ECL-EMC Test Report No.: 13-049

Equipment under test: **ION-U L 7/8/85/17P/19P Vac 850MHz Path**
FCC ID: **XS5-U7885L1719P**
IC ID: **2237E-U7885L1719P**
Type of test: **FCC 47 CFR Part 22 Subpart H:2013**
Cellular Radiotelephone Service
IC RSS-131:2005
Zone Enhancers for the Land Mobile Service

Measurement Procedures: 47 CFR Parts 2: 2013 (*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*),
Part 22: 2013 (Public Mobile Services),
ANSI/TIA-603-C (2004), *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*
IC RSS-GEN: 2010 General Requirements and Information for the Certification of Radiocommunication Equipment

Test result: **Passed**

Date of issue:	25.06.13	Signature:	
Issue-No.:	02	Author:	Tom Zahlmann Test engineer Digitally signed by Tom Zahlmann DN: cn=Tom Zahlmann, o=Bureau Veritas CPS, ou=ECL, email=tom.zahlmann@de.bureauveritas.com, c=DE Date: 2013.06.25 15:08:18 +02'00'
Date of delivery:	08.02.13	Checked:	Frank Tomandl Project manager EMC Digital unterschrieben von Frank Tomandl DN: cn=Frank Tomandl, o=Bureau Veritas CPS GmbH, ou=ECL, email=frank.tomandl@de.bureauveritas.com, c=DE Datum: 2013.06.26 16:14:21 +02'00'
Test dates:	14.01. – 08.02.13		
Pages:	65		

Manufacturer:	ANDREW Wireless Systems GmbH Industriering 10 D-86675 Buchdorf Tel.: +49 (0)9099 69 0 Fax: +49 (0)9099 69 140
Test house:	Bureau Veritas Consumer Products Services Germany GmbH European Compliance Laboratory (ECL) Thurn-und-Taxis-Straße 18 D-90411 Nürnberg Tel.: +49 40 74041 0 Fax: +49 40 74041-2755

General:
The purpose of this report is to show compliance to the FCC regulations for licensed devices operating under section 22 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	22.913	2.1046	500 Watts	Complies
Occupied Bandwidth		2.1049	Input/Output	Complies
Spurious Emissions at Antenna Terminals	22.917	2.1051	-13dBm	Complies
Field Strength of Spurious Emissions	22.917	2.1053	-13dBm E.I.R.P	Complies
Frequency Stability	n.a.	2.1055	Must stay in band	NA

Name of Test	IC Para. No.	IC Method	Result
RF Power Output	RSS-131 RSS-132	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 clause “Occupied Bandwidth”.

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

2.1 Description

Kind of equipment	ION-U L 7/8/85/17P/19P Vac
Andrew Ident. Number	Id. No. 7669582-00
Serial no.(SN)	11
Revision	00
Software version and ID	n. a.
Type of modulation and Designator	F3E (Voice) ☒ GSM (GXW) ☒ GSM EDGE (G7W) ☒ CDMA (F9W) ☒ W-CDMA (F9W) ☒ LTE (G7D) ☒
Frequency Translation	F1-F1 ☒ F1-F2 ☐ N/A ☐
Band Selection	Software ☐ Duplexer ☒ Full band ☐

2.1.1 Downlink

Pass band	Path 869 MHz – 894 MHz
Nominal 20dB bandwidth	43.32 MHz
Max. composite output power based on one carrier per path (rated)	29 dBm = 0.8 W
Gain	49 dB

2.1.2 Uplink

Pass band	Path 824 MHz – 849 MHz
Maximum rated output power	n. a.
Gain	n.a.

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

2.1.3 Description of EUT

ION-U L 7/8/85/17P/19P Vac is a multi-band, multi-operator remote unit configuration used in conjunction with a master unit in the ION optical distribution system.
This system transports up to five frequency bands simultaneously (700 MHz, 800MHz, 850 MHz, 1900 MHz, 1700MHz), providing a cost-effective solution for distributing capacity from one or more base stations.

The ION-U L 7/8/85/17P/19P Vac Repeater consists of one 700 MHz, one 800 MHz, one 850 MHz, one 1900 MHz and one 1700 MHz (2100MHz in DL) path, with the intended use of simultaneous transmission. This Test Report describes only the approval of the 850 MHz path

2.1.4 Block diagram of measurement reference points

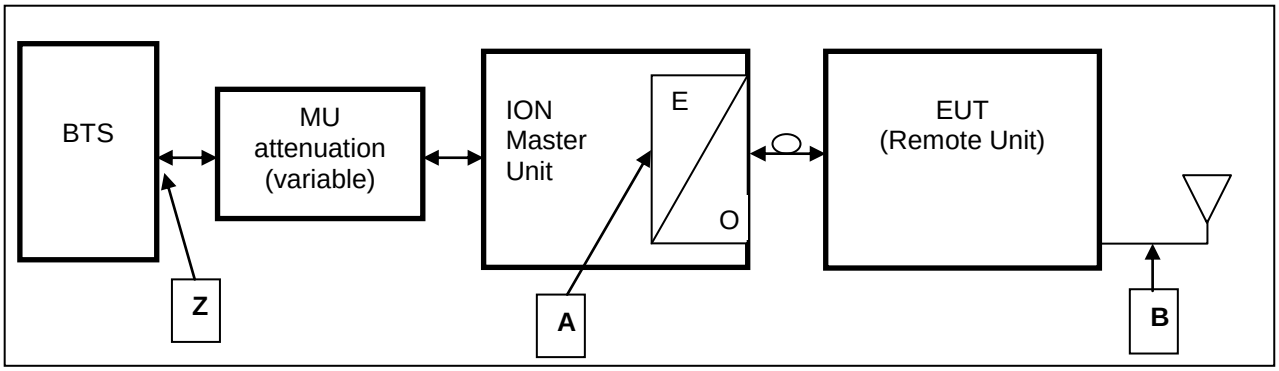


figure 2.1.4-#1 Block diagram of measurement reference points

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 A to B

Since a signal generator does not supply a good output signal with +33 or +43dBm, for the downlink measurement the MU Attenuation is not used.
That means for downlink measurements the signal generator is connected to measurement point A at the master optical / electrical converter and the analyzer to the measurement point B at the RU.

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)* **A**	RU Gain *(fixed value)* **A to B**	Maximum rated output power at RU Antenna port *(fixed value)* **B**
+33 dBm	**53 dB**	**-20 dBm**	**+49 dB**	**+29.0 dBm** *@ 1 carrier*
System Gain Z to A	**-4 dB**			
+43 dBm	**63 dB**	**-20 dBm**	**+49 dB**	**+29.0 dBm** *@ 1 carrier*
System Gain Z to A	**-14 dB**			

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	

3.2 Test equipment

ANDREW Inv. No.	Test equipment	Type	Manufacturer	Serial No.	Calibration
9102	Network Analyzer	ZVB14	R&S	100118	08/13
9054	Spectrum Analyzer	FSV13	R&S	100859	12/13
9046	Signal Generator	SMBV100A	R&S	255090	06/13
8849	Signal Generator	SMU200A	R&S	101732	04/13
8671	Power Meter	E4418B	Agilent	GB39513094	06/13
8672	Power Sensor	E9300H	Agilent	US41090179	06/13
7306	Circulator	C25E-1FFF	AEROTEK	12580	CIU
7307	Circulator	C25E-1FFF	AEROTEK	12581	CIU
7408	RF-Cable	2,0m; N-N	Andrew	---	CIU
7409	RF-Cable	2,0m; N-N	Andrew	---	CIU
7410	RF-Cable	1,0m; N-N	Andrew	---	CIU
7411	RF-Cable	2,0m; N-N	Andrew	---	CIU
7373	RF-Cable	Multiflex141	Andrew	---	CIU
7374	RF-Cable	Multiflex141	Andrew	---	CIU
7437	RF-Cable	Multiflex141	Andrew	---	CIU
7438	RF-Cable	Multiflex141	Andrew	---	CIU
7439	RF-Cable	Multiflex141	Andrew	---	CIU
7443	RF-Cable	Multiflex141	Andrew	---	CIU
7444	RF-Cable	Multiflex141	Andrew	---	CIU
7445	RF-Cable	Multiflex141	Andrew	---	CIU
7446	RF-Cable	Multiflex141	Andrew	---	CIU
7447	RF-Cable	Multiflex141	Andrew	---	CIU
7448	RF-Cable	Multiflex141	Andrew	---	CIU
7449	RF-Cable	Multiflex141	Andrew	---	CIU
7450	RF-Cable	Multiflex141	Andrew	---	CIU
7440	RF-Cable	RG-223 0.8m	Andrew	---	CIU
7441	RF-Cable	RG-223 0.8m	Andrew	---	CIU
7453	RF-Cable	RG223 2m SMA.	Andrew	---	CIU
7454	RF-Cable	RG223 2m SMA.	Andrew	---	CIU
7455	RF-Cable	RG223 2m SMA.	Andrew	---	CIU
7144	Attenuator	2N-20dB	Inmet 64671	---	CIU
7341	Power Attenuator	768-20	Narda	---	CIU
7368	Matrix		COMMSCOPE	---	weekly

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

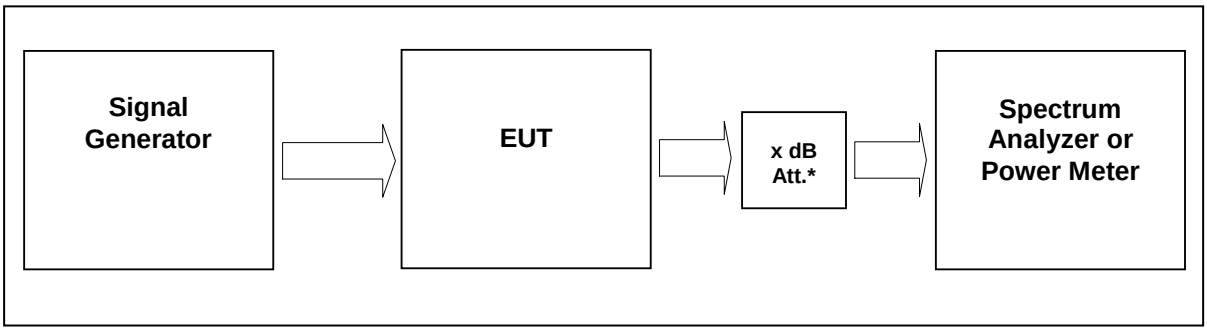
The extended measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k=2. The true value is located in the corresponding interval with a probability of 95 %.

4 Test site (Bureau Veritas Consumer Product Services)

FCC Test site: 96997
IC OATS: 2237E

See relevant dates under section 8.

5 RF Power Out: §22.913, §2.1046; IC RSS-131



External Attenuator DL x dB = 20 dB

figure 5-#1 Test setup: RF Power Out: §22.913, §2.1046; IC RSS-131

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 9046, 7444; 7306; 7144; 7454;7453; 7341; 7449; 7368

5.1 Limit

Minimum standard:
Para. No.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:

(1) Are located in counties with population densities of 100 persons or fewer per square mile, based upon the most recently available population statistics from the Bureau of the Census; or,

(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.

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 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 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 LTE:
Signal waveform according to Test Model 1.1, E-TM1.1, clause 6.1.1.1-1, table 6.1.1.1-1 of standard specification 3GPP TS 36.141 V9.3.0 (2010-03).

5.3.1 Downlink

Modulation	Measured at		RBW VBW Span	RF Power [dBm]	RF Power [W]	Plot -
Analog	Middle	881,5 MHz	0.1MHz 0.3MHz 1.5MHz	29	0.8	5.3.1.1 #1
GSM	Middle	881,5 MHz	1MHz 3MHz 10MHz	29	0.8	5.3.1.2 #1
EDGE	Middle	881,5 MHz	1MHz 3MHz 10MHz	29	0.8	5.3.1.3 #1
CDMA	Middle	881,5 MHz	3MHz 10MHz 15MHz	29	0.8	5.3.1.4 #1
WCDMA	Middle	881,5 MHz	10MHz 10MHz 50MHz	29	0.8	5.3.1.5 #1
LTE	Middle	881,5 MHz	3MHz 10MHz 50MHz	29	0.8	5.3.1.6 #1
Maximum output power = 29 dBm = 0.8 W						
Limit Maximum output power = 57 dBm = 500 W						

table 5.3.1-#1 RF Power Out: §22.913, §2.1046; IC RSS-131 Test Results Downlink

The max RF Power out is 29 dBm, so the maximum antenna gain (x) can be calculated as follow:
Limit = 500W (erp) = **57 dBm**

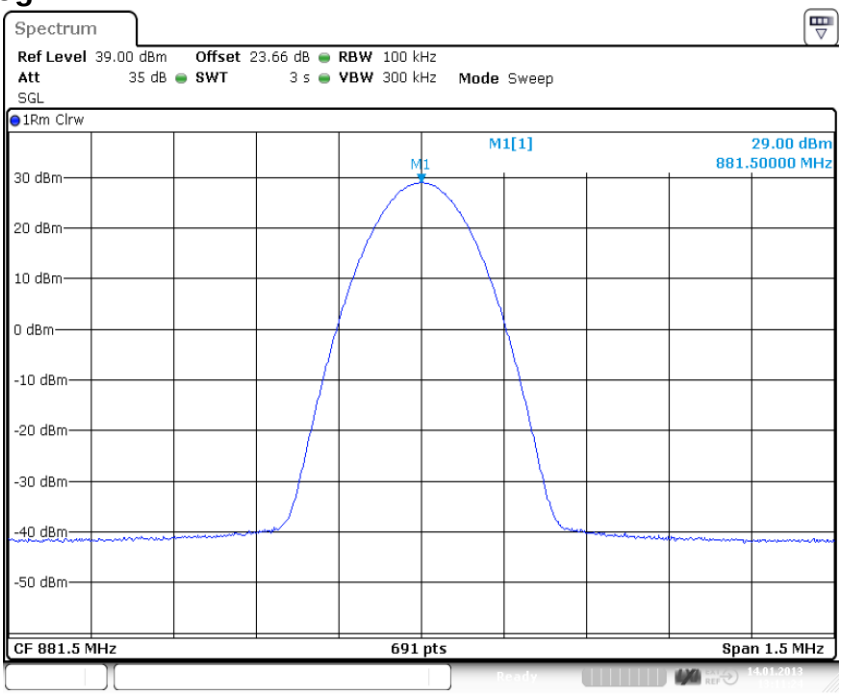
57 dBm **>** 29 dBm + x ------> x = 57 dBm – 29 dBm = 28 dBd
x dBi = 28 dBd + 2.15 = 30.15 dBi

=> The antenna that will use for the complete system have to have a gain lower than 30 dBi, relative to a dipol.

Modulation	Pin / dBm (Ref. point B)
Analog	-21.5
GSM	-21.7
EDGE	-21.6
CDMA	-21.8
WCDMA	-21.6
LTE	-21.6

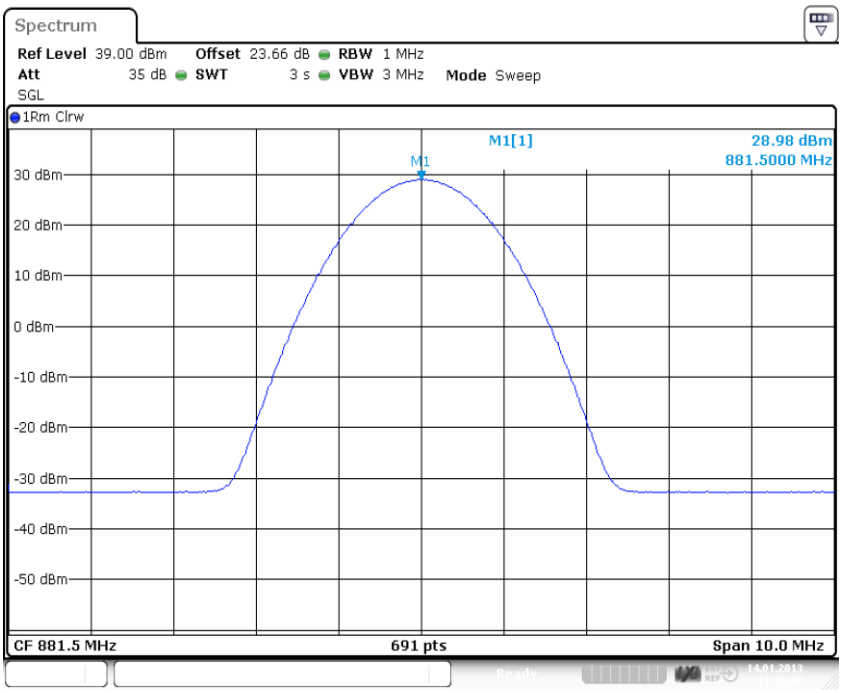
table 5.3.1-#2 RF Power Out: §22.913, §2.1046; IC RSS-131 Test Results Downlink Input power

5.3.1.1 Analog



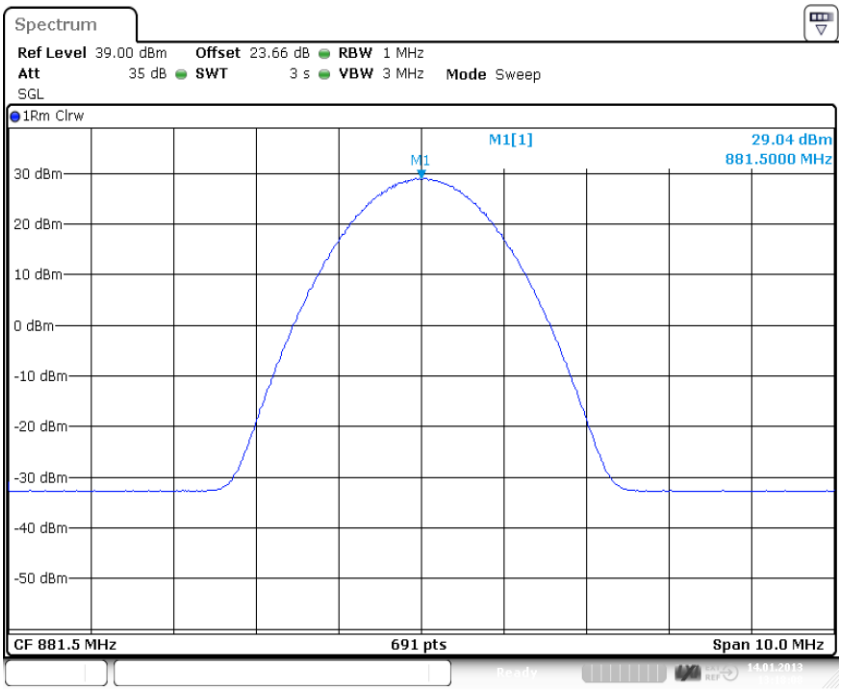
plot 5.3.1.1-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; Analog Middle

5.3.1.2 GSM



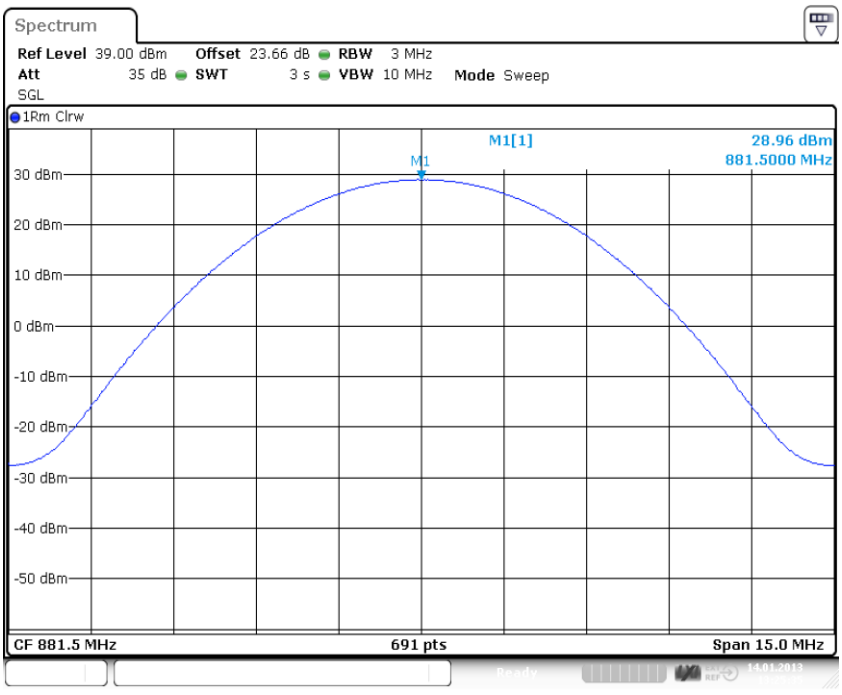
plot 5.3.1.2-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; GSM Middle

5.3.1.3 EDGE



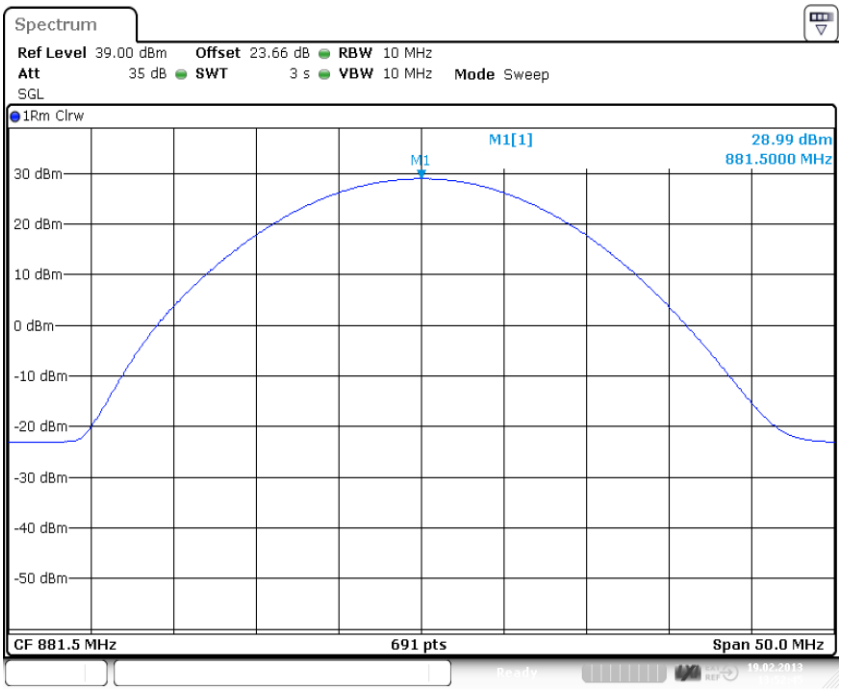
plot 5.3.1.3-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; EDGE Middle

5.3.1.4 CDMA



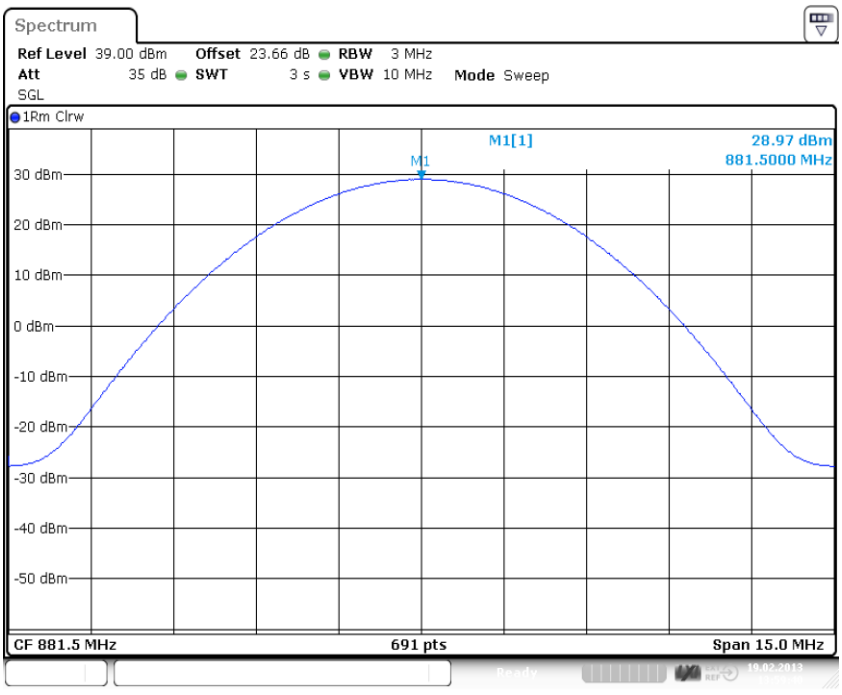
plot 5.3.1.4-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; CDMA Middle

5.3.1.5 W-CDMA



plot 5.3.1.5-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; W-CDMA Middle

5.3.1.6 LTE



plot 5.3.1.6-#1 RF Power Out: §22.913, §2.1046; IC RSS-131; Test Results; Downlink; LTE Middle

5.3.2 Uplink

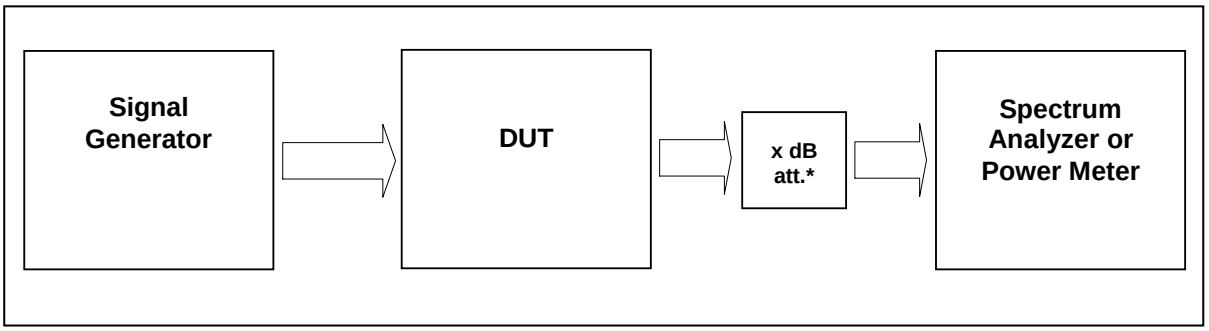
n.a.

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:	M. Leinfelder
Date:	19.02.2013

6 Occupied Bandwidth: §2.1049; RSS-GEN



External Attenuator DL x dB = 20 dB

figure 6-#1 Test setup: Occupied Bandwidth: §2.1049; RSS-GEN

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 9046, 7444; 7306; 7144; 7454;7453; 7341; 7449; 7368

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

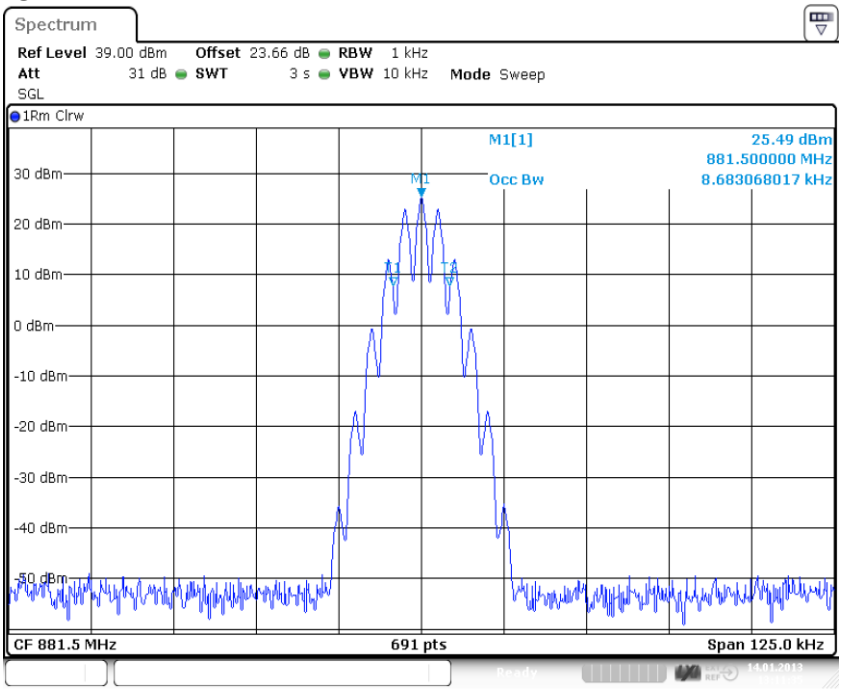
For composite power measurements: Detector RMS.

6.3.1 Downlink

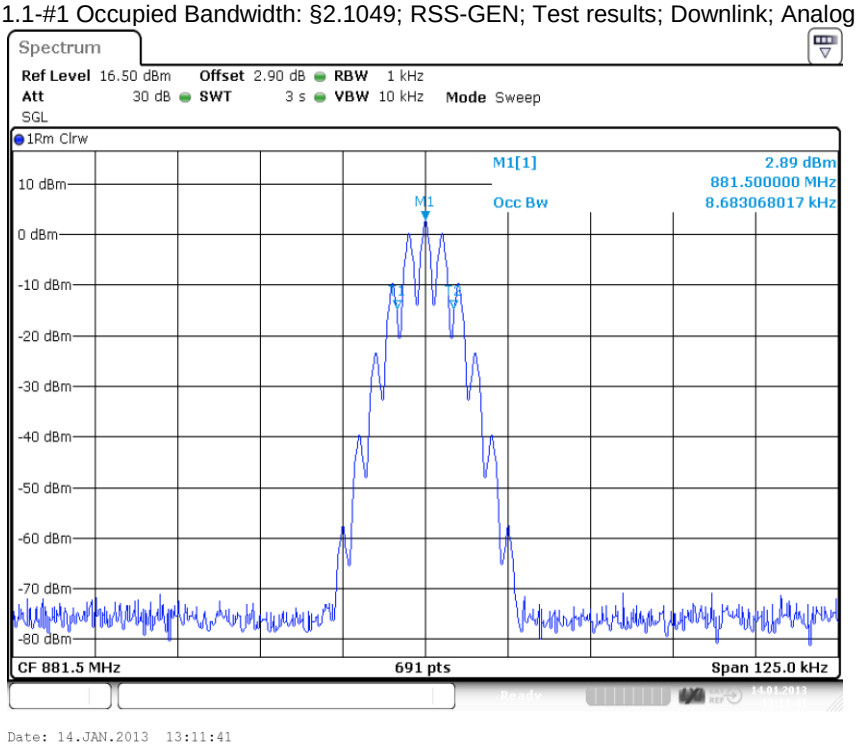
Modulation	Measured at		RBW VBW Span	Occupied Bandwidth	Plot #
Analog	Middle	881,5 MHz	1 kHz 10 kHz 125 kHz	0.0090 MHz	6.3.1.1 #1, #2
GSM	Middle	881,5 MHz	3 kHz 30 kHz 1 MHz	0.195 MHz	6.3.1.2 #1, #2
EDGE	Middle	881,5 MHz	3 kHz 30 kHz 1 MHz	0.193 MHz	6.3.1.3 #1, #2
CDMA	Middle	881,5 MHz	30 kHz 300 kHz 5 MHz	1.172 MHz	6.3.1.4 #1, #2
WCDMA	Middle	881,5 MHz	100 kHz 1 MHz 10 MHz	3.777 MHz	6.3.1.5 #1, #2
LTE	Middle	881,5 MHz	30 kHz 300 kHz 5 MHz	1.042 MHz	6.3.1.6 #1, #2

table 6.3-#1 Occupied Bandwidth: §2.1049; RSS-GEN Test results

6.3.1.1 Analog

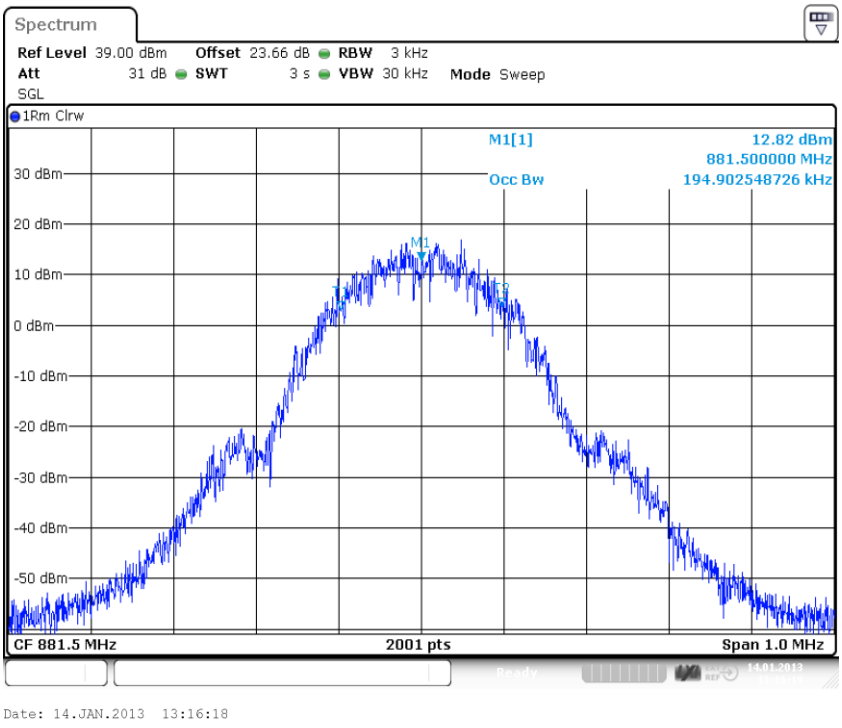


plot 6.3.1.1-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; Analog Output

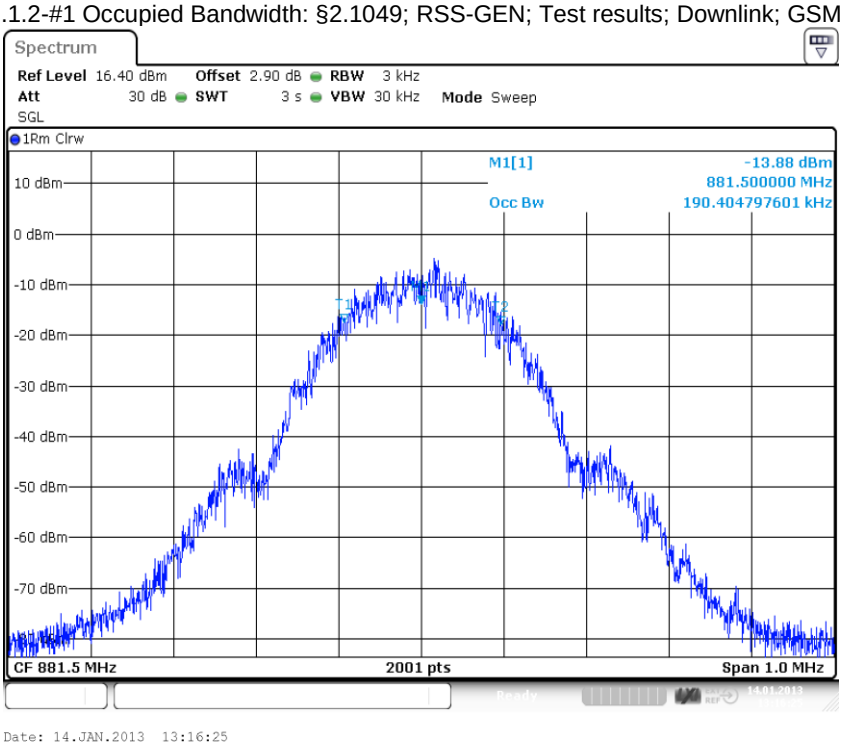


plot 6.3.1.1-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; Analog Input

6.3.1.2 GSM

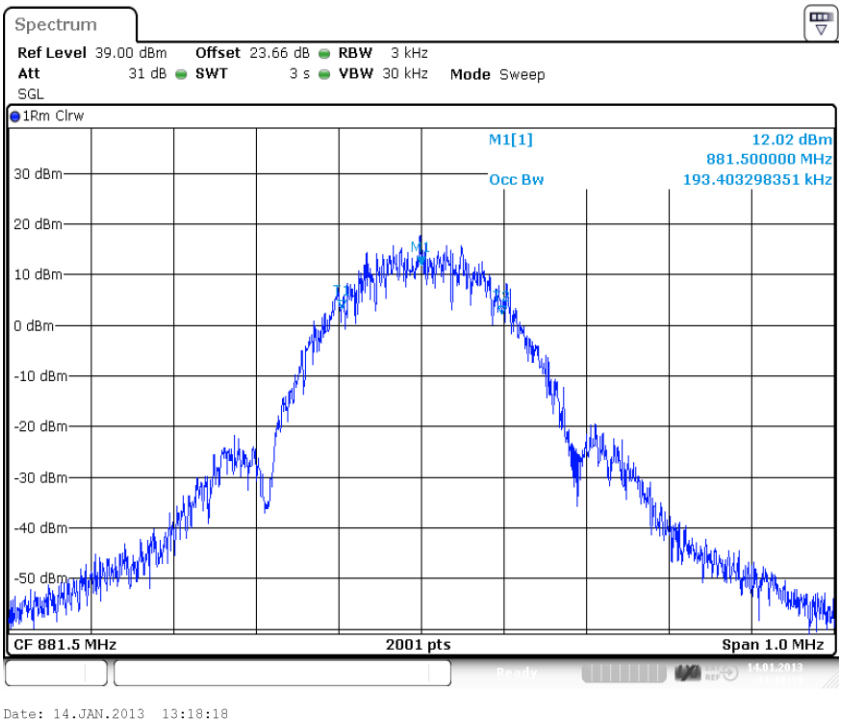


plot 6.3.1.2-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; GSM Output

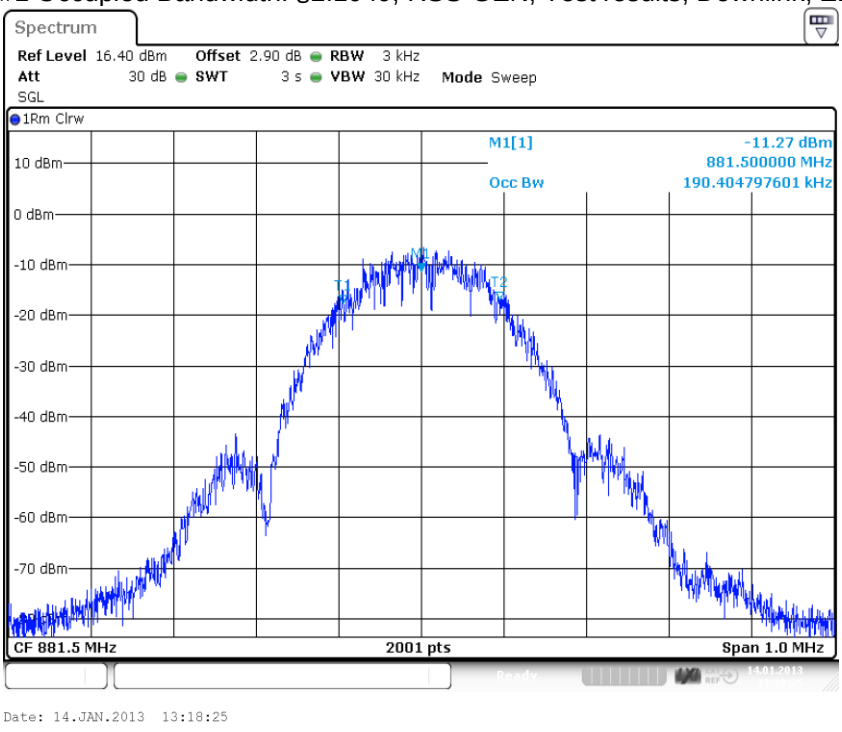


plot 6.3.1.2-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; GSM Input

6.3.1.3 EDGE

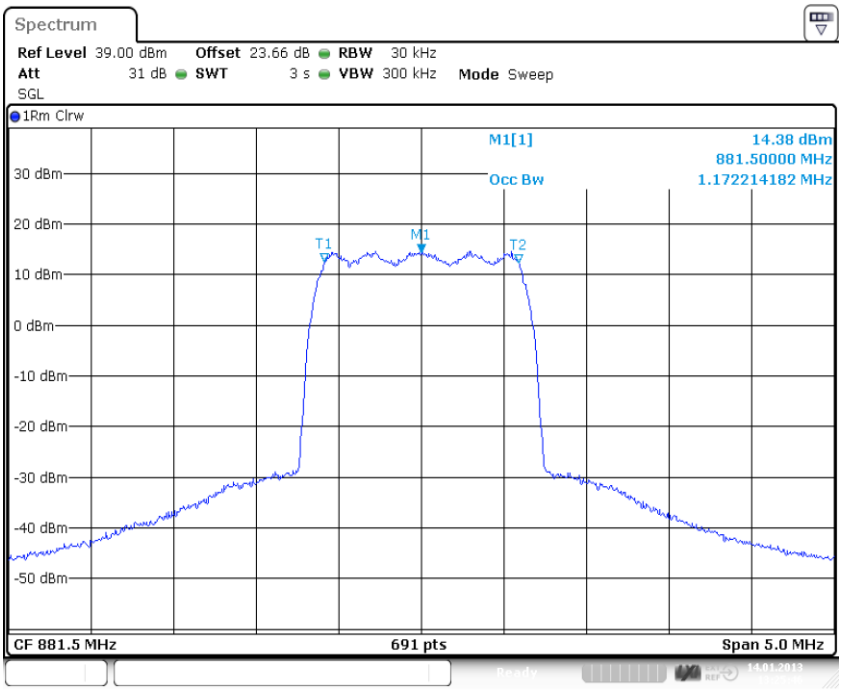


plot 6.3.1.3-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; EDGE Output

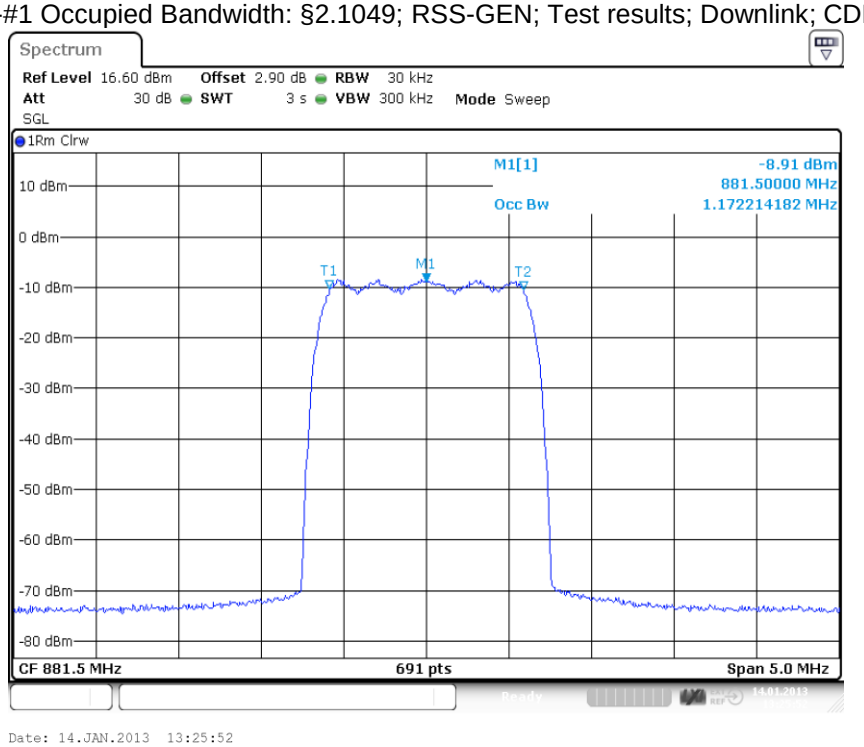


plot 6.3.1.3-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; EDGE Input

6.3.1.4 CDMA

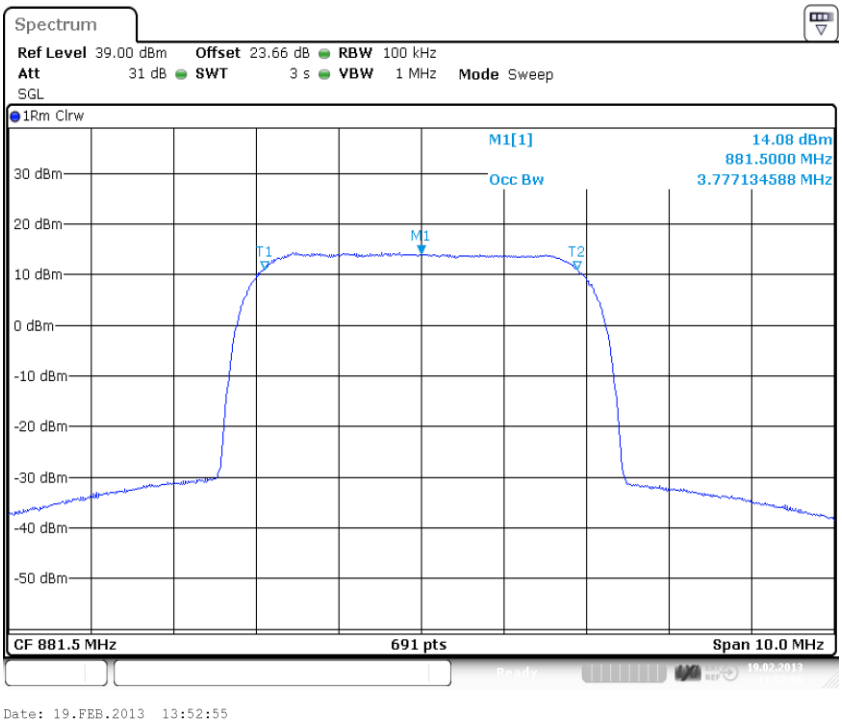


plot 6.3.1.4-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; CDMA Output

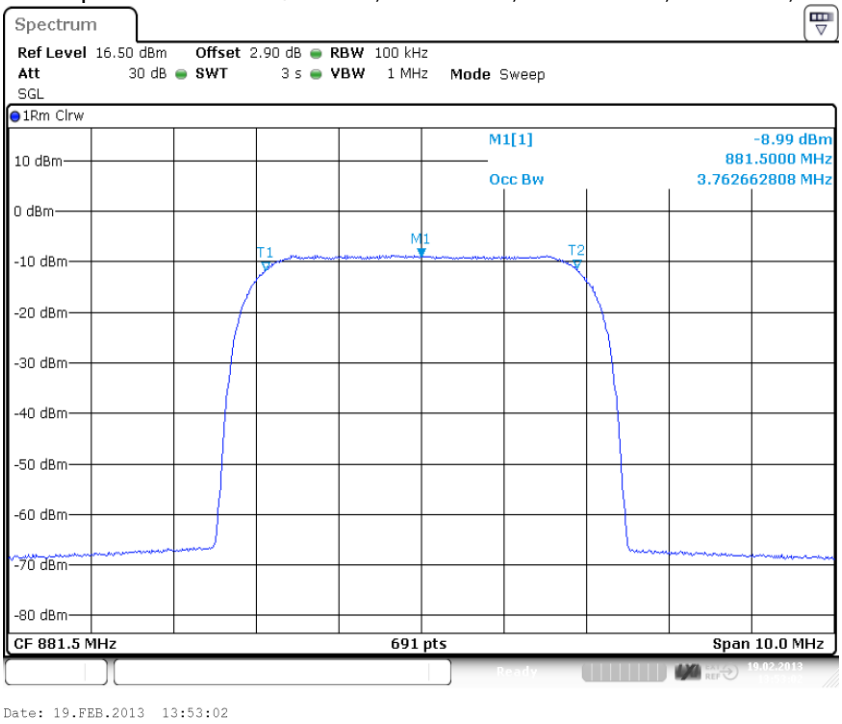


plot 6.3.1.4-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; CDMA Input

6.3.1.5 W-CDMA

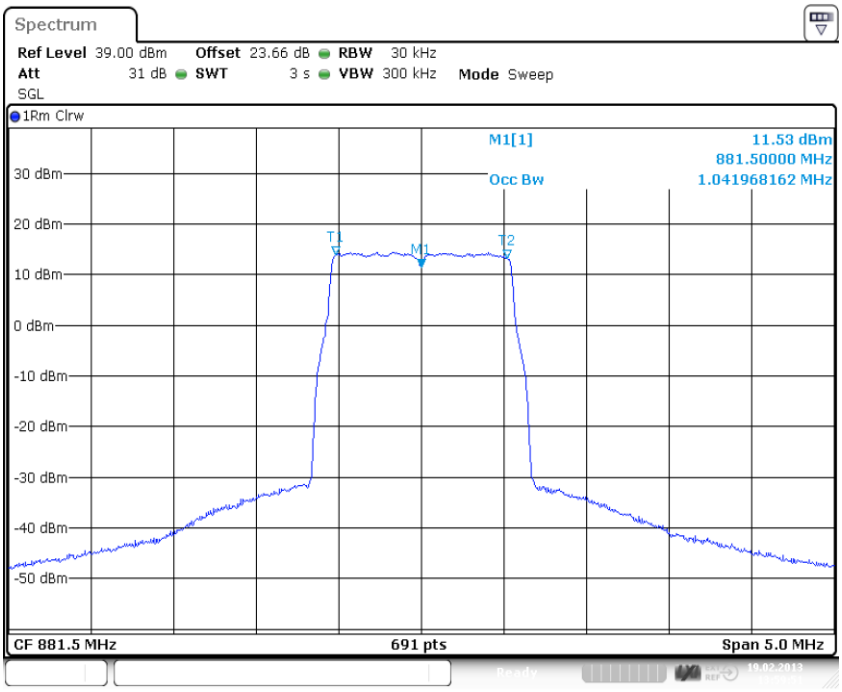


plot 6.3.1.5-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; W-CDMA Output

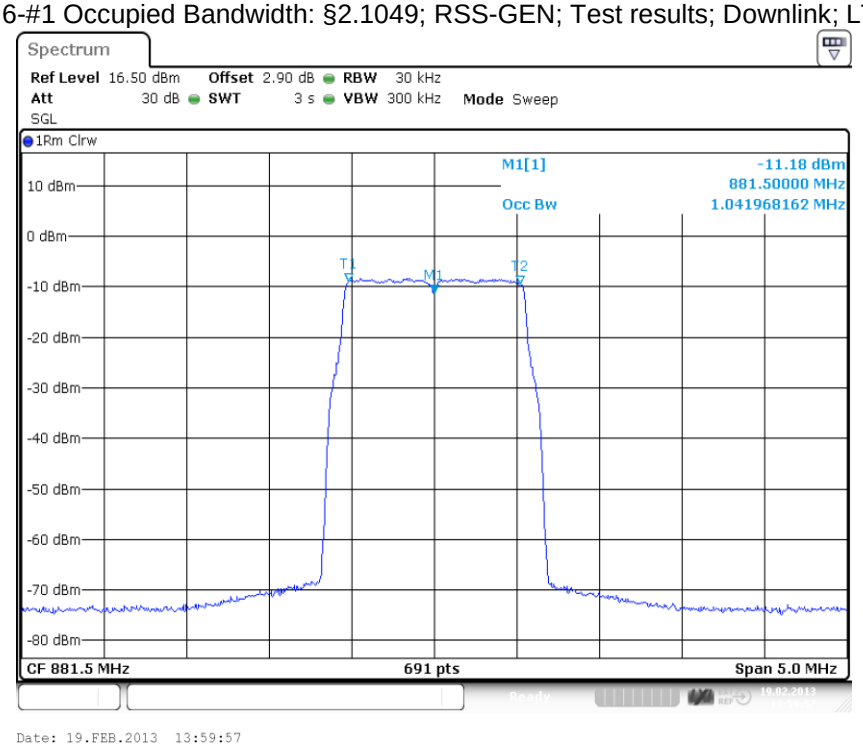


plot 6.3.1.5-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; W-CDMA Input

6.3.1.6 LTE



plot 6.3.1.6-#1 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; LTE Output



plot 6.3.1.6-#2 Occupied Bandwidth: §2.1049; RSS-GEN; Test results; Downlink; LTE Input

6.3.2 Uplink

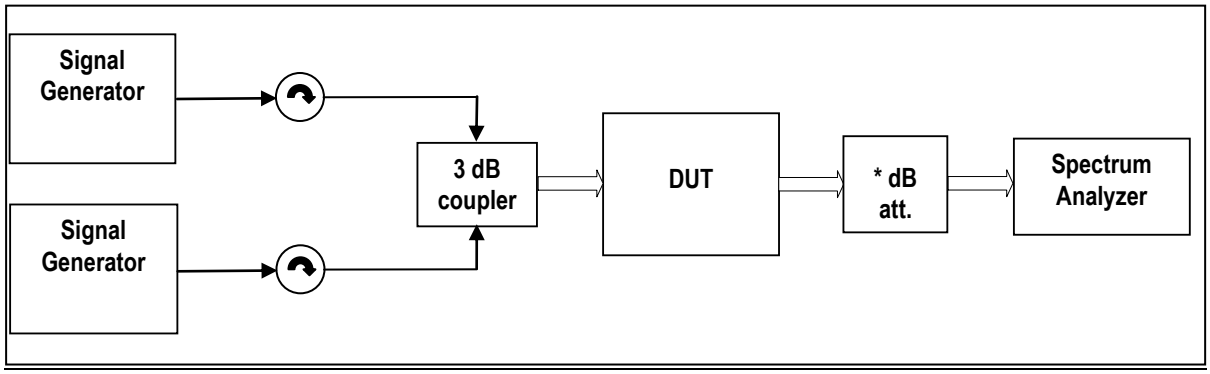
n.a.

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:	M. Leinfelder
Date:	19.02.2013

7 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN



External Attenuator DL x dB = 20 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN

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	9054, 9046, 8849; 7444; 7443; 7306; 7307; 7144; 7454;7453; 7341; 7449; 7368	

7.1 Limit

Minimum standard:
Para. No.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.

(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.

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	869,0125 MHz 869,0375 MHz 893,9625 MHz 893,9875 MHz	0.3kHz 3kHz 1.1MHz	-37.2	7.3.1.1 #1 #2
GSM	Lower Edge Upper Edge	869,4 MHz 869,6 MHz 893,4 MHz 893,6 MHz	3kHz 30kHz 2MHz	-41.8	7.3.1.2 #1 #2
EDGE	Lower Edge Upper Edge	869,4 MHz 869,6 MHz 893,4 MHz 893,6 MHz	3kHz 30kHz 2MHz	-39.9	7.3.1.3 #1 #2
CDMA	Lower Edge Upper Edge	869,775 MHz 871,025 MHz 891,975 MHz 893,225 MHz	30kHz 300kHz 6MHz	-32.1	7.3.1.4 #1 #2
WCDMA	Lower Edge Upper Edge	871,6 MHz 876.6 MHz 886.4 MHz 891.4 MHz	100kHz 1MHz 15MHz	-34.6	7.3.1.5 #1 #2
LTE	Lower Edge Upper Edge	869.7 MHz 871.1 MHz 891.9 MHz 893.3 MHz	30kHz 300kHz 6MHz	-34.6	7.3.1.6 #1 #2

table 7.3-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN Test results <1MHz from Band Edge

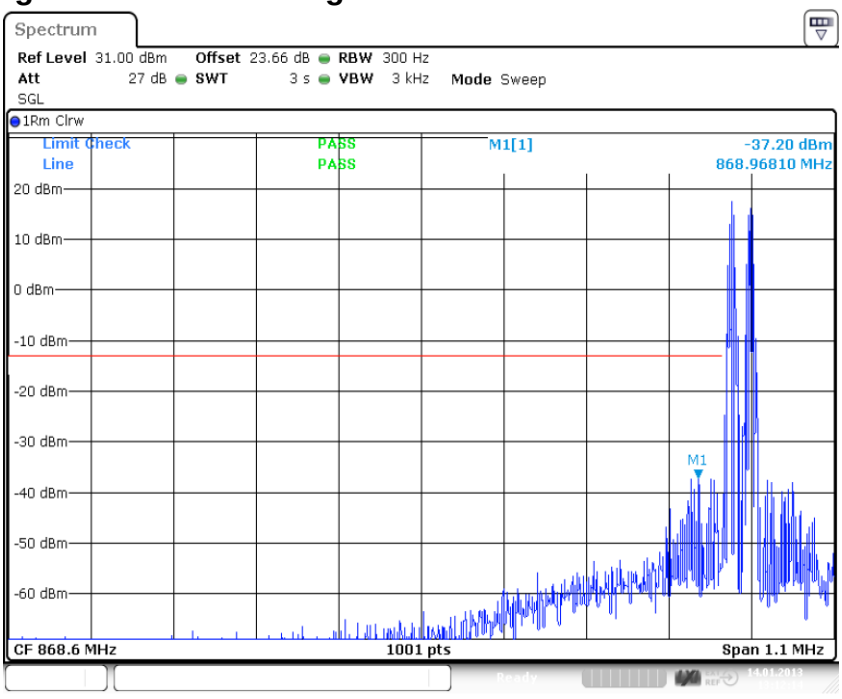
>1MHz from Band Edge

Detector: RMS.

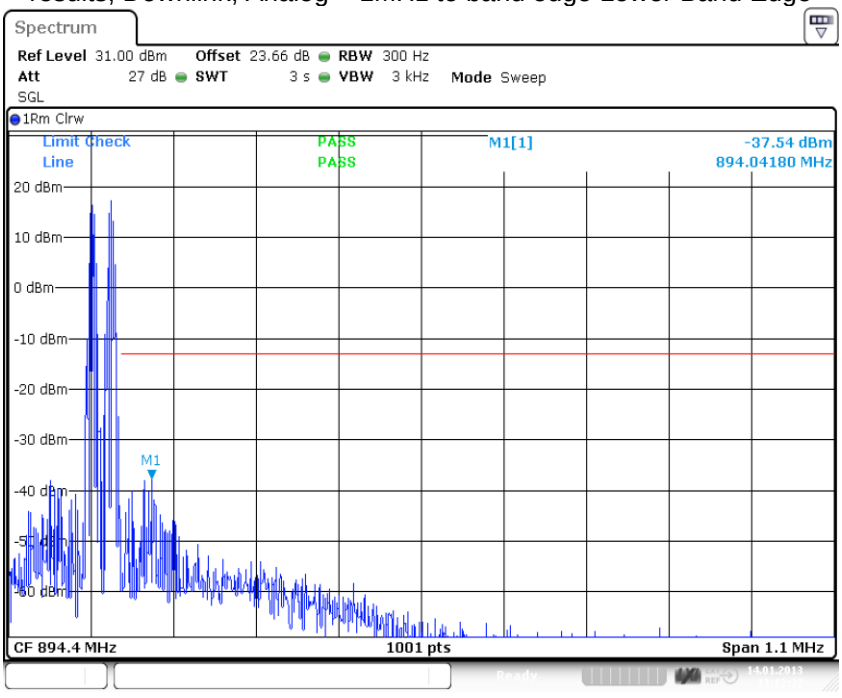
Modulation	Carrier	RBW VBW Span	Max. level (dBm)	Plot -
Analog	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-30.3	7.3.1.7 #1
GSM	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-30.0	7.3.1.8 #1
EDGE	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-30.0	7.3.1.9 #1
CDMA	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-30.2	7.3.1.10 #1
WCDMA	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-29.9	7.3.1.11 #1
LTE	881,5 MHz	1MHz 3MHz 30MHz – 10GHz	-30.1	7.3.1.12 #1

table 7.3-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN Test results <1MHz from Band Edge

7.3.1.1 Analog < 1MHz to band edge

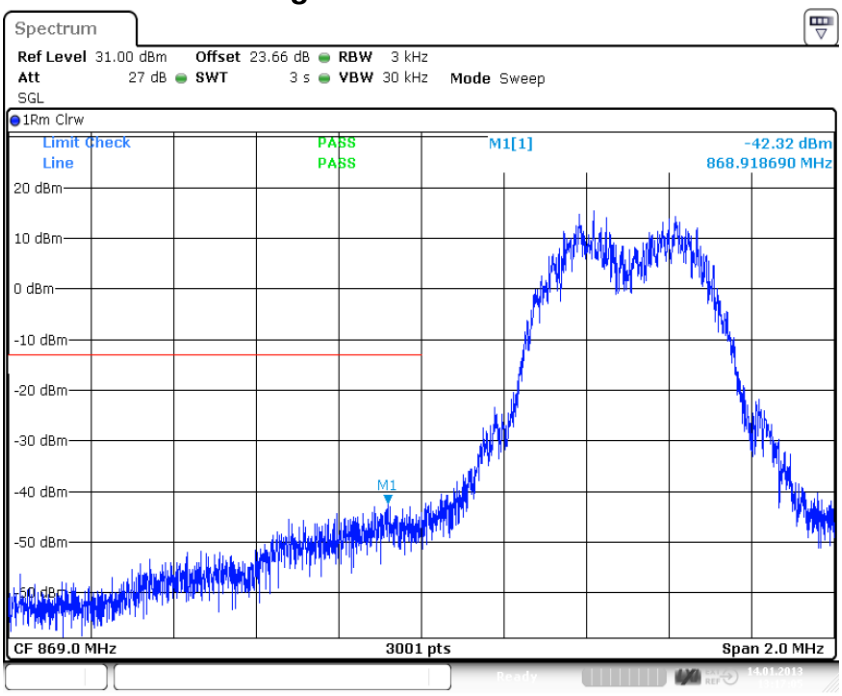


plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog < 1MHz to band edge Lower Band Edge

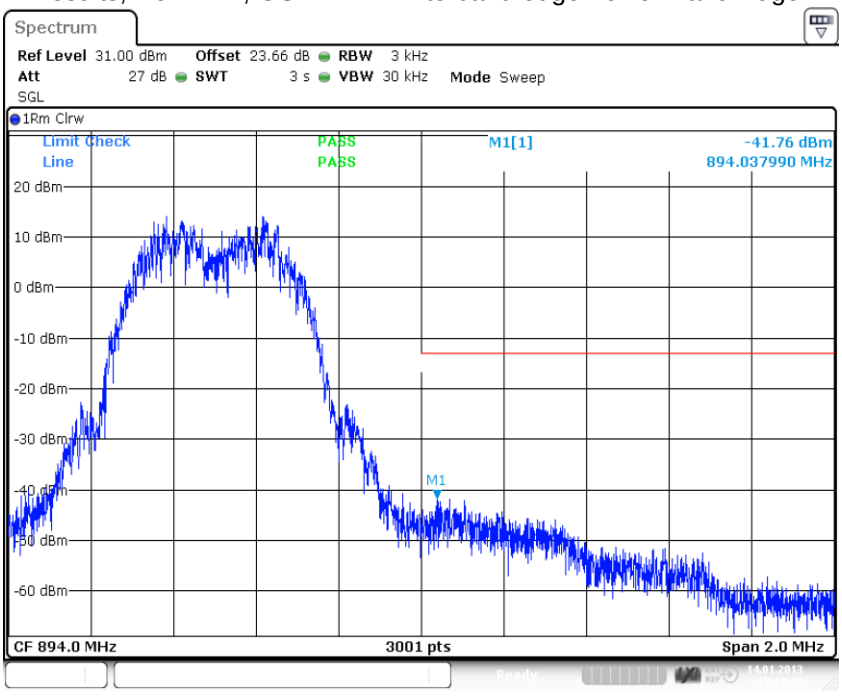


plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog < 1MHz to band edge Upper Band Edge

7.3.1.2 GSM < 1MHz to band edge

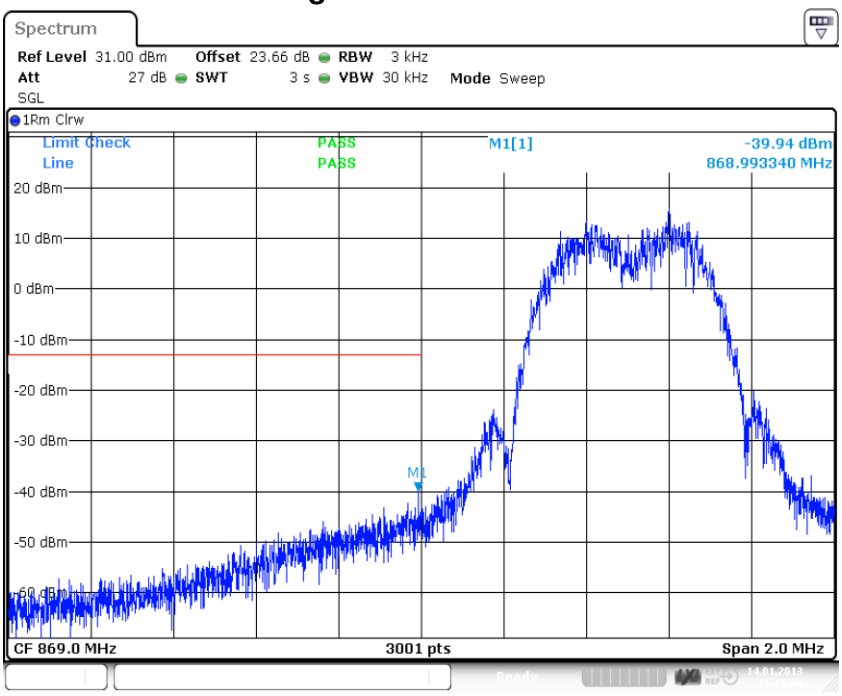


plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; GSM < 1MHz to band edge Lower Band Edge

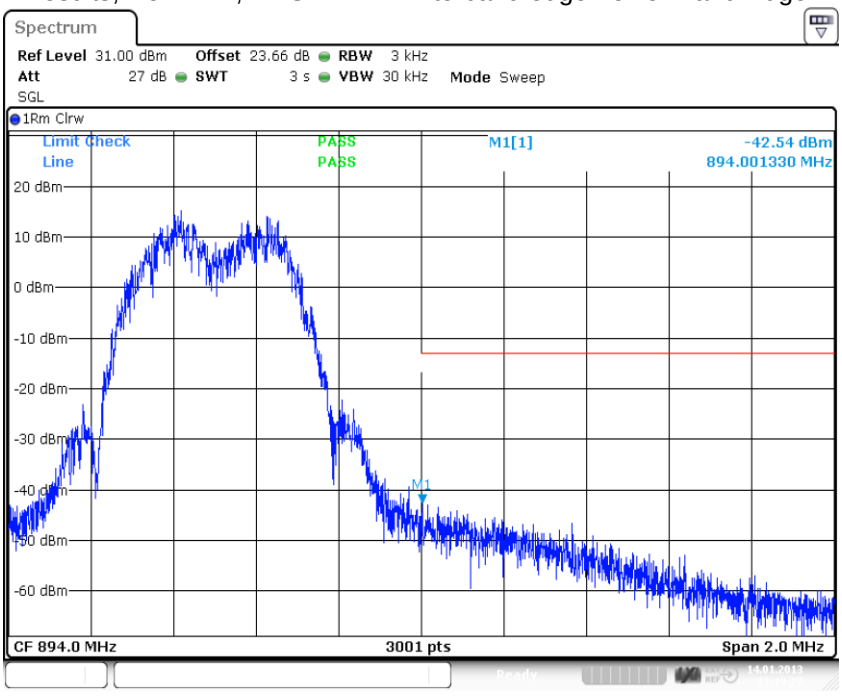


plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; GSM < 1MHz to band edge Upper Band Edge

7.3.1.3 EDGE < 1MHz to band edge

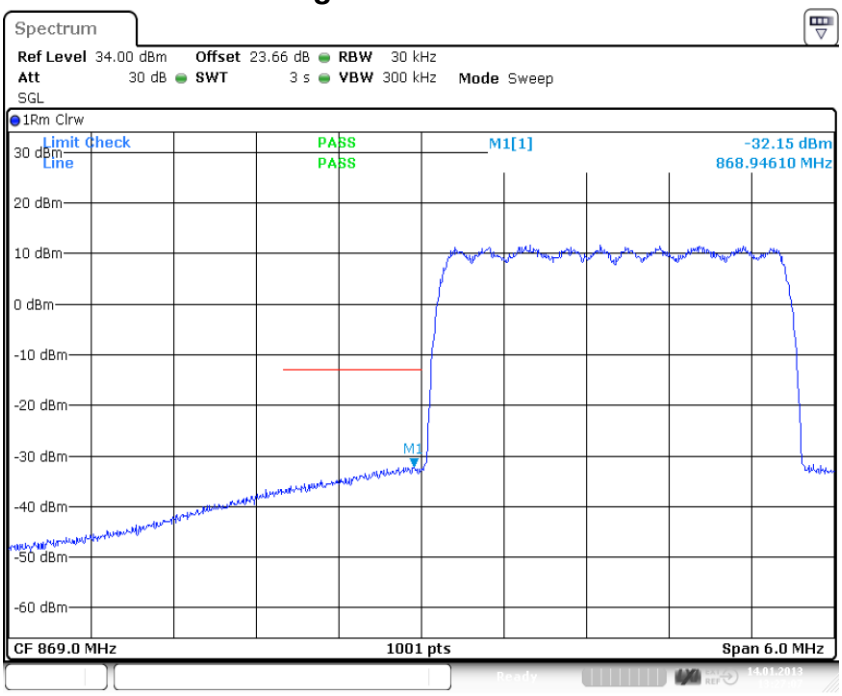


plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; EDGE < 1MHz to band edge Lower Band Edge

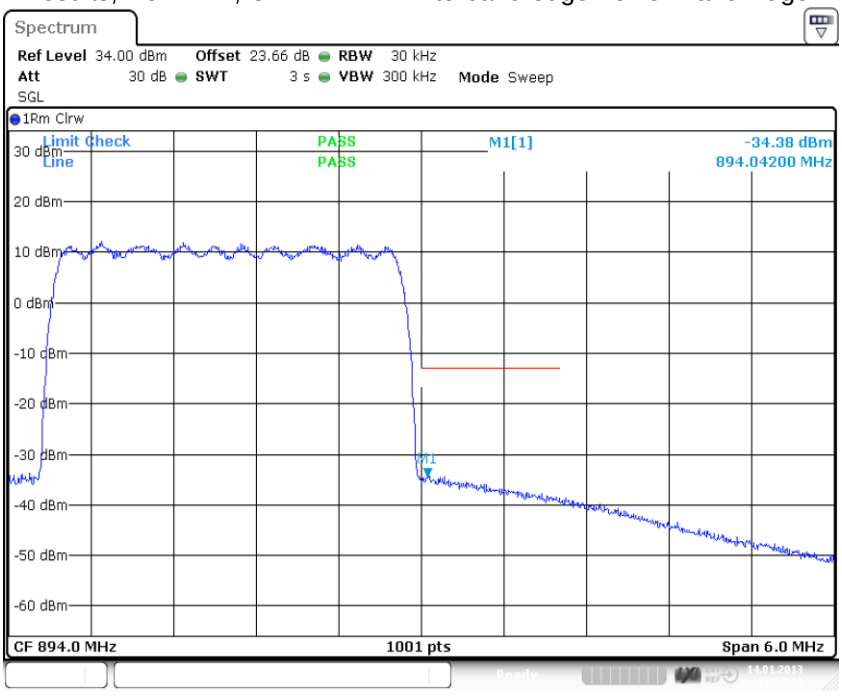


plot 7.3.1.3-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; EDGE < 1MHz to band edge Upper Band Edge

7.3.1.4 CDMA < 1MHz to band edge

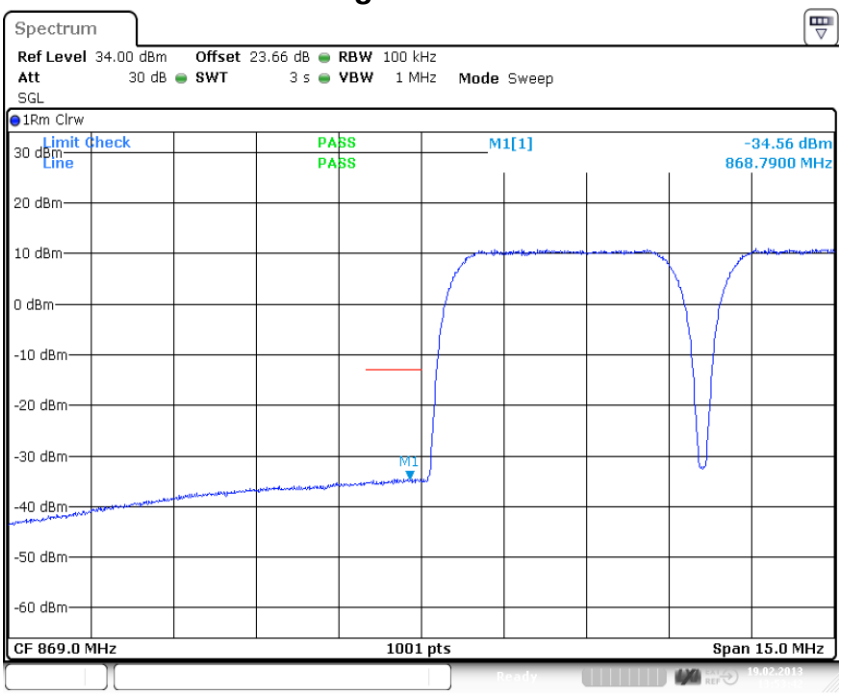


plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; CDMA < 1MHz to band edge Lower Band Edge

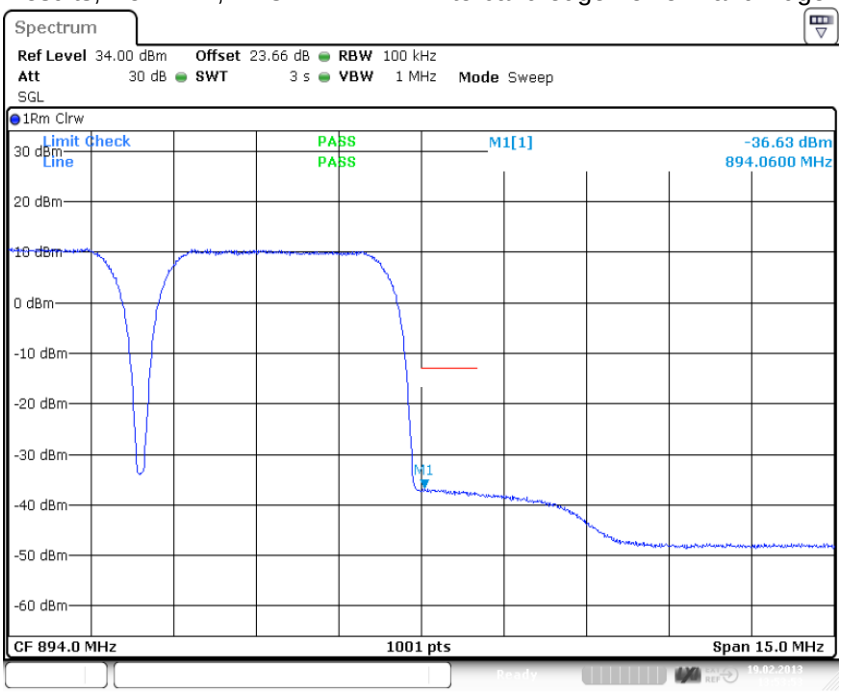


plot 7.3.1.4-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; CDMA < 1MHz to band edge Upper Band Edge

7.3.1.5 W-CDMA < 1MHz to band edge

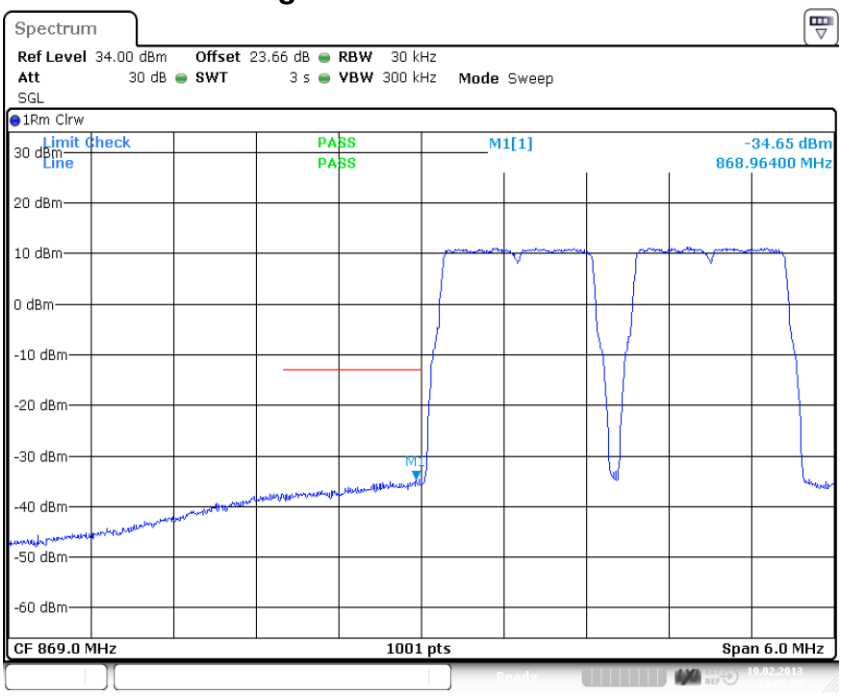


plot 7.3.1.5-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; W-CDMA < 1MHz to band edge Lower Band Edge

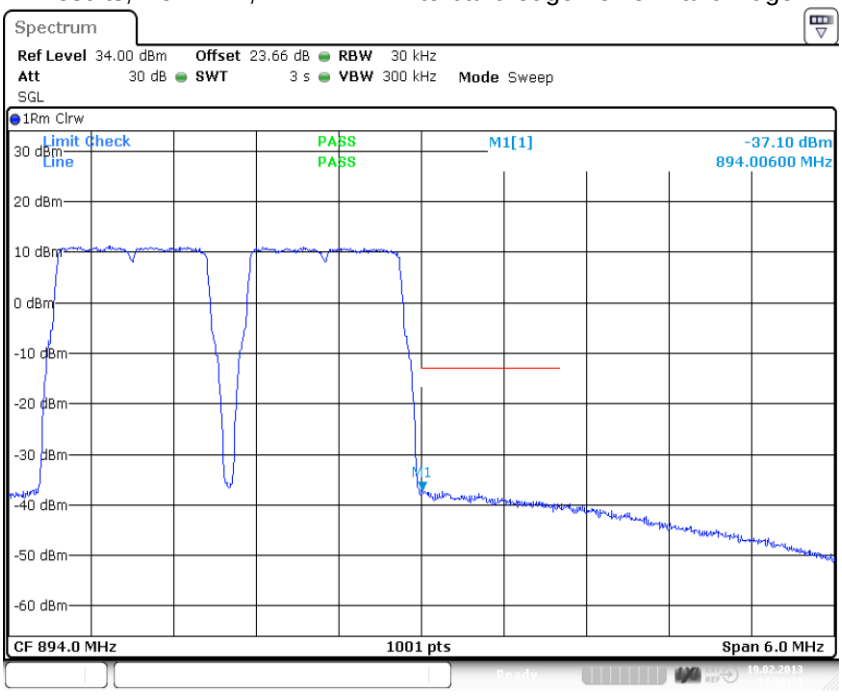


plot 7.3.1.5-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; W-CDMA < 1MHz to band edge Upper Band Edge

7.3.1.6 LTE < 1MHz to band edge

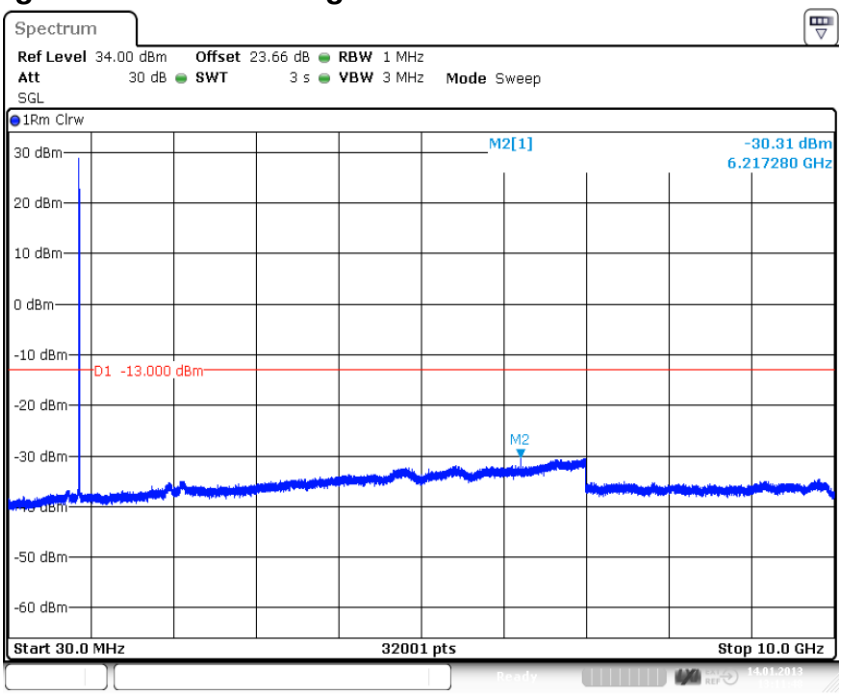


plot 7.3.1.6-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge Lower Band Edge



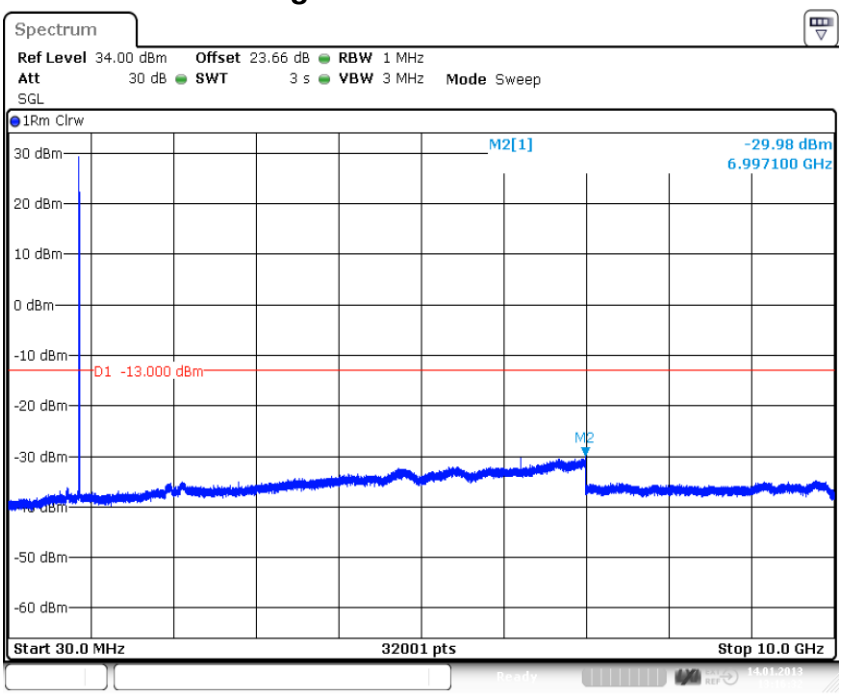
plot 7.3.1.6-#2 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge Upper Band Edge

7.3.1.7 Analog > 1MHz to band edge



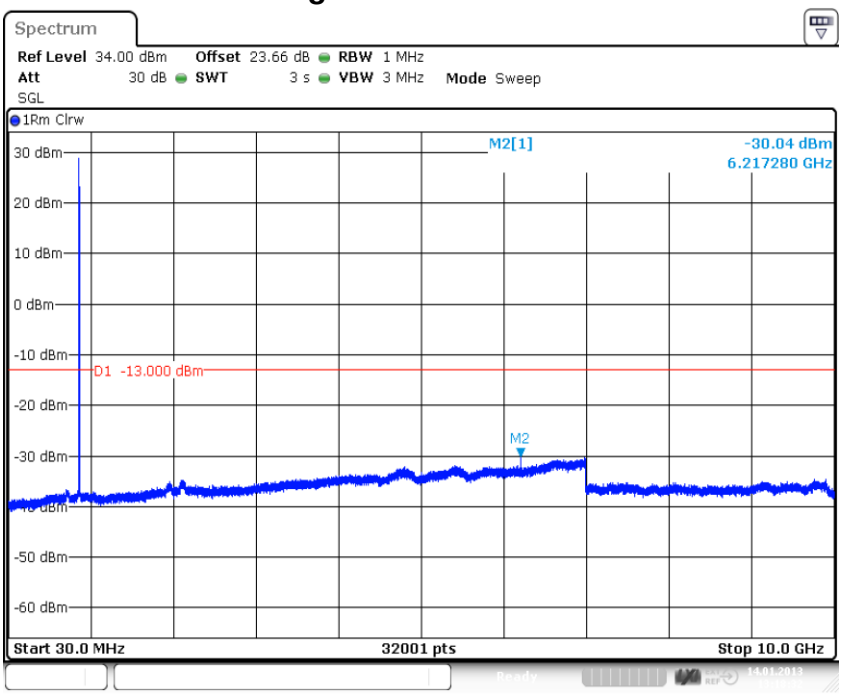
plot 7.3.1.7-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog > 1MHz to band edge;

7.3.1.8 GSM > 1MHz to band edge



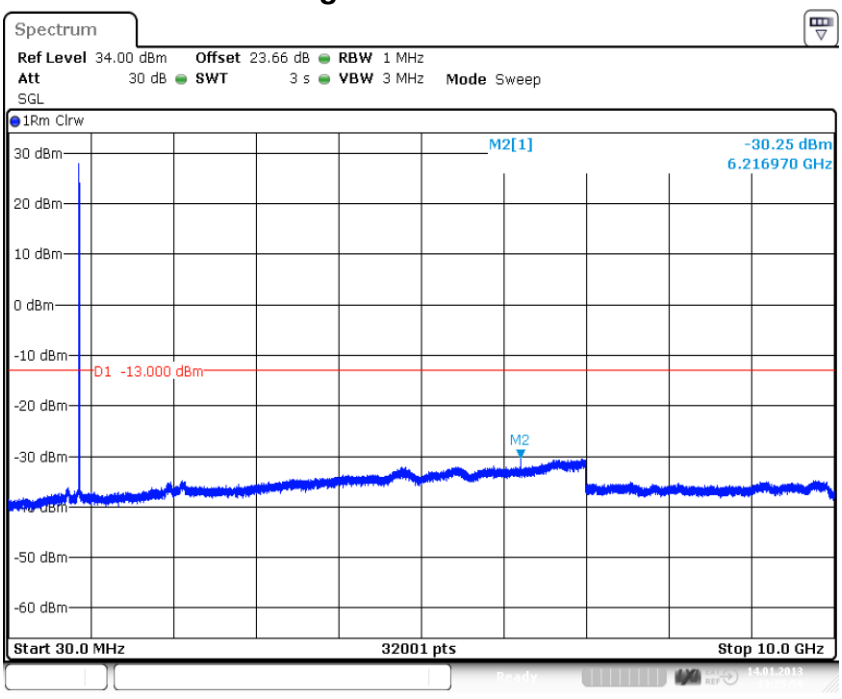
plot 7.3.1.8-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; GSM > 1MHz to band edge;

7.3.1.9 EDGE > 1MHz to band edge



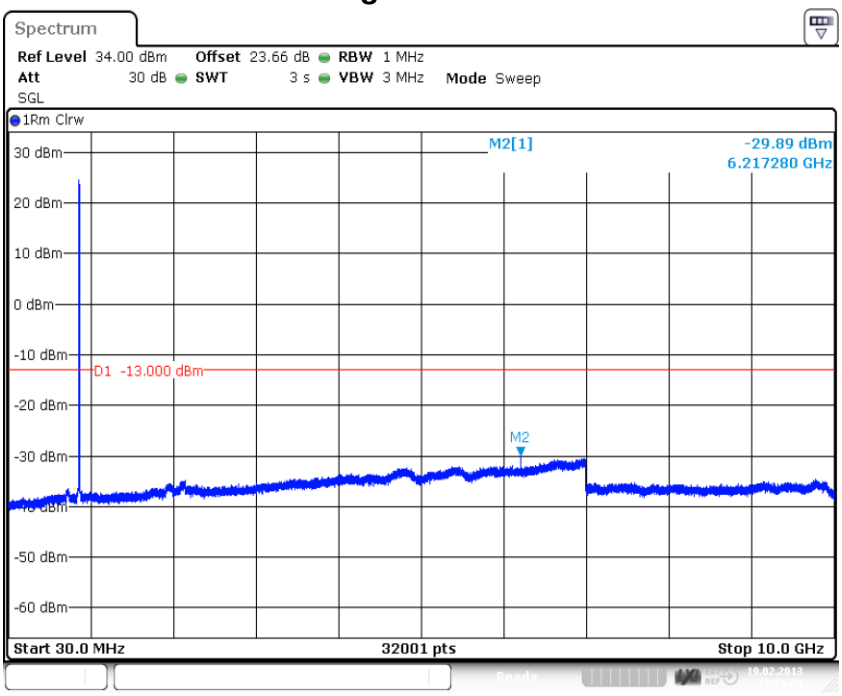
plot 7.3.1.9-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; EDGE > 1MHz to band edge;

7.3.1.10 CDMA > 1MHz to band edge



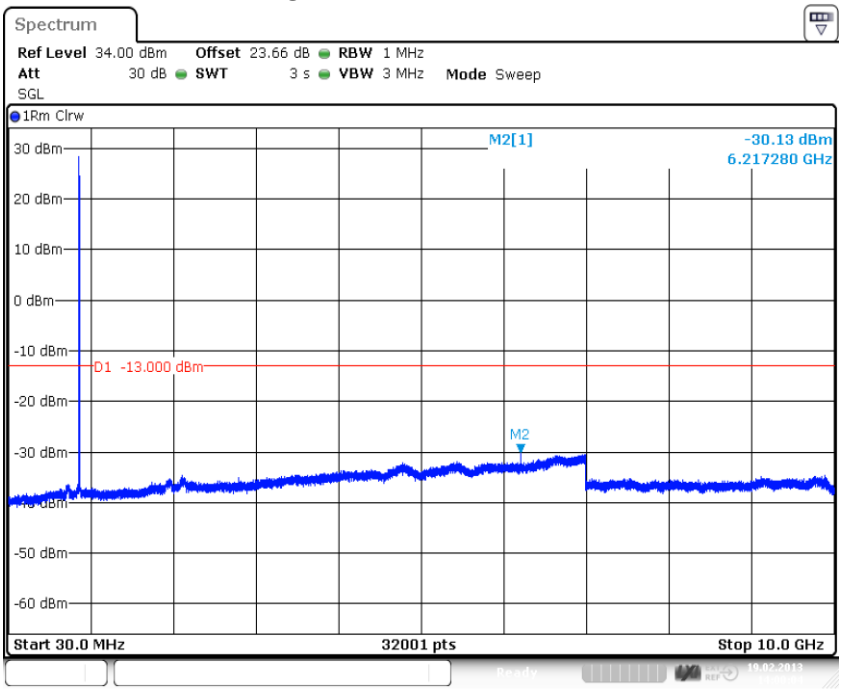
plot 7.3.1.10-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; CDMA > 1MHz to band edge;

7.3.1.11 W-CDMA > 1MHz to band edge



plot 7.3.1.11-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; W-CDMA > 1MHz to band edge;

7.3.1.12 LTE > 1MHz to band edge



plot 7.3.1.12-#1 Spurious Emissions at Antenna Terminals: §22.917, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE > 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:	M. Leinfelder
Date:	19.02.2013

8 Transmitter Output Power: IC RSS-132, RSS-GEN

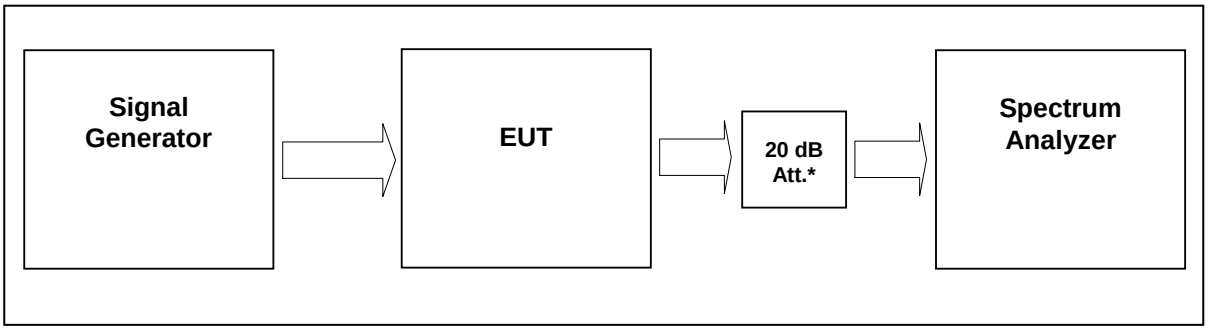


figure 7.4-#1 Test setup: Transmitter Output Power: IC RSS-132, RSS-GEN

Measurement uncertainty	± 0,38 dB
Test equipment used	9094, 9046, 7444; 7321; 7144; 7454;7453; 7341; 7449; 7368

8.1 Limit

Minimum standard:
The transmitter output power shall be measured in terms of average power. The equivalent isotropically radiated power (e.i.r.p.) for mobile equipment shall not exceed 11.5 watts. Refer to SRSP-503 for base station e.i.r.p. limits.
In addition, the peak-to-average power ratio (PAPR) of the transmitter shall not exceed 13 dB for more than 0.1% of the time using a signal corresponding to the highest PAPR during periods of continuous transmission.

IC SRSP-503 clause 5.1.1

Base stations for digital systems are limited to 1640 watts maximum equivalent isotropically radiated power (EIRP) with an antenna height above average terrain (HAAT) up to 150 m, except in urban areas where they are limited to a maximum allowable EIRP of 820 watts.

Base stations for analogue systems are limited to 820 watts maximum EIRP with an antenna height above average terrain (HAAT) up to 150 m, except in urban areas where they are limited to a maximum allowable EIRP of 164 watts.

8.2 Test results

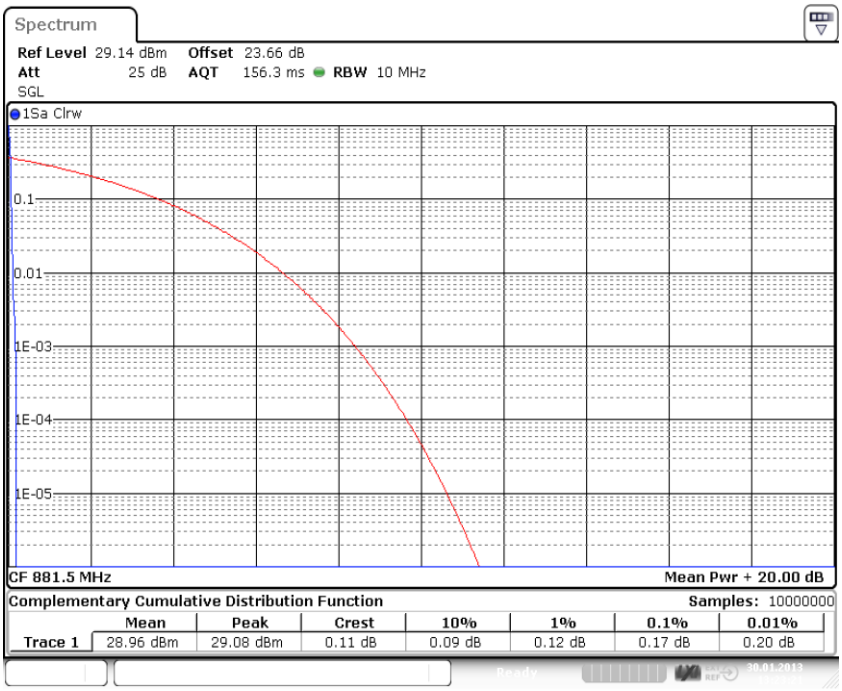
Transmitter Output Power results see
clause 5 RF Power Out: §22.913, §2.1046; IC RSS-131 sub clause 5.3 Test Results

8.2.1 Downlink

Modulation	Measured at	Peak – to - average (dB)	Plot -
Analog	881.5 MHz	0.11	8.2.1.1 #1
GSM	881.5 MHz	0.28	8.2.1.2 #1
EDGE	881.5 MHz	3.41	8.2.1.3 #1
CDMA	881.5 MHz	12.02	8.2.1.4 #1
WCDMA	881.5 MHz	10.59	8.2.1.5 #1
LTE	881.5 MHz	10.12	8.2.1.6 #1
Maximum peak to average = 12.02 dB			
Limit peak to average = 13 dB			

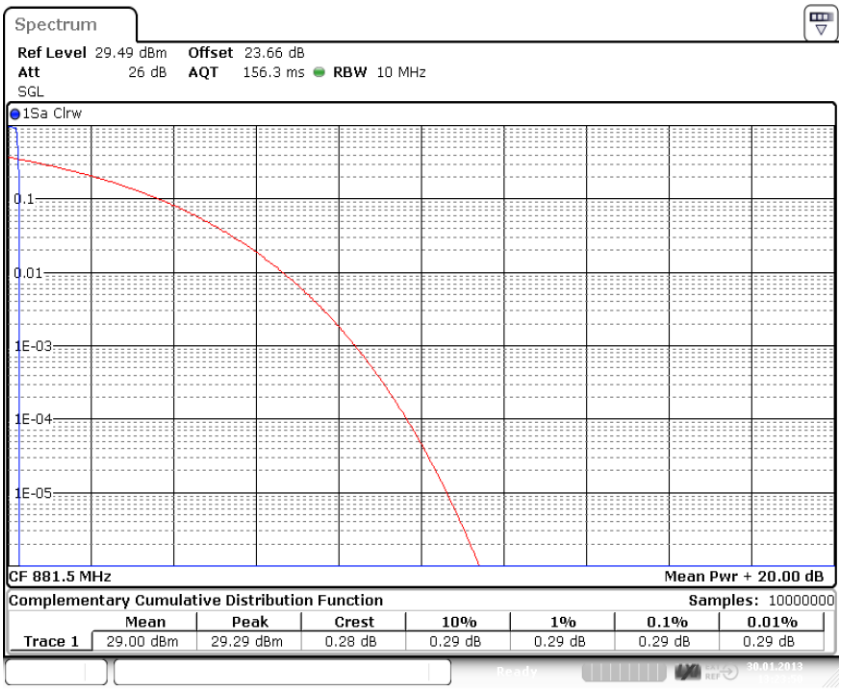
table 8.2.1-#1 Transmitter Output Power: IC RSS-132, RSS-GEN Test results Downlink Peak – to - average

8.2.1.1 Analog



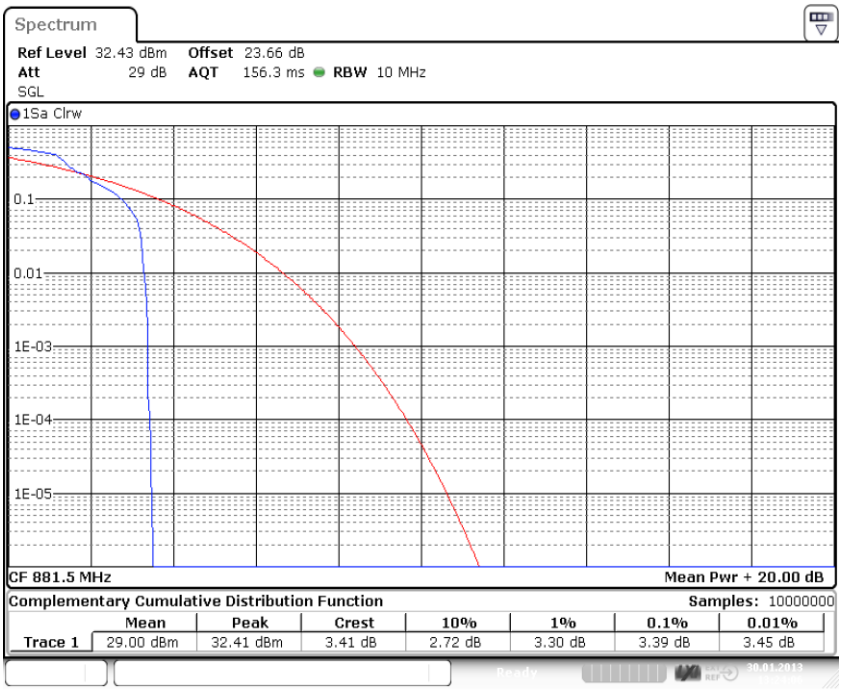
plot 8.2.1.1-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; Analog Middle Peak – to - average

8.2.1.2 GSM



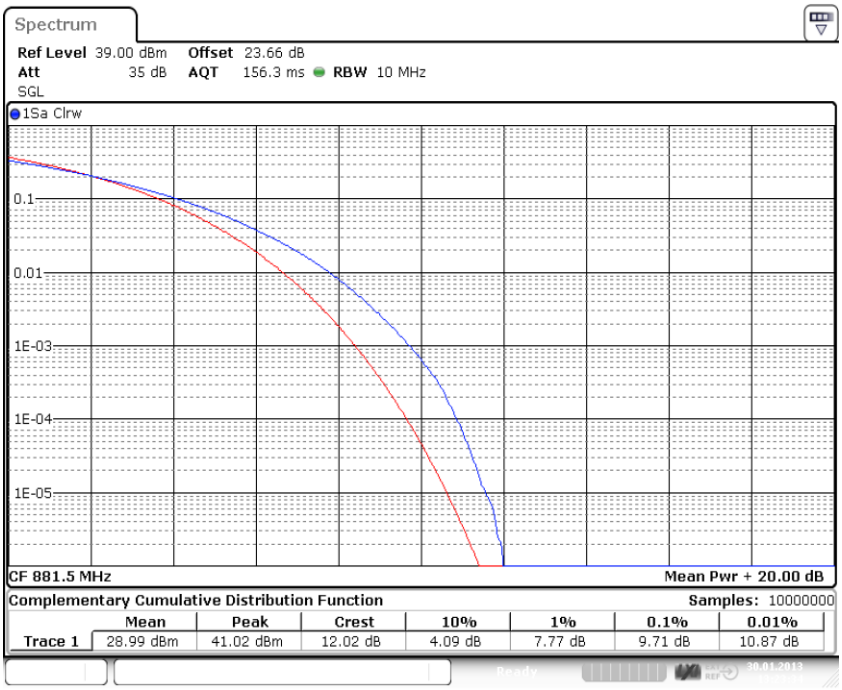
plot 8.2.1.2-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; GSM Middle Peak – to - average

8.2.1.3 EDGE



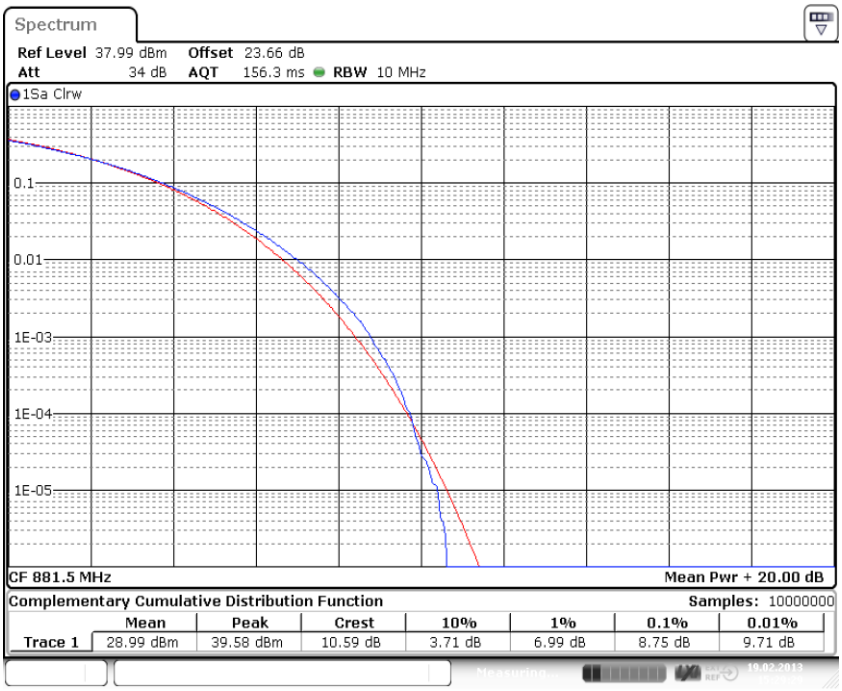
plot 8.2.1.3-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; EDGE Middle Peak – to – average

8.2.1.4 CDMA



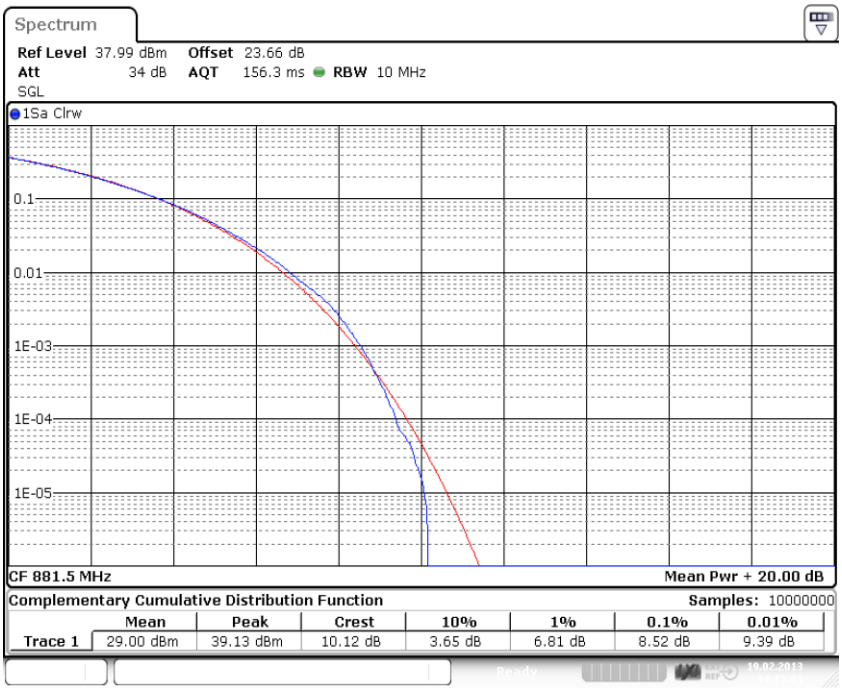
plot 8.2.1.4-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; CDMA Middle Peak – to - average

8.2.1.5 W-CDMA



plot 8.2.1.5-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; W-CDMA Middle Peak – to - average

8.2.1.6 LTE



plot 8.2.1.6-#1 Transmitter Output Power: IC RSS-132, RSS-GEN; Test results; Downlink; LTE Middle Peak – to - average

8.2.2 Uplink

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

8.3 Summary test result

Test result	complies, according the plots above
Tested by:	M. Leinfelder
Date:	19.02.2013

9 Amplifier Gain and Bandwidth: IC RSS-131

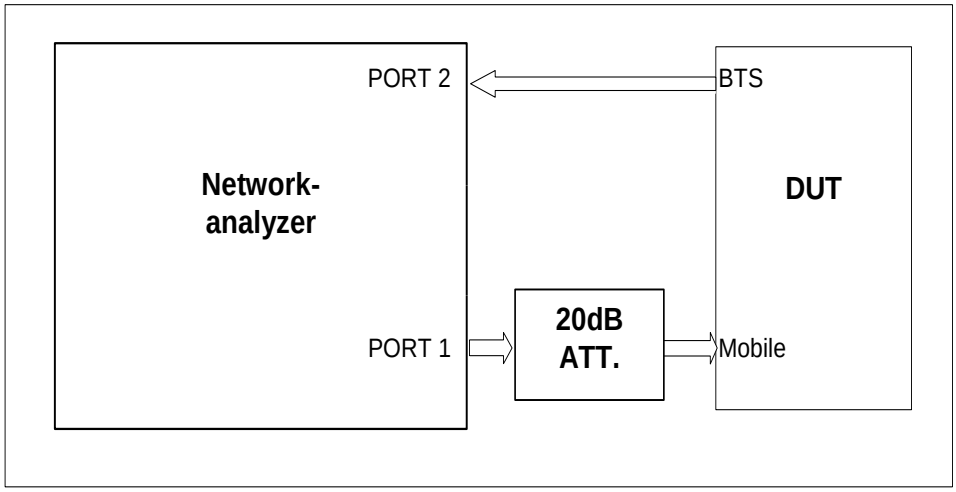


figure 9-#1 Test setup: Amplifier Gain and Bandwidth: IC RSS-131

Test equipment used	9102; 7438; 7439; 7144; 7454;7453; 7341; 7449; 7368;

9.1 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.

9.2 Test method

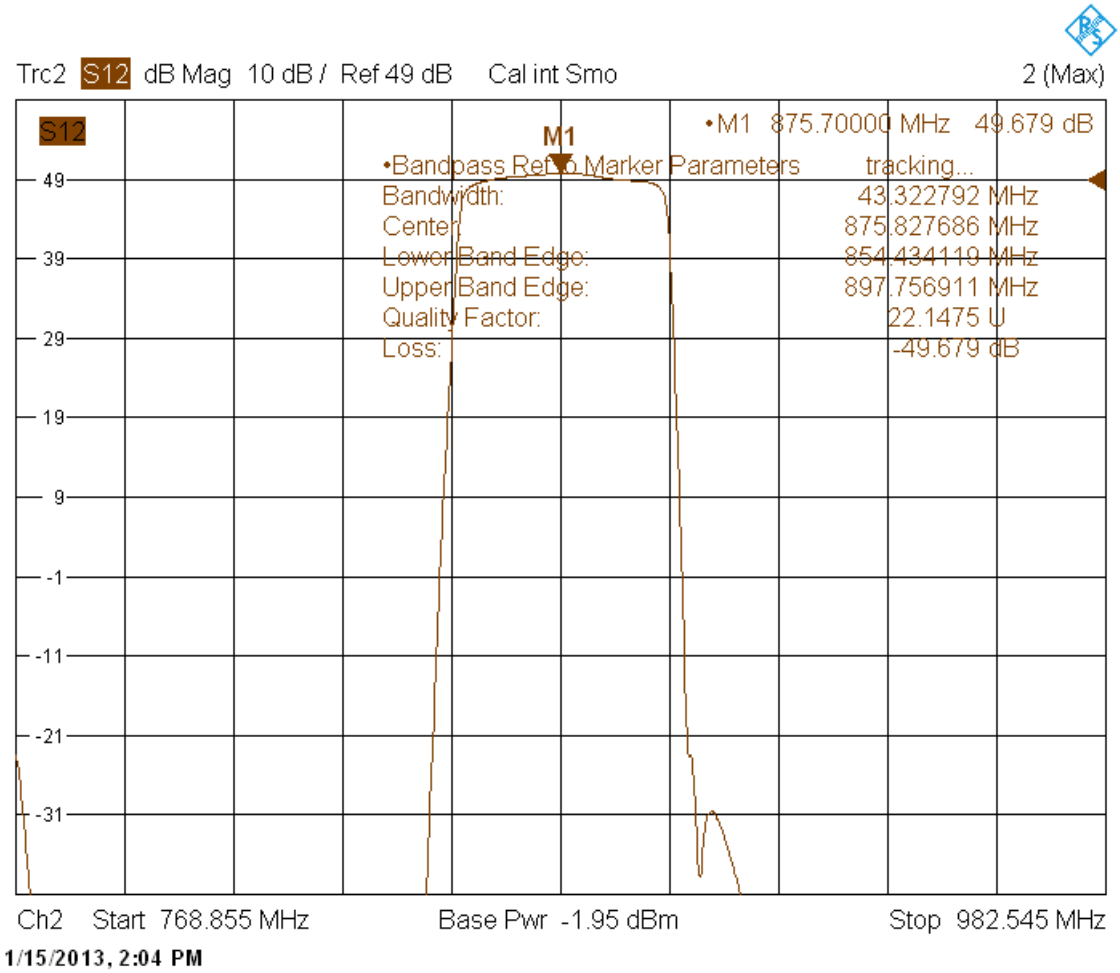
IC RSS-131 clause 4.2
Adjust the internal gain control of the equipment under test to the nominal gain for which equipment certification is sought.

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 pass band up to at least f_0 ±250% of the 20 dB bandwidth.

9.3 Test results

9.3.1 Downlink

Passband gain	49.7 dB
Lower limit of 20dB Bandwidth	854.4 MHz
Upper limit of 20dB Bandwidth	897.8 MHz
20dB Bandwidth	43.32 MHz



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

9.3.2 Uplink

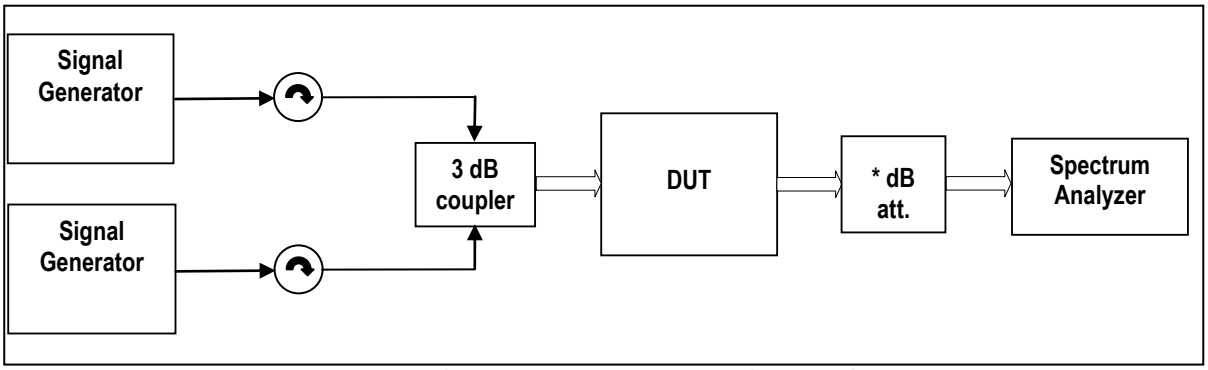
n.a.

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:	M. Leinfelder
Date:	15.01.2013

10 Output Power: IC RSS-131



External Attenuator DL x dB = 20 dB
figure 10-#1 Test setup: Output Power: IC RSS-131

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 9046, 8849; 7444; 7443; 7306; 7307; 7144; 7454;7453; 7341; 7449; 7368

10.1 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.

10.2 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 pass band 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.

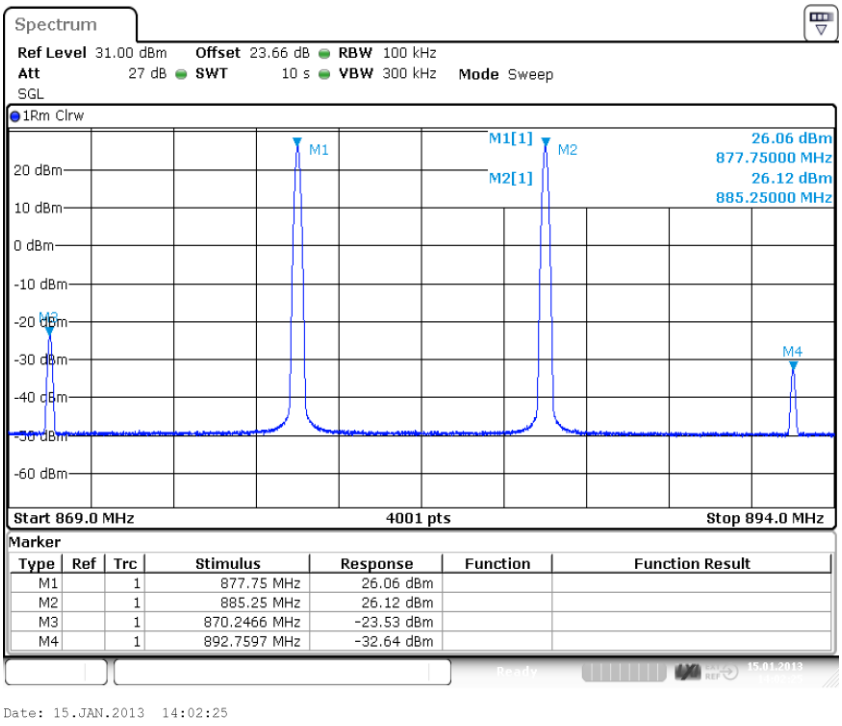
10.3 Test results

10.3.1 Downlink

P_{o1} @ f_1	26.1 dBm @ 877.75 MHz
P_{o2} @ f_2	26.1 dBm @ 885.25 MHz
P_{o3} @ f_3	-23.5 dBm @ 870.25 MHz
P_{o4}@ f_4	-32.6 dBm @ 892.76 MHz

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

P_{mean} = 26.1 dBm + 3 dB = 29.1 dBm



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

10.3.2 Uplink

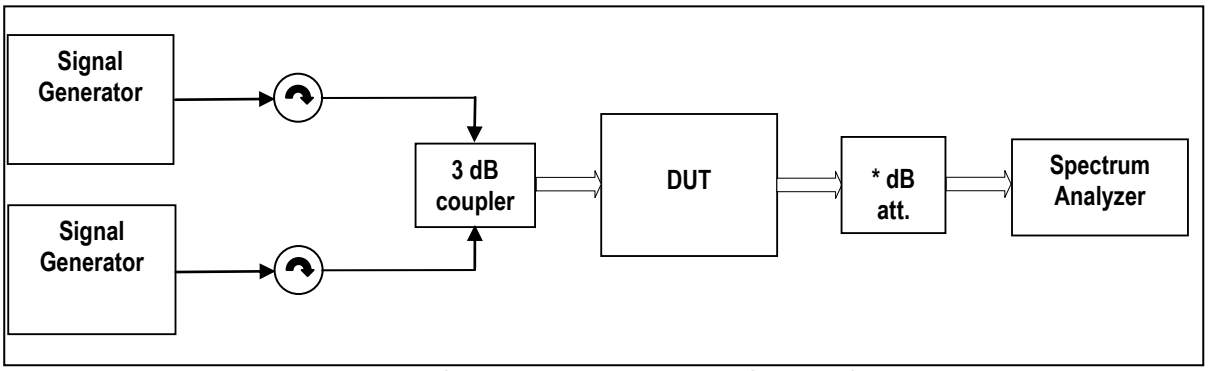
n.a.

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:	M. Leinfelder
Date:	15.01.2013

11 Non-Linearity: IC RSS-131



External Attenuator DL x dB = 20 dB
figure 11-#1 Test setup: Non-Linearity: IC RSS-131

Test equipment used	9054, 9046, 8849; 7444; 7443; 7306; 7307; 7144; 7454;7453; 7341; 7449; 7368

11.1 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.

11.2 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 pass band 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}.

11.3 Test results

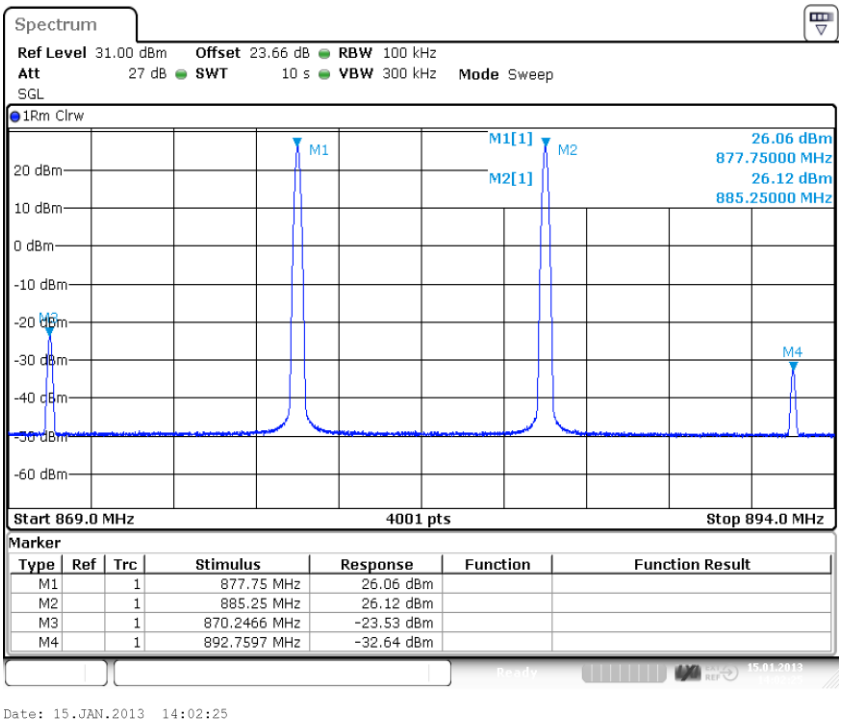
11.3.1 Downlink

Requirement calculation:

P = 26.1 dBm = 0.41W
Attenuation = 43 + 10Log10(0.41W) or 70 dB whichever is less stringent
Attenuation = 39.1 dB or 70 dB whichever is less stringent
Attenuation = 39.1 dB

Test result:

Delta P to IMD = 26.1 dBm – (-22.83 dBm) = 48.93 dB



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

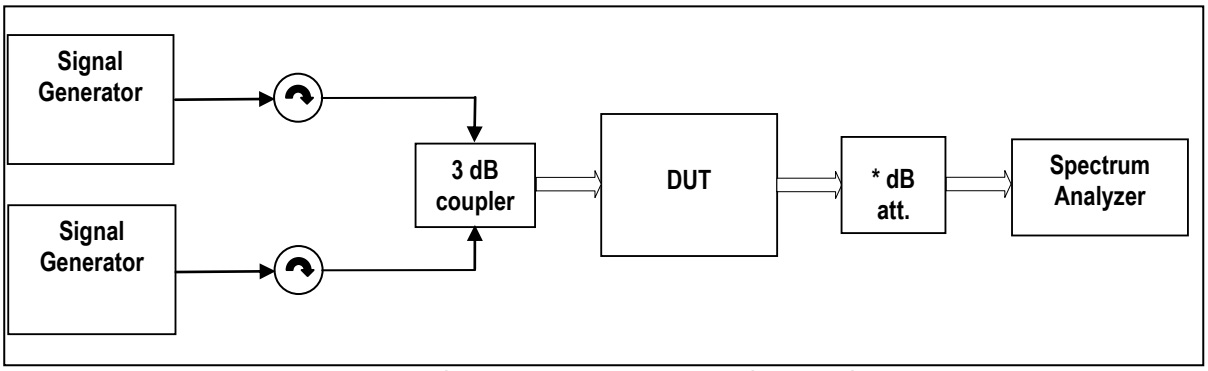
11.3.2 Uplink

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:	M. Leinfelder
Date:	15.01.2013

12 Spurious Emissions: RSS-131



External Attenuator DL x dB = 20 dB
figure 12-#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	9054, 9046, 8849; 7444; 7443; 7306; 7307; 7144; 7454;7453; 7341; 7449; 7368	

12.1 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.

12.2 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 spurious emissions from 30 MHz to at least 5 times the highest RF pass band frequency. The search may omit the band that contains the test tones and intermodulation products.

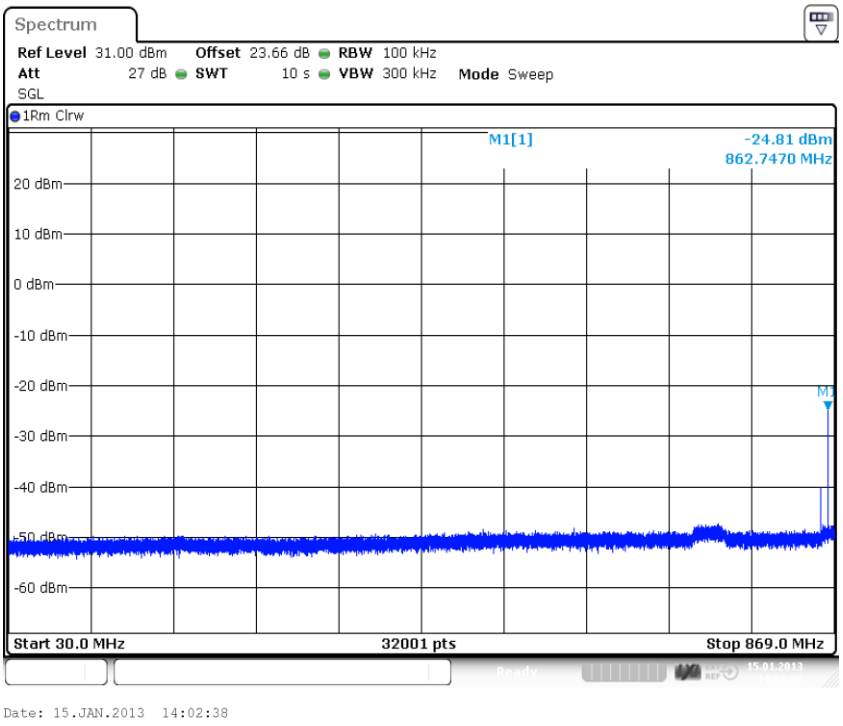
12.3 Test results

12.3.1 Downlink

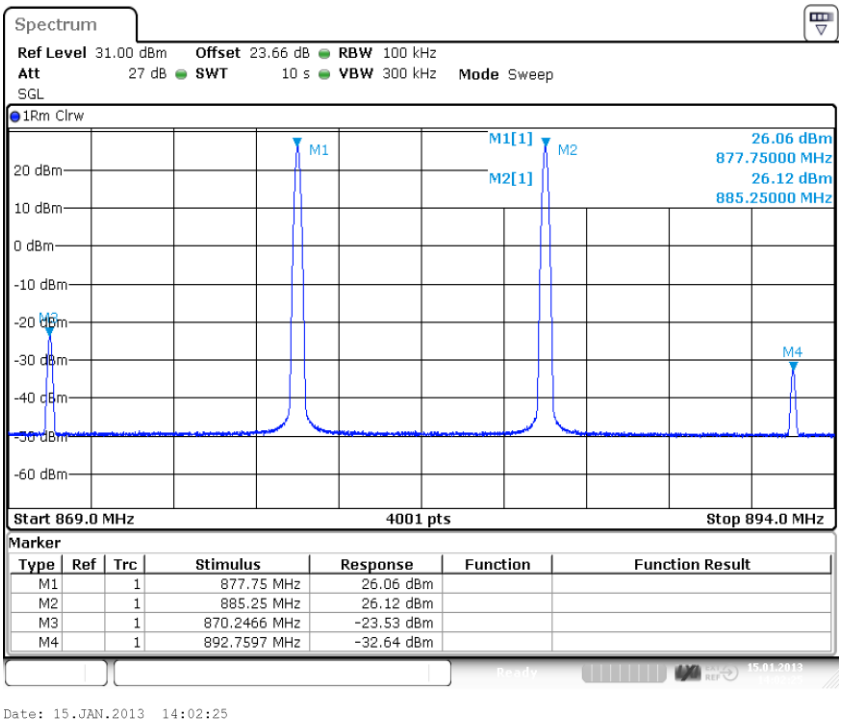
Requirement calculation:
P = 26.1 dBm = 0.41W
Attenuation = 43 + 10Log10(0.41W) or 70 dB whichever is less stringent
Attenuation = 39.1 dB or 70 dB whichever is less stringent
Attenuation = 39.1 dB

Test result:

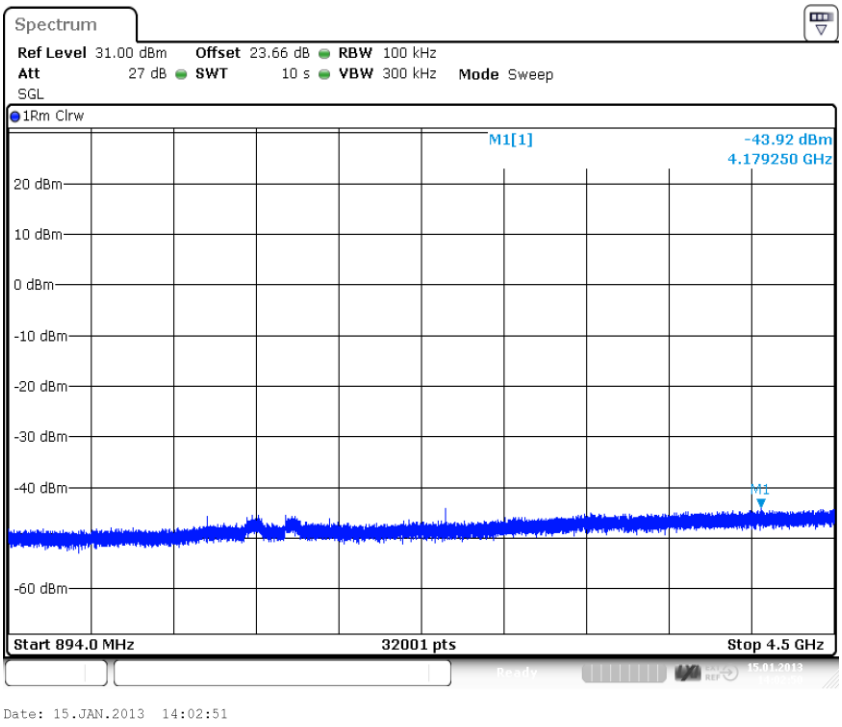
Delta P to IMD = 26.1 dBm – (-22.83 dBm) = 48.93 dB



plot 11.3.1-#1 Spurious Emissions: RSS-131; Test results; Downlink; 30 MHz – 869 MHz



plot 11.3.1-#2 Spurious Emissions: RSS-131; Test results; Downlink; 869 MHz – 894 MHz



plot 11.3.1-#3 Spurious Emissions: RSS-131; Test results; Downlink; 894 MHz – 4.5 GHz

12.3.2 Uplink

n.a.

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

12.4 Summary test result

Test result	complies, according the plots above
Tested by:	M. Leinfelder
Date:	15.01.2013

13 Field Strength of Spurious Emissions: §22.917, §2.1053

picture 8.1: label

picture 8.2: Test setup: Field Strength Emission in the SAC

This clause specifies requirements for the measurement of radiated emission.

Frequency range	Distance: EUT <-> antenna / location	Limit	Test method
30 MHz - 22 GHz	3 metres / SAC	FCC 47 CFR Part 22.917	TIA/EIA-603-C:2004
		IC RSS-131	
		FCC 47 CFR Part 22.917	
		IC RSS-131	

Test equipment used:

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.-date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1687	19.12.2012	19.12.2013	X
Antenna	CBL 6111	Chase	K1024	29.03.2012	29.03.2013	X
RF Cable	RG214	Frankonia	K1121 SET	20.02.2013	20.02.2014	X
Antenna	HL 025	R&S	K809	16.11.2012	16.11.2013	X
Preamplifier	AFS4-00102000	Miteq	K838	05.06.2012	05.06.2013	X
RF Cable	Sucoflex 100	Suhner	K1742	23.05.2012	23.05.2013	X

The REMI version 2.135 has been used for max search.

Test set-up:

Test location: SAC
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

13.1 Limit §22.917

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

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

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

The emission measurements have been made with transmission at **Bottom/Middle/Top** frequency **(869MHz/881.5MHz/894MHz)**

The limit is -13dBm (e.i.r.p).

13.2 Test method ANSI/TIA/EA-603-C

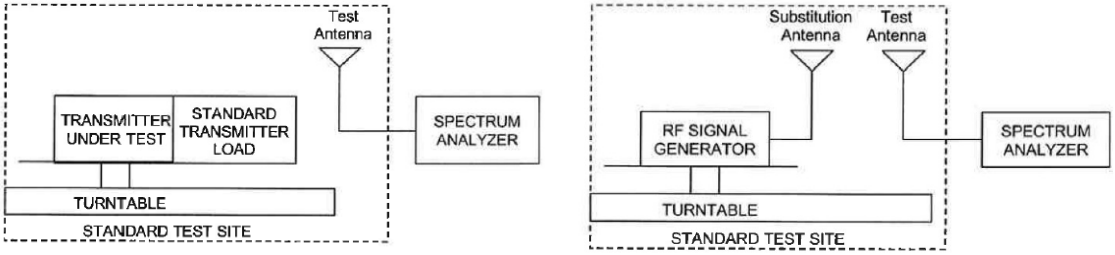
Measurement procedure. **TIA-603-C**

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.



picture 8.3: Substitution method

13.3 Receiver Settings

	up to 1 GHz	above 1 GHz
Measurement bandwidth	120 kHz	1 MHz
Step width	60 kHz	500 kHz
Dwell time	20ms	
Detector	Peak (max hold over 360°)	Peak (max hold over 360°)

13.4 Climatic values in the lab

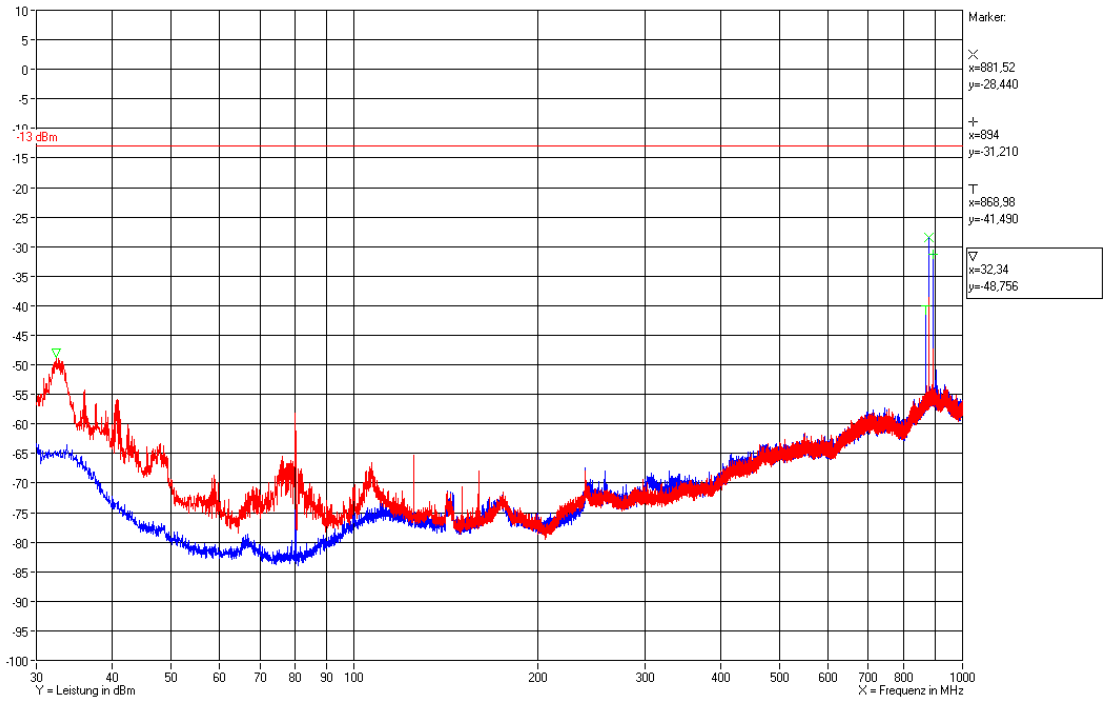
Temperature: 20°
Relative Humidity: 45%
Air-pressure: 1009hPa

13.5 Test results

13.5.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top)

F1: 869 MHz; F2: 881.5 MHz; F3: 894 MHz

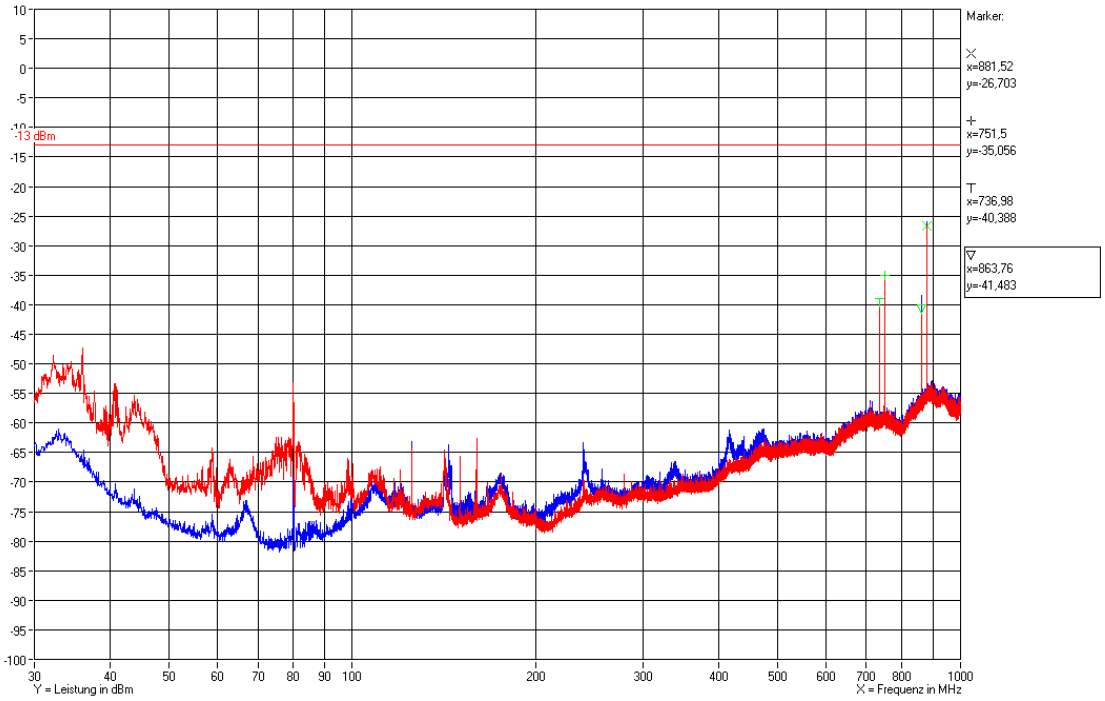
Vertikal / Horizontal



13.5.2 30 MHz to 1 GHz Downlink (Middle of all paths)

F1: 751.5 MHz; F2: 737 MHz; F3: 863.75 MHz; F4: 1962.5 MHz; F5: 2132.5 MHz

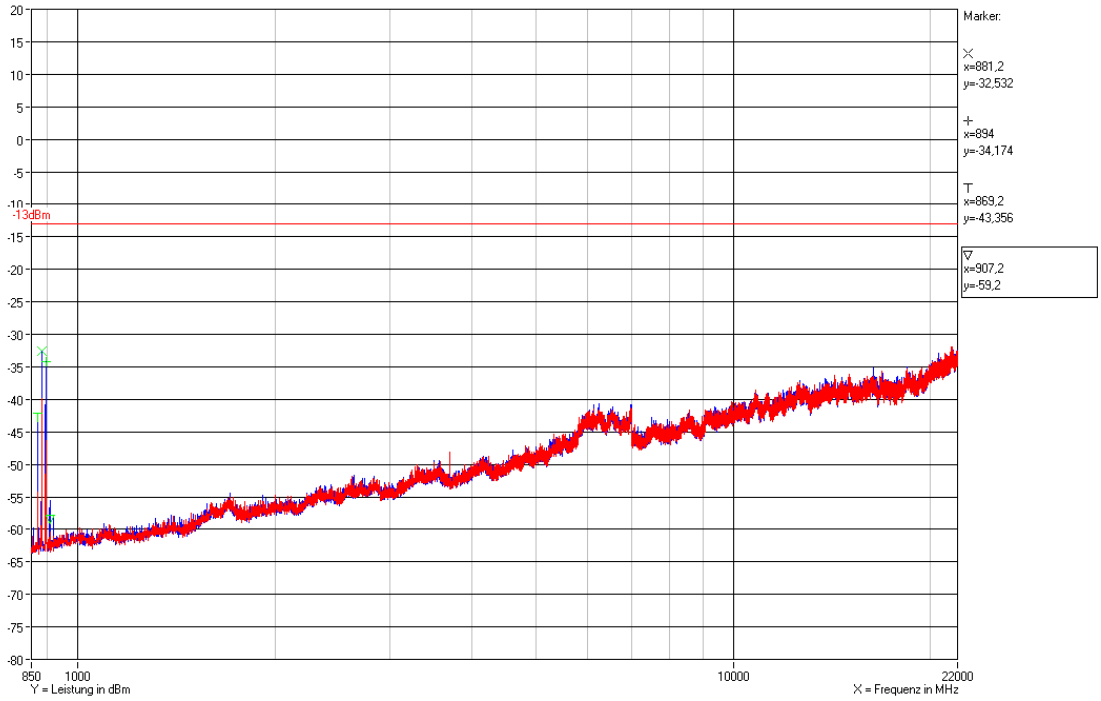
Vertikal / Horizontal



13.5.3 1 GHz to 22 GHz Downlink (Bottom – Middle – Top)

F1: 869 MHz; F2: 881.5 MHz; F3: 894 MHz

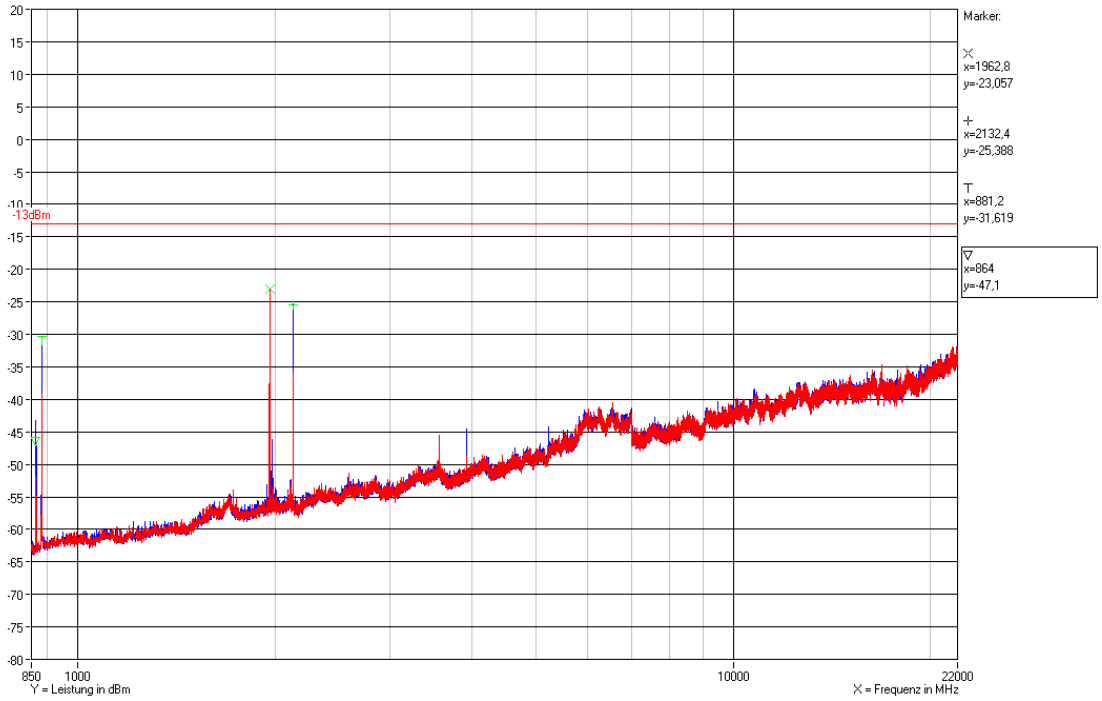
Vertikal / Horizontal



13.5.3.1 1 GHz to 22 GHz Downlink (Middle of all paths)

F1: 751.5 MHz; F2: 737 MHz; F3: 863.75 MHz; F4: 1962.5 MHz; F5: 2132.5 MHz

Vertikal / Horizontal



Za / 08.02.2013

14 History

Revision	Modification	Date	Name
01.00	Initial report	27.02.2013	Zahlmann
02.00	Delete the system diagram of the EUT on page 8	25.06.2013	Zahlmann

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