

**Radio Test Report**

**FOR**

**Light Blue Optics**

**ON**

**Light Touch 1020 and Light Touch 1220**

**Document Number TTR-001930WUS1**

**HULL**

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**TRaC Radio Test Report** : TTR-001930WUS1

**Applicant** : Light Blue Optics

**Apparatus** : Light Touch 1020 and Light Touch 1220

**Specification(s)** : CFR47 Part 15.247 July 2008

**FCCID** : YVE-LT

**Purpose of Test** : Certification

**Authorised by** :

A handwritten signature in black ink, reading "John Charters", is displayed on a light gray rectangular background.

: Radio Product Manager

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**Section 1:**

**Introduction**

**1.1 General**

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

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## **1.2 Tests Requested By**

This testing in this report was requested by:

Light Blue Optics  
4775 Centennial Blvd, Suit103  
Colorado Springs  
CO  
80919  
USA

## **1.3 Manufacturer**

As above.

## **1.4 Apparatus Assessed**

The following apparatus was assessed between 03/03/11 and 18/05/11:

Light Touch 1020 and Light Touch 1220

The above equipment was a WIFI IEEE802.11b/g enabled interactive projector operating in the 2400MHz to 2483.5MHz band.

## 1.5 Test Result Summary

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

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

Full details of test results are contained within Appendix A. The following table summarises the results of the assessment.

| Test Type                                              | Regulation                                                | Measurement standard | Result |
|--------------------------------------------------------|-----------------------------------------------------------|----------------------|--------|
| Radiated spurious emissions<br>(Restricted bands)      | Title 47 of the CFR:<br>Part 15 Subpart (c) 15.247        | ANSI C63.10          | Pass   |
| Conducted spurious emissions<br>(Non-restricted bands) | Title 47 of the CFR:<br>Part 15 Subpart (c) 15.247        | ANSI C63.10          | Pass   |
| AC Power conducted emissions                           | Title 47 of the CFR:<br>Part 15 Subpart (c) 15.207        | ANSI C63.10          | Pass   |
| 6dB Bandwidth                                          | Title 47 of the CFR :<br>Part 15 Subpart (c) 15.247(a)(2) | ANSI C63.10          | Pass   |
| Conducted Carrier Power                                | Title 47 of the CFR :<br>Part 15 Subpart (c) 15.247(b)(3) | ANSI C63.10          | Pass   |
| Power Spectral Density                                 | Title 47 of the CFR :<br>Part 15 Subpart (c); 15.247(d)   | ANSI C63.10          | Pass   |
| Unintentional Radiated Spurious Emissions              | Title 47 of the CFR:<br>Part 15 Subpart (b) 15.109        | 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 Application of Measurement Uncertainty**

The following table contains the measurement uncertainties for measurements

- The measured value related to the corresponding limit is used to decide whether equipment meets the requirements of the standard.
- The measurement uncertainty value for the measurement of each parameter is recorded in section 2.3 of this report.
- All values of measurement uncertainty are equal to or lower than the values in the table (section 2.2) below as required by the standard

## 2.2 Measurement Uncertainty Values

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

### Radio Testing – General Uncertainty Schedule

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

#### [1] Adjacent Channel Power

Uncertainty in test result = **1.86dB**

#### [2] Carrier Power

Uncertainty in test result = **0.9 dB**

#### [3] Effective Radiated Power

Uncertainty in test result = **4.1 dB**

#### [4] Spurious Emissions

Uncertainty in test result = **4.1dB**

#### [5] Maximum frequency error

Uncertainty in test result = **3.6kHz**

#### [6] Frequency deviation

Uncertainty in test result = **3.6 kHz**

#### [7] Magnetic Field Emissions

Uncertainty in test result = **2.1 dB**

#### [8] Conducted Spurious

Uncertainty in test result = **0.9 dB**

#### [9] Channel Bandwidth

Uncertainty in test result = **3.6 kHz**

#### [10] Power Line Conduction

Uncertainty in test result = **3.5 dB**

#### [11] Spectrum Mask Measurements

Uncertainty in test result = **3.6 kHz (frequency)**

Uncertainty in test result = **0.9 dB (amplitude)**

#### [12] Transmission Time Measurement

Uncertainty in test result = **5.8% ± 10ns**

**Section 3:**

**Modifications**

**3.1 Modifications Performed During Assessment**

No modifications were performed during the assessment

**Appendix A:****Formal Emission Test Results**

Abbreviations used in the tables in this appendix:

|      |                                 |      |                                |
|------|---------------------------------|------|--------------------------------|
| Spec | : Specification                 | ALSR | : Absorber Lined Screened Room |
| Mod  | : Modification                  | OATS | : Open Area Test Site          |
|      |                                 | ATS  | : Alternative Test Site        |
| EUT  | : Equipment Under Test          |      |                                |
| SE   | : Support Equipment             | Ref  | : Reference                    |
|      |                                 | Freq | : Frequency                    |
| L    | : Live Power Line               |      |                                |
| 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 | Mbps | : Mega Bits Per Second         |

**A1 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)(1) |
| Measurement standard   | ANSI C63.10:2003                                     |
| EUT sample number      | S05 and S06                                          |
| Modification state     | 0                                                    |
| SE in test environment | None                                                 |
| SE isolated from EUT   | None                                                 |
| EUT set up             | Refer to Appendix C                                  |
| Temperature            | 20°C                                                 |

| Data Rate = 11Mbps         |                           |              |        |
|----------------------------|---------------------------|--------------|--------|
| Channel Frequency<br>(MHz) | Peak Carrier Power<br>(W) | Limit<br>(W) | Result |
| 2412.0                     | 0.020                     | 1            | Pass   |
| 2437.0                     | 0.022                     |              | Pass   |
| 2462.0                     | 0.027                     |              | Pass   |
| Data Rate = 54Mbps         |                           |              |        |
| Channel Frequency<br>(MHz) | Peak Carrier Power<br>(W) | Limit<br>(W) | Result |
| 2412.0                     | 0.029                     | 1            | Pass   |
| 2437.0                     | 0.029                     |              | Pass   |
| 2462.0                     | 0.035                     |              | Pass   |

Notes:

Conducted Measurement

Measured Peak Carrier power includes highest gain of any antenna to be used.  
Highest Gain of any antenna to be used = 1.8 dBi

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

**A2 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(b)(3) |
| Measurement standard   | ANSI C63.10:2003                                     |
| EUT sample number      | S05 and S06                                          |
| Modification state     | 0                                                    |
| SE in test environment | None                                                 |
| SE isolated from EUT   | None                                                 |
| EUT set up             | Refer to Appendix C                                  |
| Temperature            | 20°C                                                 |

| <b>Channel Frequency (MHz)</b> | <b>Peak Power Spectral Density (dBm)</b> | <b>Limit (dBm)</b> | <b>Result</b> |
|--------------------------------|------------------------------------------|--------------------|---------------|
| 2412.0                         | 4.3                                      | 8.0                | Pass          |
| 2437.0                         | 4.2                                      | 8.0                | Pass          |
| 2462.0                         | 4.2                                      | 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 = 1.8 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 3MHz

The sweep time is 1000 seconds (Span/3kHz).

**A3 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 and operating at data rates of 11Mbps & 54Mbps at each frequency. Plots were taken of all data rates and frequencies. Only plots of top middle and bottom frequencies for the data rate producing highest output power are contained in appendix B.

| Test Details           |                                                           |
|------------------------|-----------------------------------------------------------|
| Regulation             | Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) |
| Measurement standard   | ANSI C63.10:2003                                          |
| Frequency range        | 9 kHz to 25 GHz                                           |
| EUT sample number      | S05 and S06                                               |
| Modification state     | 0                                                         |
| SE in test environment | None                                                      |
| SE isolated from EUT   | None                                                      |
| EUT set up             | Refer to Appendix C                                       |
| Temperature            | 20°C                                                      |

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

| Test Details : 11Mbps, 2412MHz, 2437MHZ & 2462MHz  |                     |      |                                                         |                                                    |                        |         |
|----------------------------------------------------|---------------------|------|---------------------------------------------------------|----------------------------------------------------|------------------------|---------|
| Ref No.                                            | Measured Freq (MHz) | Det. | Is measured Frequency within the Restricted bands (Y/N) | Measured Peak Conducted power (RBW =100kHz) (dBuV) | 15.247(d) Limit (dBuV) | Summary |
| No significant emissions within 20 dB of the limit |                     |      |                                                         |                                                    |                        |         |

| Test Details : 54Mbps, 2412MHz, 2437MHZ & 2462MHz  |                     |      |                                                         |                                                    |                        |         |
|----------------------------------------------------|---------------------|------|---------------------------------------------------------|----------------------------------------------------|------------------------|---------|
| Ref No.                                            | Measured Freq (MHz) | Det. | Is measured Frequency within the Restricted bands (Y/N) | Measured Peak Conducted power (RBW =100kHz) (dBuV) | 15.247(d) Limit (dBuV) | Summary |
| No significant emissions within 20 dB of the limit |                     |      |                                                         |                                                    |                        |         |

**Notes:**

1. The conducted emission limit for all emissions are based on a transmitted carrier level in a 100kHz RBW. 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/100kHz) - 20dB

**A4 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 and operating at data rates of 11Mbps & 54Mbps at each frequency. Plots were taken of all data rates and frequencies. Only plots of top middle and bottom frequencies for the data rate producing highest output power are contained in appendix B.

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: 11Mbps     |                                                                             |
|--------------------------|-----------------------------------------------------------------------------|
| Regulation               | Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205 |
| Measurement standard     | ANSI C63.10:2003                                                            |
| Frequency range          | 30MHz to 25 GHz                                                             |
| EUT sample number        | S07 and S16                                                                 |
| Modification state       | 0                                                                           |
| SE in test environment   | S17, S18, S19 and S20                                                       |
| SE isolated from EUT     | None                                                                        |
| EUT set up               | Refer to Appendix C                                                         |
| Temperature              | 20°C                                                                        |
| Photographs (Appendix F) | Photograph 1 and 2                                                          |

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

| 2412 MHz – 11Mbps |             |      |                |                 |                  |              |                      |                  |                    |              |             |
|-------------------|-------------|------|----------------|-----------------|------------------|--------------|----------------------|------------------|--------------------|--------------|-------------|
| Ref No.           | FREQ. (MHz) | Det. | MEAS Rx (dBμV) | CABLE LOSS (dB) | ANT FACT. (dB/m) | PRE AMP (dB) | FIELD ST'GH (dBμV/m) | EXTRAP FACT (dB) | FIELD ST'GH (μV/m) | LIMIT (μV/m) | Margin (dB) |
| 1                 | 35.008      | Pk   | 58.1           | 0.6             | 12.2             | 30.8         | 40.1                 | 0                | 40.1               | 88.4         | -48.3       |
| 2                 | 35.008      | QP   | 51.4           | 0.6             | 12.2             | 30.8         | 33.4                 | 0                | 33.4               | 68.4         | -35.0       |
| 3                 | 144.006     | Pk   | 50.7           | 1.3             | 12.4             | 31           | 33.4                 | 0                | 33.4               | 88.4         | -55.0       |
| 4                 | 144.006     | QP   | 46.9           | 1.3             | 12.4             | 31           | 29.6                 | 0                | 29.6               | 68.4         | -38.8       |
| 5                 | 240.014     | Pk   | 54.5           | 1.8             | 11.1             | 31.1         | 36.3                 | 0                | 36.3               | 66.0         | -29.7       |
| 6                 | 240.014     | QP   | 53.4           | 1.8             | 11.1             | 31.1         | 35.2                 | 0                | 35.2               | 46.0         | -10.8       |
| 7                 | 559.966     | Pk   | 54.8           | 2.8             | 18.5             | 30.9         | 45.2                 | 0                | 45.2               | 88.4         | -43.2       |
| 8                 | 559.966     | QP   | 54.3           | 2.8             | 18.5             | 30.9         | 44.7                 | 0                | 44.7               | 68.4         | -23.7       |
| 9                 | 599.963     | Pk   | 50.5           | 2.9             | 18.6             | 30.9         | 41.1                 | 0                | 41.1               | 88.4         | -47.3       |
| 10                | 599.963     | QP   | 48.8           | 2.9             | 18.6             | 30.9         | 39.4                 | 0                | 39.4               | 68.4         | -29.0       |
| 11                | 699.957     | Pk   | 45.7           | 3.0             | 20.7             | 30.9         | 38.5                 | 0                | 38.5               | 88.4         | -49.9       |
| 12                | 699.957     | QP   | 44.4           | 3.0             | 20.7             | 30.9         | 37.2                 | 0                | 37.2               | 68.4         | -31.2       |
| 13                | 839.949     | Pk   | 51.6           | 3.2             | 21.9             | 30.6         | 46.1                 | 0                | 46.1               | 88.4         | -42.3       |
| 14                | 839.949     | QP   | 50.6           | 3.2             | 21.9             | 30.6         | 45.1                 | 0                | 45.1               | 68.4         | -23.3       |
| 15                | 979.941     | Pk   | 50.7           | 3.6             | 23.4             | 29.7         | 48.0                 | 0                | 48.0               | 74.0         | -26.0       |
| 16                | 979.941     | QP   | 49.9           | 3.6             | 23.4             | 29.7         | 47.2                 | 0                | 47.2               | 54.0         | -6.8        |
| 17                | 1000.000    | Pk   | 55.6           | 3.5             | 22.1             | 34.6         | 46.6                 | 0                | 46.6               | 74.0         | -27.4       |
| 18                | 1000.000    | AV   | 42.1           | 3.5             | 22.1             | 34.6         | 33.1                 | 0                | 33.1               | 54.0         | -20.9       |
| 19                | 1399.915    | Pk   | 52.5           | 4.5             | 25.0             | 33.9         | 48.1                 | 0                | 48.1               | 74.0         | -25.9       |
| 20                | 1399.915    | AV   | 43.6           | 4.5             | 25.0             | 33.9         | 39.2                 | 0                | 39.2               | 54.0         | -14.8       |
| 21                | 1539.905    | Pk   | 48.1           | 5.0             | 25.9             | 33.7         | 45.3                 | 0                | 45.3               | 74.0         | -28.7       |
| 22                | 1539.905    | AV   | 41.2           | 5.0             | 25.9             | 33.7         | 38.4                 | 0                | 38.4               | 54.0         | -15.6       |
| 23                | 2412.523    | Pk   | 74.8           | 4.1             | 29.5             | N/A          | 108.4                | 0                | 108.4              | 137.0        | -28.6       |
| 24                | 2385.269    | Pk   | 64.8           | 4.7             | 29.4             | 33.8         | 65.2                 | 0                | 65.2               | 74.0         | -8.8        |
| 25                | 2385.269    | AV   | 41.6           | 4.7             | 29.4             | 33.8         | 42.0                 | 0                | 42.0               | 54.0         | -12.0       |
| 26                | 2390.000    | Pk   | 67.5           | 4.5             | 29.5             | 33.8         | 67.8                 | 0                | 67.8               | 74.0         | -6.2        |
| 27                | 2390.000    | AV   | 41.4           | 4.5             | 29.5             | 33.8         | 41.7                 | 0                | 41.7               | 54.0         | -12.3       |
| 28                | 4823.966    | Pk   | 45.0           | 8.2             | 36.0             | 34.0         | 55.2                 | 0                | 55.2               | 74.0         | -18.8       |
| 29                | 4823.966    | AV   | 31.8           | 8.2             | 36.0             | 34.0         | 42.0                 | 0                | 42.0               | 54.0         | -12.0       |

| 2437 MHz – 11Mbps |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|-------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.           | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                 | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 89.1            | -49.0          |
| 2                 | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 69.1            | -35.7          |
| 3                 | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 89.1            | -55.7          |
| 4                 | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 69.1            | -39.5          |
| 5                 | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                 | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                 | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 89.1            | -43.9          |
| 8                 | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 69.1            | -24.4          |
| 9                 | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 89.1            | -48.0          |
| 10                | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 69.1            | -29.7          |
| 11                | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 89.1            | -50.6          |
| 12                | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 69.1            | -31.9          |
| 13                | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 89.1            | -43.0          |
| 14                | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 69.1            | -24.0          |
| 15                | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                | 1000.000       | Pk   | 61.4                 | 3.5                   | 22.1                   | 34.6               | 52.4                       | 0                      | 52.4                     | 74.0            | -21.6          |
| 18                | 1000.000       | AV   | 48.0                 | 3.5                   | 22.1                   | 34.6               | 39.0                       | 0                      | 39.0                     | 54.0            | -15.0          |
| 19                | 1399.913       | Pk   | 52.1                 | 4.5                   | 25.0                   | 33.9               | 47.7                       | 0                      | 47.7                     | 74.0            | -26.3          |
| 20                | 1399.913       | AV   | 43.8                 | 4.5                   | 25.0                   | 33.9               | 39.4                       | 0                      | 39.4                     | 54.0            | -14.6          |
| 21                | 1539.905       | Pk   | 48.6                 | 5.0                   | 25.9                   | 33.7               | 45.8                       | 0                      | 45.8                     | 74.0            | -28.2          |
| 22                | 1539.905       | AV   | 41.5                 | 5.0                   | 25.9                   | 33.7               | 38.7                       | 0                      | 38.7                     | 54.0            | -15.3          |
| 23                | 2437.564       | Pk   | 75.5                 | 4.0                   | 29.6                   | N/A                | 109.1                      | 0                      | 109.1                    | 137.0           | -27.9          |
| 24                | 4873.968       | Pk   | 46.5                 | 8.3                   | 36.1                   | 34.1               | 56.8                       | 0                      | 56.8                     | 74.0            | -17.2          |
| 25                | 4873.968       | AV   | 32.9                 | 8.3                   | 36.1                   | 34.1               | 43.2                       | 0                      | 43.2                     | 54.0            | -10.8          |

| 2462 MHz – 11Mbps |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|-------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.           | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                 | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 88.5            | -48.4          |
| 2                 | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 68.5            | -35.1          |
| 3                 | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 88.5            | -55.1          |
| 4                 | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 68.5            | -38.9          |
| 5                 | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                 | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                 | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 88.5            | -43.3          |
| 8                 | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 68.5            | -23.8          |
| 9                 | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 88.5            | -47.4          |
| 10                | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 68.5            | -29.1          |
| 11                | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 88.5            | -50.0          |
| 12                | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 68.5            | -31.3          |
| 13                | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 88.5            | -42.4          |
| 14                | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 68.5            | -23.4          |
| 15                | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                | 1000.000       | Pk   | 60.9                 | 3.5                   | 22.1                   | 34.6               | 51.9                       | 0                      | 51.9                     | 74.0            | -22.1          |
| 18                | 1000.000       | AV   | 47.8                 | 3.5                   | 22.1                   | 34.6               | 38.8                       | 0                      | 38.8                     | 54.0            | -15.2          |
| 19                | 1399.913       | Pk   | 51.1                 | 4.5                   | 25.0                   | 33.9               | 46.7                       | 0                      | 46.7                     | 74.0            | -27.3          |
| 20                | 1399.913       | AV   | 42.6                 | 4.5                   | 25.0                   | 33.9               | 38.2                       | 0                      | 38.2                     | 54.0            | -15.8          |
| 21                | 1539.907       | Pk   | 47.6                 | 5.0                   | 25.9                   | 33.7               | 44.8                       | 0                      | 44.8                     | 74.0            | -29.2          |
| 22                | 1539.907       | AV   | 39.5                 | 5.0                   | 25.9                   | 33.7               | 36.7                       | 0                      | 36.7                     | 54.0            | -17.3          |
| 23                | 2460.577       | Pk   | 74.6                 | 4.2                   | 29.7                   | N/A                | 108.5                      | 0                      | 108.5                    | 137.0           | -28.5          |
| 24                | 2483.500       | Pk   | 62.6                 | 4.4                   | 29.8                   | 33.8               | 63.0                       | 0                      | 63.0                     | 74.0            | -11.0          |
| 25                | 2483.500       | AV   | 41.4                 | 4.4                   | 29.8                   | 33.8               | 41.8                       | 0                      | 41.8                     | 54.0            | -12.2          |
| 26                | 2486.269       | Pk   | 64.5                 | 4.5                   | 29.8                   | 33.8               | 65.0                       | 0                      | 65.0                     | 74.0            | -9.0           |
| 27                | 2486.269       | AV   | 42.8                 | 4.5                   | 29.8                   | 33.8               | 43.3                       | 0                      | 43.3                     | 54.0            | -10.7          |
| 28                | 4923.958       | Pk   | 48.5                 | 8.8                   | 36.2                   | 34.1               | 59.4                       | 0                      | 59.4                     | 74.0            | -14.6          |
| 29                | 4923.958       | AV   | 33.5                 | 8.8                   | 36.2                   | 34.1               | 44.4                       | 0                      | 44.4                     | 54.0            | -9.6           |

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

| Test Details: 54Mbps     |                                                                             |
|--------------------------|-----------------------------------------------------------------------------|
| Regulation               | Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205 |
| Measurement standard     | ANSI C63.10:2003                                                            |
| Frequency range          | 30MHz to 25 GHz                                                             |
| EUT sample number        | S07 and S16                                                                 |
| Modification state       | 0                                                                           |
| SE in test environment   | S17, S18, S19 and S20                                                       |
| SE isolated from EUT     | None                                                                        |
| EUT set up               | Refer to Appendix C                                                         |
| Temperature              | 20°C                                                                        |
| Photographs (Appendix F) | Photograph 1 and 2                                                          |

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

| 2412 MHz – 54Mbps |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|-------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.           | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                 | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 87.1            | -47.0          |
| 2                 | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 67.1            | -33.7          |
| 3                 | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 87.1            | -53.7          |
| 4                 | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 67.1            | -37.5          |
| 5                 | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                 | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                 | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 87.1            | -41.9          |
| 8                 | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 67.1            | -22.4          |
| 9                 | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 87.1            | -46.0          |
| 10                | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 67.1            | -27.7          |
| 11                | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 87.1            | -48.6          |
| 12                | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 67.1            | -29.9          |
| 13                | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 87.1            | -41.0          |
| 14                | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 67.1            | -22.0          |
| 15                | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                | 1000.000       | Pk   | 57.5                 | 3.5                   | 22.1                   | 34.6               | 48.5                       | 0                      | 48.5                     | 74.0            | -25.5          |
| 18                | 1000.000       | AV   | 44.7                 | 3.5                   | 22.1                   | 34.6               | 35.7                       | 0                      | 35.7                     | 54.0            | -18.3          |
| 19                | 1399.913       | Pk   | 51.9                 | 4.5                   | 25.0                   | 33.9               | 47.5                       | 0                      | 47.5                     | 74.0            | -26.5          |
| 20                | 1399.913       | AV   | 43.8                 | 4.5                   | 25.0                   | 33.9               | 39.4                       | 0                      | 39.4                     | 54.0            | -14.6          |
| 21                | 1539.904       | Pk   | 48.3                 | 5.0                   | 25.9                   | 33.7               | 45.5                       | 0                      | 45.5                     | 74.0            | -28.5          |
| 22                | 1539.904       | AV   | 41.2                 | 5.0                   | 25.9                   | 33.7               | 38.4                       | 0                      | 38.4                     | 54.0            | -15.6          |
| 23                | 2390.000       | Pk   | 68.6                 | 4.5                   | 29.5                   | 33.8               | 68.9                       | 0                      | 68.9                     | 74.0            | -5.1           |
| 24                | 2390.000       | AV   | 48.7                 | 4.5                   | 29.5                   | 33.8               | 49.0                       | 0                      | 49.0                     | 54.0            | -5.0           |
| 25                | 2414.880       | Pk   | 73.4                 | 4.1                   | 29.6                   | N/A                | 107.1                      | 0                      | 107.1                    | 137.0           | -29.9          |

| 2437 MHz – 54Mbps |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|-------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.           | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                 | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 89.2            | -49.1          |
| 2                 | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 69.2            | -35.8          |
| 3                 | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 89.2            | -55.8          |
| 4                 | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 69.2            | -39.6          |
| 5                 | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                 | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                 | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 89.2            | -44.0          |
| 8                 | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 69.2            | -24.5          |
| 9                 | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 89.2            | -48.1          |
| 10                | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 69.2            | -29.8          |
| 11                | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 89.2            | -50.7          |
| 12                | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 69.2            | -32.0          |
| 13                | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 89.2            | -43.1          |
| 14                | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 69.2            | -24.1          |
| 15                | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                | 1000.000       | Pk   | 57.4                 | 3.5                   | 22.1                   | 34.6               | 48.4                       | 0                      | 48.4                     | 74.0            | -25.6          |
| 18                | 1000.000       | AV   | 44.7                 | 3.5                   | 22.1                   | 34.6               | 35.7                       | 0                      | 35.7                     | 54.0            | -18.3          |
| 19                | 1399.917       | Pk   | 52.8                 | 4.5                   | 25.0                   | 33.9               | 48.4                       | 0                      | 48.4                     | 74.0            | -25.6          |
| 20                | 1399.917       | AV   | 44.4                 | 4.5                   | 25.0                   | 33.9               | 40.0                       | 0                      | 40.0                     | 54.0            | -14.0          |
| 21                | 1539.904       | Pk   | 49.2                 | 5.0                   | 25.9                   | 33.7               | 46.4                       | 0                      | 46.4                     | 74.0            | -27.6          |
| 22                | 1539.904       | AV   | 42.9                 | 5.0                   | 25.9                   | 33.7               | 40.1                       | 0                      | 40.1                     | 54.0            | -13.9          |
| 23                | 2431.199       | Pk   | 75.5                 | 4.1                   | 29.6                   | N/A                | 109.2                      | 0                      | 109.2                    | 137.0           | -27.8          |

| 2462 MHz – 54Mbps |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|-------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.           | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                 | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 86.7            | -46.6          |
| 2                 | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 66.7            | -33.3          |
| 3                 | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 86.7            | -53.3          |
| 4                 | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 66.7            | -37.1          |
| 5                 | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                 | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                 | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 86.7            | -41.5          |
| 8                 | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 66.7            | -22.0          |
| 9                 | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 86.7            | -45.6          |
| 10                | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 66.7            | -27.3          |
| 11                | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 86.7            | -48.2          |
| 12                | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 66.7            | -29.5          |
| 13                | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 86.7            | -40.6          |
| 14                | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 66.7            | -21.6          |
| 15                | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                | 1000.000       | Pk   | 62.7                 | 3.5                   | 22.1                   | 34.6               | 53.7                       | 0                      | 53.7                     | 74.0            | -20.3          |
| 18                | 1000.000       | AV   | 49.9                 | 3.5                   | 22.1                   | 34.6               | 40.9                       | 0                      | 40.9                     | 54.0            | -13.1          |
| 19                | 1399.915       | Pk   | 52.1                 | 4.5                   | 25.0                   | 33.9               | 47.7                       | 0                      | 47.7                     | 74.0            | -26.3          |
| 20                | 1399.915       | AV   | 44.1                 | 4.5                   | 25.0                   | 33.9               | 39.7                       | 0                      | 39.7                     | 54.0            | -14.3          |
| 21                | 1539.907       | Pk   | 49.0                 | 5.0                   | 25.9                   | 33.7               | 46.2                       | 0                      | 46.2                     | 74.0            | -27.8          |
| 22                | 1539.907       | AV   | 41.6                 | 5.0                   | 25.9                   | 33.7               | 38.8                       | 0                      | 38.8                     | 54.0            | -15.2          |
| 23                | 2464.923       | Pk   | 72.8                 | 4.2                   | 29.7                   | N/A                | 106.7                      | 0                      | 106.7                    | 137.0           | -30.3          |
| 24                | 2483.500       | Pk   | 69.2                 | 4.4                   | 29.8                   | 33.8               | 69.6                       | 0                      | 69.6                     | 74.0            | -4.4           |
| 25                | 2483.500       | AV   | 49.1                 | 4.4                   | 29.8                   | 33.8               | 49.5                       | 0                      | 49.5                     | 54.0            | -4.5           |

**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 do 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= 1MHz, VBW > RBW  
     Average          RBW= 1MHz, VBW > RBW

These settings as per ANSI C63.10 and DA 00-705.

- 6 In accordance with DA 00-705, the average level of the spurious radiated emission may be reduced by the duty cycle correction factor. If the dwell time per channel (refer to the measured channel occupancy time, section A7 of this test report) of the hopping signal is less than 100ms then the average measurement may be further adjusted by the duty cycle correction factor which is derived from

$$20\log_{10}\left(\frac{\text{dwell time}}{100\text{ms}}\right)$$

The upper and lower frequency of the measurement range was decided according to 47 CFR Part15:2008 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 uV/m | Measurement Distance m | Field strength dBuV/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 D<br>(ii) Parameter defined by client and / or single possible, refer to Appendix D<br>(iii) Parameter had a negligible effect on emission levels, refer to Appendix D<br>(iv) Worst case determined by initial measurement, refer to Appendix D |         |          |           |          |

**A5 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. The results of this test determine the limits for channel spacing.

| <b>Test Details:</b>   |                                                       |
|------------------------|-------------------------------------------------------|
| Regulation             | Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2) |
| EUT sample number      | S05 and S06                                           |
| Modification state     | 0                                                     |
| SE in test environment | None                                                  |
| SE isolated from EUT   | None                                                  |
| Temperature            | 20°C                                                  |
| EUT set up             | Refer to Appendix C                                   |

| <b>11Mbps</b>           |                               |
|-------------------------|-------------------------------|
| Channel Frequency (MHz) | Measured 6 dB Bandwidth (kHz) |
| 2412                    | 7930                          |
| 2437                    | 7481                          |
| 2462                    | 7481                          |
| <b>54Mbps</b>           |                               |
| Channel Frequency (MHz) | Measured 6 dB Bandwidth (kHz) |
| 2412                    | 16275                         |
| 2437                    | 16425                         |
| 2462                    | 16425                         |

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

**A6     Antenna Gain**

The maximum antenna gain for the antenna types to be used with the EUT, as declared by the client, is 1.8dBi. The data sheet for the antenna is contained within Appendix D

**A7 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.

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 C63.10:2003                                       |
| Frequency range          | 30MHz to 25 GHz                                        |
| EUT sample number        | S07 and S16                                            |
| Modification state       | 0                                                      |
| SE in test environment   | S17, S18, S19 and S20                                  |
| SE isolated from EUT     | None                                                   |
| EUT set up               | Refer to Appendix C                                    |
| Temperature              | 19°C                                                   |
| Photographs (Appendix F) | Photograph 1 and 2                                     |

The worst case radiated emission measurements for spurious emissions:

| 2412 MHz – Rx mode |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|--------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.            | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                  | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 60.0            | -19.9          |
| 2                  | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 40.0            | -6.6           |
| 3                  | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 63.5            | -30.1          |
| 4                  | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 43.5            | -13.9          |
| 5                  | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                  | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                  | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 66.0            | -20.8          |
| 8                  | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 46.0            | -1.3           |
| 9                  | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 66.0            | -24.9          |
| 10                 | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 46.0            | -6.6           |
| 11                 | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 66.0            | -27.5          |
| 12                 | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 46.0            | -8.8           |
| 13                 | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 66.0            | -19.9          |
| 14                 | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 46.0            | -0.9           |
| 15                 | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                 | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                 | 1331.957       | Pk   | 48.5                 | 4.2                   | 24.5                   | 34.0               | 43.2                       | 0                      | 43.2                     | 74.0            | -30.8          |
| 18                 | 1331.957       | AV   | 39.5                 | 4.2                   | 24.5                   | 34.0               | 34.2                       | 0                      | 34.2                     | 54.0            | -19.8          |
| 19                 | 1539.905       | Pk   | 48.9                 | 5.0                   | 25.9                   | 33.7               | 46.1                       | 0                      | 46.1                     | 74.0            | -27.9          |
| 20                 | 1539.905       | AV   | 41.3                 | 5.0                   | 25.9                   | 33.7               | 38.5                       | 0                      | 38.5                     | 54.0            | -15.5          |
| 21                 | 1819.889       | Pk   | 46.7                 | 5.3                   | 27.2                   | 33.7               | 45.5                       | 0                      | 45.5                     | 74.0            | -28.5          |
| 22                 | 1819.889       | AV   | 37.7                 | 5.3                   | 27.2                   | 33.7               | 36.5                       | 0                      | 36.5                     | 54.0            | -17.5          |

| 2437 MHz – Rx mode |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|--------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.            | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                  | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 60.0            | -19.9          |
| 2                  | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 40.0            | -6.6           |
| 3                  | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 63.5            | -30.1          |
| 4                  | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 43.5            | -13.9          |
| 5                  | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                  | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                  | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 66.0            | -20.8          |
| 8                  | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 46.0            | -1.3           |
| 9                  | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 66.0            | -24.9          |
| 10                 | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 46.0            | -6.6           |
| 11                 | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 66.0            | -27.5          |
| 12                 | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 46.0            | -8.8           |
| 13                 | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 66.0            | -19.9          |
| 14                 | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 46.0            | -0.9           |
| 15                 | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                 | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                 | 1331.957       | Pk   | 48.5                 | 4.2                   | 24.5                   | 34.0               | 43.2                       | 0                      | 43.2                     | 74.0            | -30.8          |
| 18                 | 1331.957       | AV   | 39.5                 | 4.2                   | 24.5                   | 34.0               | 34.2                       | 0                      | 34.2                     | 54.0            | -19.8          |
| 19                 | 1539.905       | Pk   | 48.9                 | 5.0                   | 25.9                   | 33.7               | 46.1                       | 0                      | 46.1                     | 74.0            | -27.9          |
| 20                 | 1539.905       | AV   | 41.3                 | 5.0                   | 25.9                   | 33.7               | 38.5                       | 0                      | 38.5                     | 54.0            | -15.5          |
| 21                 | 1819.889       | Pk   | 46.7                 | 5.3                   | 27.2                   | 33.7               | 45.5                       | 0                      | 45.5                     | 74.0            | -28.5          |
| 22                 | 1819.889       | AV   | 37.7                 | 5.3                   | 27.2                   | 33.7               | 36.5                       | 0                      | 36.5                     | 54.0            | -17.5          |

| 2462 MHz – Rx mode |                |      |                      |                       |                        |                    |                            |                        |                          |                 |                |
|--------------------|----------------|------|----------------------|-----------------------|------------------------|--------------------|----------------------------|------------------------|--------------------------|-----------------|----------------|
| Ref No.            | FREQ.<br>(MHz) | Det. | MEAS<br>Rx<br>(dBμV) | CABLE<br>LOSS<br>(dB) | ANT<br>FACT.<br>(dB/m) | PRE<br>AMP<br>(dB) | FIELD<br>ST'GH<br>(dBμV/m) | EXTRAP<br>FACT<br>(dB) | FIELD<br>ST'GH<br>(μV/m) | LIMIT<br>(μV/m) | Margin<br>(dB) |
| 1                  | 35.008         | Pk   | 58.1                 | 0.6                   | 12.2                   | 30.8               | 40.1                       | 0                      | 40.1                     | 60.0            | -19.9          |
| 2                  | 35.008         | QP   | 51.4                 | 0.6                   | 12.2                   | 30.8               | 33.4                       | 0                      | 33.4                     | 40.0            | -6.6           |
| 3                  | 144.006        | Pk   | 50.7                 | 1.3                   | 12.4                   | 31                 | 33.4                       | 0                      | 33.4                     | 63.5            | -30.1          |
| 4                  | 144.006        | QP   | 46.9                 | 1.3                   | 12.4                   | 31                 | 29.6                       | 0                      | 29.6                     | 43.5            | -13.9          |
| 5                  | 240.014        | Pk   | 54.5                 | 1.8                   | 11.1                   | 31.1               | 36.3                       | 0                      | 36.3                     | 66.0            | -29.7          |
| 6                  | 240.014        | QP   | 53.4                 | 1.8                   | 11.1                   | 31.1               | 35.2                       | 0                      | 35.2                     | 46.0            | -10.8          |
| 7                  | 559.966        | Pk   | 54.8                 | 2.8                   | 18.5                   | 30.9               | 45.2                       | 0                      | 45.2                     | 66.0            | -20.8          |
| 8                  | 559.966        | QP   | 54.3                 | 2.8                   | 18.5                   | 30.9               | 44.7                       | 0                      | 44.7                     | 46.0            | -1.3           |
| 9                  | 599.963        | Pk   | 50.5                 | 2.9                   | 18.6                   | 30.9               | 41.1                       | 0                      | 41.1                     | 66.0            | -24.9          |
| 10                 | 599.963        | QP   | 48.8                 | 2.9                   | 18.6                   | 30.9               | 39.4                       | 0                      | 39.4                     | 46.0            | -6.6           |
| 11                 | 699.957        | Pk   | 45.7                 | 3.0                   | 20.7                   | 30.9               | 38.5                       | 0                      | 38.5                     | 66.0            | -27.5          |
| 12                 | 699.957        | QP   | 44.4                 | 3.0                   | 20.7                   | 30.9               | 37.2                       | 0                      | 37.2                     | 46.0            | -8.8           |
| 13                 | 839.949        | Pk   | 51.6                 | 3.2                   | 21.9                   | 30.6               | 46.1                       | 0                      | 46.1                     | 66.0            | -19.9          |
| 14                 | 839.949        | QP   | 50.6                 | 3.2                   | 21.9                   | 30.6               | 45.1                       | 0                      | 45.1                     | 46.0            | -0.9           |
| 15                 | 979.941        | Pk   | 50.7                 | 3.6                   | 23.4                   | 29.7               | 48.0                       | 0                      | 48.0                     | 74.0            | -26.0          |
| 16                 | 979.941        | QP   | 49.9                 | 3.6                   | 23.4                   | 29.7               | 47.2                       | 0                      | 47.2                     | 54.0            | -6.8           |
| 17                 | 1331.957       | Pk   | 48.5                 | 4.2                   | 24.5                   | 34.0               | 43.2                       | 0                      | 43.2                     | 74.0            | -30.8          |
| 18                 | 1331.957       | AV   | 39.5                 | 4.2                   | 24.5                   | 34.0               | 34.2                       | 0                      | 34.2                     | 54.0            | -19.8          |
| 19                 | 1539.905       | Pk   | 48.9                 | 5.0                   | 25.9                   | 33.7               | 46.1                       | 0                      | 46.1                     | 74.0            | -27.9          |
| 20                 | 1539.905       | AV   | 41.3                 | 5.0                   | 25.9                   | 33.7               | 38.5                       | 0                      | 38.5                     | 54.0            | -15.5          |
| 21                 | 1819.889       | Pk   | 46.7                 | 5.3                   | 27.2                   | 33.7               | 45.5                       | 0                      | 45.5                     | 74.0            | -28.5          |
| 22                 | 1819.889       | AV   | 37.7                 | 5.3                   | 27.2                   | 33.7               | 36.5                       | 0                      | 36.5                     | 54.0            | -17.5          |

**A8 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:

| <b>Test Details: Transmit Mode 11b</b> |                                                        |
|----------------------------------------|--------------------------------------------------------|
| 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 and S06                                            |
| Modification state                     | 0                                                      |
| SE in test environment                 | S17, S18, S19 and S20                                  |
| SE isolated from EUT                   | None                                                   |
| EUT set up                             | Refer to Appendix C                                    |
| Photographs (Appendix F)               | Photograph 3                                           |

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

**Results measured using the peak detector compared to the average limit**

| Ref No. | Freq (MHz) | Conductor | Result (dBuV) | Spec Limit (dBuV) | Margin (dB) | Result Summary |
|---------|------------|-----------|---------------|-------------------|-------------|----------------|
| 1       | 0.150      | L1        | 29.5          | 56.0              | -26.5       | Pass           |
| 2       | 0.190      | L1        | 49.7          | 54.0              | -4.3        | Pass           |
| 3       | 0.380      | L1        | 38.0          | 48.3              | -10.3       | Pass           |
| 4       | 1.230      | L1        | 36.7          | 46.0              | -9.3        | Pass           |
| 5       | 1.520      | L1        | 38.2          | 46.0              | -7.8        | Pass           |
| 6       | 4.600      | L1        | 38.1          | 46.0              | -7.9        | Pass           |
| 7       | 0.150      | N         | 29.8          | 56.0              | -26.2       | Pass           |
| 8       | 0.190      | N         | 49.9          | 54.0              | -4.1        | Pass           |
| 9       | 0.380      | N         | 38.0          | 48.3              | -10.3       | Pass           |
| 10      | 1.230      | N         | 36.2          | 46.0              | -9.8        | Pass           |
| 11      | 1.520      | N         | 37.8          | 46.0              | -8.2        | Pass           |
| 12      | 4.600      | N         | 37.6          | 46.0              | -8.4        | Pass           |

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:

| <b>Test Details: Transmit Mode 11g</b> |                                                        |
|----------------------------------------|--------------------------------------------------------|
| 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 and S06                                            |
| Modification state                     | 0                                                      |
| SE in test environment                 | S17, S18, S19 and S20                                  |
| SE isolated from EUT                   | None                                                   |
| EUT set up                             | Refer to Appendix C                                    |
| Photographs (Appendix F)               | Photograph 3                                           |

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

**Results measured using the peak detector compared to the average limit**

| Ref No. | Freq (MHz) | Conductor | Result (dBuV) | Spec Limit (dBuV) | Margin (dB) | Result Summary |
|---------|------------|-----------|---------------|-------------------|-------------|----------------|
| 1       | 0.150      | L1        | 29.9          | 56.0              | -26.1       | Pass           |
| 2       | 0.190      | L1        | 50.0          | 54.0              | -4.0        | Pass           |
| 3       | 0.380      | L1        | 37.7          | 48.3              | -10.6       | Pass           |
| 4       | 1.230      | L1        | 36.5          | 46.0              | -9.5        | Pass           |
| 5       | 1.520      | L1        | 37.9          | 46.0              | -8.1        | Pass           |
| 6       | 4.600      | L1        | 37.8          | 46.0              | -8.2        | Pass           |
| 7       | 0.150      | N         | 29.4          | 56.0              | -26.6       | Pass           |
| 8       | 0.190      | N         | 49.4          | 54.0              | -4.6        | Pass           |
| 9       | 0.380      | N         | 37.4          | 48.3              | -10.9       | Pass           |
| 10      | 1.230      | N         | 35.0          | 46.0              | -11.0       | Pass           |
| 11      | 1.520      | N         | 37.6          | 46.0              | -8.4        | Pass           |
| 12      | 4.600      | N         | 36.6          | 46.0              | -9.4        | Pass           |

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 not transmit. The formal measurements are detailed below:

| 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 and S06                                            |
| Modification state         | 0                                                      |
| SE in test environment     | S17, S18, S19 and S20                                  |
| SE isolated from EUT       | None                                                   |
| EUT set up                 | Refer to Appendix C                                    |
| Photographs (Appendix F)   | Photograph 3                                           |

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

**Results measured using the peak detector compared to the average limit**

| Ref No. | Freq (MHz) | Conductor | Result (dBuV) | Spec Limit (dBuV) | Margin (dB) | Result Summary |
|---------|------------|-----------|---------------|-------------------|-------------|----------------|
| 1       | 0.150      | L1        | 30.0          | 56.0              | -26.0       | Pass           |
| 2       | 0.190      | L1        | 49.5          | 54.0              | -4.5        | Pass           |
| 3       | 0.380      | L1        | 37.5          | 48.3              | -10.8       | Pass           |
| 4       | 1.230      | L1        | 36.1          | 46.0              | -9.9        | Pass           |
| 5       | 1.520      | L1        | 37.7          | 46.0              | -8.3        | Pass           |
| 6       | 4.600      | L1        | 37.4          | 46.0              | -8.6        | Pass           |
| 7       | 0.150      | N         | 29.3          | 56.0              | -26.7       | Pass           |
| 8       | 0.190      | N         | 49.0          | 54.0              | -5.0        | Pass           |
| 9       | 0.380      | N         | 37.5          | 48.3              | -10.8       | Pass           |
| 10      | 1.230      | N         | 34.5          | 46.0              | -11.5       | Pass           |
| 11      | 1.520      | N         | 37.3          | 46.0              | -8.7        | Pass           |
| 12      | 4.600      | N         | 36.7          | 46.0              | -9.3        | Pass           |

**Specification limits :**

Conducted emission limits (47 CFR 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:

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

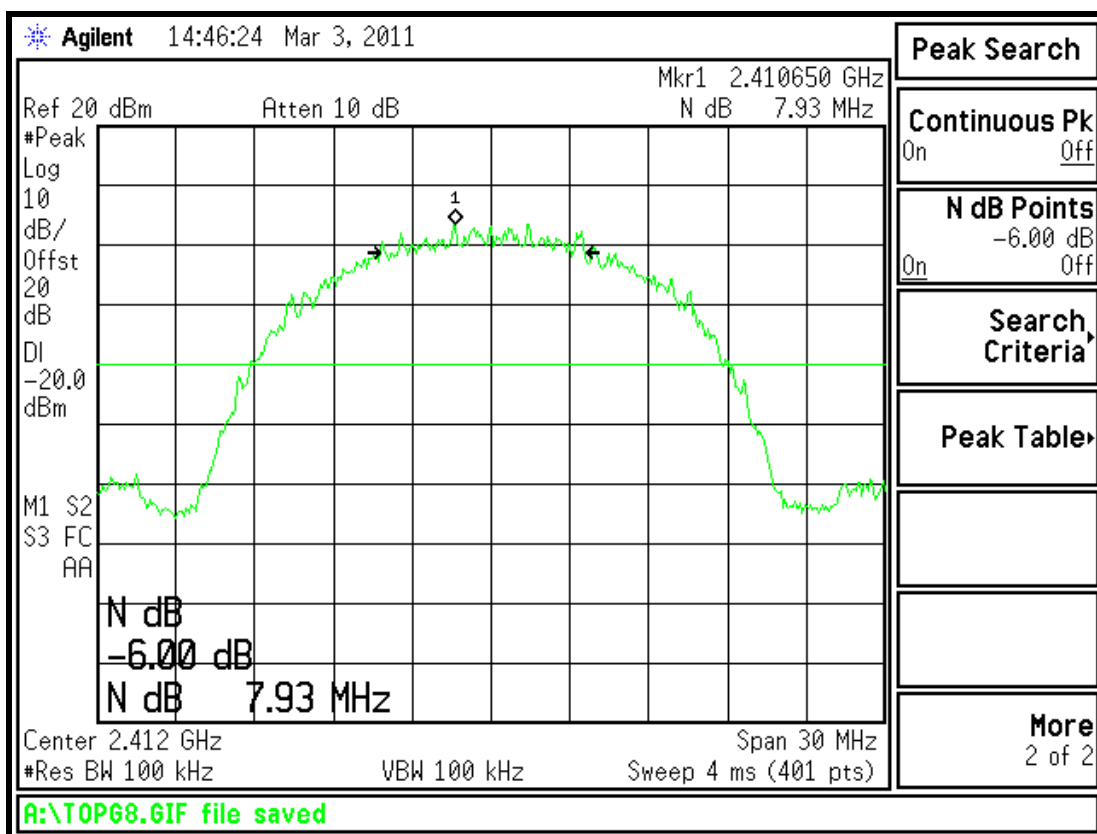
## **Appendix B:**

## **Supporting Graphical Data**

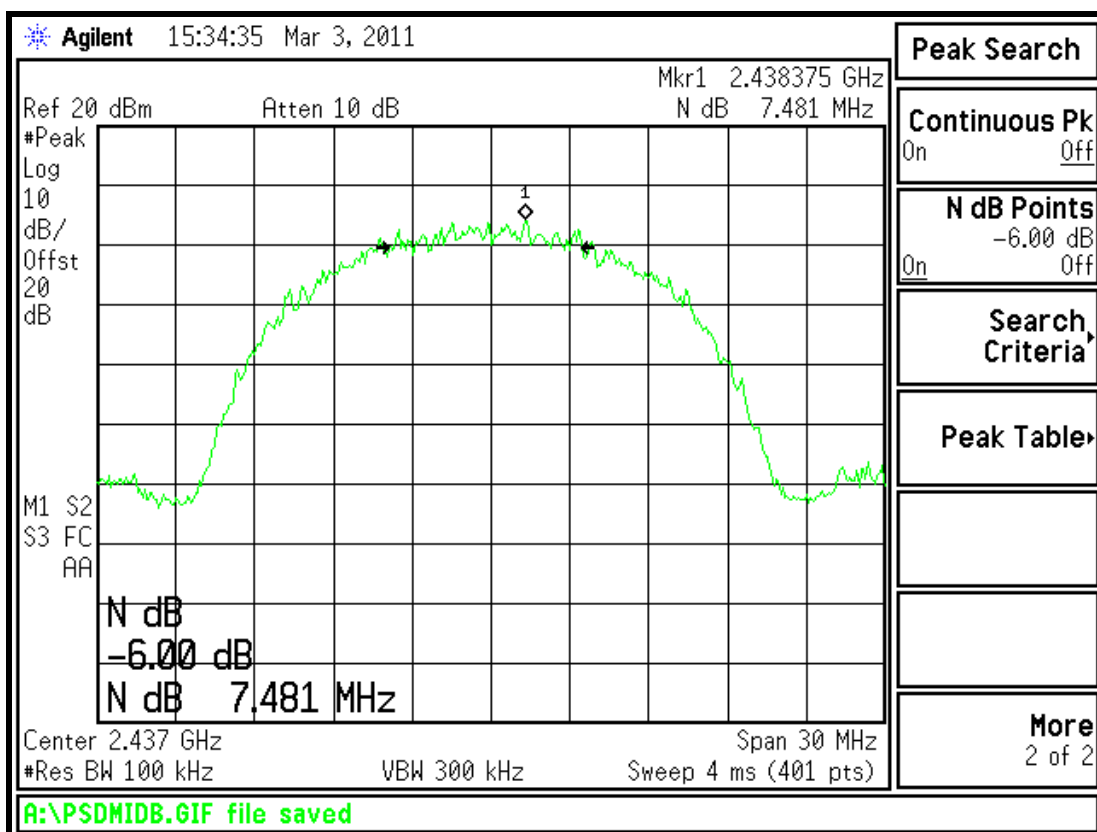
This appendix contains graphical data obtained during testing.

Notes:

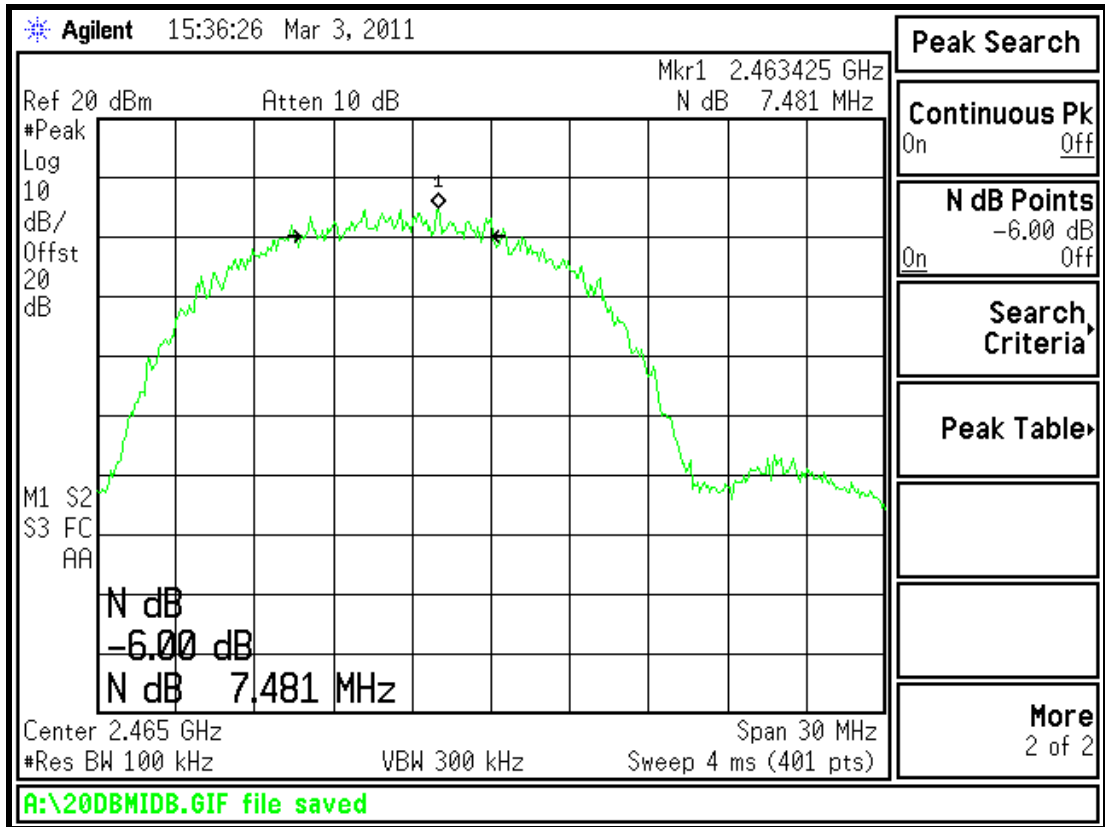
- (a) The radiated electric field emissions and conducted emissions graphical data in this appendix is preview data. For details of formal results, refer to Appendix A and Appendix B.
- (b) The time and date on the plots do not necessarily equate to the time of the test.
- (c) Where relevant, on power 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.



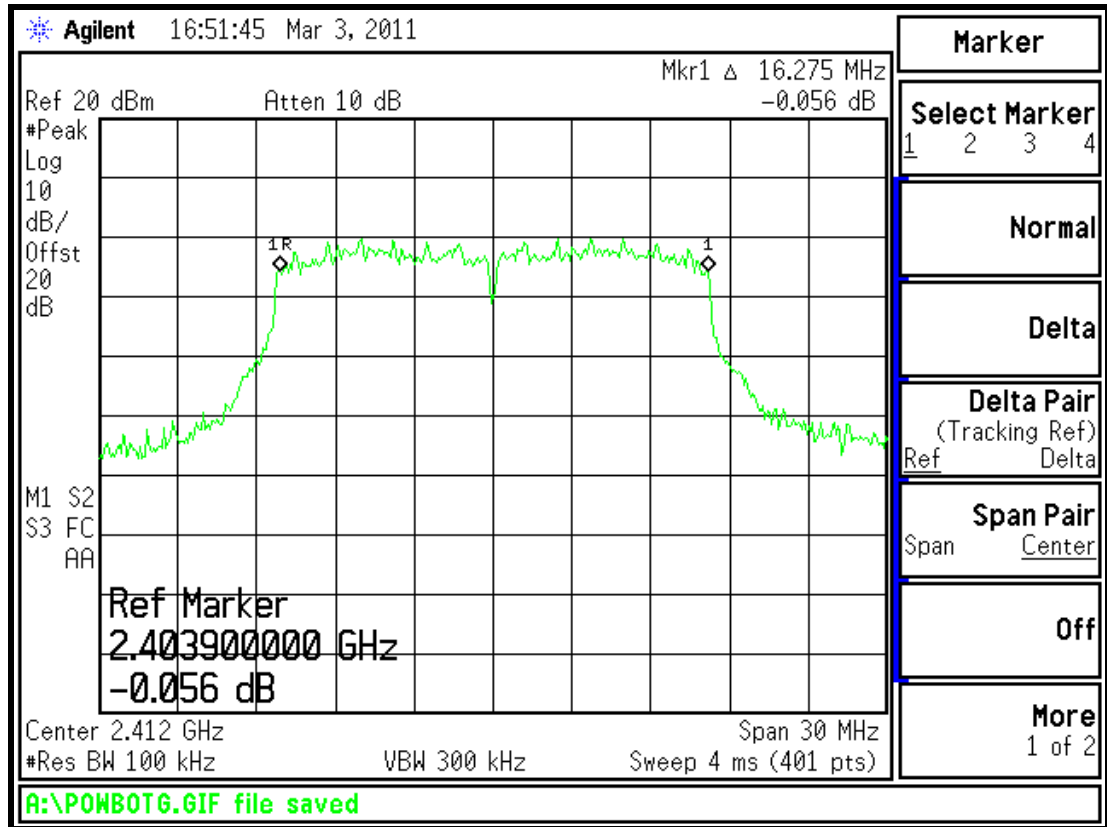
6dB Bandwidth – 11Mbps – 2412MHz



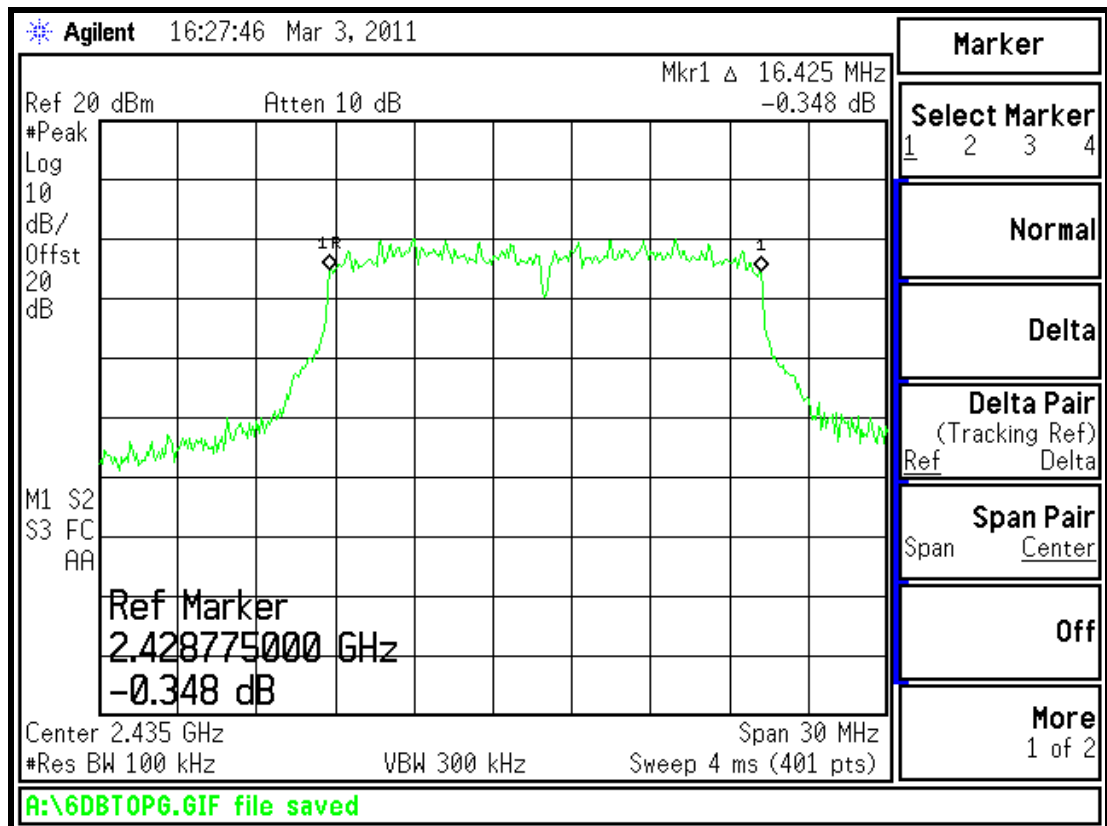
6 dB Bandwidth – 11Mbps – 2437MHz



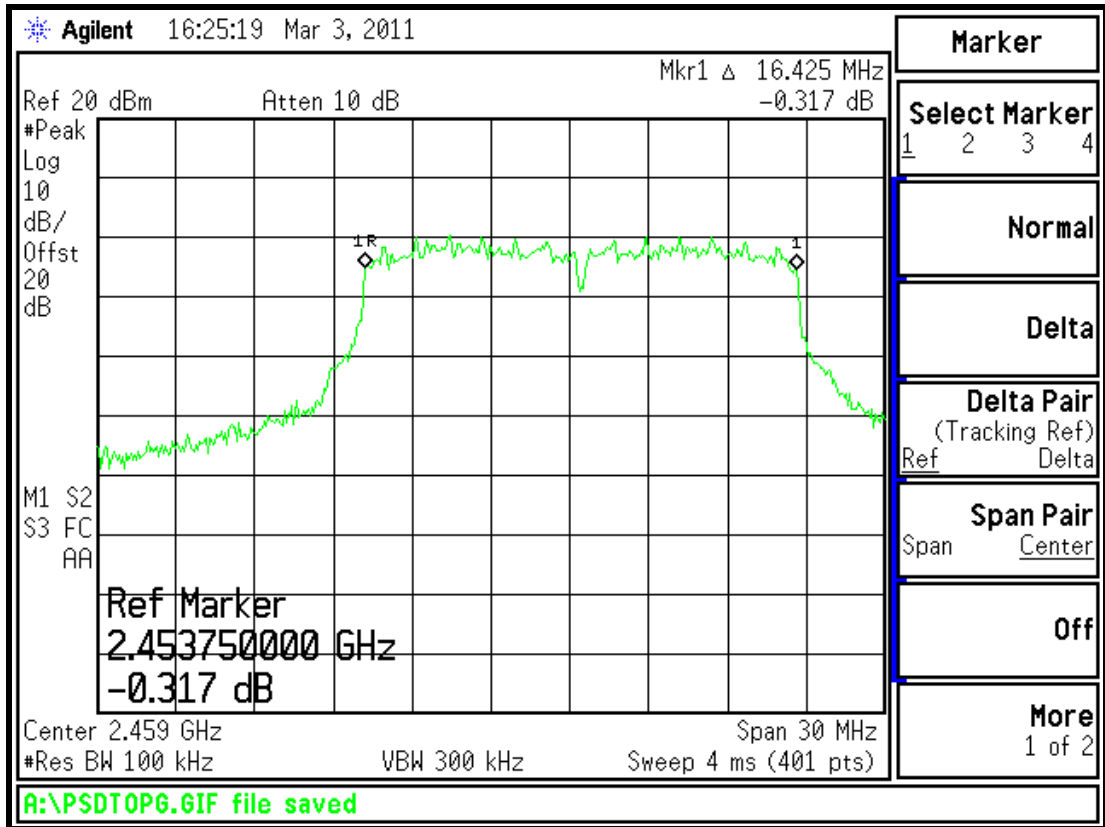
6dB Bandwidth – 11Mbps – 2462MHz



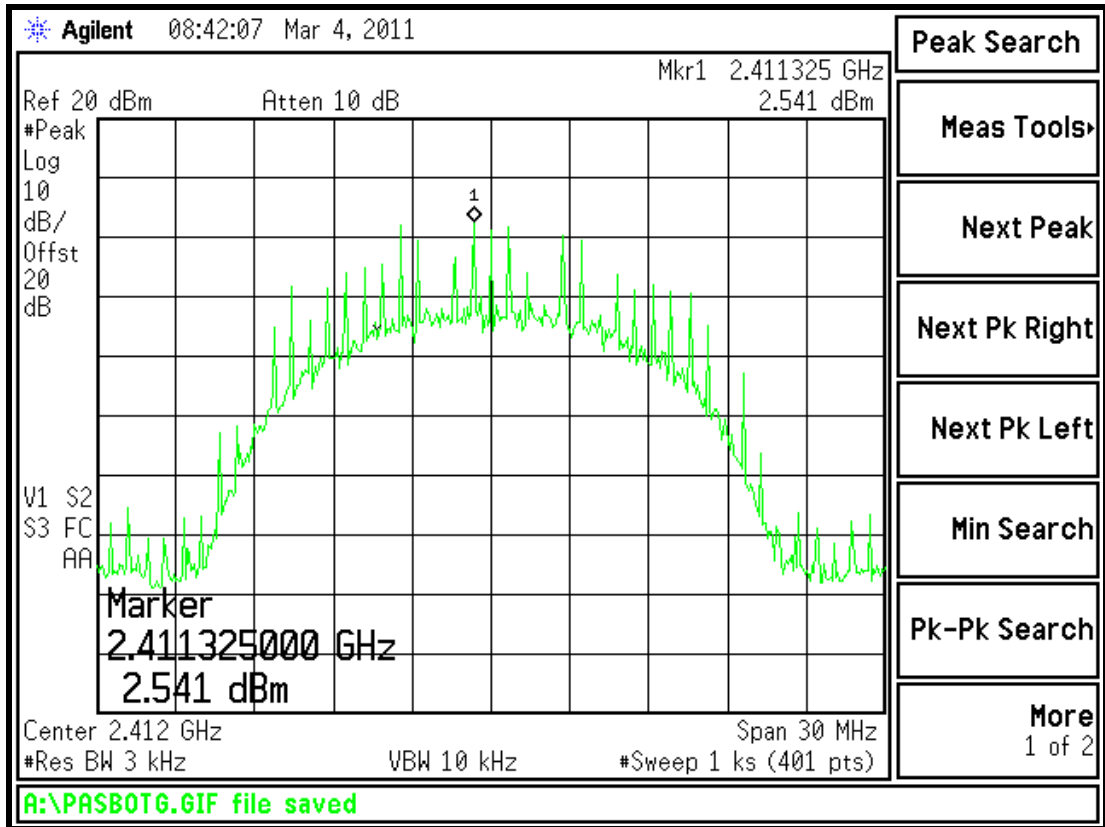
6dB Bandwidth – 54Mbps – 2412MHz



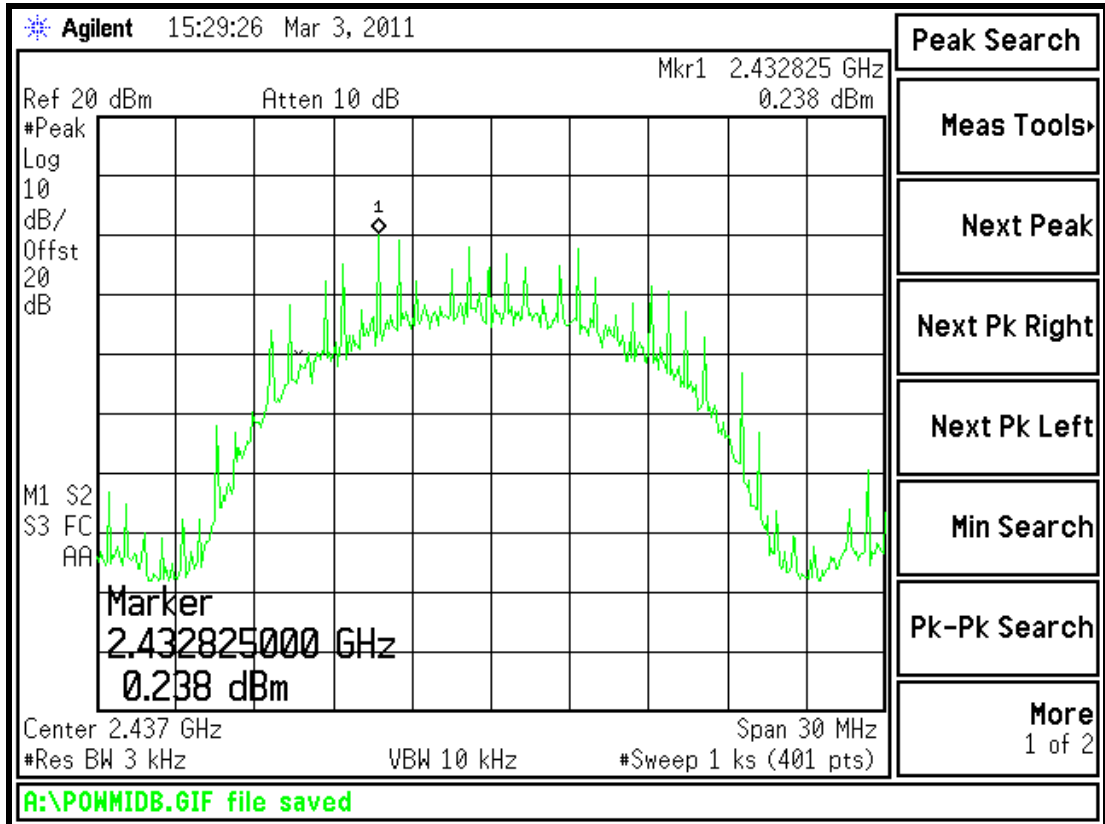
6dB Bandwidth – 54Mbps – 2437MHz



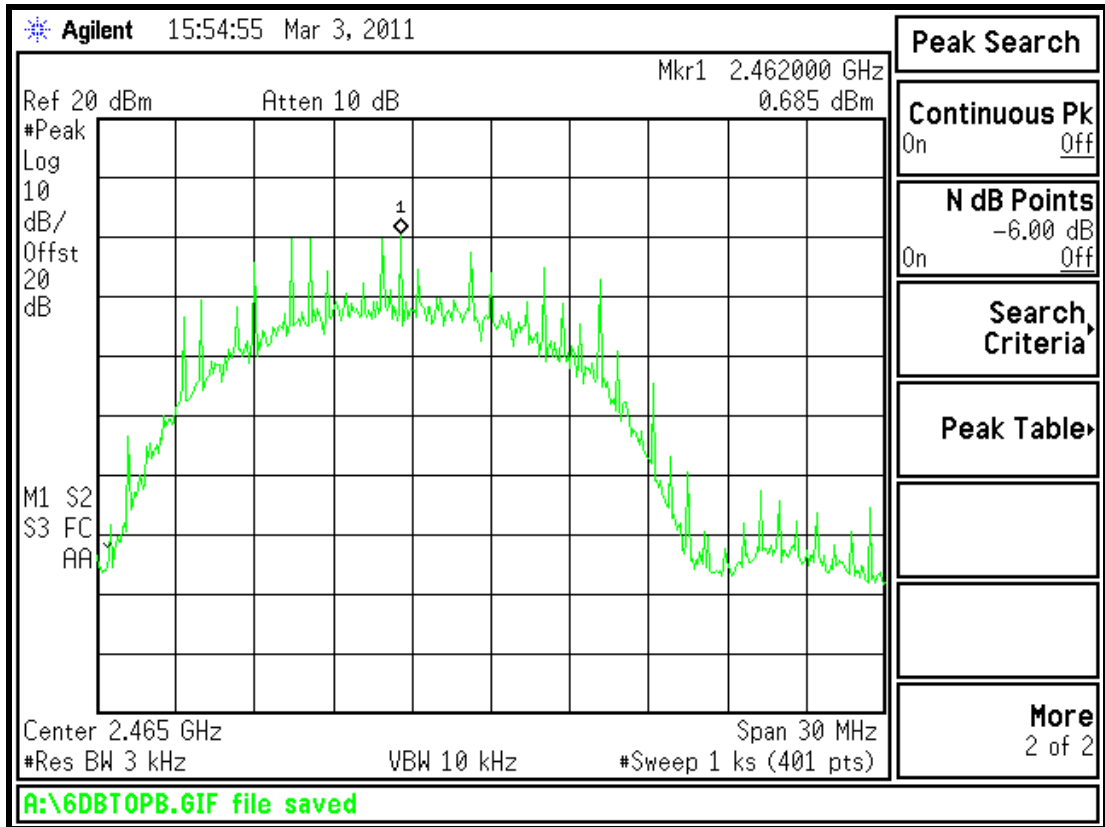
6dB Bandwidth – 54Mbps – 2462MHz



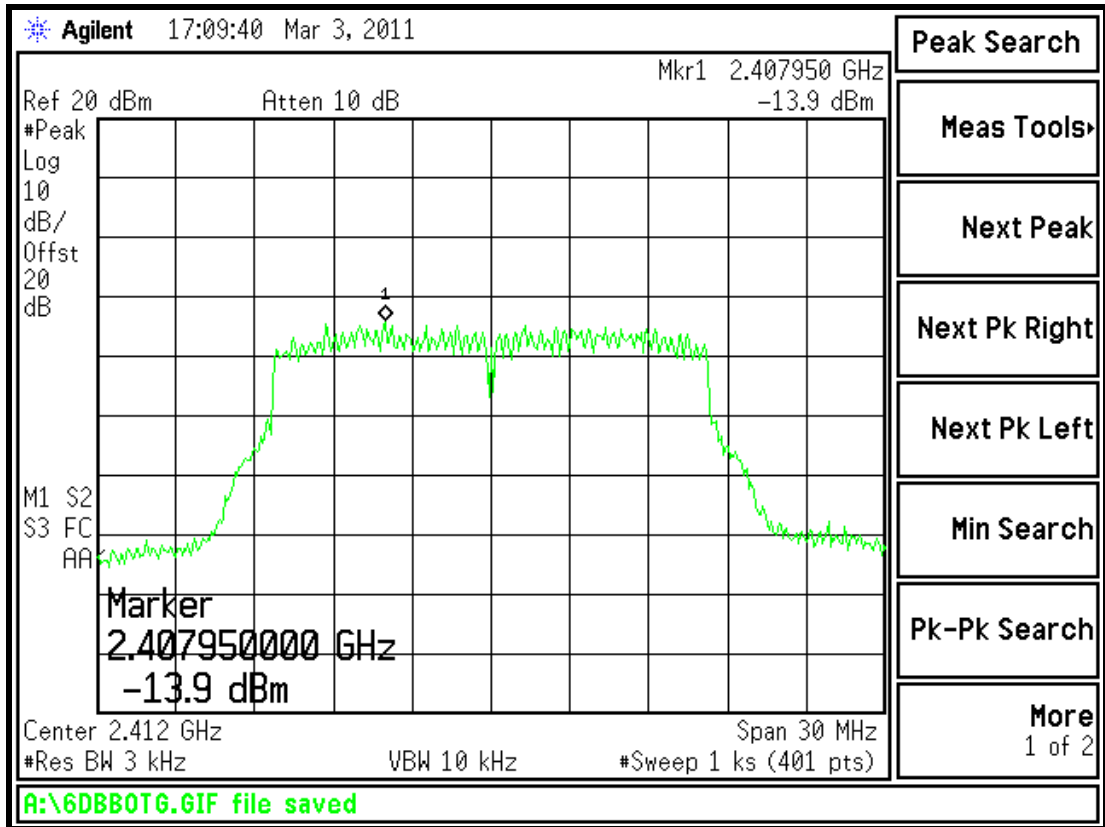
Power spectral density – 11Mbps – 2412MHz



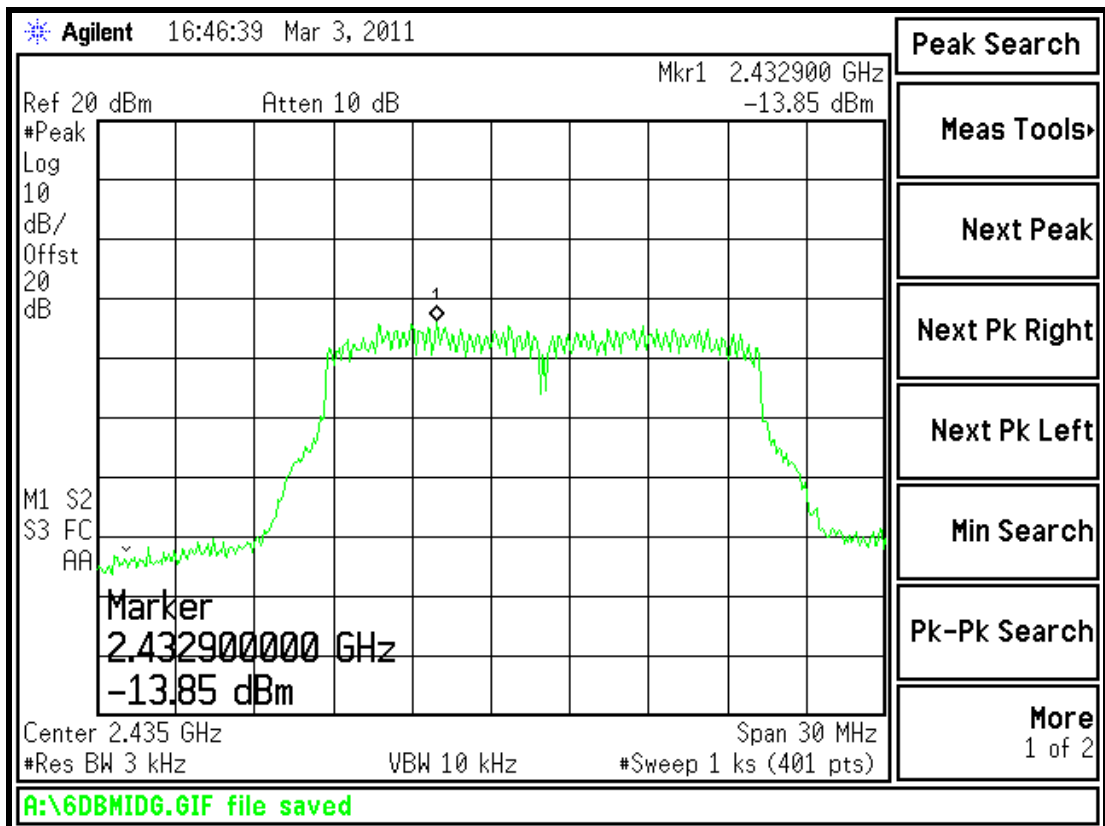
Power spectral density – 11Mbps – 2437MHz



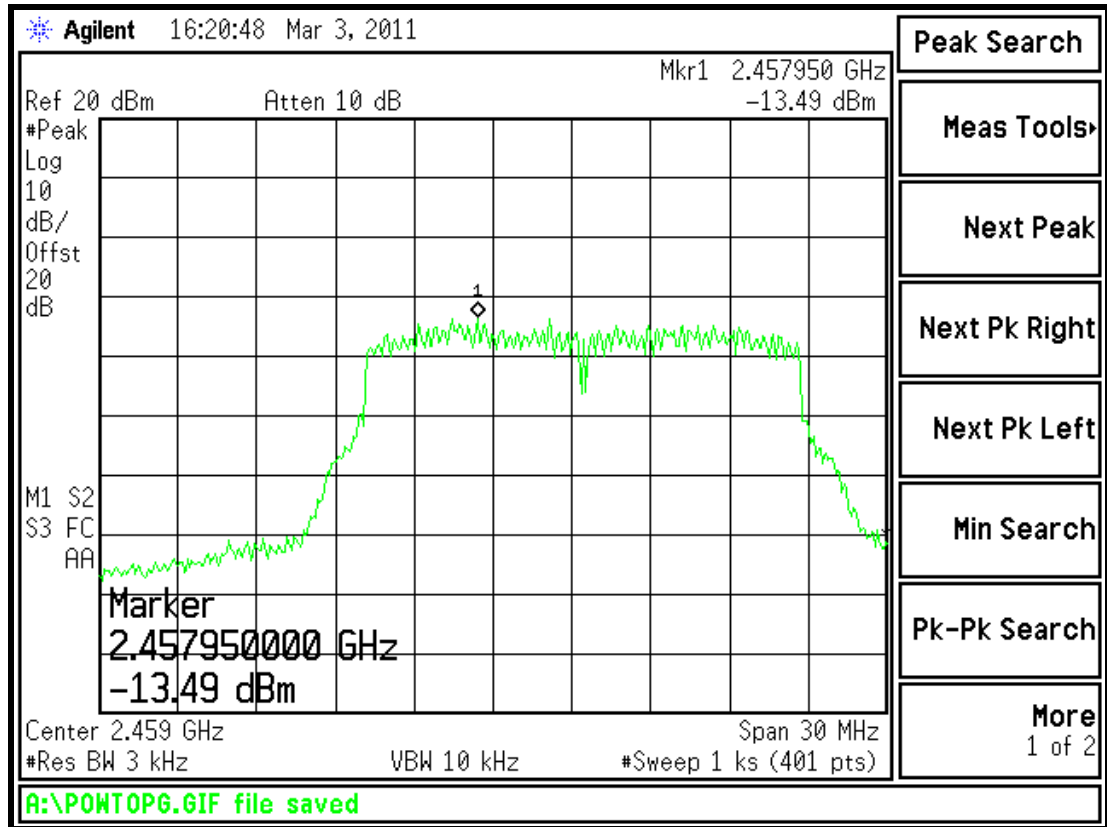
Power spectral density – 11Mbps – 2462MHz



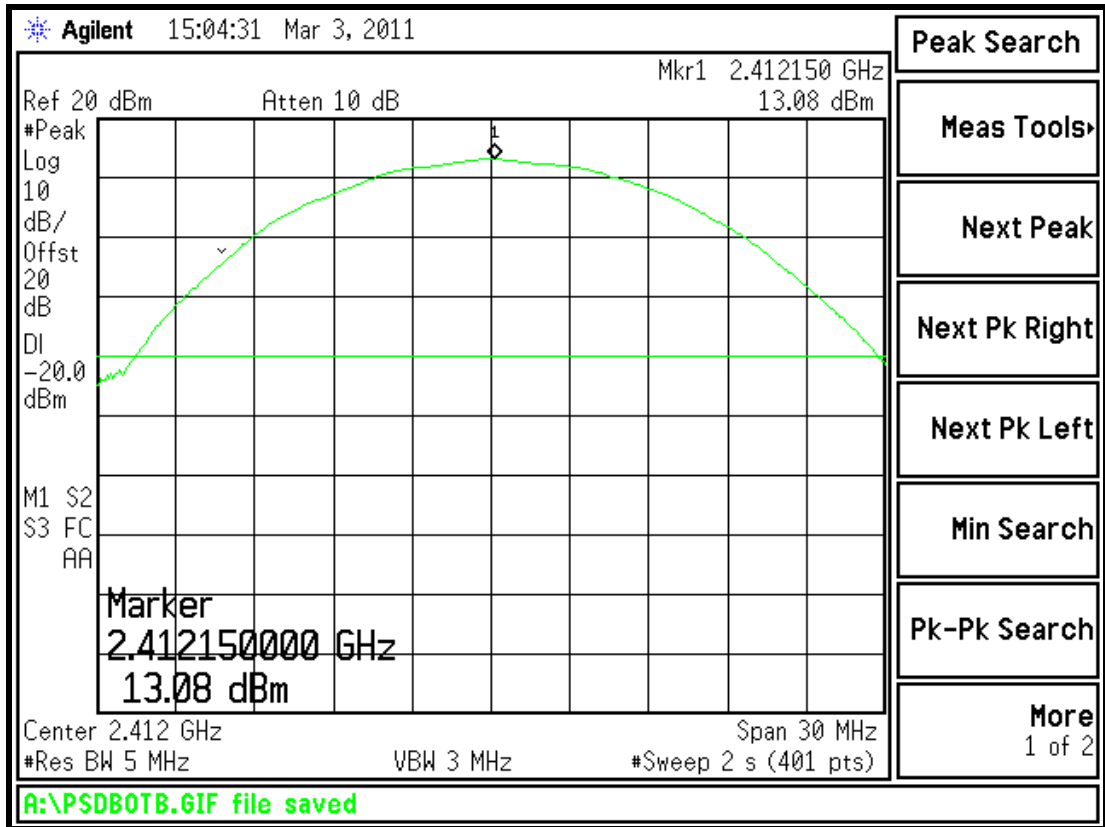
Power spectral density – 54Mbps – 2412MHz



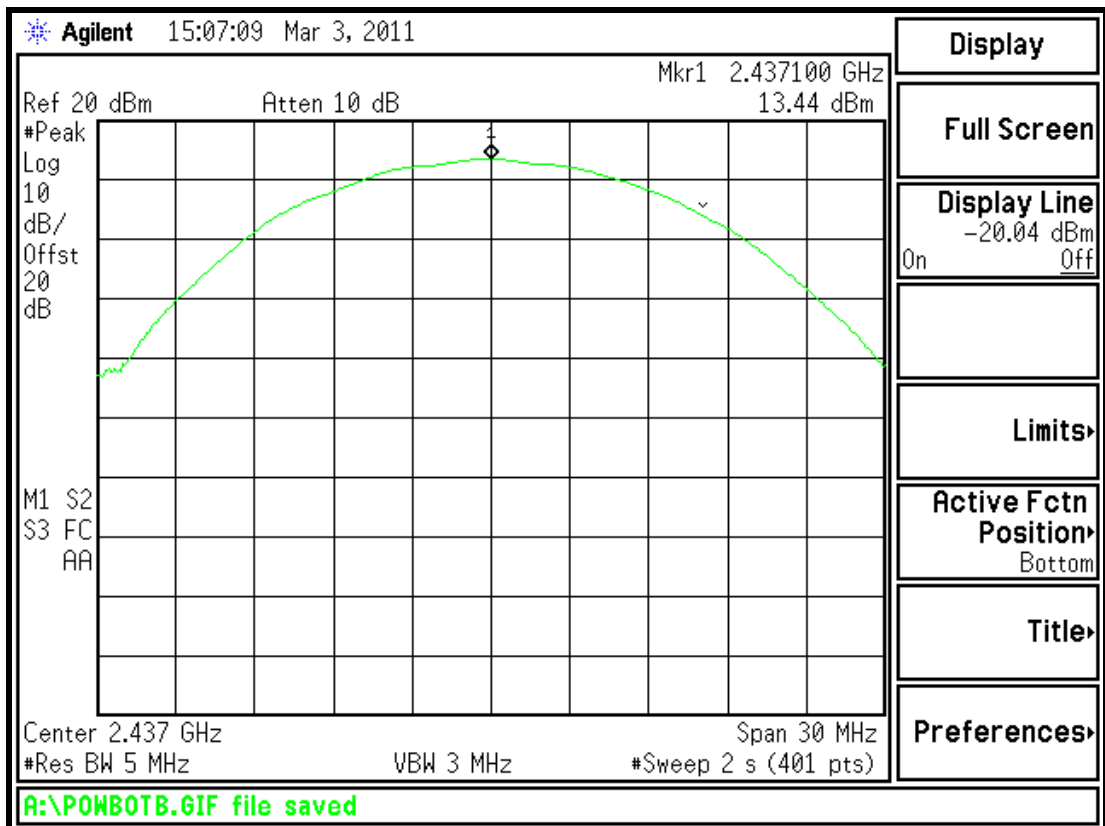
Power spectral density – 54Mbps – 2437MHz



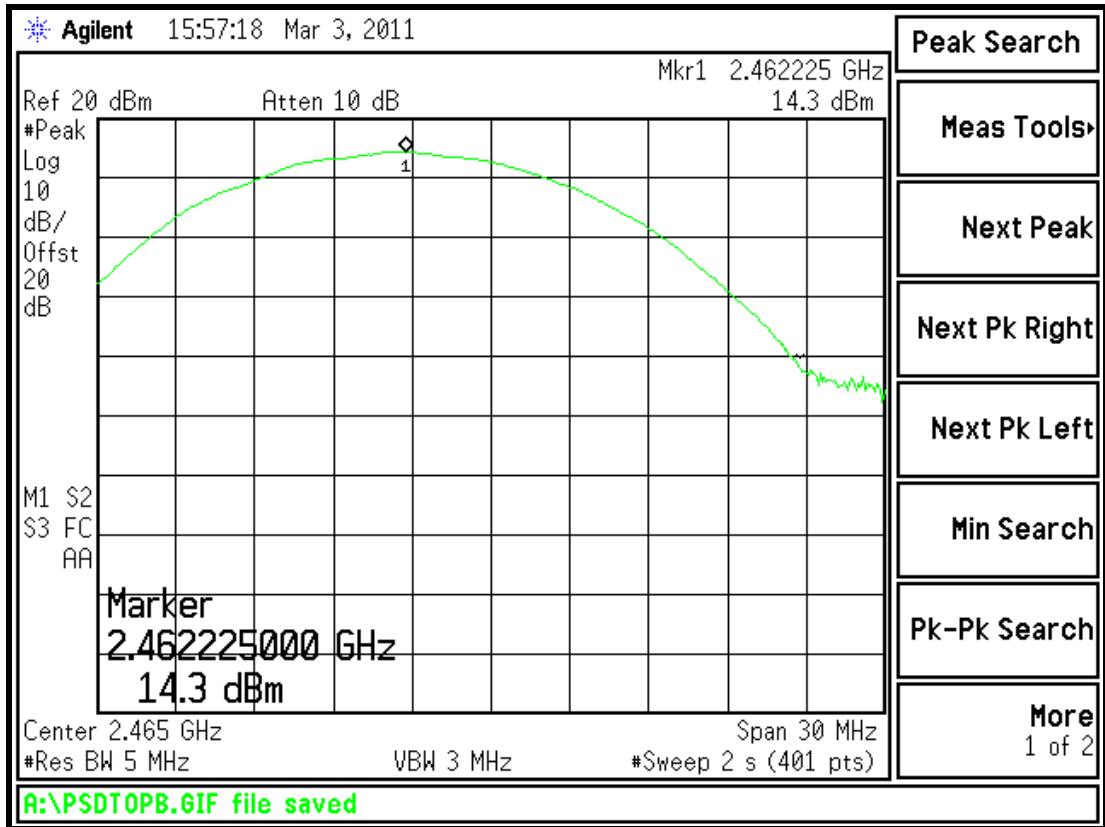
Power spectral density – 54Mbps – 2462MHz



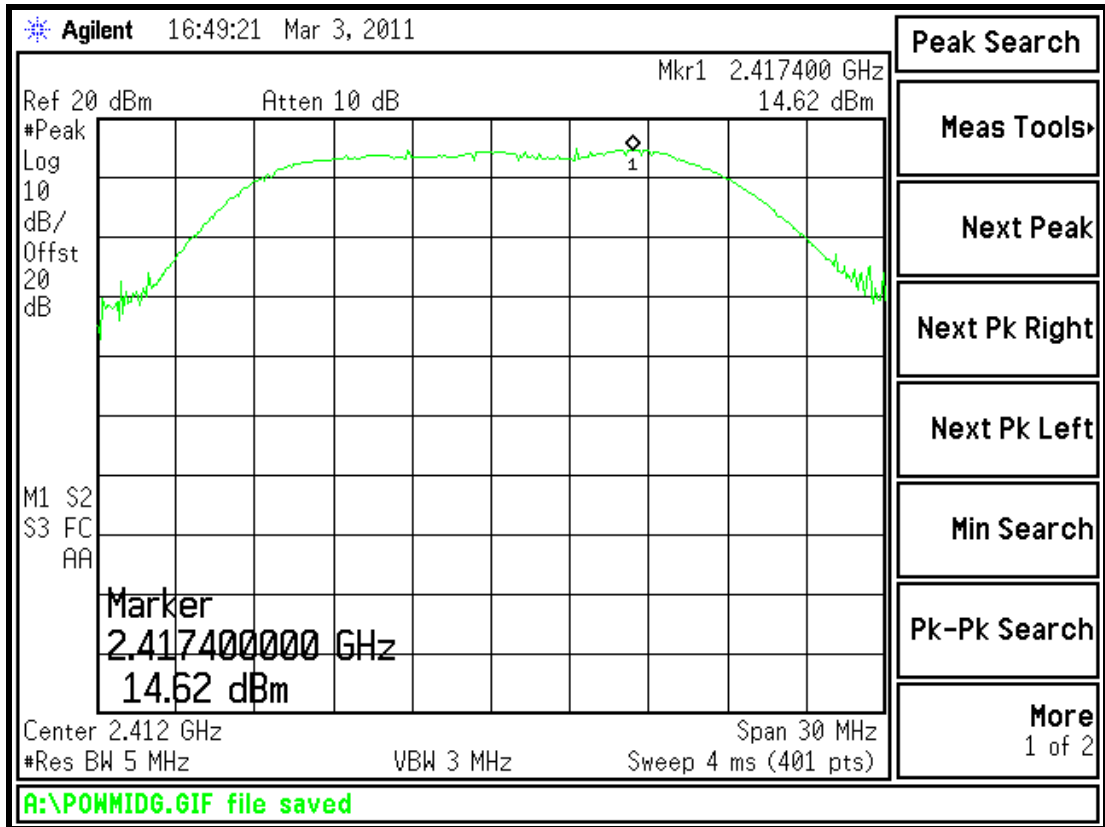
Conducted carrier power 2412MHz – 11Mbps



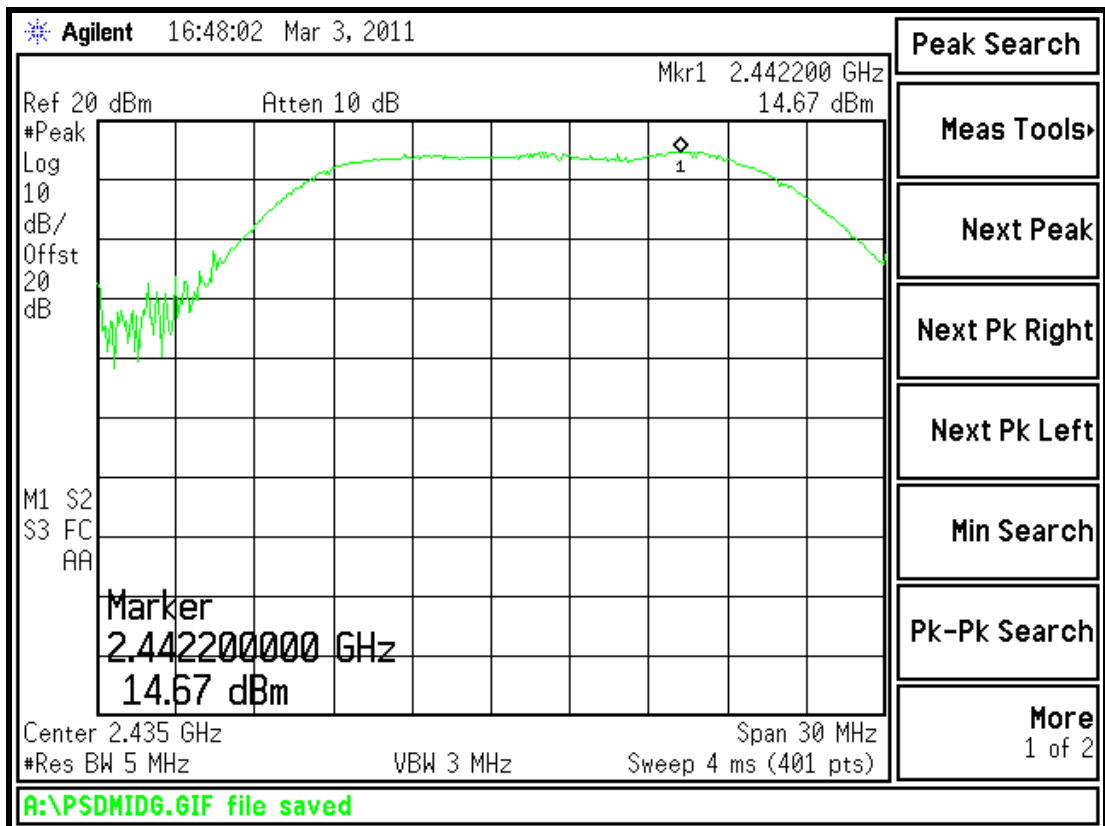
Conducted carrier power 2437MHz – 11Mbps



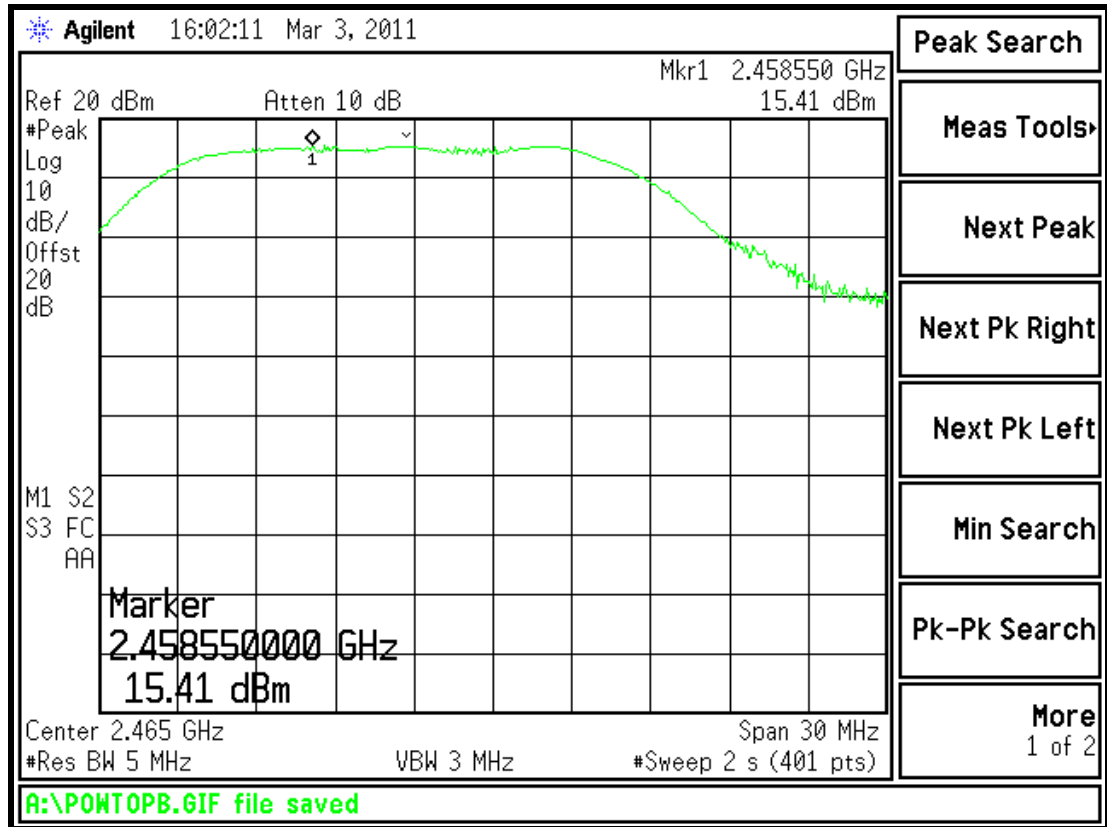
Conducted carrier power 2462MHz – 11Mbps



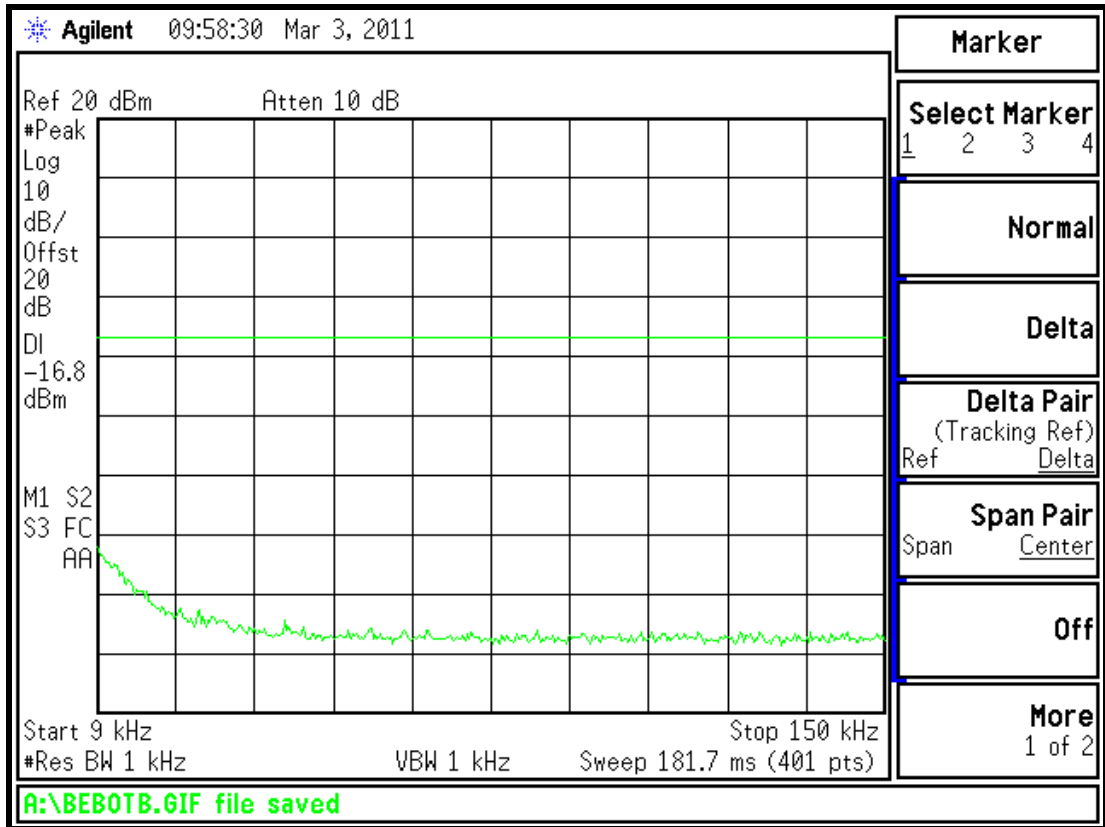
Conducted carrier power 2412MHz – 54Mbps



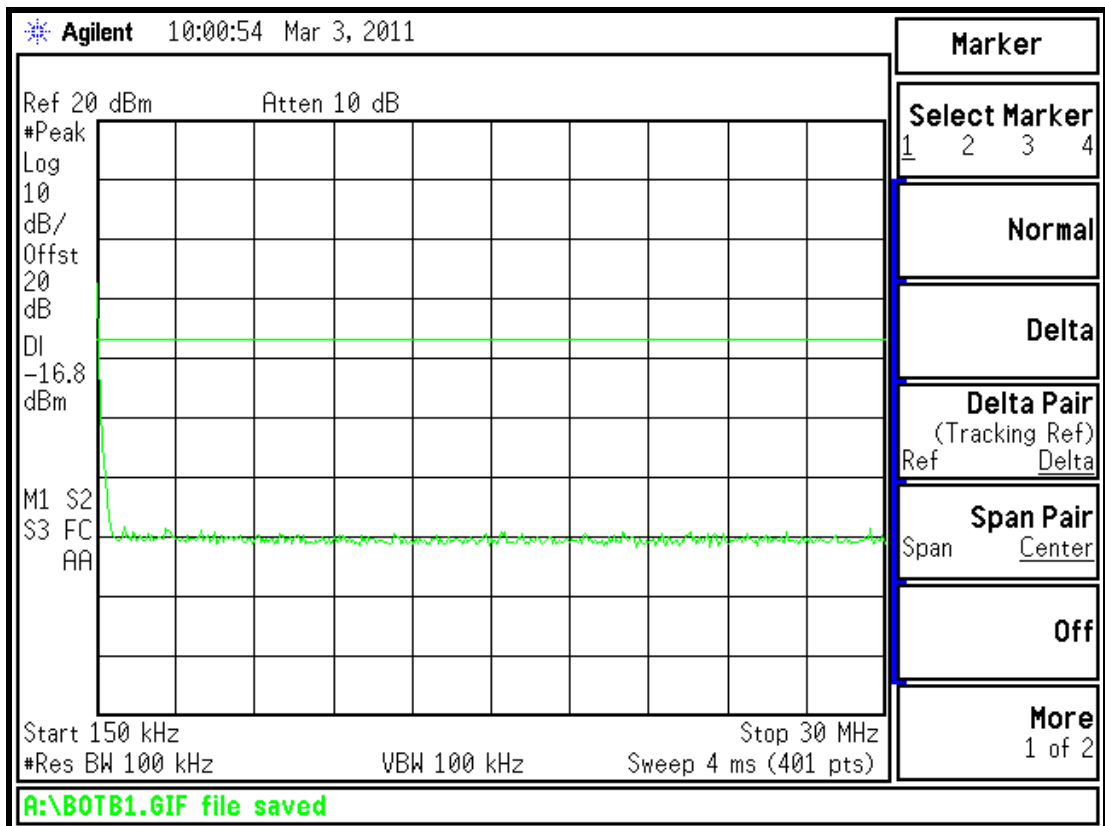
Conducted carrier power 2437MHz – 54Mbps



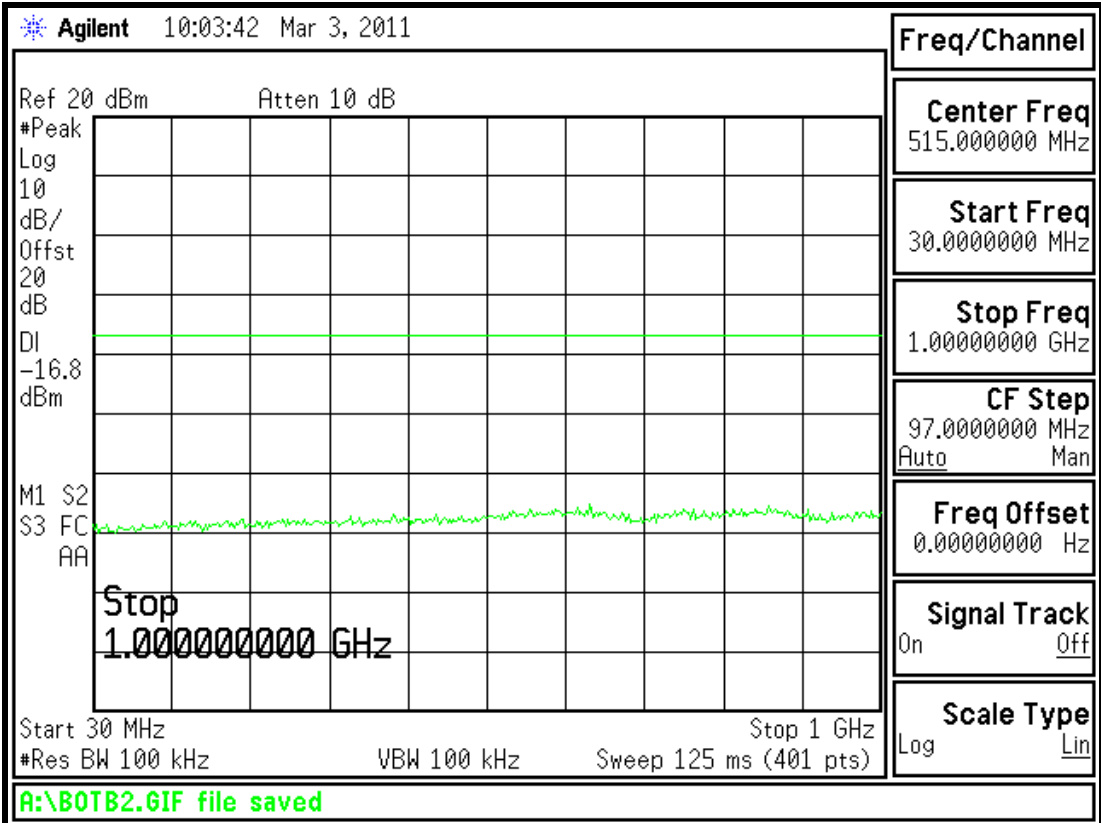
Conducted carrier power 2462MHz – 54Mbps



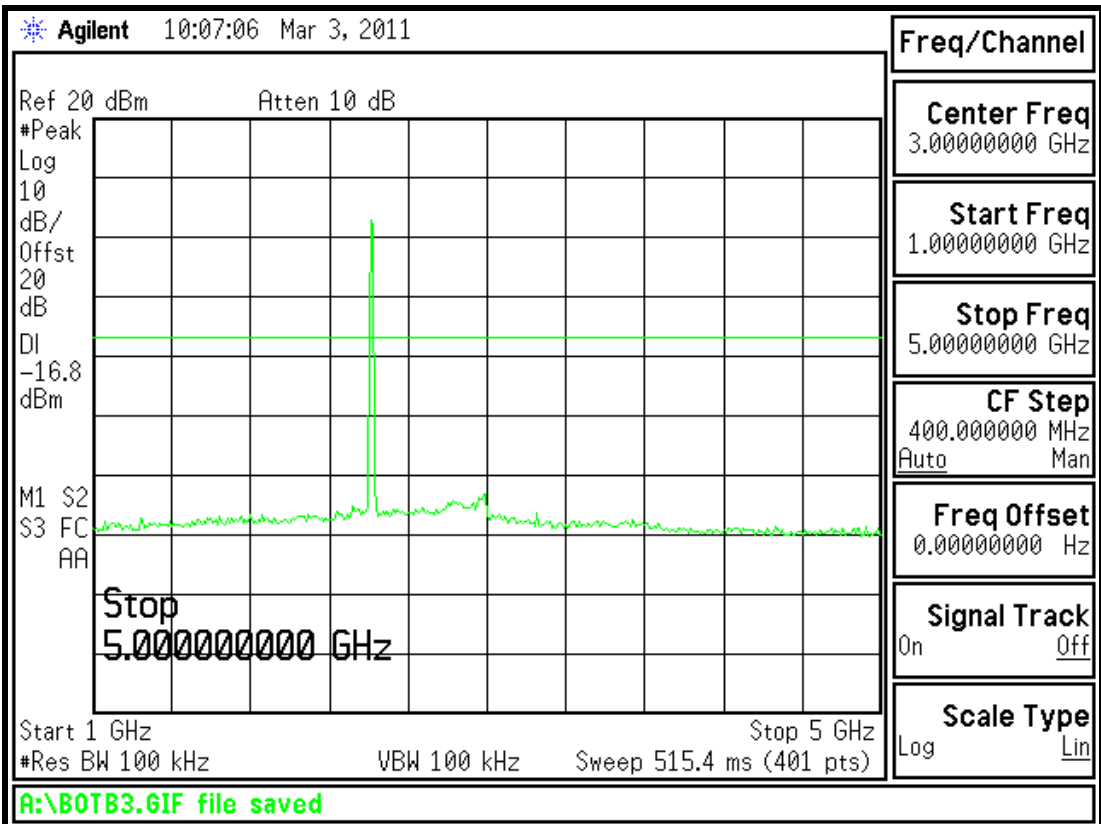
Conducted spurious emissions 9 kHz to 150 kHz – 2412MHz – 11Mbps



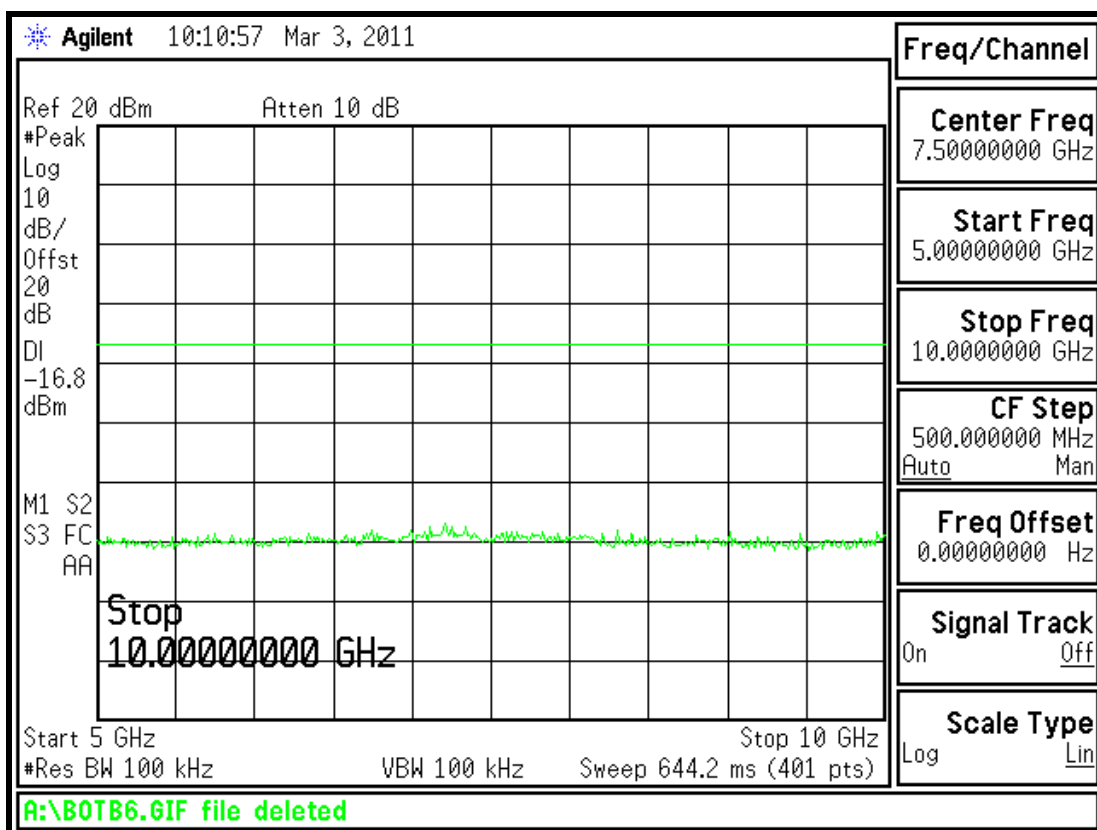
Conducted spurious emissions 150 kHz to 30 MHz – 2412MHz – 11Mbps



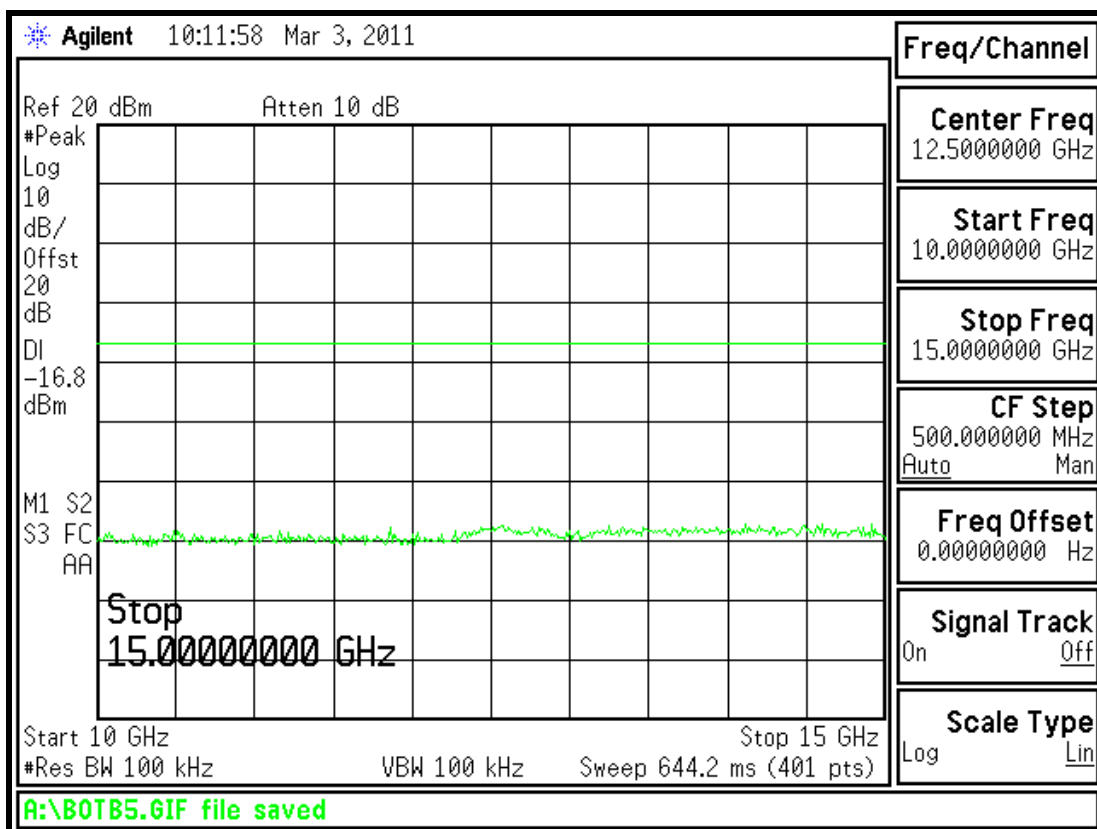
Conducted spurious emissions 30 MHz to 1 GHz – 2412MHz – 11Mbps



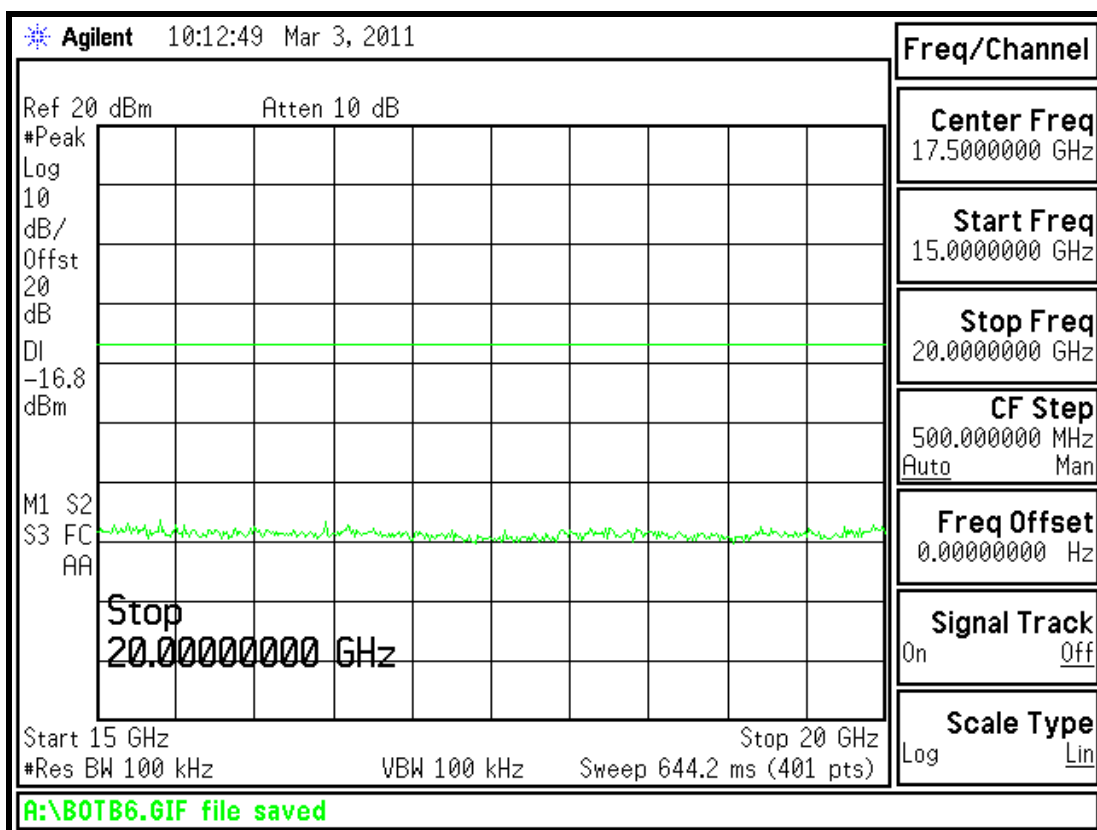
Conducted spurious emissions 1 GHz to 5 GHz – 2412MHz – 11Mbps



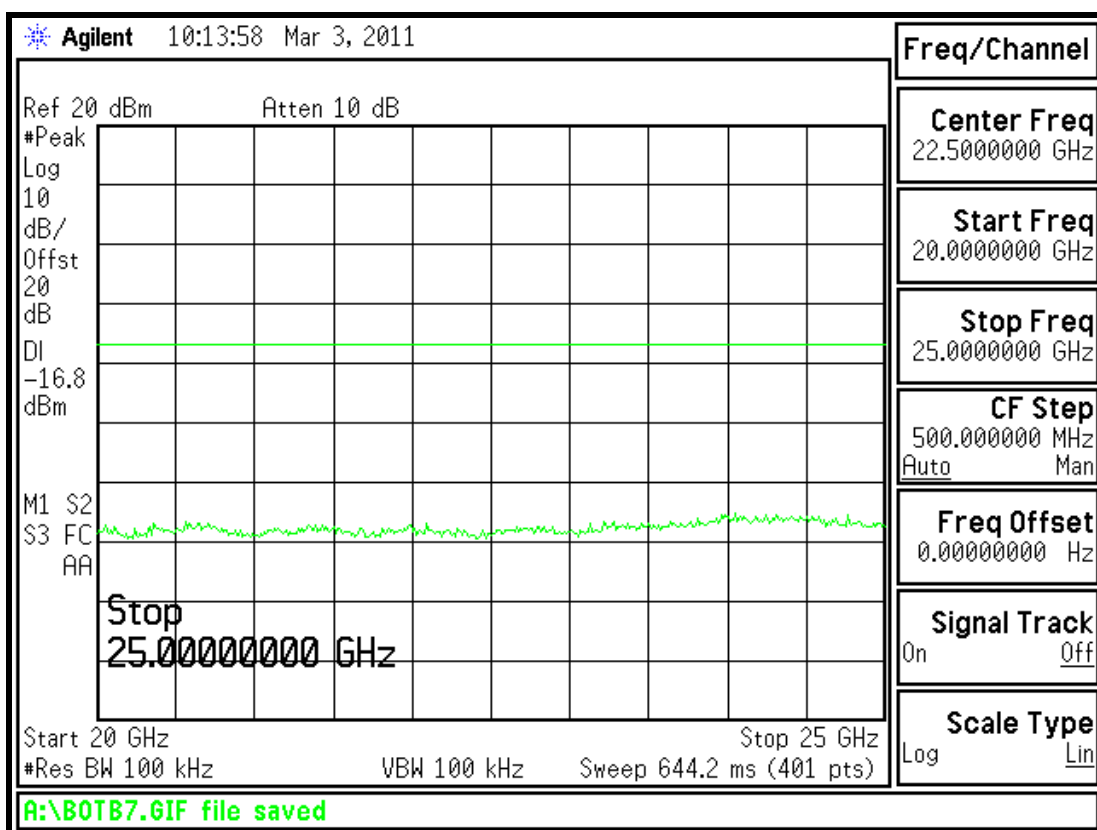
Conducted spurious emissions 5 GHz to 10 GHz – 2412MHz – 11Mbps



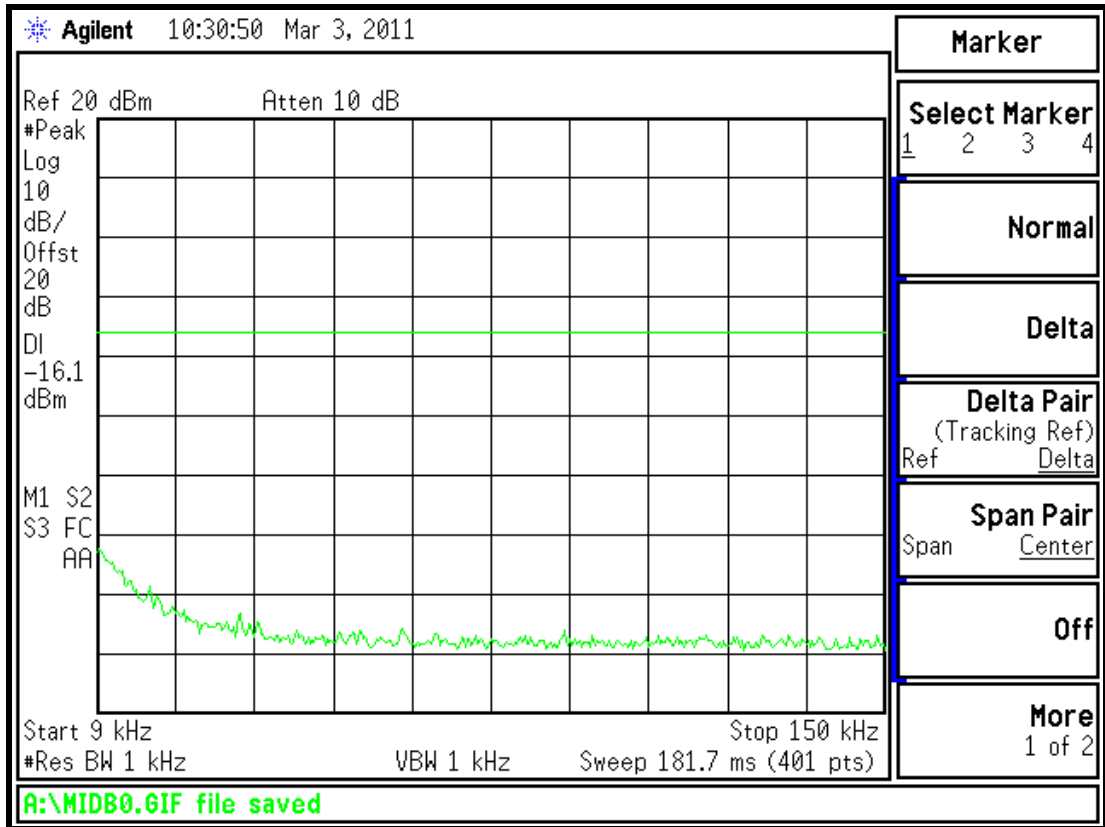
Conducted spurious emissions 10 GHz to 15 GHz – 2412MHz – 11Mbps



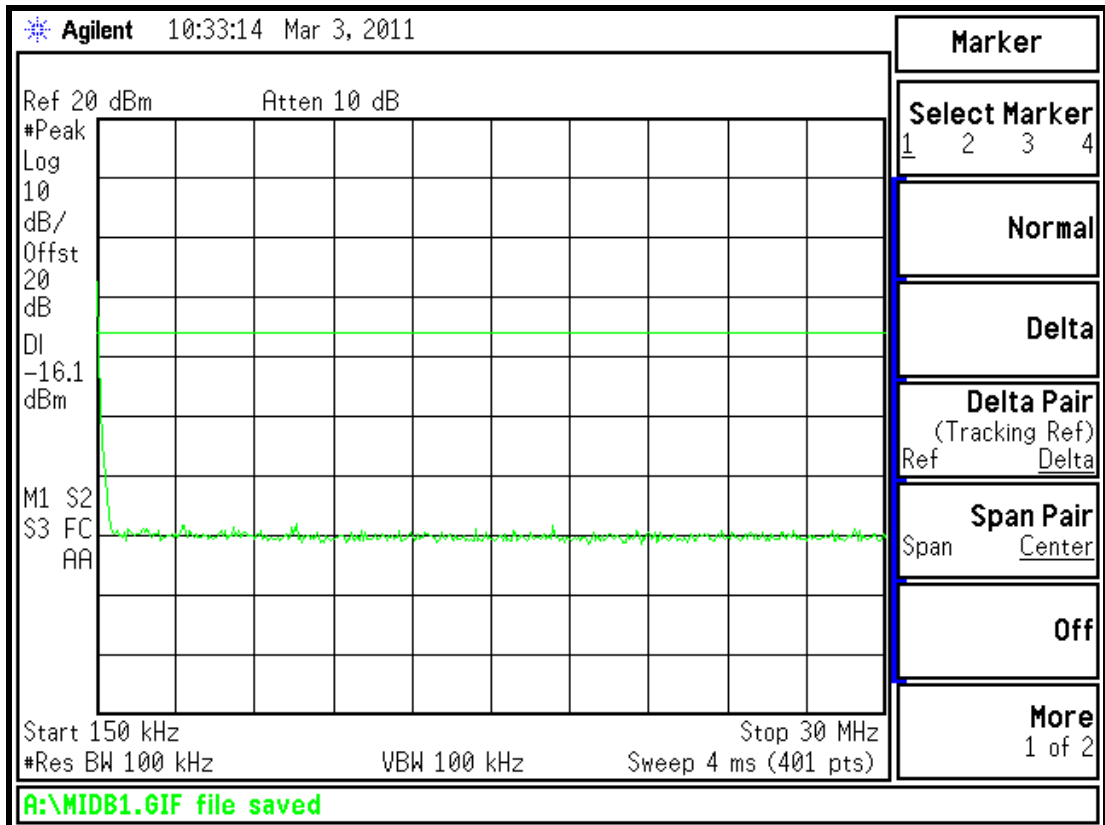
Conducted spurious emissions 15 GHz to 20 GHz – 2412MHz – 11Mbps



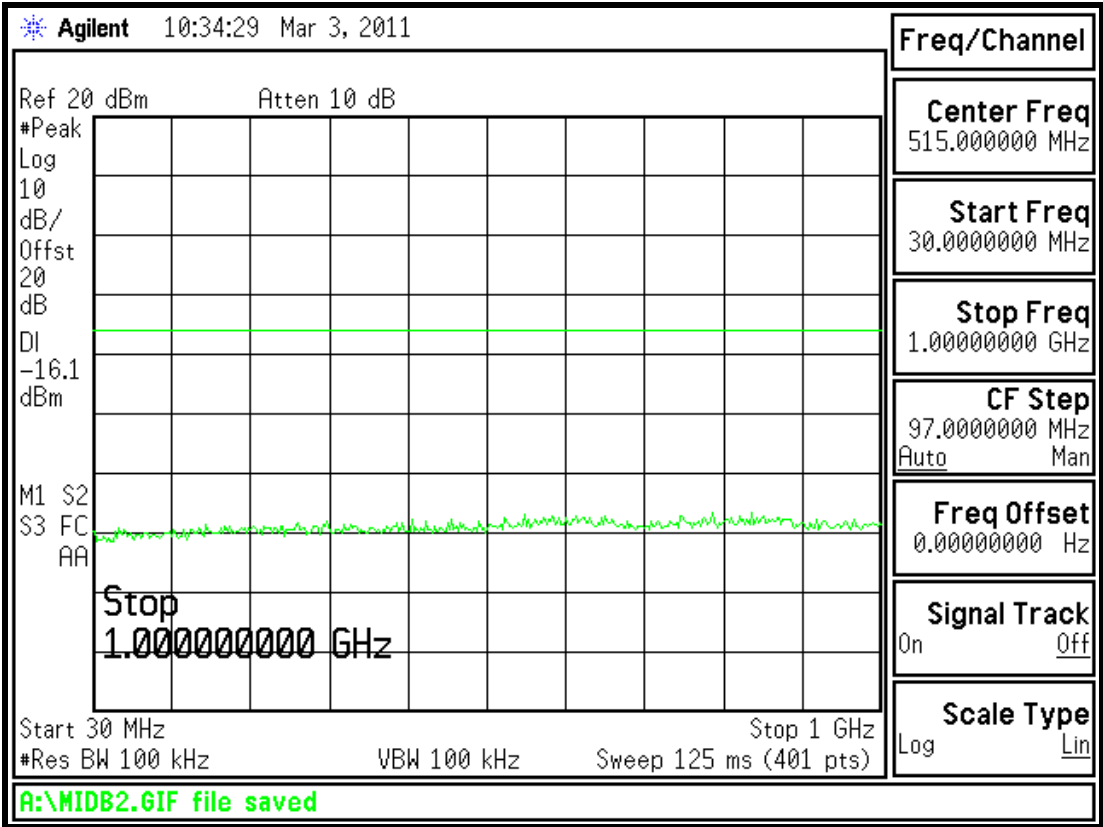
Conducted spurious emissions 20 GHz to 25 GHz – 2412MHz 11Mbps



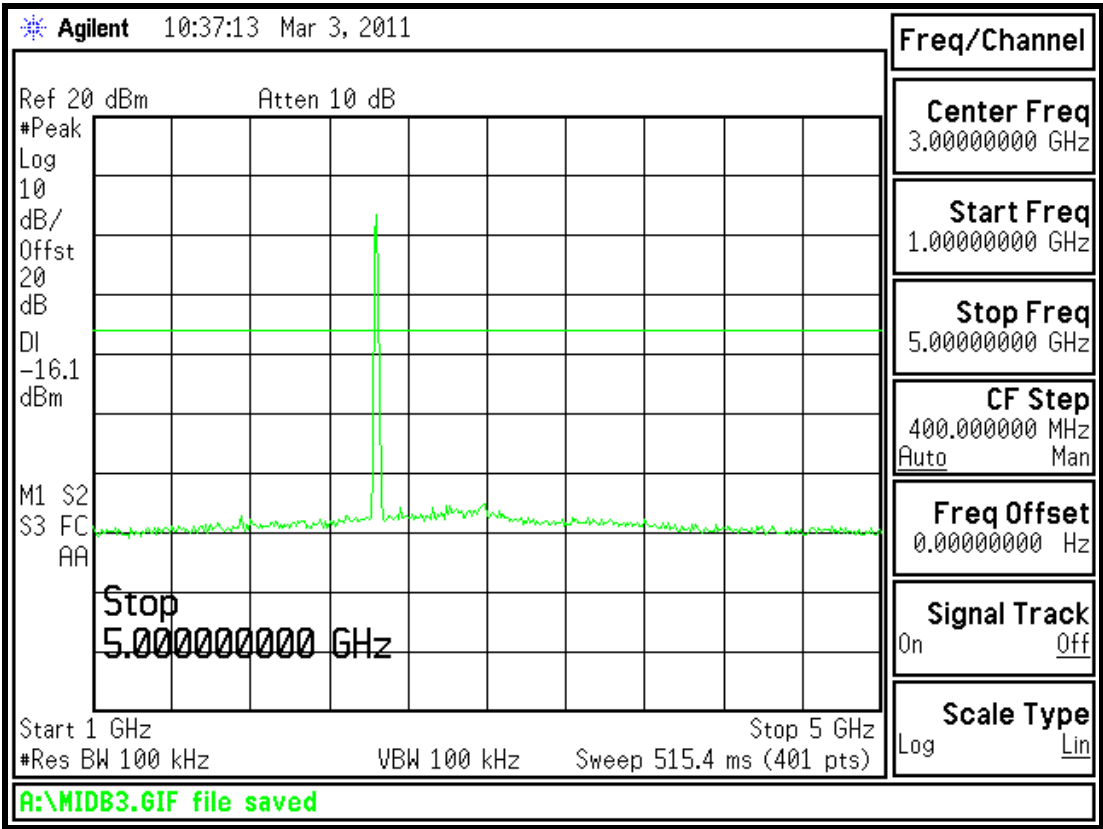
Conducted spurious emissions 9 kHz to 150 kHz – 2437MHz – 11Mbps



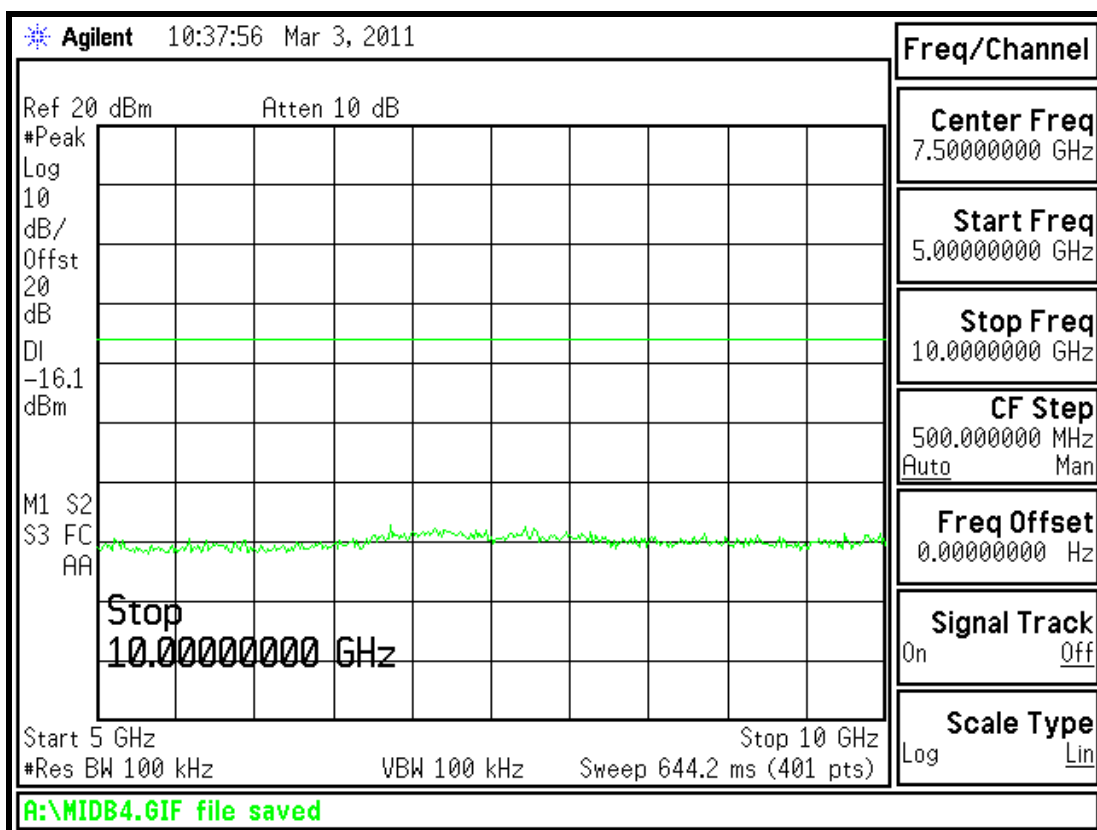
Conducted spurious emissions 150 kHz to 30 MHz – 2437MHz – 11Mbps



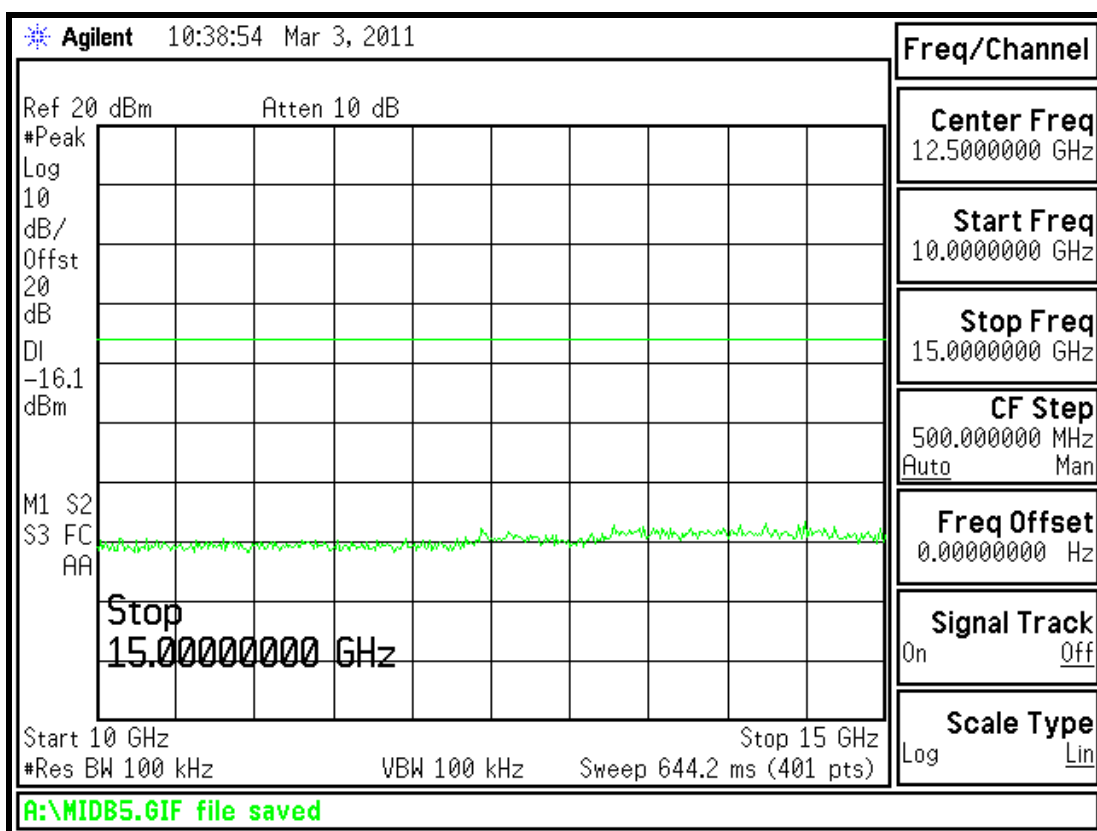
Conducted Spurious emissions 30 MHz to 1 GHz – 2437MHz – 11Mbps



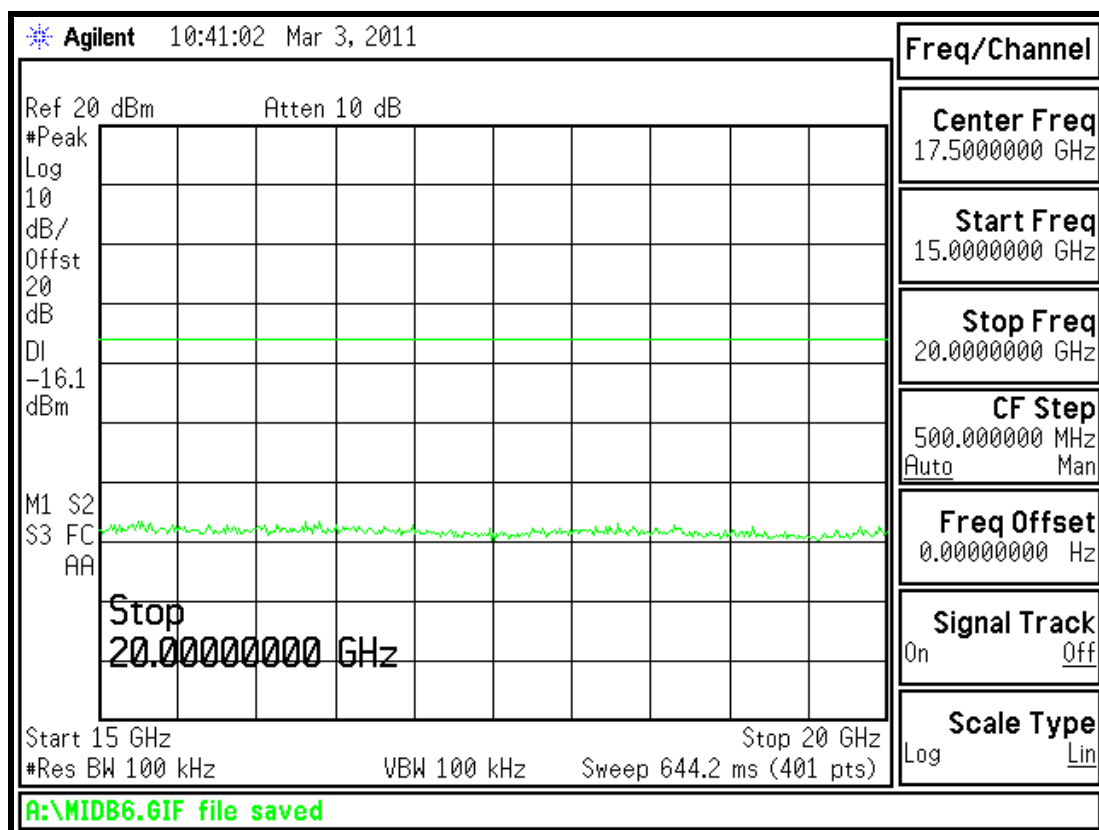
Conducted Spurious emissions 1 GHz to 5 GHz – 2437MHz – 11Mbps



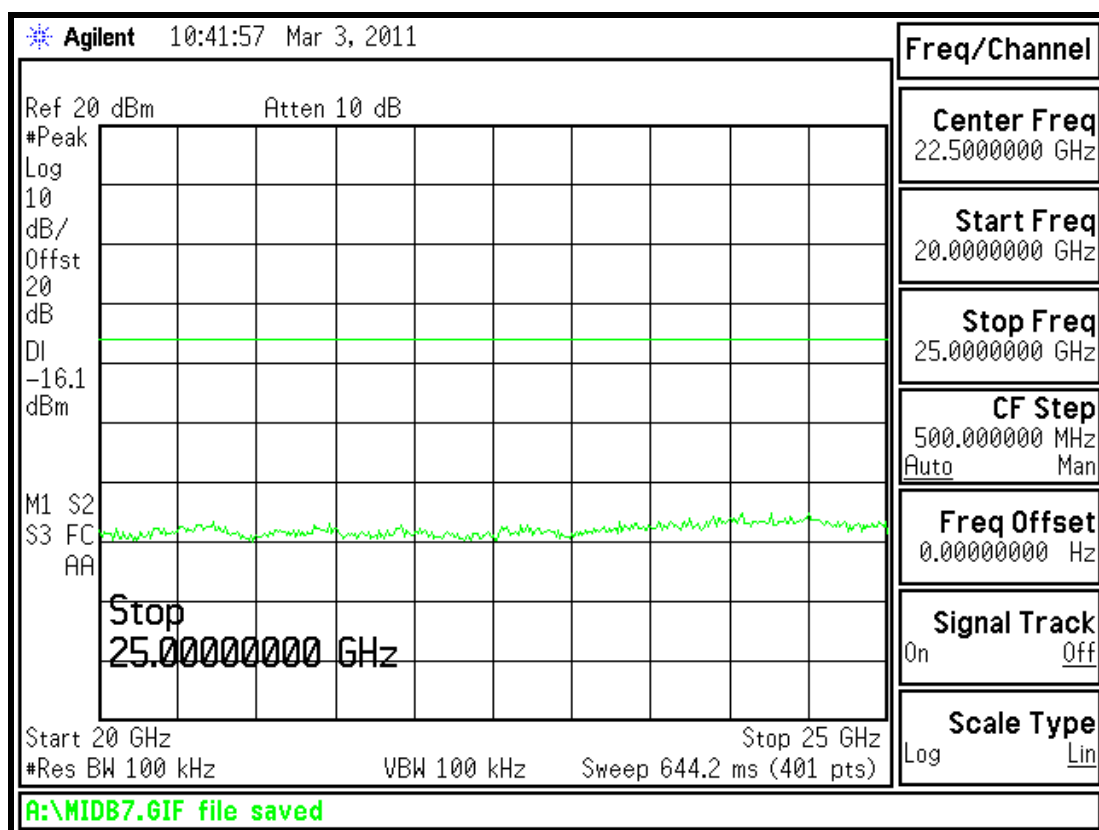
Conducted Spurious emissions 5 GHz to 10 GHz – 2437MHz – 11Mbps



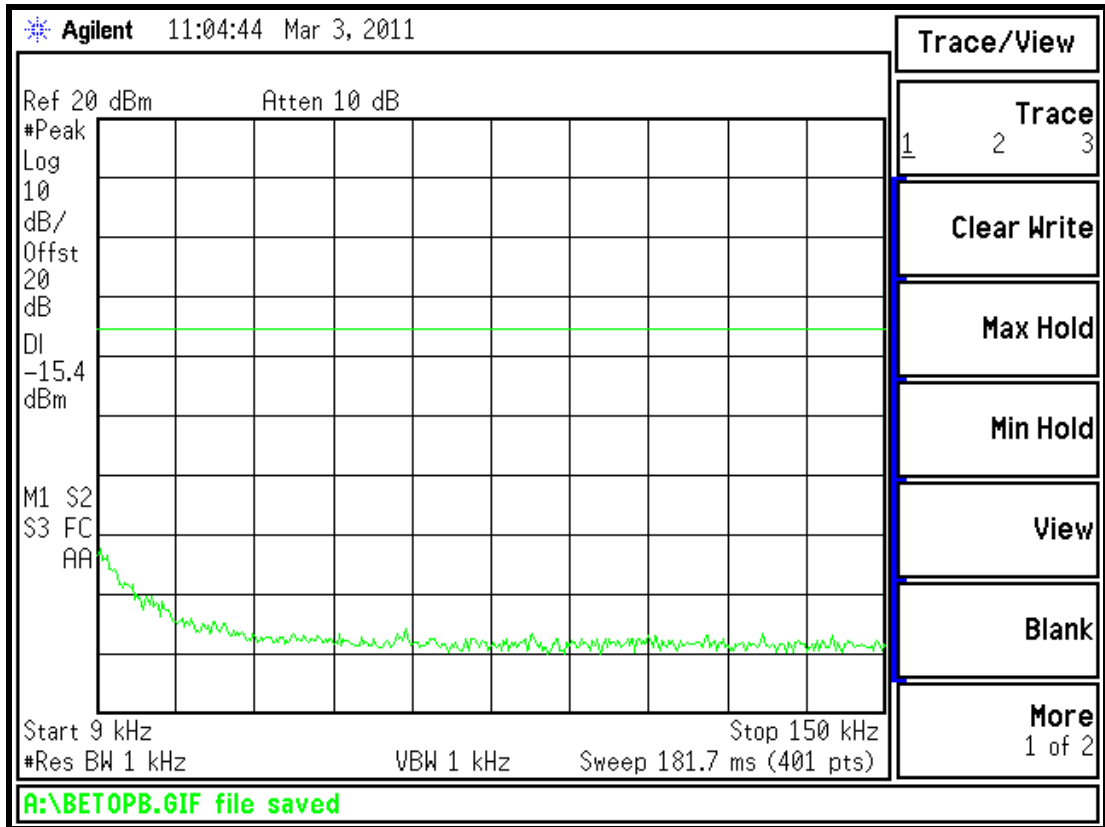
Conducted Spurious emissions 10 GHz to 15GHz – 2437MHz – 11Mbps



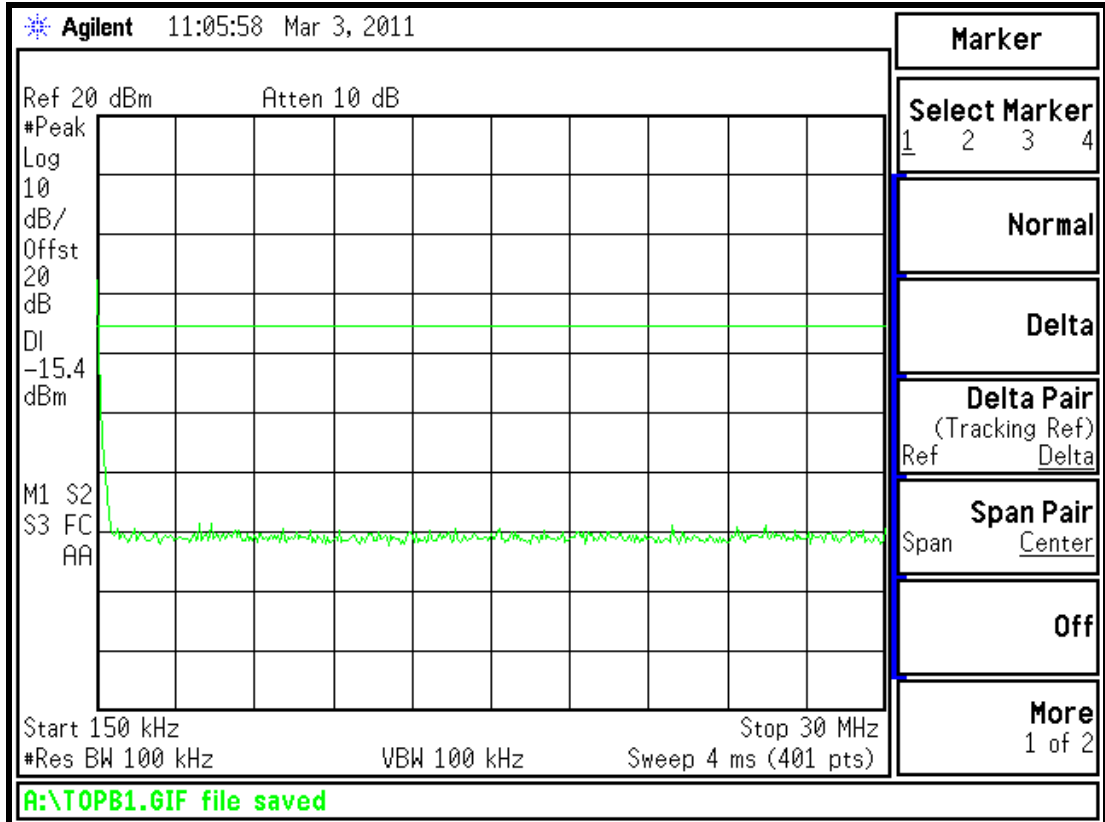
Conducted Spurious emissions 15 GHz to 20GHz – 2437MHz – 11Mbps



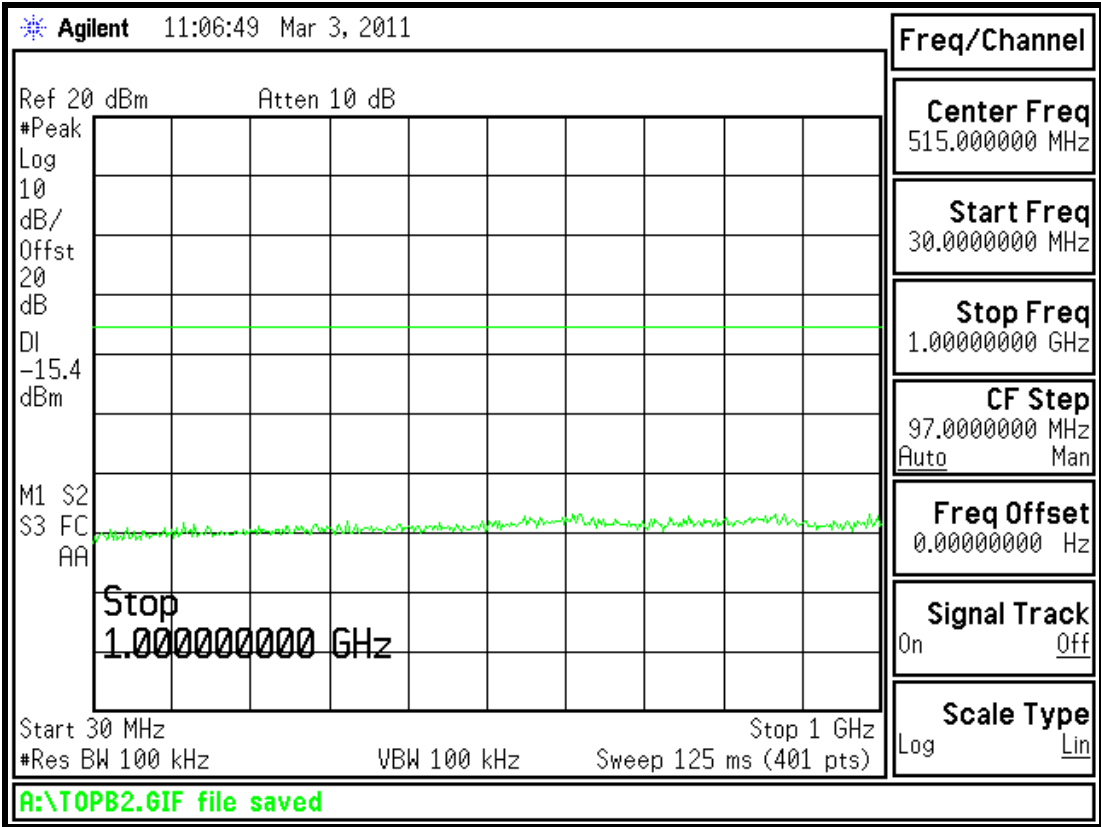
Conducted Spurious emissions 20 GHz to 25GHz – 2437MHz – 11Mbps



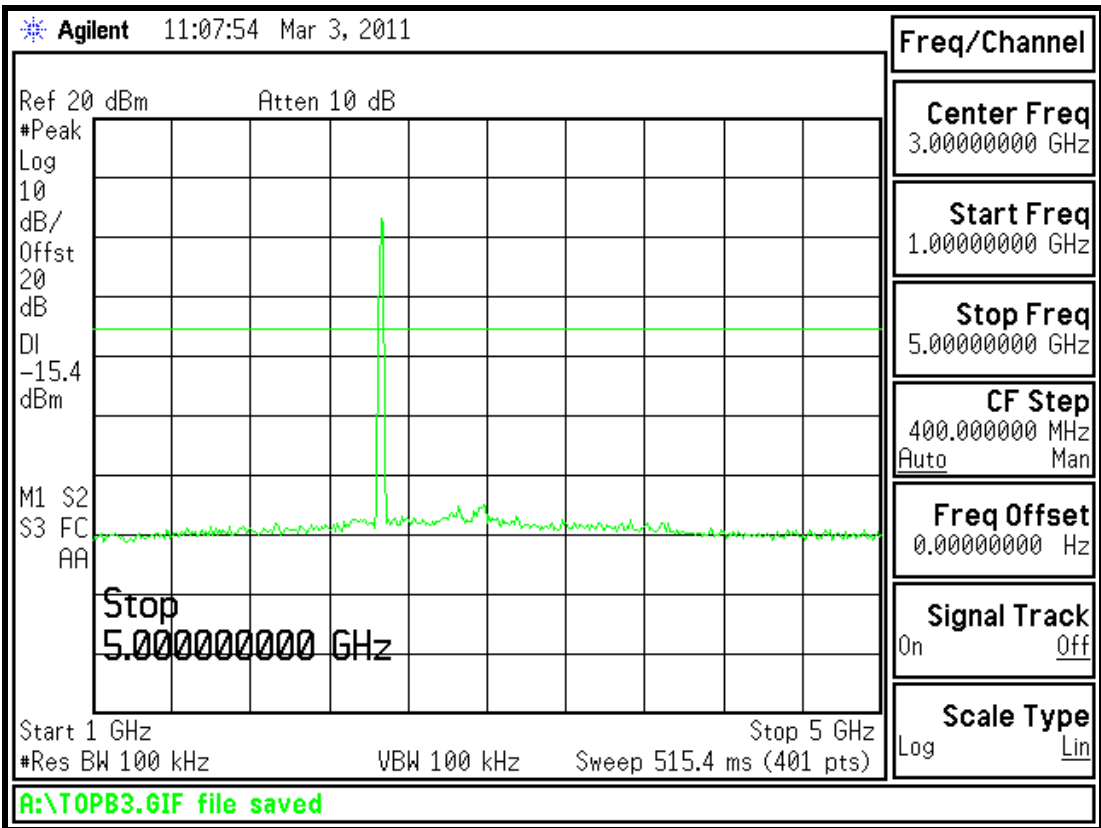
Conducted spurious emissions 9 kHz to 150 kHz – 2462MHz – 11Mbps



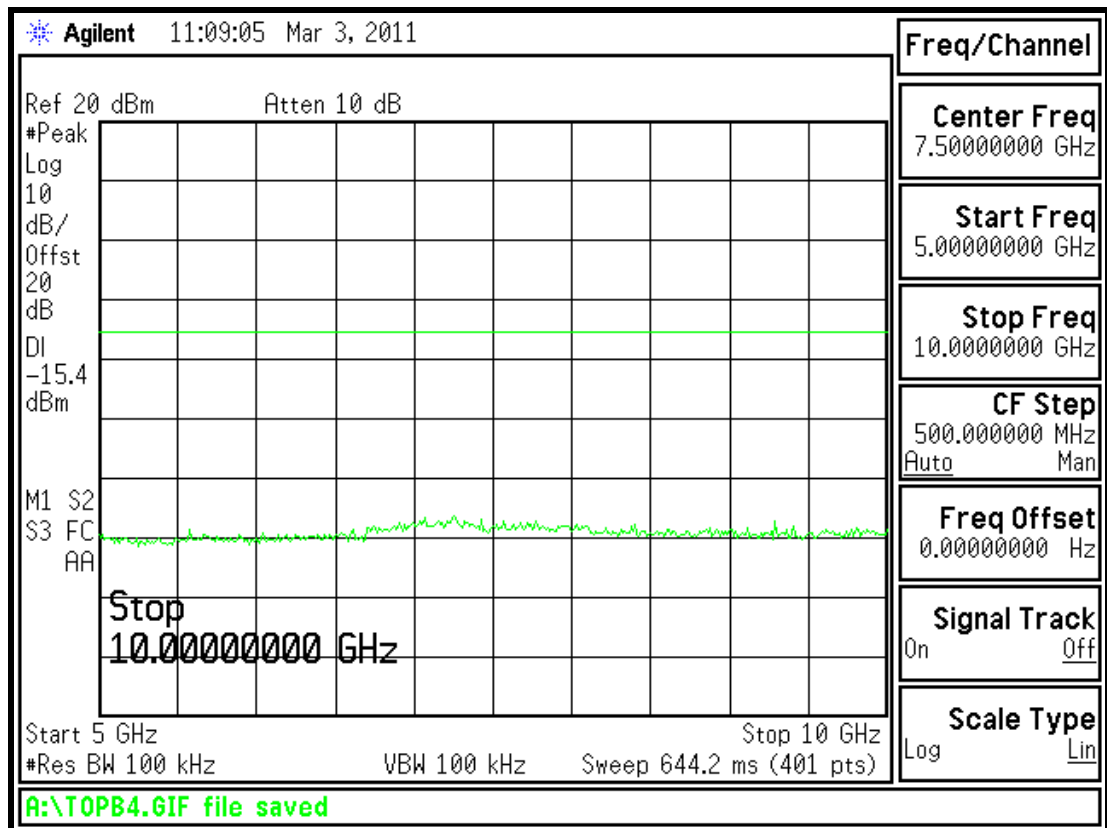
Conducted spurious emissions 150 kHz to 30 MHz – 2462MHz – 11Mbps



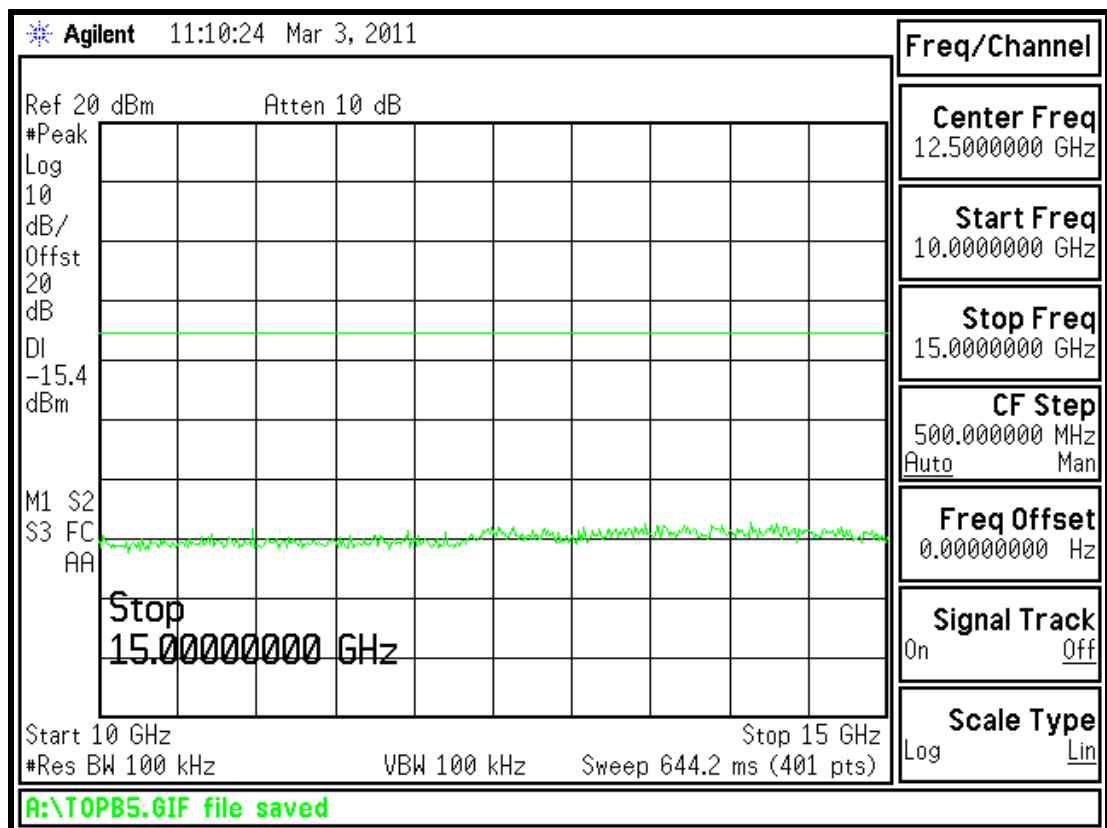
Conducted Spurious emissions 30 MHz to 1 GHz – 2462MHz – 11Mbps



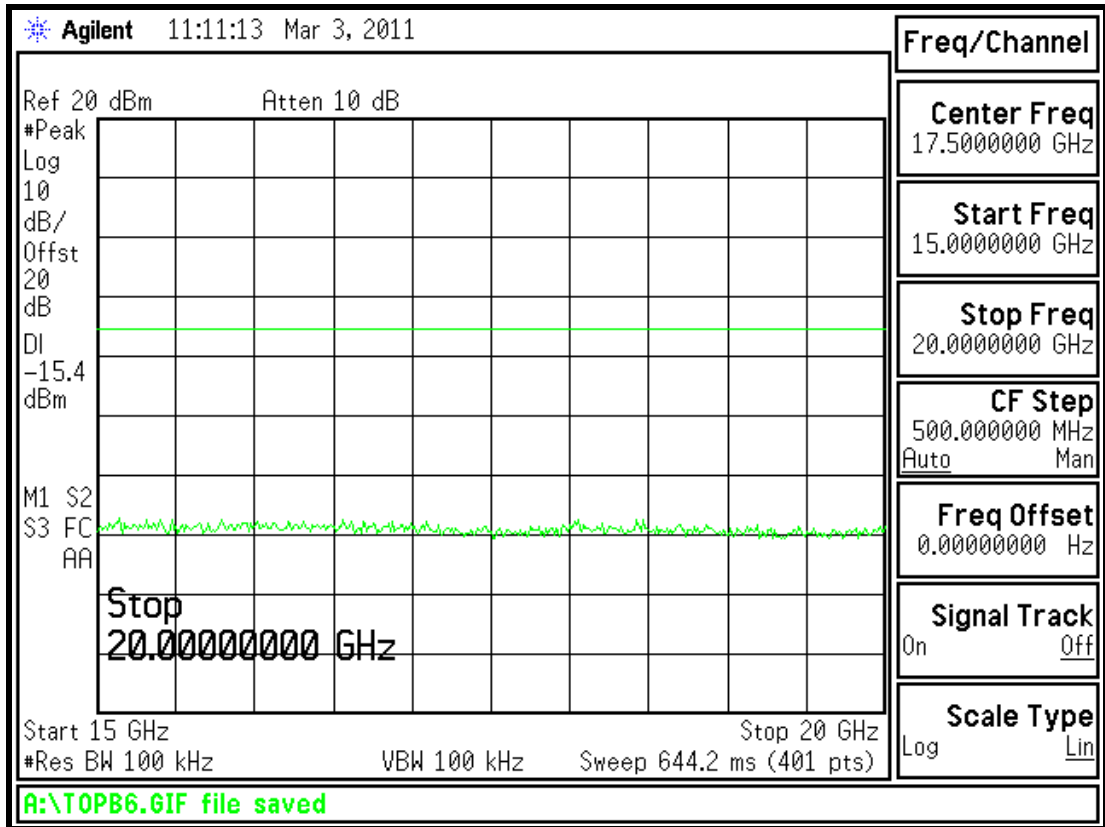
## Conducted Spurious emissions 1 GHz to 5 GHz – 2462MHz – 11Mbps



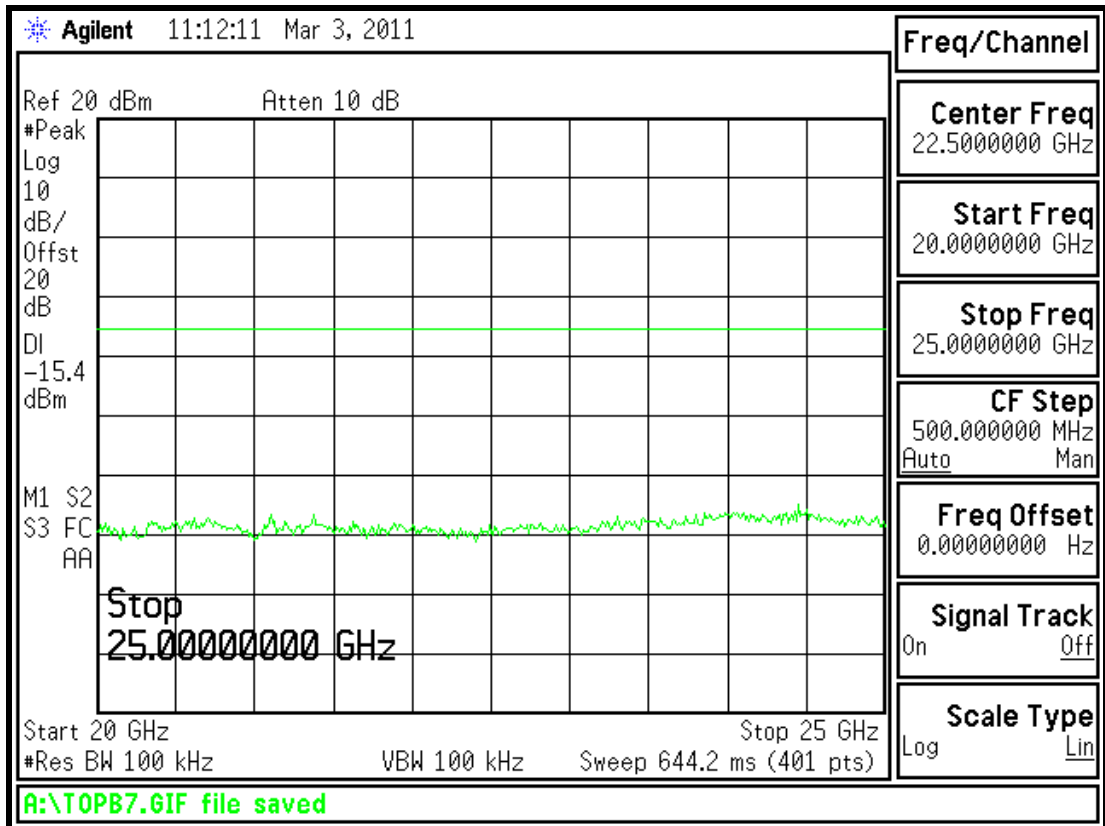
Conducted Spurious emissions 5 GHz to 10 GHz– 2462MHz – 11Mbps



Conducted Spurious emissions 10 GHz to 15 GHz– 2462MHz – 11Mbps

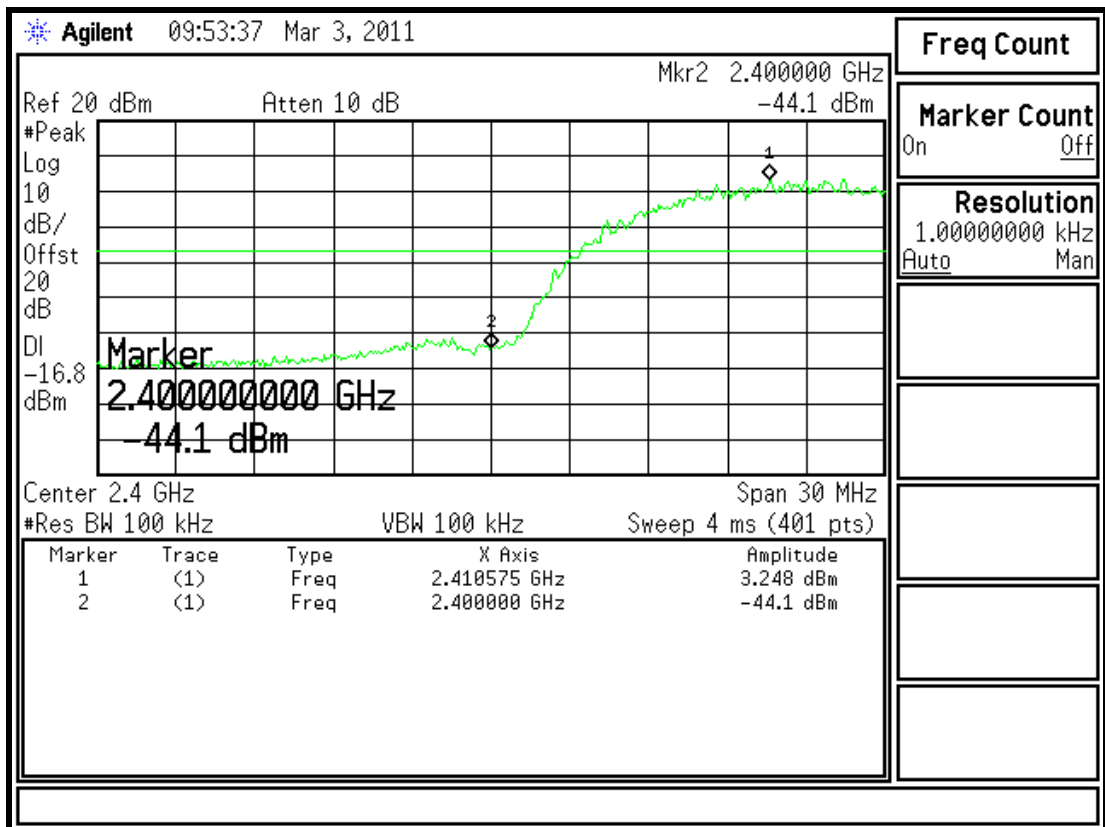


Conducted Spurious emissions 15 GHz to 20 GHz– 2462MHz – 11Mbps

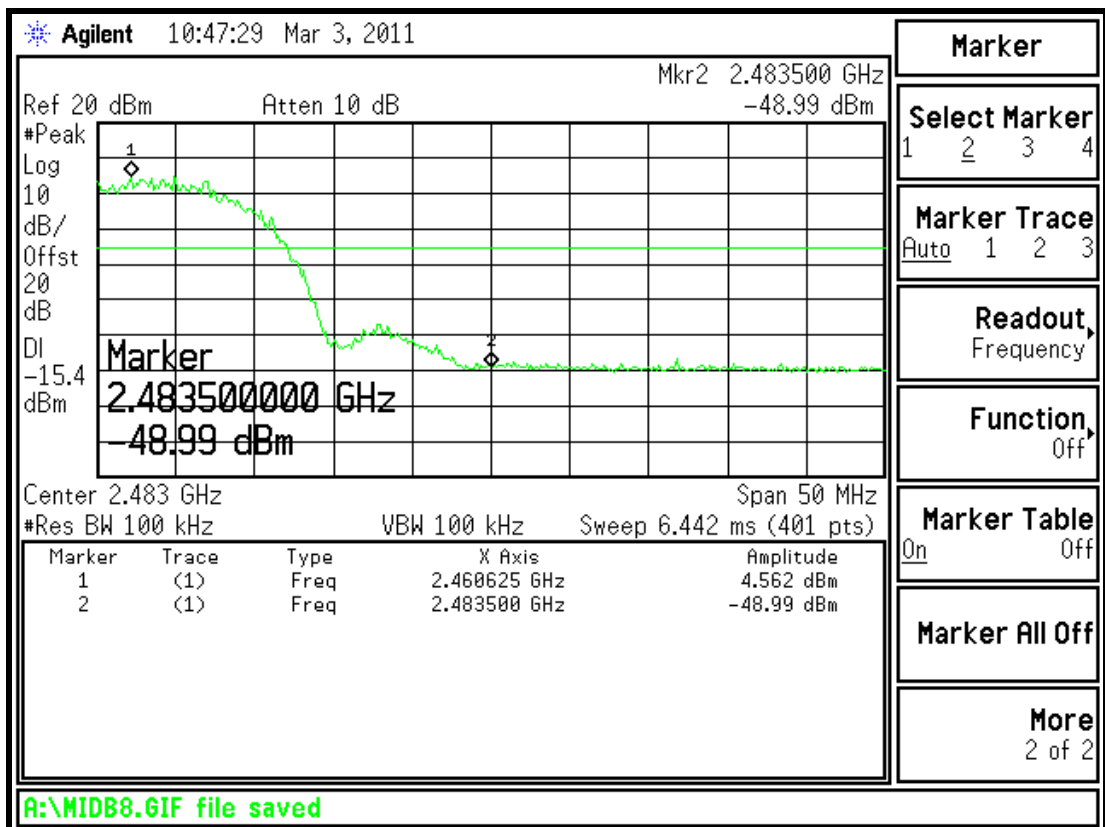


Conducted Spurious emissions 20 GHz to 25 GHz– 2462MHz – 11Mbps

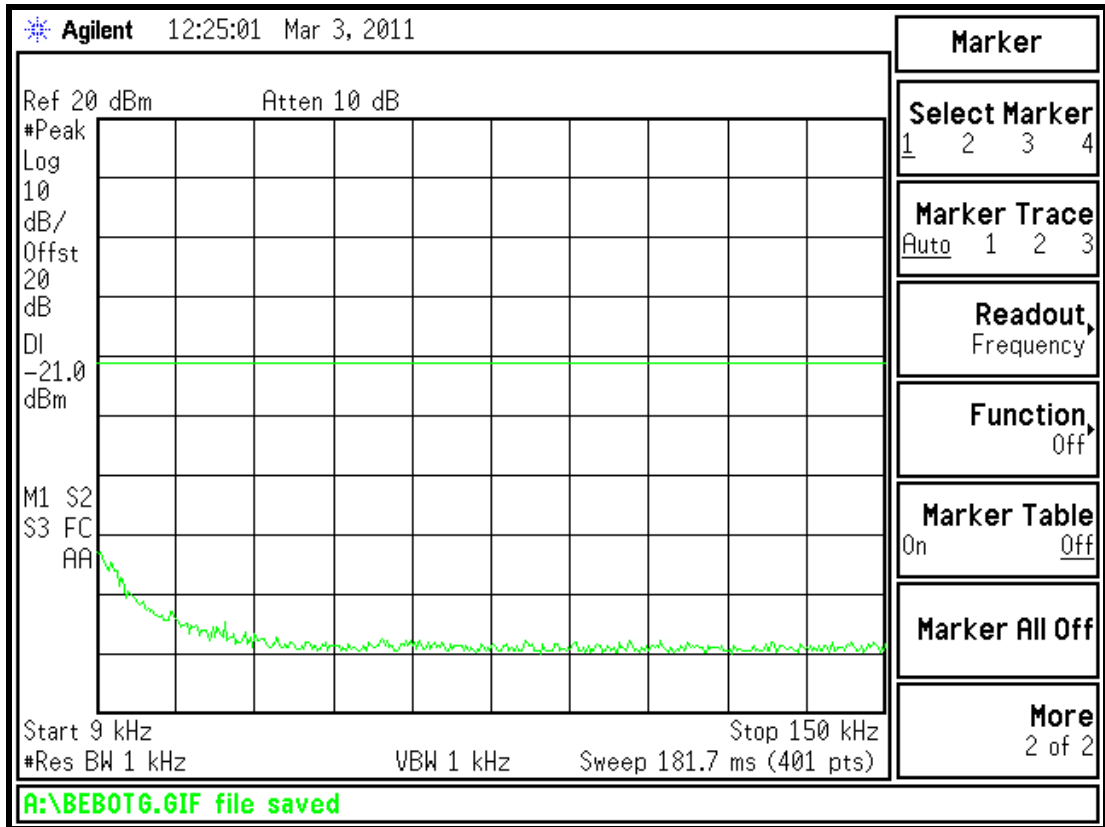
## Conducted Bandedge Compliance



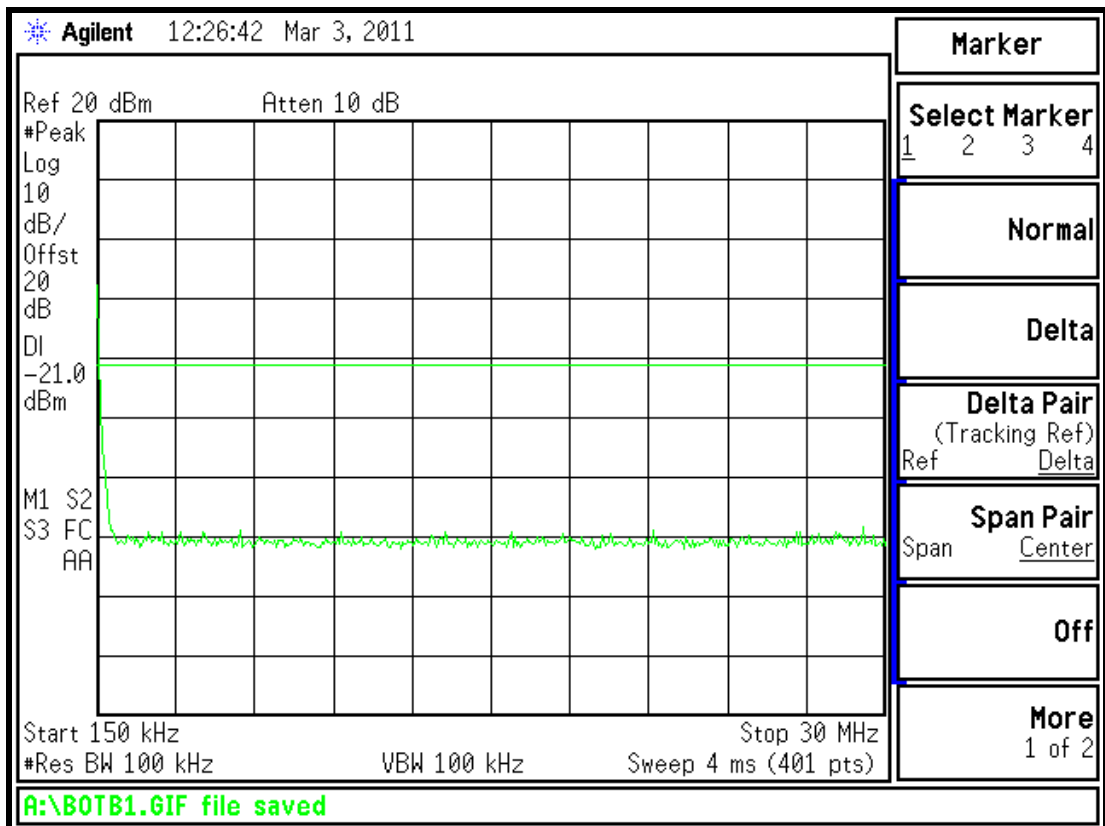
Lower Bandedge – 11Mbps



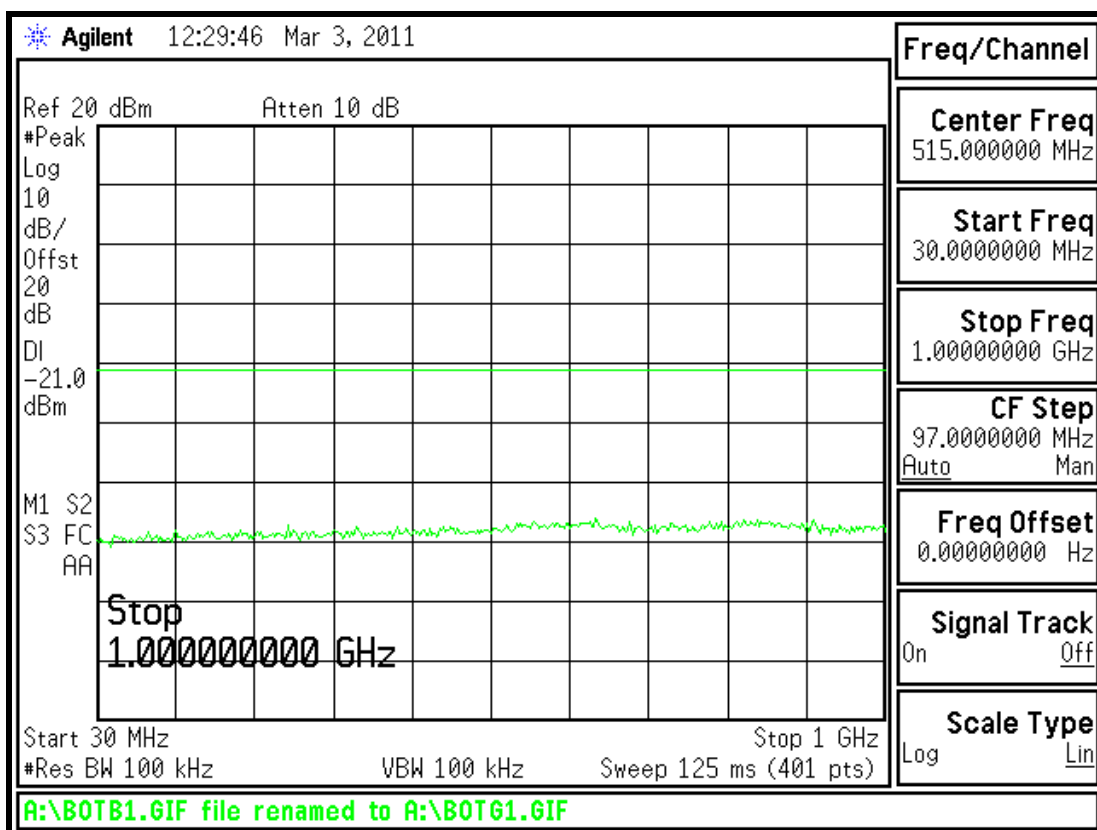
Upper Bandedge – 11Mbps



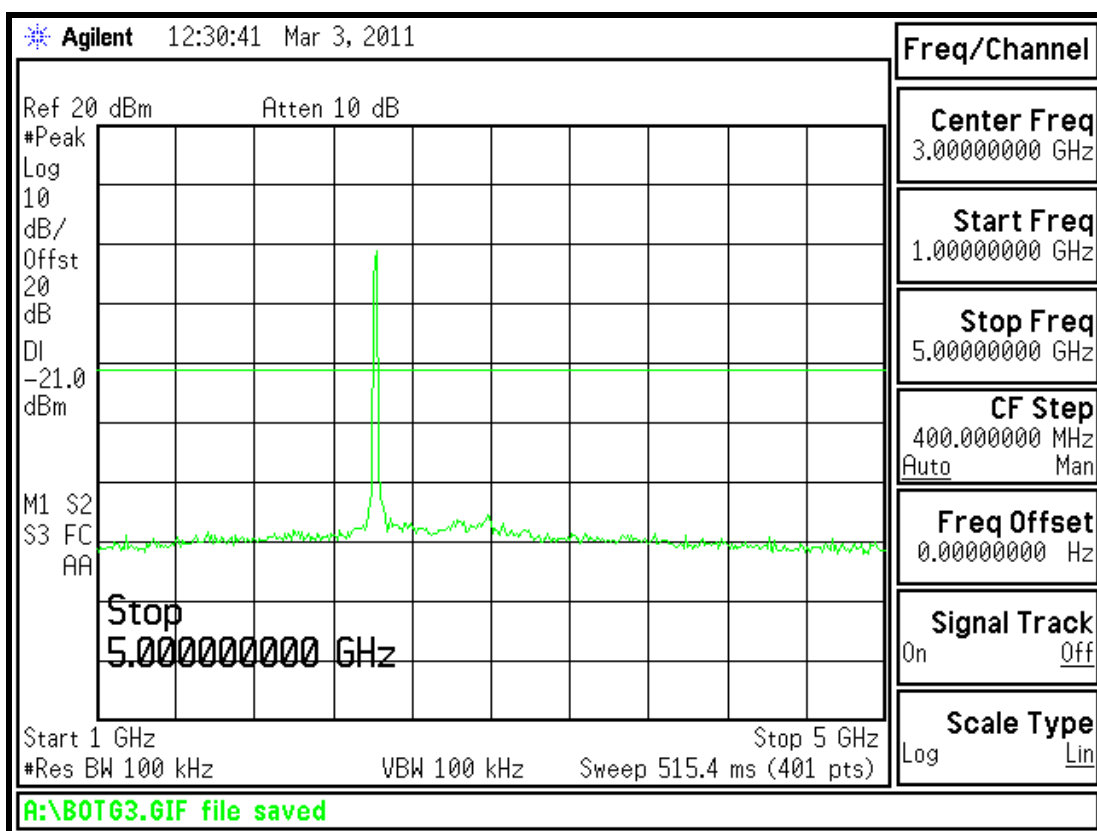
Conducted spurious emissions 9 kHz to 150 kHz – 2412MHz – 54Mbps



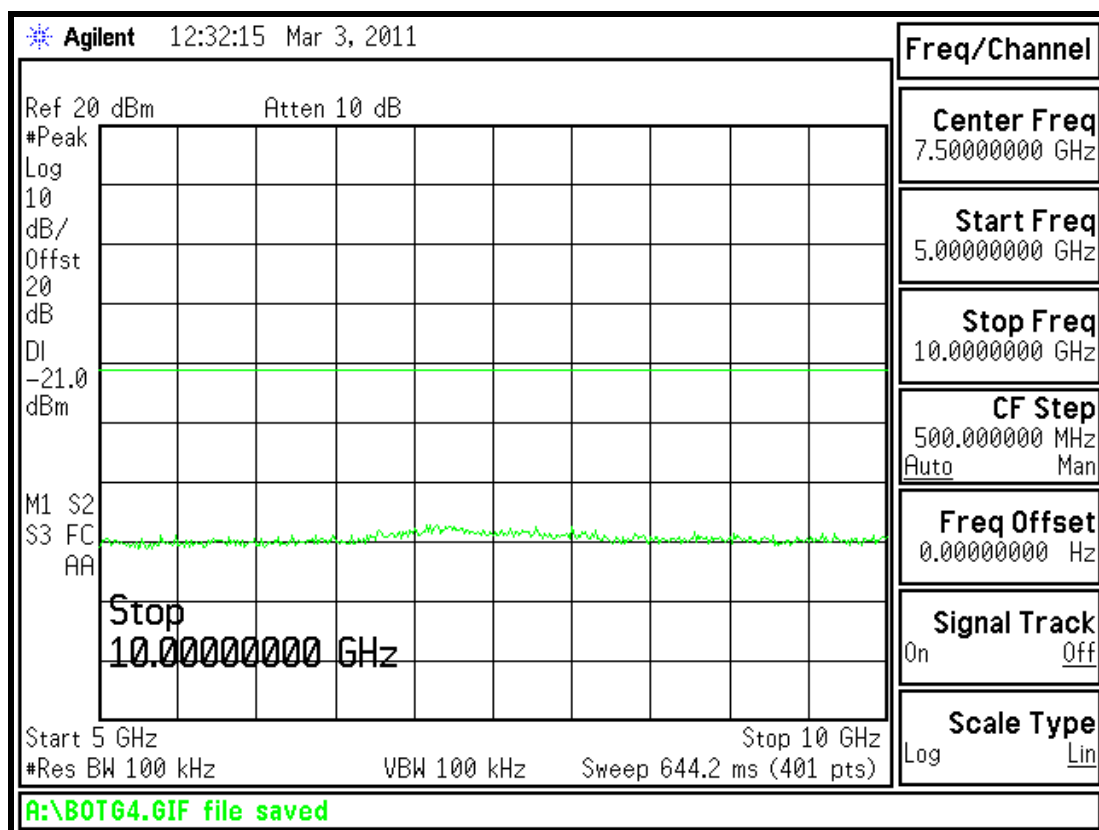
Conducted spurious emissions 150 kHz to 30 MHz – 2412MHz – 54Mbps



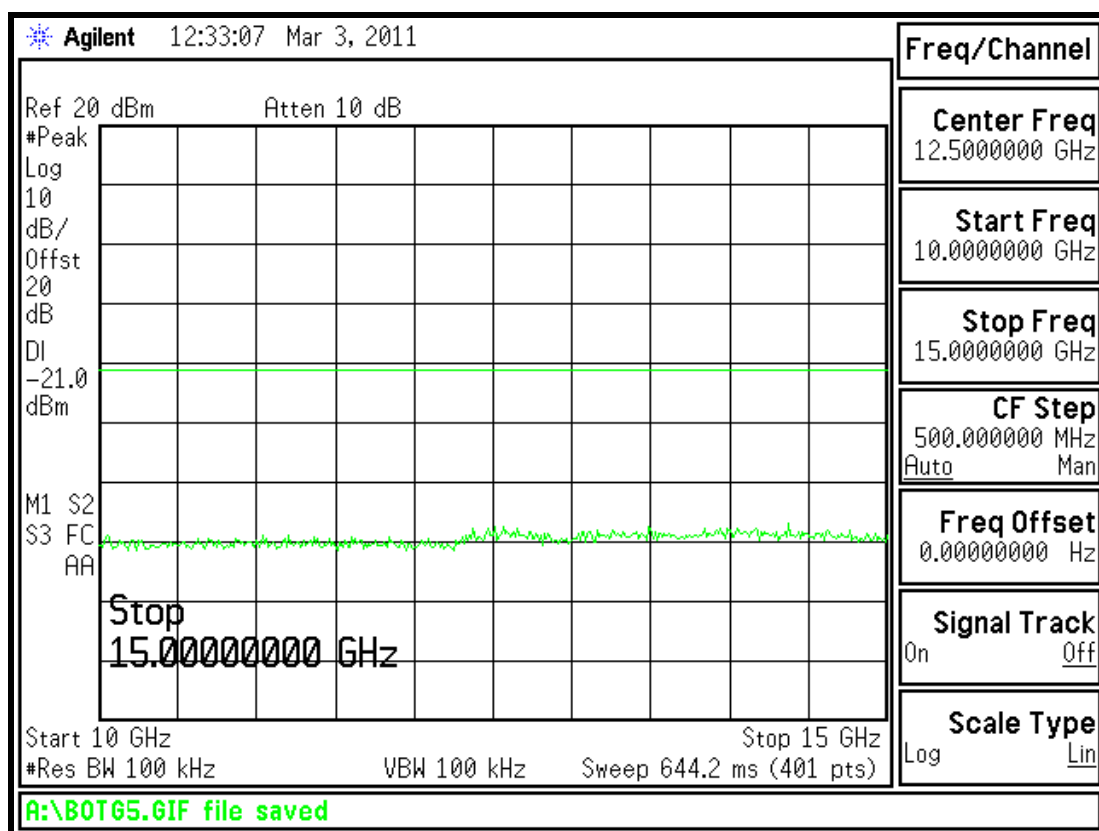
Conducted spurious emissions 30 MHz to 1 GHz – 2412MHz – 54Mbps



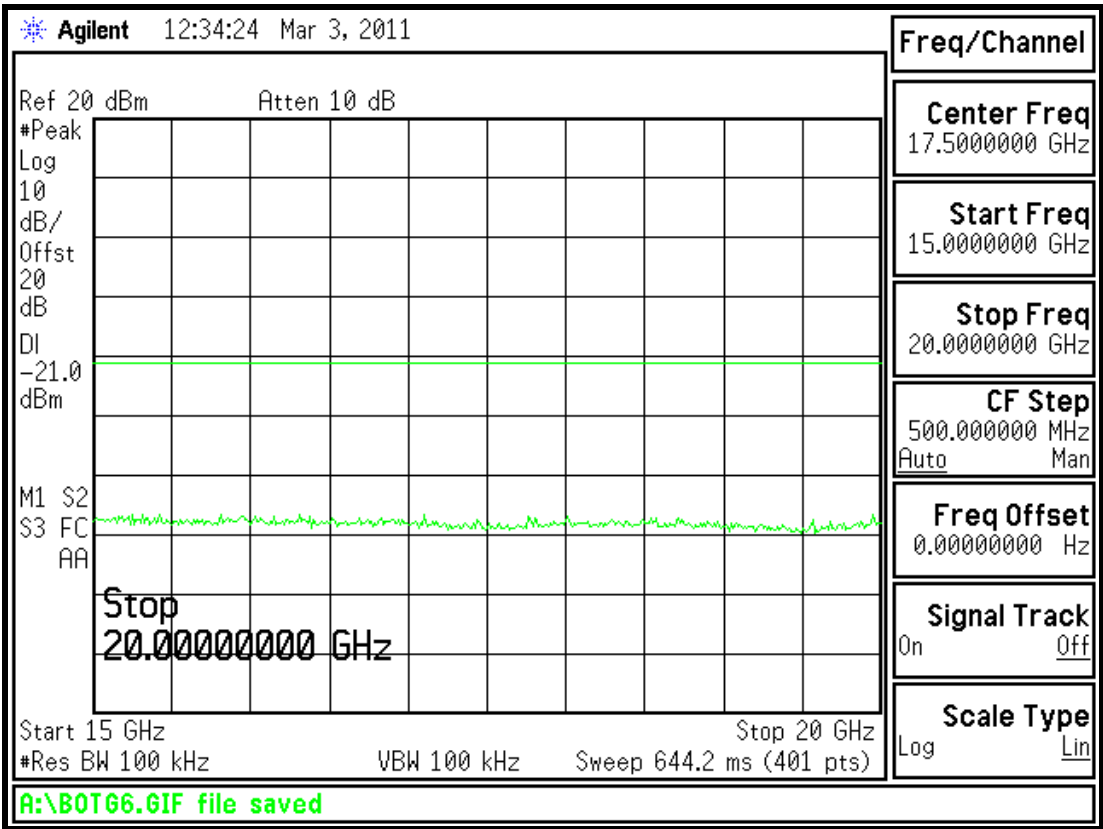
Conducted spurious emissions 1 GHz to 5 GHz – 2412MHz – 54Mbps



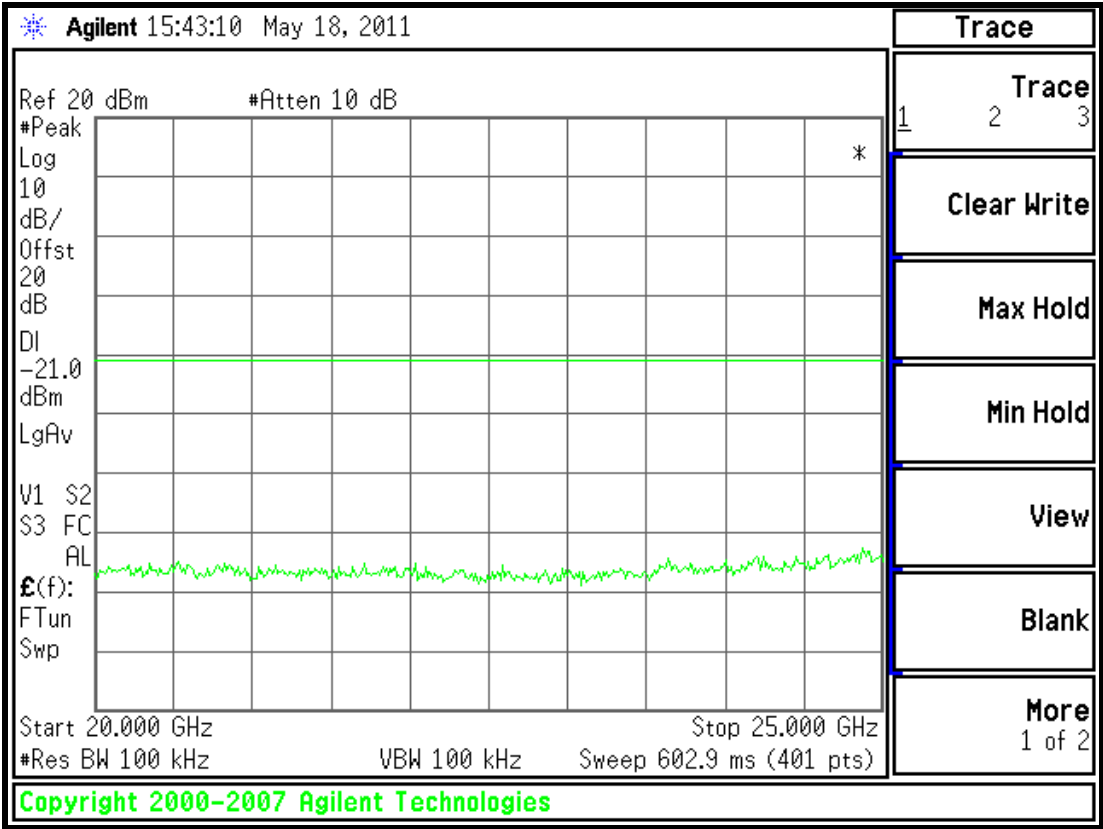
Conducted spurious emissions 5 GHz to 10 GHz – 2412MHz – 54Mbps



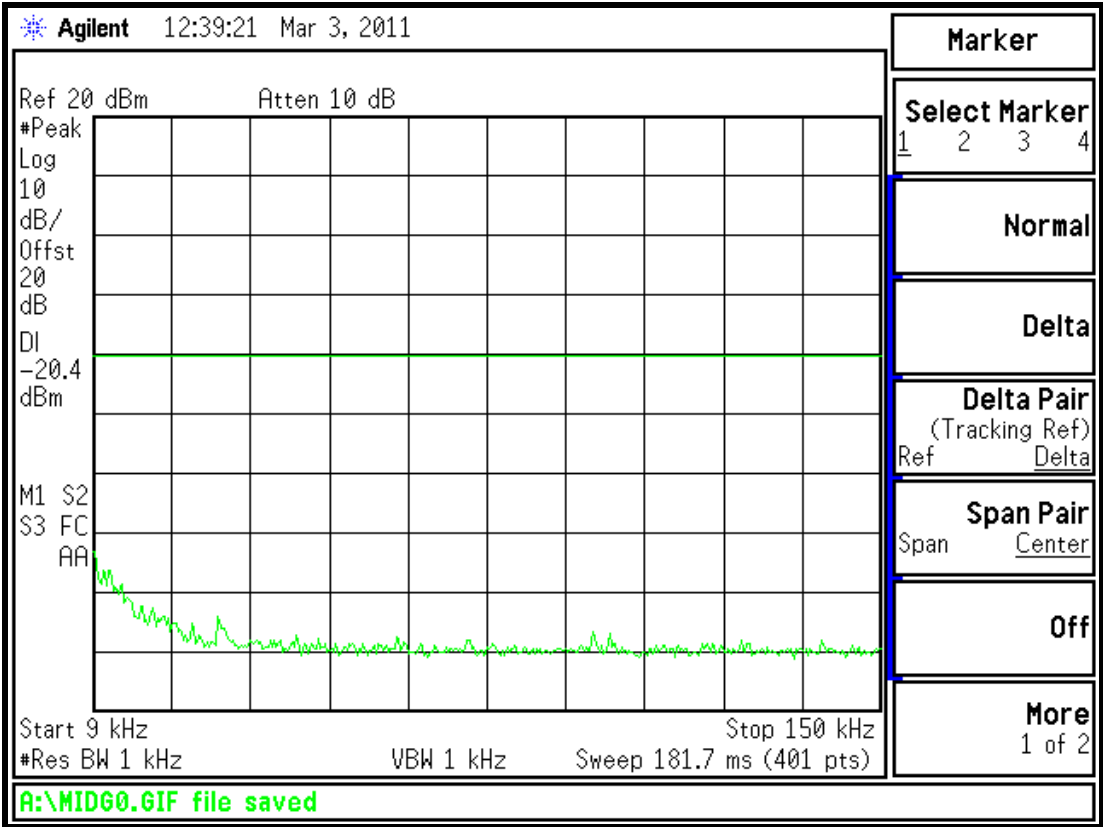
Conducted spurious emissions 10 GHz to 15 GHz – 2412MHz – 54Mbps



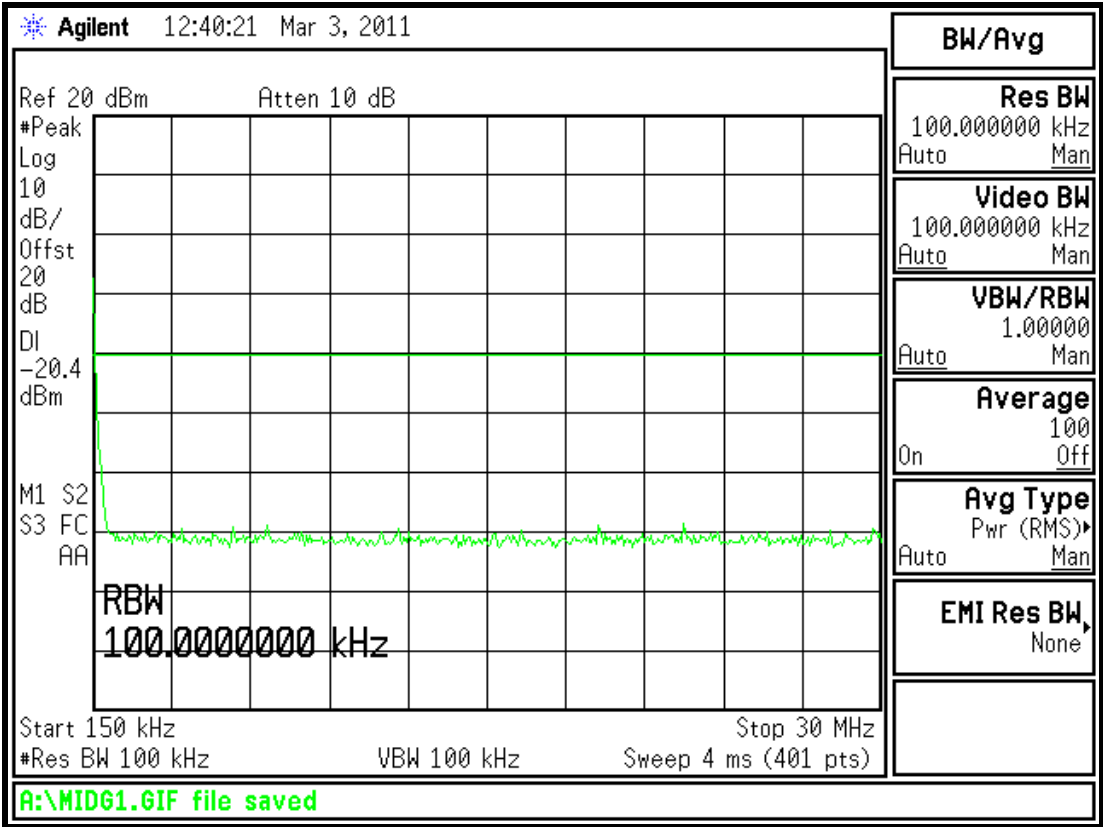
Conducted spurious emissions 15 GHz to 20 GHz – 2412MHz – 54Mbps



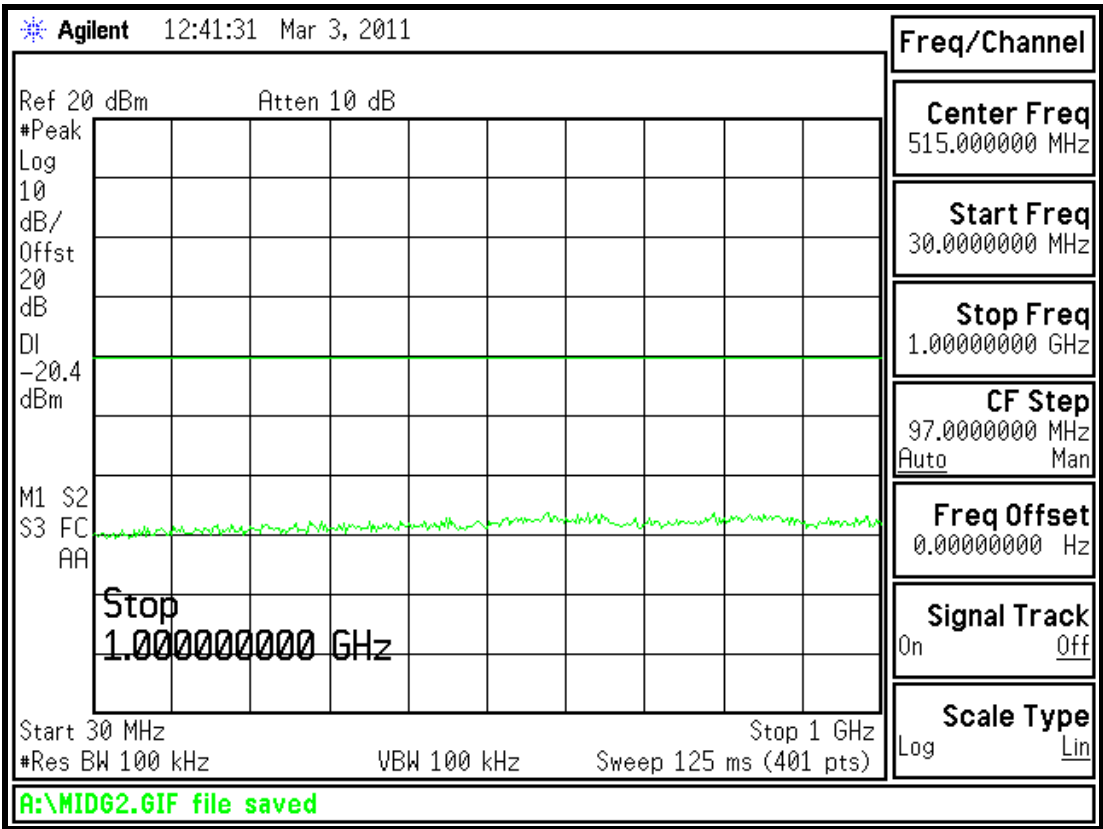
Conducted spurious emissions 20 GHz to 25 GHz – 2412MHz 54Mbps



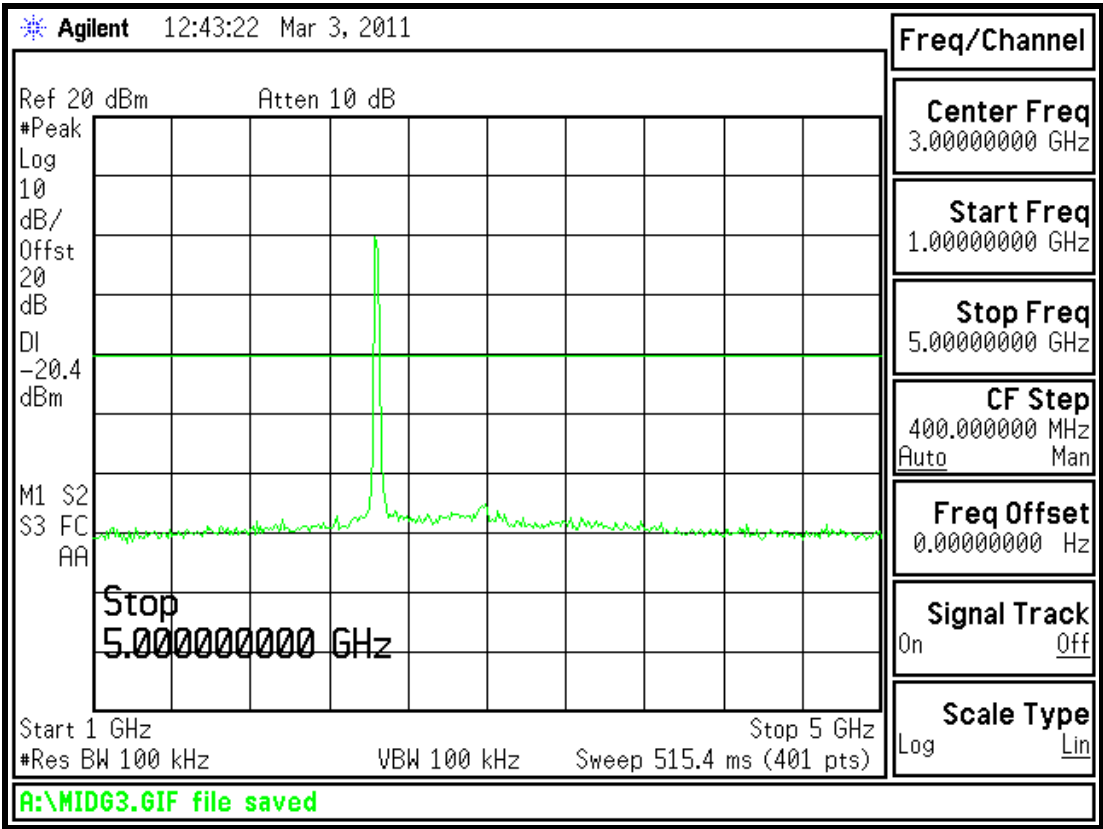
Conducted spurious emissions 9 kHz to 150 kHz – 2437MHz – 54Mbps



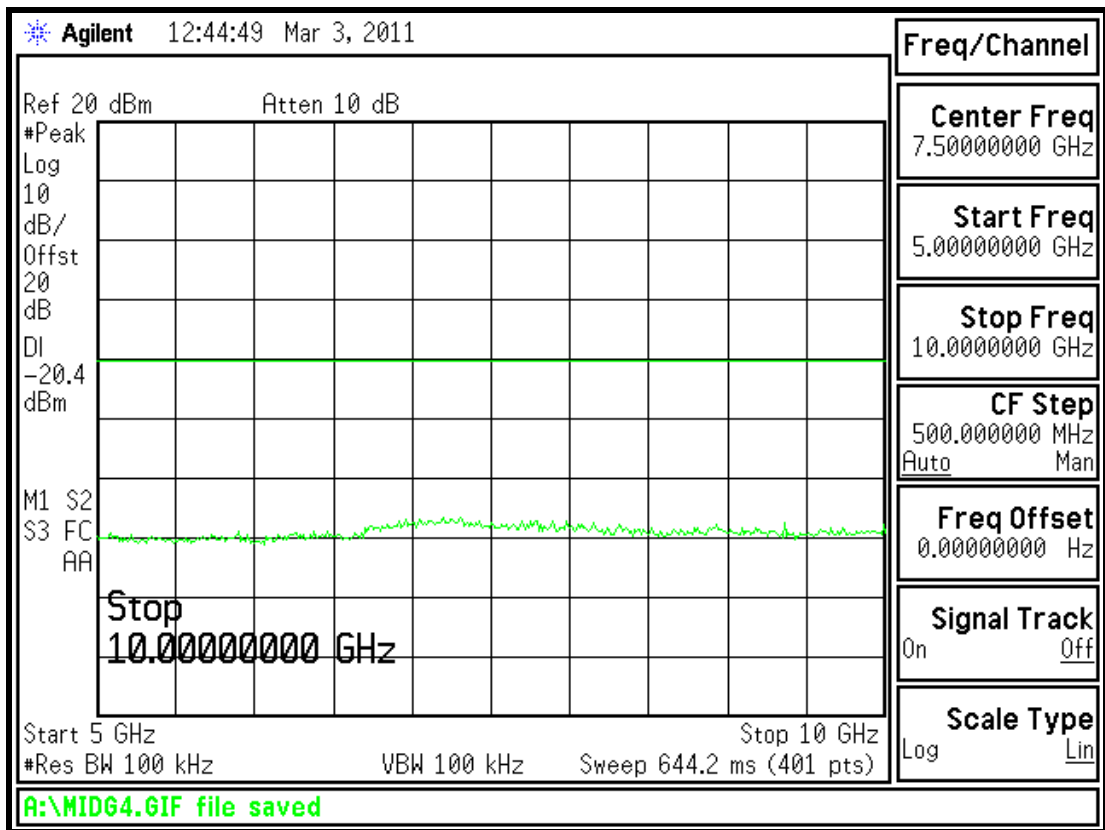
Conducted spurious emissions 150 kHz to 30 MHz – 2437MHz – 54Mbps



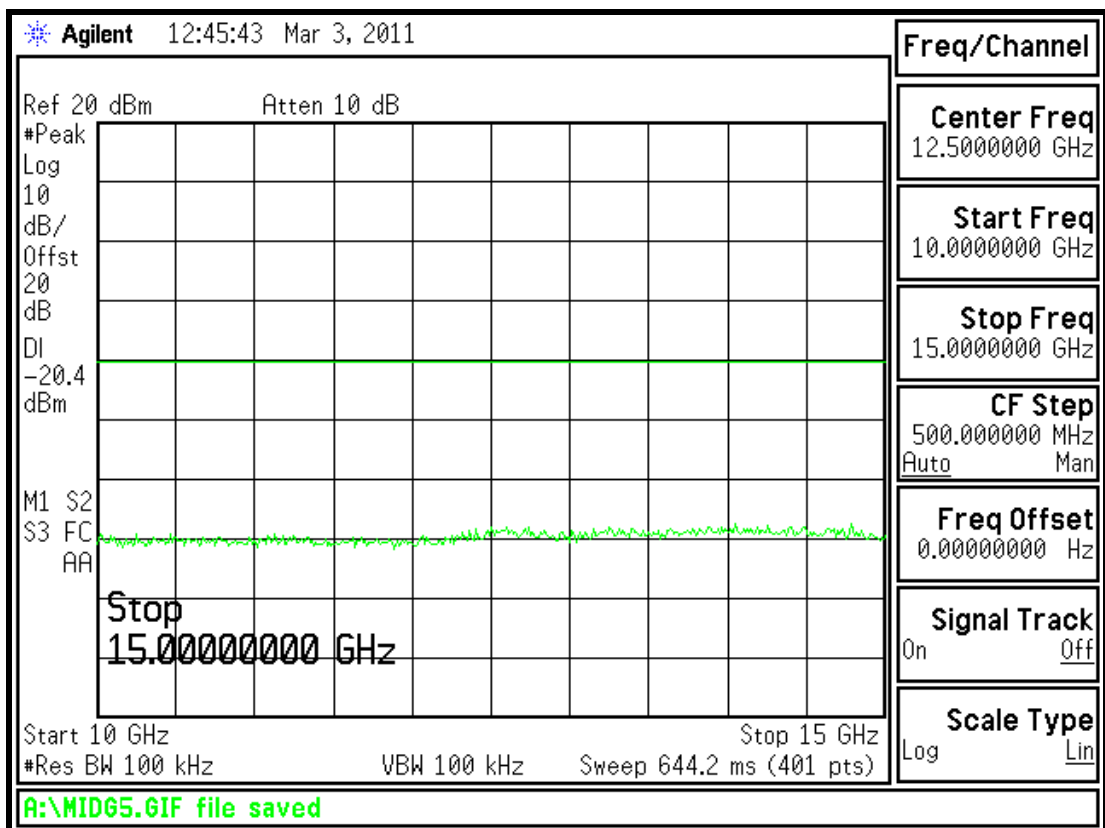
Conducted Spurious emissions 30 MHz to 1 GHz – 2437MHz – 54Mbps



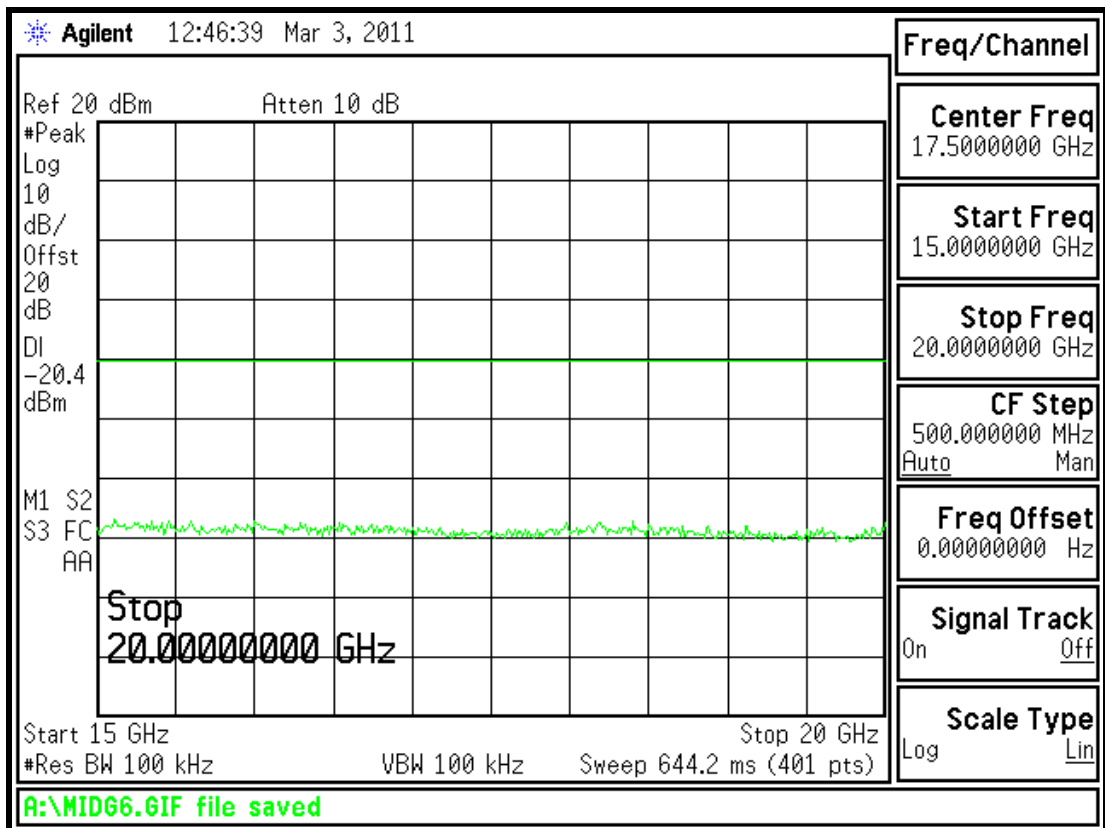
Conducted Spurious emissions 1 GHz to 5 GHz – 2437MHz – 54Mbps



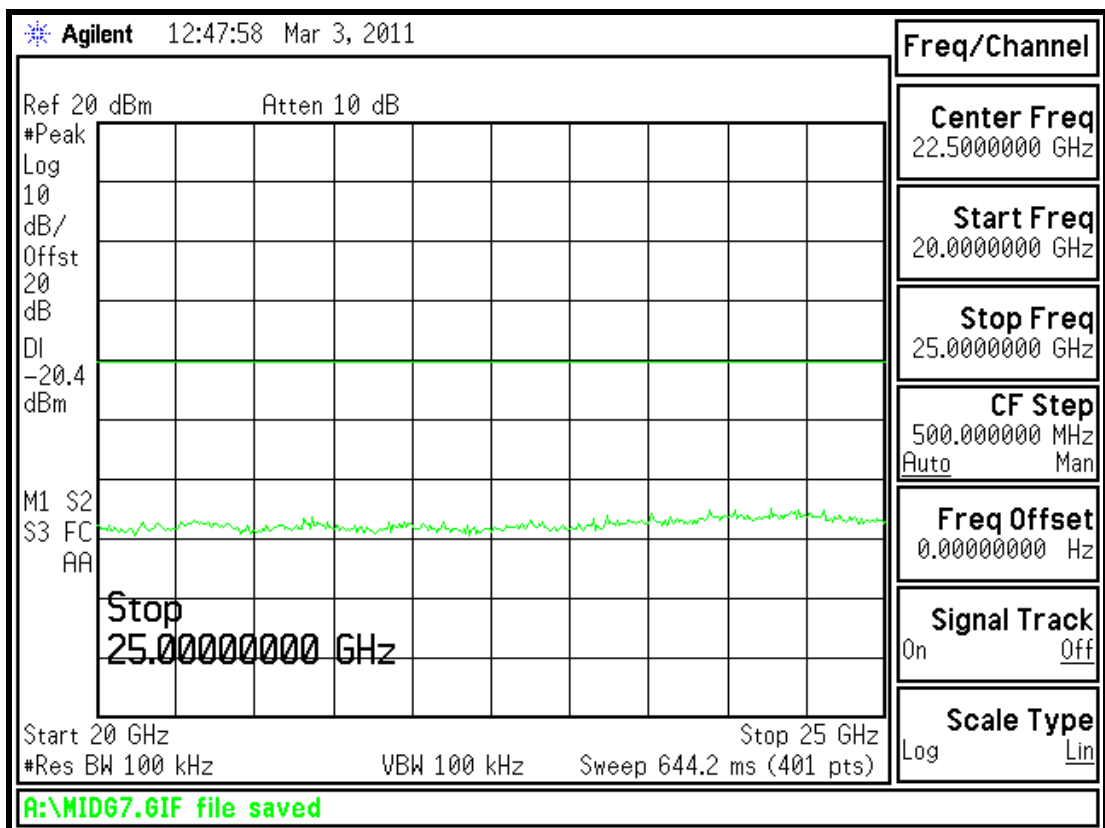
Conducted Spurious emissions 5 GHz to 10 GHz – 2437MHz – 54Mbps



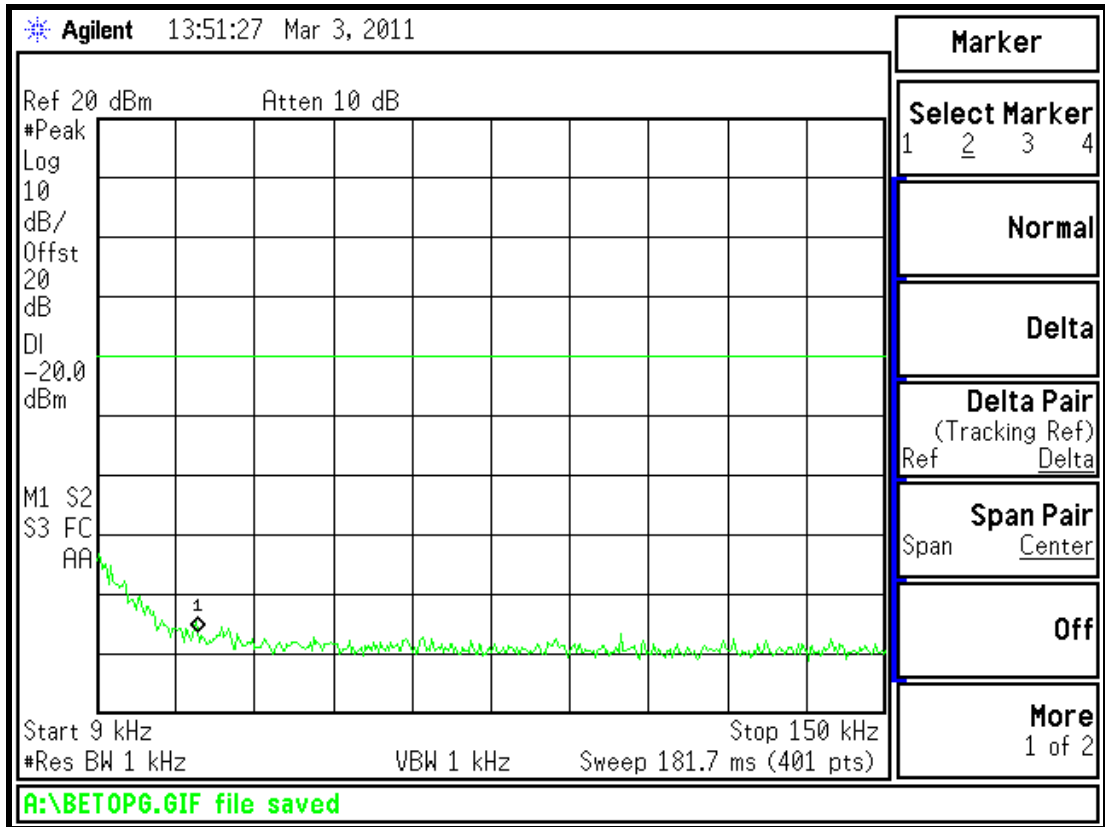
Conducted Spurious emissions 10 GHz to 15GHz – 2437MHz – 54Mbps



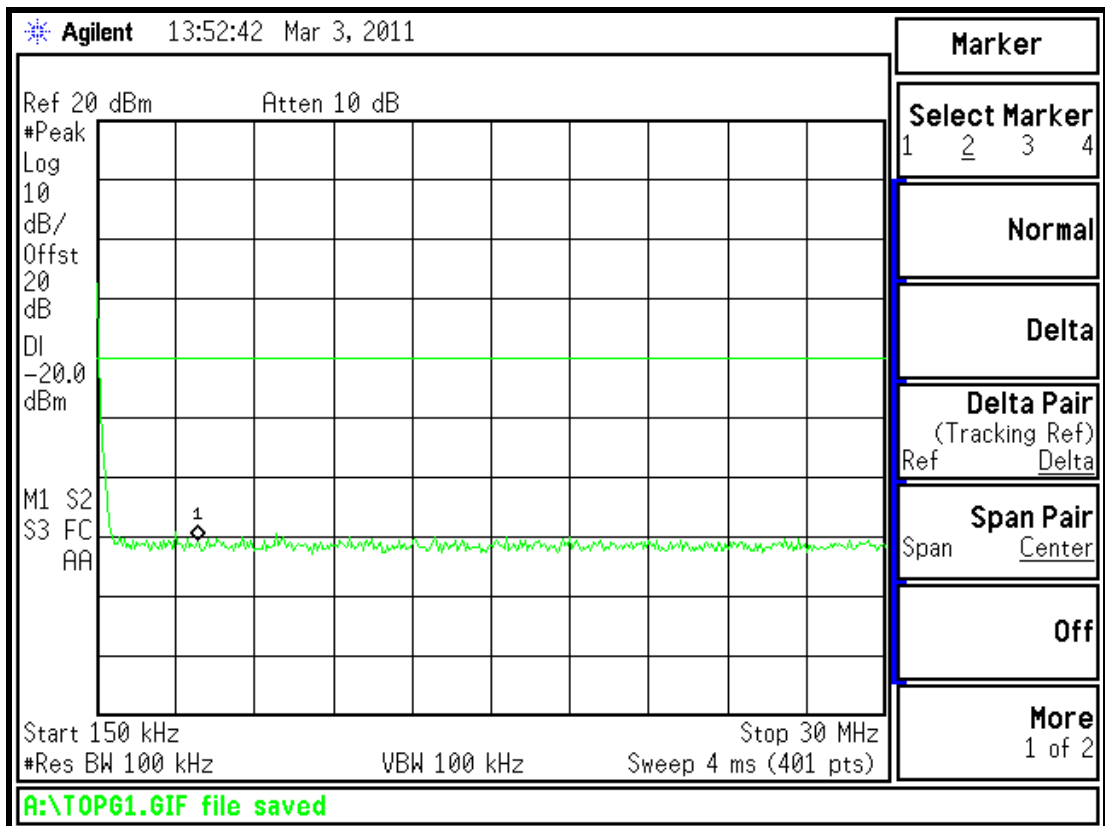
Conducted Spurious emissions 15 GHz to 20GHz – 2437MHz – 54Mbps



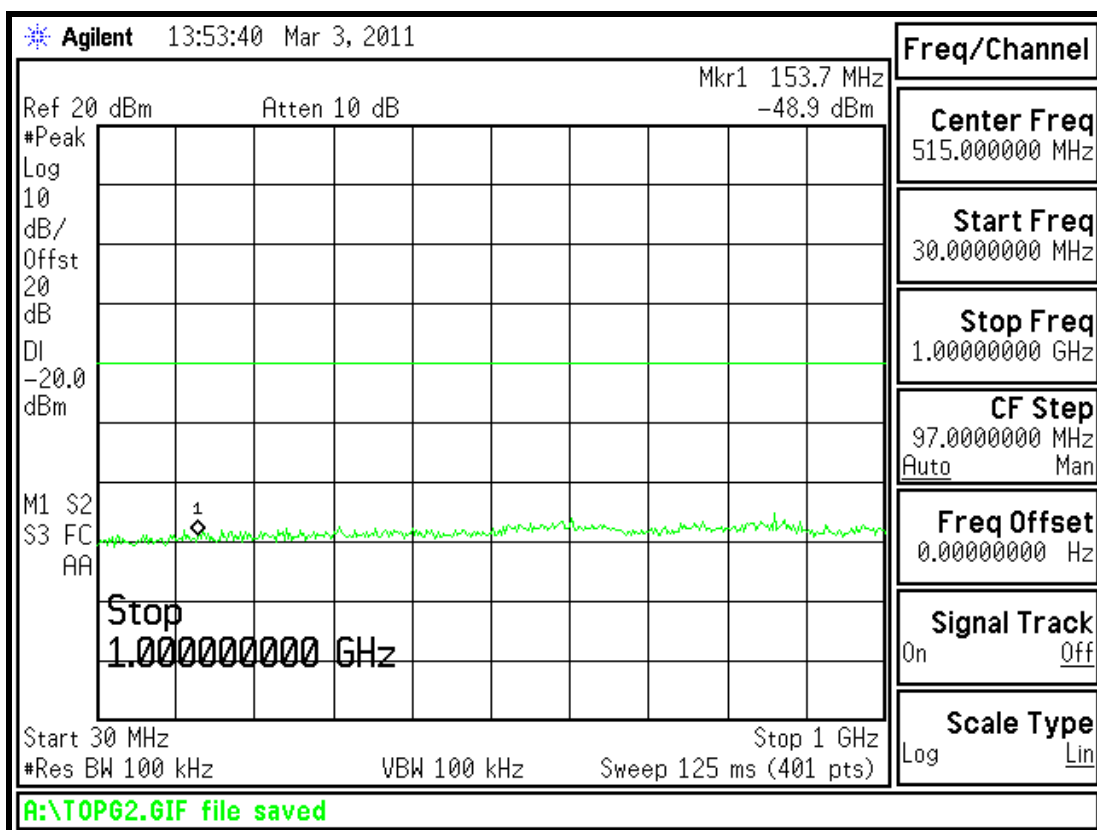
Conducted Spurious emissions 20 GHz to 25GHz – 2437MHz – 54Mbps



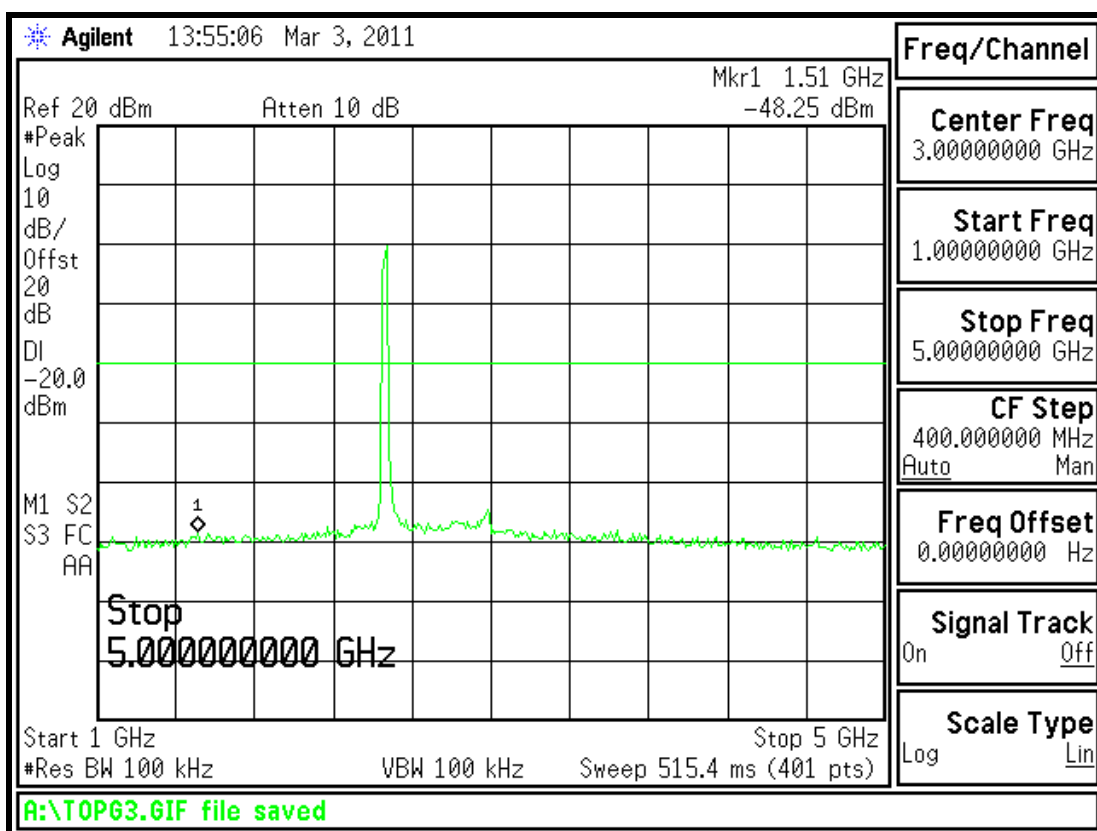
Conducted spurious emissions 9 kHz to 150 kHz – 2462MHz – 54Mbps



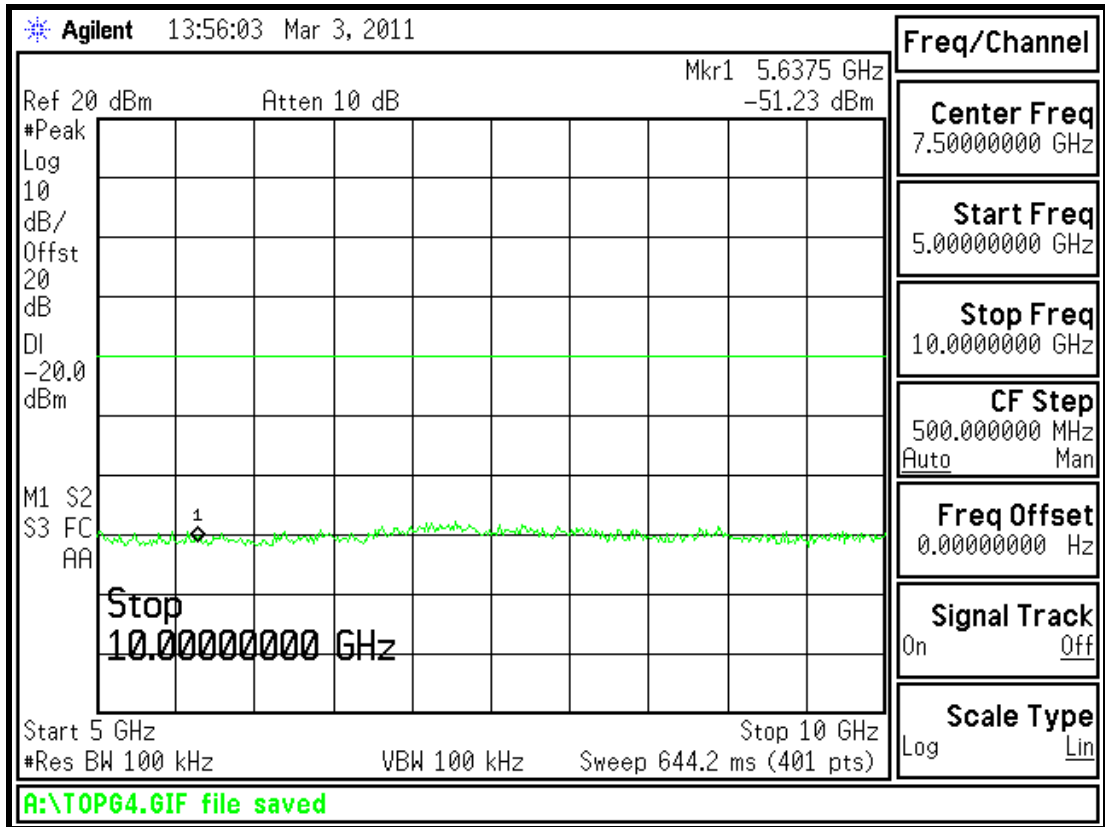
Conducted spurious emissions 150 kHz to 30 MHz – 2462MHz – 54Mbps



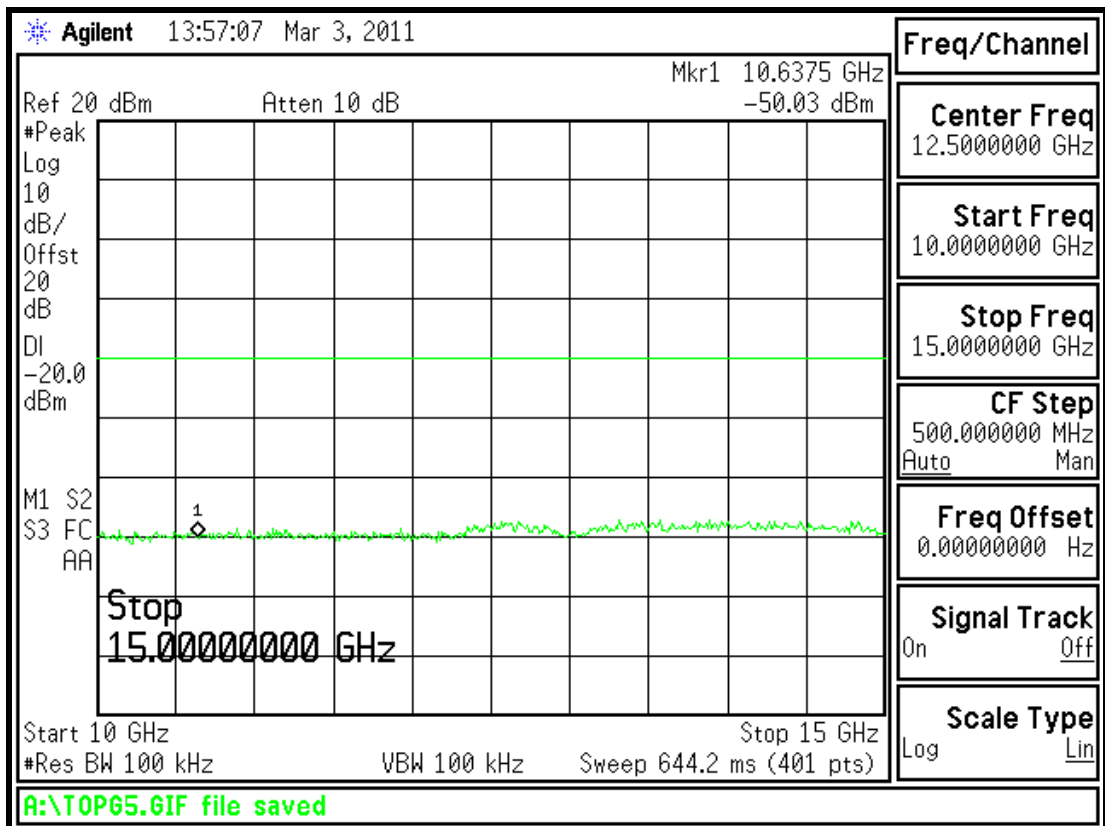
Conducted Spurious emissions 30 MHz to 1 GHz – 2462MHz – 54Mbps



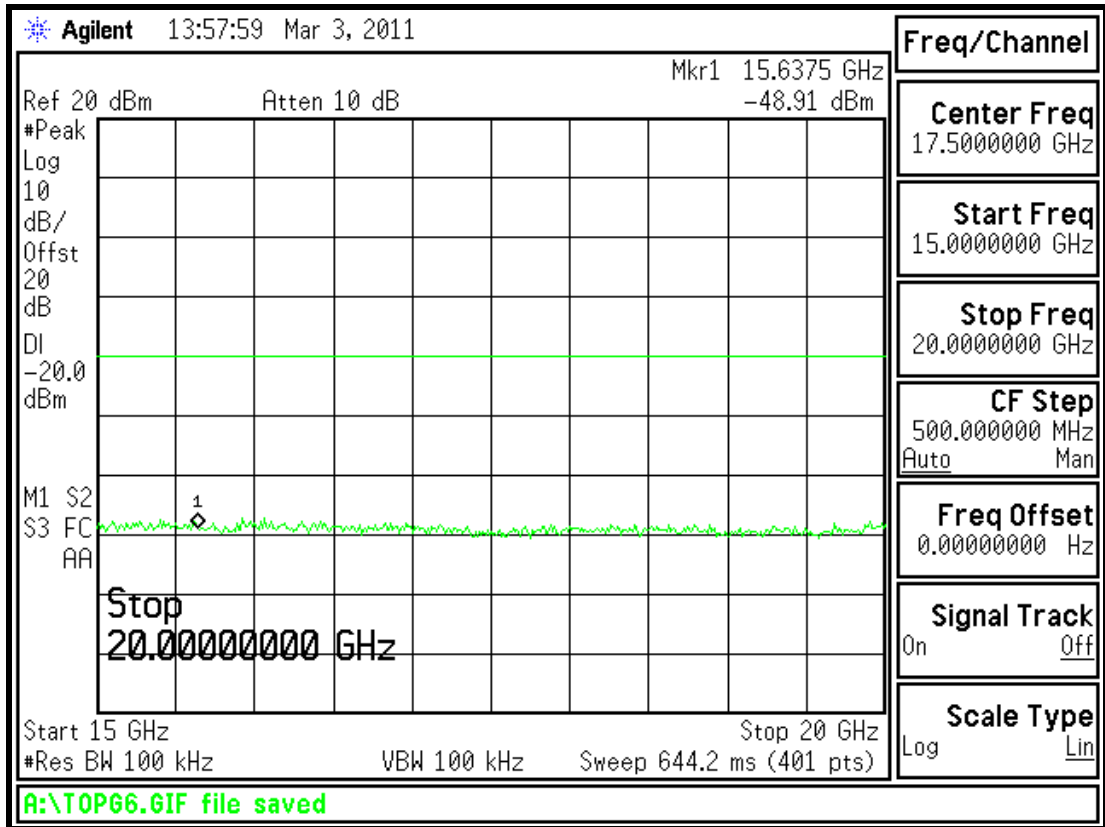
Conducted Spurious emissions 1 GHz to 5 GHz – 2462MHz – 54Mbps



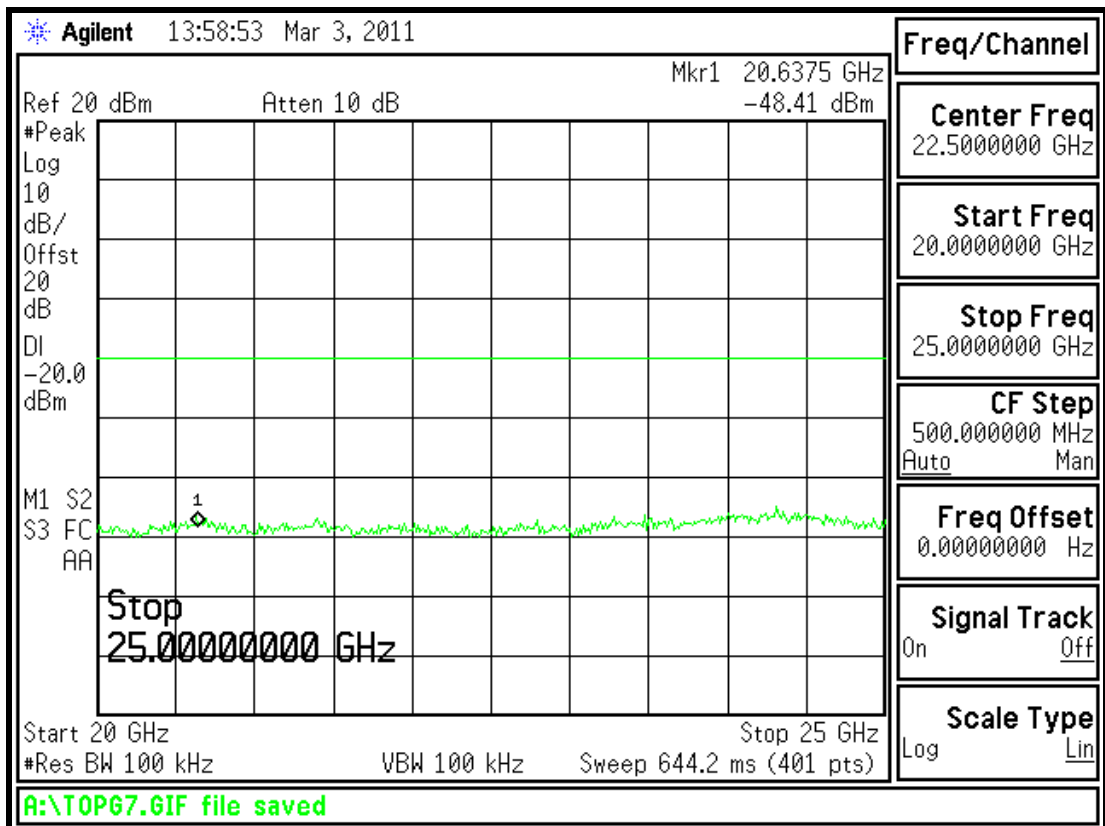
Conducted Spurious emissions 5 GHz to 10 GHz– 2462MHz – 54Mbps



Conducted Spurious emissions 10 GHz to 15 GHz– 2462MHz – 54Mbps

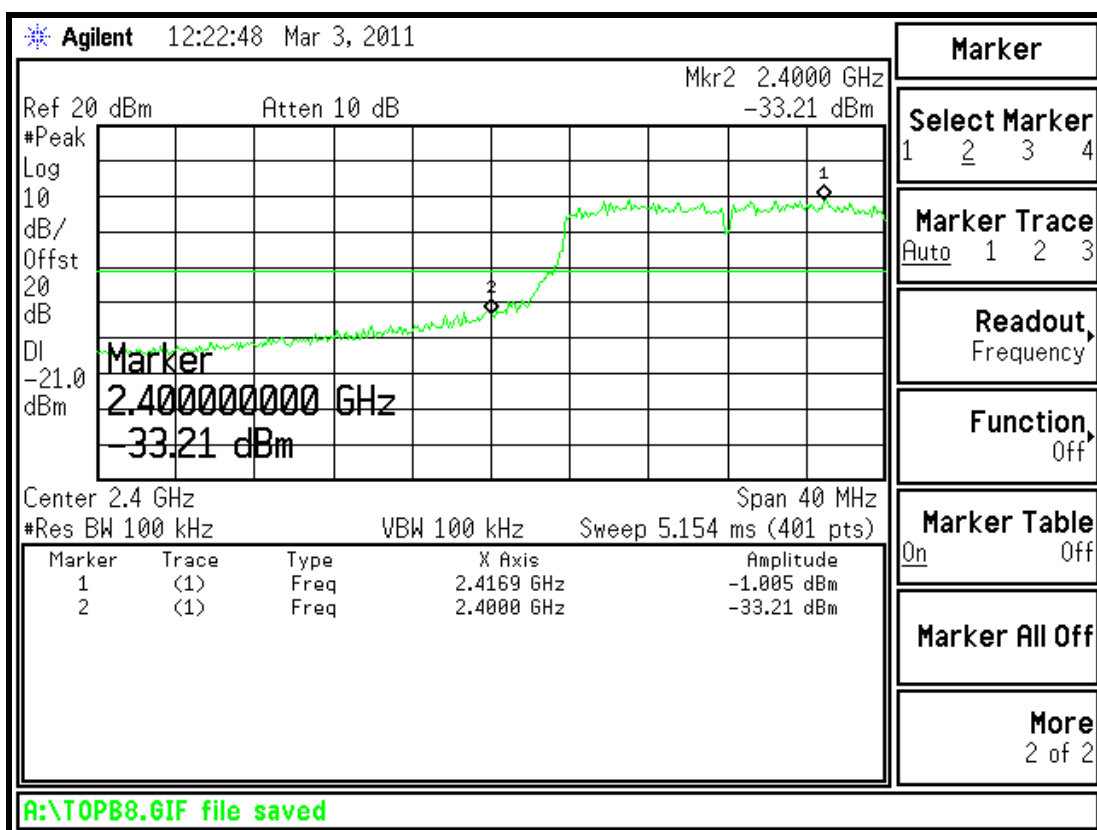


Conducted Spurious emissions 15 GHz to 20 GHz– 2462MHz – 54Mbps

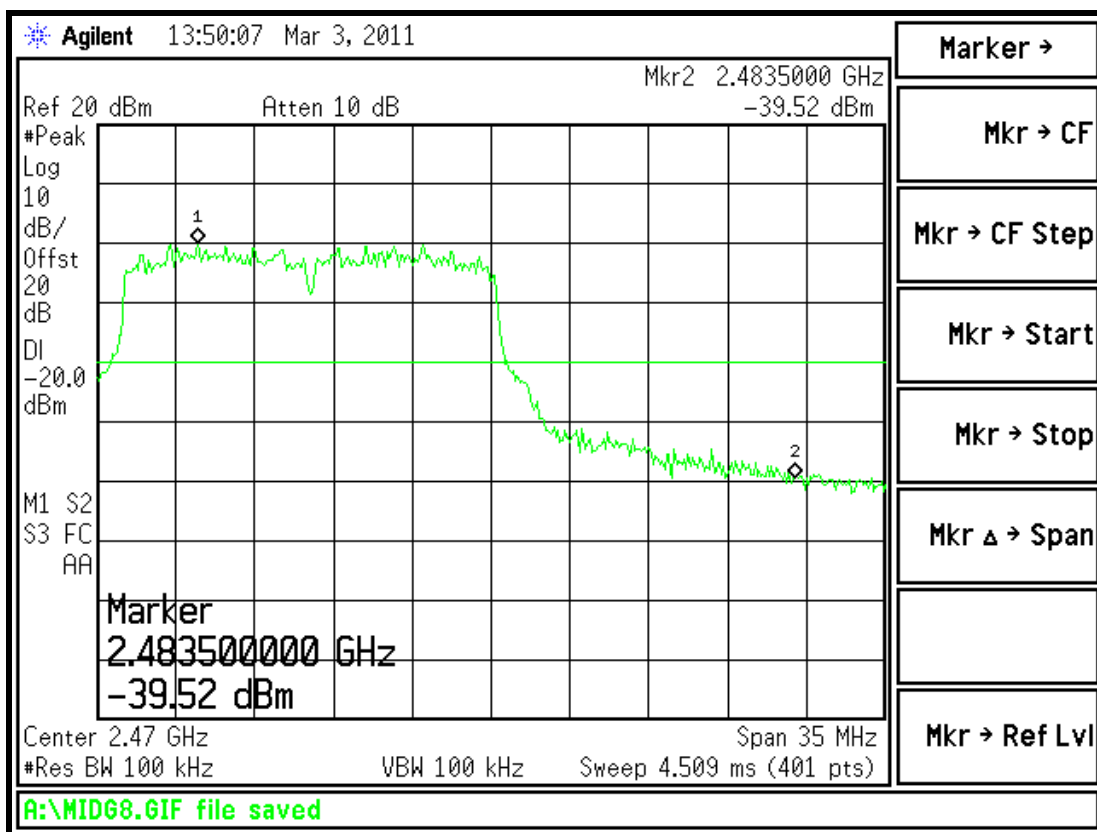


Conducted Spurious emissions 20 GHz to 25 GHz– 2462MHz – 54Mbps

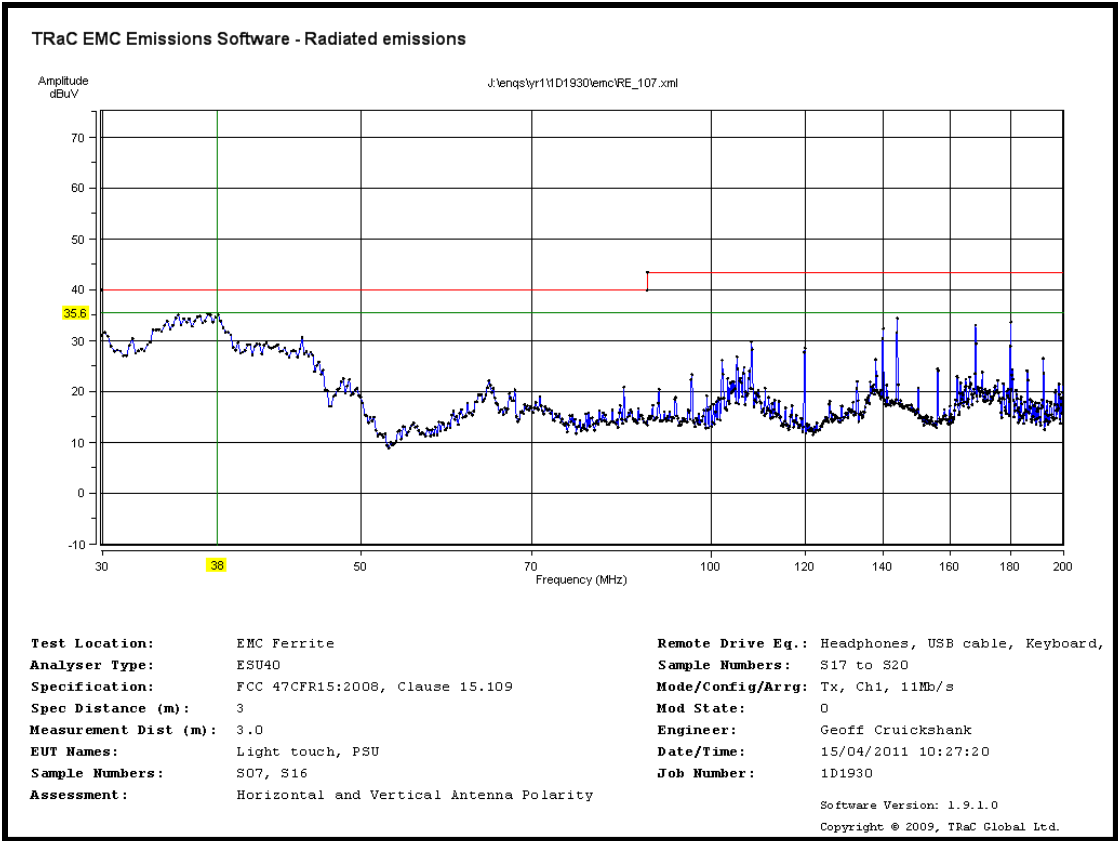
## Conducted Bandedge Compliance



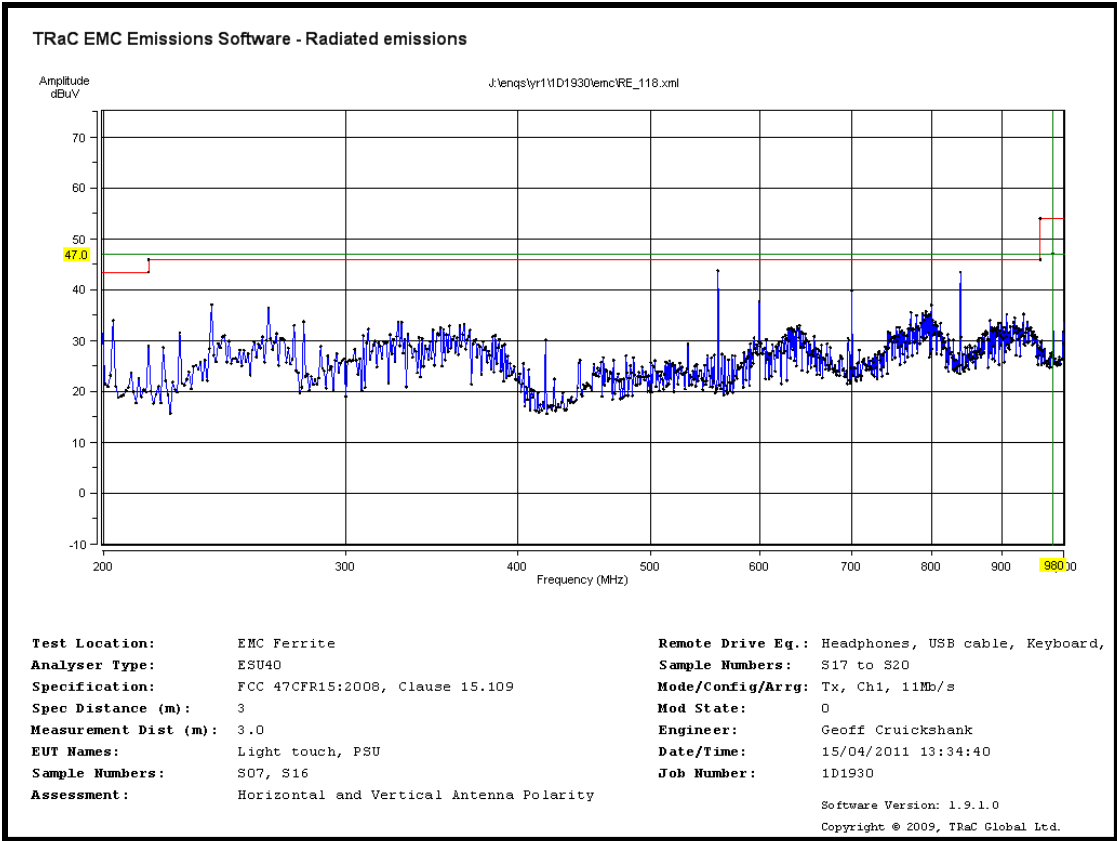
Lower Bandedge – 54Mbps



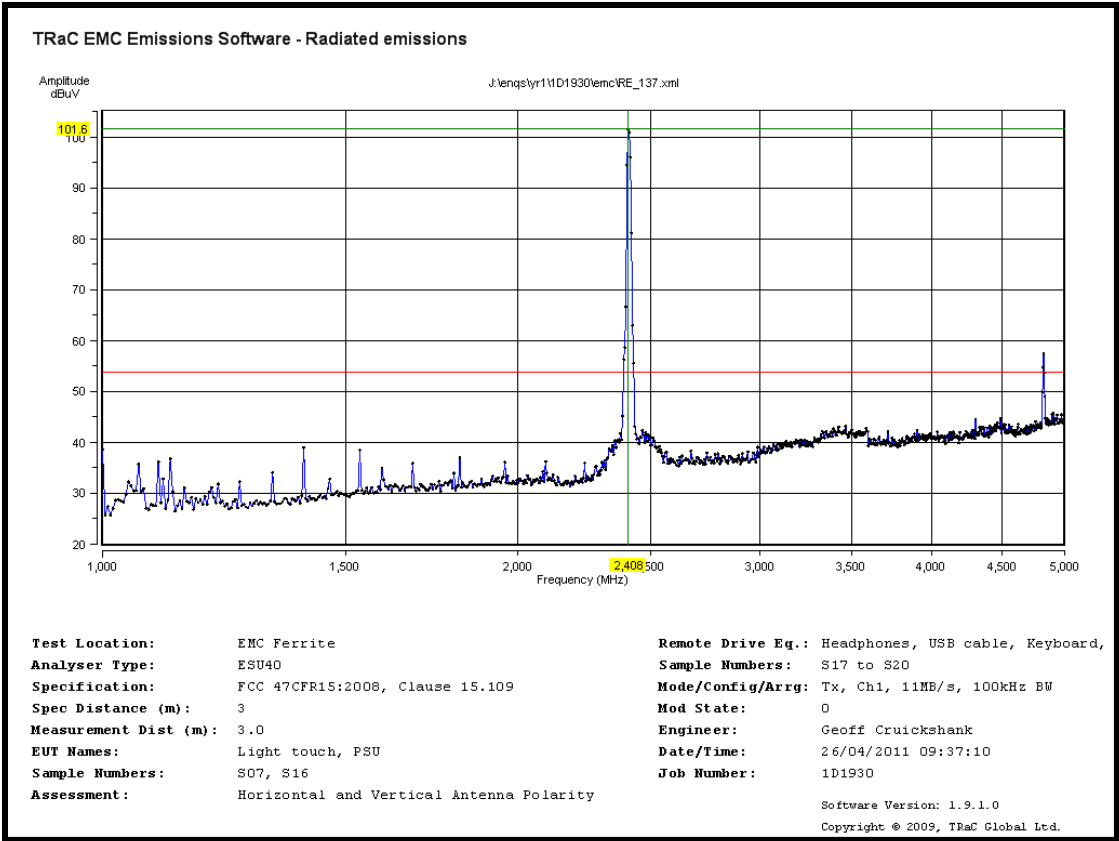
Upper Bandedge – 54Mbps



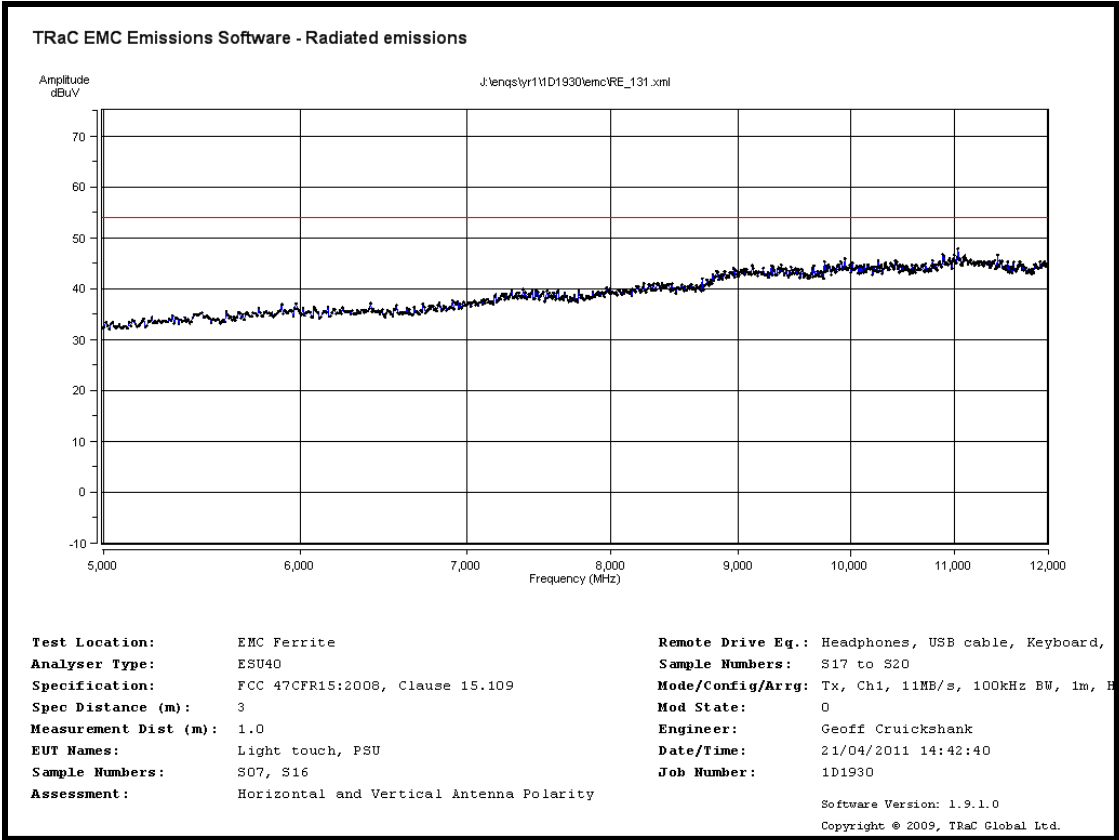
Radiated Spurious emissions 30 MHz to 200 MHz – 2412MHz – 11Mbps



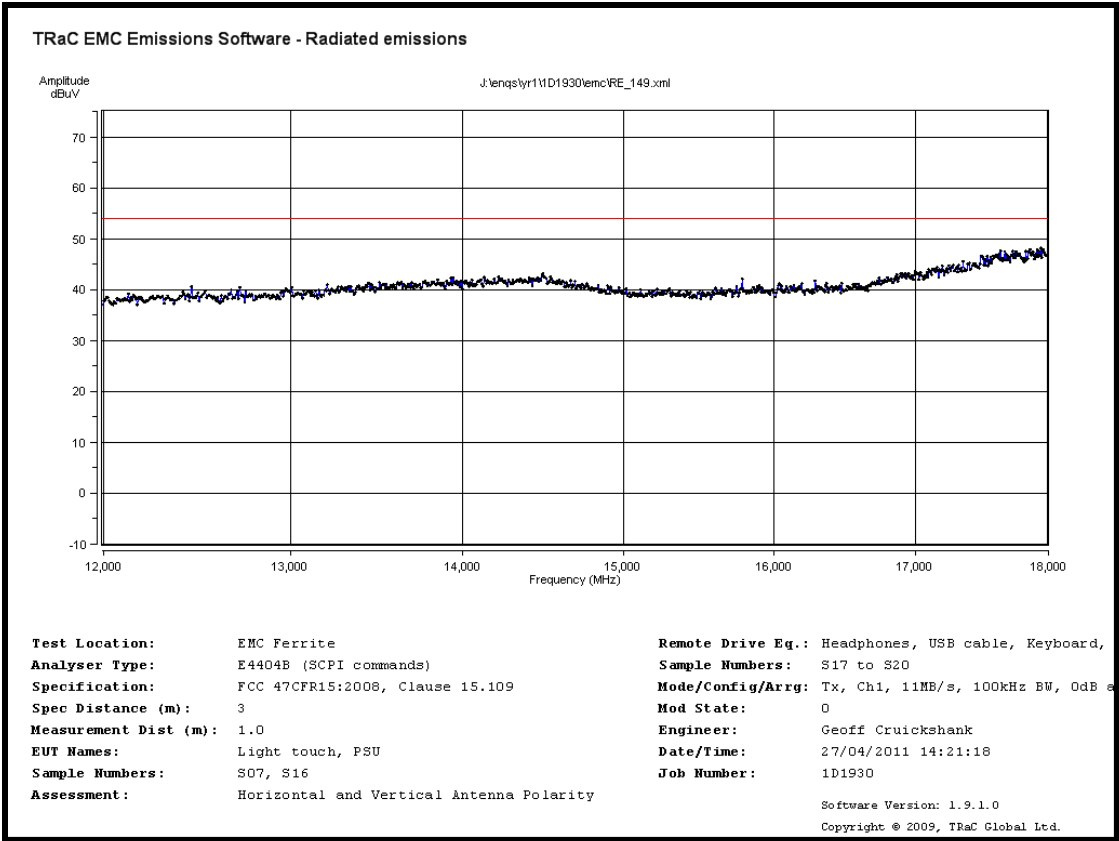
Radiated Spurious emissions 200 MHz to 1 GHz – 2412MHz – 11Mbps



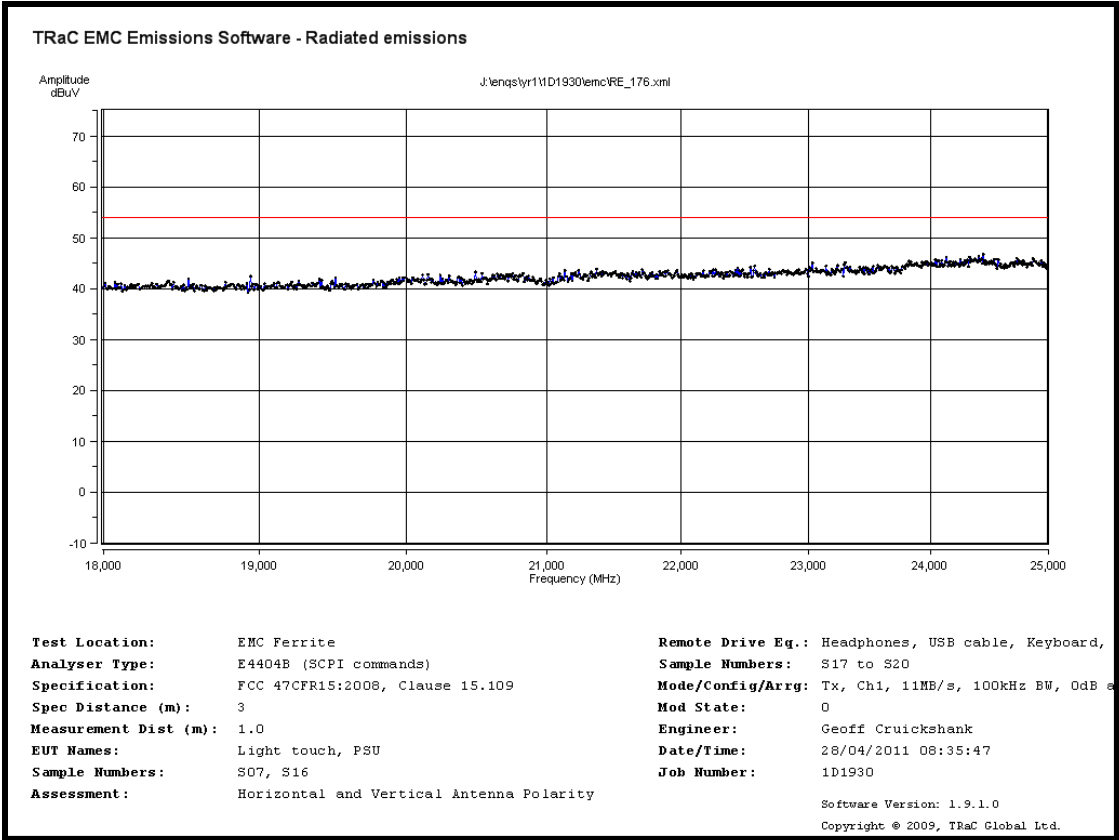
Radiated Spurious emissions 1 GHz to 5 GHz – 2412MHz – 11Mbps



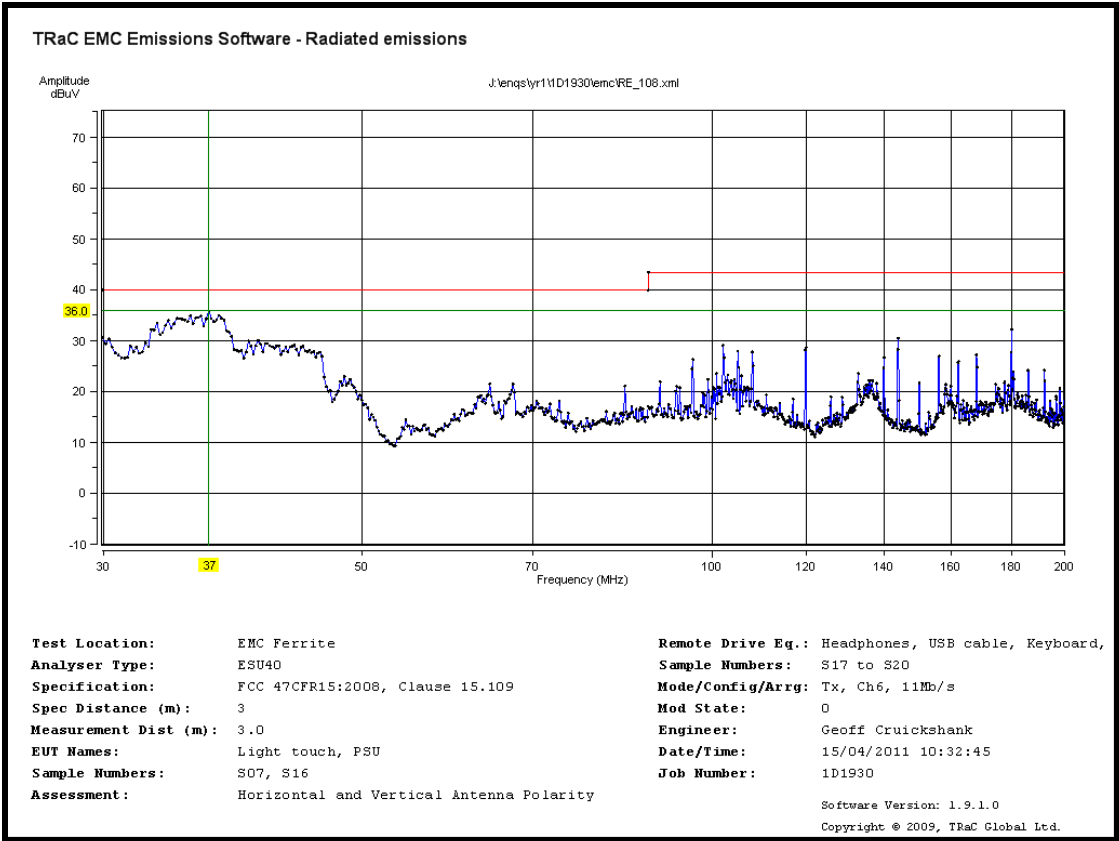
Radiated Spurious emissions 5 GHz to 12 GHz – 2412MHz – 11Mbps



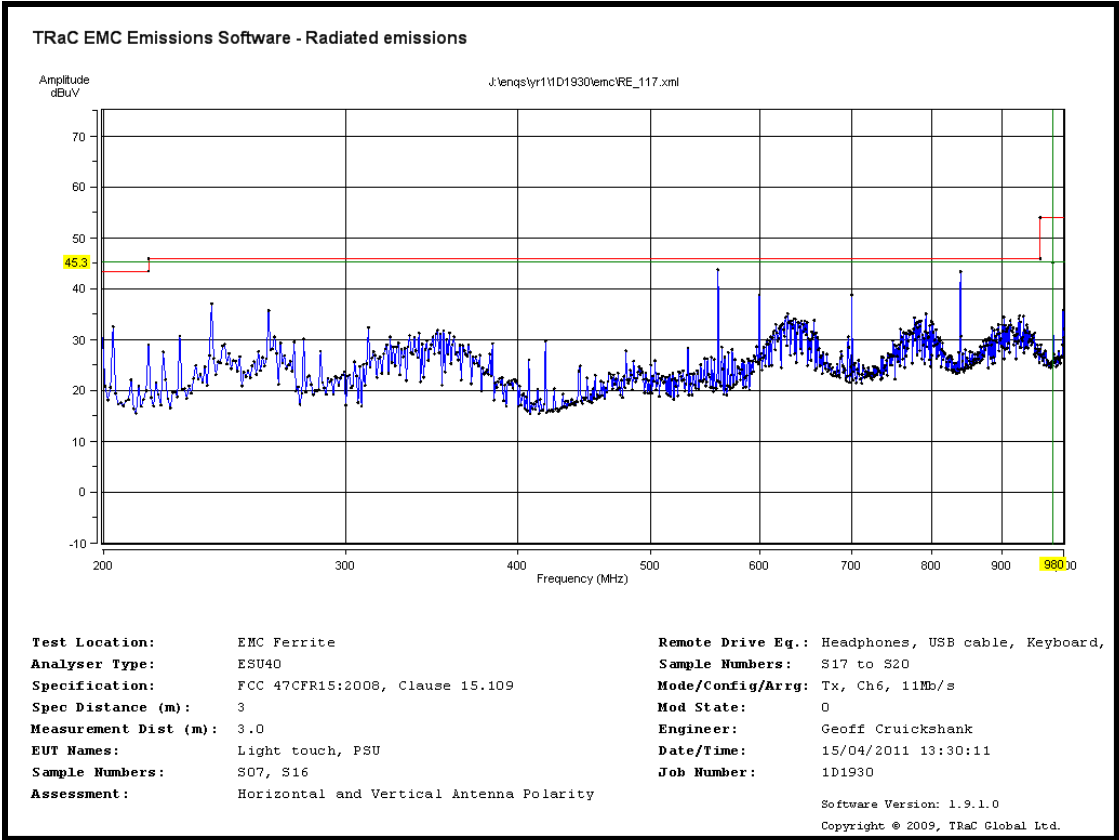
Radiated Spurious emissions 12 GHz to 18 GHz – 2412MHz – 11Mbps



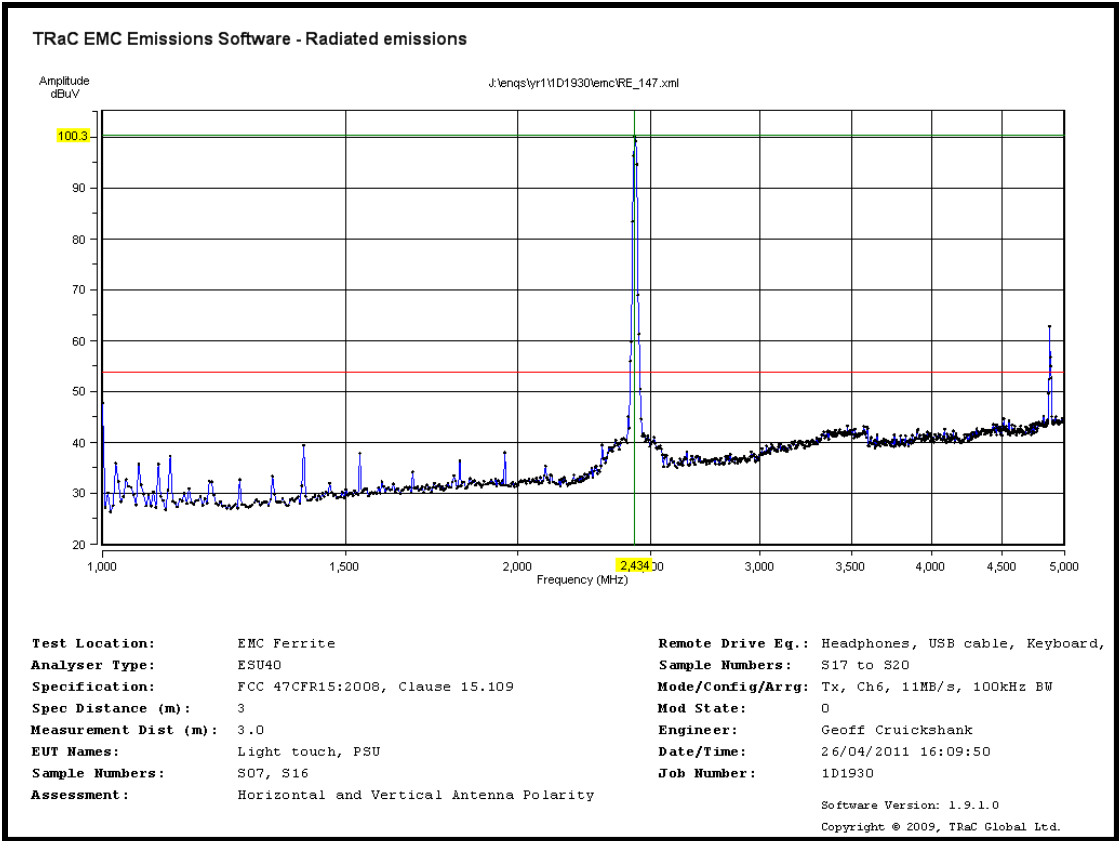
Radiated Spurious emissions 18 GHz to 25 GHz – 2412MHz – 11Mbps



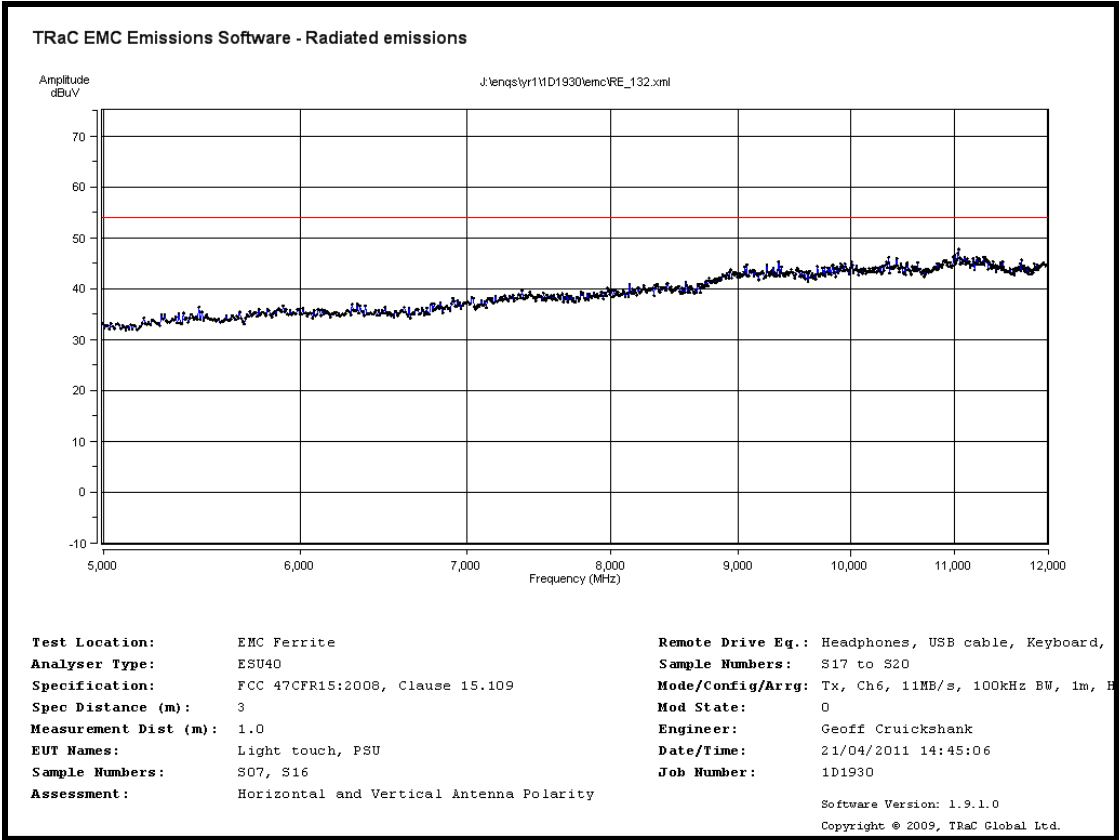
Radiated Spurious emissions 30 MHz to 200 MHz – 2437MHz – 11Mbps



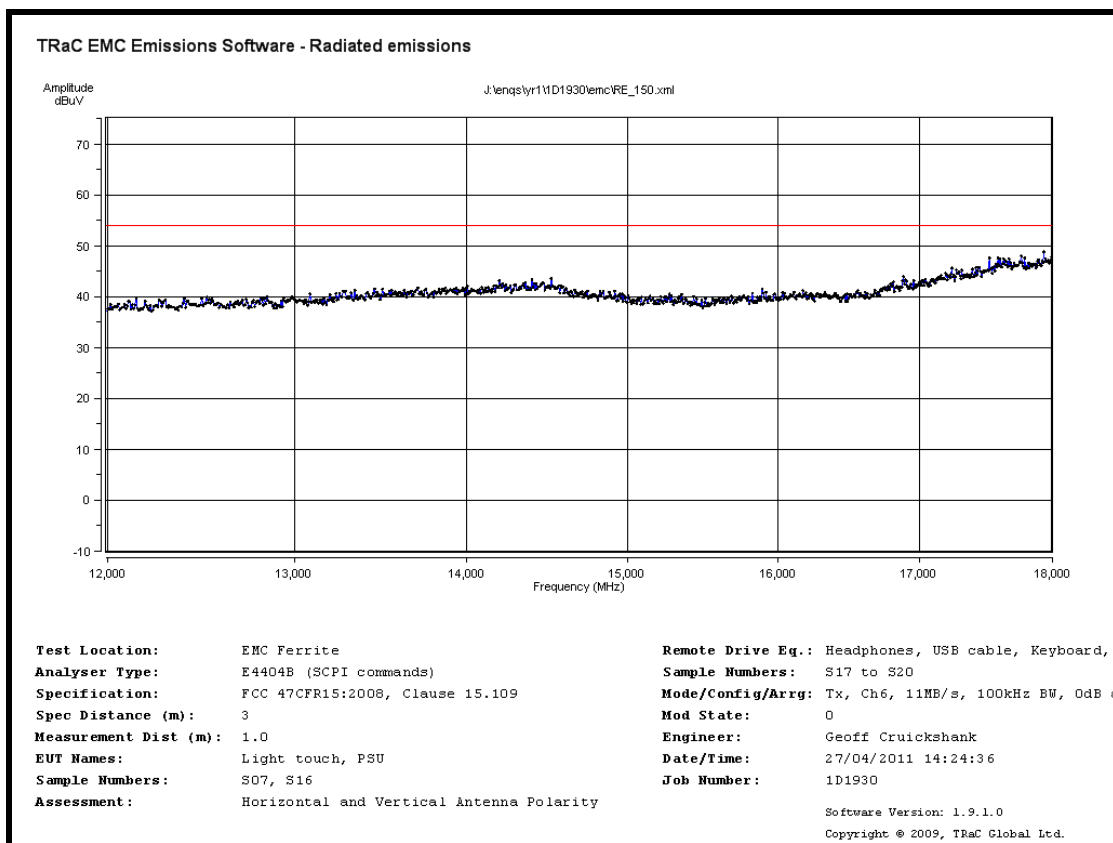
Radiated Spurious emissions 200 MHz to 1 GHz – 2437MHz – 11Mbps



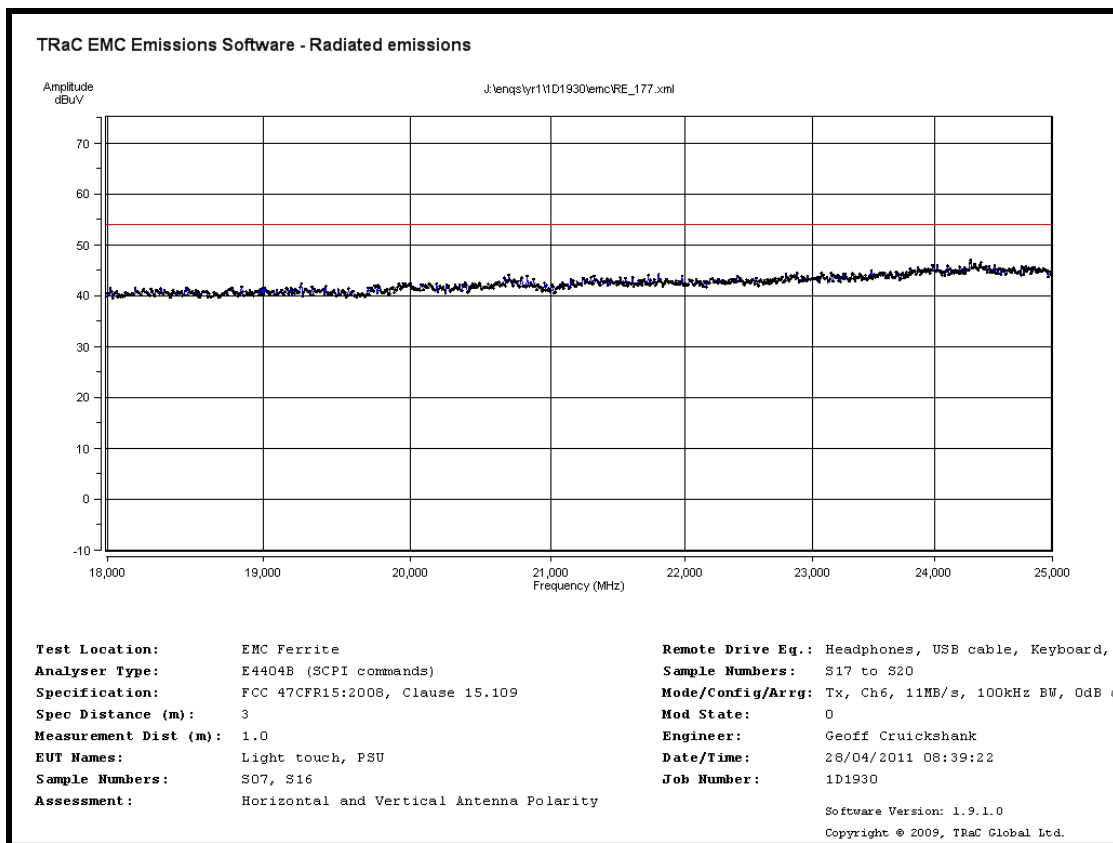
Radiated Spurious emissions 1 GHz to 5 GHz – 2437MHz – 11Mbps



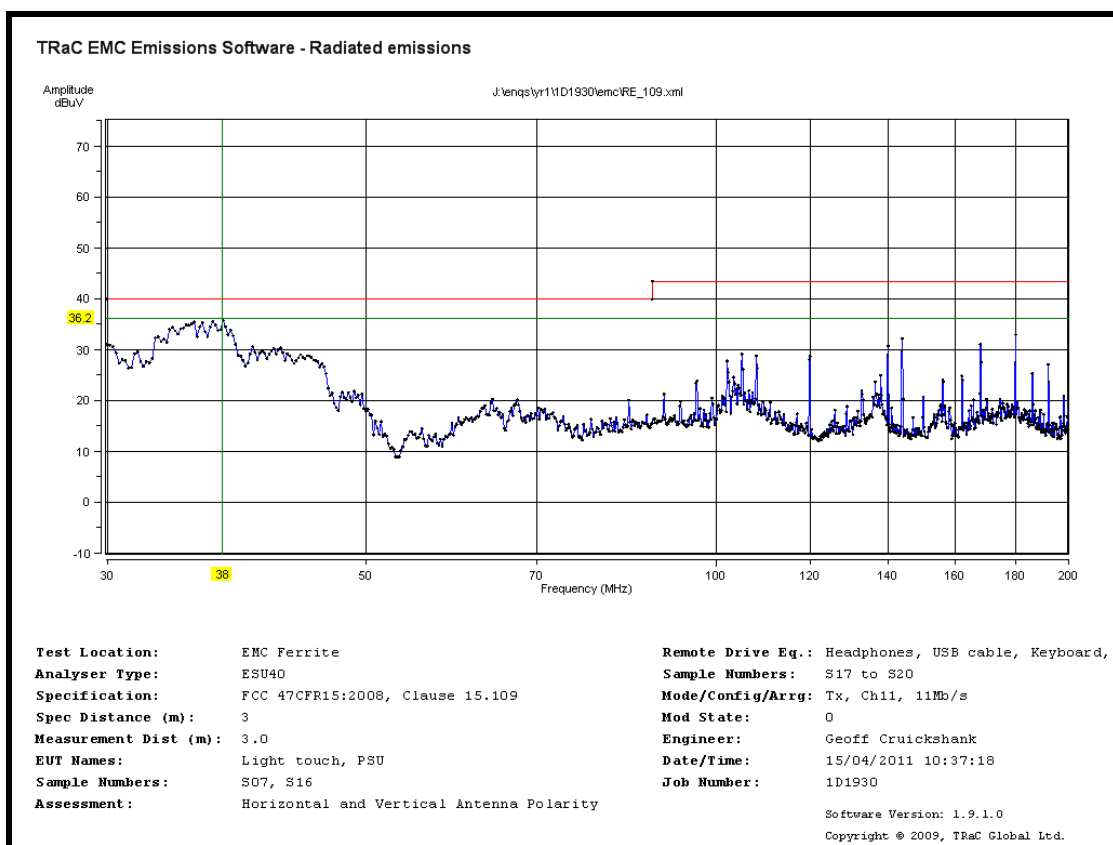
Radiated Spurious emissions 5 GHz to 12 GHz – 2437MHz – 11Mbps



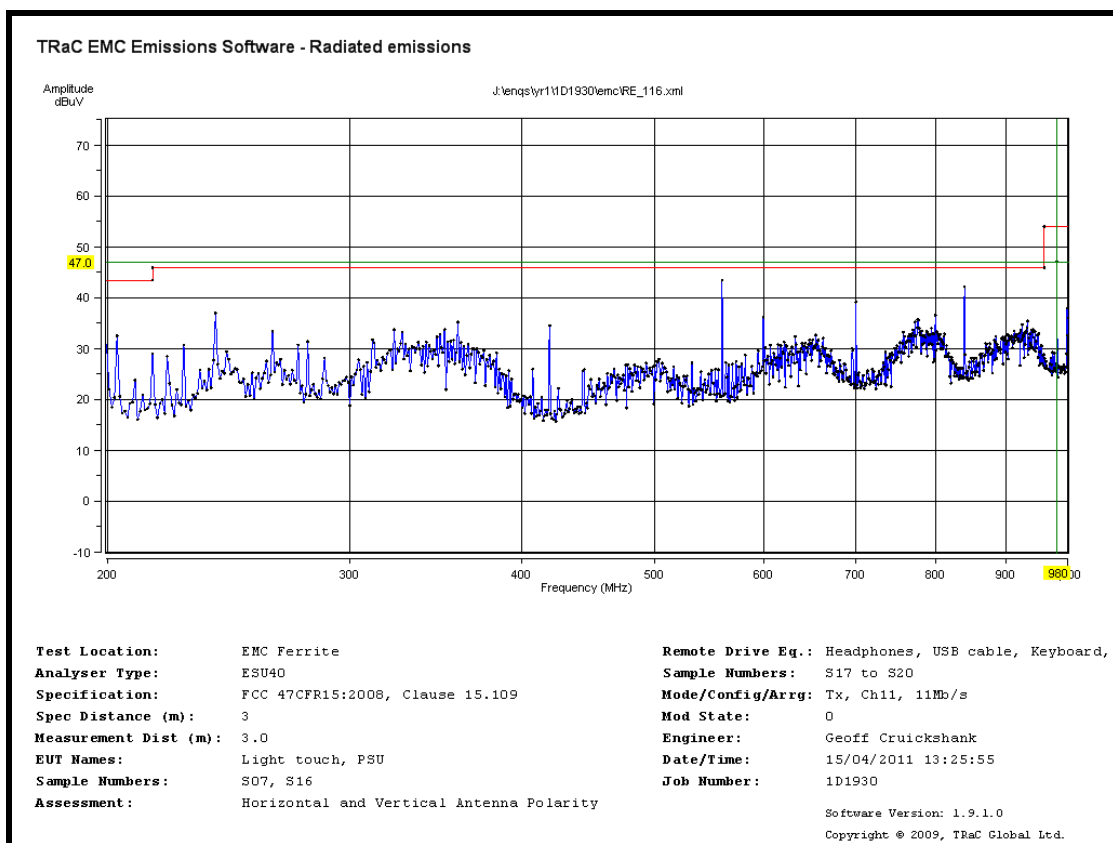
## Radiated Spurious emissions 12 GHz to 18 GHz – 2437MHz – 11Mbps



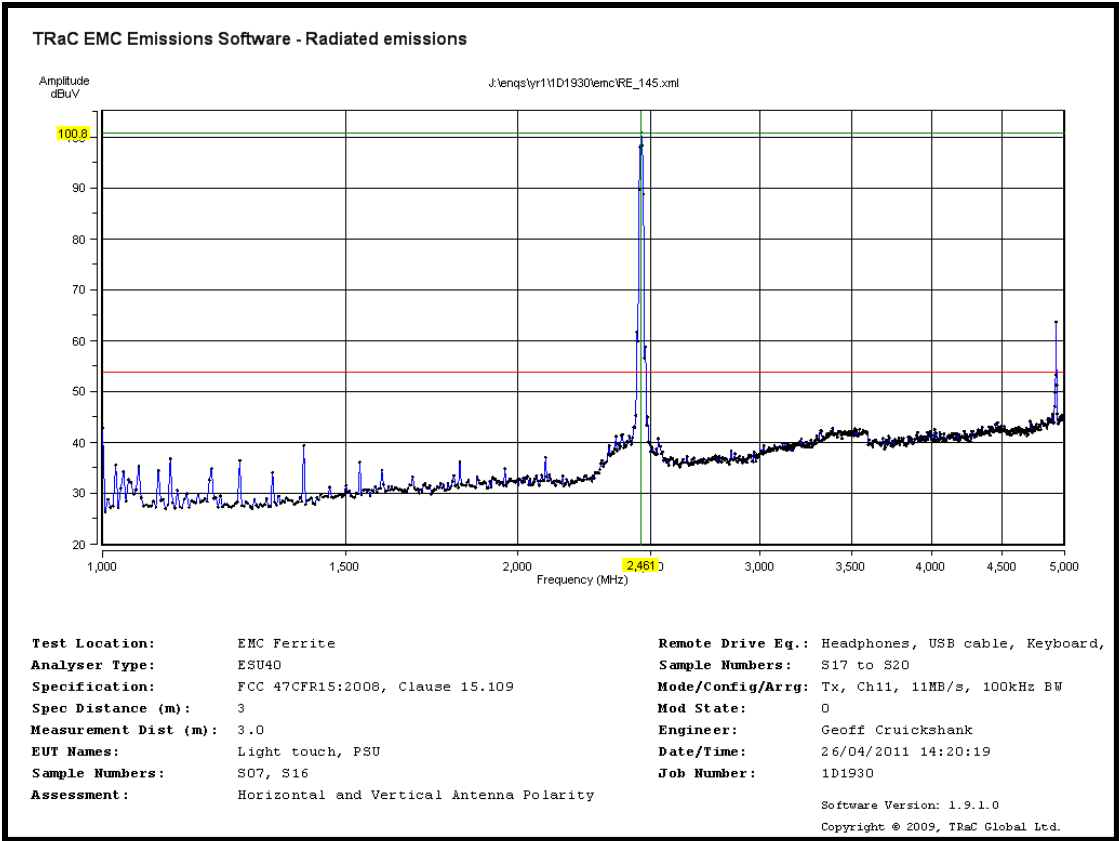
## Radiated Spurious emissions 18 GHz to 25 GHz – 2437MHz – 11Mbps



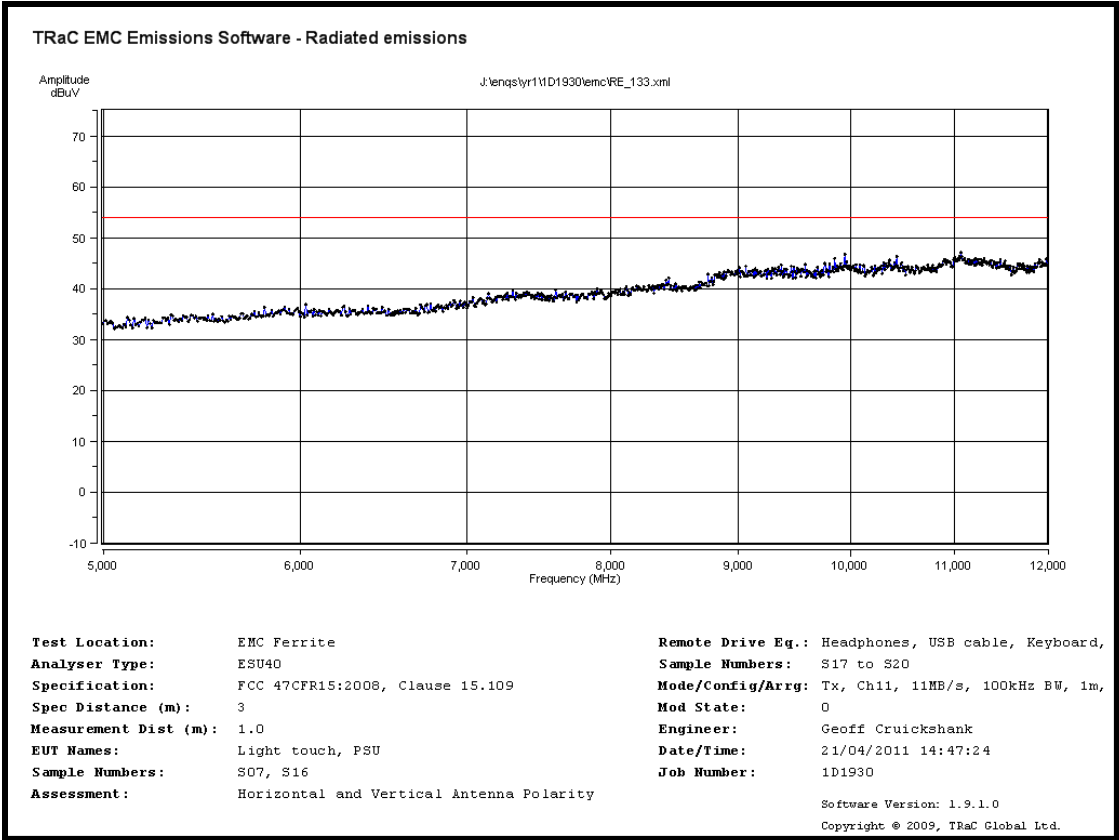
Radiated Spurious emissions 30 MHz to 200 MHz – 2462MHz – 11Mbps



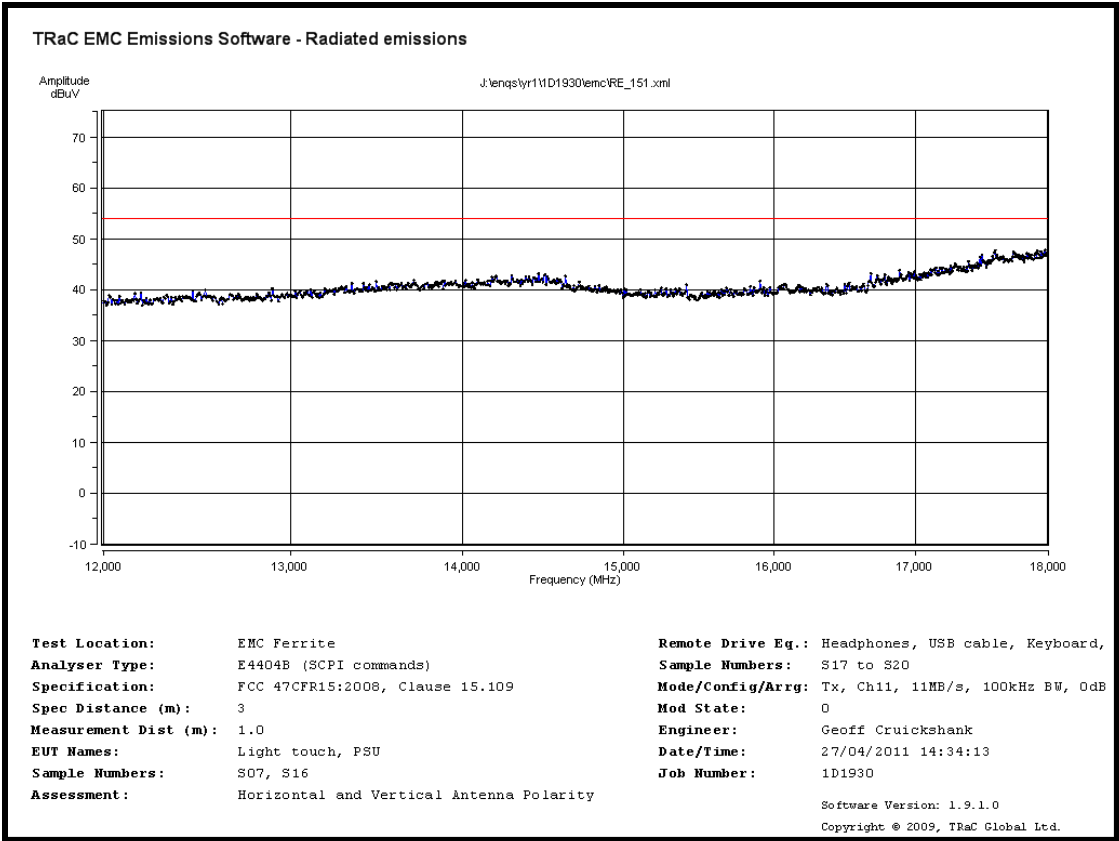
Radiated Spurious emissions 200 MHz to 1 GHz – 2462MHz – 11Mbps



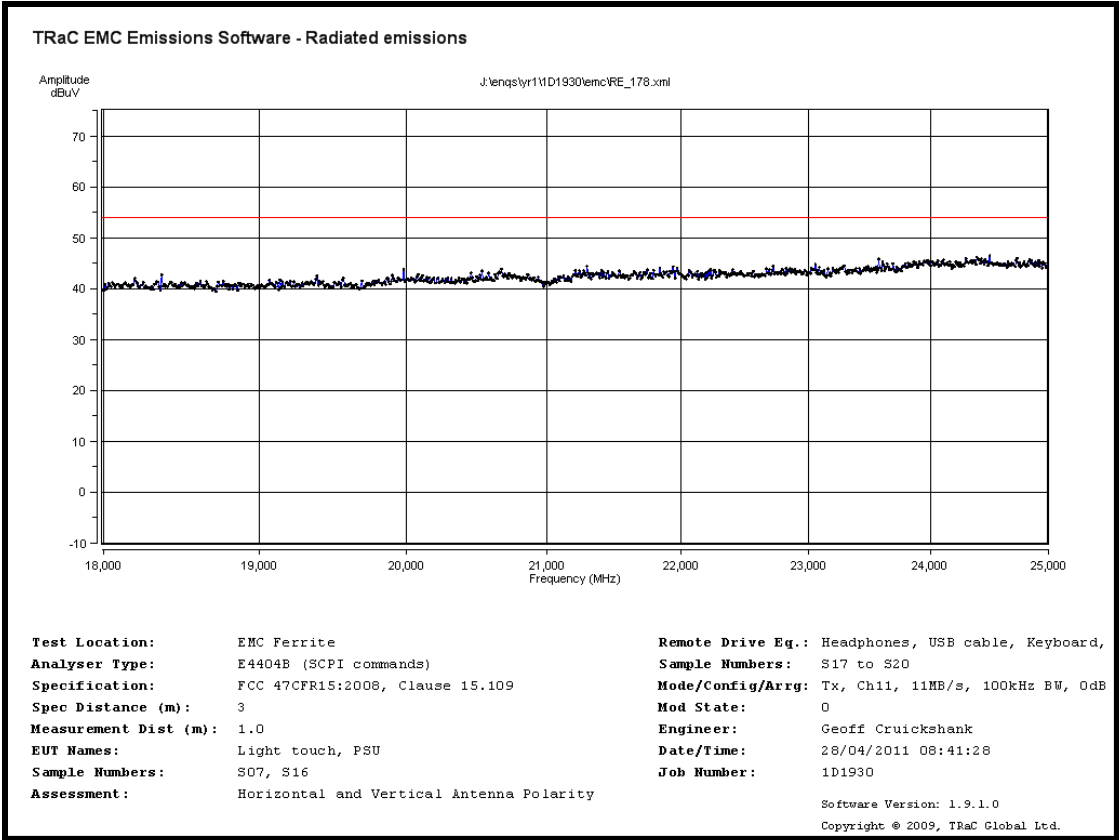
Radiated Spurious emissions 1 GHz to 5 GHz – 2462MHz – 11Mbps



Radiated Spurious emissions 5 GHz to 12 GHz – 2462MHz – 11Mbps

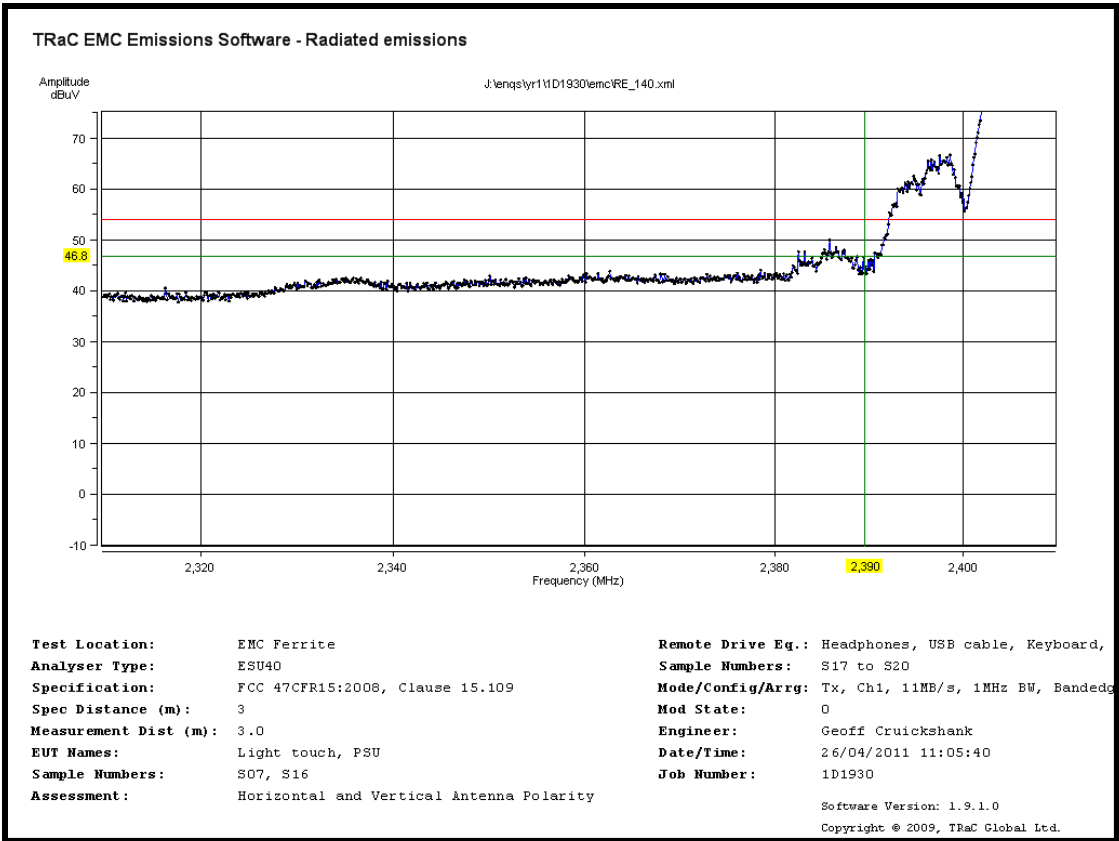


Radiated Spurious emissions 12 GHz to 18 GHz – 2462MHz – 11Mbps

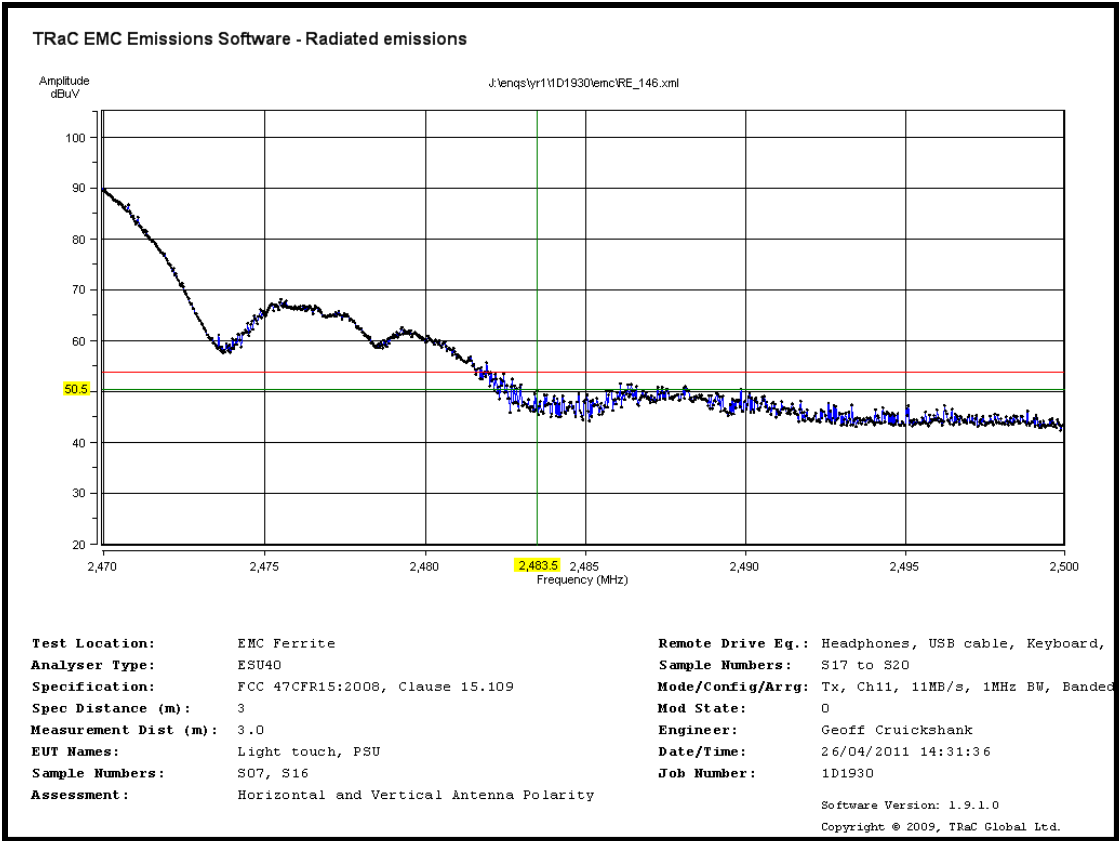


Radiated Spurious emissions 18 GHz to 25 GHz – 2462MHz – 11Mbps

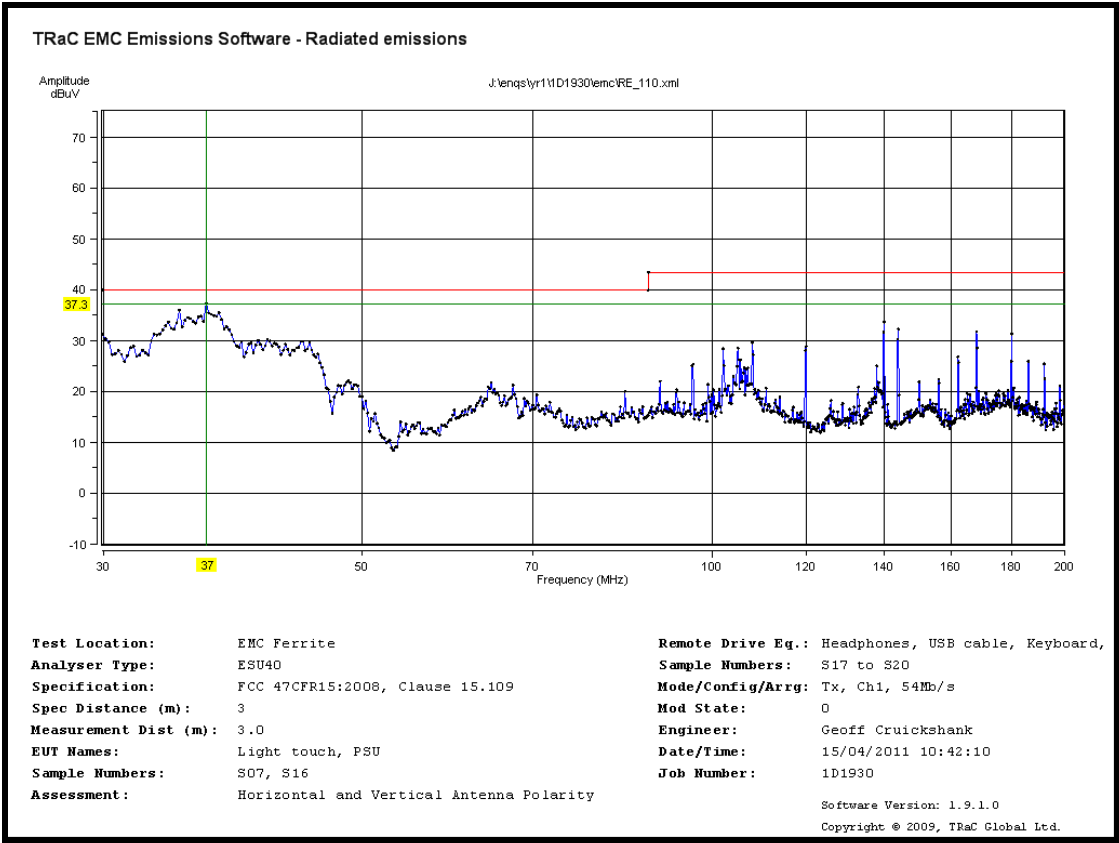
Radiated Bandedge Compliance – Average plot to average limit



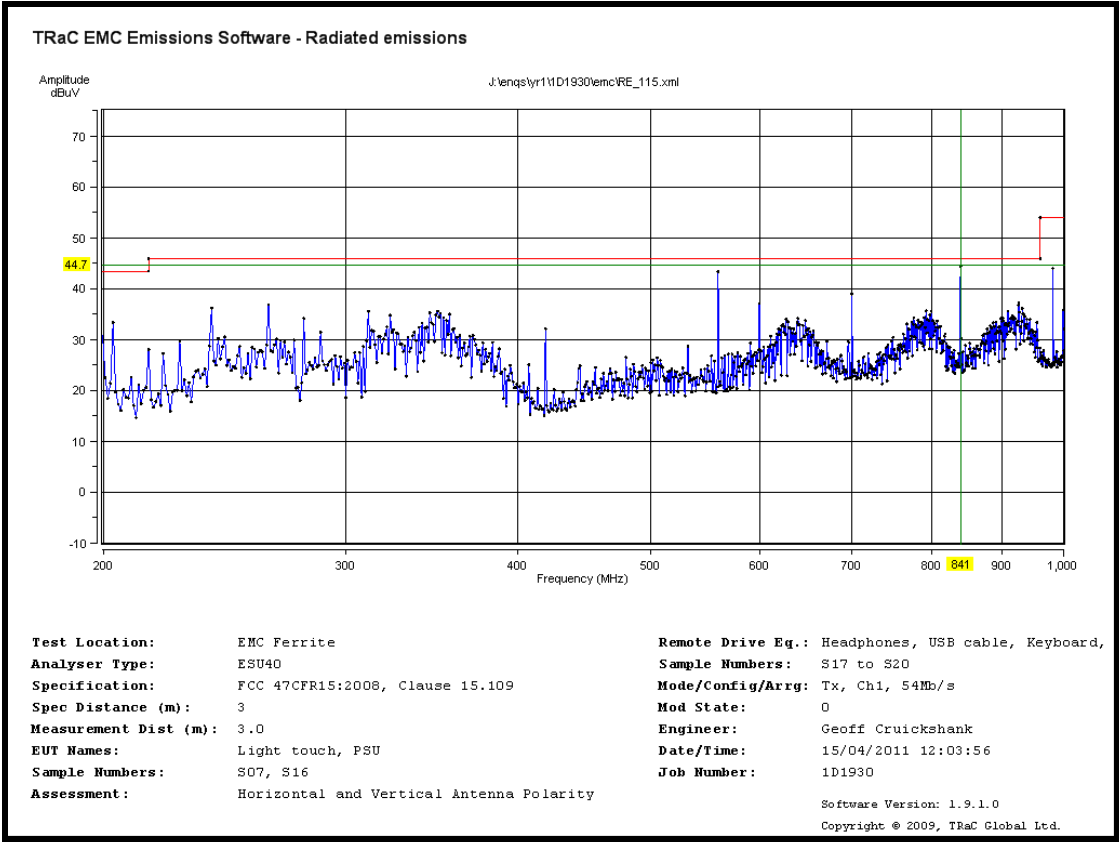
Lower Bandedge



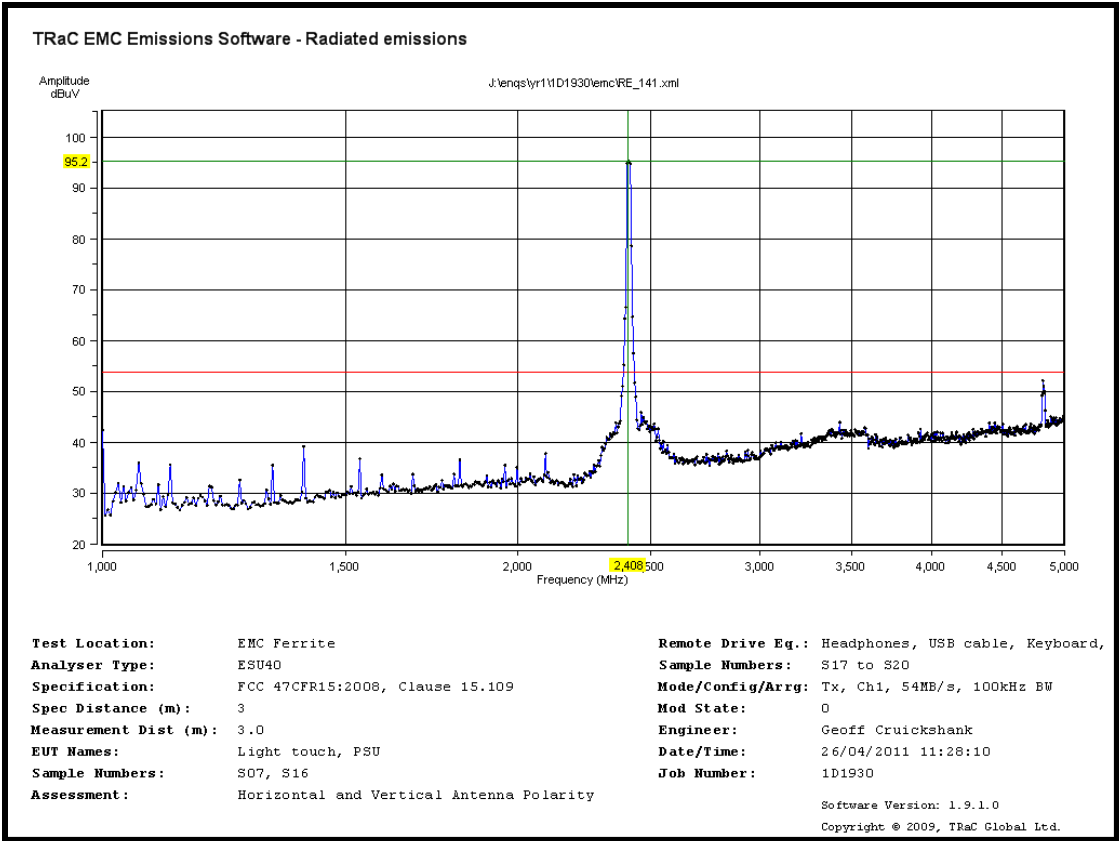
Upper Bandedge



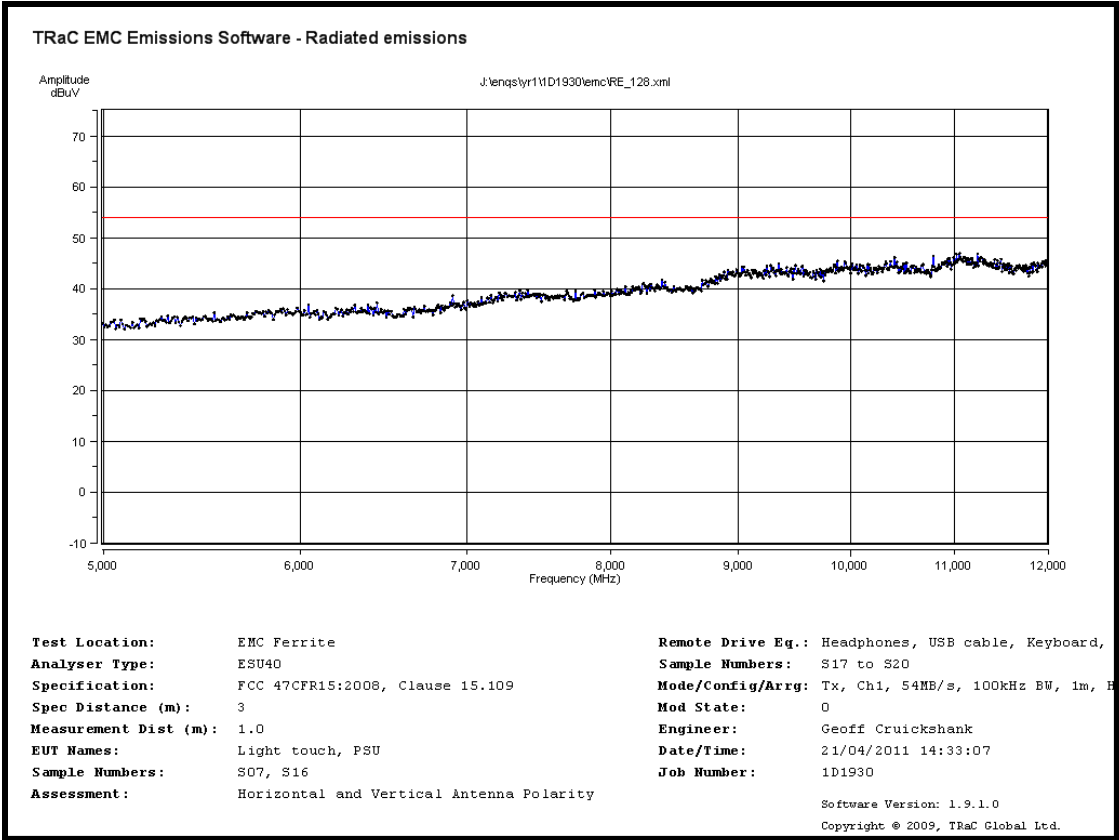
Radiated Spurious emissions 30 MHz to 200 MHz – 2412MHz – 54Mbps



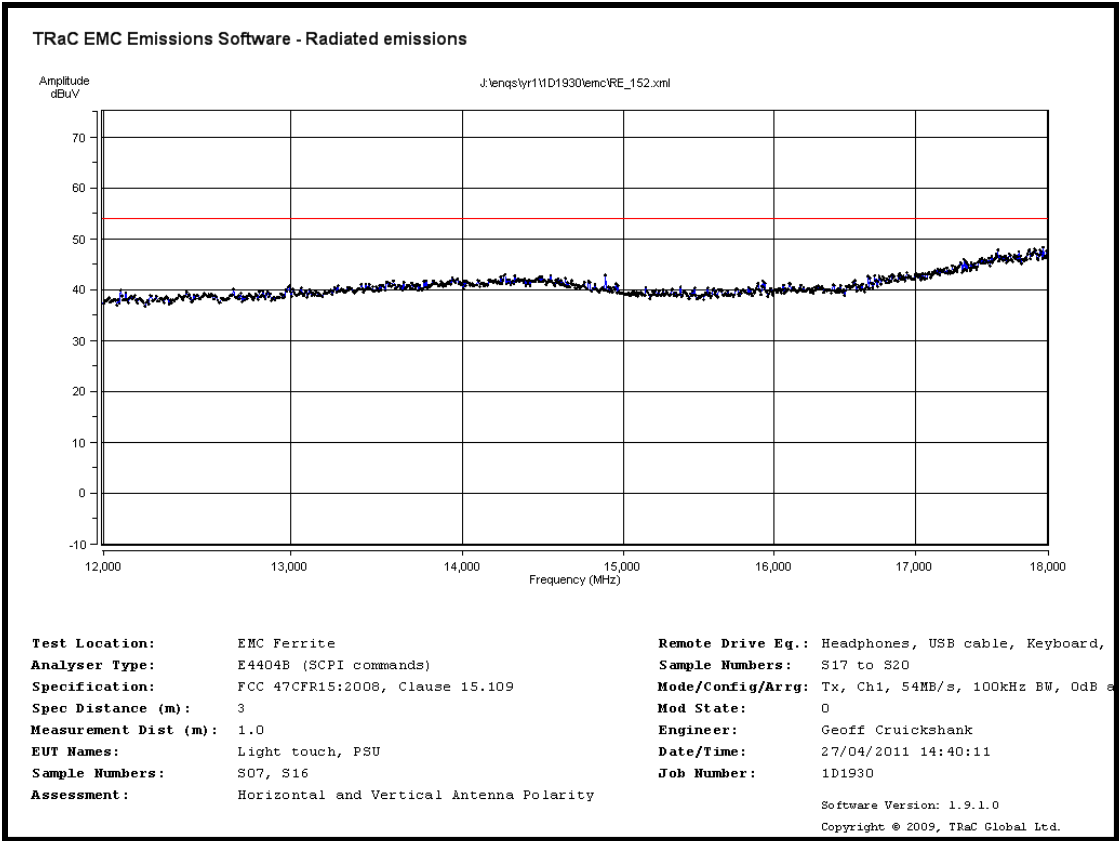
Radiated Spurious emissions 200 MHz to 1 GHz – 2412MHz – 54Mbps



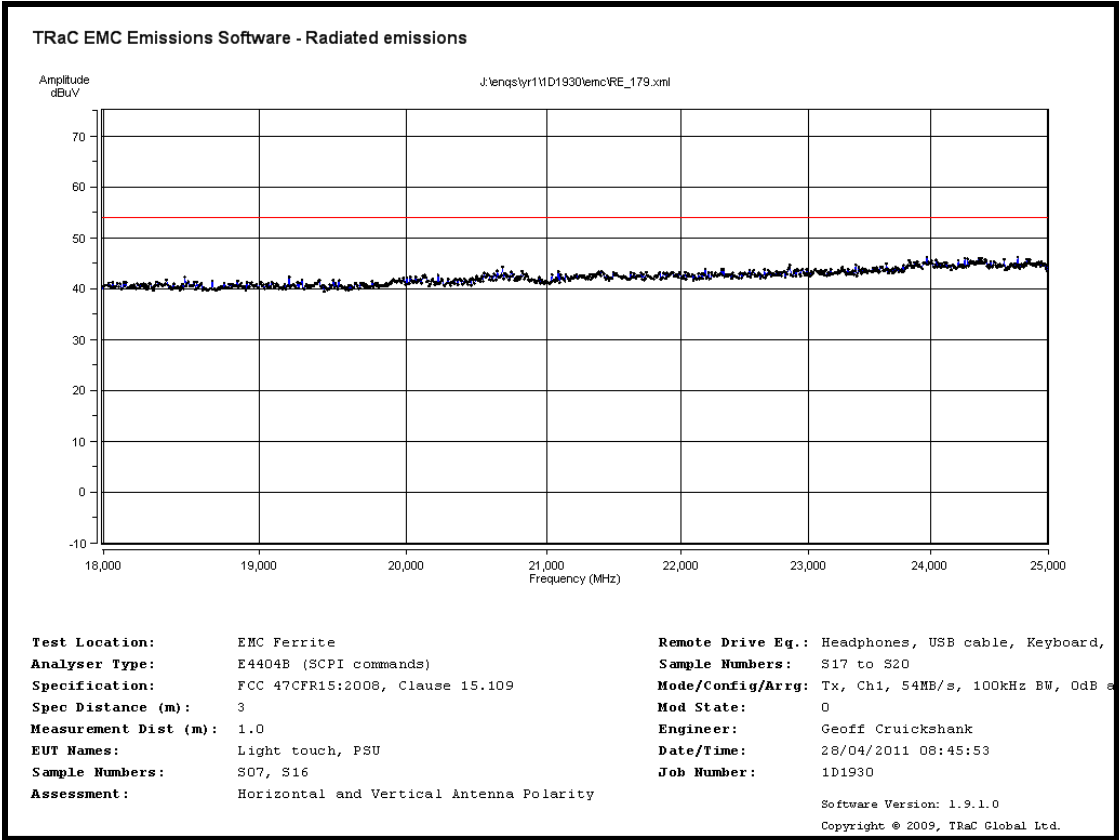
Radiated Spurious emissions 1 GHz to 5 GHz – 2412MHz – 54Mbps



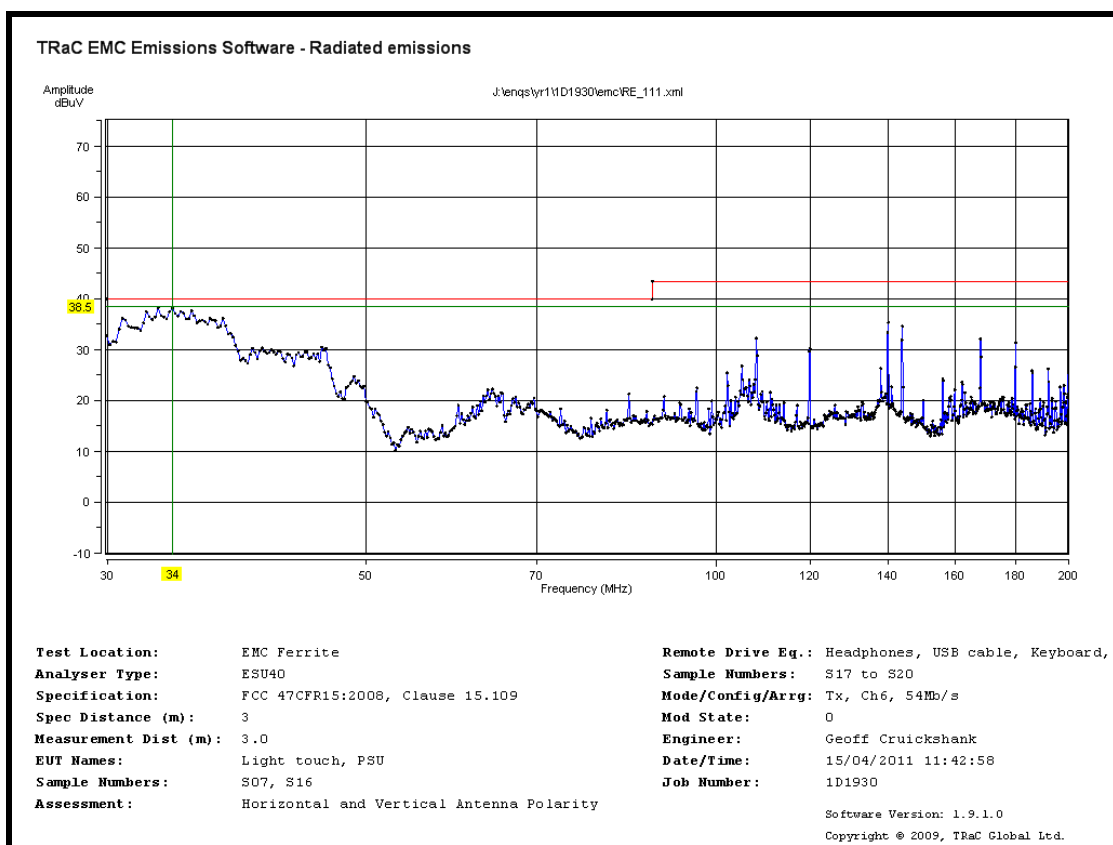
Radiated Spurious emissions 5 GHz to 12 GHz – 2412MHz – 54Mbps



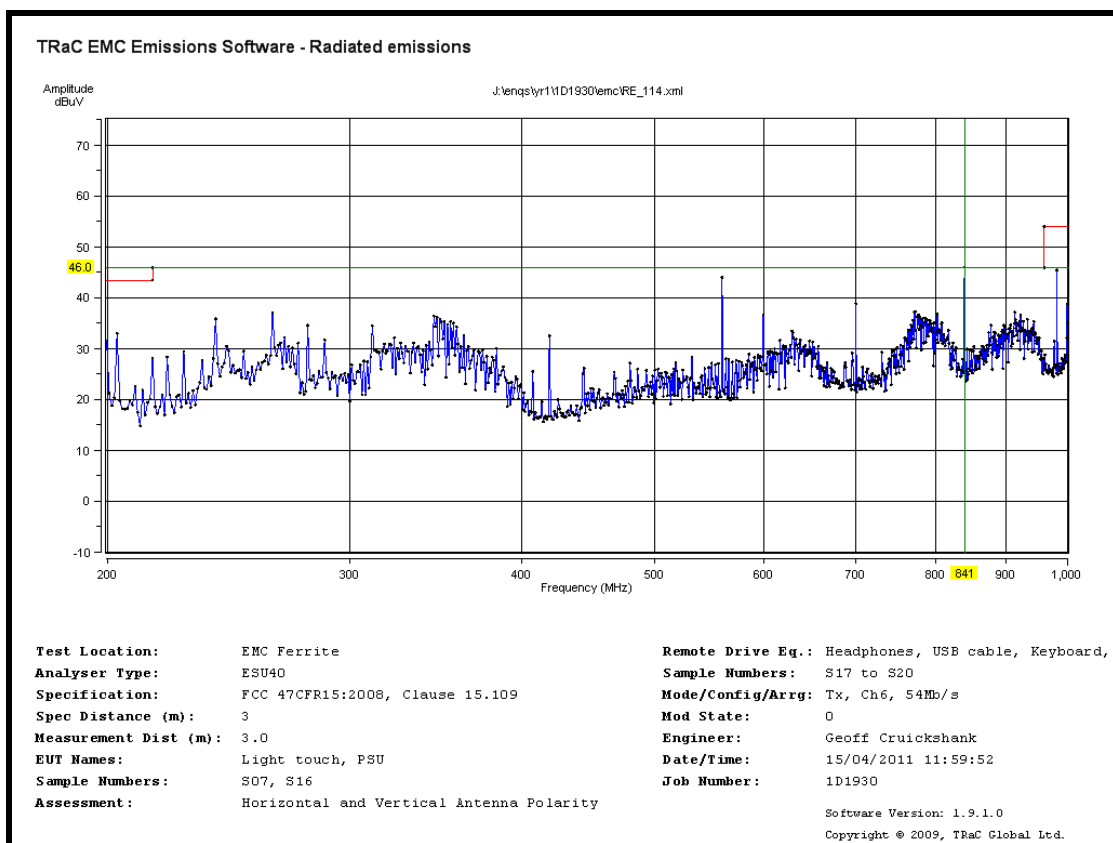
Radiated Spurious emissions 12 GHz to 18 GHz – 2412MHz – 54Mbps



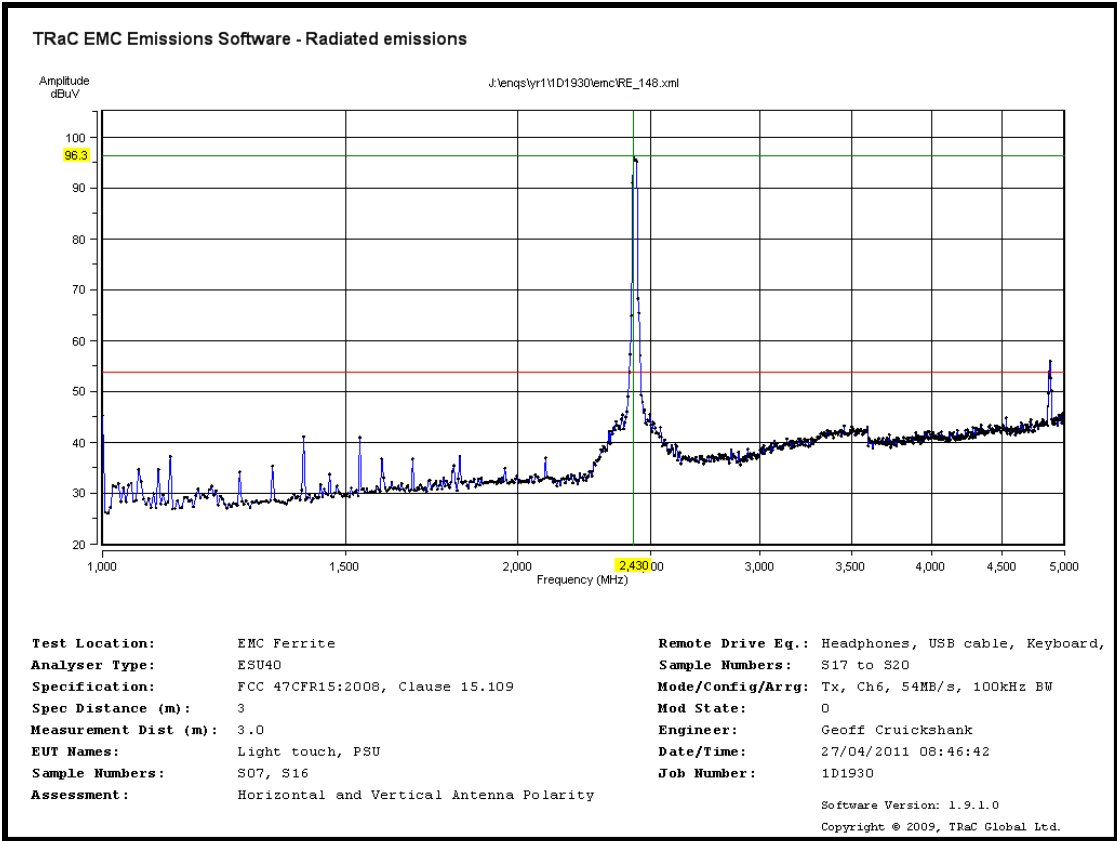
Radiated Spurious emissions 18 GHz to 25 GHz – 2412MHz – 54Mbps



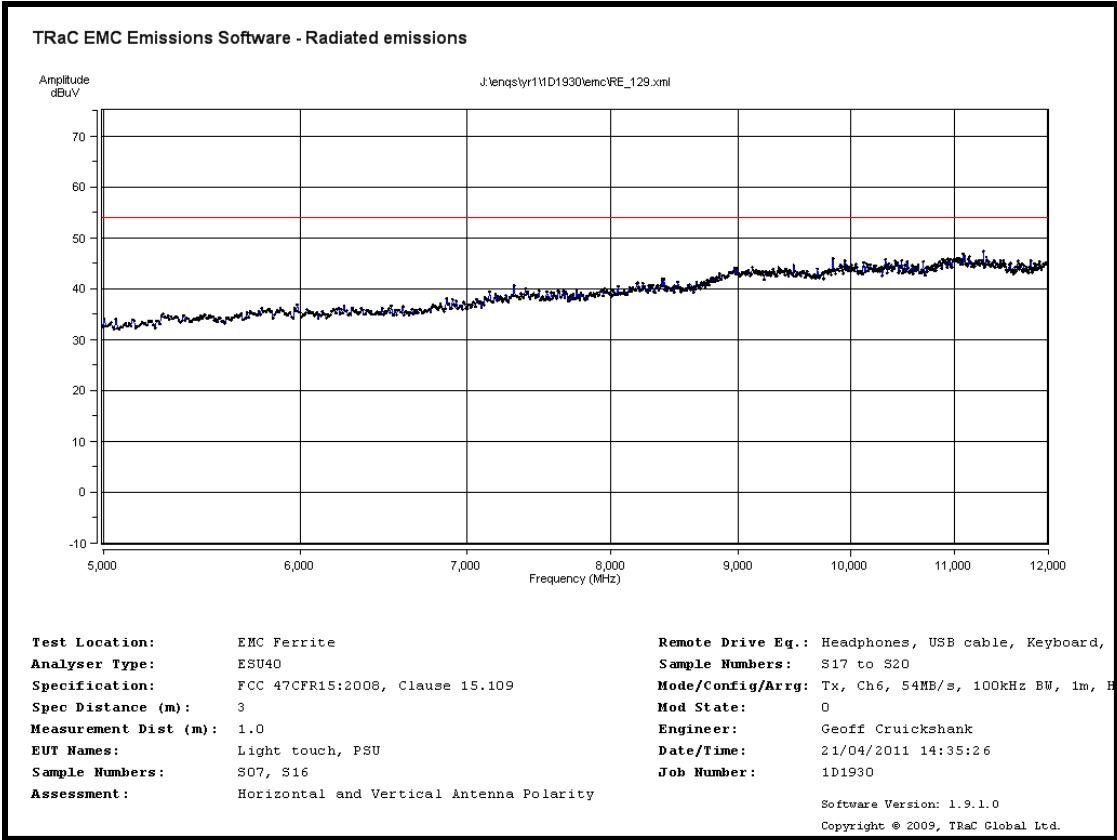
Radiated Spurious emissions 30 MHz to 200 MHz – 2437MHz – 54Mbps



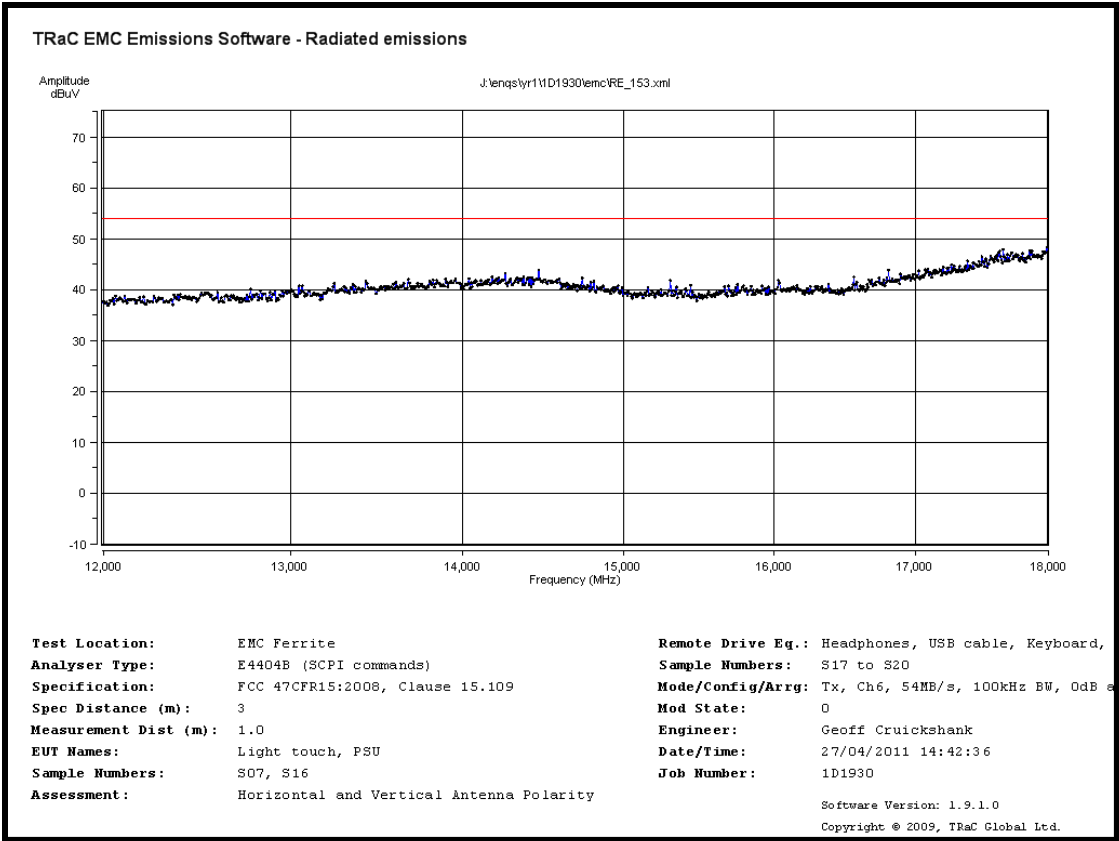
Radiated Spurious emissions 200 MHz to 1 GHz – 2437MHz – 54Mbps



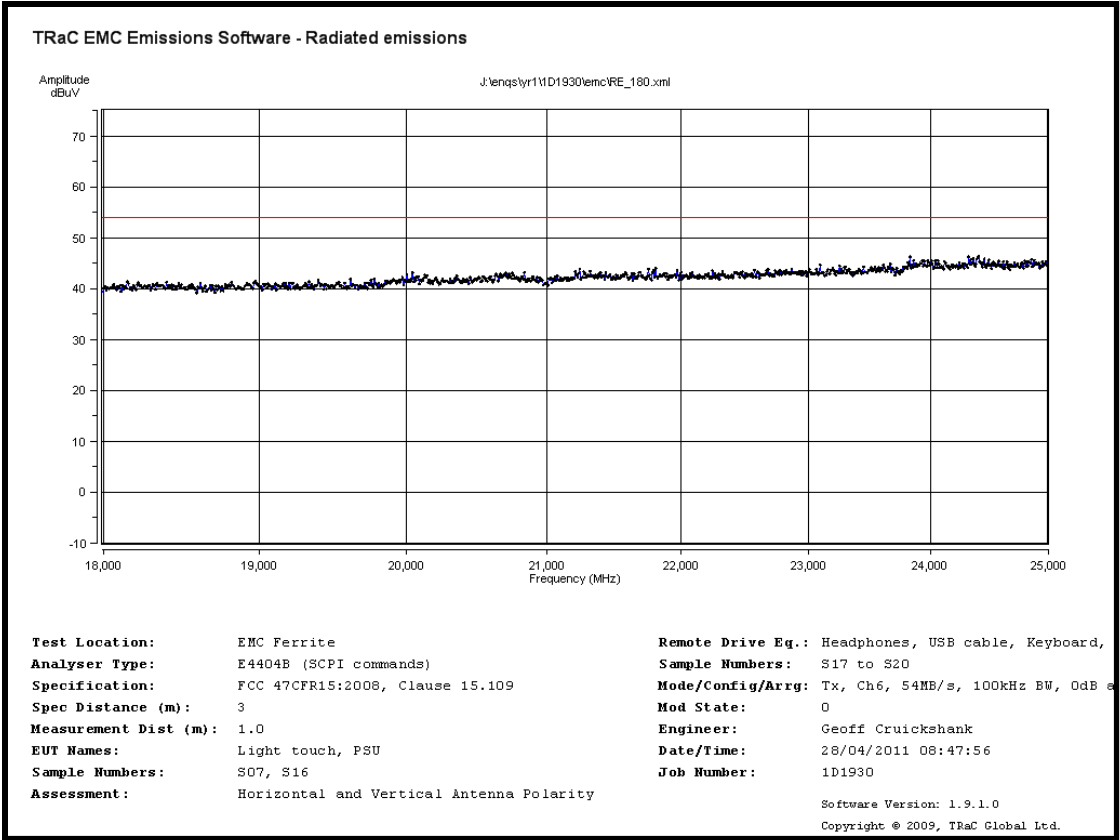
Radiated Spurious emissions 1 GHz to 5 GHz – 2437MHz – 54Mbps



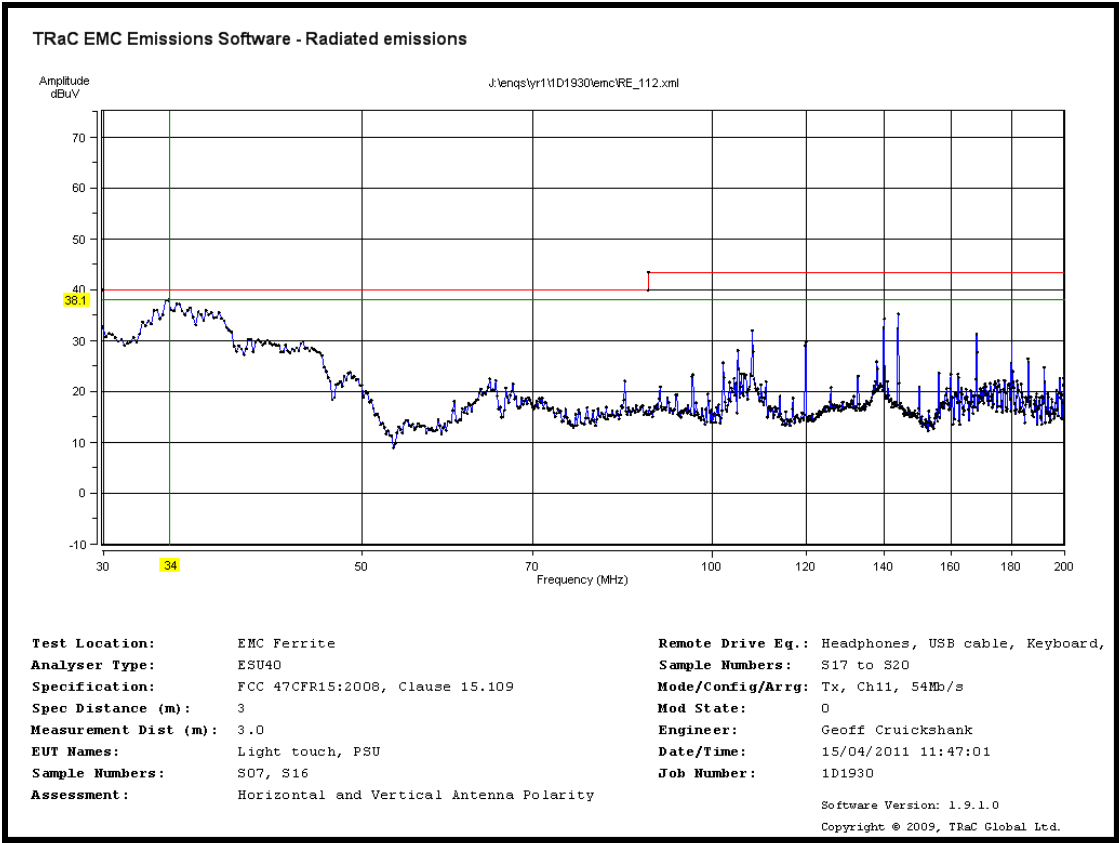
Radiated Spurious emissions 5 GHz to 12 GHz – 2437MHz – 54Mbps



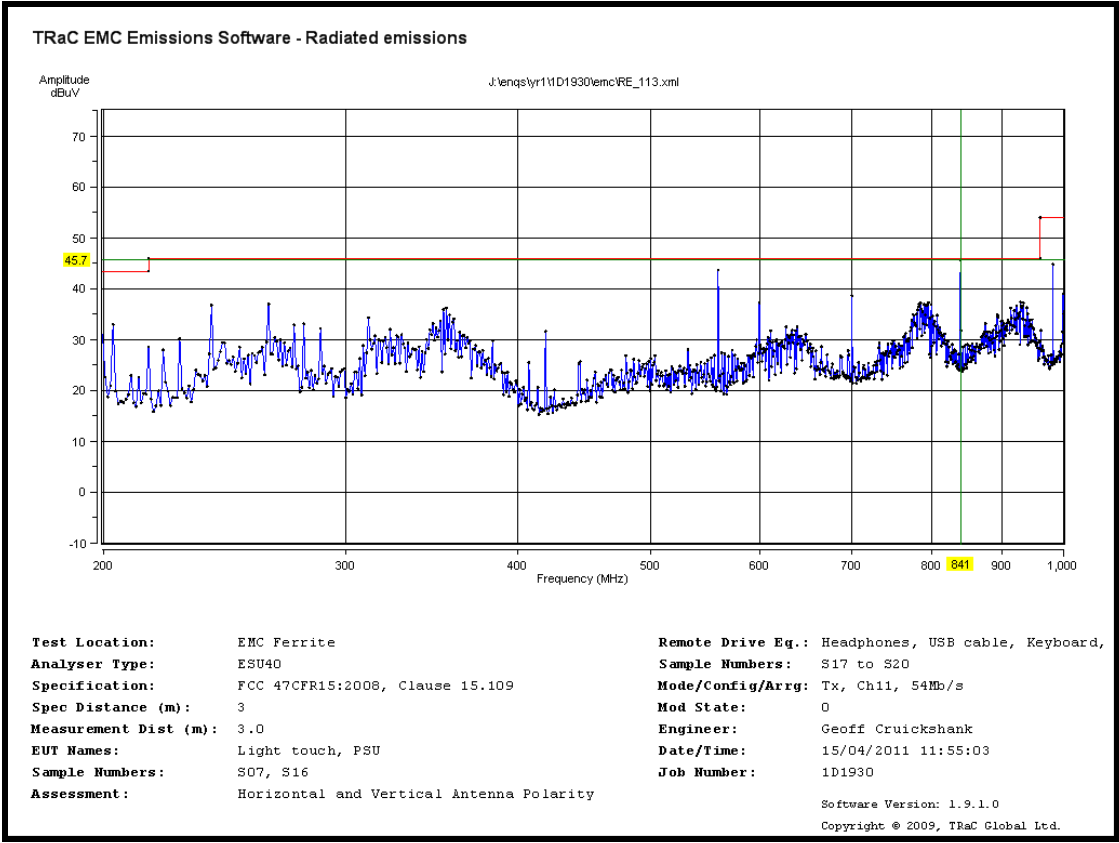
Radiated Spurious emissions 12 GHz to 18 GHz – 2437MHz – 54Mbps



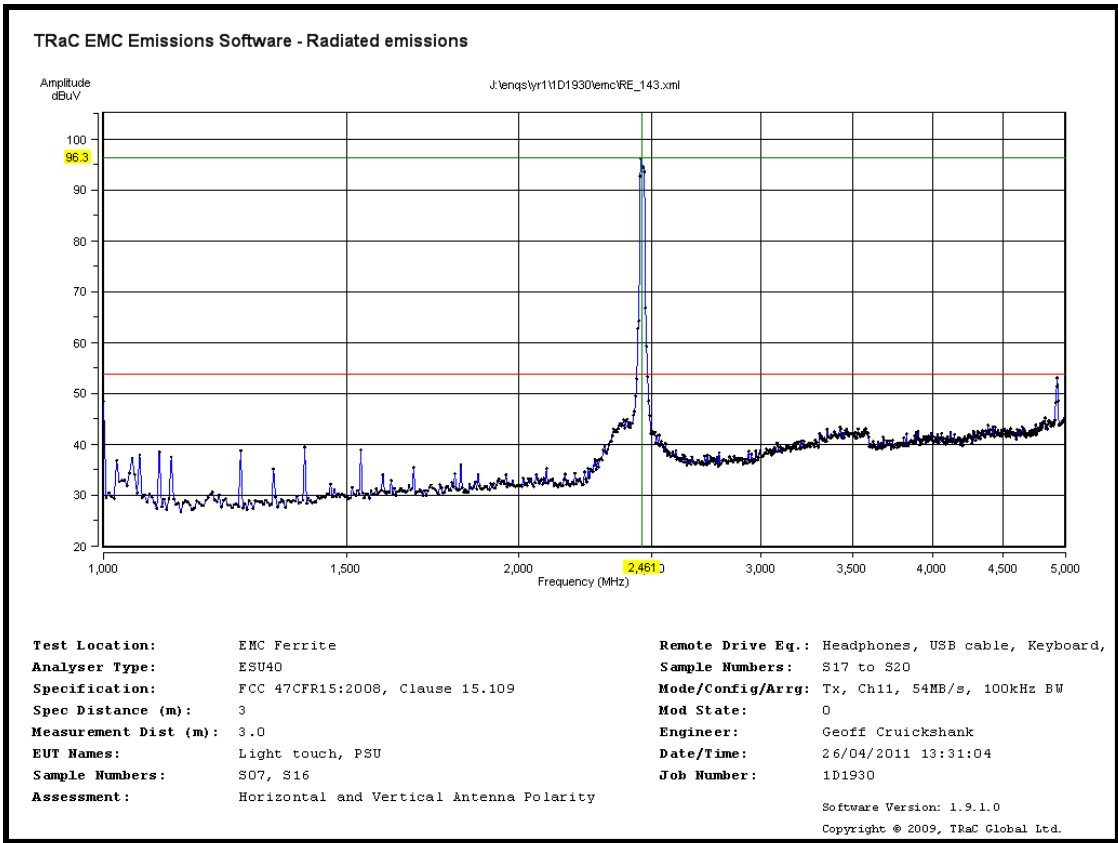
Radiated Spurious emissions 18 GHz to 25 GHz – 2437MHz – 54Mbps



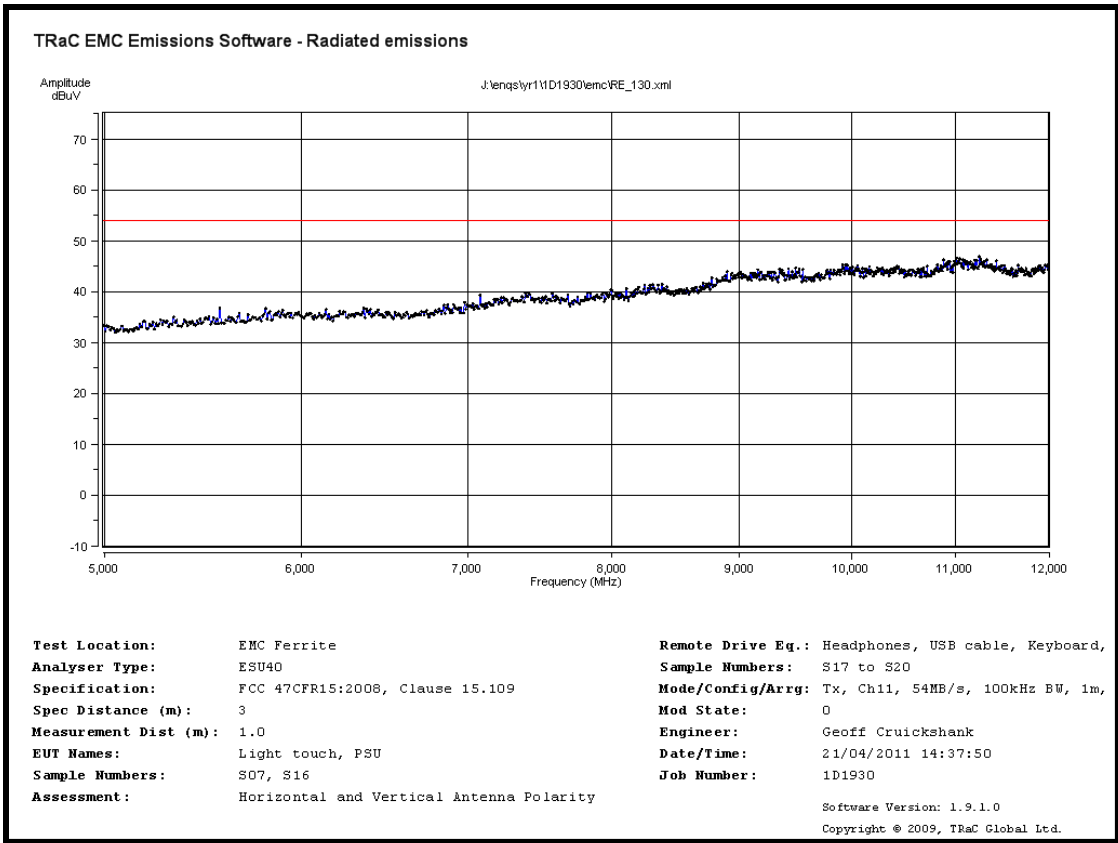
Radiated Spurious emissions 30 MHz to 200 MHz – 2462MHz – 54Mbps



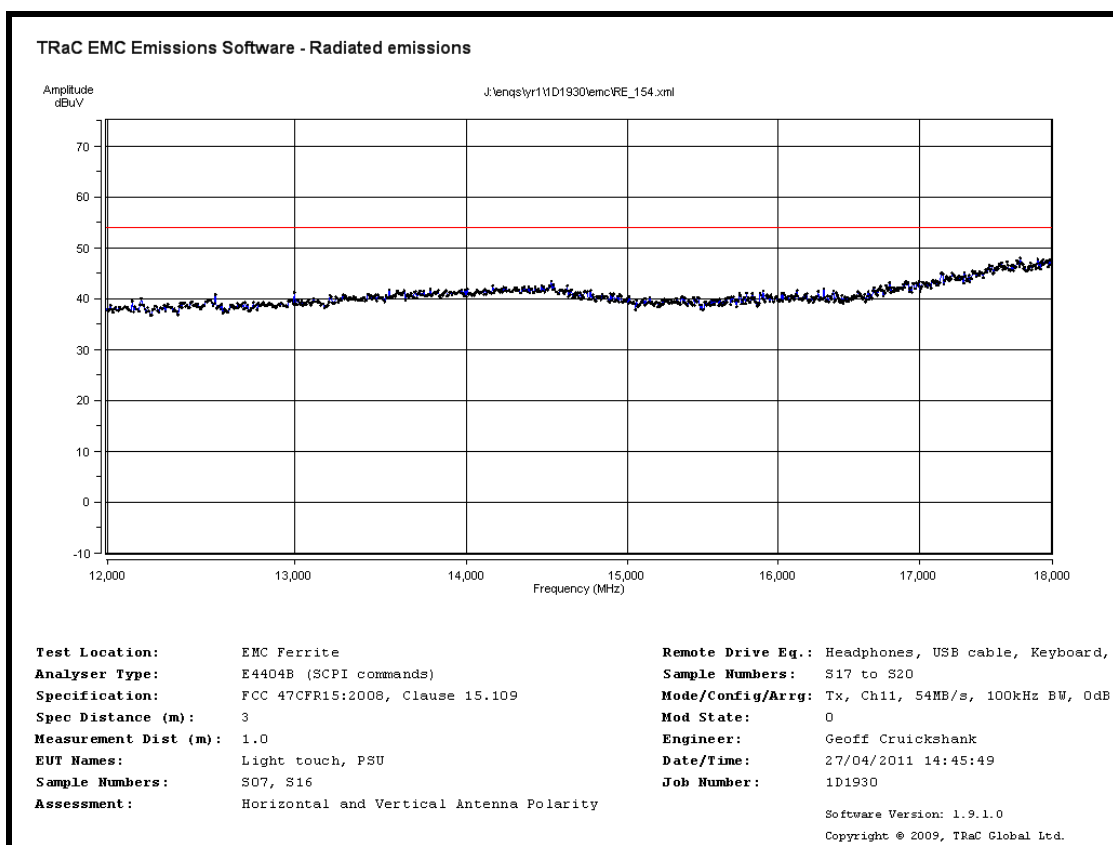
Radiated Spurious emissions 200 MHz to 1 GHz – 2462MHz – 54Mbps



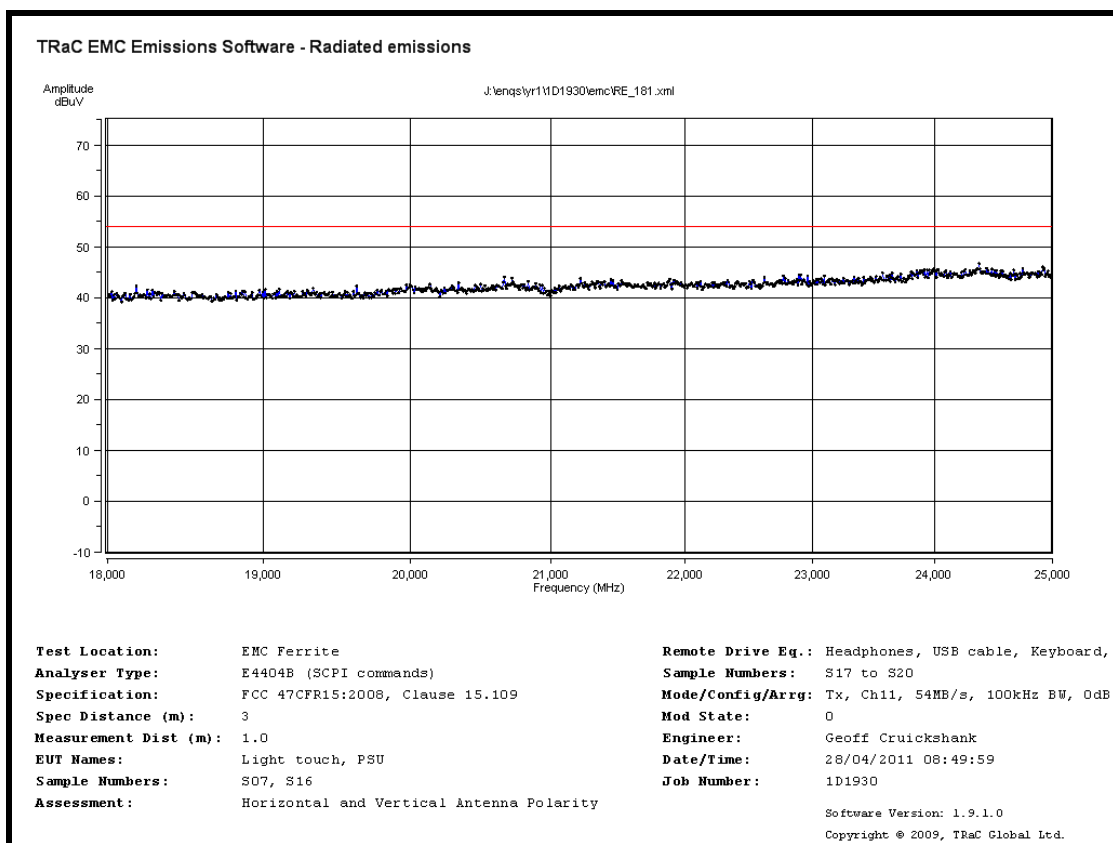
Radiated Spurious emissions 1 GHz to 5 GHz – 2462MHz – 54Mbps



Radiated Spurious emissions 5 GHz to 12 GHz – 2462MHz – 54Mbps

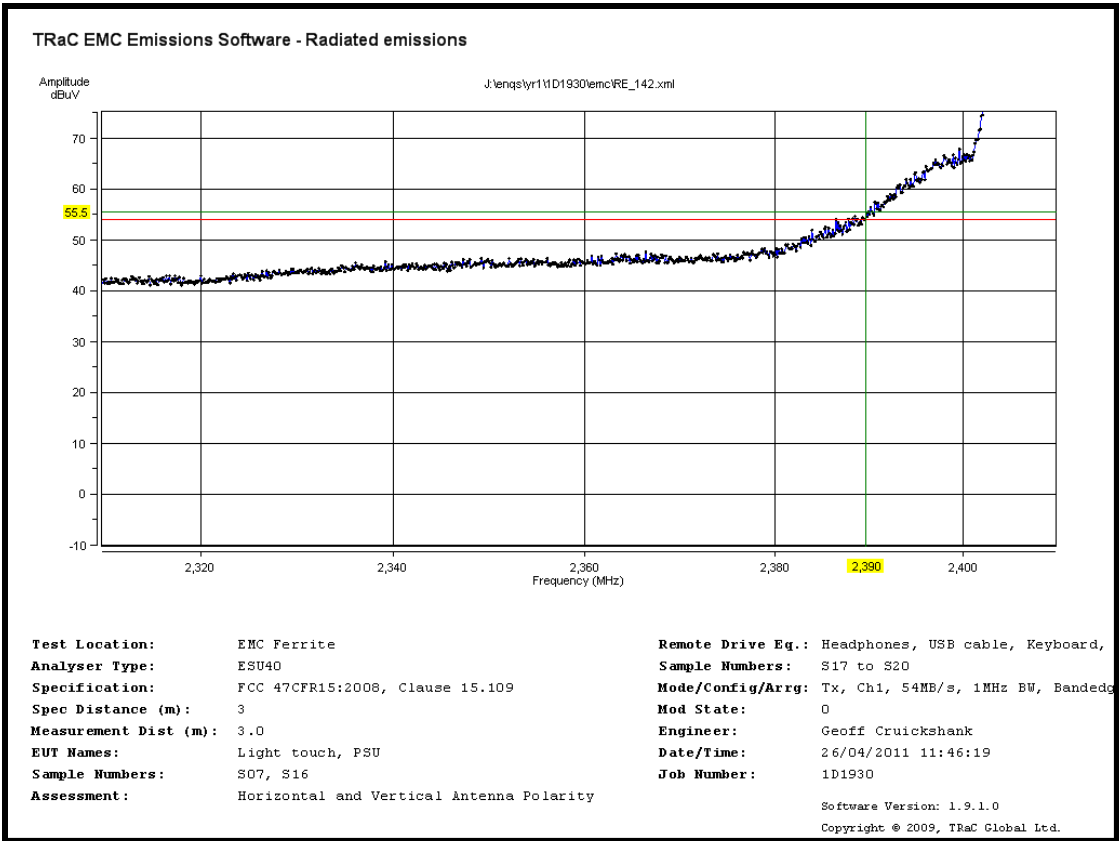


Radiated Spurious emissions 12 GHz to 18 GHz – 2462MHz – 54Mbps

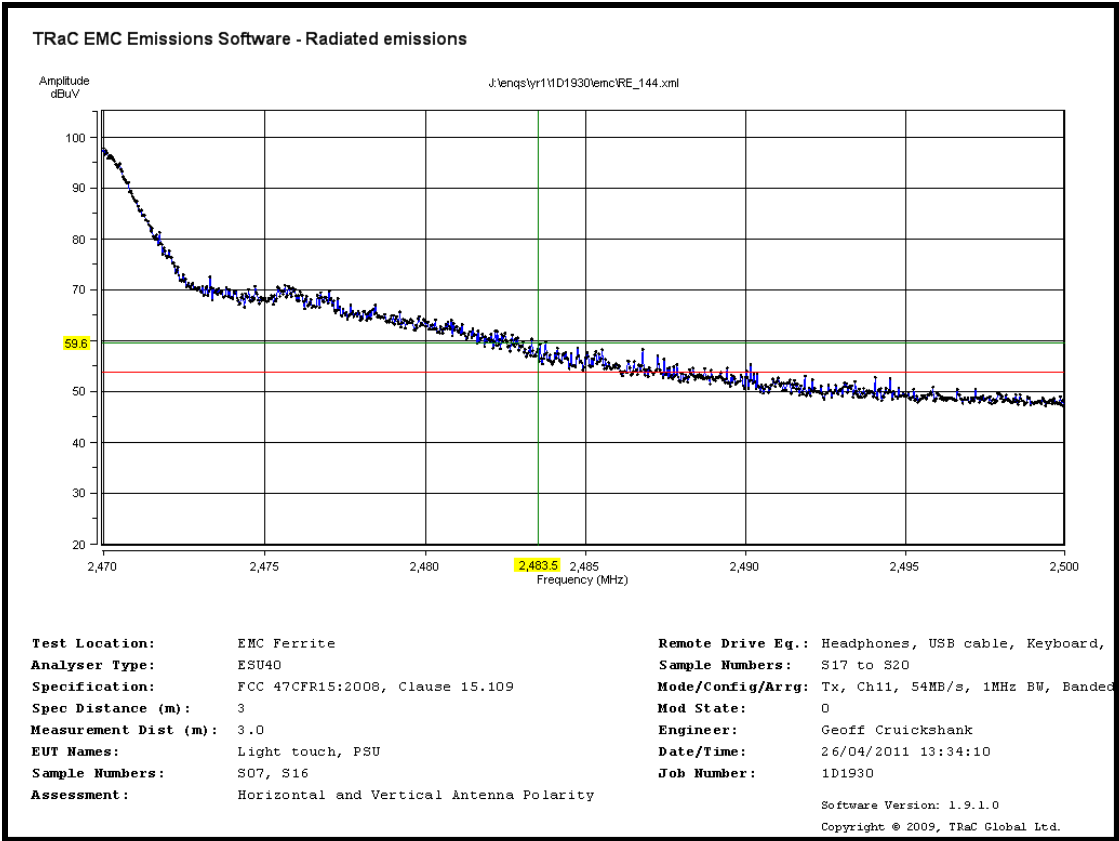


Radiated Spurious emissions 18 GHz to 25 GHz – 2462MHz – 54Mbps

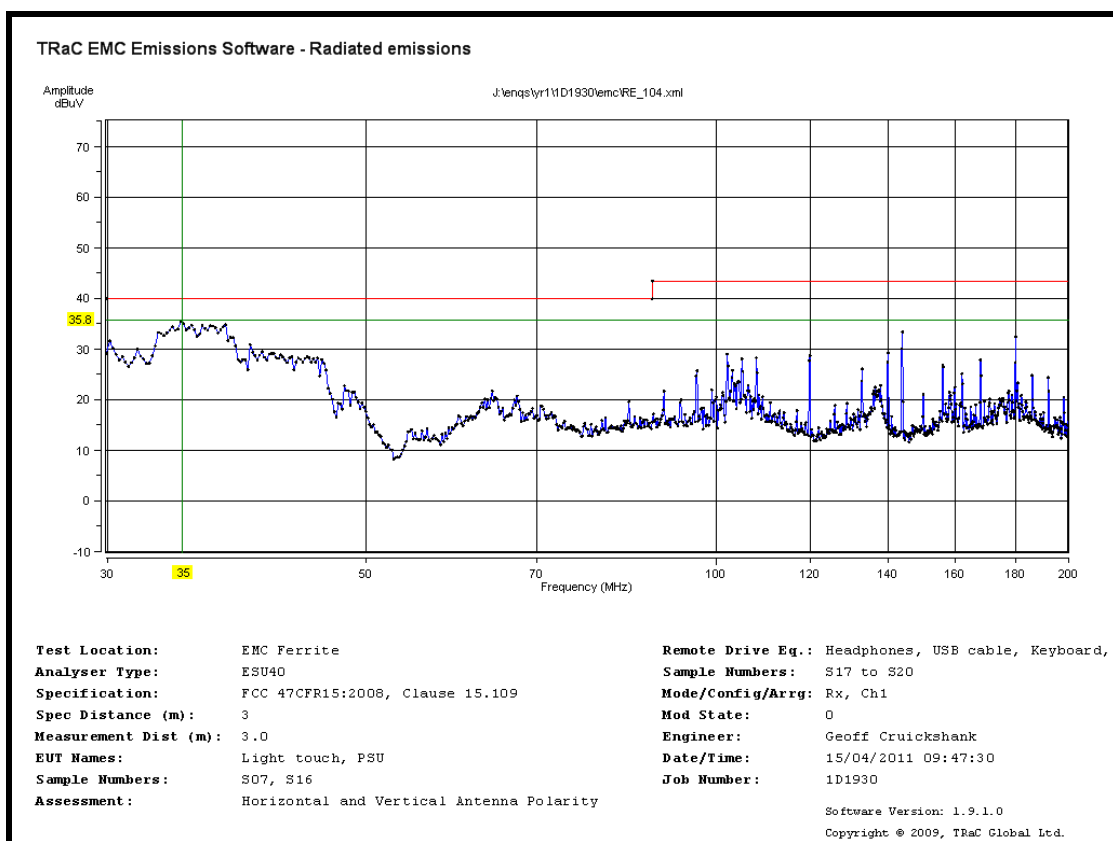
Radiated Bandedge Compliance – Average plot to average limit



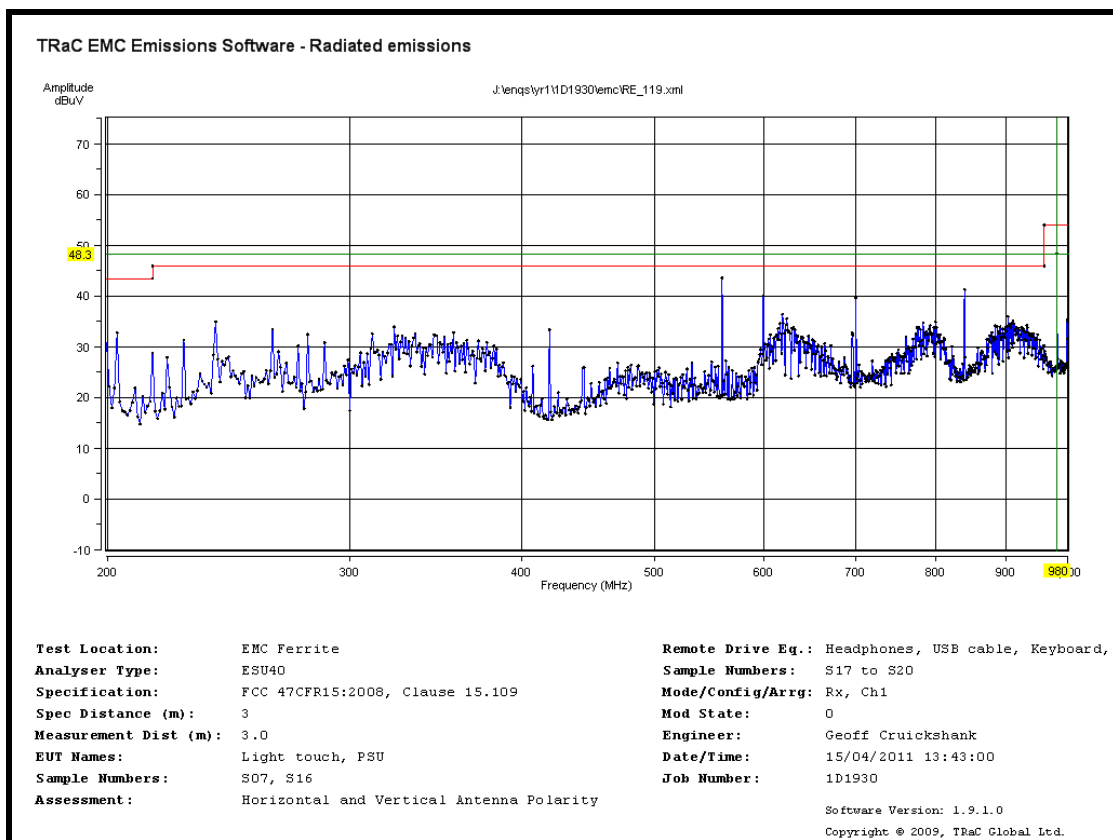
Lower Bandedge



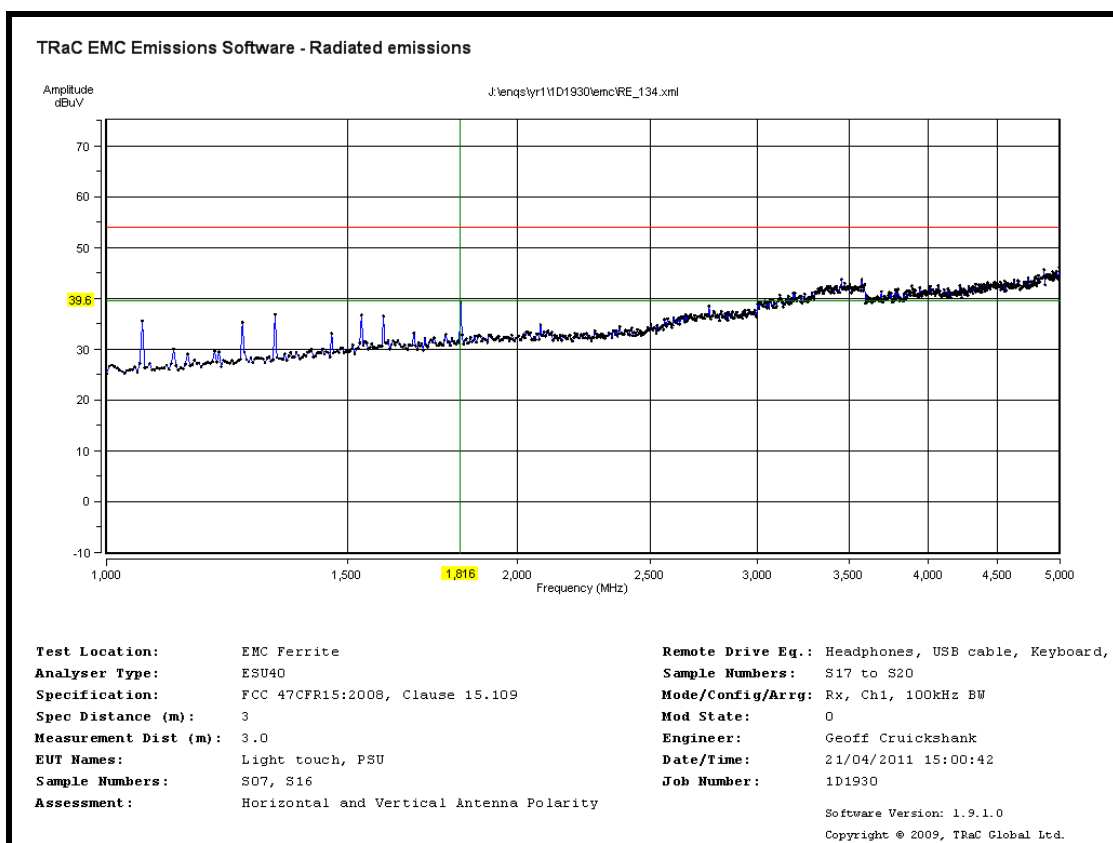
Upper Bandedge



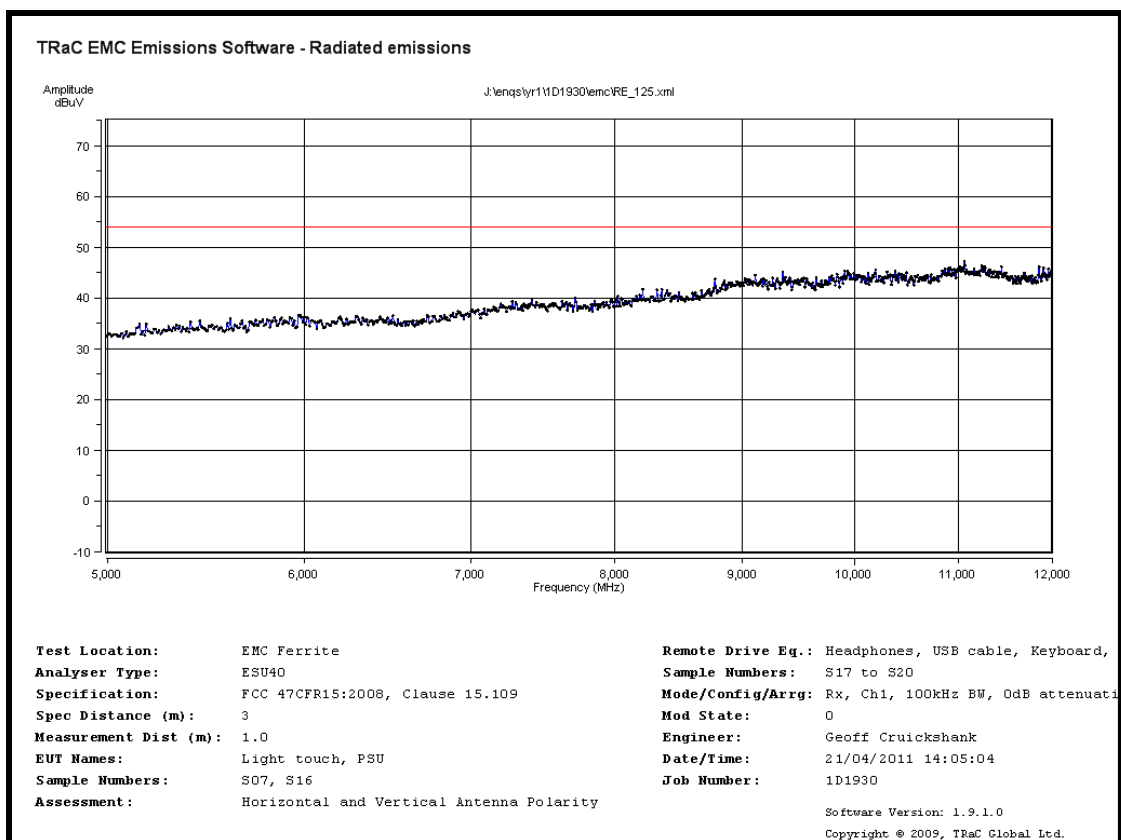
## Unintentional Radiated Spurious emissions 30 MHz to 200 MHz – 2412MHz



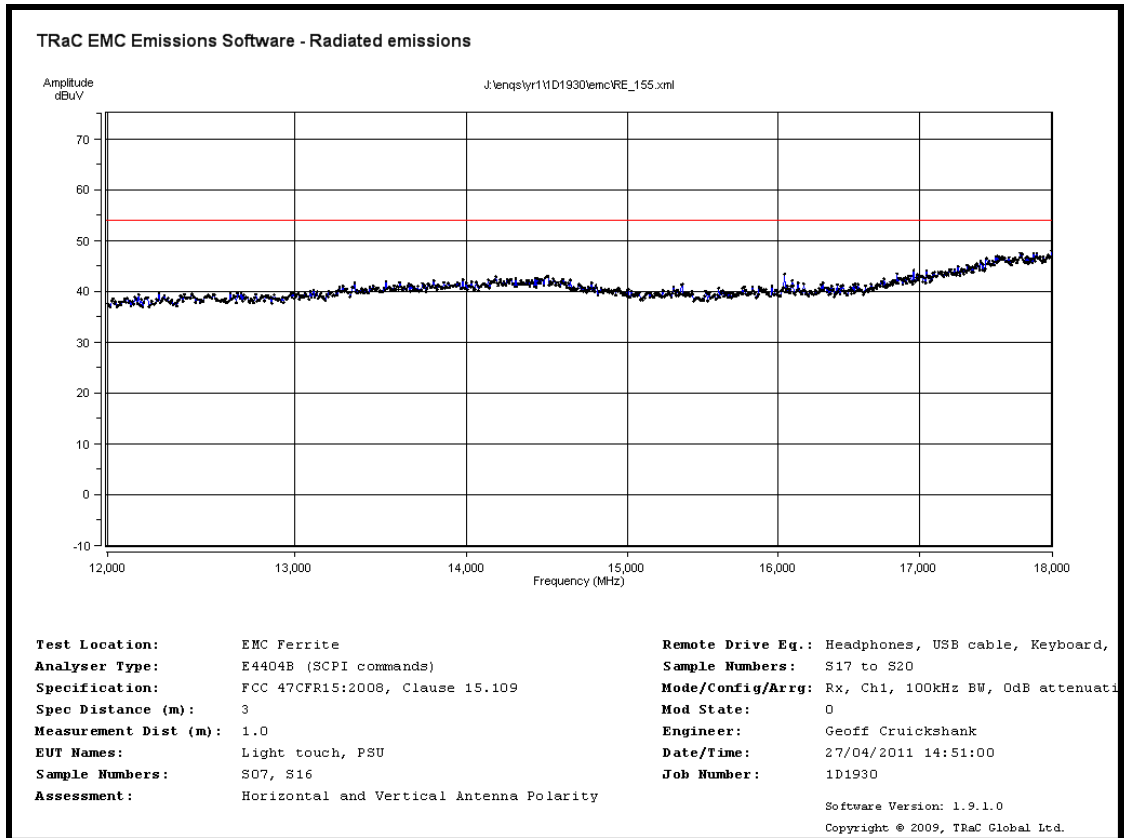
## Unintentional Radiated Spurious emissions 200 MHz to 1 GHz – 2412MHz



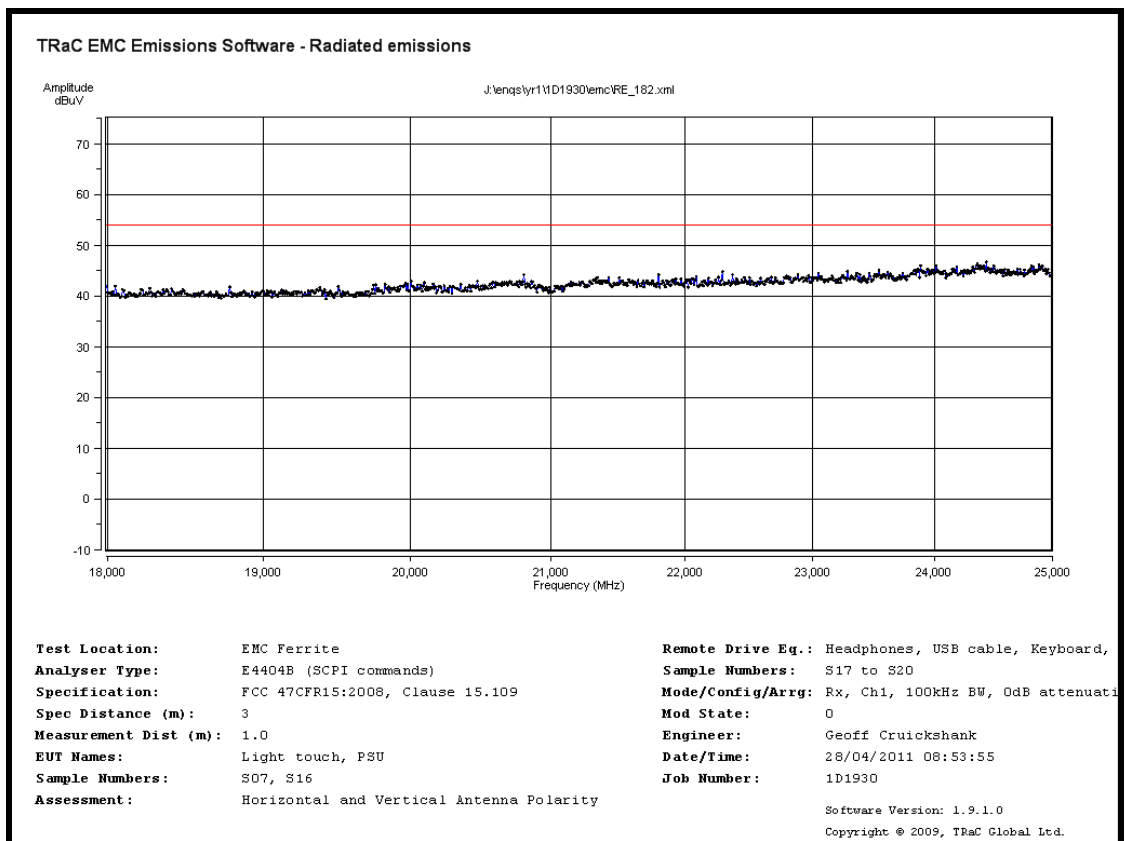
## Unintentional Radiated Spurious emissions 1 GHz to 5 GHz – 2412MHz



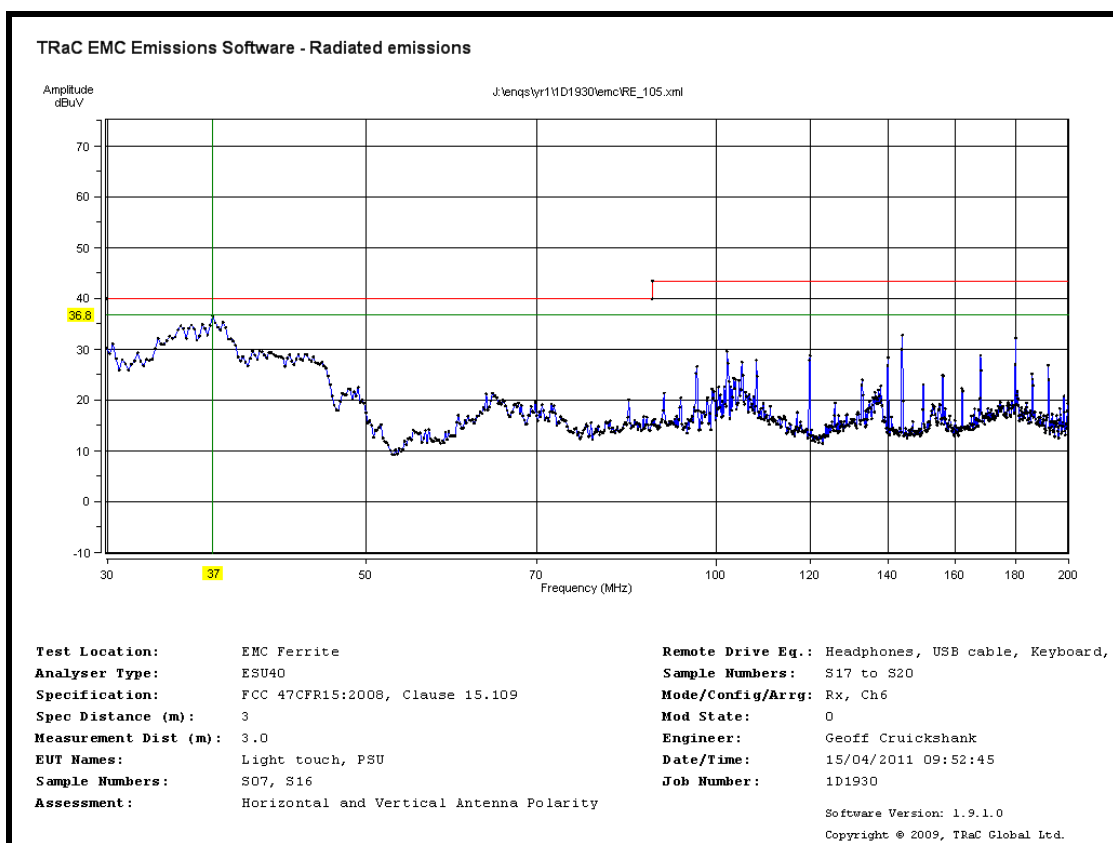
## Unintentional Radiated Spurious emissions 5 GHz to 12 GHz – 2412MHz



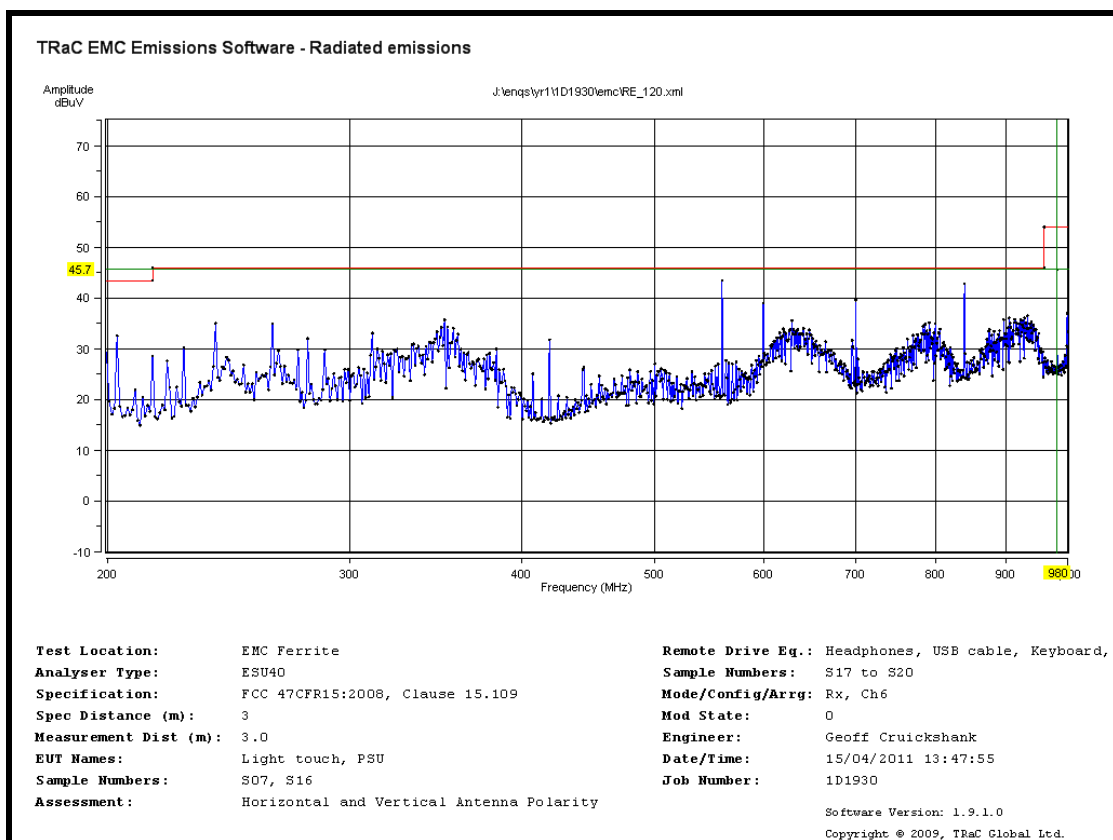
## Unintentional Radiated Spurious emissions 12 GHz to 18 GHz – 2412MHz



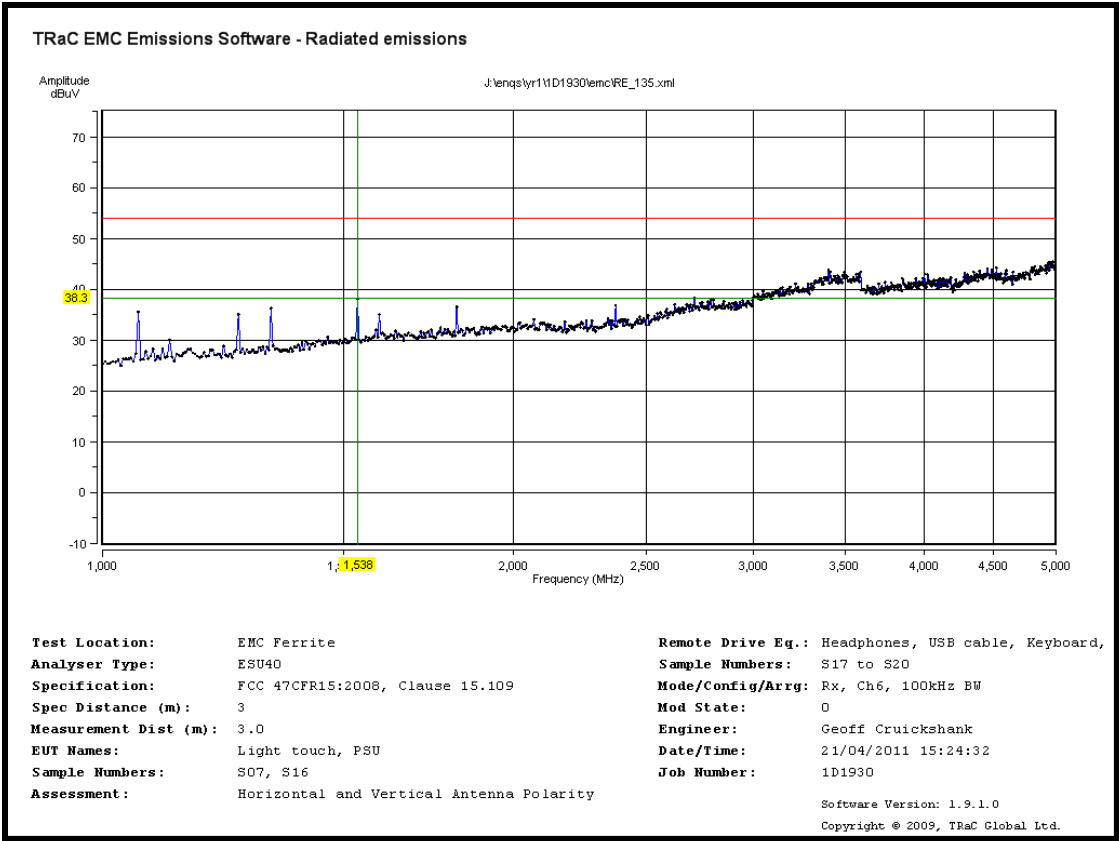
## Unintentional Radiated Spurious emissions 18 GHz to 25 GHz – 2412MHz



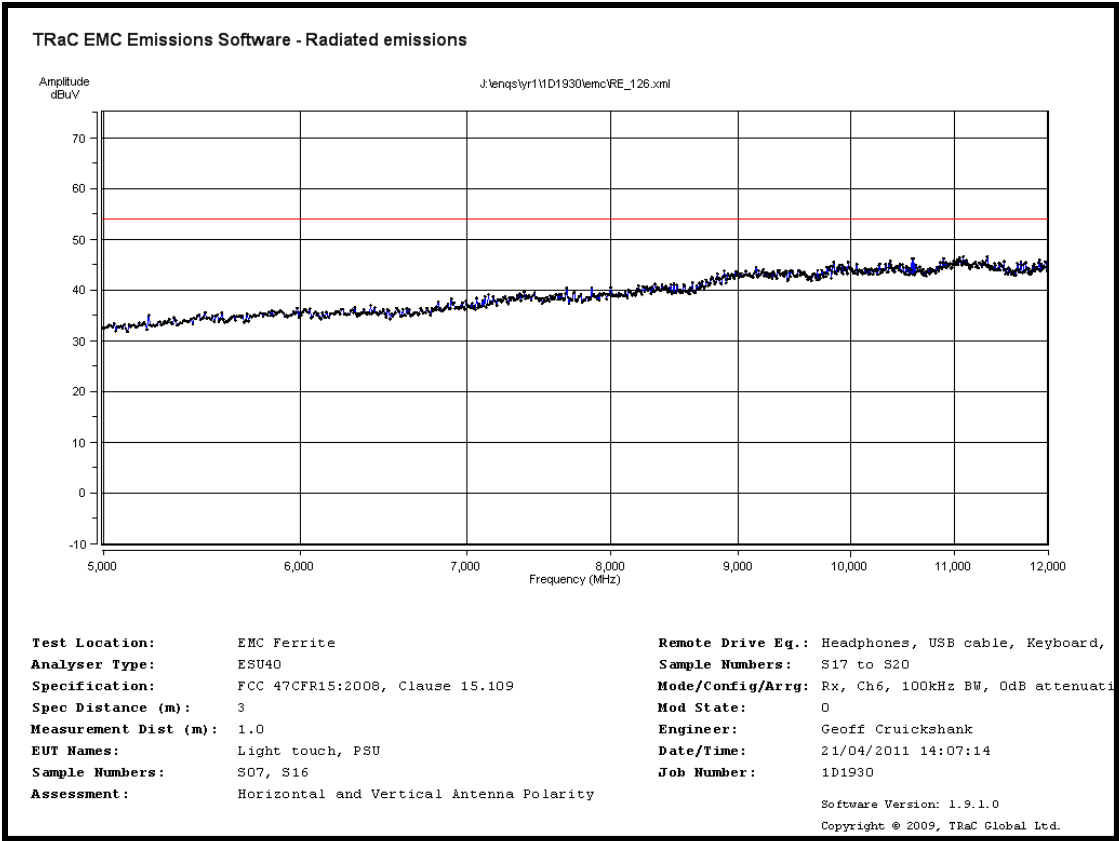
### Unintentional Radiated Spurious emissions 30 MHz to 200 MHz – 2437MHz



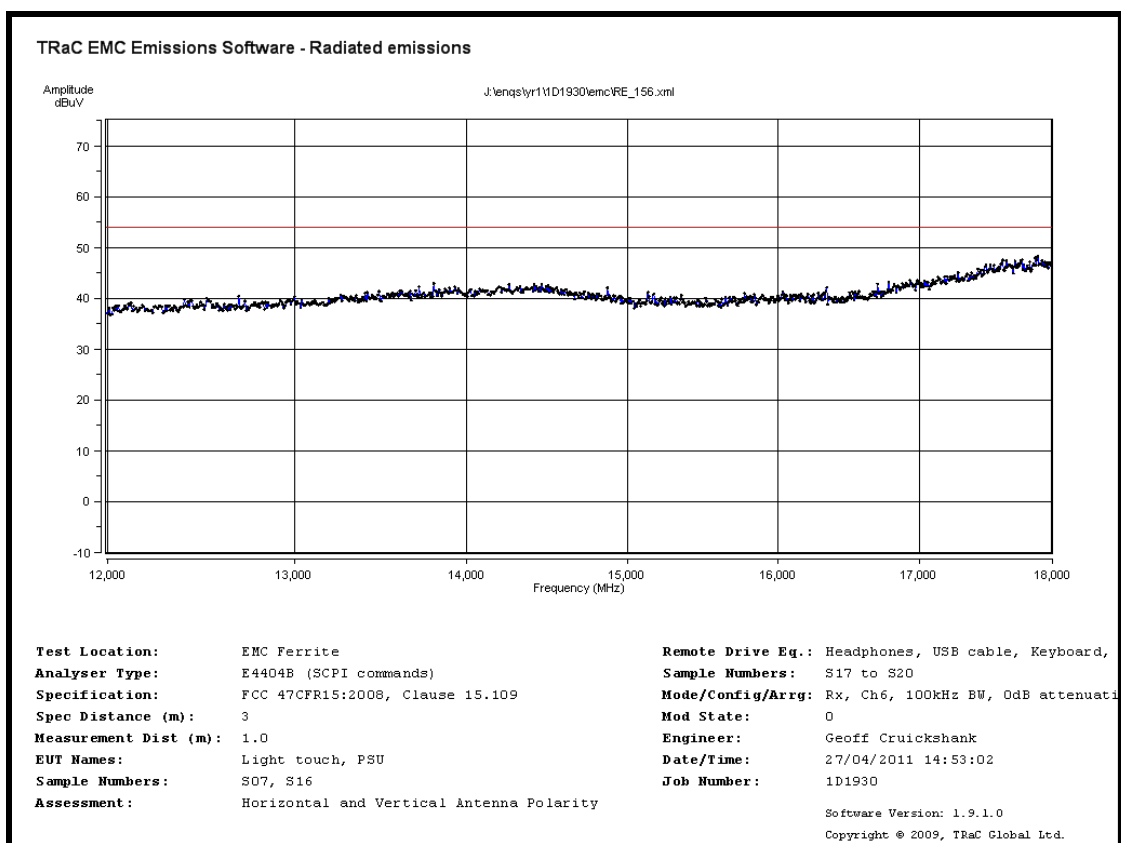
### Unintentional Radiated Spurious emissions 200 MHz to 1 GHz – 2437MHz



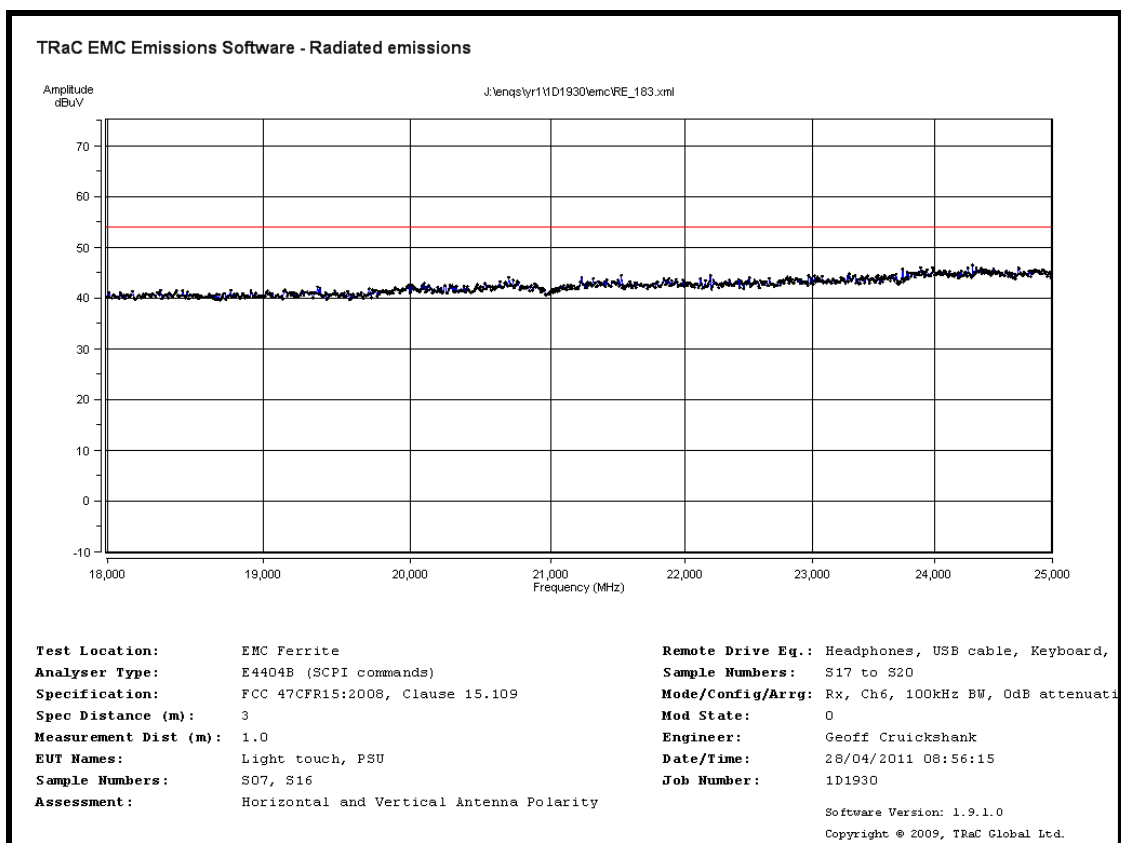
Unintentional Radiated Spurious emissions 1 GHz to 5 GHz – 2437MHz



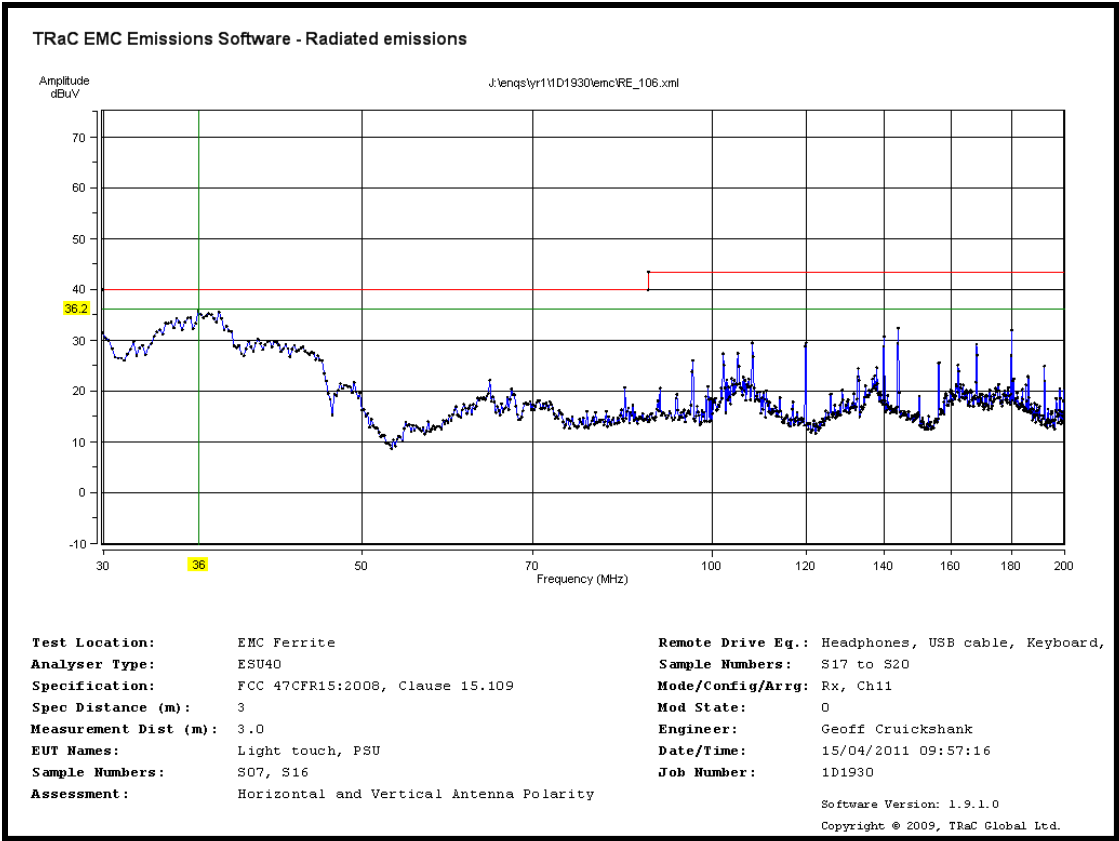
Unintentional Radiated Spurious emissions 5 GHz to 12 GHz – 2437MHz



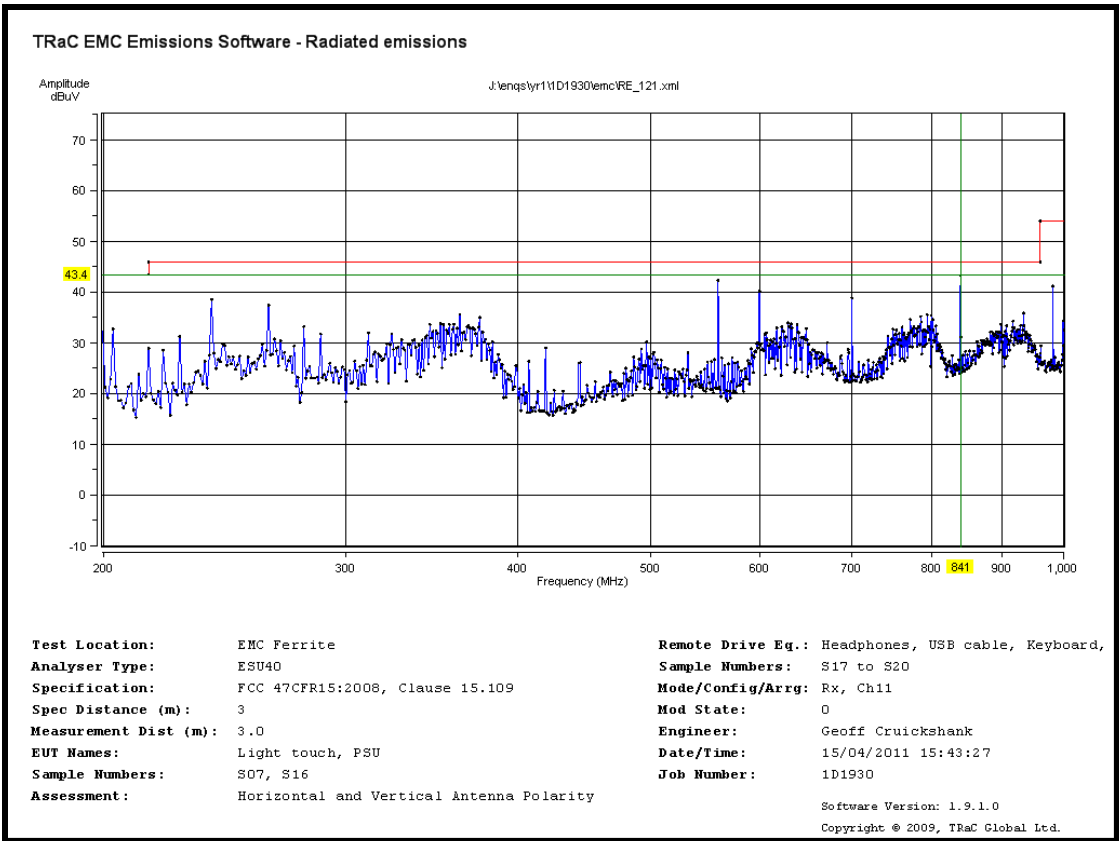
## Unintentional Radiated Spurious emissions 12 GHz to 18 GHz – 2437MHz



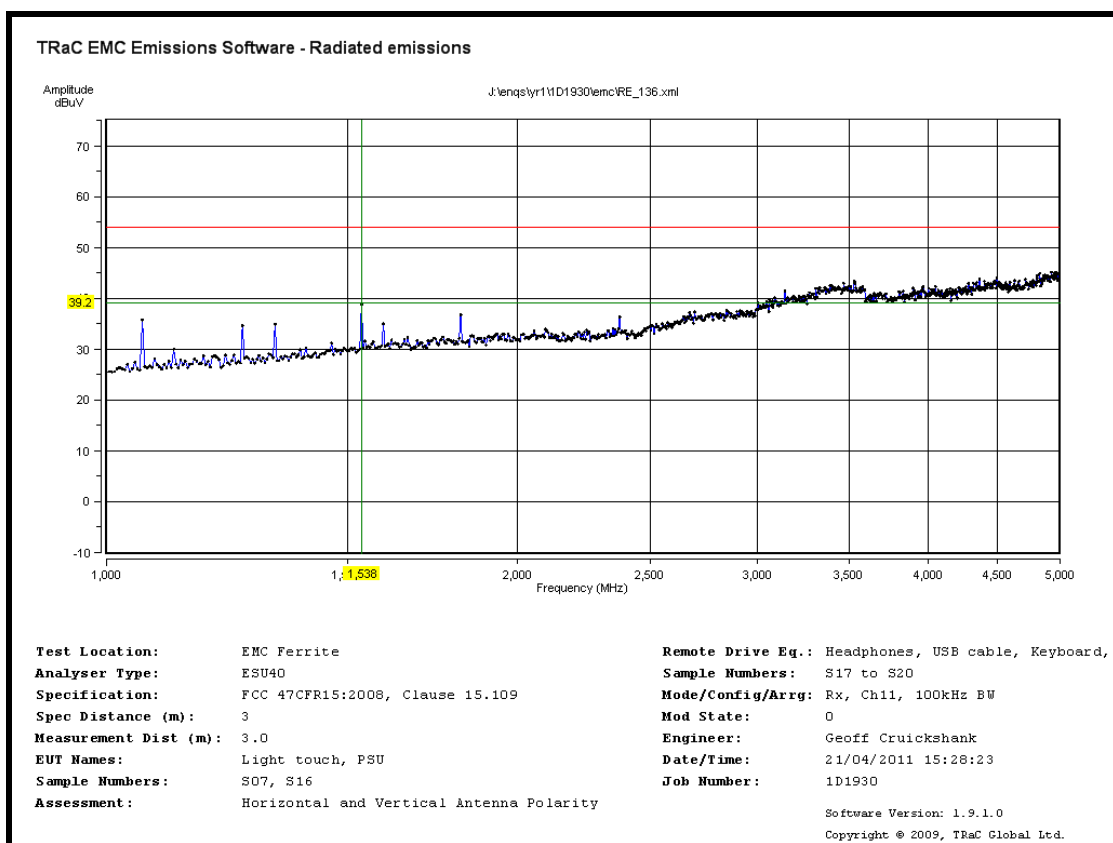
## Unintentional Radiated Spurious emissions 18 GHz to 25 GHz – 2437MHz



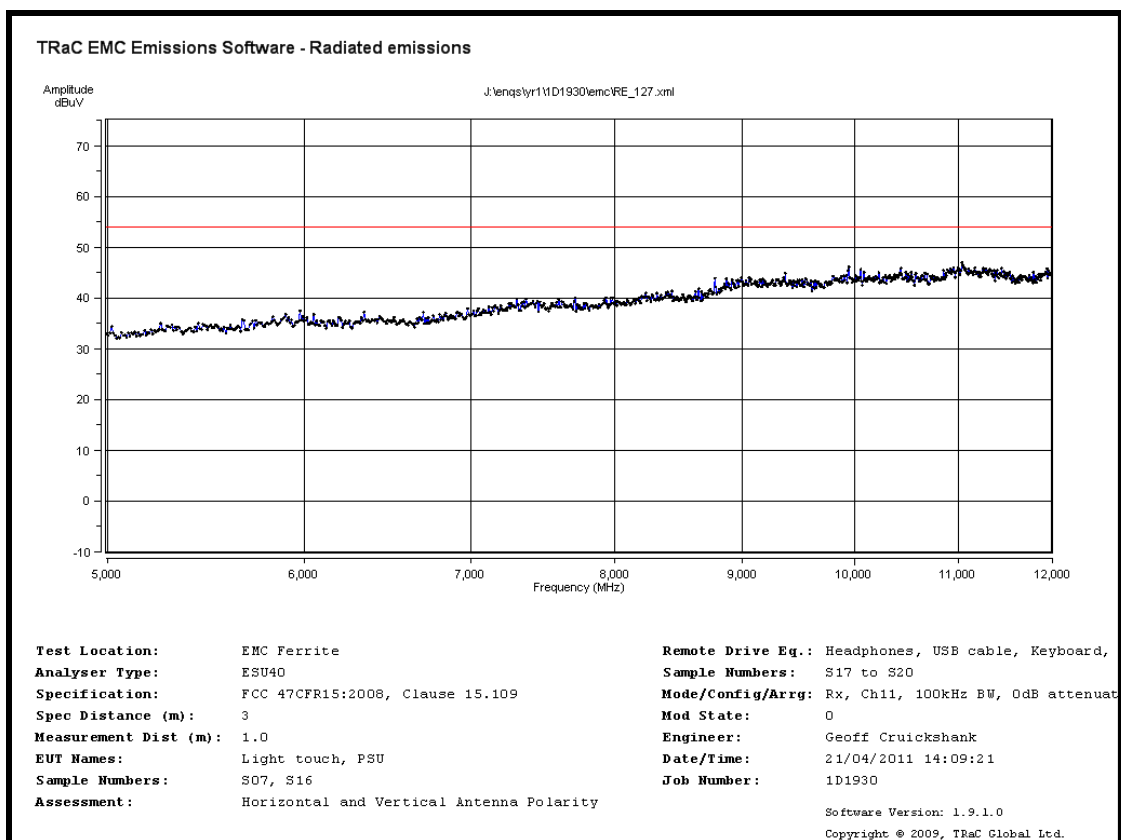
Unintentional Radiated Spurious emissions 30 MHz to 200 MHz – 2462MHz



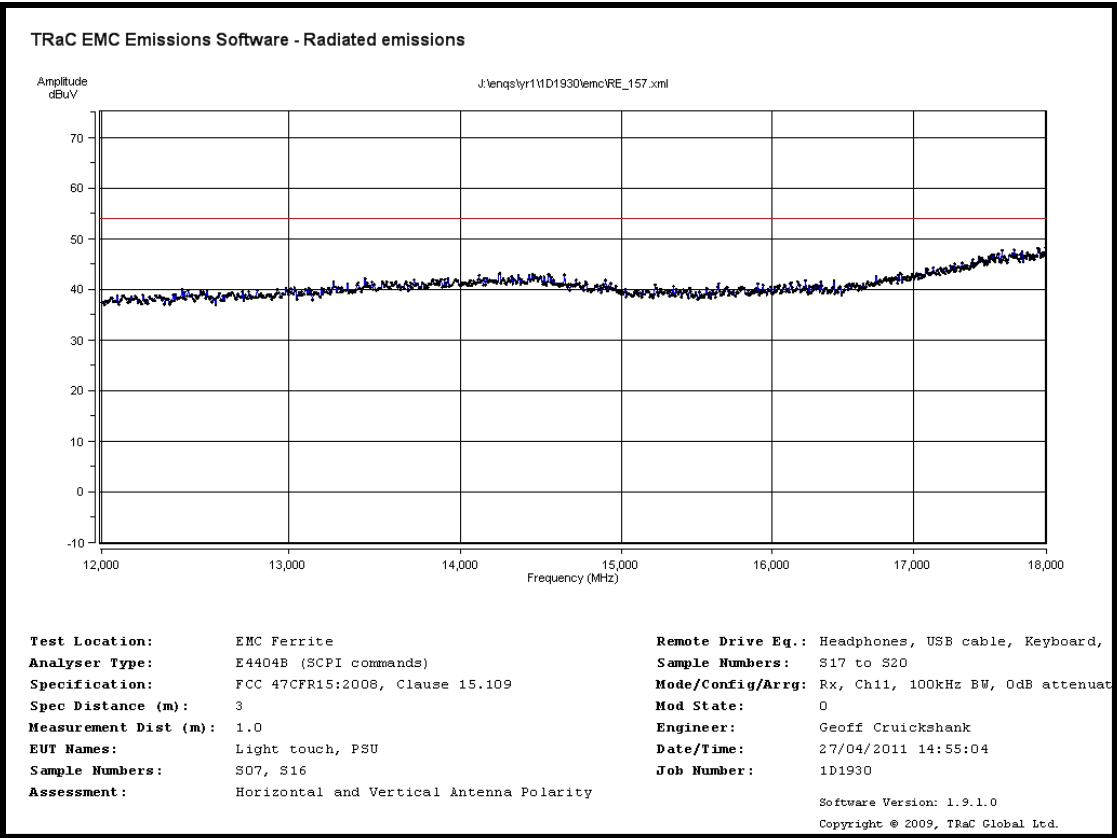
Unintentional Radiated Spurious emissions 200 MHz to 1 GHz – 2462MHz



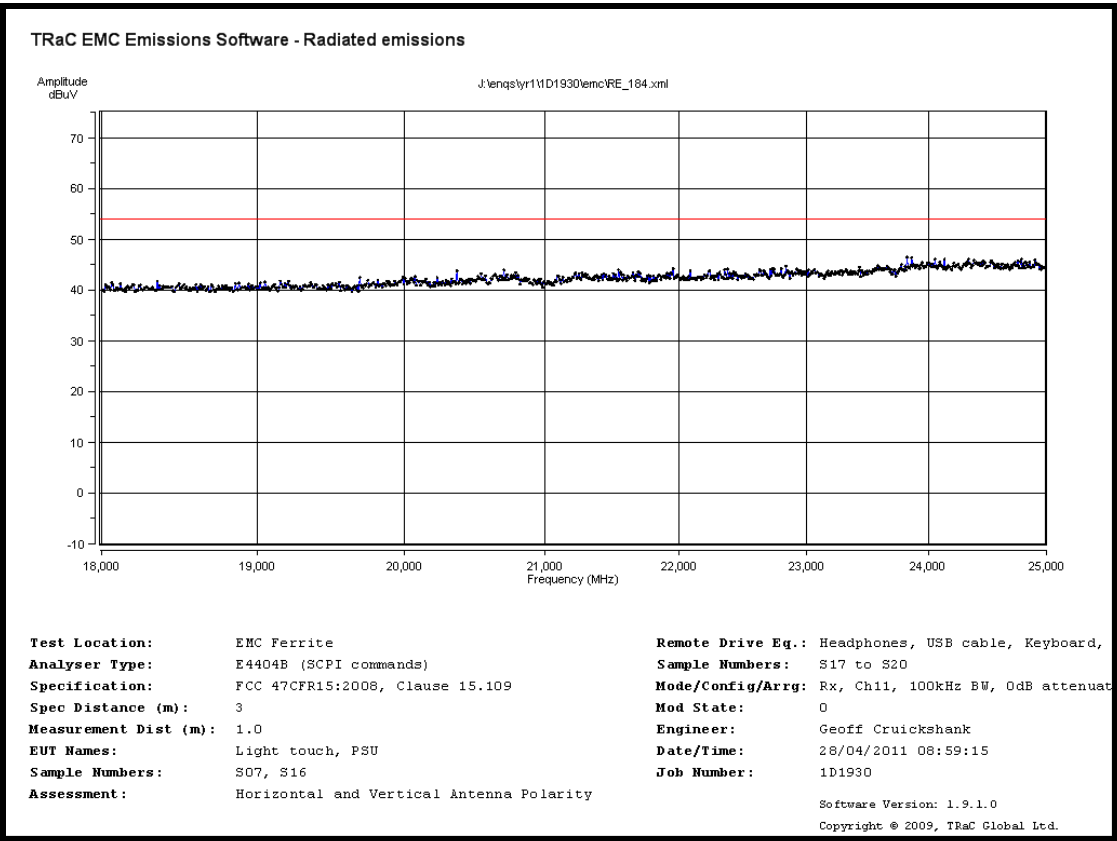
## Unintentional Radiated Spurious emissions 1 GHz to 5 GHz – 2462MHz



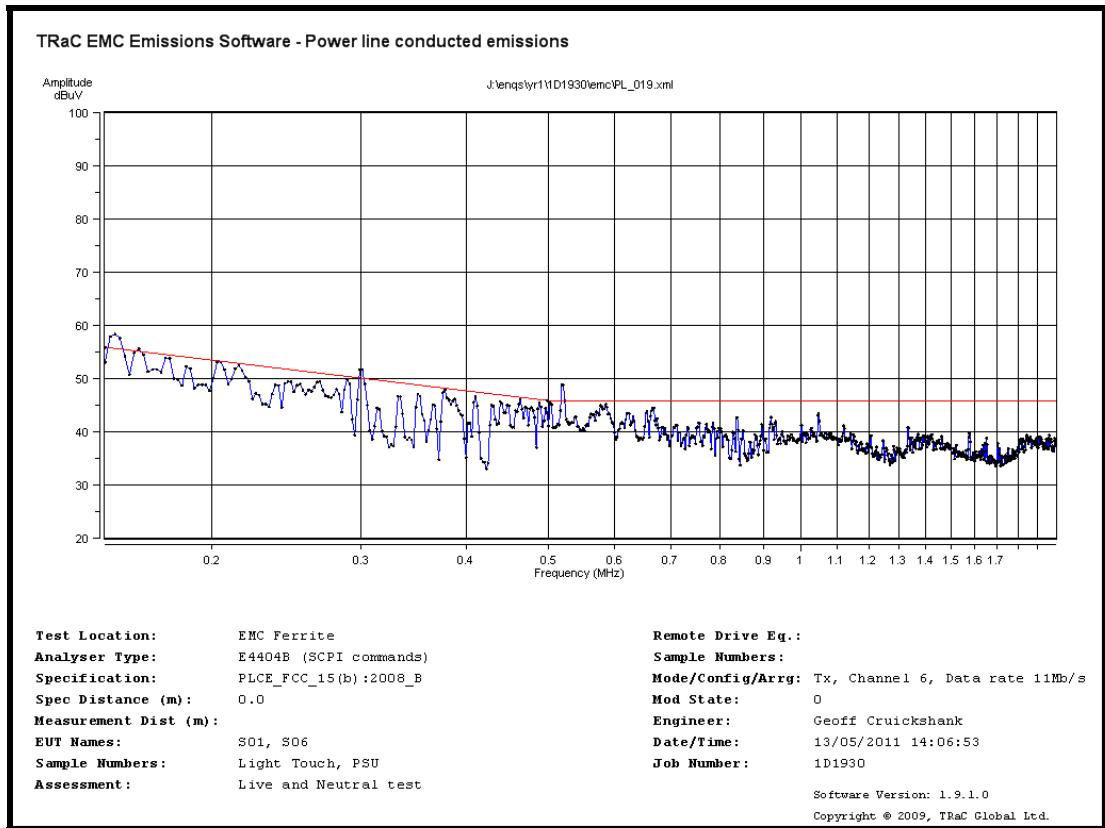
## Unintentional Radiated Spurious emissions 5 GHz to 12 GHz – 2462MHz



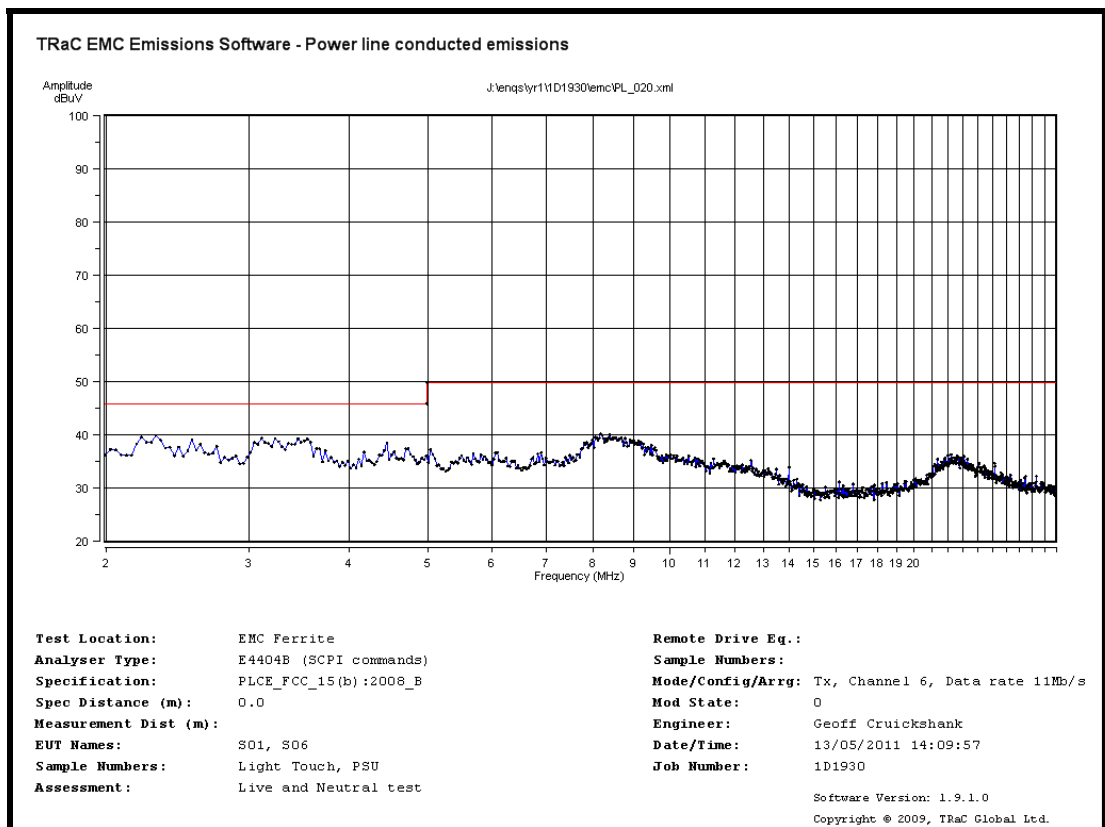
Unintentional Radiated Spurious emissions 12 GHz to 18 GHz – 2462MHz



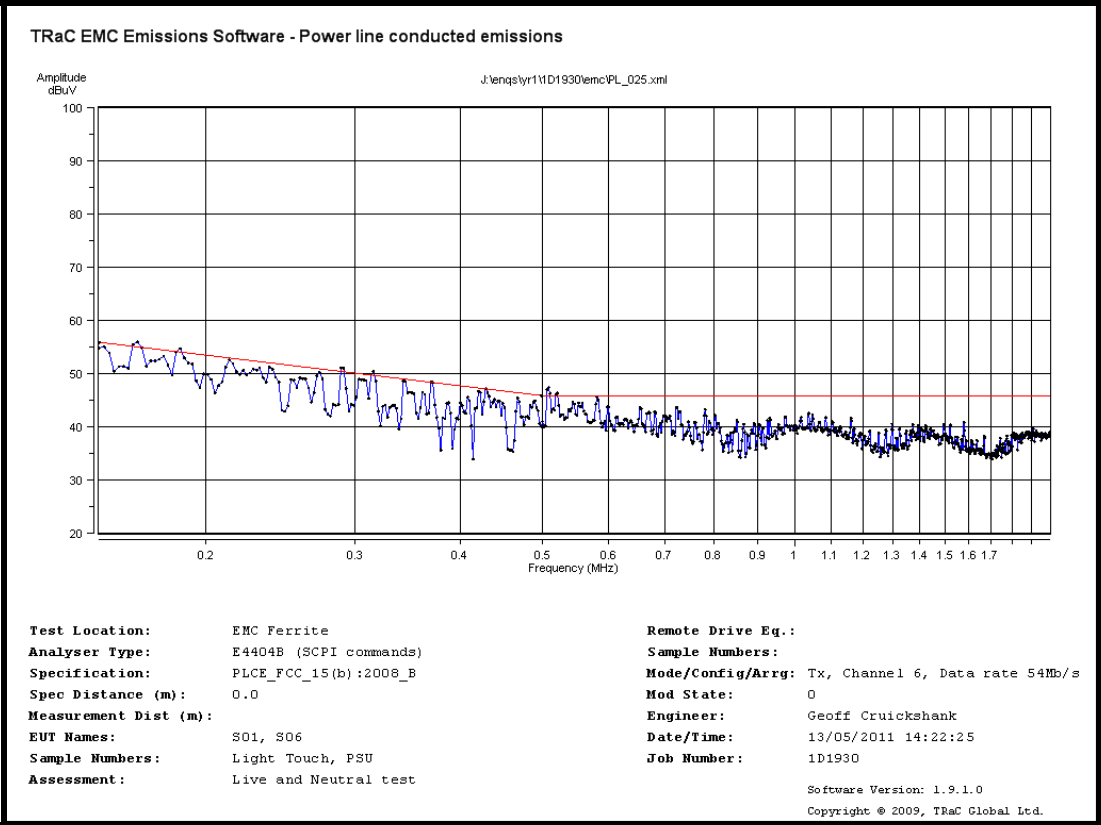
Unintentional Radiated Spurious emissions 18 GHz to 25 GHz – 2462MHz



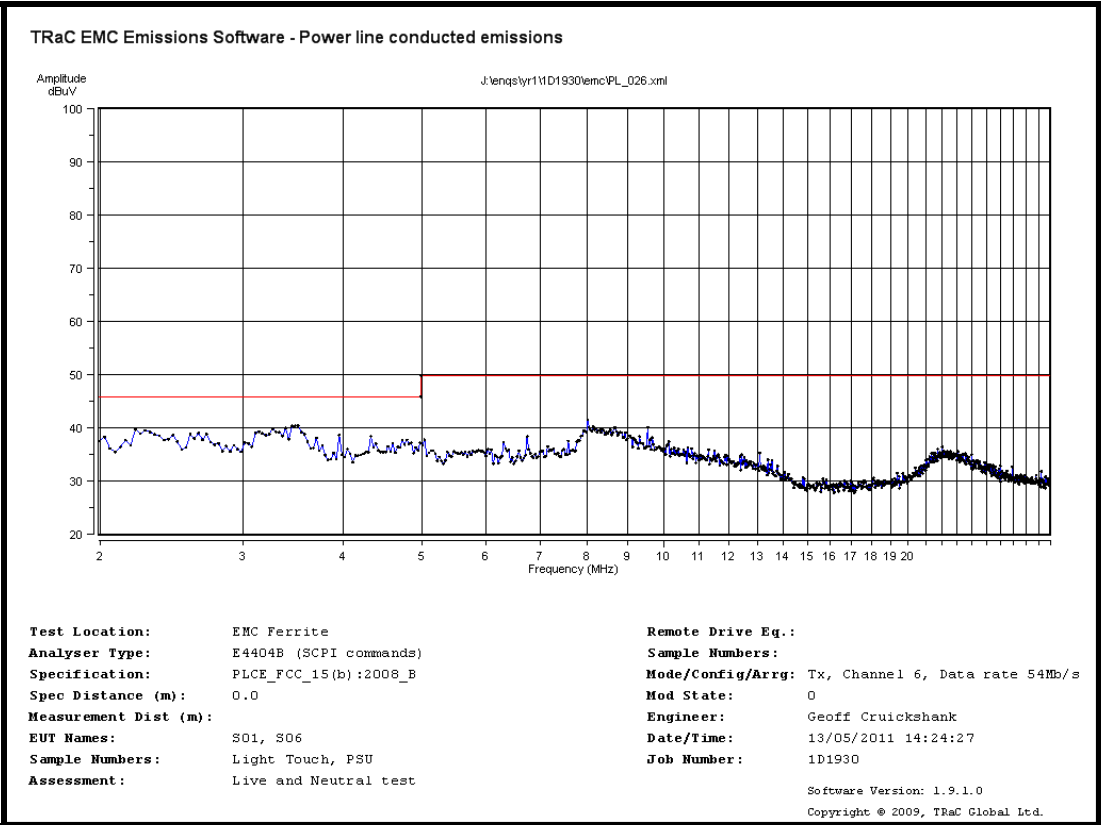
Power line conducted emissions Transmit Mode 0.15 MHz to 2 MHz - 11Mbps



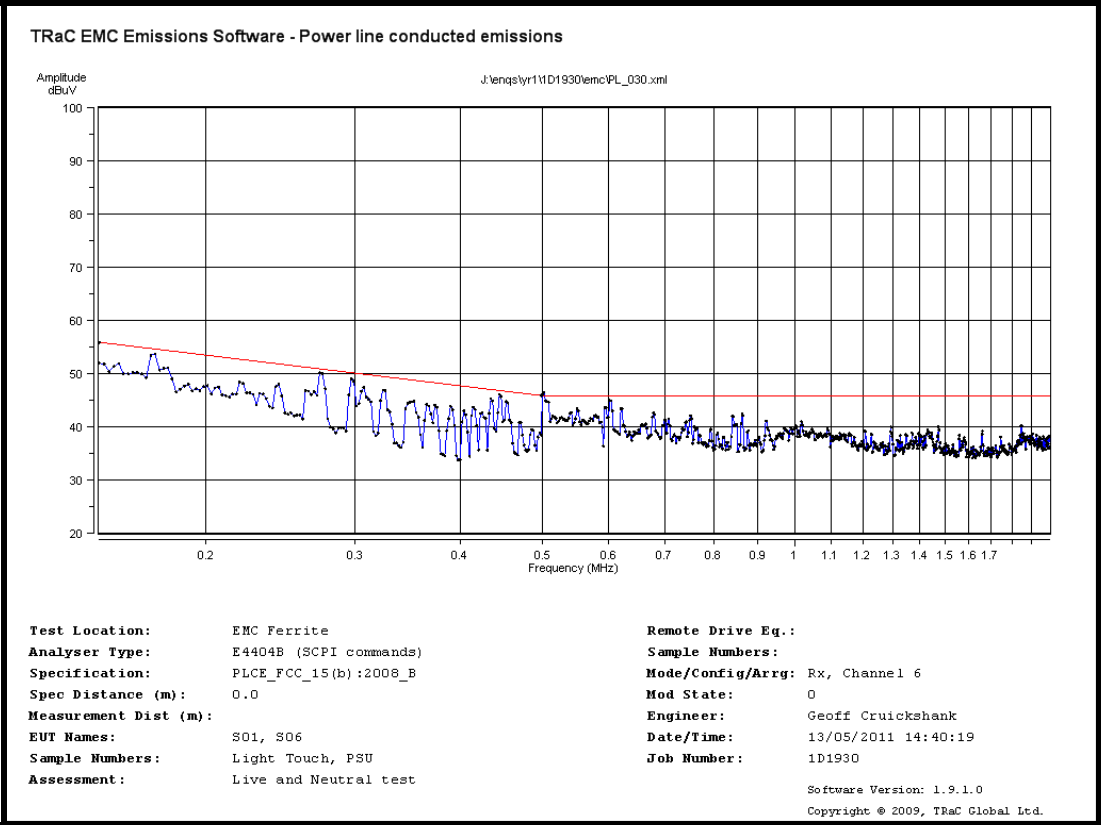
Power line conducted emissions Transmit Mode 2 MHz to 30 MHz - 11Mbps



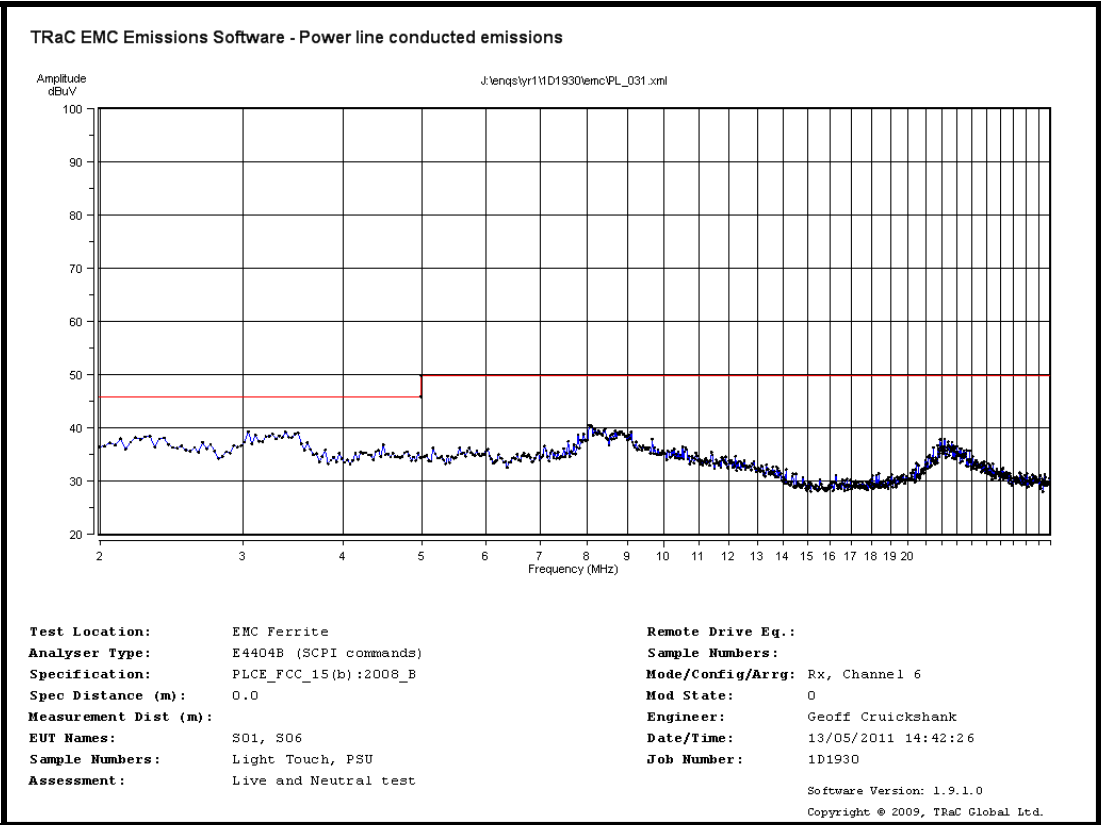
Power line conducted emissions Transmit Mode 0.15 MHz to 2 MHz - 54Mbps



Power line conducted emissions Transmit Mode 2 MHz to 30 MHz - 54Mbps



Power line conducted emissions Receive Mode 0.15 MHz to 2 MHz



Power line conducted emissions Receive Mode 2 MHz to 30 MHz

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

This appendix contains details of:

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

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

**Sample No:** Sxx Mod w

where:

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

The following terminology is used throughout the test report:

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

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

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

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

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

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

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

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

**C1 Test samples**

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

| Sample No. | Description                           | Identification       |
|------------|---------------------------------------|----------------------|
| S01        | LT1020FC 4 Light Touch Mini Projector | S/N: BG001354        |
| S05        | Light Touch 1020FC (Conducted Sample) | S/N: BG002152        |
| S06        | V-Infinity PSU 3A-181WP05             | P/N EMS050320-P5P-SZ |
| S07        | LT1020FC 4 Light Touch Mini Projector | S/N: BG002088        |
| S16        | V-Infinity Switch Mode Power Supply   | None                 |

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

| Sample No. | Description     | Identification |
|------------|-----------------|----------------|
| S17        | KB-558 Keyboard | None           |
| S18        | Sony Headset    | None           |
| S19        | USB Lead        | None           |
| S20        | Serial Cable    | None           |

**C2 EUT Operating Mode During Testing.**

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

| Test                                          | Description of Operating Mode                                                                                                                |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| All Transmitter tests detailed in this report | EUT active transmitting, operating at 11Mbps and 54Mbps data rates on the highest middle and lowest operating frequencies at each data rate. |

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

**C3 EUT Configuration Information.**

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

**C4 List of EUT Ports**

The tables below describe the termination of EUT ports:

Sample : S01  
 Tests : All Power Line Conducted emissions

| Port           | Description of Cable Attached | Cable length | Equipment Connected |
|----------------|-------------------------------|--------------|---------------------|
| dc Power Port  | 2 core unscreened             | 1m           | S06                 |
| Micro SD Port  | None                          | N/A          | None                |
| USB Port       | USB Cable                     | 1.5m         | S17                 |
| Micro USB Port | Micro USB Cable               | 2m           | S19 - Unterminated  |
| Headphone Port | Phono Cable                   | 1m           | S18                 |
| Customer Port  | 18 pin D-Type serial cable    | 1m           | S20 - Unterminated  |

Sample : S05  
 Tests : All radiated testing

| Port          | Description of Cable Attached | Cable length | Equipment Connected |
|---------------|-------------------------------|--------------|---------------------|
| dc Power Port | 2 core unscreened             | 1m           | S06                 |
| ac Power Port | None                          | N/A          | ac Mains            |

Sample : S07  
 Tests : All radiated testing

| Port           | Description of Cable Attached | Cable length | Equipment Connected |
|----------------|-------------------------------|--------------|---------------------|
| dc Power Port  | 2 core unscreened             | 1m           | S16                 |
| Micro SD Port  | None                          | N/A          | None                |
| USB Port       | USB Cable                     | 1.5m         | S17                 |
| Micro USB Port | Micro USB Cable               | 2m           | S19 - Unterminated  |
| Headphone Port | Phono Cable                   | 1m           | S18                 |
| Customer Port  | 18 pin D-Type serial cable    | 1m           | S20 - Unterminated  |

Sample : S16  
 Tests : All radiated testing

| Port          | Description of Cable Attached | Cable length | Equipment Connected |
|---------------|-------------------------------|--------------|---------------------|
| dc Power Port | 2 core unscreened             | 1m           | S07                 |
| ac Power Port | None                          | N/A          | ac Mains            |

**C5 Details of Equipment Used**

For Radiated Measurements:

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

| RFG No | Type   | Description                        | Manufacturer      | Date Calibrated. |
|--------|--------|------------------------------------|-------------------|------------------|
| REF886 | Lab 16 | Large Anechoic Chamber             | TRaC              | 10/06/10         |
| 095    | 96002  | Bicon Antena (30-200MHz)           | Eaton             | 12/05/10         |
| 191    | 3146   | Log Periodic Antenna (200-1000MHz) | EMCO              | 12/05/10         |
| 673    | 310    | Pre-Amp (9kHz-1GHz)                | Sonoma            | 14/09/10         |
| REF847 | ESU    | Spectrum Analyser                  | R&S               | 14/06/10         |
| 454    |        | HF RF coaxial cable                | Teledyne Reynolds | 04/05/10         |
| REF881 |        | HF RF coaxial cable                | Teledyne Reynolds | 10/06/10         |
| REF882 |        | HF RF coaxial cable                | Teledyne Reynolds | 10/06/10         |
| REF884 |        | HF RF coaxial cable                | Teledyne Reynolds | 10/06/10         |
| 464    | 6220B  | dc Power Supply                    | HP                | N/A              |
| REF883 |        | HF RF coaxial cable                |                   | 10/06/10         |
| REF829 | N4010A | Wireless connectivity Test Set     | Agilent           | 02/03/11         |

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

| RFG No | Type    | Description                     | Manufacturer      | Date Calibrated |
|--------|---------|---------------------------------|-------------------|-----------------|
| REF886 | Lab 16  | Large Anechoic Chamber          | TRaC              | 10/06/10        |
| REF880 | HL050   | Log Perodic Antenna (1-26.5GHz) | R&S               | 14/05/10        |
| 307    | HP8449B | Microwave Pre-Amp (1-26.5GHz)   | HP                | 01/03/10        |
| REF847 | ESU     | Spectrum Analyser               | R&S               | 14/06/10        |
| 454    |         | HF RF coaxial cable             | Teledyne Reynolds | 04/05/10        |
| REF881 |         | HF RF coaxial cable             | Teledyne Reynolds | 10/06/10        |
| REF882 |         | HF RF coaxial cable             | Teledyne Reynolds | 10/06/10        |
| REF884 |         | HF RF coaxial cable             | Teledyne Reynolds | 10/06/10        |
| 464    | 6220B   | dc Power Supply                 | HP                | N/A             |
| REF883 |         | HF RF coaxial cable             |                   | 10/06/10        |
| REF829 | N4010A  | Wireless connectivity Test Set  | Agilent           | 02/03/11        |

For Conducted Measurements

| RFG No | Type   | Description       | Manufacturer | Date Calibrated |
|--------|--------|-------------------|--------------|-----------------|
| REF909 | FSU    | Spectrum Analyser | R&S          | 14/06/10        |
| REF053 | 6634A  | dc Power Supply   | HP           | Cal before Use  |
| REF887 | 34405A | DMM               | Agilent      | 25/08/10        |

## For Power Line Conducted Measurements

| RFG No | Type         | Description       | Manufacturer | Date Calibrated |
|--------|--------------|-------------------|--------------|-----------------|
| 404    | E4407B       | Spectrum Analyser | Agilent      | 10/05/10        |
| 125    | ESHS10       | Test receiver     | R&S          | 23/11/10        |
| 232    | ESH2-Z5      | LISN              | R&S          | 22/05/10        |
| 674    | 0357.8810.54 | Pulse Limiter     | R&S          | 08/07/11        |
| 296    | BNC          | Cable             | TRaC         | 17/09/10        |
| 298    | BNC          | Cable             | TRaC         | 17/09/10        |

**Appendix D:**

**Additional Information**

Manufactures declaration of the model number differences.

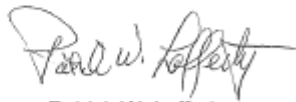


Declaration of Model Number Differences – Metal Skin

The Light Touch Product models (LT1020 & LT1220) utilize the same APM6658 module for WiFi.

The only difference in the two models is the Laser Classification. The LT1220 is a Class 2 device and the LT1020 is a Class 1 device.

Regards,

A handwritten signature in black ink, reading 'Patrick W. Lafferty'.

Patrick W. Lafferty  
Light Blue Optics  
Sustaining Engineering Manager  
4775 Centennial Blvd, Suite 103  
Colorado Springs, CO 80919

Manufactures data sheet detailing the maximum gain used by the EUT.



## Mixtus Dual-band Wi-Fi SMD Antenna

Part No. A10194

Product Specification

### 1 Features

- Designed for 2.4 – 2.5 GHz and 4.9 – 5.0 GHz applications: 802.11a/b/g/j/n, Wi-Fi®
- Easy to integrate
- High efficiency
- Light weight
- Intended for SMD mounting
- Supplied in tape on reel

### 2 Description

Mixtus is intended for use with all dual-band Wi-Fi applications, including 802.11n MIMO. The antenna requires a ground plane, i.e. your device acts as an active part of the antenna and thus demands careful consideration concerning its placement.

### 3 Applications

- Mobile phones
- PDAs
- Portable Media Players (PMPs)
- Headsets
- PC-Cards
- Game Consoles
- Access Points
- Set-top-box
- Networked Digital TVs



## Integrated Antenna and RF Solutions

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Product Specification 06MD-0010-3-PS

Manufactures data sheet detailing the maximum gain used by the EUT continued:

Mixtus Dual-band Wi-Fi SMD Antenna  
Part No. A10194

#### 4 Part No.

Mixtus: A10194



#### 5 General data

|                         |                                 |
|-------------------------|---------------------------------|
| Product name            | Mixtus Wi-Fi                    |
| Part No.                | A10194                          |
| Frequency               | 2.4 – 2.5 GHz and 4.9 – 5.9 GHz |
| Polarization            | Linear                          |
| Operating temperature   | -40 °C to +85 °C                |
| Impedance with matching | 50 Ω                            |
| Weight                  | 0.2 g                           |
| Antenna type            | SMD                             |
| Dimensions              | 10 x 10 x 0.9 [mm]              |

#### 6 Electrical characteristics

|                     | Typical performance | Conditions                                                                                                                   |
|---------------------|---------------------|------------------------------------------------------------------------------------------------------------------------------|
| Peak gain           | 1.8 dBi             | Data given for the 2.4 – 2.5 GHz frequency range<br>All data measured on Antenova's reference board<br>part number A10194-U1 |
| Average gain        | -0.5 dBi            |                                                                                                                              |
| Average efficiency  | >75%                |                                                                                                                              |
| Maximum Return Loss | -15 dB              |                                                                                                                              |
| Maximum VSWR        | 1.4:1               |                                                                                                                              |
| Peak gain           | 4.1 dBi             | Data given for the 4.9 – 5.9 GHz frequency range<br>All data measured on Antenova's reference board<br>part number A10194-U1 |
| Average gain        | -2.3 dBi            |                                                                                                                              |
| Average efficiency  | >60%                |                                                                                                                              |
| Maximum Return Loss | -11 dB              |                                                                                                                              |
| Maximum VSWR        | 1.8:1               |                                                                                                                              |

Integrated Antenna and RF Solutions

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Product Specification 06MD-0010-3-PS

## **Appendix E:**

## **Photographs and Figures**

The following photographs were taken of the test samples:

1. Radiated emissions overview: Front view
2. Radiated emissions overview: Back view
3. Power line conducted emissions overview



Photograph 1



Photograph 2



Photograph 3

**Appendix F:****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  $1\text{mW}/\text{cm}^2$  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

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

where:

S = power density

R = distance to the centre of radiation of the antenna

EIRP = EUT Maximum power

Note:

The EIRP value was determined using the peak conducted power measurement in conjunction with the declared antenna gain (1.8dBi).

**Result**

| Prediction Frequency (MHz) | Maximum EIRP (mW) | Power density limit (S) ( $\text{mW}/\text{cm}^2$ ) | Distance (R) cm required to be less than $1\text{mW}/\text{cm}^2$ |
|----------------------------|-------------------|-----------------------------------------------------|-------------------------------------------------------------------|
| 2462                       | 53                | 1                                                   | 2.1                                                               |

