ECL-EMC Test Report No.: 12-090

Equipment under test: **ION-M7HP/7HP/85HP/19P 1900MHz Path**
FCC ID: **XS5-M7785HP19P**
IC ID: **2237E-M7785HP19P**
Type of test: **FCC 47 CFR Part 24 Subpart E: 2011**
Broadband PCS
IC RSS-131:2003
Zone Enhancers for the Land Mobile Service

Measurement Procedures: 47 CFR Parts 2: 2011(*Frequency Allocations and Radio Treaty Matters; General Rules and Regulations*),
24 (Broadband PCS),
ANSI/TIA-603-C (2004), *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*
IC-GEN General Requirements and Information for the Certification of Radiocommunication Equipment

Test result: **Passed**

Date of issue:	16.05.12		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: 2012.05.16 13:23:22 +02'00'
Date of delivery:	09.05.12	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: 2012.05.16 13:47:47 +02'00'
Test dates:	08.05. – 10.05.12		
Pages:	53		

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Test Location: TEMPTON Service Plus GmbH
European Compliance Laboratory (ECL)

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General:
The purpose of this report is to show compliance to the FCC regulations for unlicensed devices operating under section 15.249 of the Code of Federal Regulations title 47.
This report informs about the results of the EMC 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

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

1 Test Results Summary

Name of Test	FCC Para. No.	FCC Method	FCC Spec.	Result
RF Power Output	24.232(a)	2.1046(a)	1640 Watts E.I.R.P	Complies
Occupied Bandwidth		2.1049(h)	Input/Output	Complies
Spurious Emissions at Antenna Terminals	24.238(a)	2.1051	-13dBm	Complies
Field Strength of Spurious Emissions	24.238(a)	2.1053	-13dBm E.I.R.P	Complies
Frequency Stability		2.1055(a)(d)	Must stay in band	NA

Name of Test	IC Para. No.	IC Method	Result
RF Power Output	RSS-139 6.4	RSS-GEN 4.8	Complies
Occupied Bandwidth	RSS-Gen 4.6	RSS-GEN 4.6.1	Complies
Spurious Emissions at Antenna Terminals	RSS-139 6.5	RSS-GEN 4.9	Complies
Field Strength of Spurious Emissions	RSS-139 6.5	RSS-GEN 4.9 SRSP-513	Complies
Frequency Stability	RSS-139 6.3	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”.

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

2.1 Description

Kind of equipment	ION-M7HP/7HP/85HP/19P
Andrew Ident. Number	Id. No. 7643936-0001
Serial no.(SN)	12
Revision	00
Software version and ID	n. a.
Type of modulation and Designator	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	1930 MHz – 1995 MHz
Max. composite output power based on one carrier (rated)	42.5 dBm = 17.8 W
System Gain*	9.5 dB @ Pout BTS of 33 dBm

*see 2.1.4 Block diagram of measurement reference points

2.1.2 Uplink

Pass band	1850 MHz – 1915 MHz
System Gain*	n. a.

*see 2.1.4 Block diagram of measurement reference points

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

2.1.3 Description of EUT

ION-M7HP/7HP/85HP/19P 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 four frequency bands simultaneously (2 * 700 MHz, 850 MHz, 1900 MHz), providing a cost-effective solution for distributing capacity from one or more base stations.

The ION-M7HP/7HP/85HP/19P Repeater consists of tow 700 MHz, one 850 MHz and one 1900 MHz path, with the intended use of simultaneous transmission. This Test Report describes only the approval of the 1900 MHz path

2.1.4 Block diagram of measurement reference points

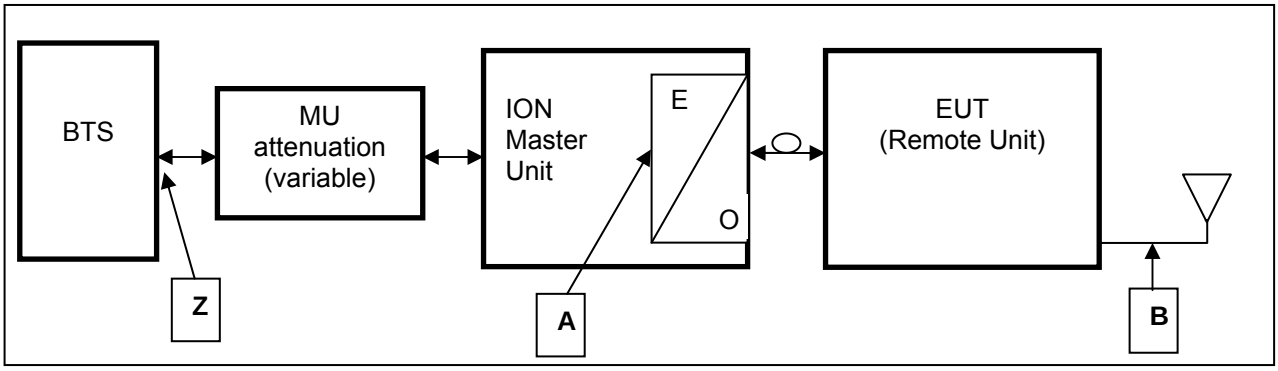

figure 2.1.4-#1 Block diagram of measurement reference points

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	**26.5 dB**	**6.5 dBm**	**+36 dB**	**+42.5 dBm** *@ 1 carrier*
System Gain Z to A	**+9.5 dB**			
+43 dBm	**36.5 dB**	**6.5 dBm**	**+36 dB**	**+42.5 dBm** *@ 1 carrier*
System Gain Z to A	**-0.5 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	ZVB 14	R&S	100118	08/12
9054	Spectrum Analyzer	FSV13	R&S	100859	12/12
9126	Spectrum Analyzer	FSV30	R&S	101237	11/12
9101	Signal Generator	SMBV100A	R&S	256443	06/12
8990	Signal Generator	SMJ100A	R&S	101288	07/12
8671	Power Meter	E4418B	Agilent	GB39513094	06/12
8672	Power Sensor	E9300H	Agilent	US41090179	06/12
7336	Power Attenuator	768-20	Narda	04904	CIU
7119	Divider	2way	Mikom	3512	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

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.

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3.4 Measurement uncertainty

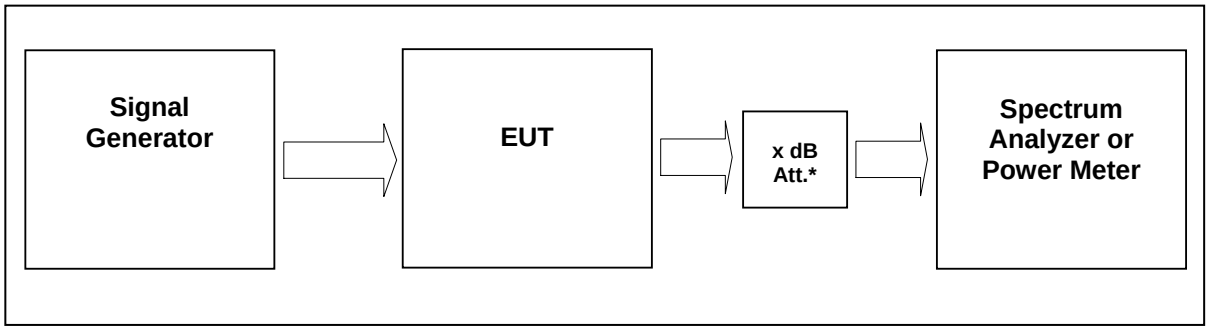
The extended measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k=2. The true value is located in the corresponding interval with a probability of 95 %.

4 Test site (TEMPTON Service Plus GmbH)

FCC Test site:
IC OATS:

See relevant dates under section 8.

5 RF Power Out: §24.232, §2.1046



External Attenuator DL x dB = 20dB

figure 3.4-#1 Test setup: RF Power Out: §24.232, §2.1046

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 9101,8990, 7336, 7119, 7409, 7449, 7443, 7444,

5.1 Limit

Minimum standard:

Para. No.24.232

(a)(1) Base stations with an emission bandwidth of 1 MHz or less are limited to 1640 watts equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

(2) Base stations with an emission bandwidth greater than 1 MHz are limited to 1640 watts/MHz equivalent isotropically radiated power (EIRP) with an antenna height up to 300 meters HAAT, except as described in paragraph (b) below.

Table 1—Reduced Power for Base Station Antenna Heights Over 300 Meters

HAAT in meters	Maximum EIRP watts
≤ 300	1640
≤ 500	1070
≤ 1000	490
≤ 1500	270
≤ 2000	160

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.

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(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 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).

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5.3.1 Downlink

Modulation	Measured at	RBW VBW Span	RF Power (dBm)	RF Power (W)	Plot -
GSM	1962,5MHz	1MHz 3MHz 10MHz	42.5	17.8	5.3.1.1 #1
GSM-EDGE	1962,5 MHz	1MHz 3MHz 10MHz	42.5	17.8	5.3.1.2 #1
CDMA	1962,5 MHz	3MHz 10MHz 15MHz	42.5	17.8	5.3.1.3 #1
WCDMA	1962,5 MHz	10MHz 10MHz 50MHz	42.5	17.8	5.3.1.4 #1
LTE	1962,5 MHz	3MHz 10MHz 50MHz	42.5	17.8	5.3.1.5 #1
Maximum output power = 42.5 dBm = 17.8 W					
Limit Maximum output power (eirp) = 1640 W					

table 5.3.1-#1 RF Power Out: §24.232, §2.1046 Test results Downlink

The max RF Power out is 42.5 dBm, so the maximum antenna gain (x) can be calculated as follow:

Limit = 1000W (erp) = **60 dBm** Info: 1000W (erp) = 1640W (eirp)

60 dBm **>** 42.5 dBm + x
17.5 dBd = 19.65 dBi > x

=> The antenna that will use for the complete system have to have a gain lower than 19.65 dBi, relative to a dipol.

Modulation	Pin / dBm (Ref. point B)
GSM	7.5
EDGE	7.6
CDMA	7.1
WCDMA	7.1
LTE	7.1

table 5.3.1-#2 RF Power Out: §24.232, §2.1046 Test results Downlink Input power

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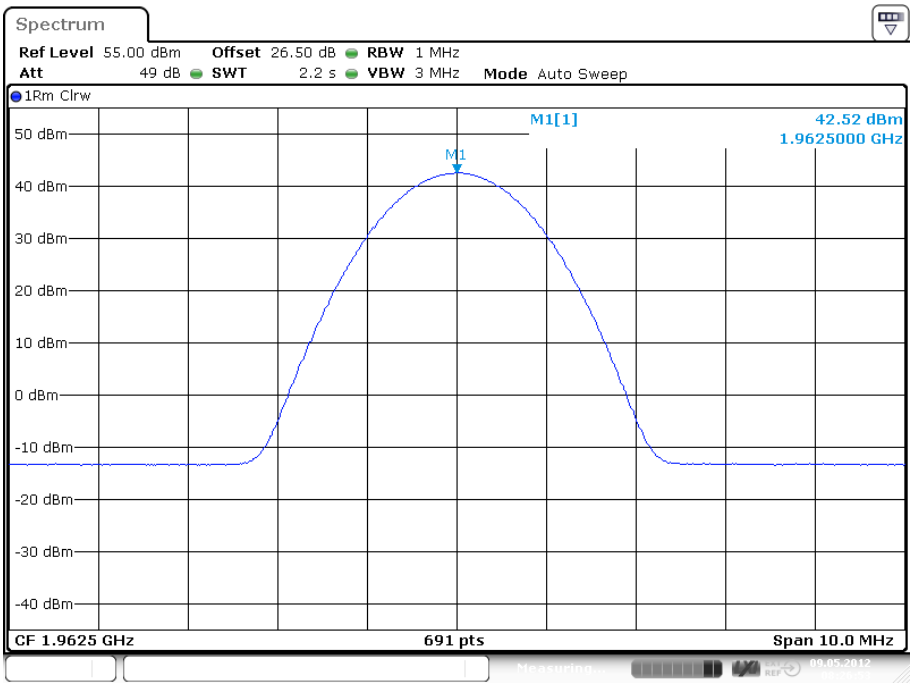
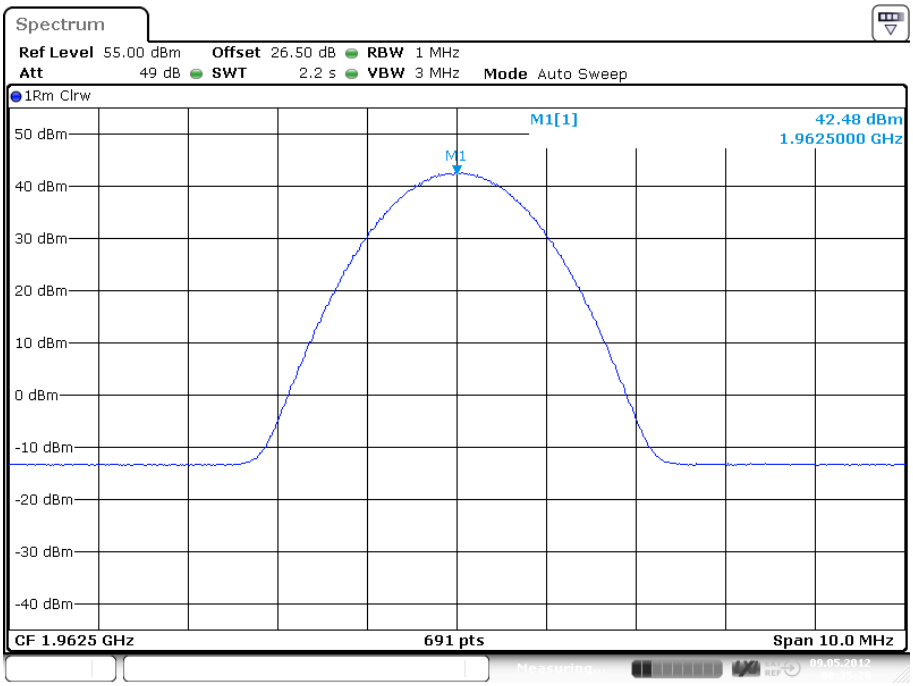
5.3.1.1 GSM



Date: 9.MAY.2012 08:26:53

plot 5.3.1.1-#1 RF Power Out: §24.232, §2.1046; Test results; Downlink; GSM Middle

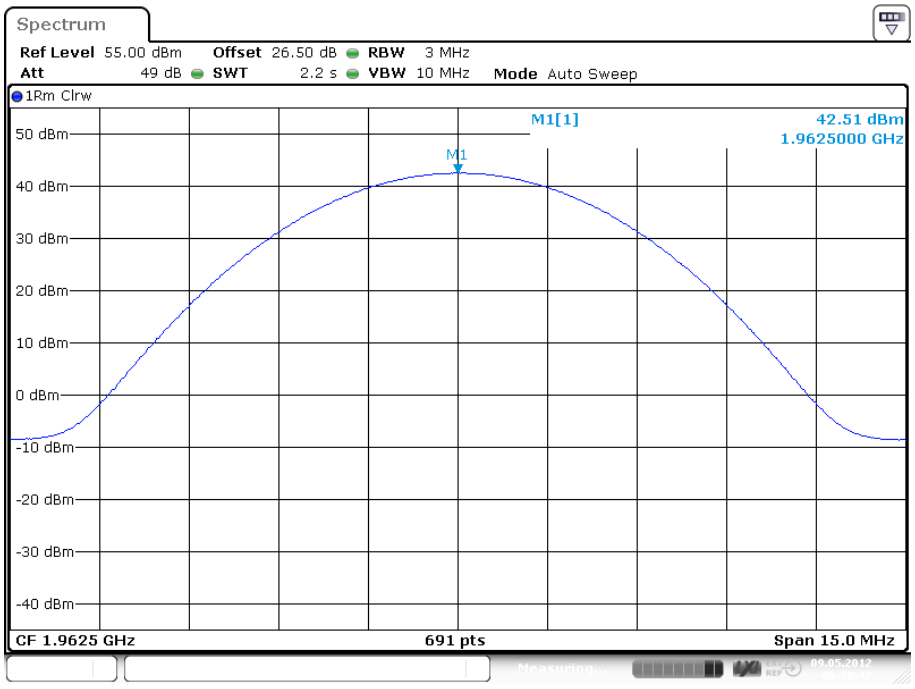
5.3.1.2 GSM-EDGE



Date: 9.MAY.2012 08:35:29

plot 5.3.1.2-#1 RF Power Out: §24.232, §2.1046; Test results; Downlink; GSM-EDGE Middle

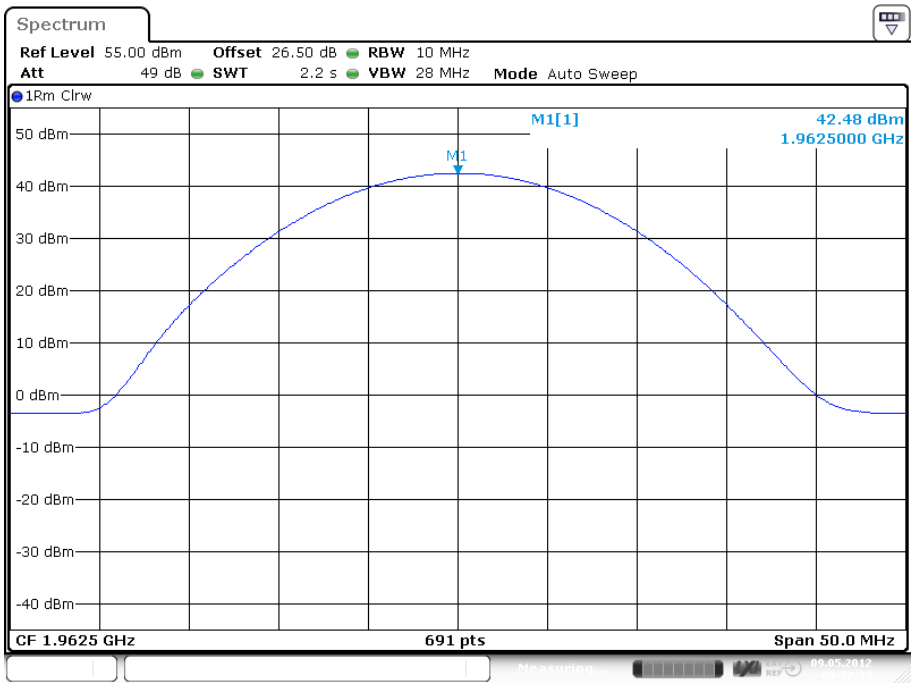
5.3.1.3 CDMA



Date: 9.MAY.2012 09:30:47

plot 5.3.1.3-#1 RF Power Out: §24.232, §2.1046; Test results; Downlink; CDMA Middle

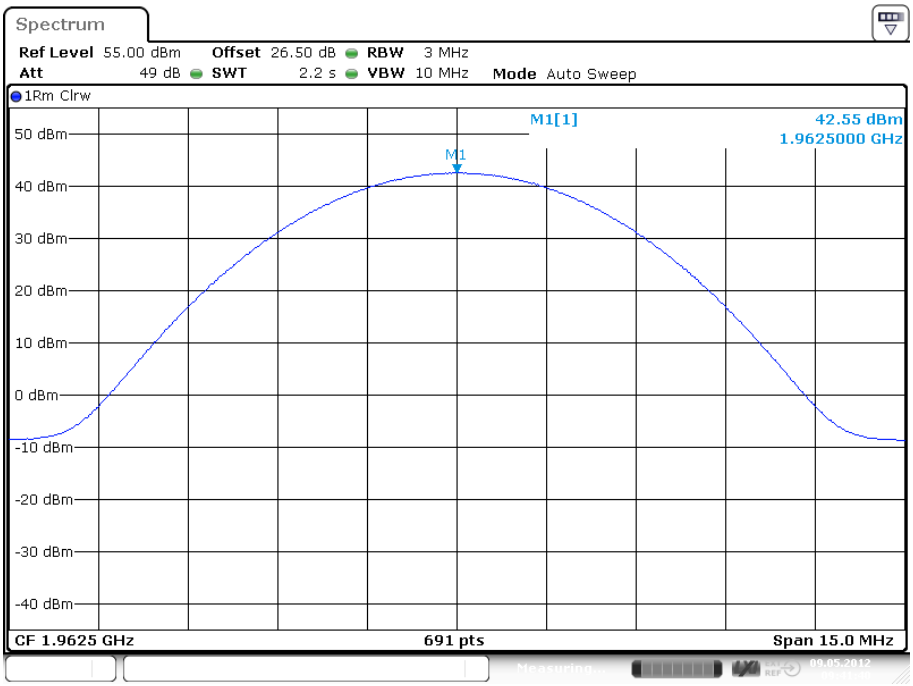
5.3.1.4 W-CDMA



Date: 9.MAY.2012 09:37:33

plot 5.3.1.4-#1 RF Power Out: §24.232, §2.1046; Test results; Downlink; W-CDMA Middle

5.3.1.5 LTE



plot 5.3.1.5-#1 RF Power Out: §24.232, §2.1046; Test results; Downlink; LTE Middle

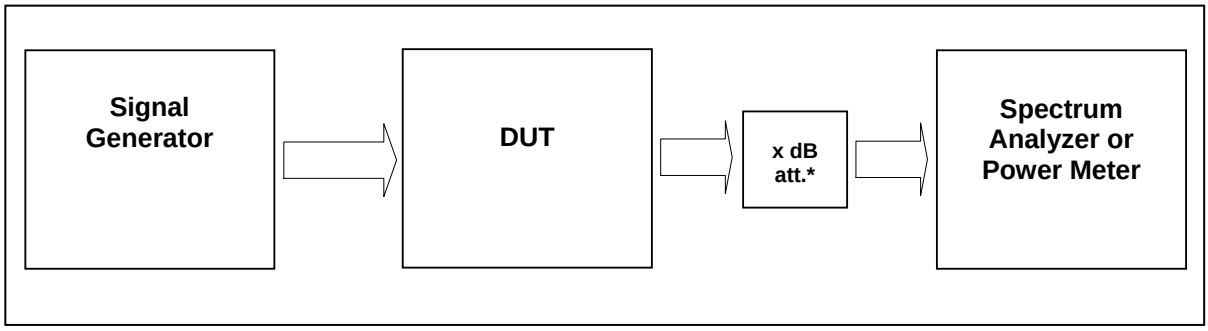
5.3.2 Uplink

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:	09.05.2012

6 Occupied Bandwidth: §2.1049



External Attenuator DL x dB = 20 dB
figure 5.4-#1 Test setup: Occupied Bandwidth: §2.1049

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 8990, 7399, 7400, 7409, 7410, 7280

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:

(h) Transmitters employing digital modulation techniques—when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

6.3 Test results

6.3.1 Downlink

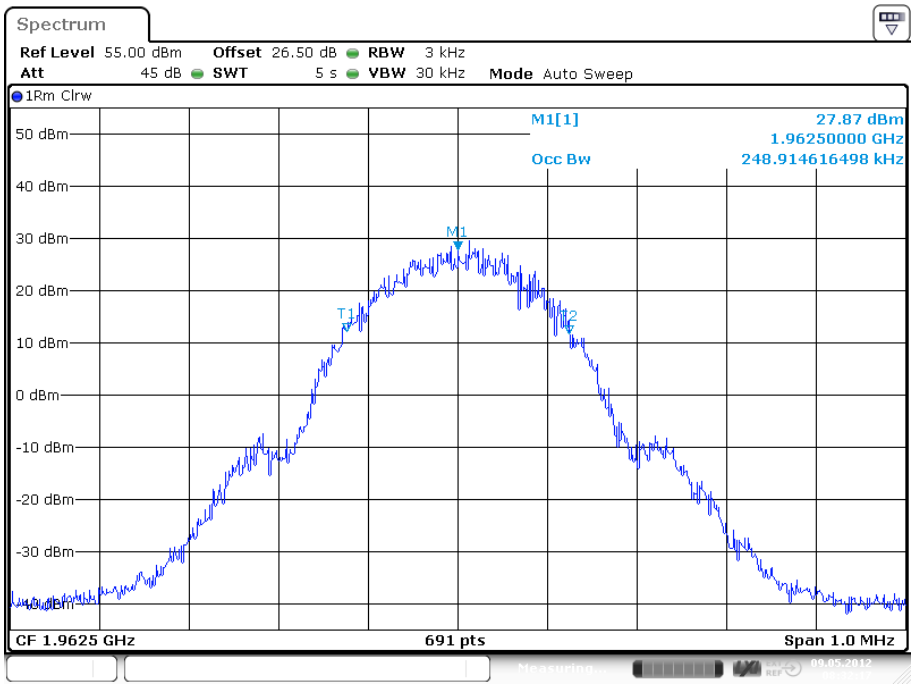
Detector RMS.

Modulation	Measured at	Carrier /MHz	RBW VBW Span	Occupied Bandwidth / MHz	Plot #
GSM	Middle	1962,5MHz	3kHz 30kHz 1MHz	0.249	6.3.1.1 #1, #2
GSM-EDGE	Middle	1962,5 MHz	3kHz 30kHz 1MHz	0.246	6.3.1.2 #1, #2
CDMA	Middle	1962,5 MHz	30kHz 300kHz 5MHz	1.245	6.3.1.3 #1, #2
WCDMA	Middle	1962,5 MHz	100kHz 1MHz 10MHz	4.168	6.3.1.4 #1, #2
LTE	Middle	1962,5 MHz	30 kHz 300 kHz 5 MHz	1,1	6.3.1.5 #1,#2

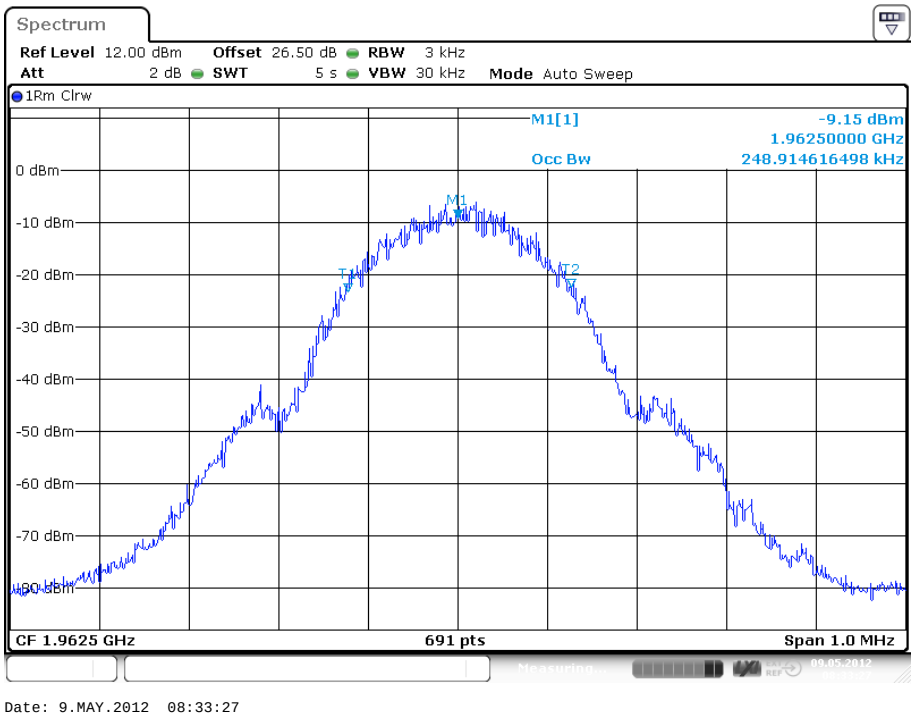
table 6.3-#1 Occupied Bandwidth: §2.1049 Test results Downlink

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

6.3.1.1 GSM

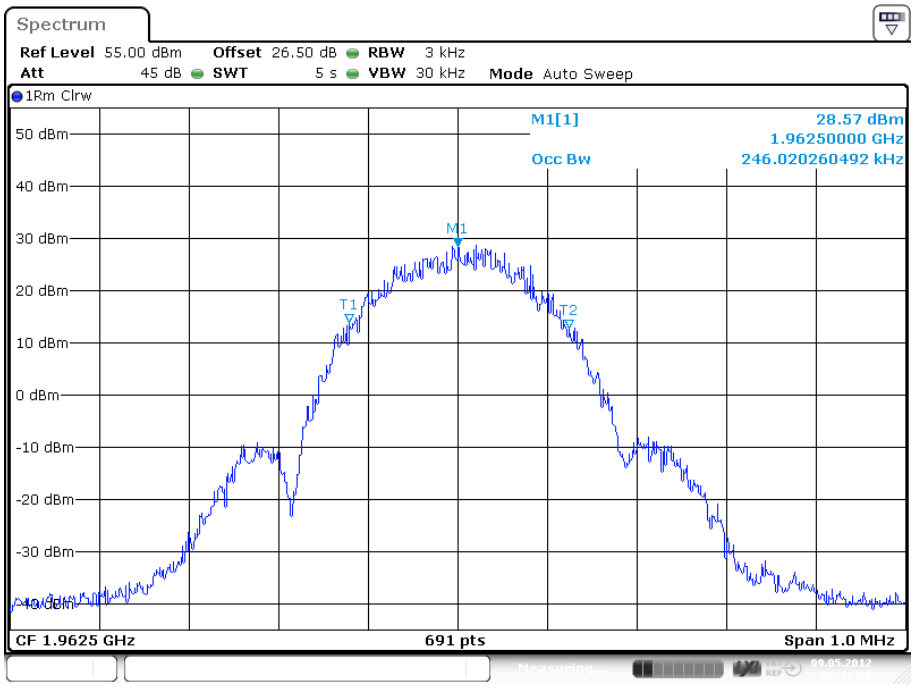


plot 6.3.1.1-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; GSM Output



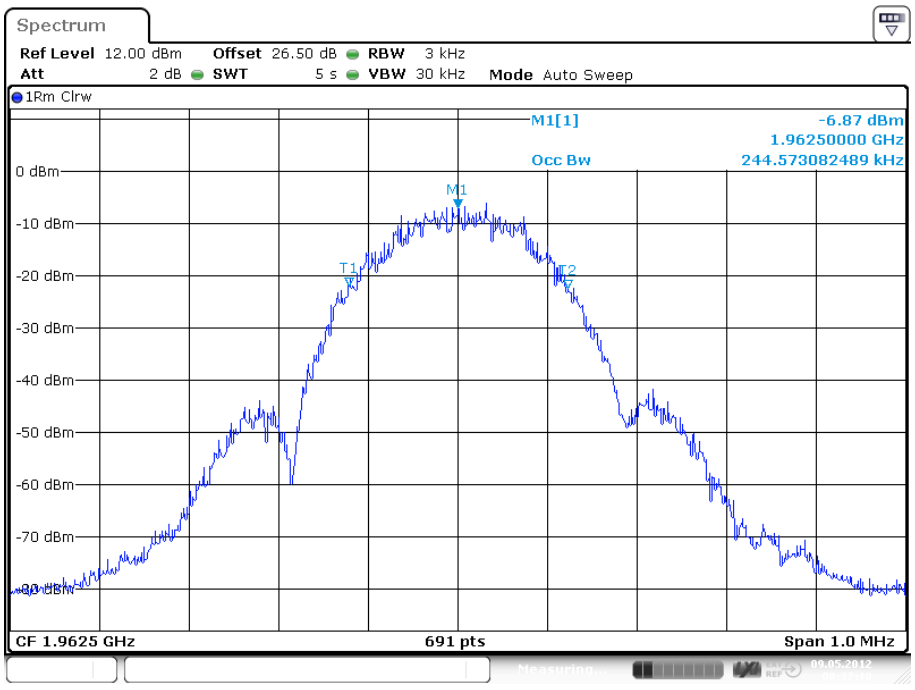
plot 6.3.1.1-#2 Occupied Bandwidth: §2.1049; Test results; Downlink; GSM Input

6.3.1.2 GSM-EDGE



Date: 9.MAY.2012 08:36:27

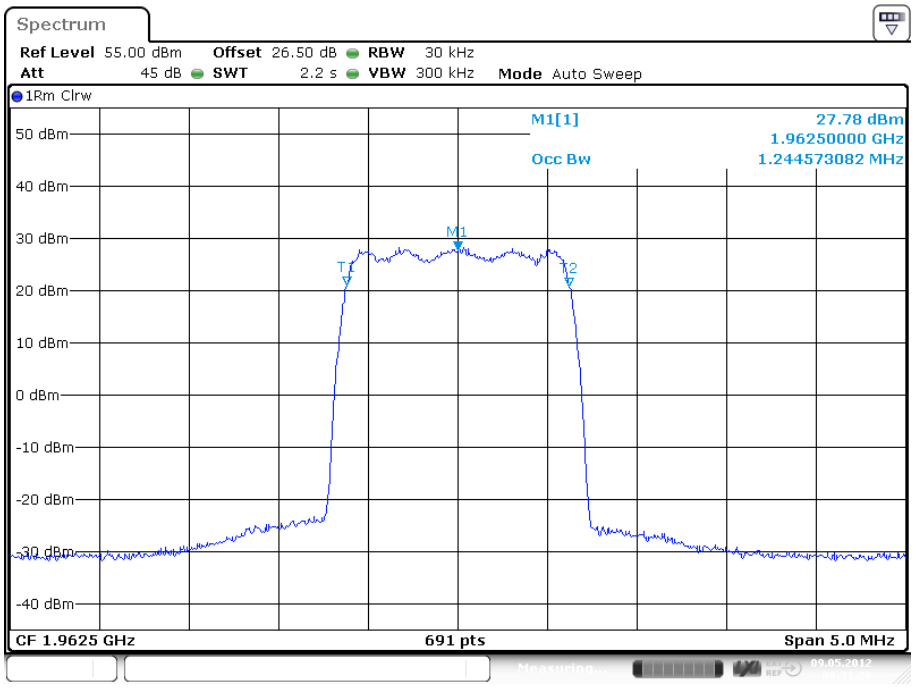
plot 6.3.1.2-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; GSM-EDGE Output



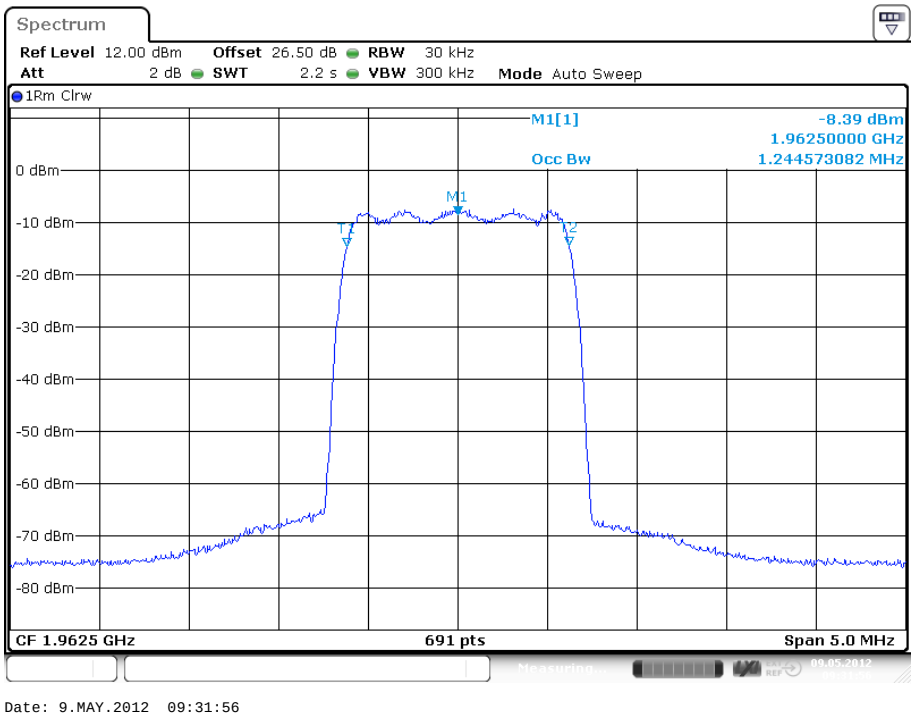
Date: 9.MAY.2012 08:37:10

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

6.3.1.3 CDMA

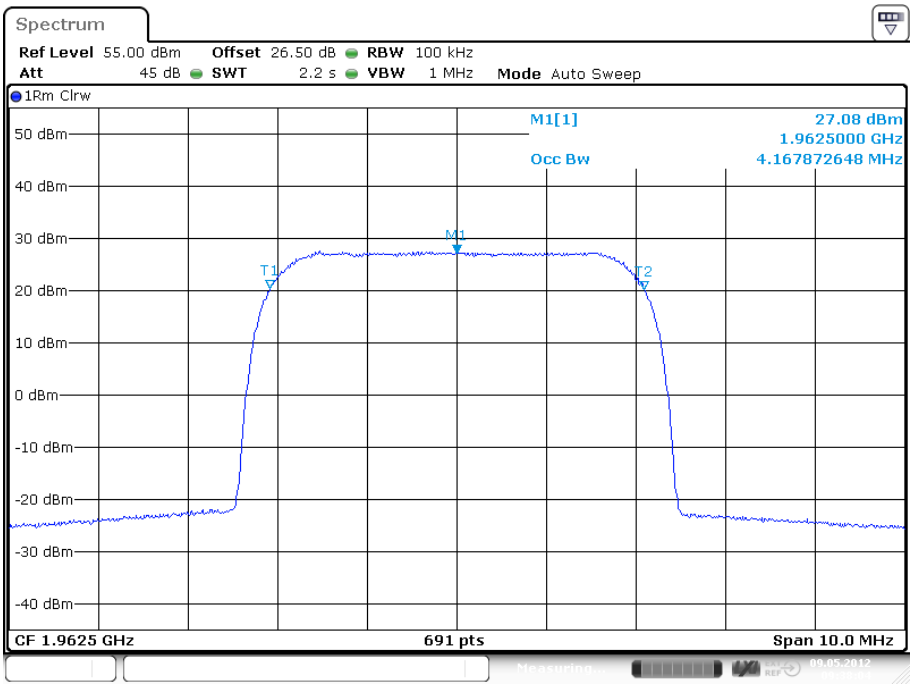


plot 6.3.1.3-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; CDMA Output



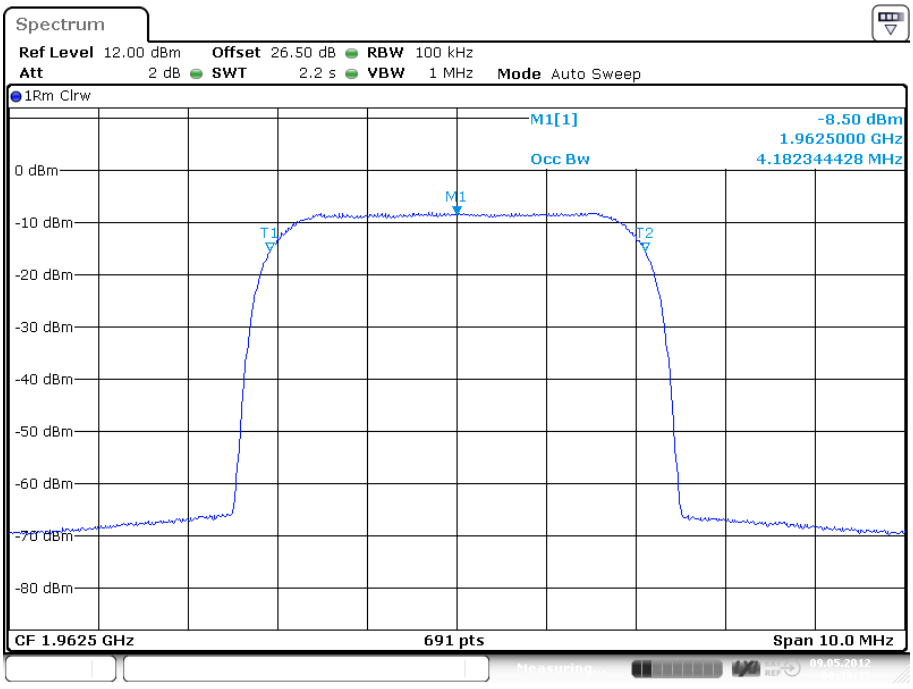
plot 6.3.1.3-#2 Occupied Bandwidth: §2.1049; Test results; Downlink; CDMA Input

6.3.1.4 W-CDMA



Date: 9.MAY.2012 09:38:04

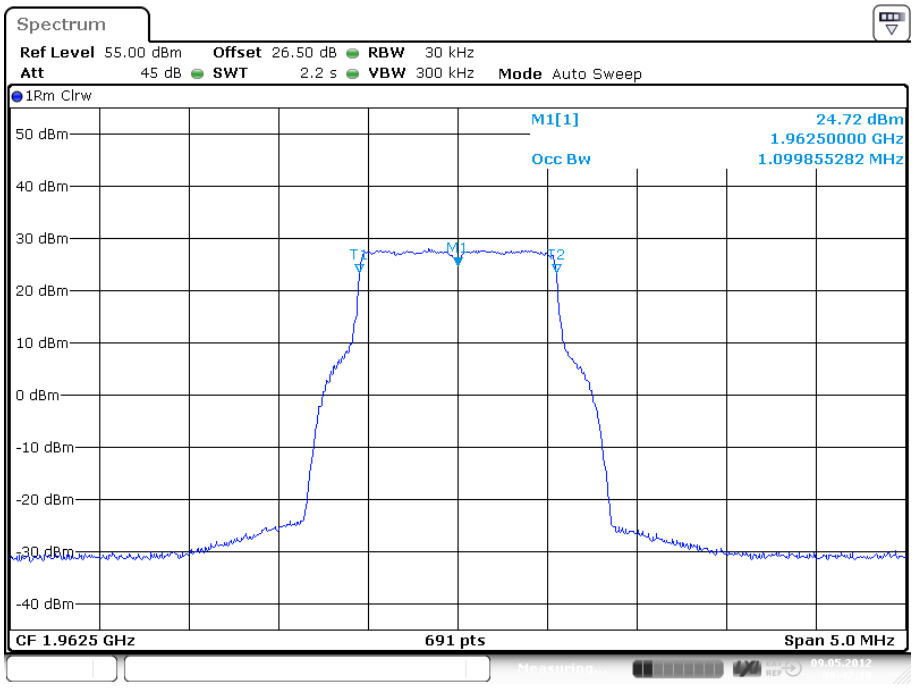
plot 6.3.1.4-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; W-CDMA Output



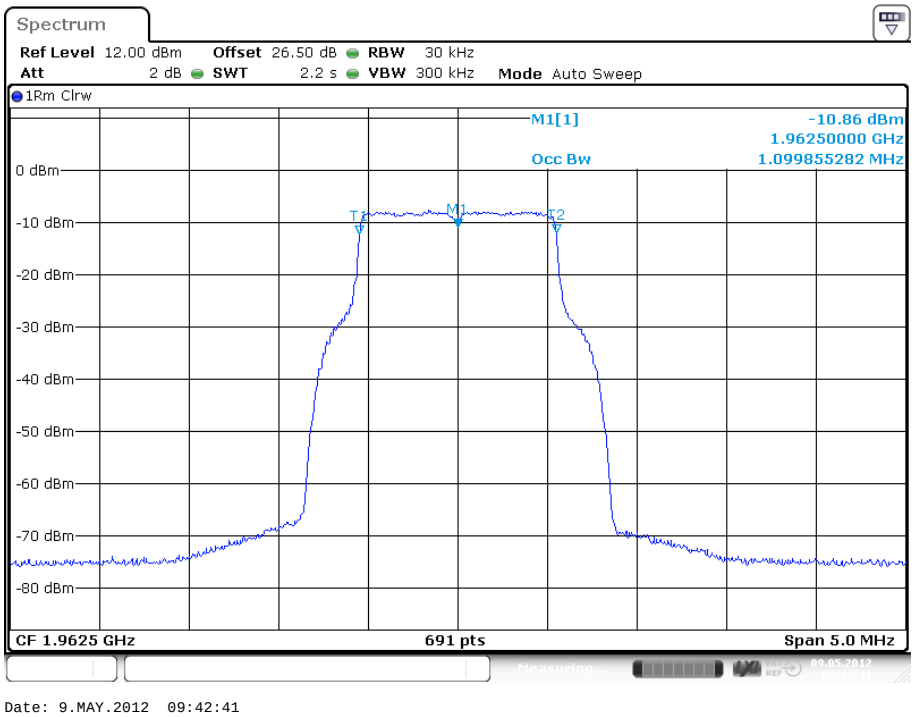
Date: 9.MAY.2012 09:38:35

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

6.3.1.5 LTE



plot 6.3.1.5-#1 Occupied Bandwidth: §2.1049; Test results; Downlink; LTE Output



plot 6.3.1.5-#2 Occupied Bandwidth: §2.1049; Test results; Downlink; LTE Input

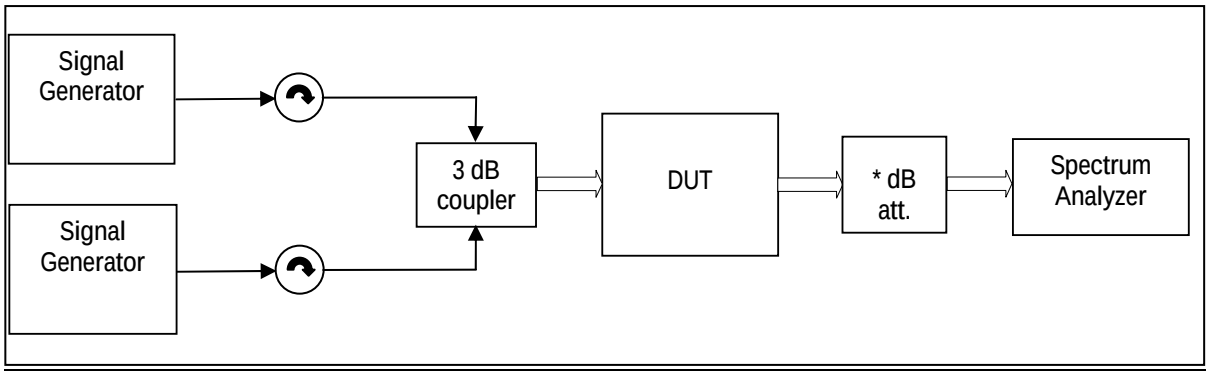
6.3.2 Uplink

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:	09.05.2012

7 Spurious Emissions at Antenna Terminals: §24.238, §2.1051



Multisignal-Generator used, External Attenuator DL x dB = 20 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §24.238, §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	9054, 9126, 9101,8990, 7336, 7119, 7409, 7449, 7443, 7444,	

7.1 Limit

Minimum standard:

Para. No.24.238(a)

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.

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	Max. level (dBm)	Plot -
GSM	Lower Edge Upper Edge	1930,4 MHz 1930,6 MHz 1994,4 MHz 1994,6 MHz	3kHz 30kHz 2MHz	-36.8	7.3.1.1 #1 #2
GSM-EDGE	Lower Edge Upper Edge	1930,4 MHz 1930,6 MHz 1994,4 MHz 1994,6 MHz	3kHz 30kHz 2MHz	-33.2	7.3.1.2 #1 #2
CDMA	Lower Edge Upper Edge	1930,775 MHz 1932,025 MHz 1992,975 MHz 1994,225 MHz	30kHz 300kHz 6MHz	-23.7	7.3.1.3 #1 #2
WCDMA	Lower Edge Upper Edge	1932,6 MHz 1937,6 MHz 1987,4 MHz 1992,4 MHz	100kHz 1MHz 15MHz	-22.8	7.3.1.4 #1 #2
LTE	Lower Edge Upper Edge	1930,7 MHz 1932,1 MHz 1992,9 MHz 1994,3 MHz	30kHz 300kHz 6MHz	-23.7	7.3.1.5 #1 #2

table 7.3-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051 Test results Downlink <1MHz from Band Edge

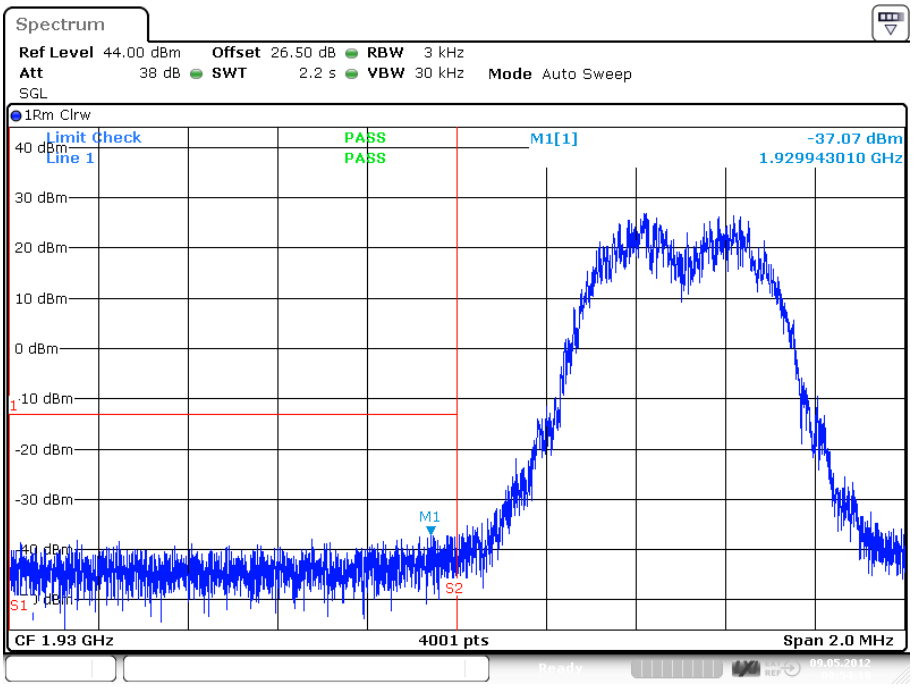
>1MHz from Band Edge
Detector: RMS.

Modulation	Carrier at	Carrier	Max. level (dBm)	RBW VBW Frequency range	Plot -
GSM	Middle	1930,4 MHz 1994,6 MHz	-23.7	1MHz 3MHz 30MHz – 20GHz	7.3.1.6 #1; #2
GSM-EDGE	Middle	1930,4 MHz 1994,6 MHz	-23.8	1MHz 3MHz 30MHz – 20GHz	7.3.1.7 #1; #2
CDMA	Middle	1930,775 MHz 1994,225 MHz	-23.6	1MHz 3MHz 30MHz – 20GHz	7.3.1.8 #1; #2
WCDMA	Middle	1932,6 MHz 1992,4 MHz	-23.9	1MHz 3MHz 30MHz – 20GHz	7.3.1.9 #1; #2
LTE	Middle	1930,7 MHz 1994,3 MHz	-23.6	1MHz 3MHz 30MHz – 20GHz	7.3.1.10 #1; #2

table 7.3-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051 Test results Downlink >1MHz from Band Edge

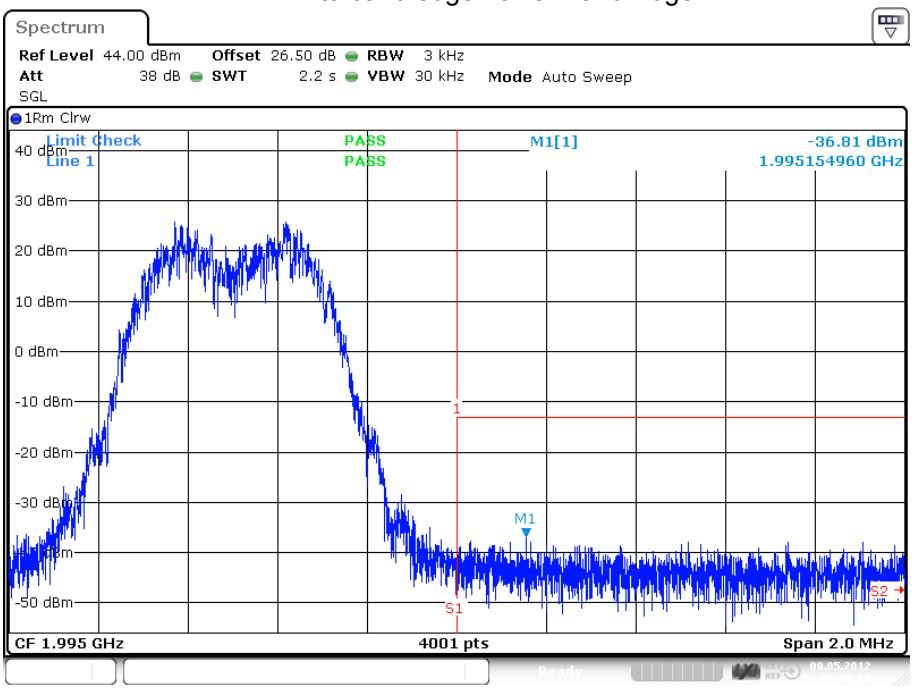
The test report shall not be reproduced except in full without the written approval of the testing laboratory.

7.3.1.1 GSM < 1MHz to band edge



Date: 9.MAY.2012 09:54:19

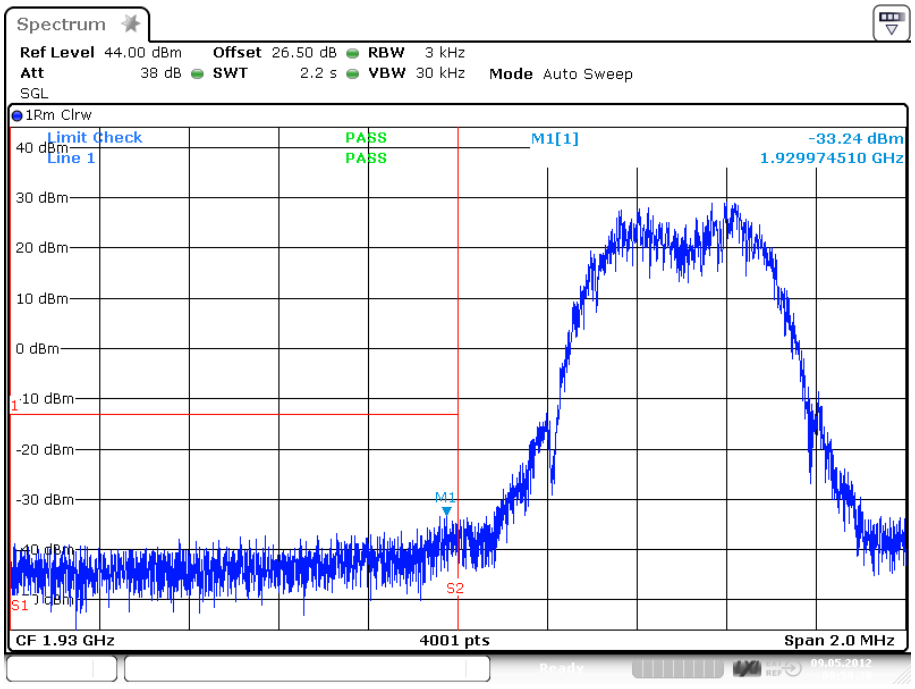
plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM < 1MHz to band edge Lower Band Edge



Date: 9.MAY.2012 09:55:10

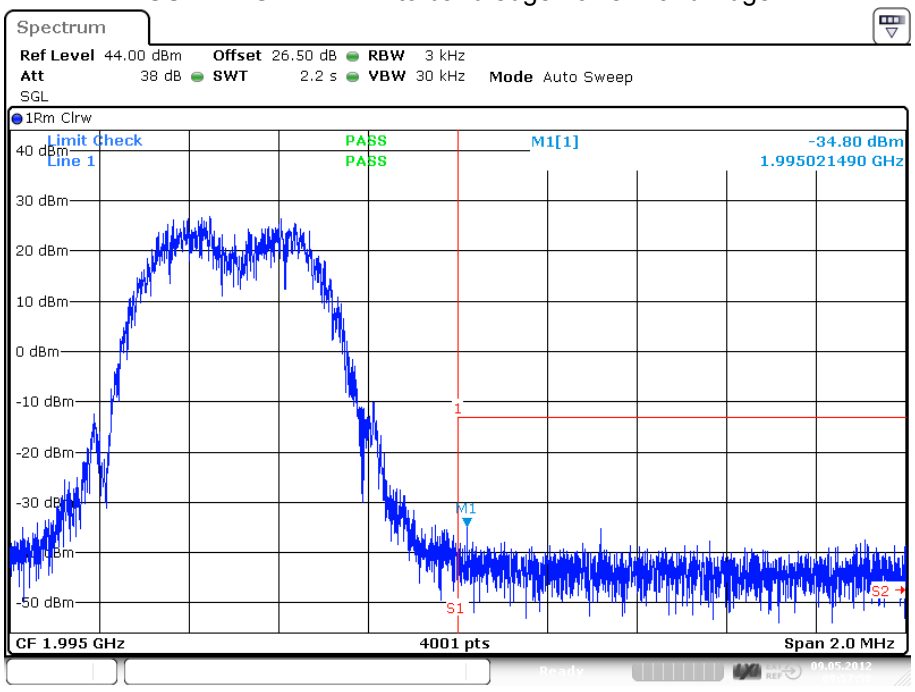
plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM < 1MHz to band edge Upper Band Edge

7.3.1.2 GSM-EDGE < 1MHz to band edge



Date: 9.MAY.2012 09:59:39

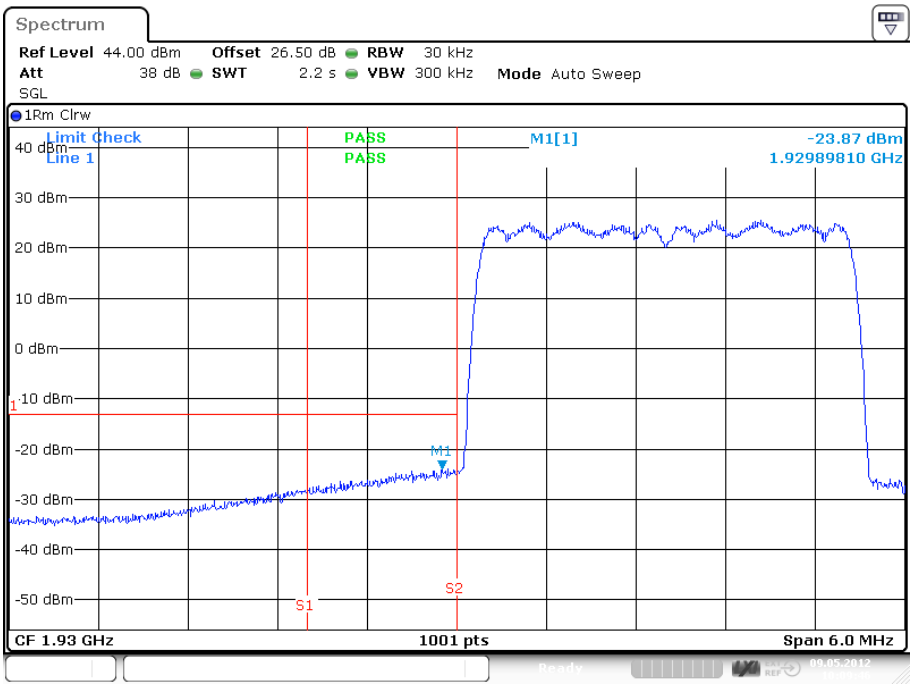
plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM-EDGE < 1MHz to band edge Lower Band Edge



Date: 9.MAY.2012 09:57:58

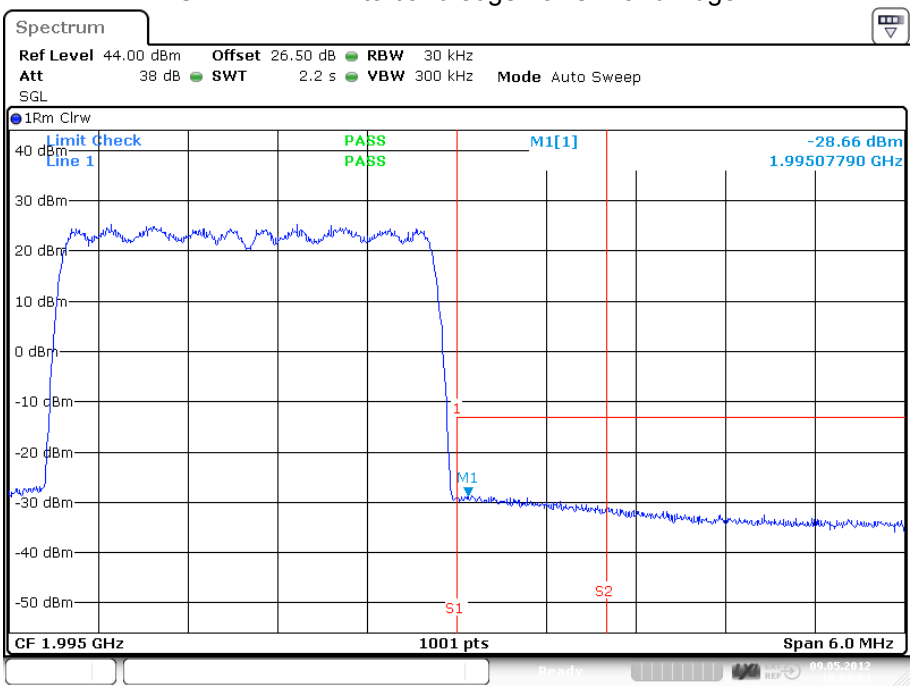
plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM-EDGE < 1MHz to band edge Upper Band Edge

7.3.1.3 CDMA < 1MHz to band edge



Date: 9.MAY.2012 10:09:46

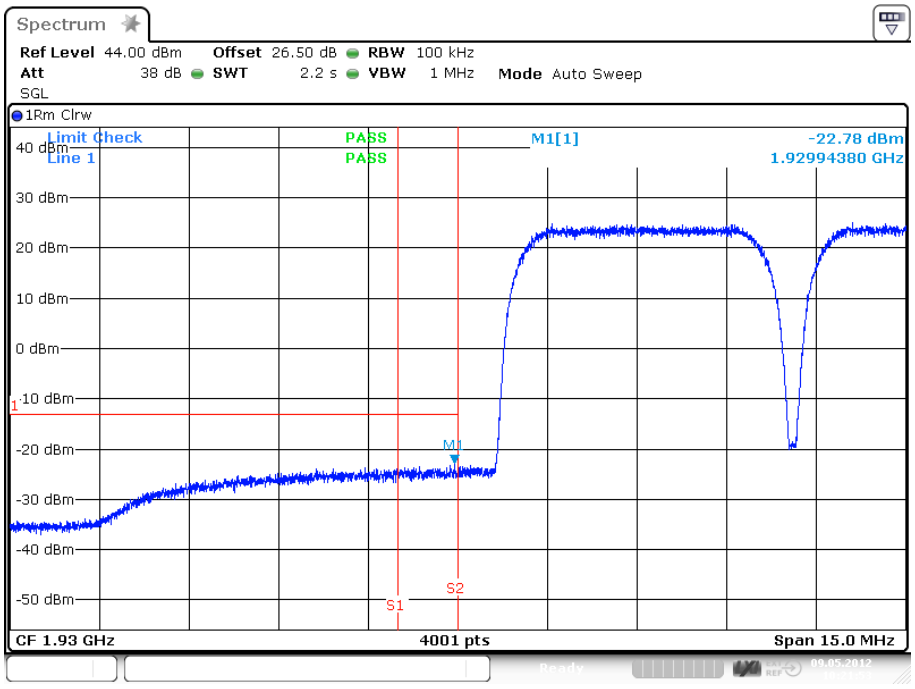
plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; CDMA < 1MHz to band edge Lower Band Edge



Date: 9.MAY.2012 10:09:04

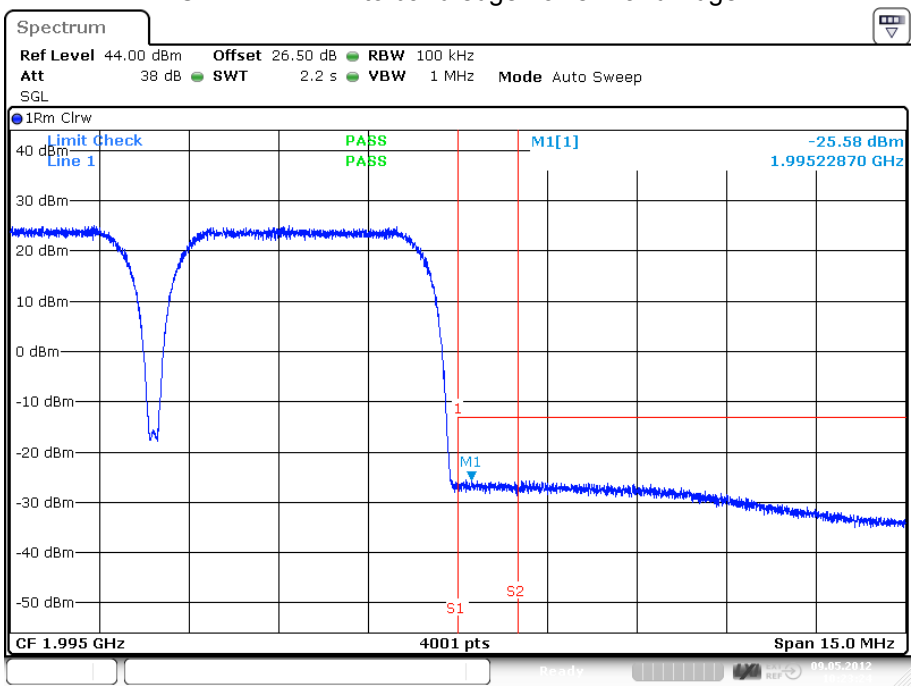
plot 7.3.1.3-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; CDMA < 1MHz to band edge Upper Band Edge

7.3.1.4 W-CDMA < 1MHz to band edge



Date: 9.MAY.2012 10:21:53

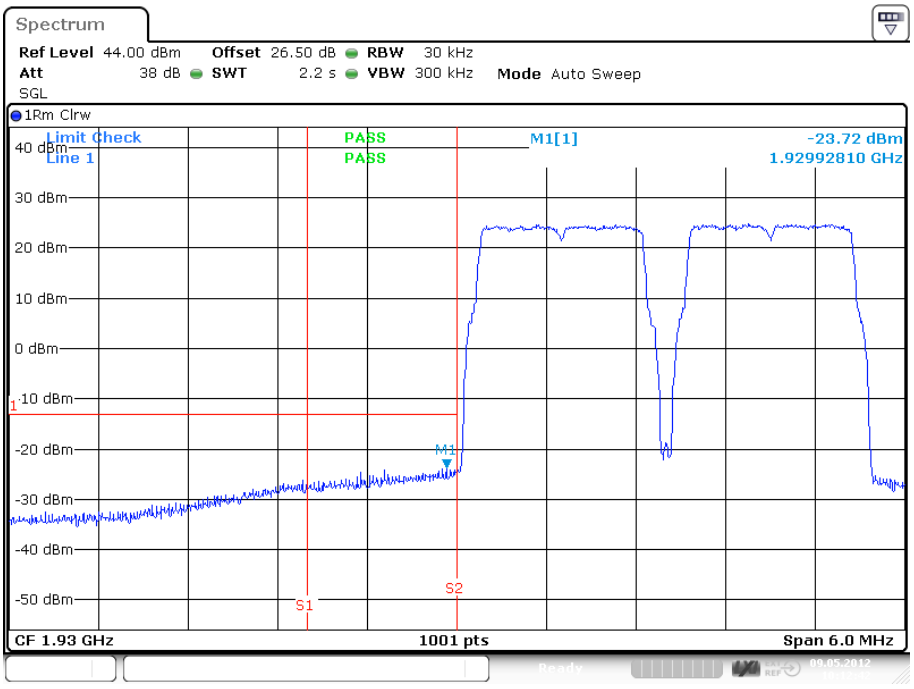
plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; W-CDMA < 1MHz to band edge Lower Band Edge



Date: 9.MAY.2012 10:23:24

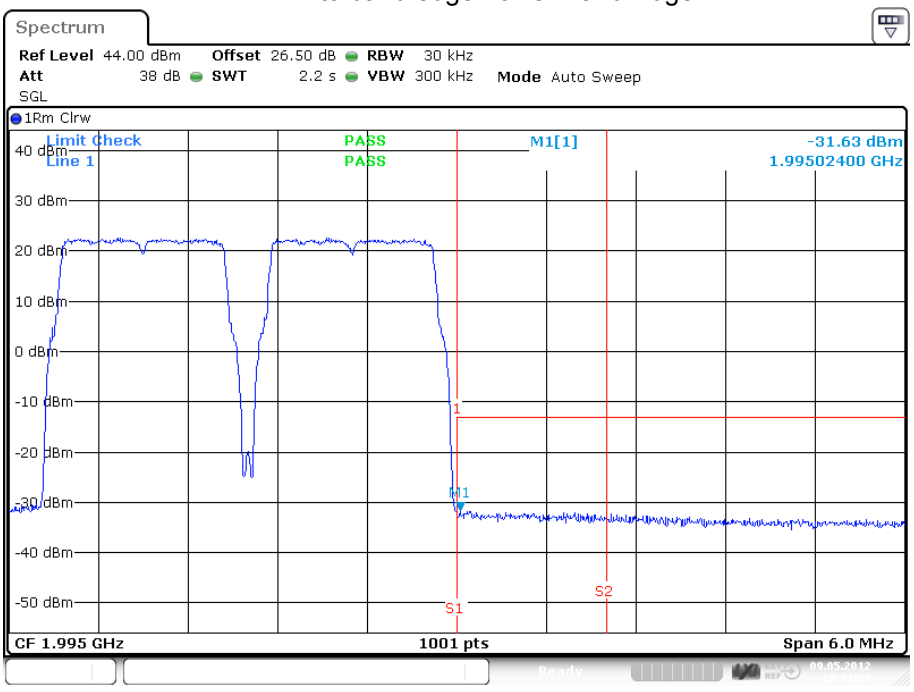
plot 7.3.1.4-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; W-CDMA < 1MHz to band edge Upper Band Edge

7.3.1.5 LTE < 1MHz to band edge



Date: 9.MAY.2012 10:12:42

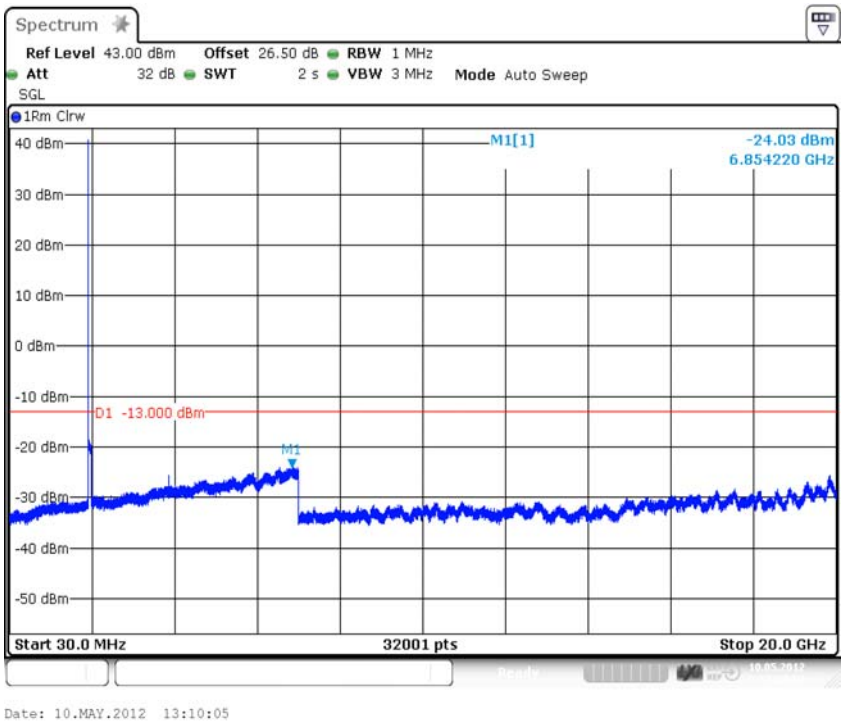
plot 7.3.1.5-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; LTE < 1MHz to band edge Lower Band Edge



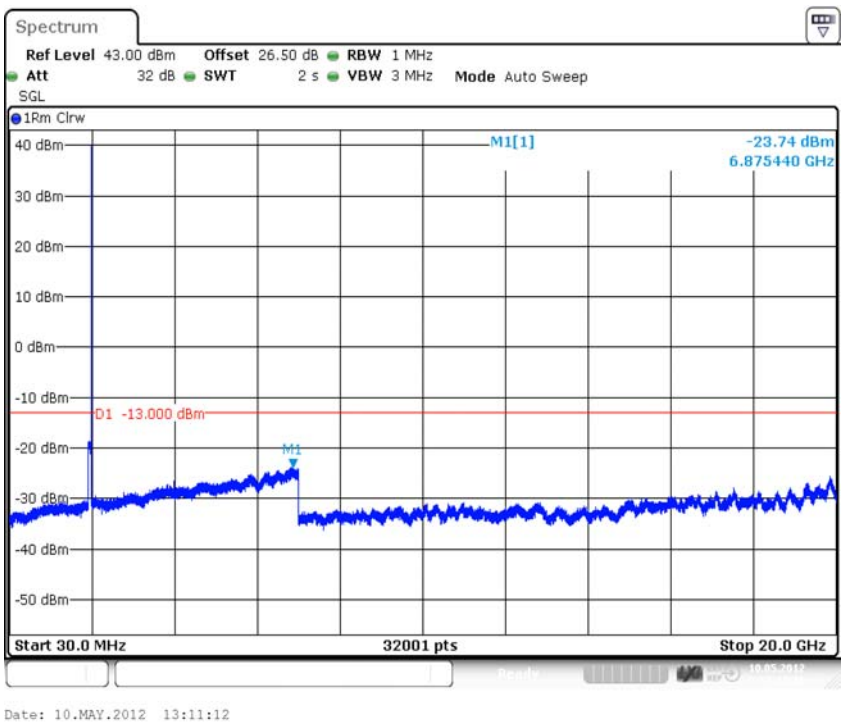
Date: 9.MAY.2012 10:14:04

plot 7.3.1.5-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; LTE < 1MHz to band edge Upper Band Edge

7.3.1.6 GSM > 1MHz to band edge

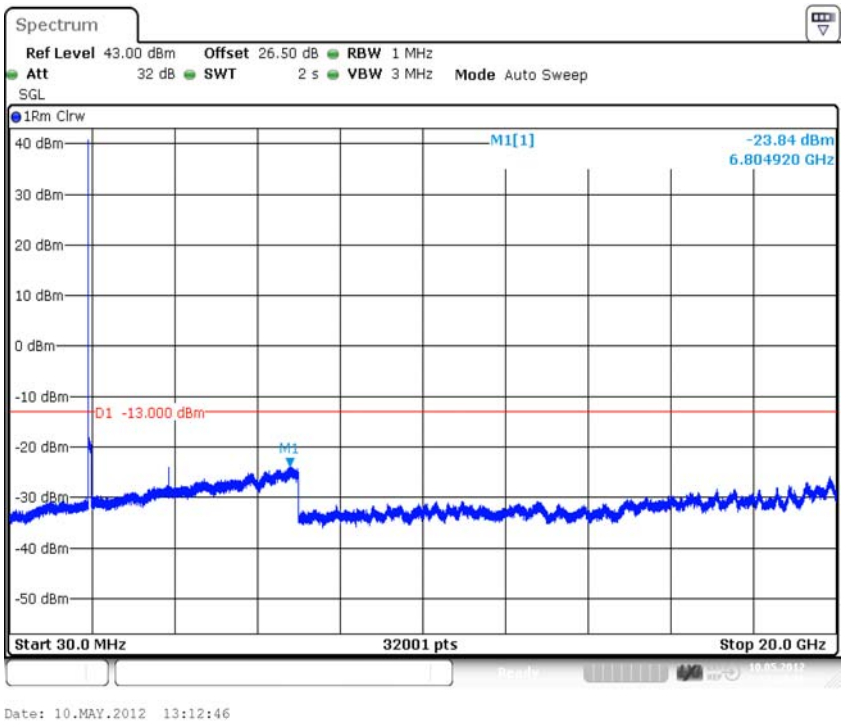


plot 7.3.1.6-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM > 1MHz to band edge;

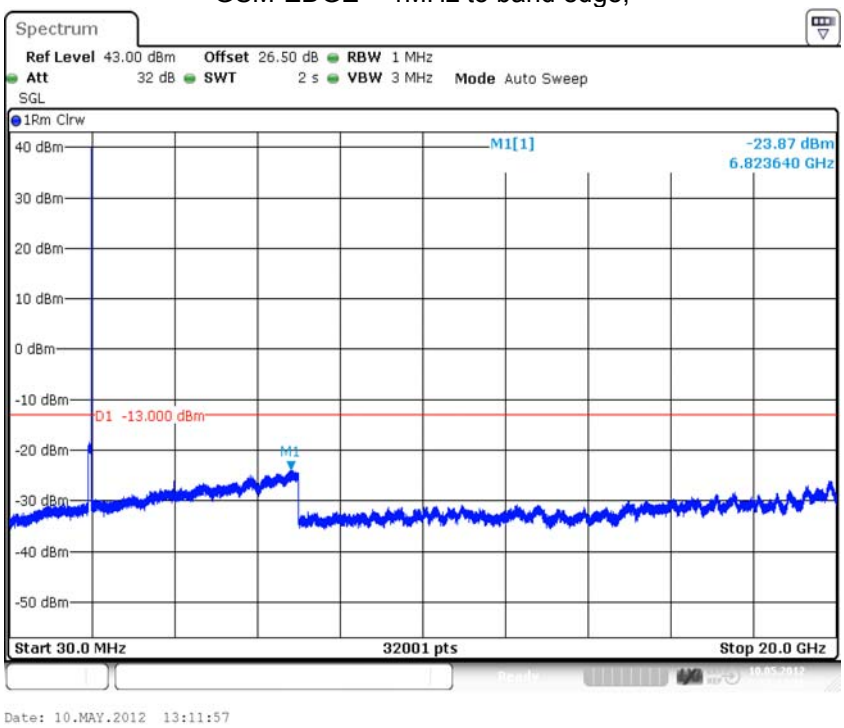


plot 7.3.1.6-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM > 1MHz to band edge;

7.3.1.7 GSM-EDGE > 1MHz to band edge



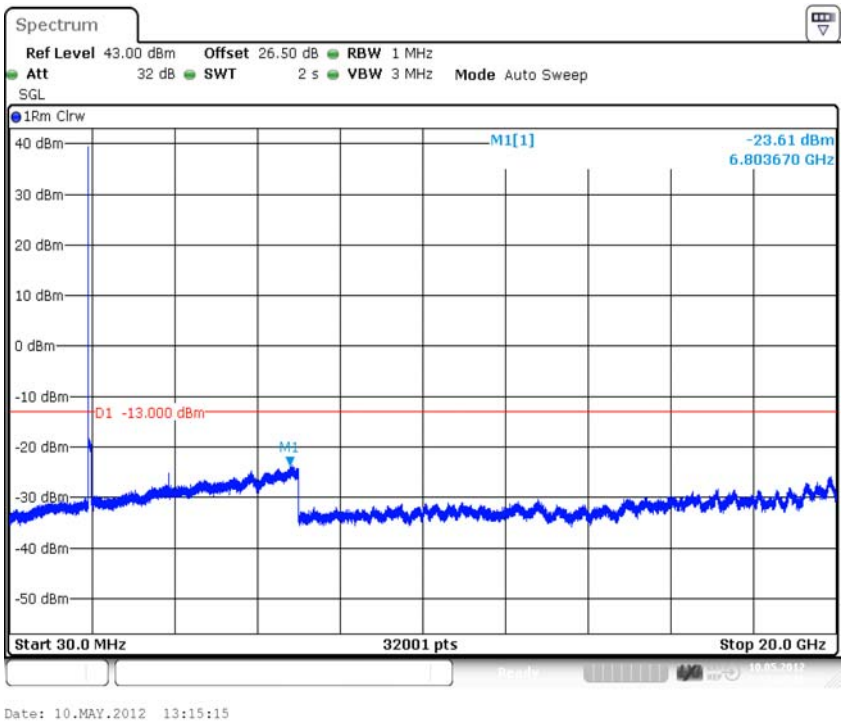
plot 7.3.1.7-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM-EDGE > 1MHz to band edge;



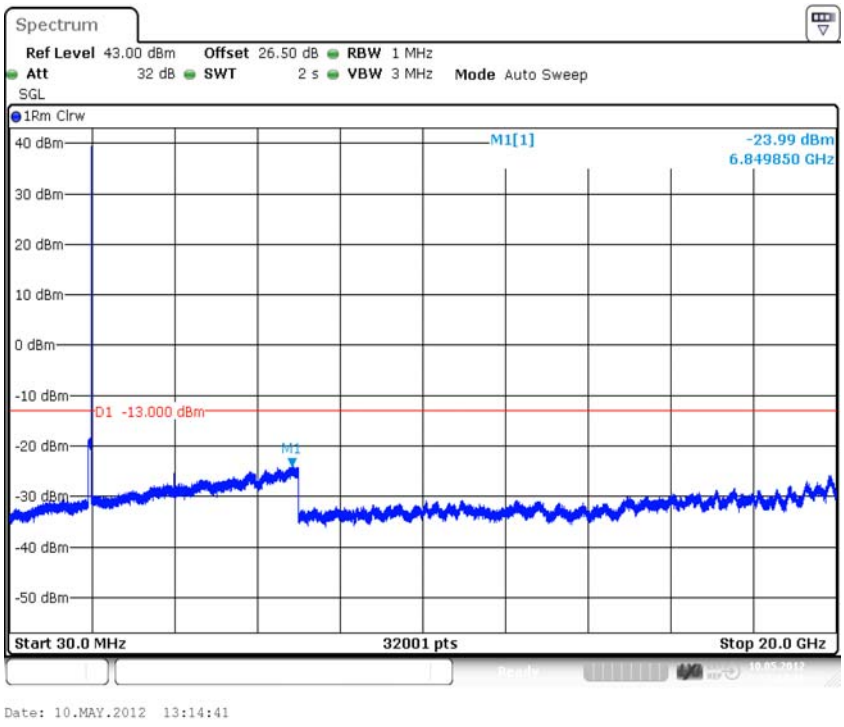
plot 7.3.1.7-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; GSM-EDGE > 1MHz to band edge;

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

7.3.1.8 CDMA > 1MHz to band edge

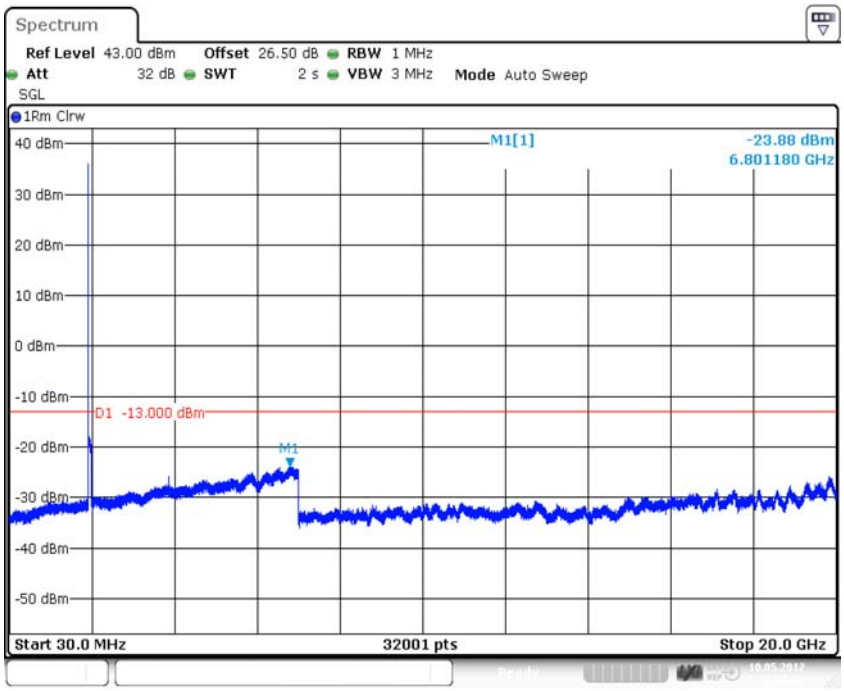


plot 7.3.1.8-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; CDMA > 1MHz to band edge;

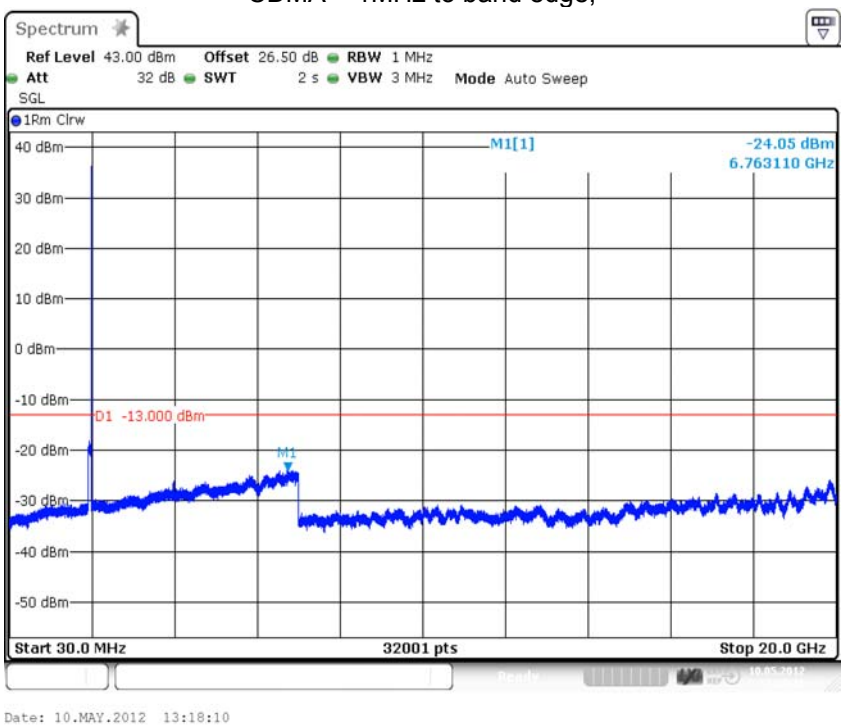


plot 7.3.1.8-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; CDMA > 1MHz to band edge;

7.3.1.9 W-CDMA > 1MHz to band edge



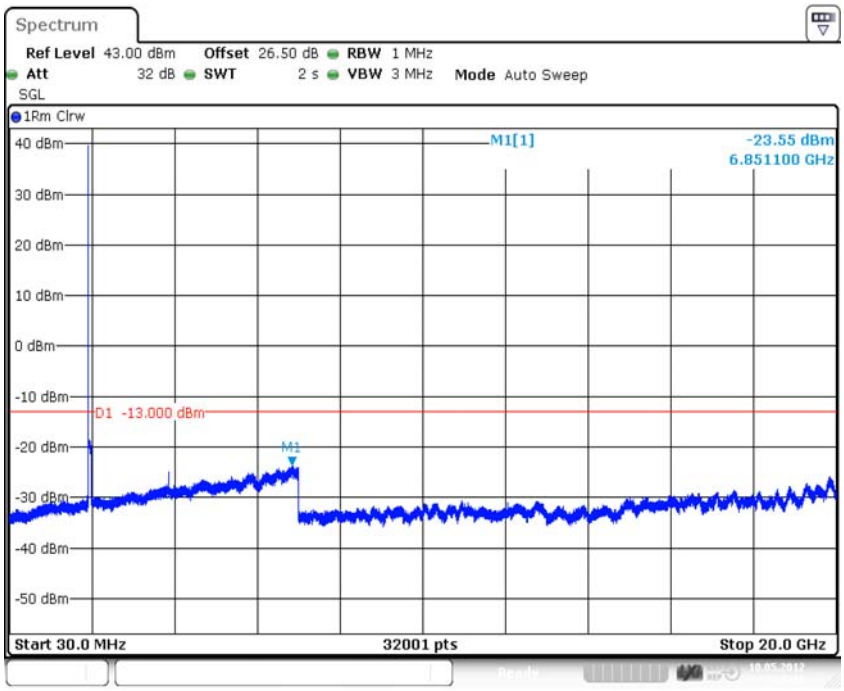
plot 7.3.1.9-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; W-CDMA > 1MHz to band edge;



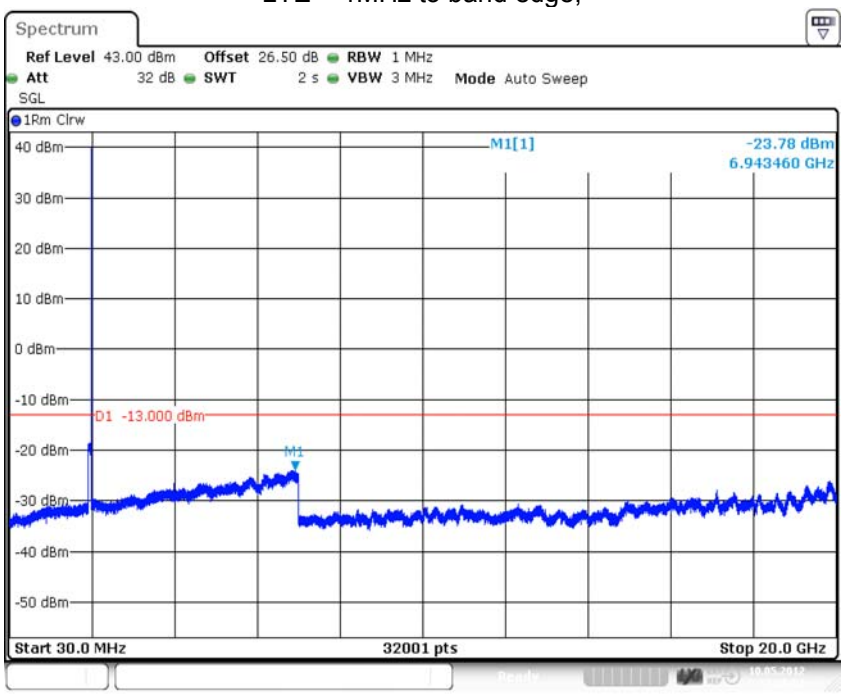
plot 7.3.1.9-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; W-CDMA > 1MHz to band edge;

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

7.3.1.10 LTE > 1MHz to band edge



plot 7.3.1.10-#1 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; Test results; Downlink; LTE > 1MHz to band edge;



plot 7.3.1.10-#2 Spurious Emissions at Antenna Terminals: §24.238, §2.1051; 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:	10.05.2012

8 Transmitter Output Power: IC RSS-133, RSS-GEN

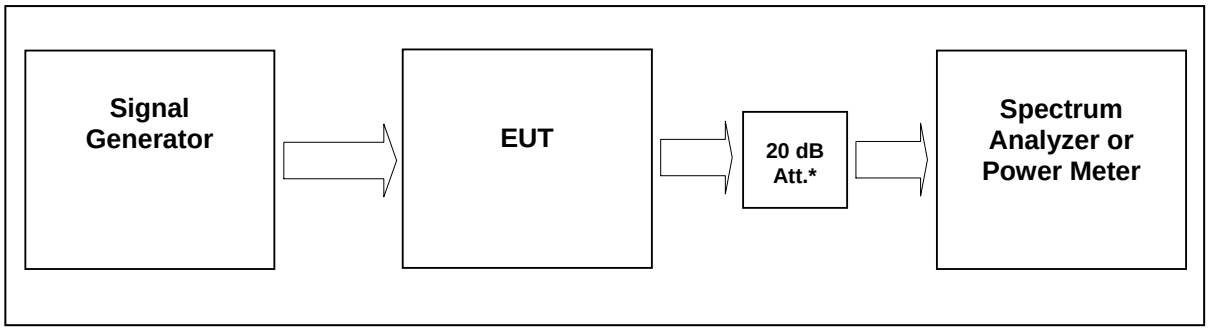


figure 7.4-#1 Test setup: Transmitter Output Power: IC RSS-133, RSS-GEN

Measurement uncertainty	± 0,38 dB
Test equipment used	9054, 9101,8990, 7336, 7119, 7409, 7449, 7443, 7444,

8.1 Limit

Minimum standard:
IC RSS-133 clause 6.4
The average equivalent isotropically radiated power (e.i.r.p.) for transmitters shall not exceed the limits given in SRSP-510. Moreover, base station transmitters operating in the band 1930-1995 MHz shall not have output power exceeding 100 watts.

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

8.2 Test method

IC RSS-133 clause 4.1

The transmitter power can be measured in peak or average value. If the transmitter power to be measured is in peak value, the transmitter power shall be measured over any interval of continuous transmission using an instrument calibrated in terms of a root-mean-square-equivalent voltage. The measurement results shall be properly adjusted for any instrument limitation, such as detector response times, sensitivity, limited resolution bandwidth capability when compared to the emission bandwidth, etc., so as to obtain the maximum transmit output power of the emission over the channel bandwidth.

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

8.3 Test results

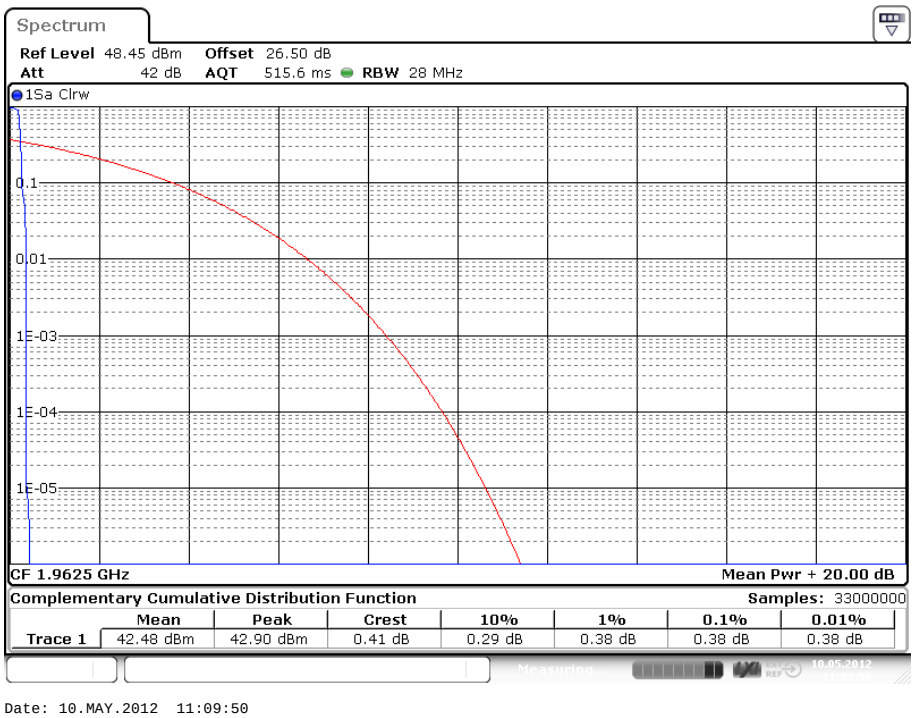
Transmitter Output Power results see
clause5 RF Power Out: §24.232, §2.1046 sub clause 5.3 Test results

8.3.1 Downlink

Modulation	Measured at	Peak – to - average (dB)	Plot -
GSM	1962,5MHz	0.41	8.3.1.1 #1
GSM-EDGE	1962,5 MHz	3.48	8.3.1.2 #1
CDMA	1962,5 MHz	10.10	8.3.1.3 #1
WCDMA	1962,5 MHz	10.23	8.3.1.4 #1
LTE	1962,5 MHz	9.81	8.3.1.5 #1
Maximum output power = 42.5 dBm			
Limit peak to average = 13 dB			

table 8.3.1-#1 Transmitter Output Power: IC RSS-133, RSS-GEN Test results Downlink Peak - to – average

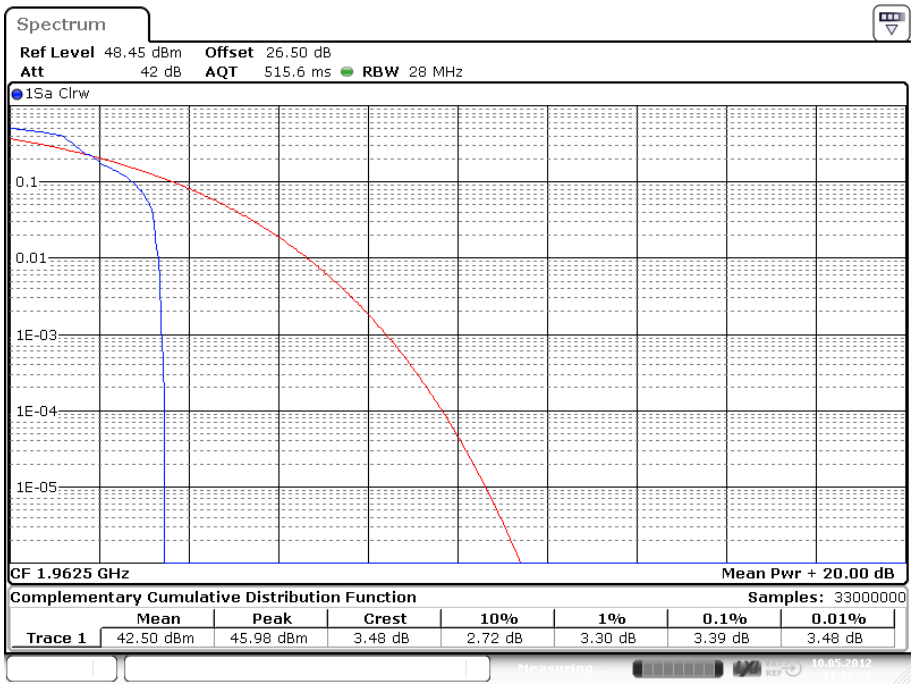
8.3.1.1 GSM



Date: 10.MAY.2012 11:09:50

plot 8.3.1.1-#1 Transmitter Output Power: IC RSS-133, RSS-GEN; Test results; Downlink; GSM Middle Peak - to - average

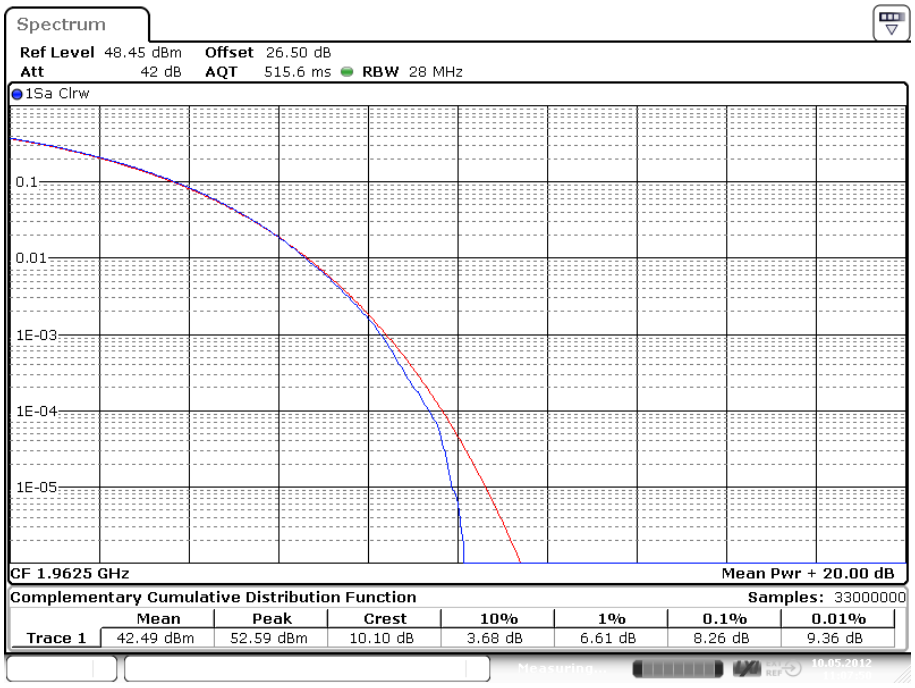
8.3.1.2 GSM-EDGE



Date: 10.MAY.2012 11:08:59

plot 8.3.1.2-#1 Transmitter Output Power: IC RSS-133, RSS-GEN; Test results; Downlink; GSM-EDGE Middle Peak - to - average

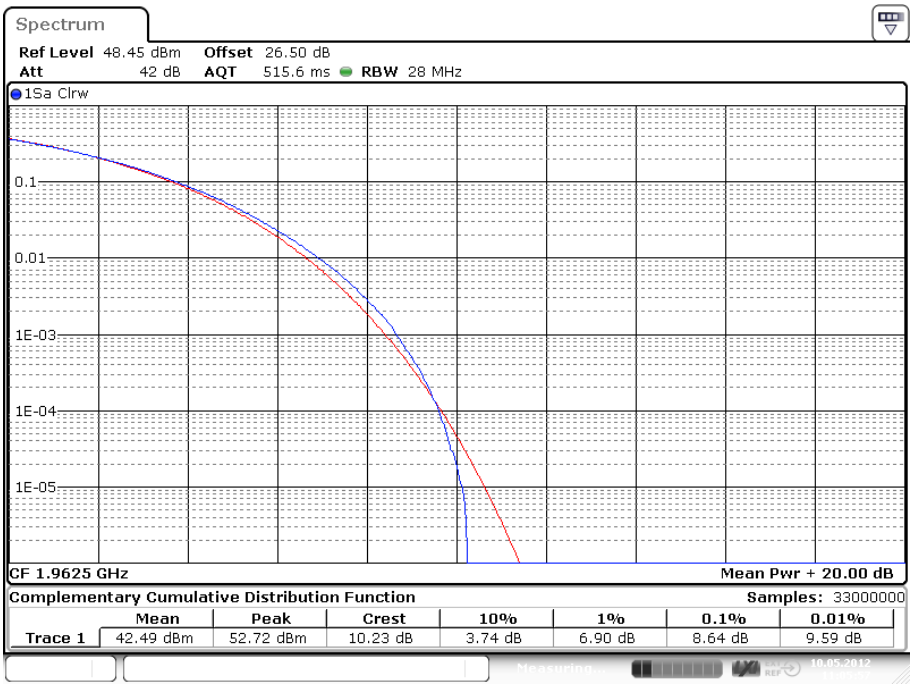
8.3.1.3 CDMA



Date: 10.MAY.2012 11:07:50

plot 8.3.1.3-#1 Transmitter Output Power: IC RSS-133, RSS-GEN; Test results; Downlink; CDMA Middle Peak - to - average

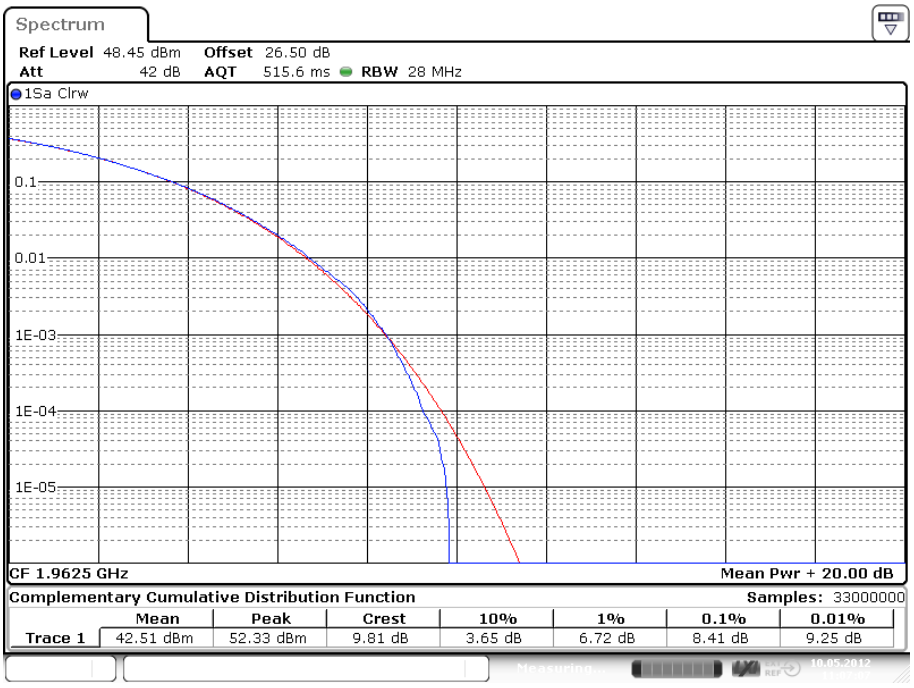
8.3.1.4 WCDMA



Date: 10.MAY.2012 11:05:58

plot 8.3.1.4-#1 Transmitter Output Power: IC RSS-133, RSS-GEN; Test results; Downlink; WCDMA Middle Peak - to - average

8.3.1.5 LTE



Date: 10.MAY.2012 11:07:07

plot 8.3.1.5-#1 Transmitter Output Power: IC RSS-133, RSS-GEN; Test results; Downlink; LTE Middle Peak - to - average

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:	M. Leinfelder
Date:	10.05.2012

9 Transmitter Unwanted Emissions: IC RSS-133

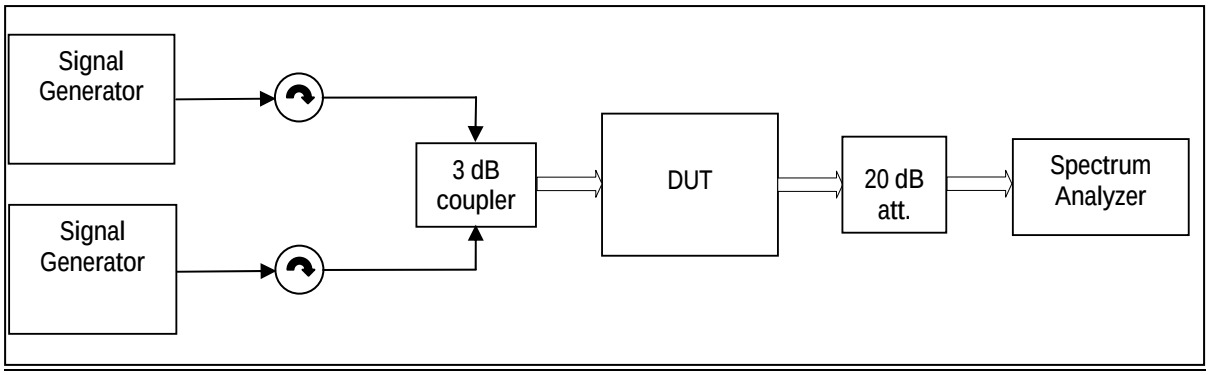


figure 9-#1 Test setup: Transmitter Unwanted Emissions: IC RSS-133

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, 9126, 9101,8990, 7336, 7119, 7409, 7449, 7443, 7444,	

9.1 Limit

IC RSS-133 clause 6.5.1 Out-of-Block Emissions (Mobile and Base Stations)
Subsection (i) choosen.

(a) Mobile stations shall comply with subsection (i) below. Base stations shall comply with either subsection (i) or subsection (ii).

(i) In the first 1.0 MHz bands immediately outside and adjacent to the equipment's operating frequency block, the emission power per any 1% of the emission bandwidth shall be attenuated below the transmitter output power P (in watts) by at least 43 + 10 log 10 (P), dB. Test method The emission limits shall be measured with the carrier frequency set at both the highest settable frequency and lowest settable frequency permitted by the design of the equipment.

(b) After the first 1.0 MHz (for equipment that complies with (a)(i) of this subsection) or 1.5 MHz (for equipment that complies with (a)(ii) of this subsection), the emission power in any 1 MHz bandwidth shall be attenuated below the transmitter output power P (in watts) by at least 43 + 10 log 10 (P), dB. (Note: If the test result using 1% of the emission bandwidth is used, power integration over 1.0 MHz is required; alternatively, the spectrum analyzer resolution and video bandwidths can be increased to 1.0 MHz for this measurement).

IC RSS-133 clause 6.5.2 Out-of-Sub-band Emissions
Outside the sub-bands 1850-1915 MHz and 1930-1995 MHz, the attenuation shall be equal to or greater than the out-of-block emission limits in Section 6.5.1.

9.2 Test method

IC RSS-133 clause 4.2
The emission limits shall be measured with the carrier frequency set at both the highest settable frequency
and the lowest settable frequency permitted by the design of the equipment.

9.3 Test results

see7 subclause Spurious Emissions at Antenna Terminals: §24.238, §2.1051
for 6.5.1 (a)(i) see table 7.3-#1
for 6.5.1 Out-of-Block Emissions (a)(ii) and 6.5.2 Out-of-Sub-band Emissions see table 7.3-#2

The test report shall not be reproduced except in full without the written approval of the testing laboratory.

10 Receiver Spurious Emissions: IC RSS-133

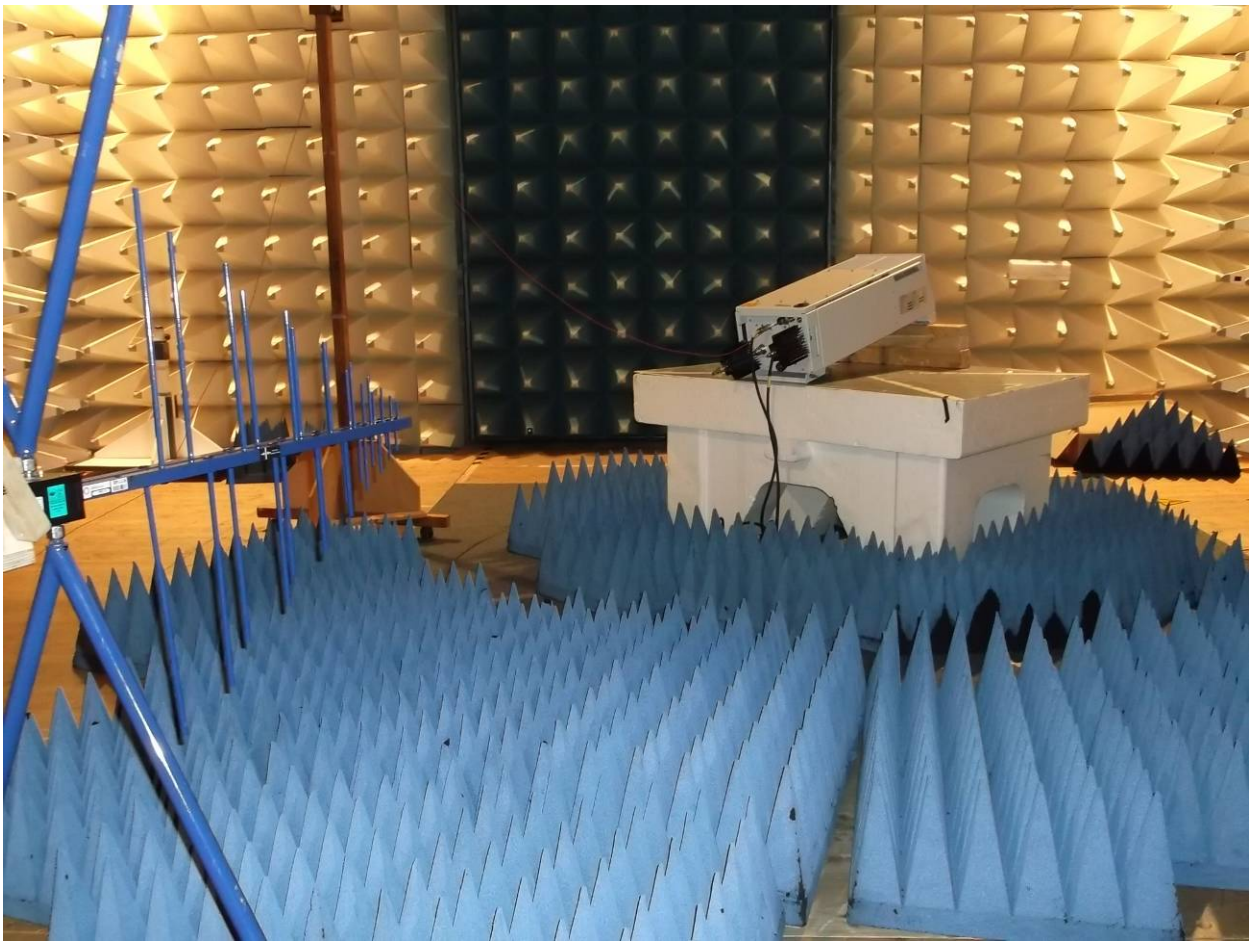
10.1 Limit

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

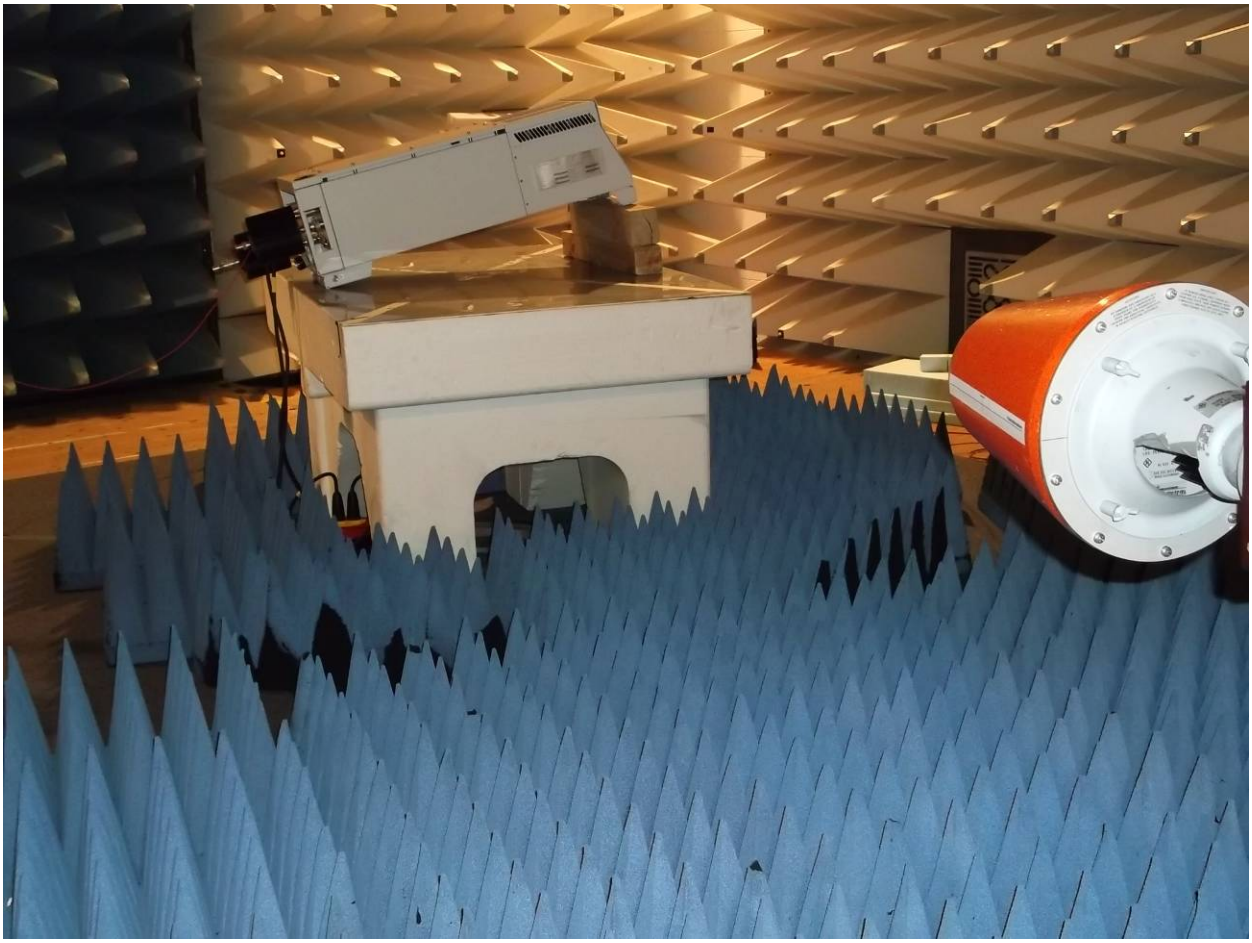
Comment:
Receiver Spurious Emissions are not measured, since the Repeater has only one antenna port to transmitt and receive at the same time (bi-directional amplifier)
The worst case for emission considerations is when the repeater is transmitting.
For transmitter unwanted emission test results see 9 Transmitter Unwanted Emissions: IC RSS-133

11 Radiated Spurious Emissions: §24.238, §2.1053, RSS-133

picture 8.1: label



picture 8.2: Test setup: Field Strength Emission <1 GHz @3m in the FAC



picture 8.3: 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 24.238	TIA/EIA-603-C:2004
		IC RSS-133 sec. 6.5	
1 GHz – 22 GHz	3 metres / FAC	FCC 47 CFR Part 24.238	
		IC RSS-133 sec. 6.5	

Test equipment used:

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.-date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1687	22.12.2011	22.12.2012	X
Antenna	CBL 6111	Chase	K1149	02.08.2011	02.08.2012	X
RF Cable		Frankonia	K1121 SET	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: SAC/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

11.1 Limit §24.238

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

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

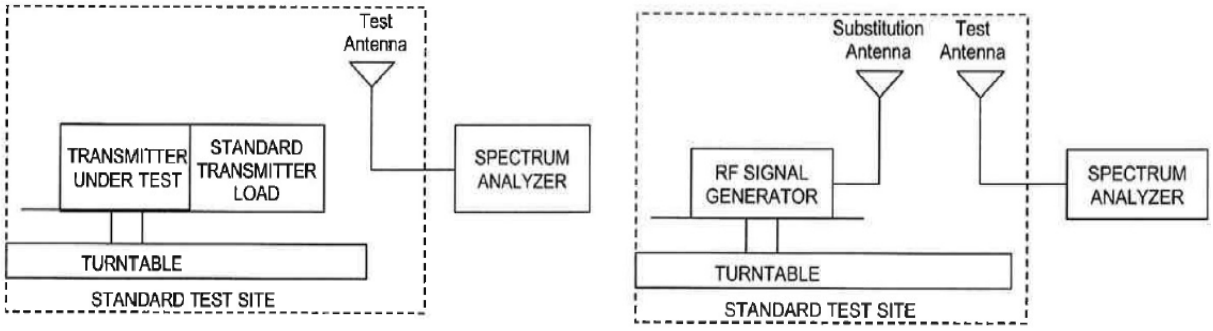
Measurement procedure. **TIA-603-C**

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

11.3 Climatic values in the lab

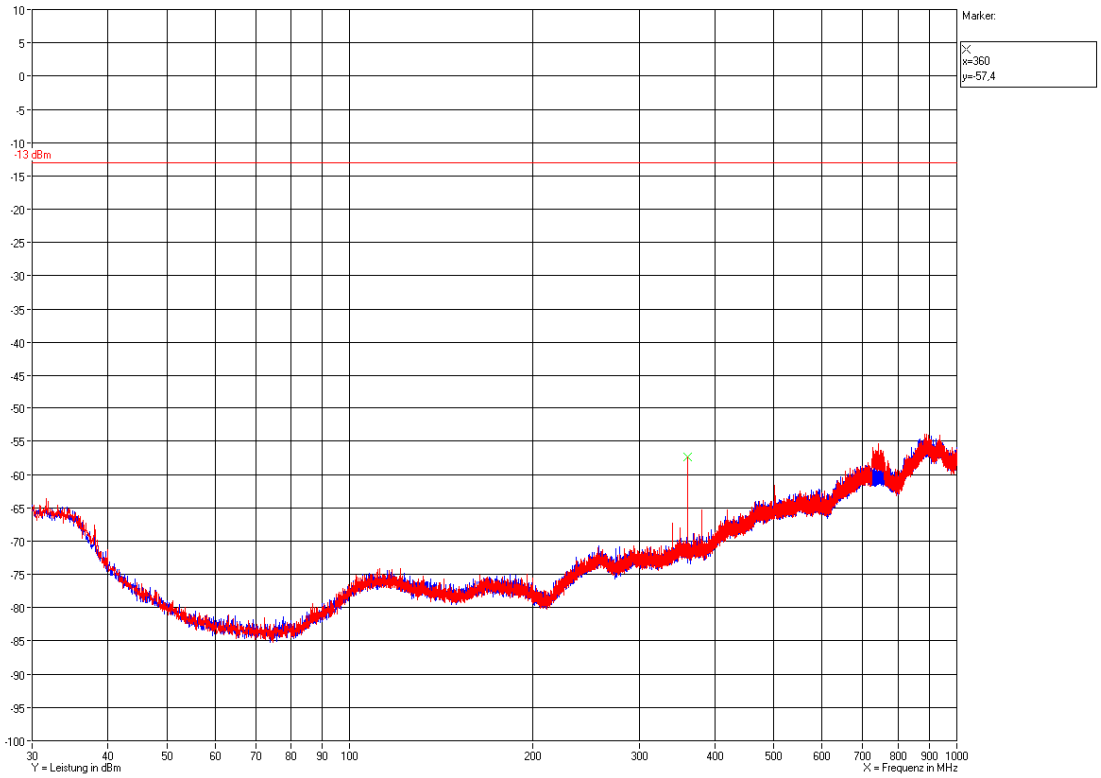
Temperature:	20°
Relative Humidity:	45%
Air-pressure:	1009hPa

11.4 Test results

11.4.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top)

Bottom 1930 MHz; Middle 1962.5 MHz; Top 1995 MHz

Horizontal / Vertikal



Measurement with Peak detector, BW 120KHz, Step width 60 kHz, dwell time 10ms

Antenna height: 1.55m; all positions of the turn table measured with max. hold function

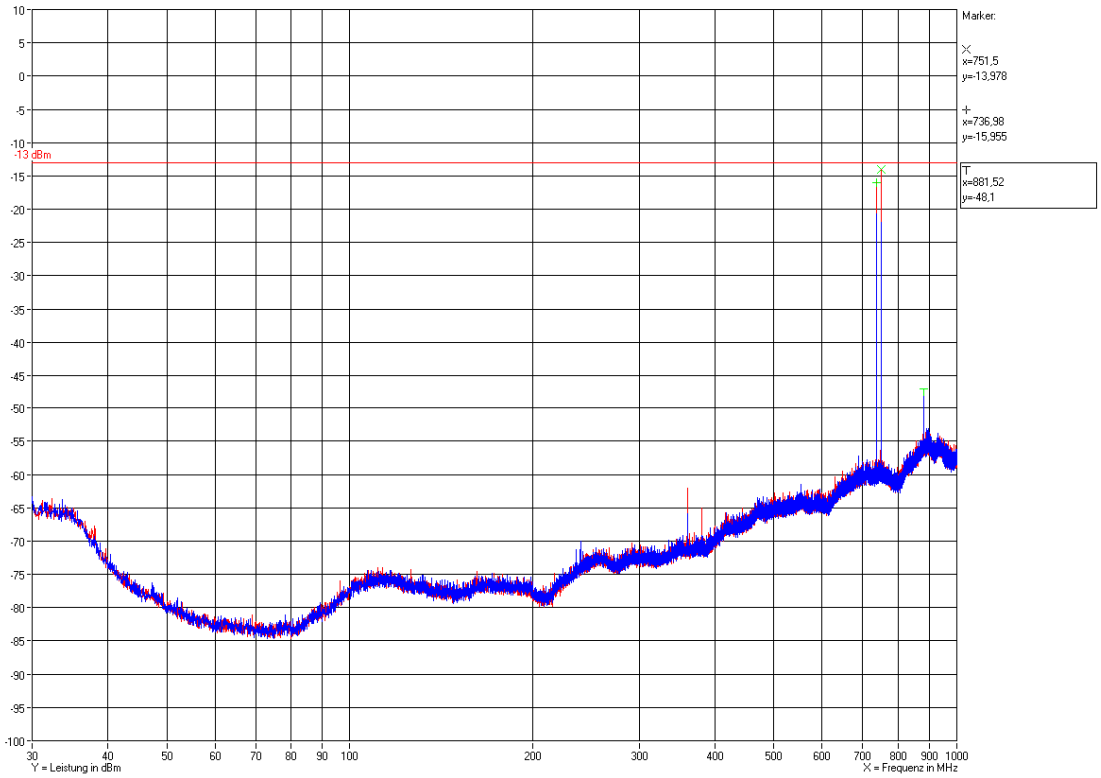
Polarization: Horizontal / Vertical

No unwanted emission detected 20dB above noise

11.4.2 30 MHz to 1 GHz Downlink (Middle of all paths)

Horizontal / Vertikal

F1: 751.5 MHz; F2: 737 MHz; F3: 881.5 MHz; F4: 1962.5 MHz



Measurement with Peak detector, BW 120KHz, Step width 60 kHz, dwell time 10ms

Antenna height: 1.55m; all positions of the turn table measured with max. hold function

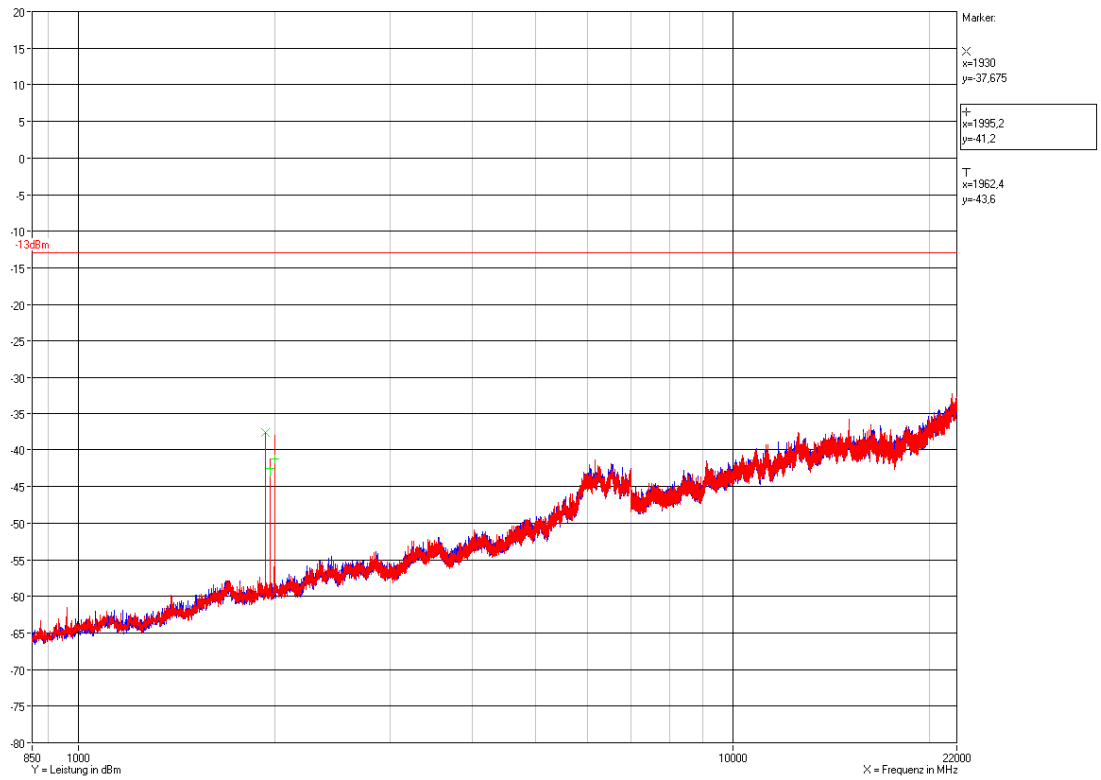
Polarization: Horizontal / Vertical

No unwanted emission detected 20dB above noise

11.4.3 1 – 22 GHz Downlink (Bottom – Middle – Top)

Bottom 1930 MHz; Middle 1962.5 MHz; Top 1995 MHz

Horizontal / Vertikal



Measurement with Peak detector, BW 1MHz, Step width 0,5 MHz, dwell time 10ms

Antenna height: 1.55m; all positions of the turn table measured with max. hold function

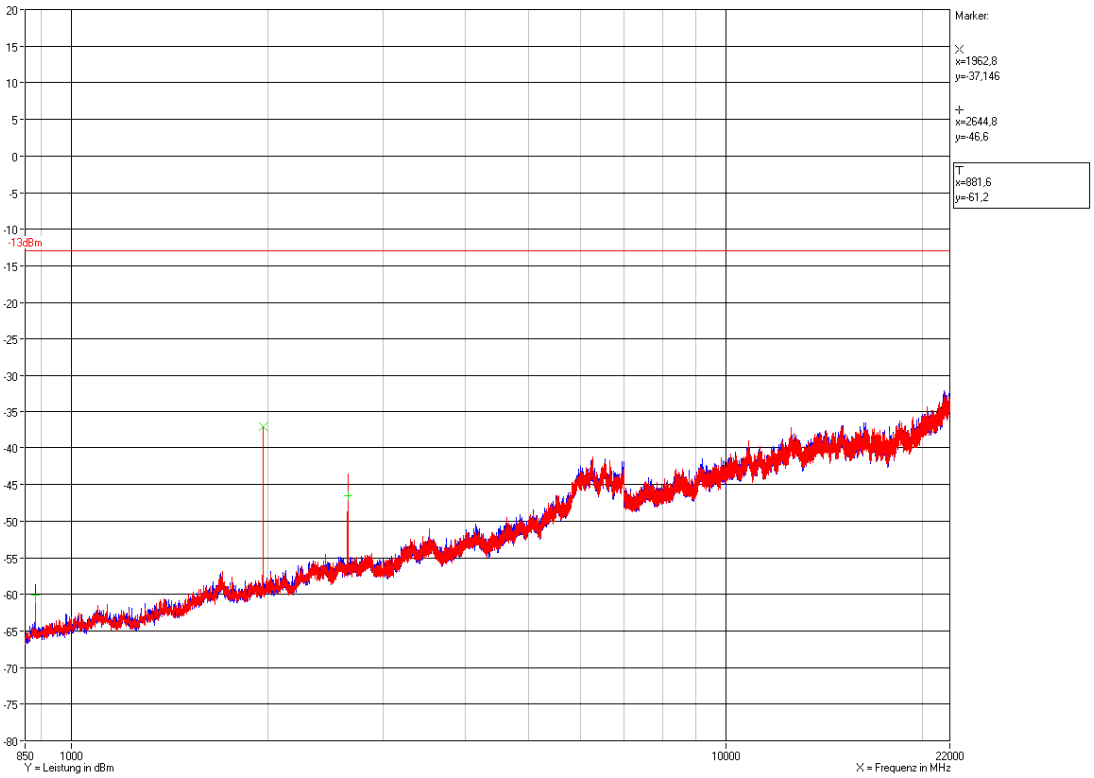
Polarization: Horizontal / Vertical

No unwanted emission detected 20dB above noise

11.4.4 1 – 22 GHz Downlink (Middle of all paths)

Horizontal / Vertikal

F1: 751.5 MHz; F2: 737 MHz; F3: 881.5 MHz; F4: 1962.5 MHz



Measurement with Peak detector, BW 1MHz, Step width 0,5 MHz, dwell time 10ms

Antenna height: 1.55m; all positions of the turn table measured with max. hold function

Polarization: Horizontal / Vertical

No unwanted emission detected 20dB above noise

Zahlmann; 09.05.12

11.4.5 History

Revision	Modification	Date	Name
V01.00	Initial Report	11.05.2012	T. Zahlmann

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