

Test Site:  
FCC Test Site No.: 96997  
IC OATS No.: IC3475A-1



## ECL-EMC Test Report No.: 10-209

Equipment under test: **ION-M 80-85HP/19P (800MHz Path)**  
FCC ID: **XS5-ION-M8085HP**  
IC ID: **IC:2237E-IONM8085HP:**  
Type of test: **FCC 47 CFR Part 90 Subpart S:2009**  
**Private Land Mobile Repeater**  
**IC RSS-GEN:2007, RSS-131:2003**  
**Zone Enhancers for the Land Mobile Service**

**Measurement Procedures:** 47 CFR Parts 2 :2009 (*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:	24.03.10			Signature:
Issue-No.:	01	Author:	<b>M. Lehmann</b> Test engineer	
Date of delivery:	16.02.10	Checked:	<b>M. Grytz</b> Operational manager	
Test dates:	14.07 – 05.08.10			
Pages:	30			

Test Report No.: 10-209

FCC ID: XS5-ION-M8085HP

IC ID: 2237E-IONM8085HP

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**General:**

The purpose of this report is to show compliance to the FCC regulations for licensed devices operating under section 90S 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	90.210	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	RSS-GEN 4.10	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-M8085HP/19P Repeater
Andrew Ident. Number	7620304-0001
Serial no.(SN)	11
Revision	00
Software version and ID	V3.19.0.4; 7162793
Type of modulation and Designator	Analog (F3E (Voice)) <input checked="" type="checkbox"/> iDEN (GXW) <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 type="checkbox"/> Full band <input checked="" type="checkbox"/>

#### 2.1.1 Downlink

Pass band	Path 851 MHz – 869 MHz
Max. composite output power based on one carrier per path (rated)	46 dBm = 40 W
Gain	13 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-M80-85HP/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 (ION-M80HP).

The ION-M80-85HP/19P Repeater system consists of one 800/850 MHz remote unit and one 1900 MHz extension unit, with the intended use of simultaneous transmission

2.1.4 System diagrams

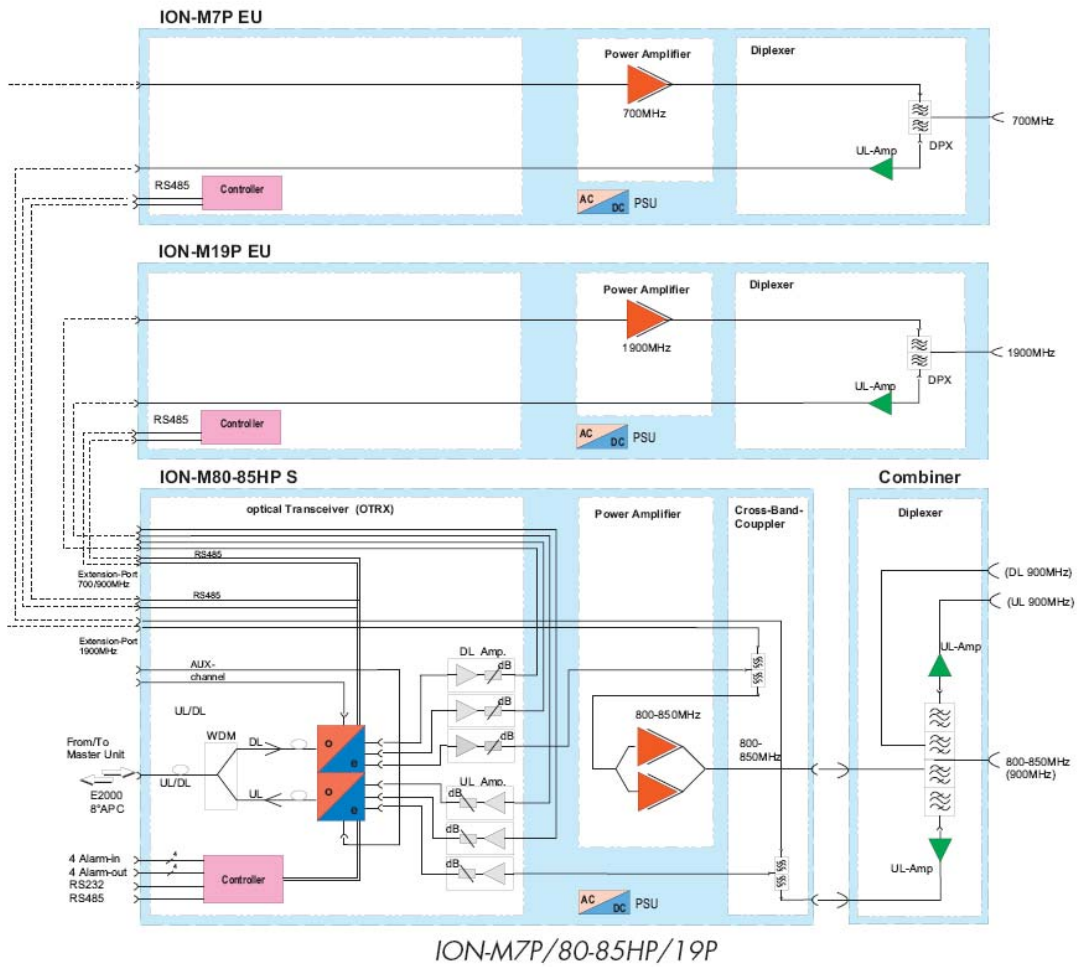
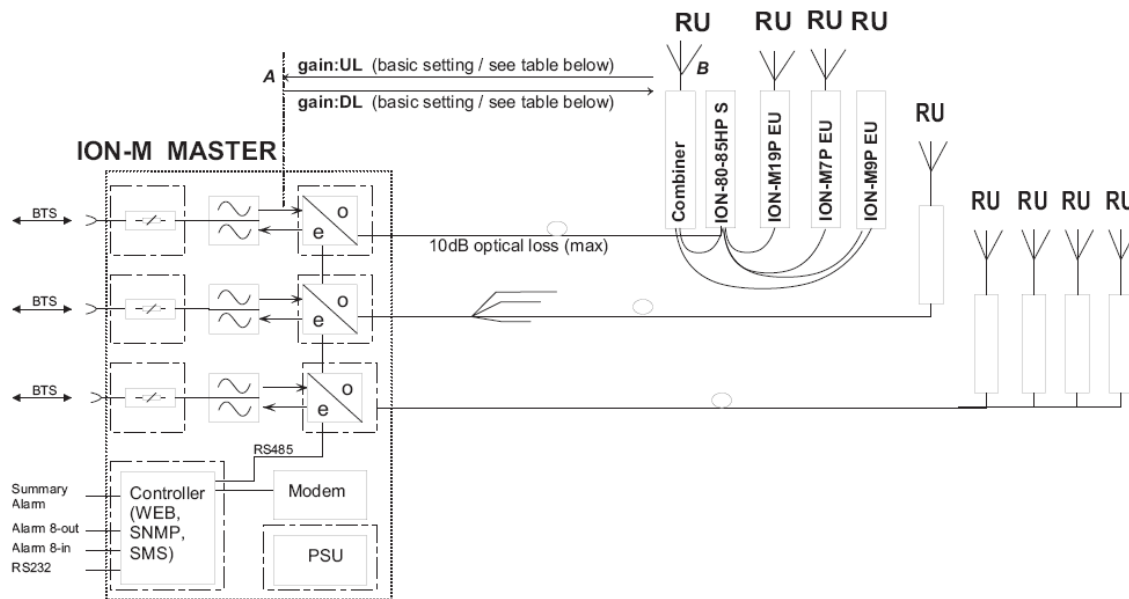


figure 2.1.4-#1 System diagrams: ION optical distribution system



ION-M7P/80-85HP/19P

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

### 2.1.5 Block diagram of measurement reference points

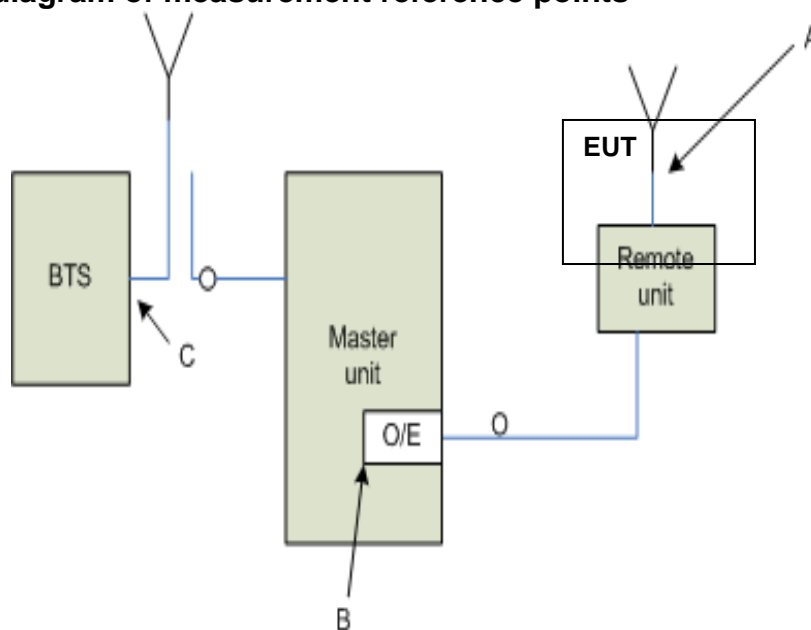


figure 2.1.5-#1 Block diagram of measurement reference points

Remote Unit is the EUT

O/E Optcal/Electrical converter

SRMU SubRackMaster Unit

Reference point A, Remote Unit DL output, UL input

Reference point B, SRMU UL output, DL input

Reference point C, BTS DL output, 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
8961	Spectrum Analyzer	FSP13	R&S	837747/023	10/10
8736	Signal Analyzer	FSIQ26	R&S	100290	12/10
8984	Signal Generator	E4438C	Agilent	MY45094089	11/10
8998	Signal Generator	SMIQ06B	R&S	100874	09/10
8689	Power Meter	E4418B	Agilent	GB40203847	08/10
8670	Power Sensor	E9300H	Agilent	MY41090174	08/10
7119	Divider	2way	Mikom	3512	CIU
7323	Circulator	E10-1FFF	AEROTEK	25357	CIU
7315	Circulator	E10-1FFF	AEROTEK	25344	CIU
7363	RF-Cable	2,0m; N-N	Huber & Suhner	28439/4PEA	CIU
7295	RF-Cable	2,5m; N-N	Huber & Suhner	28964/4PEA	CIU
7299	RF-Cable	2,5m; N-N	Huber & Suhner	28964/4PEA	CIU
7364	RF-Cable	1,0m; SMA	Huber & Suhner	36309/4P	CIU
7365	RF-Cable	1,0m; SMA	Huber & Suhner	36292/4P	CIU
7366	RF-Cable	2,0m; SMA	Huber & Suhner	36183/4P	CIU
7367	RF-Cable	2,0m; SMA	Huber & Suhner	36158/4P	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 %.

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#### 4 Test site (Herberg)

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

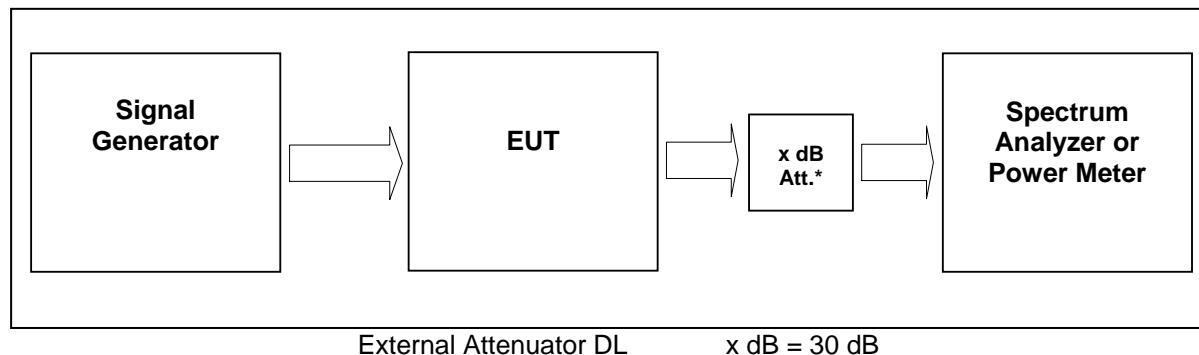


figure 5-#1 Test setup: RF Power Out: §90.635, §2.1046; IC RSS-131

Measurement uncertainty	± 0,38 dB
Test equipment used	8984,8961,8689,8670,7363,7364,7365

### 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

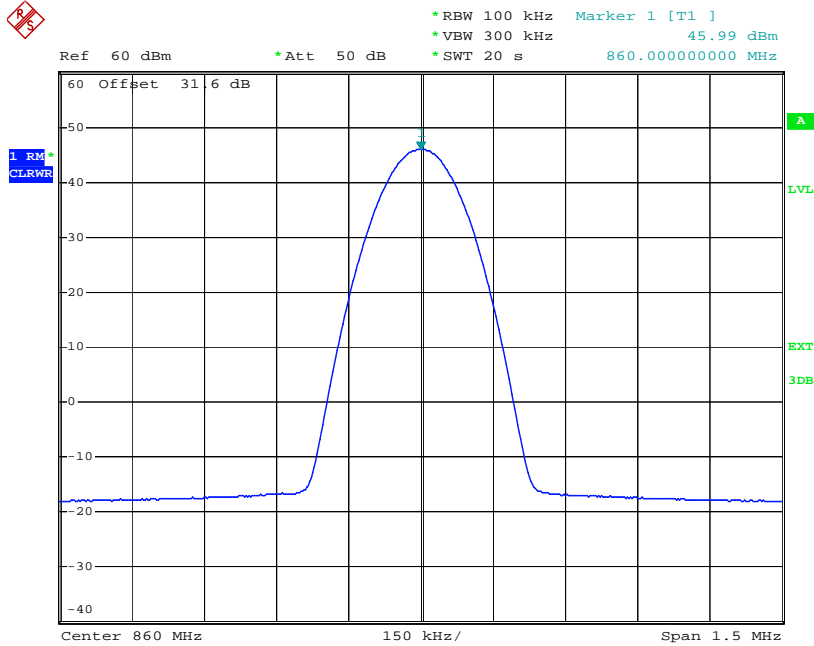
Modulation	Measured at		RBW VBW Span	RF Power [dBm]	RF Power [W]	Plot -
Analog	Middle	860 MHz	100kHz 300kHz 1,5MHz	46,0	40	5.3.1.1 #1
iDEN	Middle	860 MHz	100kHz 300kHz 1,5MHz	46,0	40	5.3.1.2 #1
Maximum output power = 44,0 dBm = 25,1 W						
Limit Maximum output power = 1000 W						

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

Modulation	Pin / dBm (Ref. point B)
Analog	5,0
iDEN	4,9

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

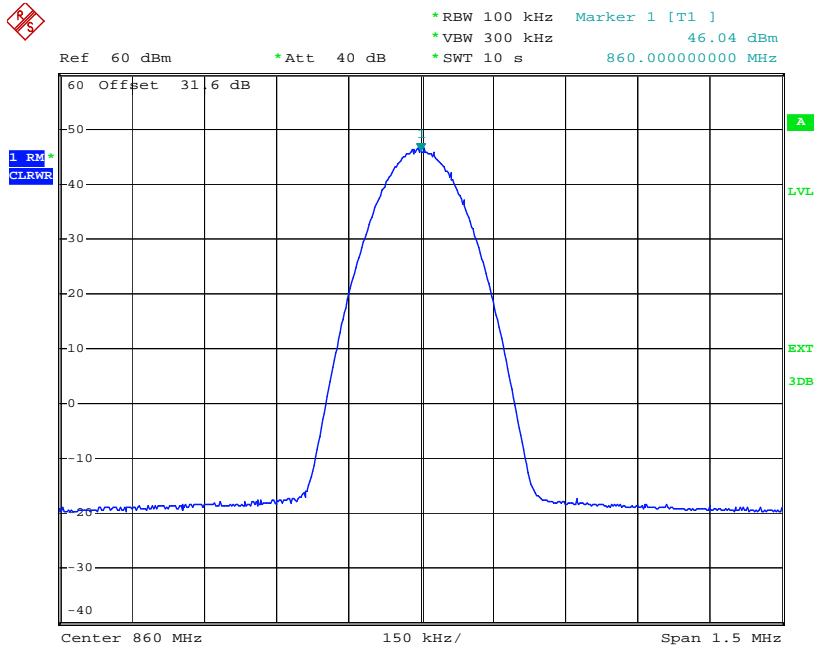
### 5.3.1.1 Analog



Date: 20.JUL.2010 12:27:58

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

### 5.3.1.2 iDEN



Date: 20.JUL.2010 11:27:22

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

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### 5.3.2 Uplink

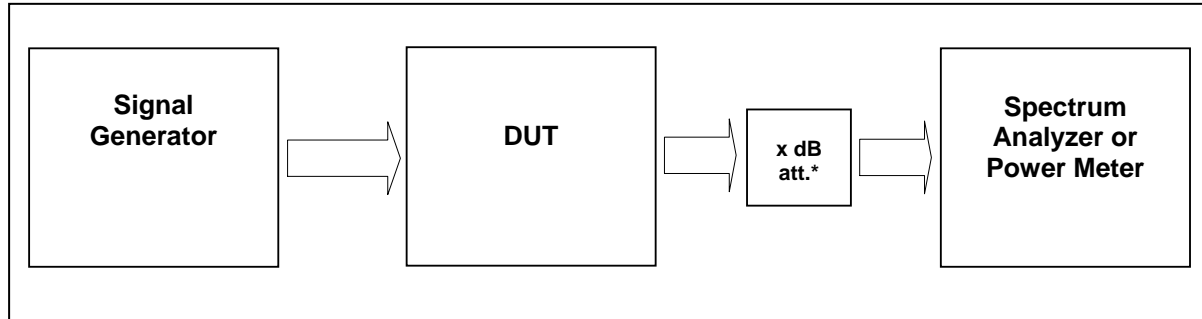
n.a.

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:	Rainer Friedrich
Date:	20.07.2010

## 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	8984,8961,8689,8670,7363,7364,7365

### 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

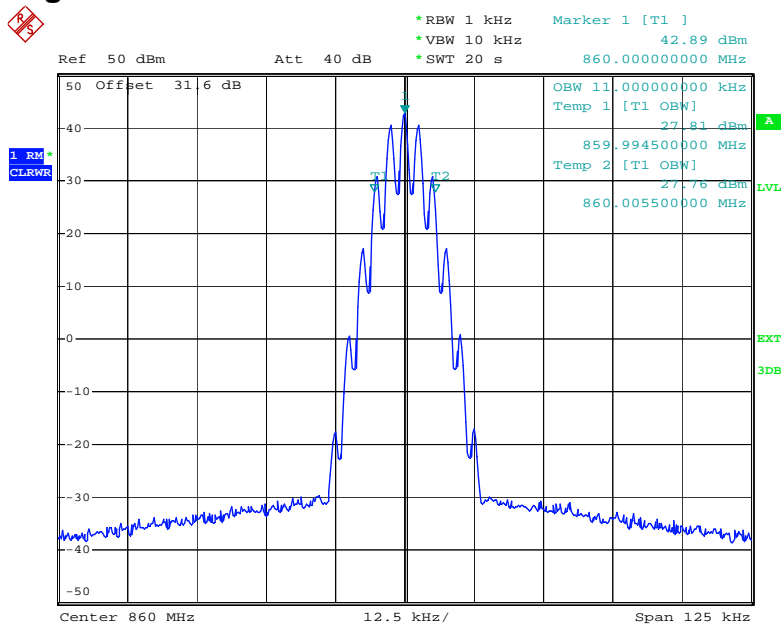
#### 6.3.1 Downlink

Detector RMS.

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

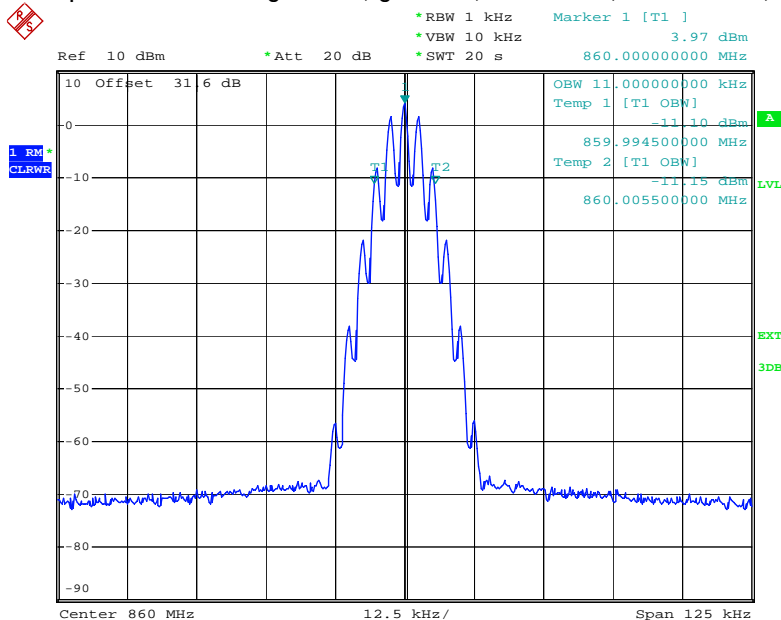
table 6.3-#1 Occupied Bandwidth: §90.210, §2.1049; RSS-GEN Test results

### 6.3.1.1 Analog



Date: 20.JUL.2010 12:24:58

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



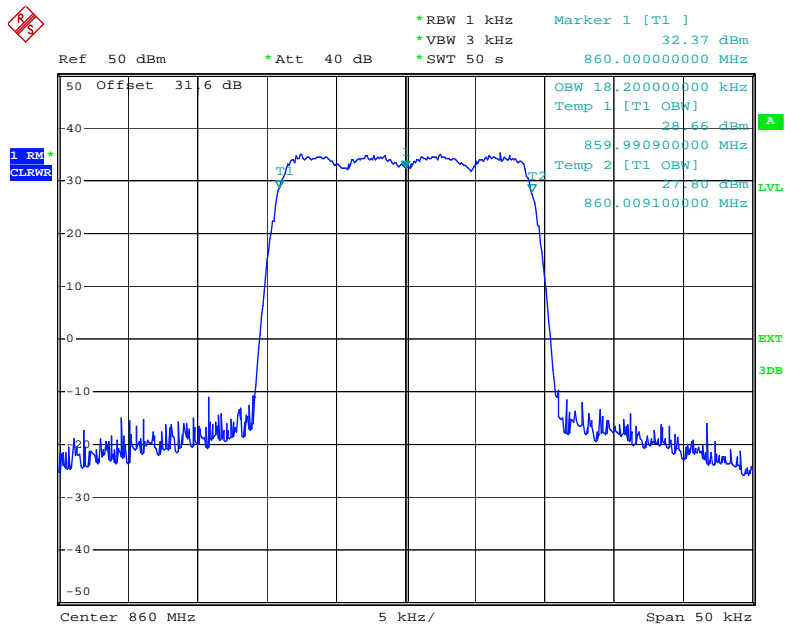
Date: 20.JUL.2010 11:50:25

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



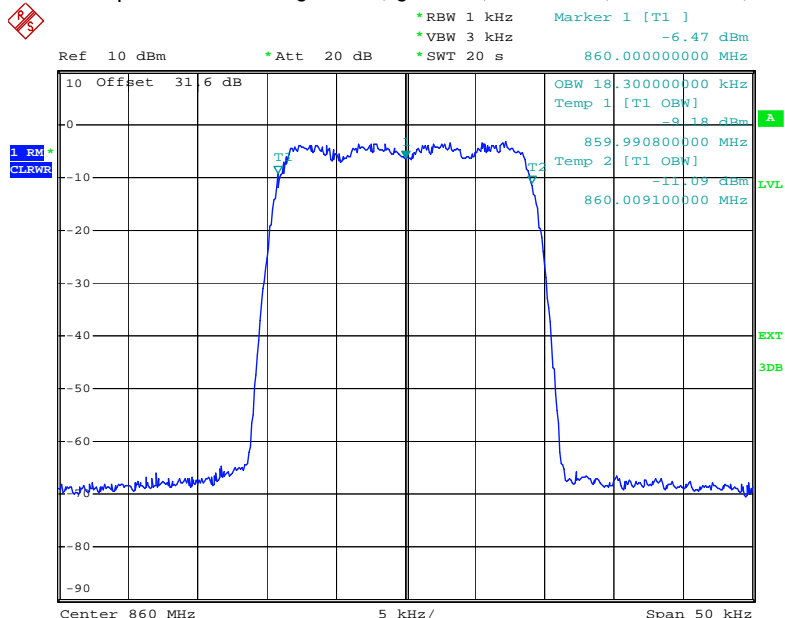


### 6.3.1.2 iDEN



Date: 20.JUL.2010 11:37:36

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



Date: 20.JUL.2010 11:41:20

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

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### 6.3.2 Uplink

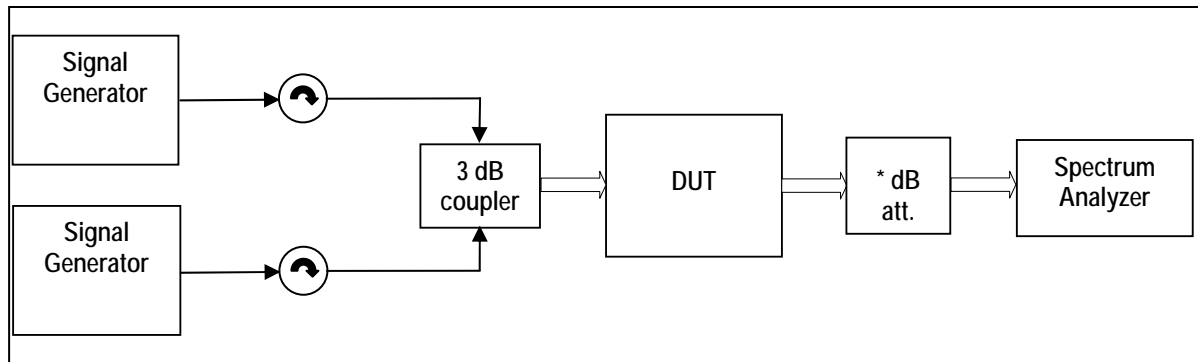
n.a.

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:	Rainer Friedrich
Date:	20.07.2010

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



External Attenuator DL x dB = 30 dB

figure 7-#1 Test setup: Spurious Emissions at Antenna Terminals: §90.210, §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	8984,8961,8689,8670,7363,7364;7323, 7315,7119;8998	

### 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 <sup>3</sup>	B	G

<sup>3</sup> 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	851,0125 MHz	300Hz	-24,7	7.3.1.1 #1
	Upper Edge	851,0375 MHz	3kHz		-23,2
iDEN	Lower Edge	868,9625 MHz	2MHz	-15,9	
	Upper Edge	868,9875 MHz	2000 points		-25,3

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**

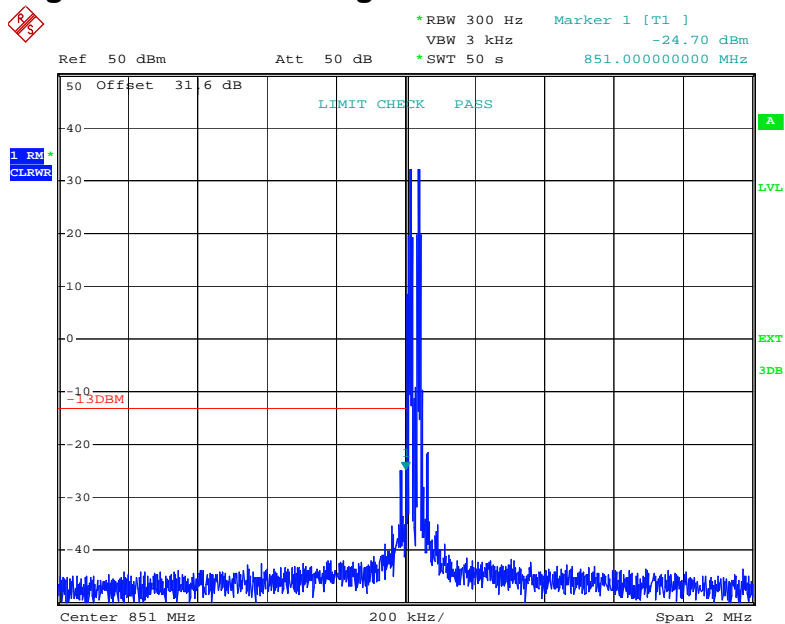
Detector: RMS.

Modulation	Carrier	RBW VBW Span	Max. level (dBm)	Plot -
Analog	860 MHz	1MHz 3MHz 30MHz – 9GHz	<-14,9	7.3.1.3 #1
iDEN	860 MHz	1MHz 3MHz 30MHz – 9GHz	<-14,9	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

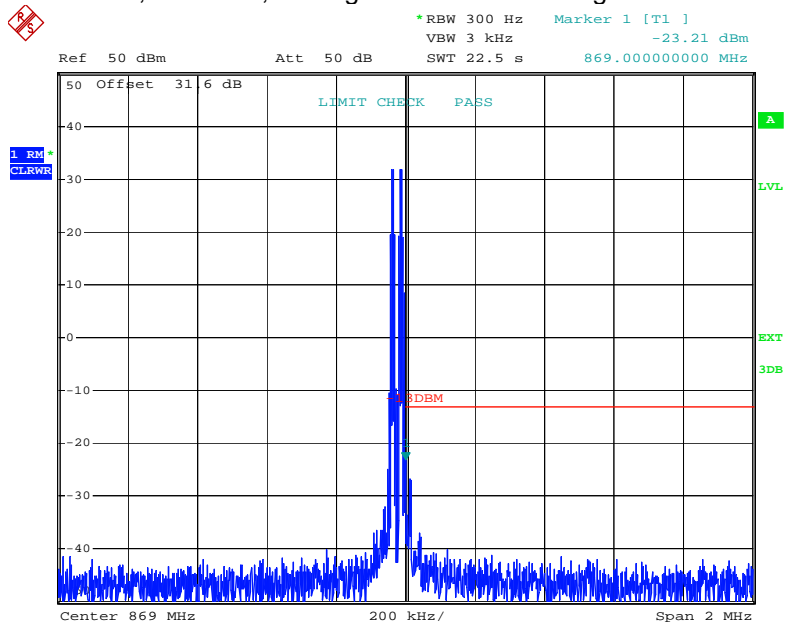


### 7.3.1.1 Analog < 1MHz to band edge



Date: 21.JUL.2010 09:30:46

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

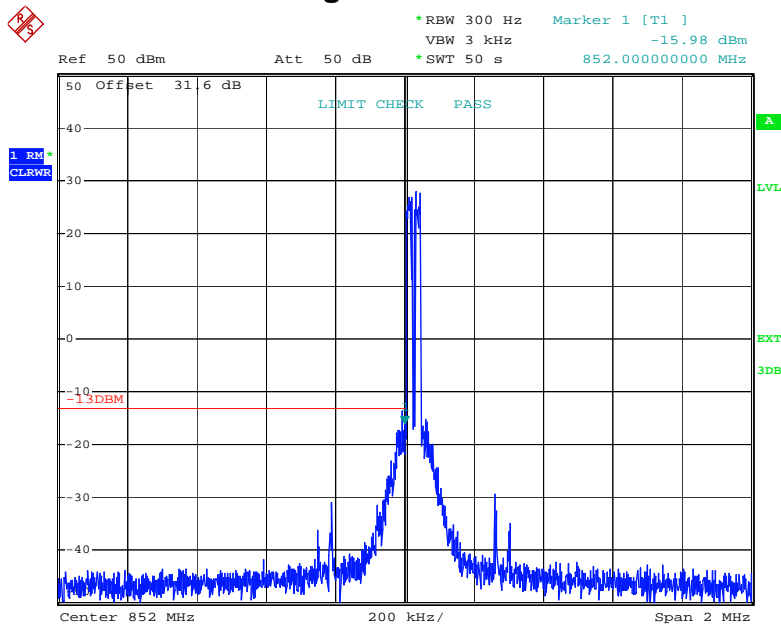


Date: 21.JUL.2010 08:36:57

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

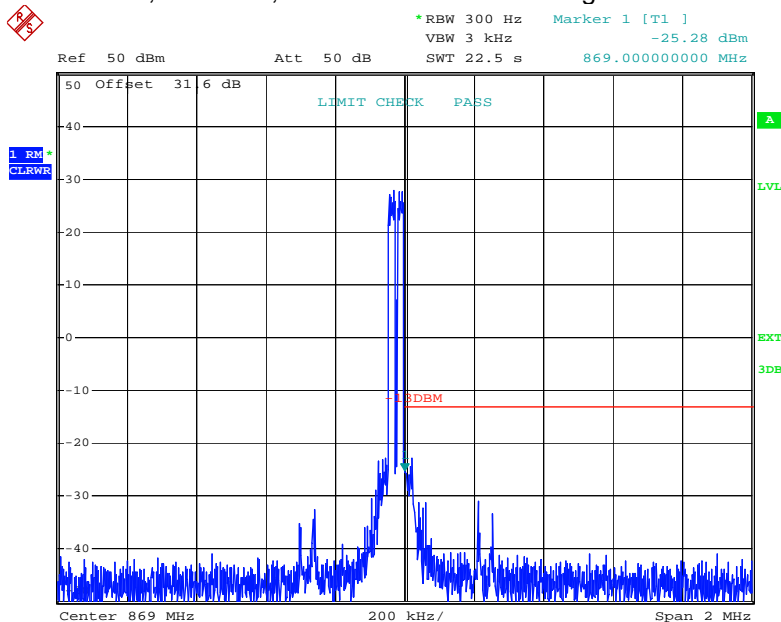


### 7.3.1.2 iDEN < 1MHz to band edge



Date: 21.JUL.2010 09:18:56

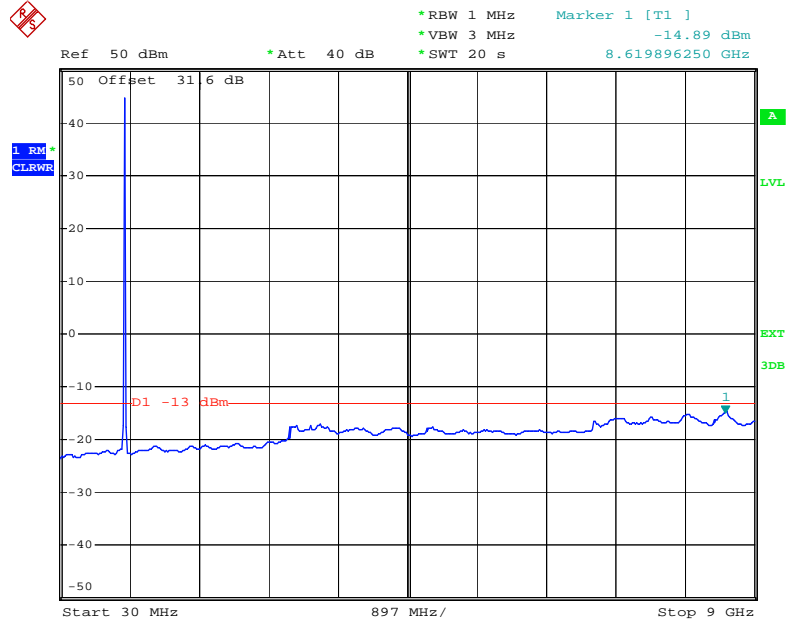
plot 7.3.1.2-#1 Spurious Emissions at Antenna Terminals: §90.210, §2.1051; RSS-131, RSS-GEN; Test results; Downlink; iDEN < 1MHz to band edge Lower Band Edge



Date: 21.JUL.2010 08:38:58

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

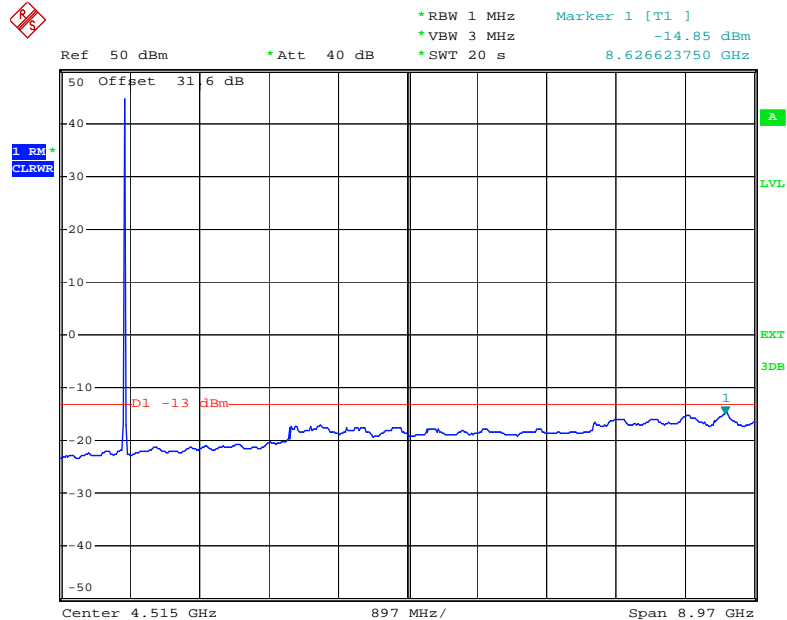
### 7.3.1.3 Analog > 1MHz to band edge



Date: 20.JUL.2010 12:35:31

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

### 7.3.1.4 iDEN > 1MHz to band edge



Date: 20.JUL.2010 13:05:08

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

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### 7.3.2 Uplink

n.a.

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

### 7.4 Summary test result

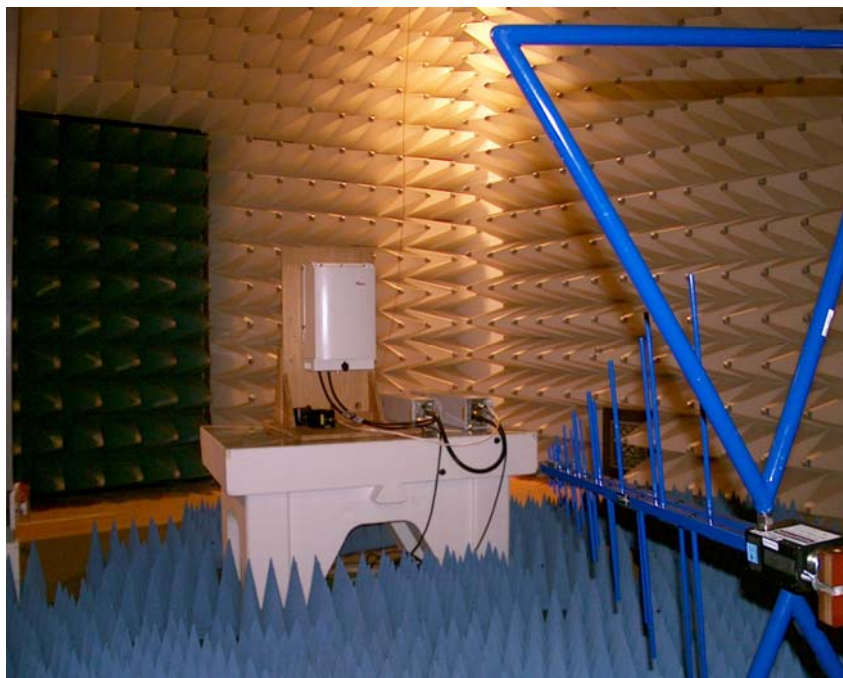
Test result	complies, according the plots above
Tested by:	Rainer Friedrich
Date:	20.07.2010



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



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



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



This clause specifies requirements for the measurement of radiated emission.

Frequency range	Distance: EUT <-> antenna / location	Limit	Test method
30 MHz - 1 GHz	3 metres / FAC	FCC 47 CFR Part 90.210 IC RSS-131	TIA-603-C:2004
1 GHz – 9 GHz	3 metres / FAC		

**Test equipment used:**

Designation	Type	Manufacturer	Invent.-no.	Cal.-date	due Cal.- date	used
EMI test receiver	ESI40	Rohde & Schwarz	E1687	20.10.2009	20.10.2010	X
EMI test receiver	ESI40	Rohde & Schwarz	E1607	04.03.2009	04.03.2010	
Antenna	CBL 6111	Chase	K1149	14.09.2009	14.09.2010	X
Antenna	CBL 6111	Chase	K1026	14.09.2009	14.09.2010	
RF Cable		Frankonia	K1121 SET	28.12.2009	28.12.2010	X
Pre amplifier	AM1431	Miteq	K1721	27.04.2009	27.04.2010	
Antenna	HL 025	R&S	K809	04.02.2010	04.02.2011	X
Antenna	MWH-1826 / B	ARA Inc.	K1042	06.04.2009	06.04.2010	
Antenna	MWH-2640 / B	ARA Inc.	K1043	06.04.2009	06.04.2010	
Preamplifier	AFS4-00102000	Miteq	K817	11.11.2009	11.11.2010	X
Preamplifier	AFS4-00102000	Miteq	K838	06.10.2009	06.10.2010	
Preamplifier	JS43-1800-4000	Miteq	K1104	26.08.2010	26.08.2011	
RF Cable	Sucoflex 100	Suhner	K1742	09.04.2010	09.04.2011	X

The REMI Version 2.135 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  
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.

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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IC ID: 2237E-IONM8085HP



## 8.1 Limit

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

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

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

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

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

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

**The Emission limit is -13dBm**

## 8.2 Climatic values in the lab

Temperature: 19,5°  
Relative Humidity: 43%  
Air-pressure: 998 hPa

### 8.3 Test method

*Measurement procedure.*

Compliance with these rules is based on the use of measurement instrumentation employing a resolution bandwidth of 100 kHz or greater. In the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. A narrower resolution bandwidth is permitted in all cases to improve measurement accuracy provided the measured power is integrated over the full required measurement bandwidth ( i.e. 100 kHz or 1 percent of emission bandwidth, as specified).

The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

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 erp is the signal level fed to the reference antenna corrected for gain referenced to a 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 ( $\pm 180$  degrees) as like defined in ANSI C63.4.

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.

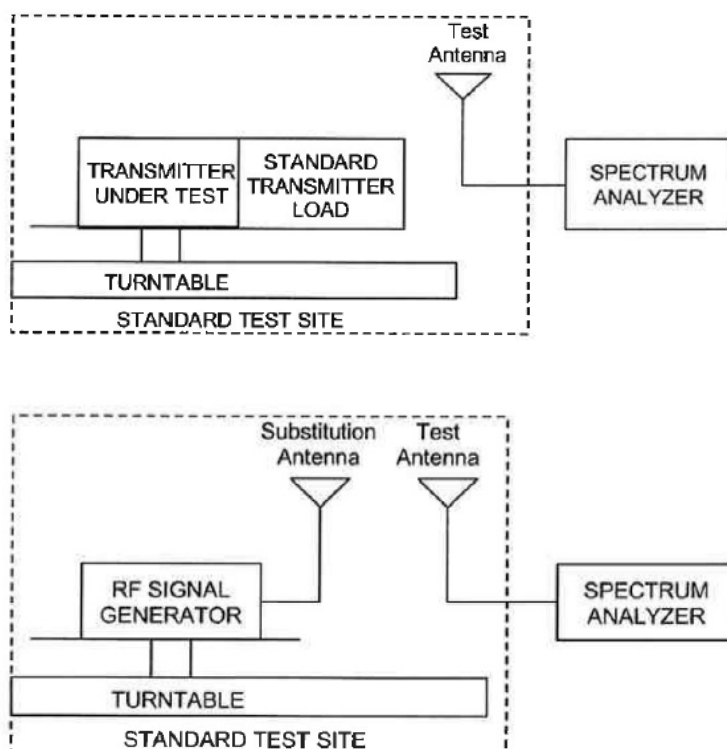


Figure #7.2 Substitution methods TIA-603-C

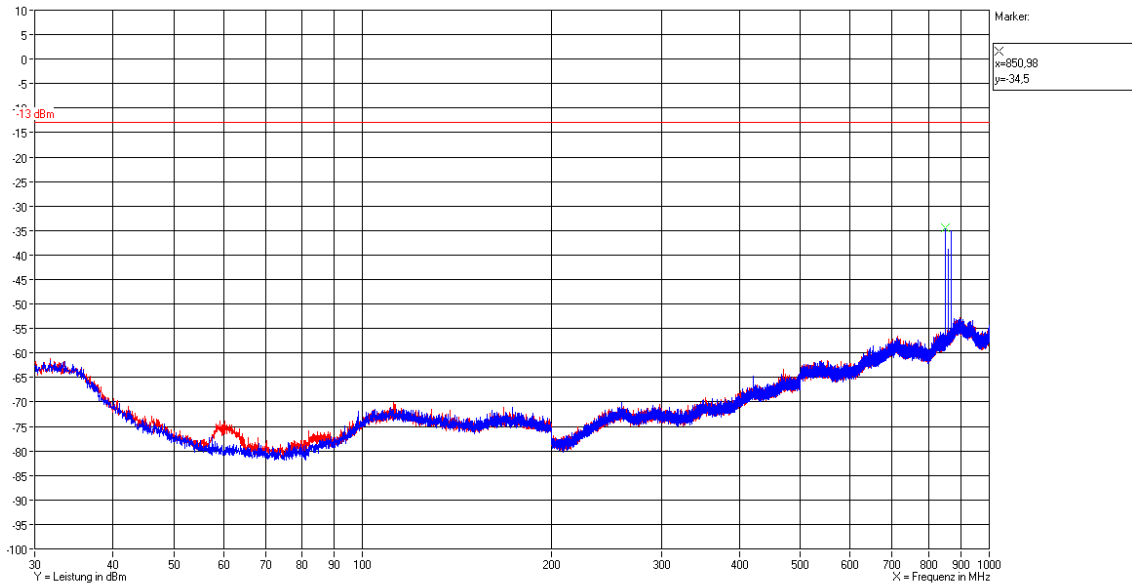
### 8.4 Test results

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

B/M/T: 851MHz – 860MHz – 869MHz

Polarisation: horizontal/vertical

Detector: Peak

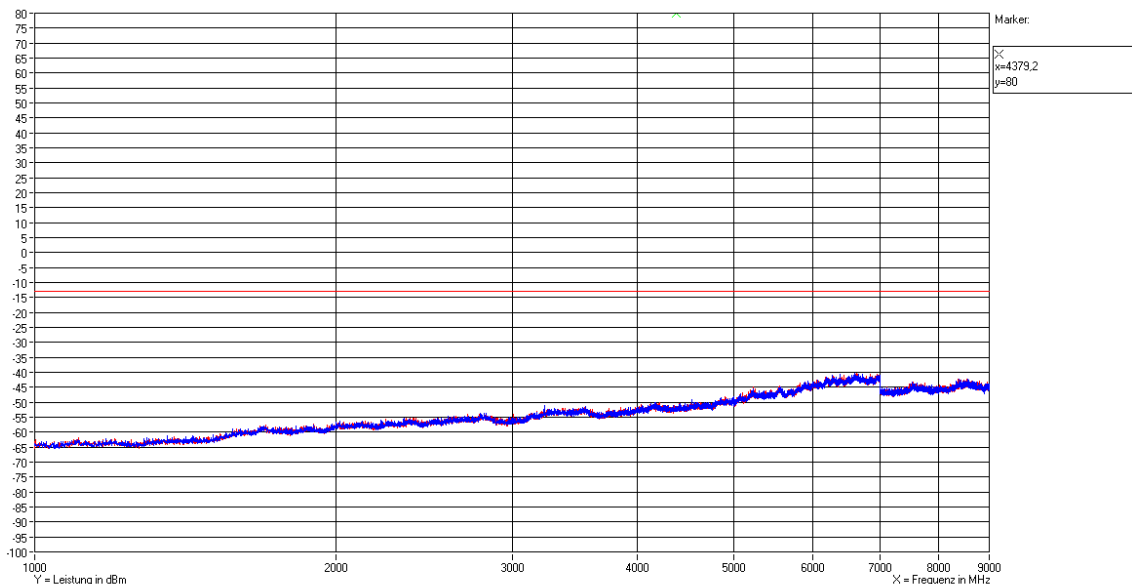


#### 8.4.2 1GHz to 9GHz Downlink (Bottom – Middle – Top)

B/M/T: 851MHz – 860MHz – 869MHz

Polarisation: horizontal/vertical

Detector: Peak



**No signals could be measured other than the fundamentals.**

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### 8.4.3 Uplink

n.a.

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

### 8.5 Summary test result

Test result	complies, according the plots above
Tested by:	Mario Lehmann
Date:	05.08.2010

## 9 History

Revision	Modification	Date	Name
V01.00	Initial	31.08.2010	Lehmann

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