ECL-EMC Test Report No.: 12-046

Equipment under test:	**ION-M8P S**
FCC ID:	**XS5-IONM8PS**
IC ID:	**2237E-IONM8PS**
Type of test:	**FCC 47 CFR Part 90 Subpart S:2009** Private Land Mobile Repeater **RSS-Gen:2007, RSS-131:2005** **Cellular Telephones Employing New Technologies Operating in the Bands 806-824 MHz and 851-869 MHz**
Measurement Procedures:	47 CFR Parts 2:2009 (*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*), Part 90:2009 (Private Land Mobile), ANSI/TIA-603-C (2004), *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards* IC-RSS-GEN:2007 General Requirements and Information for the Certification of Radiocommunication Equipment
Test result:	**Passed**

Date of issue:	11.04.2012	Signature:	
Issue-No.:	01	Author:	Tom Zahlmann Test engineer Digital unterschrieben von Tom Zahlmann DN: cn=Tom Zahlmann, o=TEMPTON Service Plus GmbH, ou=ECL, email=tom.zahlmann@tempton.de, c=DE Datum: 2012.04.11 08:39:46 +02'00'
Date of delivery:	23.02.2012	Checked:	Günter Weinfurtner Test engineer Digital unterschrieben von Günter Weinfurtner DN: cn=Günter Weinfurtner, o=Tempton Service Plus, ou=ECL, email=guenter.weinfurtner@tempton.de, c=DE Datum: 2012.04.11 08:44:08 +02'00'
Test dates:	14.02.12 – 13.03.12		
Pages:	57		

Manufacturer:	ANDREW Wireless Systems GmbH Industriering 10 D-86675 Buchdorf Tel.: +49 (0)9099 69 0 Fax: +49 (0)9099 69 140
Test Location:	TEMPTON Service Plus GmbH European Compliance Laboratory (ECL) Thurn-und-Taxis-Straße 18 D-90411 Nürnberg Tel.: +49 0911 59835 0 Fax: +49 0911 59835 90

General:
The purpose of this report is to show compliance to the FCC regulations for licensed devices operating under section 90 of the Code of Federal Regulations title 47.
This report informs about the results of the RF tests, it only refers to the equipment under test. No part of this report may be reproduced in any form, without written permission.

Table of contents

1 Test Results Summary

Name of Test	FCC Para. No.	FCC Method	FCC Spec.	Result
RF Power Output	90.635	2.1046	1000 Watts	Complies
Occupied Bandwidth	90.210	2.1049	Input/Output	Complies
Spurious Emissions at Antenna Terminals	90.210	2.1051	-13dBm	Complies
Radiated Spurious emission	90.543	2.1053	-13dBm	Complies
Frequency Stability	90.213	2.1055	1 ppm	NA

Name of Test	IC Para. No.	IC Method	Result
RF Power Output	RSS-131	RSS-GEN 4.8	Complies
Occupied Bandwidth	RSS-131	RSS-GEN 4.6.1	Complies
Spurious Emissions at Antenna Terminals	RSS-131	RSS-GEN 4.9	Complies
Field Strength of Spurious Emissions	RSS-131 6.4	RSS-GEN 4.9	Complies
Frequency Stability	RSS-131	RSS-GEN 4.7	NA

Frequency stability is given by: The system gets an electrical analog signal from the BSS which is converted into an analog optical signal, transmitted by the optical links and then reconverted in the Remote Unit into an analog electrical signal. During this process happens no frequency change/modification, so input and output have same frequency what can be seen under capture “Occupied Bandwith”.

2 Equipment under test (E.U.T.)

2.1 Description

Kind of equipment	ION-M8P S Repeater
Andrew Ident. Number	Id.No. 7611167-0002
Serial no.(SN)	11
Revision	00
Software version and ID	V4.20.1.2 Id.No. 7158950
Type of modulation and Designator	F3E (Voice) ☒ GXW ☒ G7W ☒ F9W ☒
Frequency Translation	F1-F1 ☒ F1-F2 ☐ N/A ☐
Band Selection	Software ☐ Duplexer ☒ Full band ☐

2.1.1 Downlink

Pass band	Path 851 MHz – 869 MHz
Nominal 20dB bandwidth	55 MHz
Max. composite output power based on one carrier per path (rated)	44 dBm = 25,1 W
System Gain	11 dB @ Pout BTS of 33 dBm

2.1.2 Uplink

Pass band	Path 806 MHz – 824 MHz
Gain	n.a.

Note: The EUT does not transmit over the air in the uplink direction.

2.1.3 Description of EUT

Andrew ION-M8P S is a multi-band, multi-operator remote unit with various extension units. It is used in conjunction with a master unit in the ION optical distribution system.

This Test Report describes the approval of the 800 MHz Path (ION-M8P S).

2.1.4 Block diagram of measurement reference points

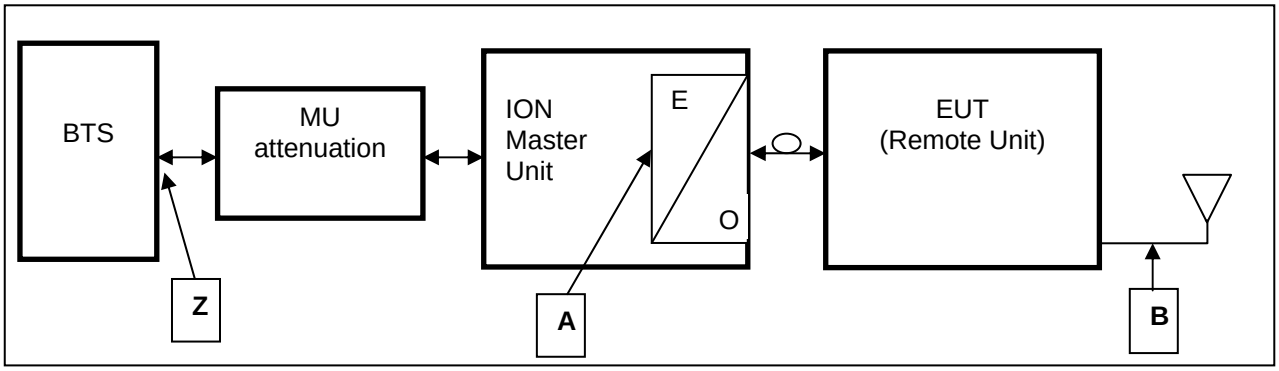


figure 2.1.4-#1 Block diagram of measurement reference points

Remote Unit is the EUT

O/E	Optical / Electrical converter
SRMU	Sub Rack Master Unit

Reference point A	SRMU	UL output,	DL input
Reference point B	Remote Unit	DL output,	UL input
Reference point Z	BTS	DL output,	UL input

Downlink: Measure from reference point B to A

2.1.5 Downlink System Gain and Output Power

System optimized for BTS power *(fixed value)* **Z**	MU Attenuation *(manual leveling)*	Maximum rated input power at the MU OTRX *(fixed value)* **B**	RU Gain *(fixed value)* **B to A**	Maximum rated output power at RU Antenna port *(fixed value)* **A**
+33 dBm	**29 dB**	**4dBm**	**+40 dB**	**+44 dBm** *@ 1 carrier*
System Gain Z to A	**+11dB**			
+43 dBm	**39 dB**	**4dBm**	**+40 dB**	**+44 dBm** *@ 1 carrier*
System Gain Z to A	**+1dB**			

table 2.1.5-#1 Equipment under test (E.U.T.) Description Downlink System Gain and Output Power

3 Test site (Andrew Buchdorf)

3.1 Test environment

All tests were performed under the following environmental conditions:

Condition	Minimum value	Maximum value
Barometric pressure	86 kPa	106 kPa
Temperature	15°C	30°C
Relative Humidity	20 %	75 %
Power supply range	±5% of rated voltages	
Test Voltage	230V AC 50Hz	

3.2 Test equipment

Andrew Inv. No.	Test equipment	Type	Manufacturer	Serial No.	Calibration
8372	Network Analyzer	8753D	HP	3410A08675	02/12
8890	Spectrum Analyzer	FSP	R&S	100674	08/12
8848	Signal Generator	E4438C	Agilent	MY45092504	07/12
9069	Signal Generator	SMBV100A	R&S	256275	08/12
8849	Signal Generator	SMU200A	R&S	101732	04/12
8667	Power Meter	E4418A	HP	GB38273230	02/13
7412	Power Attenuator	769-30	Narda	9741	CIU
7257	Power Attenuator	765-20	Narda	---	CIU
7414	RF-Cable	1,0m; N	Andrew	---	CIU
7411	RF-Cable	2,0m; N	Andrew	---	CIU
7415	RF-Cable	2,0m; N	Andrew	---	CIU
7408	RF-Cable	2,0m; N	Andrew	---	CIU
7418	RF-Cable	0,6m; SMA	Huber & Suhner	---	CIU
7419	RF-Cable	0,6m; SMA	Huber & Suhner	---	CIU
7417	RF-Cable	1,0m; SMA	Huber & Suhner	---	CIU
7413	RF-Cable	1,0m; SMA	Huber & Suhner	---	CIU

CIU = Calibrate in use

3.3 Input and output losses

All recorded power levels should be referenced to the input and output connectors of the repeater, unless explicitly stated otherwise.
The test equipment used in this test has to be calibrated, so that the functionality is also checked.
All cables, attenuators, splitter, isolator, circulator and combiner etc. must be measured before testing and used for compensation during testing.

3.4 Measurement uncertainty

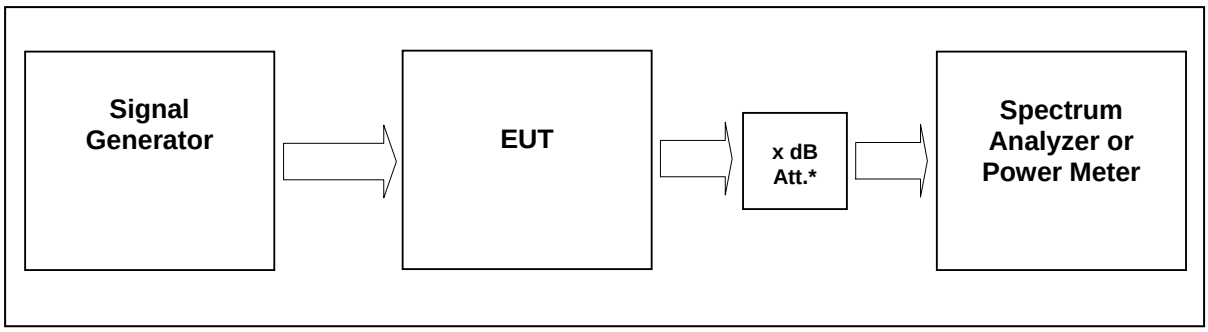
The extended measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k=2. The true value is located in the corresponding interval with a probability of 95 %.

4 Test site (TEMPTON Service Plus GmbH)

FCC Test site: **96997**
IC OATS: **IC3475A-1**

See relevant dates under section 8.

5 RF Power Out: §90.635, §2.1046



External Attenuator DL x dB = 30 dB

figure 5-#1 Test setup: RF Power Out: §90.635, §2.1046

Measurement uncertainty	± 0,38 dB
Test equipment used	8890, 7412, 9069, 8848, 7414, 7411, 7417

5.1 Limit

Minimum standard:

§ 90.635 Limitations on power and antenna height.

(a) The effective radiated power and antenna height for base stations may not exceed 1 kilowatt (30 dBW) and 304 m. (1,000 ft.) above average terrain (AAT), respectively, or the equivalent thereof as determined from the Table. These are maximum values, and applicants will be required to justify power levels and antenna heights requested.

5.2 Test method

§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit circuit elements specified in § 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

(c) For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the testconditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations

5.3 Test Results

Detector RMS.

Test signal Analog:
FM signal with 3.0 kHz deviation and 2.5 kHz rate and sine waveform.

Test signal TDMA GSM:
Signal waveform with GMSK modulation in all time slots according to 3GPP TS45.004

Test signal GSM EDGE:
Signal waveform with 8-PSK modulation in all time slots according to 3GPP TS45.004

Test signal CDMA
Signal waveform according to table 6.2-1 of standard specification 3GPP2 C.p0051-0 v1.0 16.February 2006 pilot, sync, paging, 37 traffics, which is equal to the table 6.5.2.1 of 3GPP2 C.S0010-C v2.0 24.February 2006.

Test signal EV-DO
Signal waveform according to 1xEV-DO Forward Link definition of standard specification 3GPP2 C.S0032 Recommended Minimum Performance Standards for cdma2000 High Rate Packet Data Access Network

Test signal WCDMA
Signal waveform according to Test Model 1 of standard specification 3GPP TS25.141. Signal modulated with a combination of PCCPCH, SCCPCH and Dedicated Physical Channels specified as test model 1 64 DPCH.

Test signal HSPA
Signal waveform according to Test Model 5 (8 HS-PDSCH + 30 DPCH) of standard specification 3GPP TS25.141. Each HS-PDSCH is modulated by 16QAM.

According to ANSI C63.4 section 13.1 Table 5 for operating frequencies more then 10MHz: The test shall be performed at Bottom, Middle and Top frequencies.

5.3.1 Downlink

Modulation	Measured at		RBW VBW Span	RF Power [dBm]	RF Power [W]	Plot -
Analog	Middle	860 MHz	100kHz 300kHz 1,5MHz	44.0	25.1	5.3.1.1 #1
TDMA	Middle	860 MHz	1MHz 3MHz 10MHz	44.0	25.1	5.3.1.2 #1
EDGE	Middle	860 MHz	1MHz 3MHz 10MHz	44.0	25.1	5.3.1.3 #1
CDMA	Middle	860 MHz	3MHz 10MHz 15MHz	44.0	25.1	5.3.1.4 #1
EV-DO	Middle	860 MHz	3MHz 10MHz 15MHz	44.0	25.1	5.3.1.5 #1
WCDMA	Middle	860 MHz	10MHz 10MHz 50MHz	44.0	25.1	5.3.1.6 #1
HSPA	Middle	860 MHz	10MHz 10MHz 50MHz	44.0	25.1	5.3.1.7 #1
Maximum output power = 44.0 dBm = 25.1 W						
Limit Maximum output power = 60 dBm = 1000 W (erp)						

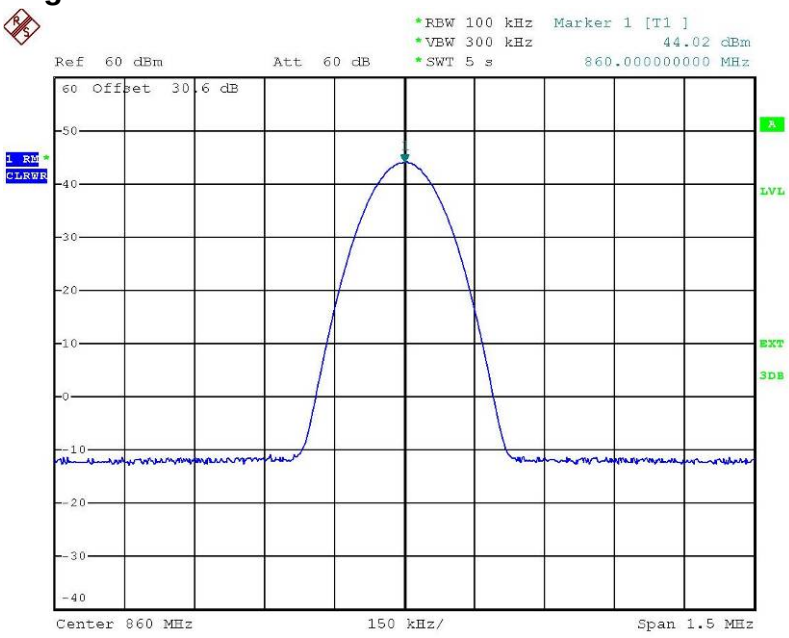
table 5.3.1-#1 RF Power Out: §90.635, §2.1046 Test Results Downlink

The max RF Power out is 43.0 dBm, so the maximum antenna gain (x) can be calculated as follow:
Limit = 1630W (eirp) = **62.15 dBm** Info: 1000W (erp) = 1640W (eirp)
62.15 dBm **>** 44 dBm + x
18.15 dBi > x
=> The antenna that will use for the complete system have to have a gain lower than 18 dBi, relative to a dipol.

Modulation	Pin / dBm (Ref. point A)
Analog	4.0
TDMA	4.0
EDGE	3.8
CDMA	4.3
EV-DO	4.2
WCDMA	4.5
HSPA	4.3

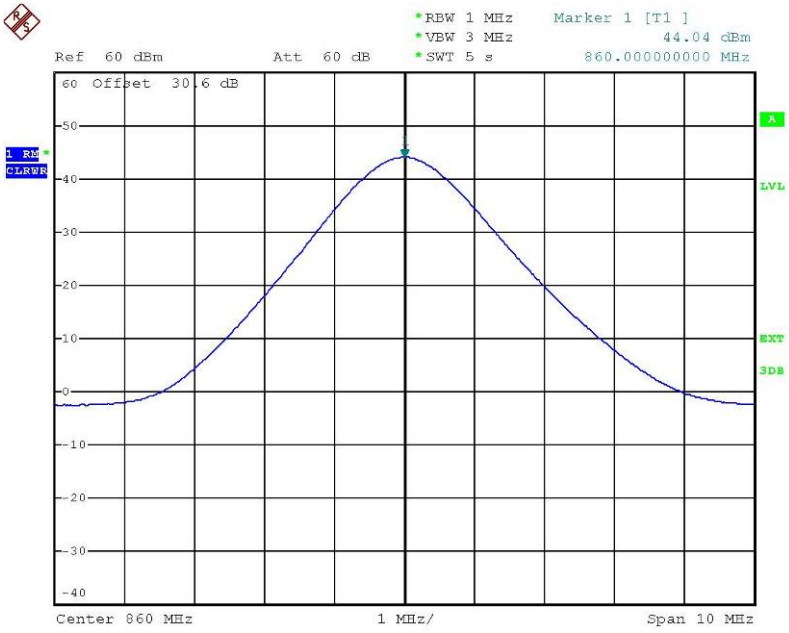
table 5.3.1-#2 RF Power Out: §90.635, §2.1046 Test Results; Downlink; Input power

5.3.1.1 Analog



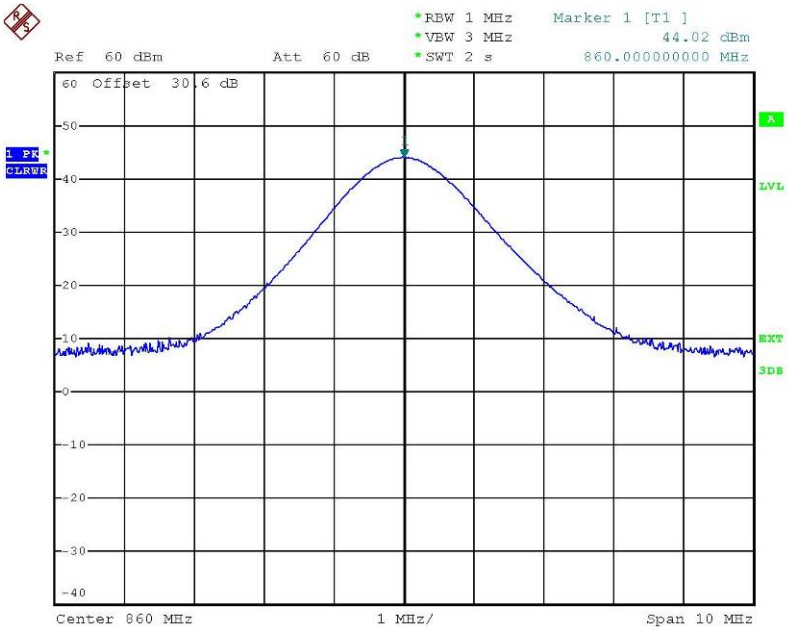
plot 5.3.1.1-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; Analog

5.3.1.2 TDMA



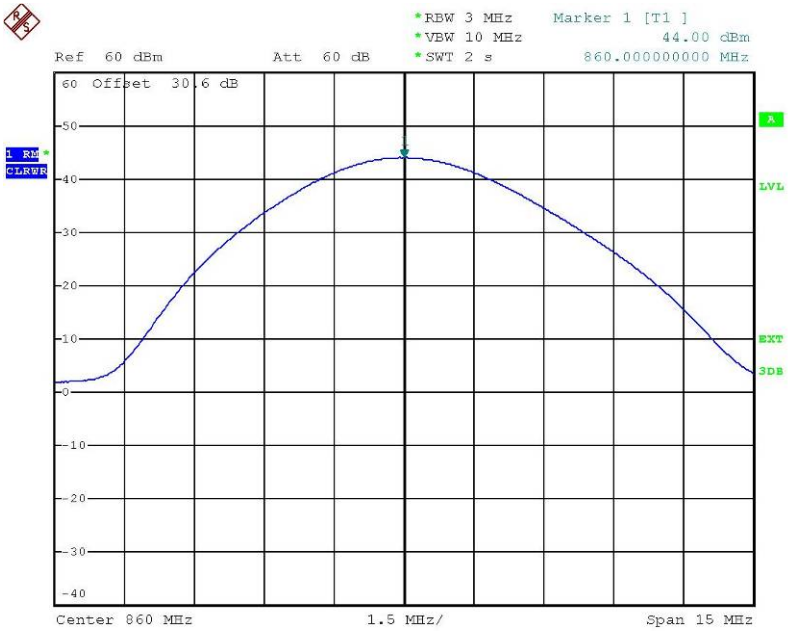
plot 5.3.1.2-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; TDMA

5.3.1.3 EDGE



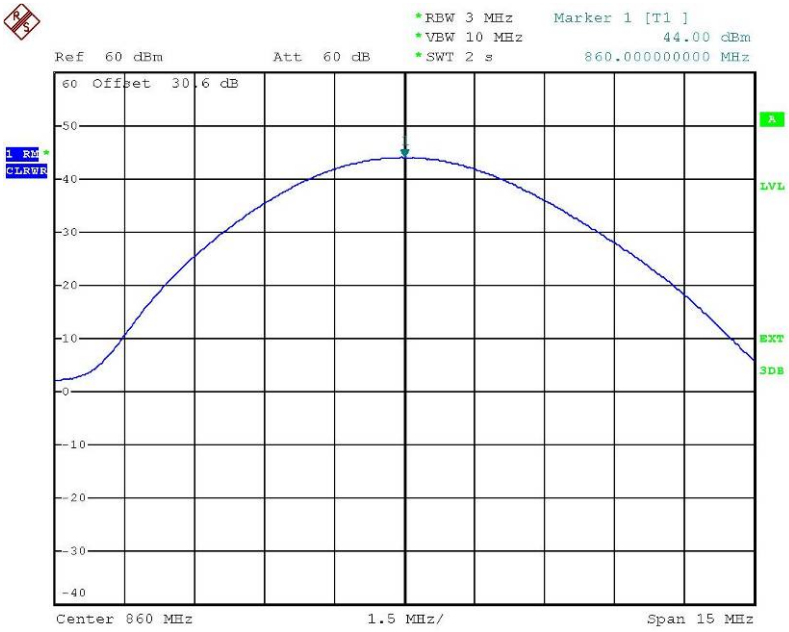
plot 5.3.1.3-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; EDGE

5.3.1.4 CDMA



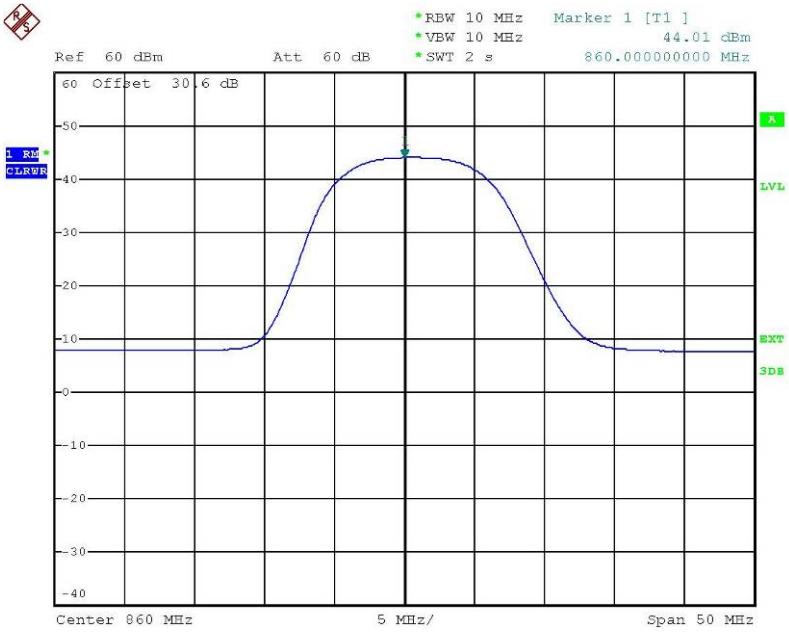
plot 5.3.1.4-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; CDMA

5.3.1.5 EV-DO



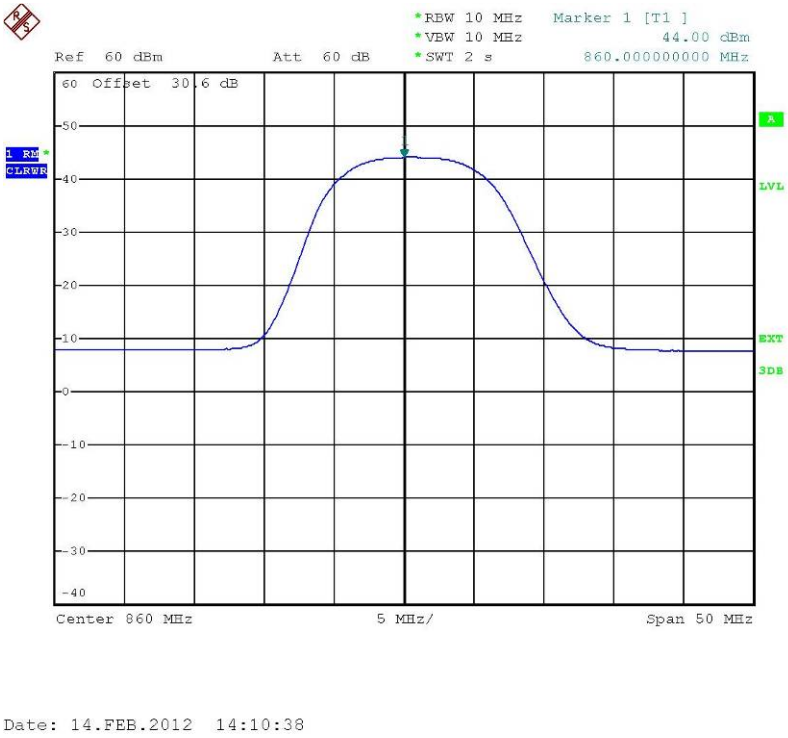
plot 5.3.1.5-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; EV-DO

5.3.1.6 WCDMA



plot 5.3.1.6-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; WCDMA

5.3.1.7 HSPA



plot 5.3.1.7-#1 RF Power Out: §90.635, §2.1046; Test Results; Downlink; HSPA

5.3.2 Uplink

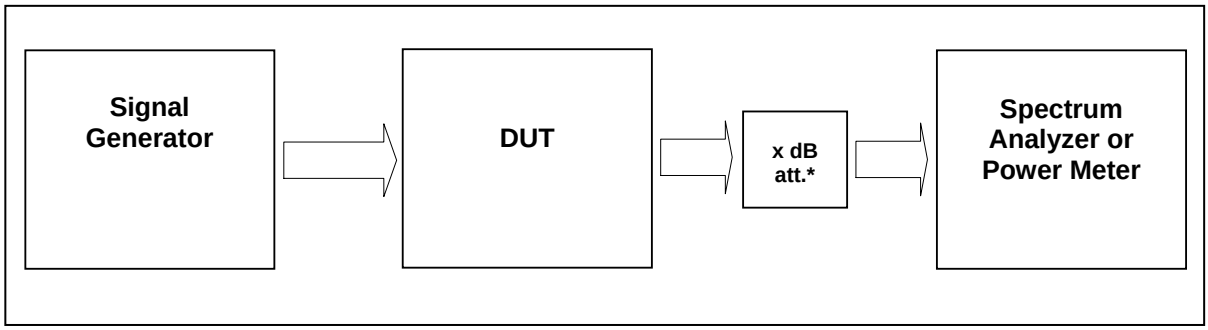
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

5.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	13.03.2012

6 Occupied Bandwidth: §90.210, §2.1049



External Attenuator DL x dB = 30 dB

figure 6-#1 Test setup: Occupied Bandwidth: §90.210, §2.1049

Measurement uncertainty	± 0,38 dB
Test equipment used	8890, 7412, 9069, 8848, 7414, 7411, 7417

6.1 Limit

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

6.2 Test method

Para. No.2.1049

The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission shall be measured under the following conditions as applicable:

6.3 Test results

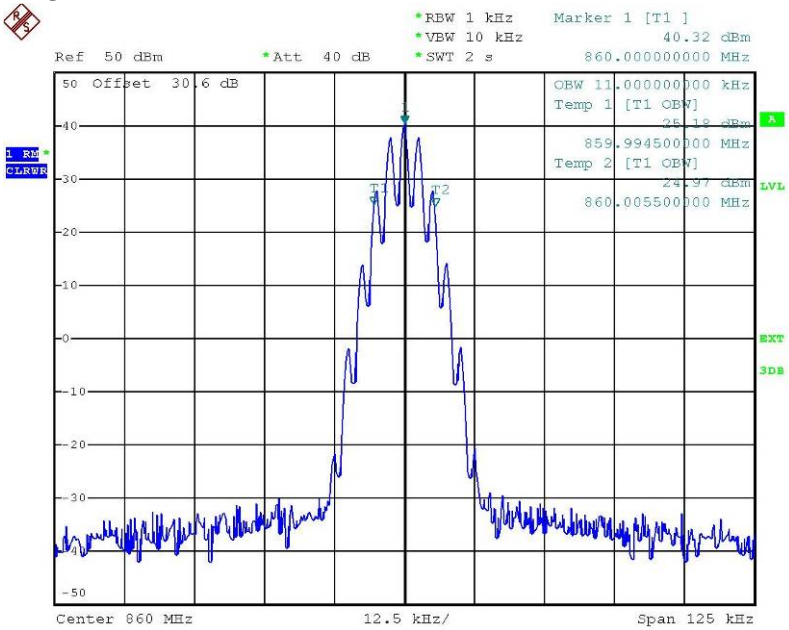
6.3.1 Downlink

Detector RMS.

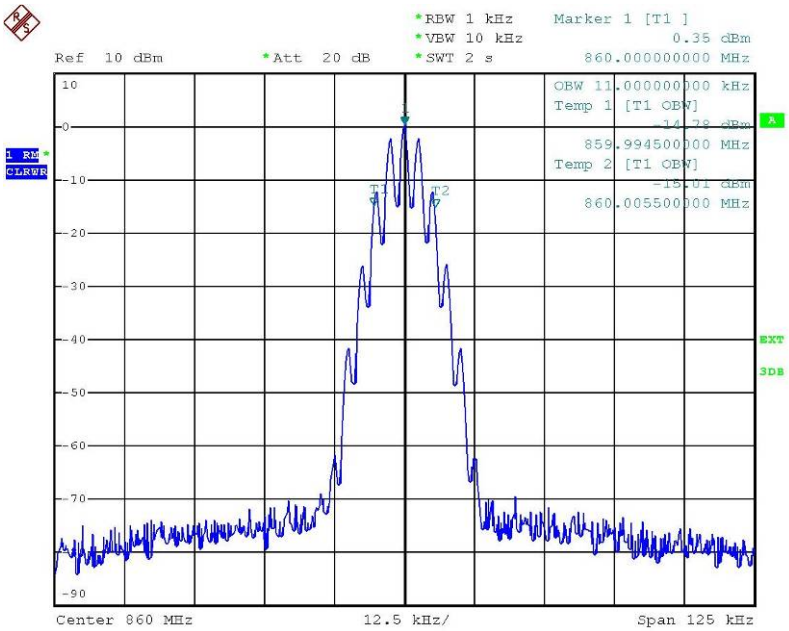
Modulation	Measured at		RBW VBW Span	Occupied Bandwidth	Plot #
Analog	Middle	860 MHz	1 kHz 10 kHz 125 kHz	11 kHz	6.3.1.1 #1, #2
TDMA	Middle	860 MHz	3 kHz 30 kHz 1 MHz	246.0 kHz	6.3.1.2 #1, #2
EDGE	Middle	860 MHz	3 kHz 30 kHz 1 MHz	246.0 kHz	6.3.1.3 #1, #2
CDMA	Middle	860 MHz	30 kHz 300 kHz 5 MHz	1.24 MHz	6.3.1.4 #1, #2
EV-DO	Middle	860 MHz	30 kHz 300 kHz 5 MHz	1.24 MHz	6.3.1.5 #1, #2
WCDMA	Middle	860 MHz	100 kHz 1 MHz 10 MHz	4.18 MHz	6.3.1.6 #1, #2
HSPA	Middle	860 MHz	100 kHz 1 MHz 10 MHz	4.18 MHz	6.3.1.7 #1, #2

table 6.3-#1 Occupied Bandwidth: §90.210, §2.1049 Test results

6.3.1.1 Analog

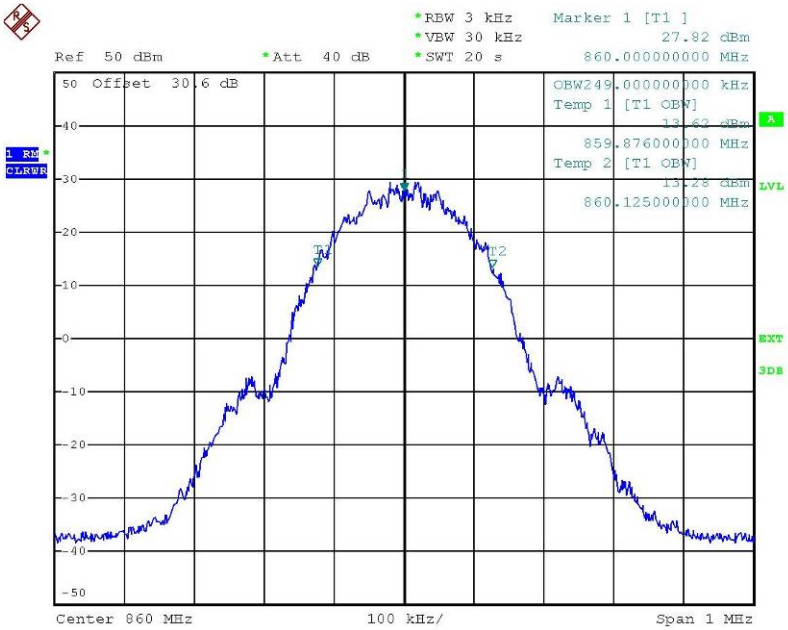


plot 6.3.1.1-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; Analog Output

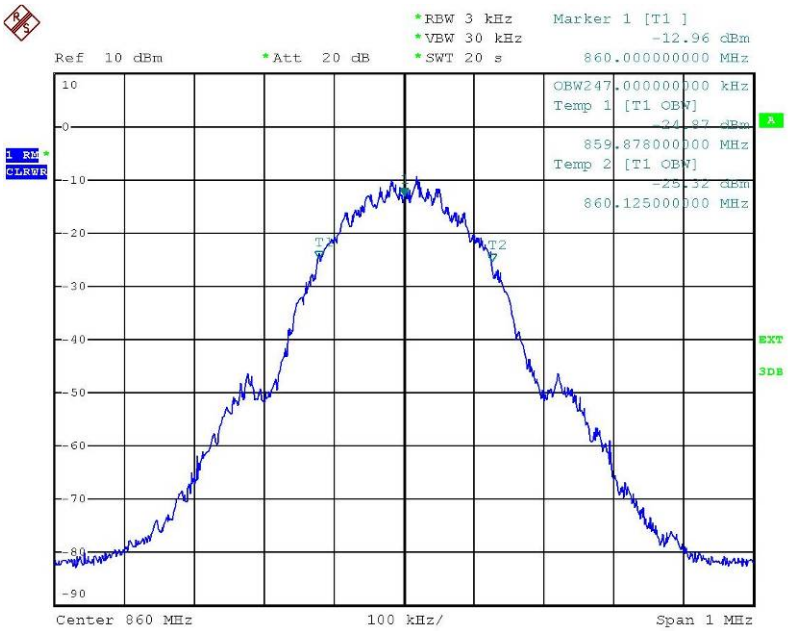


plot 6.3.1.1-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; Analog Input

6.3.1.2 TDMA

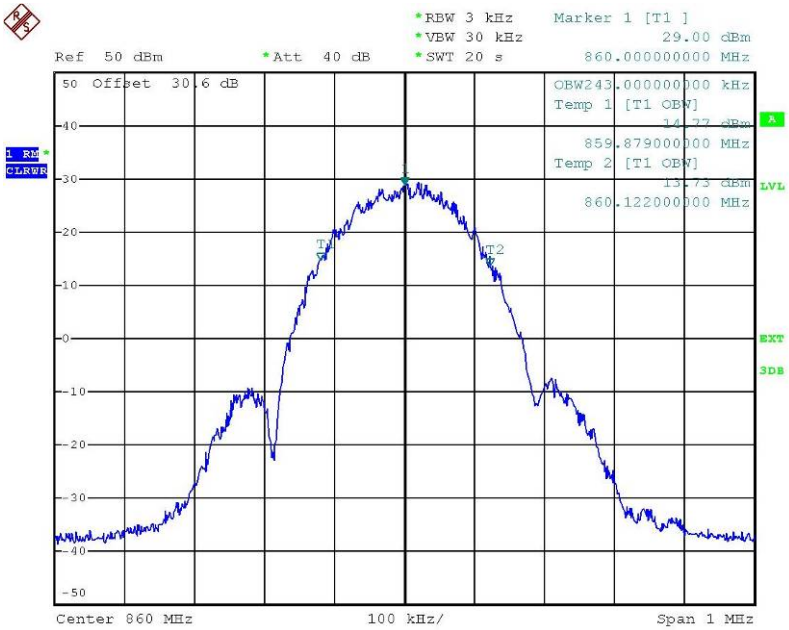


plot 6.3.1.2-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; TDMA Output

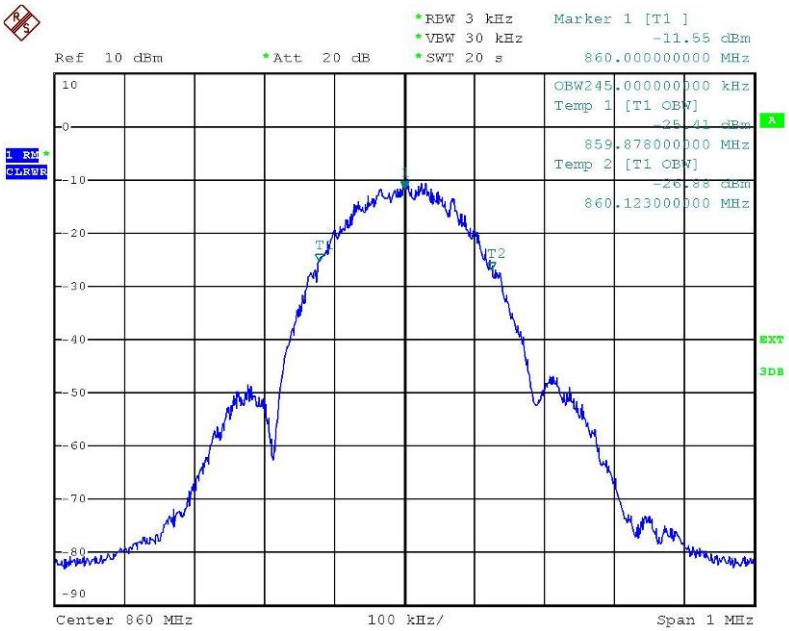


plot 6.3.1.2-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; TDMA Input

6.3.1.3 EDGE

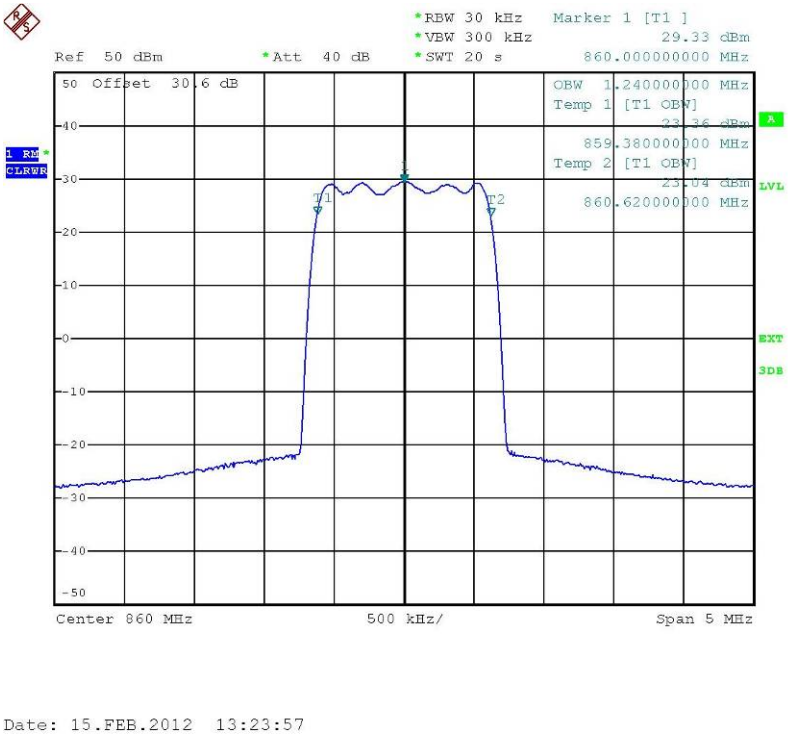


plot 6.3.1.3-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; EDGE Output

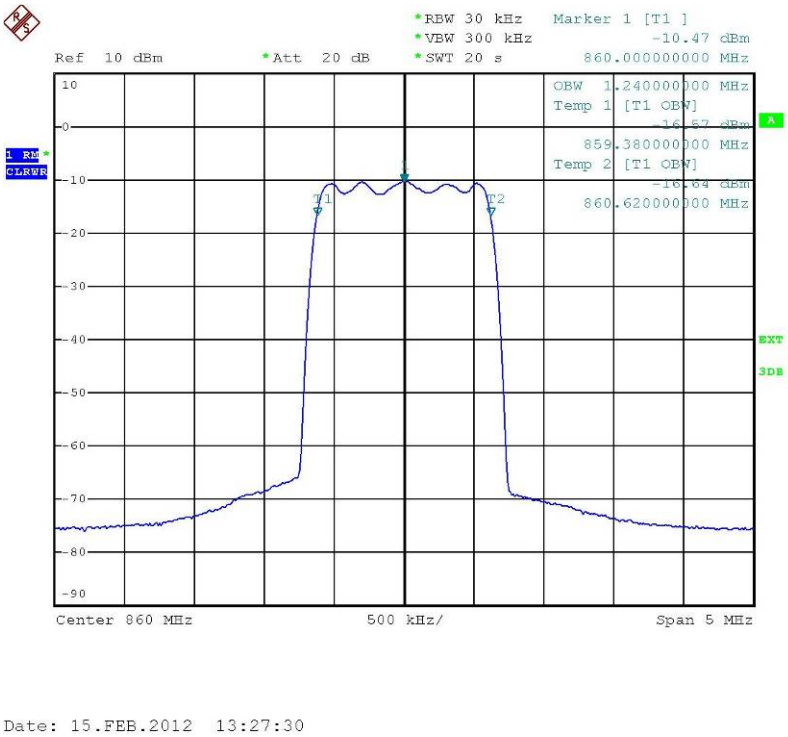


plot 6.3.1.3-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; EDGE Input

6.3.1.4 CDMA

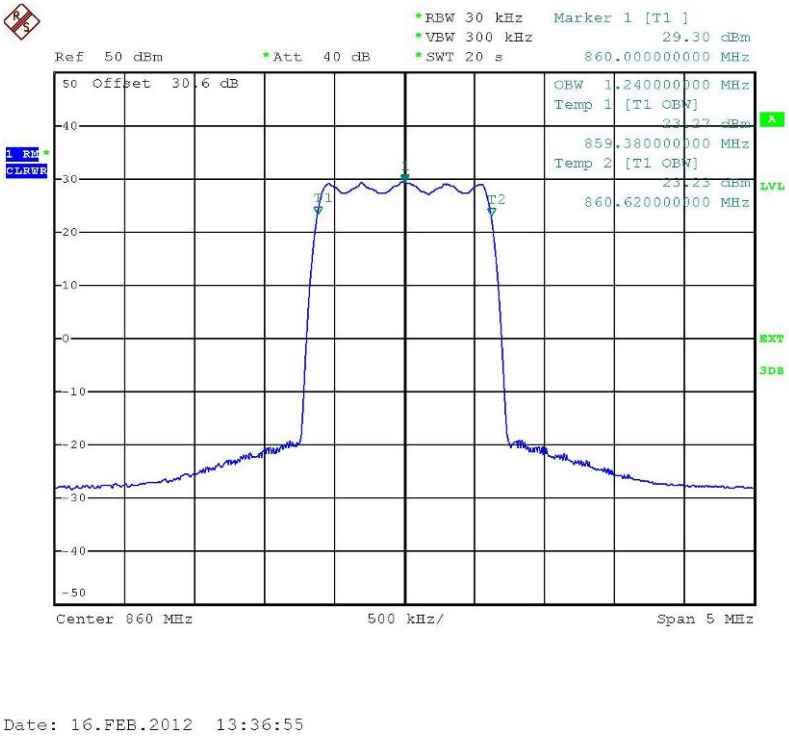


plot 6.3.1.4-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; CDMA Output

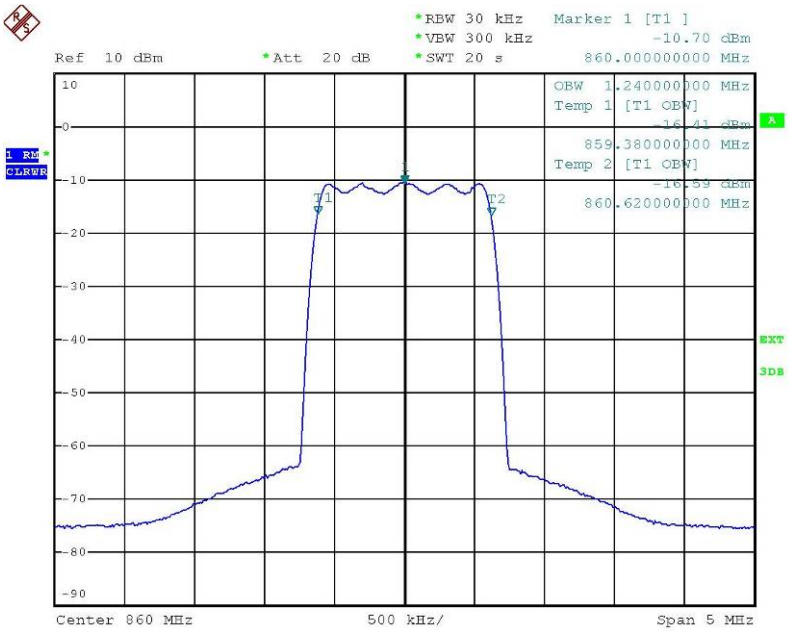


plot 6.3.1.4-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; CDMA Input

6.3.1.5 EV-DO

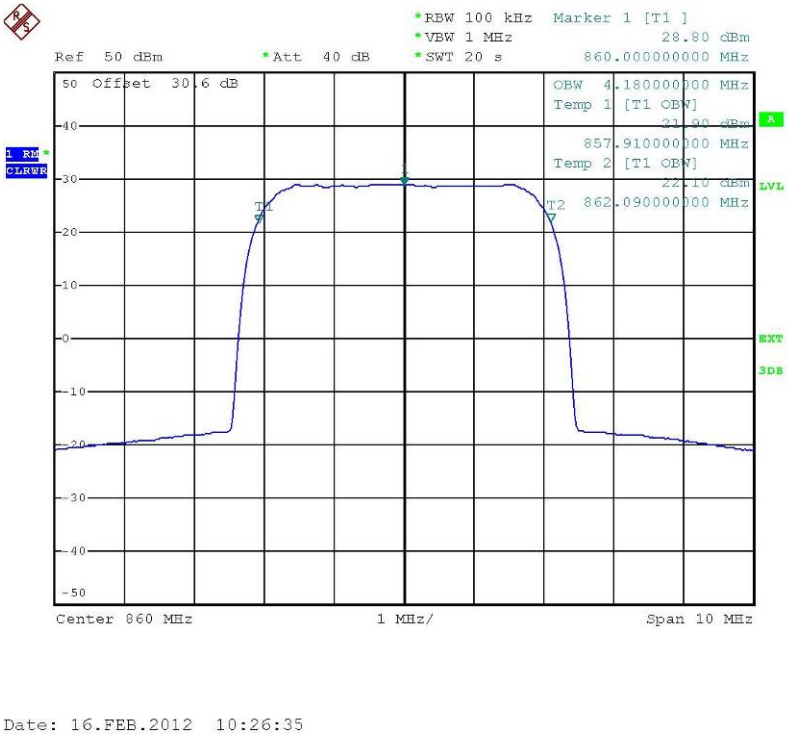


plot 6.3.1.5-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; EV-DO Output

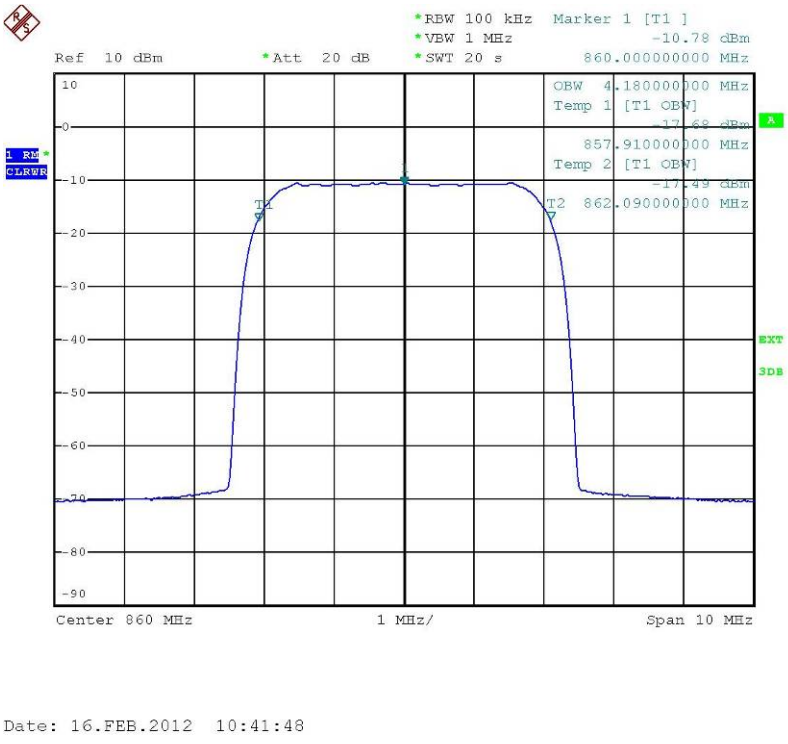


plot 6.3.1.5-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; EV-DO Input

6.3.1.6 WCDMA

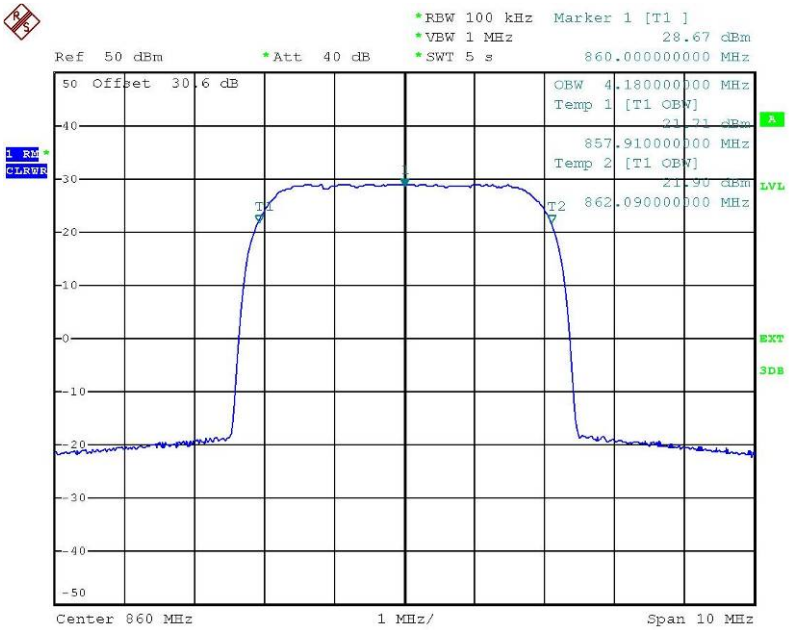


plot 6.3.1.6-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; WCDMA Output

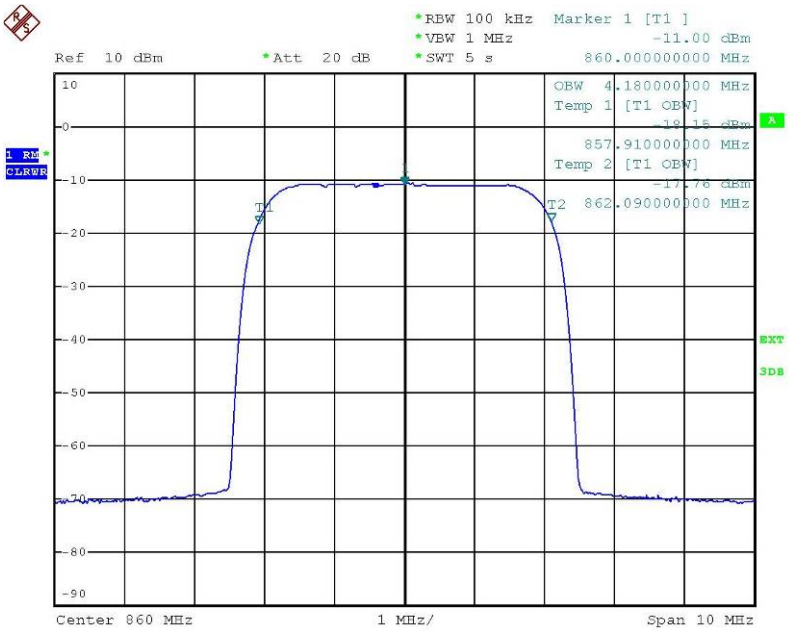


plot 6.3.1.6-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; WCDMA Input

6.3.1.7 HSPA



plot 6.3.1.7-#1 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; HSPA Output



plot 6.3.1.7-#2 Occupied Bandwidth: §90.210, §2.1049; Test results; Downlink; HSPA Input

6.3.2 Uplink

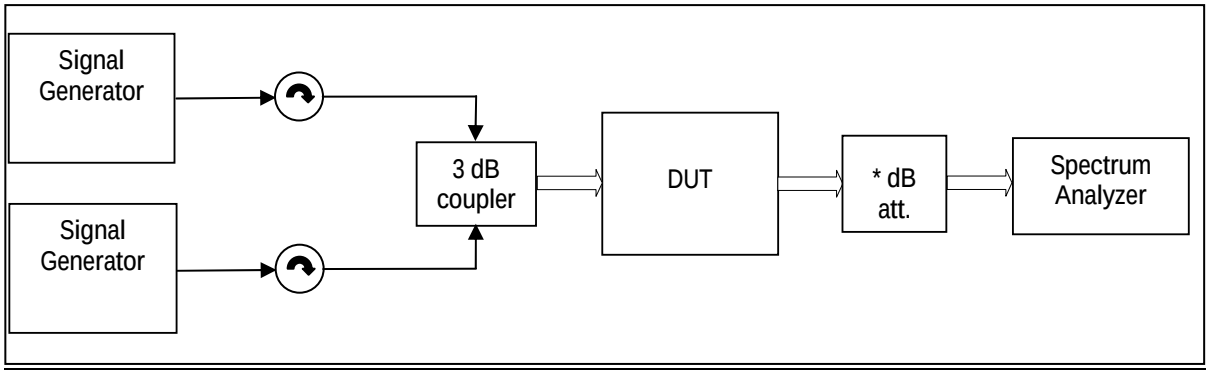
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

6.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	16.02.2012

7 Spurious Emissions at Antenna Terminals: §90.210, §2.1051



External Attenuator DL x dB = 30 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §90.210, §2.1051

Measurement uncertainty	± 0,54 dB ± 1,2 dB ± 1,5 dB	9 kHz to 3 GHz 3 GHz to 7 GHz 7 GHz to 26 GHz
Test equipment used	8890, 7412, 9069, 8849, 8848, 7414, 7411, 7417	

7.1 Limit

Minimum standard: §90.210, Table “Application Emission Mask”

Frequency Band (MHz)	Mask for equipment with Audio Low pass filter	Mask for Equipment without audio low pass filter
806–809/851–854	B	H
809–824/854–869 [3]	B	G

[3] Equipment used in this licensed to EA or non-EA systems shall comply with the emission mask provisions of § 90.691.

MASK	Spurious Limit
A,B,C,G,H,I	-13dBm

7.2 Test method

Para. No 2.1051 Measurements required: Spurious emissions at antenna terminals.

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

[39 FR 5919, Feb. 15, 1974. Redesignated andamended at 63 FR 36599, July 7, 1998]

7.3 Test results

7.3.1 Downlink

<1MHz from Band Edge

Detector: RMS

Modulation	Measured at Band Edge	Carriers	RBW VBW Span Sweep points	Max. level (dBm)	Plot
Analog	Lower Edge Upper Edge	851.0125 MHz 851.0375 MHz 868.9625 MHz 868.9875 MHz	300 Hz 3 kHz 1.1 MHz 15000 points	-25.4	7.3.1.1 #1 #2
TDMA	Lower Edge Upper Edge	851.3 MHz 851.7 MHz 868.5 MHz 868.7 MHz	3 kHz 30 kHz 2 MHz 3000 points	-29.9	7.3.1.2 #1 #2
EDGE	Lower Edge Upper Edge	851.3 MHz 851.7 MHz 868.5 MHz 868.7 MHz	3 kHz 30 kHz 2 MHz 3000 points	-31.3	7.3.1.3 #1 #2
CDMA	Lower Edge Upper Edge	852.875 MHz 854.125 MHz 865.875 MHz 867.125 MHz	30 kHz 300 kHz 10 MHz 1500 points	-27.6	7.3.1.4 #1 #2
EV-DO	Lower Edge Upper Edge	852.875 MHz 854.125 MHz 865.875 MHz 867.125 MHz	30 kHz 300 kHz 10 MHz 1500 points	-17.7	7.3.1.5 #1 #2
WCDMA	Lower Edge Upper Edge	856 MHz 861 MHz 859 MHz 864 MHz	100 kHz 1 MHz 25 MHz 1500 points	-23.4	7.3.1.6 #1 #2
HSPA	Lower Edge Upper Edge	856 MHz 861 MHz 859 MHz 864 MHz	100 kHz 1 MHz 25 MHz 1500 points	-23.2	7.3.1.7 #1 #2

table 7.3-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051 Test results <1MHz from Band Edge

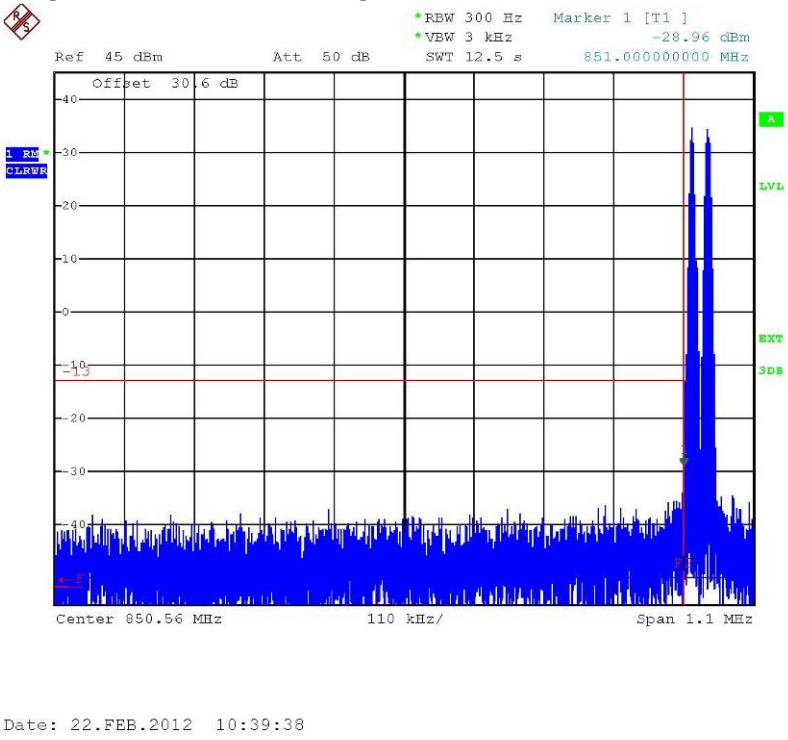
>1MHz from Band Edge

Detector: RMS

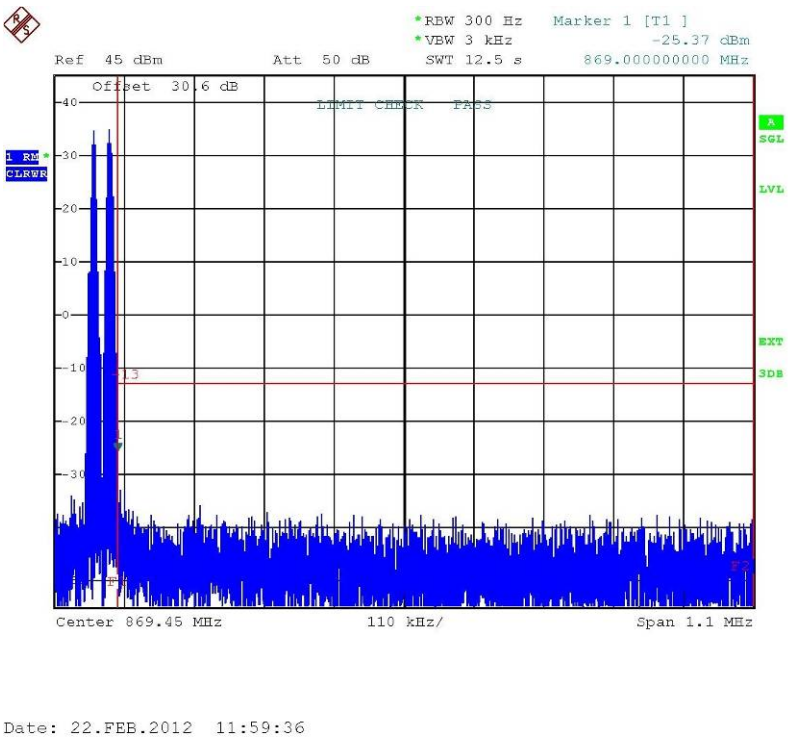
Modulation	Carrier	RBW VBW Span	Max. level (dBm)	Plot
Analog	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.5	7.3.1.8 #1
TDMA	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.3	7.3.1.9 #1
EDGE	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.3	7.3.1.10 #1
CDMA	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.3	7.3.1.11 #1
EV-DO	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.4	7.3.1.12 #1
WCDMA	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.3	7.3.1.13 #1
HSPA	860 MHz	1MHz 3MHz 30MHz – 8GHz	-26.4	7.3.1.14 #1

table 7.3-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051 Test results <1MHz from Band Edge

7.3.1.1 Analog < 1MHz to band edge

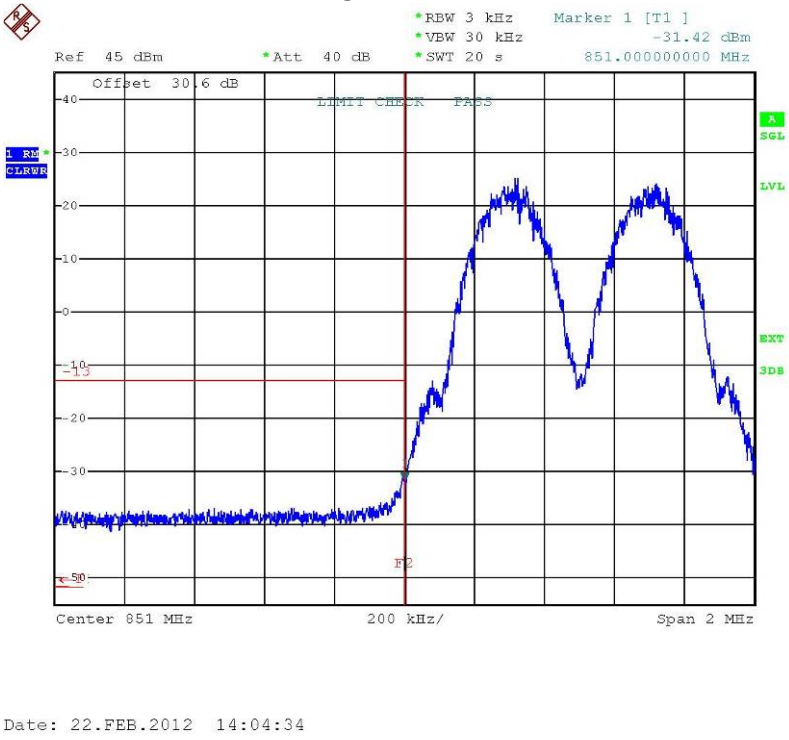


plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; Analog < 1MHz to band edge; Lower Band Edge

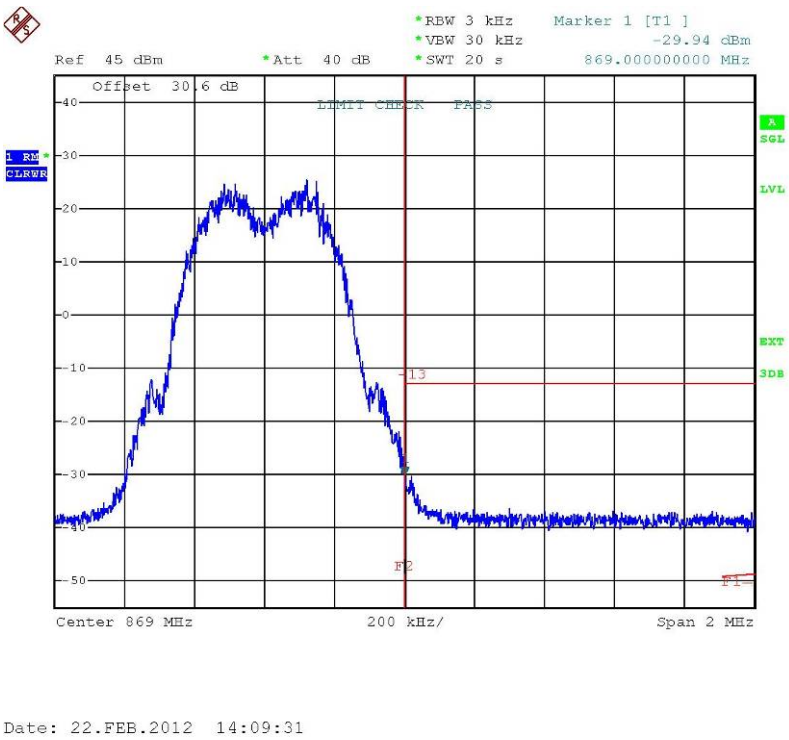


plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; Analog < 1MHz to band edge; Upper Band Edge

7.3.1.2 TDMA < 1MHz to band edge

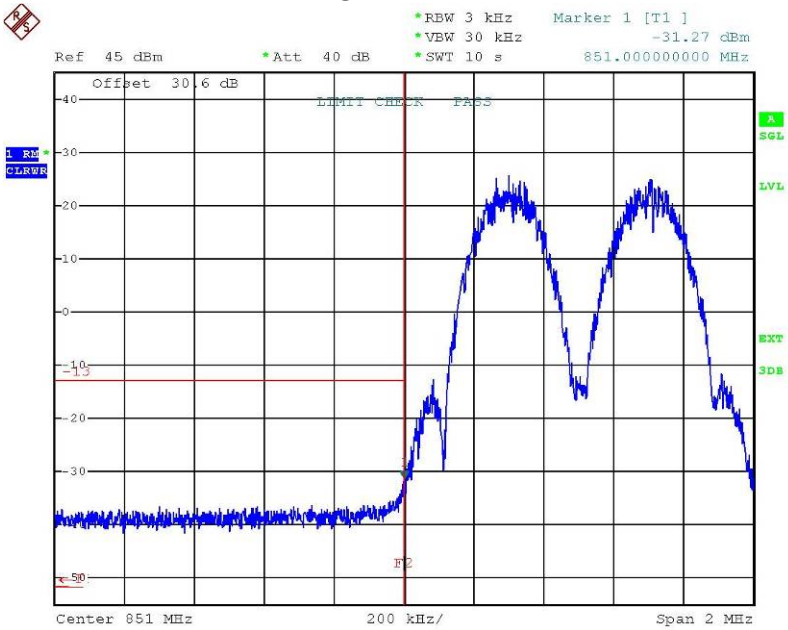


plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; TDMA < 1MHz to band edge; Lower Band Edge

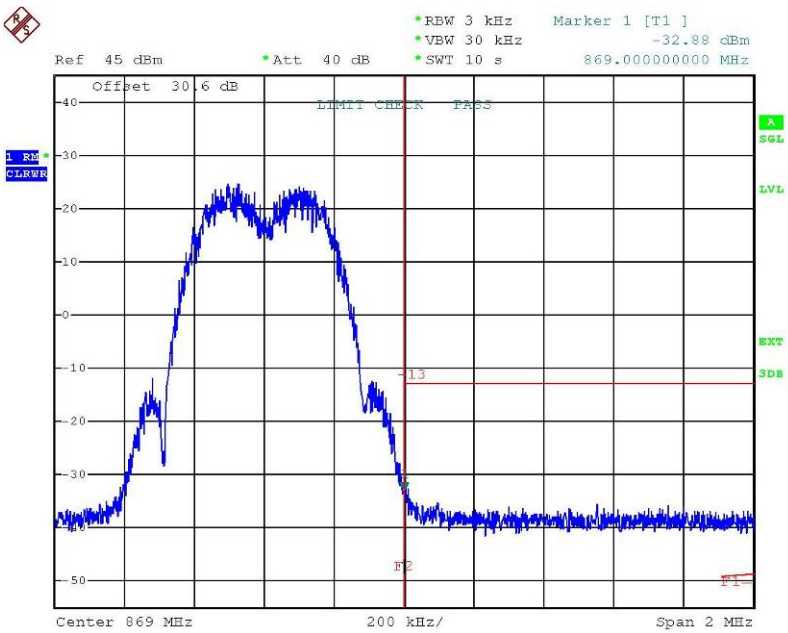


plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; TDMA < 1MHz to band edge; Upper Band Edge

7.3.1.3 EDGE < 1MHz to band edge

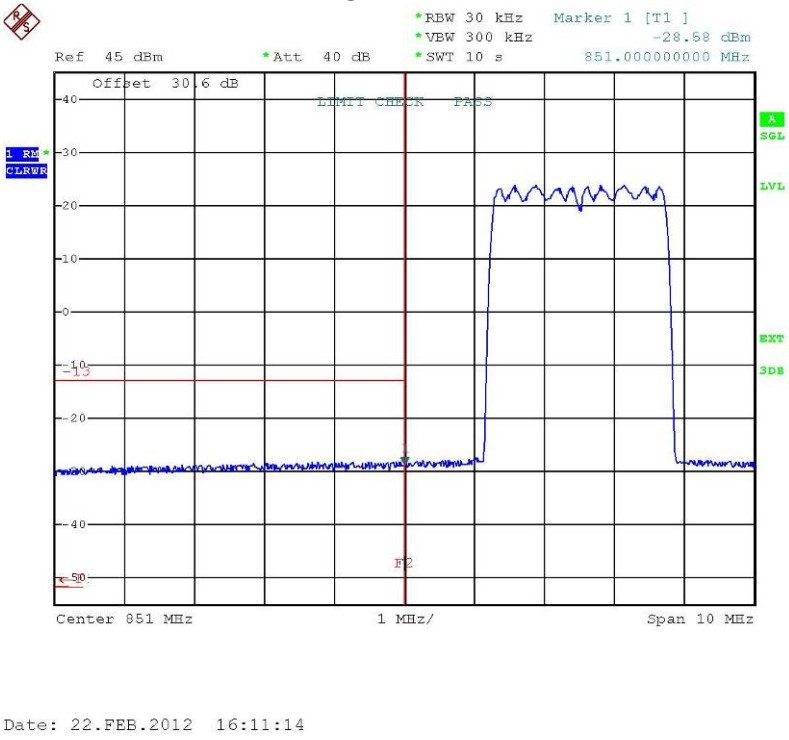


plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EDGE < 1MHz to band edge; Lower Band Edge

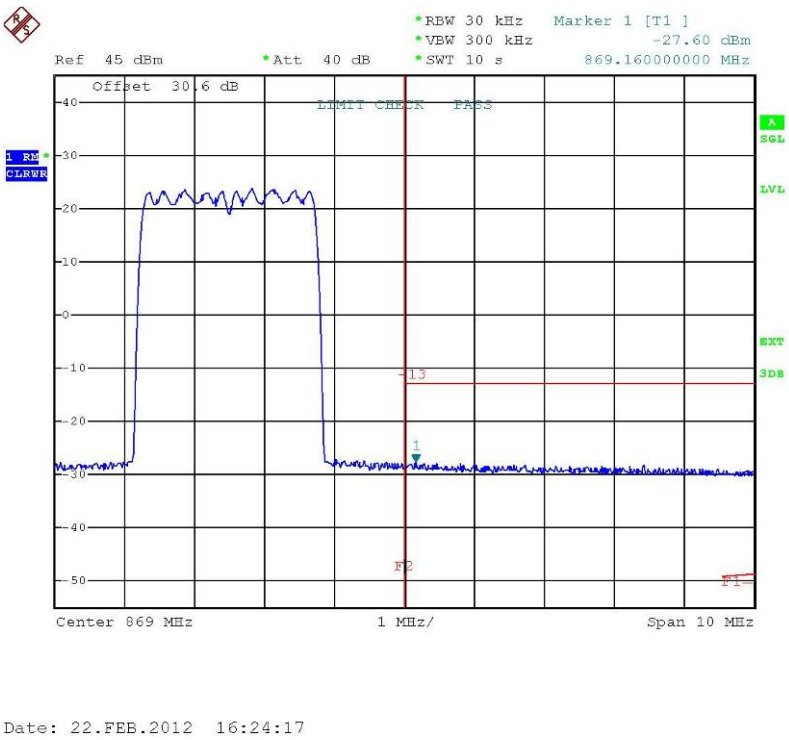


plot 7.3.1.3-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EDGE < 1MHz to band edge; Upper Band Edge

7.3.1.4 CDMA < 1MHz to band edge

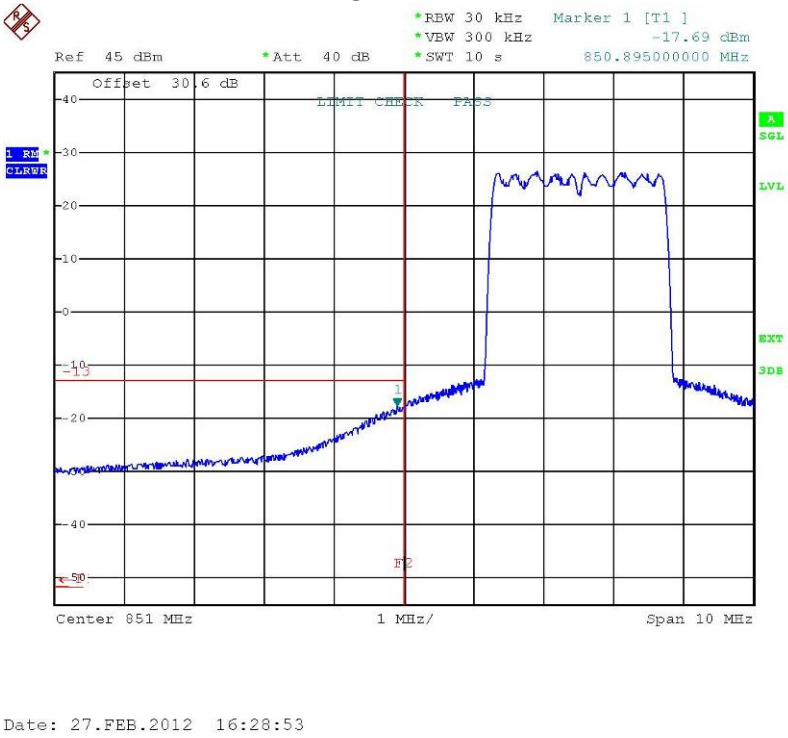


plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; CDMA < 1MHz to band edge; Lower Band Edge

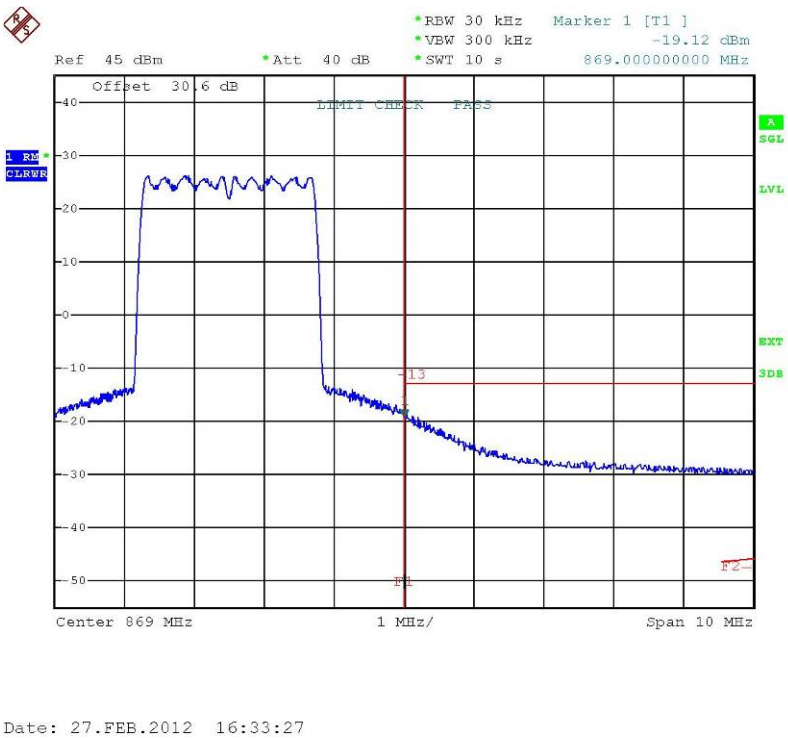


plot 7.3.1.4-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; CDMA < 1MHz to band edge; Upper Band Edge

7.3.1.5 EV-DO < 1MHz to band edge

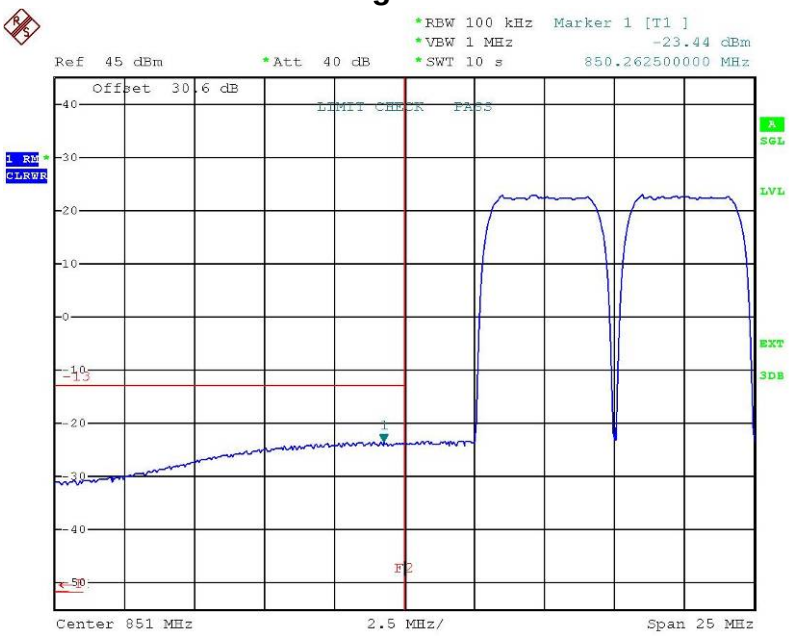


plot 7.3.1.5-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EV-DO < 1MHz to band edge; Lower Band Edge

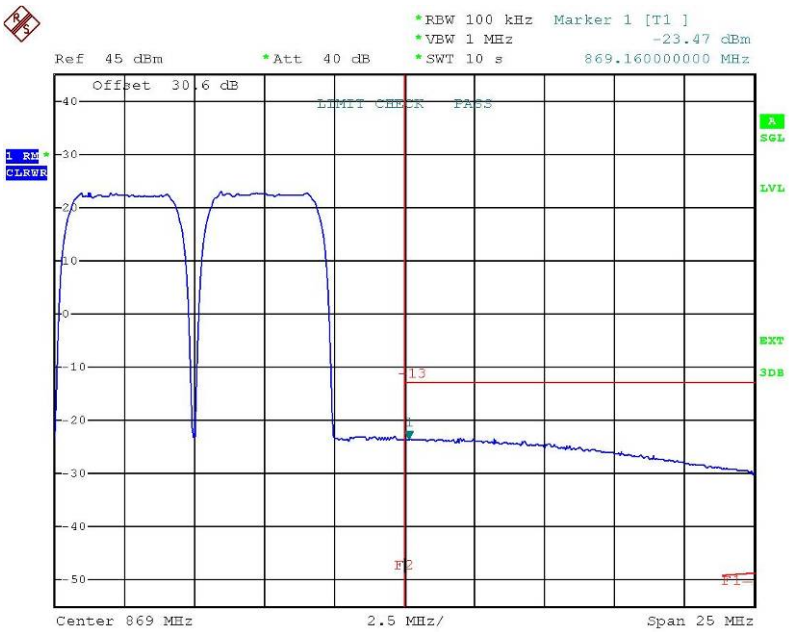


plot 7.3.1.5-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EV-DO < 1MHz to band edge; Upper Band Edge

7.3.1.6 WCDMA < 1MHz to band edge

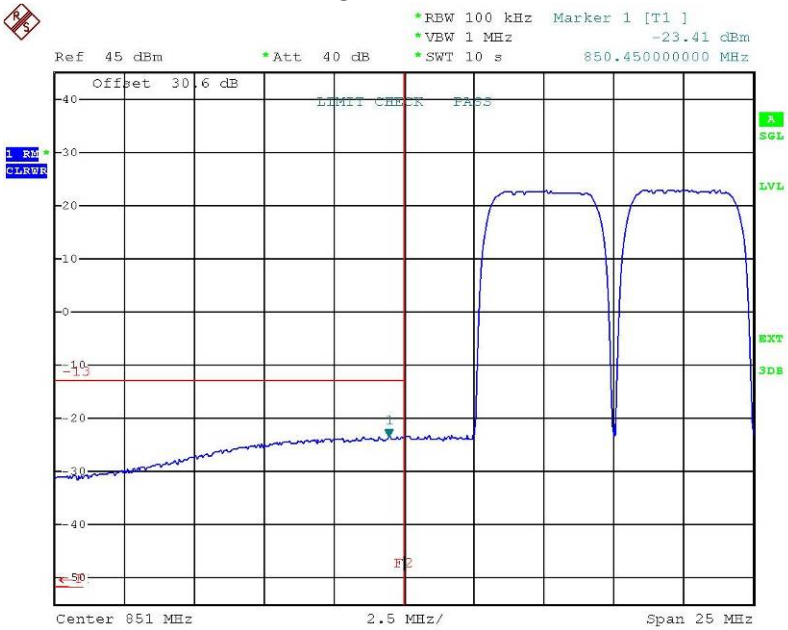


plot 7.3.1.6-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; WCDMA < 1MHz to band edge; Lower Band Edge

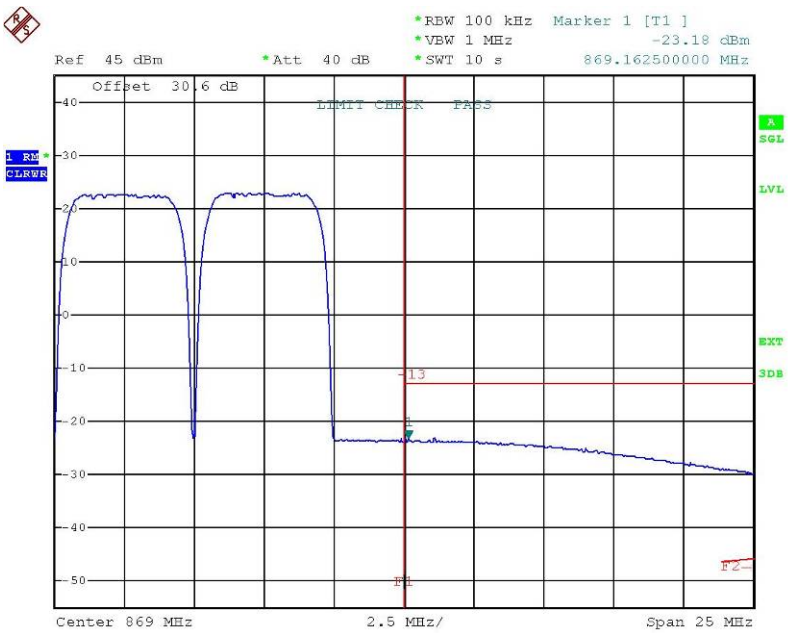


plot 7.3.1.6-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; WCDMA < 1MHz to band edge; Upper Band Edge

7.3.1.7 HSPA < 1MHz to band edge

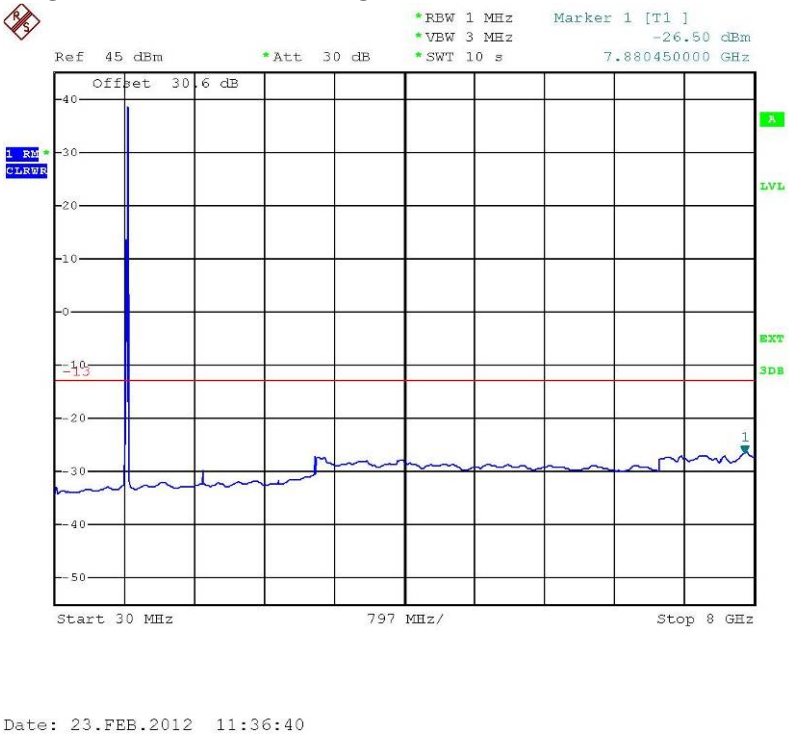


plot 7.3.1.7-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; HSPA < 1MHz to band edge; Lower Band Edge



plot 7.3.1.7-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; HSPA < 1MHz to band edge; Upper Band Edge

7.3.1.8 Analog > 1MHz to band edge

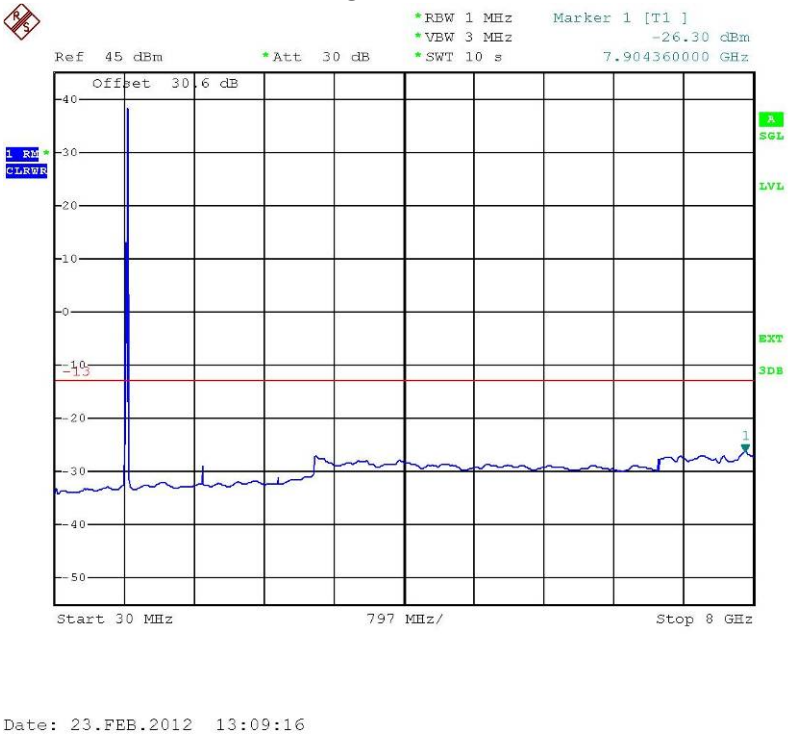


plot 7.3.1.8-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; Analog > 1MHz to band edge

7.3.1.9 TDMA > 1MHz to band edge

plot 7.3.1.9-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; TDMA > 1MHz to band edge

7.3.1.10 EDGE > 1MHz to band edge

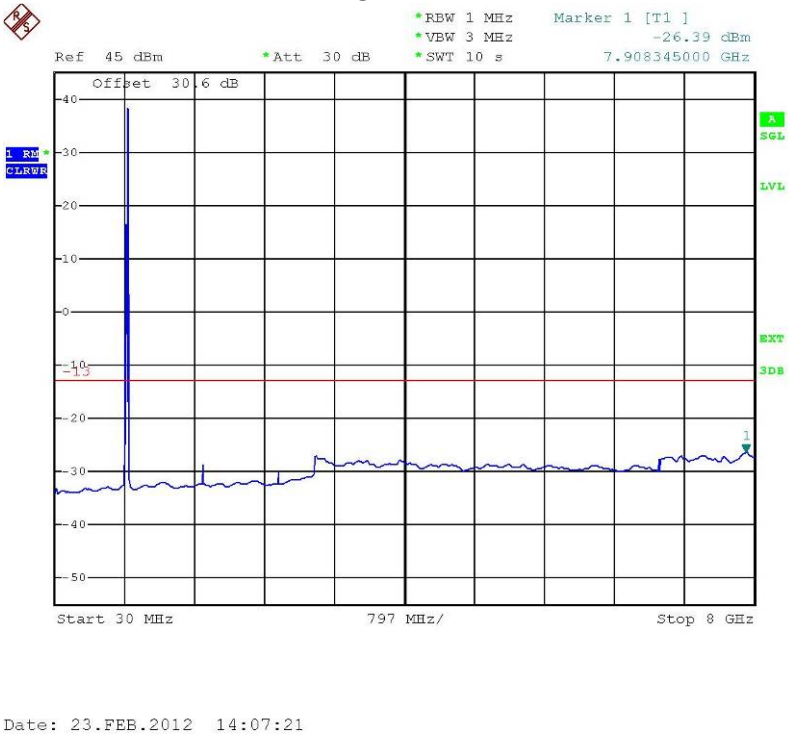


plot 7.3.1.10-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EDGE > 1MHz to band edge

7.3.1.11 CDMA > 1MHz to band edge

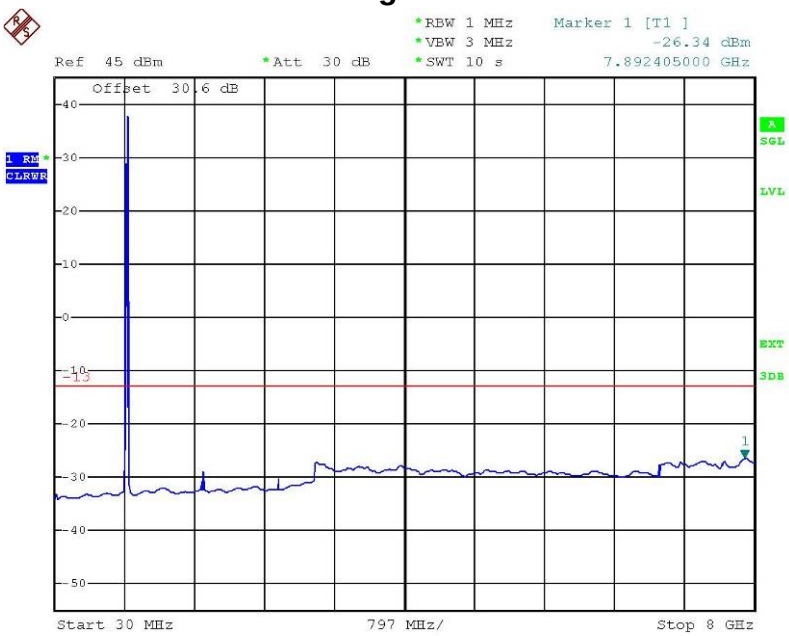
plot 7.3.1.11-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; CDMA > 1MHz to band edge

7.3.1.12 EV-DO > 1MHz to band edge



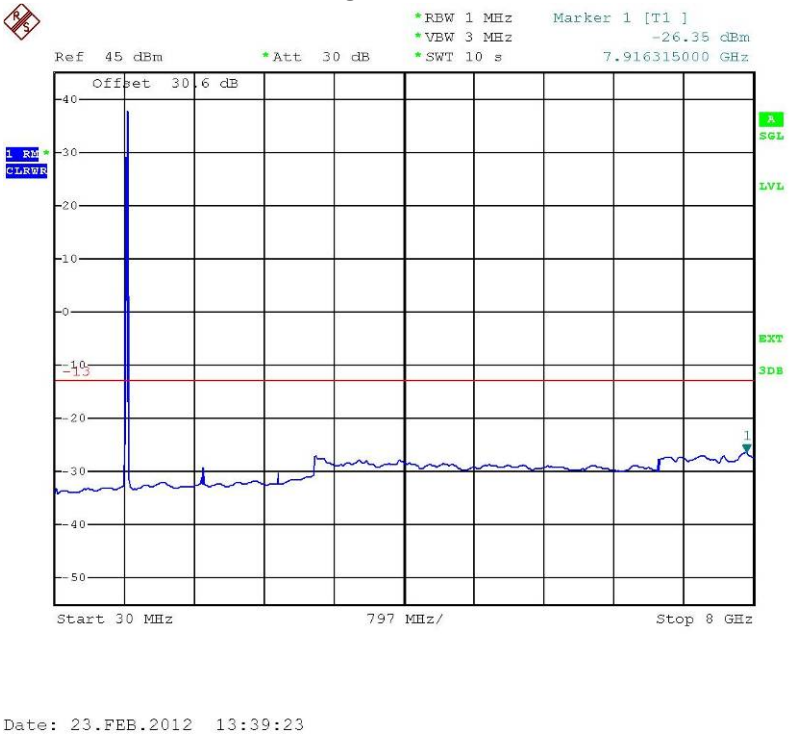
plot 7.3.1.12-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; EV-DO > 1MHz to band edge

7.3.1.13 WCDMA > 1MHz to band edge



plot 7.3.1.13-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; WCDMA > 1MHz to band edge

7.3.1.14 HSPA > 1MHz to band edge



plot 7.3.1.14-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; Test results; Downlink; HSPA > 1MHz to band edge

7.3.2 Uplink

n.a.

Note: The EUT does not transmit over the air in the uplink direction.

7.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	23.02.2012

8 Amplifier Gain and Bandwidth: IC RSS-131

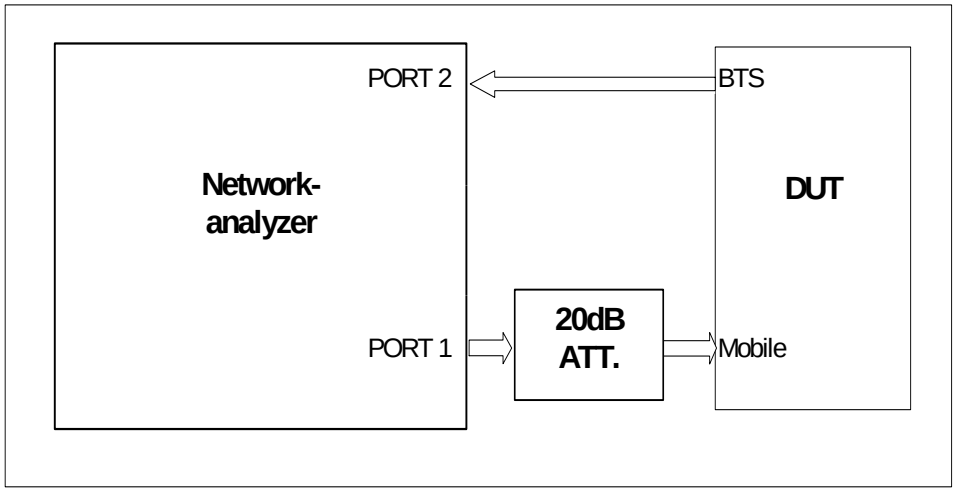


figure 8-#1 Test setup: Amplifier Gain and Bandwidth: IC RSS-131

Test equipment used	8372, 7257, 7417, 7413

8.1 Limit

IC RSS-131 clause 6.1
The passband gain shall not exceed the nominal gain by more than 1.0 dB. The 20 dB bandwidth shall not exceed the nominal bandwidth that is stated by the manufacturer. Outside of the 20 dB bandwidth, the gain shall not exceed the gain at the 20 dB point.

8.2 Test method

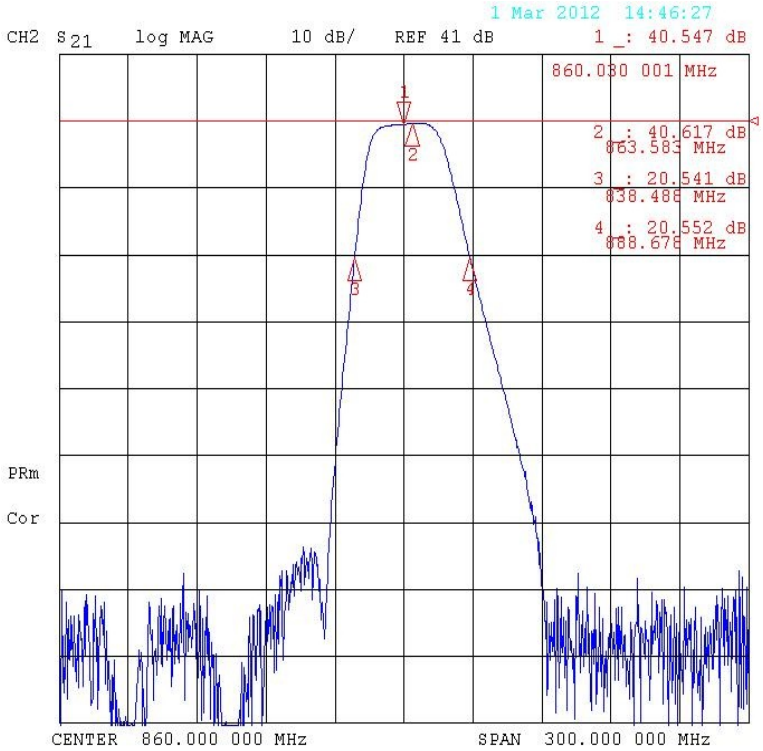
IC RSS-131 clause 4.2
Adjust the internal gain control of the equipment under test to the nominal gain for which equipment certification is sought.

With the aid of a signal generator and spectrum analyser, measure the 20 dB bandwidth of the amplifier (i.e. at the point where the gain has fallen by 20 dB). Measure the gain-versus-frequency response of the amplifier from the midband frequency f_0 of the passband up to at least f_0 ±250% of the 20 dB bandwidth.

8.3 Test results

8.3.1 Downlink

Passband gain	40.55 dB
Lower limit of 20dB Bandwidth	838.5 MHz
Upper limit of 20dB Bandwidth	888.7 MHz
20dB Bandwidth	50.2 MHz



plot 8.3.1-#1 Amplifier Gain and Bandwidth: IC RSS-131; Test results; Downlink

8.3.2 Uplink

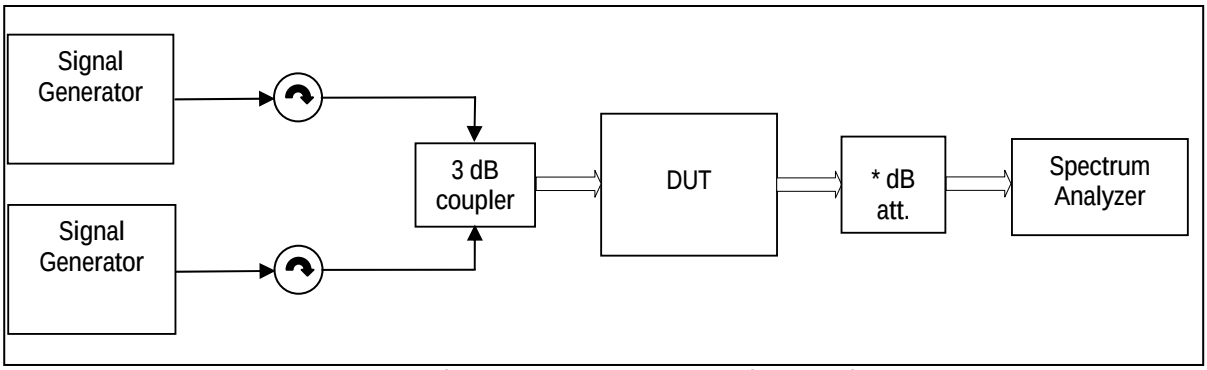
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

8.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	01.03.2012

9 Output Power: IC RSS-131



External Attenuator DL x dB = 30 dB

figure 9-#1 Test setup: Output Power: IC RSS-131

Measurement uncertainty	± 0,38 dB
Test equipment used	8890, 7412, 9069, 8849, 8848, 7414, 7411, 7417

9.1 Limit

IC RSS-131 clause 6.2
The manufacturer's output power rating P rated MUST NOT be greater than P mean for all types of enhancers.

9.2 Test method

IC RSS-131 clause 4.3.1 Multi-channel Enhancer
The following subscript "o" denotes a parameter at the enhancer output point.

Connect two signal generators to the input of the Device Under Test (DUT), via a proper impedance matching network (and preferably via a variable attenuator) so that the two input signals are equal sinusoids (and can be raised equally).

Connect a dummy load of suitable load rating to the enhancer output point. Connect also a spectrum analyser to this output point via a coupling network and attenuator, so that only a portion of the output signal is coupled to the spectrum analyser. The coupling attenuation shall be stated in the test report.

Set the two generator frequencies f_1 and f_2 such that they and their third-order intermodulation product frequencies, $f_3 = 2f_1 - f_2$ and $f_4 = 2f_2 - f_1$, are all within the passband of the DUT.

Raise the input level to the DUT while observing the output tone levels, P_{o1} and P_{o2}, and the intermodulation product levels, P_{o3} and P_{o4}.

For enhancers rated 500 watts or less: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, P_{o3} or P_{o4}, equals -43 dBW.

For enhancers rated over 500 watts: Raise the input level to the DUT until the greater level of the intermodulation products at the enhancer output terminals, P_{o3} or P_{o4}, is 67 dB below the level of either output tone level, P_{o1} or P_{o2}.

Record all signal levels and their frequencies. Calculate the mean output power (P_{mean}) under this testing condition using $P_{mean} = P_{o1} + 3$ dB.

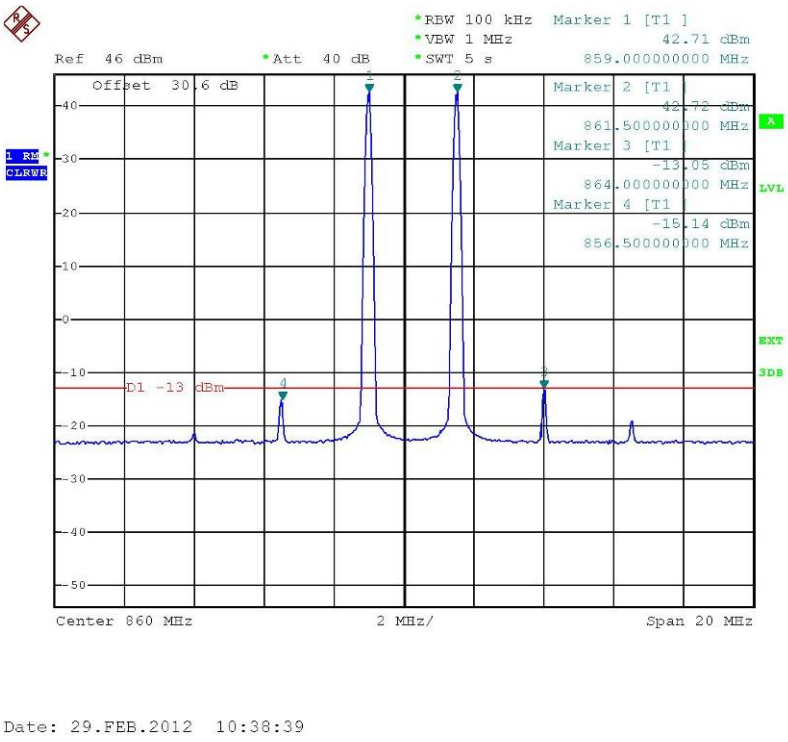
9.3 Test results

9.3.1 Downlink

P_{o1} @ f_1	42.7 dBm @ 859.0 MHz
P_{o2} @ f_2	42.7 dBm @ 861.5 MHz
P_{o3} @ f_3	-13.0 dBm @ 864.0 MHz
P_{o4} @ f_4	-15.1 dBm @ 856.5 MHz

$P_{mean} = P_{o1} + 3$ dB

P_{mean} = 42.7 dBm + 3 dB = 45.7 dBm



plot 9.3.1-#1 Output Power: IC RSS-131; Test results; Downlink

9.3.2 Uplink

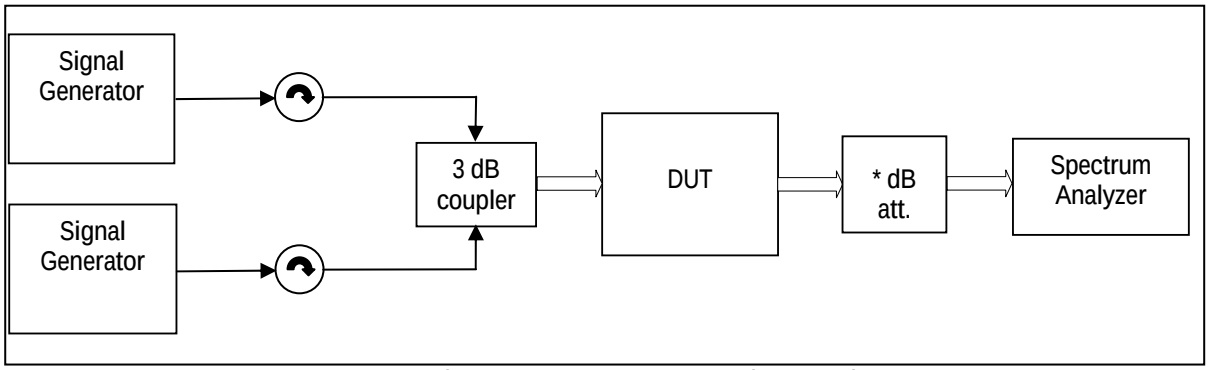
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

9.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	29.02.2012

10 Non-Linearity: IC RSS-131



External Attenuator DL x dB = 30 dB

figure 10-#1 Test setup: Non-Linearity: IC RSS-131

Test equipment used	8890, 7412, 9069, 8849, 8848, 7414, 7411, 7417

10.1 Limit

RSS-131 clause 6.3
Transmitter signals amplified by a non-linear device (enhancer or translator) will alter the occupied bandwidth of the transmitted signals; therefore, the extent of non-linearity shall be tested.

RSS-131 clause 6.3.1
For a multi-channel enhancer, any intermodulation product level must be attenuated, relative to P, by at least:

43 + 10 Log 10 P, or 70 dB, whichever is less stringent,

where P is the total RF output power of the test tones in watts.

10.2 Test method

RSS-131 clause
IC RSS-131 clause 4.3.1 Multi-channel Enhancer
The following subscript "o" denotes a parameter at the enhancer output point.

Connect two signal generators to the input of the Device Under Test (DUT), via a proper impedance matching network (and preferably via a variable attenuator) so that the two input signals are equal sinusoids (and can be raised equally).

Connect a dummy load of suitable load rating to the enhancer output point. Connect also a spectrum analyser to this output point via a coupling network and attenuator, so that only a portion of the output signal is coupled to the spectrum analyser. The coupling attenuation shall be stated in the test report.

Set the two generator frequencies f_1 and f_2 such that they and their third-order intermodulation product frequencies, $f_3 = 2f_1 - f_2$ and $f_4 = 2f_2 - f_1$, are all within the passband of the DUT.

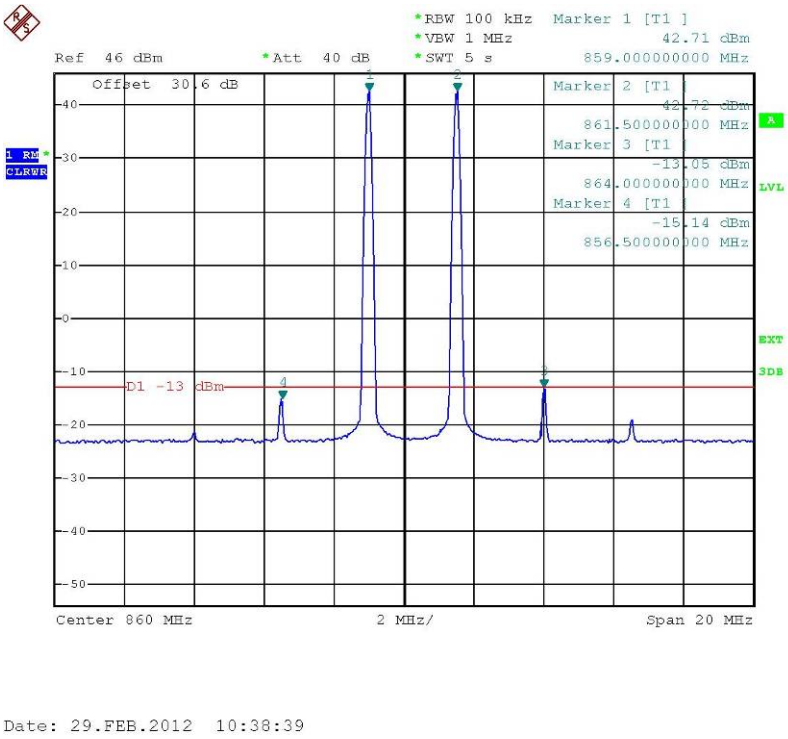
Raise the input level to the DUT while observing the output tone levels, P_{o1} and P_{o2}, and the intermodulation product levels, P_{o3} and P_{o4}.

10.3 Test results

10.3.1 Downlink

Requirement calculation:
P = 42,72 dBm = 18,71W
Attenuation = 43 + 10Log10(18,71W) or 70 dB whichever is less stringent
Attenuation = 55,72 dB or 70 dB whichever is less stringent
Attenuation = 55,72 dB

Test result:
Delta P to IMD = 42,72 dBm – (-13,05 dBm) = 55,77 dB



plot 10.3.1-#1 Non-Linearity: IC RSS-131; Test results; Downlink

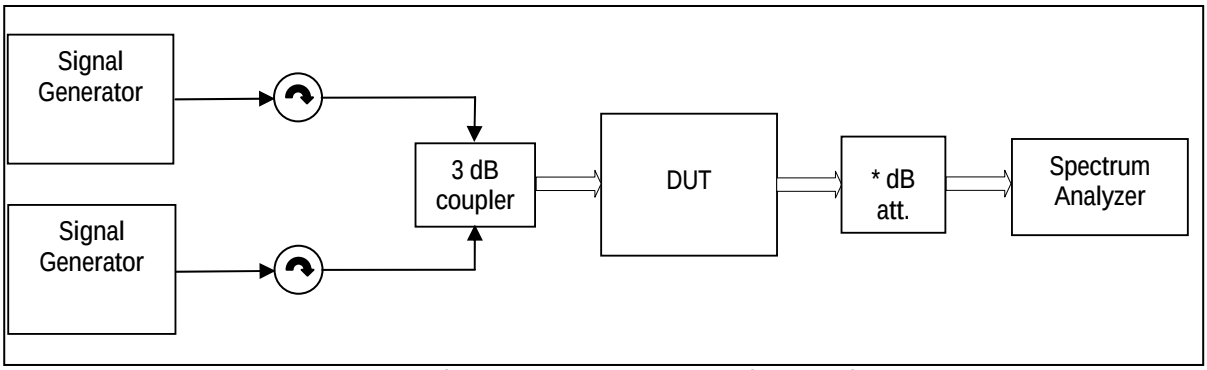
10.3.2 Uplink

n.a.
Note: The EUT does not transmit over the air in the uplink direction.

10.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	29.02.2012

11 Spurious Emissions: RSS-131



External Attenuator DL x dB = 30 dB
figure 11-#1 Test setup: Spurious Emissions: RSS-131

Measurement uncertainty	± 0,54 dB ± 1,2 dB ± 1,5 dB	9 kHz to 3 GHz 3 GHz to 7 GHz 7 GHz to 13,6 GHz
Test equipment used	8890, 7412, 9069, 8849, 8848, 7414, 7411, 7417	

11.1 Limit

RSS-131 clause 6.4
Spurious emissions of zone enhancers and translators shall be suppressed as much as possible.

Spurious emissions shall be attenuated below the rated power of the enhancer by at least:

43 + 10 Log 10 (P rated in watts), or 70 dB, whichever is less stringent.

11.2 Test method

RSS-131 clause 4.4.1
The spurious emissions of the equipment under test shall be measured using the two-tone method in section 4.3.1, with the two tones P_{o1} and P_{o2} set to the required levels.

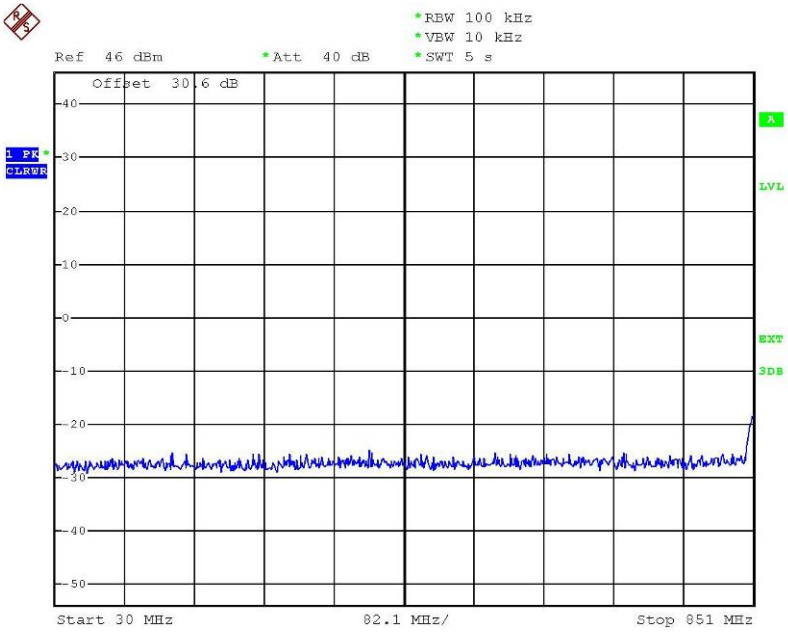
Using a spectrum analyser with a resolution bandwidth set at 100 kHz, search for spurios emissions from 30 MHz to at least 5 times the highest RF passband frequency. The search may omit the band that contains the test tones and intermodulation products.

11.3 Test results

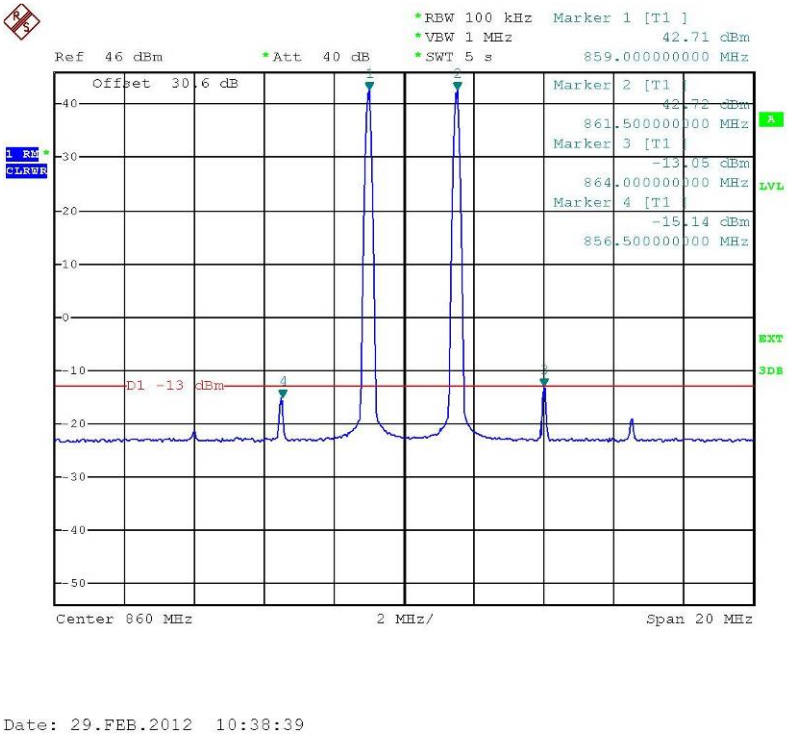
11.3.1 Downlink

Requirement calculation:
P = 42,72 dBm = 18,71W
Attenuation = 43 + 10Log10(18,71W) or 70 dB whichever is less strigent
Attenuation = 55,72 dB or 70 dB whichever is less strigent
Attenuation = 55,72 dB

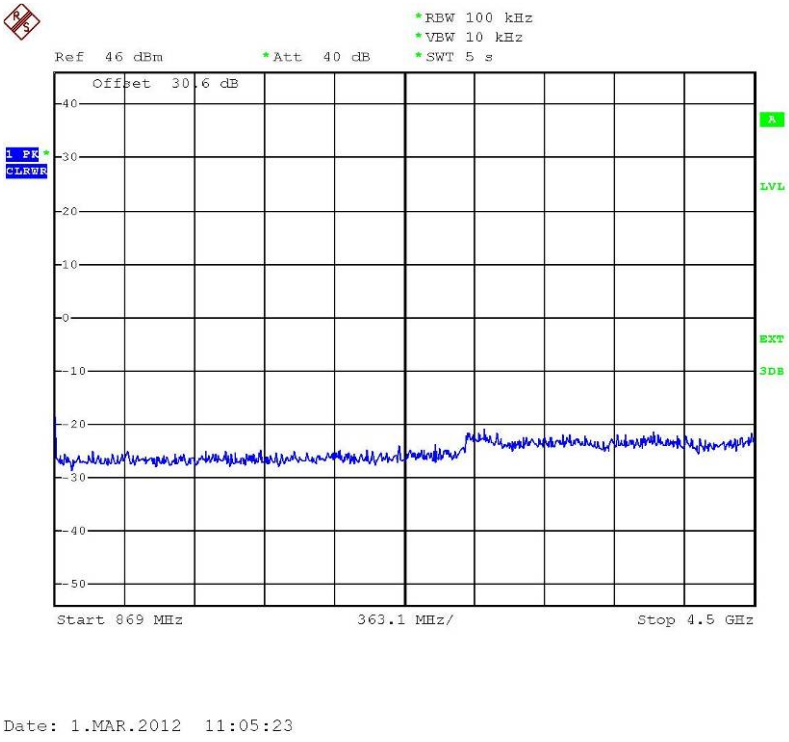
Test result:
Delta P to IMD = 42,72 dBm – (-13,05 dBm) = 55,77 dB



plot 11.3.1-#1 Spurious Emissions: RSS-131; Test results; Downlink; 30 MHz – 851 MHz



plot 11.3.1-#2 Spurious Emissions: RSS-131; Test results; Downlink; 851 MHz – 869 MHz



plot 11.3.1-#3 Spurious Emissions: RSS-131; Test results; Downlink; 869 MHz – 4.5 GHz

11.3.2 Uplink

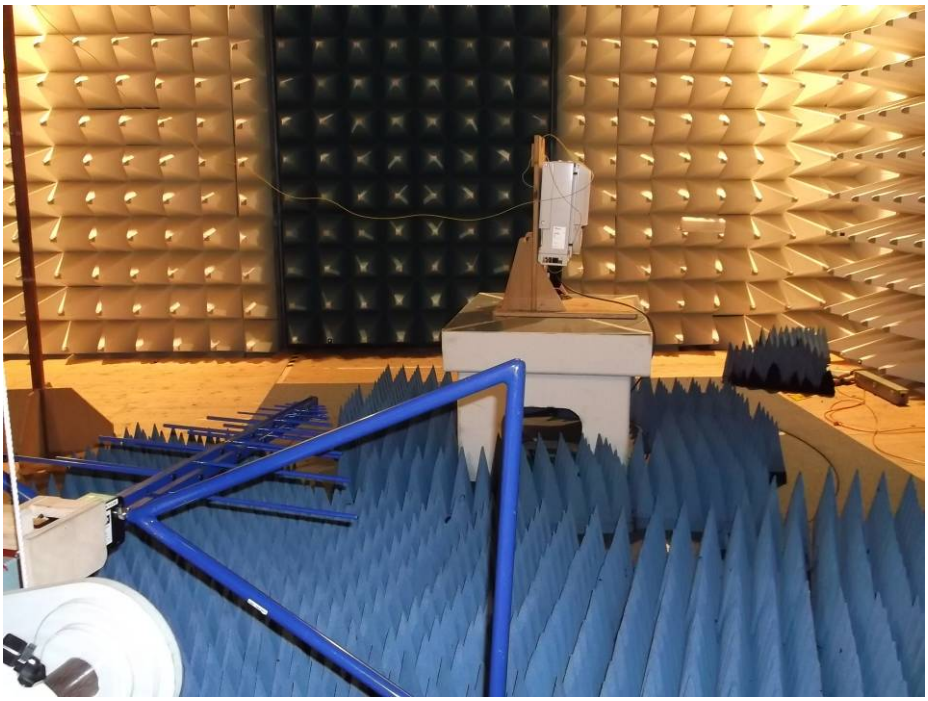
n.a.

Note: The EUT does not transmit over the air in the uplink direction.

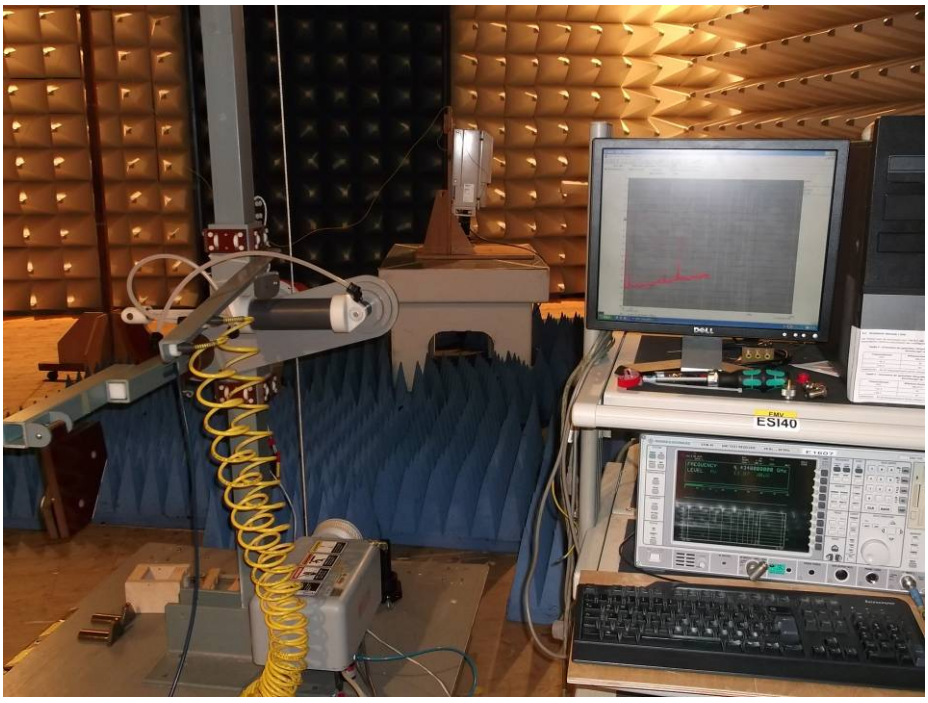
11.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	01.03.2012

12 Radiated Spurious Emissions at the ECL (TEMPTON): §90.210, §2.1053, RSS-Gen, RSS-131



picture 7.1: Test setup: Field Strength Emission <1 GHz @3m in the FAC



picture 7.2: Test setup: Field Strength Emission >1 GHz @3m in the FAC

This clause specifies requirements for the measurement of radiated emission.

Frequency range	Distance: EUT <-> antenna / location	Limit	Test method
30 MHz - 1 GHz	3 metres / FAC	FCC 47 CFR Part 90.543	TIA/EIA-603-C:2004
		IC RSS-131 sec. 6.4	
1 GHz – 9 GHz	3 metres / FAC	FCC 47 CFR Part 90.543	
		IC RSS-131 sec. 6.4	

Test equipment used:

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.-date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1687	21.12.2010	21.12.2011	X
EMI test receiver	ESI40	Rohde & Schwarz	E1607	23.05.2011	23.05.2012	
Antenna	CBL 6111	Chase	K1149	02.08.2011	02.08.2012	X
Antenna	CBL 6111	Chase	K1026	30.05.2011	30.05.2012	
RF Cable	Rosenberger	Frankonia	K1121 SET	14.07.2011	14.07.2012	X
Pre amplifier	AM1431	Miteq	K1721	14.07.2011	14.07.2012	X
Antenna	HL 025	R&S	K809	25.07.2011	25.07.2012	X
Preamplifier	AFS4-00102000	Miteq	K817	13.10.2011	13.10.2012	X
RF Cable	Sucoflex 100	Suhner	K1742	05.04.2011	05.04.2012	X

The REMI version 2.135 has been used for max search.

Test set-up:

Test location: FAC
Both, the Fully Anechoic Chamber (FAC) and the Semi Anechoic Chamber (SAC) fulfil the requirements of ANSI C63.4 and CISPR 16-1-4 with regards to NSA and SVSWR.
Test Voltage: 115V / 60 Hz
Type of EUT: Wall mounted

Measurement uncertainty:

Measurement uncertainty expanded (95% or K=2)	± 4,7 dB for ANSI C63.4 measurement ± 0,5 dB for TIA-603 measurement

12.1 Method of Measurement

Measurement procedure. **TIA-603-C**

The antenna substitution method is used to determine the equivalent radiated power at spurious frequencies. The spurious emissions are measured at a distance of 3 meters. The EUT is then replaced with a reference substitution antenna with a known gain referenced to a dipole. This antenna is fed with a signal at the spurious frequency. The level of the signal is adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic dipole (see Figure 7.2).

From KDB (AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET):
Radiated spurs (enclosure) – Use of CW signal (low, mid. and high freq.) is acceptable rather than all modulations.

The maximum RFI field strength was determined during the measurement by rotating the turntable (±180 degrees) and varying the height of the receive antenna (h = 1 ... 4 m) as like defined in ANSI C63.4. A measurement receiver has been used with a RBW 120 kHz up to 1 GHz and 1 MHz above 1 GHz. Steps with during pre measurement was half the RBW.

Both, the Fully Anechoic Chamber (FAC) and the Semi Anechoic Chamber (SAC) fulfil the requirements of ANSI C63.4 and CISPR 16-1-4 with regards to NSA and SVSWR.

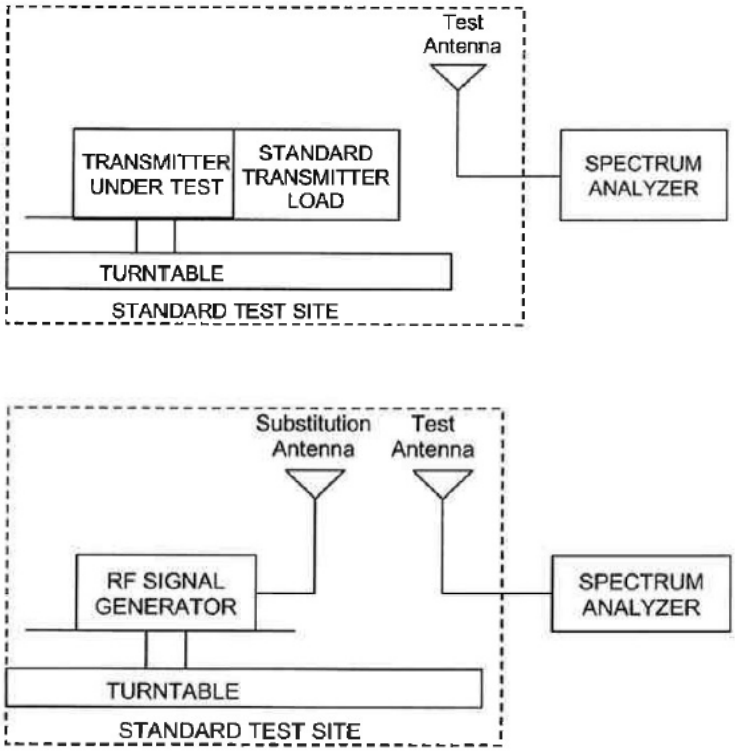


Figure #7.2 Substitution methods TIA/EIA-603-C

12.2 Limit

§90.210 Emission masks / RSS-GEN sec. 4.9; RSS-131 sec. 6.4

Frequency band (MHz)	Mask for equipment with Audio low pass filter	Mask for equipment without audio low pass filter
806–809/851–854	B	H
809–824/854–869	B	G

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

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

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

(5) On any frequency removed from the center of the authorized bandwidth by more than 25 kHz: At least 43 + log (P) dB.

The Emission limit is -13dBm

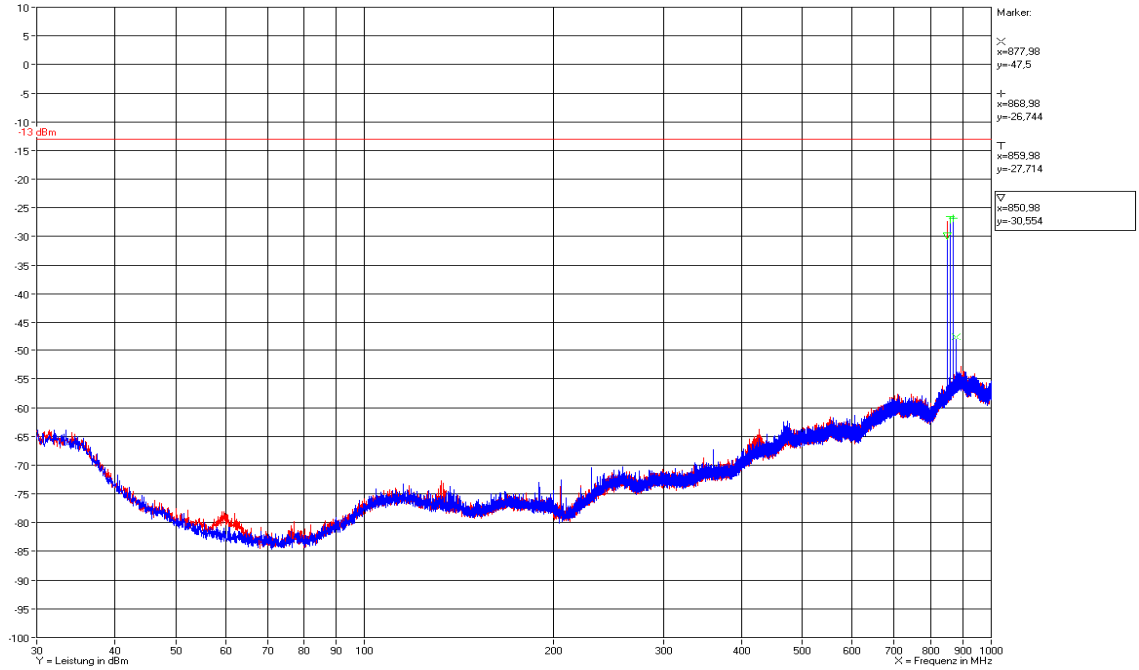
12.3 Climatic values in the lab

Temperature: 21°
Relative Humidity: 47%
Air-pressure: 998 hPa

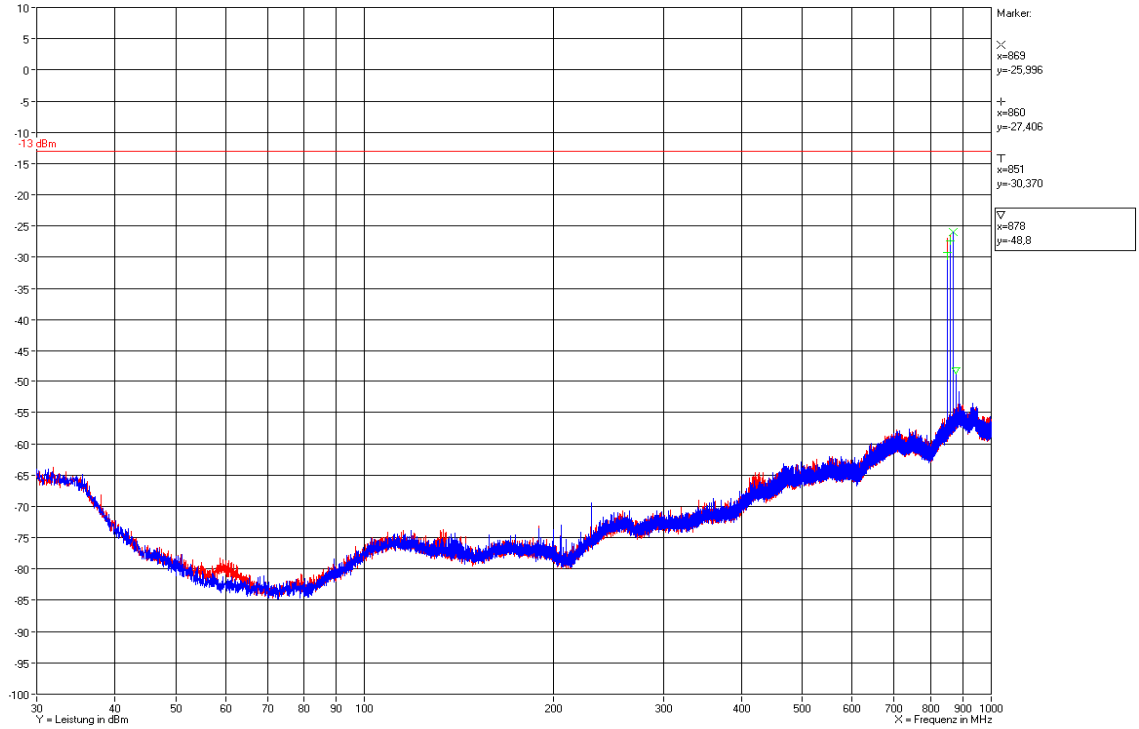
12.4 Test results

12.4.1.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top)

Vertikal / Horizontal RBW = 120kHz

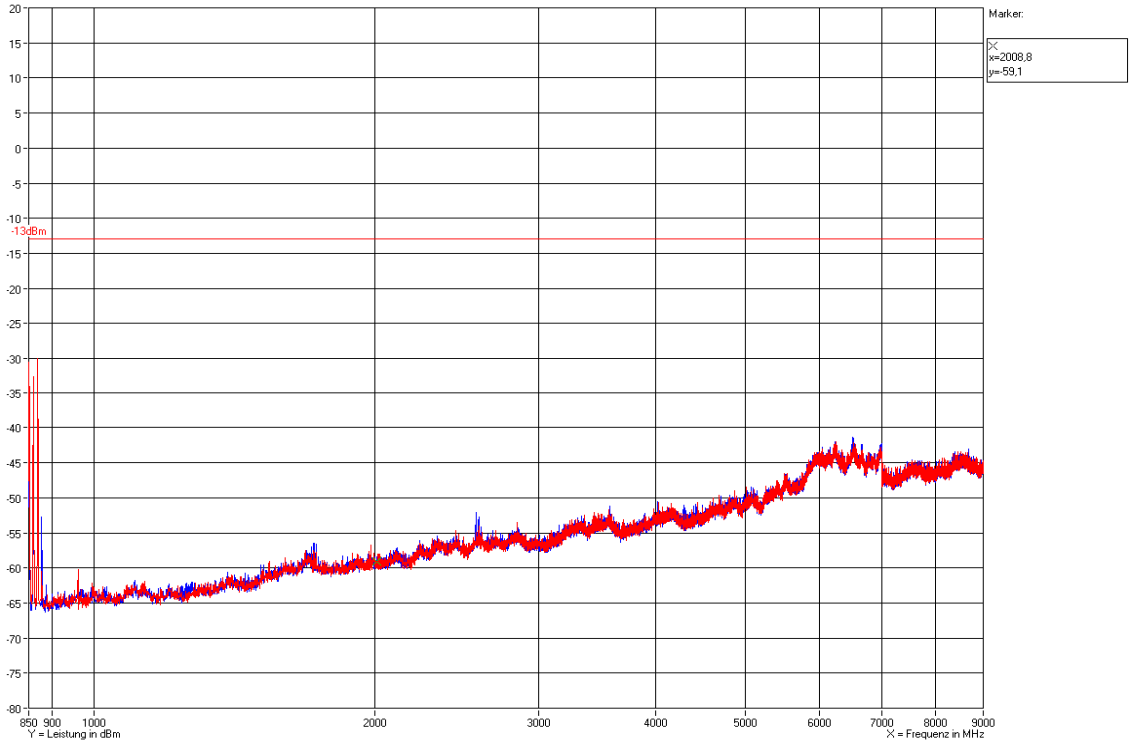


RBW = 100kHz

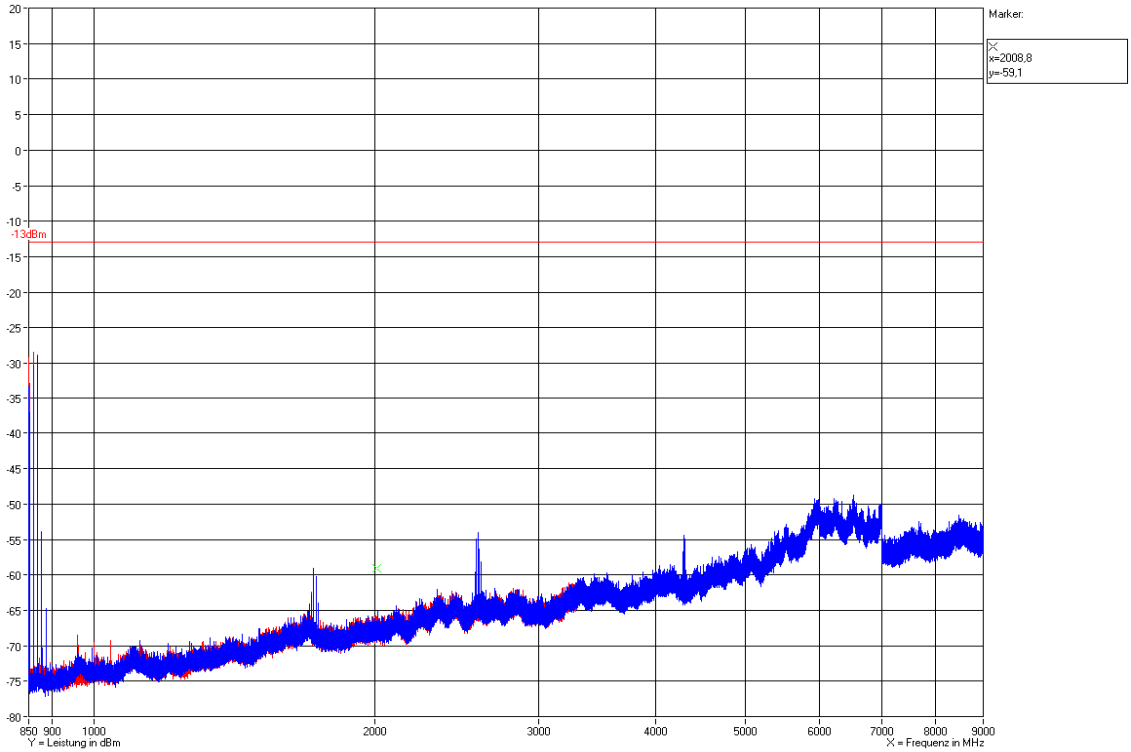


12.4.1.2 1 GHz to 9 GHz Downlink (Bottom – Middle – Top)

Vertikal / Horizontal RBW = 1MHz



RBW = 100kHz



The radiated spurious emission measurements have been passed!

13 History

Revision	Modification	Date	Name
01.00	Initial report	11.04.2012	Zahlmann

******** End of test report *******