

DASY5 Validation Report for Head TSL

Date: 29.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3500 MHz; Type: D3500V2; Serial: D3500V2 - SN:1076

Communication System: UID 0 - CW; Frequency: 3500 MHz

Medium parameters used: $f = 3500$ MHz; $\sigma = 2.9$ S/m; $\epsilon_r = 37.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.75, 7.75, 7.75) @ 3500 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm/Zoom Scan, dist=1.4mm

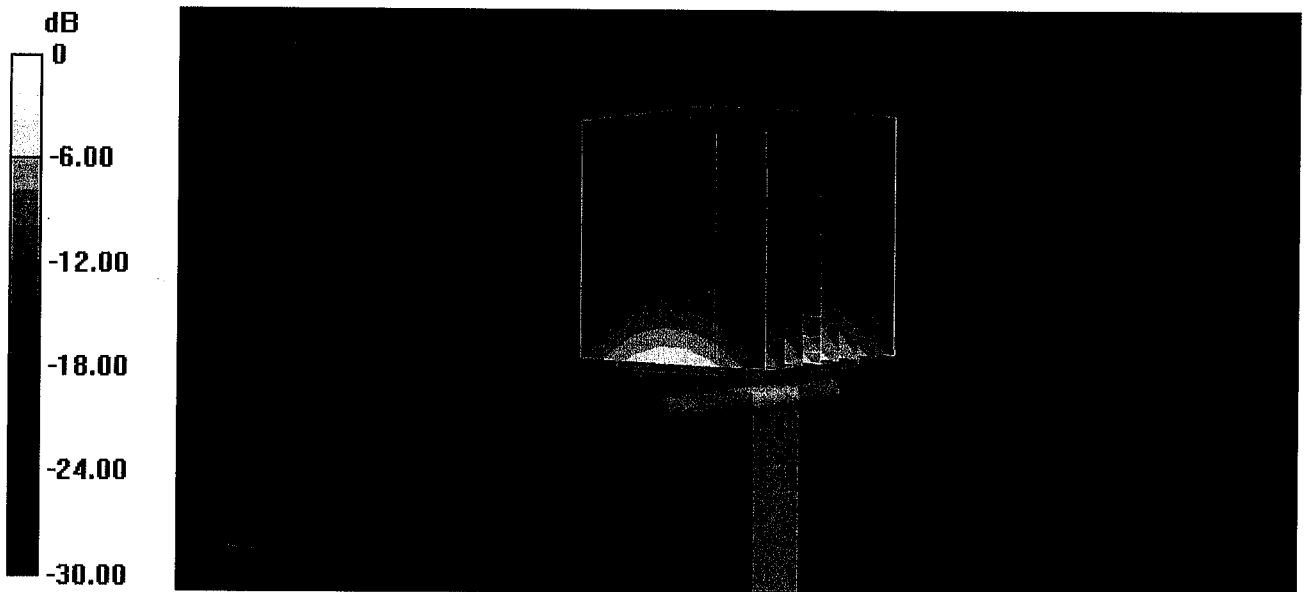
(8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.24 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 18.6 W/kg

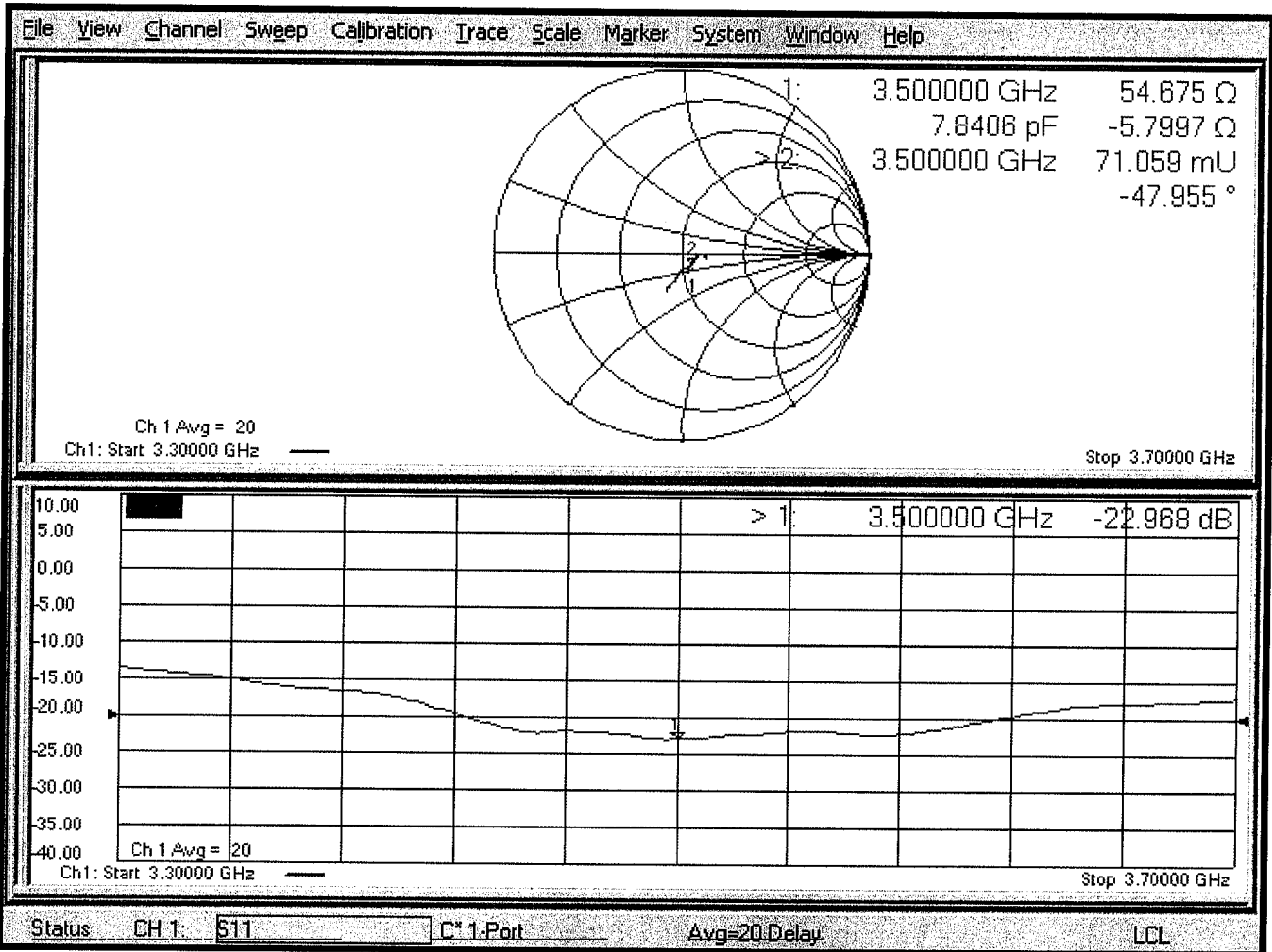
SAR(1 g) = 6.8 W/kg; SAR(10 g) = 2.54 W/kg

Maximum value of SAR (measured) = 12.8 W/kg



0 dB = 12.8 W/kg = 11.07 dBW/kg

Impedance Measurement Plot for Head TSL





D3500V2, Serial No. 1076 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

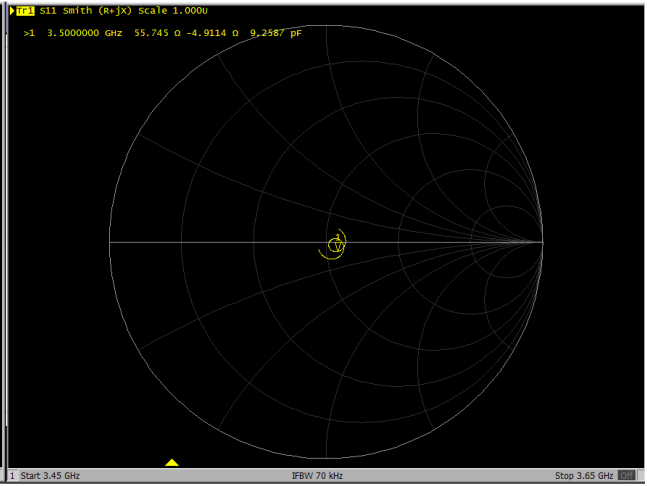
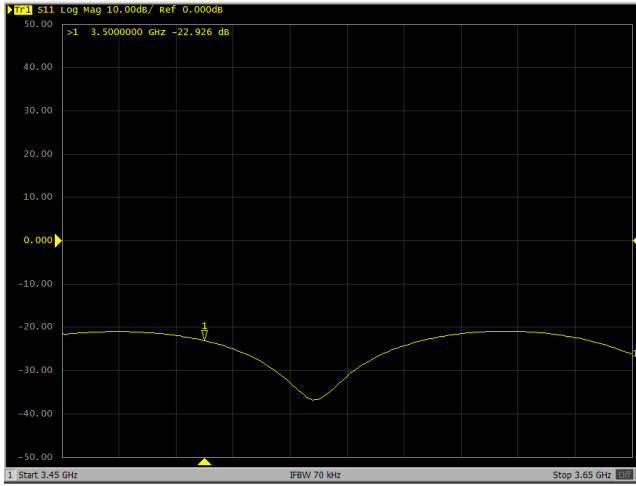
D3500V2 – serial no. 1076						
3500 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.4.29	-23		54.7		-5.8	
2020.4.15	-22.9	0.4	55.7	1	-4.9	0.9

<Justification of the extended calibration>

The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data > D3500V2, serial no. 1076

3500MHz - Head





Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **D3700V2-1037_Apr19**

CALIBRATION CERTIFICATE

Object **D3700V2 - SN:1037**

Calibration procedure(s) **QA CAL-22.v4
Calibration Procedure for SAR Validation Sources between 3-6 GHz**

Calibration date: **April 29, 2019**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 3503	25-Mar-19 (No. EX3-3503_Mar19)	Mar-20
DAE4	SN: 601	04-Oct-18 (No. DAE4-601_Oct18)	Oct-19

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	07-Oct-15 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Technical Manager Technical Manager	

Issued: April 29, 2019

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	3700 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	37.7	3.12 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	37.1 \pm 6 %	3.06 mho/m \pm 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	6.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	68.5 W/kg \pm 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.49 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.8 W/kg \pm 19.5 % (k=2)

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.4 Ω - 0.6 j Ω
Return Loss	- 28.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.138 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 29.04.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 3700 MHz; Type: D3700V2; Serial: D3700V2 - SN:1037

Communication System: UID 0 - CW; Frequency: 3700 MHz

Medium parameters used: $f = 3700$ MHz; $\sigma = 3.06$ S/m; $\epsilon_r = 37.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(7.5, 7.5, 7.5) @ 3700 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.10.2018
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Dipole Calibration for Head Tissue/Pin=100 mW, d=10mm, f=3700MHz/Zoom Scan,

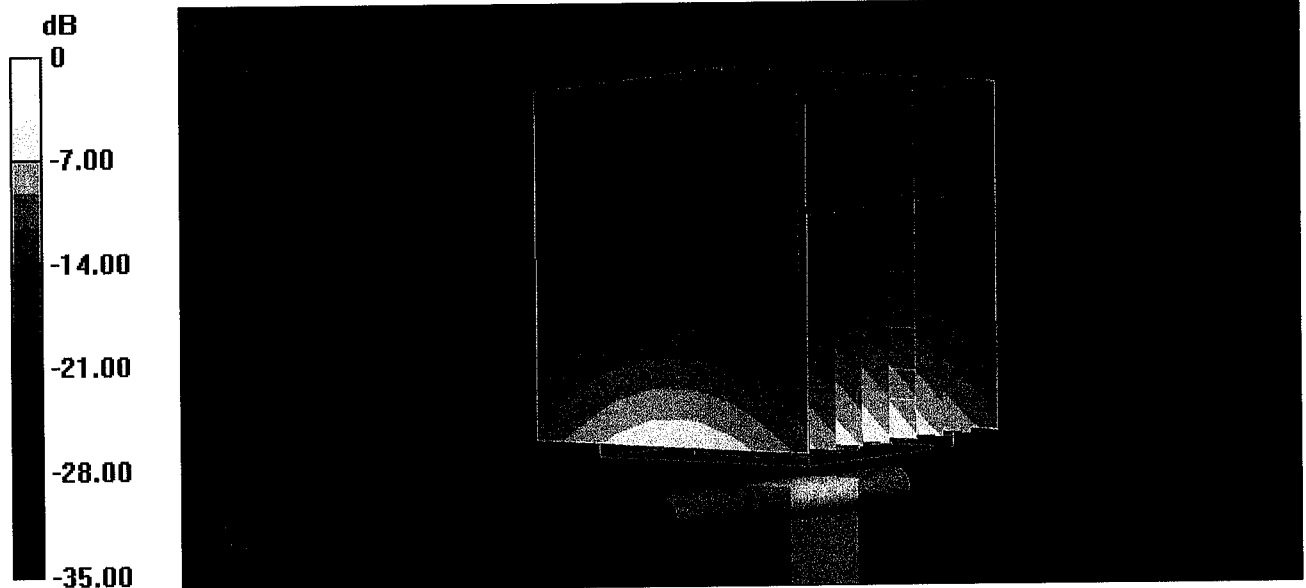
dist=1.4mm (8x8x8)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 71.88 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 19.5 W/kg

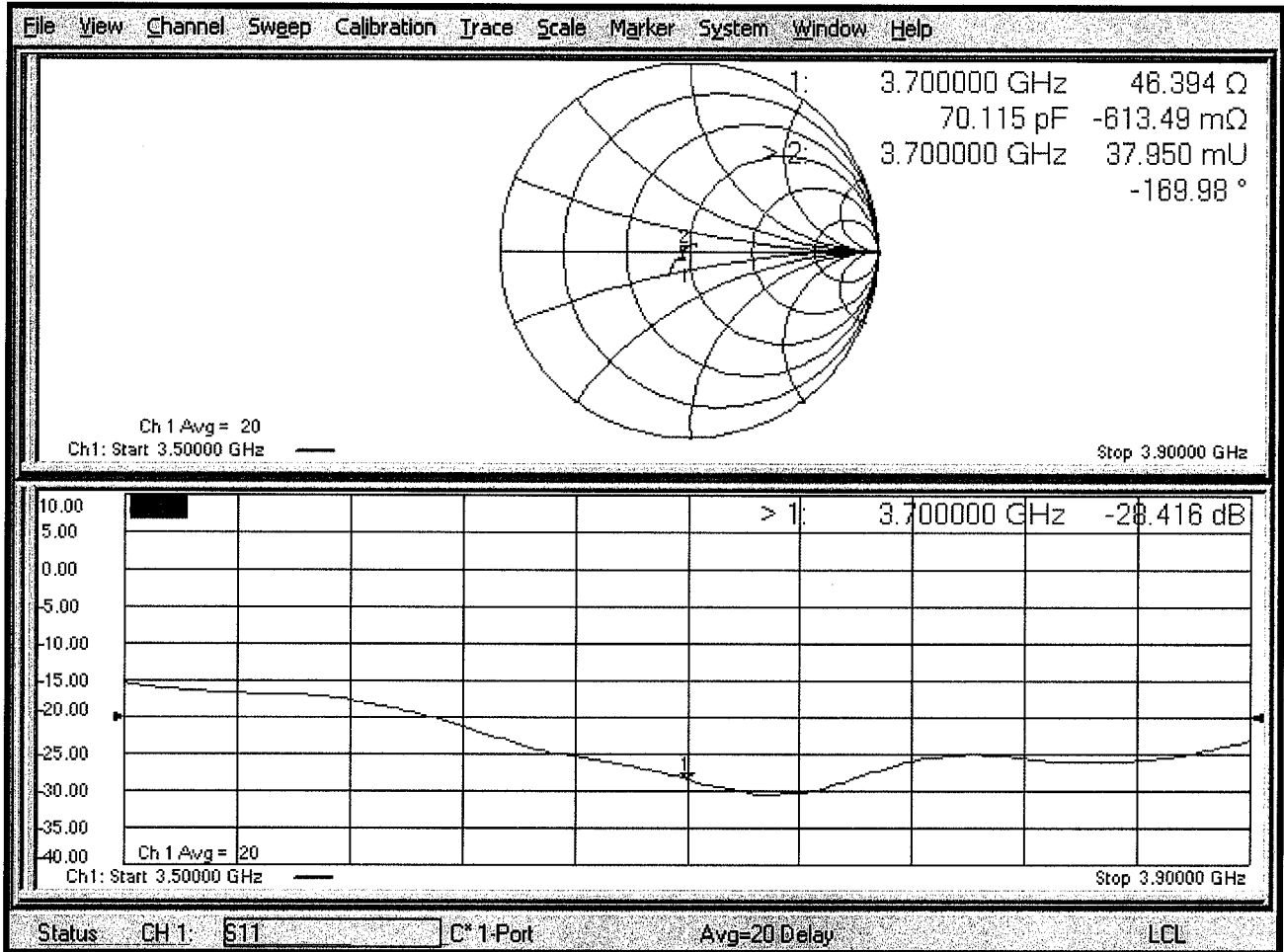
SAR(1 g) = 6.85 W/kg; SAR(10 g) = 2.49 W/kg

Maximum value of SAR (measured) = 13.5 W/kg



0 dB = 13.5 W/kg = 11.30 dBW/kg

Impedance Measurement Plot for Head TSL





D3700V2, Serial No. 1037 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss ($< -20\text{dB}$, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

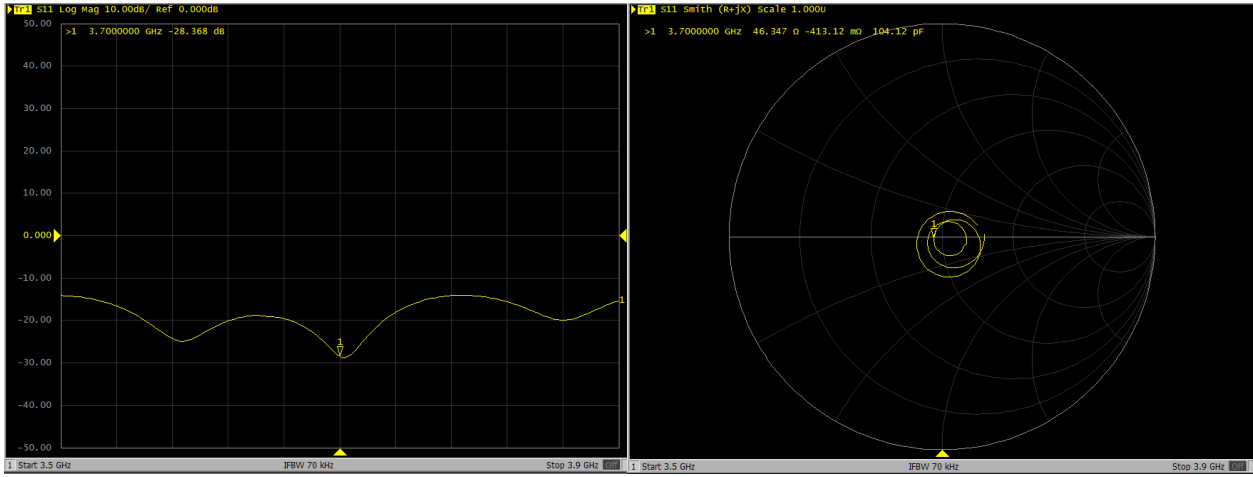
D3700V2 – serial no. 1037						
3700 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.4.29	-28.4		46.4		-0.6	
2020.4.15	-28.4	0	46.3	-0.1	-0.4	0.2

<Justification of the extended calibration>

The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data > D3700V2, serial no. 1037

3700MHz - Head





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Client **Sporton**

Certificate No: **Z18-60259**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1167**

Calibration Procedure(s) **FF-Z11-003-01**
Calibration Procedures for dipole validation kits

Calibration date: **August 03, 2018**

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRP-Z91	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
ReferenceProbe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzerE5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: August 6, 2018

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.1.1476
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.9 ± 6 %	4.82 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.69 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	77.0 mW / g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	22.0 mW / g ± 24.2 % (k=2)



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Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	5.18 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	80.8 mW / g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.32 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.2 mW / g ± 24.2 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	5.37 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.70 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	76.9 mW / g ± 24.4 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.17 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.6 mW / g ± 24.2 % (k=2)



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Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.4 ± 6 %	5.32 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	74.4 mW / g ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.10 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.9 mW / g ± 24.2 % (k=2)

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	5.79 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.73 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	77.1 mW / g ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.16 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	21.5 mW / g ± 24.2 % (k=2)



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Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.5 ± 6 %	5.93 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	74.3 mW /g ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.08 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	20.8 mW /g ± 24.2 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	50.3Ω - 9.42jΩ
Return Loss	- 20.6dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	58.1Ω - 7.15jΩ
Return Loss	- 20.0dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	53.5Ω - 7.66jΩ
Return Loss	- 21.8dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	49.5Ω - 7.40jΩ
Return Loss	- 22.6dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.0Ω - 6.37jΩ
Return Loss	- 20.5dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	54.5Ω - 7.07jΩ
Return Loss	- 21.9dB



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General Antenna Parameters and Design

Electrical Delay (one direction)	1.065 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL

Date: 07.27.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1167

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz,
Frequency: 5750 MHz,

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.822$ S/m; $\epsilon_r = 35.92$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5600$ MHz; $\sigma = 5.184$ S/m; $\epsilon_r = 35.14$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5750$ MHz; $\sigma = 5.365$ S/m; $\epsilon_r = 34.88$; $\rho = 1000$ kg/m³,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.68, 5.68, 5.68) @ 5250 MHz; Calibrated: 9/12/2017, ConvF(4.98, 4.98, 4.98) @ 5600 MHz; Calibrated: 9/12/2017, ConvF(5.04, 5.04, 5.04) @ 5750 MHz; Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.09 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 32.4 W/kg
SAR(1 g) = 7.69 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 18.0 W/kg

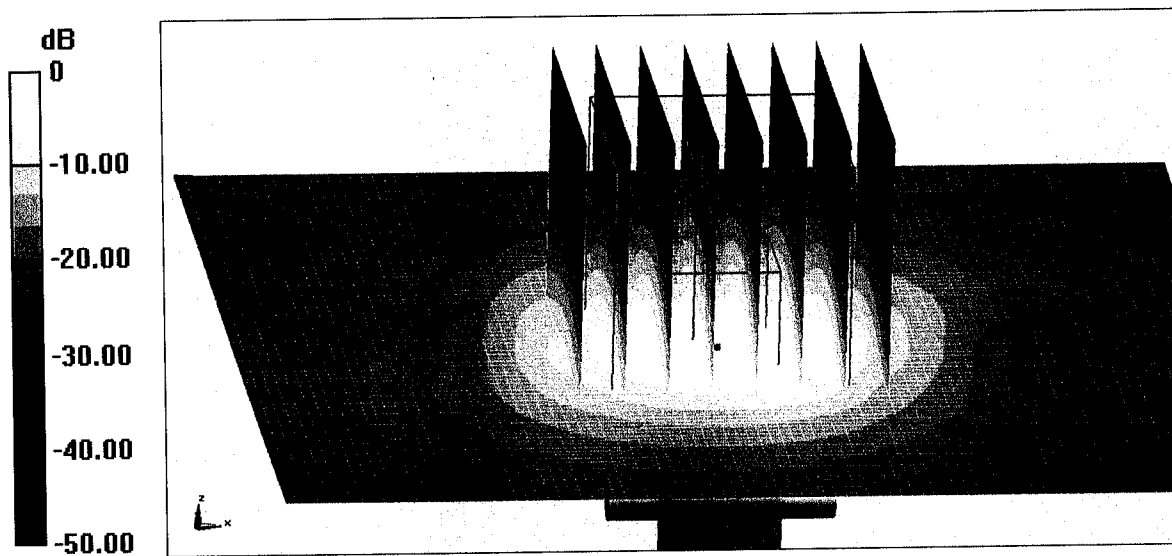
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Reference Value = 63.53 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 36.2 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.79 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 36.2 W/kg
SAR(1 g) = 7.7 W/kg; SAR(10 g) = 2.17 W/kg
Maximum value of SAR (measured) = 19.0 W/kg



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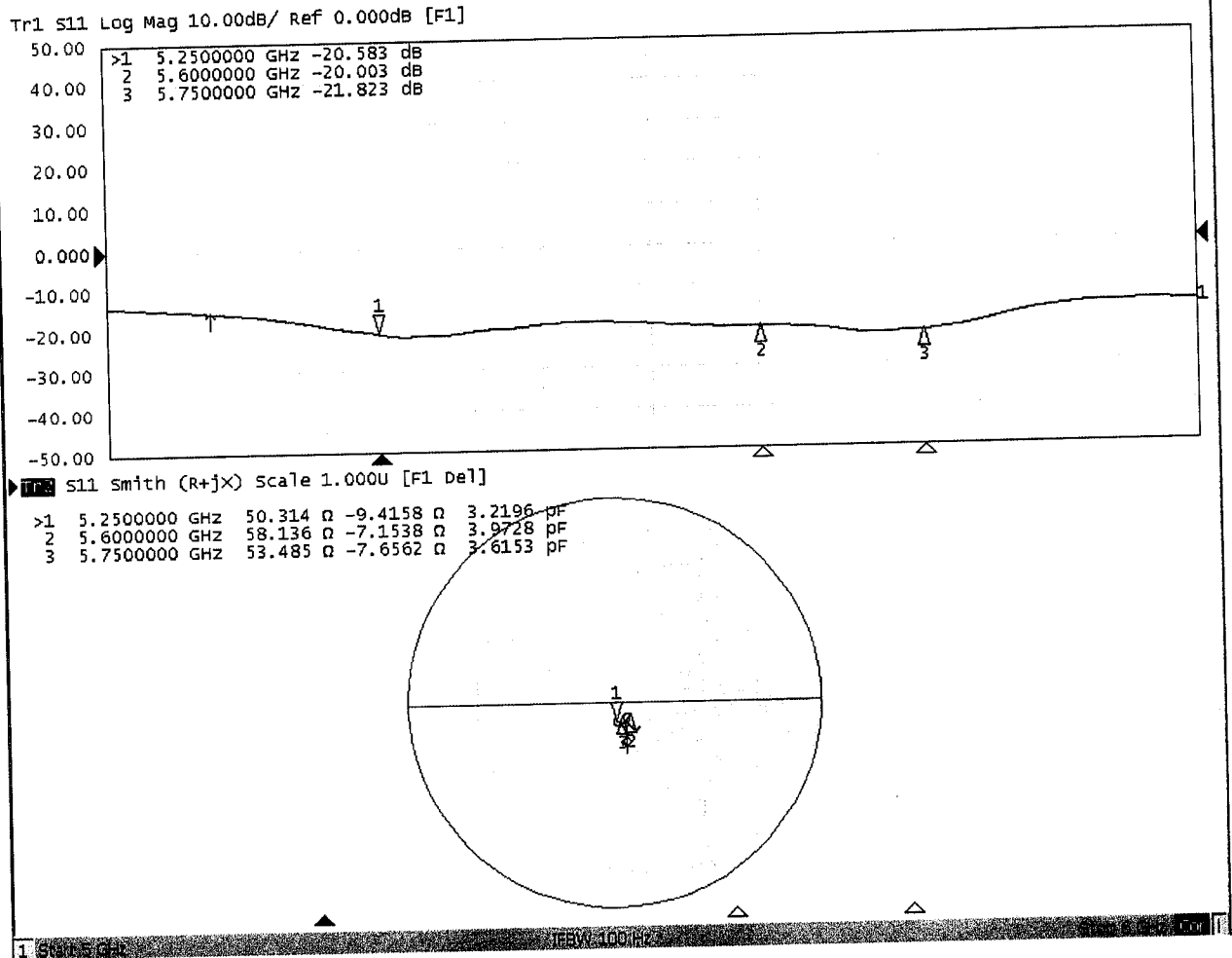


0 dB = 19.0 W/kg = 12.79 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 08.02.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1167

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz,
Frequency: 5750 MHz,

Medium parameters used: $f = 5250$ MHz; $\sigma = 5.316$ S/m; $\epsilon_r = 48.42$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5600$ MHz; $\sigma = 5.789$ S/m; $\epsilon_r = 47.7$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5750$ MHz; $\sigma = 5.926$ S/m; $\epsilon_r = 48.45$; $\rho = 1000$ kg/m³,

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.29, 5.29, 5.29) @ 5250 MHz; Calibrated: 9/12/2017, ConvF(4.5, 4.5, 4.5) @ 5600 MHz; Calibrated: 9/12/2017, ConvF(4.59, 4.59, 4.59) @ 5750 MHz; Calibrated: 9/12/2017,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

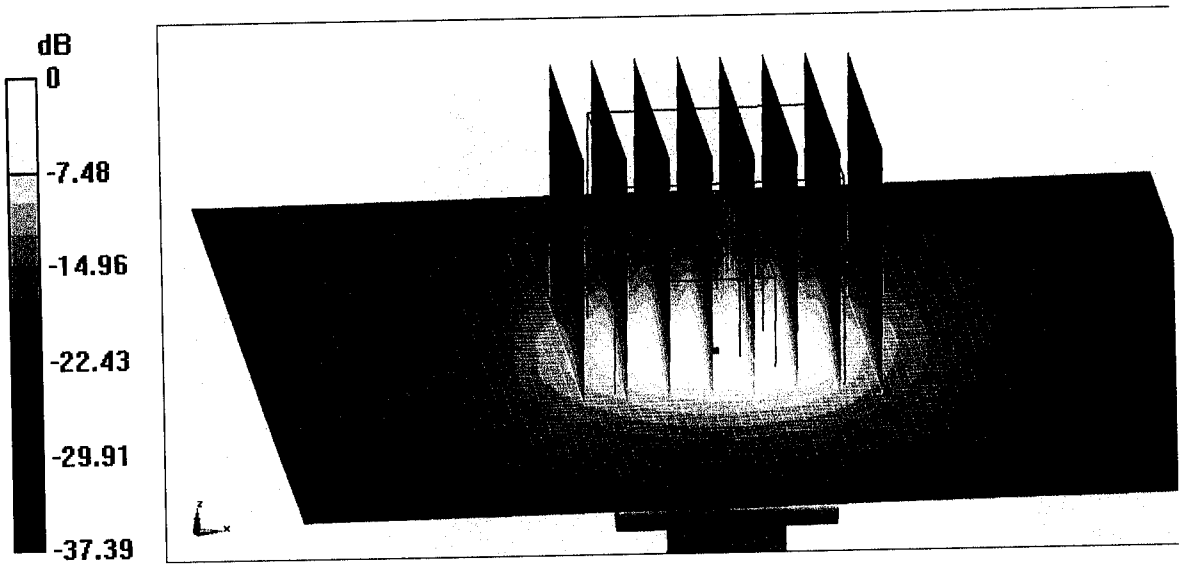
Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.14 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.46 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 17.6 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.32 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 36.3 W/kg
SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.16 W/kg
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.99 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 7.43 W/kg; SAR(10 g) = 2.08 W/kg
Maximum value of SAR (measured) = 18.0 W/kg



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0 dB = 18.0 W/kg = 12.55 dBW/kg



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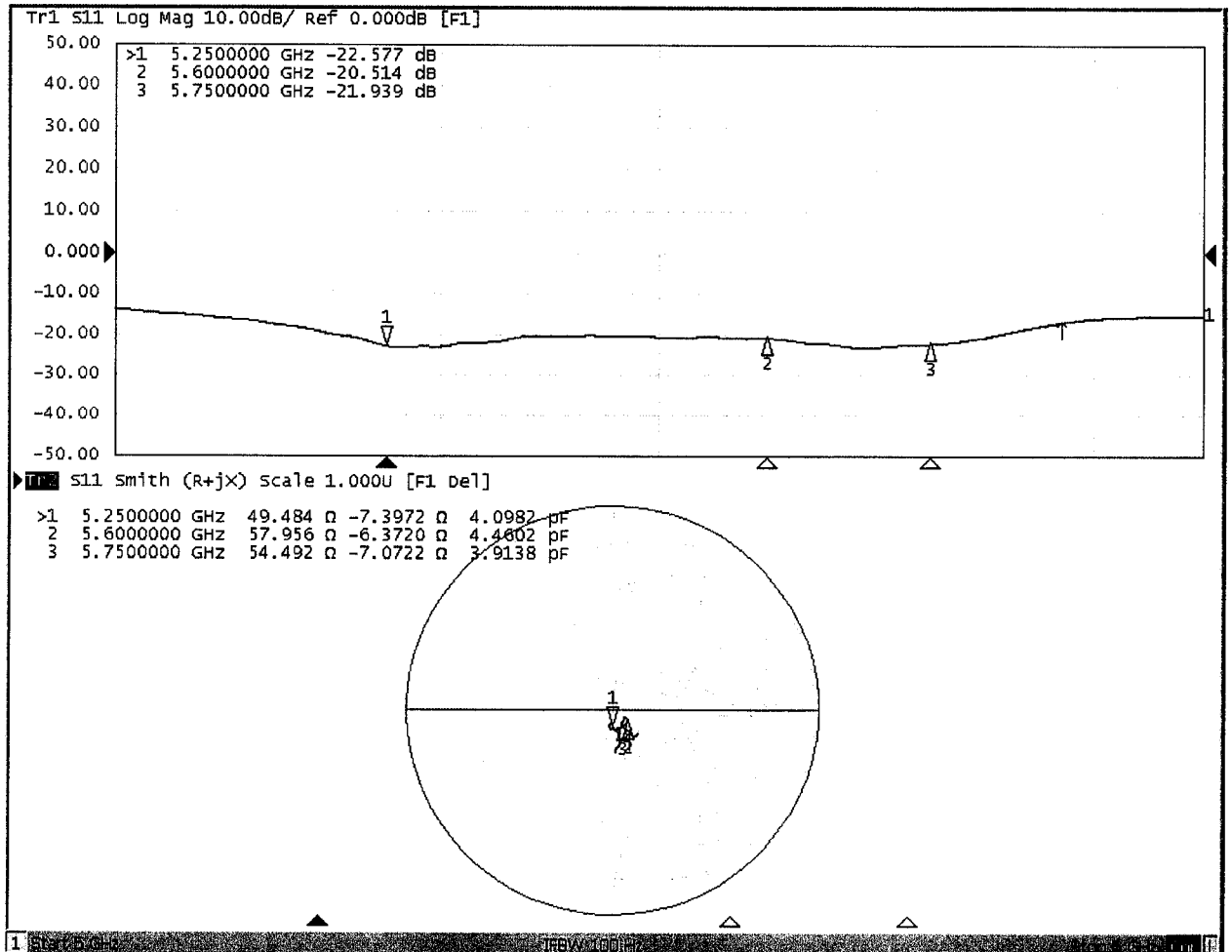
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Impedance Measurement Plot for Body TSL

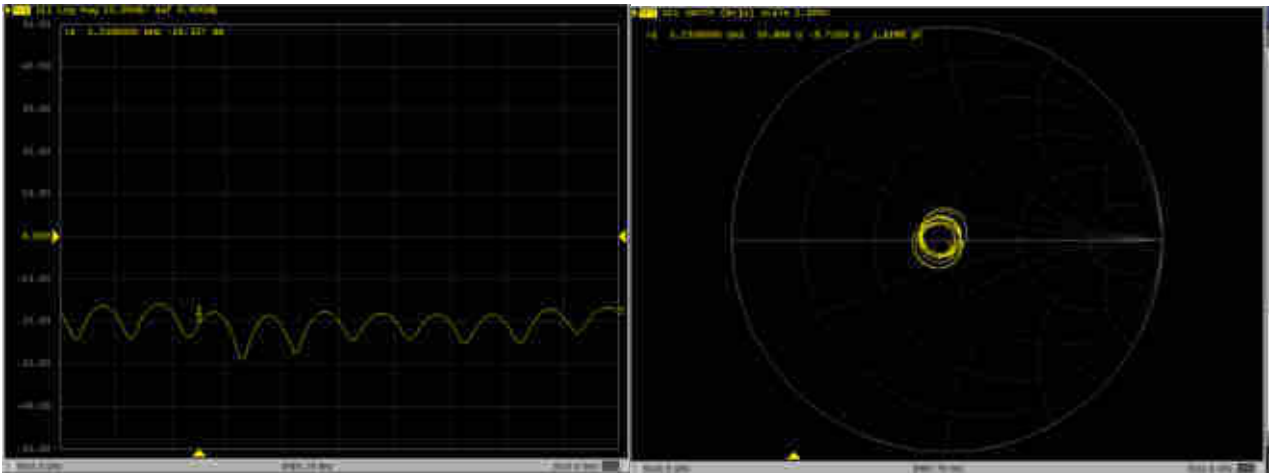


<Justification of the extended calibration>

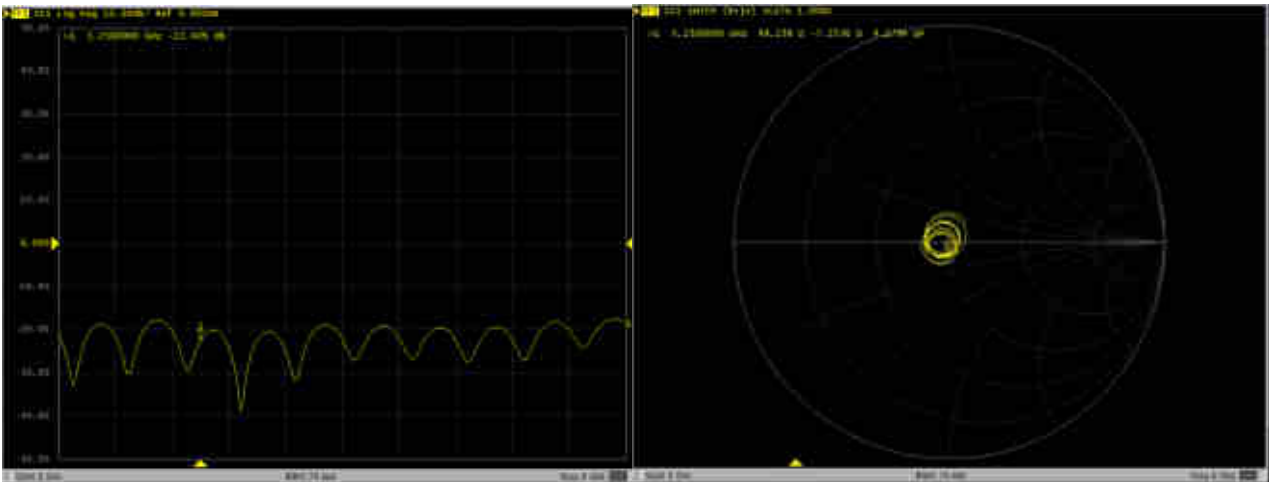
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D5GHzV3, serial no. 1167

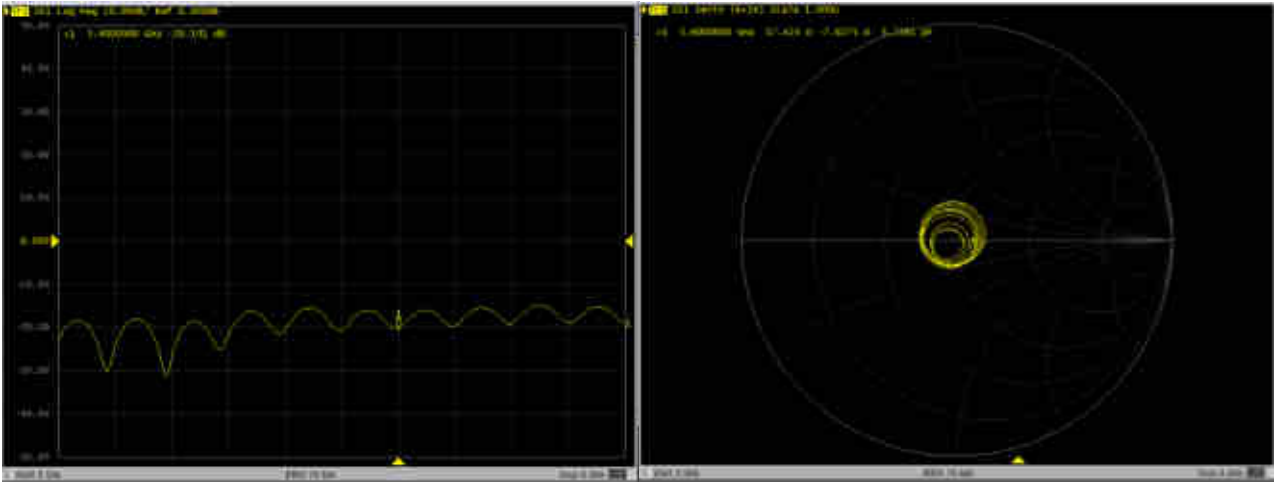
5250MHz - Head



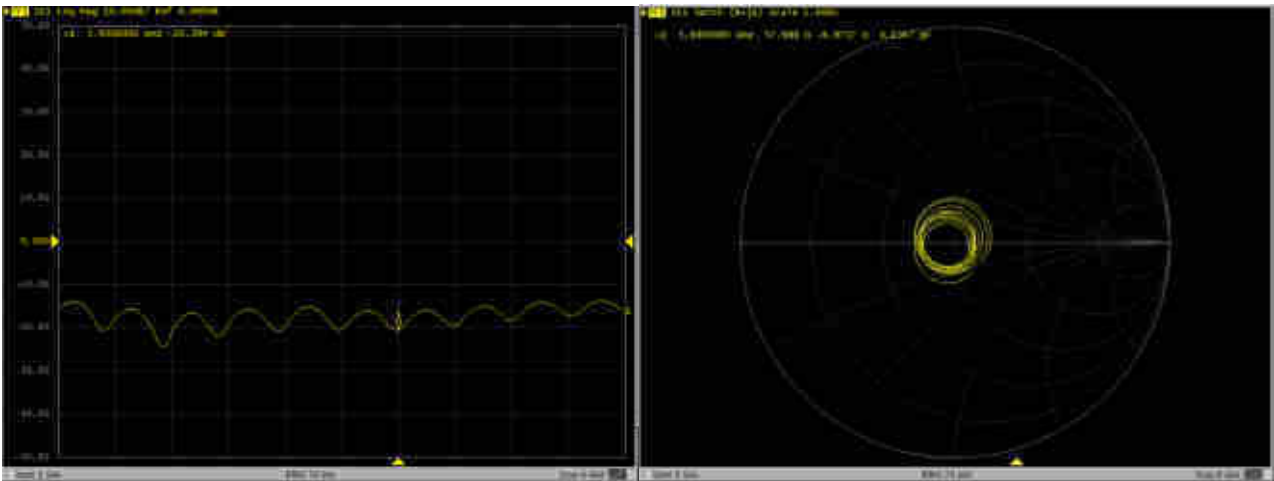
5250MHz - Body



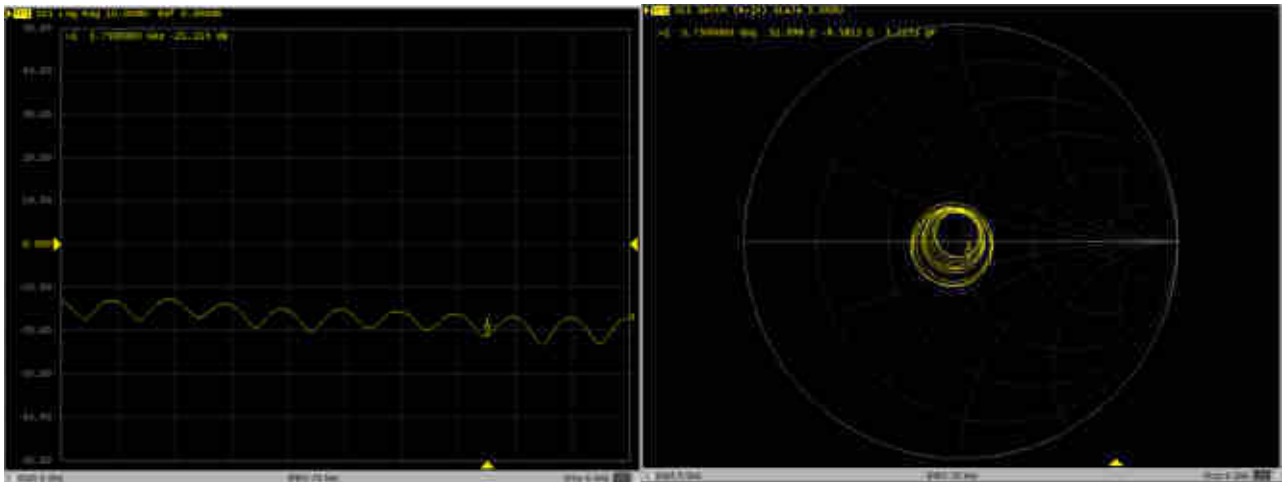
5600MHz – Head



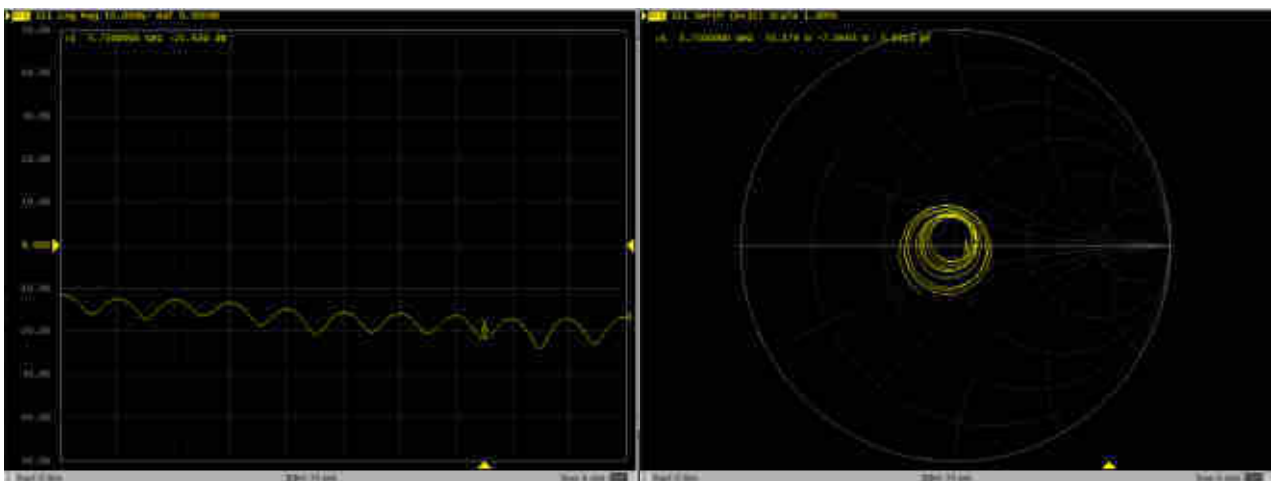
5600MHz – Body



5750MHz – Head



5750MHz – Body





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Auden**

Certificate No: **DAE3-528_Mar20**

CALIBRATION CERTIFICATE

Object **DAE3 - SD 000 D03 AA - SN: 528**

Calibration procedure(s) **QA CAL-06.v30
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **March 16, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25949)	Sep-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	09-Jan-20 (in house check)	In house check: Jan-21
Calibrator Box V2.1	SE UMS 006 AA 1002	09-Jan-20 (in house check)	In house check: Jan-21

Calibrated by:	Name Eric Hainfeld	Function Laboratory Technician	Signature
Approved by:	Name Sven Kühn	Deputy Manager	

Issued: March 16, 2020

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Accreditation No.: **SCS 0108**

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
 - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
 - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
 - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
 - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - **Input resistance:** Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
 - **Power consumption:** Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.513 \pm 0.02% (k=2)	404.615 \pm 0.02% (k=2)	404.537 \pm 0.02% (k=2)
Low Range	3.97109 \pm 1.50% (k=2)	3.95930 \pm 1.50% (k=2)	3.96568 \pm 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	50.0 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200037.58	3.28	0.00
Channel X + Input	20009.65	3.92	0.02
Channel X - Input	-20001.89	3.62	-0.02
Channel Y + Input	200037.90	3.50	0.00
Channel Y + Input	20005.83	0.31	0.00
Channel Y - Input	-20005.73	-0.03	0.00
Channel Z + Input	200033.51	-0.62	-0.00
Channel Z + Input	20006.48	0.89	0.00
Channel Z - Input	-20006.01	-0.27	0.00

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2001.68	0.24	0.01
Channel X + Input	201.09	-0.22	-0.11
Channel X - Input	-198.93	-0.12	0.06
Channel Y + Input	2001.70	0.49	0.02
Channel Y + Input	200.70	-0.24	-0.12
Channel Y - Input	-199.76	-0.76	0.38
Channel Z + Input	2001.03	-0.04	-0.00
Channel Z + Input	201.25	0.40	0.20
Channel Z - Input	-199.29	-0.32	0.16

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	9.59	7.82
	- 200	-7.34	-8.76
Channel Y	200	14.74	14.93
	- 200	-16.81	-17.15
Channel Z	200	-3.39	-3.82
	- 200	3.03	3.16

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	3.19	-1.66
Channel Y	200	6.79	-	4.73
Channel Z	200	7.16	5.28	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15972	16183
Channel Y	15900	16376
Channel Z	16167	15841

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	1.19	0.18	2.38	0.46
Channel Y	0.15	-1.39	1.24	0.47
Channel Z	0.36	-1.22	1.42	0.42

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



IMPORTANT NOTICE

USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Tejet (Auden)**

Certificate No: **DAE4-1226_May20**

CALIBRATION CERTIFICATE

Object: **DAE4 - SD 000 D04 BM - SN: 1226**

Calibration procedure(s): **QA CAL-06.v30**
Calibration procedure for the data acquisition electronics (DAE)

Calibration date: **May 15, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration):

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25849)	Sep-20
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	09-Jan-20 (in house check)	In house check: Jan-21
Calibrator Box V2.1	SE UMS 006 AA 1002	09-Jan-20 (in house check)	In house check: Jan-21

Calibrated by:	Name Eric Hainfeld	Function Laboratory Technician	Signature
Approved by:	Name Sven Kühn	Deputy Manager	

Issued: May 15, 2020

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Accreditation No.: SCS 0108

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* Typical value for information; DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.644 \pm 0.02% (k=2)	404.410 \pm 0.02% (k=2)	404.128 \pm 0.02% (k=2)
Low Range	3.98010 \pm 1.50% (k=2)	4.00441 \pm 1.50% (k=2)	3.98517 \pm 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	283.5 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200036.25	2.48	0.00
Channel X + Input	20007.54	2.38	0.01
Channel X - Input	-20005.86	0.51	-0.00
Channel Y + Input	200033.61	-0.21	-0.00
Channel Y + Input	20003.31	-1.72	-0.01
Channel Y - Input	-20007.95	-1.52	0.01
Channel Z + Input	200035.07	1.43	0.00
Channel Z + Input	20004.81	-0.10	-0.00
Channel Z - Input	-20007.44	-1.01	0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.93	0.16	0.01
Channel X + Input	200.14	-0.66	-0.33
Channel X - Input	-199.83	-0.71	0.36
Channel Y + Input	2000.72	0.15	0.01
Channel Y + Input	199.44	-1.19	-0.59
Channel Y - Input	-200.55	-1.29	0.65
Channel Z + Input	2000.71	0.18	0.01
Channel Z + Input	200.02	-0.61	-0.31
Channel Z - Input	-199.97	-0.66	0.33

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	5.07	2.90
	-200	-2.74	-4.97
Channel Y	200	-8.89	-9.14
	-200	7.09	6.94
Channel Z	200	-7.29	-7.53
	-200	5.53	5.89

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	2.16	-3.66
Channel Y	200	8.16	-	3.69
Channel Z	200	9.32	5.65	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	16032	12468
Channel Y	15897	17438
Channel Z	16001	15611

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	-0.38	-1.14	0.42	0.38
Channel Y	-0.09	-1.14	0.85	0.39
Channel Z	-0.31	-1.86	1.00	0.41

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9



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Accreditation No.: SCS 0108

Client **Sporton**

Certificate No: **EX3-3819_Apr20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3819**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes**

Calibration date: **April 30, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104775	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: CC2552 (20x)	31-Mar-20 (No. 217-03106)	Apr-21
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41495087	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-18)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: April 30, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\theta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values; i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}**: A, B, C, D are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.46	0.41	0.46	± 10.1 %
DCP (mV) ^B	104.6	101.5	102.0	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB/ $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Max dev.	Unc ^C (k=2)
0	CW	X	0.0	0.0	1.0	0.00	156.7	± 3.5 %	± 4.7 %
		Y	0.0	0.0	1.0		148.5		
		Z	0.0	0.0	1.0		139.2		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSI, (see Page 5).

^B Numerical linearization parameter; uncertainty not required.

^C Uncertainty is determined using the r_{max} deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	113.9
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3819

Calibration Parameter Determined in Head Tissue Simulating Media

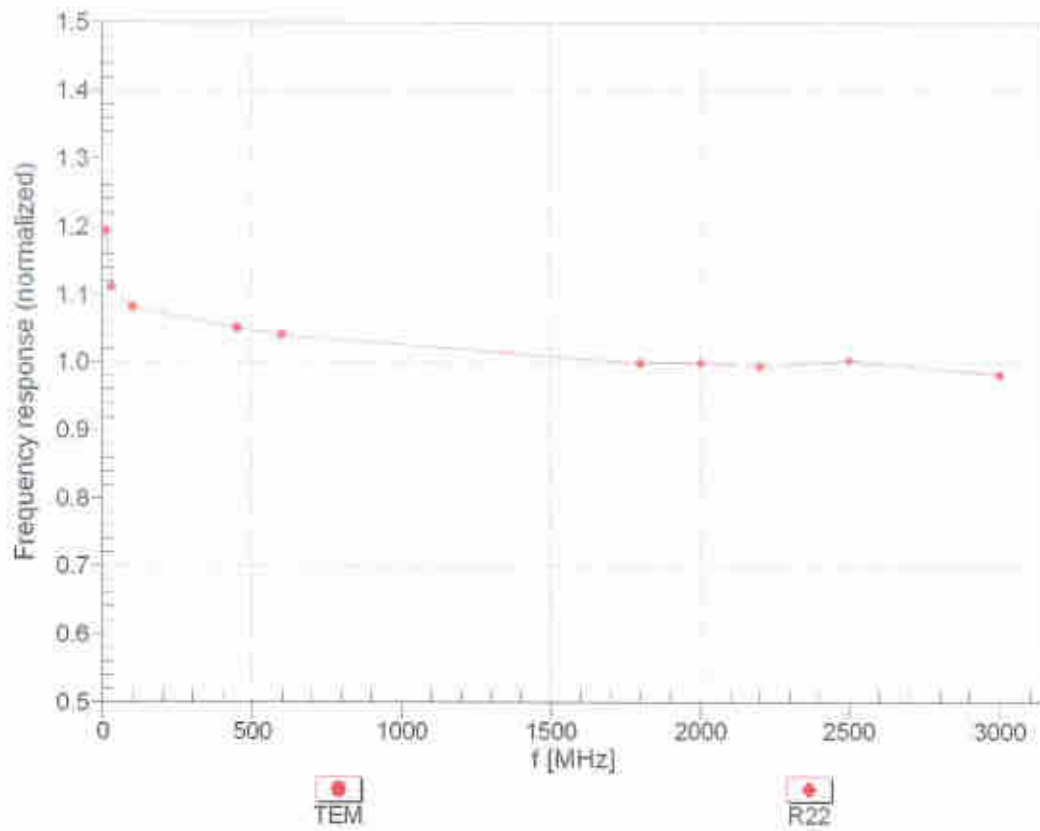
f (MHz) ^c	Relative Permittivity ^f	Conductivity (S/m) ^f	ConvF X	ConvF Y	ConvF Z	Alpha ^g	Depth (mm) ^g	Unc (k=2)
750	41.9	0.89	9.64	9.64	9.64	0.52	0.80	± 12.0 %
835	41.5	0.90	9.39	9.39	9.39	0.50	0.80	± 12.0 %
900	41.5	0.97	9.26	9.26	9.26	0.39	0.96	± 12.0 %
1750	40.1	1.37	8.43	8.43	8.43	0.34	0.80	± 12.0 %
1900	40.0	1.40	8.10	8.10	8.10	0.37	0.80	± 12.0 %
2000	40.0	1.40	7.95	7.95	7.95	0.30	0.88	± 12.0 %
2300	39.5	1.67	7.66	7.66	7.66	0.32	0.90	± 12.0 %
2450	39.2	1.80	7.42	7.42	7.42	0.38	0.90	± 12.0 %
2600	39.0	1.96	7.22	7.22	7.22	0.38	0.90	± 12.0 %
3300	38.2	2.71	6.91	6.91	6.91	0.20	1.20	± 14.0 %
3500	37.9	2.91	6.84	6.84	6.84	0.25	1.20	± 14.0 %
3700	37.7	3.12	6.75	6.75	6.75	0.25	1.25	± 14.0 %
3900	37.5	3.32	6.40	6.40	6.40	0.30	1.60	± 14.0 %
4100	37.2	3.53	6.39	6.39	6.39	0.30	1.60	± 14.0 %
4400	36.9	3.84	6.07	6.07	6.07	0.30	1.60	± 14.0 %
4600	36.7	4.04	5.98	5.98	5.98	0.30	1.70	± 14.0 %
4800	36.4	4.25	5.88	5.88	5.88	0.45	1.80	± 14.0 %
4950	36.3	4.40	5.72	5.72	5.72	0.45	1.80	± 14.0 %
5250	35.9	4.71	5.02	5.02	5.02	0.40	1.80	± 14.0 %
5600	35.5	5.07	4.56	4.56	4.56	0.40	1.80	± 14.0 %
5750	35.4	5.22	4.63	4.63	4.63	0.40	1.80	± 14.0 %

^c Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^f At frequencies up to 6 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^g Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



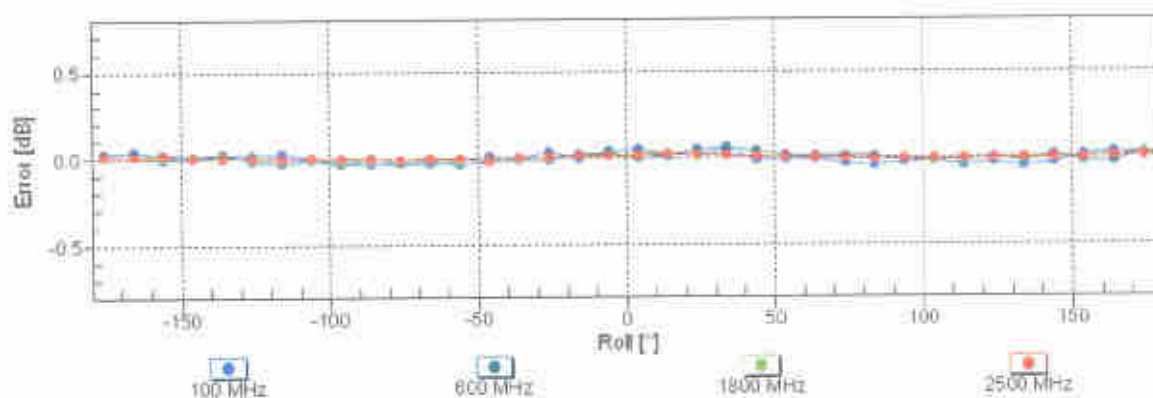
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

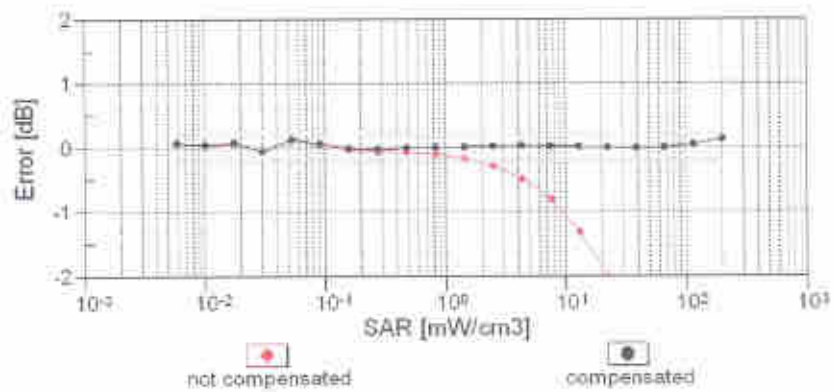
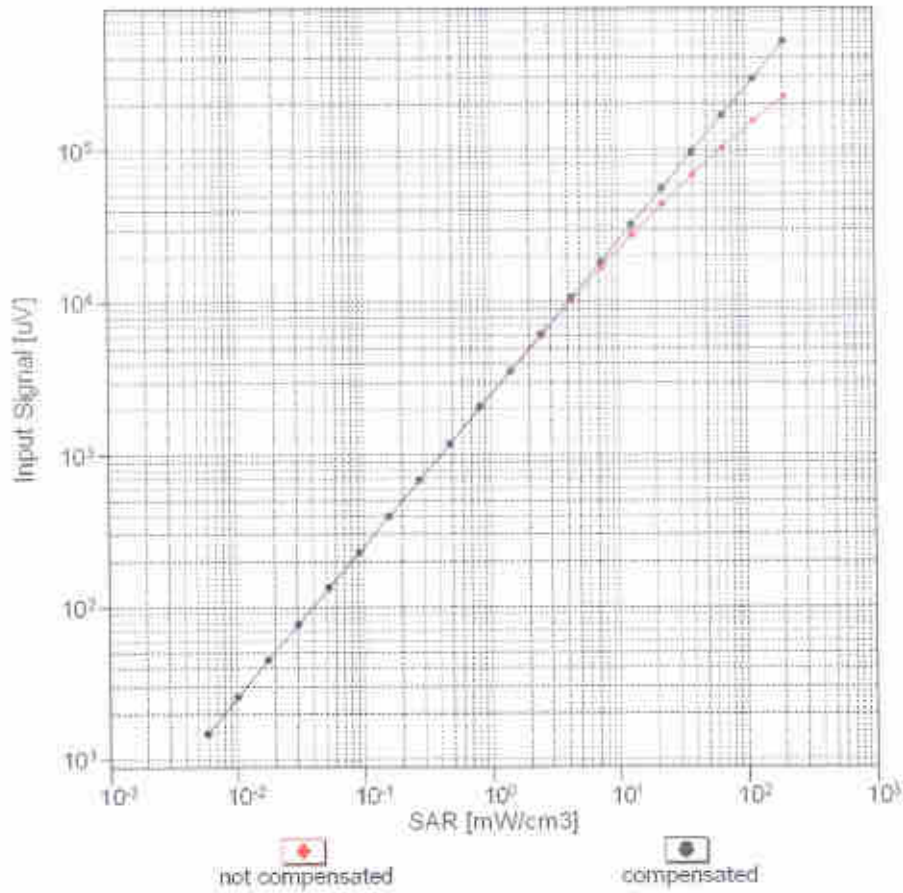


f=1800 MHz,R22



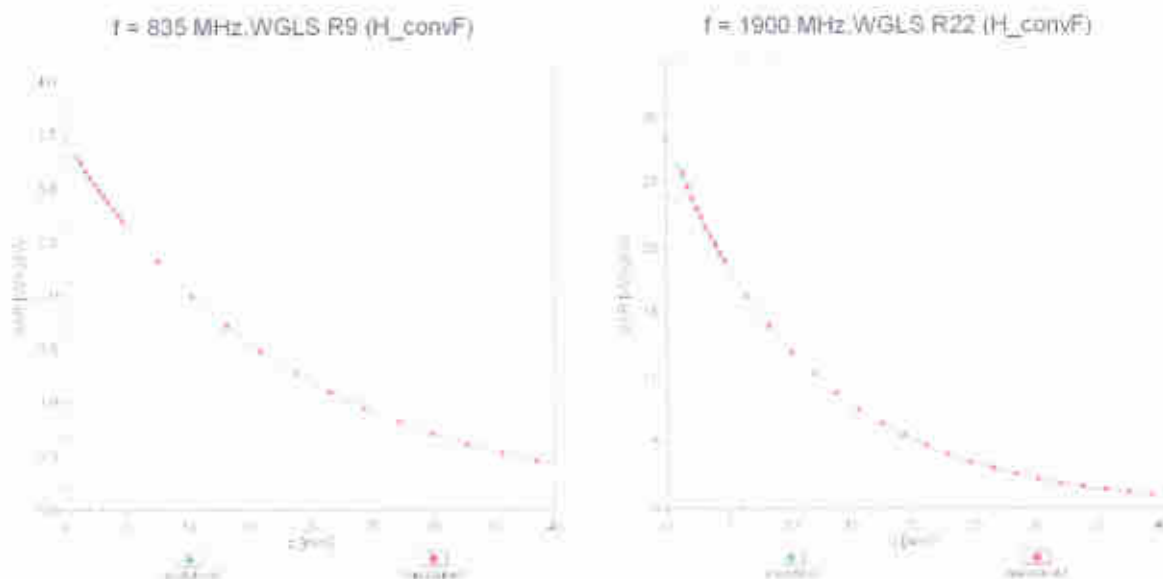
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range $f(SAR_{head})$ (TEM cell , $f_{eval} = 1900$ MHz)

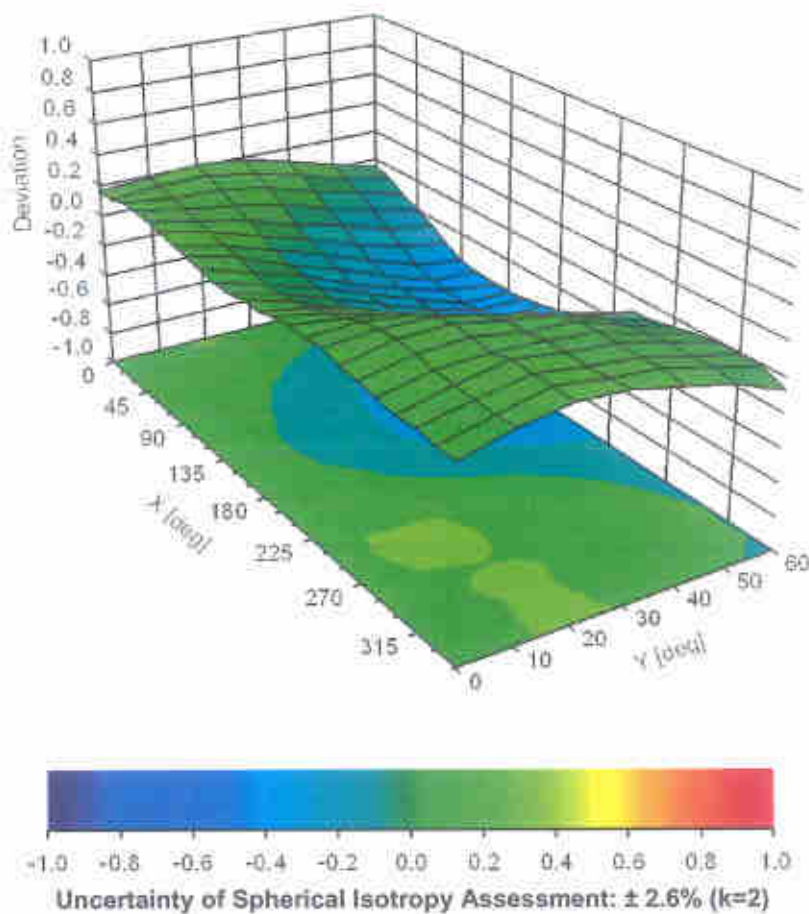


Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid Error (ϕ, θ), f = 900 MHz





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **EX3-7576_Jan20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:7576**

Calibration procedure(s) **QA CAL-01.v9, QA CAL-14.v5, QA CAL-23.v5, QA CAL-25.v7
Calibration procedure for dosimetric E-field probes**

Calibration date: **January 22, 2020**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^\circ\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: S5277 (20x)	04-Apr-19 (No. 217-02894)	Apr-20
DAE4	SN: 660	27-Dec-19 (No. DAE4-660_Dec19)	Dec-20
Reference Probe ES3DV2	SN: 3013	31-Dec-19 (No. ES3-3013_Dec19)	Dec-20
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-20
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-20
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-18)	In house check: Jun-20
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

Calibrated by:	Name Jeton Kasrati	Function Laboratory Technician	Signature
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature
			Issued: January 25, 2020
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Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: SCS 0108

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not affect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z} = NORM_{x,y,z} * frequency_response** (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; D_{x,y,z}; VR_{x,y,z}; A, B, C, D** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7576

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.48	0.63	0.63	$\pm 10.1\%$
DCP (mV) ^B	103.8	99.8	103.6	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Max dev.	Unc (k=2) ^E
0	CW	X	0.0	0.0	1.0	0.00	164.4	$\pm 2.7\%$	$\pm 4.7\%$
		Y	0.0	0.0	1.0		161.8		
		Z	0.0	0.0	1.0		164.7		

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 5).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7576**Other Probe Parameters**

Sensor Arrangement	Triangular
Connector Angle (°)	112.2
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

DASY/EASY - Parameters of Probe: EX3DV4 - SN:7576

Calibration Parameter Determined in Head Tissue Simulating Media

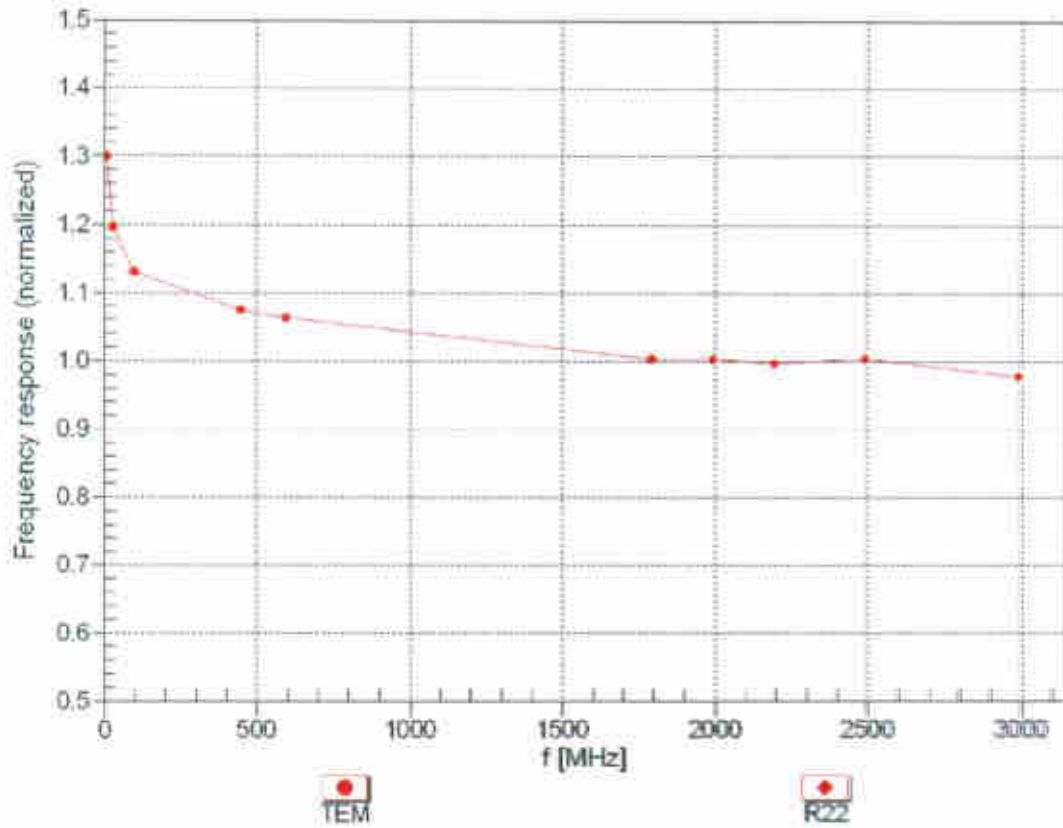
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth (mm) ^D	Unc (k=2)
750	41.9	0.89	10.71	10.71	10.71	0.62	0.80	± 12.0 %
835	41.5	0.90	10.45	10.45	10.45	0.46	0.94	± 12.0 %
900	41.5	0.97	10.16	10.16	10.16	0.33	1.09	± 12.0 %
1750	40.1	1.37	8.88	8.88	8.88	0.42	0.86	± 12.0 %
1900	40.0	1.40	8.58	8.58	8.58	0.38	0.86	± 12.0 %
2000	40.0	1.40	8.48	8.48	8.48	0.39	0.86	± 12.0 %
2300	39.5	1.67	8.03	8.03	8.03	0.41	0.90	± 12.0 %
2450	39.2	1.80	7.76	7.76	7.76	0.44	0.90	± 12.0 %
2600	39.0	1.96	7.47	7.47	7.47	0.41	0.96	± 12.0 %
3300	38.2	2.71	7.08	7.08	7.08	0.30	1.35	± 14.0 %
3500	37.9	2.91	6.77	6.77	6.77	0.30	1.35	± 14.0 %
3700	37.7	3.12	6.74	6.74	6.74	0.30	1.35	± 14.0 %
3900	37.5	3.32	6.56	6.56	6.56	0.40	1.40	± 14.0 %
4100	37.2	3.53	6.26	6.26	6.26	0.40	1.40	± 14.0 %
4400	36.9	3.84	6.19	6.19	6.19	0.40	1.60	± 14.0 %
4600	36.7	4.04	6.06	6.06	6.06	0.40	1.60	± 14.0 %
4800	36.4	4.25	5.89	5.89	5.89	0.40	1.80	± 14.0 %
4950	36.3	4.40	5.59	5.59	5.59	0.40	1.80	± 14.0 %
5250	35.9	4.71	5.20	5.20	5.20	0.40	1.80	± 14.0 %
5600	35.5	5.07	4.62	4.62	4.62	0.40	1.80	± 14.0 %
5750	35.4	5.22	4.83	4.83	4.83	0.40	1.80	± 14.0 %

^C Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Validity of ConvF assessed at 6 MHz is 4-9 MHz, and ConvF assessed at 13 MHz is 9-19 MHz. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequencies up to 6 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^D Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

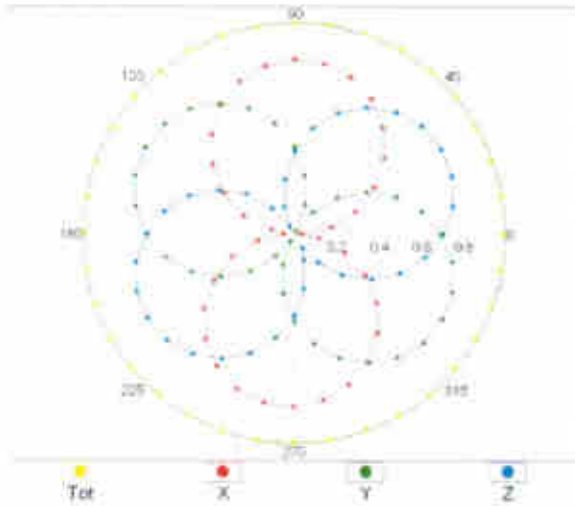
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



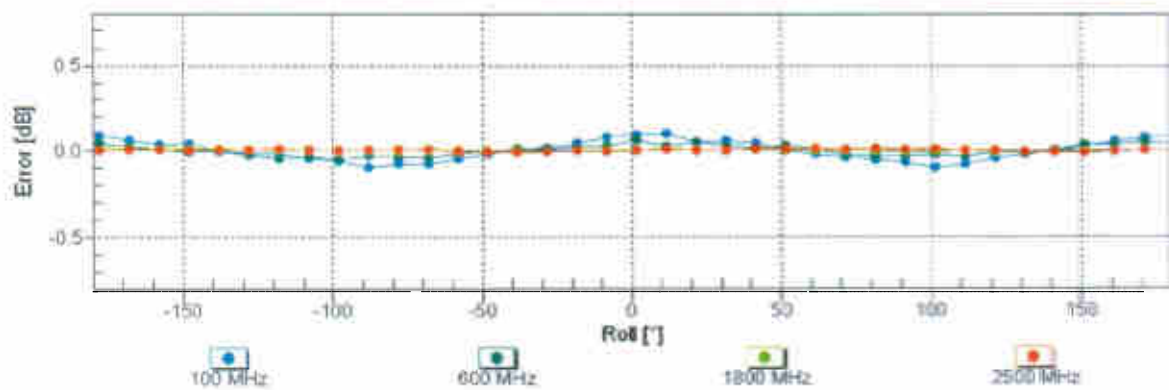
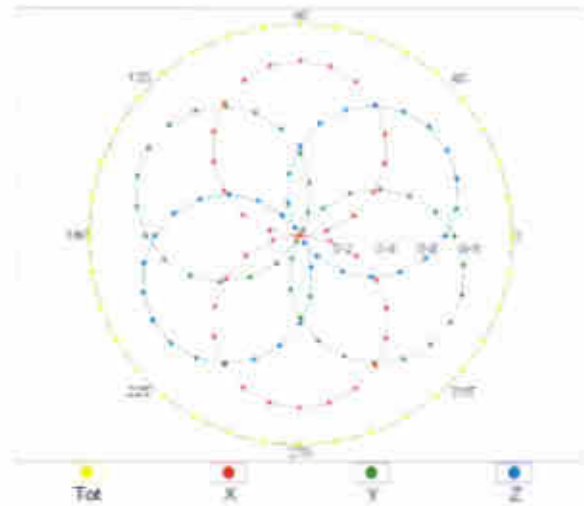
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

Receiving Pattern (ϕ), $\theta = 0^\circ$

f=600 MHz,TEM

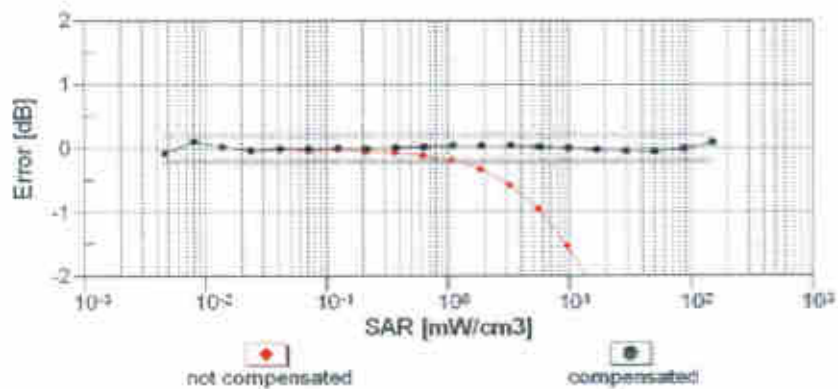
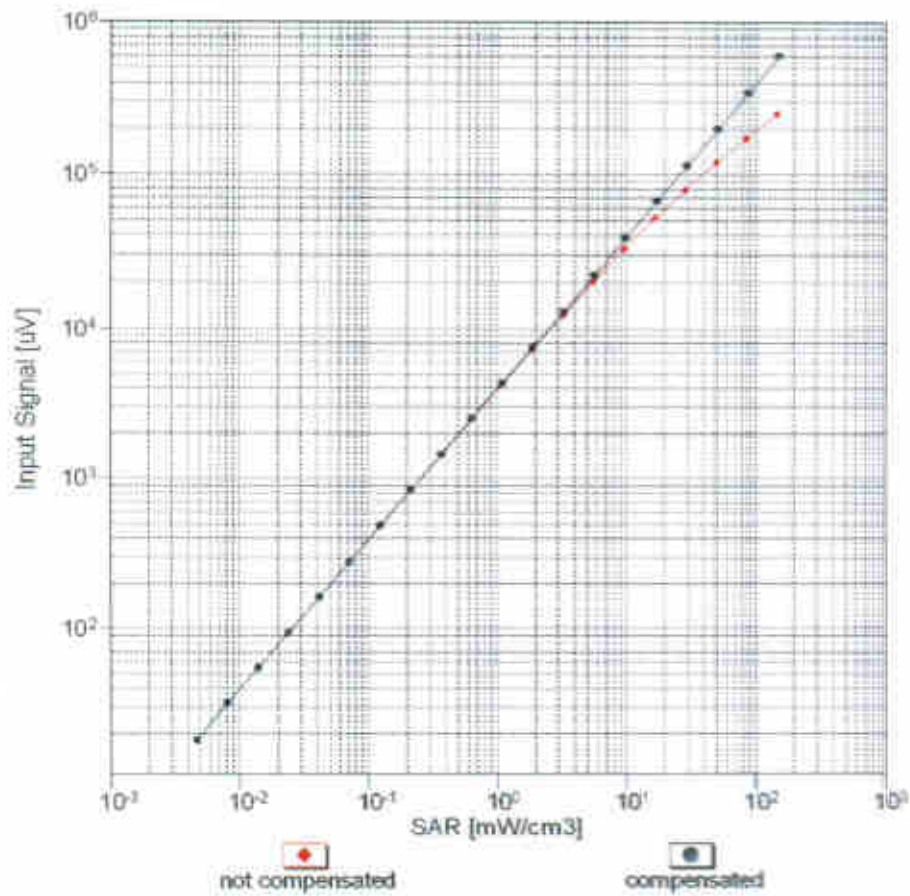


f=1800 MHz,R22



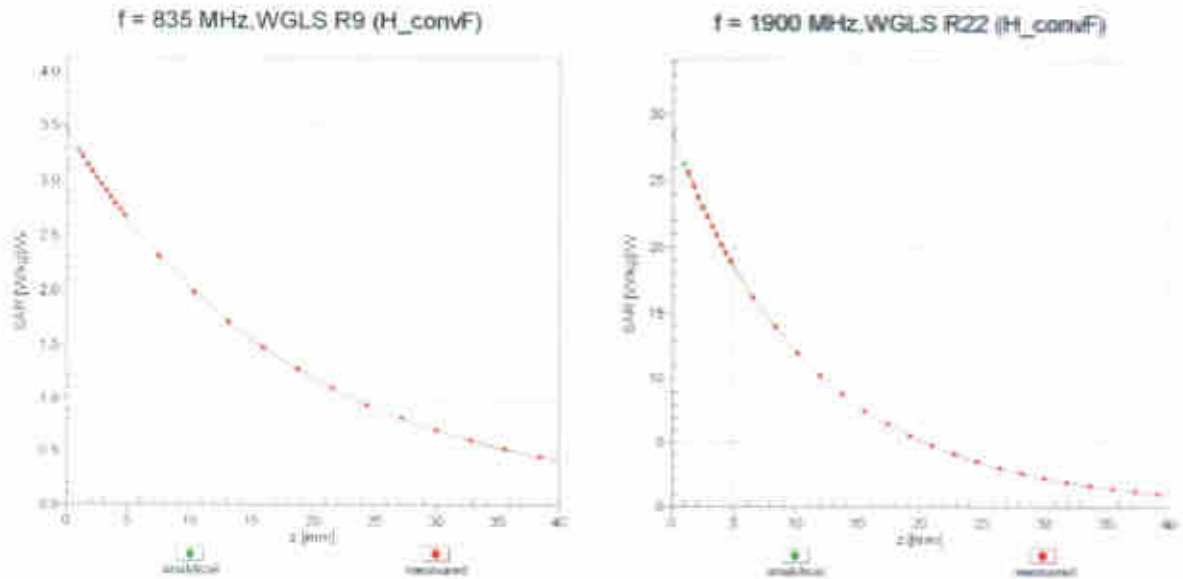
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell, $f_{\text{eval}} = 1900 \text{ MHz}$)



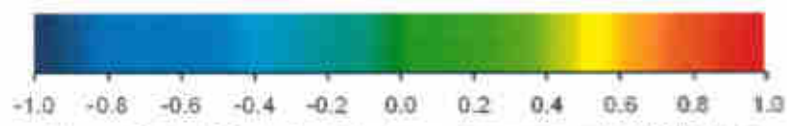
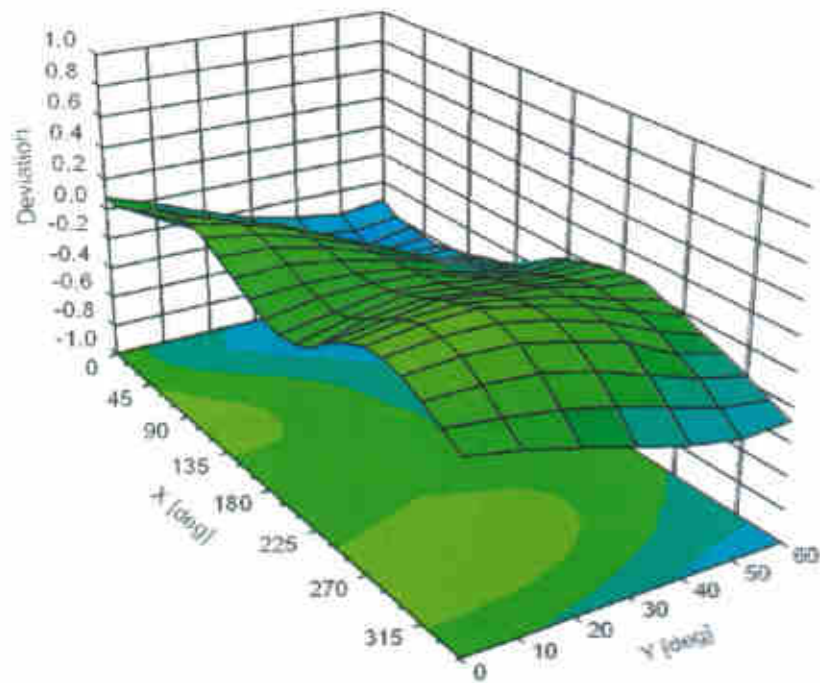
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, θ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ (k=2)



Appendix E. Conducted RF Output Power Table

The detailed power tables are shown as follows.



Full Power for UAT

TC Channel	Band Average Power (dBm)			Tx Power Limit (dBm)	Frame Average Power (dBm)			Tx Power Limit (dBm)
	834.2	834.2	834.8		834.2	834.4	834.8	
OPRS-1 Tx wide	20.86	20.82	21.02	22.30	21.86	21.62	22.02	23.30
OPRS-1 Tx wide	20.81	20.50	21.01	22.30	21.81	21.62	22.01	23.30
OPRS-2 Tx wide	20.51	20.46	20.42	20.80	20.01	20.46	20.42	20.80
OPRS-3 Tx wide	21.55	22.94	22.97	26.30	22.96	23.48	23.81	25.04
OPRS-4 Tx wide	20.81	20.60	20.72	20.60	20.81	21.08	21.72	20.50
EDGE-1 Tx wide	24.85	24.80	25.27	26.30	18.83	18.50	19.27	17.30
EDGE-2 Tx wide	23.23	23.22	23.56	24.30	17.23	17.25	17.56	18.30
EDGE-3 Tx wide	24.44	24.44	24.49	24.80	17.86	17.82	18.17	18.84
EDGE-4 Tx wide	21.44	21.52	21.75	22.70	16.44	16.62	16.75	18.70

TC Channel	Band Average Power (dBm)			Tx Power Limit (dBm)	Frame Average Power (dBm)			Tx Power Limit (dBm)
	812	861	808		812	861	810	
OPRS-1 Tx wide	20.74	20.74	20.77	20.30	17.74	17.74	17.77	18.80
OPRS-2 Tx wide	20.72	20.72	20.73	20.30	17.72	17.72	17.73	18.80
OPRS-3 Tx wide	24.77	24.75	24.76	25.30	18.77	18.52	19.30	19.80
OPRS-3 Tx wide	23.13	23.10	23.16	24.60	18.87	18.64	18.90	20.24
EDGE-1 Tx wide	21.59	21.30	21.51	23.00	16.09	16.52	16.51	19.00
EDGE-2 Tx wide	22.34	22.40	22.83	23.80	13.54	13.40	13.83	14.80
EDGE-3 Tx wide	24.41	24.28	24.50	25.70	15.41	15.26	15.50	16.70
EDGE-4 Tx wide	20.35	20.52	20.51	21.80	16.09	16.26	16.25	17.44
EDGE-4 Tx wide	19.38	19.16	19.32	20.60	16.38	16.18	16.52	17.60

TC Channel	Band Average Power (dBm)			Tx Power Limit (dBm)	Frame Average Power (dBm)			Tx Power Limit (dBm)	WCDMA V			Tx Power Limit (dBm)
	832	860	838		832	838	838		4132	4181	4233	
OPRS-1 Tx wide	21.59	21.61	21.64	22.80	21.38	21.47	21.49	22.80	23.05	23.18	23.18	24.30
OPRS-2 Tx wide	20.44	20.67	20.81	21.80	20.39	20.51	20.49	21.80	21.87	21.90	21.91	23.30
OPRS-3 Tx wide	20.80	20.64	20.81	21.80	20.42	20.53	20.52	21.80	21.85	21.82	21.82	23.30
OPRS-4 Tx wide	19.80	20.11	20.50	21.30	19.93	20.01	20.01	21.30	21.39	21.44	21.37	22.80
OPRS-5 Tx wide	20.14	20.10	20.08	21.30	19.98	20.02	19.98	21.30	21.38	21.41	21.38	22.80
OPRS-6 Tx wide	20.46	20.45	20.30	21.80	20.19	20.27	20.32	21.80	21.89	21.80	21.79	23.30
OPRS-7 Tx wide	20.44	20.50	20.43	21.80	20.27	20.33	20.35	21.80	21.85	21.77	21.71	23.30
OPRS-8 Tx wide	19.58	19.59	19.85	21.30	19.78	19.86	19.82	21.30	21.20	21.20	21.23	22.80
OPRS-9 Tx wide	19.14	20.01	19.86	21.30	19.82	19.80	19.76	21.30	21.21	21.24	21.15	22.80
OPRS-10 Tx wide	20.83	20.71	20.81	21.80	20.45	20.60	20.56	21.80	21.85	21.80	21.85	23.30
OPRS-11 Tx wide	19.65	19.60	19.84	20.80	19.41	19.38	19.52	20.80	19.86	19.80	19.91	21.30
OPRS-12 Tx wide	17.64	17.60	17.66	18.80	18.30	18.52	18.43	19.80	20.71	20.89	20.91	22.30
OPRS-13 Tx wide	18.42	18.45	18.44	19.80	19.29	19.37	19.31	19.80	19.80	19.86	19.86	21.30
OPRS-14 Tx wide	20.00	20.70	20.80	21.80	20.50	20.50	20.50	21.80	21.90	21.90	21.90	23.30
OPRS-15 Tx wide	18.21	18.24	18.17	19.30	19.17	19.27	19.15	19.30	19.53	19.81	19.73	20.80

TC Channel	Band Average Power (dBm)			Tx Power Limit (dBm)	Frame Average Power (dBm)			Tx Power Limit (dBm)	CDMA BC1			Tx Power Limit (dBm)
	812	860	838		812	838	838		216	266	306	
OPRS-1 Tx wide	22.84	22.81	22.59	24.30	21.85	21.75	21.83	22.80	22.84	22.81	22.83	24.30
OPRS-2 Tx wide	22.82	22.81	22.57	24.30	21.83	21.73	21.82	22.80	22.82	22.86	22.82	24.30
OPRS-3 Tx wide	22.81	22.80	22.56	24.30	21.85	21.73	21.84	22.80	22.82	22.84	22.80	24.30
OPRS-4 Tx wide	22.76	22.73	22.54	24.30	21.82	21.78	21.86	22.80	22.71	22.73	22.68	24.30
OPRS-5 Tx wide	22.81	22.81	22.54	24.30	21.47	21.50	21.31	22.80	22.82	22.83	22.81	24.30
OPRS-6 Tx wide	22.79	22.81	22.52	24.30	21.43	21.46	21.27	22.80	22.79	22.86	22.86	24.30



Reduced power for Hotspot on-UAT

Band	WCCMA II			Turn-up Limit (dBm)	WCCMA IV			Turn-up Limit (dBm)
	FS Channel	812	861		810	812	861	
Frequency (MHz)	354.2	374.2	394.2	32.00	21.53	21.63	21.73	23.00
OPRS 1 Tx total	30.51	30.52	30.71	32.00	21.51	21.52	21.71	23.00
OPRS 2 Tx total	27.86	27.86	27.50	21.80	21.80	21.80	21.50	23.00
OPRS 3 Tx total	25.08	25.08	25.02	22.20	21.72	21.69	21.70	23.00
OPRS 4 Tx total	24.53	24.56	24.40	20.20	21.53	21.56	21.40	23.00
EDGE 1 Tx total	24.32	24.50	24.81	20.00	19.32	19.50	19.83	17.00
EDGE 2 Tx total	21.82	21.80	21.98	22.00	18.82	18.80	18.98	18.50
EDGE 3 Tx total	20.77	20.70	20.86	21.00	18.51	18.51	18.60	17.24
EDGE 4 Tx total	19.51	19.50	19.48	20.00	18.51	18.50	18.48	17.00

Band	WCCMA II			Turn-up Limit (dBm)	WCCMA IV			Turn-up Limit (dBm)
	FS Channel	512	861		810	512	861	
Frequency (MHz)	350.2	370.2	390.2	32.00	19.02	19.00	19.03	23.00
OPRS 1 Tx total	25.96	26.11	25.95	27.10	18.96	17.11	18.95	18.10
OPRS 2 Tx total	23.46	23.52	23.67	24.00	17.46	17.52	17.67	18.00
OPRS 3 Tx total	21.06	22.05	22.10	23.20	17.73	17.62	17.84	19.04
OPRS 4 Tx total	20.40	20.61	20.52	21.80	17.40	17.61	17.52	18.80
EDGE 1 Tx total	21.70	21.73	21.76	23.10	19.70	19.73	19.76	14.10
EDGE 2 Tx total	20.41	20.42	20.53	20.00	18.41	18.42	18.53	16.00
EDGE 3 Tx total	18.96	18.90	18.46	20.00	18.10	15.12	18.20	18.84
EDGE 4 Tx total	18.08	18.11	18.27	19.00	18.08	15.13	18.27	18.00

Band	WCCMA II			Turn-up Limit (dBm)	WCCMA IV			WCCMA V			Turn-up Limit (dBm)		
	FS Channel	592	860		533	592	860	533	412	415		423	
Frequency (MHz)	992.4	960	968	32.00	187.4	187.6	187.8	4367	4467	4468	4468		
SDPP Rel 0	AMR 12.2kps	19.28	19.35	19.25	20.00	20.39	20.41	20.42	21.10	21.84	21.00	20.97	21.00
SDPP Rel 5	AMR 12.2kps	18.30	18.34	18.28	20.00	20.42	20.44	20.45	21.10	21.06	21.00	20.98	21.00
SDPP Rel 1	HSPA Subcarriers 1	18.36	18.41	18.35	19.00	19.43	19.48	19.45	20.10	19.88	19.79	19.73	20.00
SDPP Rel 2	HSPA Subcarriers 2	18.31	18.41	18.35	19.00	19.48	19.50	19.48	20.10	19.88	19.81	19.74	20.00
SDPP Rel 3	HSPA Subcarriers 3	17.51	17.61	17.60	18.00	18.97	18.99	18.97	19.60	19.46	19.31	19.16	20.40
SDPP Rel 4	HSPA Subcarriers 4	17.85	17.92	17.82	18.00	18.00	18.00	18.04	19.60	19.39	19.30	19.20	20.40
SDPP Rel 5	DC-HSPA Subcarriers 1	18.11	18.22	18.12	19.00	19.23	19.24	19.28	20.70	19.76	19.56	19.57	20.00
SDPP Rel 6	DC-HSPA Subcarriers 2	18.15	18.27	18.17	19.00	19.31	19.30	19.31	20.10	19.87	19.88	19.53	20.00
SDPP Rel 7	DC-HSPA Subcarriers 3	17.29	17.71	17.69	18.00	18.82	18.83	18.78	19.60	19.21	19.09	19.05	20.40
SDPP Rel 8	DC-HSPA Subcarriers 4	17.60	17.78	17.60	18.00	18.86	18.77	18.72	19.60	19.22	19.13	18.97	20.40
SDPP Rel 9	HSPA Subcarriers 1	18.34	18.40	18.35	19.00	19.49	19.57	19.52	20.10	19.88	19.79	19.77	20.00
SDPP Rel 10	HSPA Subcarriers 2	17.38	17.45	17.38	18.00	18.45	18.55	18.48	19.10	17.97	17.79	17.70	18.00
SDPP Rel 11	HSPA Subcarriers 3	15.35	15.43	15.40	18.00	17.34	17.49	17.39	18.10	18.72	18.78	18.73	19.00
SDPP Rel 12	HSPA Subcarriers 4	16.33	16.32	16.18	17.00	18.33	18.38	18.27	18.80	17.68	17.70	17.78	18.00
SDPP Rel 13	HSPA Subcarriers 5	18.31	18.41	18.34	19.00	19.54	19.47	19.48	20.10	19.91	19.79	19.72	20.00
SDPP Rel 14	HSPA 15QAM Subcarriers 1	15.92	16.01	15.91	18.00	18.21	18.24	18.11	17.60	17.54	17.60	17.55	18.40

Band	CCMA B/C/D			Turn-up Limit (dBm)	CCMA B/C1			CCMA B/C10			Turn-up Limit (dBm)		
	FS Channel	803	860		877	803	860	877	478	530		586	
Frequency (MHz)	841.7	836.52	848.51	22.00	181.50	1680	1686.70	817.8	820.5	823.1	22.10		
Rel 0	20.05	20.05	20.62	22.20	19.33	19.40	19.31	20.40	20.77	20.81	20.70	22.10	
Rel 1	20.63	20.63	20.81	22.20	19.32	19.38	19.31	20.40	20.76	20.81	20.70	22.10	
Rel 2	20.62	20.65	20.59	22.20	19.30	19.38	19.29	20.40	20.74	20.78	20.72	22.10	
Rel 3	20.60	20.61	20.57	22.20	19.29	19.35	19.27	20.40	20.72	20.76	20.70	22.10	
Rel 4	RTAP-H2-0kps	20.59	20.60	20.55	22.20	18.27	19.33	19.28	20.40	20.71	20.70	20.88	22.10
Rel 5	RTAP-H2-0kps	20.57	20.59	20.53	22.20	18.25	19.32	19.24	20.40	20.69	20.70	20.87	22.10



Reduced power level 1 for Head-UAT

MIMO	Base-Average Power (dBm)			Turnup Limit (dBm)	Fringe-Average Power (dBm)			Turnup Limit (dBm)
	198	199	201		198	199	201	
TX Channel	291.2	291.4	291.9	32.30	21.85	21.93	22.07	23.50
Frequency (MHz)	3038	3039	3107	32.30	21.85	21.93	22.07	23.50
OPRS-1 Tx level	19.81	19.82	19.91	22.30	18.81	18.92	19.01	19.30
OPRS-2 Tx level	28.18	28.20	28.24	23.80	22.16	22.20	22.24	23.80
OPRS-3 Tx level	25.48	25.52	25.08	27.00	25.42	25.52	25.08	24.00
EDGE-1 Tx level	24.83	24.90	25.27	26.30	19.83	19.90	19.27	17.50
EDGE-2 Tx level	22.32	22.32	22.96	24.30	17.73	17.73	17.96	18.50
EDGE-3 Tx level	22.32	22.32	22.43	23.30	17.86	17.87	18.17	18.94
EDGE-4 Tx level	21.44	21.45	21.75	22.70	16.44	16.45	16.75	16.70

MIMO	Base-Average Power (dBm)			Turnup Limit (dBm)	Fringe-Average Power (dBm)			Turnup Limit (dBm)
	198	199	200		198	199	200	
TX Channel	152.2	152.2	152.9	16.92	16.92	16.99	16.99	16.70
Frequency (MHz)	152.2	152.2	152.9	16.92	16.92	16.99	16.99	16.70
OPRS-1 Tx level	25.14	25.17	25.04	25.70	16.14	16.17	16.04	16.70
OPRS-2 Tx level	22.27	22.41	22.22	22.20	16.17	16.40	16.14	17.20
OPRS-3 Tx level	20.66	20.64	20.74	21.50	16.40	16.42	16.48	17.04
OPRS-4 Tx level	17.38	17.43	17.49	18.20	14.36	14.43	14.49	15.50
EDGE-1 Tx level	22.54	22.46	22.83	23.80	13.54	13.46	13.83	14.80
EDGE-2 Tx level	21.41	21.30	21.85	22.70	16.41	16.26	16.85	18.70
EDGE-3 Tx level	20.76	20.52	20.51	21.60	16.00	16.28	16.25	17.34
EDGE-4 Tx level	18.38	18.18	18.32	20.60	16.38	16.18	16.32	17.60

Base	WCDMA II			Turnup Limit (dBm)	WCDMA IV			Turnup Limit (dBm)	WCDMA V			Turnup Limit (dBm)
	9902	9900	9338		1312	1413	1513		4192	4192	4233	
TX Channel	9902	9900	9338	1312	1413	1513	4192	4192	4407	4406	4192	
Frequency (MHz)	1862.4	1860	1867.8	1719.4	1721.6	1729.8	1896.4	1896.4	1896.4	1896.4	1896.4	
WCDMA Ref #	112.0	112.0	112.54	18.20	17.70	17.25	17.70	18.70	21.00	21.00	21.00	
WCDMA Ref #	17.60	17.67	17.57	18.50	17.72	17.77	17.80	18.70	21.87	21.80	22.60	
WCDMA Ref #	16.85	16.67	16.65	17.60	16.73	16.81	16.78	17.70	20.69	20.62	20.55	
WCDMA Ref #	16.81	16.86	16.84	17.50	16.76	16.83	16.81	17.70	20.67	20.64	20.56	
WCDMA Ref #	15.81	16.17	16.09	17.00	16.27	16.31	16.30	17.20	20.21	20.16	20.01	
WCDMA Ref #	16.16	16.13	16.11	17.00	16.30	16.32	16.32	17.20	20.20	20.13	20.00	
WCDMA Ref #	16.41	16.43	16.41	17.50	16.53	16.57	16.61	17.70	20.51	20.59	20.59	
WCDMA Ref #	16.40	16.50	16.40	17.20	16.61	16.63	16.64	17.20	20.48	20.46	20.38	
WCDMA Ref #	15.59	15.59	15.88	17.00	16.12	16.16	16.11	17.20	20.02	19.92	19.87	
WCDMA Ref #	15.95	16.01	16.89	17.00	16.16	16.10	16.05	17.20	20.03	19.98	19.79	
WCDMA Ref #	16.44	16.71	16.84	17.50	16.79	16.80	16.80	17.70	20.67	20.62	20.56	
WCDMA Ref #	15.98	15.60	15.87	16.50	15.75	15.68	15.81	16.70	18.68	18.62	18.55	
WCDMA Ref #	13.85	13.85	13.80	14.50	14.64	14.63	14.72	15.70	19.53	19.61	19.56	
WCDMA Ref #	14.43	14.40	14.47	15.50	15.63	15.67	15.60	16.70	18.67	18.68	18.60	
WCDMA Ref #	14.61	14.76	14.63	17.20	16.84	16.89	16.79	17.70	20.72	20.62	20.54	
WCDMA Ref #	14.52	14.50	14.50	16.00	15.51	15.57	15.44	16.20	18.35	18.33	18.10	

Base	CDMA B0			Turnup Limit (dBm)	CDMA B1			Turnup Limit (dBm)	CDMA B1A			Turnup Limit (dBm)
	1913	384	777		26	600	1175		476	580	684	
TX Channel	1913	384	777	26 <td>600 <td>1175 <td>476 <td>580 <td>684 <td>1913</td> <td>384</td> <td>777</td> </td></td></td></td></td>	600 <td>1175 <td>476 <td>580 <td>684 <td>1913</td> <td>384</td> <td>777</td> </td></td></td></td>	1175 <td>476 <td>580 <td>684 <td>1913</td> <td>384</td> <td>777</td> </td></td></td>	476 <td>580 <td>684 <td>1913</td> <td>384</td> <td>777</td> </td></td>	580 <td>684 <td>1913</td> <td>384</td> <td>777</td> </td>	684 <td>1913</td> <td>384</td> <td>777</td>	1913	384	777
Frequency (MHz)	201.2	201.20	201.30	21.30	16.33	16.41	16.32	17.46	19.87	19.91	19.85	21.40
BC1 B0S5	20.15	20.18	20.12	21.30	16.33	16.41	16.32	17.46	19.87	19.91	19.85	21.40
BC1 B0S6	20.10	20.15	20.11	21.30	16.31	16.40	16.30	17.40	19.86	19.90	19.83	21.40
BC1 B0S1 (FDD)	20.12	20.15	20.09	21.30	16.30	16.38	16.28	17.40	19.84	19.85	19.82	21.40
BC1 B0S2 (FDD)	20.10	20.13	20.07	21.30	16.28	16.36	16.27	17.40	19.82	19.86	19.80	21.40
BC1 B0S3 (FDD)	20.09	20.10	20.05	21.30	16.26	16.35	16.25	17.40	19.81	19.82	19.78	21.40
BC1 B0S4 (FDD)	20.07	20.09	20.03	21.30	16.25	16.33	16.23	17.40	19.79	19.83	19.77	21.40



Reduced power level 2 for Head-UAT

MIMO	Best Average Power (dBm)			Turn-up Limit (dBm)	Furthest Average Power (dBm)			Turn-up Limit (dBm)
	15W	18W	20.1		20.2	18W	20.1	
TX Channel	24.2	18.4	18.9	21.19	21.19	21.21	21.25	22.40
Frequency (MHz)	30.19	30.21	30.25	31.40	31.19	31.21	31.25	32.40
OPBS 1 Tx side	26.16	26.11	26.21	27.40	27.19	27.21	27.25	28.40
OPBS 2 Tx side	27.42	27.41	27.51	28.60	28.42	28.45	28.51	29.60
OPBS 3 Tx side	24.41	24.40	24.57	25.70	25.41	25.45	25.57	26.70
OPBS 4 Tx side	24.41	24.40	24.57	25.70	25.41	25.45	25.57	26.70
EDGE 1 Tx side	24.83	24.80	25.27	26.50	26.83	26.90	27.27	28.50
EDGE 2 Tx side	23.23	23.25	23.56	24.70	24.23	24.25	24.56	25.70
EDGE 3 Tx side	22.12	22.23	22.43	23.50	23.86	23.97	24.17	25.04
EDGE 4 Tx side	21.44	21.61	21.75	22.50	22.44	22.52	22.75	23.70

MIMO	Best Average Power (dBm)			Turn-up Limit (dBm)	Furthest Average Power (dBm)			Turn-up Limit (dBm)
	15W	18W	20.1		20.2	18W	20.1	
TX Channel	23.2	18.5	19.0	21.19	21.19	21.21	21.25	22.40
Frequency (MHz)	23.40	23.40	23.55	24.60	24.40	24.45	24.55	25.60
OPBS 1 Tx side	23.45	23.41	23.52	24.60	24.45	24.41	24.52	25.60
OPBS 2 Tx side	21.52	21.52	21.56	22.70	22.52	22.51	22.56	23.70
OPBS 3 Tx side	19.98	19.85	19.97	21.00	20.70	20.62	20.71	21.74
OPBS 4 Tx side	19.97	19.82	19.93	21.00	20.70	20.62	20.71	21.74
EDGE 1 Tx side	22.54	22.46	22.83	24.00	23.54	23.46	23.83	24.90
EDGE 2 Tx side	21.15	21.50	21.21	22.20	21.15	21.05	21.21	22.30
EDGE 3 Tx side	19.00	19.20	19.30	20.10	19.74	19.41	19.60	20.64
EDGE 4 Tx side	17.97	18.14	18.11	19.10	18.97	18.14	18.11	19.10

Best	WCDMA E			Turn-up Limit (dBm)	WCDMA U			Turn-up Limit (dBm)	WCDMA V			Turn-up Limit (dBm)
	9262	9800	9268		1312	1413	1513		4192	4192	4293	
TX Channel	9692	9690	9689	1007	1008	9798	4927	4927	4929	4929	4929	4929
Frequency (MHz)	182.4	1890	1907	172.4	172.6	172.6	186.4	186.4	186.4	186.4	186.4	186.4
ISPP Ref #1	16.68	16.70	16.71	17.60	16.68	16.70	17.60	16.68	16.70	16.71	17.60	16.68
ISPP Ref #2	16.70	16.71	16.74	17.60	16.70	16.77	16.80	17.60	16.80	16.88	16.81	17.60
ISPP Ref #3	16.70	16.60	16.81	16.60	16.71	16.81	16.80	16.60	16.68	16.68	16.60	16.60
ISPP Ref #4	16.70	16.60	16.81	16.60	16.74	16.83	16.80	16.60	16.60	16.60	16.60	16.60
ISPP Ref #5	14.91	15.30	16.26	16.30	16.25	15.31	15.32	16.30	16.20	16.14	16.22	16.30
ISPP Ref #6	15.25	15.31	15.28	16.30	15.28	15.32	15.29	16.30	15.19	15.11	15.09	16.30
ISPP Ref #7	15.31	15.61	16.58	16.60	16.51	15.67	15.63	16.60	16.50	16.37	16.40	16.70
ISPP Ref #8	15.50	15.60	15.53	16.60	15.50	15.61	15.60	16.60	15.47	15.41	15.38	16.70
ISPP Ref #9	14.89	15.12	15.05	16.30	15.10	15.16	15.13	16.30	15.81	15.90	15.83	16.70
ISPP Ref #10	15.10	15.17	15.08	16.30	15.14	15.10	15.07	16.30	15.02	14.94	14.80	16.70
ISPP Ref #11	15.14	15.01	15.01	16.60	15.17	15.02	15.07	16.60	15.06	15.03	14.90	16.70
ISPP Ref #12	14.76	14.84	14.84	15.60	14.73	14.68	14.83	15.60	17.47	17.60	17.56	16.70
ISPP Ref #13	12.76	12.61	12.80	13.60	13.62	13.62	13.74	14.60	14.52	14.59	14.56	16.70
ISPP Ref #14	13.53	13.61	13.84	14.60	14.81	14.67	14.62	14.60	17.66	17.56	17.61	16.70
ISPP Ref #15	13.71	13.68	13.80	14.60	13.82	13.80	13.81	14.60	19.21	19.00	19.00	16.70
ISPP Ref #16	13.32	13.40	13.37	15.10	14.40	14.47	14.46	15.10	17.34	17.31	17.38	16.70

Best	CDMA BCS			Turn-up Limit (dBm)	CDMA BCI			Turn-up Limit (dBm)	CDMA BCII			Turn-up Limit (dBm)
	363	384	377		26	603	1175		476	586	684	
TX Channel	20.12	20.10	20.13	21.30	19.56	19.55	19.69	19.59	19.12	19.08	20.50	
Frequency (MHz)	20.12	20.10	20.13	21.30	19.56	19.55	19.69	19.59	19.12	19.08	20.50	
PCS BSS1 (F-SSS)	20.10	20.10	20.09	21.30	19.54	19.54	19.50	19.08	19.00	19.04	20.50	
PCS BSS2 (F-SSS)	20.10	20.10	20.07	21.30	19.54	19.50	19.60	19.05	19.07	19.03	20.50	
RTWP (F-SSS)	20.09	20.10	20.05	21.30	19.52	19.59	19.48	19.00	19.03	19.01	20.50	
RTWP (M-SSS)	20.07	20.00	20.03	21.30	19.51	19.57	19.47	19.00	19.01	19.04	19.00	



Reduced power level 3/4 for Head-UAT

ID	Band Average Power (dBm)			Tune-up Limit (dBm)	Frame Average Power (dBm)			Tune-up Limit (dBm)
	3A.5	3A.4	3A.3		3A.2	3A.4	3A.3	
TX Channel	199	198	197	194	198	198	197	194
Frequency (MHz)	245.2	245.4	245.6	245.2	245.4	245.6	245.2	245.4
OSM 1 Tx Limit	27.13	27.05	26.89	27.00	18.13	18.05	17.89	18.00
OPRS 1 Tx Limit	27.14	27.11	26.99	27.00	18.14	18.13	17.99	18.00
OPRS 2 Tx Limit	24.00	23.62	23.82	24.40	18.00	17.62	17.82	18.40
OPRS 3 Tx Limit	22.00	22.10	22.35	22.30	17.81	17.91	17.95	18.04
OPRS 4 Tx Limit	20.87	20.84	20.74	22.00	17.97	17.84	17.74	18.85
EDGE 1 Tx Limit	23.80	23.35	23.65	22.20	14.80	14.35	14.65	16.30
EDGE 2 Tx Limit	22.38	22.06	21.97	23.30	15.38	15.06	15.07	17.30
EDGE 3 Tx Limit	20.88	20.80	20.79	22.20	16.80	16.62	16.53	18.04
EDGE 4 Tx Limit	18.56	18.60	18.70	20.70	16.56	16.60	16.70	17.75

ID	Band Average Power (dBm)			Tune-up Limit (dBm)	Frame Average Power (dBm)			Tune-up Limit (dBm)
	512	561	610		512	561	610	
TX Channel	179.2	180	179.3	176.2	180	179.9	176	
Frequency (MHz)	214.1	214.2	214.3	222.0	173.2	172.7	172.3	
OSM 1 Tx Limit	21.59	21.70	21.60	22.20	12.59	12.70	12.60	
OPRS 1 Tx Limit	18.76	18.90	18.85	19.80	13.76	12.88	12.85	
OPRS 2 Tx Limit	17.41	17.47	17.60	18.50	13.15	13.21	13.34	
OPRS 3 Tx Limit	16.56	16.56	16.56	17.80	12.55	12.55	12.55	
OPRS 4 Tx Limit	15.77	15.50	15.77	22.50	13.77	12.63	12.77	
EDGE 1 Tx Limit	18.75	18.91	18.81	19.70	12.75	12.91	12.81	
EDGE 2 Tx Limit	16.96	17.27	17.10	18.70	13.76	13.91	13.84	
EDGE 3 Tx Limit	15.48	15.60	15.55	17.10	12.48	12.60	12.65	

ID	Band	WCDMA E			WCDMA IV			WCDMA V			Tune-up Limit (dBm)
		3052	3060	3068	1212	1216	1211	4122	4152	4233	
TX Channel	3662	3660	3666	3662	3668	3668	4327	4327	4327	4326	
Frequency (MHz)	1422.4	1422.4	1422.4	1722.4	1722.6	1722.6	1520.4	1520.4	1520.4	1520	
SOPF Path	1407	1413	1408	1510	1510	1510	1402	1402	1402	1402	
SOPF Path	1409	1418	1409	1510	1517	1401	1404	1520	1819	1820	
SOPF Path	1314	1326	1316	1420	1326	1326	1304	1420	1721	1820	
SOPF Path	1310	1321	1318	1410	1321	1307	1307	1420	1690	1694	
SOPF Path	1220	1214	1211	1300	1242	1235	1235	1370	1653	1648	
SOPF Path	1214	1212	1213	1360	1245	1238	1235	1370	1692	1693	
SOPF Path	1230	1302	1293	1410	1288	1281	1287	1420	1683	1689	
SOPF Path	1234	1301	1290	1410	1276	1287	1290	1420	1690	1679	
SOPF Path	1238	1253	1240	1300	1227	1240	1237	1370	1634	1642	
SOPF Path	1244	1238	1241	1380	1241	1238	1231	1370	1635	1634	
SOPF Path	1313	1320	1318	1410	1304	1314	1311	1420	1690	1692	
SOPF Path	1215	1225	1219	1330	1190	1212	1207	1320	1500	1492	
SOPF Path	1014	1021	1021	1150	1079	1108	1098	1220	1585	1591	
SOPF Path	1032	1102	1099	1210	1178	1191	1188	1220	1490	1488	
SOPF Path	1370	1321	1315	1410	1300	1304	1305	1420	1724	1691	
SOPF Path	1071	1081	1072	1200	1168	1181	1170	1272	1483	1470	

ID	Band	CDMA BC3			CDMA BC1			CDMA BC3			Tune-up Limit (dBm)
		553	584	577	25	603	1173	476	590	584	
TX Channel	602	606.26	608.31	602.52	1880	1883.24	1871.71	608.55	608.5	608.5	
Frequency (MHz)	17.53	17.69	17.51	18.00	13.04	13.10	13.03	14.00	16.39	16.42	
Path 3065	17.52	17.53	17.50	18.00	13.03	13.03	13.01	14.00	16.37	16.42	
Path 3065	17.50	17.56	17.48	18.00	13.01	13.08	12.99	14.00	16.38	16.33	
Path 3076	17.48	17.54	17.47	18.00	13.99	13.06	12.98	14.00	16.34	16.37	
Path 3089	17.47	17.52	17.45	18.00	13.98	13.04	12.96	14.00	16.32	16.36	
Path 4098	17.45	17.51	17.43	18.00	13.96	13.02	12.95	14.00	16.31	16.34	



Band 7 (600MHz Band) Part 27

Table with 11 columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power High Ch./Freq., Turn-up limit (dBm), MPR (dB). Rows include QPSK, 16QAM, and 256QAM configurations for various BW and RB sizes.

Band 12 (700MHz Low Band) Part 27 (only on channel required)

Table with 11 columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power High Ch./Freq., Turn-up limit (dBm), MPR (dB). Rows include QPSK, 16QAM, and 256QAM configurations for various BW and RB sizes.

Band 13 (700MHz Band) Part 27

Table with 11 columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power High Ch./Freq., Turn-up limit (dBm), MPR (dB). Rows include QPSK, 16QAM, and 256QAM configurations for various BW and RB sizes.



Band 3(only on channel required)

Table with columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power High Ch./Freq., Power Mid Ch./Freq., Power High+10MHz Ch./Freq., Power High+20MHz Ch./Freq., Tuning Unit (dBm), MPR (dB). Includes sub-tables for Channel, Frequency (MHz), and Channel.

Band 41 (2.6G Band)-Class 3

Table with columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power Mid Ch./Freq., Power High Ch./Freq., Power High+10MHz Ch./Freq., Power High+20MHz Ch./Freq., Tuning Unit (dBm), MPR (dB). Includes sub-tables for Channel, Frequency (MHz), and Channel.

Band 41 (2.6G Band) HPUe (Limit 27)

Table with columns: BW (MHz), Modulation, RB Size, RB Offset, Power Low Ch./Freq., Power Mid Ch./Freq., Power High Ch./Freq., Power High+10MHz Ch./Freq., Power High+20MHz Ch./Freq., Tuning Unit (dBm), MPR (dB). Includes sub-tables for Channel, Frequency (MHz), and Channel.



Full Power for LAT

Channel	Band Average Power (dBm)			Tuneup Limit (dBm)	Frame Average Power (dBm)			Tuneup Limit (dBm)
	845.2	845.4	845.8		845.2	845.4	845.8	
TX Channel	31.99	31.99	31.91	31.92	31.99	31.91	31.92	
Frequency (MHz)	31.52	31.52	31.61	32.80	32.52	32.63	32.61	
OPRS 1 Tx Limit	31.50	31.50	31.50	32.80	32.50	32.50	32.50	
OPRS 2 Tx Limit	29.89	29.70	29.80	31.30	29.89	29.70	29.80	
OPRS 3 Tx Limit	28.07	28.10	28.10	29.20	28.07	28.07	28.07	
OPRS 4 Tx Limit	27.10	27.11	27.17	28.50	24.10	24.13	24.17	
EDGE 1 Tx Limit	25.38	25.45	25.49	26.80	18.38	18.46	18.46	
EDGE 2 Tx Limit	23.85	23.86	23.86	24.92	17.85	17.85	17.85	
EDGE 3 Tx Limit	22.84	22.85	23.00	23.80	18.58	18.59	18.74	
EDGE 4 Tx Limit	22.18	22.21	22.40	23.20	18.18	18.21	18.40	

Channel	Band Average Power (dBm)			Tuneup Limit (dBm)	Frame Average Power (dBm)			Tuneup Limit (dBm)
	852	861	860		852	861	860	
TX Channel	31.99	31.99	31.91	31.92	31.99	31.91	31.92	
Frequency (MHz)	31.52	31.52	31.61	32.80	32.52	32.63	32.61	
OPRS 1 Tx Limit	31.50	31.50	31.50	32.80	32.50	32.50	32.50	
OPRS 2 Tx Limit	28.04	28.58	28.50	30.30	18.94	19.58	20.10	
OPRS 3 Tx Limit	26.26	26.10	26.30	27.80	20.00	20.25	21.00	
OPRS 4 Tx Limit	25.14	25.22	25.28	26.50	20.88	20.58	21.02	
EDGE 1 Tx Limit	24.81	24.78	24.78	25.80	15.81	15.78	15.78	
EDGE 2 Tx Limit	24.63	24.52	24.71	25.20	15.83	15.52	15.71	
EDGE 3 Tx Limit	23.49	23.55	23.59	24.70	17.49	17.55	17.59	
EDGE 4 Tx Limit	22.47	22.51	22.56	23.60	18.21	18.28	18.34	
EDGE 4 Tx Limit	21.37	21.60	21.27	22.60	18.37	18.69	18.27	

Channel	Band	WCDMA E			WCDMA IV			WCDMA V			Tuneup Limit (dBm)
		9582	9580	9588	11212	11210	11211	11222	11220	11221	
TX Channel	9602	9602	9600	9606	11212	11210	11211	11222	11220	11221	4230
Frequency (MHz)	1121.4	1121.4	1121.7	1121.4	1121.4	1121.6	1121.6	1121.4	1121.4	1121.4	4400
ISPP Ref #1	HMV 12.2600	23.80	23.83	23.82	24.80	23.81	23.70	23.73	24.80	23.52	23.59
ISPP Ref #2	HMC 14.2600	23.82	23.87	23.85	24.80	23.81	23.70	23.73	24.80	23.52	23.59
ISPP Ref #3	HMPA Subcell-1	22.80	22.72	22.86	23.80	22.82	22.88	22.70	23.80	22.58	22.68
ISPP Ref #4	HMPA Subcell-2	22.37	22.73	22.65	23.80	22.62	22.70	22.70	23.80	22.54	22.81
ISPP Ref #5	HMPA Subcell-3	22.15	22.20	22.15	23.30	22.17	22.19	22.30	22.09	22.14	22.14
ISPP Ref #6	HMPA Subcell-4	22.15	22.21	22.21	23.30	22.13	22.23	22.24	23.30	22.03	22.14
ISPP Ref #7	DCH/DPD Subcell-1	22.48	22.53	22.44	23.80	22.45	22.54	23.80	22.38	22.48	22.52
ISPP Ref #8	DCH/DPD Subcell-2	22.78	22.48	22.48	23.80	22.42	22.51	22.56	23.80	22.38	22.39
ISPP Ref #9	DCH/DPD Subcell-3	21.93	22.04	21.96	23.30	21.94	21.99	22.02	23.30	21.88	21.91
ISPP Ref #10	DCH/DPD Subcell-4	21.67	21.68	21.67	23.30	21.64	21.69	21.67	23.30	21.78	21.68
ISPP Ref #11	HSPA Subcell-1	22.63	22.71	22.70	23.80	22.61	22.71	22.69	23.80	22.67	22.64
ISPP Ref #12	HSPA Subcell-2	21.66	21.74	21.68	22.80	21.63	21.75	21.71	21.80	20.62	20.68
ISPP Ref #13	HSPA Subcell-3	19.86	19.91	19.91	21.80	20.69	20.69	20.69	21.80	21.54	21.61
ISPP Ref #14	HSPA Subcell-4	20.44	20.52	20.48	21.80	21.24	21.30	21.28	21.80	20.58	20.61
ISPP Ref #15	HSPA Subcell-5	22.60	22.70	22.60	23.80	22.60	22.70	22.70	23.80	22.60	22.70
ISPP Ref #16	HSPA Subcell-6	20.87	20.90	20.91	22.30	21.19	21.22	21.13	22.30	20.28	20.29

Channel	Band	CDMA BCS			CDMA BCI			CDMA BCS			Tuneup Limit (dBm)
		1013	1011	1017	1013	1011	1017	1013	1011	1017	
TX Channel	1013	1013	1011	1017	1013	1011	1017	1013	1011	1017	4230
Frequency (MHz)	863.2	863.2	863.3	863.3	863.2	863.0	863.2	863.2	863.0	863.2	4400
ISPP Ref #1	BCI 8055	23.43	23.60	23.15	24.80	23.49	23.05	23.55	24.80	23.44	23.49
ISPP Ref #2	BCS 8055	23.42	23.60	23.14	24.80	23.48	23.01	23.54	24.80	23.41	23.44
ISPP Ref #3	BCS 8055 (P-SCF)	22.41	23.53	23.13	24.80	23.48	23.01	23.52	24.80	23.40	23.41
ISPP Ref #4	BCI 8055 (P-SCF)	23.33	23.43	23.12	24.80	23.49	23.00	23.44	24.80	23.33	23.31
ISPP Ref #5	BCS 8055	23.43	23.61	23.11	24.80	23.51	23.07	23.53	24.80	23.39	23.42
ISPP Ref #6	BCS 8055	23.43	23.56	23.10	24.80	23.49	23.06	23.51	24.80	23.37	23.41



Reduced power for Hotspot on-LAT

CDMA1X		Burst Average Power (dBm)			Frame Average Power (dBm)		
TX Channel	815	865	915	Level	815	865	915
Frequency (MHz)	1892.2	1892	1908.8	(dBm)	1892.2	1892	1908.8
OPRS 1 Tx. Ant	27.53	27.50	27.52	28.70	18.53	18.50	18.62
OPRS 2 Tx. Ant	25.07	24.80	25.03	26.20	19.07	18.86	19.03
OPRS 3 Tx. Ant	23.44	23.71	23.83	24.92	19.78	19.69	19.97
OPRS 4 Tx. Ant	22.09	22.50	22.08	23.40	19.09	19.05	19.08
EDGE 1 Tx. Ant	22.70	22.21	22.70	24.21	18.10	18.23	18.56
EDGE 2 Tx. Ant	22.80	22.14	22.22	23.31	18.59	18.14	18.22
EDGE 3 Tx. Ant	21.06	21.11	21.18	22.00	18.80	18.85	18.92
EDGE 4 Tx. Ant	19.78	19.81	20.02	21.00	18.76	18.93	19.00

Band		MCMA II			MCMA IV		
TX Channel	960	960	968	Level	1412	1413	1413
Frequency (MHz)	1824	1888	1867.6	(dBm)	1715.4	1724.8	1725.6
ISPP Rule 0	18.31	18.36	18.34	19.40	18.65	18.76	18.82
ISPP Rule 1	18.33	18.35	18.36	19.40	18.66	18.80	18.84
ISPP Rule 2	17.34	17.44	17.30	18.40	17.80	17.78	17.81
ISPP Rule 3	17.06	17.41	17.30	18.40	17.60	17.80	17.81
ISPP Rule 4	18.86	18.61	18.86	17.60	17.20	17.27	17.30
ISPP Rule 5	18.86	18.66	18.82	17.80	17.40	17.43	17.58
ISPP Rule 6	17.19	17.24	17.15	18.40	17.50	17.55	17.65
ISPP Rule 7	18.87	17.20	17.19	18.40	17.49	17.61	17.67
ISPP Rule 8	18.44	18.75	18.87	17.80	17.01	17.09	17.13
ISPP Rule 9	18.88	18.80	18.78	17.60	17.81	17.59	17.18
ISPP Rule 10	17.18	17.42	17.41	18.40	17.60	17.61	17.80
ISPP Rule 11	18.37	18.41	18.39	17.40	18.70	18.65	18.82
ISPP Rule 12	14.51	14.60	14.62	18.40	18.86	18.70	18.80
ISPP Rule 13	15.10	15.21	15.19	18.60	18.31	18.40	18.50
ISPP Rule 14	17.31	17.41	17.31	18.40	17.87	17.80	17.81
ISPP Rule 15	19.58	18.61	18.62	18.00	18.26	18.32	18.44

Band		CDMA1X			CDMA2000			CDMA2000			
TX Channel	1013	964	777	Level	476	580	684	Level	476	580	684
Frequency (MHz)	2212	2212	2212	(dBm)	19.84	19.92	19.89	(dBm)	19.84	19.92	19.89
RCI 0005	22.23	22.50	22.04	23.60	19.82	19.60	19.87	20.00	22.14	22.14	22.07
RCI 0006	22.23	22.50	22.04	23.60	19.81	19.60	19.86	20.00	22.10	22.11	22.04
RCI 0007	22.13	22.21	22.02	23.60	19.80	19.67	19.84	20.00	22.03	22.07	22.01
RTAP 0008	22.23	22.50	22.04	23.60	19.78	19.64	19.81	20.00	22.09	22.12	22.07
RTAP 0009	22.23	22.50	22.00	23.60	19.76	19.64	19.81	20.00	22.07	22.11	22.05



Reduced power for Sensor on-LAT

Band	VODMA-B			Turn-up	VODMA-IV			Turn-up
	2982	3000	3038		3112	3132	3152	
TX Channel	5662	5600	5608	Limit	1517	1638	1738	Limit
Frequency (MHz)	112.4	1100	1107.8	(dBm)	17.024	17.024	17.024	
JOPF Pwr (W)	19.45	19.22	19.22	20.00	19.41	19.26	19.26	21.00
JOPF Pwr (W)	RMC 12.20db	19.70	19.25	19.87	20.00	19.84	20.00	20.01
JOPF Pwr (W)	HEOPA Subsite-1	18.71	18.81	18.70	19.00	18.85	18.98	18.98
JOPF Pwr (W)	HEOPA Subsite-2	18.45	18.81	18.87	19.00	18.85	19.00	18.98
JOPF Pwr (W)	HEOPA Subsite-3	18.23	18.28	18.37	18.40	18.36	18.47	18.50
JOPF Pwr (W)	HEOPA Subsite-4	18.23	18.20	18.23	18.40	18.36	18.53	18.50
JOPF Pwr (W)	DC-HEOPA Subsite-1	18.56	18.81	18.46	19.00	18.86	18.75	18.82
JOPF Pwr (W)	DC-HEOPA Subsite-2	18.24	18.57	18.50	19.00	18.85	18.81	18.84
JOPF Pwr (W)	DC-HEOPA Subsite-3	18.01	18.10	17.88	18.40	18.17	18.20	18.30
JOPF Pwr (W)	DC-HEOPA Subsite-4	18.05	18.27	18.00	18.40	18.17	18.20	18.30
JOPF Pwr (W)	HEOPA Subsite-1	18.71	18.79	18.72	18.60	18.84	18.61	18.97
JOPF Pwr (W)	HEOPA Subsite-2	17.74	17.80	17.70	18.00	17.86	18.00	17.99
JOPF Pwr (W)	HEOPA Subsite-3	18.04	18.00	18.00	17.00	18.85	18.00	18.07
JOPF Pwr (W)	HEOPA Subsite-4	18.82	18.60	18.80	17.00	17.47	17.60	17.59
JOPF Pwr (W)	HEOPA Subsite-5	18.88	18.78	18.82	18.00	18.83	18.00	18.08
JOPF Pwr (W)	HEOPA (150MHz) Subsite-1	18.95	17.04	18.93	18.40	17.42	17.52	17.41

Band	COMA-B/C1			Turn-up
	25	800	1175	
TX Channel	1851.25	1880	1868.75	Limit
Frequency (MHz)	20.45	20.53	20.49	21.60
RCS BOSS	20.44	20.51	20.48	21.60
RCS BOSS (F+DCH)	20.42	20.50	20.47	21.60
RCS BOSS (F+DCH)	20.44	20.48	20.46	21.60
RETAP 150 MHz	20.39	20.48	20.44	21.60
RETAP 400MHz	20.38	20.45	20.42	21.60



Reduced power level 1/2/3/4 for Head - Ant0

Table with columns: BW (MHz), Modulation, RB Size, RB Offset, Channel, Power Low/High, Mode, Peak High/Max, Tune-up (dB), and MPR (dB). It lists channel parameters for Part 24E across various modulation schemes and RB sizes.

Table with columns: BW (MHz), Modulation, RB Size, RB Offset, Channel, Power Low/High, Mode, Peak High/Max, Tune-up (dB), and MPR (dB). It lists channel parameters for Band 66 across various modulation schemes and RB sizes.



CA_66C											
Combination 20MHz+20MHz (100RB+100RB)											
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	Target MPR Level (dB)	Power Reduction	Measured Power (dBm)	Tune up Power (dBm)
			RB Size	RB offset	RB Size	RB offset					
132072	132270	QPSK	1	0	0	0	1	0	Full	22.25	22.80
132322	132124	QPSK	1	0	0	0	1	0	Full	22.34	22.80
132572	132374	QPSK	1	0	0	0	1	0	Full	22.24	22.80
132072	132270	QPSK	50	0	0	0	1	0	Full	21.42	21.80
132322	132124	QPSK	50	0	0	0	1	0	Full	21.52	21.80
132572	132374	QPSK	50	0	0	0	1	0	Full	21.35	21.80
132072	132270	QPSK	100	0	0	0	1	0	Full	21.42	21.80
132322	132124	QPSK	100	0	0	0	1	0	Full	21.35	21.80
132572	132374	QPSK	100	0	0	0	1	0	Full	21.36	21.80
132072	132270	QPSK	1	0	0	0	1	0	Reduced	18.14	19.20
132322	132124	QPSK	1	0	0	0	1	0	Reduced	18.23	19.20
132572	132374	QPSK	1	0	0	0	1	0	Reduced	18.17	19.20
132072	132270	QPSK	50	0	0	0	1	0	Reduced	19.72	20.50
132322	132124	QPSK	50	0	0	0	1	0	Reduced	19.76	20.50
132572	132374	QPSK	50	0	0	0	1	0	Reduced	19.71	20.50

CA_41C-Class 3											
Combination 20MHz+20MHz (100RB+100RB)											
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	Target MPR Level (dB)	Power Reduction	Measured Power (dBm)	Tune up Power (dBm)
			RB Size	RB offset	RB Size	RB offset					
39790	39988	QPSK	1	49	0	0	1	0	Full	22.55	23.80
39750	39948	QPSK	1	49	0	0	1	0	Full	22.55	23.80
40185	39987	QPSK	1	49	0	0	1	0	Full	22.68	23.80
40620	40422	QPSK	1	49	0	0	1	0	Full	22.64	23.80
41055	40857	QPSK	1	49	0	0	1	0	Full	22.65	23.80
41490	41292	QPSK	1	49	0	0	1	0	Full	22.57	23.80
39790	39988	QPSK	50	50	0	0	1	0	Full	21.62	22.80
39750	39948	QPSK	50	50	0	0	1	0	Full	21.59	22.80
40185	39987	QPSK	50	50	0	0	1	0	Full	21.76	22.80
40620	40422	QPSK	50	50	0	0	1	0	Full	21.71	22.80
41055	40857	QPSK	50	50	0	0	1	0	Full	21.73	22.80
41490	41292	QPSK	50	50	0	0	1	0	Full	21.70	22.80
39790	39988	QPSK	100	0	0	0	1	0	Full	21.58	22.80
39750	39948	QPSK	100	0	0	0	1	0	Full	21.57	22.80
40185	39987	QPSK	100	0	0	0	1	0	Full	21.74	22.80
40620	40422	QPSK	100	0	0	0	1	0	Full	21.70	22.80
41055	40857	QPSK	100	0	0	0	1	0	Full	21.65	22.80
41490	41292	QPSK	100	0	0	0	1	0	Full	21.68	22.80
39790	39988	QPSK	50	50	0	0	1	0	Reduced	20.63	21.70
39750	39948	QPSK	50	50	0	0	1	0	Reduced	20.60	21.70
40185	39987	QPSK	50	50	0	0	1	0	Reduced	20.74	21.70
40620	40422	QPSK	50	50	0	0	1	0	Reduced	20.71	21.70
41055	40857	QPSK	50	50	0	0	1	0	Reduced	20.72	21.70
41490	41292	QPSK	50	50	0	0	1	0	Reduced	20.68	21.70

