

Date: ESPOO 05.06.2006Page: 1 (27)Appendices –Number:
No. 1 / 1**66937R1**

Date of handing in: 01.06.2006

Measured by:



Timo Hietala, Test Engineer

Reviewed by:



Jyrki Leino, Manager

SORT OF EQUIPMENT:

WCDMA Base Station RF module

MARKETING NAME:

Nokia Flexi BTS RF module 1.7GHz/2.1GHz

TYPE:

FRIA

MANUFACTURER:

Nokia Corporation

FCC ID:

UAFFRIA-01

CLIENT:

Nokia Corporation

ADDRESS:

P.O.Box 319, FI-90651 OULU, FINLAND

TELEPHONE:

+358 7180 08000

TEST LABORATORY:

NET/IMN Oulu

FCC REG. NO.

411251

REFERENCE:

FCC Part 27, SUBPART L**SUMMARY:**

In regard to the performed tests the equipment under test fulfils the requirements defined in the test specifications, see page 4 for details

The test results are valid for the tested unit only. Without a written permission of Nemko Oy it is allowed to copy this report as a whole, but not partially.

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1. EUT and Accessory Information

1.1 EUT description

The EUT is a WCDMA Base station RF module 1.7GHz/2.1GHz with 2 power amplifiers.

1.2 EUT and accessories

Manufacturer: Nokia

Model: FRIA, s/n: L9062000867

Other Units: System module, FSMB
Transmission module, FTIA

General: All measurements are traceable to national standards.

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 27, Subpart L.

☒	New Submission	☒	Production Unit
☐	Class II Permissive Change	☐	Pre-Production Unit

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE. **NONE**

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This report applies only to the items tested.

Summary of Test Data

NAME OF TEST	SECTION IN CFR 47	SPEC.	RESULT
RF Power Output	27.50 (d), 2.1046	100 W	Complies
99% Occupied Bandwidth	2.1049, (i)	Unspecified	Complies
Spurious Emissions at Antenna Terminals	27.53(g), 2.1051	- 13 dBm	Complies
Field Strength of Spurious Emissions	27.53(g), 2.1053	- 13 dBm E.I.R.P	Complies
Frequency stability	27.54, 2.1055	± 0.05 ppm ¹⁾	Complies

Note ¹⁾ Limit is the manufacturer's specification

Measurement uncertainty is expressed to a confidence level of 95%.

2. General Equipment Specification

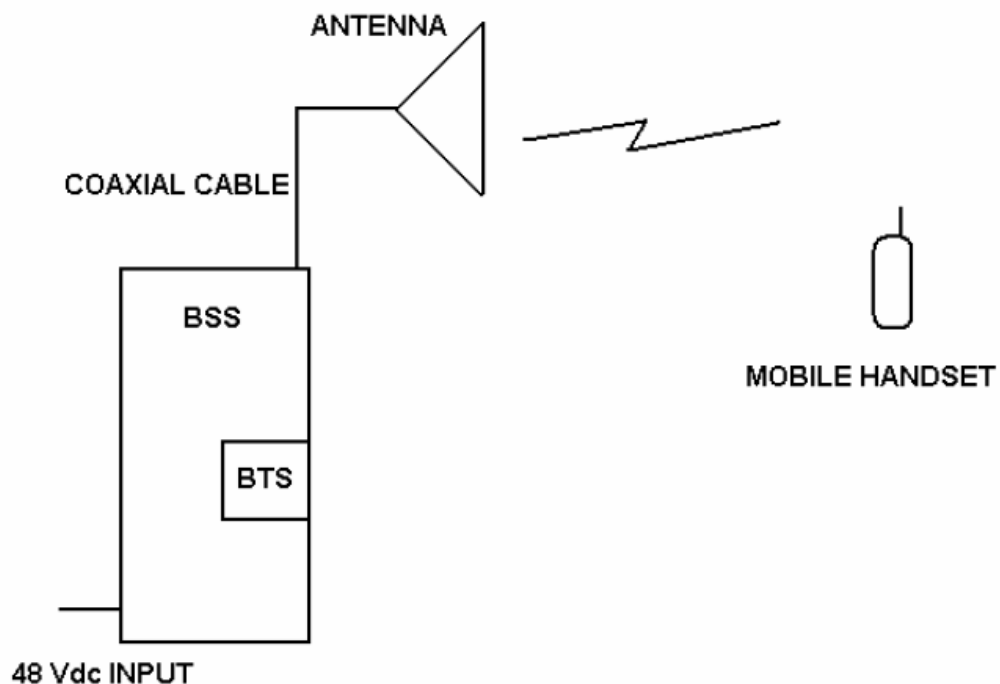
Supply Voltage Input:	48 Vdc		
Frequency Bands: TX:	☒	Block A : 2110 – 2120 MHz	
	☒	Block B : 2120 – 2130 MHz	
	☒	Block C : 2130 – 2135 MHz	
	☒	Block D : 2135 – 2140 MHz	
	☒	Block E : 2140 – 2155 MHz	
Frequency Bands: RX:	☒	Block A : 1710 – 1720 MHz	
	☒	Block B : 1720 – 1730 MHz	
	☒	Block C : 1730 – 1735 MHz	
	☒	Block D : 1735 – 1740 MHz	
	☒	Block E : 1740 – 1755 MHz	
Type of Modulation and Designator:	W-CDMA (5M00F9W) ☒	GSM (200KG7W) ☐	NADC 40K0DXW) ☐
Maximum No. of Carriers:	1+1		
Output Impedance:	50 ohms.		
RF Output:	Per channel: 40 W.		
Band Selection:	Software ☒	Duplexer ☐	Fullband ☐

System Description

The BTS performs the radio function of the Base Station System (BSS), and is connected to the Radio Network Controller (RNC) via the Iub interface, and to Mobile Stations (MS) via the Air interface (Antenna). The RNC is further connected to Serving GPRS Support Node (SGSN) or it can be connected to the Mobile Switching Centre (MSC) via IWU (Inter Working Unit).

Setup for testing: The transmitter was set up according to 3GPP TS 25.141 Test Model 1 for all tests except frequency stability. 64 DPCCHs at 30 kbps (SF=128) distributed randomly across the code space, at random power levels and random timing offsets, were defined to simulate a realistic operating scenario which may have high PAR (Peak-to-Average Ratio). The transmitter was set up according to 3GPP TS 25.141 Test Model 4 for the frequency stability tests.

System Diagram



3. RF Power Output

NAME OF TEST: RF Power Output **PARA.NO.:** 27.50 (d) & 2.1046**TESTED BY:** Timo Hietala**DATE:** 01/06/2006**Test Results:** Complies.**Measurement Data:** Refer to attached plot.

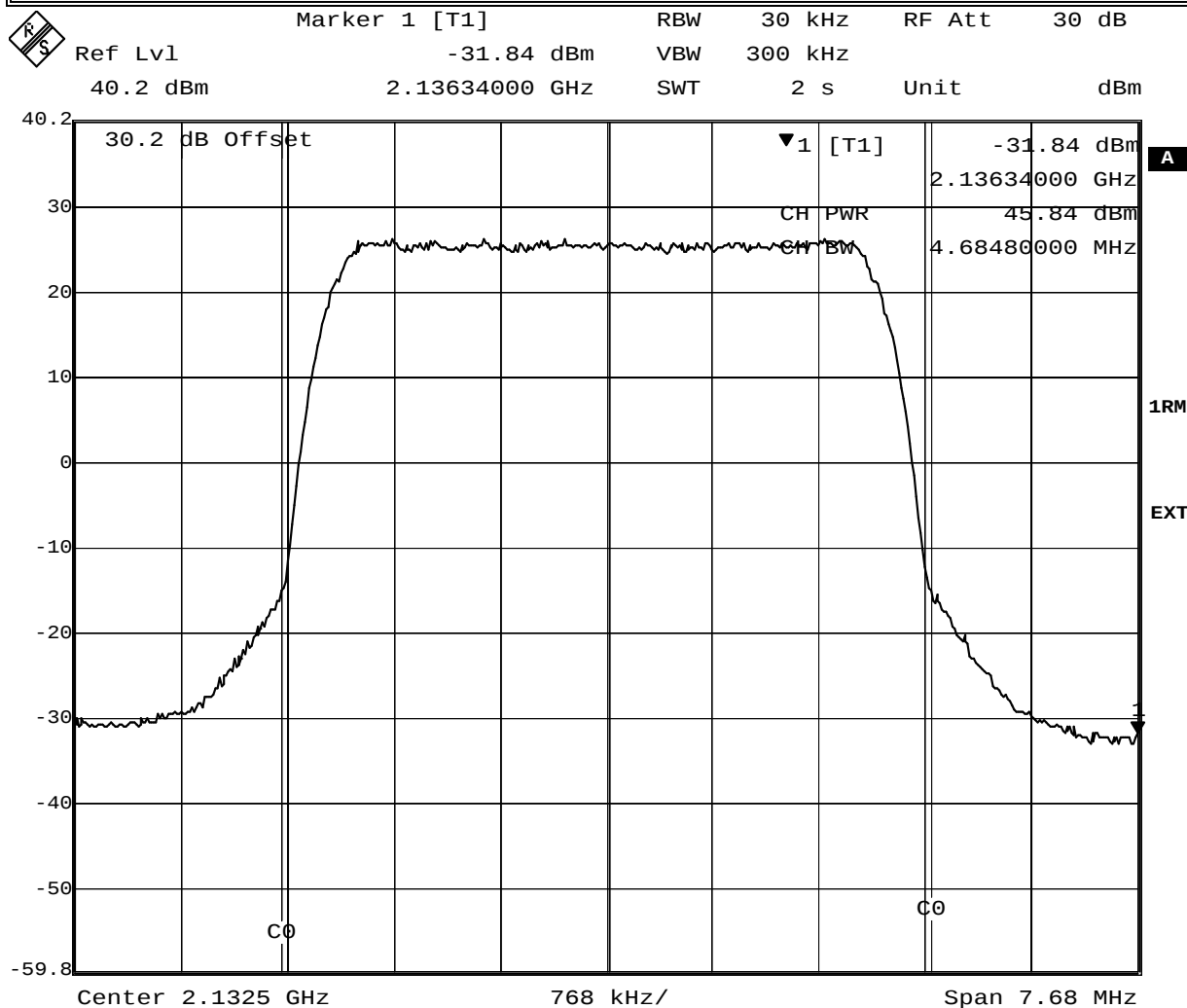
Modulation Type	Frequency (MHz)	Measured Output	Measured Output
		Power (dBm)	Power (W)
WCDMA	2112.6	45.89	38.82
WCDMA	2132.5	45.84	38.37
WCDMA	2152.4	45.98	39.63

Equipment used: 1, 2, 4, 7, 8, 9.**Measurement
Uncertainty:** ± 0.7 dB.**Temperature:** 23 °C.**Relative
Humidity:** 35 %.

Test Data – RF Power Output

Nemko Oy, Finland

Data Plot		RF POWER OUTPUT	
Page 1 of 1		Date: 01/062006	Complete ☒
Job No.: 69937		Temperature (°C): 23	Preliminary: ☐
Specification: PT27		Relative Humidity (%): 35	
Tested By: Timo Hietala			
E.U.T.: WCDMA TRANSMITTER			
Configuration: TX FULL POWER CENTER CHANNEL			
Sample Number: 1			
Location: NET/IMN Oulu		RBW: Refer to plots	Measurement
Detector type: Rms		VBW: Refer to plots	Distance: N/A m
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	
Filter:		Cable #2:	
Receiver:	1	Cable #3:	
Attenuator #1:	7	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	± 0.7 dB		



Date: 1. JUN. 2006 09:17:19

Notes:

4. 99% Occupied Bandwidth**NAME OF TEST:** Occupied Bandwidth**PARA.NO.:** 2.1049, (i)**TESTED BY:** Timo Hietala**DATE:** 01/06/2006**Test Results:** Complies.**Test Data:** See attached plot(s).

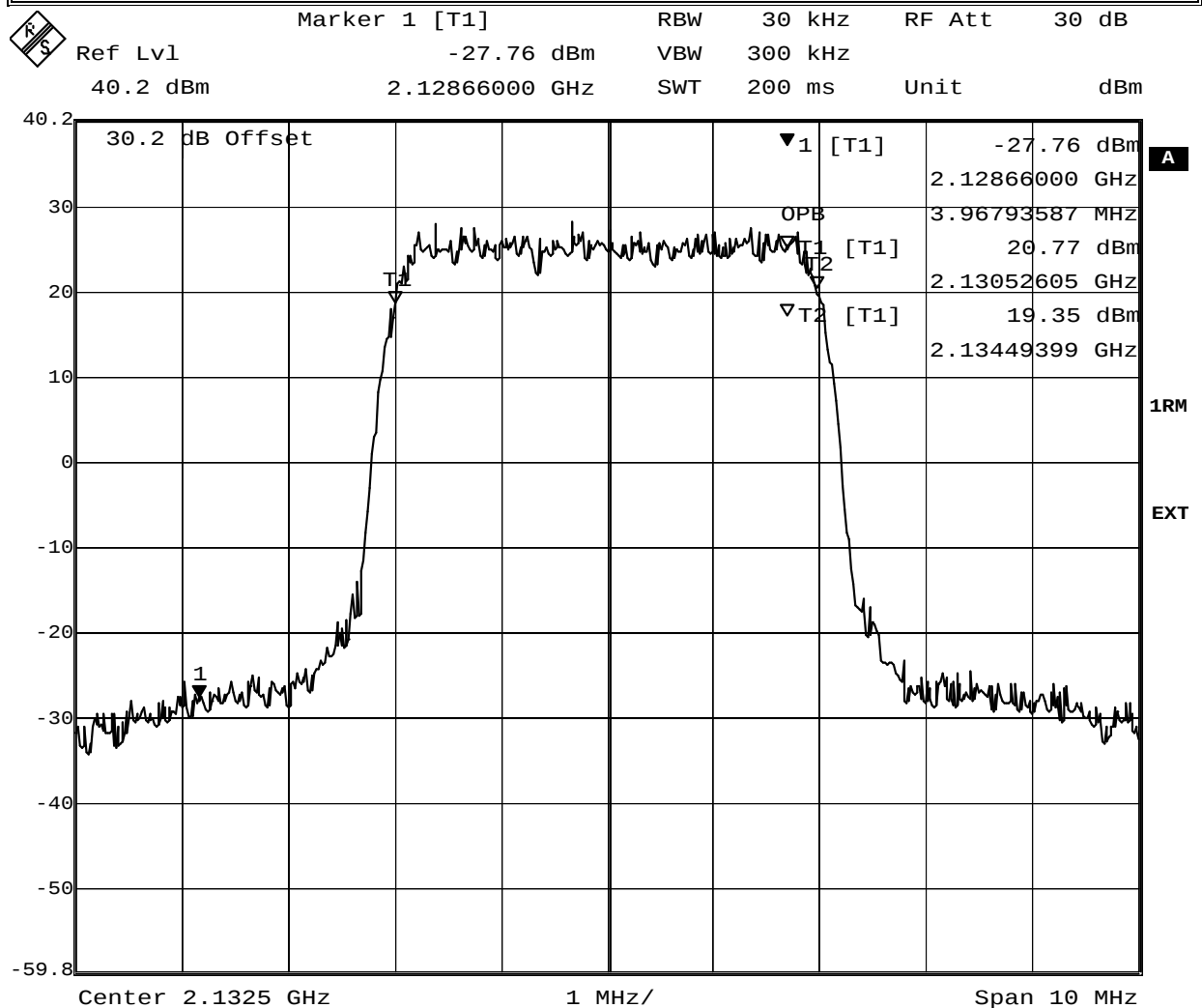
Modulation Type	Frequency	Measured 99%
	(MHz)	Occupied Bandwidth (MHz)
WCDMA	2132.5	3.9679

Equipment used: 1, 2, 4, 7, 8, 9.**Measurement
Uncertainty:** ± 0.7 dB.**Temperature:** 23 °C.**Relative
Humidity:** 35 %.

Test Data – 99% Occupied Bandwidth

Nemko Oy, Finland

Data Plot		99% Occupied Bandwidth	
Page 1 of 1		Date: 01/06/2006	Complete ☒
Job No.: 69937		Temperature (°C): 23	Preliminary: ☐
Specification: PT27		Relative Humidity (%): 35	
Tested By: Timo Hietala			
E.U.T.: WCDMA TRANSMITTER			
Configuration: TX FULL POWER CENTER CHANNEL			
Sample Number: 1			
Location: NET/IMN Oulu		RBW: Refer to plots	Measurement
Detector type: Rms		VBW: Refer to plots	Distance: N/A m
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	
Filter:		Cable #2:	
Receiver: 1		Cable #3:	
Attenuator #1: 7		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty: ± 0.7 dB			



Date: 1. JUN. 2006 09:23:26

Notes: _____

5. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals **PARA.NO.:** 27.53(g), 2.1051**TESTED BY:** Timo Hietala**DATE:** 01/06/2006**Test Results:** Complies.**Test Data:** See attached plots.

Frequency (MHz)	Spurious Emission (dBm)
1357.8	-27.8
4265.0	-29.4
6397.5	-34.0

Lower Band Edge

Frequency (MHz)	Peak Emission Level (dBm)
2109.433	-17.5

Upper Band Edge

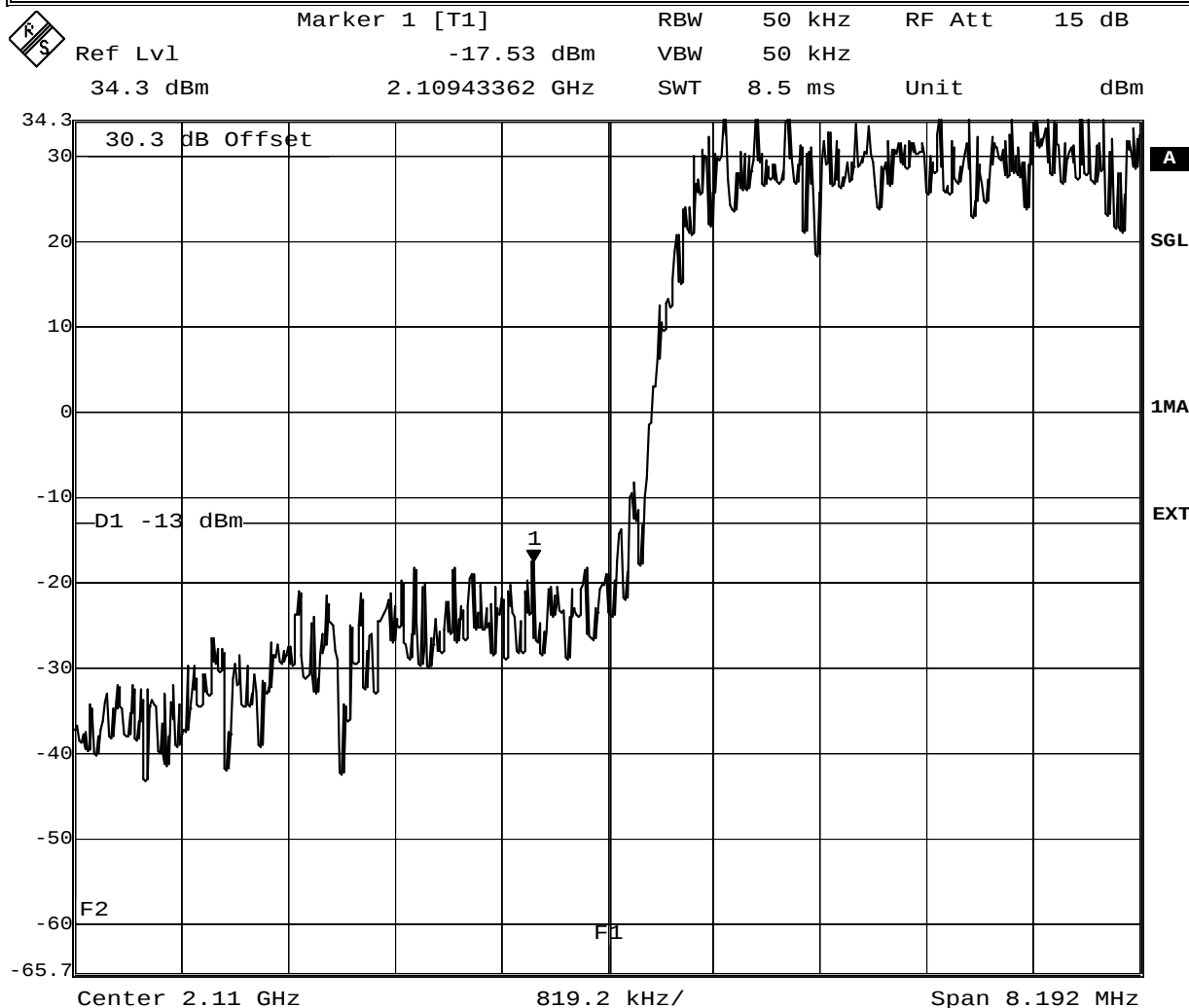
Frequency (MHz)	Peak Emission Level (dBm)
2155.106	-15.3

Equipment used: 1, 2, 3, 4, 7, 8, 9, 12, 13, 14**Measurement
Uncertainty:** ± 0.7 dB.**Temperature:** 23 °C.**Relative
Humidity:** 35 %.

Test Data – Spurious Emissions

Nemko Oy, Finland

Data Plot		Spurious Emissions at Antenna Terminals	
Page 1 of 4		Date: 01/06/2006	Complete ☒
Job No.: 69937		Temperature (°C): 23	Preliminary: ☐
Specification: PT27		Relative Humidity (%): 35	
Tested By: Timo Hietala			
E.U.T.: WCDMA TRANSMITTER			
Configuration: TX FULL POWER BOTTOM CHANNEL			
Sample Number: 1			
Location: NET/IMN Oulu		RBW: Refer to plots	Measurement
Detector type: Peak		VBW: Refer to plots	Distance: N/A m
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	
Filter:		Cable #2:	
Receiver:	1	Cable #3:	
Attenuator #1:	7	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	± 0.7 dB		



Date: 1. JUN. 2006 10:11:33

Notes: LOWER BANDEDGE, Tx 2112.6 MHz

Test Data – Spurious Emissions

Nemko Oy, Finland

Data Plot

Spurious Emissions at Antenna Terminals

Page 2 of 4

Job No.: 69937

Date: 01/06/2006

Specification: PT27

Temperature (°C): 23

Tested By: Timo Hietala

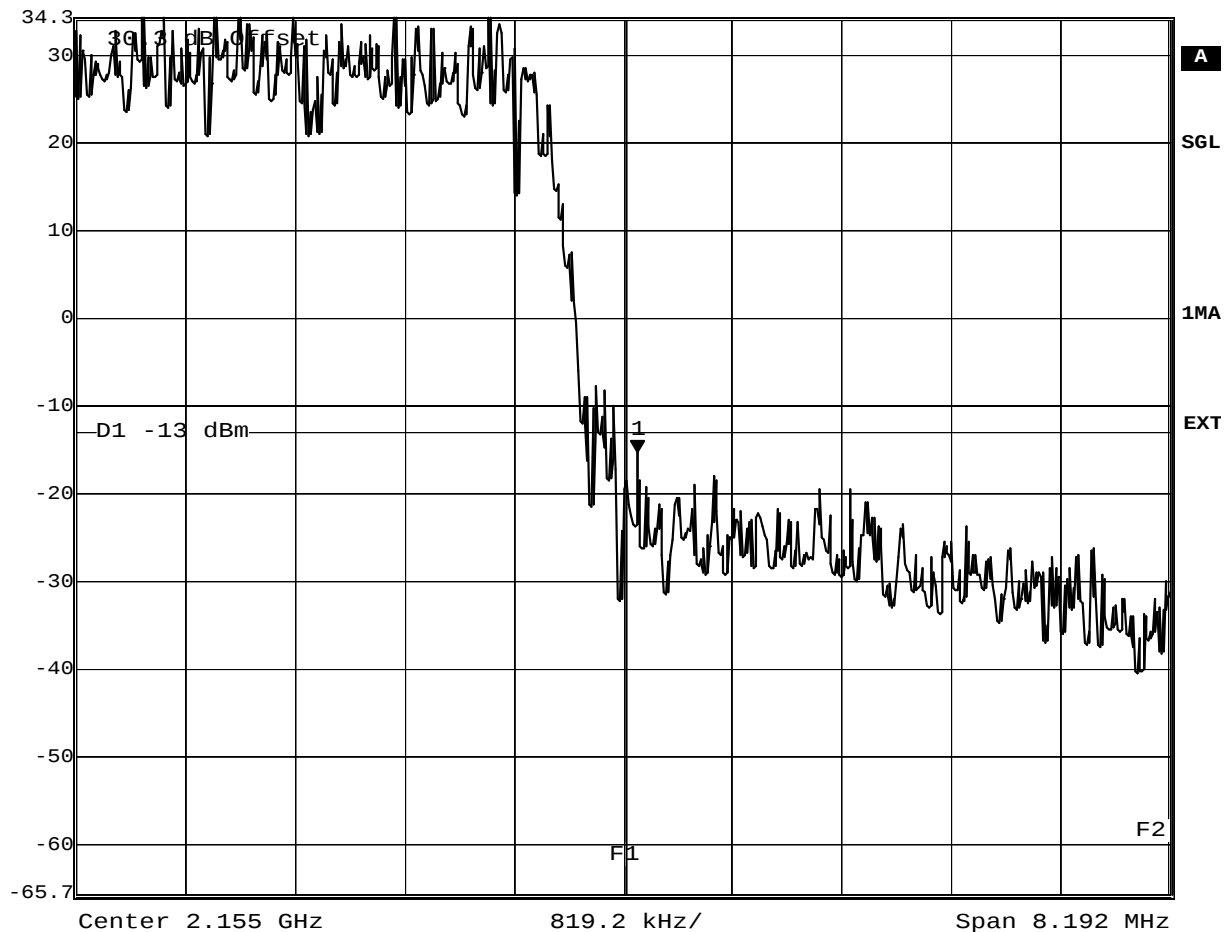
Relative Humidity (%): 35

E.U.T.: WCDMA TRANSMITTER

Configuration: TX FULL POWER TOP CHANNEL



Marker 1 [T1] RBW 50 kHz RF Att 15 dB
Ref Lvl -15.34 dBm VBW 50 kHz
34.3 dBm 2.15510671 GHz SWT 8.5 ms Unit dBm



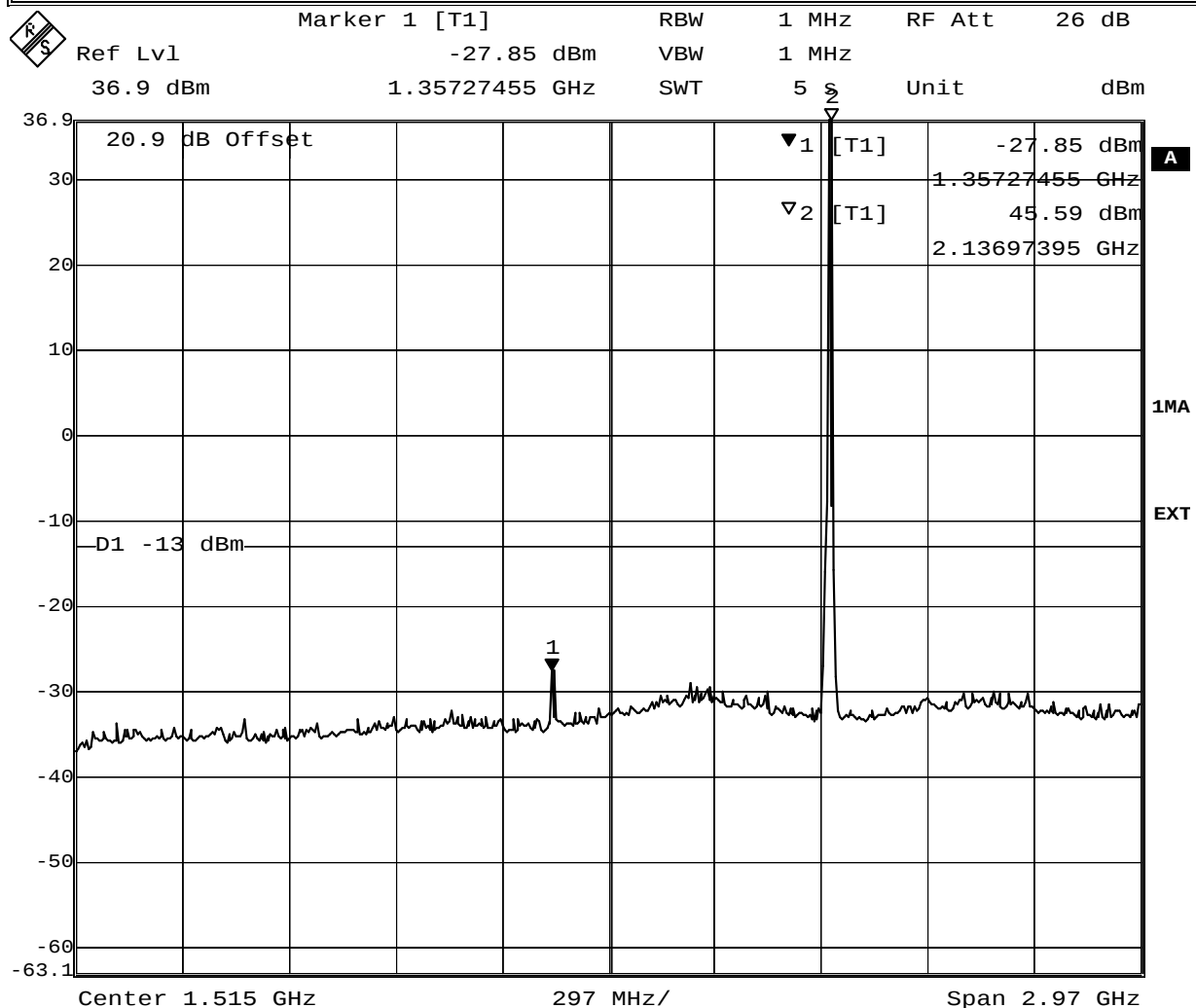
Date: 1. JUN. 2006 10:19:40

Notes: UPPER BANDEDGE, Tx 2152.4 MHz

Test Data – Spurious Emissions

Nemko Oy, Finland

Data Plot		Spurious Emissions at Antenna Terminals	
Page 3 of 4		Date: 01/06/2006	Complete ☒
Job No.: 69937		Temperature (°C): 23	Preliminary: ☐
Specification: PT27		Relative Humidity (%): 35	
Tested By: Timo Hietala			
E.U.T.: WCDMA TRANSMITTER			
Configuration: TX FULL POWER MIDDLE CHANNEL			
Sample Number: 1			
Location: NET/IMN Oulu		RBW: Refer to plots	Measurement
Detector type: Peak		VBW: Refer to plots	Distance: N/A m
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	
Filter:		Cable #2:	
Receiver:	1	Cable #3:	
Attenuator #1:	13	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty:	± 0.7 dB		



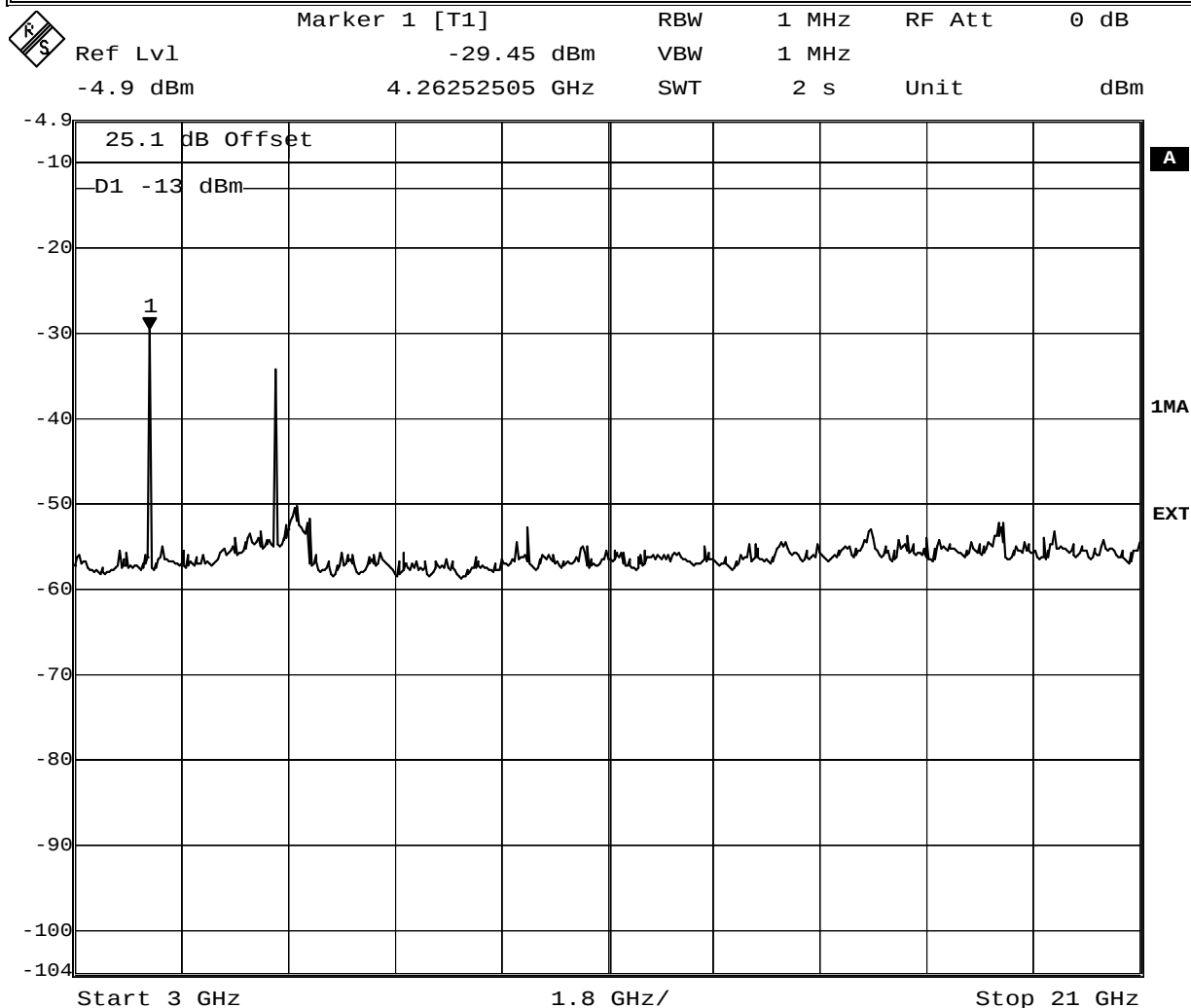
Date: 1. JUN. 2006 11:27:46

Notes: PA1 Tx 2132.5 MHz

Test Data – Spurious Emissions

Nemko Oy, Finland

Data Plot		Spurious Emissions at Antenna Terminals	
Page 4 of 4		Date: 01/06/2006	Complete ☒
Job No.: 69937		Temperature (°C): 23	Preliminary: ☐
Specification: PT27		Relative Humidity (%): 35	
Tested By: Timo Hietala			
E.U.T.: WCDMA TRANSMITTER			
Configuration: TX FULL POWER MIDDLE CHANNEL			
Sample Number: 1			
Location: NET/IMN Oulu		RBW: Refer to plots	Measurement
Detector type: Peak		VBW: Refer to plots	Distance: N/A m
Test Equipment Used			
Antenna:		Directional Coupler:	
Pre-Amp:		Cable #1:	
Filter: 12		Cable #2:	
Receiver: 1		Cable #3:	
Attenuator #1: 14		Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:			
Measurement Uncertainty: ± 0.7 dB			



Date: 1. JUN. 2006 11:34:01

Notes: PA1 Tx 2132.5 MHz

6. Field Strength of Spurious**NAME OF TEST:** Field Strength of Spurious Emissions **PARA.NO.:** 27.53(g), 2.1053**TESTED BY:** Timo Hietala**DATE:** 01/06/2006**Test Results:** Complies.**Test Data:** See attached table.

Frequency (MHz)	Spurious Emission EIRP (dBm)
4226	-30.0
4265	-23.6
4915	-36.0
8529	-42.4

Equipment used: 15, 16, 17, 18, 19, 23, 24, 25, 26**Measurement
Uncertainty:** ± 5.2 dB.**Temperature:** 23 °C.**Relative
Humidity:** 35 %.**NOTE:** _____

The spectrum was searched from 30 MHz to the 10th harmonic of the carrier.

Test Data – Radiated Emissions

Nemko Oy, Finland

Data Plot		Radiated Emissions Substitution Method	
Page <u>1</u> of <u>1</u>		Complete <u>x</u>	
Job No.:	69937	Date:	01/06/2006
Specification:	PT27	Temperature (°C):	23
Tested By:	Timo Hietala	Relative Humidity (%):	35
E.U.T.:	WCDMA TRANSMITTER		
Configuration:	TX FULL POWER MIDDLE and BOTTOM CHANNEL		
Sample Number:	1		
Location:	NET/IMN Oulu	RBW:	1 MHz
Detector type:	Ave	VBW:	1 MHz
		Measurement Distance:	3 m
Test Equipment Used			
Antenna:	17 and 18	Directional Coupler:	
Pre-Amp:	24	Cable #1:	
Filter:		Cable #2:	
Receiver:	16	Cable #3:	
Attenuator #1:	-	Cable #4:	
Attenuator #2:		Mixer:	
Additional equipment used:	19,23,25 and 26		
Measurement Uncertainty:	± 5.2 dB		

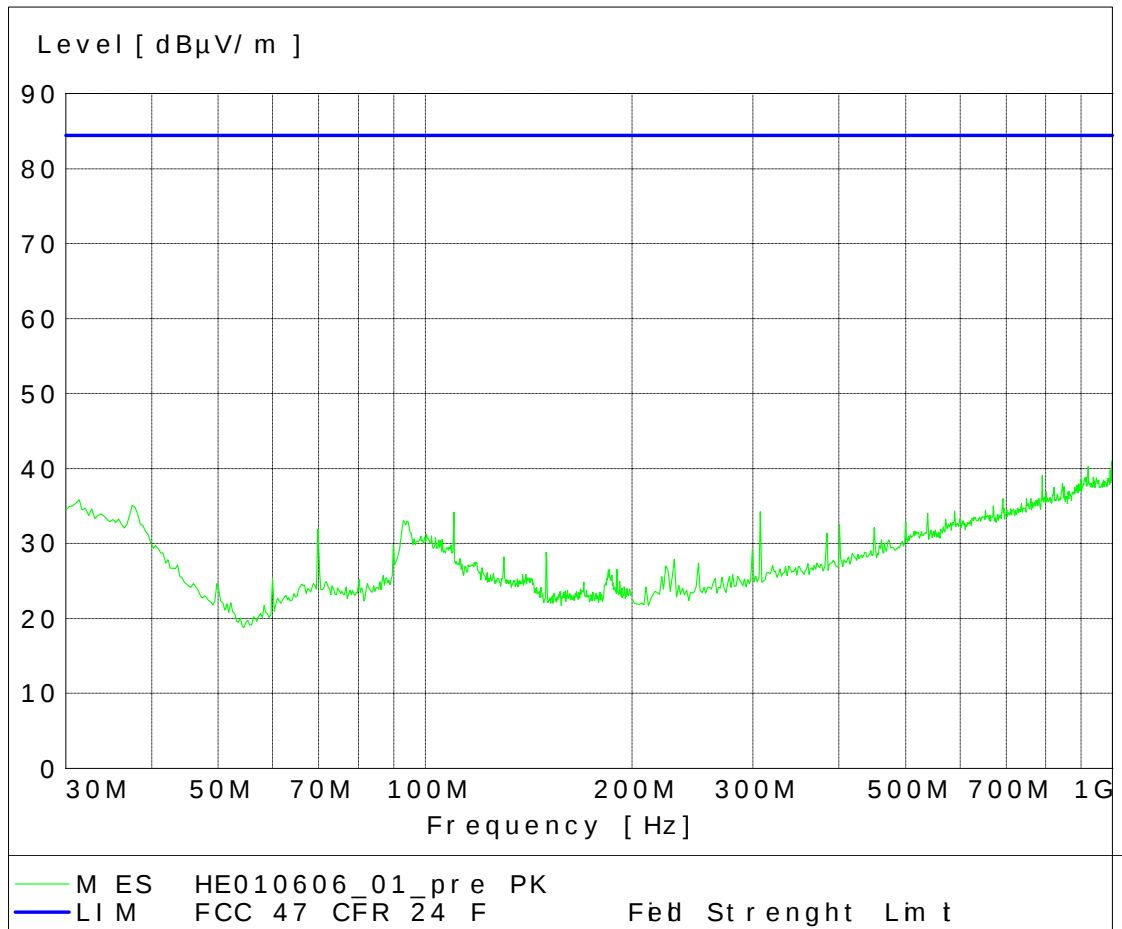
Frequency (MHz)	Meter Reading (dBm)	Correction Factor (dB)	Gen. Level (dBm)	Substitution Antenna Gain (dBi)	EIRP (dBm)	EIRP (μW)	Polarity	Comments
4226	-60.92	16.84	-23.7	10.5	-30.0	0.99	VER	
4265	-53.72	16.84	-17.3	10.5	-23.6	4.33	VER	
4915	-65.82	17.39	-29.6	11.0	-36.0	0.25	VER	
8529	-85.20	19.87	-34.1	11.6	-42.4	0.06	HOR	

Notes: PA1 2132.5MHz and PA2 2112.6 MHz

All other indicated spurious were at least 20 dB below the relevant limit.

Searched spectrum to the 10th harmonic of carrier.

Test Data – Radiated Emissions 30 MHz -1000 MHz



Notes: PA1 2132.5MHz and PA2 2112.6 MHz

. 1)Limit line (84.4 dBuV/m) is converted from substitution limit (–13 dBm) to unit dBuV/m in 3 meter measurement distance.

7. Frequency stability

NAME OF TEST: Frequency stability	PARA.NO.: 27.54, & 2.1055
TESTED BY: Timo Hietala	DATE: 02/06/2006

Test Results: Complies.

Standard Test Frequency: 2132.5 MHz.

Standard Test Voltage: 48 V DC.

Equipment used: 1, 5, 6, 7, 8, 9.

EUT: WCDMA TRANSMITTER.

Configuration: TX FULL POWER MIDDLE CHANNEL.

Measurement Data: Frequency stability with voltage variation.

Voltage (V DC)	Temp (°C)	Rated (Hz/ppm)	Deviation (Hz)	Deviation (ppm)
48.0	20	106 / 0.05	18	0.008633
55.2	20	106 / 0.05	30	0.013965
40.8	20	106 / 0.05	22	0.010242

Measurement Uncertainty: ± 0.001 ppm (± 2.0 Hz).

Relative Humidity: 35 %.

NAME OF TEST: Frequency stability**PARA.NO.:** 27.54, & 2.1055**TESTED BY:** Timo Hietala**DATE:** 02/06/2006**Test Results:** Complies.**Standard Test Frequency:** 2132.5 MHz.**Standard Test Voltage:** 48 V DC.**Equipment used:** 1, 5, 6, 7, 8, 9.**EUT:** WCDMA TRANSMITTER.**Configuration:** TX FULL POWER MIDDLE CHANNEL.**Measurement Data:** Frequency stability with temperature variation.

Voltage (V DC)	Temp (°C)	Rated (Hz/ppm)	Deviation (Hz)	Deviation (ppm)
48.0	50	106 / 0.05	-11	-0.00516
48.0	40	106 / 0.05	19	0.00891
48.0	30	106 / 0.05	48	0.022509
48.0	10	106 / 0.05	56	0.02626
48.0	0	106 / 0.05	65	0.030481
48.0	-10	106 / 0.05	65	0.030481
48.0	-20	106 / 0.05	81	0.037984
48.0	-30	106 / 0.05	92	0.043142

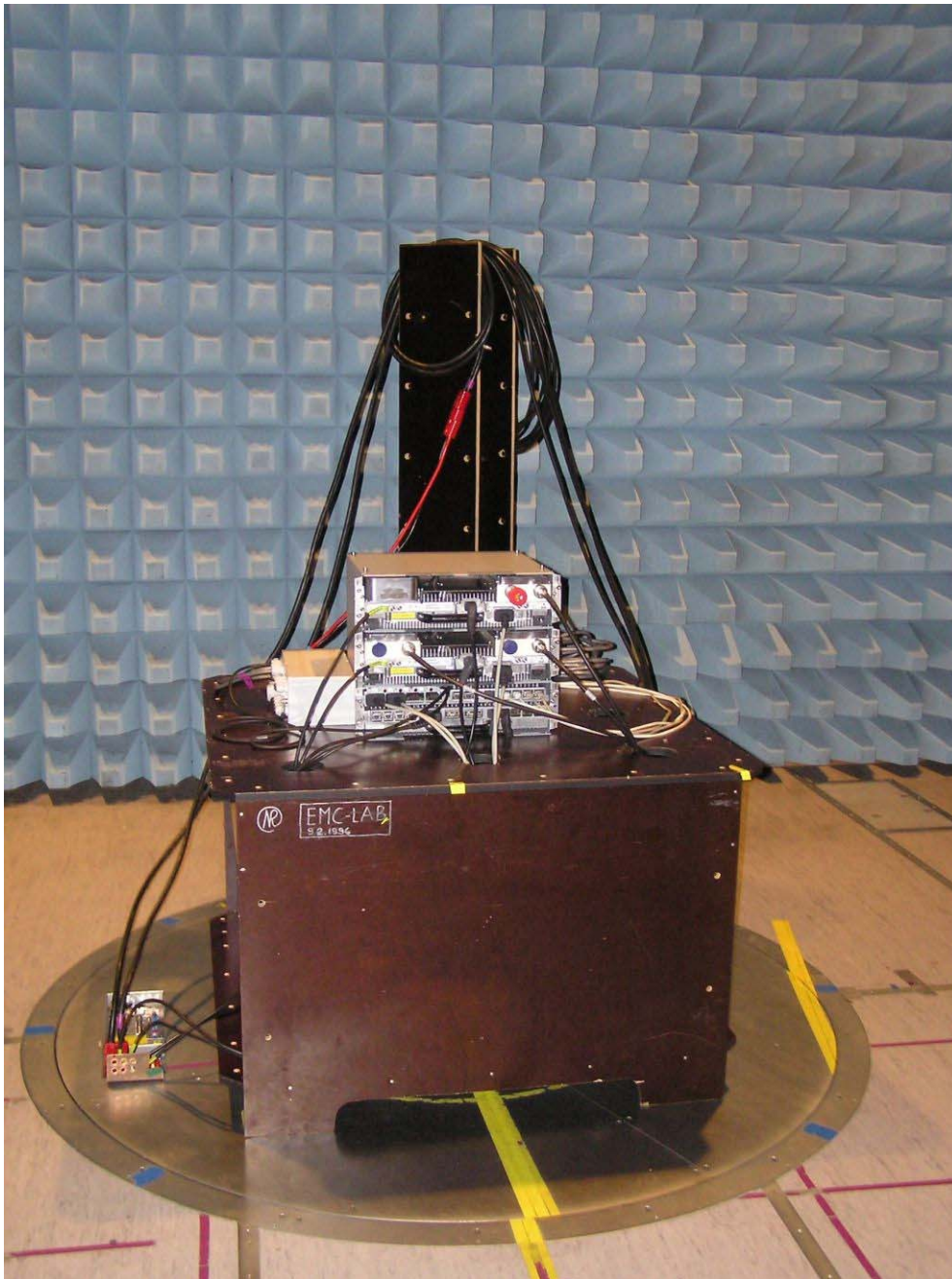
Measurement**Uncertainty:** ± 0.001 ppm (± 2.0 Hz).

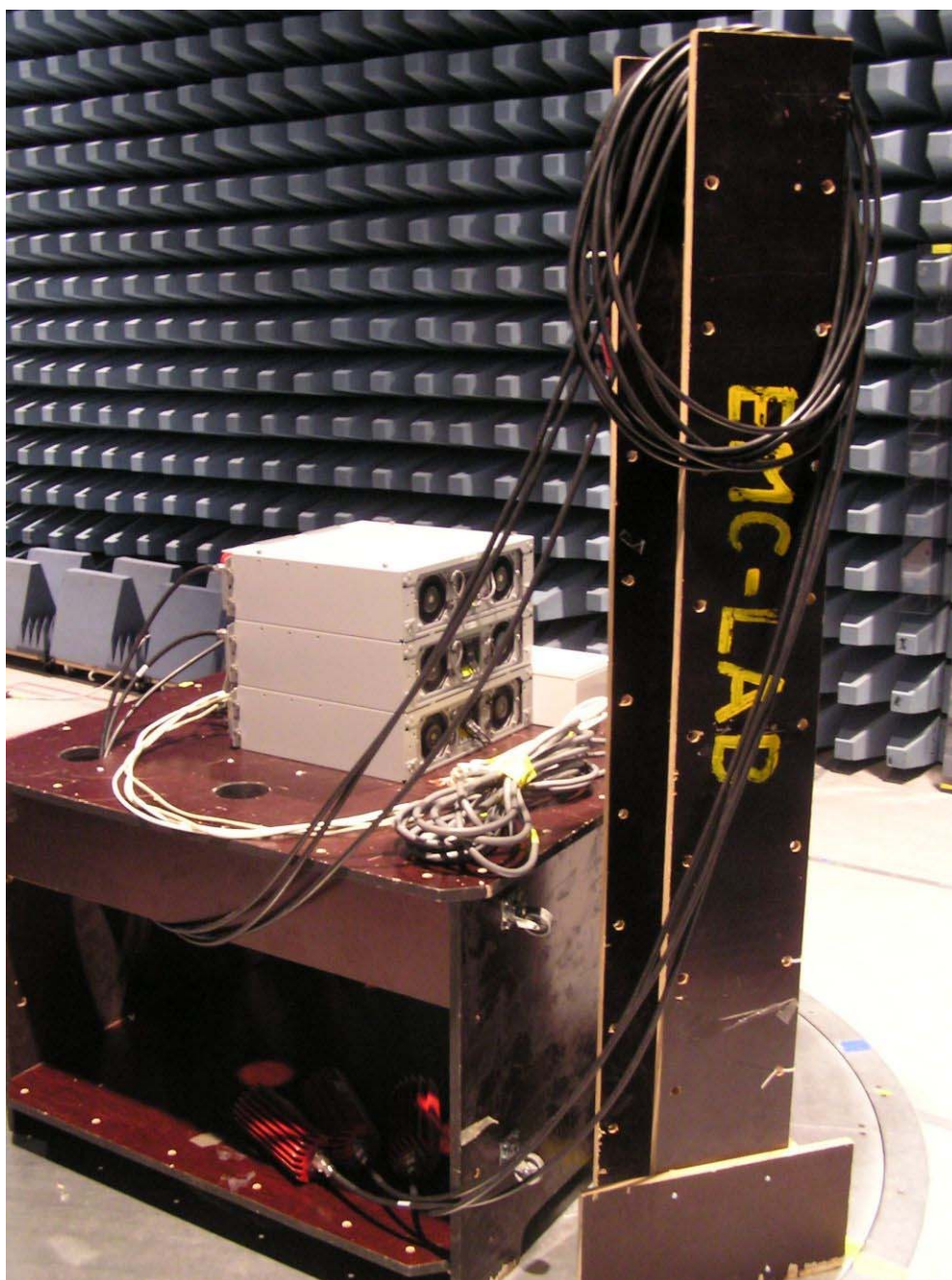
8. List of test equipment

Each active test equipment is calibrated annually.

Nr.	Equipment	Name of equipment	Serial number
1	Signal analyzer	Rohde & Schwarz:FSIQ26	836702/020
2	Network analyzer	Hewlett-Packard:HP8753E	US38431868
3	Network analyzer	Hewlett-Packard:HP8720ES	US39172107
4	Calibration kit	Hewlett-Packard:HP85032B	2919A04843
5	Environmental chamber	Weiss technik	59226012320010
6	Frequency standard	Datum 8040	23006282
7	Interface Unit	Orbis TX SSU2100A	SSU-0346-999
8	DC power	Sörensen	9950C0085
9	Temperature/humidity meter	VAISALA HMI 31	P3730008
10	Signal analyzer	Rohde & Schwarz:FSIQ26	833370/009
11	Frequency standard	Datum 8040	0041005473
12	High Pass filter	Reactel 9HSX-3/20-S11	0531
13	Attenuator	MCE/Weinschel 67-20-33	BM0633
14	Attenuator	MCE/Weinschel 66-20-34	BM6886
15	Semianechoic chamber	Siemens Matsushita 9m × 5m × 6m (room 0039)	Product No S&M B83317- C6019-T232
16	EMI Test Receiver	R&S ESIB 26	100335
17	LogPer Antenna	R&S HL025	349048/002 (1-26 GHz)
18	Bilog Antenna	Chase CBL6112B	2694
19	Horn Antenna	Emco 3115	0102A06346
20	Biconical Antenna	R&S HK116	836891/009
21	Dipole VHF	Mess-Elektronik VHA9103	
22	Dipole UHF	Mess-Elektronik UHA9105	
23	Signal Generator	R&S SMR 20	1715
24	Amplifier	Miteq AFSX4	791117
25	Antenna Mast	Deisel HD240	2401323194
26	Mast Controller	Deisel HD100	1001331

9. Photographs of Test Setup





10. ANNEX A, TEST DETAILS

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
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Minimum Standard:

Para. No. 27.50 (d). Base stations are limited to 1640 watts peak E.I.R.P. with an antenna height up to 300 meters HAAT. In no case may the peak output power of a base station transmitter exceed 100 watts.

Method Of Measurement:

CDMA Per ANSI/J-STD-014
TDMA Per ANSI/J-STD-010

Detachable Antenna:

The peak power at antenna terminals is measured using an in-line peak power meter or a spectrum analyzer.

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1049
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Minimum Standard:

Para. No. 2.1049. The 99% occupied bandwidth is the width of a frequency band such that, below the lower and above the upper frequency limits, the mean powers emitted are each equal to 0.5% of the emitted power.

Method Of Measurement:

The 99% occupied bandwidth of the carrier emission is measured using a spectrum analyzer with Resolution Bandwidth set to 1% of the necessary bandwidth of the transmitted carrier.

NAME OF TEST: Spurious Emission at Antenna Terminals	PARA. NO.: 2.1051
---	--------------------------

Minimum Standard:

Para. No. 27.53(g). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Method Of Measurement:

Spectrum analyzer settings:

RBW: 1 MHz

VBW: 1 MHz

Within 1 MHz of the upper and lower edges of the assigned band of operation the resolution bandwidth is lowered to 1 % of the 26 dB occupied bandwidth of the transmitted carrier.

NAME OF TEST: Field Strength of Spurious Radiation**PARA. NO.: 2.1053**

Minimum Standard: Para. No.227.53(g). On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power by at least $43 + 10 \log (P)$ dB.

Test Method:

TIA/EIA-603-1992, Section 2.2.12

The antenna substitution method was used to determine the equivalent radiated power at spurious frequencies. The spurious emissions were measured at a distance of 3 meters. The EUT was then replaced with a reference substitution antenna with a known gain referenced to an isotropic. This antenna was fed with a signal at the spurious frequency. The level of the signal was adjusted to repeat the previously measured level. The resulting eirp is the signal level fed to the reference antenna corrected for gain referenced to an isotropic.

NAME OF TEST: Frequency Stability**PARA. NO.: 2.1055**

Minimum Standard: Para. No. 27.54. The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Method Of Measurement:Frequency Stability With Voltage Variation

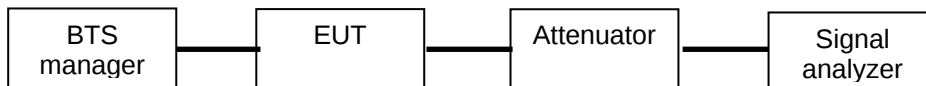
The E.U.T. is placed in an environmental chamber and allowed to stabilize at +20 degrees Celsius for at least 15 minutes. With the voltage input to the E.U.T. set to 85% S.T.V., the frequency error is measure. This procedure is repeated at 100% S.T.V. and 115% S.T.V.

Frequency Stability With Temperature Variation

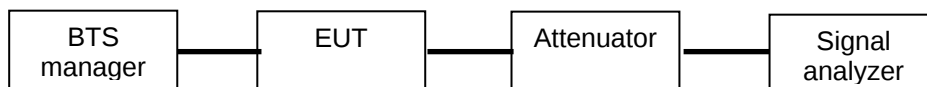
The input voltage to the E.U.T. is set to S.T.V. and the temperature of the environmental chamber is varied in 10 degree steps from -30 degrees C to +50 degrees C. The E.U.T. is allowed to stabilize at each temperature and the frequency error is measured.

11. ANNEX B, TEST DIAGRAMS

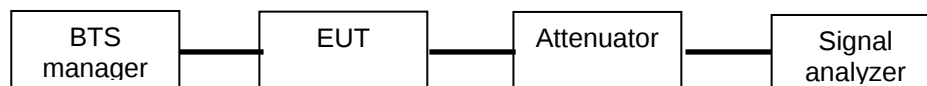
RF Power Output PARA. NO.: 2.1046



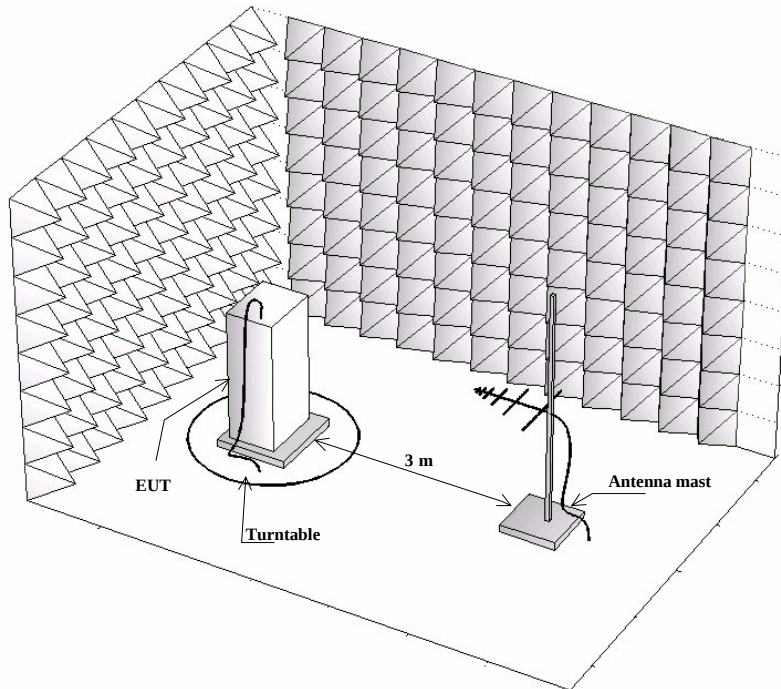
Occupied Bandwidth PARA. NO.: 2.1049



Spurious Emission at Antenna Terminals PARA. NO.: 2.1051

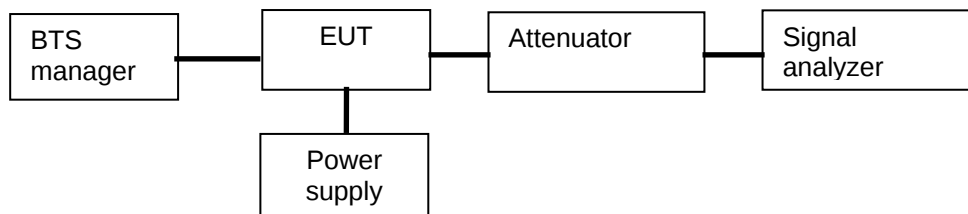


Field Strength of Spurious Radiation PARA. NO.: 2.1053



Frequency Stability PARA. NO.: 2.1055

Frequency Stability With Voltage Variation



Frequency Stability With Temperature Variation

