SGS

Center for Quality Engineering

Evaluation No.: D0QJ0001

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Client: Nokia Siemens Networks Oy

Equipment Under Test: Flexi WCDMA Base Station with antenna types:
- HBX-6516DS-VTM
- CS7278001

Manufacturer: Nokia Siemens Networks Oy

Task: Identification of compliance with the requirements
FCC 47 CFR § 1.1310 on base of

- Test Specification(s):
  - OET Bulletin 65
  - Draft IEC 62232 Ed.1.0

Result: The EUT meets the above cited requirements

The results relate only to the items tested as described in this test report.

edited by:	**Date**	**Signature**
Rieb Qualification Engineer	Jun 19, 2010	

approved by:	**Date**	**Signature**
Bauer Manager EMC	Jun 19, 2010	Josef Bauer

This document was signed electronically.

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1 Summary

This evaluation is based on numerical calculations to demonstrate the compliance of "Flexi WCDMA BTS" with the maximum permissible exposure limits for general population and occupation to radio frequency electromagnetic fields with respect to FCC 47 CFR §1.1310 [1] (see Annex A). The compliance is shown via the concept of compliance boundary of the antenna as described in section 4.2. The detailed results are shown in Table 4 of section 4.

The "Flexi WCDMA BTS" is compliant with the exposure limits of FCC 47 CFR §1.1310 for general population and occupation to radio frequency electromagnetic fields at every point outside the compliance boundary.

Provisions have to be taken to guarantee that no public access is possible to regions within the compliance boundaries for general population. For workers adequate warnings and information have to be provided for entering the exclusion area (see Annex C).

The results of this evaluation report refer exclusively to the item described in section 4 of this report

2 References

2.1 Specifications

[1]   FCC 47 CFR §1.1310
       Radiofrequency radiation exposure limits

[2]   OET Bulletin 65, Edition 97-01
       Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency
       Electromagnetic Fields
.
[3]   Draft IEC 62232 Ed.1.0 (IEC 106/165/CD);
       Determination of RF fields and SAR in the vicinity of radio communication base stations
       for the purpose of evaluating human exposure

2.2 Glossary of Terms

EUT: Equipment under Test
GP: General Population
Oc: Occupation
MPE: Maximum permissible exposure limits

3 General Information

3.1 Identification of Client

Nokia Siemens Networks Oy
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3.2 Test Laboratory

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3.3 Participants

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4 Equipment Under Test

Flexi WCDMA Base Station with antenna type:
- HBX-6516DS-VTM
- CS7278001

4.1 TYPICAL CONFIGURATION

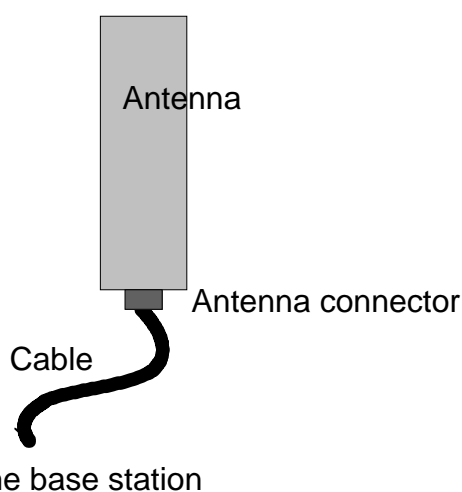The antenna is connected through a connector and cable(s) to the base station as shown in Figure 1.

Antenna

Antenna connector

Cable

To the base station

Figure 1

A detail description of the components is given below:

Power (P_{out})	20/40 W
Total connector loss	0.0 dB
Total cable loss	0 dB
Total Loss (L) = Total connector loss + Total cable loss	0 dB
Number of transmitter unit (N)	1
Power at antenna input = $P_{out} N 10^{\frac{-L}{10}}$	20/40 W

Table 1

The worst-case power level configuration is when the power at antenna input is 40 W.

A typical antenna specification is given below:

	HBX-6516DS-VTM	**CS7278001**
Frequency	1710 – 2170 MHz	1710 – 2200 MHz
Gain	17.7 – 18 dBi	17.3 – 17.6 dBi
Half-power beam width	H-plane:66 – 64 deg.	H-plane:68 – 62 deg.
	E-plane: 7.5 – 6.5 deg.	E-plane: 7.9 – 7.0 deg.
Electrical downtilt	0 – 10 deg	0 – 15 deg
Height/width/depth	1306 / 168 / 84 mm	1374 / 155 / 69 mm

Table 2

4.2 WHEN USING DIFFERENT CONFIGURATIONS

IMPORTANT:

In Table 4, the compliance boundaries are given for different power levels, including the typical and worst case levels. If an antenna and/or configuration is used which does not correspond to the levels given in Table 4, the compliance boundary must be re-calculated.

A formula for calculating the compliance boundary using the far-field model is given in ANNEX B: Far-Field Calculation Method. This model is applicable for calculating the compliance boundary for the far-field region and over estimates the compliance boundary for the radiating near-field region, but is not applicable for calculating the compliance boundary for the reactive near-field region where the distance from the antenna is less than or equal to λ.

5 Evaluation of the EUT

5.1 Definition of compliance boundary

The compliance boundary defines the volume outside which any point of investigation is deemed to be compliant. Outside the compliance boundary the exposure levels do not exceed the permissible exposure limits irrespective of the time of exposure.

5.2 Assessment of compliance boundary

When assessing the applicable compliance boundaries the permissible exposure limits for general population and occupation to radio frequency electromagnetic fields of FCC 47 CFR §1.1310 - see Annex A - have been applied.

The compliance boundary is determined as the area around the antenna, shown in Figure 2. The antenna is located at the origo. Distances from the antenna are shown. The top and side views are shown in Figure 3 and Figure 4.

Since the compliance boundaries are within the radiating near field of the antenna the calculations have been carried out with a full wave field simulation program. This program has been verified by applying the validation guideline of Draft IEC 62232 [3] for full wave analyses. The maximum deviation from the reference results from IEC 62232 is less than 10 %.

The calculations of the Flexi LTE Base Station antennas have been carried out based on the relevant antenna specifications.

The models of the antennas have been designed for far field distributions matching the measured far field distributions of the real antenna provided by the Antenna manufacturer.

The compliance boundary has bee calculated using the designed antennas and the exposure limit (Annex A) with a margin of 10 % (uncertainty of the calculation).
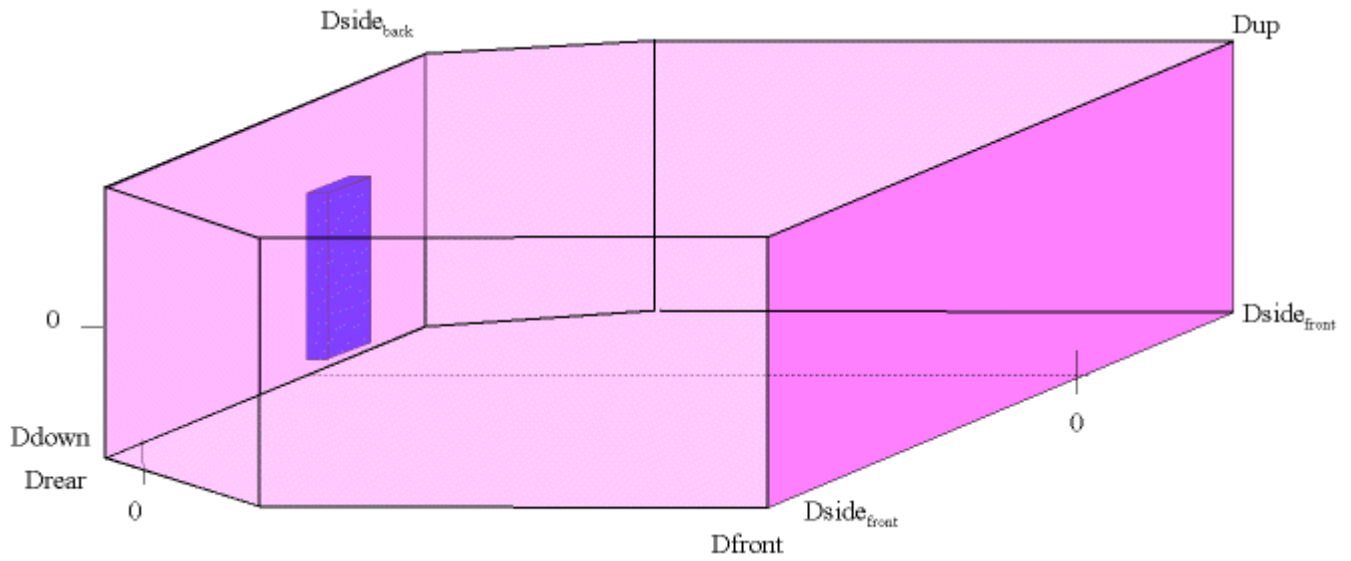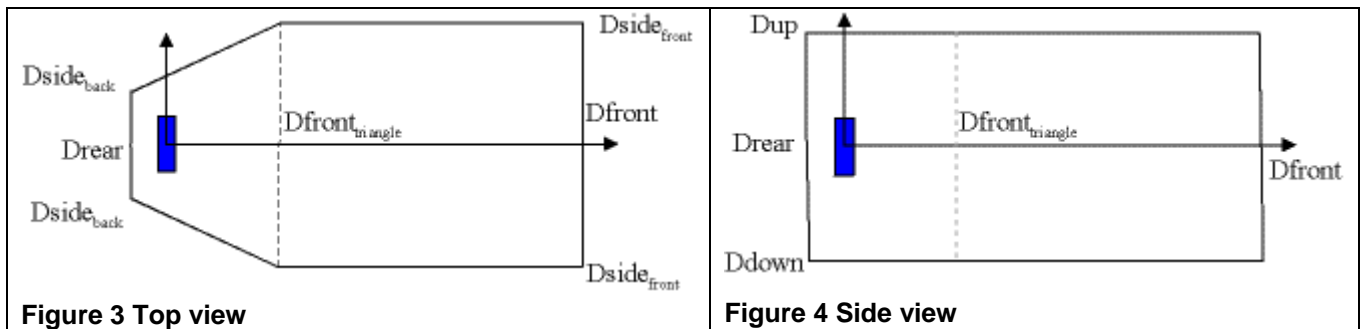
Figure 2

Figure 3 Top view

Figure 4 Side view

The compliance boundaries are given in Table 4 for different power levels at the antenna input. The Results of typical and worst case power level configurations for general public (GP) and occupational (Oc) exposure limits are included. The boundaries of the compliance region are displayed in Figure 2, 3 and 4.

Antenna type: HBX-6516DS-VTM															
		Dfront		Dfront$_{triangle}$		Drear		Dside$_{back}$		Dside$_{front}$		Dup		Ddown	
Freq. (MHz)	Power at antenna input	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc
2000	40 W	3.75	0.6	1.1	0.1	0.1	0.1	0.35	0.1	1.0	0.2	1.0	0.7	0.75	0.7
2000	20 W	1.6	0.3	0.45	0.1	0.1	0.1	0.25	0.1	0.5	0.2	0.85	0.7	0.7	0.7

Antenna type: CS7278001															
		Dfront		Dfront$_{triangle}$		Drear		Dside$_{back}$		Dside$_{front}$		Dup		Ddown	
Freq. (MHz)	Power at antenna input	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc	GP	Oc
2000	40 W	3.7	0.6	1.0	0.1	0.1	0.1	0.35	0.15	1.05	0.25	1.35	0.75	1.1	0.7
2000	20 W	1.6	0.35	0.45	0.1	0.1	0.1	0.25	0.1	0.5	0.15	0.95	0.7	0.75	0.7

Table 4 Dimensions of compliance boundary in meter

ANNEX A: Exposure limits

Electromagnetic exposure limits according FCC 47 CFR §1.1310 for occupational and general public.

Limits for maximum permissible exposure (MPE)

Exposure Characteristics	Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Equivalent plane wave power density S (mW/cm^2)
Occupational / Controlled exposure	0.3 – 3.0	614	1.63	100
	3.0 – 30	1842/f	4.89/f	900/f²
	30 – 300	61.4	0.163	1
	300 – 1500			f/300
	1500 – 100,000			5
General Population / Uncontrolled Exposure	0.3 – 3.0	614	1.63	100
	3.0 – 30	824/f	2.19/f	180/f²
	30 – 300	27.5	0.073	0.2
	300 – 1500	--	--	f/1500
	1500 – 100,000	--	--	1.0

ANNEX B: Far-Field Calculation Method

This model is applicable for calculating the compliance boundary for the far-field region and over estimates the compliance boundary for the radiating near-field region, but is not applicable for the calculating the compliance boundary for the reactive near-field region where the distance from the antenna is less than or equal to λ, which is 9 cm at 3500 MHz. Therefore all the calculations are valid when the compliance boundary is greater or equal to the antenna dimensions plus λ.

The compliance boundary in meters, or r$_{min}$, is calculated according to the following equation:

$$r_{min} = \sqrt{\frac{N10^{(G-L)/10}P_{out}}{4\pi S}}$$ **Equation 1**

where N is the number of transmitter units per one antenna, G is the antenna gain (dBi), L is the minimum cable losses (dB), P_{out} is the maximum power of one transmitter unit (W), and S is the power density limit (W/m^2).

In the far-field, the field calculation does not take into account the antenna size, which is assumed to be a point source. Therefore when calculating the compliance boundary, the far-field data, antenna size and reactive field criteria have to be taken into account.

Annex C: Safety for Public and Workers

1. INSTALLING BASE STATIONS TO ENSURE PUBLIC SAFETY

The equipment generates radio frequency energy, which has a thermal effect when absorbed by the human body. For this reason compliance boundaries specific to this equipment have been established. The thermal effects of radio frequency energy can exceed safety levels when a person is inside the established compliance boundaries. Observe the compliance boundary, and make sure the general public has no access to areas inside the established boundaries. The information shown in section 3 of this document is taken from the relevant section of Nokia's user manual containing warnings and cautions specific to the equipment.

2. INSTALLING BASE STATIONS TO ENSURE INSTALLER SAFETY

Installation engineers need to be aware of the potential risk of the thermal effects of radio frequency energy and how to protect him/herself against undue risk. The information shown in section 3 of this Annex has to be included into the adequate section of the *user manual* containing warnings and cautions specific to the equipment.

3. WARNINGS AND CAUTIONS PROVIDED

The statements shown below have to be included into the adequate section of the *user manual* containing warning and cautions specific to the equipment.

Reference safety distances

When working close to transmitter antennas, the proper safety distances must be observed. The minimum safe distance from an antenna is measured in meters.

⚠ **WARNING**

Do not go any closer to a live antenna than the compliance boundary. The radio frequency energy generated by the antenna poses a serious health risk.

⚠ **WARNING**

If performing installation or maintenance procedures on cables or antennas of the BTS in an area closer than the compliance boundary, make sure that all transmitters in this area are switched off.