

TEST REPORT

Report Number: 3108903LEX001

Project Number: 3108903

Evaluation of the Cellular Amplifier

Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

FCC Part 22 Subpart H

FCC Part 24 Subpart E

For

HomeCell, LLC

Test Performed by:

Intertek
731 Enterprise Drive
Lexington, KY 40510

Test Authorized by:

HomeCell, LLC
1699 Poe Circle
Hickory, NC 28601

Prepared By: Jason Centers Date: 1/15/2007
Jason Centers, Senior Project Engineer

Approved By: Bryan C. Taylor Date: 1/15/2007
Bryan C. Taylor, EMC Team Leader

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TABLE OF CONTENTS

1	JOB DESCRIPTION	3
1.1	COMPANY INFORMATION	3
1.2	TEST SAMPLE INFORMATION	3
1.3	SYSTEM SUPPORT EQUIPMENT	4
1.4	CABLES USED DURING TESTING	4
1.5	SYSTEM BLOCK DIAGRAM(S)	5
1.6	MODE(S) OF OPERATION / ENGINEERING JUDGMENTS	6
2	EXECUTIVE SUMMARY.....	7
2.1	MODIFICATIONS REQUIRED FOR COMPLIANCE	7
3	TEST FACILITY.....	8
3.1	TEST EQUIPMENT.....	8
4	CONDUCTED RF POWER	9
4.1	TEST PROCEDURE	9
4.2	TEST RESULTS	9
5	RADIATED RF POWER.....	12
5.1	TEST PROCEDURE	12
5.2	TEST RESULTS	12
6	MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS	15
6.1	CALCULATIONS.....	15
6.2	TEST RESULTS	15
7	EMISSION LIMITATIONS, OCCUPIED BANDWIDTH, INPUT/OUTPUT BANDWIDTH COMPARISON.....	16
7.1	TEST PROCEDURE	16
7.2	TEST RESULTS	16
8	OUT OF BAND EMISSION AT ANTENNA TERMINALS & INTERMODULATION ATTENUATION.....	31
8.1	TEST PROCEDURE	31
8.2	TEST RESULTS	32
9	FIELD STRENGTH OF SPURIOUS RADIATION	66
9.1	TEST PROCEDURE	66
9.2	TEST RESULTS	66

Evaluation For: HomeCell, LLC
Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

1 JOB DESCRIPTION

1.1 Company Information

Company Information	
Manufacturer:	HomeCell, LLC
Address:	1699 Poe Circle Hickory, NC 28601
Contact Name:	John Chamberlain
Telephone Number:	828-256-6191
Email Address:	johncchamberlain@aol.com

1.2 Test Sample Information

The Cellular Amplifier is a bi-directional amplifier for the 824-849 MHz, 869-894 MHz, 1850-1910 MHz, and 1930-1990 MHz mobile bands.

Test sample				
Model Number:	HomeCell 2.0			
Serial Number:	Not Labeled			
FCC ID:	U3FHOMECCELL20			
Device Category:	Mobile			
RF Exposure Category:	General Population/Uncontrolled Environment			
Transmission Modes:	Cell Band Downlink	Cell Band Uplink	PCS Band Downlink	PCS Band Uplink
Frequency Range (MHz)	869-894	824-849	1930-1990	1850-1910
Maximum Conducted RF Output Power:	14.1 dBm	30.3 dBm	11.8 dBm	12.2 dBm
Antenna Type:	Omni-Directional	Omni-Directional	Omni-Directional	Omni-Directional
Antenna Location:	Externally Mounted	Externally Mounted	Externally Mounted	Externally Mounted
Antenna Gain:	4 dBi	0 dBi	9 dBi	3 dBi
Power Supply	Manufacturer	Model Number	Serial Number	
	Zhong Ya Jia Hua	TSP2A110AC50	Not Labeled	

1.3 System Support Equipment

No support equipment was necessary for the evaluation.

1.4 Cables Used During Testing

Table 1-1 contains the details of the cables used during the testing.

Table 1-1: Interconnecting Cables Used During Testing

Cables					
Description	Length	Shielding	Ferrites	Connection	
				From	To
AC Power Cable	5 ft	None	None	AC Power Source	AC Input of AC/DC Converter
Uplink Antenna Cable	30 ft	Yes	None	Outside Antenna	Outside Antenna Port

1.5 System Block Diagram(s)

The diagrams below detail the interconnection of the EUT and its accessories during the testing.

Figure 1-1: Radiated Test Configuration¹

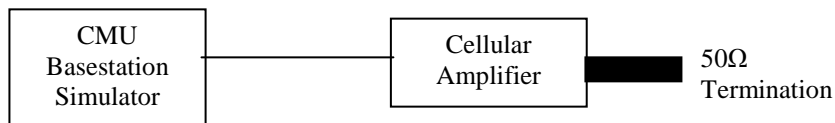
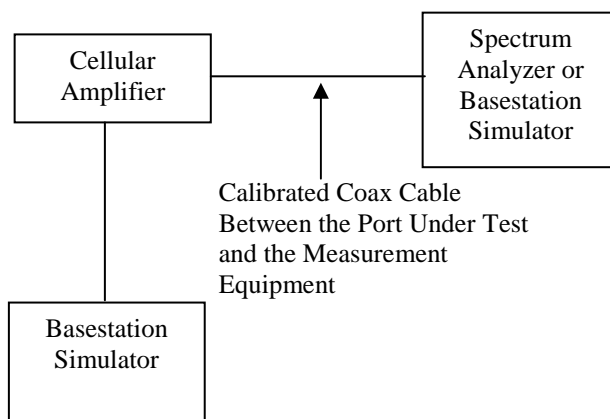


Figure 1-2: Conducted Test Configuration²



¹ For tests on the uplink channels, the basestation simulator was connected to the inside antenna port and the outside antenna port was terminated with a resistive load. For tests on the downlink channels, the basestation simulator was connected to the outside antenna port and the inside antenna port was terminated with a resistive load.

² For tests on the uplink channels, the basestation simulator was connected to the inside antenna port and the outside antenna port was connected to a spectrum analyzer. For tests on the downlink channels, the basestation simulator was connected to the outside antenna port and the inside antenna port was to a spectrum analyzer.

1.6 Mode(s) of operation / Engineering Judgments

The Cellular Amplifier was powered by the AC to DC power supply provided with the sample. The Cellular Amplifier is a bi-directional amplifier for the 824-849 MHz, 869-894 MHz, 1850-1910 MHz, and 1930-1990 MHz mobile bands. Tests were performed for each of following modulations: AMPS, CDMA, TDMA & GSM. A basestation simulator was used to provide the maximum input to the port being tested with the correct modulation. The input used was the maximum level declared by the manufacture. Tests were performed in both the uplink and downlink bands.

Evaluation For: HomeCell, LLC
Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

2 EXECUTIVE SUMMARY

Testing performed for: HomeCell, LLC

Equipment Under Test: HomeCell 2.0

Receipt of Test Sample: 11/1/2006

Test Start Date: 11/1/2006

Test End Date: 1/12/2007

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
§2.1046	RF Power Output	Compliant	9
§22.913, §24.232	ERP, EIRP	Compliant	12
§ 1.1310	Maximum Permissible Exposure (MPE) Calculations	Compliant	15
§2.1049 §22.917(b)(d)	Emission Limitation, Occupied Bandwidth – Input/Output Bandwidth Comparison	Compliant	16
§2.1051 §22.917(e) §22.917(f) §24.238(a)	Out of Band Emissions at Antenna Terminals	Compliant	32
§2.1053	Field Strength of Spurious Radiation	Compliant	66

2.1 Modifications required for compliance

No modifications were implemented by Intertek. All results in this report pertain to the un-modified sample provided to Intertek.

3 TEST FACILITY

All testing was completed at the INTERTEK-Lexington location at 731 Enterprise Drive, Lexington Kentucky, 40510. The radiated emission test site is a 10-meter semi-anechoic chamber. The chamber meets the characteristics of CISPR 16-1: 1993 and ANSI C63.4: 1992. For measurements, a remotely controlled flush-mount metal-top turntable is used to rotate the EUT a full 360 degrees. A remote controlled non-conductive antenna mast is used to scan the antenna height from one to four meters.

For radiated immunity testing, removable ferrite tiles are positioned between the transmitting antenna and the area occupied by the equipment under test. The remaining tests typically are performed outside the chamber on the conducting ground reference plane.



The Industry Canada filing number for this site is 2055. The FCC registration number is 485103. The VCCI registration numbers are R-2056, C-2214, and T-195.

3.1 Test Equipment

Description	Manufacturer	Model Number	Serial Number	Calibration due date
Signal Generator	HP	83620B	3614A00199	8/15/2007
Horn Antenna	EMCO	3115	6556	7/28/2007
Horn Antenna	Antenna Research	DRG-118/A	1086	7/16/2007
Dipole Antenna	CDI	Roberts	1	2/16/2007
EMI Receiver	Rohde & Schwarz	ESI 26	1088.7490	9/6/2007
EMI Receiver	Agilent	E7405A	2142	3/26/2007
Bilog Antenna	EMCO	3142C	00051864	11/14/2007
Preamplifier	Miteq	AFS44-00102000-30-10P-44	987410	6/15/2007
Base Station Simulator	Rohde & Schwarz	CMU200	1100.0008.02	8/31/2007
Signal Generator	Agilent	8648B	4037A03337	8/15/2007
Spectrum Analyzer	Rohde & Schwarz	FSP	1164.4391.07	8/2/2007

4 CONDUCTED RF POWER

FCC Rule: §2.1046

4.1 Test Procedure

The transmitter output was connected to a calibrated coaxial cable, the other end of which was connected to a Base Station Simulator. The Base Station Simulator was adjusted to the maximum input power declared by the manufacture for the type of modulation provided. The basestation was used to provide a modulated signal to the amplifier. The output of the amplifier was measured by the basestation in dBm. The power output at the transmitter antenna port was determined by adding the value of the cable insertion loss to the base station simulator power reading.

Tests were performed at three frequencies (low, middle, and high channels) for each type of modulation. Measurements were performed in the uplink and downlink bands.

4.2 Test Results

The Cellular Amplifier met the RF power output requirements of FCC Part 22 Subpart H and FCC Part FCC Part 24 Subpart E. The test results for the uplink bands are located in Table 4-1. The test results for the downlink bands are located in Table 4-2

Table 4-1 RF Power - Uplink

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
CDMA Cell	1013	824.7	-43.4	18	61.4
	384	836.52	-40	21.9	61.9
	777	848.31	-38.4	21.1	59.5

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
CDMA PCS	25	1851.25	-37	3.1	40.1
	600	1880	-30	12.2	42.2
	1175	1908.75	-24	12.1	36.1

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
GSM 850	128	824.2	-29	27.9	56.9
	190	836.6	-25	30.1	55.1
	251	848.8	-20	30.3	50.3

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
GSM 1900	512	1850.2	-37	2.2	39.2
	661	1880	-30	11.5	41.5
	810	1909.8	-24	10.2	34.2

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
TDMA Cell	991	824.04	-32.7	27.6	60.3
	384	836.52	-35	26.6	61.6
	799	848.97	-38.4	20.2	58.6

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
TDMA PCS	2	1850.04	-37	0.2	37.2
	999	1879.95	-30	10.6	40.6
	1998	1909.92	-24	9.2	33.2

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
AMPS	991	824.04	-48.3	13.1	61.4
	384	836.52	-48.3	13.1	61.4
	799	848.97	-48.3	9.3	57.6

Evaluation For: HomeCell, LLC
Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

Table 4-2 RF Power - Downlink

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
CDMA Cell	1013	869.7	-40	2.6	42.6
	384	881.52	-40	6	46
	777	893.31	-42.4	0.4	42.8
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
CDMA PCS	25	1931.25	-18.7	11.4	30.1
	600	1960	-56	-2.1	53.9
	1175	1988.75	-45	9.8	54.8
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
GSM 850	128	869.2	-27	11.9	38.9
	190	881.6	-25	14.1	39.1
	251	893.8	-20	13.6	33.6
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
GSM 1900	512	1930.2	-14.3	11.8	26.1
	661	1960	-41.5	10.7	52.2
	810	1989.8	-46.5	10.8	57.3
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
TDMA Cell	991	869.04	-27.7	13	40.7
	384	881.52	-30	13.8	43.8
	799	893.97	-30	12.1	42.1
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
TDMA PCS	2	1930.04	-14.7	10.7	25.4
	999	1959.95	-43.7	9.1	52.8
	1998	1989.92	-49.2	9.1	58.3
Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Output (dBm)	Gain (dB)
AMPS	991	869.04	-48.3	-5	43.3
	384	881.52	-48.3	-1.6	46.7
	799	893.97	-48.3	-6.7	41.6

5 RADIATED RF POWER

FCC Rule §22.913: The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

FCC Rule §24.232: The Equivalent Isotropic Radiated Power (EIRP) must not exceed 2 Watts.

5.1 Test Procedure

The maximum radiated output power was calculated using the conducted output measured in the previous section of this report as follows:

$$\text{ERP} = \text{Output Power (dBm)} + \text{Gain(dBd)} - \text{Cable Loss (dB)}$$

$$\text{EIRP} = \text{Output Power (dBm)} + \text{Gain(dBi)} - \text{Cable Loss (dB)}$$

where,

Gain = Manufactures maximum declared antenna gain

Cable Loss = Measured loss of RF cable connecting to outside antenna

5.2 Test Results

The Cellular Amplifier met the radiated power requirements of FCC §24.232. The test results for the uplink bands are located in Table 5-1. The test results for the downlink bands are located in Table 5-2. The maximum ERP for the Cell band was 28.86 dBm. The maximum EIRP for the PCS band was 16.5 dBm.

Evaluation For: HomeCell, LLC
Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

Table 5-1 Radiated RF Power – Uplink

Modulation	Channel	Frequency (MHz)	Conducted Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
CDMA Cell	1013	824.7	18	1.86	3.3	16.56	0.0453
	384	836.52	21.9	1.86	3.3	20.46	0.1112
	777	848.31	21.1	1.86	3.3	19.66	0.0925

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
CDMA PCS	25	1851.25	3.1	9	4.7	7.4	0.0055
	600	1880	12.2	9	4.7	16.5	0.0447
	1175	1908.75	12.1	9	4.7	16.4	0.0437

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
GSM 850	128	824.2	27.9	1.86	3.3	26.46	0.4426
	190	836.6	30.1	1.86	3.3	28.66	0.7345
	251	848.8	30.3	1.86	3.3	28.86	0.7691

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
GSM 1900	512	1850.2	2.2	9	4.7	6.5	0.0045
	661	1880	11.5	9	4.7	15.8	0.0380
	810	1909.8	10.2	9	4.7	14.5	0.0282

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
TDMA Cell	991	824.04	27.6	1.86	3.3	26.16	0.4130
	384	836.52	26.6	1.86	3.3	25.16	0.3281
	799	848.97	20.2	1.86	3.3	18.76	0.0752

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
TDMA PCS	2	1850.04	0.2	9	4.7	4.5	0.0028
	999	1879.95	10.6	9	4.7	14.9	0.0309
	1998	1909.92	9.2	9	4.7	13.5	0.0224

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Cable Loss (dB)	Radiated Power (dBm)	Radiated Power (W)
AMPS	991	824.04	13.1	9	3.3	18.8	0.0759
	384	836.52	13.1	9	3.3	18.8	0.0759
	799	848.97	9.3	9	3.3	15	0.0316

Table 5-2 Radiated RF Power – Downlink

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Radiated Power (dBm)	Radiated Power (W)
CDMA Cell	1013	869.7	2.6	-2.14	0.46	0.0011
	384	881.52	6	-2.14	3.86	0.0024
	777	893.31	0.4	-2.14	-1.74	0.0007

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Radiated Power (dBm)	Radiated Power (W)
CDMA PCS	25	1931.25	11.4	3	14.4	0.0275
	600	1960	-2.1	3	0.9	0.0012
	1175	1988.75	9.8	3	12.8	0.0191

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Radiated Power (dBm)	Radiated Power (W)
GSM 850	128	869.2	11.9	-2.14	9.76	0.0095
	190	881.6	14.1	-2.14	11.96	0.0157
	251	893.8	13.6	-2.14	11.46	0.0140

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Radiated Power (dBm)	Radiated Power (W)
GSM 1900	512	1930.2	11.8	3	14.8	0.0302
	661	1960	10.7	3	13.7	0.0234
	810	1989.8	10.8	3	13.8	0.0240

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Radiated Power (dBm)	Radiated Power (W)
TDMA Cell	991	869.04	13	-2.14	10.86	0.0122
	384	881.52	13.8	-2.14	11.66	0.0147
	799	893.97	12.1	-2.14	9.96	0.0099

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBi)	Radiated Power (dBm)	Radiated Power (W)
TDMA PCS	2	1930.04	10.7	3	13.7	0.0234
	999	1959.95	9.1	3	12.1	0.0162
	1998	1989.92	9.1	3	12.1	0.0162

Modulation	Channel	Frequency (MHz)	Output (dBm)	Antenna Gain (dBd)	Radiated Power (dBm)	Radiated Power (W)
AMPS	991	869.04	-5	-2.14	-7.14	0.0002
	384	881.52	-1.6	-2.14	-3.74	0.0004
	799	893.97	-6.7	-2.14	-8.84	0.0001

6 MAXIMUM PERMISSIBLE EXPOSURE (MPE) CALCULATIONS

The § 1.1310 Radiofrequency radiation exposure limits are listed in the table below.

	Frequency Range (MHz)	Power Density Limit (mW/cm ²)
Limits for Occupational/Controlled Exposures	0.3-3.0	100
	3.0-30	900/ Frequency ²
	30-300	1.0
	300-1500	Frequency/300
	1500-100,000	5.0
Limits for General Population/Uncontrolled Exposure	0.3-1.34	100
	1.34-30	180/Frequency ²
	30-300	0.2
	300-1500	Frequency/1500
	1500-100,000	1.0

6.1 Calculations

The radiated RF power (calculated using the stated antenna gain and the measured conducted output power) was used to calculate the maximum RF exposure at a 20 cm distance using the formula:

$$\text{Maximum RF Exposure at 20cm} = (\text{EIRP in mW}) / (4\pi(20\text{cm})^2)$$

Cell Band:

The maximum measured radiated power for the cell band was 28.86 dBm.

In order to convert to EIRP a 2.15dB factor is added to the ERP to get 31.01 dBm or 1260 mW (Isotropic).

Substituting this into the equation above, we get a Maximum RF Exposure (MPE) at 20cm of:

$$\text{MPE at 20cm} = 1260 \text{ mW} / (4\pi(20\text{cm})^2)$$

$$\text{MPE at 20cm} = 0.25 \text{ mW/cm}^2$$

PCS Band:

The maximum measured radiated power for the PCS band was 16.5 dBm or 44.7 mW. For the PCS band, there is no need to apply the 2.15dB factor to convert to EIRP since the measured radiated power is already in reference to an isotropic radiator.

Substituting 44.7mW into the equation above, we get a Maximum RF Exposure (MPE) at 20cm of:

$$\text{MPE at 20cm} = 44.7\text{mW} / (4\pi(20\text{cm})^2)$$

$$\text{MPE at 20cm} = 0.0089\text{mW/cm}^2$$

6.2 Test Results

The worst case MPE at 20cm of 0.25mW/cm² is much less than the 0.565 mW/cm² limit for general population/uncontrolled exposure shown in the table above for the cell band. For the PCS band, the worst case MPE at 20cm of 0.0089mW/cm² is much less than the 1.0 mW/cm² limit.

7 EMISSION LIMITATIONS, OCCUPIED BANDWIDTH, INPUT/OUTPUT BANDWIDTH COMPARISON

CFR 47 §2.1049: The occupied bandwidth 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.

7.1 Test Procedure

The antenna port of the EUT was connected to a spectrum analyzer using a calibrated coaxial cable and attenuator. A base station simulator was used to provide the maximum modulated input to the amplifier. The occupied bandwidth function of the analyzer was used to measure the occupied bandwidth of the input and the output of the amplifier. The measurement was repeated for the center channel for each type of modulation in the uplink and downlink bands.

7.2 Test Results

The following is the occupied bandwidth data for the Cellular Amplifier is show in Table 7-1 for the uplink band. The occupied bandwidth data for the downlink band is shown in Table 7-2. Plots of the input and output bandwidth are shown in Figure 7-1 through Figure 7-14 for comparison.

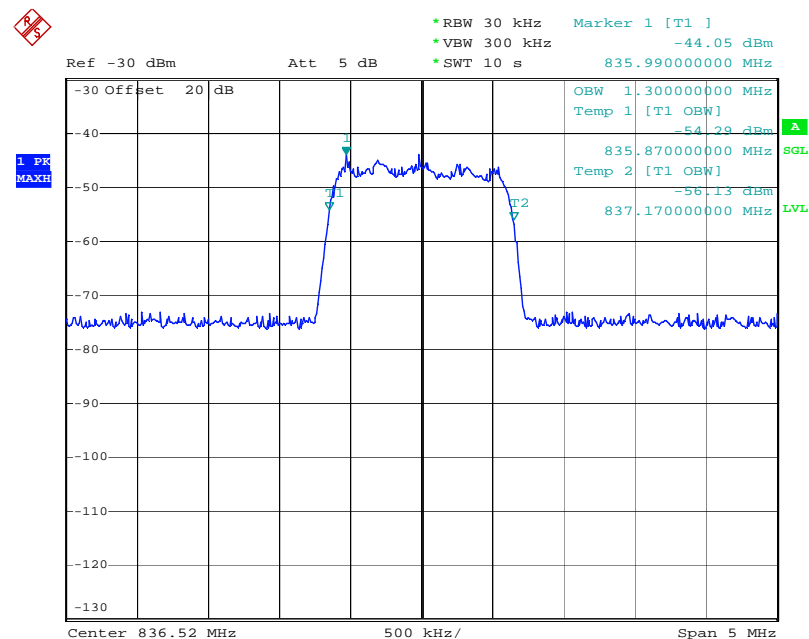
Table 7-1: Occupied bandwidth measurements – Uplink

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Input Bandwidth	Output Bandwidth
CDMA Cell	384	836.52	-40	1.3	1.29
CDMA PCS	600	1880	-30	1.27	1.28
GSM 850	190	836.6	-25	0.244	0.244
GSM 1900	661	1880	-30	0.246	0.244
TDMA Cell	384	836.52	-35	0.0288	0.0284
TDMA PCS	999	1879.95	-30	0.0288	0.028
AMPS	384	836.52	-48.3	0.069	0.068

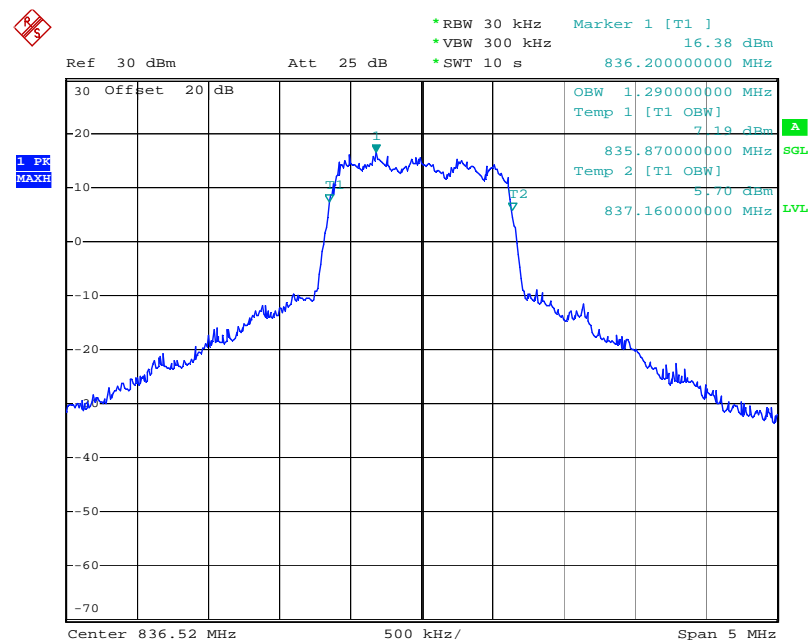
Table 7-2: Occupied bandwidth measurements – Downlink

Modulation	Channel	Frequency (MHz)	Max Input (dBm)	Input Bandwidth	Output Bandwidth
CDMA Cell	384	881.52	-40	1.31	1.28
CDMA PCS	600	1960	-56	1.28	1.29
GSM 850	190	881.6	-25	0.244	0.244
GSM 1900	661	1960	-41.5	0.25	0.244
TDMA Cell	384	881.52	-30	0.0288	0.0324
TDMA PCS	999	1959.95	-43.7	0.028	0.0496
AMPS	384	881.52	-48.3	0.069	0.07

Figure 7-1: Input/Output Bandwidth Comparison – CDMA Cell Channel 384, Uplink

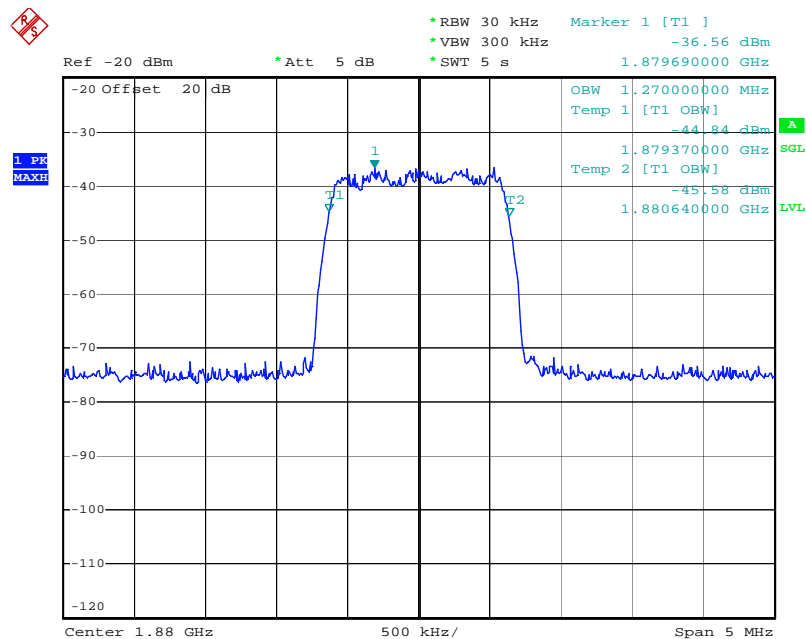


Date: 11.JAN.2007 12:03:50

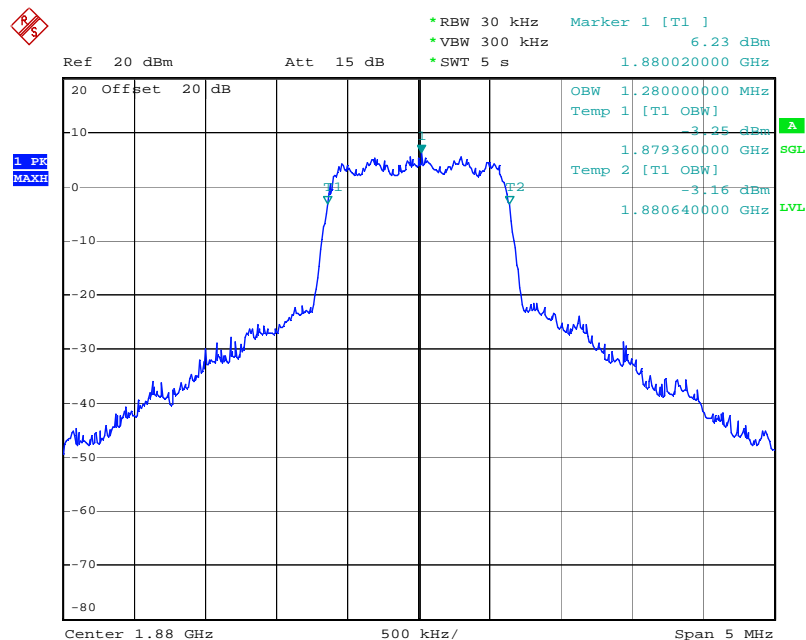


Date: 11.JAN.2007 12:09:08

Figure 7-2: Input/Output Bandwidth Comparison – CDMA PCS Channel 600, Uplink

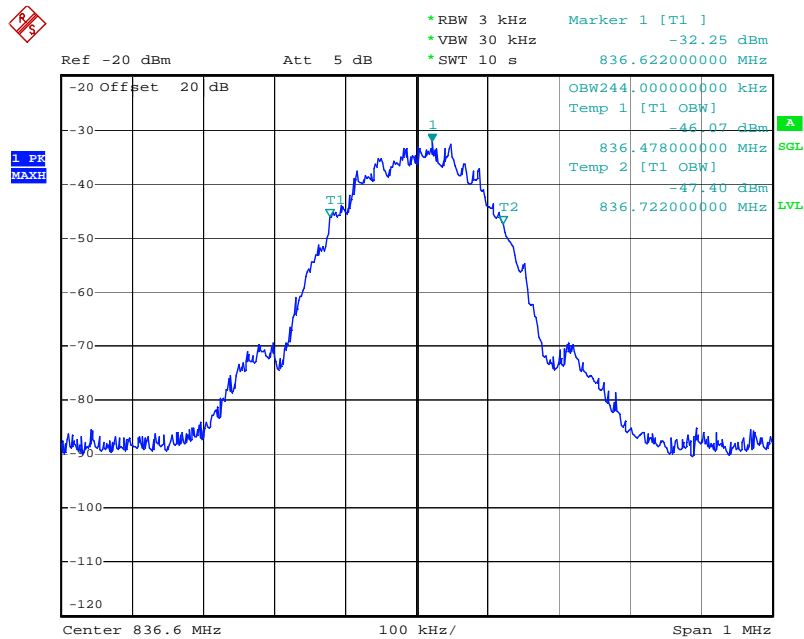


Date: 11.JAN.2007 10:23:53

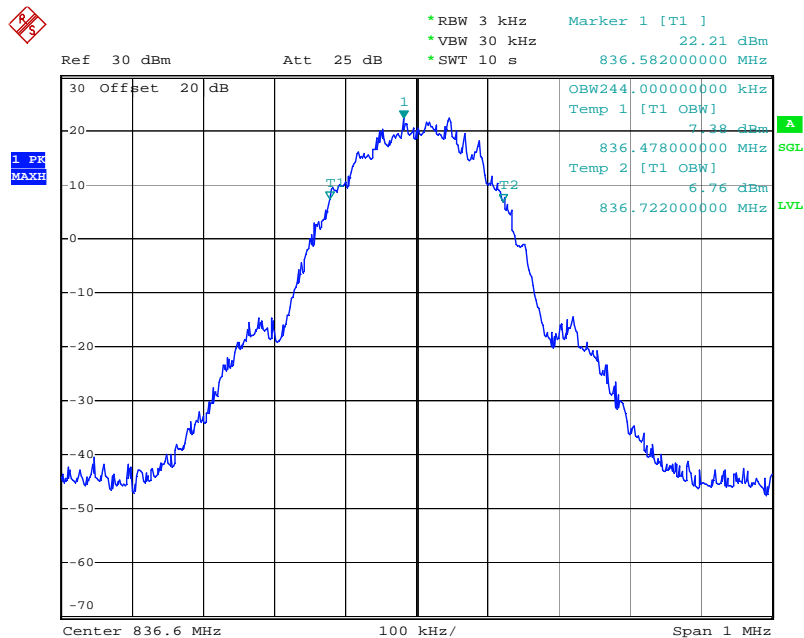


Date: 11.JAN.2007 10:27:51

Figure 7-3: Input/Output Bandwidth Comparison – GSM 850 Channel 190, Uplink

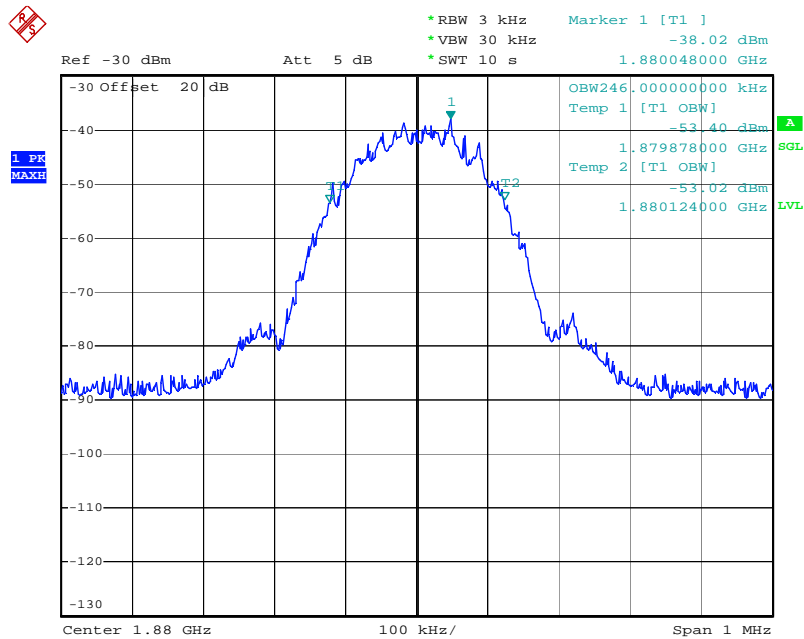


Date: 11.JAN.2007 10:49:42

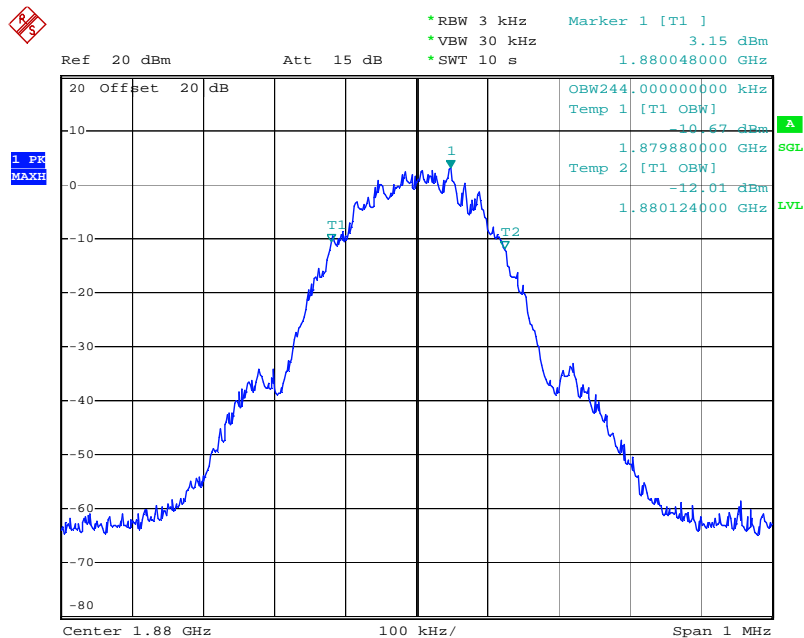


Date: 11.JAN.2007 10:31:36

Figure 7-4: Input/Output Bandwidth Comparison – GSM 1900 Channel 661, Uplink

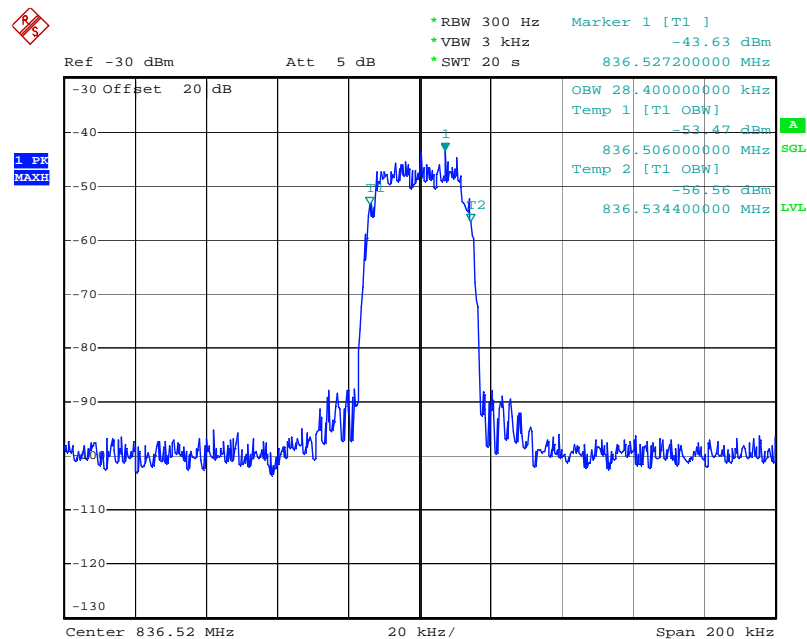


Date: 11.JAN.2007 10:52:50

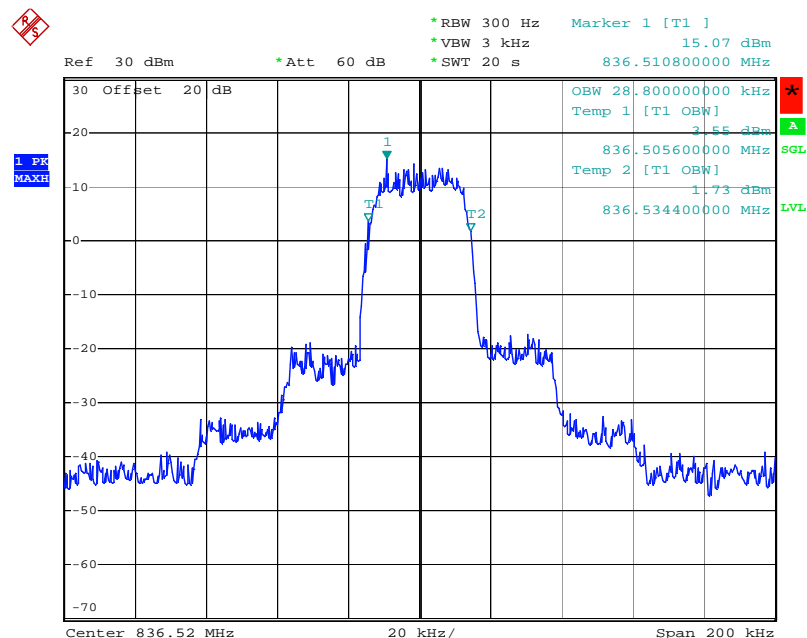


Date: 11.JAN.2007 11:01:02

Figure 7-5: Input/Output Bandwidth Comparison – TDMA Cell Channel 384, Uplink

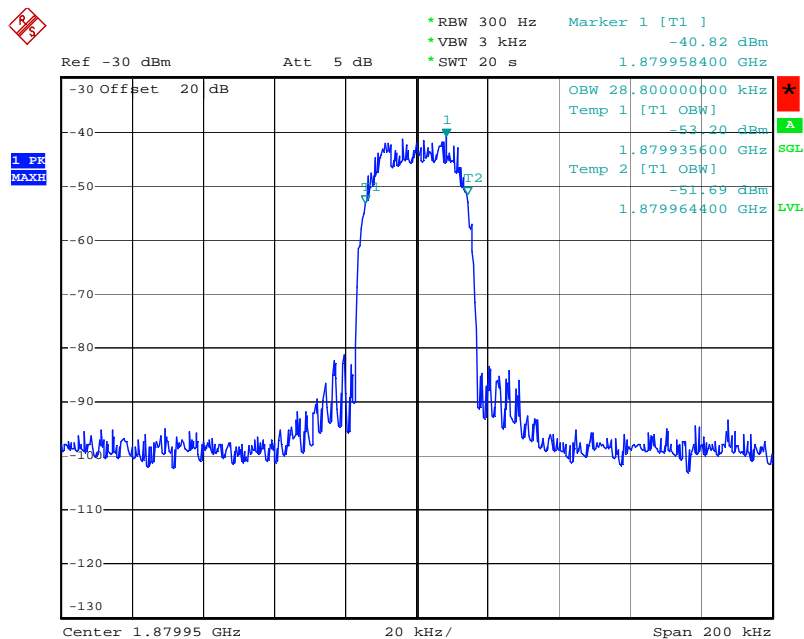


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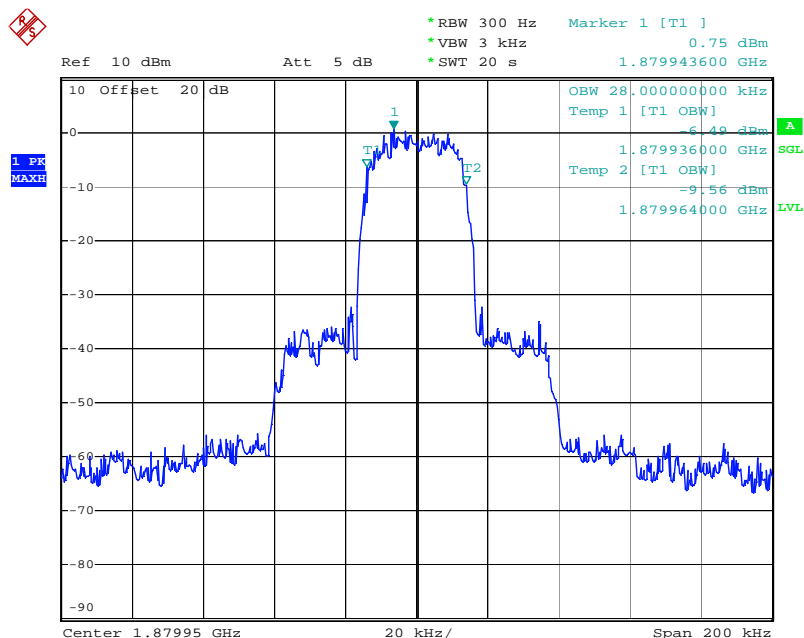


Date: 11.JAN.2007 11:05:45

Figure 7-6: Input/Output Bandwidth Comparison – TDMA PCS Channel 999, Uplink

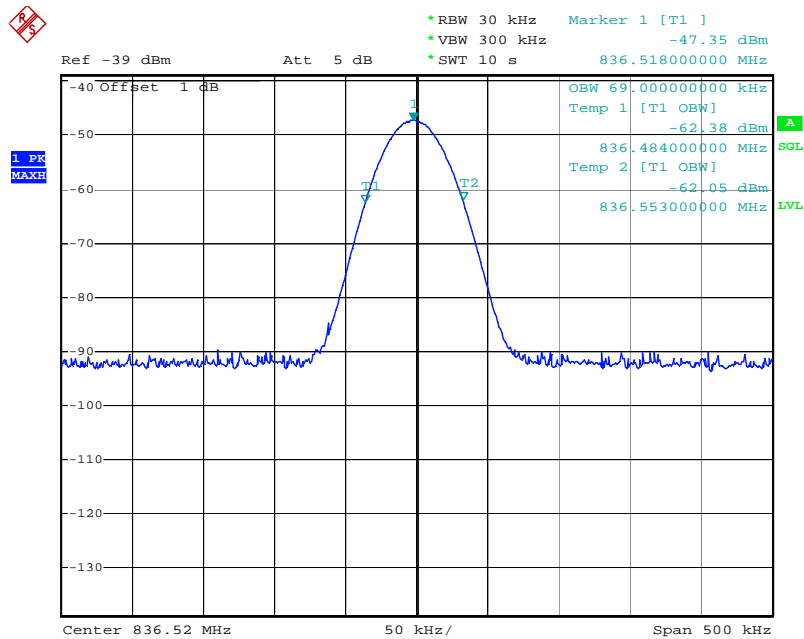


Date: 11.JAN.2007 11:11:53

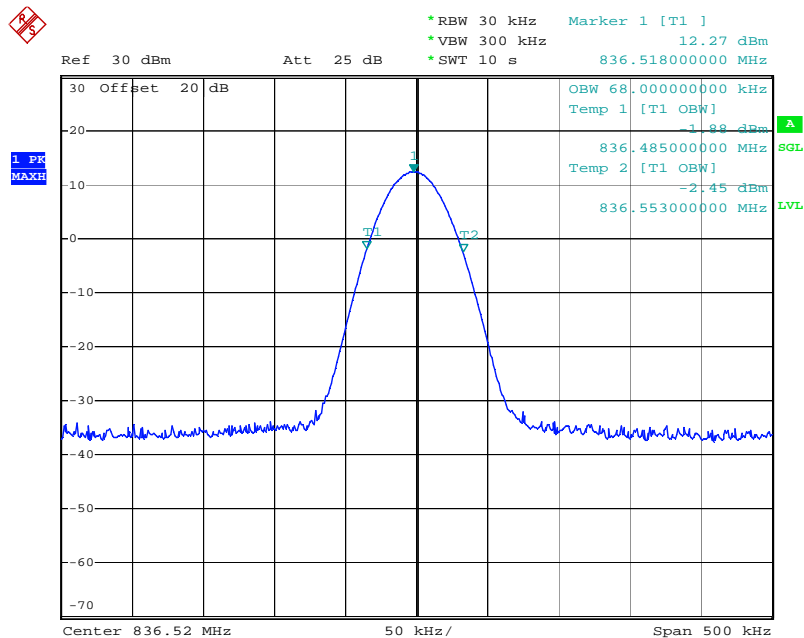


Date: 11.JAN.2007 11:17:20

Figure 7-7: Input/Output Bandwidth Comparison – AMPS Channel 384, Uplink

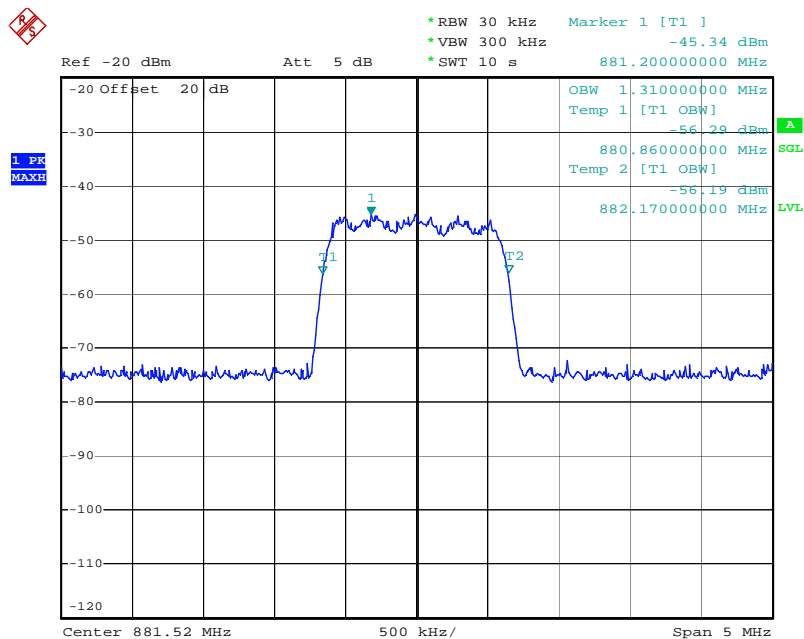


Date: 11.JAN.2007 11:59:18

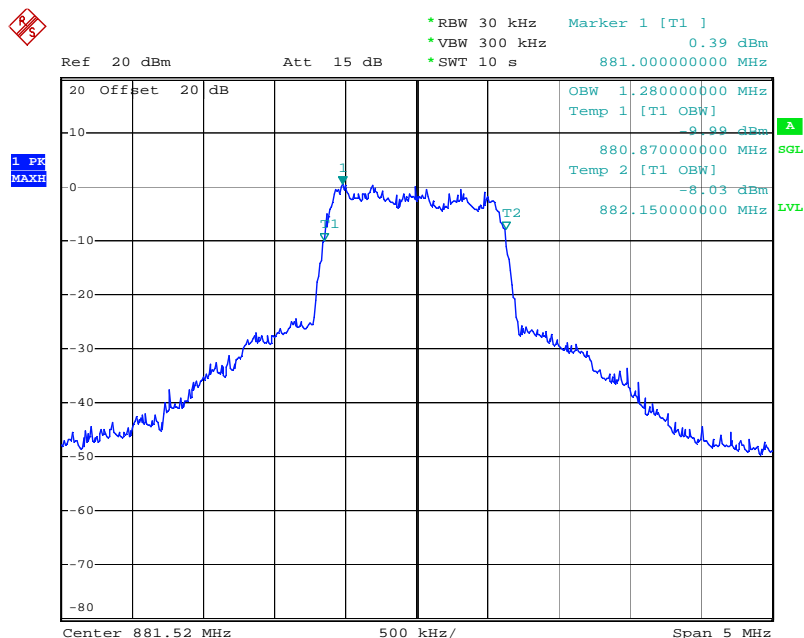


Date: 11.JAN.2007 11:56:41

Figure 7-8: Input/Output Bandwidth Comparison – CDMA Cell Channel 384, Downlink

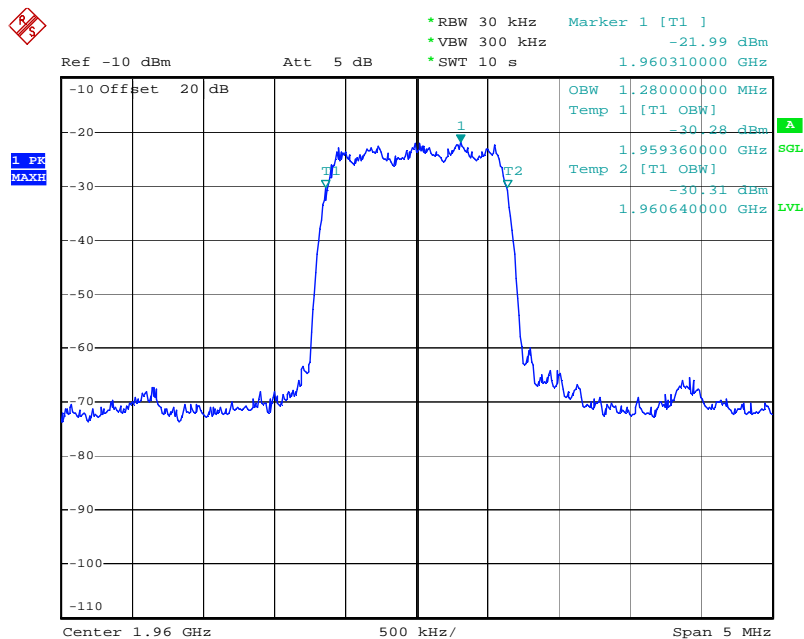


Date: 11.JAN.2007 12:18:14

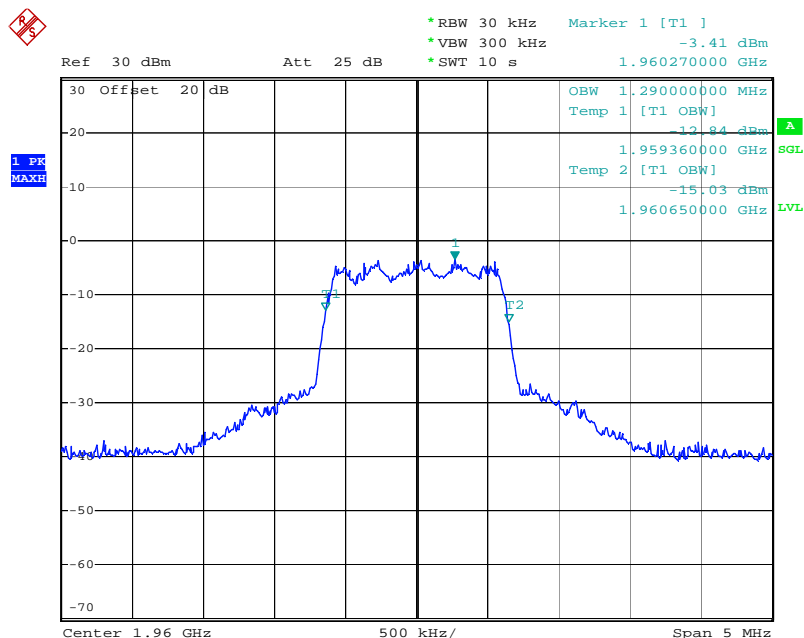


Date: 11.JAN.2007 12:14:15

Figure 7-9: Input/Output Bandwidth Comparison – CDMA PCS Channel 600, Downlink

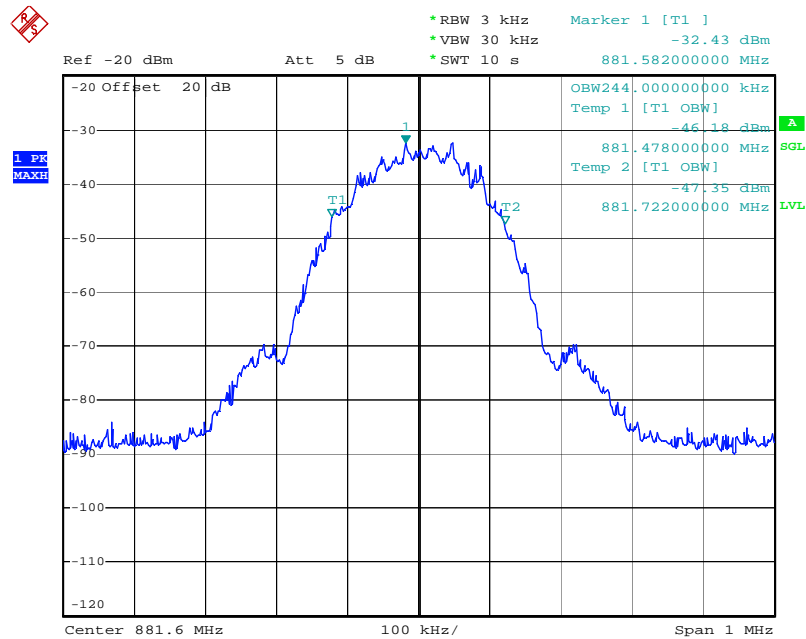


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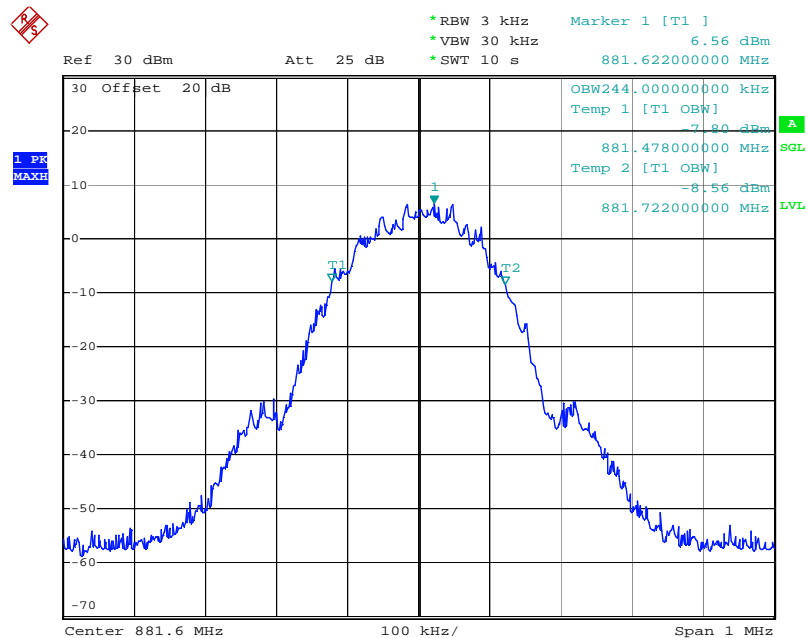


Date: 11.JAN.2007 12:49:33

Figure 7-10: Input/Output Bandwidth Comparison – GSM 850 Channel 190, Downlink

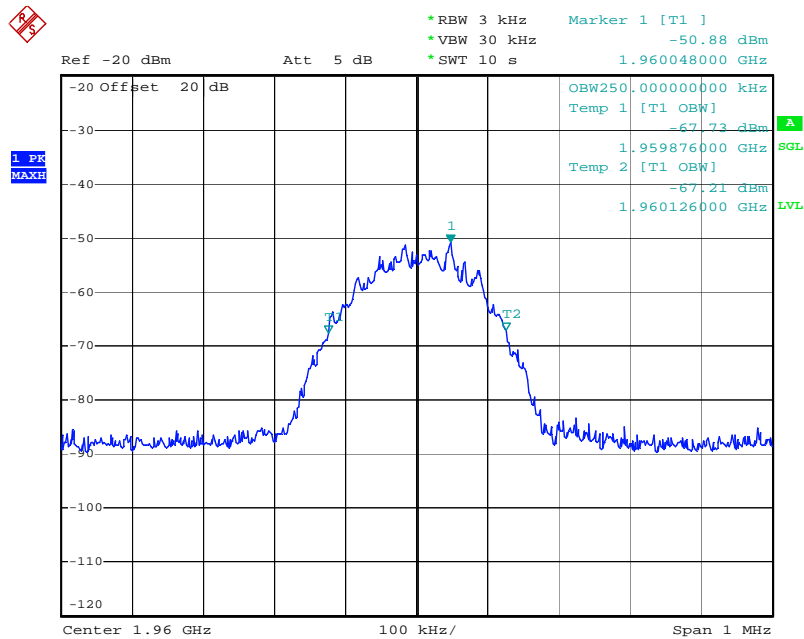


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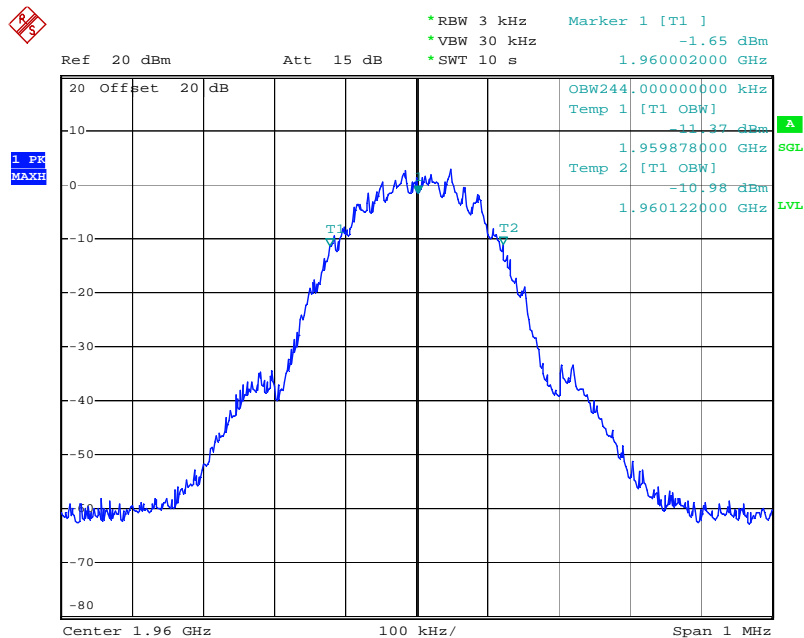


Date: 11.JAN.2007 12:53:47

Figure 7-11: Input/Output Bandwidth Comparison – GSM 1900 Channel 661, Downlink

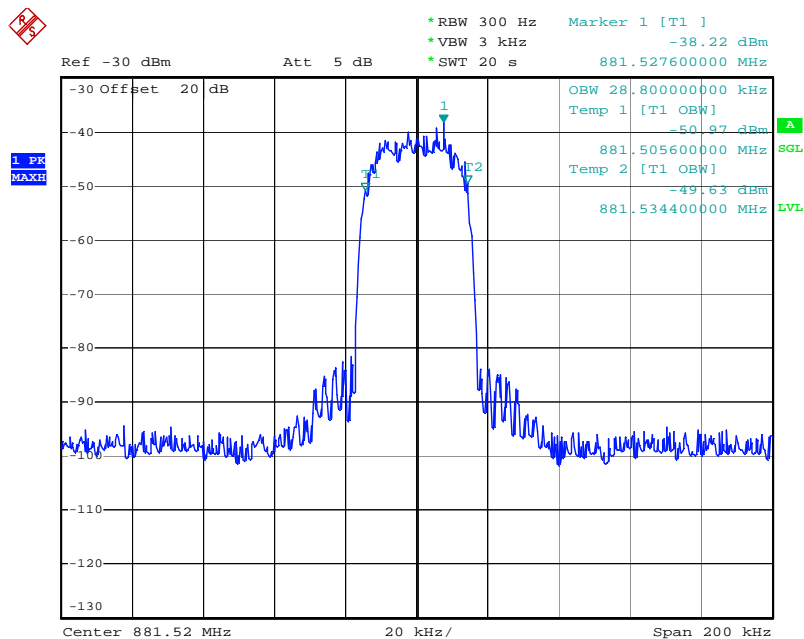


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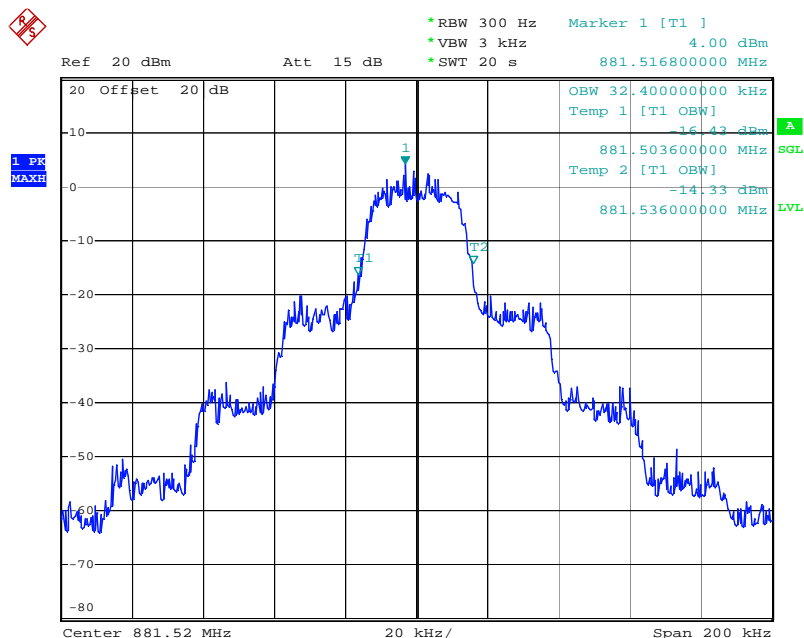


Date: 11.JAN.2007 14:26:50

Figure 7-12: Input/Output Bandwidth Comparison – TDMA Cell Channel 384, Downlink

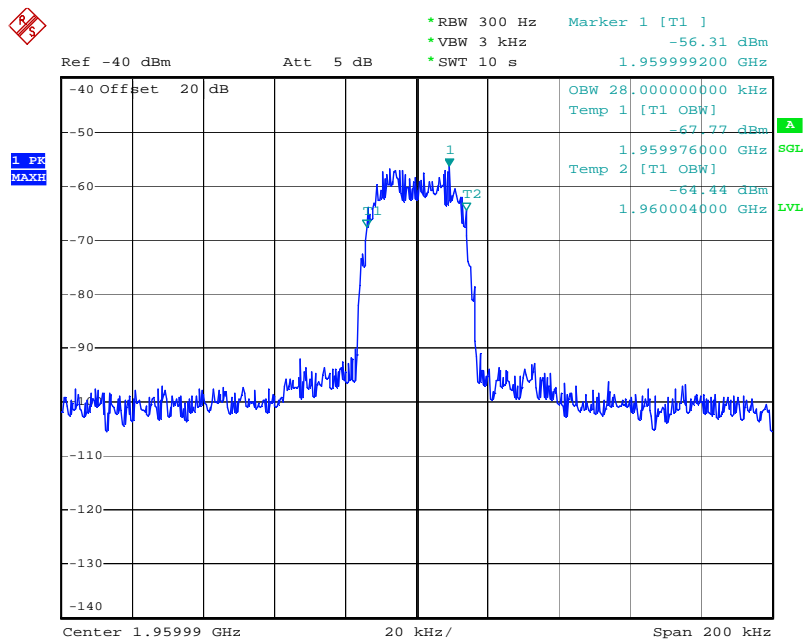


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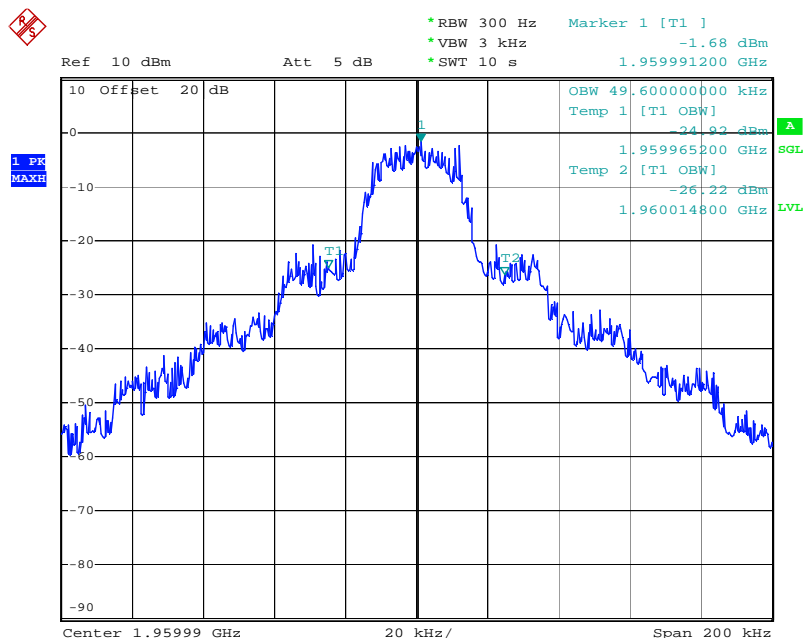


Date: 11.JAN.2007 14:10:25

Figure 7-13: Input/Output Bandwidth Comparison – TDMA PCS Channel 999, Downlink

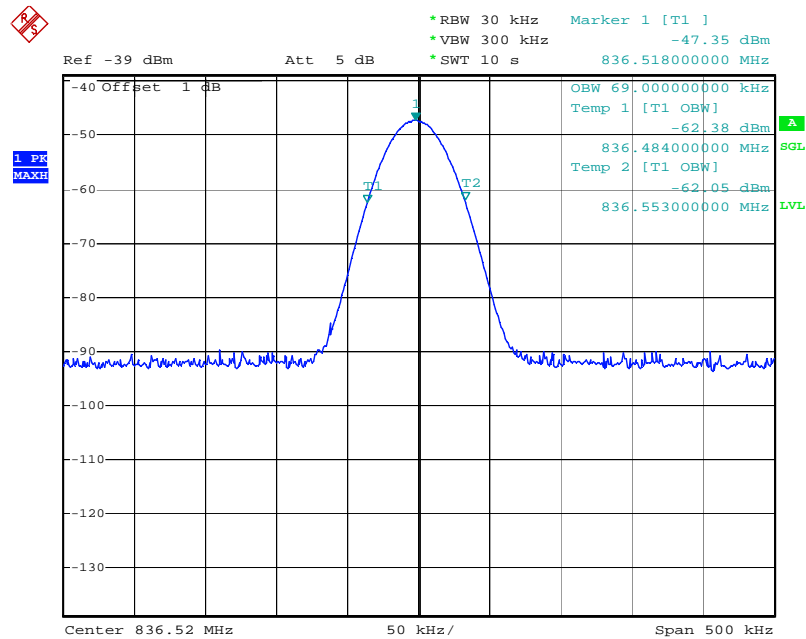


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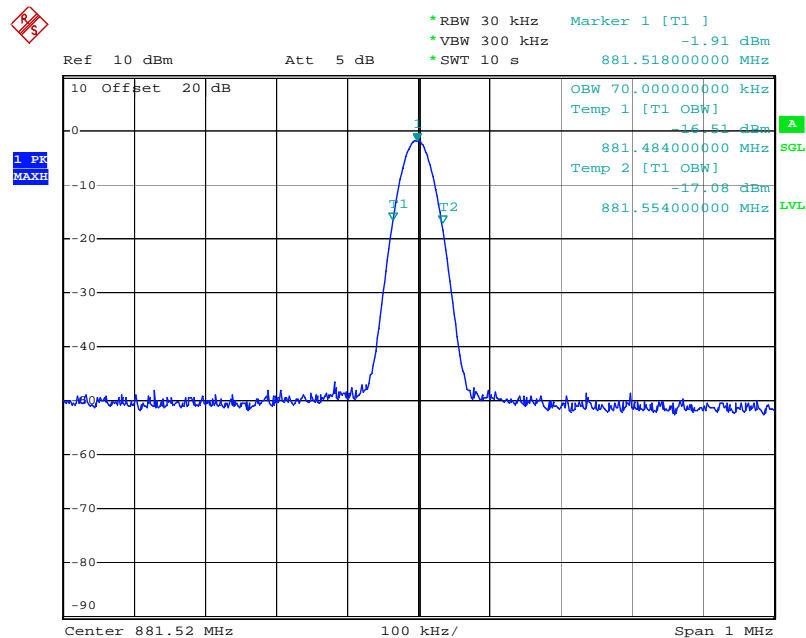


Date: 11.JAN.2007 14:17:54

Figure 7-14: Input/Output Bandwidth Comparison – AMPS Channel 384, Downlink



Date: 11.JAN.2007 11:59:18



Date: 11.JAN.2007 14:20:27

8 OUT OF BAND EMISSION AT ANTENNA TERMINALS & INTERMODULATION ATTENUATION

FCC §2.1049, FCC §2.1051, §22.917(a), FCC §24.238(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.

8.1 Test Procedure

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater for the Cellular band and 1 MHz or greater in the PCS band. 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.

The RF output of the amplifier was connected to a spectrum analyzer through appropriate attenuation. A base station simulator was provide a modulated input signal. The resolution bandwidth of the spectrum analyzer was set at 1 MHz. Scans were taken to show the out of band emissions up to 10th harmonic. The test was repeated for each low, mid, and high channel of each modulation type in the uplink and downlink directions.

Intermodulation Attenuation was performed using three tone method using CW sources. In each pass band for the uplink and downlink, two signals were selected on the low end of the passband and one signal at the high end of the passband. The output of three signal generators was connected to a passive combiner. The output of the signal generators was adjusted to provide the maximum rated input for the amplifier for a CW signal. As described above, scans were taken to show the out of band emissions up to 10th harmonic.

8.2 Test Results

The Cellular Amplifier met the out of band emission at antenna terminal requirements. Spurious emissions for the uplink band are shown in Table 8-1. Spurious emissions for the downlink band are shown in Figure 8-2. Intermodulation attenuation is shown in Table 8-2 for the uplink band and Table 8-4 for the downlink band. See for Figure 8-1 through Figure 8-64 for graphical results.

Table 8-1: Out of band emissions at antenna terminals – Uplink

EUT Mode	TX Channel	Spurious Emission Frequency	Device Reading (dBuV)	Attenuation (dB)	Cable Loss (dB)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)
CDMA PCS	25	833.5	-47.06	20	0.2	-26.86	-13	-13.86
CDMA PCS	600	833.5	-45.46	20	0.2	-25.26	-13	-12.26
CDMA PCS	1175	833.5	-45.34	20	0.2	-25.14	-13	-12.14
CDMA Cell	384	842.29	-39.3	20	0.2	-19.1	-13	-6.1
GSM 850	128	829.67	-41.2	20	0.2	-21	-13	-8
GSM 850	128	837.92	-41.87	20	0.2	-21.67	-13	-8.67
GSM 850	128	1648	-37.01	20	0.3	-16.71	-13	-3.71
GSM 850	190	842.14	-37.3	20	0.2	-17.1	-13	-4.1
GSM 850	190	850.34	-43.16	20	0.2	-22.96	-13	-9.96
GSM 850	190	1673	-38.5	20	0.3	-18.2	-13	-5.2
GSM 850	251	854.1	-45.02	20	0.2	-24.82	-13	-11.82
GSM 850	251	1697	-43.14	20	0.3	-22.84	-13	-9.84
GSM 1900	512	834.47	-51.27	20	0.2	-31.07	-13	-18.07
GSM 1900	661	834.47	-49.2	20	0.2	-29	-13	-16
GSM 1900	810	834.47	-46.13	20	0.2	-25.93	-13	-12.93
TDMA 850	991	829.67	-40.09	20	0.2	-19.89	-13	-6.89
TDMA 850	991	1648	-37.85	20	0.3	-17.55	-13	-4.55
TDMA 850	384	842.2	-38.9	20	0.2	-18.7	-13	-5.7
TDMA 850	384	1673	-40.24	20	0.3	-19.94	-13	-6.94
TDMA 1900	2	834.47	-47.28	20	0.2	-27.08	-13	-14.08
TDMA 1900	999	834.47	-46.51	20	0.2	-26.31	-13	-13.31
TDMA 1900	1998	834.47	-46.42	20	0.2	-26.22	-13	-13.22

Table 8-2: Intermodulation Attenuation – Uplink

Band	Spurious Emission Frequency (MHz)	Device Reading (dBm)	Attenuation (dB)	Cable Loss (dB)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)
Uplink PCS	3.9775	-35.1	20	0.5	-14.6	-13	-1.6
Uplink PCS	5.91	-40.3	20	0.7	-19.6	-13	-6.6
Uplink PCS	5.9665	-39.3	20	0.8	-18.5	-13	-5.5

Figure 8-1: Out of band emissions at antenna terminals – CDMA Cell Channel 384, 777, and 1013 – Uplink

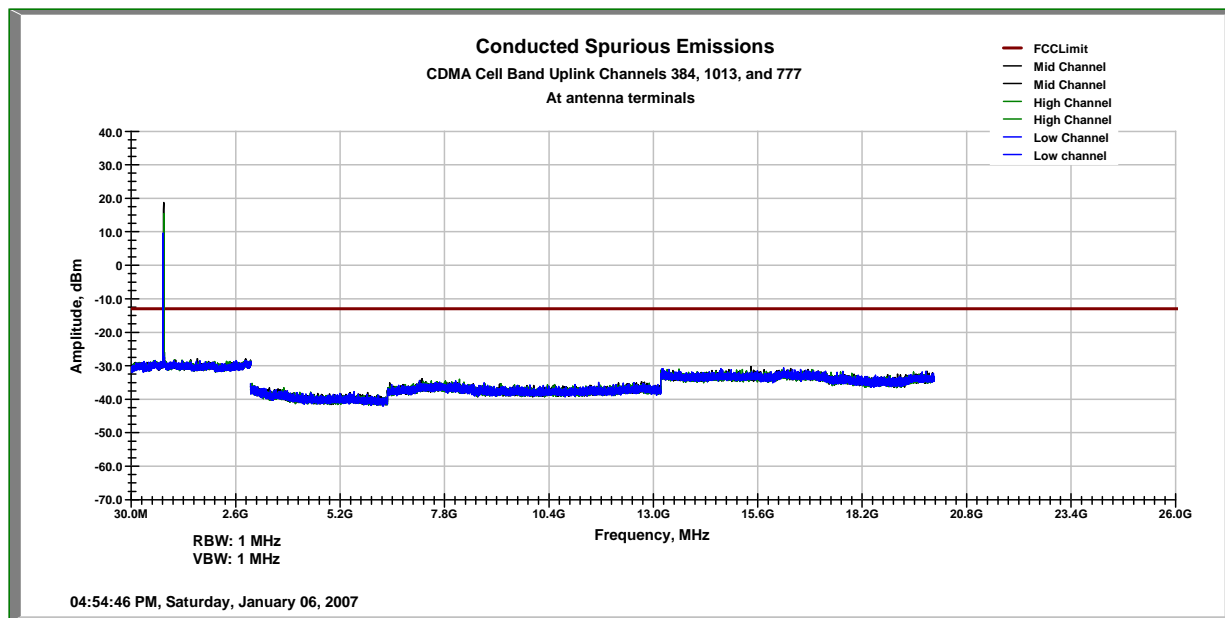


Figure 8-2: Out of band emissions at antenna terminals – CDMA Cell Channel 384, 777, and 1013 (Zoomed Around Carrier Frequencies) – Uplink

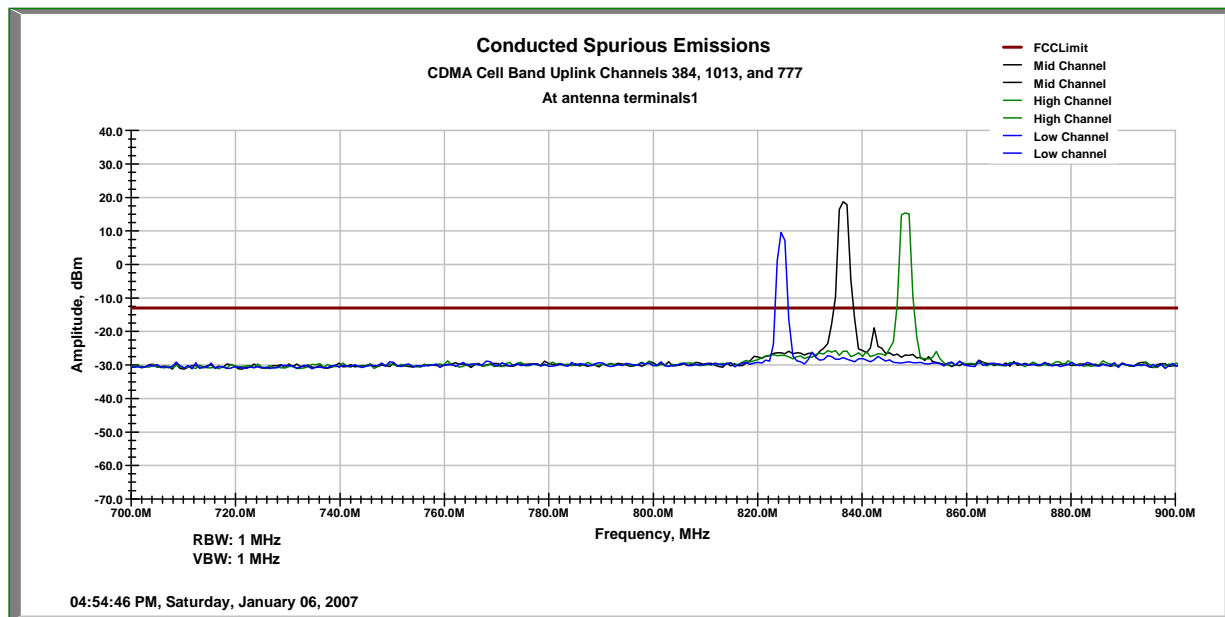


Figure 8-3: Out of band emissions at antenna terminals – CDMA PCS Channel 25, 600, 1175 – Uplink

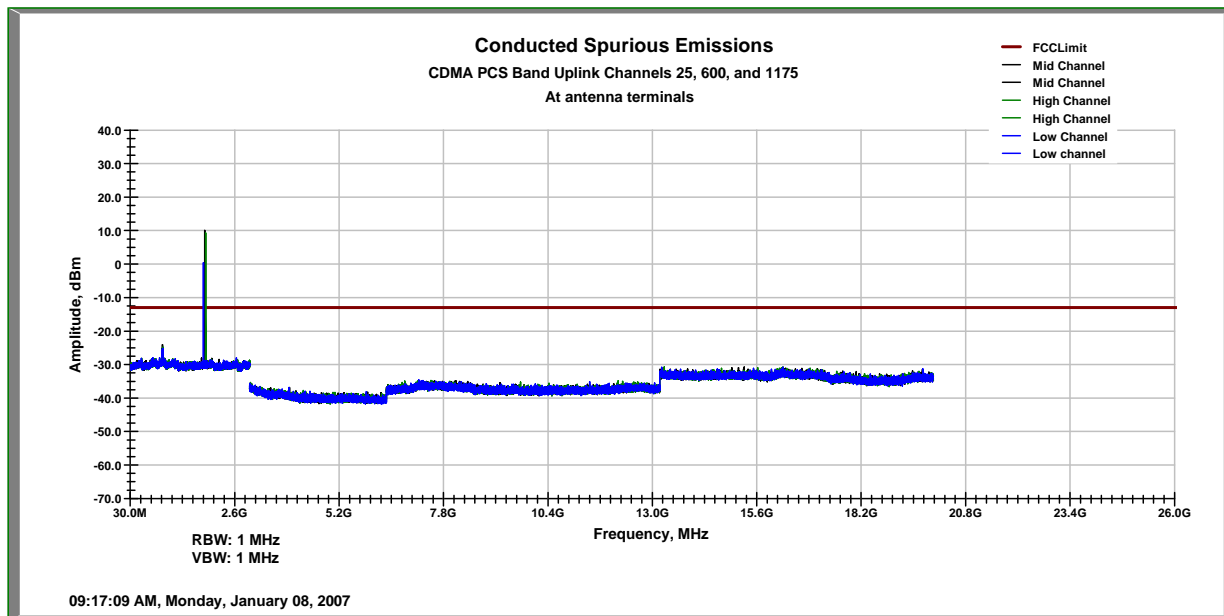


Figure 8-4: Out of band emissions at antenna terminals – CDMA PCS Channel 25, 600, 1175 (Zoomed In on Carrier Frequencies) – Uplink

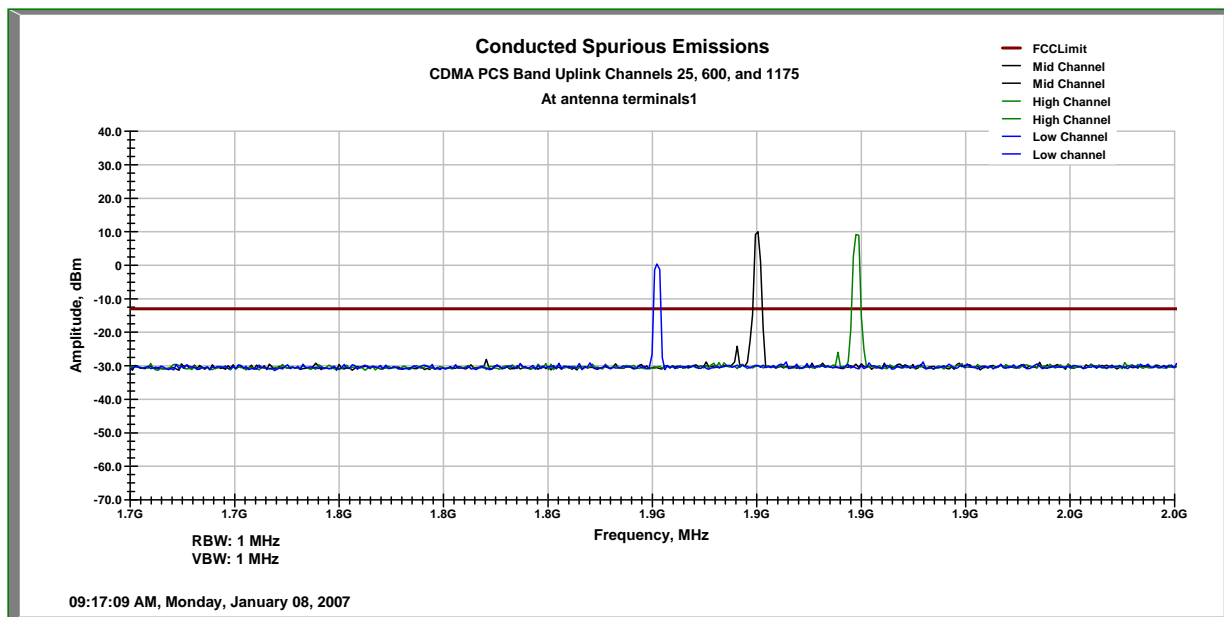


Figure 8-5: Emissions within 1 MHz of band edge, CDMA Cell Channel 1013 – Uplink

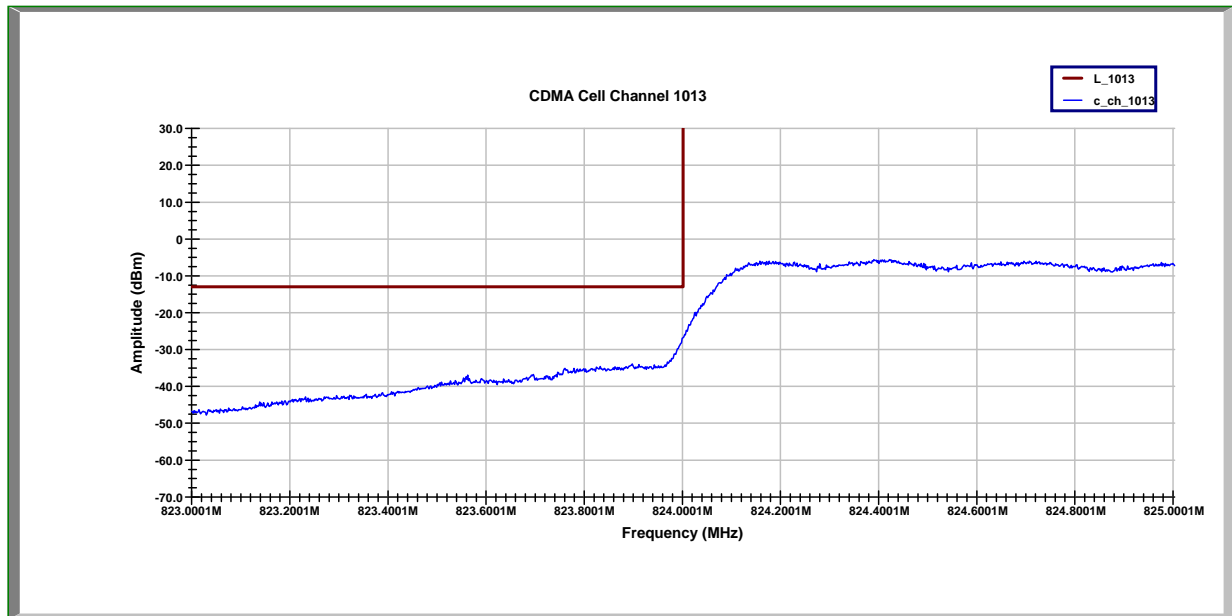


Figure 8-6: Emissions within 1 MHz of band edge, CDMA Cell Channel 777 – Uplink

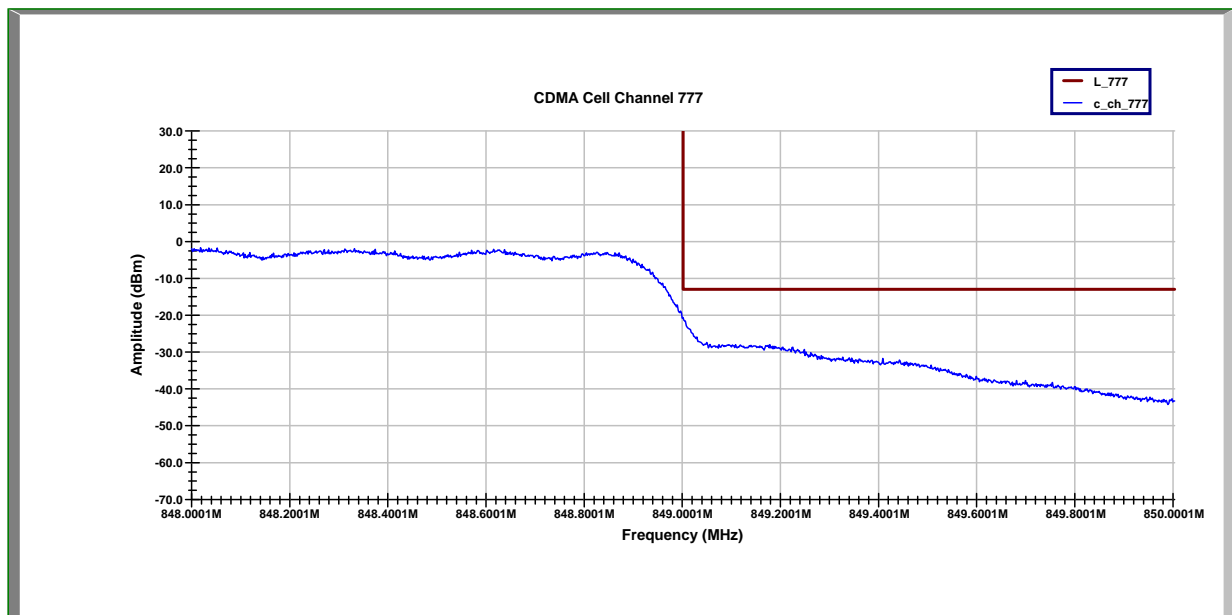


Figure 8-7: Emissions within 1 MHz of band edge, CDMA PCS Channel 25 – Uplink

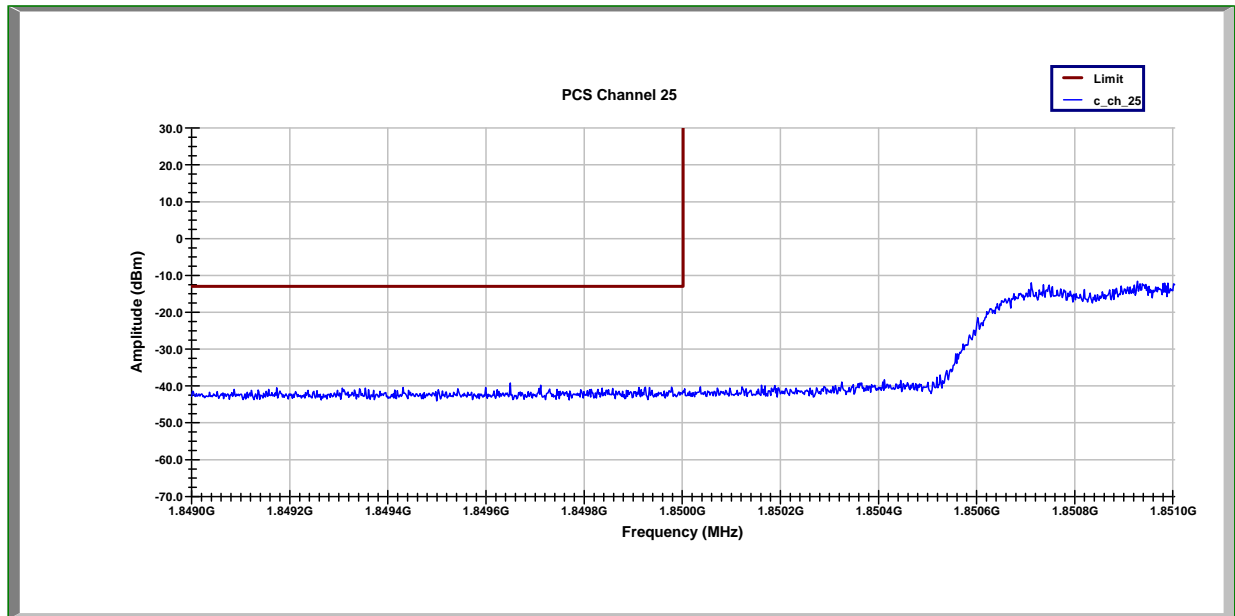


Figure 8-8: Emissions within 1 MHz of band edge, CDMA PCS Channel 1175 – Uplink

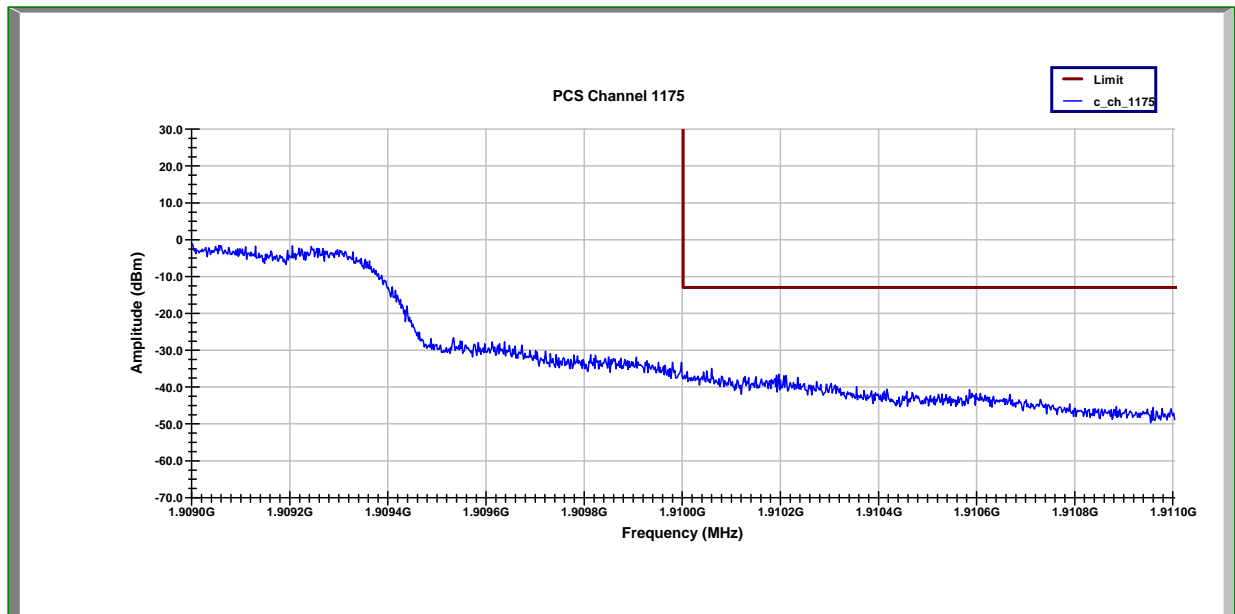


Figure 8-9: Out of band emissions at antenna terminals – GSM 850 Channel 128, 190, and 251 – Uplink

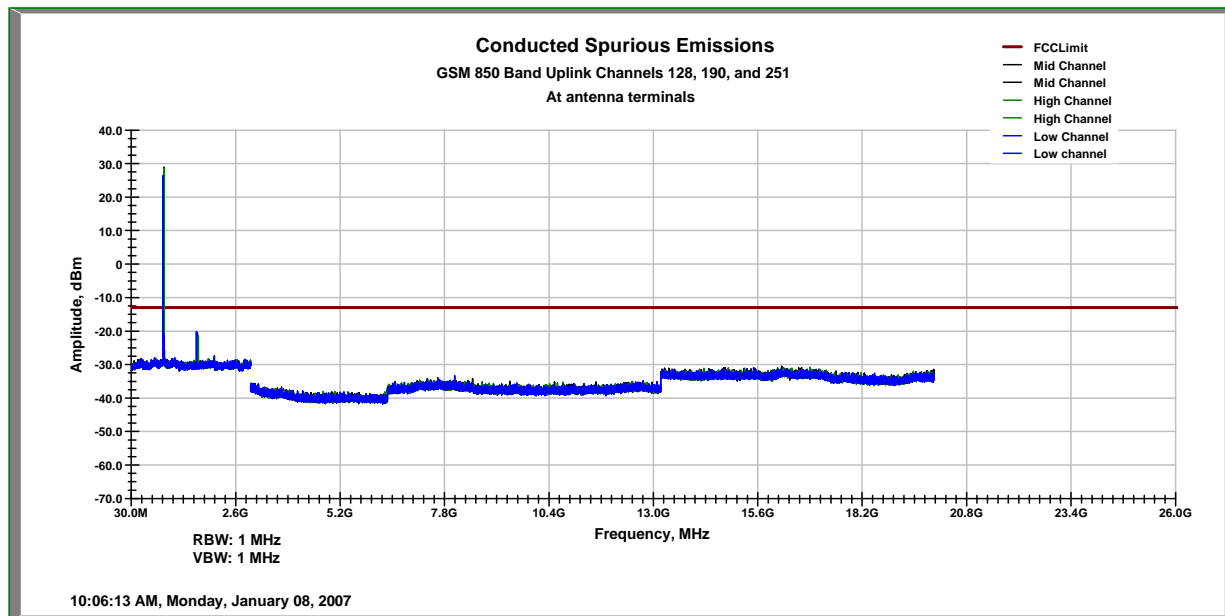


Figure 8-10: Out of band emissions at antenna terminals – GSM 850 Channel 128, 190, and 251 (Zoomed Around Carrier Frequencies) – Uplink

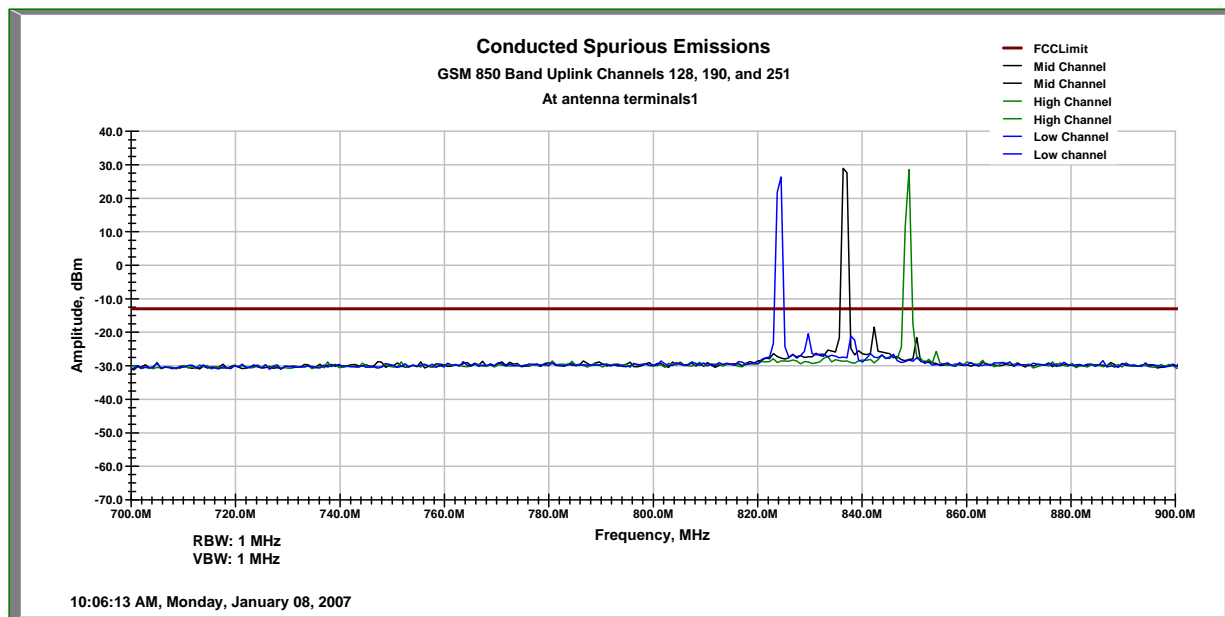


Figure 8-11: Out of band emissions at antenna terminals – GSM 1900 Channel 512, 661, 810 – Uplink

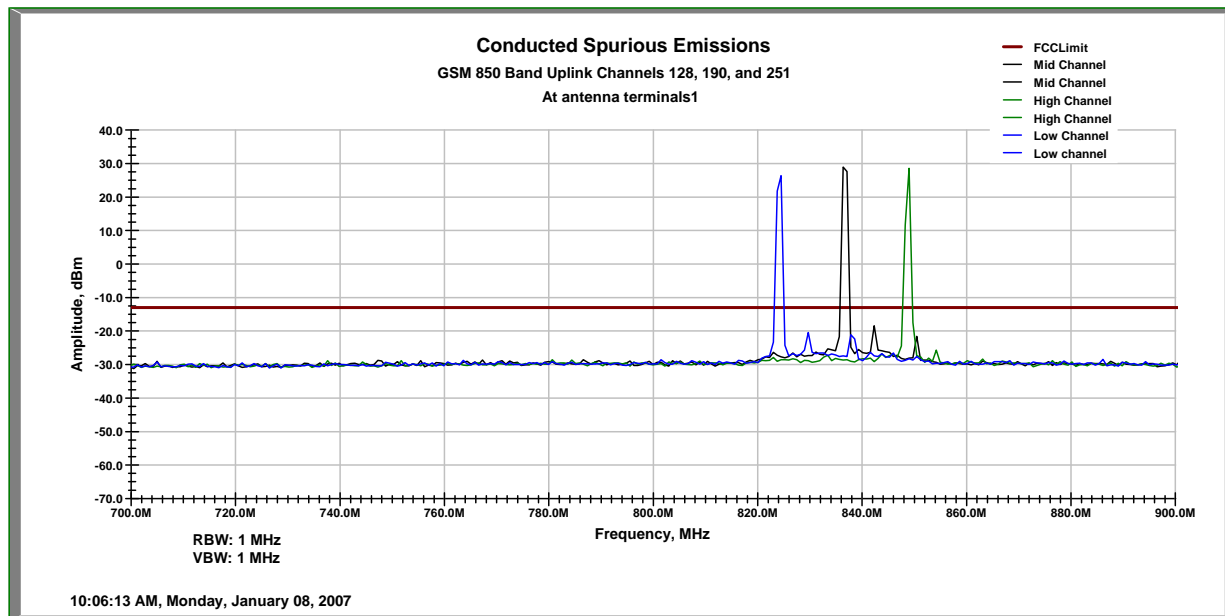


Figure 8-12: Out of band emissions at antenna terminals – GSM 1900 Channel 512, 661, 810 (Zoomed In on Carrier Frequencies) – Uplink

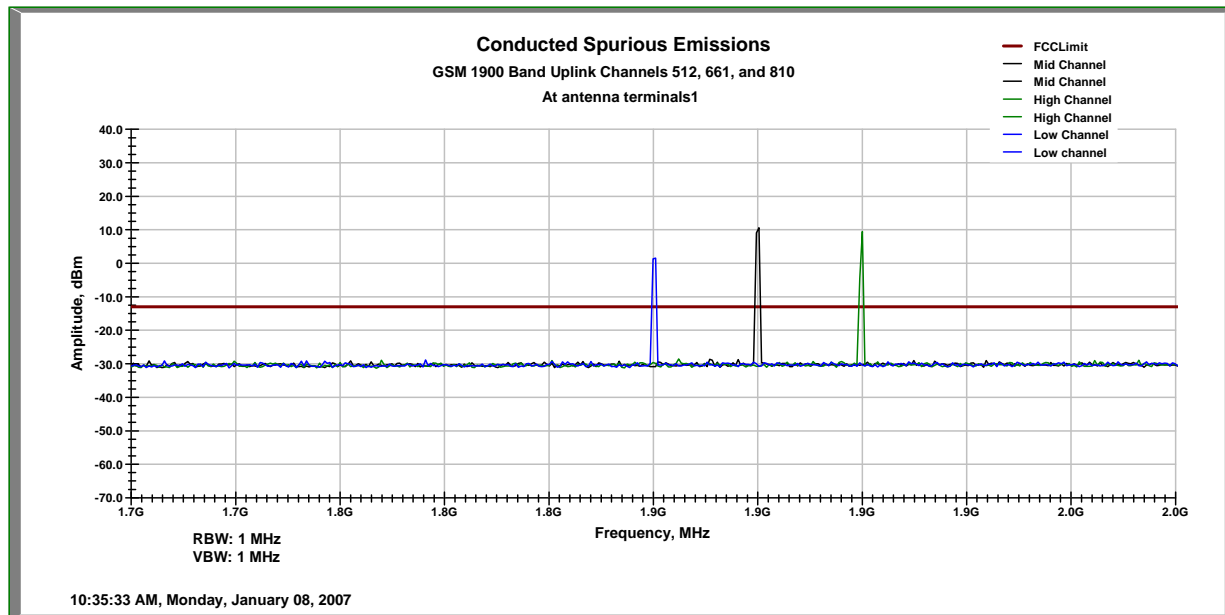


Figure 8-13: Emissions within 1 MHz of band edge, GSM 850 Channel 128 – Uplink

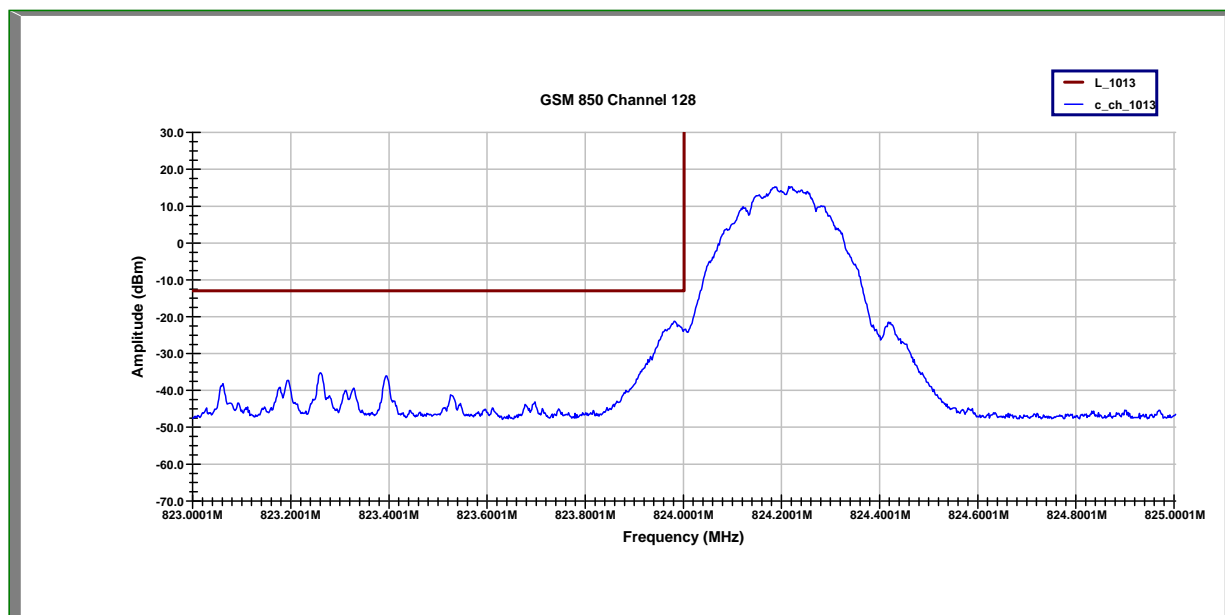


Figure 8-14: Emissions within 1 MHz of band edge, GSM 850 Channel 251 – Uplink

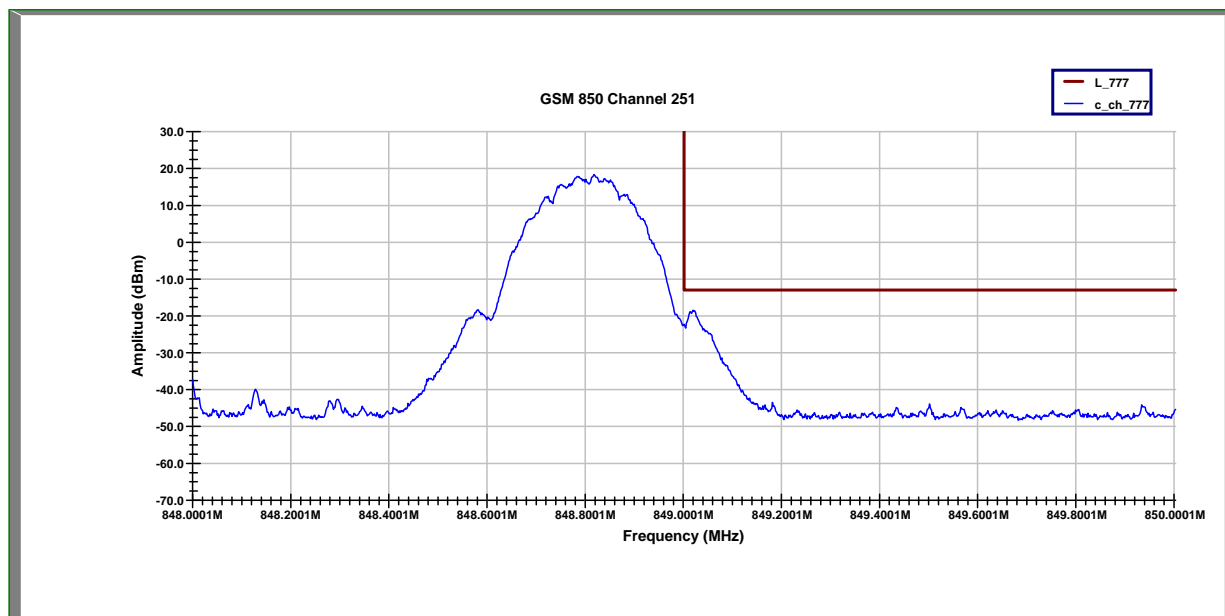


Figure 8-15: Emissions within 1 MHz of band edge, GSM 1900 Channel 512 – Uplink

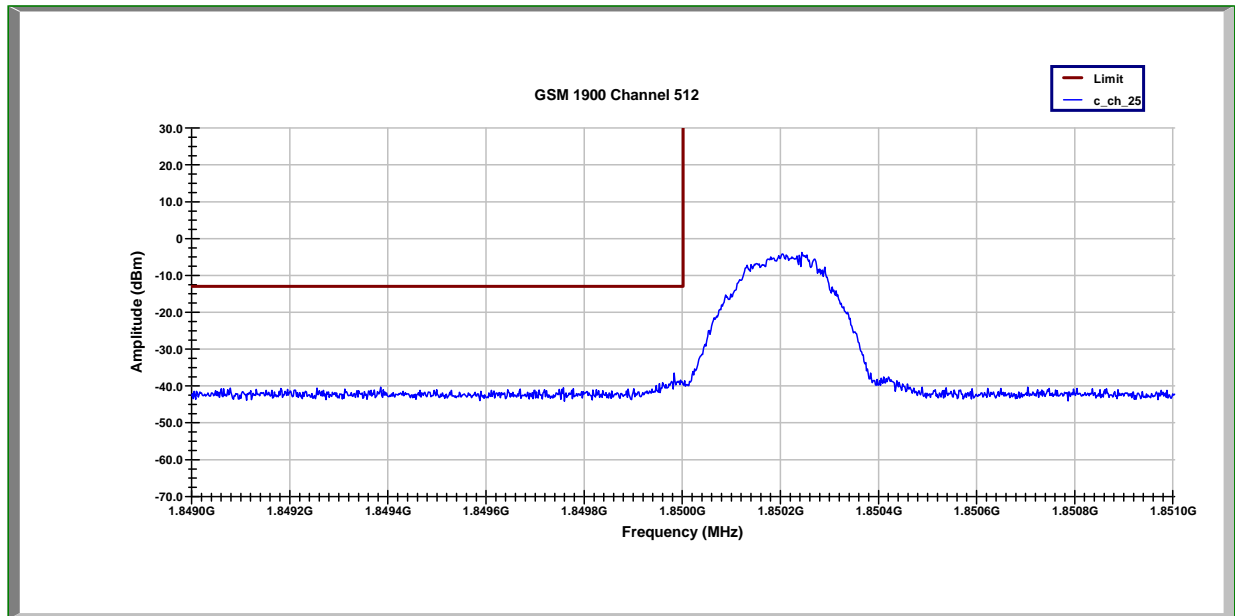


Figure 8-16: Emissions within 1 MHz of band edge, GSM 1900 Channel 810 – Uplink

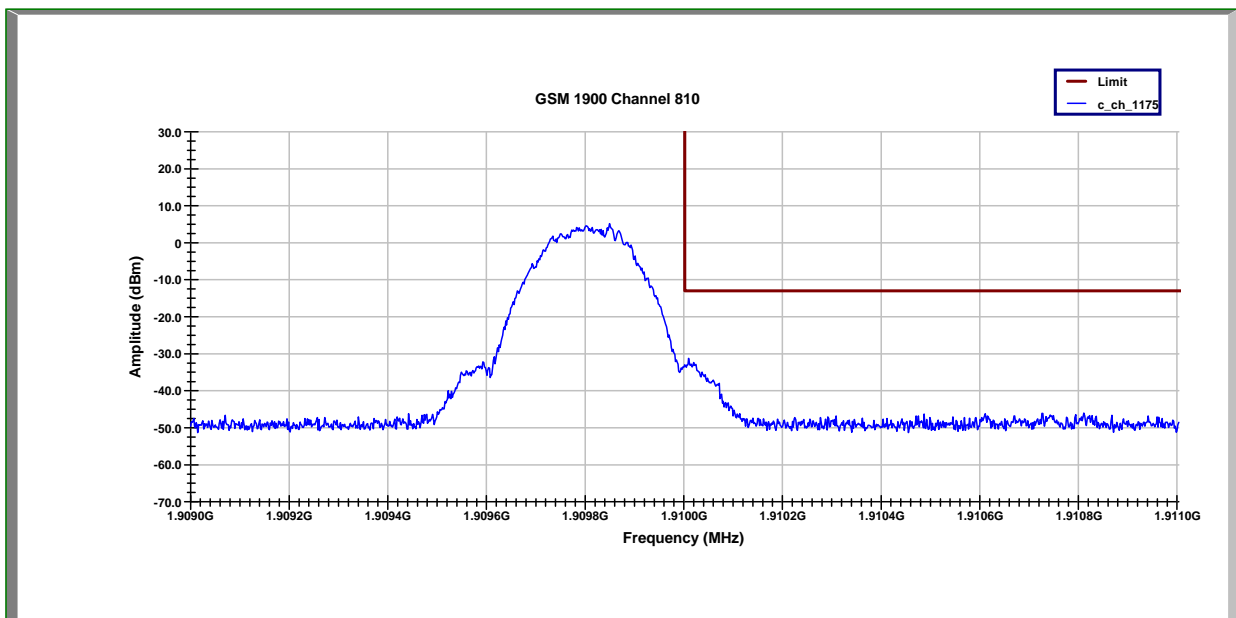


Figure 8-17: Out of band emissions at antenna terminals – TDMA Cell Channel 991, 384, and 799 – Uplink

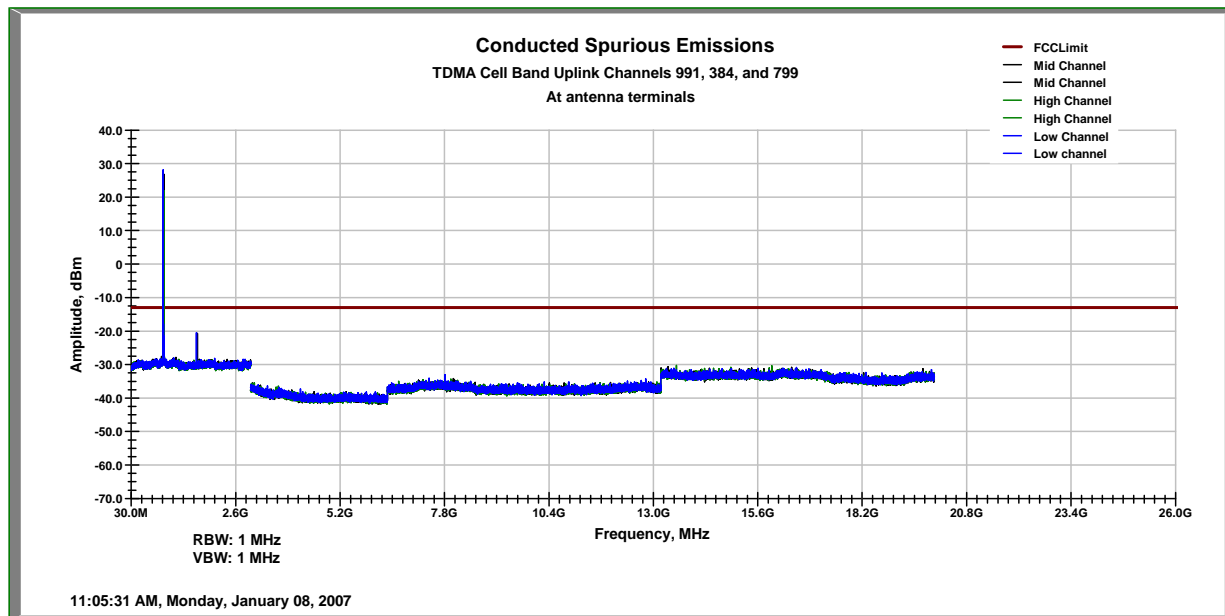


Figure 8-18: Out of band emissions at antenna terminals – TDMA Cell Channel 991, 384, and 799 (Zoomed Around Carrier Frequencies) – Uplink

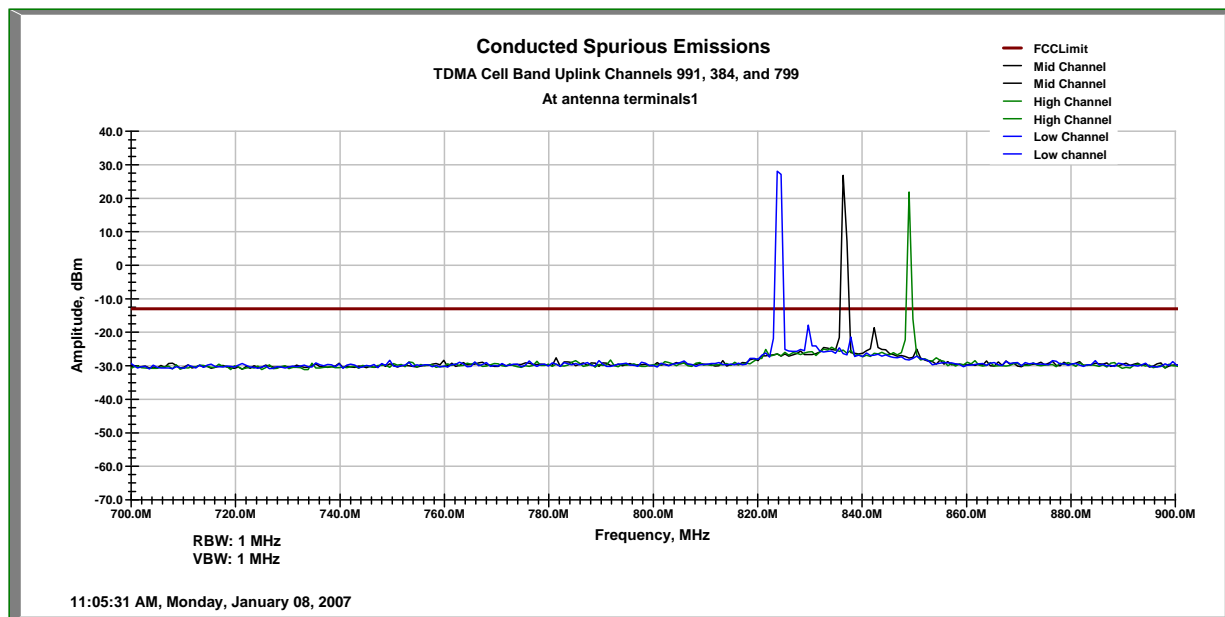


Figure 8-19: Out of band emissions at antenna terminals – TDMA PCS Channel 2, 999, 1998 – Uplink

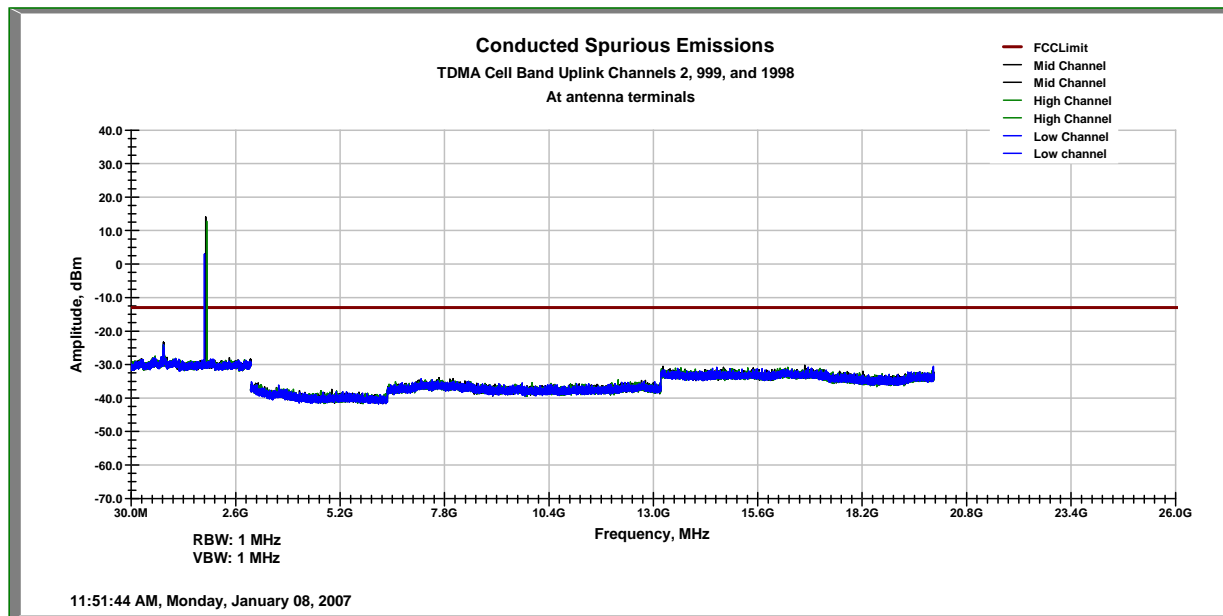


Figure 8-20: Out of band emissions at antenna terminals – TDMA PCS Channel 2, 999, 1998 (Zoomed In on Carrier Frequencies) – Uplink

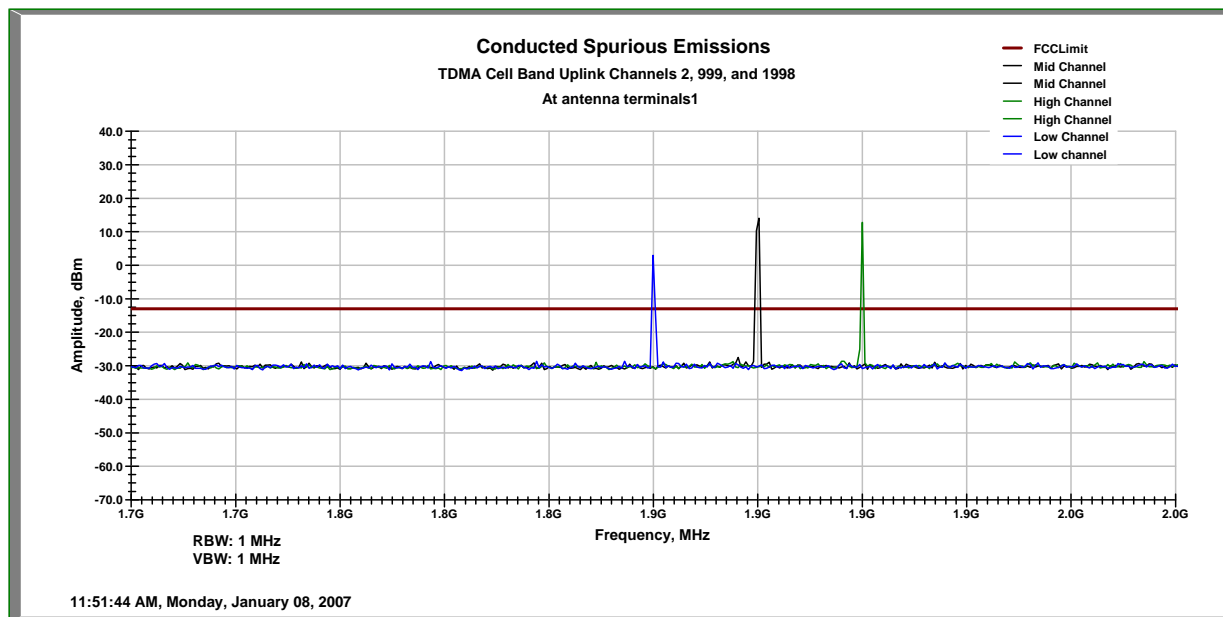


Figure 8-21: Emissions within 1 MHz of band edge, TDMA Cell Channel 991 – Uplink

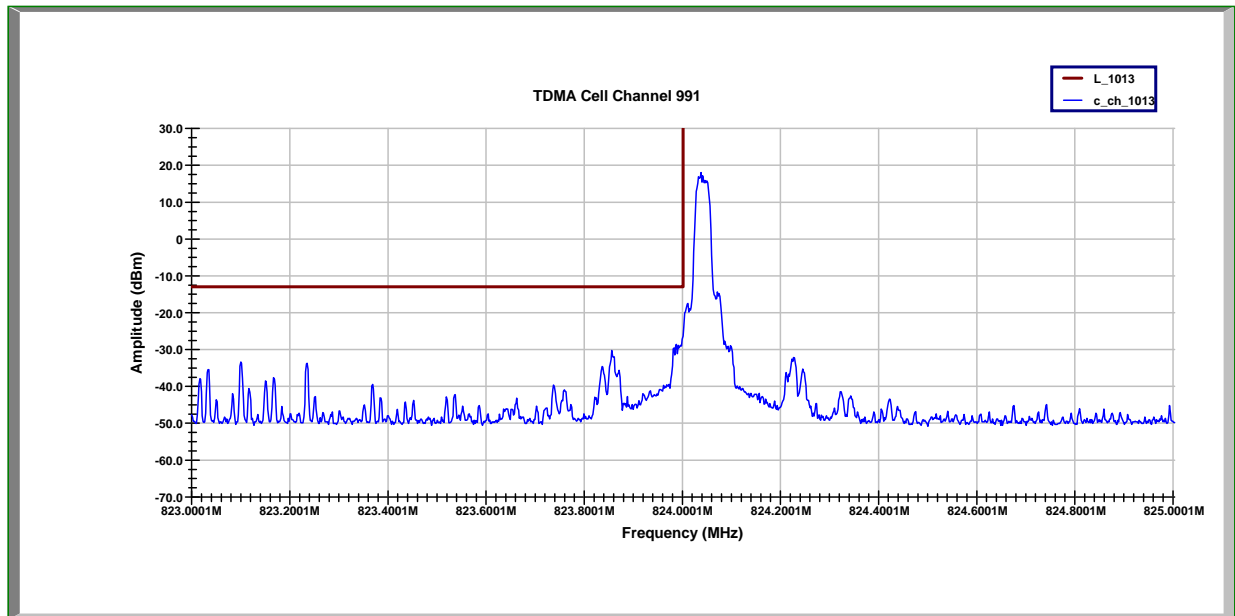


Figure 8-22: Emissions within 1 MHz of band edge, TDMA Cell Channel 799 – Uplink

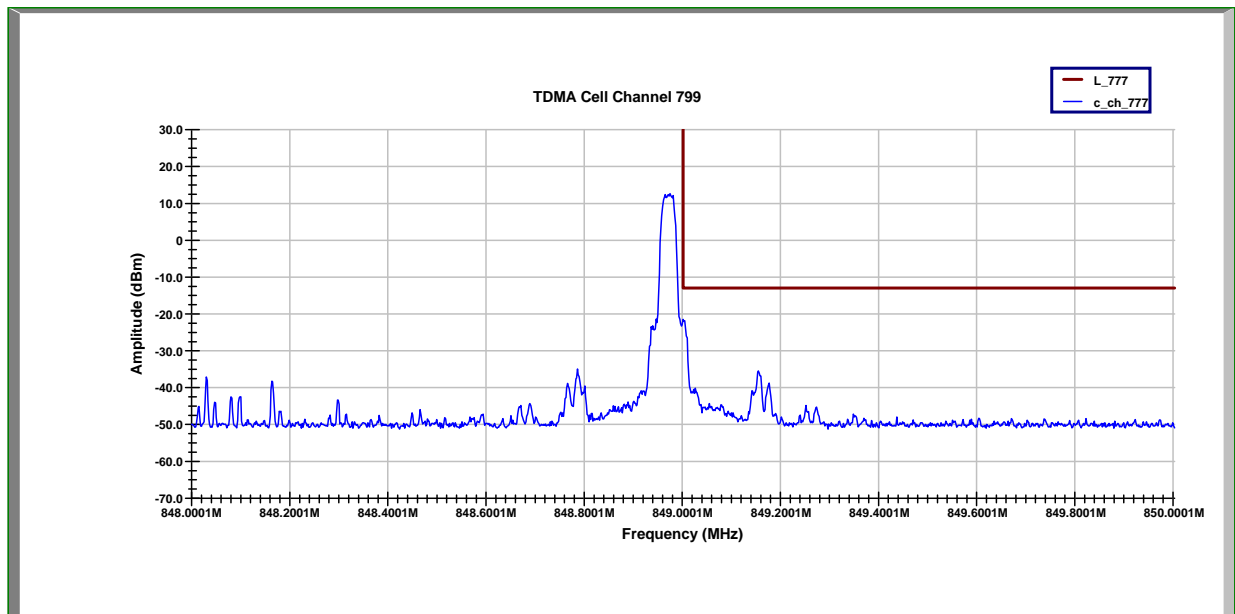


Figure 8-23: Emissions within 1 MHz of band edge, TDMA PCS Channel 2 – Uplink

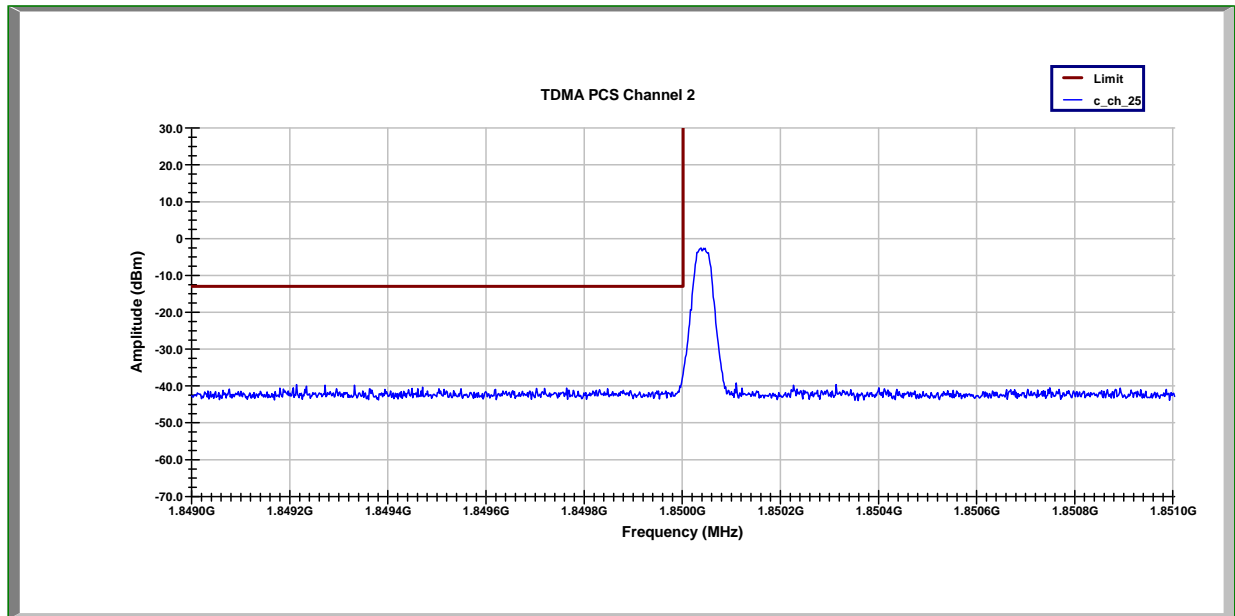


Figure 8-24: Emissions within 1 MHz of band edge, TDMA PCS Channel 1998 – Uplink

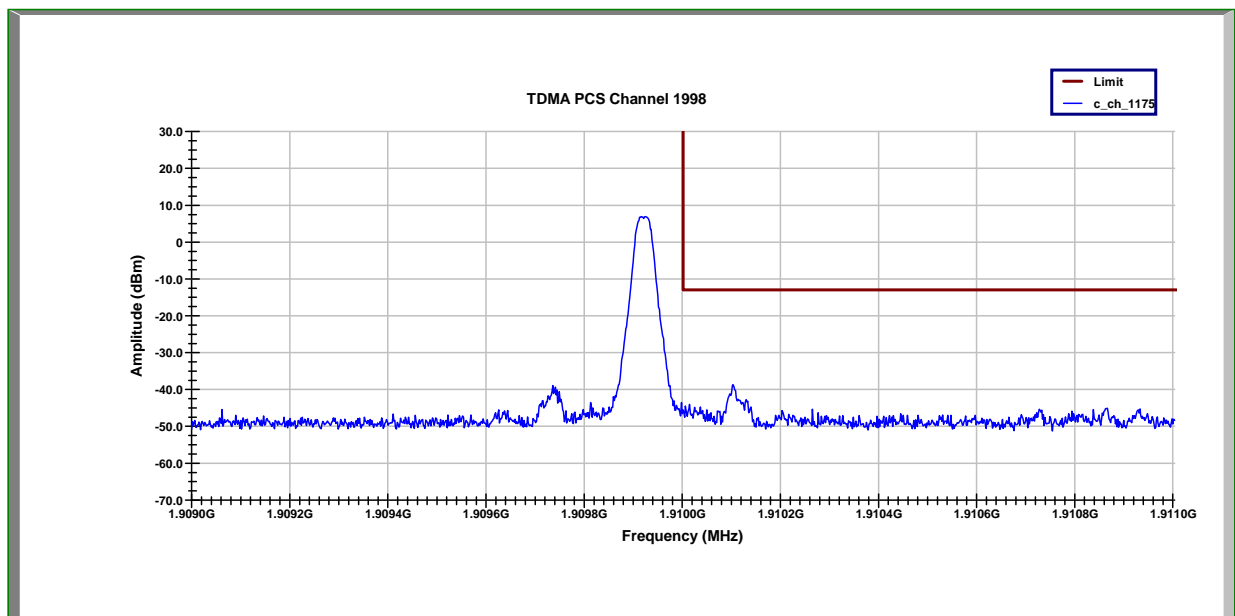


Figure 8-25: Out of band emissions at antenna terminals – AMPS Channel 991, 384, and 799 – Uplink

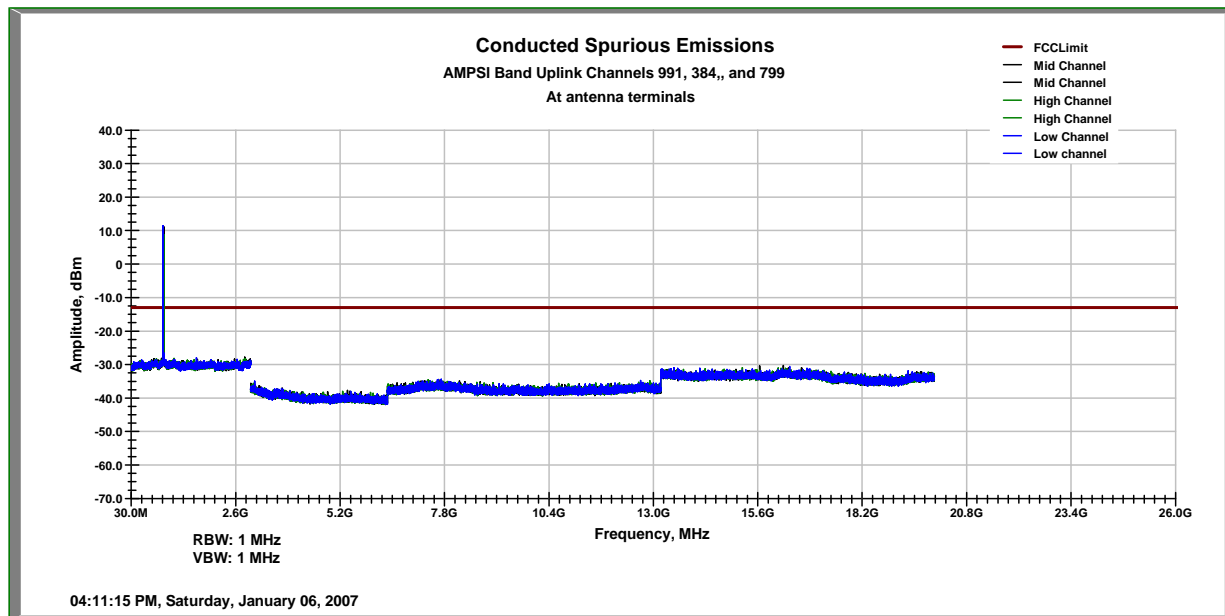


Figure 8-26: Out of band emissions at antenna terminals – AMPS Channel 991, 384, and 799 (Zoomed Around Carrier Frequencies) - Uplink

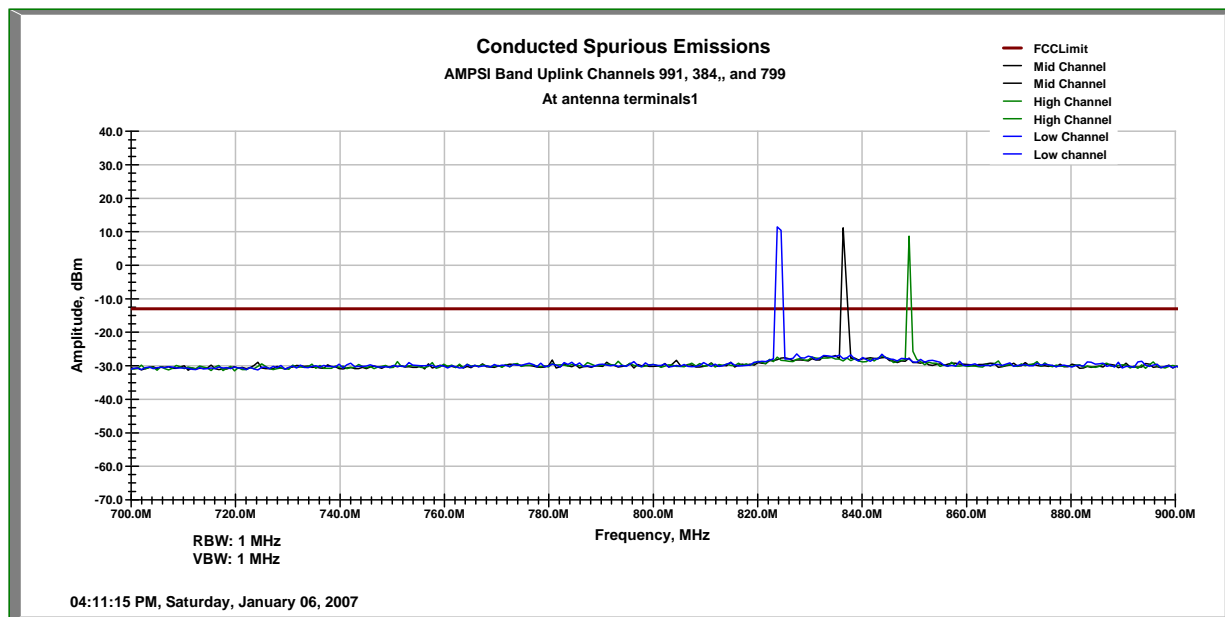


Figure 8-27: Emissions within 1 MHz of band edge, AMPS Channel 991 – Uplink

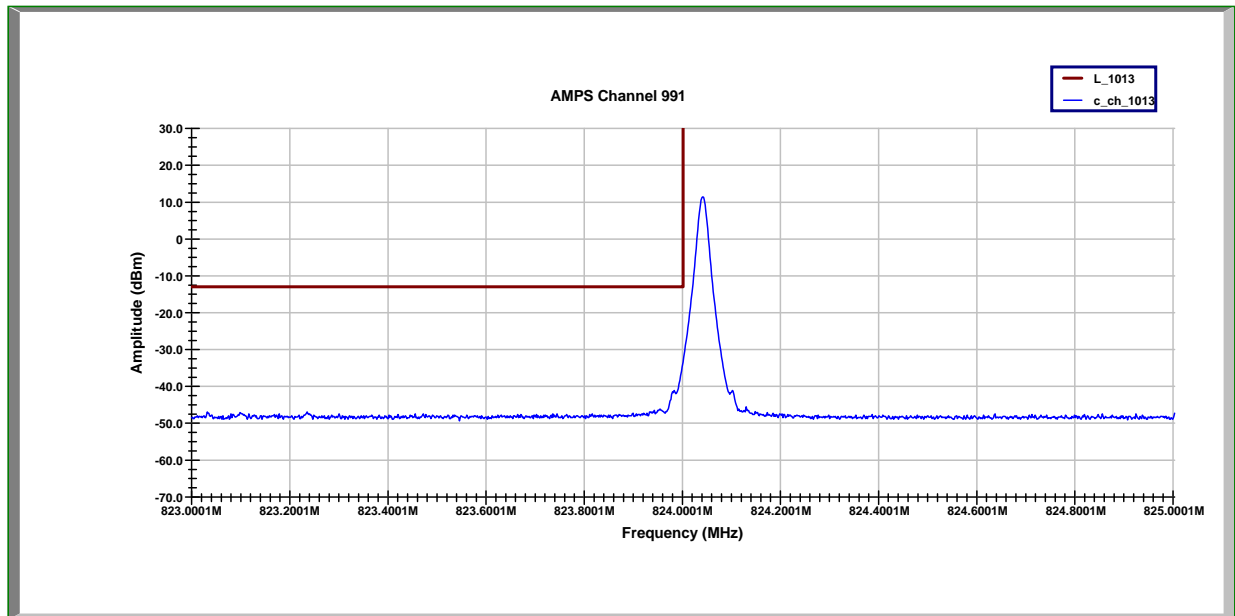


Figure 8-28: Emissions within 1 MHz of band edge, AMPS Channel 799 - Uplink

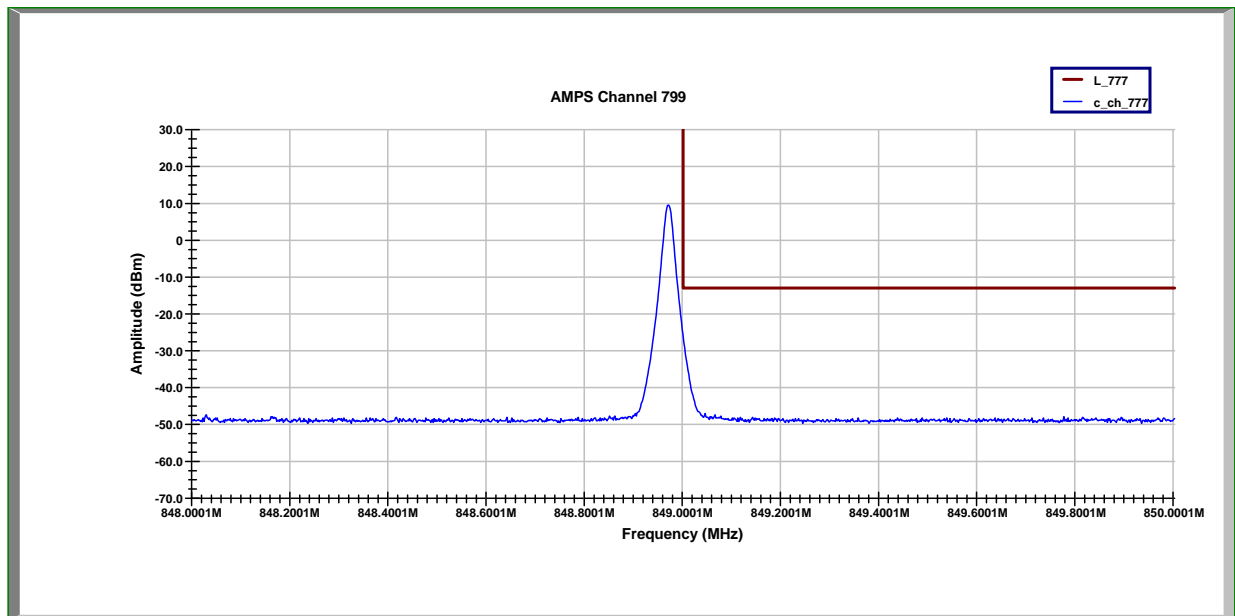


Figure 8-29: Out of band emissions at antenna terminals – Intermodulation Cell Band - Uplink

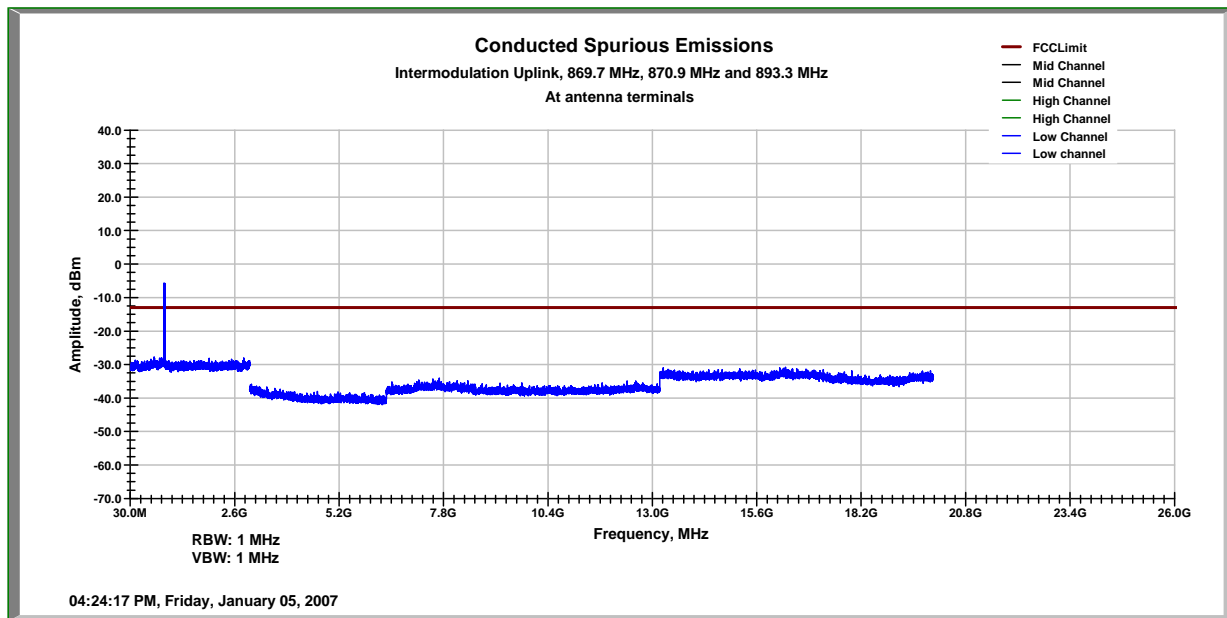


Figure 8-30: Out of band emissions at antenna terminals – Intermodulation (Zoomed Around Carrier Frequencies) Cell Band - Uplink

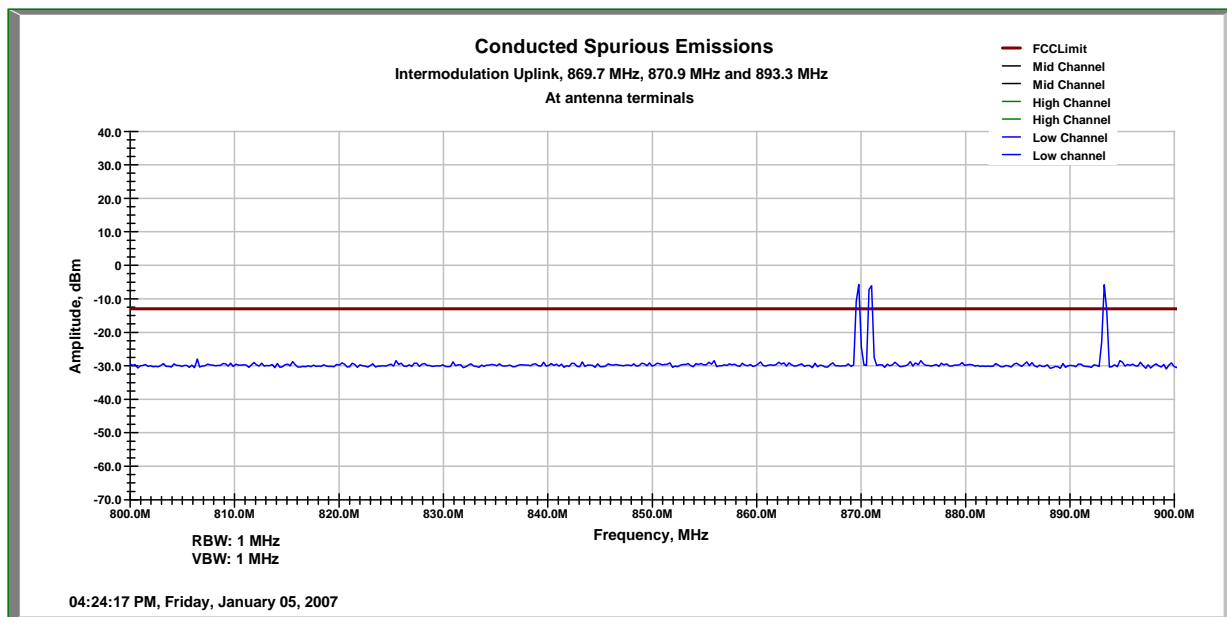


Figure 8-31: Out of band emissions at antenna terminals – Intermodulation PCS Band - Uplink

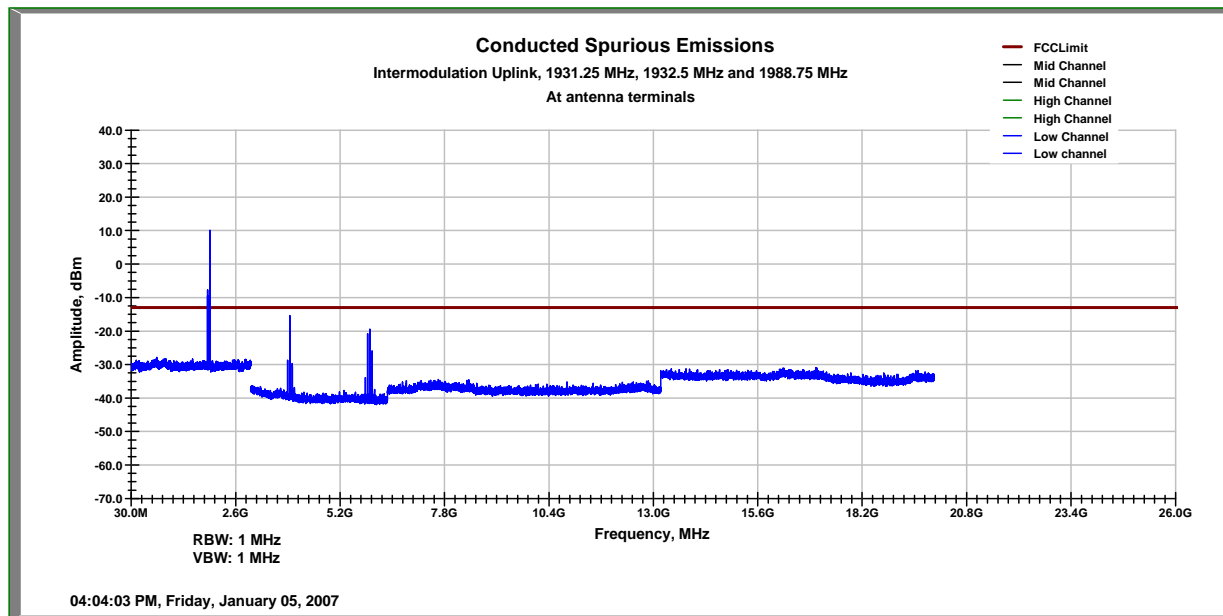


Figure 8-32: Out of band emissions at antenna terminals – Intermodulation (Zoomed Around Carrier Frequencies) PCS Band - Uplink

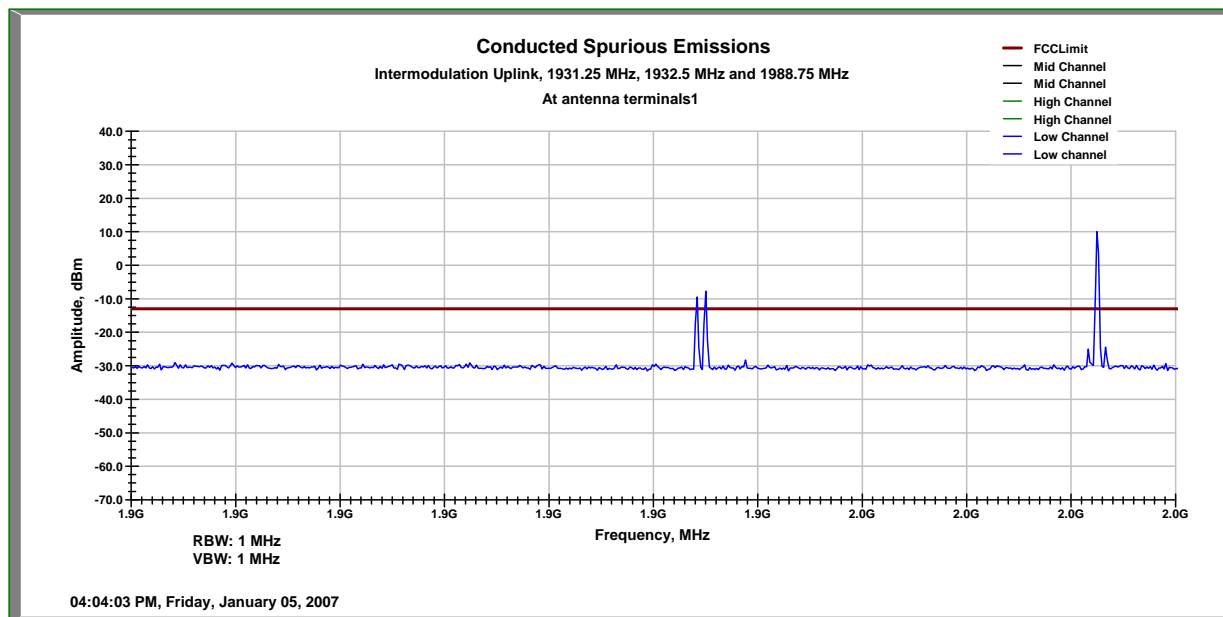


Table 8-3: Out of band emissions at antenna terminals – Downlink

EUT Mode	TX Channel	Spurious Emission Frequency (MHz)	Device Reading (dBuV)	Attenuation (dB)	Cable Loss (dB)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)
AMPS	991	1990	-43.5	20	0.3	-23.2	-13	-10.2
AMPS	384	1990	-42.5	20	0.3	-22.2	-13	-9.2
AMPS	799	1990	-42.89	20	0.3	-22.59	-13	-9.59
CDMA PCS	25	879.42	-57.98	20	0.2	-37.78	-13	-24.78
CDMA PCS	25	3863	-44.07	20.1	0.5	-23.47	-13	-10.47
CDMA PCS	25	5794	-48.71	20.1	0.8	-27.81	-13	-14.81
CDMA PCS	600	3920	-61.2	20.1	0.5	-40.6	-13	-27.6
CDMA PCS	600	5880	-57.8	20.1	0.8	-36.9	-13	-23.9
CDMA PCS	1175	3977.5	-36.12	20.1	0.5	-15.52	-13	-2.52
CDMA PCS	1175	5966.5	-39.19	20.1	0.8	-18.29	-13	-5.29
GSM 850	128	1990	-37.1	20	0.3	-16.8	-13	-3.8
GSM 850	190	1990	-38.1	20	0.3	-17.8	-13	-4.8
GSM 850	251	1990	-36.83	20	0.3	-16.53	-13	-3.53
GSM 1900	512	3859	-42.37	20.1	0.5	-21.77	-13	-8.77
GSM 1900	512	5790	-44.86	20.1	0.8	-23.96	-13	-10.96
GSM 1900	661	3920	-47.4	20.1	0.5	-26.8	-13	-13.8
GSM 1900	661	5880	-34.1	20.1	0.8	-13.2	-13	-0.2
GSM 1900	810	3980	-33.9	20.1	0.5	-13.3	-13	-0.3
GSM 1900	810	5969	-36.2	20.1	0.8	-15.3	-13	-2.3
TDMA 850	991	1990	-39.8	20	0.3	-19.5	-13	-6.5
TDMA 850	384	1990	-36.5	20	0.3	-16.2	-13	-3.2
TDMA 850	799	1990	-37.3	20	0.3	-17	-13	-4
TDMA 1900	2	3860	-42.2	20.1	0.5	-21.6	-13	-8.6
TDMA 1900	2	5790	-44.5	20.1	0.8	-23.6	-13	-10.6
TDMA 1900	999	3920	-45.7	20.1	0.5	-25.1	-13	-12.1
TDMA 1900	999	5880	-34.1	20.1	0.8	-13.2	-13	-0.2
TDMA 1900	1998	3980	-33.85	20.1	0.5	-13.25	-13	-0.25
TDMA 1900	1998	5969	-36.09	20.1	0.8	-15.19	-13	-2.19

Table 8-4: Intermodulation Attenuation – Downlink

Band	Spurious Emission Frequency (MHz)	Device Reading (dBm)	Attenuation (dB)	Cable Loss (dB)	Conducted Power (dBm)	Limit (dBm)	Margin (dB)
Downlink Cell	823.5	-39.57	20	0.2	-19.37	-13	-6.37
Downlink Cell	849.5	-34.83	20	0.2	-14.63	-13	-1.63
Downlink Cell	847.1	-33.8	20	0.2	-13.6	-13	-0.6
Downlink Cell	827.1	-39.1	20	0.2	-18.9	-12	-6.9

Figure 8-33: Out of band emissions at antenna terminals – CDMA Cell Channel 384, 777, and 1013 – Downlink

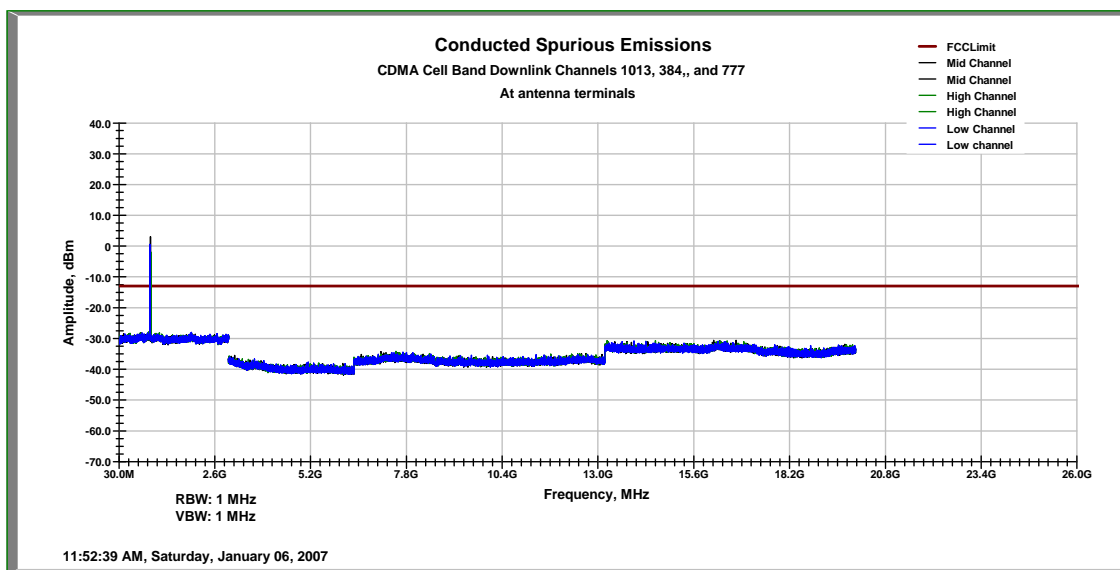


Figure 8-34: Out of band emissions at antenna terminals – CDMA PCS Channel 384, 777, and 1013 (Zoomed Around Carrier Frequencies) – Downlink

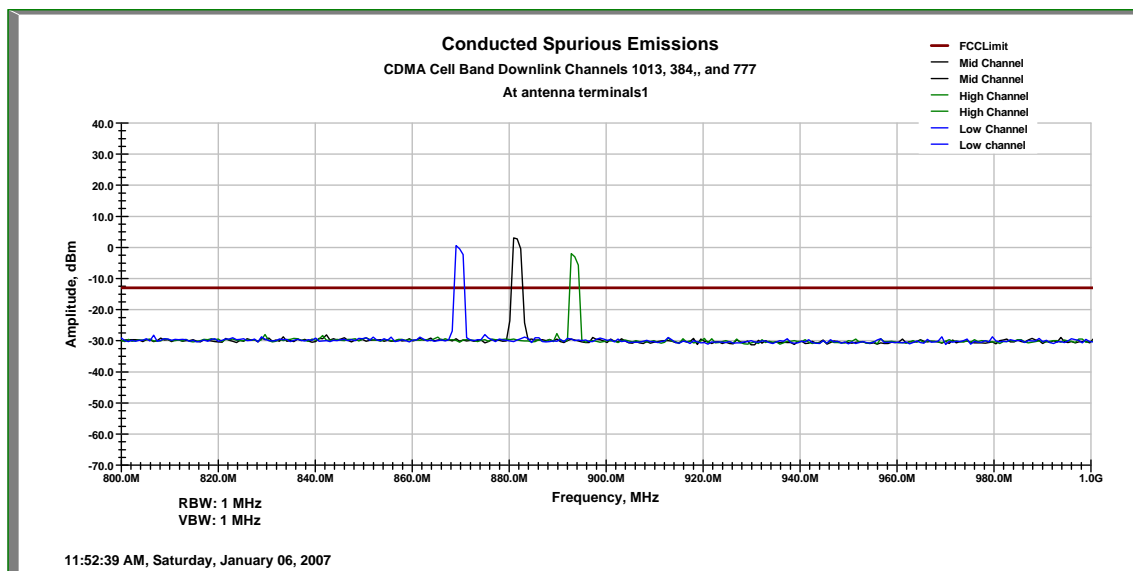


Figure 8-35: Out of band emissions at antenna terminals – CDMA PCS Channel 25, 600, 1175 – Downlink

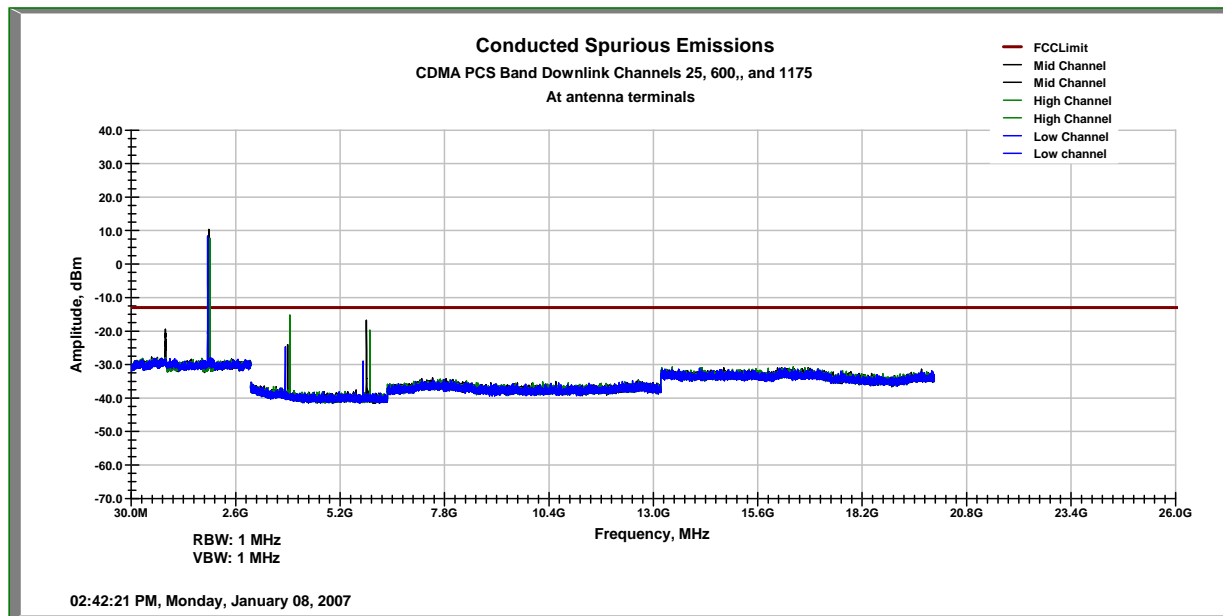


Figure 8-36: Out of band emissions at antenna terminals – CDMA PCS Channel 25, 600, 1175 (Zoomed In on Carrier Frequencies) – Downlink

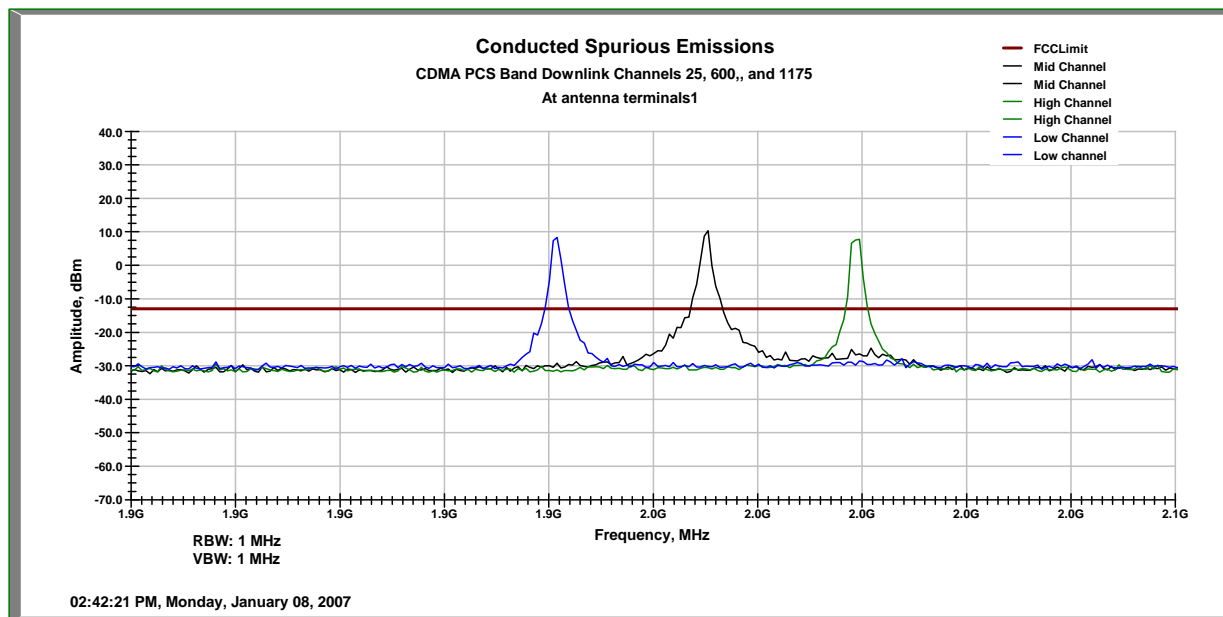


Figure 8-37: Emissions within 1 MHz of band edge, CDMA Cell Channel 1013 – Downlink

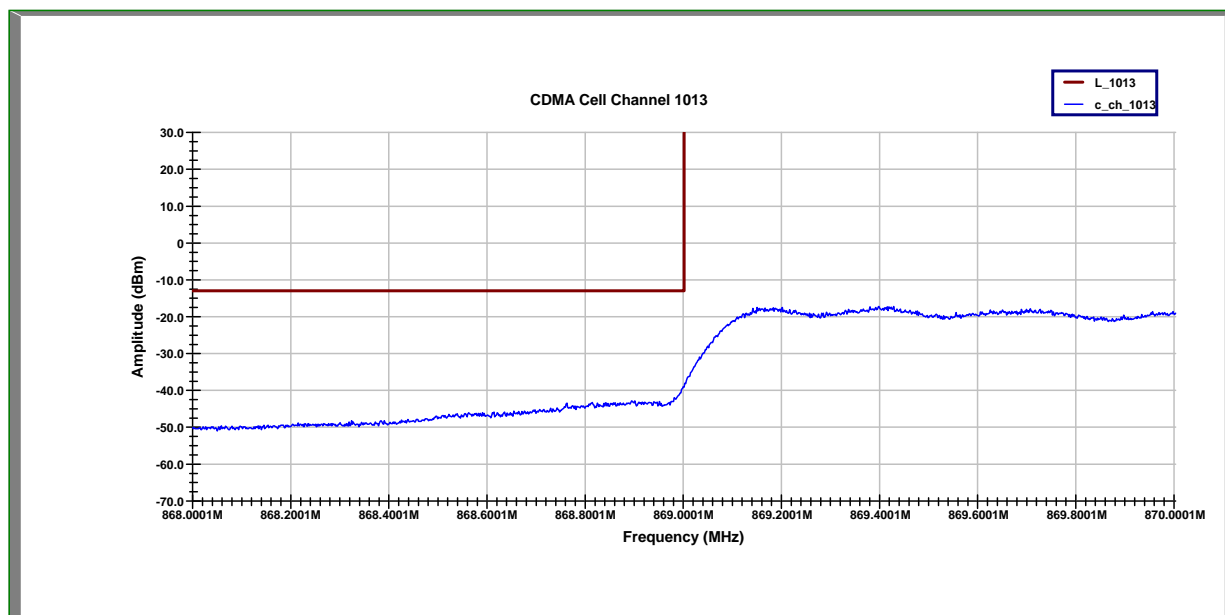


Figure 8-38: Emissions within 1 MHz of band edge, CDMA Cell Channel 777 – Downlink

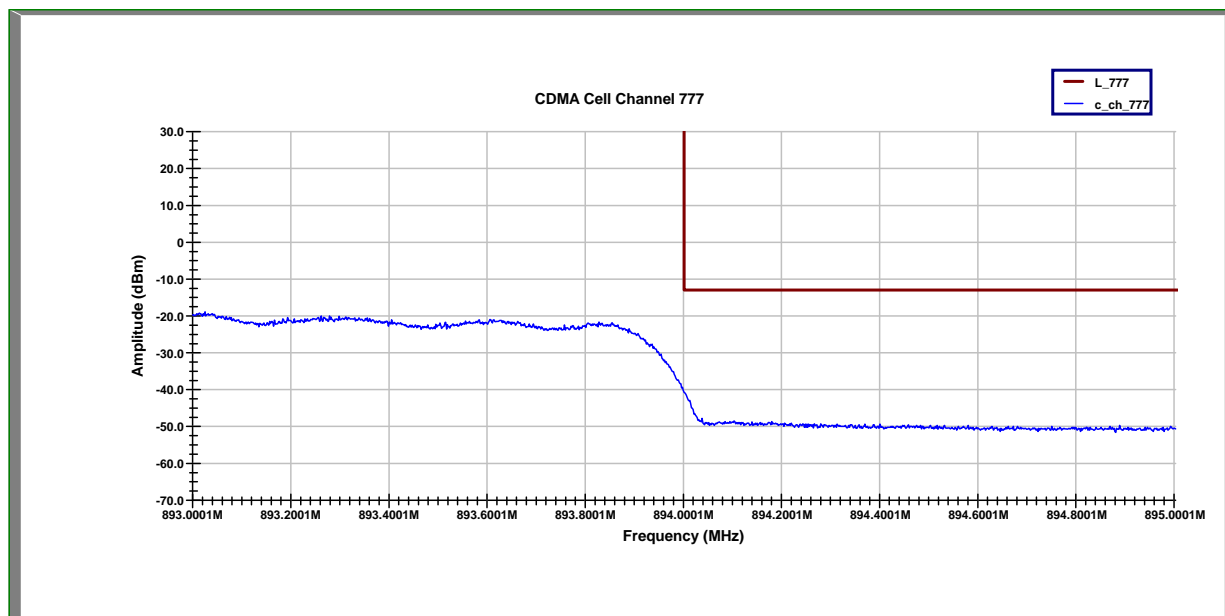


Figure 8-39: Emissions within 1 MHz of band edge, CDMA PCS Channel 25 – Downlink

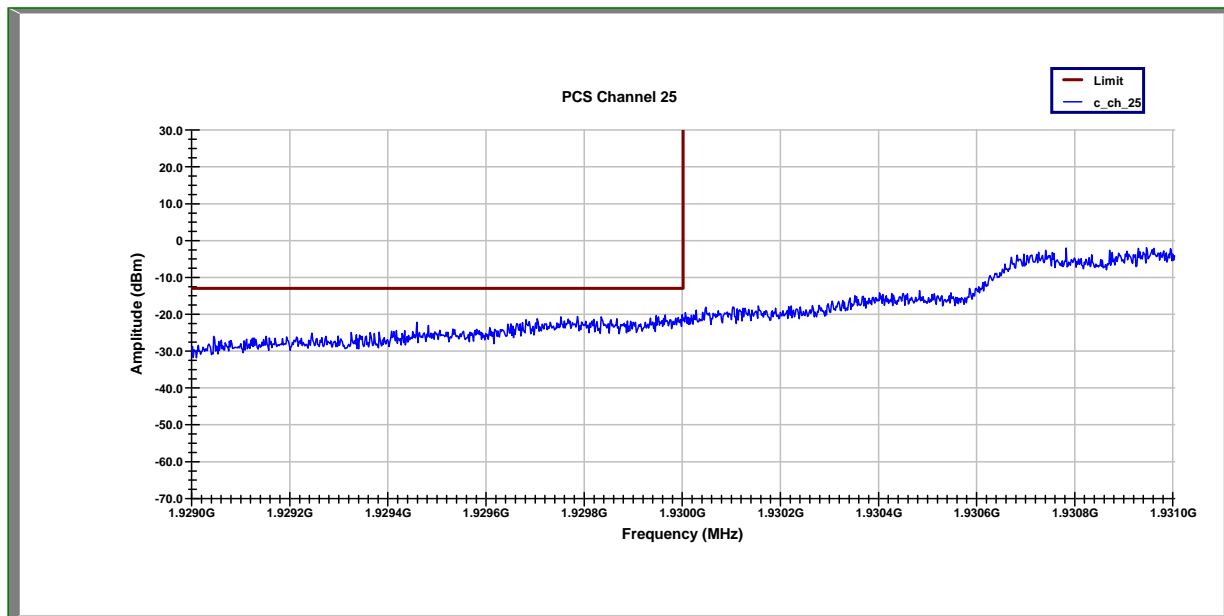


Figure 8-40: Emissions within 1 MHz of band edge, CDMA PCS Channel 1175 – Downlink

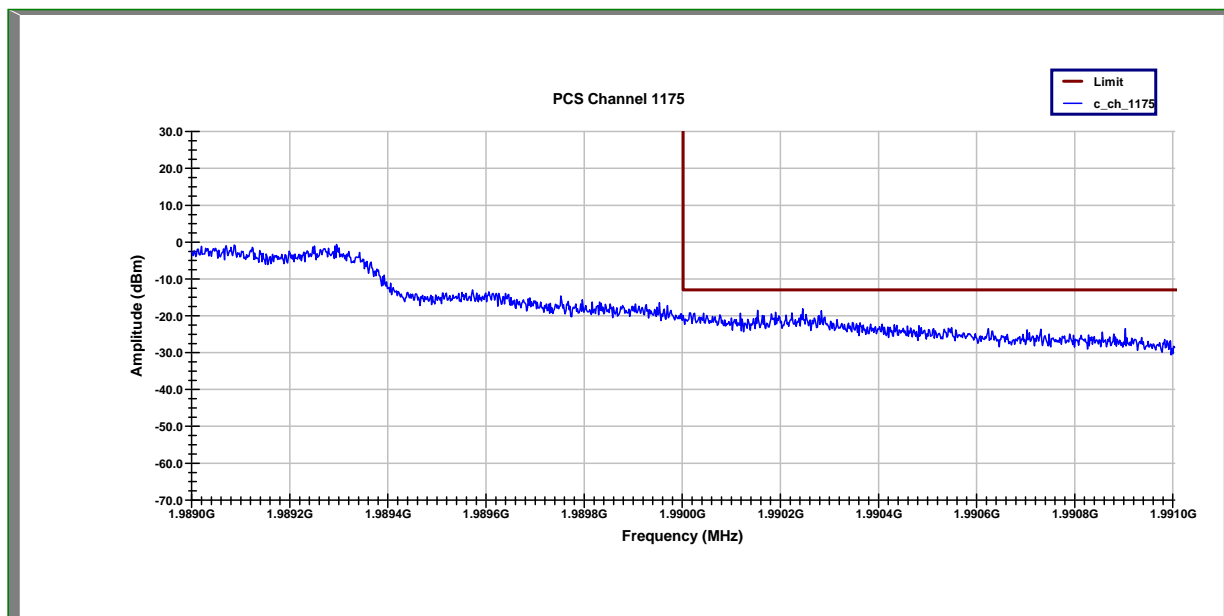


Figure 8-41: Out of band emissions at antenna terminals – GSM 850 Channel 128, 190, and 251 – Downlink

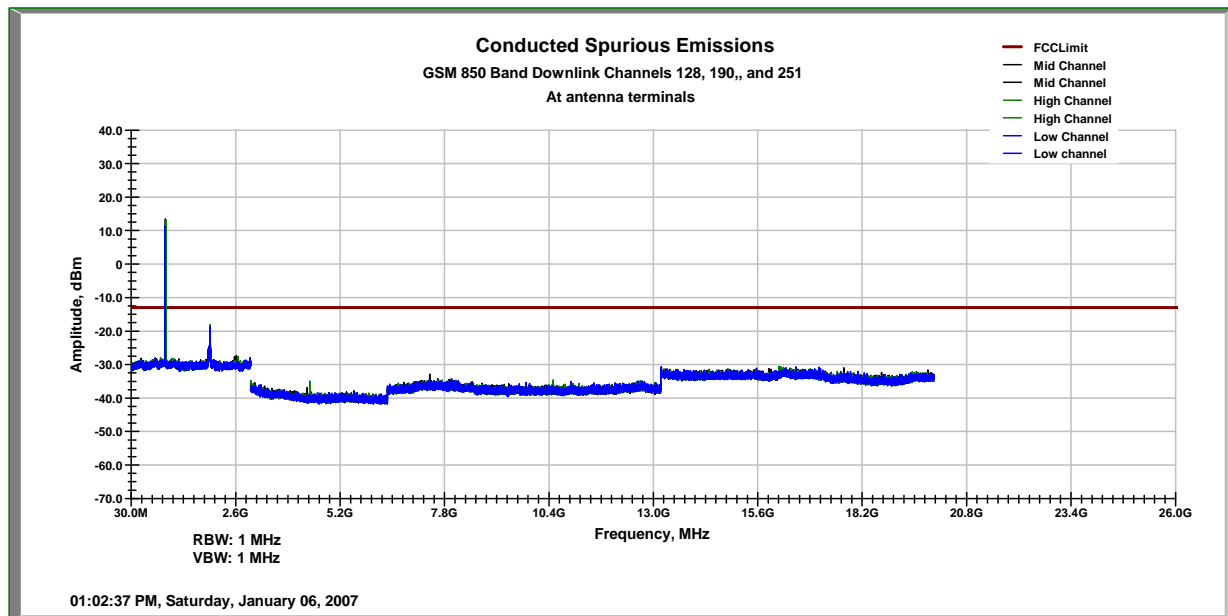


Figure 8-42: Out of band emissions at antenna terminals – GSM 850 Channel 128, 190, and 251 (Zoomed Around Carrier Frequencies) - Downlink

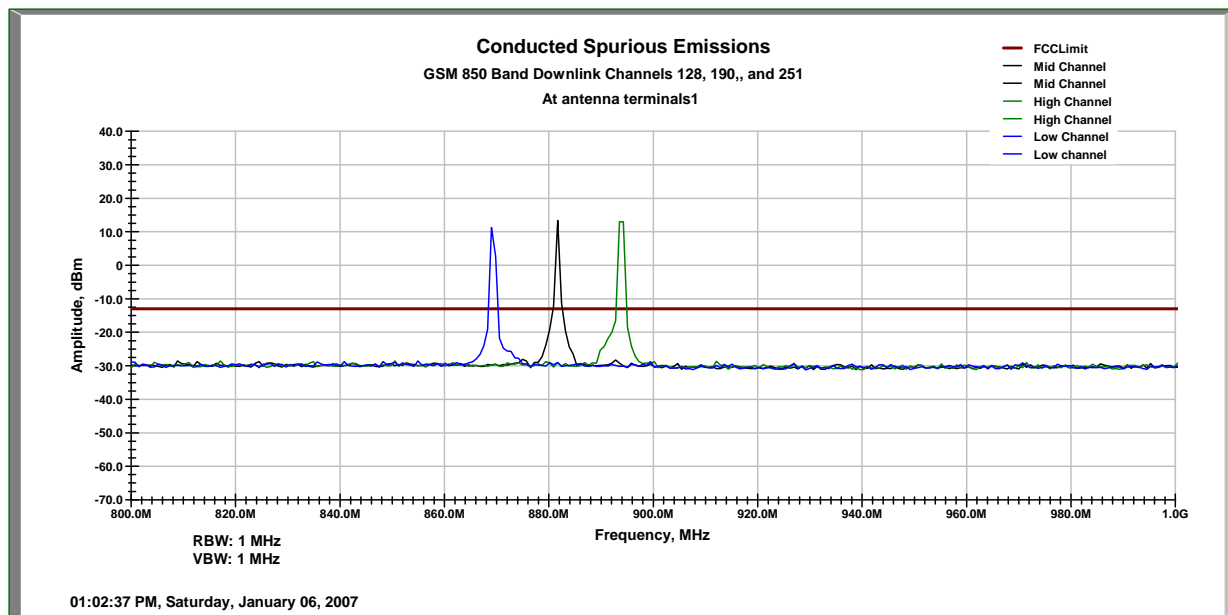


Figure 8-43: Out of band emissions at antenna terminals – GSM 1900 Channel 512, 661, 810 - Downlink

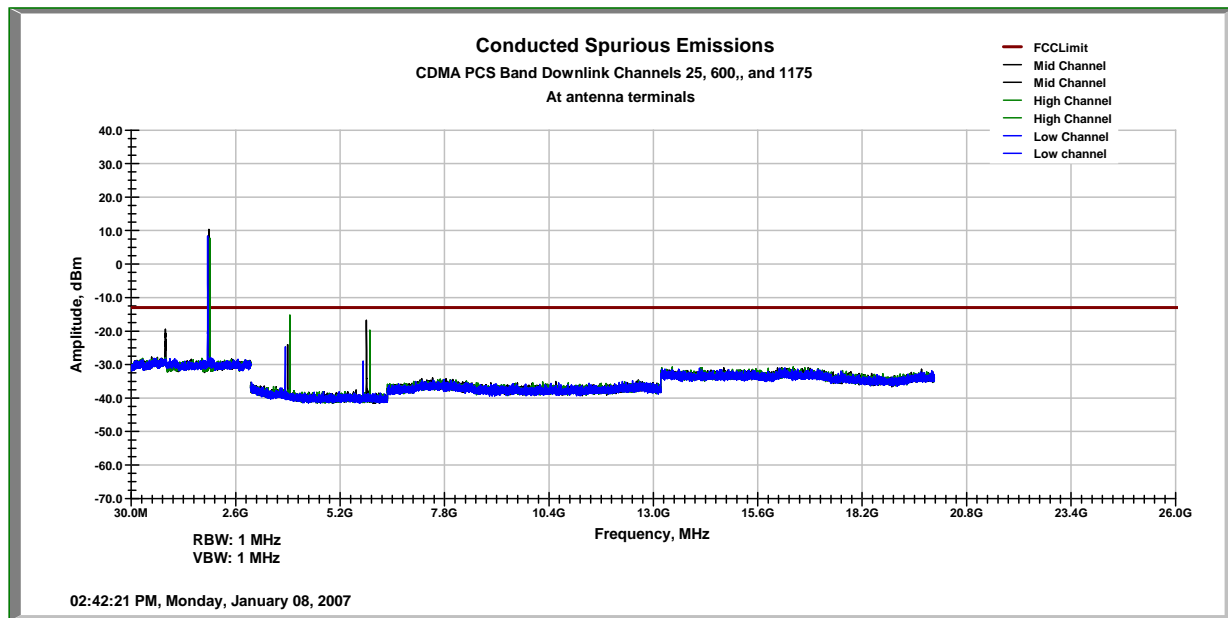


Figure 8-44: Out of band emissions at antenna terminals – GSM 1900 Channel 512, 661, 810 (Zoomed In on Carrier Frequencies) – Downlink

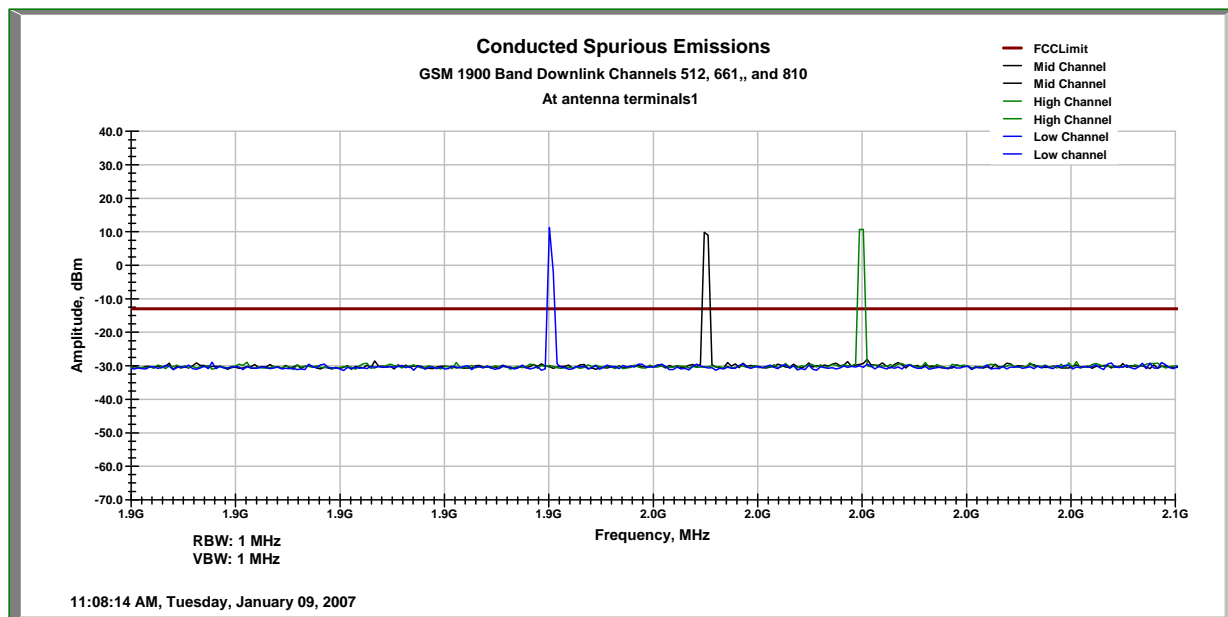


Figure 8-45: Emissions within 1 MHz of band edge, GSM 850 Channel 128 – Downlink

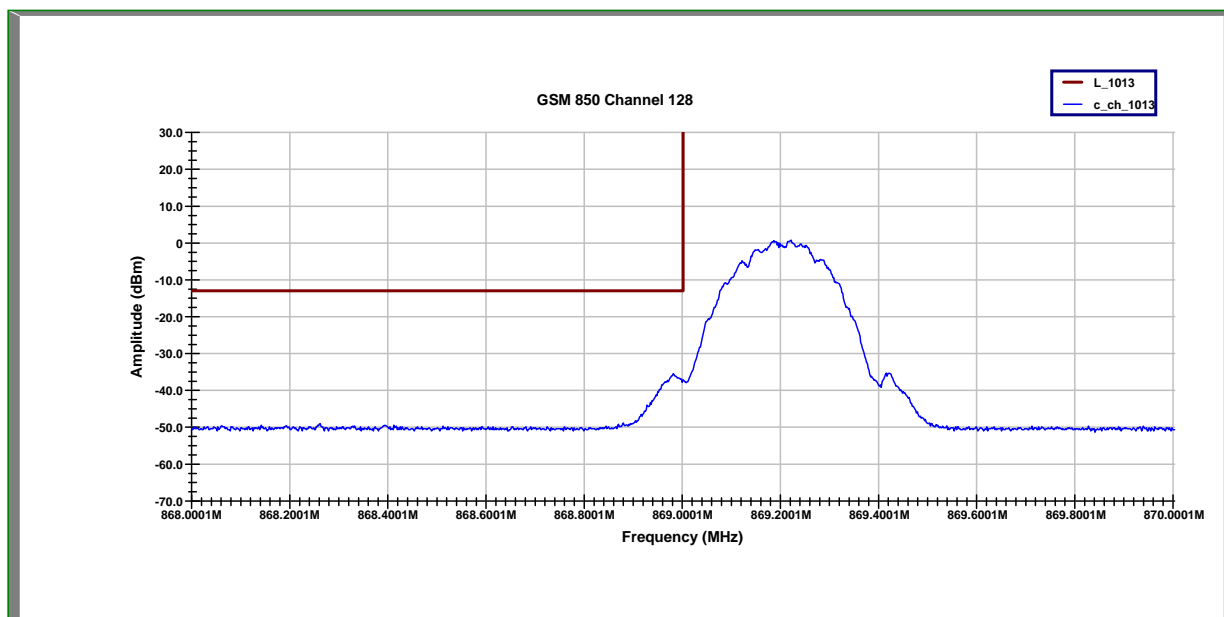
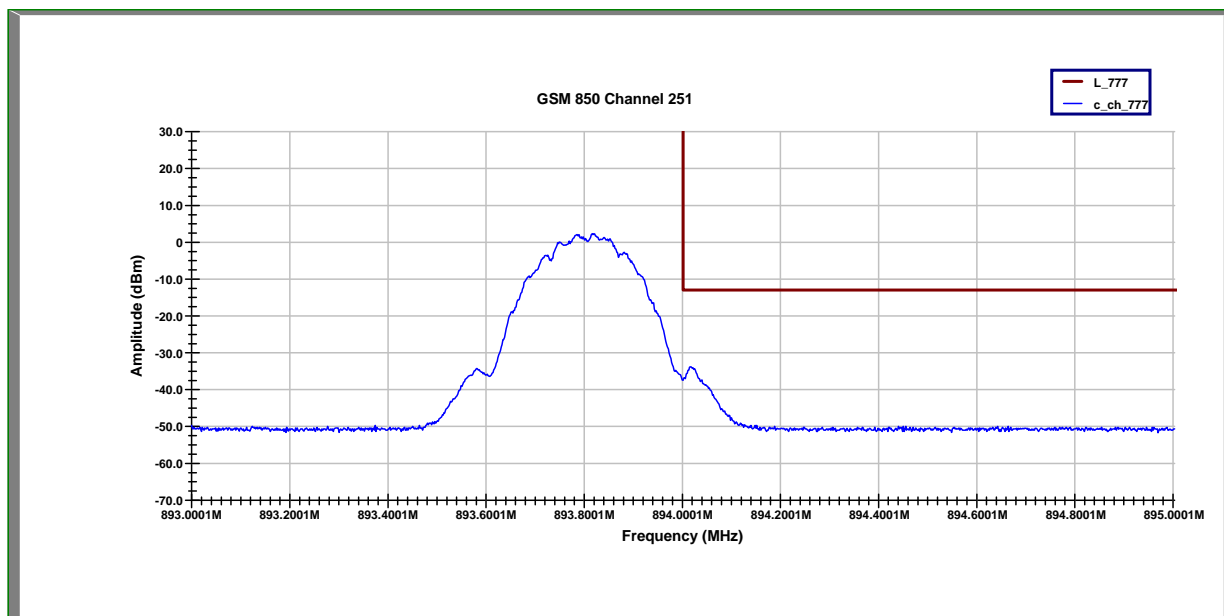


Figure 8-46: Emissions within 1 MHz of band edge, GSM 850 Channel 251 - Downlink



Evaluation For: HomeCell, LLC
Model Number: HomeCell 2.0

FCC ID: U3FHOMECCELL20

Figure 8-47: Emissions within 1 MHz of band edge, GSM 1900 Channel 512 – Downlink

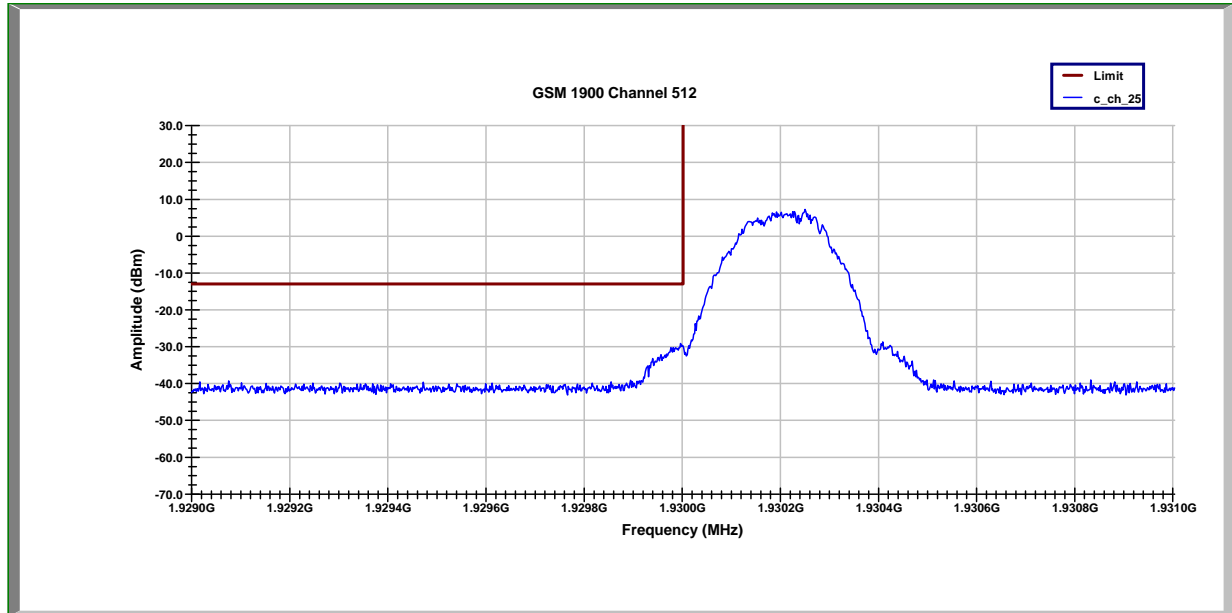


Figure 8-48: Emissions within 1 MHz of band edge, GSM 1900 Channel 810 – Downlink

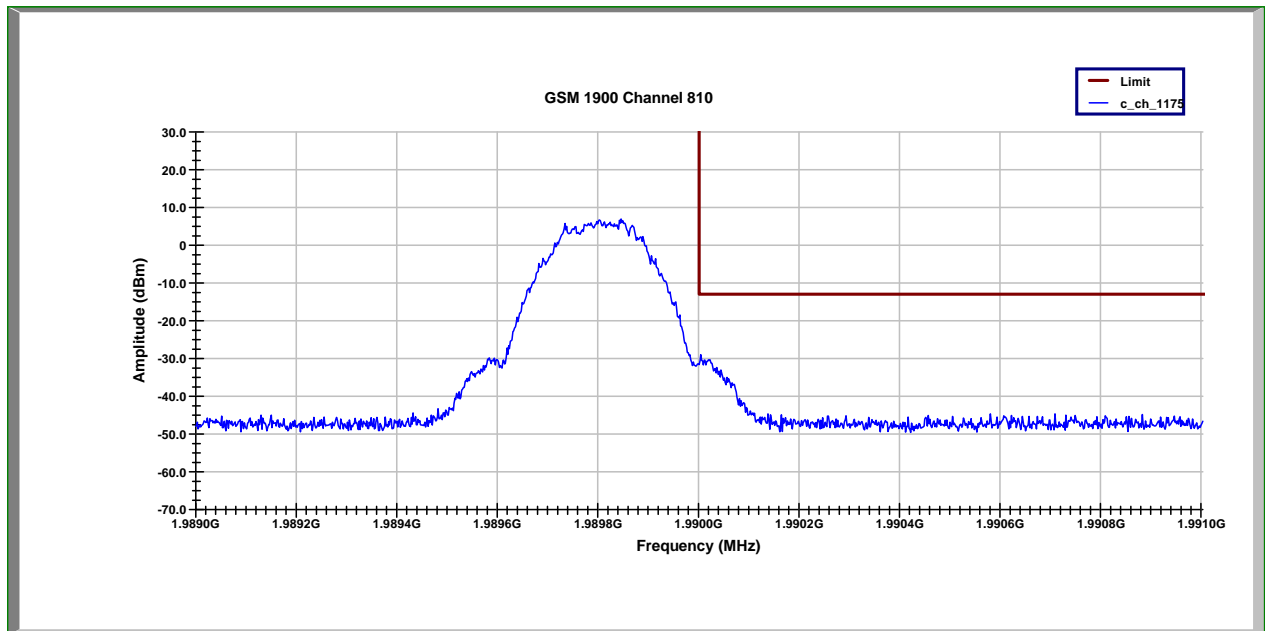


Figure 8-49: Out of band emissions at antenna terminals – TDMA Cell Channel 991, 384, and 799 – Downlink

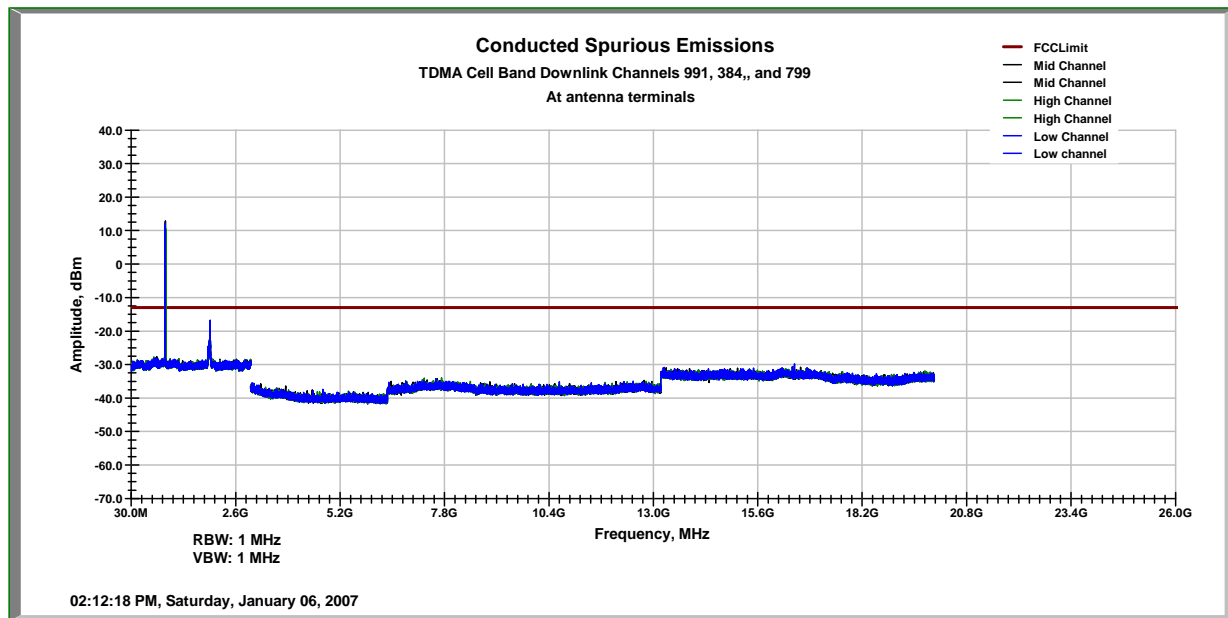


Figure 8-50: Out of band emissions at antenna terminals – TDMA Cell Channel 991, 384, and 799 (Zoomed Around Carrier Frequencies) – Downlink

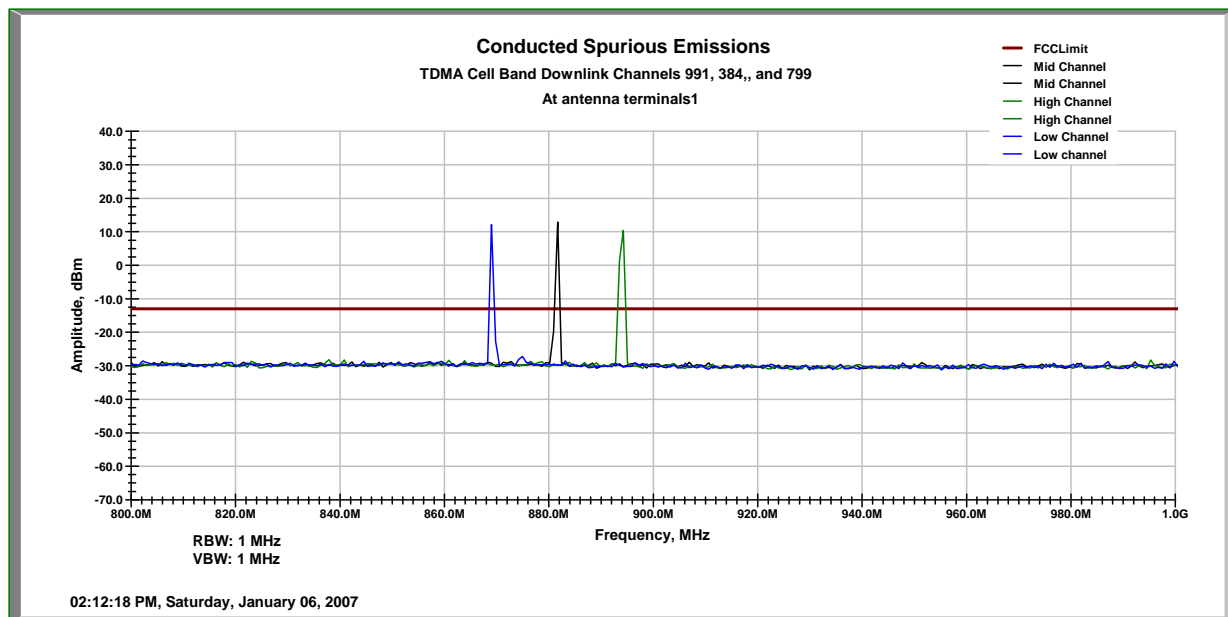


Figure 8-51: Out of band emissions at antenna terminals – TDMA PCS Channel 2, 999, 1998 – Downlink

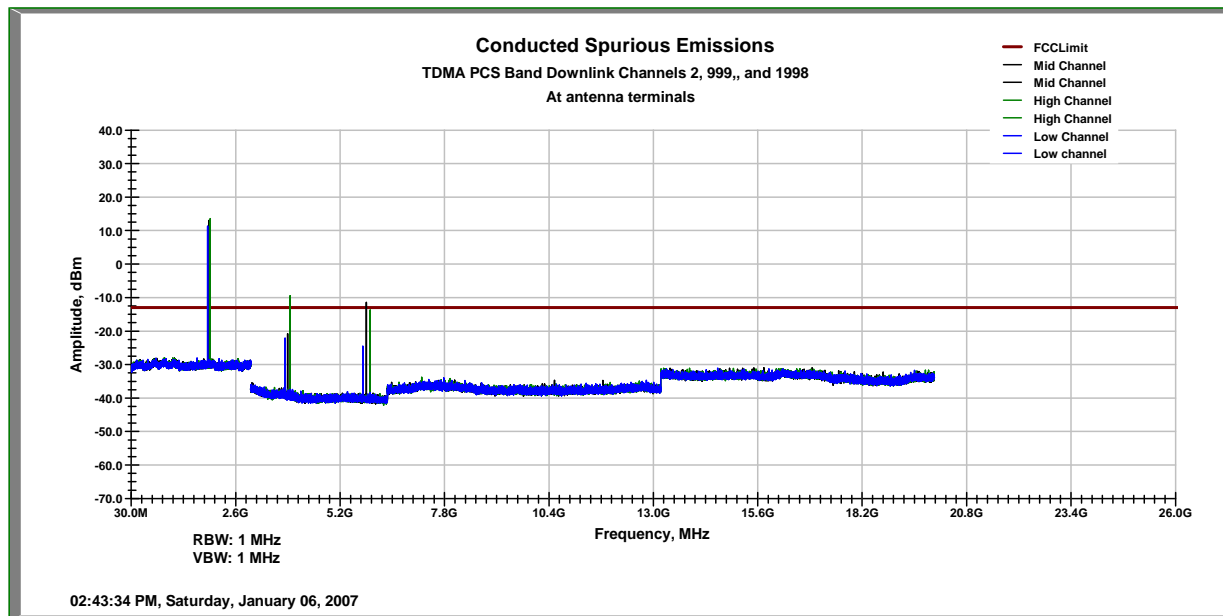


Figure 8-52: Out of band emissions at antenna terminals – TDMA PCS Channel 2, 999, 1998 (Zoomed In on Carrier Frequencies) – Downlink

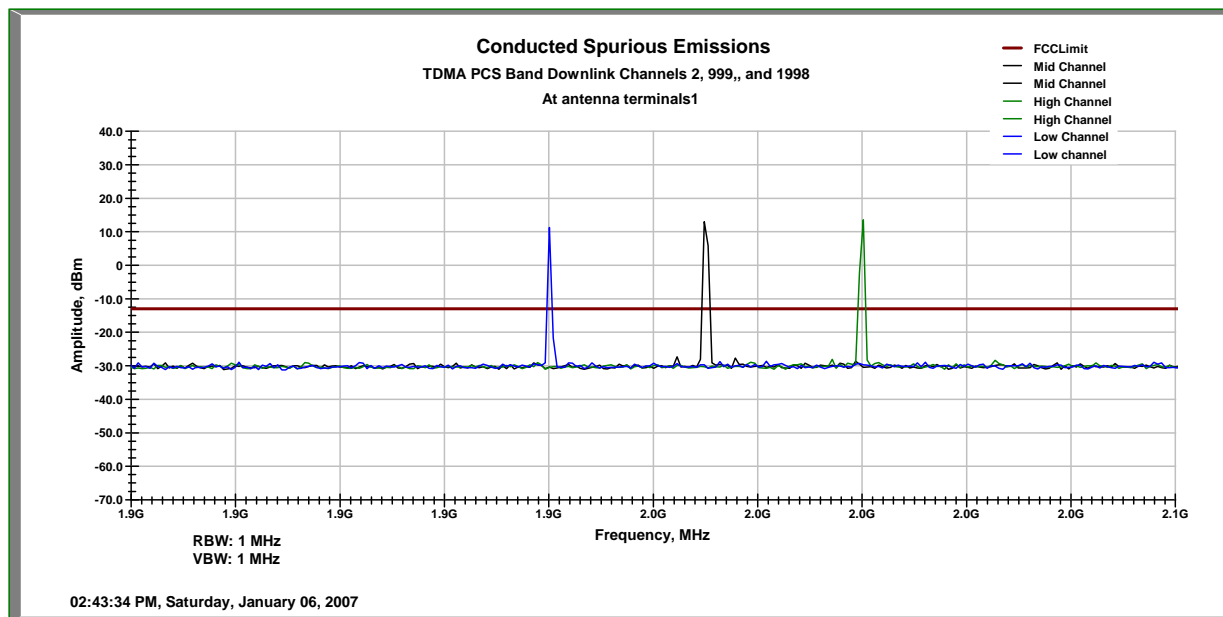


Figure 8-53: Emissions within 1 MHz of band edge, TDMA Cell Channel 991 – Downlink

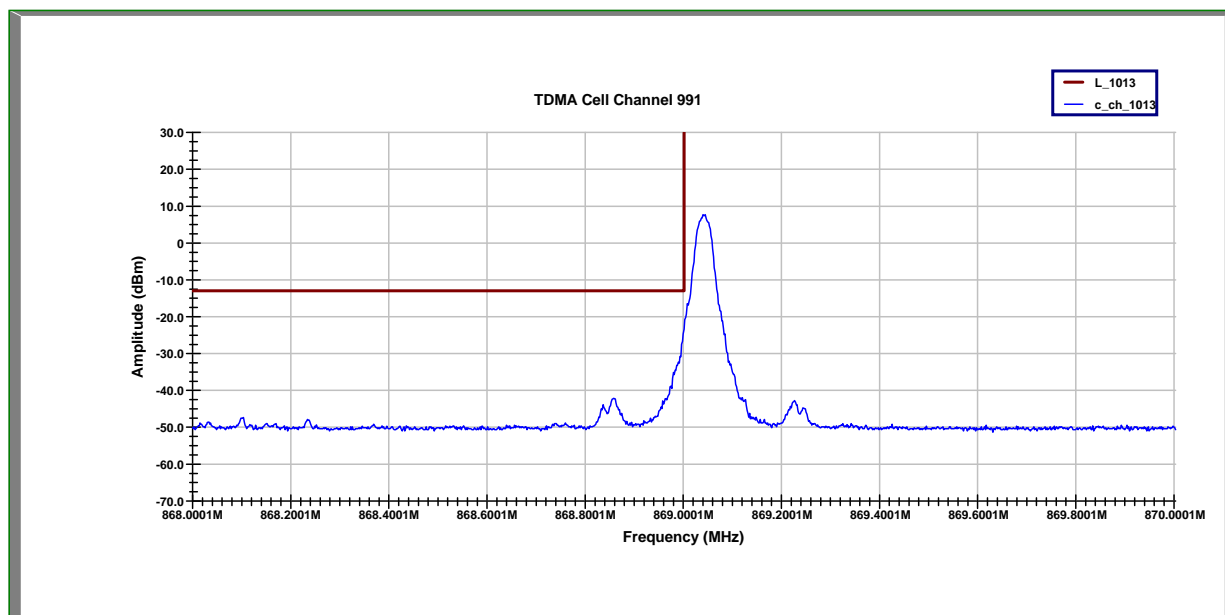


Figure 8-54: Emissions within 1 MHz of band edge, TDMA Cell Channel 799 – Downlink

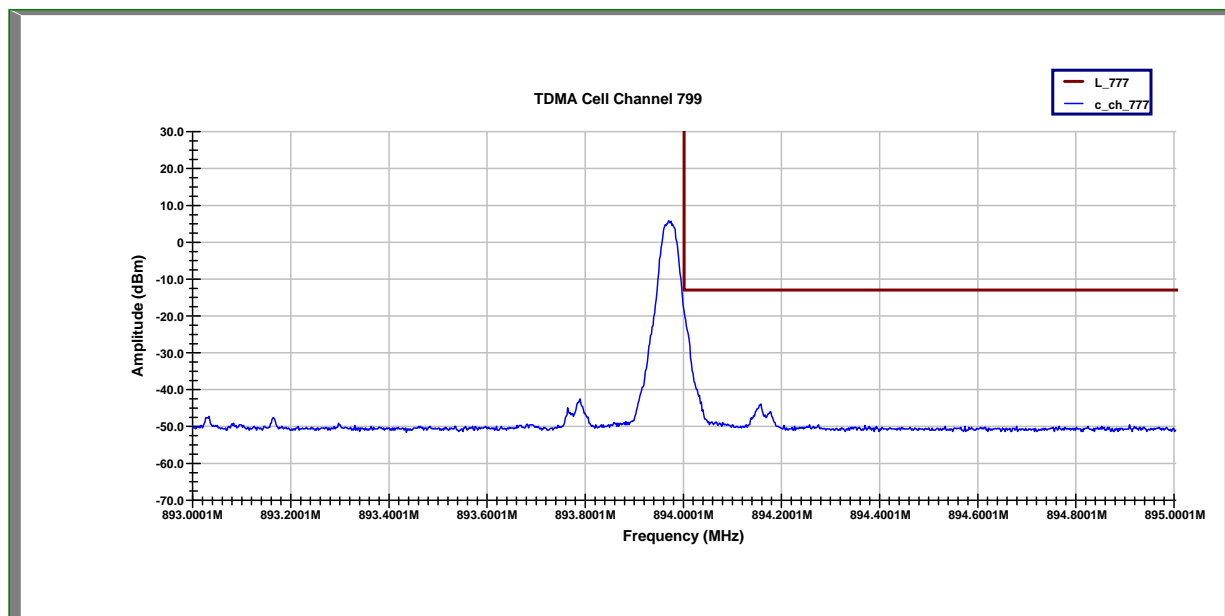


Figure 8-55: Emissions within 1 MHz of band edge, TDMA PCS Channel 2 – Downlink

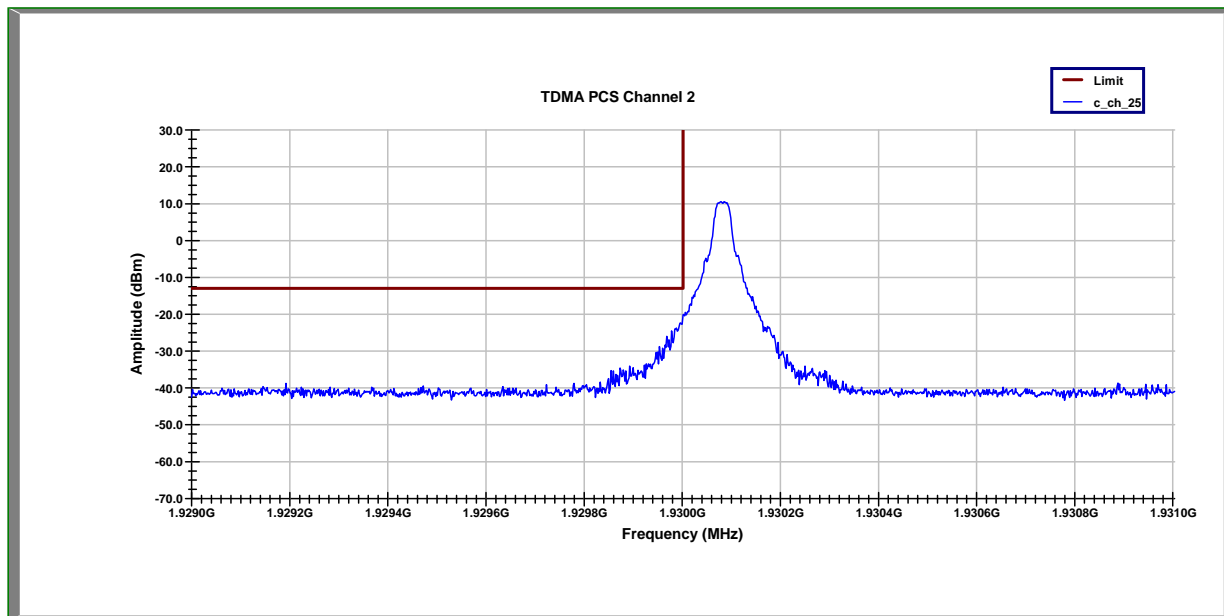


Figure 8-56: Emissions within 1 MHz of band edge, TDMA PCS Channel 1998 - Downlink

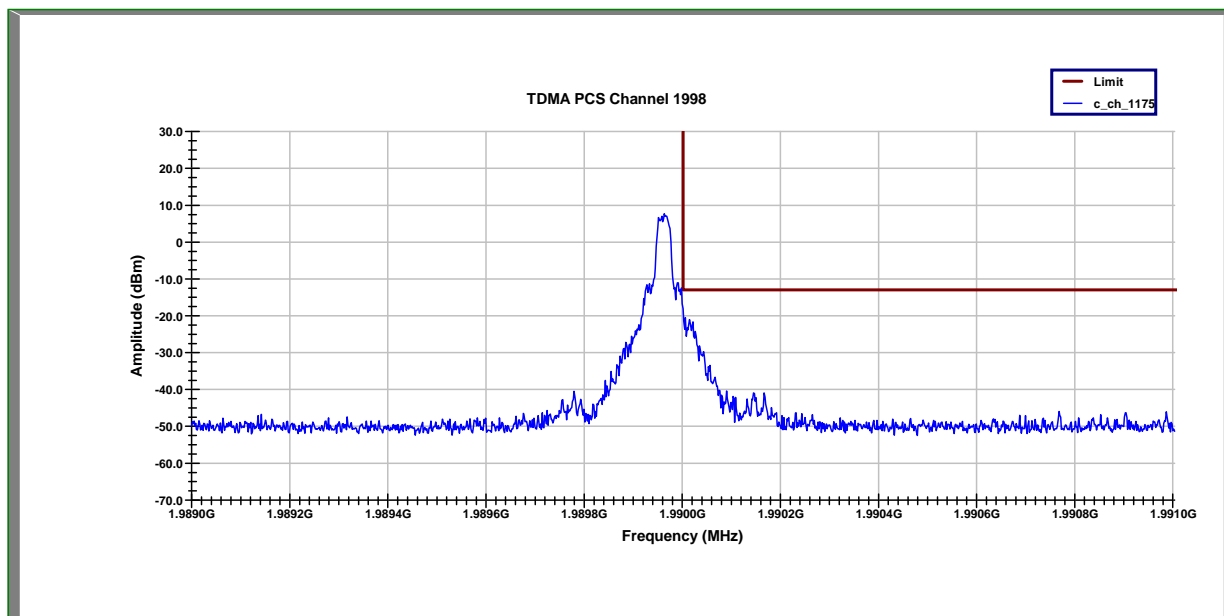


Figure 8-57: Out of band emissions at antenna terminals – AMPS Channel 991, 384, and 799 – Downlink

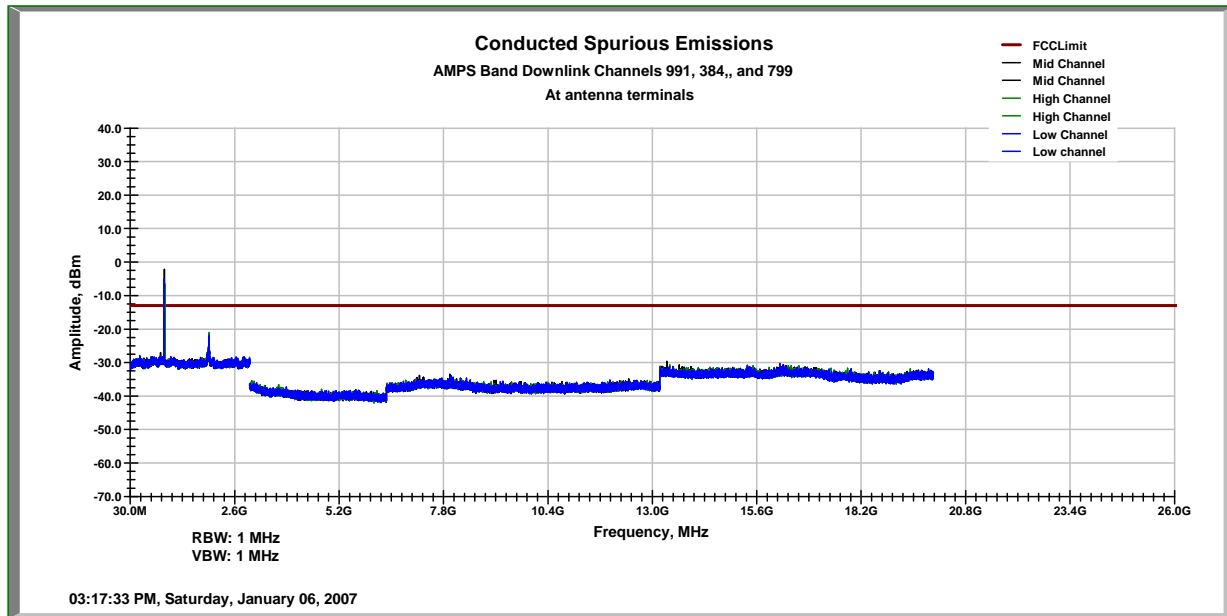


Figure 8-58: Out of band emissions at antenna terminals – AMPS Channel 991, 384, and 799 (Zoomed Around Carrier Frequencies) – Downlink

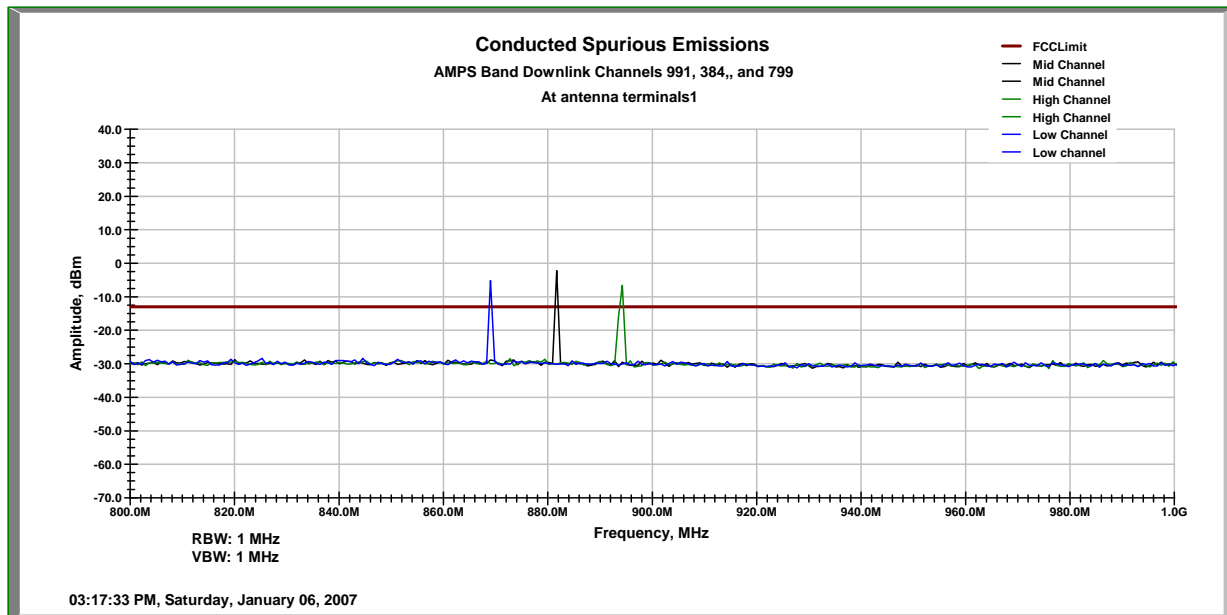


Figure 8-59: Emissions within 1 MHz of band edge, AMPS Channel 991 – Downlink

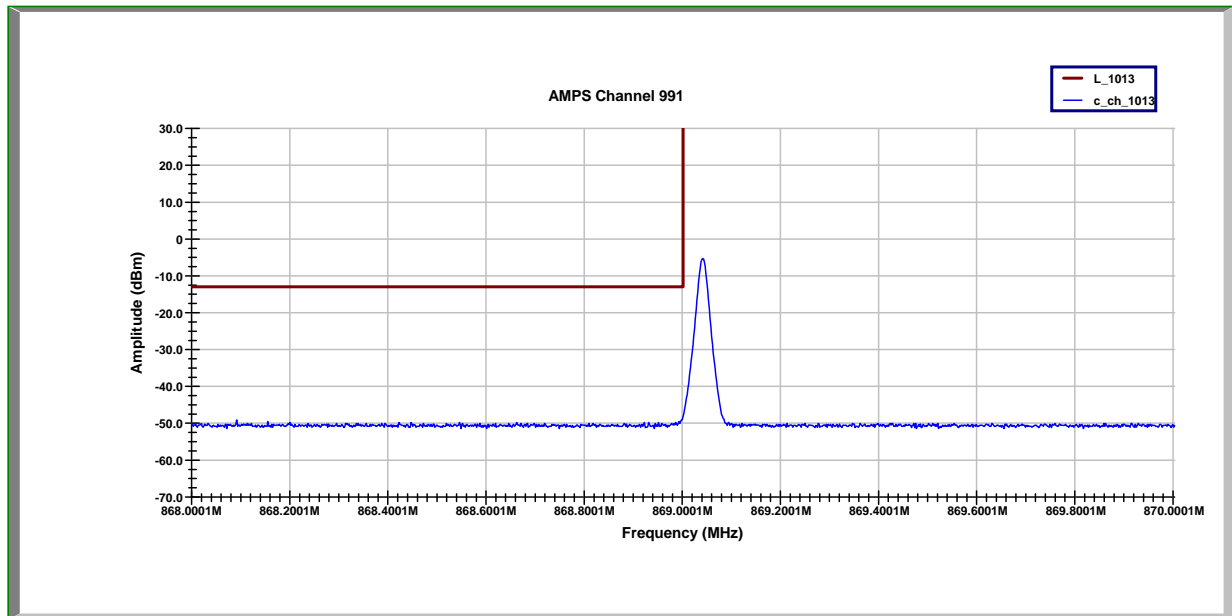


Figure 8-60: Emissions within 1 MHz of band edge, CDMA Cell Channel 777 – Downlink

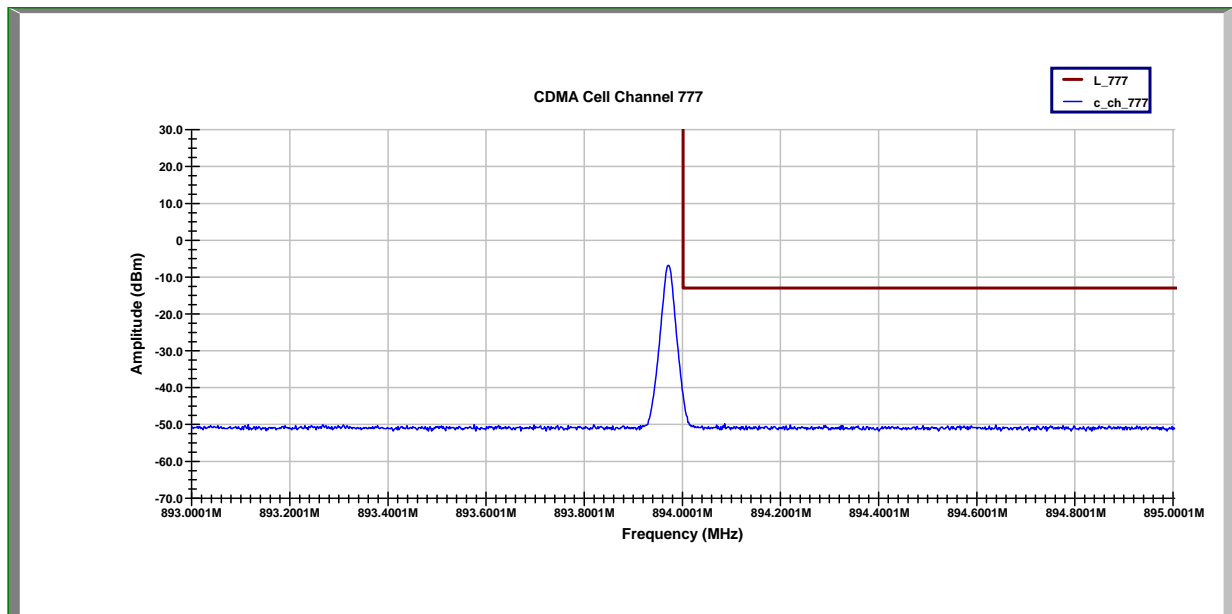


Figure 8-61: Out of band emissions at antenna terminals – Intermodulation Cell Band - Downlink

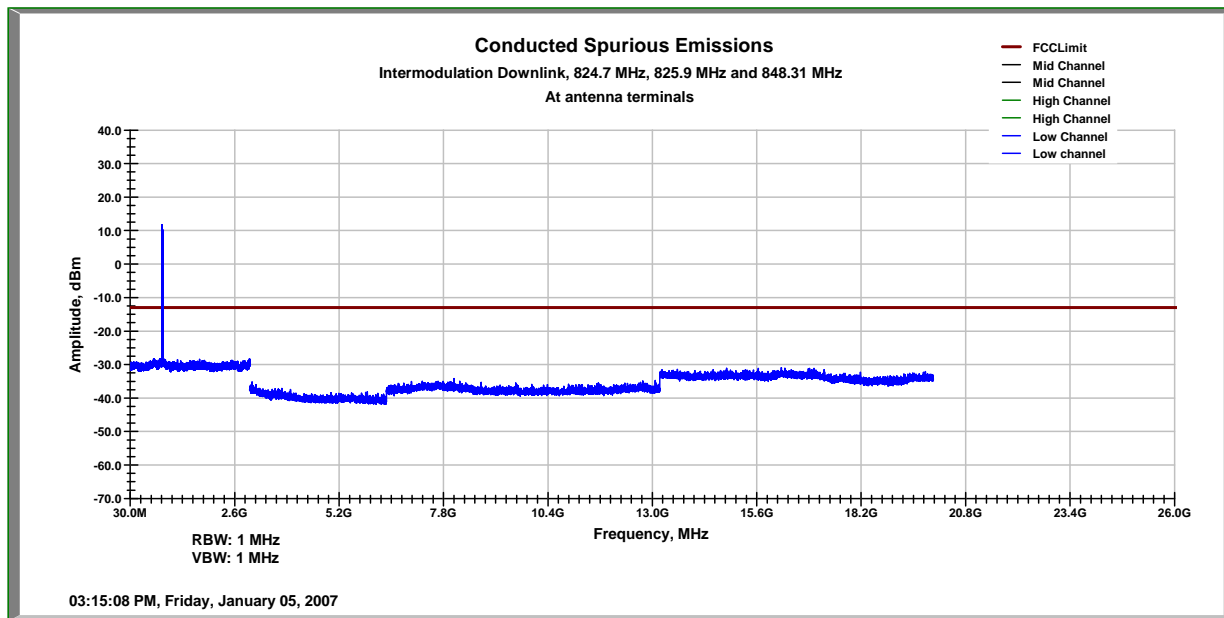


Figure 8-62: Out of band emissions at antenna terminals – Intermodulation (Zoomed Around Carrier Frequencies) Cell Band – Downlink

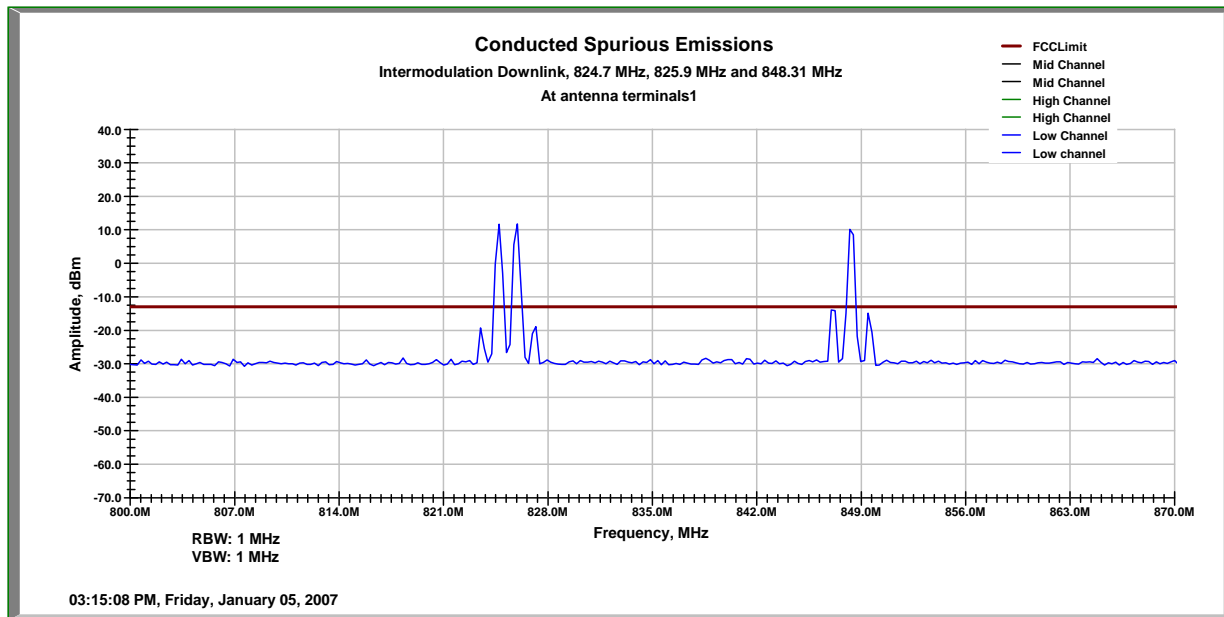


Figure 8-63: Out of band emissions at antenna terminals – Intermodulation PCS Band - Downlink

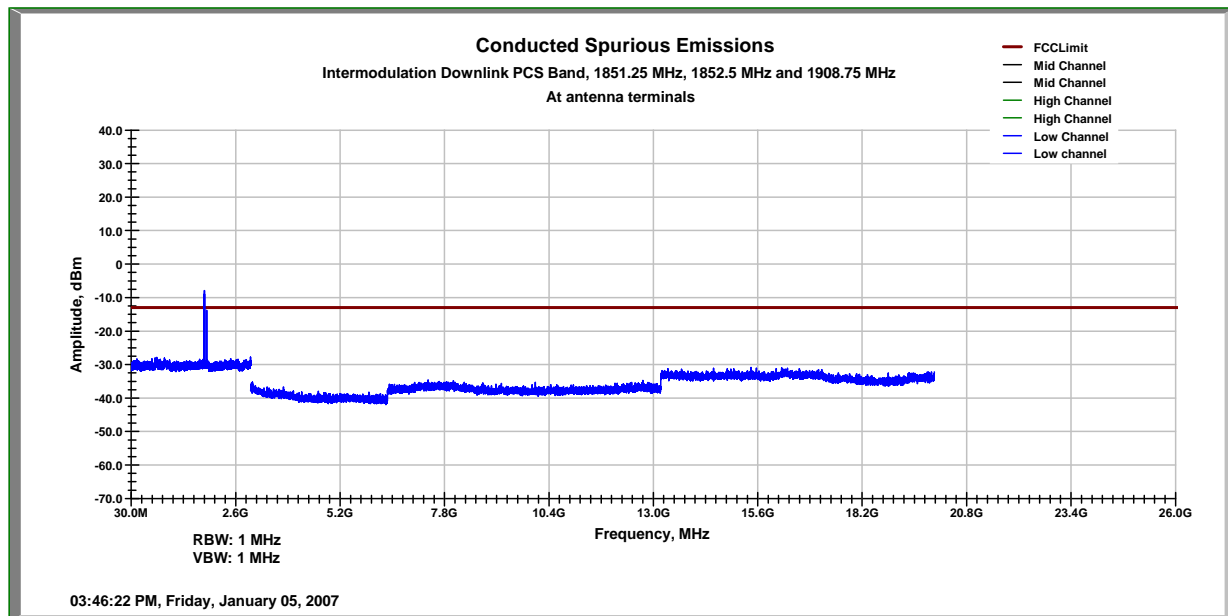
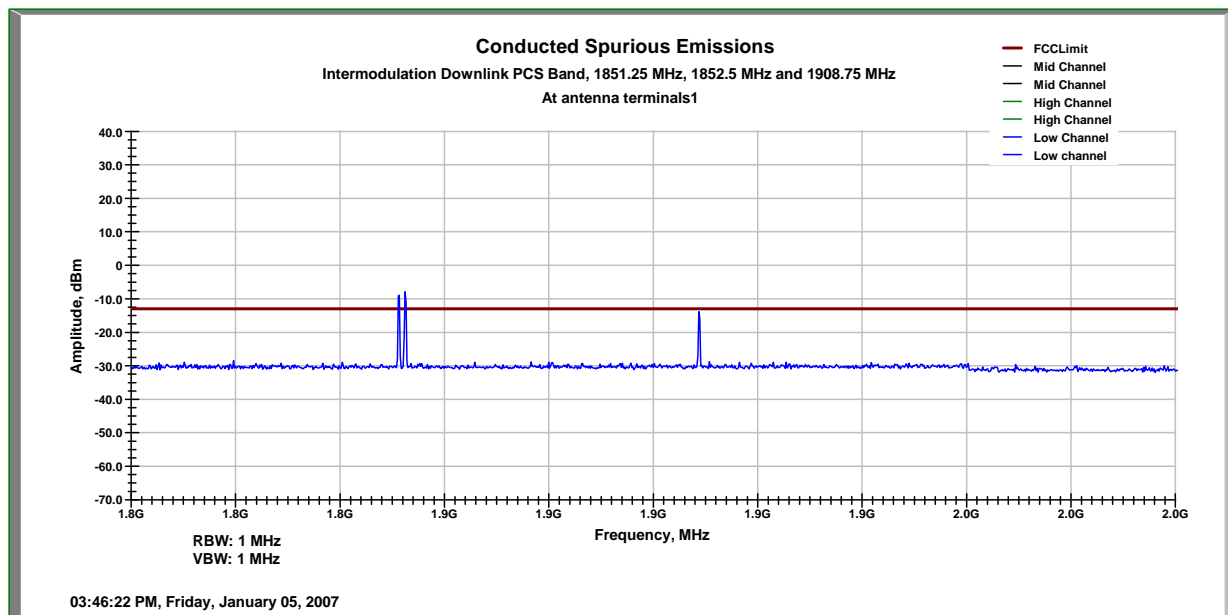


Figure 8-64: Out of band emissions at antenna terminals – Intermodulation (Zoomed Around Carrier Frequencies) PCS Band – Downlink



9 FIELD STRENGTH OF SPURIOUS RADIATION

FCC §2.1053

9.1 Test Procedure

The EUT was placed on a non-conductive turntable. The measurement antenna was placed at a distance of 3 meters from the EUT. The base station simulator was used to provide a maximum modulated input the amplifier. During the tests, the antenna height and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT. This maximization process was repeated with the EUT positioned in each of its three orthogonal orientations.

The frequency range up to tenth harmonic was investigated for each of three fundamental frequencies (low, middle, and high channels) in each operating band and each modulation type. Once spurious emissions were identified, the power of the emission was determined using the substitution method described in TIA-603-B section 2.2.12 (Radiated Spurious Emissions).

The spurious emissions attenuation was calculated as the difference between radiated power at the fundamental frequency and at the spurious emissions frequency.

The spurious emissions test was performed using three CW signals provided to the input of the amplifier. In each uplink and downlink band, two signals were selected on the low end of the passband and one signal at the high end of the passband. The output of three signal generators was connected to a passive combiner. The output of the signal generators was adjusted to provide the maximum rated input for the amplifier for a CW signal. As described above, the radiated spurious emissions test was performed.

9.2 Test Results

The Cellular Amplifier met the field strength of spurious radiation requirements of FCC §2.1053. See Table 9-1 and Table 9-2 for the measured spurious emissions. All other spurious emissions not shown below were greater than 20dB below the limit.

Frequency (MHz)	Antenna Polarity	Measurement Method (ERP/EIRP)	EUT Reading (dBuV)	Substitution Reading (dBuV)	Cable Reading (dBm)	Tx Antenna Gain (dBi)	ERP / EIRP (dBm)
5550	H	EIRP	52.15	70.63	-22.2	10.6	-7.88
7520	H	EIRP	54.9	60.17	-28.9	9.5	-24.67
7630	H	EIRP	49.29	60.22	-28.77	9.3	-26.91
5550	V	EIRP	57.58	71.14	-22	10.8	-24.76
7520	V	EIRP	51.72	61.53	-28.9	9.5	-29.21
7630	V	EIRP	52.78	62.61	-28.77	9.3	-29.3

Table 9-1: Field Strength of Spurious Radiation

EUT Mode	TX Channel	Polarity	Spurious Emission Frequency	Device Reading (dBuV)	Signal Generator Output (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Tx Antenna Gain (dBd)	Radiated Power (dBm)	Limit (dBm)	Margin (dB)
CDMA PCS	1175	V	5.965	56.91	-41.3	7.7	10.9	8.76	-40.24	-13	-27.24
CDMA PCS	1175	H	5.965	62.75	-32.6	7.7	10.5	8.36	-31.94	-13	-18.94
CDMA PCS	1175	V	7.955	58.33	-31.1	9.4	10.6	8.46	-32.04	-13	-19.04
CDMA PCS	1175	H	7.955	57.9	-28.4	9.4	10.1	7.96	-29.84	-13	-16.84
CDMA PCS	1175	V	9.943	58.2	-27.5	10.2	10.8	8.66	-29.04	-13	-16.04
CDMA PCS	1175	H	9.943	54.81	-28.4	10.2	10.4	8.26	-30.34	-13	-17.34
GSM 1900	810	V	5.969	56.44	-41.8	7.7	10.9	8.76	-40.74	-13	-27.74
GSM 1900	810	H	5.969	62.02	-33.1	7.7	10.5	8.36	-32.44	-13	-19.44
GSM 1900	810	V	7.959	57.33	-32.4	9.4	10.6	8.46	-33.34	-13	-20.34
GSM 1900	810	H	7.959	57.04	-29.4	9.4	10.1	7.96	-30.84	-13	-17.84
GSM 1900	810	V	9.949	53.98	-32.5	10.2	10.8	8.66	-34.04	-13	-21.04
GSM 1900	810	H	9.949	51.08	-31.6	10.2	10.4	8.26	-33.54	-13	-20.54
TDMA PCS	1998	V	5.9699	56.34	-41.9	7.7	10.9	8.76	-40.84	-13	-27.84
TDMA PCS	1998	H	5.9699	62.07	-33.1	7.7	10.5	8.36	-32.44	-13	-19.44
TDMA PCS	1998	V	7.96	58.09	-31.3	9.4	10.6	8.46	-32.24	-13	-19.24
TDMA PCS	1998	H	7.96	57.59	-28.9	9.4	10.1	7.96	-30.34	-13	-17.34
TDMA PCS	1998	V	9.949	55.17	-30.8	10.2	10.8	8.66	-32.34	-13	-19.34
TDMA PCS	1998	H	9.949	52.94	-30.1	10.2	10.4	8.26	-32.04	-13	-19.04

Table 9-2: Field Strength of Spurious Radiation - 3 Tone Intermodulation Input

EUT Mode	Polarity	Spurious Emission Frequency	Device Reading (dBuV)	Signal Generator Output (dBm)	Cable Loss (dB)	Tx Antenna Gain (dBi)	Tx Antenna Gain (dBd)	Radiated Power (dBm)	Limit (dBm)	Margin (dB)
Uplink PCS	V	9.944	54.34	-32.1	10.2	10.8	8.66	-33.64	-13	-20.64
Uplink PCS	H	5.966	61.87	-33.7	7.7	10.5	8.36	-33.04	-13	-20.04