

## FCC Part 27 Compliance Test Report

<b>Test Report no.:</b>	EMC_BO_001771	<b>Date of Report:</b>	12-Nov-2012
<b>Number of pages:</b>	22	<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 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".		
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<b>Testing Laboratory:</b>	novero Test Center, Meesmannstr.103, 44807 Bochum, Germany		
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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:**

12-Nov-2012, Jürgen Mitterer  
Manager Validation Services  
Approval

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## 1. Summary for FCC Part 27 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	SN	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-139	Name of the test	Result
3	2.1046	6.4	Conducted RF output power	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.

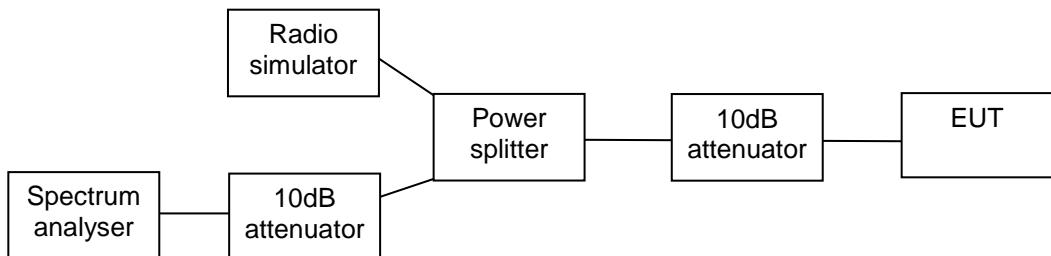
NA: The test was not applicable.

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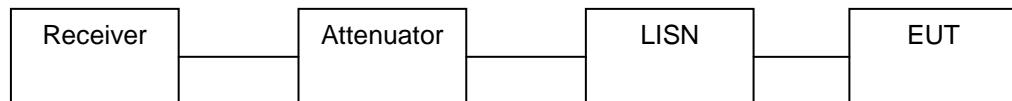
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## 2. Test setups

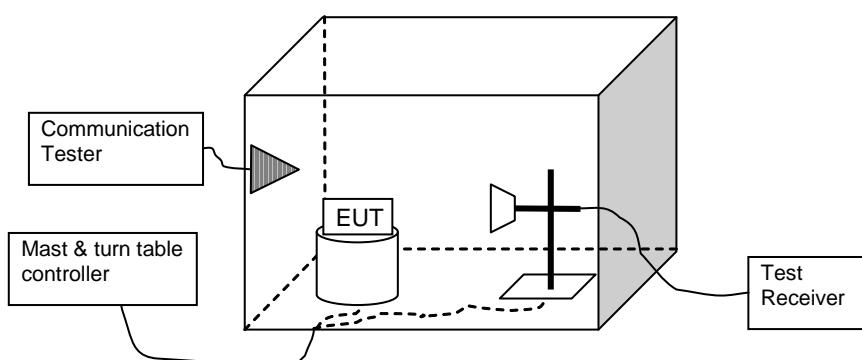
### 2.1. Conducted test setup



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



### 2.3. Radiated test setup



### 3. Conducted RF output power (FCC §2.1046, RSS-139 6.4)

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

Limits for conducted RF output power measurements

Frequency range [MHz]	Limit [W]	Limit [dBm]
1710 - 1755	1	30.00

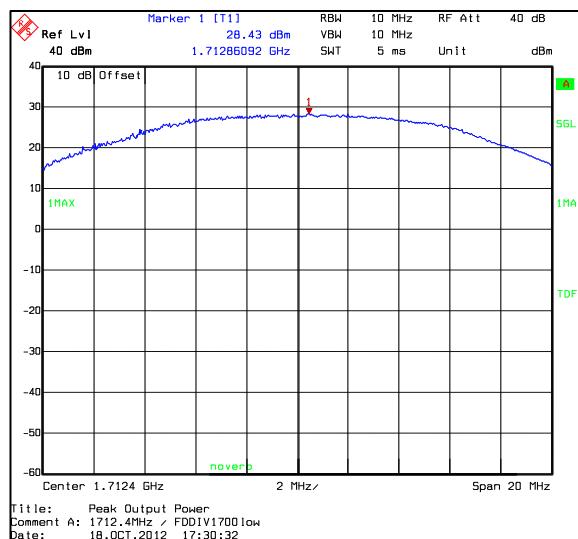
## 3.2. WCDMA1700 Test results

### 3.2.1 FDD mode, RMC

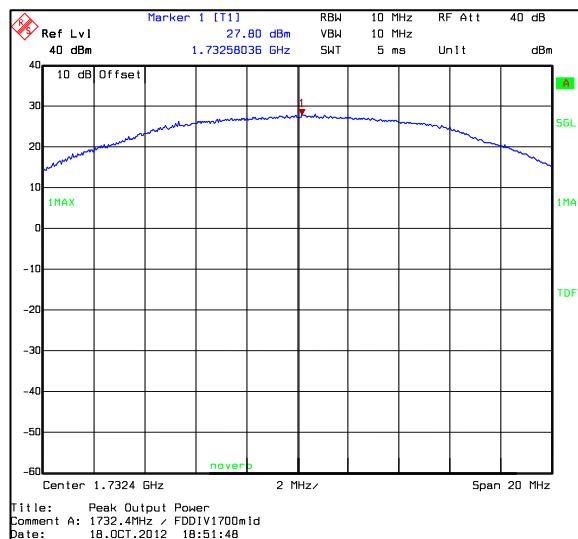
Channel / f <sub>c</sub> [MHz]	P [dBm]	P [mW]	Max. Antenna gain [dBi]	Result
1392 / 1712.4	28.43	696.63	1.57	PASS
1420 / 1740	27.80	602.56	2.20	PASS
1432 / 1752.6	27.80	602.56	2.20	PASS

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] = 30 dBm – Conducted Output Power [dBm].

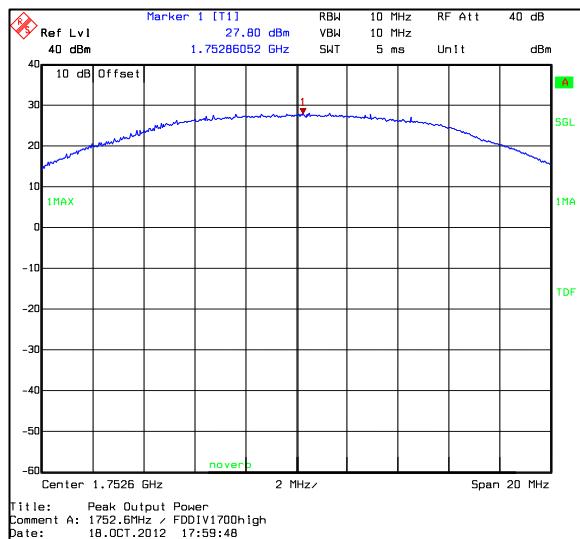
#### Channel 1392 / 1712.4 MHz



#### Channel 1412 / 1732.4 MHz



Channel 1432 / 1752.6 MHz



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#### 4. 99% occupied bandwidth (FCC §27.53(h), §2.1049, RSS-139 4.6.1)

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

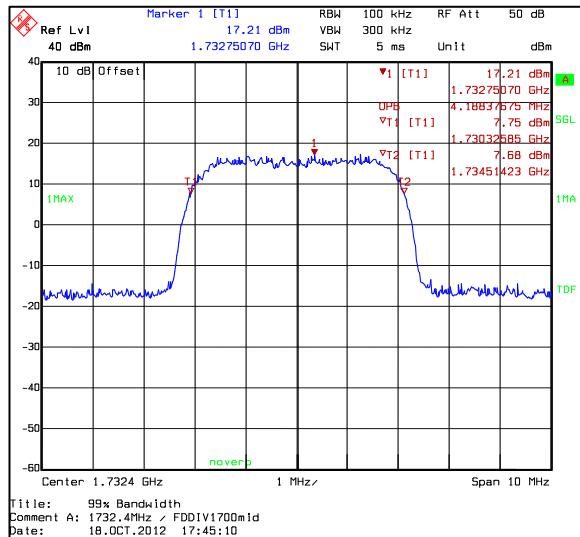
##### 4.1. Test reference and limit

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

## 4.2. WCDMA1700 Test results

### 4.2.1 FDD mode, RMC

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



## 5. Band edge compliance

(FCC §27.53(h), §2.1051, RSS-139 6.5)

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

### 5.1. 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

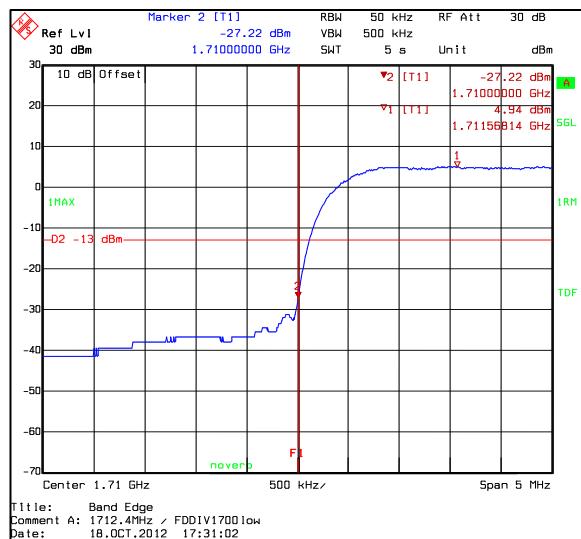
Frequency range [MHz]	Limit [dBm]
Below 1710 and above 1755	-13

### 5.3. WCDMA1700 Test results

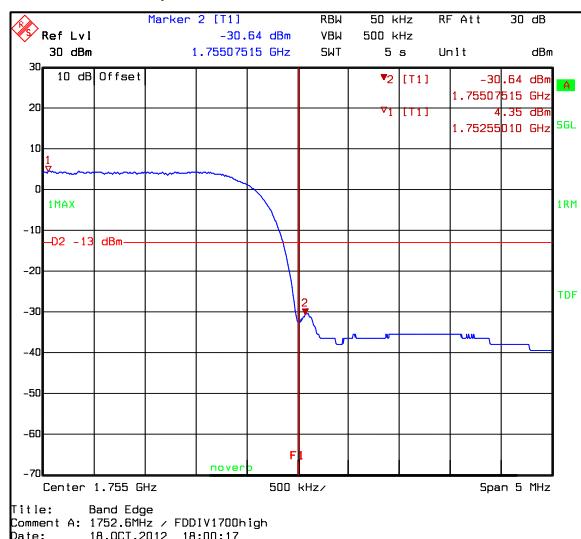
#### 5.3.1 FDD mode, RMC

Channel / $f_c$ [MHz]	Level [dBm]	Result
1392 / 1712.4	-27.22	PASS
1432 / 1752.6	-30.64	PASS

Channel 1392 / 1712.4 MHz



Channel 1432 / 1752.6 MHz



## 6. Spurious emissions at antenna terminals

(FCC §27.53(h),§2.1051 RSS-139 6.5)

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

### 6.1. 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

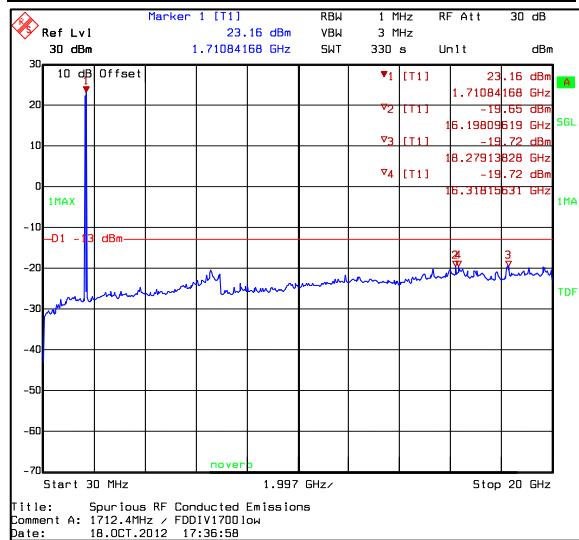
Frequency range [MHz]	Limit [dBm]
30 – 18000	-13

### 6.3. WCDMA1700 Test results

#### 6.3.1 FDD4 mode, RMC

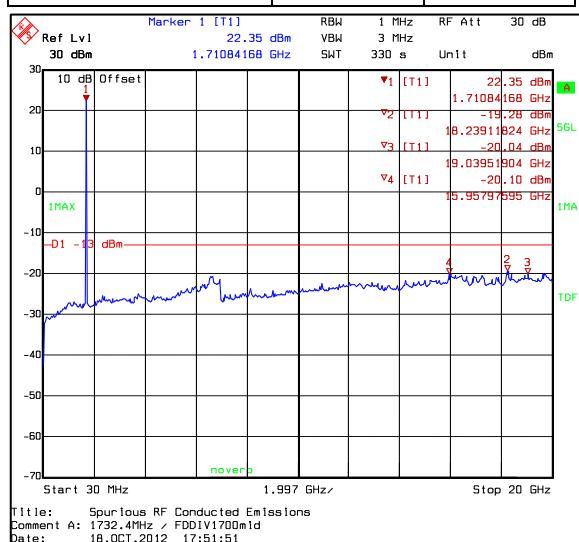
Channel 1392 / 1712.4 MHz

Frequency [MHz]	P [dBm]	Result
16198.10	-19.65	PASS
16318.16	-19.72	PASS
18279.14	-19.72	PASS



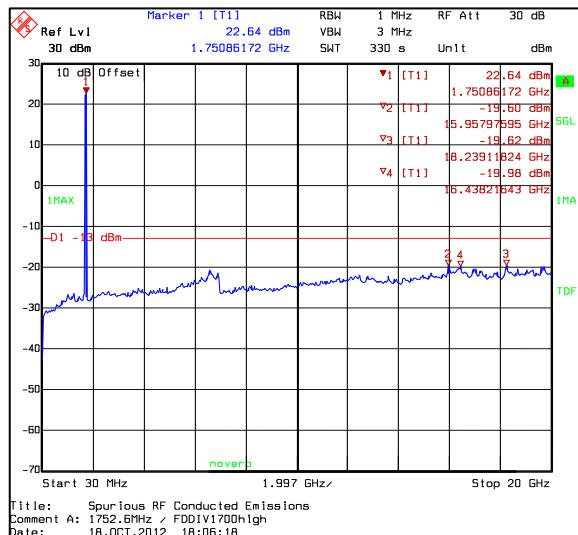
Channel 1412 / 1732.4 MHz

Frequency [MHz]	P [dBm]	Result
15957.98	-20.10	PASS
18239.12	-19.28	PASS
19039.52	-20.04	PASS



Channel 1432 / 1752.6 MHz

Frequency [MHz]	P [dBm]	Result
15957.98	-19.60	PASS
16438.22	-19.98	PASS
18239.12	-19.62	PASS



Project support engineer: Robert Müller  
Date of issue: 12-Nov-2012  
Report No.: EMC BO 001771

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## 7. Spurious radiated emissions

(FCC §27.53(h), §2.1053, RSS-139 6.5)

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

### 7.1. 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:

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

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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:

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

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

Limits for spurious radiated emissions measurements

Frequency range [MHz]	Limit [dBm]
30 - 1800	-13

## 7.2. WCDMA1700 Test results

### 7.2.1 FDD mode, RMC

Channel 1412 / 1732.4 MHz

Frequency [MHz]	P [dBm]	P [ $\mu$ W]	P <sub>MEAS</sub> [dBm]	A <sub>CF</sub> [dB]	Polarisation	Result
3466.93	-23.90	4.074	-23.40	-0.50	VERTICAL	PASS

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

## 8. Frequency stability, temperature variation

(FCC §27.54, §2.1055, RSS-139 6.3)

<b>EUT with DUT number</b>	DIS039
<b>Accessories with DUT numbers</b>	None
<b>Operation Voltage [V] / [Hz]</b>	13.2 / DC
<b>Result</b>	PASS
<b>Remarks</b>	None
<b>Temp [°C] / Humidity [%RH]</b>	25 / 45
<b>Date of measurements</b>	22.Oct.2012
<b>Measured by</b>	Robert Müller

### 8.1. 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

## 8.2. WCDMA1700 Test results

### 8.2.1 FDD4 mode, RMC

Temperature [°C]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
50	1712.4	-19.70	-0,0115	PASS
	1732.4	-11.67	-0,0067	PASS
	1752.6	-15.98	-0,0091	PASS
40	1712.4	-18.88	-0,0110	PASS
	1732.4	14.66	0,0085	PASS
	1752.6	9.12	0,0052	PASS
30	1712.4	-16.72	-0,0098	PASS
	1732.4	17.01	0,0098	PASS
	1752.6	13.79	0,0079	PASS
20	1712.4	-18.22	-0,0106	PASS
	1732.4	-12.60	-0,0073	PASS
	1752.6	-12.25	-0,0070	PASS
10	1712.4	-15.96	-0,0093	PASS
	1732.4	-18.98	-0,0110	PASS
	1752.6	13.52	0,0077	PASS
0	1712.4	-6.56	-0,0038	PASS
	1732.4	-16.43	-0,0095	PASS
	1752.6	13.08	0,0075	PASS
-10	1712.4	-11.73	-0,0069	PASS
	1732.4	-12.76	-0,0074	PASS
	1752.6	14.43	0,0082	PASS
-20	1712.4	7.20	0,0042	PASS
	1732.4	10.18	0,0059	PASS
	1752.6	11.25	0,0064	PASS
-30	1712.4	-8.74	-0,0051	PASS
	1732.4	-10.39	-0,0060	PASS
	1752.6	12.44	0,0071	PASS

## 9. Frequency stability, voltage variation

(FCC §27.54, §2.1055, RSS-139 6.3

<b>EUT with DUT number</b>	DIS039
<b>Accessories with DUT numbers</b>	None
<b>Operation Voltage [V] / [Hz]</b>	6.0 to 15.6 / DC
<b>Result</b>	PASS
<b>Remarks</b>	None
<b>Temp [°C] / Humidity [%RH]</b>	25 / 45
<b>Date of measurements</b>	22.Oct.2012
<b>Measured by</b>	Robert Müller

### 9.1. 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

## 9.2. WCDM1700 Test results

### 9.2.1 FDD4 mode, RMC

Voltage [V]	Frequency [MHz]	Deviation [Hz]	Deviation [ppm]	Result
Maximum (15.6)	1712.4	-13.49	-0.0079	PASS
	1732.4	-12.00	-0.0070	PASS
	1752.6	6.64	0.0038	PASS
Nominal (13.2)	1712.4	-12.88	-0.0075	PASS
	1732.4	-8.70	-0.0050	PASS
	1752.6	18.66	0.0106	PASS
Operation end point (6.0)	1712.4	-15.29	-0.0089	PASS
	1732.4	8.54	0.0049	PASS
	1752.6	-46.00	-0.0263	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 800/880-0,2/40-5SSD	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.	--