

<u>ATTACHMENT S – DIPOLE CALIBRATION DATA</u>



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

Client

Hyundai (Dymstec)

	Deep le Ou				
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 docum 17025 international standard.	ents traceability of M&TE	E used in the calibration procedures and conformity of	of the procedures with the ISO/IEC		
All calibrations have been conduc	ted in the closed laborat	tory facility: environment temperature 22 +/- 2 degree	es Celsius and humidity < 75%.		
Calibration Equipment used (M&T	TE critical for calibration)				
Model Type	ID#	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration		
ower sensor HP 8481A	MY41092317	18-Oct-02 (Agilent, No. 20021018)	Oct-04		
ower sensor HP 8481A	US37292783	30-Oct-02 (METAS, No. 252-0236)	Oct-03		
	GB37480704	30-Oct-02 (METAS, No. 252-0236)	Oct-03		
50000 10000 1000 1000 1000 1000 1000 10					
RF generator R&S SML-03	100698	27-Mar-2002 (R&S, No. 20-92389)	In house check: Mar-05		
RF generator R&S SML-03	100698 US37390585	27-Mar-2002 (R&S, No. 20-92389) 18-Oct-01 (Agilent, No. 24BR1033101)	In house check; Mar-05 In house check; Oct 03		
Power meter EPM E442 RF generator R&S SML-03 Network Analyzer HP 8753E			In house check; Oct 03		
RF generator R&S SML-03 Network Analyzer HP 8753E	US37390585	18-Oct-01 (Agilent, No. 24BR1033101)	In house check; Oct 03 Signature		
RF generator R&S SML-03 letwork Analyzer HP 8753E	US37390585 Name	18-Oct-01 (Agilent, No. 24BR1033101) Function	In house check; Oct 03		
RF generator R&S SML-03 letwork Analyzer HP 8753E Calibrated by:	US37390585 Name	18-Oct-01 (Agilent, No. 24BR1033101) Function	In house check; Oct 03 Signature		
RF generator R&S SML-03	US37390585 Name Judith Mueller	18-Oct-01 (Agilent, No. 24BR1033101) Function Technician	In house check; Oct 03 Signature Alexa - May -		
RF generator R&S SML-03 letwork Analyzer HP 8753E calibrated by:	US37390585 Name Judith Mueller	18-Oct-01 (Agilent, No. 24BR1033101) Function Technician	In house check; Oct 03 Signature		

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DASY

Dipole Validation Kit

Type: D835V2

Serial: 441

Manufactured: March 9, 2001

Calibrated: October 3, 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 835 MHz:

Relative Dielectricity 43.0 ± 5% Conductivity 0.90 mho/m ± 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 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 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

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.

Power Test

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

Page 1 of 1

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

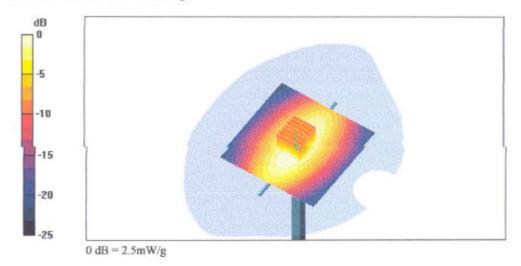
Peak SAR (extrapolated) = 3.45 W/kg

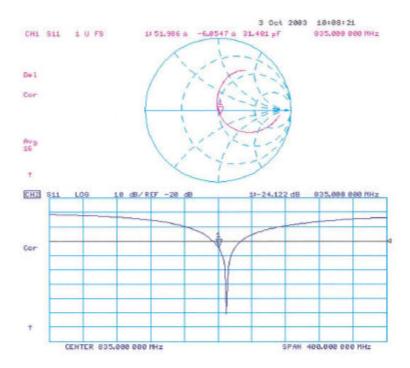
SAR(1 g) = 2.31 mW/g; SAR(10 g) = 1.52 mW/g

Reference Value = 54.7 V/m

Power Drift = 0.003 dB

Maximum value of SAR = 2.5 mW/g





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

Client Hyundai CT (Dymstec)

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Object(s)	D1900V2 - SN:5d032				
Calibration procedure(s)	QA CAL-05 v Calibration pr	2 ocedure for dipole validation kits			
Calibration date:	May 12, 2003				
Condition of the calibrated item	Formselvi Ed	according to the specific calibration	on document)		
This calibration statement docume 17025 international standard.	ents traceability of M&TE	E used in the calibration procedures and conformity	of the procedures with the ISO/IEC		
All calibrations have been conduc	ted in the closed laborat	ory facility: environment temperature 22 +/- 2 degre	es Celsius and humidity < 75%.		
Calibration Equipment used (M&T	E 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		
Power meter EPM E442 Network Analyzer HP 8753E	GB37480704 US38432426	30-Oct-02 (METAS, No. 252-0236) 3-May-00 (Aglient, No. 8702K064602)	Oct-03 In house check: May 03		
Network Analyzer Fire 0755E	0330432420	5-may-00 (Agreen, No. 6702/004002)	in nouse check, may 05		
	Name	Function	Signature		
Calibrated by:	Just Kuder	Technicals	JAHL		
Approved by:	Kelja Pokoda	Librariany Directors	Minis Hof-		
			Date issued: May 13, 2003		
This calibration certificate is issue Calibration Laboratory of Schmid		ution until the accreditation process (based on ISO/I AG is completed.	EC 17025 International Standard) for		

880-KP0301061-A Page 1 (1)

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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 advanced extrapolation 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.

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 (σ = 1.44 mho/m, ϵ_r = 38.8, ρ = 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

