FCC ID: PP4TX-170SA DATE: June 05, 2004

ATTACHMENT S – DIPOLE CALIBRATION DATA

Report No.: HCT-SAR04-0601 FCC ID: PP4TX-170SA DATE: June 05, 2004

Calibration Laboratory of

Schmid & Partner Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Client

Hyundai (Dymstec)

CALIBRATION CERTIFICATE Object(s) D835V2 - SN:441

Calibration procedure(s)

QA CAL-05.v2 Calibration procedure for dipole validation kits

Calibration date:

October 3, 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	
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	
Power meter EPM E442	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03	
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05	
Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check: Oct 03	

Calibrated by:

Name Function Signature

Judith Mueller Technician

Approved by:

Katja Pokovic Laboratory Director

Date issued: October 10, 2003

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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.

880-KP0301061-A

FCC ID: PP4TX-170SA Report No.: HCT-SAR04-0601 **DATE:** June 05, 2004

Schmid & Partner Engineering AG

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 1 245 9700, Fax +41 1 245 9779 info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D835V2

Serial: 441

Manufactured:

March 9, 2001

Calibrated:

October 3, 2003



Report No.: HCT-SAR04-0601 FCC ID: PP4TX-170SA **DATE: June 05, 2004**

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 835 MHz:

Relative Dielectricity Conductivity $0.90 \text{ mho/m} \pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 6.7 at 835 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 15mm from dipole center to the solution surface. The included distance spacer was used during measurements for accurate distance

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 ± 3 %. The results are normalized to 1W input power.

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 advanced extrapolation are:

averaged over 1 cm3 (1 g) of tissue: 9.24 mW/g \pm 16.8 % (k=2)¹

averaged over 10 cm³ (10 g) of tissue: **6.08 mW/g** \pm 16.2 % (k=2)¹

1 validation uncertainty

TEL: +82 31 639 8518 FAX: +82 31 639 8525

FCC ID: PP4TX-170SA DATE: June 05, 2004

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:

1.377 ns (one direction)

Transmission factor:

0.983

(voltage transmission, one direction)

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

Feedpoint impedance at 835 MHz:

 $Re{Z} = 52.0 \Omega$

Im $\{Z\} = -6.1 \Omega$

Return Loss at 835 MHz

-24.1 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.

6. Power Test

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.



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ConvF(6.7, 6.7, 6.7)Date/Time: 10/03/03 12:18:18

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN441

Communication System: CW-835; Frequency: 835 MHz; Duty Cycle: 1:1 Medium: HSL 835 MHz ($\sigma = 0.9$ mho/m, $\varepsilon_r = 43$, $\rho = 1000$ kg/m³)

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 SN1507; ConvF(6.7, 6.7, 6.7); 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, V1.8 Build 60

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

Reference Value = 54.7 V/m

Power Drift = 0.003 dB

Maximum value of SAR = 2.48 mW/g

Pin = 250 mW; d = 15 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

dz–5mm

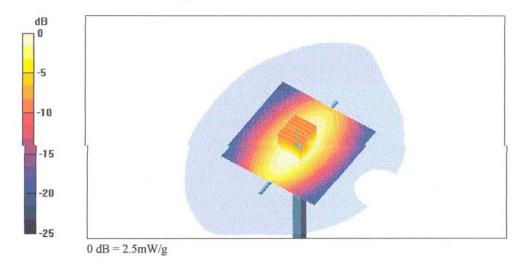
Peak SAR (extrapolated) = 3.45 W/kg

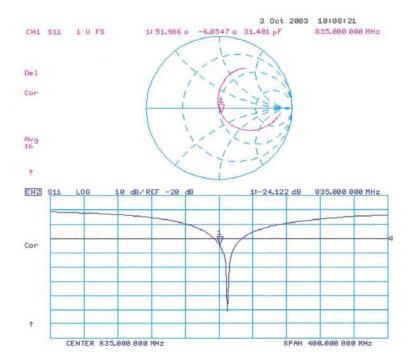
SAR(1 g) = 2.31 mW/g; SAR(10 g) = 1.52 mW/g

Reference Value = 54.7 V/m

Power Drift = 0.003 dB

Maximum value of SAR = 2.5 mW/g







Report No.: HCT-SAR04-0601 FCC ID : PP4TX-170SA DATE : June 05, 2004

Calibration Laboratory of Schmid & Partner

Engineering AG Zeughausstrasse 43, 8004 Zurich, Switzerland

Client

H-CT (Dymstec)

CALIBRATION	CERTIFICA	ΠE					
Object(s)	D1900V2 - SN:5d032						
Calibration procedure(s)	dure(s) QA CAL-05.v2 Calibration procedure for dipole validation kits						
Calibration date:	e: April 26, 2004						
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				
Power meter EPM E442	GB37480704	6-Nov-03 (METAS, No. 252-0254)	Nov-04				
Power sensor HP 8481A	US37292783	6-Nov-03 (METAS, No. 252-0254)	Nov-04				
Power sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04				
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05				
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Nov-03)	In house check: Oct 05				
	Name	Function	Signature				
Calibrated by:	Judith Mueller	Technician	Bruthe				
Approved by:	Katja Pokovic	Laboratory Director	Murilliano Mats				
			Date issued: April 27, 2004				
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.							

880-KP0301061-A

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Report No.: HCT-SAR04-0601

Schmid & Partner Engineering AG

DATE: June 05, 2004

Zeughausstrasse 43, 8004 Zurich, Switzerland Phone +41 1 245 9700, Fax +41 1 245 9779 info@speag.com, http://www.speag.com

DASY

Dipole Validation Kit

Type: D1900V2

Serial: 5d032

Manufactured:

March 17, 2003

Calibrated:

April 26, 2004

R04-0601 FCC ID: PP4TX-170SA DATE: June 05, 2004

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 40.1 $\pm 5\%$ Conductivity 1.45 mho/m $\pm 5\%$

The DASY4 System with a dosimetric E-field probe ET3DV6 (SN:1507, Conversion factor 4.96 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 spacer 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: $40.0 \text{ mW/g} \pm 16.8 \% (k=2)^1$

averaged over 10 cm 3 (10 g) of tissue: 21.0 mW/g \pm 16.2 % (k=2) 1

1 validation uncertainty

HCT-SAR04-0601 FCC ID: PP4TX-170SA DATE: June 05, 2004

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:

1.192 ns

(one direction)

Transmission factor:

0.999

(voltage transmission, one direction)

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

Feedpoint impedance at 1900 MHz:

 $Re{Z} = 49.8 \Omega$

 $Im \{Z\} = 3.4 \Omega$

Return Loss at 1900 MHz

-29.5 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.

5. 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: June 05, 2004

Date/Time: 04/26/04 13:04:32

Test Laboratory: SPEAG, Zurich, Switzerland

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

Communication System: CW-1900; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL 1900 MHz;

Medium parameters used: f = 1900 MHz; $\sigma = 1.45$ mho/m; $\varepsilon_r = 40.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ET3DV6 SN1507; ConvF(4.96, 4.96, 4.96); Calibrated: 1/23/2004
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn411; Calibrated: 11/6/2003
- Phantom: SAM with CRP TP1006; Type: SAM 4.0; Serial: TP:1006;
- Measurement SW: DASY4, V4.2 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 112

Pin = 250 mW; d = 10 mm/Area Scan (81x81x1): Measurement grid: dx=15mm, dy=15mm Reference Value = 92 V/m; Power Drift = 0.0 dB

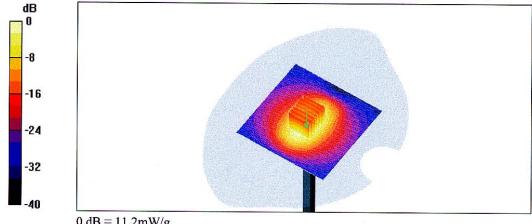
Maximum value of SAR (interpolated) = 11.4 mW/g

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

Reference Value = 92 V/m; Power Drift = 0.0 dB Maximum value of SAR (measured) = 11.2 mW/g

Peak SAR (extrapolated) = 17.8 W/kg

SAR(1 g) = 10 mW/g; SAR(10 g) = 5.25 mW/g



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