

APPENDIX E – DIPOLE CALIBRATION DATA

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Calibration Laboratory of Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Client Hyundai CT (Dymstec)

Object(s) Calibration procedure(s) Calibration procedure for dipole validation kits Calibration date: May 12, 2003 Condition of the calibrated item In Tolerance (according to the specific calibration document) This calibration statement documents traceability of M&TE used in the calibration procedures and conformity of the procedures with the ISO/IEC 17025 international standard. All calibrations have been conducted in the closed laboratory facility: environment temperature 22 +/- 2 degrees Celsius and humidity < 75%. Calibration Equipment used (M&TE critical for calibration) Model Type ID# Cal Date (Calibrated by, Certificate No.) **Scheduled Calibration** RF generator R&S SML-03 100698 27-Mar-2002 (R&S, No. 20-92389) In house check: Mar-05 Power sensor HP 8481A MY41092317 18-Oct-02 (Agilent, No. 20021018) Oct-04 Power sensor HP 8481A US37292783 30-Oct-02 (METAS, No. 252-0236) Oct-03 Oct-03 Power meter EPM E442 GB37480704 30-Oct-02 (METAS, No. 252-0236) Network Analyzer HP 8753E US38432426 3-May-00 (Agilent, No. 8702K064602) In house check: May 03 Function Name Signature Calibrated by: Approved by: Date issued: May 13, 2003

This calibration certificate is issued as an intermediate solution until the accreditation process (based on ISO/IEC 17025 International Standard) for Calibration Laboratory of Schmid & Partner Engineering AG is completed.

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DATE: April 27, 2004

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DASY

Dipole Validation Kit

Type: D1900V2

Serial: 5d032

Manufactured: March 17, 2003

Calibrated:

May 12, 2003

1. Measurement Conditions

The measurements were performed in the flat section of the SAM twin phantom filled with head simulating solution of the following electrical parameters at 1900 MHz:

Relative Dielectricity 38.8 ± 5% Conductivity 1.44 mho/m ± 5%

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 5.2 at 1900 MHz) was used for the measurements.

The dipole was mounted on the small tripod so that the dipole feedpoint was positioned below the center marking of the flat phantom section and the dipole was oriented parallel to the body axis (the long side of the phantom). The standard measuring distance was 10mm from dipole center to the solution surface. The included distance holder was used during measurements for accurate distance positioning.

The coarse grid with a grid spacing of 15mm was aligned with the dipole. The 7x7x7 fine cube was chosen for cube integration.

The dipole input power (forward power) was 250 mW \pm 3 %. The results are normalized to 1W input power.

2. SAR Measurement with DASY4 System

Standard SAR-measurements were performed according to the measurement conditions described in section 1. The results (see figure supplied) have been normalized to a dipole input power of 1W (forward power). The resulting averaged SAR-values measured with the dosimetric probe ET3DV6 SN:1507 and applying the <u>advanced extrapolation</u> are:

averaged over 1 cm³ (1 g) of tissue: 42.0 mW/g \pm 16.8 % (k=2)¹

averaged over 10 cm³ (10 g) of tissue: 21.6 mW/g \pm 16.2 % (k=2)¹

1 validation uncertainty

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3. Dipole Impedance and Return Loss

The impedance was measured at the SMA-connector with a network analyzer and numerically transformed to the dipole feedpoint. The transformation parameters from the SMA-connector to the dipole feedpoint are:

Electrical delay: 1.195 ns (one direction)

Transmission factor: 0.980 (voltage transmission, one direction)

The dipole was positioned at the flat phantom sections according to section 1 and the distance holder was in place during impedance measurements.

Feedpoint impedance at 1900 MHz: $Re\{Z\} = 50.5 \Omega$

Im $\{Z\} = 3.2 \Omega$

Return Loss at 1900 MHz -29.9 dB

4. Handling

Do not apply excessive force to the dipole arms, because they might bend. Bending of the dipole arms stresses the soldered connections near the feedpoint leading to a damage of the dipole.

Design

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

Small end caps have been added to the dipole arms in order to improve matching when loaded according to the position as explained in Section 1. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

Power Test

After long term use with 40W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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Date/Time: 05/12/03 20:36:30

Test Laboratory: SPEAG, Zurich, Switzerland File Name: SNSd032 SN1507 HSL1900 120503.da4

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN5d032

Program: Dipole Calibration

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1 Medium: HSL 1900 MHz ($\sigma = 1.44$ mho/m, $\epsilon_r = 38.8$, $\rho = 1000$ kg/m³)

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 SN1507; ConvF(5.2, 5.2, 5.2); Calibrated: 1/18/2003
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 SN411; Calibrated: 1/16/2003
- Phantom: SAM with CRP TP1006; Type: SAM 4.0; Serial: TP:1006
- Measurement SW: DASY4, V4.1 Build 47; Postprocessing SW: SEMCAD, V1.6 Build 115

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm

Reference Value = 94.9 V/m

Power Drift = 0.06 dB

Maximum value of SAR - 11.6 mW/g

Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm,

dz=5mm

Peak SAR (extrapolated) = 18.4 W/kg

SAR(1 g) = 10.5 mW/g; SAR(10 g) = 5.39 mW/g

Reference Value = 94.9 V/m

Power Drift = 0.06 dB

Maximum value of SAR = 11.8 mW/g



