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P.O. Box 86
Joensuunkatu 7E
FIN-24101 SALO
Finland

FEDERAL COMMUNICATIONS COMMISSION
Equipment Authorization Branch
7435 Oaklands Mills Road
Columbia, MD 21046

SAR TEST REPORT of Nokia 7190

Gentlemen,

Please find attached SAR test report of FCC ID: GMLNSB-5NX

For and on behalf of Nokia Mobile Phones Ltd.

Respectfully,

Sami Savela
RF Design Engineer
Responsible for NMP SAR measurements

Contents Page

1. Description of the measurement

This measurement was done by E-field scanning system for dosimetric assessments. It is robot-based system which allows automated E-field scanning in tissue simulating solutions. The measurements are based on the induced specific absorption rate (SAR) definition of relevant ANSI / IEEE standards. The dosimetric assessment system of Nokia Mobile Phones is manufactured by Prof. Niels Kuster at ETH (Schmid & Partner Engineering AG) in Switzerland, Europe.

The method used to determine the 1 gram average value of SAR is:

Initially a coarse scan is performed over the whole area on a 15 x 15 mm grid. From this coarse scan, the location at which the maximum value is measured is used as the centre for a second, more detailed scan. This second scan is based on a 3 dimensional grid of 5 x 5 x 7 points on a grid of 8 mm. The average SAR values are computed using the 3D spline inter-polation algorithm. The 3D spline is composed on three one-dimensional splines with the “Not a knot” condition in the x, y and z directions (1), (2). The volume is integrated with the trapezoidal algorithm. 1000 points (10x10x10) are interpolated to calculate the average. All neighbouring volumes are evaluated until no neighbouring volume with a higher average is found.

(1) W. Gander, Computermathematik, Birkhauser, Basel, 1992

(2) W. H. Press, S. A Teukolsky, W. T. Vettering and B. P. Flannery, Numerical Recipes in C, The Art of Scientific Computing, second edition, Cambridge University Press, 1992

2. Description of calibration by manufacturer

The calibration of data acquisition electronics and probe was done by the manufacturer. (Appendix 3 and 7)

- the data acquisition unit is calibrated and tested using a FLUKE 702 Process Calibrator

- measurement uncertainty is less than ± 20% for various tissues simulating solutions and frequencies:
    - these calibration parameters were measured using a temperature probe developed by manufacturer
    - description of the probe calibration and examples of the evaluation are enclosed in Appendix 7

3. List of standards

ANSI/IEEE Std C95.1-1992
IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

ANSI/IEEE Std C95.3-1992
IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields-RF and Microwave

4. Device list:

Automated E-field scanning system for dosimetric assessments System. Calibration due August 1999. Technical data (Appendix 1)

Probe ET3DV4, SN: 1105, Recalibrated due August 1999
Technical data (Appendix 2)

DASY-dosimetric assessment system, DAE V2, SN: 213, Calibration due August 1999 (Appendix 3)

Industrial robot and Control unit, type STÄUBLI CS7 RX 90(CR) NO:595148-01, Technical data (Appendix 4)

Generic Twin Phantom Version 3 (Appendix 6).

PC COMPAQ 466
laser printer QMS magicolor plus

Devices for preparation of the brain tissue simulating liquids
-General laboratory equipment for preparation of liquids
-Magnetic stirrer with heating plate IKA RET CV, SN:792708
-Scale Mettler Doleto, SN: 2114177678

HP 85070A Dielectric probe system
- network analyzer HP 8753B, SN:2716U00762, Calibration due April 1999
- cables
- probe stand
- dielectric probe kit NO: US33020242
- PC AST PREMMIA 4/66 d
- HP-IB 82335B (interface and software)

Dipole Validation kit for 1800 MHz band, Schmid & Partner Engineering AG, Typ: D1800V2, SN: 207, Recalibrated/Verification due August 1999
- signal generator ROHDE & SCHWARZ, 1038.6002.03 , Calibration due July 2000
- power meter, ROHDE & SCHWARZ, 857.8008.02, Calibration due November 1999
- amplifier ZHL-42 (SMA), 022488-RM:4152

5. Equipment under test

Unit: **NOKIA 7190**
FCC-ID: **GMLNSB-5NX**

5.1 Verification and results

Validation of the measurement system was made before measurement using the Validation kit. Appendix: 8 and 9

This validation measurement makes sure that the repeatability of SAR measurement value with careful positioning is better than 10 %.

On 1800 MHz band error was < 7 % compared to the parameter of manufacturer SAR results (0.25W): 9.28 mW/g (1g) and 9.85 mW/g (1g). Appendix: 8 and 9

5.2 Specification of Liquid

The liquids were done using the “Recipe 1800MHz” for liquid of brain tissue, respectively, and preparation bases on brochure. Appendix 5

1800 MHz liquid was used with the 1800 MHz validation kit measurement.

The parameters was measured by liquid testing of HP85070A Dielectric probe system. The amount of used liquid were 20 litres.

Liquid parameters ε_r *(Relative permittivity) and* σ *(Conductivity)* were measured by HP 85070A Dielectric probe system.

1800 MHz: $\varepsilon_r = 40.3$ $\sigma = 1.73$
1850 MHz: $\varepsilon_r = 40.1$ $\sigma = 1.75$
1880 MHz: $\varepsilon_r = 40.0$ $\sigma = 1.78$
1910 MHz: $\varepsilon_r = 39.8$ $\sigma = 1.81$

5.3 Specification of position with phone against generic twin phantom

The position of the phone relative to the head phantom is shown on page 8. The centre of the phone's earpiece is aligned such that it is co-axial with a mark on the phantom which represents the centre of the ear on the left side of the head.

Measurement was done with a Left-Hand (L.H.) side because the helix phone antenna is situated in the top right corner of the phone (viewed from the earpiece side). Therefore, the antenna is closer to the head in the measurement position using a L.H. side rather than a R.H. side. It is concluded that the L.H. side is worst case measurement position.

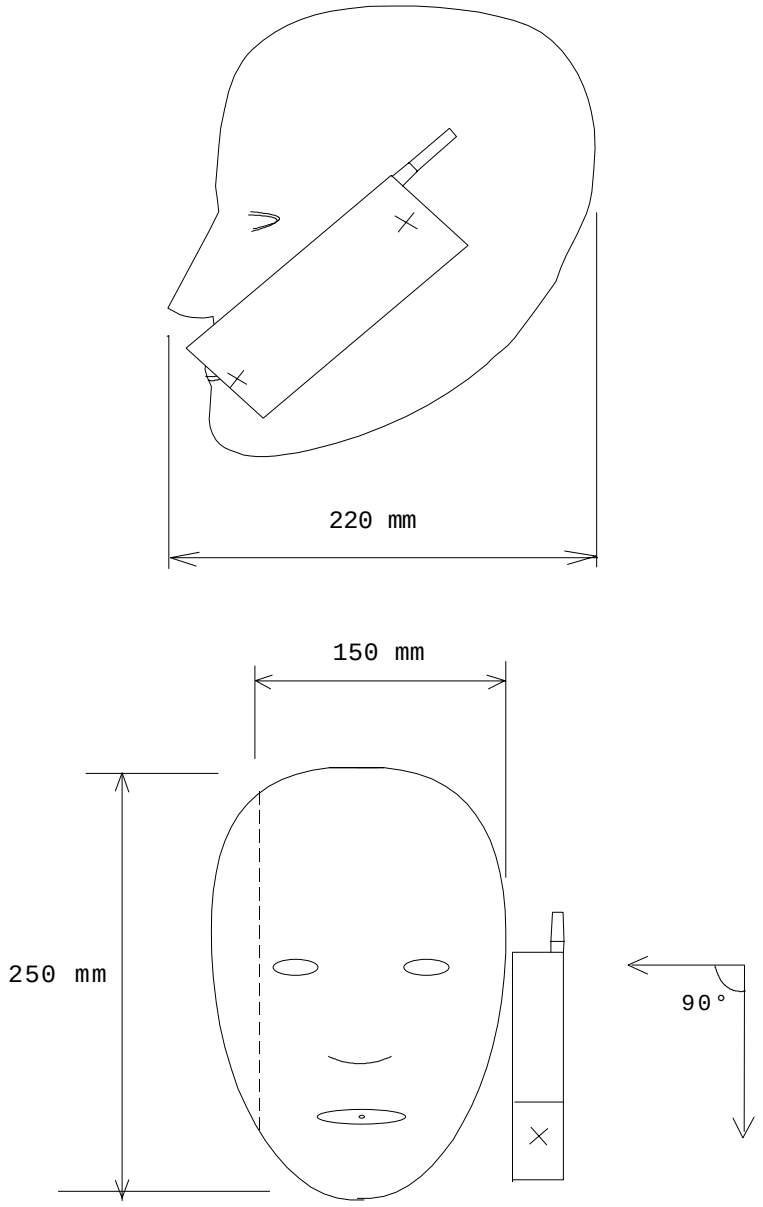
The test signal for SAR measurement was DCS 1900.

The phone position against the head was in Normal phone position (for the IEEE Std C95.1-1991 (ANSI / IEEE) and FCC measurement). The angle between the reference line of the phone and the line connecting both auditory canal opening was 90°. The distance between the handset and the ear area of phantom head is 4 mm (page 8).

The used radio channels on were: 512, 661 and 810.
Peak TX power ("Power" in the table of the paragraph 5.5) was measured from external antenna connector of the transceiver using power level 0.
During the tests the battery was fully charged.

Ambient and "brain tissue" liquid temperature was 23 °C ± 1 °C.

5.4 The phone position against generic twin phantom



5.5 Results of SAR for 1g.

Appendix: 10

The plots in Appendix 10 are a graphical representation of the SAR values over the whole area being scanned.

Appendix 10, page 4 (nr:4), has sketch of the phone added on the plot for clarifying the position of the phone with respect to the measured SAR values.

The size of the area being scanned is sufficiently large to ensure that all possible regions of peak SAR are measured. This is indicated by the fact that the position of peak SAR is in the measured area, and the value of SAR reduces asymptotically in the x- and y- directions as the probe is moved towards the border of the measured area.

SAR results- Maximum Power Output From Pre-Amplifier

meas nr:	Phone position	Frequency MHz / channel	Power [dBm]	SAR (1g)[mW/g]
1	90°	1850 / 512	30.5	1.29
2	90°	1880 / 661	30.5	1.14
3	90°	1910 / 810	29.0	0.81
FCC ID: GMLNSB-5NX MEASURED: 23.3.1999 / NMP		FCC limit		1.60[mW/g] (ANSI/IEEE)

Plots of the above measurements can be found in appendix 10. These values were generated by maximizing the output of the RF pre-amplifier. The power output during production will be set at 29.5dBm, ±0.5dBm. Transmitter power for the nominal and nominal + statistical variance during production can be found below.

SAR results- Maximum Power Output Settings During Production

meas nr:	Phone position	Frequency MHz / channel	Power [dBm]	SAR (1g)[mW/g]
1	90°	1850 / 512	30.0	1.15
2	90°	1880 / 661	30.0	1.02
3	90°	1910 / 810	29.0	0.81

FCC ID: GMLNSB-5NX MEASURED: 23.3.1999 / NMP	FCC limit	1.60[mW/g] (ANSI/IEEE)

SAR results- Nominal Power Output Settings During Production

meas nr:	Phone position	Frequency MHz / channel	Power [dBm]	SAR (1g)[mW/g]
1	90°	1850 / 512	29.5	1.02
2	90°	1880 / 661	29.5	0.91
3	90°	1910 / 810	28.5	0.72
FCC ID: GMLNSB-5NX MEASURED: 23.3.1999 / NMP		FCC limit		1.60[mW/g] (ANSI/IEEE)

Appendix 1

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AUTOMATED E-FIELD SCANNING SYSTEM FOR DOSIMETRIC ASSESSMENTS

Appendix 2

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PROBE ET3DV4 SN: 1105

Appendix 3

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DASY- DOSIMETRIC ASSESSMENT SYSTEM
CALIBRATION REPORT

DATA ACQUISITION ELECTRONICS

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INDUSTRIAL ROBOT AND CONTROL UNIT

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BRAIN TISSUE SIMULATING LIQUIDS

Appendix 6

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GENERIC TWIN PHANTOM
Version 3.

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PROBE CALIBRATION

Appendix 8

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DIPOLE VALIDATION KIT

Appendix 9

pages 1

VERIFY WITH DIPOLE VALIDATION KIT

Appendix 10

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SAR MEASUREMENT RESULTS