FCC Part 24 Compliance Test Report

Test Report no.:	EMC_BO_001741	**Date of Report:**	06-Aug-2012
Number of pages:	25	**Project support engineer:**	Robert Müller

Customer:	novero GmbH, Meesmannstrasse 103, 44807 Bochum, Germany		
Customers contact:	Jürgen Hindersmann		
Manufacturer	novero GmbH		
EUT ident.:	**Hands-Free Unit with Bluetooth, WLAN and GSM/WCDMA, HT-5**		
FCC ID	WJLHT-5	**IC:**	7847A-HT5

Referred documents:	CFR 47, FCC rules Part 24, TIA-603-C-2004 and IC standards RSS-GEN (Issue 3). Deviations or clarifications to these standards are noted in the related test result under "test reference and limit".

Testing Laboratory:	novero Test Center, Meesmannstr.103, 44807 Bochum, Germany			
	Tel.:	+49 234/51668-0	Fax.:	+49 234 51668 4880
	FCC listing no.:	881111	IC recognition no.:	7847A-1
	Laboratory manager:	Jürgen Mitterer		

Test result	The EUT complies with the requirements made in the referred test documents.

Date and signature:

Digitally signed by Juergen Mitterer
DN: cn=Juergen Mitterer, o=novero, ou=QVC, email=jurgen.mitterer@novero.com, c=DE
Date: 2012.08.22 09:50:13 +02'00'

1. Summary for FCC Part 24 Compliance Test Report

Date of receipt	11-May-2012
Testing completed	13-Jun-2012
The customer's contact person	Jürgen Hindersmann
Notes	none

1.1. EUT and Accessory Information

The EUT is a DC powered GSM850/900/1800/1900/FDDI/FDDV with WLAN and Bluetooth device for automotive applications. EUT is tested with maximum rated TX power. EUT has separate BT and WLAN antennas and fixed GSM/FDD antenna connector. No dedicated external antenna specified.

Product	Type	SN	HW	MV	SW	DUT
UHV Premium	HT-5	A09737413	X21		X907	GEM010
UHV Premium	HT-5	A09738048	X21		X907	GEM013

1.2. Summary of Test Results

GSM1900:

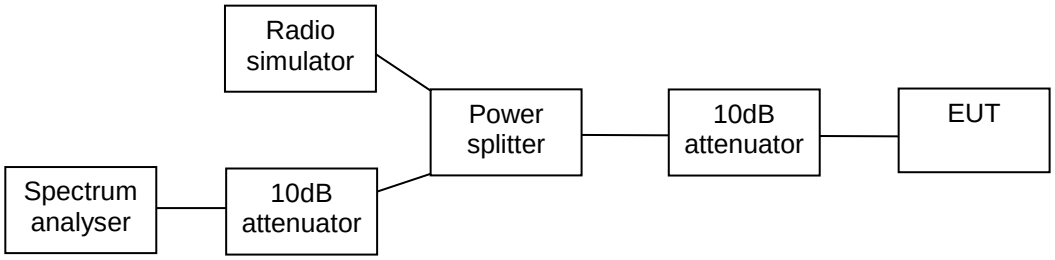
Section in CFR 47	Section in *RSS-GEN* or RSS-133	Name of the test	Result
§2.1046(a)	6.4	Conducted RF output power	PASSED
§24.232(b)	6.4	Radiated RF output power	NA
§2.1049(h)	4.6.1	99% occupied bandwidth	PASSED
§24.238(a)	6.5	Band edge compliance	PASSED
§24.238(a), §2.1051	6.5	Spurious emissions at antenna terminals	PASSED
§24.238(a), §2.1053	6.5	Spurious radiated emissions	PASSED
§2.1055(a)	6.3	Frequency stability, temperature variation	PASSED
§2.1055(d)	6.3	Frequency stability, voltage variation	PASSED

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

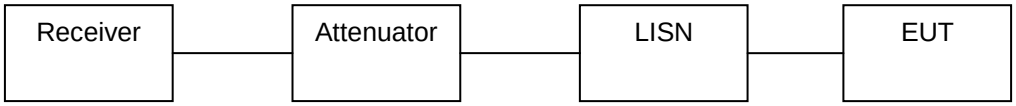
CONTENTS

2. Test setups

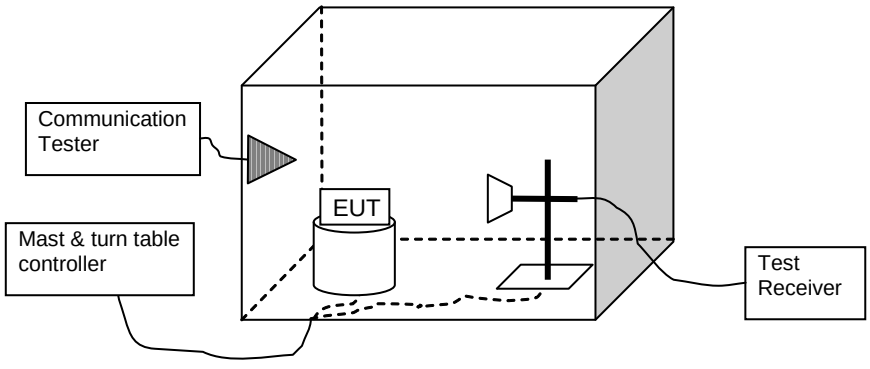
2.1. Conducted test setup



2.2. Conducted AC power line conducted emissions test setup



2.3. Radiated test setup



3. Conducted RF output power

(FCC §24.232 §2.1046(a), RSS-133 6.4)

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	11-May-2012
Measured by	Robert Müller

3.1. Test reference and limit

The measurement is made according to FCC rules parts 24, IC standard RSS-133 and TIA-603-C.

Limits for conducted RF output power measurements

Frequency range [MHz]	Limit [W]	Limit [dBm]
1850 – 1910	2	33

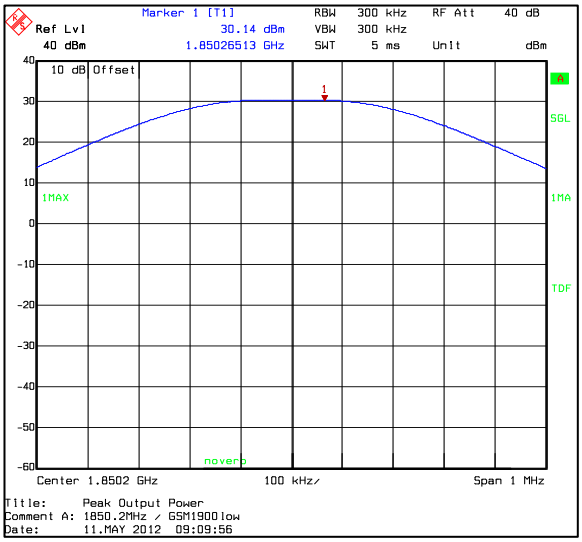
3.2. GSM1900 Test results

3.2.1 GSM mode

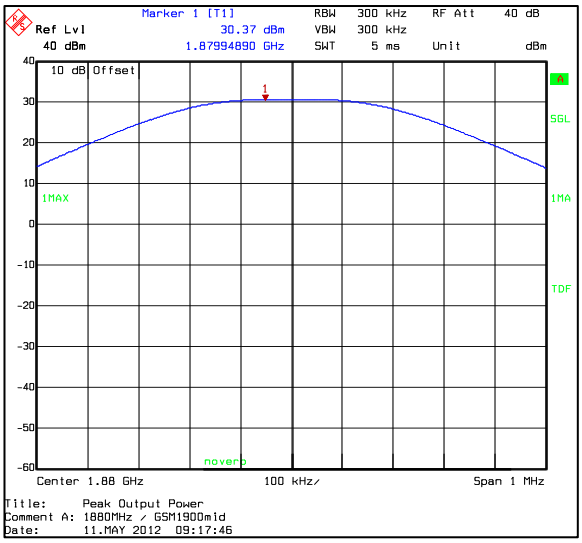
Channel / f_C [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
512 / 1850.2	30.14	1032.76	2.86	PASSED
661 / 1880.0	30.37	1088.93	2.63	PASSED
810 / 1909.8	30.27	1064.14	2.73	PASSED

No external antenna gain is specified by the manufacturer. The result is passed for external antenna gains equal or less than specified above. Max. Antenna gain [dBi] = 33 dBm – Conducted Output Power [dBm].

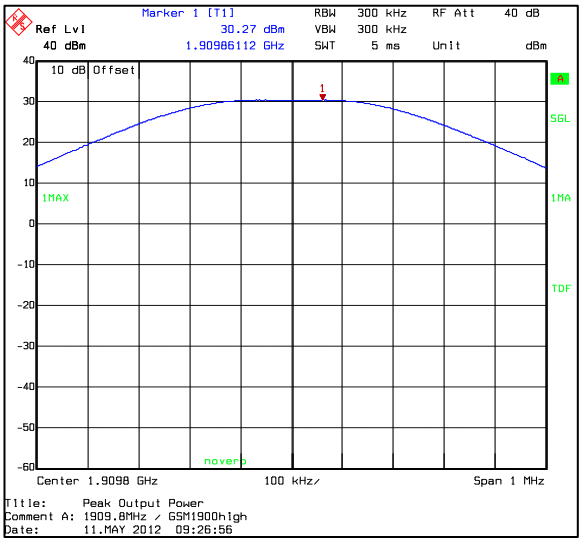
Channel 512 / 1850.2 MHz



Channel 661 / 1880.0 MHz



Channel 810 / 1909.8 MHz

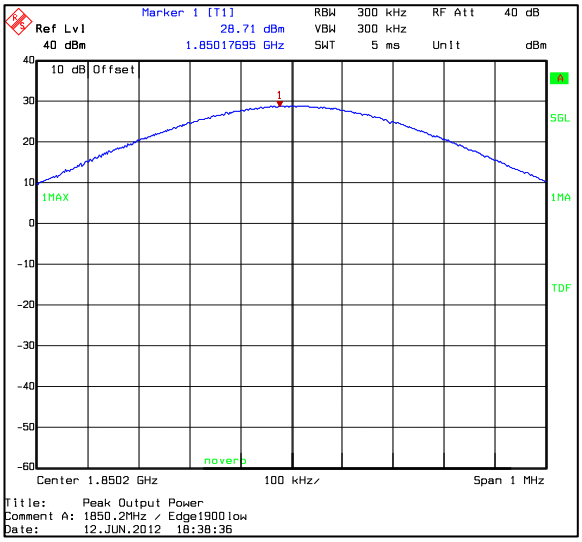


3.2.2 EGPRS mode

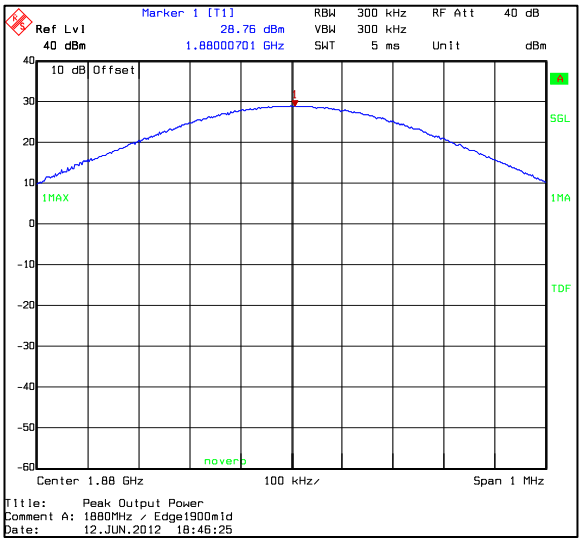
Channel / f_C [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
512 / 1850.2	28.71	743.02	4.29	PASSED
661 / 1880.0	28.76	751.62	4.24	PASSED
810 / 1909.8	28.53	712.85	4.47	PASSED

No external antenna gain is specified by the manufacturer. The result is passed for external antenna gains equal or less than specified above. Max. Antenna gain [dBi] = 33 dBm – conducted output Power [dBm].

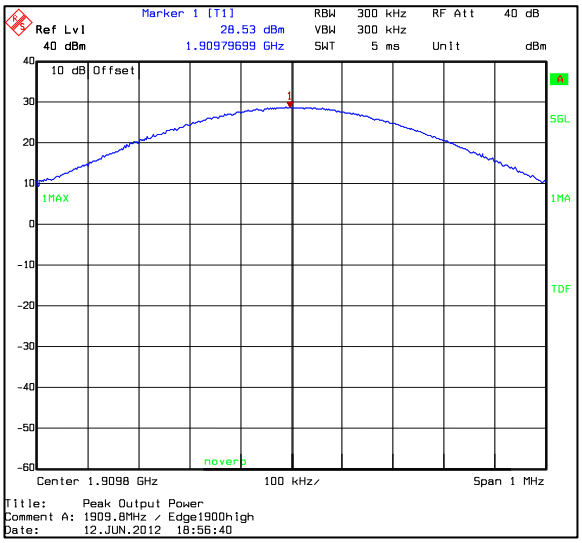
Channel 512 / 1850.2 MHz



Channel 661 / 1880.0 MHz



Channel 810 / 1909.8 MHz



4. 99% occupied bandwidth

(FCC §2.1049(h), RSS-133 4.6.1)

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	11-May-2012
Measured by	Robert Müller

4.1. Test reference and limit

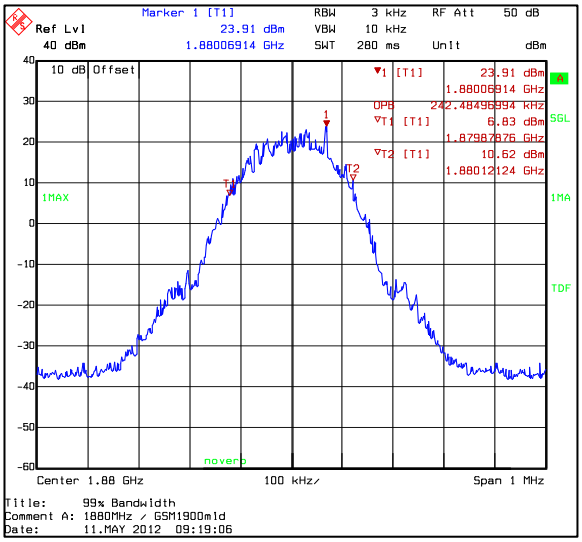
The measurement is made according to FCC rules parts 24, IC standard RSS-GEN, RSS-133 and TIA-603-C.

4.2. GSM1900 Test results

4.2.1 GSM mode

Channel / f_C [MHz]	99% occupied bandwidth [kHz]	Result
661 / 1880	242.48	PASSED

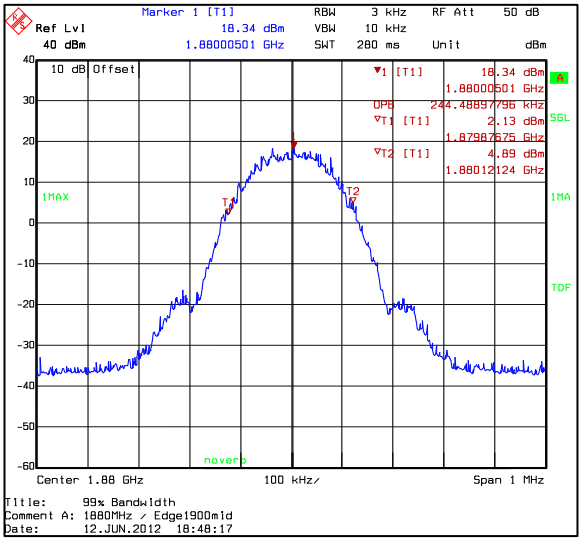
Channel 661 / 1880 MHz



4.2.2 EGPRS mode

Channel / f_C [MHz]	99% occupied bandwidth [kHz]	Result
661 / 1880	244.49	PASSED

Channel 661 / 1880 MHz



5. Band edge compliance

(FCC §24.238(a), RSS-133 6.5)

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	11-May-2012
Measured by	Robert Müller

5.1. Test reference and limit

The measurement is made according to FCC rules parts 24 and IC standard RSS-133.

Limits for band edge compliance measurements

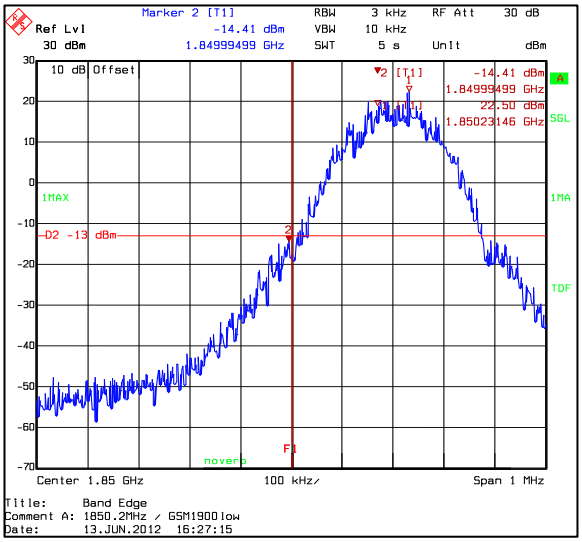
Frequency range [MHz]	Limit [dBm]
Below 1850 and above 1910	-13

5.2. GSM1900 Test results

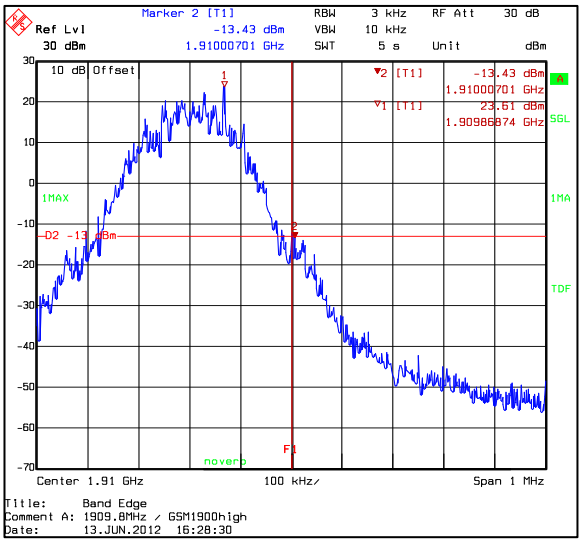
5.2.1 GSM mode

Channel / f_C [MHz]	Level [dBm]	Result
512 / 1850.2	-14.41	PASSED
810 / 1909.8	-13.43	PASSED

Channel 512 / 1850.2 MHz (Peak detector, RBW: 3 KHz)



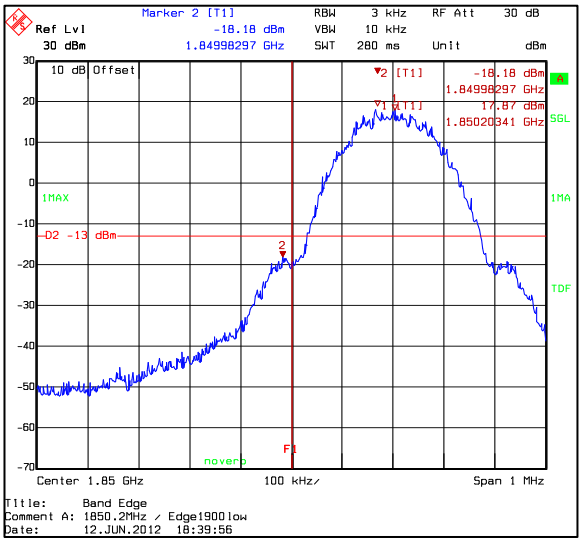
Channel 810 / 1909.8 MHz (Peak detector, RBW: 3 KHz)



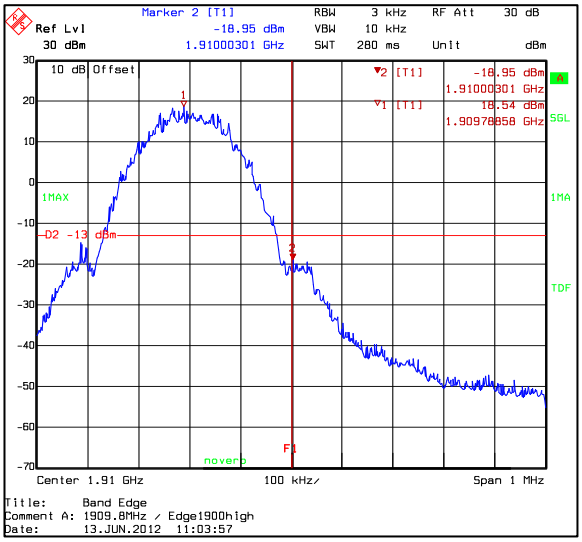
5.2.2 EGPRS mode

Channel / f_C [MHz]	Level [dBm]	Result
512 / 1850.2	-18.18	PASSED
810 / 1909.8	-18.95	PASSED

Channel 512 / 1850.2 MHz (Peak detector, RBW: 3 KHz)



Channel 512 / 1909.8 MHz (Peak detector, RBW: 3 KHz)



6. Spurious emissions at antenna terminals

(FCC §24.238(a), §2.1051 RSS-133 6.5)

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	11-May-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

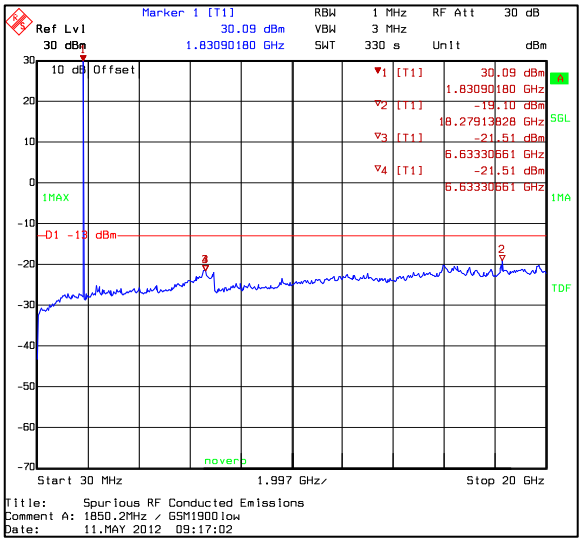
Frequency range [MHz]	Limit [dBm]
1 – 18000	-13

6.2. GSM1900 Test results

6.2.1 GSM mode

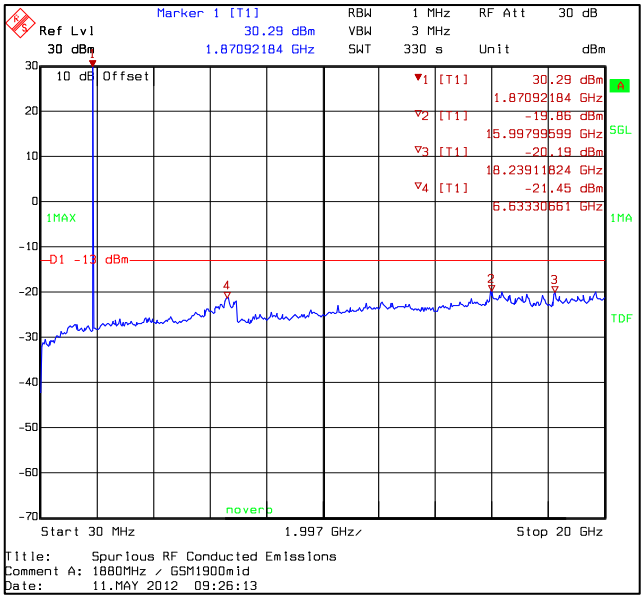
Channel 512 / 1850.2 MHz

Frequency [MHz]	P [dBm]	Result
6633.31	-21.51	PASSED
18279.14	-19.10	PASSED



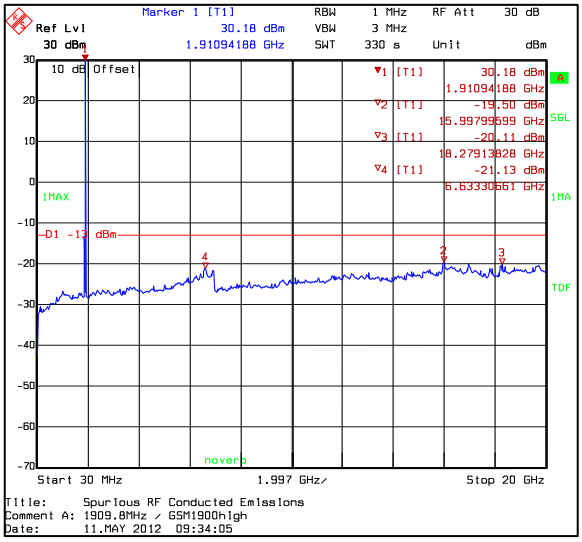
Channel 661 / 1880.0 MHz

Frequency [MHz]	P [dBm]	Result
6633.31	-21.45	PASSED
15998.00	-19.86	PASSED
18239.12	-10.19	PASSED



Channel 810 / 1909.8 MHz

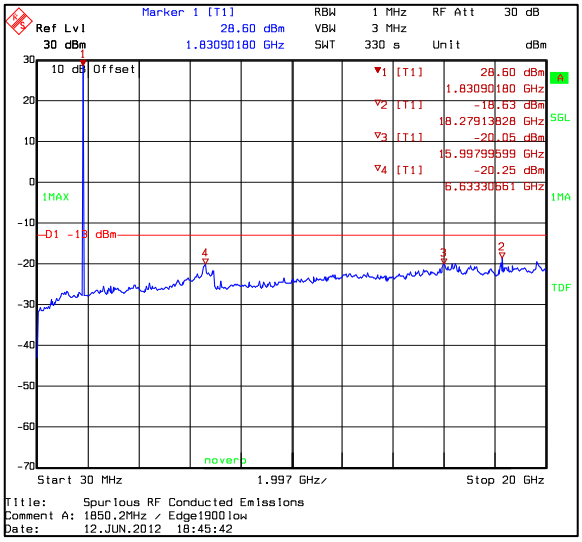
Frequency [MHz]	P [dBm]	Result
6633.31	-21.13	PASSED
15998.00	-19.50	PASSED
18279.14	-20.11	PASSED



6.2.2 EGPRS mode

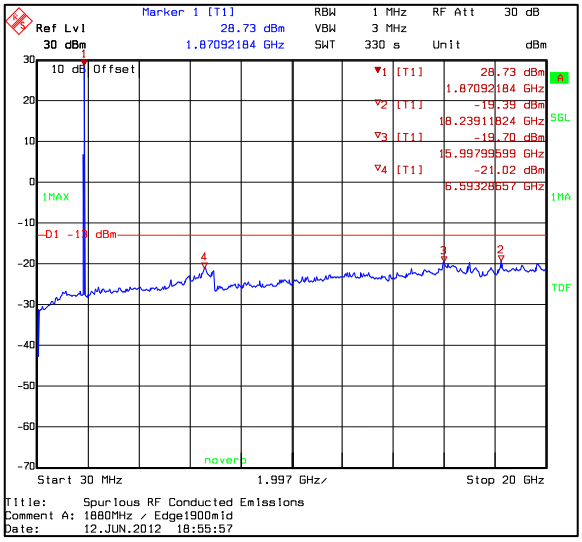
Channel 512 / 1850.2 MHz

Frequency [MHz]	P [dBm]	Result
6633.31	-20.25	PASSED
15998.00	-20.05	PASSED
18279.14	-18.63	PASSED



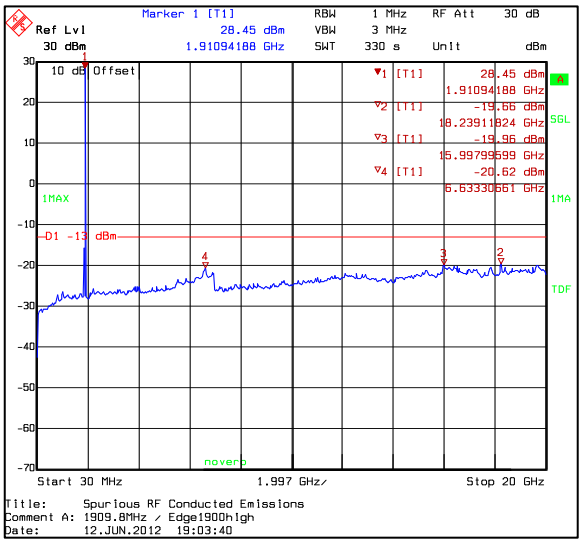
Channel 661 / 1880.0 MHz

Frequency [MHz]	P [dBm]	Result
6593.29	-21.02	PASSED
15998.00	-19.70	PASSED
18239.12	-19.39	PASSED



Channel 810 / 1909.8 MHz

Frequency [MHz]	P [dBm]	Result
6633.31	-20.62	PASSED
15998.00	-19.96	PASSED
18239.12	-19.66	PASSED



8. Spurious radiated emissions

(FCC §24.238(a), §2.1053, RSS-133 6.5)

EUT with DUT number	GEM010
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	22.5 / 55
Date of measurements	14-May-2012
Measured by	Robert Müller

8.1. Test reference and limit

The measurement is made according to TIA-603-C-2004 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 frequency 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 - 18000	-13

8.2. GSM1900 TX Test results

8.2.1 GSM mode

Channel 661 / 1880.0 MHz

Frequency [MHz]	P [dBm]	P [µW]	P_{MEAS} [dBm]	A_{CF} [dB]	Polarisation	Result
5639.78	-42.80	0.052	-46.70	3.90	HORIZONTAL	PASSED

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

8.2.2 EGPRS mode

Channel 661 / 1880.0 MHz, 1 TX slot

Frequency [MHz]	P [dBm]	P [µW]	P_{MEAS} [dBm]	A_{CF} [dB]	Polarisation	Result
3760.02	-53.00	0.005	-53.00	0.00	VERTICAL	PASSED
5640.28	-47.80	0.017	-51.70	3.90	HORIZONTAL	PASSED

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

9. Frequency stability, temperature variation

(FCC §2.1055(a), RSS-133 6.3

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	-30 to 50 / 50
Date of measurements	25-July-2012
Measured by	Robert Müller

9.1. Test reference and limit

The measurement is made according to FCC rules parts 24, IC standard RSS-133 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

9.2. GSM1900 Test results

9.2.1 GSM mode

Temperature [°C]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
50	1850.2	-24.54	-0.0133	PASSED
	1880.0	-30.93	-0.165	PASSED
	1909.8	-36.35	-0.0190	PASSED
40	1850.2	-36.22	-0.0196	PASSED
	1880.0	18.73	0.0010	PASSED
	1909.8	12.59	0.0066	PASSED
30	1850.2	-31.51	-0.0170	PASSED
	1880.0	-24.21	-0.0129	PASSED
	1909.8	-21.70	-0.0114	PASSED
20	1850.2	-30.22	-0.0163	PASSED
	1880.0	-27.77	-0.0148	PASSED
	1909.8	-23.63	-0.0124	PASSED
10	1850.2	17.63	0.0095	PASSED
	1880.0	-19.95	-0.0106	PASSED
	1909.8	-27.31	-0.0143	PASSED
0	1850.2	-17.24	-0.0093	PASSED
	1880.0	16.14	0.0086	PASSED
	1909.8	-13.69	-0.0072	PASSED
-10	1850.2	-28.41	-0.0154	PASSED
	1880.0	-35.64	-0.0190	PASSED
	1909.8	-17.50	-0.0092	PASSED
-20	1850.2	-30.09	-0.0163	PASSED
	1880.0	-17.82	-0.0095	PASSED
	1909.8	-16.27	-0.0087	PASSED
-30	1850.2	-14.53	-0.0079	PASSED
	1880.0	-19.24	-0.0102	PASSED
	1909.8	-20.79	-0.0109	PASSED

10. Frequency stability, voltage variation

(FCC §2.1055(d), RSS-133 6.3

EUT with DUT number	GEM013
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	13.2 / DC
Result	PASSED
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 50
Date of measurements	25-July-2012
Measured by	Robert Müller

10.1. Test reference and limit

The measurement is made according to FCC rules parts 24 and IC standard RSS-133 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

10.2. GSM1900 Test results

10.2.1 GSM mode

Voltage [V]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
Maximum (15.6)	1850.2	-24.67	-0.0133	PASSED
	1880.0	-18.92	-0.0101	PASSED
	1909.8	-28.02	-0.0147	PASSED
Nominal (13.2)	1850.2	-19.37	-0.0105	PASSED
	1880.0	-26.47	-0.0141	PASSED
	1909.8	-22.60	-0.0118	PASSED
Operation end point (6.7)	1850.2	-17.50	-0.0095	PASSED
	1880.0	-26.99	-0.0144	PASSED
	1909.8	16.79	0.0088	PASSED

11. Test Equipment

11.1. Conducted measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
EMI Test Receiver	ESCS 30	R&S	May 2011	1
LISN 50 µH	ESH3-Z5	R&S	Jul 2011	1
LISN 50 µH	ESH3-Z5	R&S	Jul 2011	1
V network	ESH3-Z6	R&S	May 2011	1
V network	ESH3-Z6	R&S	May 2011	1
T-ISN	ISN T800	Teseq	Jul 2010	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	Jun 2012	1
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--
EMI Test Receiver	FSEM30	R&S	Jul 2011	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	N4010A	Agilent	May 2011	2
Digital Radio Communication Tester	CMU200	R&S	Jun 2012	1
RF Radio Software	RADIO	novero	n.a.	--

11.2. Radiated measurements

Equipment	Type	Manufacturer	Calibrated	Cycle [Years]
Controller	2090	ETS	n.a.	--
MAST	2075	ETS	n.a.	--
Ultra Broadband Antenna	HL562	R&S	Mar 2009	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
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--