ECL-EMC Test Report No.: 11-250

Equipment under test: **ION-M7P/7P/85P/19P 2x 700MHz path**
FCC ID: **XS5-M778519P**
IC ID: **2237E-M778519P**
Type of test: **FCC 47 CFR Part 27 Subpart H, F: 2011**
Miscellaneous Wireless Communication Services
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*),
Part 27:2011 (Miscellaneous Wireless Communication Services),
ANSI/TIA-603-C:2004, *Land Mobile FM or PM Communications Equipment Measurement and Performance Standards*
IC-GEN:2007 General Requirements and Information for the Certification of Radiocommunication Equipment

Test result: **Passed**

Date of issue:	16.01.12			Signature:
Issue-No.:	02	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: 2012.01.16 16:06:05 +01'00'
Date of delivery:	17.10.11	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: 2012.01.16 16:08:59 +01'00'
Test dates:	14.10.11 – 10.01.12			
Pages:	36			

Manufacturer:	ANDREW Wireless Systems GmbH Industriering 10 D-86675 Buchdorf Tel.: +49 (0)9099 69 0 Fax: +49 (0)9099 69 140
Test Location:	TEMPTON Service Plus GmbH European Compliance Laboratory (ECL) Thurn-und-Taxis-Straße 18 D-90411 Nürnberg Tel.: +49 (0) 911 59835 0 Fax: +49 (0) 911 59835 90

General:
The purpose of this report is to show compliance to the FCC regulations for devices operating under Part 27 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

1 Test Results Summary

Name of Test	FCC Para. No.	FCC Method	FCC Spec.	Result
RF Power Output	27.50(b)(c)	2.1046	1000 Watts ERP	Complies
Occupied Bandwidth	2.1049	2.1049	Input/Output	Complies
Spurious Emissions at Antenna Terminals	27.53(c)(d)(g)	2.1051	-13dBm	Complies
Radiated Spurious emission	27.53(m)	2.1053 TIA/EA-603	-13dBm E.I.R.P	Complies
Frequency Stability	27.54	2.1055	Must stay in band	NA

Name of Test	IC Para. No.	IC Method	Result
RF Power Output	RSS-131 6.2	RSS-GEN 4.8	Complies
Occupied Bandwidth	RSS-Gen 6.3	RSS-GEN 4.6.1	Complies
Spurious Emissions at Antenna Terminals	RSS-131 6.4	RSS-GEN 4.9	Complies
Field Strength of Spurious Emissions	RSS-131 6.4	RSS-GEN 4.9 SRSP-513	Complies
Frequency Stability	RSS-131 6.5	RSS-GEN 4.7	NA

Frequency stability is given by: The system gets an electrical analog signal from the BSS which is converted in the master into 2 analog optical signals on 2 different frequencies. These signals are transmitted by optical links and then reconverted in the Remote Unit into 2 analog electrical signals with same frequency for each of the 2 transmitting sectors. During this process happens no frequency change/modification, as the oscillator responsible for both conversions is the same, so input and output have same frequency what can be seen under capture “Occupied Bandwith”.

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

2.1 Description

Kind of equipment	ION-M7P/7P/85P/19P
Andrew Ident. Number	7631019-0001
Serial no.(SN)	11
Revision	00
Software version and ID	n.a.
Type of modulation and Designator	LTE (G7D) ☒
Frequency Translation	F1-F1 ☒ F1-F2 ☐ N/A ☐
Band Selection	Software ☐ Duplexer ☒ Full band ☐

2.1.1 Downlink

Pass band	Path 728 MHz – 757 MHz
Max. composite output power based on one carrier per path (rated)	43 dBm = 20 W
System Gain*	10 dB @ Pout BTS of 33 dBm

*see 2.1.5

2.1.2 Uplink

Pass band	n. a.
System Gain*	n. a.

*see 2.1.5
Note: The EUT does not transmit over the air in the uplink direction.

2.1.3 Description of EUT

ION-M7P/7P/85P/19P is a LTE MIMO, 850 MHz, and1900 MHz CDMA/WCDMA multi-operator Remote Unit with various Extension Units. It is used in conjunction with a Master Unit in the ION optical distribution system. This system transports multiple LTE channels, a 850 MHz, and a 1900 MHz wideband signal simultaneously, providing a cost-effective solution for distributing capacity from one or more base stations.

The ION-M7P/7P/85P/19P consists of two identical 700 MHz paths with one antenna port each.
This Test Report describes only the approval of one path in the range 728 MHz – 757 MHz.
Each path covers Cellular 700, with the intended use of simultaneous transmission.

2.1.4 System diagram of EUT

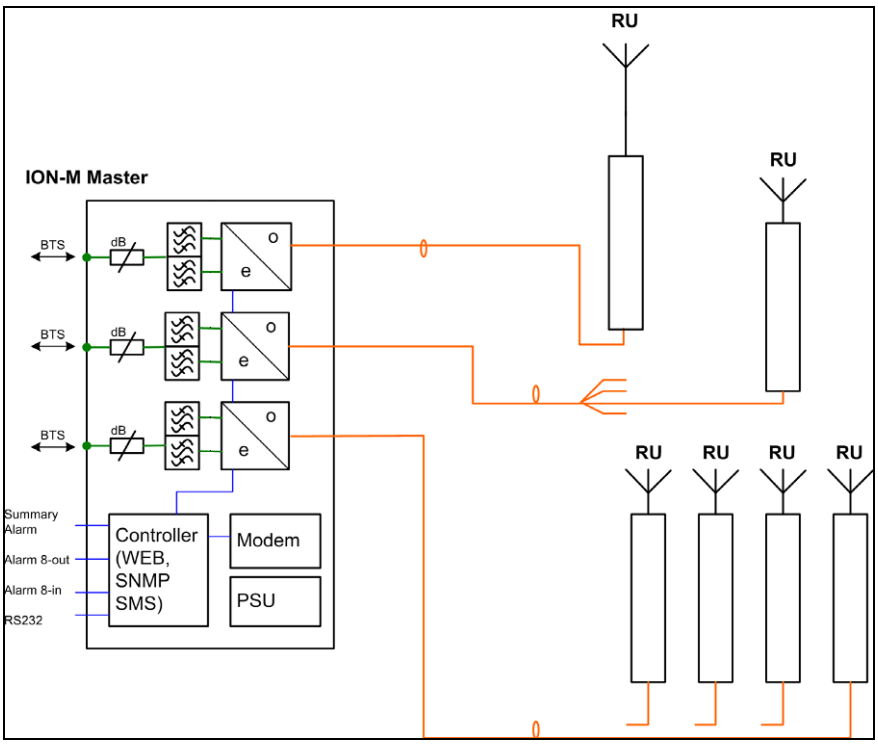


figure 2.1.4-#1 System diagram of EUT: EUT is Remote Unit (RU)

2.1.5 Block diagram of measurement reference points

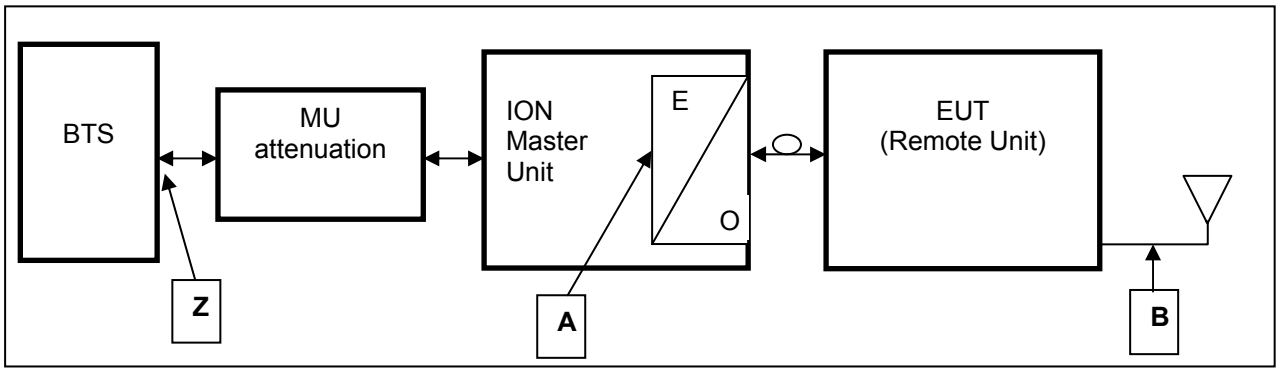


figure 2.1.5-#1 Block diagram of measurement reference points

Remote Unit is the EUT
O/E Optical / Electrical converter
SRMU Sub Rack Master Unit

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

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.

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
8372	Network Analyzer	8753D	HP	3410A08675	02/12
8890	Spectrum Analyzer	FSP	R&S	100674	08/12
8736	Spectrum Analyzer	FSIQ-26	R&S	100290	12/11
9069	Signal Generator	SMBV100A	R&S	256275	08/12
7412	Power Attenuator	769-30	Narda	09741	CIU
7416	Divider	2way	Andrew	4943	CIU
7414	RF-Cable	1,0m; N-N	Andrew	---	CIU
7415	RF-Cable	2,0m; N-N	Andrew	---	CIU
7418	RF-Cable	0,6m; SMA	Huber & Suhner	---	CIU
7419	RF-Cable	0,6m; SMA	Huber & Suhner	---	CIU
7417	RF-Cable	1,0m; SMA	Huber & Suhner	---	CIU
7413	RF-Cable	1,0m; SMA	Huber & Suhner	---	CIU

CIU = Calibrate in use

3.3 Input and output losses

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

3.4 Measurement uncertainty

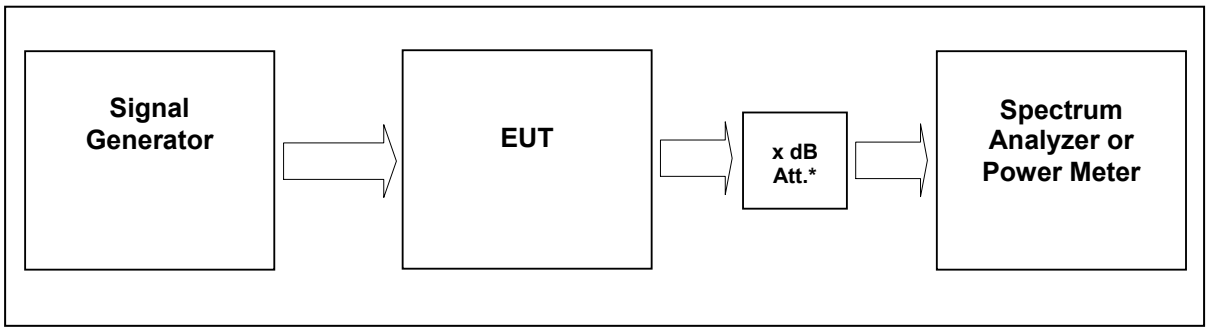
The extended measurement uncertainty corresponds to the measurement results from the standard measurement uncertainty multiplied by the coverage factor k=2. The true value is located in the corresponding interval with a probability of 95 %.

4 Test site (TEMPTON)

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

See relevant dates under 8 (Radiated Spurious Emissions at the ECL (TEMPTON): §27.53, §2.1053, RSS-Gen, RSS-131**) of this test report.**

5 RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN



External Attenuator DL x dB = 30 dB

figure 5-#1 Test setup: RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN

Measurement uncertainty	± 0,38 dB
Test equipment used	8372, 8890, 8736, 9069, 7412, 7416, 7414, 7415, 7418, 7419, 7417, 7413

5.1 Limit

Minimum standard:
Para. No.27.50(b)(4), (c)(1)(3)
(b) The following power and antenna height limits apply to transmitters operating in the 746–763 MHz,775–793 MHz and 805–806 MHz bands:

(4) Fixed and base stations transmitting a signal in the 746–757 MHz, 758–763 MHz, 776–787 MHz, and 788–793 MHz bands with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP accordance with Table 3 of this section.

Para. No.27.50(c)(1 and 3)

(c) The following power and antenna height requirements apply to stations transmitting in the 698–746 MHz band:

(1) Fixed and base stations transmitting a signal with an emission bandwidth of 1 MHz or less must not exceed an effective radiated power (ERP) of 1000 watts and an antenna height of 305 m height above average terrain (HAAT), except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts ERP in accordance with Table 1 of this section;

(3) Fixed and base stations transmitting a signal with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz and an antenna height of 305 m HAAT, except that antenna heights greater than 305 m HAAT are permitted if power levels are reduced below 1000 watts/MHz ERP in accordance with Table 3 of this section;

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 test conditions 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 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	Path	RBW VBW Span	RF Power (dBm)	RF Power (W)	Plot #
LTE	Middle Band 12	737 MHz, MIMO	3MHz 10MHz 15MHz	43.0	20	5.3.1.1 #1
LTE	Middle Band 13	751,5 MHz, MIMO	3MHz 10MHz 15MHz	43.0	20	5.3.1.2 #1
Maximum output power = 43.0 dBm = 20 W						
Limit Maximum output power = 1000 W ERP						

table 5.3.1-#1 RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN Test Results Downlink

The max RF Power out is 43.0 dBm, so the maximum antenna gain (x) can be calculated as follow:

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

60 dBm **>** 43 dBm + x

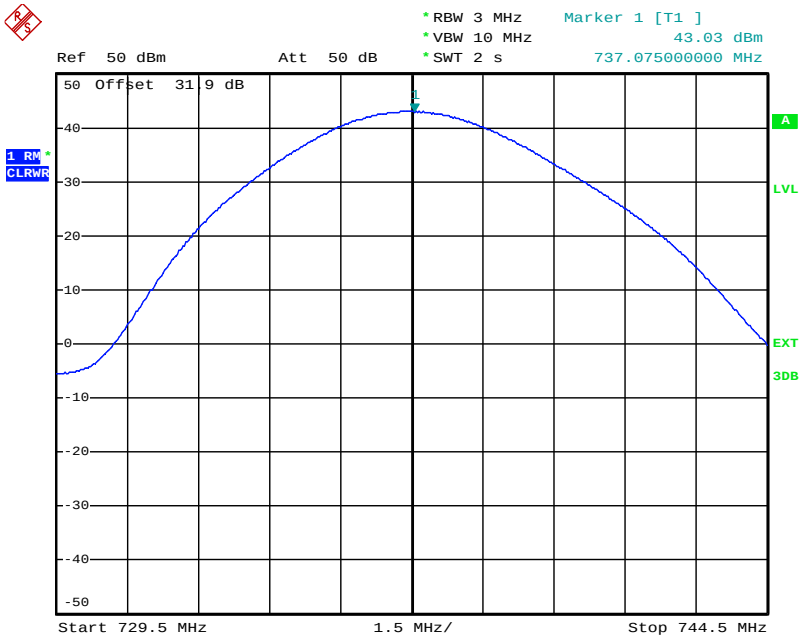
17 dBd = 19.15 dBi > x

=> The antenna that will use for the complete system have to have a gain lower than 19 dBi, relative to a dipol.

Modulation	Pin / dBm (Ref. point A)
LTE	7.3
LTE	7.5

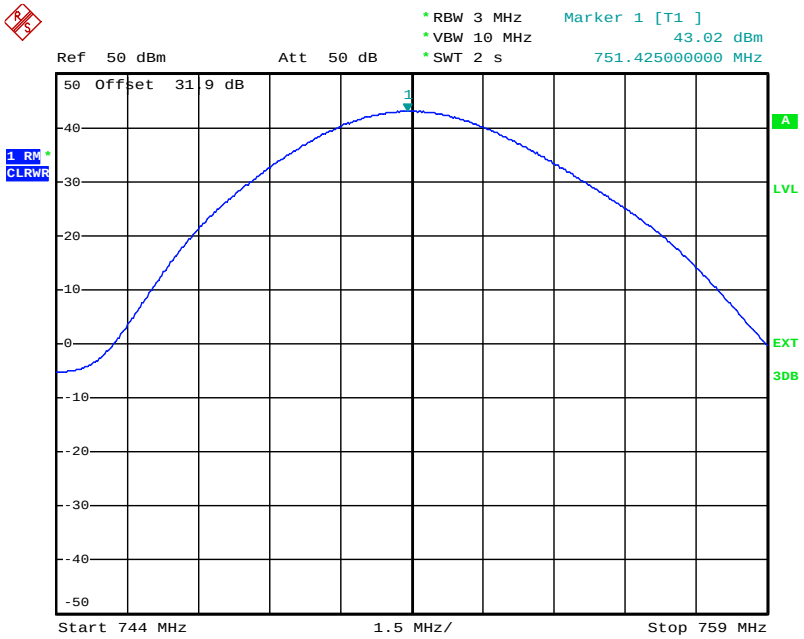
table 5.3.1-#2 RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN Test Results Downlink Input power Middle

5.3.1.1 LTE 728 – 746MHz, MIMO



plot 5.3.1.1-#1 RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN; Test Results; Downlink; LTE 728 – 746MHz, MIMO Middle

5.3.1.2 LTE 746 – 757MHz, MIMO



plot 5.3.1.2-#1 RF Power Out: §27.50, §2.1046; RSS-131, RSS-GEN; Test Results; Downlink; LTE 746 – 757MHz, MIMO Middle

5.3.2 Uplink

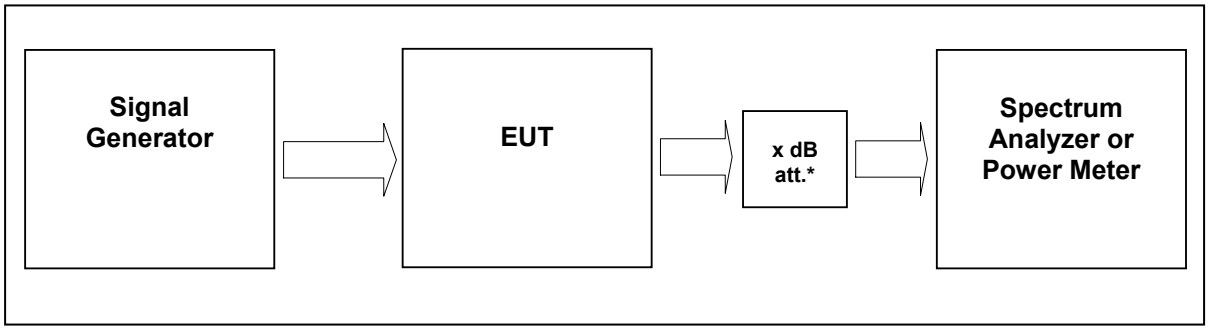
n.a.

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:	Ph. Wagner
Date:	14.10.2011

6 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN



External Attenuator DL x dB = 30 dB

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

Measurement uncertainty	± 0,38 dB
Test equipment used	8372, 8890, 8736, 9069, 7412, 7416, 7414, 7415, 7418, 7419, 7417, 7413

6.1 Limit

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

6.2 Test method

Para. No.2.1049

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

6.3 Test results

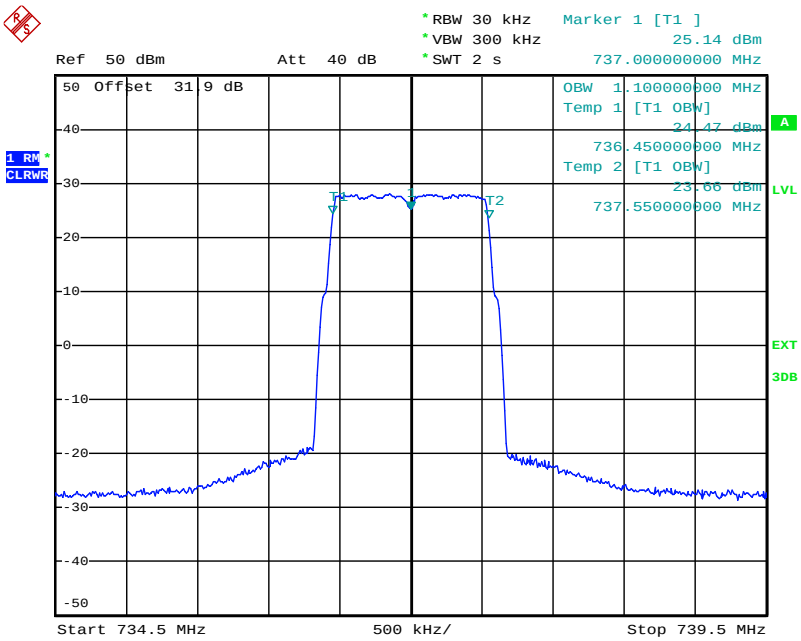
6.3.1 Downlink

Detector RMS.

Modulation	Measured at	Path	RBW VBW Span	Occupied Bandwidth / MHz	Plot #
LTE	Middle	737 MHz, MIMO	30 kHz 300 kHz 5 MHz	1.1	6.3.1.1 #1, #2
LTE	Middle	751,5 MHz, MIMO	30 kHz 300 kHz 5 MHz	1.1	6.3.1.2 #1, #2

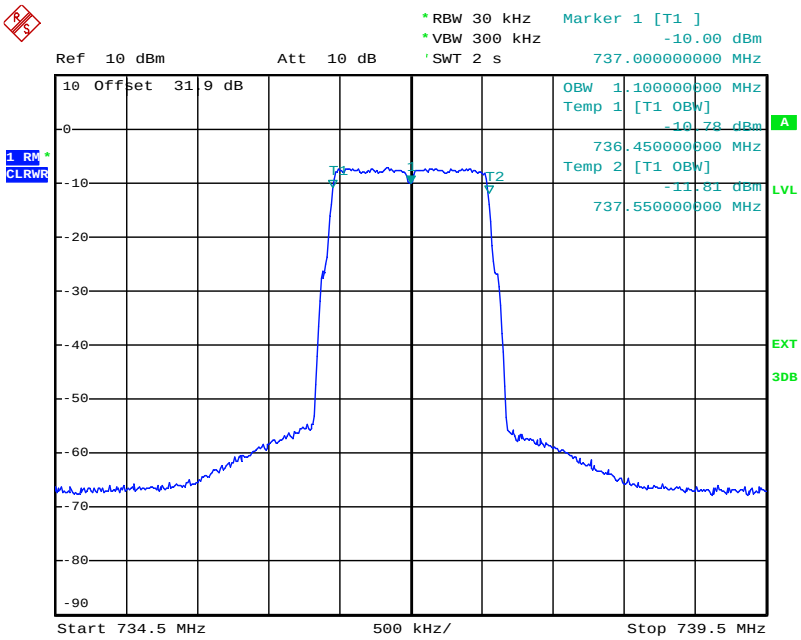
table 6.3-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN Test results

6.3.1.1 LTE 728 – 746MHz MIMO



Date: 14.OCT.2011 09:58:27

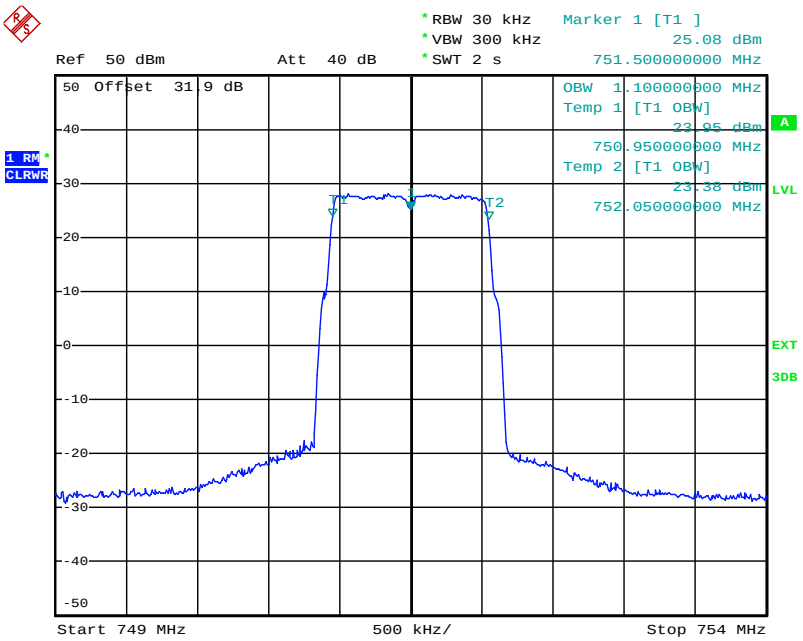
plot 6.3.1.1-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; LTE 728 – 746MHz MIMO Output



Date: 14.OCT.2011 10:00:57

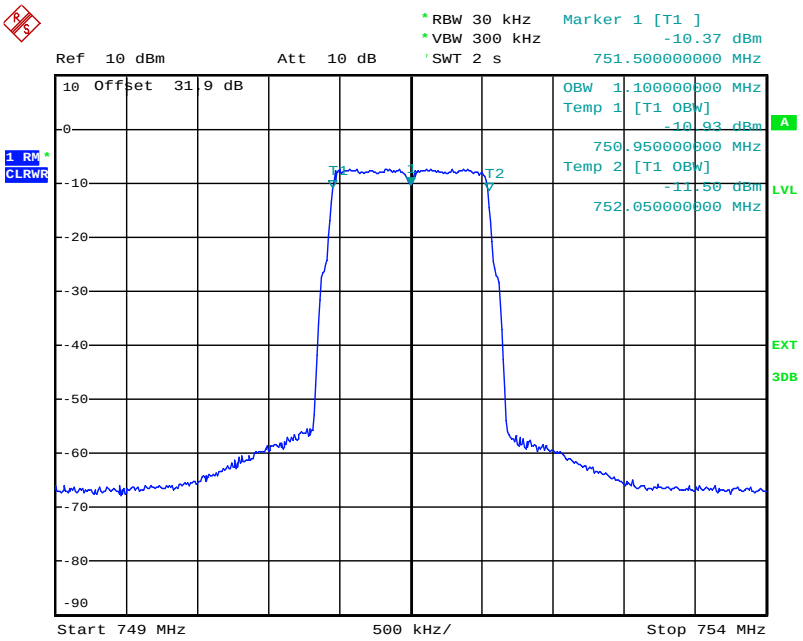
plot 6.3.1.1-#2 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; LTE 728 – 746MHz MIMO Input

6.3.1.2 LTE 746 – 757MHz MIMO



Date: 14.OCT.2011 09:44:56

plot 6.3.1.2-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; LTE 746 – 757MHz MIMO Output



Date: 14.OCT.2011 09:46:43

plot 6.3.1.2-#2 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; LTE 746 – 757MHz MIMO Input

Uplink

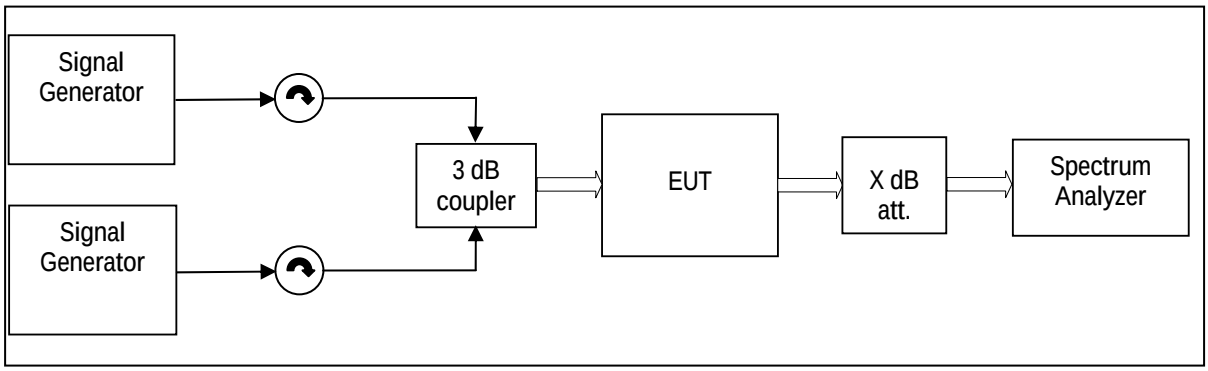
n.a.

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

6.4 Summary test result

Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	14.10.2011

7 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN



External Attenuator DL x dB = 30 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §27.53, §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	8372, 8890, 8736, 9069, 7412, 7416, 7414, 7415, 7418, 7419, 7417, 7413	

7.1 Limit

Minimum standard:
Para. No.27.53 (c) and (g)
(c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:
(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB;
(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;
(g) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed

Para. No.27.53(f)
For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation. (see 7.3.1.5)

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.

Modu-lation	Measured at Band Edge	Carriers		RBW VBW Span	Max. level (dBm)	Plot #
LTE	Lower Edge	728,7 MHz 730,1 MHz	MIMO	30kHz 300kHz 6MHz	-19.41	7.3.1.1
						#1
	Upper Edge	743,9 MHz 745,3 MHz				7.3.1.1
						#2
LTE	Lower Edge	746,7 MHz 748,1 MHz		30kHz 300kHz 6MHz	-19.53	7.3.1.2
						#1
	Upper Edge	754,9 MHz 756,3 MHz				7.3.1.2
						#2

table 7.3-#1 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN Test results <1MHz from Band

The Emission limit is -13dBm. maximum measured emission level is -20,42dBm: passed.

>1MHz from Band Edge

Detector: RMS.

Modulation	Carrier	RBW VBW Span	Max. level (dBm)	Plot -
LTE	737 MHz	1MHz 3MHz 30MHz – 8GHz	-34.07	7.3.1.3
				#1
LTE	751,5 MHz	1MHz 3MHz 30MHz – 8GHz	-34.27	7.3.1.4
				#1

table 7.3-#2 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN Test results >1MHz from Band Edge

Calculation of the limit according to §27.53 (c)(3) On all frequencies between 763–775 MHz and 793–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment:
Pout = 43dBm = 20W.

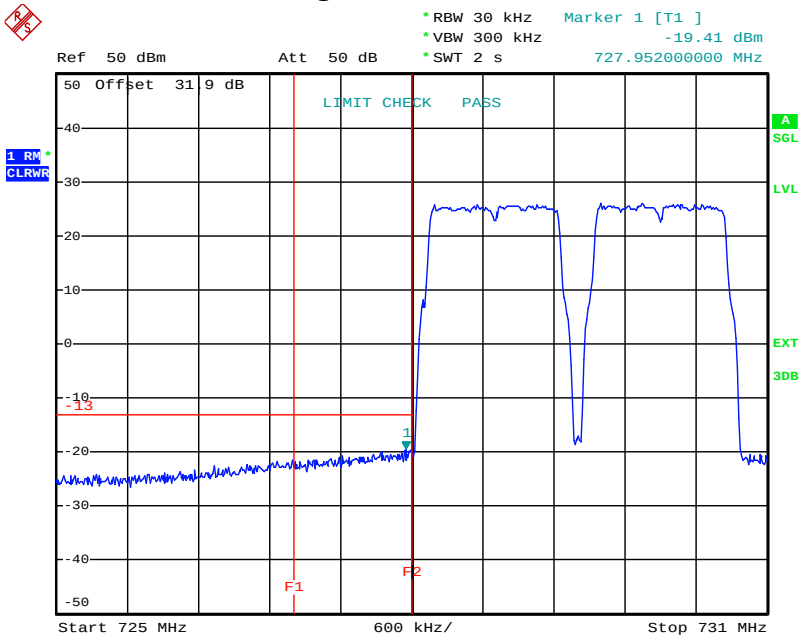
76+ 10*log(20W/1W) dB = 89 dB Attenuation => 43dBm – 89dB = -46 dBm in a 6.25 kHz band segment
Spurious measured in the plot with a RBW of 1MHz so the limit is calculated:

=> -46dBm / 6,25kHz + 10*log(1MHz/6,25kHz) = -23,96dBm / 1MHz

The Emission limit is -13dBm.

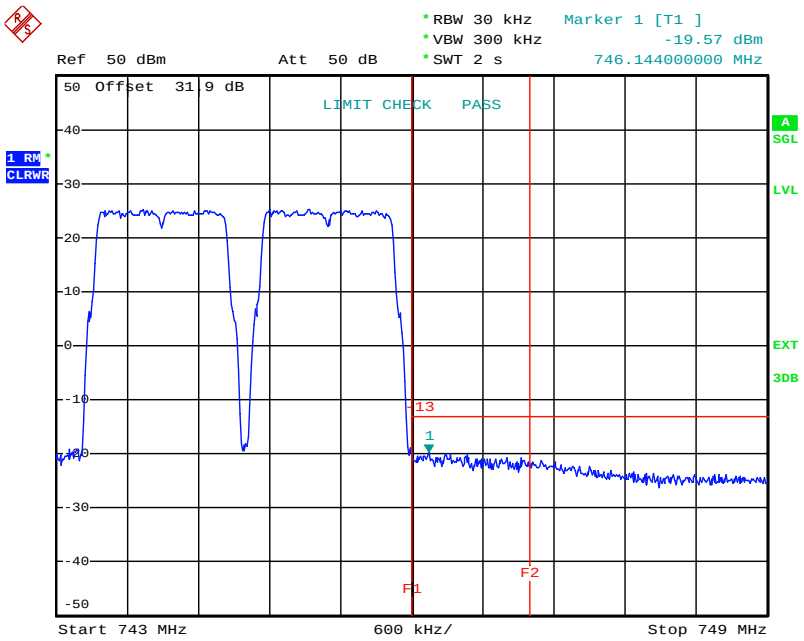
maximum measured emission level is -37,04 dBm / 1MHz: passed.

7.3.1.1 LTE < 1MHz to band edge 728 – 746MHz, MIMO



Date: 14.OCT.2011 11:13:49

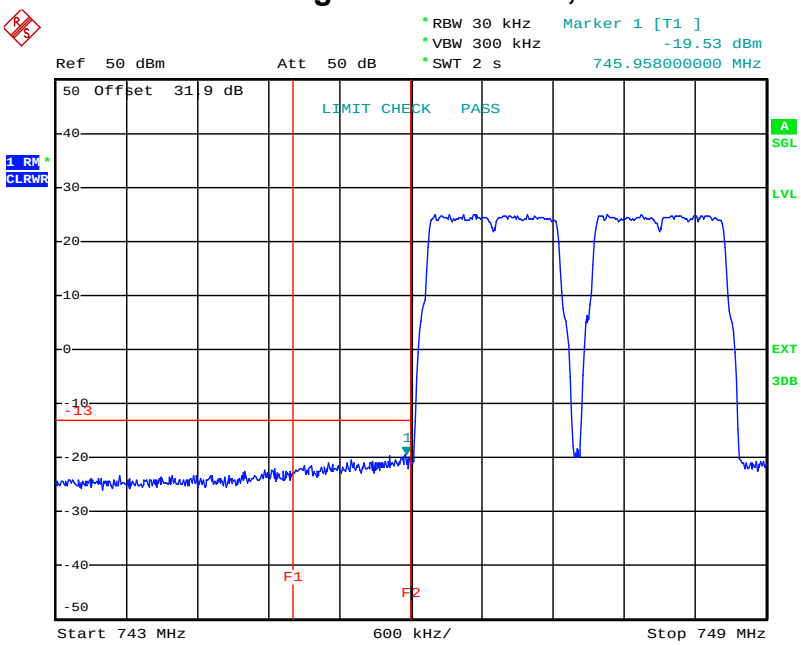
plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge 728 – 746MHz, MIMO Lower Band Edge



Date: 14.OCT.2011 11:01:21

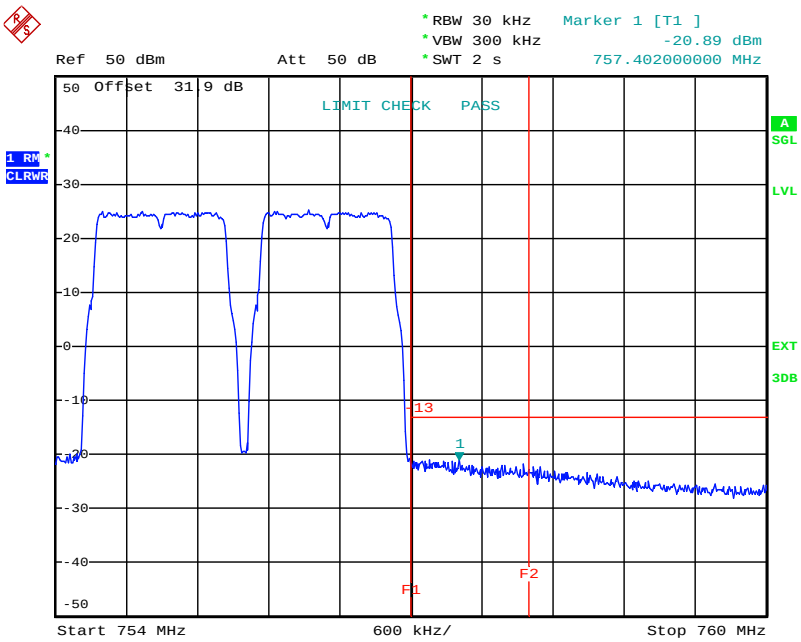
plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge 728 – 746MHz, MIMO Upper Band Edge

7.3.1.2 LTE < 1MHz to band edge 746 – 757MHz, MIMO



Date: 14.OCT.2011 11:18:25

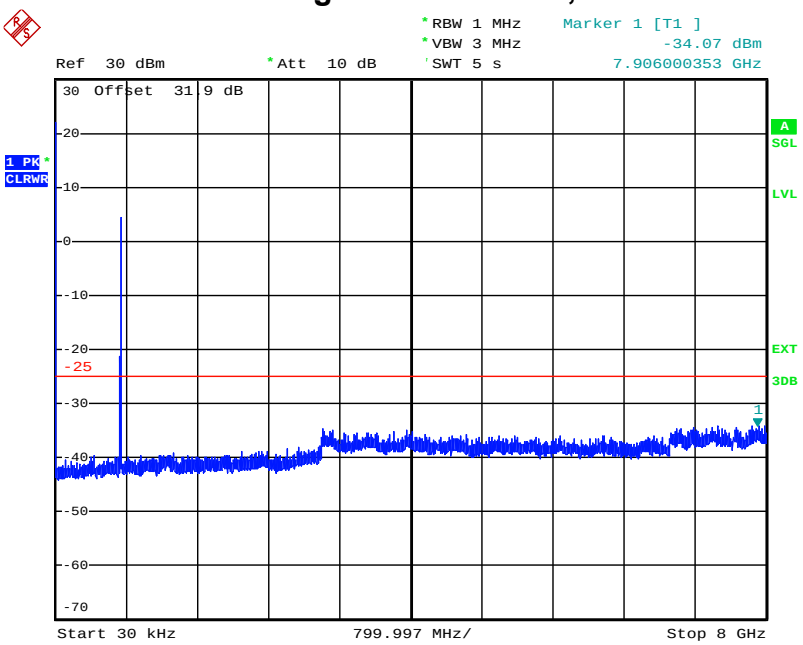
plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge 746 – 757MHz, MIMO Lower Band Edge



Date: 14.OCT.2011 11:24:50

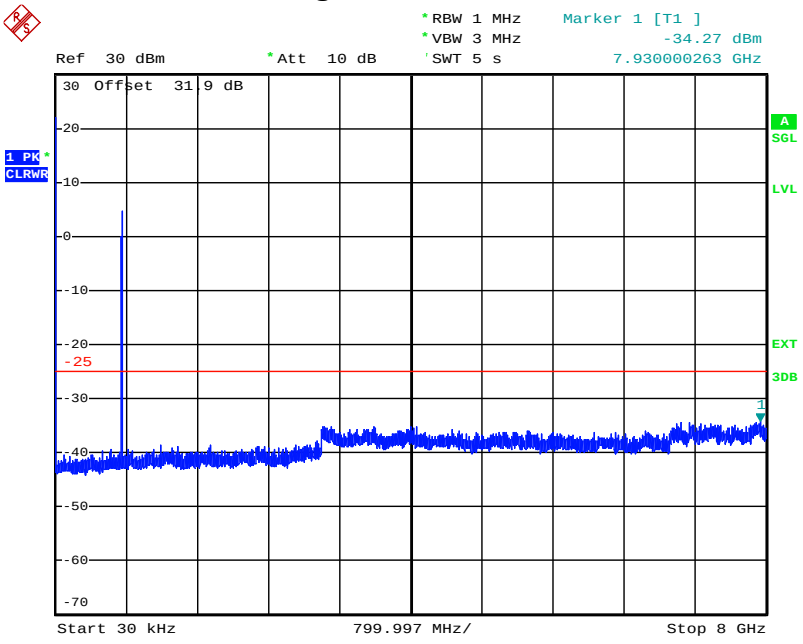
plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE < 1MHz to band edge 746 – 757MHz, MIMO Upper Band Edge

7.3.1.3 LTE > 1MHz to band edge 728 – 746MHz, MIMO



plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE > 1MHz to band edge 728 – 746MHz, MIMO; carrier notched

7.3.1.4 LTE > 1MHz to band edge 746 – 757MHz, MIMO



plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §27.53, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; LTE > 1MHz to band edge 746 – 757MHz, MIMO; carrier notched

7.3.1.5 Measurement in the band of 1559 MHz – 1610 MHz

7.3.2 Uplink

n.a.

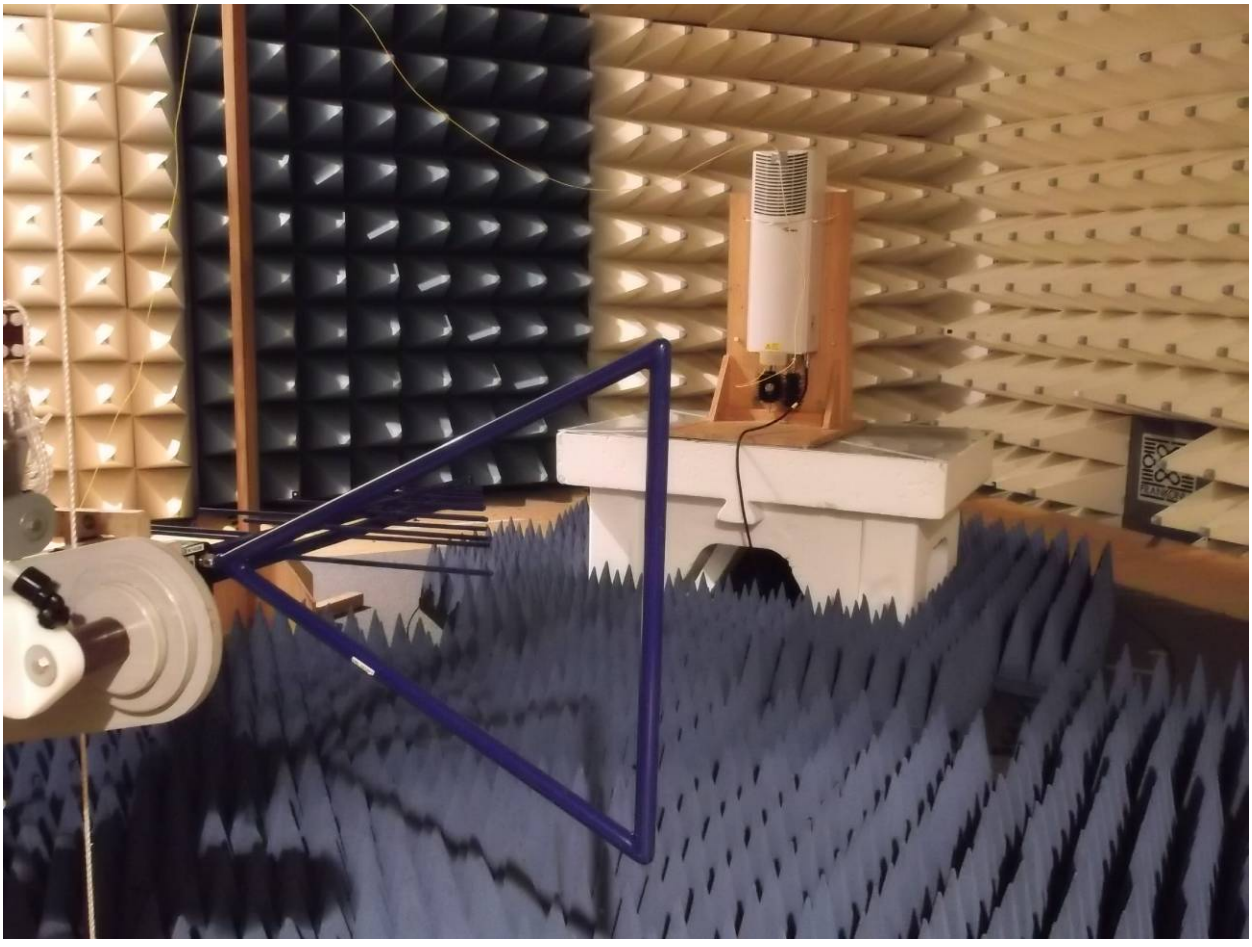
Note: The EUT does not transmit over the air in the uplink direction.

7.4 Summary test result

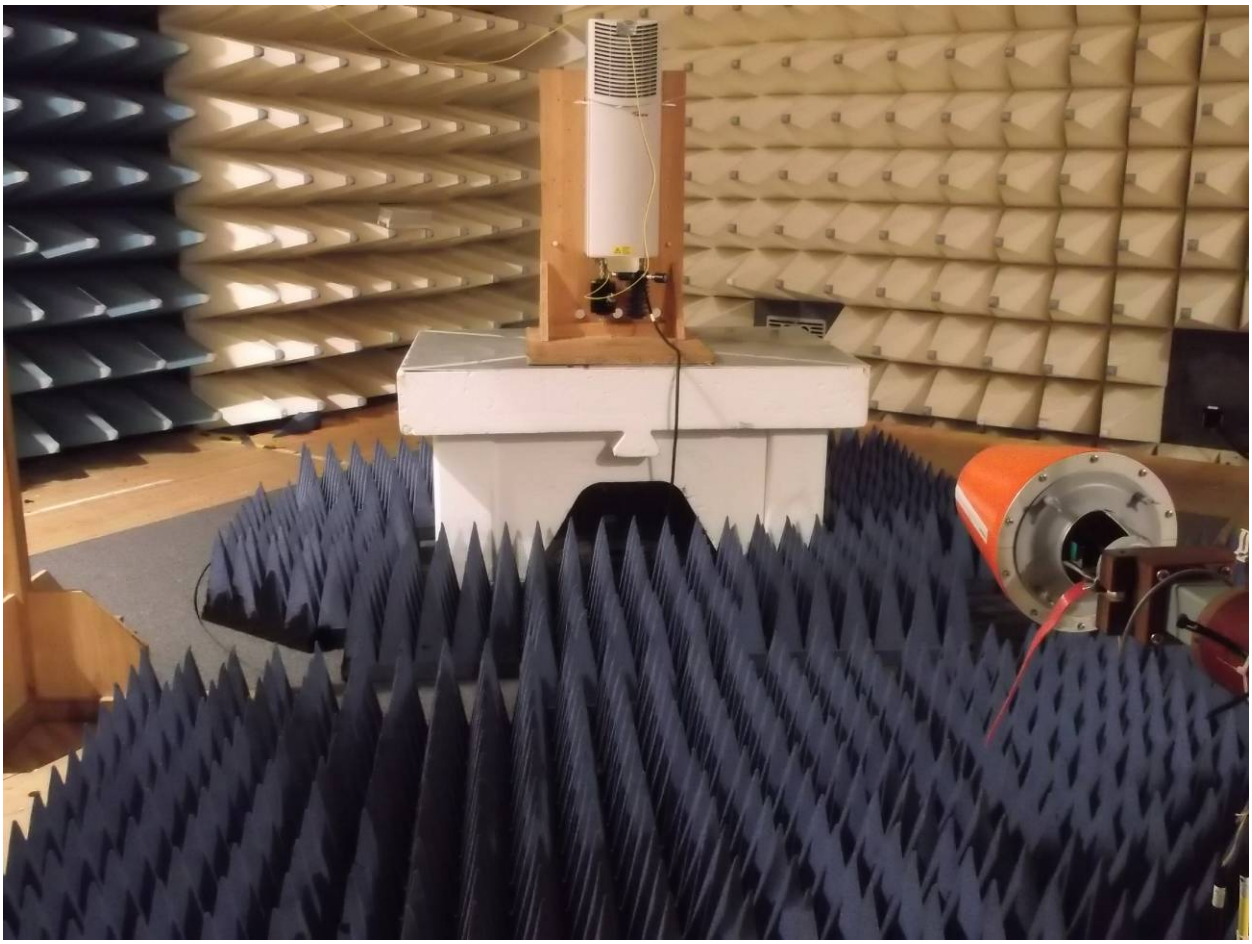
Test result	complies, according the plots above
Tested by:	Ph. Wagner
Date:	14.10.2011 and 10.01.2012

8 Radiated Spurious Emissions at the ECL (TEMPTON): §27.53, §2.1053, RSS-Gen, RSS-131

picture 8.1: EUT



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 – 20 GHz	3 metres / FAC	FCC 47 CFR Part 27.53 IC RSS-131 sec. 4.4	TIA/EIA-603-C:2004

Test equipment used:

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.-date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1607	23.05.2011	23.05.2012	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
Pre amplifier	AM1431	Miteq	K1721	14.07.2011	14.07.2012	X
Antenna	HL 025	R&S	K809	25.07.2011	25.07.2012	X
RF Cable	Sucoflex 100	Suhner	K1742	05.04.2011	05.04.2012	X
Preamplifier	AFS4-00102000	Miteq	K838	09.02.2011	09.02.2012	X

The REMI version 2.135 has been used to maximize radiated emission from the EUT with regards to ANSI C63.4:2009.

Test set-up:

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

Measurement uncertainty:

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

8.1 Method of Measurement

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

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

From KDB (AMPLIFIER, BOOSTER, AND REPEATER REMINDER SHEET):
Radiated spurs (enclosure) – Use of CW signal (low, mid. and high freq.) is acceptable rather than all modulations.
The Bottom/Middle/Top frequencies for Part 27 F/H are as follows:

- 728/737/746 MHz (§27 Subpart H)
- 746/755/763 MHz (§27 Subpart F)

The maximum RFI field strength was determined during the measurement by rotating the turntable (±180 degrees) 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 width during the measurement was half the RBW.

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

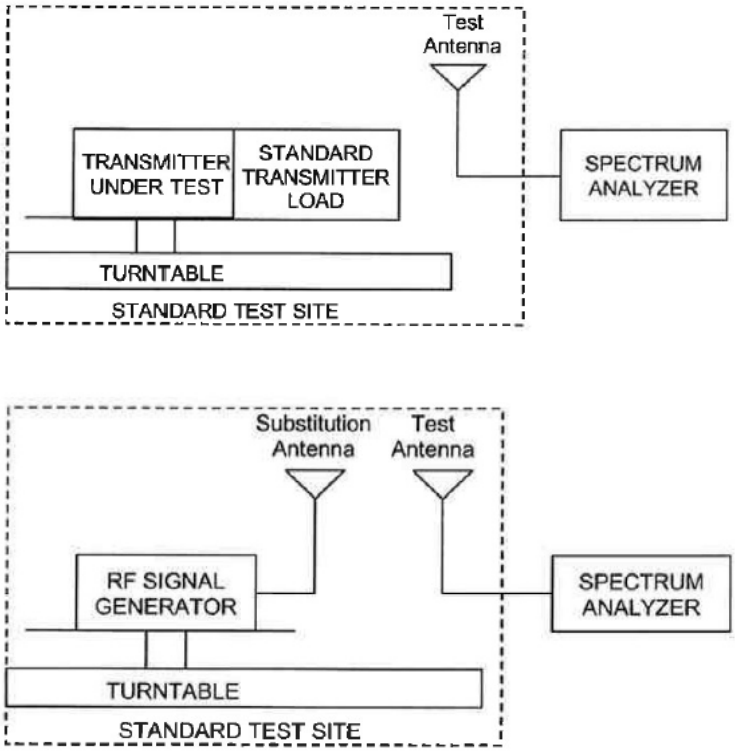


Figure #8.3 Substitution methods TIA/EIA-603-C

8.2 Limit

§27.53 Emission limitations / RSS-GEN sec. 4.9; RSS-131 sec. 4.4

Minimum standard:
Para. No.27.53 (c/d/g)

(c) For operations in the 746–758 MHz band and the 776–788 MHz band, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On any frequency outside the 746–758 MHz band, the power of any emission shall be attenuated outside the band below the transmitter power (P) by at least 43 + 10 log (P) dB.

(g) For operations in the 698–746 MHz band, the power of any emission outside a licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, by at least 43 + 10 log (P) dB. Compliance with this provision is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kilohertz or greater. However, in the 100 kilohertz bands immediately outside and adjacent to a licensee's frequency block, a resolution bandwidth of at least 30 kHz may be employed

The Emission limit is **-13dBm**.

(d) For operations in the 758–763 MHz and 788–793 MHz bands, the power of any emission outside the licensee's frequency bands of operation shall be attenuated below the transmitter power (P) within the licensed band(s) of operation, measured in watts, in accordance with the following:

(1) On all frequencies between 769–775 MHz and 799–805 MHz, by a factor not less than 76 + 10 log (P) dB in a 6.25 kHz band segment, for base and fixed stations;

The Emission limit is:

- **-33dBm** for measurements up to 1GHz
- **-24dBm** for measurements above 1 GHz

These Values have been calculated by a formula, which was a result of an inquiry (No. 141765) of the KDB:

$$Limit = P_{OUT} - (76 + 10LOG(P_{OUT}) - 10LOG(Bwdth / 6.25kHz))$$

8.3 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	Average

8.4 Climatic values in the lab

Temperature	18,5°C
Relative Humidity	45%
Air-pressure	1014 hPa

8.5 Test results

8.5.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top) Subpart H

Bottom: 728MHz; Middle: 737MHz; Top: 746MHz

Vertical / Horizontal

8.5.2 30 MHz to 1 GHz Downlink (Bottom – Middle – Top) Subpart F

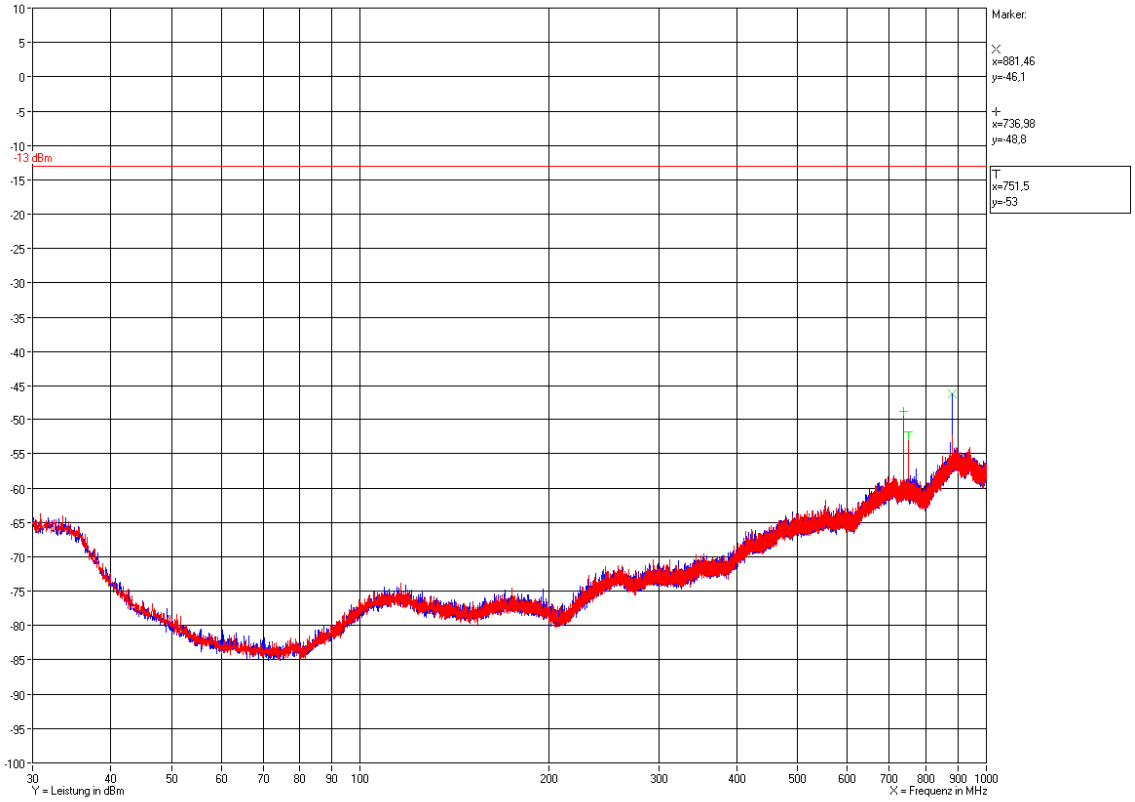
Bottom: 746MHz; Middle: 751,5MHz; Top: 757MHz

Vertical / Horizontal

8.5.3 30 MHz to 1 GHz Downlink (middle of all carrier)

737 MHz + 751.5 MHz + 881.5 MHz + 1982.5 MHz

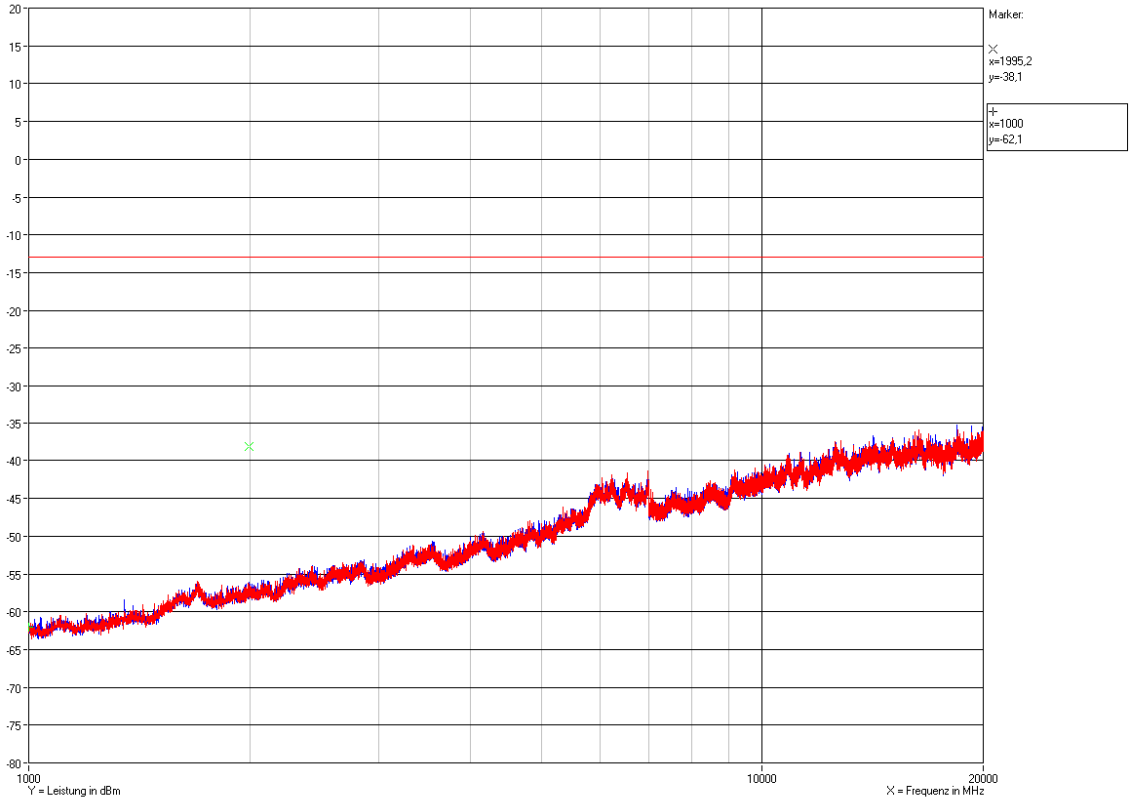
Vertical / Horizontal



8.5.4 1 GHz to 20 GHz Downlink (Bottom – Middle – Top) Subpart H

Bottom: 728MHz; Middle: 737MHz; Top: 746MHz

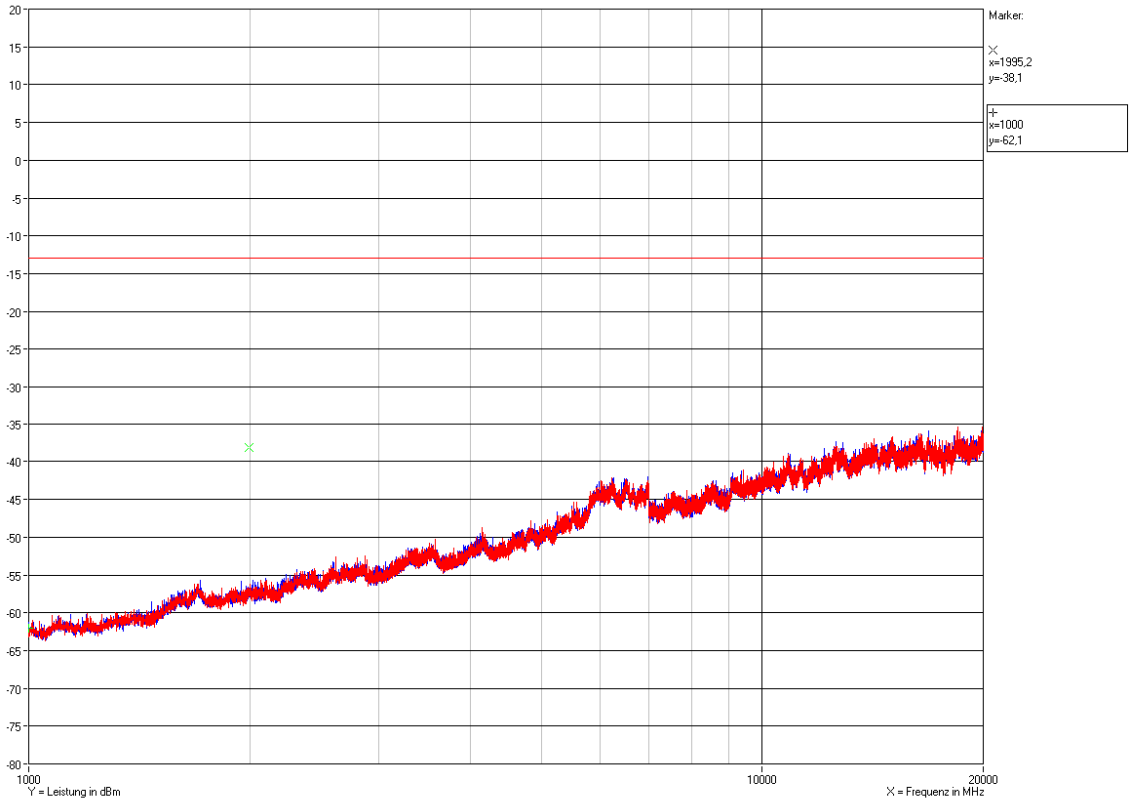
Vertical / Horizontal



8.5.5 1 GHz to 20 GHz Downlink (Bottom – Middle – Top) Subpart F

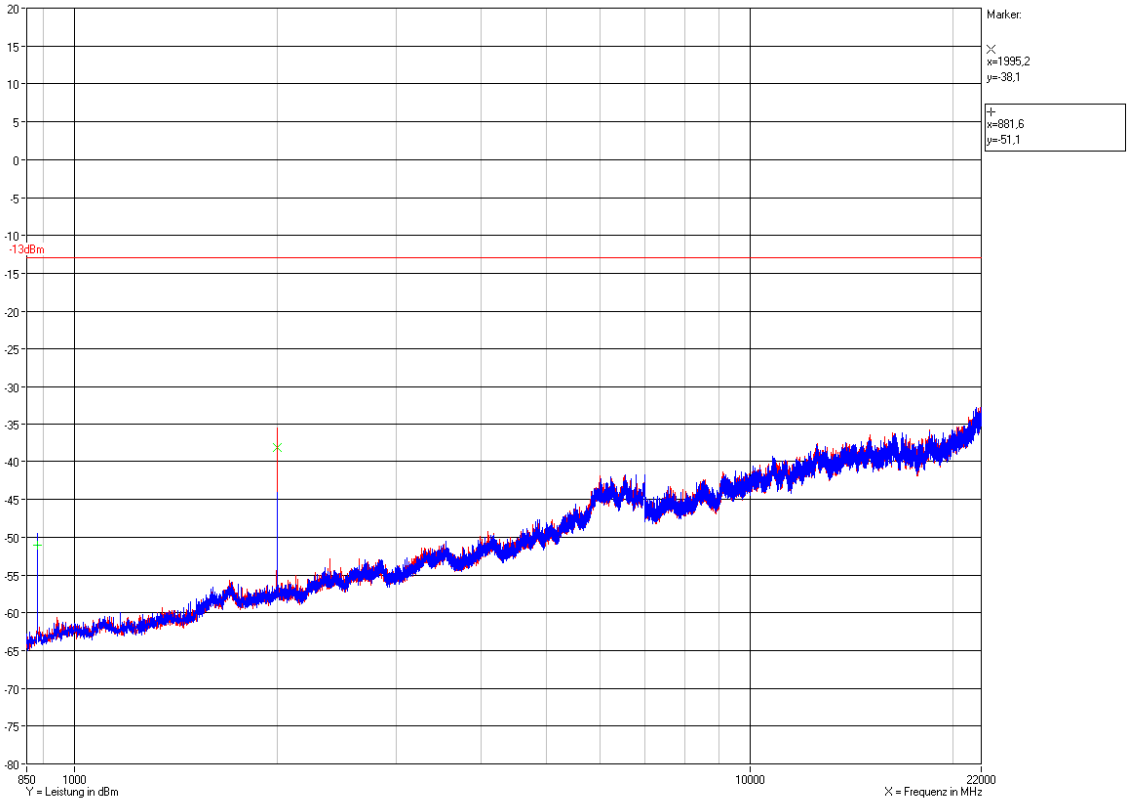
Bottom: 746MHz; Middle: 751.5MHz; Top: 757MHz

Vertical / Horizontal



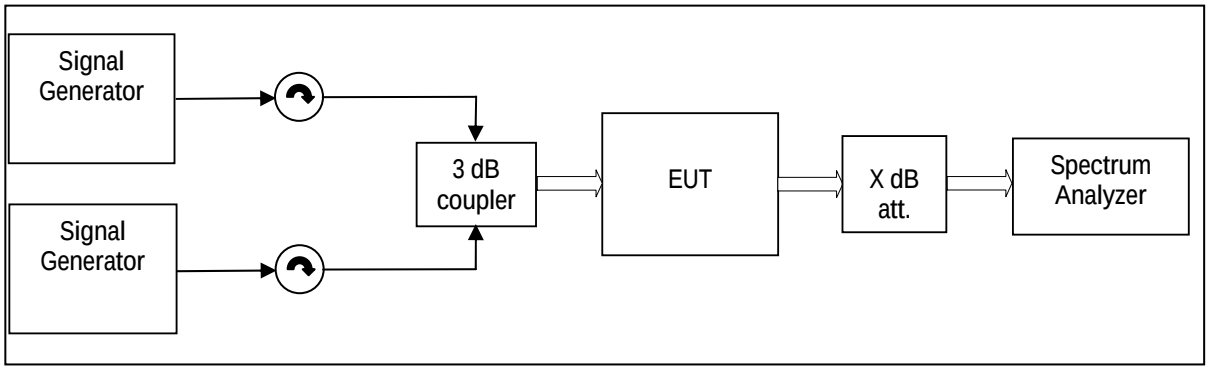
8.5.6 1 GHz to 20 GHz Downlink (middle of all carrier)

737 MHz + 751.5 MHz + 881.5 MHz + 1982.5 MHz



Zahlmann / 18.10.2011

8.5.7 Measurement in the band of 1559 MHz – 1610 MHz



External Attenuator DL x dB = 30 dB

figure 8-#1 Test setup: Radiated Spurious Emissions at the ECL (TEMPTON): §27.53, §2.1053, RSS-Gen, 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 26 GHz
Test equipment used	8372, 8890, 8736, 9069, 7412, 7416, 7414, 7415, 7418, 7419, 7417, 7413	

8.5.7.1 Limit

Minimum standard:
Para. No.27.53(f)
For operations in the 746–763 MHz, 775–793 MHz, and 805–806 MHz bands, emissions in the band 1559–1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. For the purpose of equipment authorization, a transmitter shall be tested with an antenna that is representative of the type that will be used with the equipment in normal operation.

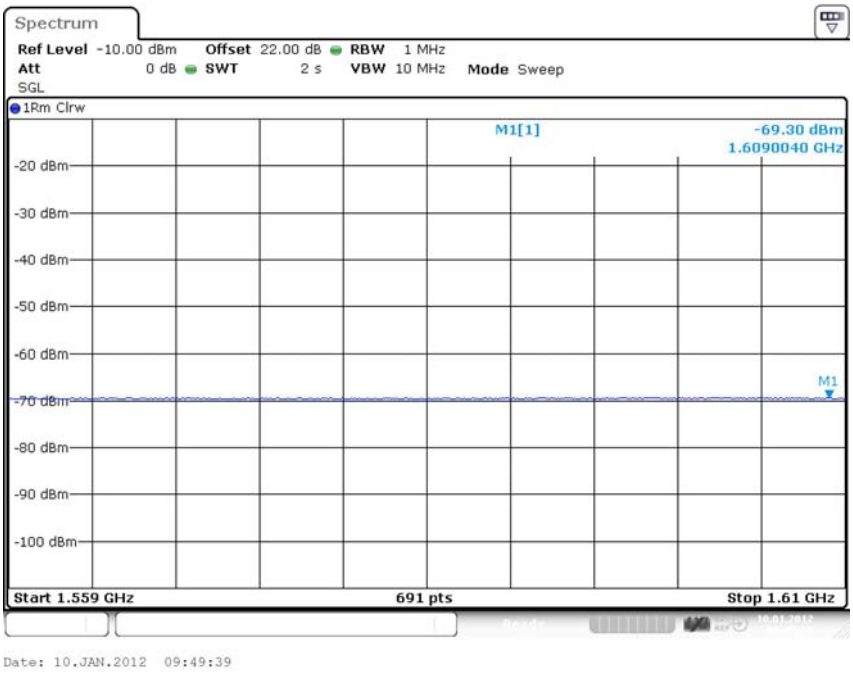
8.5.7.2 Test method

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]

8.5.7.3 Measurement

Limit is: −70 dBW/MHz = -40 dBm/MHz

To see if the standard 27.53(f) were met a calculation of the radiated power is necessary. The modulated carrier in the range of 747-757 MHz is working with maximum power of 43dBm and the frequency range of 1559-1610MHz is measured. For the calculation of the radiated power in this band, it was calculated with a typical antenna gain and typical cable loss.



plot 8.5.7.3 Spurious Emissions at Antenna Terminals; Measurement in the band of 1559 MHz – 1610 MHz; Measurement in the band of 1559 – 1610 MHz

Used 700 MHz narrow band antennas offer a gain of 0 dBi in the in the frequency range 1559 - 1610 MHz, furthermore an antenna cable with a loss of 2 dB is used.
The measured conducted emissions in the frequency range of 1599 - 1610 MHz are below -69 dBm/MHz (see at plot 8.5.7.2).
Conducted emissions (<-69 dBm) + antenna gain (0 dBi) - cable loss (0 dB) = radiated emissions (<-69 dBm) which is below the limit of Part 27.53(f).
Even with an antenna gain of 20 dBi (more than worst case) in the frequency range of 1599 - 1610 MHz, we are still under the limit of Part 27.53(f) with a radiated emission of -49 dBm. Therefore the emission limit is met.

The radiated spurious emission measurements have been passed!

9 History

Revision	Modification	Date	Name
01.00	Initial report	19.10.2011	Zahlmann
02.00	There were added the measurements of the rule part 27.53(f) in the section 8.5.7.	16.01.2012	Zahlmann

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