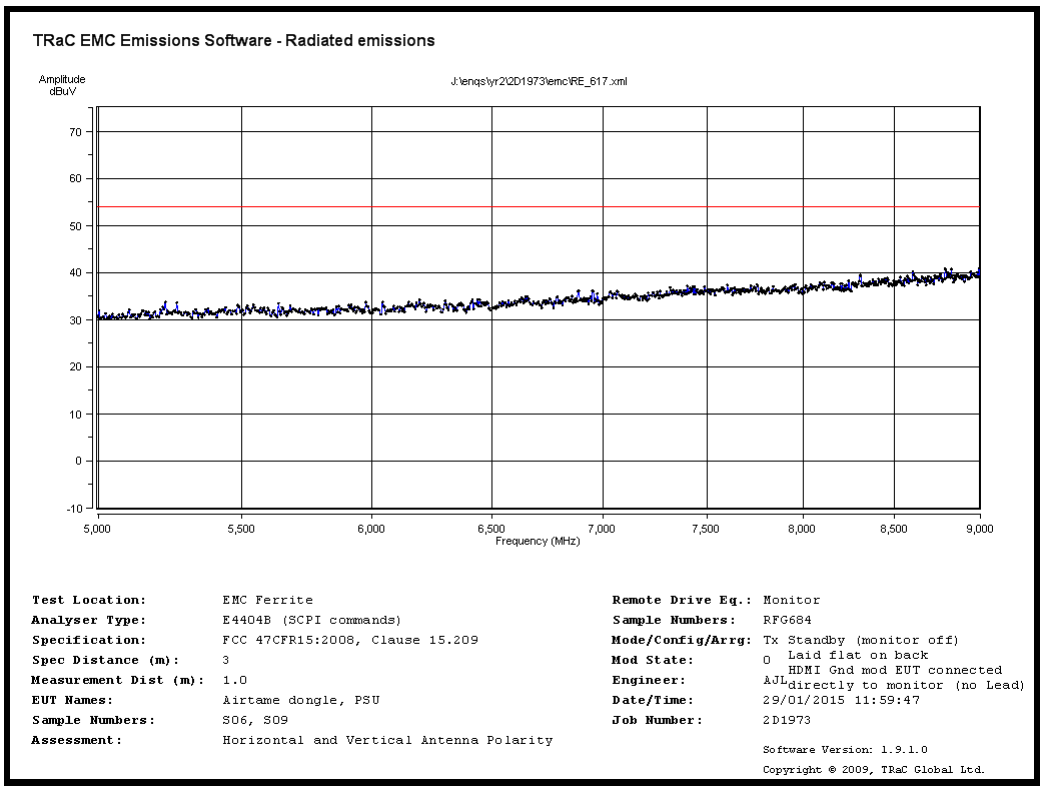
Radiated Spurious emissions 30MHz to 200MHz – Rx



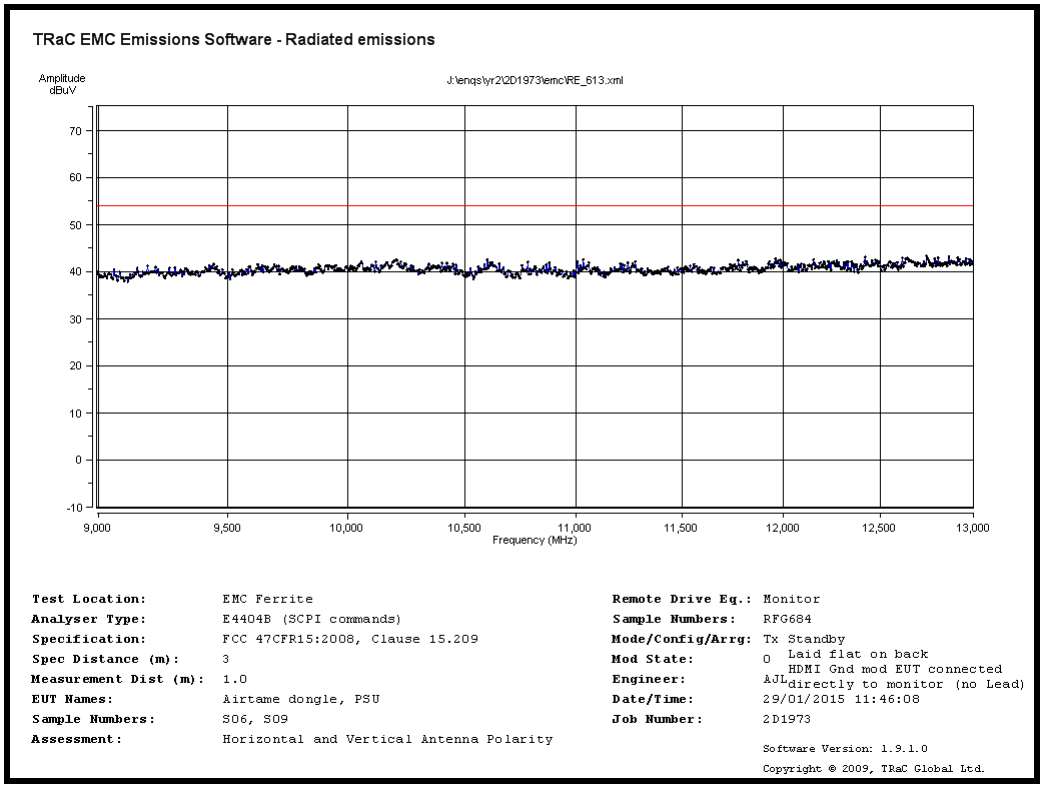
Radiated Spurious emissions 200MHz to 1GHz – Rx



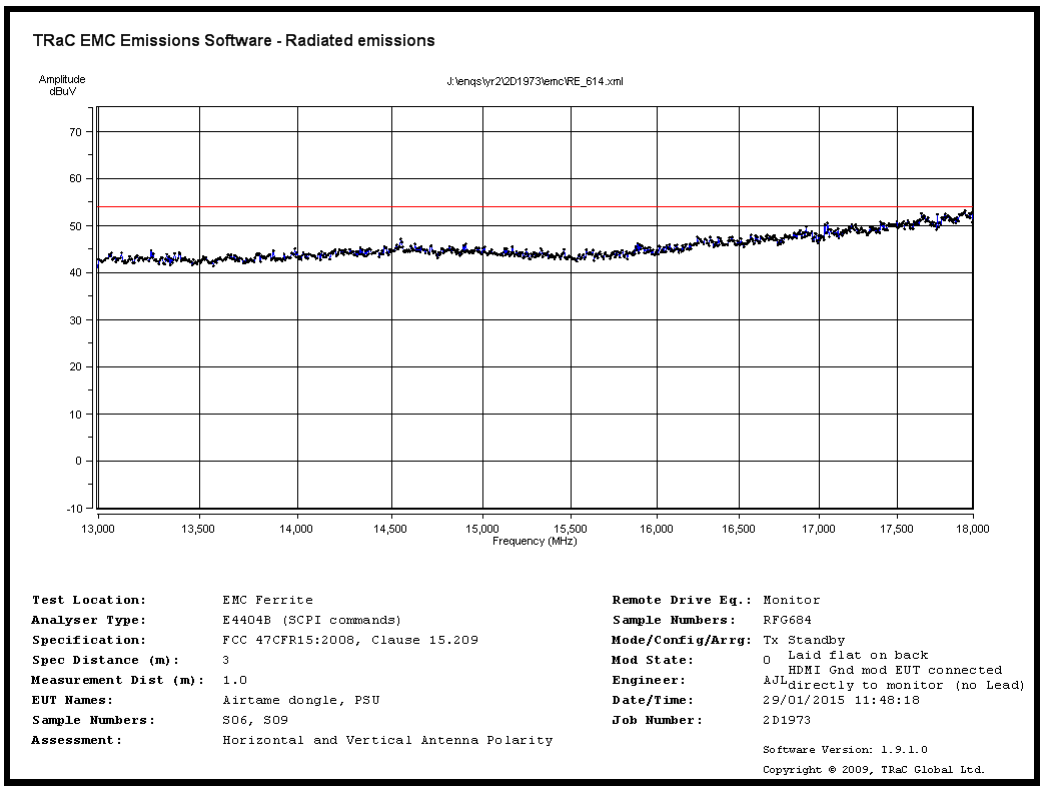
Radiated Spurious emissions 1GHz to 5GHz – Rx



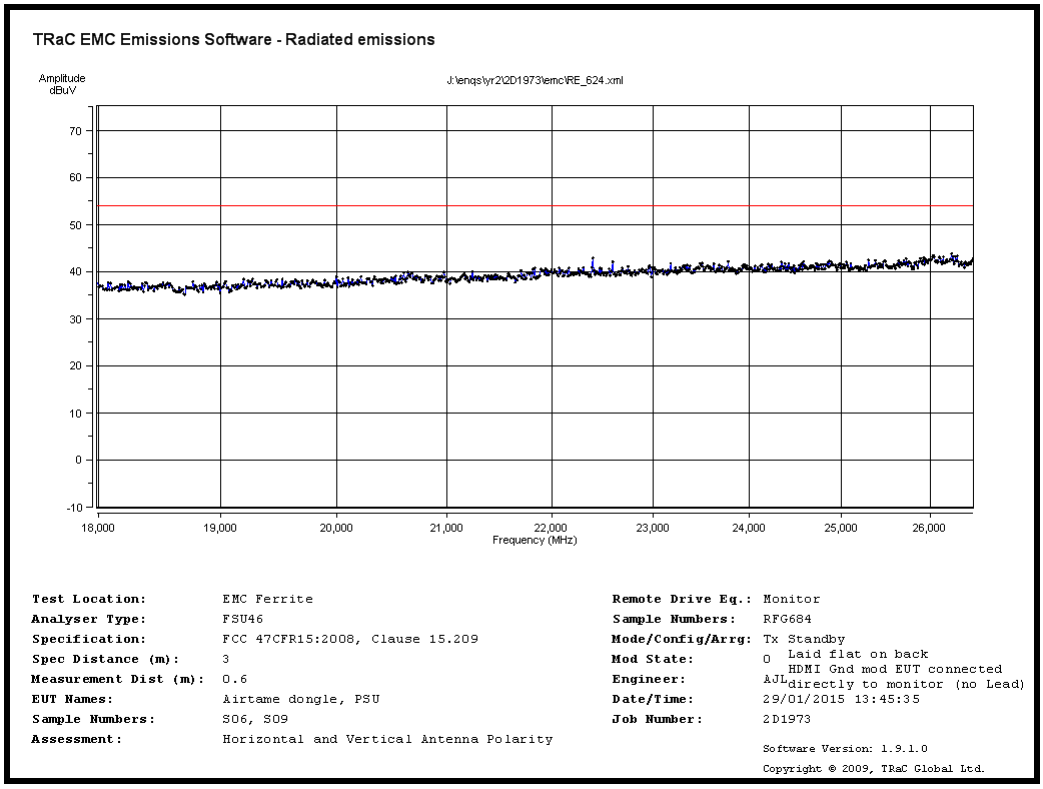
Radiated Spurious emissions 5GHz to 9GHz – Rx



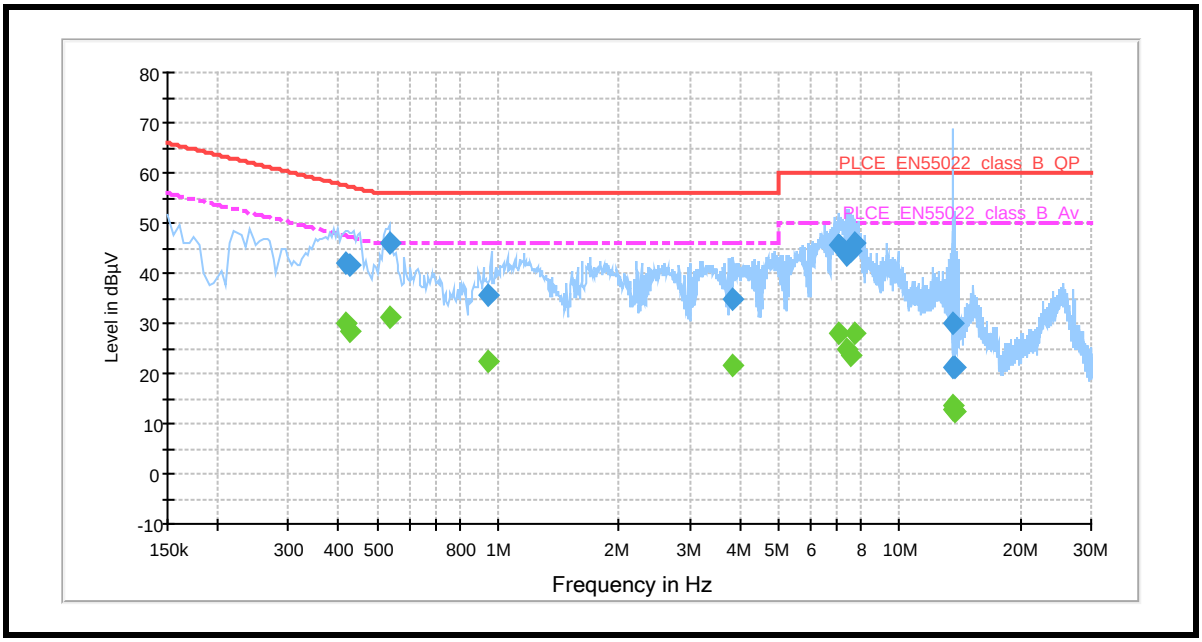
Radiated Spurious emissions 9GHz to 13GHz – Rx



Radiated Spurious emissions 13GHz to 18GHz – Rx



Radiated Spurious emissions 18GHz to 25GHz – Rx



Power Line Conducted 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
S01	Airtame HDMI Dongle	
S03	Airtame HDMI Dongle (RF Conducted Sample)	RF1
S06	Airtame HDMI Dongle	RF4
S07	Plug-top USB PSU (used with S03)	Model: ADS-12BA-06B 05075G
S08	Plug-top USB PSU (used with S01)	Model: ADS-12BA-06B 05075G
S09	Plug-top USB PSU (used with S06)	Model: ADS-12BA-06B 05075G

The following samples of apparatus were supplied by TRaC Global as support or drive equipment (auxiliary equipment):

Identification	Description
RFG684	Panasonic TV
TRaC Laptop	Compaq 6720s Laptop PC

C2) EUT Operating Mode During Testing.

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

Test	Description of Operating Mode
All tests detailed in this report	2.4GHz IEEE 802.11 WiFi transmitting on frequency and operating mode selected using the client's test script installed on the EUT as appropriate to the test requirements. Using the command line: athtestcmd –tx tx99 –txfreq xxxx –txrate yy –txpwr zz Where: xxxx = Required channel frequency in MHz yy = 18 (MCS6), 12 (MCS0), 11 (54Mb/s), 4 (6Mb/s), 3 (11Mb/s) or 0 (1Mb/s) zz = 18 (unless otherwise noted in the main body of this report.

Test	Description of Operating Mode:
Receiver conducted and radiated (ERP) spurious emissions	EUT active but non-transmitting.

Test	Description of Operating Mode:
PLCE	EUT active and transmitting on 2.4GHz and 5GHz bands.

MCS6 and MCS0 modes are 802.11n
54Mb/s and 6 Mb/s modes are 802.11g
11Mb/s and 1Mb/s modes are 802.11b

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 : S03
Tests : Conducted

Port	Description of Cable Attached	Cable length	Equipment Connected
HDMI	None	-	None
Micro USB	USB A to micro USB cable	1m	USB PSU
USB Programming	USB A to 6-way header cable	2m	TRaC Laptop
SMA RF port	SMA – SMA coaxial rf cable	1m	Test Instruments

Sample : S06
Tests : Radiated Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
HDMI	None (direct connection)	-	RFG684 TV
Micro USB	USB A to micro USB cable	1m	USB PSU
USB Programming	USB A to 6-way header cable	2m	TRaC Laptop

Sample : S01
Tests : Power Line Conducted Emissions

Port	Description of Cable Attached	Cable length	Equipment Connected
HDMI	None (direct connection)	-	RFG684 TV
Micro USB	USB A to micro USB cable	1m	USB PSU
USB Programming	USB A to 6-way header cable	2m	TRaC Laptop

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
129	3115	Horn Antenna	EMCO	05/02/14	05/02/16
RFG629		Horn Antenna	Q-Par	19/09/13	19/09/15
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
RFG450		SMA RF coaxial cable		03/07/13	03/07/15
REF881		N-Type RF coaxial cable		06/10/14	06/10/15
REF882		N-Type RF coaxial cable		06/10/14	06/10/15
REF884		N-Type RF coaxial cable		06/10/14	06/10/15
REF885		N-Type RF coaxial cable		06/10/14	06/10/15
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.	Calibration Due
REF910	FSU	Spectrum Analyser	Rhode & Schwarz	31/03/14	31/03/15
REF837	E4440A	Spectrum Analyser	Agilent	19/05/14	19/05/15
REF2112	RPR3006W	Power Meter	Dare	10/03/14	10/03/15

For Power Line Conducted Measurements:

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.	Calibration Due
RFG680	ESH3-Z2	Pulse Limiter	R & S	01/07/14	01/07/15
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	04/09/14	04/09/15
RFG125	ESHS10	Measuring Receiver	R & S	24/04/14	24/04/15

Power Line Conducted Emissions testing was performed on the 29th October 2014.

Appendix D: Additional Information

No additional information is included within this test report.

Appendix E: Calculation of the duty cycle correction factor

No duty cycle correction has been applied to the results in this report.

Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement: front view.
2. Radiated electric field emissions arrangement: rear view.
3. Radiated electric field emissions arrangement: rear view close up.

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 in the 2400 – 2483.5 MHz band will be determined as follows

SAR Exclusion Threshold

NT= $\{ [(MP/TSD) * \sqrt{f_{GHz}}] + (TSD – 50mm) * 10] \}$

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= $\{ [(NT \times TSD) / \sqrt{f_{GHz}}] + (TSD – 50) * 10] \}$

Operating Frequency 2.412 GHz

MP= $\{ [(3.0 \times 50) / \sqrt{2.412}] + (50 – 50) * 10 \}$
MP= { [150 / 1.55] + (0 * 10 }
MP= 96.77mW

Operating Frequency 2.442 GHz

MP= $\{ [(3.0 \times 50) / \sqrt{2.442}] + (50 – 50) * 10 \}$
MP= { [150 / 1.56] + (0 * 10 }
MP= 96.15mW

Operating Frequency 2.472 GHz

MP= $\{ [(3.0 \times 50) / \sqrt{2.472}] + (50 – 50) * 10 \}$
MP= { [150 / 1.57] + (0 * 10 }
MP= 95.54mW

Channel Frequency (MHz)	EIRP (mW)	SAR Exclusion Threshold	SAR Evaluation
2412	69.18	96.77	Not Required
2442	28.84	96.15	Not Required
2472	26.92	95.54	Not Required

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

Appendix H: **MPE exclusion calculation**

As per KDB 447498

47 CFR §§1.1307 and 2.1091

2.1091 Radio frequency radiation exposure evaluation: Portable 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 (cm)
2412	69.18	0.6	3.9
2442	28.84	0.6	2.5
2472	26.92	0.6	2.4

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