

# Test report

Report Reference ID:	251589-1TRFWL
Test specification:	<p>Title 47-Telecommunication</p> <p>Chapter I - Federal Communications Commission</p> <p>Subchapter D – Safety and special radio services</p> <p>Part 90 – Private land mobile services</p> <ul style="list-style-type: none"> <li>– Subpart R – Regulations governing the licensing and use of frequencies in the 763–775 and 793–805 MHz bands</li> </ul> <p><b>Class II Permissive Change</b> (addition of 50 kHz emission designator)</p>
Applicant:	CalAmp Wireless Networks Inc. 101-5540 Ferrier St. Mount-Royal, QC H4P 1M2
Apparatus:	700 MHz Band SDR Exciter for BDP4 digital base station
Model:	SDR-T-001-763
FCC ID:	EOTBDP4-EXCT769
Testing laboratory:	<p><b>Nemko Canada Inc.</b></p> <p>303 River Road</p> <p>Ottawa, ON, Canada</p> <p>K1V 1H2</p> <p>Telephone: (613) 737-9680</p> <p>Facsimile: (613) 737-9691</p>

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

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## Section 1: Report summary

### 1.1 Test specification

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)
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### 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
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### 1.3 Exclusions

Exclusions	None
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### 1.4 Registration number

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

- 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 contained 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 <sup>(1)</sup>
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 <sup>(2)</sup>
Frequency stability	§ 2.1055, § 90.539	N/A <sup>(2)</sup>

Notes: <sup>(1)</sup>This equipment uses digital modulation

<sup>(2)</sup>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
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### 3.5 Composite/related equipment

a) Composite equipment	The EUT is <b>Not</b> a composite device subject to an additional equipment authorization.
b) Related equipment	The EUT is <b>Not</b> 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**

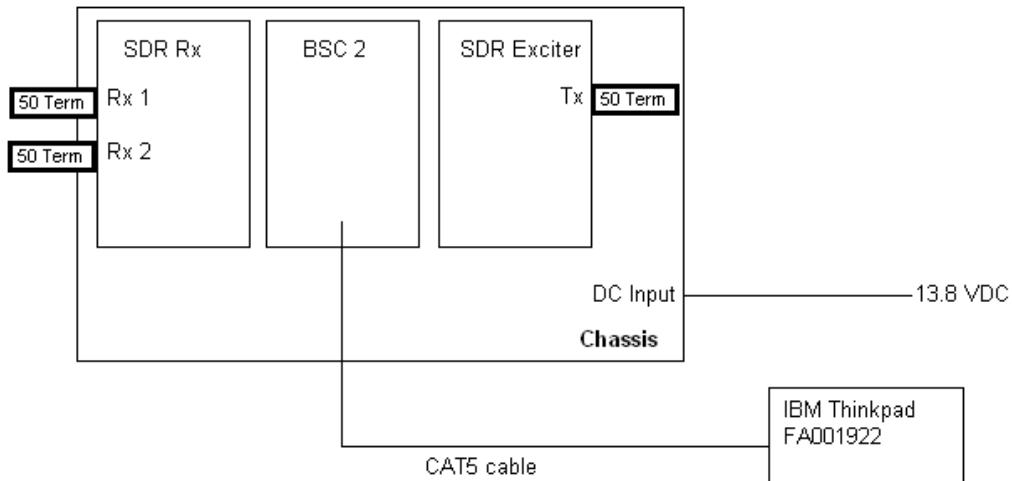
Receipt date:	August 19, 2010
Nemko sample ID number:	Item # 1 and 3

**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 <sub>DC</sub>

**3.8 Operation of the EUT during testing**

Details:	The EUT was controlled to transmit continuously by special test mode.
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**3.9 EUT setup diagram**




## Section 4: Engineering considerations

### 4.1 Modifications incorporated in the EUT

Modifications:	There were no modifications performed to the EUT during this assessment.
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### 4.2 Deviations from laboratory tests procedures

Deviations:	No deviations were made from laboratory procedures.
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### 4.3 Technical judgment

Judgment:	None
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## 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



<b>Section 8: Testing data</b>	<b>Product: 700 MHz Band SDR Exciter for BDP4 digital base station</b>	
<b>Test name:</b> RF output power		
<b>Test date:</b> September 14, 2010	<b>Test engineer:</b> David Duchesne	<b>Verdict:</b> Pass
<b>Temperature:</b> 25 °C	<b>Air pressure:</b> 1000 mbar	<b>Relative humidity:</b> 55 %
<b>Specification:</b> 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.

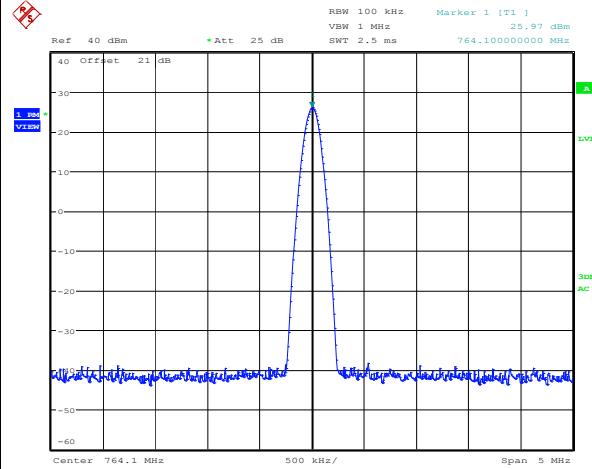
Notes: Frequency range which device operates is greater than 10 MHz

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

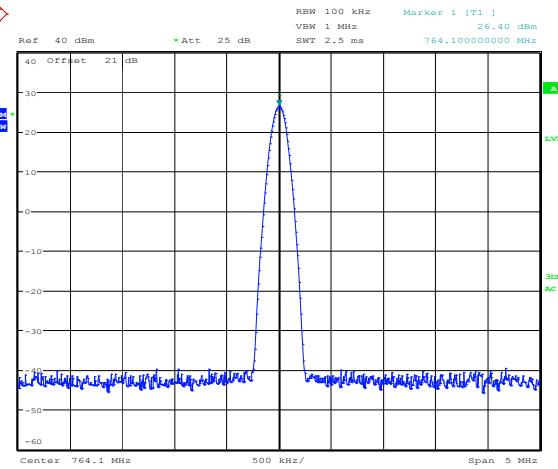
Test data				
Frequency (MHz)	Power setting (dBm)	Modulation Type	P <sub>TX</sub> (dBm)	P <sub>TX</sub> (Watts)
764.1 (Low channel)	26	128 Kbps – Level 16	25.97	0.39537
769.1 (Mid channel)	26	128 Kbps – Level 16	26.69	0.46666
775.9 (High channel)	26	128 Kbps – Level 16	25.54	0.35810
764.1 (Low channel)	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:

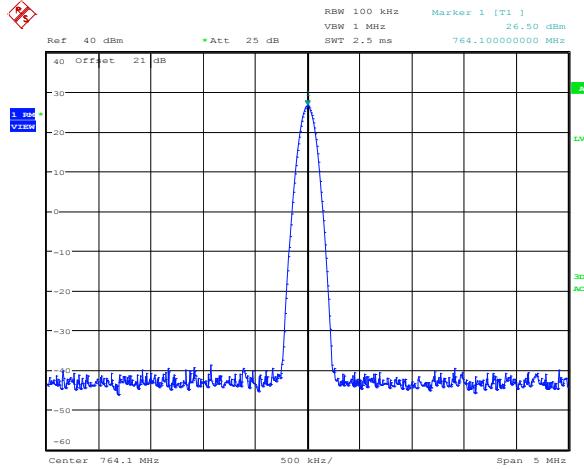
- The output RF power was measured on the antenna port by means of a spectrum analyzer with RBW/VBW set to 100 kHz/1 MHz and detector function set to RMS mode.
- The output power was within  $\pm 1.0$  dB of the manufacturer's minimum and maximum output rating of 6 dBm and 26 dBm respectively.

**Section 8: Testing data****Test name:** RF output power**Test date:** September 14, 2010**Temperature:** 25 °C**Specification:** FCC Part 90 – Private land mobile radio services**Product:** 700 MHz Band SDR Exciter for BDP4 digital base station**Test engineer:** David Duchesne**Verdict:** Pass**Air pressure:** 1000 mbar**Relative humidity:** 55 %**Test data, continued****Sample spectral plots (50 kHz channel spacing)****128 Kbps – Level 16**

Date: 14.SEP.2010 17:32:21

**96 Kbps – Level 8**

Date: 14.SEP.2010 17:33:34

**64 Kbps – Level 4**

Date: 14.SEP.2010 17:33:59



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

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

**Test engineer:** David Duchesne

**Verdict:** Pass

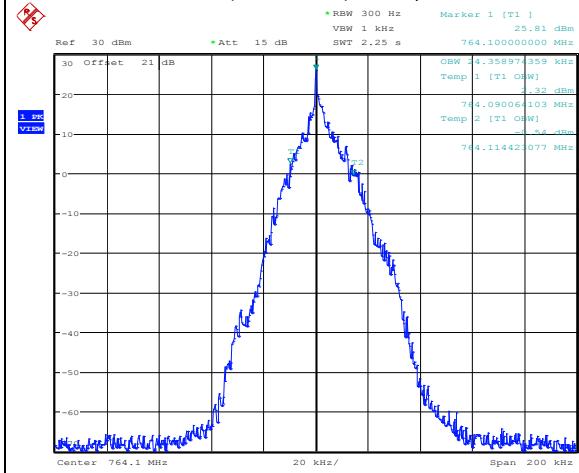
**Air pressure:** 1000 mbar

**Relative humidity:** 55 %

Test data, continued

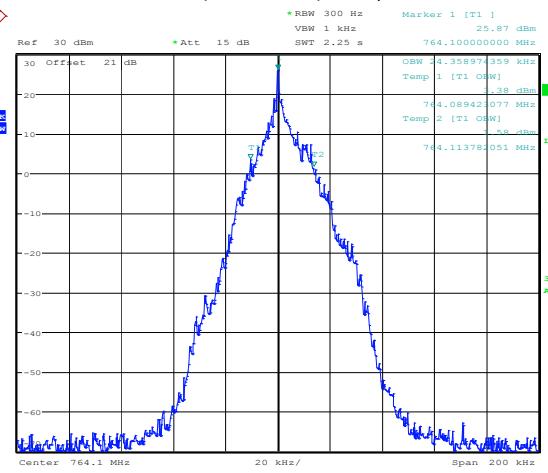
Spectral plots (50 kHz channel spacing)

764.1 (Low channel) 128 Kbps – Level 16



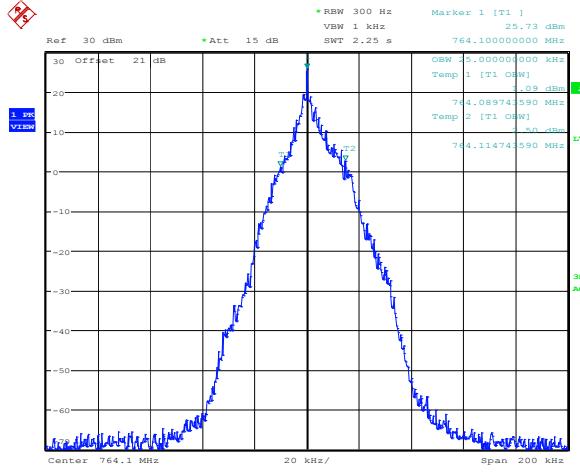
Date: 22.SEP.2010 18:28:30

764.1 (Low channel) 96 Kbps – Level 8



Date: 14.SEP.2010 17:53:09

764.1 (Low channel) 64 Kbps – Level 4



Date: 14.SEP.2010 17:54:17



**Section 8: Testing data**  
**Test name:** Occupied bandwidth  
**Test date:** September 14, 2010  
**Temperature:** 25 °C  
**Specification:** FCC Part 90 – Private land mobile radio services

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

**Test engineer:** David Duchesne

**Verdict:** Pass

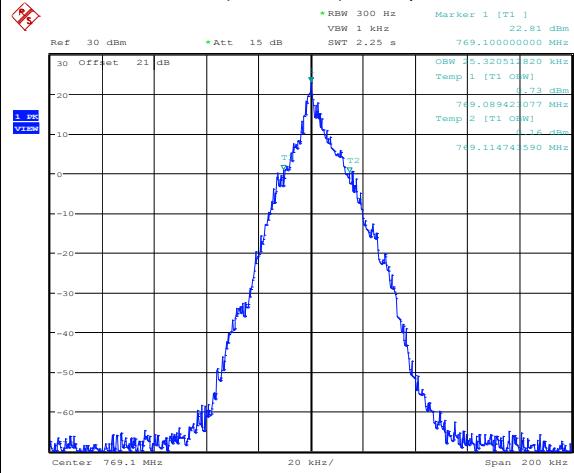
**Air pressure:** 1000 mbar

**Relative humidity:** 55 %

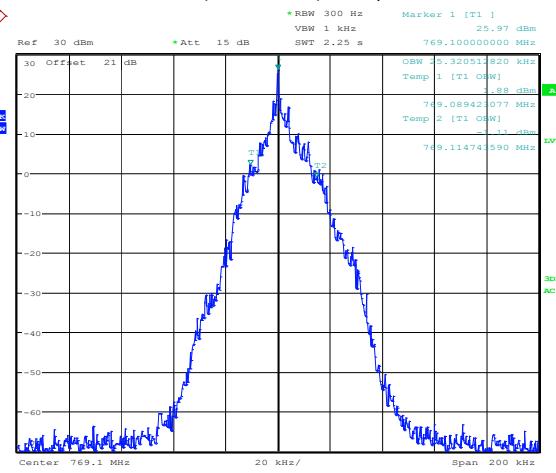
Test data, continued

Spectral plots (50 kHz channel spacing), continued

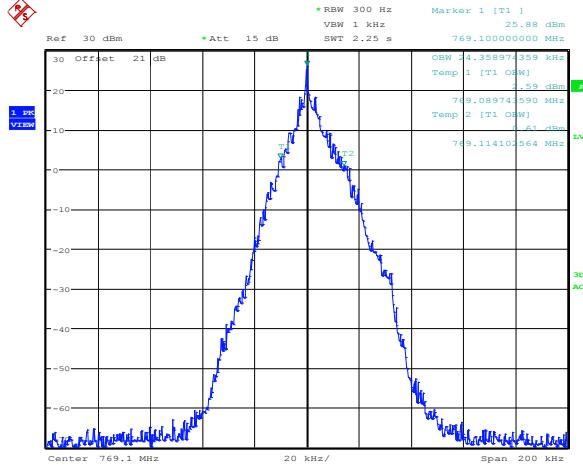
769.1 (Mid channel) 128 Kbps – Level 16



769.1 (Mid channel) 96 Kbps – Level 8



769.1 (Mid channel) 64 Kbps – Level 4





**Section 8: Testing data**  
**Test name:** Occupied bandwidth  
**Test date:** September 14, 2010  
**Temperature:** 25 °C  
**Specification:** FCC Part 90 – Private land mobile radio services

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

**Test engineer:** David Duchesne

**Verdict:** Pass

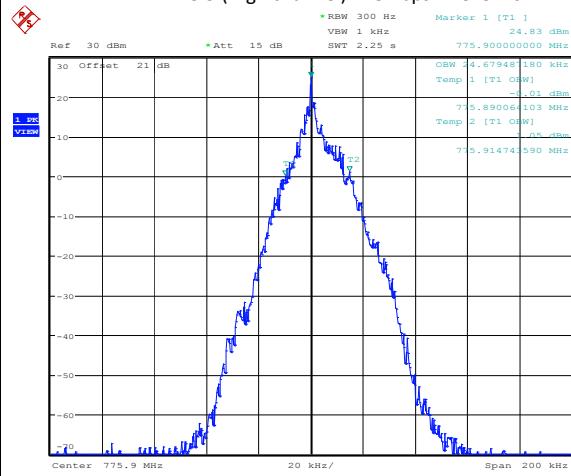
**Air pressure:** 1000 mbar

**Relative humidity:** 55 %

Test data, continued

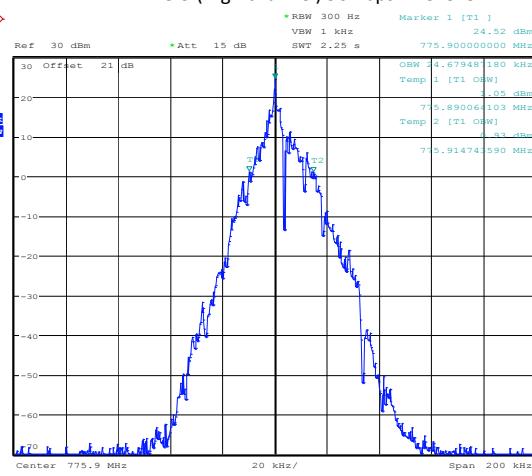
Spectral plots (50 kHz channel spacing), continued

775.9 (High channel) 128 Kbps – Level 16



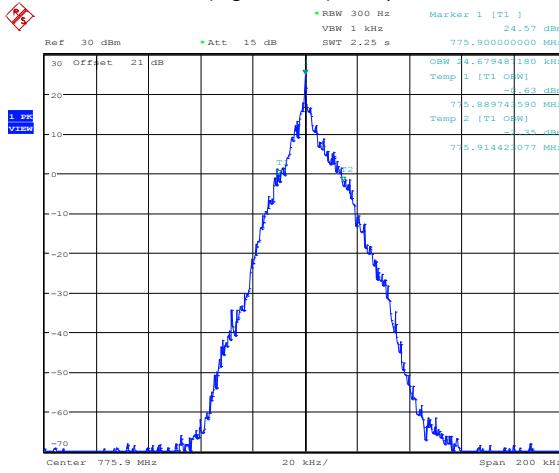
Date: 14.SEP.2010 17:59:07

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



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

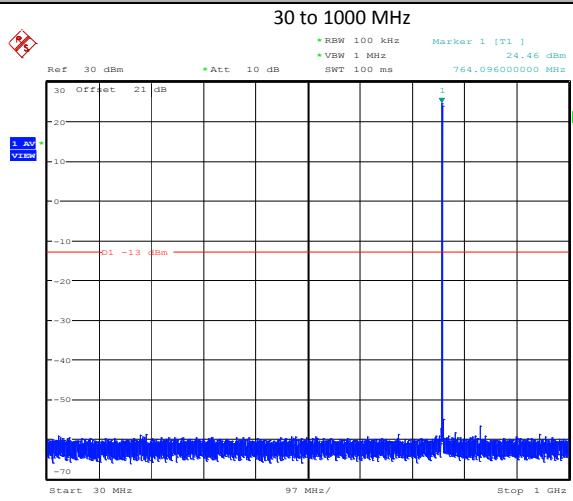
## 8.3 Spurious emissions at antenna terminal port

### § 90.543 Emission limitations

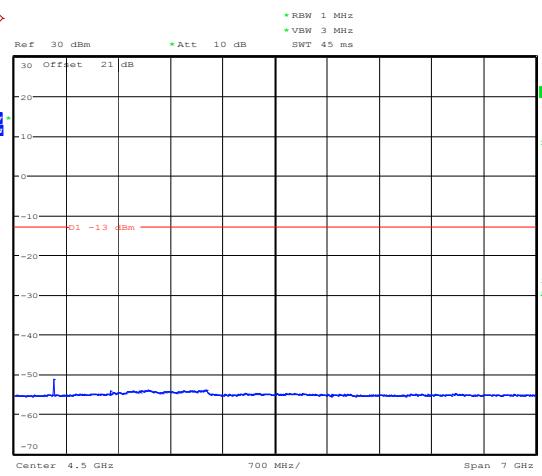
(c) *Out-of-band emission limit.* On any frequency outside of the frequency ranges covered by the ACP tables in this section, the power of any emission must be reduced below the mean output power (P) by at least  $43 + 10\log(P)$  dB measured in a 100 kHz bandwidth for frequencies less than 1 GHz, and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

### Special notes

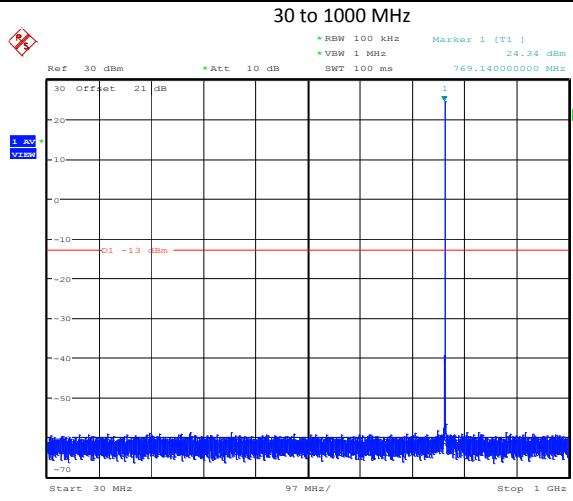
- The EUT is a base transmitter.
- The spectrum was searched from 30 MHz to the 10<sup>th</sup> Harmonic.
- Test were performed with all modulation schemes (128 Kbps – Level 16, 96 Kbps – Level 8, and 64 Kbps – Level 4)
- It was discovered that 128 Kbps level 16 was the worst case.
- Only the worst-case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

**Section 8: Testing data****Test name:** Spurious emissions at antenna terminal port**Test date:** September 14, 2010**Product:** 700 MHz Band SDR Exciter for BDP4 digital base station**Temperature:** 25 °C**Test engineer:** David Duchesne**Verdict:** Pass**Specification:** FCC Part 90 – Private land mobile radio services**Test data****Spectral plots 764.1 MHz (128 Kbps – Level 16)**

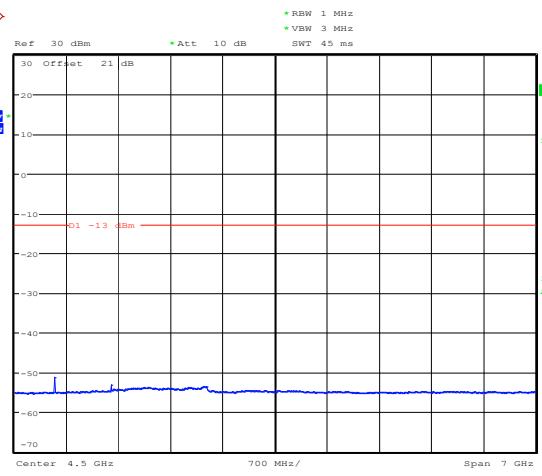
Date: 22.SEP.2010 16:15:54

**1000 to 8000 MHz**

Date: 15.SEP.2010 01:05:51

**Spectral plots 769.1 MHz (128 Kbps – Level 16)**

Date: 22.SEP.2010 16:15:17

**1000 to 8000 MHz**

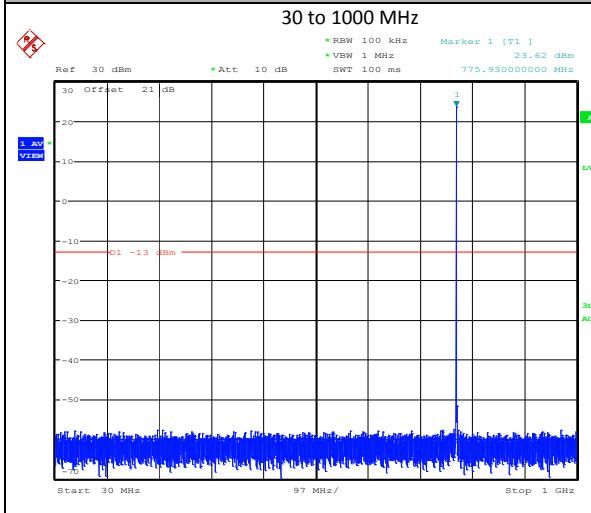
Date: 15.SEP.2010 00:57:17



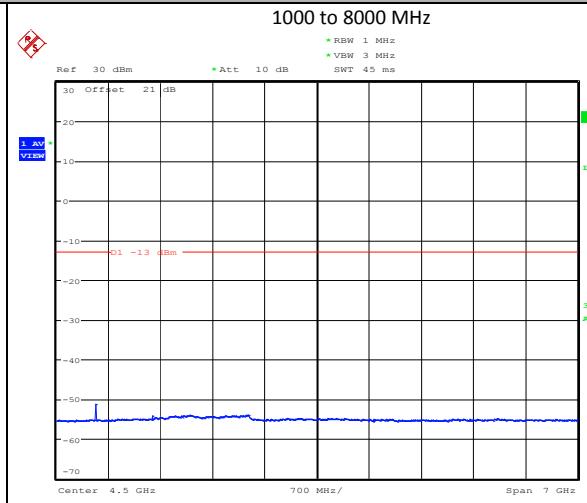
<b>Section 8: Testing data</b>		<b>Product: 700 MHz Band SDR Exciter for BDP4 digital base station</b>
<b>Test name:</b> Spurious emissions at antenna terminal port		
<b>Test date:</b> September 14, 2010	<b>Test engineer:</b> David Duchesne	<b>Verdict:</b> Pass
<b>Temperature:</b> 25 °C	<b>Air pressure: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

### Test data, continued

#### Spectral plots 775.9 MHz (128 Kbps – Level 16)



Date: 22.SEP.2010 16:14:30



Date: 15.SEP.2010 01:05:51