



Nemko

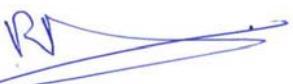
www.nemko.com

Report Reference ID:	155790-1TRFWL
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Test specification:	Title 47-Telecommunication Chapter I - Federal Communications Commission Subchapter D – Safety and special radio services 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
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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:	Nemko Canada Inc. 303 River Road Ottawa, ON, Canada K1V 1H2 Telephone: (613) 737-9680 Facsimile: (613) 737-9691
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	Name and title	Date
Tested by:	David Duchesne, Wireless/EMC Specialist	September 29, 2010
Reviewed by:	 Richard Brazeau, Laboratory Manager	September 29, 2010



Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.
The tests included in this report are within the scope of this accreditation.

Table of contents

Section 1: Report summary	3
1.1 Test specification	3
1.2 Statement of compliance	3
1.3 Exclusions	3
1.4 Registration number	3
1.5 Test report revision history	3
1.6 Limits of responsibility	3
Section 2: Summary of test results	4
2.1 FCC Part 90 – Private land mobile radio services	4
Section 3: Equipment under test (EUT) and application details	5
3.1 Applicant details	5
3.2 Modular equipment	5
3.3 Product details	5
3.4 Application purpose	5
3.5 Composite/related equipment	5
3.6 Sample information	6
3.7 EUT technical specifications	6
3.8 Operation of the EUT during testing	6
3.9 EUT setup diagram	6
Section 4: Engineering considerations	7
4.1 Modifications incorporated in the EUT	7
4.2 Deviations from laboratory tests procedures	7
4.3 Technical judgment	7
Section 5: Test conditions	8
5.1 Power source and ambient temperatures	8
Section 6: Measurement uncertainty	9
Section 7: Test equipment	10
7.1 Test equipment list	10
Section 8: Testing data	11
8.1 RF power output	11
8.2 Occupied bandwidth	14
8.3 Spurious emissions at antenna terminal port	16
8.4 Field strength of spurious radiation	29
8.5 Frequency stability	33
Section 9: Block diagrams of test set-ups	34

**Section 1: Report summary****Product: 700 MHz Band SDR Exciter for BDP4 digital base station****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
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1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant This report contains an assessment of apparatus against specifications based upon tests carried out 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

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.

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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, § 90.210, § 90.543	Pass
Field strength of spurious radiation	§ 2.1053, § 90.210, § 90.543	Pass
Frequency stability	§ 2.1055, § 90.539	Pass

Notes: ⁽¹⁾ This equipment uses digital modulation

**Section 3: Equipment under test (EUT) details****Product: 700 MHz Band SDR Exciter for BDP4 digital base station****Section 3: Equipment under test (EUT) and application details****3.1 Applicant details**

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

3.2 Modular equipment

a) Single modular approval	Single modular approval Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
b) Limited single modular approval	Limited single modular approval Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>

3.3 Product details

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

3.4 Application purpose

Type of application	<input checked="" type="checkbox"/> Original certification <input type="checkbox"/> Change in identification of presently authorized equipment Original FCC ID: _____ Grant date: _____ <input type="checkbox"/> 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 a composite device subject to an additional equipment authorization Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
c) Related FCC ID	If either of the above is "yes": <input type="checkbox"/> has been granted under the FCC ID(s) listed below: <input type="checkbox"/> is in the process of being filled under the FCC ID(s) listed below: <input type="checkbox"/> is pending with the FCC ID(s) listed below: <input type="checkbox"/> has a mix of pending and granted statuses under the FCC ID(s) listed below: i FCC ID: ii FCC ID:

**Section 3: Equipment under test (EUT) details****Product:** 700 MHz Band SDR Exciter for BDP4 digital base station**3.6 Sample information**

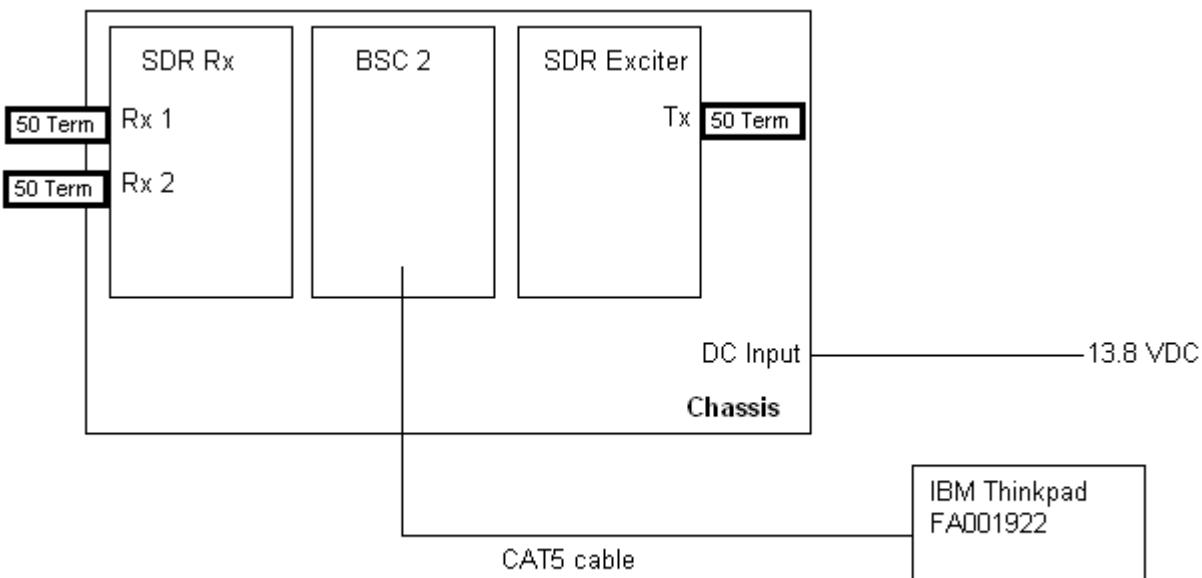
Receipt date:	August 19, 2010
Nemko sample ID number:	Item # 1 and 3

3.7 EUT technical specifications

Operating band:	763 – 775 MHz
Operating frequency:	763.1 – 774.9 MHz
Modulation type:	25kHz-chn spacing: 64Kbps 16-lvl FSK, 48Kbps 8-lvl FSK, 43.2Kbps 8-lvl FSK, 32Kbps 4-lvl FSK.
Occupied bandwidth:	14 kHz
Channel spacing:	25 kHz
Emission designator:	14K0F1D
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 VDC

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

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	Modifications performed to the EUT during this assessment None <input checked="" type="checkbox"/> Yes <input type="checkbox"/> , performed by Client <input type="checkbox"/> or Nemko <input type="checkbox"/> Details:
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4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None <input checked="" type="checkbox"/> Yes <input type="checkbox"/> - details are listed below:
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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 measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	Mar. 09/11
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 40	FA002071	Nov. 30/10
Bilog Antenna	Sunol	JB3	FA002108	Jan. 18/11
Horn Antenna #2	EMCO	3115	FA000825	Jan. 18/11
1–18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 07/10
Temperature Chamber	Thermotron	SM-16C	FA001030	NCR
Multimeter	Fluke	16	FA001831	Jan. 12/11
Air probe	Fluke	None	FA001561	NCR
Frequency Counter	HP	5352B	FA001915	Jan 27/11
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Jan. 14/11

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use



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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		

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.

Frequency range which device operates is greater than 10MHz



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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

Frequency (MHz)	Power setting (dBm)	Modulation Type	P _{TX} (dBm)	P _{TX} (Watts)
763.1 (Low channel)	26	64 Kbps – Level 16	25.96	0.39446
769.1 (Mid channel)	26	64 Kbps – Level 16	26.1	0.40738
774.9 (High channel)	26	64 Kbps – Level 16	25.23	0.33343
763.1 (Low channel)	6	64 Kbps – Level 16	6.28	0.00425
769.1 (Mid channel)	6	64 Kbps – Level 16	6.19	0.00416
774.9 (High channel)	6	64 Kbps – Level 16	6.26	0.00423
763.1 (Low channel)	26	43.2 Kbps – Level 8	26.18	0.41495
769.1 (Mid channel)	26	43.2 Kbps – Level 8	26.20	0.41687
774.9 (High channel)	26	43.2 Kbps – Level 8	25.42	0.34834
763.1 (Low channel)	6	43.2 Kbps – Level 8	6.81	0.00480
769.1 (Mid channel)	6	43.2 Kbps – Level 8	6.69	0.00467
774.9 (High channel)	6	43.2 Kbps – Level 8	6.21	0.00418
763.1 (Low channel)	26	48 Kbps – Level 8	25.98	0.39628
769.1 (Mid channel)	26	48 Kbps – Level 8	26.13	0.41020
774.9 (High channel)	26	48 Kbps – Level 8	25.76	0.37670
763.1 (Low channel)	6	48 Kbps – Level 8	6.64	0.00461
769.1 (Mid channel)	6	48 Kbps – Level 8	6.13	0.00410
774.9 (High channel)	6	48 Kbps – Level 8	6.35	0.00432
763.1 (Low channel)	26	32 Kbps – Level 4	26.01	0.39902
769.1 (Mid channel)	26	32 Kbps – Level 4	26.49	0.44566
774.9 (High channel)	26	32 Kbps – Level 4	25.49	0.35400
763.1 (Low channel)	6	32 Kbps – Level 4	6.35	0.00432
769.1 (Mid channel)	6	32 Kbps – Level 4	6.65	0.00462
774.9 (High channel)	6	32 Kbps – Level 4	6.24	0.00421

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.



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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

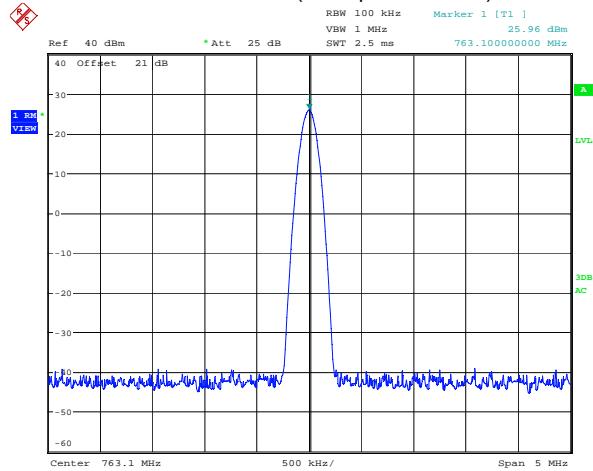
Air pressure: 1000 mbar

Relative humidity: 55 %

Test data, continued

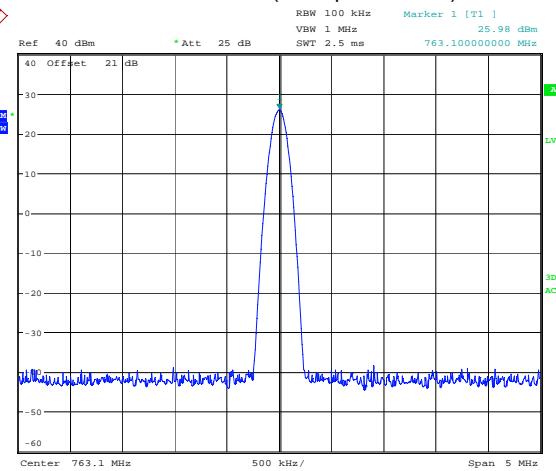
Sample spectral plots

763.1MHz (64 Kbps – Level 16)



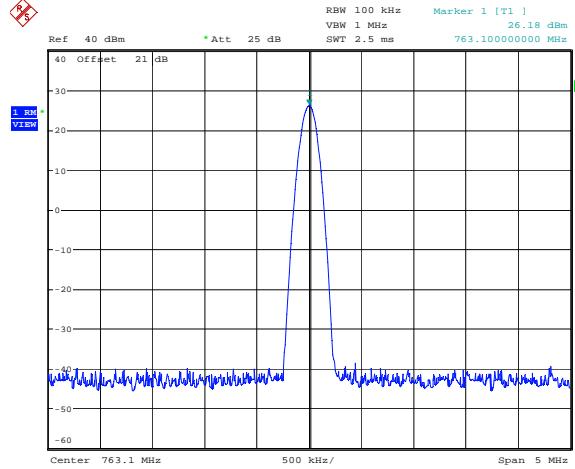
Date: 14.SEP.2010 16:48:57

763.1MHz (48 Kbps – Level 8)



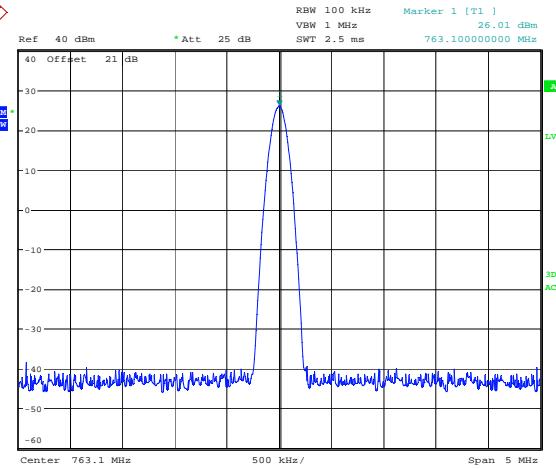
Date: 14.SEP.2010 16:49:47

763.1MHz (43.2 Kbps – Level 8)



Date: 14.SEP.2010 16:51:14

763.1MHz (32 Kbps – Level 4)



Date: 14.SEP.2010 16:51:57



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)
763.1 (Low channel)	25	32 Kbps – Level 4	26	13.78
		64 Kbps – Level 16	26	13.14
		48 Kbps – Level 8	26	13.46
		43.2 Kbps – Level 8	26	13.3
769.1 (Mid channel)	25	32 Kbps – Level 4	26	13.46
		64 Kbps – Level 16	26	13.96
		48 Kbps – Level 8	26	13.46
		43.2 Kbps – Level 8	26	13.3
774.9 (High channel)	25	32 Kbps – Level 4	26	13.6
		64 Kbps – Level 16	26	13.46
		48 Kbps – Level 8	26	13.78
		43.2 Kbps – Level 8	26	13.14



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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

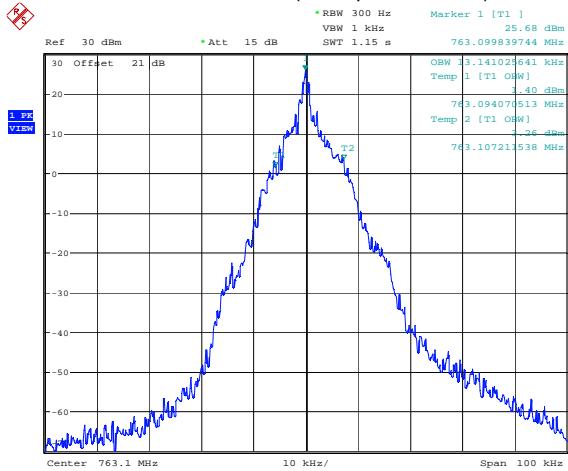
Air pressure: 1000 mbar

Relative humidity: 55 %

Test data, continued

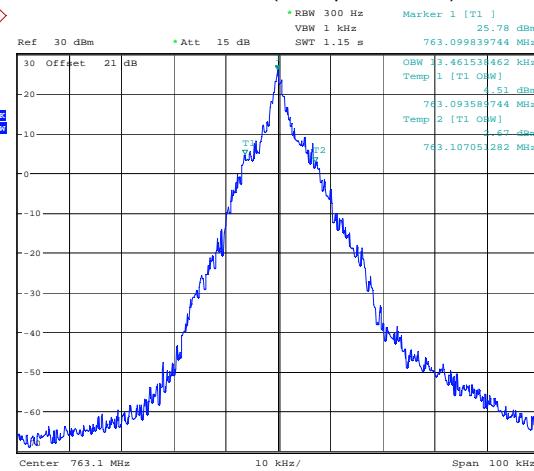
Sample spectral plots

763.1MHz (64 Kbps – Level 16)



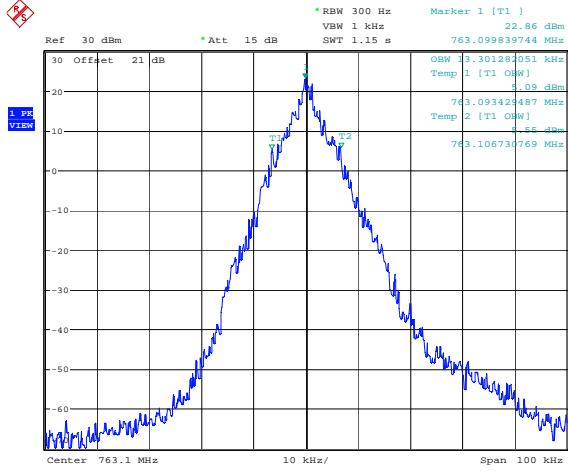
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763.1MHz (48 Kbps – Level 8)



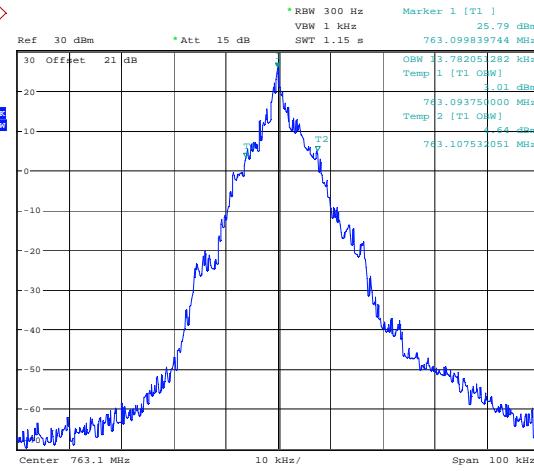
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763.1MHz (43.2 Kbps – Level 8)



Date: 14.SEP.2010 18:18:04

763.1MHz (32 Kbps – Level 4)



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



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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

§ 90.210 Emission masks

(c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (1) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 5 kHz, but not more than 10 kHz: At least $83 \log (f_d/5)$ dB;
- (2) On any frequency removed from the center of the authorized bandwidth by a displacement frequency (f_d in kHz) of more than 10 kHz, but not more than 250 percent of the authorized bandwidth: At least $29 \log (f_d^2/11)$ dB or 50 dB, whichever is the lesser attenuation;
- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

§ 90.543 Emission limitations

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the emission limitations in paragraphs (a) through (d) of this section. Transmitters operating in 763–768 MHz and 793–798 MHz bands must meet the emission limitations in (e) of this section.

(a) The adjacent channel power (ACP) requirements for transmitters designed for various channel sizes are shown in the following tables. Mobile station requirements apply to handheld, car mounted and control station units. The tables specify a value for the ACP as a function of the displacement from the channel center frequency and measurement bandwidth. In the following tables, "(s)" indicates a swept measurement may be used.

25 kHz Base Transmitter ACP Requirements		
Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)
15.625	6.25	-40
21.875	6.25	-60
37.5	25	-60
62.5	25	-65
87.5	25	-65
150	100	-65
250	100	-65
350	100	-65
>400 kHz to 12 MHz	30(s)	-80
12 MHz to paired receive band	30(s)	-80
In the paired receive band	30(s)	-100



Section 8: Testing data		
Test name: Spurious emissions at antenna terminal port	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
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		

§ 90.543 Emission limitations, continued

(b) *ACP measurement procedure.* The following are the procedures for making the transmitter ACP measurements. For all measurements modulate the transmitter as it would be modulated in normal operating conditions. For time division multiple access (TDMA) systems, the measurements are to be made under TDMA operation only during time slots when the transmitter is active. All measurements are made at the transmitter's output port. If a transmitter has an integral antenna, a suitable power coupling device shall be used to couple the RF signal to the measurement instrument. The coupling device shall substantially maintain the proper transmitter load impedance. The ACP measurements may be made with a spectrum analyzer capable of making direct ACP measurements. "Measurement bandwidth", as used for non-swept measurements, implies an instrument that measures the power in many narrow bandwidths equal to the nominal resolution bandwidth and integrates these powers to determine the total power in the specified measurement bandwidth.

- (1) *Setting reference level.* Set transmitter to maximum output power. Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth to the channel size. For example, for a 6.25 kHz transmitter set the measurement bandwidth to 6.25 kHz. Set the frequency offset of the measurement bandwidth to zero and adjust the center frequency of the instrument to the assigned center frequency to measure the average power level of the transmitter. Record this power level in dBm as the "reference power level."
- (2) *Non-swept power measurement.* Using a spectrum analyzer capable of ACP measurements, set the measurement bandwidth and frequency offset from the assigned center frequency as shown in the tables in §90.543 (a) above. Any value of resolution bandwidth may be used as long as it does not exceed 2 percent of the specified measurement bandwidth. Measure the power level in dBm. These measurements should be made at maximum power. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.
- (3) *Swept power measurement.* Set a spectrum analyzer to 30 kHz resolution bandwidth, 1 MHz video bandwidth and average, sample, or RMS detection. Set the reference level of the spectrum analyzer to the RMS value of the transmitter power. Sweep above and below the carrier frequency to the limits defined in the tables. Calculate ACP by subtracting the reference power level measured in (b)(1) from the measurements made in this step. The absolute value of the calculated ACP must be greater than or equal to the absolute value of the ACP given in the table for each condition above.

(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.

(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.

(e) For operations in the 763–768 MHz and the 793–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $76 + 10 \log(P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $65 + 10 \log(P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.



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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		

§ 2.1051 Measurements required: Spurious emissions at antenna terminals.

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

Special notes

- The EUT is a base transmitter.
- The spectrum was searched from 30MHz to the 10th Harmonic.



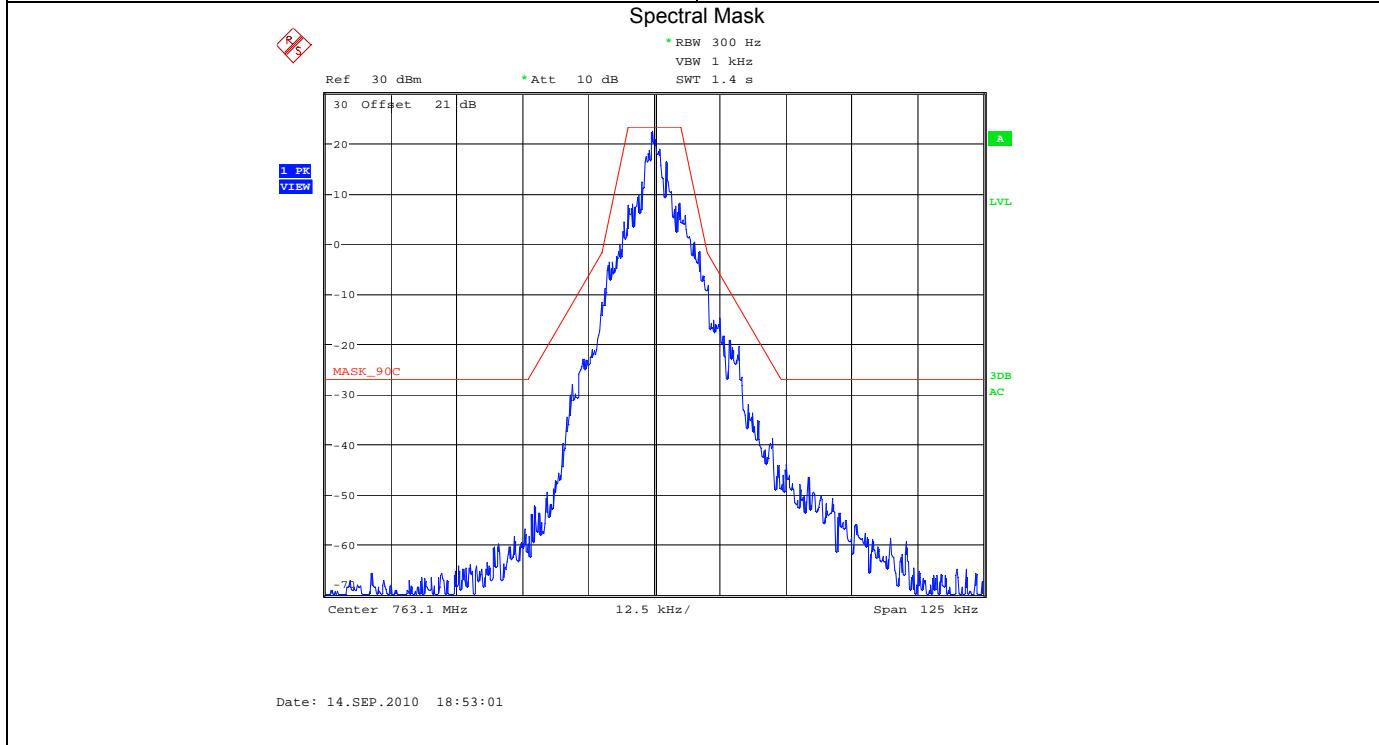
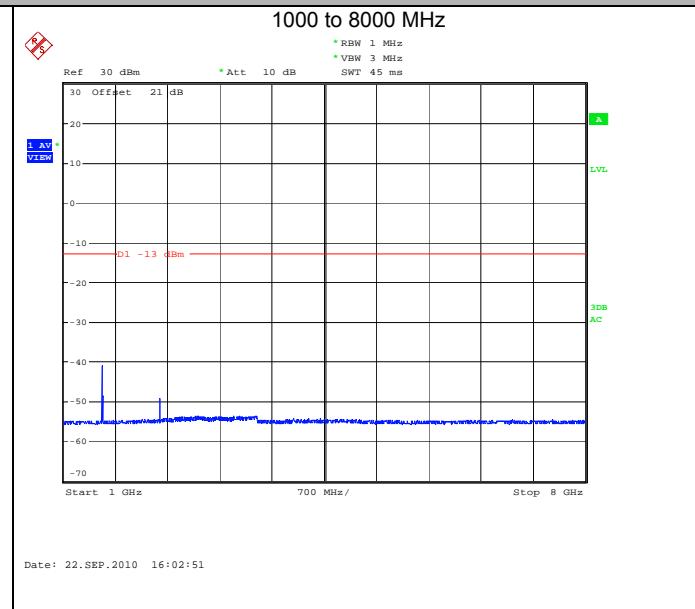
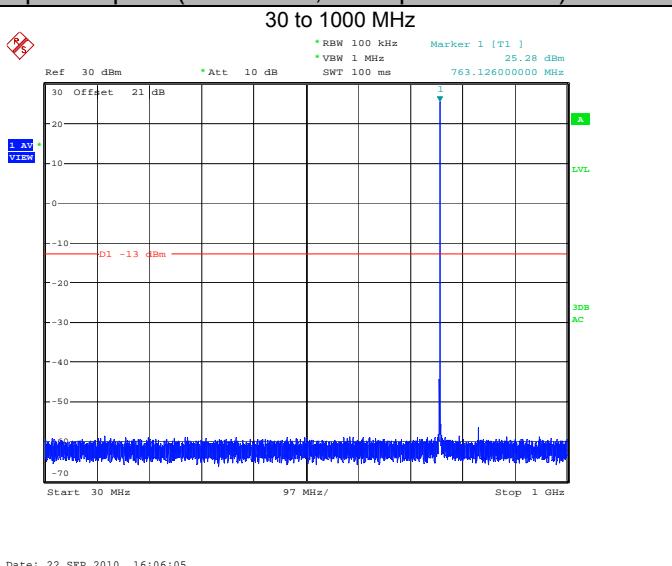
Nemko Canada Inc.,
303 River Rd, Ottawa, ON, Canada, K1V 1H2

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

§ 90.210

Spectral plots (763.1 MHz, 64 Kbps – Level 16)





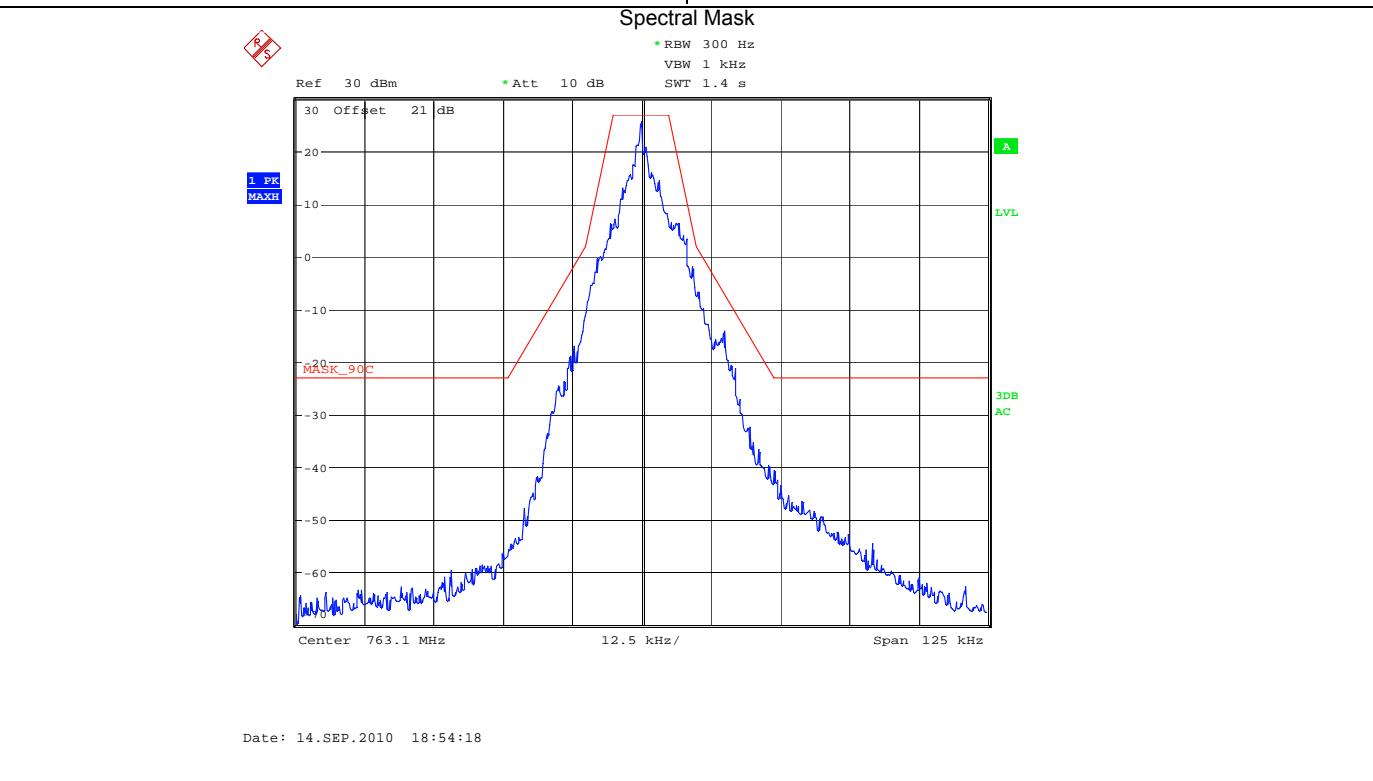
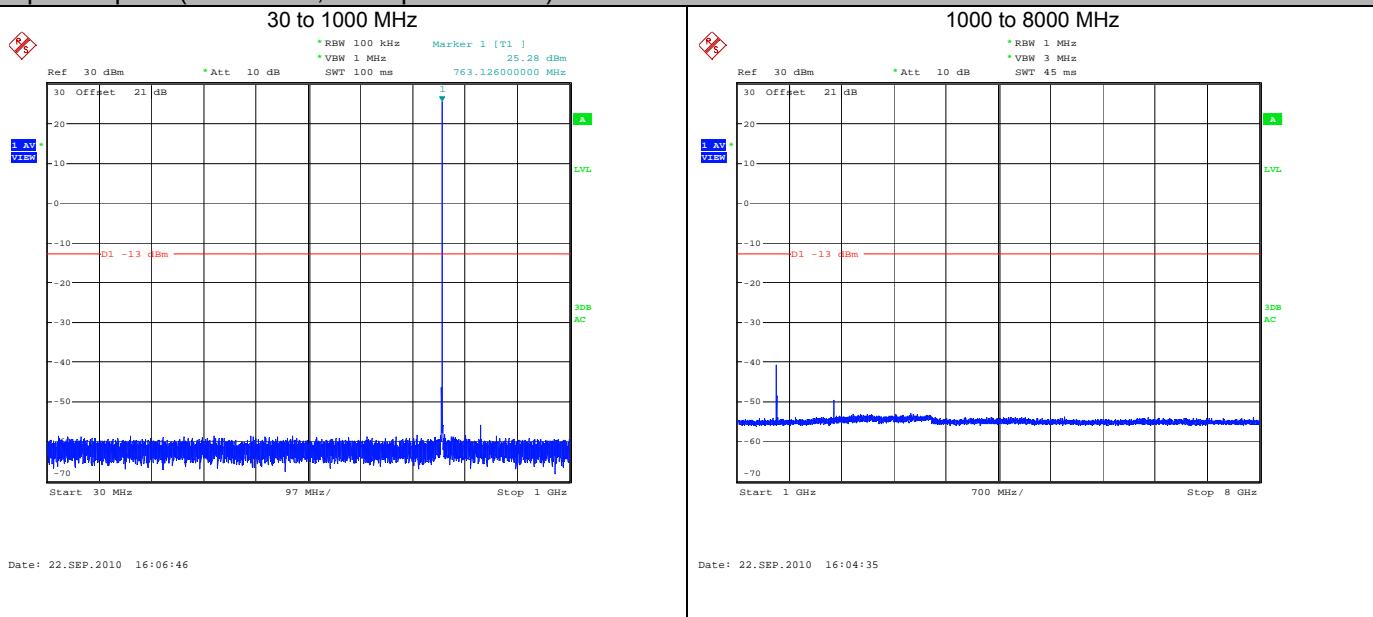
Nemko Canada Inc.,
303 River Rd, Ottawa, ON, Canada, K1V 1H2

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

§ 90.210, continued

Spectral plots (763.1 MHz, 48 Kbps – Level 8)





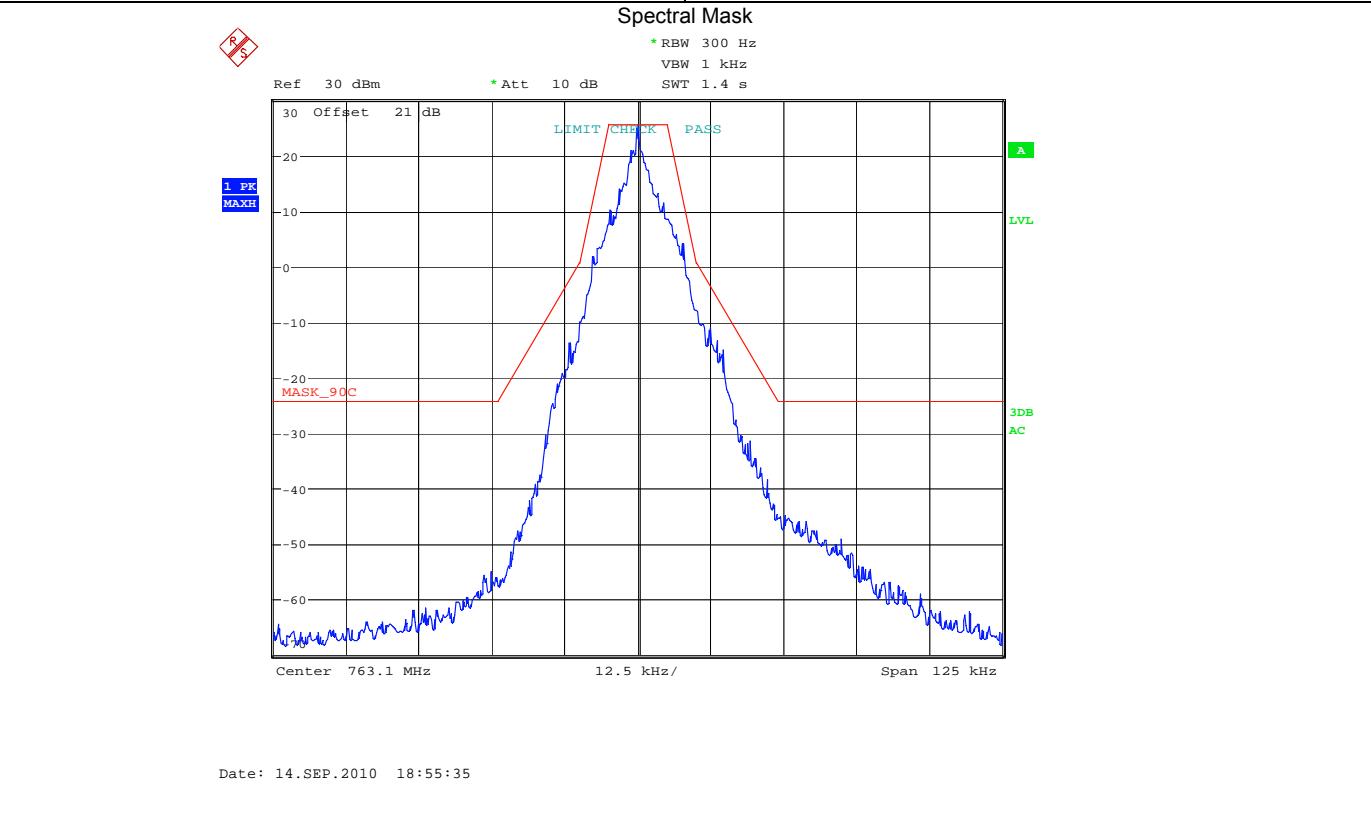
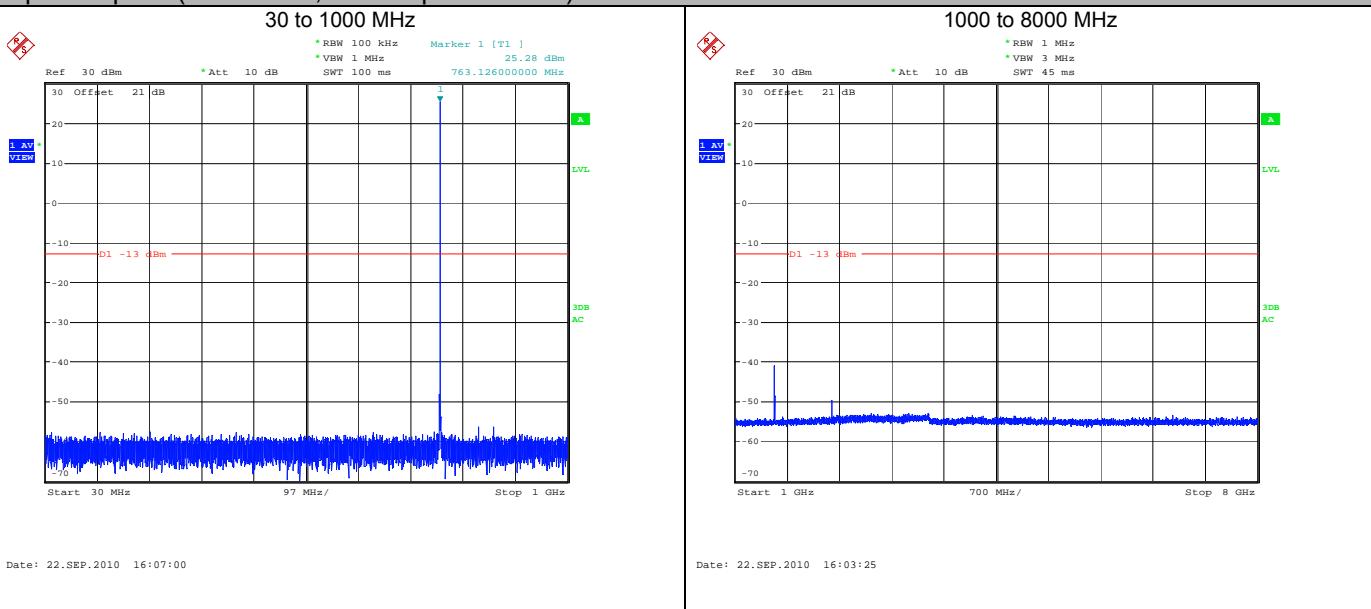
Nemko Canada Inc.,
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Section 8: Testing data		Product: 700 MHz Band SDR Exciter for BDP4 digital base station
Test name: Spurious emissions at antenna terminal port		
Test date: September 14, 2010	Test engineer: David Duchesne	Verdict: Pass
Temperature: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

Test data, continued

§ 90.210, continued

Spectral plots (763.1 MHz, 43.2 Kbps – Level 8)





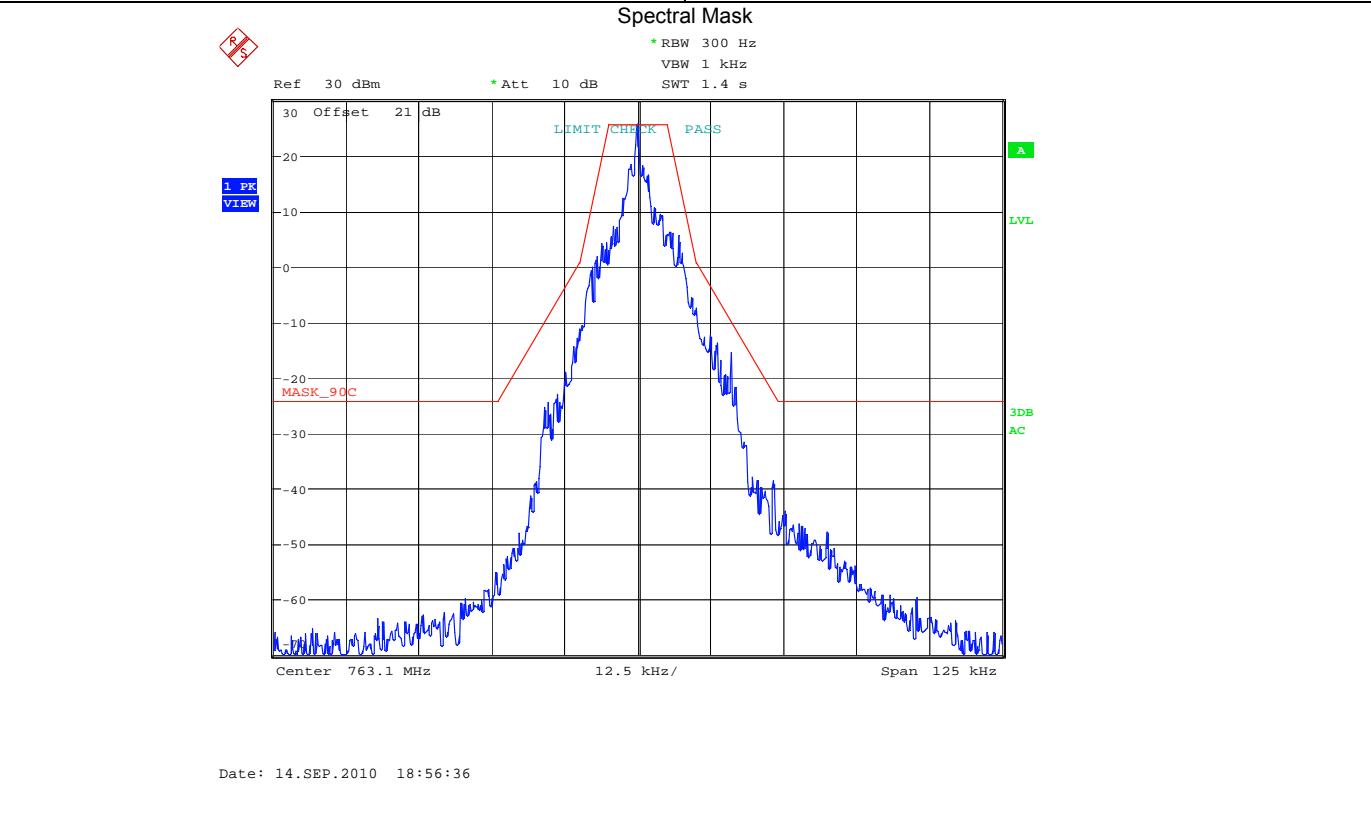
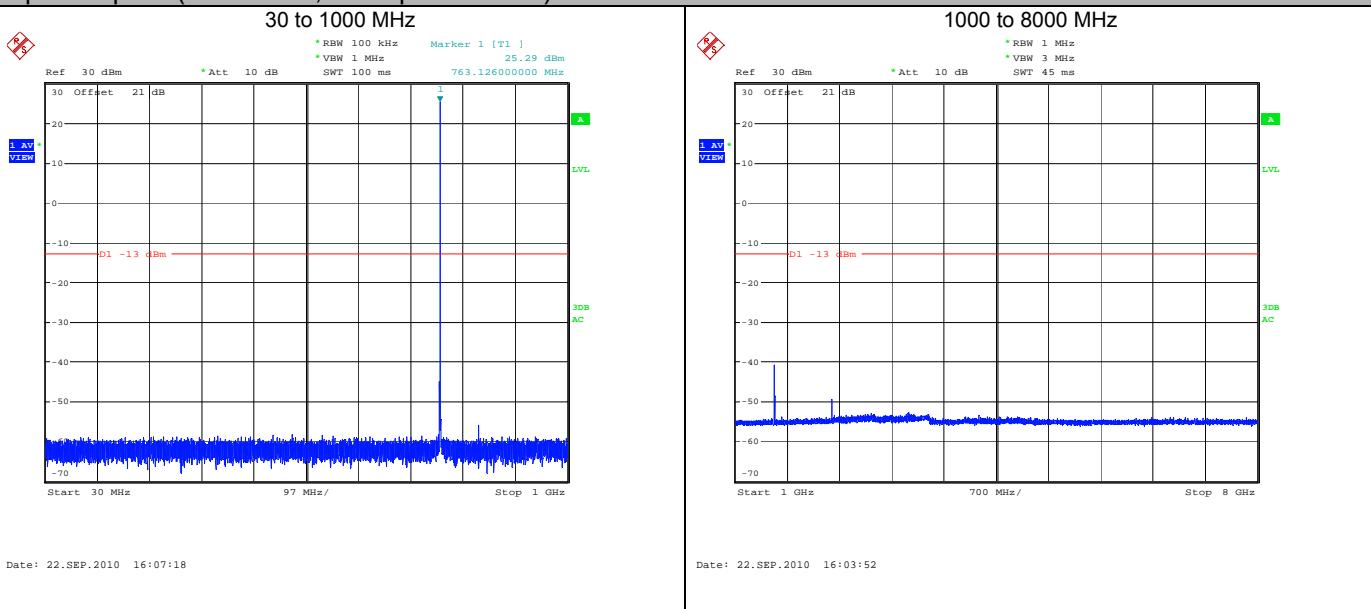
Nemko Canada Inc.,
303 River Rd, Ottawa, ON, Canada, K1V 1H2

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

§ 90.210, continued

Spectral plots (763.1 MHz, 32 Kbps – Level 4)





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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

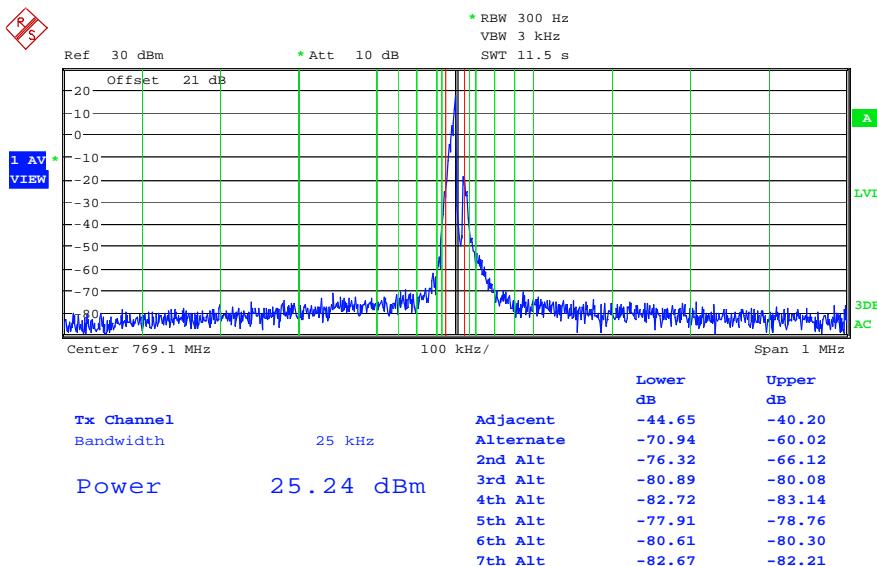
§ 90.543 (a) (b)

- ACP for 25 kHz base transmitter
- Test were performed with all modulation schemes (64 Kbps – Level 16, 48 Kbps – Level 8, 43.2 Kbps – Level 8, and 32 Kbps – Level 4)
- It was discovered that 64 Kbps level 16 was the worst case.
- Only the worst-case test results have been included

Tabular data: 769.1 MHz (64 Kbps – Level 16)

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)	Measured maximum ACP low offset (dBc)	Measured maximum ACP high offset (dBc)
15.625	6.25	-40	-44.65	-40.20
21.875	6.25	-60	-70.94	-60.02
37.5	25	-60	-76.32	-66.12
62.5	25	-65	-80.89	-80.08
87.5	25	-65	-82.72	-83.14
150	100	-65	-77.91	-78.76
250	100	-65	-80.61	-80.30
350	100	-65	-82.67	-82.21
>400 kHz to 12 MHz	30 (sweep)	-80	-86.85	-85.7
Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)	Measured maximum ACP (dBc)	
12 MHz to paired receive band	30 (sweep)	-80	-89.39	
In the paired receive band	30 (sweep)	-100	-106.04	

Spectral plot: 769.1 MHz (64 Kbps – Level 16)



Date: 14.SEP.2010 20:51:07



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Section 8: Testing data

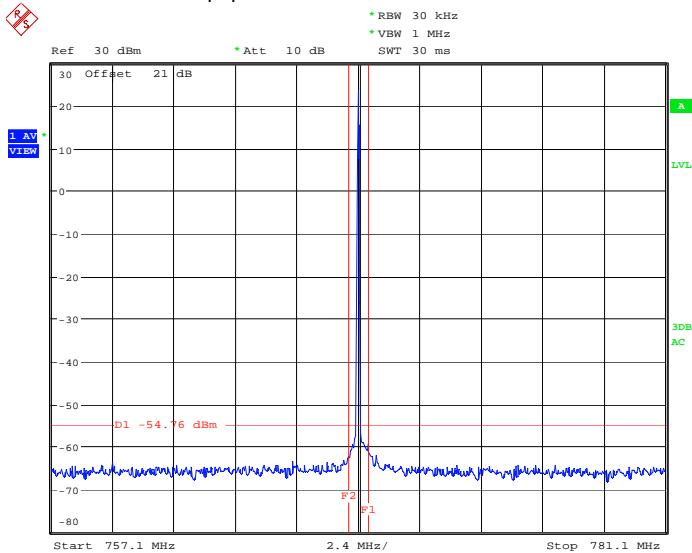
Test name: Spurious emissions at antenna terminal port	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
Test date: September 14, 2010	Test engineer: David Duchesne	Verdict: Pass
Temperature: 25 °C	Air pressure: 1000 mbar	Relative humidity: 55 %
Specification: FCC Part 90 – Private land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

Test data, continued

§ 90.543 (a) (b), continued

Spectral plot: 769.1 MHz (64 Kbps – Level 16), continued

Swept power measurement: >400 kHz to 12 MHz



Date: 14.SEP.2010 22:50:49

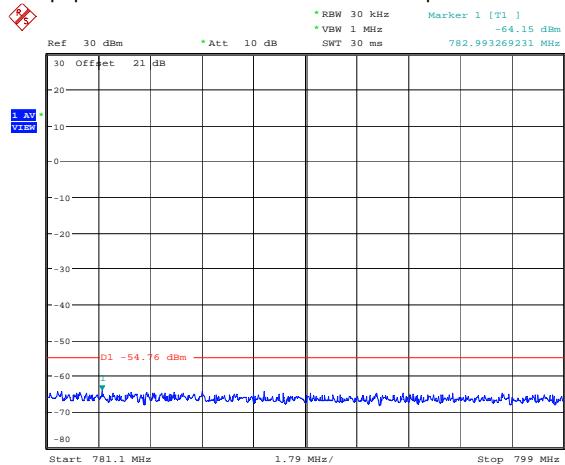
F1 = 769.1 + 0.4 MHz

F2 = 769.1 – 0.4 MHz

D1 = ACP Limit -54.76 dBm

ACP Limit = Ref. Power Level: 25.24 dBm – 80 (Max ACP (dBc))

Swept power measurement: Fd +12 MHz to paired receive band

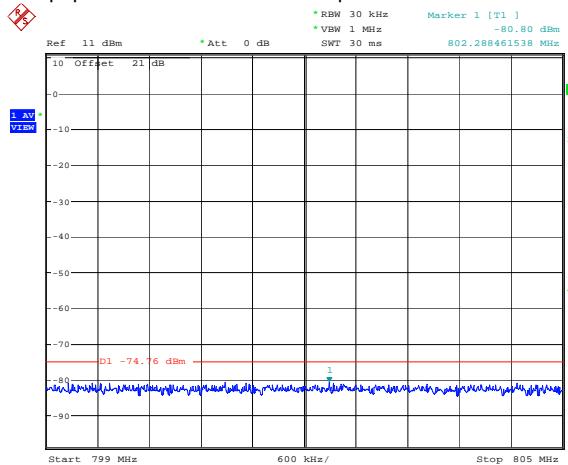


Date: 14.SEP.2010 22:57:38

D1 = ACP Limit -54.76 dBm

ACP Limit = Ref. Power Level: 25.24 dBm – 80 (Max ACP (dBc))

Swept power measurement: In the paired receive band



Date: 14.SEP.2010 23:01:35

D1 = ACP Limit -74.76 dBm

ACP Limit = Ref. Power Level: 25.24 dBm – 100 (Max ACP (dBc))



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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		

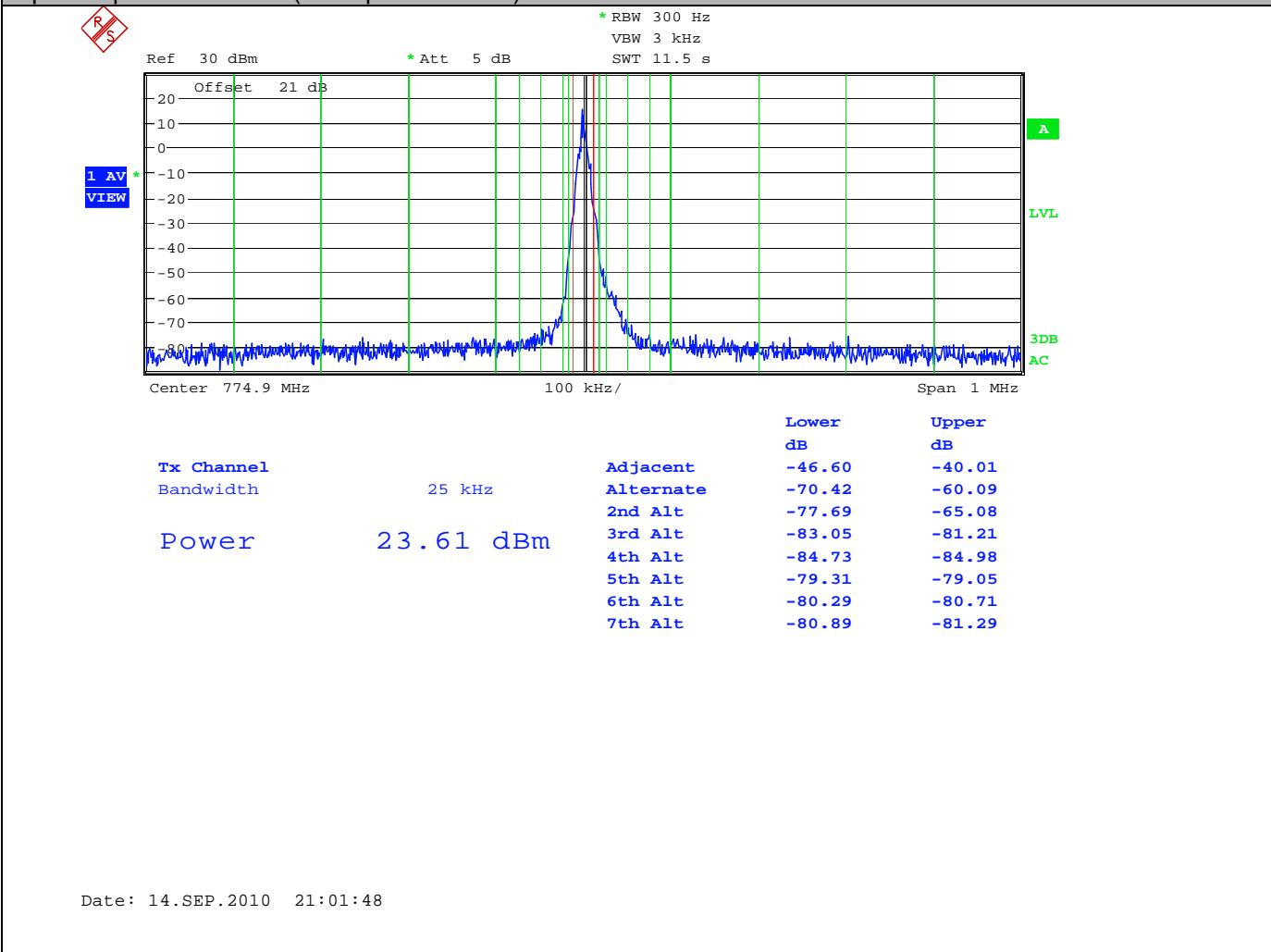
Test data, continued

§ 90.543 (a) (b), continued

Tabular data: 774.9 MHz (64 Kbps – Level 16)

Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP relative (dBc)	Measured maximum ACP low offset (dBc)	Measured maximum ACP high offset (dBc)
15.625	6.25	-40	-46.60	-40.01
21.875	6.25	-60	-70.42	-60.09
37.5	25	-60	-77.69	-65.08
62.5	25	-65	-83.05	-81.21
87.5	25	-65	-84.73	-84.98
150	100	-65	-79.31	-79.05
250	100	-65	-80.29	-80.71
350	100	-65	-80.89	-81.29
>400 kHz to 12 MHz	30 (sweep)	-80	-85.71	-86.01
Offset from center frequency (kHz)	Measurement bandwidth (kHz)	Maximum ACP (dBc)	Measured maximum ACP (dBc)	
12 MHz to paired receive band	30 (sweep)	-80	-87.94	
In the paired receive band	30 (sweep)	-100	-104.31	

Spectral plot: 774.9 MHz (64 Kbps – Level 16)





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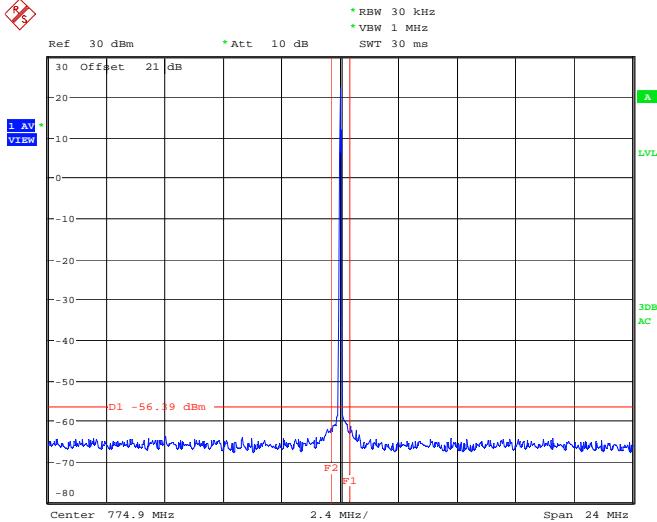
Section 8: Testing data	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
Test name: Spurious emissions at antenna terminal port		
Test date: September 14, 2010	Test engineer: David Duchesne	Verdict: Pass
Temperature: 25 °C	Air pressure: 1000 mbar	Relative humidity: 55 %
Specification: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

Test data, continued

§ 90.543 (a) (b), continued

Spectral plot: 774.9 MHz (64 Kbps – Level 16), continued

Swept power measurement: >400 kHz to 12 MHz



Date: 14.SEP.2010 23:18:47

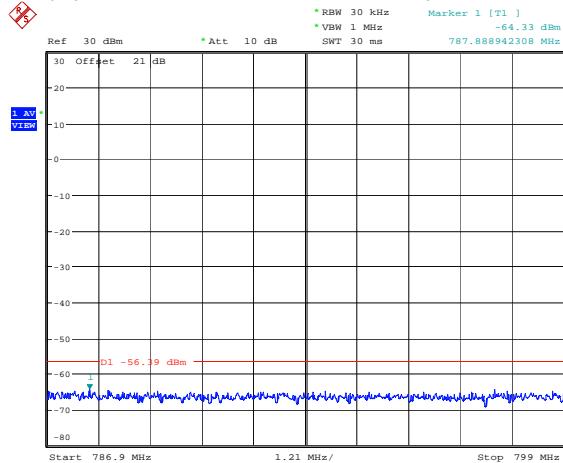
$$F1 = 774.9 + 0.4 \text{ MHz}$$

$$F2 = 774.9 - 0.4 \text{ MHz}$$

D1= ACP Limit -56.39 dBm

ACP Limit = Ref. Power Level: 23.61 dBm – 80 (Max ACP (dBc))

Swept power measurement: Fd +12 MHz to paired receive band

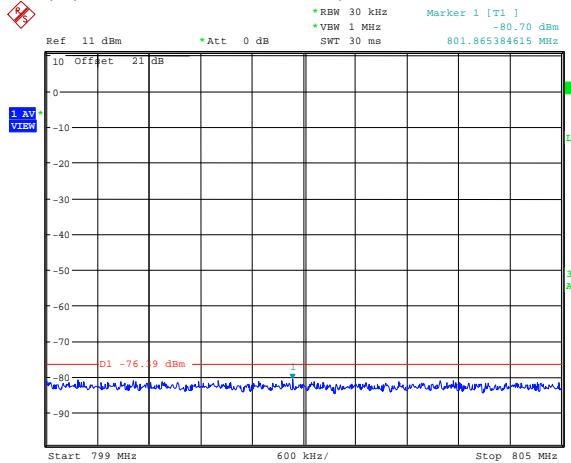


Date: 14.SEP.2010 23:10:54

D1= ACP Limit -56.39 dBm

ACP Limit = Ref. Power Level: 23.61 dBm – 80 (Max ACP (dBc))

Swept power measurement: In the paired receive band



D1= ACP Limit -76.39 dBm

ACP Limit = Ref. Power Level: 23.61 dBm = 100 (Max ACP (dBc))



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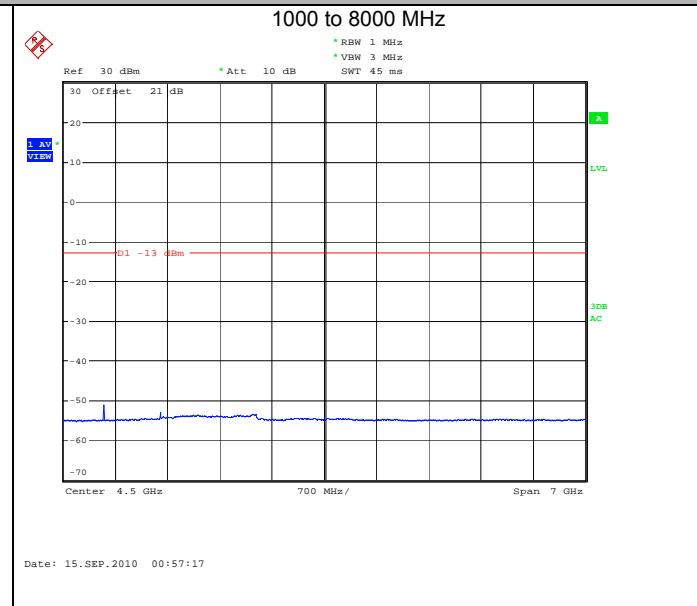
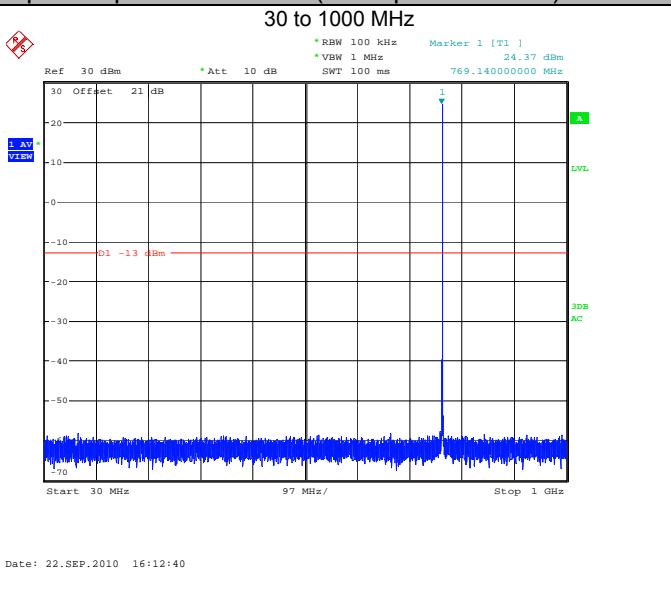
Section 8: Testing data		Product: 700 MHz Band SDR Exciter for BDP4 digital base station
Test name: Spurious emissions at antenna terminal port		
Test date: September 14, 2010	Test engineer: David Duchesne	Verdict: Pass
Temperature: 25 °C	Air pressure: 1000 mbar	Relative humidity: 55 %
Specification: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

Test data, continued

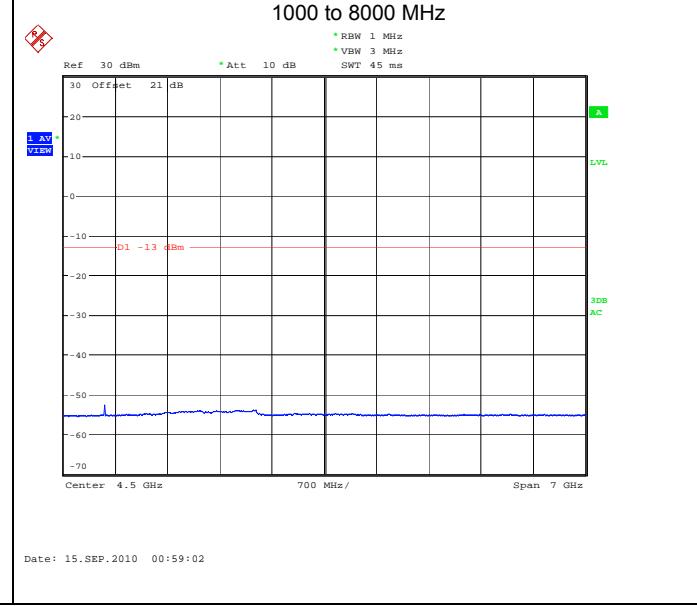
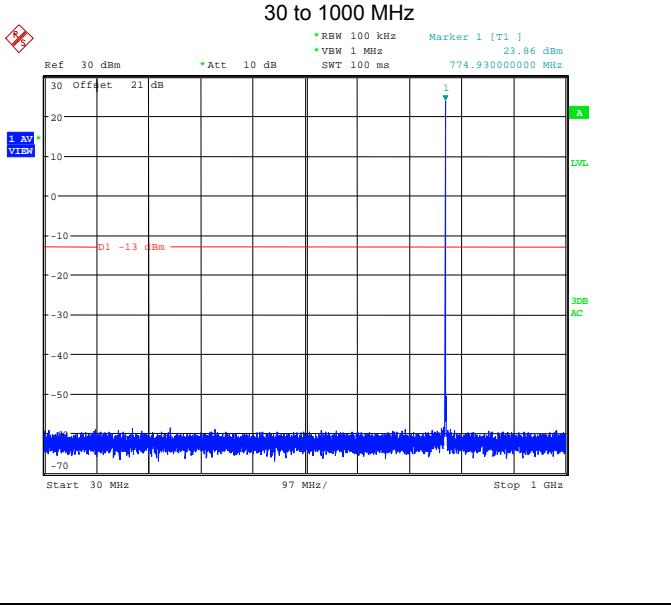
§ 90.543 (c) Out-of-band emission limit

- Test were performed with all modulation schemes (64 Kbps – Level 16, 48 Kbps – Level 8, 43.2 Kbps – Level 8, and 32 Kbps – Level 4)
- It was discovered that 64 Kbps level 16 was the worst case.
- Only the worst-case test results have been included
- Limit = $46 + 10 \log (P)$ dB

Spectral plots 769.1 MHz (64 Kbps – Level 16)



Spectral plots 774.9 MHz (64 Kbps – Level 16)



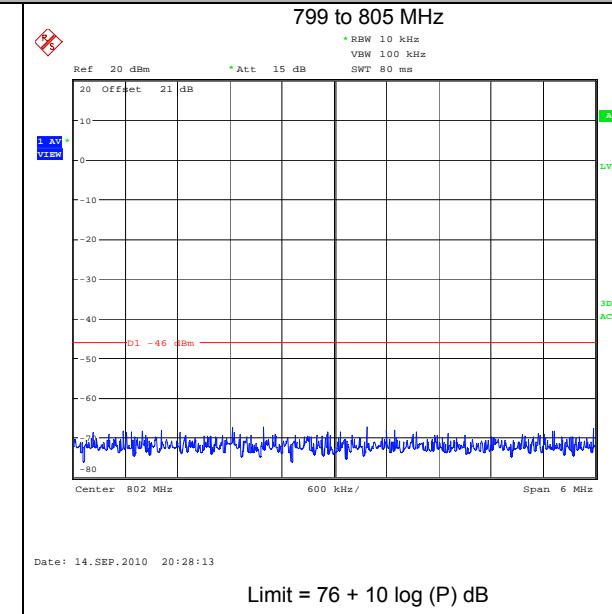
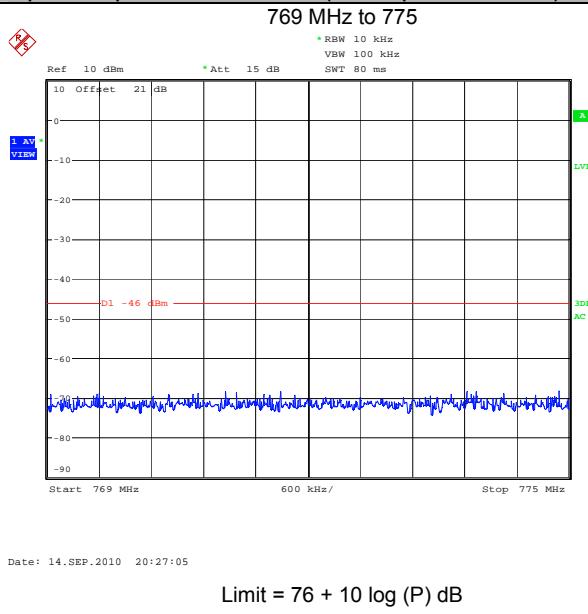
Section 8: Testing data		Product: 700 MHz Band SDR Exciter for BDP4 digital base station
Test name: Spurious emissions at antenna terminal port		
Test date: September 14, 2010	Test engineer: David Duchesne	Verdict: Pass
Temperature: 25 °C	Air pressure: 1000 mbar	Relative humidity: 55 %
Specification: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

Test data, continued

§ 90.543 (e)

- Test were performed with all modulation schemes (64 Kbps – Level 16, 48 Kbps – Level 8, 43.2 Kbps – Level 8, and 32 Kbps – Level 4)
- It was discovered that 64 Kbps level 16 was the worst case.
- Only the worst-case test results have been included

Spectral plots: 767.9 MHz (64 Kbps – Level 16)





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Section 8: Testing data	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
Test name: Frequency stability		
Test date: August 19, 2010	Test engineer: David Duchesne	Verdict: Pass
Specification: FCC Part 90 – Private land mobile radio services		

8.4 Field strength of spurious radiation

§ 90.210 Emission masks

(c) *Emission Mask C.* For transmitters that are not equipped with an audio low-pass filter, the power of any emission must be attenuated below the unmodulated carrier output power (P) as follows:

- (3) On any frequency removed from the center of the authorized bandwidth by more than 250 percent of the authorized bandwidth: At least $43 + 10 \log (P)$ dB.

§ 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.

(e) For operations in the 763–768 MHz and the 793–798 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

- (1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $76 + 10 \log (P)$ dB in a 6.25 kHz band segment, for base and fixed stations.
- (2) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than $65 + 10 \log (P)$ dB in a 6.25 kHz band segment, for mobile and portable stations.

Compliance with the provisions of paragraphs (e)(1) and (2) of this section is based on the use of measurement instrumentation such that the reading taken with any resolution bandwidth setting should be adjusted to indicate spectral energy in a 6.25 kHz segment.

(f) For operations in the 763–775 MHz and 793–805 MHz bands, all emissions including harmonics in the band 1559–1610 MHz shall be limited to -70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and -80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

Special notes

- Test Method § 2.1053 Measurements required: Field strength of spurious radiation.
- The spectrum was searched from 30MHz to the 10th Harmonic.
- Radiated spurious emissions were measured by substitution method where EUT was being replaced with tuned dipoles for emissions below 1 GHz and calibrated horn antenna for emissions above 1GHz.
- All radiated measurements were performed at a distance of 3 meters using a peak detector with 100 kHz RBW on frequencies below 1 GHz and 1 MHz RBW on frequencies above 1 GHz with VBW > RBW.



Section 8: Testing data		Product: 700 MHz Band SDR Exciter for BDP4 digital base station
Test name: Frequency stability		
Test date: August 19, 2010	Test engineer: David Duchesne	Verdict: Pass
Specification: FCC Part 90 – Private land mobile radio services		

Test data

§ 90.210 (c)(3), and § 90.543 (c)

Tx Freq. (MHz)	Scanned Freq. (MHz)	Limit (dBm) ERP	Result
763.1 (Low channel)	30 to 8000	-13	No emissions detected within 10 dB of limit
769.1 (Mid channel)	30 to 8000	-13	No emissions detected within 10 dB of limit
774.9 (High Channel)	30 to 8000	-13	No emissions detected within 10 dB of limit

§ 90.543 (e)

Tx Freq. (MHz)	Scanned Freq. (MHz)	Limit (dBm) ERP	Result
763.1	769–775	-46 dBm	No emissions detected within 10 dB of limit
763.1	799–805	-46 dBm	No emissions detected within 10 dB of limit

§ 90.543 (f)

Tx Freq. (MHz)	Scanned Freq. (MHz)	Limit (dBW/MHz) EIRP	Result
767.9	1559 to 1610	-70	No emissions detected within 10 dB of limit

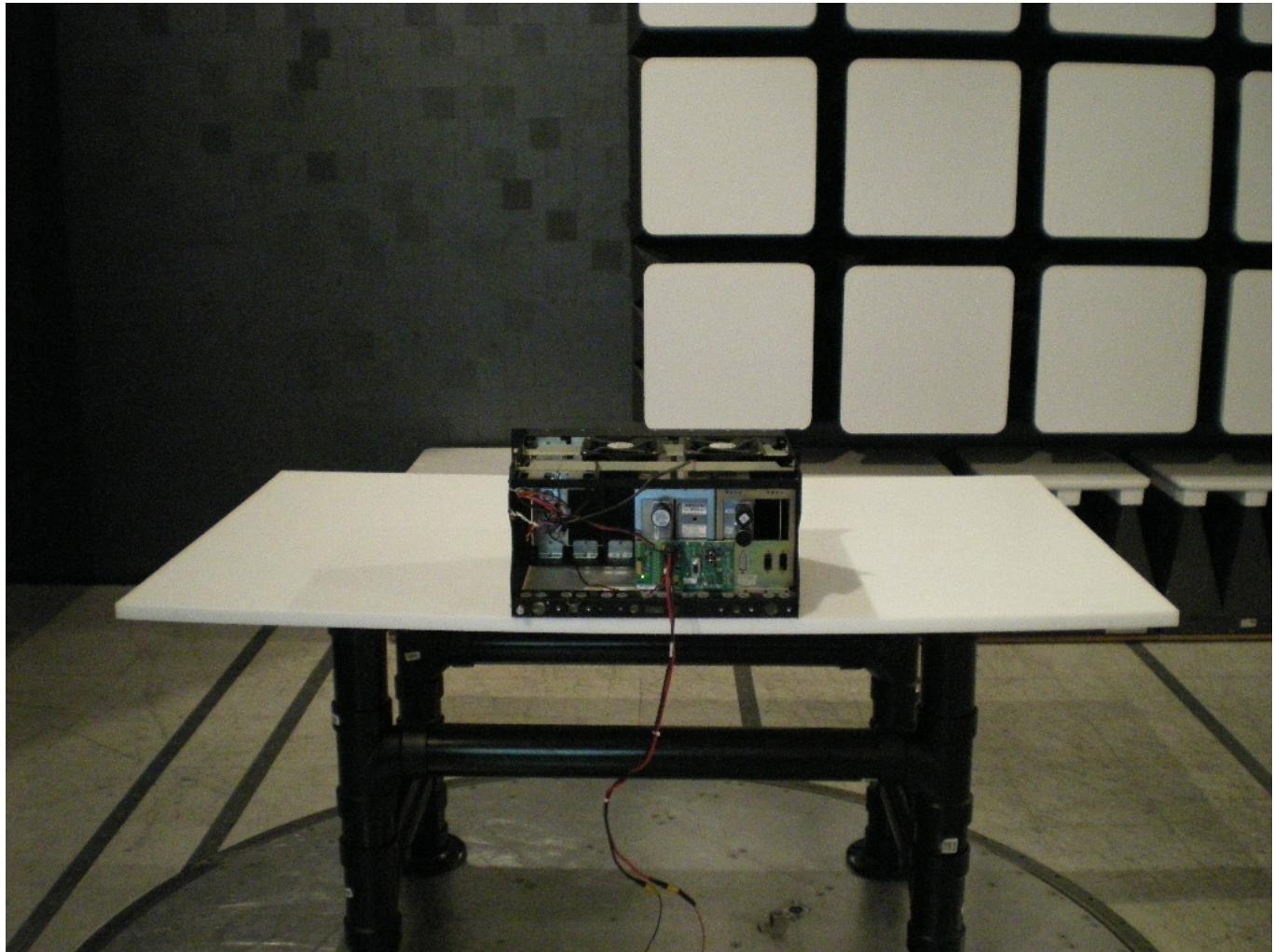
Tested with representative sample, provided by client.



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Section 8: Testing data	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
Test name: Frequency stability		
Test date: August 19, 2010	Test engineer: David Duchesne	Verdict: Pass
Specification: FCC Part 90 – Private land mobile radio services		

Setup photos

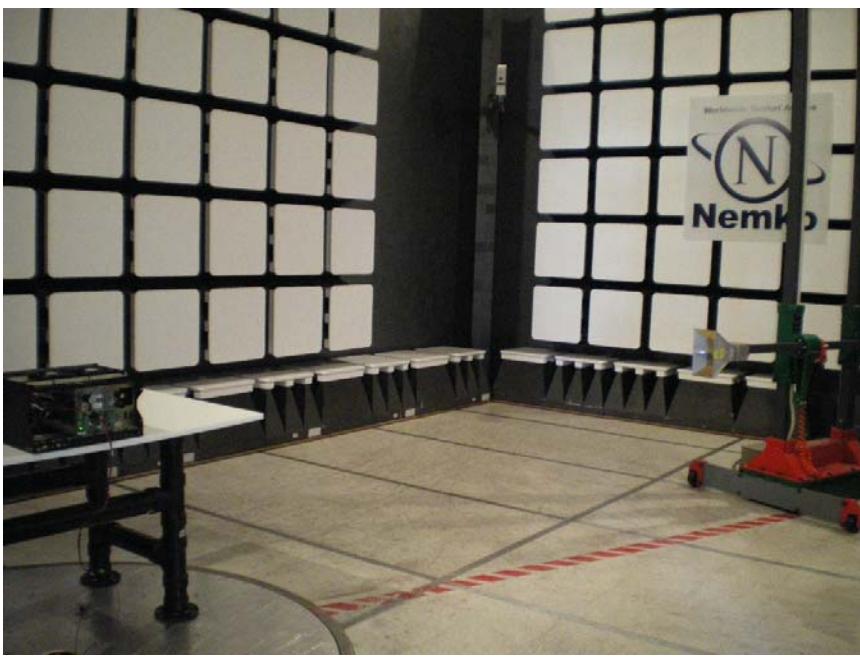




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Section 8: Testing data	Product: 700 MHz Band SDR Exciter for BDP4 digital base station	
Test name: Frequency stability		
Test date: August 19, 2010	Test engineer: David Duchesne	Verdict: Pass
Specification: FCC Part 90 – Private land mobile radio services		

Setup photos, continued





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Section 8: Testing data		Product: 700 MHz Band SDR Exciter for BDP4 digital base station
Test name: Frequency stability		
Test date: August 19, 2010	Test engineer: David Duchesne	Verdict: Pass
Specification: FCC Part 90 – Private land mobile radio services		

8.5 Frequency stability

§ 90.539 Frequency stability

Transmitters designed to operate in 769–775 MHz and 799–805 MHz frequency bands must meet the frequency stability requirements in this section.

(b) The frequency stability of base transmitters operating in the narrowband segment must be 100 parts per billion or better.

Special notes

Test Method § 2.1055 Measurements required: Frequency stability

Test data

Voltage DC	Temperature (°C)	Measured frequency (Hz)	Offset (ppm)	Limit (ppm)
13.8 (nominal)	50	770 000 001	0.0013	0.1
13.8 (nominal)	40	770 000 001	0.0013	
13.8 (nominal)	30	770 000 001	0.0013	
15.87 (115 %)	20 (nominal)	770 000 002	0	
13.8 (nominal)	20 (nominal)	770 000 002	Reference	N/A
11.73 (85 %)	20 (nominal)	770 000 002	0	0.1
13.8 (nominal)	10	770 000 002	0	
13.8 (nominal)	0	770 000 001	0.0013	
13.8 (nominal)	-10	770 000 001	0.0013	
13.8 (nominal)	-20	770 000 001	0.0013	
13.8 (nominal)	-30	770 000 001	0.0013	

$$\text{Offset calculation: } \frac{F_{\text{Measured}} - F_{\text{reference}}}{F_{\text{reference}}} \times 1 \cdot 10^6$$

The maximum allowable frequency drift is $0.1 \times 770 \text{ MHz} = 77 \text{ Hz}$

Section 9: Block diagrams of test set-ups

Radiated emissions set-up

