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DASY5 Validation Report for Head TSL Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.37 S/m; ε_r = 41.27; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.38, 8.38, 8.38) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

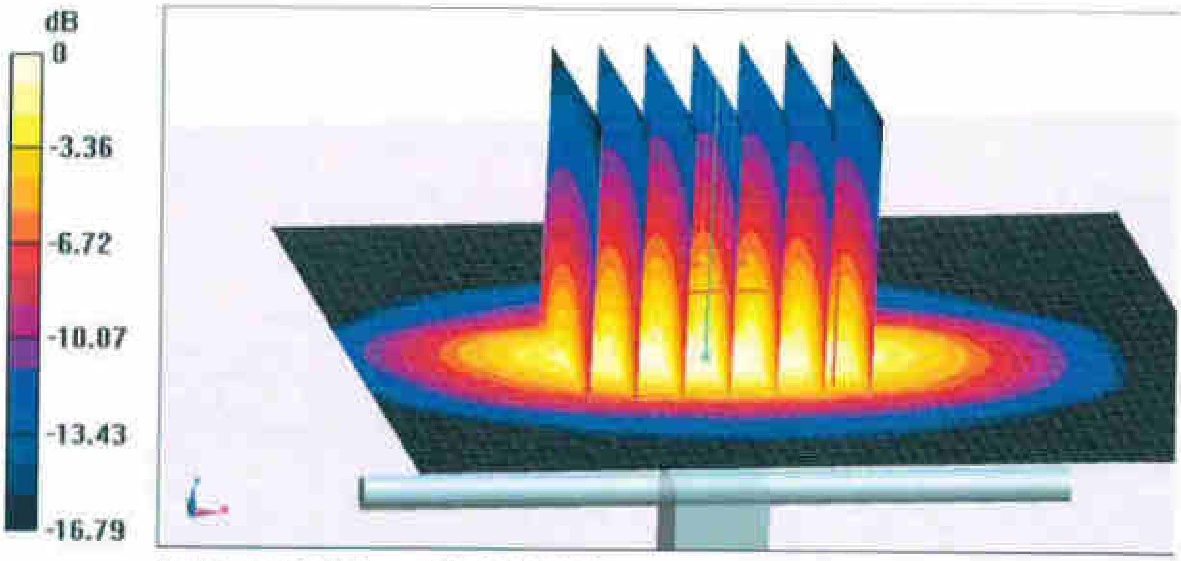
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.03 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 17.1 W/kg

SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.79 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

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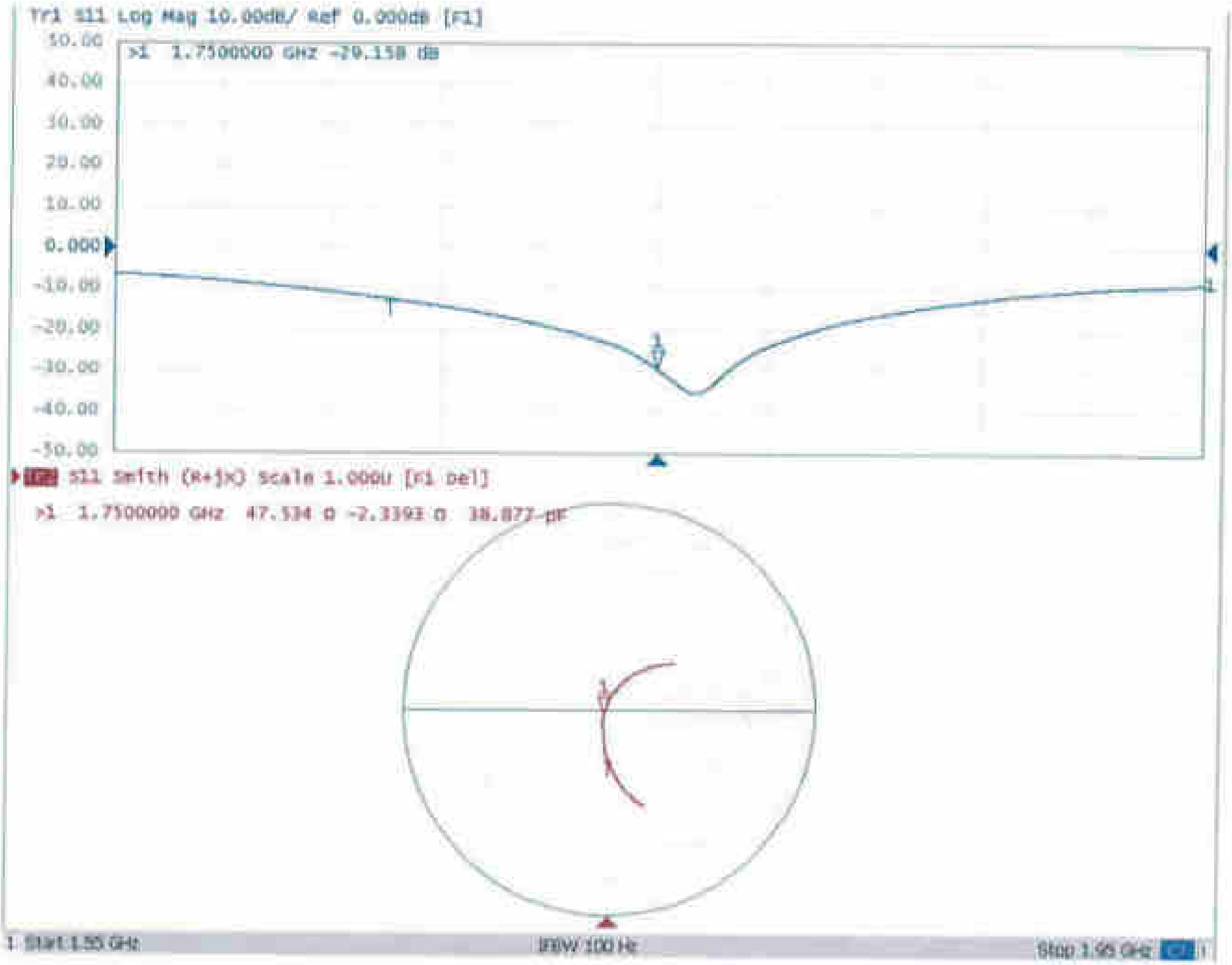
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1090

Communication System: UID 0, CW; Frequency: 1750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.449 S/m; ε_r = 54.97; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.03, 8.03, 8.03) @ 1750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

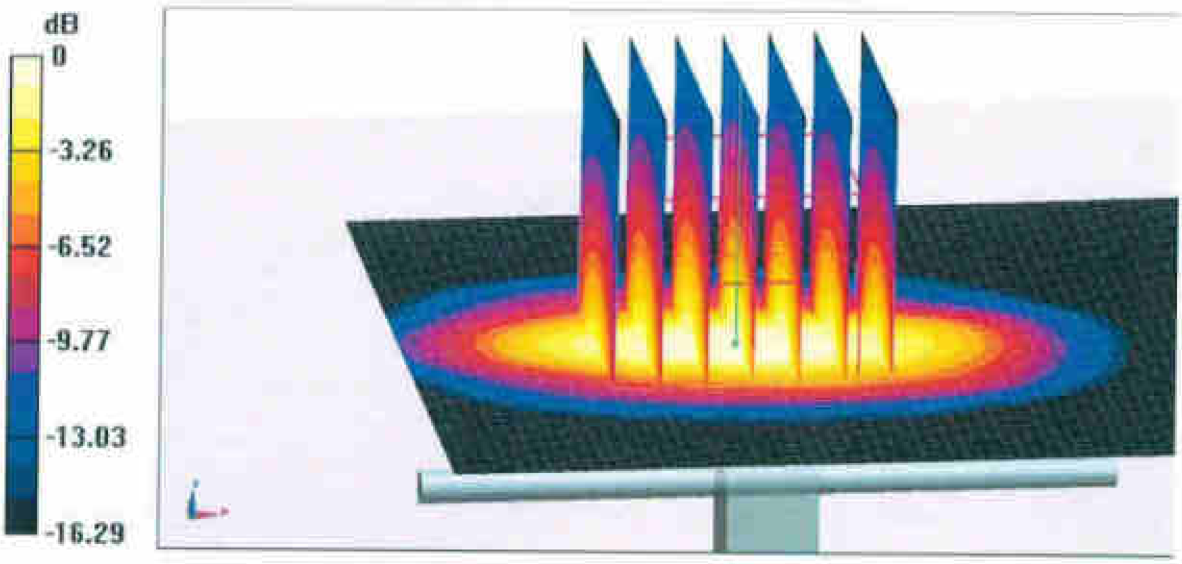
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.13 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 16.8 W/kg

SAR(1 g) = 9.21 W/kg; SAR(10 g) = 4.89 W/kg

Maximum value of SAR (measured) = 14.2 W/kg



0 dB = 14.2 W/kg = 11.52 dBW/kg

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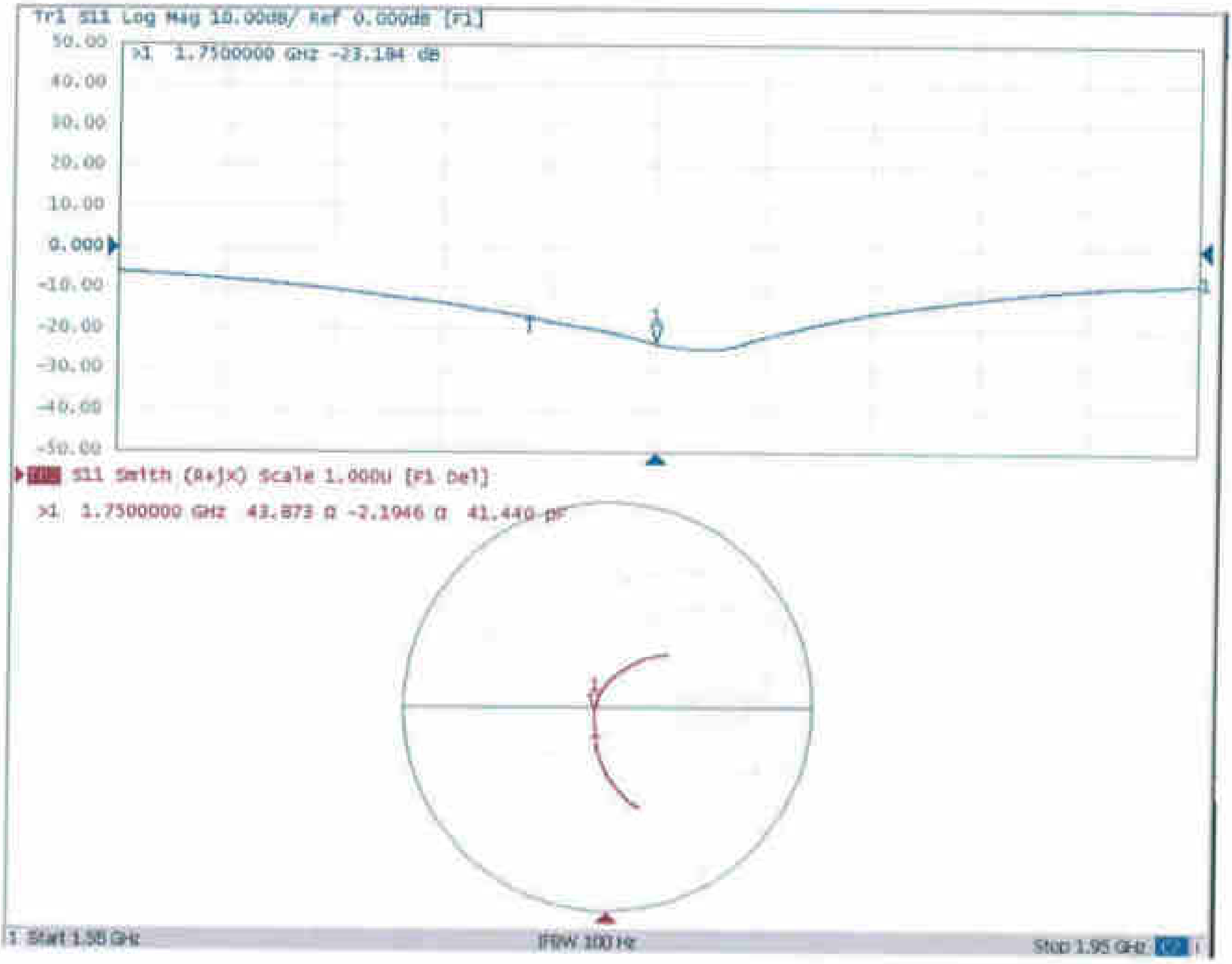
Impedance Measurement Plot for Body TSL



D1750V2, Serial No. 1090 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, 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.

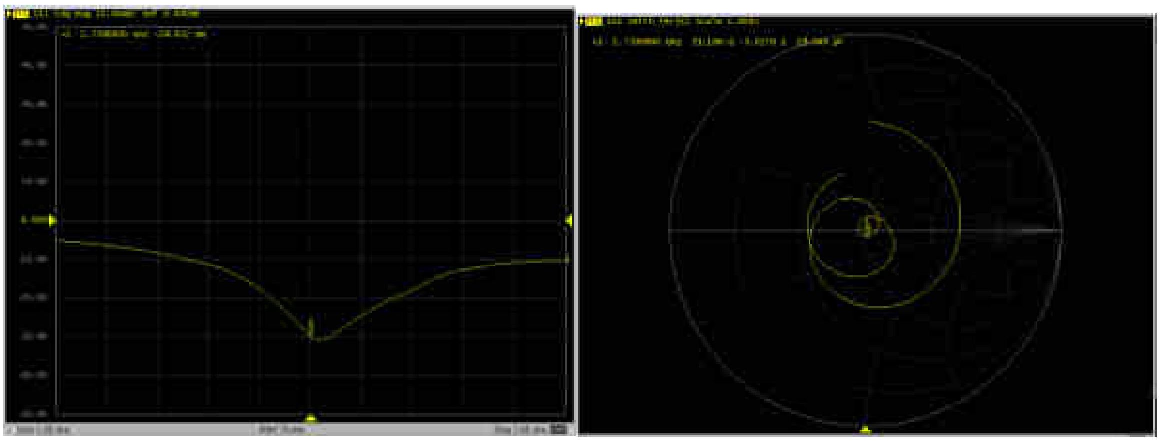
1750V2 – serial no. 1090												
	1750 Head						1750 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.27	-29.2		47.5		-2.3		-23.2		43.9		-2.2	
2020.3.26	-29.8	-0.02	51.2	-3.66	-3.0	0.70	-25.0	-0.08	45.1	-1.22	-2.17	-0.02

<Justification of the extended calibration>

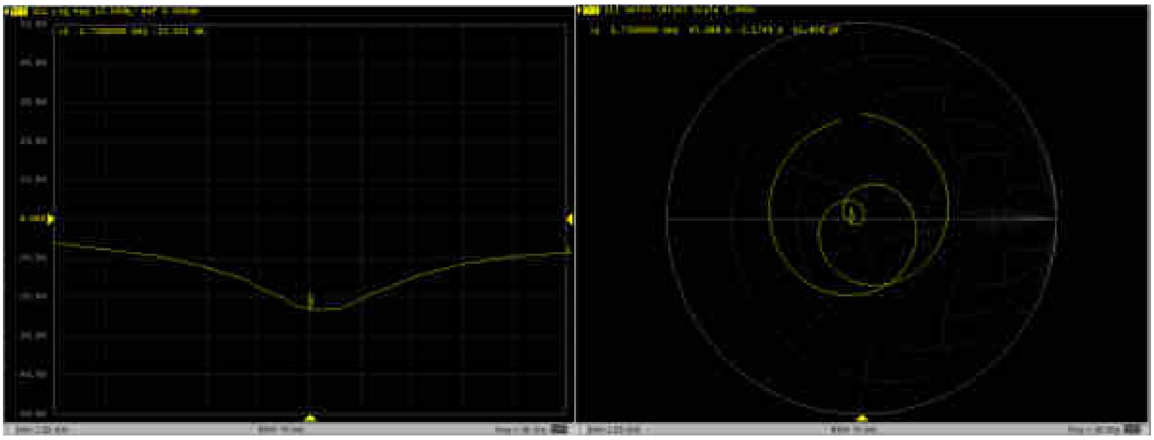
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1750V2, serial no. 1090

1750MHz – Head



1750MHz – Body



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CNAS L0570

Client **Sporton** **Certificate No: Z19-60085**

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d170
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 26, 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)℃ 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	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: March 29, 2019

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lossary:

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

Calibration is Performed According to the Following Standards:

a) 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
b) 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
c) 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
d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) 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	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.5 ± 6 %	1.44 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**39.0 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.12 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.3 W/kg ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.5 ± 6 %	1.56 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**40.0 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 6.73jΩ
Return Loss	- 23.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8Ω+ 6.72jΩ
Return Loss	- 22.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 ns

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: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.441 S/m; ε_r = 40.48; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(8.14, 8.14, 8.14) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

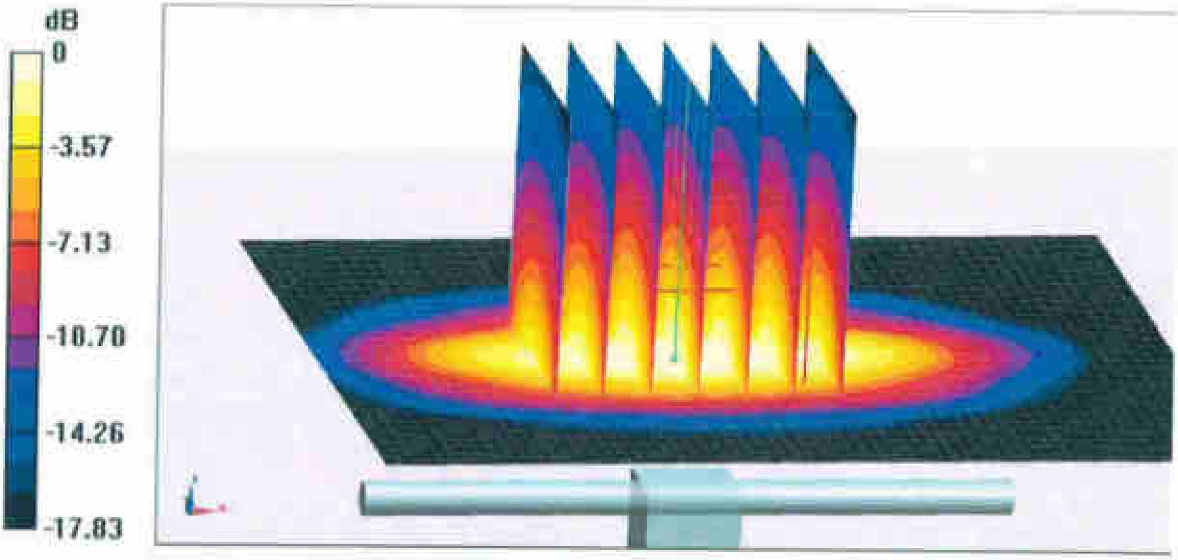
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.54 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.12 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



0 dB = 15.6 W/kg = 11.93 dBW/kg

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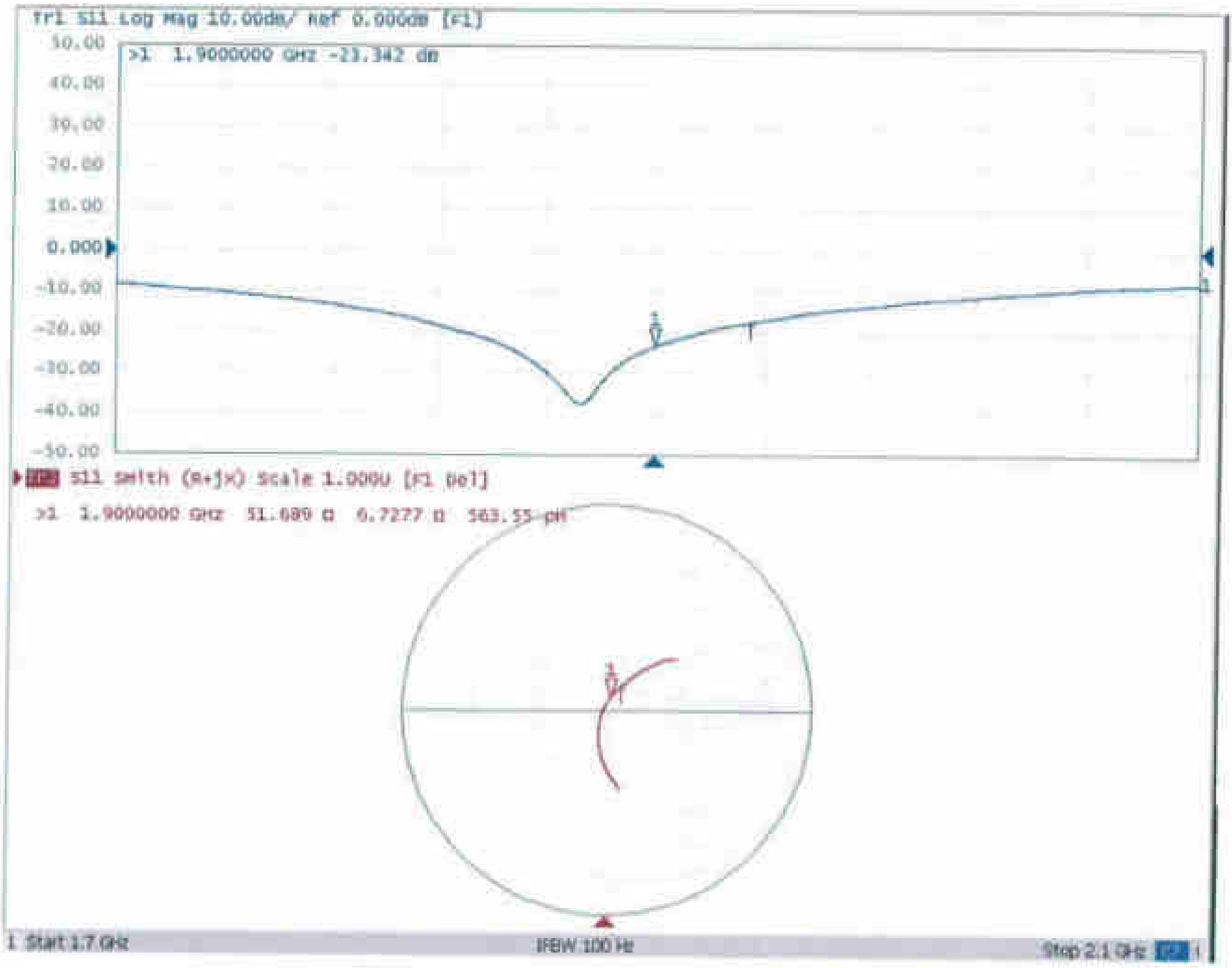
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.26.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d170

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.56 S/m; ε_r = 54.52; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.78, 7.78, 7.78) @ 1900 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

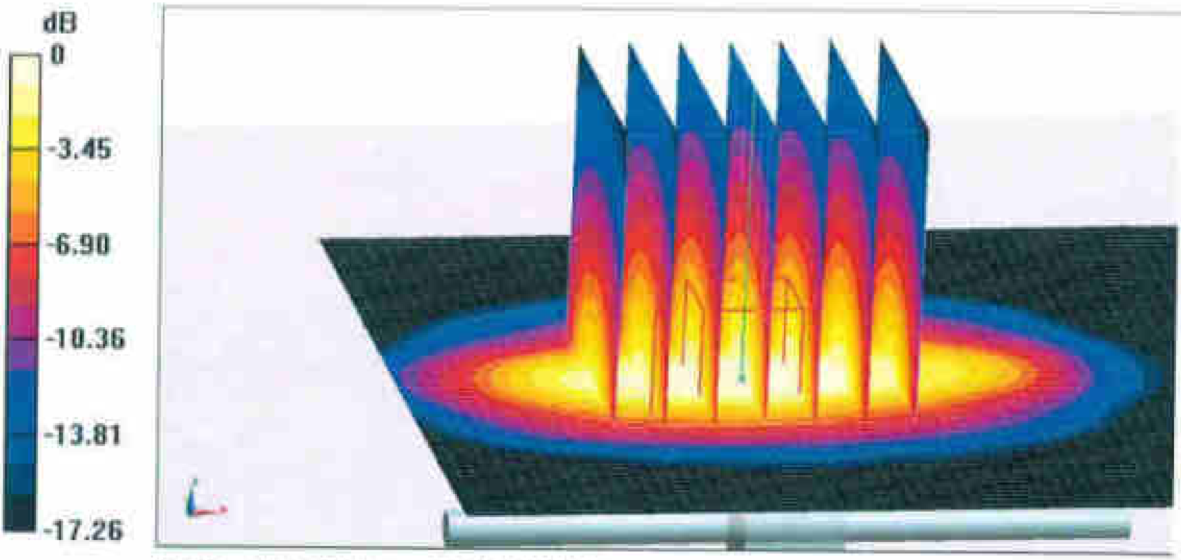
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.48 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.6 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 15.7 W/kg



0 dB = 15.7 W/kg = 11.96 dBW/kg

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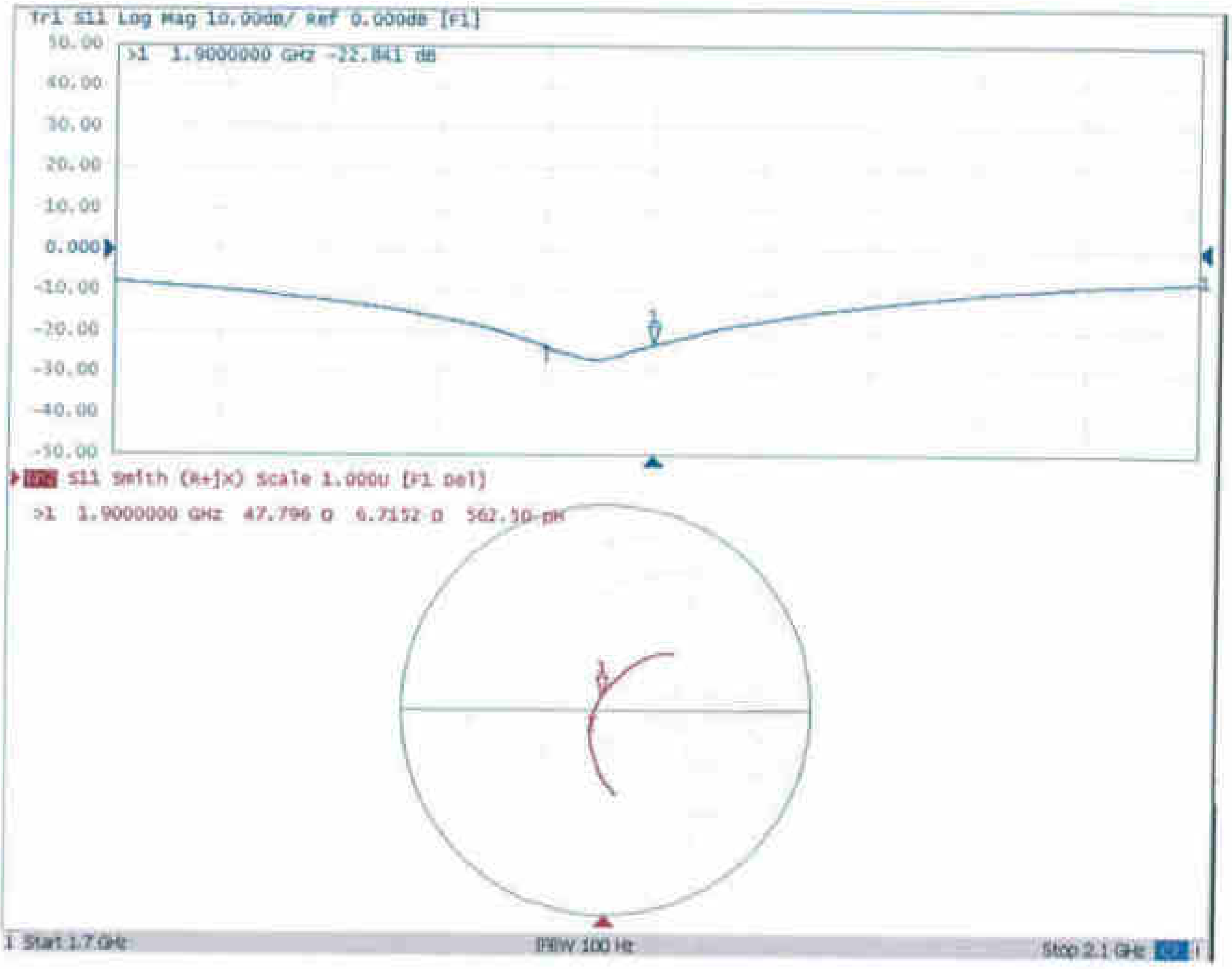
Impedance Measurement Plot for Body TSL



D1900V2, Serial No. 5d170 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, 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.

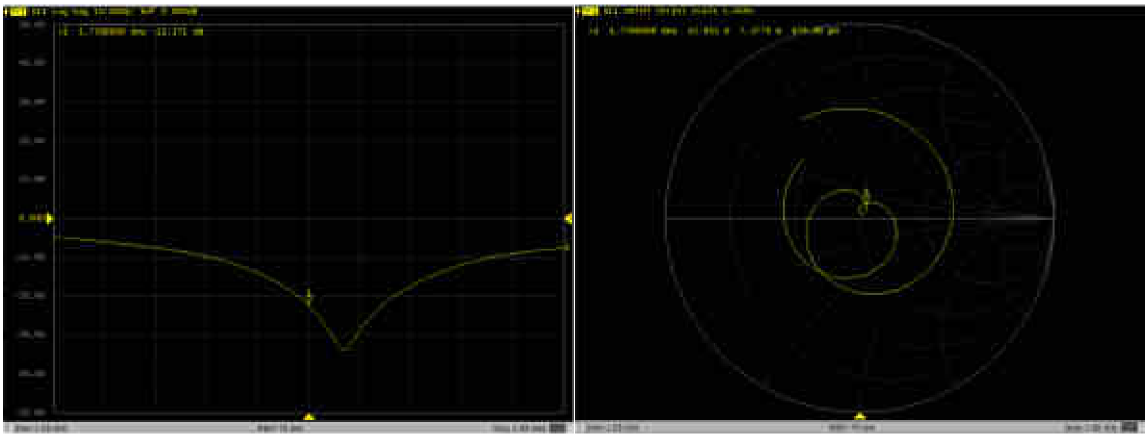
1900V2 – serial no. 5d170												
	1900 Head						1900 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.26	-23.3		51.7		6.7		-22.8		47.8		6.7	
2020.3.25	-22.3	0.05	53.0	-1.26	7.4	-0.64	-22.5	0.01	49.2	-1.37	7.41	-0.69

<Justification of the extended calibration>

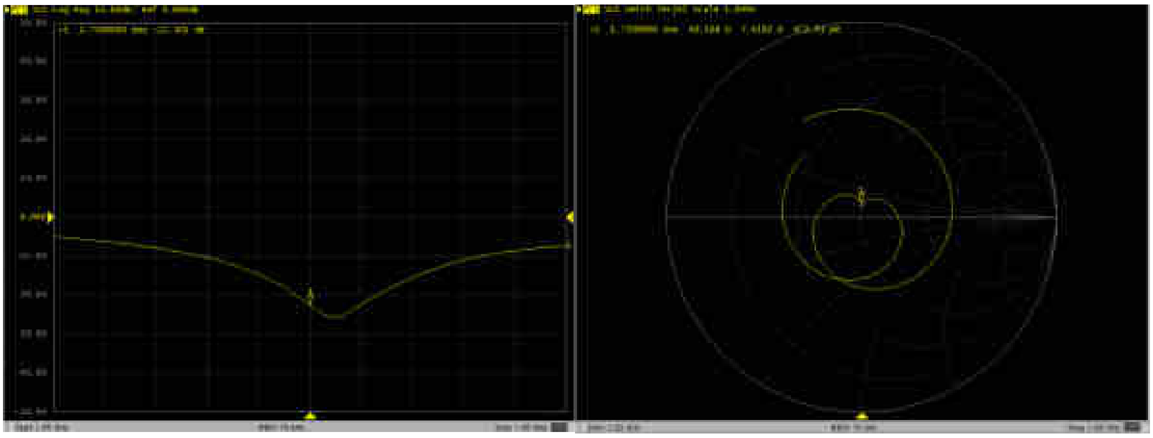
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1900V2, serial no. 5d170

1900MHz – Head



1900MHz – Body



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CNAS L0570

Client **Sporton** Certificate No: **Z19-60087**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 908
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	March 25, 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)℃ 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	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1331	06-Feb-19(SPEAG,No.DAE4-1331_Feb19)	Feb-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

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

Issued: March 28, 2019

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Glossary:

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

Calibration is Performed According to the Following Standards:

a) 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

b) 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

c) 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

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) 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	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.6 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.8 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.2 W/kg ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**50.8 W/kg ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.6 W/kg ± 18.7 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	57.3Ω+ 5.18 jΩ
Return Loss	- 21.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.6Ω+ 5.81 jΩ
Return Loss	- 24.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 ns

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: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 1.841 S/m; ε_r = 39.63; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.62, 7.62, 7.62) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

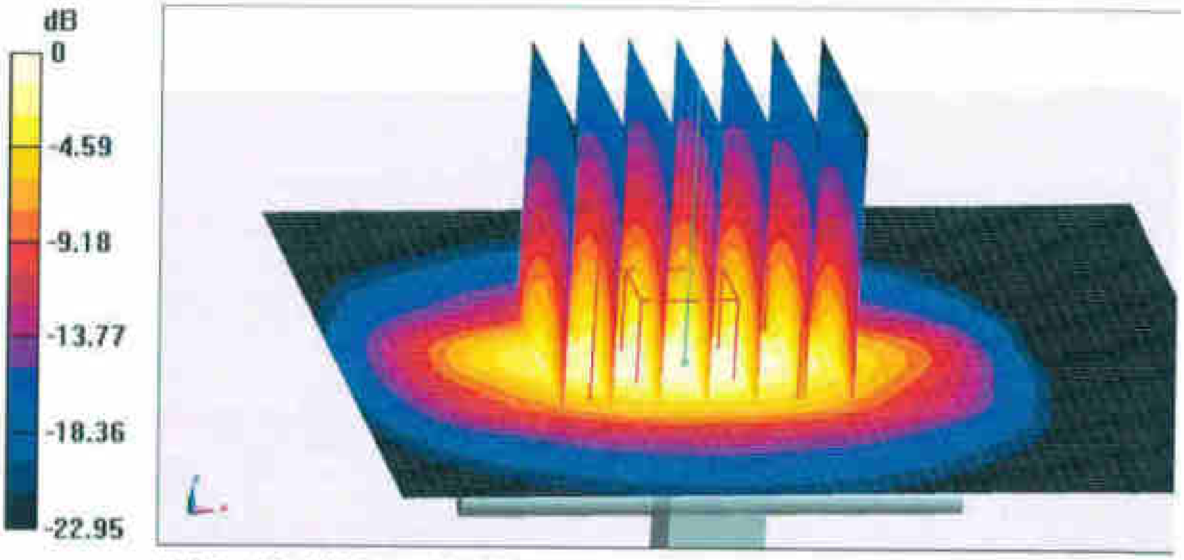
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.04 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 28.3 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.07 W/kg

Maximum value of SAR (measured) = 22.4 W/kg



0 dB = 22.4 W/kg = 13.50 dBW/kg

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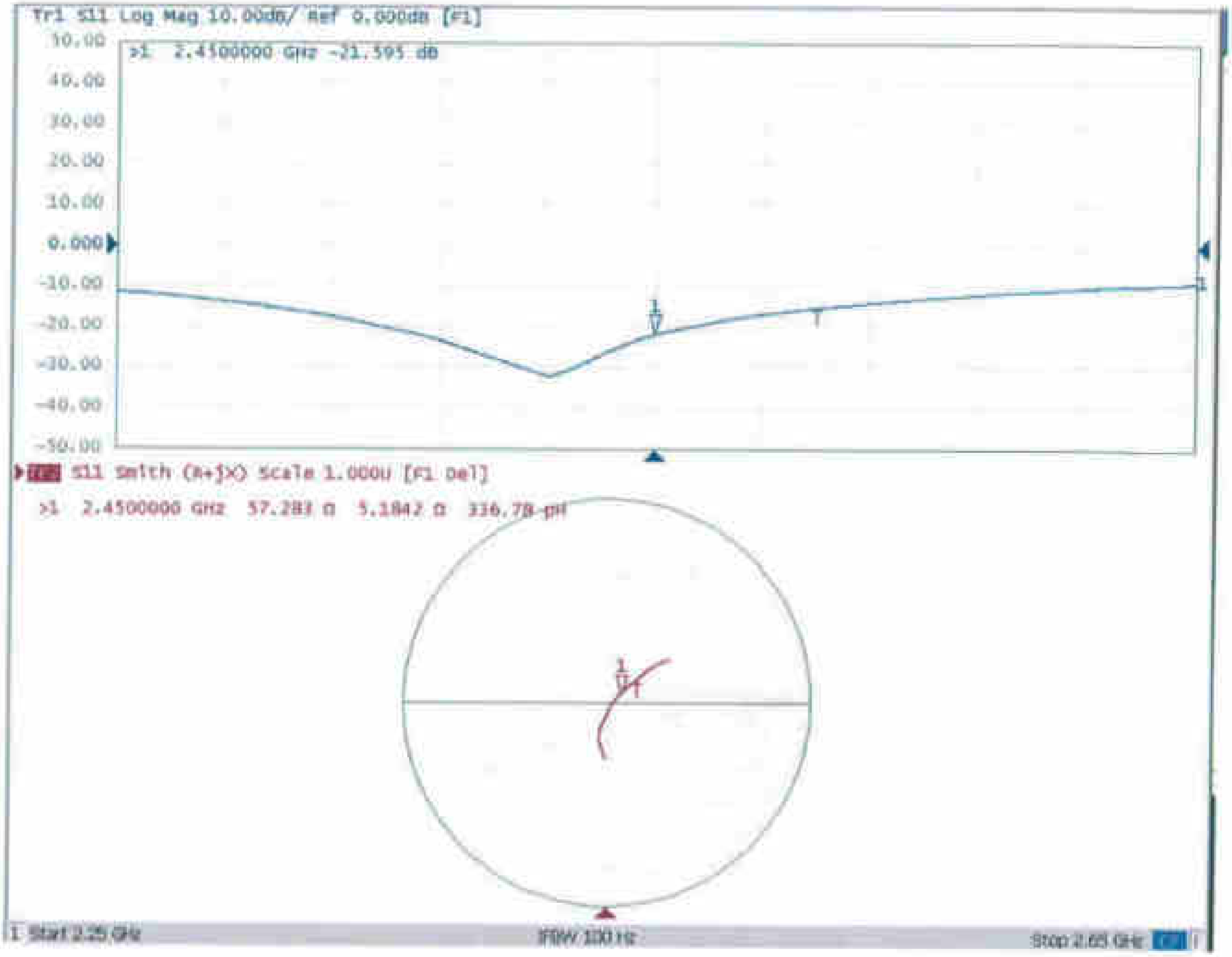
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 03.25.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 908

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: f = 2450 MHz; σ = 2.003 S/m; ε_r = 53.78; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.79, 7.79, 7.79) @ 2450 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1331; Calibrated: 2/6/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

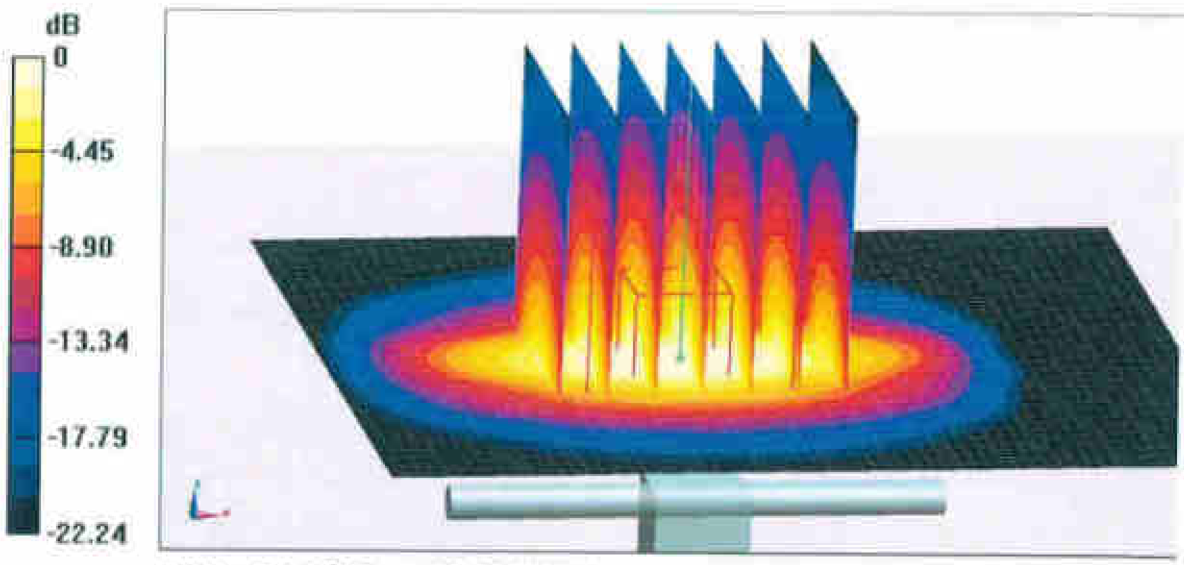
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.51 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 27.1 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.91 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

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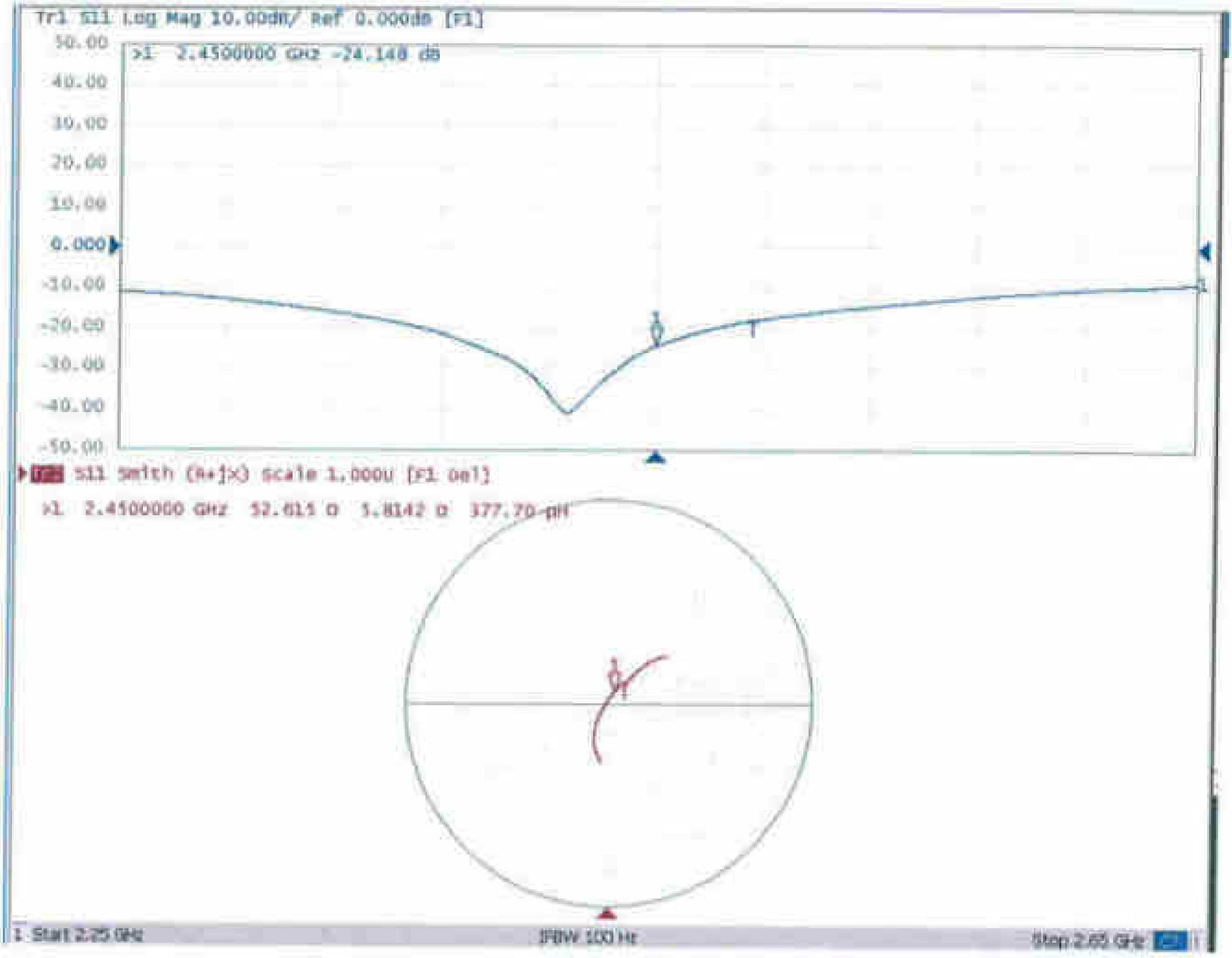
Impedance Measurement Plot for Body TSL



D2450V2, Serial No. 908 Extended Dipole Calibrations

Referring to KDB 865664 D01 v01r02, if dipoles are verified in return loss (<-20dB, 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.

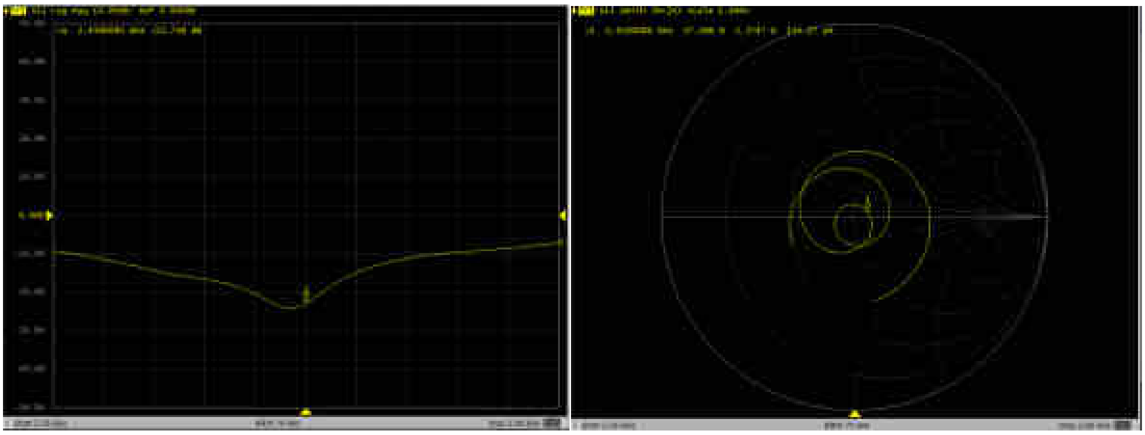
2450V2 – serial no. 908												
	2450 Head						2450 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.25	-21.6		57.3		5.2		-24.1		52.6		5.8	
2020.3.24	-22.7	-0.05	57.5	-0.18	2.4	2.81	-26.1	-0.08	55.01	-2.40	1.493	4.32

<Justification of the extended calibration>

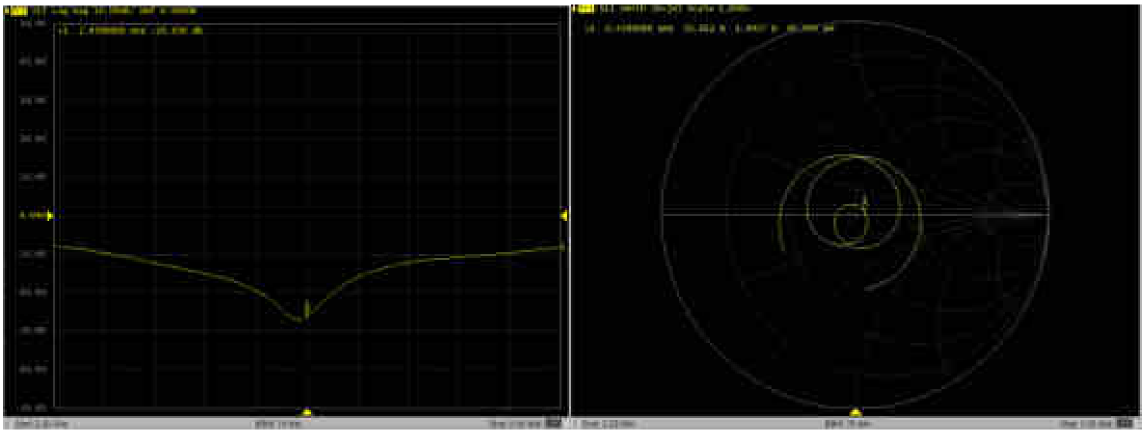
The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D2450V2, serial no. 908

2450MHz – Head



2450MHz – Body



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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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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: D5GHzV2-1128_Dec19

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1128
Calibration procedure(s)	QA CAL-22.v4 Calibration Procedure for SAR Validation Sources between 3-6 GHz
Calibration date:	December 16, 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	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (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-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 17, 2019

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:

a) 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
b) 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
c) 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
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 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	34.8 ± 6 %	4.48 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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	8.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.9 W/kg ± 19.5 % (k=2)**

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	34.3 ± 6 %	4.83 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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	8.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.6 W/kg ± 19.5 % (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	34.1 ± 6 %	4.98 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.29 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	47.7 Ω - 6.4 jΩ
Return Loss	- 23.1 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.6 Ω - 3.5 jΩ
Return Loss	- 26.3 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.3 Ω - 3.5 jΩ
Return Loss	- 28.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.208 ns

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

DASY5 Validation Report for Head TSL

Date: 16.12.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1128

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.48 S/m; ε_r = 34.8; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.83 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 4.98 S/m; ε_r = 34.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

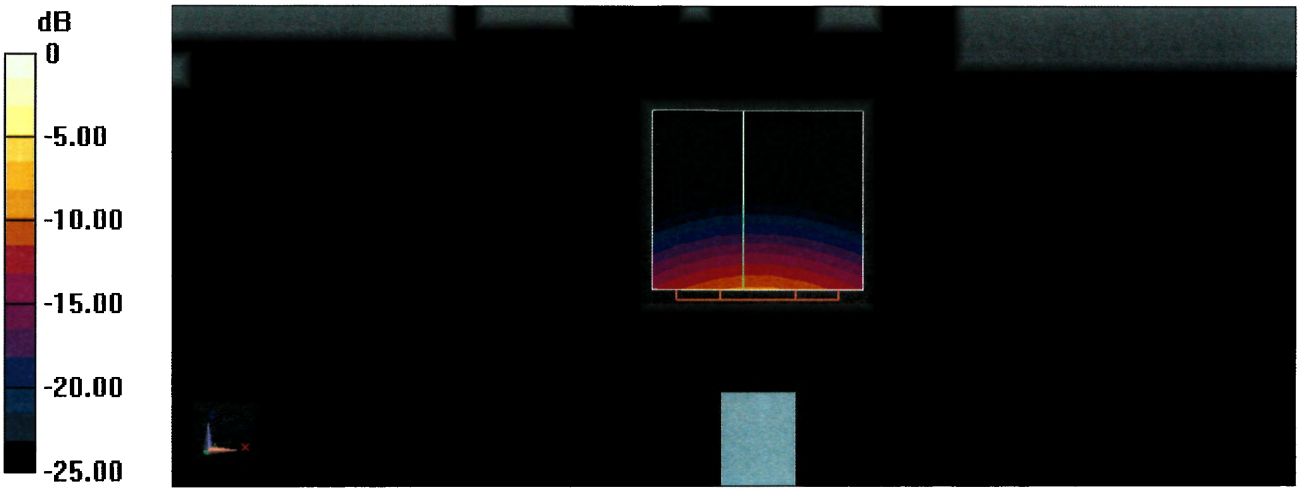
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.4, 5.4, 5.4) @ 5250 MHz, ConvF(4.95, 4.95, 4.95) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.60 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.32 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.9%
Maximum value of SAR (measured) = 18.2 W/kg

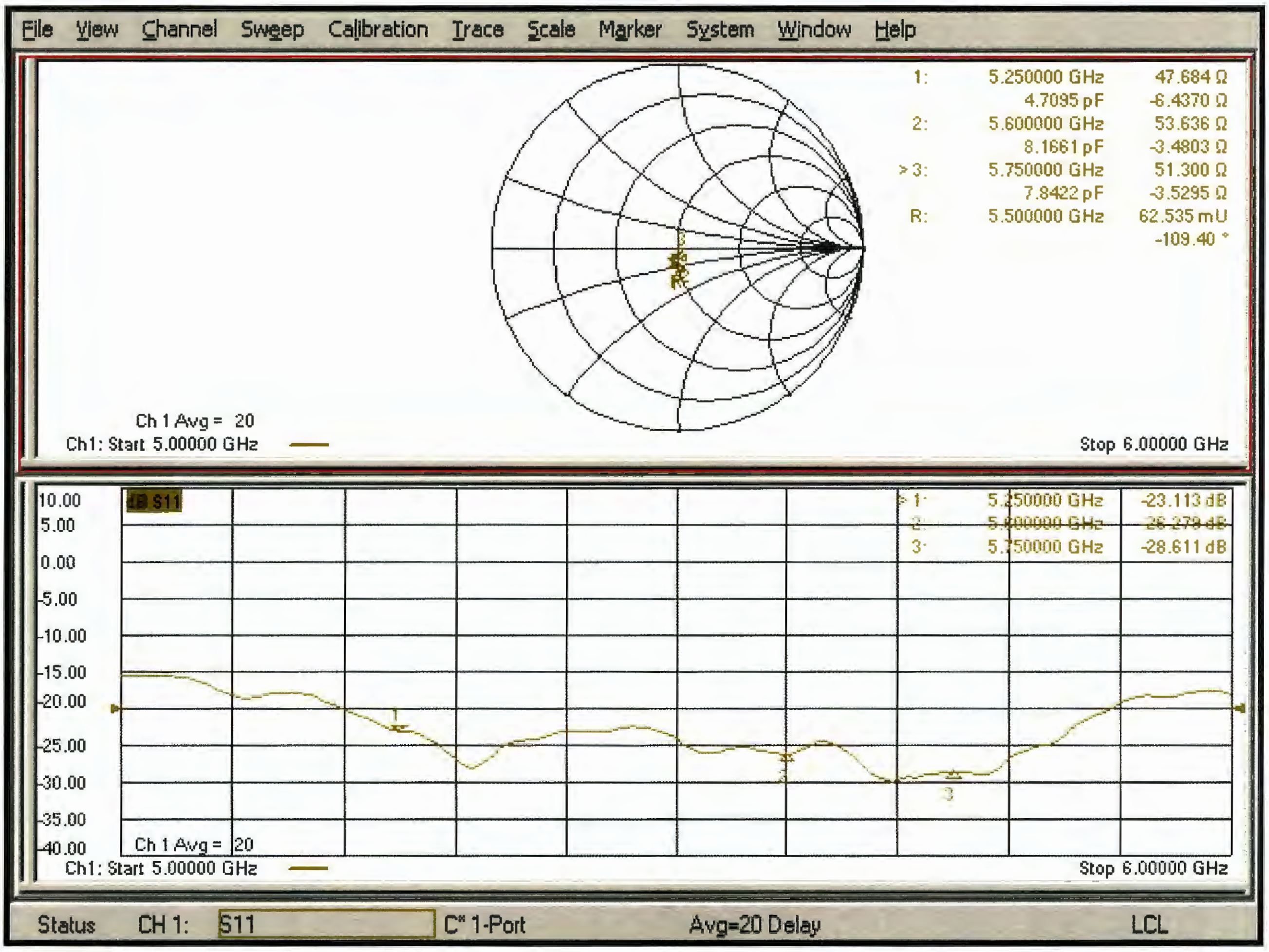
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.23 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 31.2 W/kg
SAR(1 g) = 8.32 W/kg; SAR(10 g) = 2.39 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 67.1%
Maximum value of SAR (measured) = 19.3 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.23 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 31.3 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.7%
Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.77 dBW/kg

Impedance Measurement Plot for Head TSL



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Client : **Sporton** **Certificate No: Z19-60486**

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 656
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	December 17, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	24-Jun-19 (CTTL, No.J19X05126)	Jun-20

	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: December 18, 2019

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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 report provide only calibration results for DAE, it does not contain other performance test results.

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DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , 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	404.164 ± 0.15% (k=2)	404.676 ± 0.15% (k=2)	404.945 ± 0.15% (k=2)
Low Range	3.95208 ± 0.7% (k=2)	3.96430 ± 0.7% (k=2)	3.93942 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	314° ± 1 °

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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: **EX3-3843_Sep20**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3843
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	September 23, 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
Power meter NRP	SN: 104778	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-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	[signature]

Issued: September 30, 2020

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Accreditation No.: SCS 0108

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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., ϑ = 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:

a) 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
b) 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
c) 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
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
- *DCPx,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
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,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 ≤ 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 *NORMx,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 *NORMx* (no uncertainty required).

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3843

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.34	0.36	0.26	± 10.1 %
DCP (mV)[B]	110.3	104.4	106.5	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Max dev.	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	187.4	± 2.2 %	± 4.7 %
		Y	0.0	0.0	1.0		173.2		
		Z	0.0	0.0	1.0		179.7		

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 E^2-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:3843

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	146.7
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

Note: Measurement distance from surface can be increased to 3-4 mm for an *Area Scan* job.

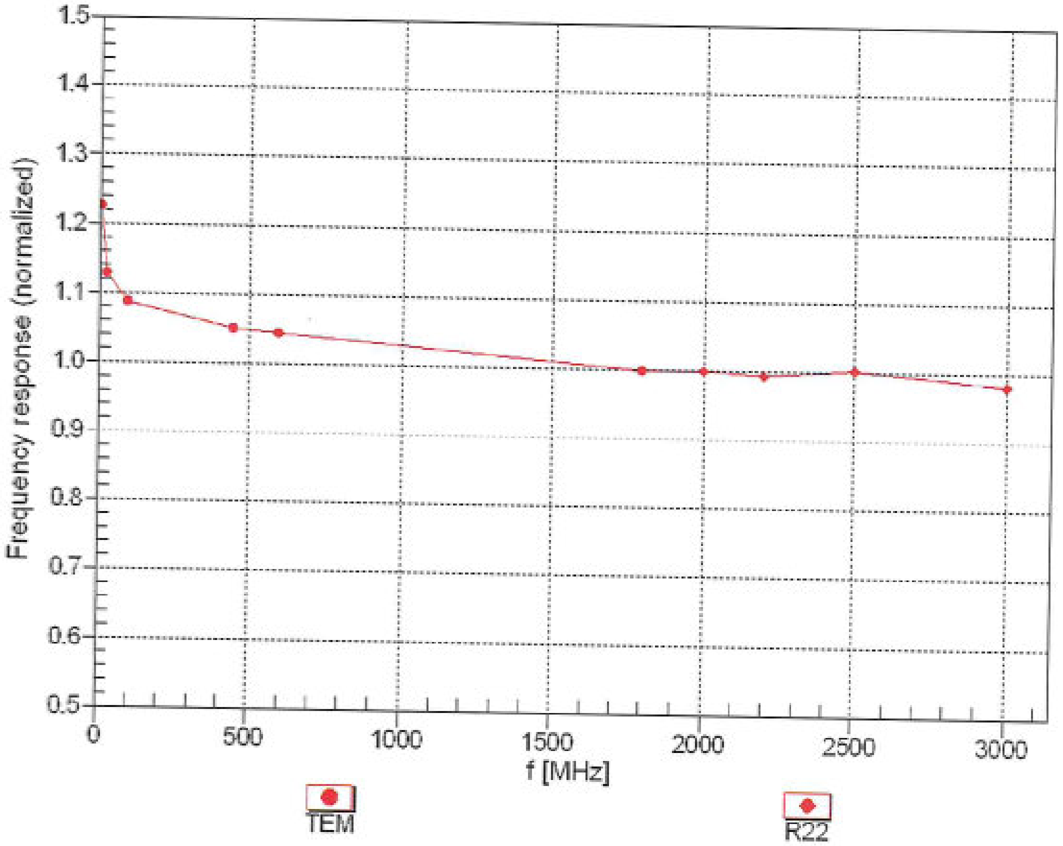
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3843

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 [G] (mm)	Unc (k=2)
750	41.9	0.89	9.06	9.06	9.06	0.36	1.11	± 12.0 %
835	41.5	0.90	8.69	8.69	8.69	0.35	1.01	± 12.0 %
900	41.5	0.97	8.62	8.62	8.62	0.41	0.96	± 12.0 %
1450	40.5	1.20	7.82	7.82	7.82	0.47	0.80	± 12.0 %
1750	40.1	1.37	7.72	7.72	7.72	0.30	0.88	± 12.0 %
1900	40.0	1.40	7.41	7.41	7.41	0.27	0.88	± 12.0 %
2000	40.0	1.40	7.39	7.39	7.39	0.32	0.88	± 12.0 %
2300	39.5	1.67	7.06	7.06	7.06	0.28	0.90	± 12.0 %
2450	39.2	1.80	6.85	6.85	6.85	0.21	0.90	± 12.0 %
2600	39.0	1.96	6.76	6.76	6.76	0.41	0.90	± 12.0 %
5250	35.9	4.71	4.66	4.66	4.66	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.30	4.30	4.30	0.40	1.80	± 13.1 %
5750	35.4	5.22	4.35	4.35	4.35	0.40	1.80	± 13.1 %

[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 below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. 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)

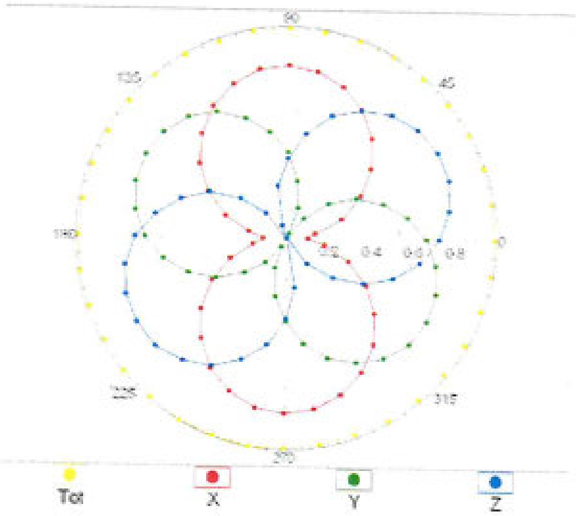


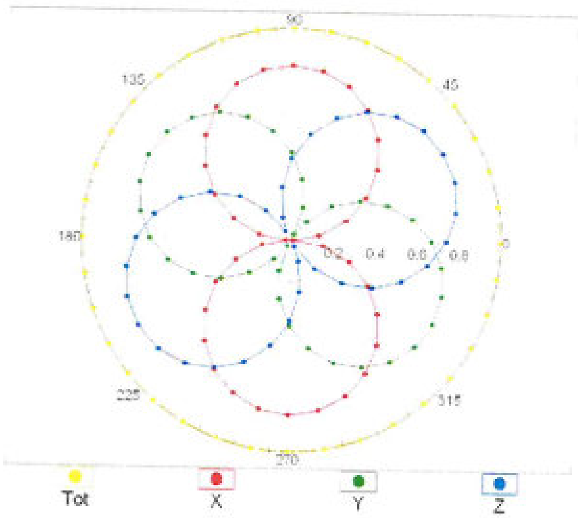
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

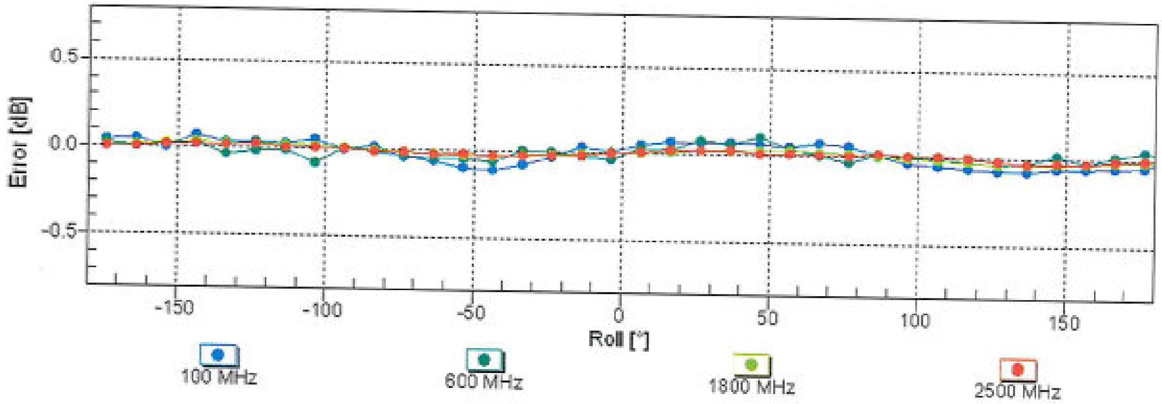
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM

f=1800 MHz,R22

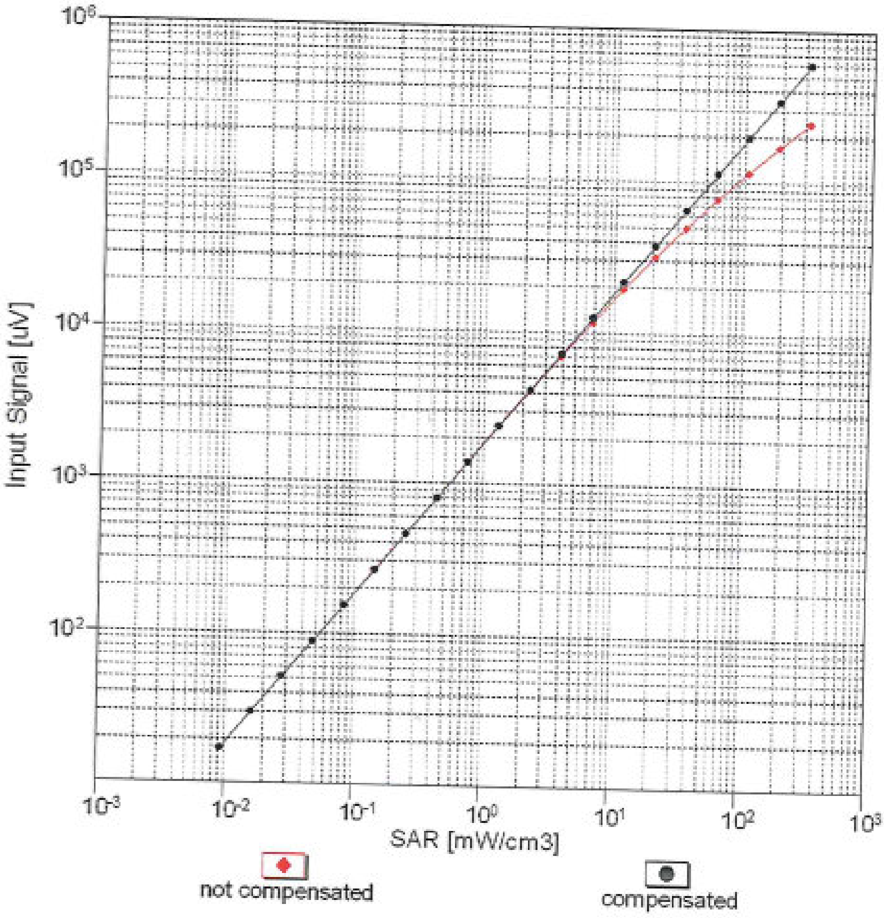


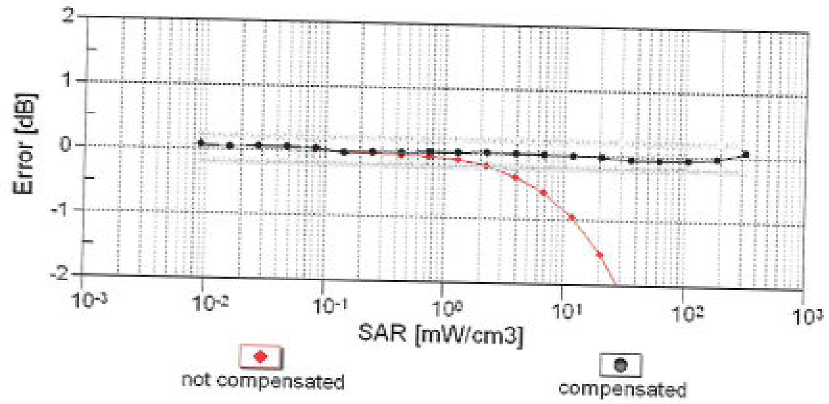




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

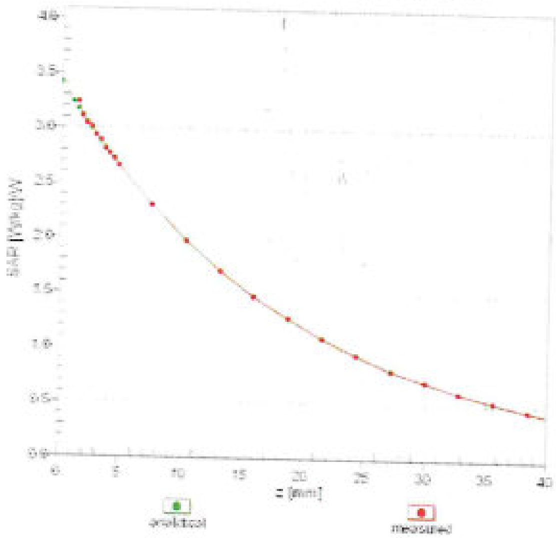




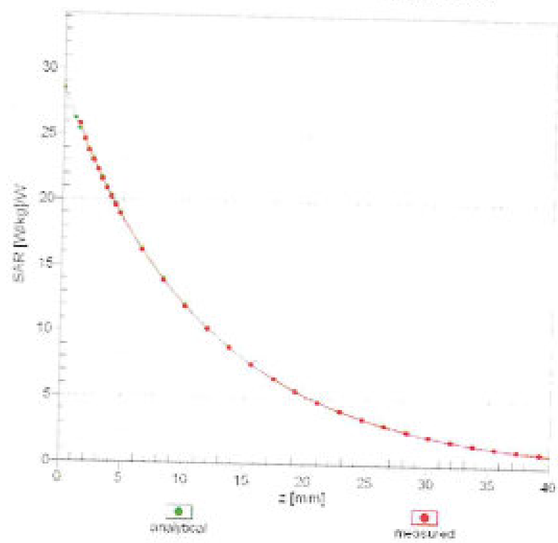
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

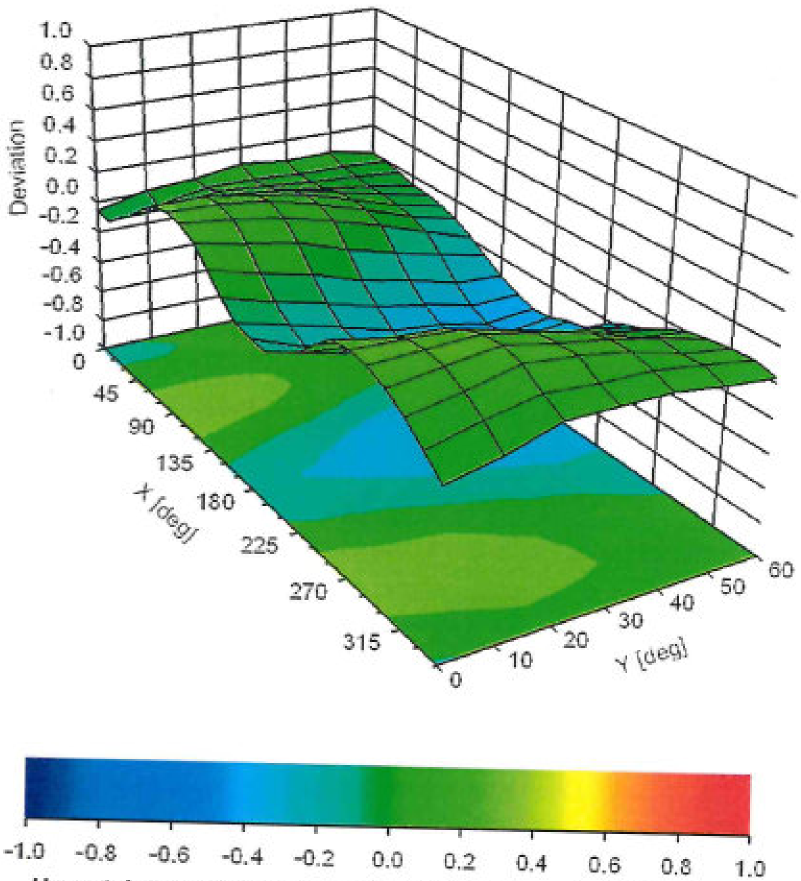


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

Appendix E. Conducted RF Output Power Table

The detailed power tables are shown as follows.

Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
TX Channel		9262	9400	9538		1312	1413	1513		4132	4182	4233	
Rx Channel		9662	9800	9938		1537	1638	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1880	1907.6		1712.4	1732.6	1752.6		826.4	836.4	846.6	
3GPP Rel 99	RMC 12.2Kbps	22.42	22.57	22.56	24.00	22.57	22.65	22.60	24.00	22.79	22.82	22.75	24.00
3GPP Rel 6	HSDPA Subtest-1	21.42	21.58	21.49	23.00	21.56	21.60	21.55	23.00	21.77	21.72	21.82	23.00
3GPP Rel 6	HSDPA Subtest-2	21.49	21.57	21.51	23.00	21.59	21.71	21.59	23.00	21.75	21.75	21.86	23.00
3GPP Rel 6	HSDPA Subtest-3	21.02	21.10	21.05	22.50	21.11	21.26	21.13	22.50	21.29	21.30	21.31	22.50
3GPP Rel 6	HSDPA Subtest-4	21.01	21.09	21.05	22.50	21.11	21.26	21.13	22.50	21.28	21.30	21.31	22.50
3GPP Rel 8	DC-HSDPA Subtest-1	21.39	21.56	21.45	23.00	21.54	21.56	21.52	23.00	21.73	21.69	21.80	23.00
3GPP Rel 8	DC-HSDPA Subtest-2	21.46	21.55	21.47	23.00	21.57	21.67	21.56	23.00	21.71	21.72	21.84	23.00
3GPP Rel 8	DC-HSDPA Subtest-3	20.99	21.08	21.01	22.50	21.09	21.22	21.10	22.50	21.25	21.27	21.29	22.50
3GPP Rel 8	DC-HSDPA Subtest-4	20.98	21.07	21.01	22.50	21.09	21.22	21.10	22.50	21.24	21.27	21.29	22.50
3GPP Rel 6	HSUPA Subtest-1	21.99	21.89	21.97	23.00	22.13	22.20	22.12	23.00	21.78	21.98	22.03	23.00
3GPP Rel 6	HSUPA Subtest-2	20.08	20.34	20.06	21.00	20.02	20.21	20.18	21.00	19.87	19.99	20.01	21.00
3GPP Rel 6	HSUPA Subtest-3	20.98	21.10	21.14	22.00	21.01	20.99	20.89	22.00	20.98	20.99	20.87	22.00
3GPP Rel 6	HSUPA Subtest-4	20.03	19.80	19.99	21.00	20.15	20.27	20.20	21.00	20.01	19.89	20.23	21.00
3GPP Rel 6	HSUPA Subtest-5	21.98	22.02	22.01	23.00	21.90	21.80	22.00	23.00	21.88	21.70	21.80	23.00

Band 2 (1900MHz Band)
Part 24E

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				18700	18900	19100		
Frequency (MHz)				1860	1880	1900		
20	QPSK	1	0	22.93	23.01	22.77	24	0
20	QPSK	1	49	22.98	22.89	22.73		
20	QPSK	1	99	22.64	22.69	22.69		
20	QPSK	50	0	21.75	21.96	21.83	23	1
20	QPSK	50	24	21.76	21.92	21.78		
20	QPSK	50	50	21.71	21.79	21.78		
20	QPSK	100	0	21.73	21.94	21.79		
20	16QAM	1	0	21.88	21.62	21.67	23	1
20	16QAM	1	49	21.88	21.88	21.77		
20	16QAM	1	99	21.87	21.89	21.76		
20	16QAM	50	0	20.68	20.90	20.67	22	2
20	16QAM	50	24	20.70	20.77	20.82		
20	16QAM	50	50	20.64	20.83	20.70		
20	16QAM	100	0	20.79	20.77	20.77		
Channel				18675	18900	19125	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1857.5	1880	1902.5		
15	QPSK	1	0	22.69	22.86	22.64	24	0
15	QPSK	1	37	22.93	22.94	22.88		
15	QPSK	1	74	22.71	22.70	22.74		
15	QPSK	36	0	21.77	21.91	21.55	23	1
15	QPSK	36	20	21.84	21.92	21.94		
15	QPSK	36	39	21.74	21.86	21.95		
15	QPSK	75	0	21.78	21.91	21.85		
15	16QAM	1	0	21.39	21.56	21.44	23	1
15	16QAM	1	37	21.33	21.51	21.40		
15	16QAM	1	74	21.24	21.41	21.29		
15	16QAM	36	0	20.73	20.88	20.71	22	2
15	16QAM	36	20	20.63	20.83	20.82		
15	16QAM	36	39	20.74	20.81	20.83		
15	16QAM	75	0	20.69	20.98	20.72		
Channel				18650	18900	19150	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1855	1880	1905		
10	QPSK	1	0	22.57	22.69	22.76	24	0
10	QPSK	1	25	22.84	22.89	22.87		
10	QPSK	1	49	22.69	22.61	22.88		
10	QPSK	25	0	21.73	22.02	21.79	23	1
10	QPSK	25	12	21.83	21.92	21.94		
10	QPSK	25	25	21.78	21.84	21.70		
10	QPSK	50	0	21.81	21.91	21.78		
10	16QAM	1	0	21.41	21.65	21.36	23	1
10	16QAM	1	25	21.47	21.73	21.56		
10	16QAM	1	49	21.27	21.46	21.43		
10	16QAM	25	0	20.80	21.04	20.77	22	2
10	16QAM	25	12	20.81	21.03	20.83		
10	16QAM	25	25	20.76	20.95	20.70		
10	16QAM	50	0	20.74	20.88	20.83		
Channel				18625	18900	19175	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1852.5	1880	1907.5		
5	QPSK	1	0	22.59	22.64	22.64	24	0
5	QPSK	1	12	22.69	22.61	22.63		
5	QPSK	1	24	22.69	22.48	22.66		
5	QPSK	12	0	21.66	21.77	21.73	23	1
5	QPSK	12	7	21.65	21.88	21.87		
5	QPSK	12	13	21.75	21.70	21.81		
5	QPSK	25	0	21.74	21.73	21.72		
5	16QAM	1	0	21.43	21.42	21.44	23	1
5	16QAM	1	12	21.09	21.42	21.41		
5	16QAM	1	24	21.29	21.35	21.35		
5	16QAM	12	0	20.61	20.76	20.64	22	2
5	16QAM	12	7	20.44	20.50	20.77		
5	16QAM	12	13	20.84	20.52	20.81		
5	16QAM	25	0	20.77	20.64	20.65		
Channel				18615	18900	19185	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1851.5	1880	1908.5		
3	QPSK	1	0	22.80	22.96	22.62	24	0
3	QPSK	1	8	22.66	22.70	22.60		
3	QPSK	1	14	22.84	22.77	22.63		
3	QPSK	8	0	21.78	21.86	21.71	23	1
3	QPSK	8	4	21.82	21.87	21.74		
3	QPSK	8	7	21.78	21.82	21.69		
3	QPSK	15	0	21.79	21.93	21.70		
3	16QAM	1	0	21.49	21.56	21.42	23	1
3	16QAM	1	8	21.41	21.87	21.41		
3	16QAM	1	14	21.41	21.61	21.45		
3	16QAM	8	0	20.73	20.82	20.75	22	2
3	16QAM	8	4	20.86	20.84	20.81		
3	16QAM	8	7	20.76	20.95	20.70		
3	16QAM	15	0	20.77	20.81	20.82		
Channel				18607	18900	19193	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1850.7	1880	1909.3		
1.4	QPSK	1	0	22.50	22.83	22.54	24	0
1.4	QPSK	1	3	22.53	22.94	22.65		
1.4	QPSK	1	5	22.63	22.75	22.56		
1.4	QPSK	3	0	22.92	22.93	22.72		
1.4	QPSK	3	1	22.75	22.87	22.80		
1.4	QPSK	3	3	22.80	23.00	22.75		
1.4	QPSK	6	0	21.71	22.01	21.80	23	1
1.4	16QAM	1	0	21.83	21.69	21.49	23	1
1.4	16QAM	1	3	21.94	21.67	21.89		
1.4	16QAM	1	5	21.78	21.63	21.73		
1.4	16QAM	3	0	21.84	22.07	21.79		
1.4	16QAM	3	1	21.87	22.19	21.79		
1.4	16QAM	3	3	21.84	22.12	21.76		
1.4	16QAM	6	0	20.77	21.00	20.82	22	2

Band 4 (AWS Band)
Part 27L (only on channel required)

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				20050	20175	20300		
Frequency (MHz)				1720	1732.5	1745		
20	QPSK	1	0	22.93	23.04	22.74	24	0
20	QPSK	1	49	22.60	22.90	22.89		
20	QPSK	1	99	22.88	23.03	22.84		
20	QPSK	50	0	21.88	22.16	22.15	23	1
20	QPSK	50	24	21.81	21.79	22.08		
20	QPSK	50	50	21.78	21.96	21.78		
20	QPSK	100	0	21.80	21.87	22.07		
20	16QAM	1	0	21.67	21.59	21.90	23	1
20	16QAM	1	49	21.67	21.66	21.74		
20	16QAM	1	99	21.66	21.76	21.76		
20	16QAM	50	0	20.89	21.03	21.01	22	2
20	16QAM	50	24	20.57	20.77	21.05		
20	16QAM	50	50	20.74	20.85	20.76		
20	16QAM	100	0	20.69	20.82	21.03		
Channel				20025	20175	20325	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1732.5	1747.5		
15	QPSK	1	0	22.93	22.60	22.89	24	0
15	QPSK	1	37	22.70	23.00	23.01		
15	QPSK	1	74	22.67	22.96	22.78		
15	QPSK	36	0	22.09	21.95	22.07	23	1
15	QPSK	36	20	21.86	21.97	21.88		
15	QPSK	36	39	21.80	22.02	21.79		
15	QPSK	75	0	21.88	21.93	21.94		
15	16QAM	1	0	21.71	21.59	21.93	23	1
15	16QAM	1	37	21.69	21.90	21.63		
15	16QAM	1	74	21.51	21.58	21.65		
15	16QAM	36	0	21.05	20.90	21.13	22	2
15	16QAM	36	20	20.84	20.91	20.95		
15	16QAM	36	39	20.87	20.99	20.86		
15	16QAM	75	0	20.88	21.02	21.04		
Channel				20000	20175	20350	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1732.5	1750		
10	QPSK	1	0	22.82	22.48	22.87	24	0
10	QPSK	1	25	22.82	22.94	22.71		
10	QPSK	1	49	22.65	22.68	22.64		
10	QPSK	25	0	22.07	21.98	22.03	23	1
10	QPSK	25	12	21.96	21.89	21.91		
10	QPSK	25	25	21.81	21.86	21.81		
10	QPSK	50	0	21.94	21.93	22.00		
10	16QAM	1	0	21.89	21.44	21.75	23	1
10	16QAM	1	25	21.74	21.71	21.73		
10	16QAM	1	49	21.46	21.60	21.57		
10	16QAM	25	0	21.00	20.99	20.98	22	2
10	16QAM	25	12	20.99	20.89	20.96		
10	16QAM	25	25	20.73	20.78	20.75		
10	16QAM	50	0	21.00	20.79	20.99		
Channel				19975	20175	20375	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1732.5	1752.5		
5	QPSK	1	0	22.79	22.79	22.75	24	0
5	QPSK	1	12	22.81	22.98	22.73		
5	QPSK	1	24	22.49	22.79	22.57		
5	QPSK	12	0	21.80	21.94	22.04	23	1
5	QPSK	12	7	21.98	21.91	21.85		
5	QPSK	12	13	21.96	21.98	21.90		
5	QPSK	25	0	21.85	21.90	21.87		
5	16QAM	1	0	21.57	21.76	21.69	23	1
5	16QAM	1	12	21.57	21.68	21.87		
5	16QAM	1	24	21.43	21.66	21.57		
5	16QAM	12	0	20.88	20.93	20.86	22	2
5	16QAM	12	7	20.89	20.99	20.78		
5	16QAM	12	13	20.85	20.97	20.73		
5	16QAM	25	0	20.89	20.92	20.82		
Channel				19965	20175	20385	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1732.5	1753.5		
3	QPSK	1	0	22.72	22.63	22.83	24	0
3	QPSK	1	8	22.58	22.67	22.43		
3	QPSK	1	14	22.69	22.72	22.50		
3	QPSK	8	0	21.82	21.92	21.80	23	1
3	QPSK	8	4	21.88	21.99	21.80		
3	QPSK	8	7	21.85	21.91	21.74		
3	QPSK	15	0	21.83	21.87	21.78		
3	16QAM	1	0	21.60	21.77	21.46	23	1
3	16QAM	1	8	21.69	21.56	21.46		
3	16QAM	1	14	21.79	21.56	21.71		
3	16QAM	8	0	20.62	20.88	20.70	22	2
3	16QAM	8	4	20.93	21.04	20.68		
3	16QAM	8	7	20.92	21.06	20.74		
3	16QAM	15	0	20.73	20.95	20.70		
Channel				19957	20175	20393	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1732.5	1754.3		
1.4	QPSK	1	0	22.59	22.70	22.79	24	0
1.4	QPSK	1	3	22.78	22.86	22.89		
1.4	QPSK	1	5	22.71	22.80	22.62		
1.4	QPSK	3	0	22.82	22.97	22.92		
1.4	QPSK	3	1	22.78	23.01	22.78		
1.4	QPSK	3	3	22.75	22.87	22.87		
1.4	QPSK	6	0	21.79	21.86	22.01	23	1
1.4	16QAM	1	0	21.57	21.67	21.60	23	1
1.4	16QAM	1	3	21.82	21.82	21.70		
1.4	16QAM	1	5	21.60	21.49	21.62		
1.4	16QAM	3	0	21.77	21.70	21.78		
1.4	16QAM	3	1	21.59	21.95	21.88		
1.4	16QAM	3	3	21.63	22.01	21.87		
1.4	16QAM	6	0	20.80	20.84	20.95	22	2

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

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				23060	23095	23130		
Frequency (MHz)				704	707.5	711		
10	QPSK	1	0	23.23	23.49	23.34	24	0
10	QPSK	1	25	23.28	23.21	23.26		
10	QPSK	1	49	23.43	23.33	23.46		
10	QPSK	25	0	22.42	22.69	22.59	23	1
10	QPSK	25	12	22.60	22.62	22.56		
10	QPSK	25	25	22.67	22.59	22.57		
10	QPSK	50	0	22.59	22.62	22.58		
10	16QAM	1	0	22.17	21.96	22.19	23	1
10	16QAM	1	25	22.19	22.40	22.41		
10	16QAM	1	49	22.35	22.29	22.33		
10	16QAM	25	0	21.40	21.72	21.57	22	2
10	16QAM	25	12	21.48	21.51	21.50		
10	16QAM	25	25	21.56	21.63	21.46		
10	16QAM	50	0	21.43	21.45	21.41		
Channel				23035	23095	23155	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				701.5	707.5	713.5		
5	QPSK	1	0	23.01	23.12	23.35	24	0
5	QPSK	1	12	23.30	23.34	23.33		
5	QPSK	1	24	23.22	23.29	23.32		
5	QPSK	12	0	22.52	22.51	22.49	23	1
5	QPSK	12	7	22.52	22.59	22.51		
5	QPSK	12	13	22.52	22.60	22.51		
5	QPSK	25	0	22.47	22.50	22.60		
5	16QAM	1	0	22.30	22.26	22.32	23	1
5	16QAM	1	12	22.24	22.34	21.94		
5	16QAM	1	24	22.14	22.32	22.03		
5	16QAM	12	0	21.33	21.65	21.54	22	2
5	16QAM	12	7	21.38	21.63	21.63		
5	16QAM	12	13	21.36	21.46	21.36		
5	16QAM	25	0	21.47	21.49	21.57		
Channel				23025	23095	23165	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				700.5	707.5	714.5		
3	QPSK	1	0	23.47	23.20	23.32	24	0
3	QPSK	1	8	23.48	23.27	23.29		
3	QPSK	1	14	23.34	23.33	23.36		
3	QPSK	8	0	22.54	22.55	22.50	23	1
3	QPSK	8	4	22.66	22.64	22.59		
3	QPSK	8	7	22.63	22.57	22.53		
3	QPSK	15	0	22.56	22.61	22.60		
3	16QAM	1	0	22.56	22.23	22.27	23	1
3	16QAM	1	8	22.65	22.21	22.56		
3	16QAM	1	14	22.26	22.28	22.36		
3	16QAM	8	0	21.53	21.56	21.57	22	2
3	16QAM	8	4	21.58	21.67	21.58		
3	16QAM	8	7	21.62	21.36	21.43		
3	16QAM	15	0	21.61	21.37	21.32		
Channel				23017	23095	23173	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				699.7	707.5	715.3		
1.4	QPSK	1	0	23.28	23.20	23.25	24	0
1.4	QPSK	1	3	23.10	23.10	23.11		
1.4	QPSK	1	5	23.12	23.12	23.11		
1.4	QPSK	3	0	23.41	23.22	23.35		
1.4	QPSK	3	1	23.45	23.21	23.21		
1.4	QPSK	3	3	23.44	23.43	23.22		
1.4	QPSK	6	0	22.56	22.66	22.55	23	1
1.4	16QAM	1	0	22.45	22.54	22.27	23	1
1.4	16QAM	1	3	22.55	22.45	22.65		
1.4	16QAM	1	5	22.63	22.55	22.63		
1.4	16QAM	3	0	22.42	22.50	22.47		
1.4	16QAM	3	1	22.51	22.48	22.60		
1.4	16QAM	3	3	22.65	22.46	22.61		
1.4	16QAM	6	0	21.67	21.55	21.60	22	2

Band 66

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up limit (dBm)	MPR (dB)
Channel				132072	132322	132572		
Frequency (MHz)				1720	1745	1770		
20	QPSK	1	0	23.02	23.06	22.94	24	0
20	QPSK	1	49	22.63	22.95	22.86		
20	QPSK	1	99	22.82	22.91	22.88		
20	QPSK	50	0	21.90	22.24	22.15	23	1
20	QPSK	50	24	21.95	21.96	21.90		
20	QPSK	50	50	21.92	22.17	22.10		
20	QPSK	100	0	22.07	22.09	21.80		
20	16QAM	1	0	21.75	22.03	22.01	23	1
20	16QAM	1	49	21.59	21.99	21.71		
20	16QAM	1	99	21.99	21.79	21.88		
20	16QAM	50	0	20.74	21.18	21.08	22	2
20	16QAM	50	24	20.86	20.87	21.11		
20	16QAM	50	50	20.88	21.03	20.87		
20	16QAM	100	0	20.79	20.74	20.86		
Channel				132047	132322	132597	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1717.5	1745	1772.5		
15	QPSK	1	0	22.86	22.83	22.85	24	0
15	QPSK	1	37	23.00	22.97	23.02		
15	QPSK	1	74	22.92	22.97	22.96		
15	QPSK	36	0	21.76	21.80	21.87	23	1
15	QPSK	36	20	21.75	21.77	21.70		
15	QPSK	36	39	21.63	21.69	21.64		
15	QPSK	75	0	22.10	21.78	21.99		
15	16QAM	1	0	21.61	21.90	21.85	23	1
15	16QAM	1	37	21.45	21.80	21.70		
15	16QAM	1	74	21.47	21.69	21.71		
15	16QAM	36	0	20.99	21.09	21.06	22	2
15	16QAM	36	20	20.96	21.05	20.98		
15	16QAM	36	39	20.68	20.77	20.74		
15	16QAM	75	0	20.94	21.04	20.93		
Channel				132022	132322	132622	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1715	1745	1775		
10	QPSK	1	0	22.71	22.68	22.69	24	0
10	QPSK	1	25	22.64	22.81	22.76		
10	QPSK	1	49	22.45	22.67	22.50		
10	QPSK	25	0	22.04	22.12	22.03	23	1
10	QPSK	25	12	21.90	21.92	22.00		
10	QPSK	25	25	21.88	21.92	21.88		
10	QPSK	50	0	22.26	22.20	21.78		
10	16QAM	1	0	21.62	21.53	21.59	23	1
10	16QAM	1	25	21.54	21.64	21.55		
10	16QAM	1	49	21.42	21.51	21.58		
10	16QAM	25	0	20.77	20.76	20.76	22	2
10	16QAM	25	12	20.77	20.64	20.81		
10	16QAM	25	25	20.88	20.86	20.50		
10	16QAM	50	0	21.02	21.02	21.06		
Channel				131997	132322	132647	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1712.5	1745	1777.5		
5	QPSK	1	0	22.58	22.98	22.80	24	0
5	QPSK	1	12	22.92	22.77	22.86		
5	QPSK	1	24	22.74	22.75	22.69		
5	QPSK	12	0	21.81	21.88	21.89	23	1
5	QPSK	12	7	21.80	21.76	21.78		
5	QPSK	12	13	21.70	21.75	21.65		
5	QPSK	25	0	21.92	22.19	21.82		
5	16QAM	1	0	21.75	21.71	21.49	23	1
5	16QAM	1	12	21.38	21.60	21.55		
5	16QAM	1	24	21.42	21.39	21.57		
5	16QAM	12	0	20.82	20.73	20.63	22	2
5	16QAM	12	7	20.75	20.74	20.81		
5	16QAM	12	13	20.74	20.82	20.53		
5	16QAM	25	0	20.71	20.75	21.09		
Channel				131987	132322	132657	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1711.5	1745	1778.5		
3	QPSK	1	0	22.81	22.64	22.74	24	0
3	QPSK	1	8	22.80	22.57	22.60		
3	QPSK	1	14	22.62	22.80	22.62		
3	QPSK	8	0	21.77	21.69	21.87	23	1
3	QPSK	8	4	21.80	21.92	21.81		
3	QPSK	8	7	21.91	21.92	21.57		
3	QPSK	15	0	21.74	21.64	21.80		
3	16QAM	1	0	21.85	21.62	21.44	23	1
3	16QAM	1	8	21.66	21.81	21.41		
3	16QAM	1	14	21.84	21.61	21.53		
3	16QAM	8	0	21.02	20.83	20.95	22	2
3	16QAM	8	4	20.96	21.12	20.89		
3	16QAM	8	7	21.07	21.21	20.94		
3	16QAM	15	0	20.55	20.85	20.84		
Channel				131979	132322	132665	Tune-up limit (dBm)	MPR (dB)
Frequency (MHz)				1710.7	1745	1779.3		
1.4	QPSK	1	0	22.43	22.59	22.84	24	0
1.4	QPSK	1	3	22.51	22.80	22.79		
1.4	QPSK	1	5	22.49	22.56	22.41		
1.4	QPSK	3	0	22.80	22.89	22.45		
1.4	QPSK	3	1	22.82	22.77	22.88		
1.4	QPSK	3	3	22.80	22.91	22.78		
1.4	QPSK	6	0	21.46	21.77	21.69	23	1
1.4	16QAM	1	0	21.87	21.61	21.54	23	1
1.4	16QAM	1	3	21.89	21.87	21.83		
1.4	16QAM	1	5	21.56	21.51	21.67		
1.4	16QAM	3	0	21.85	21.96	21.89		
1.4	16QAM	3	1	21.77	21.84	21.80		
1.4	16QAM	3	3	21.89	22.04	21.75		
1.4	16QAM	6	0	20.99	21.02	21.01	22	2

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
2.4GHz WLAN	802.11b 1Mbps	1	2412	16.33	18.00	100.00
		6	2437	16.41	18.00	
		11	2462	16.37	18.00	
	802.11g 6Mbps	1	2412	12.22	13.50	97.94
		6	2437	12.27	13.50	
		11	2462	12.18	13.50	
	802.11n-HT20 MCS0	1	2412	11.99	13.50	98.16
		6	2437	12.01	13.50	
		11	2462	12.07	13.50	
	802.11n-HT40 MCS0	3	2422	11.28	12.50	94.93
		6	2437	11.44	12.50	
		9	2452	11.38	12.50	

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
2.4GHz WLAN	802.11b 1Mbps	1	2412	16.38	18.00	100.00
		6	2437	16.28	18.00	
		11	2462	16.42	18.00	
	802.11g 6Mbps	1	2412	12.10	13.50	98.28
		6	2437	12.35	13.50	
		11	2462	12.26	13.50	
	802.11n-HT20 MCS0	1	2412	11.87	13.50	98.16
		6	2437	12.40	13.50	
		11	2462	12.20	13.50	
	802.11n-HT40 MCS0	3	2422	11.19	13.00	94.93
		6	2437	11.21	13.00	
		9	2452	11.45	13.00	

2.4GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1+2					
2.4GHz WLAN	802.11b 1Mbps	1	2412			
		6	2437			
		11	2462			
	802.11g 6Mbps	1	2412			
		6	2437			
		11	2462			
	802.11n-HT20 MCS0	1	2412	14.94	16.50	98.16
		6	2437	15.22	16.50	
		11	2462	15.15	16.50	
	802.11n-HT40 MCS0	3	2422	14.24	15.50	94.93
		6	2437	14.33	15.50	
		9	2452	14.42	15.50	

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
5.2GHz WLAN	802.11a 6Mbps	36	5180	12.21	13.50	98.28
		40	5200	12.15	13.50	
		44	5220	11.77	13.50	
		48	5240	11.79	13.50	
	802.11n-HT20 MCS0	36	5180	11.79	13.00	96.16
		40	5200	11.76	13.00	
		44	5220	11.62	13.00	
		48	5240	11.73	13.00	
	802.11n-HT40 MCS0	38	5190	10.91	12.50	96.32
		46	5230	10.85	12.50	
	802.11ac-VHT20 MCS0	36	5180	10.23	11.50	97.79
		40	5200	10.02	11.50	
		44	5220	10.14	11.50	
		48	5240	10.15	11.50	
	802.11ac-VHT40 MCS0	38	5190	10.03	11.50	96.32
		46	5230	9.93	11.50	
	802.11ac-VHT80 MCS0	42	5210	10.07	11.50	93.28

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
5.2GHz WLAN	802.11a 6Mbps	36	5180	12.02	13.50	98.28
		40	5200	12.21	13.50	
		44	5220	12.12	13.50	
		48	5240	11.97	13.50	
	802.11n-HT20 MCS0	36	5180	11.61	13.00	98.90
		40	5200	11.69	13.00	
		44	5220	11.72	13.00	
		48	5240	11.51	13.00	
	802.11n-HT40 MCS0	38	5190	10.61	12.00	96.32
		46	5230	10.51	12.00	
	802.11ac-VHT20 MCS0	36	5180	10.24	11.50	98.53
		40	5200	10.32	11.50	
		44	5220	10.07	11.50	
		48	5240	10.23	11.50	
	802.11ac-VHT40 MCS0	38	5190	9.82	11.00	96.32
		46	5230	9.78	11.00	
	802.11ac-VHT80 MCS0	42	5210	9.78	11.00	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1+2					
5.2GHz WLAN	802.11a 6Mbps	36	5180			
		40	5200			
		44	5220			
		48	5240			
	802.11n-HT20 MCS0	36	5180	14.71	16.50	98.90
		40	5200	14.73	16.50	
		44	5220	14.68	16.50	
		48	5240	14.63	16.50	
	802.11n-HT40 MCS0	38	5190	13.78	15.50	96.32
		46	5230	13.70	15.50	
	802.11ac-VHT20 MCS0	36	5180	13.25	14.50	98.53
		40	5200	13.18	14.50	
		44	5220	13.12	14.50	
		48	5240	13.20	14.50	
	802.11ac-VHT40 MCS0	38	5190	12.94	14.50	96.32
		46	5230	12.87	14.50	
	802.11ac-VHT80 MCS0	42	5210	12.94	14.50	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
5.3GHz WLAN	802.11a 6Mbps	52	5260	12.00	13.50	98.28
		56	5280	12.04	13.50	
		60	5300	11.86	13.50	
		64	5320	11.96	13.50	
	802.11n-HT20 MCS0	52	5260	11.72	13.00	96.16
		56	5280	11.68	13.00	
		60	5300	11.80	13.00	
		64	5320	11.66	13.00	
	802.11n-HT40 MCS0	54	5270	10.80	12.50	96.32
		62	5310	10.71	12.50	
	802.11ac-VHT20 MCS0	52	5260	10.01	11.50	97.79
		56	5280	9.92	11.50	
		60	5300	9.71	11.50	
		64	5320	9.90	11.50	
	802.11ac-VHT40 MCS0	54	5270	9.88	11.50	96.32
		62	5310	9.95	11.50	
	802.11ac-VHT80 MCS0	58	5290	10.14	11.50	93.28

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
5.3GHz WLAN	802.11a 6Mbps	52	5260	12.23	13.50	98.28
		56	5280	12.18	13.50	
		60	5300	12.14	13.50	
		64	5320	12.19	13.50	
	802.11n-HT20 MCS0	52	5260	11.72	13.00	98.90
		56	5280	11.81	13.00	
		60	5300	11.64	13.00	
		64	5320	11.72	13.00	
	802.11n-HT40 MCS0	54	5270	10.74	12.50	96.32
		62	5310	10.50	12.50	
	802.11ac-VHT20 MCS0	52	5260	10.07	12.00	98.53
		56	5280	10.04	12.00	
		60	5300	10.22	12.00	
		64	5320	10.06	12.00	
	802.11ac-VHT40 MCS0	54	5270	9.92	11.50	96.32
		62	5310	9.83	11.50	
	802.11ac-VHT80 MCS0	58	5290	9.58	11.50	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1+2					
5.3GHz WLAN	802.11a 6Mbps	52	5260			
		56	5280			
		60	5300			
		64	5320			
	802.11n-HT20 MCS0	52	5260	14.73	16.50	98.90
		56	5280	14.75	16.50	
		60	5300	14.73	16.50	
		64	5320	14.70	16.50	
	802.11n-HT40 MCS0	54	5270	13.78	15.50	96.32
		62	5310	13.62	15.50	
	802.11ac-VHT20 MCS0	52	5260	13.05	14.50	98.53
		56	5280	12.99	14.50	
		60	5300	12.98	14.50	
		64	5320	12.99	14.50	
	802.11ac-VHT40 MCS0	54	5270	12.91	14.50	96.32
		62	5310	12.90	14.50	
	802.11ac-VHT80 MCS0	58	5290	12.88	14.50	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
5.5GHz WLAN	802.11a 6Mbps	100	5500	11.81	13.50	98.28
		116	5580	11.69	13.50	
		124	5620	11.68	13.50	
		132	5660	11.77	13.50	
		140	5700	11.67	13.50	
	802.11n-HT20 MCS0	100	5500	11.97	13.50	96.16
		116	5580	12.11	13.50	
		124	5620	12.04	13.50	
		132	5660	11.81	13.50	
		140	5700	11.97	13.50	
	802.11n-HT40 MCS0	102	5510	10.93	12.00	96.32
		110	5550	10.82	12.00	
		126	5630	10.91	12.00	
		134	5670	10.73	12.00	
	802.11ac-VHT20 MCS0	100	5500	9.60	11.00	97.79
		116	5580	9.95	11.00	
		124	5620	10.07	11.00	
		132	5660	9.89	11.00	
		140	5700	10.01	11.00	
	802.11ac-VHT40 MCS0	102	5510	9.81	11.00	96.32
		110	5550	9.94	11.00	
		126	5630	9.86	11.00	
		134	5670	9.88	11.00	
	802.11ac-VHT80 MCS0	106	5530	10.09	11.00	93.28
		122	5610	9.69	11.00	

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
5.5GHz WLAN	802.11a 6Mbps	100	5500	11.70	13.50	98.28
		116	5580	11.87	13.50	
		124	5620	11.73	13.50	
		132	5660	11.80	13.50	
		140	5700	11.77	13.50	
	802.11n-HT20 MCS0	100	5500	11.98	13.50	98.90
		116	5580	11.71	13.50	
		124	5620	12.00	13.50	
		132	5660	12.10	13.50	
		140	5700	11.94	13.50	
	802.11n-HT40 MCS0	102	5510	10.64	12.00	96.32
		110	5550	10.92	12.00	
		126	5630	10.55	12.00	
		134	5670	11.19	12.00	
	802.11ac-VHT20 MCS0	100	5500	10.08	11.50	98.53
		116	5580	10.18	11.50	
		124	5620	10.11	11.50	
		132	5660	10.26	11.50	
		140	5700	10.08	11.50	
	802.11ac-VHT40 MCS0	102	5510	9.75	11.50	96.32
		110	5550	9.90	11.50	
		126	5630	9.71	11.50	
		134	5670	10.27	11.50	
	802.11ac-VHT80 MCS0	106	5530	10.17	11.50	93.31
		122	5610	10.13	11.50	

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1+2					
5.5GHz WLAN	802.11a 6Mbps	100	5500			
		116	5580			
		124	5620			
		132	5660			
		140	5700			
	802.11n-HT20 MCS0	100	5500	14.98	16.50	98.90
		116	5580	14.92	16.50	
		124	5620	15.03	16.50	
		132	5660	14.97	16.50	
		140	5700	14.96	16.50	
	802.11n-HT40 MCS0	102	5510	13.80	15.50	96.32
		110	5550	13.88	15.50	
		126	5630	13.75	15.50	
		134	5670	13.98	15.50	
	802.11ac-VHT20 MCS0	100	5500	12.86	14.50	98.53
		116	5580	13.08	14.50	
		124	5620	13.10	14.50	
		132	5660	13.09	14.50	
		140	5700	13.06	14.50	
	802.11ac-VHT40 MCS0	102	5510	12.79	14.50	96.32
		110	5550	12.93	14.50	
		126	5630	12.80	14.50	
		134	5670	13.09	14.50	
	802.11ac-VHT80 MCS0	106	5530	13.14	14.50	93.31
		122	5610	12.93	14.50	

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
5.8GHz WLAN	802.11a 6Mbps	149	5745	11.89	13.50	98.28
		157	5785	12.11	13.50	
		165	5825	12.30	13.50	
	802.11n-HT20 MCS0	149	5745	11.89	13.00	96.16
		157	5785	12.02	13.00	
		165	5825	11.88	13.00	
	802.11n-HT40 MCS0	151	5755	10.75	12.50	96.32
		159	5795	10.84	12.50	
	802.11ac-VHT20 MCS0	149	5745	9.77	11.50	97.79
		157	5785	9.72	11.50	
		165	5825	9.69	11.50	
	802.11ac-VHT40 MCS0	151	5755	9.74	11.50	96.32
		159	5795	9.84	11.50	
	802.11ac-VHT80 MCS0	155	5775	9.91	11.50	93.28

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
5.8GHz WLAN	802.11a 6Mbps	149	5745	11.95	13.50	98.28
		157	5785	11.80	13.50	
		165	5825	11.77	13.50	
	802.11n-HT20 MCS0	149	5745	11.80	13.50	98.90
		157	5785	12.00	13.50	
		165	5825	12.11	13.50	
	802.11n-HT40 MCS0	151	5755	11.20	12.50	96.32
		159	5795	11.04	12.50	
	802.11ac-VHT20 MCS0	149	5745	10.22	11.50	98.53
		157	5785	9.95	11.50	
		165	5825	10.13	11.50	
	802.11ac-VHT40 MCS0	151	5755	10.00	11.50	96.32
		159	5795	9.92	11.50	
	802.11ac-VHT80 MCS0	155	5775	10.25	11.50	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1+2					
5.8GHz WLAN	802.11a 6Mbps	149	5745			
		157	5785			
		165	5825			
	802.11n-HT20 MCS0	149	5745	14.85	16.50	98.90
		157	5785	15.02	16.50	
		165	5825	15.01	16.50	
	802.11n-HT40 MCS0	151	5755	13.99	15.50	96.32
		159	5795	13.95	15.50	
	802.11ac-VHT20 MCS0	149	5745	13.01	14.50	98.53
		157	5785	12.85	14.50	
		165	5825	12.93	14.50	
	802.11ac-VHT40 MCS0	151	5755	12.89	14.50	96.32
		159	5795	12.89	14.50	
	802.11ac-VHT80 MCS0	155	5775	13.10	14.50	93.31

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 1					
5GHz WLAN	802.11ac VHT80+80	42+106	5210+5530	10.39	11.00	86.95
		42+58	5210+5290	10.20	11.00	
		42+155	5210+5775	10.30	11.00	

5GHz WLAN	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Duty Cycle %
	Ant 2					
5.8GHz WLAN	802.11ac VHT80+80	42+106	5210+5530	10.20	11.00	85.87
		42+58	5210+5290	9.33	11.00	
		42+155	5210+5775	10.52	11.00	

BR/EDR

Mode	Channel	Frequency (MHz)	Average power (dBm) 1Mbps	Average power (dBm) 2Mbps	Average power (dBm) 3Mbps
BR / EDR	CH 00	2402	10.50	8.03	8.26
	CH 39	2441	11.82	9.09	9.29
	CH 78	2480	10.48	8.88	9.02
Tune-up Limit			12	9.5	9.5

BLE 4.0

Mode	Channel	Frequency (MHz)	Average power (dBm) GFSK
LE	CH 00	2402	4.39
	CH 19	2440	5.86
	CH 39	2480	6.86
Tune-up Limit			7

BLE 5.0

Mode	Channel	Frequency (MHz)	Average power (dBm) 1Mbps	Average power (dBm) 2Mbps
LE	CH 00	2402	4.12	
	CH 19	2440	5.90	
	CH 39	2480	6.79	
Tune-up Limit			7	