

TRaC Wireless Test Report : TTR-003264WS1

Applicant : Telegesis (UK)

Apparatus : ETRX357-LRS & ETRX357HR-LRS

Specification(s) : CFR47 Part 15.247 July 10th 2008

FCCID : S4GEM35XB

Purpose of Test : Certification

Authorised by :



: Radio Product Manager

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Contents

| | | |
|-------------|---|----|
| Section 1: | Introduction | 3 |
| 1.1 | General | 3 |
| 1.2 | Tests Requested By | 4 |
| 1.3 | Manufacturer | 4 |
| 1.4 | Apparatus Assessed | 4 |
| 1.5 | Test Result Summary | 5 |
| 1.6 | Notes Relating To The Assessment | 6 |
| 1.7 | Deviations from Test Standards | 6 |
| Section 2: | Measurement Uncertainty | 7 |
| 2.1 | Application of Measurement Uncertainty | 7 |
| Section 3: | Modifications | 9 |
| 3.1 | Modifications Performed During Assessment | 9 |
| Appendix A: | Formal Emission Test Results | 10 |
| A1 | Transmitter Peak Output Power | 11 |
| A2 | RF Antenna Conducted Spurious Emissions | 12 |
| A3 | Radiated Electric Field Emissions Within The Restricted Bands of 15.205 | 14 |
| A4 | Power spectral density | 20 |
| A5 | 6 dB Bandwidth | 21 |
| A6 | Antenna Gain | 22 |
| A7 | Unintentional Radiated Electric Field Emissions - 15.109 | 23 |
| A8 | Power Line Conducted Emissions | 27 |
| Appendix B: | Supporting Graphical Data | 29 |
| Appendix C: | Additional Test and Sample Details | 67 |
| Appendix D: | Additional Information | 73 |
| Appendix E: | Calculation of the duty cycle correction factor | 74 |
| Appendix F: | Photographs and Figures | 75 |

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.

Test performed by:

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1.2 Tests Requested By

This testing in this report was requested by :

Telegesis
Abbey Barn Business Centre
Abbey Barn Lane
High Wycombe
Bucks HP10 9QQ
United Kingdom

1.3 Manufacturer

Telegesis
Abbey Barn Business Centre
Abbey Barn Lane
High Wycombe
Bucks HP10 9QQ
United Kingdom

1.4 Apparatus Assessed

The following Zigbee device, ETRX357-LRS & ETRX357HR-LRS were assessed between: 13th - 24th December 2010

ETRX357-LRS has an integral Antenova Chip antenna
ETRX357HR-LRS has a unique antenna connector

1.5 Test Result Summary

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

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

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

| Test Type | Regulation | Measurement standard | Result |
|--|--|----------------------|--------|
| Radiated spurious emissions (Restricted bands) | Title 47 of the CFR: Part 15 Subpart (c) 15.247 | ANSI C63.10 | Pass |
| Conducted spurious emissions (Non-restricted bands) | Title 47 of the CFR: Part 15 Subpart (c) 15.247 | ANSI C63.10 | Pass |
| 6dB Bandwidth and Channel Spacing | Title 47 of the CFR : Part 15 Subpart (c) 15.247(a)(1)(i) | ANSI C63.10 | Pass |
| Conducted Carrier Power | Title 47 of the CFR : Part 15 Subpart (c) 15.247(b)(2) | ANSI C63.10 | Pass |
| Unintentional Radiated Spurious Emissions | Title 47 of the CFR: Part 15 Subpart (b) 15.109 | ANSI C63.10 | Pass |
| Power Spectral Density | Title 47 of the CFR : Part 15 Subpart (c) 15.247(e) | 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 | : 13 to 20 °C |
| Humidity | : 40 to 45 % |

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 page contains the measurement uncertainties for measurements

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 (Equipment - TRLUH120) = **2.18dB**

Uncertainty in test result (Equipment - TRL05) = **1.08dB**

Uncertainty in test result (Equipment - TRL479) = **2.48dB**

[3] Effective Radiated Power

Uncertainty in test result = **4.71dB**

[4] Spurious Emissions

Uncertainty in test result = **4.75dB**

[5] Maximum frequency error

Uncertainty in test result (Equipment - TRLUH120) = **119ppm**

Uncertainty in test result (Equipment - TRL05) = **0.113ppm**

Uncertainty in test result (Equipment - TRL479) = **0.265ppm**

[6] Radiated Emissions, field strength OATS 14kHz-18GHz Electric Field

Uncertainty in test result (14kHz - 30MHz) = **4.8dB**,

Uncertainty in test result (30MHz - 1GHz) = **4.6dB**,

Uncertainty in test result (1GHz-18GHz) = **4.7dB**

[7] Frequency deviation

Uncertainty in test result = **3.2%**

[8] Magnetic Field Emissions

Uncertainty in test result = **2.3dB**

[9] Conducted Spurious

Uncertainty in test result (Equipment TRL479) Up to 8.1GHz = **3.31dB**

Uncertainty in test result (Equipment TRL479) 8.1GHz - 15.3GHz = **4.43dB**

Uncertainty in test result (Equipment TRL479) 15.3GHz - 21GHz = **5.34dB**

Uncertainty in test result (Equipment TRLUH120) Up to 26GHz = **3.14dB**

[10] Channel Bandwidth

Uncertainty in test result = **15.5%**

[11] Amplitude and Time Measurement – Oscilloscope

Uncertainty in overall test level = **2.1dB**, Uncertainty in time measurement = **0.59%**, Uncertainty in Amplitude measurement = **0.82%**

[11] Power Line Conduction

Uncertainty in test result = **3.4dB**

[12] Spectrum Mask Measurements

Uncertainty in test result = **2.59% (frequency)**
Uncertainty in test result = **1.32dB (amplitude)**

[13] Adjacent Sub Band Selectivity

Uncertainty in test result = **1.24dB**

[14] Receiver Blocking – Listen Mode, Radiated

Uncertainty in test result = **3.42dB**

[15] Receiver Blocking – Talk Mode, Radiated

Uncertainty in test result = **3.36dB**

[16] Receiver Blocking – Talk Mode, Conducted

Uncertainty in test result = **1.24dB**

[17] Receiver Threshold

Uncertainty in test result = **3.23dB**

[18] Transmission Time Measurement

Uncertainty in test result = **7.98%**

Section 3:

Modifications

3.1 Modifications Performed During Assessment

No modifications were performed during the assessment

Appendix A:

Formal Emission Test Results

Abbreviations used in the tables in this appendix:

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

A1 Transmitter Peak Output Power

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

| Test Details: | |
|--------------------------|--|
| Regulation | Title 47 of the CFR: Part15 Subpart (c) 15.247(b)(1) |
| Measurement standard | ANSI C63.10:2003 |
| EUT sample number | S01 |
| Modification state | 0 |
| SE in test environment | N/A |
| SE isolated from EUT | YES |
| EUT set up | Refer to Appendix C |
| Temperature | 20 |
| Photographs (Appendix F) | |

| Channel Frequency (MHz) | Peak Carrier Power (W) | Limit (W) | Result |
|-------------------------|------------------------|-----------|--------|
| 2405.00 | 0.051 | 1.0 | Pass |
| 2445.00 | 0.057 | | Pass |
| 2480.00 | 0.007 | | Pass |

Notes: See appendix D for settxpower settings

Conducted Measurement

Measured Peak Carrier power includes highest gain of any antenna to be used.
Highest Gain of any antenna to be used = 2 dBi

A2 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.

| Test Details: 2405/2441/2480GHz | |
|--|---|
| 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 | 9 kHz to 25 GHz |
| EUT sample number | S01 |
| Modification state | 0 |
| SE in test environment | No |
| SE isolated from EUT | Yes |
| EUT set up | Refer to Appendix C |
| Temperature | 20 |
| Photographs (Appendix F) | |

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

| 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 | | | | | | |

Notes:

1. The conducted emission limit for emissions outside the restricted bands, defined in 47CFR15.205(a) are based on a transmitted carrier level of 15.247(b). With the EUT transmitting on its lowest, centre and highest carrier frequencies in turn, emissions from the EUT are required to be 20 dB below the level of the highest fundamental as measured within a 100 kHz RBW in accordance with 15.247(d) using a peak detector.
2. The RBW = 100 kHz, Video bandwidth (VBW) > RBW and the radio spectrum was investigated up to the 10th harmonic in accordance 15.33 (a)(1).
3. The measurements at 2400 MHz and 2483.5 MHz were made to ensure band edge compliance.
4. The carrier level was measured whilst varying the supply voltage between 85% and 105% of the nominal supply voltage as required by 15.31(e). No variation in carrier level was observed. All other emissions were at least 20dB below the test limit

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

$$\text{The limit in 100 kHz RBW} = (\text{Maximum Peak Conducted Carrier}) - 20\text{dB}$$

Where:

The maximum peak conducted power was measured using a peak power meter. Please refer to section A1 of this test report.

| Channel No. | Channel Frequency (MHz) | Measured Peak Carrier Power (W) | Measured Peak Carrier (dBm) | Measured Peak Carrier -20dB (dBm) | Emission Limit In a 100 kHz RBW (dBm) |
|-------------|-------------------------|---------------------------------|-----------------------------|-----------------------------------|---------------------------------------|
| 11 | 2405.0 | 0.051 | 17.10 | -2.90 | -2.90 |
| 19 | 2441.0 | 0.057 | 17.59 | -2.41 | -2.41 |
| 26 | 2480.0 | 0.007 | 8.81 | -11.19 | -11.19 |

A3 Radiated Electric Field Emissions Within The Restricted Bands of 15.205

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

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

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

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

| Test Details: 2.0dBi /0dBi/ Chip Antenna | |
|---|--|
| Regulation | Title 47 of the CFR 2008, Part 15 Subpart (c) Clause 15.247(d) and Clause 15.205 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 30MHz – 25GHz |
| EUT sample number | S01 |
| Modification state | 0 |
| SE in test environment | No |
| SE isolated from EUT | Yes |
| EUT set up | Refer to Appendix C |
| Temperature | 20 |
| Photographs (Appendix F) | Photograph 1 and 2 |

The worst case radiated emission measurements for spurious emissions 30MHz -25GHz and that fall within the restricted bands are listed below:

2.0dBi Antenna Bottom channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 34.79 | - | 34.79 | 40.00 | 5.21 | Pass |
| 2. | 75.08 | V | 35.20 | - | 35.20 | 40.00 | 4.80 | Pass |
| 3. | 4810.81(r) | V | 64.73pk | - 11.37dB Av | 64.73pk | 74.00pk | 9.27pk | Pass |
| | 4810.81(r) | V | 54.85Av | | 43.48 Av | 54.00Av | 10.52Av | Pass |

2.0dBi Antenna Middle channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 35.25 | - | 35.25 | 40.00 | 4.75 | Pass |
| 2. | 75.08 | V | 35.17 | - | 35.17 | 40.00 | 4.83 | Pass |
| 3. | 4890.86(r) | V | 64.87pk | - 11.37dB Av | 64.87pk | 74.00pk | 9.13pk | Pass |
| | 4890.86(r) | V | 55.52Av | | 43.15Av | 54.00Av | 10.85Av | Pass |
| 4. | 7336.45(r) | V | 73.60pk | - 11.37dB Av | 73.60pk | 74.00pk | 0.4pk | Pass |
| | 7336.45(r) | V | 63.44Av | | 52.07Av | 54.00Av | 1.93Av | Pass |

2.0dBi Antenna Top channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 33.16 | - | 33.16 | 40.00 | 6.84 | Pass |
| 2. | 75.08 | V | 30.92 | - | 30.92 | 40.00 | 9.08 | Pass |
| 3. | 4959.93(r) | V | 63.73pk | - 11.37dB Av | 63.73pk | 74.00pk | 10.27pk | Pass |
| | 4959.93(r) | V | 54.10Av | | 42.73Av | 54.00Av | 11.27Av | Pass |
| 4. | 7442.74(r) | V | 64.15pk | - 11.37dB Av | 64.15pk | 74.00pk | 9.85pk | Pass |
| | 7442.74(r) | V | 51.25Av | | 39.88Av | 54.00Av | 14.12Av | Pass |

0 dBi Antenna Bottom channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|-------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 30.79 | - | 30.79 | 40.00 | 9.21 | Pass |
| 2. | 75.08 | V | 31.94 | - | 31.94 | 40.00 | 8.06 | Pass |
| 3. | 4810.89(r) | V | 65.71pk | - | 65.71pk | 74.00pk | 8.29pk | Pass |
| | 4810.89(r) | V | 56.63Av | 11.37dB Av | 45.26Av | 54.00Av | 8.74Av | Pass |
| 4. | 12022.37(r) | V | 73.00pk | - | 73.00pk | 74.00pk | 1.00pk | Pass |
| | 12022.37(r) | V | 62.12Av | 11.37dB Av | 50.75Av | 54.00Av | 3.25Av | Pass |

0 dBi Antenna Middle channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 31.17 | - | 31.17 | 40.00 | 8.83 | Pass |
| 2. | 75.08 | V | 31.89 | - | 31.89 | 40.00 | 8.11 | Pass |
| 3. | 4890.84(r) | V | 66.75pk | - | 66.75pk | 74.00pk | 7.25pk | Pass |
| | 4890.84(r) | V | 58.38Av | 11.37dB Av | 47.01Av | 54.00Av | 6.99Av | Pass |
| 4. | 7333.49(r) | V | 71.44pk | - | 71.44pk | 74.00pk | 2.56pk | Pass |
| | 7333.49(r) | V | 63.40Av | 11.37dB Av | 52.03Av | 54.00Av | 1.97Av | Pass |

0 dBi Antenna Top channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 30.19 | - | 30.19 | 40.00 | 9.81 | Pass |
| 2. | 75.08 | V | 30.74 | - | 30.74 | 40.00 | 9.26 | Pass |
| 3. | 4960.91(r) | V | 65.64pk | - | 65.64pk | 74.00pk | 8.36pk | Pass |
| | 4960.91(r) | V | 56.87Av | 11.37dB Av | 45.50Av | 54.00Av | 8.50Av | Pass |
| 4. | 7438.17(r) | V | 65.38pk | - | 65.38pk | 74.00pk | 8.62pk | Pass |
| | 7438.17(r) | V | 53.66Av | 11.37dB Av | 42.29Av | 54.00Av | 11.71Av | Pass |

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 30.19 | - | 30.19 | 40.00 | 9.81 | Pass |
| 2. | 75.08 | V | 30.74 | - | 30.74 | 40.00 | 9.26 | Pass |
| 3. | 4960.91(r) | V | 65.64pk | - | 65.64pk | 74.00pk | 8.36pk | Pass |
| | 4960.91(r) | V | 56.87Av | 11.37dB Av | 45.50Av | 54.00Av | 8.50Av | Pass |
| 4. | 7438.17(r) | V | 65.38pk | - | 65.38pk | 74.00pk | 8.62pk | Pass |
| | 7438.17(r) | V | 53.66Av | 11.37dB Av | 42.29Av | 54.00Av | 11.71Av | Pass |

Chip Antenna Bottom channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.10 | V | 30.79 | - | 30.79 | 40.00 | 9.21 | Pass |
| 2. | 4808.83(r) | V | 62.69pk | 11.37dB Av | 62.69pk | 74.00pk | 11.31pk | Pass |
| | 4808.83(r) | V | 52.46Av | | 41.09Av | 54.00Av | 12.91Av | Pass |

Chip Antenna Antenna Middle channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 31.17 | - | 31.17 | 40.00 | 8.83 | Pass |
| 2. | 4890.06(r) | V | 65.16pk | 11.37dB Av | 65.16pk | 74.00pk | 8.84pk | Pass |
| | 4890.06(r) | V | 56.34Av | | 44.97Av | 54.00Av | 9.03Av | Pass |
| 3. | 7333.99(r) | V | 64.81pk | 11.37dB Av | 64.81pk | 74.00pk | 9.19pk | Pass |
| | 7333.99(r) | V | 52.21Av | | 40.84Av | 54.00Av | 13.16Av | Pass |

Chip Antenna Antenna Top channel

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Duty cycle Correction factor | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|------------------------------|-----------------------|----------------------------|-------------|---------|
| 1. | 73.53 | V | 31.17 | - | 31.17 | 40.00 | 8.83 | Pass |
| 3. | 4959.93(r) | V | 60.52pk | 11.37dB Av | 60.52pk | 74.00pk | 13.48pk | Pass |
| | 4959.93(r) | V | 49.18Av | | 37.81Av | 54.00Av | 16.19Av | Pass |
| 4. | 7439.87(r) | V | 64.24pk | 11.37dB Av | 64.24pk | 74.00pk | 9.76pk | Pass |
| | 7439.87(r) | V | 50.94Av | | 39.57Av | 54.00Av | 14.43Av | Pass |

Notes:

- 1 Any testing performed below 30 MHz was performed using a magnetic loop antenna in accordance with ANSI C63.10: section 4.5, Table 1
- 2 In accordance with 15.35(b), above 1 GHz, emissions measured using a peak detector shall not exceed a level 20 dB above the average limit.
- 3 Measurements at 2400 & 2483.5 MHz were made to ensure band edge compliance.
- 4 Testing was performed with the EUT orientated in three orthogonal planes and the maximum emissions level recorded. In addition, the EUT antenna was varied within its range of motion in order to maximise emissions.
- 5 For Frequencies below 1 GHz, RBW= 100 kHz, testing was performed with CISPR16 compliant test receiver with QP detector. Above 1 GHz tests were performed using a spectrum analyser using the following settings:

| | |
|---------|---------------|
| Peak | RBW=VBW= 1MHz |
| Average | RBW=VBW= 1MHz |

These settings as per ANSI C63.10 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 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 15:2008 Clause 15.33(a) and 15.33(a)(1).

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

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

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

A4 Power spectral density

| Test Details: | |
|--------------------------|---|
| Regulation | Title 47 of the CFR: Part 15 Subpart (c) Clause 15.247(e) |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 2.4GHz – 2.4835GHz |
| EUT sample number | S01 |
| Modification state | 0 |
| SE in test environment | N |
| SE isolated from EUT | Y |
| EUT set up | Refer to Appendix C |
| Photographs (Appendix F) | Photograph 3 |

| Channel Frequency (MHz) | Power spectral density (dBm) | Limit (dBm) | Result |
|-------------------------|------------------------------|-------------|--------|
| 2405.00 | 2.38 | 8.0 | Pass |
| 2445.00 | 3.10 | | Pass |
| 2480.00 | -5.52 | | Pass |

A5 6 dB Bandwidth

Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(1)(i) 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. The formal measurements are detailed below:

| Test Details: | |
|------------------------|---|
| Regulation | Title 47 of the CFR: Part 15 Subpart (c) 15.247(a)(2) |
| EUT sample number | S01 |
| Modification state | 0 |
| SE in test environment | N/A |
| SE isolated from EUT | Yes |
| Temperature | 20°C |
| EUT set up | Refer to Appendix C |

| Channel Frequency (MHz) | Measured 6dB Bandwidth (kHz) | Limit | Result |
|-------------------------|------------------------------|---------|--------|
| 2405.0 | 1.618 MHz | ≥500kHz | Pass |
| 2441.0 | 1.618 MHz | ≥500kHz | Pass |
| 2480.0 | 1.618 MHz | ≥500kHz | Pass |

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 not specified by the client, however 15.247 (a)(4) states.

The conducted output power limit specified in paragraph 15.247(b) is based on the use of antennas with a directional gains that do not exceed 6dBi.

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 on its lowest, centre and highest carrier frequency in turn.

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

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

| Test Details: 2.0dBi/0dBi antenna port terminated | |
|--|--|
| 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 | S01 S02 |
| Modification state | 0 |
| SE in test environment | No |
| SE isolated from EUT | Yes |
| EUT set up | Refer to Appendix C |
| Temperature | 20 |
| Photographs (Appendix F) | |

The worst case radiated emission measurements for spurious emissions

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|----------------------------|-------------|---------|
| 1. | 31.55 | V | 26.82 | 40.00 | -13.18 | Pass |
| 2. | 33.11 | V | 33.56 | 40.00 | -6.44 | Pass |
| 3. | 34.66 | V | 29.35 | 40.00 | -10.65 | Pass |
| 4. | 36.22 | V | 35.77 | 40.00 | -4.23 | Pass |
| 5. | 37.77 | V | 32.64 | 40.00 | -7.36 | Pass |
| 6. | 39.33 | V | 25.36 | 40.00 | -14.64 | Pass |
| 7. | 43.99 | V | 29.28 | 40.00 | -10.72 | Pass |
| 8. | 45.54 | V | 30.22 | 40.00 | -9.78 | Pass |
| 9. | 47.10 | V | 27.60 | 40.00 | -12.40 | Pass |
| 10. | 48.65 | V | 23.76 | 40.00 | -16.24 | Pass |
| 11. | 50.21 | V | 31.48 | 40.00 | -8.52 | Pass |
| 12. | 51.76 | V | 29.56 | 40.00 | -10.44 | Pass |
| 13. | 53.32 | V | 26.71 | 40.00 | -13.29 | Pass |
| 14. | 54.87 | V | 30.57 | 40.00 | -9.43 | Pass |
| 15. | 56.43 | V | 26.01 | 40.00 | -13.99 | Pass |
| 16. | 57.98 | V | 32.80 | 40.00 | -7.20 | Pass |
| 17. | 59.54 | V | 34.33 | 40.00 | -5.67 | Pass |
| 18. | 61.09 | V | 34.64 | 40.00 | -5.36 | Pass |
| 19. | 62.64 | V | 30.71 | 40.00 | -9.29 | Pass |
| 20. | 64.20 | V | 30.68 | 40.00 | -9.32 | Pass |
| 21. | 65.75 | V | 28.39 | 40.00 | -11.61 | Pass |
| 22. | 68.86 | V | 30.37 | 40.00 | -9.63 | Pass |
| 23. | 70.42 | V | 29.22 | 40.00 | -10.78 | Pass |
| 24. | 71.97 | V | 27.82 | 40.00 | -12.18 | Pass |
| 25. | 73.53 | V | 30.25 | 40.00 | -9.75 | Pass |
| 26. | 75.08 | V | 30.02 | 40.00 | -9.98 | Pass |
| 27. | 76.63 | V | 27.55 | 40.00 | -12.45 | Pass |
| 28. | 79.73 | V | 28.06 | 40.00 | -11.94 | Pass |
| 29. | 81.30 | V | 28.33 | 40.00 | -11.67 | Pass |
| 30. | 82.85 | V | 30.53 | 40.00 | -9.47 | Pass |
| 31. | 84.41 | V | 26.74 | 40.00 | -13.26 | Pass |
| 32. | 114.16 | V | 28.71 | 43.50 | -14.79 | Pass |

Unintentional Radiated Electric Field Emissions 15.109 continued:

| Test Details: Chip Antenna | |
|-----------------------------------|--|
| 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 | S02 |
| Modification state | 0 |
| SE in test environment | No |
| SE isolated from EUT | Yes |
| EUT set up | Refer to Appendix C |
| Temperature | 20 |
| Photographs (Appendix F) | Photograph 1 and 2 |

The worst case radiated emission measurements for spurious emissions

| Ref No. | Freq (MHz) | Pol. | Result (dB μ V/m) | Spec. Limit (dB μ V/m) | Margin (dB) | Summary |
|---------|------------|------|-----------------------|----------------------------|-------------|---------|
| 1. | 31.45 | V | 25.90 | 40.00 | 14.10 | Pass |
| 2. | 32.55 | V | 24.30 | 40.00 | 15.70 | Pass |
| 3. | 35.30 | V | 33.30 | 40.00 | 6.70 | Pass |
| 4. | 36.00 | V | 31.80 | 40.00 | 8.20 | Pass |
| 5. | 42.55 | V | 20.70 | 40.00 | 19.3 | Pass |
| 6. | 43.00 | V | 24.50 | 40.00 | 15.50 | Pass |
| 7. | 45.60 | V | 28.90 | 40.00 | 11.10 | Pass |
| 8. | 46.70 | V | 28.00 | 40.00 | 12.00 | Pass |
| 9. | 48.10 | V | 36.60 | 40.00 | 3.40 | Pass |
| 10. | 50.95 | V | 36.90 | 40.00 | 3.10 | Pass |
| 11. | 51.95 | V | 34.30 | 40.00 | 5.70 | Pass |
| 12. | 53.20 | V | 36.00 | 40.00 | 4.00 | Pass |
| 13. | 54.45 | V | 36.10 | 40.00 | 3.90 | Pass |
| 14. | 58.70 | V | 39.40 | 40.00 | 0.60 | Pass |
| 15. | 60.95 | V | 39.30 | 40.00 | 0.70 | Pass |
| 16. | 62.85 | V | 36.00 | 40.00 | 4.00 | Pass |
| 17. | 65.15 | V | 35.00 | 40.00 | 5.00 | Pass |
| 17. | 66.55 | V | 34.50 | 40.00 | 5.50 | Pass |
| 18. | 69.65 | V | 31.70 | 40.00 | 8.30 | Pass |
| 19. | 72.80 | V | 33.90 | 40.00 | 6.10 | Pass |
| 20. | 74.35 | V | 33.10 | 40.00 | 6.90 | Pass |
| 21. | 77.20 | V | 31.90 | 40.00 | 8.10 | Pass |
| 22. | 81.15 | V | 29.50 | 40.00 | 10.50 | Pass |
| 23. | 85.05 | V | 30.20 | 40.00 | 9.80 | Pass |
| 24. | 85.95 | V | 26.40 | 40.00 | 13.60 | Pass |

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.

| Test Details: | |
|------------------------|--|
| Regulation | Title 47 of the CFR: Part 15 Subpart (c) Clause 15.207 |
| Measurement standard | ANSI C63.10:2003 |
| Frequency range | 150kHz to 30MHz |
| EUT sample number | S01 S02 |
| Modification state | 0 |
| SE in test environment | No |
| SE isolated from EUT | Yes |
| EUT set up | Refer to Appendix C |

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

Results measured using the average detector compared to the average limit

| Ref No. | Freq (MHz) | Conductor | Result (dBuV) | Spec Limit (dBuV) | Margin (dB) | Result Summary |
|--|------------|-----------|---------------|-------------------|-------------|----------------|
| No Significant Emissions Within 20 dB of the limit | | | | | | |

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

| Ref No. | Freq (MHz) | Conductor | Result (dBuV) | Spec Limit (dBuV) | Margin (dB) | Result Summary |
|--|------------|-----------|---------------|-------------------|-------------|----------------|
| No Significant Emissions Within 20 dB of the limit | | | | | | |

*See section 2.2 Note (iii).

Specification limits :

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

Conducted disturbance at the mains ports.

| Frequency range MHz | Limits dB μ V | |
|---------------------|-----------------------|-----------------------|
| | Quasi-peak | Average |
| 0.15 to 0.5 | 66 to 56 ² | 56 to 46 ² |
| 0.5 to 5 | 56 | 46 |
| 5 to 30 | 60 | 50 |

Notes:

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

Notes:

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

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

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

Appendix B:

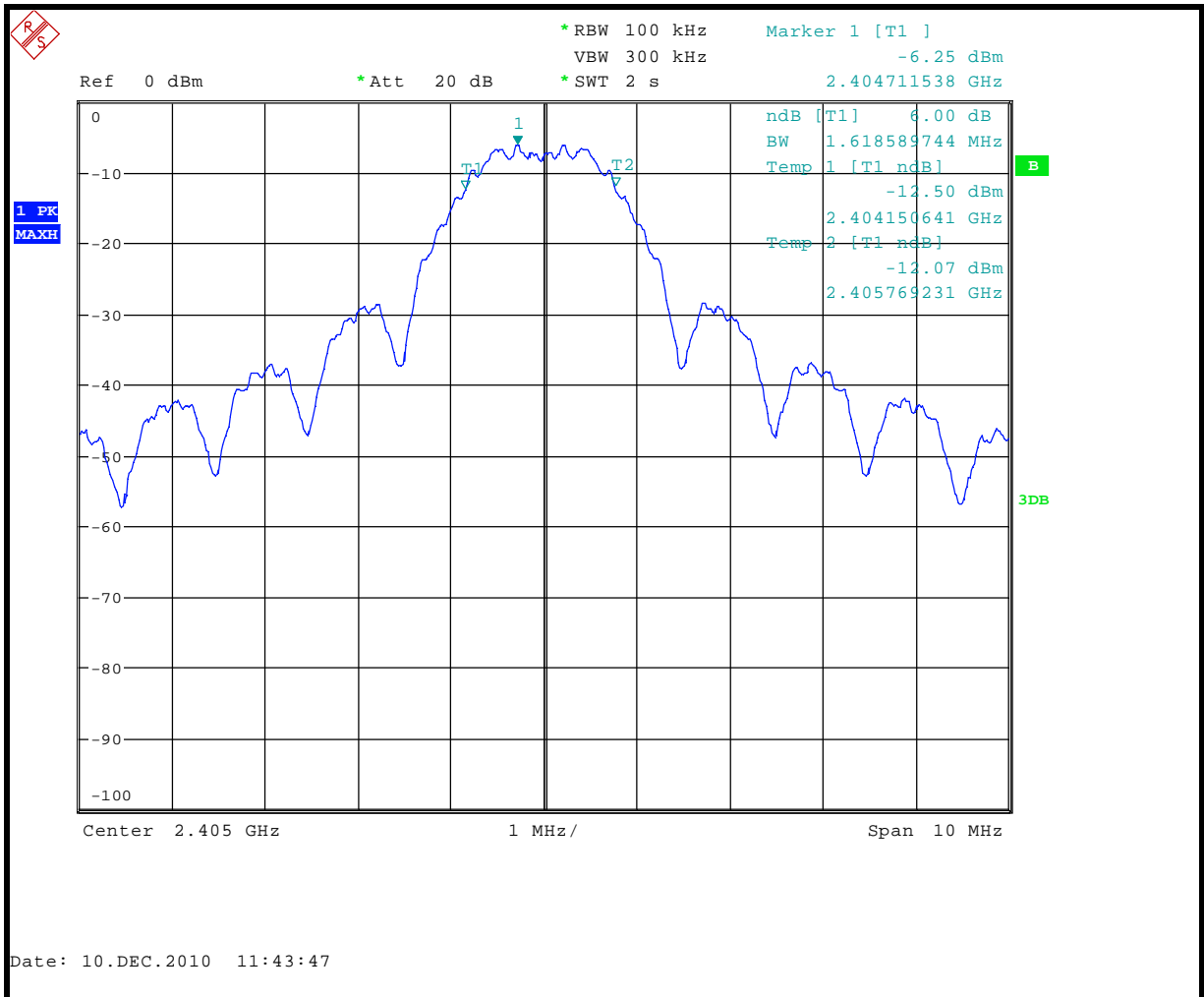
Supporting Graphical Data

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.

Bottom channel 6dB Bandwidth plot



FL = 2.404150641GHz

FH = 2.405769231GHz

Occupied bandwidth = 1.618589744MHz

Middle channel 6dB Bandwidth plot

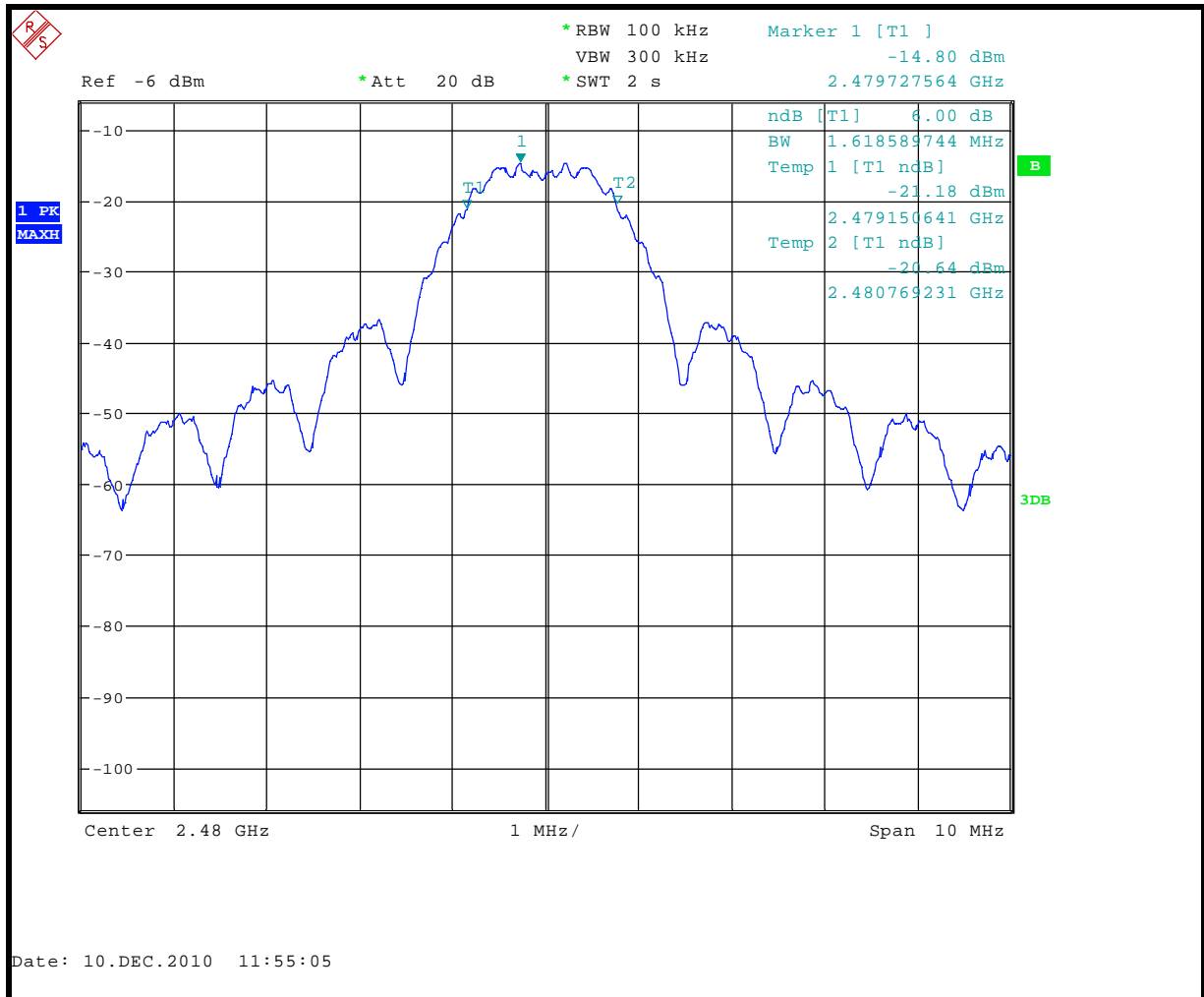


FL = 2.444160256GHz

FH = 2.445778846GHz

Occupied bandwidth = 1.618589744MHz

Top channel 6dB Bandwidth plot

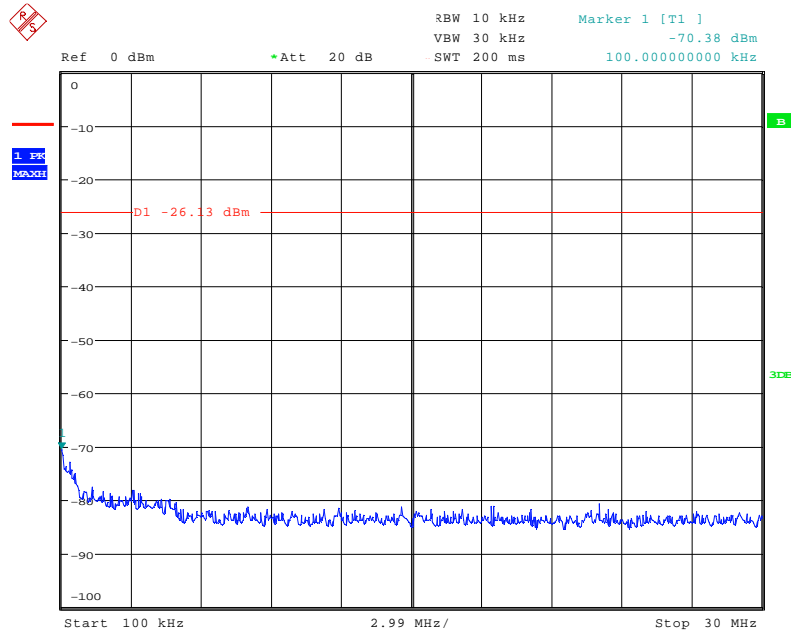


FL = 2.444160256GHz

FH = 2.445778846GHz

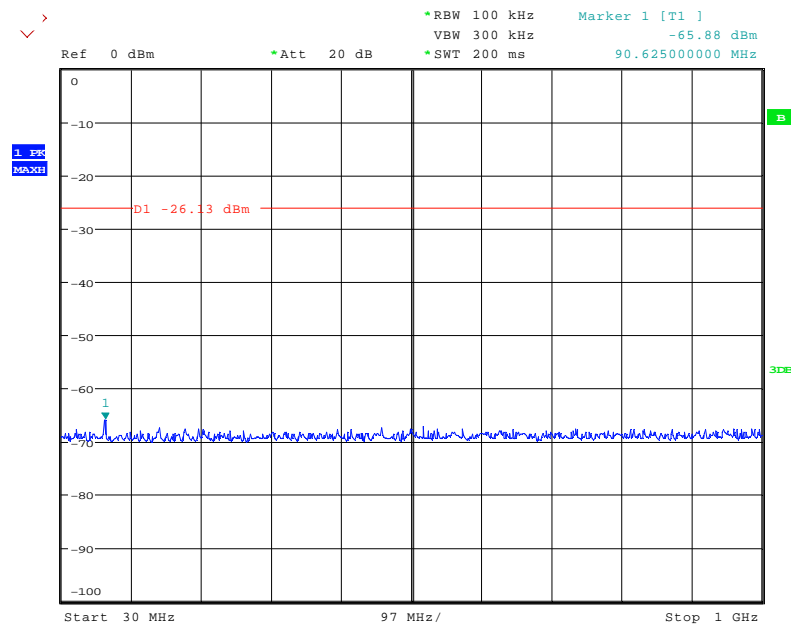
Occupied bandwidth = 1.618589744MHz

Bottom Channel Conducted Spurious emissions 100kHz to 30 MHz



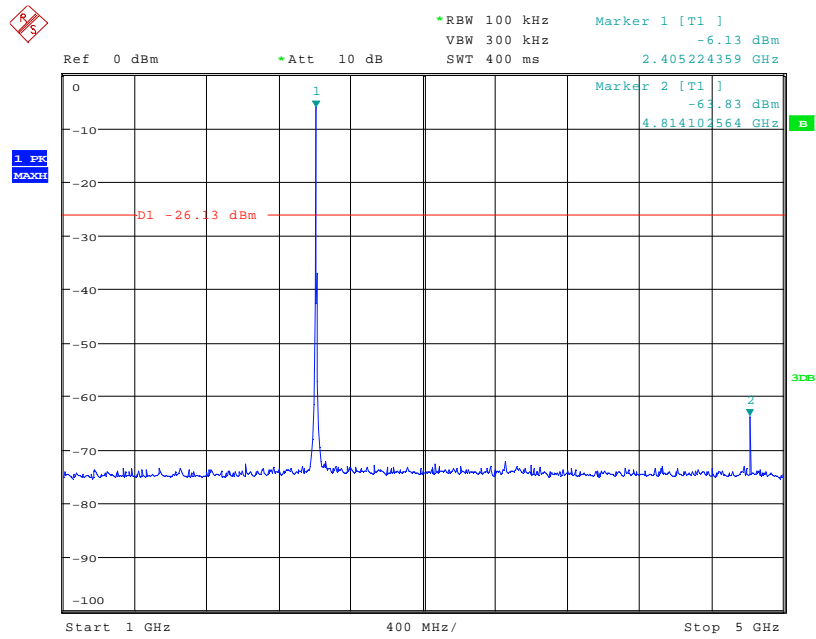
Date: 10.DEC.2010 09:52:53

Bottom Channel Conducted Spurious emissions 30 MHz – 1GHz



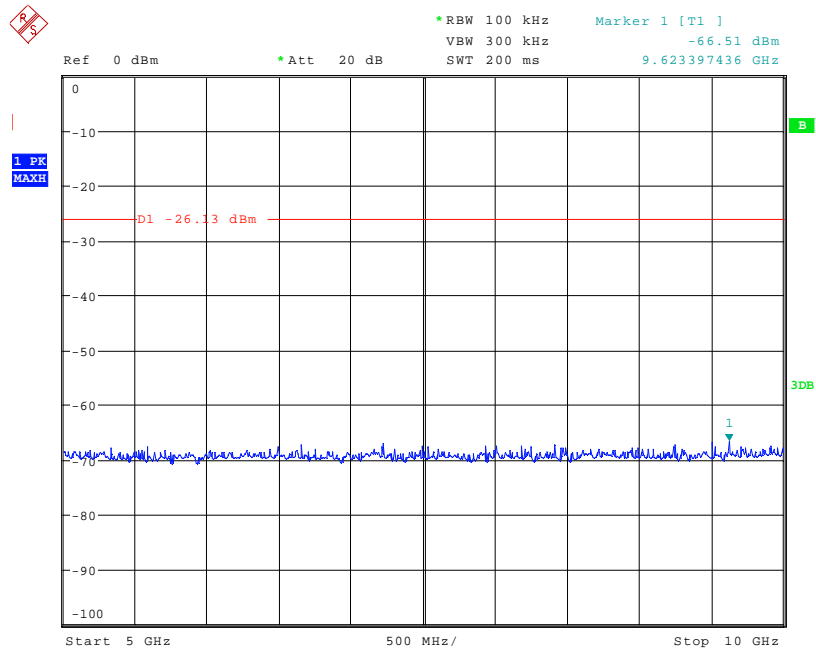
Date: 10.DEC.2010 09:37:18

Bottom Channel Conducted Spurious emissions 1 GHz to 5 GHz



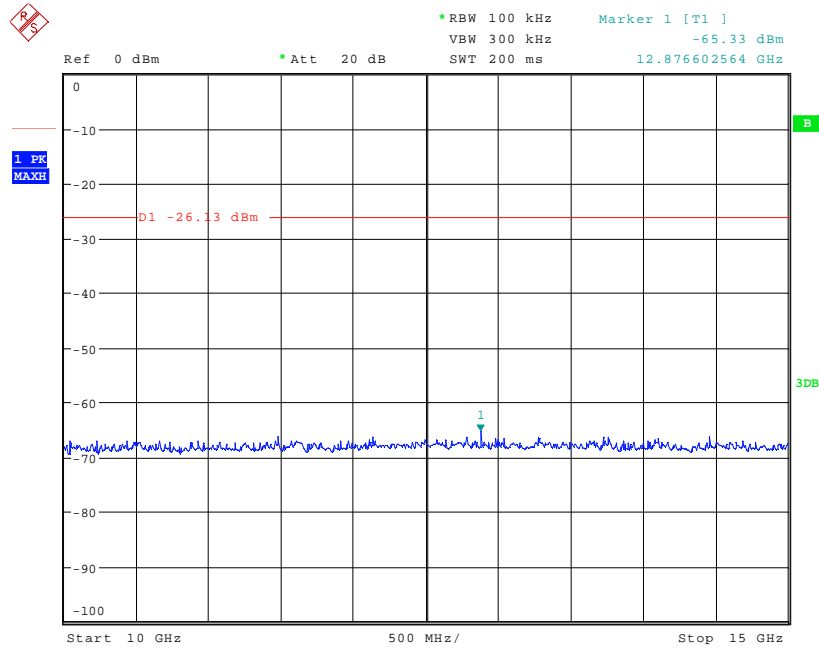
Date: 10.DEC.2010 09:24:19

Bottom Channel Conducted Spurious emissions 5 GHz to 10 GHz



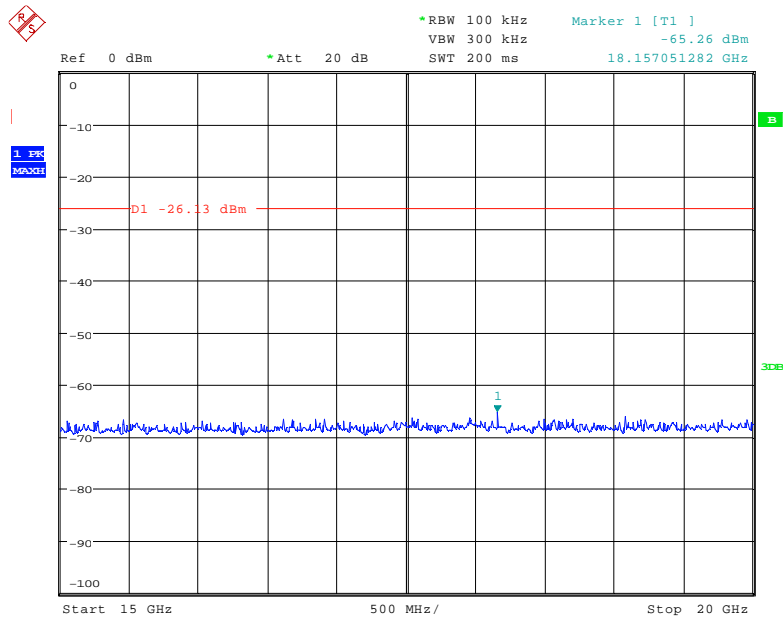
Date: 10.DEC.2010 09:46:59

Bottom Channel Conducted Spurious emissions 10 GHz to 15 GHz



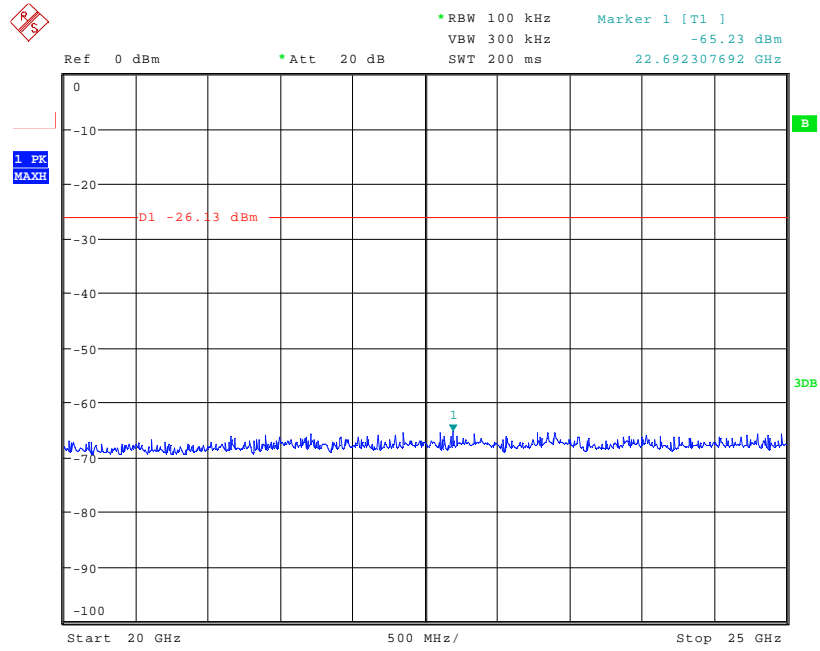
Date: 10.DEC.2010 09:49:58

Bottom Channel Conducted Spurious emissions 15 GHz to 20 GHz



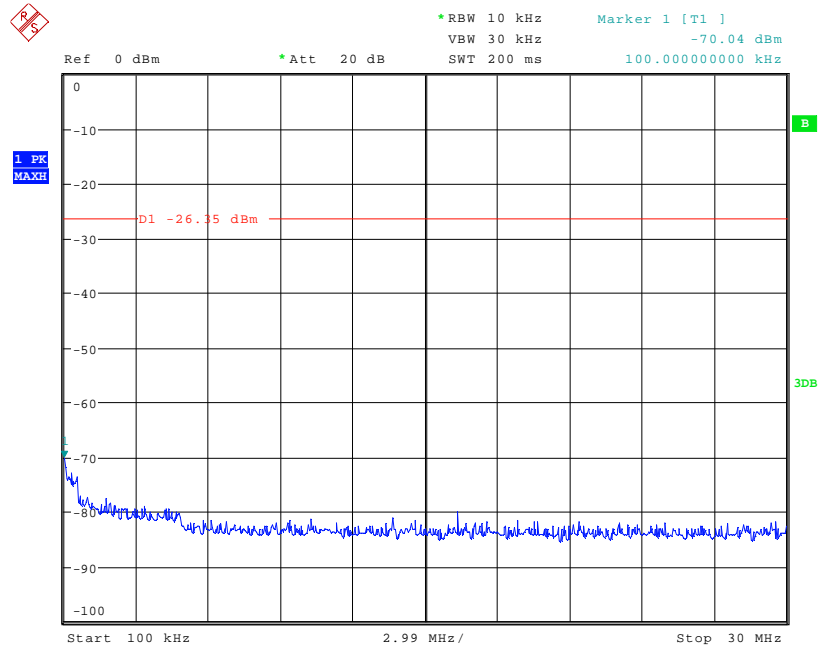
Date: 10.DEC.2010 09:50:58

Bottom Channel Conducted Spurious emissions 20 GHz to 25 GHz



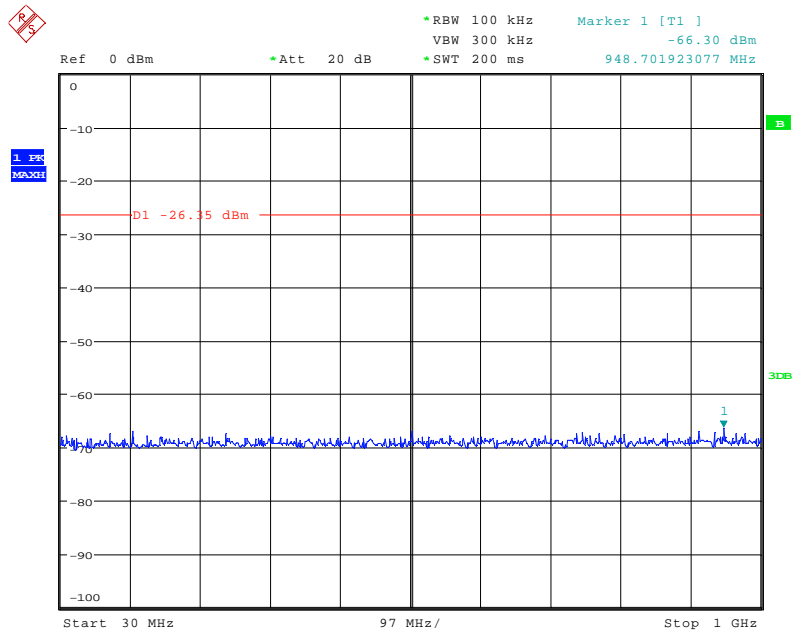
Date: 10.DEC.2010 09:51:42

Middle Channel Conducted Spurious emissions 100kHz to 30 MHz



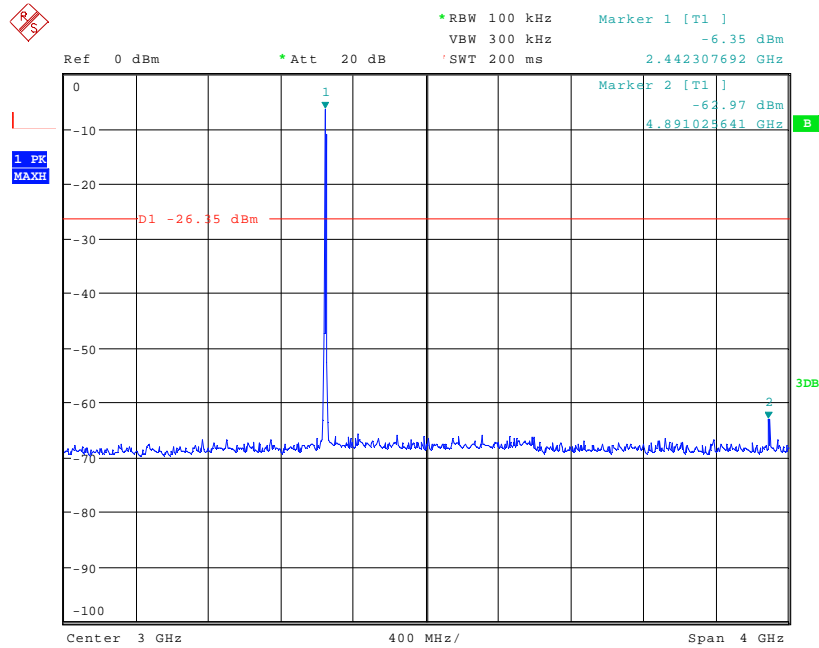
Date: 10.DEC.2010 10:06:08

Middle Channel Conducted Spurious emissions 30 MHz to 1 GHz



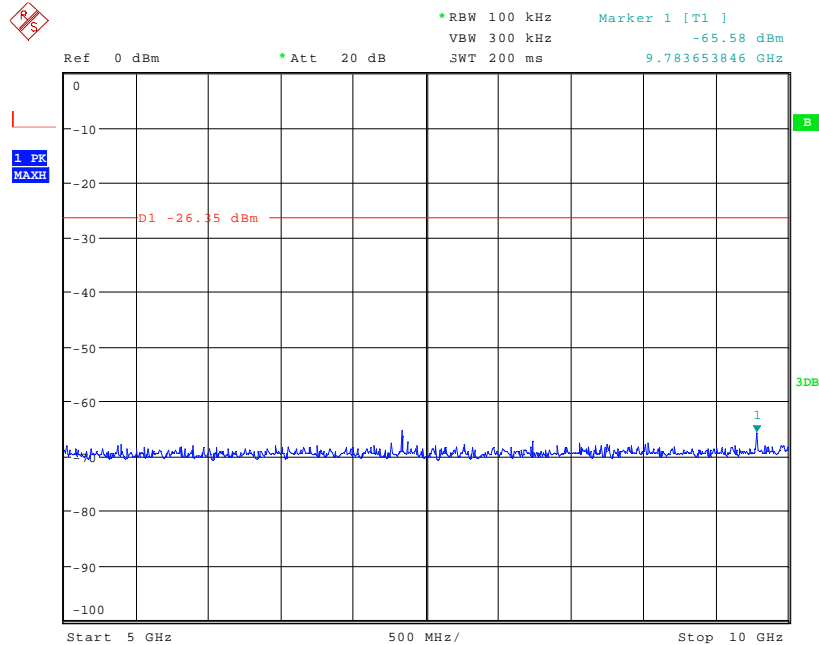
Date: 10.DEC.2010 10:02:02

Middle Channel Conducted Spurious emissions 1 GHz to 5 GHz



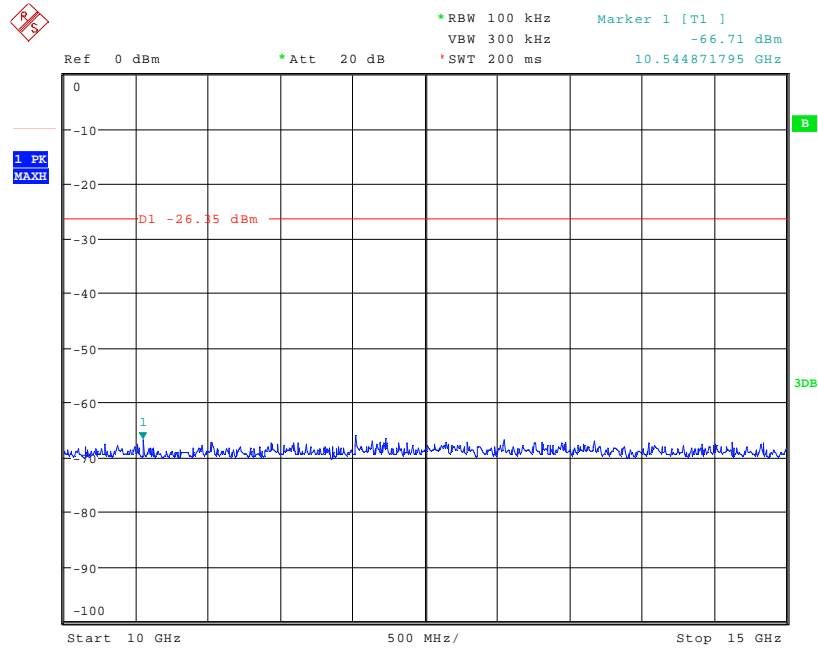
Date: 10.DEC.2010 10:01:17

Middle Channel Conducted Spurious emissions 5 GHz to 10 GHz



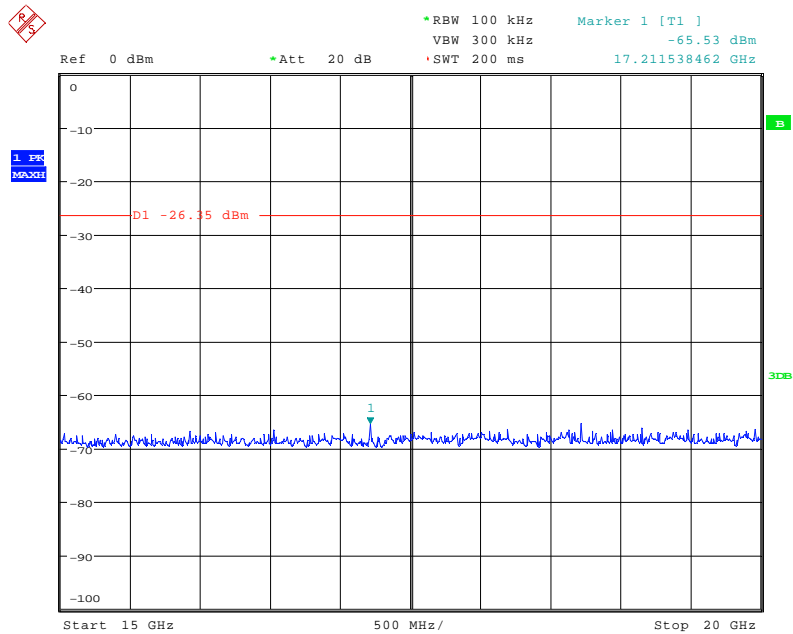
Date: 10.DEC.2010 10:02:47

Middle Channel Conducted Spurious emissions 10 GHz to 15GHz



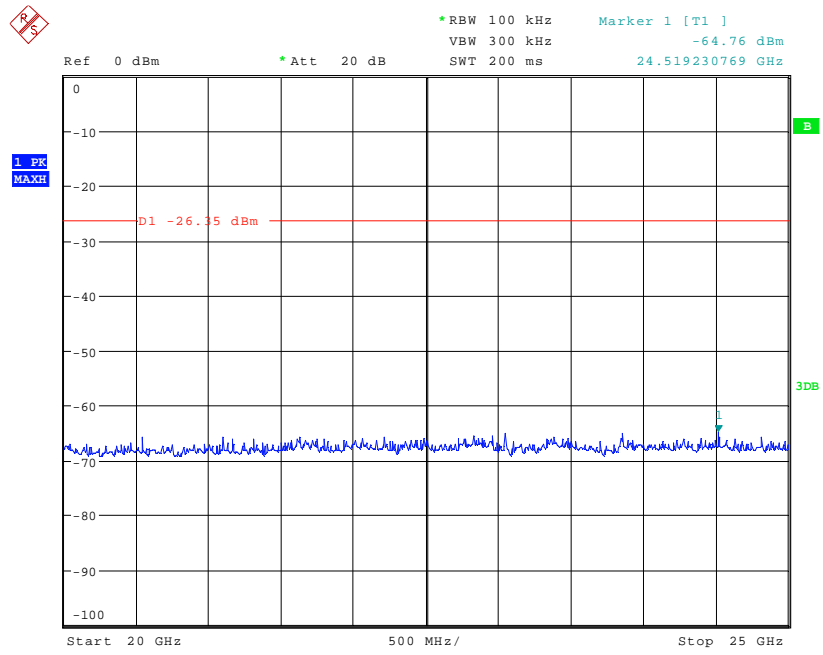
Date: 10.DEC.2010 10:03:27

Middle Channel Conducted Spurious emissions 15 GHz to 20GHz



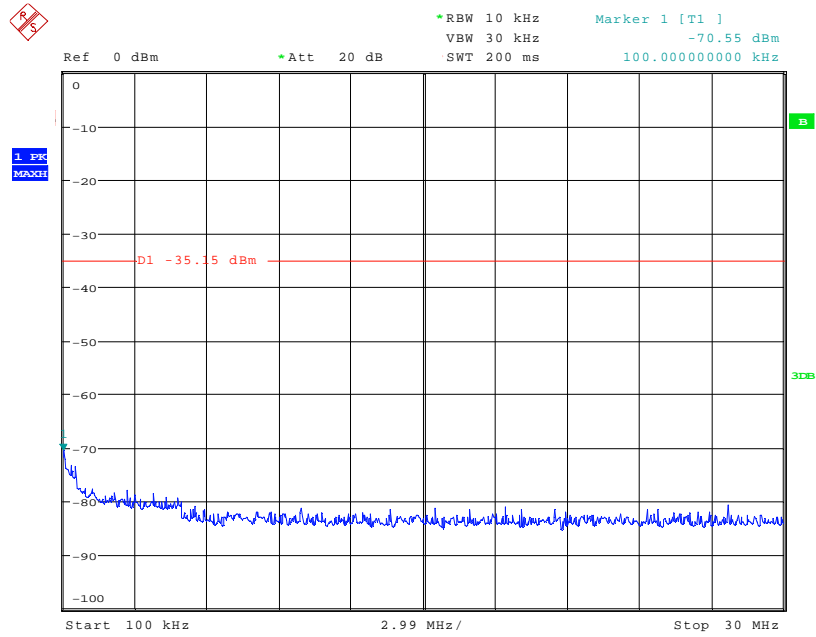
Date: 10.DEC.2010 10:04:08

Middle Channel Conducted Spurious emissions 20 GHz to 25GHz



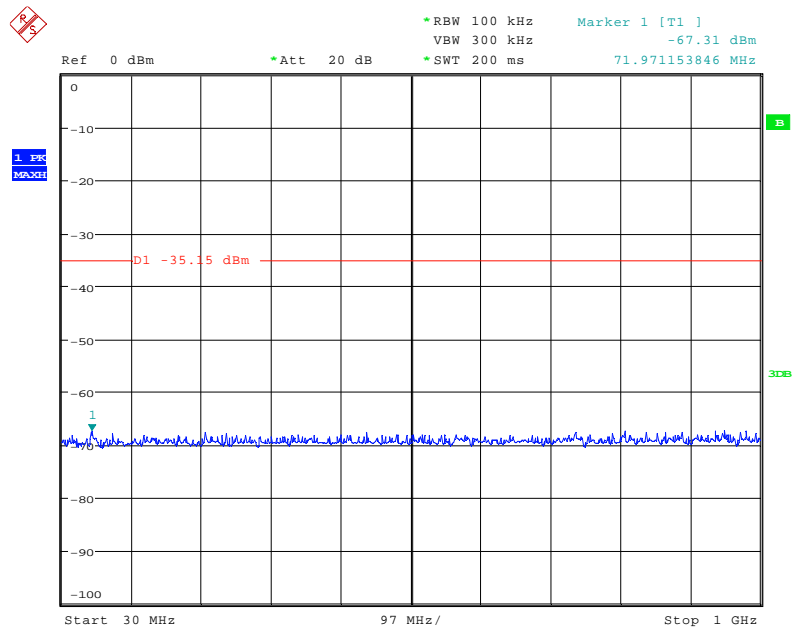
Date: 10.DEC.2010 10:04:55

Top Channel Conducted Spurious emissions 100 kHz to 30 MHz



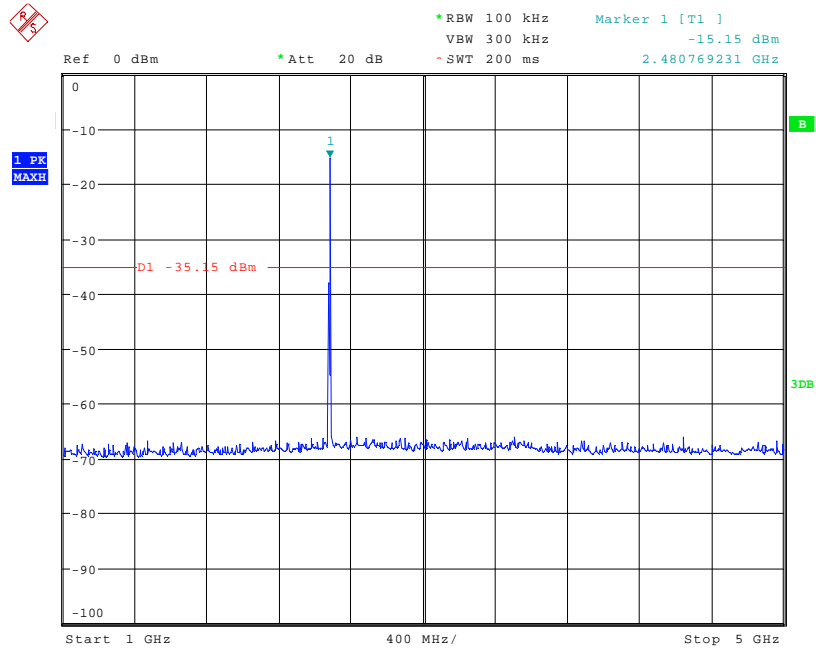
Date: 10.DEC.2010 10:12:34

Top Channel Conducted Spurious emissions 30 MHz to 1 GHz



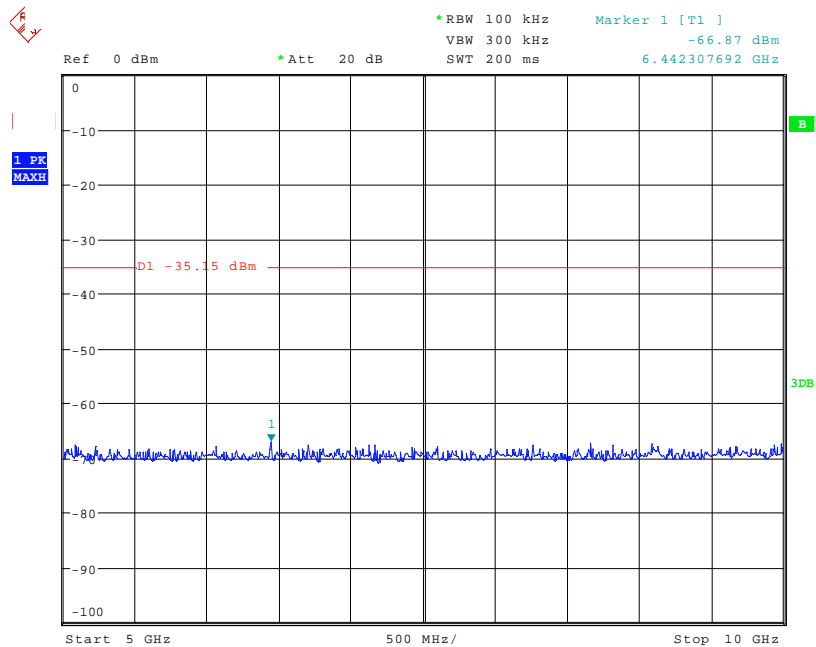
Date: 10.DEC.2010 10:13:44

Top Channel Conducted Spurious emissions 1 GHz to 5 GHz



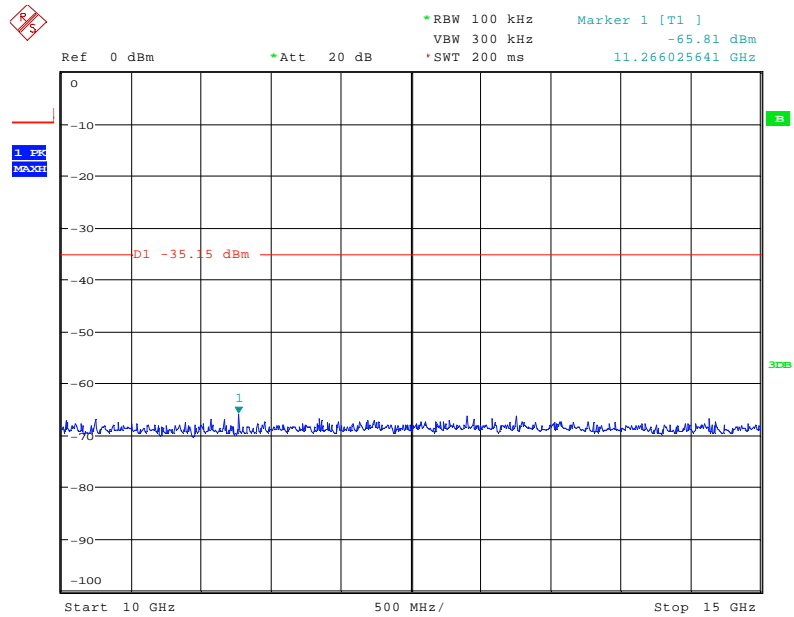
Date: 10.DEC.2010 10:08:38

Top Channel Conducted Spurious emissions 5 GHz to 10 GHz



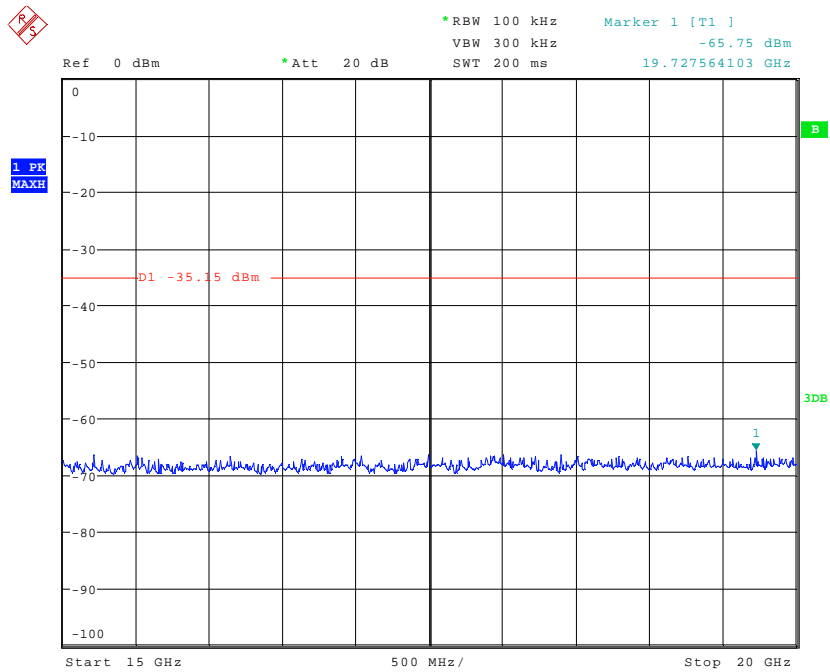
Date: 10.DEC.2010 10:09:16

Top Channel Conducted Spurious emissions 10 GHz to 15 GHz



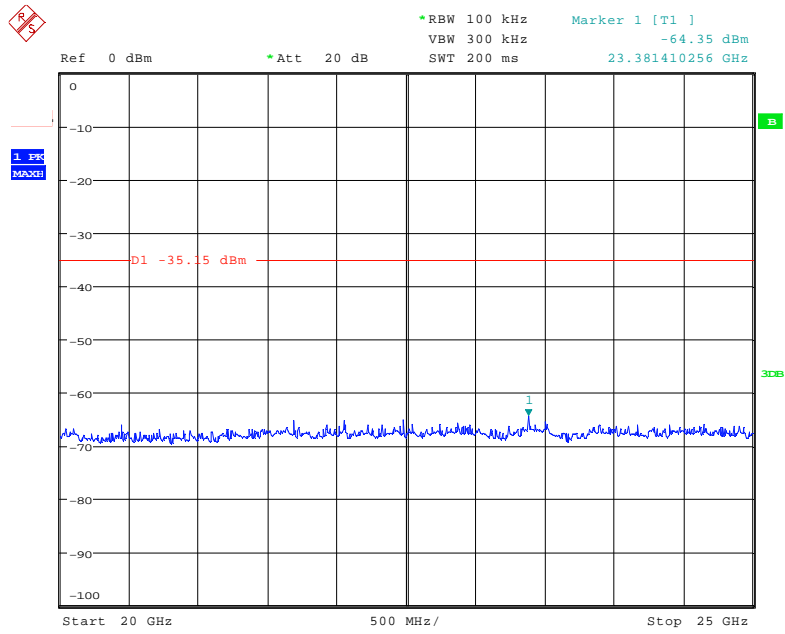
Date: 10.DEC.2010 10:10:03

Top Channel Conducted Spurious emissions 15 GHz to 20 GHz



Date: 10.DEC.2010 10:10:43

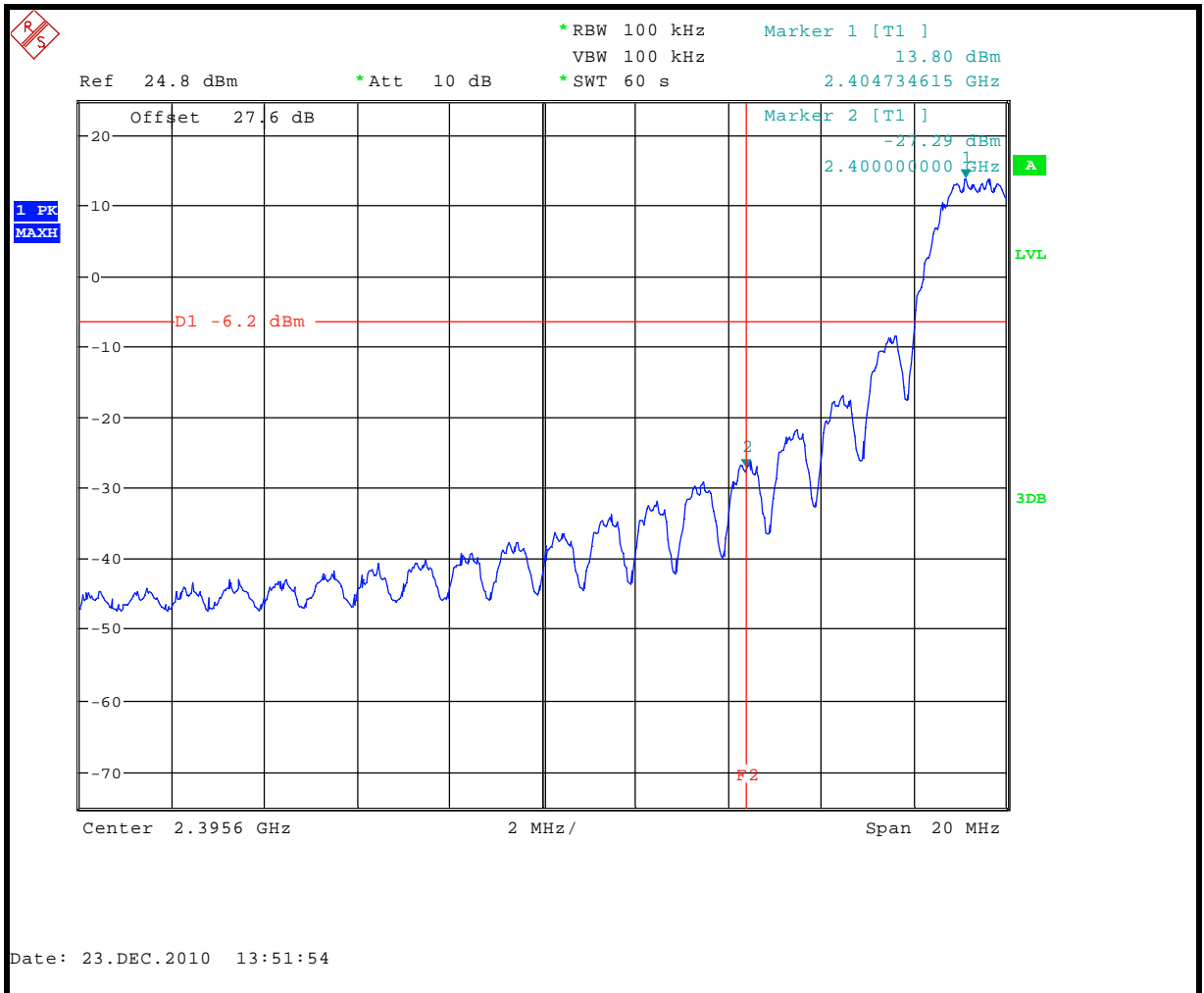
Top Channel Conducted Spurious emissions 20 GHz to 25 GHz



Date: 10.DEC.2010 10:11:23

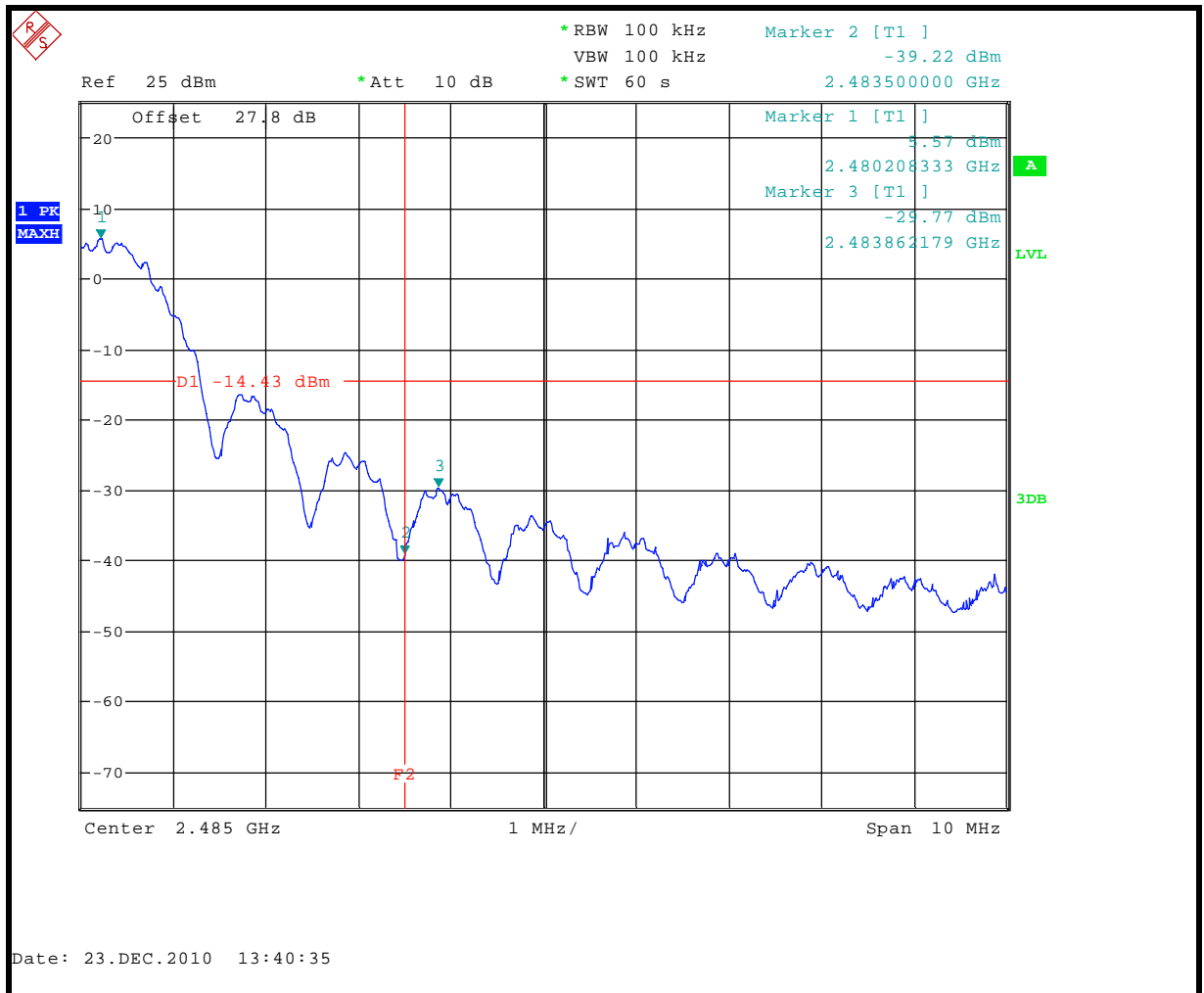
Conducted Bandedge Compliance

Lower Bandedge

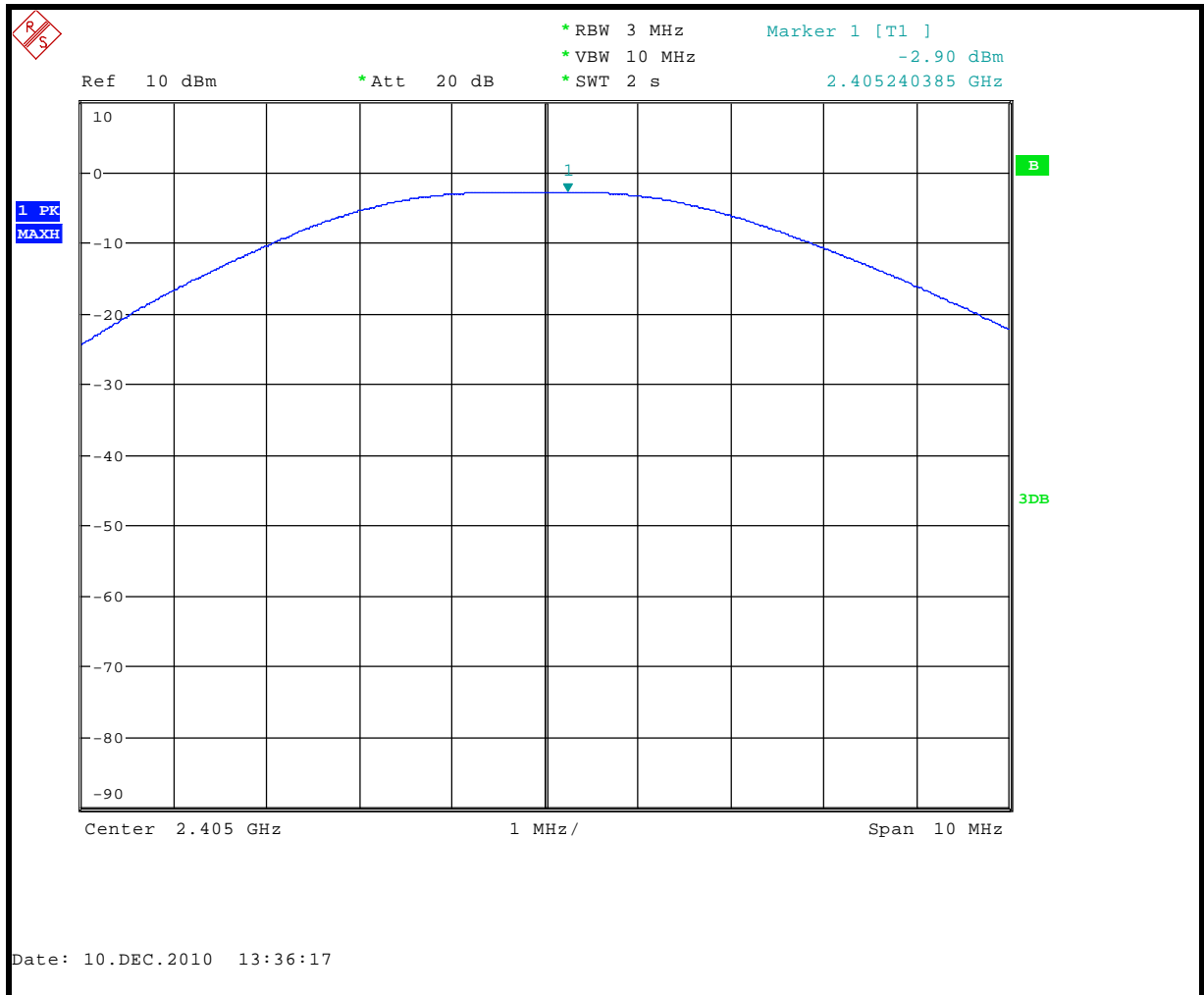


Conducted Bandedge Compliance

Upper Bandedge



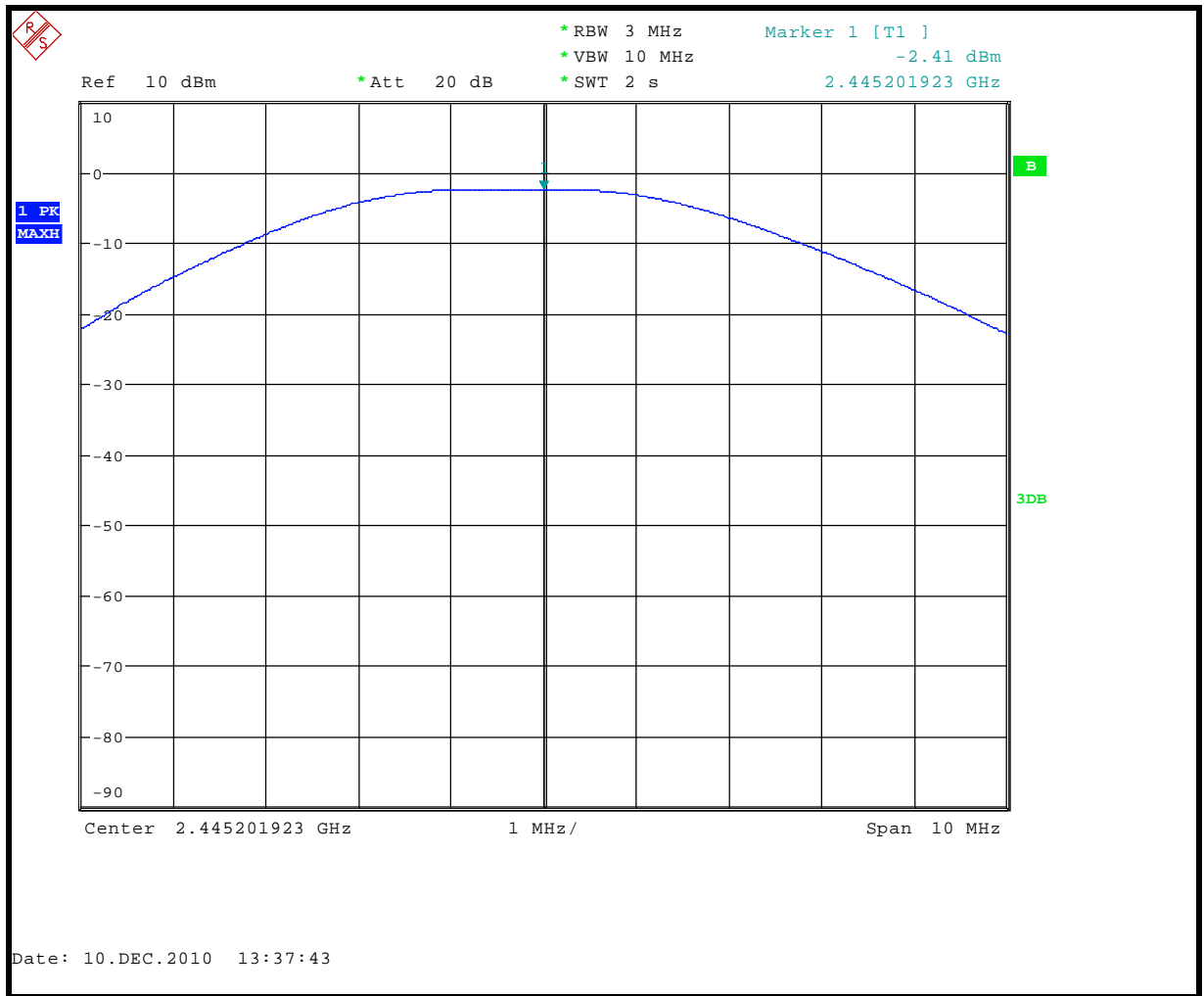
Bottom Channel Conducted carrier power



The above plot does not take into account the cable and attenuation loss

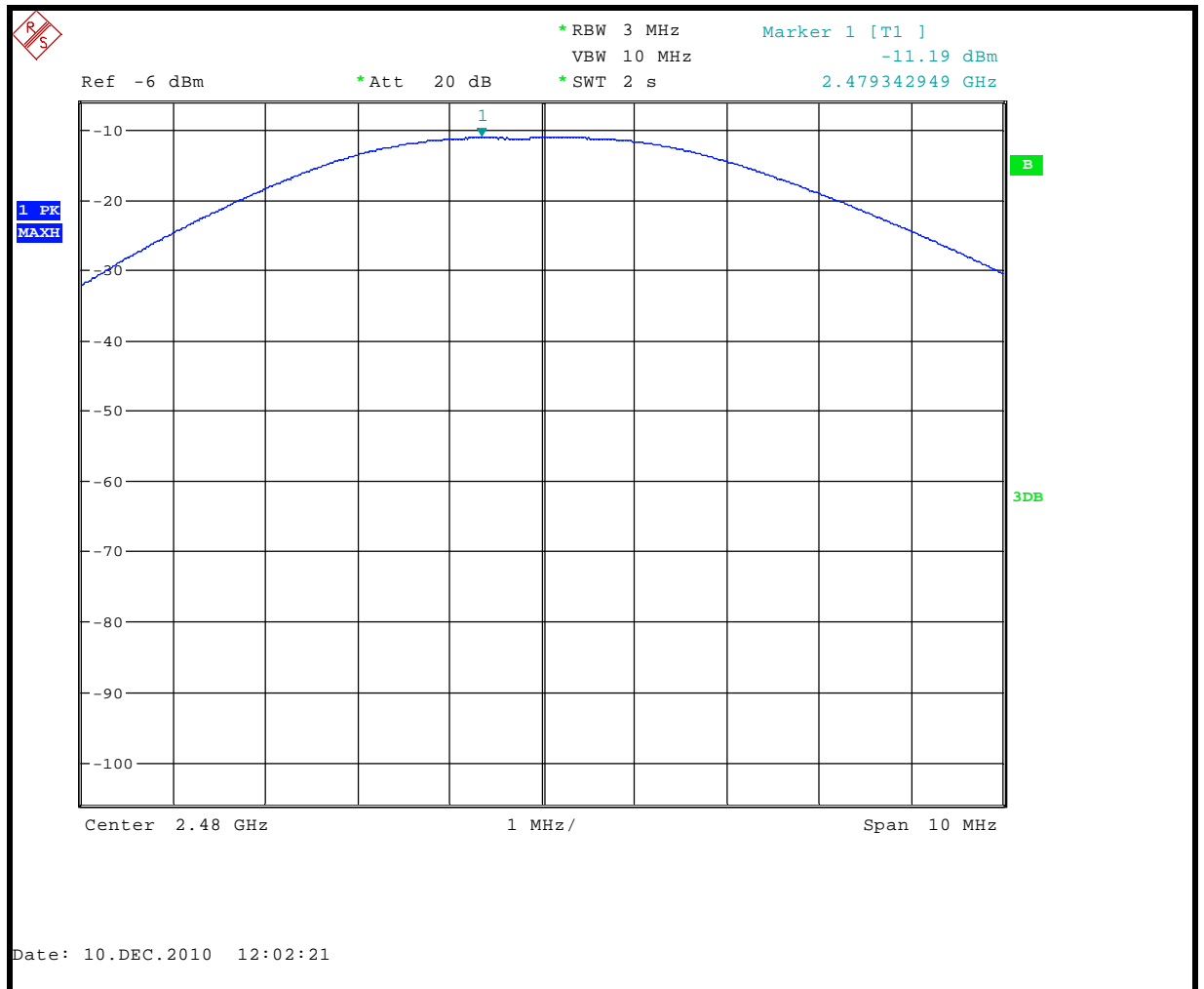
Recorded Tx carrier power = - 2.90dBm + 20dBm system loss = 17.10 dBm Carrier Power

Middle Channel Conducted carrier power



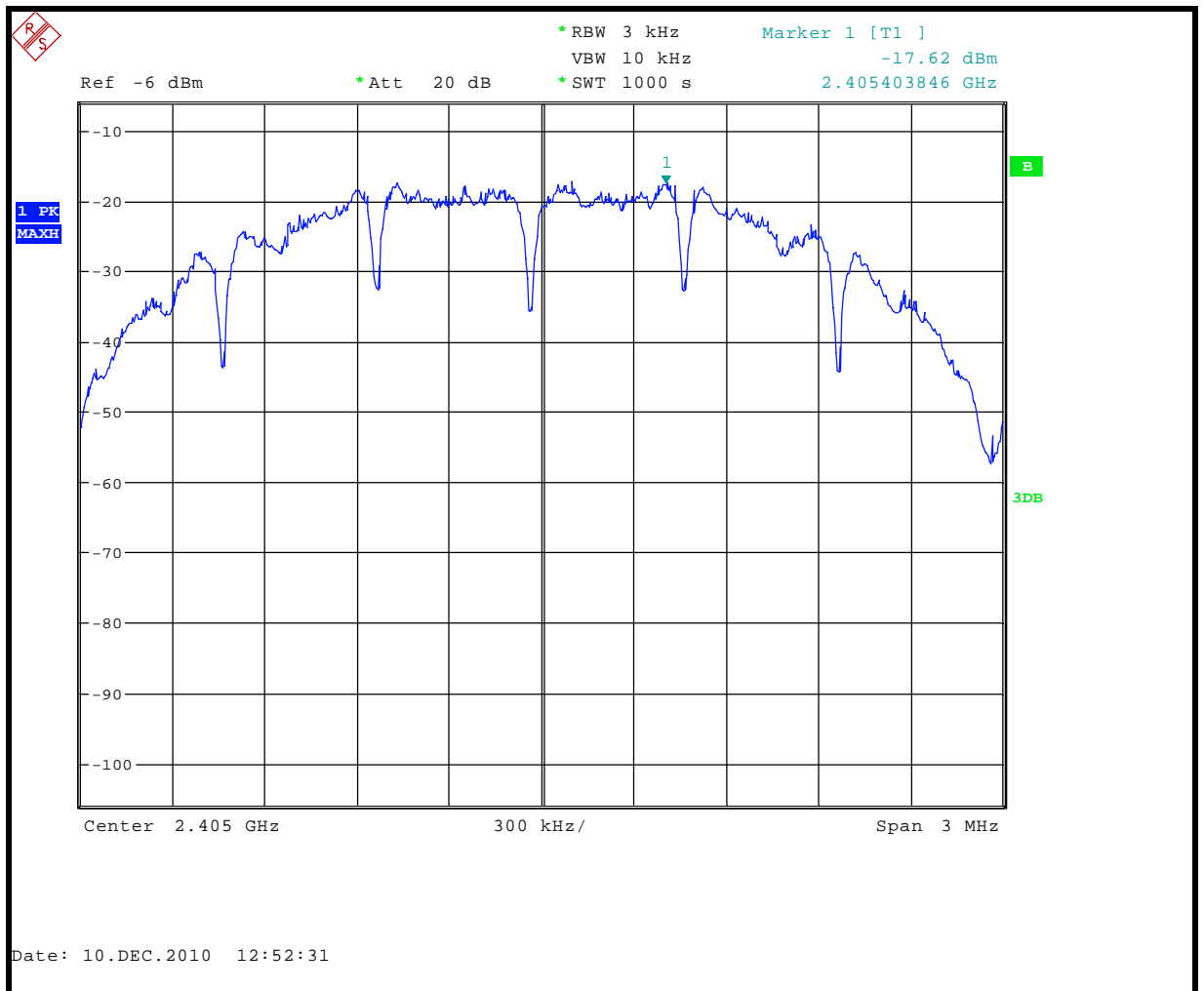
Recorded Tx carrier power = - 2.41dBm + 20dBm system loss = 17.59dBm Carrier Power

Top Channel Conducted carrier power



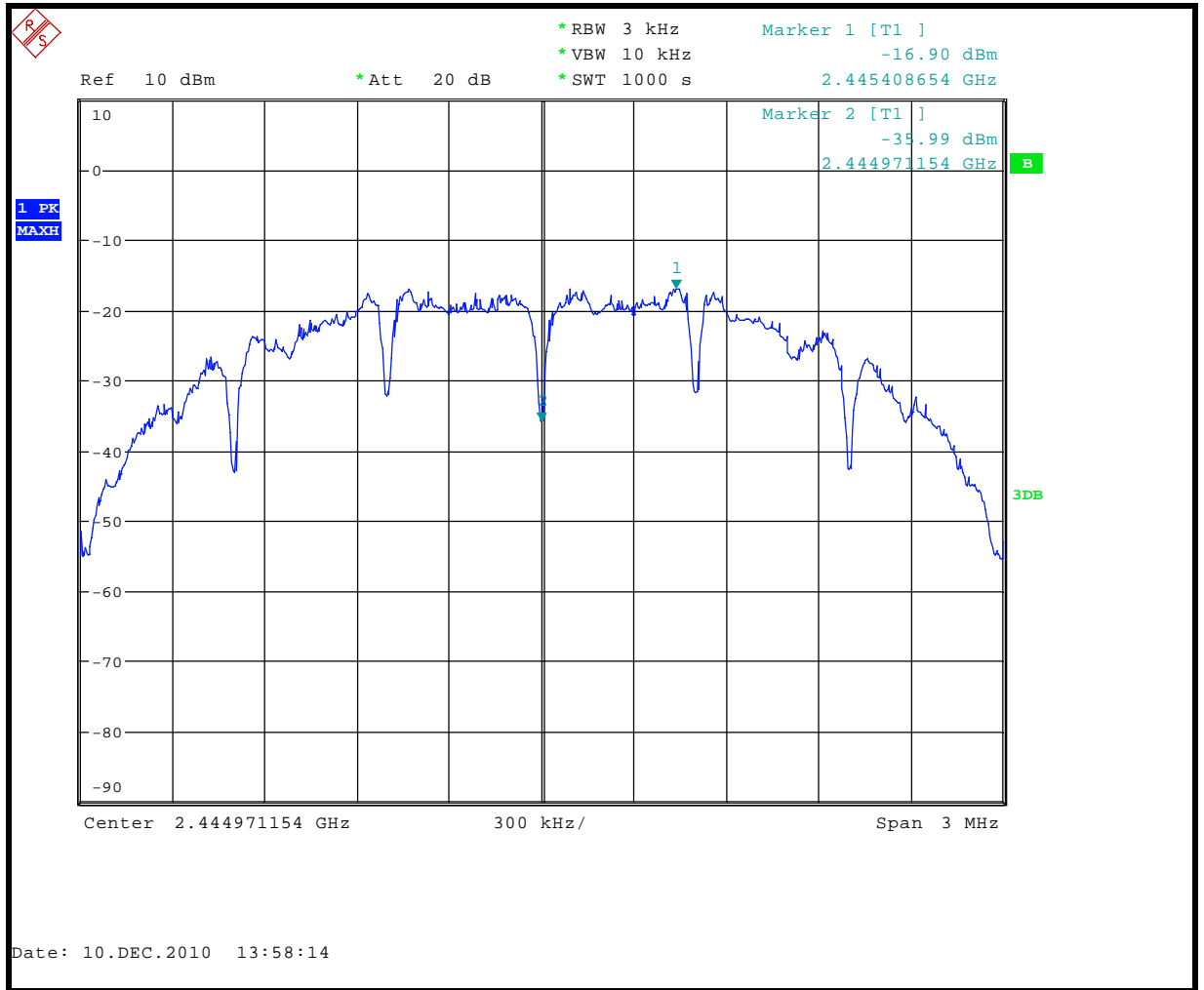
Recorded Tx carrier power = - 11.19dBm + 20dBm system loss = 8.81dBm Carrier Power

Bottom Channel Power Spectral Density



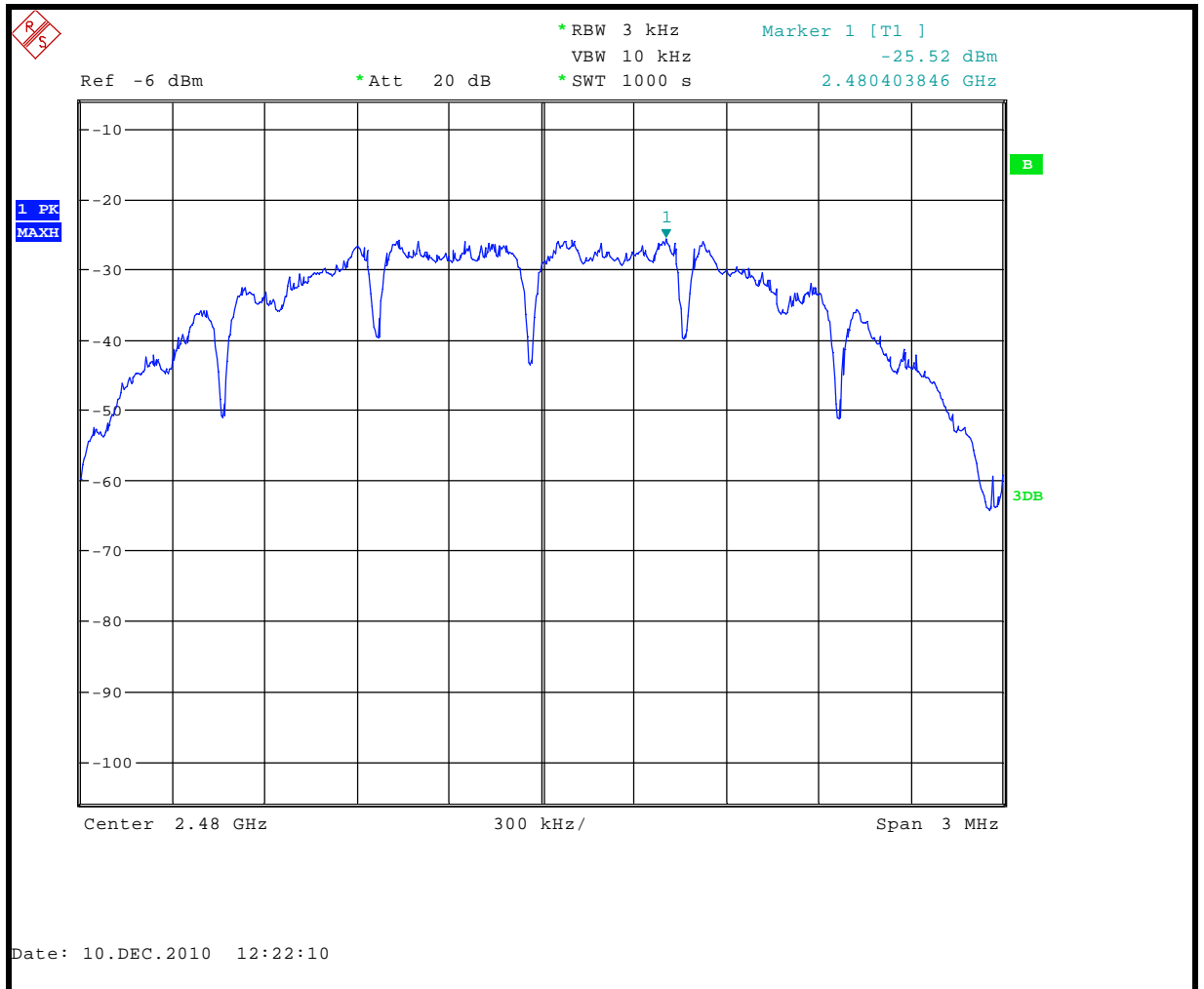
Recorded power Spectral Density = -17.62dBm + 20dBm system loss
 = a power Spectral Density 2.38dBm /3kHz

Middle Channel Power Spectral Density



Recorded power Spectral Density = -16.90dBm + 20dBm system loss
 = a power Spectral Density 3.10dBm /3kHz

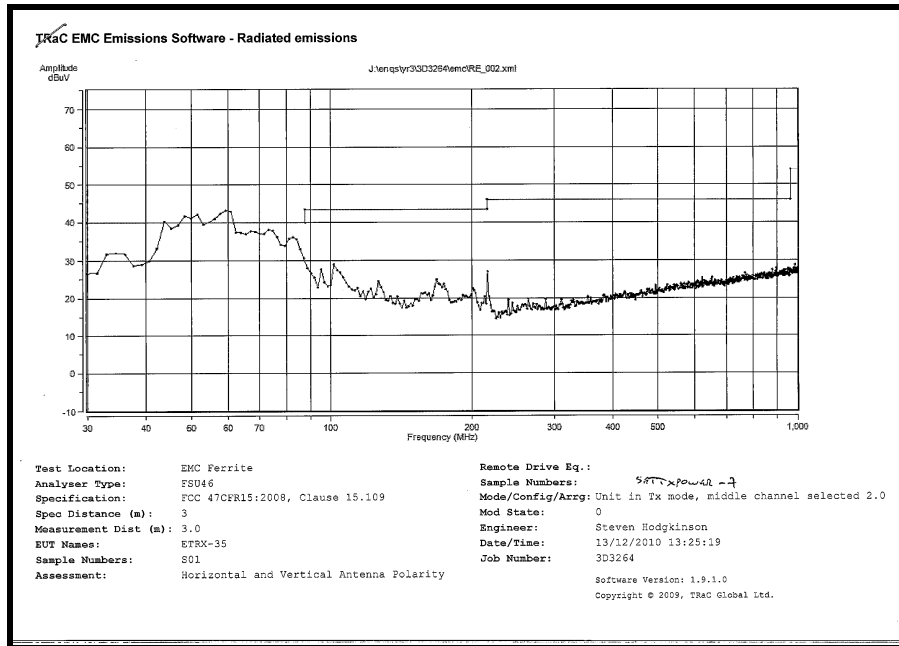
Top Channel Power Spectral Density



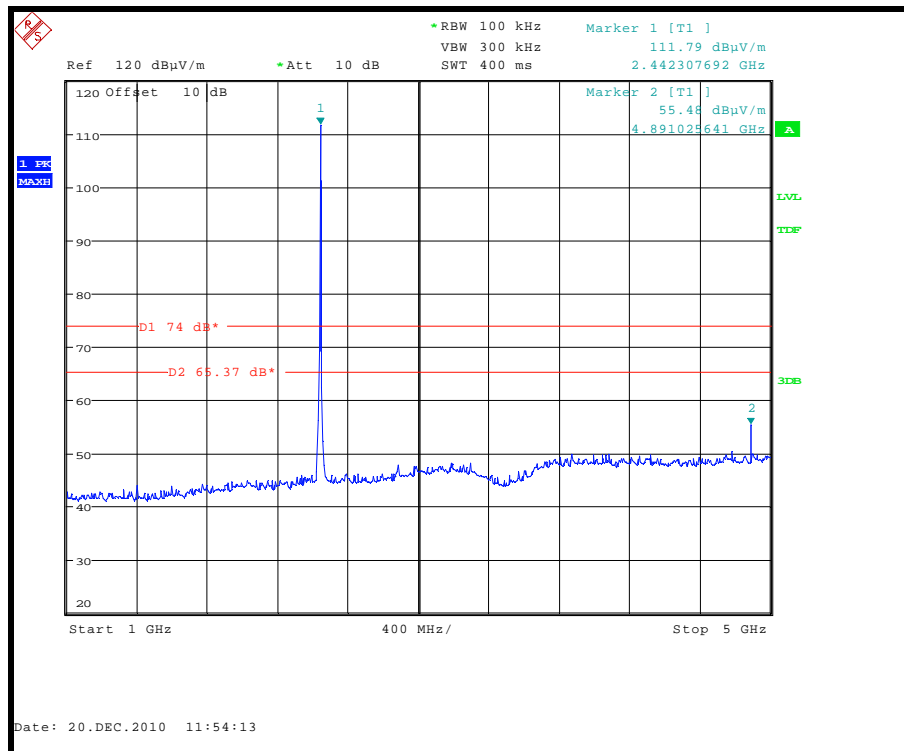
Recorded power Spectral Density = -25.52dBm + 20dBm system loss
 = a power Spectral Density -5.52dBm /3kHz

Plots showing highest output channel plots of each antenna type used.

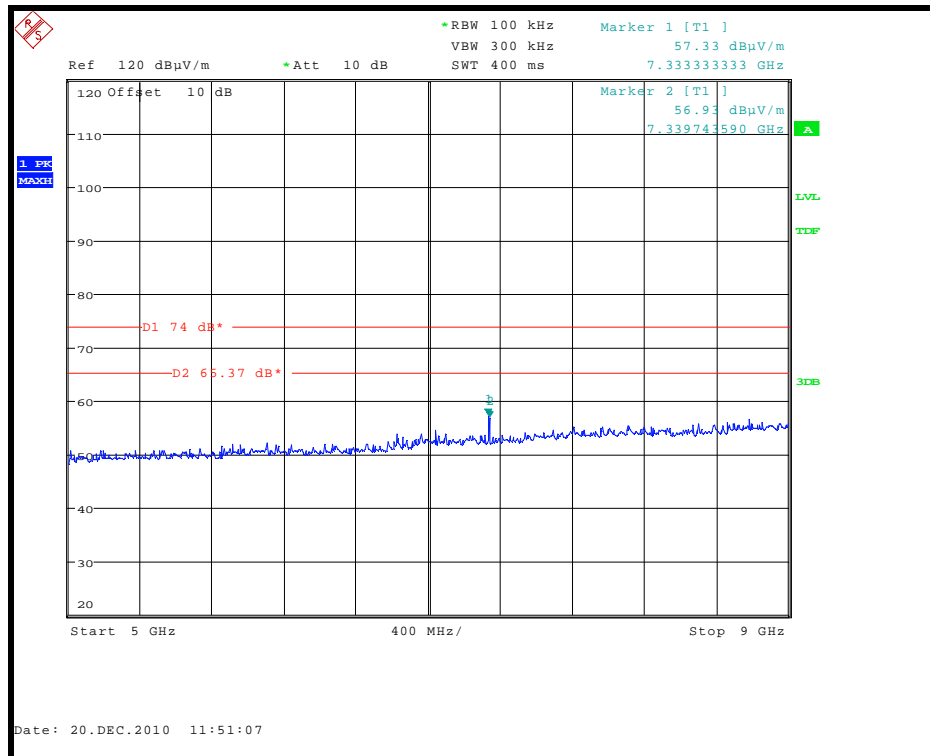
Middle channel 2.0 dBi Antenna Radiated Spurious emissions 30 MHz to 1 GHz



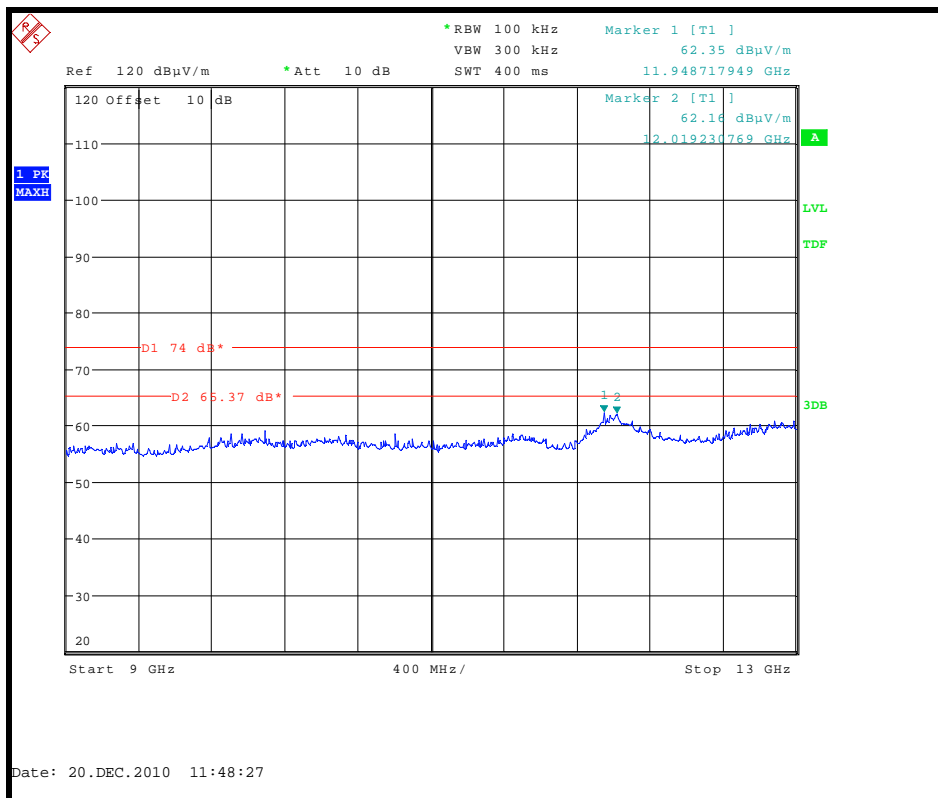
Radiated Spurious emissions 1 GHz to 5 GHz



Radiated Spurious emissions 5 GHz to 9 GHz



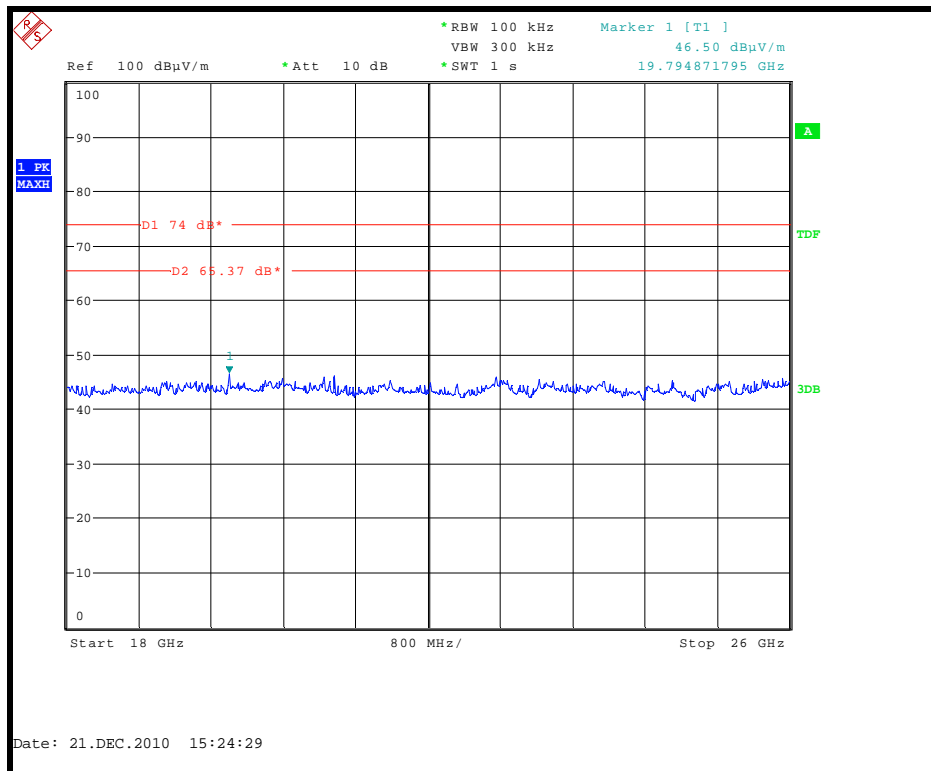
Radiated Spurious emissions 9 GHz to 13 GHz



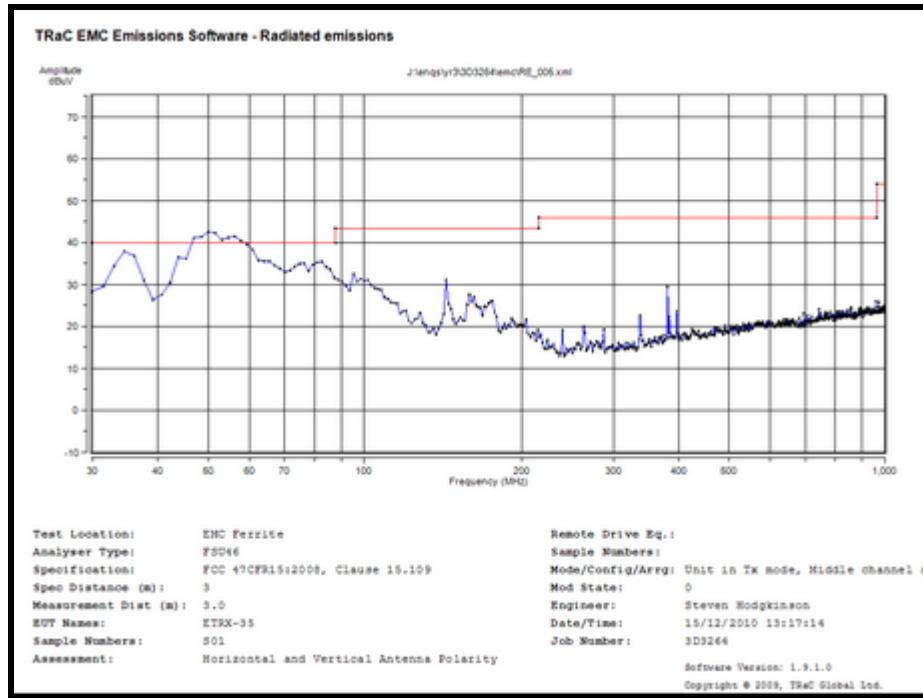
Radiated Spurious emissions 13 GHz to 18GHz



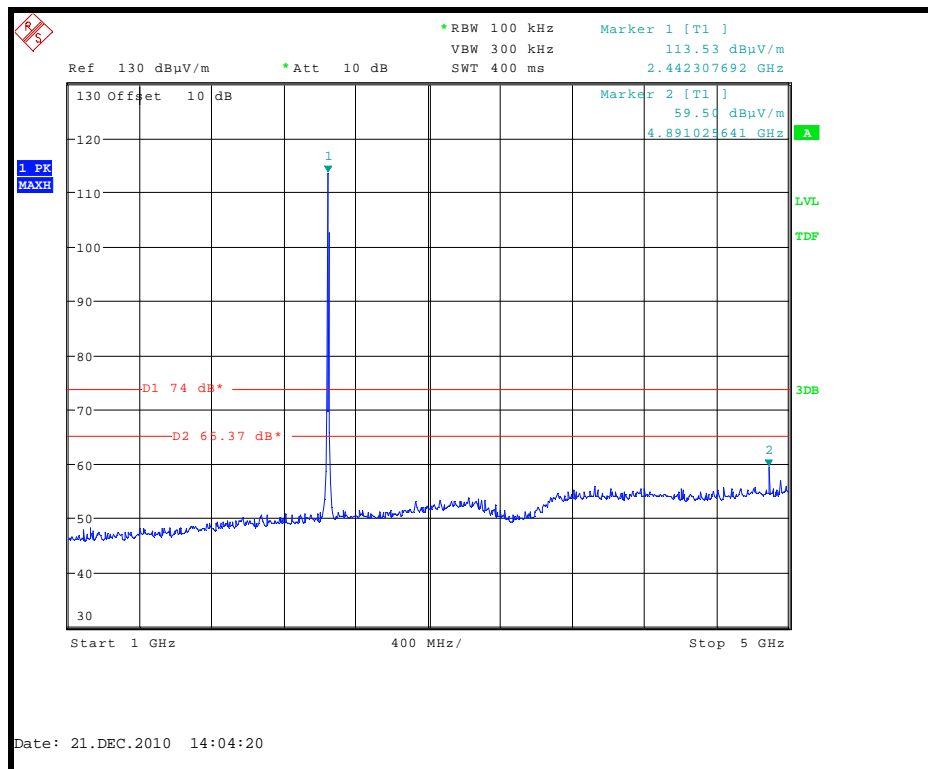
Radiated Spurious emissions 18 GHz to 25 GHz



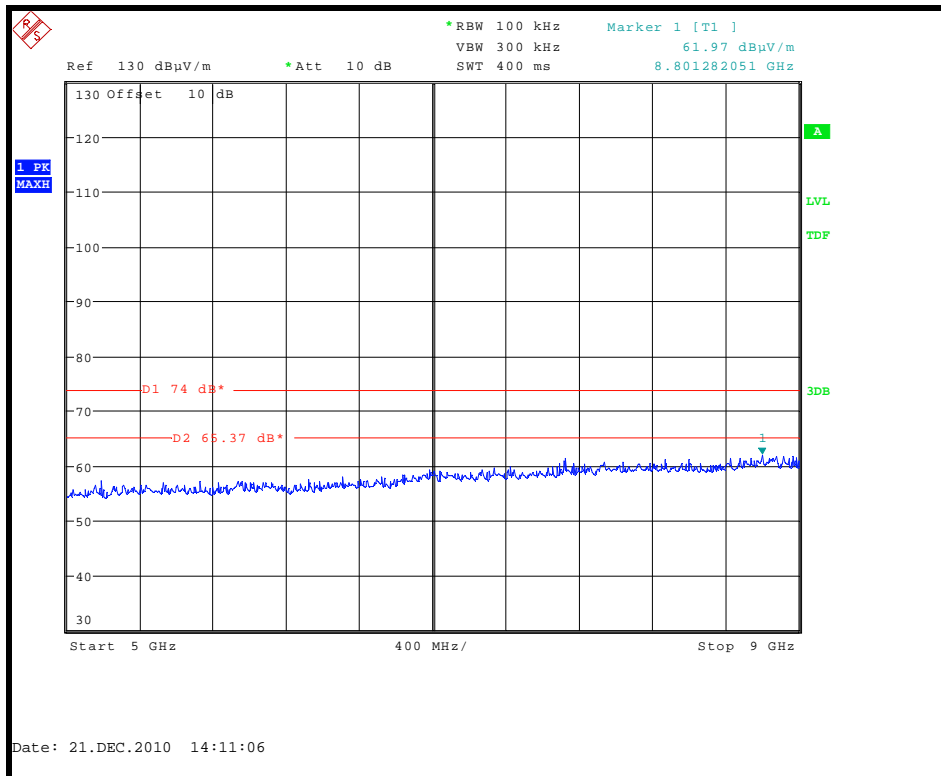
Middle channel 0 dBi Antenna Radiated Spurious emissions 30 MHz to 1 GHz



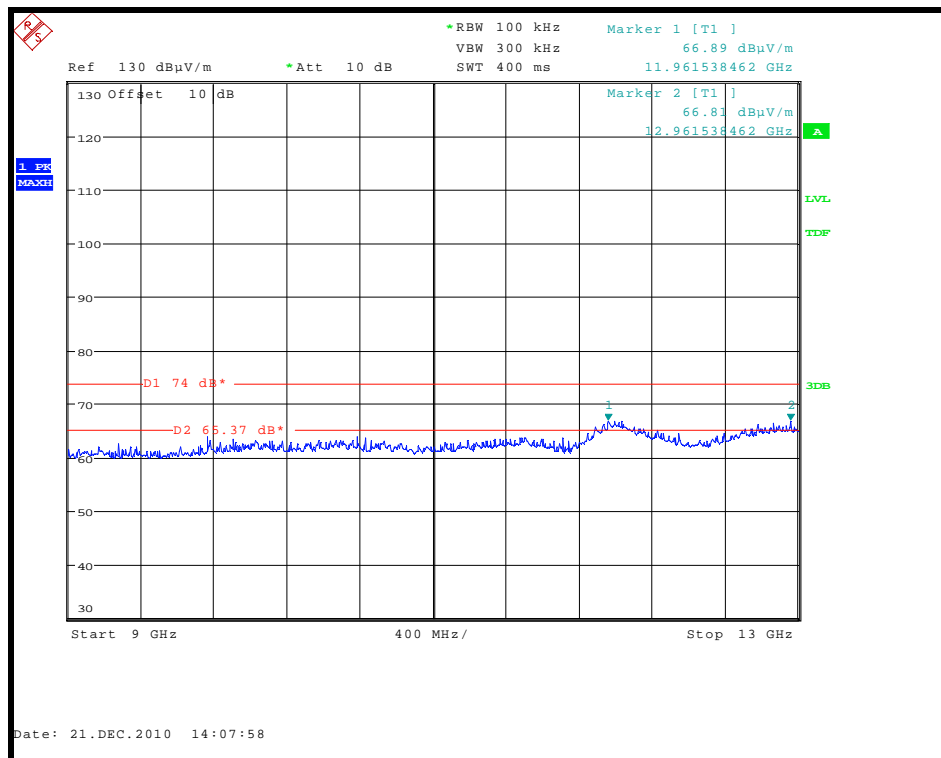
Radiated Spurious emissions 1 GHz to 5 GHz



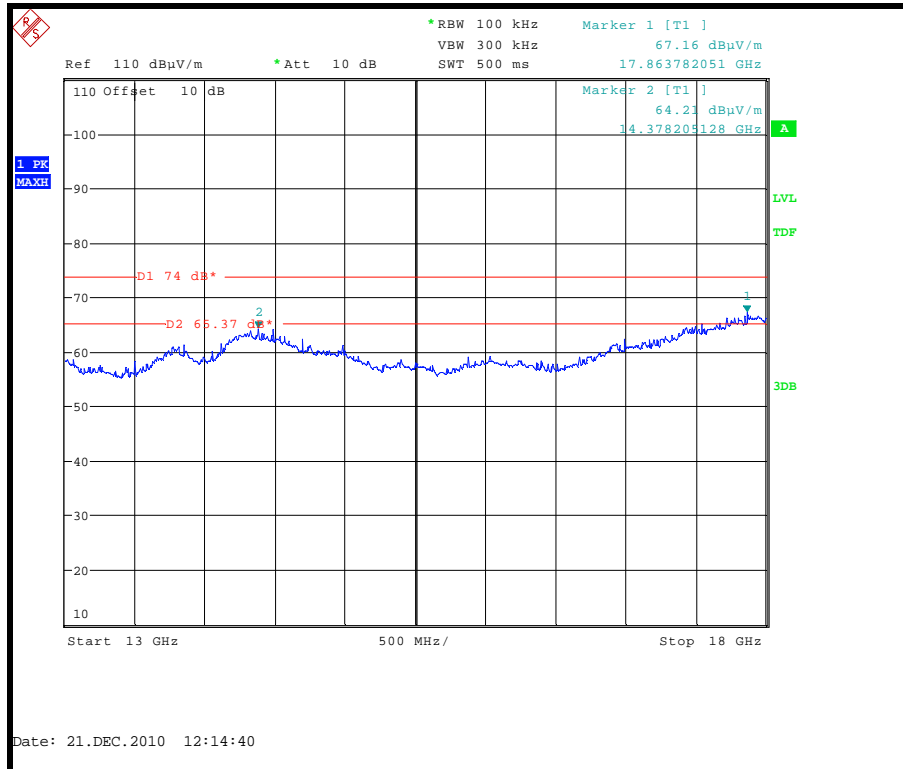
Radiated Spurious emissions 5 GHz to 9 GHz



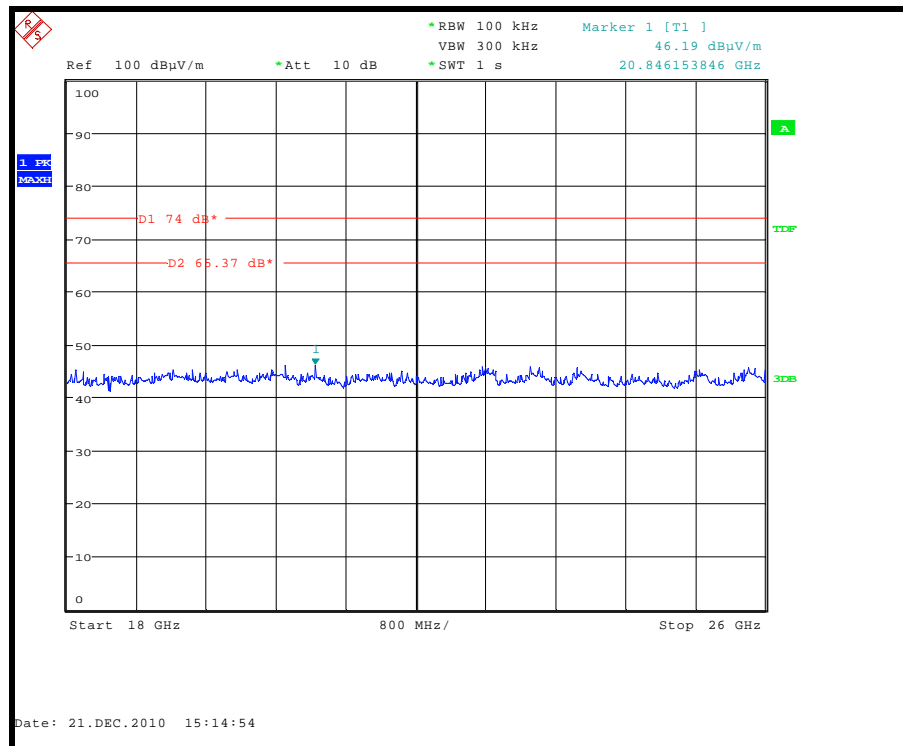
Radiated Spurious emissions 9 GHz to 13 GHz



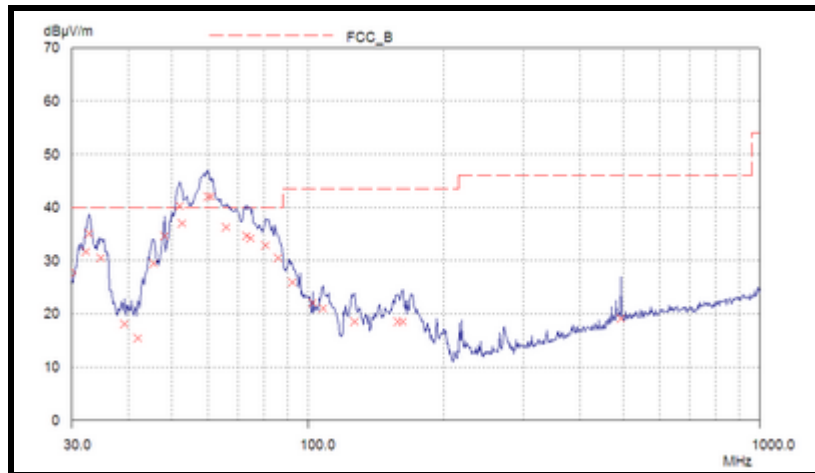
Radiated Spurious emissions 13 GHz to 18GHz



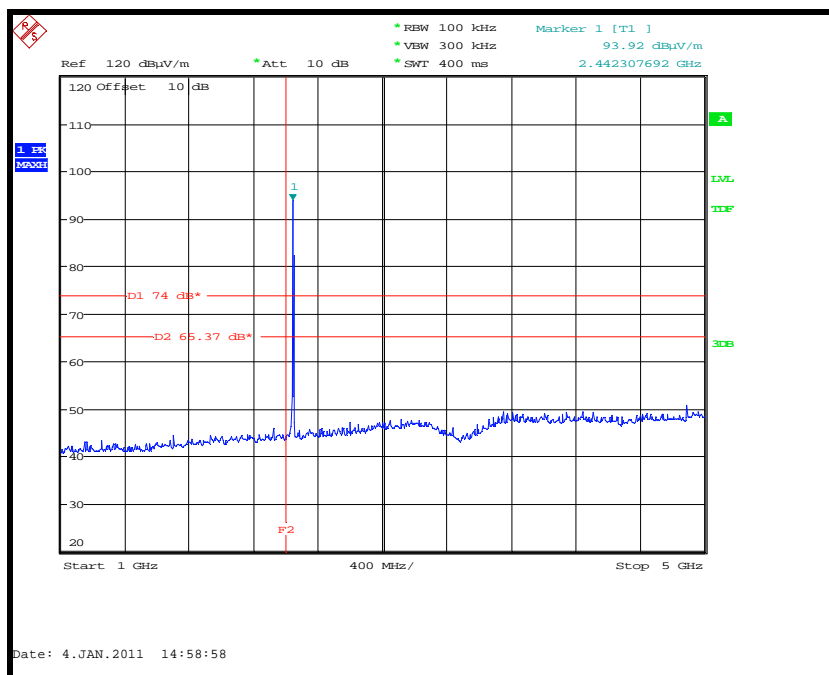
Radiated Spurious emissions 18 GHz to 25 GHz



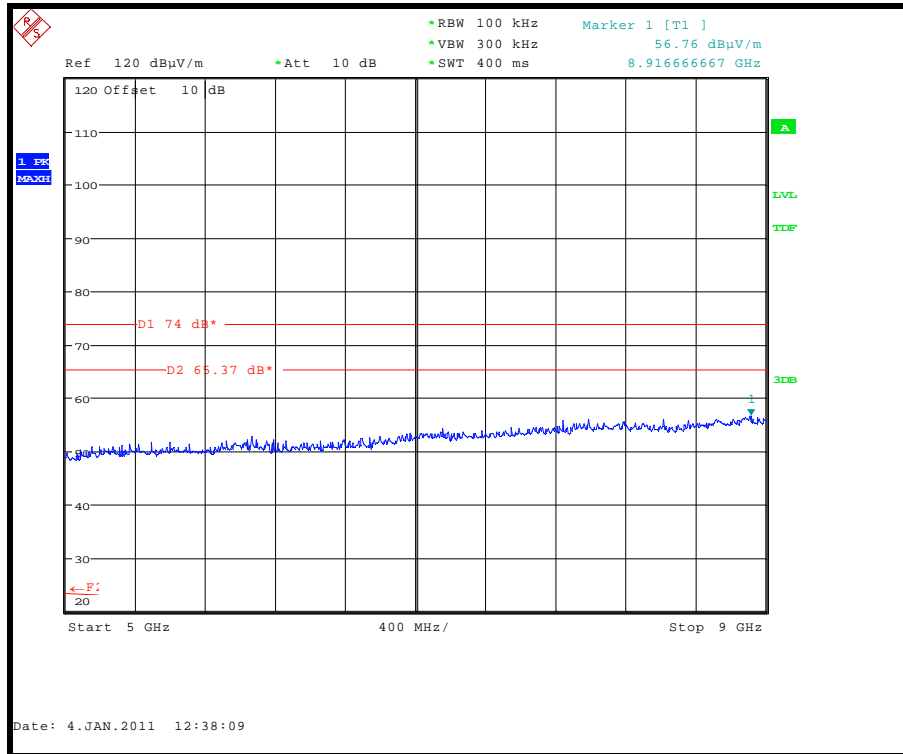
Middle channel chip Antenna Radiated Spurious emissions 30 MHz to 1 GHz



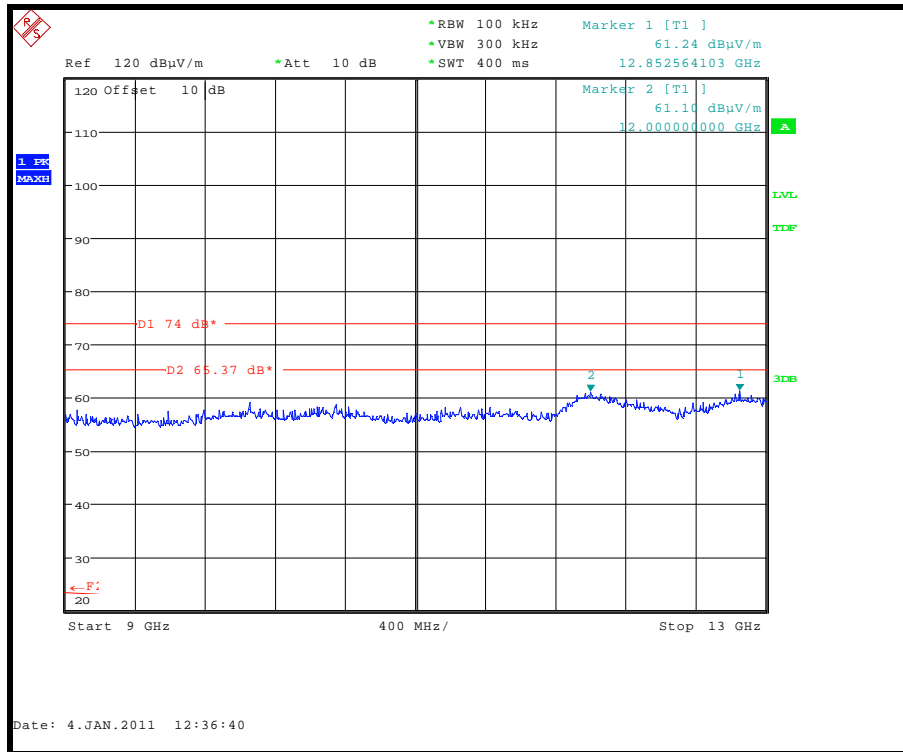
Radiated Spurious emissions 1 GHz to 5 GHz



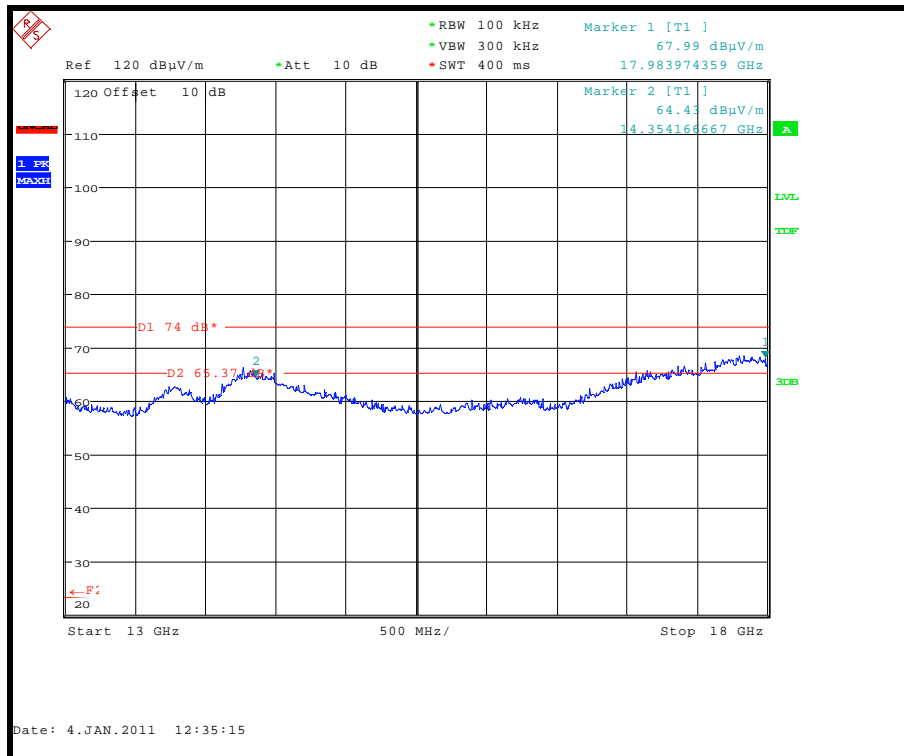
Radiated Spurious emissions 5 GHz to 9 GHz



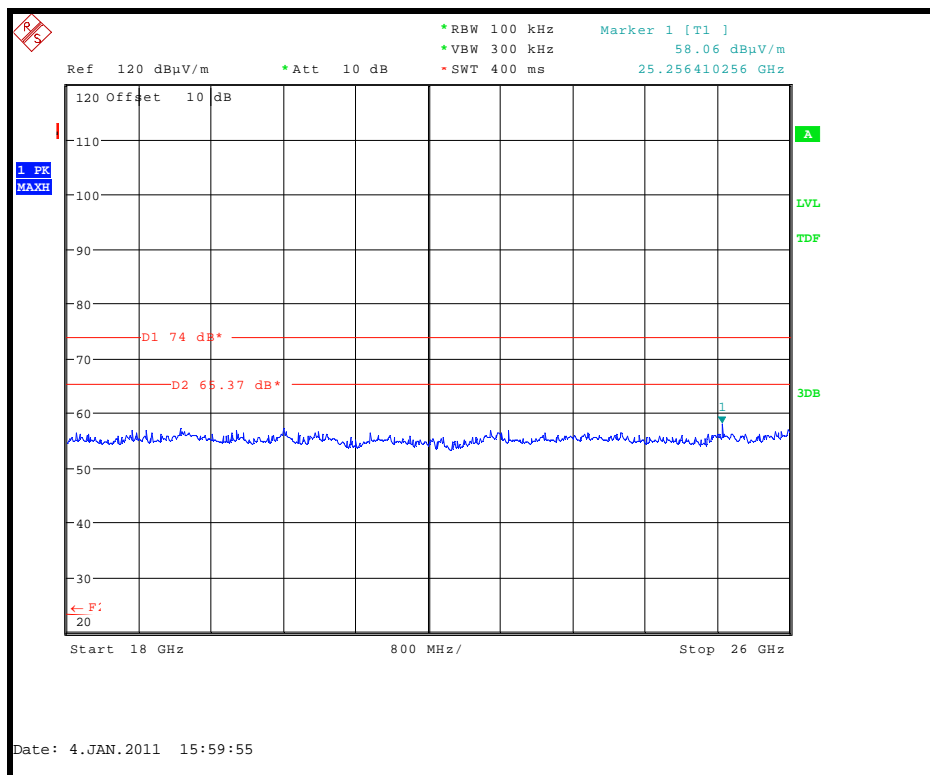
Radiated Spurious emissions 9 GHz to 13 GHz



Radiated Spurious emissions 13 GHz to 18GHz

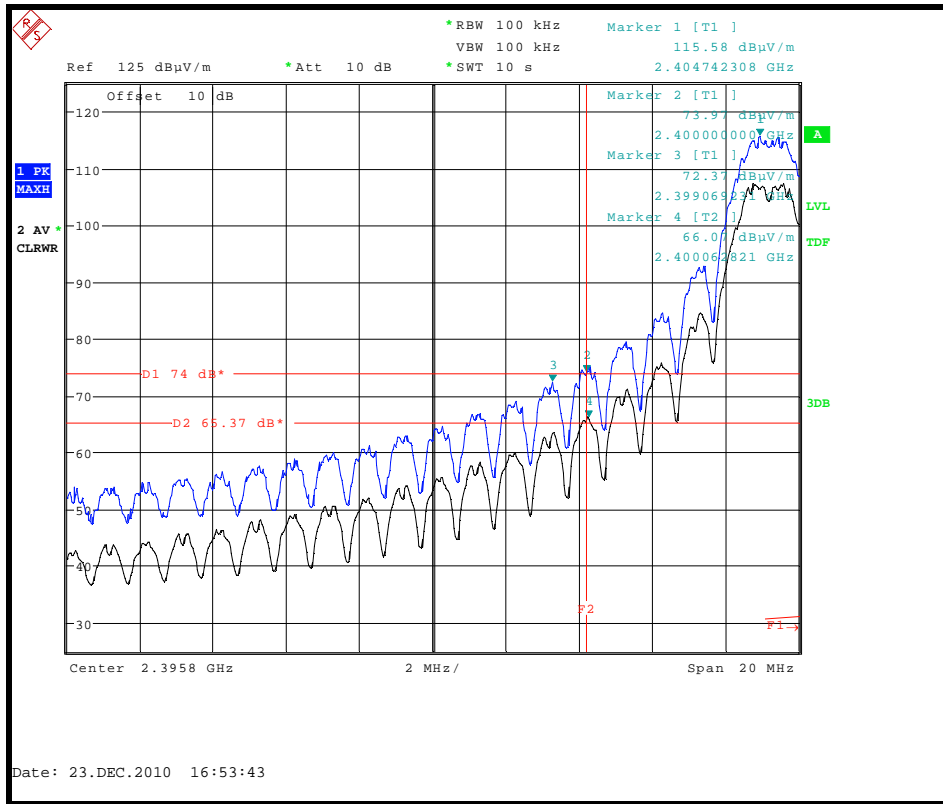


Radiated Spurious emissions 18 GHz to 25 GHz

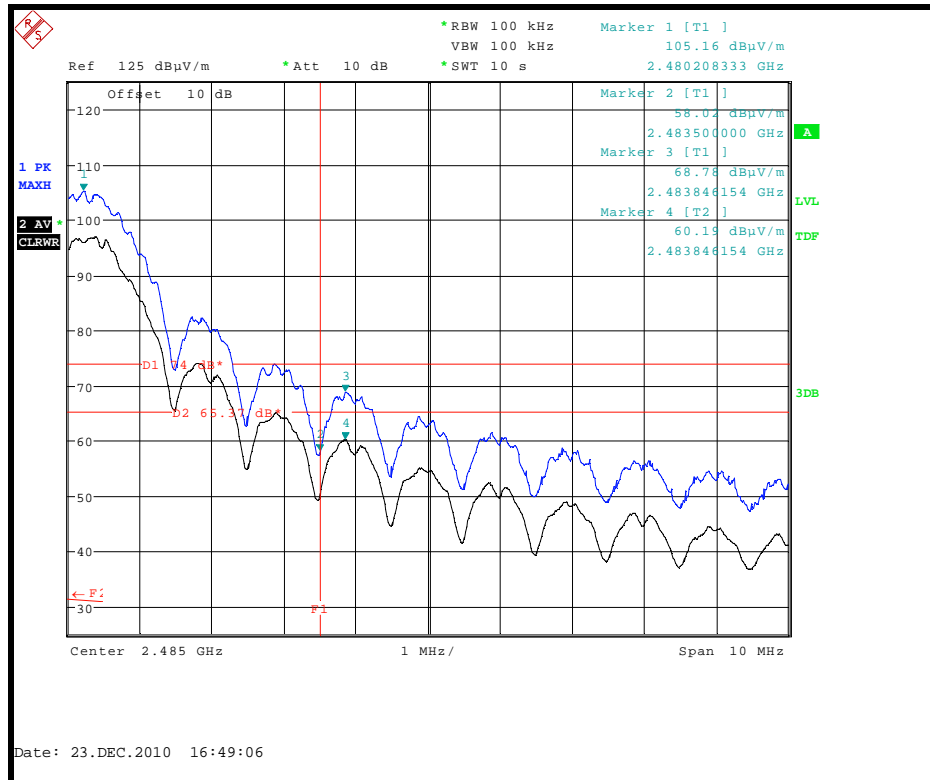


Radiated Bandedge Compliance 0dBi Antenna

Lower Bandedge

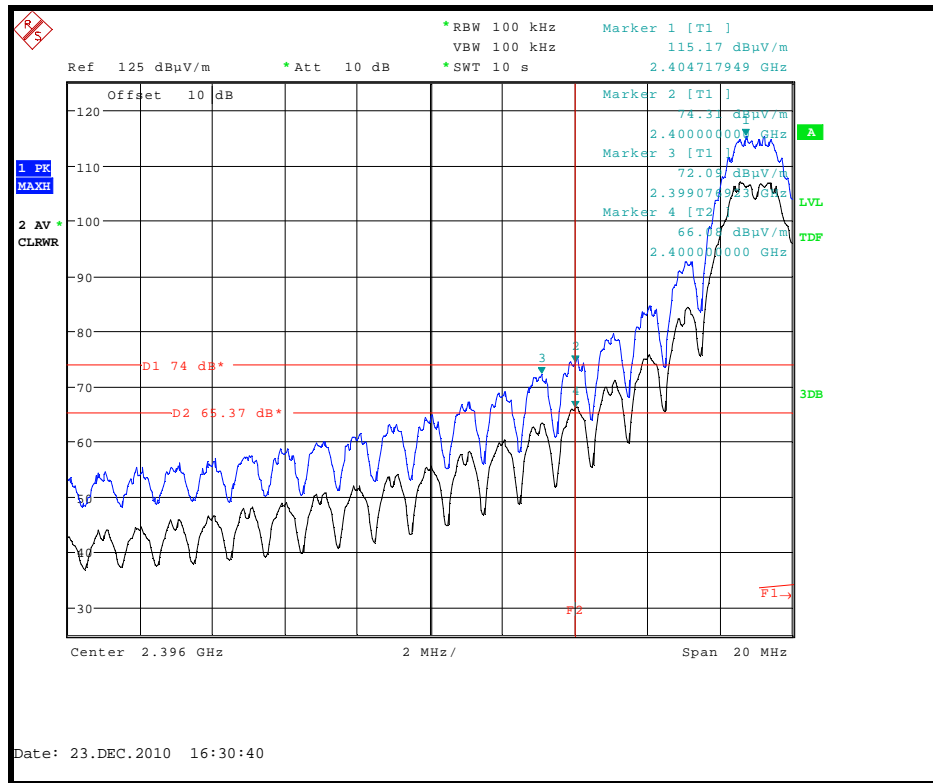


Upper Bandedge

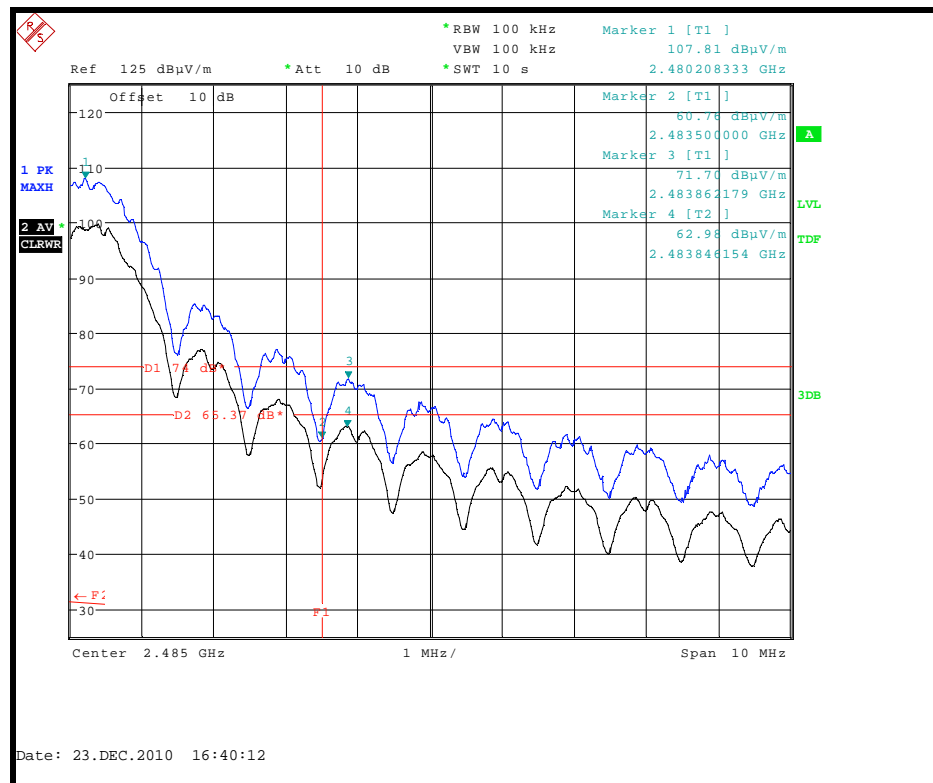


Radiated Bandedge Compliance 2dBi Antenna

Lower Bandedge

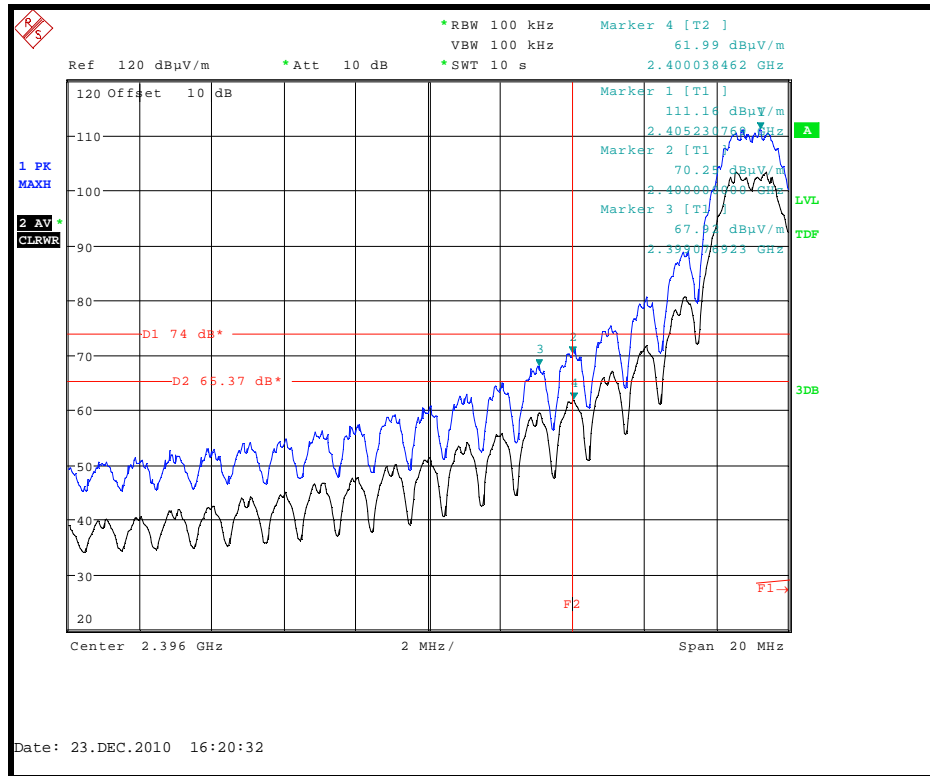


Upper Bandedge

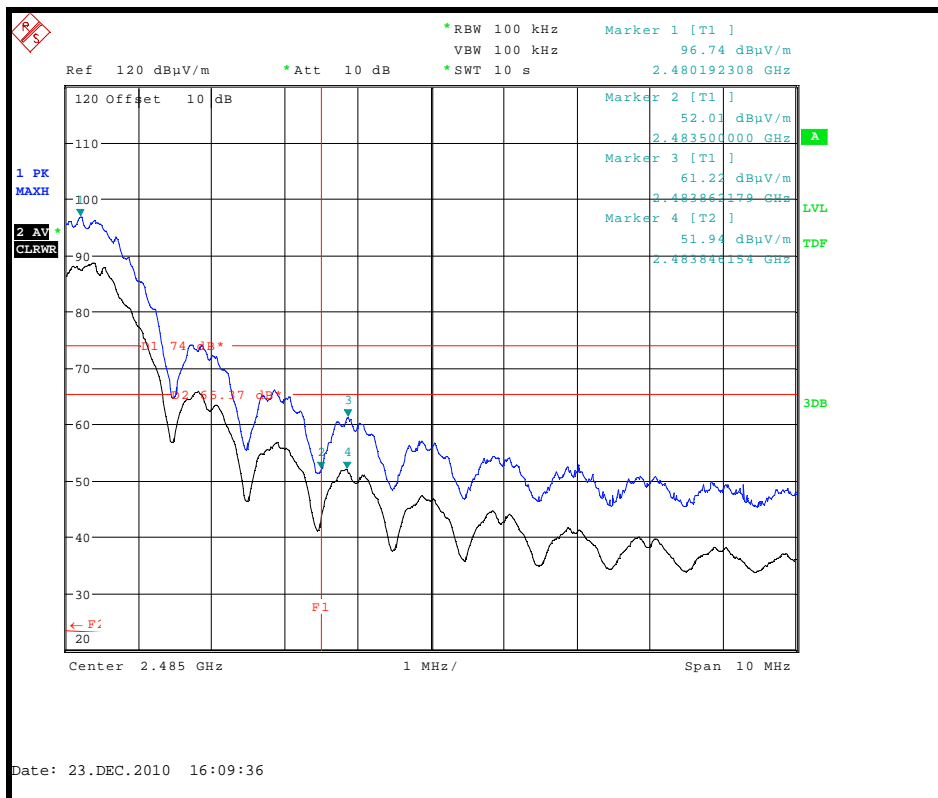


Radiated Bandedge Compliance Chip Antenna

Lower Bandedge



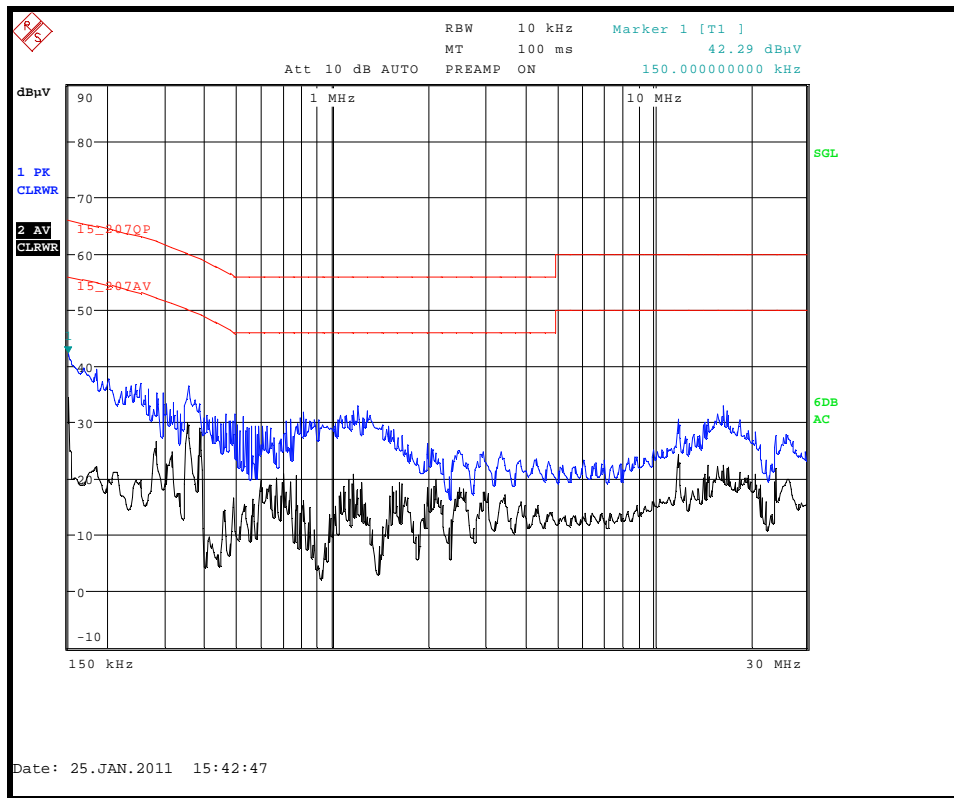
Upper Bandedge



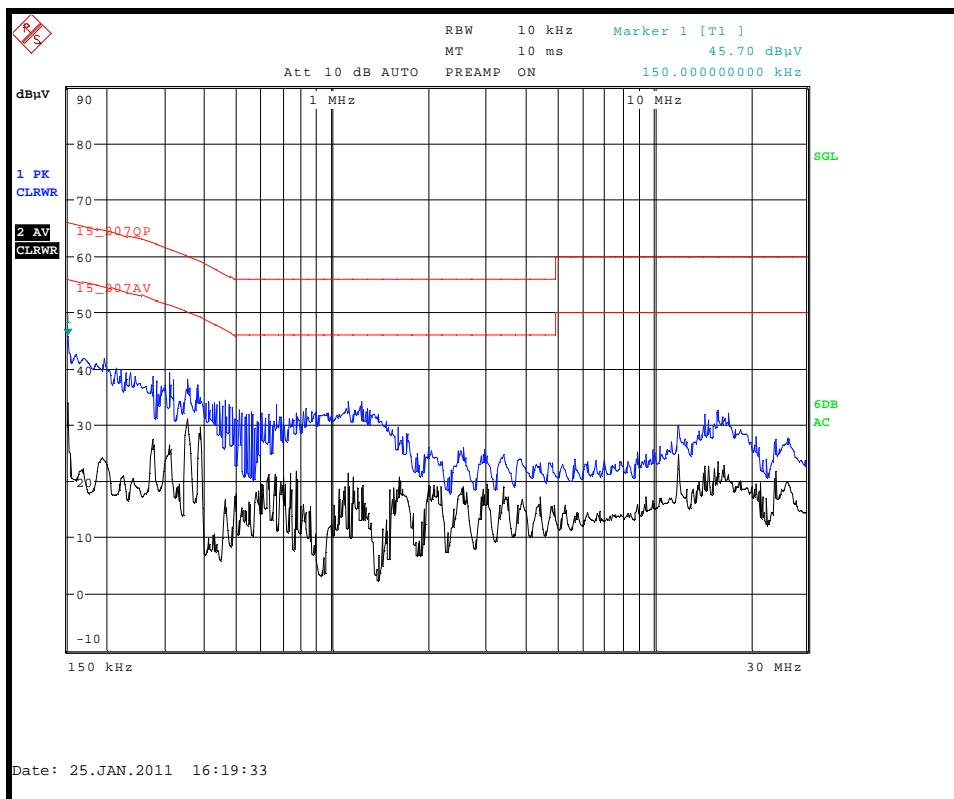
Note: Radiated Bandedge

- (1) The measurements at 2400 MHz and 2483.5 MHz were made to ensure bandedge compliance.
- (2) The lower bandedge level falls into the -20dBc band 2.390GHz – 2.40GHz. the markers are set on the bandedge to record the level at the bandedge.
- (3) The Upper bandedge 2.4835GHz – 2.5GHz is a restricted band therefore the highest emission level falling into this band is recorded by the marker, and checked for compliance against the limit.
- (4) The upper Bandedge and radiated emission levels that fall into the restricted bands section part 15.205 the radiated emission limit $\geq 1\text{GHz}$ 15.209 is based on a measurements employing an average detector.
- (5) Refer to section 15.35 (b) for Measurement and detector functions and bandwidth.
- (6) The peak limit is $\approx 74.0\text{ dB}\mu\text{V/m}$ The average limit is $54.0\text{ dB}\mu\text{V/m}$ the average limit is then adjusted up by 11.37db to take into account the duty cycle correction factor of the ERTX357 under test.

AC Powerline Conduction



Receive Mode



Transmit Mode

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 its modification state:

Sample No: Sxx Mod w

where:

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

The following terminology is used throughout the test report:

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

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

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

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

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

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

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

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

C1) Test samples

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

| Sample No. | Description | Identification |
|------------|----------------|----------------|
| SO1 | Conducted unit | ETRX357-LRS |
| SO2 | Radiated unit | ETRX357HR-LRS |
| | | |

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

| Sample No. | Description | Identification |
|------------|-------------|----------------|
| SO3 | Test board | |
| | | |
| | | |

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

| Identification | Description |
|----------------|--------------|
| Laptop | TRaC Toshiba |
| | |
| | |

C2) EUT Operating Mode During Testing.

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

| Test | Description of Operating Mode |
|-----------------------------------|--|
| All tests detailed in this report | EUT Transmitting on bottom middle and top channels |

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

| Test | Description of Operating Mode: |
|------|--------------------------------|
| PLCE | |

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

| Test | Description of Operating Mode: |
|------|--------------------------------|
| PLCE | |

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 S02
Tests : Conducted

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|------|-------------------------------|--------------|---------------------|
| USB | USB | 5m | Test PC |

Sample :
Tests : Radiated Emissions

| Port | Description of Cable Attached | Cable length | Equipment Connected |
|------|-------------------------------|--------------|---------------------|
| USB | USB | 5m | Test PC |

C5 Details of Equipment Used

| TRAC Ref | Type | Description | Manufacturer | Date Calibrated. |
|----------|----------|-----------------------------|-----------------|------------------|
| TRLUH281 | FSU46 | Spectrum Analyser | Rhode & Schwarz | 29/10/2010 |
| TRL138 | 3115 | 1-18GHz Horn Antenna | EMCO | 10/09/2009 |
| TRL139 | 3115 | 1-18GHz Horn Antenna | EMCO | 17/08/2009 |
| TRL572 | 8499B | 1 – 26.5 GHz Pre Amplifier | Agilent | 24/11/2010 |
| TRLUH186 | ESHS10 | Receiver | Rhode & Schwarz | 14/12/2010 |
| TRLUH191 | CBL611/A | BiLog Periodic Antenna | York | 08/11/2010 |
| TRLUH372 | 6201-69 | 30MHz – 1 GHz Pre Amplifier | Watkins Johnson | 14/04/2010 |
| UH387 | | Chamber 1 | Rainford EMC | 26/06/2010 |
| UH388 | | Chamber 2 | Rainford EMC | 23/06/2010 |
| UH377 | ESU 26 | Spectrum Analyser | Rhode & Schwarz | 11/06/2010 |

Appendix D:**Additional Information**

SETTXPOWER settings are used for the above results

| Frequency | Settxpower setting |
|-----------|--------------------|
| 2405.00 | -7 |
| 2445.00 | -7 |
| 2480.00 | -11 |

Appendix E: Calculation of the duty cycle correction factor

Using a spectrum analyser in zero span mode, centred on the fundamental carrier frequency with a RBW of 1MHz and a video Bandwidth of 1MHz the sweep time was set accordingly to capture the pulse train. The transmit pulsewidths and period was measured. A plots of the pulse train is contained in Appendix B of this test report.

If the pulse train was less than 100 ms, including blanking intervals, the duty cycle was calculated by averaging the sum of the pulsewidths over one complete pulse train. However if the pulse train exceeds 100ms then the duty cycle was calculated by averaging the sum of the pulsewidths over the 100ms width with the highest average value. (The duty cycle is the value of the sum of the pulse widths in one period (or 100ms), divided by the length of the period (or 100ms). The duty cycle correction factor was then expressed in dB and the peak emissions adjusted accordingly to give an average value of the emission.

Correction factor dB = $20 \times (\text{Log}_{10} \text{ Calculated Duty Cycle})$

Therefore the calculated duty cycle was determined:

The pulse train period was greater than >100ms and in as shown from the plots in contained in appendix B of this test report.

Duty cycle = $\frac{\text{the sum of the highest average value pulsewidths over 100ms}}{100\text{ms}}$

e.g

$$= \frac{7.459\text{ms}}{100\text{ms}} = 0.07459$$

0.07459 or 7.459%

Correction factor (dB) = $20 \times (\text{Log}_{10} 0.07459) = -22.54\text{dB}$

Appendix F:

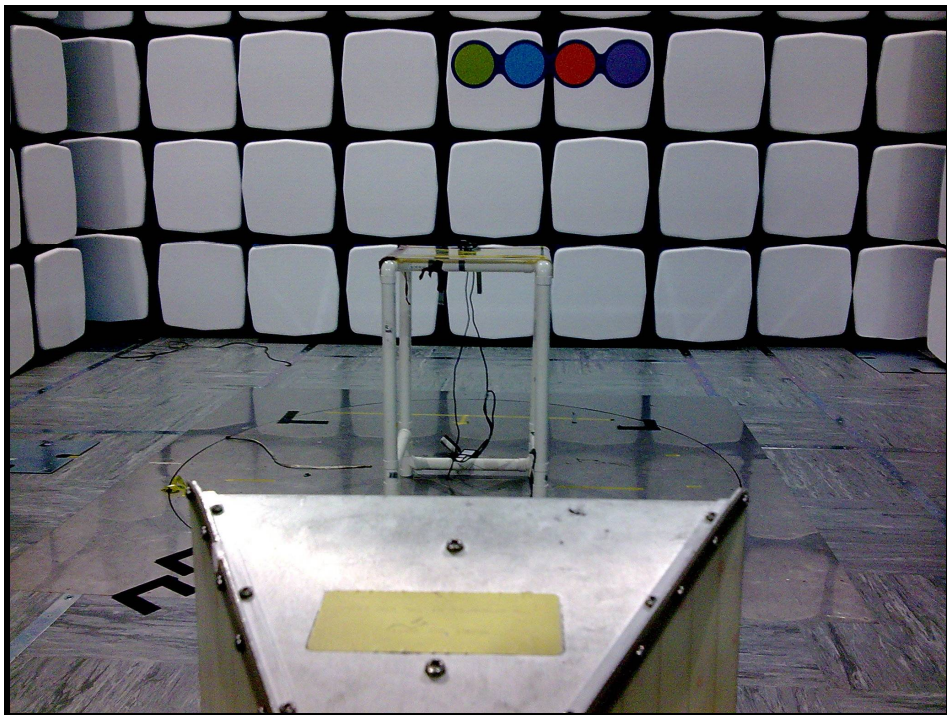
Photographs and Figures

The following photographs were taken of the test samples:

1. Radiated electric field emissions arrangement:
2. AC Powerline Conduction
3. Top view PCB/ Underside View PCB.
4. Screening can removed
5. Top View PCB Antenova antenna/Underside View Antenova Antenna
6. Screening can removed.

Photograph 1

Setup



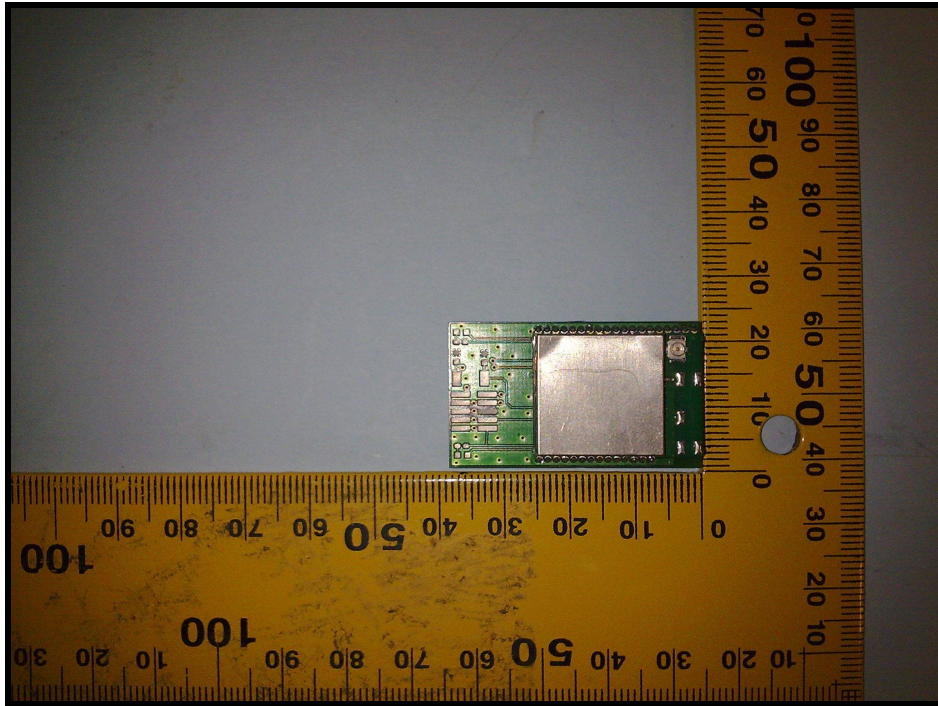
Photograph 2

AC Powerline Conduction

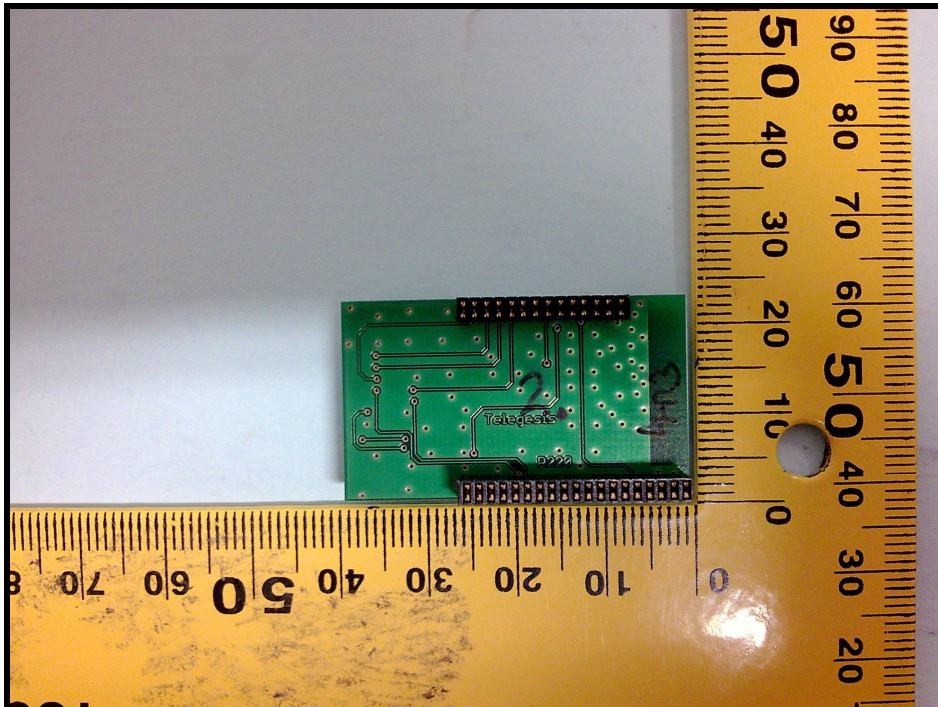


Photograph 3

Top view PCB

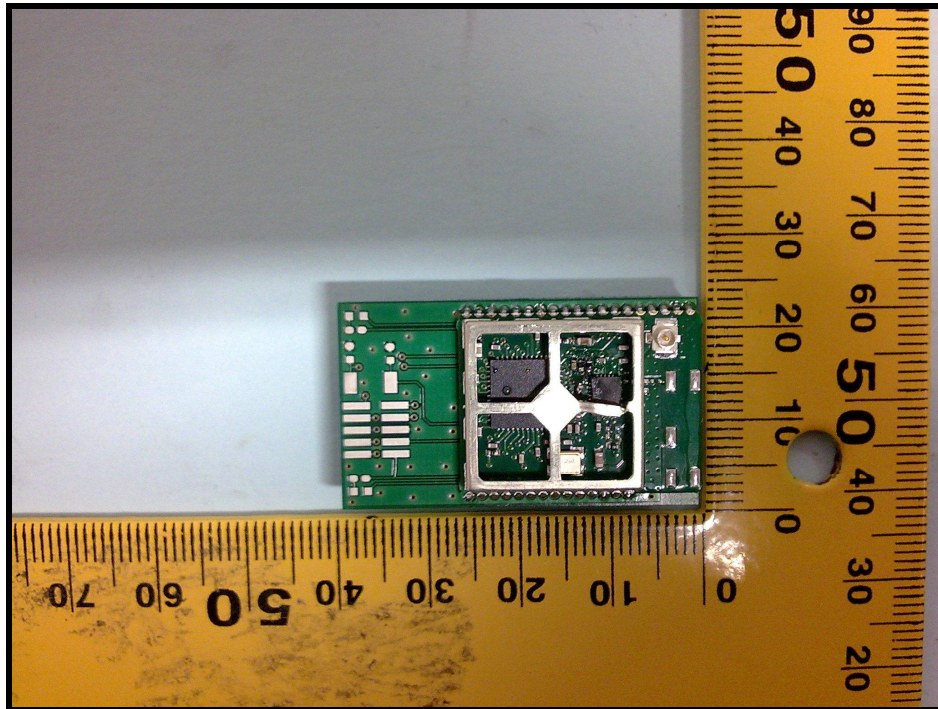


Underside View PCB



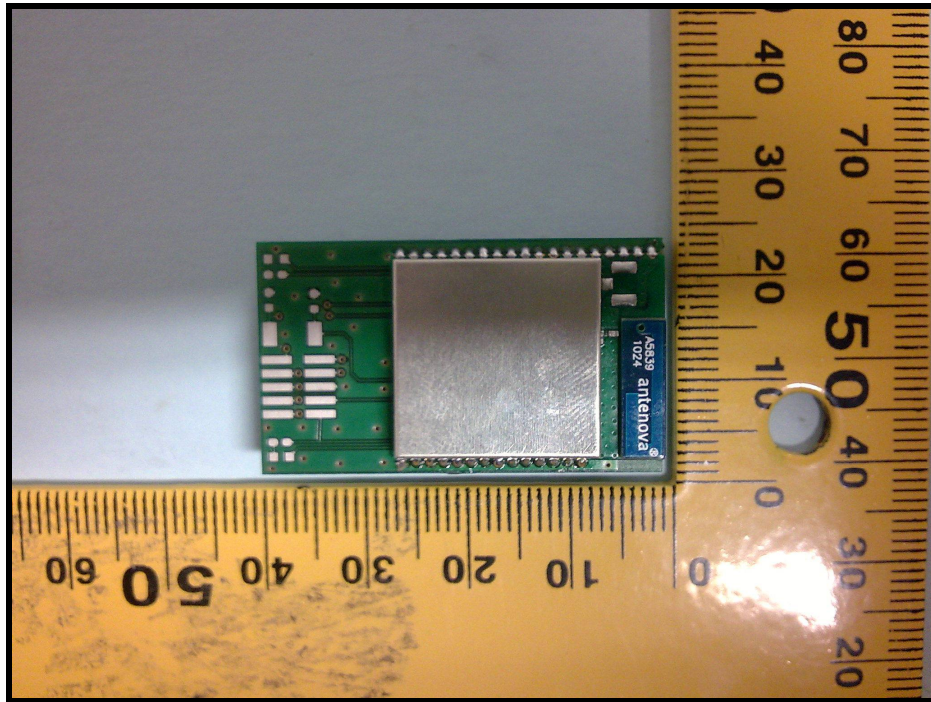
Photograph 4

Screening can removed

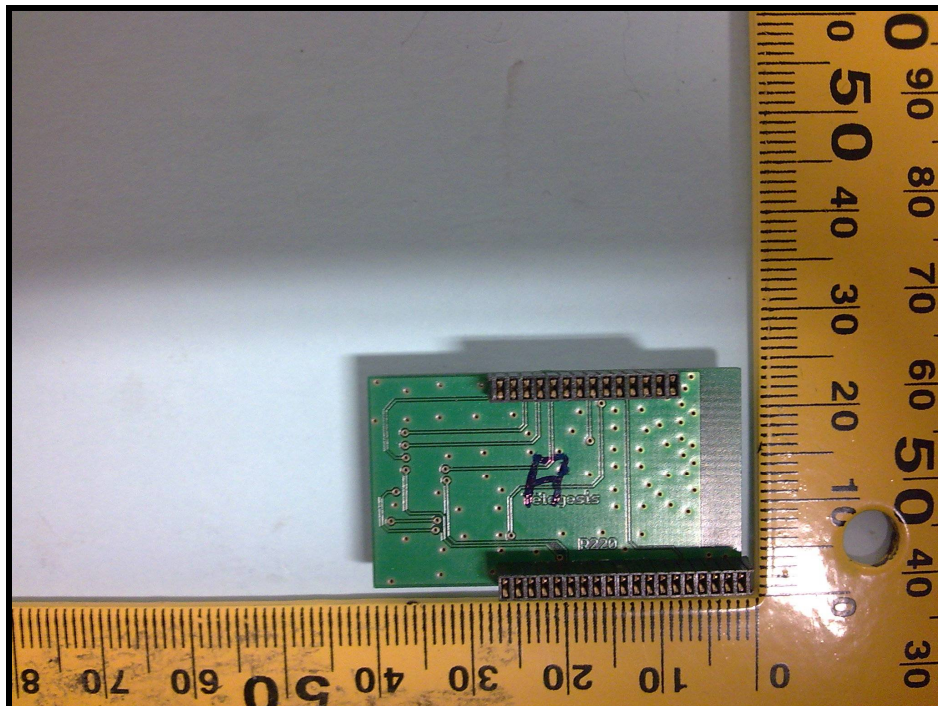


Photograph 5

Top View PCB Antenna antenna



Underside View PCB Antenna Antenna



Photograph 6 Top View Screening can removed Antenova Antenna

