Radio Test Report

for

Digi International Ltd
on

Wi-i.MX53

Document No: TRA-007055-W-US1

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TRaC Wireless Test Report	**:** TRA-007055-W-US1
Applicant	**:** Digi International Ltd
Apparatus	**:** Wi-i.MX53
Specification	**:** CFR47 Parts 15.247 and 15.407, July 2011
FCCID	**: MCQ-50M1782**
Purpose of Test	**:** Certification
Authorised by	**:** 
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Contents

Section 1: Introduction

1.1 General

This report contains an assessment of an apparatus against Electromagnetic Compatibility Standards based upon tests carried out on samples submitted to the Laboratory.

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1.2 Tests requested by

This testing in this report was requested by:

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1.3 Manufacturer

Same as above.

1.4 Apparatus Assessed

The following apparatus was assessed between:

Wi-i.MX53

The above device is a Wi-Fi transmitter module capable of generating 802.11a 802.11b, 802.11g, 802.11n HT20 and 802.11n HT40 signals.

1.5 Test Result Summary

Full details of test results are contained within Appendices A and B. The following tables 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 Appendices A and B. The following table summarises the results of the assessment.

Testing to Title 47 of the CFR:Part 15 Subpart C 15.247 (2400–2483.5 MHz, and 5725–5850 MHz.).

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
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart B; 15.107	ANSI C63.4	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 C63.4	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(i)	-	Pass

Testing to Title 47 of the CFR:Part 15 Subpart C 15.407 (All other bands).

Test Type	Regulation	Measurement standard	Result
Carrier Power and Power Density 5.15 to 5.25 GHz	Title 47 of the CFR:Part 15 Subpart C: 15.407(a)(1)	ANSI C63.10:2009	Pass
Carrier Power and Power Density 5.25 to 5.35 GHz and 5.47 to 5.725 GHz	Title 47 of the CFR:Part 15 Subpart C: 15.407(a)(2)	ANSI C63.10:2009	Pass
Carrier Power and Power Density 5.725 GHz to 5.850 GHz	Title 47 of the CFR:Part 15 Subpart C: 15.407(a)(3)	ANSI C63.10:2009	Pass
26 dB Bandwidth	Title 47 of the CFR:Part 15 Subpart C: 15.407(a)(5)	ANSI C63.10:2009	Pass
Peak to average power ratio	Title 47 of the CFR:Part 15 Subpart C: 15.407(a)(6)	ANSI C63.10:2009	Pass
Undesirable emission 5.15 to 5.25 GHz operation	Title 47 of the CFR:Part 15 Subpart C: 15.407(b)(1)	ANSI C63.10:2009	Pass
Undesirable emission 5.25 to 5.35 GHz operation	Title 47 of the CFR:Part 15 Subpart C: 15.407(b)(2)	ANSI C63.10:2009	Pass
Undesirable emission 5.47 to 5.725 GHz operation	Title 47 of the CFR:Part 15 Subpart C: 15.407(b)(3)	ANSI C63.10:2009-	Pass
Undesirable emission 5.725 GHz to 5.850 GHz operation	Title 47 of the CFR:Part 15 Subpart C: 15.407(b)(4)	ANSI C63.10:2009-	Pass
Unwanted emissions below 1 GHz	Title 47 of the CFR:Part 15 Subpart C: 15.407(b)(6)	ANSI C63.10:2009	Pass
Frequency stability under all normal operating conditions	Title 47 of the CFR:Part 15 Subpart C: 15.407(g)	ANSI C63.10:2009	Pass
Transmit power control 5.25 to 5.35 GHz and 5.47 to 5.725 GHz	Title 47 of the CFR:Part 15 Subpart C: 15.407(h)	ANSI C63.10:2009	Pass

Abbreviations used in the above tables:

ANSI C 63.10:2009 falls outside the scope of the laboratory's 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

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

Test type	Quantity	Quantity frequency range	Uncertainty
Radiated electric field emissions 3m alternative test site Effective Radiated Power 3m alternative test site	Amplitude	30MHz to 300MHz Horizontal	±4.6dB
		30MHz to 300MHz Vertical	±5.1dB
		300MHz to 1000MHz Horizontal	±5.2dB
		300MHz to 1000MHz Vertical	±5.5dB
		1GHz to 26.5GHz Horizontal and Vertical	±4.1dB
Conducted emissions		N/A	±0.9 dB
Absolute RF power (via antenna connector)		N/A	±0.9 dB
PSD		N/A	±0.9 dB
Frequency Range	Frequency	9kHz to 26.5GHz	3.611kHz

Section 3: Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment.

Appendix A: Formal Test Results Title 47 of the CFR: Part 15 Subpart C 15.247

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 6dB 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 6dB points on the transmitted spectrum.

Test Details: 802.11n HT 40 Tx mode	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2)
Measurement standard	ANSI C63.10, OET Guidance Notes
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
Temperature	20^0C
EUT set up	Refer to Appendix C

Channel Frequency (MHz)	6dB Bandwidth (MHz)	Limit (kHz)	Result
2412	17.203	≥500	Pass
2437	17.594	≥500	Pass
2462	17.415	≥500	Pass

Notes:

1. Measurements were performed as per DTS 558074 D01 DTS Meas Guidance v02

A2 Maximum Conducted Output Power

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

Test Details: 802.11b 1x1 Tx mode	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10, OET Guidance Notes
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C

Channel Frequency (MHz)	**Peak Conducted Carrier Power**		**Limit (W)**	**Result**
	dBm	**W**		
2412	14.1	0.026	1	Pass
2437	14.3	0.027	1	Pass
2462	14.2	0.026	1	Pass

Notes:

1. Measured peak output power does not include the gain of any antenna being used
2. Measurements were performed as per DTS 558074 D01 DTS Meas Guidance v02

A3 Transmitter Power Spectral Density

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

Test Details: 802.11b Tx mode	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10, OET Guidance Notes
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C

Channel Frequency (MHz)	Conducted Peak Power Spectral Density (dBm/100kHz)	Conducted Peak Power Spectral Density (dBm/3kHz)	Limit (dBm/3kHz)	Result
2412	-0.5	-15.7	8	Pass
2437	-0.7	-15.9	8	Pass
2462	-1.2	-16.4	8	Pass

Notes:

1. Measured Power Spectral Density does not include the gain of any antenna being used
2. Measurements were performed as per DTS 558074 D01 DTS Meas Guidance v02

A4 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. Frequencies were scanned up through to the 10th harmonic with the EUT transmitting on its lowest, centre and highest carrier frequency in turns.

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	9 kHz to 25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C

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

Ref No.	Emission Freq (MHz)	Det.	Restricted band? (Y/N)	Emission power (RBW =100kHz) (dBm)	15.247(d) Limit (dBm)	Summary
No emissions detected within 20dB of the limit						

Notes:

1. The conducted emission limit for emissions outside the restricted bands, defined in 47CFR Part 15.205(a) are based on a transmitted carrier level of 15.247(b). With the EUT transmitting on its lowest, centre and highest carrier frequencies in turn, emissions from the EUT are required to be 20 dB below the level of the highest fundamental as measured within a 100 kHz RBW in accordance with 15.247(d) using a peak detector.
2. The RBW = 100 kHz, Video bandwidth (VBW) > RBW and the radio spectrum was investigated up to the 10th harmonic in accordance15.33 (a)(1).
3. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance.
4. The carrier level was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier level was observed. All other emissions were at least 20dB below the test limit.
5. The plots for worst case emissions on one of the modulation types can be found in Appendix B

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 Carrier)-20dB

A5 Radiated Electric Field Emissions

Preliminary scans were performed using a peak detector with 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: 802.11b Tx mode	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz – 25GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

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

Frequency (MHz)	Max Reading (dBuV)	Cable Loss (dB)	Antenna Fact (dB/m)	Preamp (dB)	Field Strength (dBuV/m)	Extrap Fact (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)
37.900	53.9	0.7	7.1	31.5	34.6	0	34.6	40
51.000	46.4	0.8	10.8	31.5	25.3	0	25.3	43.5
81.171	56.8	0.9	12.1	31.5	33.0	0	33.0	43.5
108.800	50.7	1.3	13	31.5	30.7	0	30.7	43.5
166.715	50.6	1.3	11.4	31.5	32.1	0	32.1	43.5
190.800	47.3	3.2	21.2	31.4	30.1	0	30.1	43.5
250.000	53.7	0.7	7.1	31.4	34.9	0	34.9	46
799.982	52.7	0.8	10.8	31.5	45.7	0	45.7	46

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

1. The plots for worst case emissions on all modulation types can be found in Appendix B

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

A6 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: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	150kHz to 30MHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Photographs (Appendix F)	2

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

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

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	5.863	L	37.7	60.0	-22.3	Pass
2	6.931	L	36.3	60.0	-23.7	Pass
3	13.300	L	32.3	60.0	-27.7	Pass
4	18.700	L	28.3	60.0	-31.7	Pass
5	23.128	L	31.9	60.0	-28.1	Pass
6	24.349	L	33.1	60.0	-26.9	Pass
7	5.863	N	34.7	60.0	-25.3	Pass
8	6.931	N	35.8	60.0	-24.2	Pass
9	13.300	N	35.1	60.0	-24.9	Pass
10	18.700	N	32.0	60.0	-28.0	Pass
11	23.128	N	36.7	60.0	-23.3	Pass
12	24.349	N	36.3	60.0	-23.7	Pass

Results measured using the average detector compared to the average limit

Ref No.	Freq (MHz)	Conductor	Result (dBuV)	Spec Limit (dBuV)	Margin (dB)	Result Summary
1	5.863	L	36.3	50.0	-13.7	Pass
2	6.931	L	36.3	50.0	-13.7	Pass
3	13.300	L	26.9	50.0	-23.1	Pass
4	18.700	L	22.8	50.0	-27.2	Pass
5	23.128	L	28.8	50.0	-21.2	Pass
6	24.349	L	30.0	50.0	-20.0	Pass
7	5.863	N	31.5	50.0	-18.5	Pass
8	6.931	N	34.3	50.0	-15.7	Pass
9	13.300	N	29.7	50.0	-20.3	Pass
10	18.700	N	26.7	50.0	-23.3	Pass
11	23.128	N	33.7	50.0	-16.3	Pass
12	24.349	N	33.1	50.0	-16.9	Pass

Note: The above emissions were seen on all channels and modulation types

Specification limits:

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

Conducted disturbance at the mains ports shall not exceed the following values.

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

A7 Antenna Gain

The antenna gain details are contained within a separate exhibit.

A8 Unintentional Radiated Electric Field Emissions

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 EUT was also checked for common unintentional emissions in all modulation types and channels.

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: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz to 25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

The worst case radiated emission measurements are listed overleaf:

Frequency (MHz)	Max Reading (dBuV)	Cable Loss (dB)	Antenna Fact (dB/m)	Preamp (dB)	Field Strength (dBuV/m)	Extrap Fact (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)
37.900	53.9	0.7	7.1	31.5	34.6	0	34.6	40
51.000	46.4	0.8	10.8	31.5	25.3	0	25.3	43.5
81.171	56.8	0.9	12.1	31.5	33.0	0	33.0	43.5
108.800	50.7	1.3	13	31.5	30.7	0	30.7	43.5
166.715	50.6	1.3	11.4	31.5	32.1	0	32.1	43.5
190.800	47.3	3.2	21.2	31.4	30.1	0	30.1	43.5
250.000	53.7	0.7	7.1	31.4	34.9	0	34.9	46
799.982	52.7	0.8	10.8	31.5	45.7	0	45.7	46

Note: The above emissions were seen on all channels and modulation types

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

Appendix B: Formal Test Results Title 47 of the CFR: Part 15 Subpart C 15.407

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

B.1 Carrier Power and Power Density 5.15 to 5.25 GHz

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(a)(1)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	5.15 to 5.25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

Frequency (MHz)	Measured Power (dBm)	26 dB Bandwidth (MHz)	Limit (dBm)	Verdict
5180	13.2	37.845	17	Pass
5220	13.4	37.212	17	Pass
5240	13.1	37.632	17	Pass

Frequency (MHz)	Measured Power (dBm)	Measurement bandwidth (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz))	Verdict
5180	3.4	1	3,4	4	Pass
5220	3.9	1	3.9	4	Pass
5240	3.9	1	3.9	4	Pass

Limit 15.407(a)(1):

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW (17dBm) or 4 dBm + 10 log B, where B is the 26–dB emission bandwidth in MHz.

In addition, the peak power spectral density shall not exceed 4 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

B.2 Carrier Power and Power Density 5.25 to 5.35 GHz and 5.47 to 5.725 GHz

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(a)(2)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	5.25 to 5.35 GHz and 5.47 to 5.725 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

Frequency (MHz)	Measured Power (dBm)	26 dB Bandwidth (MHz)	Limit (dBm)	Verdict
5260	13.3	37.636	24	Pass
5280	13.2	37.017	24	Pass
5320	13.5	37.069	24	Pass
5500	13.3	42.991	24	Pass
5600	13.1	42.950	24	Pass
5700	13.0	42.228	24	Pass

Frequency (MHz)	Measured Power (dBm)	Measurement bandwidth (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz))	Verdict
5260	4.4	1	4.4	11	Pass
5280	4.5	1	4.5	11	Pass
5320	4.2	1	4.2	11	Pass
5500	6.2	1	6.2	11	Pass
5600	4.2	1	6.2	11	Pass
5700	0.2	1	0.2	11	Pass

Limit 15.407(a)(2):

For the 5.25–5.35 GHz and 5.47–5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW (24dBm) or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz.

In addition, the peak power spectral density shall not exceed 11 dBm in any 1 megahertz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

B.3 Carrier Power and Power Density 5.725 GHz to 5.825 GHz

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(a)(3)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	5.725 GHz to 5.825 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

Frequency (MHz)	Measured Power (dBm)	26 dB Bandwidth (MHz)	Limit (dBm)	Verdict
5745	12.9	38.177	30	Pass
5785	12.7	32.048	30	Pass
5825	12.5	31.187	30	Pass

Frequency (MHz)	Measured Power (dBm)	Measurement bandwidth (MHz)	PSD (dBm/MHz)	Limit (dBm/MHz))	Verdict
5745	3.9	1	3.9	17	Pass
5785	3.6	1	3.6	17	Pass
5825	1.8	1	1.8	17	Pass

Limit 15.407(a)(3):

For the band 5.725–5.825 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 1 W or 17 dBm + 10 log B, where B is the 26-dB emission bandwidth in MHz.
In addition, the peak power spectral density shall not exceed 17 dBm in any 1 MHz band.

If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain up to 23 dBi without any corresponding reduction in the transmitter peak output power or peak power spectral density.

For fixed, point-to-point U-NII transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in peak transmitter power and peak power spectral density for each 1 dB of antenna gain in excess of 23 dBi would be required. Fixed, point to-point operations exclude the

use of point-to-multipoint systems, omni-directional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations

B.4 26 dB Bandwidth

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(a)(5)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz to 25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C

Frequency (MHz)	26 dB Bandwidth (MHz)
5180	37.845
5220	37.212
5240	37.632
5260	37.636
5280	37.017
5320	37.069
5500	42.991
5600	42.950
5700	42.228
5745	38.177
5785	32.048
5825	31.187

Limit 15.407(a)(5):

No limit is specified for this parameter, the values recorded are used to derive limits for other measurements.

B.5 Peak to average power ratio

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(a)(6)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz to 25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C

Frequency (MHz)	Peak Power (dBm)	Average Power (dBm)	Peak/Average Ratio (dB)	Verdict
5180	17.4	13.2	4.2	Pass
5220	17.8	13.4	4.4	Pass
5240	17.5	13.1	4.4	Pass
5260	17.4	13.3	4.1	Pass
5280	17.4	13.2	4.2	Pass
5320	17.7	13.5	4.2	Pass
5500	17.3	13.3	4.0	Pass
5600	17.2	13.1	4.1	Pass
5700	17.4	13.0	4.4	Pass
5745	17.1	12.9	4.2	Pass
5785	17.0	12.7	4.3	Pass
5825	16.8	12.5	4.3	Pass

Limit 15.407(a)(6):

The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power (measured as specified above in Sections B.1 to B.3) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

B.6 Undesirable emission 5.15 to 5.25 GHz operation

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(b)(1)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	1GHz to 40 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

All emissions were at least 20db below the test limit

Limit 15.407(b)(1):

For transmitters operating in the5.15–5.25 GHz band: all emissions above 1 GHz outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz. (equivalent to an electric field strength of 70 dBµV at 3m)

B.7 Undesirable emission 5.25 to 5.35 GHz operation

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(b)(2)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	1GHz to 40 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

All emissions were at least 20db below the test limit

Limit 15.407(b)(2):

For transmitters operating in the 5.25–5.35 GHz band: all emissions above 1 GHz outside of the 5.15–5.35 GHz band shall not exceed an EIRP of –27 dBm/MHz (equivalent to an electric field strength of 70 dBµV at 3m). Devices operating in the 5.25–5.35 GHz band that generate emissions in the 5.15–5.25 GHz band must meet all applicable technical requirements for operation in the 5.15–5.25 GHz band (including indoor use) or alternatively meet an out-of-band emission EIRP limit above 1 GHz of –27 dBm/MHz in the 5.15–5.25 GHz band (equivalent to an electric field strength of 70 dBµV at 3m).

B.8 Undesirable emission 5.47 to 5.725 GHz operation

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(b)(3)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	1GHz to 40 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

All emissions were at least 20db below the test limit

Limit 15.407(b)(3):

For transmitters operating in the 5.47–5.725 GHz band: all emissions above 1 GHz outside of the 5.47–5.725 GHz band shall not exceed an EIRP of -27 dBm/MHz (equivalent to an electric field strength of 70 dBμV at 3m).

B.9 Undesirable emission 5.725 GHz to 5.825 GHz operation

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(b)(4)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	1GHz to 40 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

All emissions were at least 20db below the test limit

Limit 15.407(b)(4):

For transmitters operating in the 5.725–5.825 GHz band: all emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an EIRP of –17 dBm/MHz (equivalent to an electric field strength of 80 dBµV at 3m); for frequencies above 1 GHz which are 10 MHz or greater above or below the band edge, emissions shall not exceed an EIRP of –27 dBm/MHz (equivalent to an electric field strength of 70 dBµV at 3m).

B.10 Unwanted emissions below 1 GHz

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(b)(6)
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz to 1 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	Laptop
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

Frequency (MHz)	Max Reading (dBuV)	Cable Loss (dB)	Antenna Fact (dB/m)	Preamp (dB)	Field Strength (dBuV/m)	Extrap Fact (dB)	Field Strength (dBuV/m)	Limit (dBuV/m)
37.900	53.9	0.7	7.1	31.5	34.6	0	34.6	40
51.000	46.4	0.8	10.8	31.5	25.3	0	25.3	43.5
81.171	56.8	0.9	12.1	31.5	33.0	0	33.0	43.5
108.800	50.7	1.3	13	31.5	30.7	0	30.7	43.5
166.715	50.6	1.3	11.4	31.5	32.1	0	32.1	43.5
190.800	47.3	3.2	21.2	31.4	30.1	0	30.1	43.5
250.000	53.7	0.7	7.1	31.4	34.9	0	34.9	46
799.982	52.7	0.8	10.8	31.5	45.7	0	45.7	46

Limit 15.407(b)(6):

Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in section 15.209.

B.11 Frequency stability under all normal operating conditions

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.407(g)
Measurement standard	ANSI C63.10, OET Guidance Notes
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	S03
EUT set up	Refer to Appendix C
Temperature	20^0C

Channel frequency (MHz)	**Maximum Measured frequency deviation of modulation envelope (ppm)**	**Maximum Permissible frequency deviation of modulation envelope (ppm)**
5180	+245	-1930
5320	+292	+1880
5500	+268	-1818
5785	+277	+3457

Note: The values in the table above rep[resent the worst case results under the declared operating voltage temperature extremes.

Limit 15.407(g):

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the users manual.

For WLAN operating in the bands 5.15 to 5.25 GHz, 5.25 to 5.35 GHz, 5.47 to 5.725 and 5.725 to 5.825 GHz bands using 40 MHz channel bandwidths (Ch_{BW}) (worst case values), the following maximum values of frequency deviation are derived below.

Channel frequency (MHz) (C_f)	Band edge frequency (MHz) (B_f)	Maximum Permissible frequency deviation of modulation envelope (MHz) (B_f-(C_f±(Ch_{BW}/2))	Maximum Permissible frequency deviation of modulation envelope (ppm)
5180	5150	-10	-1930
5320	5350	+10	+1880
5500	5470	-10	-1818
5785	5825	+20	+3457

B.12 Transmit power control 5.25 to 5.35 GHz and 5.47 to 5.725 GHz

Test Details: See note	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.10, OET Guidance Notes
Frequency range	30MHz to 25 GHz
EUT sample number	S03
Modification state	0
SE in test environment	S05/S06
SE isolated from EUT	S03
EUT set up	Refer to Appendix C
Temperature	20^0C
Photographs (Appendix F)	1

This requirement is not applicable as the device transmits less than 500 mW (27dBm)

Limit 15.407(h)(1):

UNII devices operating in the 5.25–5.35 GHz band and the 5.47–5.725 GHz band shall employ a TPC mechanism. The UNII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

Appendix C: Supporting Graphical Data

This appendix contains graphical data obtained during testing.

Notes:

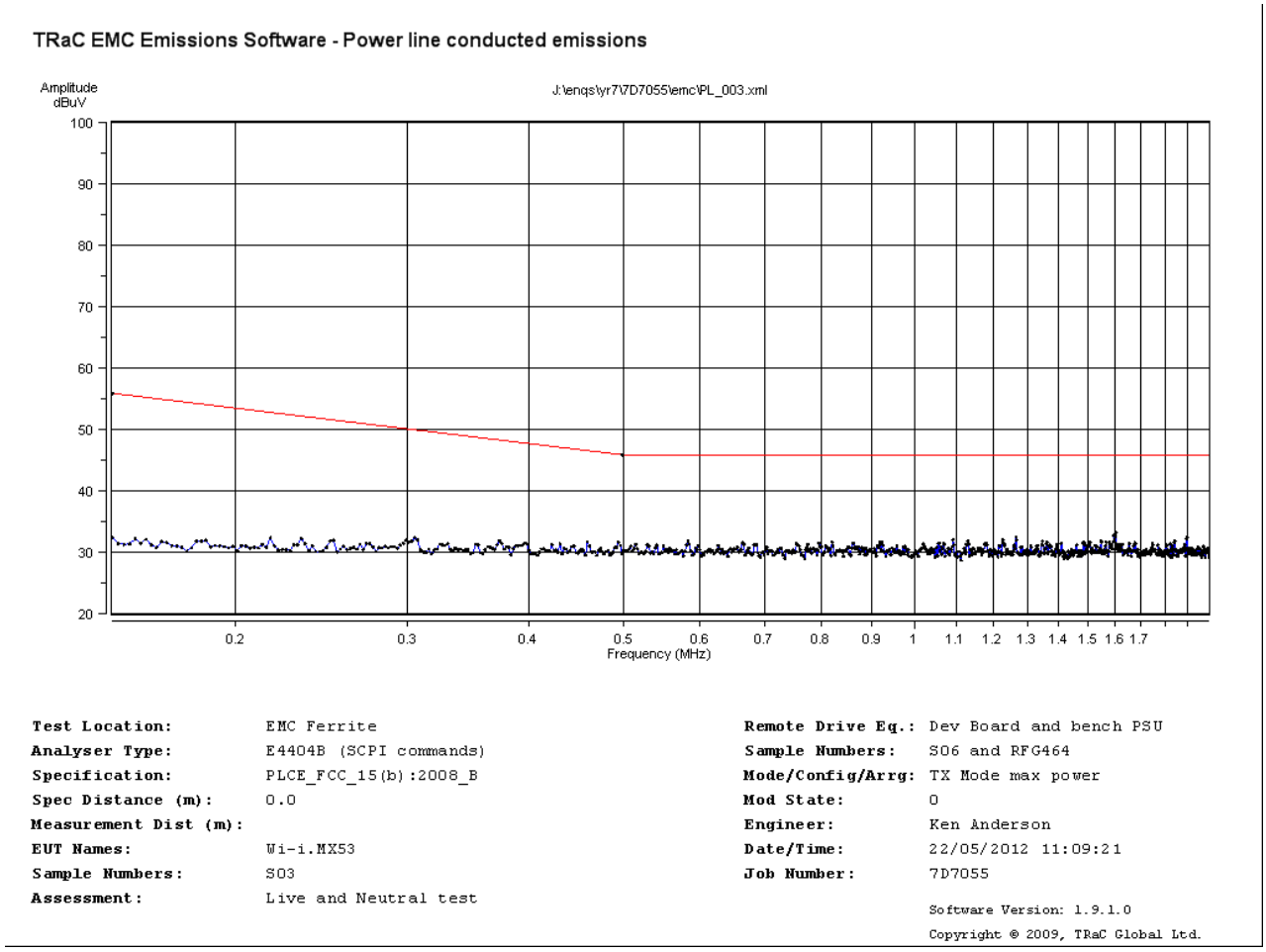
(a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.

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

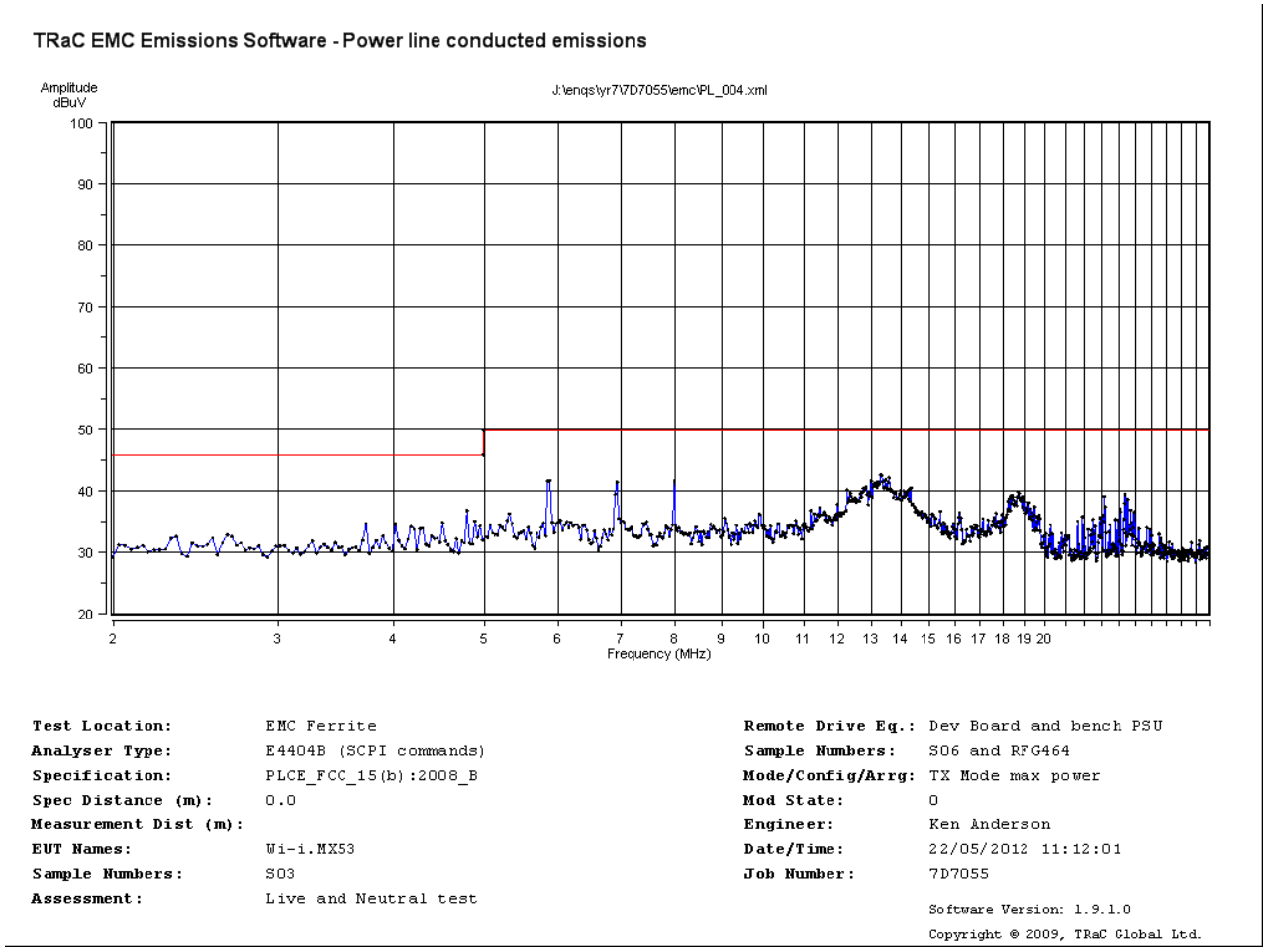
(c) Where relevant, on power line conducted emission plots, the limit displayed is the average limit, which is stricter than the quasi peak limit.

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

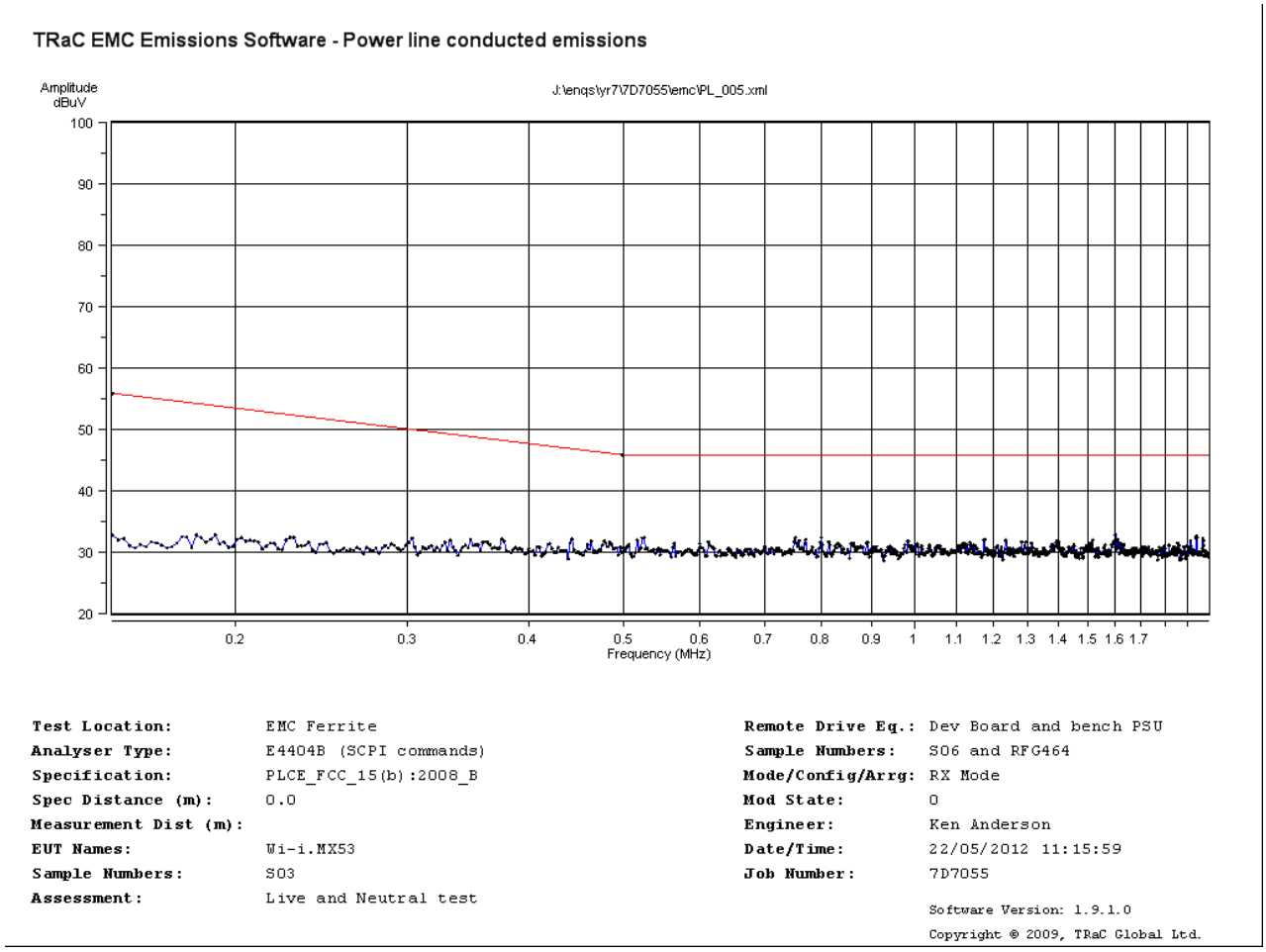
(e) The plots presented in this appendix may not be a complete record of the measurements performed, but are a representative sample, relative to the final assessment.



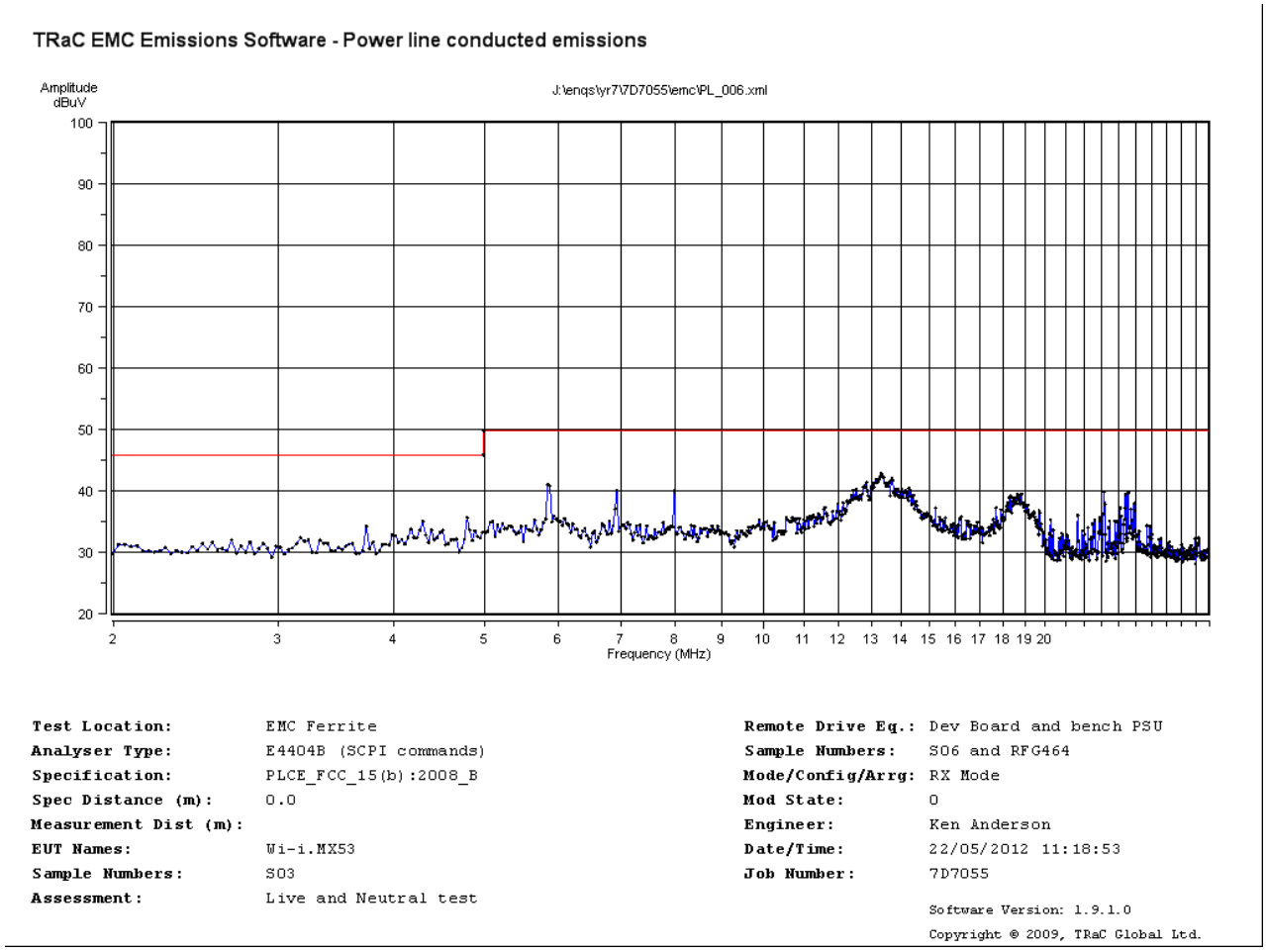
Powerline conducted emissions –Tx 0.15 MHz to 2 MHz



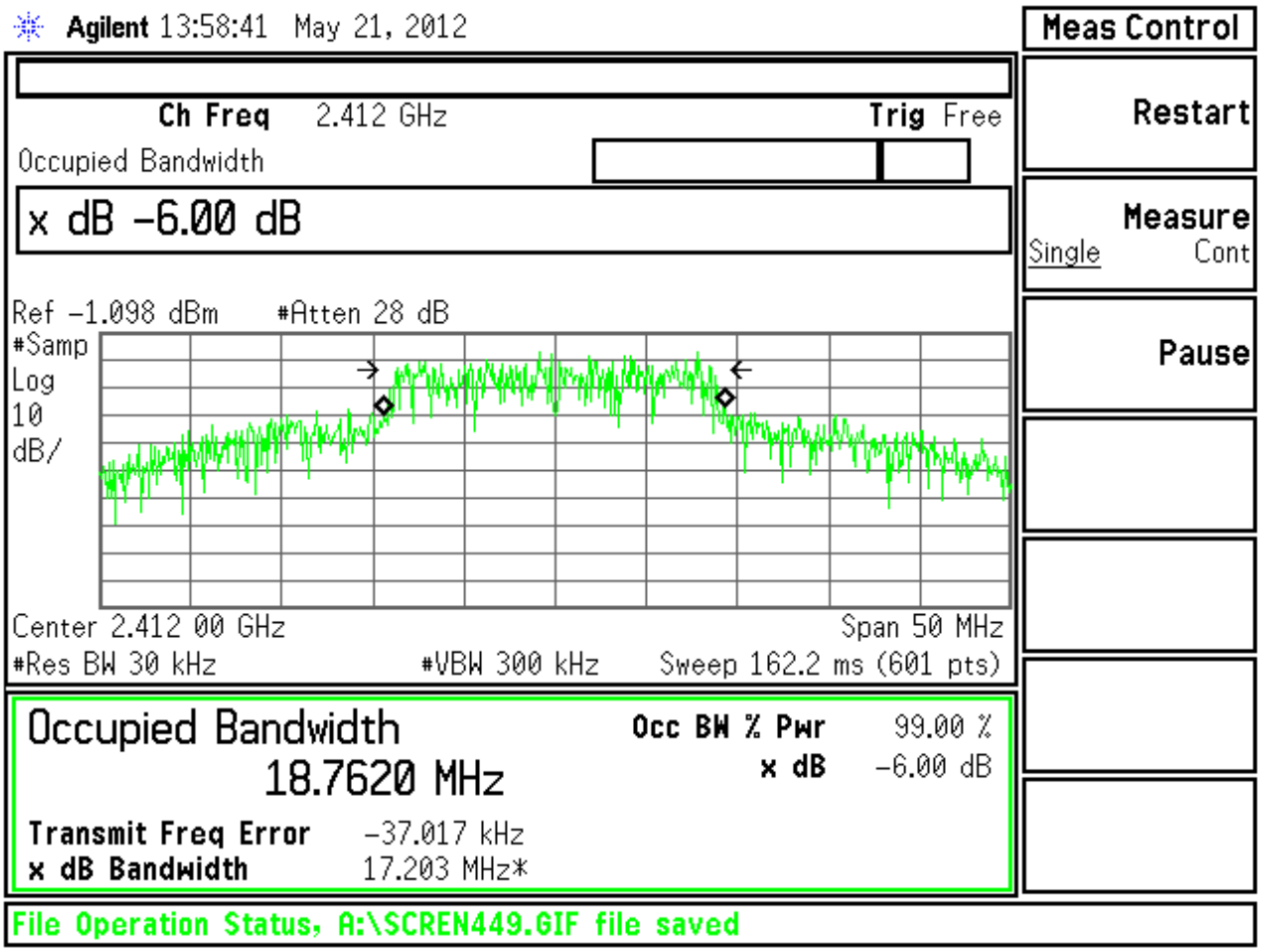
Powerline conducted emissions – Tx 2MHz to 30 MHz



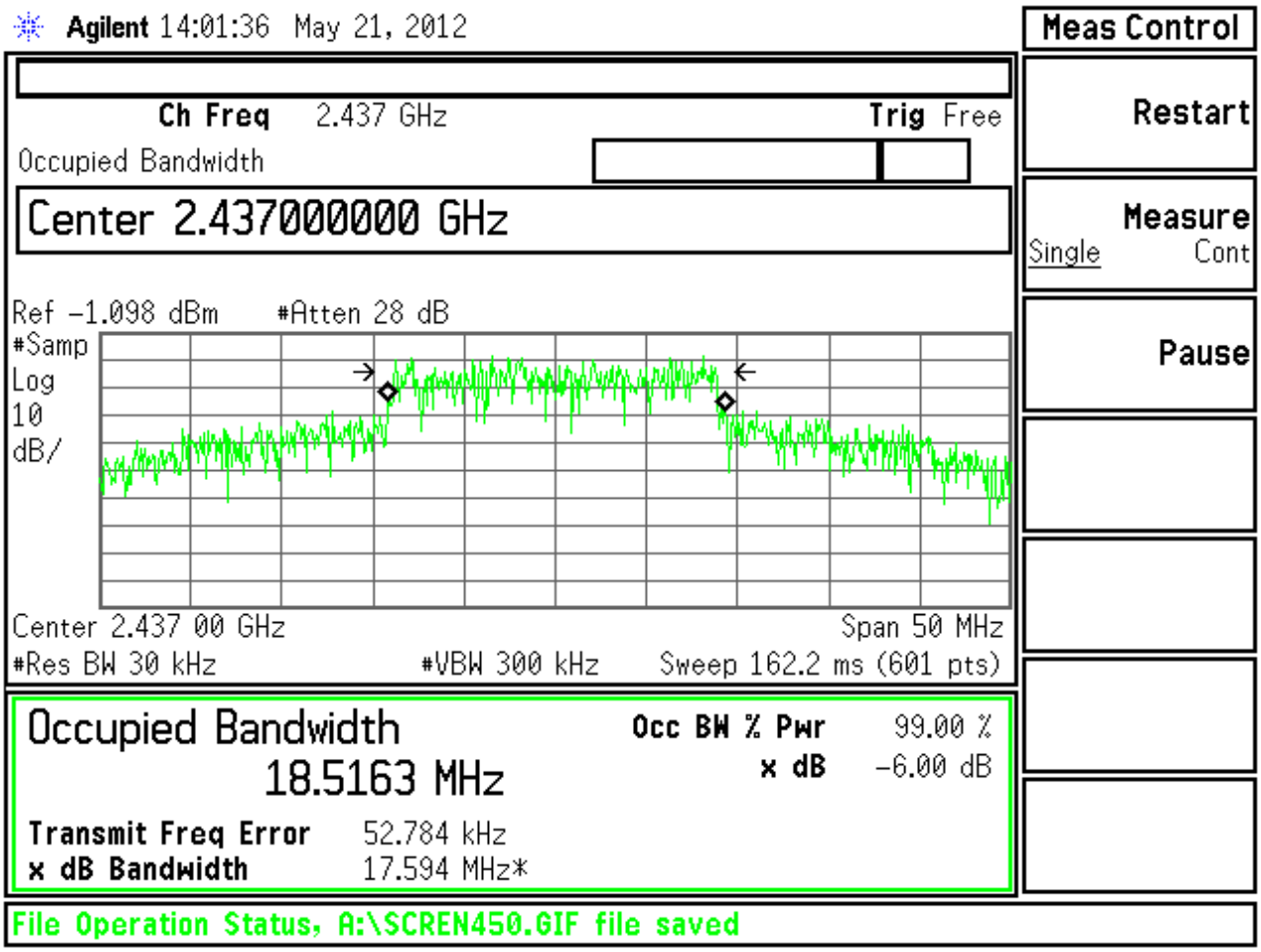
Powerline conducted emissions – Tx 0.15 MHz to 2 MHz



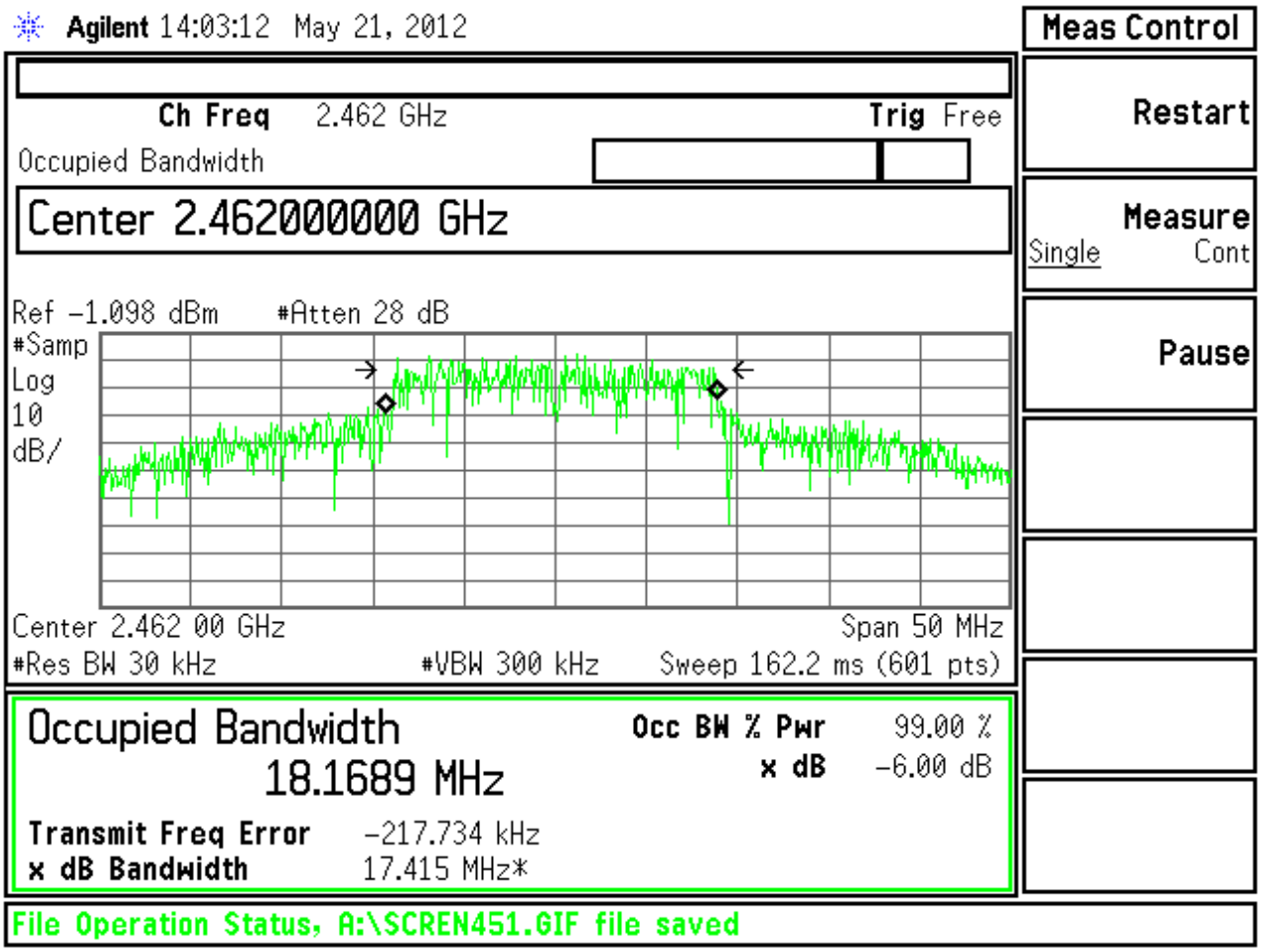
Powerline conducted emissions – Tx 2MHz to 30 MHz



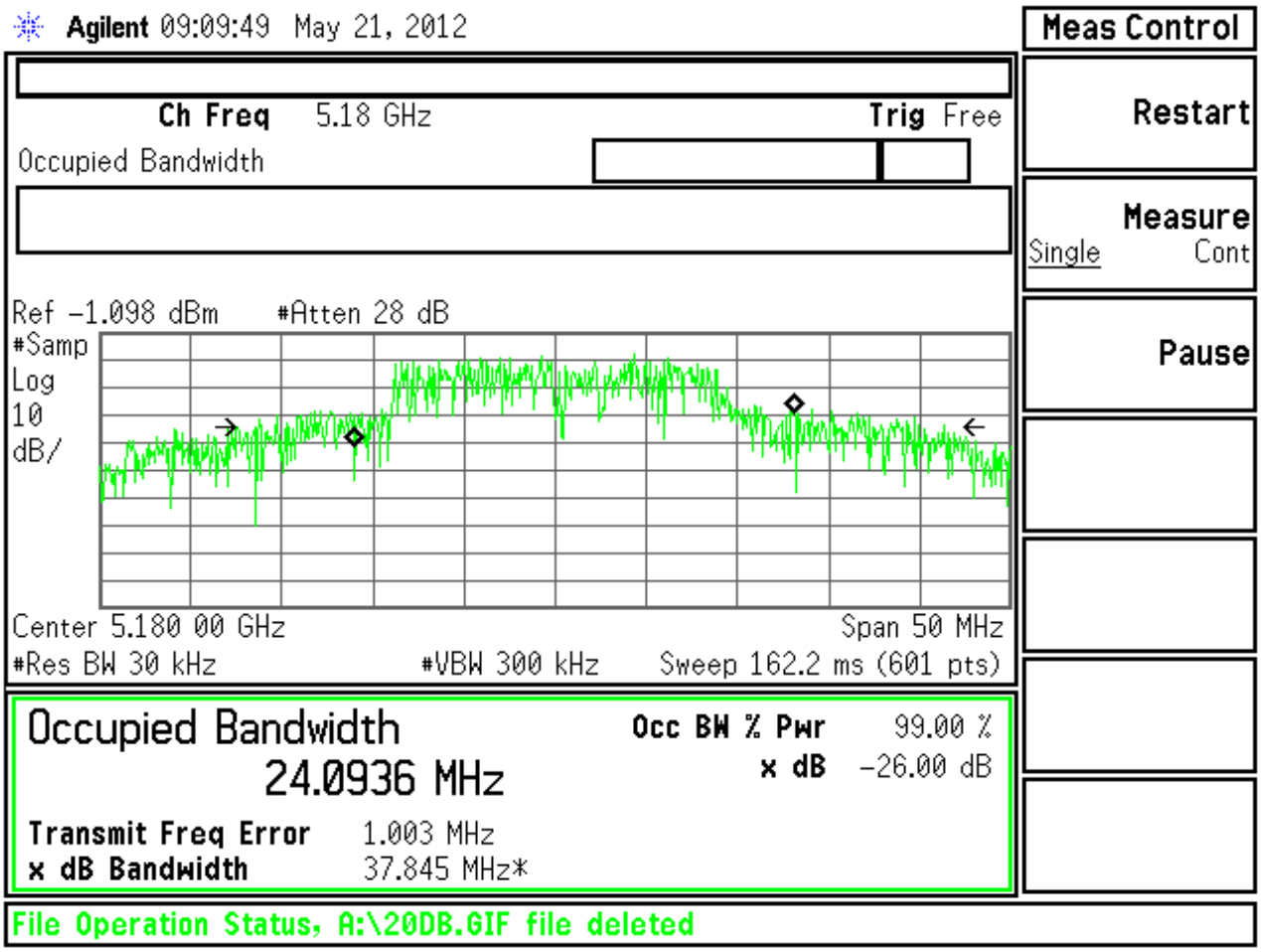
6dB Bandwidth - Channel 2412 MHz



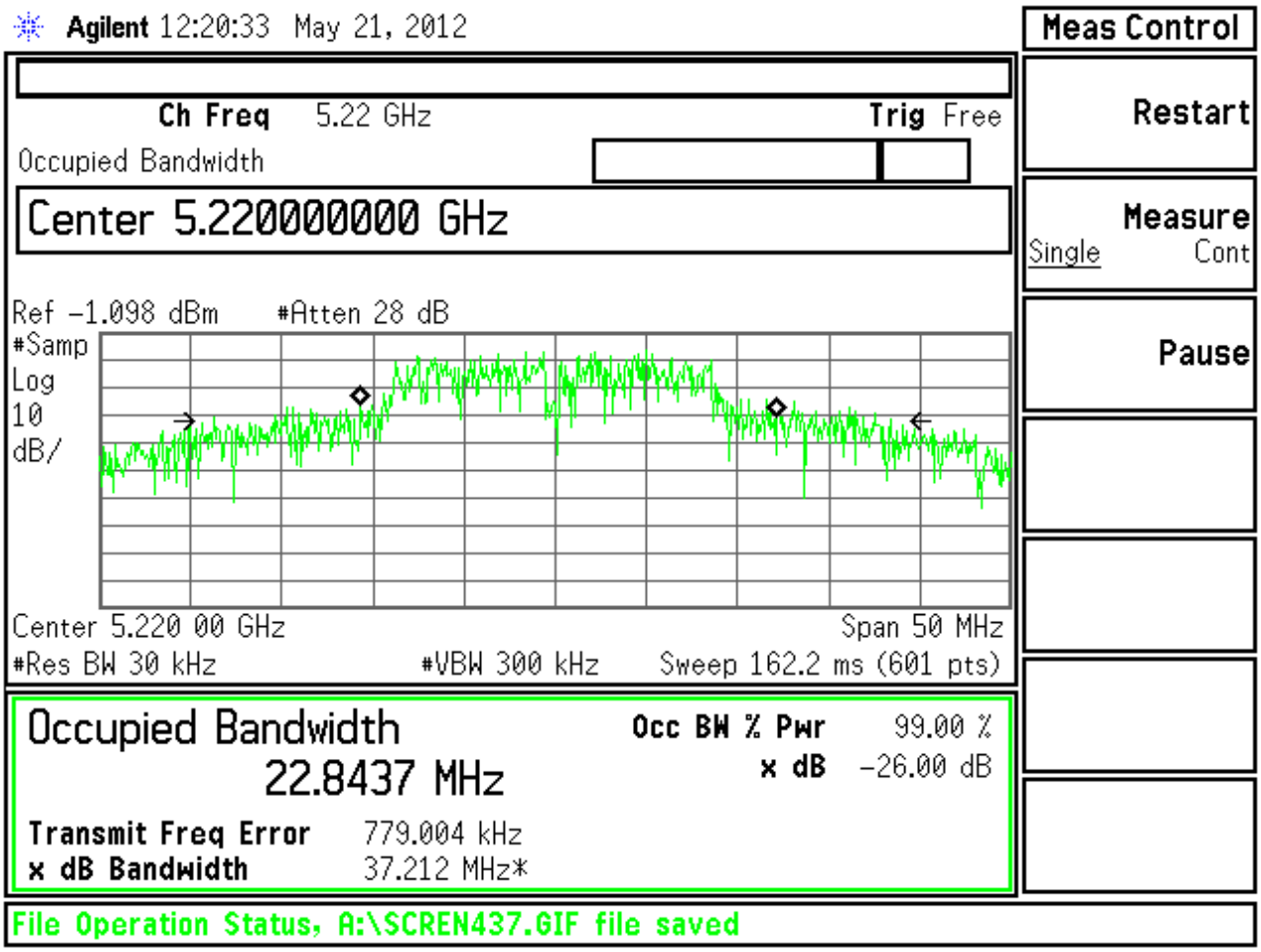
6dB Bandwidth - 2437 MHz



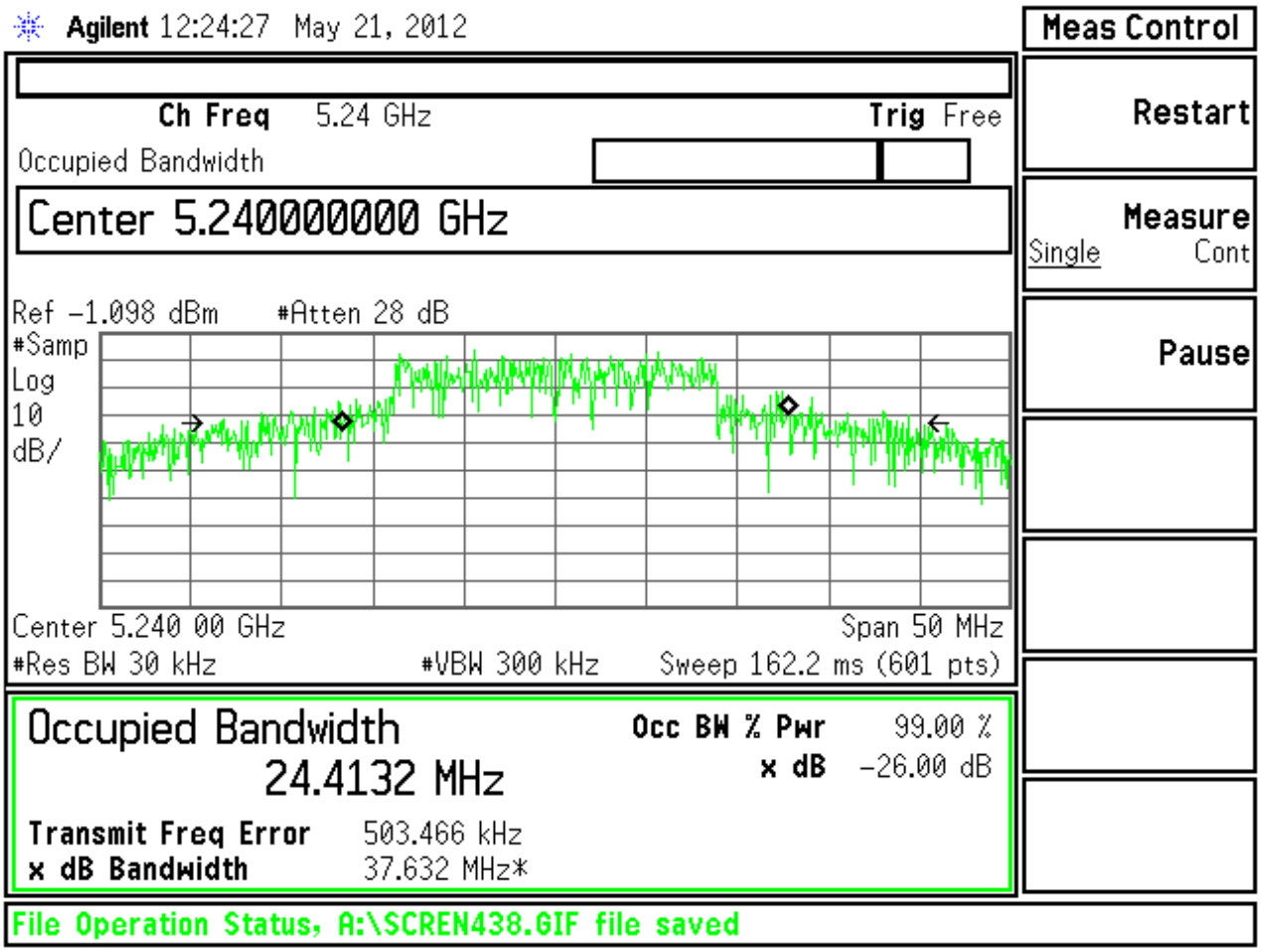
6dB Bandwidth - 2462 MHz



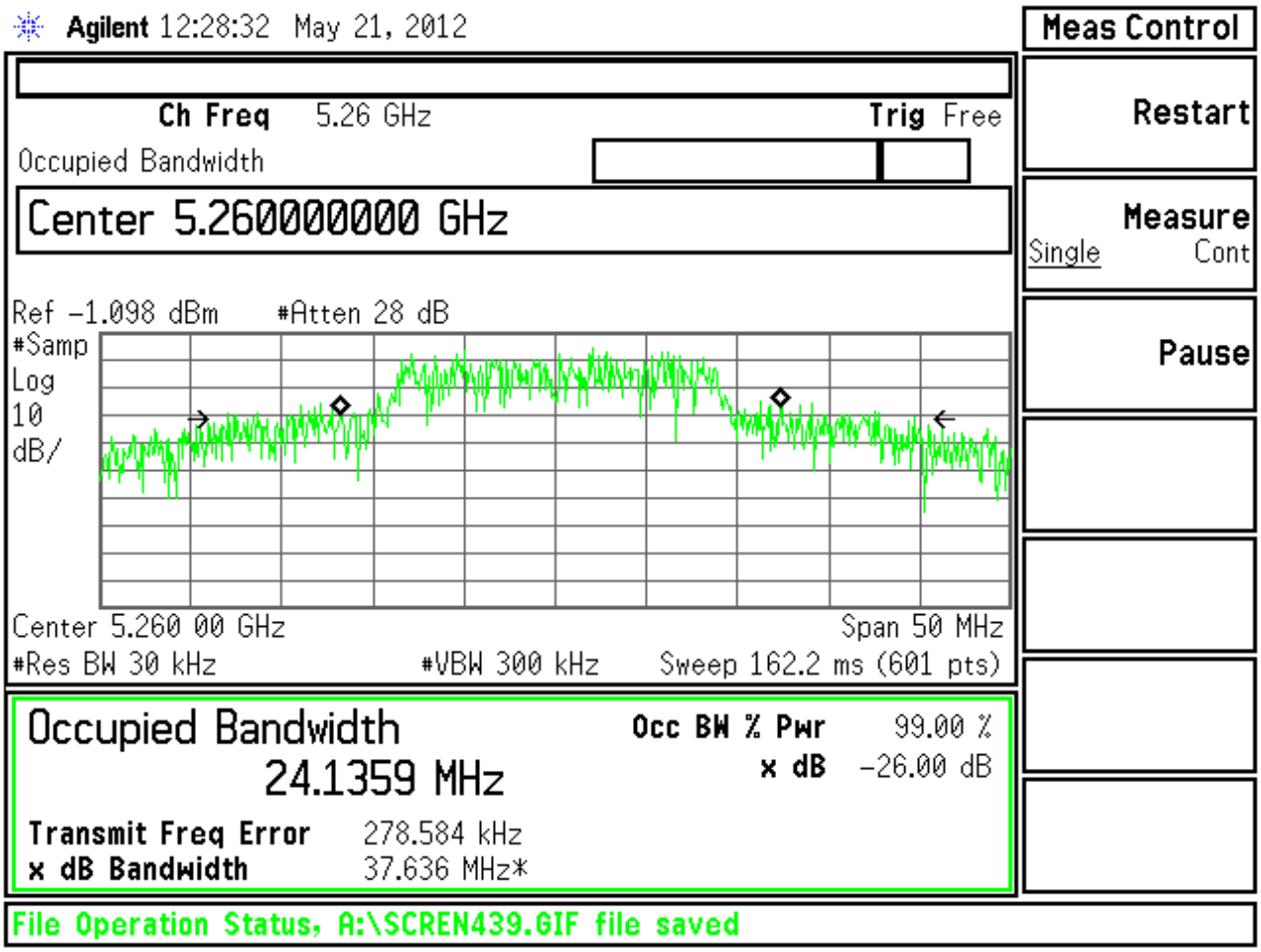
26dB Bandwidth - 5180 MHz



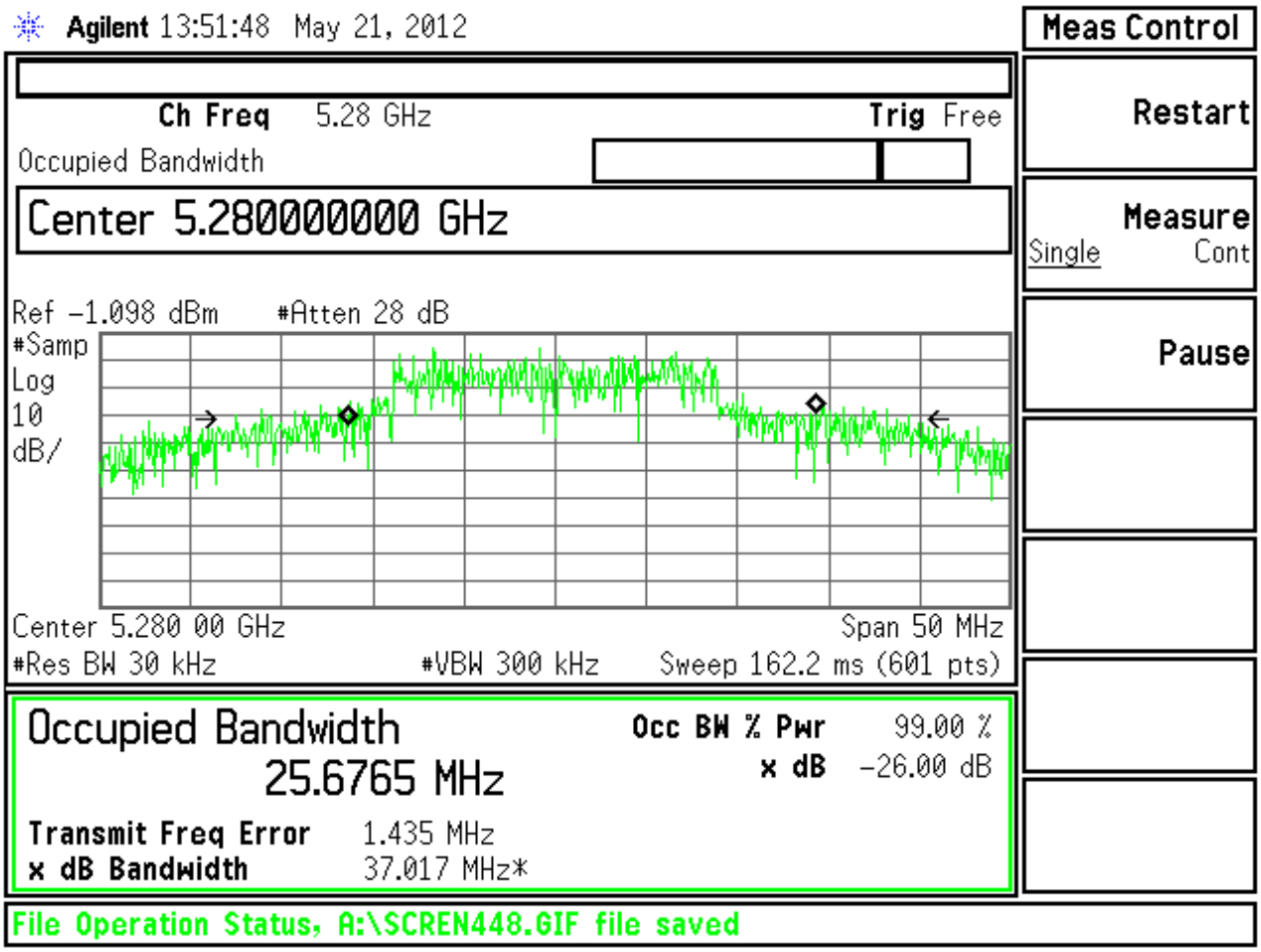
26dB Bandwidth – 5220 MHz



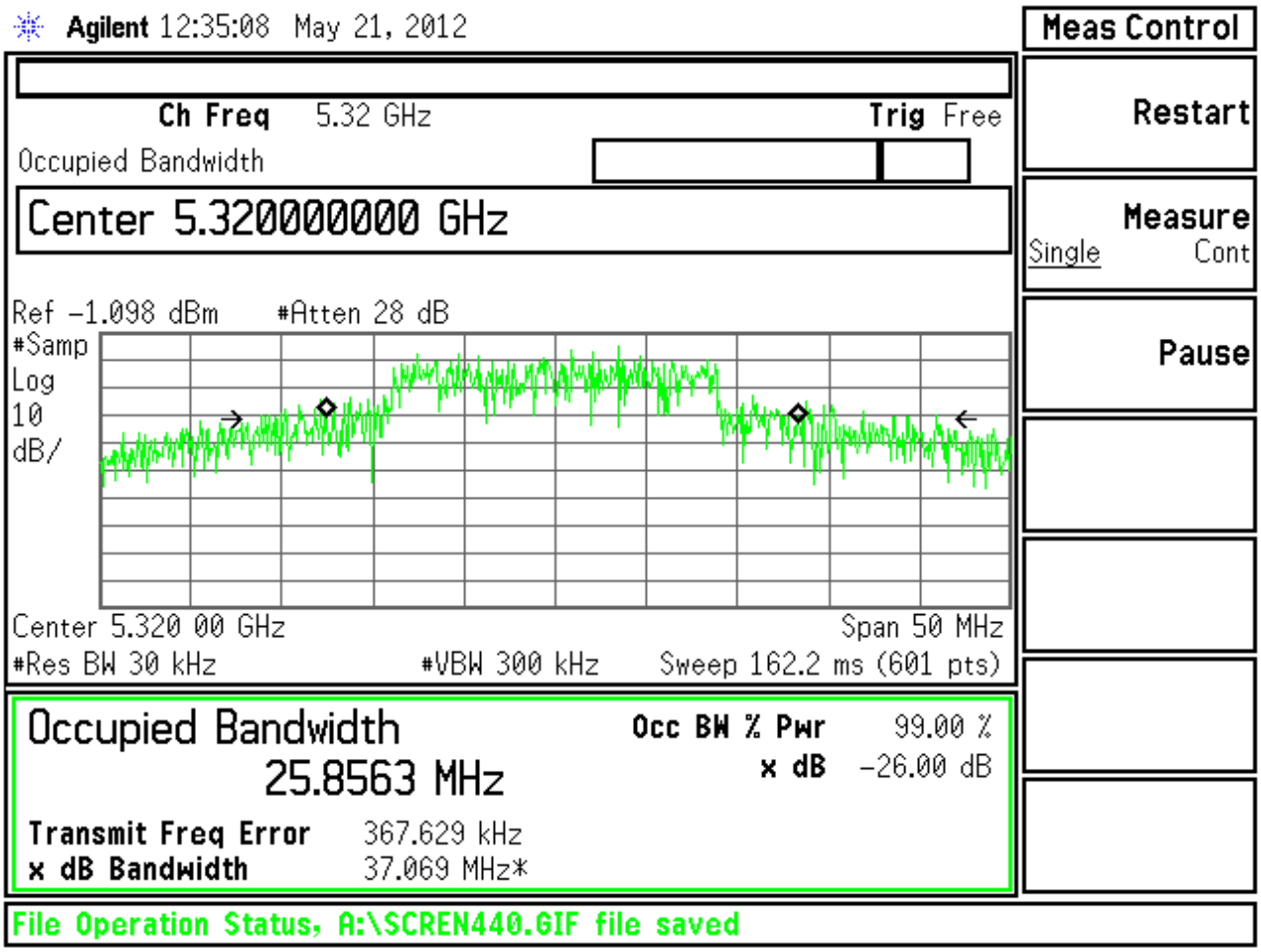
26dB Bandwidth – 5240 MHz



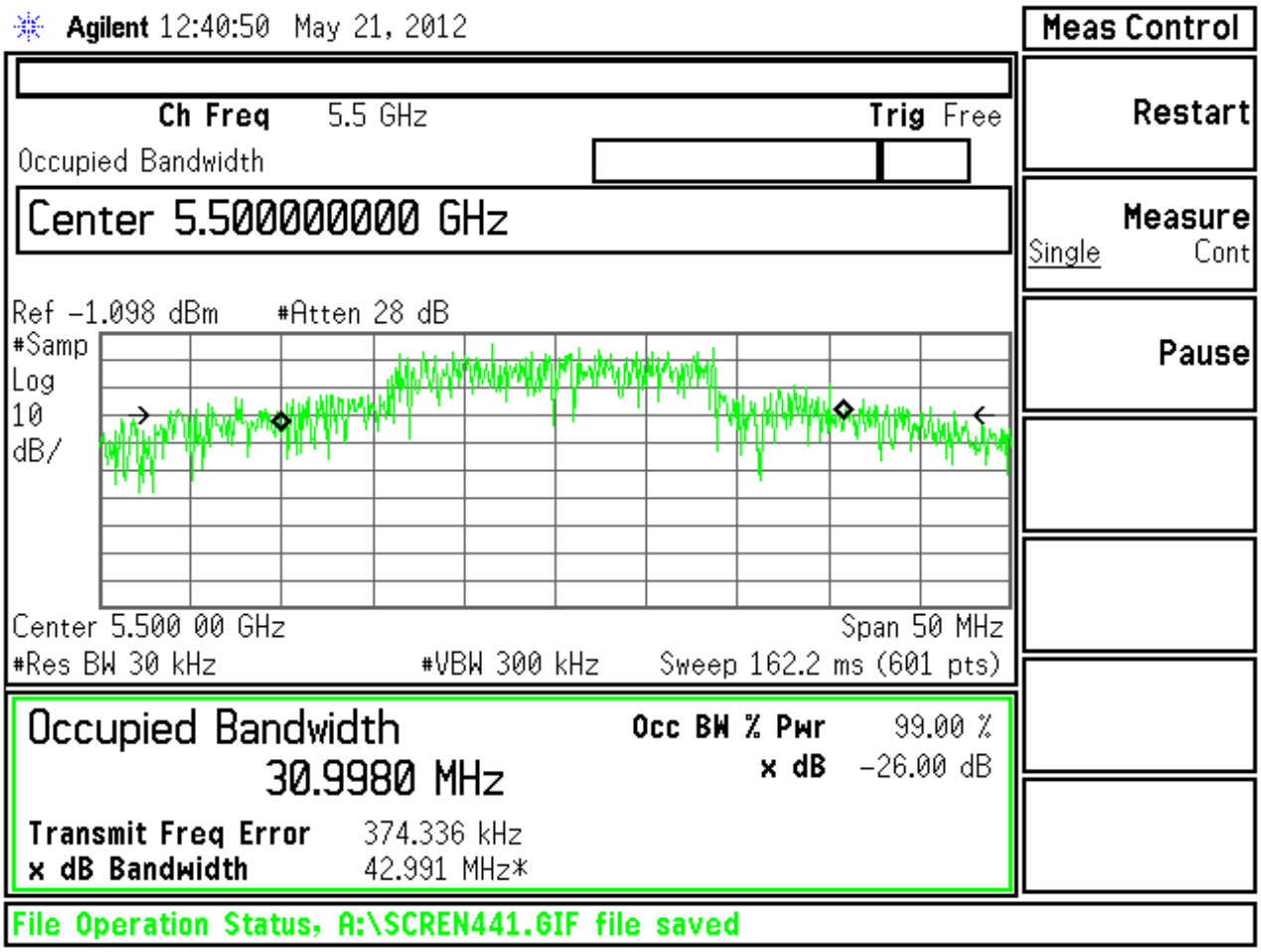
26dB Bandwidth – 5260 MHz



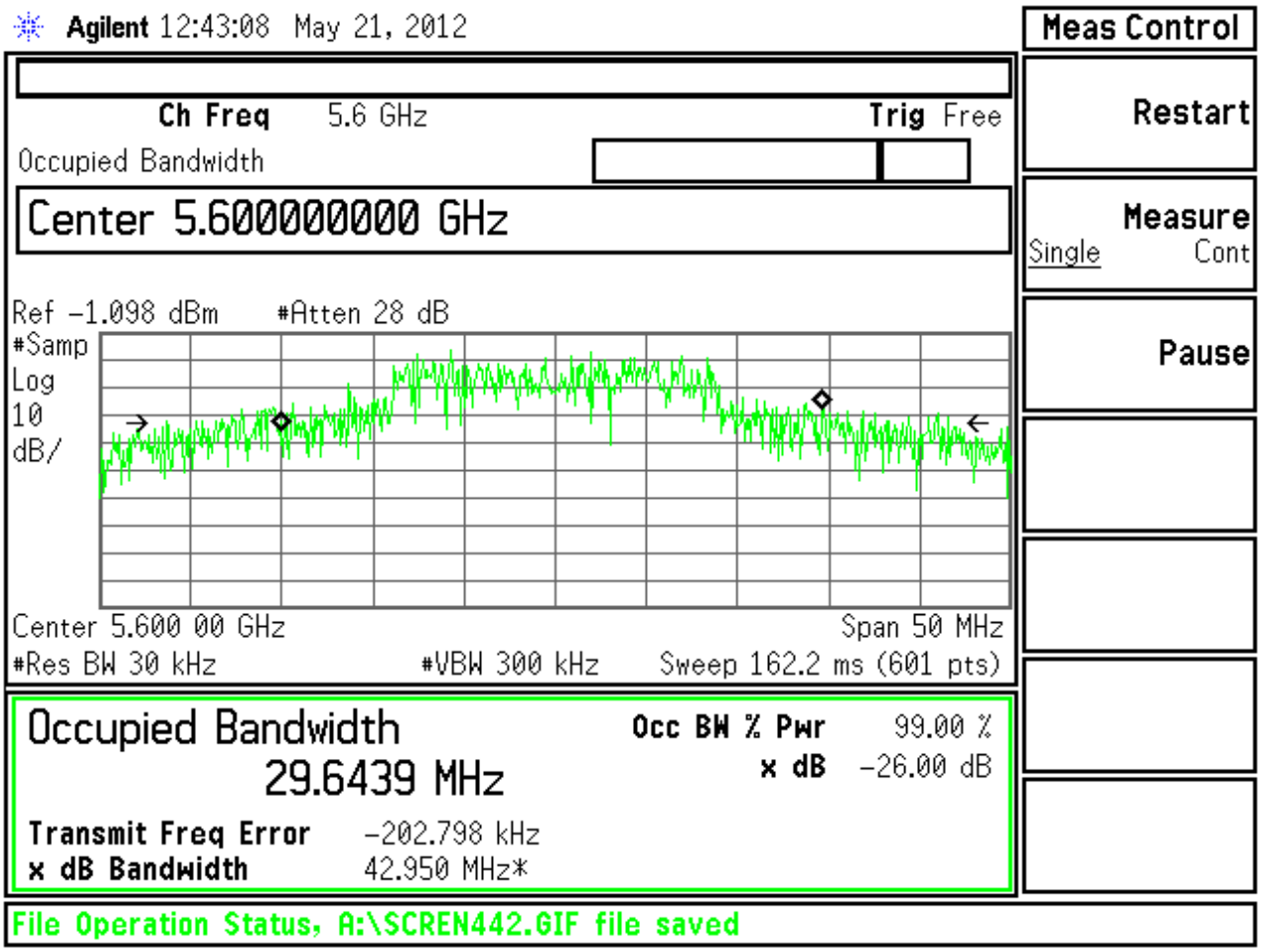
26dB Bandwidth – 5280 MHz



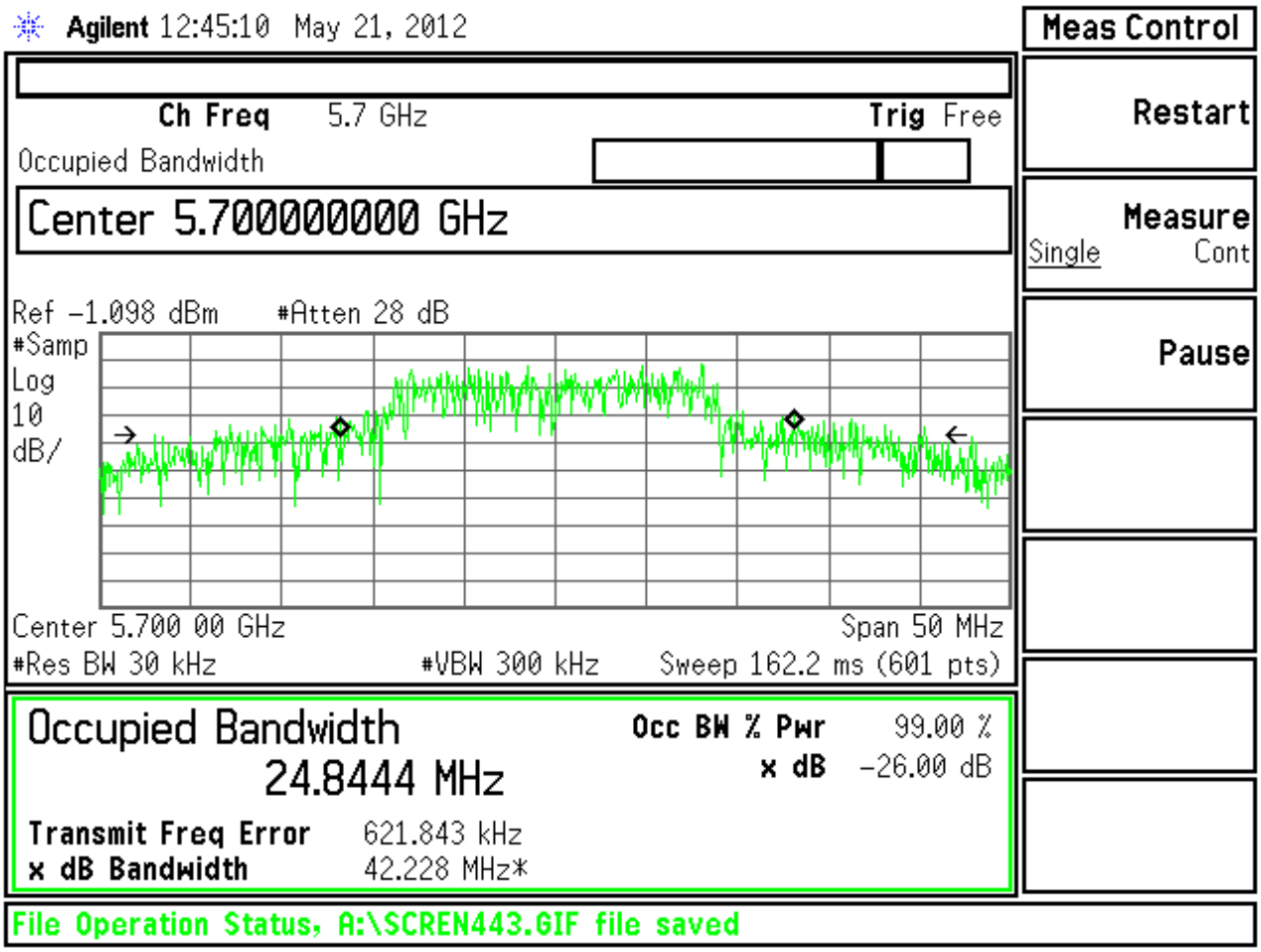
26dB Bandwidth – 5320 MHz



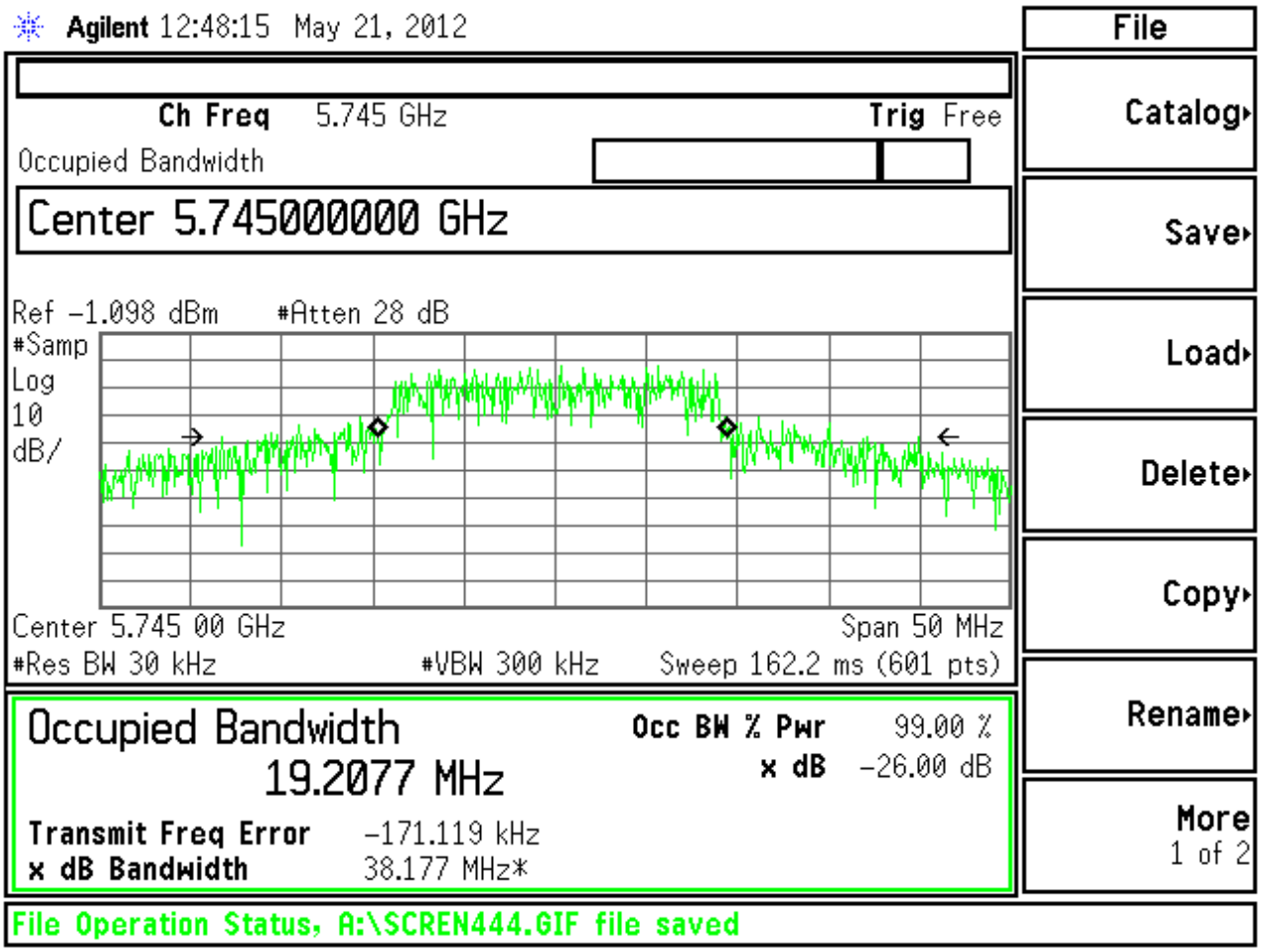
26dB Bandwidth – 5500 MHz



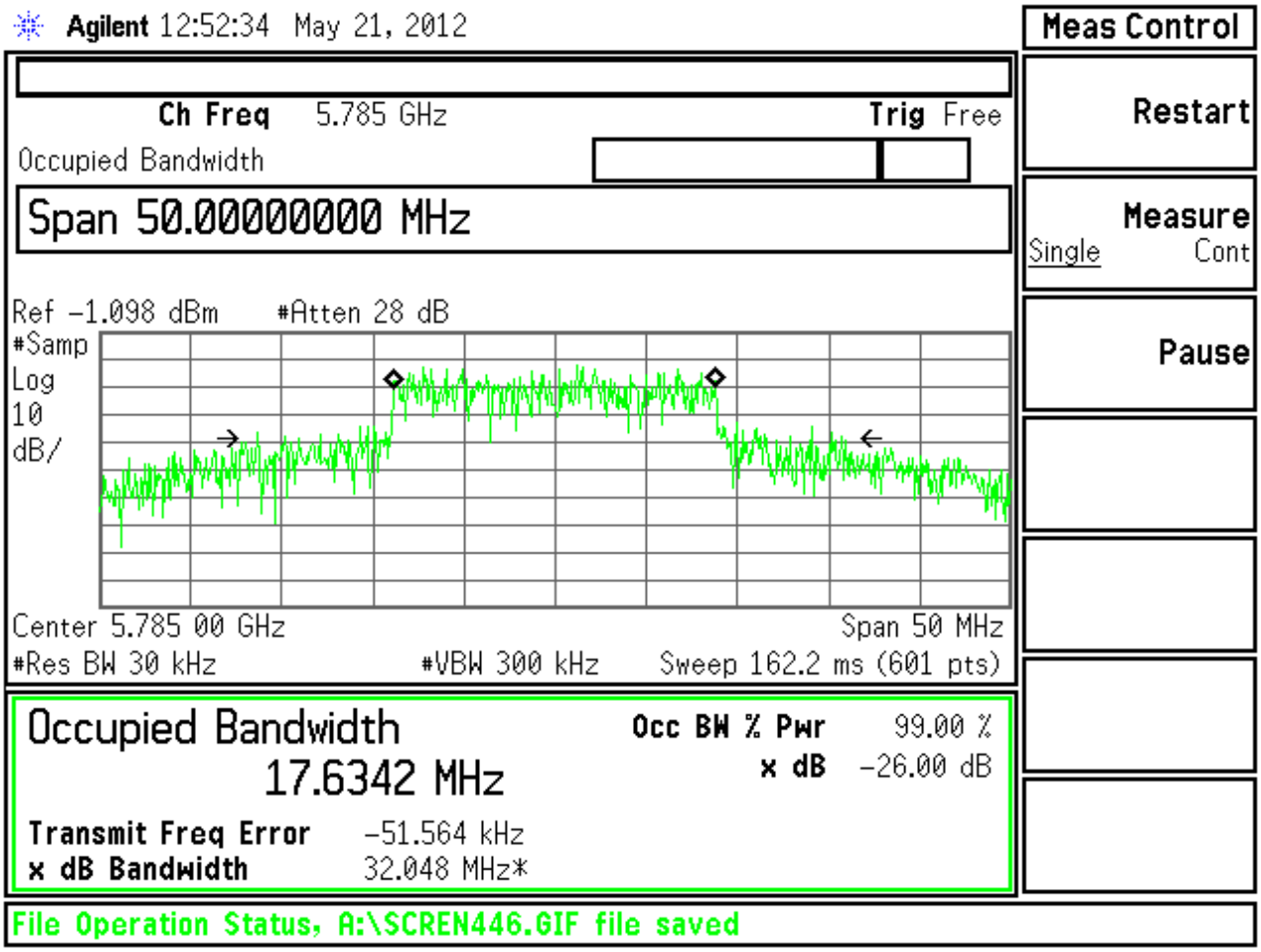
26dB Bandwidth – 5600 MHz



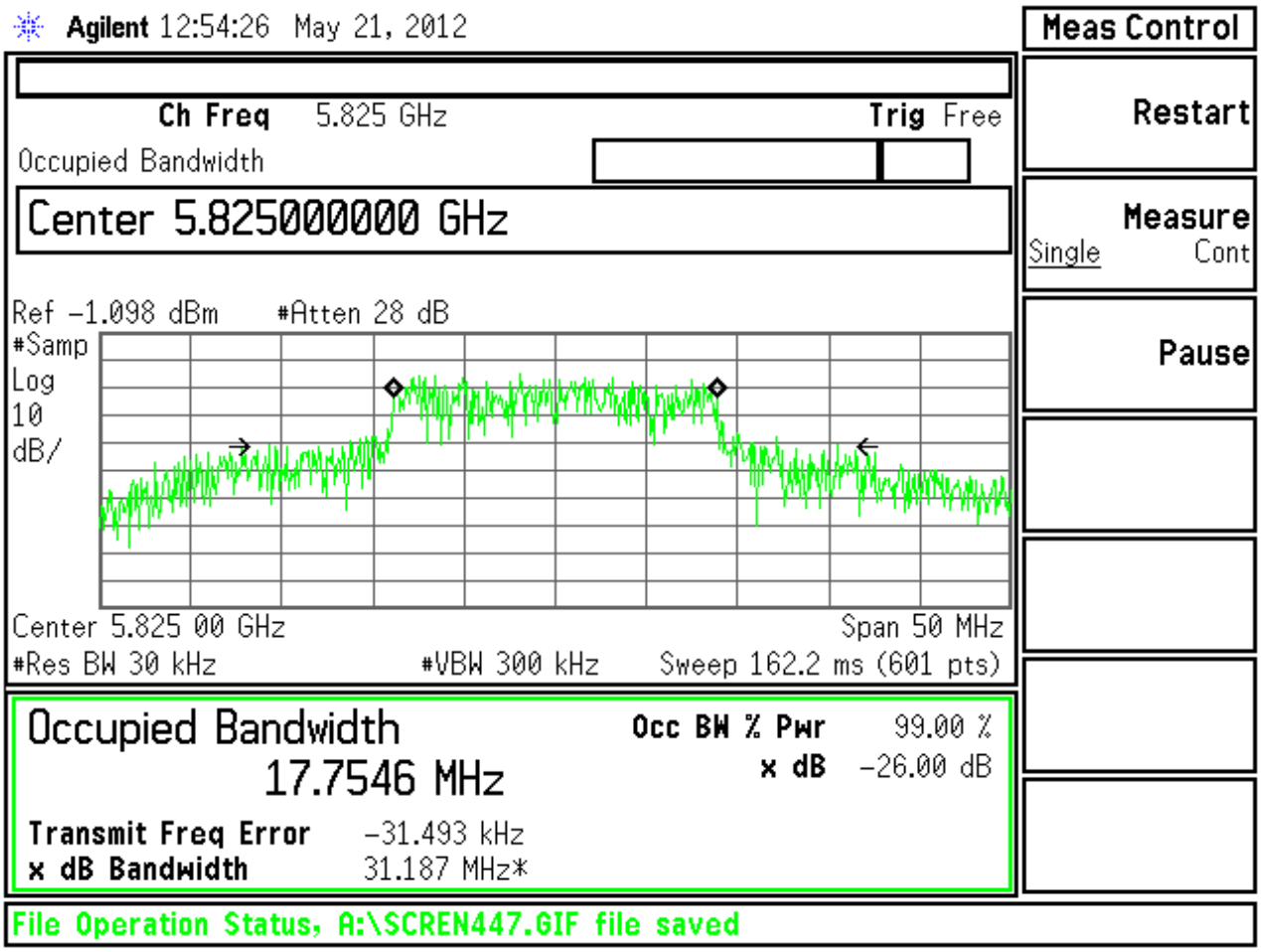
26dB Bandwidth – 5700 MHz



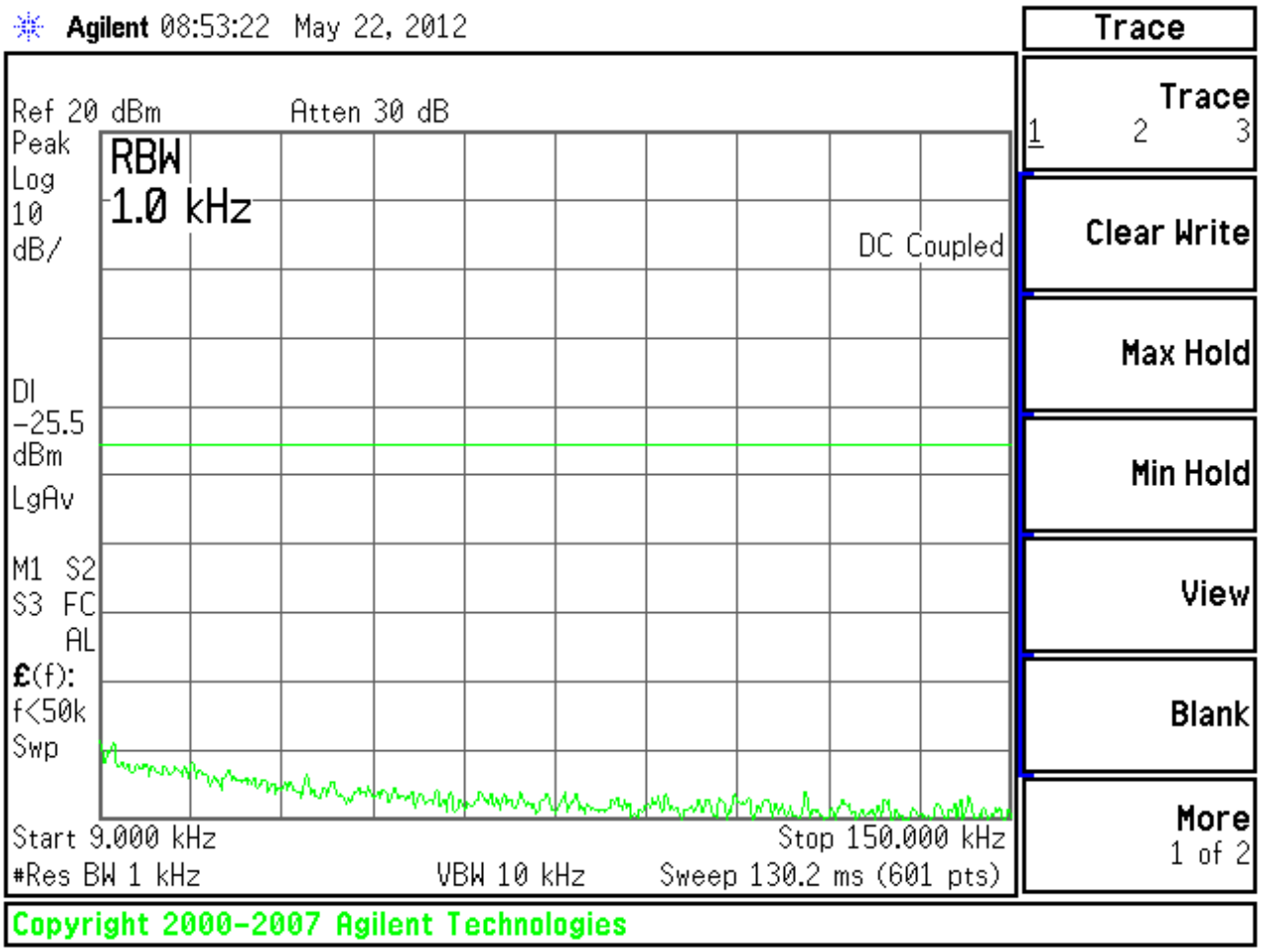
26dB Bandwidth – 5745 MHz



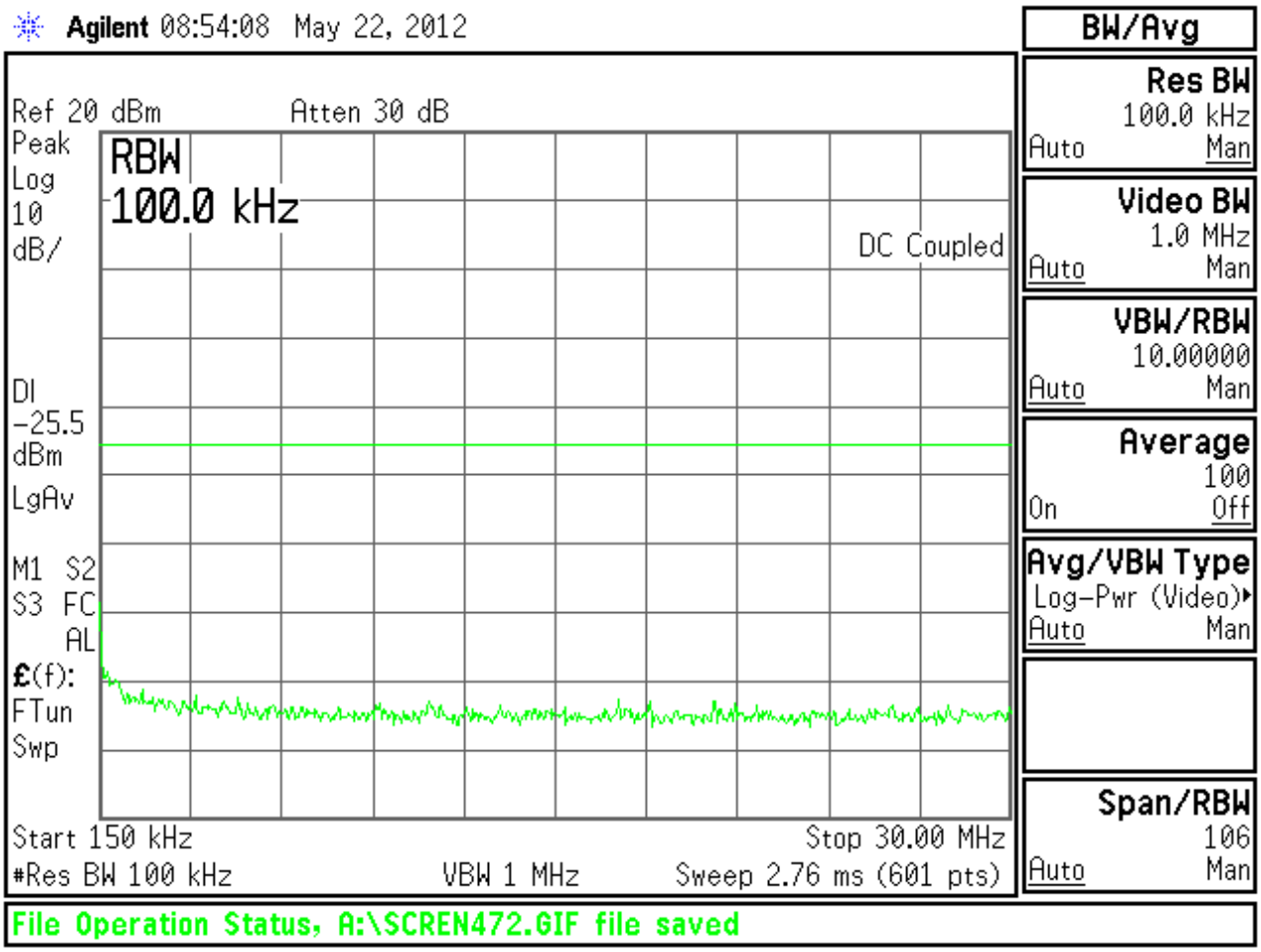
26dB Bandwidth – 5785 MHz



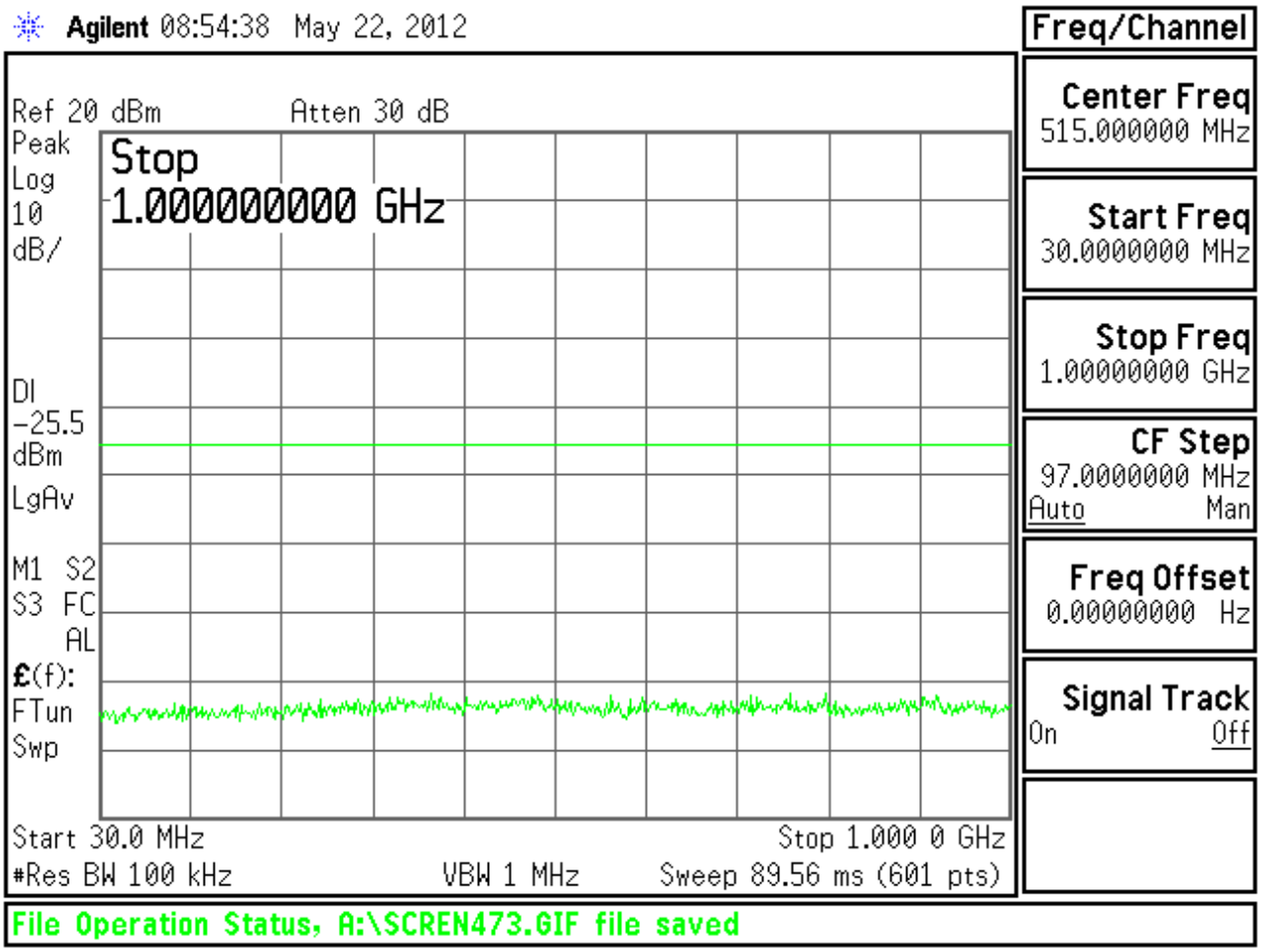
26dB Bandwidth – 5825 MHz



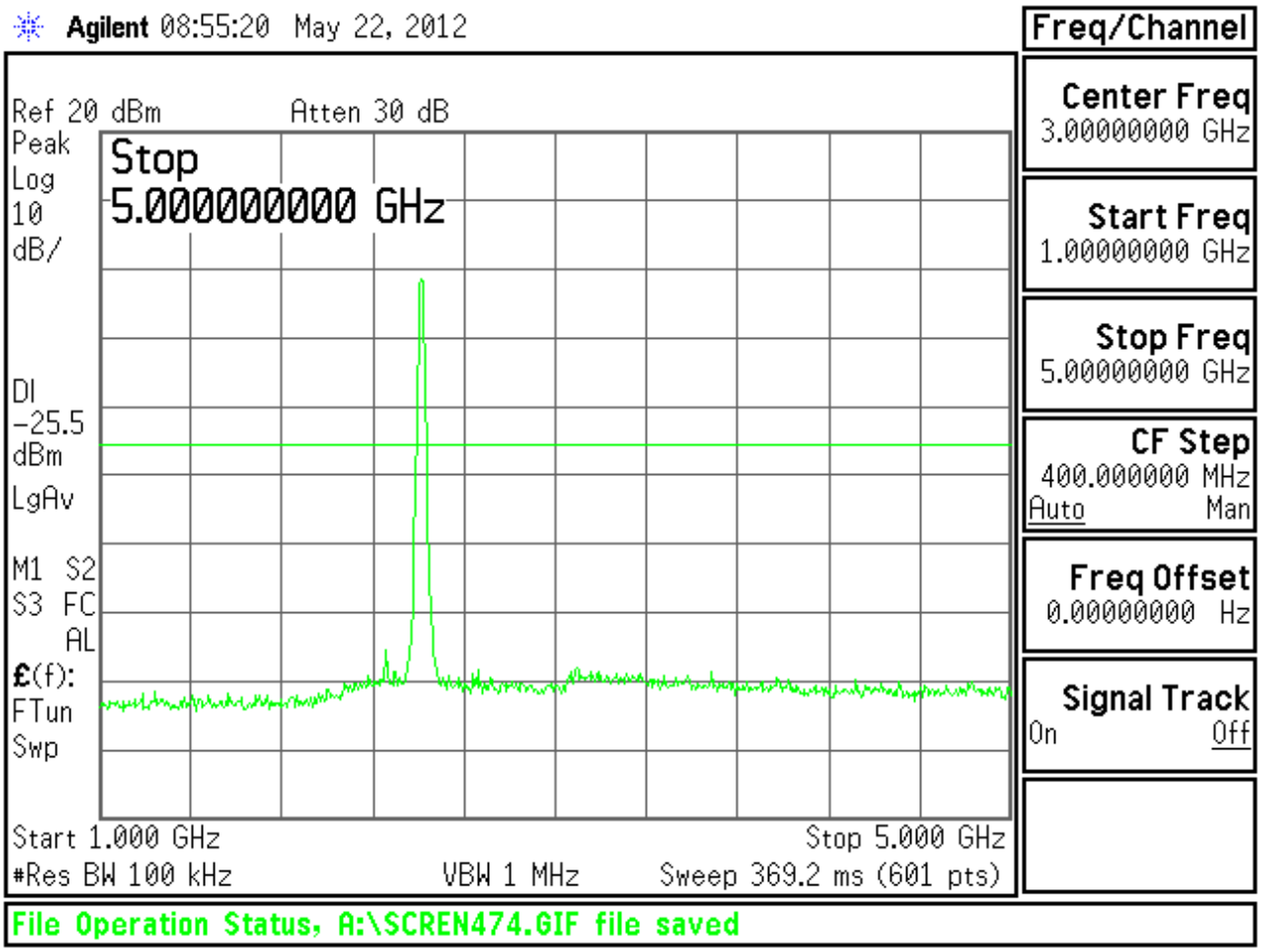
Conducted Spurious emissions 9kHz to 150 kHz Channel 1



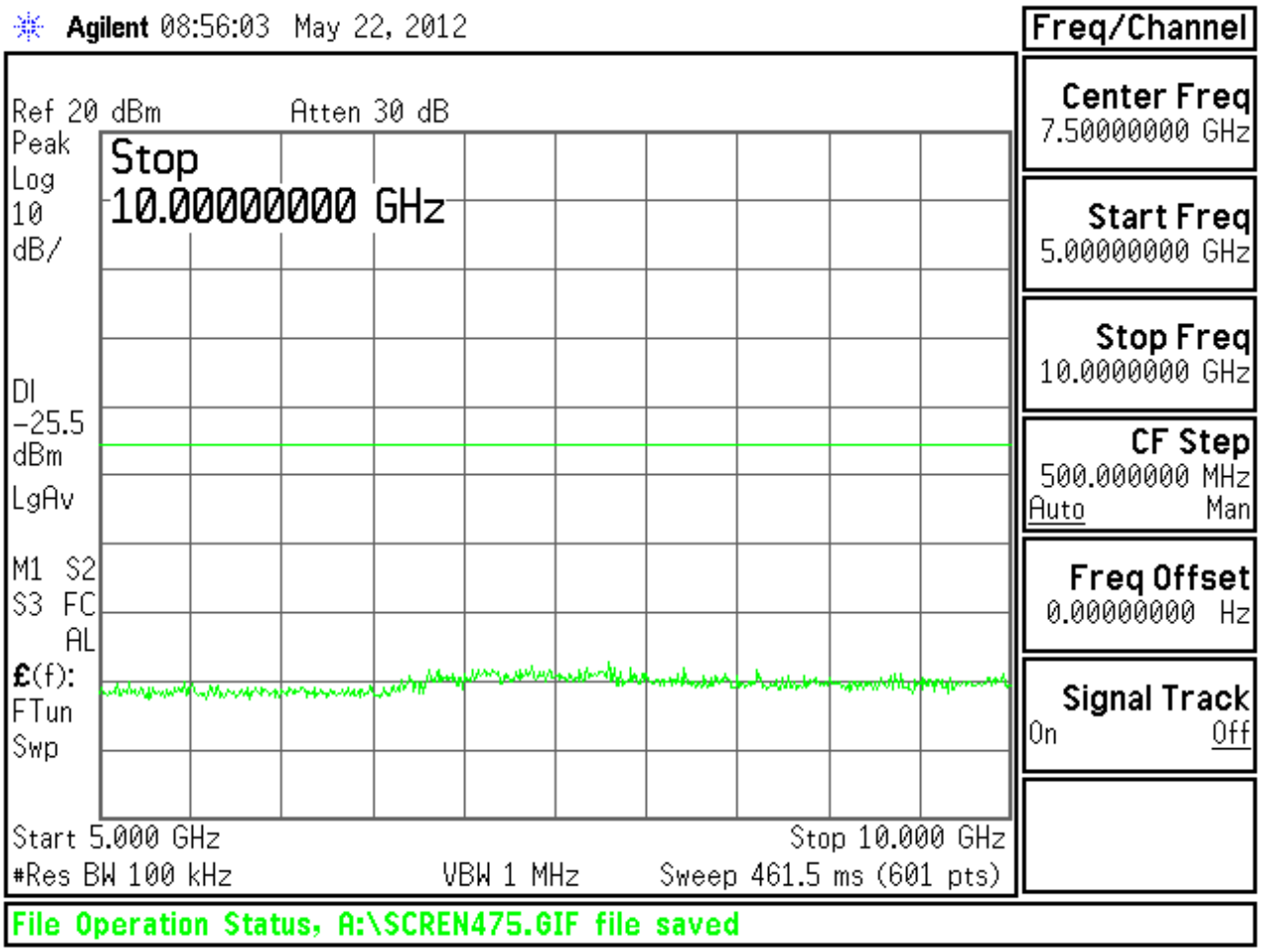
Conducted Spurious emissions 150 kHz to 30 MHz Channel 1



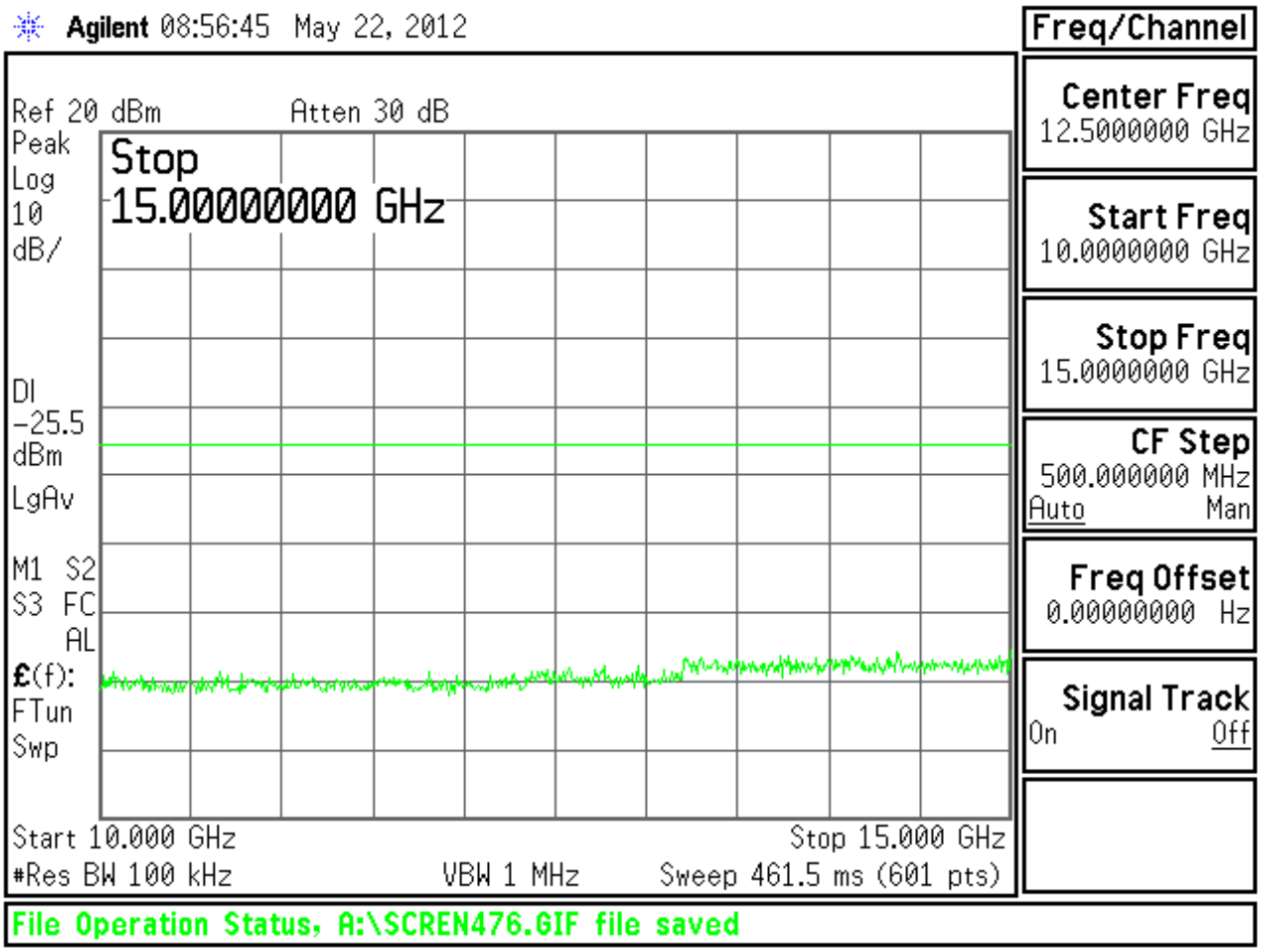
Conducted Spurious emissions 30 MHz to 1 GHz Channel 1



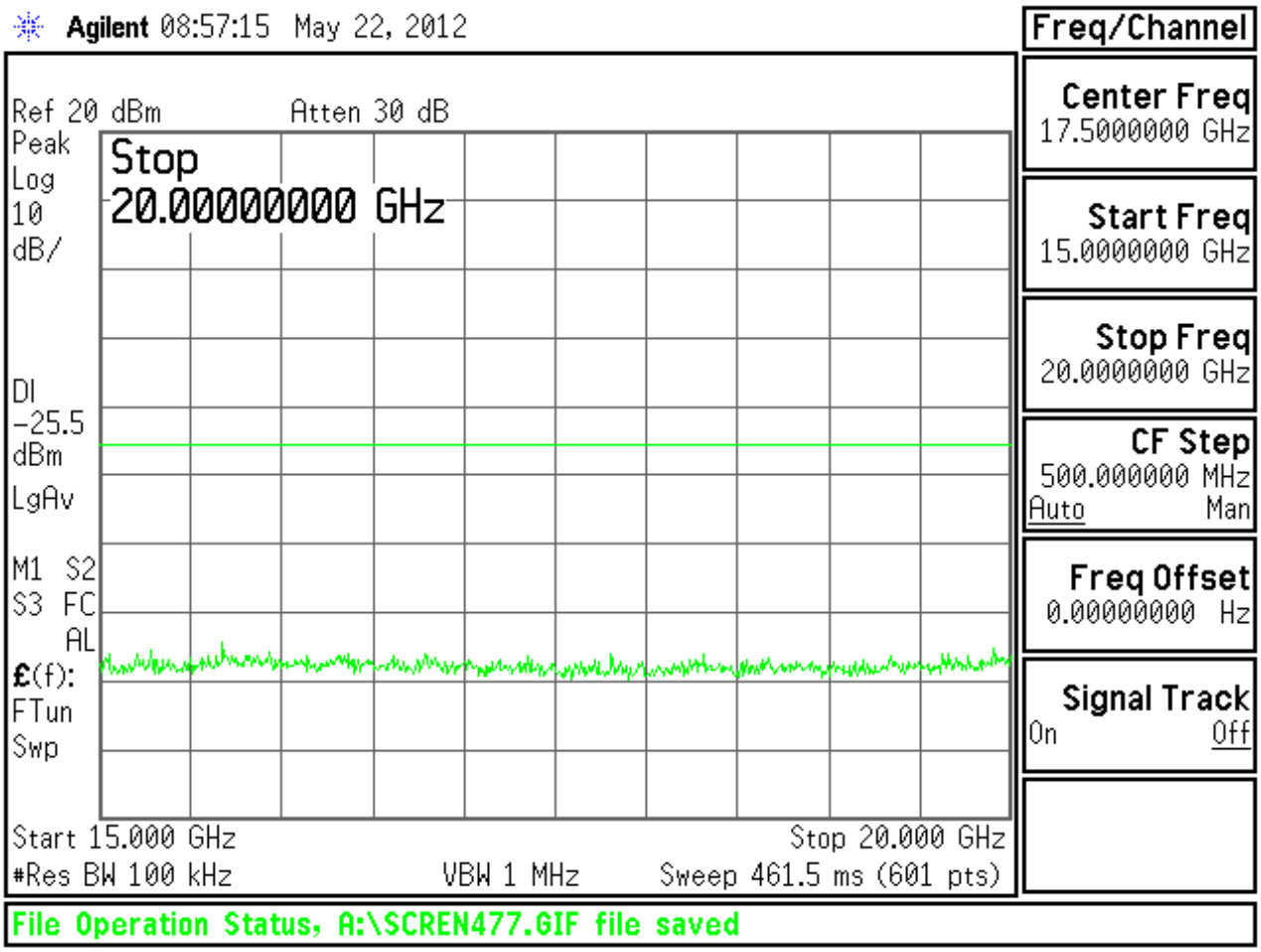
Conducted Spurious emissions 1 GHz to 5 GHz Channel 1



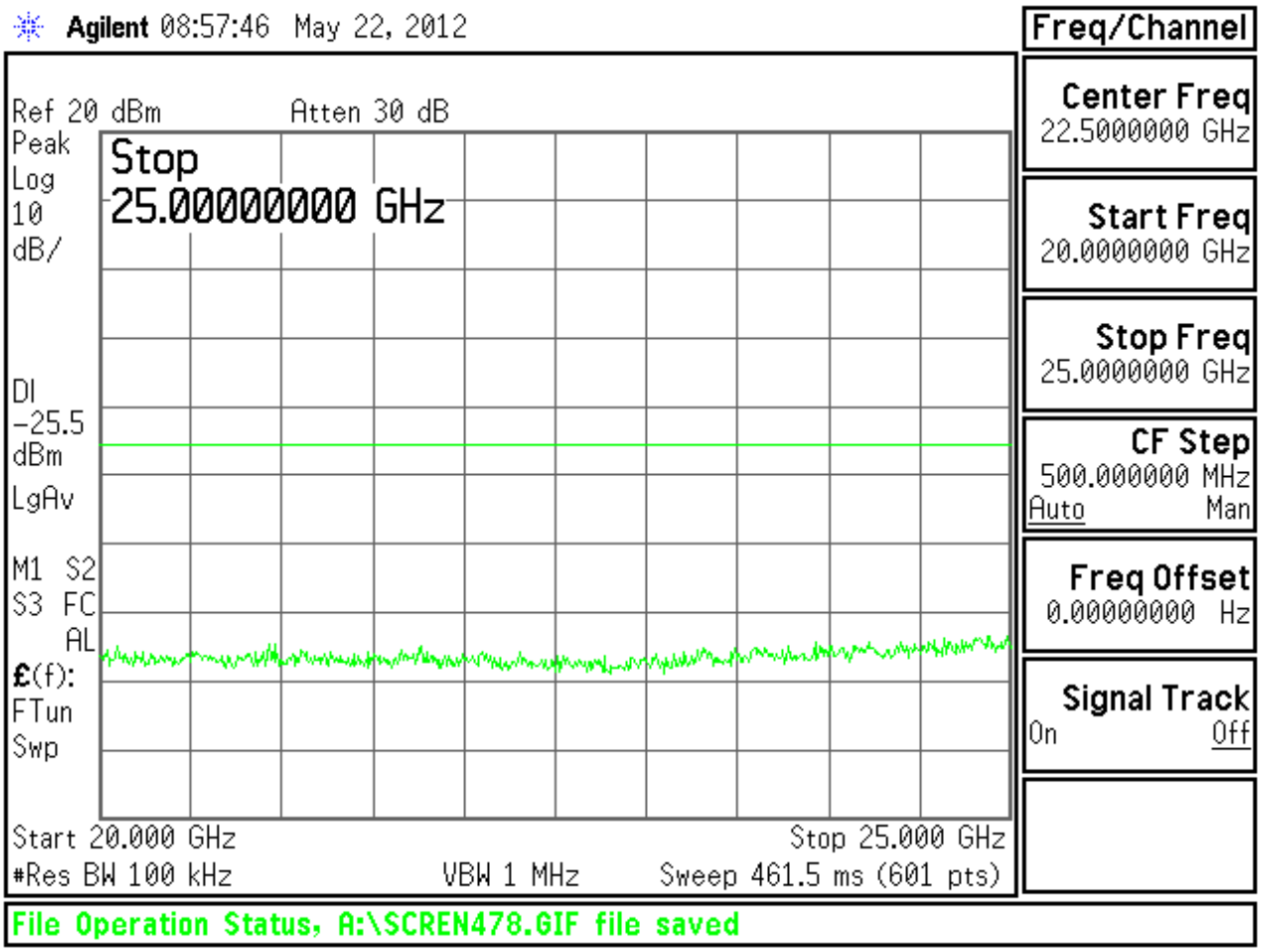
Conducted Spurious emissions 5 GHz to 10 GHz Channel 1



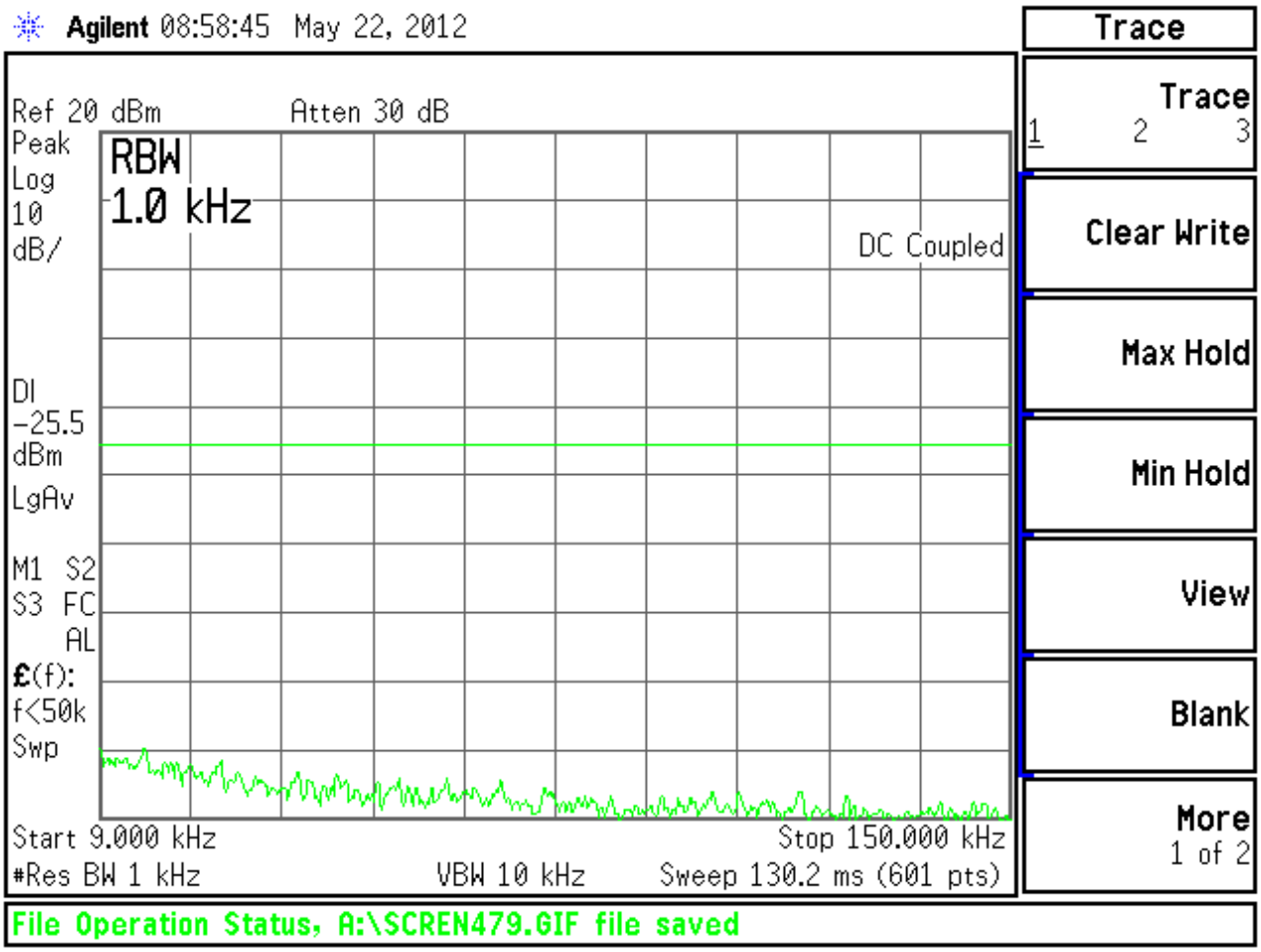
Conducted Spurious emissions 10 GHz to 15 GHz Channel 1



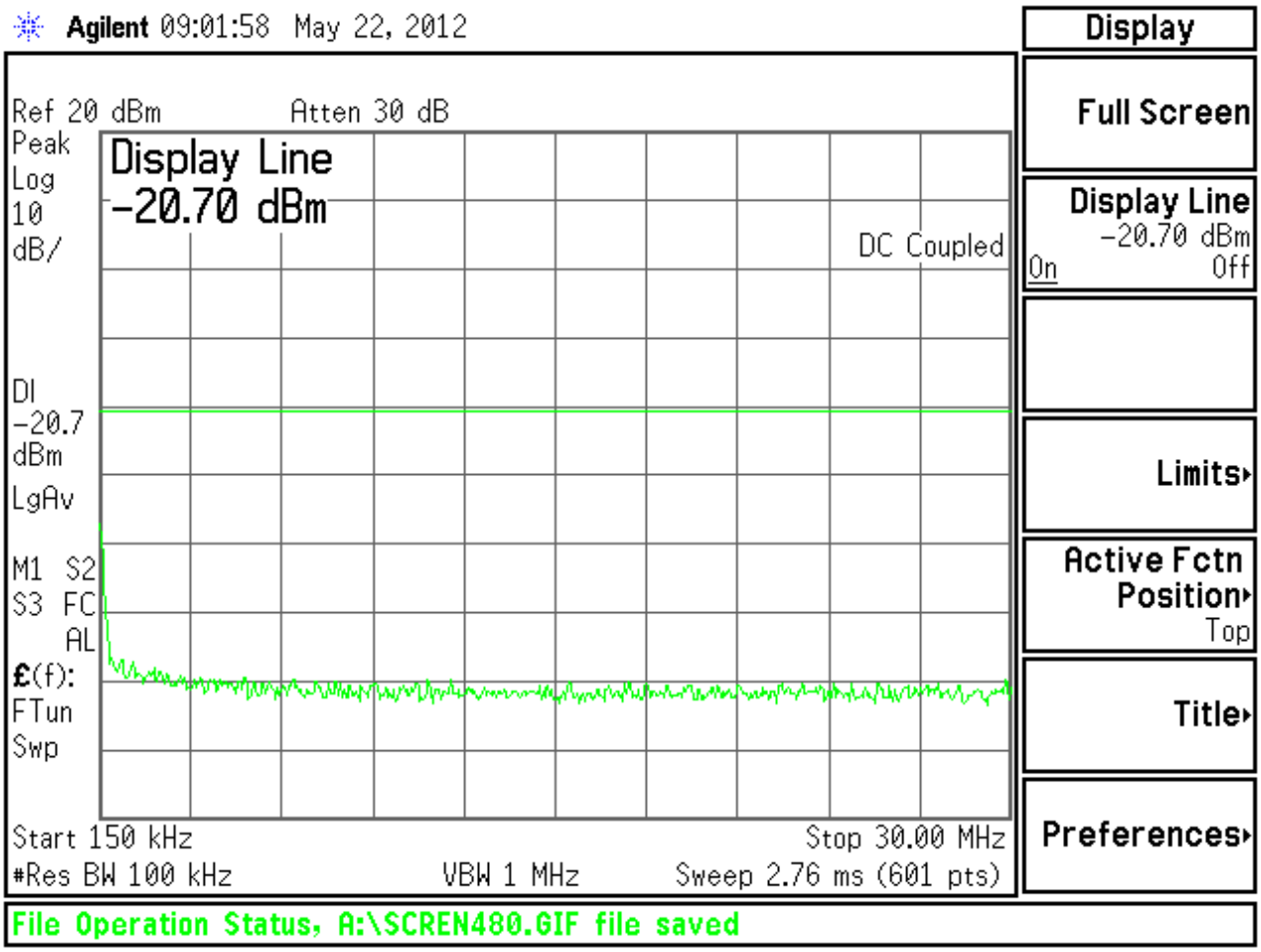
Conducted Spurious emissions 15 GHz to 20 GHz Channel 1



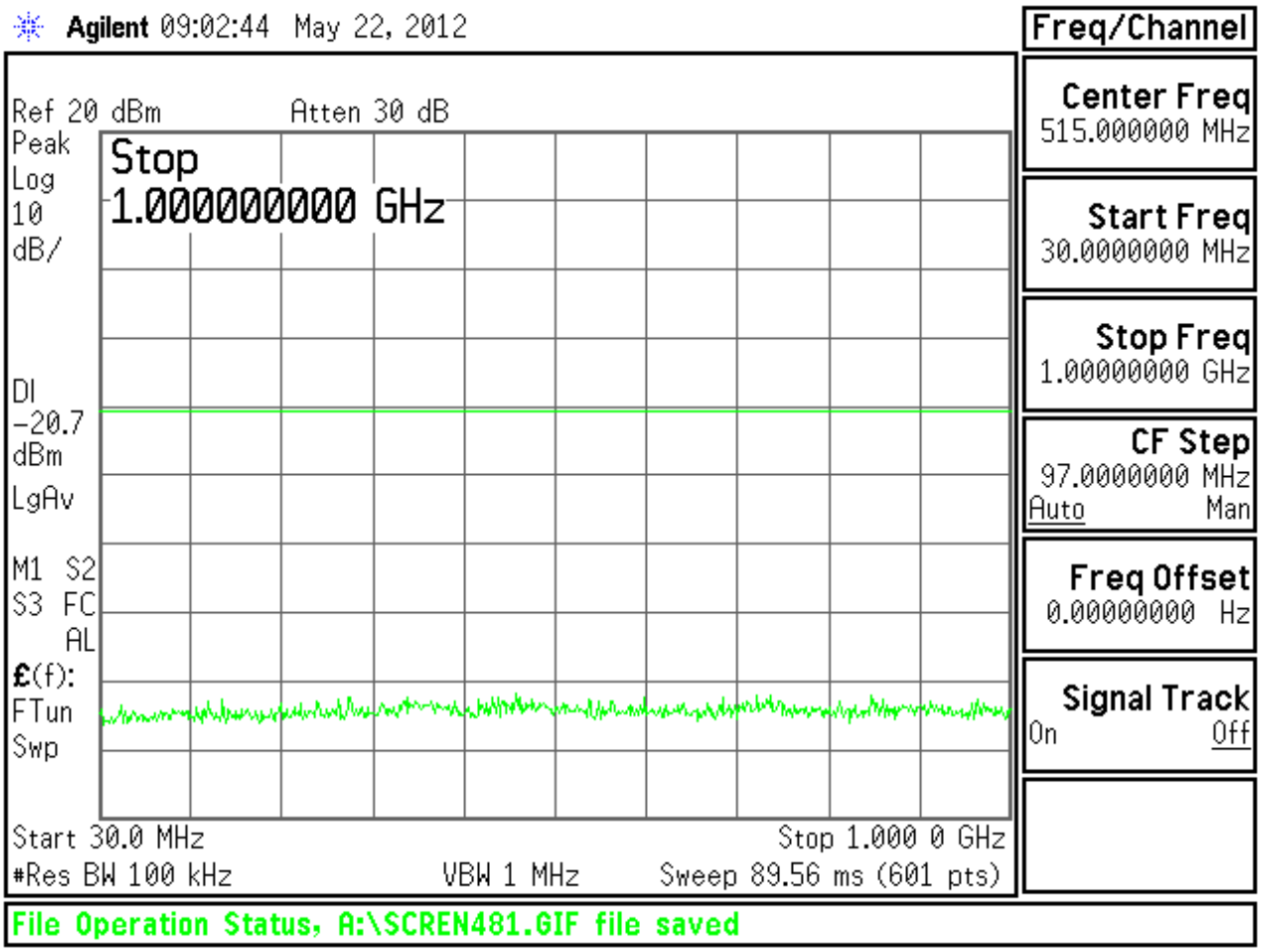
Conducted Spurious emissions 20 GHz to 25 GHz Channel 1



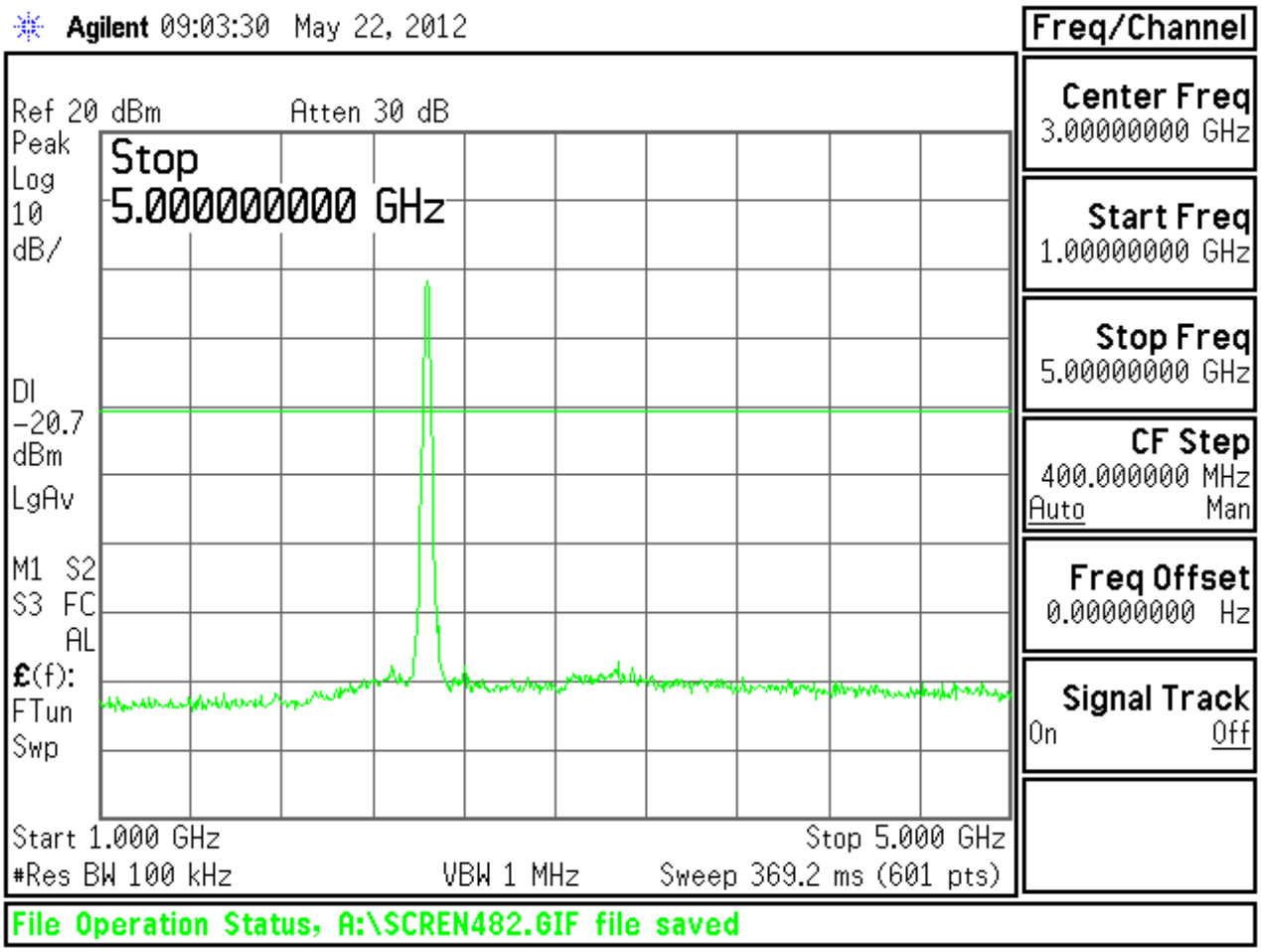
Conducted Spurious emissions 9kHz to 150 kHz Channel 6



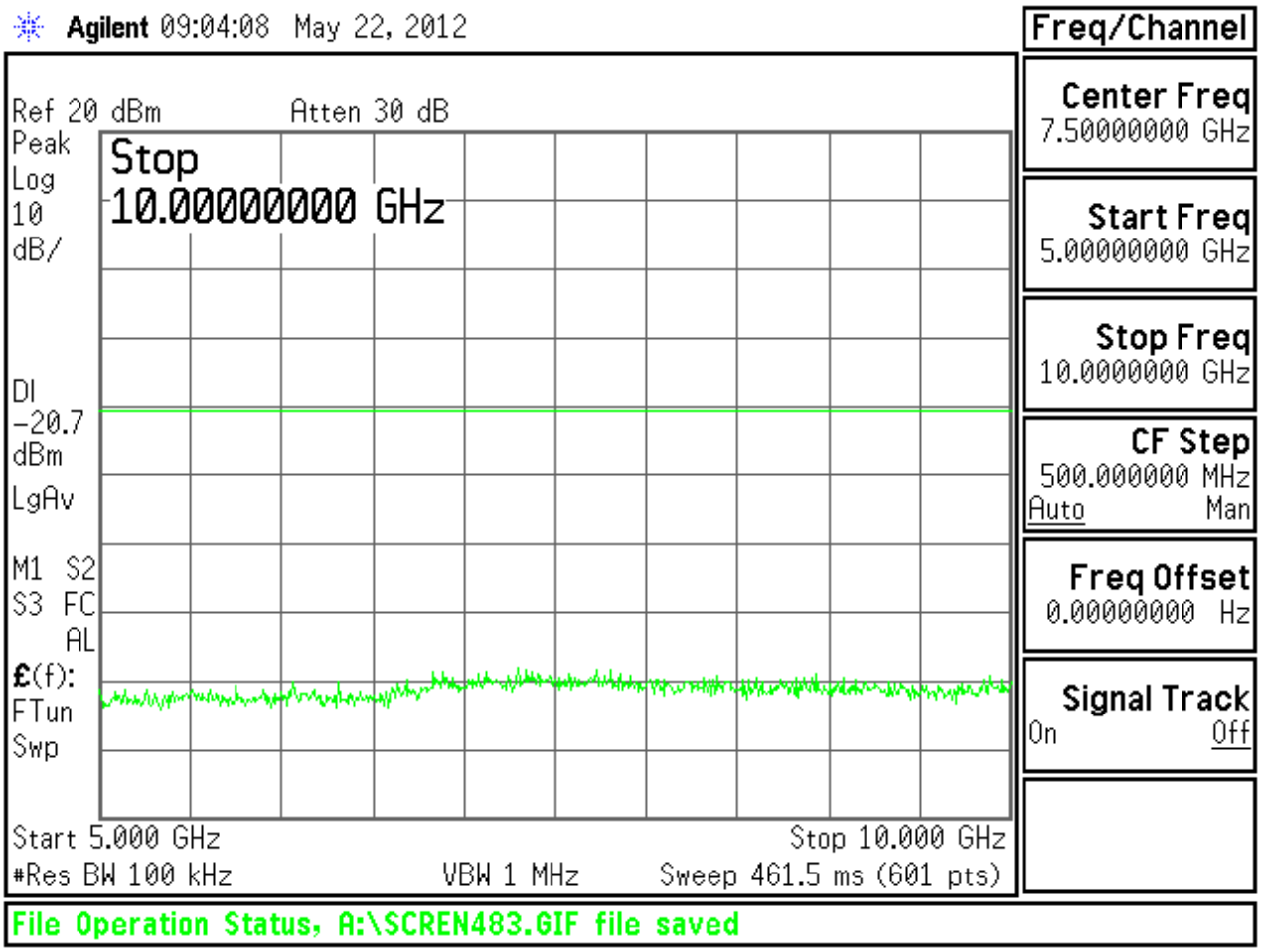
Conducted Spurious emissions 150 kHz to 30 MHz Channel 6



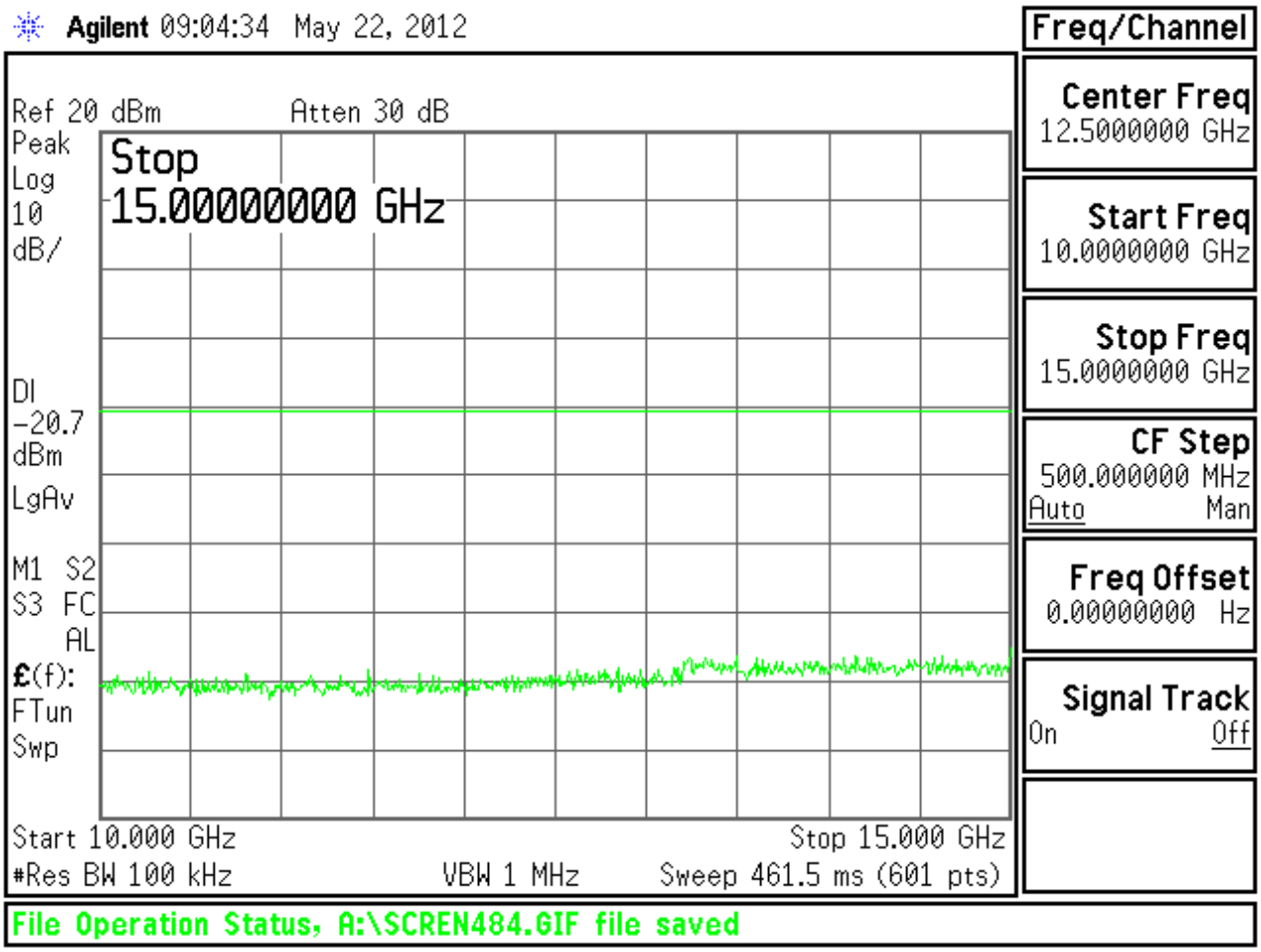
Conducted Spurious emissions 30 MHz to 1 GHz Channel 6



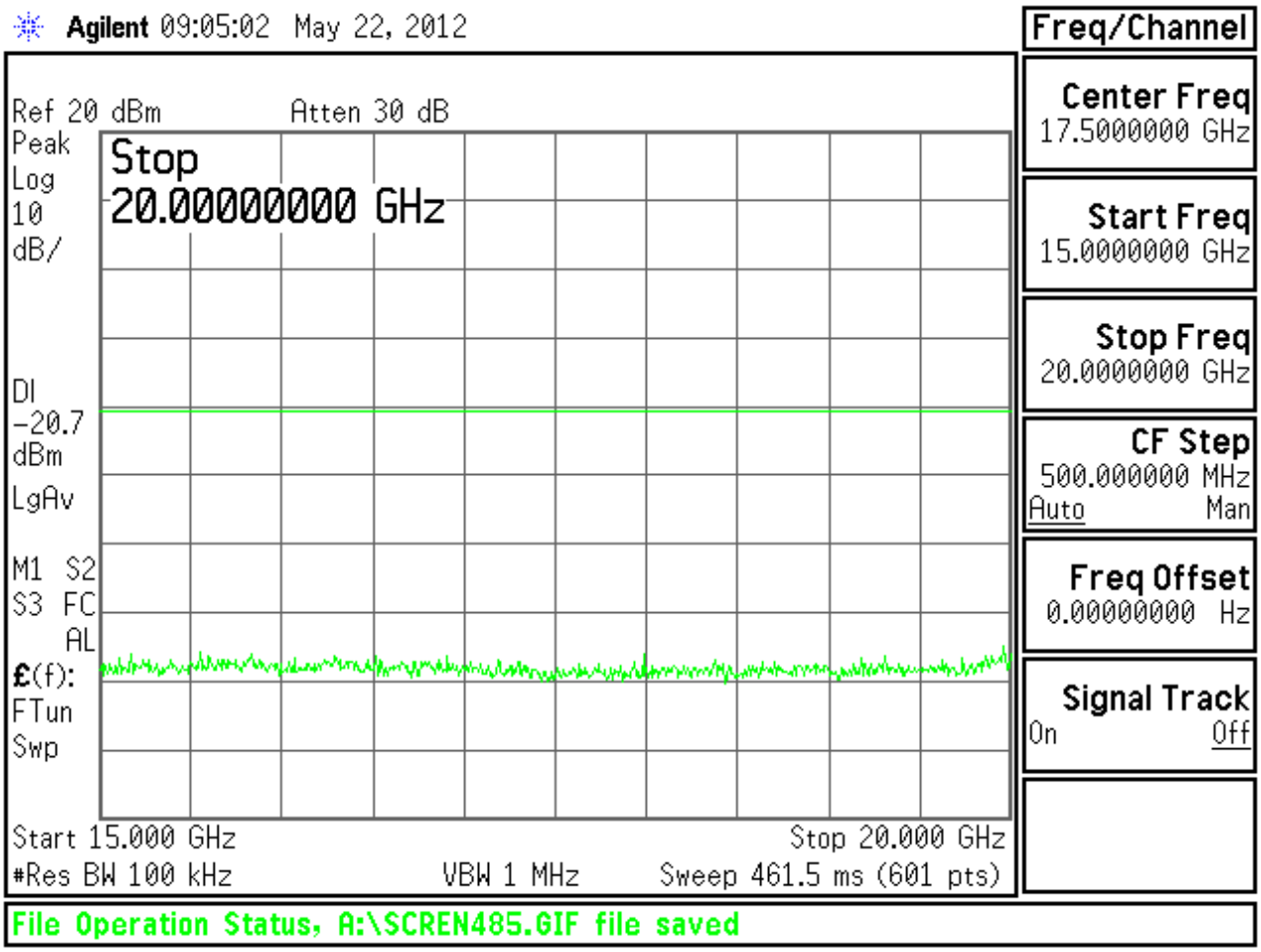
Conducted Spurious emissions 1 GHz to 5 GHz Channel 6



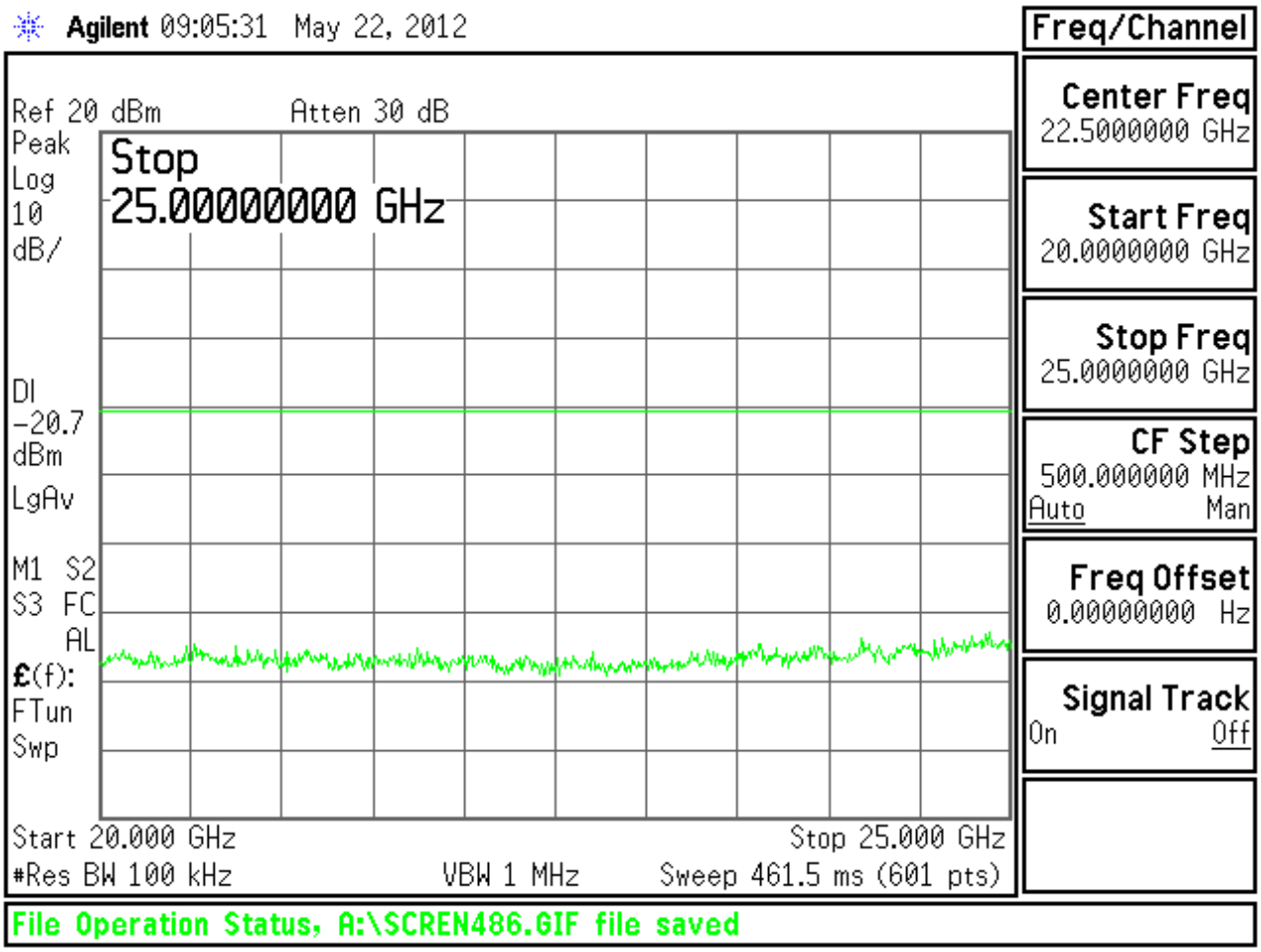
Conducted Spurious emissions 5 GHz to 10 GHz Channel 6



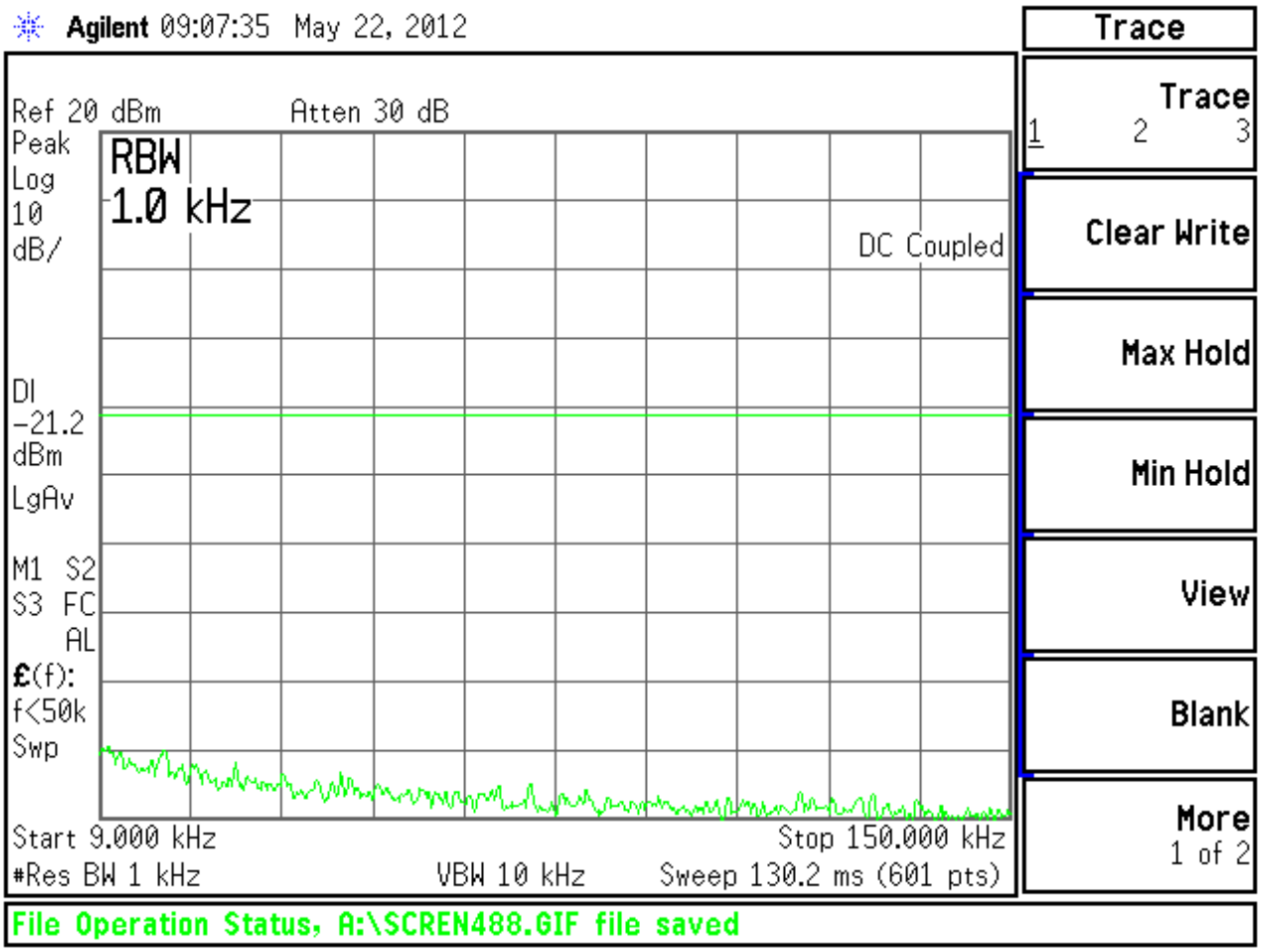
Conducted Spurious emissions 10 GHz to 15 GHz Channel 6



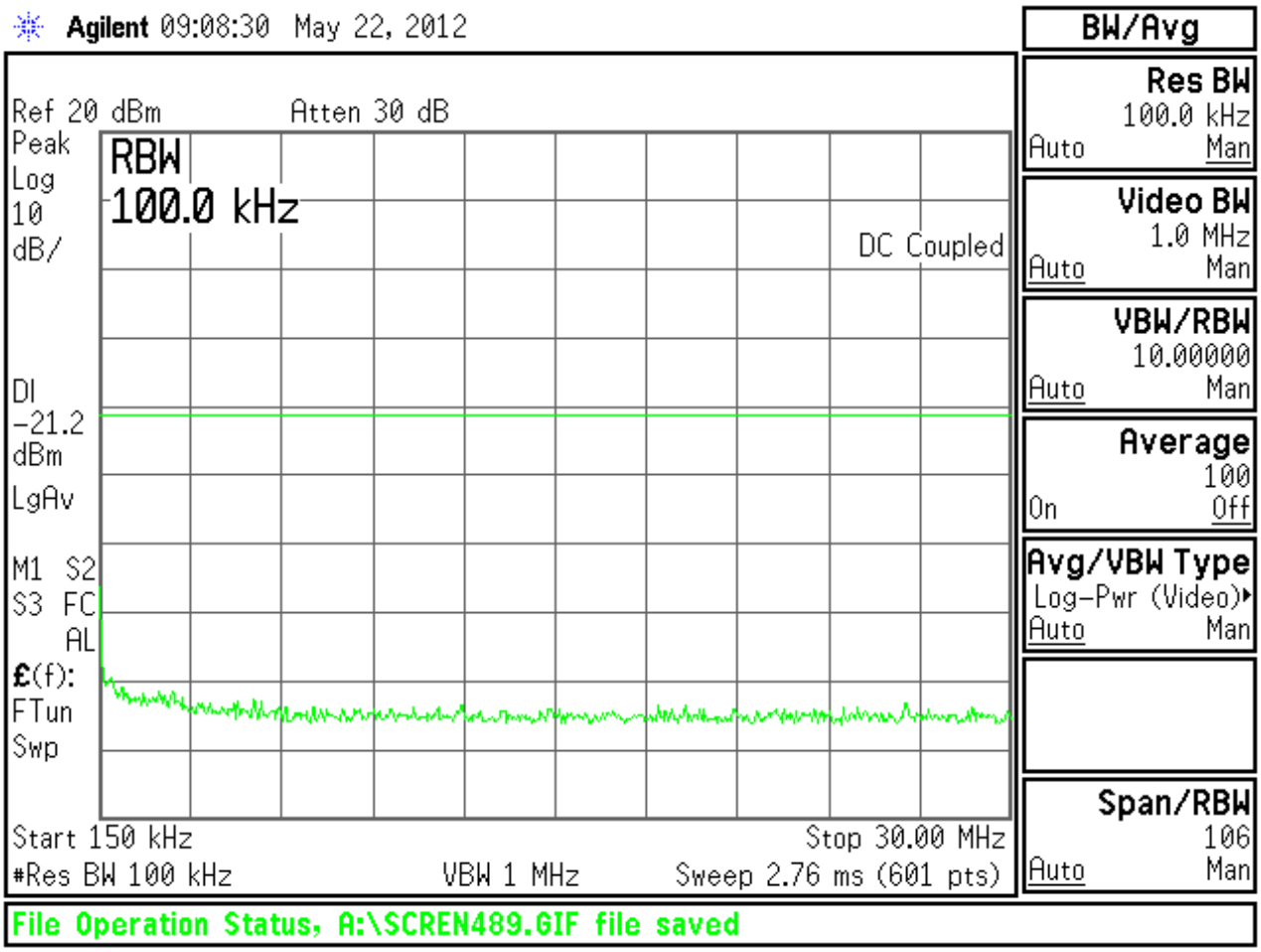
Conducted Spurious emissions 15 GHz to 20 GHz Channel 6



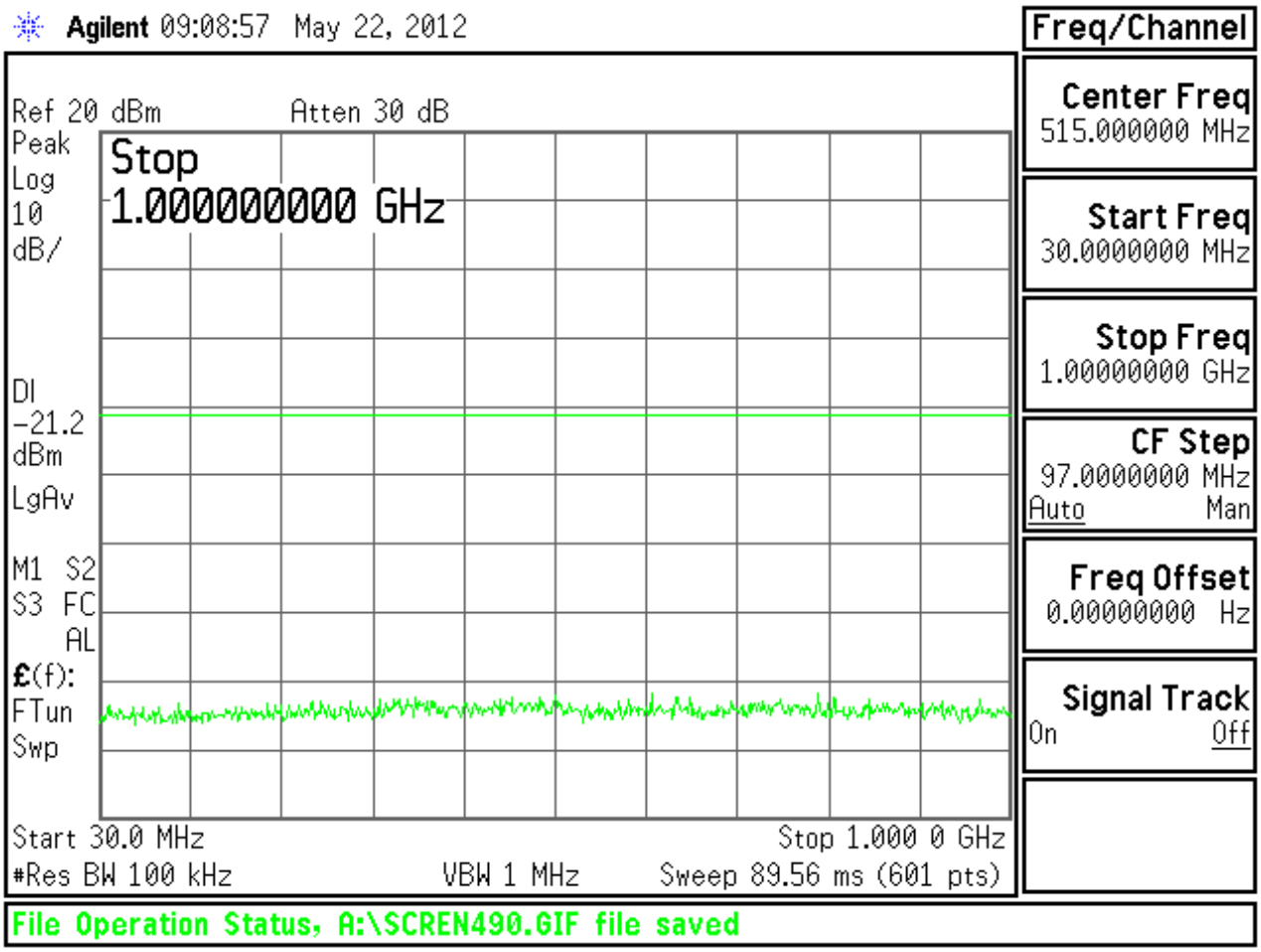
Conducted Spurious emissions 20 GHz to 25 GHz Channel 6



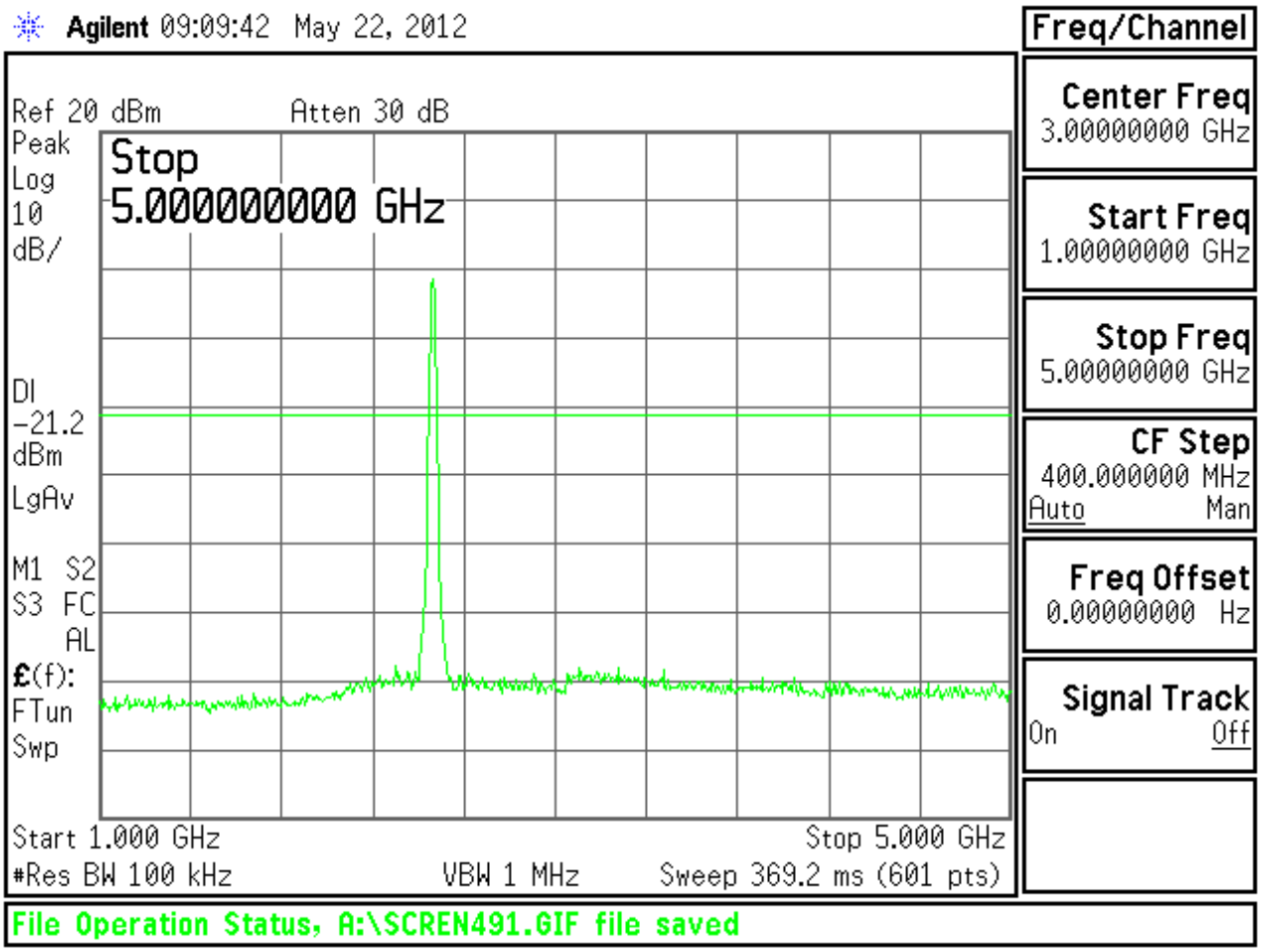
Conducted Spurious emissions 9kHz to 150 kHz Channel 11



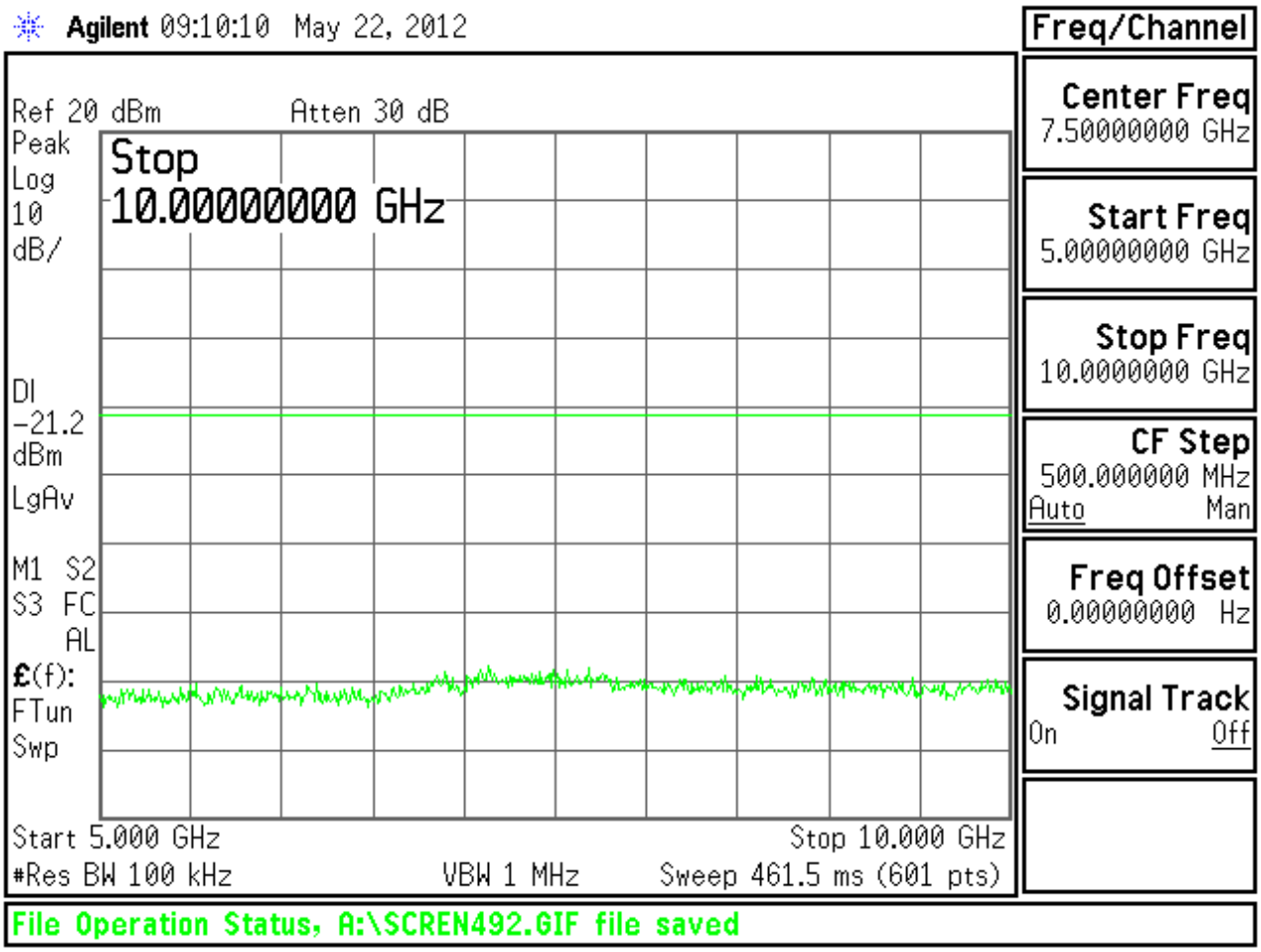
Conducted Spurious emissions 150 kHz to 30 MHz Channel 11



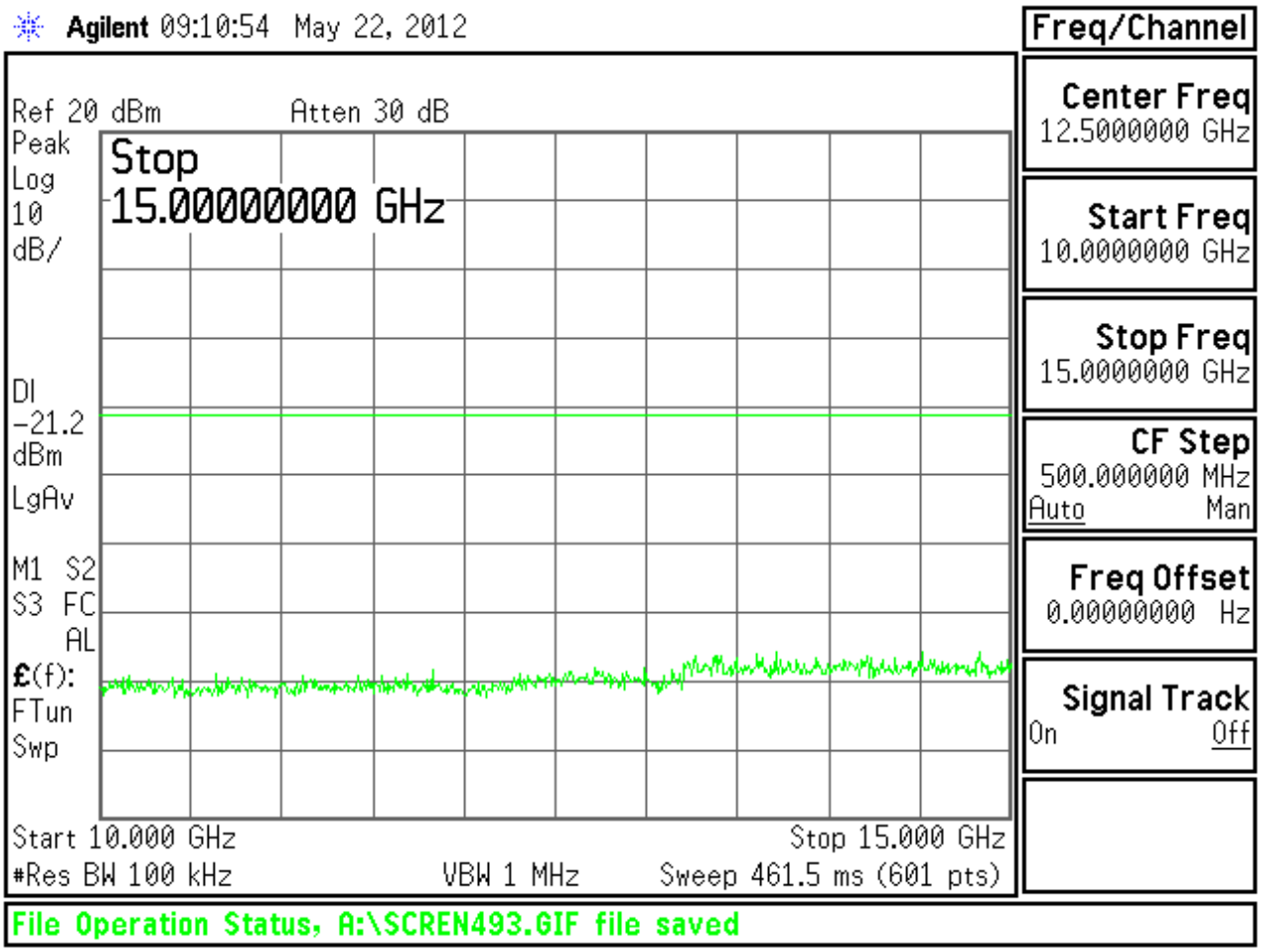
Conducted Spurious emissions 30 MHz to 1 GHz Channel 11



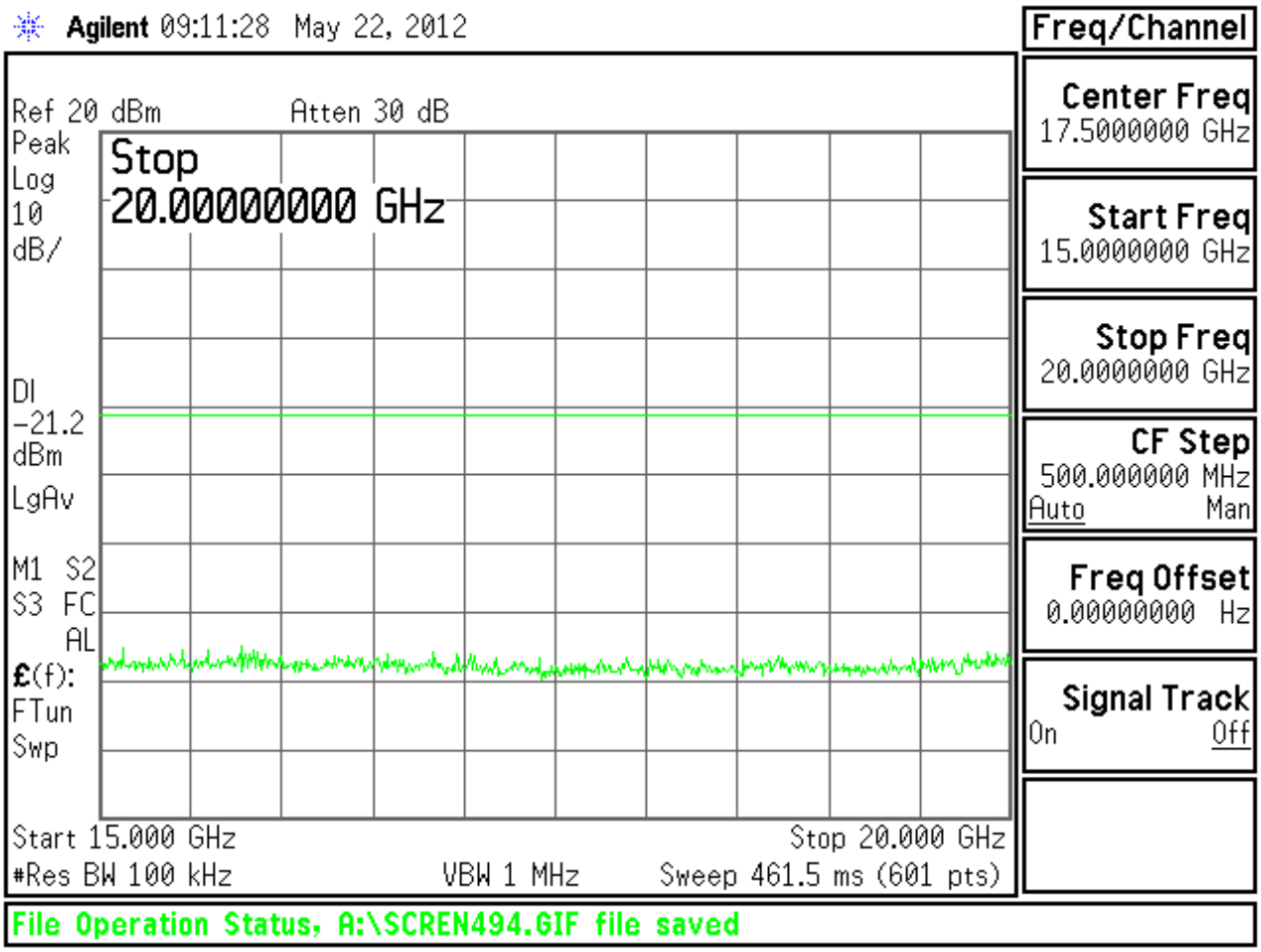
Conducted Spurious emissions 1 GHz to 5 GHz Channel 11



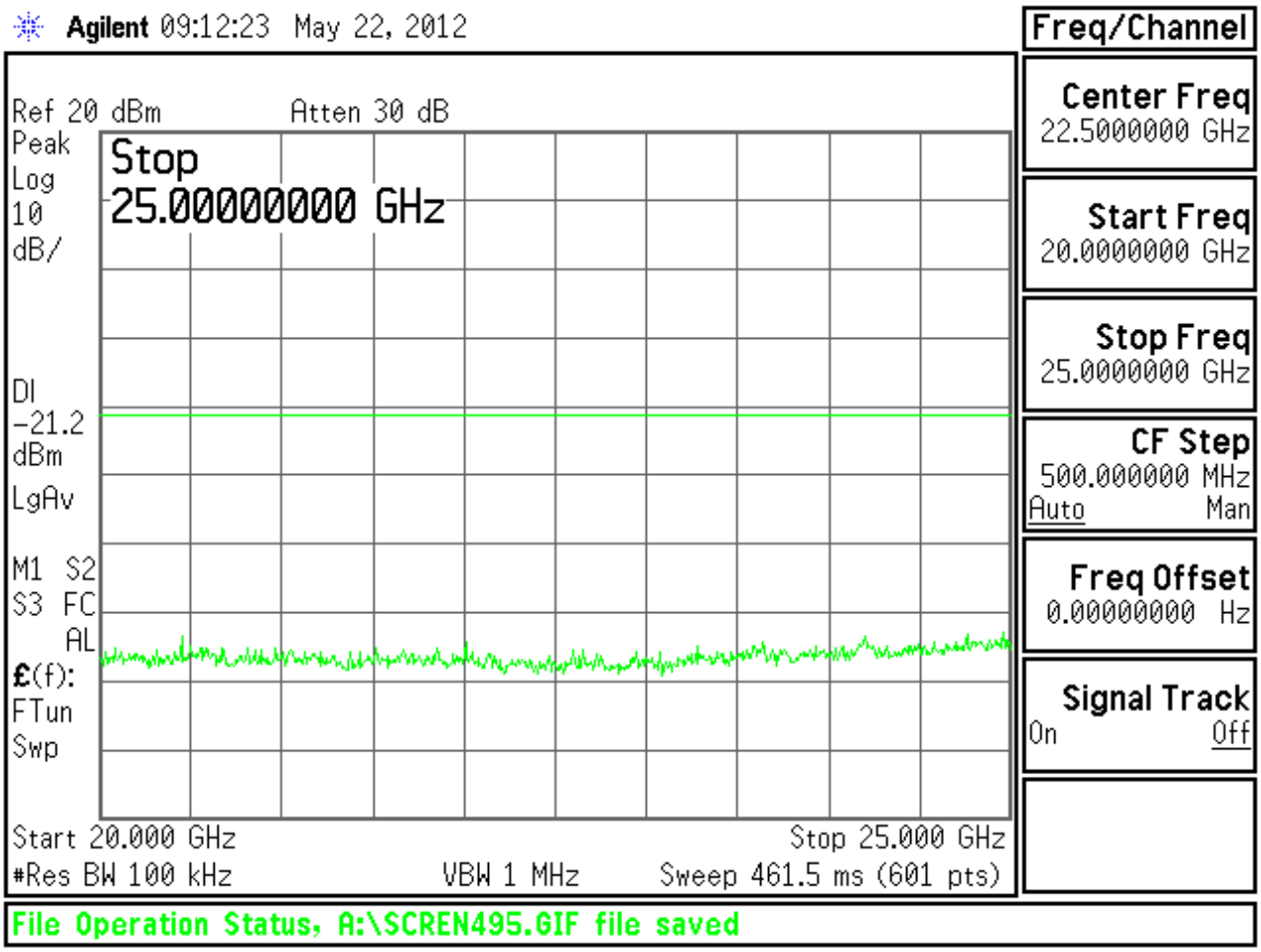
Conducted Spurious emissions 5 GHz to 10 GHz Channel 11



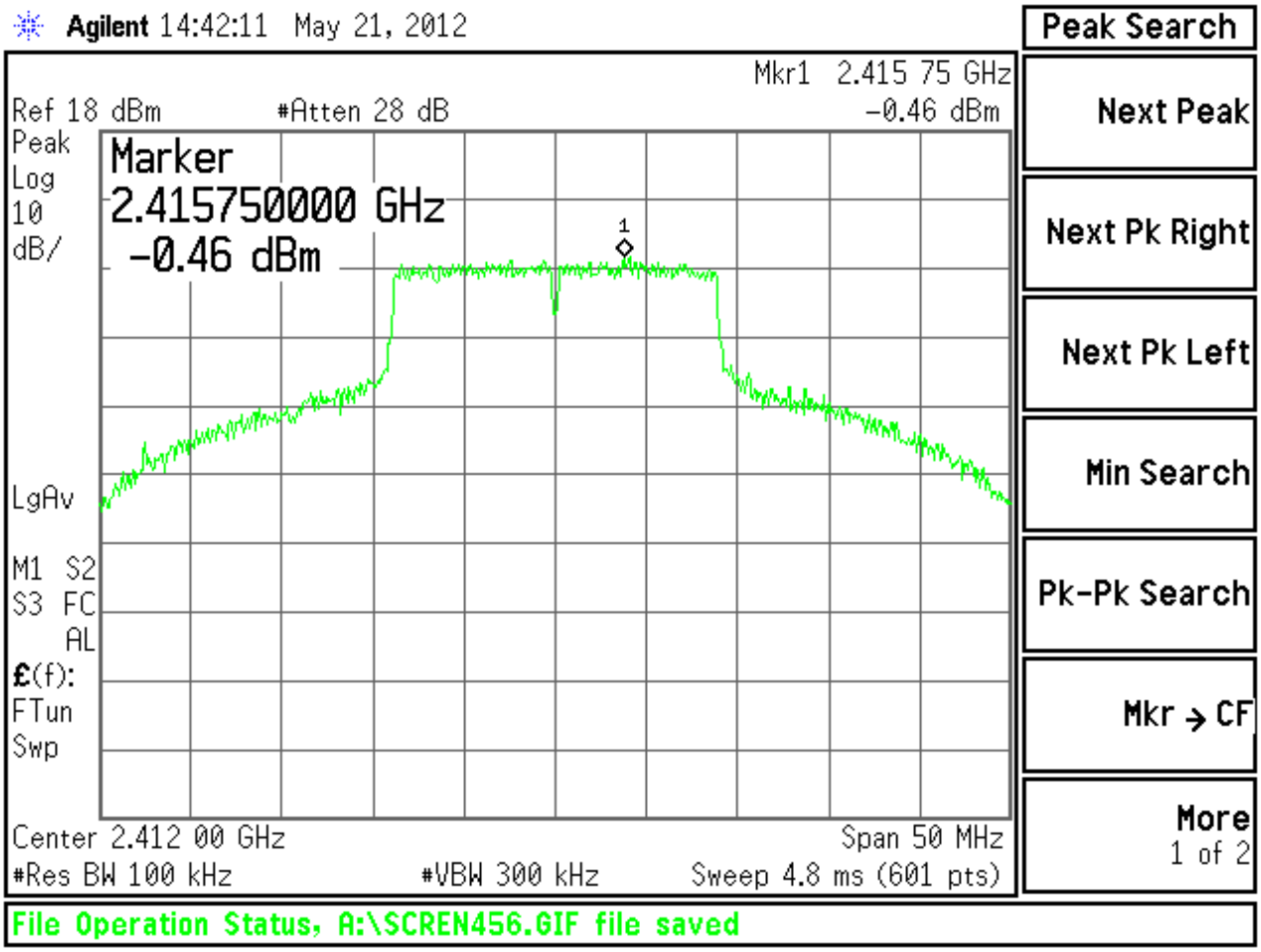
Conducted Spurious emissions 10 GHz to 15 GHz Channel 11



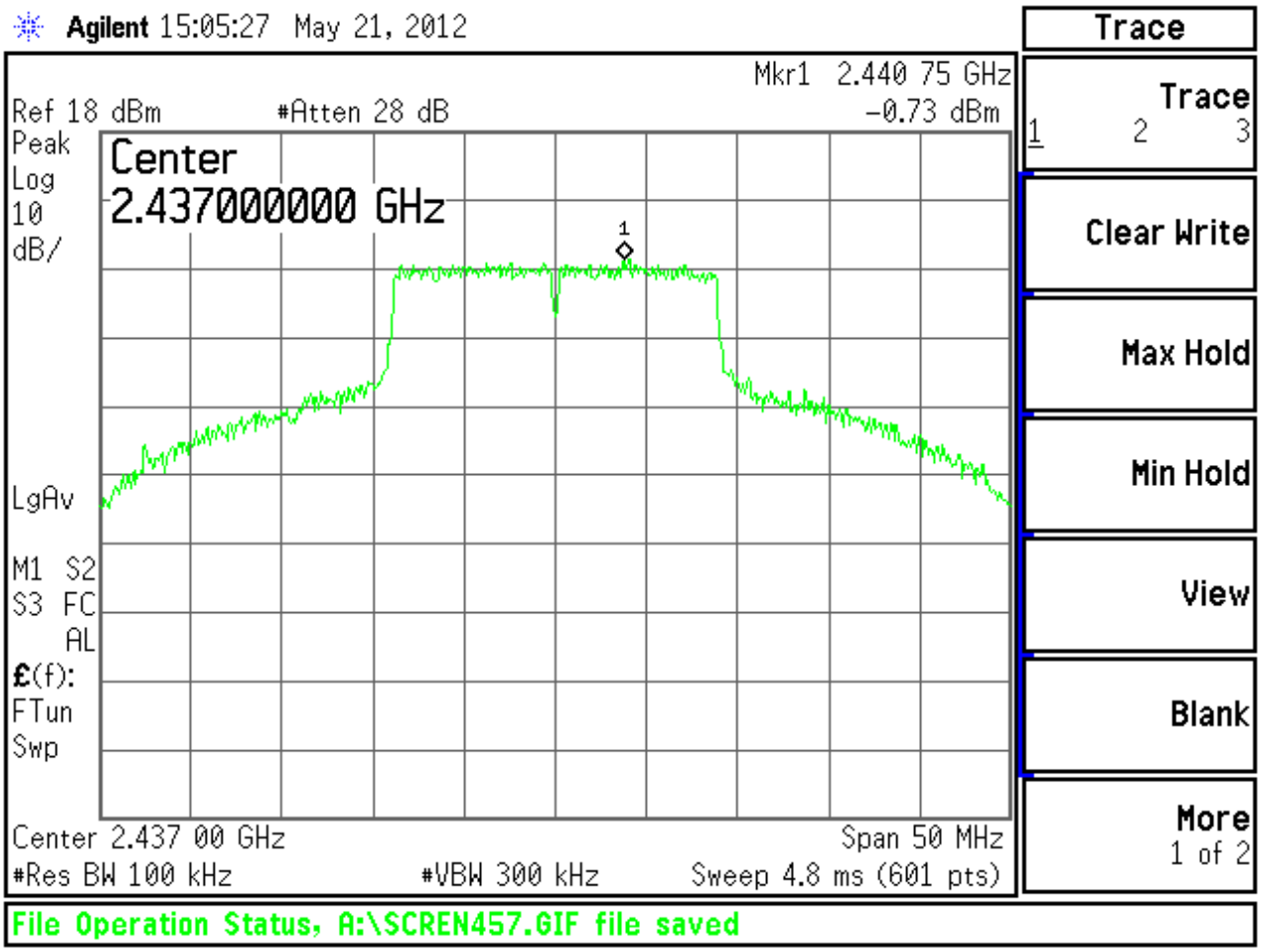
Conducted Spurious emissions 15 GHz to 20 GHz Channel 11



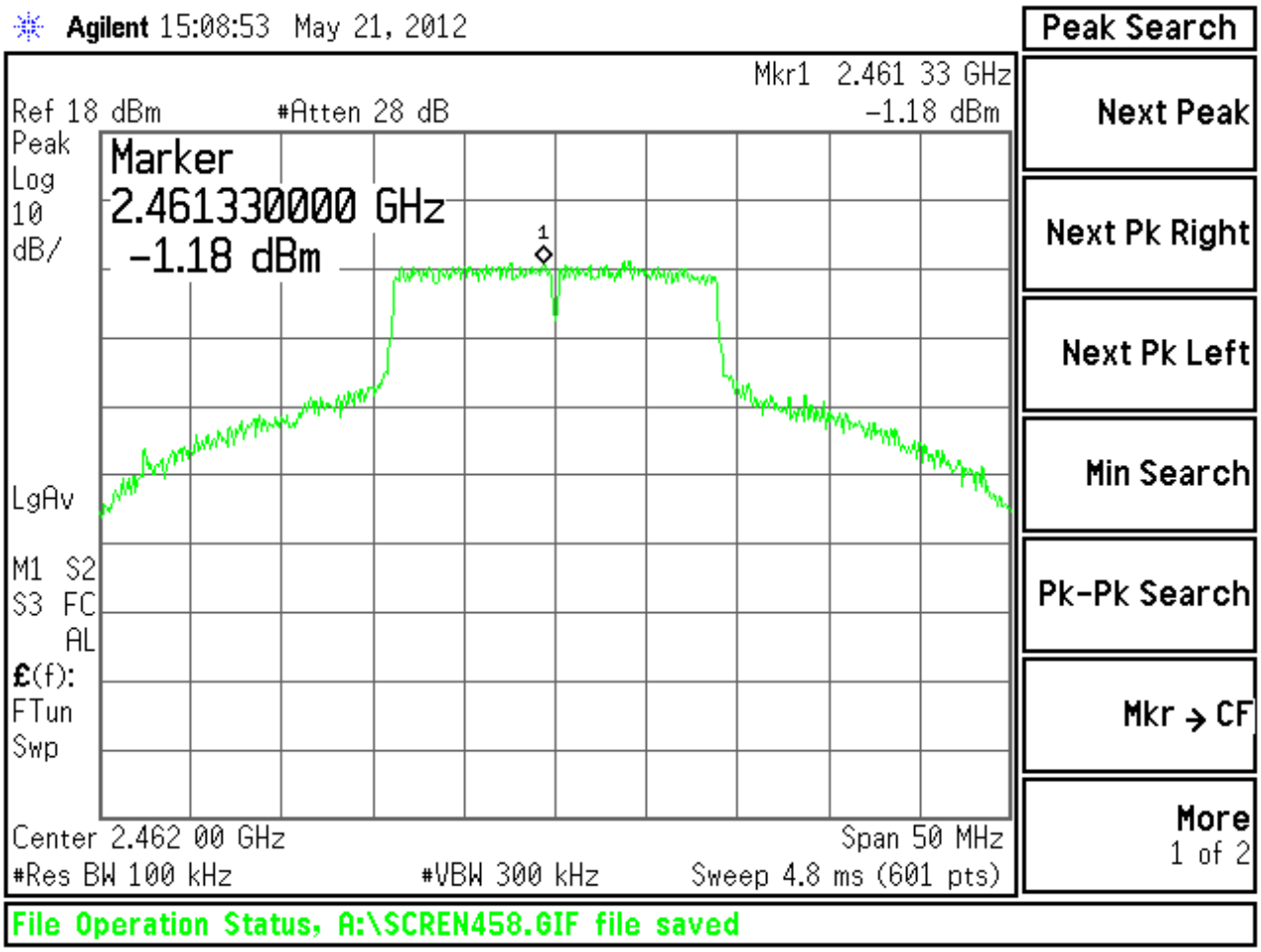
Conducted Spurious emissions 20 GHz to 25 GHz Channel 11



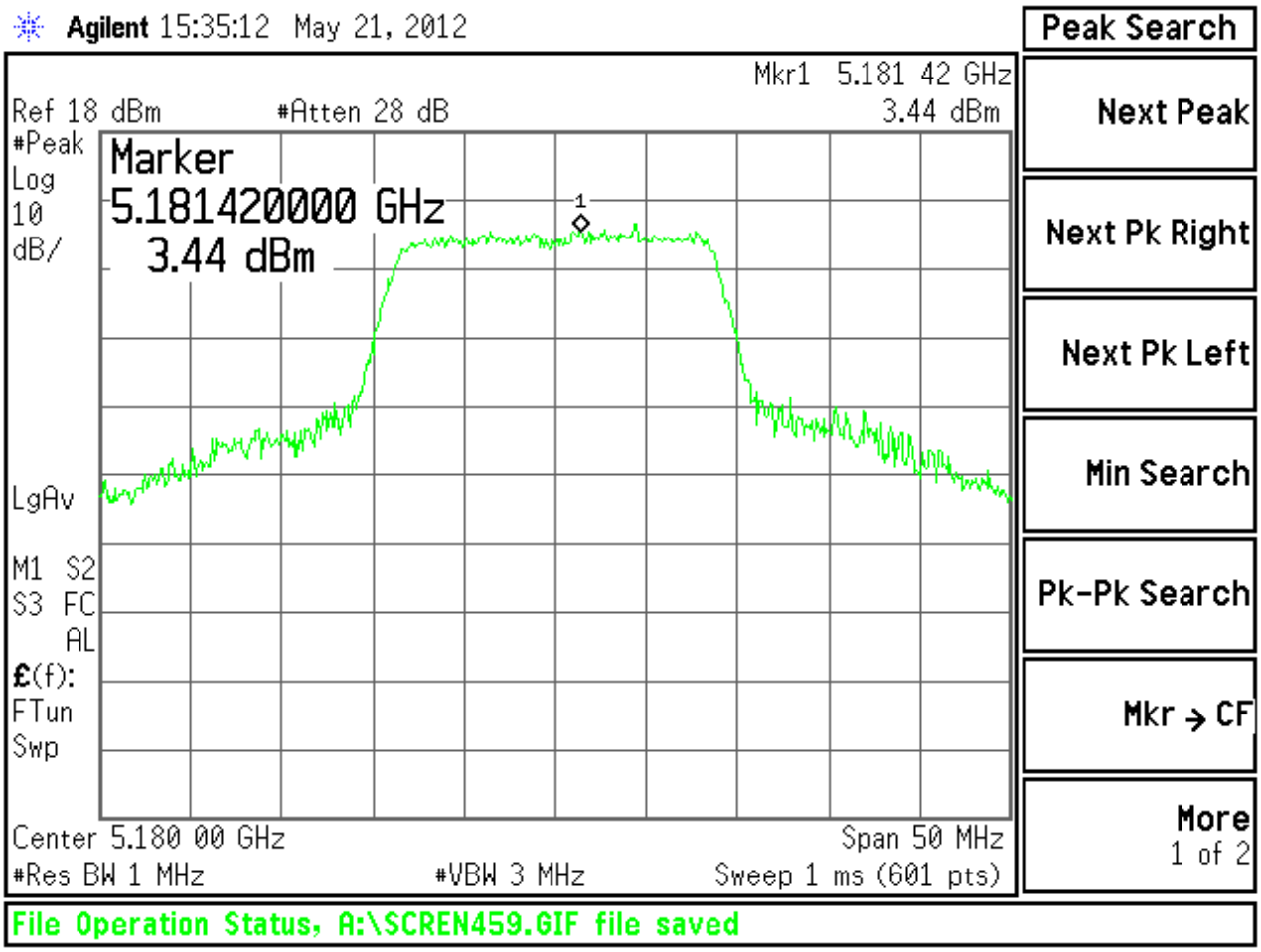
Conducted power spectral density – 2412 MHz



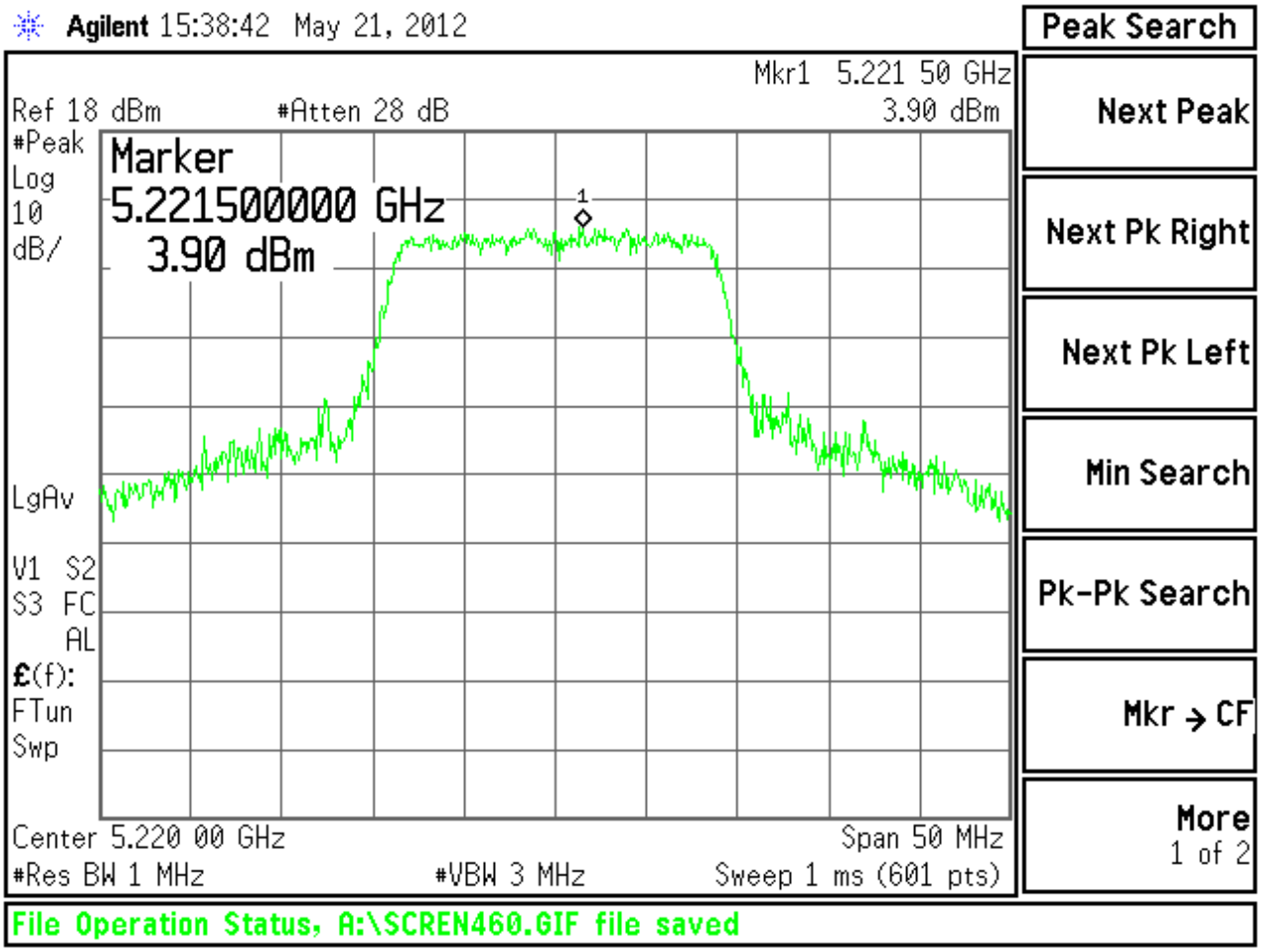
Conducted power spectral density – 2437 MHz



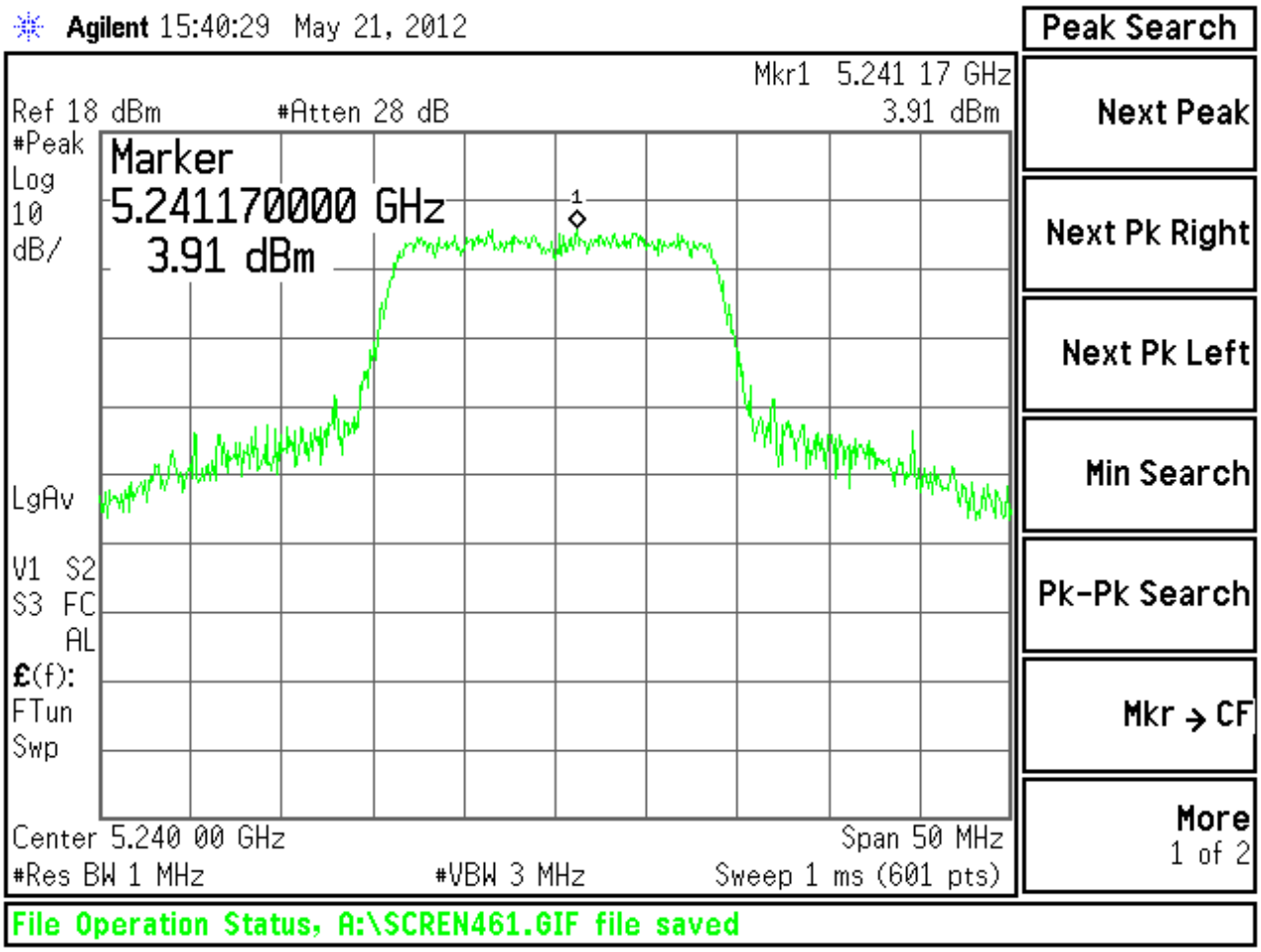
Conducted power spectral density – 2462 MHz



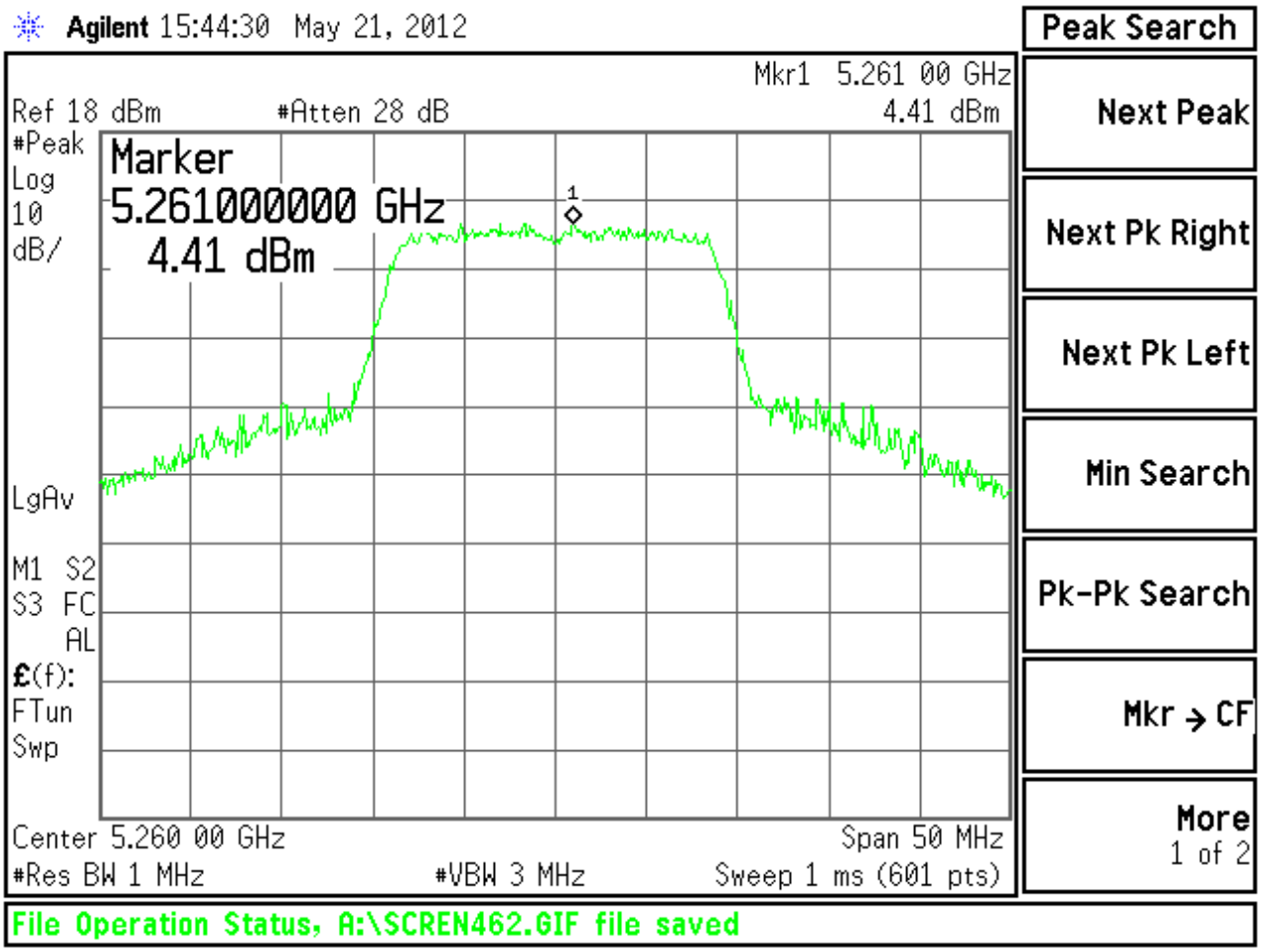
Conducted power spectral density – 5180 MHz



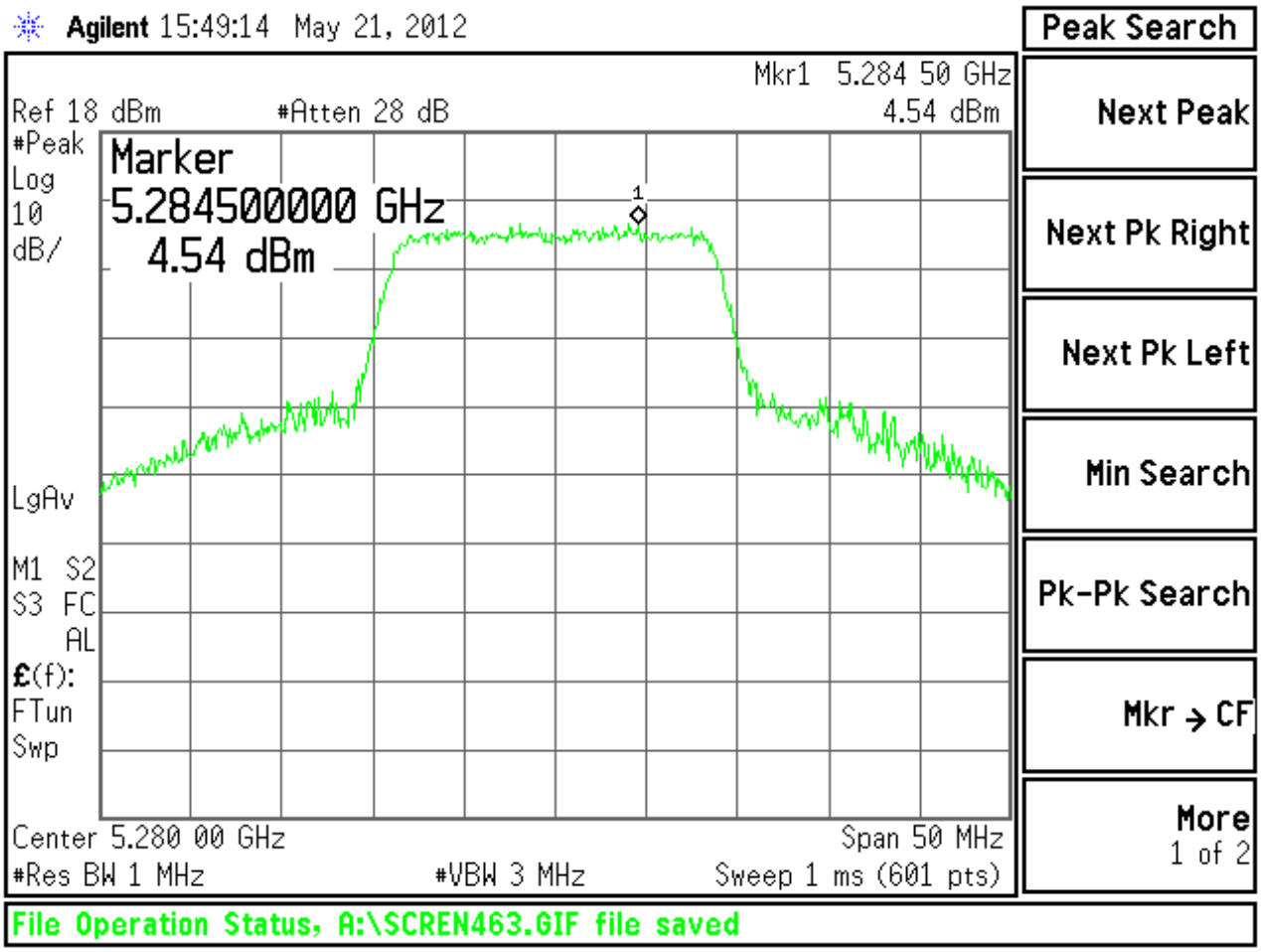
Conducted power spectral density – 5220 MHz



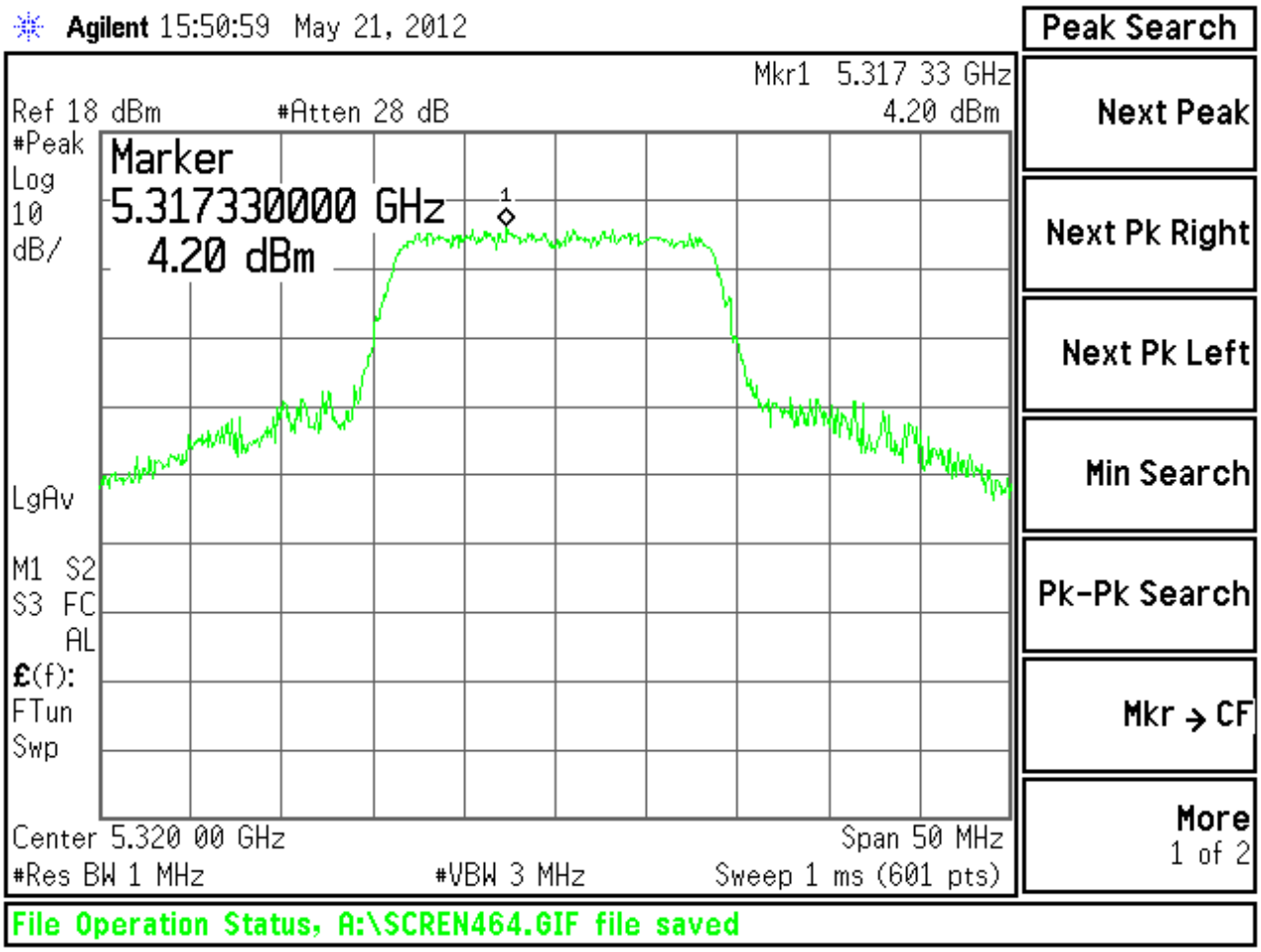
Conducted power spectral density – 5240 MHz



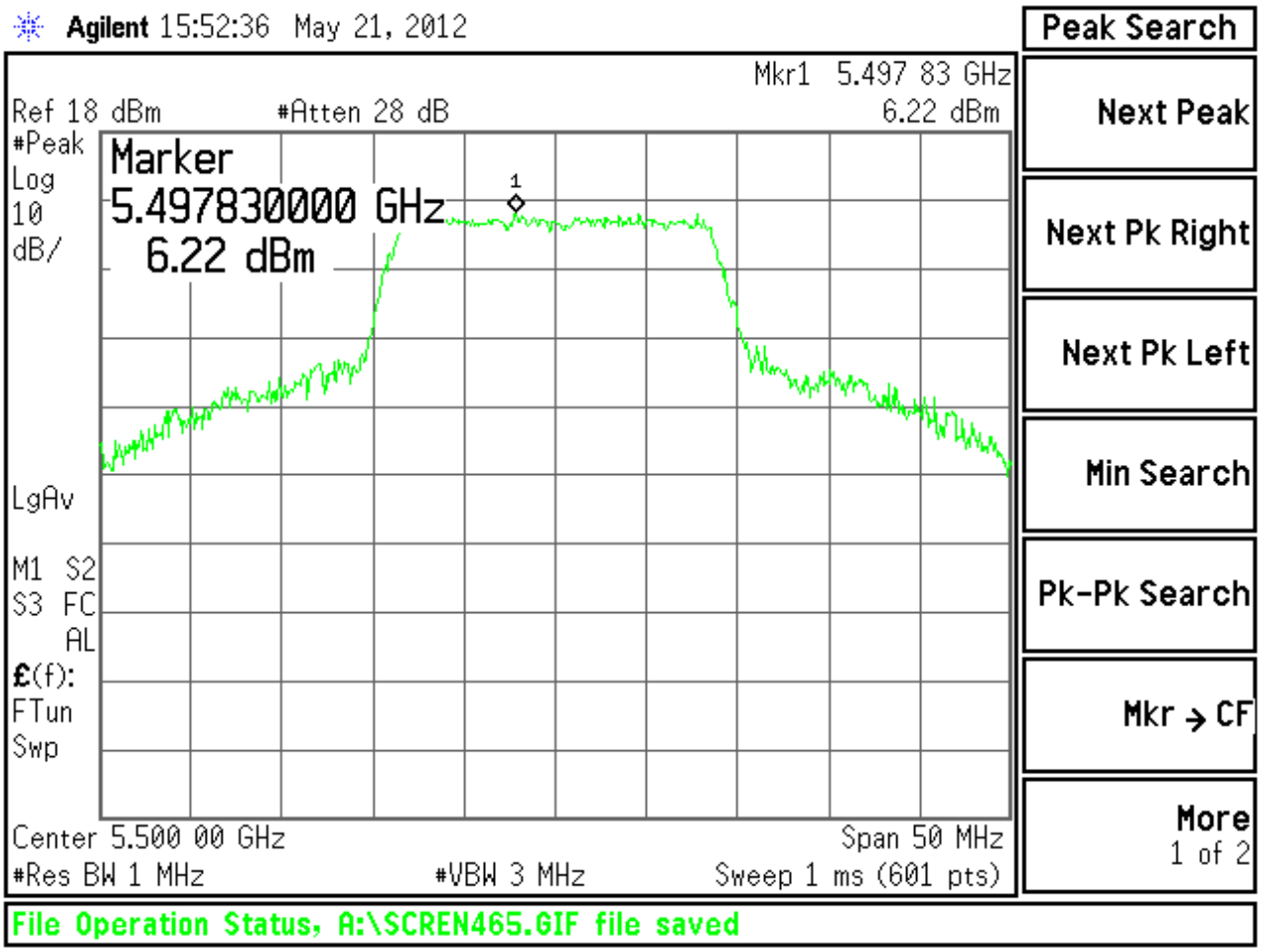
Conducted power spectral density – 5260 MHz



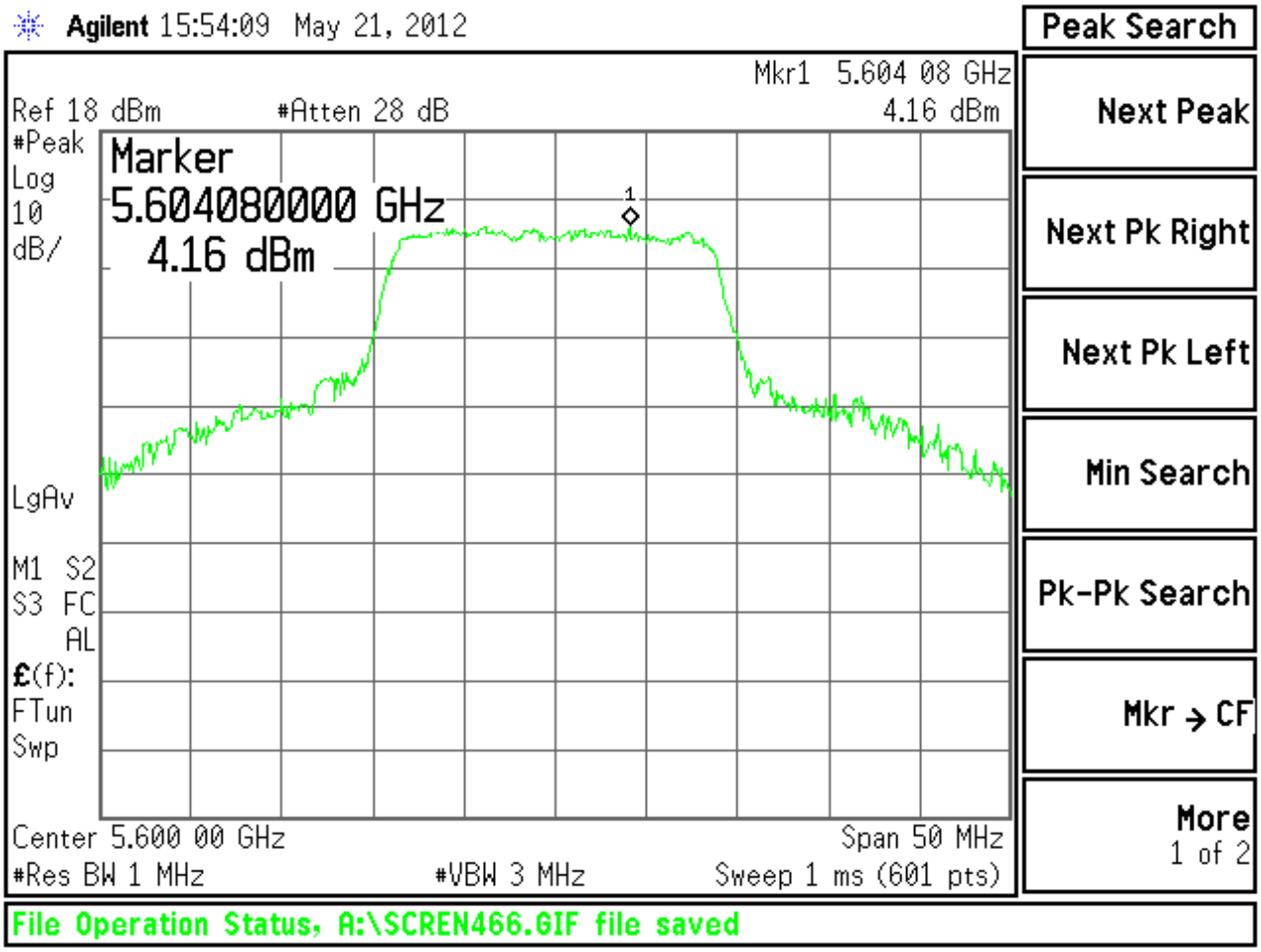
Conducted power spectral density – 5280 MHz



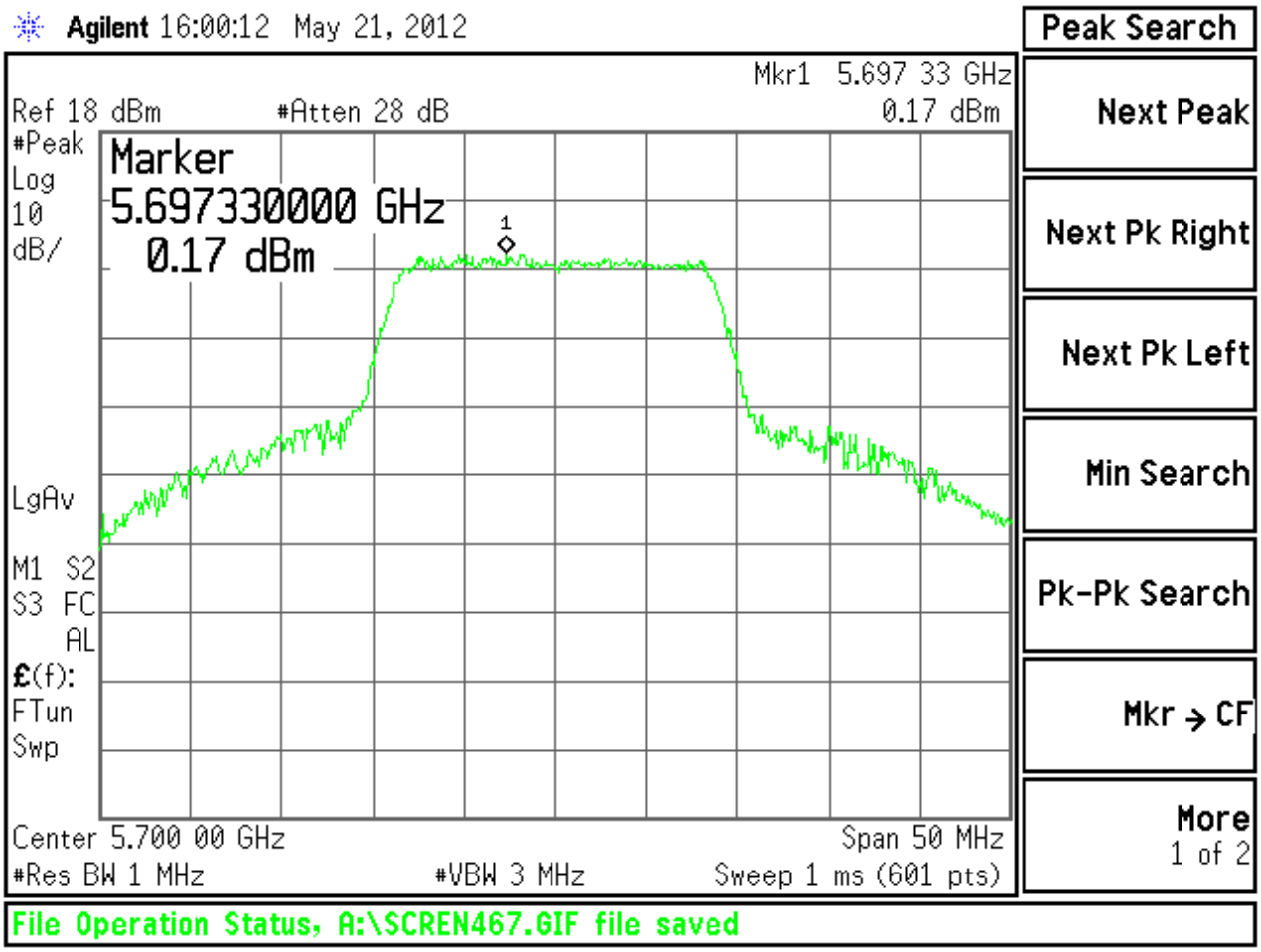
Conducted power spectral density – 5320 MHz



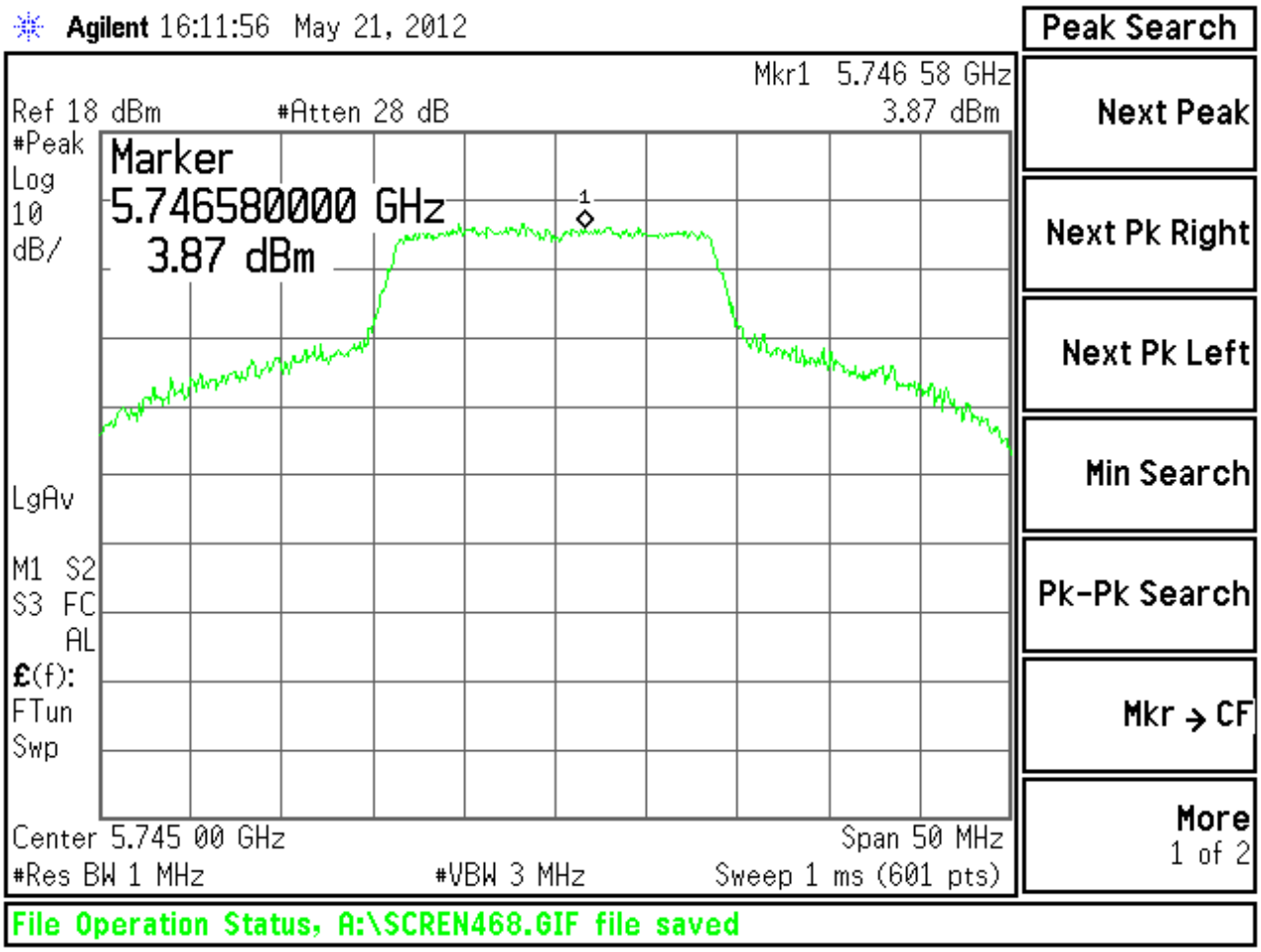
Conducted power spectral density – 5500 MHz



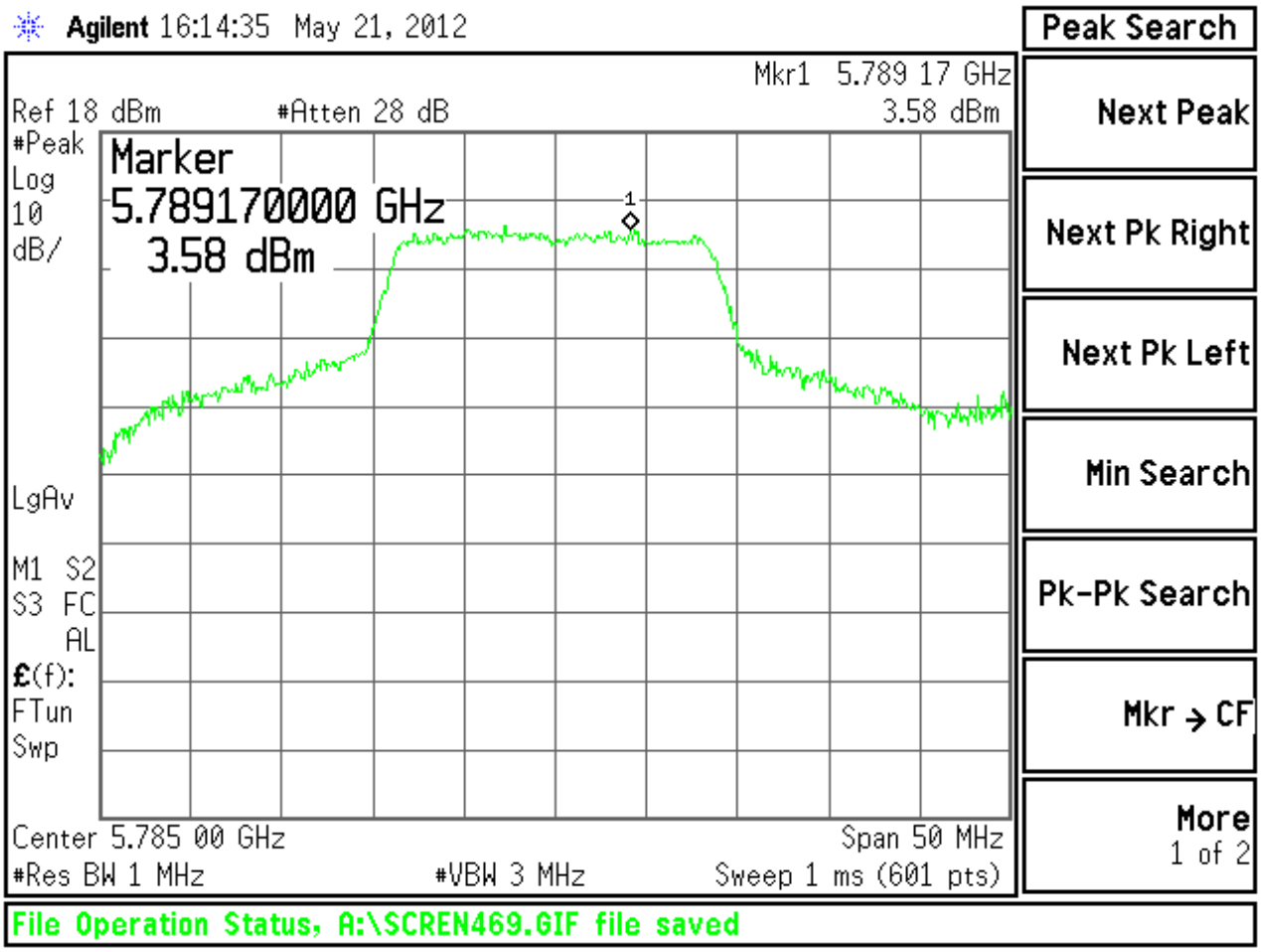
Conducted power spectral density – 5600 MHz



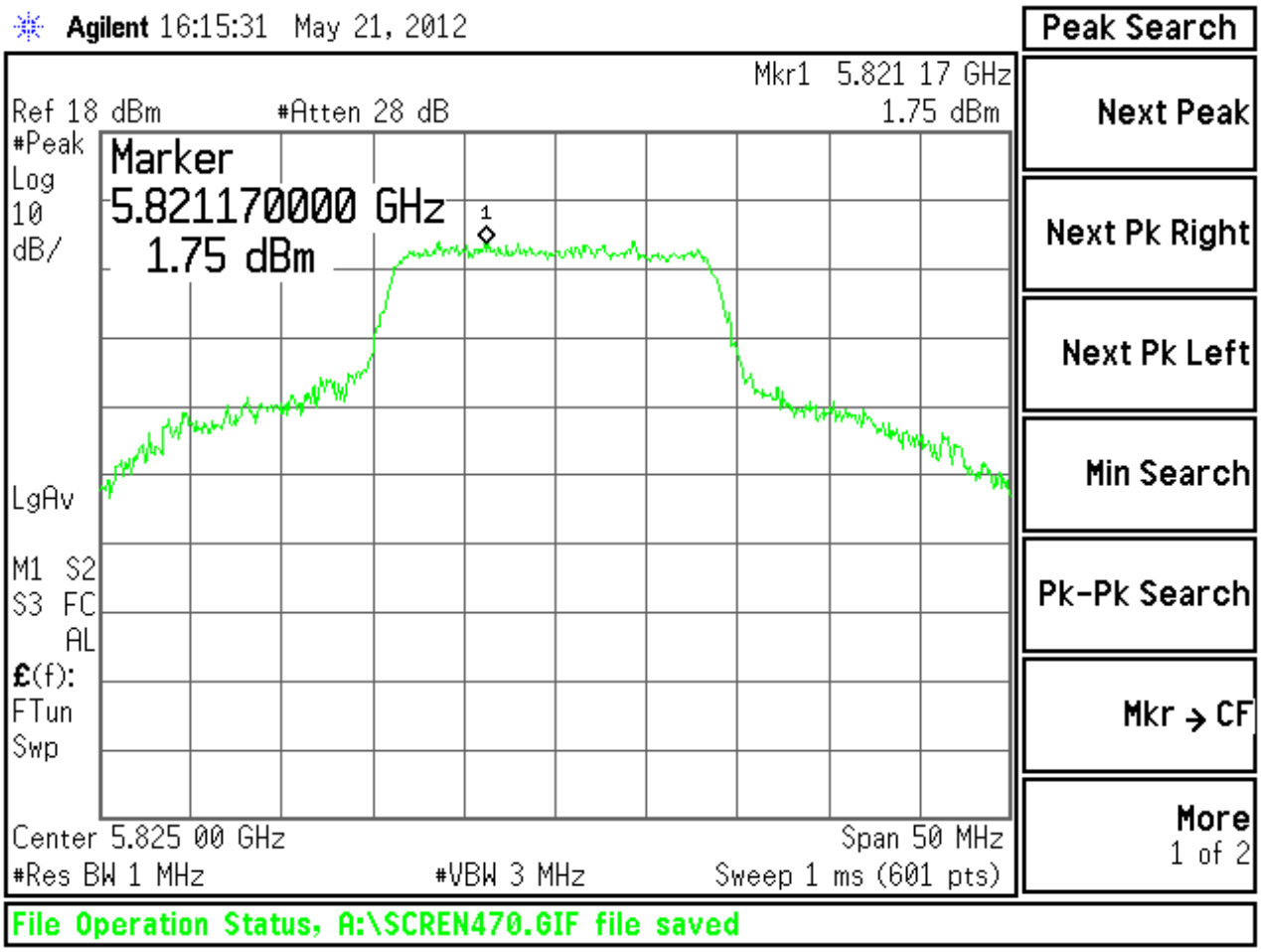
Conducted power spectral density – 5700 MHz



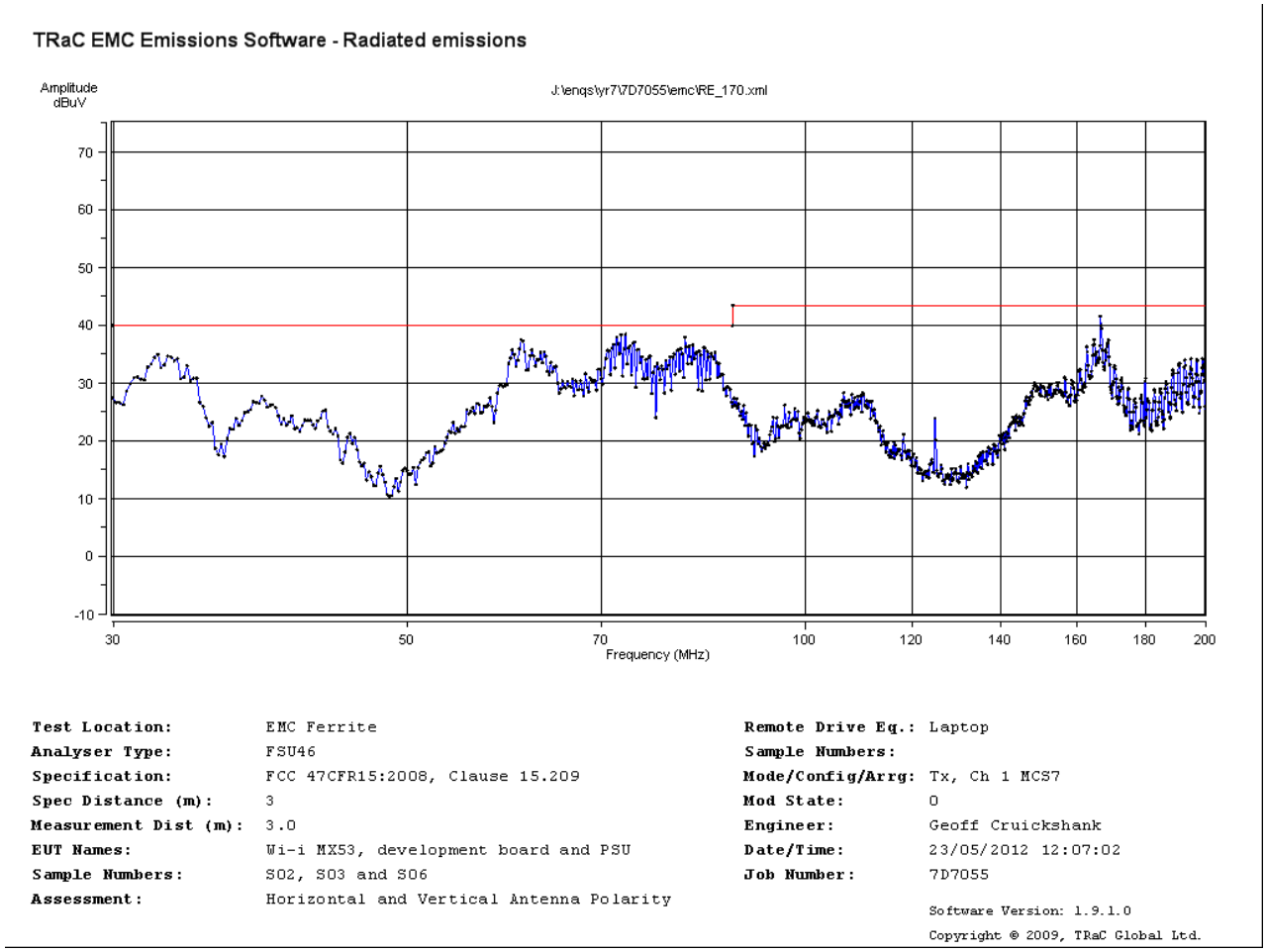
Conducted power spectral density – 5745 MHz



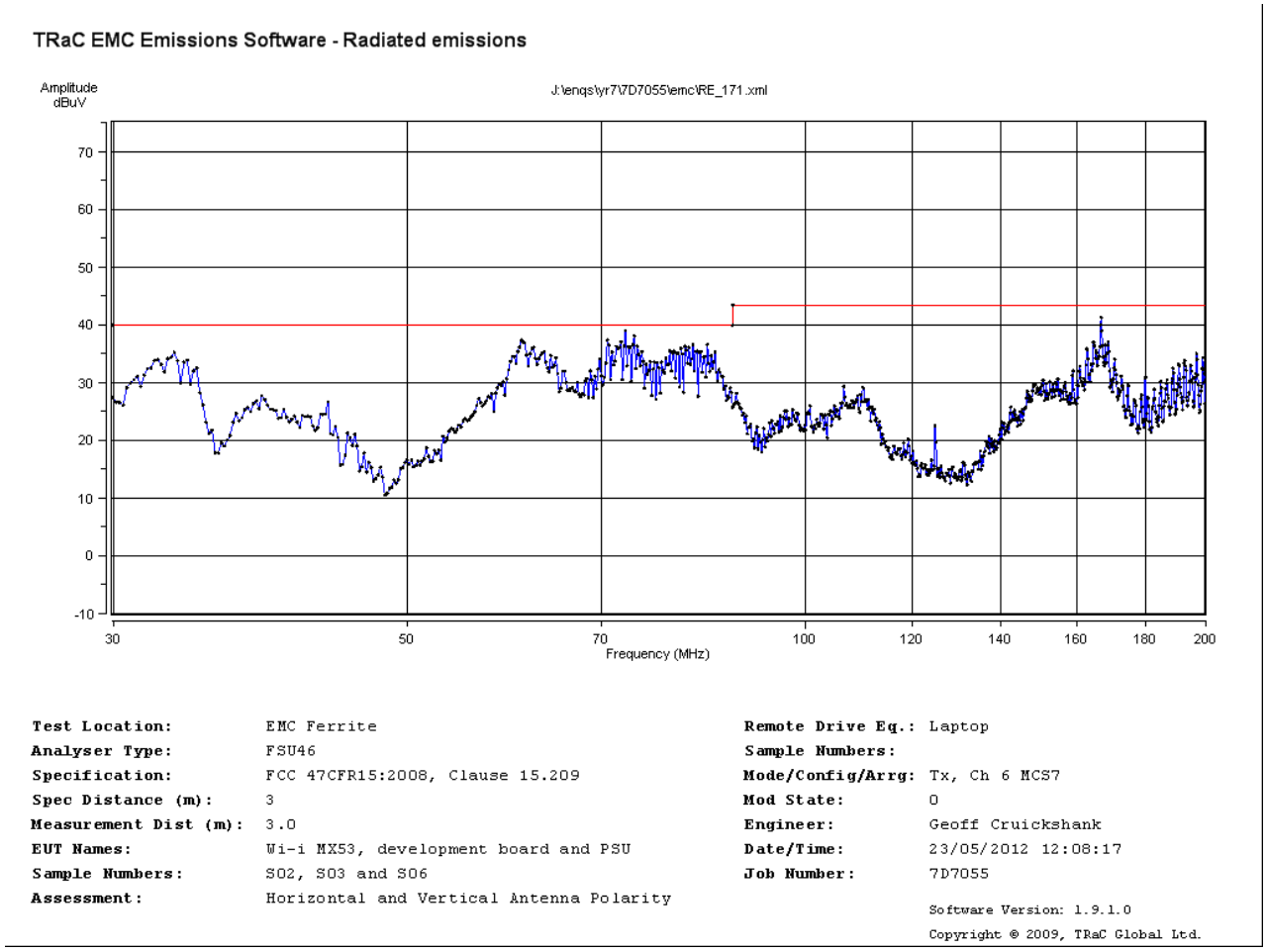
Conducted power spectral density – 5785 MHz



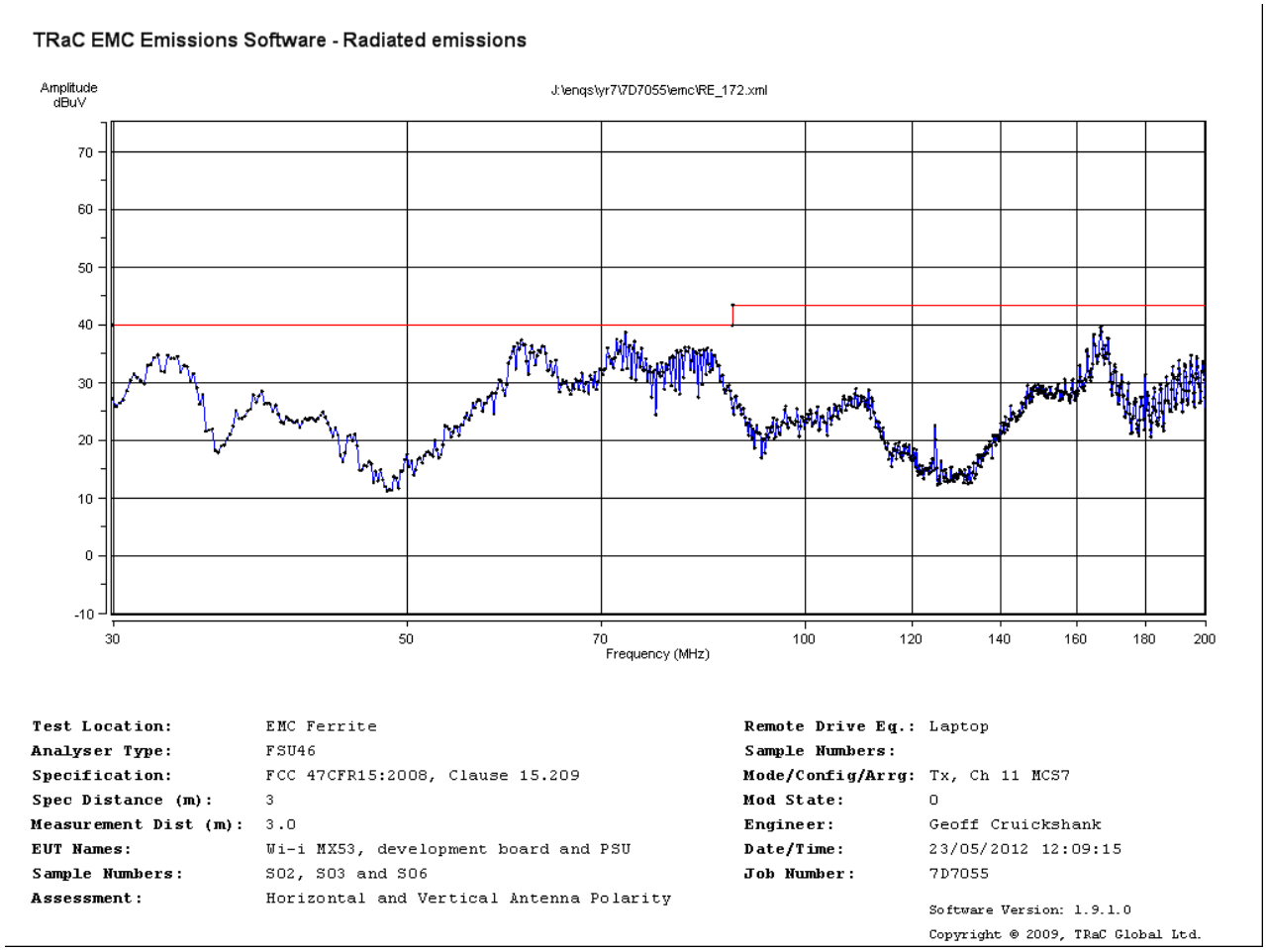
Conducted power spectral density – 5825 MHz



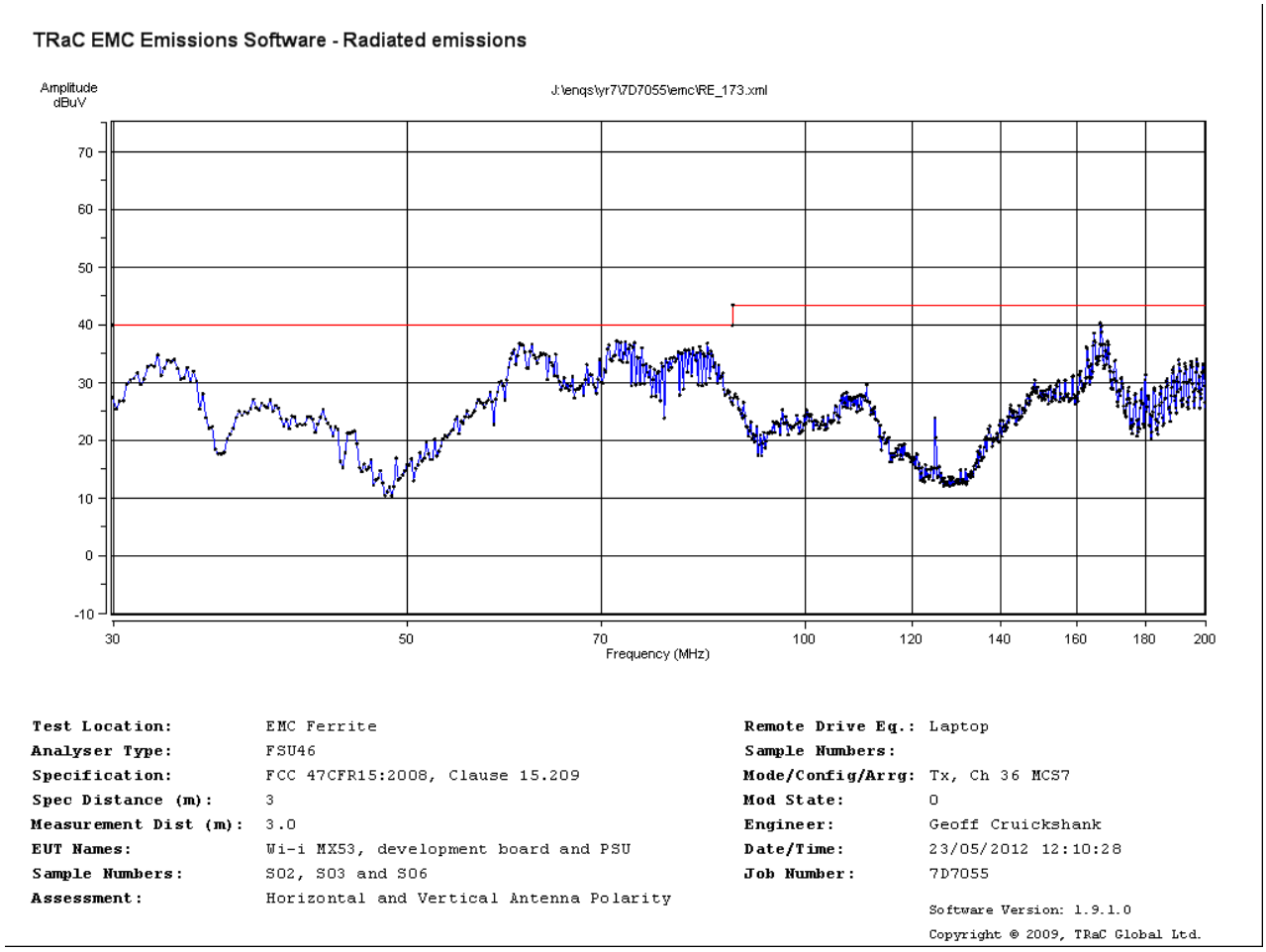
Radiated spurious emissions 30MHz to 200MHz Channel 1



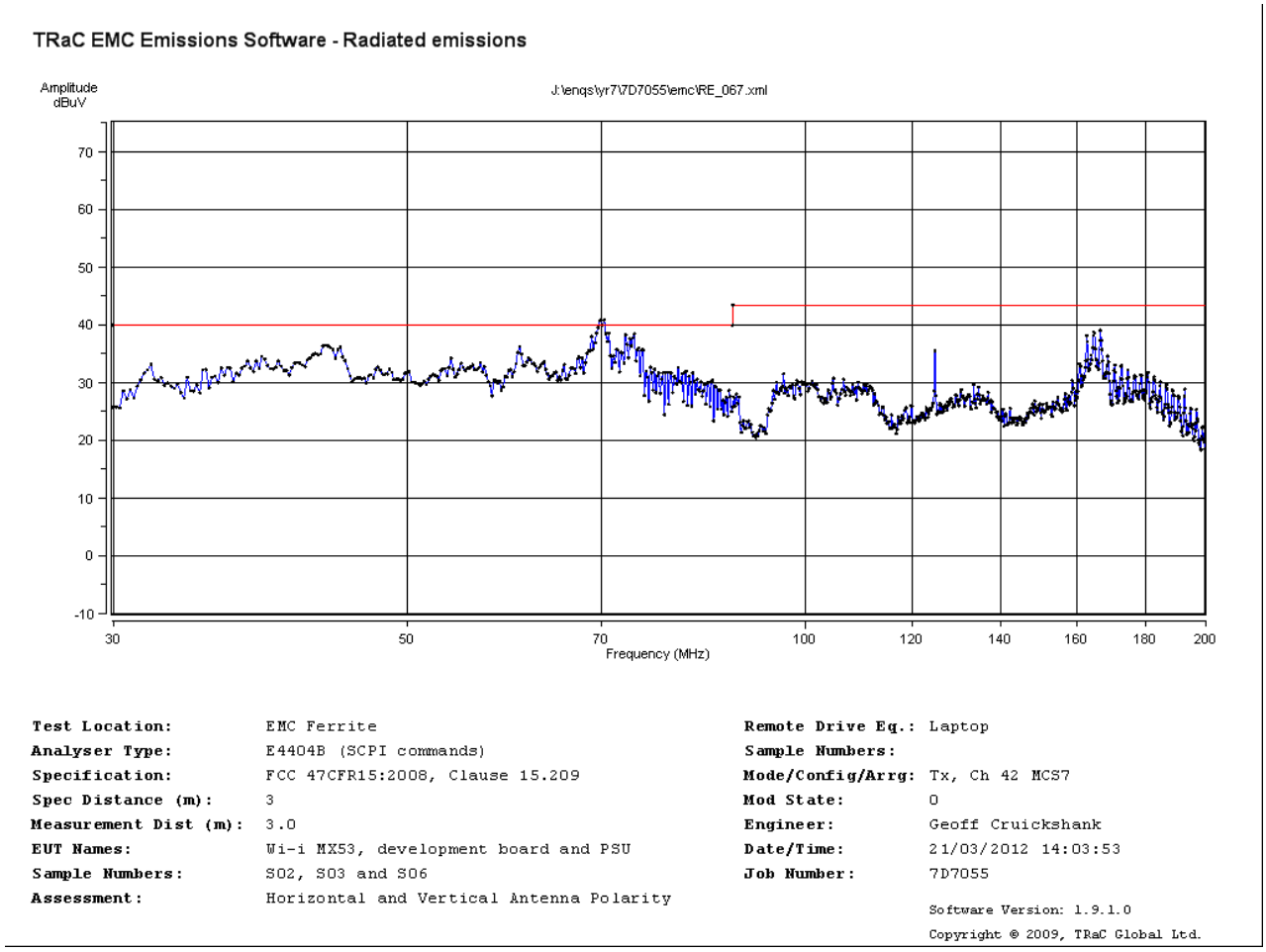
Radiated spurious emissions 30MHz to 200MHz Channel 6



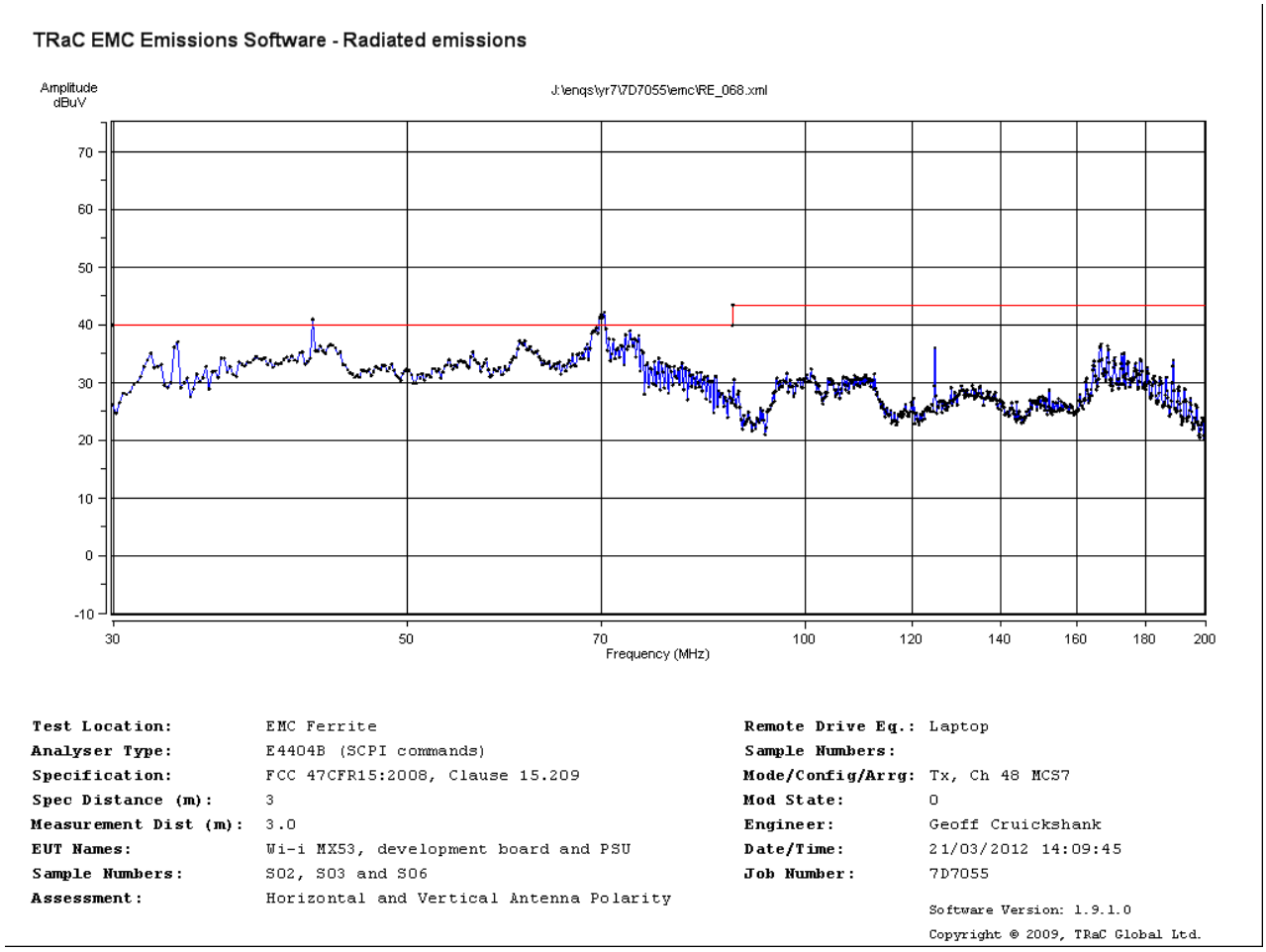
Radiated spurious emissions 30MHz to 200MHz Channel 11



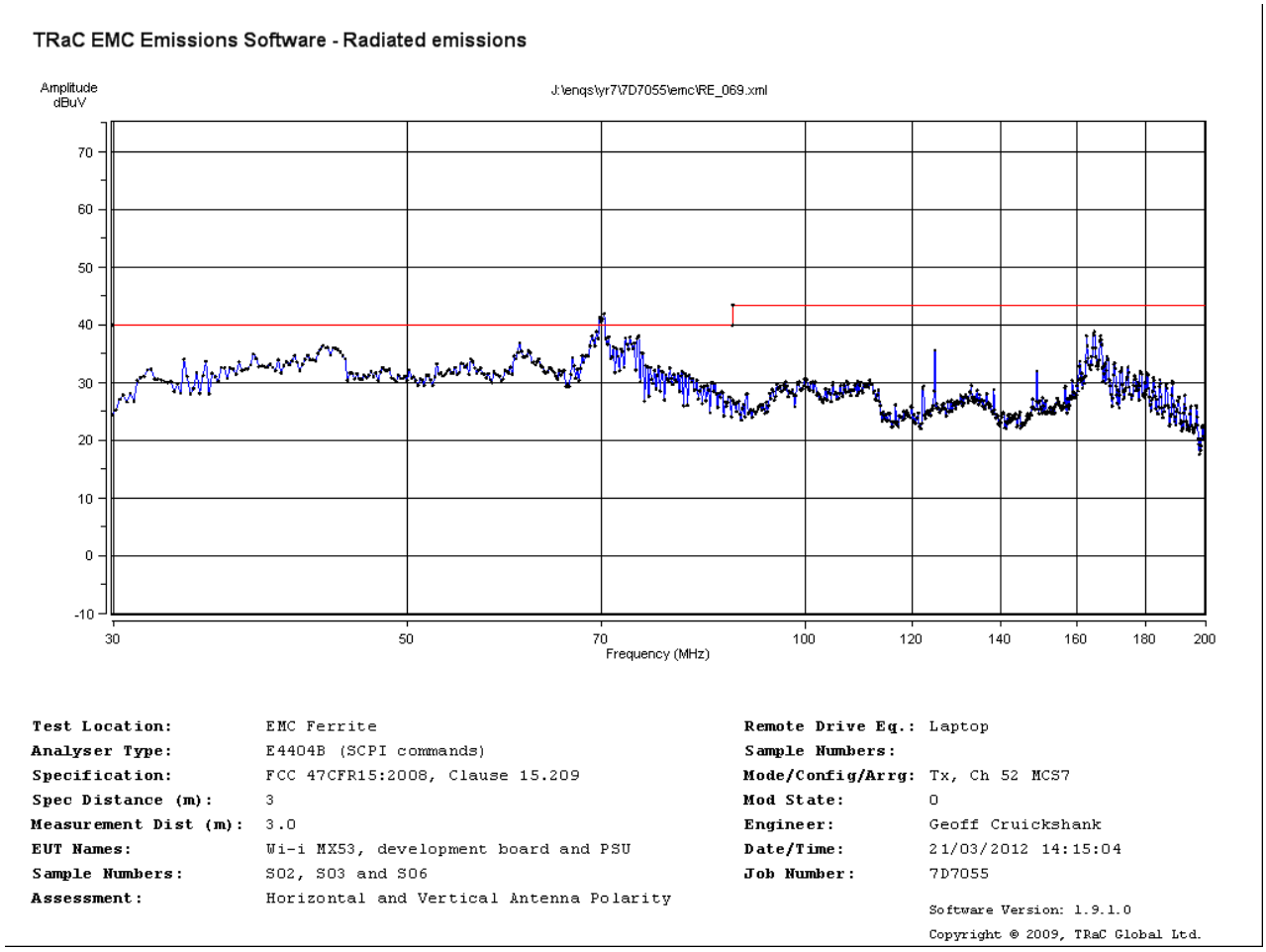
Radiated spurious emissions 30MHz to 200MHz Channel 36



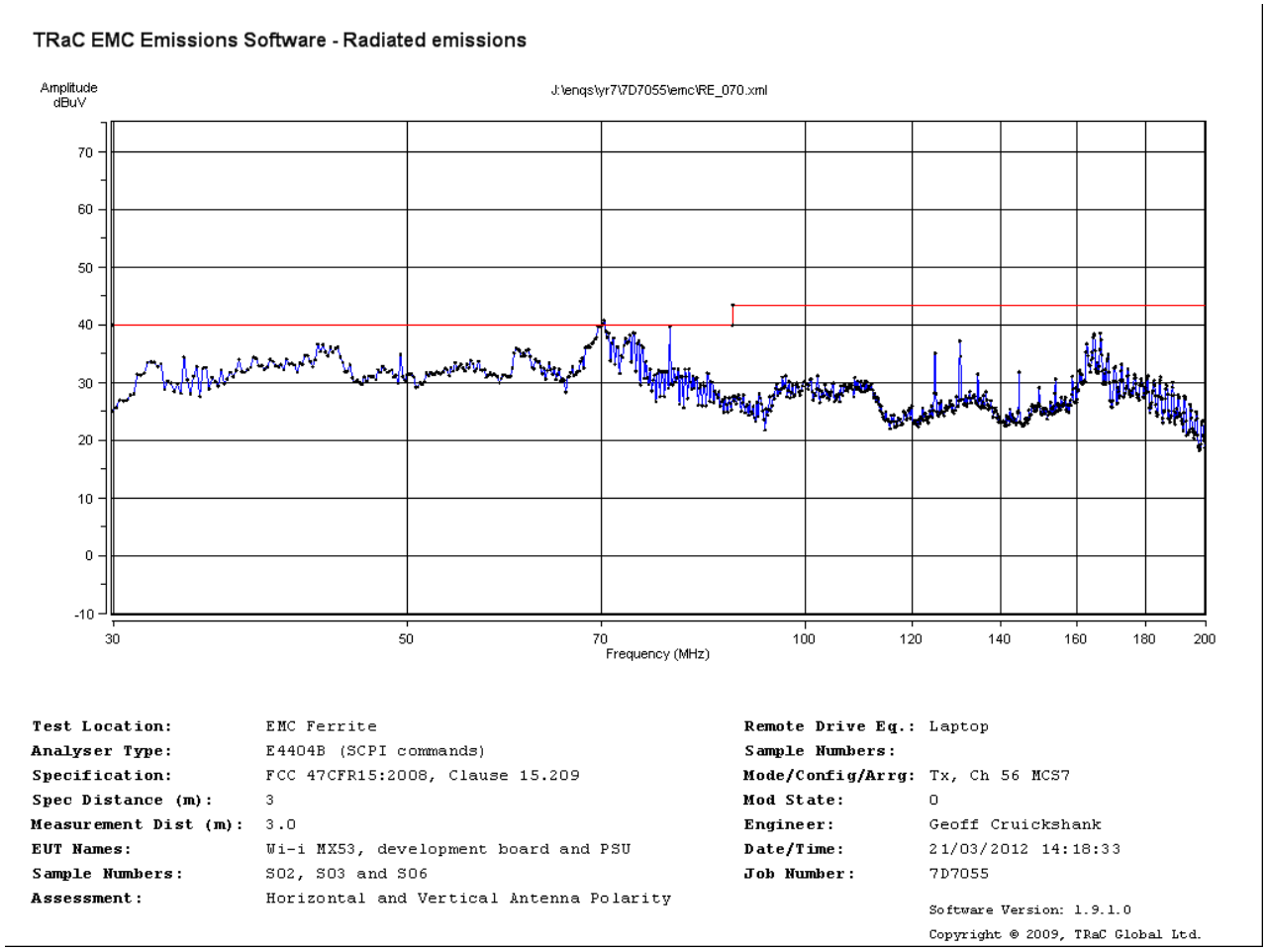
Radiated spurious emissions 30MHz to 200MHz Channel 44



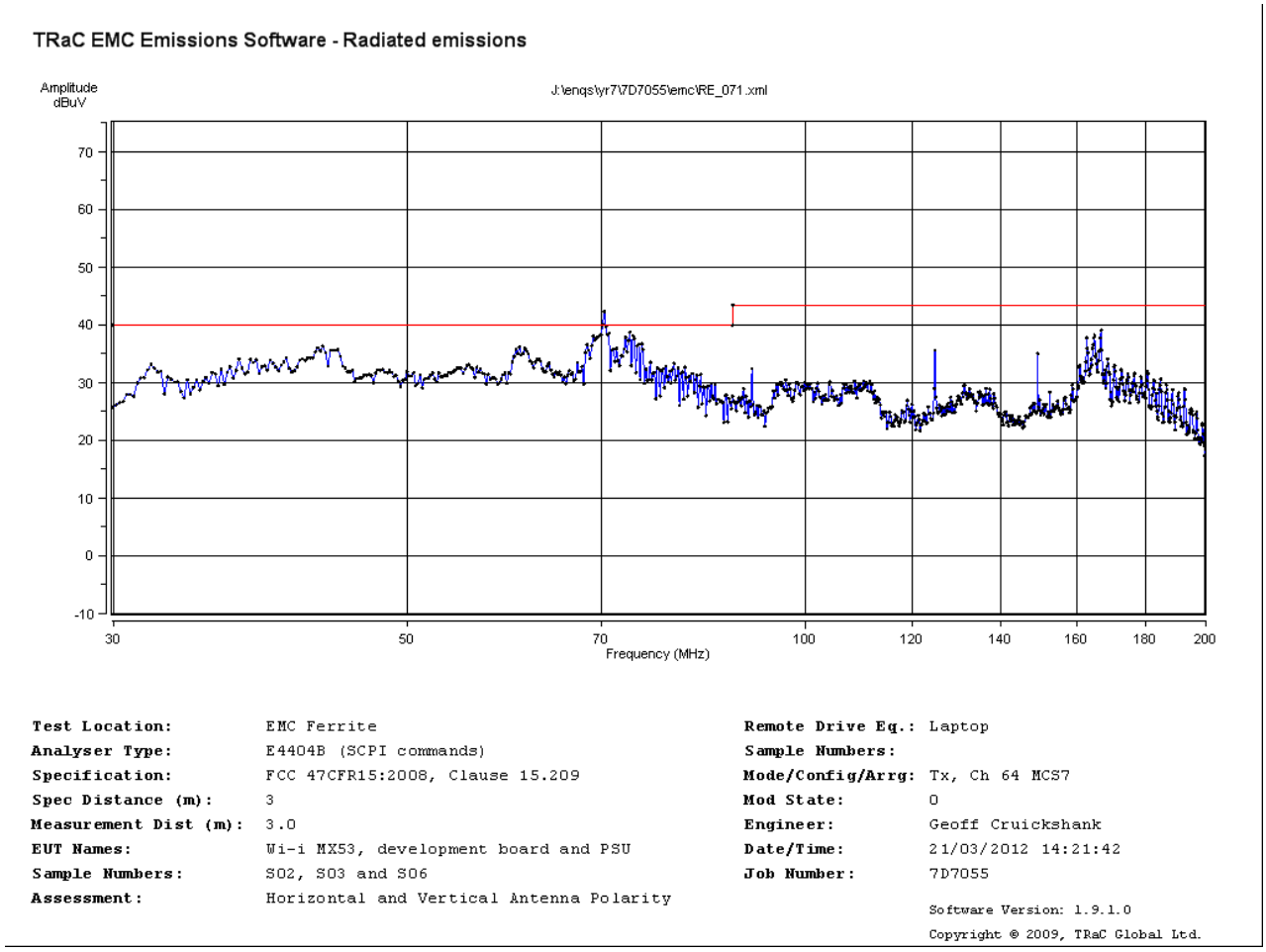
Radiated spurious emissions 30MHz to 200MHz Channel 48



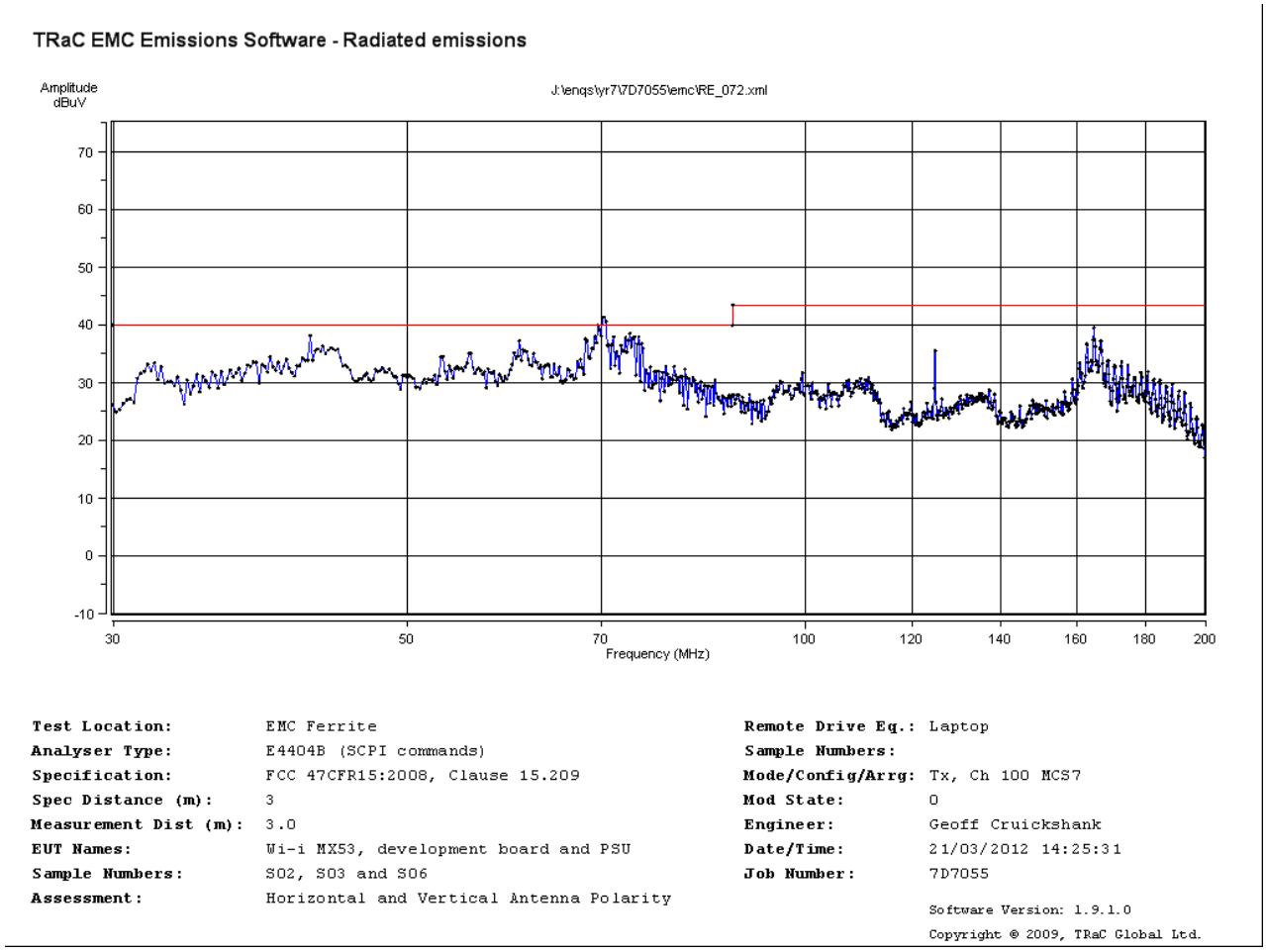
Radiated spurious emissions 30MHz to 200MHz Channel 52



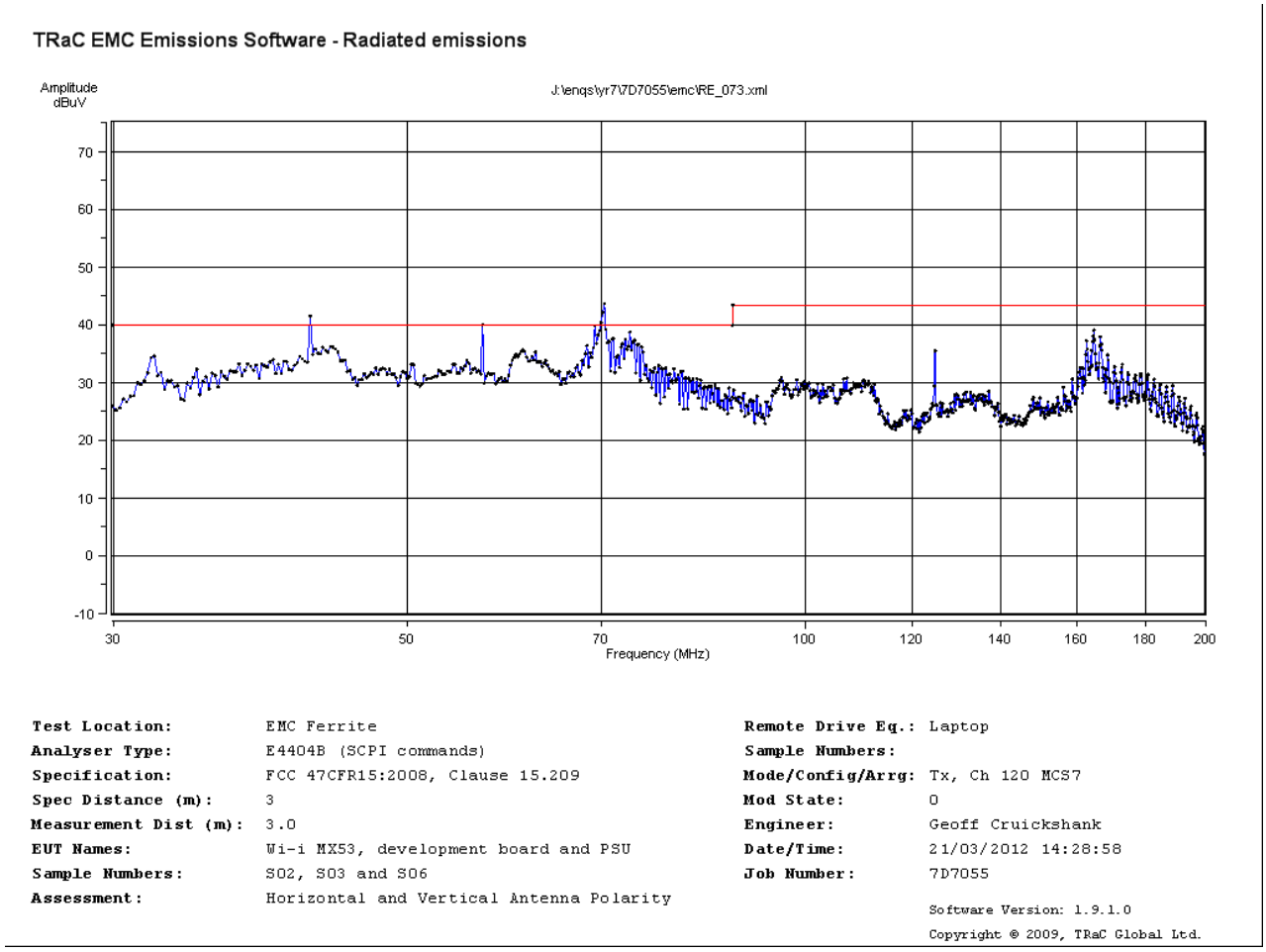
Radiated spurious emissions 30MHz to 200MHz Channel 56



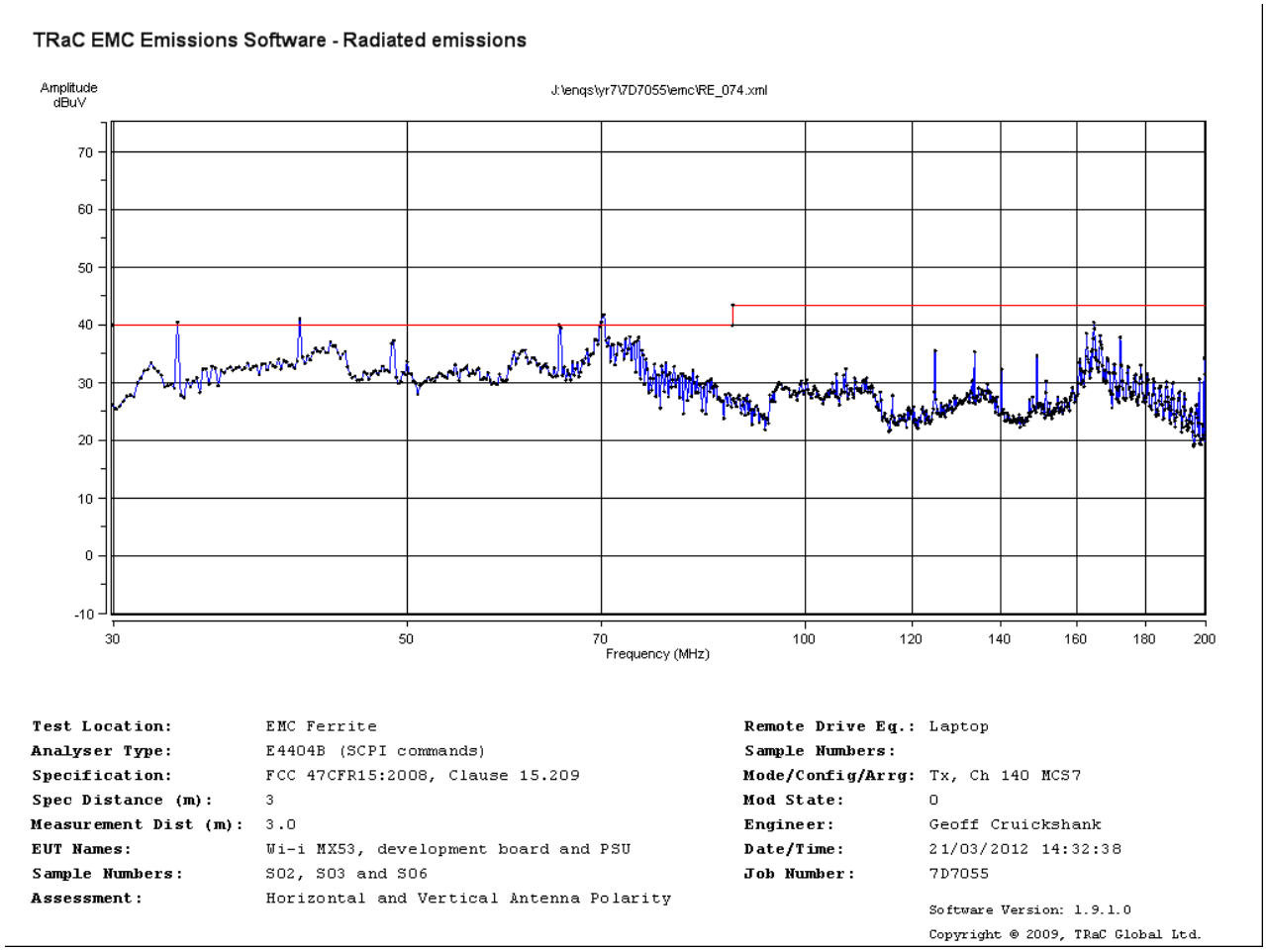
Radiated spurious emissions 30MHz to 200MHz Channel 64



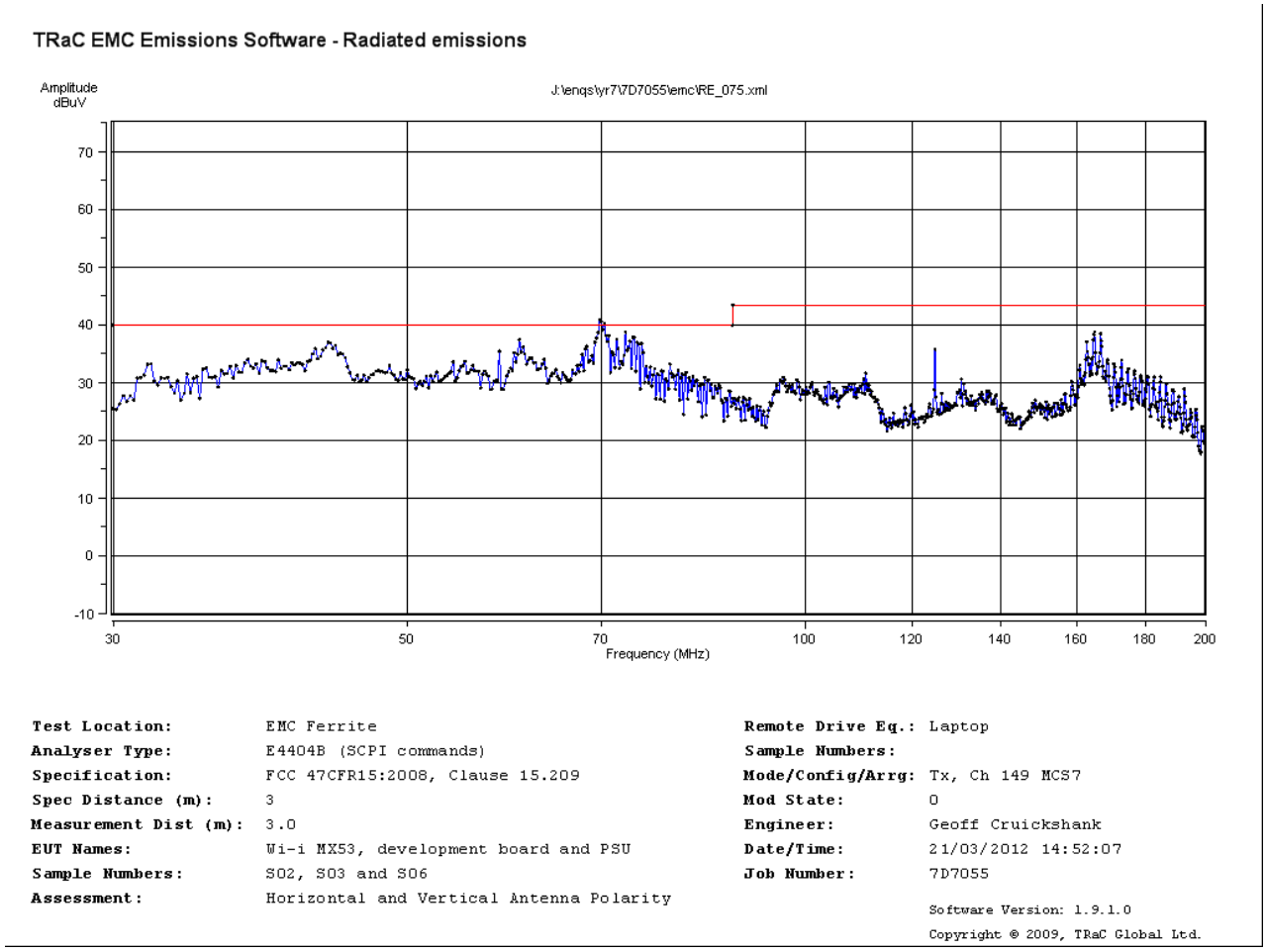
Radiated spurious emissions 30MHz to 200MHz Channel 100



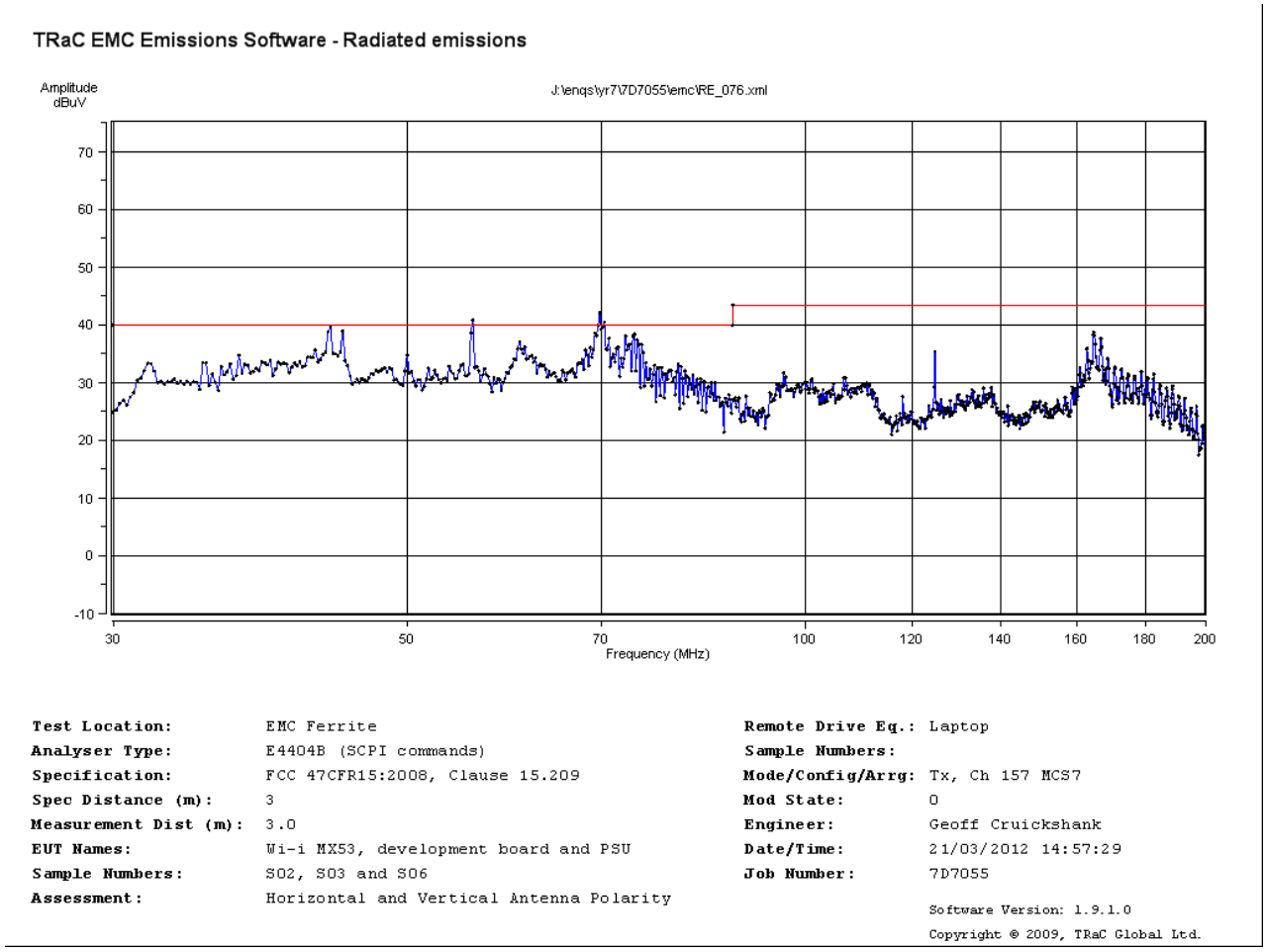
Radiated spurious emissions 30MHz to 200MHz Channel 120



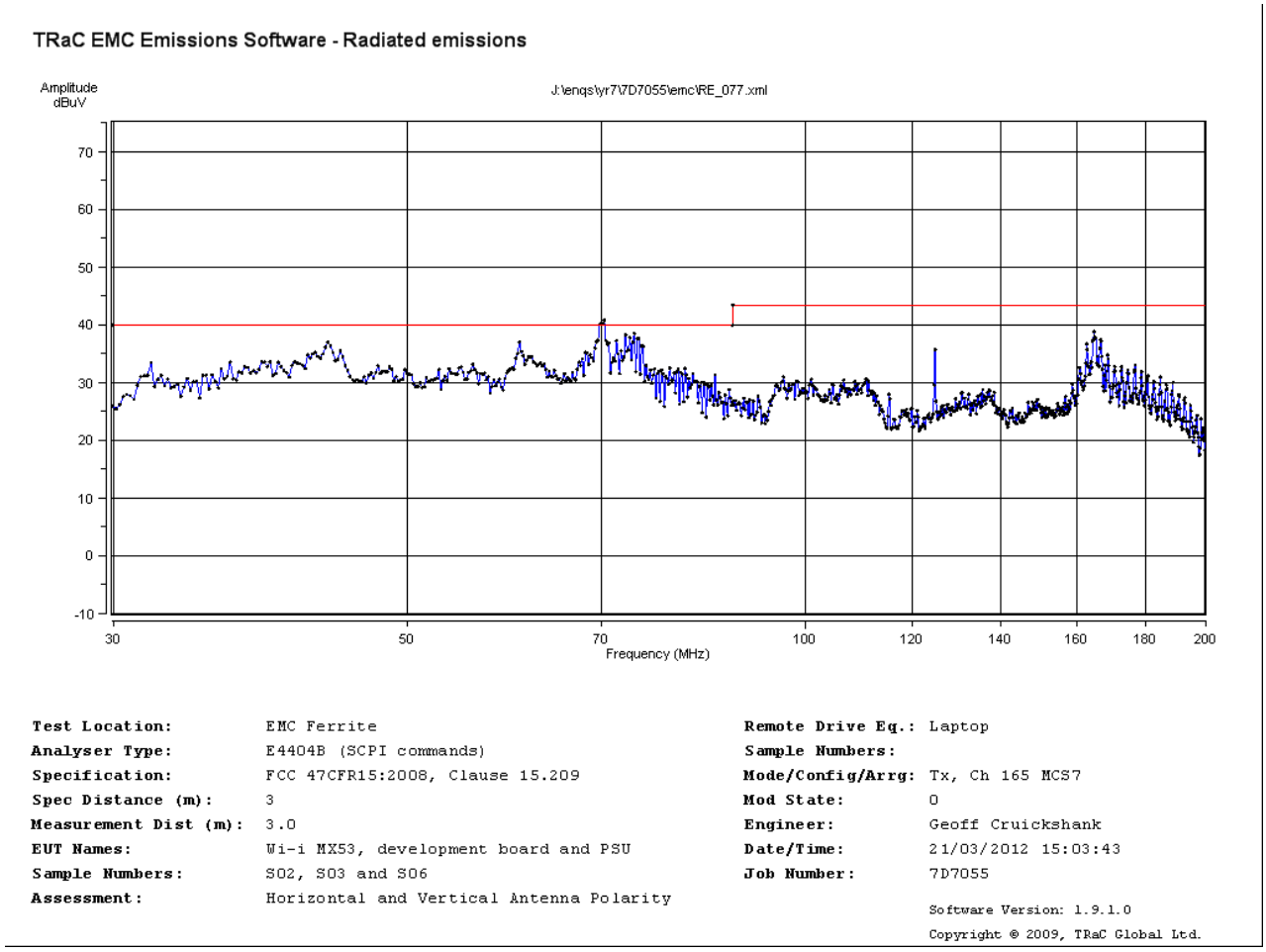
Radiated spurious emissions 30MHz to 200MHz Channel 140



Radiated spurious emissions 30MHz to 200MHz Channel 149

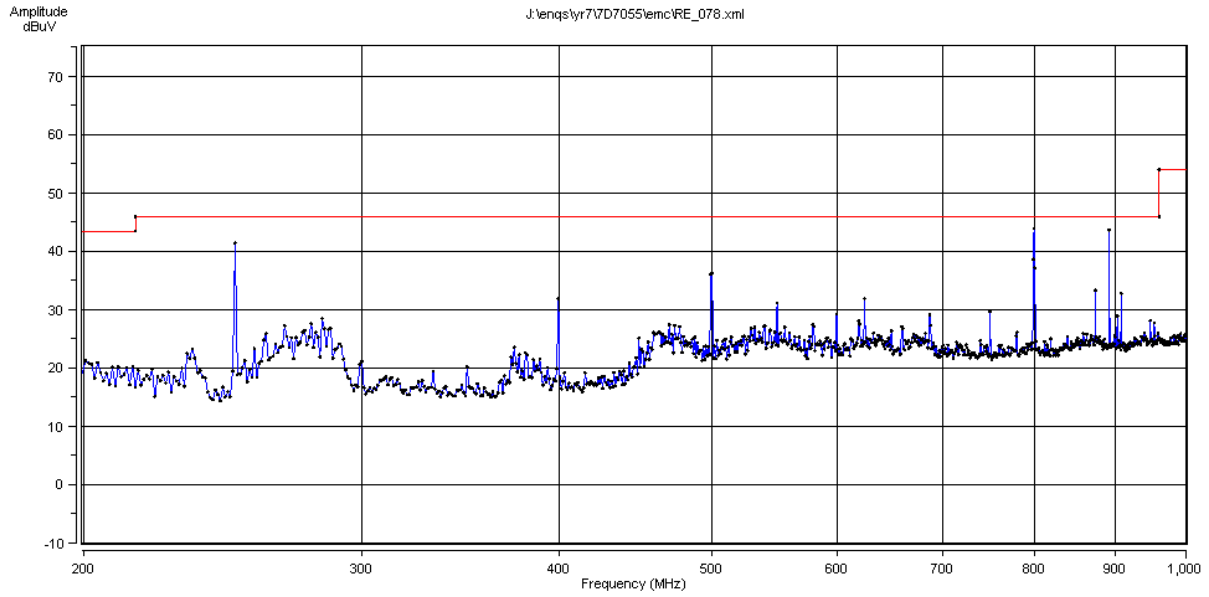


Radiated spurious emissions 30MHz to 200MHz Channel 157



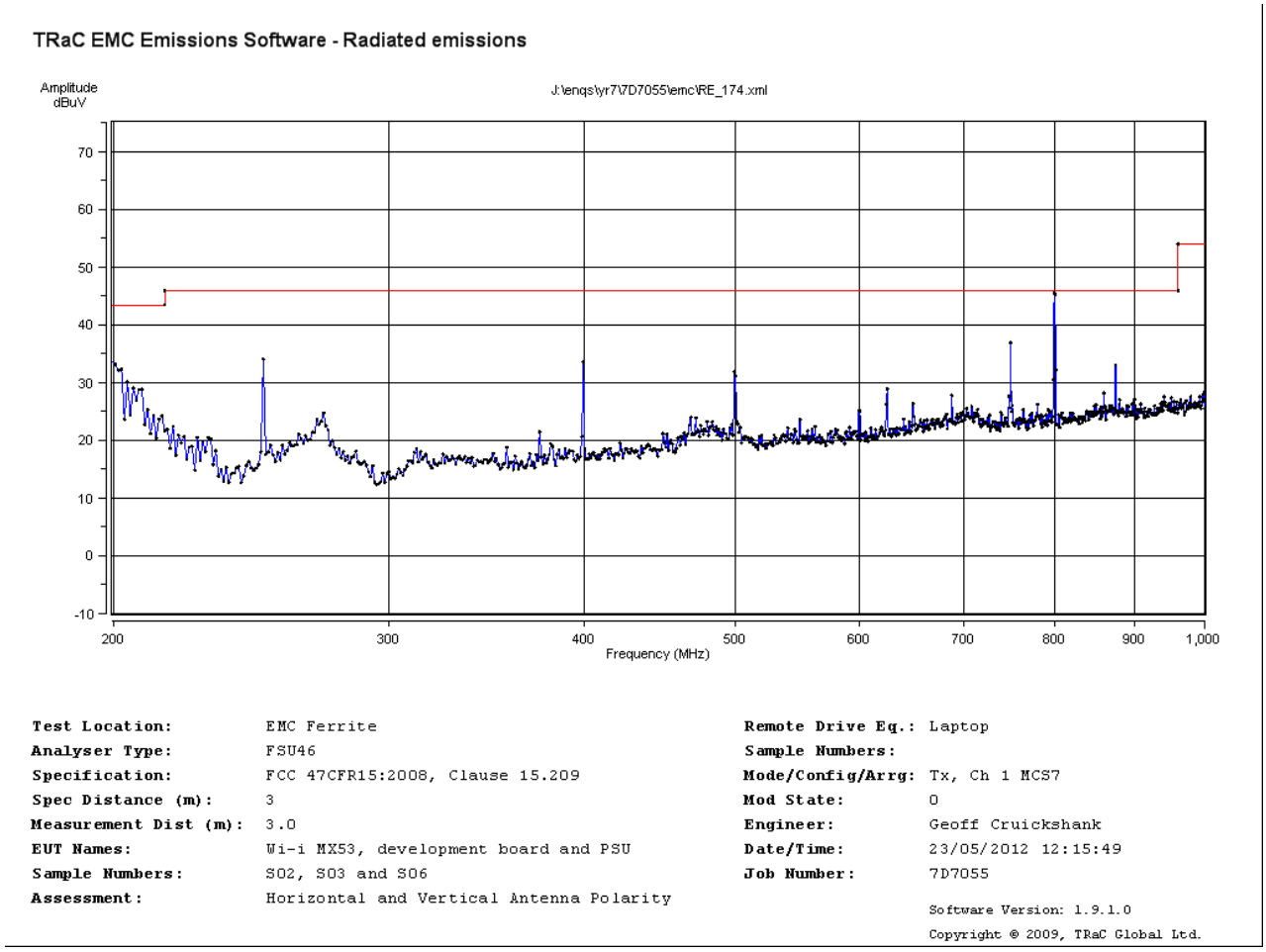
Radiated spurious emissions 30MHz to 200MHz Channel 165

TRaC EMC Emissions Software - Radiated emissions

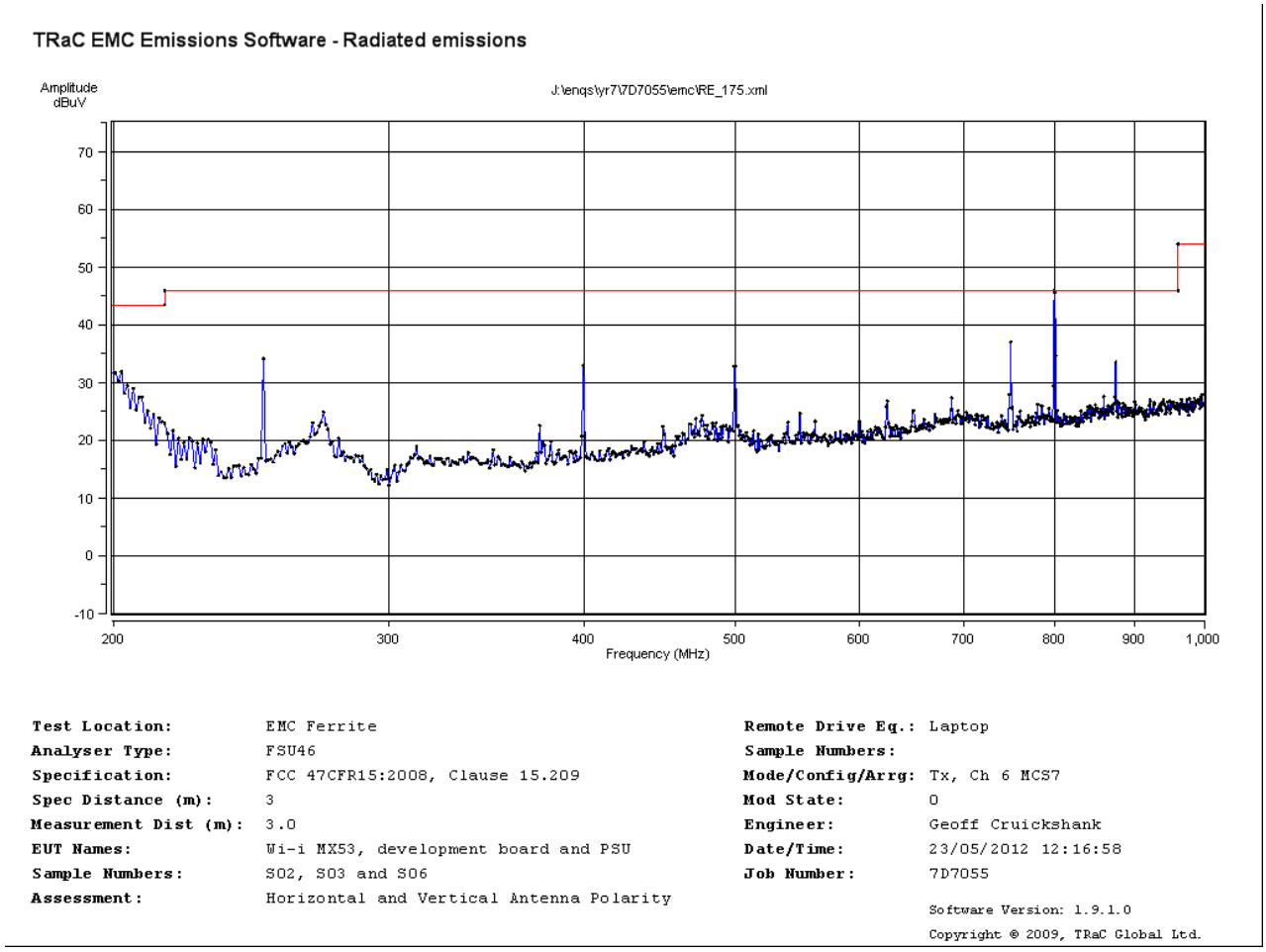


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	E4404B (SCPI commands)	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx, Ch 36 MCS7
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	3.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	21/03/2012 15:13:10
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

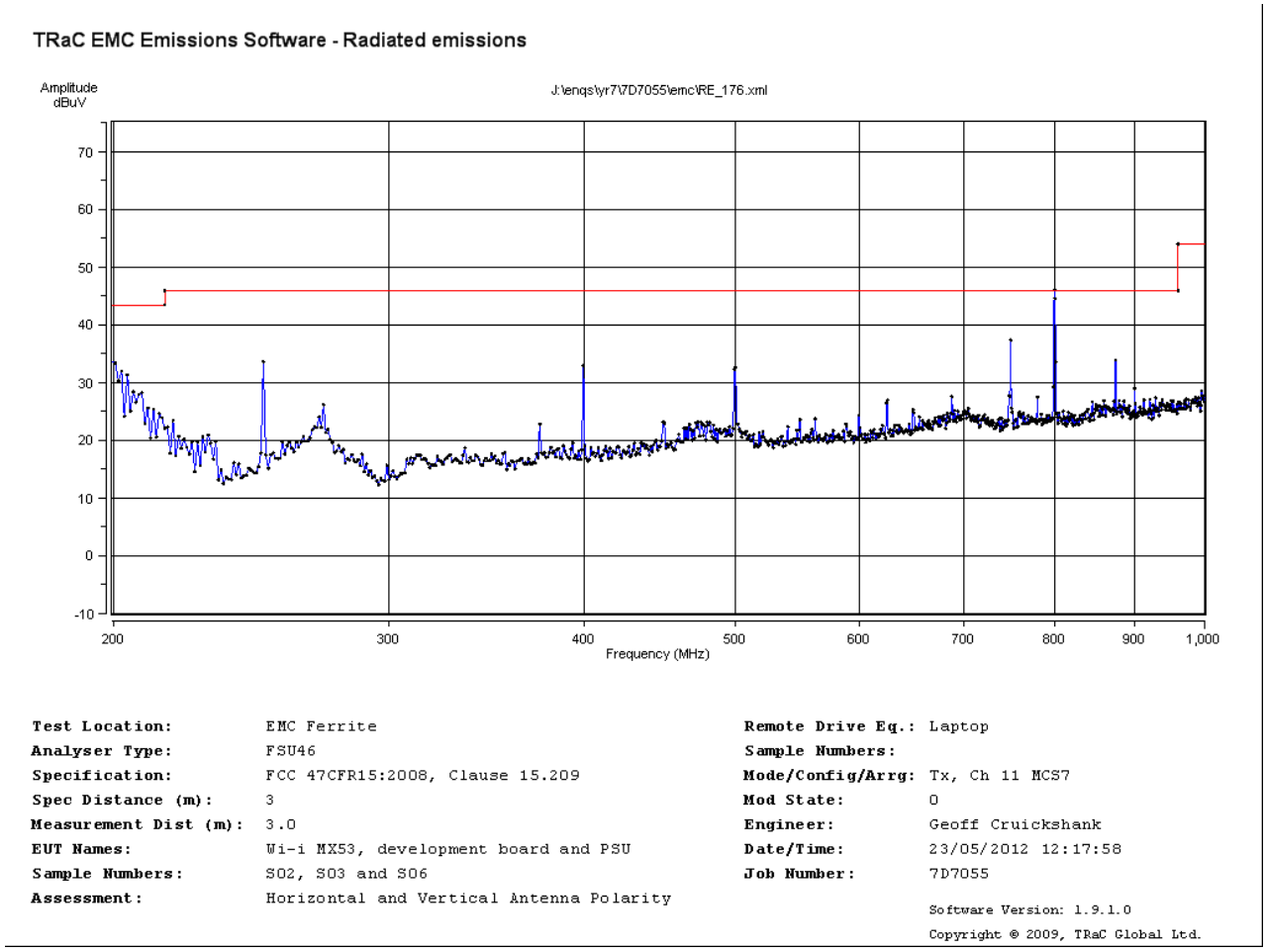
Software Version: 1.9.1.0



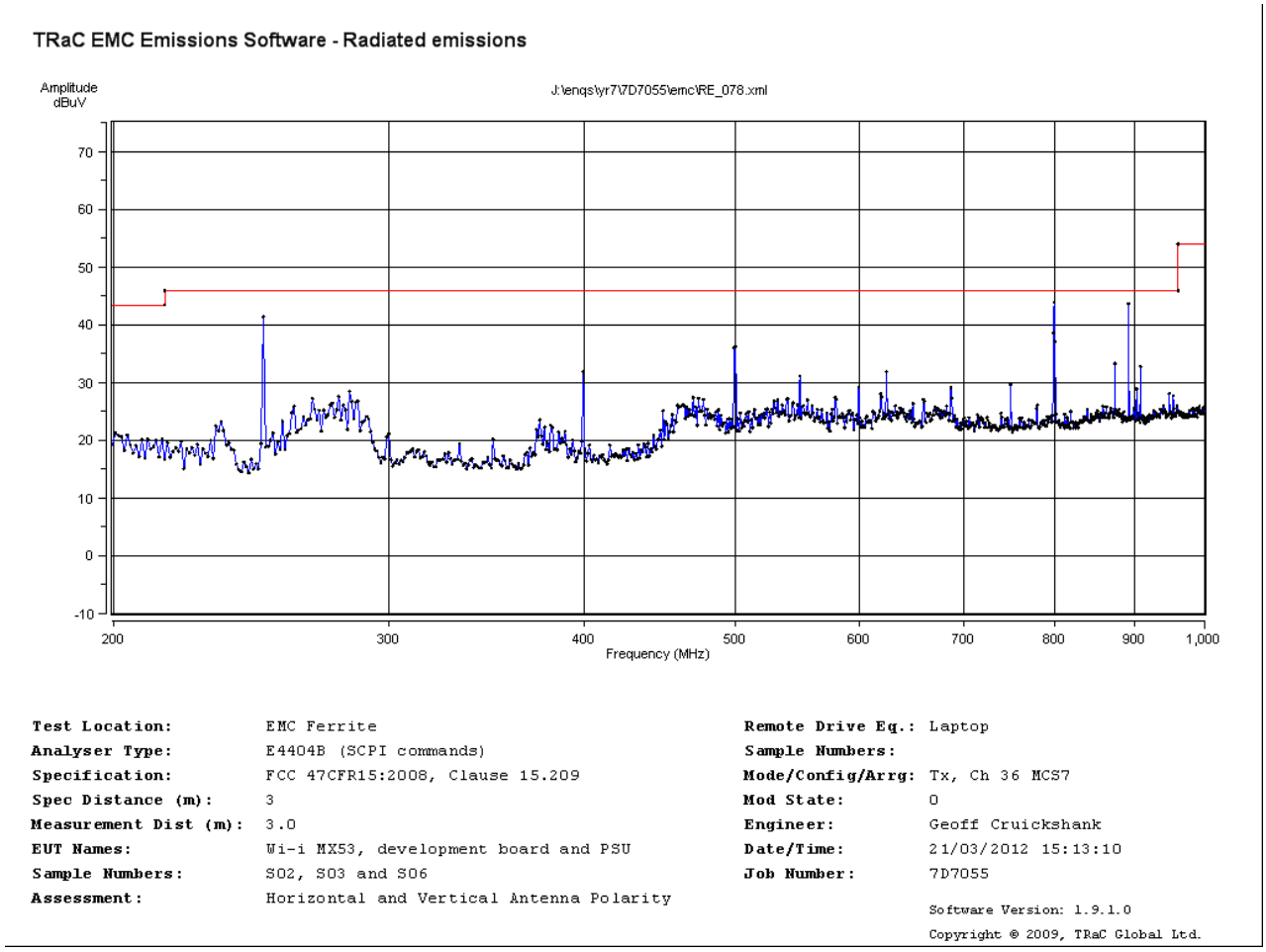
Radiated spurious emissions 200 MHz – 1GHz Channel 1



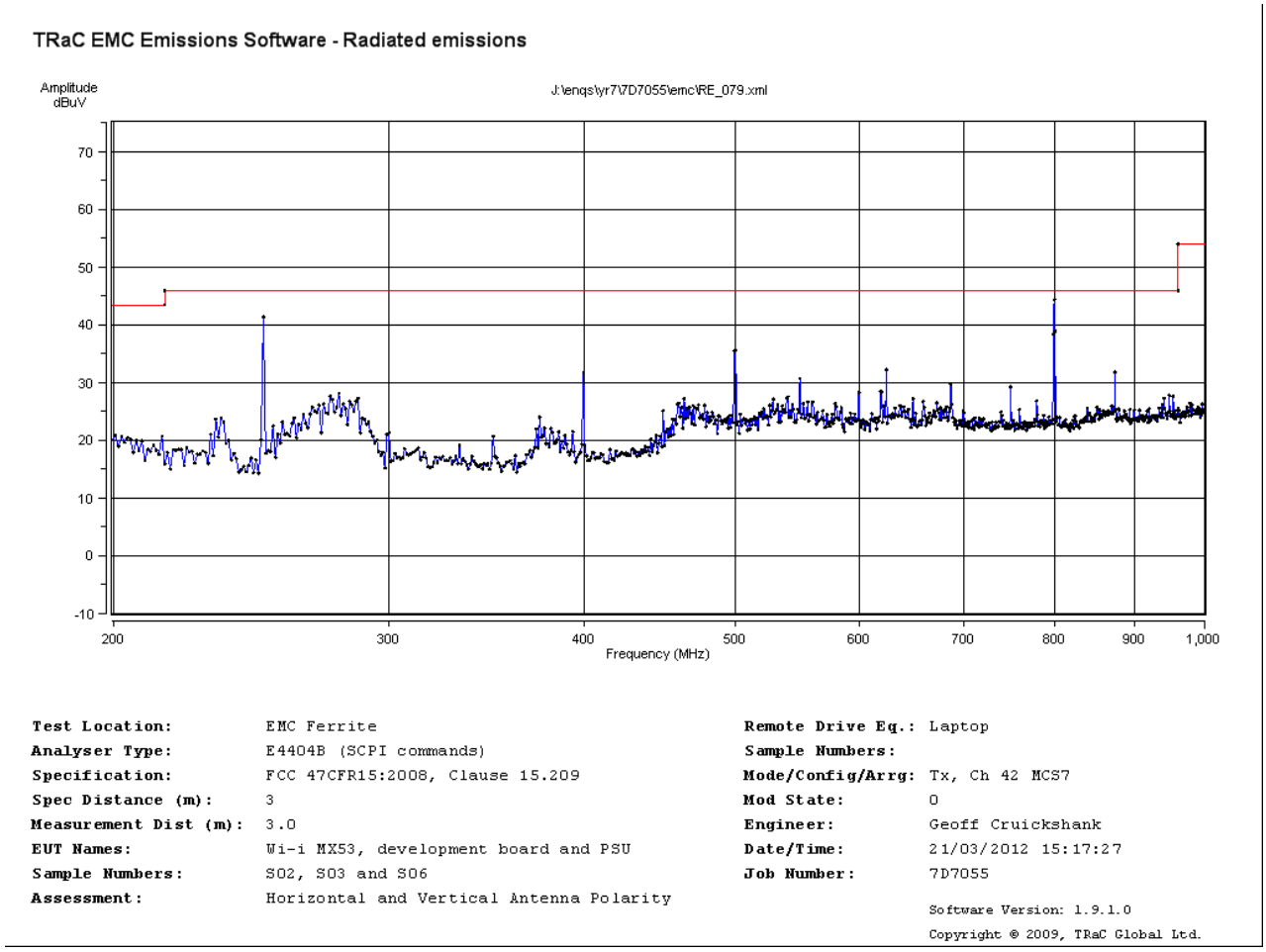
Radiated spurious emissions 200 MHz – 1GHz Channel 6



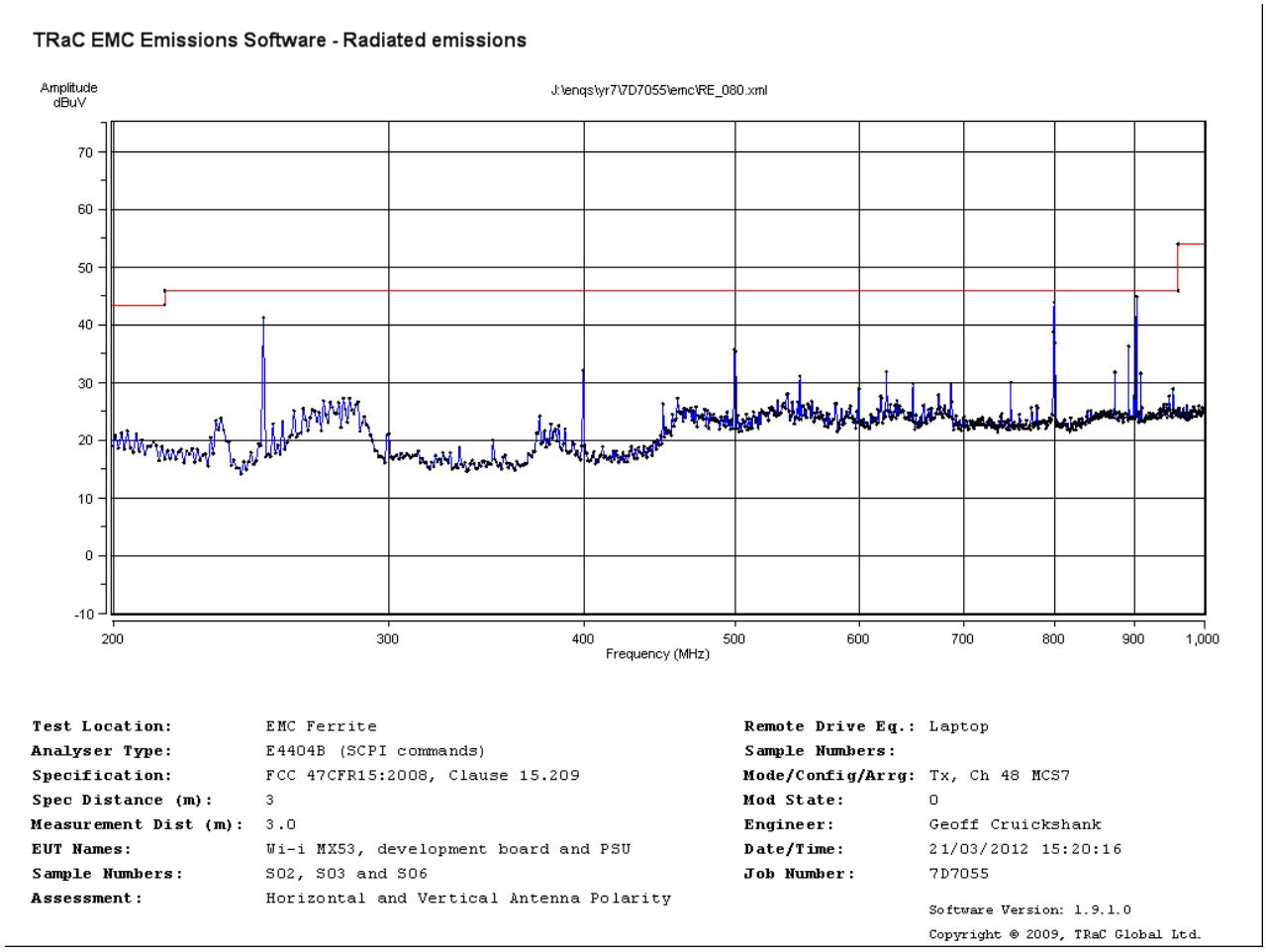
Radiated spurious emissions 200 MHz – 1GHz Channel 11



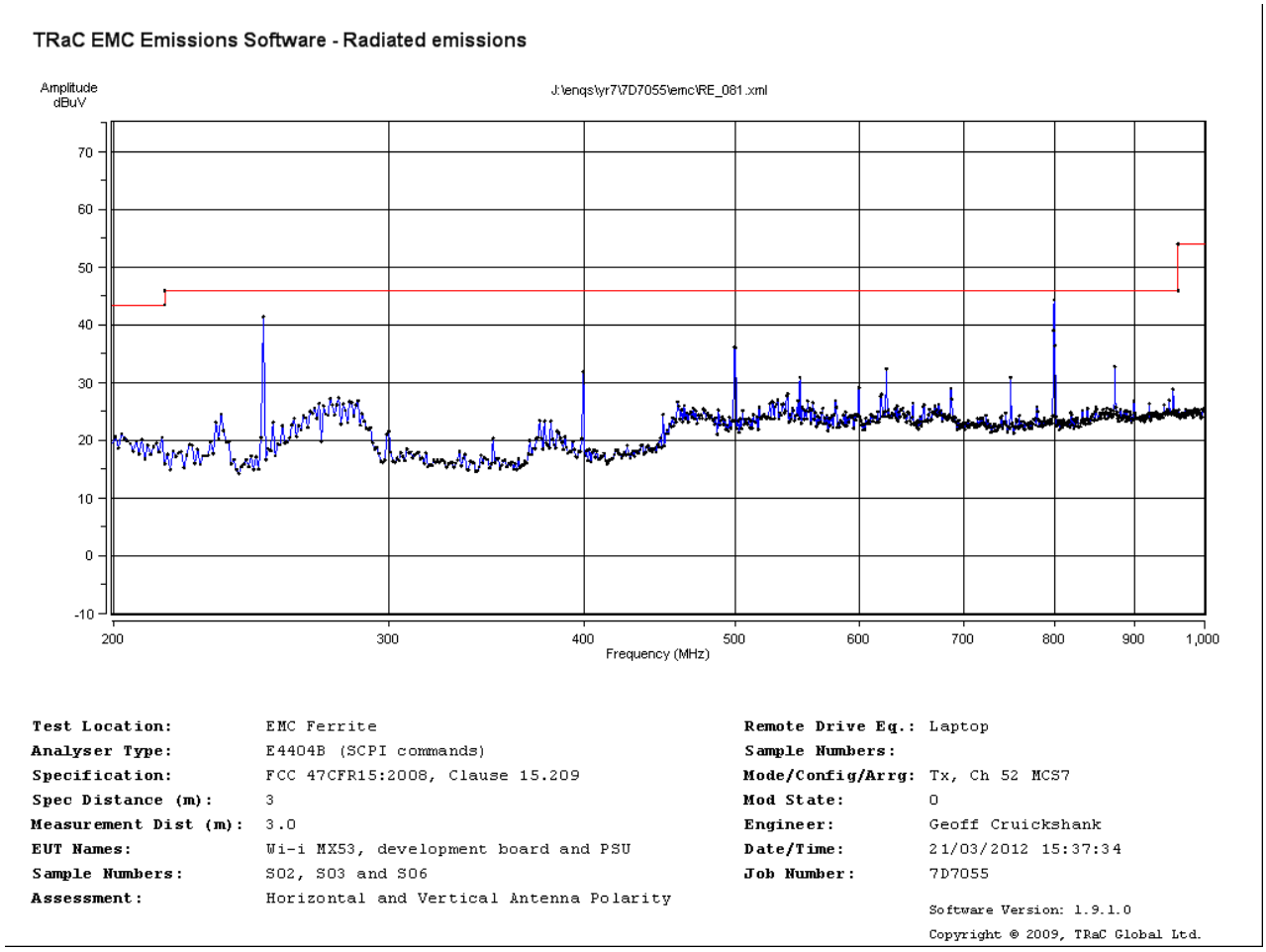
Radiated spurious emissions 200 MHz – 1GHz Channel 36



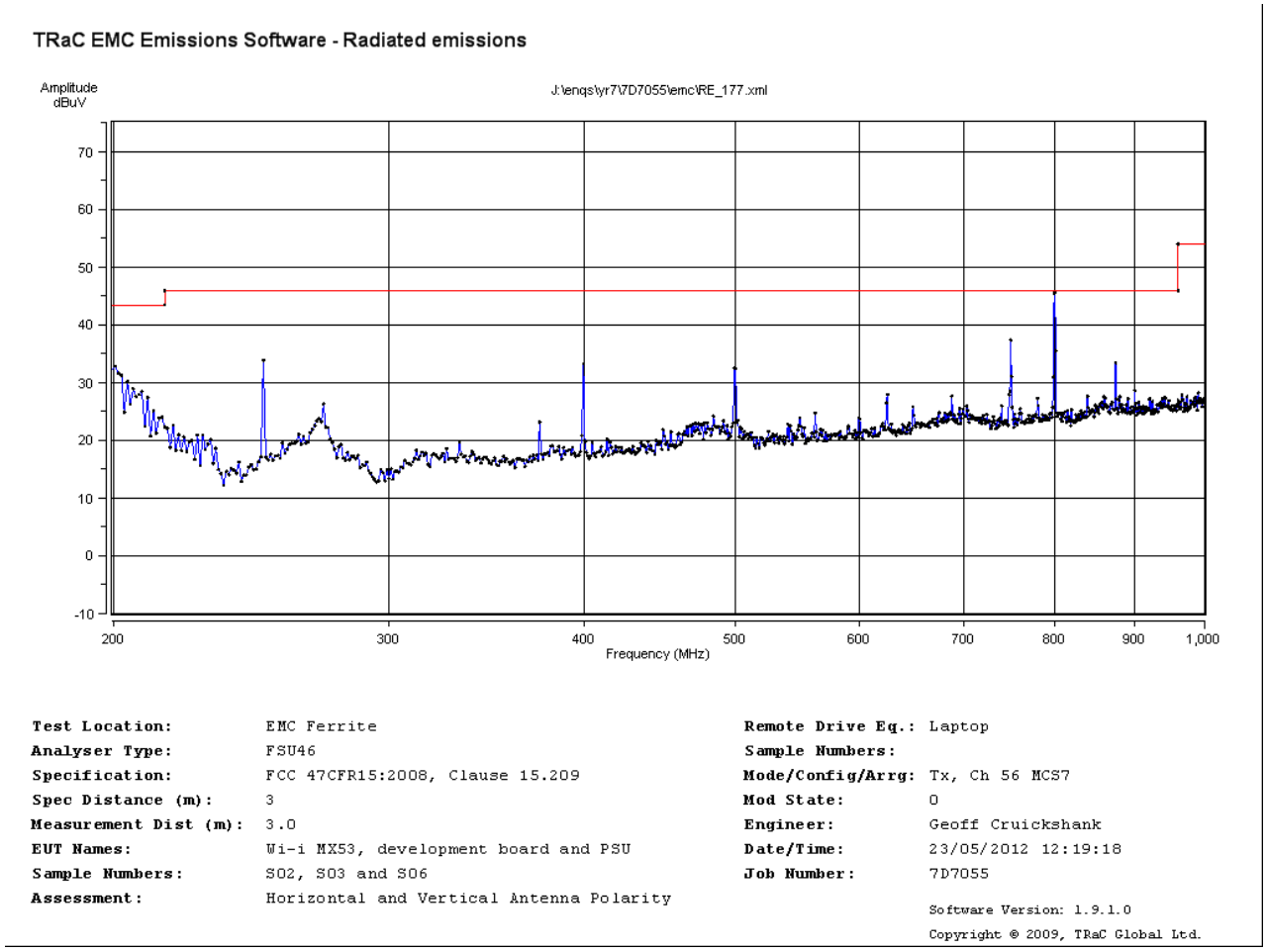
Radiated spurious emissions 200 MHz – 1GHz Channel 44



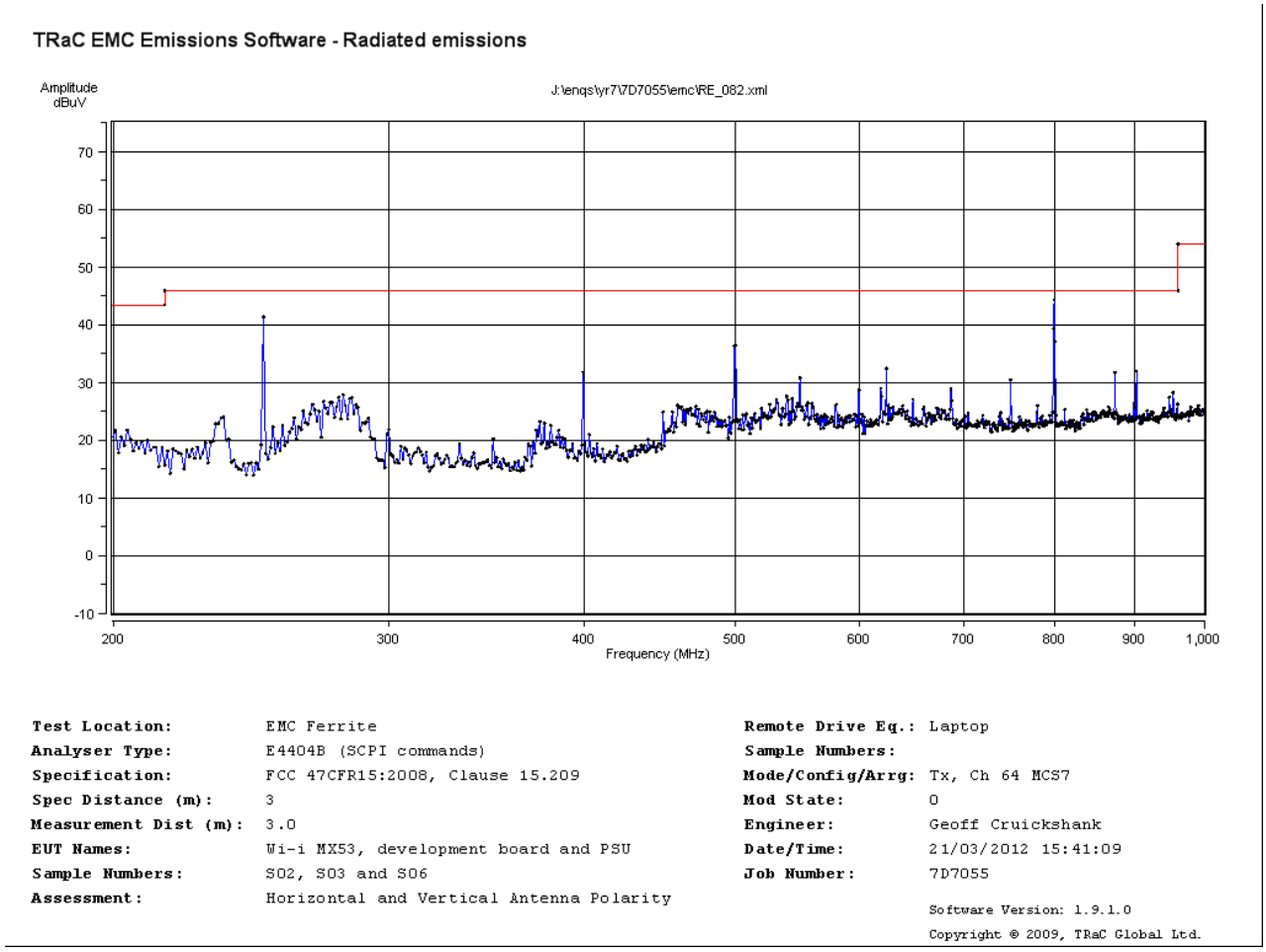
Radiated spurious emissions 200 MHz – 1GHz Channel 48



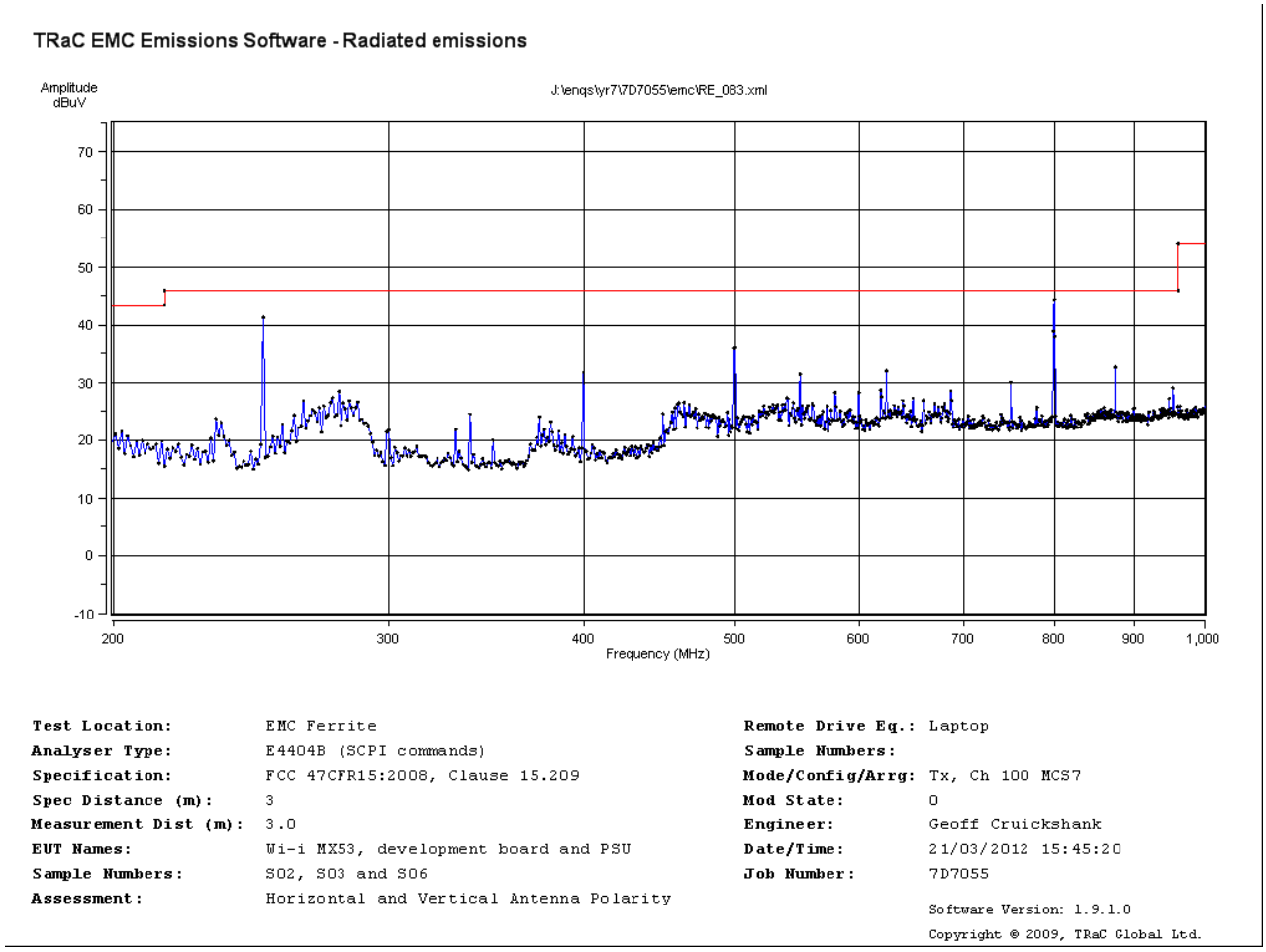
Radiated spurious emissions 200 MHz – 1GHz Channel 52



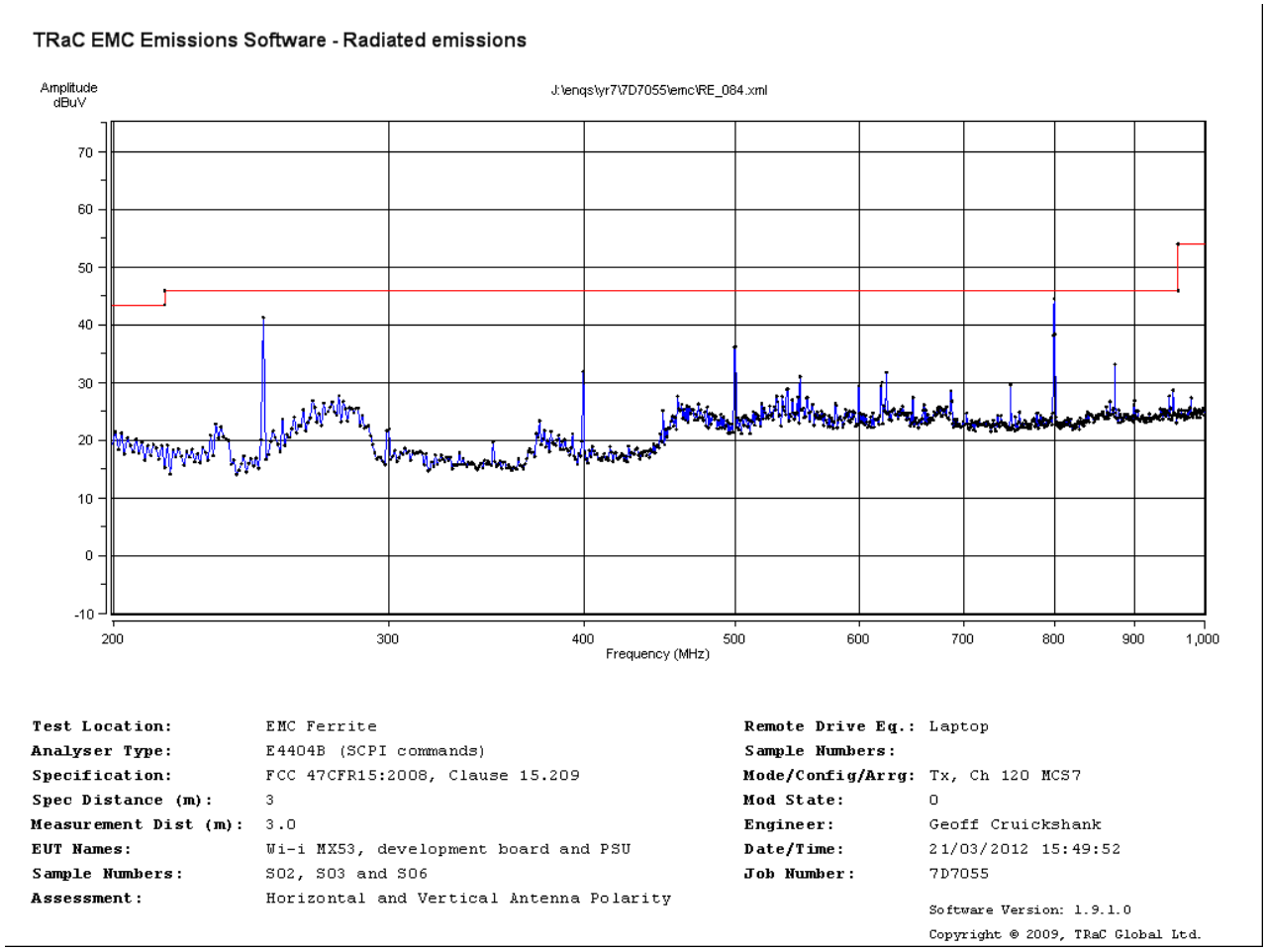
Radiated spurious emissions 200 MHz – 1GHz Channel 56



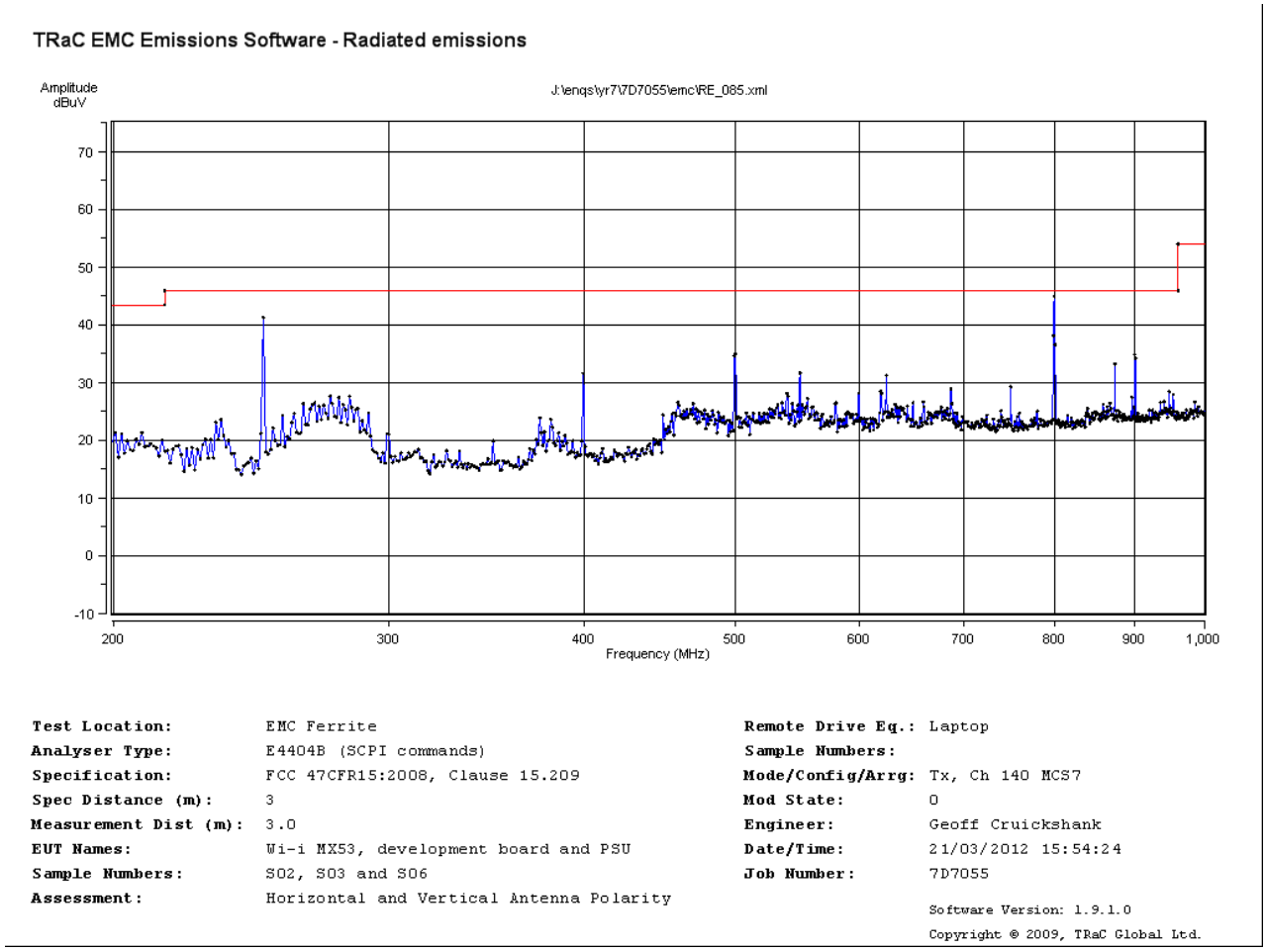
Radiated spurious emissions 200 MHz – 1GHz Channel 64



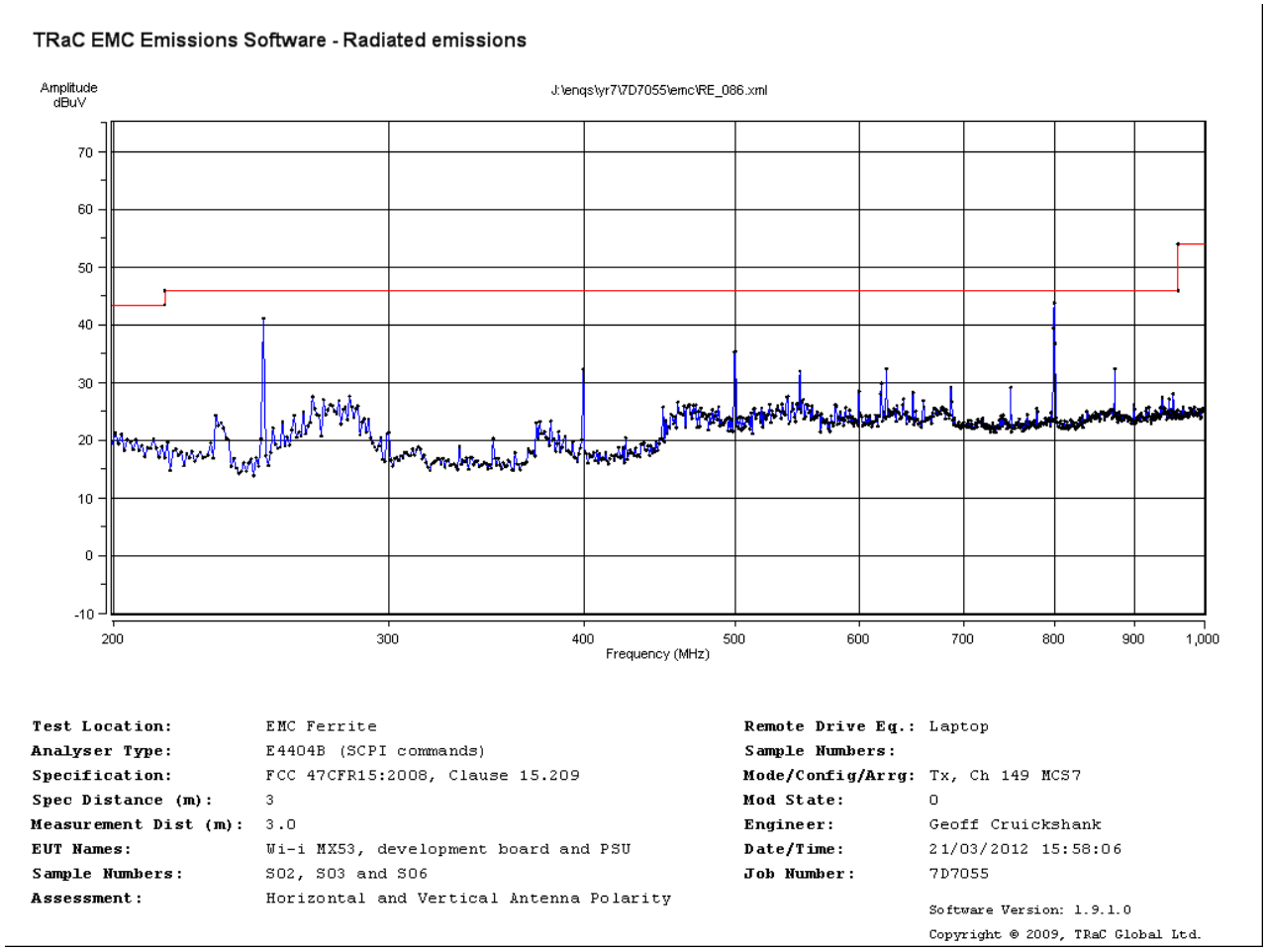
Radiated spurious emissions 200 MHz – 1GHz Channel 100



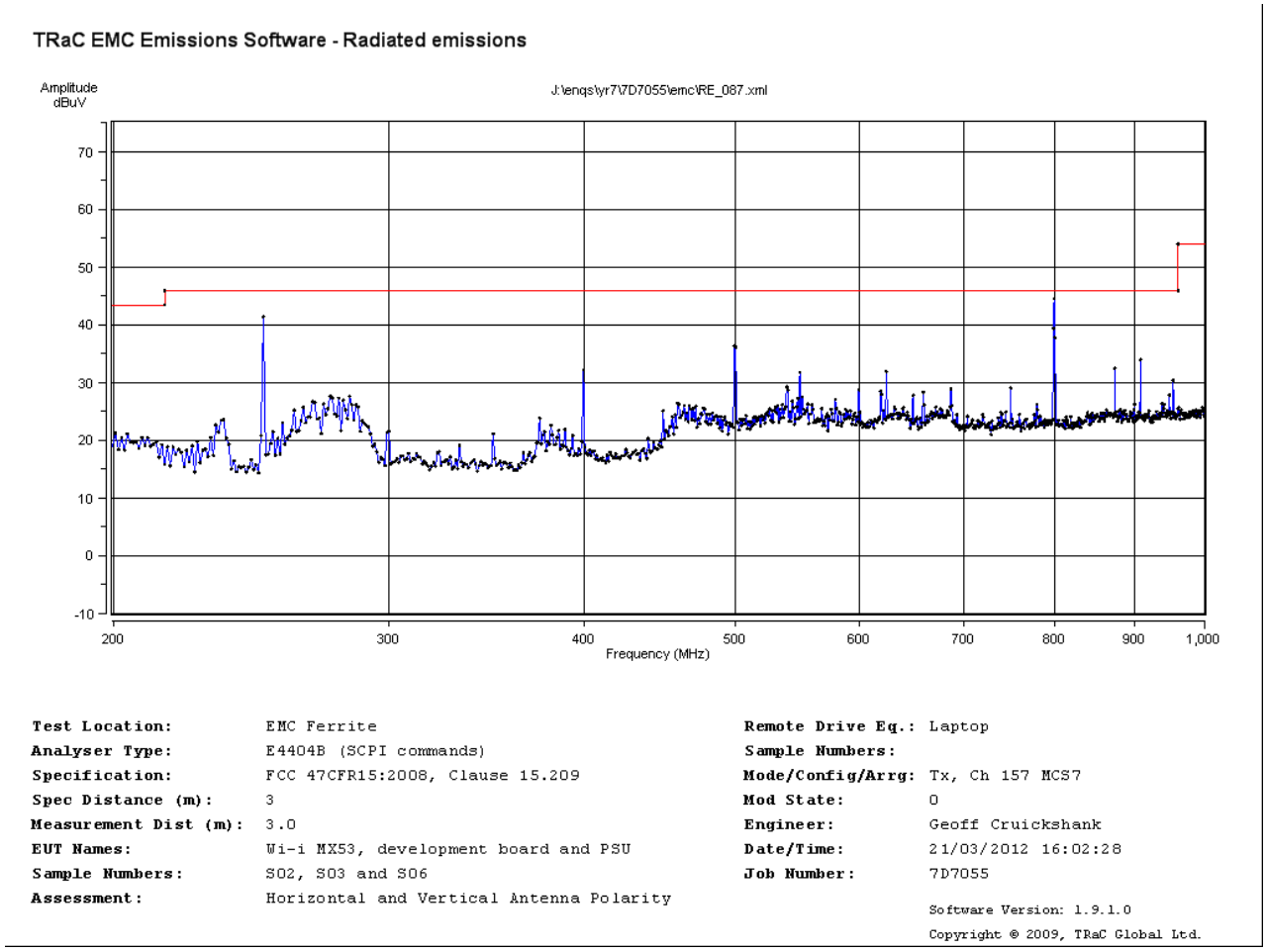
Radiated spurious emissions 200 MHz – 1GHz Channel 120



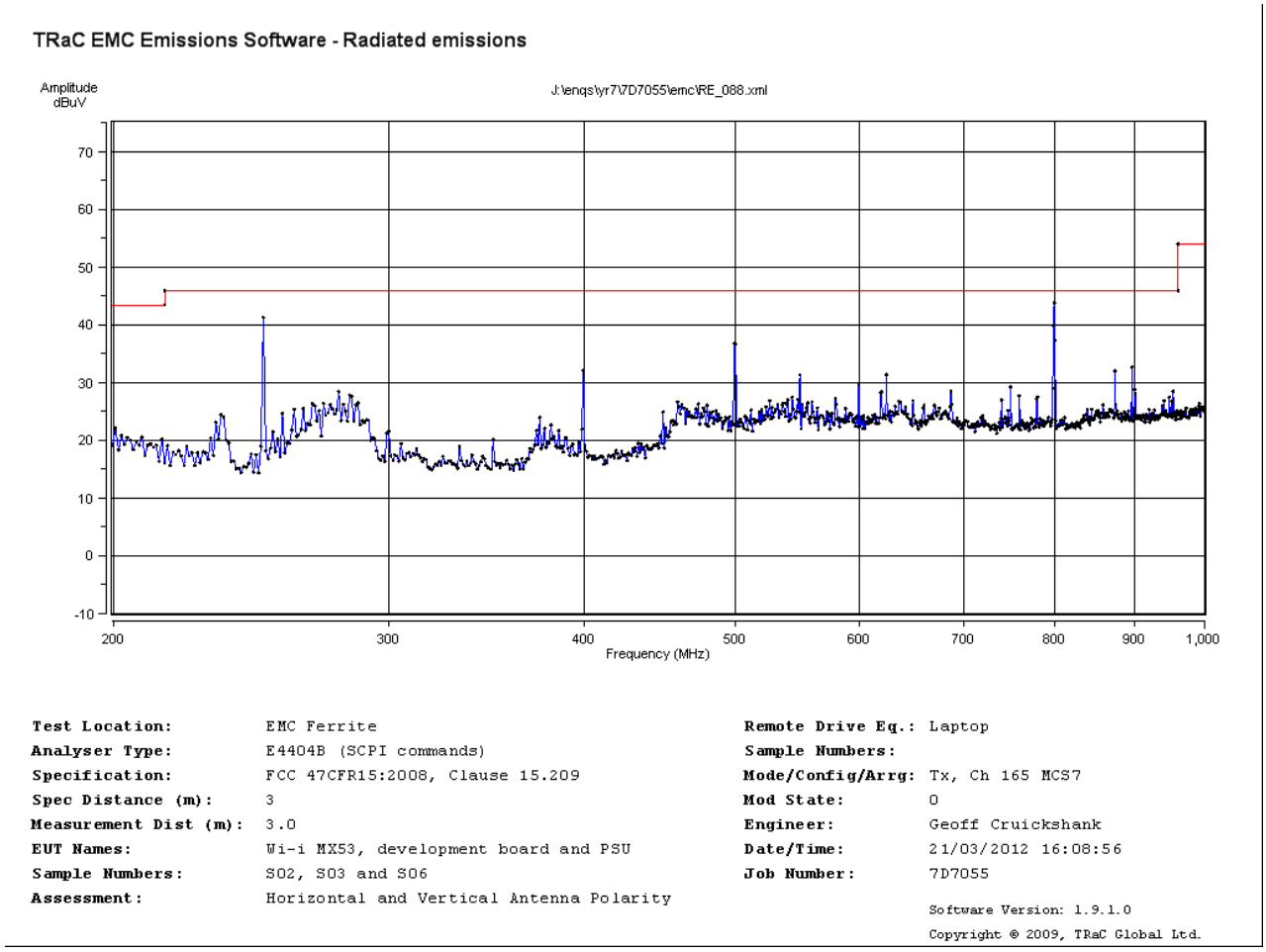
Radiated spurious emissions 200 MHz – 1GHz Channel 140



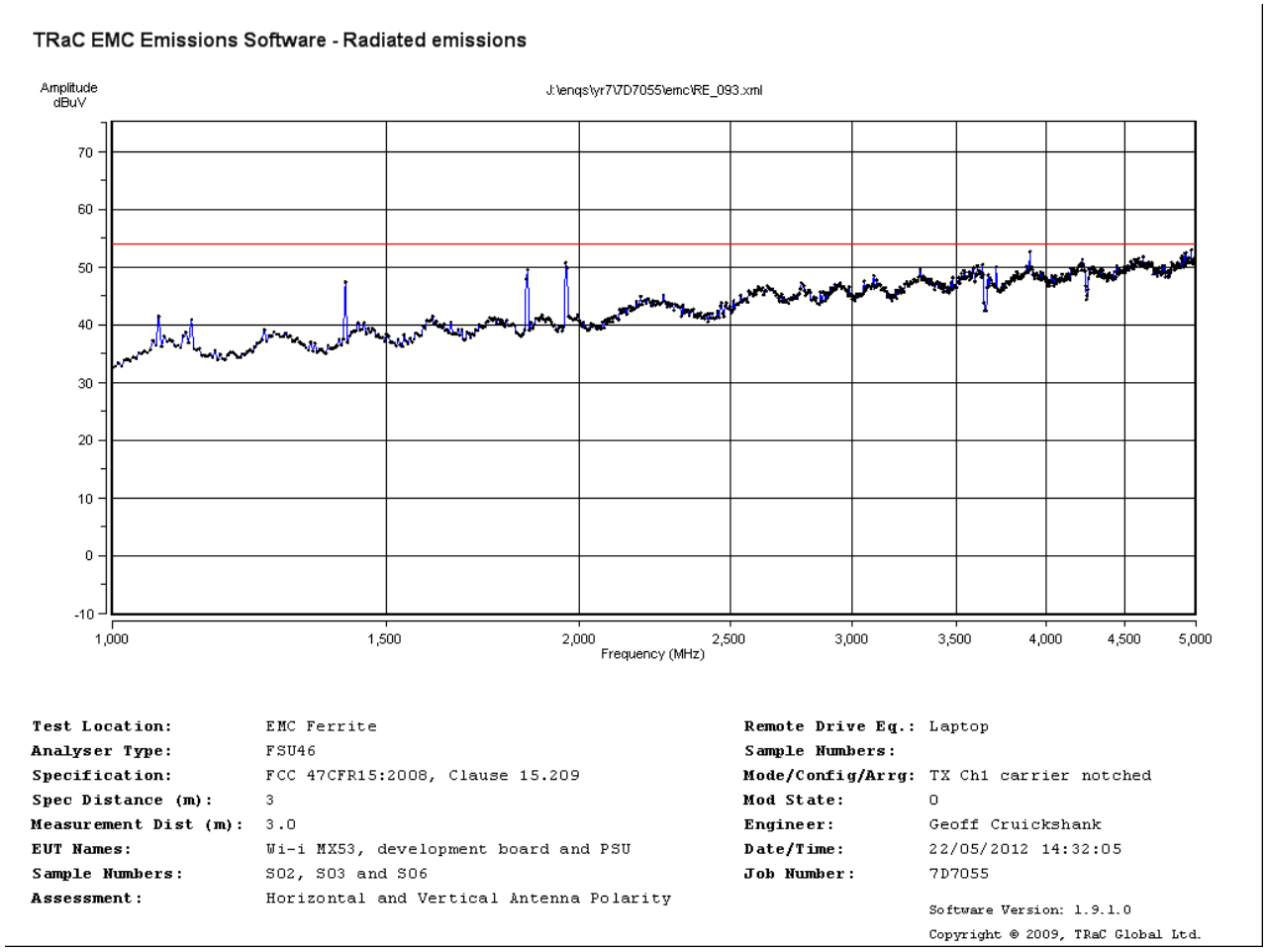
Radiated spurious emissions 200 MHz – 1GHz Channel 149



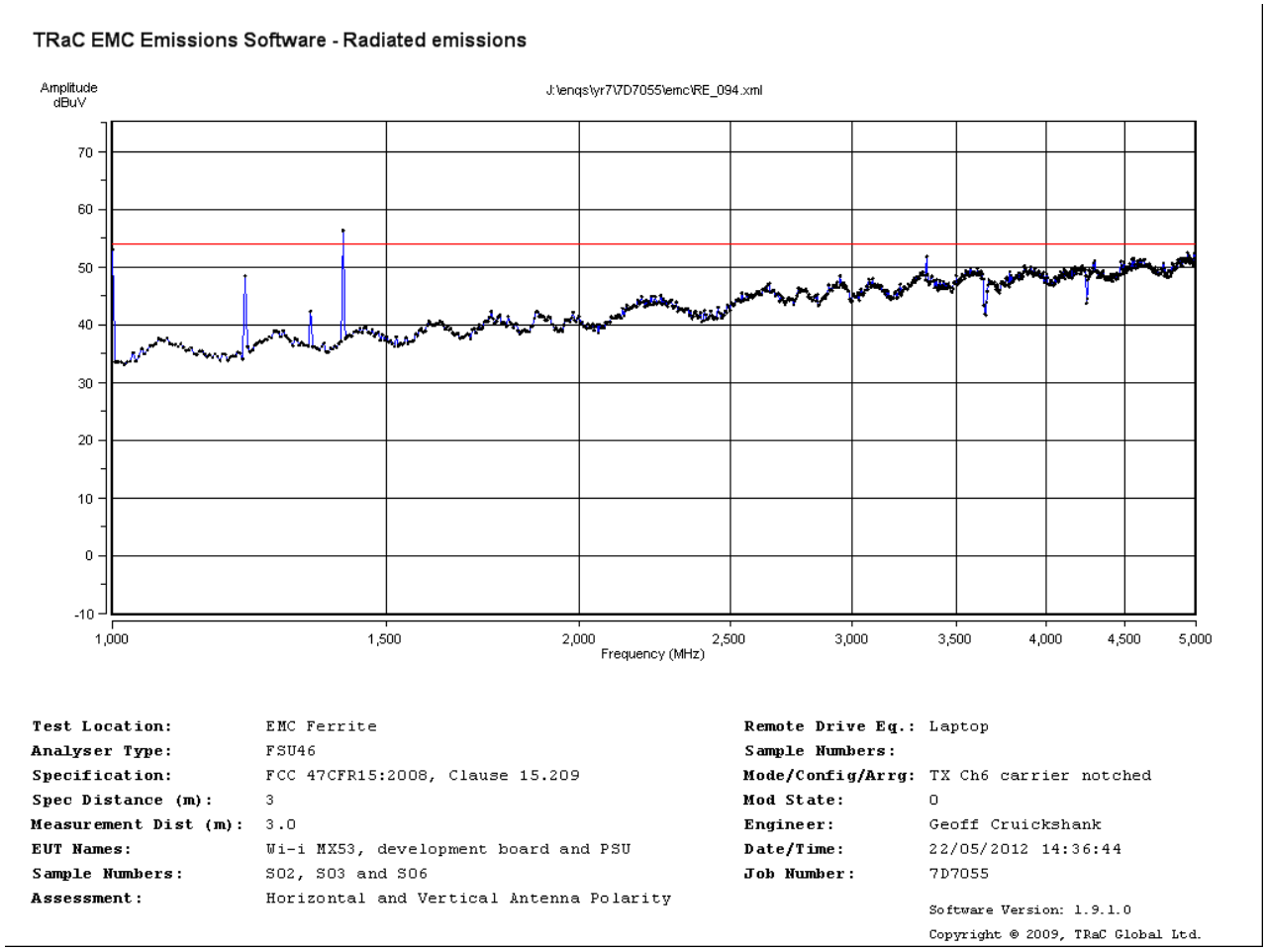
Radiated spurious emissions 200 MHz – 1GHz Channel 157



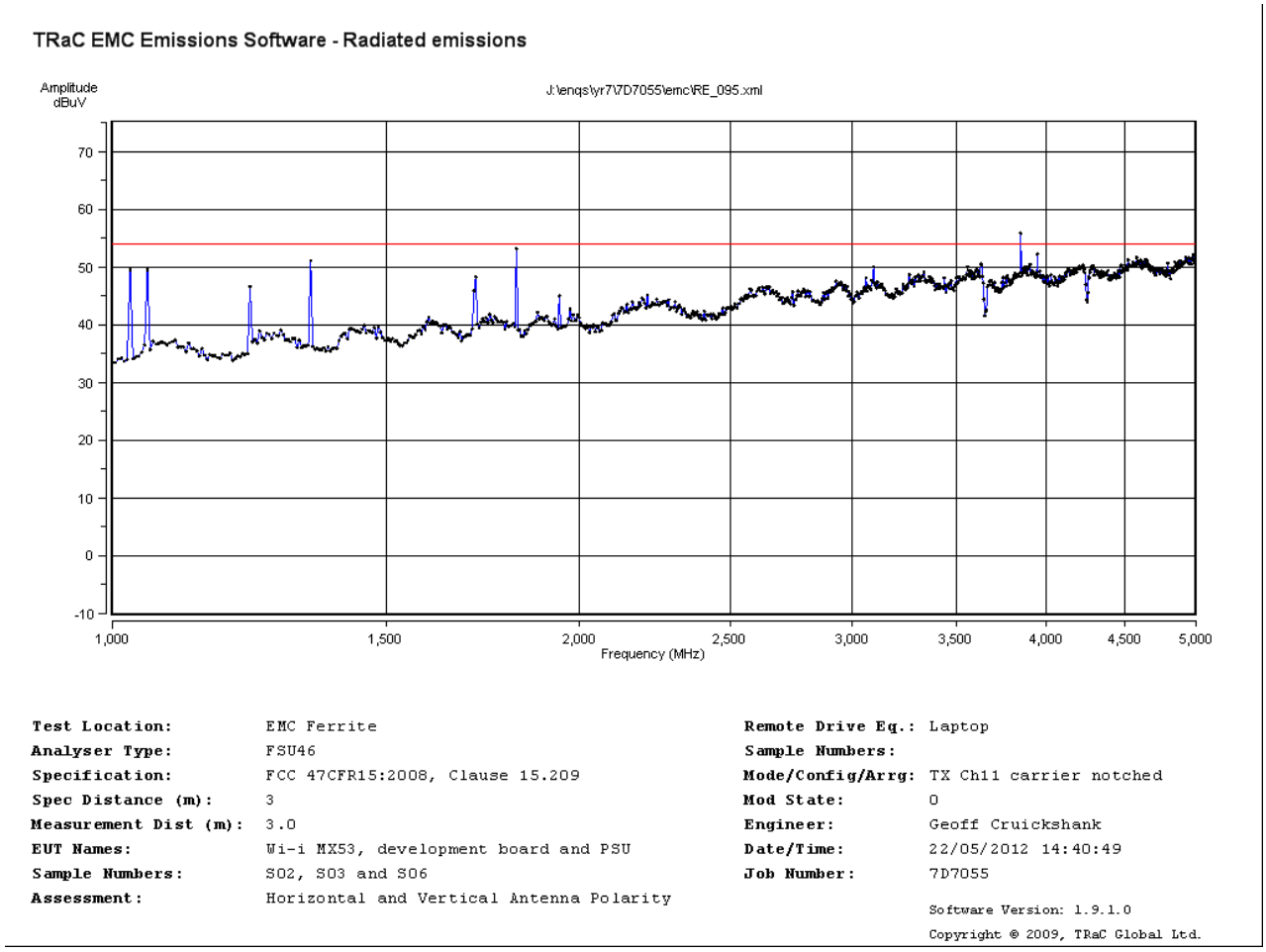
Radiated spurious emissions 200 MHz – 1GHz Channel 165



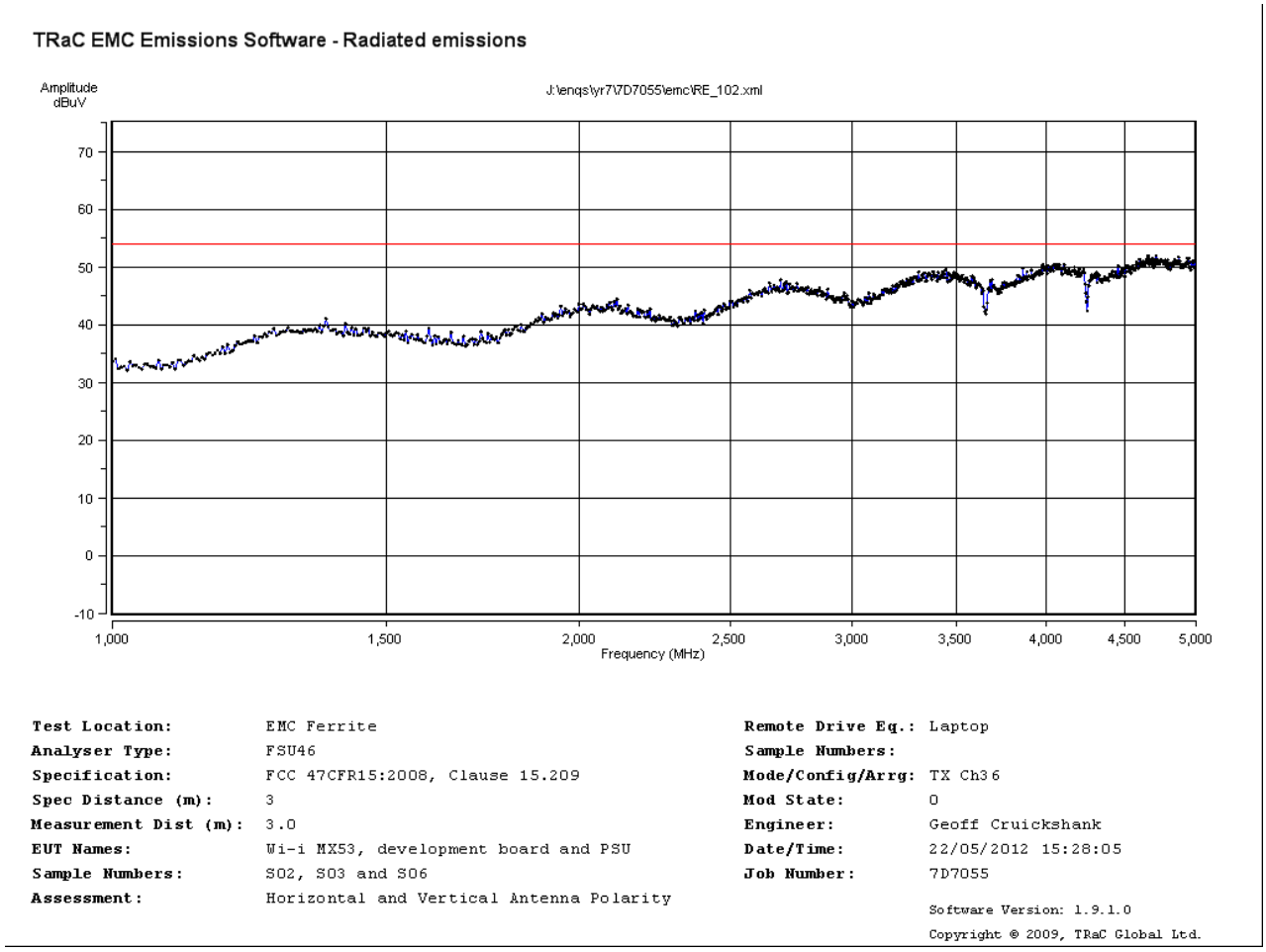
Radiated spurious emissions 1GHz to 5GHz – Channel 1



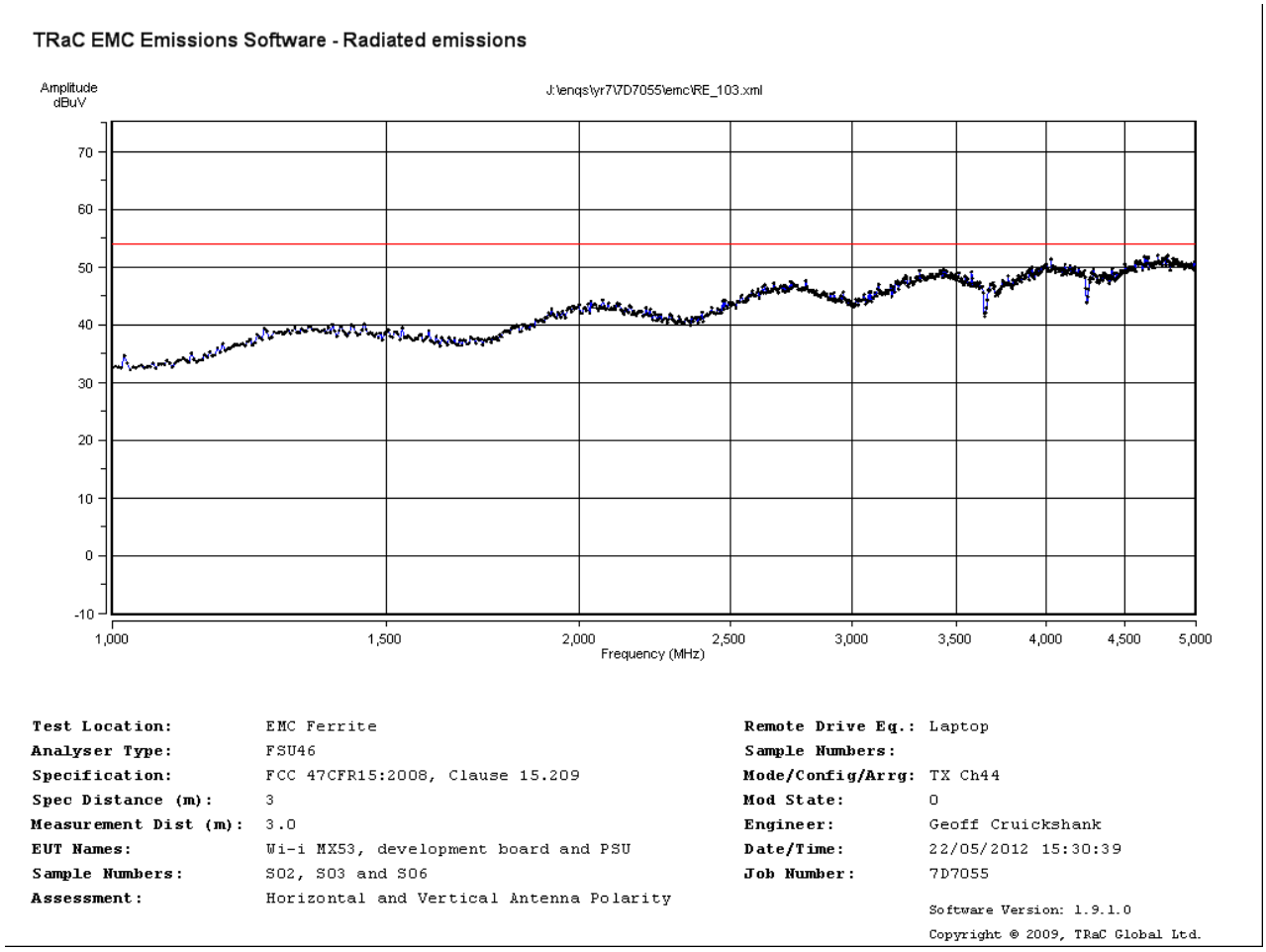
Radiated spurious emissions 1GHz to 5GHz – Channel 6



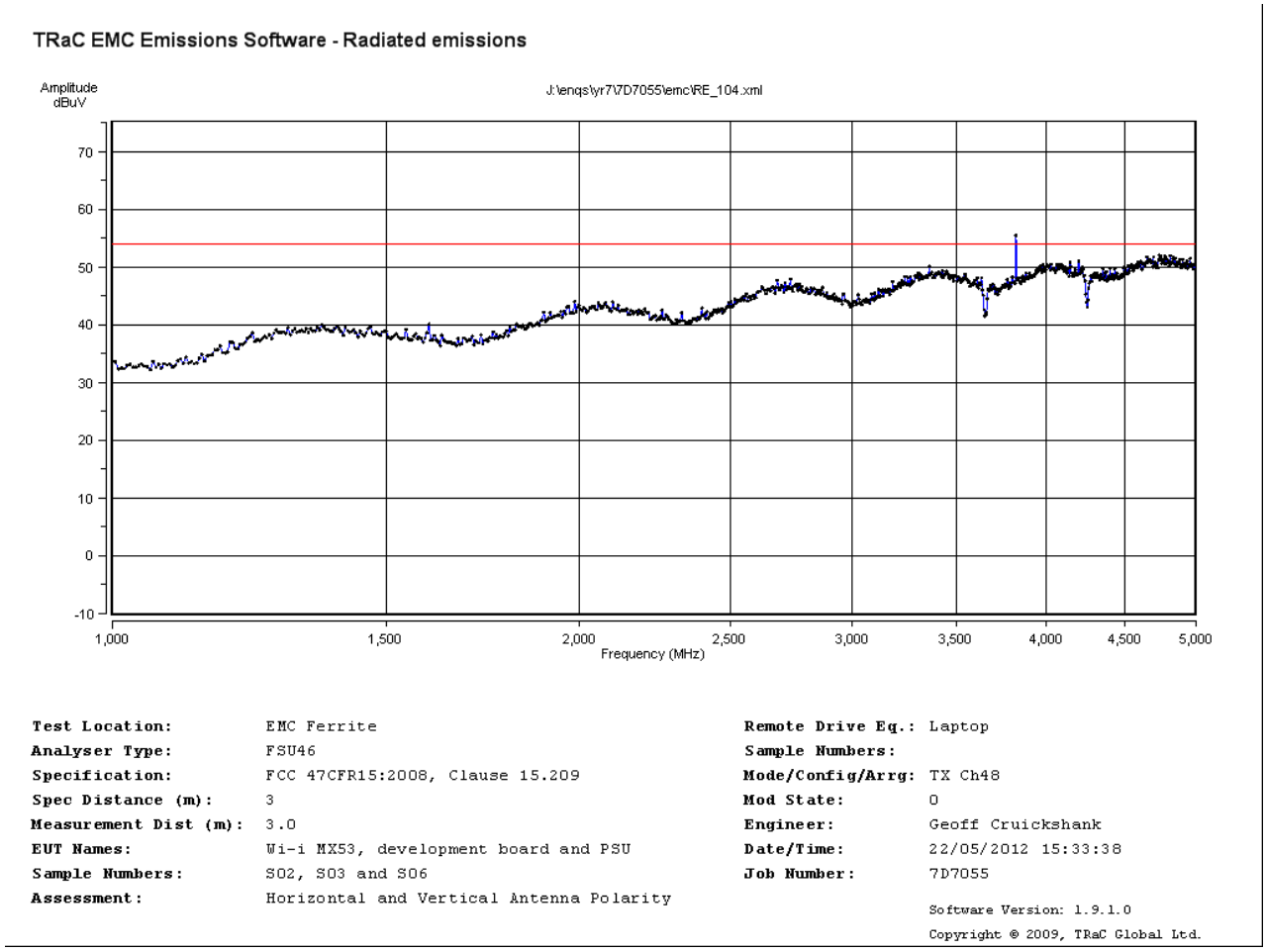
Radiated spurious emissions 1GHz to 5GHz – Channel 11



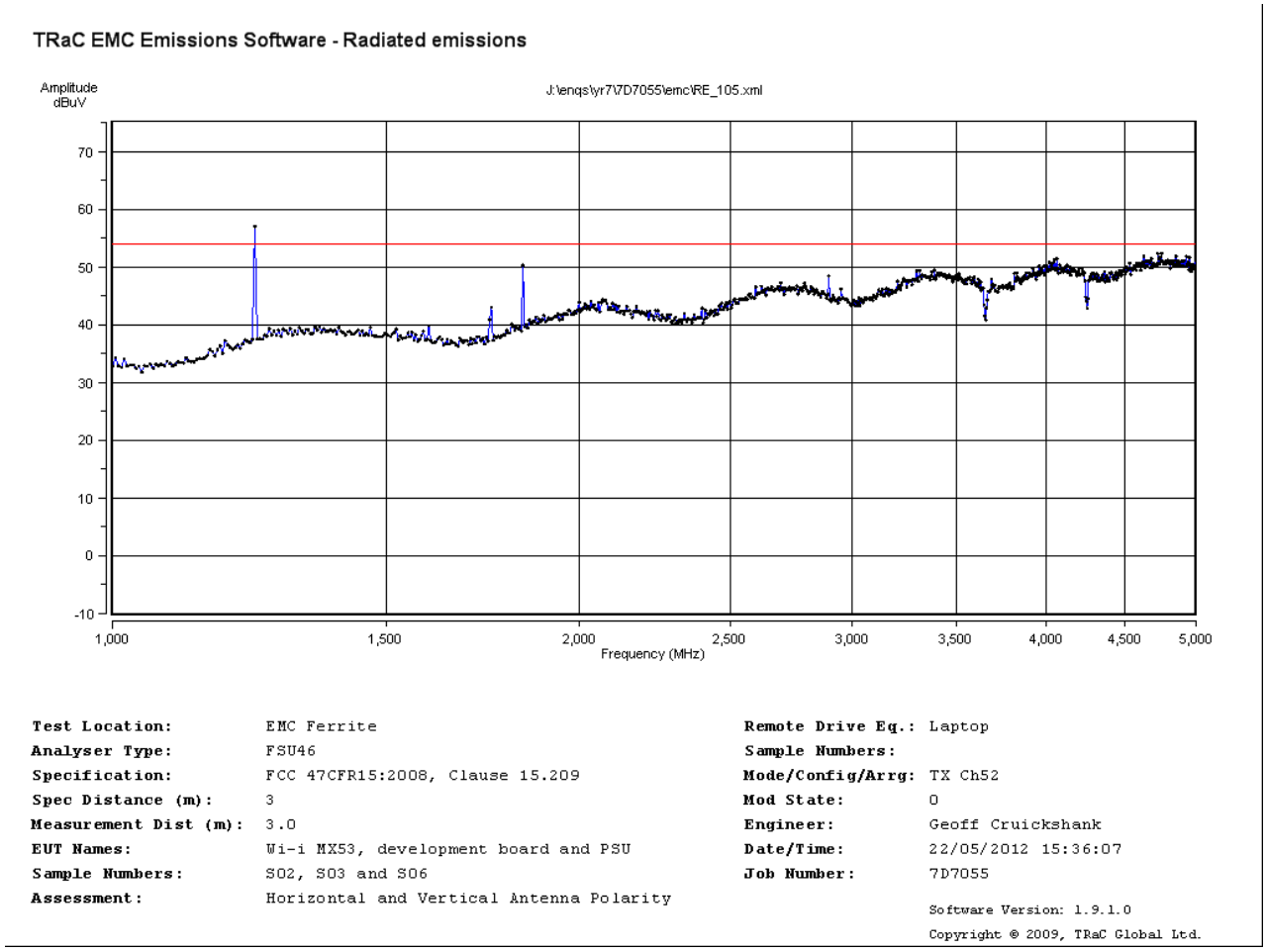
Radiated spurious emissions 1GHz to 5GHz – Channel 36



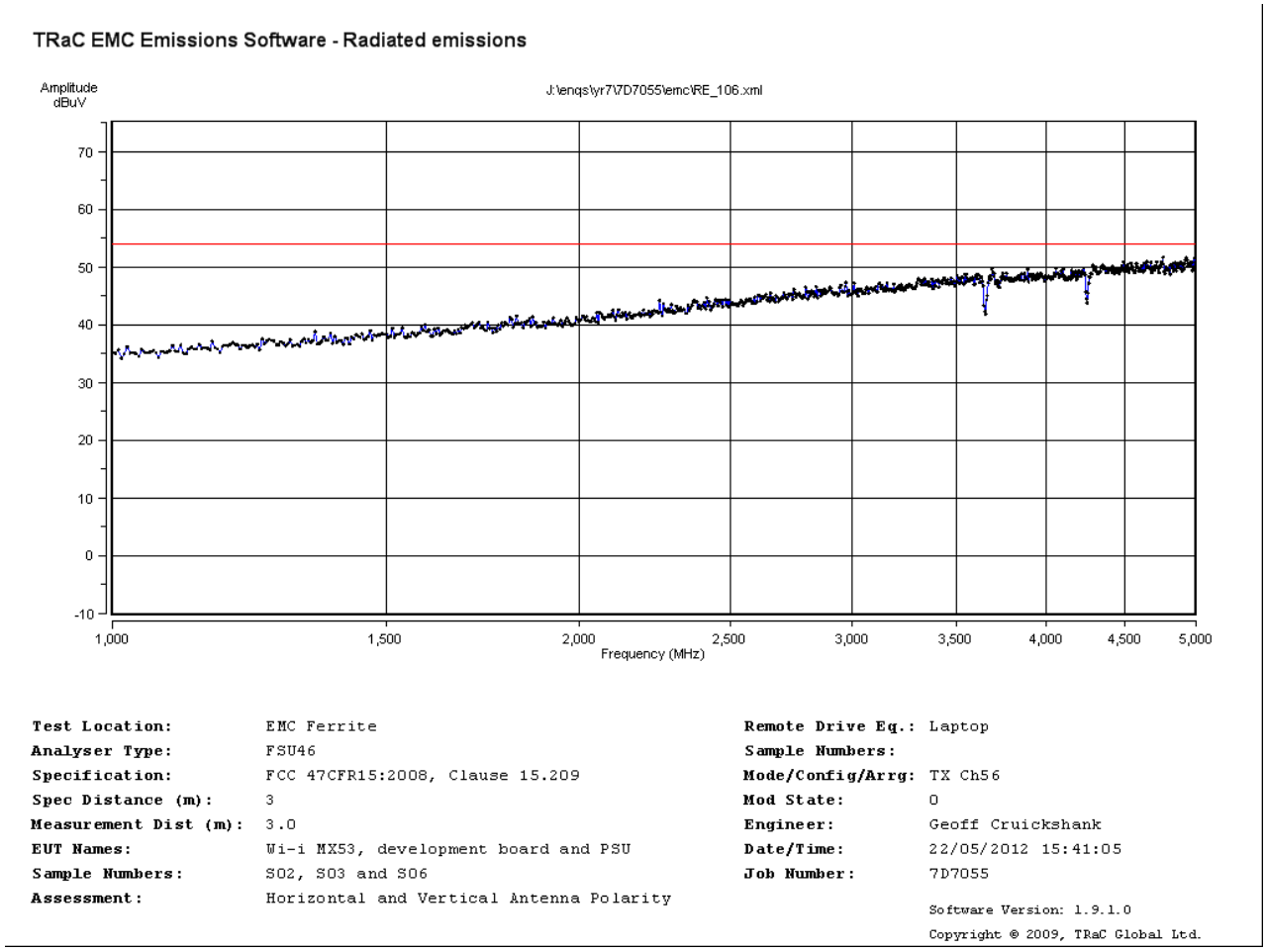
Radiated spurious emissions 1GHz to 5GHz – Channel 44



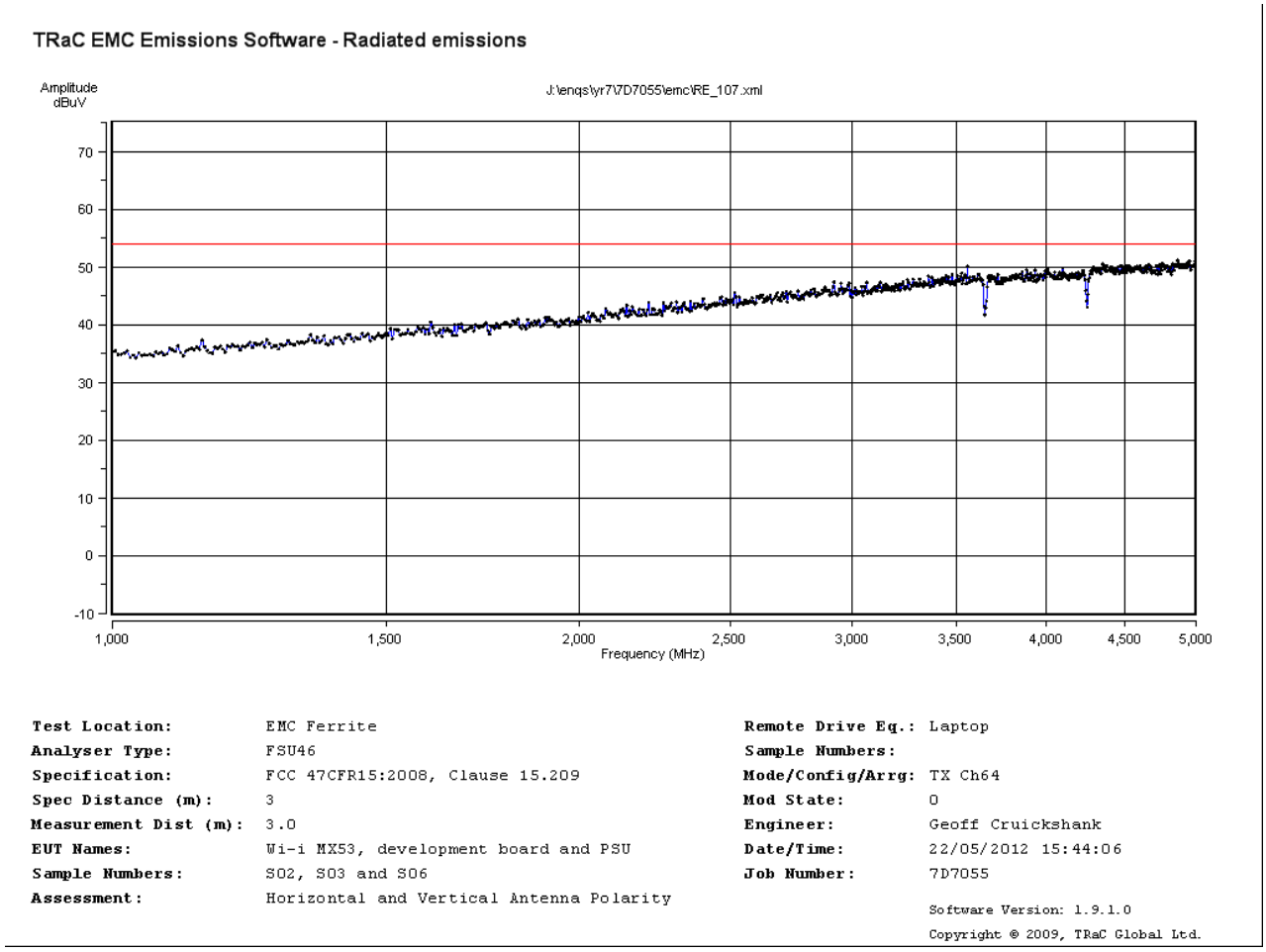
Radiated spurious emissions 1GHz to 5GHz – Channel 48



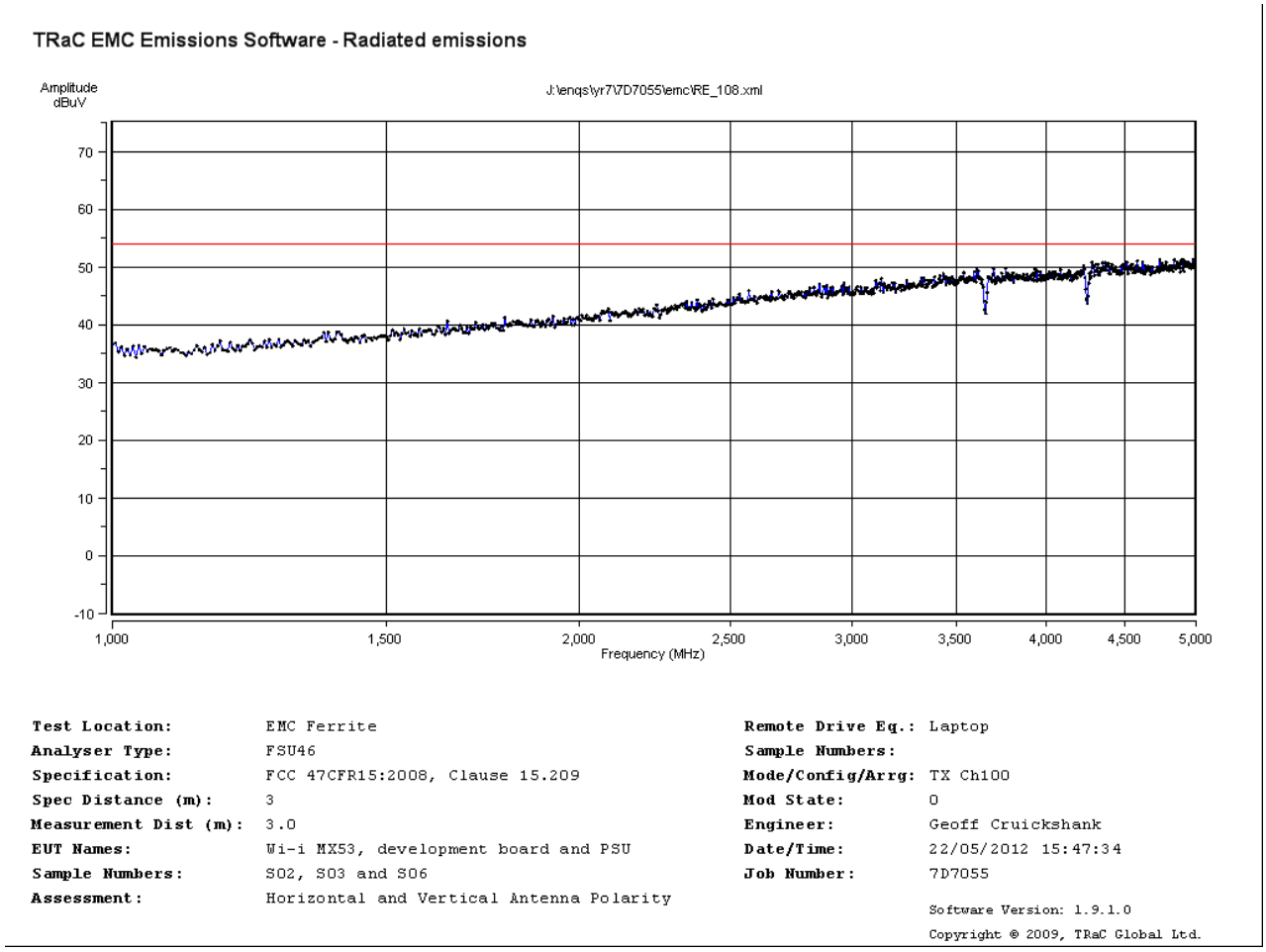
Radiated spurious emissions 1GHz to 5GHz – Channel 52



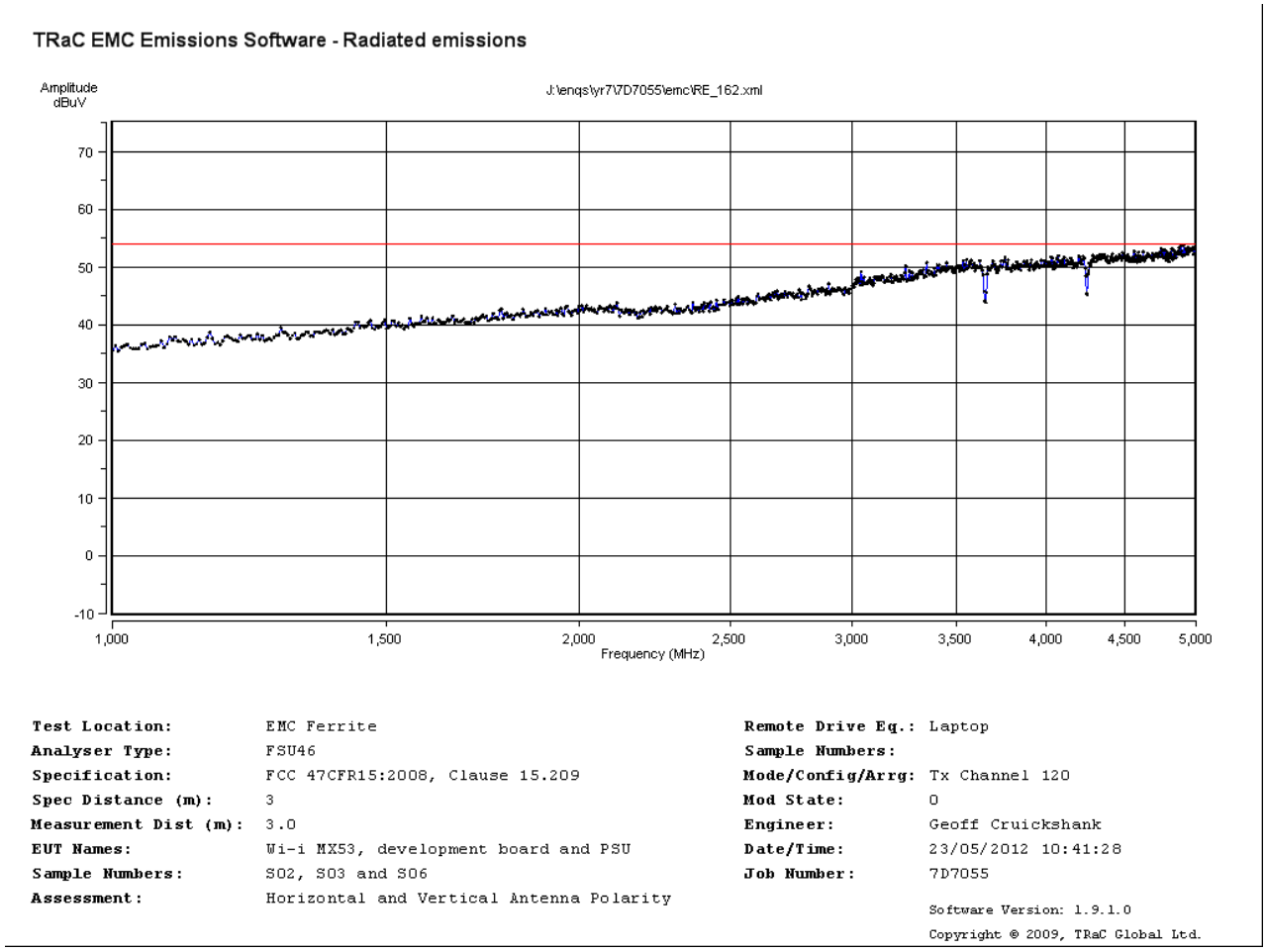
Radiated spurious emissions 1GHz to 5GHz – Channel 56



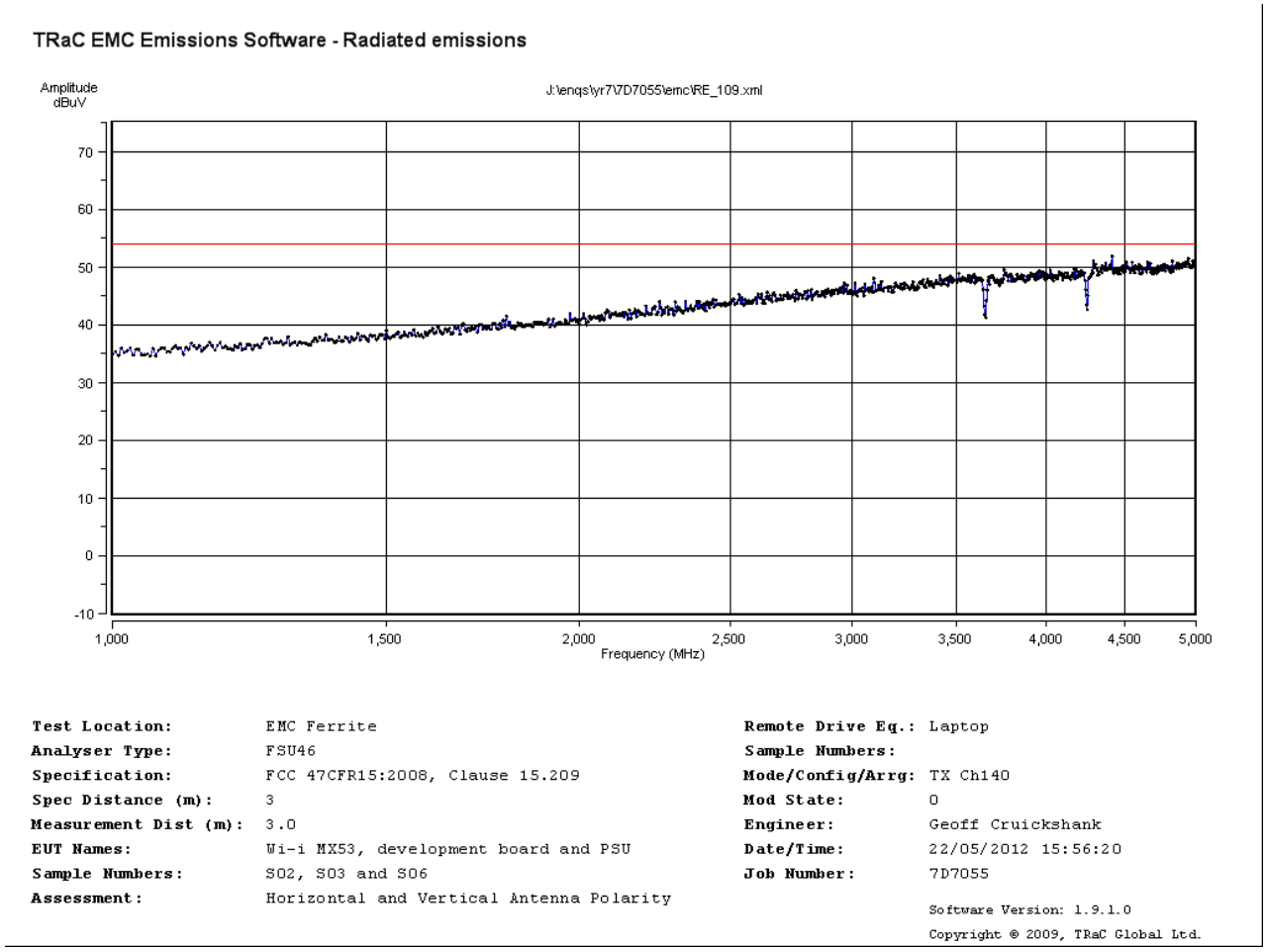
Radiated spurious emissions 1GHz to 5GHz – Channel 64



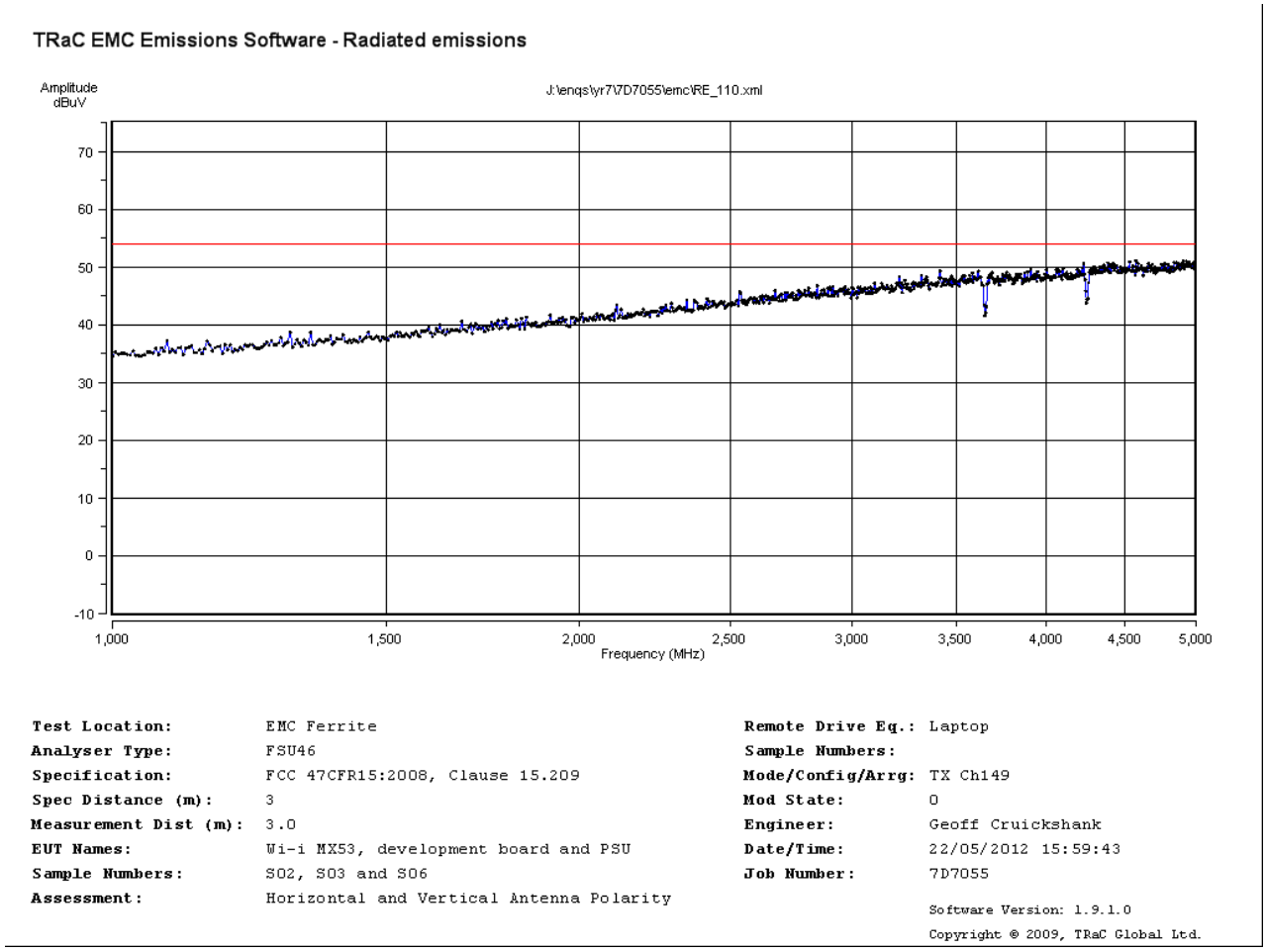
Radiated spurious emissions 1GHz to 5GHz – Channel 100



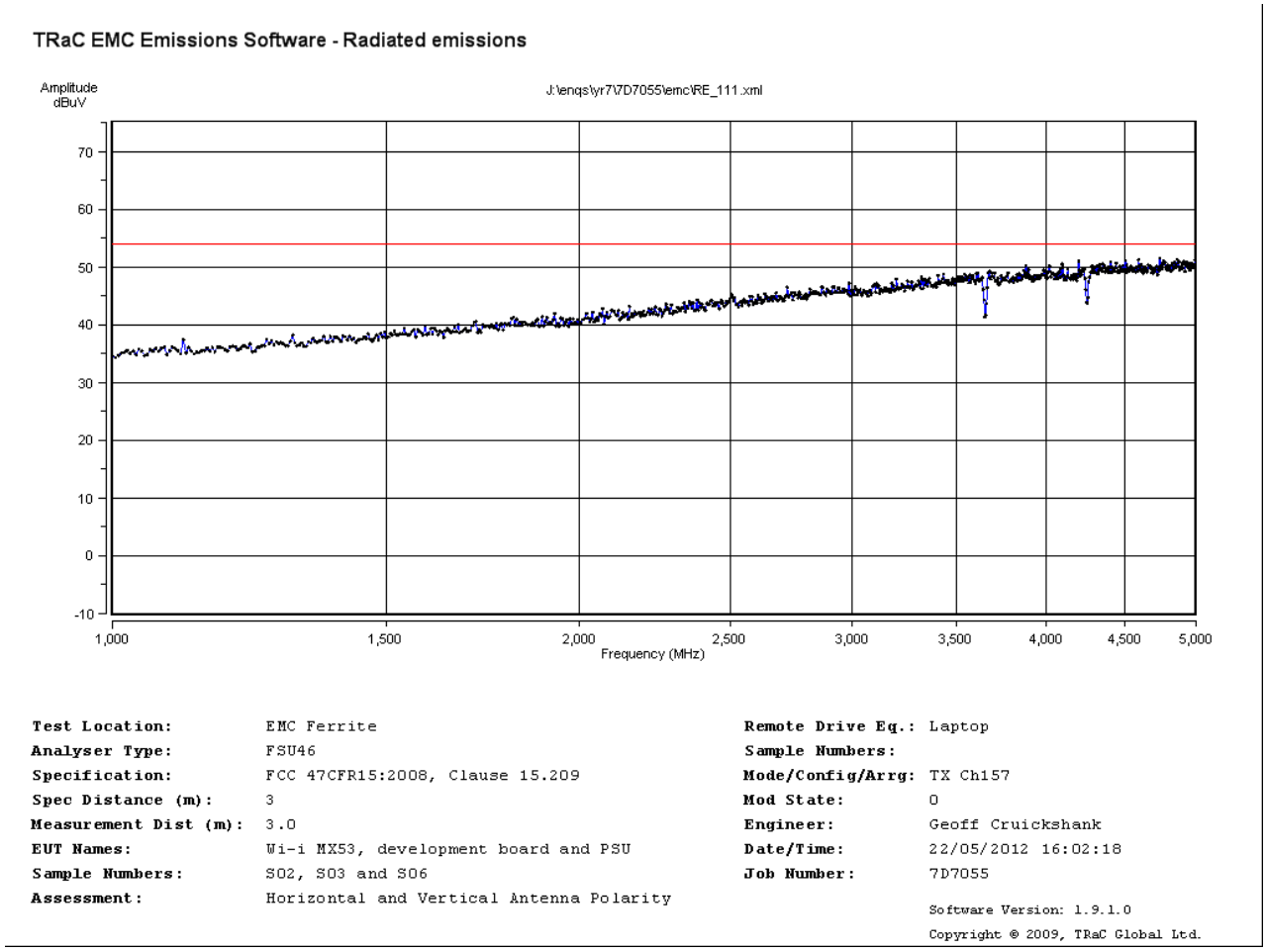
Radiated spurious emissions 1GHz to 5GHz – Channel 120



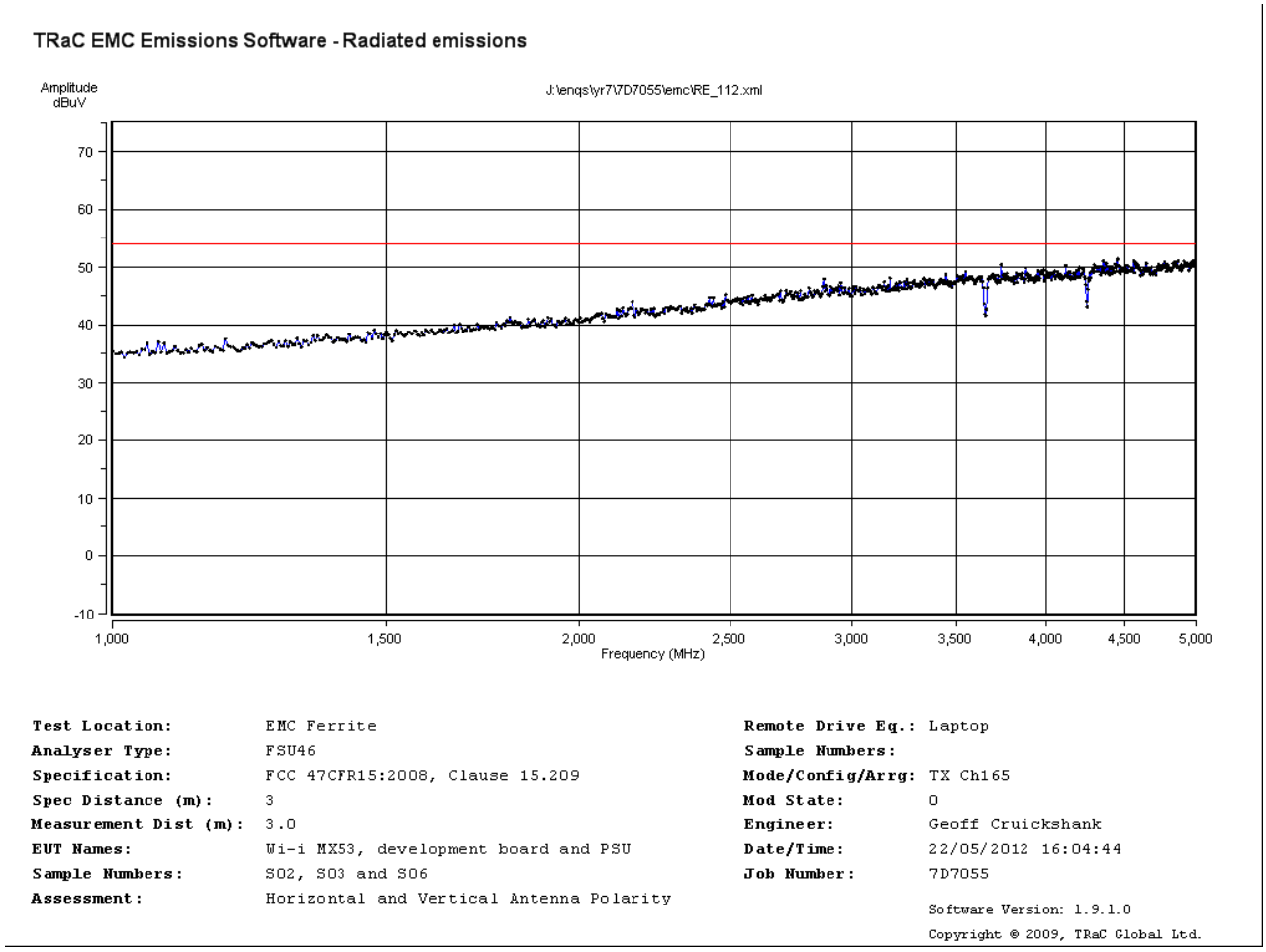
Radiated spurious emissions 1GHz to 5GHz – Channel 140



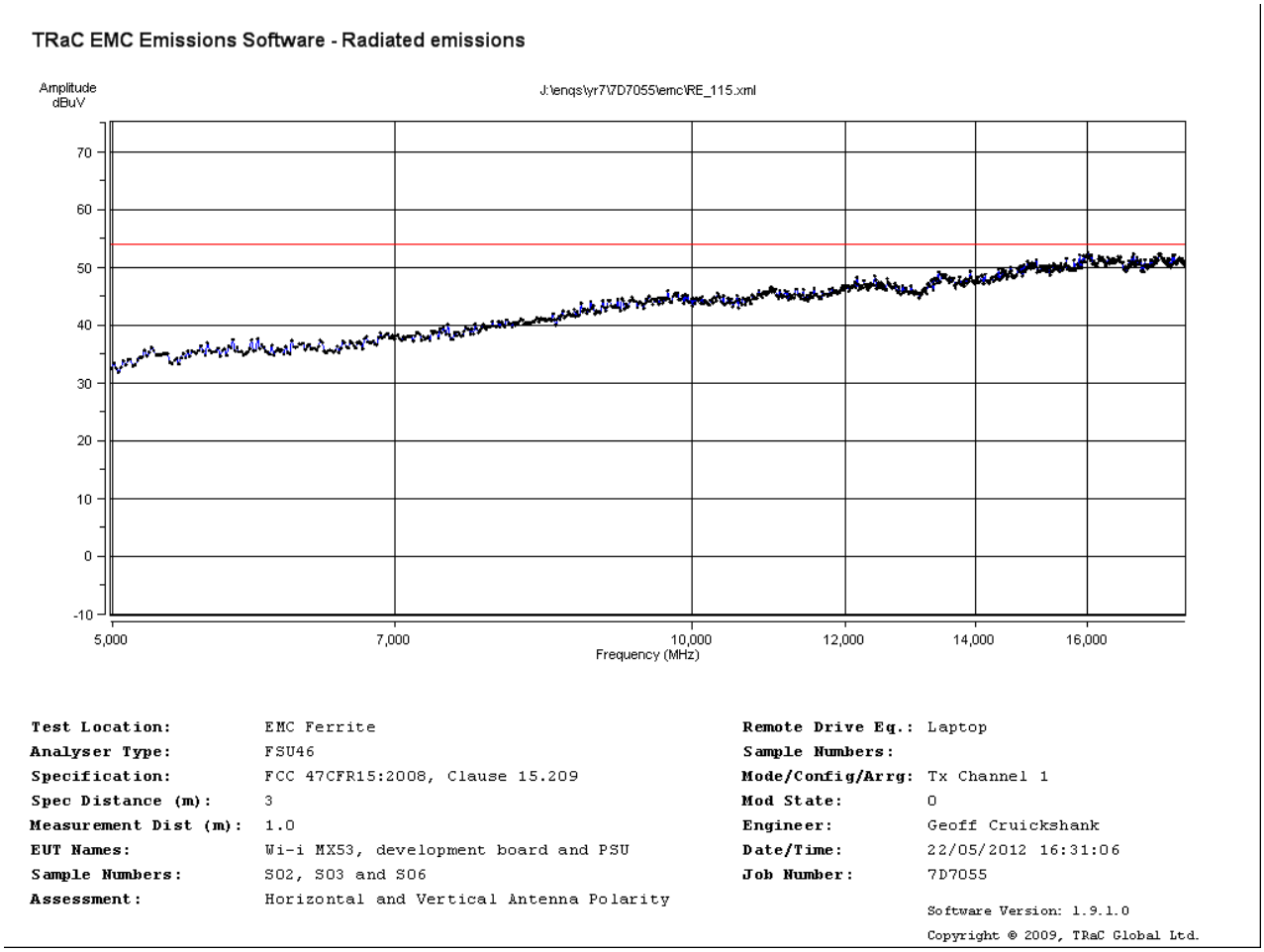
Radiated spurious emissions 1GHz to 5GHz – Channel 149



Radiated spurious emissions 1GHz to 5GHz – Channel 157

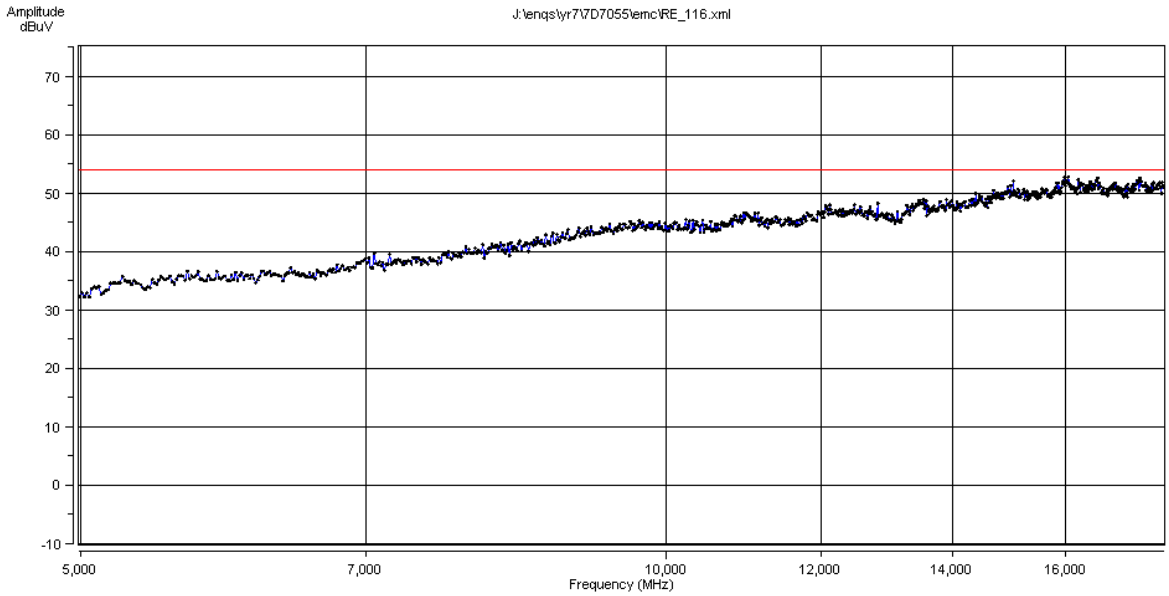


Radiated spurious emissions 1GHz to 5GHz – Channel 165



Radiated spurious emissions 5 GHz to 18GHz –Channel 1

TRaC EMC Emissions Software - Radiated emissions

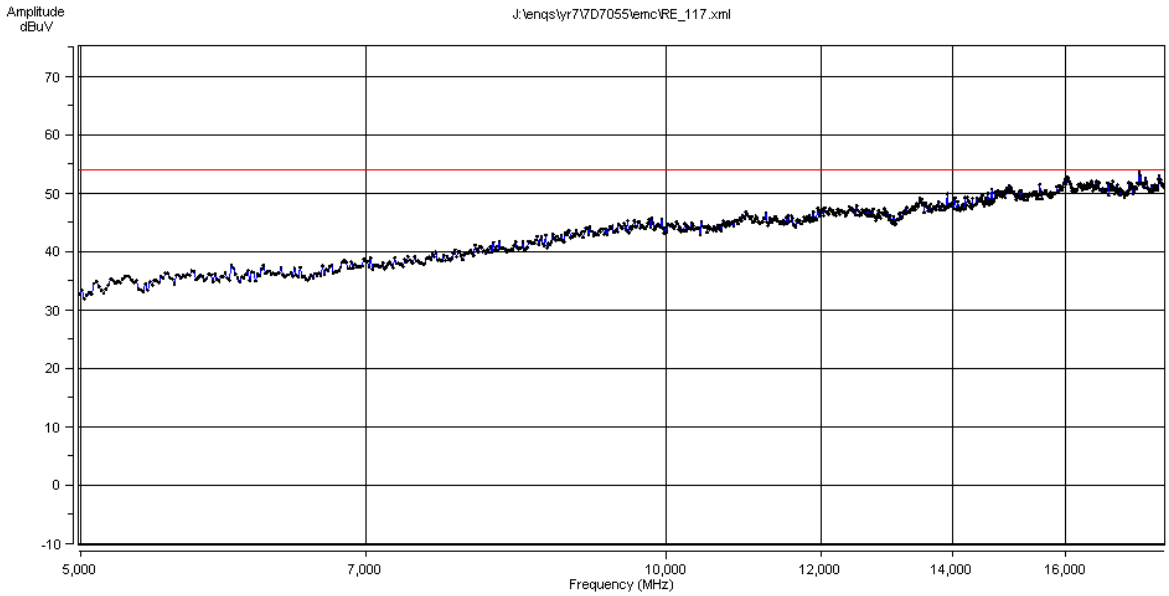


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 6
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:33:50
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 6

TRaC EMC Emissions Software - Radiated emissions

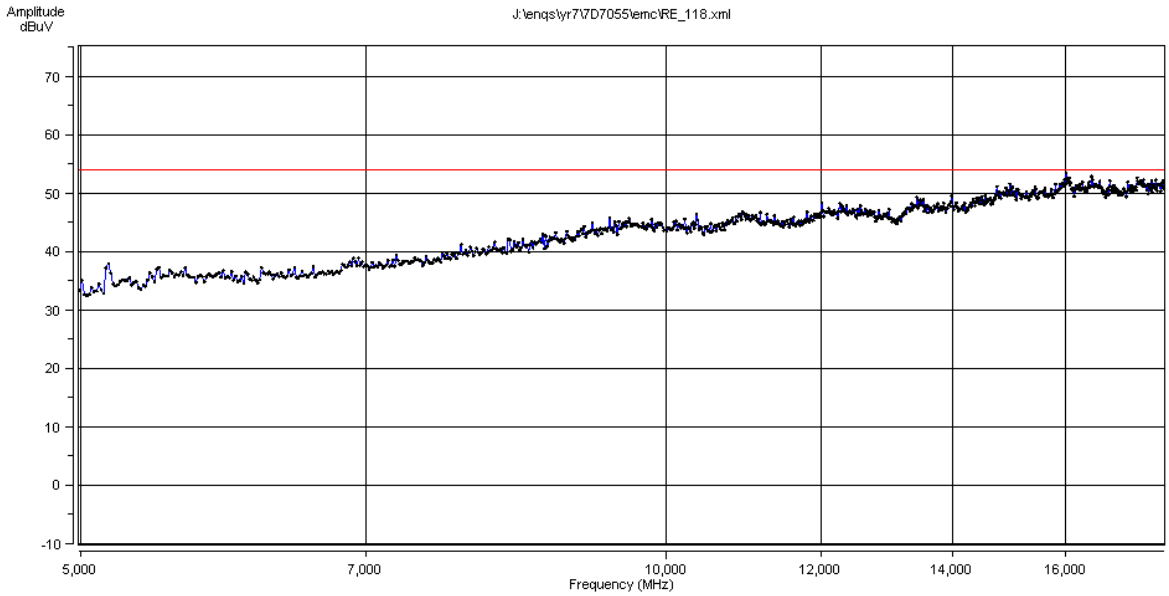


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 11
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:36:03
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 11

TRaC EMC Emissions Software - Radiated emissions

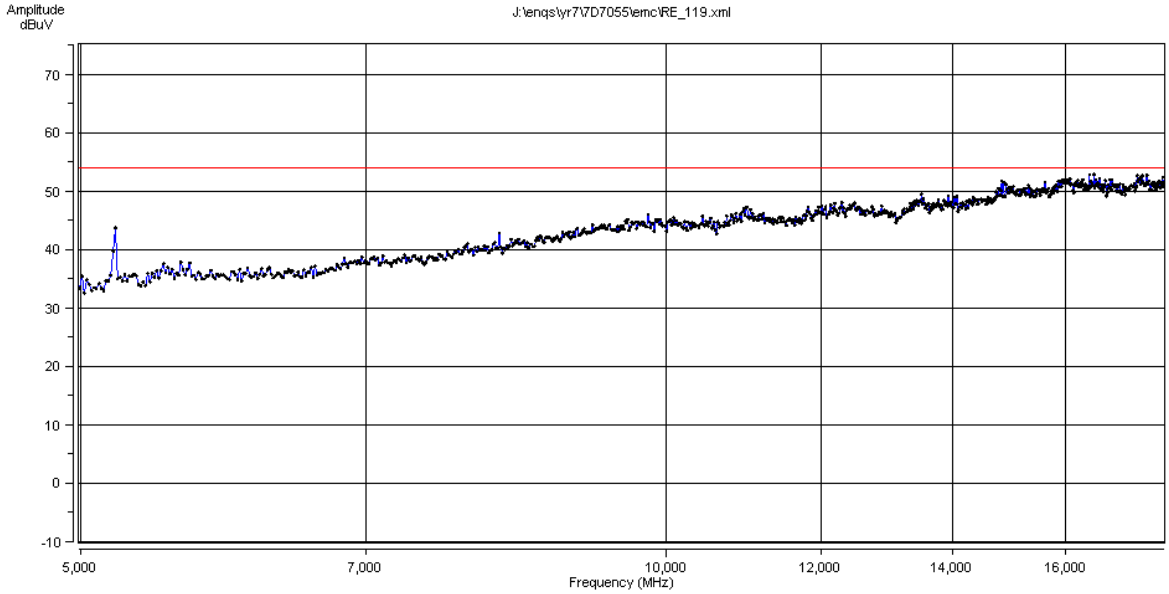


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 36
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:42:04
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 36

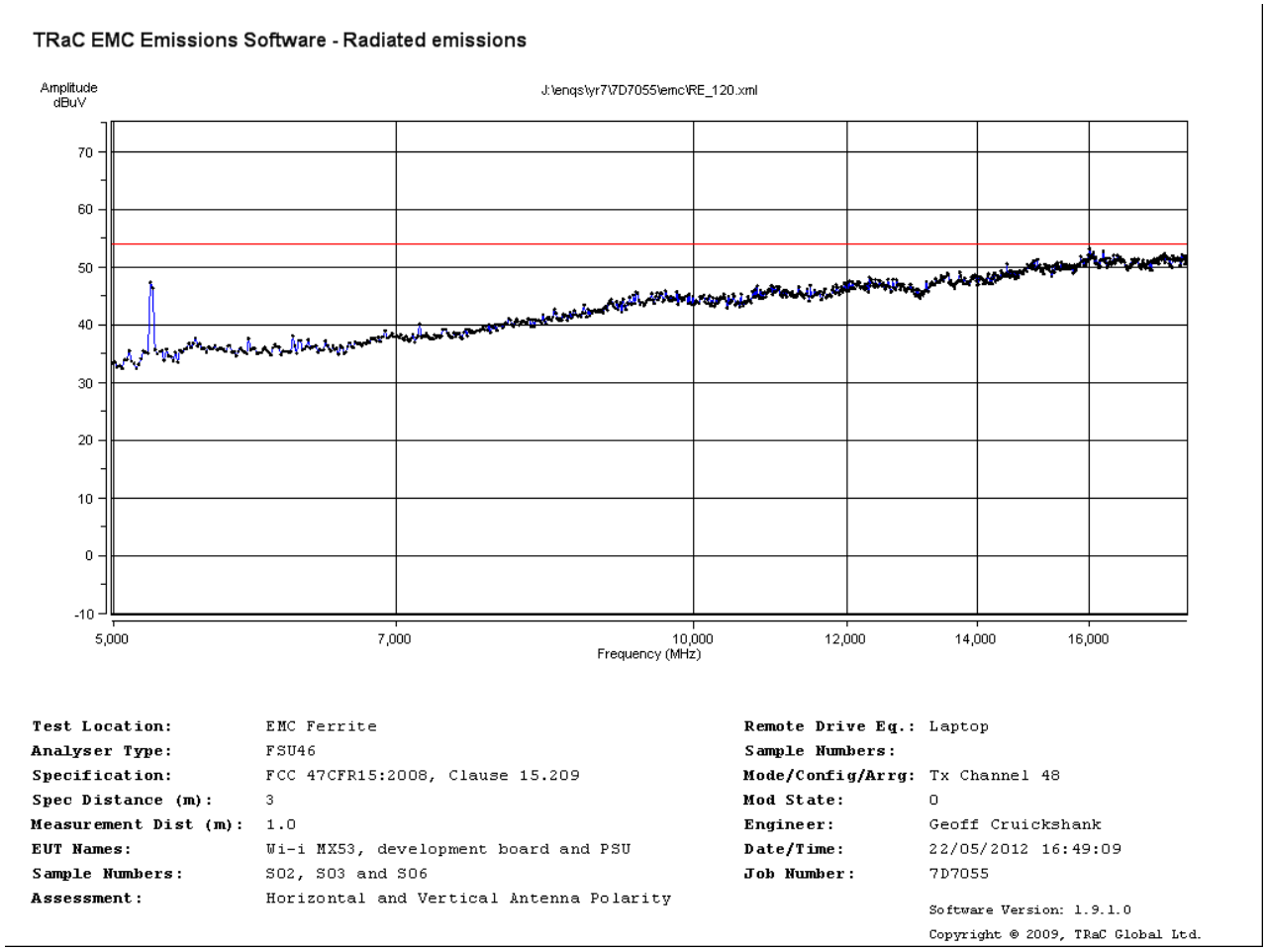
TRaC EMC Emissions Software - Radiated emissions



Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 44
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:45:10
Sample Numbers:	SO2, SO3 and SO6	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

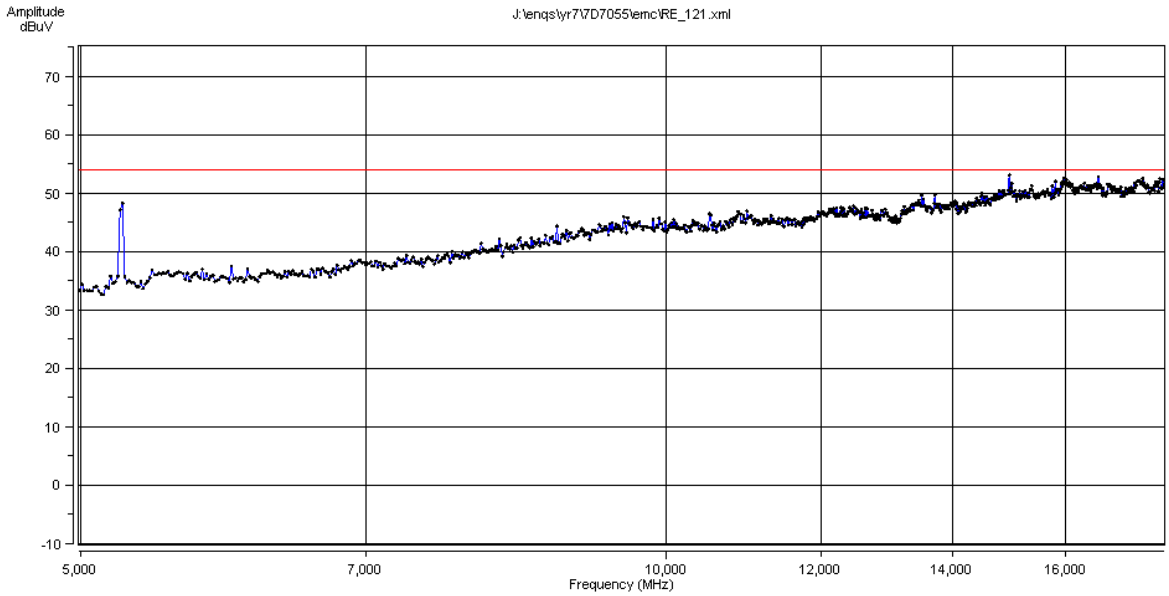
Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 44



Radiated spurious emissions 5 GHz to 18GHz –Channel 48

TRaC EMC Emissions Software - Radiated emissions

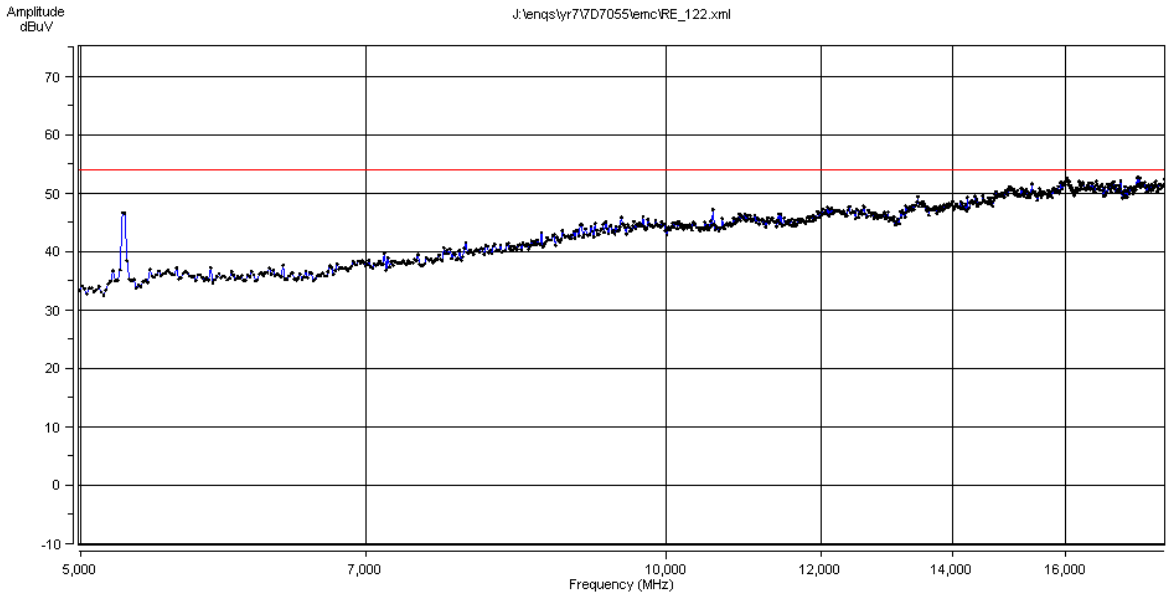


Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 52
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:53:10
Sample Numbers:	SO2, SO3 and SO6	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 52

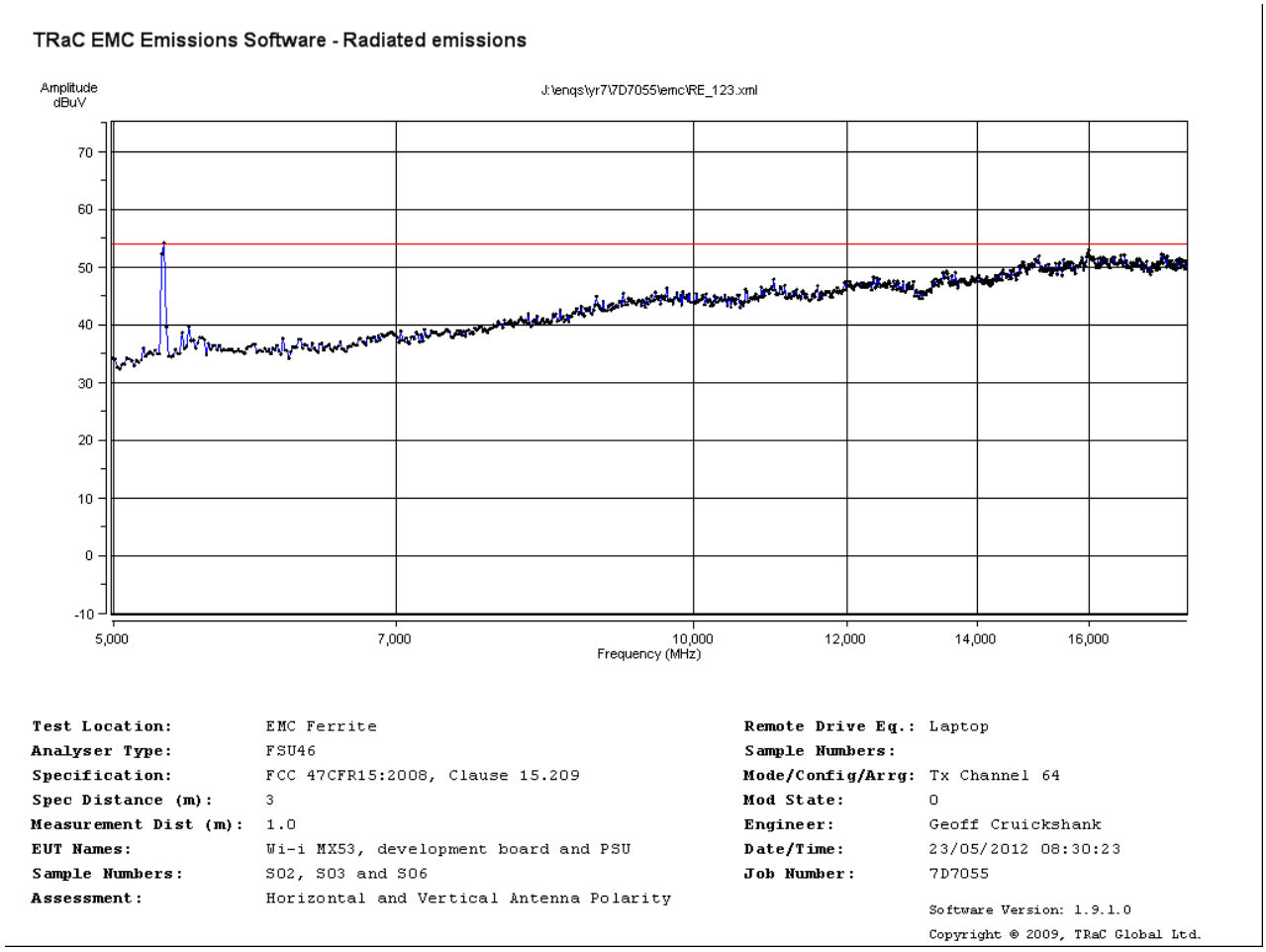
TRaC EMC Emissions Software - Radiated emissions



Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 56
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	22/05/2012 16:56:26
Sample Numbers:	SO2, SO3 and SO6	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

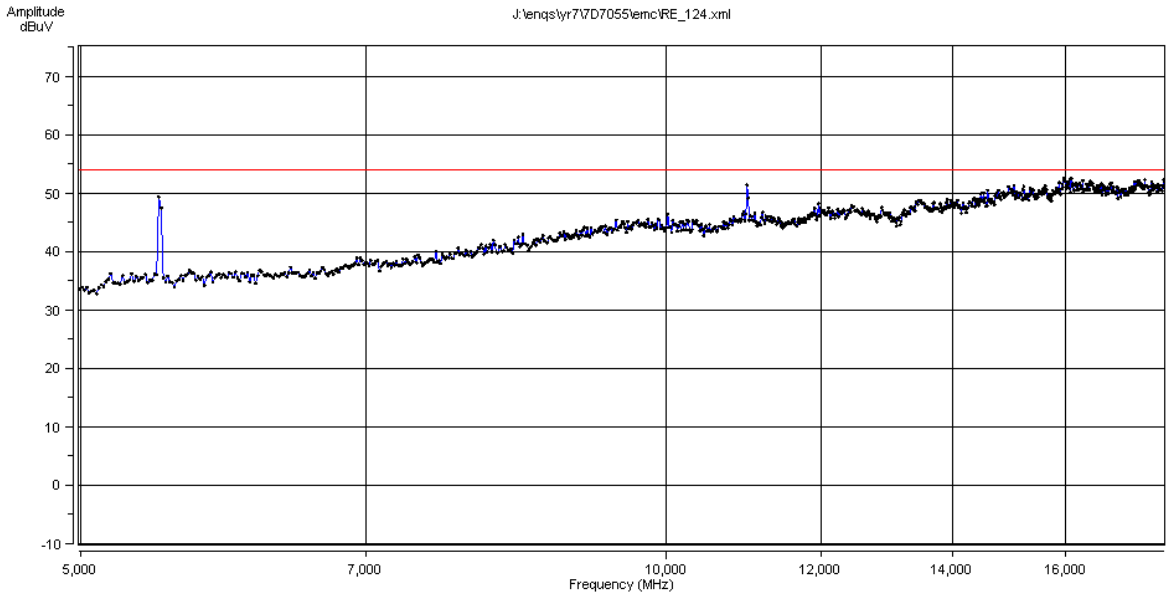
Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 56



Radiated spurious emissions 5 GHz to 18GHz –Channel 64

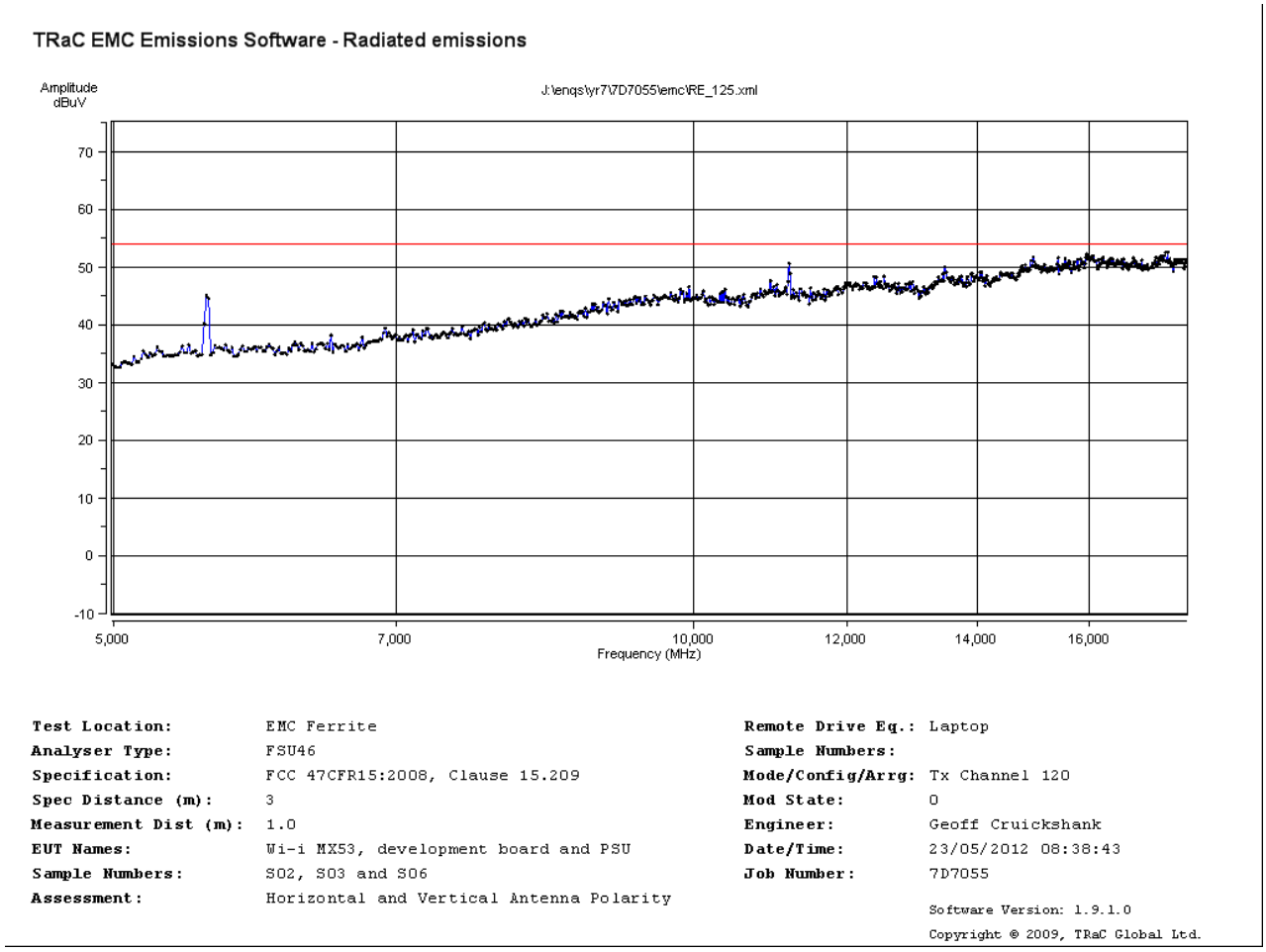
TRaC EMC Emissions Software - Radiated emissions



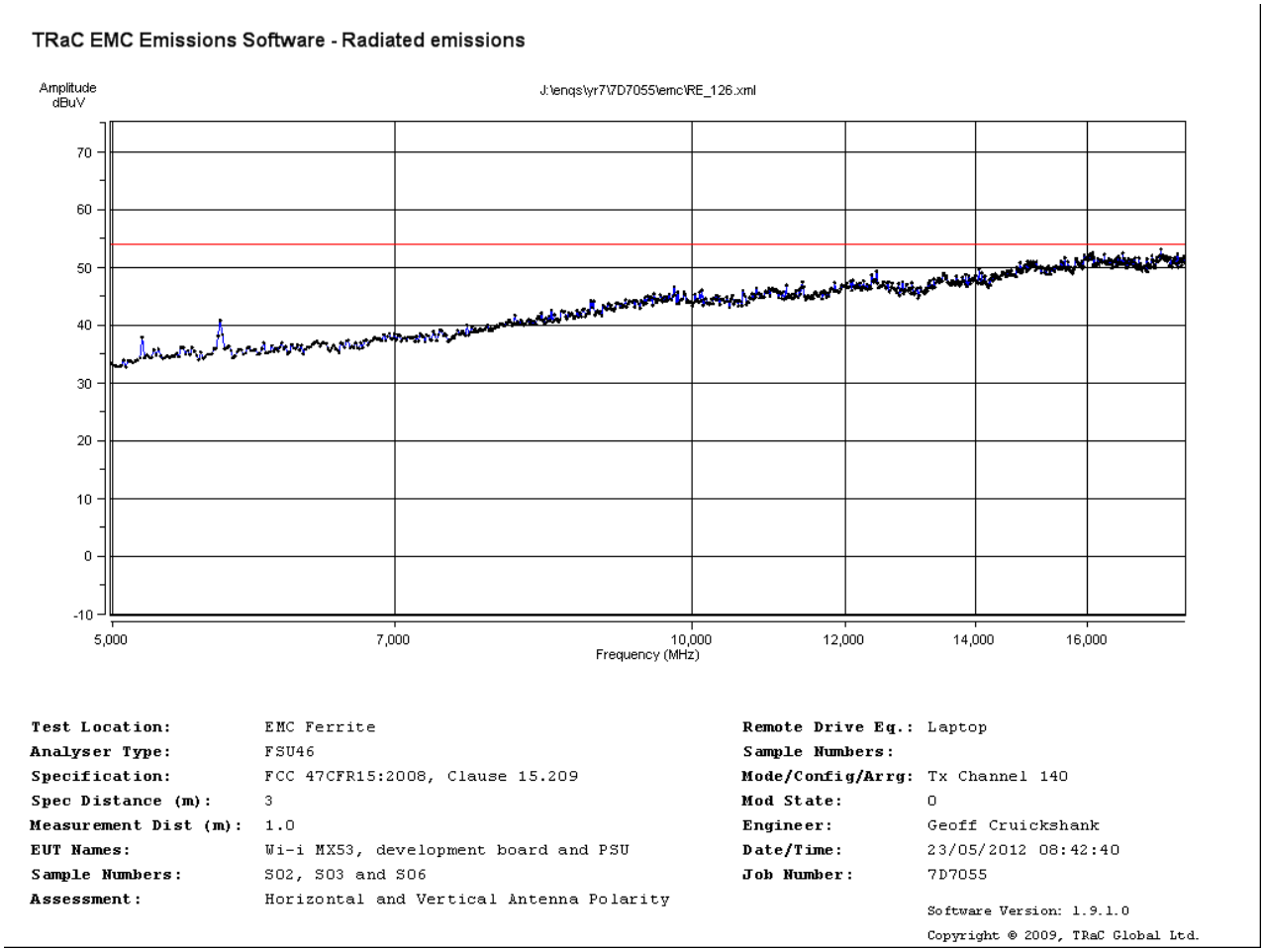
Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 100
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	23/05/2012 08:35:31
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

Radiated spurious emissions 5 GHz to 18GHz –Channel 100

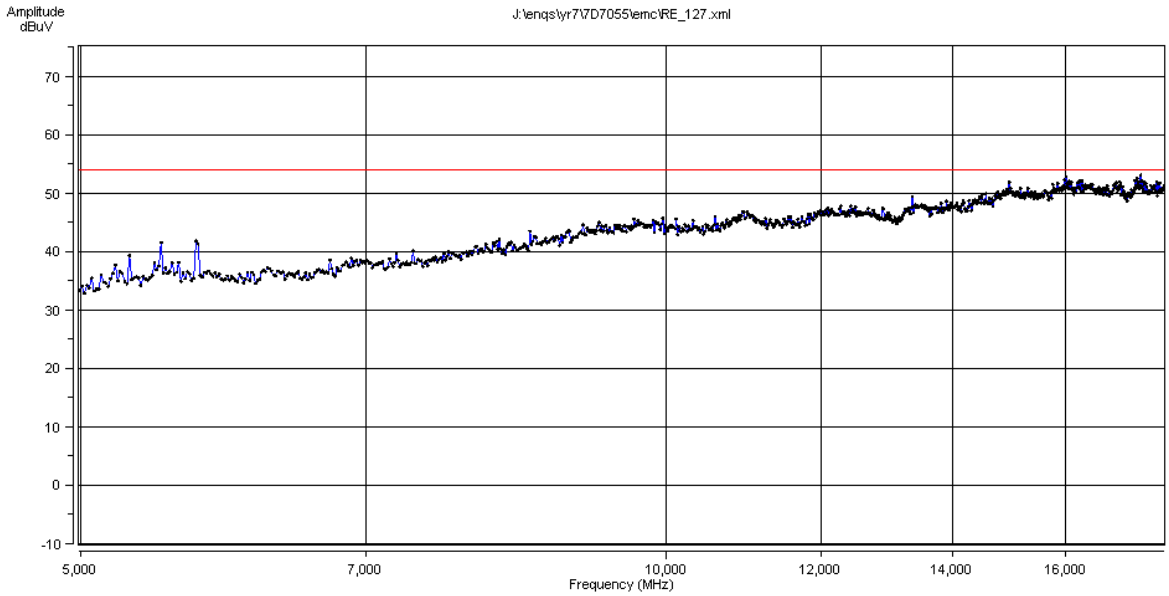


Radiated spurious emissions 5 GHz to 18GHz –Channel 120



Radiated spurious emissions 5 GHz to 18GHz –Channel 140

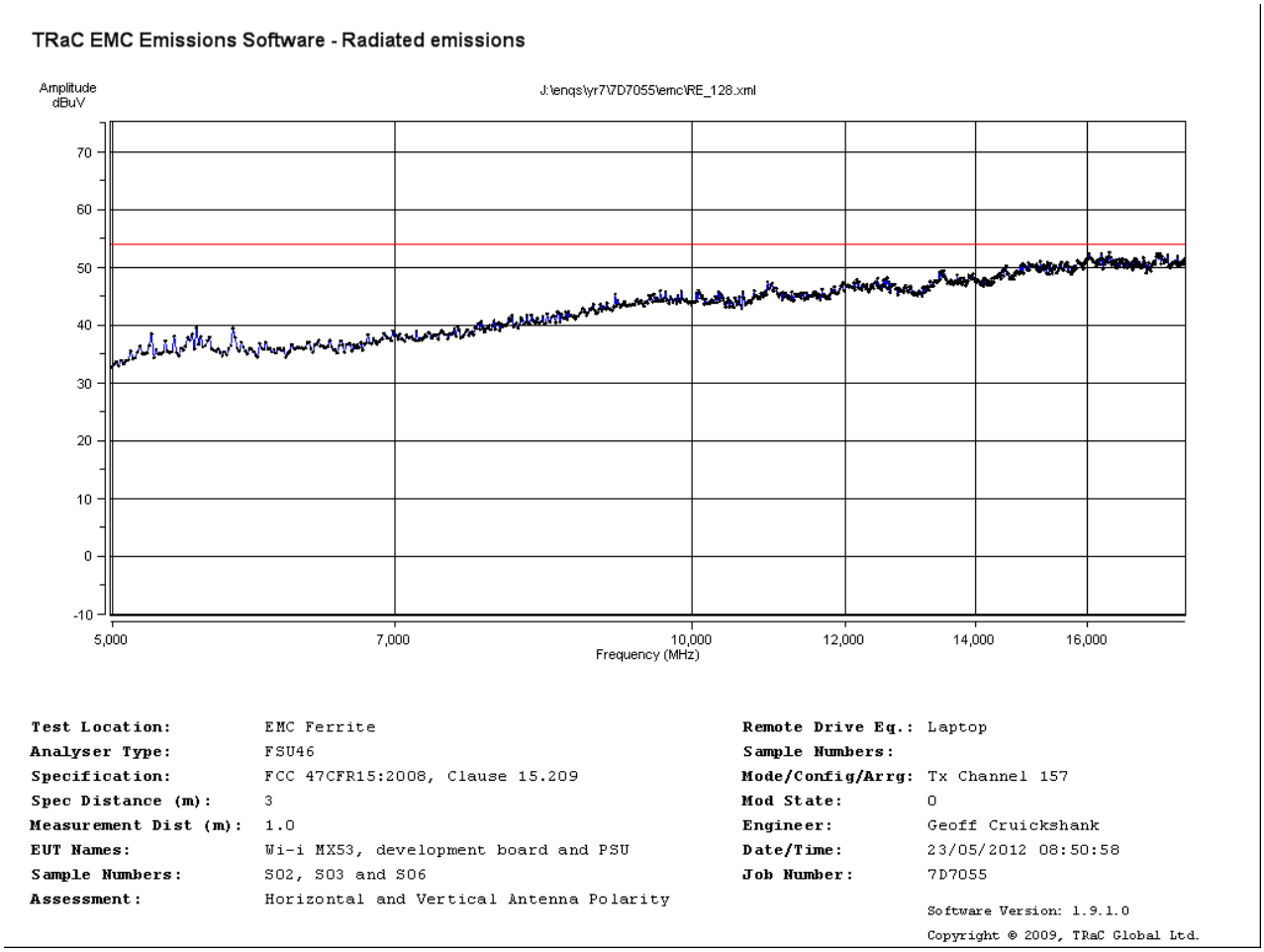
TRaC EMC Emissions Software - Radiated emissions



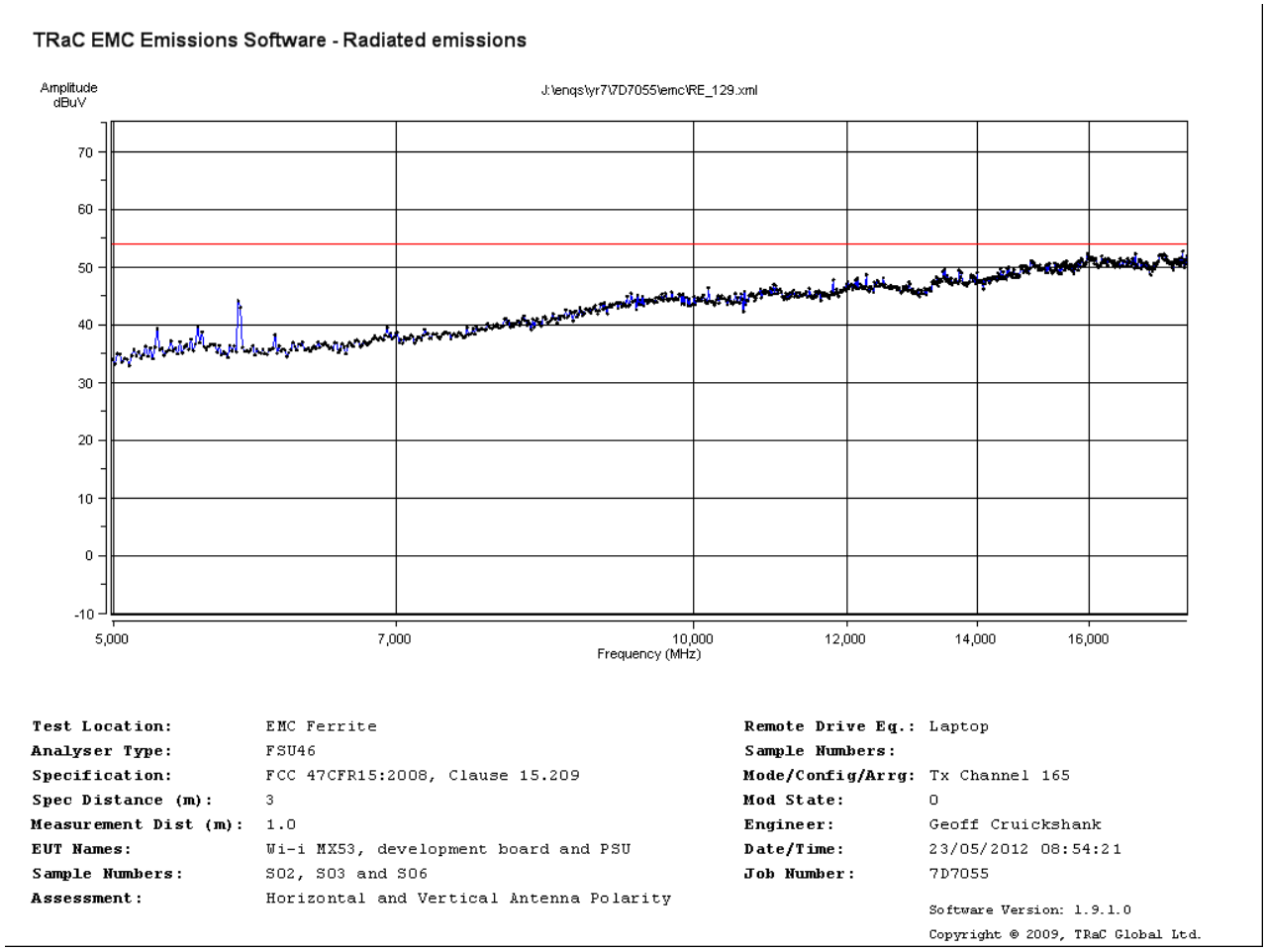
Test Location:	EMC Ferrite	**Remote Drive Eq.:**	Laptop
Analyser Type:	FSU46	**Sample Numbers:**	
Specification:	FCC 47CFR15:2008, Clause 15.209	**Mode/Config/Arrg:**	Tx Channel 149
Spec Distance (m):	3	**Mod State:**	0
Measurement Dist (m):	1.0	**Engineer:**	Geoff Cruickshank
EUT Names:	Wi-i MX53, development board and PSU	**Date/Time:**	23/05/2012 08:48:04
Sample Numbers:	S02, S03 and S06	**Job Number:**	7D7055
Assessment:	Horizontal and Vertical Antenna Polarity		

Software Version: 1.9.1.0

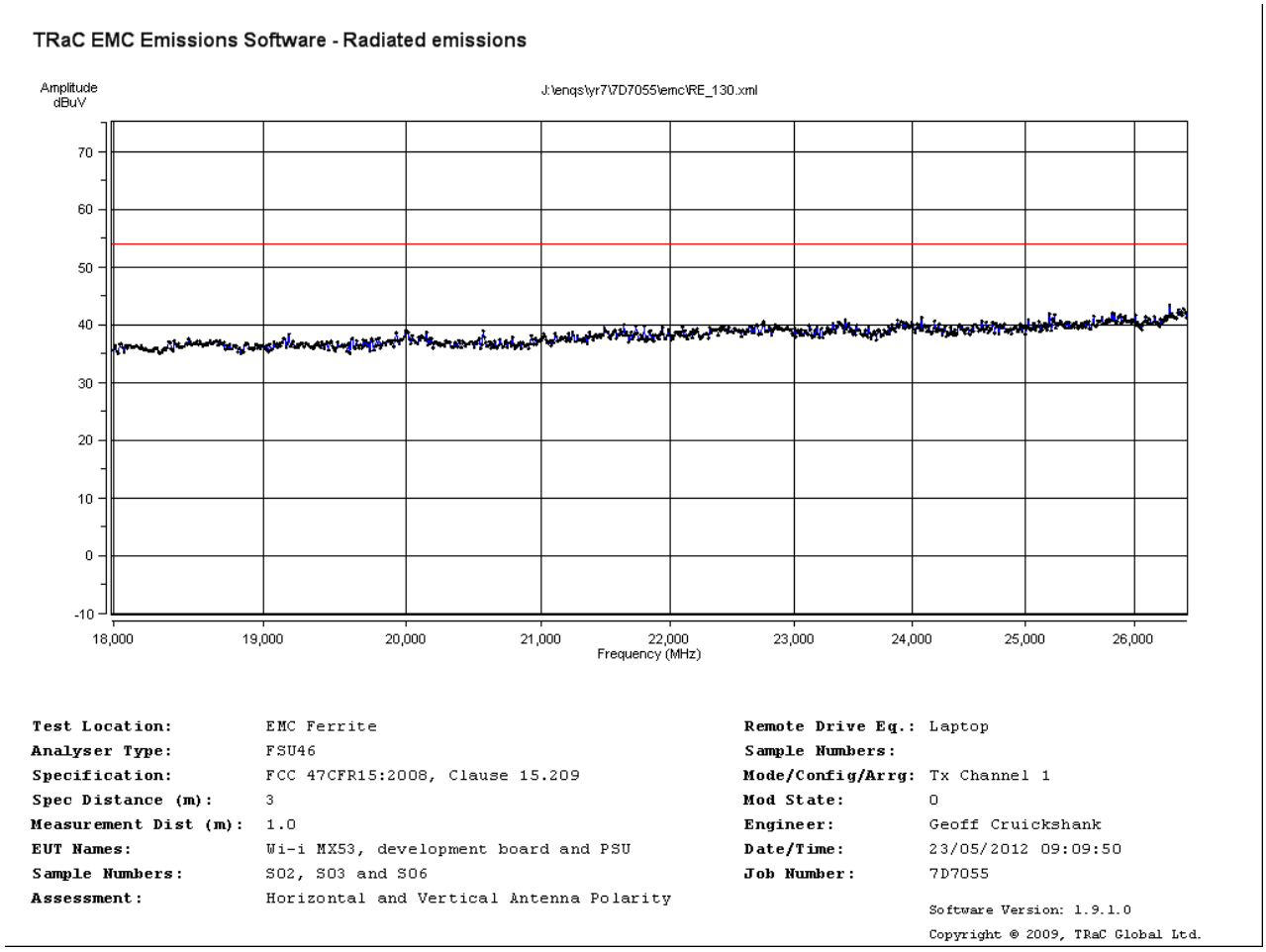
Radiated spurious emissions 5 GHz to 18GHz –Channel 149



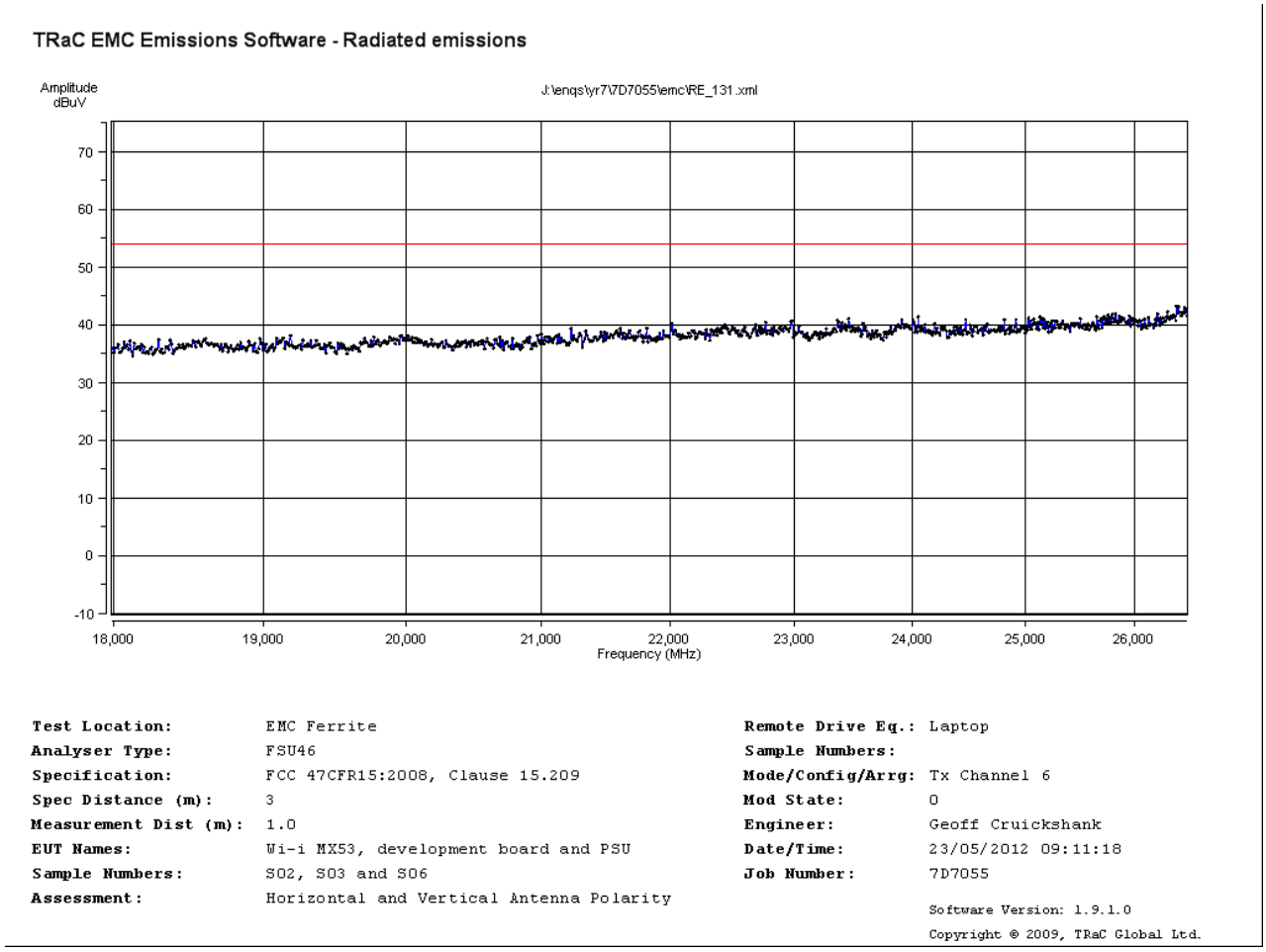
Radiated spurious emissions 5 GHz to 18GHz –Channel 157



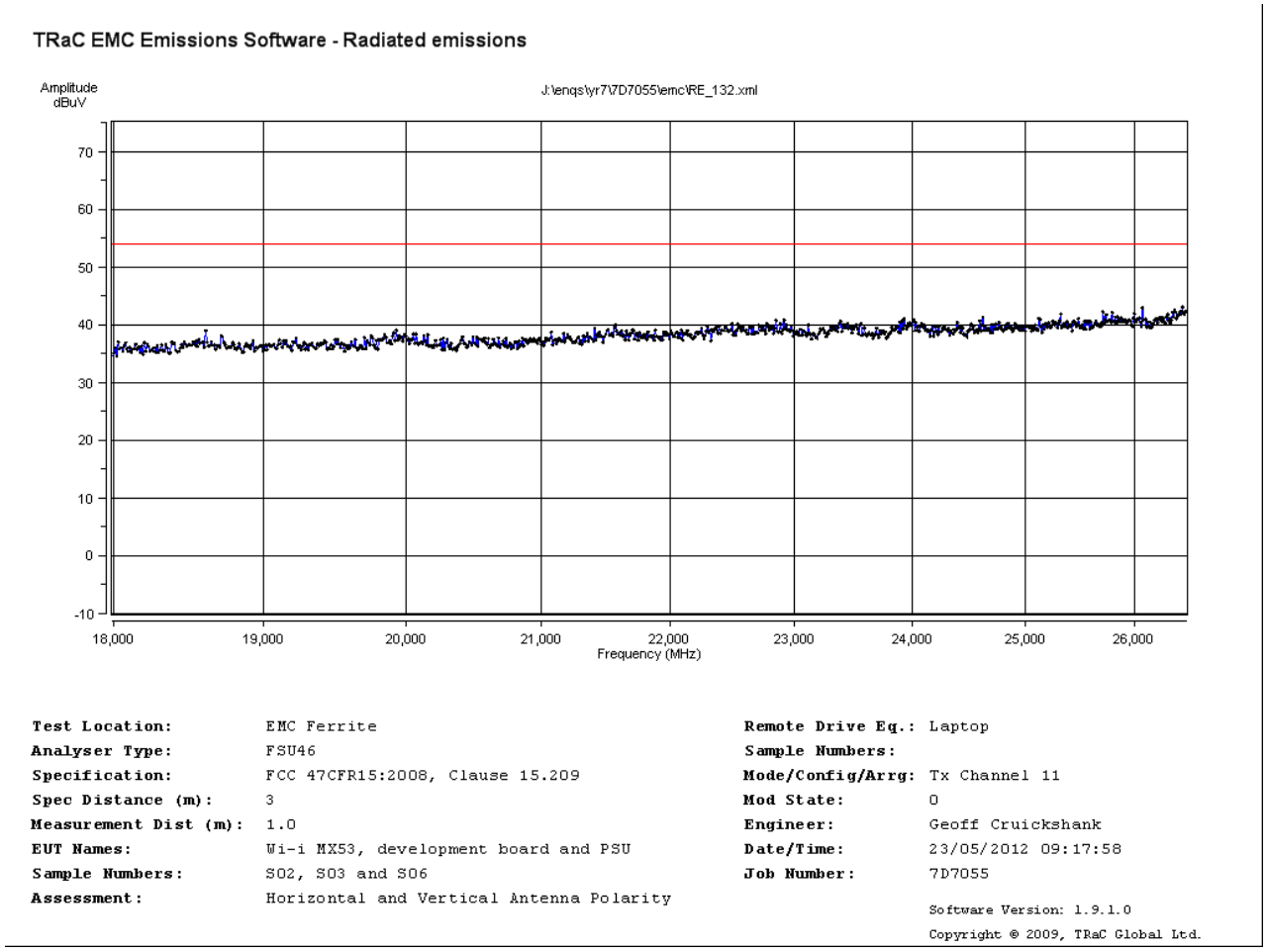
Radiated spurious emissions 5 GHz to 18GHz –Channel 165



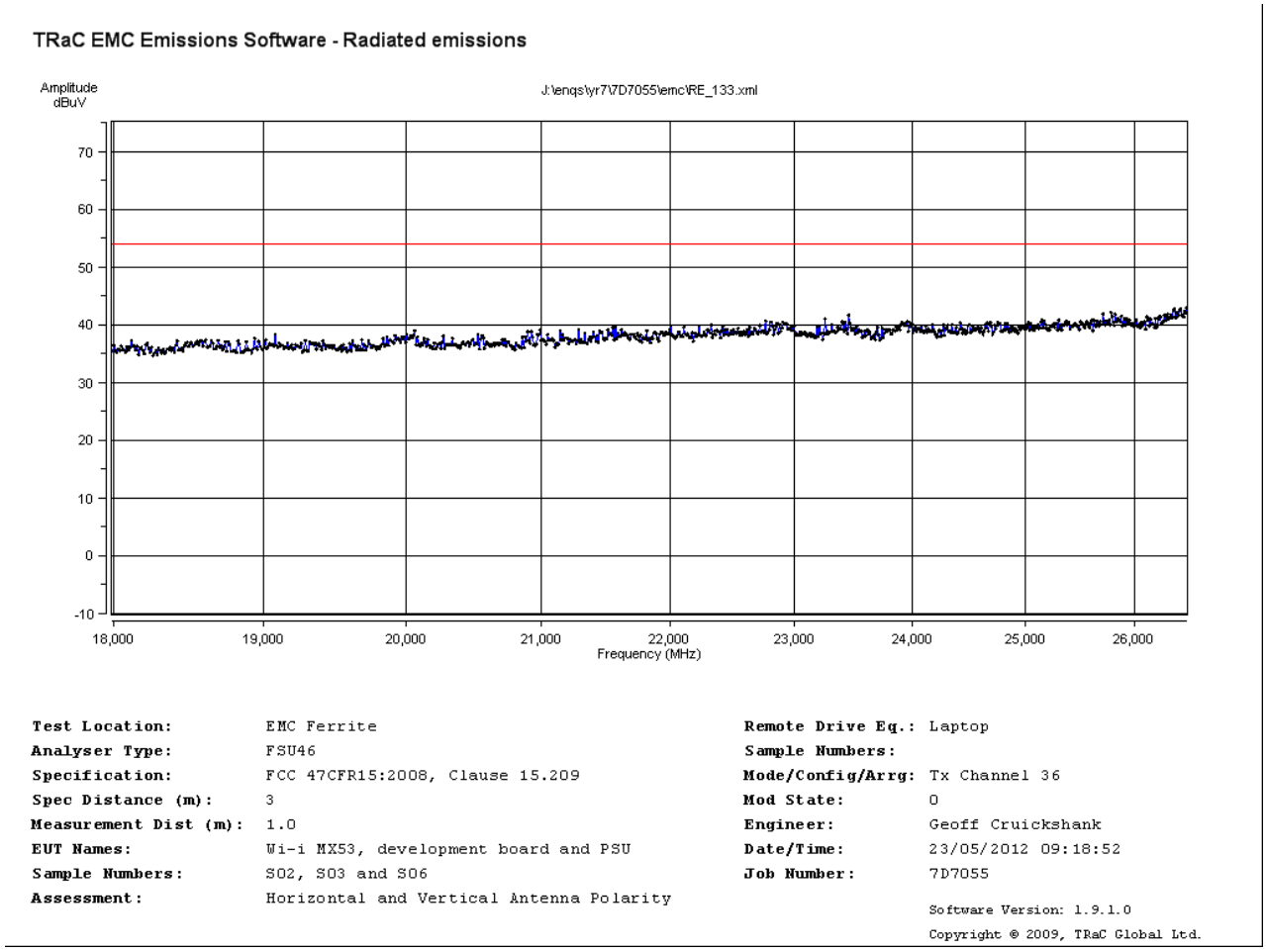
Radiated spurious emissions 18GHz to 26.5GHz – Channel 1



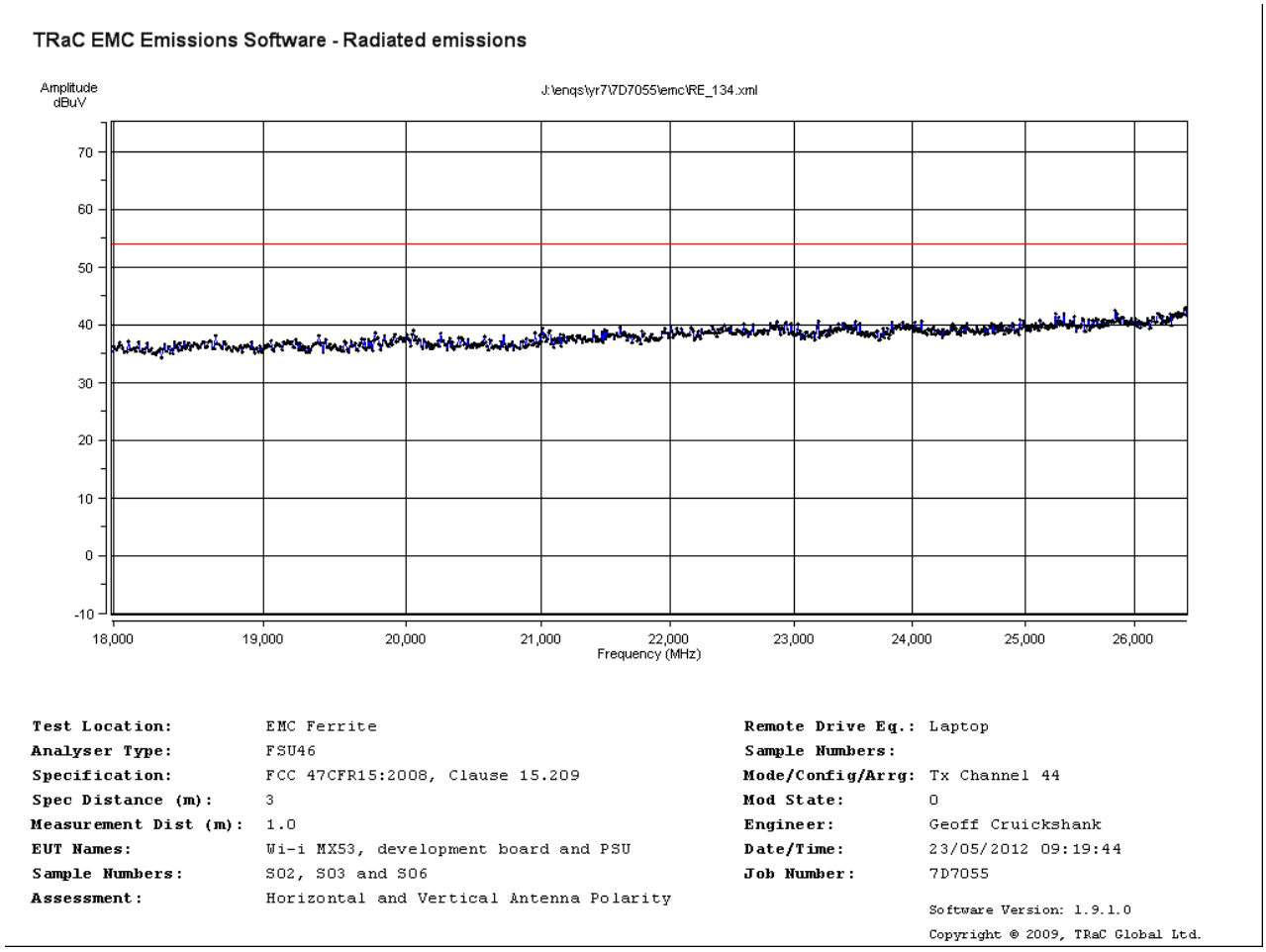
Radiated spurious emissions 18GHz to 26.5GHz – Channel 6



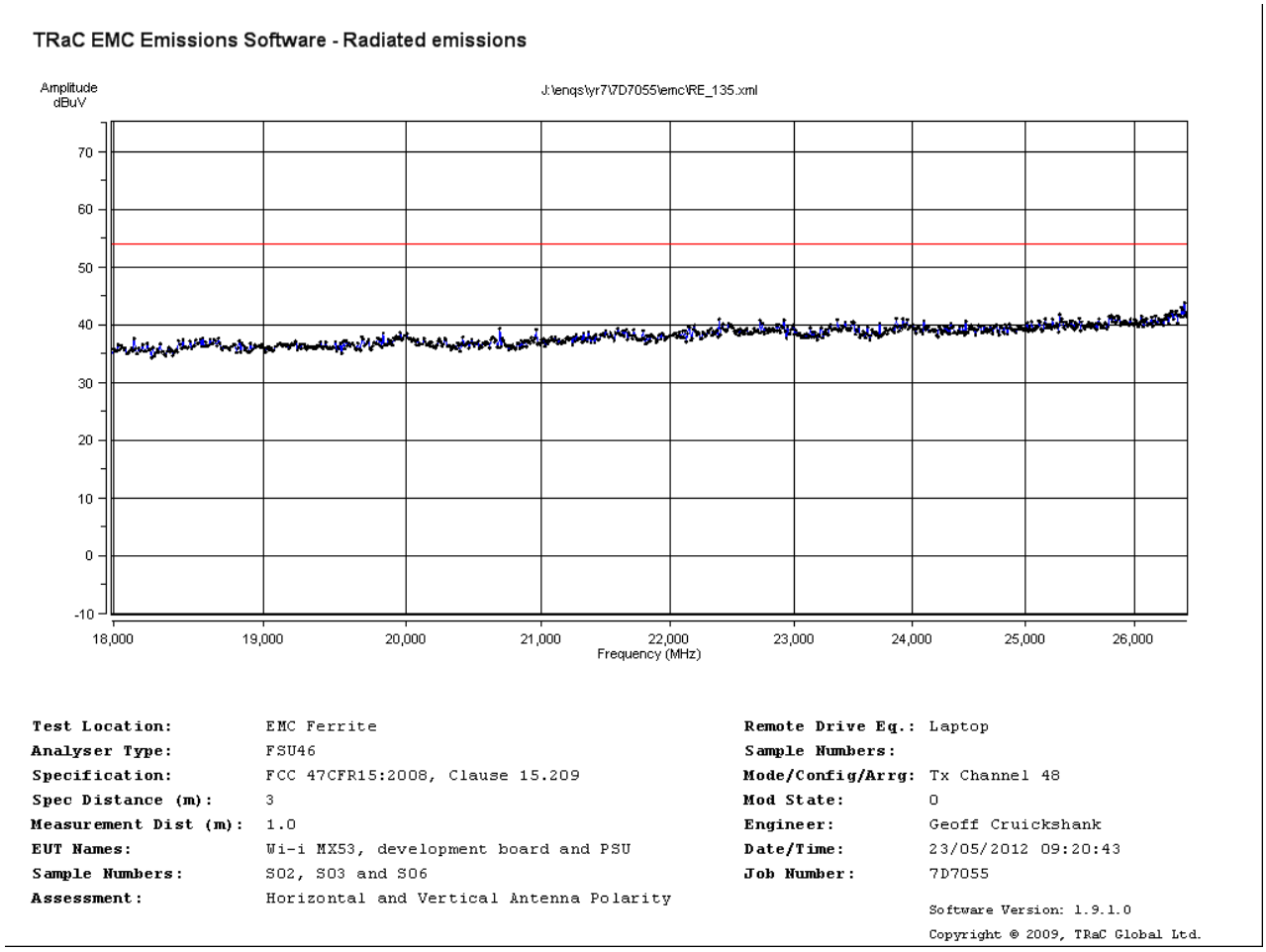
Radiated spurious emissions 18GHz to 26.5GHz – Channel 11



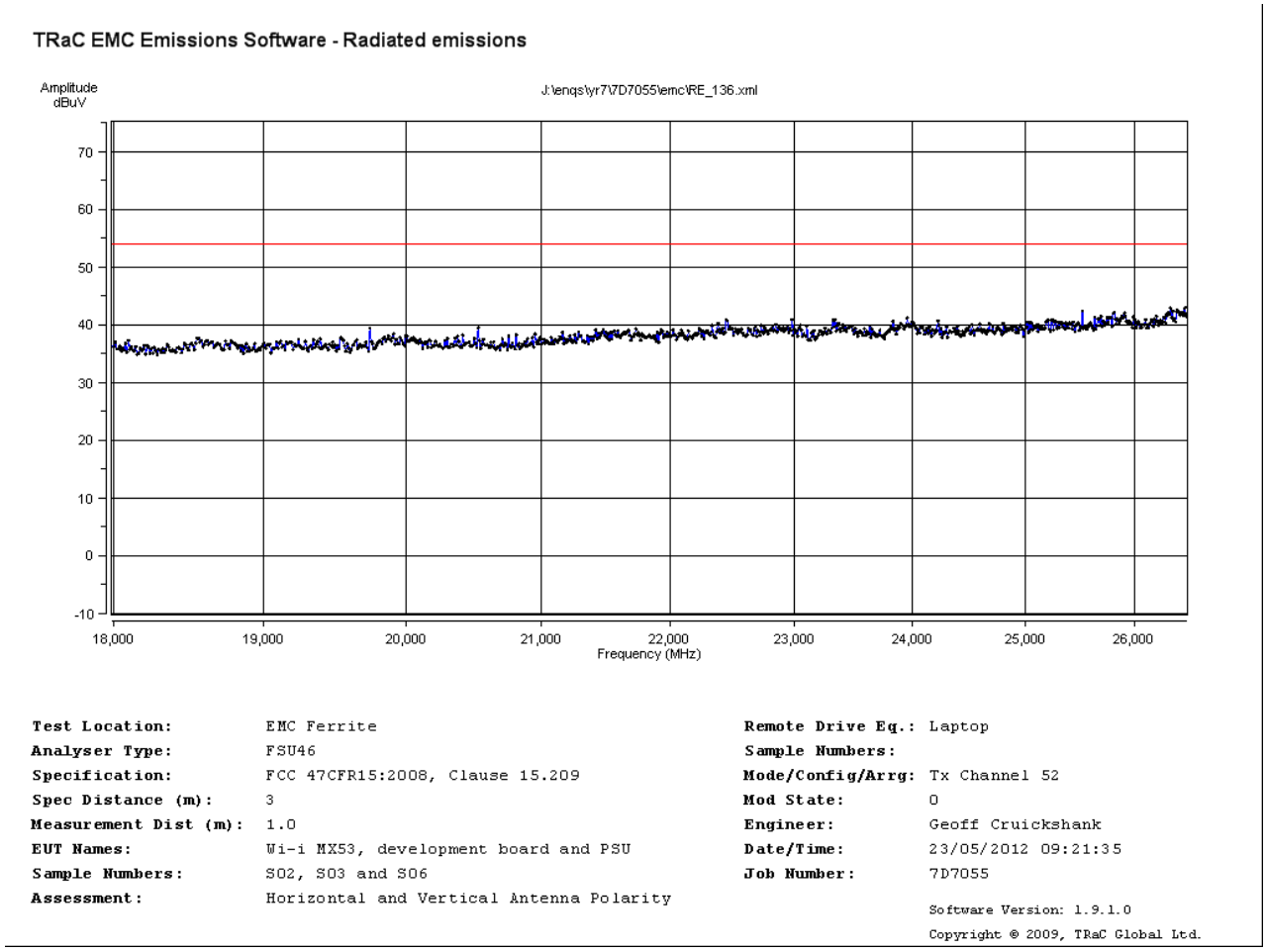
Radiated spurious emissions 18GHz to 26.5GHz – Channel 36



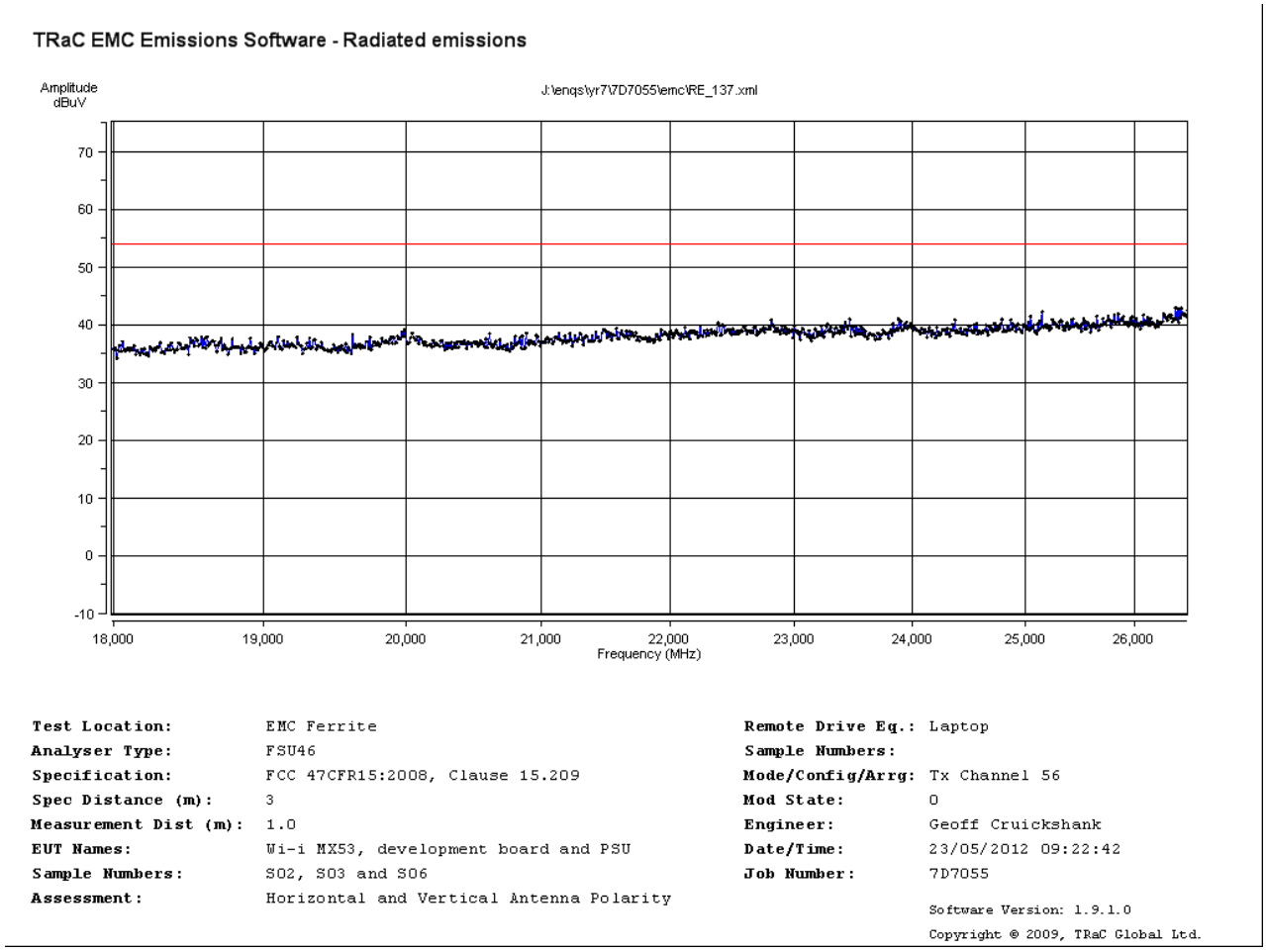
Radiated spurious emissions 18GHz to 26.5GHz – Channel 44



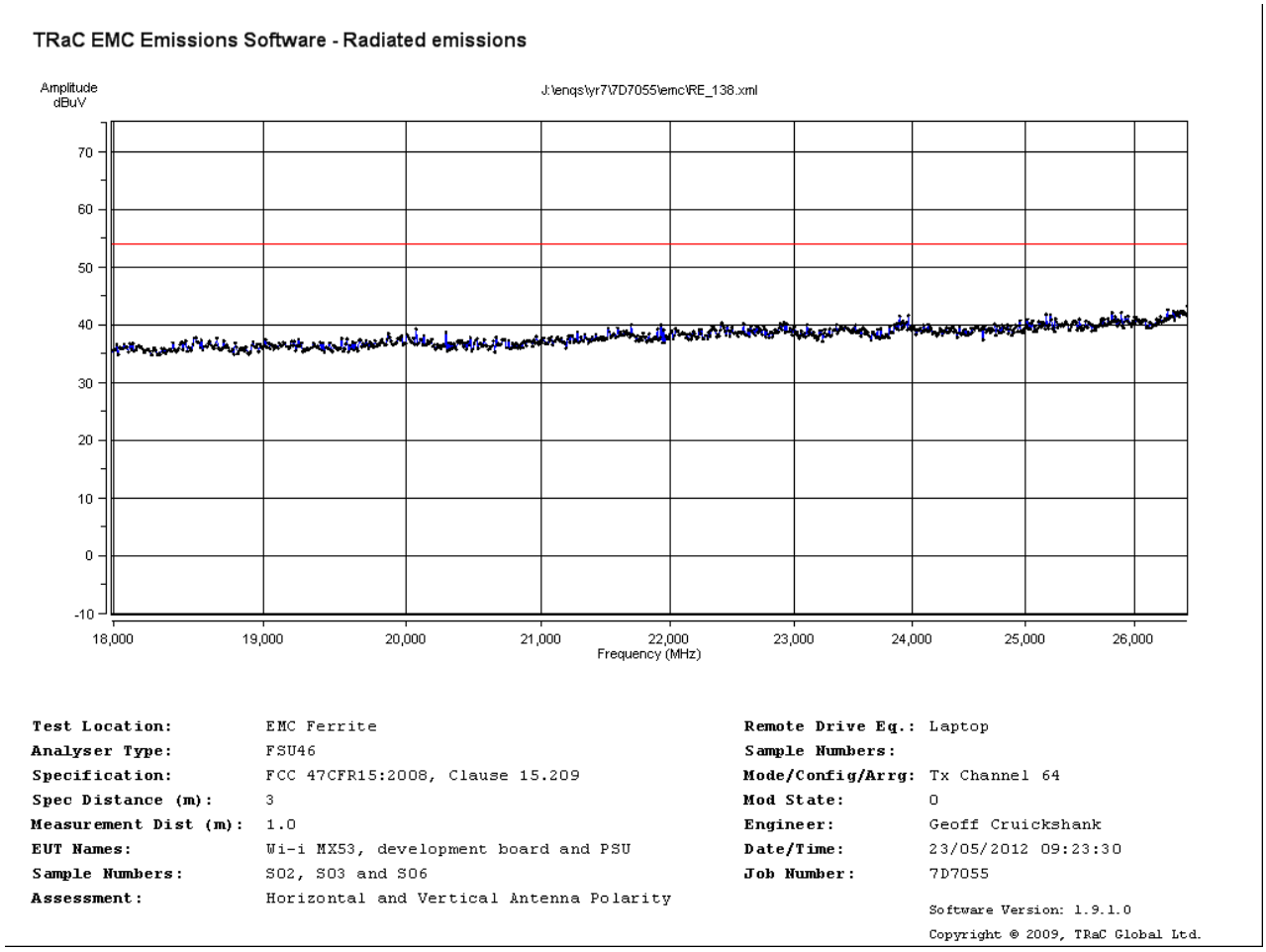
Radiated spurious emissions 18GHz to 26.5GHz – Channel 48



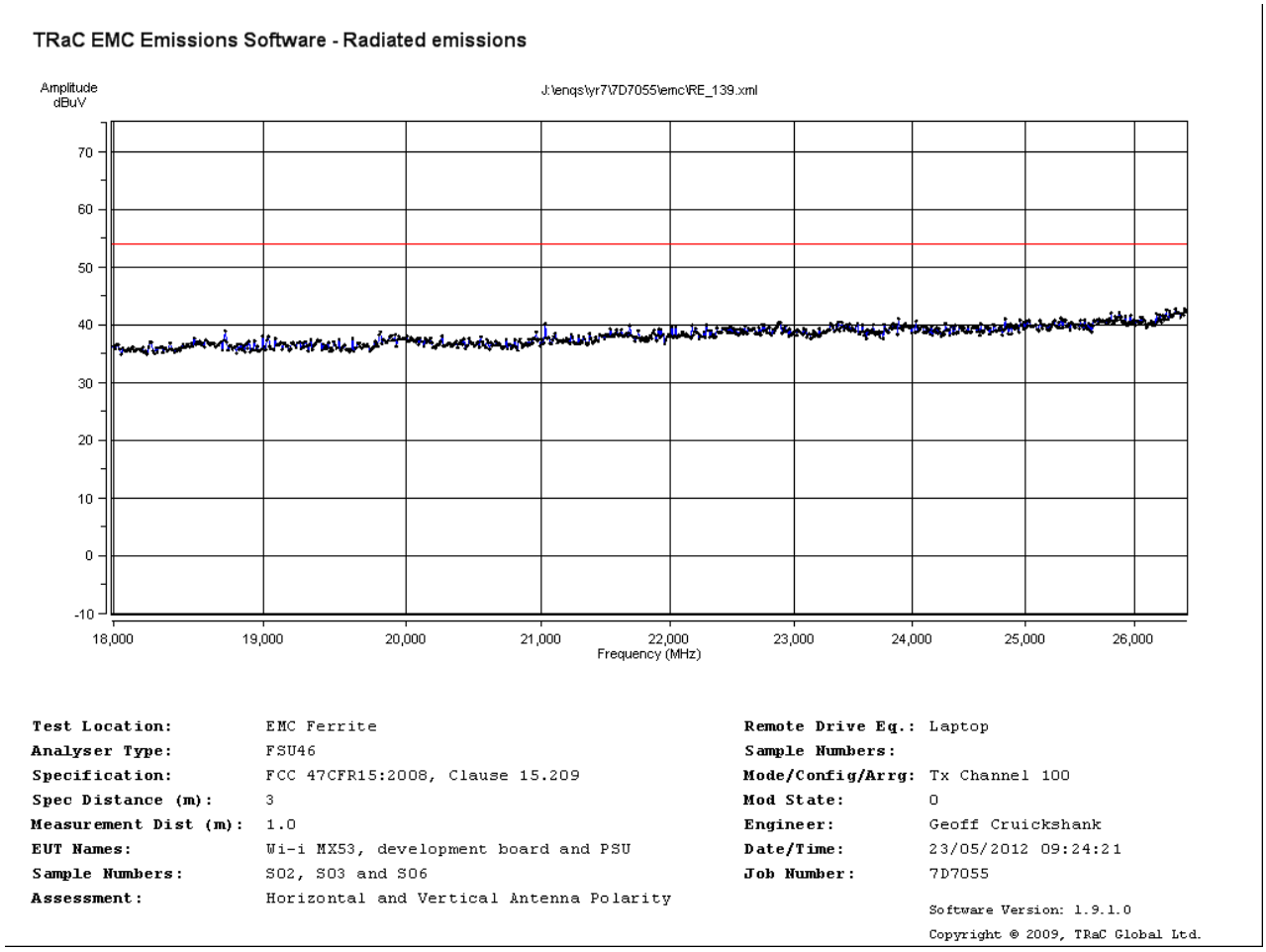
Radiated spurious emissions 18GHz to 26.5GHz – Channel 52



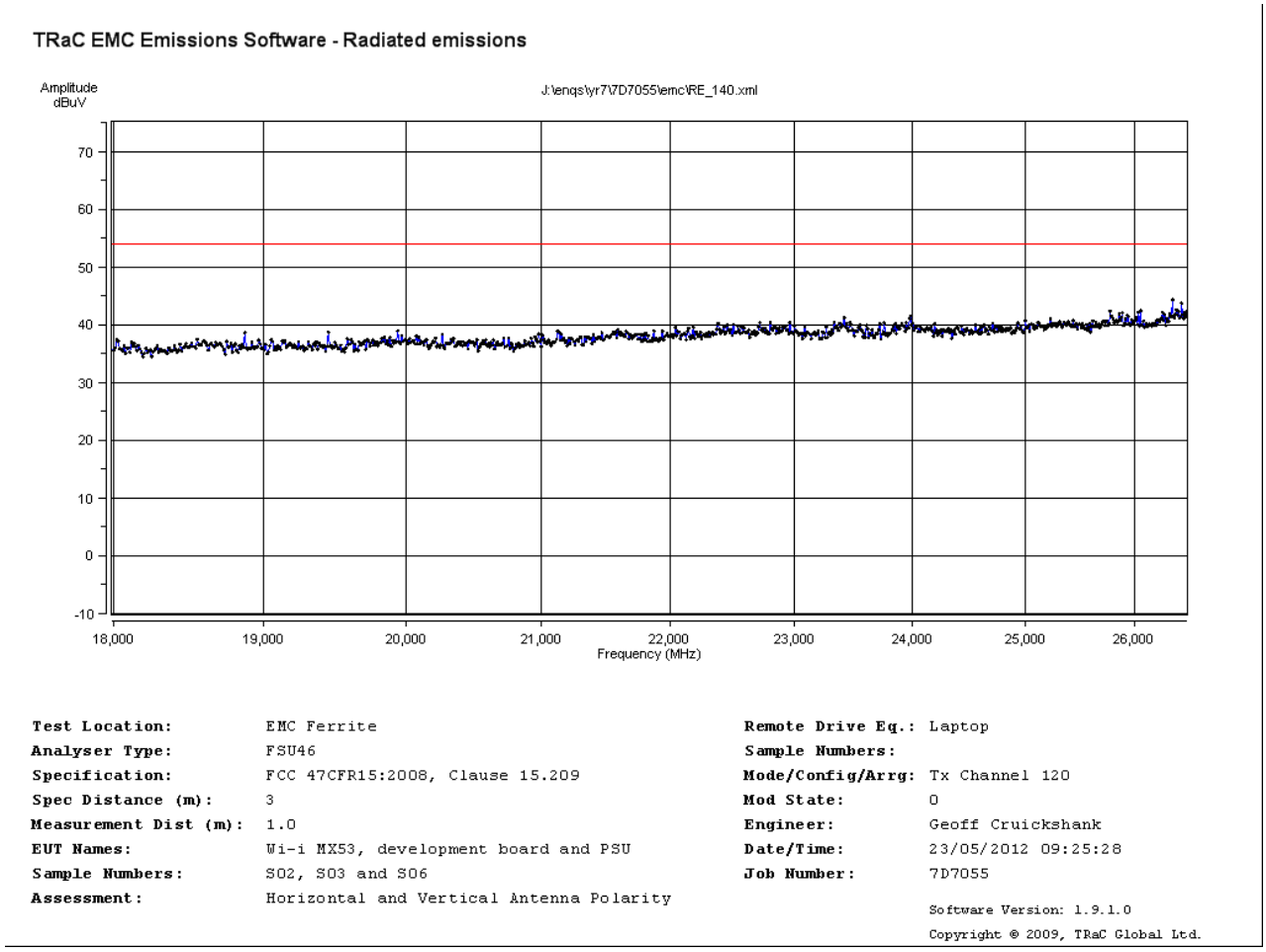
Radiated spurious emissions 18GHz to 26.5GHz – Channel 56



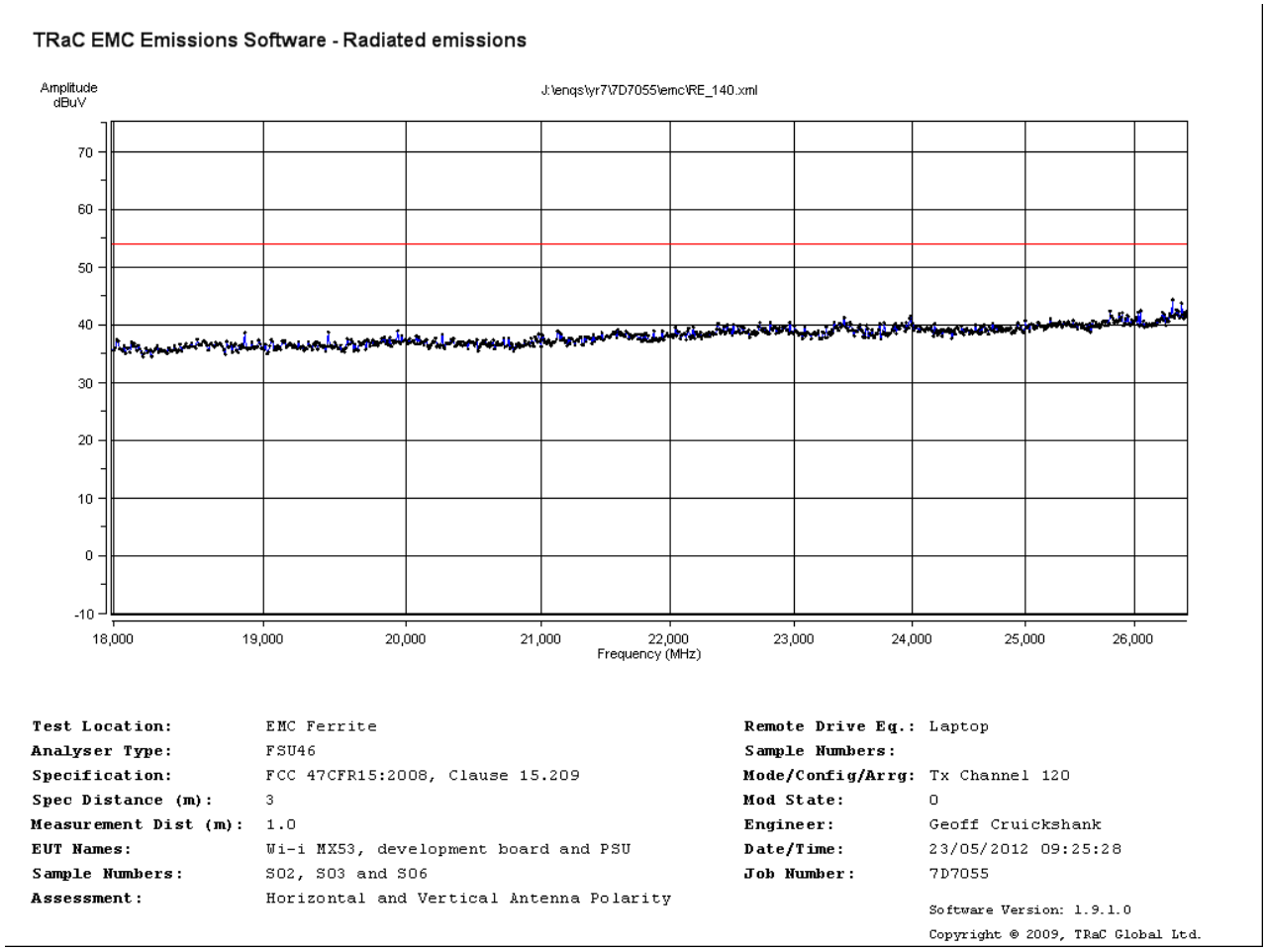
Radiated spurious emissions 18GHz to 26.5GHz – Channel 64



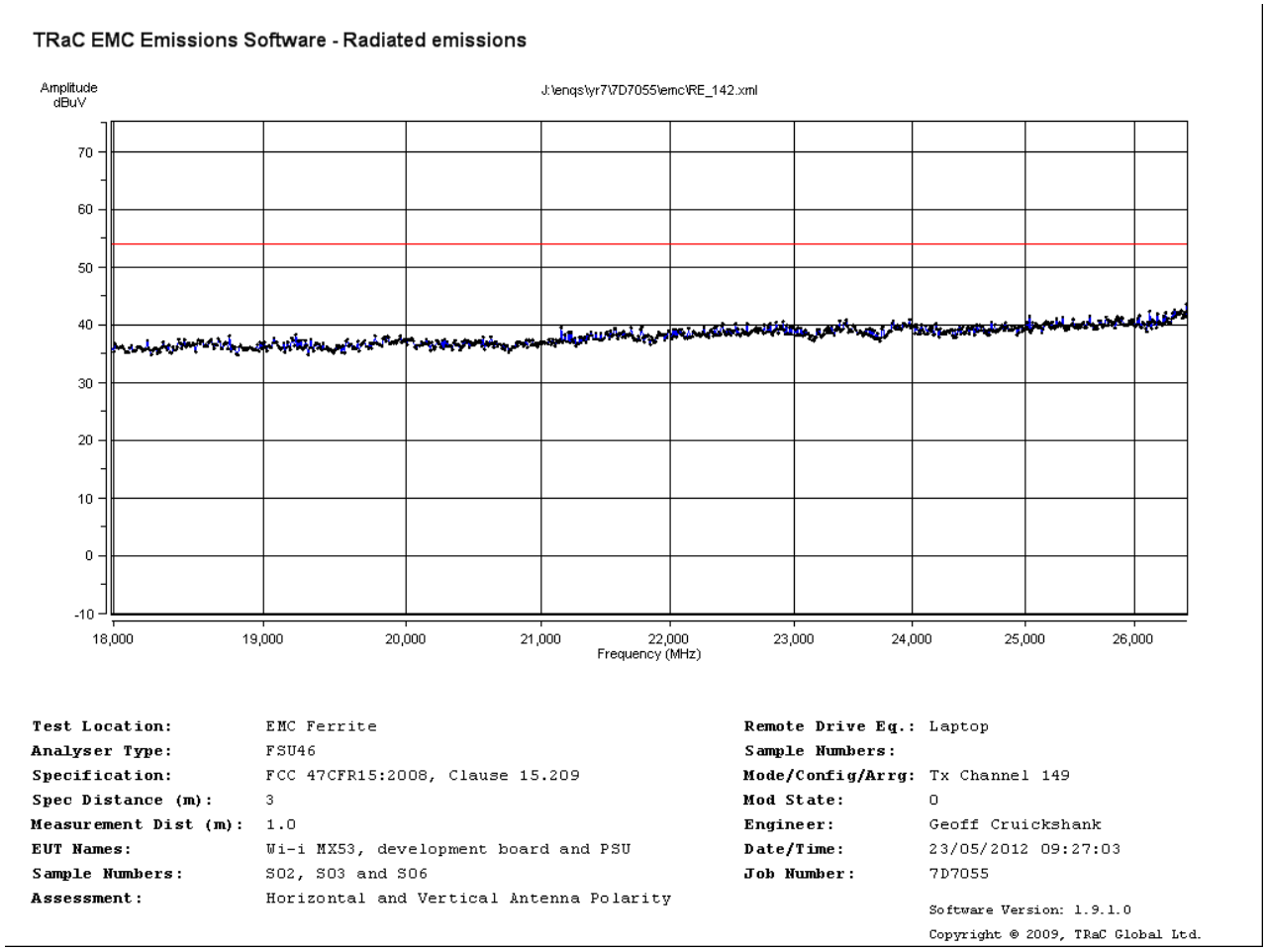
Radiated spurious emissions 18GHz to 26.5GHz – Channel 100



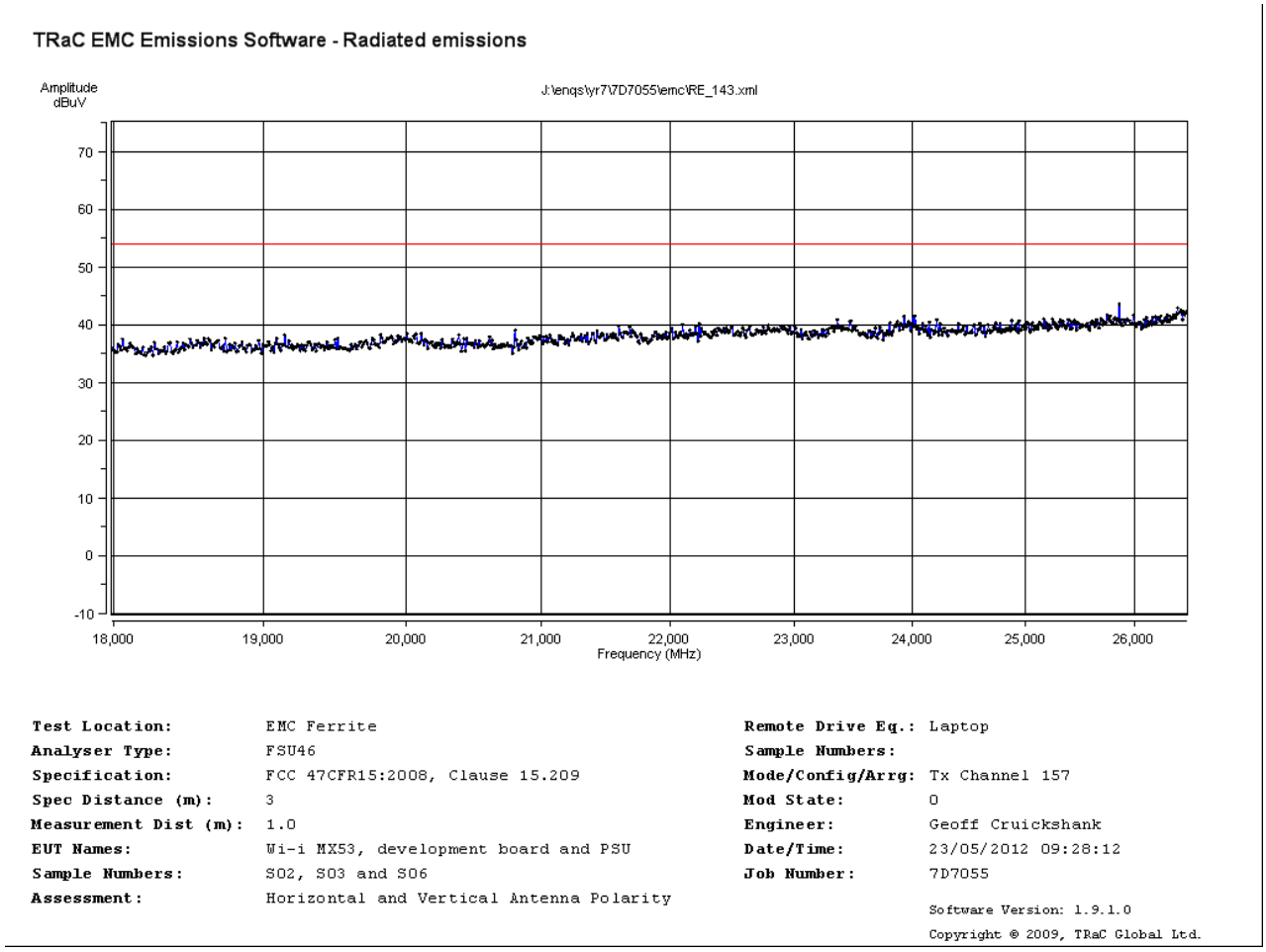
Radiated spurious emissions 18GHz to 26.5GHz – Channel 120



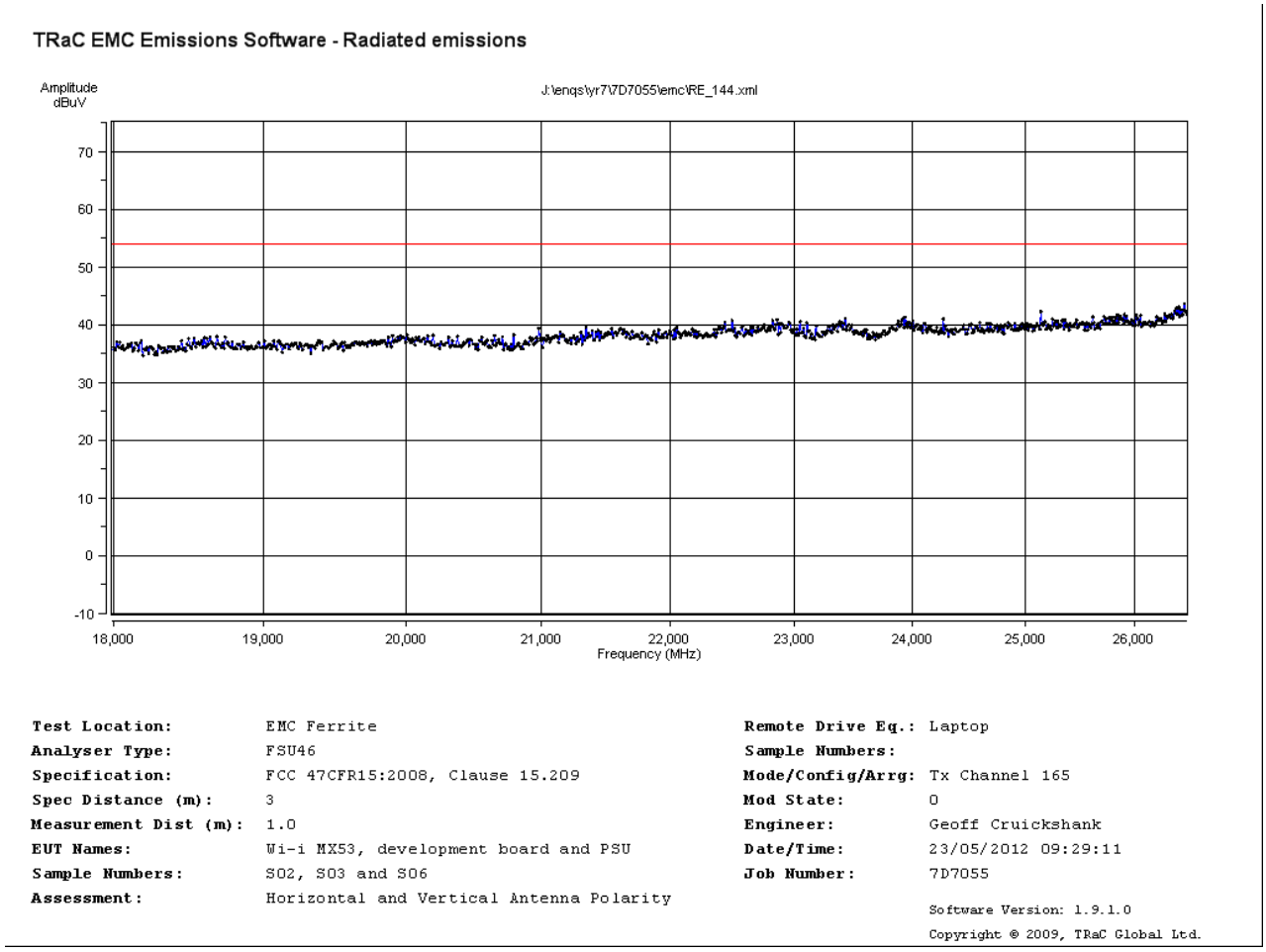
Radiated spurious emissions 18GHz to 26.5GHz – Channel 140



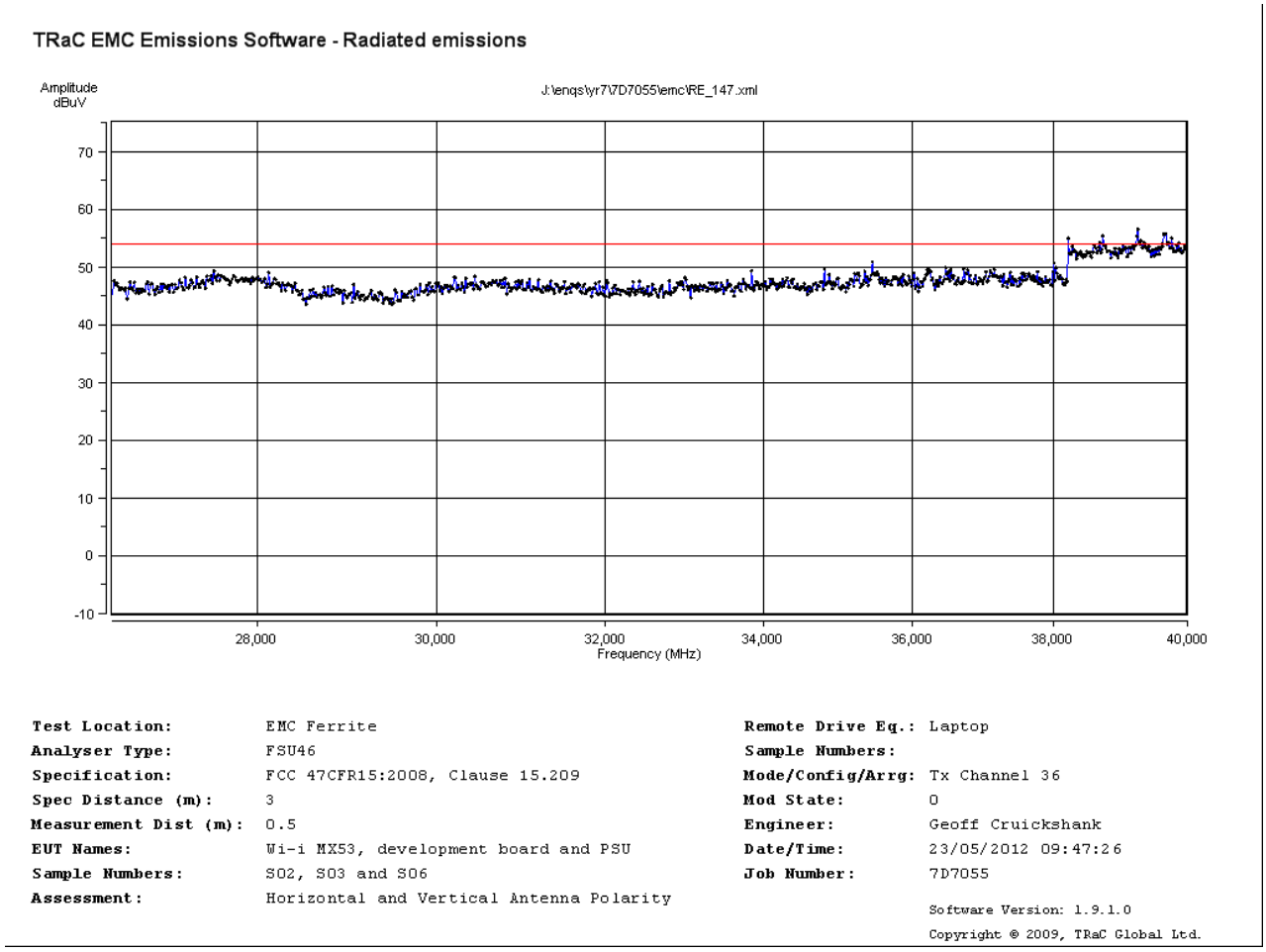
Radiated spurious emissions 18GHz to 26.5GHz – Channel 149



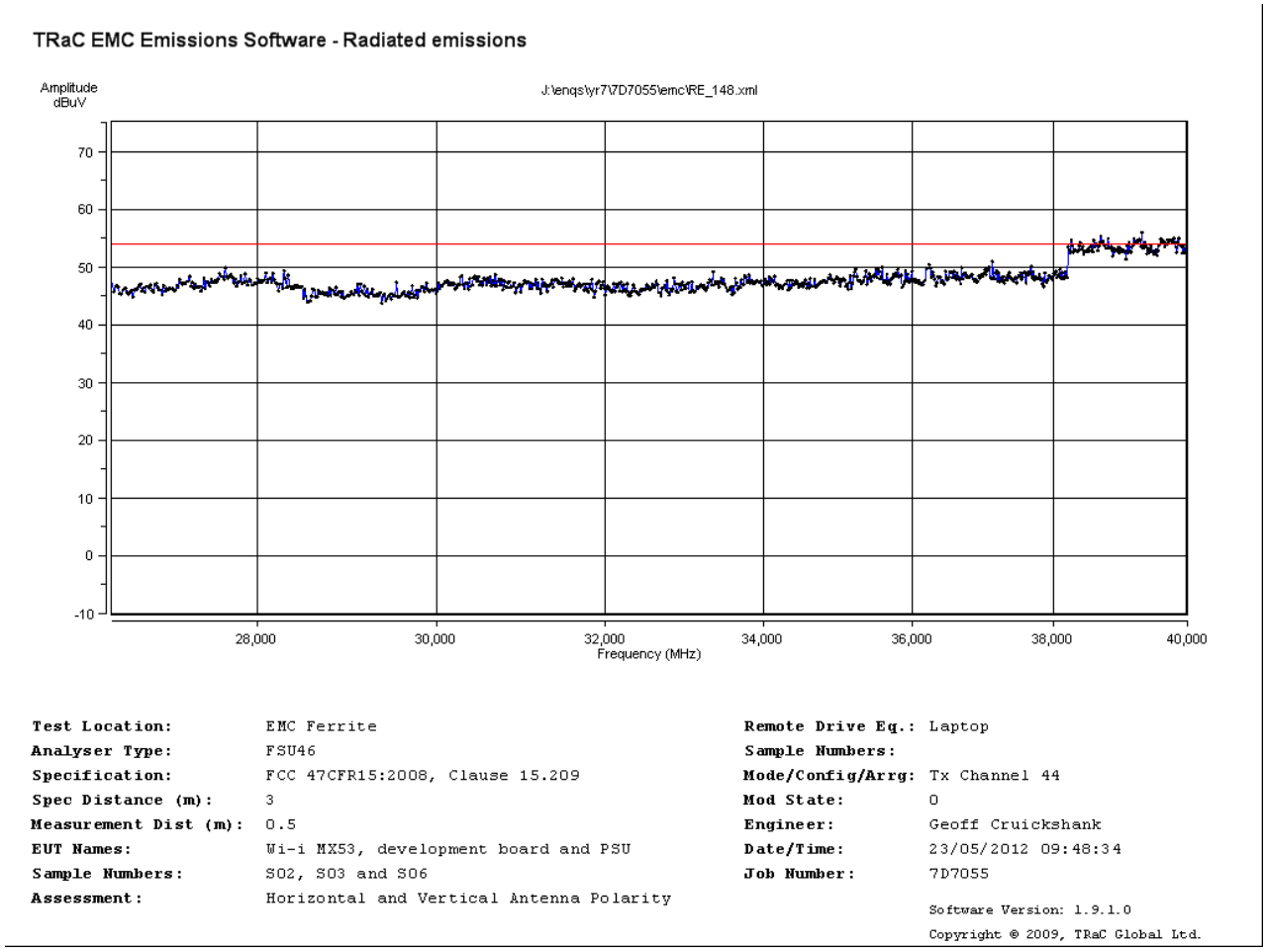
Radiated spurious emissions 18GHz to 26.5GHz – Channel 157



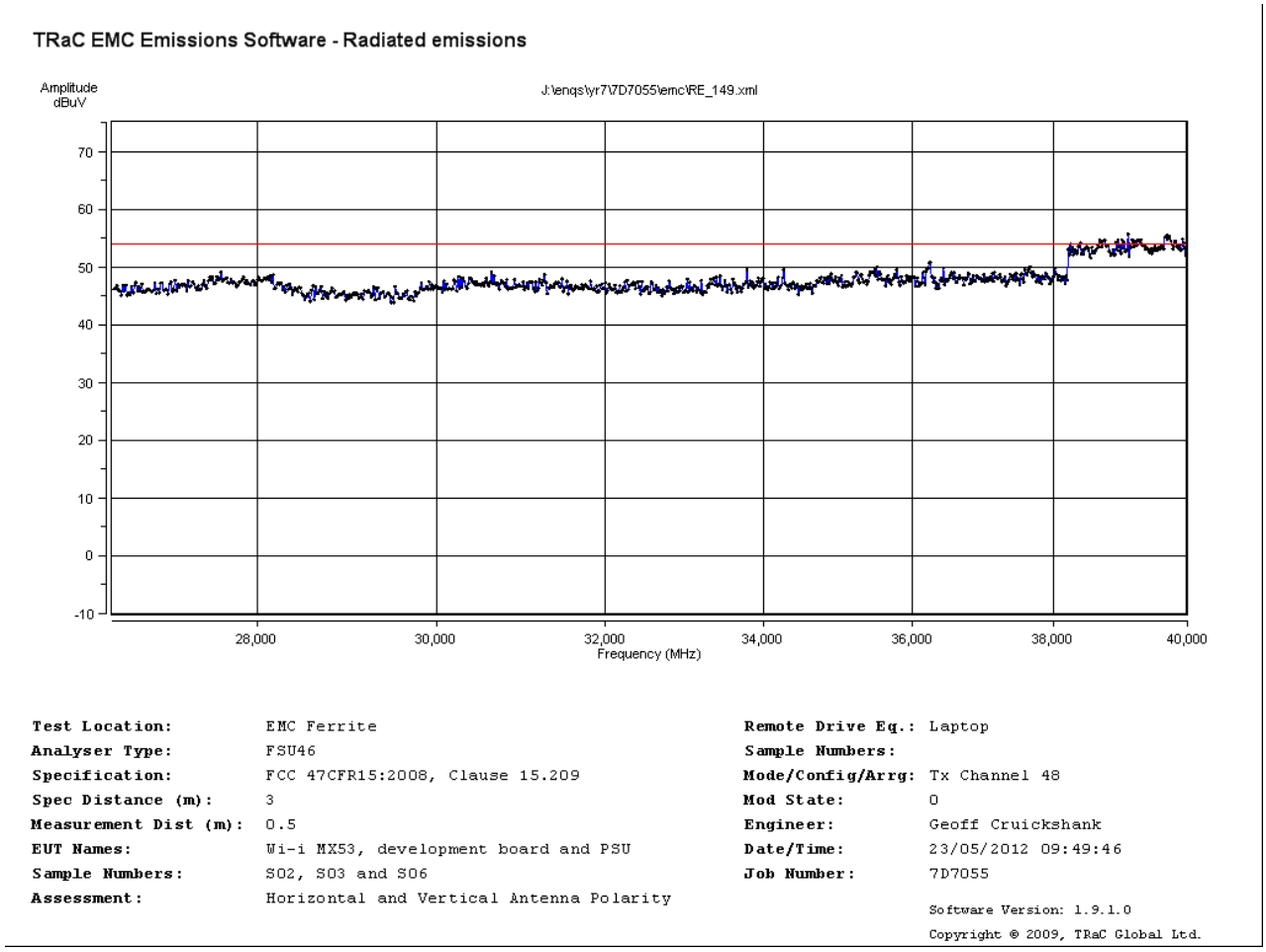
Radiated spurious emissions 18GHz to 26.5GHz – Channel 165



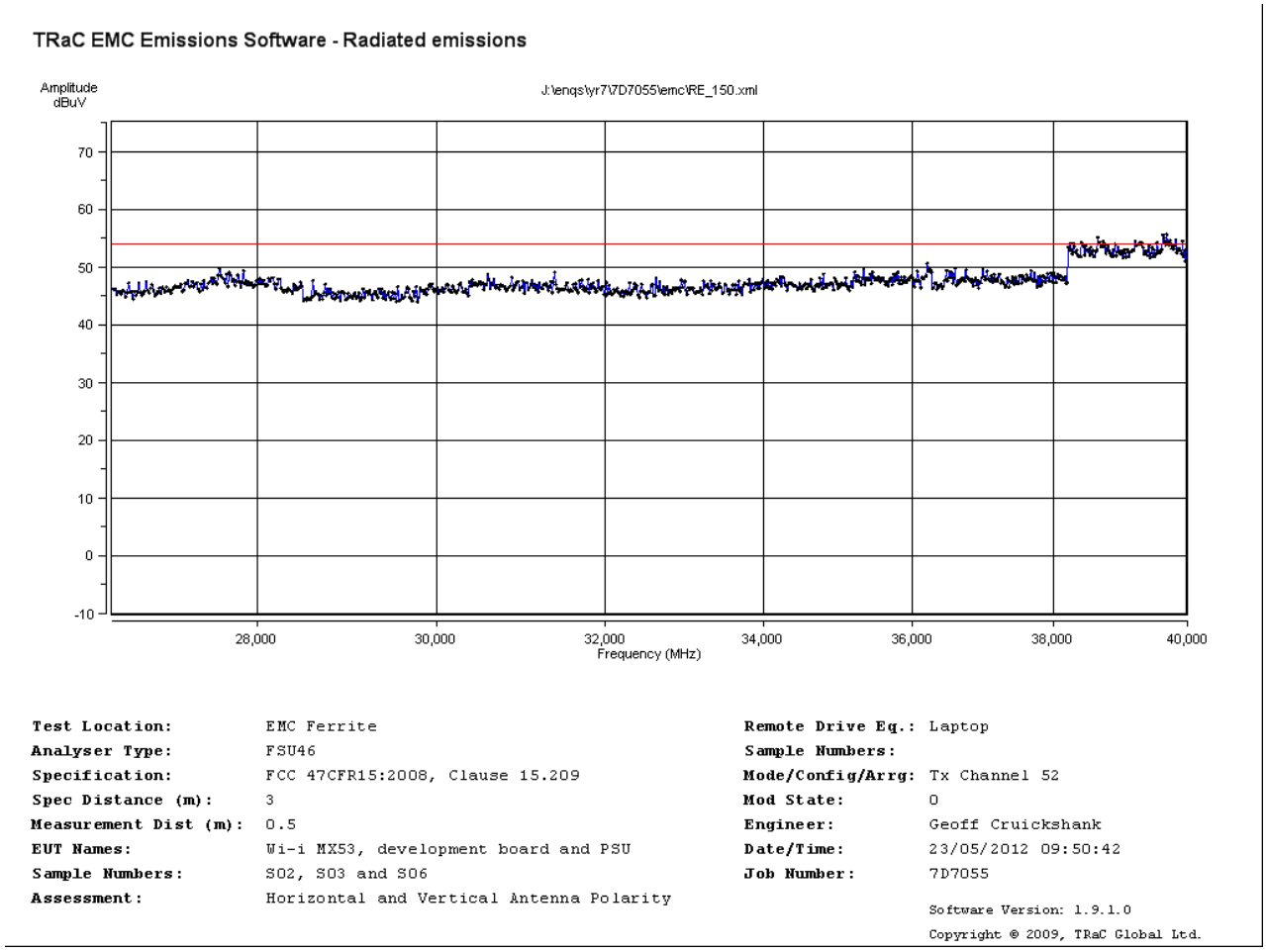
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 36



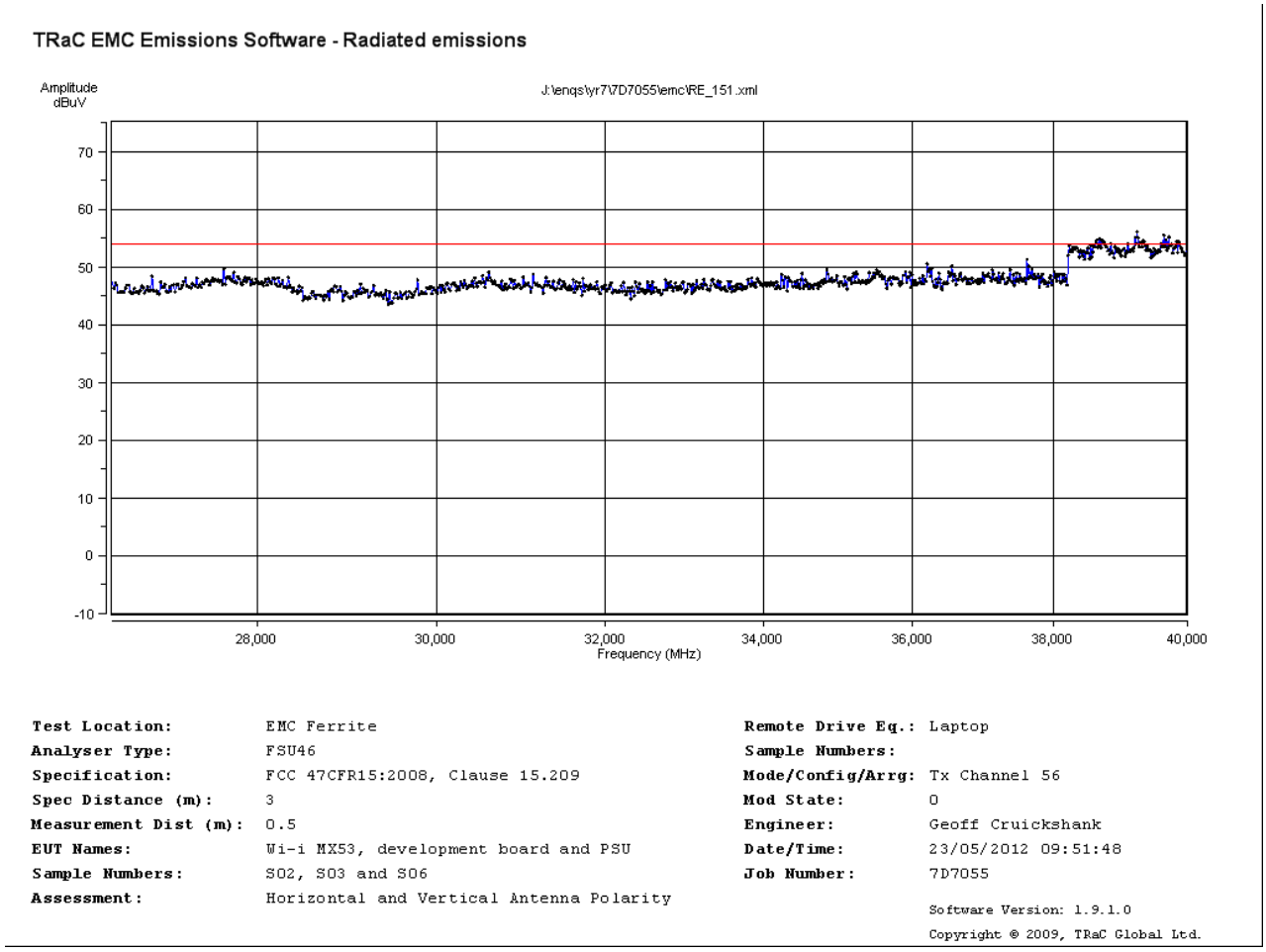
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 44



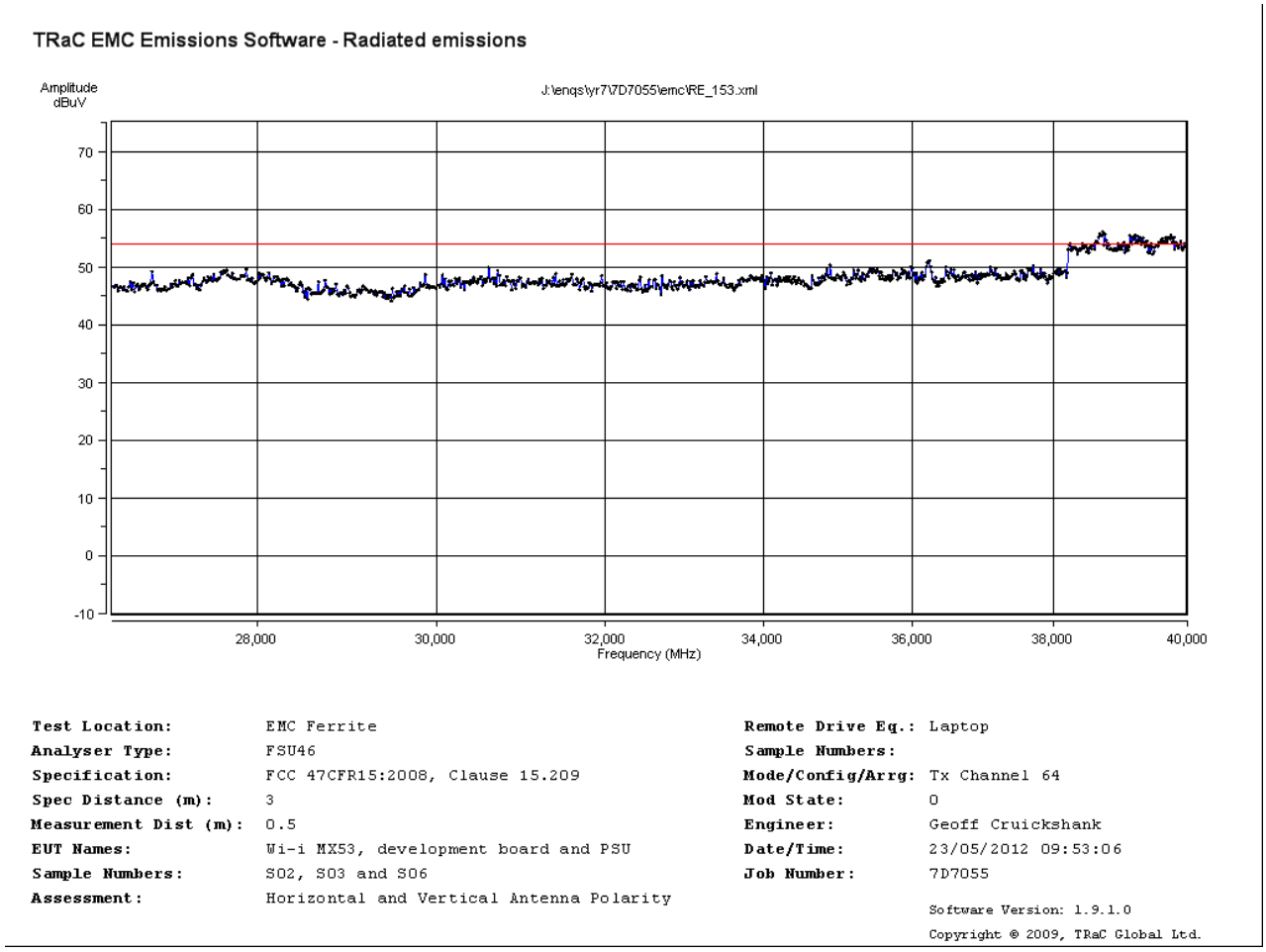
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 48



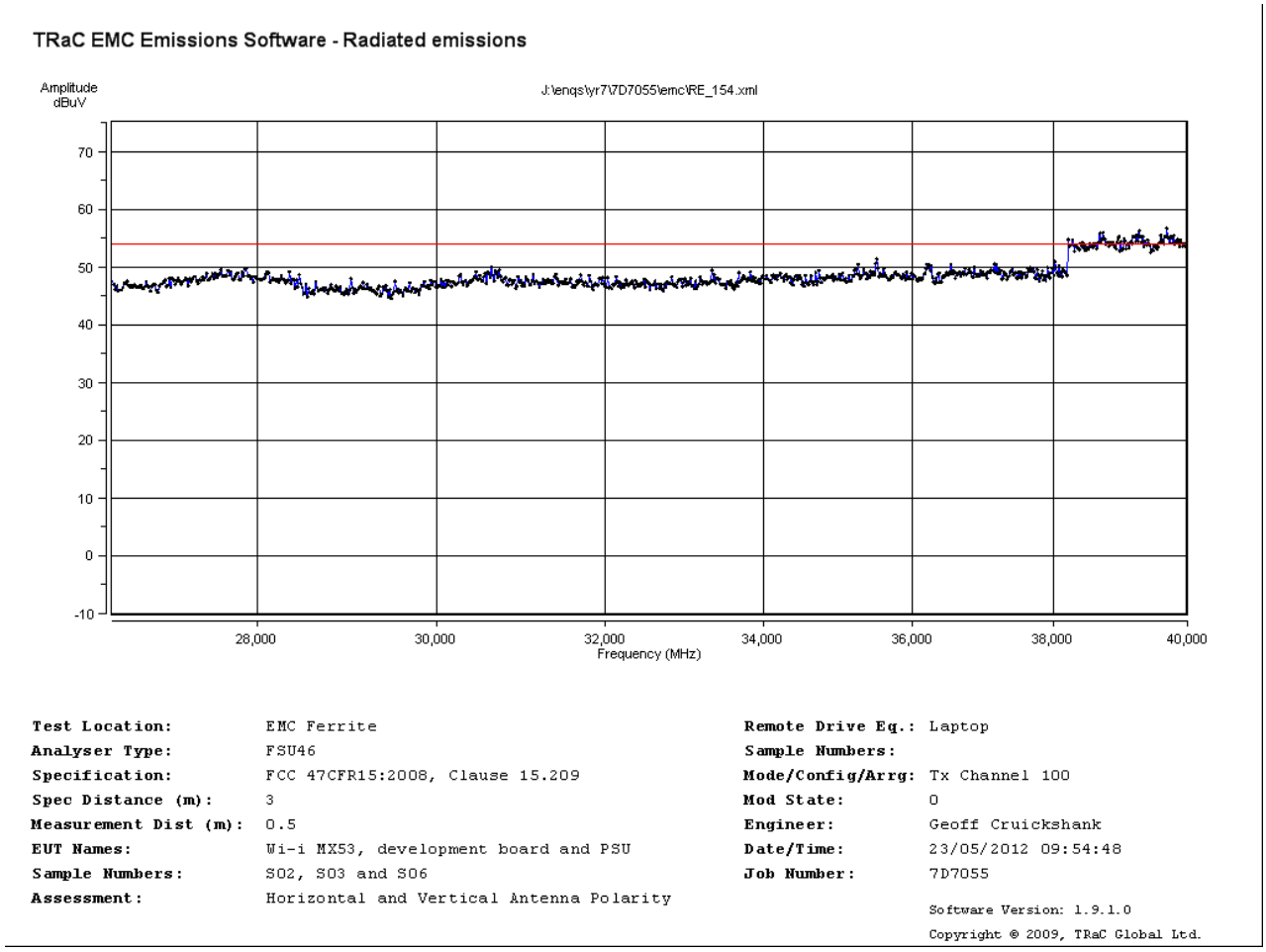
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 52



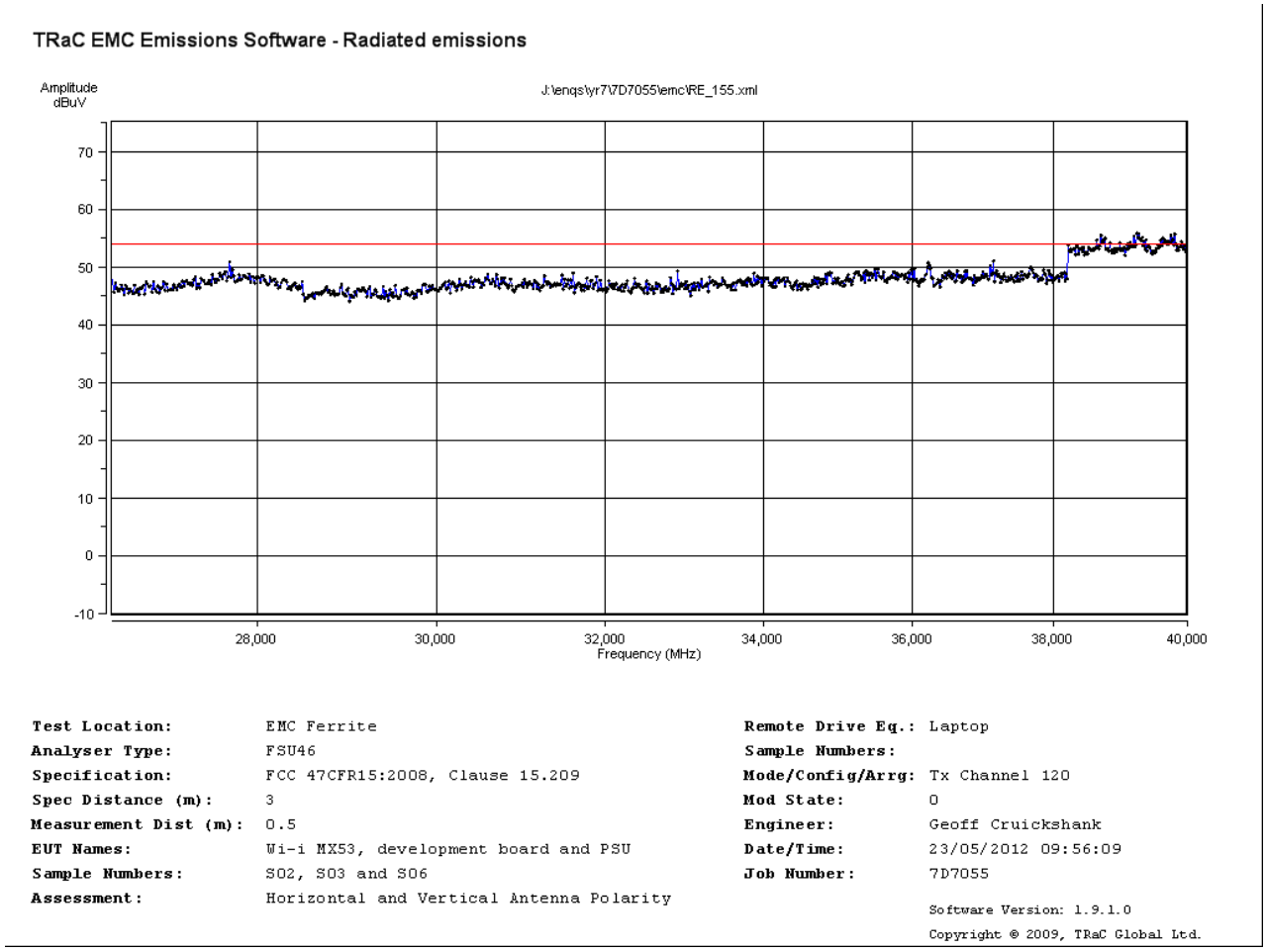
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 56



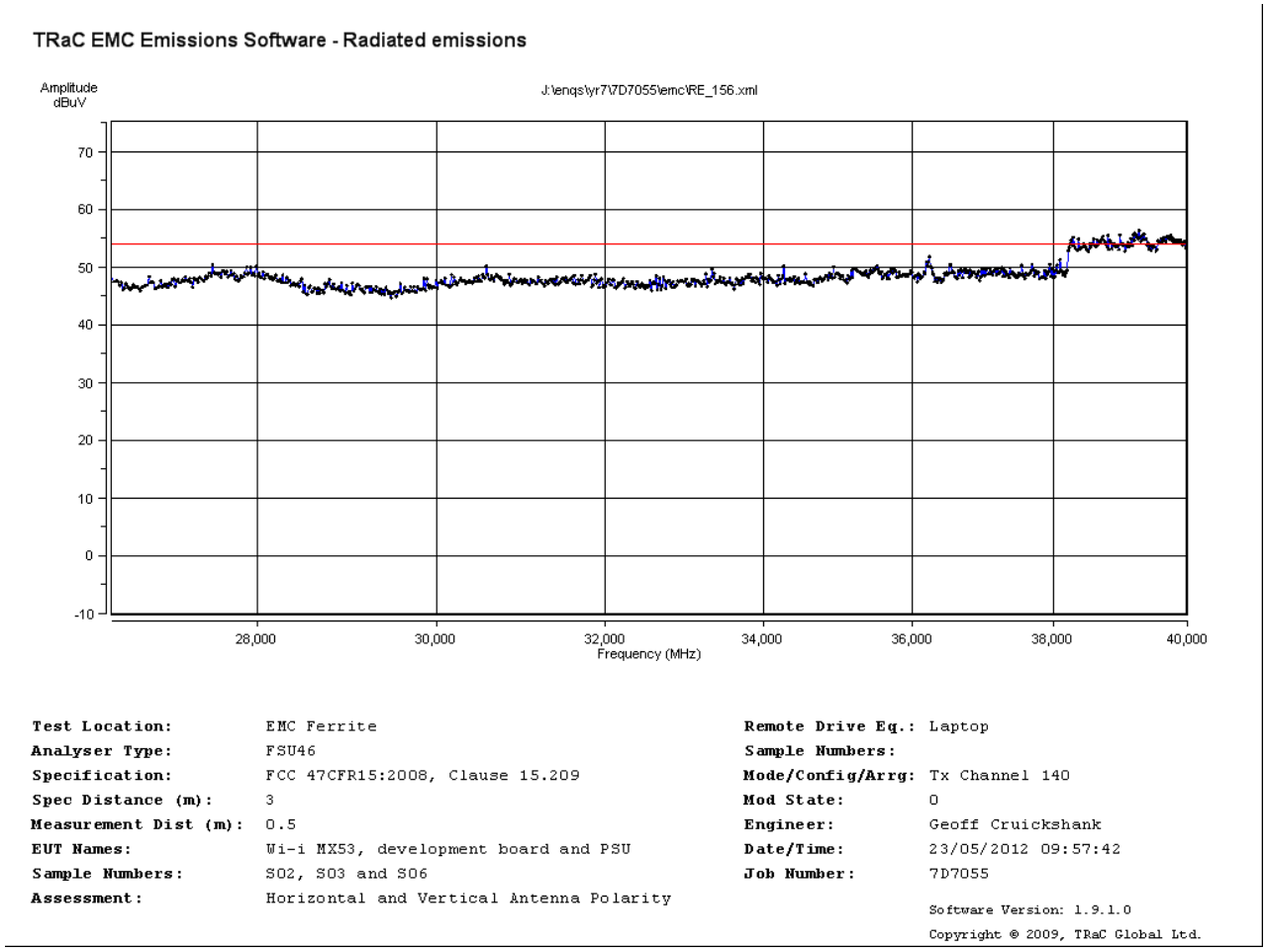
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 64



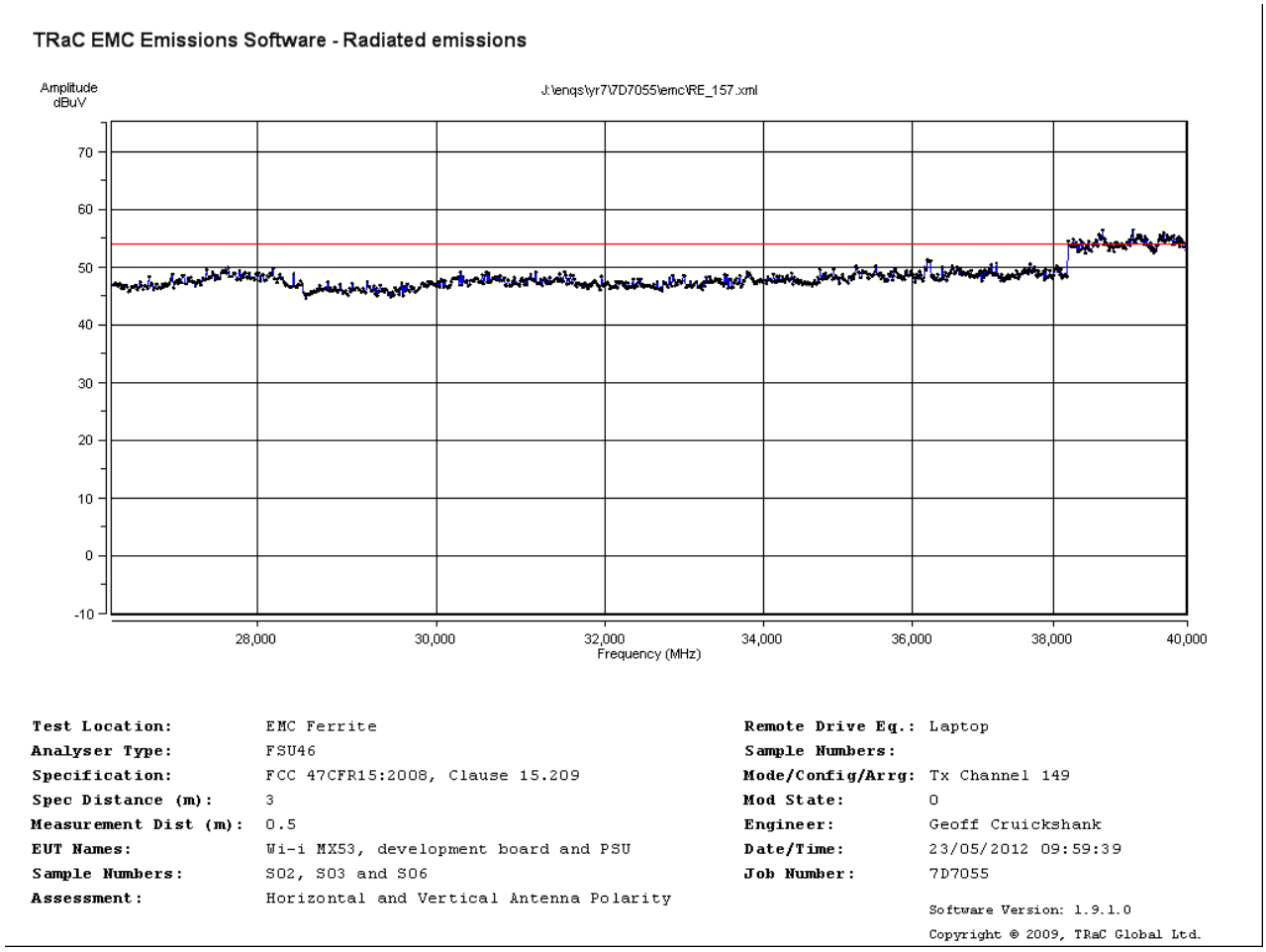
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 100



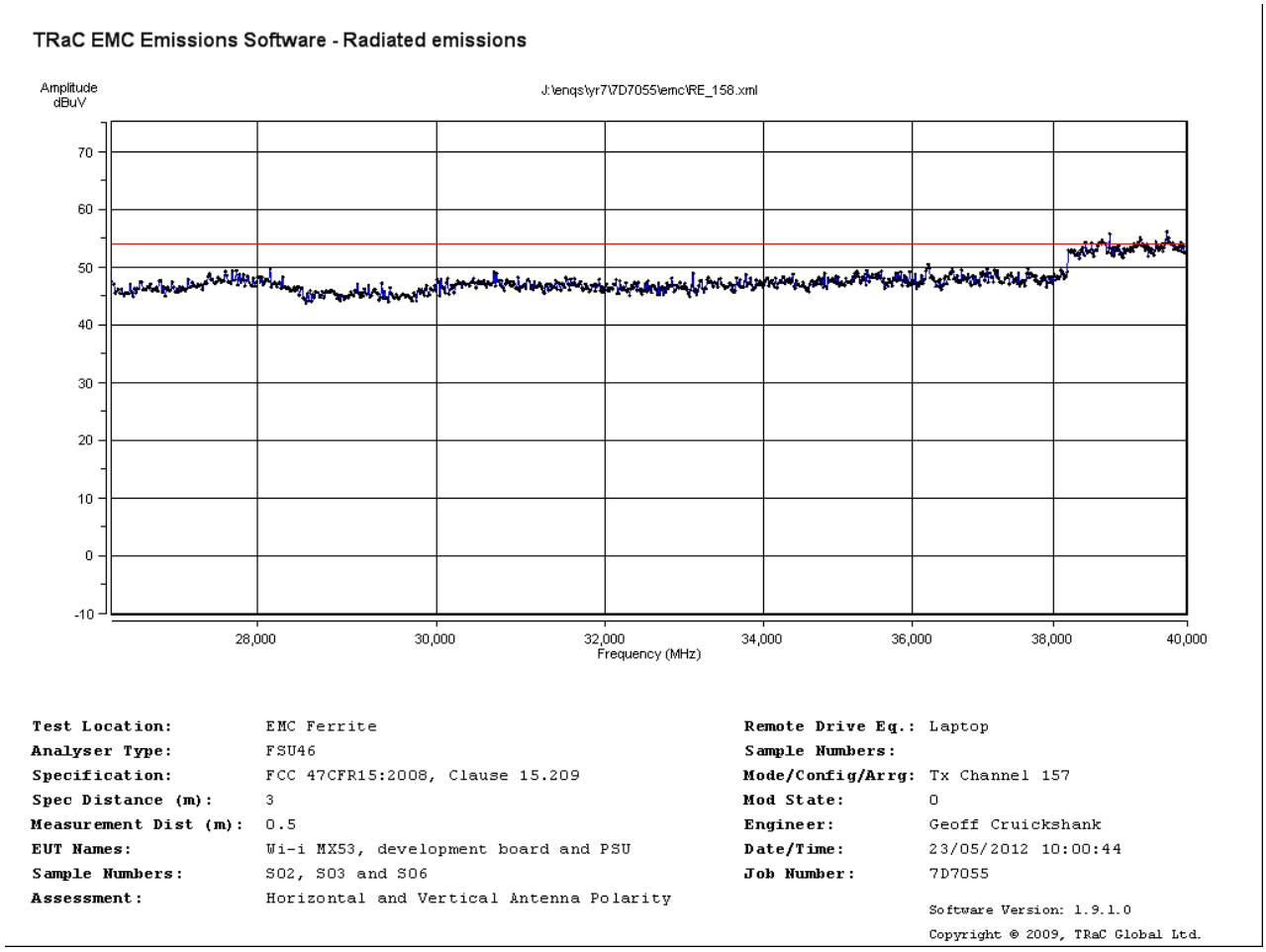
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 120



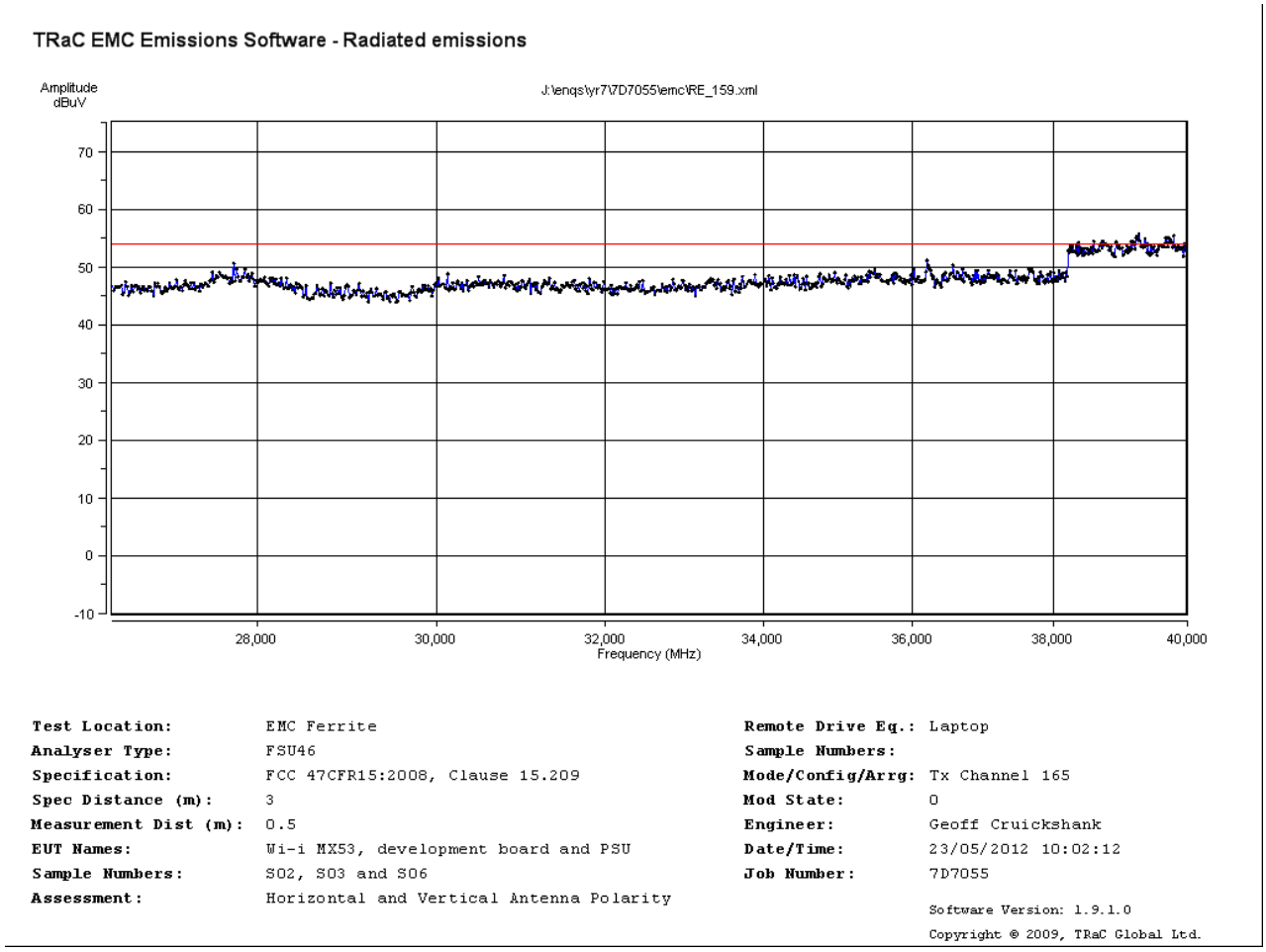
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 140



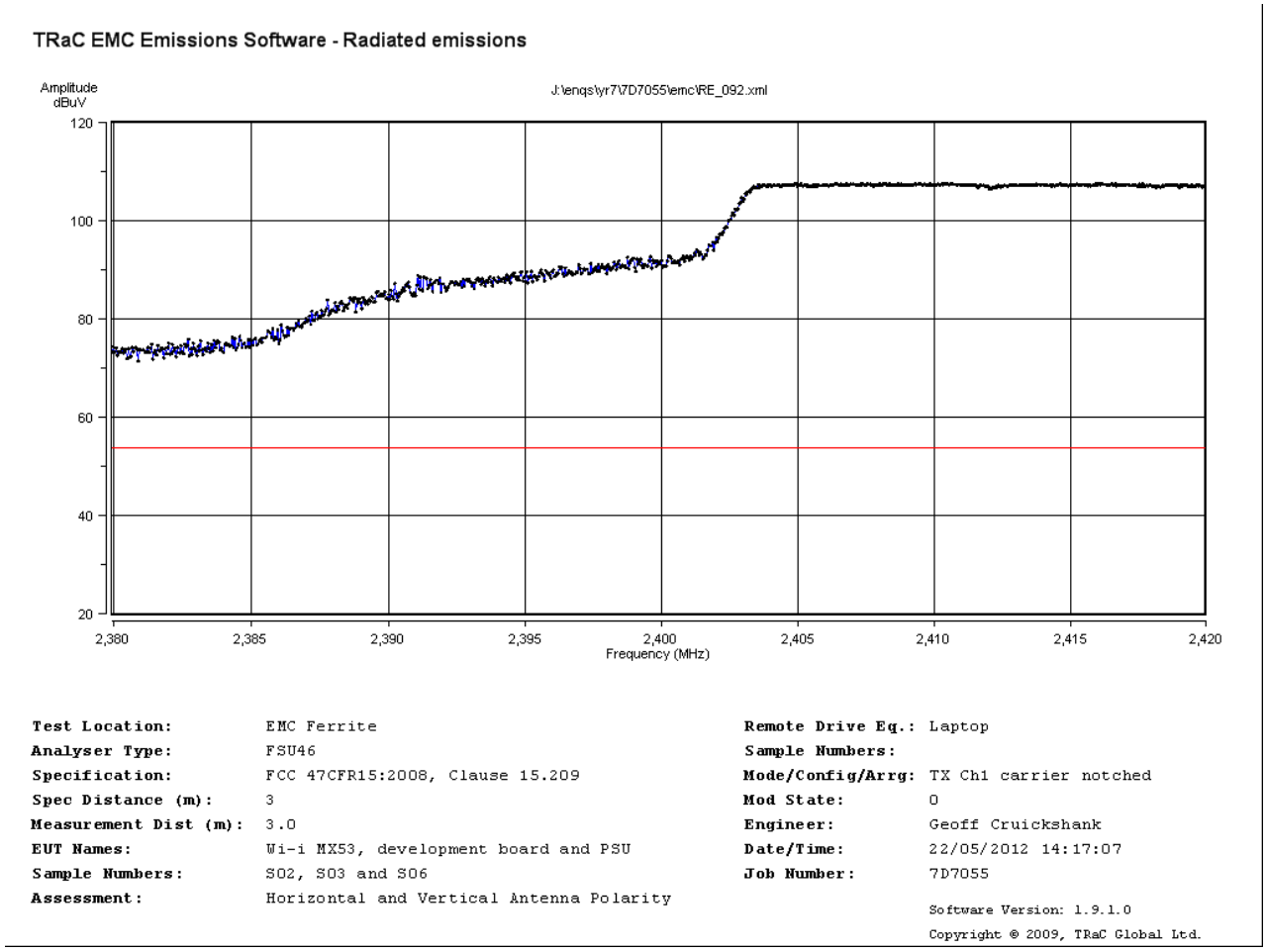
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 149



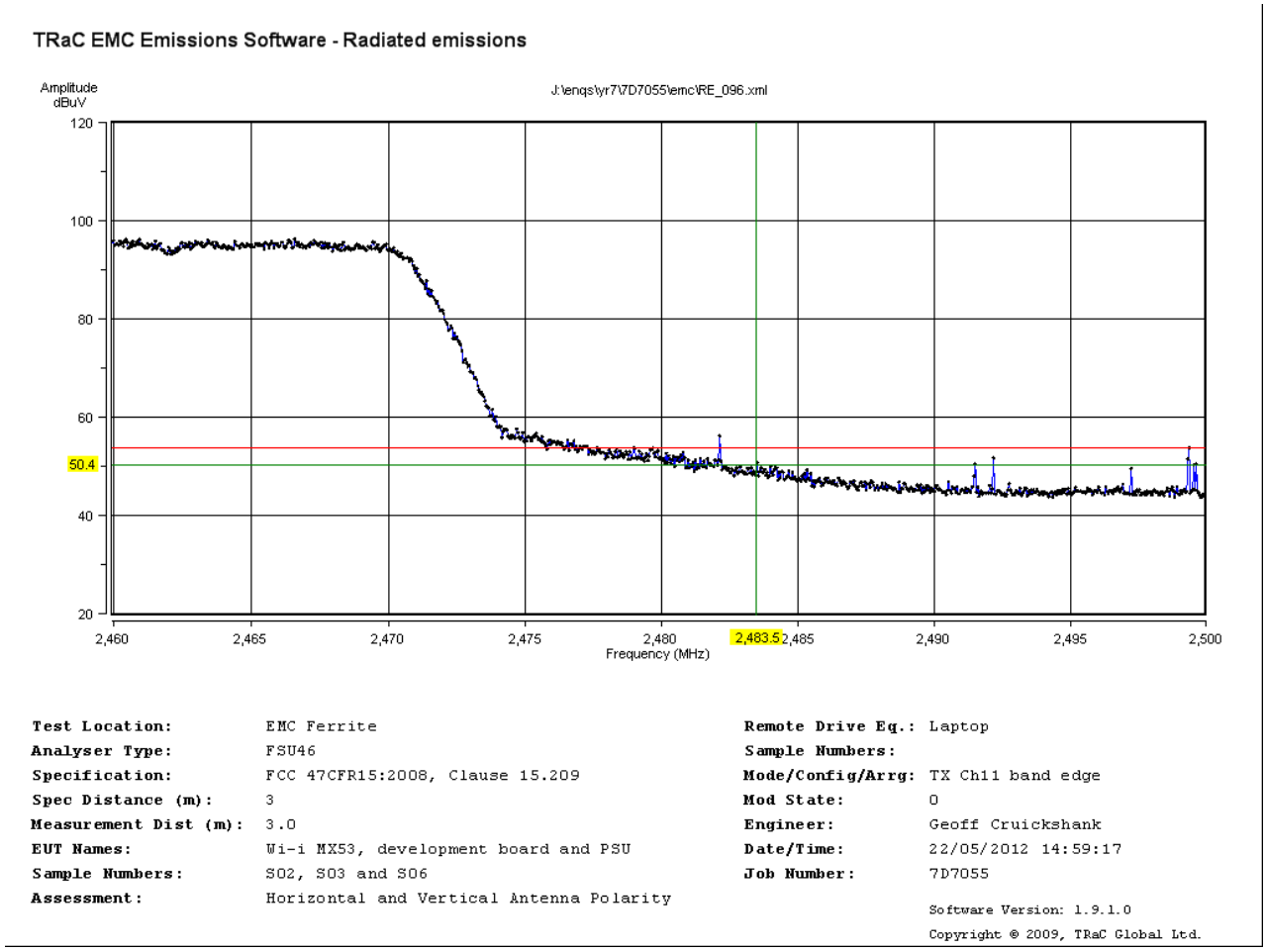
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 157



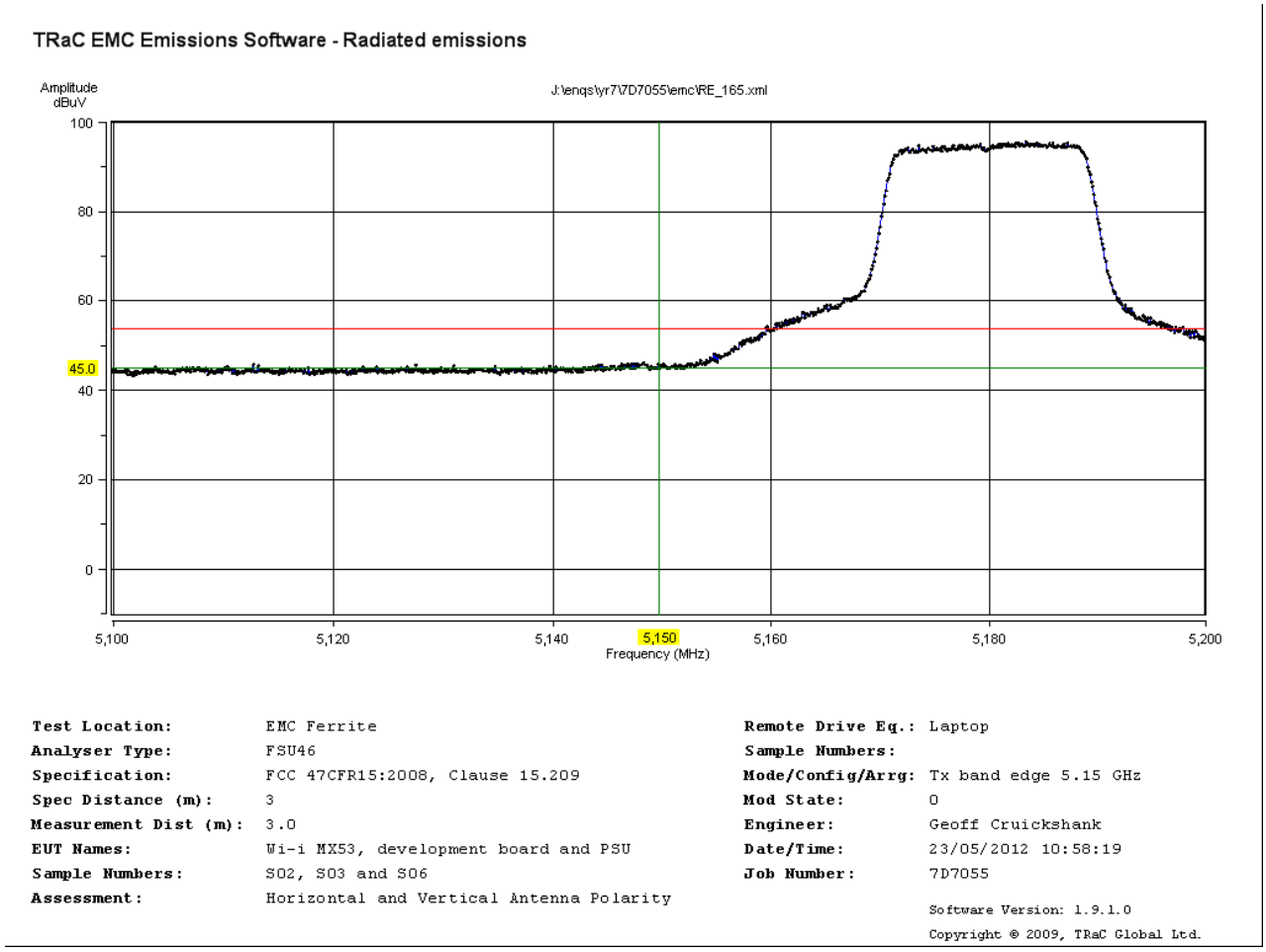
Radiated spurious emissions 26.5GHz to 40 GHz – Channel 164



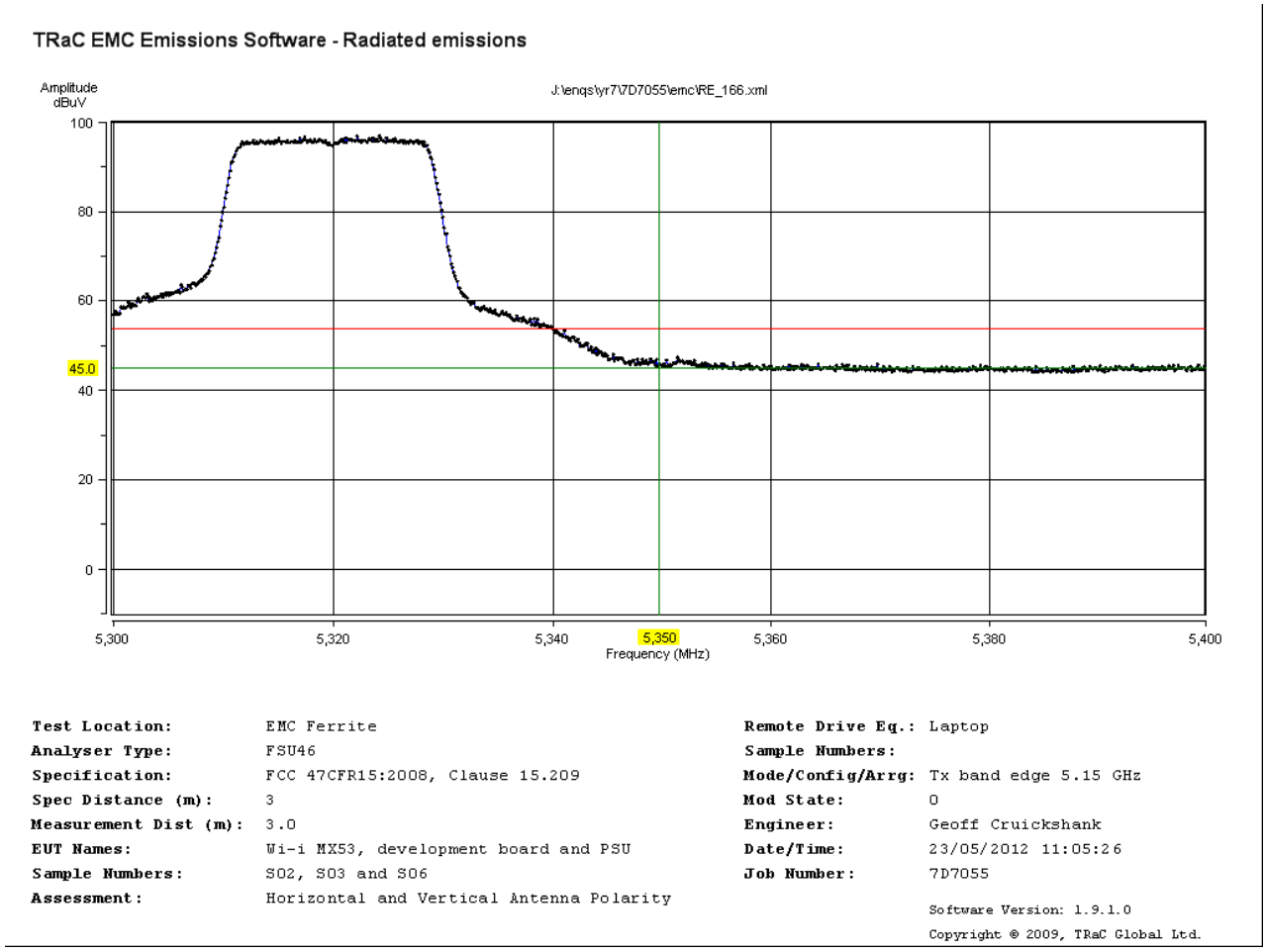
Radiated Band Edge 2400 MHz



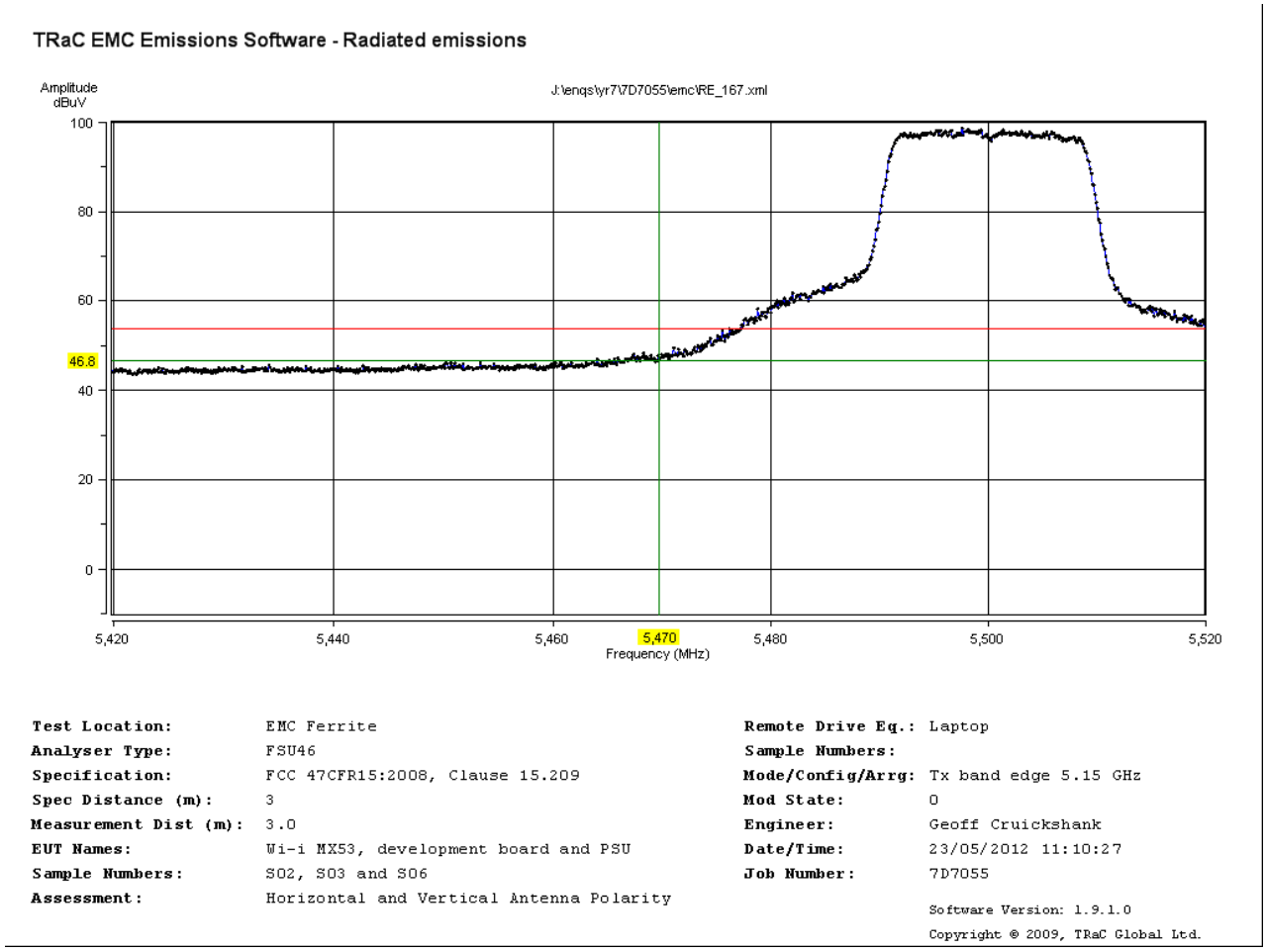
Radiated Band Edge 2483.5 MHz



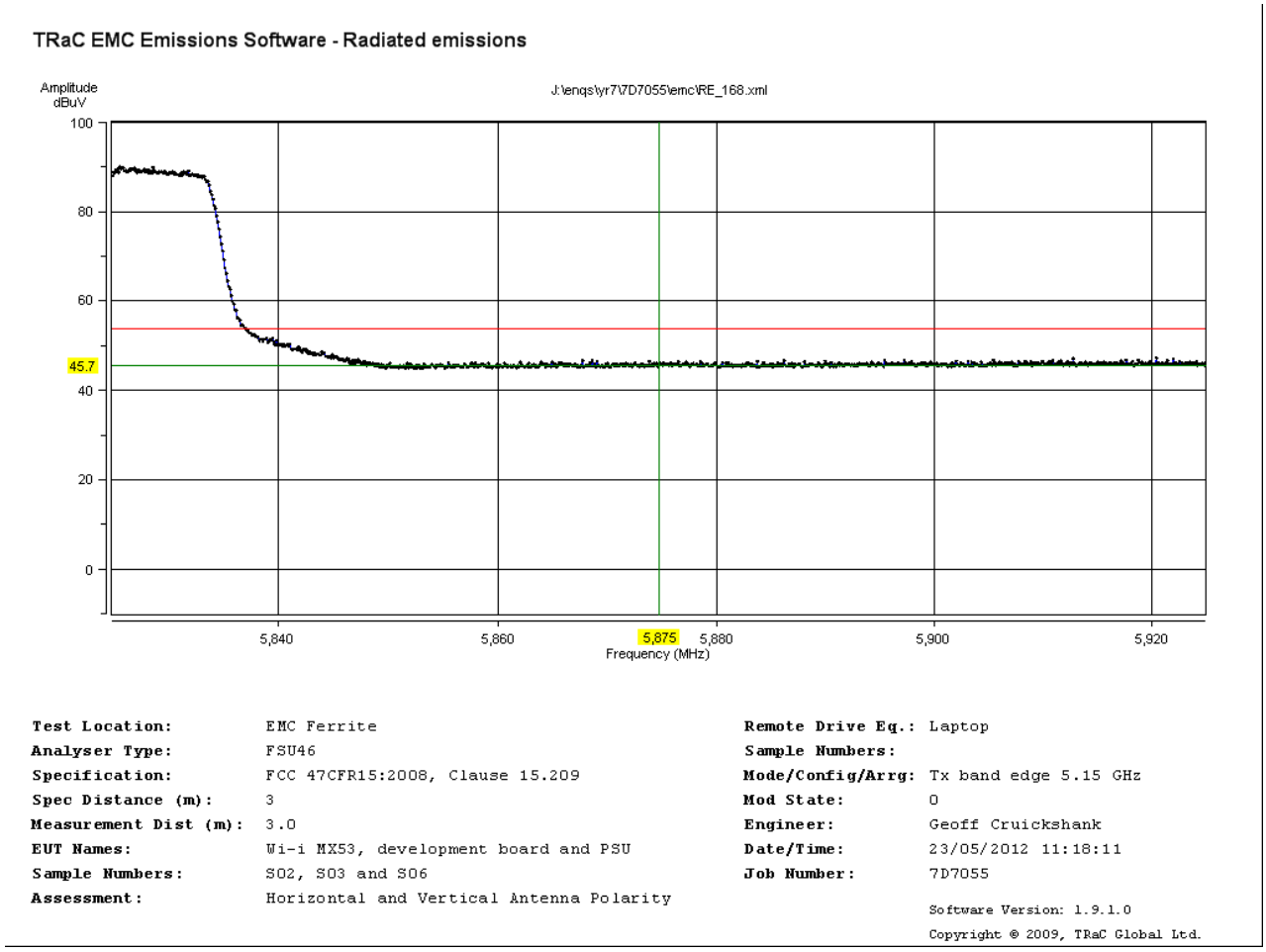
Radiated Band Edge 5150 MHz



Radiated Band Edge 5350 MHz



Radiated Band Edge 5470 MHz



Radiated Band Edge 5875 MHz

Appendix D: 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 its 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.

D1 Test samples

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

Sample No.	Description	Identification
S01	Wi-I MX53 (Conducted tests)	None
S03	Wi-I MX53 (Radiated tests)	None

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

Sample No.	Description	Identification
S02	Globtek GT-41060-2512 power supply	None
S04	CCWi-iMX53 Motherboard	None
S05	CCWi-iMX53 Motherboard	None
S06	Globtek GT-41060-2512 power supply	None

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

TRaC Identification	Description
None	HP Laptop PC

D2 EUT operating mode during testing

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

Test	Description of Operating Mode
All tests detailed in this report excluding: RX emissions	The EUT (S03) was powered via S05. The EUT was transmitting on maximum power, 100% duty cycle using the following operating modes : **Operating band: 2.4 to 2.4835GHz** 802.11b (DSSS): Channels 1, 7 and 13 with data rates: 5.5Mbps and 11MBps 802.11g (OFDM): Channels 1, 7 and 13 with data rates: 6Mbps and 54Mbps 802.11n (20MHz): (OFDM):Channels 1, 7 and 13 using a single spatial stream with a modulation and coding scheme (MCS) 0 and 7 802.11n (40MHz) (OFDM): Channels 3, 7 and 11 using a single spatial stream with a modulation and coding scheme (MCS) 0 and 7 **Operating band: 5.150 to 5.250GHz band, 5.250 GHz to 5.350 GHz, 5.470 to 5.725 GHz and 5.725 to 5.825GHz bands** 802.11a (OFDM): Channels 36, 44 and 48 with data rate:54Mbps 802.11n (20MHz): (OFDM):Channels 36, 44 and 48 using a single spatial stream with a modulation and coding scheme (MCS) 1 802.11n (40MHz)(OFDM): Channels 36, 40 and 44 using a single spatial streams with a modulation and coding scheme (MCS) 7
RX emissions	The EUT S05 was powered via S11. The EUT was in continuous Receive mode

After initial tests to determine the worst case emissions mode were performed, formal measurements were made using 802.11n (40MHz) (OFDM) mode using a single spatial stream with a modulation and coding scheme (MCS) 0 and 7.

D3 EUT Configuration Information

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

D4 List of EUT Ports

The tables below describe the termination of EUT ports: Sample : S01/S03
Tests : ALL

Port	Description of Cable Attached	Cable length	Equipment Connected
Power, control and signals	None	N/A	S05

Sample : S04/S05
Tests : All

Port	Description of Cable Attached	Cable length	Equipment Connected
Power, control and signals	None	N/A	S01/S03
dc power port	2 core unscreened	1m	S02/S06
Ethernet 1	None	N/A	None
Ethernet 2	Cat 5e UTP	>3m	Laptop
USB	None	N/A	None
Serial	None	N/A	None
BAT IN	None	N/A	None

The only active interface that is used by the EUT under normal operation is the Ethernet port. The other interfaces are only used to set up the support board, which is not EUT.

D5 Details of Equipment Used

Equivalent isotropic radiated power (Carrier Power EIRP)

Lab 16				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	TRaC	27/07/11
REF910	FSU46	Spectrum analyser	R & S	02/12/11
REF880	HL050	Log Perodic Antenna (1-26.5GHz)	R & S	14/05/10
129	3115	Horn Antennas	EMCO	14/09/11
913	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	19/01/12
RFG452	-	HF RF coaxial cable	UTIFLEX	25/05/11
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	25/05/11
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	01/03/11
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/11
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	06/10/10
360	SMP22	Signal Generator	R & S	23/04/11
464	6220B	dc Power supply	HP	Cal Before Use

For Radiated TX and Standby/RX spurious emissions (ERP) 30MHz to 1GHz

Lab 16				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated.
REF886	Lab 16	Large Anechoic Chamber	TRaC	27/07/11
RFG095	96002	Bicon Antenna (30-200MHz)	Eaton	12/05/10
RFG191	3146	Log Periodic Antenna (200-1000MHz)	EMCO	12/05/10
REF927	310	Pre-Amp (9kHz-1GHz)	Sonoma	15/09/11
REF910	FSU46	Spectrum Analyser	R&S	02/12/11
RFG452	-	HF RF coaxial cable	UTIFLEX	25/05/11
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF889	N	6dB PAD		28/09/11
REF859	9117	Bicon Antenna	VUBA	21/09/11
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	25/05/11
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	01/03/11
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/11
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	06/10/10

Details of Equipment Used Continued:

Radiated TX and Standby/RX spurious emissions (ERP) 1GHz to 12.75GHz

Lab 16				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated
REF886	Lab 16	Large Anechoic Chamber	TRaC	27/07/11
REF910	FSU46	Spectrum analyser	R & S	02/12/11
REF880	HL050	Log Perodic Antenna (1-26.5GHz)	R & S	14/05/10
129	3115	Horn Antennas	EMCO	14/09/11
913	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	19/01/12
RFG452	-	HF RF coaxial cable	UTIFLEX	25/05/11
REF881	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF882	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF884	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF885	-	HF RF coaxial cable	Teledyne Reynolds	06/06/11
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	25/05/11
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	26/03/12
REF883	-	HF RF coaxial cable 3.0m	Teledyne Reynolds	06/06/11
441	ESG E4432A	Vector Signal Generator	Hewlett Packard	06/10/10
360	SMP22	Signal Generator	R & S	23/04/11

Radiated TX and Standby/RX spurious emissions (ERP) 1GHz to 40GHz

Lab 10				
RFG/REF No	Type	Description	Manufacturer	Date Calibrated
274	ATS	Ferrite Lined Chamber	Panashield	20/07/11
REF847	ESU	EMI Test Receiver (Spectrum analyser)	Rhode & Schwarz	18/10/11
REF880	HL050	Log Perodic Antenna (1-26.5GHz)	R & S	14/05/10
REF820	22240-25	Horn Antenna (1-26.5GHz)	FM Ltd	11/02/08
REF832	219-8004-2000 0608	Type K Male to Type K Male Cable 2.0m	Teledyne Reynolds	25/05/11
REF919	219-8004-4000 0311	Type K Male to Type K Male Cable 4.0m	Teledyne Reynolds	26/03/12
307	HP8449B	Microwave Pre-Amp (1-26.5GHz)	HP	29/02/12
643	N-type	Sucotest Microwave Cable 1m	Huber & Suhner	12/09/11
651	N-type	Sucotest Microwave Cable 7m	Huber & Suhner	12/09/11
678	N-type	Sucotest Microwave Cable 2m	Huber & Suhner	12/09/11

Details of Equipment Used Continued:

Conducted Antenna Port Tests

RFG/REF No	Type	Description	Manufacturer	Date Calibrated
REF835/836	N1911A P-Series Power meter & N1922A	Power Meter/ Power Head	Agilent	18/05/11
REF837	PSA	Spectrum Analyser	Agilent	18/05/11
REF847	ESU	EMI Test Receiver (Spectrum analyser)	Rhode & Schwarz	18/10/11
REF910	FSU46	Spectrum analyser	R & S	02/12/11
RFG453	SMA	HF cable (SMA to SMA)	Utiflex	10/09/11
RFG454	SMA	HF cable (SMA to SMA)	Utiflex	17/06/11
REF887	34405A	Multi-meter	Agilent	25/08/11
REF1270	N/A	VARIAC	TRaC	CAL date N/A
RFG365	BM80/-20/150/P	Environmental chamber	JTS	17/06/11

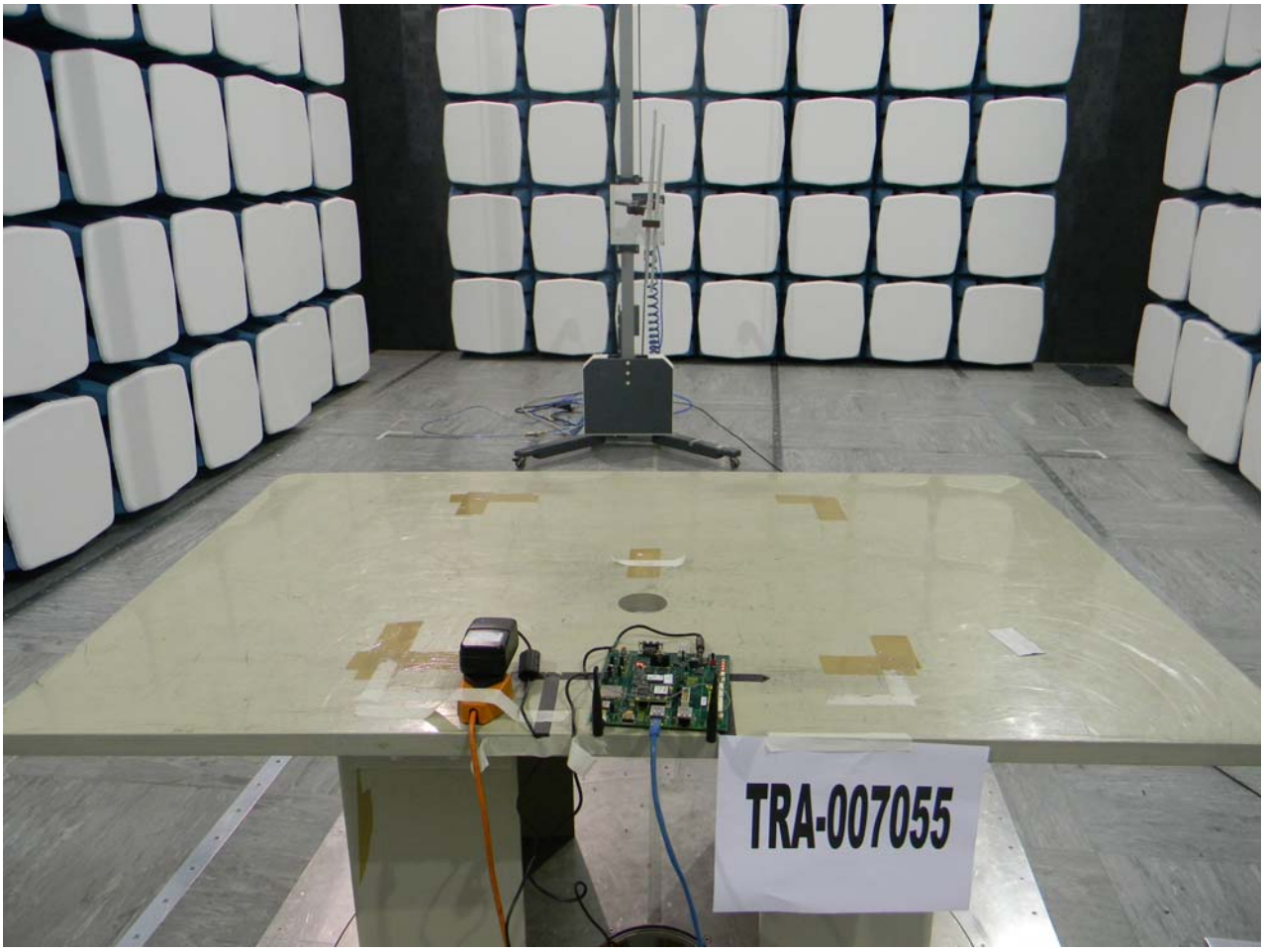
Appendix E: Additional Information

No additional information is included within this test report.

Appendix F: Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement
2. Powerline conducted emissions setup



Photograph 1

Photograph 2

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