Nemko USA, Inc.
2210 Faraday Avenue, Suite 150
Carlsbad, CA 92008
Phone (760) 444-3500 Fax (760) 444-3005

CERTIFICATION TEST REPORT

Applicant:	U-Blox 12626 High Bluff Drive, Suite 200 San Diego, CA 92130
Equipment Under Test (EUT):	CDMA 1xRTT Module
Model:	LISA-C200
FCC ID:	R5Q-LISAC200A
IC ID:	8595B-LISAC200A
In Accordance With:	FCC Part 22, Subpart H RSS-132, Issue 2 September 2005 FCC Part 24 Subpart E RSS 133 Issue 5 February 2009 RSS GEN Issue 3 December 2010
Tested By:	Nemko USA Inc. 2210 Faraday Avenue, Suite 150 Carlsbad, CA 92008
Date:	December 7, 2012
Report Number:	2012 12225324 FCC
Project Number:	10234402
Nex Number:	225324
Total Number of Pages:	53

Section 1: Summary of Test Results

General

All measurements are traceable to national standards

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC rules parts CFR47 Part 2 and 24 subpart E for the United States and RSS132 Issue 2, RSS133 Issue 5, and RSS-Gen Issue 3 for Canada. Radiated tests were conducted is accordance with ANSI C63.4-2003. Radiated emissions are made on an open area test site. A description of the test facility is on file with the FCC and IC.

The assessment summary is as follows:

Apparatus Assessed:	CDMA 1xRTT Module
Model:	LISA-C200
Serial:	A10000157C0792
Specifications:	FCC Part 22, Subpart H Industry Canada RSS-132, Issue 2, September 2005 FCC Part 2, Part 24 Subpart E RSS 133 Issue 5, February 2009 RSS-GEN Issue 3 December 2010
Date Received in Laboratory:	November 27, 2012
Compliance Status:	Complies
Exclusions:	None
Non-compliances:	None

1.1 Report Release History

REVISION	DATE	COMMENTS
-	DECEMBER 7, 2012	Prepared By: Andreas Gillmeier
-	DECEMBER 7, 2012	Initial Release: Alan Laudani

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025.

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TESTED BY: _____ Date: DECEMBER 7, 2012
Andreas Gillmeier, Sr. EMC Wireless Engineer

RELEASED BY: _____ Date: December 10, 2012
Alan Laudani, Test Report Verificator

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Section 2: Equipment Under Test

2.1 Product Identification

The Equipment Under Test was identified as follows:

Sample No.	Description	Serial No.
LISA-C200	CDMA 1xRTT Module, LISA-C200	A10000157C0792

2.2 Technical Specifications of the EUT

Manufacturer:	U-Blox
Transmit Frequency:	Cellular Band: 824.70 to 848.31 MHz PCS Band: 1851.25 to 1908.75 MHz
Rated Power:	Cellular Band: 0.289 W PCS Band: 0.234 W
Modulation:	CDMA
Emission Designator:	Cellular Band: 1M38F9W PCS Band: 1M38F9W
Antenna:	taoglas Part No. TG.09.0113 1.0 (Cell)/ 2.8 (PCS) dBi penta-band cellular hinged SMA(M) monopole
Antenna Connector:	SMA
Power Source:	3.4 – 4.3 V DC from host (supplied by 115V AC).

Section 3: Test Conditions

3.1 Test Environment

All tests were performed under the following environmental conditions:

Temperature range	:	21-23 ºC
Humidity range	:	43-68 %
Pressure range	:	100.4-101.5 kPa
Power supply range	:	N/A

3.2 Test Equipment

Nemko ID	Device	Manufacturer	Model	Serial Number	Cal Date	Cal Due Date
835	Spectrum Analyzer	Rohde & Schwarz	RHDFSEK	829058/005	9/6/2012	9/6/2013
911	Spectrum Analyzer	Agilent	E4440A	US41421266	10/15/2012	10/15/2013
E1017	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	839337/0022	3/8/2012	3/8/2013
E1018	9kHz to 7GHz Spectrum Analyzer	Rohde & Schwarz	FSP7	835363/0003	2/23/2012	2/23/2013
Customer furnished	Radio Communications Tester	Rohde & Schwarz	CMU200	111814	11/12/2012	11/12/2013
E1020	Two Line V-Network	Rohde & Schwarz	ENV216	101044	4/6/2012	4/6/2013
384	LISN	Solar	9348-50-R-24-BNC	941716	10/18/2012	10/18/2013
128	Antenna, Bicon	EMCO	3104	2882	3/21/2011	3/21/2013
110	Antenna, LPA	Electrometrics	LPA-25	1217	Apr. 01, 2011	Apr. 01, 2013
529	Antenna, DRWG	EMCO	3115	2505	10/31/2012	10/31/2013
836	Signal Generator	Agilent	E8254A	US41140229	3/7/2012	3/7/2013
NA	10 dB Attenuator	MCE / Weinschel	24-10-34	BP5399	Verified with 835	Verified with 835
901	Preamplifier	Sonoma	310 N	130607	10/15/2012	10/15/2013
317	Preamplifier	HP	8449A	2749A00167	6/11/2012	6/11/2013
814	Multimeter	Fluke	111	78130063	10/15/2012	10/15/2013
N149	Environmental Chamber	Cincinnati Sub-Zero	ZPHS-32-2-2-H/AC	ZP0552665	4/16/2012	4/16/2013

Registrations of the 10m Semi-anechoic chamber are on file with the Federal Communications Commission and with Industry Canada under Site Number 2040B-3.

Section 4: Observations

4.1 Modifications Performed During Assessment

A ferrite (Wuerth Electronics, part #: 742 717 22) was added close to the mini-USB connector on the USB cable with one turn to pass the FCC Part 15B class B emissions for the receiver spurious radiated emission test.

4.2 Record Of Technical Judgments

No technical judgments were made during the assessment.

4.3 EUT Parameters Affecting Compliance

The user of the apparatus could not alter parameters that would affect compliance.

4.4 Test Deleted

No Tests were deleted from this assessment.

4.5 Additional Observations

There were no additional observations made during this assessment.

Section 5: Results Summary

5.1 Test Result summary table

FCC Part 2 Subpart J: Frequency Allocations and Radio Treaty Matters; General Rules and Regulations. Equipment Authorization Procedures.

FCC CFR 47 Part 24 Subpart E – Personal Communications Services – Broadband PCS
RSS-GEN Issue 3 (December 2010) – General requirements and information for the Certification of Radiocommunication Equipment
RSS-132, Issue 2 September 2005-- Cellular Telephones Employing New Technologies Operating in the Bands 824-849 MHz and 869-894 MHz
RSS-133 Issue 5 (February 2009) – 2 GHz Personal Communications Services

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

N No: not applicable / not relevant
Y Yes: Mandatory i.e. the apparatus shall conform to these test.
N/T Not Tested, mandatory but not assessed. (See section 4.4 Test deleted)

The results contained in this section are representative of the operation of the apparatus as originally submitted.

FCC Part 2 Part 22/24	RSS Paragraph RSS-GEN/RSS-133	Test/Requirement Description	Required	Result
15.207 (A)	RSS-GEN 7.2.4	Power line conducted emissions	Y	COMPLIES
2.1046/24.232	RSS-133 6.4 4.8/6.4	RF Power Output	Y	COMPLIES
22.913	RSS-132/4.4	RF Power Output	Y	COMPLIES
2.1049/24.238	4.6.1/6.5	Occupied Bandwidth	Y	COMPLIES
22.917(D)		Occupied Bandwidth	Y	COMPLIES
2.1051/24.238	RSS-133 6.5.1 4.9/6.5	Spurious Emissions at antenna Terminals	Y	COMPLIES
22.917(B)	RSS-132/4.5	Spurious Emissions at antenna Terminals	Y	COMPLIES
2.1053/22.917	RSS-133 4.2/6.5	Field Strength of Spurious Emissions	Y	COMPLIES
22.917(B)		Field Strength of Spurious Emissions	Y	COMPLIES
2.1055/24.235	RSS-133 6.3 4.7/6.3	Frequency Stability	Y	COMPLIES
22.355	RSS-132/4.3	Frequency Stability	Y	COMPLIES
	RSS-132/4.6 RSS-133 6.7 4.10/6.6	Receiver Spurious	Y	COMPLIES

Appendix A: Test Results

A1. Powerline conducted emissions

15.207(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
.5–5	5	46
5–30	60	50

*Decreases with the logarithm of the frequency.

Conditions:

Model:	LISA-C200	Temperature:	21ºC
Date:	November 27-28, 2012	Humidity:	53-57%
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

Test Results: EUT complies

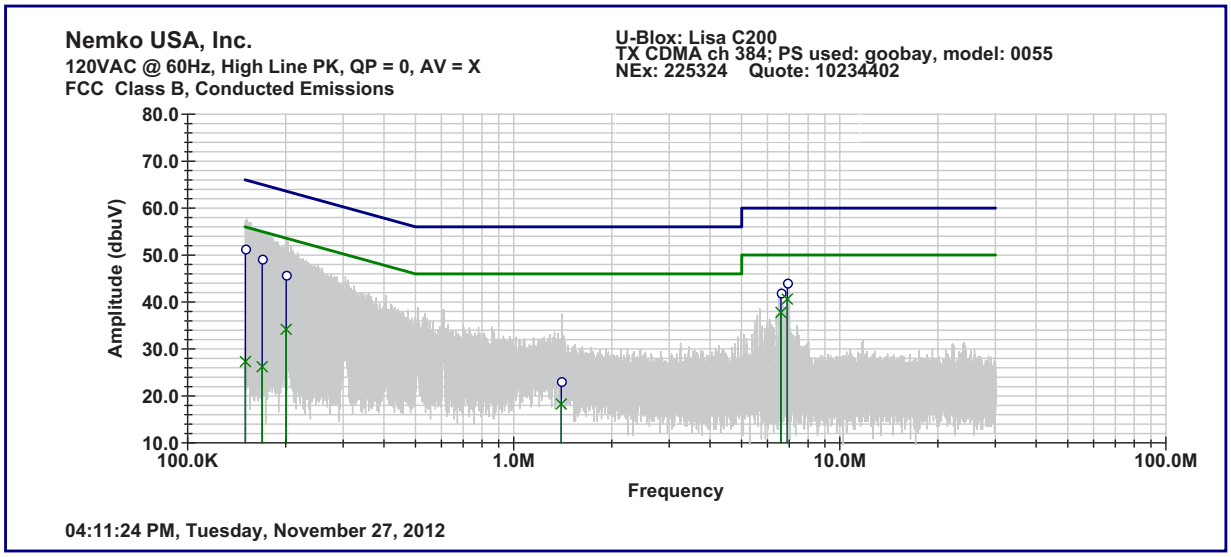
See attached plots

Additional Observations:

- Measurement was done on host's AC power supply
- EUT was tested using the following modes: Mid channel TX and Receive Test Mode for each band.
- Green limit line is Average limit and blue limit line is Quasi-peak limit.
- o represents final quasi peak measurements while x represent final average measurements.
- Instrumentation settings are 9kHz RBW/30kHz VBW for Average measurements and 120kHz RBW/300kHz VBW for Quasi-Peak measurements.

Cell band TX: channel 384

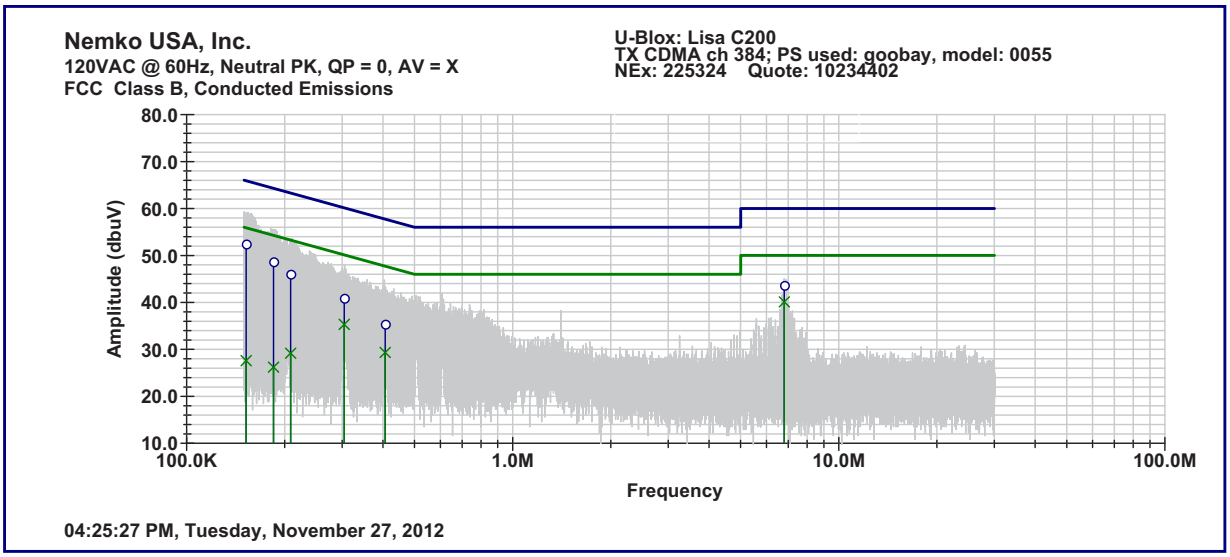
Line 1:



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
150.380	51.3	27.3	66.0	56.0	-14.7	-28.7
169.407	49.1	26.2	65.0	55.0	-15.9	-28.8
200.668	45.7	34.2	63.6	53.6	-17.9	-19.4
1398.600	23.1	18.3	56.0	46.0	-32.9	-27.7
6594.950	41.9	37.8	60.0	50.0	-18.1	-12.2
6900.880	44.0	40.6	60.0	50.0	-16.0	-9.4

Cell band TX: channel 384

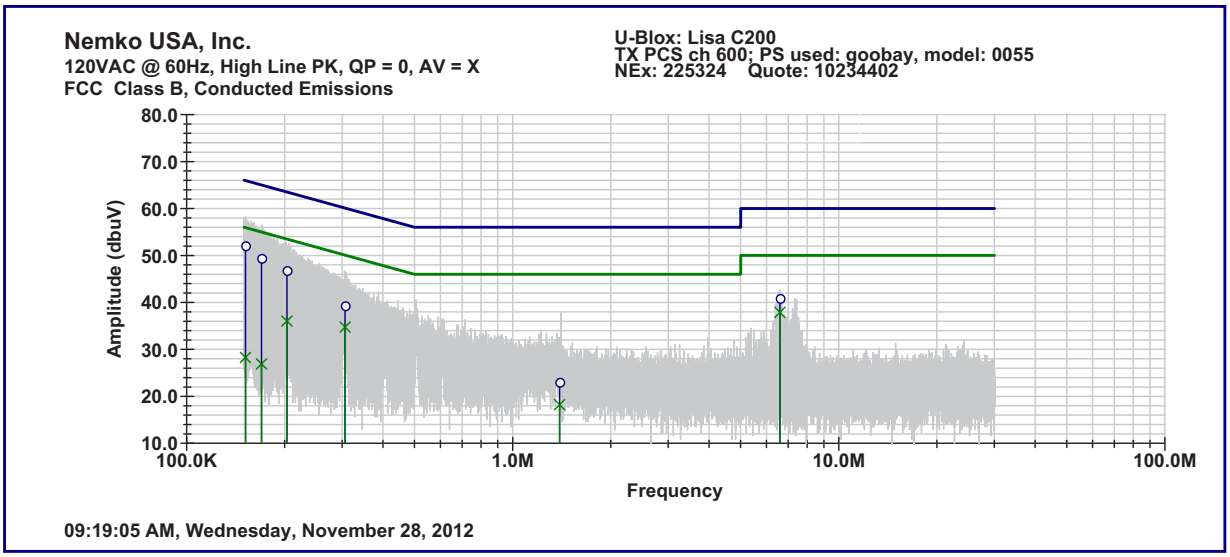
Line 2 (N):



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
152.253	52.4	27.6	65.9	55.9	-13.5	-28.3
184.724	48.7	26.2	64.3	54.3	-15.6	-28.1
208.507	46.0	29.2	63.3	53.3	-17.3	-24.1
304.448	40.9	35.3	60.1	50.1	-19.2	-14.8
406.637	35.4	29.3	57.7	47.7	-22.3	-18.4
6800.420	43.6	40.1	60.0	50.0	-16.4	-9.9

PCS band TX: channel 600

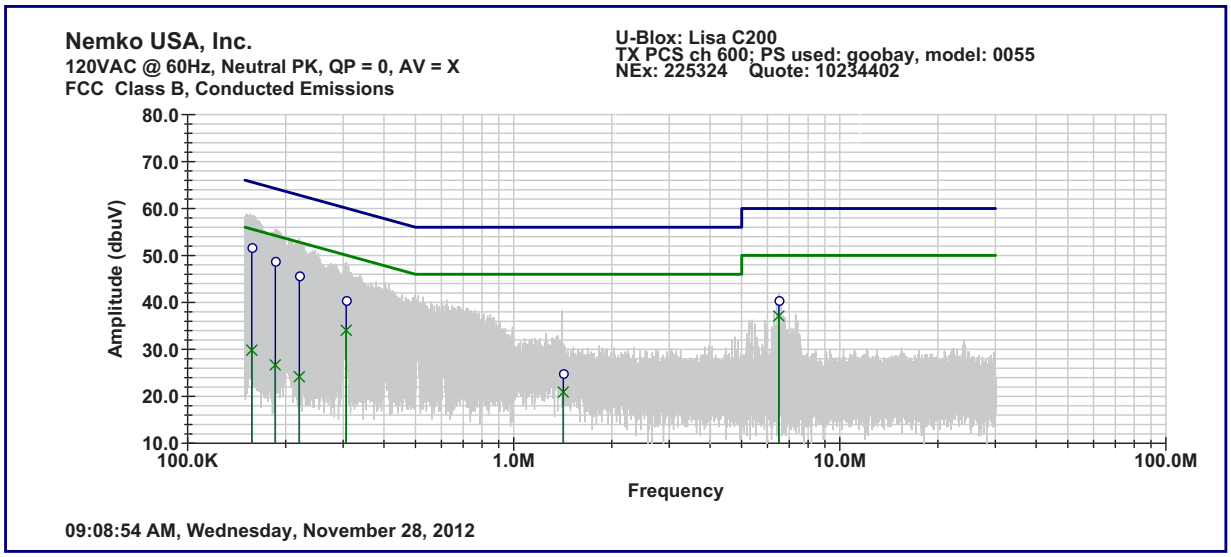
Line 1:



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
151.530	52.1	28.3	65.9	55.9	-13.8	-27.6
169.710	49.4	26.9	65.0	55.0	-15.6	-28.1
203.107	46.8	36.0	63.5	53.5	-16.7	-17.5
306.184	39.3	34.7	60.1	50.1	-20.8	-15.4
1392.200	23.0	18.2	56.0	46.0	-33.0	-27.8
6598.440	40.9	37.9	60.0	50.0	-19.1	-12.1

PCS band TX: channel 600

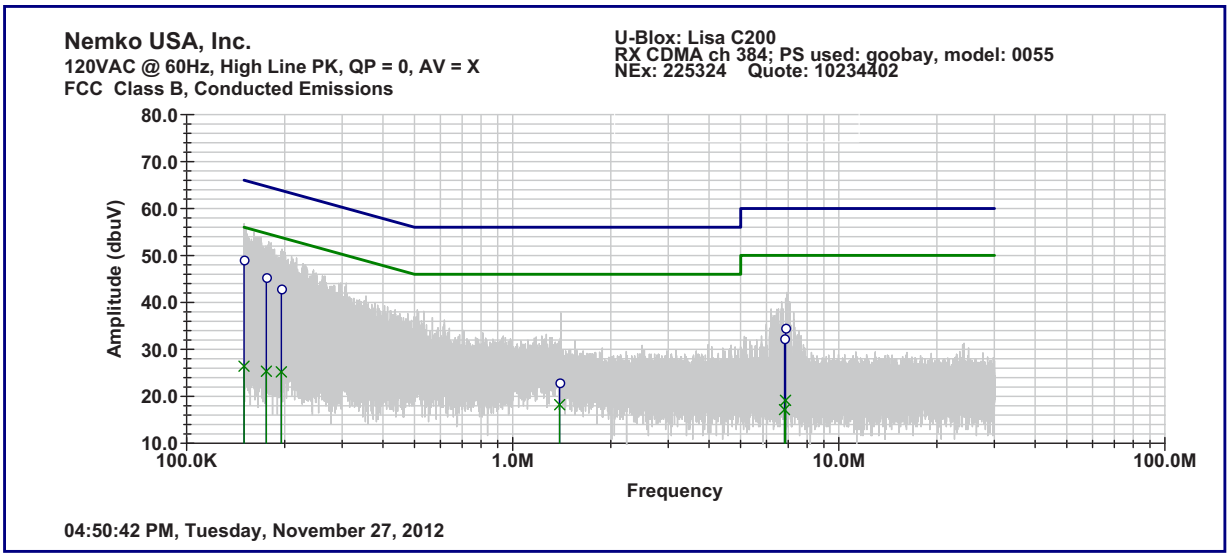
Line 2 (N):



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
152.253	52.4	27.6	65.9	55.9	-13.5	-28.3
184.724	48.7	26.2	64.3	54.3	-15.6	-28.1
208.507	46.0	29.2	63.3	53.3	-17.3	-24.1
304.448	40.9	35.3	60.1	50.1	-19.2	-14.8
406.637	35.4	29.3	57.7	47.7	-22.3	-18.4
6800.420	43.6	40.1	60.0	50.0	-16.4	-9.9

Cell band RX

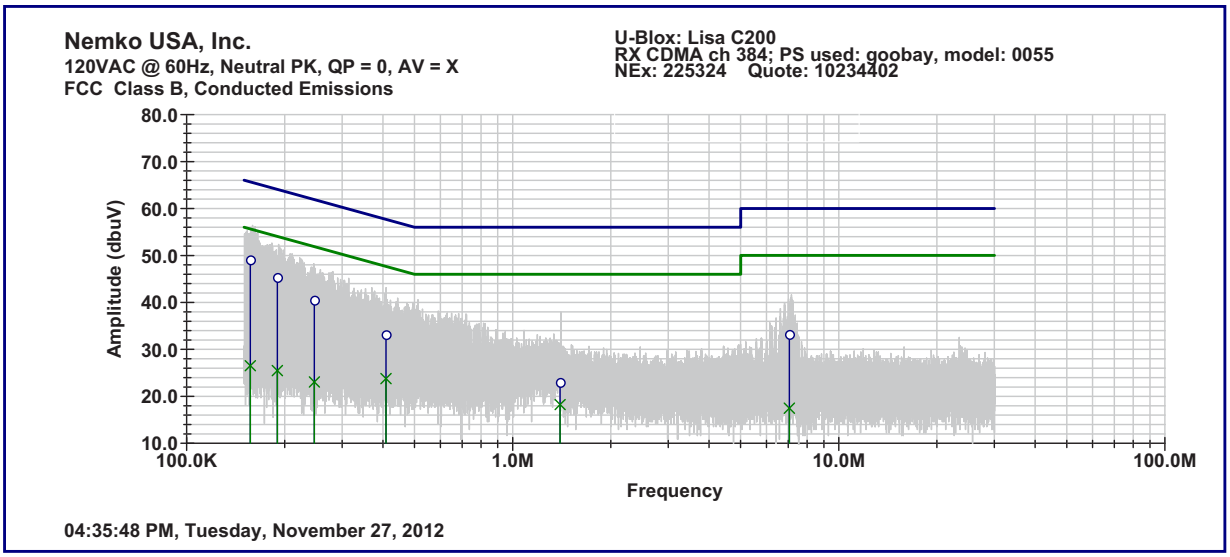
Line 1:



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
150.006	49.0	26.4	66.0	56.0	-17.0	-29.6
175.709	45.3	25.3	64.7	54.7	-19.4	-29.4
195.284	42.9	25.2	63.8	53.8	-20.9	-28.6
1392.800	22.9	18.2	56.0	46.0	-33.1	-27.8
6811.010	32.3	17.2	60.0	50.0	-27.7	-32.8
6861.040	34.5	19.1	60.0	50.0	-25.5	-30.9

Cell band RX

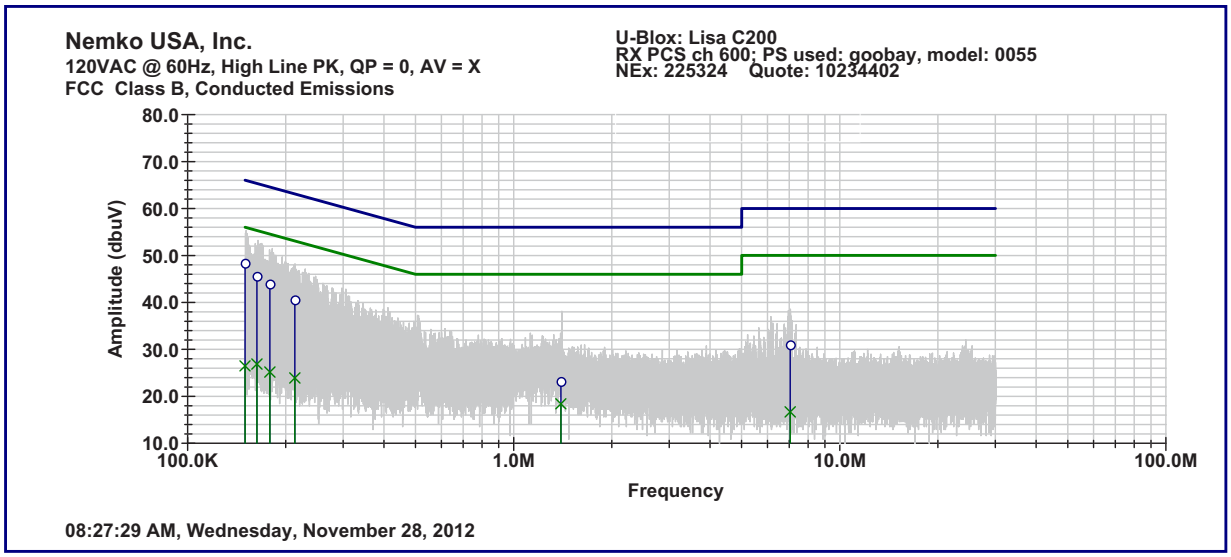
Line 2 (N):



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
156.905	49.1	26.5	65.6	55.6	-16.5	-29.1
189.842	45.3	25.5	64.0	54.0	-18.7	-28.5
246.613	40.5	23.1	61.9	51.9	-21.4	-28.8
408.612	33.2	23.8	57.7	47.7	-24.5	-23.9
1397.020	23.0	18.2	56.0	46.0	-33.0	-27.8
7048.930	33.2	17.4	60.0	50.0	-26.8	-32.6

PCS band RX

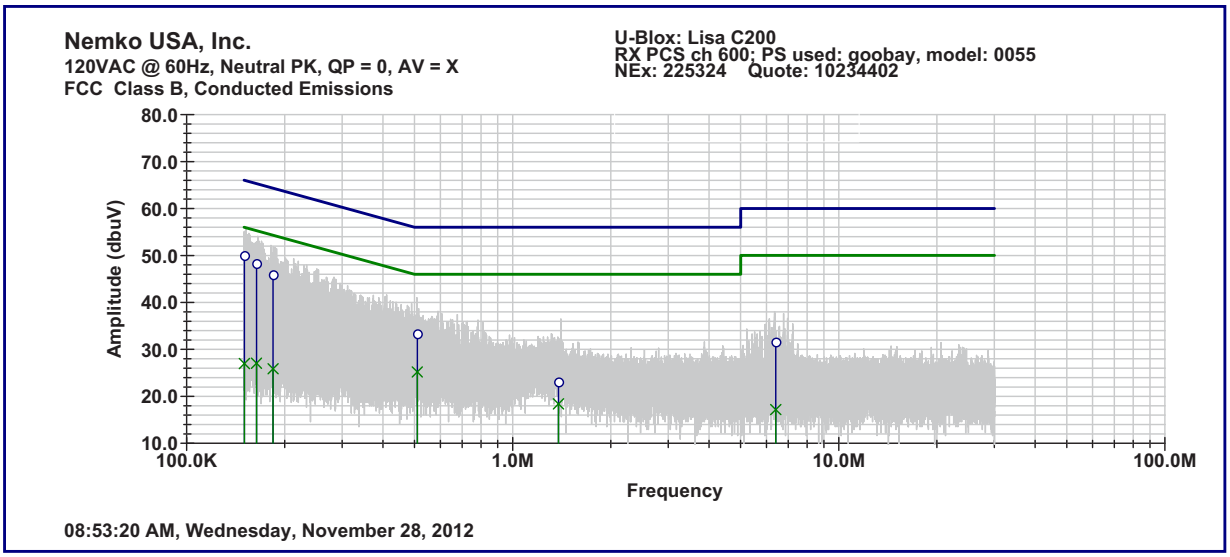
Line 1:



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
149.999	48.4	26.5	66.0	56.0	-17.6	-29.5
163.173	45.6	26.8	65.3	55.3	-19.7	-28.5
178.756	43.9	25.2	64.5	54.5	-20.6	-29.3
213.272	40.5	23.9	63.1	53.1	-22.6	-29.2
1394.220	23.2	18.4	56.0	46.0	-32.8	-27.6
7039.400	31.0	16.7	60.0	50.0	-29.0	-33.3

PCS band RX

Line 2 (N):



Frequency	Measured		Limit		Margin	
(kHz)	Quasi-Peak	Average	Quasi-Peak	Average	Quasi-Peak	Average
150.453	50.0	27.0	66.0	56.0	-16.0	-29.0
163.816	48.3	27.0	65.3	55.3	-17.0	-28.3
184.204	45.9	25.9	64.3	54.3	-18.4	-28.4
509.798	33.3	25.2	56.0	46.0	-22.7	-20.8
1381.120	23.1	18.4	56.0	46.0	-32.9	-27.6
6402.050	31.6	17.2	60.0	50.0	-28.4	-32.8

A2. RF Power Output

Para. No. : FCC 2.1046 & RSS-GEN 4.8

§ 22.913
The effective radiated power (ERP) of transmitters in the Cellular Radiotelephone Service must not exceed the limits in this section.
(a) Maximum ERP. In general, the effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts. However, for those systems operating in areas more than 72 km (45 miles) from international borders that:
(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.

24.232.
(b) Mobile/portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
(c) Mobile/portable stations are limited to 2 watts EIRP power and the equipment must employ means to limit the power to the minimum necessary for successful communications.
(d) Peak transmit power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitations, such as detector response times, limited resolution bandwidth capability when compared to the emission bandwidth, sensitivity, etc., so as to obtain a true peak measurement for the emission in question over the full bandwidth of the channel.

RSS-132
4.4 Transmitter Output Power
The transmitter output power shall not exceed the limits given in SRSP-503.
NOTE: From SRSP-503 issue 7, Feb 2008:
5.1.3 The maximum EIRP shall be 11.5 watts for mobile stations.

RSS-133
6.4 Transmitter Output Power
The average equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510.

NOTE: From SRSP-510 issue 5, Feb 2009:
5.1.2 Mobile Stations
Mobile stations and hand-held portables are limited to 2 watts maximum e.i.r.p. The equipment shall employ means to limit the power to the minimum necessary for successful communication.

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

Conditions:

Model:	LISA-C200	Temperature:	22ºC
Date:	November 30, 2012	Humidity:	68%
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

Observations:

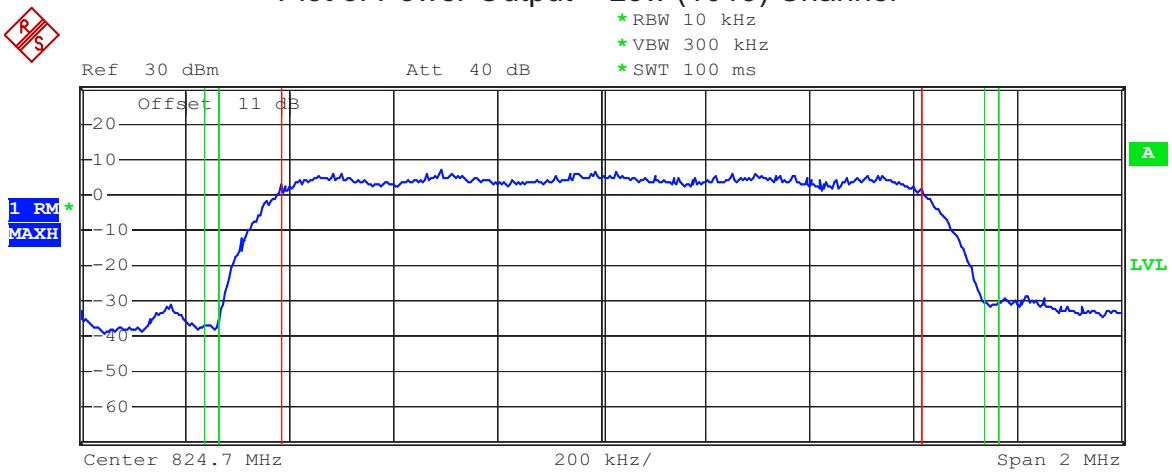
- Input voltage varied from 3.4 to 4.3 VDC
- Cellular macro of standard used in spectrum analyzer for conducted power measurement. 11.0 dB offset measured prior to test.
- PCS macro of standard used in spectrum analyzer for conducted power measurement. 11.3-11.5 dB offset measured prior to test.

Test Results: Complies

Carrier Frequency (MHz)	Channel	Voltage Nom +/- 15% VDC	Output Power (dBm)	Output Power (W)	ERP (with Ant. Gain)
824.70	1013	3.4	24.05		26.05
		3.9	24.49		26.49
		4.3	24.60	0.288	26.60
836.52	384	3.4	24.12		26.12
		3.9	24.45		26.45
		4.3	24.61	0.289	26.61
848.31	777	3.4	24.01		26.01
		3.9	24.33		26.33
		4.3	24.48	0.281	26.48

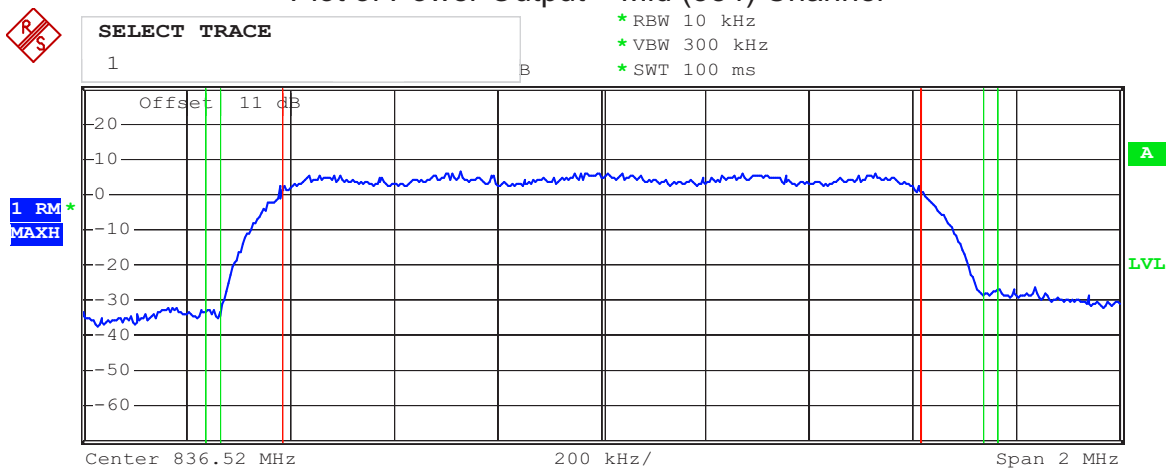
Carrier Frequency (MHz)	Channel	Voltage Nom +/- 15% VDC	Output Power (dBm)	Output Power (W)	EIRP (with Ant. Gain)	Peak Output Power (dBm)	Peak to Average Ratio (dB)
1851.25	25	3.4	23.46		25.96		
		3.9	23.53		26.03		
		4.3	23.69	0.234	26.19	24.73	1.04
1880.00	600	3.4	23.50		26.00		
		3.9	23.50		26.00		
		4.3	23.54	0.226	26.04	24.55	1.04
1908.75	1175	3.4	23.35		25.85		
		3.9	23.58		26.08		
		4.3	23.60	0.229	26.10	24.27	1.03

Plot of Power Output – Low (1013) Channel



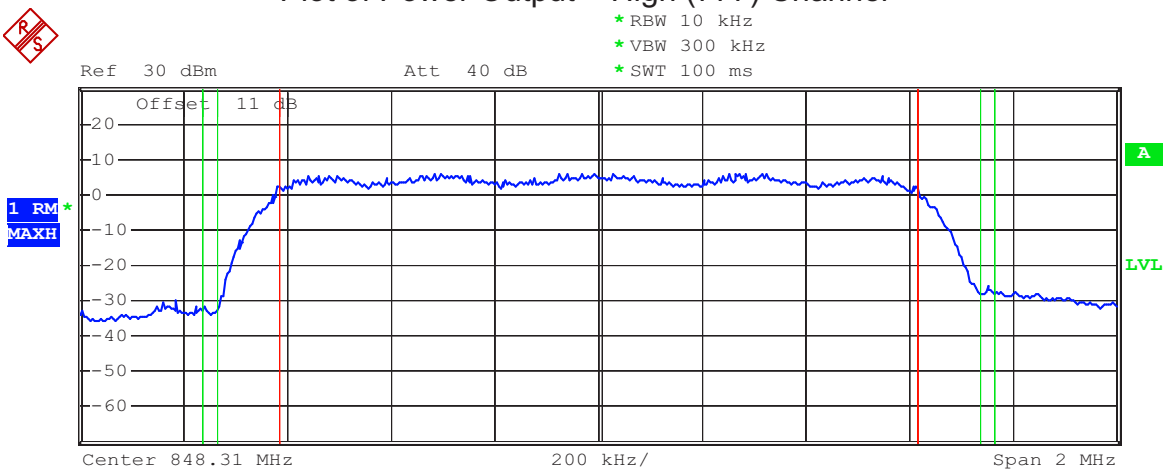
Tx Channel		**CDMA IS95A FWD**	
Bandwidth	1.2288 MHz	Power	24.60 dBm
Adjacent Channel			
Bandwidth	30 kHz	Lower	-57.10 dB
Spacing	750 kHz	Upper	-50.82 dB
Alternate Channel			
Bandwidth	30 kHz	Lower	-----
Spacing	1.98 MHz	Upper	-----

Plot of Power Output – Mid (384) Channel



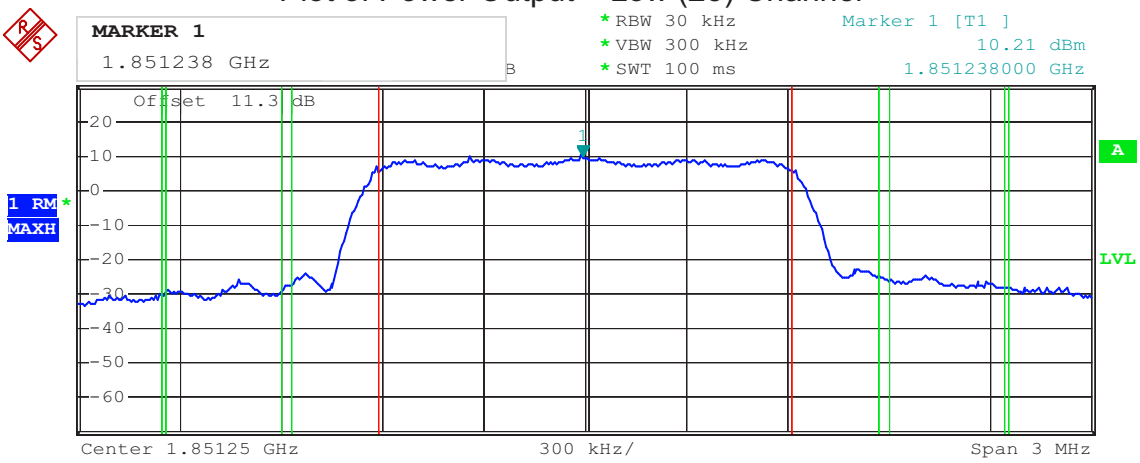
Tx Channel		**CDMA IS95A FWD**	
Bandwidth	1.2288 MHz	Power	24.61 dBm
Adjacent Channel			
Bandwidth	30 kHz	Lower	-53.76 dB
Spacing	750 kHz	Upper	-47.96 dB
Alternate Channel			
Bandwidth	30 kHz	Lower	-----
Spacing	1.98 MHz	Upper	-----

Plot of Power Output – High (777) Channel



Tx Channel		**CDMA IS95A FWD**	
Bandwidth	1.2288 MHz	Power	24.48 dBm
Adjacent Channel			
Bandwidth	30 kHz	Lower	-52.88 dB
Spacing	750 kHz	Upper	-47.60 dB
Alternate Channel			
Bandwidth	30 kHz	Lower	-----
Spacing	1.98 MHz	Upper	-----

Plot of Power Output – Low (25) Channel



Tx Channel
Bandwidth 1.2288 MHz

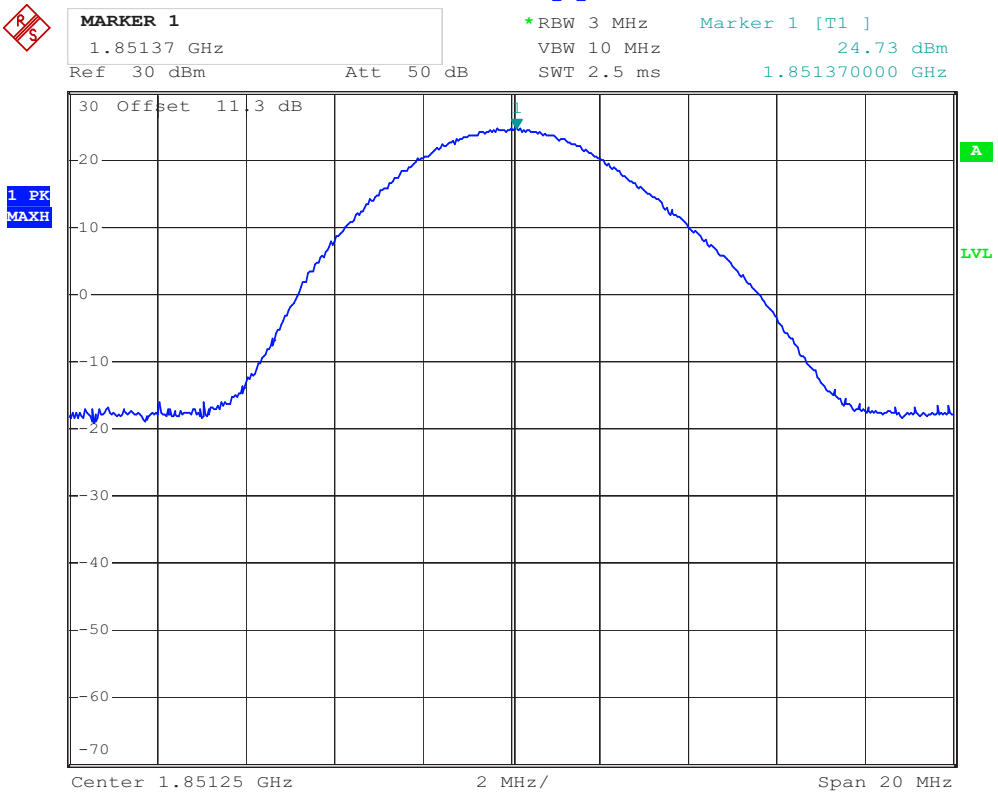
CDMA J-STD008 FWD
Power 23.69 dBm

Adjacent Channel
Bandwidth 30 kHz
Spacing 885 kHz

Lower -52.00 dB
Upper -49.21 dB

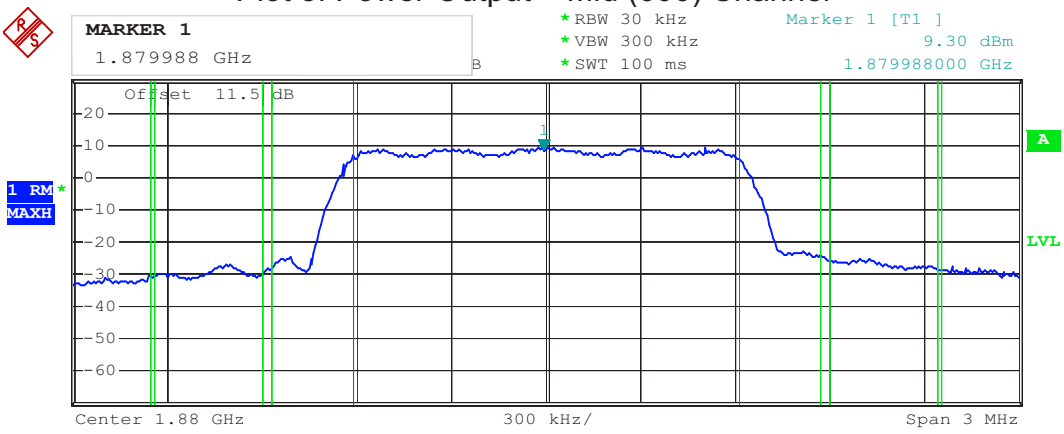
Alternate Channel
Bandwidth 12.5 kHz
Spacing 1.25 MHz

Lower -57.99 dB
Upper -55.81 dB



Date: 30.NOV.2012 10:32:32

Plot of Power Output – Mid (600) Channel



Tx Channel
Bandwidth 1.2288 MHz

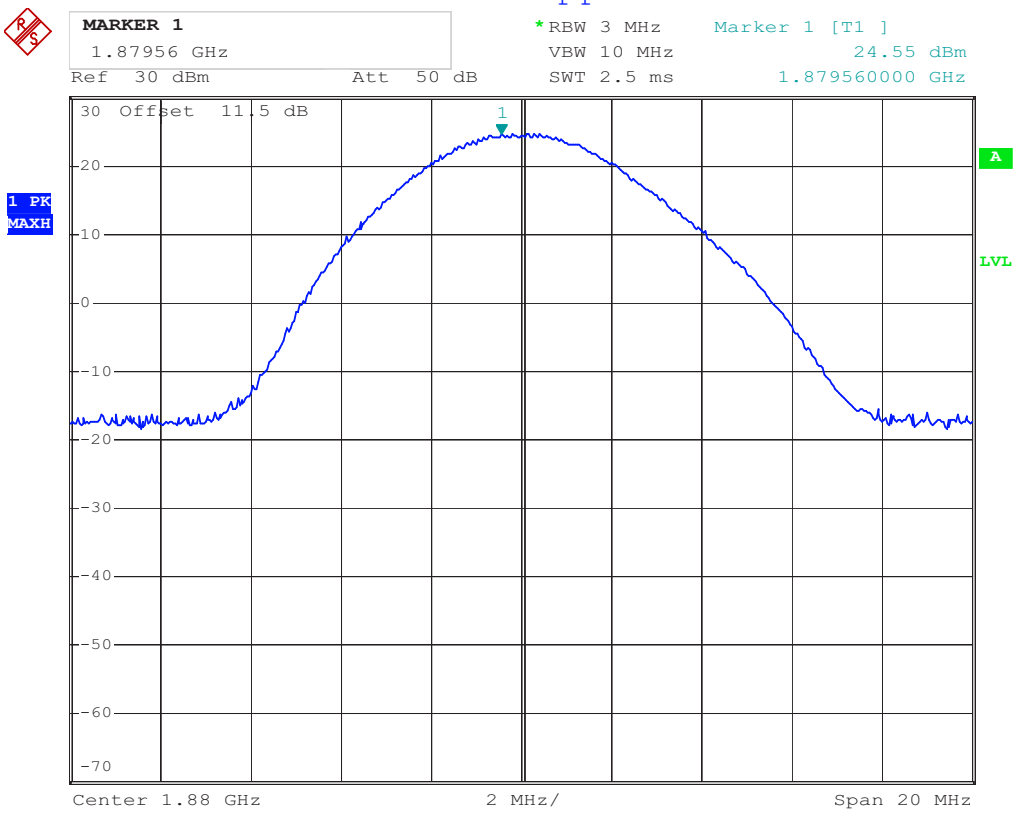
CDMA J-STD008 FWD
Power 23.54 dBm

Adjacent Channel
Bandwidth 30 kHz
Spacing 885 kHz

Lower -52.52 dB
Upper -48.59 dB

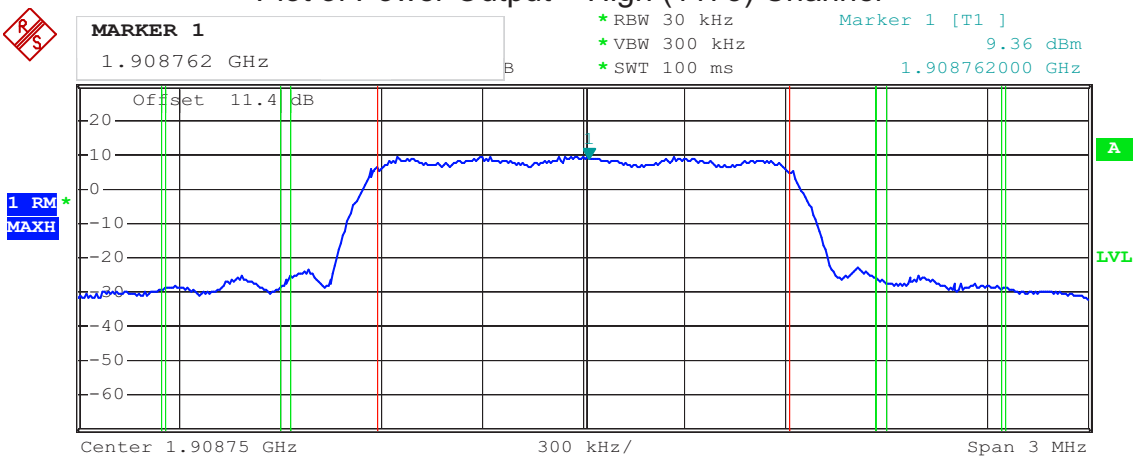
Alternate Channel
Bandwidth 12.5 kHz
Spacing 1.25 MHz

Lower -58.24 dB
Upper -56.29 dB



Date: 30.NOV.2012 10:30:32

Plot of Power Output – High (1175) Channel



Tx Channel
Bandwidth 1.2288 MHz

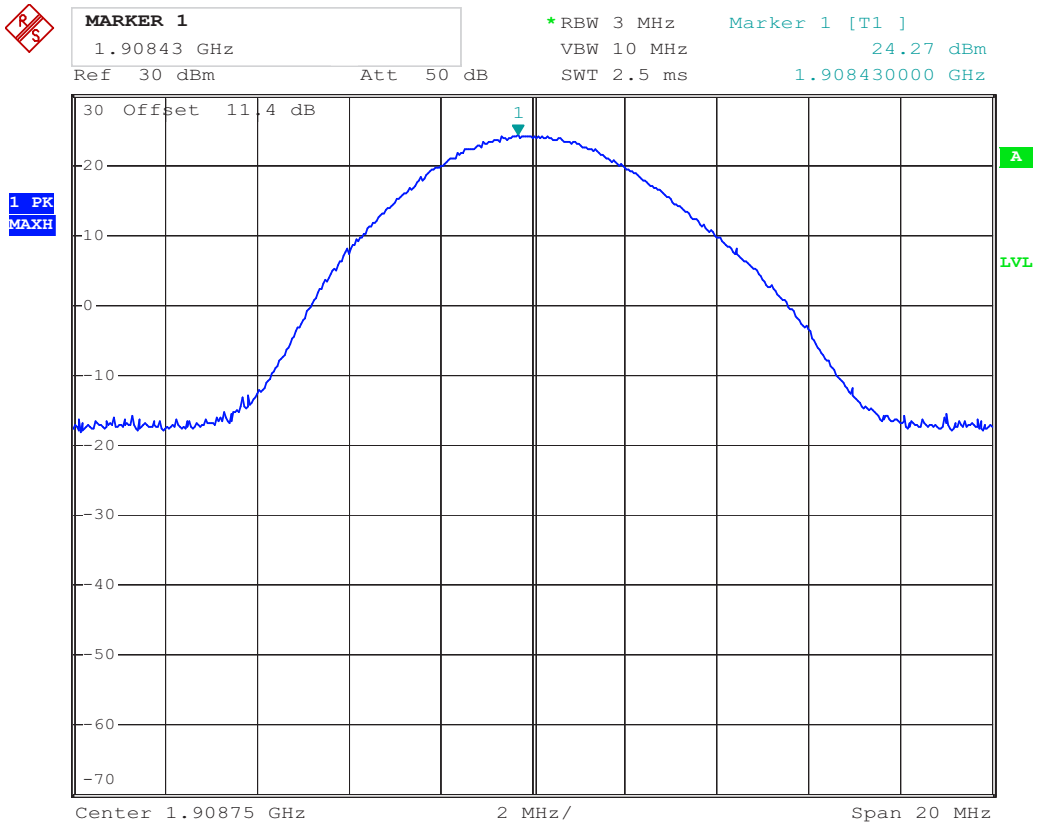
Adjacent Channel
Bandwidth 30 kHz
Spacing 885 kHz

Alternate Channel
Bandwidth 12.5 kHz
Spacing 1.25 MHz

CDMA J-STD008 FWD
Power 23.60 dBm

Lower -50.87 dB
Upper -50.11 dB

Lower -56.95 dB
Upper -56.17 dB



Date: 30.NOV.2012 10:27:50

A3. Occupied Bandwidth

Para. No.: 2.1049 and RSS-GEN 4.6

Part 22.917

(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.

24.238

(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.

RSS-GEN 4.6.1 Occupied Bandwidth

When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used since a peak or, peak hold, may produce a wider bandwidth than actual.
The trace data points are recovered and are directly summed in linear terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points. This frequency is recorded.
The span between the two recorded frequencies is the occupied bandwidth.

Conditions:

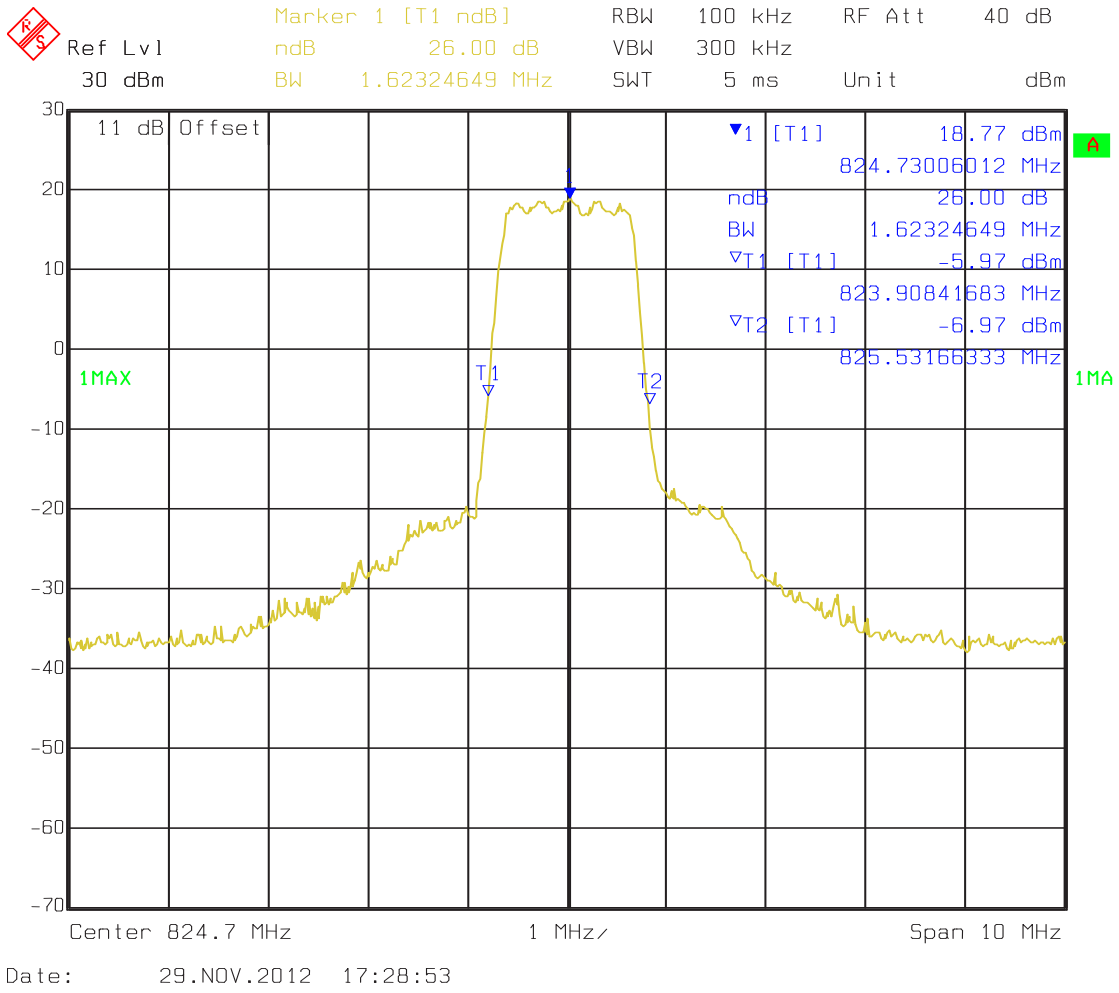
Model:	LISA-C200	Temperature:	21ºC
Date:	November 29, 2012	Humidity:	61%
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

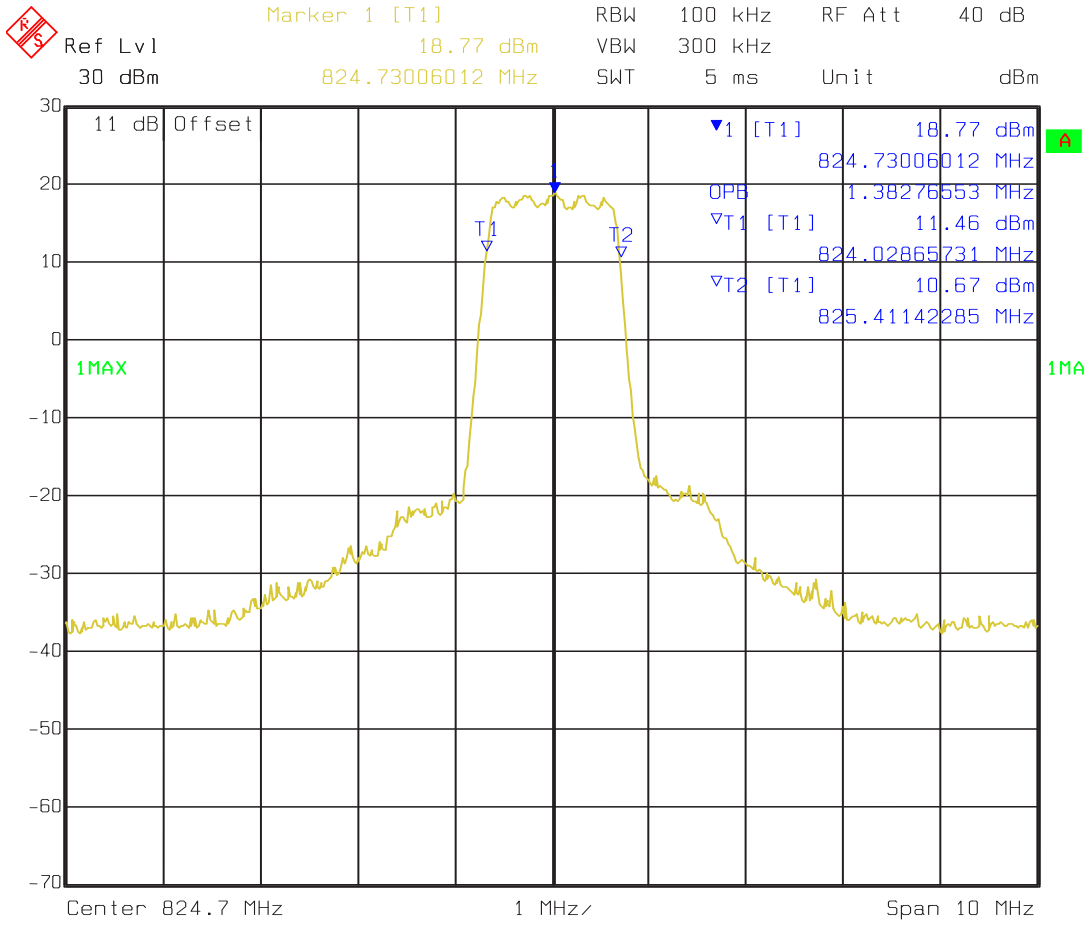
Observations: None

Test Results: Complies

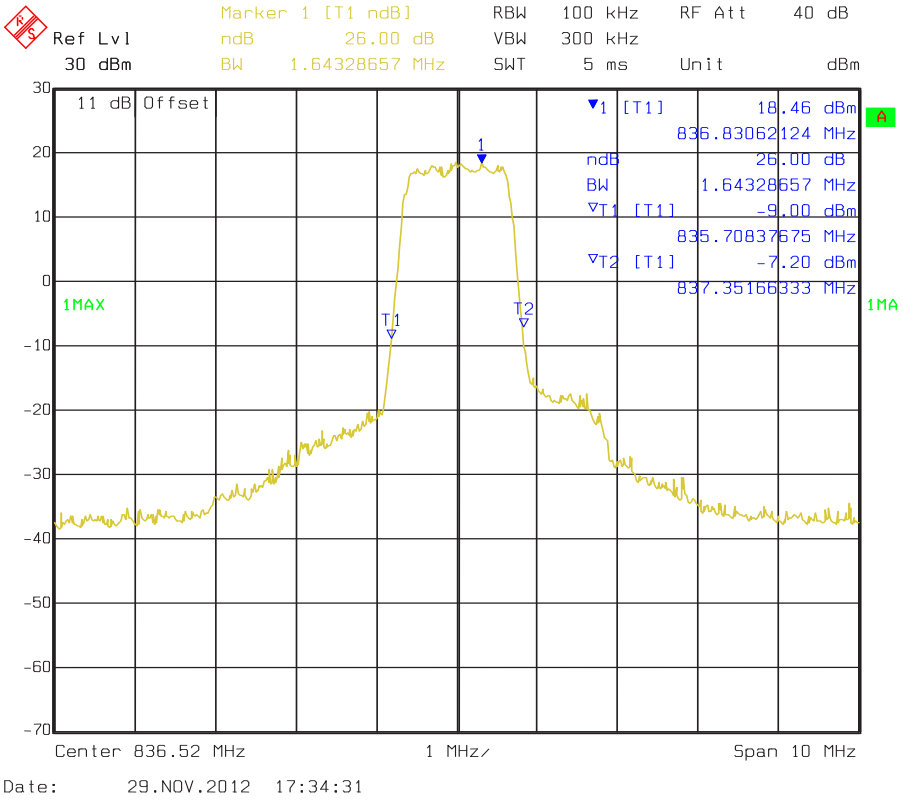
Test Data:

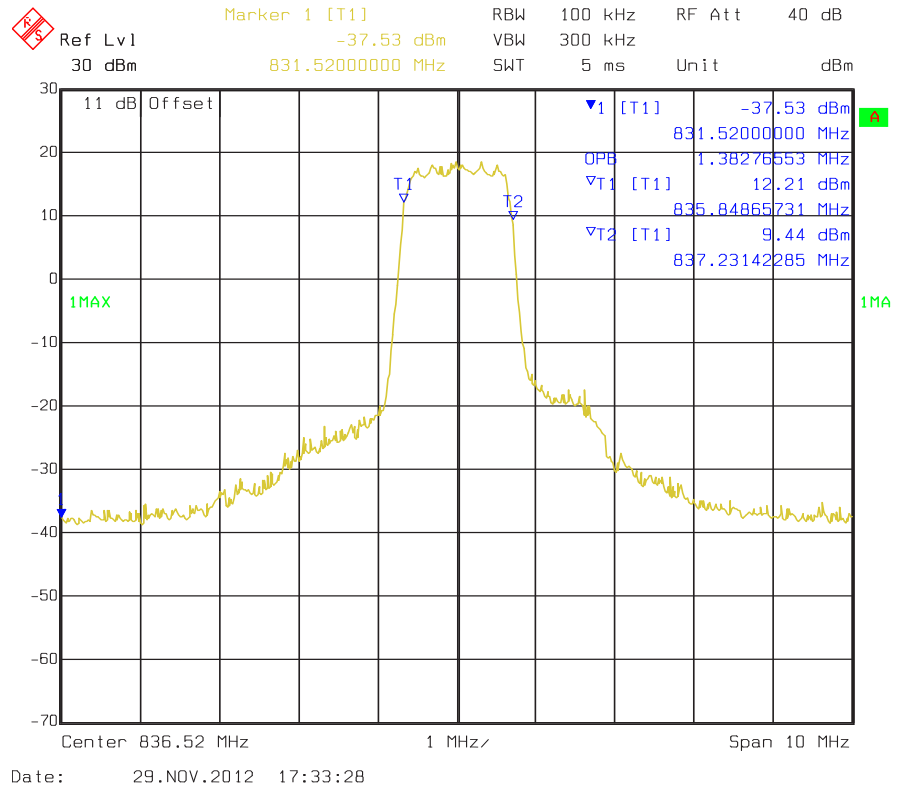
Frequency	26 dB Bandwidth	99% Bandwidth
824.70 MHz	1.62 MHz	1.38 MHz
836.52 MHz	1.64 MHz	1.38 MHz
848.31 MHz	1.64 MHz	1.38 MHz
1851.25 MHz	1.62 MHz	1.38 MHz
1880.00 MHz	1.64 MHz	1.38 MHz
1908.75 MHz	1.62 MHz	1.38 MHz



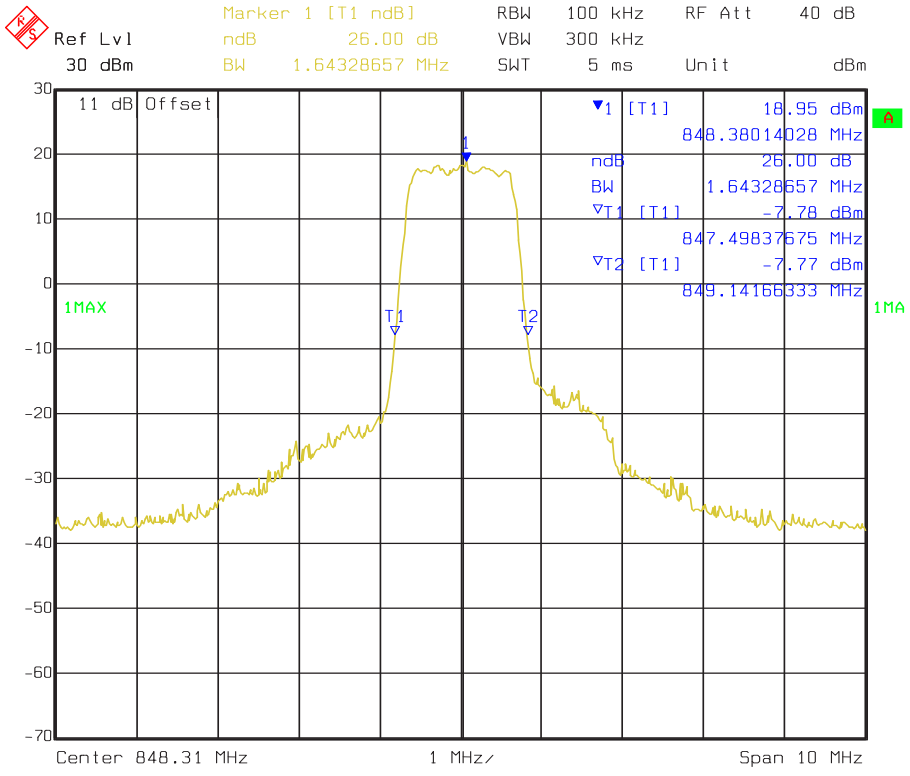


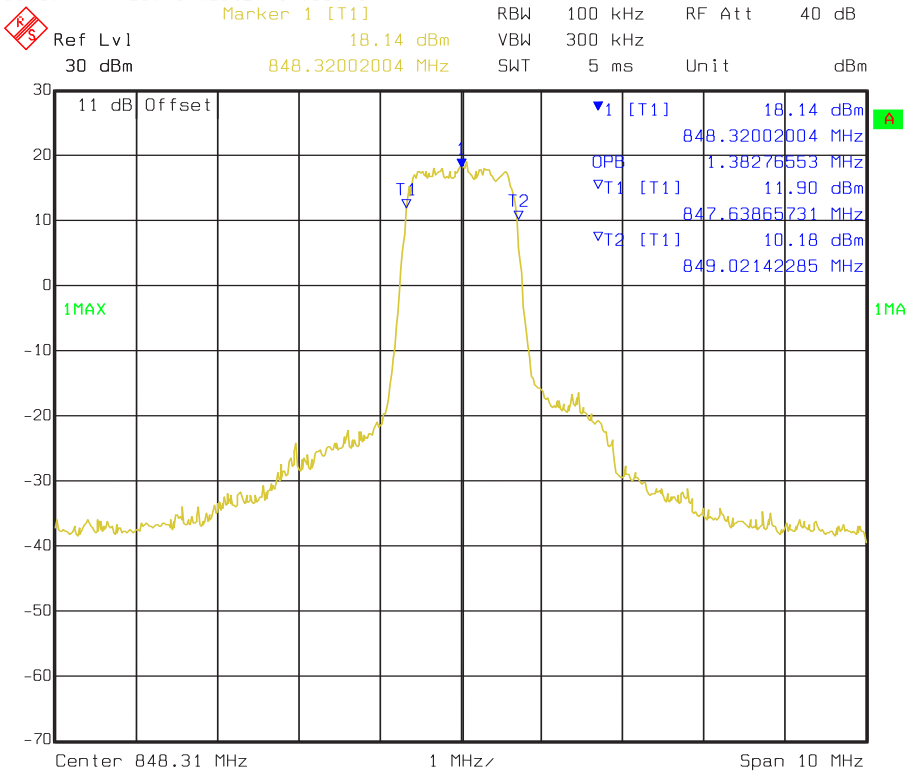
Cellular Band Frequency Low Channel (1013) – 824.70 MHz



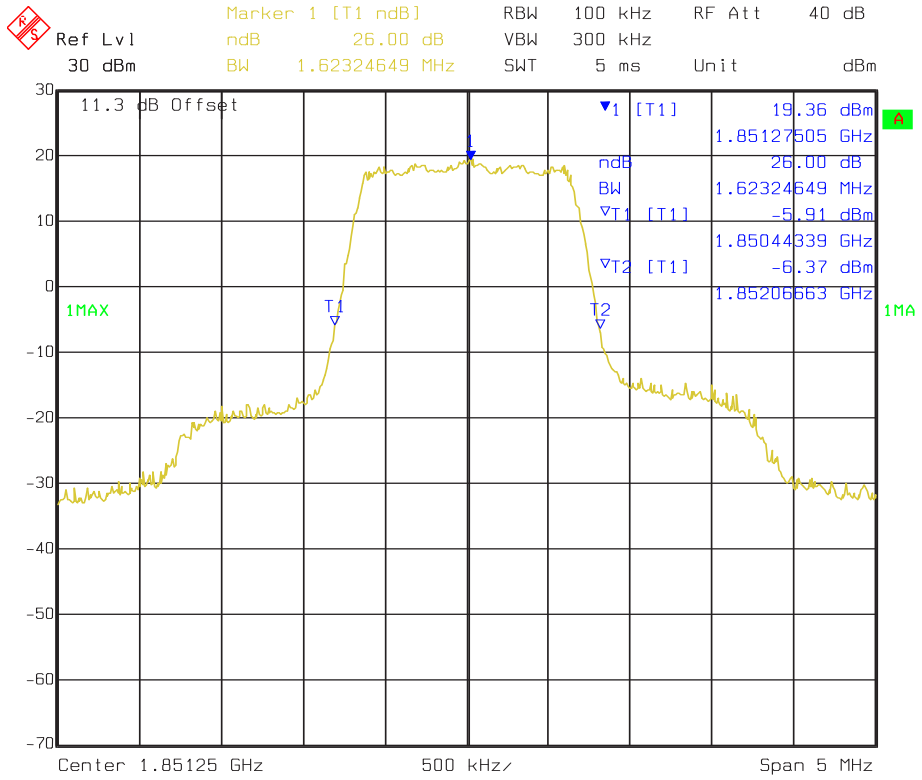


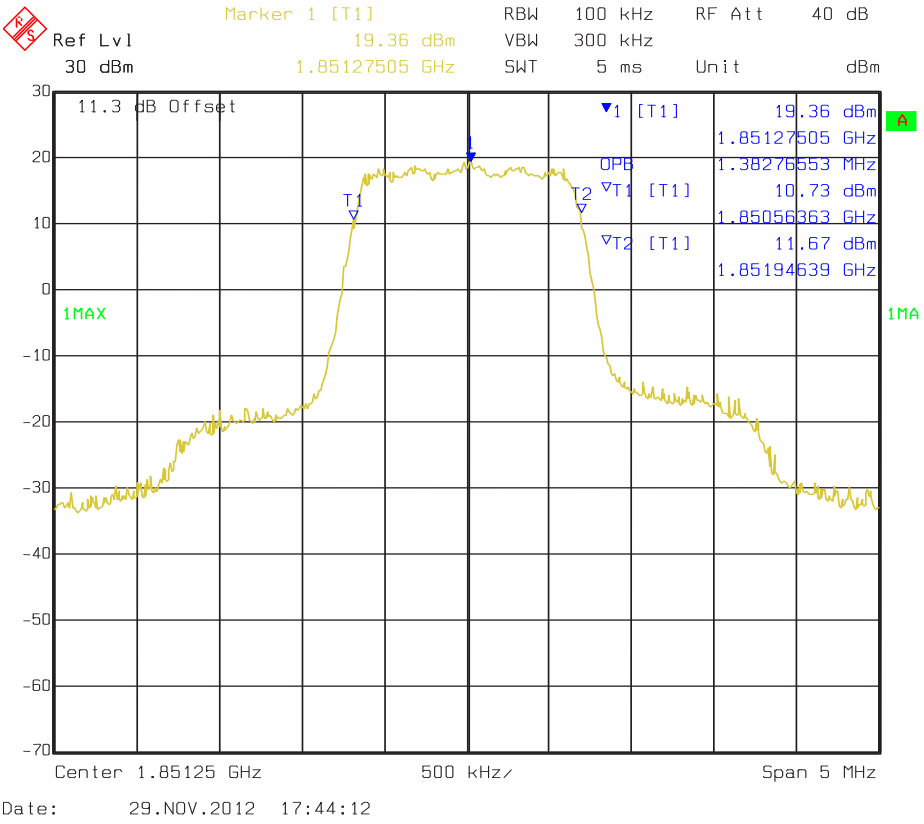
Cellular Band Frequency Mid Channel (384) – 836.52 MHz



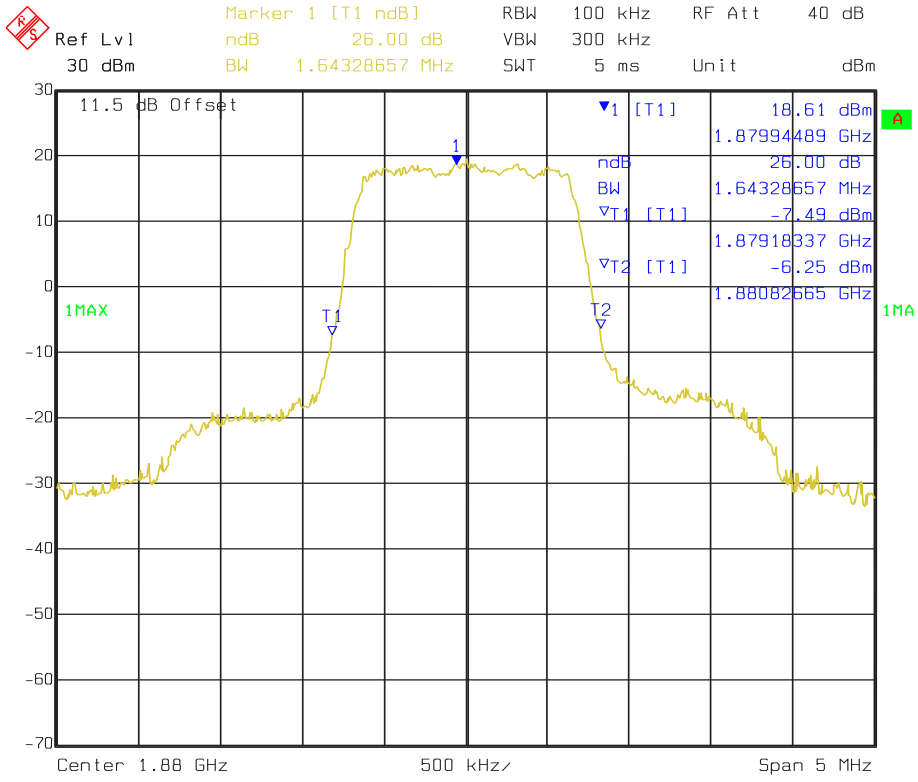


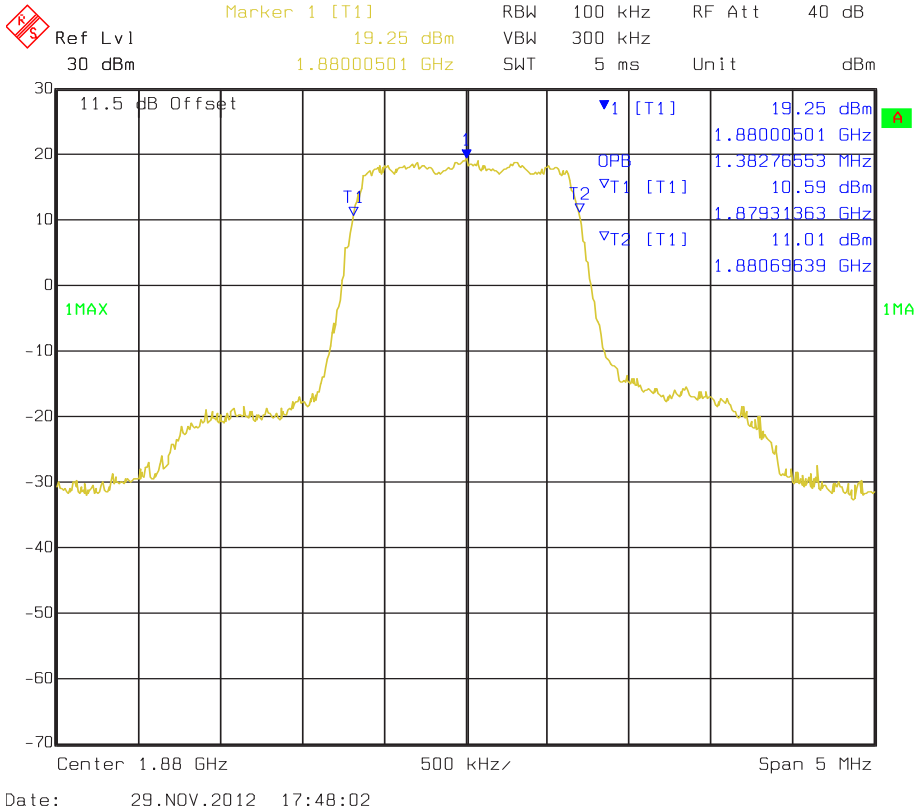
Cellular Band Frequency High Channel (777) – 848.31 MHz



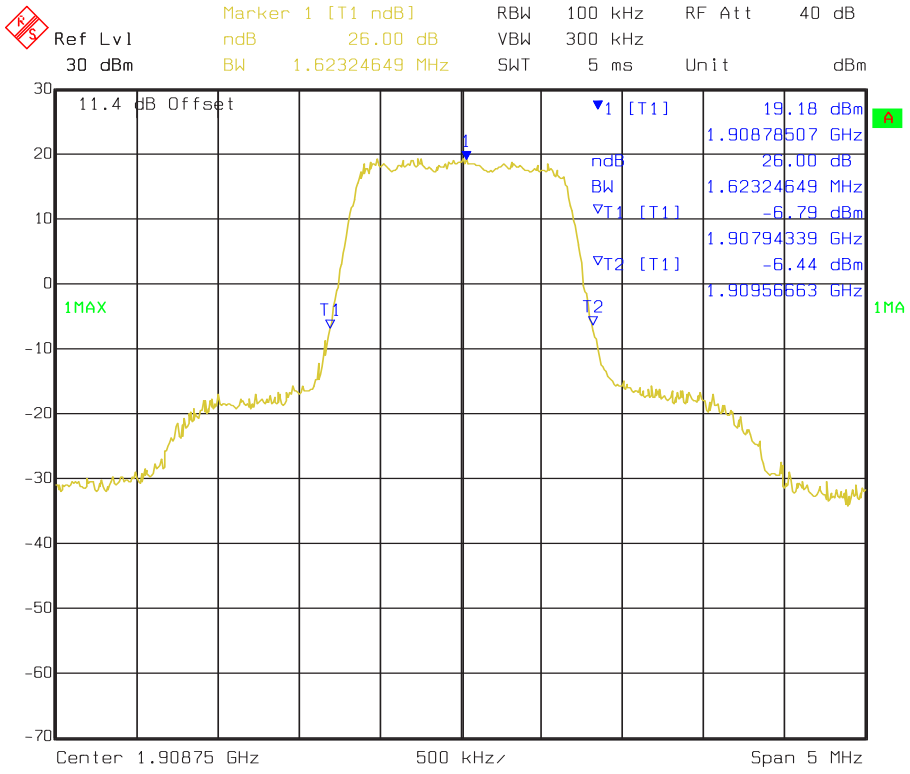


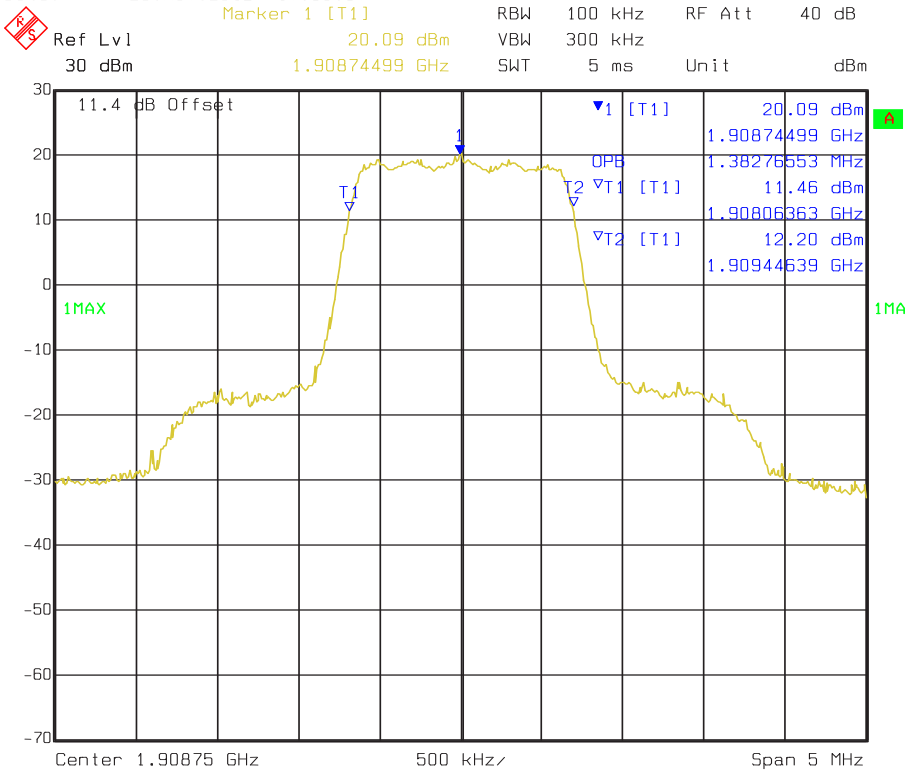
PCS Band Frequency Low Channel (25) – 1851.25 MHz





PCS Band Frequency Mid Channel (600) – 1880.00 MHz





PCS Band Frequency High Channel (1175) – 1908.75 MHz

A4. Spurious Emissions At Antenna Terminals

Para. No.: FCC 2.1051 & RSS-GEN 4.9

Part 22.917
(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.

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.
(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).

RSS 132 4.5 Transmitter Unwanted Emissions
RSS 133 6.5 Transmitter Unwanted Emissions
6.5.1 Out-of-Block Emissions (Mobile and Base Stations)
(a) Mobile stations shall comply with subsection (i) below. Base stations shall comply with either subsection (i) or subsection (ii).
(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in watts) by at least 43 + 10 log10(P), dB.

Conditions:

Model:	LISA-C200	Temperature:	21 ºC
Date:	November 28, 2012	Humidity:	53 %
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

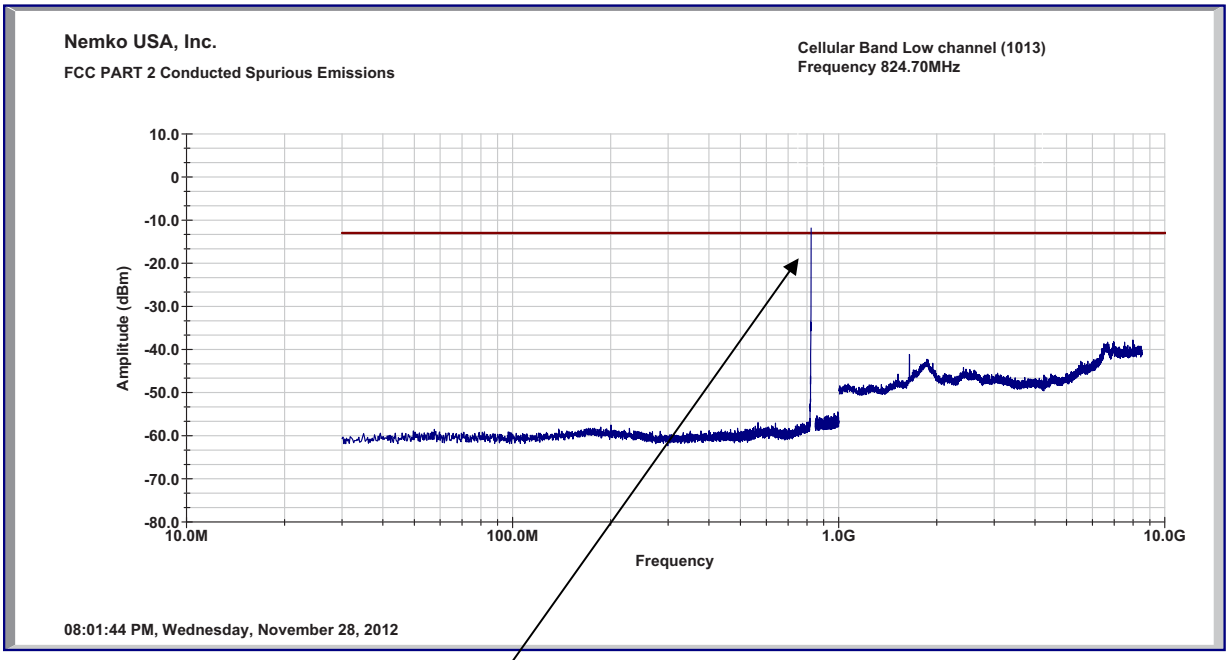
Observations:

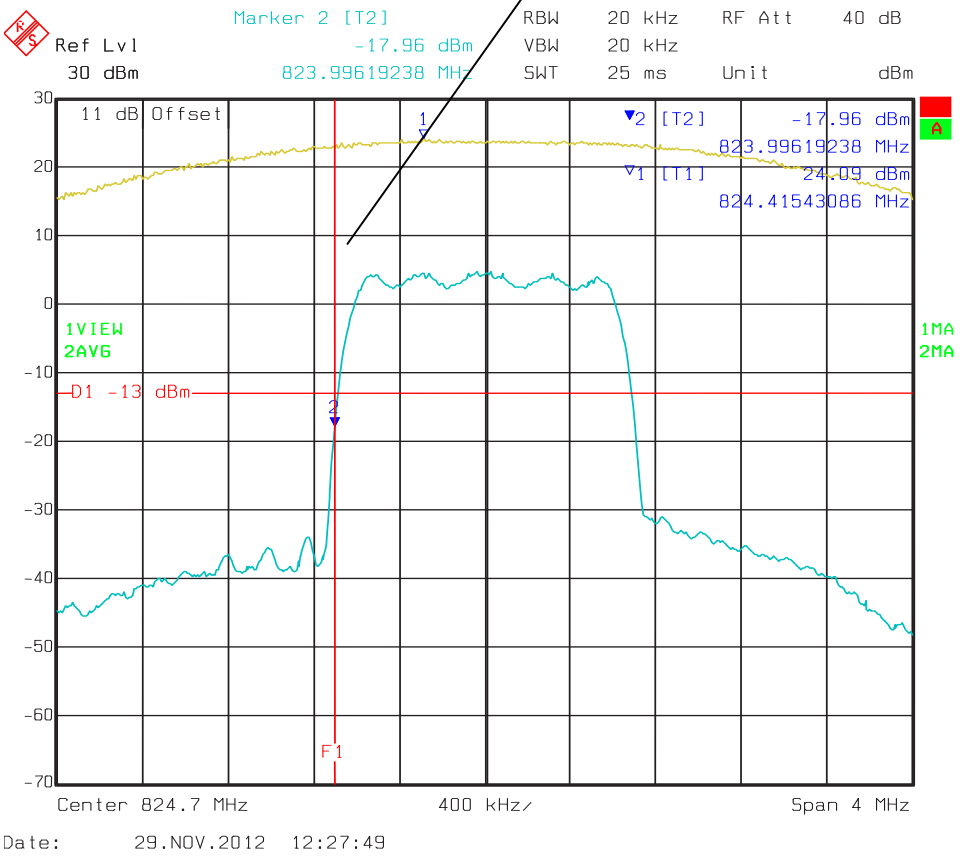
1. Video (100 sample) averaging was used to demonstrate compliance within the band edges. RBW > 1 % of emission bandwidth.
2. 1 MHz RBW, 3 MHz VBW, Max Hold is used outside the band.
3. Screenshots below demonstrate compliance at band edges. Plots show compliance from 30 MHz to 10 x Transmit Frequencies.

Test Results: Complies

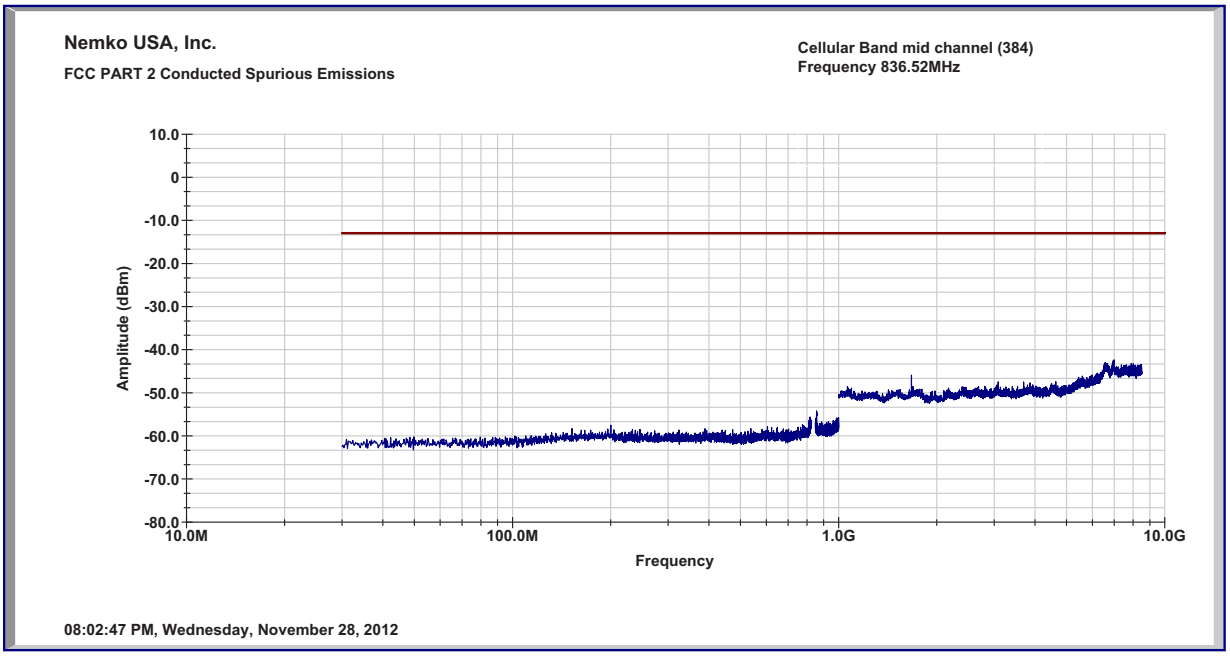
Test Data: See attached graphs.

Channel 1013 Spurious Emissions – Cellular Band Low Channel

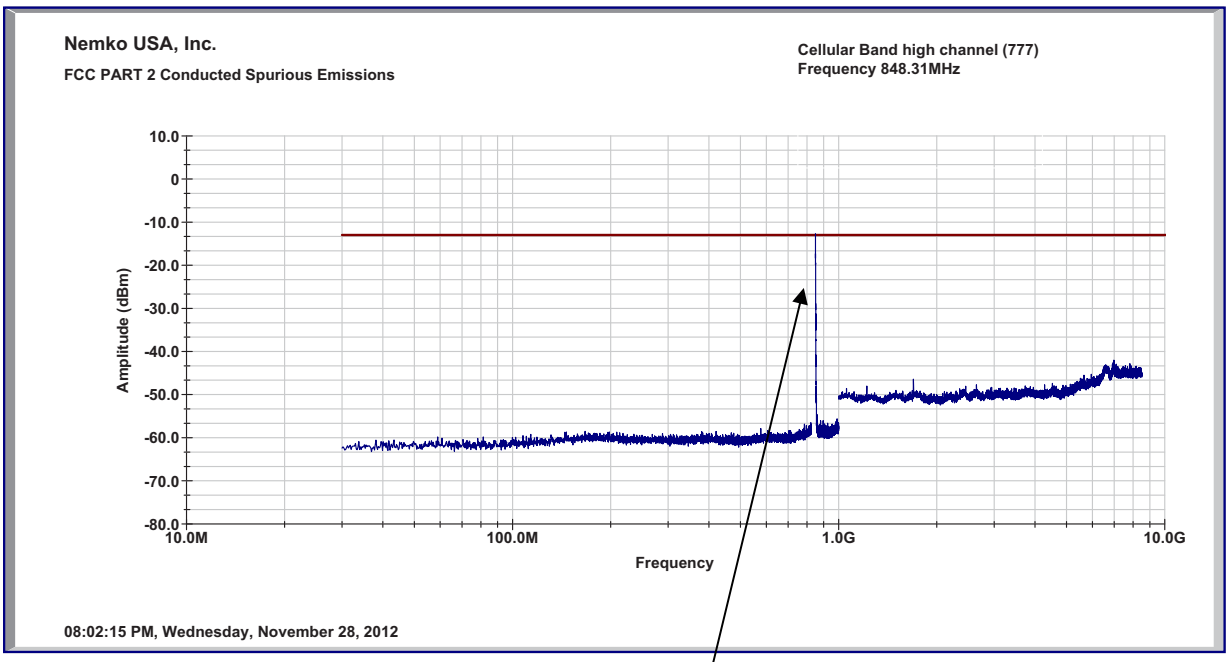


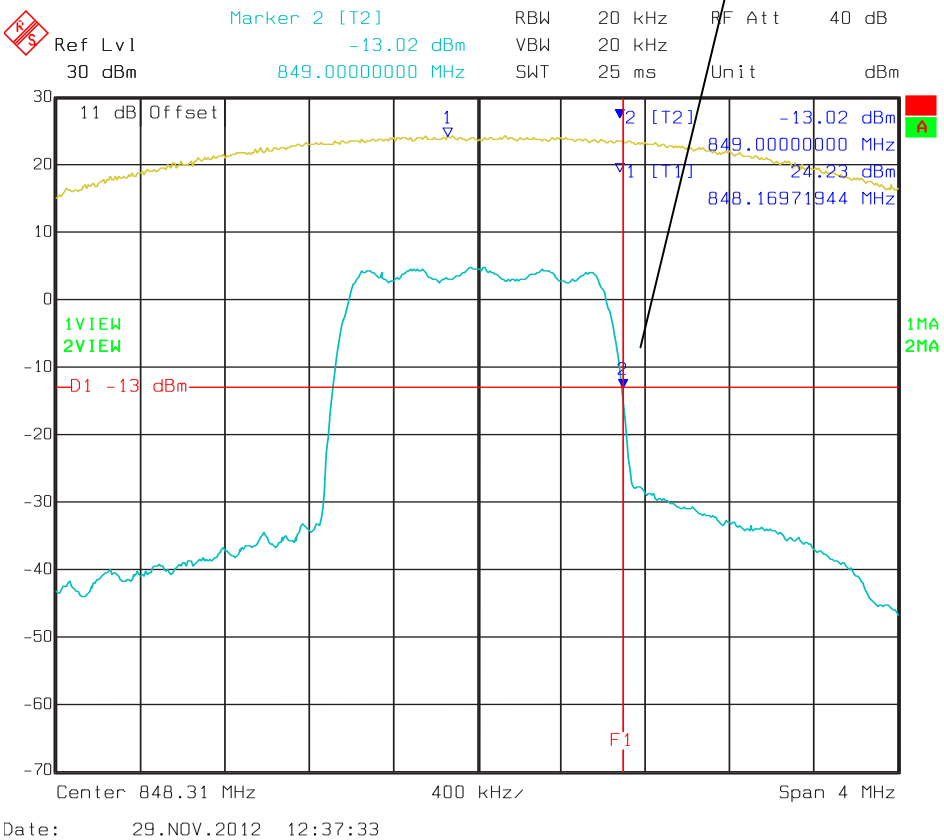


Channel Band 384 Spurious Emissions – Cellular Band Mid Channel

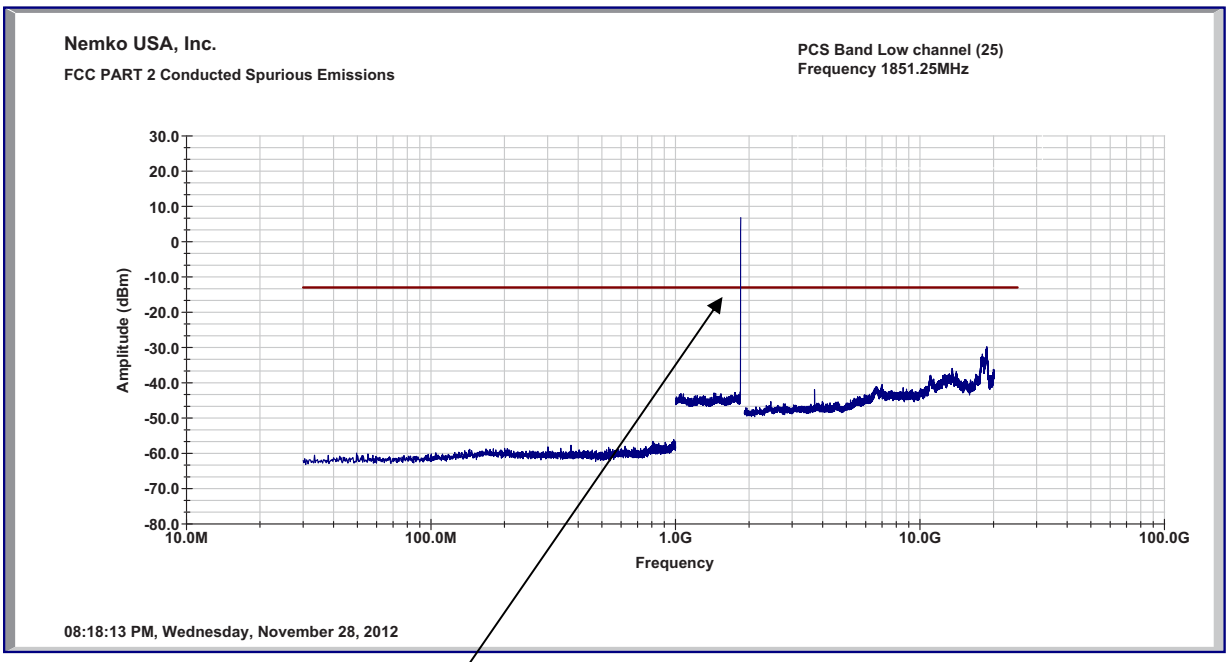


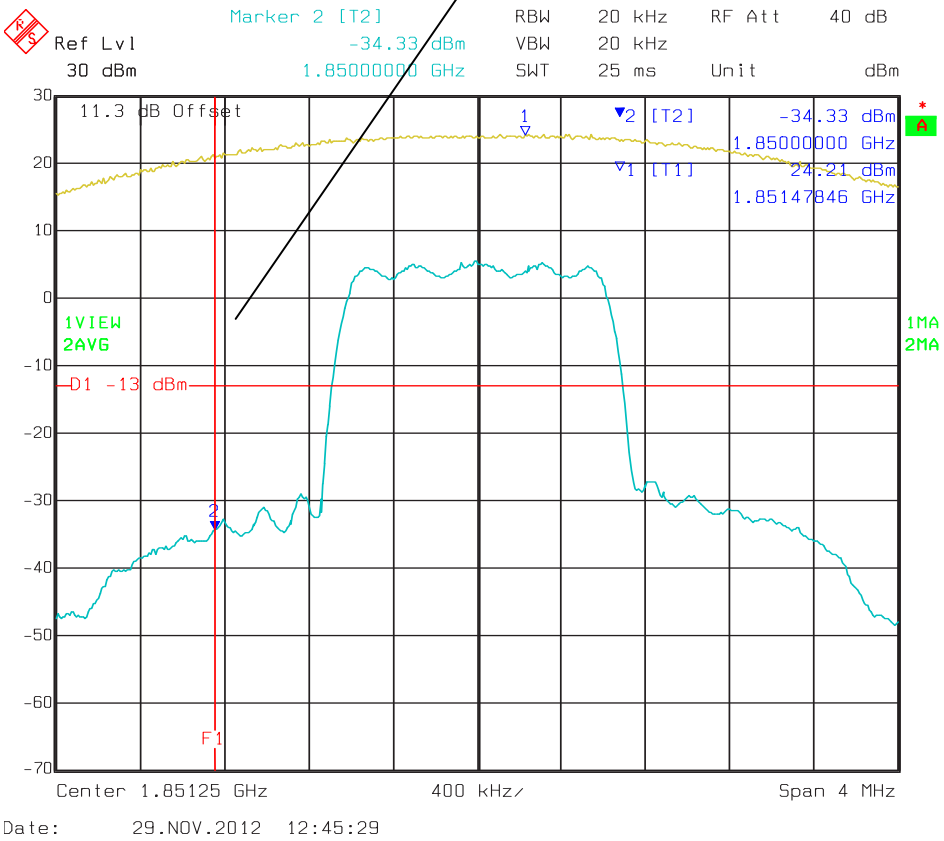
Channel 777 Spurious Emissions – Cellular Band High Channel



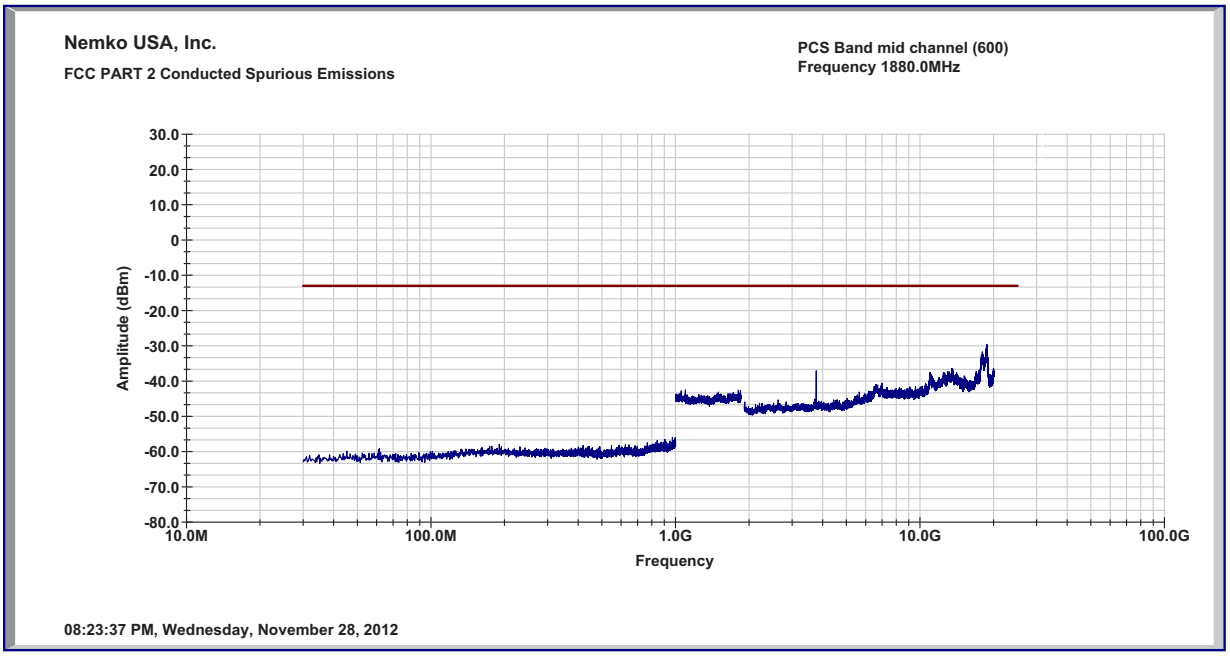


Channel 25 Spurious Emissions – PCS Band Low Channel

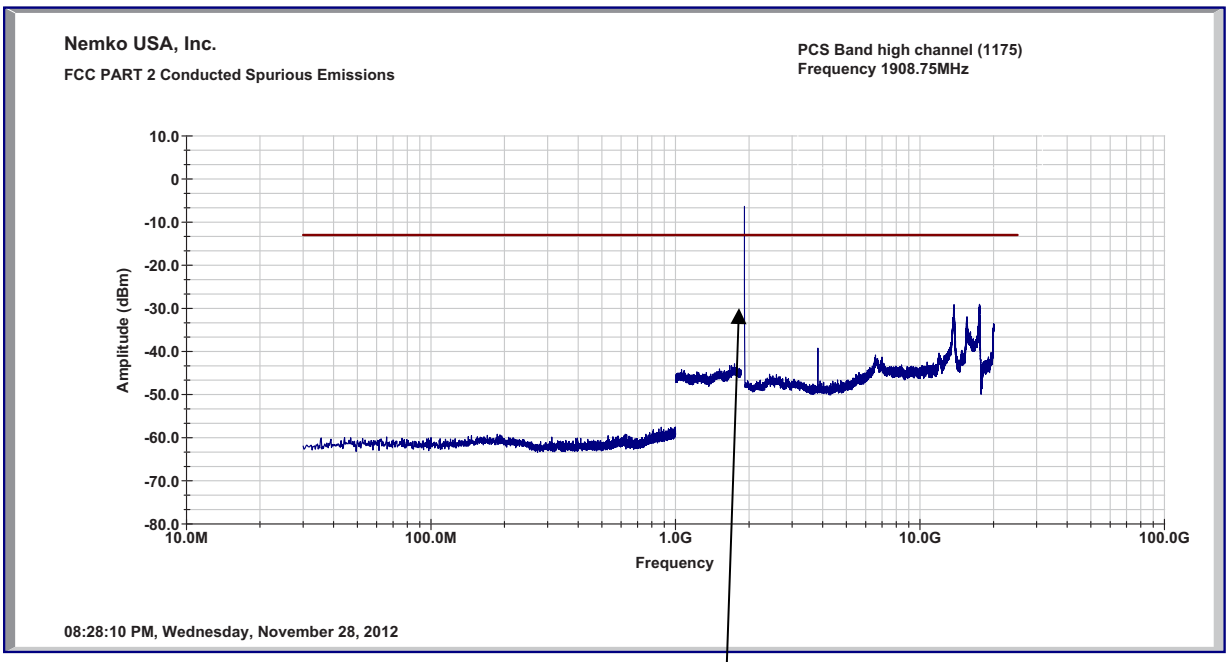


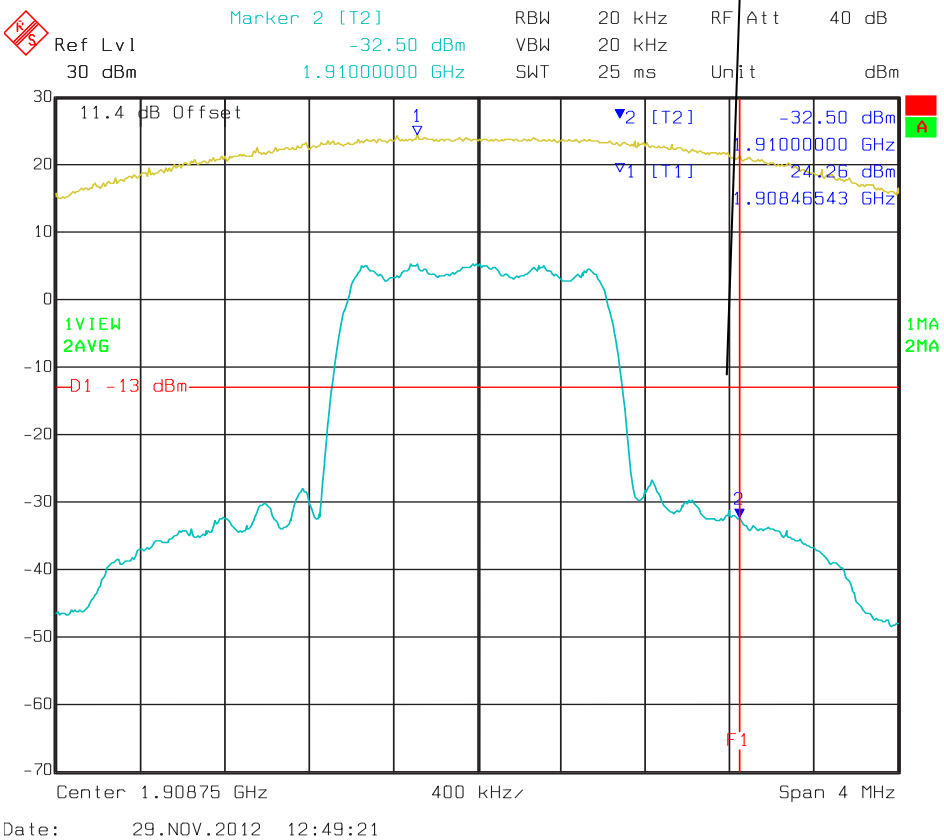


Channel 600 Spurious Emissions - PCS Band Mid Channel



Channel 1175 Spurious Emissions – PCS Band High Channel





A5. Field strength of Spurious Emissions

Para. No.: FCC 2.1053 & RSS-GEN 6.5.2

Minimum Standard is part 22

§ 22.917 Emission limitations for cellular equipment.

(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.

§ 24.238 Emission limitations for Broadband PCS equipment.

(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.

Conditions:

Model:	LISA-C200	Temperature:	21-23 ºC
Date:	Nov 28 to Dec 06, 2012	Humidity:	51-53 %
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

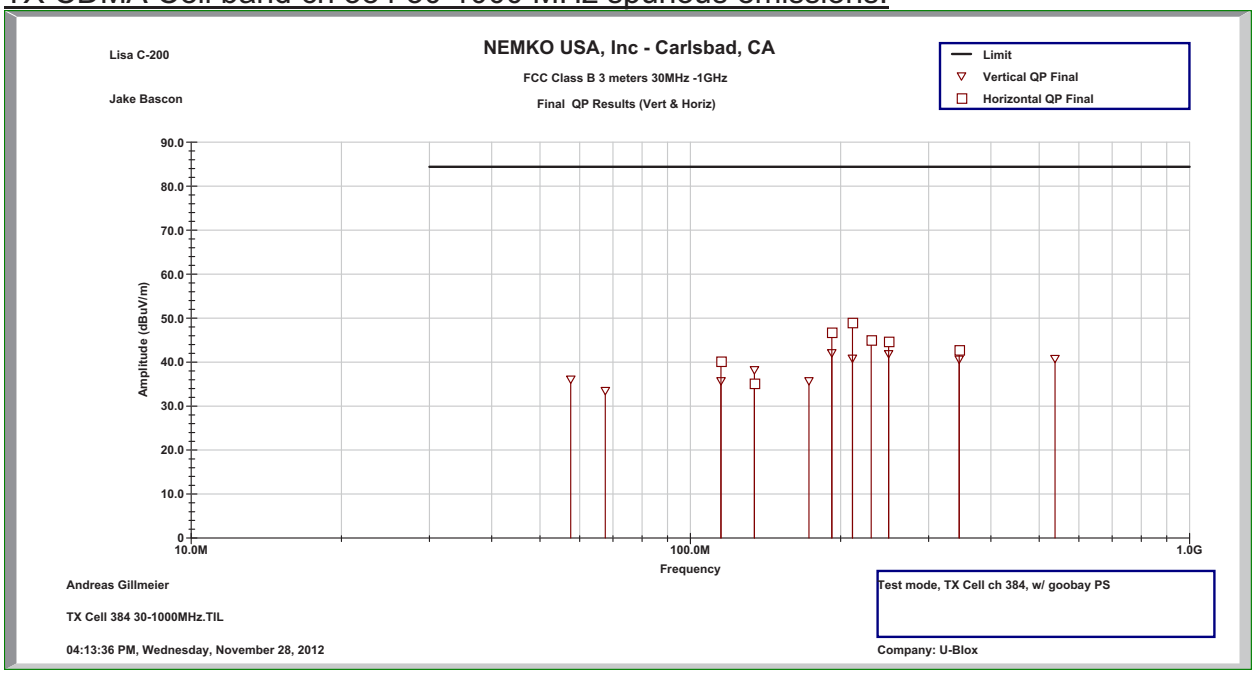
Observations:

No Emissions were noted or measured above 3rd harmonic of the transmitter frequency, however the emission's range was searched up to and including the 10th Harmonic.

Test Results: Passed

Test Data:

TX CDMA Cell band ch 384 30-1000 MHz spurious emissions:



Limit line is 84.4 dBuV/m, which is the conversion of -13 dBm (dBd)

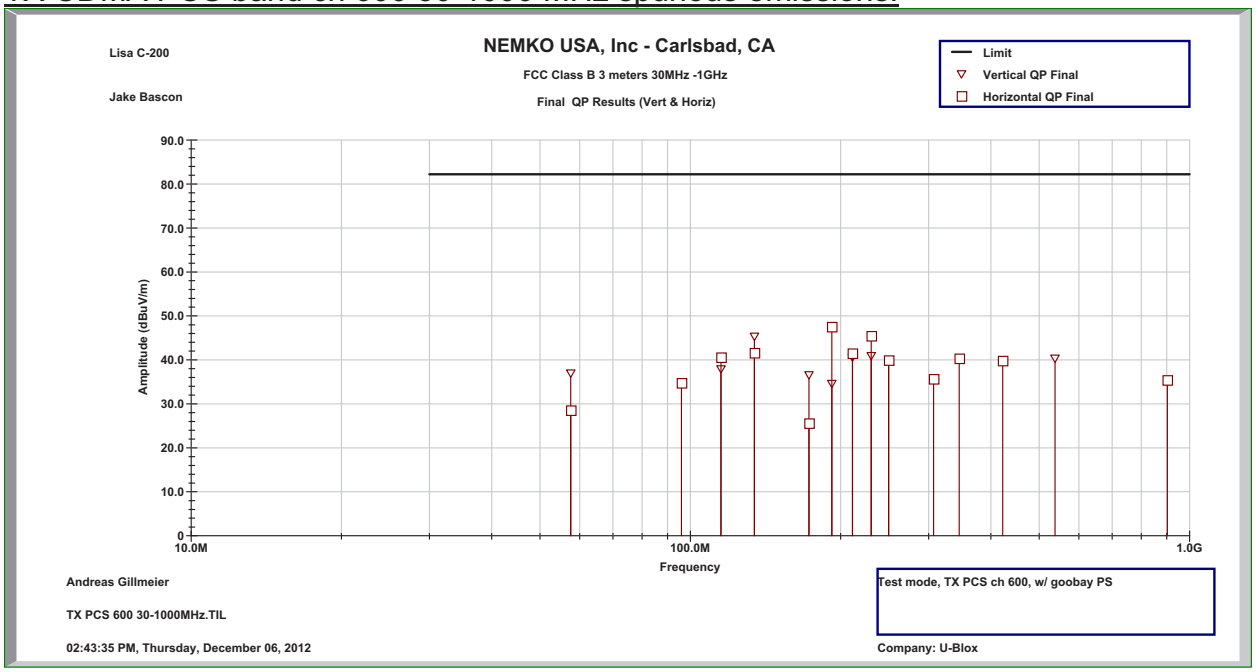
Vertical:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
57.60	55.7	-19.6	1	122	36.1	84.4	-48.3	Pass	
67.57	55.4	-21.9	-1	111	33.5	84.4	-50.9	Pass	
115.20	51.5	-15.8	115	111	35.7	84.4	-48.7	Pass	
134.40	57	-18.7	10	110	38.3	84.4	-46.1	Pass	
172.79	50.2	-14.5	327	111	35.8	84.4	-48.6	Pass	
192.00	55	-13	279	113	42.1	84.4	-42.3	Pass	
211.20	58.3	-17.4	270	106	40.9	84.4	-43.5	Pass	
249.60	58.6	-16.7	357	110	41.9	84.4	-42.5	Pass	
345.60	54.3	-13.6	341	140	40.7	84.4	-43.7	Pass	
537.59	50.4	-9.6	113	111	40.8	84.4	-43.6	Pass	

Horizontal:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
115.20	56	-15.8	222	254	40.2	84.4	-44.2	Pass	
134.40	53.9	-18.7	349	389	35.2	84.4	-49.2	Pass	
192.00	59.7	-13	74	160	46.7	84.4	-37.7	Pass	
211.20	66.4	-17.4	275	176	49	84.4	-35.4	Pass	
230.40	62.9	-17.8	60	112	45	84.4	-39.4	Pass	
249.60	61.4	-16.7	118	138	44.7	84.4	-39.7	Pass	
345.60	56.4	-13.6	277	122	42.8	84.4	-41.6	Pass	

TX CDMA PCS band ch 600 30-1000 MHz spurious emissions:



Limit line is 82.2 dBuV/m, which is the conversion of -13 dBm (dBi)

Vertical:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
57.60	56.6	-19.6	69	113	37	82.2	-45.2	Pass	
115.19	53.7	-15.8	148	110	37.9	82.2	-44.3	Pass	
134.40	64.1	-18.7	292	111	45.3	82.2	-36.9	Pass	
172.79	51.1	-14.5	295	111	36.6	82.2	-45.6	Pass	
191.99	47.6	-13	351	111	34.6	82.2	-47.6	Pass	
211.20	58.1	-17.4	267	105	40.6	82.2	-41.6	Pass	
230.41	58.8	-17.8	362	136	41	82.2	-41.2	Pass	
249.60	56.6	-16.7	361	115	39.9	82.2	-42.3	Pass	
537.61	49.9	-9.6	127	112	40.4	82.2	-41.8	Pass	

Horizontal:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
57.61	48.1	-19.6	304	274	28.5	82.2	-53.7	Pass	
95.98	54.2	-19.5	80	353	34.8	82.2	-47.4	Pass	
115.19	56.4	-15.8	276	274	40.6	82.2	-41.6	Pass	
134.41	60.3	-18.7	104	226	41.6	82.2	-40.6	Pass	
172.79	40.1	-14.5	10	111	25.6	82.2	-56.6	Pass	
192.00	60.5	-13	107	187	47.5	82.2	-34.7	Pass	
211.20	59	-17.4	9	175	41.5	82.2	-40.7	Pass	
230.40	63.3	-17.8	311	169	45.5	82.2	-36.7	Pass	
249.59	56.6	-16.7	97	138	39.9	82.2	-42.3	Pass	
307.20	49.6	-13.9	10	284	35.7	82.2	-46.5	Pass	
345.60	54	-13.6	327	109	40.4	82.2	-41.8	Pass	
422.40	52	-12.1	289	111	39.8	82.2	-42.4	Pass	
902.40	37.6	-2.2	351	111	35.4	82.2	-46.8	Pass	

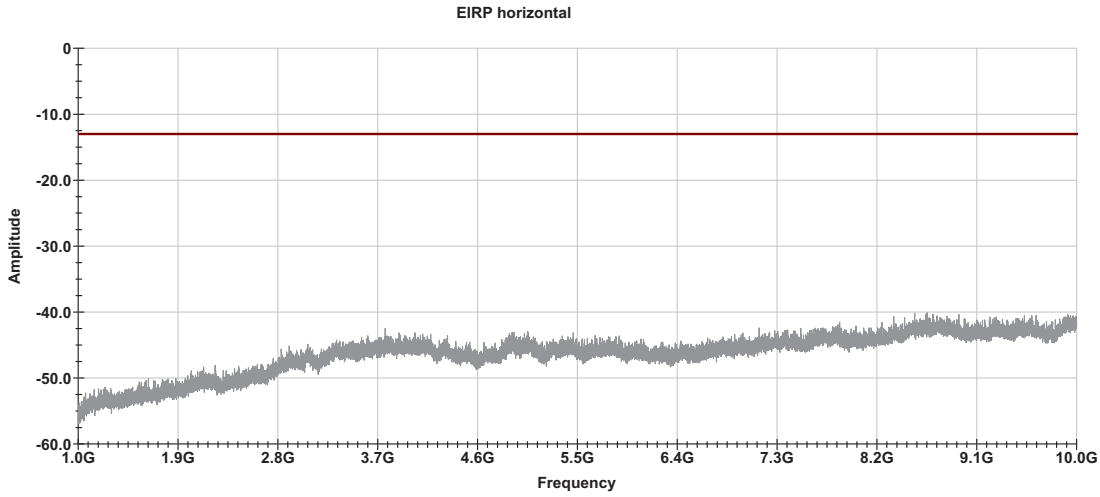
Example: A=RR+CL+AF
A = Amplitude dBµV/m
RR = Receiver Reading dBµV
CL = cable loss dB
AF = antenna factor dB/m

Example Frequency = 5640.8 MHz
-62.3dBm (spectrum analyzer reading)
+12.4 dB (cable loss @ frequency)
-49.9 dBm
-11.0 dBm (receive antenna gain @ frequency)
-60.9 dBµV/m
-31.8 dB amplifier gain
-92.7 dBm
+57.1 dB propagation loss
-35.6 dBmV/m Final adjusted value

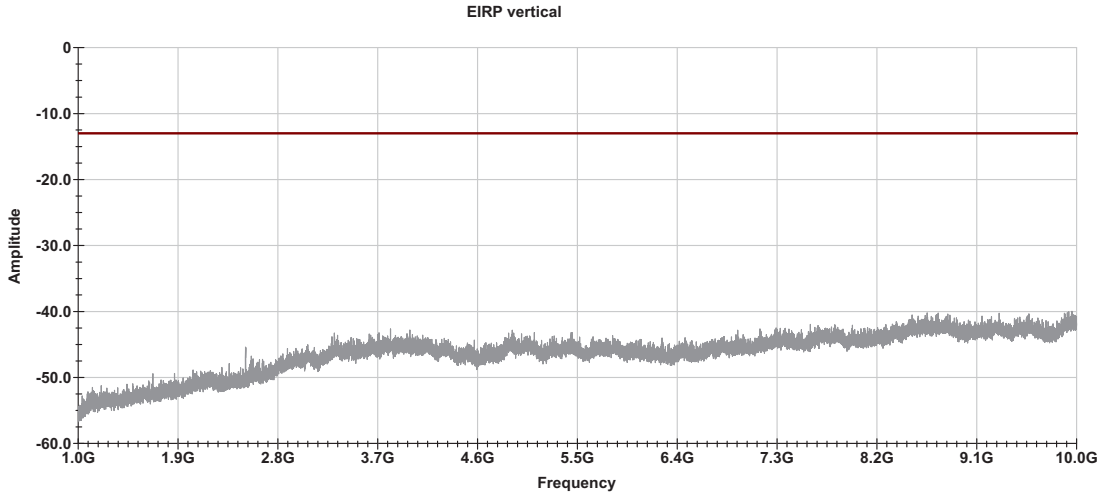
TX CDMA Cell and PCS band above 1 GHz spurious emissions:

Cell Ch 384:

Horizontal:

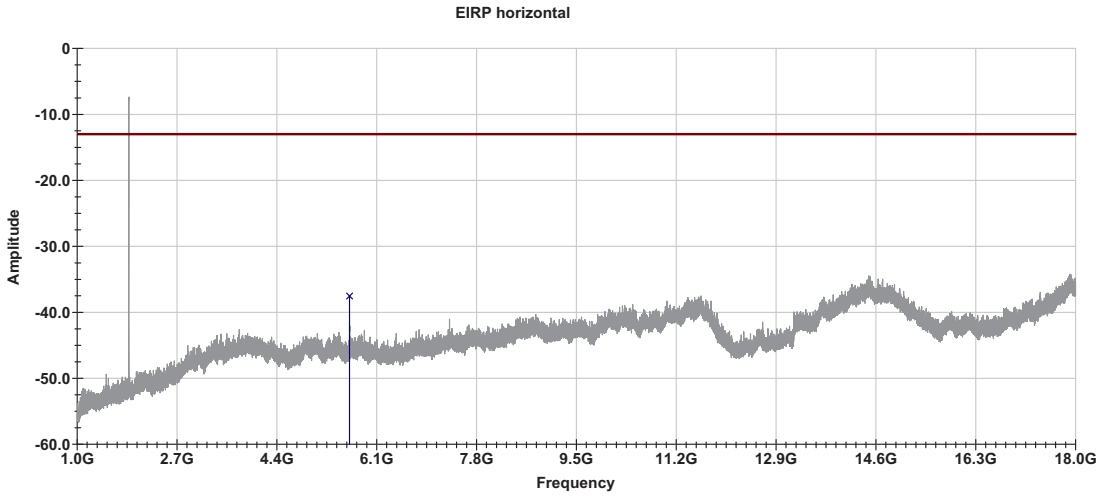


Vertical:



PCS Ch 600: (high peak is TX frequency)

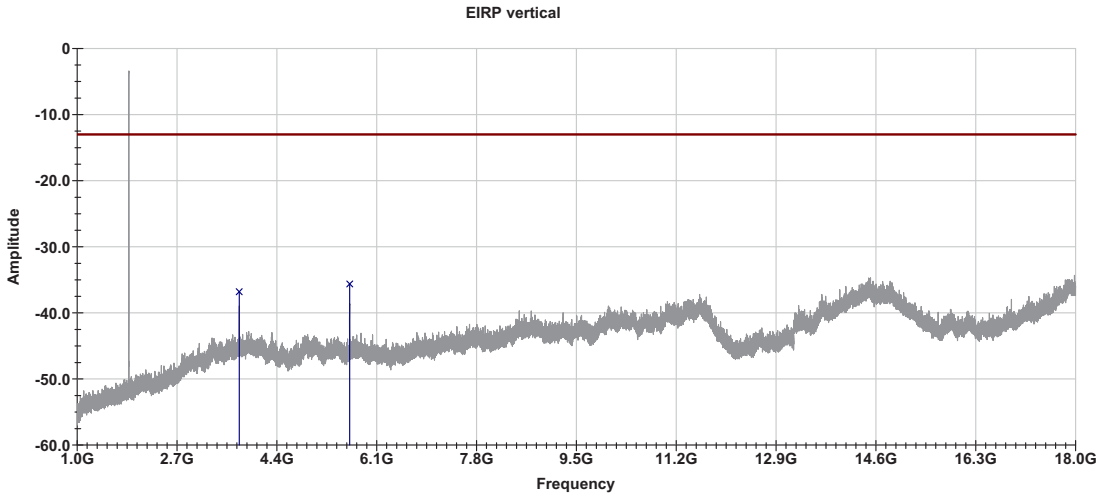
Horizontal:



Frequency (MHz)	Peak Measurement (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Pass Fail	Comments
5638.1	-37.54	-13	-24.5	Pass	Horizontal Polarity

No emissions from 18-20 GHz detected.

Vertical:



Frequency (MHz)	Peak Measurement (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Pass Fail	Comments
3759.8	-36.80	-13	-23.8	Pass	Vertical Polarity
5640.8	-35.63	-13	-22.6	Pass	Vertical Polarity

No emissions from 18-20 GHz detected.

2.3 Frequency Stability

Para. No.: FCC 2.1055 & RSS-GEN 4.7

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

RSS 132
The carrier frequency shall not depart from the reference frequency in excess of ±2.5 ppm for mobile stations and ±1.5 ppm for base stations.

RSS 133
6.3 Frequency Stability
The carrier frequency shall not depart from the reference frequency, in excess of ±2.5 ppm for mobile Stations.

Conditions:

Model:	LISA-C200	Temperature:	23 ºC
Date:	November 30, 2012	Humidity:	43 %
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

Observations:

Test Results: Passed

Frequency Stability data:

Channel	384	Cellular band		
Frequency	836.52	MHz		
Voltage Volt	Temp. °C	Peak Power dBm	Frequency Error HZ	Frequency Error (PPM)
3.4	20	24.12	-31	-0.0376
3.9		24.45	-23	-0.0279
4.3		24.61	-24	-0.0291
3.9	0		-23	-0.0279
3.9	10		-25	-0.0303
3.9	30		23	0.0279
3.9	40		-23	-0.0279
3.9	50		-31	-0.0376
3.9	-10		-24	-0.0291
3.9	-20		-44	-0.0534
3.9	-30		29	0.0352

Channel	25	PCS band		
Frequency	1851.25	MHz		
Voltage Volt	Temp. °C	Peak Power dBm	Frequency Error HZ	Frequency Error (PPM)
3.4	20	23.46	-37	-0.0200
3.9		23.53	-34	-0.0184
4.3		23.69	-33	-0.0178
3.9	0		-34	-0.0184
3.9	10		-35	-0.0189
3.9	30		-35	-0.0189
3.9	40		31	0.0167
3.9	50		50	0.0270
3.9	-10		-37	-0.0200
3.9	-20		-44	-0.0238
3.9	-30		45	0.0243

Frequency Stability over low voltage conditions

Date:	30-Nov-12			
Mode:	CDMA 800		CDMA 1900	
Channel:	384	836.52MHz	25	1851.25 MHz

Voltage	Frequency Error	Frequency Error	Frequency Error	Frequency Error
Volt DC	HZ	(PPM)	HZ	(PPM)
2.60Vdc	EUT turns OFF		EUT turns OFF	
2.65Vdc	-37.00	-0.044	-51	-0.028
2.70Vdc	-40	-0.048	-55	-0.030
2.75Vdc	-36	-0.043	-49	-0.026
2.80Vdc	-65	-0.078	-59	-0.032
2.85Vdc	36	0.043	-48	-0.026
2.90Vdc	-23	-0.027	-83	-0.045
2.95Vdc	-35	-0.042	-35	-0.019
3.0Vdc	-22	-0.026	-38	-0.021
3.1Vdc	43	0.051	-34	-0.018
3.2Vdc	-23	-0.027	-34	-0.018
3.3Vdc	-23	-0.027	-35	-0.019
3.4Vdc	-31	-0.037	-37	-0.020
3.5Vdc	-24	-0.029	-30	-0.016
3.6Vdc	-27	-0.032	-34	-0.018
3.7Vdc	-30	-0.036	-32	-0.017
3.8Vdc	-53	-0.063	-34	-0.018

A6. Receiver Spurious

Para. No.: RSS-GEN 4.10

RSS 132
4.6 Receiver Spurious Emissions
Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

RSS 133
6.6 Receiver Spurious Emissions
Receiver spurious emissions shall comply with the limits specified in RSS-Gen.

4.10 Receiver Spurious Emissions
The receiver shall be operated in the normal receive mode near the mid-point of the band over which the receiver is designed to operate.
Unless otherwise specified in the applicable RSS, the radiated emission measurement is the standard measurement method (with the device's antenna in place) to measure receiver spurious emissions.
Radiated emission measurements are to be performed using a calibrated open-area test site. As an alternative, the conducted measurement method may be used when the antenna is detachable. In such a case, the receiver spurious signal may be measured at the antenna port.

6. Receiver Spurious Emission Standard
The following receiver spurious emission limits shall be complied with: (b) If a conducted measurement is made, no spurious output signals appearing at the antenna terminals shall exceed 2 nanowatts per any 4 kHz spurious frequency in the band 30-1000 MHz, or 5 nanowatts above 1 GHz.

Model:	LISA-C200	Temperature:	21-23 ºC
Date:	Nov 29 to Dec 6, 2012	Humidity:	51-61%
Modification State:	None	Tester:	Andreas Gillmeier
		Laboratory:	Nemko

Observations:

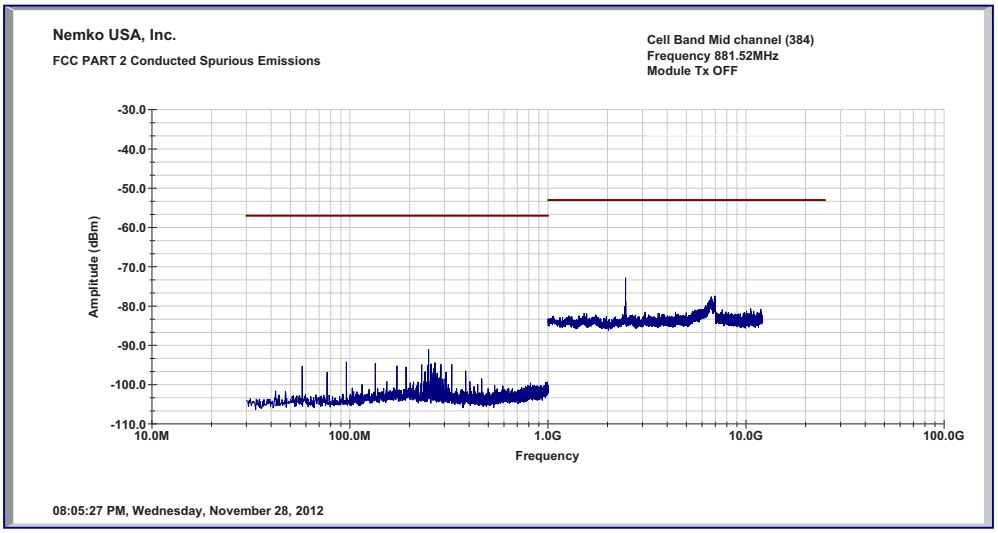
Selecting receive versus frequency (high, mid or low) did not result in any noticeable differences.

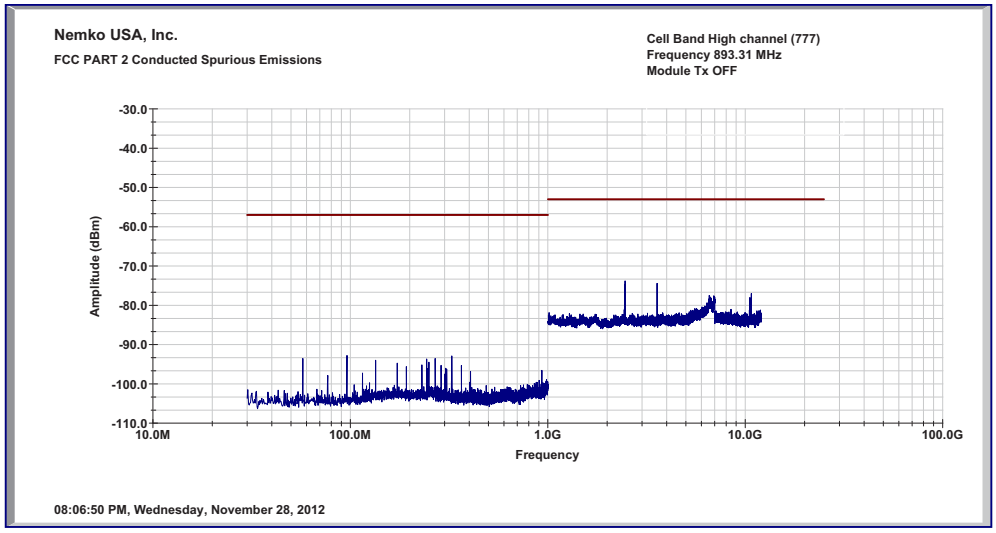
Test Results: Complies

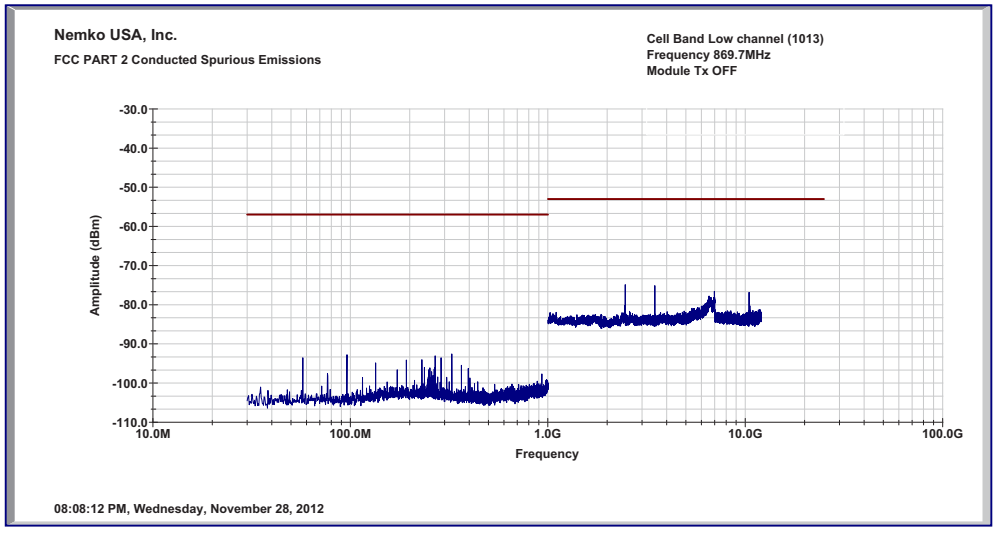
Test Data: See attached plots.

Direct conducted measurement
No emissions evident within 20 dB of the conducted Limits.

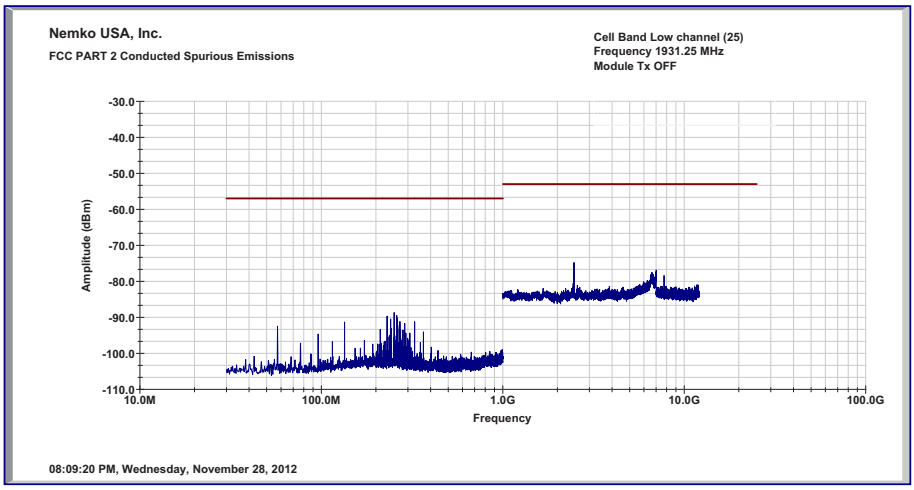
RBW 10kHz, VBW 30kHz, max hold peak
Limit
2 nanowatts = -57dBm
5 nanowatts = -53 dBm

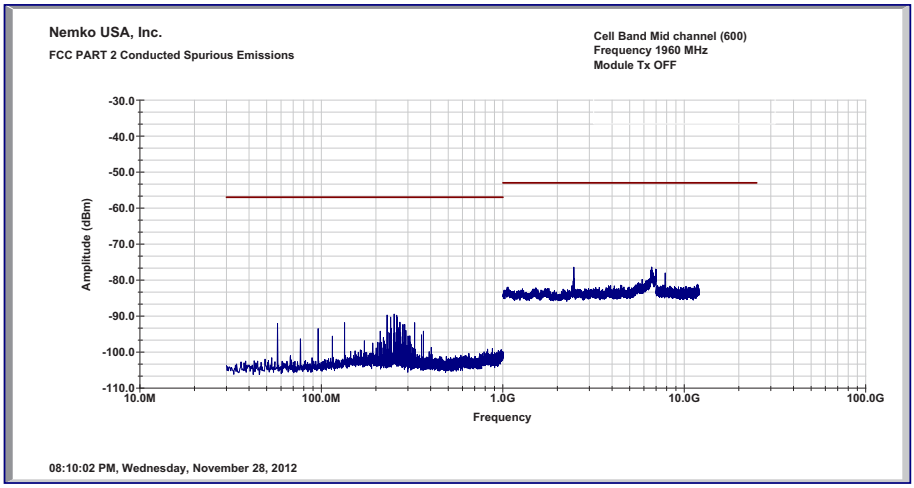


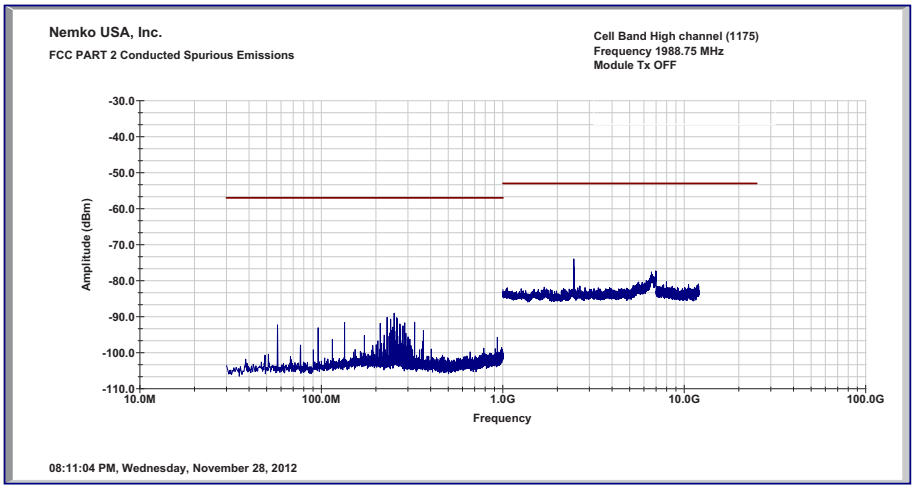




Cellular Band: Low, Mid and High channels

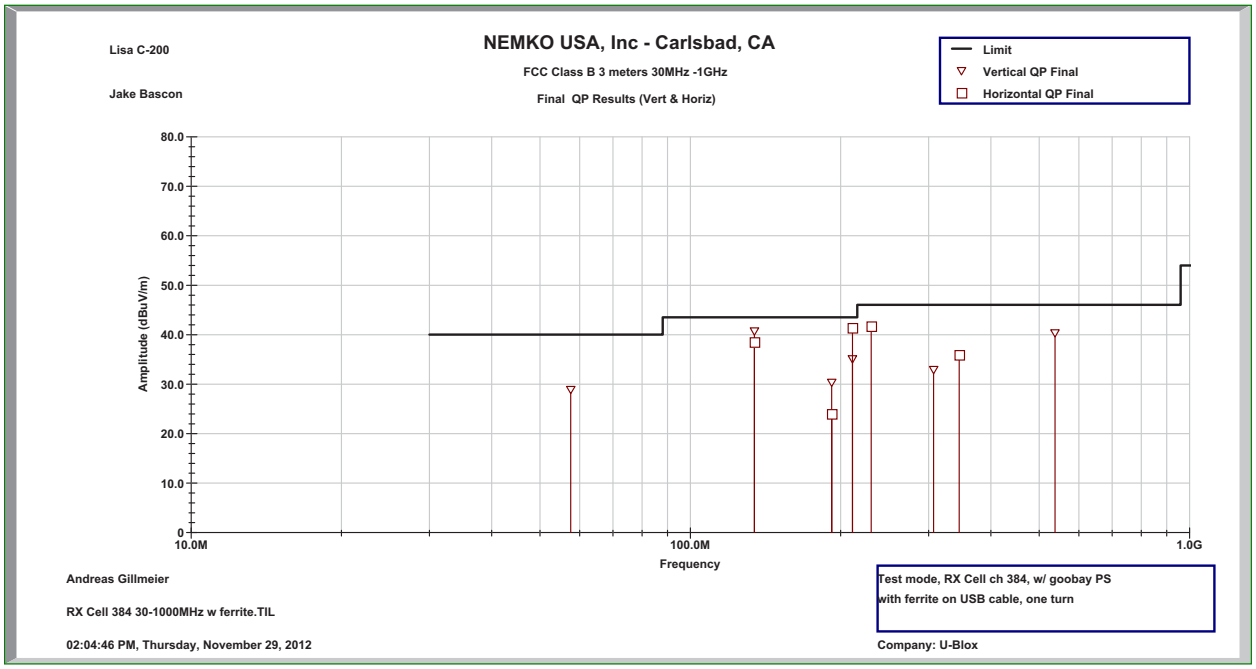






PCS Band: Low, Mid and High channels

RX CDMA Cell band ch 384 30-1000 MHz spurious emissions:



Horizontal:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
134.40	57.2	-18.7	64	237	38.5	43.5	-5	Pass	
192.00	36.9	-13	11	383	24	43.5	-19.5	Pass	
211.21	58.8	-17.4	67	184	41.4	43.5	-2.1	Pass	
230.41	59.5	-17.8	112	168	41.7	46	-4.3	Pass	
345.60	49.5	-13.6	239	121	35.9	46	-10.1	Pass	

Vertical:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
57.60	48.5	-19.6	360	111	28.9	40	-11.1	Pass	
134.41	59.4	-18.7	263	111	40.7	43.5	-2.8	Pass	
191.98	43.3	-13	303	111	30.4	43.5	-13.1	Pass	
211.20	52.6	-17.4	121	188	35.1	43.5	-8.4	Pass	
307.20	46.9	-13.9	295	111	32.9	46	-13.1	Pass	
537.60	49.9	-9.6	174	111	40.4	46	-5.6	Pass	

No emissions could be measured in RX for Cell band from 1-5 GHz.

RX CDMA Cell band ch 1013 30-1000 MHz spurious emissions (worst emissions remeasured):

Horizontal:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
134.40	57.4	-18.7	82	148	38.7	43.5	-4.8	Pass	
211.20	58.3	-17.4	112	186	40.9	43.5	-2.6	Pass	
230.40	51	-17.8	10	123	33.2	46	-12.8	Pass	

Vertical:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
134.40	58	-18.7	256	110	39.3	43.5	-4.2	Pass	
537.60	48.2	-9.6	149	110	38.7	46	-7.3	Pass	

RX CDMA Cell band ch 777 30-1000 MHz spurious emissions (worst emissions remeasured):

Horizontal:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
134.41	57.8	-18.7	72	243	39.1	43.5	-4.4	Pass	
211.21	47.2	-17.4	11	111	29.7	43.5	-13.8	Pass	
230.40	59	-17.8	103	166	41.1	46	-4.9	Pass	

Vertical:

Measurement Frequency (MHz)	QP Measured (dBµV)	Adjustments (dBm)	Turn Table (degrees)	Antenna Height (cm)	Corrected Reading (dBµV/m)	Limit (dBµV/m)	Margin (dBµV/m)	Pass Fail	Comments
134.40	56.7	-18.7	255	117	37.9	43.5	-5.6	Pass	
537.61	48.2	-9.6	149	110	38.6	46	-7.4	Pass	