



Product Integrity Laboratory

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Certification Test Report
FCC Part 22, Subpart H/ Industry Canada RSS 132
Part 24, Subpart E/ Industry Canada RSS 133

Novatel Wireless Inc
Merlin X950D

FCC ID # NBZNRM-X950D
IC ID # 3229A-X950D
Project Code CG-626
(Report CG-626-RA-1-2)
Revision: 2
(Replaces CG-626-RA-1-1)

August 30, 2007

Prepared for: Novatel Wireless Inc

Author: Glen Moore
EMC Manager

Approved by: Nick Kobrosly
Lab Manager

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Report Summary

NTS Canada

Product Integrity Laboratory
5151-47th Street, N.E. Calgary Alberta T3J 3R2

Accreditation Numbers: FCC 101386
IC 46405-3978 File # IC3978-2
Standards Council of Canada Accredited Laboratory No. 440

Applicant: Novatel Wireless Inc.
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Calgary, Alta. T2E-7H7

Customer Representative: Mr. Jim Turner
Regulatory Specialist
Ph: (403) 295-4855
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E Mail: jturner@nvtl.com

EUT Description:

EUT Description	Applicant	Model	Revision	Serial Number
PC Express Card	Novatel Wireless Inc	Merlin X950D	HW – Rev 1.0 Firmware- Rev 2.1	001018-00-013613-6 001018-00-013612-8

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Test Summary

Appendix	Test/Requirement Description	Deviations* from:			Status	Applicable Rule Parts		
		Base Standard	Test Basis	NTS Procedure		Mode	FCC	IC
A	Occupied BW	No	No	No	PASS	Cell	2.1049/22.905	RSS 132 4.5
						PCS	2.1049/24.238	RSS 133 6.5
B	Peak Power Output (Conducted)	No	No	No	PASS	Cell	2.1046/22.913	RSS 132 4.4
						PCS	2.1046/24.232	RSS 133 6.4
C	Peak Power Output (Radiated)	No	No	No	PASS	Cell	2.1046/22.913	RSS 132 4.4
						PCS	2.1046/24.232	RSS 133 6.4
D	TX Frequency Stability	No	No	No	PASS	Cell	2.1055/22.335	RSS 132 4.3
						PCS	2.1055/24.235	RSS 133 6.3
E	Conducted Spurious Emissions (including bandedge measurements)	No	No	No	PASS	Cell	2.1051/22.917	RSS 132 4.5
						PCS	2.1051/24.238	RSS 133 6.5
F	Field Strength of Spurious Emissions RSS 129/133 RX Spurious Emissions	No	No	No	PASS	Cell	2.1053/22.917	RSS 132 4.3
						PCS	2.1053/24.238	RSS 133 6.3
G	Test Equipment List	No	No	No	PASS			

Test Log

Appendix	Test Case	Test Dates	Tested by
A	Occupied BW	June 5-26 , 2007	Andrew Gibson/Glen Moore
B	Peak Power Output (Conducted)	June 5-July 25, 2007	Andrew Gibson/Glen Moore
C	Peak Power Output (Radiated)	June 5- July 25, 2007	Glen Moore/Deniz Demerci
D	TX Frequency Stability	July 30, 2007	Glen Moore
E	TX Conducted Spurious Emissions (including bandedge measurements)	June 5-July 25, 2007	Andrew Gibson/Glen Moore
F	Field Strength of Spurious Emissions RSS 129/133 RX Spurious Emissions	June 5- July 18, 2007	David Raynes/Glen Moore

Prepared By: _____
Glen Moore
EMC Manager

Reviewed By: _____
Alex Mathews
Compliance Specialist

Approved By: _____
Robyn Zuehlke
Quality Manager

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Register of revisions

Revision	Date	Description of Revisions
0	July 24, 2007	Initial release TCB for Review
1	July 30, 2007	Updated FCC ID number on report and Frequency Stability data
2	August 30, 2007	Removed reference to HSUPA in eut description and clarified release number of HSDPA

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this document is to describe the tests applied by NTS Canada to demonstrate compliance of the Merlin X950D from Novatel Wireless Inc to the following specifications:

FCC Part 22, Subpart H Public Mobile Services
FCC Part 24, Subpart E Personal Communications Services
RSS 132 – Issue 2
RSS-133, Issue 3, Rev.1 2GHz Personal Communications Services

2.0 EUT DESCRIPTION

2.1 CONFIGURATION

Description of EUT

	Name	Model	Revision	Serial Number
EUT	Merlin X950D	NRMX95 D	Hardware = Rev 1 Firmware = 2.7	001018-00-013613-6 001018-00-013612-8
Classification	Mobile			
TX Operating Frequency Range	GSM 850	824-849 MHz		
	PCS 1900	1850-1910 MHz		
	WCDMA Band V:	824-849 MHz		
	WCDMA Band II:	1850-1910 MHz		
RX Operating Frequency Range	GSM 850	869-894 MHz		
	PCS 1900	1930-1990 MHz		
	WCDMA Band V:	869-894 MHz		
	WCDMA Band II:	1930-1990 MHz		
Maxium Output Power	Cell band 31.8 dbm in GSM Mode PCS band 28.8 dbm in GSM Mode			
Antenna Type/Gain	Integral Antenna: 3 dbi External antenna: 8 dbi for cellular bands 4 dBi for PCS bands			
Manufactured by	Ms. Sherry Cao Customer Value Development Representative Inventec Appliances (Shanghai) Co., Ltd. 7 Gui Qing Road, Shanghai 200233, China, P.R.C. Ph: +86-21-6485-3668 Ext:2817 Fax: +86-21-6485-0019 E Mail: cao.sherry@iac.com.tw			
Functional description	The Merlin X950D ExpressCard is a global, tri-band and quad-band EDGE/GPRS wireless modem. The card can be used in both ExpressCard/34 and 54 slots as well as with Novatel Wireless adapters in PCMCIA and USB slots. Unique to the Merlin X950D is HSDPA release 5			

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Voltage/Power source	Host system
Voltage/current into final amplifier stage	➤ 3.3v (+/- 0.3v) @ 1A average to final PA.
Tune up procedure	See separate exhibit

2.2 MODE OF OPERATION DURING TESTS

The EUT was tested while in a continuous transmit mode. The EUT was tuned to a low, middle, and high channel to perform tests. For all test cases pre-scans were completed in all modes to determine worst case levels.

3.0 SUPPORT EQUIPMENT

3.1 CONFIGURATION

The following equipment was used as the host system for the eut

Host Device Description	Manufacturer	Model	Revision	Serial Number
Laptop Computer	Dell Computers	Inspiron E1720	Rev X00	CN DGE2CI 48643 6C9 0003
Laptop Power Supply	Dell Computers	Model XD757	Not applicable	CN OXD757 48661 6BI MBKO

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APPENDICES

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APPENDIX A: OCCUPIED BANDWIDTH

A.1. Base Standard & Test Basis

Base Standard	Cell Mode - FCC PART 22.905, PCS Mode – FCC Part 24.238
Test Basis	FCC PART 2.1049
Test Method	FCC PART 2.1049/24.238

A.2. Specifications

Using an RBW of 300Hz or 1% of the emission bandwidth, The spectral shape of the output should look similar to the input for all modulations.

Sec. 24.238 Emission limits

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

A.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

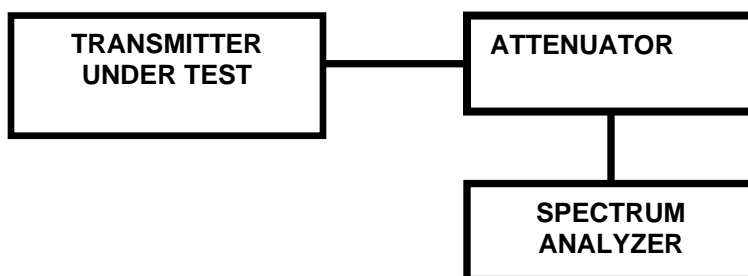
A.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

A.5. Test Procedure

FCC 2.1049 or TIA 603-C-2004

A.6. Test Setup diagram



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A.7. Test Results

The EUT is in compliance with the limits as specified above. The worst case bandwidths are provided below

Cell Mode

Modulation type	Channel	Frequency (MHz)	Occupied Bandwidth
GSM	128	824.2	244.49 KHz
GPRS	128	824.2	244.49 KHz
EDGE	189	836.4	250.50 KHz
WCDMA	4132	826.4	4.21 MHz
HSDPA	4233	846.6	4.17 MHz

PCS Mode

Modulation type	Channel	Frequency (MHz)	Occupied Bandwidth (MHz)
GSM	810	1907.8	245.48
GPRS	810	1907.8	245.49
EDGE	810	1907.8	248.49
WCDMA	9262	1852.4	4.21
HSDPA	9262	1852.4	4.21

A.8. Operating Mode During Test

The EUT was tested while in a continuous transmit mode operating at maximum rated RF output power.

A.9. Sample Calculation

NA

A.10. Test Data

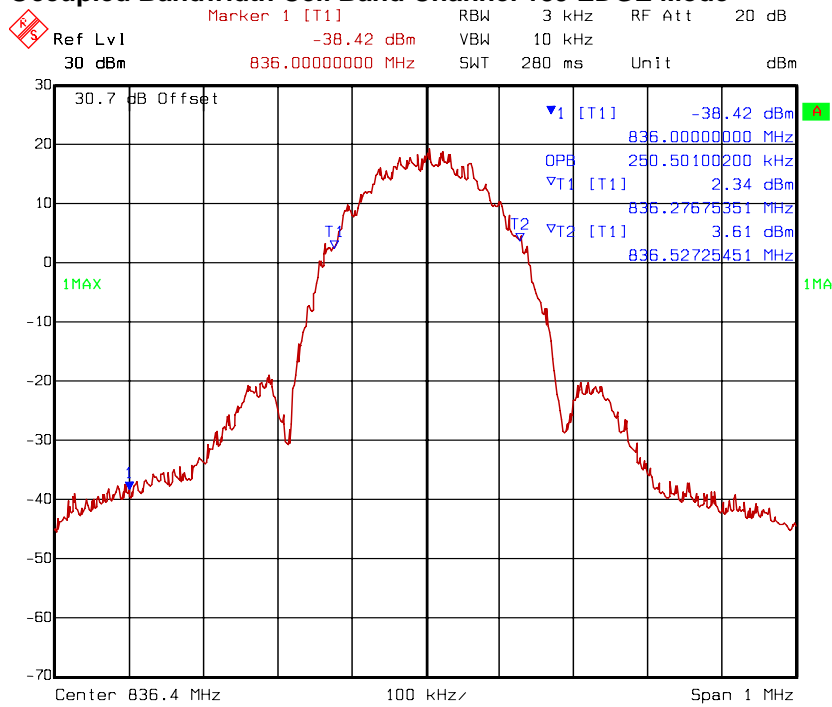
See plots on following pages

A.11. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

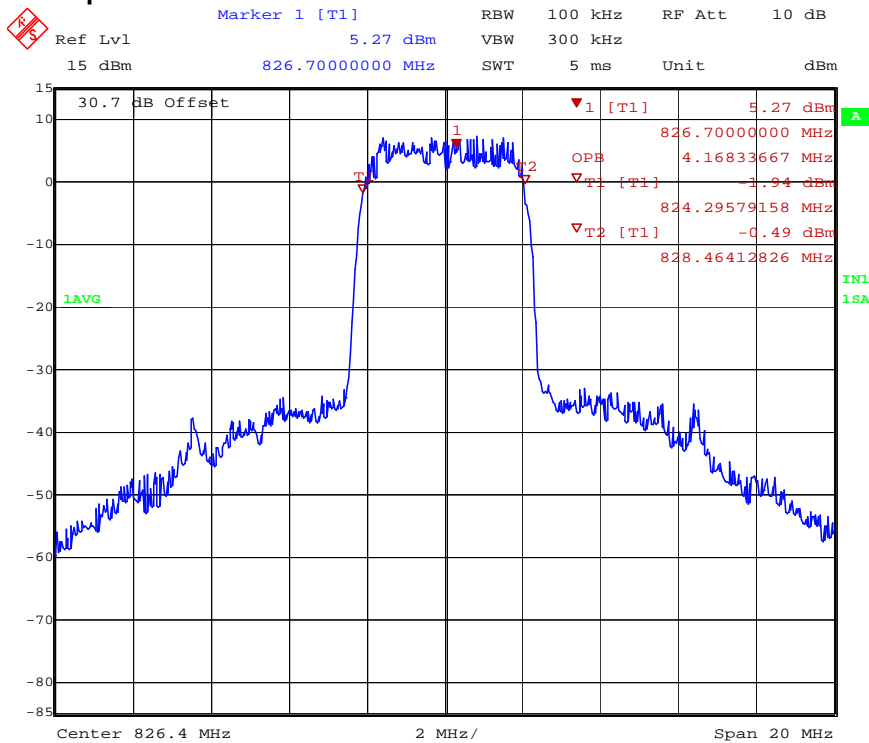
Name: Andrew F. Gibson
Function: RF Engineer

Figure 3 Occupied Bandwidth Cell Band Channel 189 EDGE Mode



Comment A: CG-626 Occupied BW Edge mode Channel 189
Date: 24.JUL.2007 21:17:04

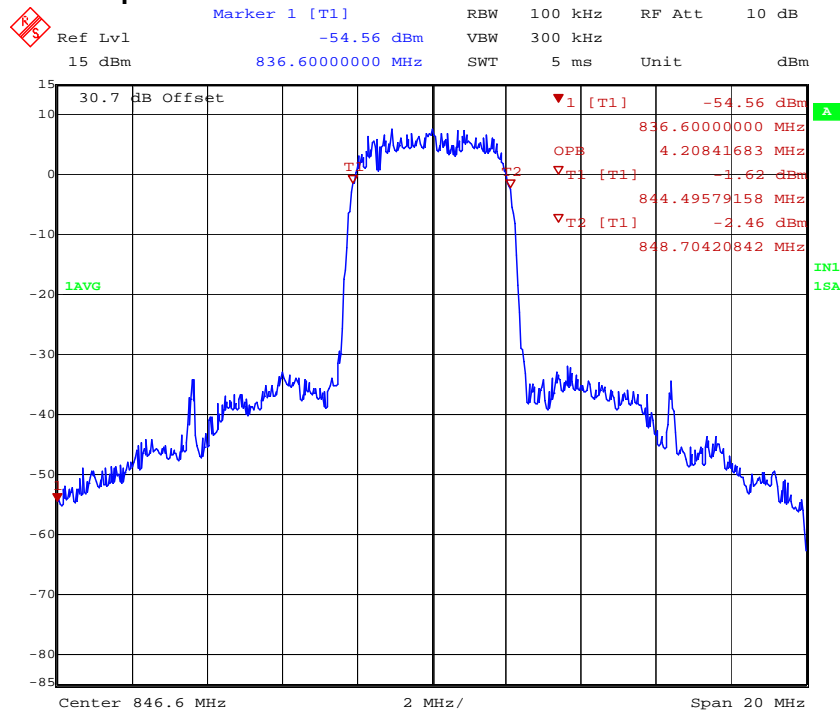
Figure 4 Occupied Bandwidth Cell Band Channel 4132 HSDPA Mode



Title: CG-626
Comment A: WCDMA HSDPA Ch 4132 Occ BW
Date: 31.MAY.2007 13:42:47

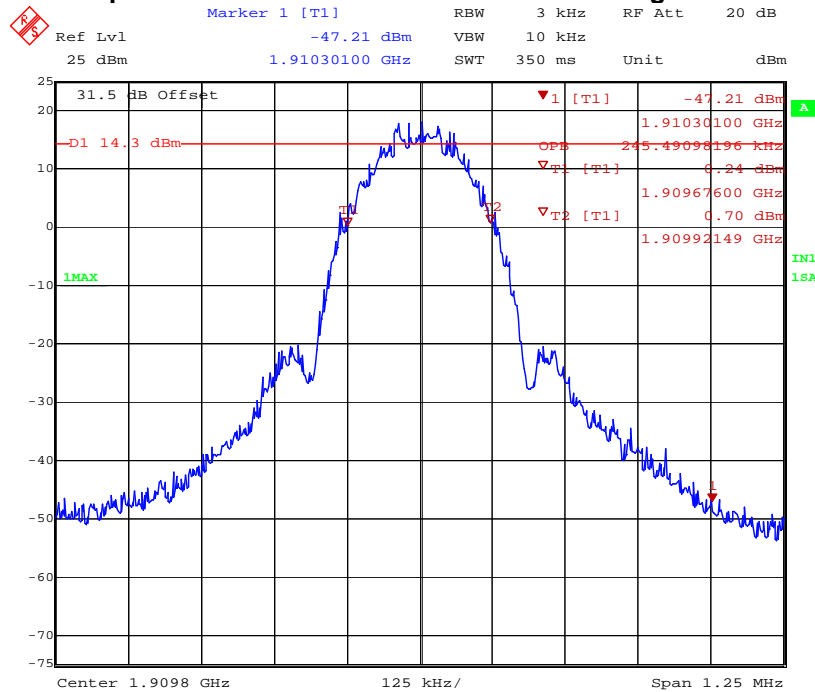
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Figure 5 Occupied Bandwidth Cell Band Channel 4233 WCDMA Mode



Title: CG-626
Comment A: WCDMA Ch 4233 Occ BW
Date: 31.MAY.2007 14:33:29

Figure 6 Occupied Bandwidth PCS Band Channel 810 Edge Mode

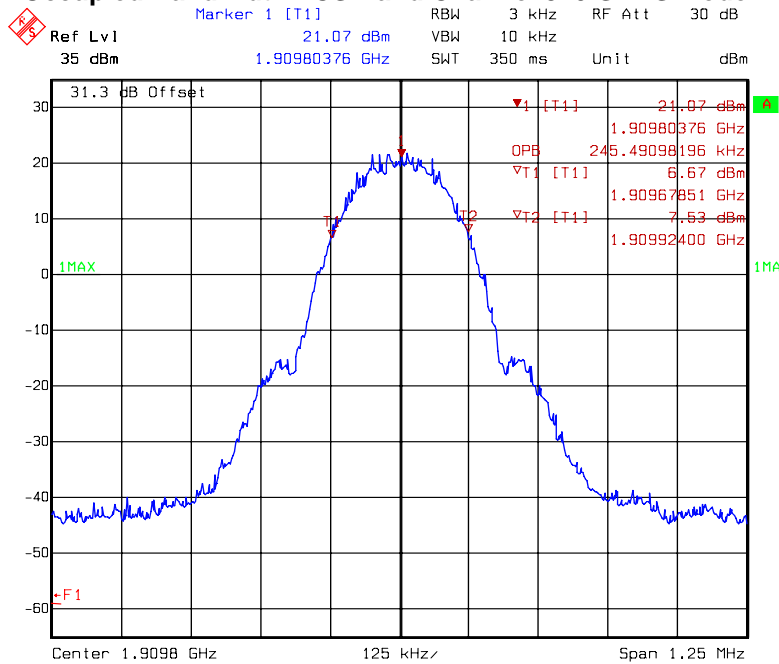


Title: CG-626 Novatel Wireless
Comment A: EDGE 1900 Ch 810 Occ BW
Date: 26.JUN.2007 10:11:54

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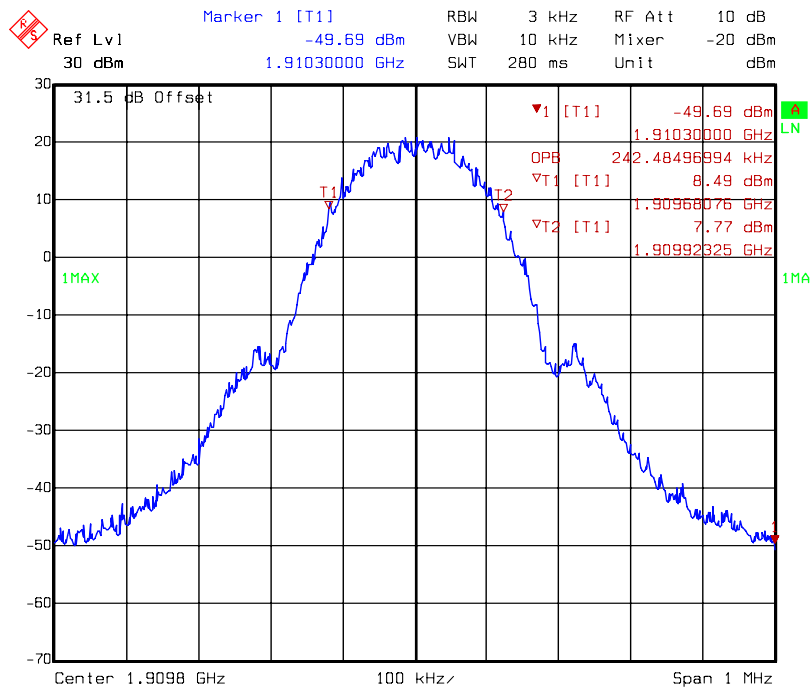
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Figure 7 Occupied Bandwidth PCS Band Channel 810 GPRS Mode



Title: CG-626 Novatel Wireless
Comment A: GPRS 1900 Band Ch 810 Occ BW
Date: 6 JUN.2007 14:59:20

Figure 8 Occupied Bandwidth PCS Band Channel 810 GSM Mode



Title: CG-626 Novatel
Comment A: GSM PCS1900 Ch 810 Occ BW
Date: 5 JUN.2007 16:55:52

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Figure 9 Occupied Bandwidth PCS Band Channel 9262 WCDMA Mode

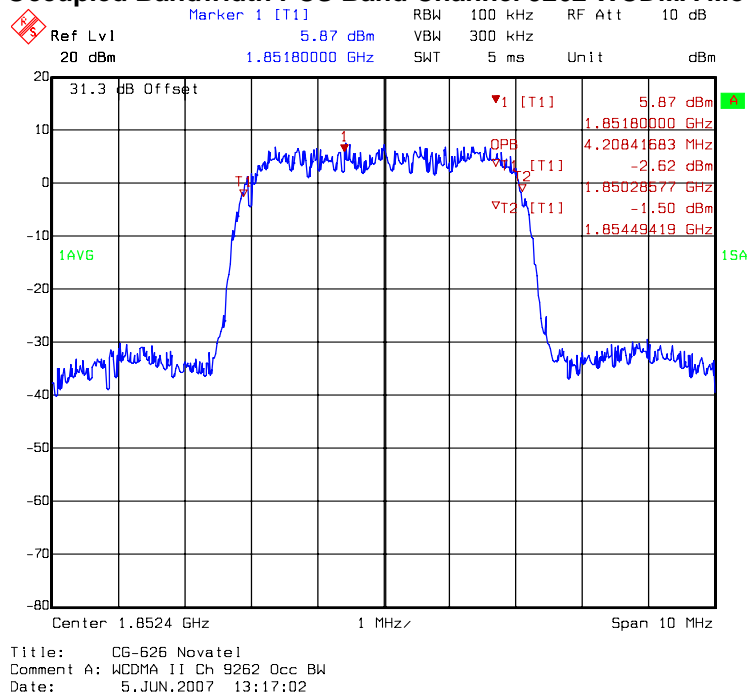
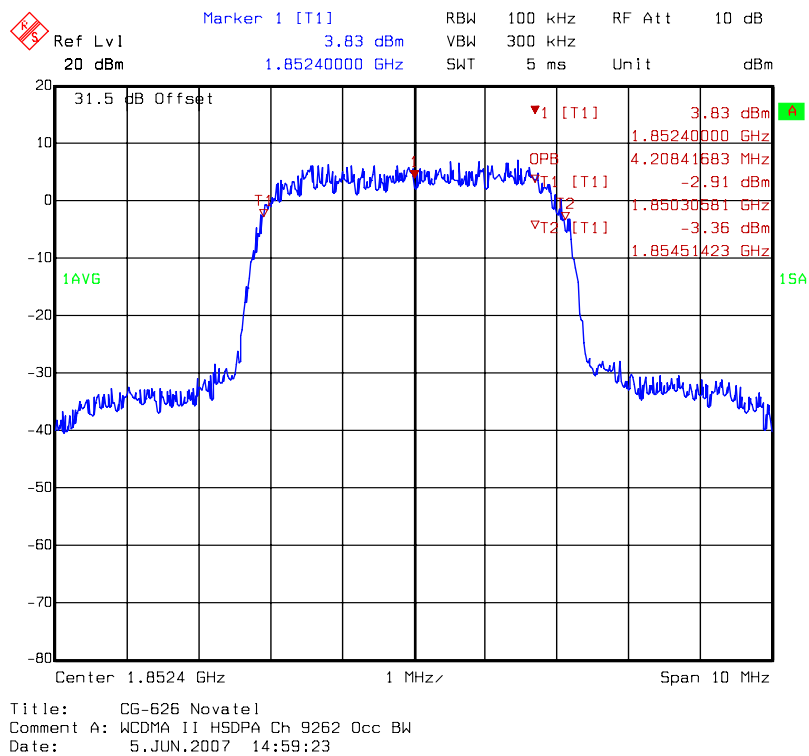


Figure 10 Occupied Bandwidth PCS Band Channel 9262 HSDPA Mode



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APPENDIX B: PEAK POWER OUTPUT (CONDUCTED FROM AUX ANTENNA PORT)

B.1. Base Standard & Test Basis

Base Standard	Cell Mode: FCC Part 22.913 - PCS Mode: FCC Part 24.232
Test Basis	FCC 2.1046
Test Method	TIA/EIA 603

B.2. Specifications

Cell Mode

22.913 Effective radiated power limits.

(2) Extend coverage on a secondary basis into cellular unserved areas, as those areas are defined in §22.949, the ERP of base transmitters and cellular repeaters of such systems must not exceed 1000 Watts. **The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.**

PCS Mode

24.232 Power and antenna height limits.

(c) 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.

B.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

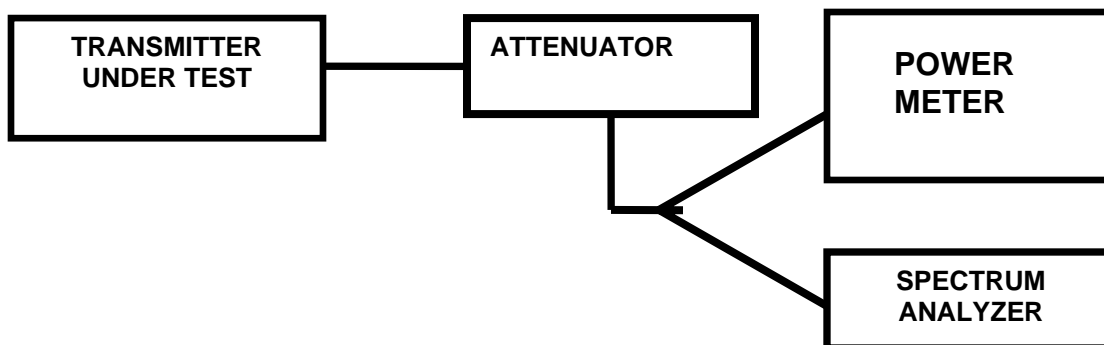
B.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

B.5. Test Method

TIA 603-C-2004

B.6. Test Setup block diagram



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B.7. Cell Mode – FCC 22.913 Test Results

Compliant – The maximum ERP is 37.7 dbm on channel 128 in GSM Mode with an 8 dbi maximum antenna. This is 0.8 db below the limit. Results each channel are indicated in the table below

EUT Transmit Channel	Frequency MHz	Modulation Mode	Conducted Average Output Power (dbm)	Conducted Peak Output Power (dbm)	Peak ERP (with worst case antenna gain of 8 dbi)
128	824.2	GSM	22.2	31.7	37.7
189	836.4		22.4	31.8	37.6
251	848.8		22.4	31.8	37.7
128	824.2	GPRS	25.2	31.8	37.6
189	836.4		25.3	31.7	37.7
251	848.8		25.2	31.7	37.7
128	824.2	EDGE	18.3	25.8	31.6
189	836.4		18.3	26	31.8
251	848.8		18.4	26	31.8
4132	826.4	WCDMA	23	28.3	34.1
4182	836.4		23	27.7	33.5
4233	846.6		23	27.7	33.3
4132	826.4	HSDPA	23.2	28.4	34.2
4182	836.4		22.9	27.5	33.3
4233	846.6		23.1	27.8	33.6

B.8. PCS Mode – FCC 24.232 Test Results

Compliant – The maximum EIRP is 37.7 dbm on channel 128 in GSM Mode with a 4 dbi maximum antenna. This is 0.8 db below the limit. Results each channel are indicated in the table below

EUT Transmit Channel	Frequency MHz	Modulation Mode	Conducted Average Output Power (dbm)	Conducted Peak Output Power (dbm)	Peak EIRP (with worst case antenna gain of 4dbi)
512	1850.2	GSM	19.2	28.8	32.8
661	1880		19.1	28.7	30.9
810	1909.8		19.2	28.8	32.8
512	1850.2	GPRS	22.1	28.7	32.7
661	1880		22.3	28.6	32.6
810	1909.8		22.3	28.7	32.7
512	1850.2	EDGE	16.7	28.1	30.3
661	1880		16.7	27.9	30.1
810	1909.8		16.8	27.7	29.9
9262	1852.4	WCDMA	23	24.7	28.7
9400	1880		22.8	24	28
9538	1907.6		22.9	23.9	27.9
9262	1852.4	HSDPA	21.8	24.5	26.5
9400	1880		21.8	24.4	26.4
9538	1907.6		21.9	24.5	26.5

B.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Andrew Gibson, RF Engineer Glen Moore, EMC Manager

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APPENDIX C: RADIATED PEAK POWER OUTPUT

C.1. Base Standard & Test Basis

Base Standard	Cell Mode: FCC Part 22.913 - PCS Mode: FCC Part 24.232
Test Basis	FCC 2.1046
Test Method	TIA/EIA 603

C.2. Specifications

Cell Mode

22.913 Effective radiated power limits.

(2) Extend coverage on a secondary basis into cellular unserved areas, as those areas are defined in §22.949, the ERP of base transmitters and cellular repeaters of such systems must not exceed 1000 Watts. **The ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.**

PCS Mode

24.232 Power and antenna height limits.

(c) 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.

C.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

C.4. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

C.5. Test Method

TIA 603-C-2004 using signal substitution. The eut was tested in 3 orthogonal planes to determine worst case. In all frequency bands the worst case position was with the eut in the horizontal plane and the with the receive antenna horizontally polarized. The date reported below is for these worst case combinations.

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C.6. Test Results

Compliant – The maximum ERP is dbm on channel 251 in GSM Mode This is 10.95 db below the limit. Results are indicated for each channel in the table below

C.7. Radiated Power Measurement Test Data Summary

EUT Transmit Channel	Frequency MHz	Mode	Final Corrected Field Strength (dbuv/m @ 3 meters)	Substituted Peak ERP (dbm)	Limit (dbm)	Margin (db)
128	824.2	GSM	123.99	26.49	38.45	11.96
189	836.4		123.79	26.29	38.45	12.16
251	848.8		125.00	27.50	38.45	10.95
128	824.2	GPRS	122.30	24.80	38.45	13.65
189	836.4		123.17	25.67	38.45	12.78
251	848.8		124.70	27.2	38.45	11.25
128	824.2	EDGE	121.57	24.07	38.45	14.38
189	836.4		121.71	24.21	38.45	14.24
251	848.8		122.59	25.09	38.45	13.36
4132	826.4	WCDMA	118.63	21.13	38.45	17.32
4182	836.4		119.09	21.59	38.45	16.86
4233	846.6		119.64	22.14	38.45	16.31
4132	826.4	HSDPA	119.24	21.74	38.45	16.71
4182	836.4		119.71	22.21	38.45	16.24
4233	846.6		119.51	22.01	38.45	16.44

C.8. PCS Mode – FCC 24.232 Test Results

Compliant – The maximum EIRP is 30.64 dbm on channel 512 in GPRS Mode antenna. This is 2.36 db below the limit. Results for each channel are indicated in the table below

EUT Transmit Channel	Frequency MHz	Mode	Final Corrected Field Strength (dbuv/m @ 3 meters)	Substituted Peak EIRP Level dbm	Limit (dbm)	Margin (db)
512	1850.2	GSM	125.7	30.4	33	2.6
661	1880		125.73	30.43	33	2.57
810	1909.8		124.7	29.4	33	3.6
512	1850.2	GPRS	125.94	30.64	33	2.36
661	1880		125.59	30.29	33	2.71
810	1909.8		124.4	29.1	33	3.9
512	1850.2	EDGE	125.05	29.75	33	3.25
661	1880		123.97	28.67	33	4.33
810	1909.8		124.95	29.65	33	3.35
9262	1852.4	WCDMA	122.86	27.56	33	5.44
9400	1880		125.66	30.4	33	2.64
9538	1907.6		124.08	28.78	33	4.22
9262	1852.4	HSDPA	122.3	27	33	6.0
9400	1880		125.4	30.1	33	2.9
9538	1907.6		123.5	28.2	33	4.8

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C.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: David Raynes, Senior EMC Technologist
Deniz Demerci, EMC Specialist
Glen Moore, EMC Manager

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APPENDIX D: FREQUENCY STABILITY

D.1. Base Standard & Test Basis

Base Standard	Cell Mode: FCC 22.335 – PCS Mode: FCC 24.235
Test Basis	FCC Part 2.1055
Test Method	FCC Part 2.1055/EIA/TIA 603

D.2. Specifications

Cell Mode

22.355

Except as otherwise provided in this part, the carrier frequency of each transmitter in the Public Mobile Services must be maintained within the tolerances given in Table C-1 of this section.

Table C-1. - Frequency Tolerance for Transmitters in the Public Mobile Services

Frequency range (MHz)	Base, fixed	Mobile >3	Mobile <=3
	(ppm)	watts (ppm)	watts (ppm)
25 to 50	20.0	20.0	50.0
50 to 450	5.0	5.0	50.
450 to 512	2.5	5.0	5.0
821 to 896	1.5	2.5	2.5
928 to 929	5.0	n/a	n/a
929 to 960	1.5	n/a	n/a
2110 to 2220	10.0	n/a	n/a

PCS Mode

Sec. 24.235 Frequency stability. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

D.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
+1.11/-1.22

D.4. Deviations

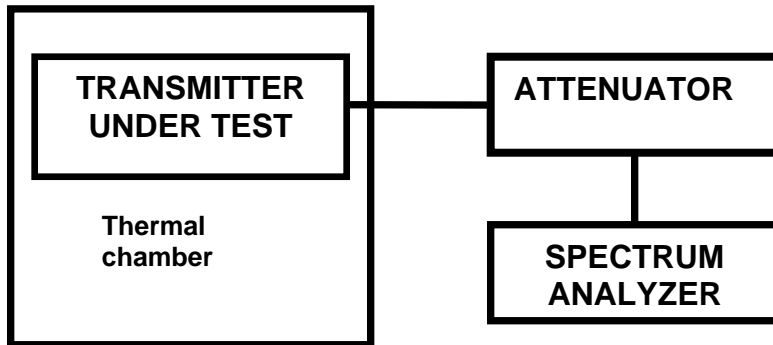
Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

D.5. Test Method

The eut was placed in the thermal chamber and tested at 20 celcius and increased in 10 degree increments to 50 celcius and then down to -30 c. After a sufficient time of temperature stabilization the eut was keyed on to transmit unmodulated in CW mode on a center channel in each band and the maximum frequency drift was recorded. This verified the tolerance of the frequency determining components of the EUT.

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D.6. Test Setup diagram



D.7. Test Results

Compliant. The maximum measured frequency drift in cell mode (Part 22 Subpart H – 2.5ppm limit) was 1503 Hz. The maximum measured drift in PCS mode was 1000 Hz (Part 24 subpart E), sufficient to stay within the frequency block.

800 MHz Cell Mode

Temperature	Channel	Assigned Frequency	Measured Frequency	Drift (Hz)	Maximum allowable drift
-30	4182	836400000	836399499	501	2091
-20	4182	836400000	836399200	800	2091
-10	4182	836400000	836399244	756	2091
0	4182	836400000	836399100	900	2091
10	4182	836400000	836398998	1002	2091
102 VAC	4182	836400000	836398881	1119	2091
120 VAC	4182	836400000	836398962	1038	2091
138 VAC	4182	836400000	836398912	1088	2091
30	4182	836400000	836398497	1503	2091
40	4182	836400000	836401003	1003	2091
50	4182	836400000	836401108	1108	2091

1900 MHz PCS Mode

Temperature	Channel	Assigned Frequency	Measured Frequency	Drift (Hz)	Maximum allowable drift
-30	9400	1880000000	1880000678	678	Must stay in assigned pcs block
-20	9400	1880000000	1880000544	544	
-10	9400	1880000000	1880000777	777	
0	9400	1880000000	1880000856	856	
10	9400	1880000000	1880001004	1004	
102 VAC	9400	1880000000	1880000906	906	
120 VAC	9400	1880000000	1880000955	955	
138 VAC	9400	1880000000	1880000875	875	
30	9400	1880000000	1880001000	1000	

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40	9400	1880000000	1880001200	1200	
50	9400	1880000000	1880001002	1002	

D.8. Deviations from Normal Operating Mode During Test

The device was operated in cw mode for the frequency stability testing as all operating/modulation modes derive their operation frequencies from the same source

D.9. Sample Calculation

None.

D.10. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: David Raynes
Function: Sr EMC Technologist

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APPENDIX E: TX/RX CONDUCTED SPURIOUS EMISSIONS

E.1. Base Standard & Test Basis

Base Standard	Cell Mode: FCC Part 22.917 - PCS Mode: FCC Part 24.238
Test Basis	FCC 2.1051
Test Method	FCC 2.1051

E.2. Specifications

Cell Mode:

a) *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.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

PCS Mode:

24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(a) *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.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power

E.3. Measurement Uncertainty

Expanded Uncertainty (K=2)
1.11/-1.22

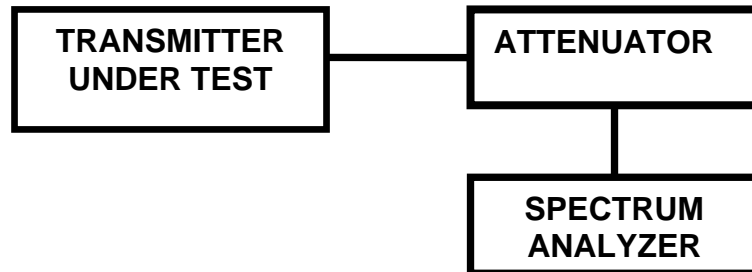
E.4. Deviations – None

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E.5. Test Method

The eut was connected to a spectrum analyzer via a calibrated cable and attenuator assembly. Testing was done with the eut operating in all modes at highest power level available and on low, mid and high channels. The test procedure was as per E2 b above

E.6. Test Setup Diagram



E.7. Test Results Summary

Compliant see plots on following pages and summary tables below

Cell Band

Channel	Mode	Note	Emission Frequency (MHz)	Level (dbm)	Limit (dbm)	Margin (db)
128	GPRS	Lower band edge	823.98	-15.45	-13	2.45
251	GPRS	Upper band edge	849.02	-15.68	-13	2.68
128	GSM	Lower band edge	823.98	-13.92	-13	.92
251	GSM	Upper band edge	849.02	-13.22	-13	.22
128	EDGE	Lower band edge	823.99	-19.42	-13	6.42
251	EDGE	Upper band edge	849.03	-21.72	-13	8.72
4132	WCDMA	Lower band edge	820.04	-36.14	-13	23.14
4233	WCDMA	Upper band edge	849.00	-31.00	-13	18.0
4132	HSDPA	Lower band edge	823.99	-34.00	-13	21.0
4233	HSDPA	Upper band edge	850.6	-32.5	-13	19.5
128	GSM	Spurious (Noise floor)	2856	-37.5	-13	24.5
128	GSM	Spurious (Noise floor)	6993	-33.13	-13	20.13

Note: The above are the worst case measurements, no reportable emissions were detected in any of the modes (GSM, GPRS, EDGE, WCDMA, HSDPA). Therefore for spurious emissions noise floor readings are reported along with plots of the eut operating at highest power mode (GSM)

PCS Band

Channel	Mode	Note	Emission Frequency (MHz)	Level (dbm)	Limit (dbm)	Margin (db)
512	GPRS	Lower band edge	1849.98	-14.76	-13	1.8
810	GPRS	Upper band edge	1919.02	-14.16	-13	1.2
512	GSM	Lower band edge	1849.99	-14.66	-13	1.7
810	GSM	Upper band edge	1910.02	-14.98	-13	2.0
512	EDGE	Lower band edge	1849.99	-20.0	-13	7.0
810	EDGE	Upper band edge	1910.02	-20.8	-13	7.8
9262	WCDMA	Lower band edge	1849.99	-33.8	-13	20.8
9535	WCDMA	Upper band edge	1910.02	-24.7	-13	11.7
9262	HSDPA	Lower band edge	1849.98	-19	-13	6
9535	HSDPA	Upper band edge	1910	-35	-13	22
9262	WCDMA	Spurious (Noise floor)	3810	-32.5	-13	19.5

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9262	WCDMA	Spurious (Noise floor)	15000	-35.5	-13	22.5
Note: The above are the worst case measurements, no reportable emissions were detected in any of the modes (GSM, GPRS, EDGE, WCDMA, HSDPA). Therefore for spurious emissions noise floor readings are reported along with plots of the eut operating in WCDMA Mode						

E.8. Test Data

See following pages for plots of band edge for all modes and spurious data to the 10th harmonic. To reduce file size only worst case data has been provided for conducted spurious to 10th harmonic. As the euts reciever is always active, no rx related spurious emissions were detected.

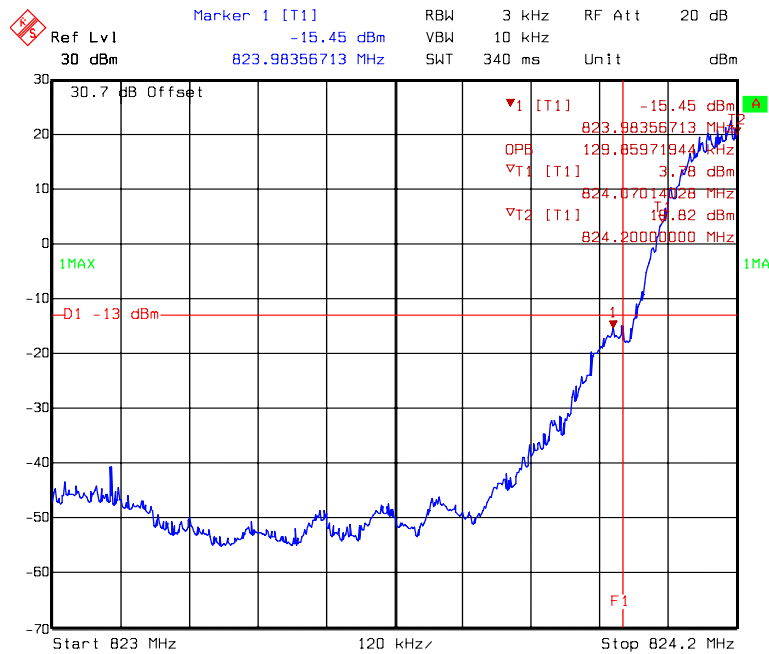
E.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name: Glen Moore
Function: EMC Manager

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Figure 11 Cell band GPRS Mode Lower band edge



Title: CG-626 Novatel Wireless
Comment A: GPRS 850 Band Ch 128 Band Edge Inner
Date: 6.JUN.2007 16:32:50

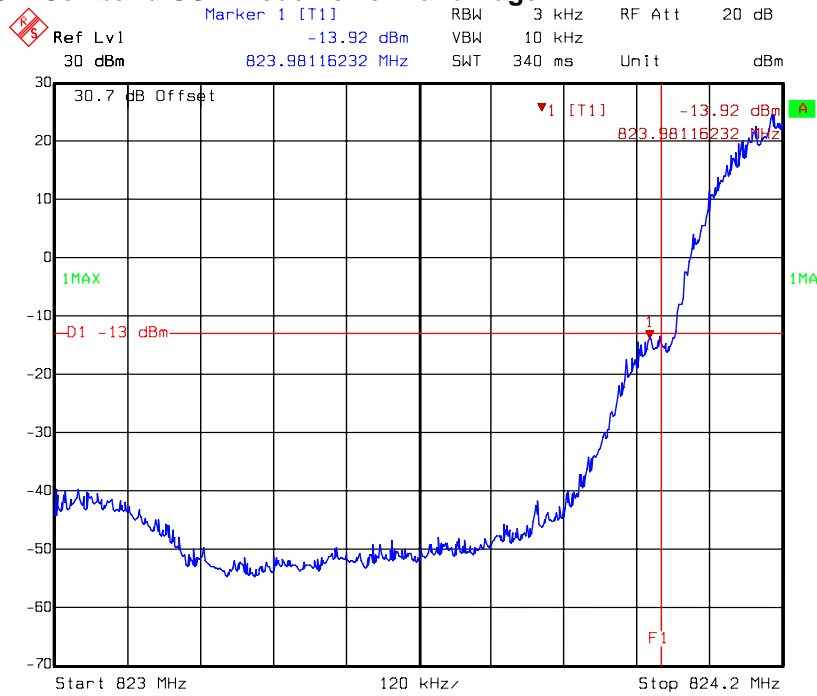
Figure 12 Cell band GPRS Mode Upper Band Edge



Title: CG-626 Novatel Wireless
Comment A: GPRS 850 Band Ch 251 Band Edge Inner
Date: 6.JUN.2007 16:35:38

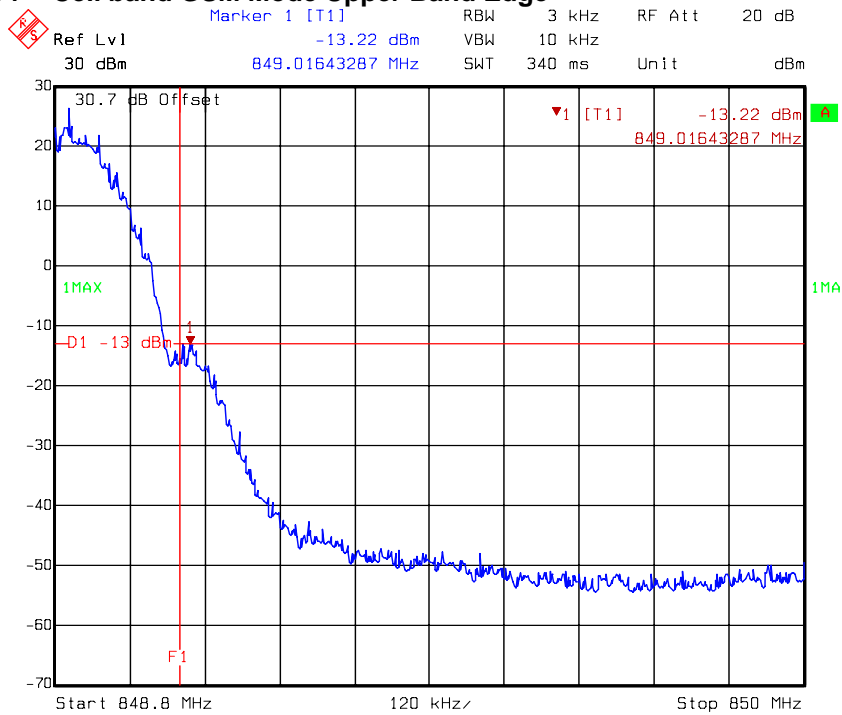
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Figure 13 Cell band GSM Mode Lower Band Edge



Title: CG-626 Novatel
Comment A: GSM850 Bandedge
Date: 5.JUN.2007 11:04:31

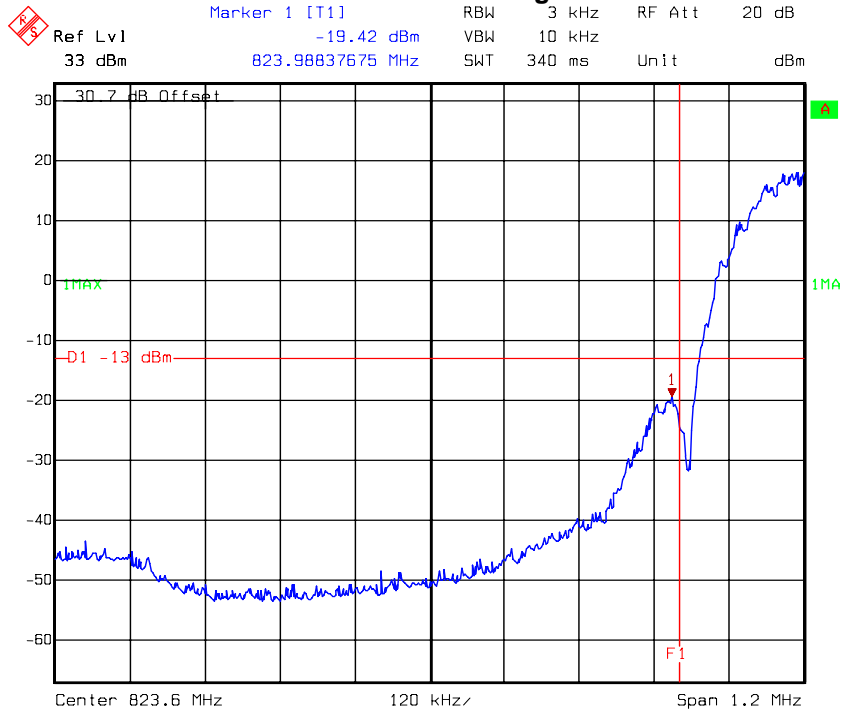
Figure 14 Cell band GSM Mode Upper Band Edge



Title: CG-626 Novatel
Comment A: GSM850 Bandedge Ch 251
Date: 5.JUN.2007 11:15:25

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Figure 15 Cell band EDGE Mode Lower Band Edge



Comment A: CG-626 Lower bandedge spurious
channel 128 EDGE Mode
Date: 25.JUL.2007 9:35:58

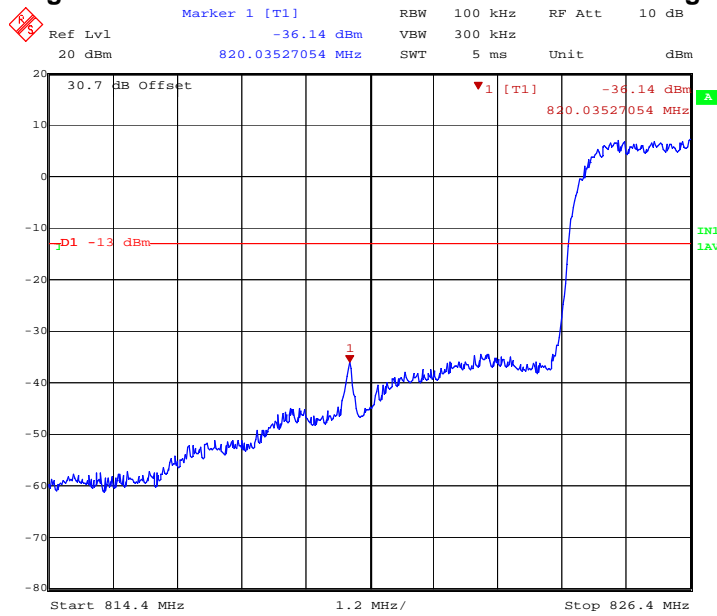
Figure 16 Cell band EDGE Mode Upper Band Edge



Comment A: CG-626 Upper bandedge spurious
channel 251 EDGE Mode
Date: 25.JUL.2007 9:42:23

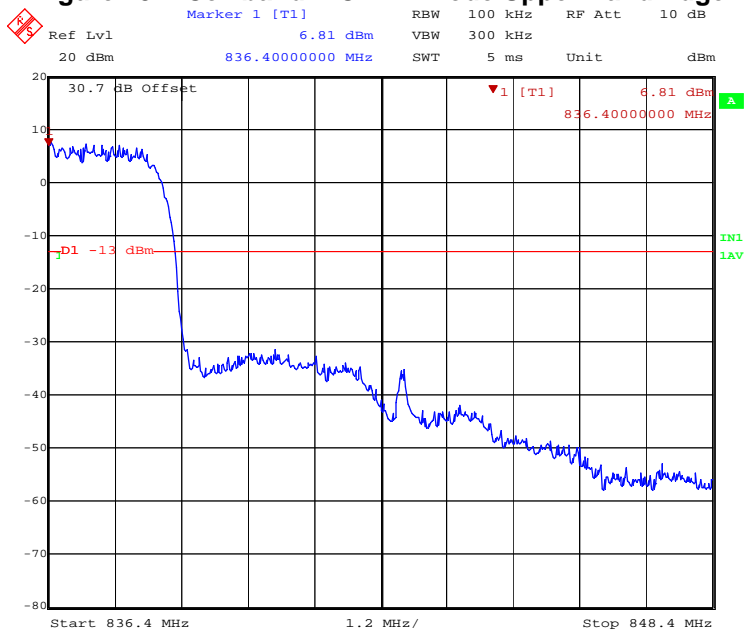
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 17 Cell band WCDMA Mode Lower Band Edge



Title: CG-626
 Comment A: WCDMA Ch 4132 Lower Band Edge Wide
 Date: 31.MAY.2007 15:10:00

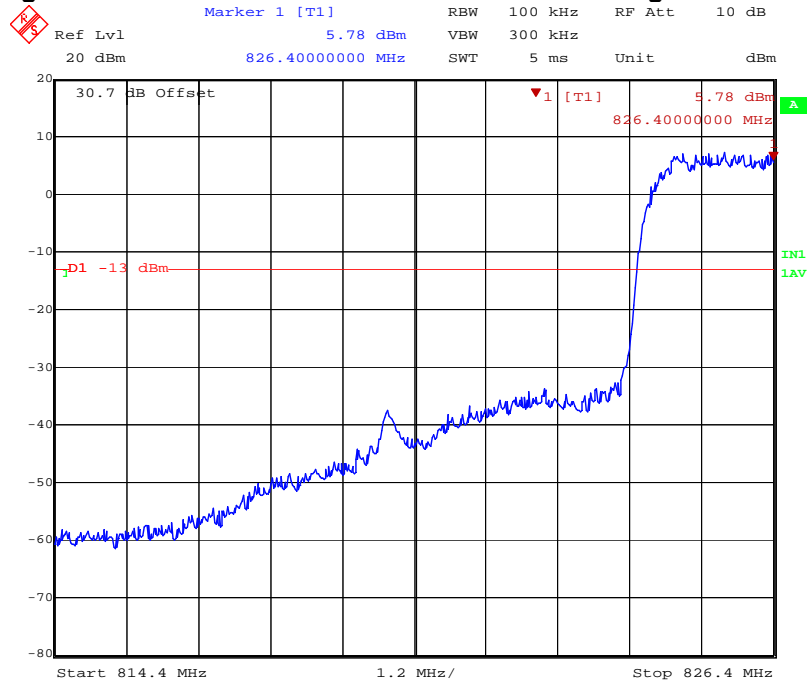
Figure 18 Cell band WCDMA Mode Upper Band Edge



Title: CG-626
 Comment A: WCDMA Ch 4182 Upper Band Edge Wide
 Date: 31.MAY.2007 15:14:44

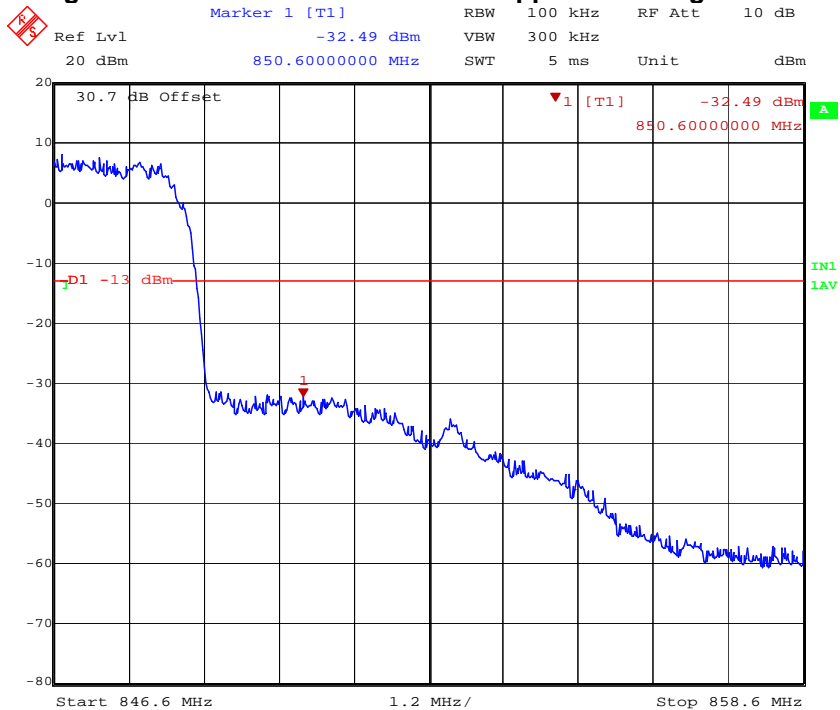
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 19 Cell band HSDPA Mode Lower Band Edge



Title: CG-626
 Comment A: WCDMA HSDPA Ch 4132 Lower Band Edge Wide
 Date: 31.MAY.2007 15:02:09

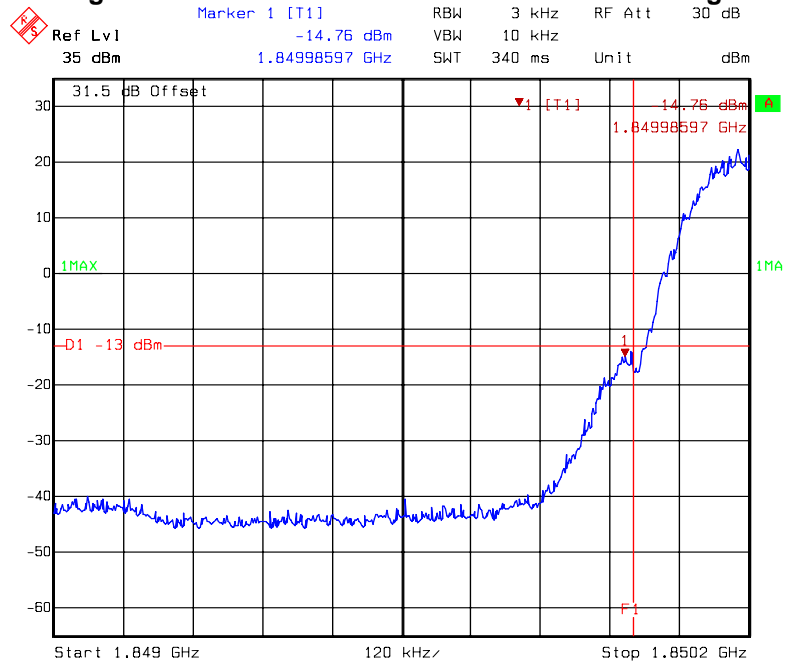
Figure 20 Cell band HSDPA Mode Upper Band Edge



Title: CG-626
 Comment A: WCDMA HSDPA Ch 4233 Upper Band Edge Wide
 Date: 31.MAY.2007 14:58:11

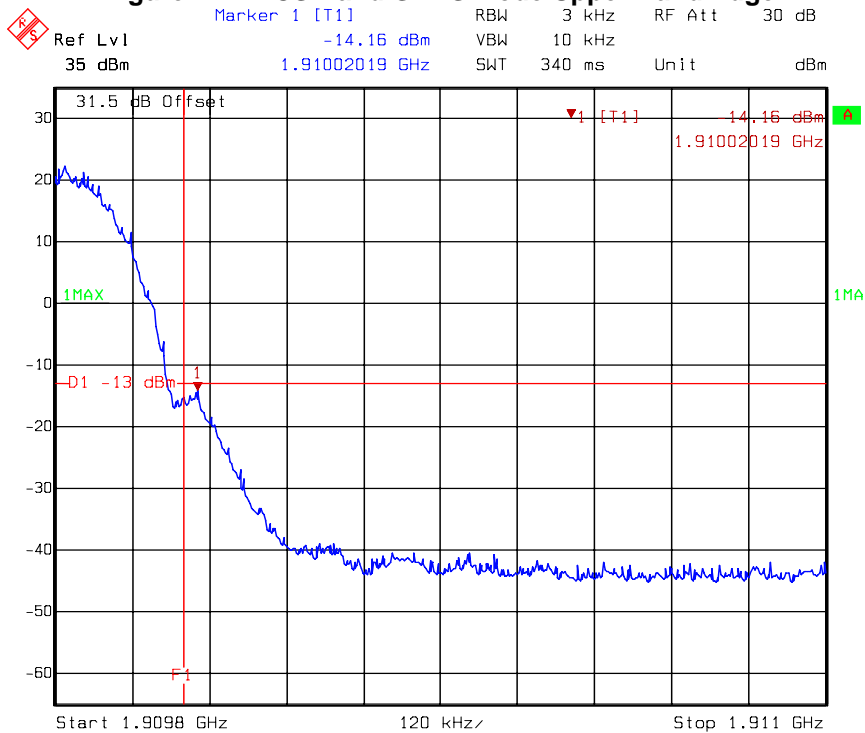
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 21 PCS Band GPRS Mode Lower Band Edge



Title: CG-626 Novatel Wireless
Comment A: GPRS 1900 Band Ch 512 Band Edge Inner
Date: 6.JUN.2007 15:08:01

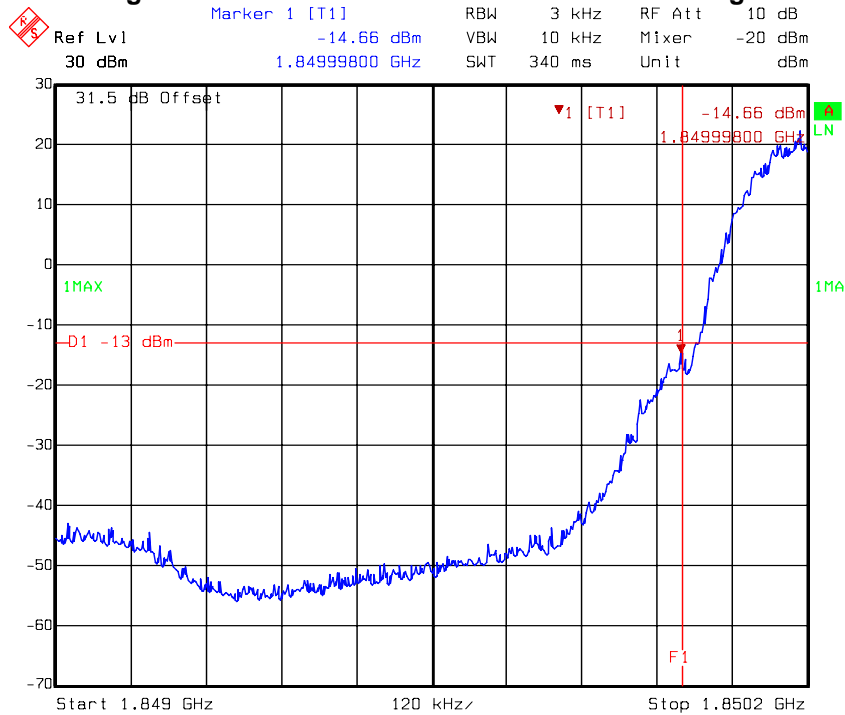
Figure 22 PCS Band GPRS Mode Upper Band Edge



Title: CG-626 Novatel Wireless
Comment A: GPRS 1900 Band Ch 810 Band Edge Inner
Date: 6.JUN.2007 15:05:15

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Figure 23 PCS Band GSM Mode Lower Band Edge



Title: CG-626 Novatel
Comment A: GSM PCS1900 Ch 512 Band Edge Inner
Date: 5.JUN.2007 17:29:02

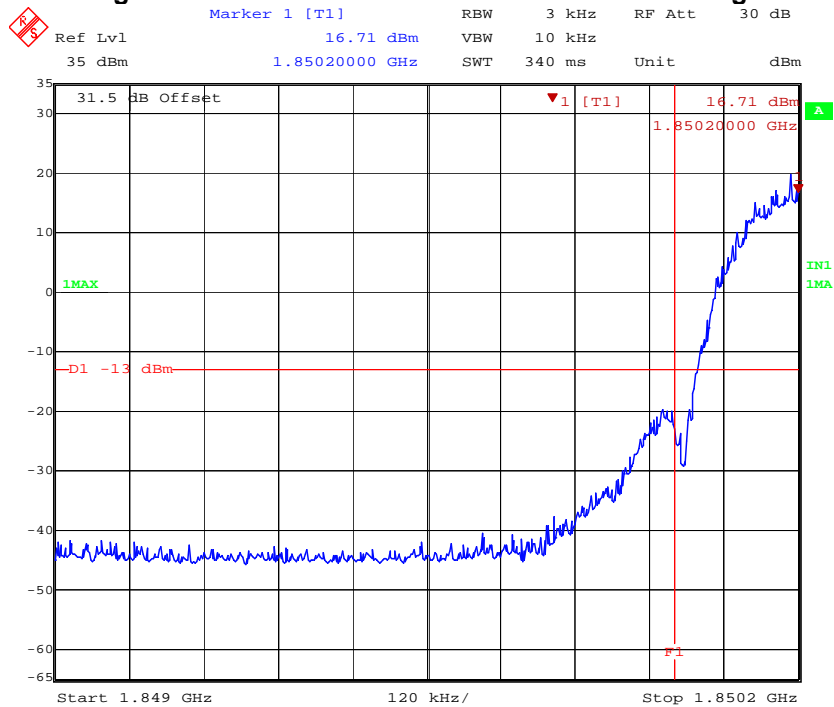
Figure 24 PCS Band GSM Mode Upper Band Edge



Title: CG-626 Novatel
Comment A: GSM PCS1900 Ch 810 Band Edge Inner
Date: 5.JUN.2007 17:07:46

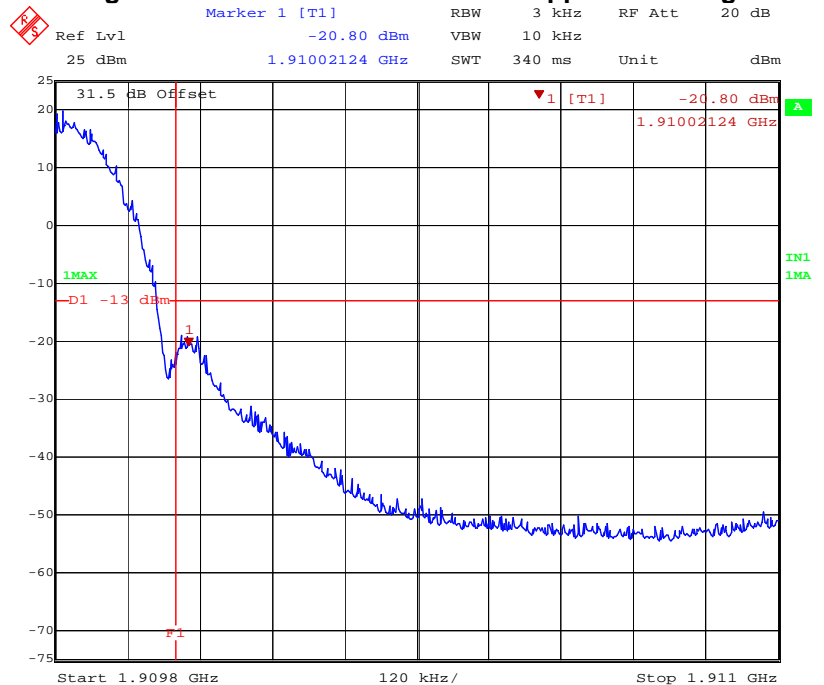
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 25 PCS Band EDGE Mode Lower Band Edge



Title: CG-626 Novatel Wireless
Comment A: EDGE 1900 Ch 512 Band Edge Inner
Date: 26.JUN.2007 10:46:51

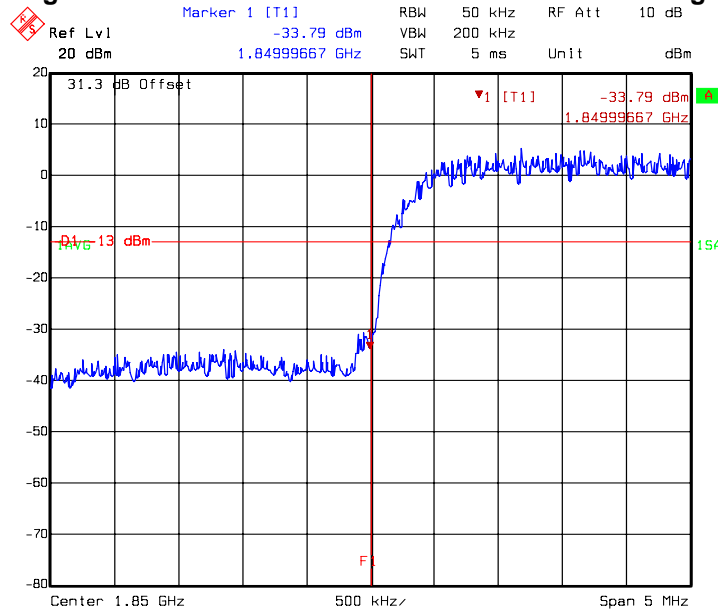
Figure 26 PCS Band EDGE Mode Upper Band Edge



Title: CG-626 Novatel Wireless
Comment A: EDGE 1900 Ch 810 Band Edge Inner
Date: 26.JUN.2007 10:29:56

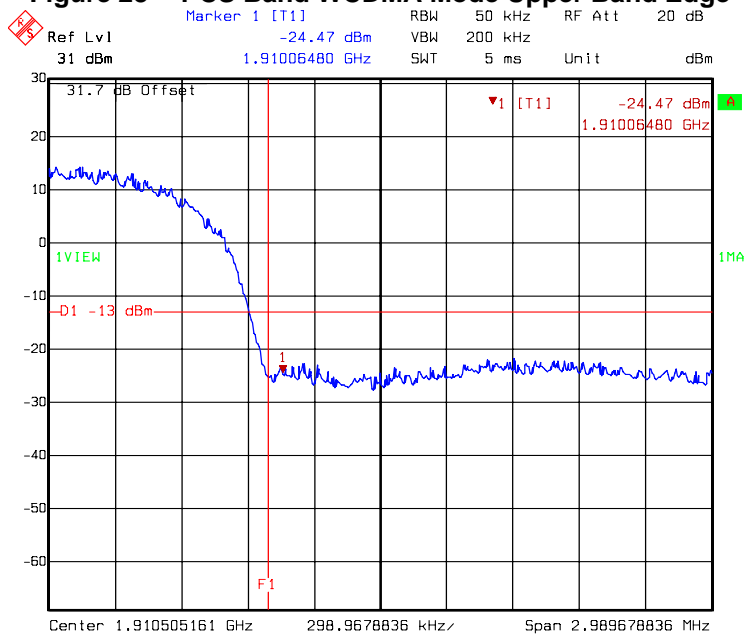
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 27 PCS Band WCDMA Mode Lower Band Edge



Title: CG-626 Novatel
 Comment A: WCDMA II Ch 9262 Lower Band Edge
 Date: 5.JUN.2007 13:27:06

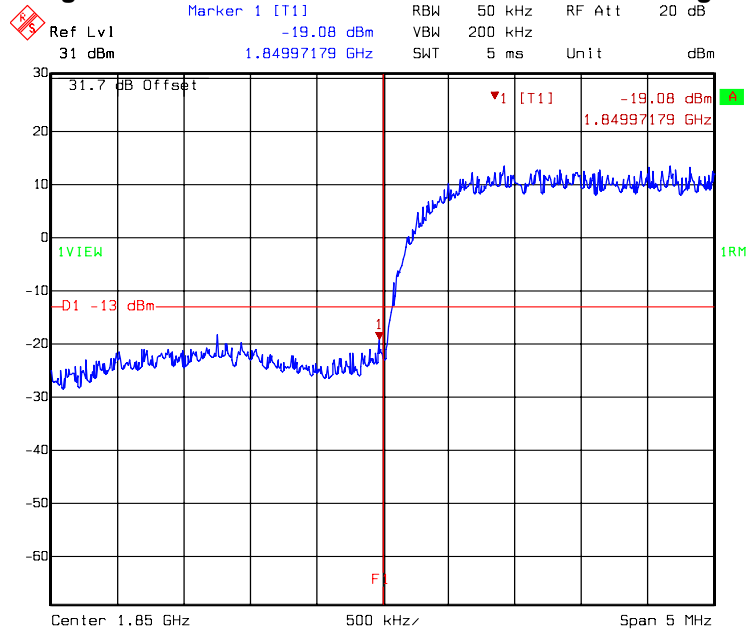
Figure 28 PCS Band WCDMA Mode Upper Band Edge



Comment A: CG-626 Upper bandedge spurious
 channel 9535 WCDMA Mode
 Date: 25.JUL.2007 10:35:38

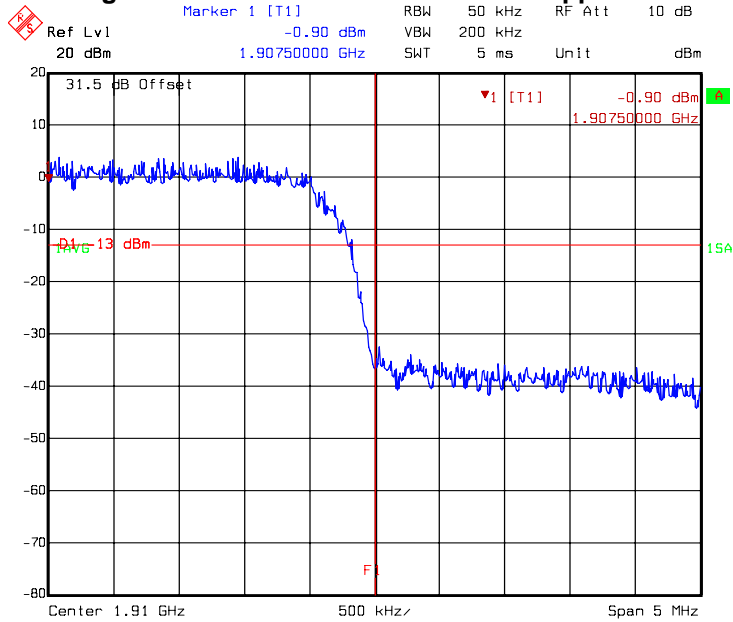
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 29 PCS Band HSDPA Mode Lower Band Edge



Comment A: CG-626 Lower bandedge spurious
channel 9262 HSDPA Mode
Date: 25.JUL.2007 10:48:37

Figure 30 PCS Band HSDPA Mode Upper Band Edge

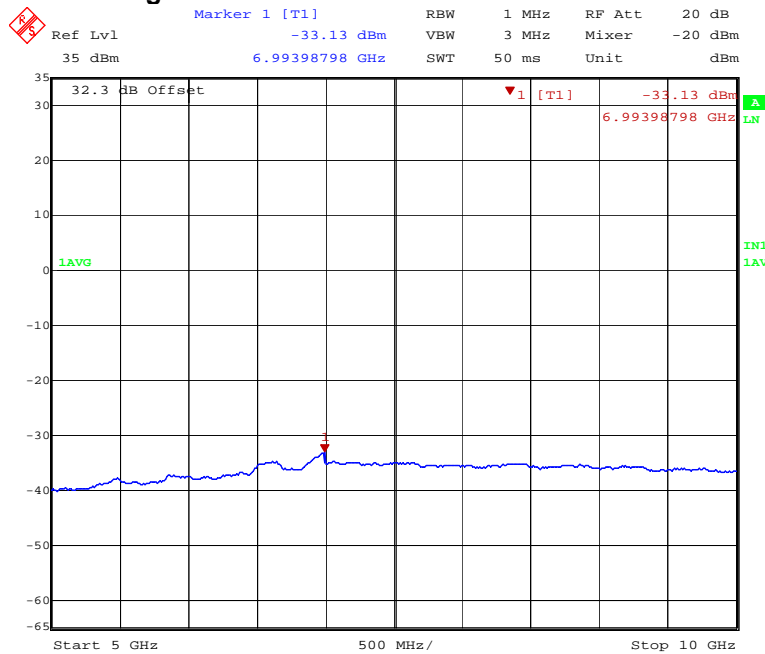


Title: CG-626 Novatel
Comment A: WCDMA II HSDPA Ch 9538 Band Edge Inner
Date: 5.JUN.2007 15:08:16

The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

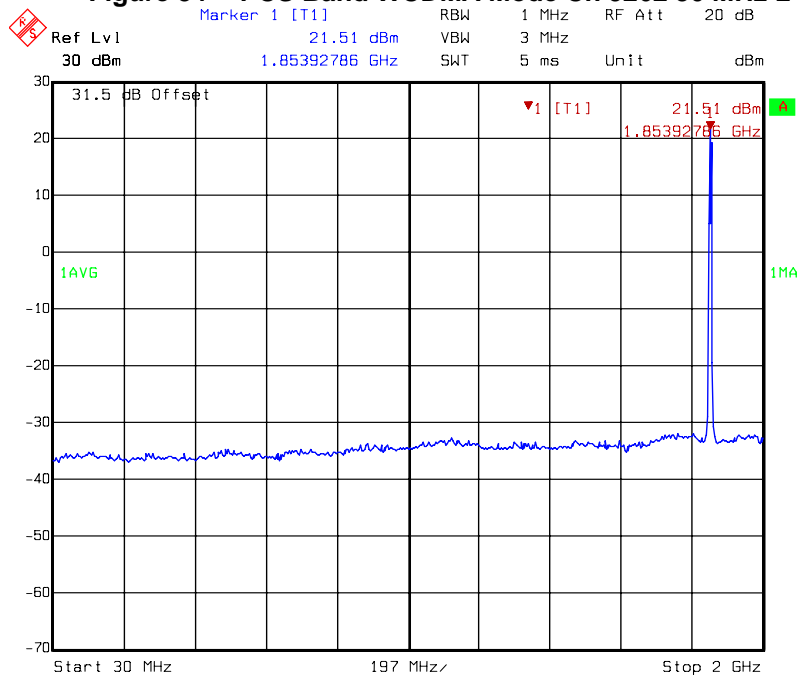
NTS Product Integrity Laboratory, 5151-47th Street N.E. Tel: 403-568-6605, Fax: 403-568-6970

Figure 33 Cell Band GSM Mode Ch 128 5 GHz-10 GHz



Title: CG-626
Comment A: GSM Ch 128 Spurious
Date: 31.MAY.2007 13:01:35

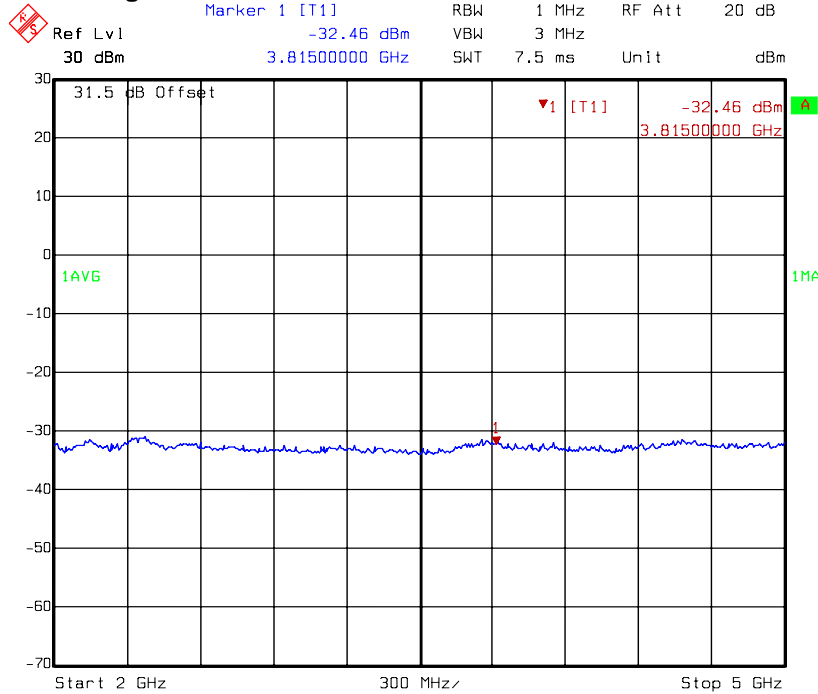
Figure 34 PCS Band WCDMA Mode Ch 9262 30 MHz-2 GHz



Title: CG-626 Novatel
Comment A: WCDMA II Ch 9262 Spurious
Date: 5.JUN.2007 14:06:06

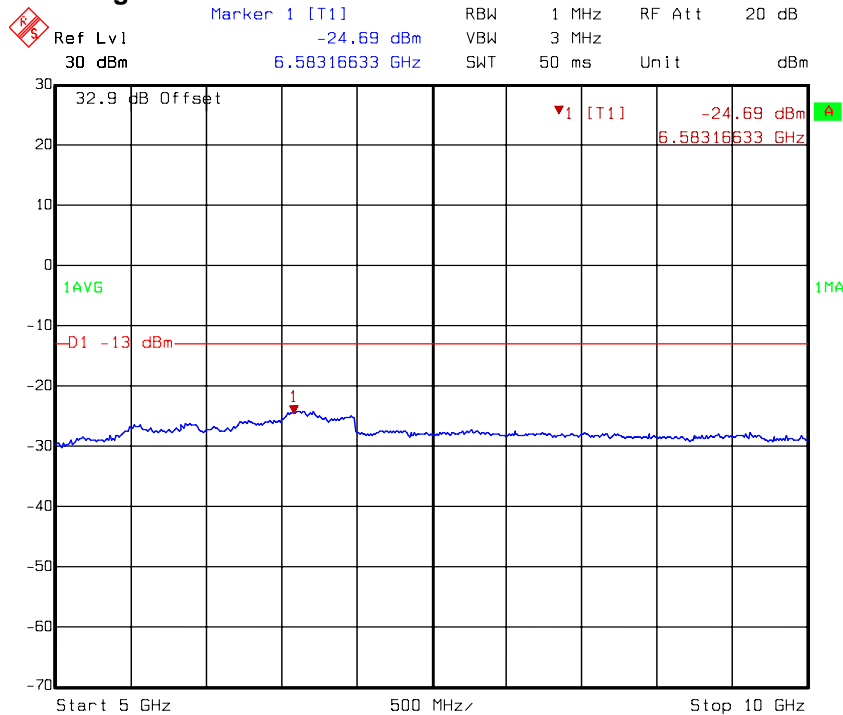
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 35 PCS Band WCDMA Mode Ch 9262 2 GHz-5GHz



Title: CG-626 Novatel
Comment A: WCDMA II Ch 9262 Spurious
Date: 5.JUN.2007 14:13:06

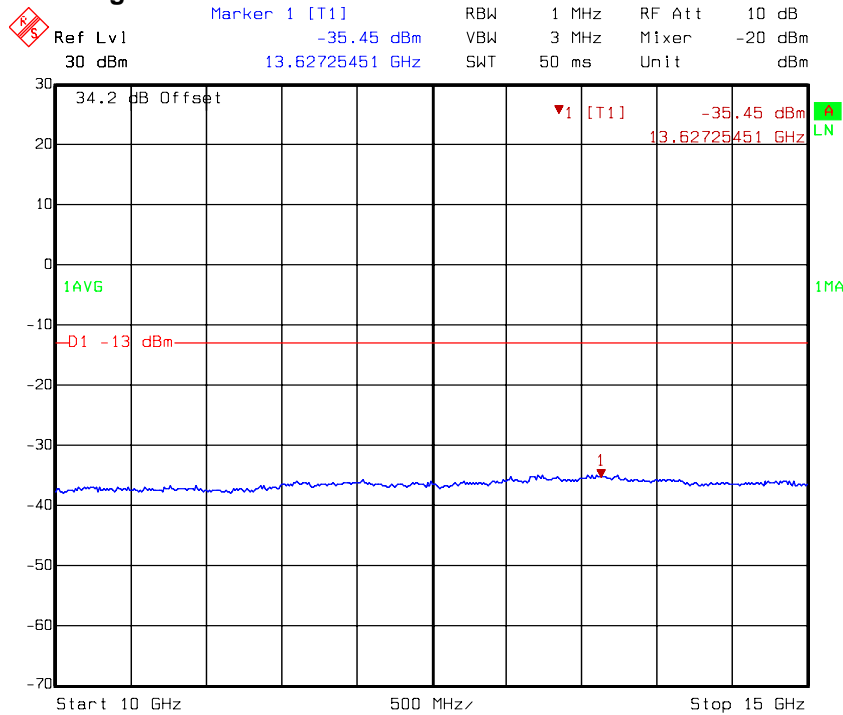
Figure 36 PCS Band WCDMA Mode Ch 9262 5 GHz-10 GHz



Title: CG-626 Novatel
Comment A: WCDMA II Ch 9262 Spurious
Date: 5.JUN.2007 14:15:55

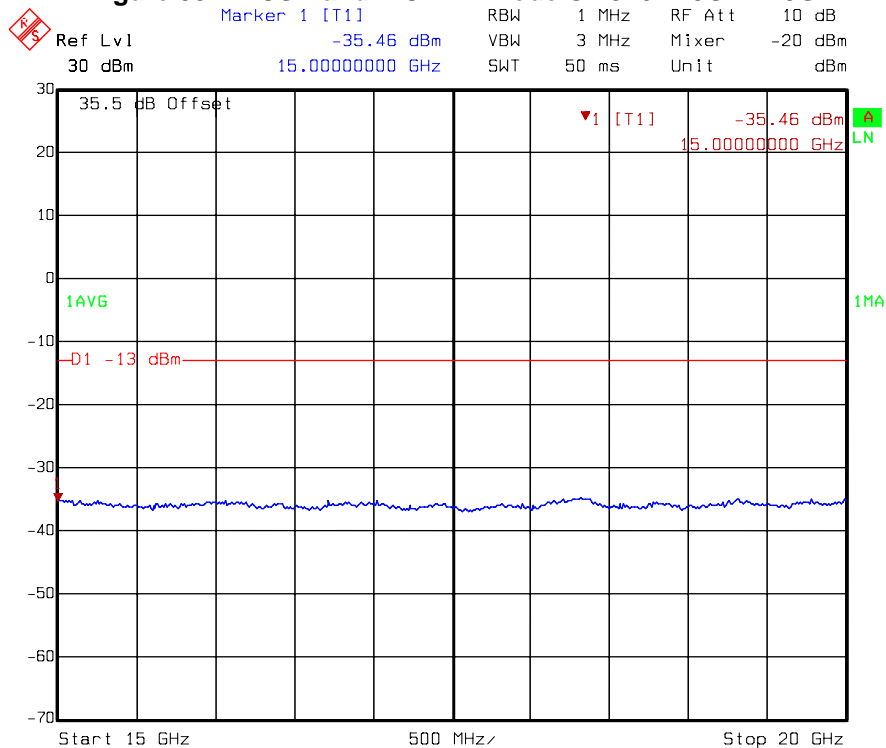
The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

Figure 37 PCS Band WCDMA Mode Ch 9262 10GHz-15 GHz



Title: CG-626 Novatel
Comment A: WCDMA II Ch 9262 Spurious
Date: 5.JUN.2007 14:25:11

Figure 38 PCS Band WCDMA Mode Ch 9262 15GHz-20GHz



Title: CG-626 Novatel
Comment A: WCDMA II Ch 9262 Spurious
Date: 5.JUN.2007 14:26:19

The test results contained in this report refer exclusively to the product(s) presented for testing. The test results do not cover models or products not referred herein. This test report should not be published or duplicated in whole or part without permission from the testing body and the customer.

APPENDIX F: TX RADIATED SPURIOUS EMISSIONS 30 MHZ – 19 GHZ

F.1. Base Standard & Test Basis

Base Standard	Cell Mode: FCC Part 22.917 - PCS Mode: FCC Part 24.238, RSS 129/133
Test Basis	FCC 2.1053
Test Method	TIA/EIA 603 – B 2002

Specifications

TX Spurious emissions

Cell Mode:

a) *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.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 100 kHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

PCS Mode:

24.238 Emission limitations for Broadband PCS equipment.

The rules in this section govern the spectral characteristics of emissions in the Broadband Personal Communications Service.

(a) *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.

(b) *Measurement procedure.* Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth (*i.e.* 1 MHz or 1 percent of emission bandwidth, as specified). The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power

F.2. Measurement Uncertainty

Radiated Emissions	Measurement Uncertainty	Expanded Uncertainty (K=2)
30 MHz – 1 GHz	+2.32/-2.36	+4.65/-4.72
1 – 19 GHz	+3.48/-3.51	+6.96/-7.02

F.3. Deviations

Deviation Number	Time & Date	Description and Justification of Deviation	Deviation Reference			Approval
			Base Standard	Test Basis	NTS Procedure	
none						

F.4. Test Results

No spurious emissions were detected within 20 dB of the limit in any operating mode or band

F.5. Observations

The EUT was operating in RX and TX mode during this test.

F.6. Deviations from Normal Operating Mode During Test

None.

F.7. Sample Calculation

Emission Level = Measured Level + Correction Factors.

Margin = Limit – Emission Level.

F.8. Test Data

Plots were not provided in order to reduce file size.

F.9. Tested By

This testing was conducted in accordance with the ISO 17025:1999 scope of accreditation, table 1; Quality Manual.

Name:	Glen Moore	Deniz Demerci
Function:	EMC Manager	EMC Tester

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APPENDIX G: EMISSION TEST EQUIPMENTS LIST

G.1. Radiated Emissions 30 MHz – 1 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Bilog Antenna	<input type="checkbox"/> Chase	CBL 6111B	CG0408	24AUG07	24AUG06
	<input checked="" type="checkbox"/> Chase	CBL 6112B	CG0314		
RF Cable	Suhner Sucoflex	Ferrite bead loaded cable	CG0398	13APR08	13APR06
CONTROL ROOM					
Test Receiver	Rohde & Schwarz	ESMI	CG0433/ CG0434	27FEB08	27FEB07
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Multi Device Controller TT1 (Turntable)	EMCO	2090	CG0178	N/A	N/A
RF 10m East site Link				13APR08	13APR06
- Cable 1	Suhner Sucoflex	NA	CG0690		
- Cable 2	Suhner Sucoflex	NA	CG0634		
- Cable 3	Suhner Sucoflex	NA	CG0660		
- Cable 4	Suhner Sucoflex	NA	CG0661		
- Switch Matrix Controller	TDL	SMC-002	CG0175		
- Amplifier	Hewlett Packard	8447F	CG0177		

G.2. Radiated Emissions 1 GHz – 40 GHz Measurement Equipment

Description	Manufacturer	Type/Model	Asset #	Cal Due	Cal Date
10m ANECHOIC CHAMBER					
Horn Antenna (Rx) 1 GHz – 18 GHz	<input checked="" type="checkbox"/> EMCO	3115	CG0103	30AUG07	30AUG06
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	<input type="checkbox"/> EMCO	3160-09	CG0075	N/A	27NOV01
Standard Gain Horn (Rx) 26.5 GHz – 40 GHz	<input type="checkbox"/> EMCO	3160-10	CG0076	N/A	27NOV01
High pass filter f>1000 MHz	<input checked="" type="checkbox"/> MicroTronics	HPM14576	CG0963	10AUG07	10AUG06
Band Reject Filter 2400MHz<f<2500MHz	<input type="checkbox"/> MicroTronics	BRM50702	CG0933	02MAR09	02MAR06
Band Reject Filter 5725MHz<f<5875 MHz	<input type="checkbox"/> MicroTronics	BRC50705	CG0904	02MAR09	02MAR06
High pass filter f>2800 MHz	<input type="checkbox"/> MicroTronics	HPM50111	CG0964	08JAN09	08JAN06
High pass filter f>6400 MHz	<input type="checkbox"/> MicroTronics	HPM50112	CG0965	09JAN09	09JAN06
LNA 1 GHz<f<18 GHz	<input checked="" type="checkbox"/> Miteq	JSD00121	CG0317	10AUG07	10AUG06

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LNA 18GHz<f<26.5GHz	<input type="checkbox"/> Miteq	JSD00119	CG0482	19JAN08	19JAN07
LNA 26.5GHz<f<40GHz	<input type="checkbox"/> Miteq	JSD00120	CG0483	19JAN08	19JAN07
Cable from Antenna to LNA	Sucoflex 104	2422774A	CG0686	10AUG07	10AUG06
Cable from LNA to SA	Sucoflex 100	115757-4	CG0686	10AUG07	10AUG06
Spectrum Analyzer 9 kHz – 40 GHz	Rohde & Schwarz	FSEK-20	CG0118	15JUN07	09MAY06
LNA DC Power Supply	Xantrex	LXO 30-2	CG0493	NA	NA
Spectrum Analyzer	Rohde & Schwarz	ESI-40	CG0109	13SEP07	13SEP06
Power Meter	Agilent	E4418B	CG0119	21MAY08	21MAY07
Attenuator	Weisnschel	66-30-34	CG0752	Verify before use	
HPIB Extender	HP	37204	CG0110	N/A	N/A
CONTROL ROOM					
PC with FSEK Manual ctrl S/W	N/A	N/A	N/A	N/A	N/A
HPIB Extender	HP	37204	CG0181	N/A	N/A
Mast Controller	EMCO	2090	CG0179	N/A	N/A
Multi Device Controller TT1	EMCO	2090	CG0178	N/A	N/A

VERIFICATION EQUIPMENT					
Horn Antenna (Tx)	<input checked="" type="checkbox"/> EMCO	3115	CG0099	N/A	N/A
Standard Gain Horn (Rx) 18 GHz – 26.5 GHz	<input checked="" type="checkbox"/> EMCO	3160-09	CG0075	N/A	27NOV01
Standard Gain Horn (Rx) 26.5 GHz – 40 GHz	<input checked="" type="checkbox"/> EMCO	3160-10	CG0077	N/A	27NOV01
Signal Generator	<input type="checkbox"/> Rohde & Schwarz	SMP-04	CG0435	N/A	N/A
	<input type="checkbox"/> Rohde & Schwarz	SMIQ	CG0117	N/A	N/A
	<input checked="" type="checkbox"/> Wiltron	68369B	CG0043	N/A	N/A
Cable TX antenna to Signal Generator	Sucoflex	115745-4	CG0635	19JAN08	19JAN07

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END OF DOCUMENT

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