

Test report

| | |
|----------------------|---|
| Report Reference ID: | 251589-1TRFWL |
| Test specification: | <p>Title 47-Telecommunication</p> <p>Chapter I - Federal Communications Commission Subchapter D – Safety and special radio services Part 90 – Private land mobile services</p> <p>– Subpart R – Regulations governing the licensing and use of frequencies in the 763–775 and 793–805 MHz bands</p> <p>Class II Permissive Change (addition of 50 kHz emission designator)</p> |
| Applicant: | <p>CalAmp Wireless Networks Inc. 101-5540 Ferrier St. Mount-Royal, QC H4P 1M2</p> |
| Apparatus: | 700 MHz Band SDR Exciter for BDP4 digital base station |
| Model: | SDR-T-001-763 |
| FCC ID: | EOTBDP4-EXCT769 |
| Testing laboratory: | <p>Nemko Canada Inc. 303 River Road Ottawa, ON, Canada K1V 1H2</p> <p>Telephone: (613) 737-9680 Facsimile: (613) 737-9691</p> |


| | Name and title | Date |
|--------------|--|-----------------|
| Tested by: | David Duchesne, Wireless/EMC Specialist | January 9, 2013 |
| Reviewed by: |  <hr/> Andrey Adelberg, Senior Wireless/EMC Specialist | January 9, 2013 |

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Section 1: Report summary

1.1 Test specification

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|----------------|---|
| Specifications | Part 90 – Private land mobile services Subpart R – Regulations governing the licensing and use of frequencies in the 763–775 and 793–805 MHz bands Class II Permissive (Change to add 50 kHz emission designator) |
|----------------|---|

1.2 Statement of compliance

| | |
|------------|---|
| Compliance | As documented on p30 of test report “155790-1TRFWL (FCC Part 90) original” and on p18 of this test report the equipment complies with the 2011 version of 90.543(c), (e), and (f). In the configuration tested the EUT was found compliant This report contains an assessment of apparatus against specifications based upon tests carried out on Sept 14, 2010 on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90; Subpart R. The FCC use signal substitution test method from ANSI/TIA-603-C-2004 for radiated emissions from licensed devices |
|------------|---|

1.3 Exclusions

| | |
|------------|------|
| Exclusions | None |
|------------|------|

1.4 Registration number

| | |
|-------------------------|------------------------------------|
| Test site FCC ID number | 176392 (3 m Semi anechoic chamber) |
|-------------------------|------------------------------------|

1.5 Test report revision history

| Revision # | Details of changes made to test report |
|------------|--|
| TRF | Original report issued |
| R1TRF | Class II permissive change updates |

1.6 Limits of responsibility

| |
|---|
| <ul style="list-style-type: none">– Note that 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.– This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko Canada’s ISO/IEC 17025 accreditation.– Nemko Canada Inc. authorizes the applicant to reproduce this report provided it is reproduced in its entirety and for use by the company’s employees only.– Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties.– Nemko Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. |
|---|



Section 2: Summary of test results

2.1 FCC Part 90 – Private land mobile radio services

| Test description | FCC Reference | Verdict |
|--|---------------------------------------|--------------------|
| RF power output | § 2.1046, § 90.541, § 90.542 § 90.635 | Pass |
| Modulation characteristics | § 2.1047 | N/A ⁽¹⁾ |
| Occupied bandwidth | § 2.1049, § 90.543 | Pass |
| Spurious emissions at antenna terminal | § 2.1051, § 90.543 | Pass |
| Field strength of spurious radiation | § 2.1053, § 90.543 | N/A ⁽²⁾ |
| Frequency stability | § 2.1055, § 90.539 | N/A ⁽²⁾ |

Notes: ⁽¹⁾ This equipment uses digital modulation

⁽²⁾ Class II permissive change to add a 50 kHz emission designator



Section 3: Equipment under test (EUT) and application details

3.1 Applicant details

| | | |
|----------------------------------|-----------------|--------------------------------|
| Applicant complete business name | Name: | CalAmp |
| Mailing address | Address: | 5540 Ferrier Street, Suite 101 |
| | City: | Town of Mount Royal |
| | Province/State: | QC |
| | Post code: | H4P 1M2 |
| | Country: | Canada |

3.2 Modular equipment

| | |
|------------------------------------|----|
| a) Single modular approval | No |
| b) Limited single modular approval | No |

3.3 Product details

| | |
|--|--|
| FCC ID | EOTBDP4-EXCT769 |
| Equipment class | TNB (Licensed Non-Broadcast Station Transmitter) |
| Description of product as it is marketed | 700 MHz Band SDR Exciter for BDP4 digital base station |
| | Model number: SDR-T-001-763 |
| | Serial number: 448149 |

3.4 Application purpose

| | |
|---------------------|--|
| Type of application | Class II permissive change or modification of presently authorized equipment |
|---------------------|--|

3.5 Composite/related equipment

| | |
|------------------------|--|
| a) Composite equipment | The EUT is Not a composite device subject to an additional equipment authorization. |
| b) Related equipment | The EUT is Not part of a system that operates with, or is marketed with, another device that requires an equipment authorization. |
| c) Related FCC ID | Not applicable |



3.6 Sample information

| | |
|-------------------------|-----------------|
| Receipt date: | August 19, 2010 |
| Nemko sample ID number: | Item # 1 and 3 |

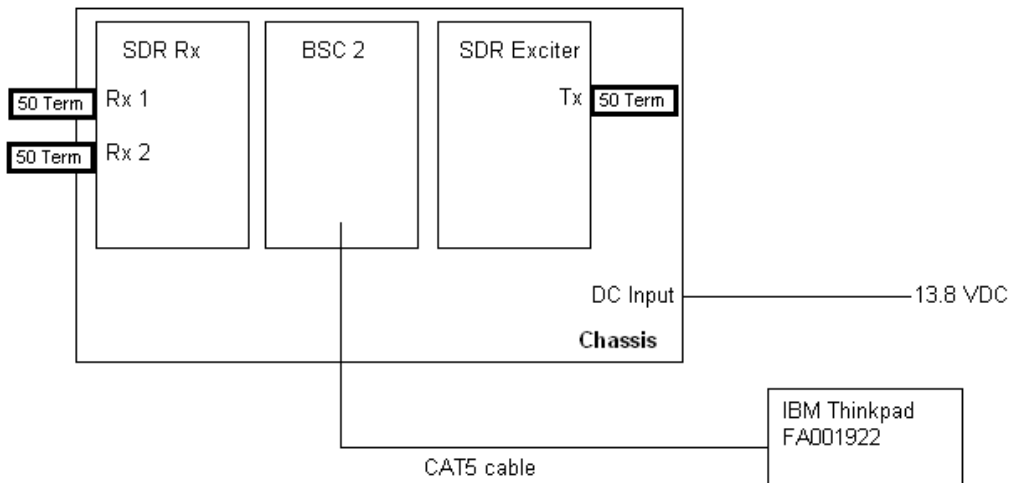
3.7 EUT technical specifications

| | |
|----------------------|---|
| Operating band: | 763–775 MHz |
| Operating frequency: | 764.1–775.9 MHz |
| Modulation type: | 128 Kbps 16-lvl FSK, 96 Kbps 8-lvl FSK, 64 Kbps 4-lvl FSK |
| Occupied bandwidth: | 25.3 kHz |
| Channel spacing: | 50 kHz |
| Emission designator: | 25K3F1D |
| RF output power: | 4 to 400 mW (6 to 26 dBm) Fixed once installed |
| Antenna type/data: | Detachable antenna. N-type male RF in/out port |
| Power source: | 13.8 V _{DC} |

3.8 Operation of the EUT during testing

| | |
|----------|---|
| Details: | The EUT was controlled to transmit continuously by special test mode. |
|----------|---|

3.9 EUT setup diagram



RF ports were connected with 50 Ohm via termination, receiver, or antenna, as required.

Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications: There were no modifications performed to the EUT during this assessment.

4.2 Deviations from laboratory tests procedures

Deviations: No deviations were made from laboratory procedures.

4.3 Technical judgment

Judgment: None

Section 5: Test conditions

5.1 Power source and ambient temperatures

| | |
|---|---|
| Normal temperature, humidity and air pressure test conditions | Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated. |
| Power supply range: | The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages $\pm 5\%$, for which the equipment was designed. |

Section 6: Measurement uncertainty

Nemko Canada Inc. has calculated measurement uncertainty and is documented in EMC/MUC/001 "Uncertainty in EMC measurements." Measurement uncertainty was calculated using the methods described in CISPR 16-4 Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC measurements; as well as described in UKAS LAB34: The expression of Uncertainty in EMC Testing. Measurement uncertainty calculations assume a coverage factor of K=2 with 95% certainty.



Section 7: Test equipment

7.1 Test equipment list

| Equipment | Manufacturer | Model No. | Asset/Serial No. | Next cal. |
|--|-----------------|-----------|------------------|------------|
| Receiver/Spectrum Analyzer | Rohde & Schwarz | ESU 26 | FA002043 | Jan. 14/11 |
| Notes: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use | | | | |



| | | |
|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: RF output power | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

Section 8: Testing data

8.1 RF power output

§ 90.541 Transmitting power limits

The transmitting power of base, mobile, portable and control stations operating in the 769–775 MHz and 799–805 MHz frequency bands must not exceed the maximum limits in this section, and must also comply with any applicable effective radiated power limits in §90.545.

(a) The transmitting power of base transmitters must not exceed the limits given in paragraphs (a), (b) and (c) of §90.635.

§ 90.635 Limitations on power and antenna height.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBw) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

§ 90.542 Broadband transmitting power limits.

(a) The following power limits apply to the 763–768/793–798 MHz band:

- (1) Fixed and base stations transmitting a signal in the 763–768 MHz band with an emission bandwidth of 1 MHz or less must not exceed an ERP of 1000 watts and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section.

Special notes

- Test Method § 2.1046 Measurements required: RF power output.
- The EUT is a base transmitter.
- Utilized FCC 15.31 (m) guidelines for determining the number of test frequencies. See table below

| Frequency range over which device operates | Number of frequencies | Location in the range of operation |
|--|-----------------------|--|
| 1 MHz or less | 1 | Middle |
| 1 to 10 MHz | 2 | 1 near top and 1 near bottom. |
| More than 10 MHz | 3 | 1 near top, 1 near middle and 1 near bottom. |

Notes: Frequency range which device operates is greater than 10 MHz



| | | | |
|--|--|--|--------------------------------|
| Section 8: Testing data | | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: RF output power | | | |
| Test date: September 14, 2010 | | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | | |

| Test data | | | | |
|----------------------|---------------------|---------------------|-----------------------|-------------------------|
| Frequency (MHz) | Power setting (dBm) | Modulation Type | P _{TX} (dBm) | P _{TX} (Watts) |
| 764.1 (Low channel) | 26 | 128 Kbps – Level 16 | 25.97 | 0.39537 |
| 769.1 (Mid channel) | 26 | 128 Kbps – Level 16 | 26.69 | 0.46666 |
| 775.9 (High channel) | 26 | 128 Kbps – Level 16 | 25.54 | 0.35810 |
| 764.1 (Low channel) | 6 | 128 Kbps – Level 16 | 6.06 | 0.00404 |
| 769.1 (Mid channel) | 6 | 128 Kbps – Level 16 | 6.83 | 0.00482 |
| 775.9 (High channel) | 6 | 128 Kbps – Level 16 | 6.12 | 0.00409 |
| 764.1 (Low channel) | 26 | 96 Kbps – Level 8 | 26.4 | 0.43652 |
| 769.1 (Mid channel) | 26 | 96 Kbps – Level 8 | 26.75 | 0.47315 |
| 775.9 (High channel) | 26 | 96 Kbps – Level 8 | 25.39 | 0.34594 |
| 764.1 (Low channel) | 6 | 96 Kbps – Level 8 | 6.06 | 0.00404 |
| 769.1 (Mid channel) | 6 | 96 Kbps – Level 8 | 5.96 | 0.00394 |
| 775.9 (High channel) | 6 | 96 Kbps – Level 8 | 6.09 | 0.00406 |
| 764.1 (Low channel) | 26 | 64 Kbps – Level 4 | 26.5 | 0.44668 |
| 769.1 (Mid channel) | 26 | 64 Kbps – Level 4 | 26.46 | 0.44259 |
| 775.9 (High channel) | 26 | 64 Kbps – Level 4 | 25.82 | 0.38194 |
| 764.1 (Low channel) | 6 | 64 Kbps – Level 4 | 6.04 | 0.00402 |
| 769.1 (Mid channel) | 6 | 64 Kbps – Level 4 | 6.0 | 0.00398 |
| 775.9 (High channel) | 6 | 64 Kbps – Level 4 | 6.0 | 0.00398 |

Notes:

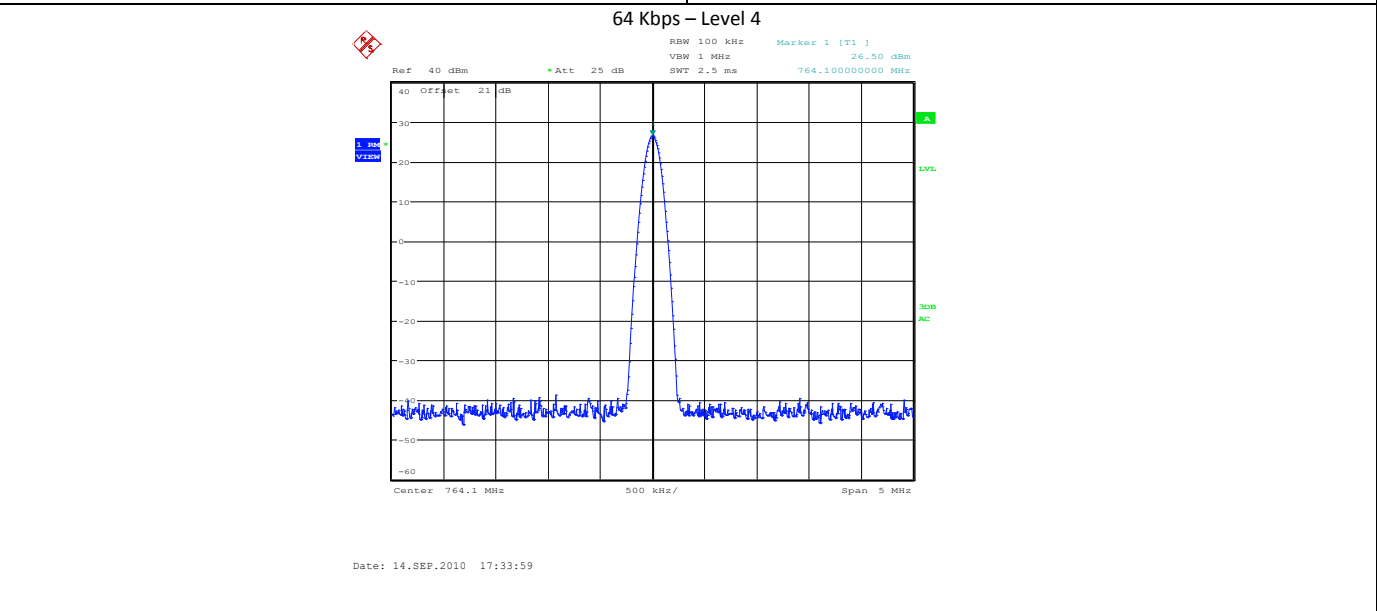
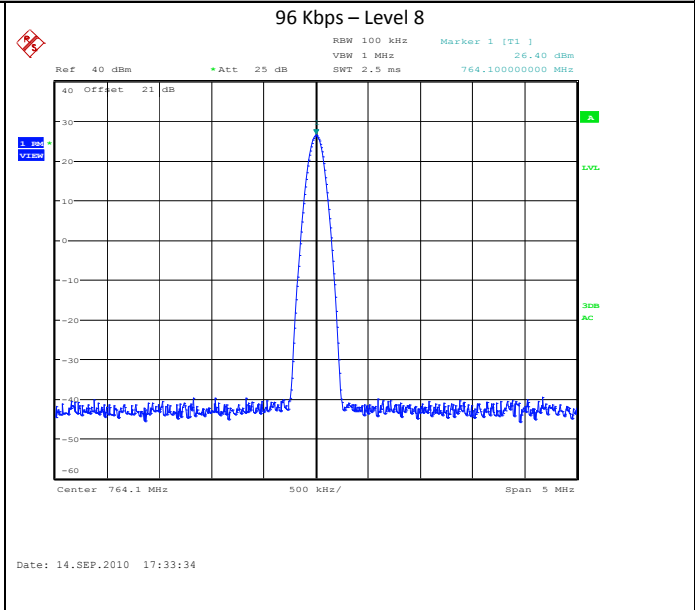
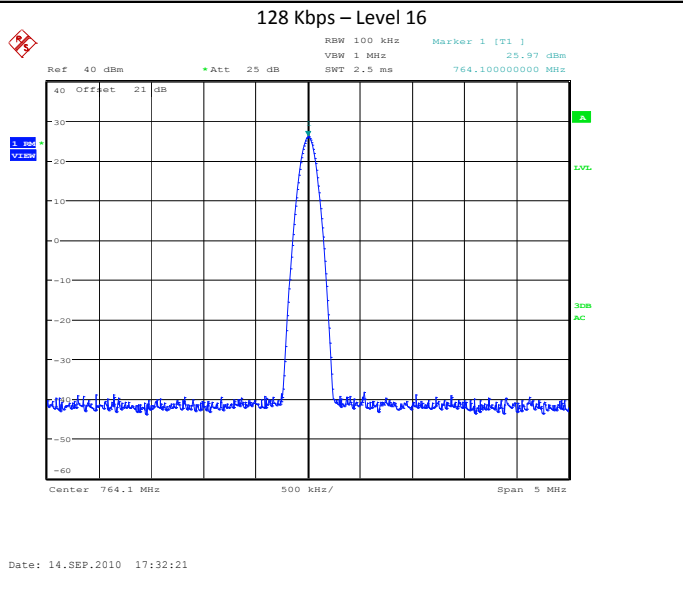
- The output RF power was measured on the antenna port by means of a spectrum analyzer with RBW/VBW set to 100 kHz/1 MHz and detector function set to RMS mode.
- The output power was within ±1.0 dB of the manufacturer's minimum and maximum output rating of 6 dBm and 26 dBm respectively.



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|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: RF output power | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

Test data, continued

Sample spectral plots (50 kHz channel spacing)





| | | |
|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: Occupied bandwidth | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

8.2 Occupied bandwidth

§ 90.543 Emission limitations

(d) *Authorized bandwidth.* Provided that the ACP requirements of this section are met, applicants may request any authorized bandwidth that does not exceed the channel size.

Special notes

– **§ 2.1049 Measurements required: Occupied bandwidth**

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable

- The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99% bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function was utilized.

Test data

| Frequency (MHz) | Channel spacing (kHz) | Modulation Type | Power level (dBm) | 99% OBW (kHz) |
|----------------------|-----------------------|---------------------|-------------------|---------------|
| 764.1 (Low channel) | 50 | 128 Kbps – Level 16 | 26 | 24.35 |
| | | 96 Kbps – Level 8 | 26 | 25.00 |
| | | 64 Kbps – Level 4 | 26 | 25.00 |
| 769.1 (Mid channel) | 50 | 128 Kbps – Level 16 | 26 | 25.32 |
| | | 96 Kbps – Level 8 | 26 | 25.32 |
| | | 64 Kbps – Level 4 | 26 | 24.35 |
| 775.9 (High channel) | 50 | 128 Kbps – Level 16 | 26 | 24.67 |
| | | 96 Kbps – Level 8 | 26 | 24.67 |
| | | 64 Kbps – Level 4 | 26 | 24.67 |

Notes: A spectrum analyzer with internal 99% bandwidth function was utilized.



Section 8: Testing data

Product: 700 MHz Band SDR Exciter for BDP4 digital base station

Test name: Occupied bandwidth

Test date: September 14, 2010

Test engineer: David Duchesne

Verdict: Pass

Temperature: 25 °C

Air pressure: 1000 mbar

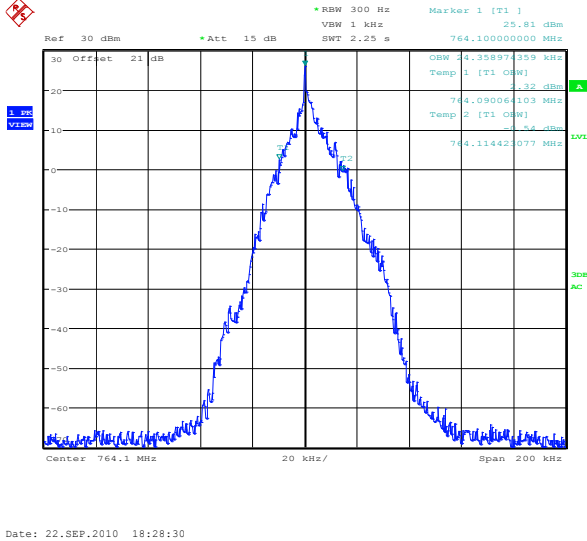
Relative humidity: 55 %

Specification: FCC Part 90 – Private land mobile radio services

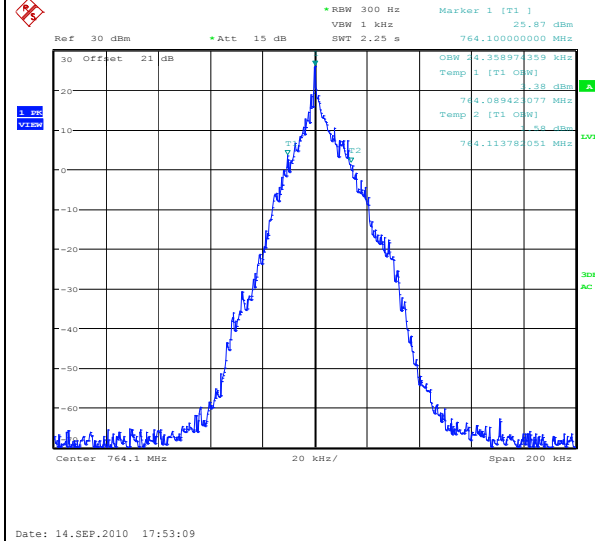
Test data, continued

Spectral plots (50 kHz channel spacing)

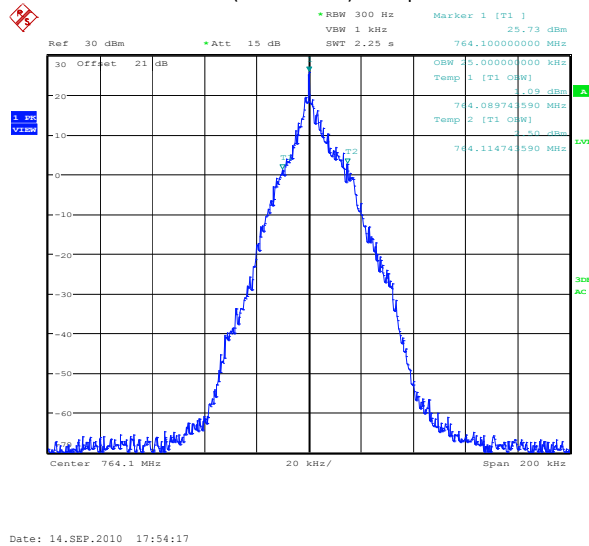
764.1 (Low channel) 128 Kbps – Level 16



764.1 (Low channel) 96 Kbps – Level 8



764.1 (Low channel) 64 Kbps – Level 4



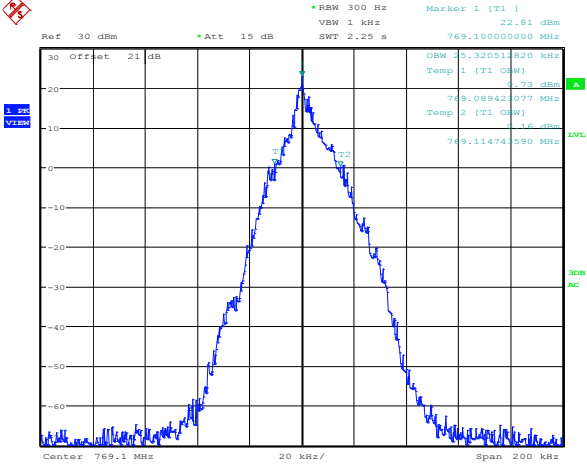


| | | |
|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: Occupied bandwidth | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

Test data, continued

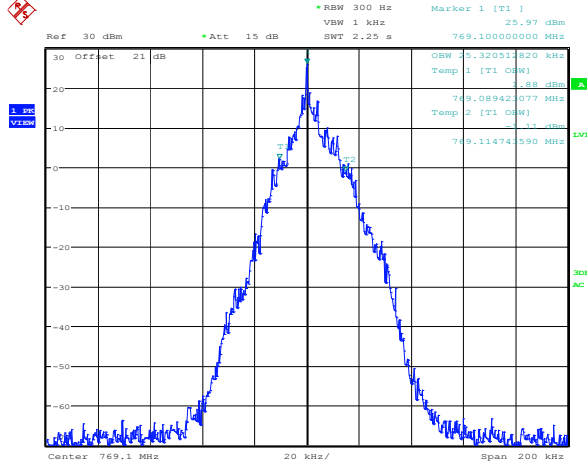
Spectral plots (50 kHz channel spacing), continued

769.1 (Mid channel) 128 Kbps – Level 16



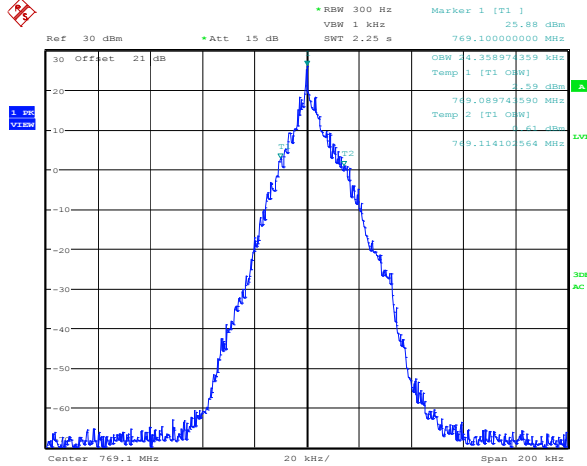
Date: 14.SEP.2010 17:55:34

769.1 (Mid channel) 96 Kbps – Level 8



Date: 14.SEP.2010 17:56:20

769.1 (Mid channel) 64 Kbps – Level 4



Date: 14.SEP.2010 17:57:25



Section 8: Testing data

Product: 700 MHz Band SDR Exciter for BDP4 digital base station

Test name: Occupied bandwidth

Test date: September 14, 2010

Test engineer: David Duchesne

Verdict: Pass

Temperature: 25 °C

Air pressure: 1000 mbar

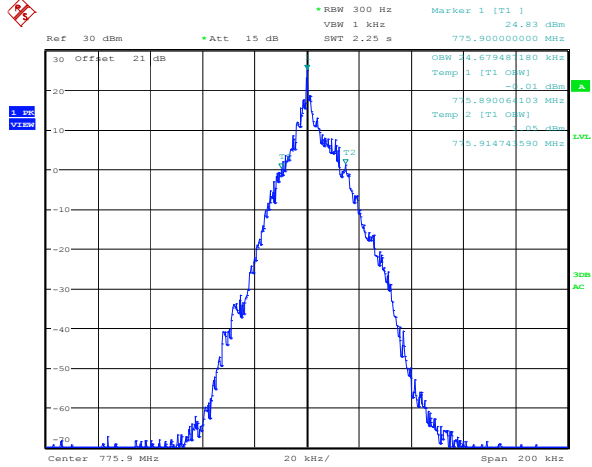
Relative humidity: 55 %

Specification: FCC Part 90 – Private land mobile radio services

Test data, continued

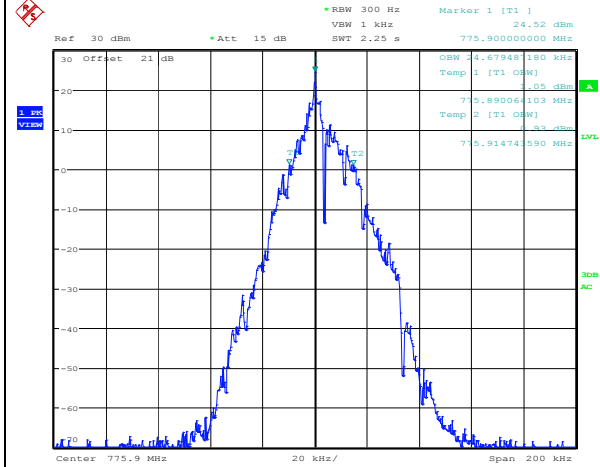
Spectral plots (50 kHz channel spacing), continued

775.9 (High channel) 128 Kbps – Level 16



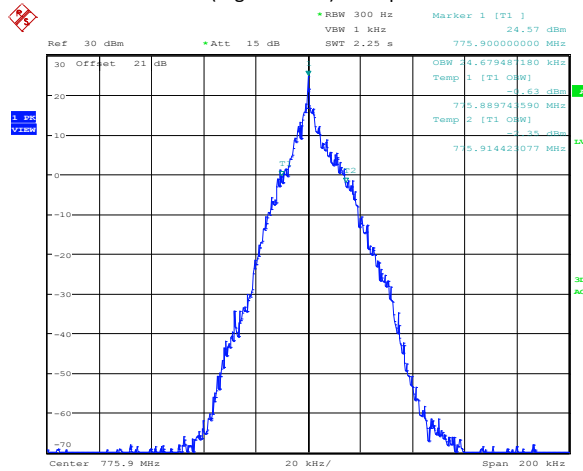
Date: 14.SEP.2010 17:59:07

775.9 (High channel) 96 Kbps – Level 8



Date: 14.SEP.2010 18:00:45

775.9 (High channel) 64 Kbps – Level 4



Date: 14.SEP.2010 18:01:56



| | | |
|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: Spurious emissions at antenna terminal port | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

8.3 Spurious emissions at antenna terminal port

§ 90.543 Emission limitations

(c) *Out-of-band emission limit.* On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least $43 + 10\log(P)$ dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and in a 1 MHz bandwidth for frequencies greater than 1 GHz.

Special notes

- The EUT is a base transmitter.
- The spectrum was searched from 30 MHz to the 10th Harmonic.
- Test were performed with all modulation schemes (128 Kbps – Level 16, 96 Kbps – Level 8, and 64 Kbps – Level 4)
- It was discovered that 128 Kbps level 16 was the worst case.
- Only the worst-case test results have been included



Section 8: Testing data

Product: 700 MHz Band SDR Exciter for BDP4 digital base station

Test name: Spurious emissions at antenna terminal port

Test date: September 14, 2010

Test engineer: David Duchesne

Verdict: Pass

Temperature: 25 °C

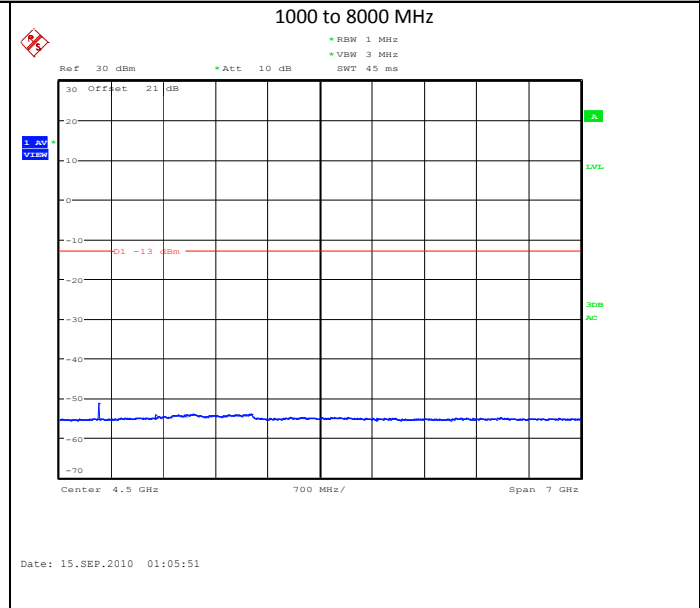
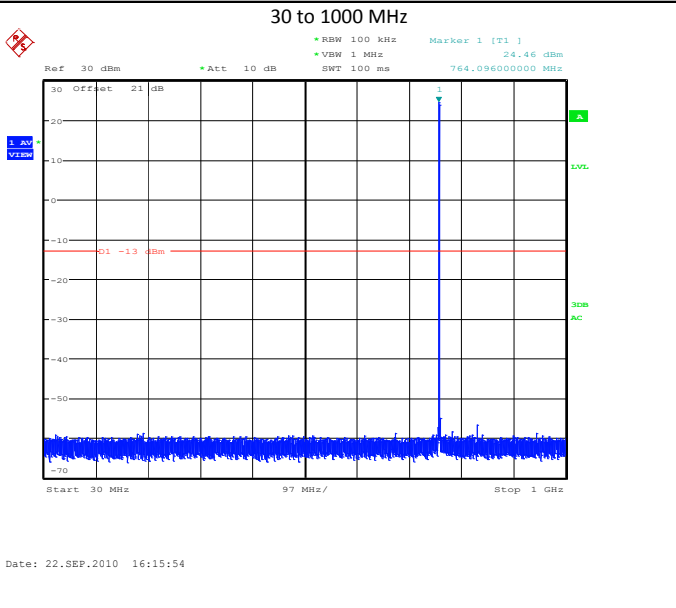
Air pressure: 1000 mbar

Relative humidity: 55 %

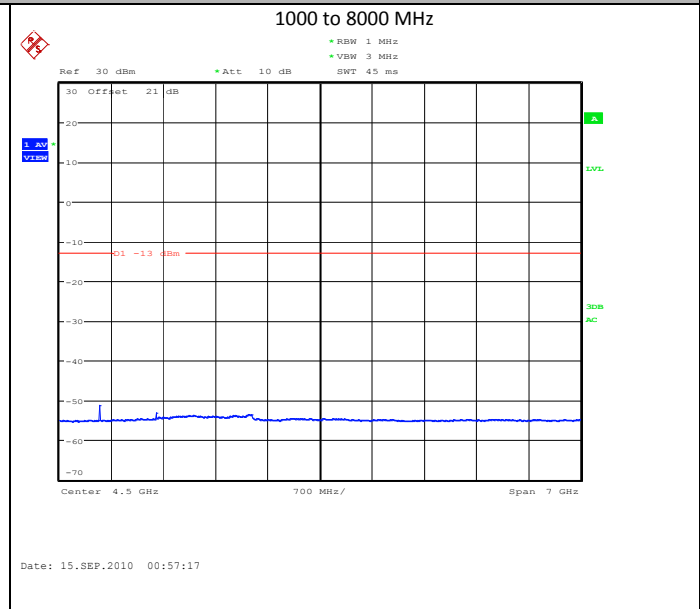
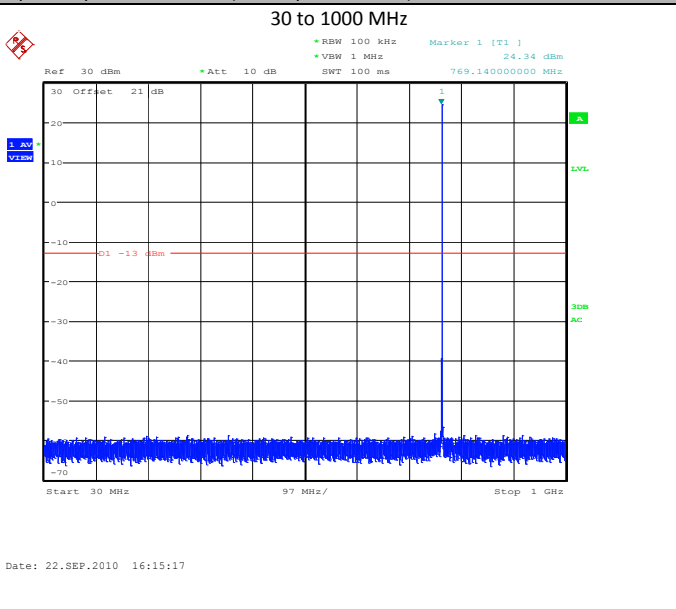
Specification: FCC Part 90 – Private land mobile radio services

Test data

Spectral plots 764.1 MHz (128 Kbps – Level 16)



Spectral plots 769.1 MHz (128 Kbps – Level 16)





| | | |
|--|--|--------------------------------|
| Section 8: Testing data | Product: 700 MHz Band SDR Exciter for BDP4 digital base station | |
| Test name: Spurious emissions at antenna terminal port | | |
| Test date: September 14, 2010 | Test engineer: David Duchesne | Verdict: Pass |
| Temperature: 25 °C | Air pressure: 1000 mbar | Relative humidity: 55 % |
| Specification: FCC Part 90 – Private land mobile radio services | | |

Test data, continued

Spectral plots 775.9 MHz (128 Kbps – Level 16)

