

Nemko Test Report: 128225-2TRFWL

Applicant: Axell Wireless Israel
12Bazel Street
POB 10241
Petah-Tikva 49002
Israel

Apparatus: Axell-819

FCC ID: NEOCSRCELLPCS2480

In Accordance With: FCC Part 24 Personal Communications
Services
Subpart E Broadband PCS

Authorized By: 
Andrey Adelberg, EMC/Wireless Specialist

Date: July 7, 2009

Total Number of Pages: 34

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Section 1 : Report Summary

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 24. Conducted measurements were performed in accordance with TIA-603-B-2002. Radiated tests were conducted in accordance with ANSI C63.4-2003.

The assessment summary is as follows:

Apparatus Assessed:	Axell-819
Specification:	FCC Part 24 Subpart E
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None
Report Release History:	Original Release
Test Location:	Nemko Canada Inc. 303 River Road Ottawa, Ontario K1V 1H2
Registration Number:	176392 (3 m Semi-Anechoic Chamber)
Tests Performed By:	David Duchesne, Senior EMC Specialist
Test Dates:	June 12–24, 2009

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.

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Section 2 : Equipment Under Test

2.1 Identification of Equipment Under Test (EUT)

The following information identifies the EUT under test:

Type of Equipment:	Dual-Band Cellular/PCS Selective Repeater
Brand Name:	Axell
Model Name or Number:	MW-CRS-CELL-PCS-2480-M1X
Serial Number:	0905D1008
Nemko Sample Number:	Item # 1
FCC ID:	NEOCSRCELLPCS2480
Date of Receipt:	May 22, 2009

2.2 Accessories

The following information identifies accessories used to exercise the EUT during testing:

Description:	Laptop
Brand Name:	IBM
Model Name or Number:	FA001894
Serial Number:	
Connection Port:	LAN
Cable Length and Type:	RJ45 CAT 5 Cable 3 meter

2.3 EUT Description

Axell 819 is a dual-band Cellular/PCS band selective repeater in a single compact unit. The repeater is specifically designed for simultaneous dual-band operation of Cellular and PCS bands.

The dual band repeater can be installed in a wide variety of applications particularly when adjacent band selectivity and/or very high spectral purity are required. The Repeater provides a solution for situations in which flexible, high quality and high resolution filtering methods are necessary due to low coverage (i.e. dense urban environments or tunnels).

Axell 819 has switchable and tunable IF-SAW. These enable highly accurate out-of-band-rejection and provide simple, fast procedures for adjusting the pass band according to customer requirements.

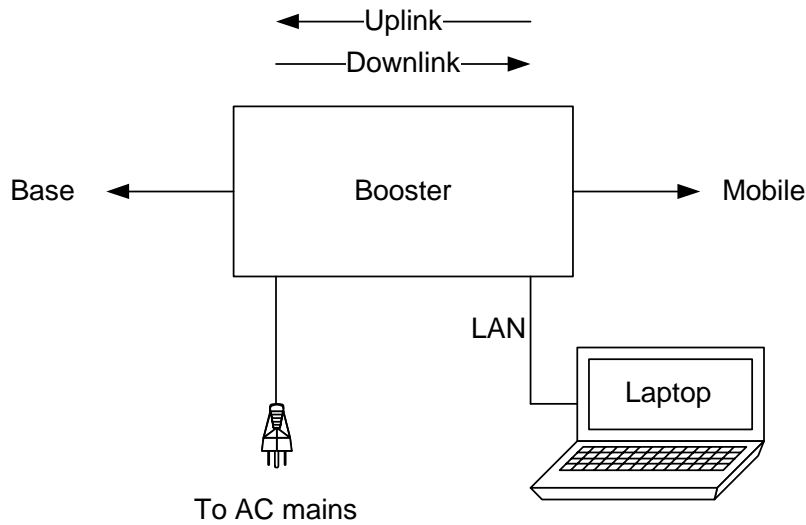
Axell 819 consists of two internal mini-repeaters (PCS/Cellular) that incorporate Axell's Smart Automatic Level Control (Smart-ALC) power control algorithm that automatically optimizes the gain setting by learning the actual range of RSSI levels over a userspecified period of time. The SmartALC algorithm prevents oscillations, reduces the amount of isolation required by the system and optimizes the system to minimize noise rise at the donor cell site.

Intuitive Web access monitoring and management GUI is accessible via a local Ethernet connection (using a cross-cable). An option for remote wireless communication connection (via a separately purchased internal modem) is also available.

2.4 Technical Specifications of the EUT

Operating Band:	Uplink: 1850–1910 MHz Downlink: 1930–1990 MHz
Operating Frequency:	Uplink: 1850.5–1906.5 MHz Downlink: 1930.5–1989.5 MHz
Modulation:	GSM, CDMA, WCDMA
Emission Designator:	GXW, F9W
Power Supply Requirements:	120 VAC, 60 Hz

2.5 EUT Setup diagram



2.6 Modifications incorporated in the EUT

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

Section 3 : Test Conditions

3.1 Specifications

The apparatus was assessed against the following specifications:

FCC Part 2 Subpart J, Equipment Authorization Procedures
FCC Part 24 Subpart E, Broadband PCS

3.2 Deviations From Laboratory Test Procedures

No deviations were made from laboratory test procedures.

3.3 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	15–30 °C
Humidity range	:	20–75 %
Pressure range	:	86–106 kPa
Power supply range	:	±5 % of rated voltages

3.4 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.

3.5 Test Equipment

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next Cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	May 06/10
Bilog	Sunol	JB3	FA002108	Jan. 27/10
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/10
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct. 02/09
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/09
50 Coax cable	HUBER + SUHNER	None	FA002022	July 07/09
50 Coax cable	HUBER + SUHNER	None	FA002074	July 07/09
Spectrum Analyzer	Rohde & Schwarz	FSU	FA001877	Sept. 03/09
Power Meter	Agilent	N1911A	FA001946	Jan. 21/10
Power Sensor	Agilent	N1922A	FA001947	Jan. 21/10
Power Meter	HP	E4418B	FA001678	June 11/10
Power Sensor	HP	8482A	FA001944	Aug. 22/09
Signal Generator	Rohde & Schwarz	SMIQ03E	FA001269	Aug 18/09
Signal Generator	Rohde & Schwarz	SMIQ06B	FA001878	Sept. 12/09
Combiner	Mini-circuits	ZA3PD-2	FA001155	COU

COU – Calibrate on Use

NCR – No Calibration Required



Section 4 : Results Summary

This section contains the following:

FCC Part 24 Subpart E : Test Results

The column headed 'Required' indicates whether the associated clauses were invoked for the apparatus under test. The following abbreviations are used:

N No : not applicable / not relevant.

Y Yes : Mandatory i.e. the apparatus shall conform to these tests.

N/T Not Tested, mandatory but not assessed. (See Report Summary)

4.1 FCC Part 24 Subpart E : Test Results

Clause	Test Method	Test Description	Required	Result
24.232(c)	2.1046	EIRP Limits	Y	PASS
—	2.1047	Modulation Characteristics	N	
2-11-04/EAB/RF	2.1049	Occupied bandwidth	Y	PASS
24.238(a)	2.1051	Spurious Emissions at the antenna terminal	Y	PASS
24.238(a)	2.1053	Field strength of spurious radiation	Y	PASS
24.235	2.1055	Frequency stability	N	
2-11-04/EAB/RF	—	Out of band rejection	Y	PASS



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Appendix A : Test Results

Clause 24.232(c) Effective Isotropic Radiated Power Limits

Mobile/portable stations are limited to 2 watts EIRP peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.

Test Results: Pass

Special Notes:

- The average output power measurements were performed using a power meter and thermocouple power sensor.
- The peak output power measurements were performed using a power meter and peak power sensor.
- The transmitter was set to maximum output power 1 dB compression point.
- The Uplink and Downlink were verified with a GSM, CDMA and WCDMA modulation signal on a low, middle and high channel.

Clause 24.232(c) Effective Isotropic Radiated Power Limits, continued

Test Data:

Maximum Downlink RF output power: 1640 W (62.15 dBm) EIRP

Maximum Uplink RF output power: 2 W (33 dBm) EIRP

The peak to average ratio (PAR) of the transmission may not exceed 13 dB.

Uplink Output Power (dBm)			
Modulation			
GSM	1850.5 MHz	1880.0 MHz	1909.5 MHz
	AV 21.9 dBm	AV 21.7 dBm	AV 20.1 dBm
	PK 22.5 dBm	PK 22 dBm	PK 20.6 dBm
	PAR 0.6 dB	PAR 0.3 dB	PAR 0.5 dB
CDMA	1851.0 MHz	1880 MHz	1909.0 MHz
	AV 22 dBm	AV 21.7 dBm	AV 20.2 dBm
	PK 28 dBm	PK 27.8 dBm	PK 26.5 dBm
	PAR 6 dB	PAR 6.1 dB	PAR 6.3 dB
WCDMA	1852.5 MHz	1880.0 MHz	1907.5 MHz
	AV 21.9 dBm	AV 21.7 dBm	AV 20.5 dBm
	PK 27.2 dBm	PK 27 dBm	PK 25.8 dBm
	PAR 5.3 dB	PAR 5.3 dB	PAR 5.3 dB
Maximum output = 28 dBm <i>(Antenna connected to Uplink should not have a gain of greater than 5 dBi. Amplifier gain should be reduced accordingly to accommodate antennas with higher gains.)</i>			
Maximum peak to average ratio = 6.3 dB			

Downlink Output Power (dBm)			
Modulation			
GSM	1930.5 MHz	1960.0 MHz	1989.5 MHz
	AV 20.4 dBm	AV 21.5 dBm	AV 21.4 dBm
	PK 21.1 dBm	PK 21.9 dBm	PK 23 dBm
	PAR 0.7 dB	PAR 0.4 dB	PAR 1.6 dB
CDMA	1931.0 MHz	1960.0 MHz	1989 MHz
	AV 19.9 dBm	AV 21.8 dBm	AV 21.3 dBm
	PK 26.9 dBm	PK 28.8 dBm	PK 27.6 dBm
	PAR 7 dB	PAR 7 dB	PAR 6.3 dB
WCDMA	1932.5 MHz	1960 MHz	1987.5 MHz
	AV 20.9 dBm	AV 21.9 dBm	AV 21.4 dBm
	PK 26 dBm	PK 28.8 dBm	PK 26.8 dBm
	PAR 5.1 dB	PAR 6.9 dB	PAR 5.4 dB
Maximum output = 28.8 dBm <i>dBi. (Antenna connected to downlink should not have a gain of greater than 33.35 dBi. Amplifier gain should be reduced accordingly to accommodate antennas with higher gains.)</i>			
Maximum peak to average ratio = 7 dB			



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APPENDIX A : TEST RESULTS

Report Number: 128225-2TRFWL

Specification: FCC Part 24

Clause 2-11-04/EAB/RF Occupied Bandwidth

The spectral shape of the output should look similar to the input for all modulations.

Test Results: Pass

Special Notes:

The Uplink and Downlink were verified with a GSM, CDMA and WCDMA modulation signal on a single channel, using an RBW of 300 Hz or 1 % of the emission bandwidth.

Test Data:

See plots of this section



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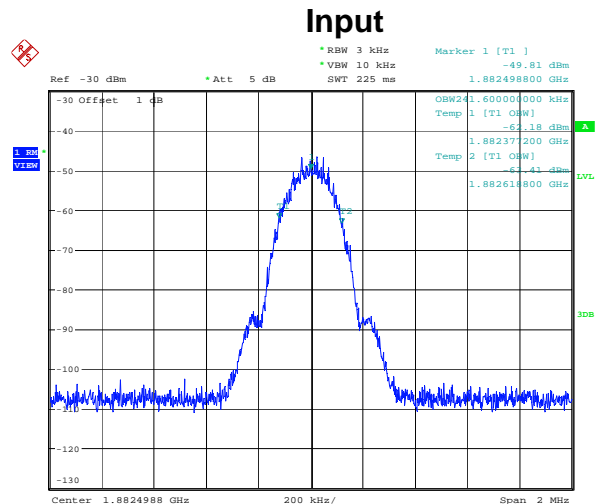
APPENDIX A : TEST RESULTS

Report Number: 128225-2TRFWL

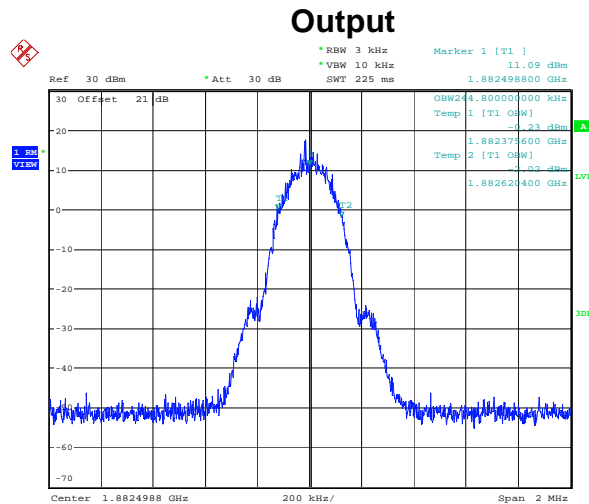
Specification: FCC Part 24

Clause 2-11-04/EAB/RF Occupied Bandwidth, continued

Uplink: GSM Modulation

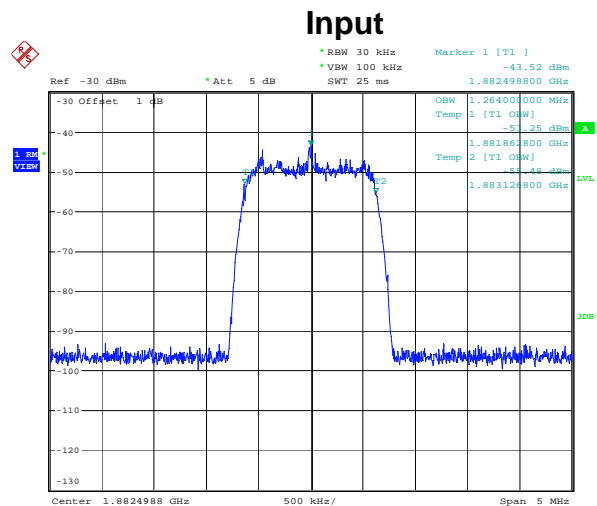


Date: 12.JUN.2009 12:54:26



Date: 12.JUN.2009 12:47:08

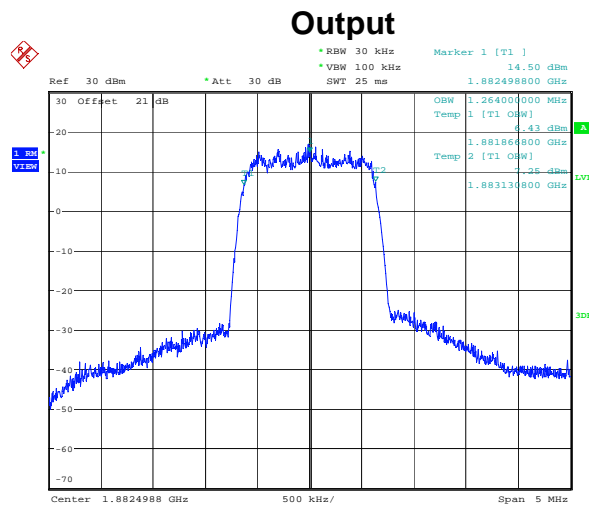
1882.5 MHz CDMA Modulation



Date: 12.JUN.2009 12:53:35

1882.5 MHz

1882.5 MHz



Date: 12.JUN.2009 12:48:17

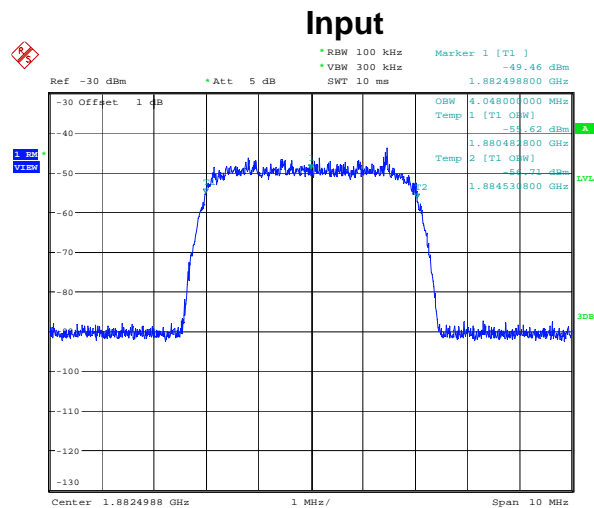
1882.5 MHz



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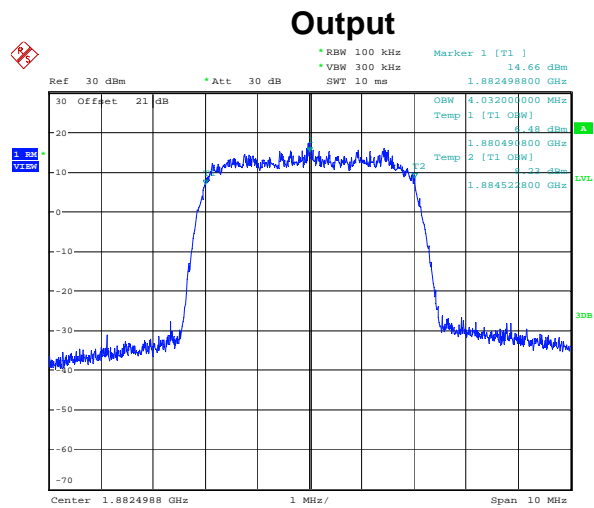
Clause 2-11-04/EAB/RF Occupied Bandwidth, continued

Uplink: WCDMA Modulation



Date: 12.JUN.2009 12:52:27

1882.5 MHz



Date: 12.JUN.2009 12:49:24

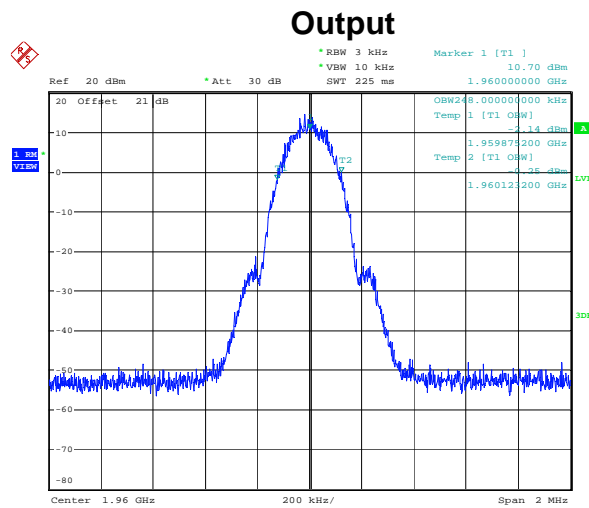
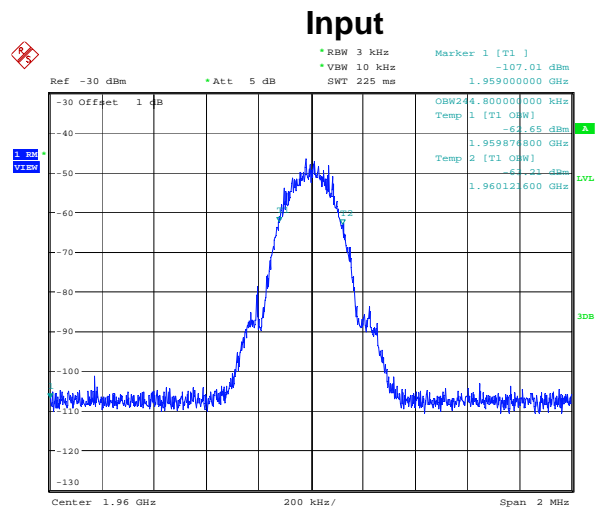
1882.5 MHz



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Clause 2-11-04/EAB/RF Occupied Bandwidth, continued

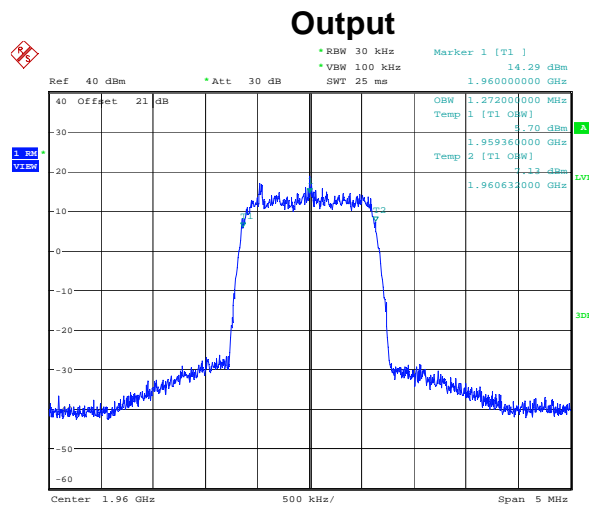
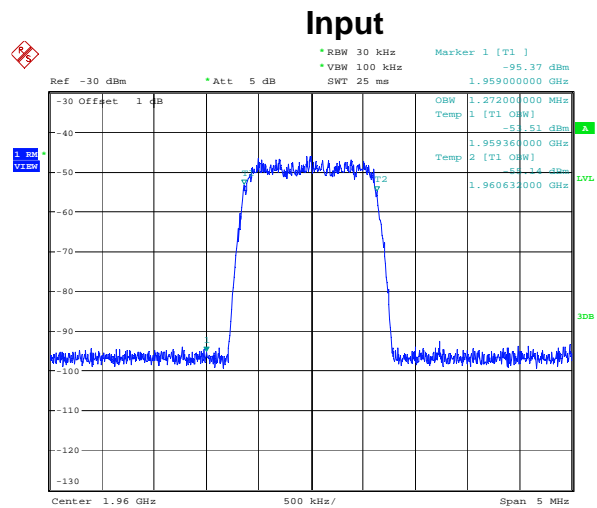
Downlink: GSM Modulation



Date: 12.JUN.2009 13:00:58

Date: 12.JUN.2009 13:11:42

1960 MHz CDMA Modulation



Date: 12.JUN.2009 13:01:49

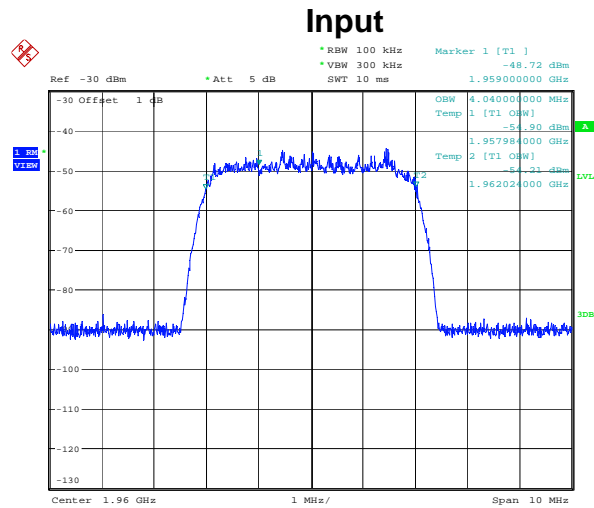
Date: 12.JUN.2009 13:10:35

1960 MHz

1960 MHz

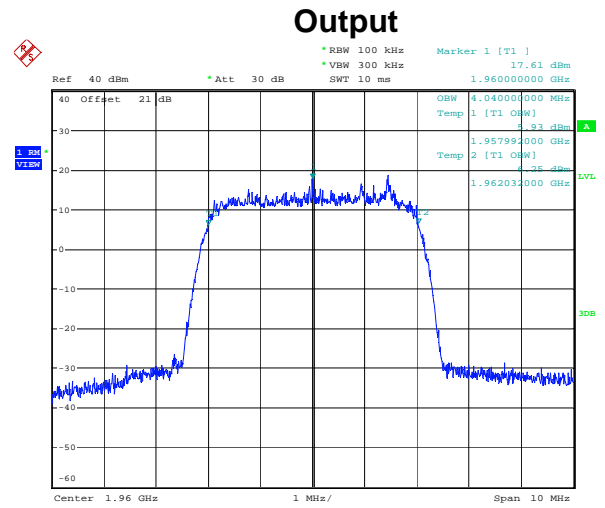
Clause 2-11-04/EAB/RF Occupied Bandwidth, continued

**Uplink:
 WCDMA Modulation**



Date: 12.JUN.2009 13:02:42

1960 MHz



Date: 12.JUN.2009 13:09:33

1960 MHz



Clause 24.238(a) Spurious emissions at the antenna terminal

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Results: Pass

Special Notes:

- The Uplink lower and upper band edges were verified with a two-tone intermodulation GSM, CDMA and WCDMA modulation signal.
- The downlink lower and upper band edges were verified with a two-tone intermodulation GSM, CDMA and WCDMA modulation signal.
- The Uplink and Downlink were verified with a GSM, CDMA and WCDMA modulation signal on a low, middle and high channel with a single tone.

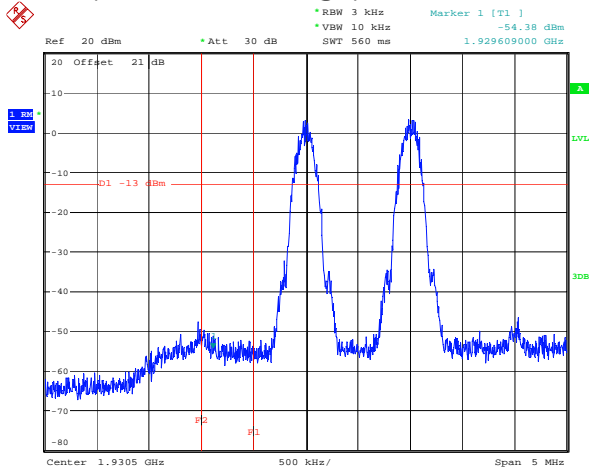
Test Data:

See spectral plots of this section.

Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Downlink 3rd Order Intermodulation

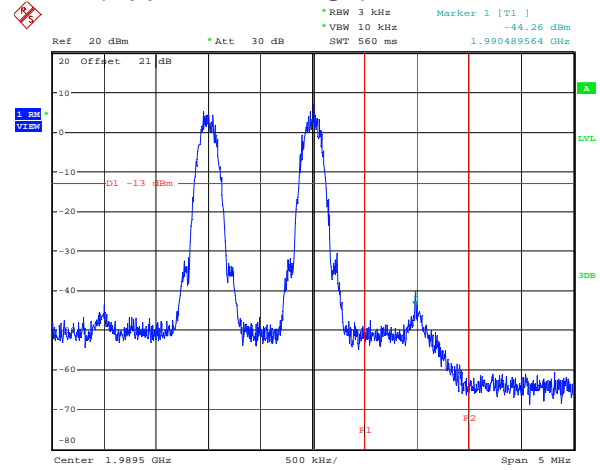
GSM (Lower Band Edge)



Date: 12.JUN.2009 13:29:32

1930.5 MHz + 1931.5 MHz

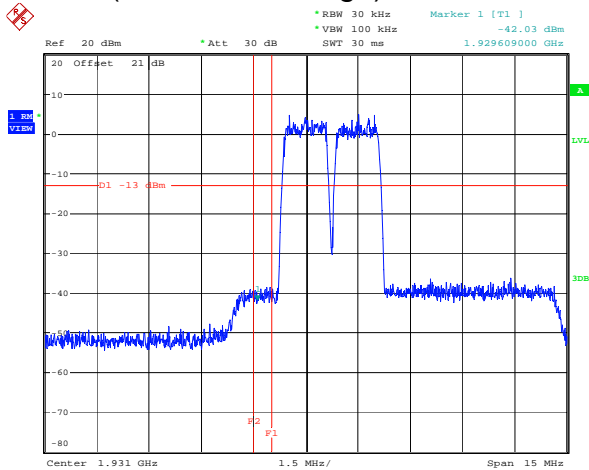
GSM (Upper Band Edge)



Date: 12.JUN.2009 14:53:47

1988.5 MHz + 1989.5 MHz

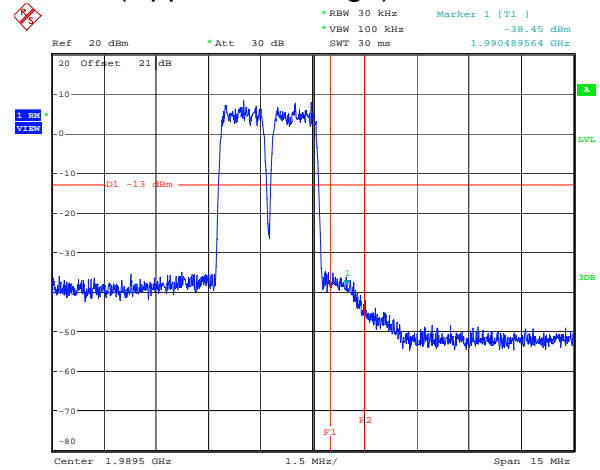
CDMA (Lower Band Edge)



Date: 12.JUN.2009 14:42:35

1931 MHz + 1932.5 MHz

CDMA (Upper Band Edge)



Date: 12.JUN.2009 14:56:10

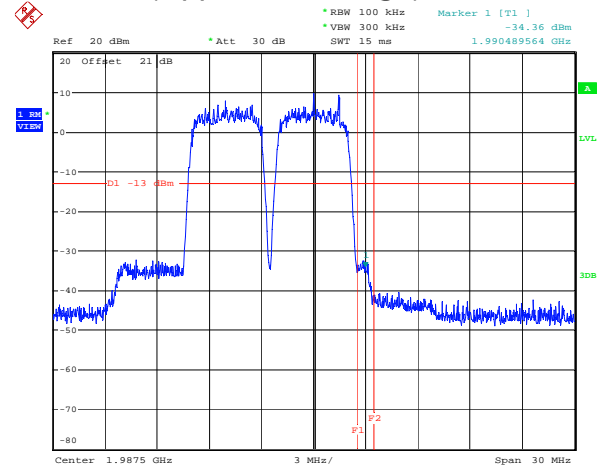
1987.5 MHz + 1989 MHz

Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Downlink 3rd Order Intermodulation

WCDMA (Lower Band Edge)
 Filter will not accommodate two WCDMA signals
 (10 MHz Filter)

WCDMA (Upper Band Edge)



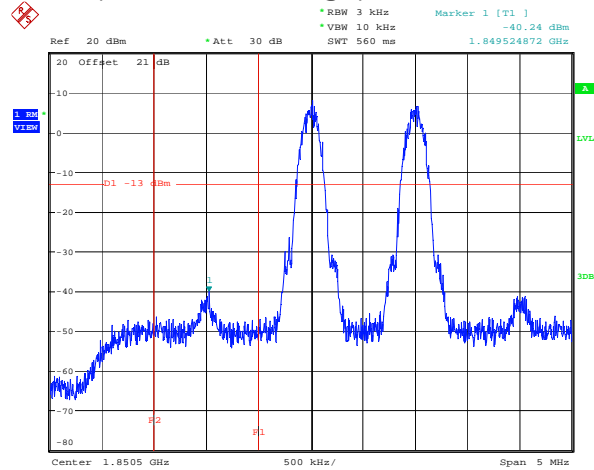
Date: 12.JUN.2009 14:57:56

1982.5 MHz + 1987.5 MHz

Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Uplink 3rd Order Intermodulation

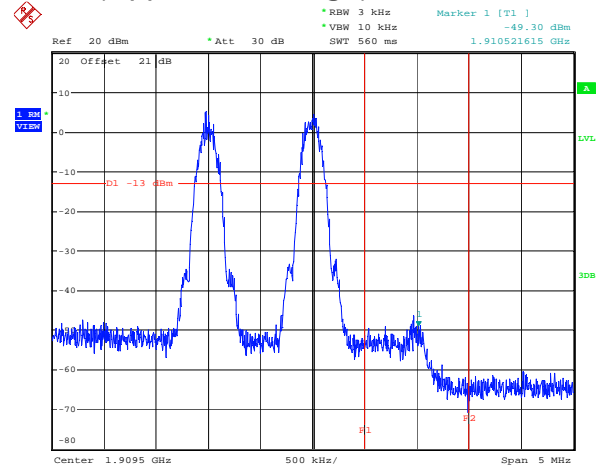
GSM (Lower Band Edge)



Date: 12.JUN.2009 15:08:56

1850.5 MHz + 1851.5 MHz

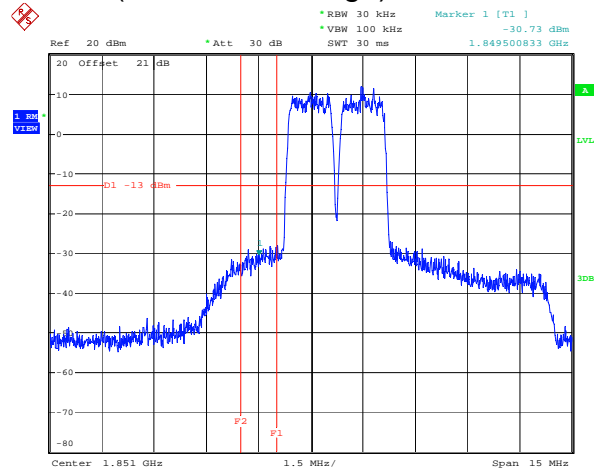
GSM (Upper Band Edge)



Date: 12.JUN.2009 15:14:20

1908.5 MHz + 1909.5 MHz

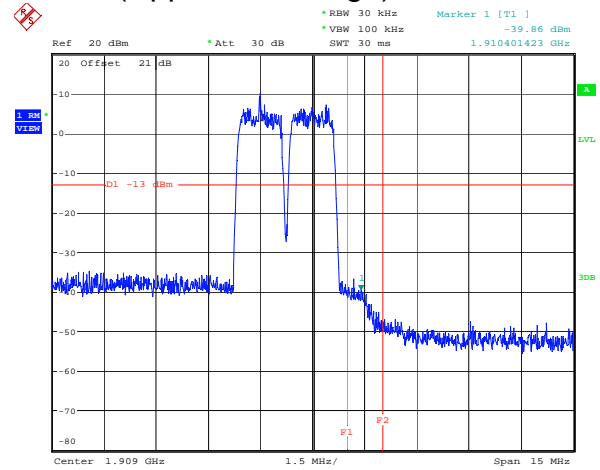
CDMA (Lower Band Edge)



Date: 12.JUN.2009 15:10:40

1851 MHz + 1852.5 MHz

CDMA (Upper Band Edge)



Date: 12.JUN.2009 15:16:17

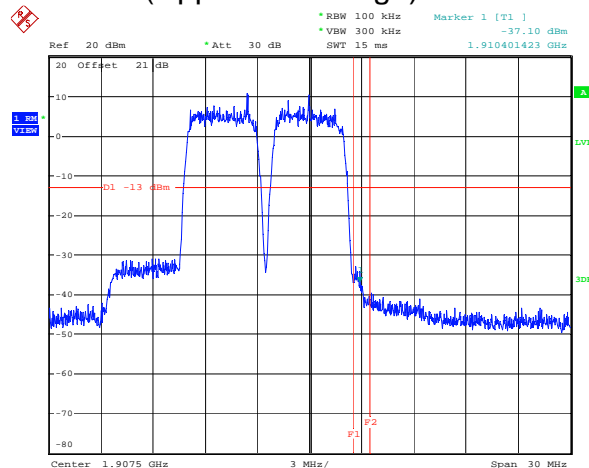
1907.5 MHz + 1909 MHz

Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Uplink 3rd Order Intermodulation

WCDMA (Lower Band Edge)
 Filter will not accommodate two WCDMA signals
 (10 MHz Filter)

WCDMA (Upper Band Edge)

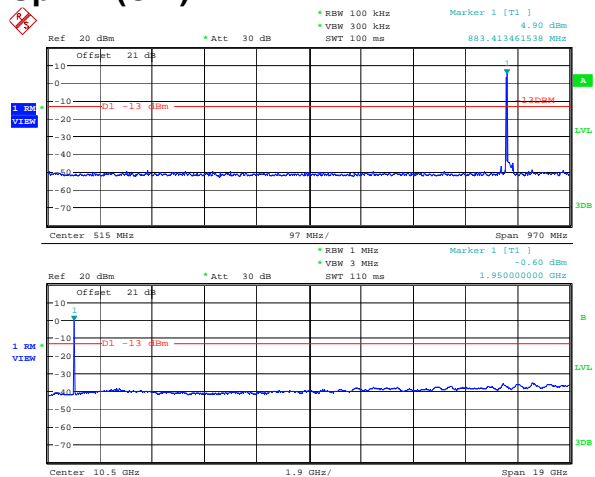


Date: 12.JUN.2009 15:18:19

1902.5 MHz + 1907.5 MHz

Uplink 3rd Order Intermodulation (Two-Tone Intermodulation Spectral plots)

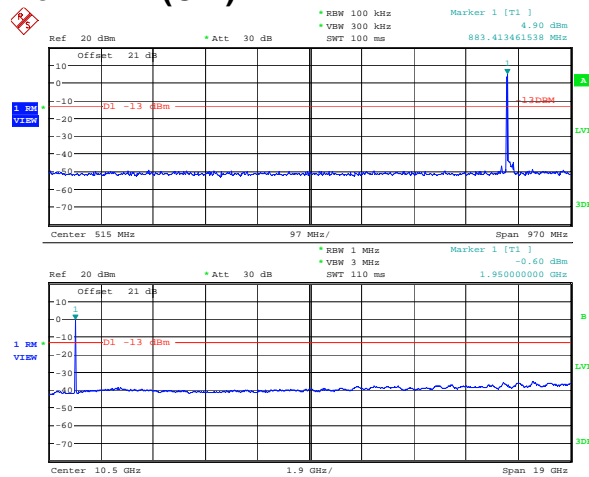
Uplink (CW)



Date: 12.JUN.2009 06:31:21

836.5 MHz + 1880MHz

Downlink (CW)

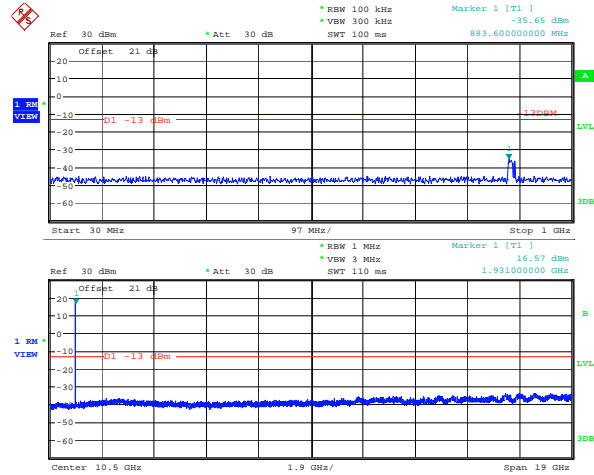


Date: 12.JUN.2009 06:31:21

881.5 MHz + 1960MHz

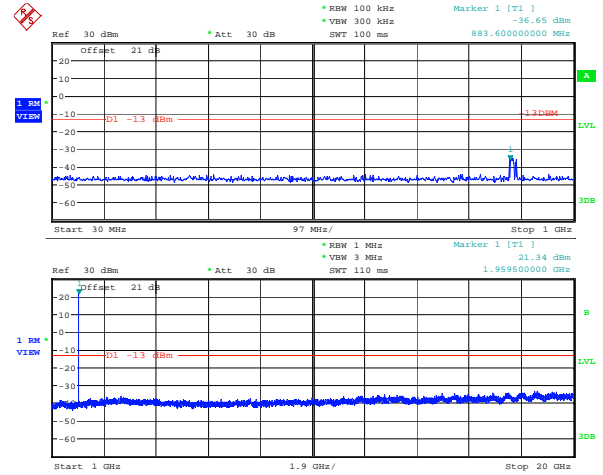
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Downlink Conducted Emissions
 GSM Modulation



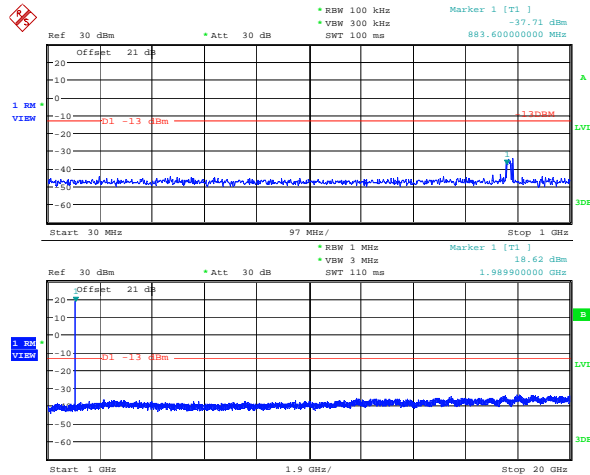
Date: 12.JUN.2009 15:45:11

1930.5 MHz



Date: 12.JUN.2009 15:48:22

1960 MHz



Date: 12.JUN.2009 15:50:48

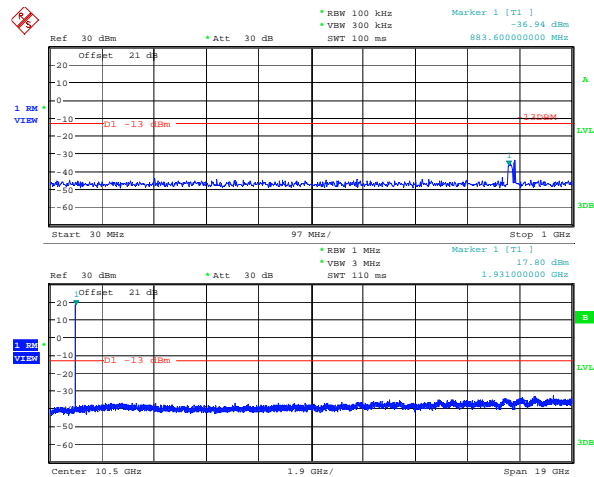
1989.5 MHz



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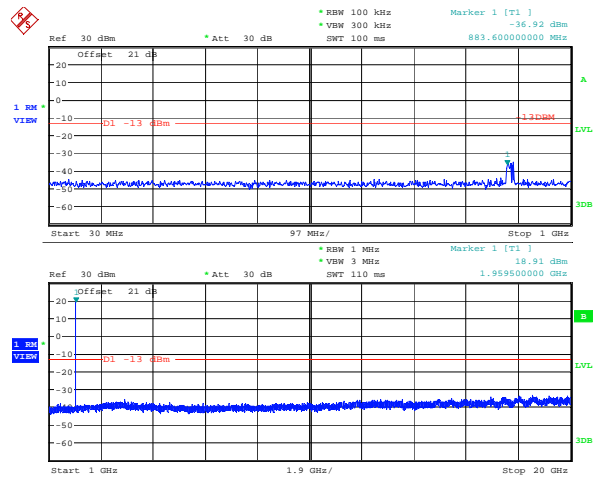
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Downlink Conducted Emissions
CDMA Modulation:



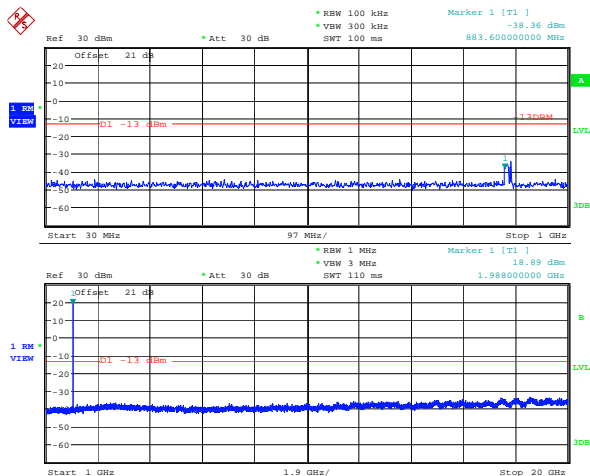
Date: 12.JUN.2009 15:46:05

1931 MHz



Date: 12.JUN.2009 15:49:08

1960 MHz

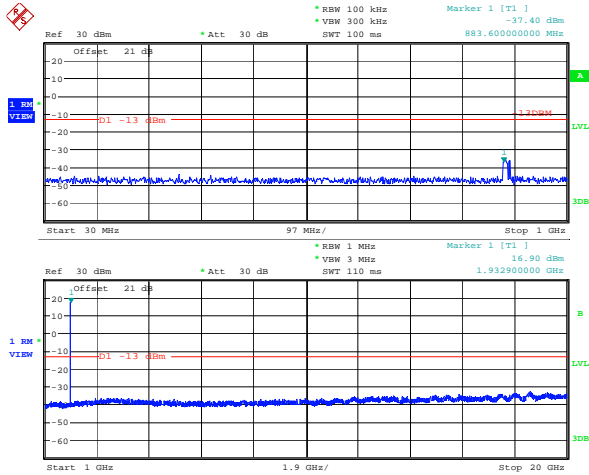


Date: 12.JUN.2009 15:52:34

1989 MHz

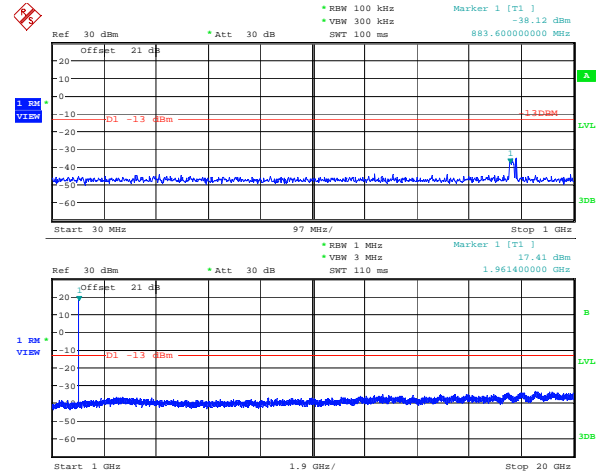
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Downlink Conducted Emissions
WCDMA Modulation



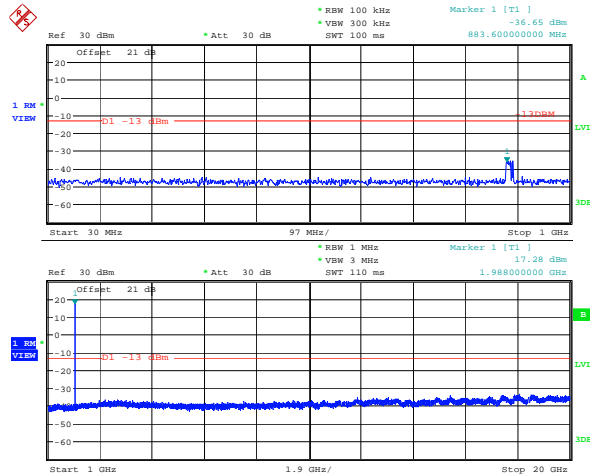
Date: 12.JUN.2009 15:46:53

1932.5 MHz



Date: 12.JUN.2009 15:49:40

1960 MHz

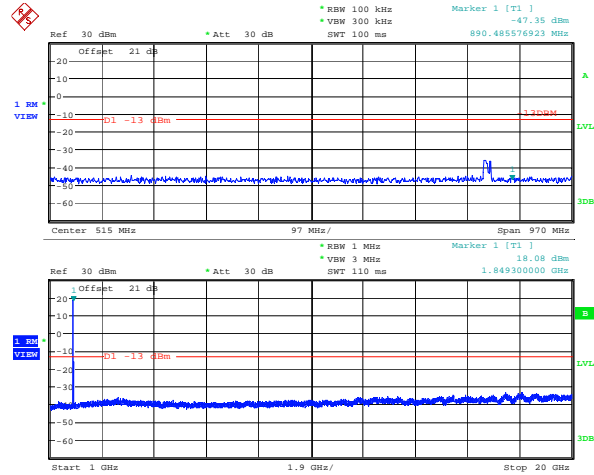


Date: 12.JUN.2009 15:53:28

1987.5 MHz

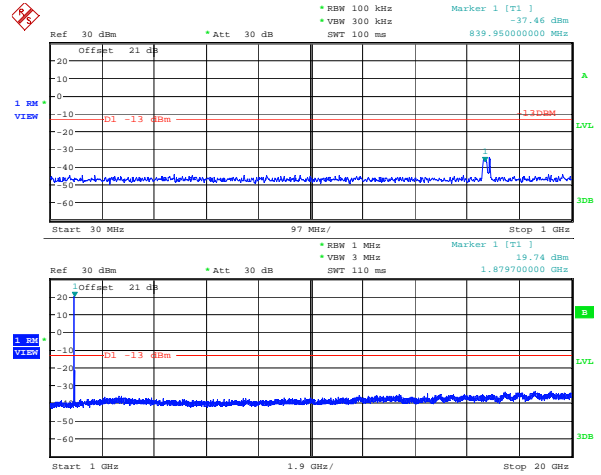
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

Uplink Conducted Emissions
GSM Modulation:



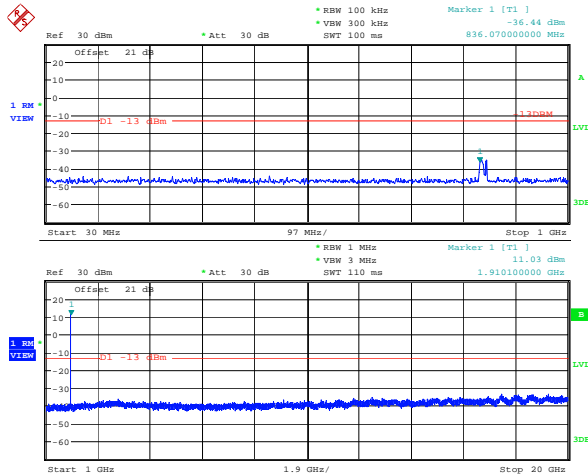
Date: 12.JUN.2009 15:26:19

1850.5 MHz



Date: 12.JUN.2009 15:32:17

1880 MHz

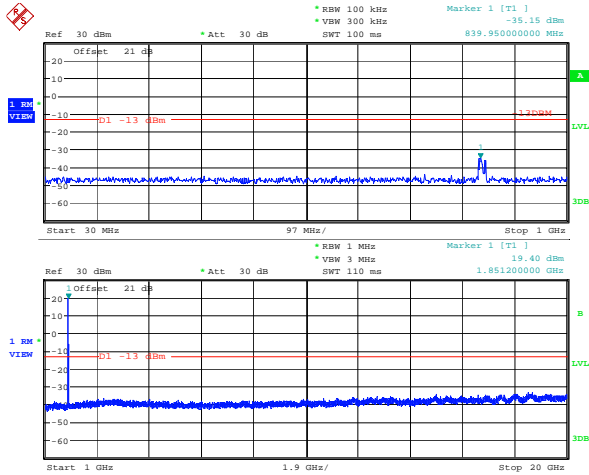


Date: 12.JUN.2009 15:34:50

1909.5 MHz

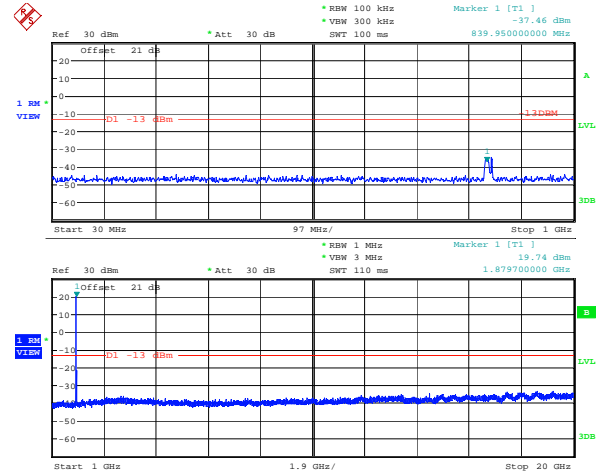
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

**Uplink Conducted Emissions
 CDMA Modulation:**



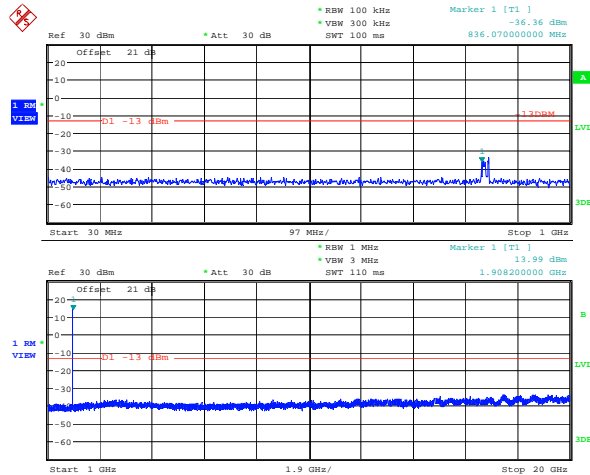
Date: 12.JUN.2009 15:27:57

1851 MHz



Date: 12.JUN.2009 15:32:17

1880 MHz

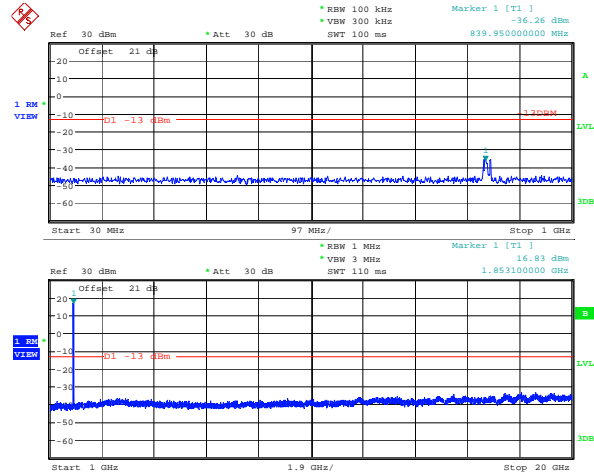


Date: 12.JUN.2009 15:35:57

1909 MHz

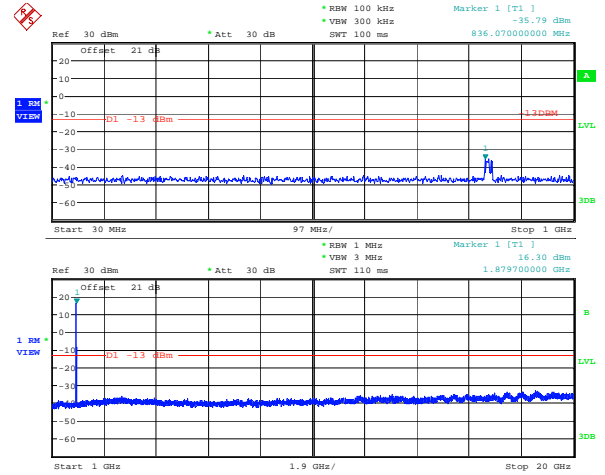
Clause 24.238(a) Spurious emissions at the antenna terminal, continued

**Uplink Conducted Emissions
WCDMA Modulation:**



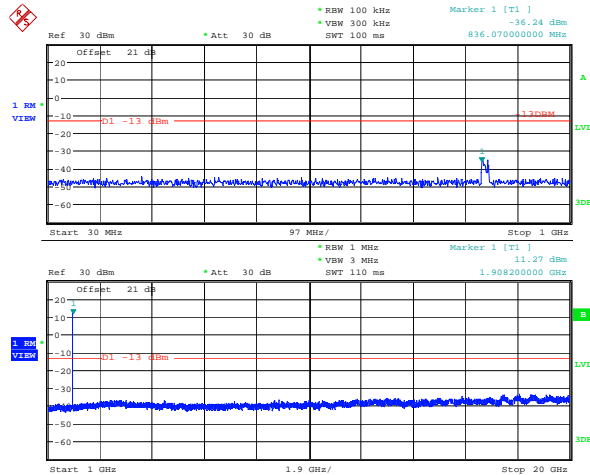
Date: 12.JUN.2009 15:29:12

1852.5 MHz



Date: 12.JUN.2009 15:32:58

1880 MHz



Date: 12.JUN.2009 15:36:52

1907.5 MHz

Clause 24.238(a) Field Strength of spurious radiation

Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

Test Results: Pass

Special Notes:

- The cabinet radiation was measured with the equipment transmitting a CW signal into a non-radiating 50 Ohm load at maximum output power on a single frequency
- Measurements were performed on a low, middle, and high channel for both the Uplink and Downlink
- The spectrum was searched from 30 MHz to 20 GHz. (10th Harmonic)
- All measurements were performed with a spectrum analyzer with the following settings:
 - RMS Detector, in 30 MHz to 1GHz range, using 100 kHz RBW and 300 kHz VBW
 - RMS Detector, in 1 to 22 GHz range, using 1 MHz RBW and 3 MHz VBW
- All measurements were performed at distance of 3 meters.

Test Data:

No emissions were detected within 20 dB below the limit for the Downlink direction.
No emissions were detected within 20 dB below the limit for the Uplink direction.



Nemko Canada Inc.

Clause 2-11-04/EAB/RF Out of Band Rejection

Plots showing the filter frequency response.

Test Results: Pass

Special Notes:

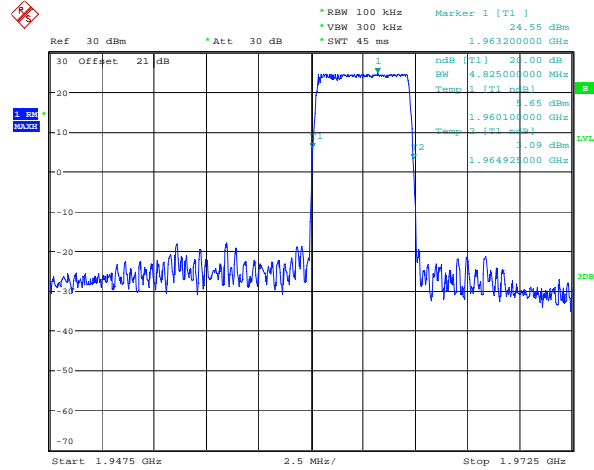
Verification of both uplink and downlink for all available filter selections.

Test Data:

See spectral plots of this section.

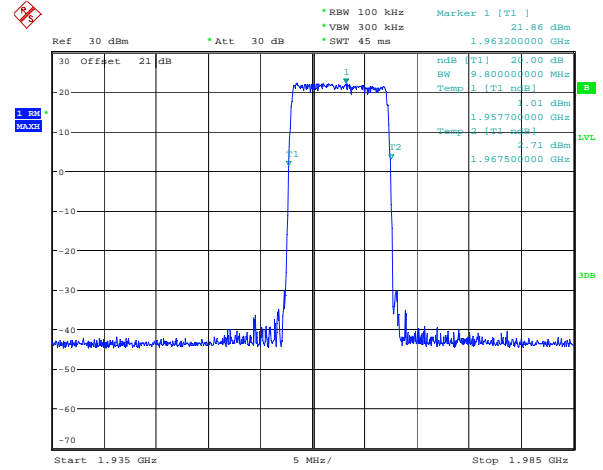
Clause 2-11-04/EAB/RF Out of Band Rejection, continued

Downlink – 5 MHz Filter



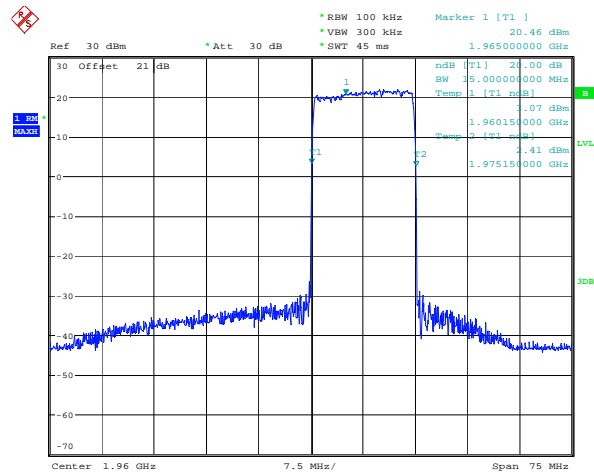
Date: 12.JUN.2009 16:08:46

Downlink – 10 MHz Filter



Date: 12.JUN.2009 16:11:03

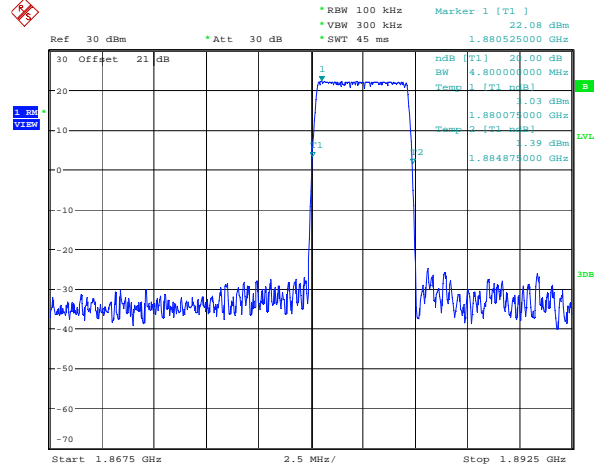
Downlink – 15 MHz Filter



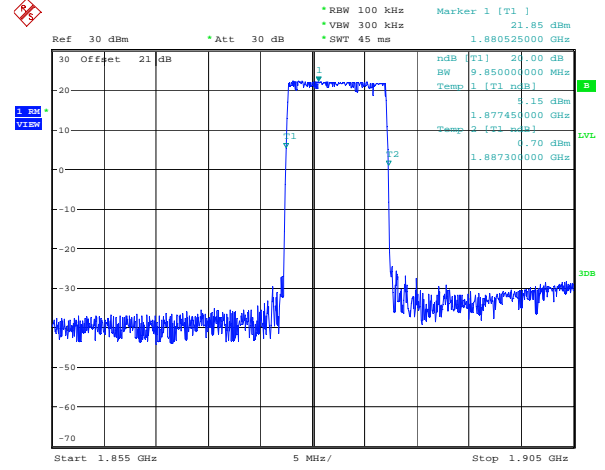
Date: 12.JUN.2009 16:05:54

Clause 2-11-04/EAB/RF Out of Band Rejection, continued

Uplink – 5 MHz Filter



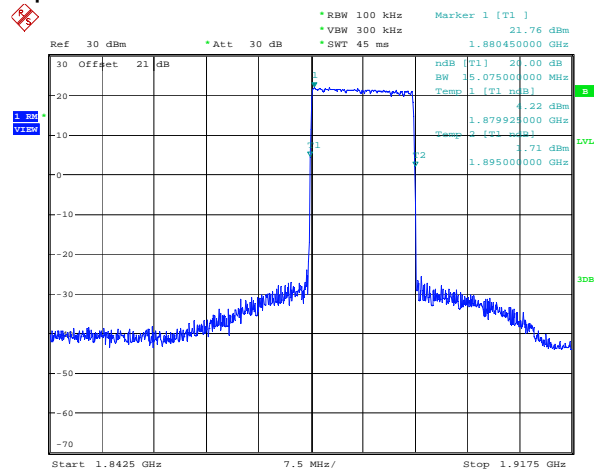
Uplink – 10 MHz Filter



Date: 12.JUN.2009 16:21:17

Date: 12.JUN.2009 16:23:47

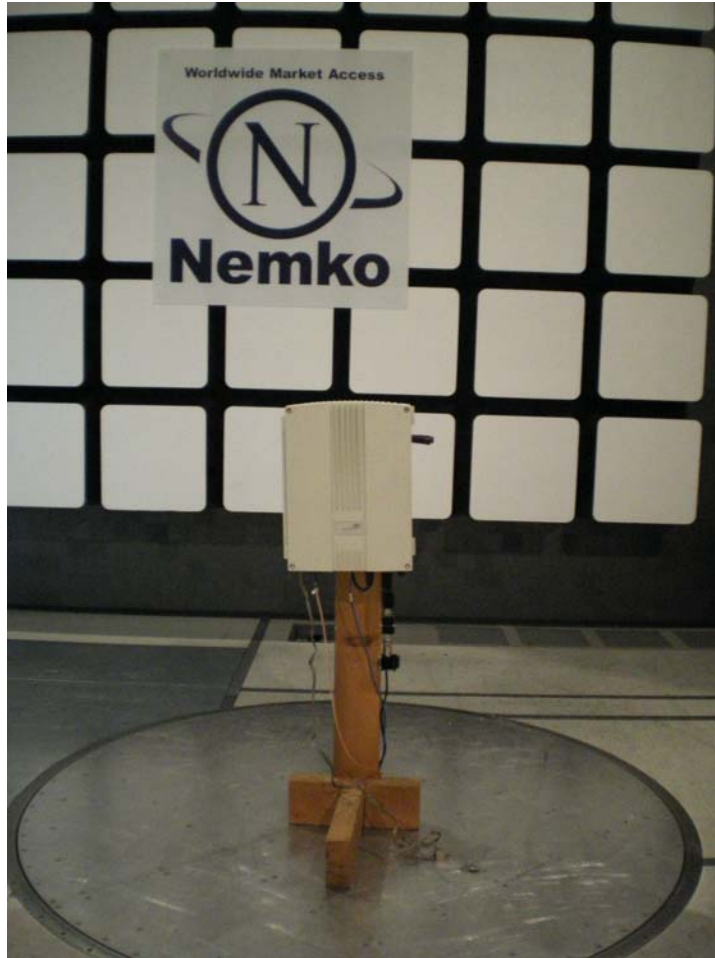
Uplink – 15 MHz Filter



Date: 12.JUN.2009 16:18:54

Appendix B : Setup Photographs

Radiated Spurious Emissions Setup:

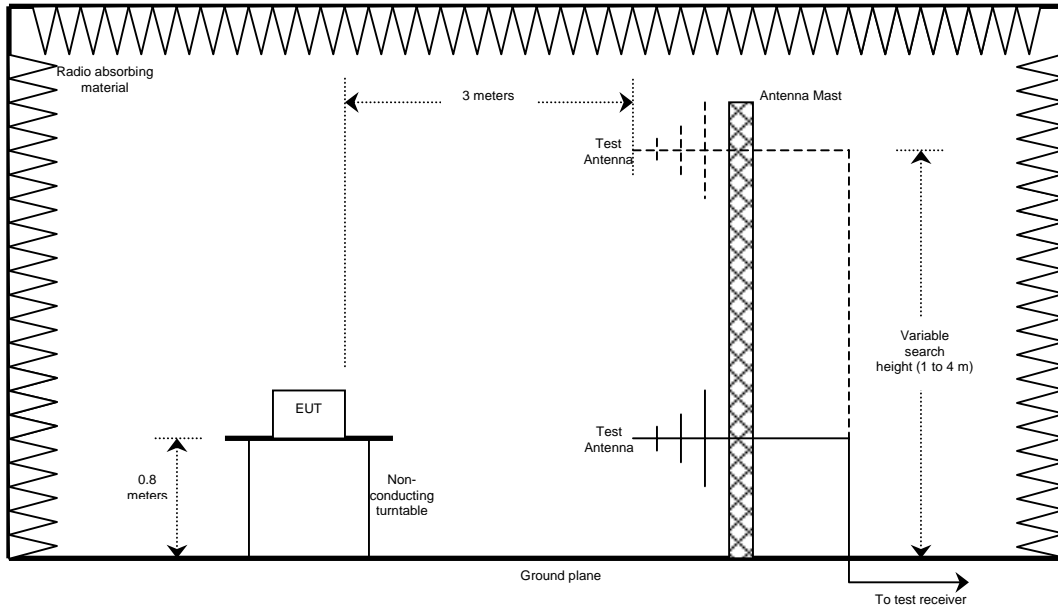


Radiated Spurious Emissions Setup, continued:

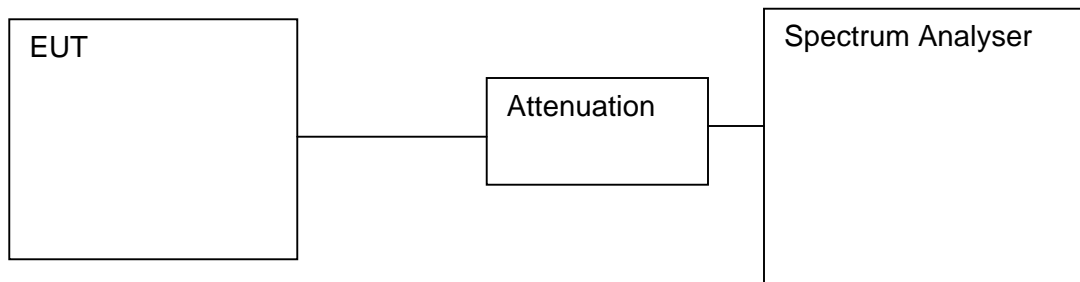


Appendix C : Block Diagram of Test Setups

Test Site For Radiated Emissions



Conducted Emissions, Output power, Occupied Bandwidth



Frequency Stability

