

Test Site:
FCC Test Site No.:
IC OATS No.:

96997
IC3475A-1



ECL-EMC Test Report No.: 11-115

Equipment under test: **ION-M80/90/19P (800MHz path)**
FCC ID: **XS5-IONM8919P**
IC ID: **2237E-IONM8919P**
Type of test: **FCC 47 CFR Part 90 Subpart S: 2011**
Private Land Mobile Repeater
IC RSS-131
Zone Enhancers for the Land Mobile Service

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

Test result: **Passed**

Date of issue:	10.05.11			Signature:
Issue-No.:	01	Author:	T. Zahlmann Test engineer	
Date of delivery:	24.04.11	Checked:	M. Lehmann Head of ECL	
Test dates:	05.04. – 26.04.11			
Pages:	34			



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General:

The purpose of this report is to show compliance to the FCC regulations for licensed devices operating under section 90 of the Code of Federal Regulations title 47.

This report informs about the results of the RF tests, it only refers to the equipment under test. No part of this report may be reproduced in any form, without written permission.



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1 Test Results Summary

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

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

Frequency stability is not applicable because the device uses a common oscillator to up convert and down convert the RF signal. The EUT does not contain modulation circuitry, or frequency generation, therefore the test was not performed.



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

2.1 Description

Kind of equipment	ION-M80/90/19P Repeater	
Andrew Ident. Number	7547041-0001	
Serial no.(SN)	48	
Revision	00	
Software version and ID	V03.19.0.12 Id.No. 7162793	
Type of modulation and Designator	Analog (F3E (Voice))	<input checked="" type="checkbox"/>
	iDEN	<input checked="" type="checkbox"/>
Frequency Translation	F1-F1	<input checked="" type="checkbox"/>
	F1-F2	<input type="checkbox"/>
	N/A	<input type="checkbox"/>
Band Selection	Software	<input type="checkbox"/>
	Duplexer	<input checked="" type="checkbox"/>
	Full band	<input type="checkbox"/>

2.1.1 Downlink

Pass band	Path 851 MHz – 869 MHz
Max. composite output power based on one carrier (rated)	40,0 dBm = 10 W
Gain	7 dB @ Pout BTS of 33 dBm

2.1.2 Uplink

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

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

2.1.3 Description of EUT

Andrew ION-M80/90/19P is a multi-band, multi-operator remote unit with various extension units. It is used in conjunction with a master unit in the ION optical distribution system.

This Test Report describes only the approval of the 800 MHz Path.

The ION-M80/90/19P Repeater system consists of one 800 MHz remote unit, one 900 MHz remote unit and one 1900 MHz remote unit, with the intended use of simultaneous transmission.

The antenna(s) used with device must be fixed-mounted on permanent structures.

2.1.4 System diagrams

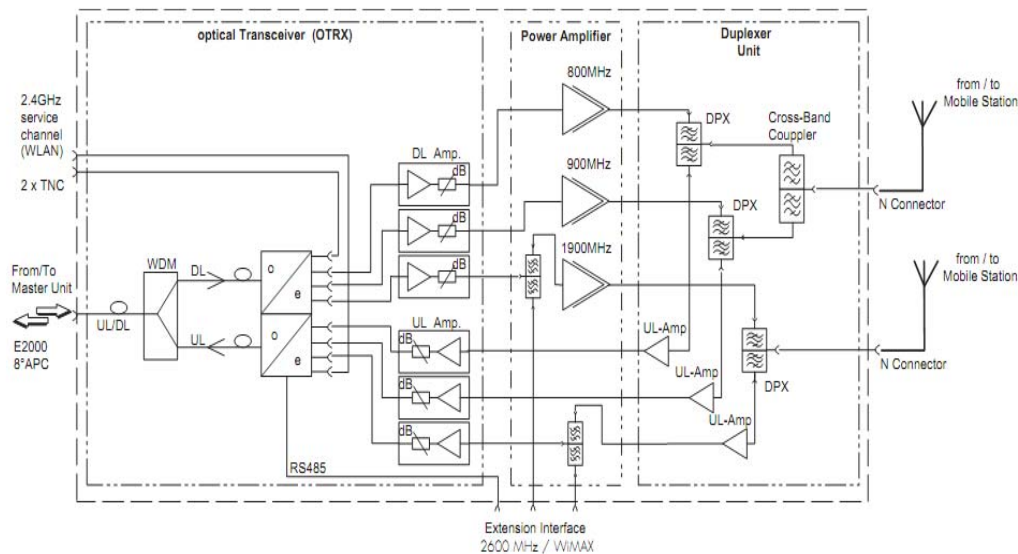


figure 2.1.4-#1 System diagrams: ION optical distribution system

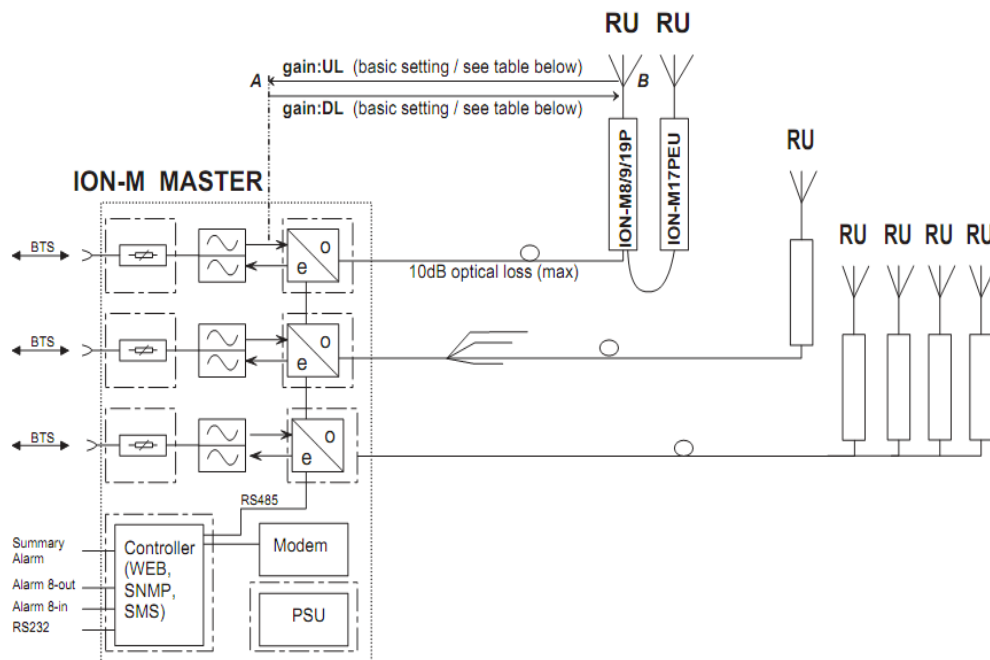


figure 2.1.4-#2 System diagrams: EUT is Remote Unit

2.1.5 Block diagram of measurement reference points

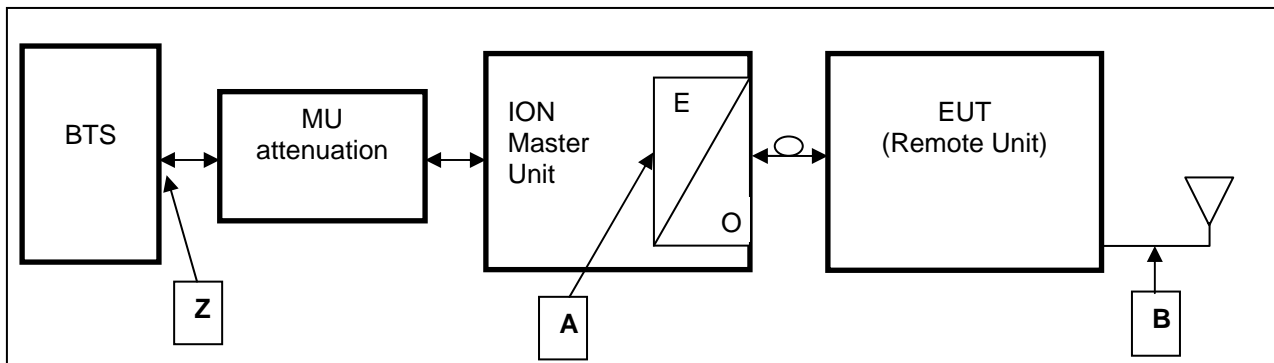


figure 2.1.5-#2 Block diagram of measurement reference points

Remote/Extension 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, BTS UL input

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
8741	Network Analyzer	ZVRE	R&S	100034	02/2012
8890	Spectrum Analyzer	FSP	R&S	100674	07/2011
9069	Generator	SMBV100A	R&S		08/2011
8799	Generator	SMIQ	R&S	My45092504	12/2011
8667	Power Meter	E4418A	Agilent	GB38273230	04/2011
8668	Power Sensor	E8481H	Agilent	US3318A19208	04/2011
7157	RF-Cable	Succoflex	Suhner	36180/4P	CIU
7158	RF-Cable	Succoflex	Suhner	36182/4P	CIU
7289	RF-Cable	Succoflex	Suhner	28443/4PE	CIU
7290	RF-Cable	Succoflex	Suhner	28444/4PE	CIU
7385	RF-Cable	Succoflex	Suhner	36267/4P	CIU
7387	RF-Cable	Succoflex	Suhner	36267/4P	CIU
7390	RF-Cable	Succoflex	Suhner	40193/4P	CIU
7381	RF-Cable	Succoflex	Suhner	40200/4P	CIU
7384	RF-Cable	Succoflex	Suhner	40448/4P	CIU
7294	RF-Cable	Succoflex	Suhner	40448/4P	CIU
7382	RF-Cable	Succoflex	Suhner	40221/4P	CIU
7406	Test Matrix	-----	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.

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 %.

EMC Test Report No.: 11-115

FCC ID: XS5-IONM8919P

IC ID: 2237E-IONM8919P



4 Test site (TEMPTON Service Plus GmbH)

FCC Test site: 96997
IC OATS: IC3475A-1

See relevant dates under section 8.

5 RF Power Out: §90.635, §2.1046; IC RSS-131

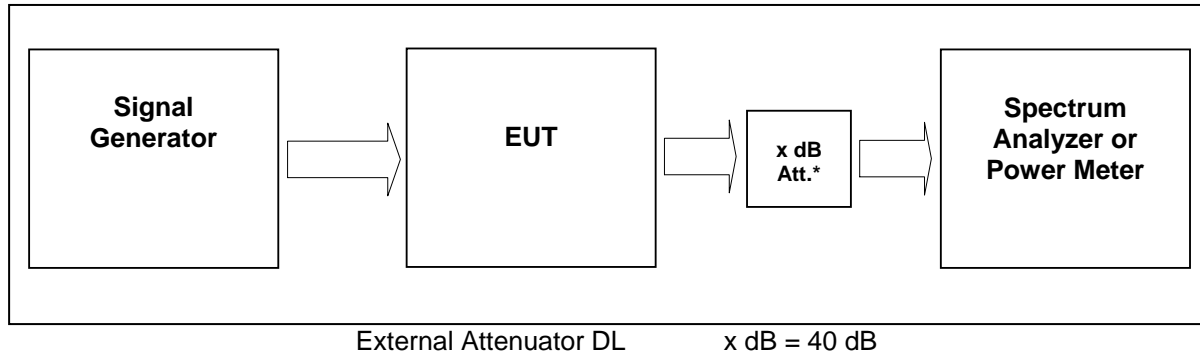


figure 5-#1 Test setup: RF Power Out: §90.635, §2.1046; IC RSS-131

Measurement uncertainty	± 0,38 dB
Test equipment used	8890; 9069; 8799; 8667; 8668; 7406

5.1 Limit

Minimum standard:

§ 90.635 Limitations on power and antenna height.

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

5.2 Test method

§ 2.1046 Measurements required: RF power output.

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit 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 Analog:

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

Test signal iDEN:

Signal waveform according to Motorola iden Technical Overview 68P81095E55-E

5.3.1 Downlink

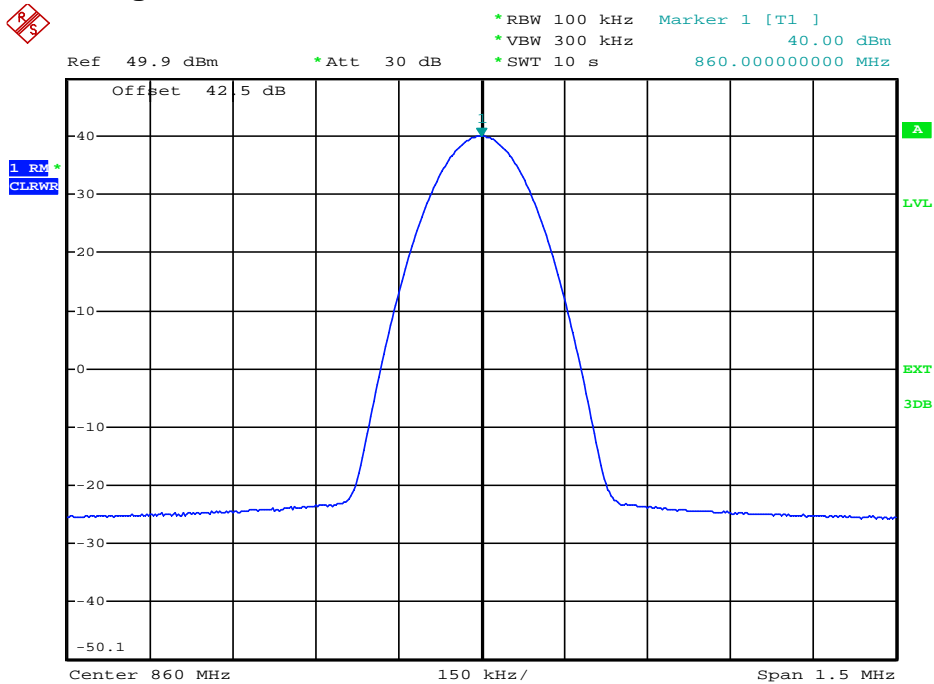
Modulation	Measured at		RBW VBW Span	RF Power [dBm]	RF Power [W]	Plot -
Analog	Middle	860 MHz	100kHz 300kHz 1,5MHz	40,00	10,00	5.3.1.1 #1
iDEN	Middle	860 MHz	100kHz 300kHz 1,5MHz	40,03	10,07	5.3.1.2 #1
Maximum output power = 40,0 dBm = 10 W						
Limit Maximum output power = 1000 W						

table 5.3.1-#1 RF Power Out: §90.635, §2.1046; IC RSS-131 Test Results Downlink

Modulation	Pin / dBm (Ref. point A)
Analog	-0,5
iDEN	-0,5

table 5.3.1-#2 RF Power Out: §90.635, §2.1046; IC RSS-131 Test Results Downlink Input power

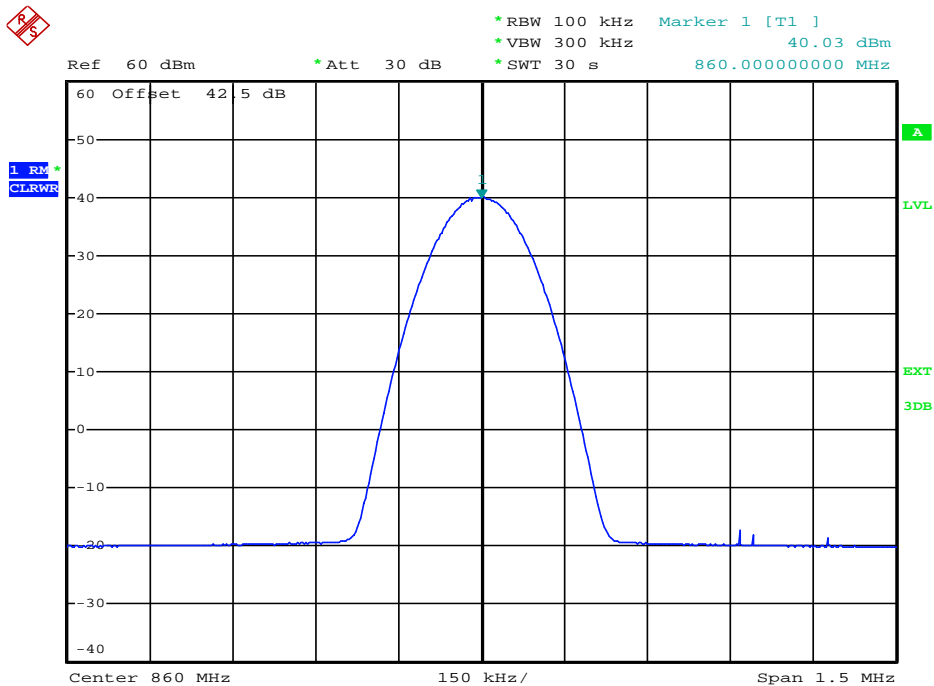
5.3.1.1 Analog



Date: 5.APR.2011 15:56:47

plot 5.3.1.1-#1 RF Power Out: §90.635, §2.1046; IC RSS-131; Test Results; Downlink; Analog Middle

5.3.1.2 iDEN



Date: 5.APR.2011 17:01:31

plot 5.3.1.2-#1 RF Power Out: §90.635, §2.1046; IC RSS-131; Test Results; Downlink; iDEN Middle



5.3.2 Uplink

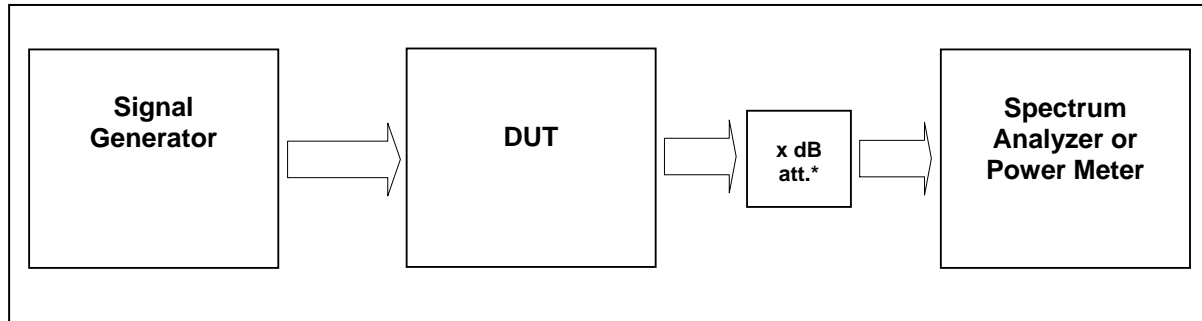
n.a.

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:	W.Meir
Date:	5.04.2011

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



External Attenuator DL x dB = 40 dB

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

Measurement uncertainty	± 0,38 dB
Test equipment used	8890; 9069; 8799; 8667; 8668; 7406

6.1 Limit

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

6.2 Test method

Para. No.2.1049

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

6.3 Test results

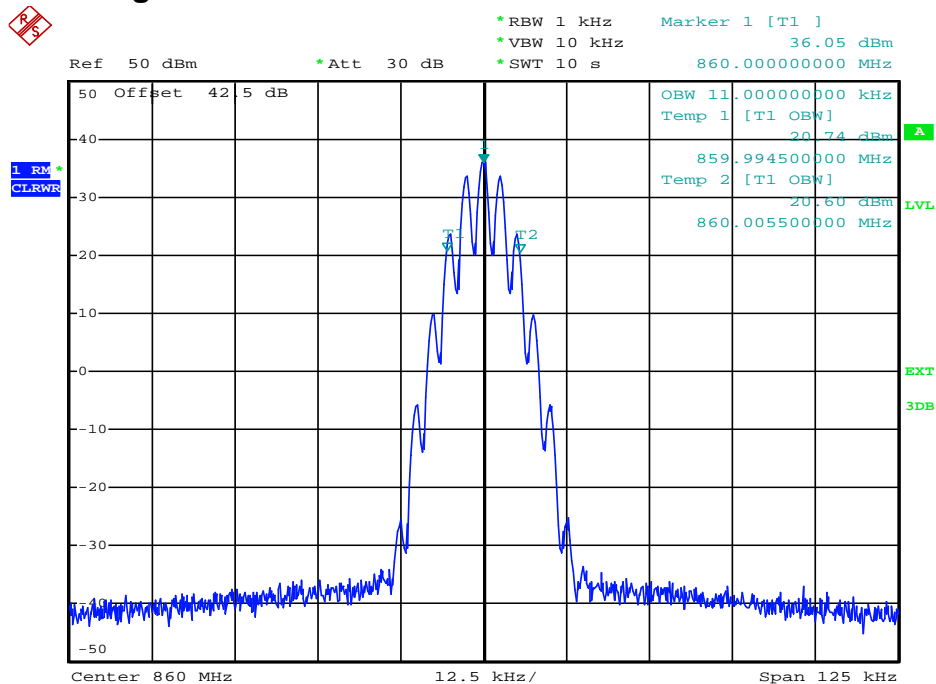
6.3.1 Downlink

Detector RMS.

Modulation	Measured at		RBW VBW Span	Occupied Bandwidth	Plot #
Analog	Middle	860 MHz	1 kHz 10 kHz 125 kHz	11,00 kHz	6.3.1.1 #1, #2
iDEN	Middle	860 MHz	1 kHz 3 kHz 50 kHz	18,25 kHz	6.3.1.2 #1, #2

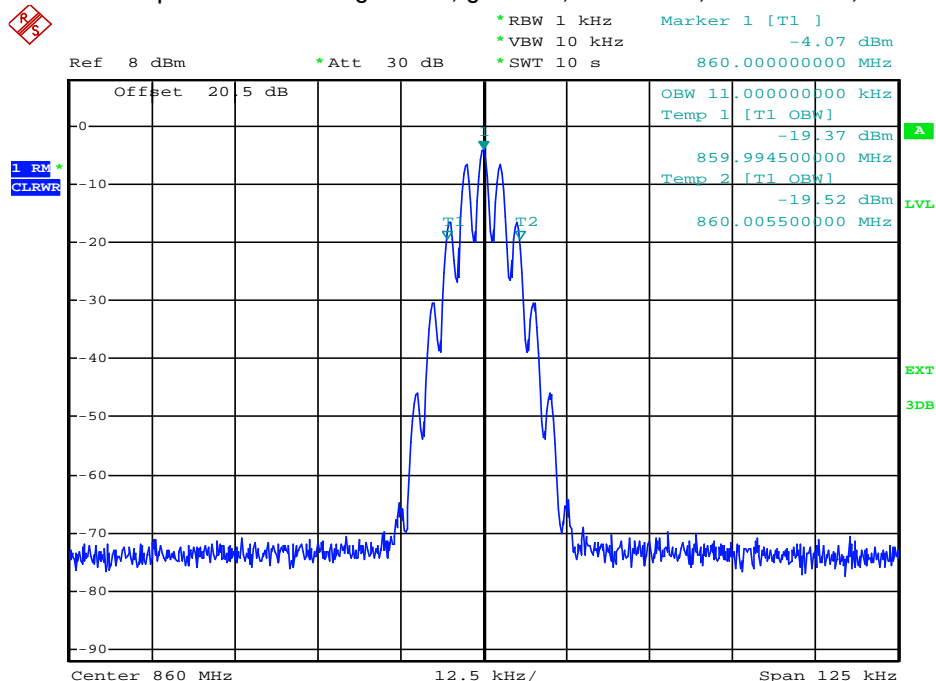
table 6.3-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN Test results

6.3.1.1 Analog



Date: 6.APR.2011 12:33:34

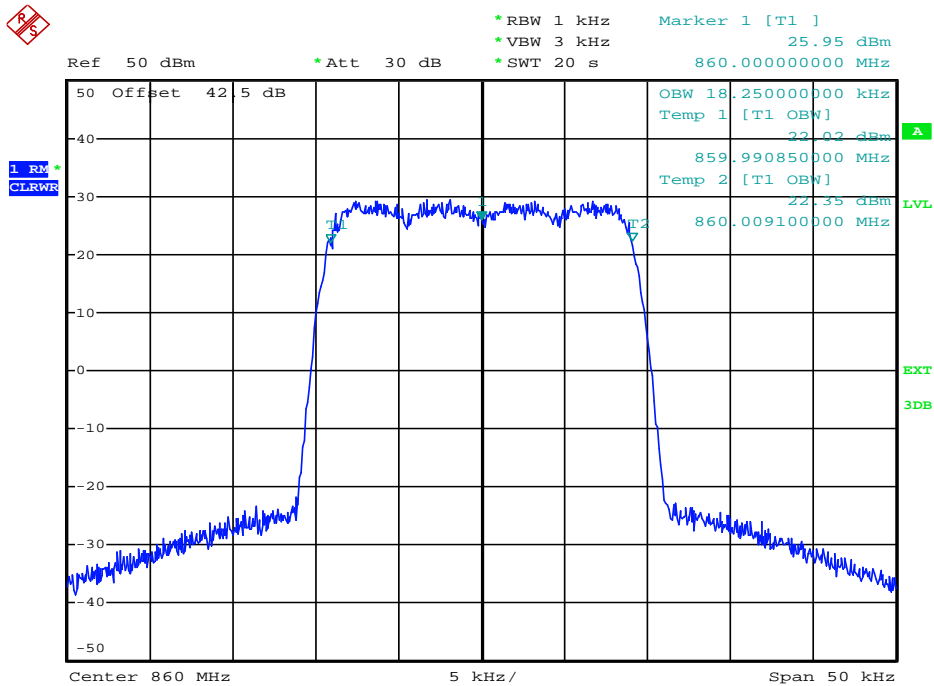
plot 6.3.1.1-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; Analog Output



Date: 6.APR.2011 12:35:54

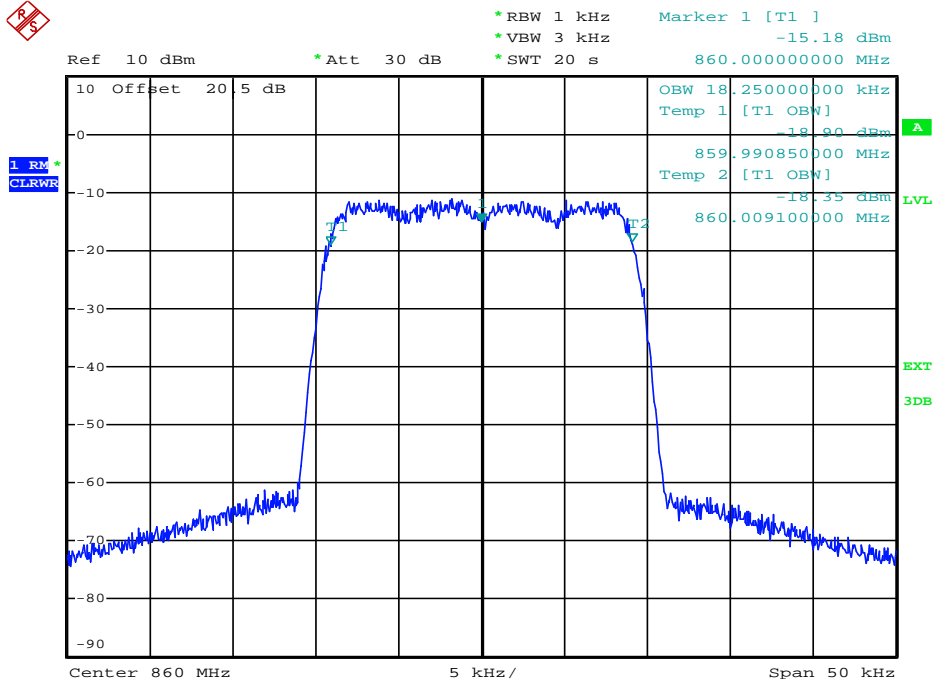
plot 6.3.1.1-#2 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN; Test results; Downlink; Analog Input

6.3.1.2 iDEN



Date: 6.APR.2011 12:41:53

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



Date: 6.APR.2011 12:44:04

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



6.3.2 Uplink

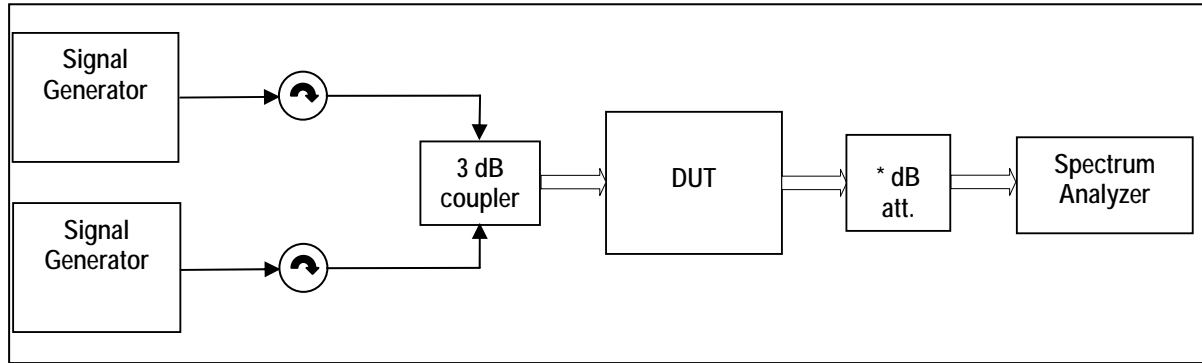
n.a.

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:	W.Meir
Date:	6.04.2011

7 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN



External Attenuator DL x dB = 40 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN

Measurement uncertainty	$\pm 0,54$ dB $\pm 1,2$ dB $\pm 1,5$ dB	9 kHz to 3 GHz 3 GHz to 7 GHz 7 GHz to 26 GHz
Test equipment used	8890; 9069; 8799; 8667; 8668; 7406	

7.1 Limit

Minimum standard: §90.210, Table "Application Emission Mask"

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

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

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

7.2 Test method

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

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

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



7.3 Test results

7.3.1 Downlink

<1MHz from Band Edge

Detector: RMS.

Modulation	Measured at Band Edge	Carriers	RBW VBW Span Sweep points	Max. level [dBm]	Plot -
Analog	Lower Edge Upper Edge	851,0125 MHz 851,0375 MHz 868,9625 MHz 868,9875 MHz	300Hz 3kHz 2MHz 2000 points	<-20	7.3.1.1 #1 #2
iDEN	Lower Edge Upper Edge	851,0125 MHz 851,0375 MHz 868,9625 MHz 868,9875 MHz	300Hz 3kHz 2MHz 2000 points	<-20	7.3.1.2 #1 #2

table 7.3-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN Test results <1MHz from Band Edge

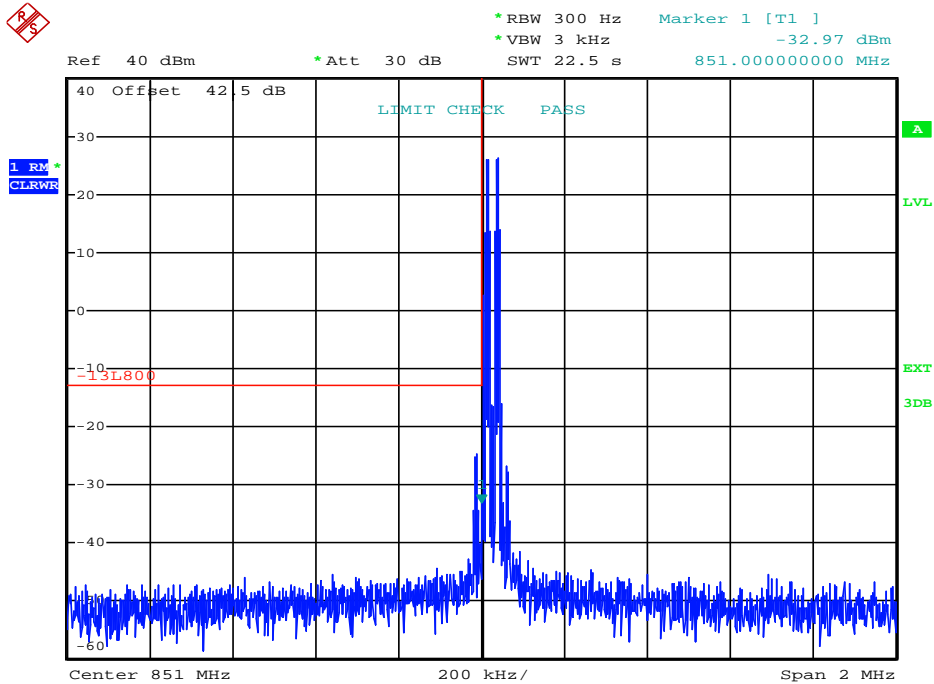
>1MHz from Band Edge

Detector: RMS.

Modulation	Carrier	RBW VBW Span	Max. level (dBm)	Plot -
Analog	860 MHz	1MHz 3MHz 30MHz – 8GHz	-28	7.3.1.3 #1
iDEN	860 MHz	1MHz 3MHz 30MHz – 8GHz	-28	7.3.1.4 #1

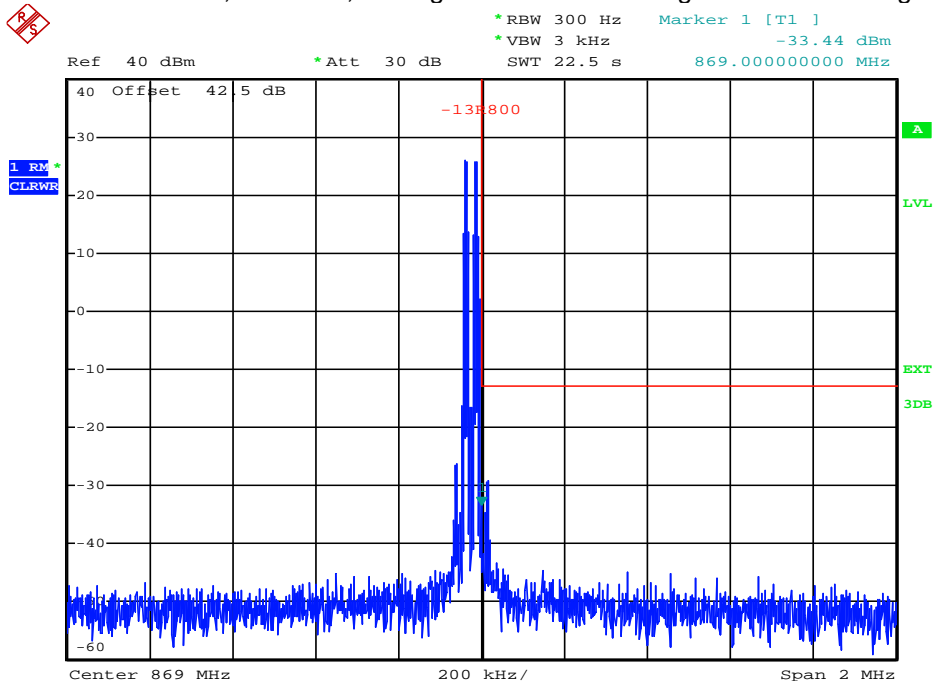
table 7.3-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN Test results <1MHz from Band Edge

7.3.1.1 Analog < 1MHz to band edge



Date: 6.APR.2011 15:18:41

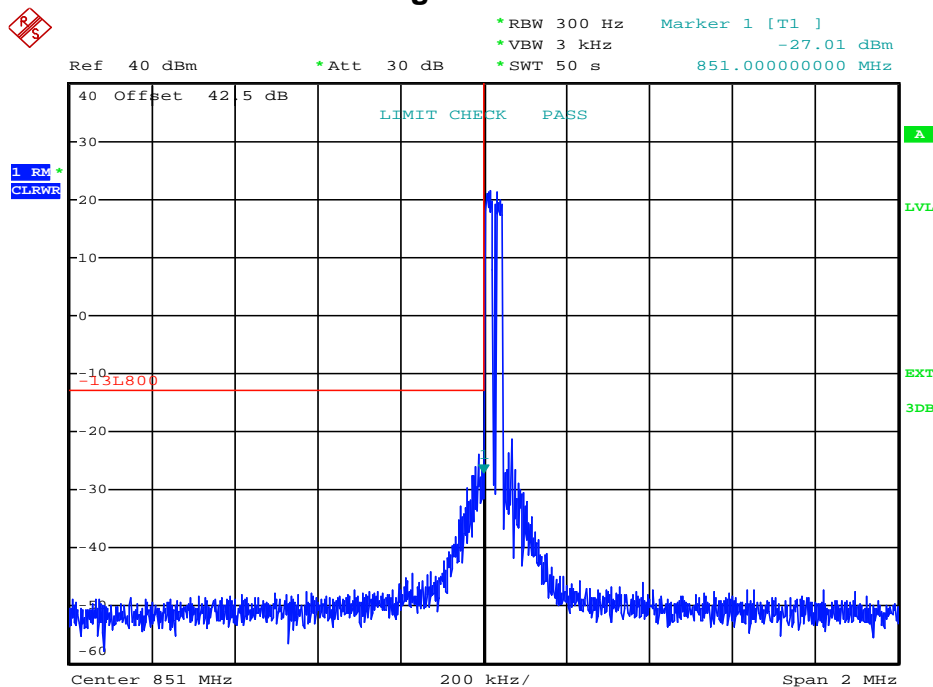
plot 7.3.1.1-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog < 1MHz to band edge Lower Band Edge



Date: 6.APR.2011 15:53:26

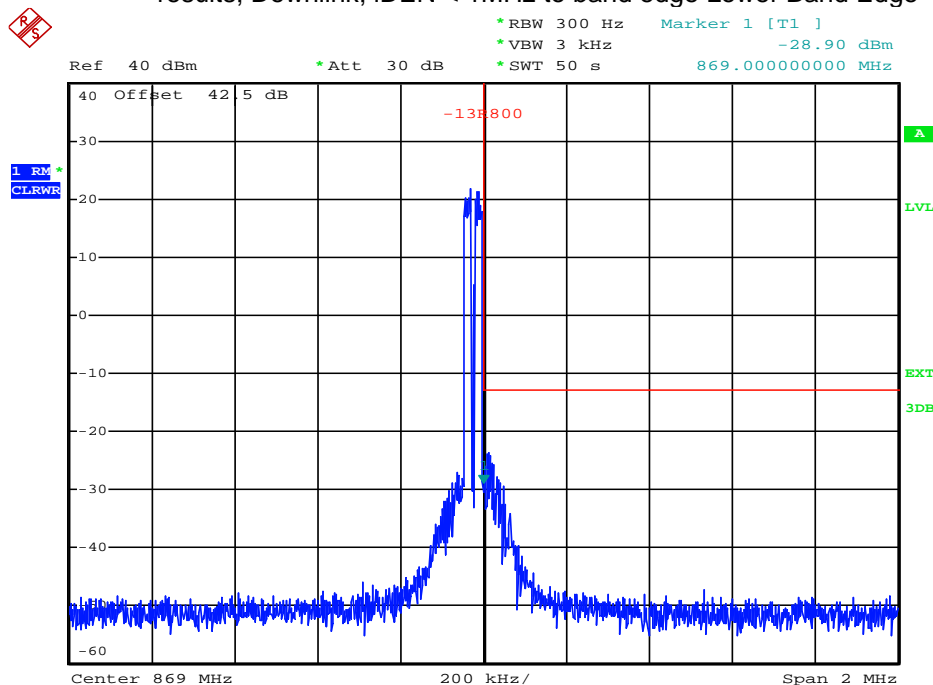
plot 7.3.1.1-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog < 1MHz to band edge Upper Band Edge

7.3.1.2 iDEN < 1MHz to band edge



Date: 6.APR.2011 16:32:30

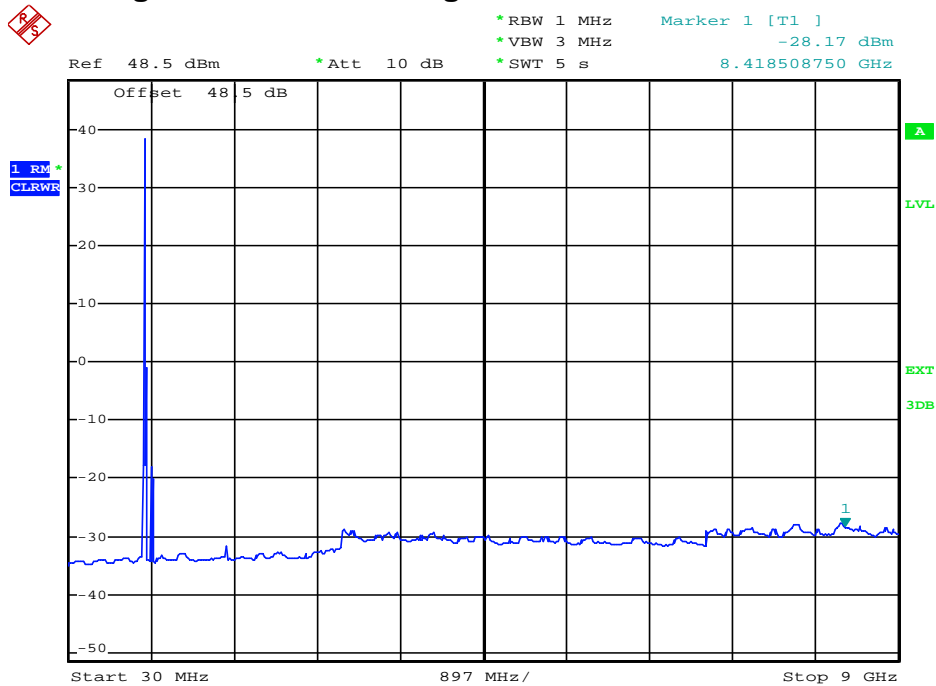
plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; iDEN < 1MHz to band edge Lower Band Edge



Date: 6.APR.2011 16:05:03

plot 7.3.1.2-#2 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; iDEN < 1MHz to band edge Upper Band Edge

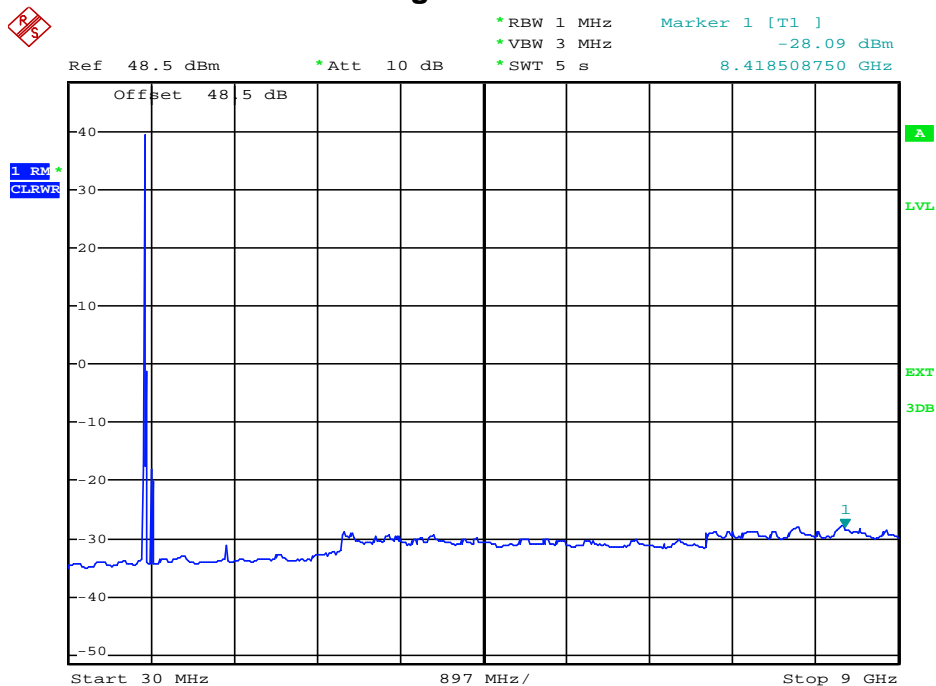
7.3.1.3 Analog > 1MHz to band edge



Date: 8.APR.2011 11:25:47

plot 7.3.1.3-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; Analog > 1MHz to band edge; carrier notched

7.3.1.4 iDEN > 1MHz to band edge



Date: 8.APR.2011 11:39:27

plot 7.3.1.4-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; iDEN > 1MHz to band edge; carrier notched



7.3.2 Uplink

n.a.

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

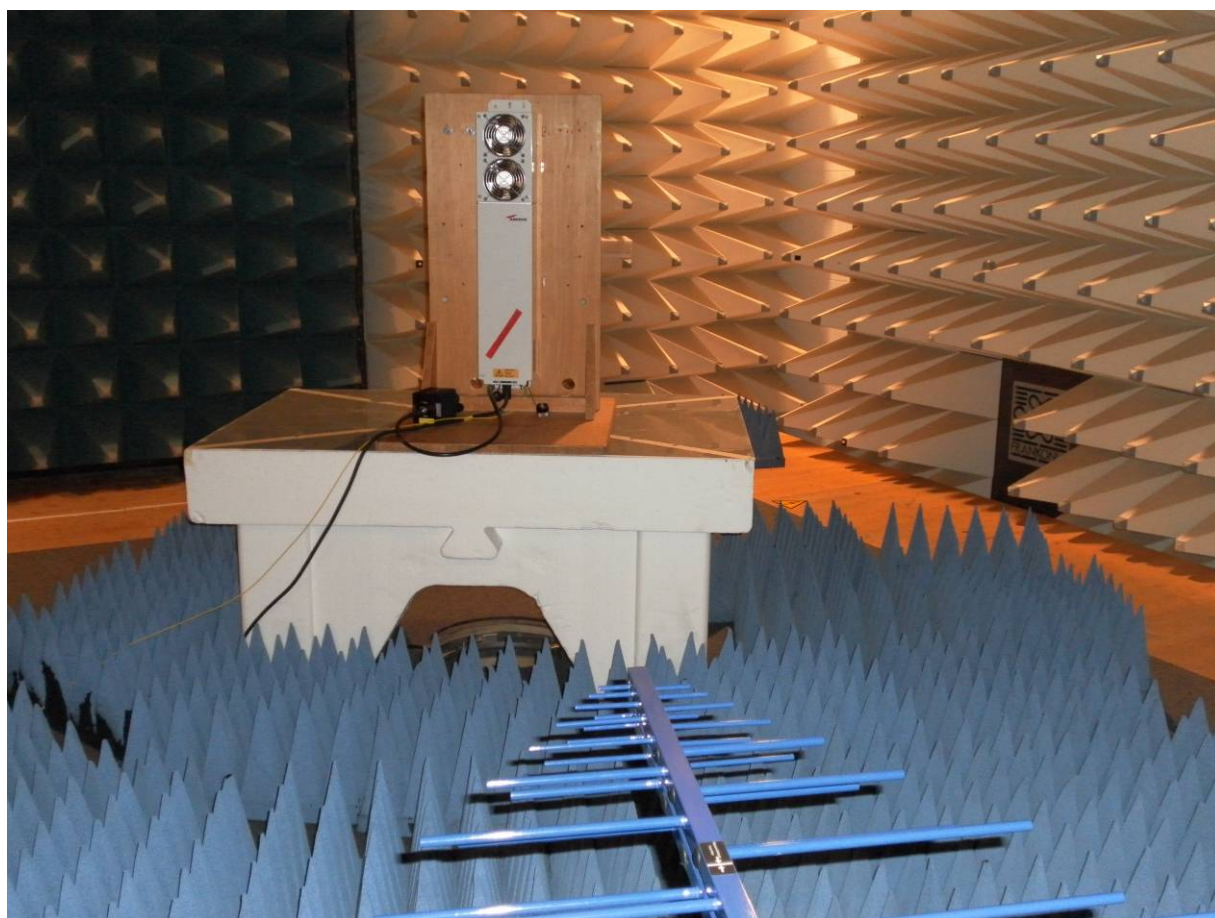
7.4 Summary test result

Test result	complies, according the plots above
Tested by:	W.Meir
Date:	8.04.2011

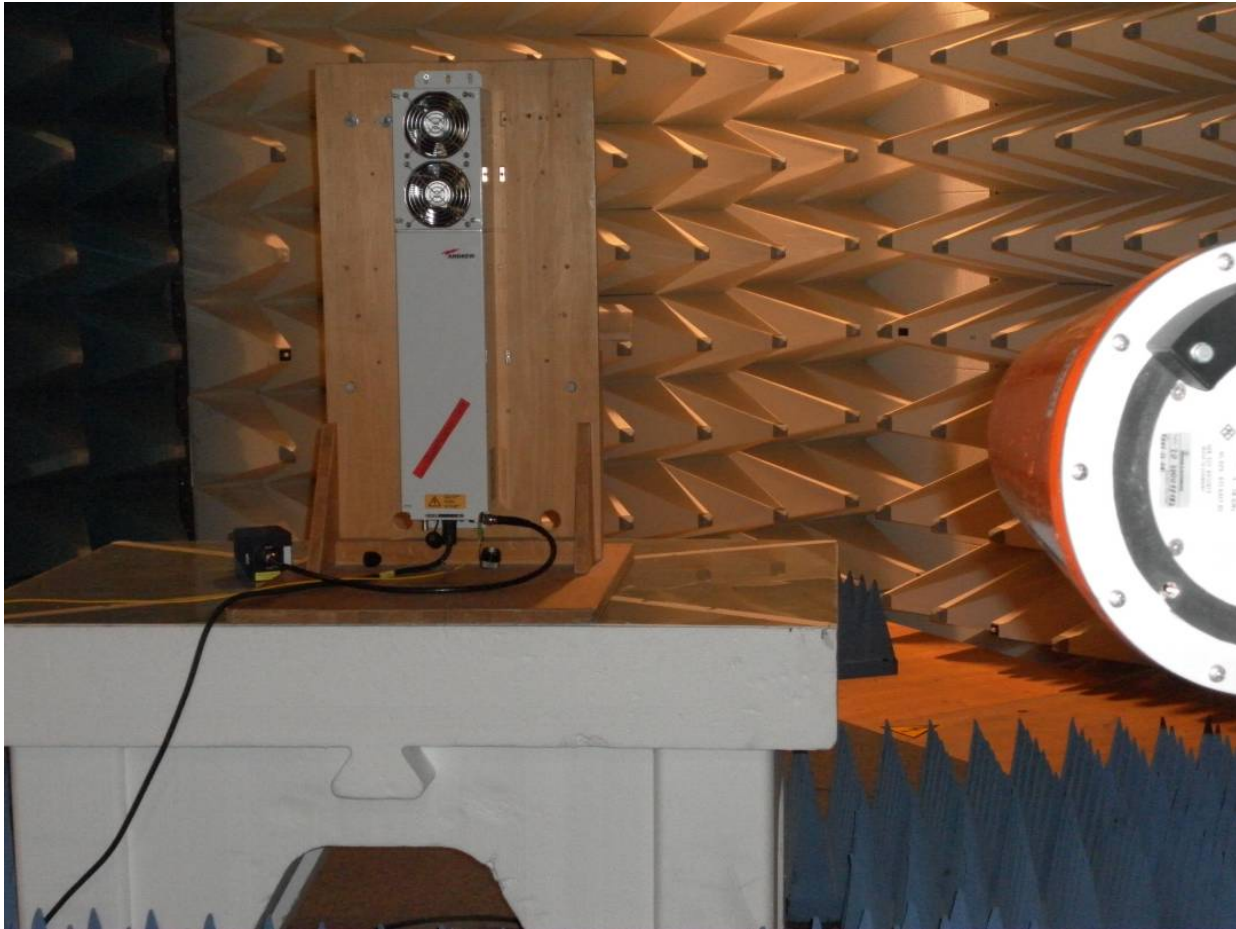
8 Radiated Spurious Emissions at the ECL (TEMPTON): §90.210, §2.1053, RSS-Gen, RSS-131



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 90 Sub S	TIA/EIA-603-C:2004
		IC RSS-131	
1 GHz – 20 GHz		FCC 47 CFR Part 90 Sub S	
		IC RSS-131	

Test equipment used:

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.-date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1687	21.12.2010	21.12.2011	X
Antenna	CBL 6111	Chase	K1149	24.09.2010	24.09.2011	X
RF Cable		Frankonia	K1121 SET	01.07.2010	01.07.2011	X
Pre amplifier	AM1431	Miteq	K1721	02.07.2010	02.07.2011	X
Antenna	HL 025	R&S	K809	28.09.2010	28.09.2011	X
Preamplifier	AFS4-00102000	Miteq	K838	09.02.2011	09.02.2012	X
RF Cable	Sucoflex 100	Suhner	K1742	05.04.2011	05.04.2012	X

The Tile-Software Version 4 has been used to maximize radiated emission from the EUT in the frequency area up to 1 GHz. Above 1 GHz the REMI version 2.135 has been used for max search.

Test set-up:

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

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

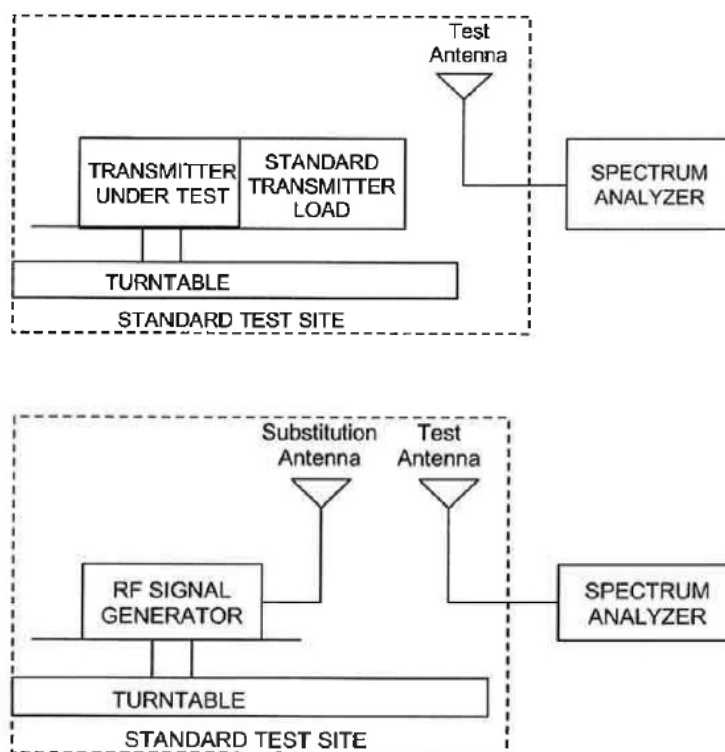


Figure #7.2 Substitution methods TIA/EIA-603-C



8.2 Limit

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

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

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

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

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

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

The Emission limit is -13dBm

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

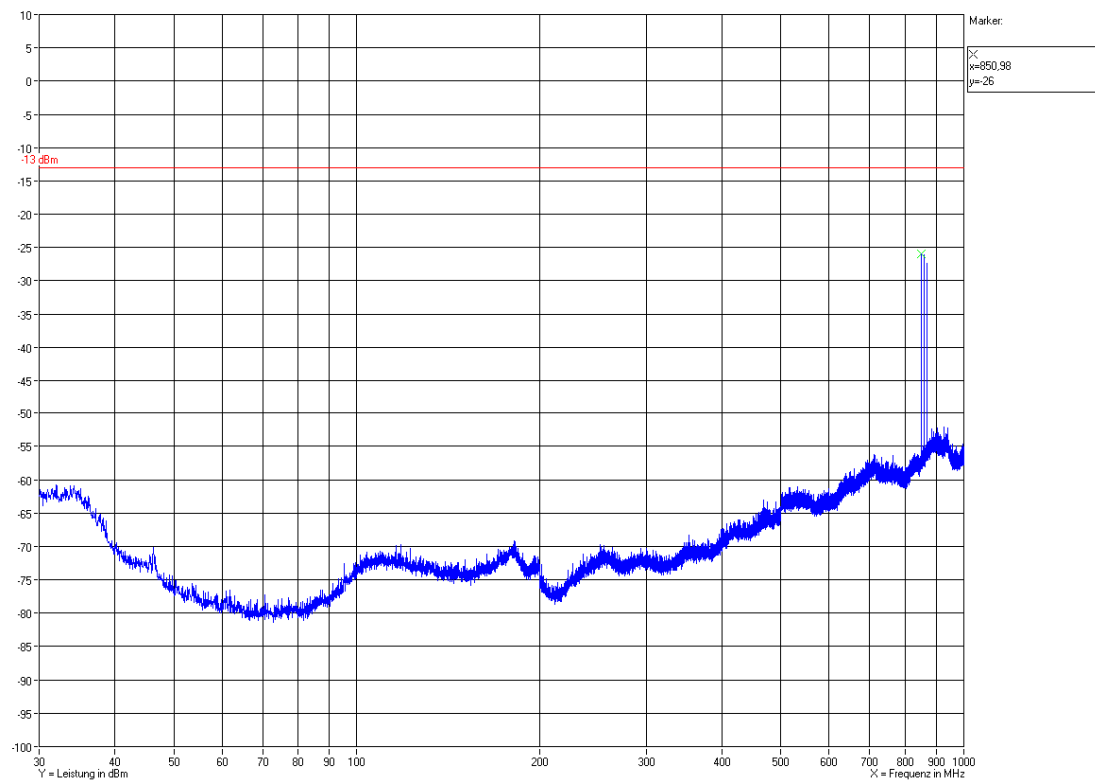
8.3 Climatic values in the lab

Temperature: 21°
 Relative Humidity: 45%
 Air-pressure: 1004 hPa

8.4 Test results

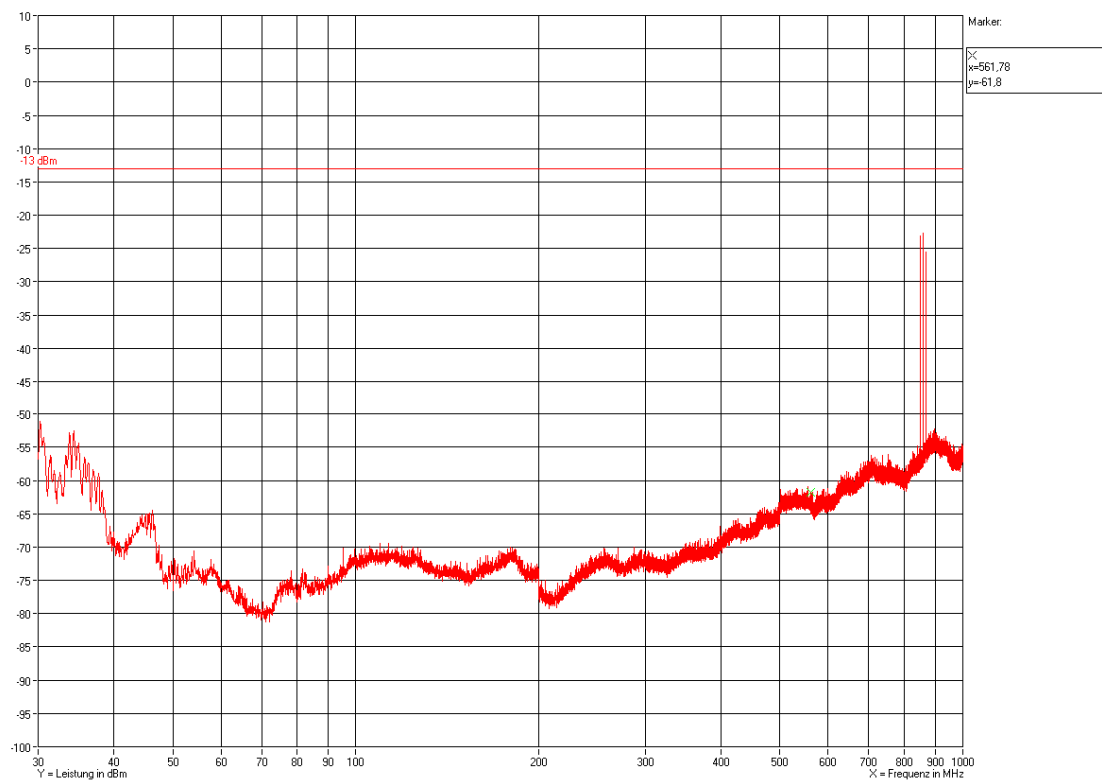
8.4.1 30 MHz to 1 GHz Downlink (Bottom – Middle – Top)

Horizontal 851- 860 – 869MHz



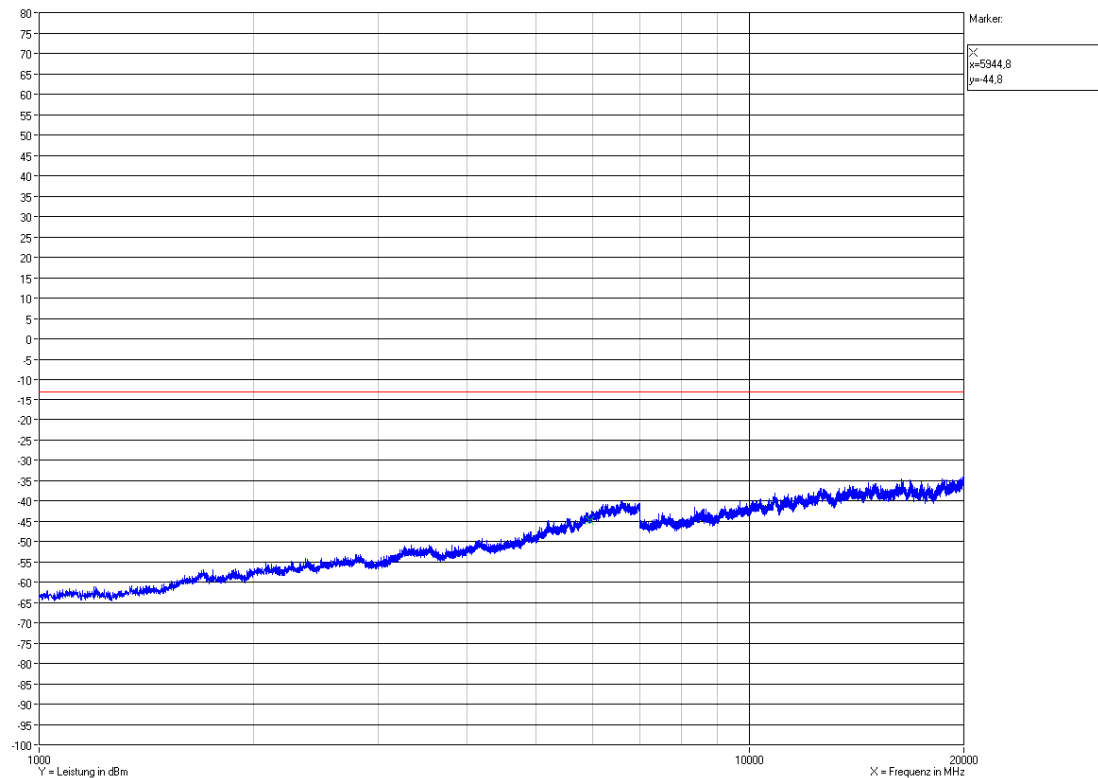


Vertical 851- 860 – 869MHz



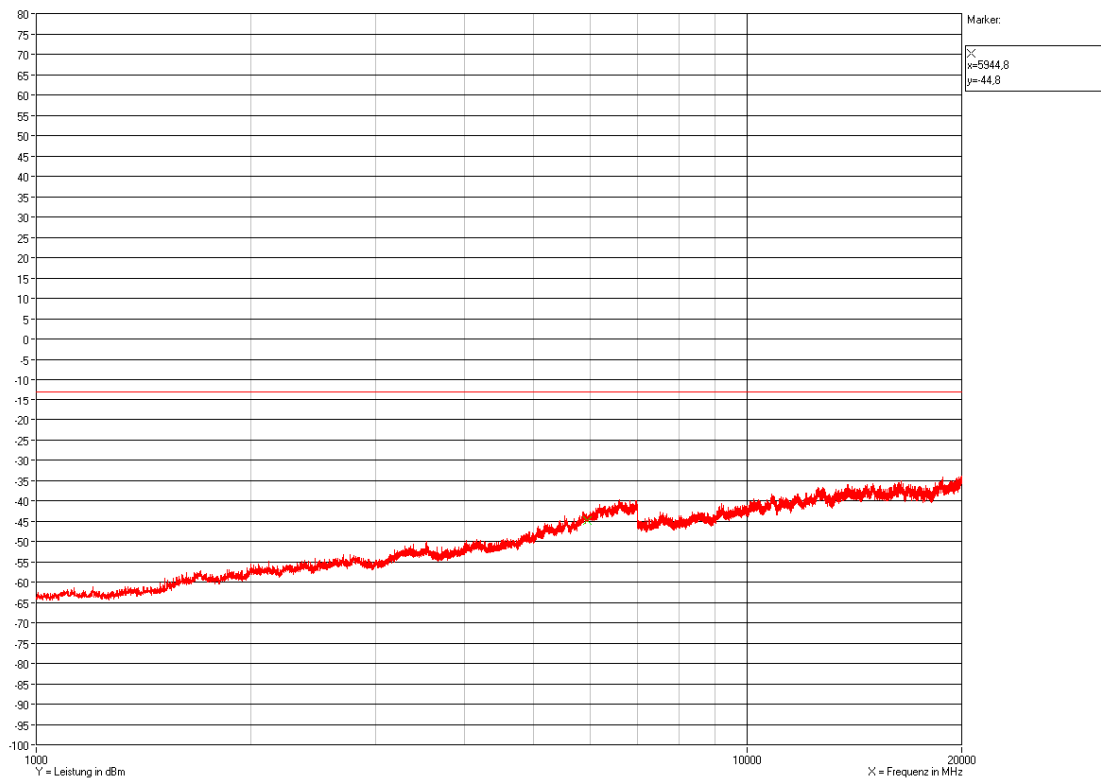
8.4.2 1 GHz to 20 GHz Downlink (Bottom – Middle – Top)

Horizontal 851-860-869





Vertikal 851-860-869



The radiated spurious emission requirements have been met in all frequency bands.

9 History

Revision	Modification	Date	Name
01.00	Initial Test report	10.05.2011	T. Zahlmann

EMC Test Report No.: 11-115

FCC ID: XS5-IONM8919P

IC ID: 2237E-IONM8919P



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