FCC Part 27 Compliance Test Report

Test Report no.:	EMC_BO_001848	**Date of Report:**	11-July-2013
Number of pages:	22	**Project support engineer:**	Robert Müller

Customer:	novero GmbH, Meesmannstrasse 103, 44807 Bochum, Germany		
Customers contact:	Hindersmann, Jürgen		
Manufacturer:	novero GmbH		
EUT ident.:	Novero, HT-6g		
FCC ID:	WJLHT-6G	**IC ID:**	7847A-HT6G

Referred documents:	CFR 47, FCC rules Part 27, TIA-603-C-2004 and IC standards RSS-GEN (Issue 3), RSS-139 (Issue 2). 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	e-mail:	product-validation@novero.com
	FCC listing no.:	881111	IC recognition no.:	7847A-1
	Laboratory manager:	Jürgen Mitterer		

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

Signature:

11-July-2013, Jürgen Mitterer
Manager Validation Services
Approval

This test report may not be reproduced, except in full, without written permission of testing laboratory. The test results in this test report relates only to the tested sample, which is mentioned in this test report. Novero GmbH cannot be made responsible for any generalisations or conclusions drawn from this test report. Modification of the tested sample is prohibited and leads to invalidity of this test report.

1. Summary for FCC Part 27 Compliance Test Report

Date of receipt	02-May-2013
Testing completed	09-July-2013
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	SN	HW	MV	SW	DUT
Onboard Connectivity Unit	HT-6g	004402000061519	0531	--	X478	DIS065
Onboard Connectivity Unit	HT-6g	004402000061527	0531	--	X478	DIS066

1.2. Summary of Test Results

Section	Section in CFR 47	Section in *RSS-GEN* or RSS-139	Name of the test	Result
3	2.1046	6.4	Conducted RF output power	PASS
4	24.232(d)	6.4	Peak to average power ratio	PASS
5	27.53(h), 2.1049	4.6.1	99% occupied bandwidth	PASS
6	27.53(h), 2.1051	6.5	Band edge compliance	PASS
7	27.53(h), 2.1051	6.5	Spurious emissions at antenna terminals	PASS
8	27.53(h), 2.1053	6.5	Spurious radiated emissions	PASS
9	27.54, 2.1055	6.3	Frequency stability, temperature variation	PASS
10	27.54, 2.1055	6.3	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.

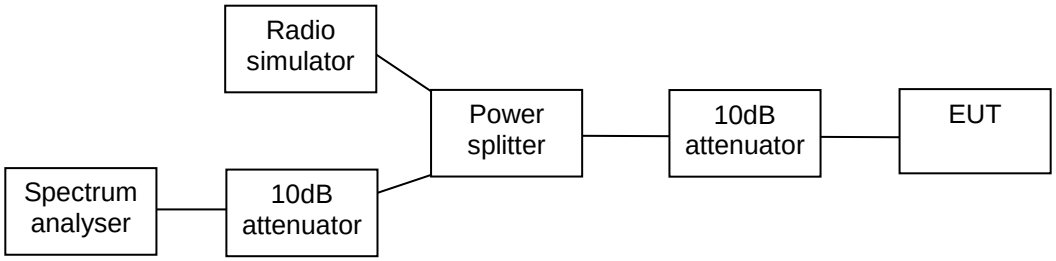
Copyright © 2013 novero. All rights reserved.

CONTENTS

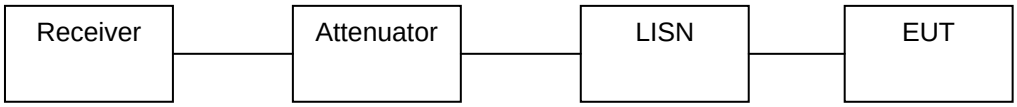
Copyright © 2013 novero. All rights reserved.

2. Test setups

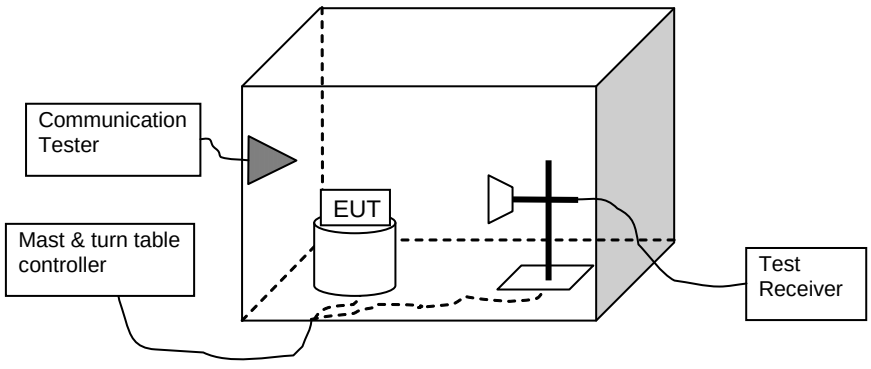
2.1. Conducted test setup



2.2. Conducted AC power line conducted emissions test setup



2.3. Radiated test setup



Copyright © 2013 novero. All rights reserved.

3. Conducted RF output power

(FCC §2.1046, RSS-139 6.4)

EUT with DUT number	DIS066
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	09.July.2013
Measured by	Robert Müller

3.1. Test reference and limit

The measurement is made according to FCC rules parts 27, IC standard RSS-139 and TIA-603-C by reading the maximum peak power values from the signalisation unit (CMU200).

Limits for conducted RF output power measurements

Frequency range [MHz]	Limit [W]	Limit [dBm]
1710 - 1755	1	30

Copyright © 2013 novero. All rights reserved.

3.2. WCDMA1700 Test results

3.2.1 FDD mode, RMC

Channel / f_C [MHz]	Peak Power [dBm] (Peak)	Average Power [dBm] (RMS)	EIRP [dBi]	Result
1312 / 1712.4	26.13	22.97	29.13	PASS
1420 / 1740	26.17	22.71	29.17	PASS
1432 / 1752.6	26.09	22.70	29.09	PASS

Antenna gain: 3dBi

Copyright © 2013 novero. All rights reserved.

4. Peak to average power ratio

(FCC §24.232(d), RSS-139 6.4)

EUT with DUT number	DIS066
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	09.July.2013
Measured by	Robert Müller

4.1. Test reference and limit

The measurement is made according to FCC rules parts 27, IC standard RSS-139 and TIA-603-C by reading the power values from the signalisation unit (CMU200).

Limits for peak to average power ratio measurements

Limit [dBm]
13

Copyright © 2013 novero. All rights reserved.

4.2. WCDMA1700 Test results

4.2.1 FDD mode, RMC

Channel / f_C [MHz]	Peak Power [dBm] (Peak)	Average Power [dBm] (RMS)	PAPR [dB]	Result
1312 / 1712.4	26.13	22.97	3.16	PASS
1420 / 1740	26.17	22.71	3.46	PASS
1432 / 1752.6	26.09	22.70	3.39	PASS

Copyright © 2013 novero. All rights reserved.

5. 99% occupied bandwidth

(FCC §27.53(h), §2.1049, RSS-139 4.6.1)

EUT with DUT number	DIS066
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	03.May.2013
Measured by	Robert Müller

5.1. Test reference and limit

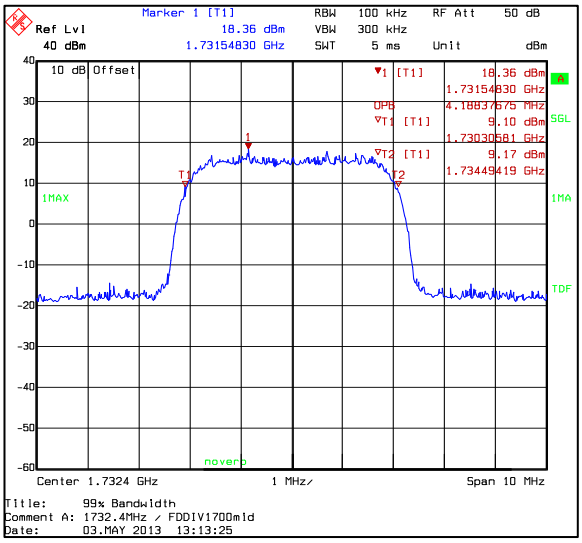
The measurement is made according to FCC rules parts 27, IC standard RSS-GEN, RSS-139 and TIA-603-C.

Copyright © 2013 novero. All rights reserved.

5.2. WCDMA1700 Test results

5.2.1 FDD mode, RMC

Channel / f_C [MHz]	99% occupied bandwidth [kHz]	Result
1412 / 1732.4	4188.38	PASS



Copyright © 2013 novero. All rights reserved.

6. Band edge compliance

(FCC §27.53(h), §2.1051, RSS-139 6.5)

EUT with DUT number	DIS066
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	03.May.2013
Measured by	Robert Müller

6.1. Test reference and limit

The measurement is made according to FCC rules parts 27 and IC standard RSS-139.

Limits for band edge compliance measurements

Frequency range [MHz]	Limit [dBm]
Below 1710 and above 1755	-13

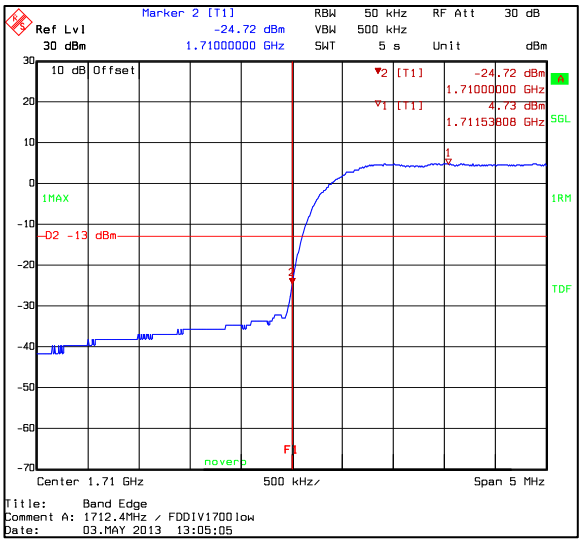
Copyright © 2013 novero. All rights reserved.

6.3. WCDMA1700 Test results

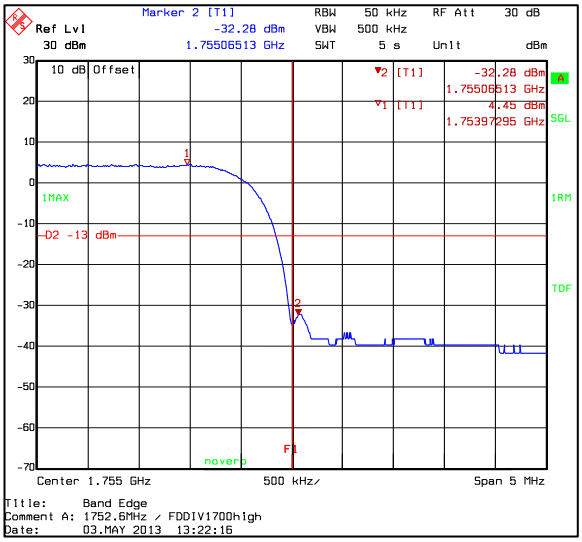
6.3.1 FDD mode, RMC

Channel / f_C [MHz]	Level [dBm]	Result
1392 / 1712.4	-24.72	PASS
1432 / 1752.6	-32.28	PASS

Channel 1312 / 1712.4 MHz



Channel 1432 / 1752.6 MHz



Copyright © 2013 novero. All rights reserved.

7. Spurious emissions at antenna terminals

(FCC §27.53(h),§2.1051 RSS-139 6.5)

EUT with DUT number	DIS066
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	03.May.2013
Measured by	Robert Müller

7.1. Test reference and limit

The measurement is made according to FCC rules parts 27, IC standard RSS-GEN, RSS-139 and TIA-603-C.

Limits for spurious emissions at antenna terminals measurements

Frequency range [MHz]	Limit [dBm]
30 – 18000	-13

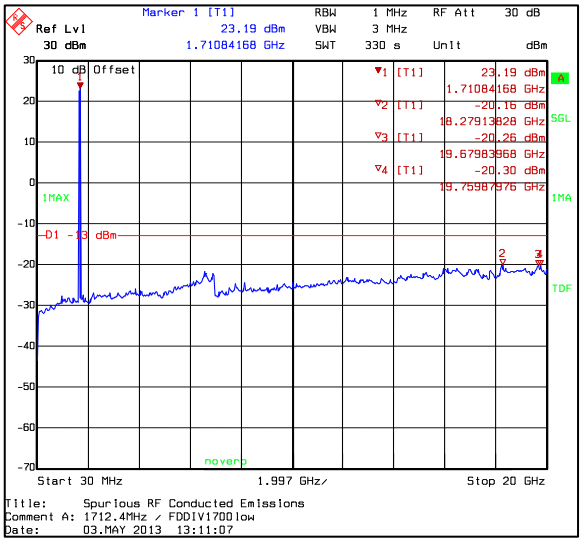
Copyright © 2013 novero. All rights reserved.

7.3. WCDMA1700 Test results

7.3.1 FDD4 mode, RMC

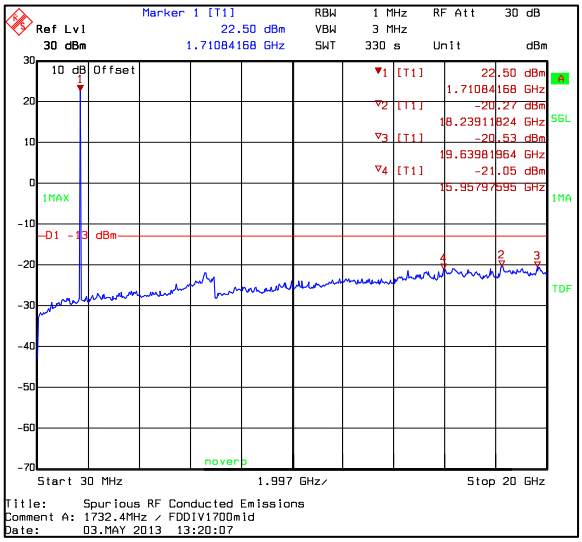
Channel 1312 / 1712.4 MHz

Frequency [MHz]	P [dBm]	Result
18279.14	-20.16	PASS
19679.84	-20.26	PASS
19759.88	-20.30	PASS



Channel 1412 / 1732.4 MHz

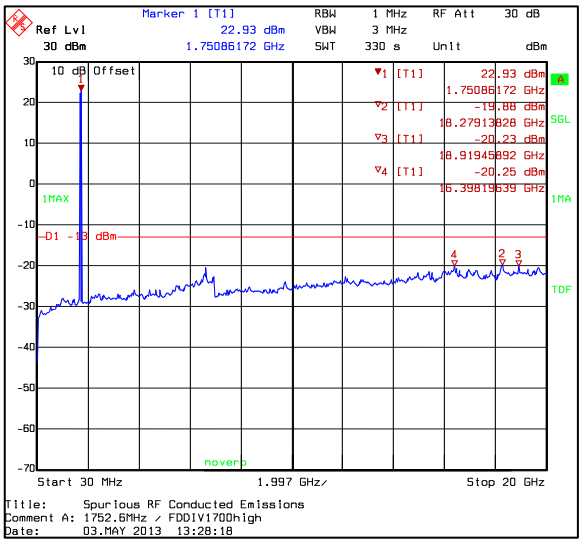
Frequency [MHz]	P [dBm]	Result
15957.98	-21.05	PASS
18239.12	-20.27	PASS
19639.82	-20.53	PASS



Copyright © 2013 novero. All rights reserved.

Channel 1432 / 1752.6 MHz

Frequency [MHz]	P [dBm]	Result
16398.20	-20.25	PASS
18279.14	-19.88	PASS
18919.46	-20.23	PASS



Copyright © 2013 novero. All rights reserved.

8. Spurious radiated emissions

(FCC §27.53(h), §2.1053, RSS-139 6.5)

EUT with DUT number	DIS065
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	02.May.2013
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 frequencies are measured in beforehand and saved to the test software. The substitution corrections are obtained as described below:

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

Copyright © 2013 novero. All rights reserved.

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 ACF 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

Copyright © 2013 novero. All rights reserved.

8.2. WCDMA1700 Test results

8.2.1 FDD mode, RMC

Channel 1412 / 1732.4 MHz

Frequency [MHz]	P [dBm]	P [µW]	P_{MEAS} [dBm]	A_{CF} [dB]	Polarisation	Result
3467.24	-21.80	6.607	-21.90	-0.10	VERTICAL	PASS
5196.12	-50.20	0.010	-48.70	1.50	VERTICAL	PASS
6933.49	-33.50	0.447	-30.40	3.10	HORIZONTAL	PASS

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

Copyright © 2013 novero. All rights reserved.

9. Frequency stability, temperature variation

(FCC §27.54, §2.1055, RSS-139 6.3

EUT with DUT number	DIS066
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	03.May.2013
Measured by	Robert Müller

9.1. Test reference and limit

The measurement is made according to FCC rules parts 27, IC standard RSS-139 and TIA-603-C as follows:

1. The EUT is placed in the chamber.
2. The climate chamber temperature is set to the minimum value and the temperature is allowed to stabilize.
3. The EUT is set in idle mode for 15minutes.
4. The EUT is set to transmit.
5. The maximum transmit frequency error was measured immediately over 500 bursts.
6. The steps 3-5 were repeated for each temperature changing from low to high temperature.

Limits for frequency stability, temperature variation measurements

Frequency deviation [ppm]
+\- 2.5

Copyright © 2013 novero. All rights reserved.

9.2. WCDMA1700 Test results

9.2.1 FDD4 mode, RMC

Temperature [°C]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
50	1712.4	-14.80	-0.0086	PASS
	1732.4	-11.93	-0.0069	PASS
	1752.6	-13.90	-0.0079	PASS
40	1712.4	-12.86	-0.0075	PASS
	1732.4	16.33	0,0094	PASS
	1752.6	11.23	0,0065	PASS
30	1712.4	13.05	0,0076	PASS
	1732.4	8.70	0,0047	PASS
	1752.6	9.74	0,0056	PASS
20	1712.4	16.22	0.0095	PASS
	1732.4	16.69	0.0096	PASS
	1752.6	17.00	0.0097	PASS
10	1712.4	-10.25	-0.0060	PASS
	1732.4	17.97	0.0104	PASS
	1752.6	9.83	0.0056	PASS
0	1712.4	12.18	0.0071	PASS
	1732.4	12.65	0.0073	PASS
	1752.6	11.40	0.0065	PASS
-10	1712.4	16.62	0.0097	PASS
	1732.4	13.26	0.0077	PASS
	1752.6	9.17	0.0052	PASS
-20	1712.4	6.41	0.0037	PASS
	1732.4	11.60	0.0067	PASS
	1752.6	14.31	0.0082	PASS
-30	1712.4	11.12	0.0065	PASS
	1732.4	10.27	0.0059	PASS
	1752.6	-13.17	-0.0075	PASS

Copyright © 2013 novero. All rights reserved.

10. Frequency stability, voltage variation

(FCC §27.54, §2.1055, RSS-139 6.3

EUT with DUT number	DIS066
Accessories with DUT numbers	None
Operation Voltage [V] / [Hz]	6.0 to 15.6 / DC
Result	PASS
Remarks	None
Temp [°C] / Humidity [%RH]	25 / 45
Date of measurements	03.May.2013
Measured by	Robert Müller

10.1. Test reference and limit

The measurement is made according to FCC rules parts 27 and IC standard RSS-139 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

Copyright © 2013 novero. All rights reserved.

10.2. WCDM1700 Test results

10.2.1 FDD4 mode, RMC

Voltage [V]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
Maximum (15.6)	1712.4	-13.06	-0,0076	PASS
	1732.4	11.96	-0,0081	PASS
	1752.6	-11.89	-0,0068	PASS
Nominal (13.2)	1712.4	13.49	0,0079	PASS
	1732.4	-10.51	-0,0061	PASS
	1752.6	-9.14	-0,0052	PASS
Operation end point (6.0)	1712.4	-12.19	-0,0071	PASS
	1732.4	14.50	0,0084	PASS
	1752.6	6.32	0,0036	PASS

Copyright © 2013 novero. All rights reserved.

11. Test Equipment

11.1. 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	2
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	Jul 2012	3
Digital Radio Communication Tester	CMU200	R&S	Jul 2011	2
EMI Test receiver	ESIB26	R&S	Jul 2012	1
EMI Test receiver	ESU26	R&S	Jul 2011	2
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 2013	1
Notch Filter GSM850	WRCD 800/880-0,2/40-5SSSD	Wainwright	Mar 2013	1
Band Reject Filter WCDMA850	WRCG 832/838-825/845-40/5SS	Wainwright	Mar 2013	1
Notch Filter GSM1900	WRCD 1700/2000-0,2/40-5SSSD	Wainwright	Mar 2013	1
Band Reject Filter AWS 1700	WRCGV1729.4/1735.4-1722.4/1742.4-40/6SS	Wainwright	Mar 2013	1
RF Emission Software	ES-K1 v.1.71	R&S	n.a.	--

Copyright © 2013 novero. All rights reserved.