# REPORT ON THE CERTIFICATION TESTING OF A
# PROMETHEAN LIMITED
# ACTIVEXPRESSION
# MODEL NUMBER PRM-AE1-01
# WITH RESPECT TO
# THE FCC RULES CFR 47, PART 15.247 May 2007
# INTENTIONAL RADIATOR SPECIFICATION

TEST REPORT NO: RU1455/8558

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**PROMETHEAN LIMITED**
**ACTIVEXPRESSION**
**MODEL NUMBER PRM-AE1-01**
**WITH RESPECT TO**
**THE FCC RULES CFR 47, PART 15.247 September 2007**
**INTENTIONAL RADIATOR SPECIFICATION**

TEST DATE: 15th – 18th April 2008

TESTED BY: Daniel Winstanley Digitally signed by Daniel Winstanley DN: CN = Daniel Winstanley, C = <n Reason: I am the author of this document Date: 2008.04.28 10:12:53 +01'00' D WINSTANLEY

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DATE: 25th April 2008

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**Notes:**

1. Component failure during test — YES [ ] NO [X]

2. If Yes, details of failure:

3. The facilities used for the testing of the product contain in this report are FCC Listed.

4. The contents of the attached applicants declarations and other supplied information are not covered by the scope of this laboratory's UKAS or FCC accreditations' and is provided in good faith.

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# CERTIFICATE OF CONFORMITY & COMPLIANCE

| | | | | | | |
|---|---|---|---|---|---|---|
| FCC IDENTITY: | QAM011 | | | | | |
| PURPOSE OF TEST: | Certification, Class II Permissive Change | | | | | |
| TEST SPECIFICATION: | FCC RULES CFR 47, Part 15.247 May 2007 | | | | | |
| TEST RESULT: | Compliant to Specification | | | | | |
| EQUIPMENT UNDER TEST: | Activexpression | | | | | |
| ITU: EMISSION CODE: | 1M40F7D | | | | | |
| EQUIPMENT TYPE: | Learner response system | | | | | |
| PRODUCT USE: | Wireless LAN | | | | | |
| CARRIER EMISSION: | 0.00398 Watts eirp | | | | | |
| ANTENNA TYPE: | Integral | | | | | |
| ALTERNATIVE ANTENNA: | Not Applicable | | | | | |
| BAND OF OPERATION: | 2400 MHz – 2483.5 MHz | | | | | |
| CHANNEL SPACING: | 1.73 MHz | | | | | |
| NUMBER OF CHANNELS: | 46 | | | | | |
| FREQUENCY GENERATION: | SAW Resonator | [ ] | Crystal | [ ] | Synthesiser | [X] |
| MODULATION METHOD: | FHSS | [X] | DSSS | [ ] | Other | [ ] |
| POWER SOURCE(s): | +4.5Vdc | | | | | |
| TEST DATE(s): | 15th – 18th April 2008 | | | | | |
| ORDER No(s): | PG0003382 | | | | | |
| APPLICANT: | Promethean Limited | | | | | |
| ADDRESS: | Promethean House<br>Lower Philips Road<br>Blackburn<br>BB1 5TH | | | | | |

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TRAC testing regulatory and compliance

## APPLICANT'S SUMMARY

| | |
|---|---|
| EQUIPMENT UNDER TEST (EUT): | Activexpression |
| EQUIPMENT TYPE: | Learner response system |
| PURPOSE OF TEST: | Certification, Class II Permissive Change |
| TEST SPECIFICATION(s): | FCC RULES CFR 47, Part 15.247 May 2007 |
| TEST RESULT: | COMPLIANT Yes [X]<br>No [ ] |
| APPLICANT'S CATEGORY: | MANUFACTURER [X]<br>IMPORTER [ ]<br>DISTRIBUTOR [ ]<br>TEST HOUSE [ ]<br>AGENT [ ] |
| APPLICANT'S ORDER No(s): | PG0003382 |
| APPLICANT'S CONTACT PERSON(s): | Mr Bryan Lofthouse |
| E-mail address: | Bryan.Lofthouse@prometheanworld.com |
| APPLICANT: | Promethean Limited |
| ADDRESS: | Promethean House<br>Lower Philips Road<br>Blackburn<br>BB1 5TH |
| TEL: | +44(0)1254 298598 |
| FAX: | +44(0)1254 581574 |
| EUT(s) COUNTRY OF ORIGIN: | United Kingdom |
| TEST LABORATORY: | TRL Compliance Ltd |
| UKAS ACCREDITATION No: | 0728 |
| TEST DATE(s): | 15th – 18th April 2008 |
| TEST REPORT No: | RU1455/8558 |

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

| TEST/EXAMINATION | RULE PART | DETECTOR | APPLICABILITY |
|---|---|---|---|
| Intentional Emission Frequency: | 15.247 | Peak | Yes |
| Intentional Emission Field Strength: | - | - | No |
| Intentional Emission Band Occupancy: | 15.247(a)1 | Peak | Yes |
| Intentional Emission EIRP (mW): | 15.247(b)1 | Peak | Yes |
| Spurious Emissions – Conducted: | - | - | No |
| Spurious Emissions – Conducted: | 15.247 | Peak | Yes |
| Spurious Emissions – Radiated <1000MHz: | 15.209 ,15.247 | Quasi Peak | Yes |
| Spurious Emissions – Radiated >1000MHz: | 15.247<br>15.209 | Peak<br>average | Yes |
| Transmitter Carrier Frequency Separation: | 15.247(a)(1) | Peak | Yes |
| Transmitter Maximum Peak Power Output Power: | 15.247(b)(1) | Peak | Yes |
| Transmitter Band Edge Conducted Emissions: | 15.247(c) | Peak | Yes |
| Transmitter Band Edge Radiated Emission: | 15.247(c) | Peak | Yes |
| Extrapolation Factor: | 15.31(f) | - | Yes |
| Maximum Frequency of Search: | 15.33 | - | Yes |
| Antenna Arrangements Integral: | 15.203 | - | Yes |
| Antenna Arrangements External Connector: | 15.204 | - | Yes |
| Restricted Bands: | 15.205 | - | Yes |

2. Product Description : Learner response system

3. Temperatures: Ambient (Tnom) 19$^{o}$C

4. Supply Voltages: Vnom +4.5Vdc

Note: +4.5Vdc voltages are as stated above unless otherwise shown on the test report page

5. Equipment Category: Single channel [ ]
Multi-channel [X]

6. Channel spacing: Narrowband [ ]
Wideband [X]

**TRANSMITTER TESTS**

**TRANSMITTER CARRIER FREQUENCY SEPARATION – CONDUCTED – Part 15.247(a)(1)**

| | | |
|---|---|---|
| Ambient temperature | = | $18^{o}$C |
| Relative humidity | = | 50% |
| Conditions | = | Conducted –Radio Lab |
| Supply voltage | = | +4.5Vdc |

| **Transmitter Carrier Frequency Separation (MHz)** |
|---|
| 1.73 MHz |
| Limit<br>The channels should be separated by at least 25kHz or $^{2}/_{3}$ the 20dB bandwidth which ever is greater. |

See spectrum analyser plot – Annex D
See note 1

**Notes**:

1 20dB Bandwidth of one carrier is 1397.435 kHz therefore carrier frequency separation must be greater than 931.623 kHz.
2 Conducted measurements were performed with a temporary antenna connector provided by the client.
3 For analyser setting see scan data annex F.

**Test Method**:

1 Test method as per 15.247 and public notice DA 00-705.
2 With the unit operating in hopping mode with maximum data rate a graphical plot of two adjacent channels was taken.
3 Delta marker function was used to measure the difference between the peak emissions of each channel.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER 20dB BANDWIDTH – CONDUCTED – Part 15.247(a)(1)**

| | | |
|---|---|---|
| Ambient temperature | = | 18$^{o}$C |
| Relative humidity | = | 50% |
| Conditions | = | Conducted –Radio Lab |
| Supply voltage | = | +4.5Vdc |

| **20dB Bandwidth (kHz)** |
|---|
| 1397.435 kHz |
| Limit >500kHz |

See spectrum analyser plot – Annex F

**Notes**:

1 The EUT has 46 hopping channels see annex E.
2 Conducted measurements were performed with a temporary antenna connector provided by the client.
3 For analyser setting see scan data annex F.

**Test Method**:

1 Test method as per 15.247 and public notice DA 00-705.
2 With the unit operating in hopping mode with maximum data rate.
3 The analyser was centre frequency was tuned to the centre of a hopping channel.
4 The peak hold function was used to establish a 20dB band width level.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER AVERAGE TIME OF OCCUPANCY – CONDUCTED – Part 15.247(a)(1)(iii)**

Ambient temperature = $18^{o}$C
Relative humidity = 50%
Conditions = Conducted –Radio Lab
Supply voltage = +4.5Vdc

| **Packet Width (µs)** | **Number of Transmissions in 18.4 seconds** | **Average time of Occupancy (s)** |
|---|---|---|
| 532.61 µs | 48 | 0.0255 |
| Limit 0.4 seconds | | |

See spectrum analyser plot – Annex G

**Notes**:

1 Conducted measurements were performed with a temporary antenna connector provided by the client.
2 For analyser setting see scan data annex G.
3 Average time of occupancy within a period of 0.4 * number of hopping channels
4 Number of hopping channels = 46
5 0.4 * 46 = 18.4 seconds

**Test Method**:

1 As per15.247 and Public Notice DA 00-705.
2 The analyser was tuned to the centre frequency of the hopping channel
3 With the analyser set to zero span a sweep of 18.4 seconds was performed. The number of transmission was recorded.
4 The sweep time was reduced to show the length of one transmission.
The time occupancy of the system was tested on a single carrier. The maximum packet length was measured and multiplied by the number of transmissions within a 18.4 second period. The result was noted as being the average time of occupancy.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER PEAK OUTPUT POWER – CONDUCTED – Part 15.247(b)(1)**

Ambient temperature = 20°C
Relative humidity = 65%
Conditions = Conducted –Radio Lab
Supply voltage = +4.5Vdc

| Channel Frequency | Measured Level (dBm) | Cable & Attenuator Loss (dB) | Antenna Gain (dBi) | Transmitter Peak Power Output (dBm) | Transmitter Peak Power Output (Watts) | Limit (Watts) |
|---|---|---|---|---|---|---|
| Bottom | -0.50 | 6.5 | 0 | 6.00 | 0.00398 | 0.125 |
| Middle | -0.68 | 6.5 | 0 | 5.82 | 0.00382 | 0.125 |
| Top | -0.90 | 6.5 | 0 | 5.60 | 0.00363 | 0.125 |

See spectrum analyser plot – Annex I

**Notes**:
1 Number of hopping channels employed is 46 see annex E.
2 Conducted measurements were performed with a temporary antenna connector provided by the client.
3 For analyser setting see scan data annex H.

**Test Method**:
1 As per 15.247 and Public Notice DA 00-705.
2 The analyser was centered on a hopping channel with peak hold enabled.
3 Marker to peak function was used to find the peak emission.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER BAND EDGE EMISSIONS – CONDUCTED – Part 15.247(c)**

Ambient temperature = $12^{o}$C
Relative humidity = 55%
Conditions = Conducted –Radio Lab
Supply voltage = +4.5Vdc

**Test Result**

Measured as compliant see analyser plots

| **Channel Frequency** | **EUT Operation** | **Emission Frequency (MHz)** | **Emission Level (dBC)** | **Limit (dBC)** |
|---|---|---|---|---|
| Bottom | Modulated Carrier | 2399.376 | 40.88 | 20 |
| All | Hopping | 2399.355 | 41.51 | 20 |
| Top | Modulated Carrier | 2483.923 | 40.87 | 20 |
| All | Hopping | 2483.923 | 41.31 | 20 |

See spectrum analyser scan plots – Annex J

**Notes**:

1 The EUT was set to bottom operating frequency only with a modulated carrier.
2 The EUT was set to top operating frequency only with a modulated carrier.
3 The EUT was set in a hopping mode using all hopping channels.
4 A temporary antenna connector was used to take the measurement.
5 See Annex I for analysers plots.

**Test Method**:

1 As per section 15.247 and Public Notice DA 00-705.
2 A plot covering the lowest channel and band edge was taken. A marker was set on the peak emission of the lowest channel. The delta marker function was then used to measure the highest out of band emissions. (If no peaks exist outside the band the level is taken at the band edge).
3 A plot covering the highest channel and band edge was taken. A marker was set on the peak emission of the highest channel. The delta marker function was then used to measure the highest out of band emissions. (If no peaks exist outside the band the level is taken at the band edge).

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER CONDUCTED SPURIOUS EMISSIONS – CONDUCTED – Part 15.247(c)**

Ambient temperature = 15°C
Relative humidity = 56%
Conditions = Conducted –Radio Lab
Supply voltage = +4.5Vdc

**Bottom Channel**

| Frequency Range | Emission Frequency (MHz) | Emission Level | Cable loss | Level (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| 30MHz – 25GHz | No Significant Emissions Within 20 dB of the Limit | | | | -14.35 |

See spectrum analyser scan plots – Annex J

**Middle Channel**

| Frequency Range | Emission Frequency (MHz) | Emission Level | Cable loss | Level (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| 30MHz – 25GHz | No Significant Emissions Within 20 dB of the Limit | | | | -14.35 |

See spectrum analyser scan plots – Annex J

**Top Channel**

| Frequency Range | Emission Frequency (MHz) | Emission Level | Cable loss | Level (dBm) | Limit (dBm) |
|---|---|---|---|---|---|
| 30MHz – 25GHz | No Significant Emissions Within 20 dB of the Limit | | | | -14.35 |

See spectrum analyser scan plots – Annex J

**Notes**:

1 During the scans the unit was operated in the following modes:
Hopping stopped unit operating on lowest channel
Hopping stopped unit operating on middle channel
Hopping stopped unit operating on highest channel
2 Section 15.247(c) states that all spurious emissions measured within a100kHz bandwidth shall be attenuated by at least 20dB below the level of the highest fundamental level measured within a 100kHz bandwidth.
3 Only emissions within 20dB of limit are recorded.

**Test Method**:

1 As per section 15.247 and Public Notice DA 00-705.
2 Frequency sweeps were performed to check for spurious emissions.
3 Any emissions discovered were checked for compliance with the limit.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU 46 | 200034 | UH281 | **X** |
| ATTENUATOR | BIRD | 8304-0600N | N/A | 246 | **X** |
| CABLE | TRL | N/A | N/A | UH358 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER EMISSIONS – RADIATED – Part 15.247(c) and 15.209**

Ambient temperature = 18$^{o}$C
Relative humidity = 48%
Conditions = Radiated OATS
Supply voltage = +4.5Vdc

**Bottom Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz Restricted bands | | | | | | | | Note 6 | 100 |
| 88MHz – 216MHz Restricted bands | | | | | | | | Note 6 | 150 |
| 216MHz – 960MHz Restricted bands | | | | | | | | Note 6 | 200 |
| 960MHz – 1GHz Restricted bands | | | | | | | | Note 6 | 500 |
| 1GHz – 25GHz Restricted bands | 2255.938<br>4805.540 | 45.27<br>50.45 | 1.7<br>1.9 | 28.0<br>32.7 | 35.0<br>35.7 | 39.97<br>49.35 | -<br>- | 99.65<br>293.43 | 500<br>500 |
| 30MHz -25GHz | | | | | | | | Note 6 | 1810 |

**Middle Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz Restricted bands | | | | | | | | Note 6 | 100 |
| 88MHz – 216MHz Restricted bands | | | | | | | | Note 6 | 150 |
| 216MHz – 960MHz Restricted bands | | | | | | | | Note 6 | 200 |
| 960MHz – 1GHz Restricted bands | | | | | | | | Note 6 | 500 |
| 1GHz – 25GHz Restricted bands | 2274.833<br>2316.336<br>4881.563<br>7322.334 | 43.52<br>46.67<br>52.65<br>41.70 | 1.7<br>1.7<br>1.9<br>1.9 | 28.0<br>28.0<br>32.7<br>35.9 | 35.0<br>35.0<br>35.7<br>36.2 | 38.22<br>41.37<br>51.55<br>43.30 | -<br>-<br>-<br>- | 81.47<br>117.08<br>378.00<br>146.22 | 500<br>500<br>500<br>500 |
| 30MHz -25GHz | | | | | | | | Note 6 | 1810 |

**TRANSMITTER TESTS**

**TRANSMITTER EMISSIONS cont. – RADIATED – Part 15.247(c) and 15.209**

**Top Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz Restricted bands | | | | | | | | Note 6 | 100 |
| 88MHz – 216MHz Restricted bands | | | | | | | | Note 6 | 150 |
| 216MHz – 960MHz Restricted bands | | | | | | | | Note 6 | 200 |
| 960MHz – 1GHz Restricted bands | | | | | | | | Note 6 | 500 |
| 1GHz – 25GHz Restricted bands | 2356.174<br>2483.987<br>4961.060<br>7441.590 | 45.27<br>55.76<br>51.29<br>35.64 | 1.70<br>2.56<br>2.20<br>1.90 | 28.00<br>28.48<br>33.23<br>36.35 | 35.0<br>35.0<br>35.6<br>35.9 | 37.97<br>51.80<br>51.12<br>37.99 | -<br>-<br>-<br>- | 99.65<br>389.04<br>359.75<br>79.34 | 500<br>500<br>500<br>500 |
| 30MHz -25GHz | | | | | | | | Note 6 | 1810 |

**Notes**:

1 During the scans the unit was operated in the following modes:
Hopping stopped unit operating on lowest channel
Hopping stopped unit operating on middle channel
Hopping stopped unit operating on highest channel
2 Initial pre scans were performed see Annex L for plots.
3 Emissions above 1GHz were measured with both a peak and average detectors.
4 Measurements <1GHz were performed at 3 meters.
5 Measurements >1GHz were initial performed at 3 metres.
6 Only emissions with in 20dB of limit are recorded.
7 Average emissions recorded.

**Test Method**:

1 As per section 15.247 and Public Notice DA 00-705.
2 Measuring distances as Notes 5 to 6 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m >30MHz.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes. Maximum results recorded.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| RECEIVER | ROHDE & SCHWARZ | ESHS 10 | 825892/006 | UH04 | **X** |
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU46 | 200034 | UH281 | **X** |
| RANGE 1 | TRL | 3 METRE | N/A | UH06 | **X** |
| BILOG ANTENNA | CHASE | CBL6112B | 2803 | UH93 | **X** |
| HORN ANTENNA | EMCO | 3115 | 9010-3580 | 138 | **X** |
| PRE APMLIFIER | AGILENT | 8449B | 3008A016 | 572 | **X** |

**TRANSMITTER TESTS**

**TRANSMITTER BAND EDGE EMISSIONS – RADIATED – Part 15.247(c)**

| | | |
|---|---|---|
| Ambient temperature | = | $18^{o}$C |
| Relative humidity | = | 48% |
| Conditions | = | Radiated OATS |
| Supply voltage | = | +4.5Vdc |

**Test Result**

Measure as compliant, see analyser plots.

**Notes**:

1 The EUT was set in a hopping mode using all hopping channels.
2 See Annex K for analysers plots.

**Test Method**:

1 As per section 15.247 and Public Notice DA 00-705.
2 A plot covering the lowest channel and band edge was taken. A marker was set on the peak emission of the lowest channel. The delta marker function was then used to measure the highest out of band emissions. (If no peaks exist outside the band the level is taken at the band edge).
3 A plot covering the highest channel and band edge was taken. A marker was set on the peak emission of the highest channel. The delta marker function was then used to measure the highest out of band emissions. (If no peaks exist outside the band the level is taken at the band edge).

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| RECEIVER | ROHDE & SCHWARZ | ESHS 10 | 825892/006 | UH04 | |
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU46 | 200034 | UH281 | **X** |
| RANGE 1 | TRL | 3 METRE | N/A | UH06 | |
| BILOG ANTENNA | CHASE | CBL6112B | 2803 | UH93 | |
| HORN ANTENNA | EMCO | 3115 | 9010-3580 | 138 | **X** |
| PRE APMLIFIER | AGILENT | 8449B | 3008A016 | 572 | **X** |

**RECEIVER TESTS**

**RECEIVER EMISSIONS RADIATED – Part 15.109**

Ambient temperature = 24$^{o}$C
Relative humidity = 68%
Conditions = Radiated OATS
Supply voltage = +4.5Vdc

**Bottom Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz | | | | | | | | Note 5 | 100 |
| 88MHz – 216MHz | | | | | | | | Note 5 | 150 |
| 216MHz – 960MHz | | | | | | | | Note 5 | 200 |
| 960MHz – 1GHz | | | | | | | | Note 5 | 500 |
| 1GHz – 25GHz | 4807.271 | 39.86 | 1.9 | 32.7 | 35.7 | 38.76 | - | 86.69 | 500 |

**Middle Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz | | | | | | | | Note 5 | 100 |
| 88MHz – 216MHz | | | | | | | | Note 5 | 150 |
| 216MHz – 960MHz | | | | | | | | Note 5 | 200 |
| 960MHz – 1GHz | | | | | | | | Note 5 | 500 |
| 1GHz – 25GHz | 4883.314 | 39.80 | 1.9 | 32.7 | 35.7 | 38.70 | - | 86.10 | 500 |

**Top Channel 30MHz -25000MHz**

| | Emission Freq (MHz) | Meas Rx. (dBuV) | Cable loss (dB) | Ant. Factor (dB/m) | Pre Amp Gain (dB) | Field Strength (dBµV/m) | Extrap. Factor (dB) | Result (µV/m) | Limit (µV/m) |
|---|---|---|---|---|---|---|---|---|---|
| 30MHz – 88MHz | | | | | | | | Note 5 | 100 |
| 88MHz – 216MHz | | | | | | | | Note 5 | 150 |
| 216MHz – 960MHz | | | | | | | | Note 5 | 200 |
| 960MHz – 1GHz | | | | | | | | Note 5 | 500 |
| 1GHz – 25GHz | 4962.780 | 40.07 | 2.20 | 33.23 | 35.6 | 39.90 | - | 98.85 | 500 |

**Notes**:

1 During the scans the unit was operated in the following receive modes:
Hopping stopped unit operating on lowest channel
Hopping stopped unit operating on middle channel
Hopping stopped unit operating on highest channel
2 Emissions above 1GHz were measured with both a peak and average detectors.
3 Measurements <1GHz were performed at 3 meters.
4 Measurements >1GHz were initially performed at 3 metres.
5 Only emissions with in 20dB of limit are recorded.
6 Peak emissions recorded, peak emissions meet the average limit.

**Test Method**:

1 As per section 15.247 and Public Notice DA 00-705.
2 Measuring distances as Notes 3 to 4 above.
3 EUT 0.8 metre above ground plane.
4 Emissions maximised by rotation of EUT, on an automatic turntable.
Raising and lowering the receiver antenna between 1m & 4m >30MHz.
Horizontal and vertical polarisations, of the receive antenna.
EUT orientation in three orthagonal planes. Maximum results recorded.

The test equipment used for the tests is shown below:

| TYPE OF EQUIPMENT | MAKER/ SUPPLIER | MODEL No | SERIAL No | TRL No | ACTUAL EQUIPMENT USED |
|---|---|---|---|---|---|
| RECEIVER | ROHDE & SCHWARZ | ESHS 10 | 825892/006 | UH04 | **X** |
| SPECTRUM ANALYSER | ROHDE & SCHWARZ | FSU46 | 200034 | UH281 | **X** |
| RANGE 1 | TRL | 3 METRE | N/A | UH06 | **X** |
| BILOG ANTENNA | CHASE | CBL6112B | 2803 | UH93 | **X** |
| HORN ANTENNA | EMCO | 3115 | 9010-3580 | 138 | **X** |
| PRE APMLIFIER | AGILENT | 8449B | 3008A016 | 572 | **X** |

**ANNEX A**

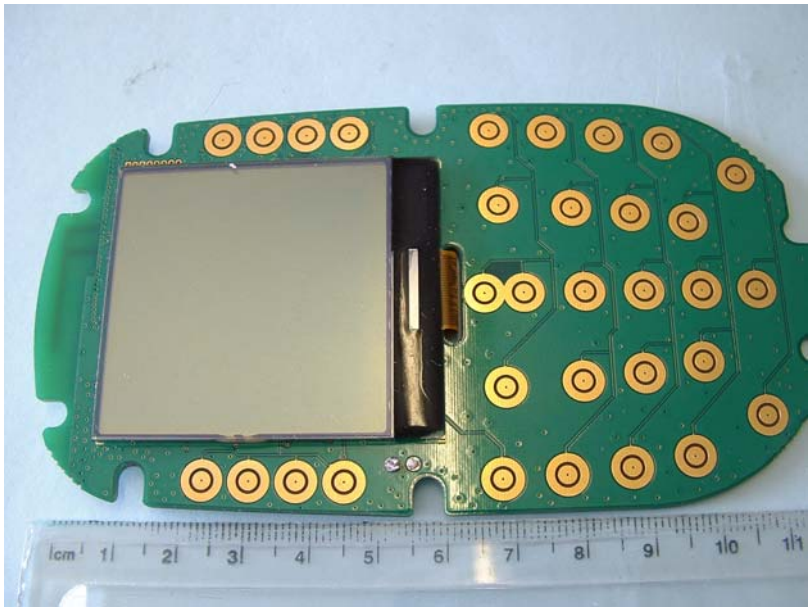
**PHOTOGRAPHS**

PHOTOGRAPH No. 1 **TEST SETUP**

PHOTOGRAPH No. 2 **FRONT VIEW**

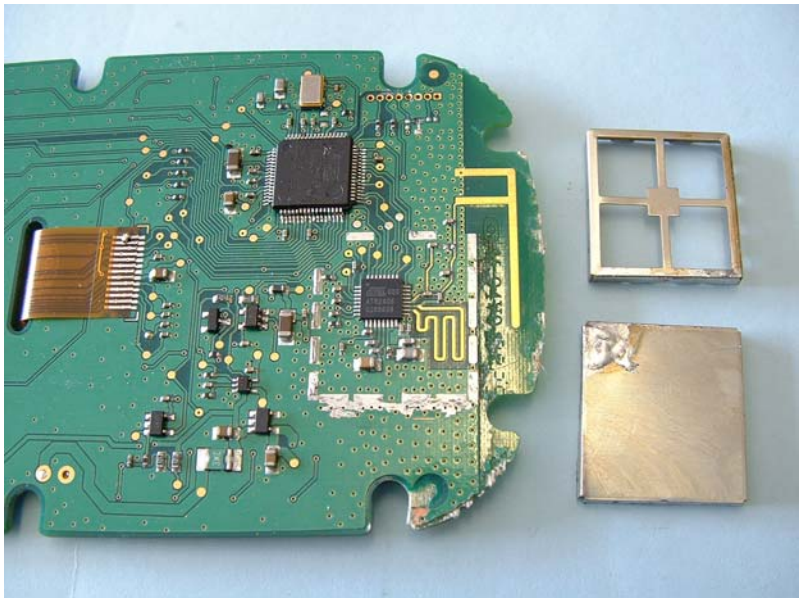
PHOTOGRAPH No. 3 **BACK VIEW**

PHOTOGRAPH No. 4 **TRANSMITTER PCB TRACK SIDE**



PHOTOGRAPH No. 5 **TRANSMITTER PCB COMPONENT SIDE**

PHOTOGRAPH No. 5 **RF CLOSE UP CAN REMOVED**



**ANNEX B**

**APPLICANT'S SUBMISSION OF DOCUMENTATION LIST**

## APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

| | | | | |
|---|---|---|---|---|
| a. | TCB | - | APPLICATION | [X] |
| | | - | FEE | [X] |
| b. | AGENT'S LETTER OF AUTHORISATION | - | | [X] |
| c. | MODEL(s) vs IDENTITY | - | | [ ] |
| d. | ALTERNATIVE TRADE NAME DECLARATION(s) | - | | [X] |
| e. | LABELLING | - | PHOTOGRAPHS | [X] |
| | | - | DECLARATION | [ ] |
| | | - | DRAWINGS | [X] |
| f. | TECHNICAL DESCRIPTION | - | | [X] |
| g. | BLOCK DIAGRAMS | - | Tx | [X] |
| | | - | Rx | [ ] |
| | | - | PSU | [ ] |
| | | - | AUX | [ ] |
| h. | CIRCUIT DIAGRAMS | - | Tx | [X] |
| | | - | Rx | [ ] |
| | | - | PSU | [ ] |
| | | - | AUX | [ ] |
| i. | COMPONENT LOCATION | - | Tx | [X] |
| | | - | Rx | [ ] |
| | | - | PSU | [ ] |
| | | - | AUX | [ ] |
| j. | PCB TRACK LAYOUT | - | Tx | [X] |
| | | - | Rx | [ ] |
| | | - | PSU | [ ] |
| | | - | AUX | [ ] |
| k. | BILL OF MATERIALS | - | Tx | [X] |
| | | - | Rx | [ ] |
| | | - | PSU | [ ] |
| | | - | AUX | [ ] |
| l. | USER INSTALLATION / OPERATING INSTRUCTIONS | - | | [X] |

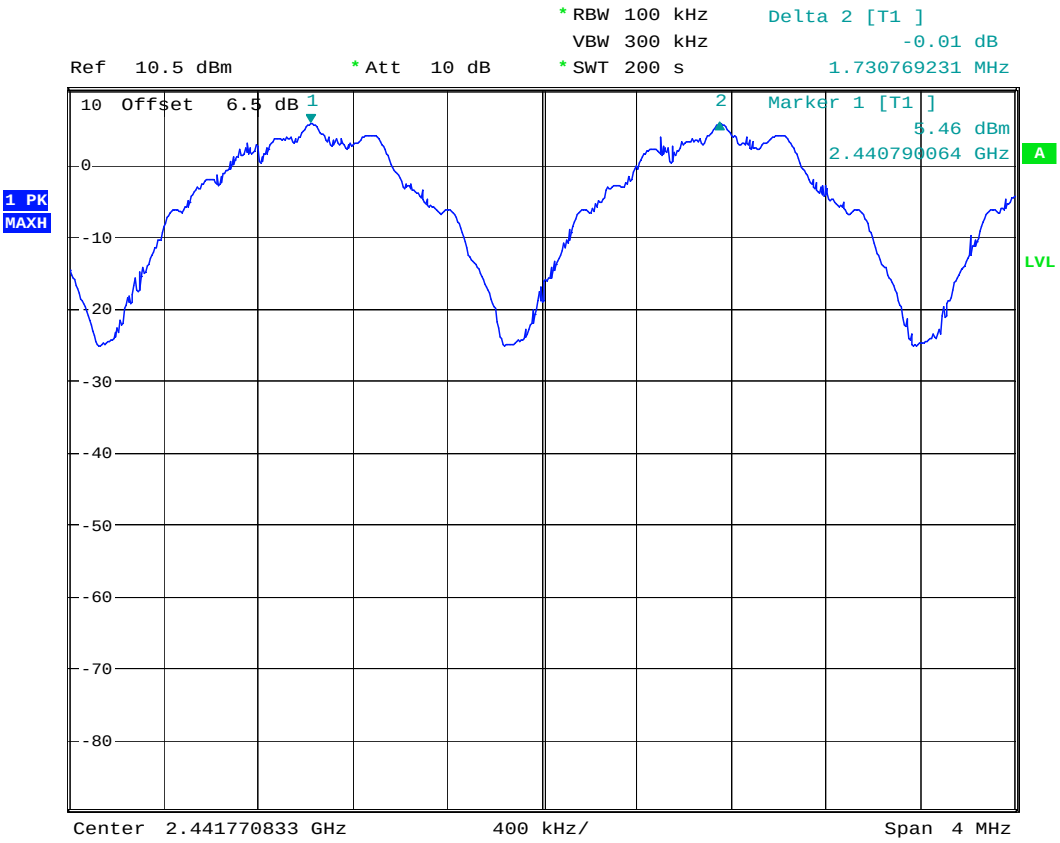
## ANNEX C

## EQUIPMENT CALIBRATION DETAILS

| TRL Number | Equipment Type | Manufacturer | Last Cal Calibration | Calibration Period | Due For Calibration |
|---|---|---|---|---|---|
| UH003 | Receiver | R&S | 24/07/2006 | 12 | 24/07/2007 |
| UH004 | Receiver | R&S | | | |
| UH005 | LISN | R&S | 11/04/2006 | 12 | 11/04/2007 |
| UH006 | 3m Range ERP CAL | TRL | 06/01/2006 | 12 | 06/01/2007 |
| UH028 | Log Periodic Ant | Schwarbeck | 28/04/2005 | 24 | 28/04/2007 |
| UH029 | Bicone Antenna | Schwarbeck | 27/04/2005 | 24 | 27/04/2007 |
| UH041 | Multimeter | AVOmeter | 20/12/2005 | 12 | 20/12/2006 |
| UH093 | Bilog Antenna | Chase | | | |
| UH122 | Oscilloscope | Tektronix | 07/06/2005 | 24 | 07/06/2007 |
| UH132 | Power meter | Marconi | 03/01/2006 | 12 | 03/01/2007 |
| UH162 | ERP Cable Cal | TRL | 06/01/2006 | 12 | 06/01/2007 |
| UH187 | Receiver | R&S | 01/02/2006 | 12 | 01/02/2007 |
| UH228 | Power Sensor | Marconi | 03/01/2006 | 12 | 03/01/2007 |
| UH253 | 1m Cable N type | TRL | 23/02/2006 | 12 | 23/02/2007 |
| UH254 | 1m Cable N type | TRL | 05/01/2006 | 12 | 05/01/2007 |
| UH265 | Notch filer | Telonic | 24/06/2005 | 12 | 24/06/2006 |
| UH271 | 1m Cable N type | TRL | 23/02/2006 | 12 | 23/02/2007 |
| UH273 | 1m Cable N type | TRL | 23/02/2006 | 12 | 23/02/2007 |
| UH281 | Spectrum Analyser | R&S | 24/07/2006 | 12 | 24/07/2007 |
| UH358 | Cable | TRL | | Calibrate in use | |
| L005 | CMTA | R&S | 05/12/2005 | 12 | 05/12/2006 |
| L007 | Loop Antenna | R&S | 29/03/2005 | 24 | 29/03/2007 |
| L138 | 1-18GHz Horn | EMCO | 15/04/2005 | 24 | 15/04/2007 |
| L139 | 1-18GHz Horn | EMCO | 03/05/2005 | 24 | 03/05/2007 |
| L176 | Signal Generator | Marconi | 15/02/2006 | 12 | 15/02/2007 |
| L193 | Bicone Antenna | Chase | 12/10/2003 | 24 | 12/10/2005 |
| L203 | Log Periodic Ant | Chase | 21/10/2003 | 24 | 21/10/2005 |
| L222 | Attenuator | Bird | | Calibrate in use | |
| L280 | 18GHz Cable | Rosenberger | 05/01/2006 | 12 | 05/01/2007 |
| L290 | Bilog Antenna | Chase | 20/10/2005 | 24 | 20/10/2007 |
| L343 | CCIR Noise Filter | TRL | 20/09/2006 | 12 | 20/09/2007 |
| L426 | Temperature Indicator | Fluke | 04/01/2006 | 12 | 04/01/2007 |
| L479 | Analyser | Anritsu | 18/11/2005 | 12 | 18/11/2006 |
| L552 | Signal Generator | Agilent | 24/07/2006 | 12 | 24/07/2007 |
| L572 | Pre Amp | Agilent | 03/02/2006 | 12 | 03/02/2007 |
| N/A | High Pass Filter | AFL | 23/02/2006 | 12 | 23/02/2007 |

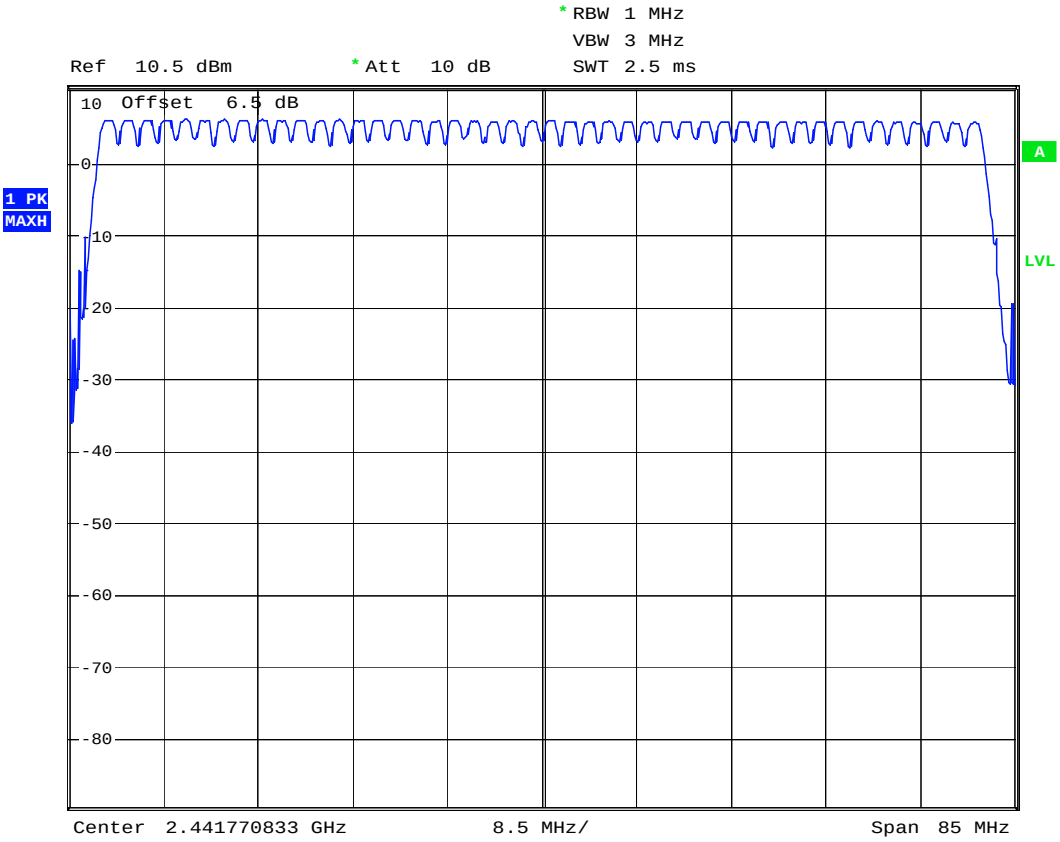
## ANNEX D

## CARRIER FREQUENCY SEPARATION


*RBW 100 kHz
VBW 300 kHz
*SWT 200 s
Delta 2 [T1 ]
-0.01 dB
1.730769231 MHz
Ref 10.5 dBm
*Att 10 dB
Offset 6.5 dB
Marker 1 [T1 ]
5.46 dBm
2.440790064 GHz
1 PK
MAXH
A
LVL
10
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.441770833 GHz
400 kHz/
Span 4 MHz

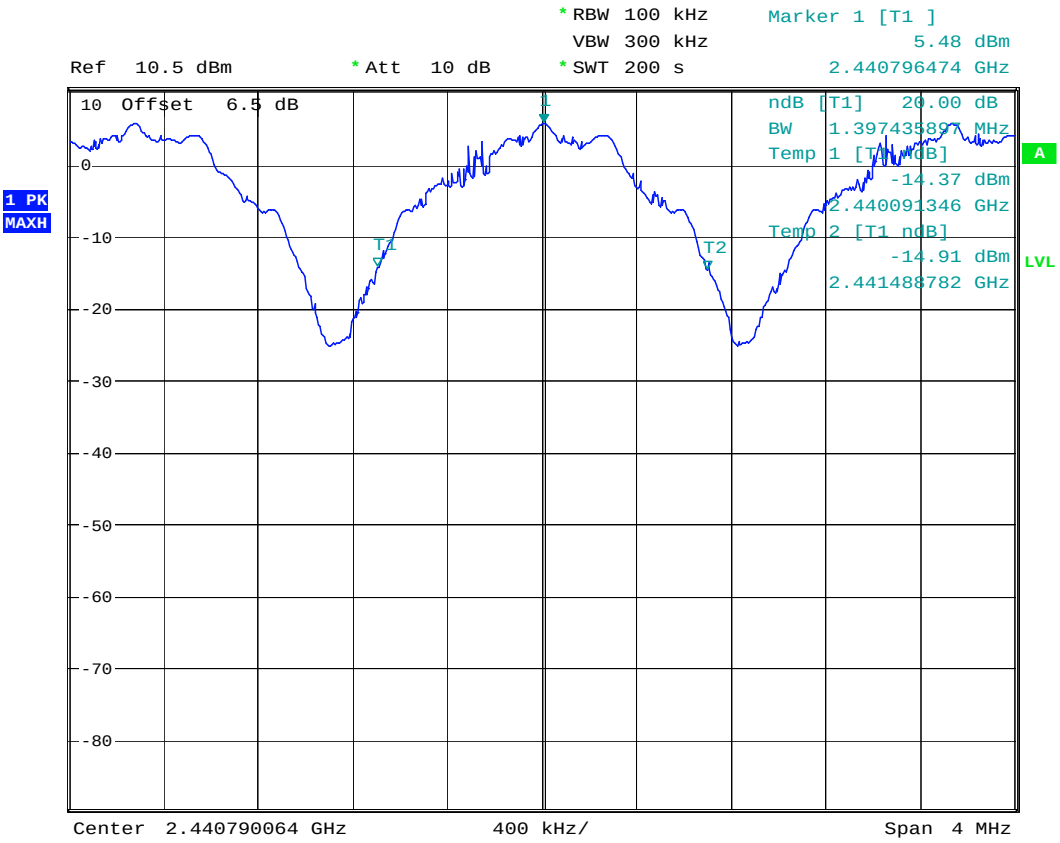
## ANNEX E

## NUMBER OF HOPPING CHANNELS


*RBW 1 MHz
VBW 3 MHz
Ref 10.5 dBm
*Att 10 dB
SWT 2.5 ms
10 Offset 6.5 dB
1 PK
MAXH
A
LVL
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.441770833 GHz
8.5 MHz/
Span 85 MHz

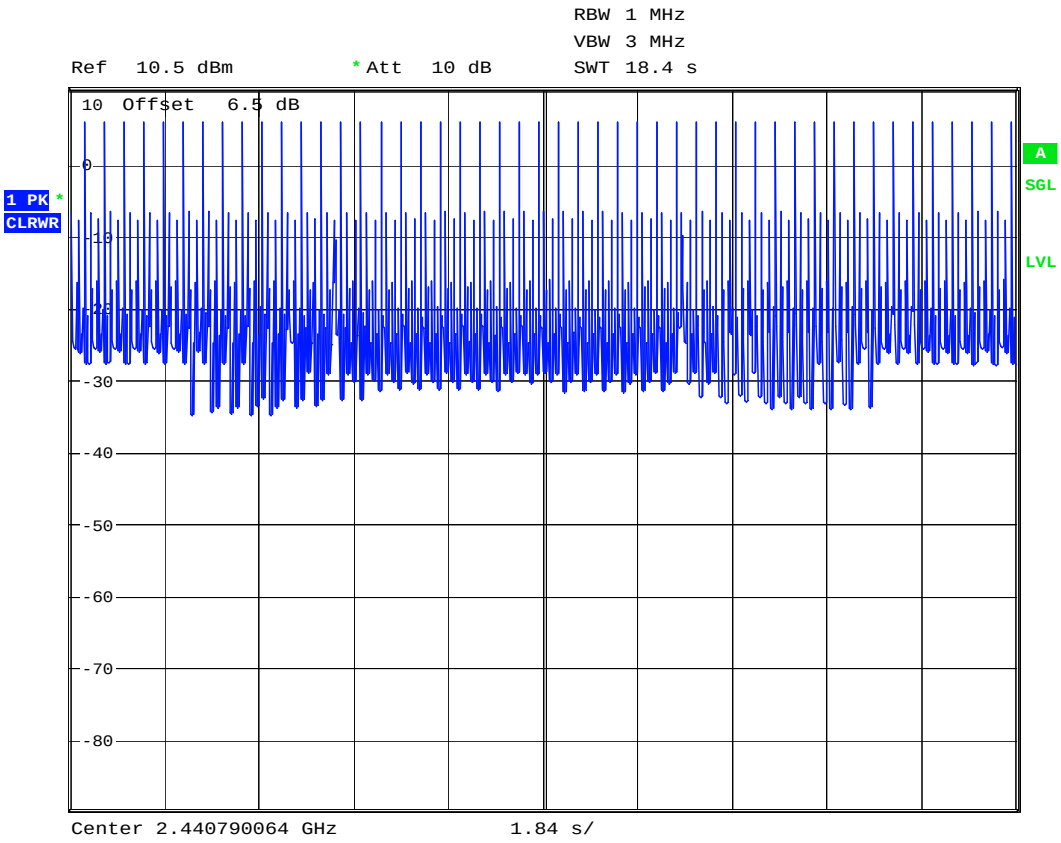
**ANNEX F**

**20dB BANDWIDTH**

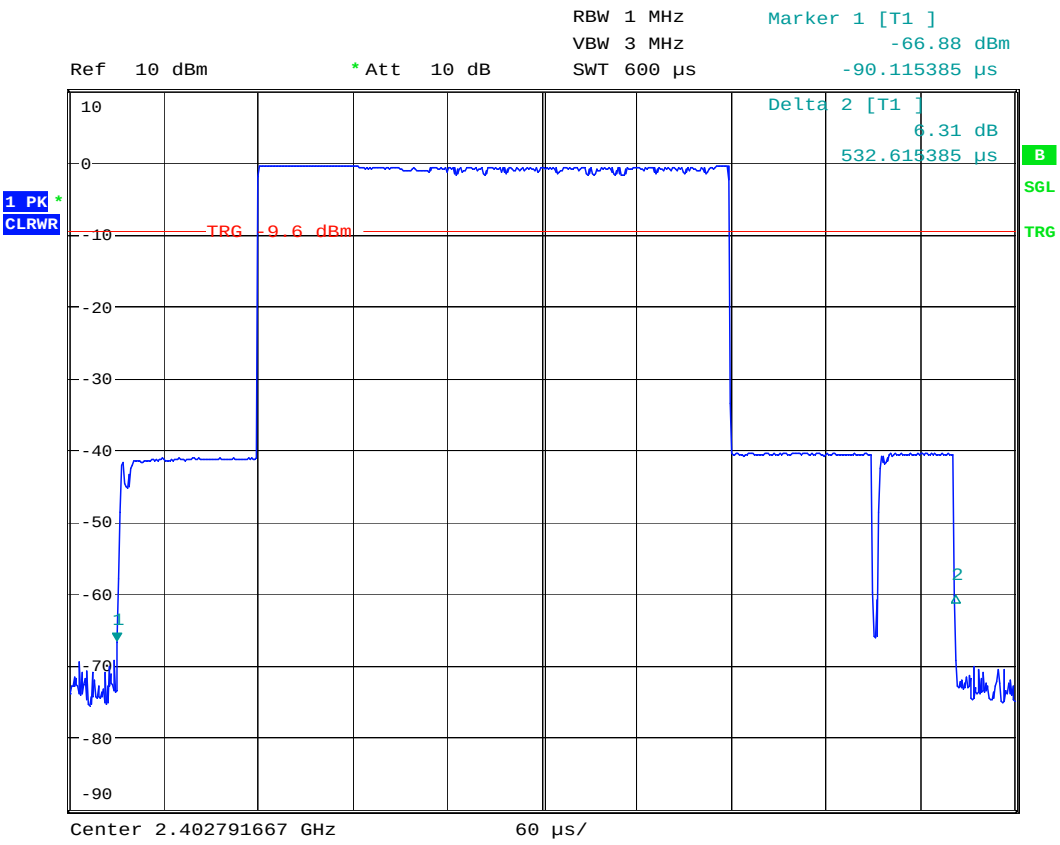

*RBW 100 kHz
VBW 300 kHz
*SWT 200 s
Marker 1 [T1 ]
5.48 dBm
2.440796474 GHz
Ref 10.5 dBm
*Att 10 dB
10 Offset 6.5 dB
ndB [T1] 20.00 dB
BW 1.397435897 MHz
Temp 1 [T1 ndB]
-14.37 dBm
2.440091346 GHz
Temp 2 [T1 ndB]
-14.91 dBm
2.441488782 GHz
1 PK
MAXH
A
LVL
T1
T2
0
-10
-20
-30
-40
-50
-60
-70
-80
Center 2.440790064 GHz
400 kHz/
Span 4 MHz

## ANNEX G

## AVERAGE TIME OF OCCUPANCY



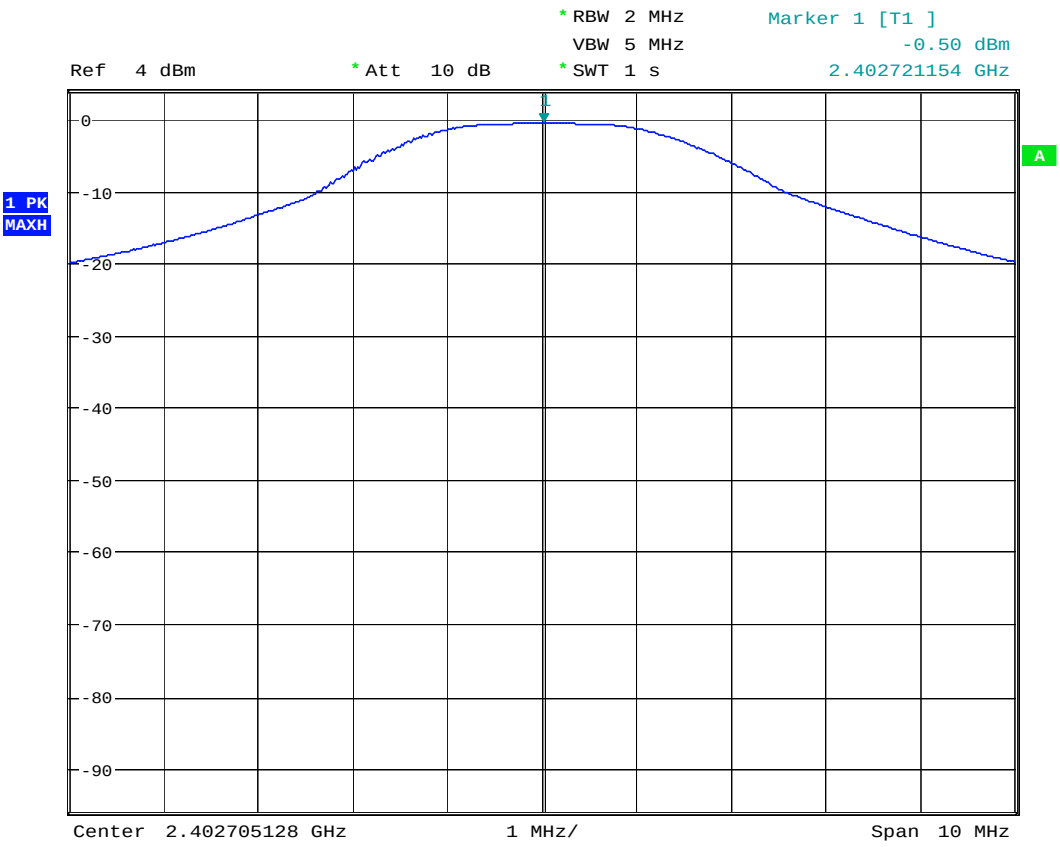

**Number of transmissions made within 18.4 seconds**



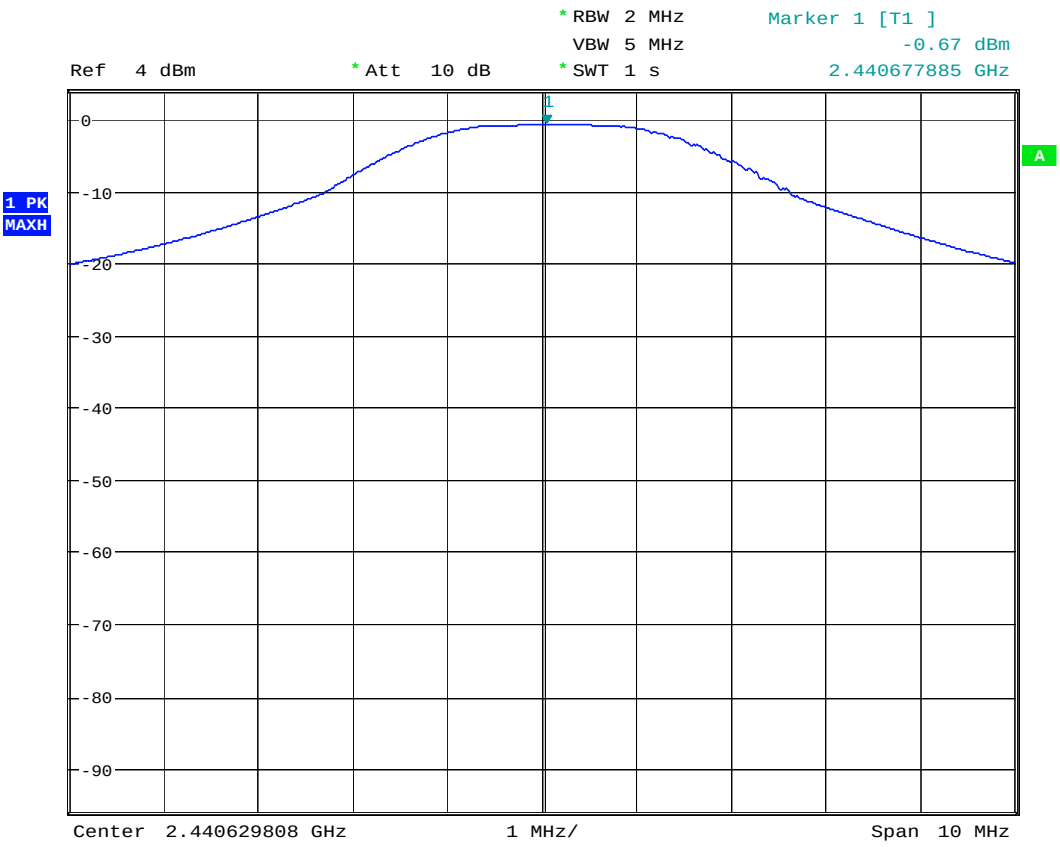

**Length of one packet**

## ANNEX H

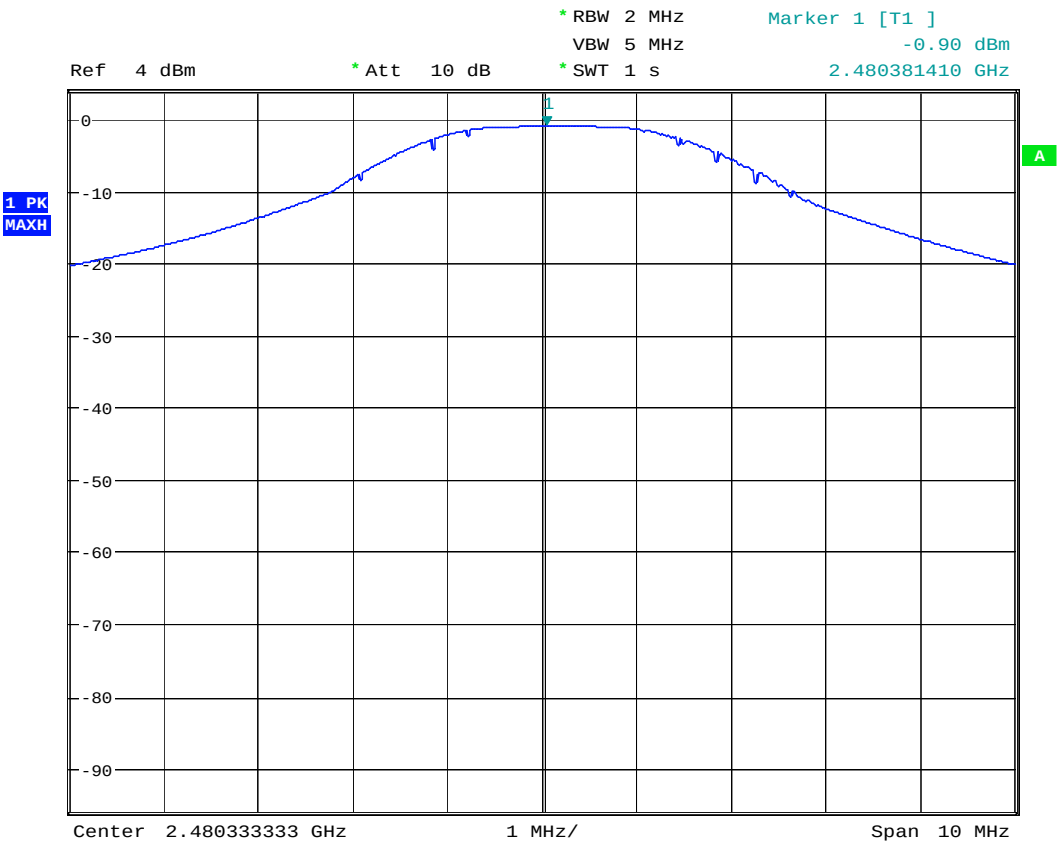
## PEAK POWER CONDUCTED




**PEAK POWER LOW CHANNEL**



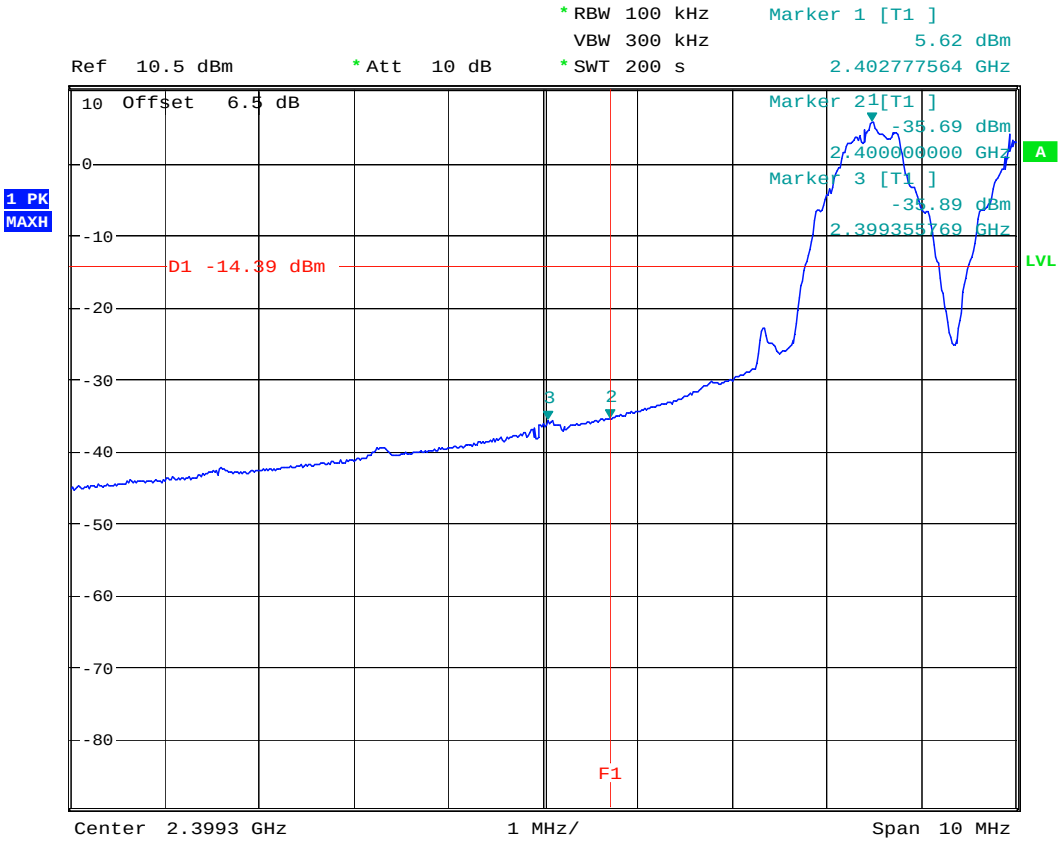

**PEAK POWER MID CHANNEL**



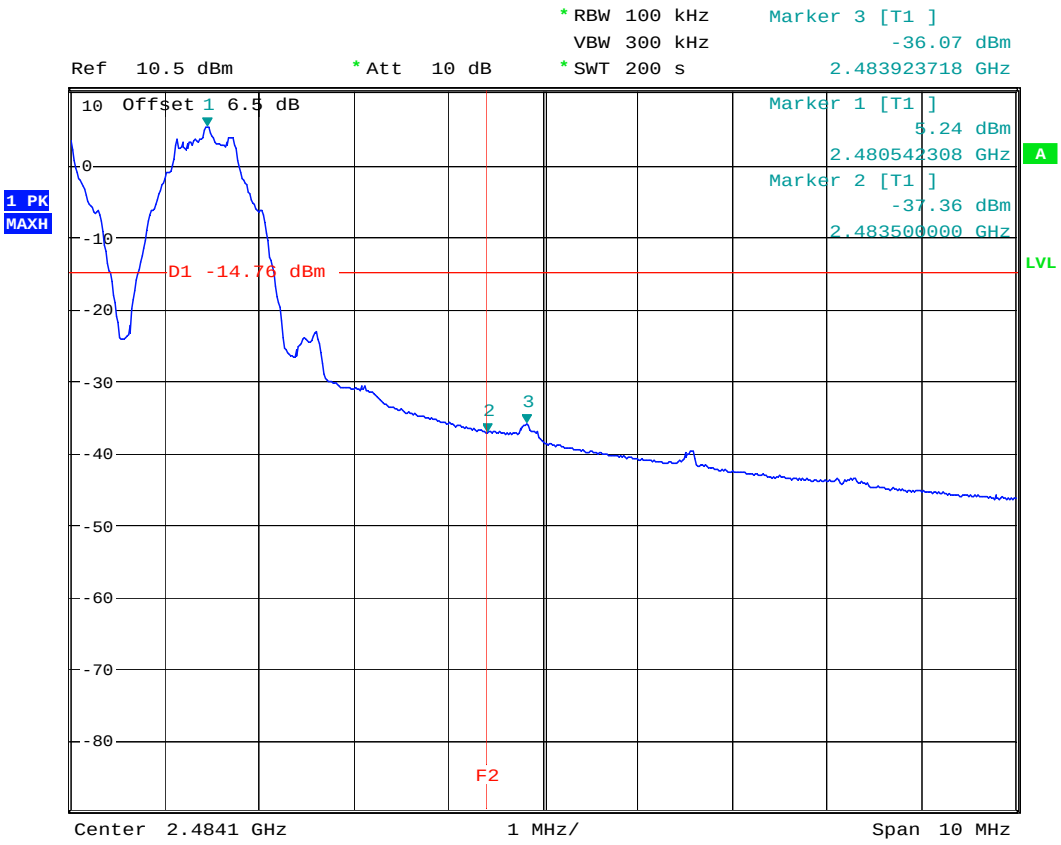

**PEAK POWER HIGH CHANNEL**

## ANNEX I

## BAND EDGE CONDUCTED EMISSION




Date: 16.APR.2008 10:43:12

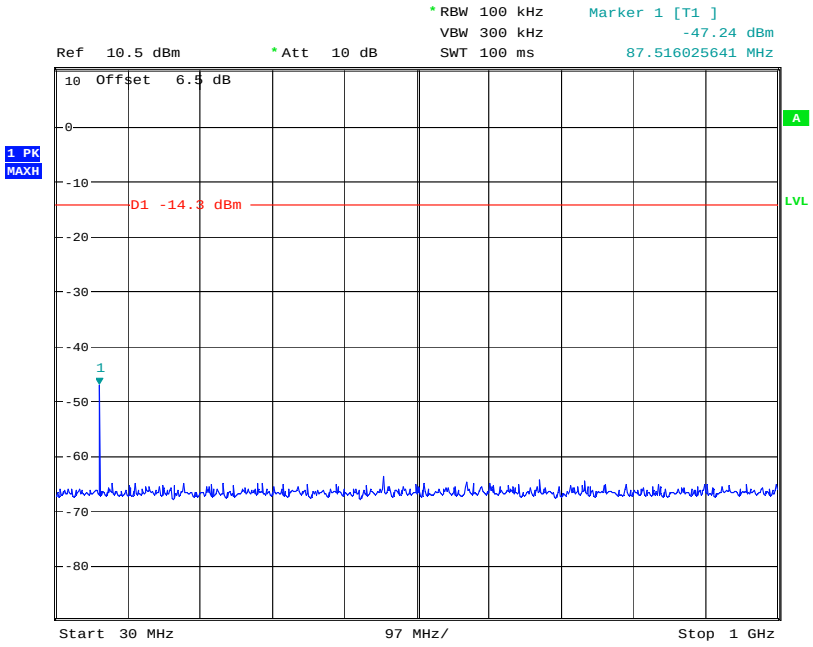



Date: 16.APR.2008 10:11:17

## ANNEX J

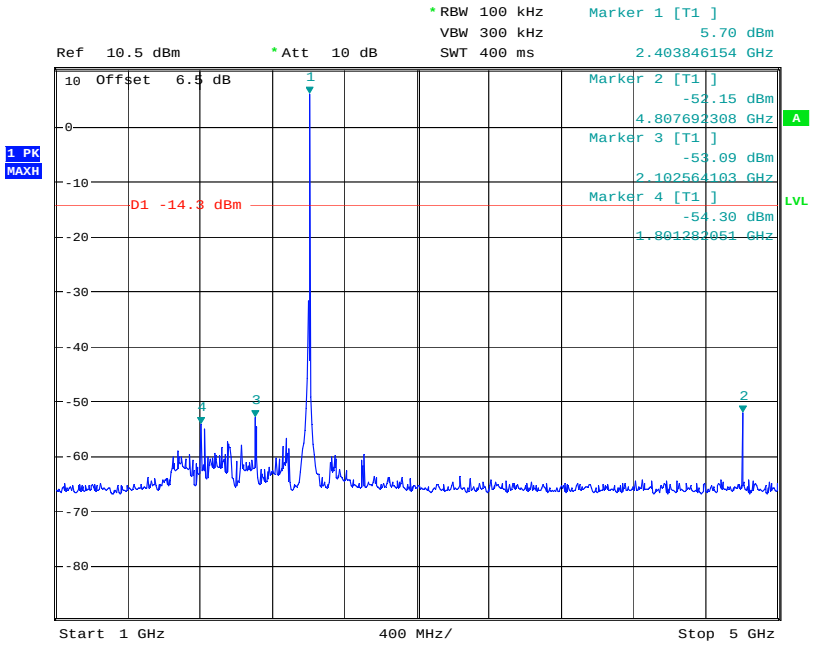
## CONDUCTED SPURIOUS EMISSION

## Bottom Channel 30 MHz – 1 GHz



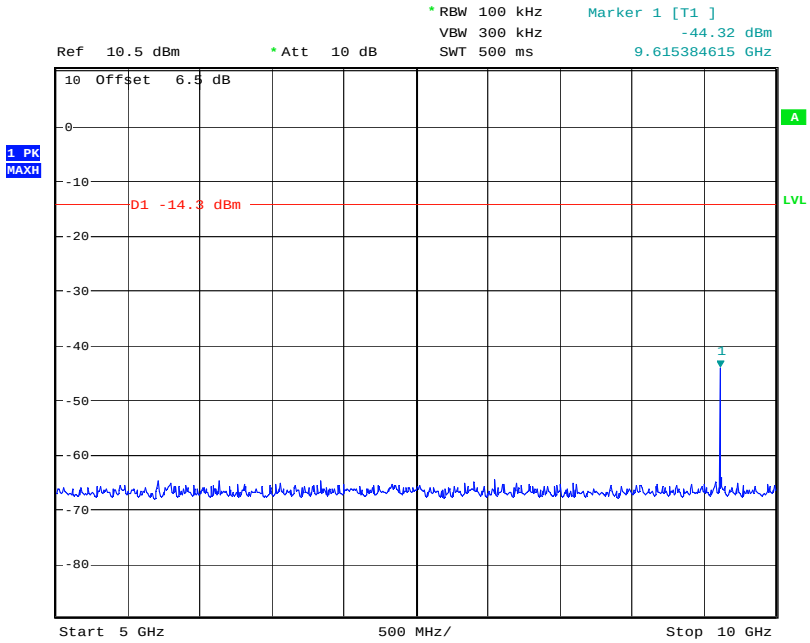

Date: 16.APR.2008 11:05:37

## Bottom Channel 1 GHz – 5 GHz



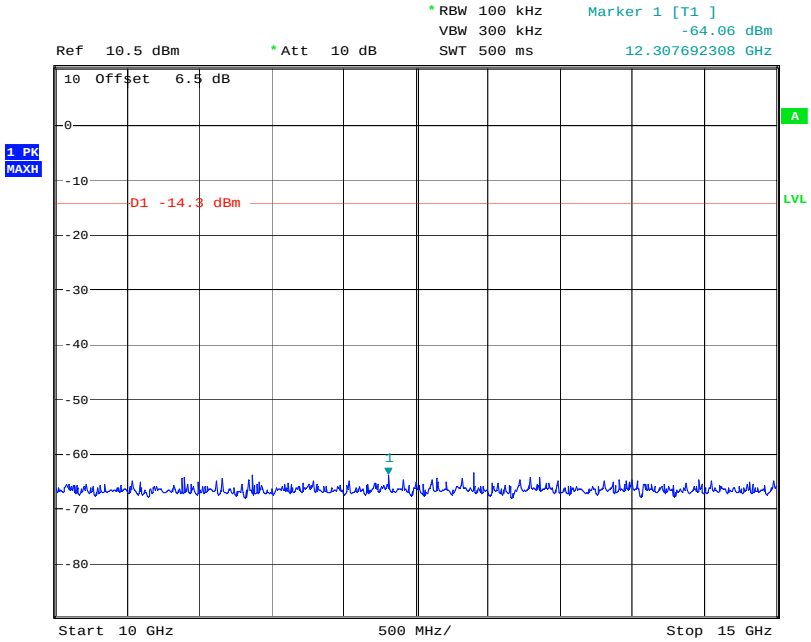

Date: 16.APR.2008 11:05:08

## Bottom Channel 5 GHz – 10 GHz



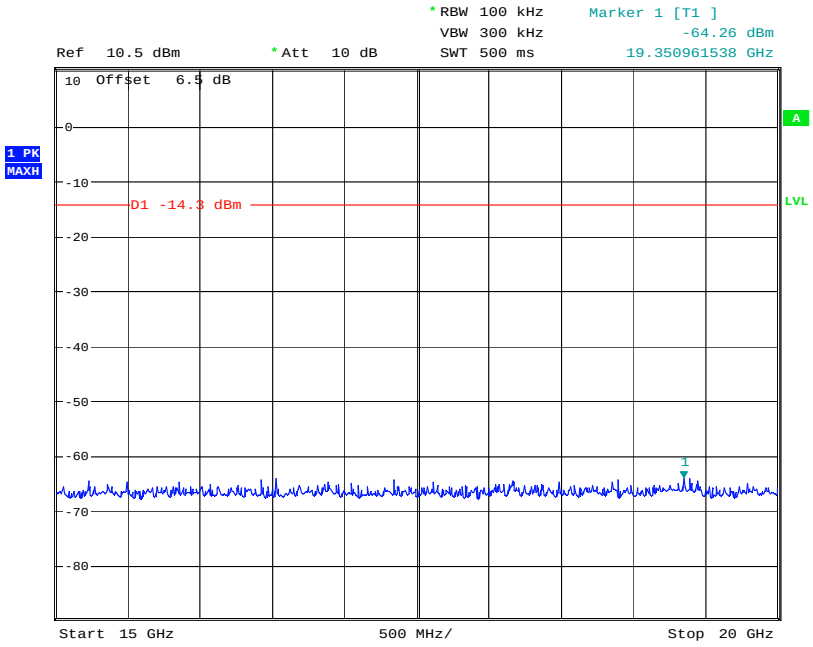

Date: 16.APR.2008 11:05:51

## Bottom Channel 10 GHz – 15 GHz



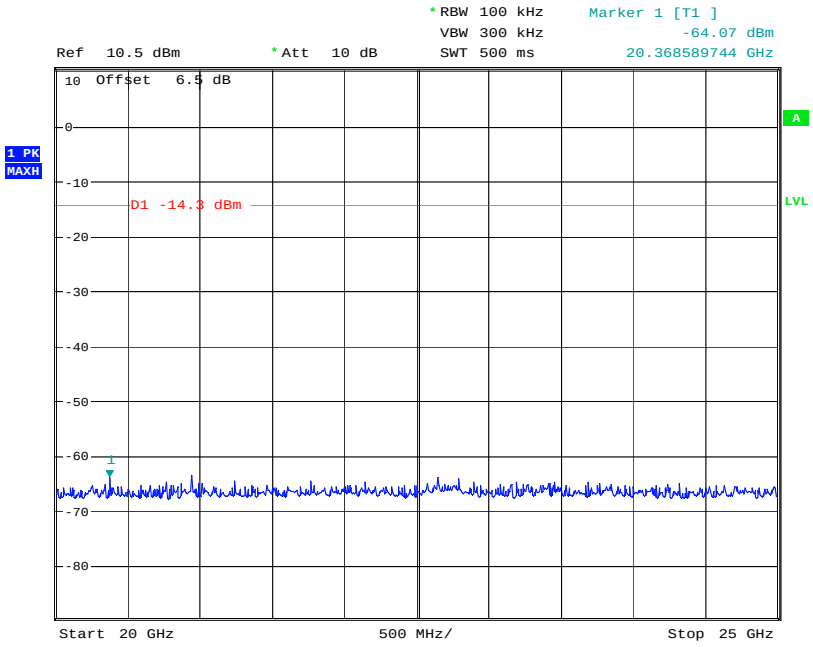

Date: 16.APR.2008 11:06:07

## Bottom Channel 15 GHz – 20 GHz



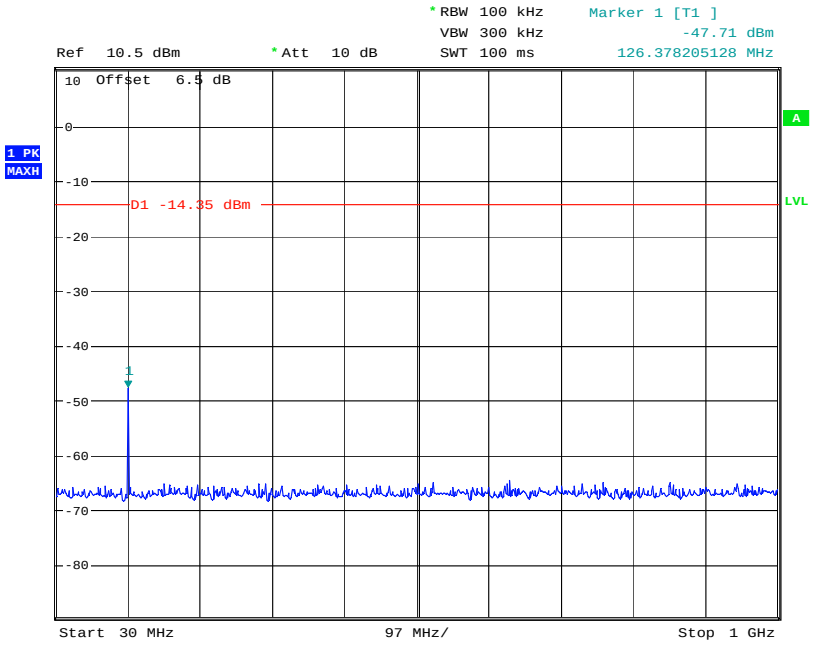

Date: 16.APR.2008 11:06:23

## Bottom Channel 20 GHz – 25 GHz



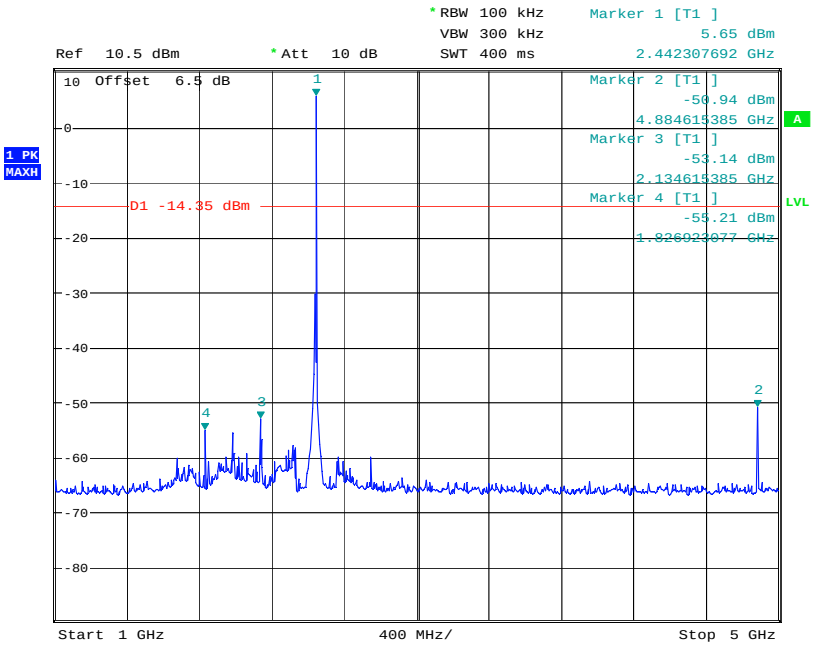

Date: 16.APR.2008 11:06:35

## Middle Channel 30 MHz – 1 GHz



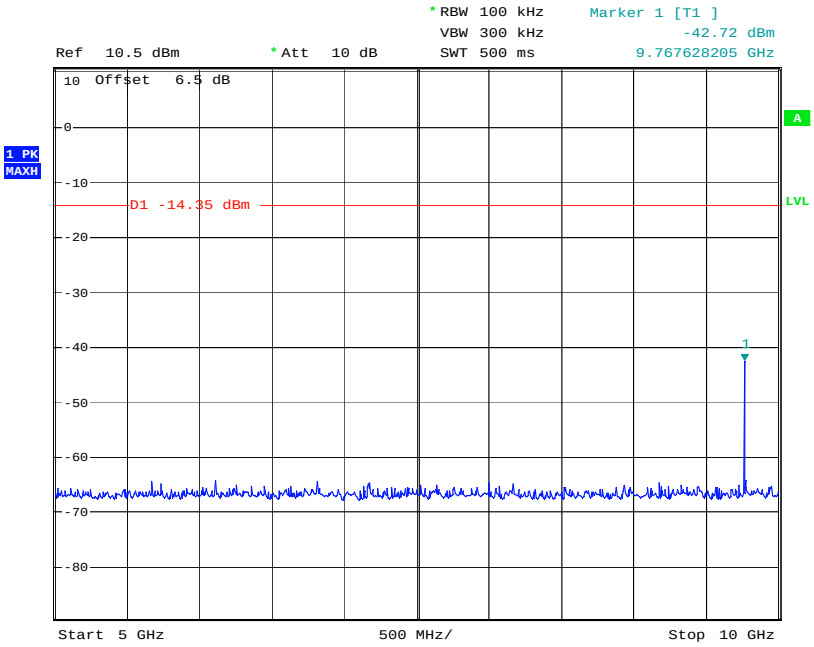

Date: 16.APR.2008 11:01:52

## Middle Channel 1 GHz – 5 GHz



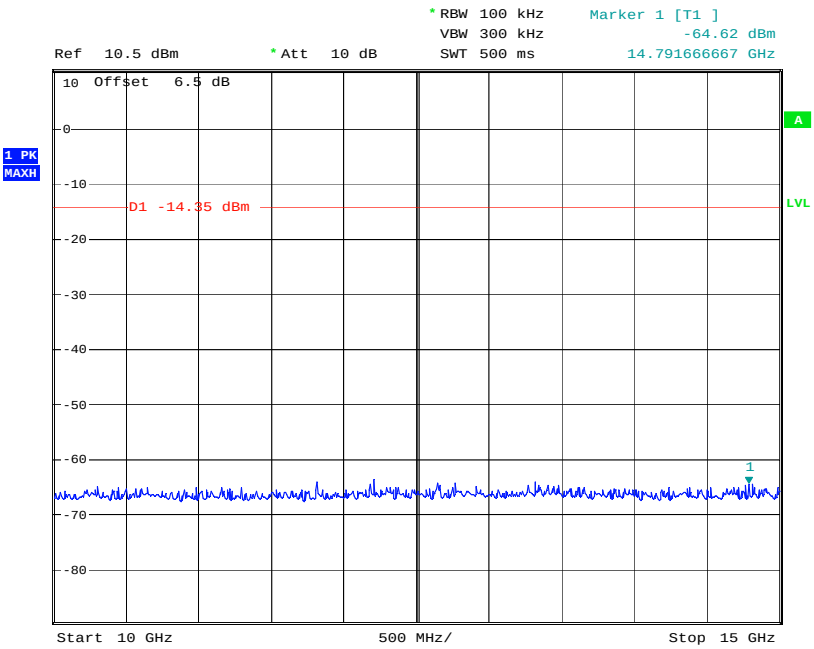

Date: 16.APR.2008 11:01:29

## Middle Channel 5 GHz – 10 GHz



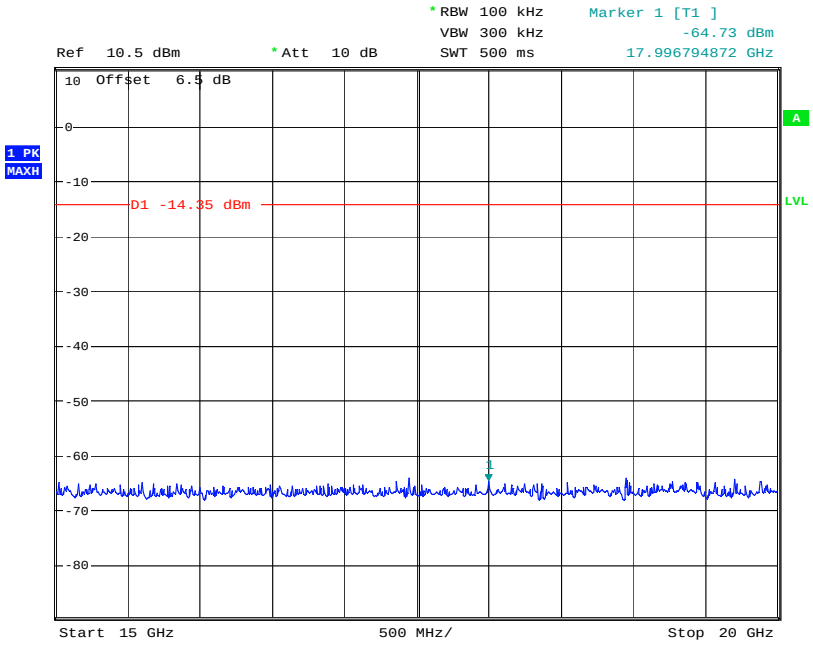

Date: 16.APR.2008 11:02:12

## Middle Channel 10 GHz – 15 GHz



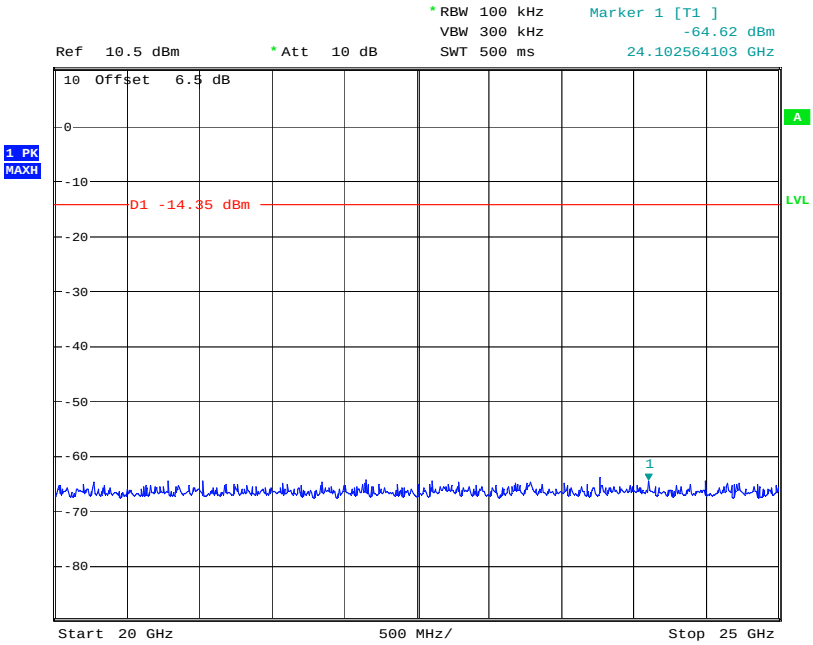

Date: 16.APR.2008 11:02:40

## Middle Channel 15 GHz – 20 GHz



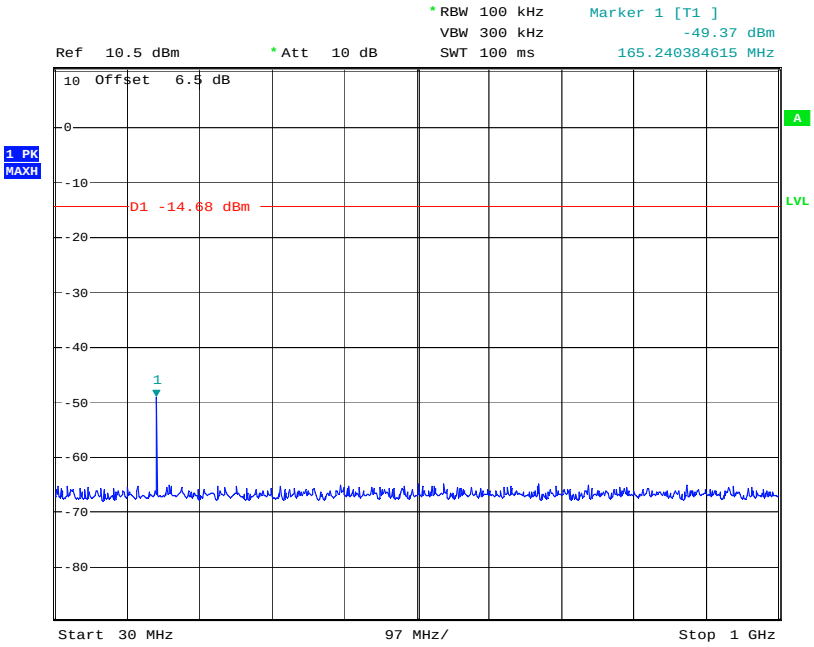

Date: 16.APR.2008 11:02:55

## Middle Channel 20 GHz – 25 GHz



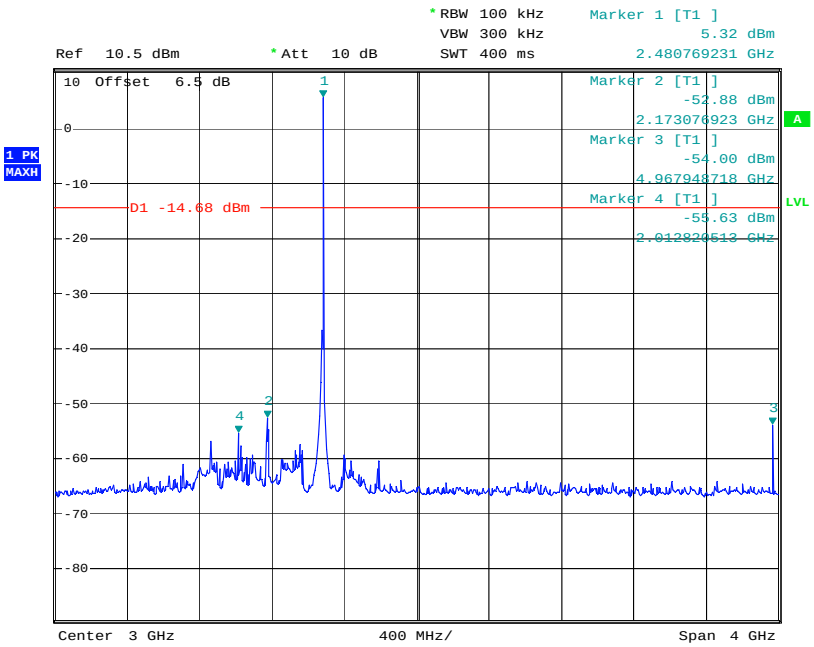

Date: 16.APR.2008 11:03:08

## Top Channel 30 MHz – 1 GHz



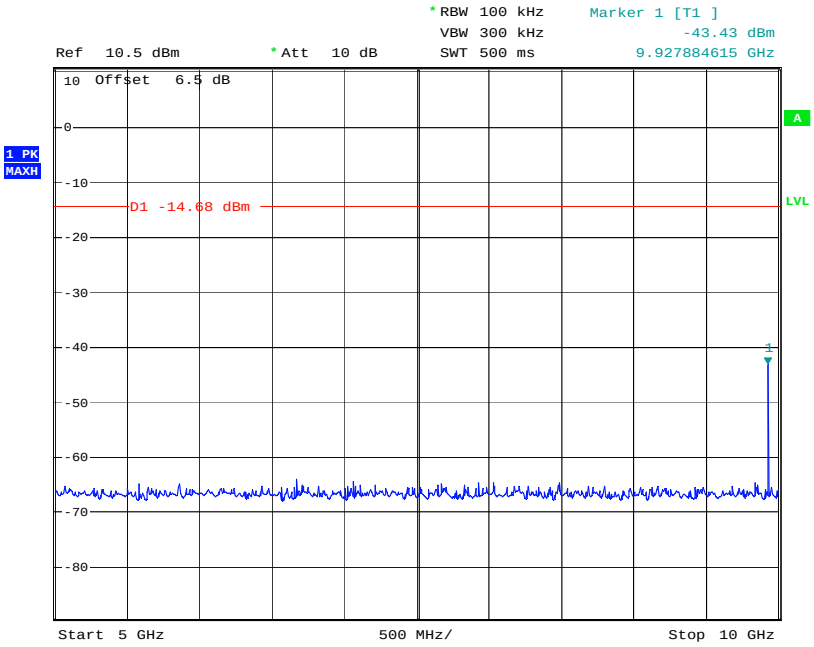

Date: 16.APR.2008 10:59:01

## Top Channel 1 GHz – 5 GHz



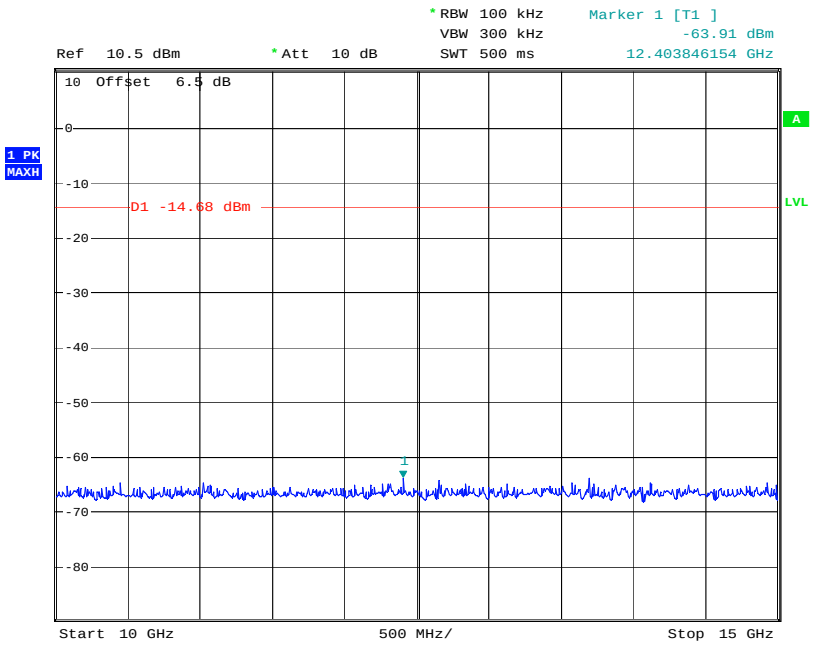

Date: 16.APR.2008 10:57:20

## Top Channel 5 GHz – 10 GHz



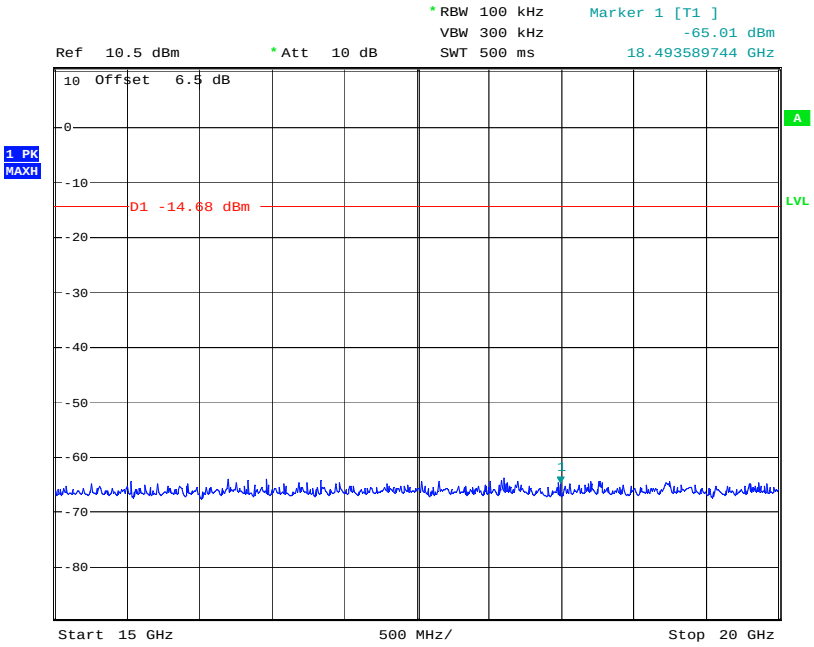

Date: 16.APR.2008 10:57:40

## Top Channel 10 GHz – 15 GHz



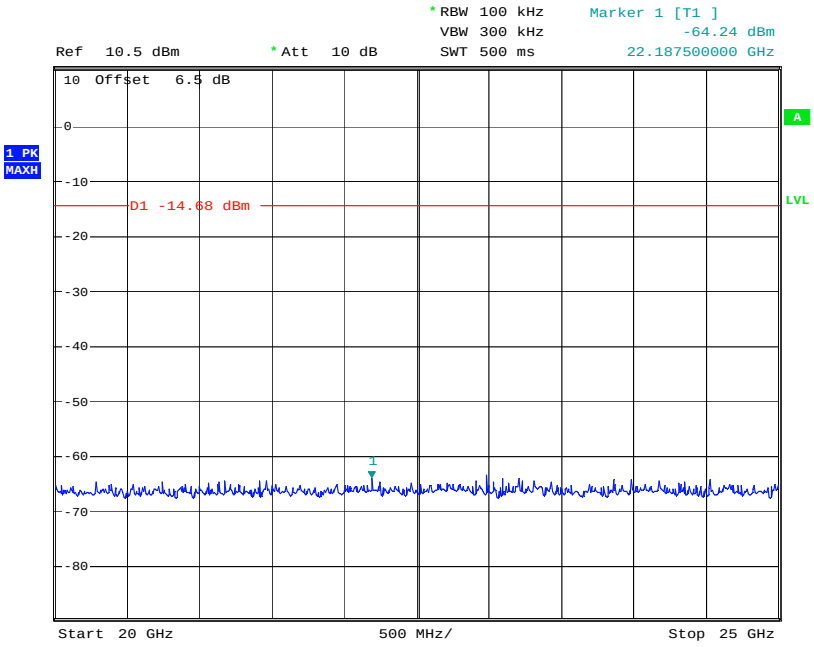

Date: 16.APR.2008 10:58:01

## Top Channel 15 GHz – 20 GHz




Date: 16.APR.2008 10:58:23

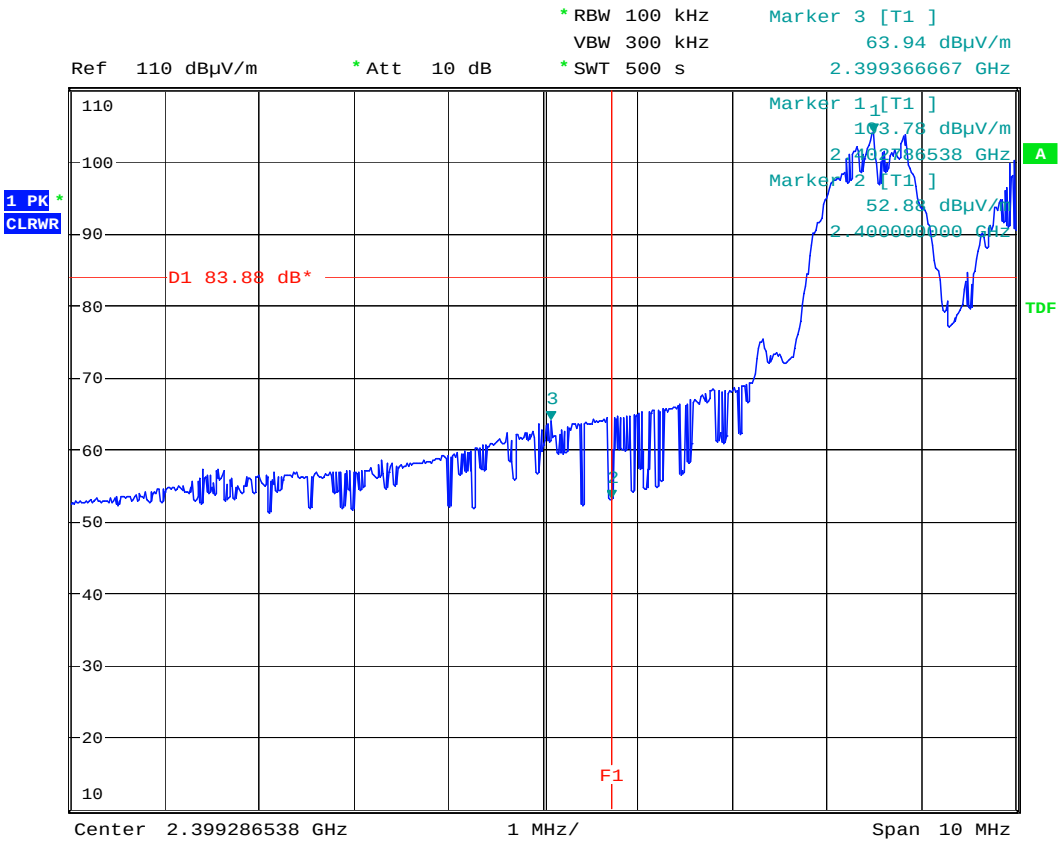
## Top Channel 20 GHz – 25 GHz



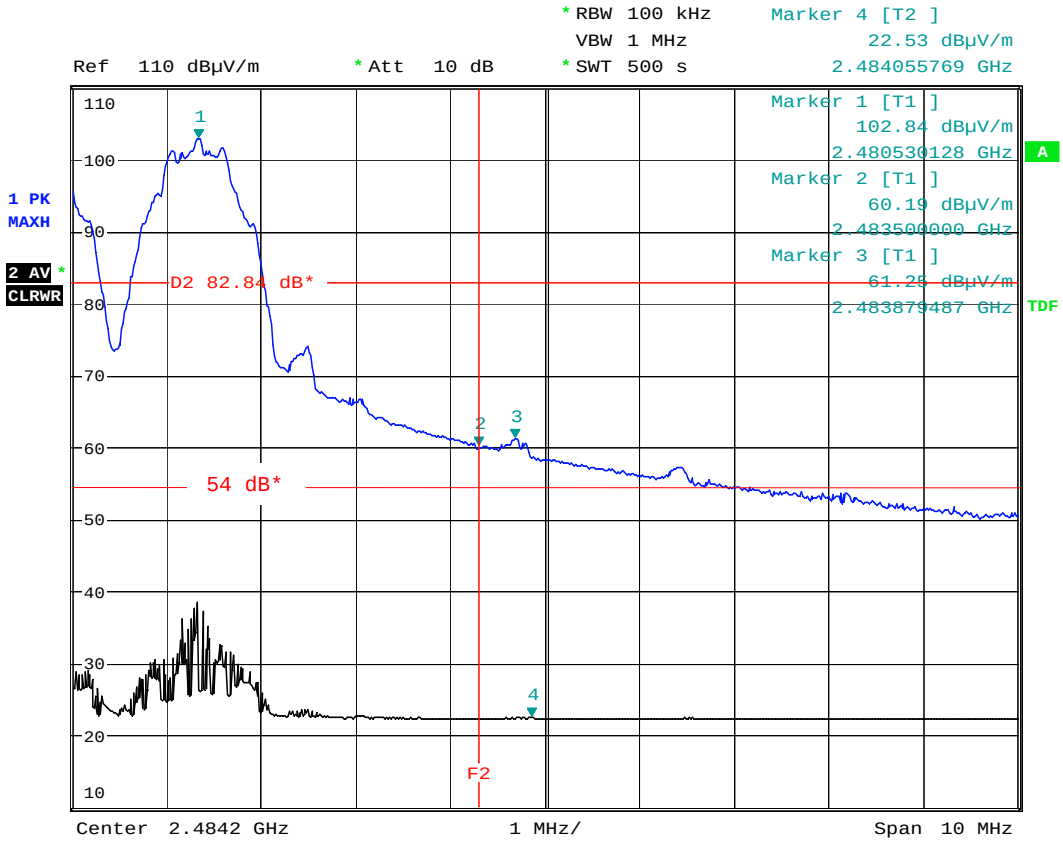

Date: 16.APR.2008 10:58:46

## ANNEX K

## BAND EDGE EMISSIONS RADIATED




Date: 18.APR.2008 15:57:50




Date: 18.APR.2008 11:35:39

## ANNEX L

## MEASUREMENT UNCERTAINTY

## 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 (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%**