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

SAR TEST REPORT of Nokia 5180i

Gentlemen,

Please find attached SAR test report of FCC ID: GMLNSD-1GW

For and on behalf of Nokia Mobile Phones Ltd.

Respectfully,

Sami Savela

Sami Savela
RF Design Engineer
Responsible for NMP SAR measurements

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1. Description of the measurement

This measurements were 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 4 x 4 x 7 points on a grid of 10 mm for 900 MHz band . 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 July 2000. Technical data (Appendix 1)

Probe ET3DV4, SN: 1105, Recalibrated due July 2000
Technical data (Appendix 2)

DASY-dosimetric assessment system, DAE V2, SN: 213, Calibration due July 2000 (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 2000
- cables
- probe stand
- dielectric probe kit NO: US33020242
- PC AST PREMMIA 4/66 d
- HP-IB 82335B (interface and software)

Dipole Validation kit for 900 MHz band, Schmid & Partner Engineering AG, Typ: D900V2, SN: 003, Recalibrated/Verification due July 2001 and

Dipole Validation kit for 1800 MHz band, Schmid & Partner Engineering AG, Typ: D1800V2, SN: 207, Recalibrated/Verification due July 2001

- signal generator ROHDE & SCHWARZ, 1038.6002.03 , Calibration due July 2000
- power meter, ROHDE & SCHWARZ, 857.8008.02, Calibration due December 2001
- amplifier ZHL-42 (SMA), 022488-RM:4152

5. Equipment under test

Unit: **NOKIA 5180i**
FCC-ID: **GMLNSD-1GX**

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 900 MHz band error was < 1 % compared to the parameter of manufacturer SAR results (0.25W): 2.34 mW/g (1g) and 2.33 mW/g (1g). Appendix: 8 and 9

5.2 Specification of Liquid

The liquids were done using the "Recipe 900MHz ", respectively, and preparation bases on brochure. Appendix 5

900 MHz liquid was used with the 900 MHz validation kit measurement.

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

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

Frequency / MHz	Relative permittivity / ε_r	Conductivity / mho/m
824	44.4	0.79
836	44.3	0.80
849	44.2	0.81
900	43.3	0.85

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 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 measurements was analog AMPS.

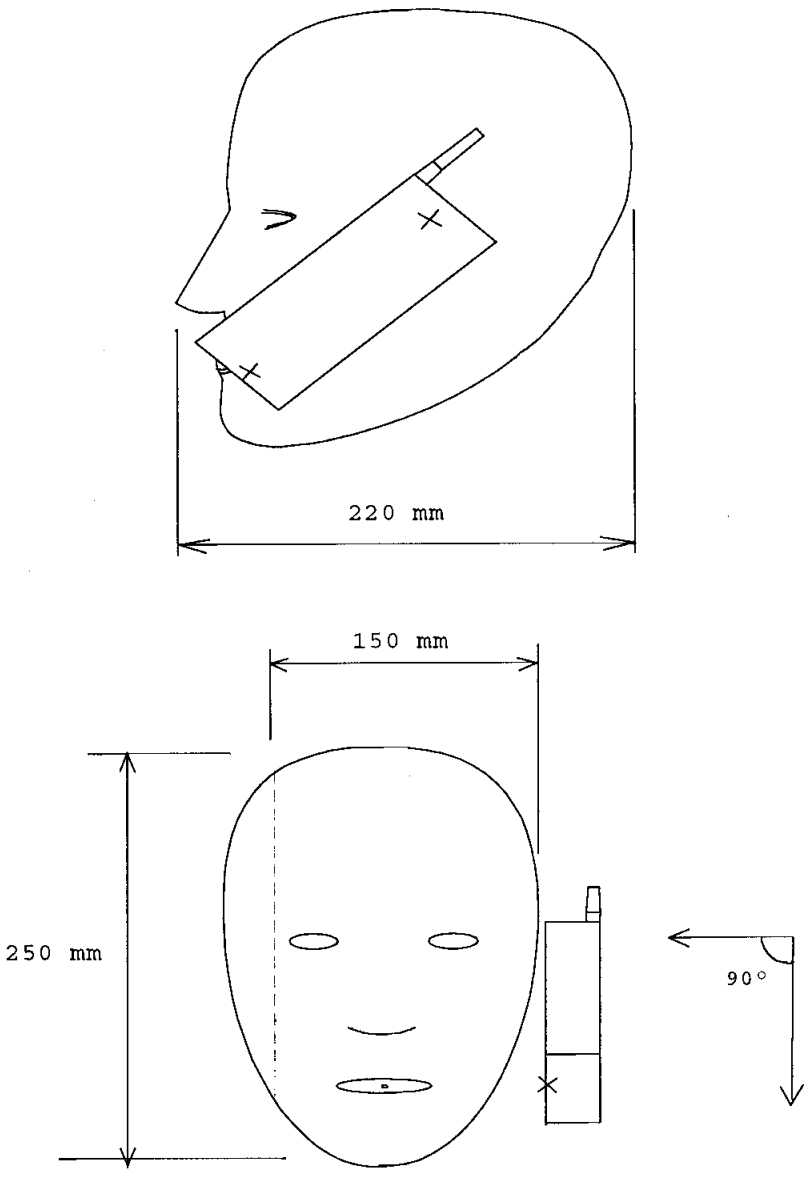
The phone position against the head was in Normal phone position (for the IEEE Std C95.1-1991 (ANSI / IEEE) and FCC measurement). The angle between the reference line of the phone and the line connecting both auditory canal opening was 90°. The distance between the handset and the brain simulation liquid was 6 mm (page 8).

The used radio channels on AMPS mode were: 991, 383 and 799.

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



Picture 5.4.
The centre of the ear piece were placed directly at the entrance of the imaginary auditory canal of the phantom. The reference line of the phone lie in the reference plane defined by the following three points: auditory canal openings of both ears and the centre of the mouth.

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.

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.

Analog mode AMPS (Cellular), Left Hand Phantom

meas nr:	Phone position	Frequency MHz / channel	Power [dBm]	Whip in (1g) [mW/g]	Whip up (1g) [mW/g]
1,2	90°	824 / 991	26.5	**0.58**	**0.87**
3,4	90°	836 / 383	26.5	**0.89**	**1.10**
5,6	90°	849 / 799	26.5	**0.86**	**1.32**
FCC ID:GMLNSD-1GW MEASURED: 29.02.1999 / NMP		FCC limit		1.60 [mW/g] (ANSI/IEEE)	1.60 [mW/g] (ANSI/IEEE)

Sami Saarela