

**TRaC Radio Test Report** : TRA-016954WUS1

**Applicant** : Pace Plc

**Apparatus** : PX032ANI Set Top Box

**Specification(s)** : CFR47 Part 15.225  
: CFR47 Part 15.247

**FCCID** :NQ8PX032ANI

**Purpose of Test** : Certification

**Authorised by** :



: Authorised Signatory

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**Section 1:****Introduction****1.1 General**

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

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## **1.2 Tests Requested By**

This testing in this report was requested by:

Pace Plc  
Victoria Road  
Saltaire  
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## **1.3 Manufacturer**

As above

#### **1.4 Apparatus Assessed**

The following apparatus was assessed between: 02/12/13 and 19/12/13

PX032ANI Set Top Box

The PX032ANI Set Top Box was fitted with a RF4CE remote control, and a 13.56MHz NFC.

Radiated testing was performed using the EUTs integral antennas, conducted tests on the RF4CE were performed on a sample with coaxial cables fitted to the antenna terminals.

## 1.5 Test Result Summary

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

The statements relating to compliance with the standards below apply ONLY as qualified in the notes and deviations stated in sections 1.6 to 1.7 of this test report.

Test Type	Regulation	Measurement standard	Result
Radiated spurious emissions (Restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10	Pass
Conducted spurious emissions (Non-restricted bands)	Title 47 of the CFR: Part 15 Subpart C; 15.247	ANSI C63.10	Pass
AC Power conducted emissions	Title 47 of the CFR: Part 15 Subpart C; 15.207	ANSI C63.10	Pass
Occupied Bandwidth	Title 47 of the CFR : Part 15 Subpart C; 15.247(a)(2)	ANSI C63.10	Pass
Conducted Carrier Power	Title 47 of the CFR : Part 15 Subpart C; 15.247(b)	ANSI C63.10	Pass
Power Spectral Density	Title 47 of the CFR : Part 15 Subpart C; 15.247(d)	ANSI C63.10	Pass
Unintentional Radiated Spurious Emissions	Title 47 of the CFR: Part 15 Subpart C; 15.109	ANSI C63.10	Pass
RF Safety	Title 47 of the CFR : Part 15 Subpart C; 15.247(b)(5)	-	Pass
Spurious Emissions Radiated <1000MHz	Title 47 of the CFR: Part 15 Subpart (c) 15.209	ANSI C63.10	Pass
Intentional Emission Frequency	Title 47 of the CFR: Part 15 Subpart (c) 15.225	ANSI C63.10	Pass
Intentional Emission Field Strength	Title 47 of the CFR: Part 15 Subpart (c) 15.225	ANSI C63.10	Pass

Abbreviations used in the above table:

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

## Radiated Electric Field Emissions

Quantity Range	Quantity	Expanded Uncertainty
9kHz to 150 kHz	Amplitude dB( $\mu$ V/m)	$\pm$ 1.6dB
150 kHz to 30 MHz	Amplitude dB( $\mu$ V/m)	$\pm$ 2.1dB
30MHz to 300MHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 5.1dB
30MHz to 300MHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 5.2dB
300MHz to 1GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 5.4dB
300MHz to 1GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 5.2dB
1GHz to 18GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 4.4dB
1GHz to 18GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 4.4dB
18GHz to 26.5GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 4.2dB
18GHz to 26.5GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 4.2dB
26.5GHz to 40GHz Horizontal	Amplitude dB( $\mu$ V/m)	$\pm$ 4.3dB
26.5GHz to 40GHz Vertical	Amplitude dB( $\mu$ V/m)	$\pm$ 4.3dB

## Power Line Conducted Emissions

Quantity Range	Quantity	Expanded Uncertainty
9kHz to 150kHz	Amplitude dB( $\mu$ V)	$\pm$ 4.2dB
150kHz to 30MHz	Amplitude dB( $\mu$ V)	$\pm$ 3.1dB



**Section 3:**

**Modifications**

**3.1 Modifications Performed During Assessment**

No modifications were performed during the assessment

**Appendix A:****RF4CE (Part 15.247) Test Results**

Abbreviations used in the tables in this appendix:

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

**A1 6 dB Bandwidth**

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

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2)
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

## Antenna 0

Channel Frequency (MHz)	F <sub>lower</sub>	F <sub>Higher</sub>	Measured 6 dB Bandwidth (MHz)	Limit (kHz)	Result
2425	2424.199	2425.817	1.618	>500	Pass
2450	2449.215	2450.785	1.570	>500	Pass
2475	2474.219	2475.789	1.570	>500	Pass

## Antenna 1

Channel Frequency (MHz)	F <sub>lower</sub>	F <sub>Higher</sub>	Measured 6 dB Bandwidth (MHz)	Limit (kHz)	Result
2425	2424.195	2425.813	1.618	>500	Pass
2450	2449.191	2450.794	1.603	>500	Pass
2475	2474.219	2475.797	1.578	>500	Pass

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

**A2 Transmitter Peak Output Power**

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

<b>Test Details:</b>	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(3)
Measurement standard	ANSI C63.10
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

## Antenna 0

Channel Frequency (MHz)	Peak Carrier Power (W)	Antenna Gain dBi	Radiated Power (W) (EIRP)	Limit (W)	Result
2425	0.00179	2.2	0.00297	1.0000	Pass
2450	0.00175	2.2	0.00290	1.0000	Pass
2475	0.00172	2.2	0.00285	1.0000	Pass

## Antenna 1

Channel Frequency (MHz)	Peak Carrier Power (W)	Antenna Gain dBi	Radiated Power (W) (EIRP)	Limit (W)	Result
2425	0.00138	3.6	0.00316	1.0000	Pass
2450	0.00137	3.6	0.00314	1.0000	Pass
2475	0.00139	3.6	0.00318	1.0000	Pass

**Notes:**

Conducted Measurement

Measured Peak Carrier power includes the gain of each of the fixed antennas.

Highest Gain of any antenna to be used = 3.6 dBi

Conducted measurements were performed with a temporary antenna connector provided by the client.

**A3 Transmitter Power Spectral Density**

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

<b>Test Details:</b>	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.247(e)
Measurement standard	ANSI C63.10
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

## Antenna 0

<b>Channel Frequency (MHz)</b>	<b>Peak Power Spectral Density (dBm/3kHz)</b>	<b>Limit (dBm/3kHz)</b>	<b>Result</b>
2425	-11.6	8.0	Pass
2450	-11.9	8.0	Pass
2475	-11.4	8.0	Pass

## Antenna 1

<b>Channel Frequency (MHz)</b>	<b>Peak Power Spectral Density (dBm/3kHz)</b>	<b>Limit (dBm/3kHz)</b>	<b>Result</b>
2425	-12.4	8.0	Pass
2450	-12.7	8.0	Pass
2475	-13.0	8.0	Pass

**Notes:**

Conducted Measurement

Measured Power Spectral Density includes highest gain of any antenna to be used.

Highest Gain of any antenna to be used = 3.6 dBi

Conducted measurements were performed with a temporary antenna connector provided by the client.

The resolution bandwidth on the analyser was set to 3kHz and trace set to max hold.

The span is set to 2 MHz

The sweep time is 670 seconds (Span/3kHz).

**A4 RF Antenna Conducted Spurious Emissions**

Measurement of conducted spurious emissions at the antenna port was performed using a peak detector with the RBW set to 100kHz and the VBW>RBW. Frequencies were scanned up through to the 10th harmonic with the EUT transmitting on its lowest, centre and highest carrier frequency in turn.

<b>Test Details: 2425 MHz</b>	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	9 kHz to 25 GHz
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

No emissions were detected within 20 dB of the test limit from either antenna port.

**RF Antenna Conducted Spurious Emissions continued:**

<b>Test Details: 2450 MHz</b>	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	9 kHz to 25 GHz
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

No emissions were detected within 20 dB of the test limit from either antenna port.

**RF Antenna Conducted Spurious Emissions continued:**

<b>Test Details: 2475 MHz</b>	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205
Measurement standard	ANSI C63.10
Frequency range	9 kHz to 25 GHz
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

No emissions were detected within 20 dB of the test limit from either antenna port.



**Notes:**

1. The conducted emission limit for emissions outside the restricted bands, defined in 47CFR15.205(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 accordance 15.33 (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

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 measured in 100kHz RBW)-20dB

Where:

The maximum peak conducted power was measured using a spectrum analyser using a 100kHz resolution bandwidth.

Antenna 0:

Channel No.	Channel Frequency (MHz)	Measured Peak Carrier (dBm)	Measured Peak Carrier -20dB (dBm)	Emission Limit In a 100 kHz RBW (dBm)
15	2425	-0.36	-20.36	-20.36
20	2450	-1.06	-21.06	-21.06
25	2475	-1.36	-21.36	-21.36

Antenna 1:

Channel No.	Channel Frequency (MHz)	Measured Peak Carrier (dBm)	Measured Peak Carrier -20dB (dBm)	Emission Limit In a 100 kHz RBW (dBm)
15	2425	-1.75	-21.75	-21.75
20	2450	-1.73	-21.73	-21.73
25	2475	-1.75	-21.75	-21.75

**A5 Antenna Gain**

The maximum antenna gain for the antenna type to be used with the EUT, as declared by the client, is 2.2 dBi Peak gain for antenna 0 (on the front left), and 3.6 dBi Peak gain for antenna 1 (on the front right).

**A6 Radiated Electric Field Emissions within the Restricted Bands of 15.205**

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

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

3m open area test site :       3m alternative test site :

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

<b>Test Details: 2475</b>	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.209
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

The worst case radiated emission measurements for spurious emissions:

Ref No.	FREQ. (MHz)	DETECTOR	FIELD ST'GH (dBµV/m)	Duty Cycle Fact (dB)	FIELD ST'GH (dBµV/m)	LIMIT (dBµV/m)
1.	31.900	Pk	38.7	0	38.7	60
2.	31.900	QP	32.4	0	32.4	40
3.	63.622	Pk	37.4	0	37.4	60
4.	63.622	QP	32.3	0	32.3	40
5.	73.000	Pk	36.9	0	36.9	60
6.	73.000	QP	29.1	0	29.1	40
7.	75.200	Pk	31.9	0	31.9	60
8.	75.200	QP	22.8	0	22.8	40
9.	84.856	Pk	45.0	0	45.0	60
10.	84.856	QP	38.0	0	38.0	40
11.	98.000	Pk	37.1	0	37.1	63.5
12.	98.000	QP	30.0	0	30.0	43.5
13.	118.000	Pk	44.4	0	44.4	63.5
14.	118.000	QP	38.3	0	38.3	43.5
15.	161.444	Pk	42.9	0	42.9	63.5
16.	161.444	QP	34.7	0	34.7	43.5
17.	241.889	Pk	38.3	0	38.3	66
18.	241.889	QP	30.5	0	30.5	46
19.	472.000	Pk	38.0	0	38.0	66
20.	472.000	QP	29.1	0	29.1	46
21.	650.000	Pk	39.6	0	39.6	66
22.	650.000	QP	37.3	0	37.3	46
23.	741.741	Pk	42.7	0	42.7	66
24.	741.741	QP	34.7	0	34.7	46
25.	750.000	Pk	43.4	0	43.4	66
26.	750.000	QP	41.3	0	41.3	46
27.	850.000	Pk	42.4	0	42.4	66
28.	850.000	QP	40.9	0	40.9	46
29.	950.000	Pk	43.9	0	43.9	66
30.	950.000	QP	42.2	0	42.2	46

No further Spurious emissions within 20 dB of the test limit were detected.

Preview measurements indicated that there was no difference in emissions profile below 1GHz when the EUT was operating on channels 15, 20 and 25.

The Upper Band Edge radiated emission measurements – Channel 25, Antenna 0:

Ref No.	FREQ. (MHz)	DETECTOR	FIELD ST'GH (dBµV/m)	Duty Cycle Fact (dB)	FIELD ST'GH (dBµV/m)	LIMIT (dBµV/m)
31.	2483.5	Pk	46.4	0	46.4	74
32.	2483.5	Av	38.6	0	38.6	54

The Upper Band Edge radiated emission measurements – Channel 25, Antenna 1:

Ref No.	FREQ. (MHz)	DETECTOR	FIELD ST'GH (dBµV/m)	Duty Cycle Fact (dB)	FIELD ST'GH (dBµV/m)	LIMIT (dBµV/m)
31.	2483.5	Pk	45.0	0	45.0	74
32.	2483.5	Av	34.9	0	34.9	54

**Notes:**

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 4 For Frequencies below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:
 

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

These settings as per ANSI C63.10

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

Radiated emission limits (CFR 47 Part 15: Clause 15.209) for emissions falling within the restricted bands defined in 15.205(a):

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

**Notes:**

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

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

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

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

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

**Appendix B:****NFC (Part 15.225) Test Results**

Abbreviations used in the tables in this appendix:

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

**B1 Transmitter Intentional Emission Radiated**

Test Details	
Regulation	Title 47 of the CFR: Part15 Subpart (c) 15.225
Measurement standard	ANSI C63.10
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

Frequency (MHz)	Receiver Level (dB $\mu$ V/m)	Measurement Distance (m)	Specification Distance (m)	Extrapolation Factor (dB)	Field Strength (dB $\mu$ V/m)	Field Strength ( $\mu$ V/m)
13.56	35.4	3	30	40	15.5	5.957
13.56	47.2	1	30	59.1	8.2	2.512
<b>Limit value @ <math>f_c</math></b>			15848 $\mu$ V/m at 30m			
<b>Band occupancy @ -20 dBc</b>			<b>20dB Bandwidth = 93.884kHz</b>			
<b>Band occupancy @ 99%</b>			<b>99% Bandwidth = 258.7256kHz</b>			

- Notes:**
- 1 Results quoted are extrapolated as indicated
  - 2 Receiver detector at  $f_c$  was Peak with 10kHz bandwidth
  - 3 When battery powered the EUT was powered with new batteries

- Test Method:**
- 1 As per Radio – Noise Emissions, ANSI C63.10
  - 2 Measuring distances 3m
  - 3 EUT 0.8 metre above ground plane
  - 4 Emissions maximised by rotation of EUT, on an automatic turntable
  - 5 EUT orientation in three orthogonal planes
  - 6 Maximum results recorded



**B2 Radiated Magnetic Field Emissions**

Preliminary scans were performed using a peak detector. The radiated magnetic field emissions test applies to all spurious emissions and harmonics emissions. The maximum permitted field strength is listed in Section 15.209. The EUT was set to transmit as required.

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

3m open area test site :       3m alternative test site :

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

Test Details	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.209
Measurement standard	ANSI C63.10
Frequency range	9kHz to 30MHz
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

The worst case radiated emission measurements for spurious emissions are listed below.

Frequency (MHz)	Pk Level (dBuV/m)	Pk Limit (dBuV/m)	Pk Delta (dB)	Result Summary
No Significant emissions detected within 20dB of the limit				

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

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

The upper and lower frequency of the measurement range was decided according to CFR 47 Part 15 Clause 15.33(a) and 15.33(a)(1). Radiated emission limits CFR 47 Part 15: Clause 15.209 for all emissions:

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

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

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

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

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

**B3 Frequency Stability**

<b>Test Details:</b>	
Regulation	Title 47 of the CFR, Part 15 Subpart (c) Clause 15.225
Measurement standard	ANSI C63.10
EUT sample number	S02
Modification state	0
SE in test environment	None
SE isolated from EUT	S06
EUT set up	Refer to Appendix E

**Worse Case**

<b>Vnom (Vac)</b>	<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Deviation (kHz)</b>	<b>Limit = ± 0.01% = ±1.3562kHz</b>
115Vac	50	13.559984	0.000016	Pass
115Vac	40	13.560048	0.000048	Pass
115Vac	30	13.560096	0.000096	Pass
115Vac	20	13.560160	0.000160	Pass
115Vac	10	13.560208	0.000208	Pass
115Vac	0	13.560224	0.000224	Pass
115Vac	-10	13.560224	0.000224	Pass
115Vac	-20	13.560224	0.000224	Pass

<b>Voltage (Vac) 85% - 115%</b>	<b>Temperature (°C)</b>	<b>Frequency (MHz)</b>	<b>Deviation (kHz)</b>	<b>Limit = ± 0.01% = 1.3562kHz</b>
85% = 85	+20 °C	13.560144	0.000144	Pass
115% = 138	+20 °C	13.560128	0.000128	Pass

Note: The Voltage operating range of the RFID Transmitter 100Vac-120Vac

**Appendix C:****General Test Results**

Abbreviations used in the tables in this appendix:

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

## C1 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: Transmit mode	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207
Measurement standard	ANSI C63.10
Frequency range	150kHz to 30MHz
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

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

### 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	0.198	L	35.9	53.7	-17.8	Pass
2	0.307	L	20.2	50.1	-29.9	Pass
3	0.500	L	22.6	46.0	-23.4	Pass
4	0.600	L	19.0	46.0	-27.0	Pass
5	3.400	L	33.0	46.0	-13.0	Pass
6	13.560	L	25.2	50.0	-24.8	Pass
7	18.242	L	41.2	50.0	-8.8	Pass
8	19.708	L	40.1	50.0	-9.9	Pass
9	20.258	L	38.1	50.0	-11.9	Pass
10	0.198	N	35.9	53.7	-17.8	Pass
11	0.307	N	20.5	50.1	-29.6	Pass
12	0.500	N	24.1	46.0	-21.9	Pass
13	0.600	N	18.7	46.0	-27.3	Pass
14	3.400	N	32.9	46.0	-13.1	Pass
15	13.560	N	28.8	50.0	-21.2	Pass
16	18.242	N	41.1	50.0	-8.9	Pass
17	19.708	N	40.0	50.0	-10.0	Pass
18	20.258	N	37.8	50.0	-12.2	Pass

**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	0.198	L	52.4	63.7	-11.3	Pass
2	0.307	L	38.6	60.1	-21.5	Pass
3	0.500	L	36.4	56.0	-19.6	Pass
4	0.600	L	34.6	56.0	-21.4	Pass
5	3.400	L	39.3	56.0	-16.7	Pass
6	13.560	L	33.5	60.0	-26.5	Pass
7	18.242	L	45.8	60.0	-14.2	Pass
8	19.708	L	44.3	60.0	-15.7	Pass
9	20.258	L	42.7	60.0	-17.3	Pass
10	0.198	N	52.1	63.7	-11.6	Pass
11	0.307	N	38.0	60.1	-22.1	Pass
12	0.500	N	37.2	56.0	-18.8	Pass
13	0.600	N	34.4	56.0	-21.6	Pass
14	3.400	N	38.6	56.0	-17.4	Pass
15	13.560	N	44.9	60.0	-15.1	Pass
16	18.242	N	45.6	60.0	-14.4	Pass
17	19.708	N	44.1	60.0	-15.9	Pass
18	20.258	N	42.6	60.0	-17.4	Pass

Test Details: Receive mode	
Regulation	Title 47 of the CFR: Part 15 Subpart (c) Clause 15.107
Measurement standard	ANSI C63.10
Frequency range	150kHz to 30MHz
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

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

**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	0.198	L	35.4	53.7	-18.3	Pass
2	0.307	L	19.8	50.1	-30.3	Pass
3	0.500	L	22.8	46.0	-23.2	Pass
4	0.600	L	18.1	46.0	-27.9	Pass
5	3.400	L	32.4	46.0	-13.6	Pass
6	13.560	L	25.0	50.0	-25.0	Pass
7	18.242	L	39.5	50.0	-10.5	Pass
8	19.708	L	38.8	50.0	-11.2	Pass
9	20.258	L	38.8	50.0	-11.2	Pass
10	0.198	N	35.5	53.7	-18.2	Pass
11	0.307	N	20.4	50.1	-29.7	Pass
12	0.500	N	23.9	46.0	-22.1	Pass
13	0.600	N	17.1	46.0	-28.9	Pass
14	3.400	N	17.7	46.0	-28.3	Pass
15	13.560	N	24.2	50.0	-25.8	Pass
16	18.242	N	39.3	50.0	-10.7	Pass
17	19.708	N	38.7	50.0	-11.3	Pass
18	20.258	N	38.7	50.0	-11.3	Pass

**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	0.198	L	51.6	63.7	-12.1	Pass
2	0.307	L	38.0	60.1	-22.1	Pass
3	0.500	L	35.9	56.0	-20.1	Pass
4	0.600	L	33.8	56.0	-22.2	Pass
5	3.400	L	38.6	56.0	-17.4	Pass
6	13.560	L	33.1	60.0	-26.9	Pass
7	18.242	L	43.6	60.0	-16.4	Pass
8	19.708	L	42.5	60.0	-17.5	Pass
9	20.258	L	42.5	60.0	-17.5	Pass
10	0.198	N	51.6	63.7	-12.1	Pass
11	0.307	N	37.7	60.1	-22.4	Pass
12	0.500	N	36.7	56.0	-19.3	Pass
13	0.600	N	33.0	56.0	-23.0	Pass
14	3.400	N	33.5	56.0	-22.5	Pass
15	13.560	N	31.0	60.0	-29.0	Pass
16	18.242	N	43.4	60.0	-16.6	Pass
17	19.708	N	42.3	60.0	-17.7	Pass
18	20.258	N	42.4	60.0	-17.6	Pass



**Specification limits :**

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

Conducted disturbance at the mains ports.

Frequency range MHz	Limits dB $\mu$ V	
	Quasi-peak	Average
0.15 to 0.5	66 to 56 <sup>2</sup>	56 to 46 <sup>2</sup>
0.5 to 5	56	46
5 to 30	60	50

Notes:

- The lower limit shall apply at the transition frequency.
- 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 E  
(ii) Parameter defined by client and / or single possible, refer to Appendix E  
(iii) Parameter had a negligible effect on emission levels, refer to Appendix E  
(iv) Worst case determined by initial measurement, refer to Appendix E

**C2 Unintentional Radiated Electric Field Emissions - 15.109**

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

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

3m open area test site :

3m alternative test site :

Test Details:	
Regulation	Title 47 of the CFR: Part 15 Subpart (b) Clause 15.109
Measurement standard	ANSI C63.10
Frequency range	30MHz to 25 GHz
EUT sample number	S01
Modification state	0
SE in test environment	S05, S07, S08
SE isolated from EUT	S04, S06
EUT set up	Refer to Appendix E

Ref No.	FREQ. (MHz)	DETECTOR	FIELD ST'GH (dBµV/m)	Duty Cycle Fact (dB)	FIELD ST'GH (dBµV/m)	LIMIT (dBµV/m)
1.	31.900	Pk	38.7	0	38.7	60
2.	31.900	QP	32.4	0	32.4	40
3.	63.622	Pk	37.4	0	37.4	60
4.	63.622	QP	32.3	0	32.3	40
5.	84.856	Pk	45.0	0	45.0	60
6.	84.856	QP	38.0	0	38.0	40
7.	98.000	Pk	37.1	0	37.1	63.5
8.	98.000	QP	30.0	0	30.0	43.5
9.	118.000	Pk	44.4	0	44.4	63.5
10.	118.000	QP	38.3	0	38.3	43.5
11.	161.444	Pk	42.9	0	42.9	63.5
12.	161.444	QP	34.7	0	34.7	43.5
13.	241.889	Pk	38.3	0	38.3	66
14.	241.889	QP	30.5	0	30.5	46
15.	472.000	Pk	38.0	0	38.0	66
16.	472.000	QP	29.1	0	29.1	46
17.	650.000	Pk	39.6	0	39.6	66
18.	650.000	QP	37.3	0	37.3	46
19.	741.741	Pk	42.7	0	42.7	66
20.	741.741	QP	34.7	0	34.7	46
21.	750.000	Pk	43.4	0	43.4	66
22.	750.000	QP	41.3	0	41.3	46
23.	850.000	Pk	42.4	0	42.4	66
24.	850.000	QP	40.9	0	40.9	46
25.	950.000	Pk	43.9	0	43.9	66
26.	950.000	QP	42.2	0	42.2	46

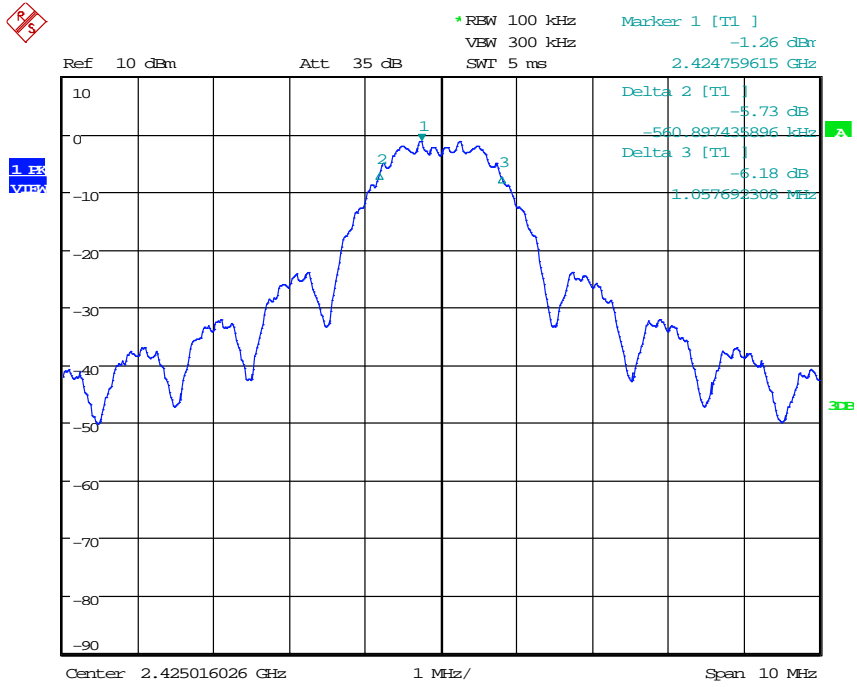
No further Spurious emissions within 20 dB of the test limit were detected.

**Appendix D:****Supporting Graphical Data**

This appendix contains graphical data obtained during testing.

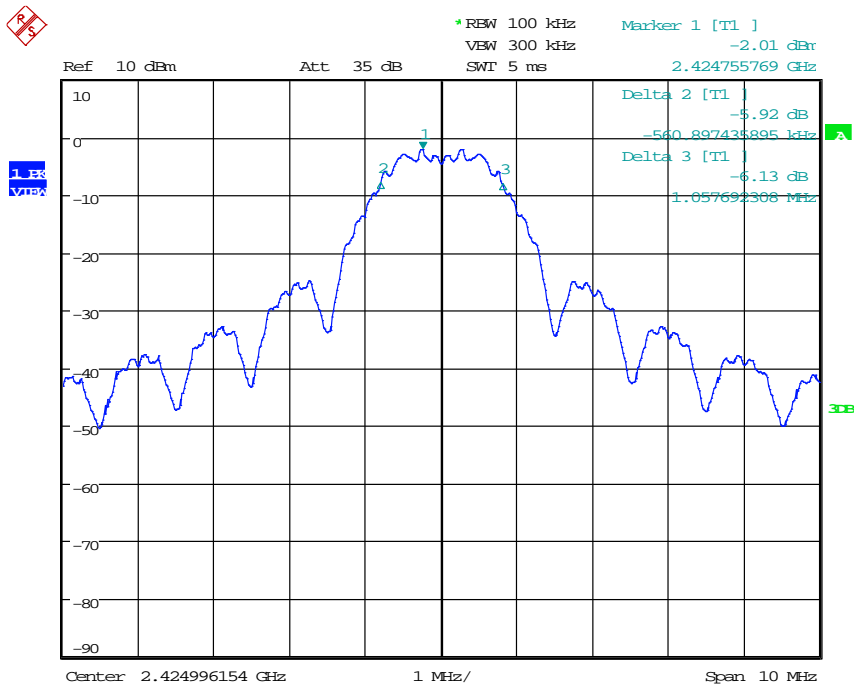
**Notes:**

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



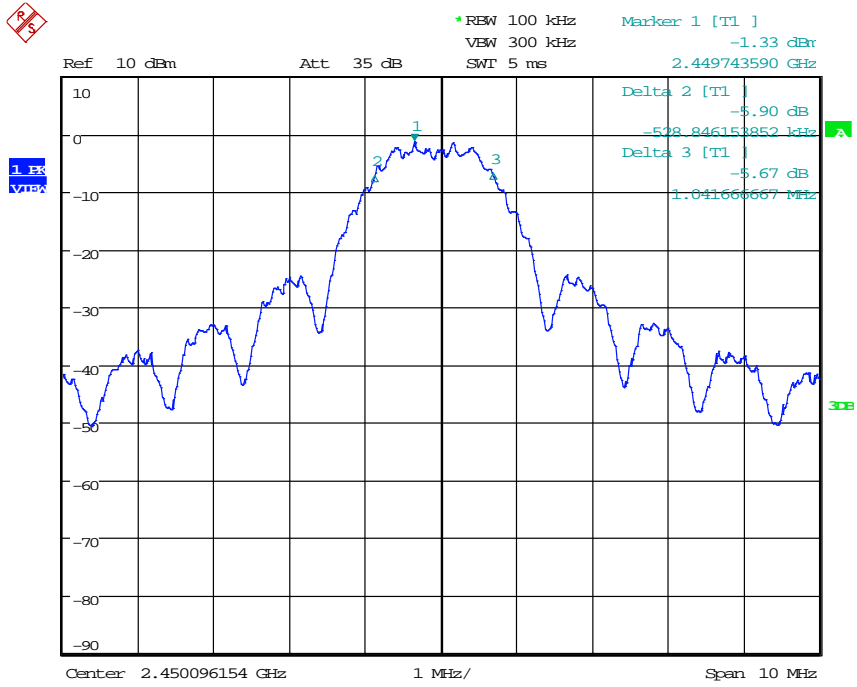
Date: 5.DEC.2013 14:54:52

### 6dB Bandwidth Antenna 0 -2425 MHz



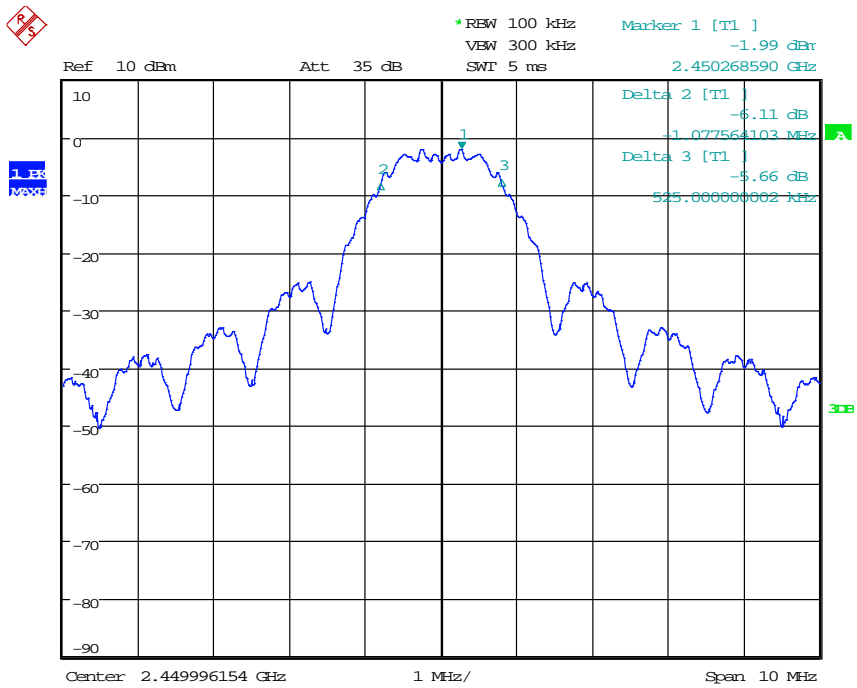
Date: 5.DEC.2013 15:30:44

### 6dB Bandwidth Antenna 1 -2425 MHz



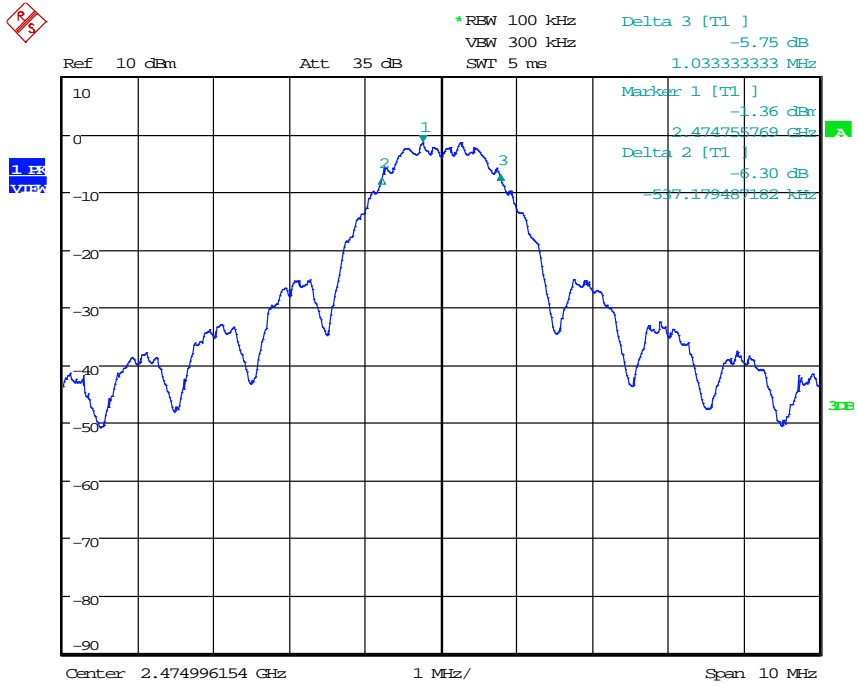
Date: 5.DEC.2013 14:57:53

### 6dB Bandwidth Antenna 0 – 2450 MHz



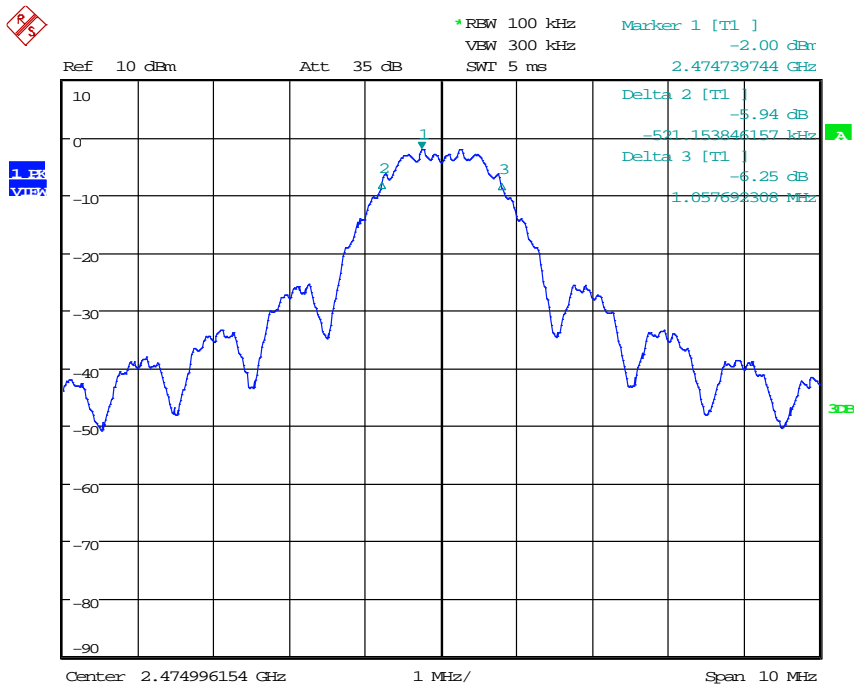
Date: 5.DEC.2013 15:17:06

### 6dB Bandwidth Antenna 1 – 2450 MHz



Date: 5.DEC.2013 15:01:31

6dB Bandwidth Antenna 0 - 2475 MHz



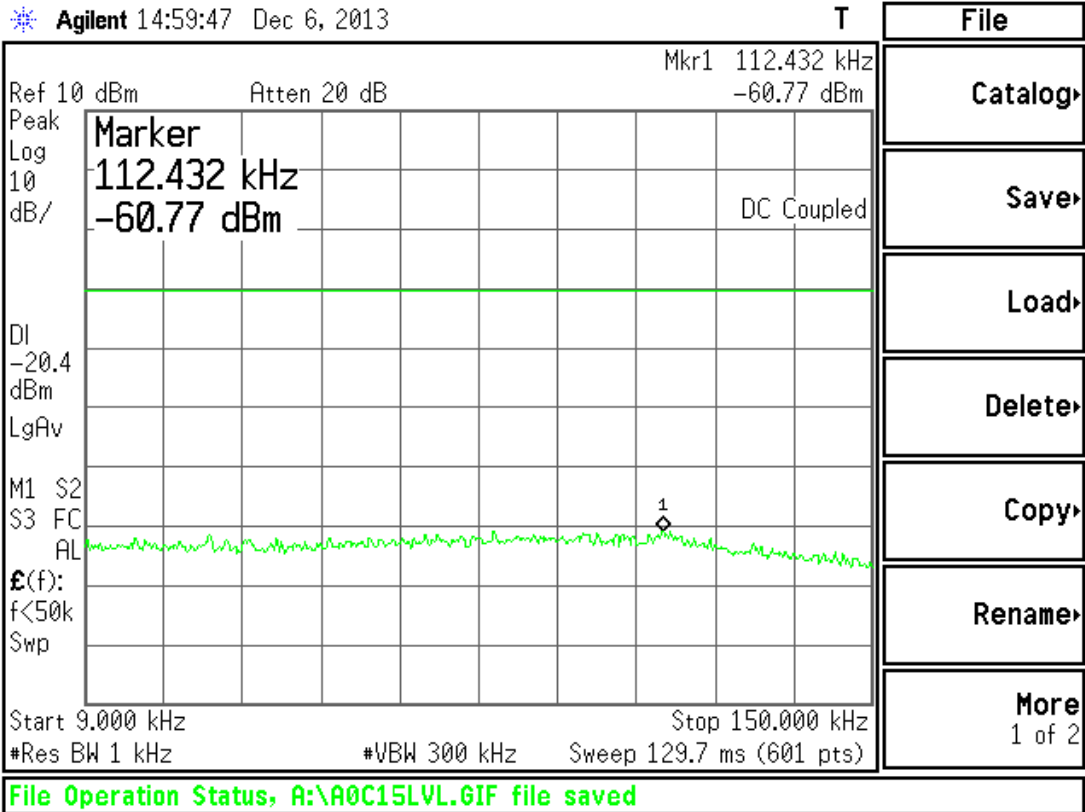
Date: 5.DEC.2013 15:09:51

6dB Bandwidth Antenna 1 - 2475 MHz

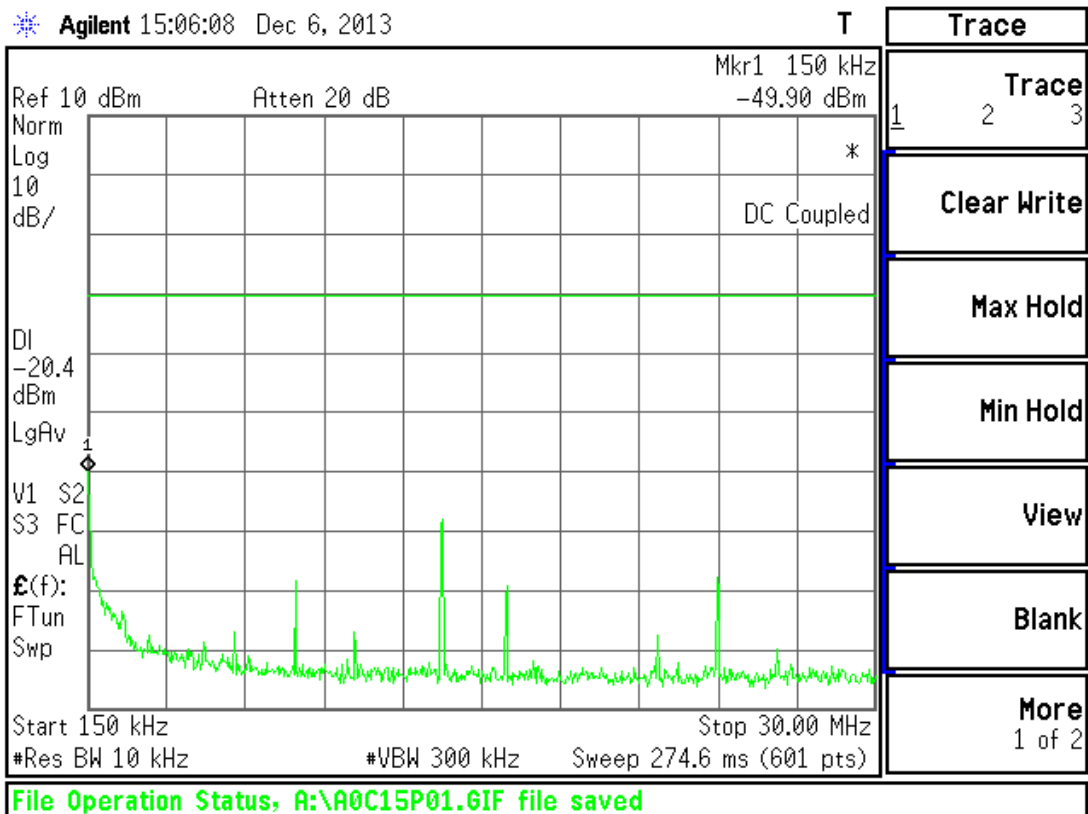
Agilent 13:36:35 Dec 11, 2013

<p>Ch Freq 13.56 MHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Occupied Bandwidth Span 500.000000 kHz</p> <p>Ref -30 dBm #Atten 2 dB</p> <p>Center 13.560 0 MHz Span 500 kHz Res BW 4.7 kHz VBW 4.7 kHz Sweep 27.32 ms (601 pts)</p>		<p><b>Meas Setup</b></p> <p><b>Avg Number</b> 10 On Off</p> <p><b>Avg Mode</b> Exp Repeat</p> <p><b>Max Hold</b> On Off</p> <p><b>Occ BW % Pwr</b> 99.00 %</p> <p><b>OBW Span</b> 500.000000 kHz</p> <p><b>x dB</b> -20.00 dB</p> <p><b>Optimize Ref Level</b></p>
<p><b>Occupied Bandwidth</b> Occ BW % Pwr 99.00 % 258.7256 kHz x dB -20.00 dB</p> <p>Transmit Freq Error -9.506 kHz x dB Bandwidth 93.884 kHz</p>		
<p>File Operation Status, A:\A0C15CCP.GIF file saved</p>		

20dB Bandwidth NFC – 13.56MHz



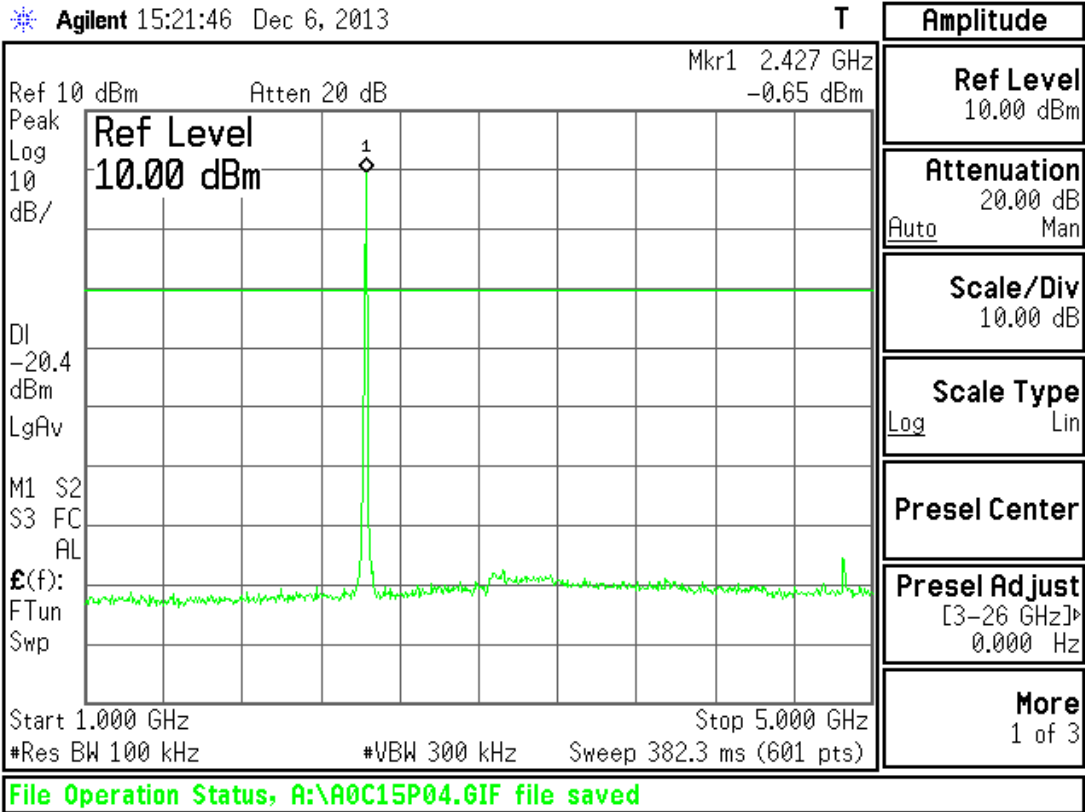
Conducted Spurious emissions 9kHz to 150 kHz Antenna 0 – 2425 MHz



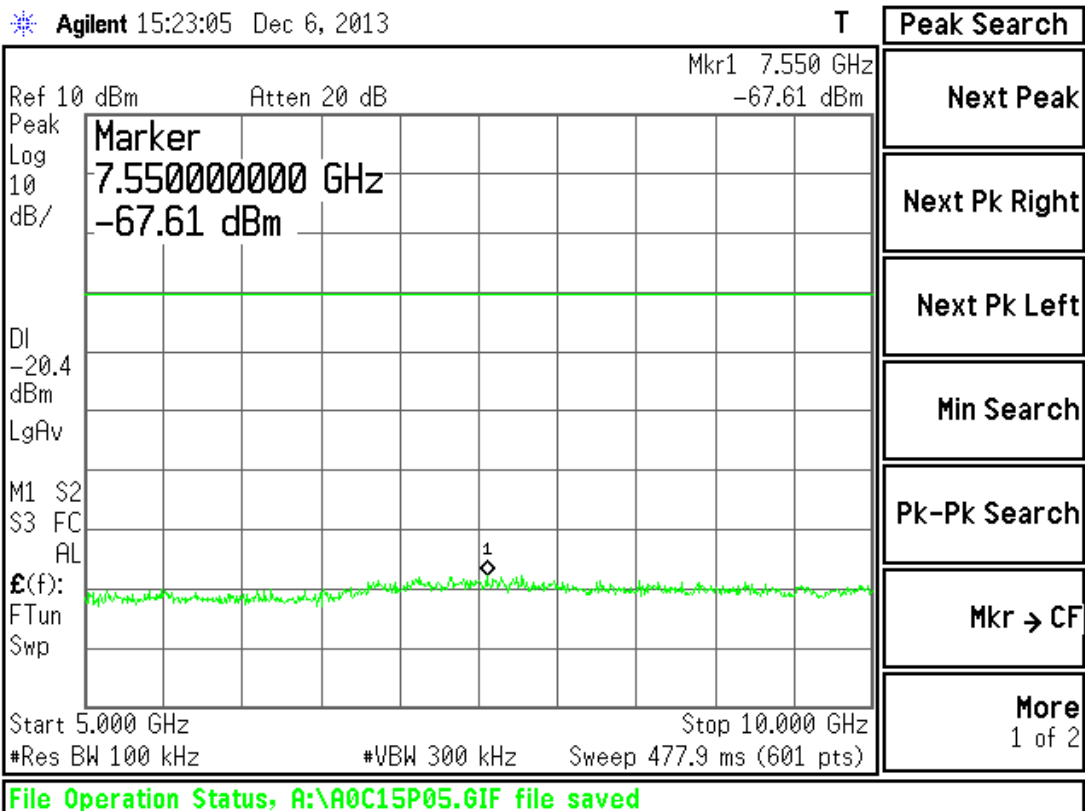
Conducted Spurious emissions 150 kHz to 30 MHz Antenna 0 – 2425 MHz



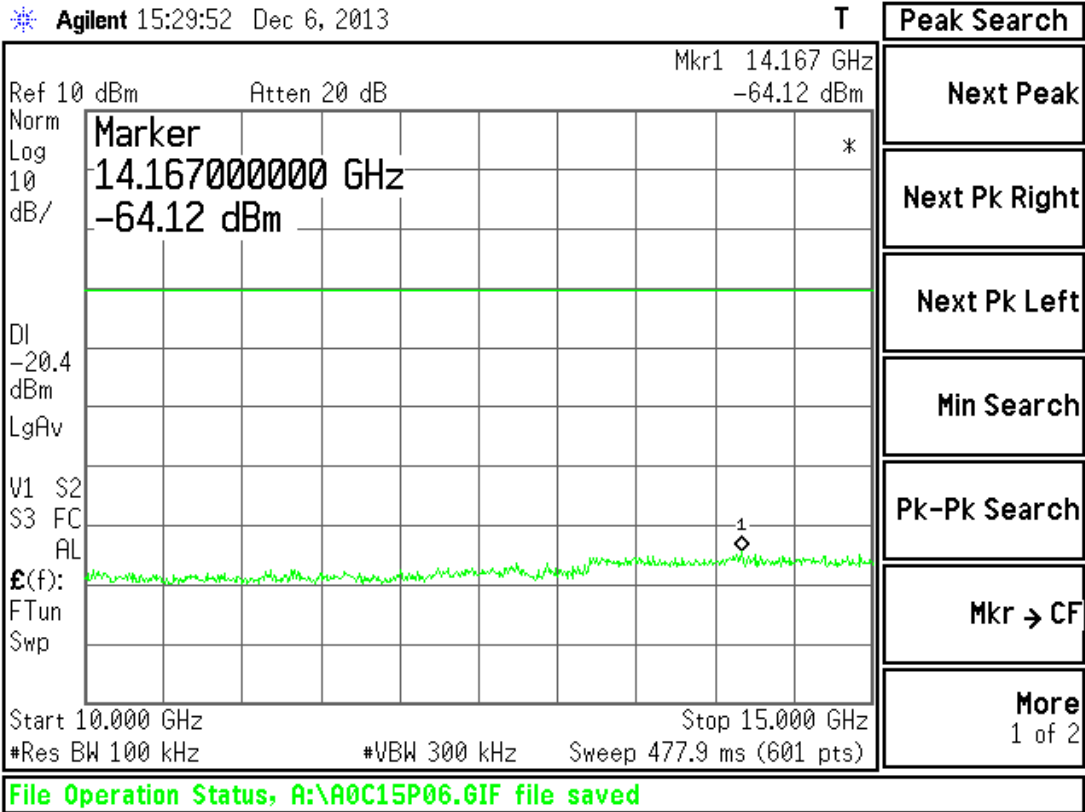




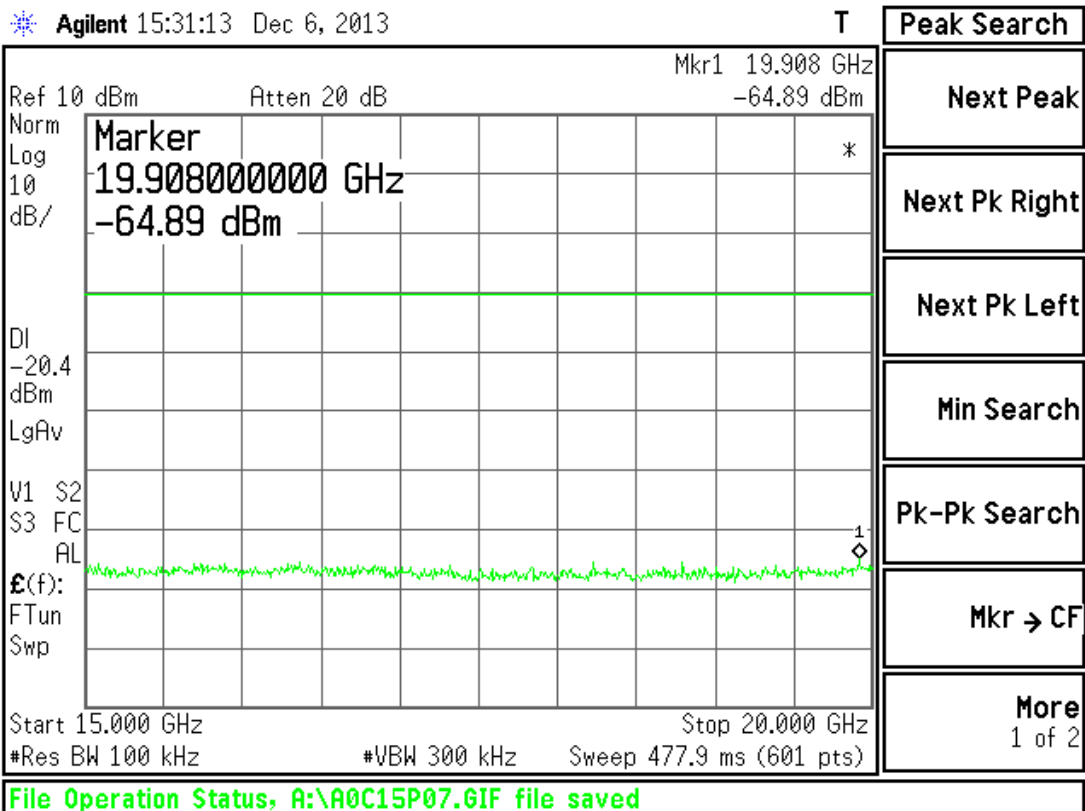
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 0 - 2425 MHz



Conducted Spurious emissions 5 GHz to 10 GHz Antenna 0 - 2425 MHz

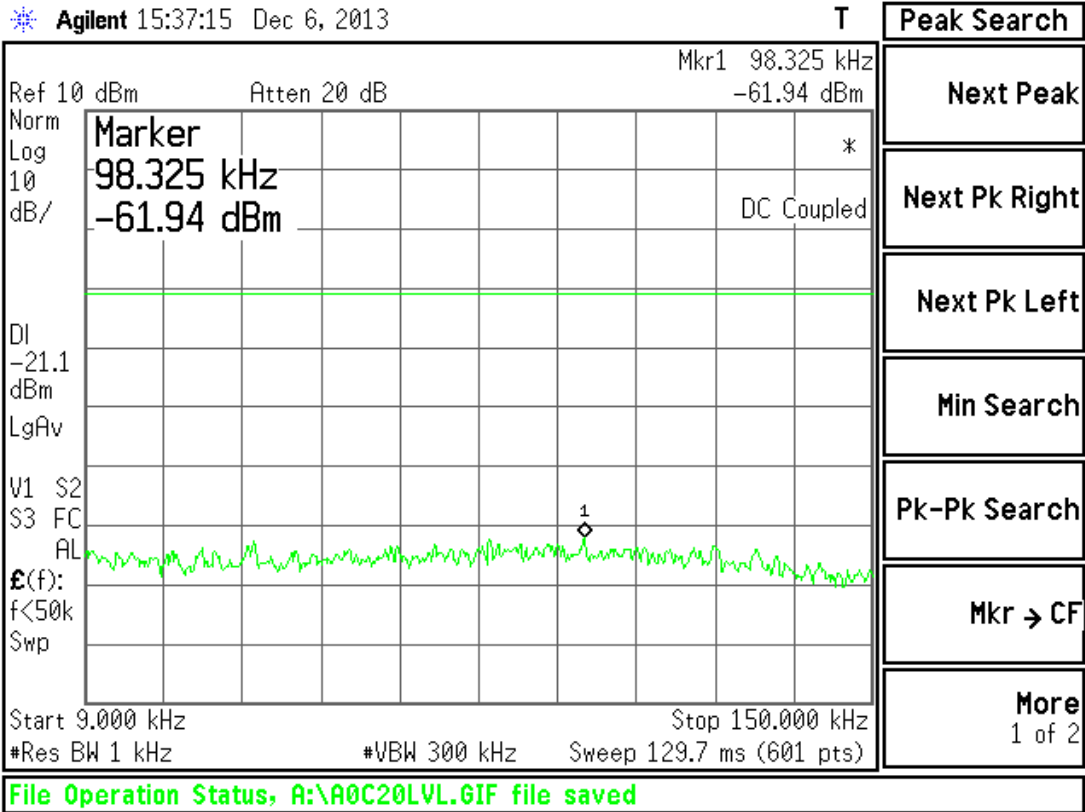


Conducted Spurious emissions 10 GHz to 15 GHz Antenna 0 - 2425 MHz

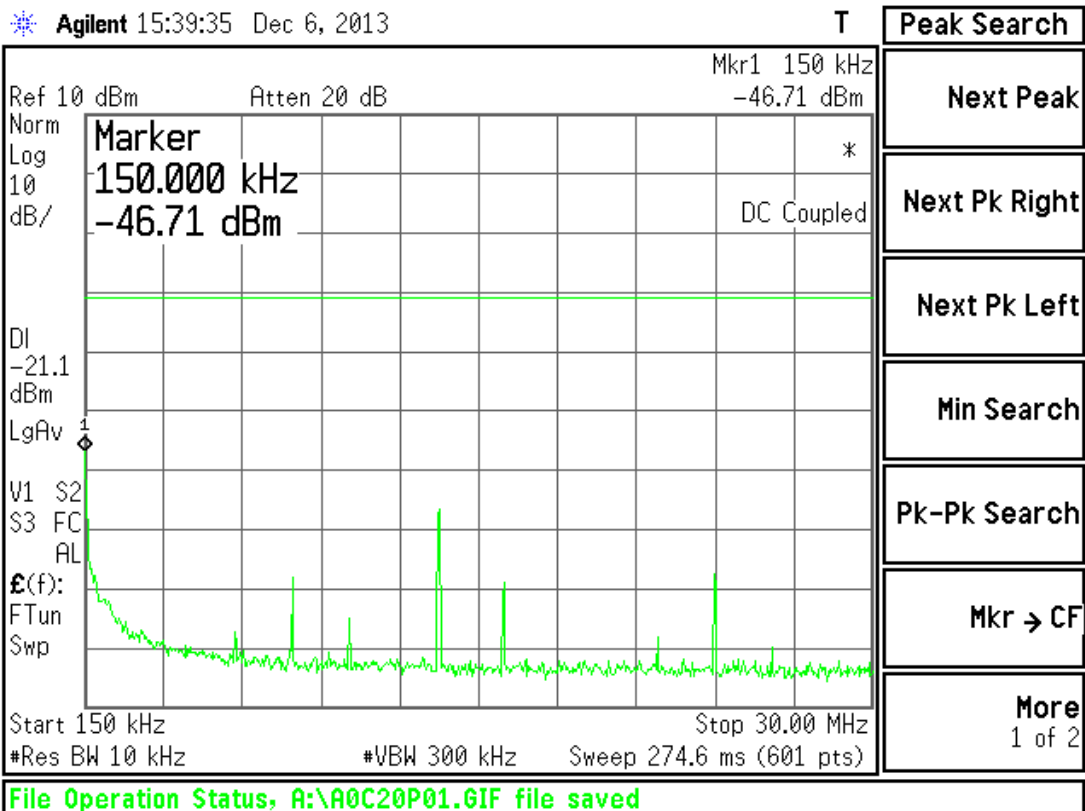


Conducted Spurious emissions 15 GHz to 20GHz Antenna 0 - 2425 MHz

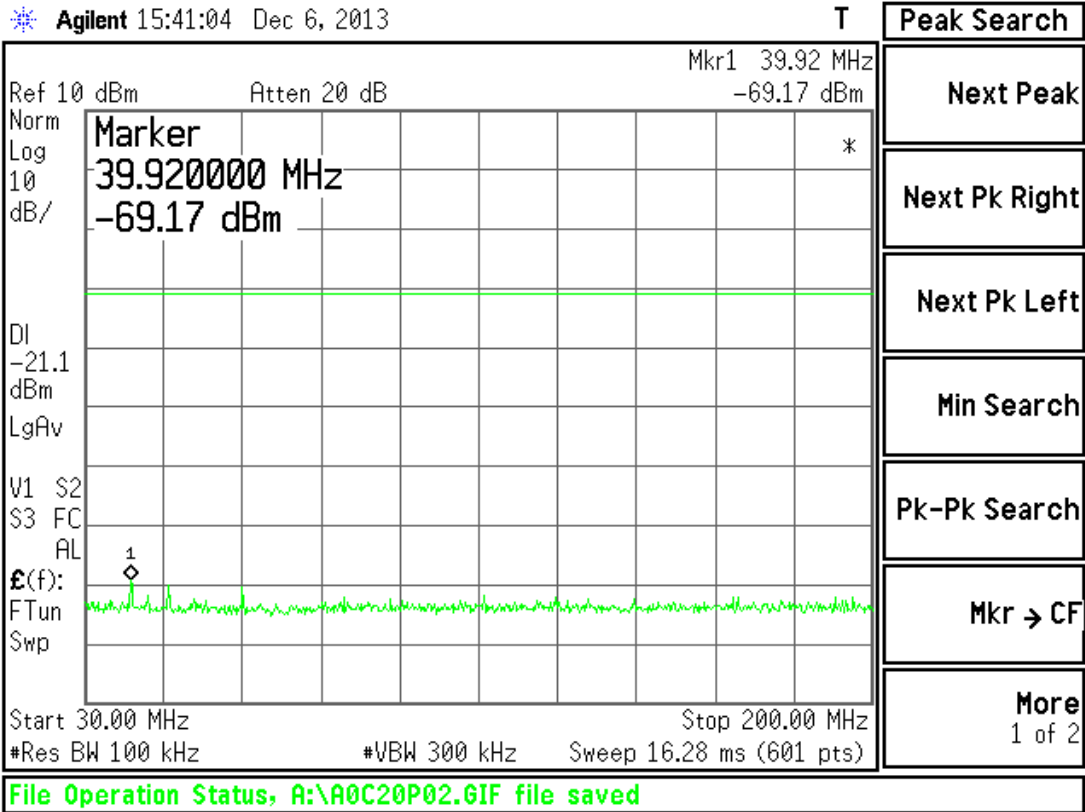




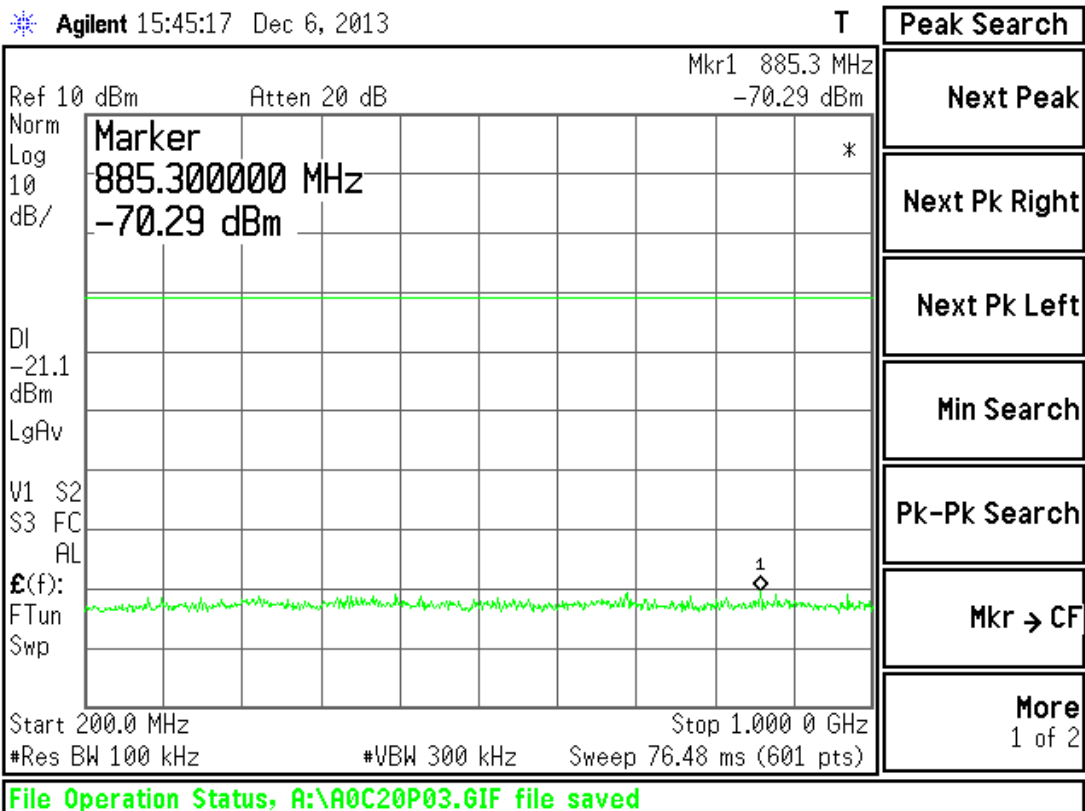
Conducted Spurious emissions 9kHz to 150 kHz Antenna 0 – 2450 MHz



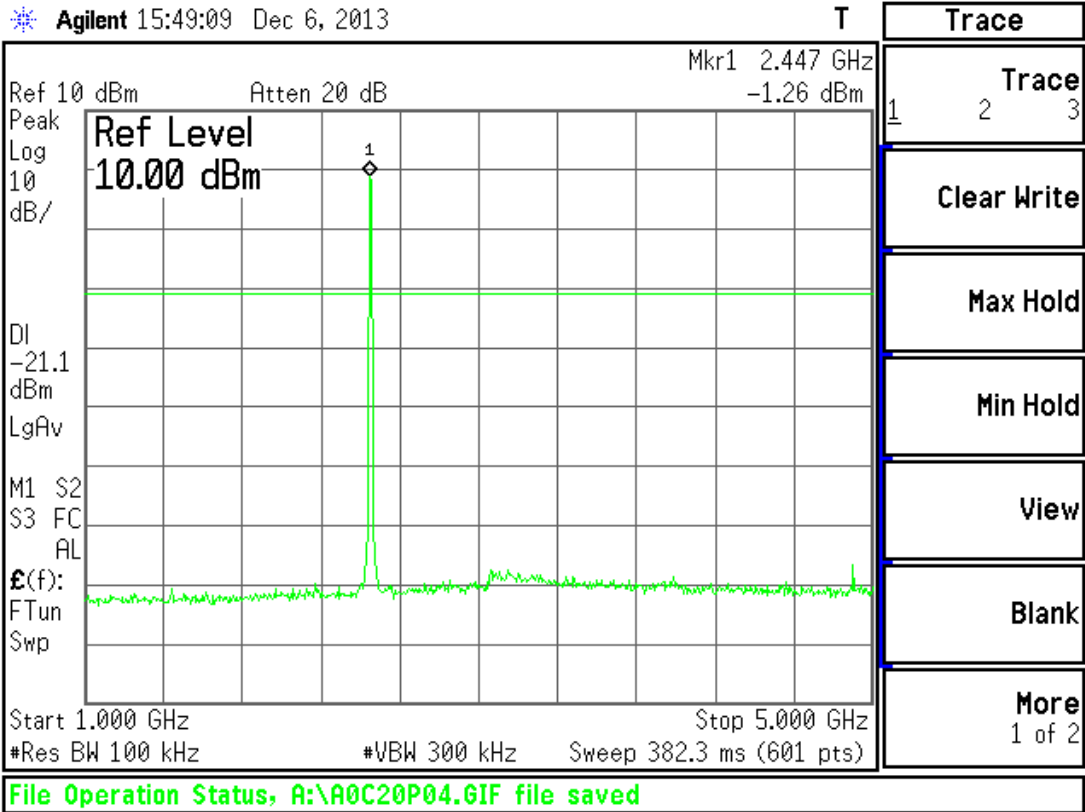
Conducted Spurious emissions 150 kHz to 30 MHz Antenna 0 – 2450 MHz



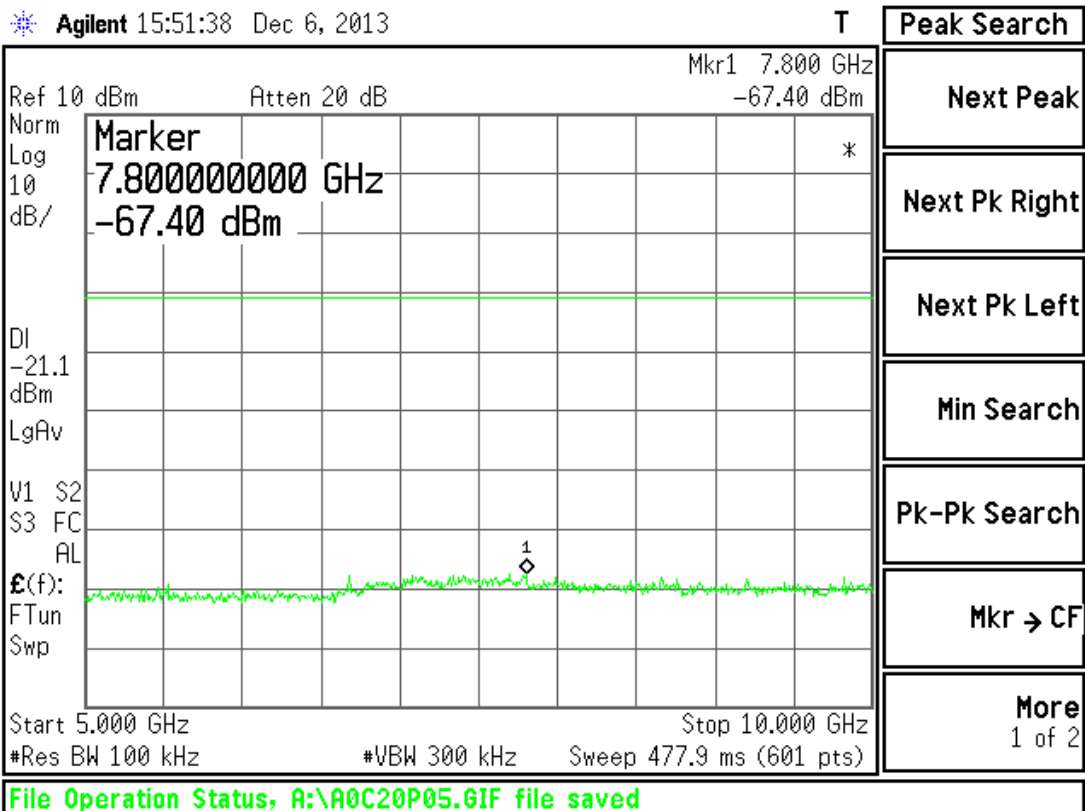
Conducted Spurious emissions 30 MHz to 200 MHz Antenna 0 - 2450 MHz



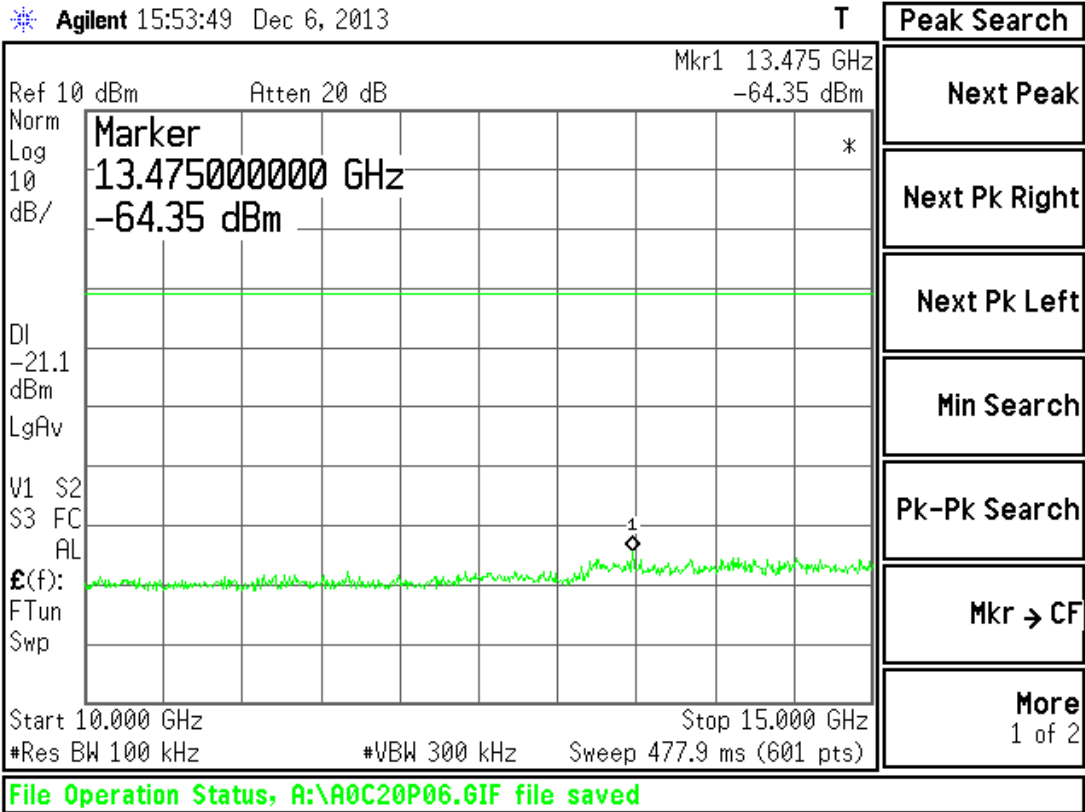
Conducted Spurious emissions 200 MHz to 1 GHz Antenna 0 - 2450 MHz



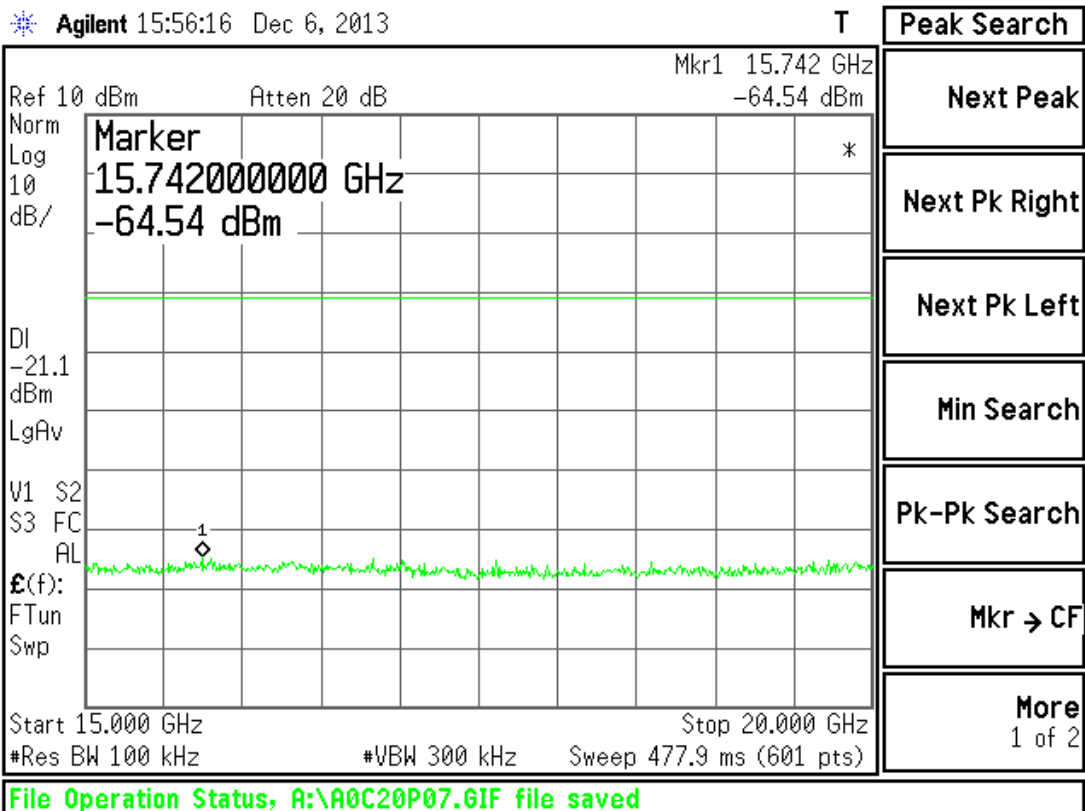
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 0 - 2450 MHz



Conducted Spurious emissions 5 GHz to 10 GHz Antenna 0 - 2450 MHz



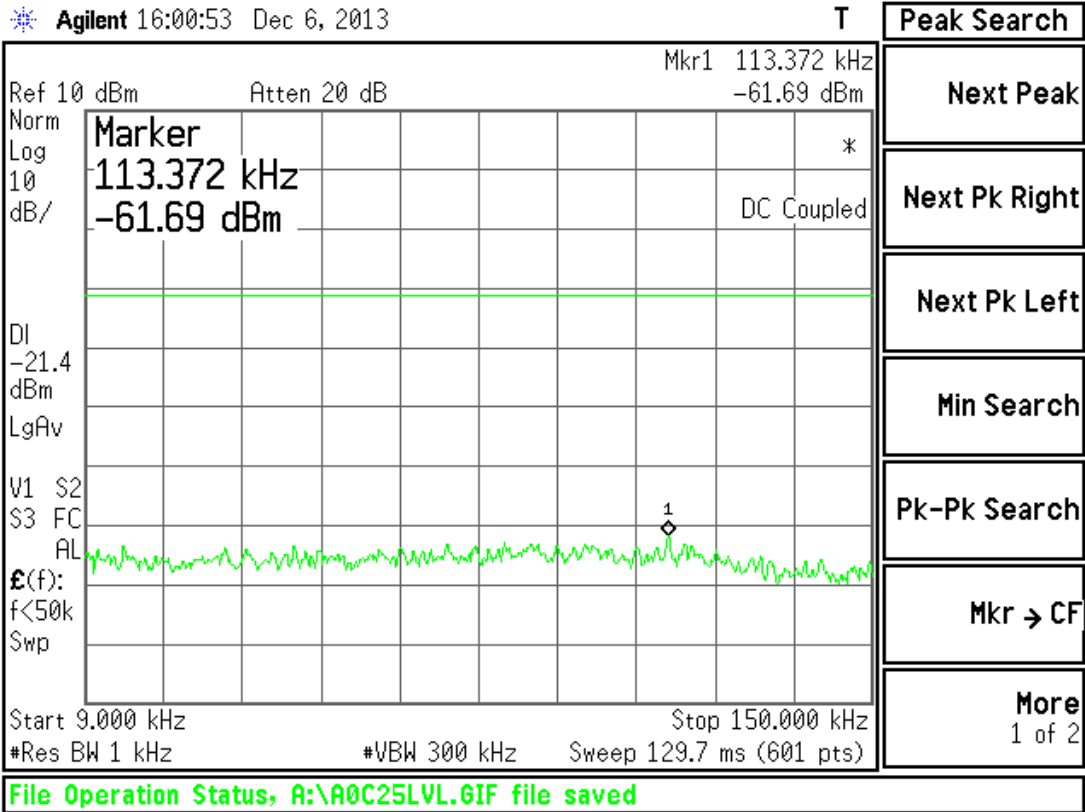
Conducted Spurious emissions 10 GHz to 15 GHz Antenna 0 - 2450 MHz



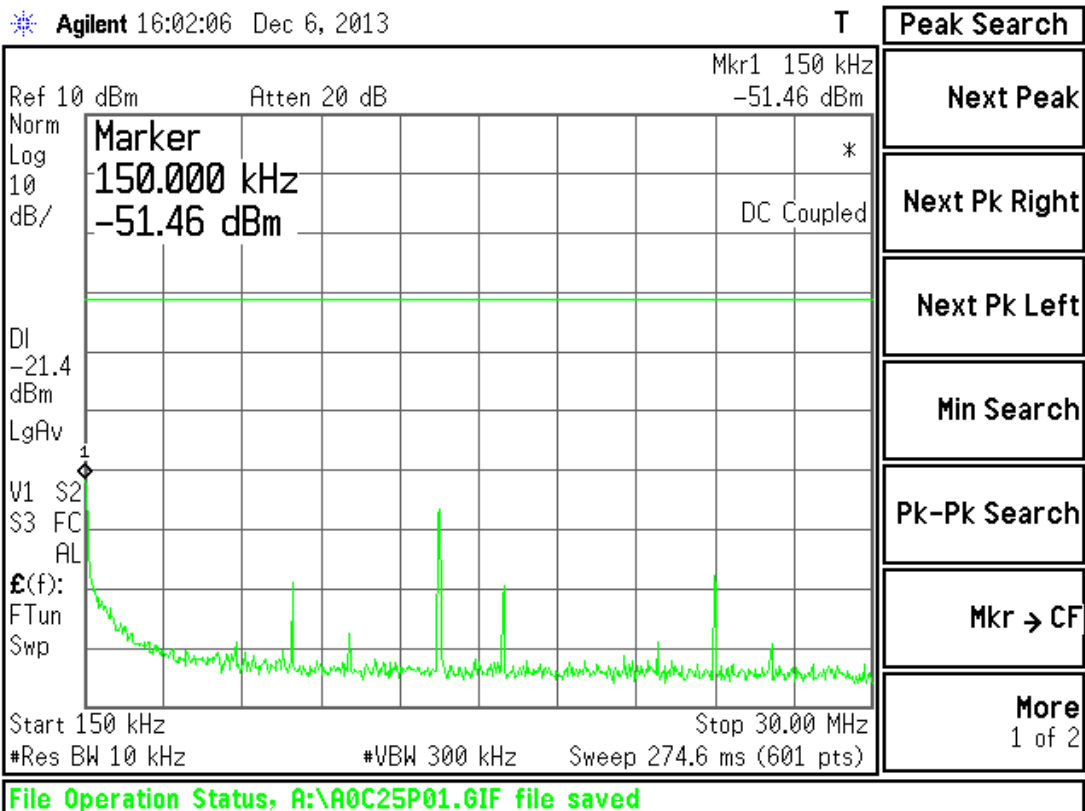
Conducted Spurious emissions 15 GHz to 20 GHz Antenna 0 - 2450 MHz



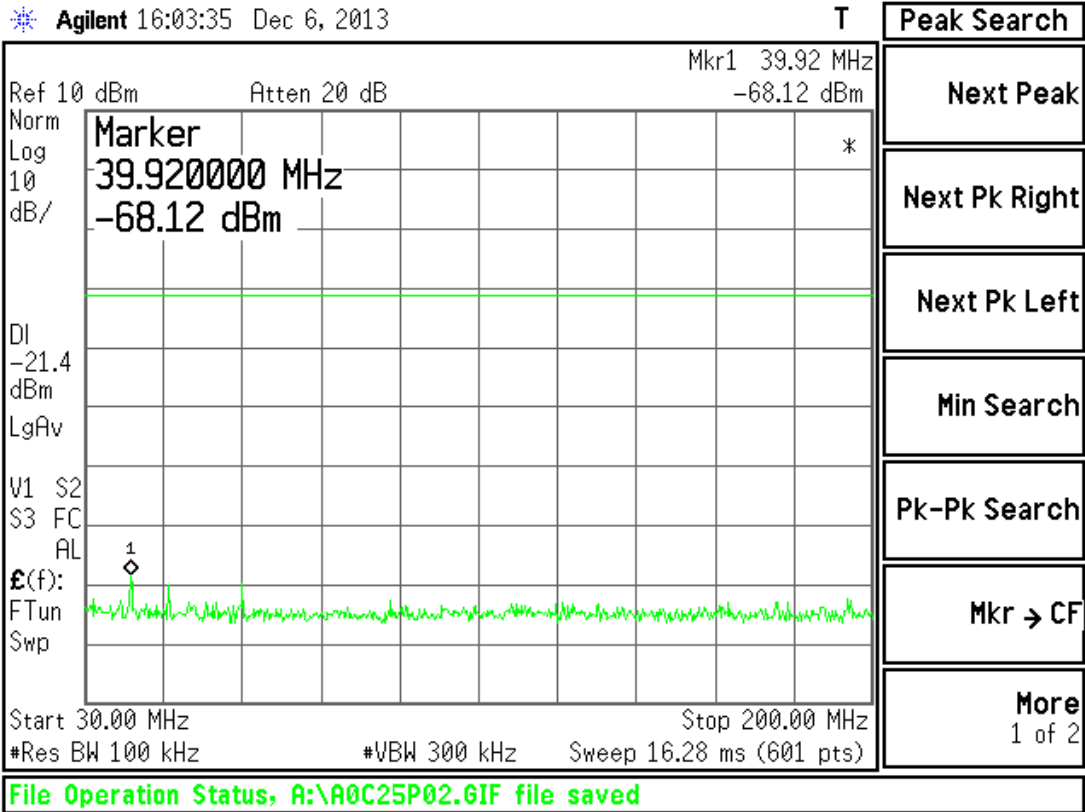




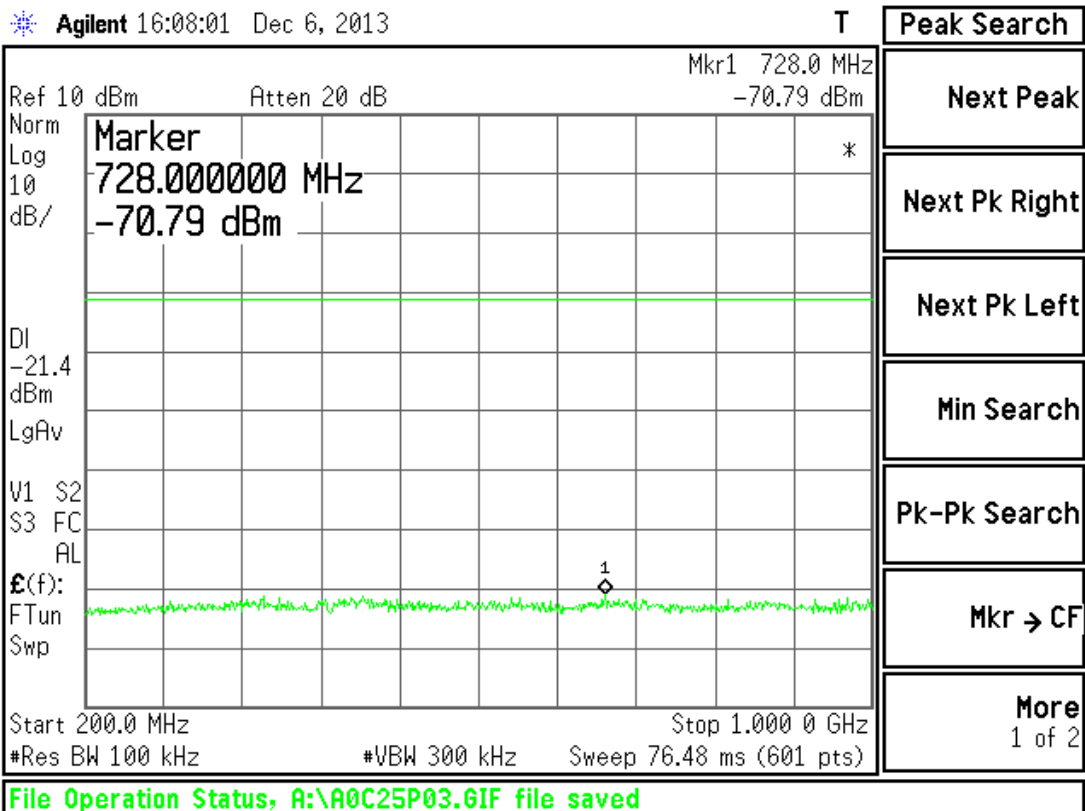
Conducted Spurious emissions 9kHz to 150 kHz Antenna 0 – 2475 MHz



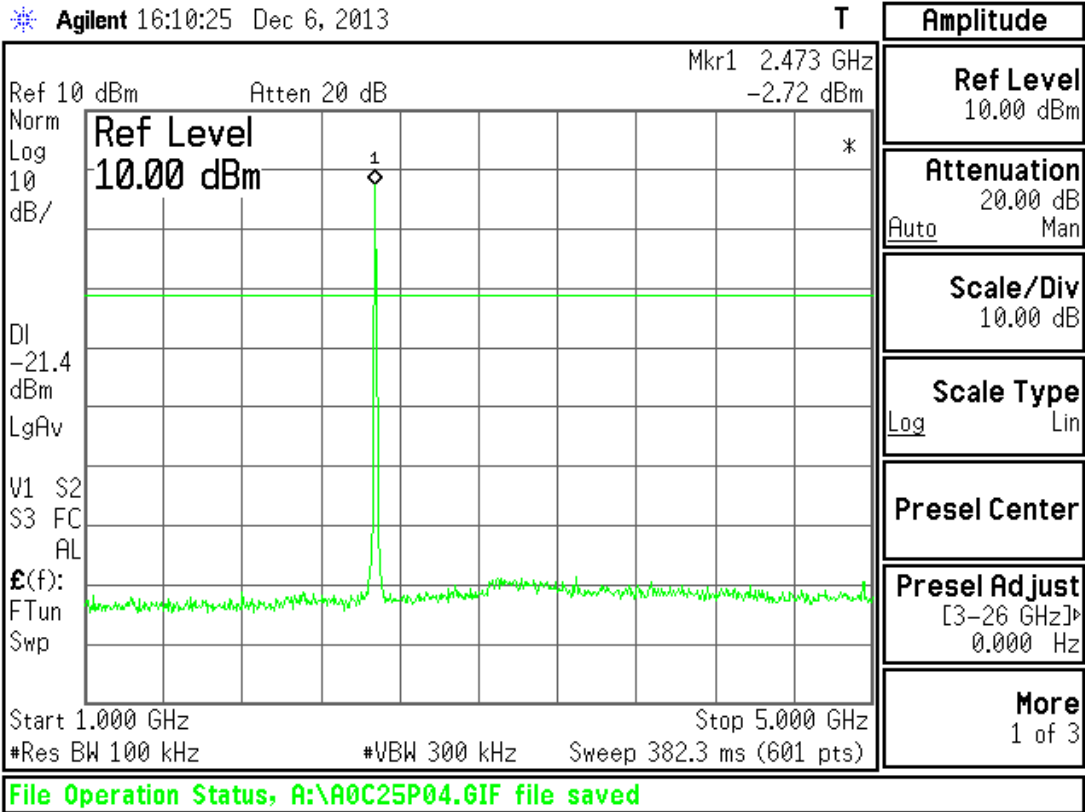
Conducted Spurious emissions 150 kHz to 30 MHz Antenna 0 – 2475 MHz



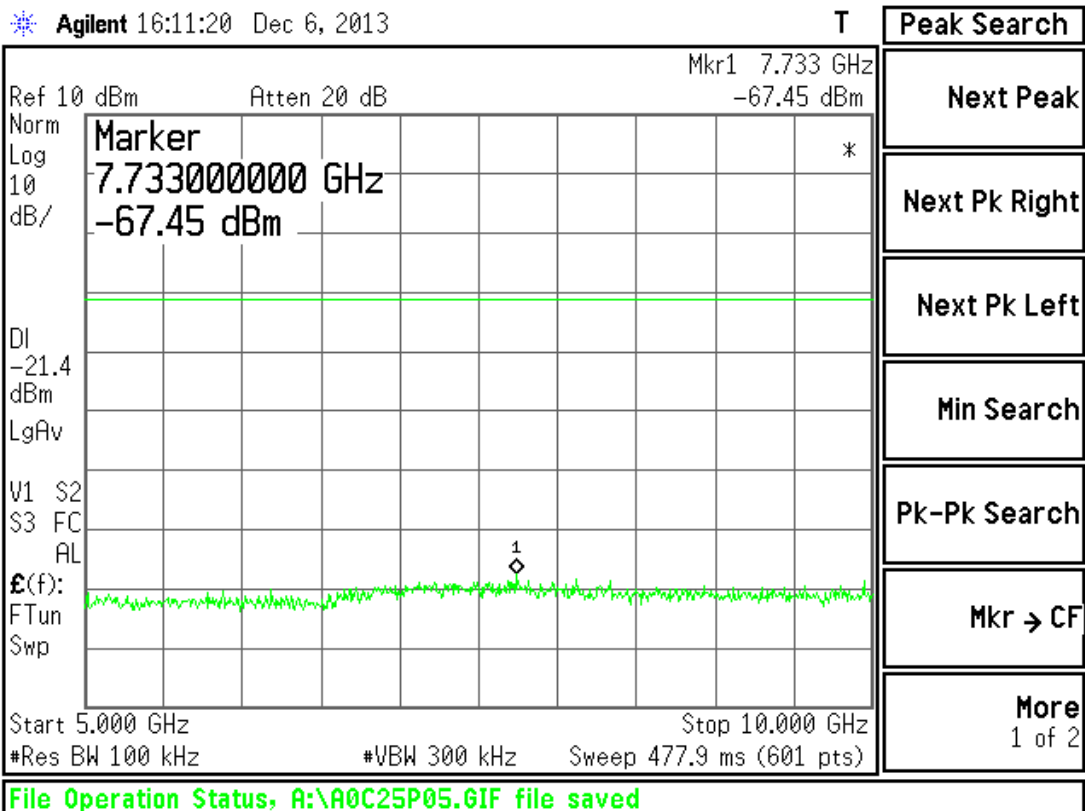
Conducted Spurious emissions 30 MHz to 200 MHz Antenna 0 - 2475 MHz



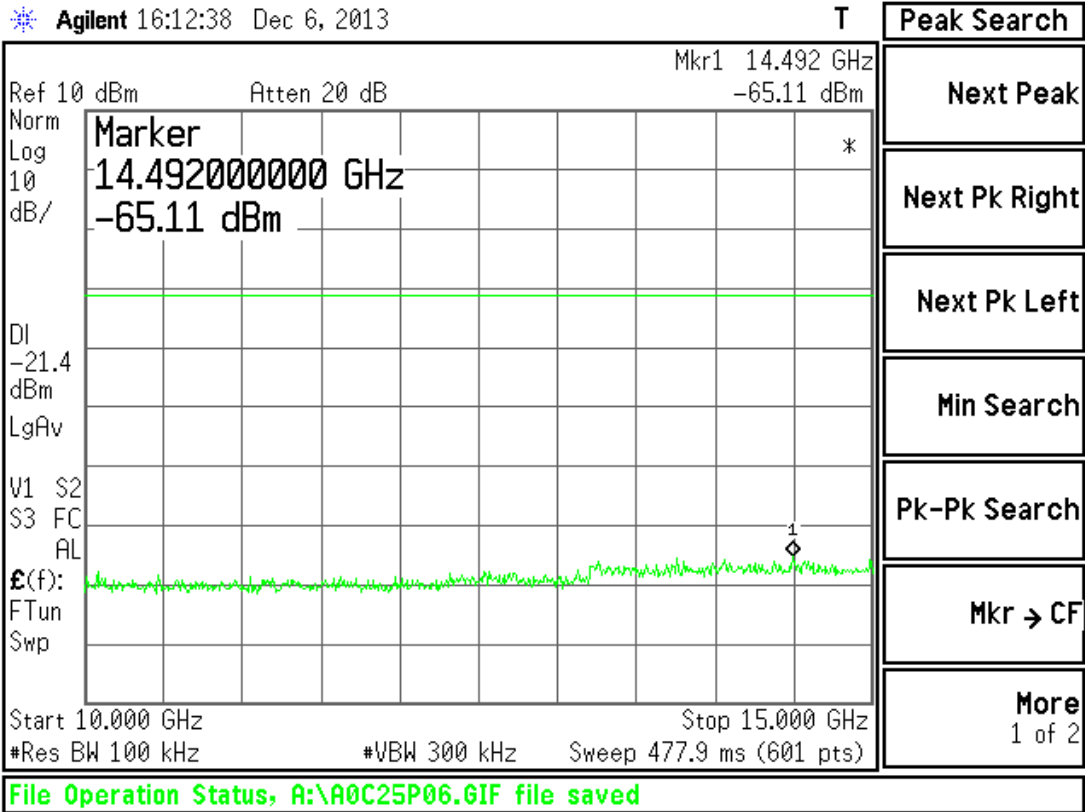
Conducted Spurious emissions 200 MHz to 1 GHz Antenna 0 - 2475 MHz



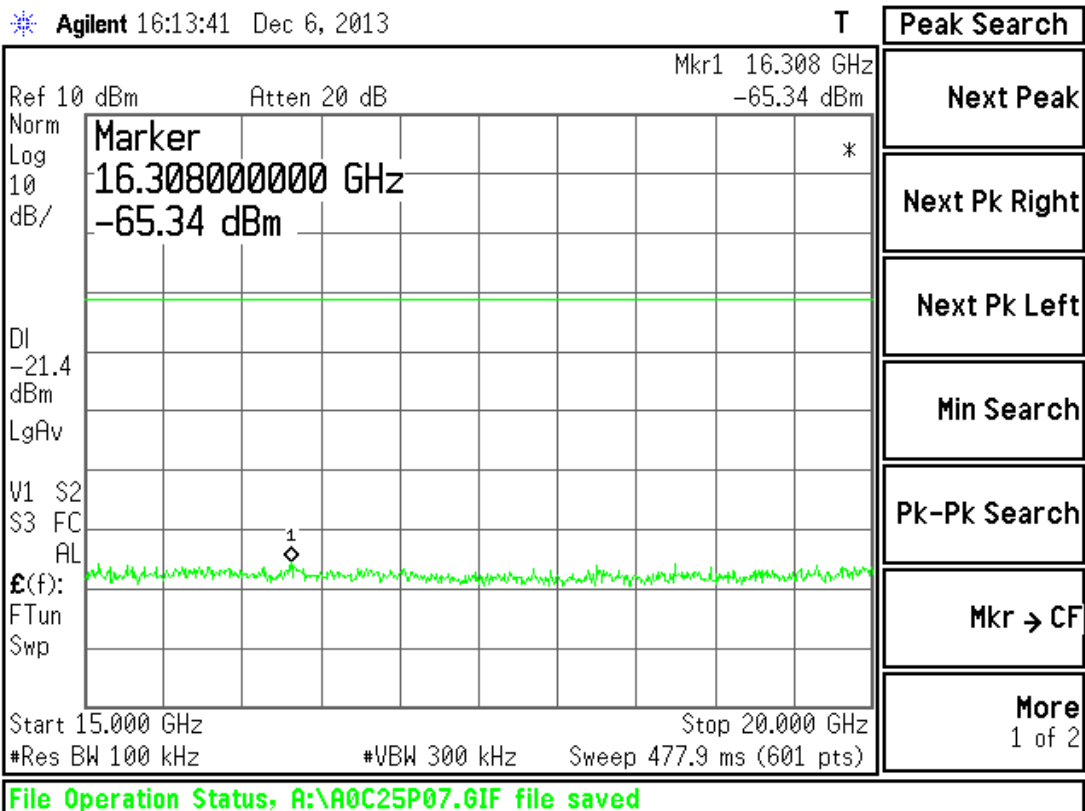
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 0 - 2475 MHz



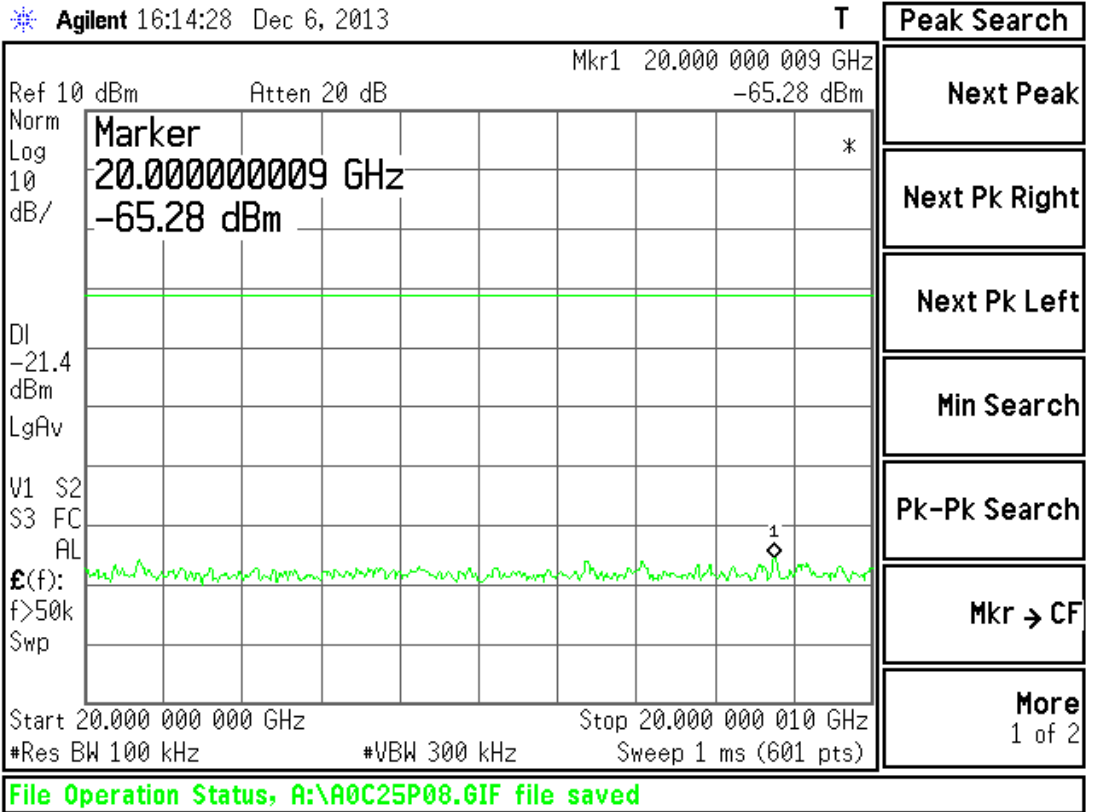
Conducted Spurious emissions 5 GHz to 10 GHz Antenna 0 - 2475 MHz



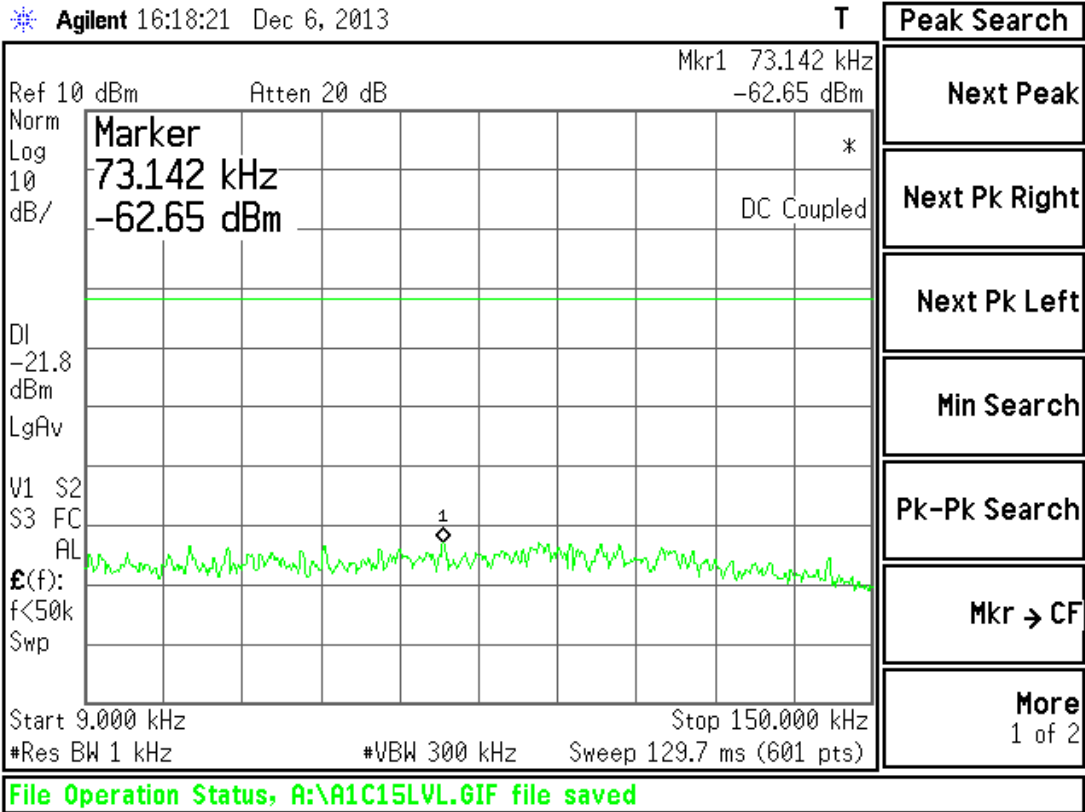
Conducted Spurious emissions 10 GHz to 15 GHz Antenna 0 - 2475 MHz



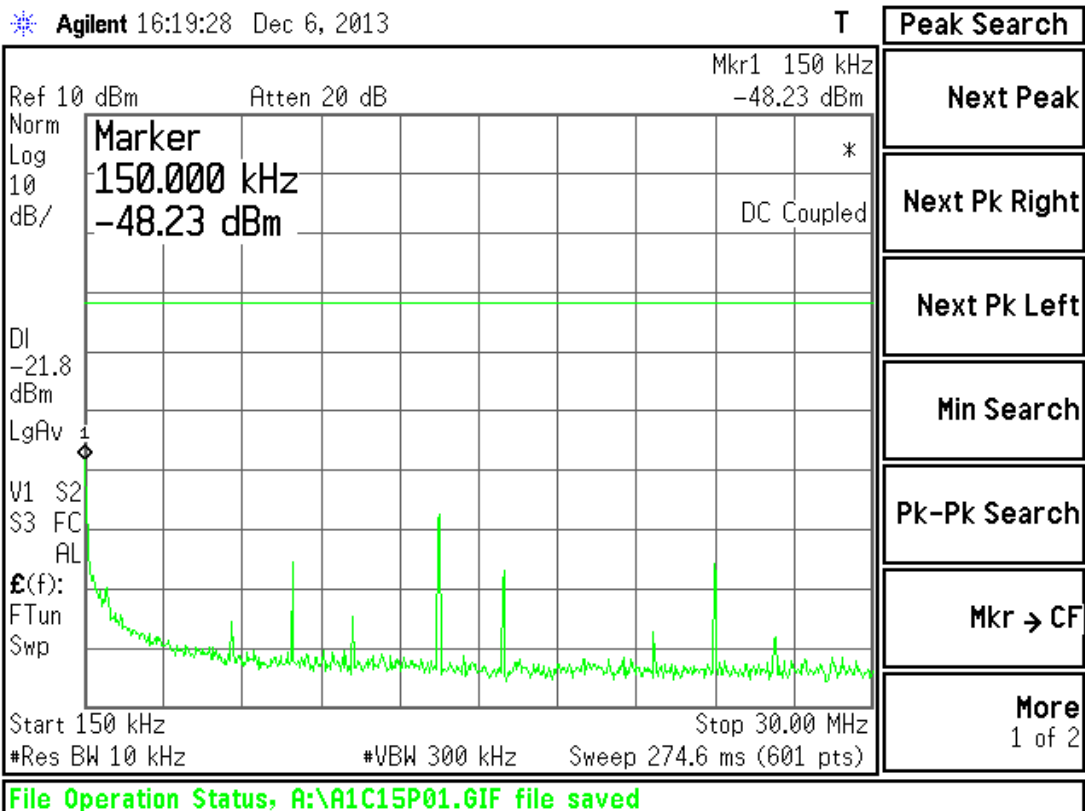
Conducted Spurious emissions 15 GHz to 20 GHz Antenna 0 - 2475 MHz



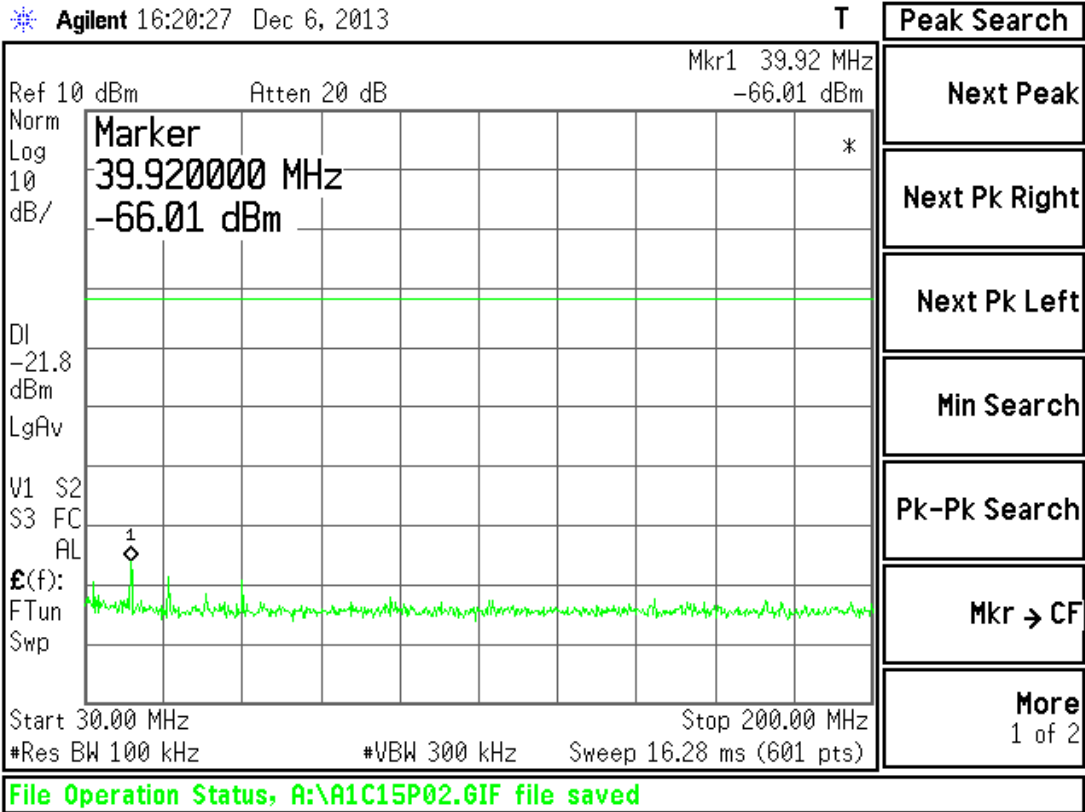
Conducted Spurious emissions 20 GHz to 25 GHz Antenna 0 - 2475 MHz



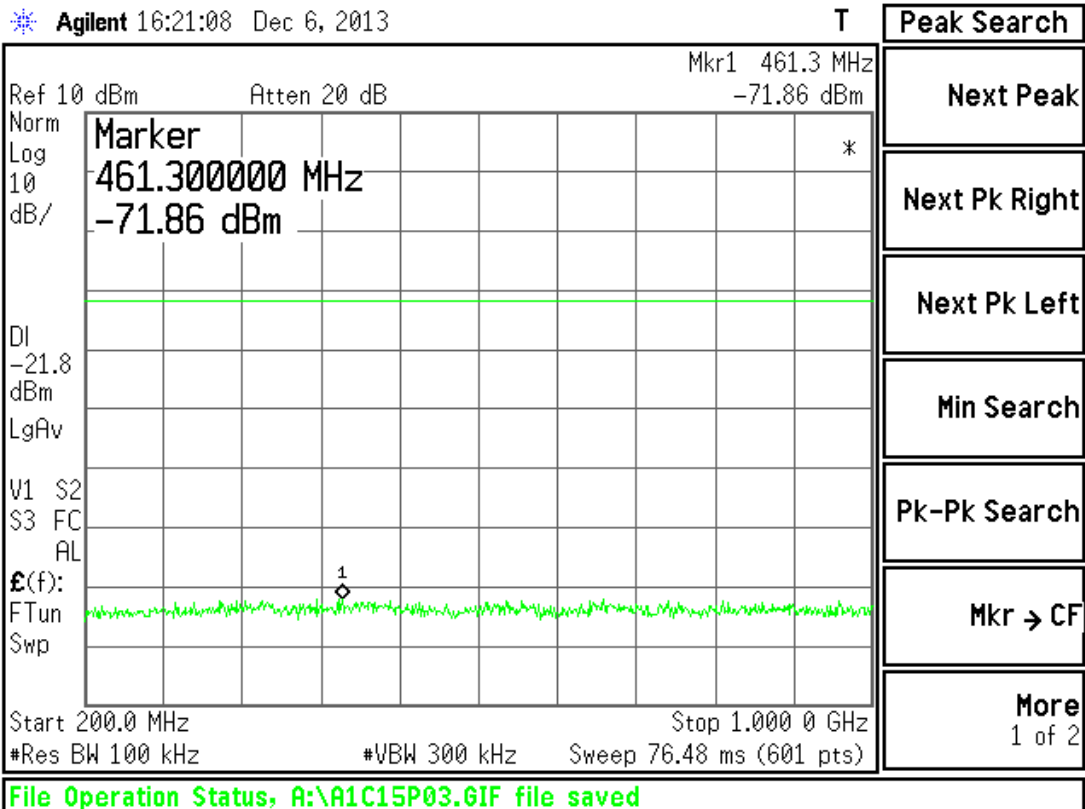
Conducted Spurious emissions 9kHz to 150 kHz Antenna 1 – 2425 MHz



Conducted Spurious emissions 150 kHz to 30 MHz Antenna 1 – 2425 MHz

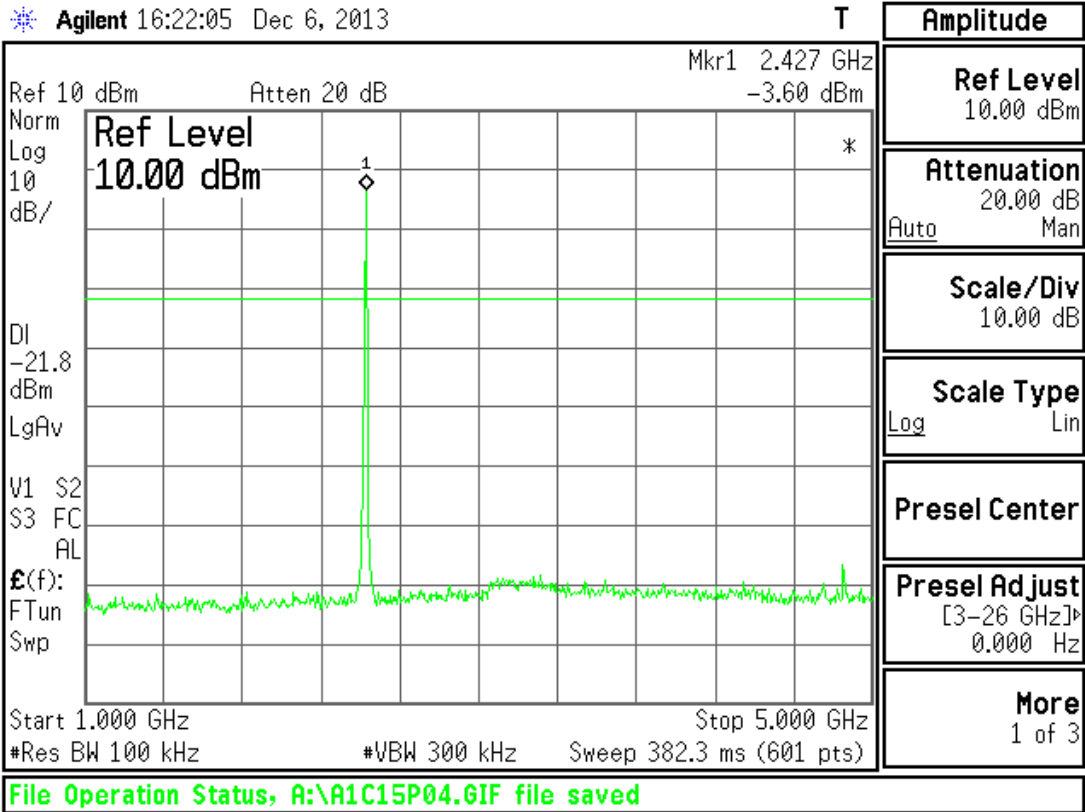


Conducted Spurious emissions 30 MHz to 200 MHz Antenna 1 - 2425 MHz

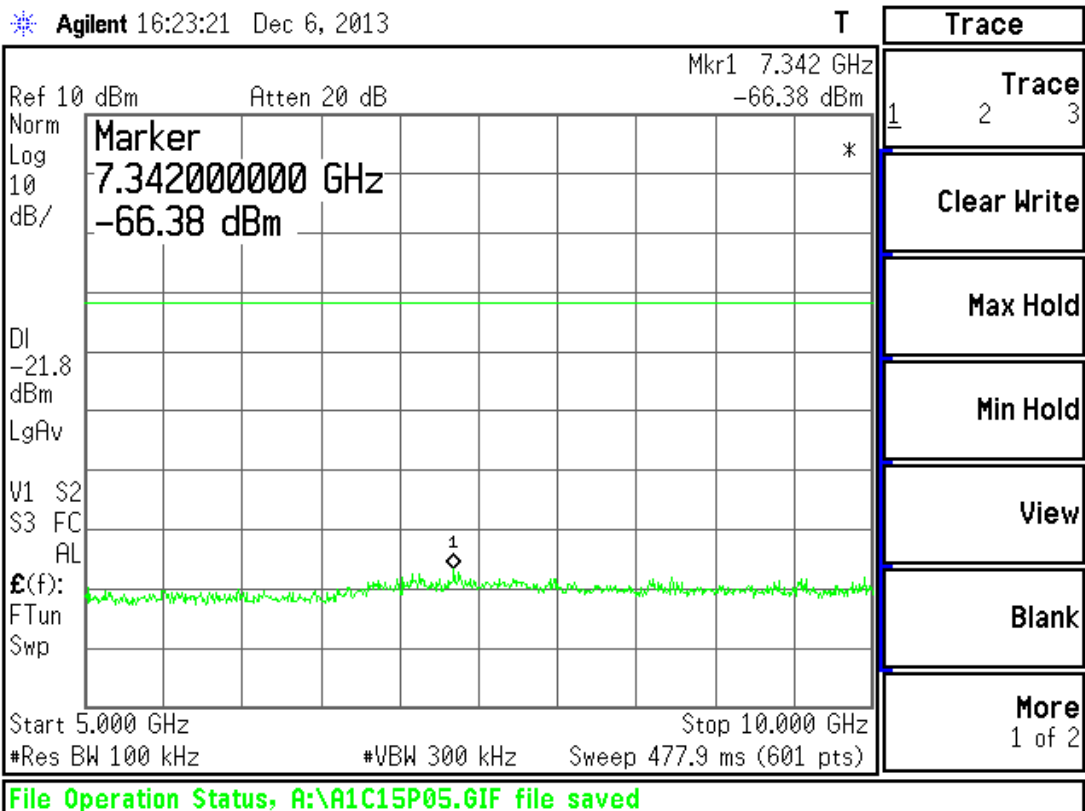


Conducted Spurious emissions 200 MHz to 1 GHz Antenna 1 - 2425 MHz

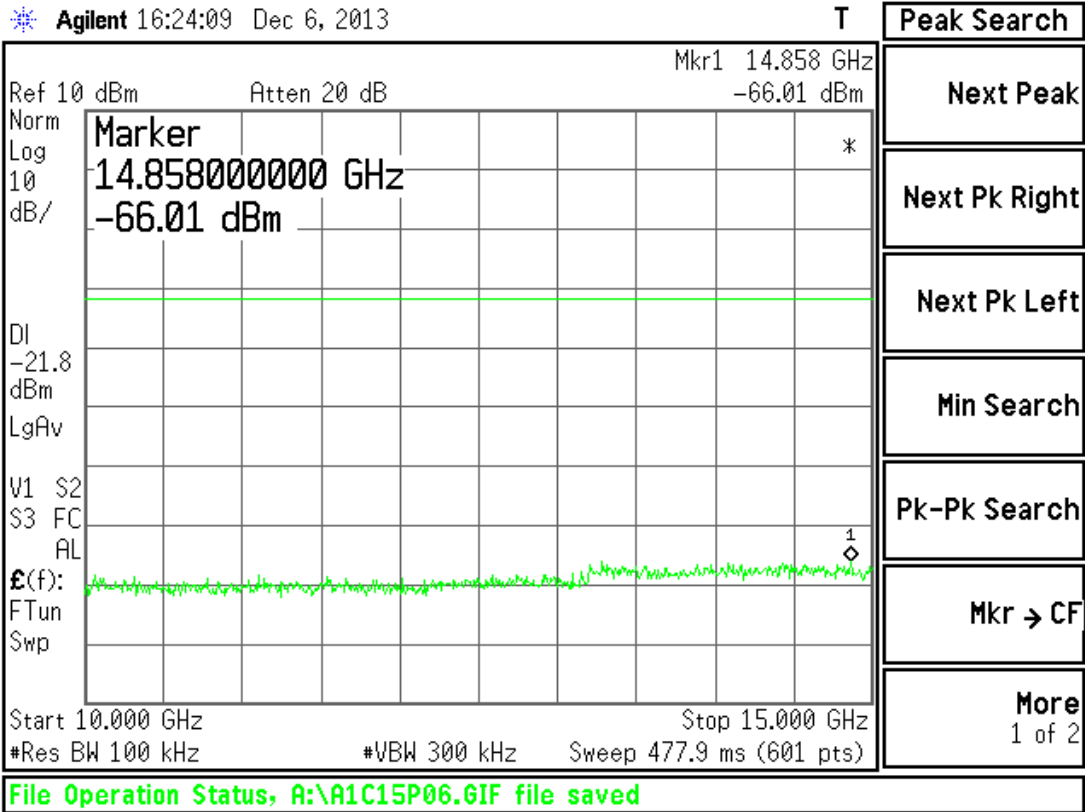




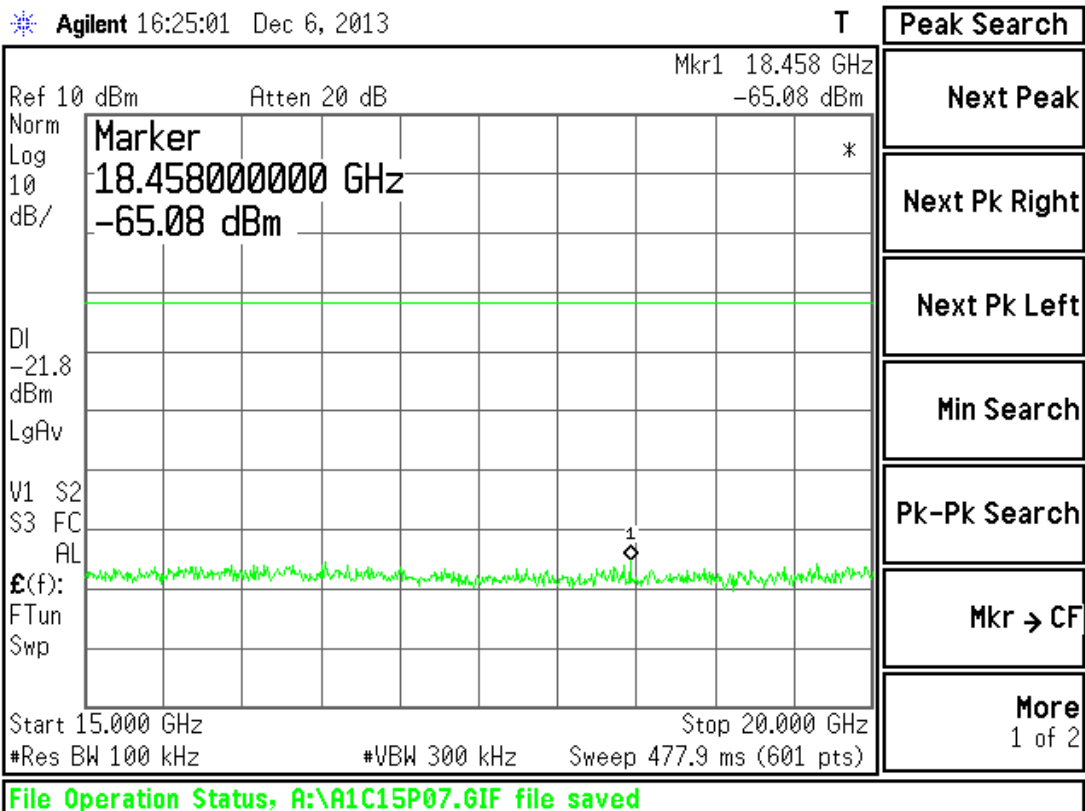
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 1 - 2425 MHz



Conducted Spurious emissions 5 GHz to 10 GHz Antenna 1 - 2425 MHz

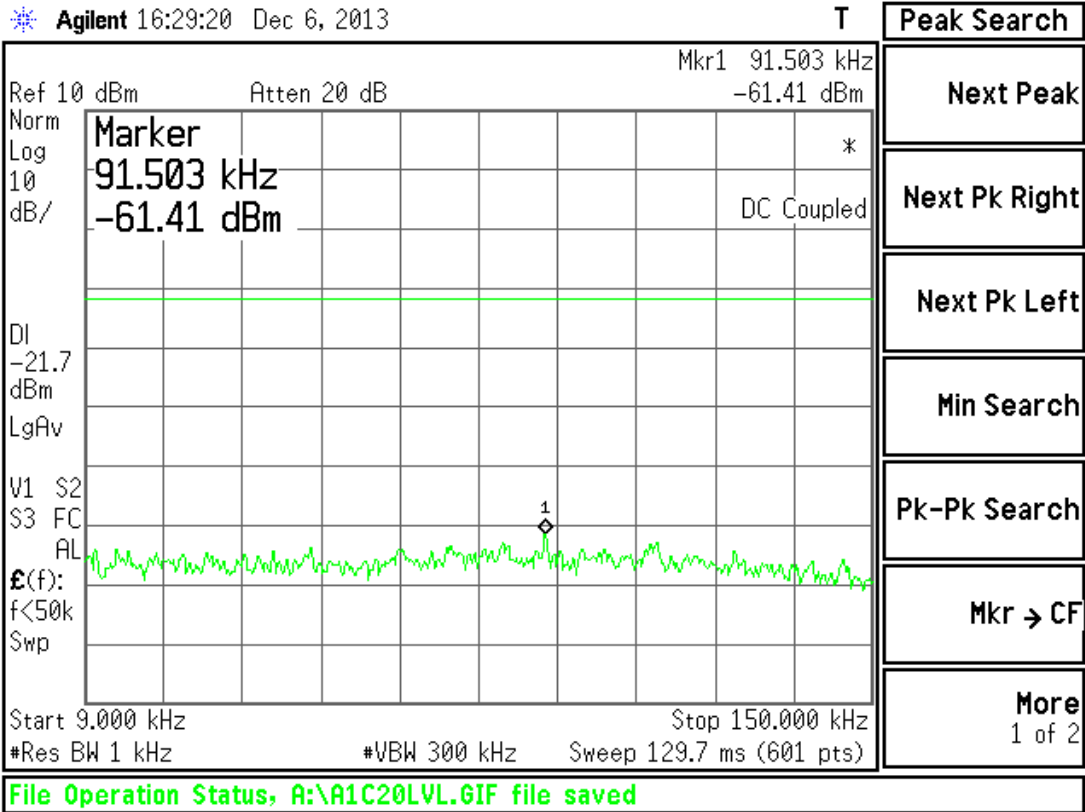


Conducted Spurious emissions 10 GHz to 15 GHz Antenna 1 - 2425 MHz

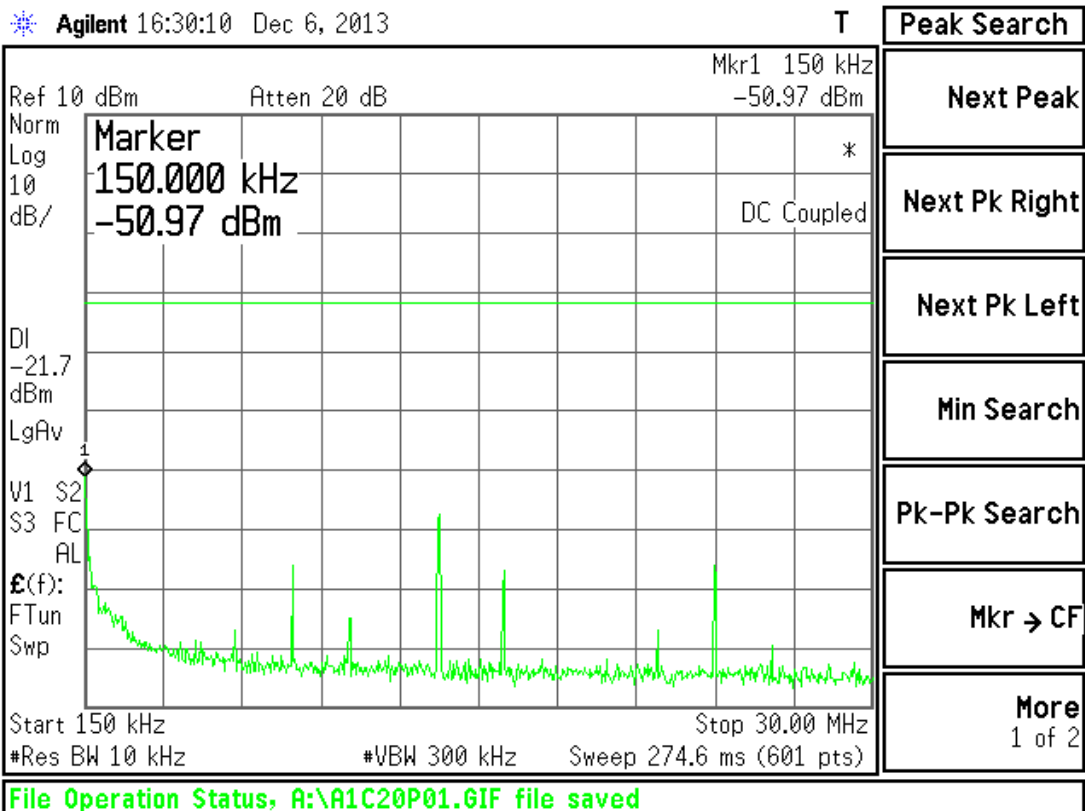


Conducted Spurious emissions 15 GHz to 20 GHz Antenna 1 - 2425 MHz

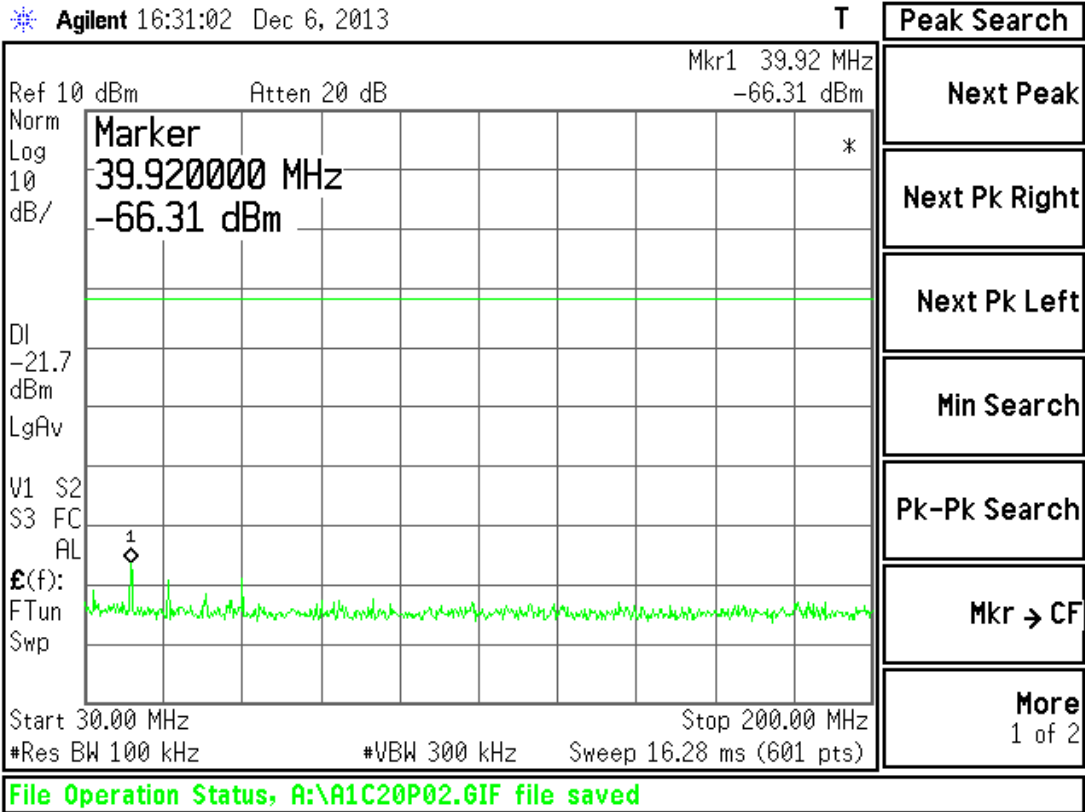




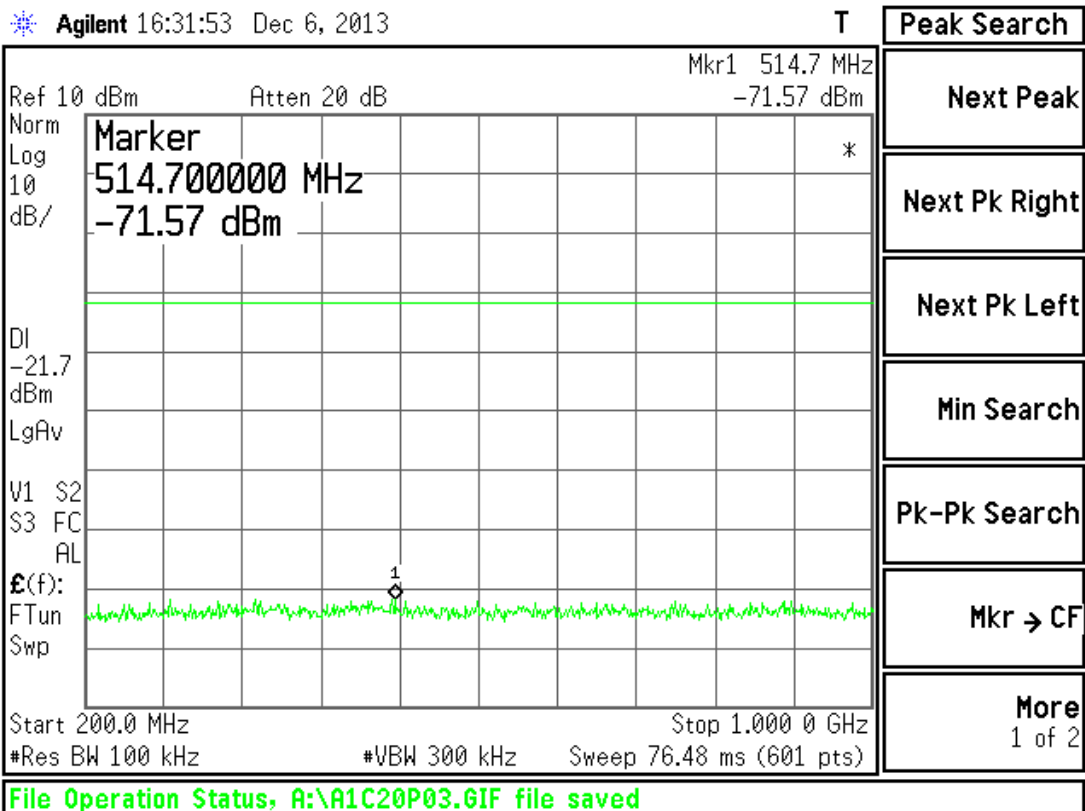
Conducted Spurious emissions 9kHz to 150 kHz Antenna 1 – 2450 MHz



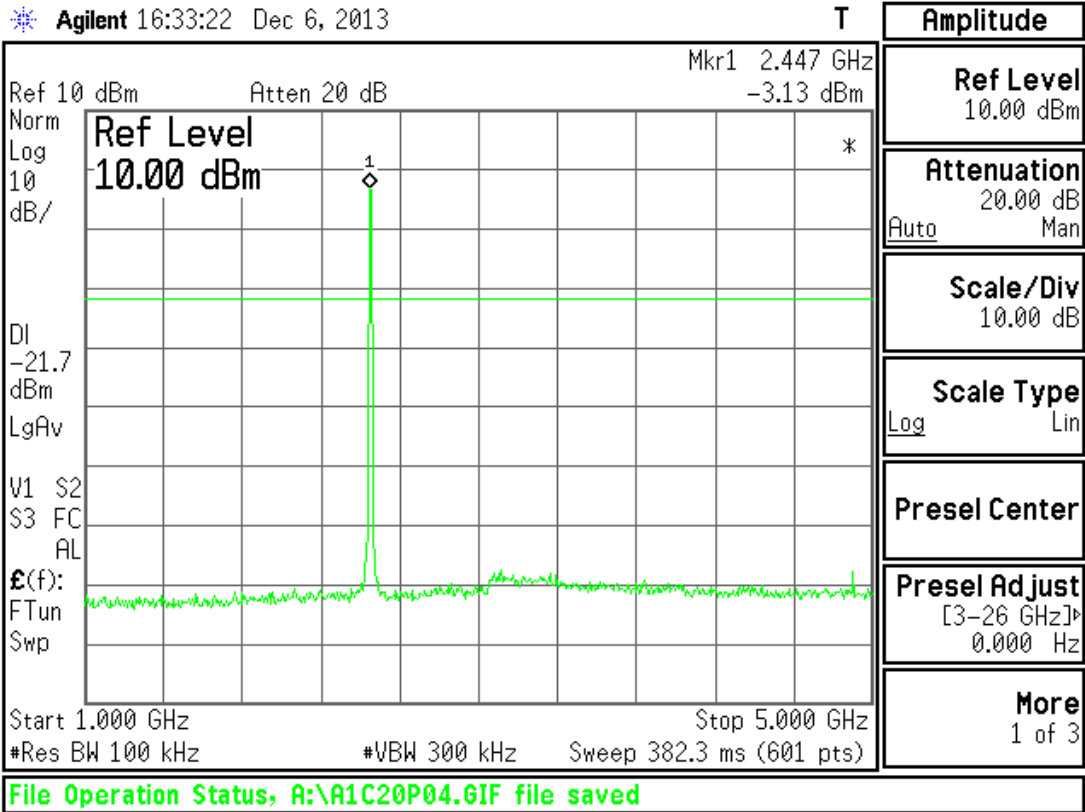
Conducted Spurious emissions 150 kHz to 30 MHz Antenna 1 – 2450 MHz



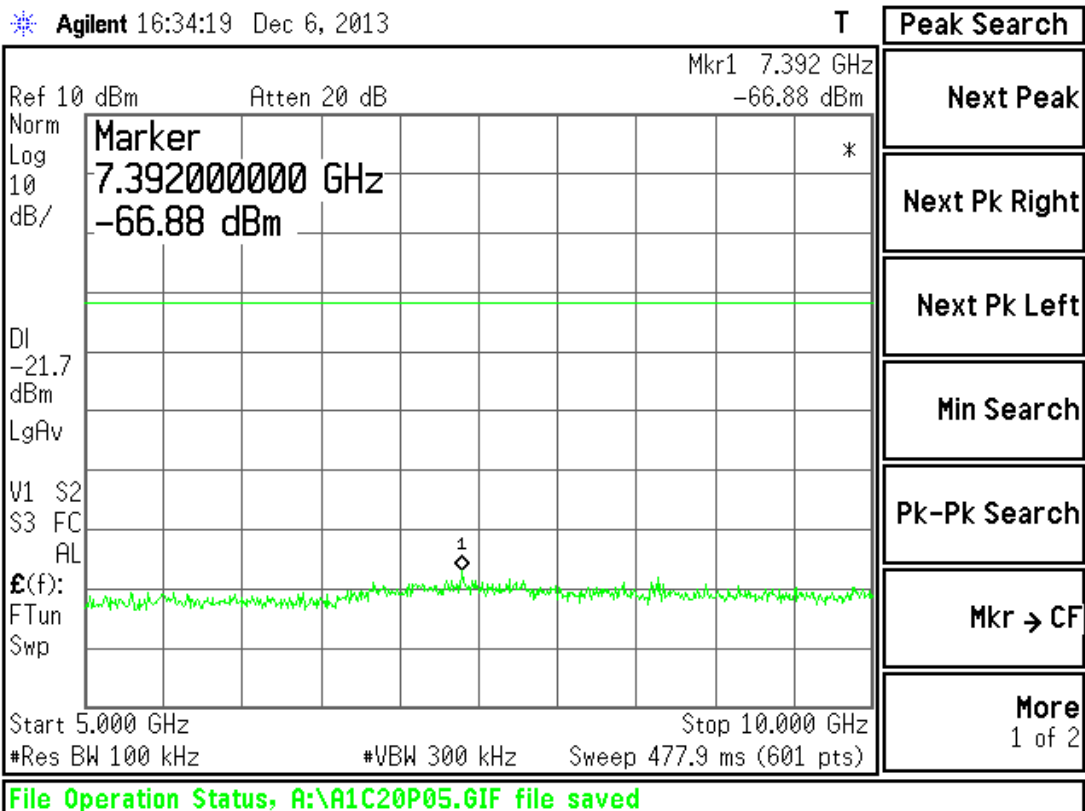
Conducted Spurious emissions 30 MHz to 200 MHz Antenna 1 - 2450 MHz



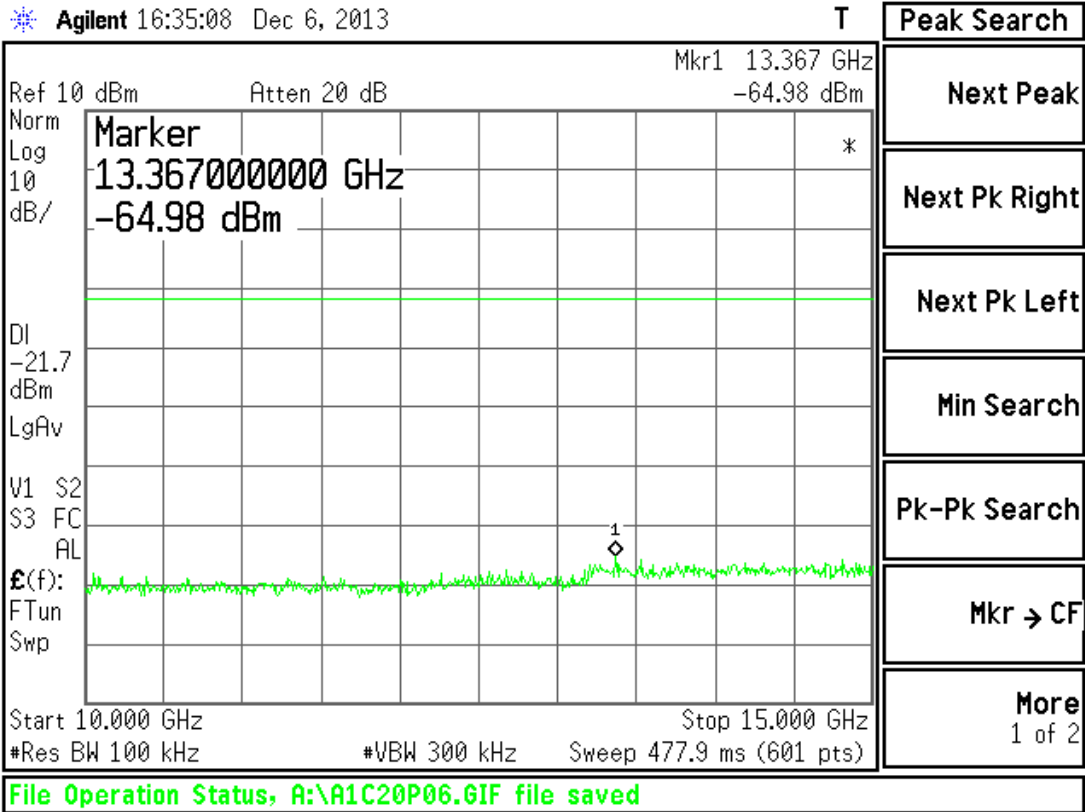
Conducted Spurious emissions 200 MHz to 1 GHz Antenna 1 - 2450 MHz



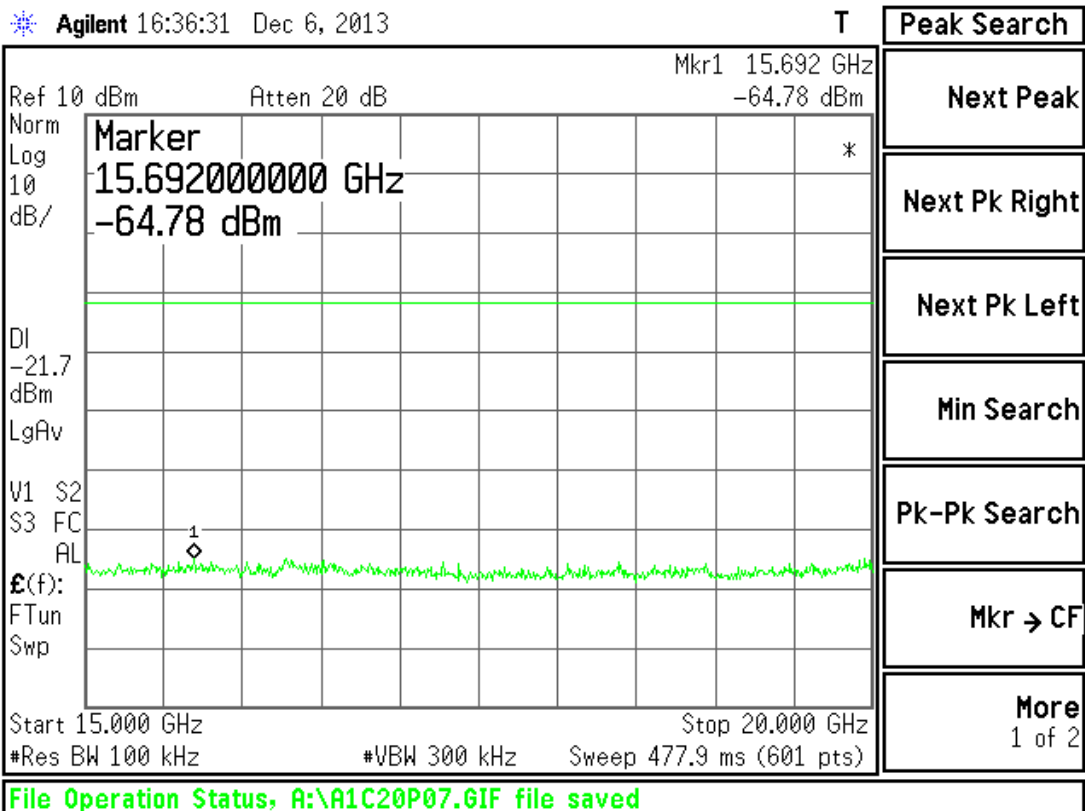
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 1 - 2450 MHz



Conducted Spurious emissions 5 GHz to 10 GHz Antenna 1 - 2450 MHz



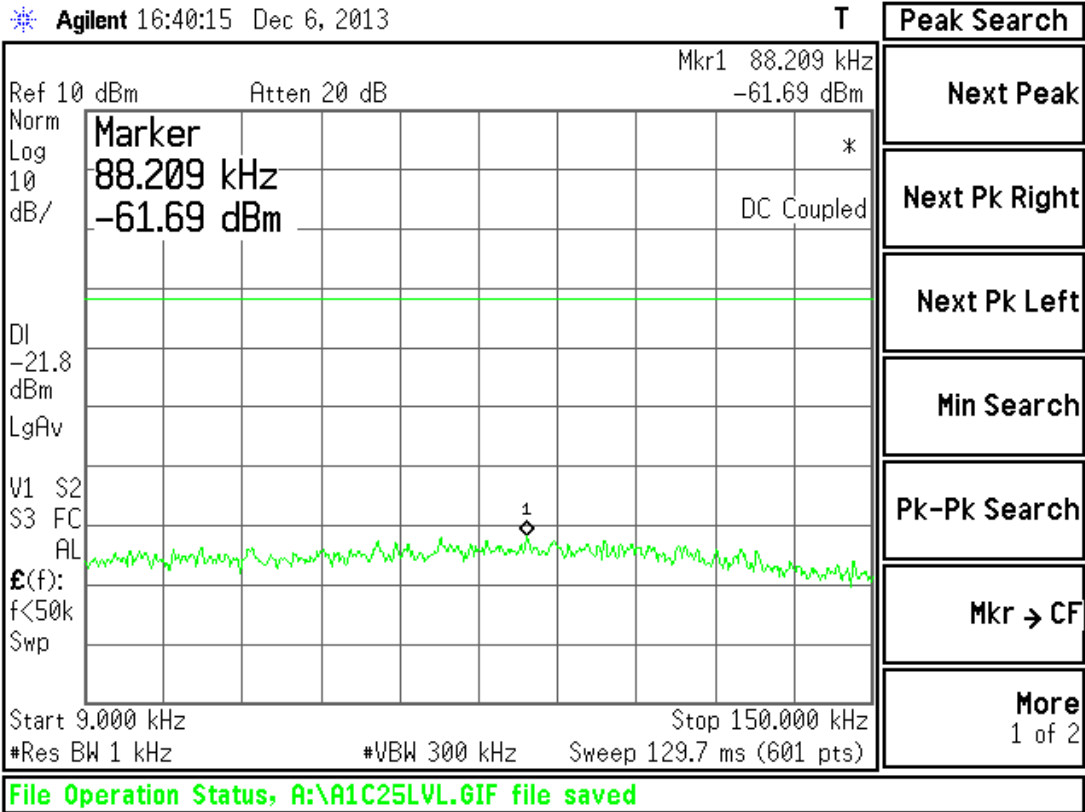
Conducted Spurious emissions 10 GHz to 15 GHz Antenna 1 - 2450 MHz



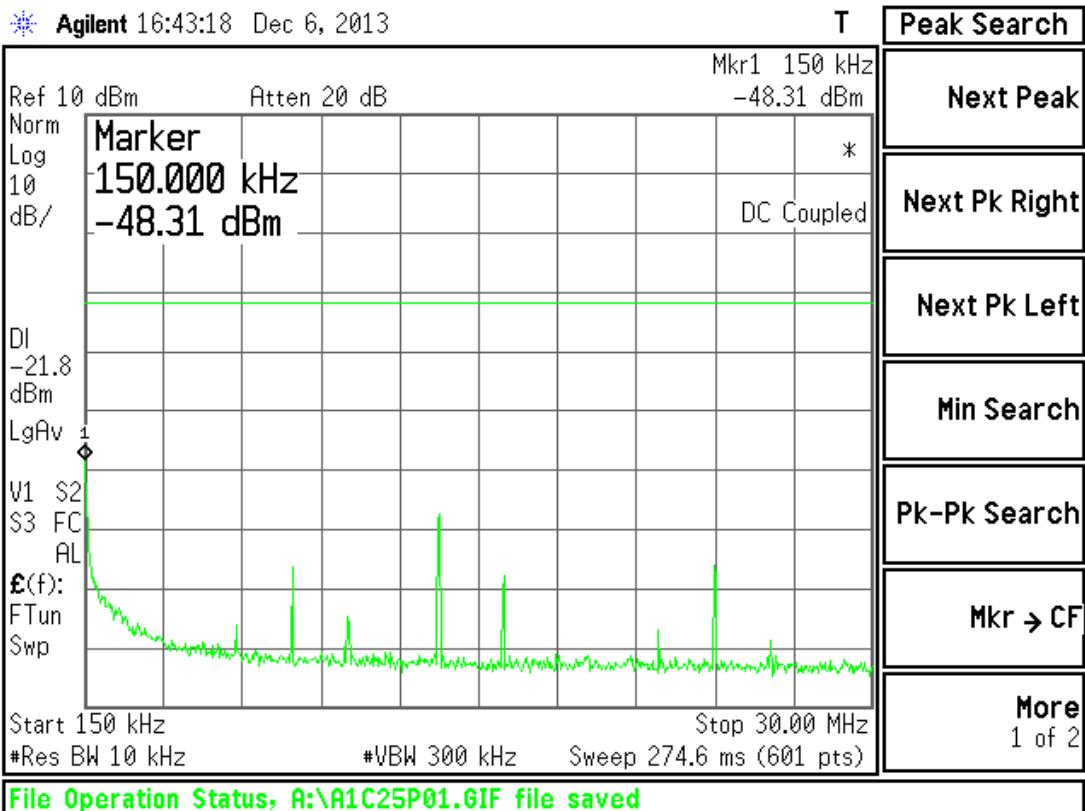
Conducted Spurious emissions 15 GHz to 20 GHz Antenna 1 - 2450 MHz





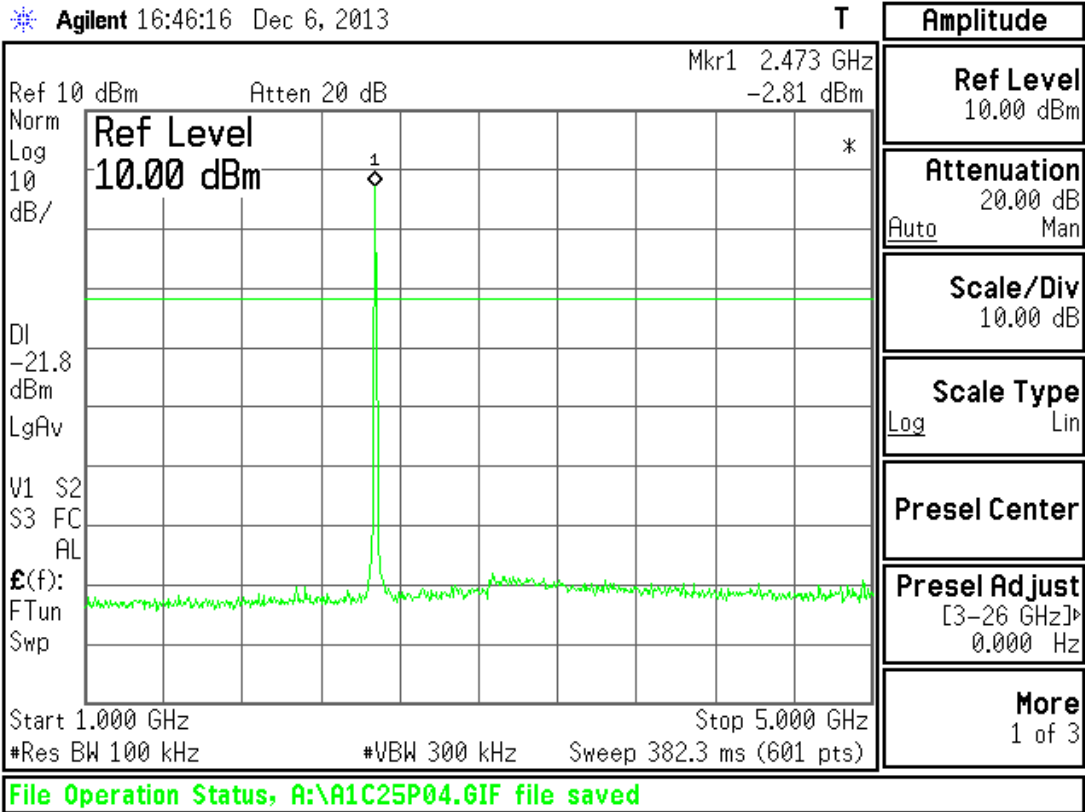


Conducted Spurious emissions 9kHz to 150 kHz Antenna 1 – 2475 MHz

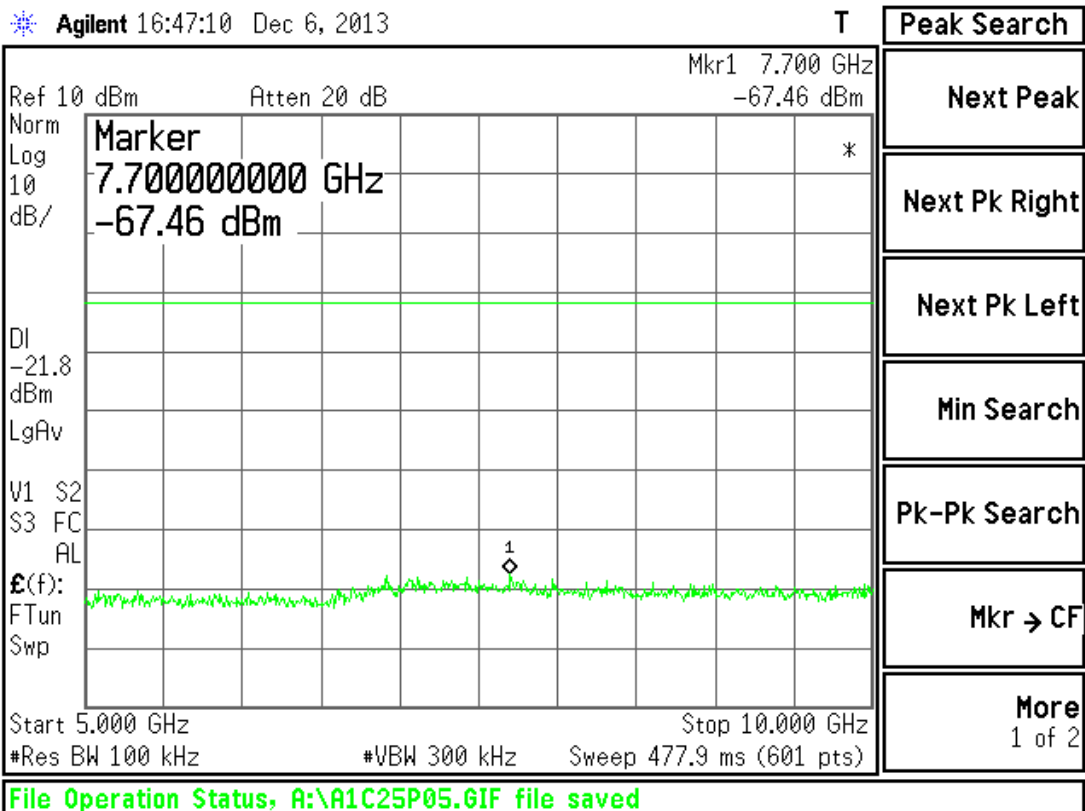


Conducted Spurious emissions 150 kHz to 30 MHz Antenna 1 – 2475 MHz

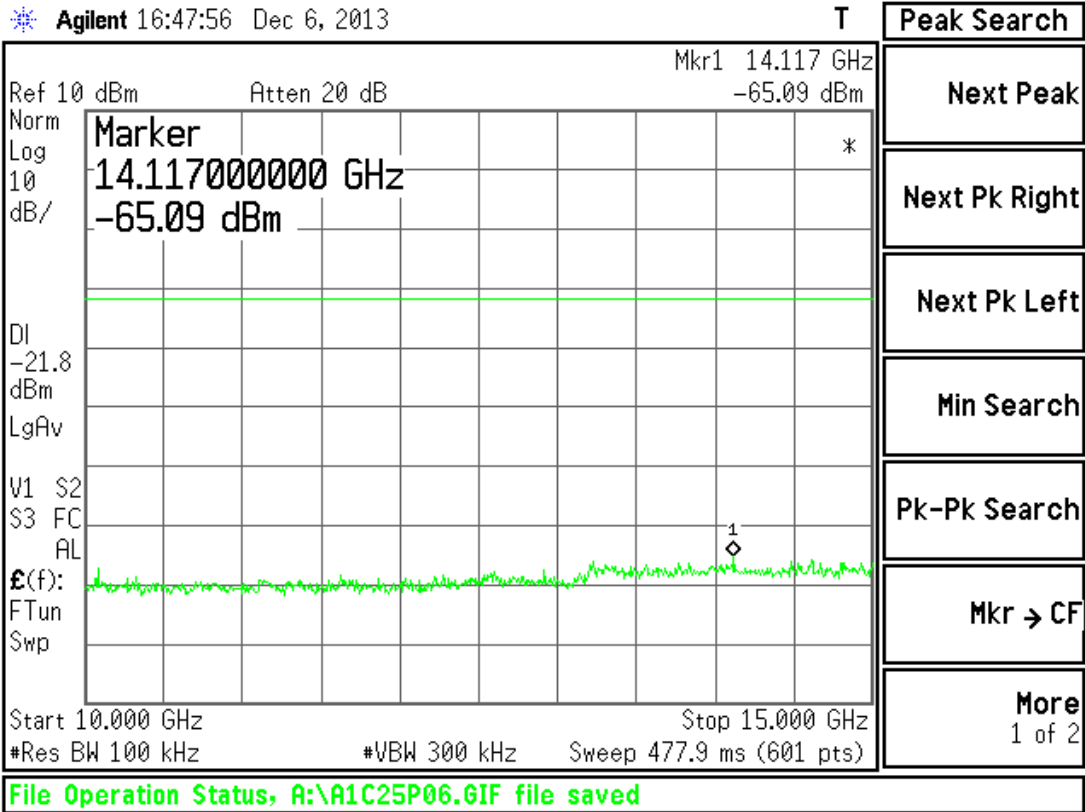




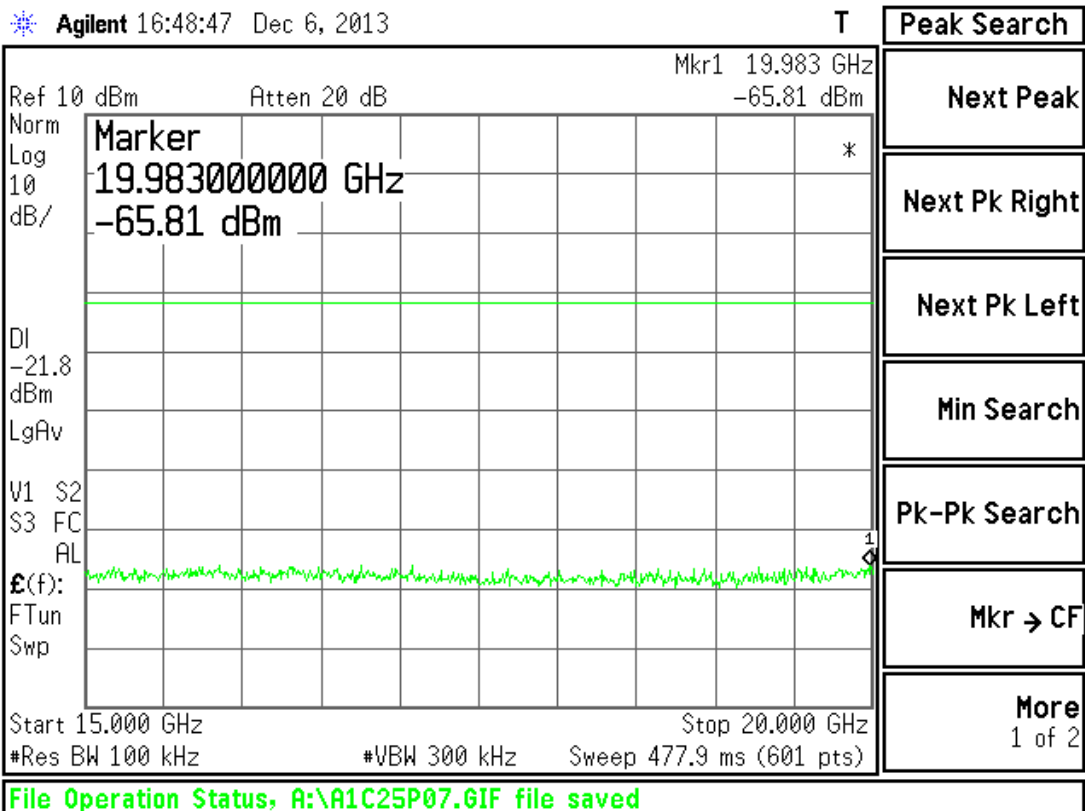
Conducted Spurious emissions 1 GHz to 5 GHz Antenna 1 - 2475 MHz



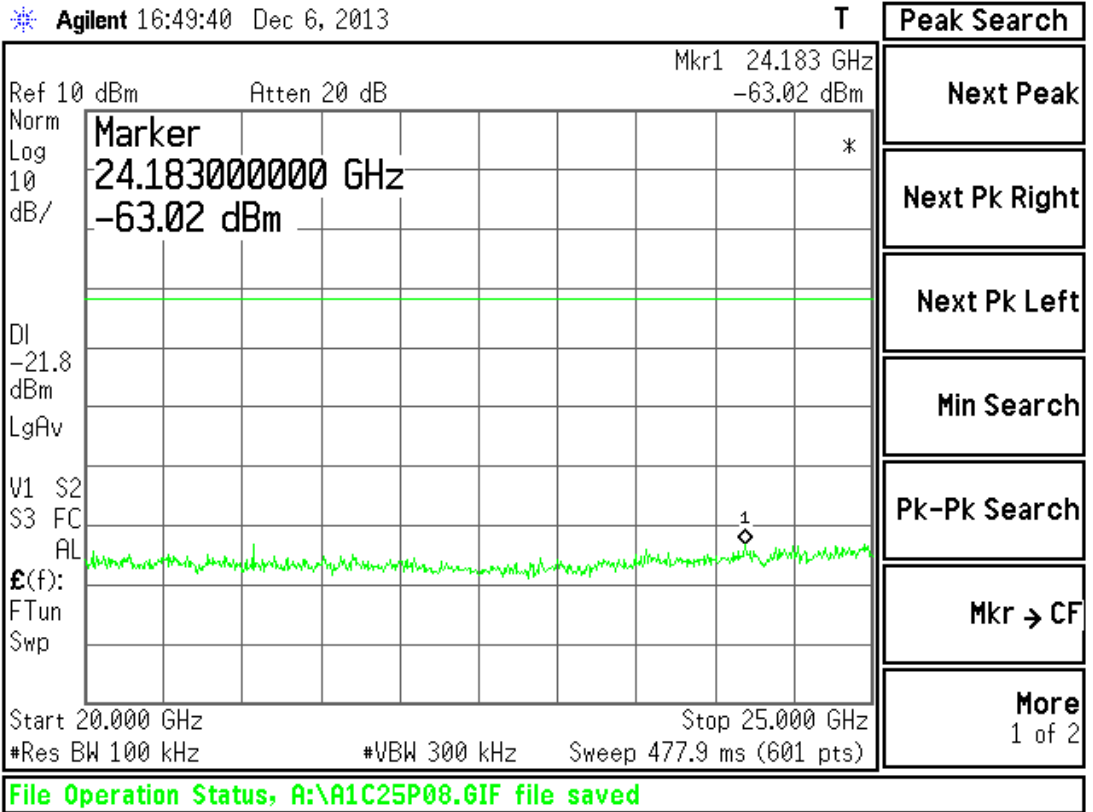
Conducted Spurious emissions 5 GHz to 10 GHz Antenna 1 - 2475 MHz



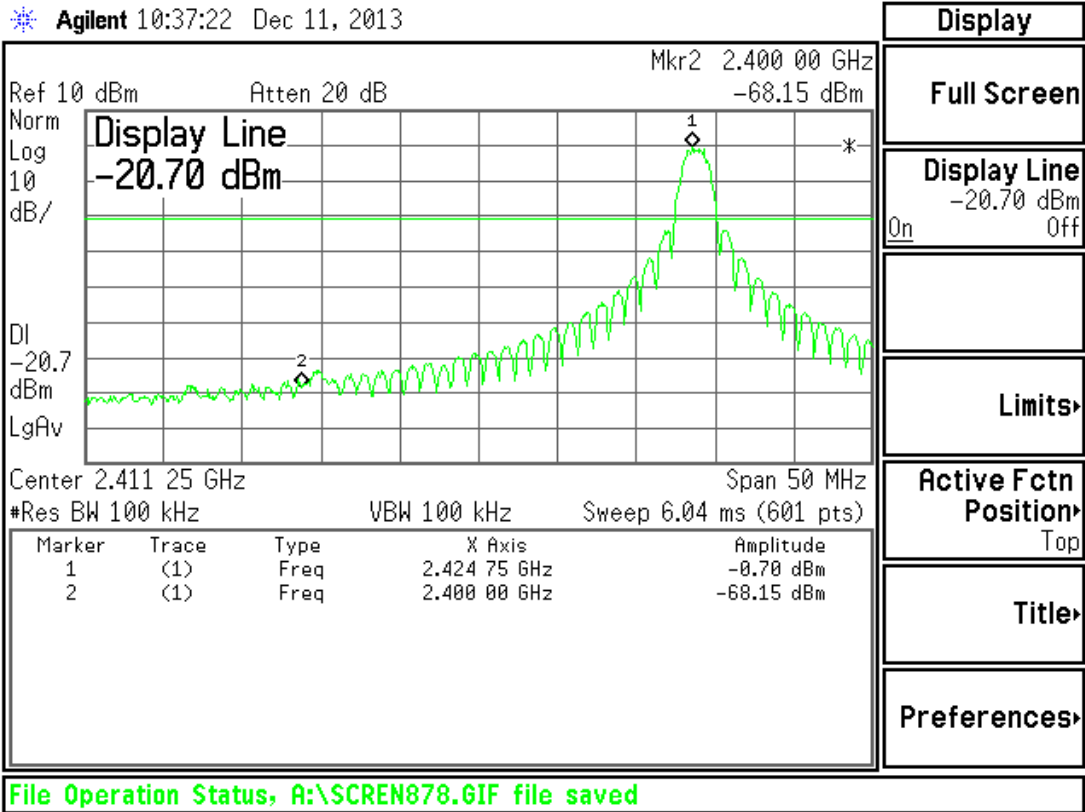
Conducted Spurious emissions 10 GHz to 15 GHz Antenna 1 - 2475 MHz



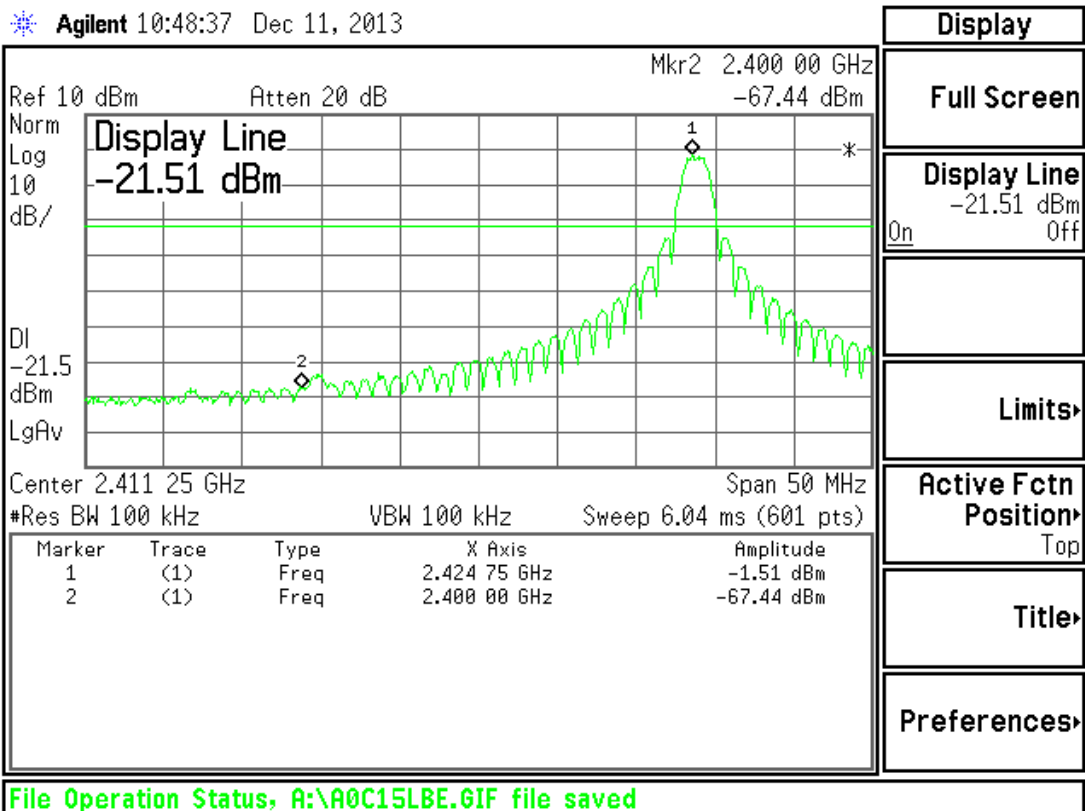
Conducted Spurious emissions 15 GHz to 20 GHz Antenna 1 - 2475 MHz



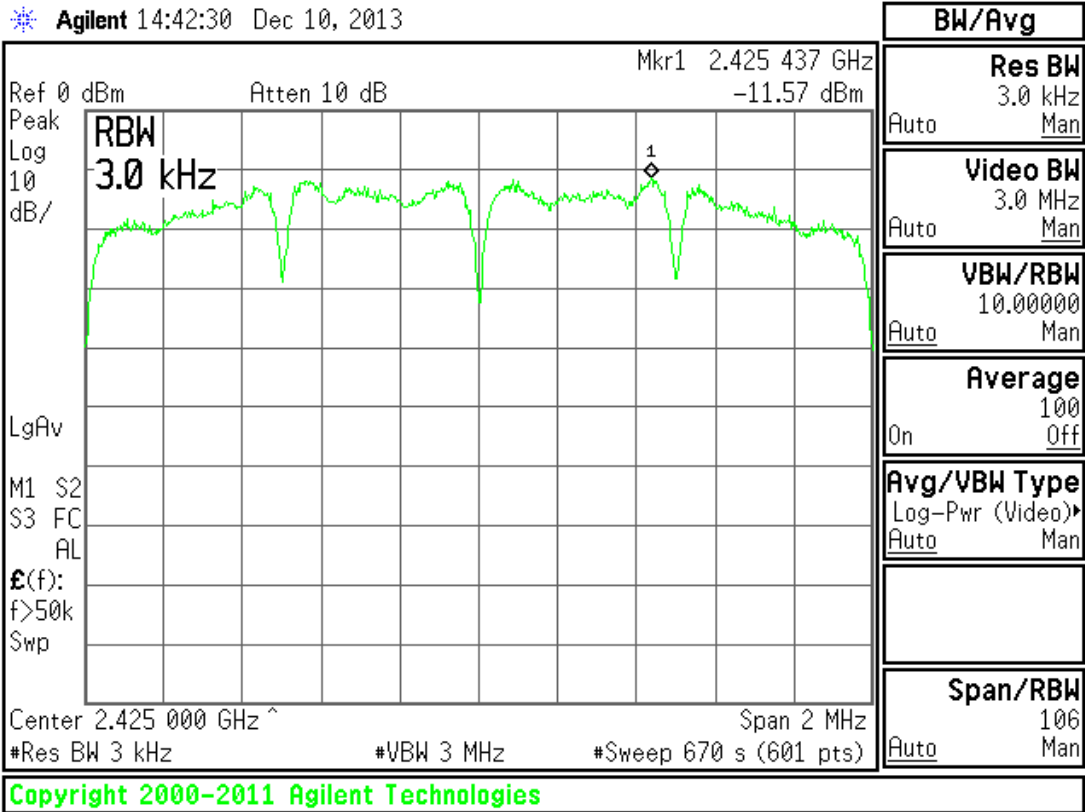
Conducted Spurious emissions 20 GHz to 25 GHz Antenna 1 - 2475 MHz



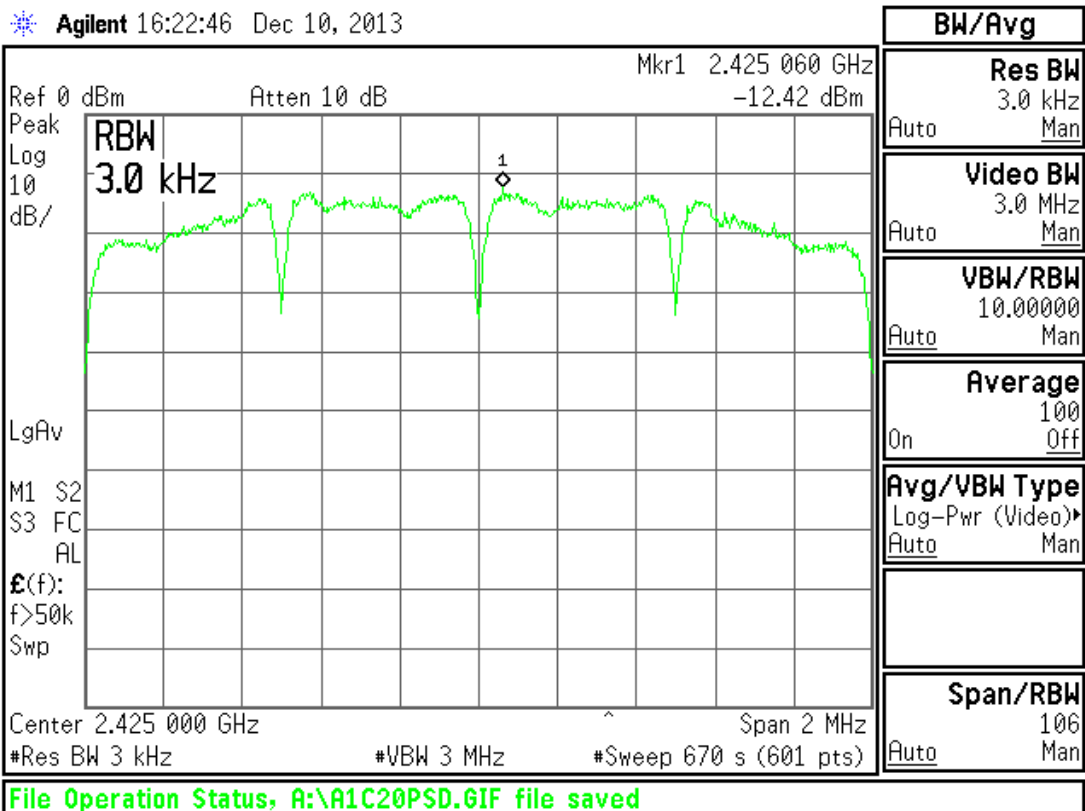
Lower Band Edge Antenna 0



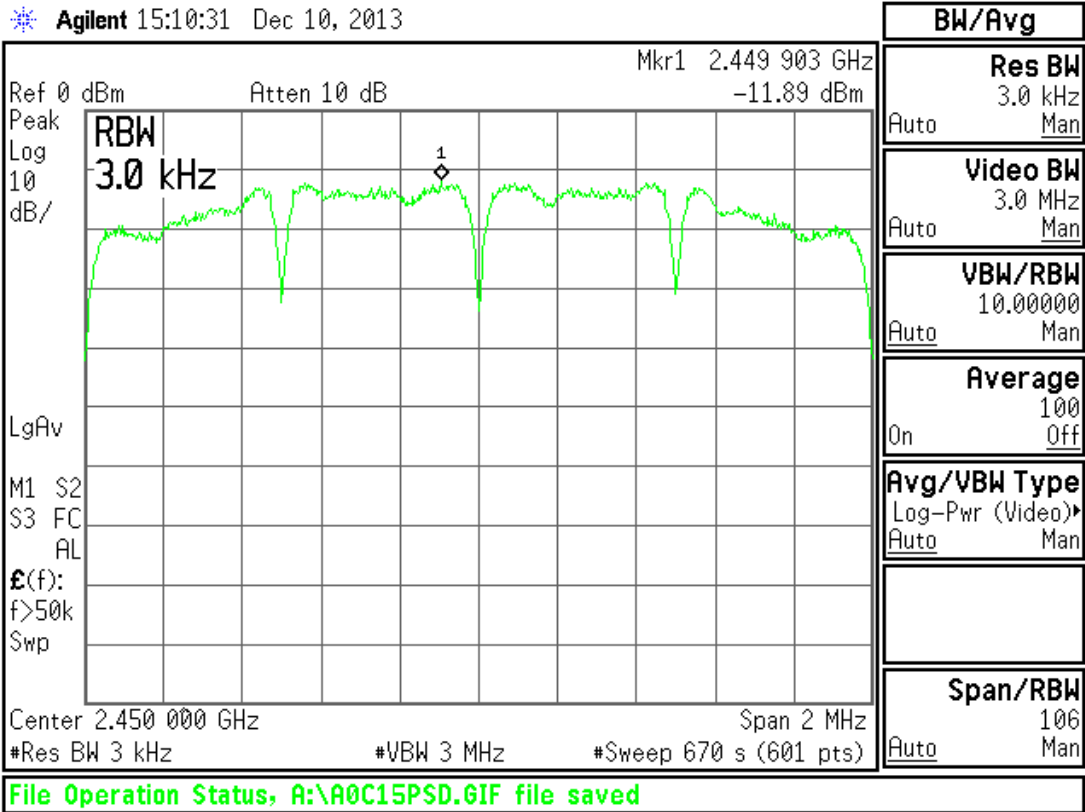
Lower Band Edge Antenna 1



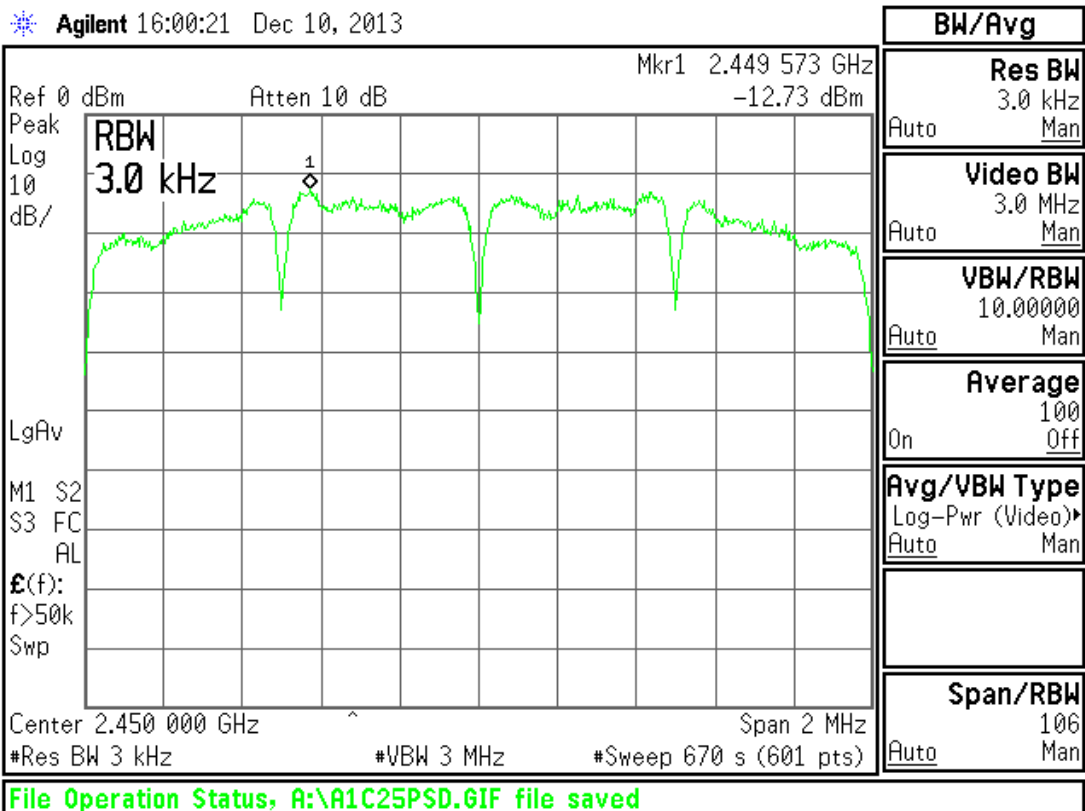
Conducted power spectral density Antenna 0 – 2425 MHz



Conducted power spectral density Antenna 1 – 2425 MHz

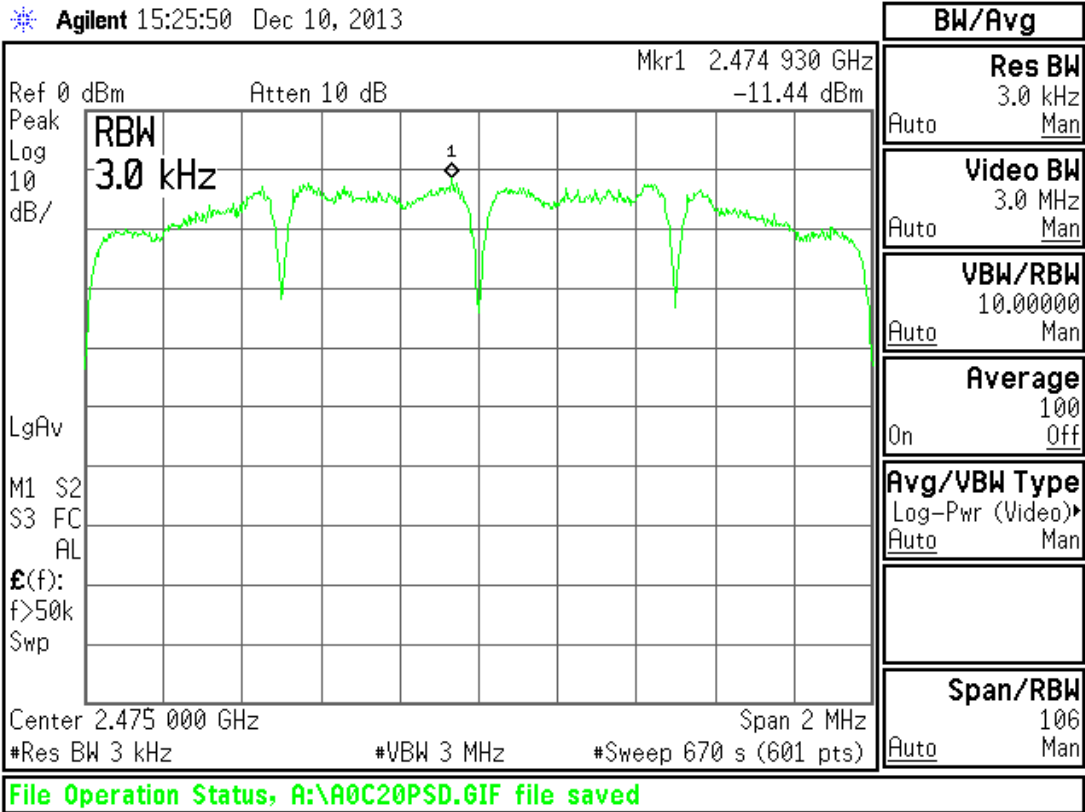


Conducted power spectral density Antenna 0- 2450 MHz

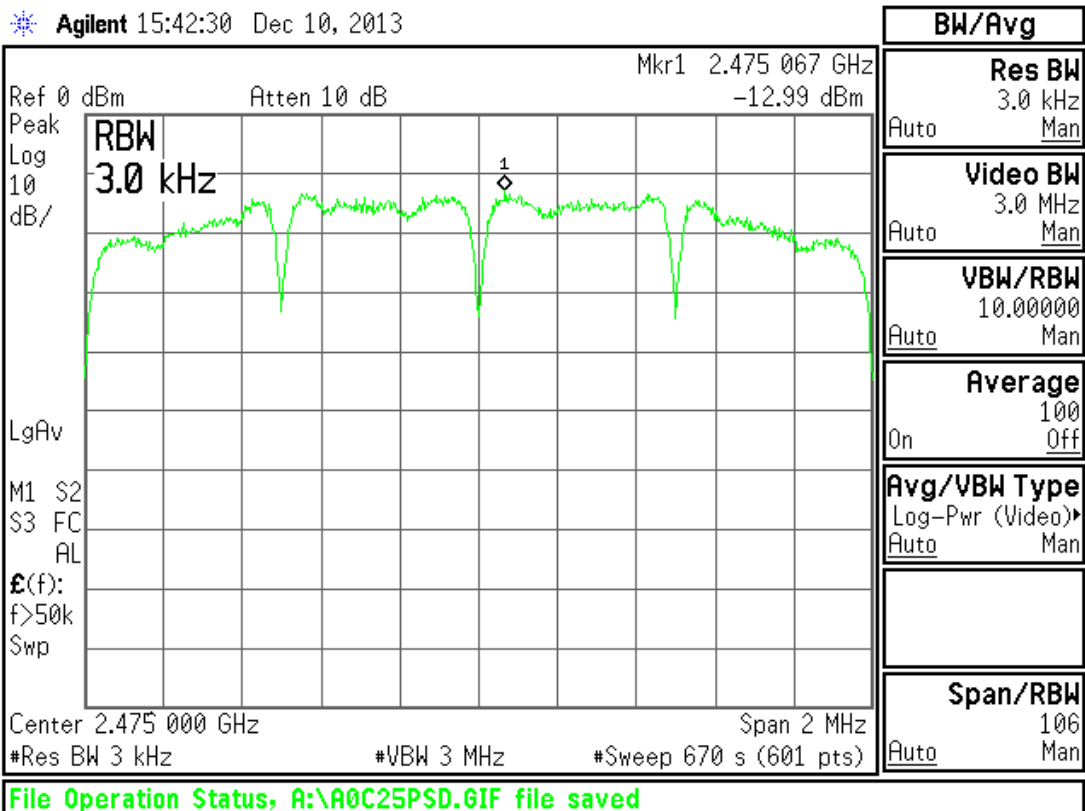


Conducted power spectral density Antenna 1- 2450 MHz

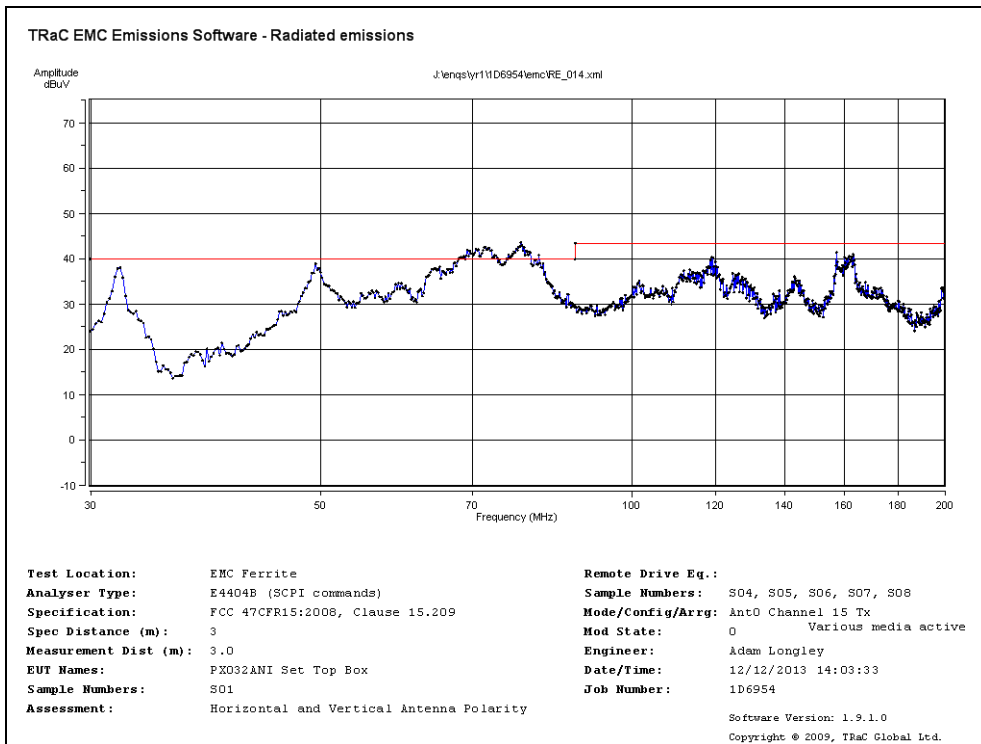




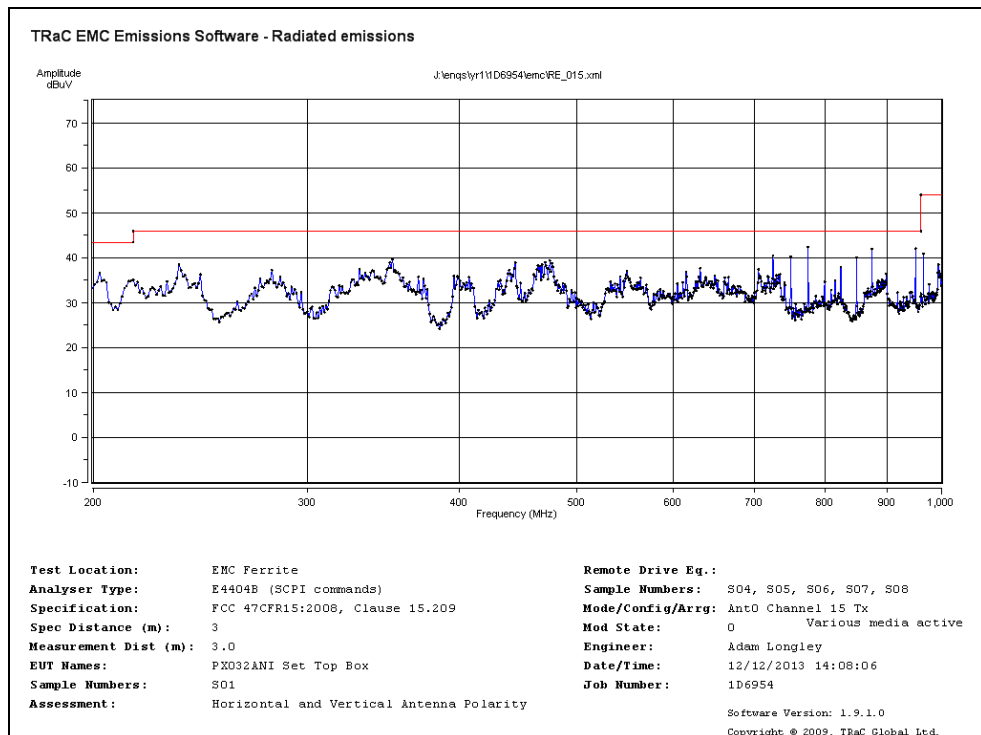
Conducted power spectral density Antenna 0- 2475 MHz



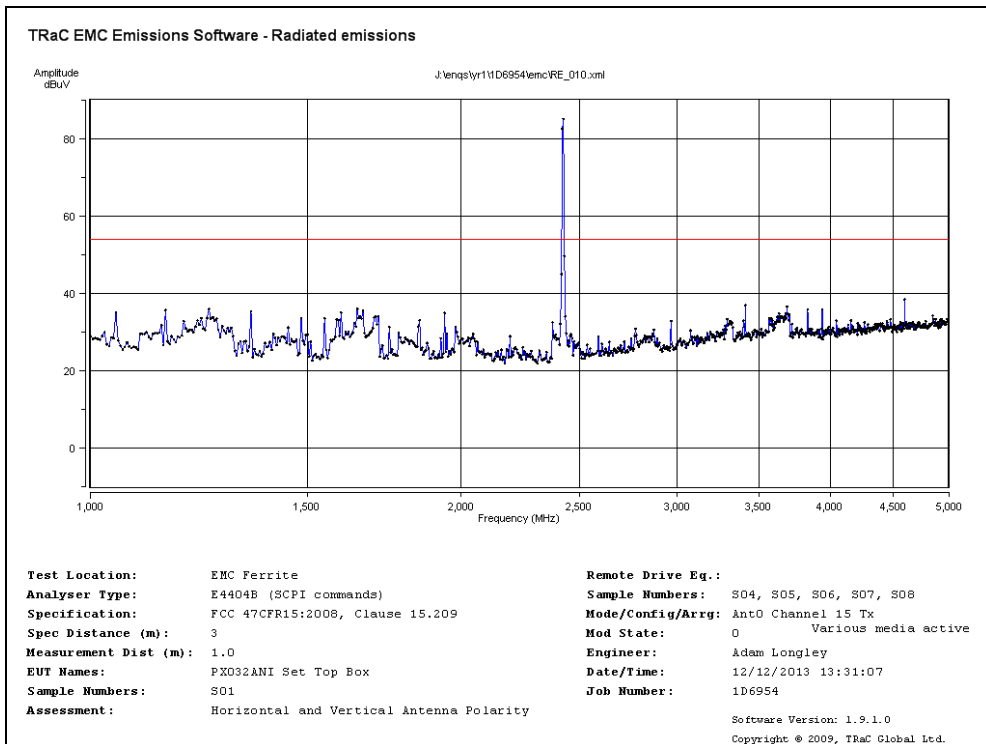
Conducted power spectral density Antenna 1- 2475 MHz



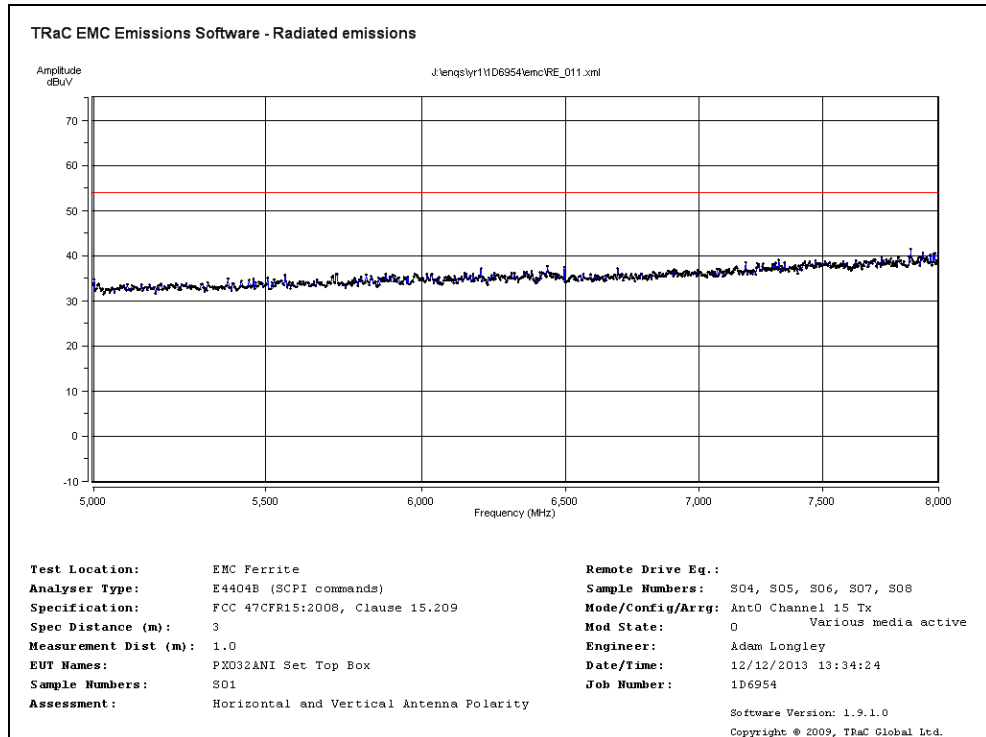
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
30MHz -200MHz



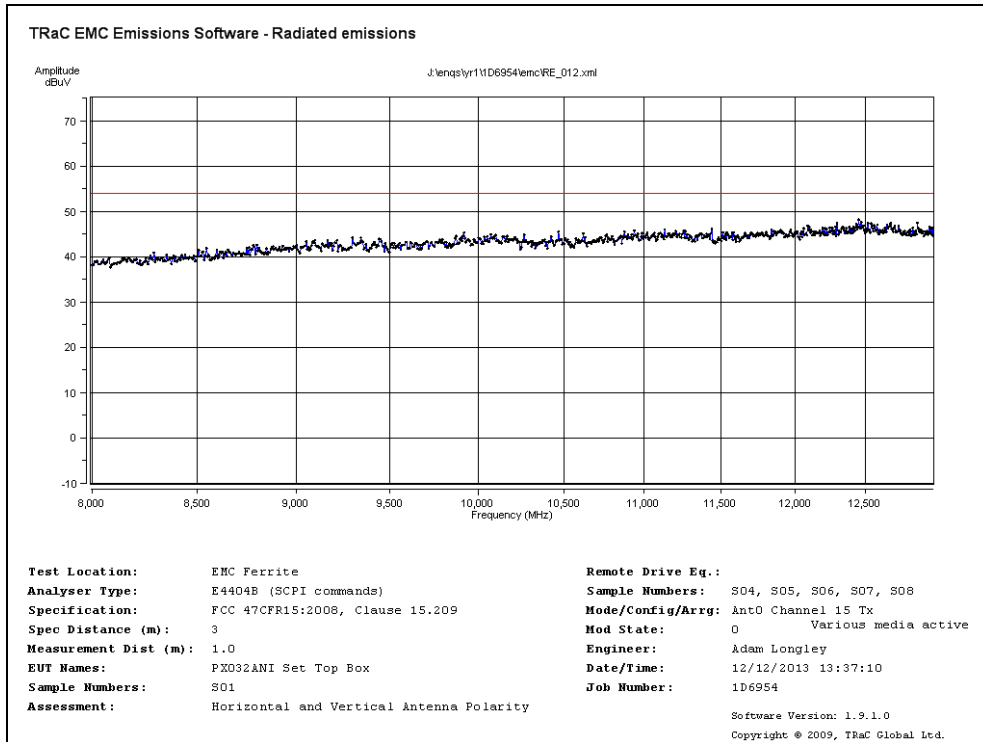
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
200MHz - 1GHz



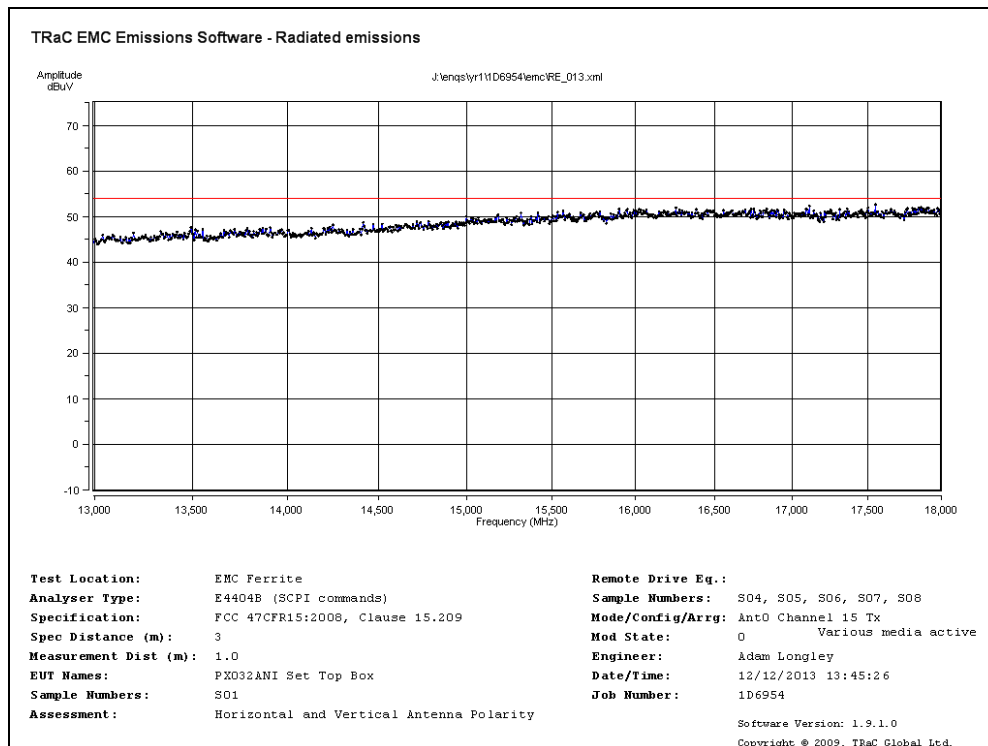
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
1GHz- 5GHz



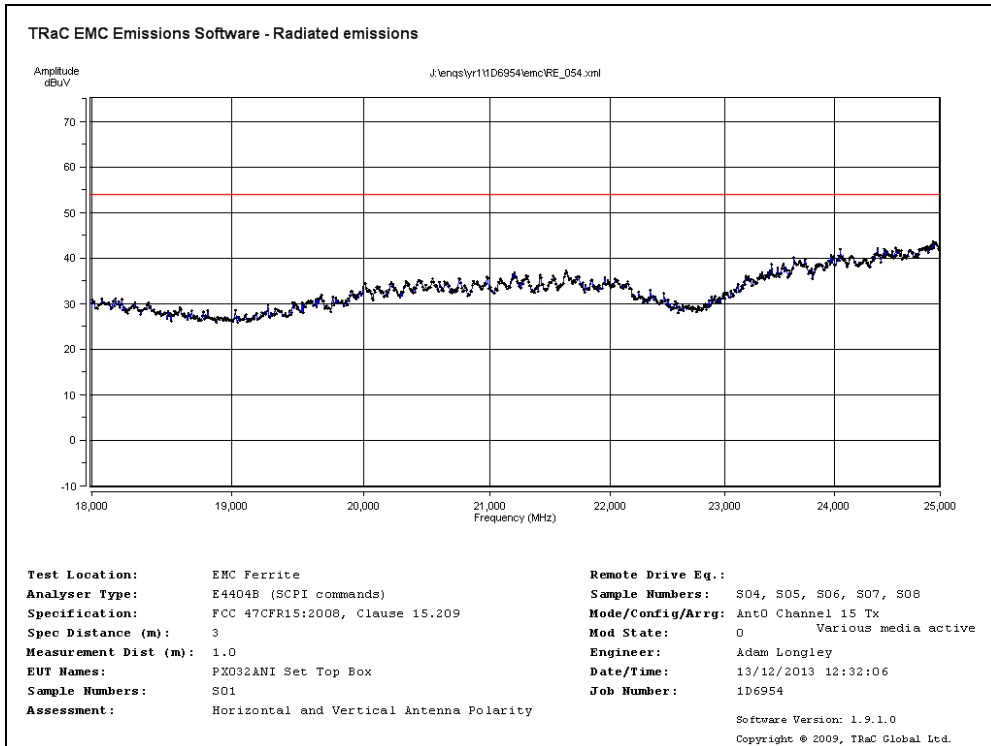
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
5GHz- 8GHz



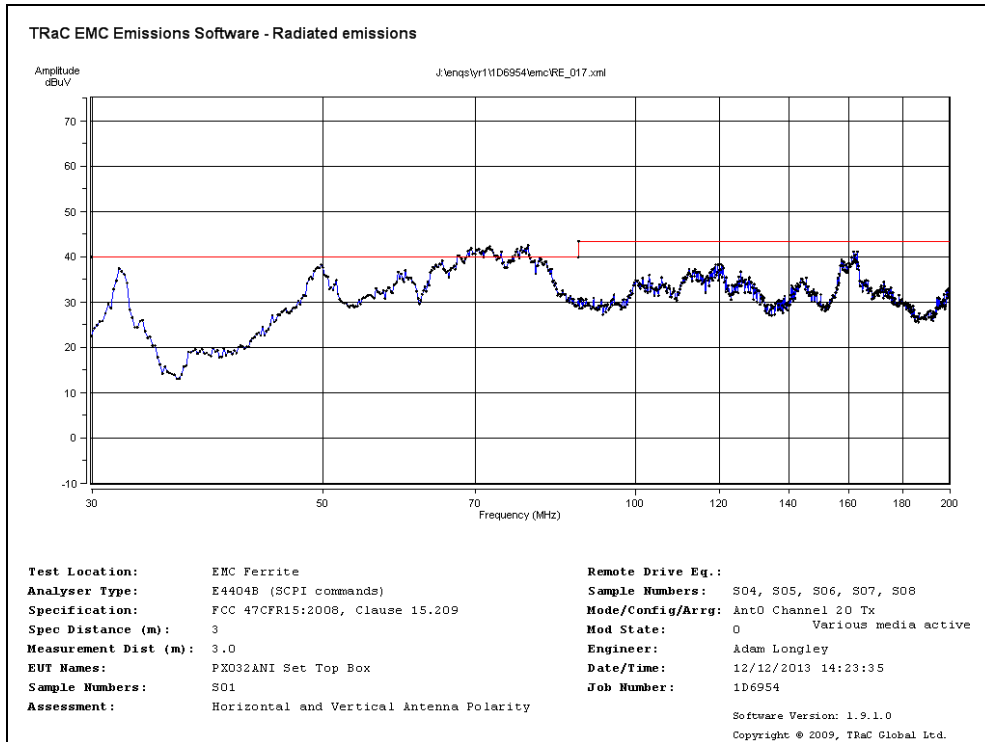
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
8GHz- 13GHz



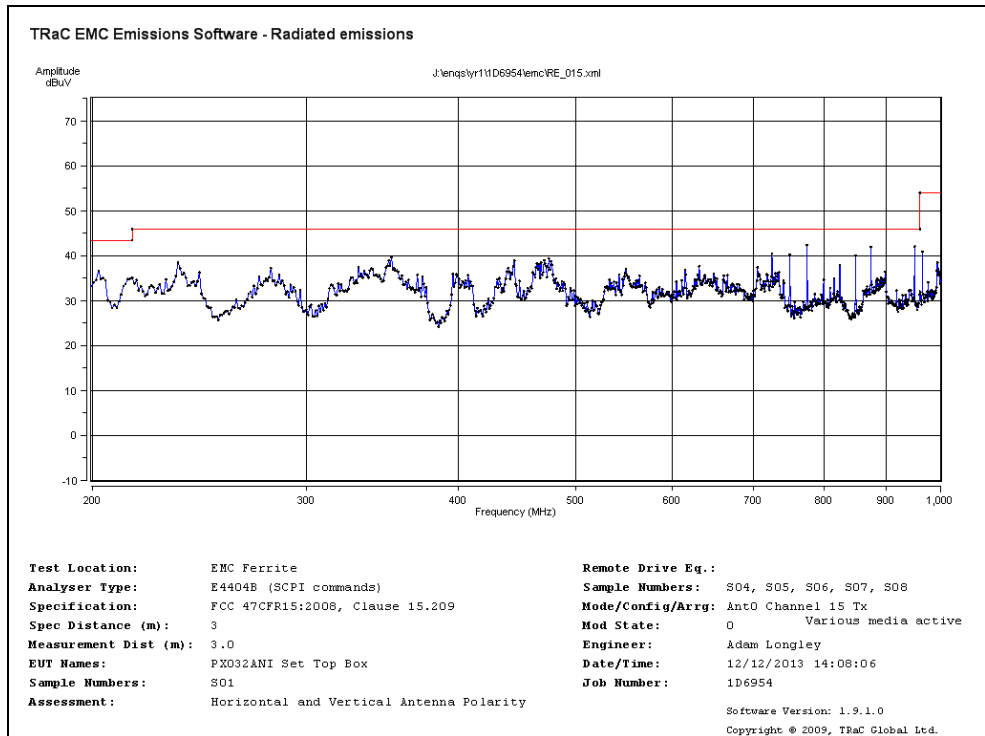
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
13GHz- 15GHz



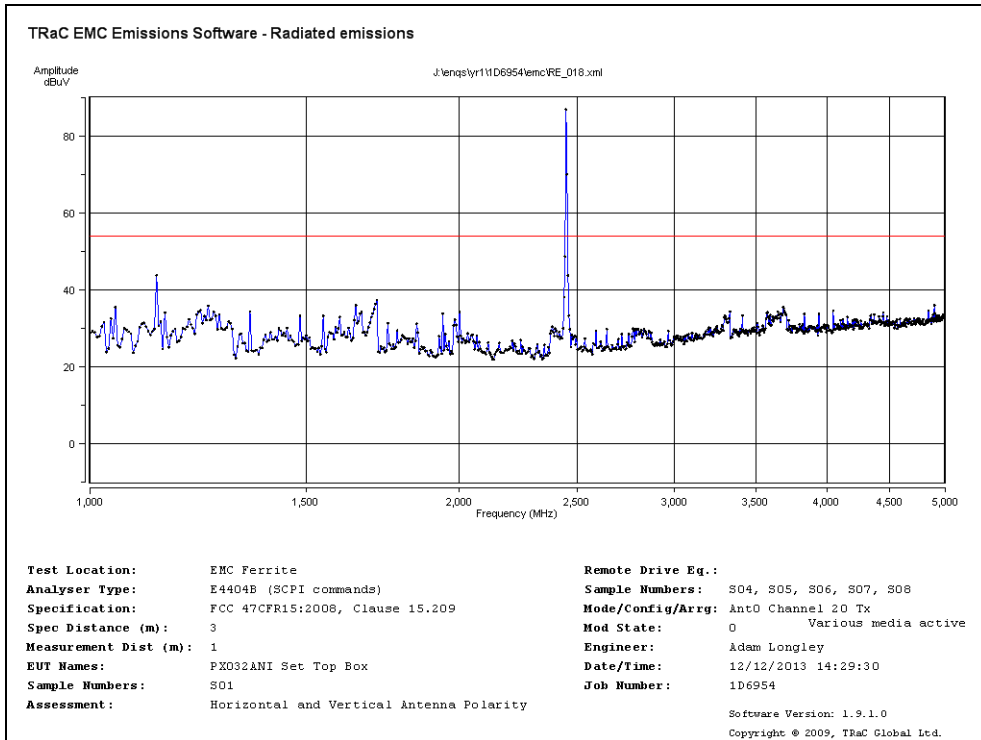
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 0  
13GHz- 25GHz



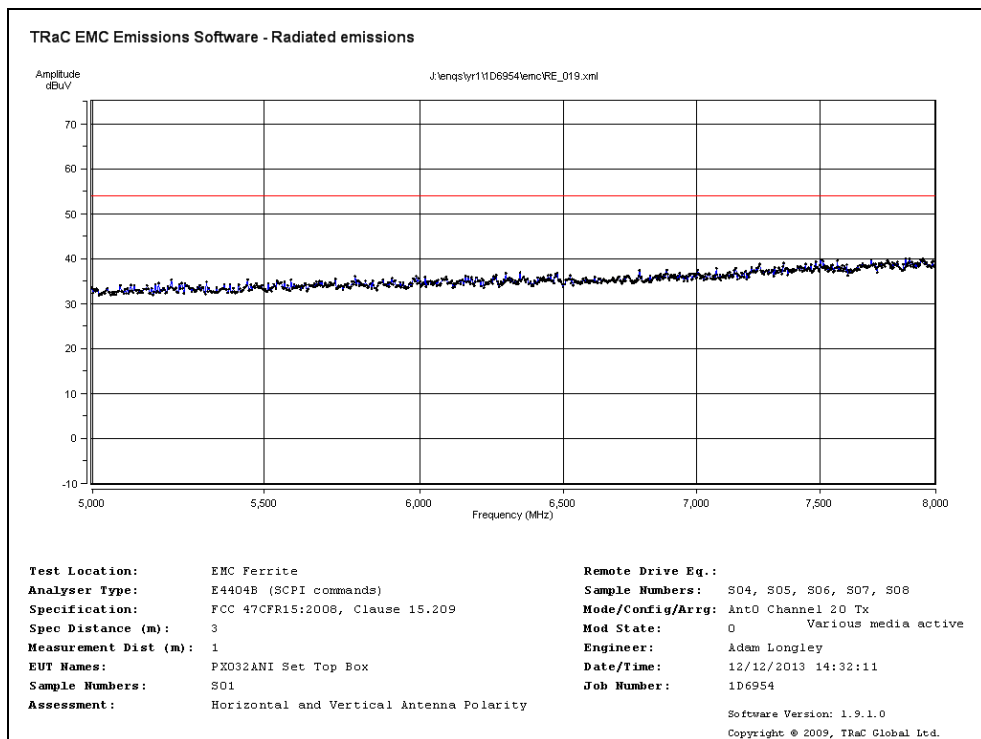
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
30MHz -200MHz



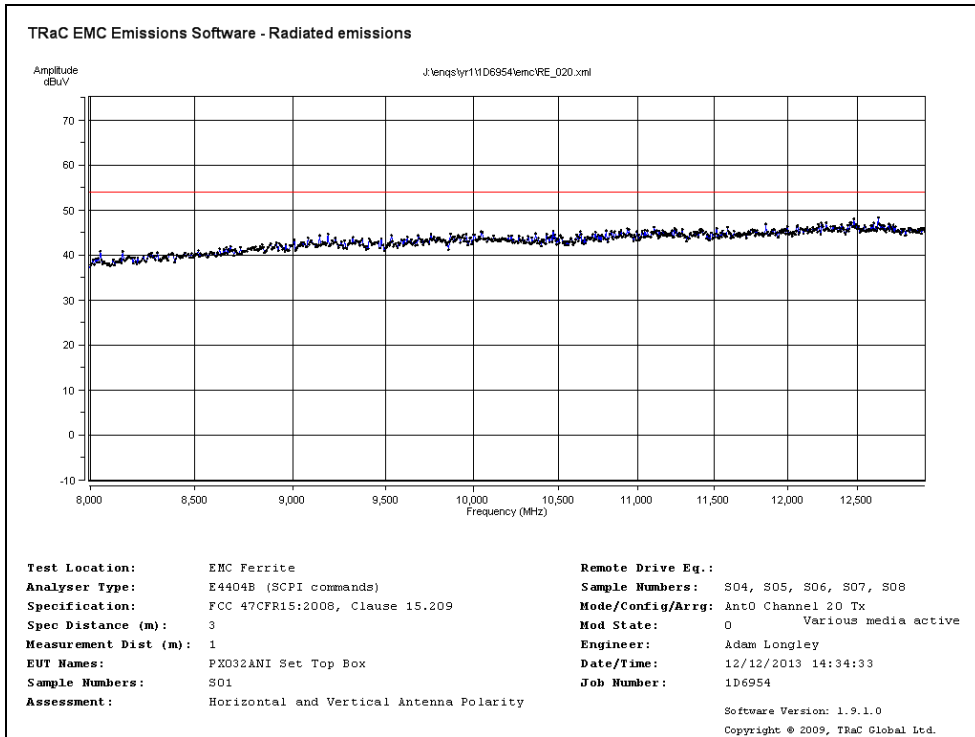
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
200MHz -1GHz



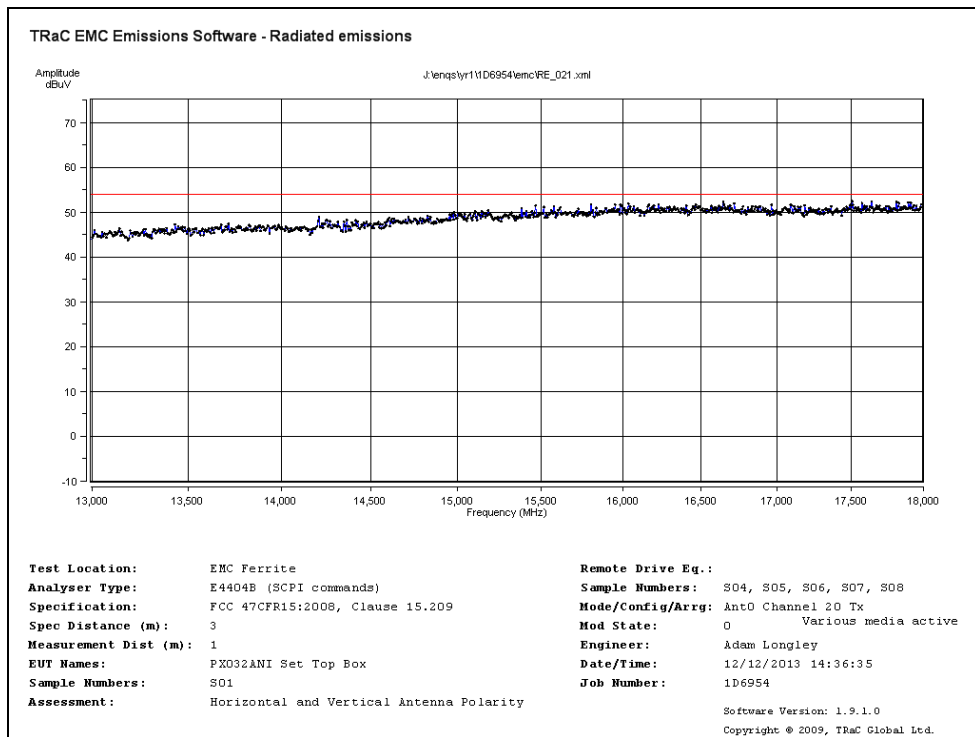
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
1GHz -5GHz



Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
5GHz -8GHz

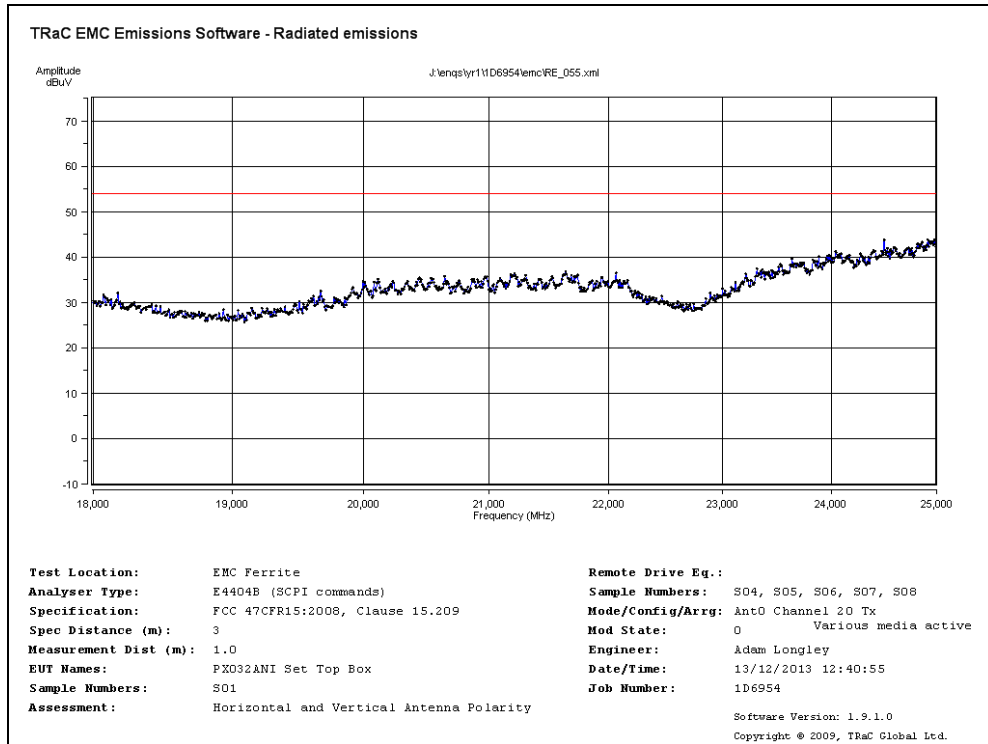


Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
8GHz -13GHz

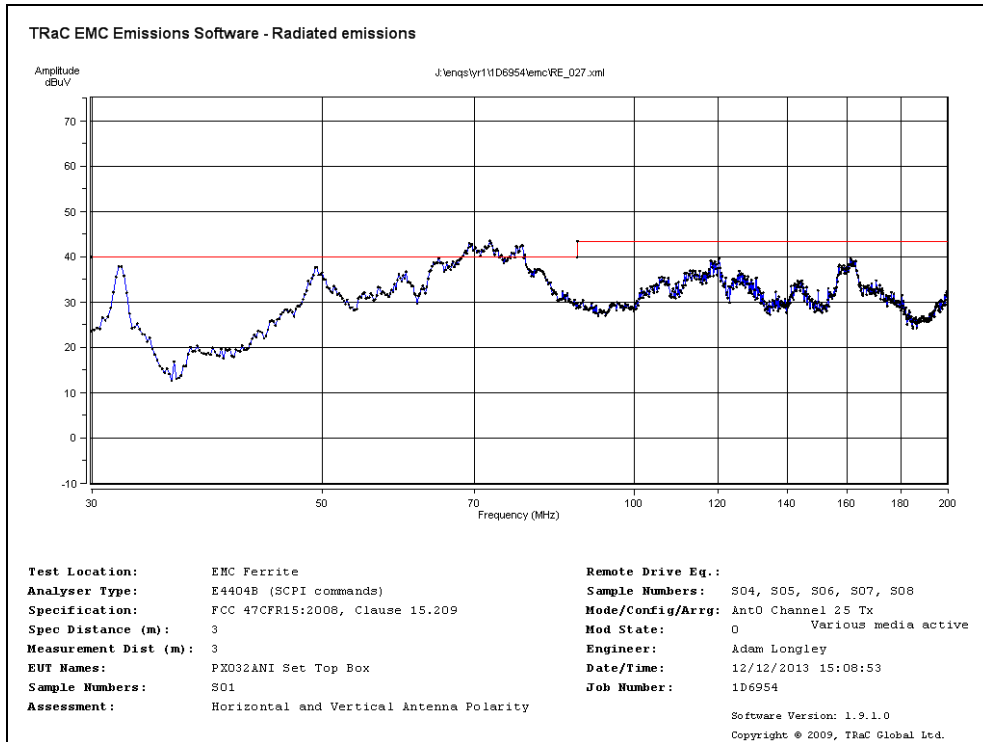


Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
13GHz -15GHz

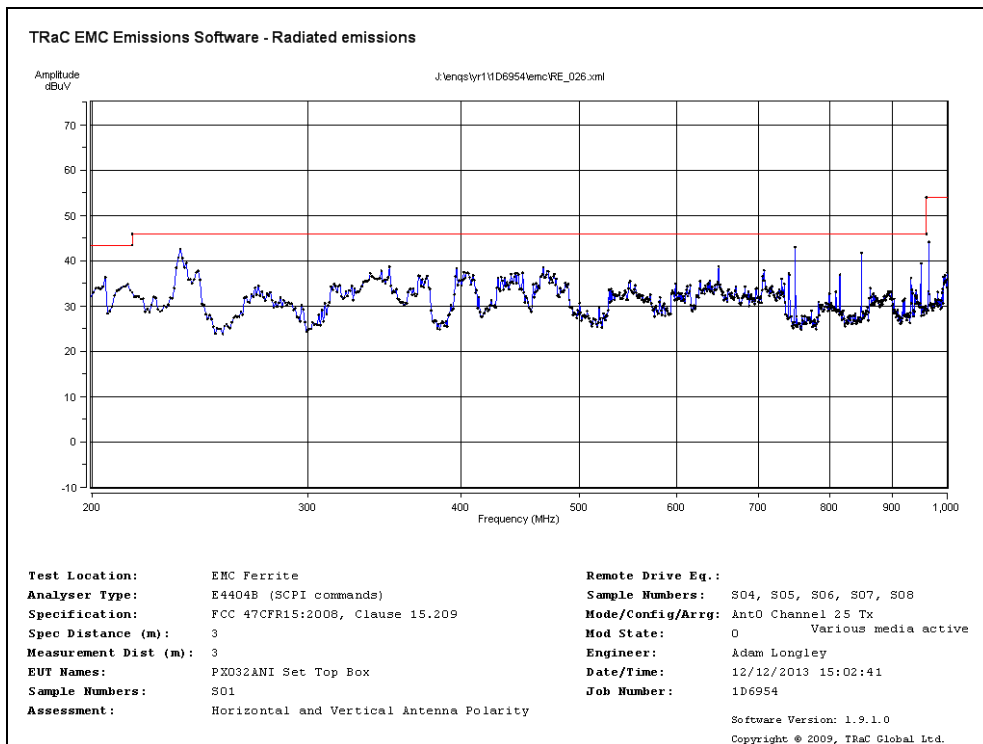




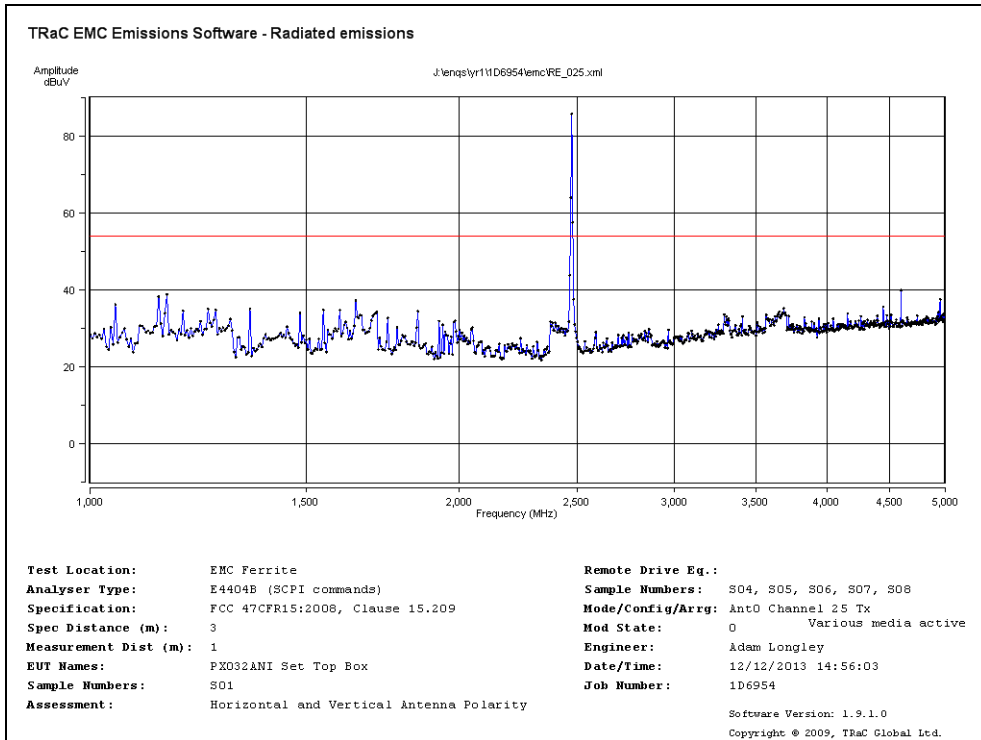
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 0  
15GHz -25GHz



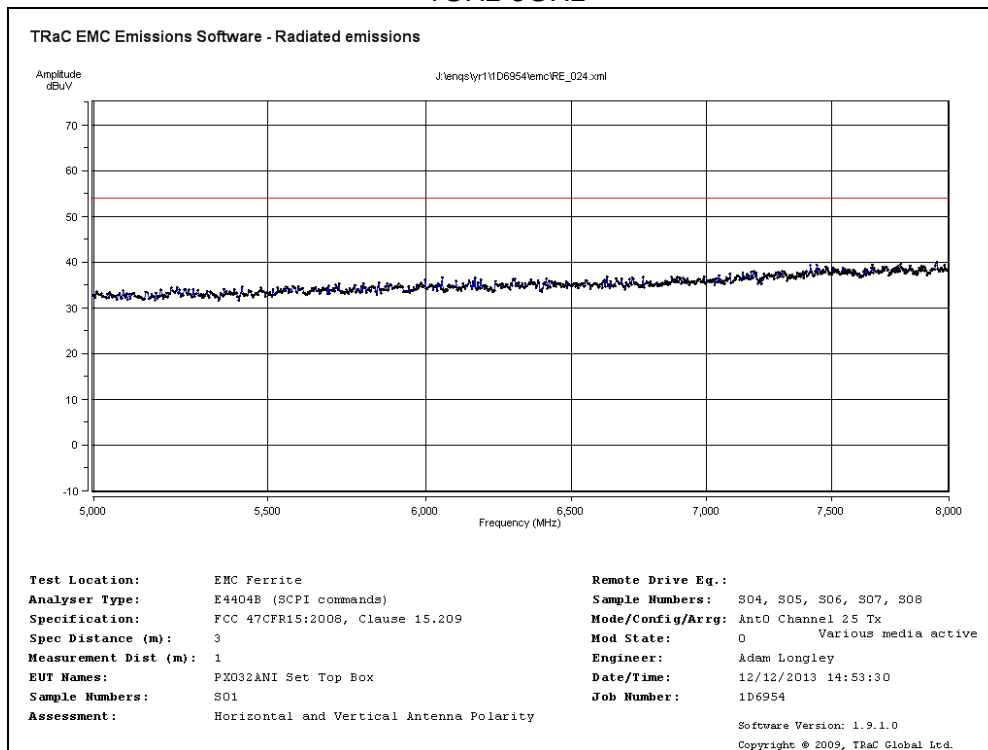
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
30MHz-200MHz



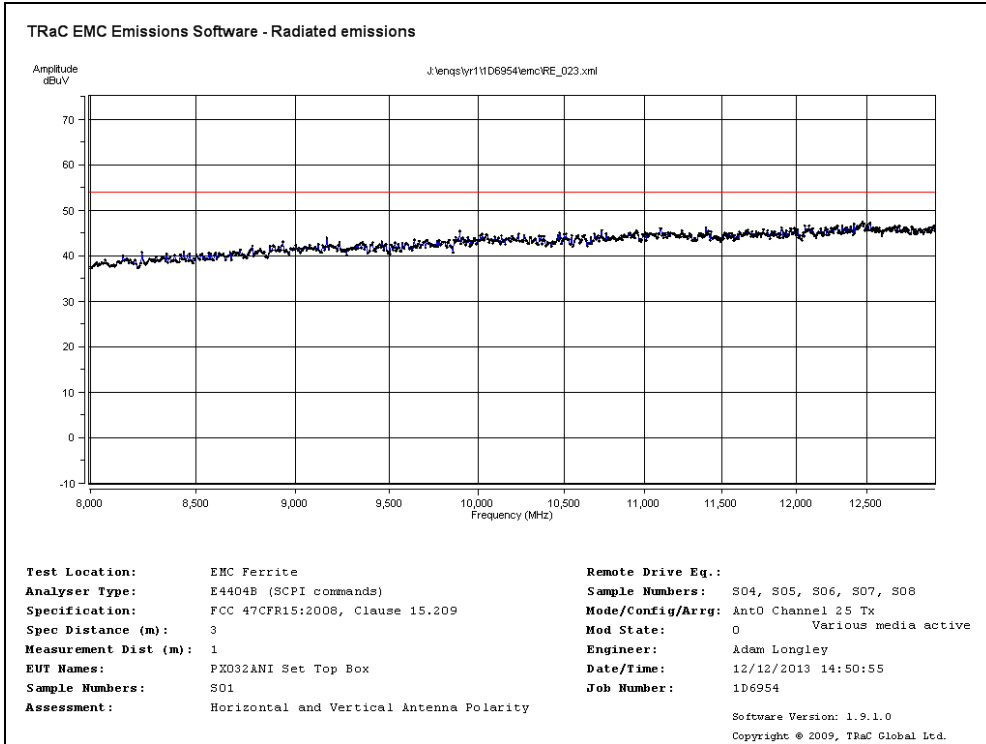
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
200MHz-1GHz



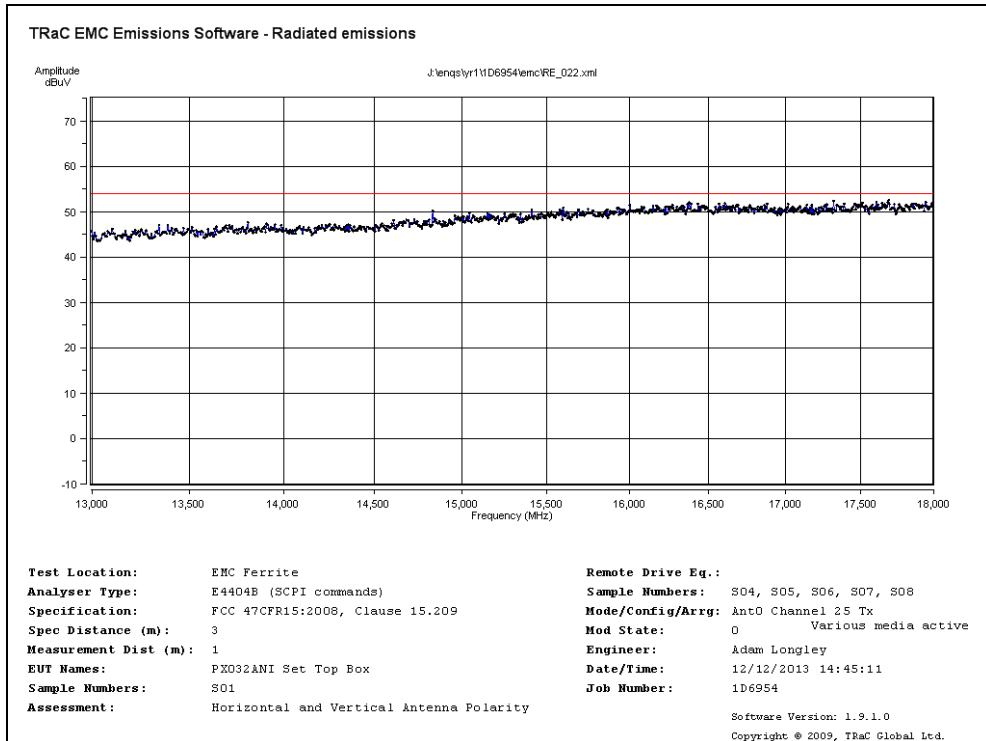
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
1GHz-5GHz



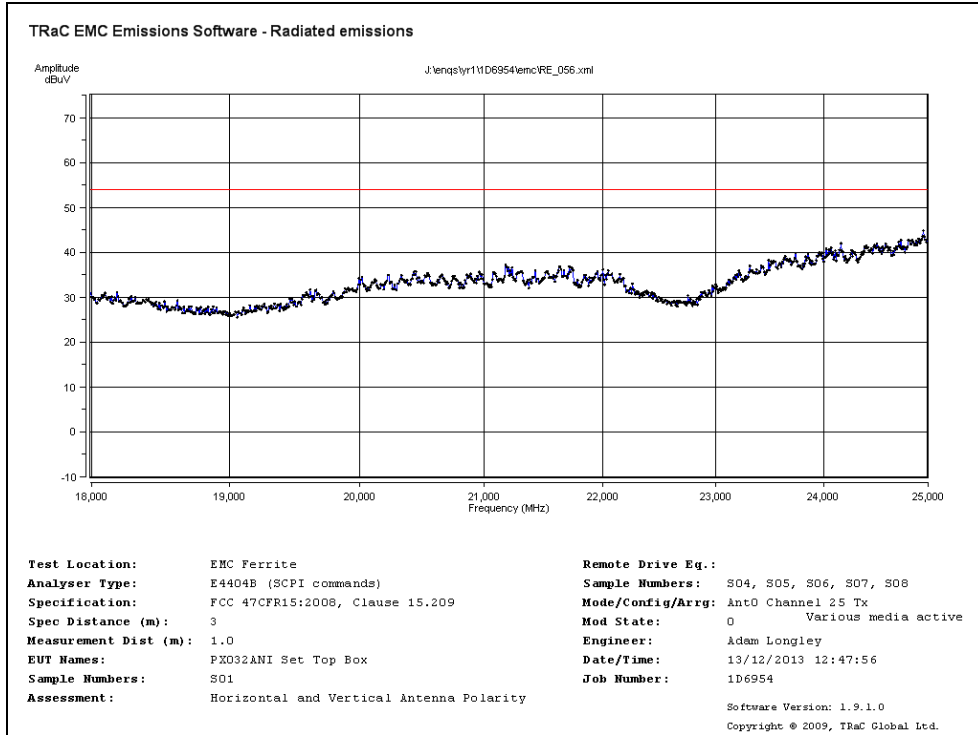
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
5GHz-8GHz



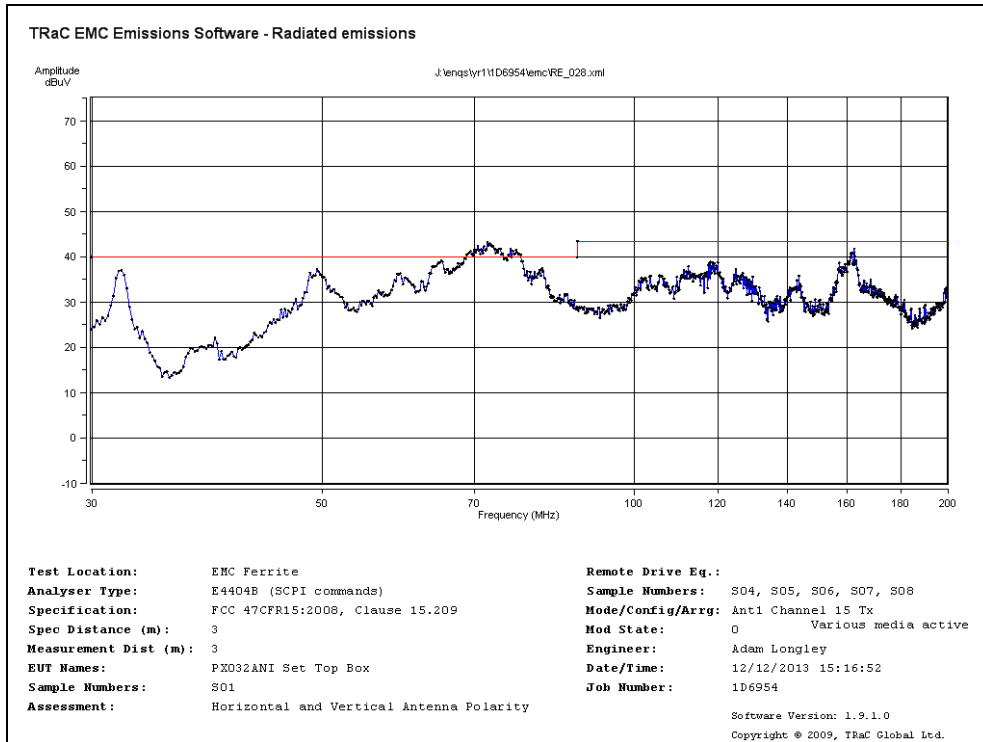
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
8GHz-13GHz



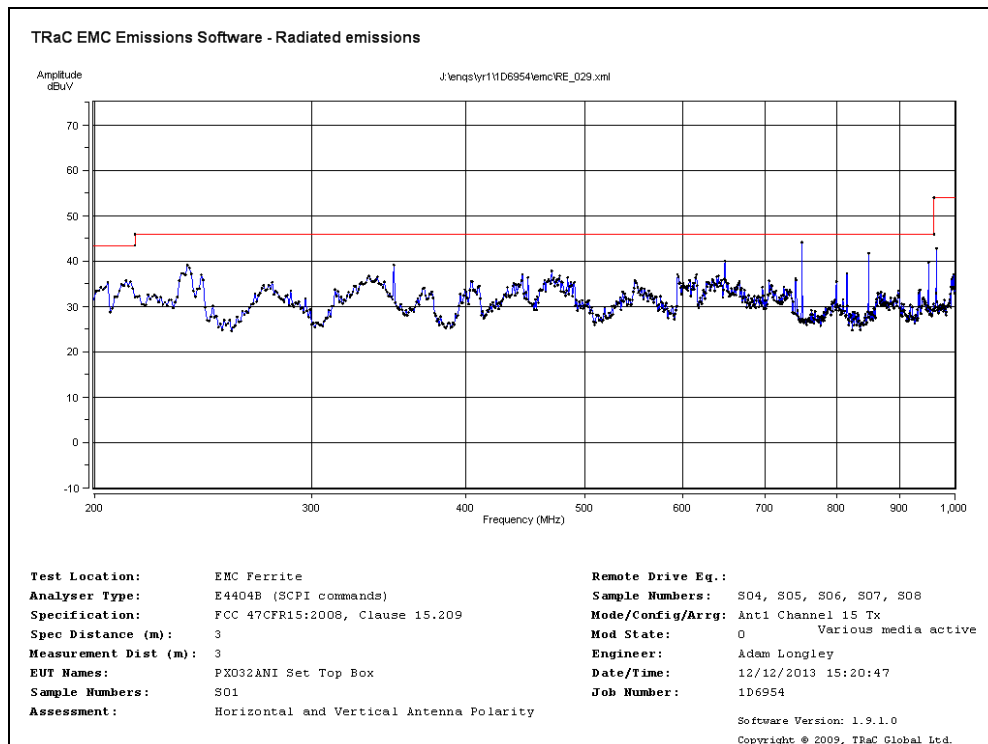
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
13GHz-18GHz



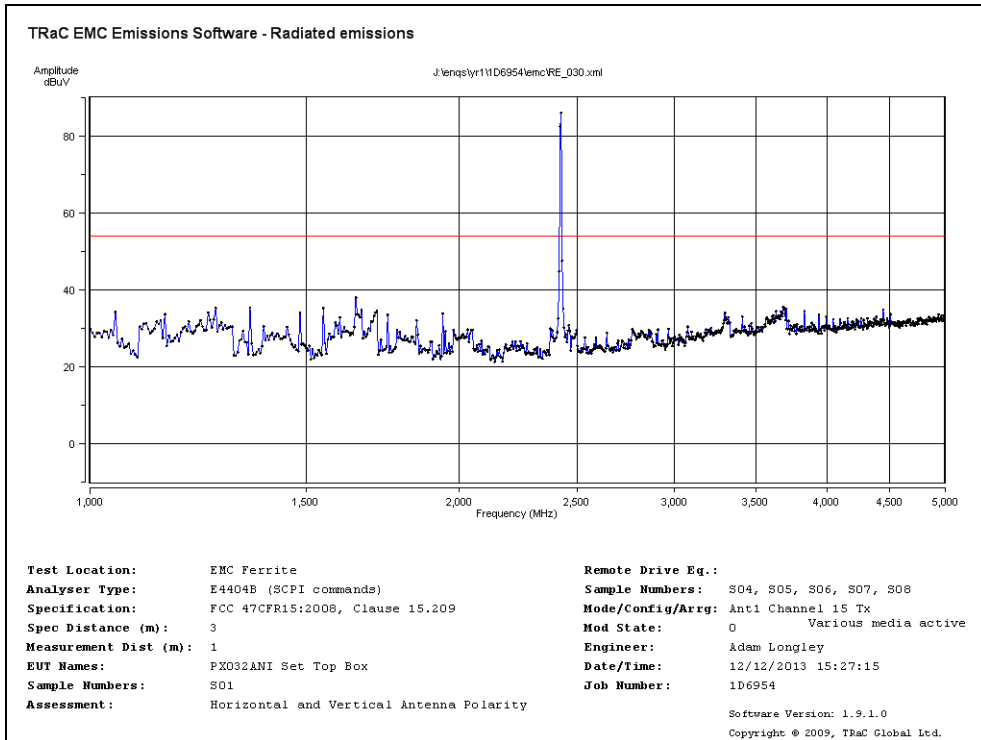
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 0  
18GHz-25GHz



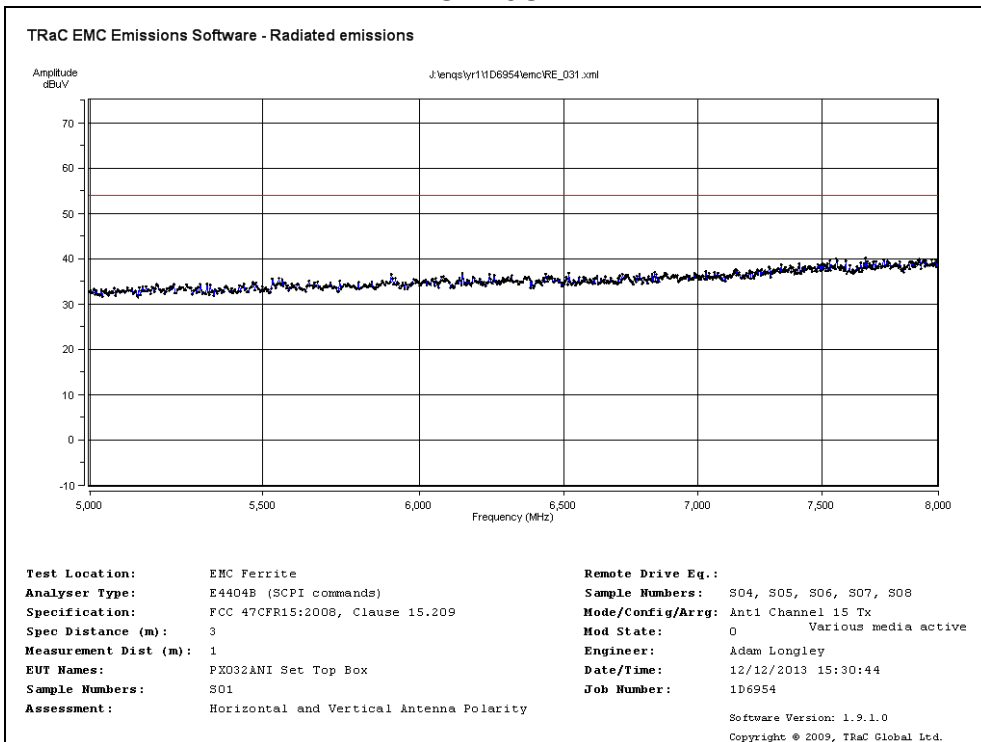
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
30MHz-200MHz



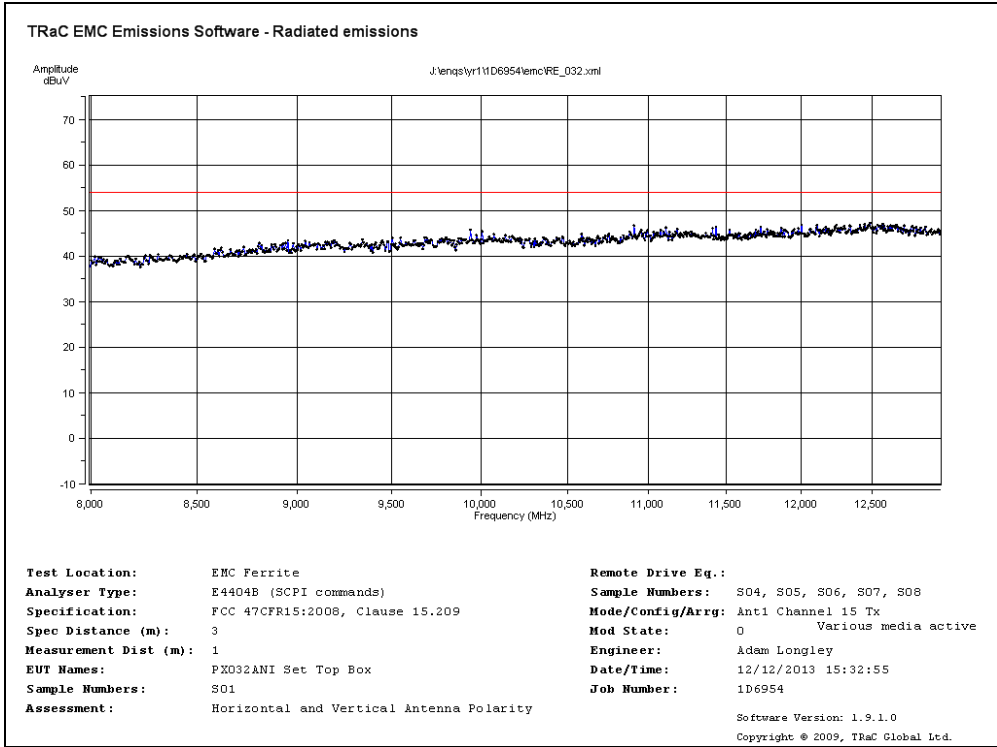
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
200MHz-1GHz



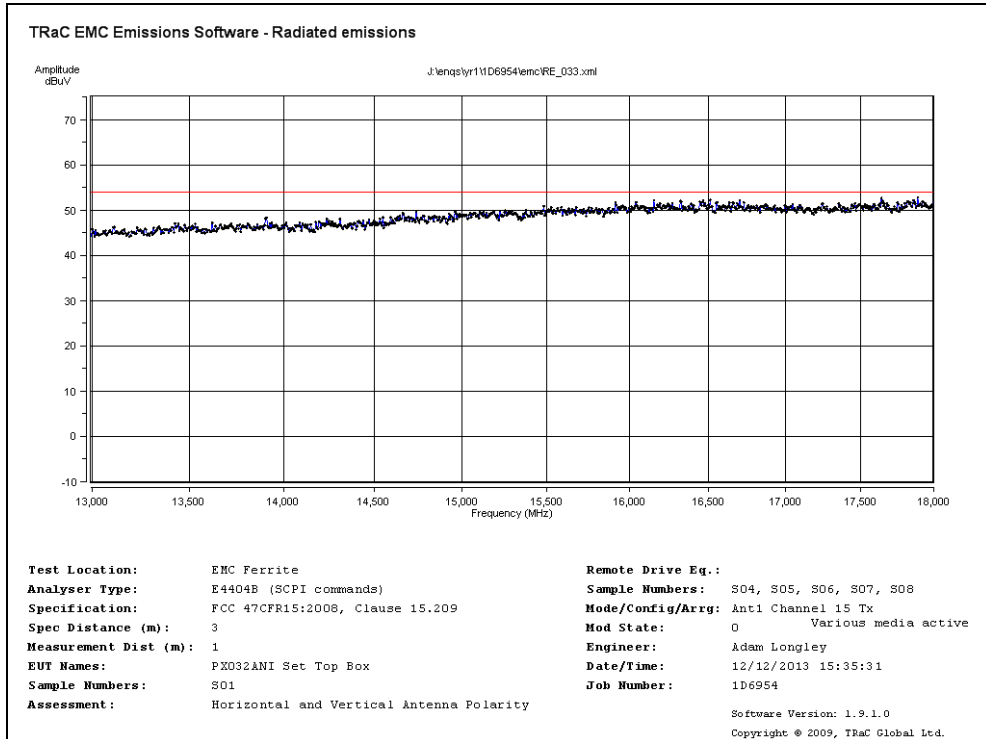
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
1GHz-5GHz



Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
5GHz-8GHz

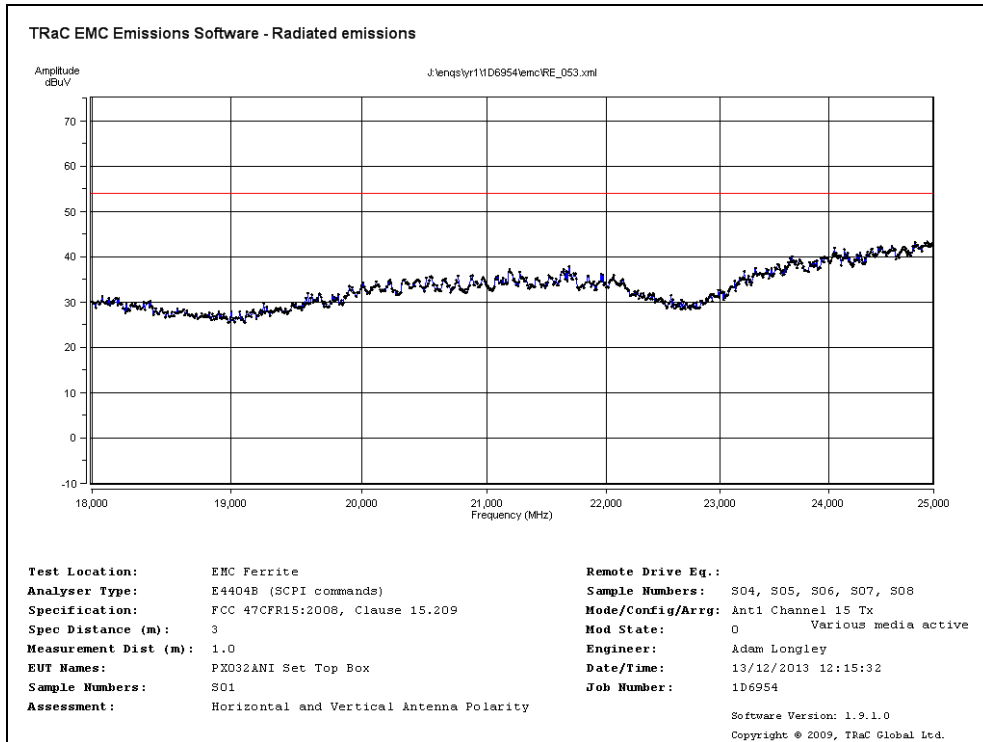


Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
8GHz-13GHz

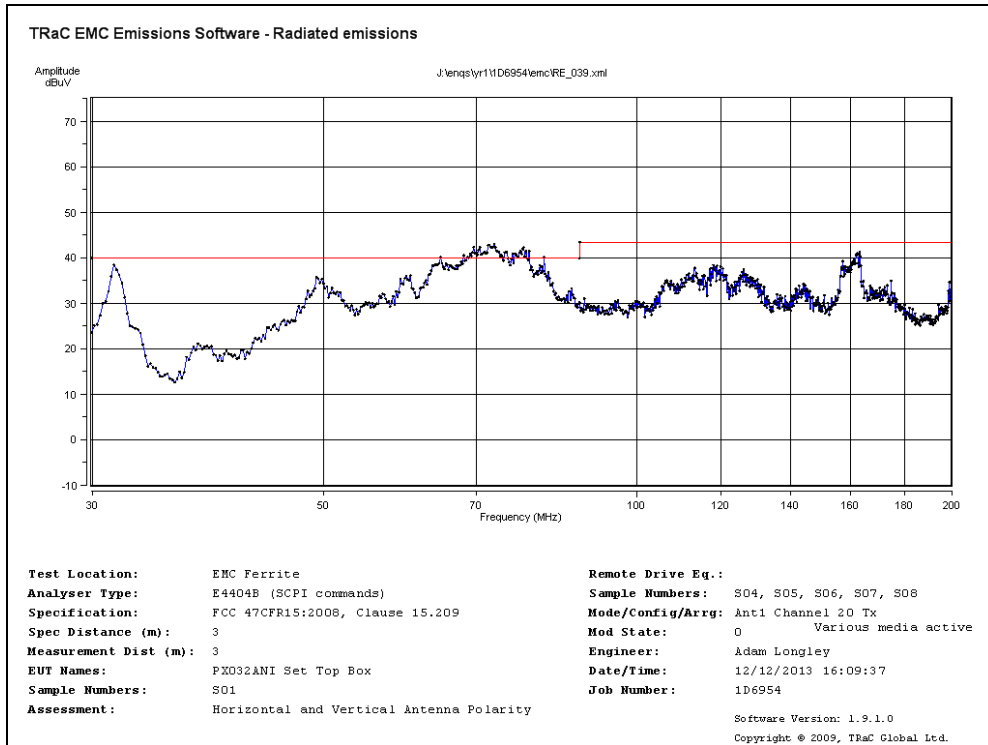


Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
13GHz-18GHz

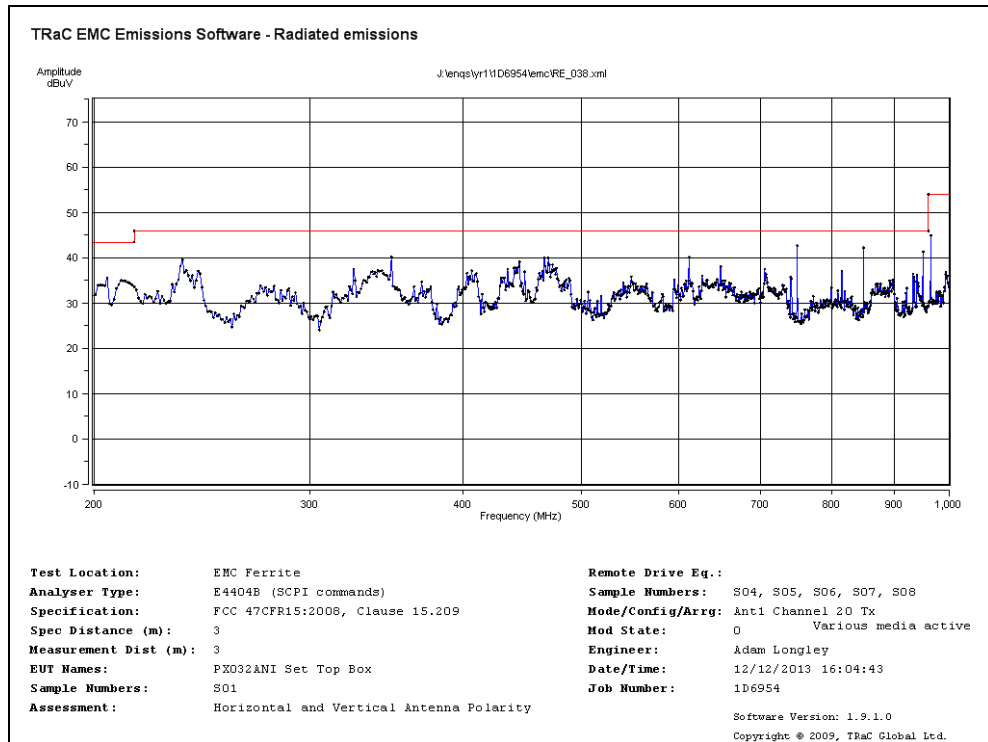




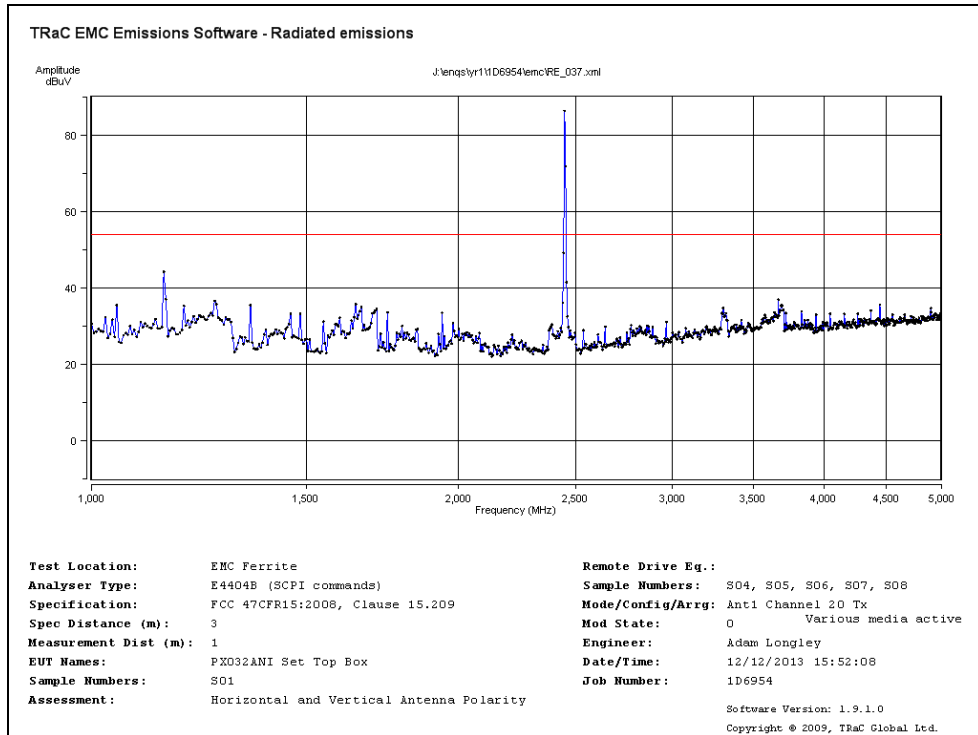
Radiated Transmitter Emissions Channel 15 2425MHz (15.209) Antenna 1  
18GHz-25GHz



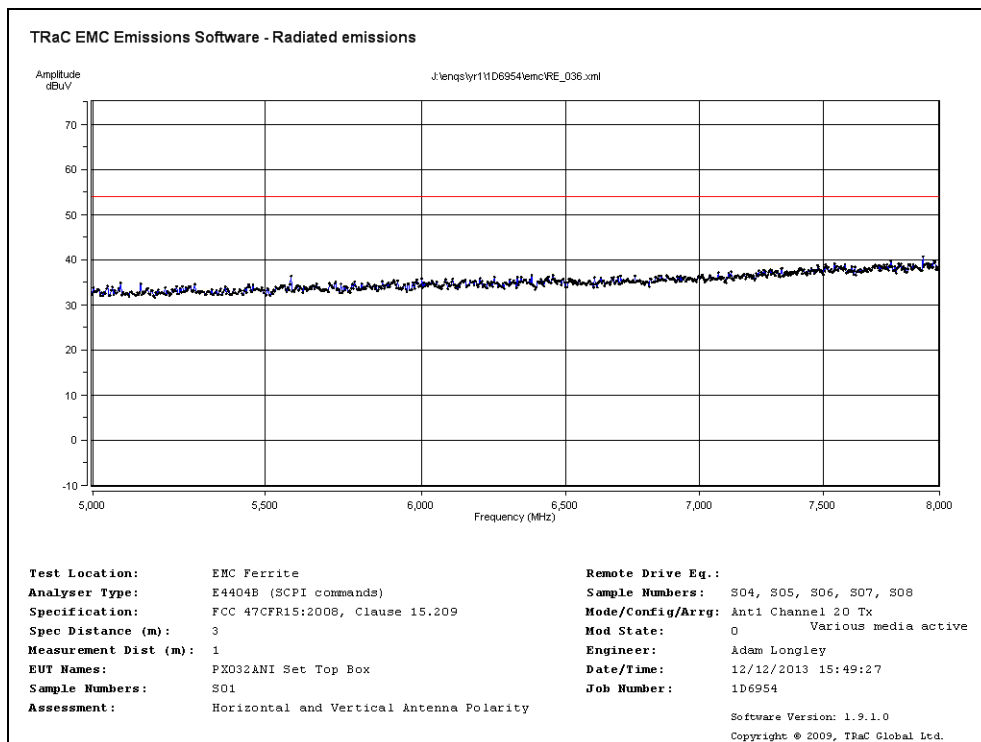
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
30MHz -200MHz



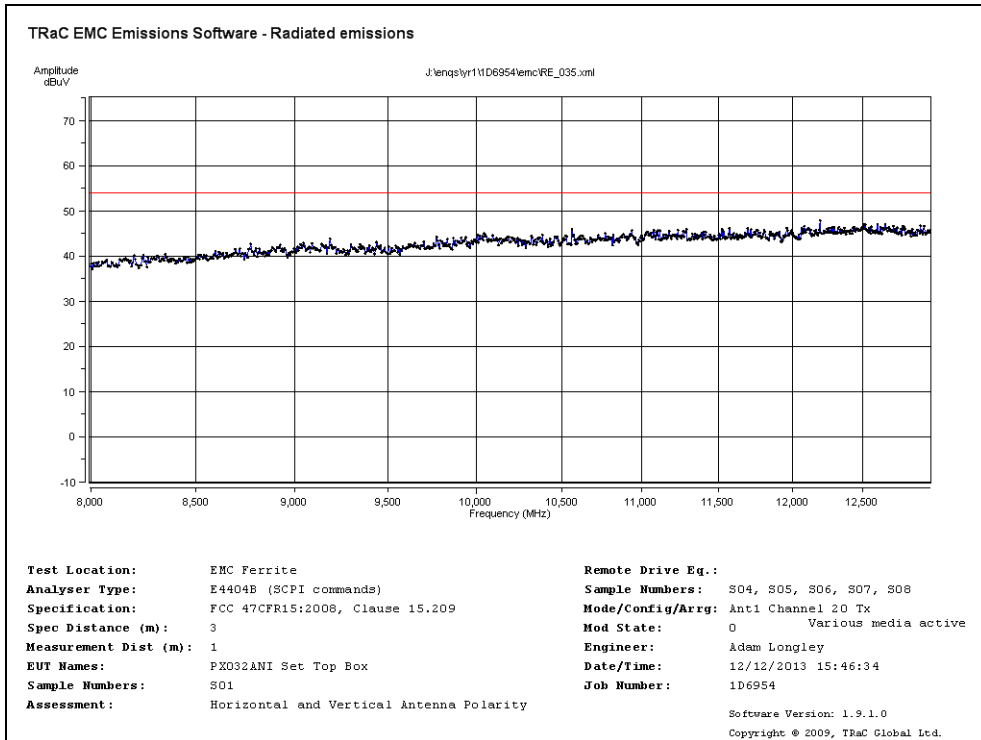
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
200MHz -1GHz



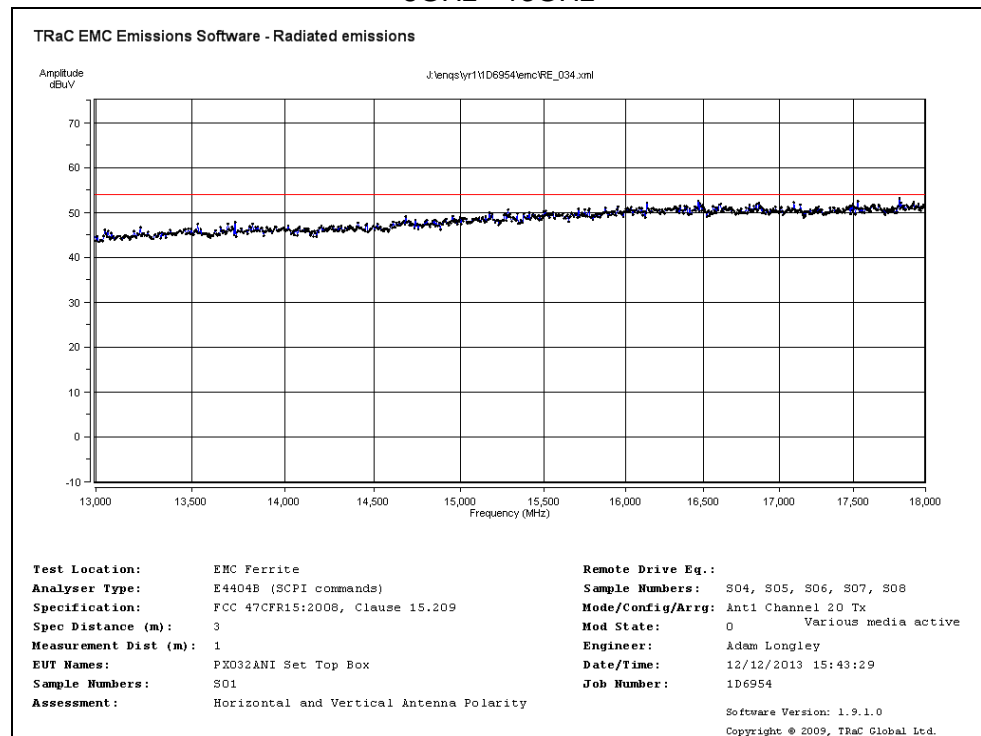
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
1GHz - 5GHz



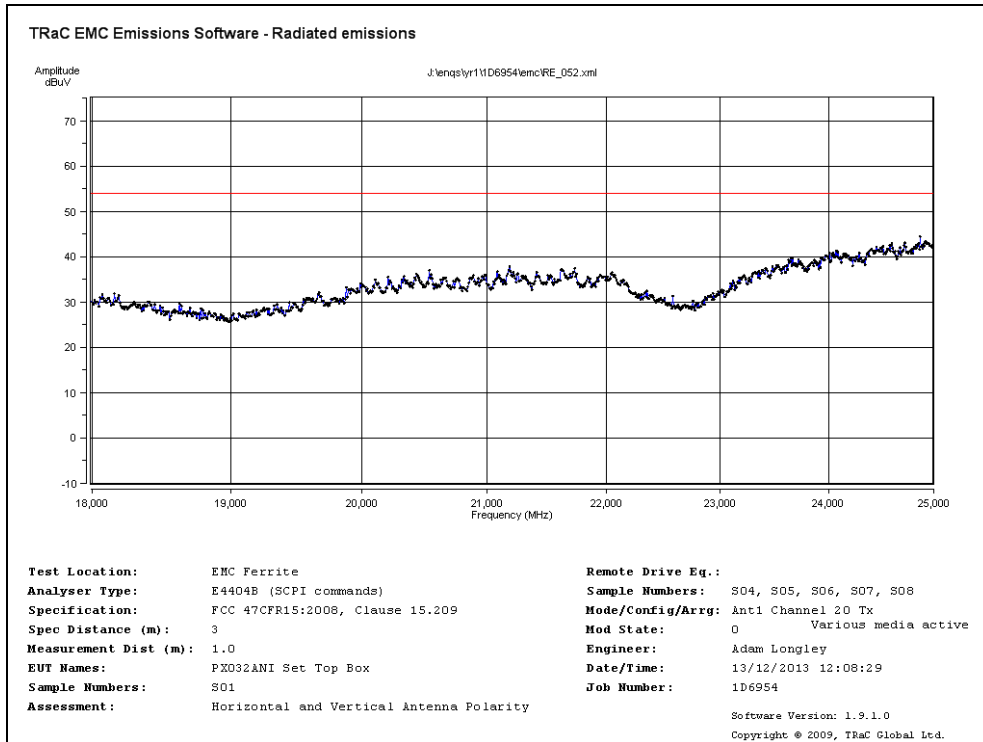
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
5GHz - 8GHz



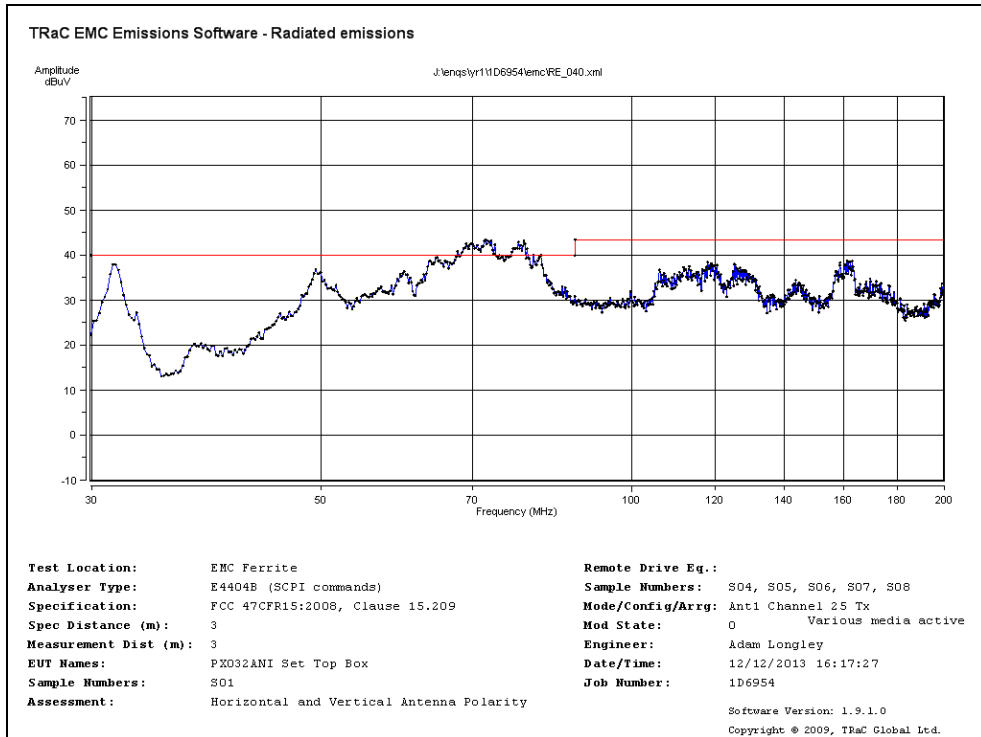
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
8GHz - 13GHz



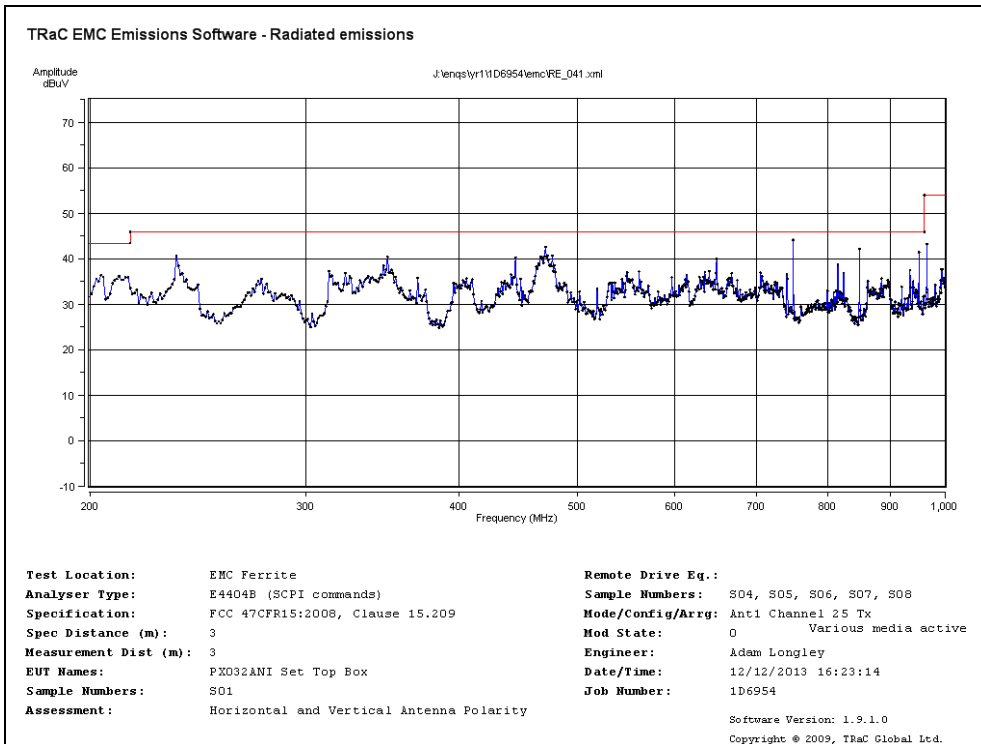
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
13GHz - 18GHz



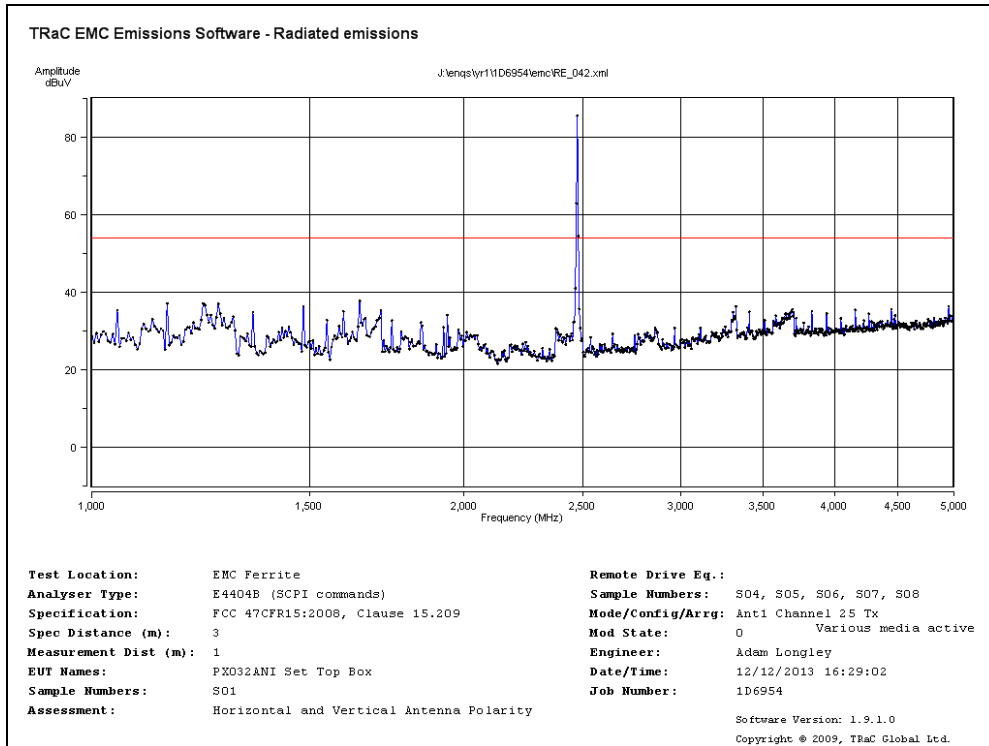
Radiated Transmitter Emissions Channel 20 2450MHz (15.209) Antenna 1  
18GHz - 25GHz



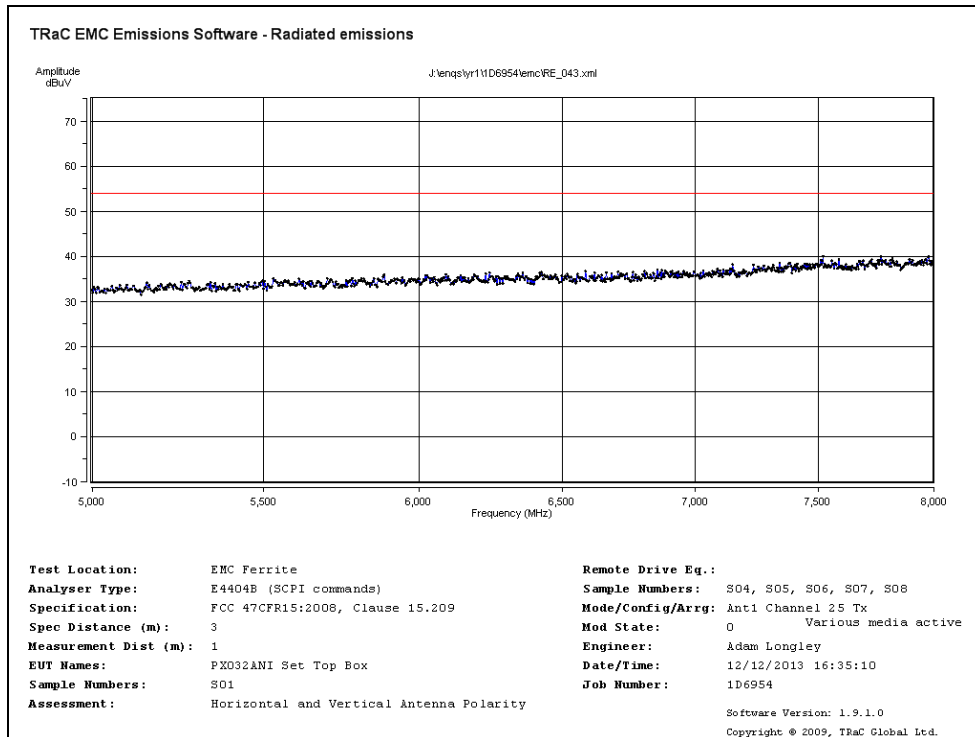
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
30MHz-200MHz



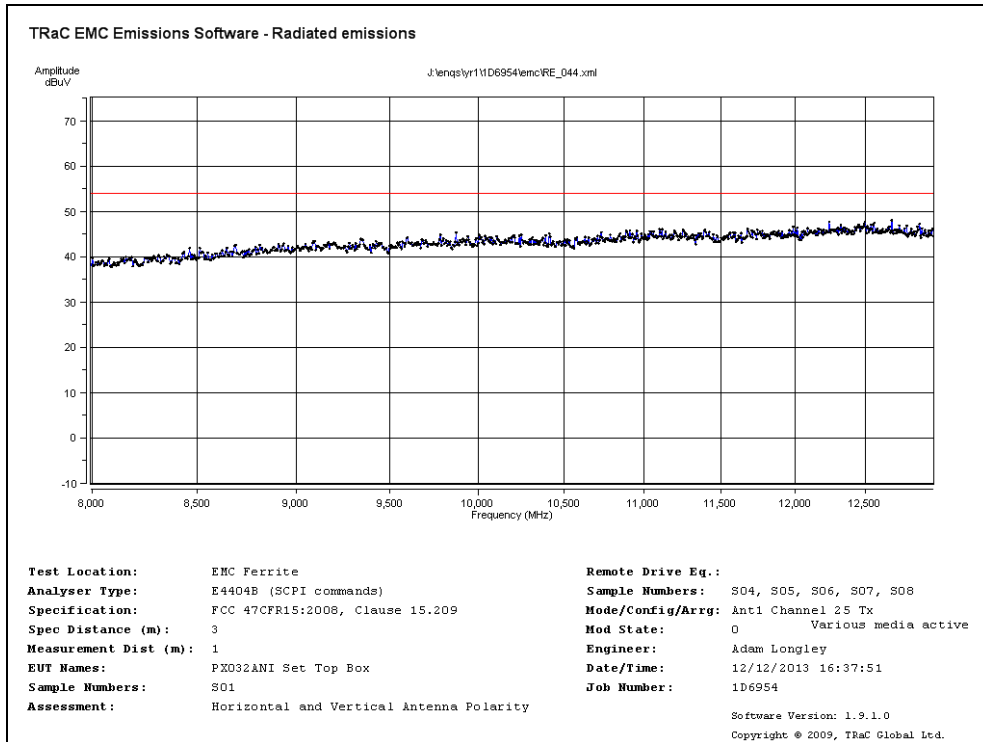
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
200MHz-1GHz



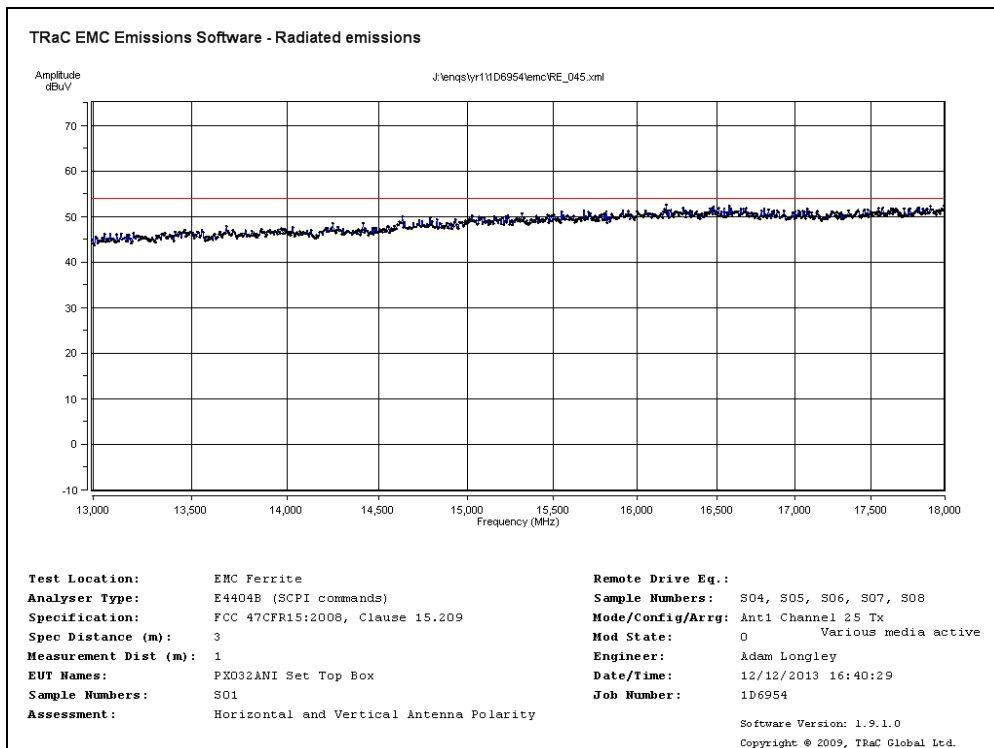
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
1GHz-5GHz



Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
5GHz-8GHz

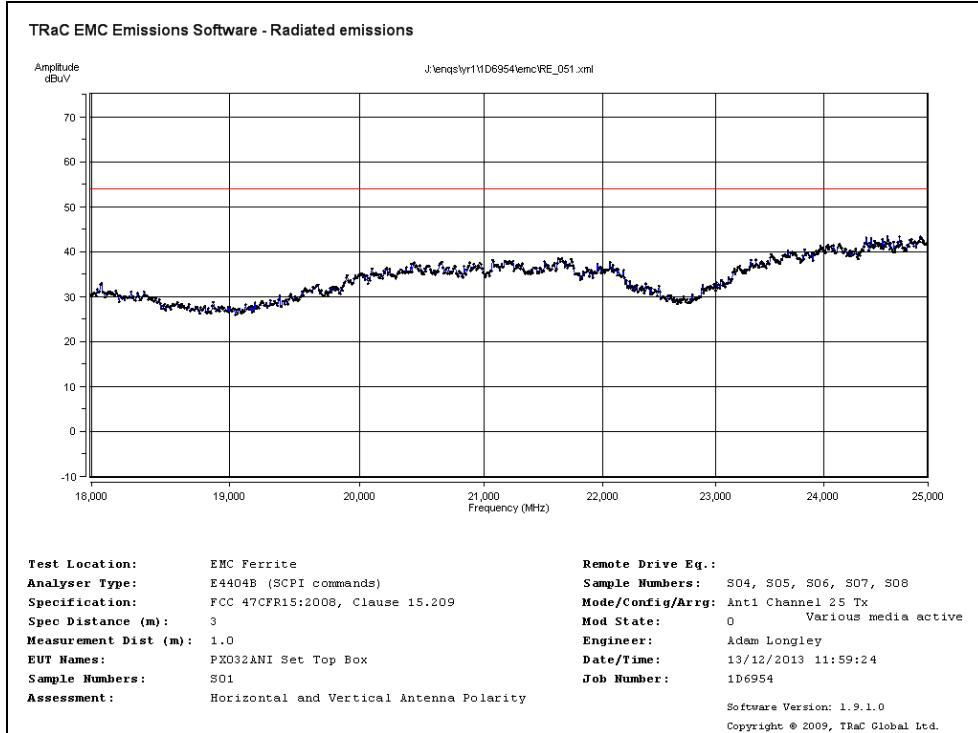


Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
8GHz-13GHz

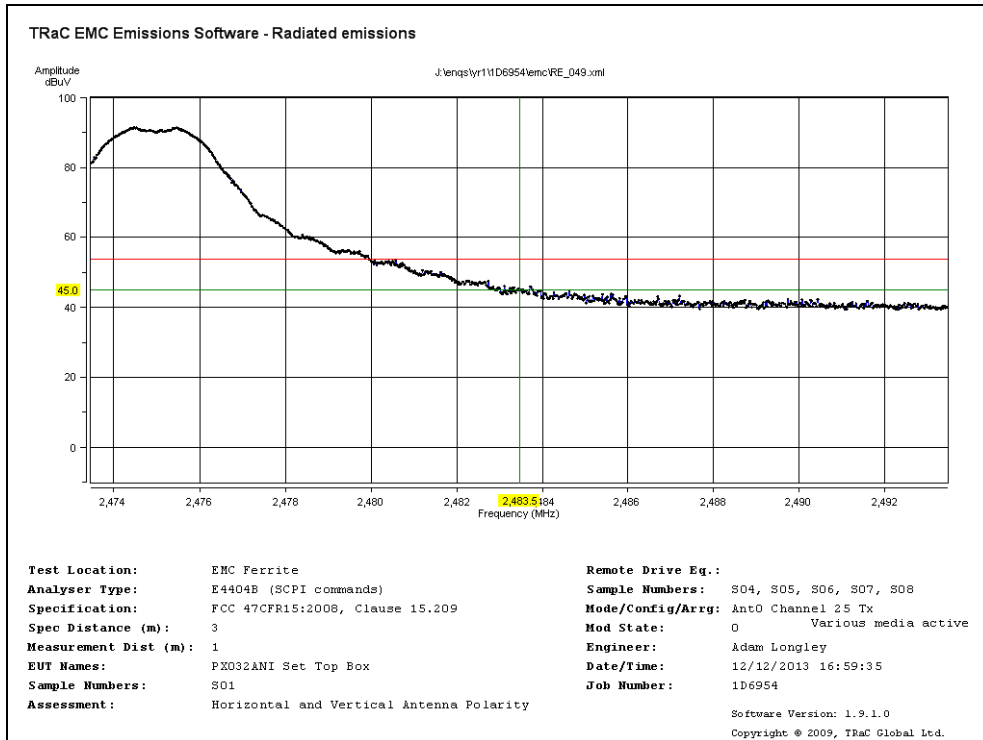


Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
13GHz-18GHz

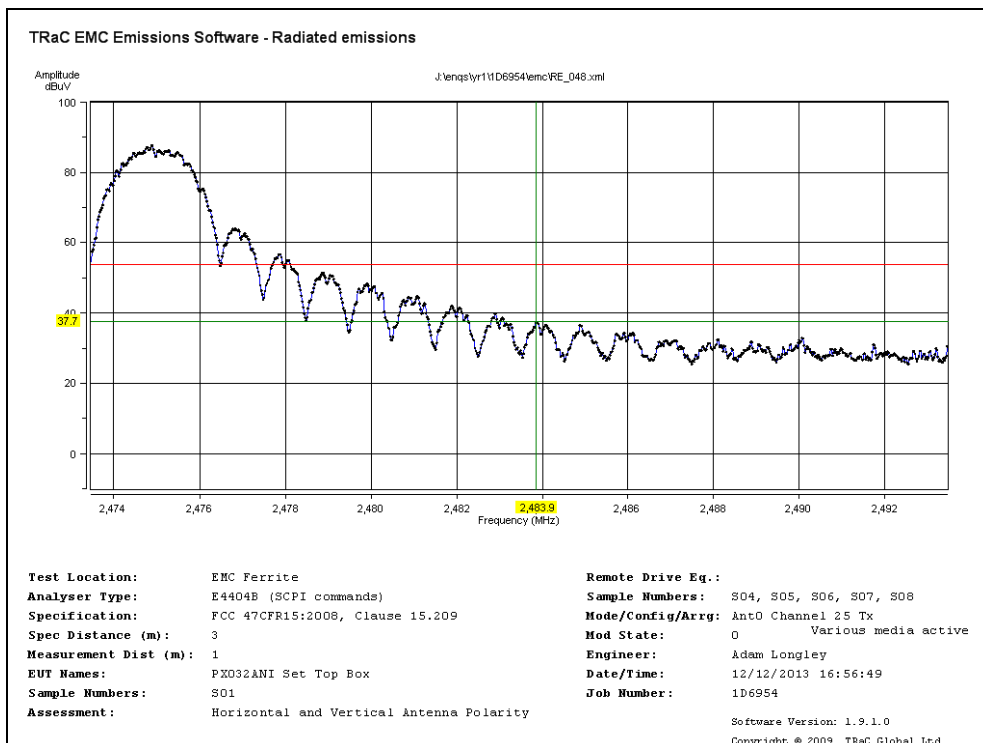




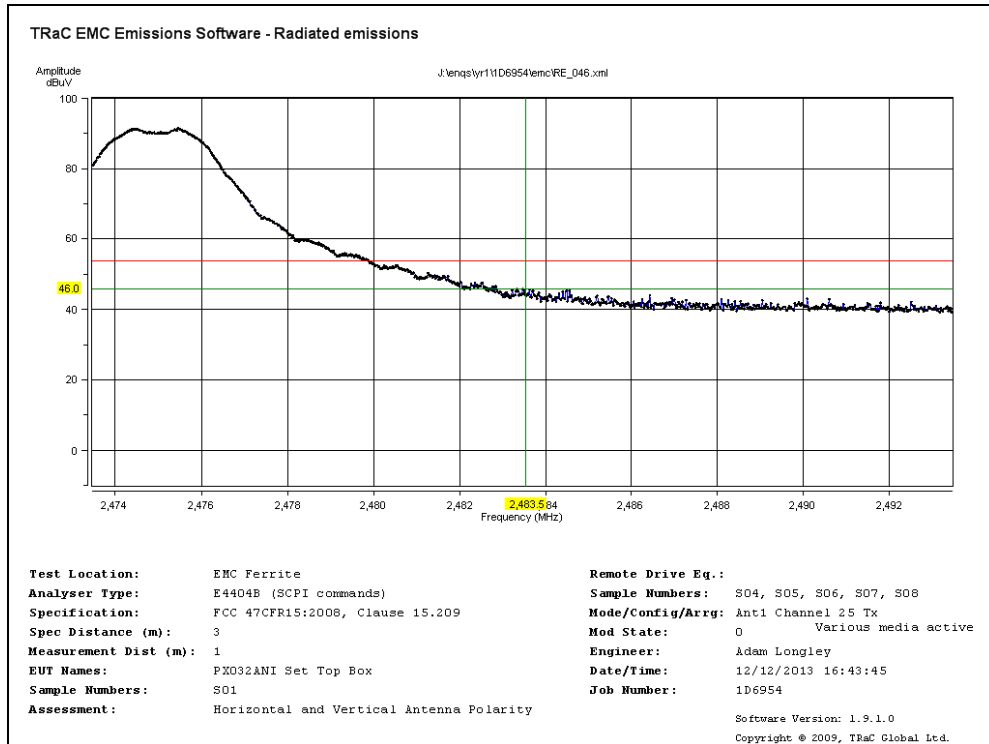
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Antenna 1  
18GHz-25GHz



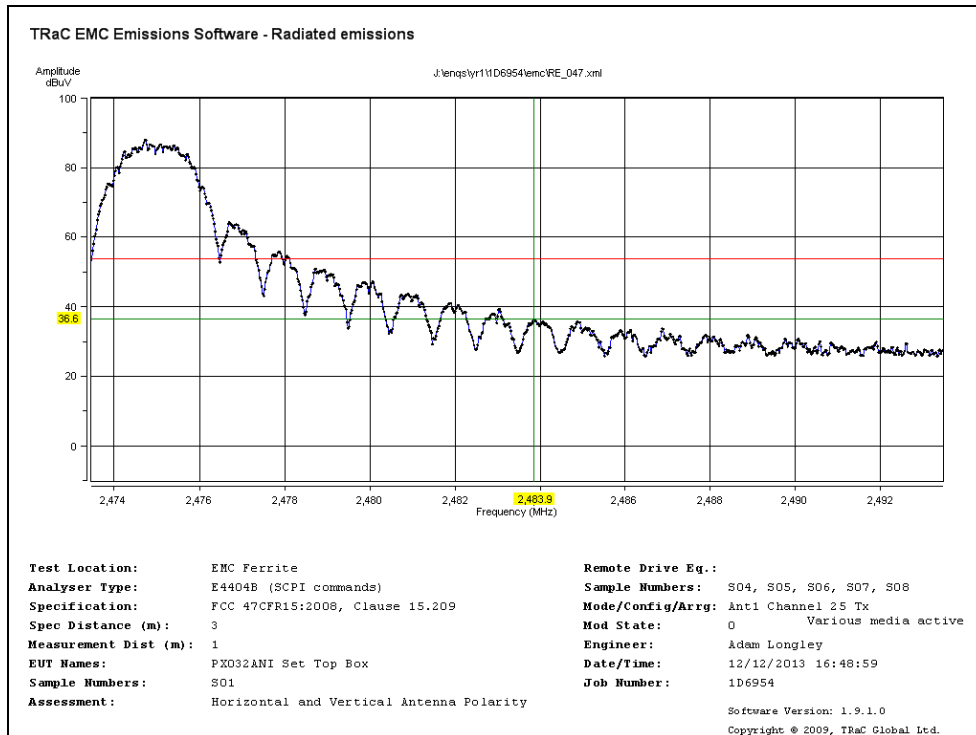
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Band Edge Compliance  
Antenna 0 - RBW 1MHz



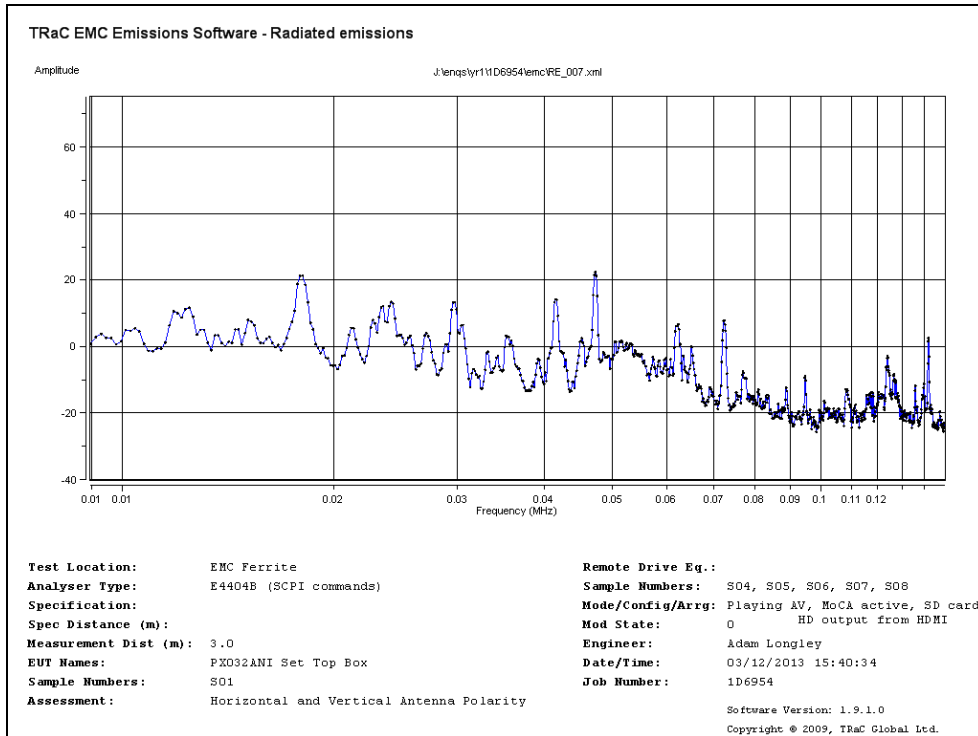
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Band Edge Compliance  
Antenna 0 - RBW 100kHz



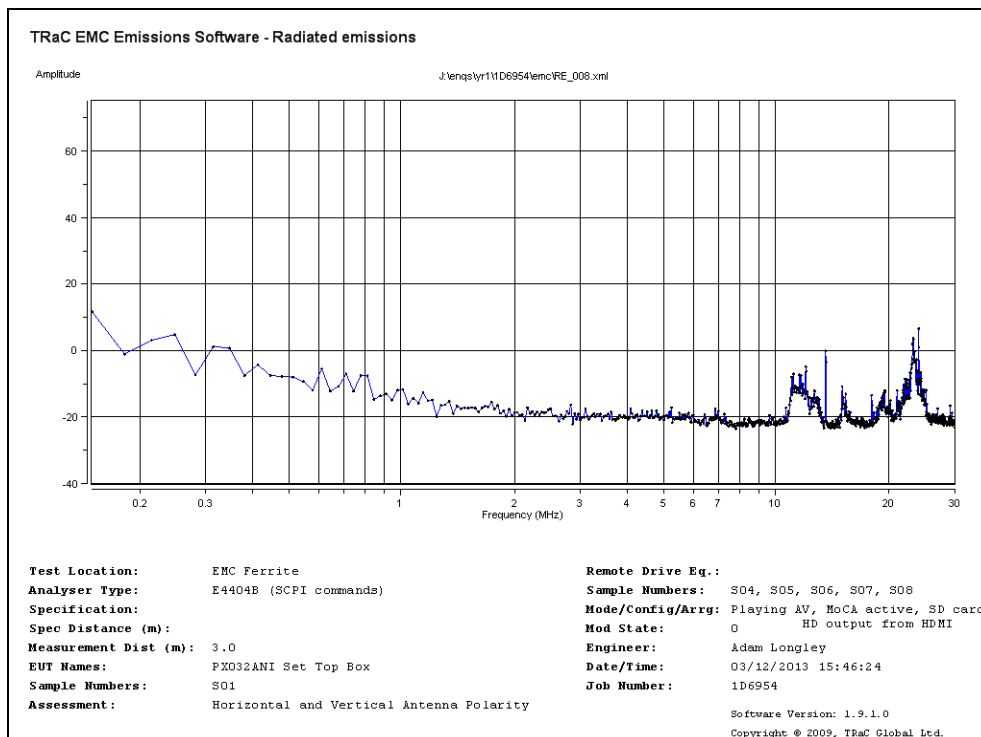
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Band Edge Compliance  
Antenna 1 - RBW 1MHz



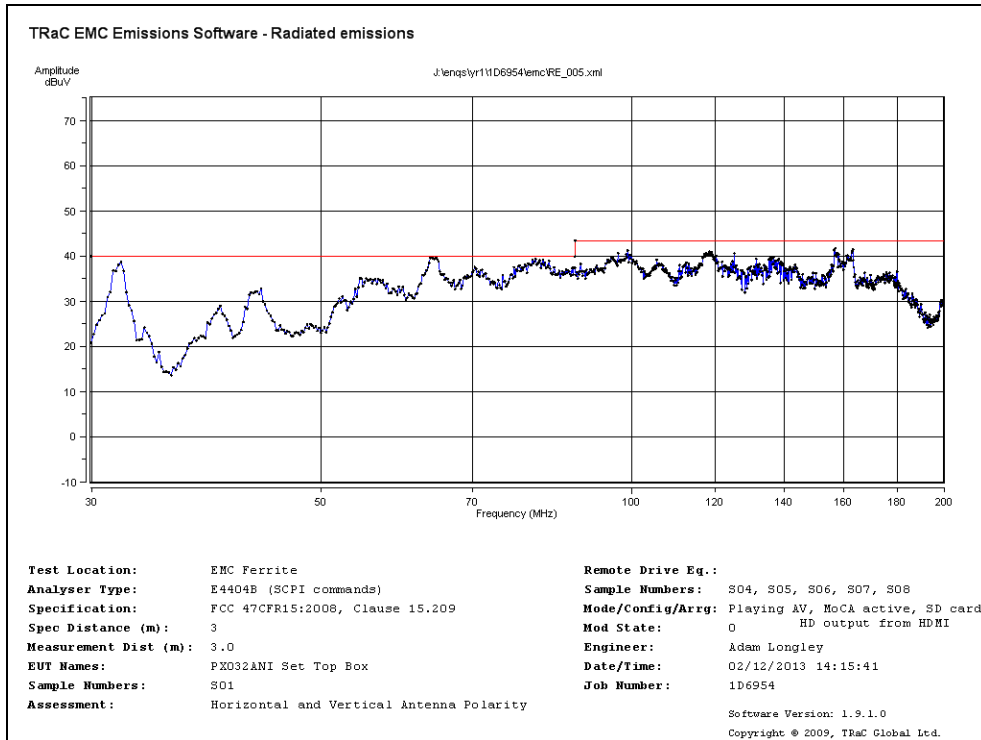
Radiated Transmitter Emissions Channel 25 2475MHz (15.209) Band Edge Compliance  
Antenna 1 - RBW 100kHz



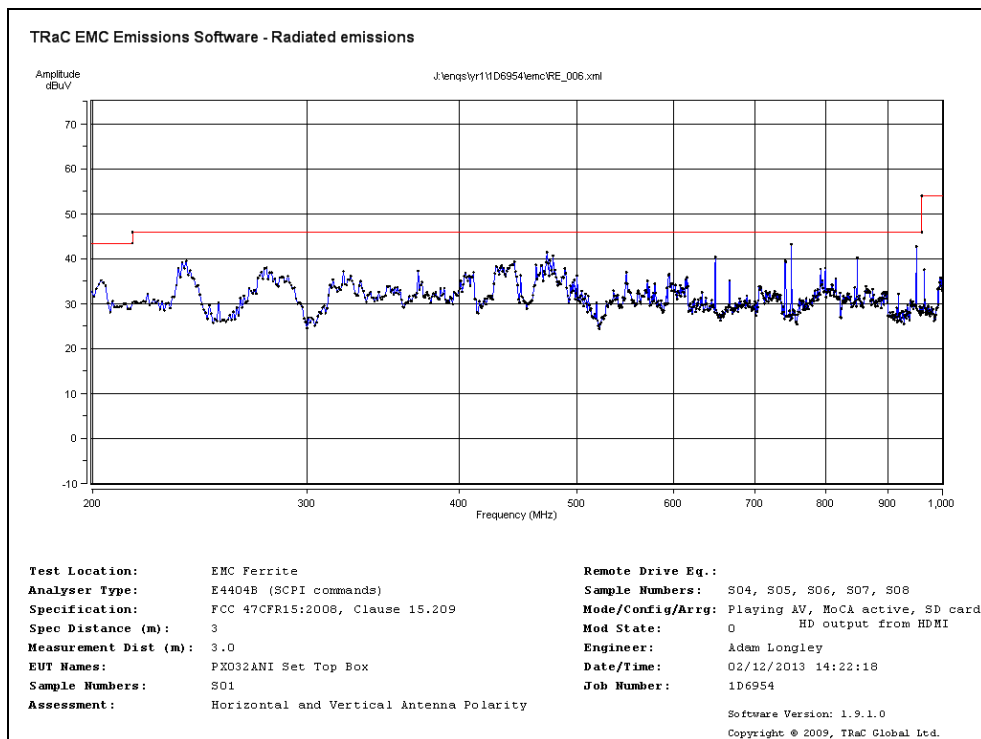
Radiated RX Mode Emissions (15.109)  
9kHz-150kHz



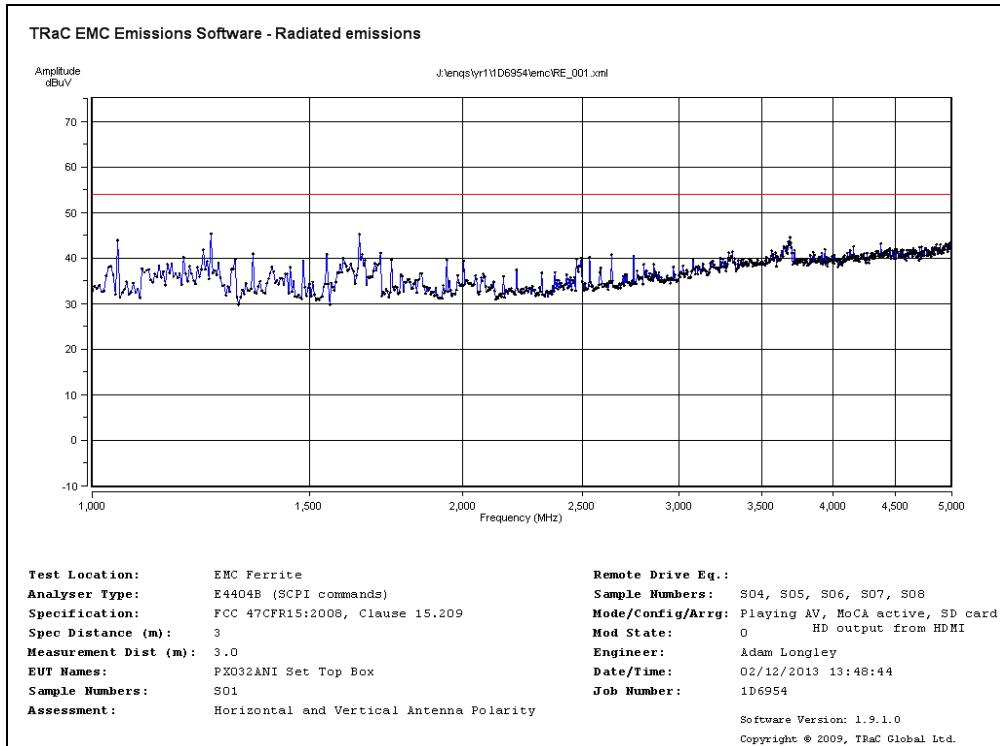
Radiated RX Mode Emissions (15.109)  
150kHz - 30MHz



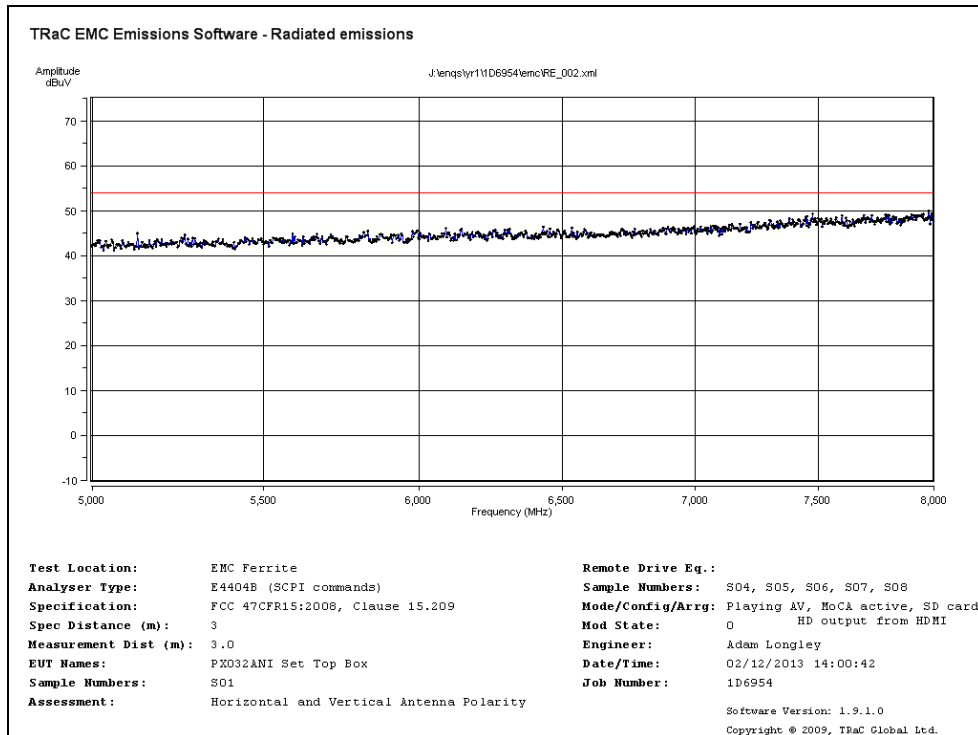
Radiated RX Mode Emissions (15.109)  
30MHz-200MHz



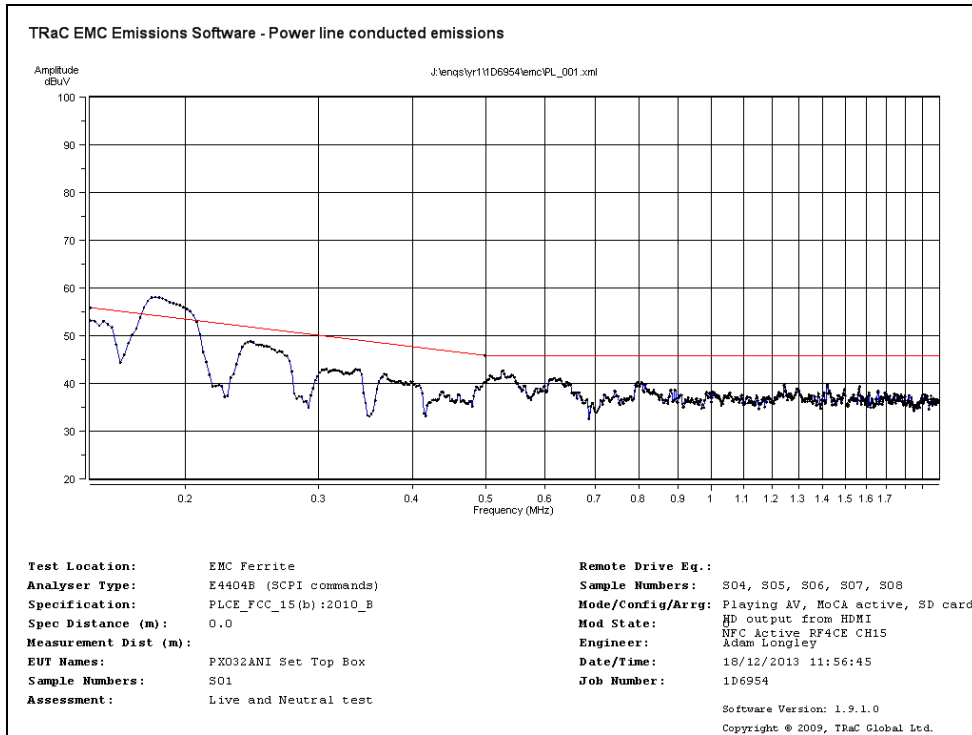
Radiated RX Mode Emissions (15.109)  
200MHz-1GHz



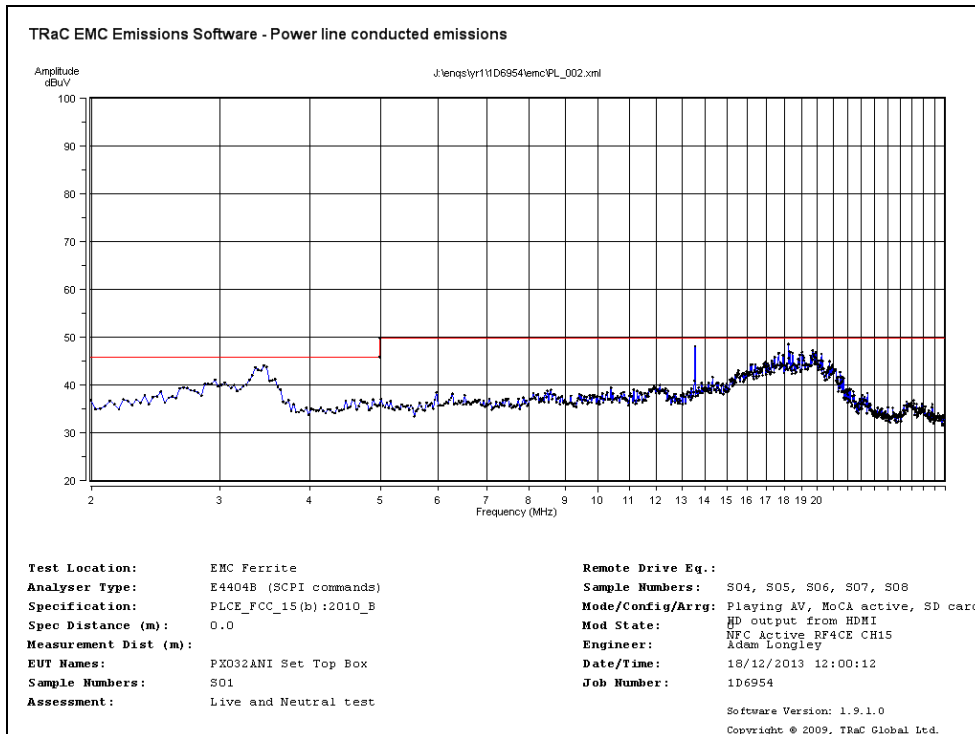
Radiated RX Mode Emissions (15.109)  
1GHz-5GHz



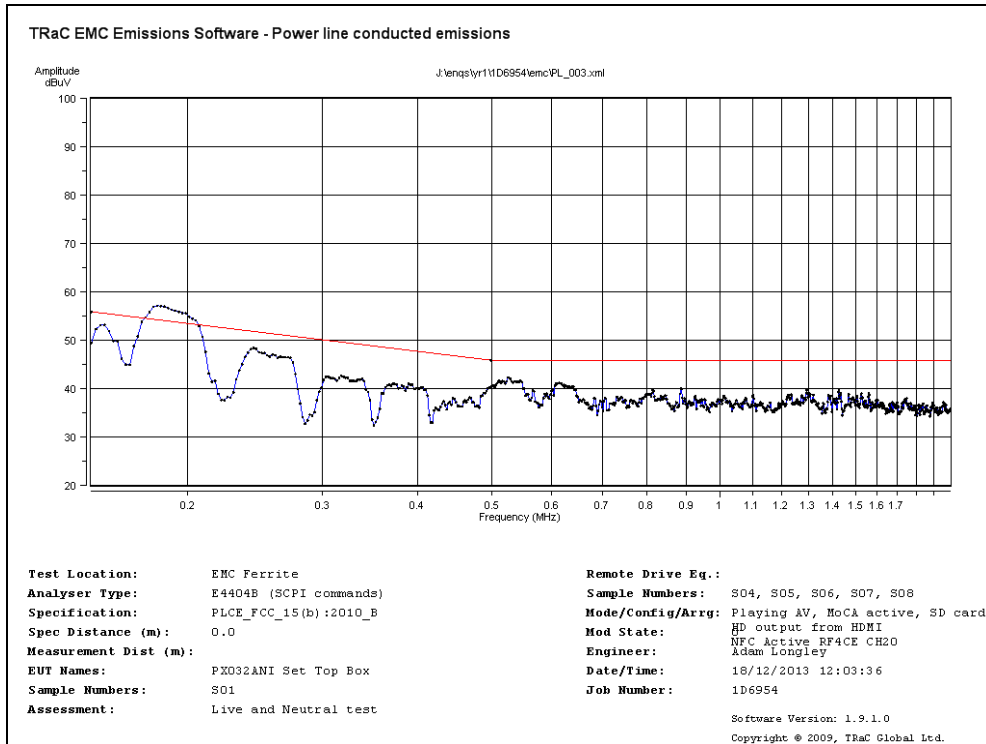
Radiated RX Mode Emissions (15.109)  
5GHz-8GHz



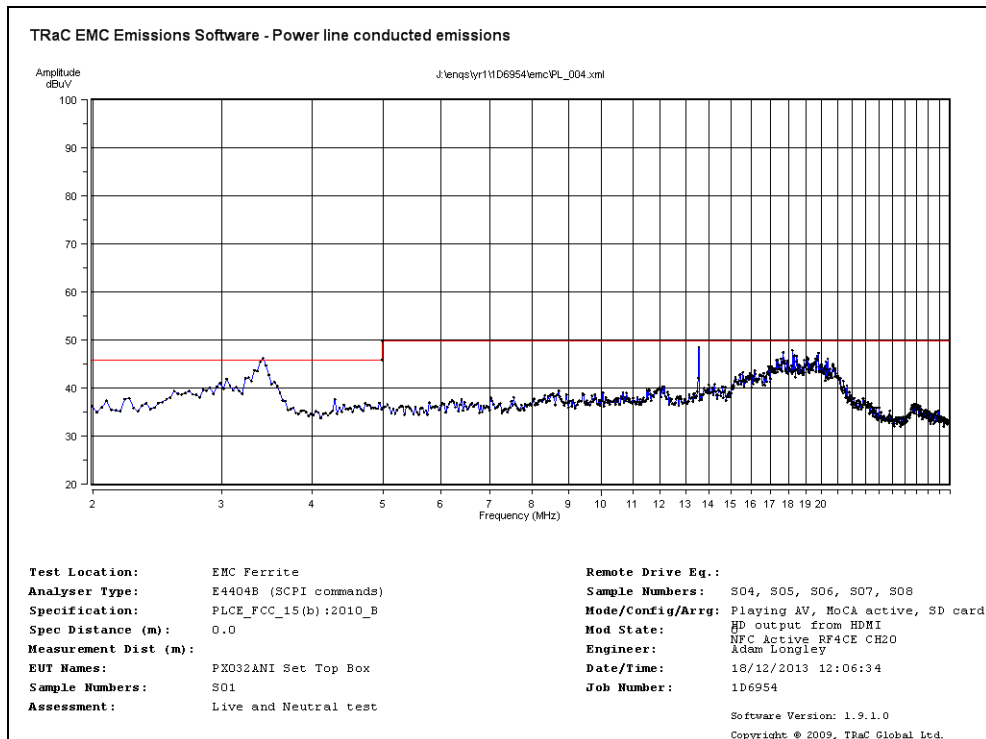
PLCE- EUT NFC Transmitting (RF4CE Ch15) 0.15MHz - 2 MHz



PLCE- EUT NFC Transmitting (RF4CE Ch15) 2MHz - 30 MHz

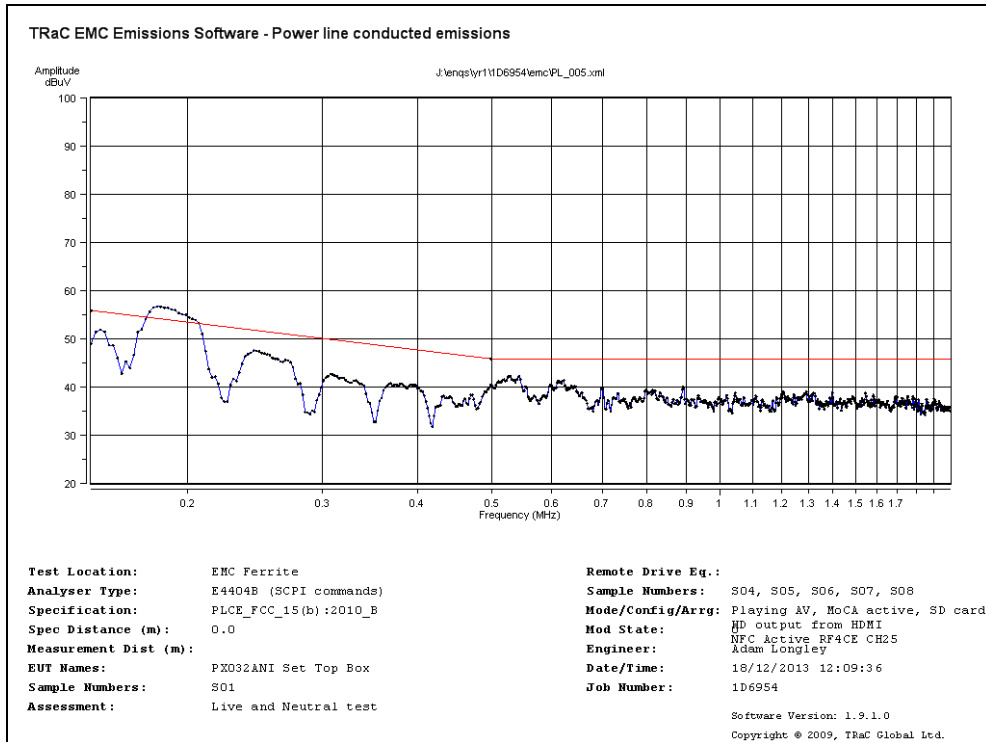


PLCE- EUT NFC Transmitting (RF4CE Ch20) 0.15MHz - 2 MHz

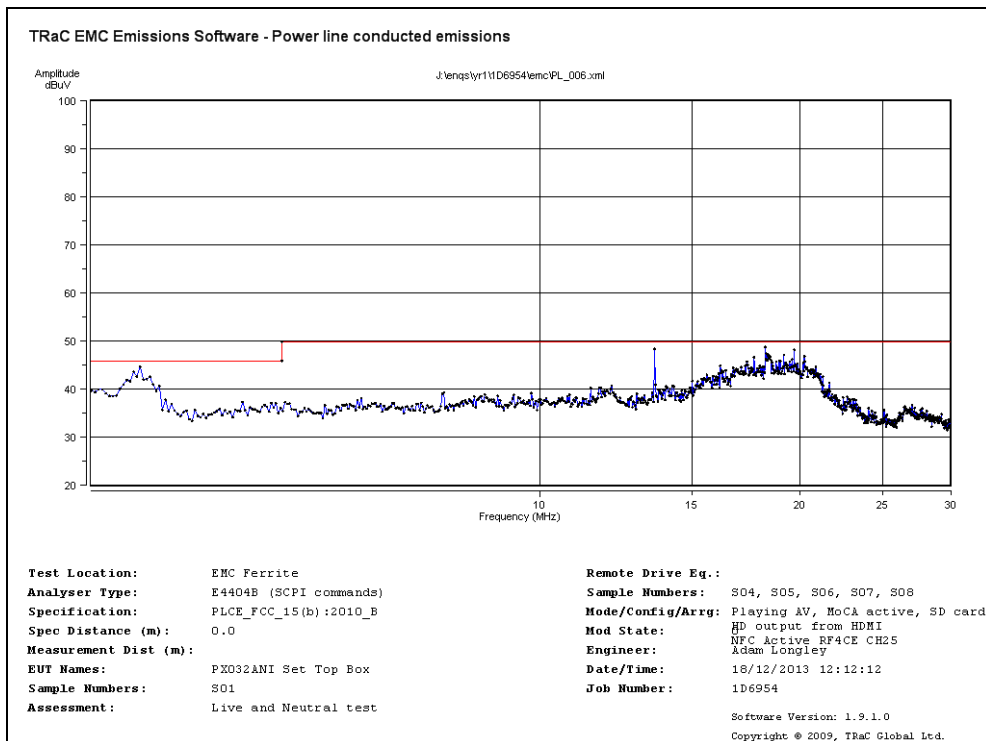


PLCE- EUT NFC Transmitting (RF4CE Ch20) 2MHz - 30 MHz

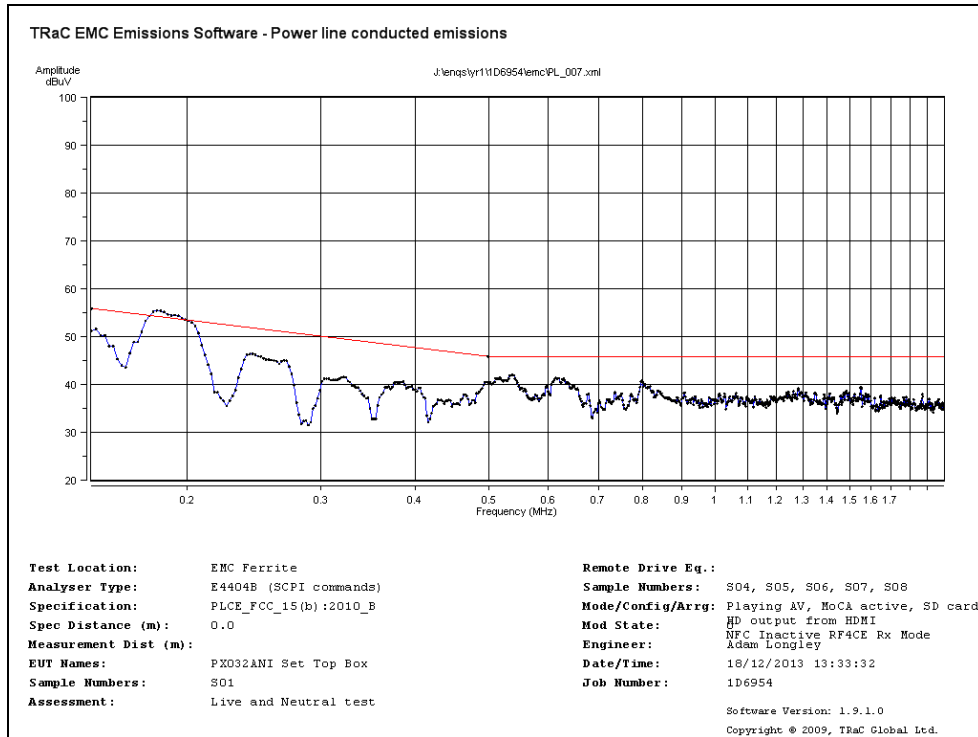




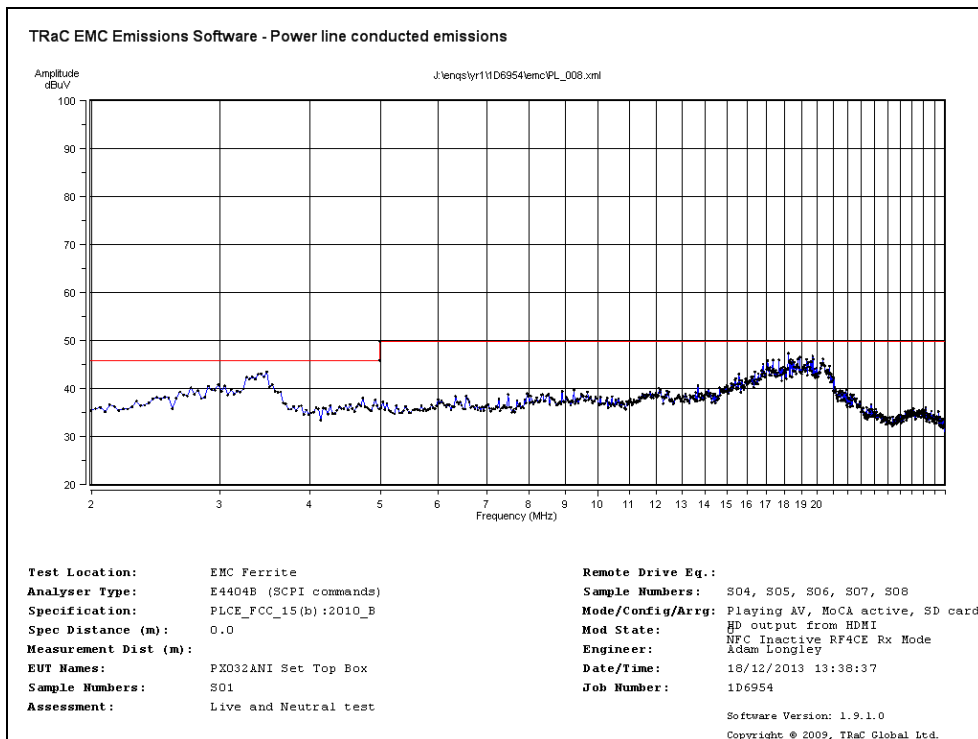
PLCE- EUT NFC Transmitting (RF4CE Ch25) 0.15MHz - 2 MHz



PLCE – EUT NFC Transmitting (RF4CE Ch25) 2 to 30 MHz



PLCE – EUT NFC Receiving (RF4CE Rx) 0.15 to 2 MHz



PLCE- EUT NFC Receiving (RF4CE Rx) 2MHz - 30 MHz

**Appendix E:****Additional Test and Sample Details**

This appendix contains details of:

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

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

**Sample No:** Sxx Mod w

where:

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

The following terminology is used throughout the test report:

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

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

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

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

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

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

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

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

**E1) Test samples**

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

Sample No.	Description	Identification
S01	PX032ANI Set Top Box (Radiated sample)	PADA00042725
S02	PX032ANI Set Top Box (Conducted sample)	PADA00042737

The following samples of the apparatus were submitted by the client as support equipment (SE)

Sample No.	Description	Identification
S04	D-link Ethernet to coaxial bridge	F3XX18A000018
S05	Xi3 7428	DP2012110026
S06	Dell Laptop (Latitude D620)	Pace Asset No = Pace0000015275
S07	Samsung LCD monitor LE19B450C4W	85793HMS600925K
S08	Block SAT100 Autotransformer (115V O/P)	Pace Asset No = 0111

**E2) EUT Operating Mode During Testing.**

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

Test	Description of Operating Mode: Transmit
All tests, except as described below	NFC powered and scan mode enabled RF4CE powered and placed in transmit mode Connected to ECB via MoCA link decoding HD AV stream SD card inserted and powered HDMI output resolution = 1080i HDMI input connected to HDMI output of set-top box (S05) playing HD stream USB port loaded with USB stick

Test	Description of Operating Mode: Receive/Standby mode
Receiver Radiated Spurious Emissions Receiver Power Line Conducted Emissions	NFC powered and scan mode enabled RF4CE powered and placed in receive mode Connected to ECB via MoCA link decoding HD AV stream SD card inserted and powered HDMI output resolution = 1080i HDMI input connected to HDMI output of set-top box (S05) playing HD stream USB port loaded with USB stick

Test	Description of Operating Mode: Transmit
Conducted RF port tests on RF4CE	NFC powered and scan mode enabled RF4CE powered and placed in transmit mode SD card inserted and powered HDMI output resolution = 1080i USB port loaded with control laptop (S06)

**E3) EUT Configuration Information.**

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

**E4) List of EUT Ports**

The tables below describe the termination of EUT ports:

The table below describes the termination of EUT ports:

Sample : S02

Tests : RF Antenna Port Conducted Spurious Emissions, 6dB Bandwidth, Power Spectral Density and Conducted Fundamental Carrier Power

Port	Description of Cable Attached	Cable length	Equipment Connected
Cable In	None	-	None
HDMI In	None	-	None
HDMI Out	None	-	None
USB	USB Null modem cable	7m	Laptop S06
SD card slot	N/A	N/A	SD card
Mains Power	2 core figure-8 mains lead	2m	Mains supply

Sample : S01

Tests : Radiated Electric Field Emissions Restricted band 15.209 (15.205) and 15.109 digital circuitry

Port	Description of Cable Attached	Cable length	Equipment Connected
Cable In	75Ohm coax	>3m	D-Link S04
HDMI In	HDMI to HDMI cable	2m	S05
HDMI Out	HDMI to HDMI cable	2m	TV S07
USB	None	-	USB drive
SD card slot	N/A	N/A	SD card
Mains Power	2 core figure-8 mains lead	2m	Mains supply

**E5 Details of Equipment Used**

For Radiated Measurements:

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

For Conducted Measurements

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.
REF909	FSU	Spectrum Analyser	Rhode & Schwarz	30/02/13
REF837	E4440A	Spectrum Analyser	Agilent	10/05/13

For Power Line Conducted Emissions

TRAC REF/RFG No.	Type	Description	Manufacturer	Date Calibrated.
n/a	Lab 5	Screened room 2	TRaC	CAL date N/A
189	ESH3-Z5	2-phase LISN	Rhode & Schwarz	17/06/13
680	ESH3-Z2	Pulse Limiter	Rhode & Schwarz	29/06/13
404	E4407B	Spectrum Analyser	Agilent	12/07/13
125	ESHS10	Measuring Receiver	Rhode & Schwarz	17/06/13
109	8859	AC 110 /60Hz power supply	-	CAL date N/A



**Appendix F:**

**Additional Information**

No additional information provided.

**Appendix G:**

**Photographs and Figures**

Attached to the FCC submission as separate exhibits.

**Appendix H:****MPE Calculation**

OET Bulletin No. 65, Supplement C 01-01

**47 CFR §§1.1307 and 2.1091**

2.1091 Radio frequency radiation exposure evaluation: mobile devices.

For purposes of these requirements mobile devices are defined by the FCC as transmitters designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimetres is normally maintained between radiating structures and the body of the user or nearby persons. These devices are normally evaluated for exposure potential with relation to the MPE limits. As the 20cm separation specified under FCC rules may not be achievable under normal operation of the EUT, an RF exposure calculation is needed to show the minimum distance required to be less than 1mW/cm<sup>2</sup> power density limit, as required under FCC rules.

**Prediction of MPE limit at a given distance**

Equation from page 18 of OET Bulletin 65, Edition 97-01

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

where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Note:

The EIRP measurement was performed using the peak conducted power measurement in conjunction with the maximum declared antenna gain.

Result

Prediction Frequency (MHz)	Maximum EIRP (mW)	Power density limit (S) (mW/cm <sup>2</sup> )	Distance (R) cm required to be less than 1mW/cm <sup>2</sup> (cm)
2475	3.184	1	0.504

