

# FCC Part 22 Compliance Test Report

<b>Test Report no.:</b>	EMC_BO_001769	<b>Date of Report:</b>	12-Nov-2012
<b>Number of pages:</b>	32	<b>Project support engineer:</b>	Robert Müller

<b>Customer:</b>	novero GmbH, Meesmannstrasse 103, 44807 Bochum, Germany		
<b>Customers contact:</b>	Hindersmann, Jürgen		
<b>Manufacturer:</b>	novero GmbH		
<b>EUT ident.:</b>	Novero, HT-6c		
<b>FCC ID:</b>	WJLHT-6C	<b>IC ID:</b>	7847A-HT6C

<b>Referred documents:</b>	CFR 47, FCC rules Part 22, TIA-603-C-2004 and IC standards RSS-GEN (Issue 3), RSS-132 (Issue 2). Deviations or clarifications to these standards are noted in the related test result under “test reference and limit”.
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	FCC listing no.:	881111	IC recognition no.: 7847A-1
	Laboratory manager:	Jürgen Mitterer	

<b>Test result</b>	The EUT does comply with the requirements made in the referred test documents.
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**Signature:**

31-Oct-2012, Jürgen Mitterer  
Manager Validation Services  
Approval

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Project support engineer:	Robert Müller	Test Report for FCC Part 22H
Date of issue:	12-Nov-2012	Template version 1.0
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## 1. Summary for FCC Part 22 Compliance Test Report

Date of receipt	15-Oct-2012
Testing completed	22-Oct-2012
The customer's contact person	Hindersmann, Jürgen
Notes	None

### 1.1. EUT and Accessory Information

The EUT is a 12V DC powered device with quad band GSM / tri band WCDMA device (GSM850/900/1800/1900; FDDII/IV/V) with an external antenna connector and internal back-up antenna. EUT is tested with maximum rated TX power, modulated with pseudo random bit sequence (PRBS9). No dedicated external antenna specified by the manufacturer. Since the device has only one cellular port which will be switched to internal antenna or external antenna connector, radiated measurements were done with internal antenna and conducted related measurements via the external antenna connector.

Product	Type	IMEI	HW	MV	SW	DUT
Onboard Connectivity Unit	HT-6c	004402000051593	0501	--	N036	DIS039

### 1.2. Summary of Test Results

Section	Section in CFR 47	Section in RSS-GEN or RSS-132	Name of the test	Result
3	2.1046(a), 22.913(a)	4.4	Conducted RF output power	PASS
4	2.1049(h)	4.6.1	99% occupied bandwidth	PASS
5	22.917(a)	4.5	Band edge compliance	PASS
6	22.917(a), 2.1051	4.5	Spurious emissions at antenna terminals	PASS
7	22.917(a), 2.1053	4.5	Spurious radiated emissions	PASS
8	2.1055(a)	4.3	Frequency stability, temperature variation	PASS
9	2.1055(d)	4.3	Frequency stability, voltage variation	PASS

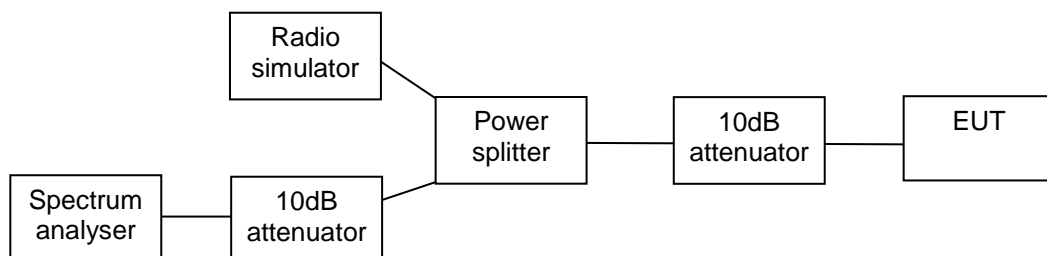
PASS: The EUT complies with the essential requirements in the standard.  
 FAIL: The EUT does not comply with the essential requirements in the standard.  
 NP: The test was not performed.  
 NA: The test was not applicable

## CONTENTS

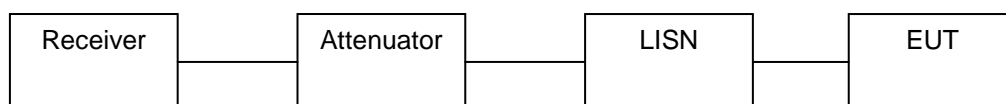
<b>1. SUMMARY FOR FCC PART 22 COMPLIANCE TEST REPORT .....</b>	<b>2</b>
1.1. EUT AND ACCESSORY INFORMATION .....	2
1.2. SUMMARY OF TEST RESULTS.....	2
<b>2. TEST SETUPS .....</b>	<b>4</b>
2.1. CONDUCTED TEST SETUP .....	4
2.2. CONDUCTED AC POWER LINE CONDUCTED EMISSIONS TEST SETUP.....	4
2.3. RADIATED TEST SETUP .....	4
<b>3. CONDUCTED RF OUTPUT POWER (FCC §22.913(A)(2), §2.1046(A), RSS-132 4.4) .....</b>	<b>5</b>
3.1. TEST REFERENCE AND LIMIT .....	5
3.2. GSM850 TEST RESULTS.....	6
3.3. WCDMA850 TEST RESULTS.....	9
<b>4. 99% OCCUPIED BANDWIDTH (FCC §2.1049(H), RSS-132 4.6.1) .....</b>	<b>11</b>
4.1. TEST REFERENCE AND LIMIT .....	11
4.2. GSM850 TEST RESULTS.....	12
4.3. WCDMA850 TEST RESULTS.....	13
<b>5. BAND EDGE COMPLIANCE (FCC §22.917(B), RSS-132 4.5) .....</b>	<b>14</b>
5.1. TEST REFERENCE AND LIMIT .....	14
5.2. GSM850 TEST RESULTS.....	15
5.3. WCDMA850 TEST RESULTS.....	17
<b>6. SPURIOUS EMISSIONS AT ANTENNA TERMINALS (FCC §22.917(A),§2.1051 RSS-132 4.5) .....</b>	<b>18</b>
6.1. TEST REFERENCE AND LIMIT .....	18
6.2. GSM850 TEST RESULTS.....	19
6.3. WCDMA850 TEST RESULTS.....	22
<b>7. SPURIOUS RADIATED EMISSIONS (FCC §22.917(A), §2.1053, RSS-132 4.5) .....</b>	<b>24</b>
7.1. TEST REFERENCE AND LIMIT .....	24
7.2. GSM850 TEST RESULTS.....	26
7.3. WCDMA850 TEST RESULTS.....	27
<b>8. FREQUENCY STABILITY, TEMPERATURE VARIATION (FCC §2.1055(A), RSS-132 4.3 .....</b>	<b>28</b>
8.1. TEST REFERENCE AND LIMIT .....	28
8.2. GSM850 TEST RESULTS.....	29
<b>9. FREQUENCY STABILITY, VOLTAGE VARIATION (FCC §2.1055(D), RSS-132 4.3 .....</b>	<b>30</b>
9.1. TEST REFERENCE AND LIMIT .....	30
9.2. GSM850 TEST RESULTS.....	31
<b>10. TEST EQUIPMENT .....</b>	<b>32</b>
10.1. CONDUCTED MEASUREMENTS .....	32
10.2. RADIATED MEASUREMENTS .....	32

## 2. Test setups

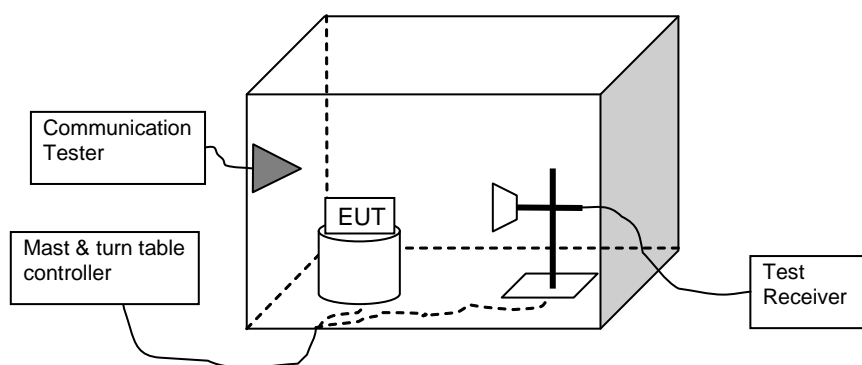
### 2.1. Conducted test setup



### 2.2. Conducted AC power line conducted emissions test setup



### 2.3. Radiated test setup



### 3. Conducted RF output power (FCC §22.913(a)(2), §2.1046(a), RSS-132 4.4)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	18.Oct.2012
Measured by	Robert Müller

#### 3.1. Test reference and limit

The measurement is made according to FCC rules parts 22, IC standard RSS-132 and TIA-603-C.

Limits for conducted RF output power measurements

Frequency range [MHz]	Limit [W]	Limit [dBm]
824 - 849	7	38.45

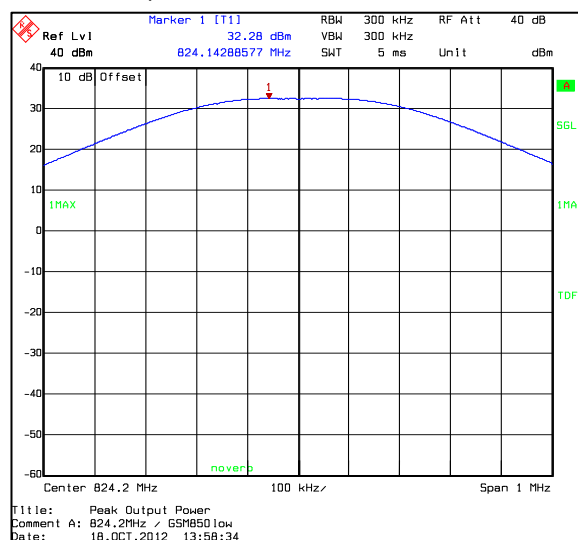
## 3.2. GSM850 Test results

### 3.2.1 GSM mode

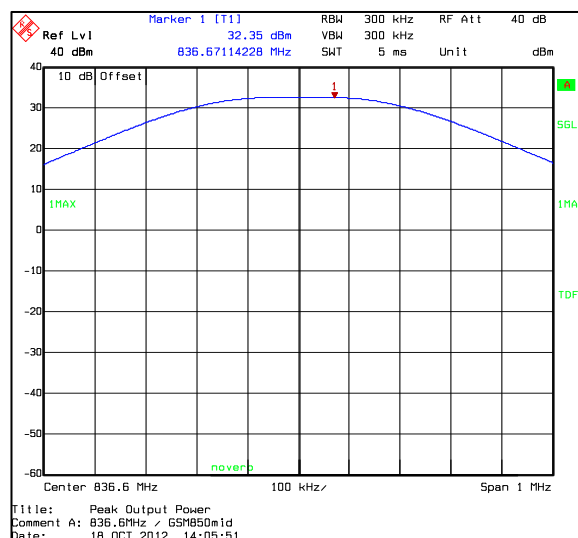
Channel / f <sub>c</sub> [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
128 / 824.2	32.28	1690.44	8.32	PASS
190 / 836.6	32.35	1717.91	8.25	PASS
251 / 848.8	32.29	1694.34	8.31	PASS

No external antenna gain is specified by the manufacturer. The result is PASS for external antenna gains equal or less than specified above. Max. Antenna gain [dBd] = 38.45 dBm – Conducted Output Power [dBm]. Conversion from dBd to dBi 2.15dB has to be added.

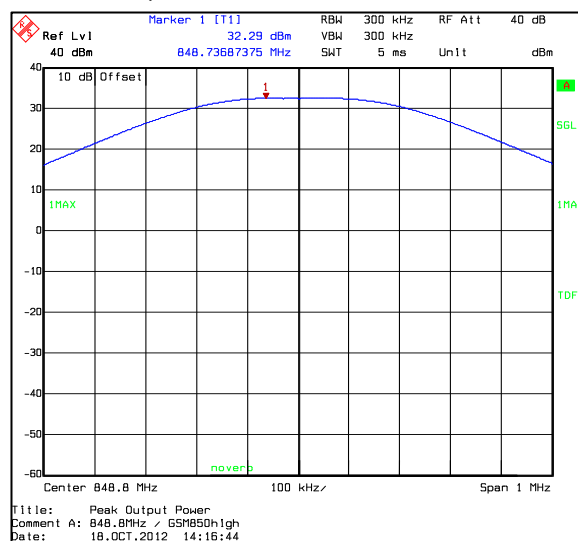
#### Channel 128 / 824.2 MHz



#### Channel 190 / 836.6 MHz



Channel 251 / 848.8 MHz

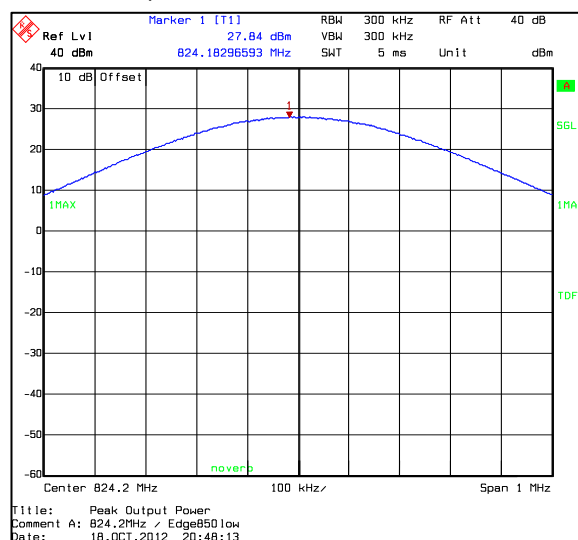


### 3.2.2 EGPRS mode

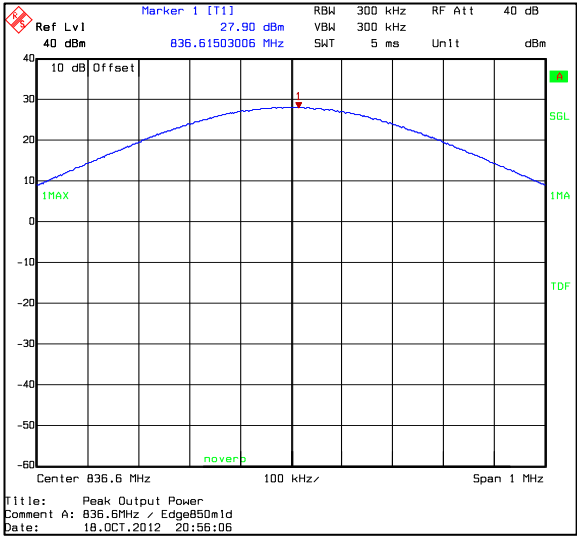
Channel / $f_c$ [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
128 / 824.2	27.84	608.14	12.76	PASS
190 / 836.6	27.90	616.60	12.70	PASS
251 / 848.8	27.98	628.06	12.62	PASS

No external antenna gain is specified by the manufacturer. The result is PASS for external antenna gains equal or less than specified above. Max. Antenna gain [dBd] = 38.45 dBm – Conducted Outout Power [dBm]. Conversion from dBd to dBi 2.15dB has to be added.

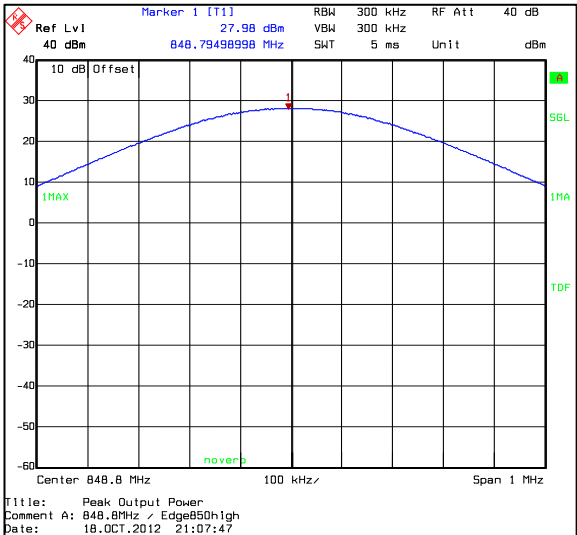
Channel 128 / 824.2 MHz



Channel 190 / 836.6 MHz



Channel 251 / 848.8 MHz





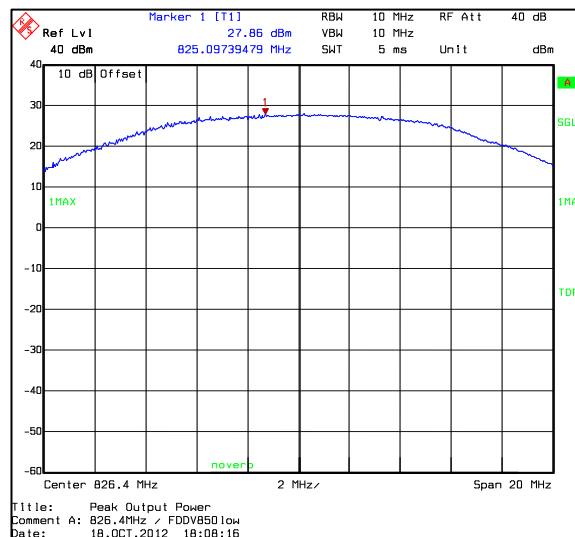
### 3.3. WCDMA850 Test results

#### 3.3.1 FDD5 mode, RMC

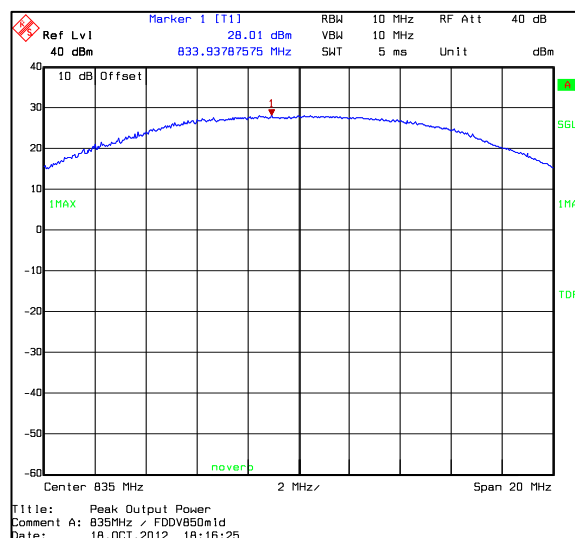
Channel / f <sub>c</sub> [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
4132 / 826.4	27.86	610.94	12.74	PASS
4183 / 836.6	28.01	632.41	12.59	PASS
4233 / 846.6	28.10	645.65	12.50	PASS

No external antenna gain is specified by the manufacturer. The result is PASS for external antenna gains equal or less than specified above. Max. Antenna gain [dBd] = 38.45 dBm – conducted output Power [dBm]. Conversion from dBd to dBi 2.15dB has to be added.

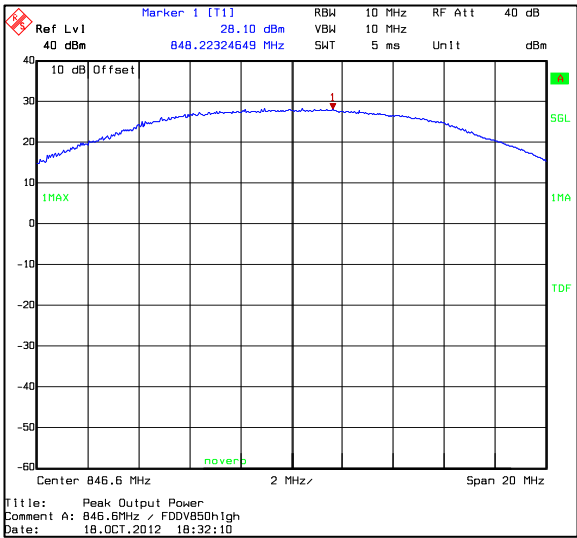
##### Channel 4132 / 826.4 MHz



##### Channel 4175 / 835 MHz



Channel 4233 / 846.6 MHz



#### 4. 99% occupied bandwidth (FCC §2.1049(h), RSS-132 4.6.1)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	18.Oct.2012
Measured by	Robert Müller

##### 4.1. Test reference and limit

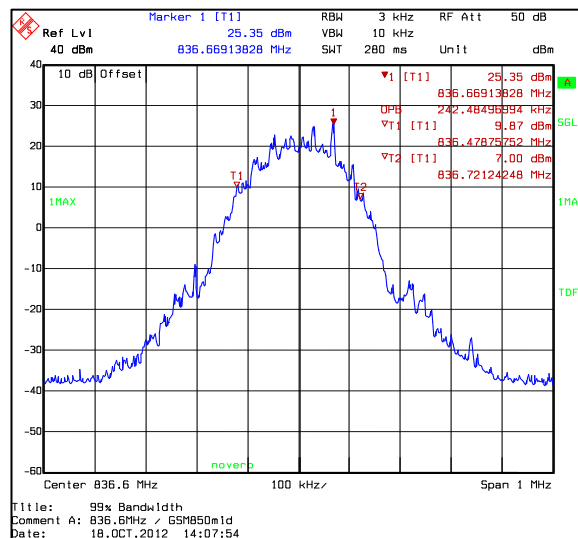
The measurement is made according to FCC rules parts 22, IC standard RSS-GEN, RSS-132 and TIA-603-C.

## 4.2. GSM850 Test results

### 4.2.1 GSM mode

Channel / $f_c$ [MHz]	99% occupied bandwidth [kHz]	Result
190 / 836.6	242.48	PASS

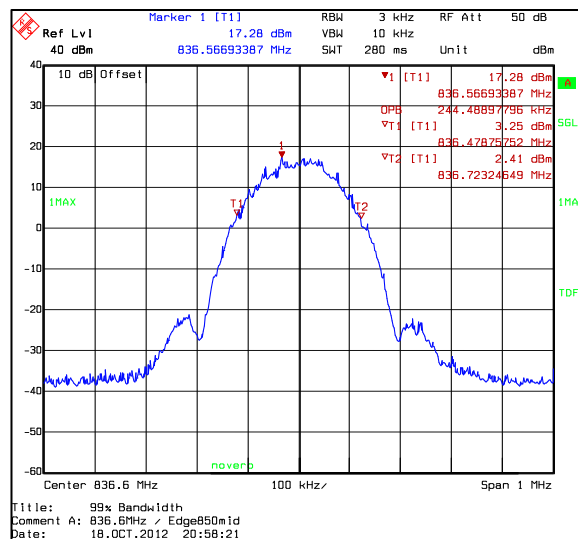
Channel 190 / 836.6 MHz



### 4.2.2 EGPRS mode

Channel / $f_c$ [MHz]	99% occupied bandwidth [kHz]	Result
190 / 836.6	244.49	PASS

Channel 190 / 836.6 MHz

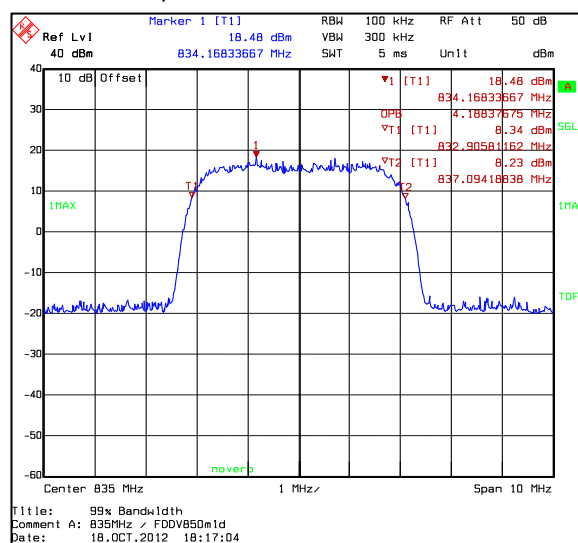


### 4.3. WCDMA850 Test results

#### 4.3.1 FDD5 mode, RMC

Channel / $f_c$ [MHz]	99% occupied bandwidth [kHz]	Result
4183 / 836.6	4188.38	PASS

Channel 4183 / 836.6 MHz



## 5. Band edge compliance

(FCC §22.917(b), RSS-132 4.5)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	18.Oct.2012
Measured by	Robert Müller

### 5.1. Test reference and limit

The measurement is made according to FCC rules parts 22 and IC standard RSS-132.

Limits for band edge compliance measurements

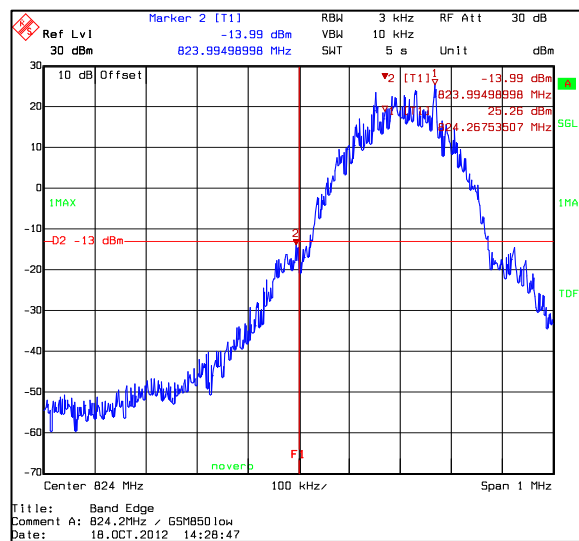
Frequency range [MHz]	Limit [dBm]
Below 824 and above 849	-13

## 5.2. GSM850 Test results

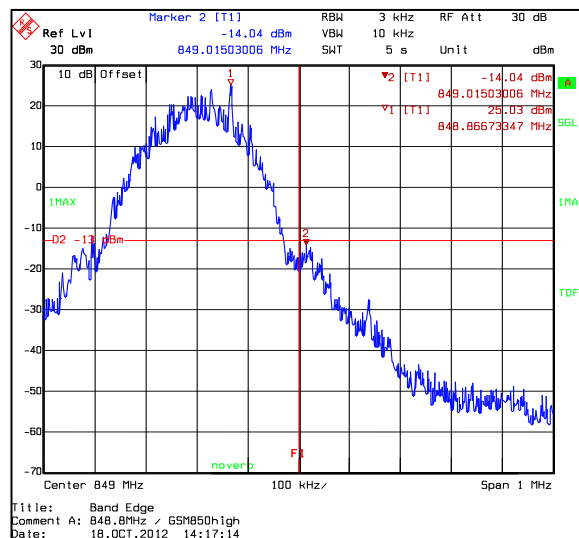
### 5.2.1 GSM mode

Channel / f <sub>c</sub> [MHz]	Level [dBm]	Result
128 / 824.2	-13.99	PASS
251 / 848.8	-14.04	PASS

Channel 128 / 824.2 MHz



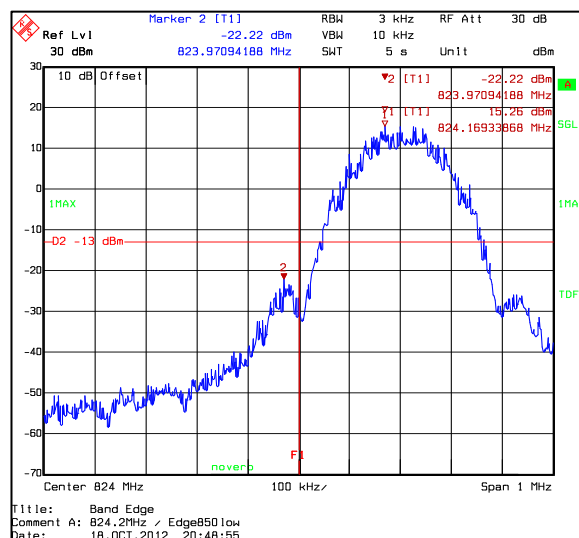
Channel 251 / 848.8 MHz



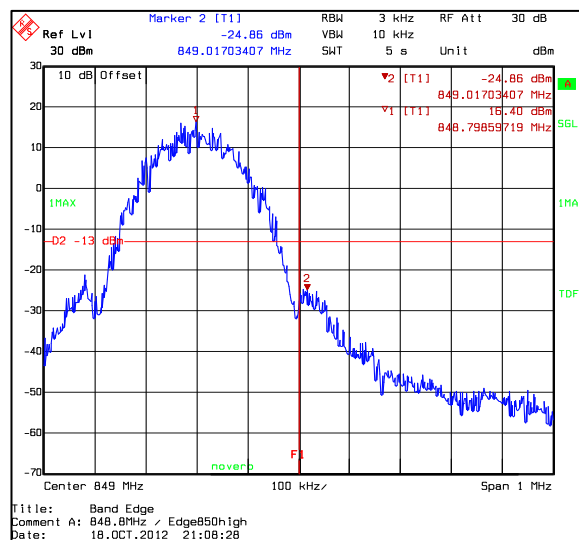
## 5.2.2 EGPRS mode

Channel / f <sub>c</sub> [MHz]	Level [dBm]	Result
128 / 824.2	-22.22	PASS
251 / 848.8	-24.86	PASS

Channel 128 / 824.2 MHz



Channel 251 / 848.8 MHz







## 6. Spurious emissions at antenna terminals (FCC §22.917(a), §2.1051 RSS-132 4.5)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	18.Oct.2012
Measured by	Robert Müller

### 6.1. Test reference and limit

The measurement is made according to TIA-603-C

Limits for spurious emissions at antenna terminals measurements

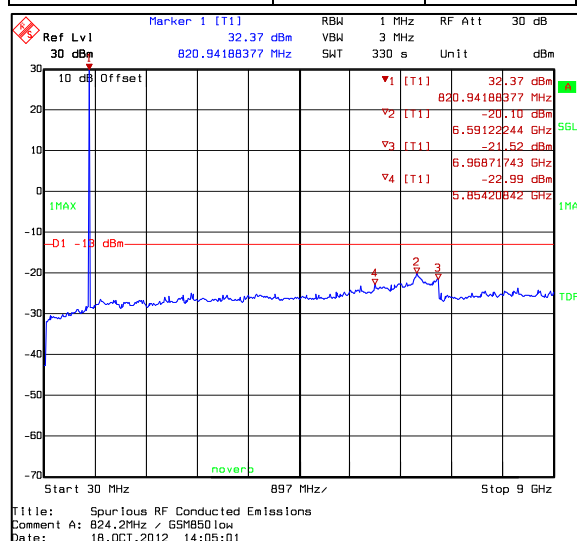
Frequency range [MHz]	Limit [dBm]
1 – 8500	-13

## 6.2. GSM850 Test results

### 6.2.1 GSM mode

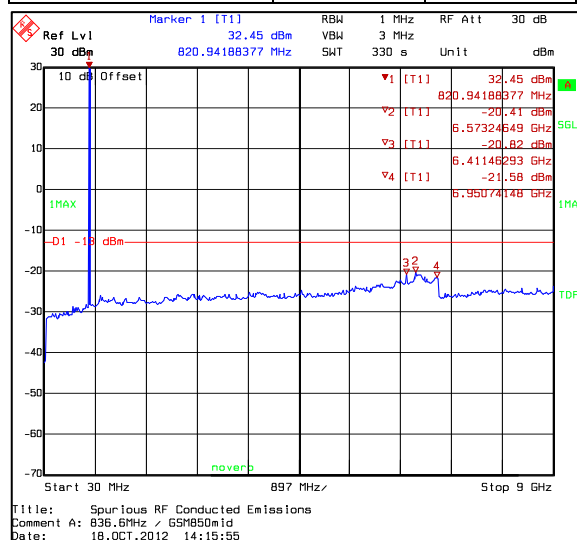
Channel 128 / 824.2 MHz

Frequency [MHz]	P [dBm]	Result
5854.21	-22.99	PASS
6591.22	-21.52	PASS
6968.72	-20.10	PASS



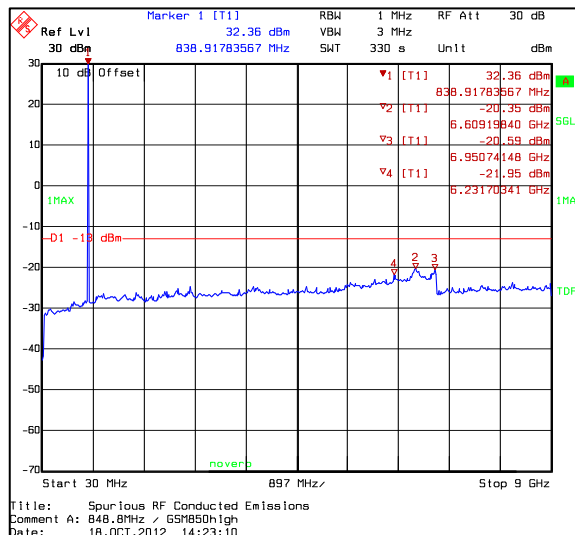
Channel 190 / 836.6 MHz

Frequency [MHz]	P [dBm]	Result
6411.46	-21.58	PASS
6573.25	-20.82	PASS
6950.74	-21.58	PASS



Channel 251 / 848.8 MHz

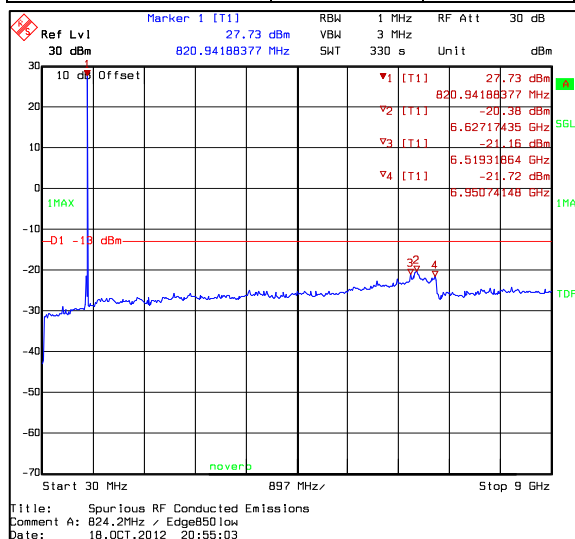
Frequency [MHz]	P [dBm]	Result
6231.70	-21.95	PASS
6609.20	-20.35	PASS
6950.74	-20.59	PASS



## 6.2.2 EGPRS mode

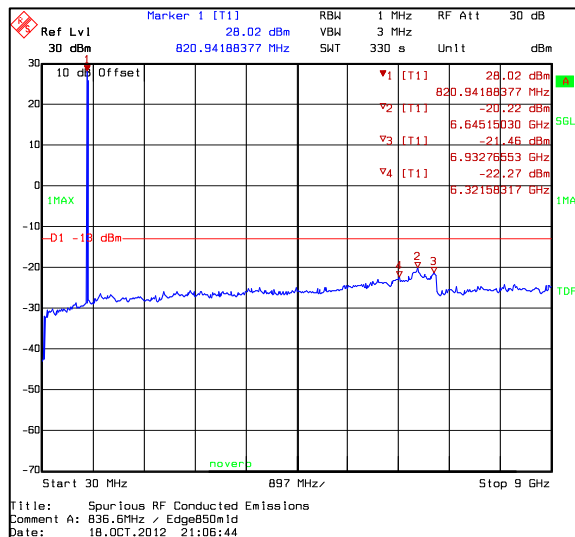
Channel 128 / 824.2 MHz

Frequency [MHz]	P [dBm]	Result
6519.32	-21.16	PASS
6627.17	-20.38	PASS
6950.74	-21.72	PASS



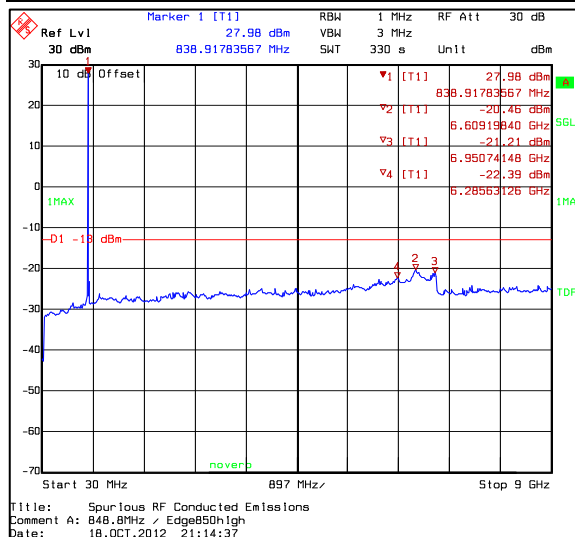
Channel 190 / 836.6 MHz

Frequency [MHz]	P [dBm]	Result
6321.58	-22.27	PASS
6645.15	-20.22	PASS
6932.77	-21.46	PASS



Channel 251 / 848.8 MHz

Frequency [MHz]	P [dBm]	Result
6285.63	-22.39	PASS
6609.20	-20.46	PASS
6950.74	-21.21	PASS

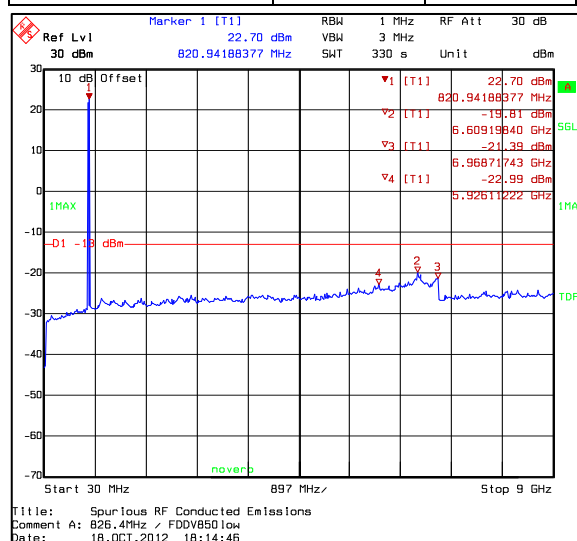


### 6.3. WCDMA850 Test results

#### 6.3.1 FDD5 mode, RMC

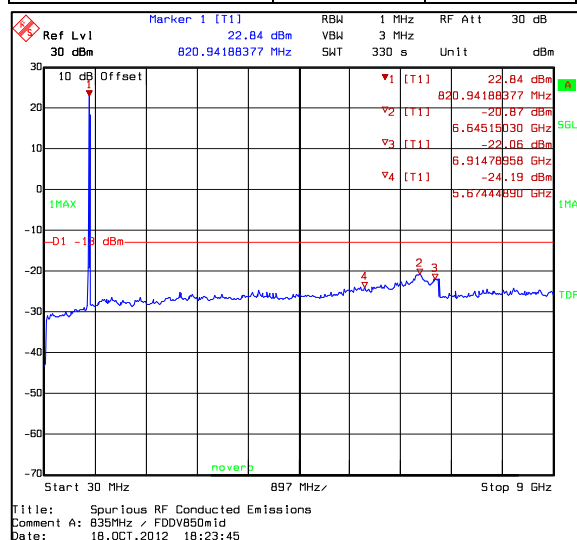
Channel 4132 / 826.4 MHz

Frequency [MHz]	P [dBm]	Result
5926.11	-22.99	PASS
6609.20	-19.81	PASS
6968.72	21.39	PASS



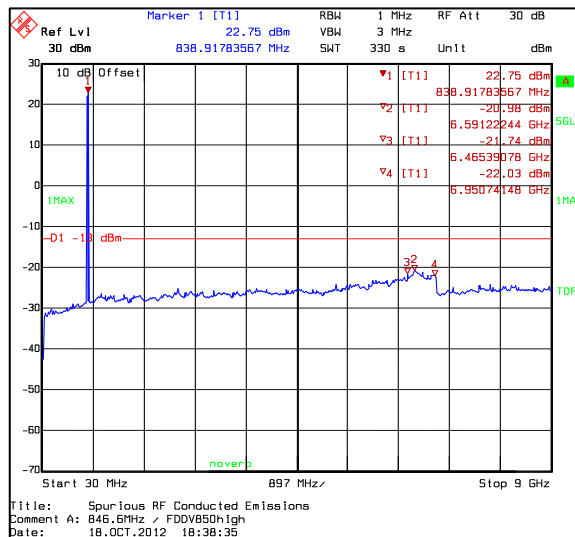
Channel 4183 / 836.6 MHz

Frequency [MHz]	P [dBm]	Result
5674.45	-24.19	PASS
6645.15	-20.87	PASS
6914.79	-22.06	PASS



Channel 4233 / 846.6 MHz

Frequency [MHz]	P [dBm]	Result
6465.39	-21.74	PASS
6591.22	-20.98	PASS
6950.74	-22.03	PASS



## 7. Spurious radiated emissions

(FCC §22.917(a), §2.1053, RSS-132 4.5)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	16.Oct.2012
Measured by	Robert Müller

### 7.1. Test reference and limit

The measurement is made according to TIA-603-C as follows:

Below 3GHz:

The Preliminary Measurement and the Final Measurement is performed in 3m distance by rotating the turntable of 360 degrees at fixed height.

The Preliminary Measurement and the Final Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed, if the Preliminary Measurement results are closer than 20 dB to the permissible limit.

Above 3GHz:

The Preliminary Measurement and the Final Measurement is performed in 1.5m distance by rotating the turntable of 360 degrees at fixed height.

The Preliminary Measurement and the Final Measurement with absorbers on the floor and measuring antenna at fixed height using 2-axis EUT position system.

The Final Measurement is performed, if the Preliminary Measurement results are closer than 20 dB to the permissible limit.

General:

Regarding RSS-GEN I3 Section 4.3 (i), the transmitter spurious emissions have been measured in 3 channels, see section 6 "Spurious emissions at antenna terminals" of this test report. The spurious radiated emission test shows emissions radiated from the enclosure of the EUT in one TX channel.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The EUT is placed at nonconductive plate at the turntable center.

The emissions less than 20 dB below the permissible value are reported.

The substitution method is used. Substitution values at each frequencies are measured in beforehand and saved to the test software. The substitution corrections are obtained as described below:

$$A_{SUBST} = P_{SUBST\ TX} - P_{SUBST\ RX} - L_{SUBST\ CABLES} + G_{SUBST\ TX\ ANT}$$



Where  $A_{SUBST}$  is the final substitution correction including receive antenna gain.  $P_{SUBST\ TX}$  is the signal generator level,  $P_{SUBST\ RX}$  is receiver level,  $A_{SUBST}$  and  $L_{SUBST\ CABLES}$  is cable losses including both TX and RX cables and  $G_{SUBST\ TX\ ANT}$  is substitution antenna gain.

The measurement results are obtained as described below:

$$P[dBm] = P_{MEAS} + A_{CF}$$

Where  $P_{MEAS}$  is the receiver reading in dBm and  $A_{CF}$  is the correction factor including cable loss and substitution correction ( $A_{CF} = L_{CABLES} G_{PREAMP} + A_{SUBST}$ ).

Limits for spurious radiated emissions measurements

Frequency range [MHz]	Limit [dBm]
30 - 8500	-13

## 7.2. GSM850 Test results

### 7.2.1 GSM mode

Channel 190 / 836.6 MHz

Frequency [MHz]	P [dBm]	P [ $\mu$ W]	P <sub>MEAS</sub> [dBm]	A <sub>CF</sub> [dB]	Polarisation	Result
1673.14	-39.90	0.102	-38.80	-1.10	HORIZONTAL	PASS
2509.82	-29.10	1.230	-35.20	6.10	HORIZONTAL	PASS
3346.69	-34.10	0.389	-31.30	-2.80	VERTICAL	PASS

Substitution method could not be utilized as no emission above noise floor were found during measurements

### 7.2.2 EGPRS mode

Channel 190 / 836.6 MHz

Frequency [MHz]	P [dBm]	P [ $\mu$ W]	P <sub>MEAS</sub> [dBm]	A <sub>CF</sub> [dB]	Polarisation	Result
1673.14	-44.20	0.038	-43.10	-1.10	HORIZONTAL	PASS
2509.82	-45.60	0.028	-51.70	6.10	HORIZONTAL	PASS
3346.69	-47.30	0.019	-44.50	-2.80	VERTICAL	PASS

Substitution method could not be utilized as no emission above noise floor were found during measurements

### 7.3. WCDMA850 Test results

#### 7.3.1 FDD5 mode, RMC

Channel 4175 / 835.0 MHz

Frequency [MHz]	P [dBm]	P [ $\mu$ W]	P <sub>MEAS</sub> [dBm]	A <sub>CF</sub> [dB]	Polarisation	Result
1668.73	-45.30	0.030	-46.20	-0.90	HORIZONTAL	PASS
2507.62	-45.40	0.029	-51.50	6.10	HORIZONTAL	PASS
3344.68	-42.10	0.062	-39.30	-2.80	VERTICAL	PASS
4180.86	-47.50	0.018	-46.00	-1.50	HORIZONTAL	PASS

Substitution method could not be utilized as no emission above noise floor were found during measurements

## 8. Frequency stability, temperature variation (FCC §2.1055(a), RSS-132 4.3)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	-30 to +50 / 45
Date of measurements	22.Oct.2012
Measured by	Robert Müller

### 8.1. Test reference and limit

The measurement is made according to FCC rules parts 22, IC standard RSS-132 and TIA-603-C as follows:

1. The climate chamber temperature is set to the maximum value and the temperature is allowed to stabilize.
2. The EUT is placed in the chamber.
3. The EUT is set in idle mode for 15minutes.
4. The EUT is set to transmit.
5. The transmit frequency error was measured immediately.
6. The steps 3-5 were repeated for each temperature.

Limits for frequency stability, temperature variation measurements

Frequency deviation [ppm]
+/- 2.5

## 8.2. GSM850 Test results

### 8.2.1 GSM mode

Temperature [°C]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
50	824.2	-33.96	-0.0412	PASS
	836.6	-35.64	-0.0426	PASS
	848.8	-36.48	-0.0430	PASS
40	824.2	-37.19	-0.0451	PASS
	836.6	-35.51	-0.0424	PASS
	848.8	-34.22	-0.0403	PASS
30	824.2	-36.48	-0.0443	PASS
	836.6	-33.06	-0.0395	PASS
	848.8	-34.61	-0.0408	PASS
20	824.2	-34.55	-0.0419	PASS
	836.6	-30.80	-0.0368	PASS
	848.8	-31.19	-0.0367	PASS
10	824.2	-31.83	-0.0386	PASS
	836.6	-34.09	-0.0407	PASS
	848.8	-29.96	-0.0353	PASS
0	824.2	-33.84	-0.0411	PASS
	836.6	-34.03	-0.0407	PASS
	848.8	-28.67	-0.0338	PASS
-10	824.2	-28.86	-0.0350	PASS
	836.6	-30.22	-0.0361	PASS
	848.8	-30.61	-0.0361	PASS
-20	824.2	-26.22	-0.0318	PASS
	836.6	-25.18	-0.0301	PASS
	848.8	-27.70	-0.0326	PASS
-30	824.2	-33.25	-0.0403	PASS
	836.6	-24.60	-0.0294	PASS
	848.8	-34.61	-0.0408	PASS

## 9. Frequency stability, voltage variation

(FCC §2.1055(d), RSS-132 4.3)

EUT with DUT number	DIS039
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	6.2 to 15.6 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	22.Oct.2012
Measured by	Robert Müller

### 9.1. Test reference and limit

The measurement is made according to FCC rules parts 22, IC standard RSS-132 and TIA-603-C as follows:

The EUT is connected to an adjustable power supply. The frequency stability was measured at nominal voltage and at the operation end point.

Limits for frequency stability, voltage variation measurements

Frequency deviation [ppm]
+/- 2.5

## 9.2. GSM850 Test results

### 9.2.1 GSM mode

Voltage [V]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
Maximum (15.6)	824.2	-31.32	-0.0380	PASS
	836.6	-27.96	-0.0334	PASS
	848.8	-39.58	-0.0466	PASS
Nominal (13.2)	824.2	-32.41	-0.0393	PASS
	836.6	-27.89	-0.0333	PASS
	848.8	-30.54	-0.0360	PASS
Operation end point (6.0)	824.2	-28.54	-0.0346	PASS
	836.6	-31.90	-0.0381	PASS

## 10. Test equipment

### 10.1. Conducted measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
EMI Test Receiver	ESCS 30	R&S	Aug 2012	1
LISN 50 µH	ESH3-Z5	R&S	Aug 2012	1
LISN 50 µH	ESH3-Z5	R&S	Aug 2012	1
V network	ESH3-Z6	R&S	Apr 2012	1
V network	ESH3-Z6	R&S	Apr 2012	1
T-ISN	ISN T800	Teseq	Aug 2012	2
Thermo- Hygrograph	OPUS 10	Lufft	Jun 2011	2
EM Injection clamp	F-33-1	Fischer	Apr 2012	2
Signal generator	SML01	R&S	Apr 2012	2
Digital Radio Communication Tester	CMU200	R&S	Aug 2012	1
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--
EMI Test Receiver	FSEM30	R&S	Aug 2012	1
Temperature Test system	VT4004	Vötsch	Jul 2012	2
Power Supply	E3632A	Agilent	Jul 2012	1
Signal generator	SMP02	R&S	Jun 2011	2
BT/WLAN Tester	N 4010 A	Agilent	May 2011	2
Digital Radio Communication Tester	CMU200	R&S	Jun 2012	1
RF Radio Software	RADIO	novero	n.a.	--

### 10.2. Radiated measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
Controller	2090	ETS	n.a.	--
MAST	2075	ETS	n.a.	--
Ultra Broadband Antenna	HL562	R&S	Jul 2012	3
Digital Radio Communication Tester	CMU200	R&S	Jul 2011	2
EMI Test receiver	ESIB26	R&S	Jul 2012	1
Yaesu controller	G-1000DXC	YAESU	n.a.	--
Computer controller (Yaesu)	GS-232B	YAESU	n.a.	--
Anechoic chamber	3 meter semi/full anechoic chamber	ETS Euroshield	Mar 2012	3
Horn Antenna	3115	EMCO	Apr 2012	3
Horn Antenna	BBHA9120LF	Schwarzbeck	Aug 2011	3
Standard Horn Antenna	3160-09	EMCO	n.a.	--
Thermo- Hygrograph	OPUS 10	Lufft	Jun 2011	2
Band Reject Filter	WRCG 2400/2485 - 2375/2510 - 60/20EE	Wainwright	Mar 2012	1
Notch Filter GSM850	WRCD 800/880-0,2/40-5SSSD	Wainwright	Mar 2012	1
Band Reject Filter WCDMA850	WRCG 832/838-825/845-40/5SS	Wainwright	Mar 2012	1
Notch Filter GSM1900	WRCD 1700/2000-0,2/40-5SSSD	Wainwright	Mar 2012	1
Band Reject Filter AWS 1700	WRCGV1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	Mar 2012	1