



In Collaboration with

s p e a g
CALIBRATION LABORATORY

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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	52.10.2.1495
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
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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: 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; $\sigma = 1.441$ S/m; $\epsilon_r = 40.48$; $\rho = 1000$ 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)

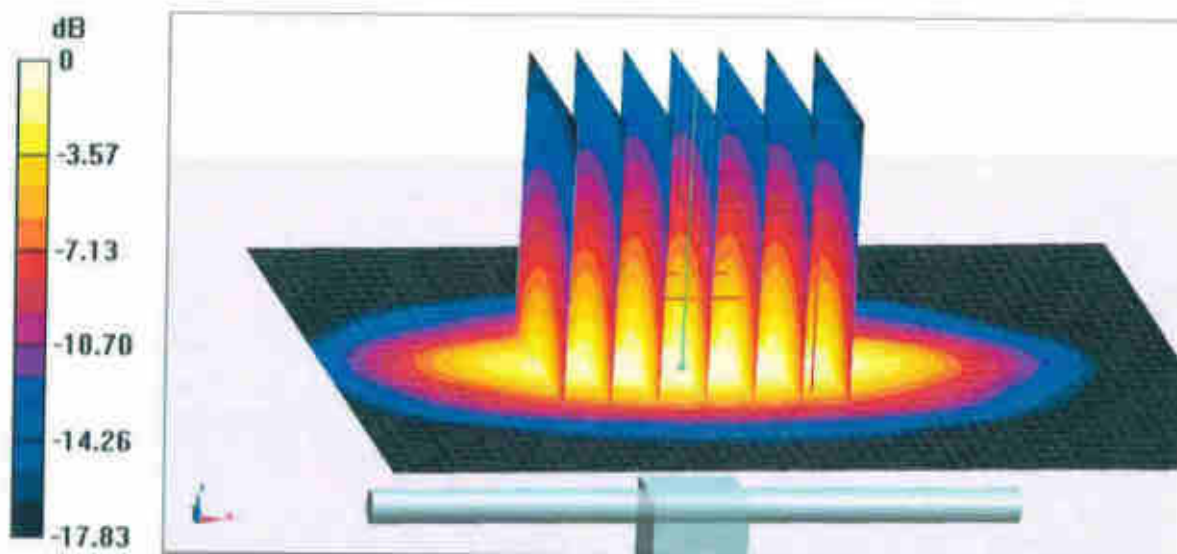
System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:
 $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

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

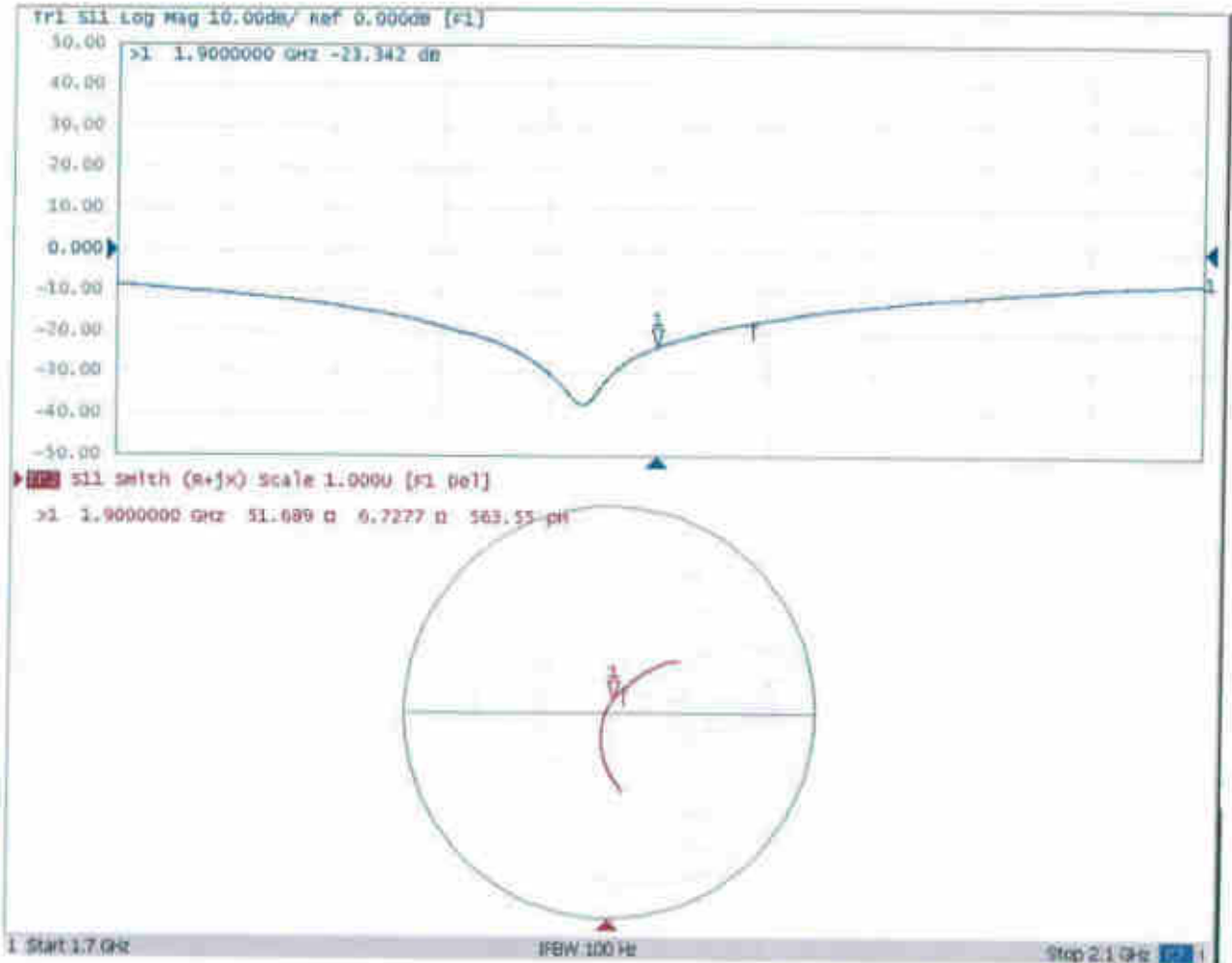


0 dB = 15.6 W/kg = 11.93 dBW/kg



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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; $\sigma = 1.56$ S/m; $\epsilon_r = 54.52$; $\rho = 1000$ 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:

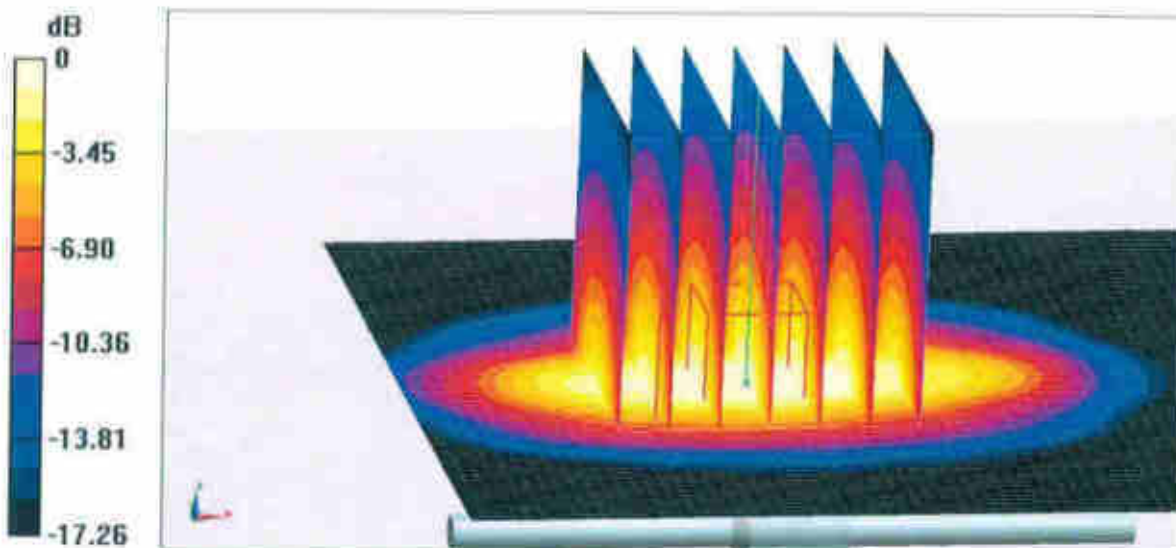
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

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

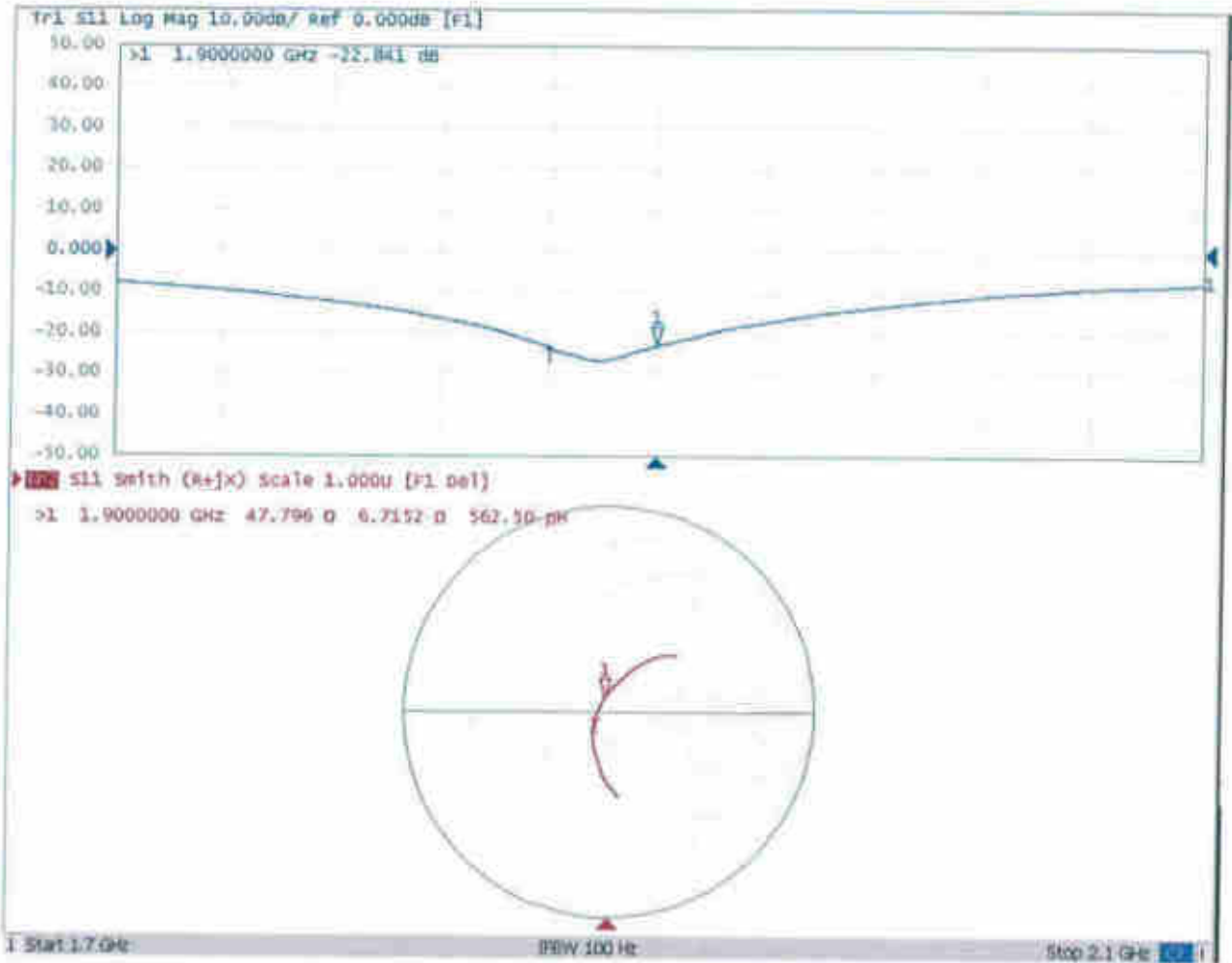


0 dB = 15.7 W/kg = 11.96 dBW/kg



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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 ($< -20\text{dB}$, 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.

1900V2 – serial no. 5d170

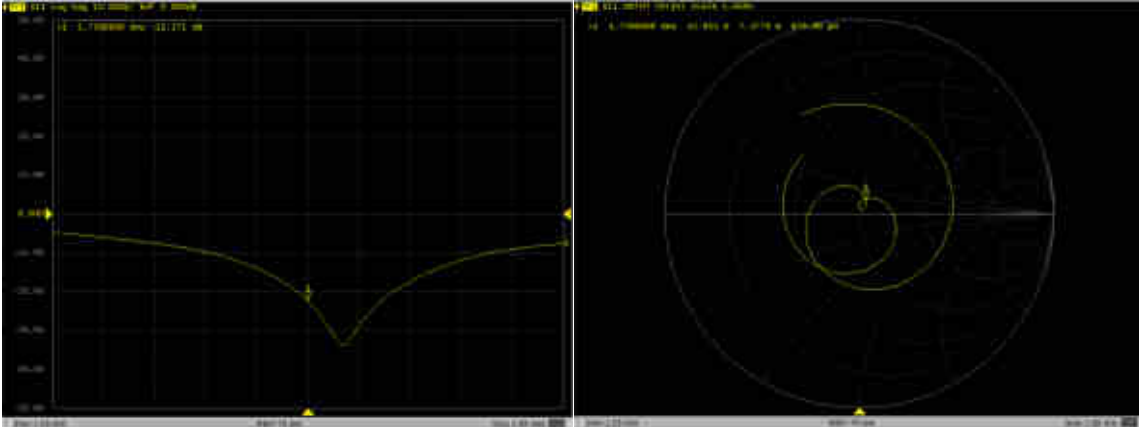
1900V2 – serial no. 5d170												
	1900 Head						1900 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.26	-23.3		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>

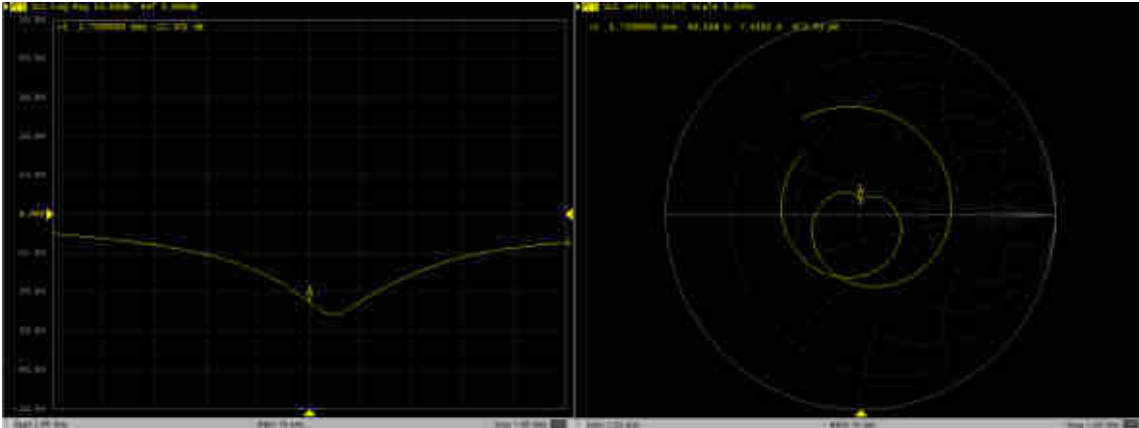
The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D1900V2, serial no. 5d170

1900MHz – Head



1900MHz – Body





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Client **Sporton**

Certificate No: **Z18-60365**

CALIBRATION CERTIFICATE

Object **D2300V2 - SN: 1055**

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

Calibration date: **September 20, 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 NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	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: September 23, 2018

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



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%.



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, dz = 5 mm	
Frequency	2300 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.5	1.67 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	40.3 ± 6 %	1.72 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	12.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	48.7 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.82 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.2 mW / g ± 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.9	1.81 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.82 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	11.9 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	47.6 mW / g ± 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.64 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.6 mW / g ± 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	45.6Ω- 2.03jΩ
Return Loss	- 25.9dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	44.0Ω- 0.86jΩ
Return Loss	- 23.8dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.034 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: 09.20.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1055

Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.718$ S/m; $\epsilon_r = 40.3$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.42, 7.42, 7.42) @ 2300 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

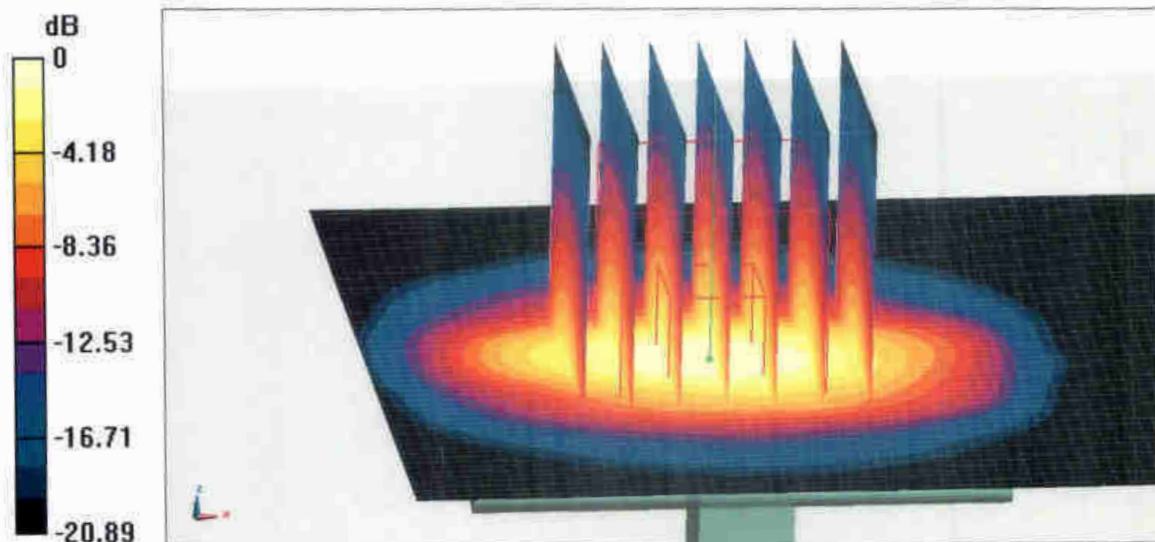
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.59 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 25.4 W/kg

SAR(1 g) = 12.3 W/kg; SAR(10 g) = 5.82 W/kg

Maximum value of SAR (measured) = 20.4 W/kg

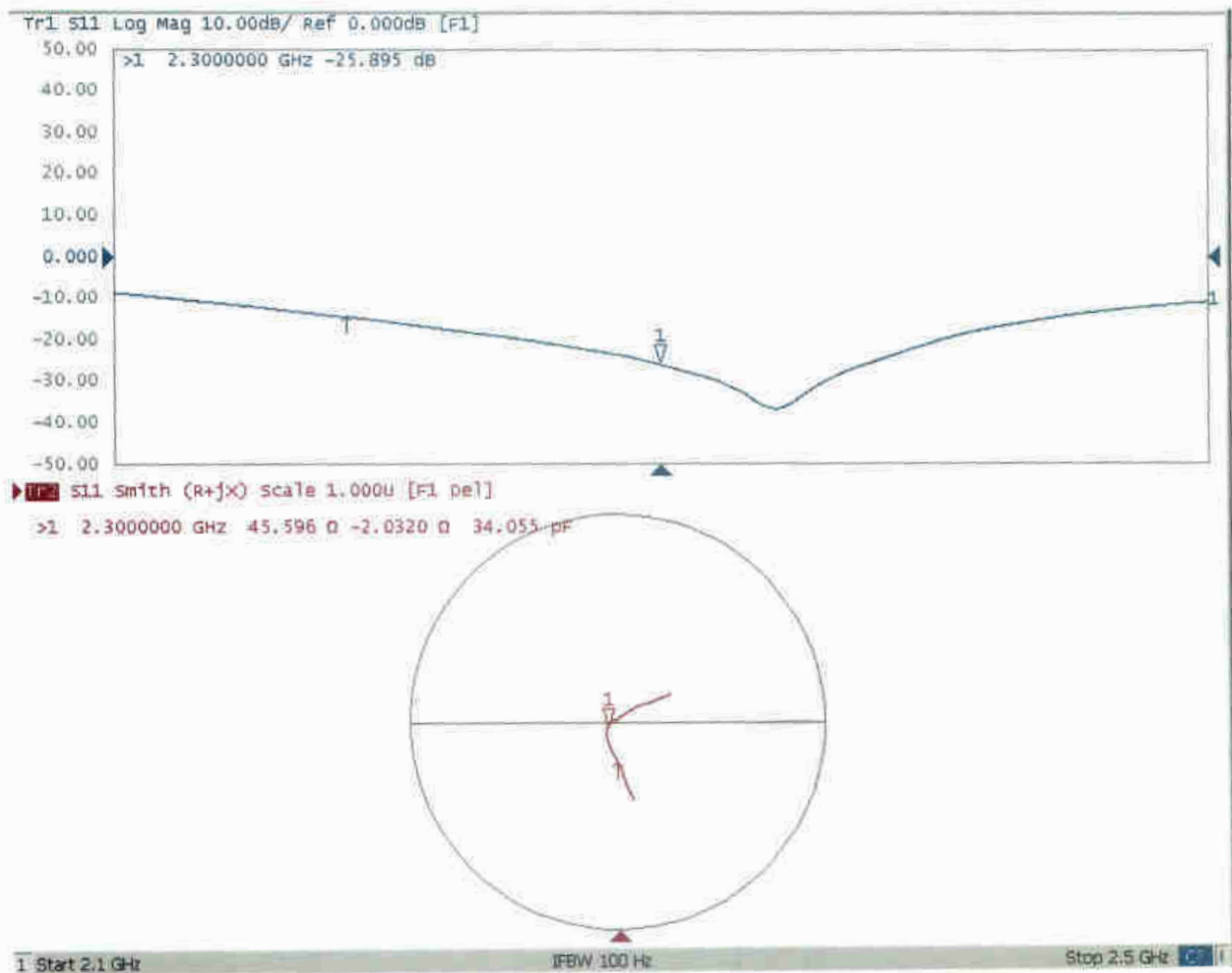


0 dB = 20.4 W/kg = 13.10 dBW/kg



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Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.20.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2300 MHz; Type: D2300V2; Serial: D2300V2 - SN: 1055

Communication System: UID 0, CW; Frequency: 2300 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2300$ MHz; $\sigma = 1.834$ S/m; $\epsilon_r = 54.44$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.25, 7.25, 7.25) @ 2300 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

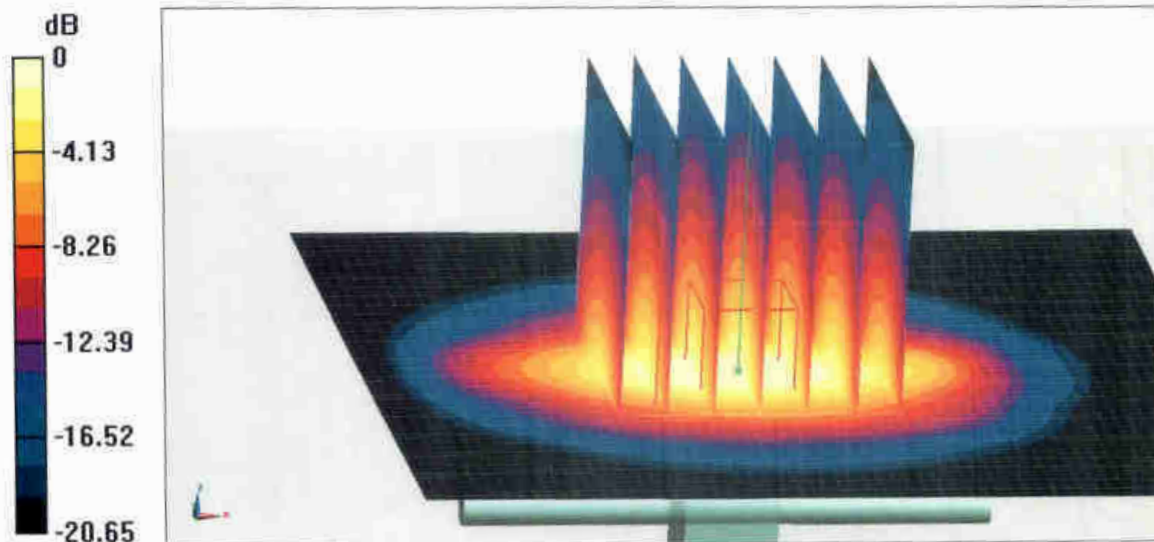
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.37 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 23.9 W/kg

SAR(1 g) = 11.9 W/kg; SAR(10 g) = 5.64 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

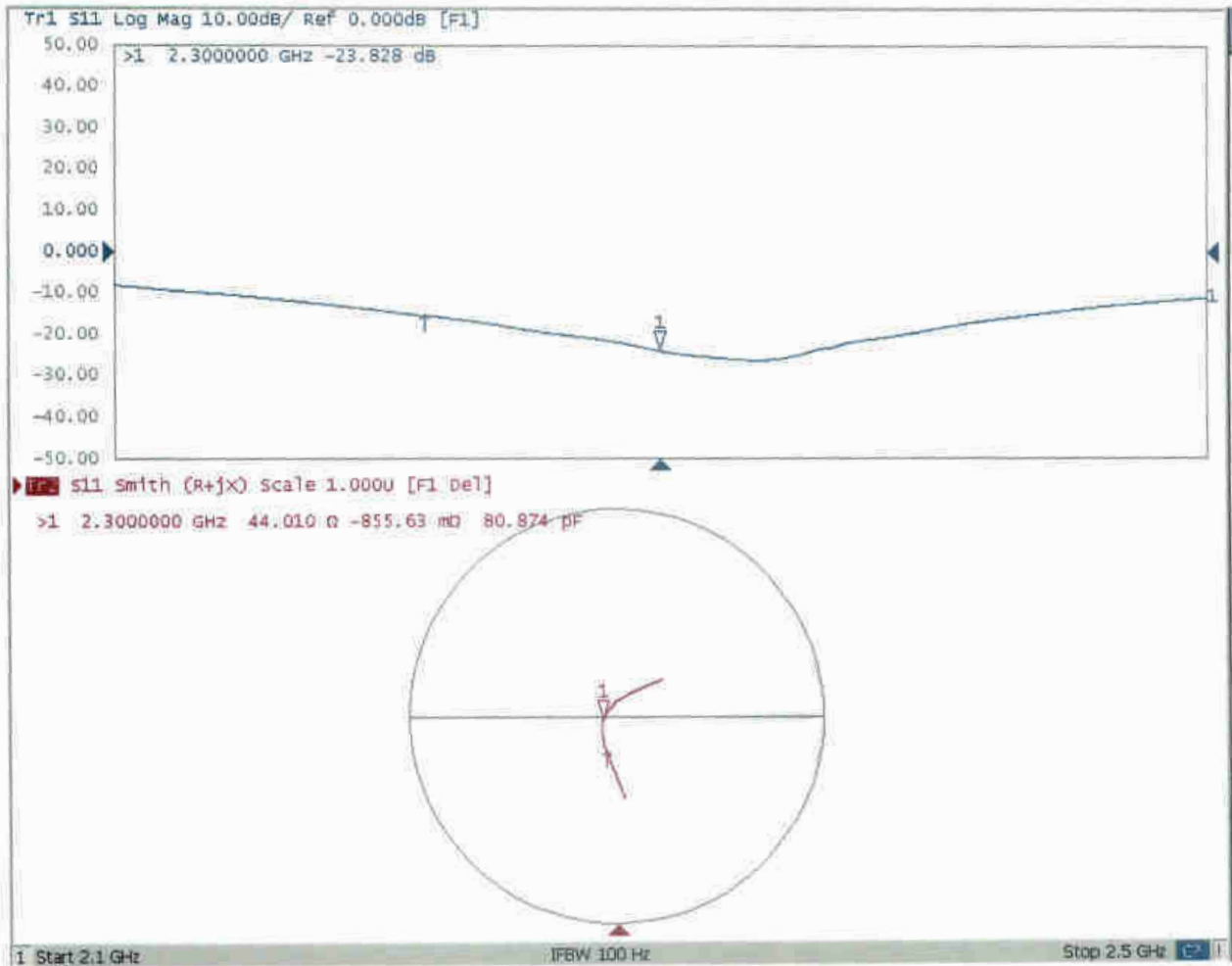


0 dB = 19.4 W/kg = 12.88 dBW/kg



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Impedance Measurement Plot for Body TSL



D2300V2, Serial No. 1055 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.

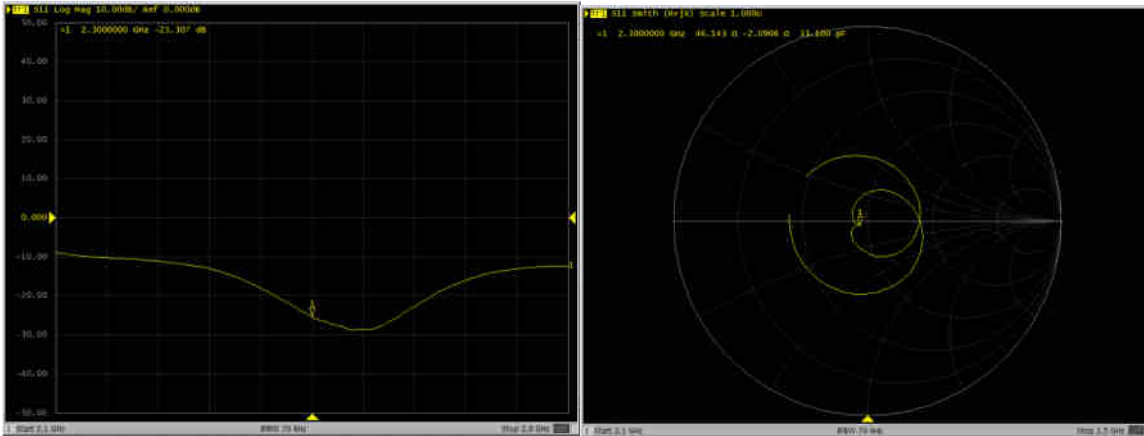
2300V2 – serial no. 1055						
2300 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2018.09.20	-25.9		45.6		-2.03	
2019.09.19	-25.3	0.02	46.1	-0.5	-2.09	0.06

<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> D2300V2, serial no. 1055

2300MHz – Head





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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)°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	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 28, 2019

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In Collaboration with

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CALIBRATION LABORATORY

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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%.



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 ± 18.6 % (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)



Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$57.3\Omega + 5.18 j\Omega$
Return Loss	- 21.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$52.6\Omega + 5.81 j\Omega$
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; $\sigma = 1.841$ S/m; $\epsilon_r = 39.63$; $\rho = 1000$ 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)

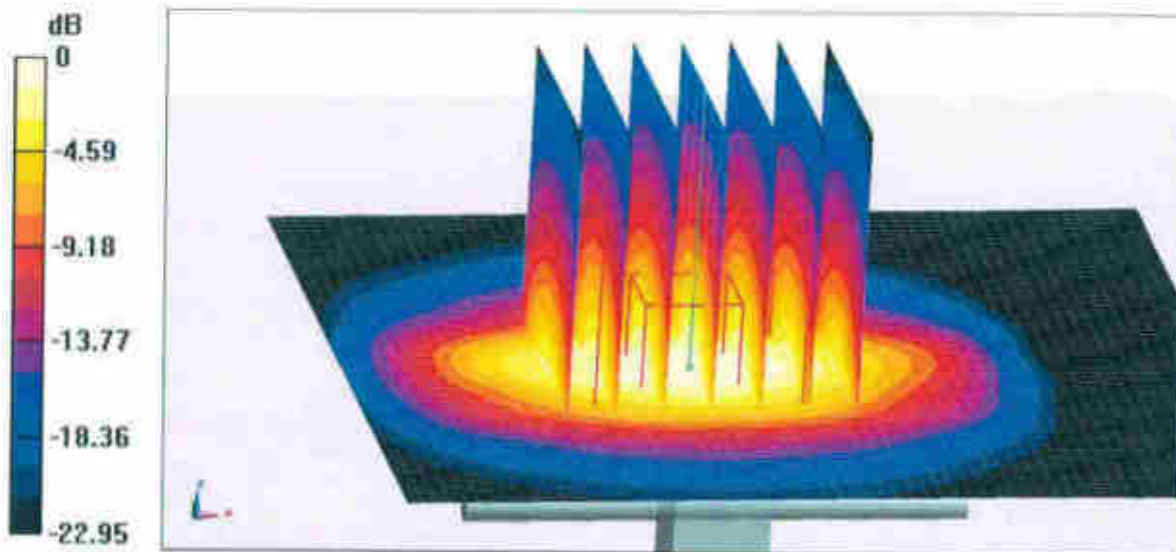
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

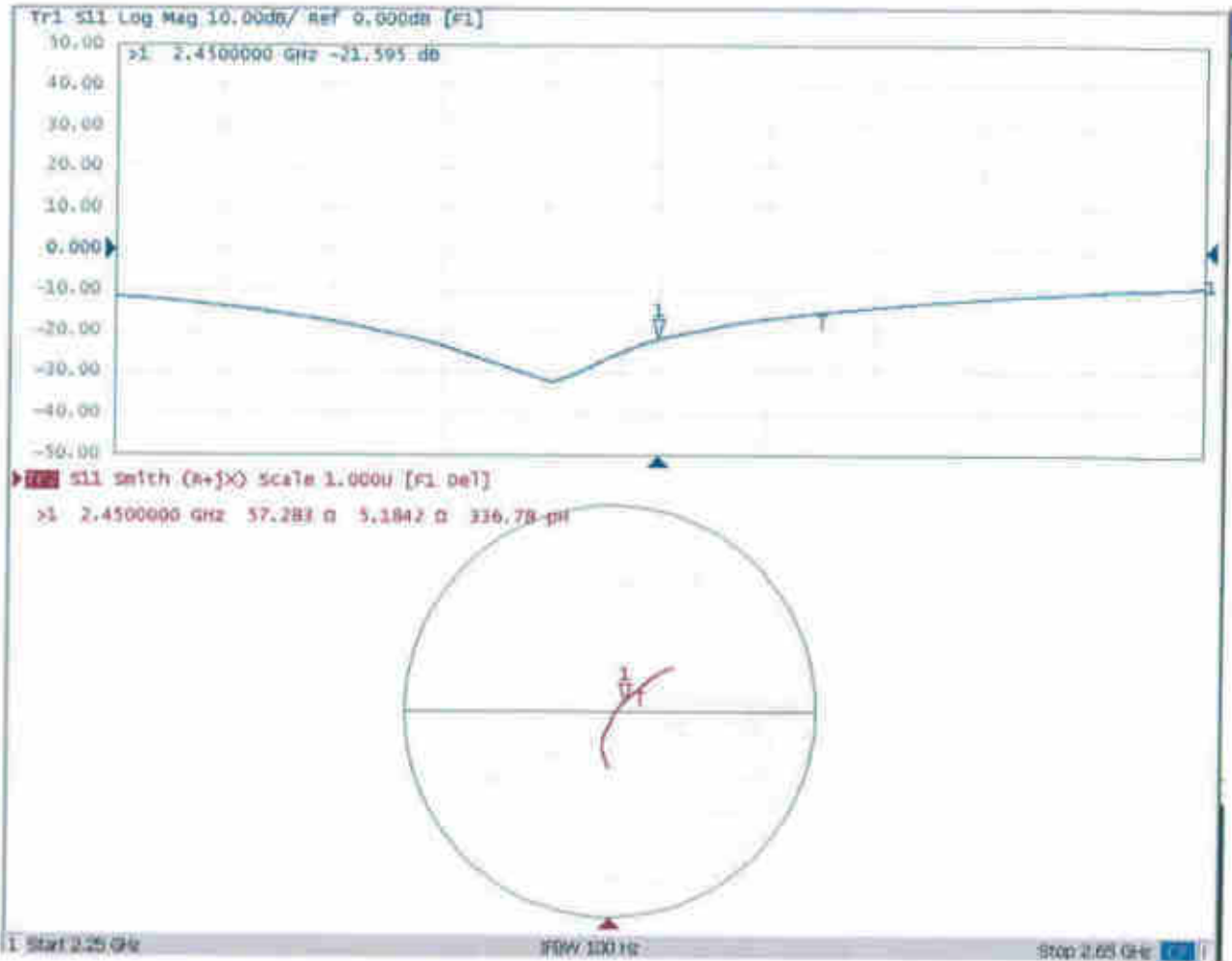


0 dB = 22.4 W/kg = 13.50 dBW/kg



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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; $\sigma = 2.003$ S/m; $\epsilon_r = 53.78$; $\rho = 1000$ 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)

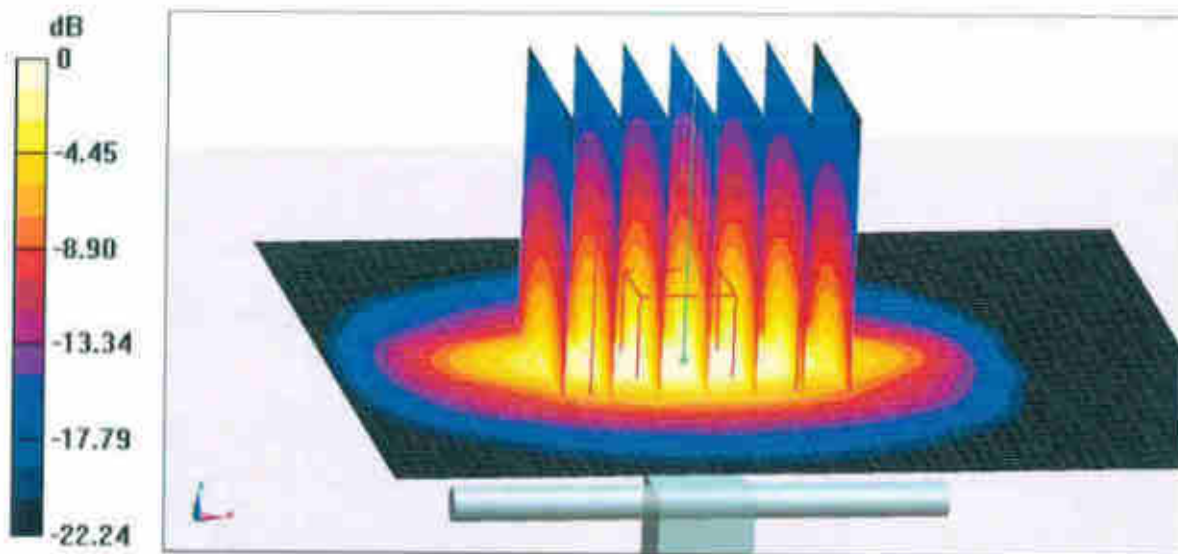
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

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

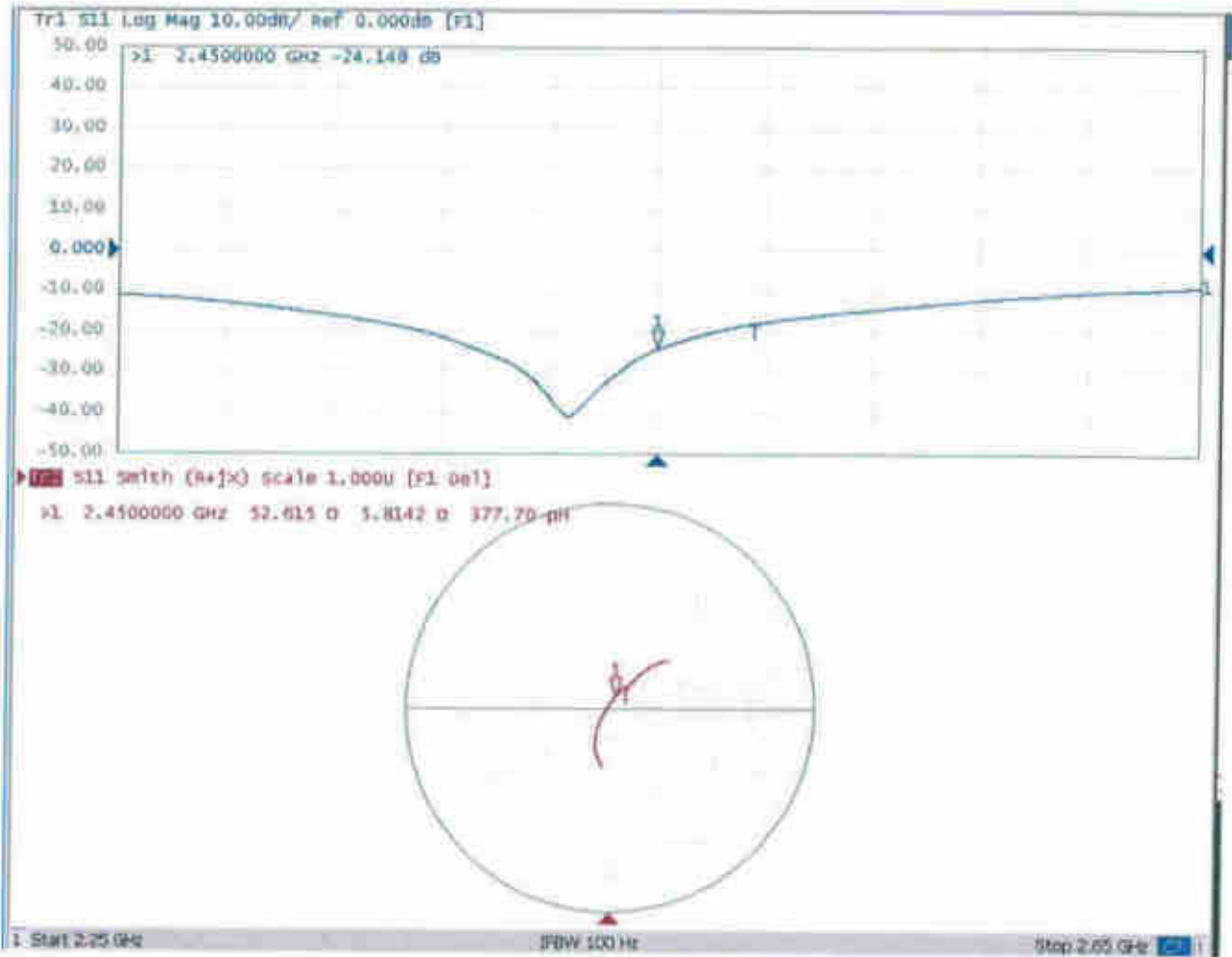


0 dB = 21.4 W/kg = 13.30 dBW/kg



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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 ($< -20\text{dB}$, 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.

2450V2 – serial no. 908

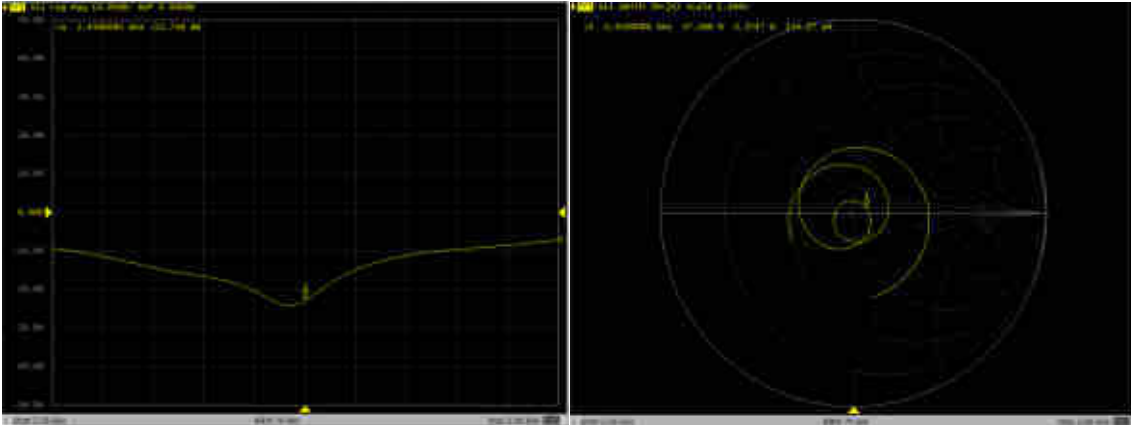
2450V2 – serial no. 908												
	2450 Head						2450 Body					
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.3.25	-21.6		57.3		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>

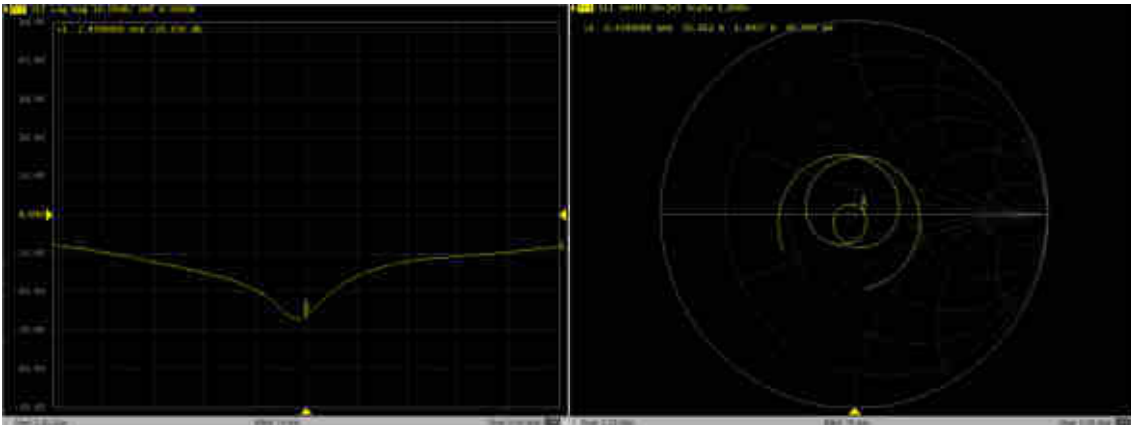
The return loss is $< -20\text{dB}$, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D2450V2, serial no. 908

2450MHz – Head



2450MHz – Body





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **D5GHzV2-1113_Sep19**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN:1113**

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

Calibration date: **September 24, 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 $(22 \pm 3)^{\circ}\text{C}$ 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: 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-18)	In house check: Oct-19

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

Issued: September 25, 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 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	35.1 ± 6 %	4.53 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	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	80.5 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.1 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	34.6 ± 6 %	4.88 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	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	83.4 W/kg ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.8 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	34.4 ± 6 %	5.03 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	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	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.8 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	51.7 Ω - 6.2 $j\Omega$
Return Loss	- 24.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 2.7 $j\Omega$
Return Loss	- 24.1 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.7 Ω - 1.0 $j\Omega$
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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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Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1113

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz,
Frequency: 5750 MHz

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.53$ S/m; $\epsilon_r = 35.1$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5600$ MHz; $\sigma = 4.88$ S/m; $\epsilon_r = 34.6$; $\rho = 1000$ kg/m³,

Medium parameters used: $f = 5750$ MHz; $\sigma = 5.03$ S/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³

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 52.10.2(1504); SEMCAD X 14.6.12(7470)

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 = 78.54 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 27.9 W/kg

SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.33 W/kg

Maximum value of SAR (measured) = 18.1 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 = 78.00 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 31.1 W/kg

SAR(1 g) = 8.40 W/kg; SAR(10 g) = 2.40 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan,

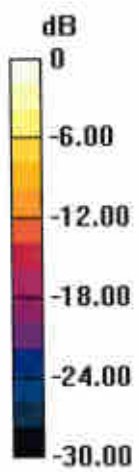
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 75.13 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 31.8 W/kg

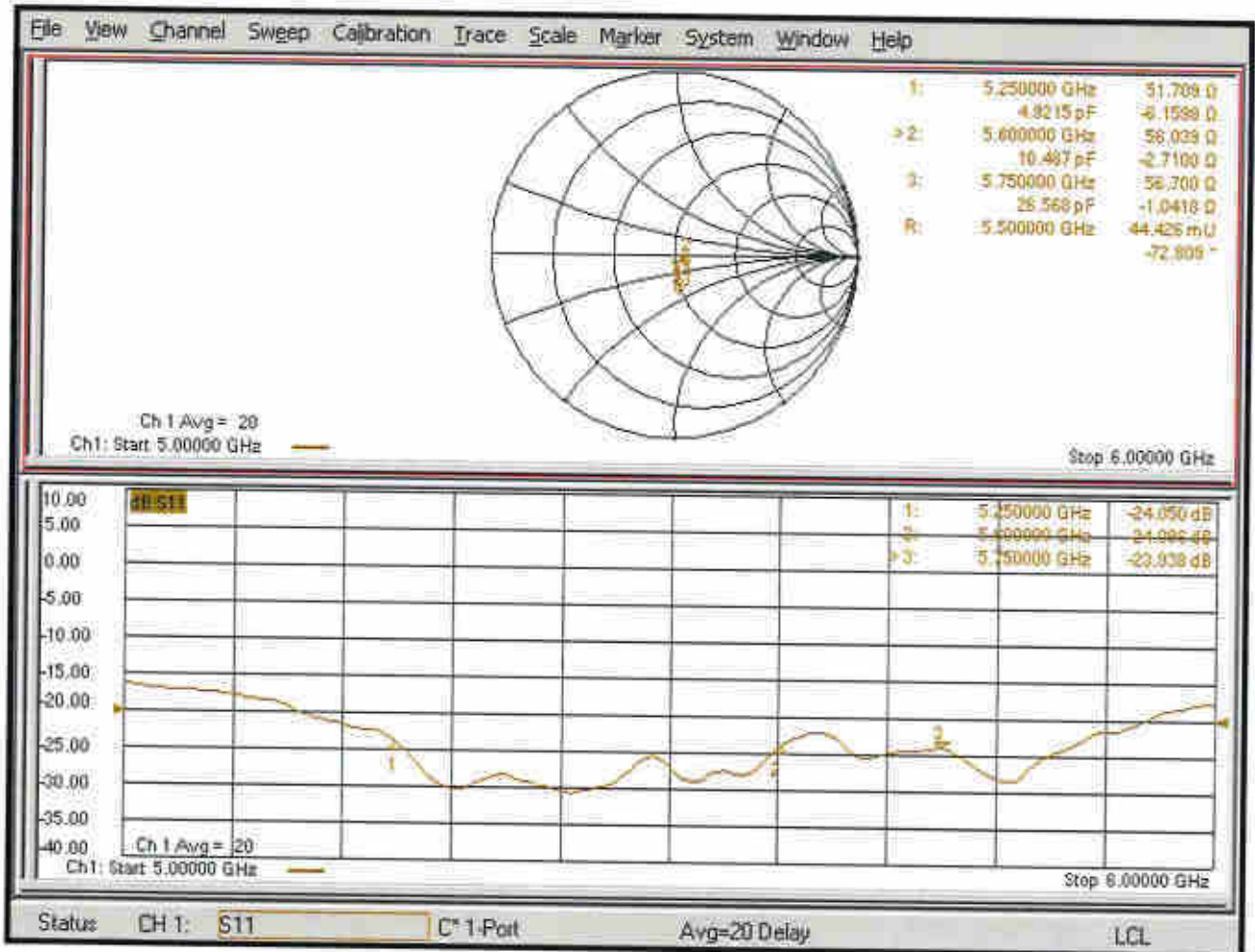
SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.30 W/kg

Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Head TSL





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Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **DAE4-1358_Apr20**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BN - SN: 1358**

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

Calibration date: **April 28, 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: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: **Sven Kühn** Deputy Manager

Issued: April 29, 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	403.411 \pm 0.02% (k=2)	403.452 \pm 0.02% (k=2)	403.463 \pm 0.02% (k=2)
Low Range	3.96158 \pm 1.50% (k=2)	3.98747 \pm 1.50% (k=2)	3.99174 \pm 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	113.5 $^{\circ}$ \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	200024.85	-8.32	-0.00
Channel X + Input	20005.36	0.39	0.00
Channel X - Input	-20003.50	2.72	-0.01
Channel Y + Input	200030.06	-2.90	-0.00
Channel Y + Input	20004.14	-0.70	-0.00
Channel Y - Input	-20008.00	-1.63	0.01
Channel Z + Input	200034.52	1.89	0.00
Channel Z + Input	20005.02	0.16	0.00
Channel Z - Input	-20007.28	-0.87	0.00

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2000.94	0.03	0.00
Channel X + Input	200.94	0.01	0.01
Channel X - Input	-198.93	0.16	-0.08
Channel Y + Input	2000.58	-0.17	-0.01
Channel Y + Input	199.97	-0.81	-0.40
Channel Y - Input	-200.24	-0.99	0.50
Channel Z + Input	2000.83	0.21	0.01
Channel Z + Input	199.97	-0.67	-0.34
Channel Z - Input	-199.90	-0.63	0.32

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	23.26	21.16
	- 200	-21.29	-22.70
Channel Y	200	-27.83	-28.04
	- 200	26.48	26.49
Channel Z	200	-11.47	-11.06
	- 200	9.80	9.70

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	-	1.92	-3.40
Channel Y	200	8.27	-	3.32
Channel Z	200	9.47	5.42	-

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	15579	16774
Channel Y	16044	14871
Channel Z	16074	16518

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	0.87	-0.93	1.98	0.46
Channel Y	-0.62	-1.71	0.15	0.38
Channel Z	-0.46	-1.45	0.52	0.39

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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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **EX3-3935_May20**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3935**

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: **May 27, 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-18)	In house check: Jun-20
Power sensor E4412A	SN: MY41498087	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: June 1, 2020

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



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:3935

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.49	0.53	0.48	$\pm 10.1 \%$
DCP (mV) ^B	102.6	103.2	102.3	

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 ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	137.0	$\pm 3.3 \%$	$\pm 4.7 \%$
		Y	0.0	0.0	1.0		150.1		
		Z	0.0	0.0	1.0		141.6		

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:3935

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	44.5
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:3935

Calibration Parameter Determined in Head Tissue Simulating Media

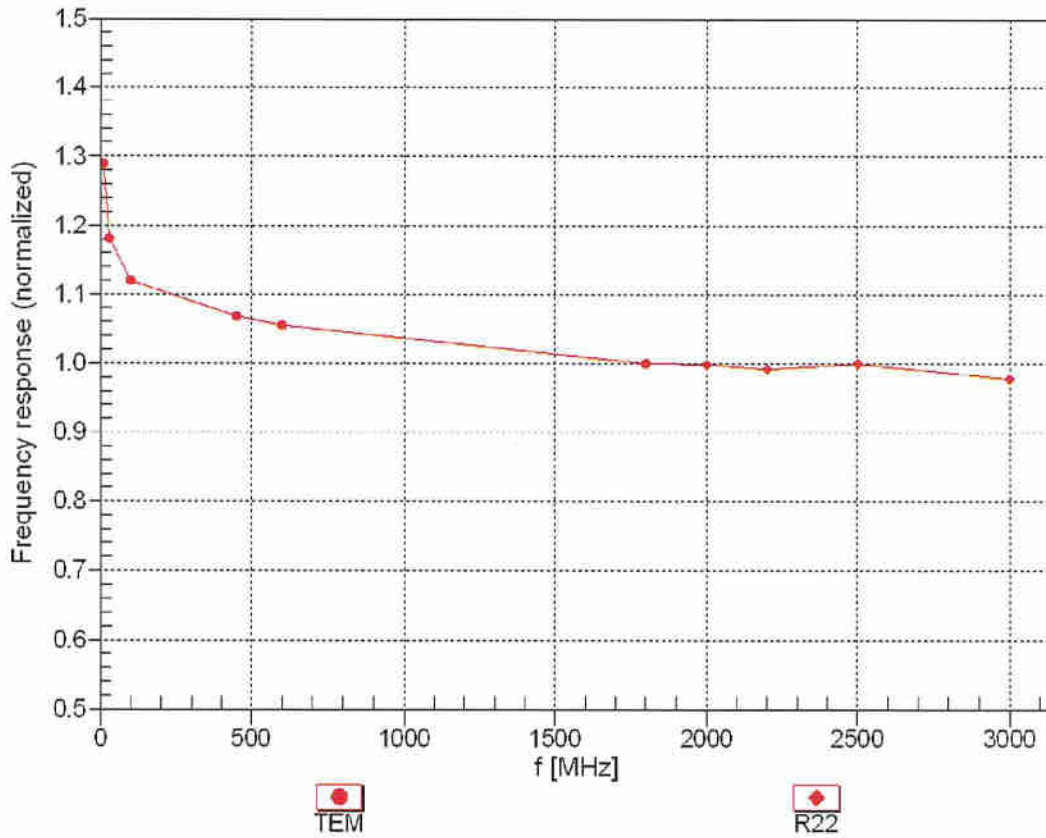
f (MHz) ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth (mm) ^G	Unc (k=2)
750	41.9	0.89	10.58	10.58	10.58	0.57	0.80	± 12.0 %
835	41.5	0.90	10.31	10.31	10.31	0.38	0.93	± 12.0 %
900	41.5	0.97	10.16	10.16	10.16	0.40	0.88	± 12.0 %
1750	40.1	1.37	8.60	8.60	8.60	0.27	0.86	± 12.0 %
1900	40.0	1.40	8.35	8.35	8.35	0.24	0.86	± 12.0 %
2000	40.0	1.40	8.25	8.25	8.25	0.34	0.86	± 12.0 %
2300	39.5	1.67	7.86	7.86	7.86	0.35	0.90	± 12.0 %
2450	39.2	1.80	7.60	7.60	7.60	0.33	0.90	± 12.0 %
2600	39.0	1.96	7.43	7.43	7.43	0.37	0.90	± 12.0 %
5250	35.9	4.71	5.04	5.04	5.04	0.40	1.80	± 14.0 %
5600	35.5	5.07	4.76	4.76	4.76	0.40	1.80	± 14.0 %
5750	35.4	5.22	4.67	4.67	4.67	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.

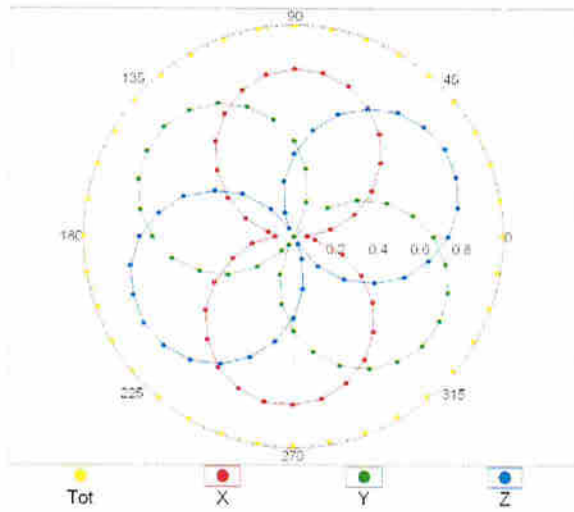
Frequency Response of E-Field (TEM-Cell:ifi110 EXX, Waveguide: R22)



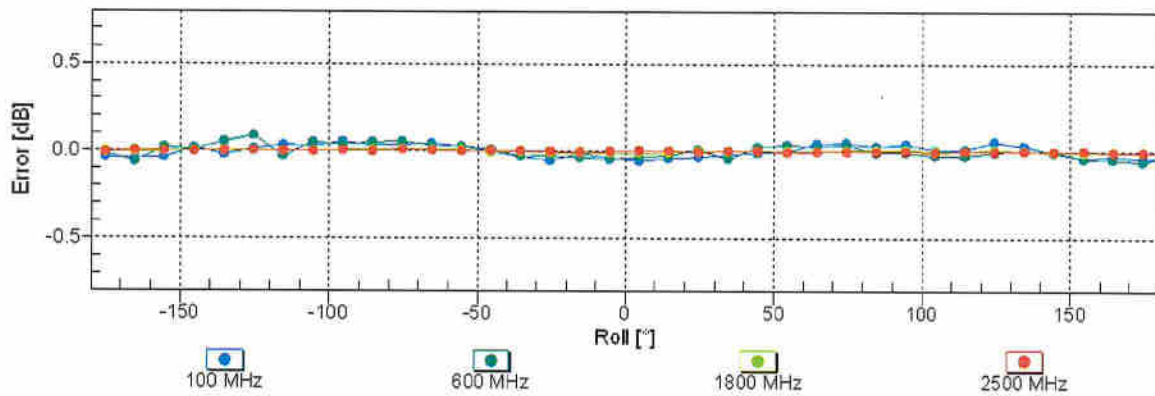
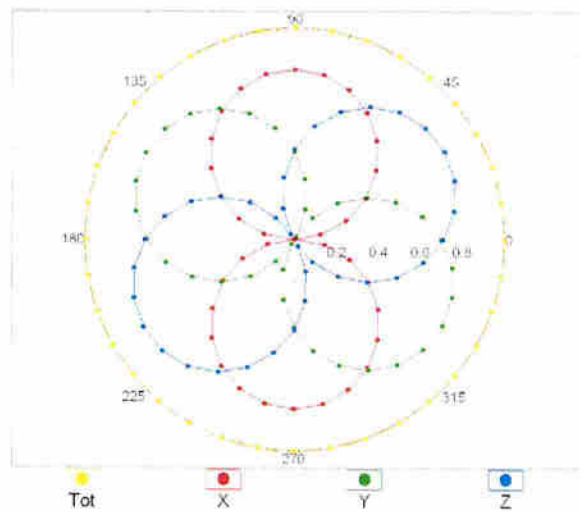
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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

f=600 MHz,TEM

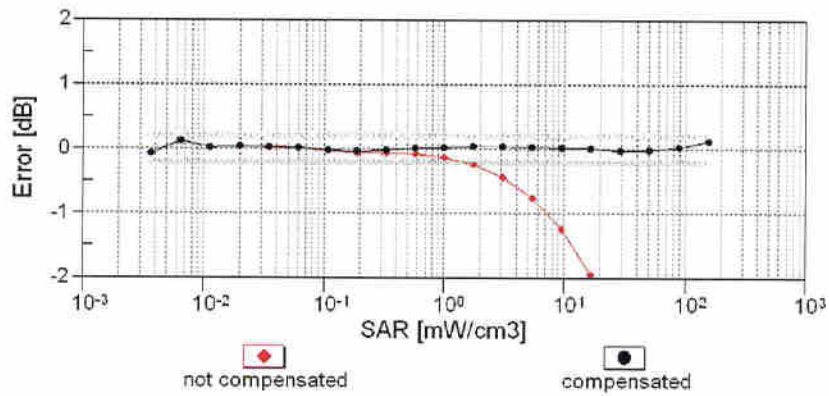
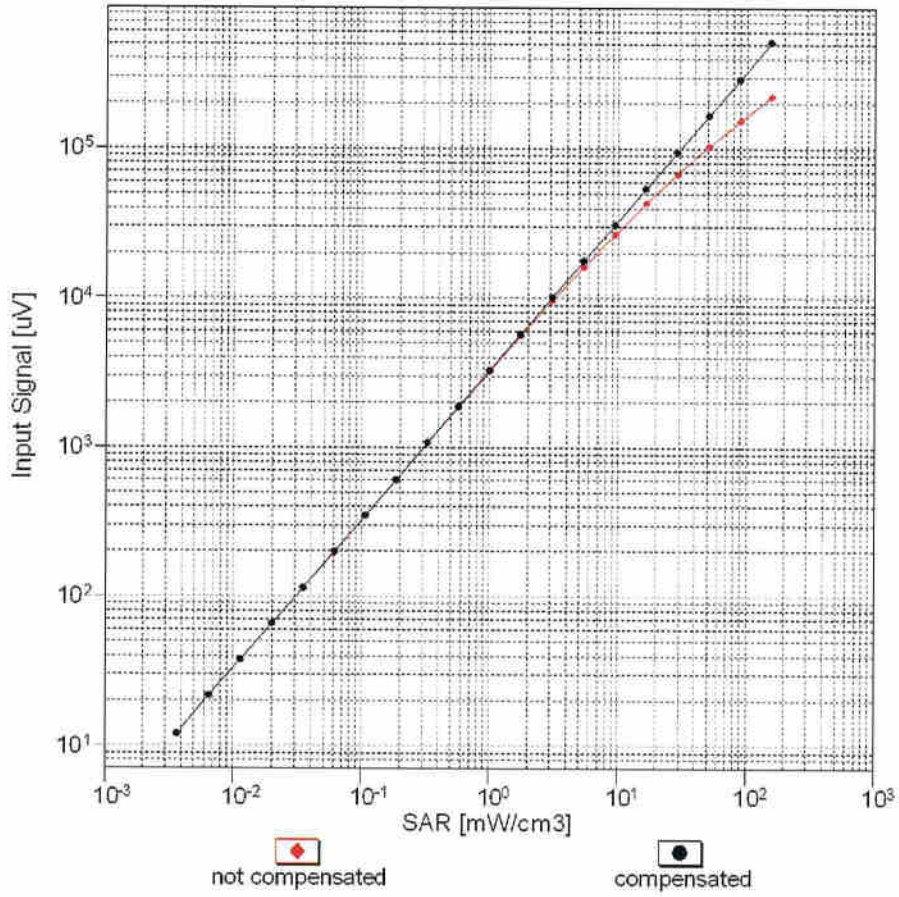


f=1800 MHz,R22



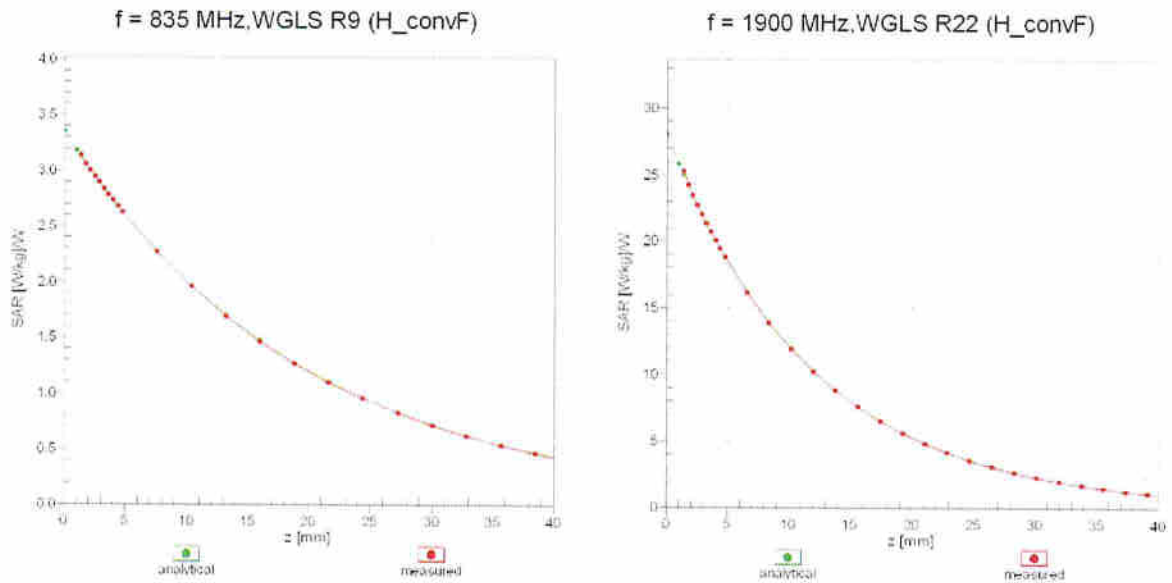
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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



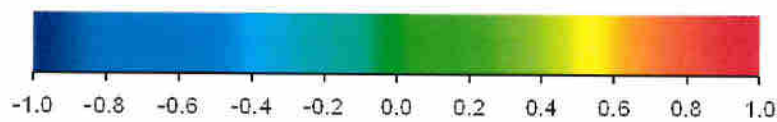
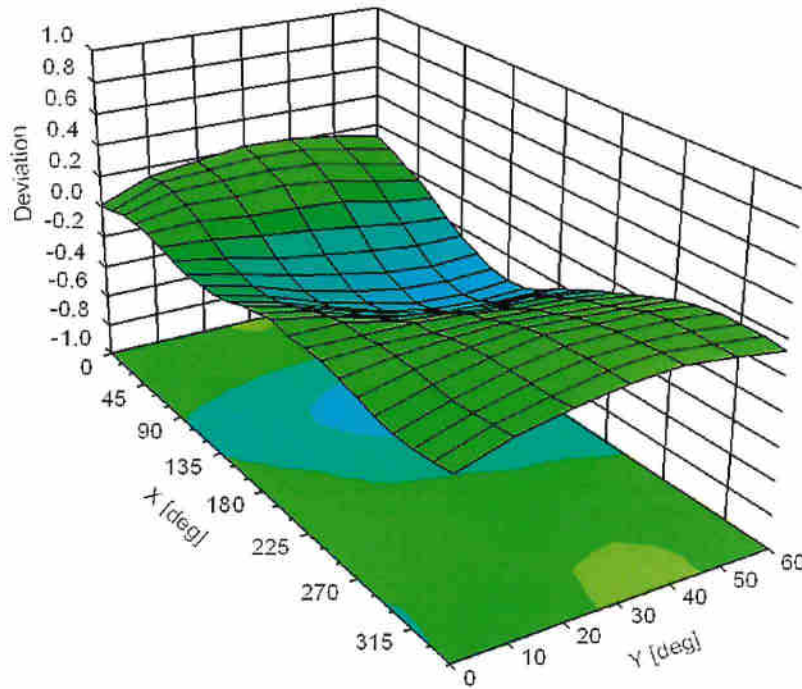
Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

Conversion Factor Assessment



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



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



Appendix E. Conducted RF Output Power Table

The detailed power table are shown as follows.



Full Power

GSM850	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	152	169	251		152	169	251	
TX Channel	524.2	532.4	543.3		524.2	532.4	542.9	
Frequency (MHz)								
GSM 1 Tx slot	31.85	31.96	32.03	33.50	22.85	22.98	23.03	24.50
GPRS 1 Tx slot	31.83	31.96	32.01	33.50	22.83	22.96	23.01	24.50
GPRS 2 Tx slots	28.66	29.11	29.10	30.50	22.86	23.11	23.10	24.50
GPRS 3 Tx slots	26.79	26.94	27.01	28.50	22.53	22.68	22.75	24.24
GPRS 4 Tx slots	25.42	25.11	25.26	26.50	22.42	22.11	22.26	23.50
EDGE 1 Tx slot	25.38	25.42	25.53	27.00	18.38	18.42	18.53	18.00
EDGE 2 Tx slots	25.25	25.27	25.40	26.50	19.25	19.27	19.40	20.50
EDGE 3 Tx slots	23.88	23.85	23.89	25.50	19.62	19.59	19.63	21.24
EDGE 4 Tx slots	22.37	22.48	22.45	24.00	19.37	19.48	19.45	21.00

GSM1900	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512	661	810		512	661	810	
TX Channel	1550.2	1680	1909.8		1550.2	1680	1909.8	
Frequency (MHz)								
GSM 1 Tx slot	28.25	28.26	29.10	30.50	20.25	20.28	20.10	21.50
GPRS 1 Tx slot	28.24	28.26	29.09	30.50	20.24	20.26	20.09	21.50
GPRS 2 Tx slots	26.34	26.35	26.25	27.50	20.34	20.35	20.25	21.50
GPRS 3 Tx slots	24.36	24.34	24.14	25.50	20.10	20.08	19.88	21.24
GPRS 4 Tx slots	22.87	22.87	22.74	24.00	19.87	19.87	19.74	21.00
EDGE 1 Tx slot	25.12	25.01	24.92	28.00	16.12	16.01	15.92	17.00
EDGE 2 Tx slots	25.01	24.91	24.81	28.00	19.01	18.91	18.81	20.00
EDGE 3 Tx slots	23.11	23.11	22.97	24.00	18.85	18.85	18.71	19.74
EDGE 4 Tx slots	21.72	21.68	21.56	23.00	18.72	18.68	18.56	20.00



Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
Tx Channel		9502	9500	9538		1512	1513	1513		4192	4192	4233	
Rx Channel		9652	9600	9938		1537	1639	1738		4357	4407	4458	
Frequency (MHz)		1852.4	1860	1907.6	1712.4	1732.6	1752.6	826.4	836.4	846.6			
3GPP Rel 99	AMR 12.2kops	22.95	23.03	22.84	24.00	23.14	23.21	23.08	24.00	23.20	23.28	23.11	24.00
3GPP Rel 99	RMC 12.2kops	22.96	23.05	22.86	24.00	23.16	23.23	23.10	24.00	23.23	23.29	23.14	24.00
3GPP Rel 6	HSDPA Subtest-1	21.69	21.49	21.57	23.00	22.20	22.04	22.07	23.00	22.24	21.96	22.25	23.00
3GPP Rel 6	HSDPA Subtest-2	21.66	21.81	21.51	23.00	22.13	22.07	22.08	23.00	22.23	21.98	22.22	23.00
3GPP Rel 6	HSDPA Subtest-3	21.12	21.00	21.04	22.50	21.65	21.59	21.60	22.50	21.73	21.50	21.74	22.50
3GPP Rel 6	HSDPA Subtest-4	21.12	21.25	21.05	22.50	21.66	21.60	21.58	22.50	21.71	21.43	21.71	22.50
3GPP Rel 6	DC-HSDPA Subtest-1	21.66	21.59	21.56	23.00	22.18	22.03	22.04	23.00	22.23	21.93	22.23	23.00
3GPP Rel 8	DC-HSDPA Subtest-2	21.63	21.79	21.50	23.00	22.11	22.06	22.05	23.00	22.22	21.95	22.20	23.00
3GPP Rel 8	DC-HSDPA Subtest-3	21.69	21.25	21.03	22.50	21.63	21.58	21.57	22.50	21.72	21.47	21.72	22.50
3GPP Rel 8	DC-HSDPA Subtest-4	21.69	21.23	21.04	22.50	21.64	21.59	21.55	22.50	21.70	21.46	21.69	22.50
3GPP Rel 6	HSUPA Subtest-1	21.79	21.65	21.66	23.00	22.28	22.27	22.08	23.00	22.23	22.05	22.30	23.00
3GPP Rel 6	HSUPA Subtest-2	19.81	19.68	19.77	21.00	20.26	20.15	20.22	21.00	20.30	20.08	20.27	21.00
3GPP Rel 6	HSUPA Subtest-3	20.80	20.66	20.75	22.00	21.06	21.03	20.96	22.00	21.19	21.11	21.22	22.00
3GPP Rel 6	HSUPA Subtest-4	19.80	19.68	19.73	21.00	20.17	20.04	20.04	21.00	20.19	20.12	20.28	21.00
3GPP Rel 6	HSUPA Subtest-5	21.79	21.72	21.83	23.00	22.28	22.17	22.15	23.00	22.09	22.18	22.16	23.00



LTE Band 2

BWP (MHz)	Modulation	RB Size	RB Offset	Power Low Ch. (Freq.)	Power High Ch. (Freq.)	Power High Ch. (Freq.)	Time-up link (dBm)	MPE (dB)	Channel		
									Frequency (MHz)	1800	1800
20	QPSK	1	0	23.21	23.22	23.22	24	0	Channel		
20	QPSK	1	40	23.08	23.10	23.22			Channel		
20	QPSK	1	80	23.12	23.12	23.21			Channel		
20	QPSK	3	0	23.01	23.04	23.10			Channel		
20	QPSK	3	40	23.02	23.03	23.05			Channel		
20	QPSK	3	80	23.04	23.07	23.07			Channel		
20	QPSK	3	120	23.05	23.06	23.06			Channel		
20	QPSK	3	160	23.07	23.08	23.09			Channel		
20	QPSK	3	200	23.08	23.09	23.09			Channel		
20	QPSK	3	240	23.09	23.10	23.10			Channel		
20	QPSK	3	280	23.10	23.11	23.11			Channel		
20	QPSK	3	320	23.11	23.12	23.12			Channel		
20	QPSK	3	360	23.12	23.13	23.13			Channel		
20	QPSK	3	400	23.13	23.14	23.14			Channel		
20	QPSK	3	440	23.14	23.15	23.15			Channel		
20	QPSK	3	480	23.15	23.16	23.16			Channel		
20	QPSK	3	520	23.16	23.17	23.17			Channel		
20	QPSK	3	560	23.17	23.18	23.18			Channel		
20	QPSK	3	600	23.18	23.19	23.19			Channel		
20	QPSK	3	640	23.19	23.20	23.20			Channel		
20	QPSK	3	680	23.20	23.21	23.21			Channel		
20	QPSK	3	720	23.21	23.22	23.22			Channel		
20	QPSK	3	760	23.22	23.23	23.23			Channel		
20	QPSK	3	800	23.23	23.24	23.24			Channel		
20	QPSK	3	840	23.24	23.25	23.25			Channel		
20	QPSK	3	880	23.25	23.26	23.26			Channel		
20	QPSK	3	920	23.26	23.27	23.27			Channel		
20	QPSK	3	960	23.27	23.28	23.28			Channel		
20	QPSK	3	1000	23.28	23.29	23.29			Channel		
20	QPSK	3	1040	23.29	23.30	23.30			Channel		
20	QPSK	3	1080	23.30	23.31	23.31			Channel		
20	QPSK	3	1120	23.31	23.32	23.32			Channel		
20	QPSK	3	1160	23.32	23.33	23.33			Channel		
20	QPSK	3	1200	23.33	23.34	23.34			Channel		
20	QPSK	3	1240	23.34	23.35	23.35			Channel		
20	QPSK	3	1280	23.35	23.36	23.36			Channel		
20	QPSK	3	1320	23.36	23.37	23.37			Channel		
20	QPSK	3	1360	23.37	23.38	23.38			Channel		
20	QPSK	3	1400	23.38	23.39	23.39			Channel		
20	QPSK	3	1440	23.39	23.40	23.40			Channel		
20	QPSK	3	1480	23.40	23.41	23.41			Channel		
20	QPSK	3	1520	23.41	23.42	23.42			Channel		
20	QPSK	3	1560	23.42	23.43	23.43			Channel		
20	QPSK	3	1600	23.43	23.44	23.44			Channel		
20	QPSK	3	1640	23.44	23.45	23.45			Channel		
20	QPSK	3	1680	23.45	23.46	23.46			Channel		
20	QPSK	3	1720	23.46	23.47	23.47			Channel		
20	QPSK	3	1760	23.47	23.48	23.48			Channel		
20	QPSK	3	1800	23.48	23.49	23.49			Channel		
20	QPSK	3	1840	23.49	23.50	23.50			Channel		
20	QPSK	3	1880	23.50	23.51	23.51			Channel		
20	QPSK	3	1920	23.51	23.52	23.52			Channel		
20	QPSK	3	1960	23.52	23.53	23.53			Channel		
20	QPSK	3	2000	23.53	23.54	23.54			Channel		
20	QPSK	3	2040	23.54	23.55	23.55			Channel		
20	QPSK	3	2080	23.55	23.56	23.56			Channel		
20	QPSK	3	2120	23.56	23.57	23.57			Channel		
20	QPSK	3	2160	23.57	23.58	23.58			Channel		
20	QPSK	3	2200	23.58	23.59	23.59			Channel		
20	QPSK	3	2240	23.59	23.60	23.60			Channel		
20	QPSK	3	2280	23.60	23.61	23.61			Channel		
20	QPSK	3	2320	23.61	23.62	23.62			Channel		
20	QPSK	3	2360	23.62	23.63	23.63			Channel		
20	QPSK	3	2400	23.63	23.64	23.64			Channel		
20	QPSK	3	2440	23.64	23.65	23.65			Channel		
20	QPSK	3	2480	23.65	23.66	23.66			Channel		
20	QPSK	3	2520	23.66	23.67	23.67			Channel		
20	QPSK	3	2560	23.67	23.68	23.68			Channel		
20	QPSK	3	2600	23.68	23.69	23.69			Channel		
20	QPSK	3	2640	23.69	23.70	23.70			Channel		
20	QPSK	3	2680	23.70	23.71	23.71			Channel		
20	QPSK	3	2720	23.71	23.72	23.72			Channel		
20	QPSK	3	2760	23.72	23.73	23.73			Channel		
20	QPSK	3	2800	23.73	23.74	23.74			Channel		
20	QPSK	3	2840	23.74	23.75	23.75			Channel		
20	QPSK	3	2880	23.75	23.76	23.76			Channel		
20	QPSK	3	2920	23.76	23.77	23.77			Channel		
20	QPSK	3	2960	23.77	23.78	23.78			Channel		
20	QPSK	3	3000	23.78	23.79	23.79			Channel		
20	QPSK	3	3040	23.79	23.80	23.80			Channel		
20	QPSK	3	3080	23.80	23.81	23.81			Channel		
20	QPSK	3	3120	23.81	23.82	23.82			Channel		
20	QPSK	3	3160	23.82	23.83	23.83			Channel		
20	QPSK	3	3200	23.83	23.84	23.84			Channel		
20	QPSK	3	3240	23.84	23.85	23.85			Channel		
20	QPSK	3	3280	23.85	23.86	23.86			Channel		
20	QPSK	3	3320	23.86	23.87	23.87			Channel		
20	QPSK	3	3360	23.87	23.88	23.88			Channel		
20	QPSK	3	3400	23.88	23.89	23.89			Channel		
20	QPSK	3	3440	23.89	23.90	23.90			Channel		
20	QPSK	3	3480	23.90	23.91	23.91			Channel		
20	QPSK	3	3520	23.91	23.92	23.92			Channel		
20	QPSK	3	3560	23.92	23.93	23.93			Channel		
20	QPSK	3	3600	23.93	23.94	23.94			Channel		
20	QPSK	3	3640	23.94	23.95	23.95			Channel		
20	QPSK	3	3680	23.95	23.96	23.96			Channel		
20	QPSK	3	3720	23.96	23.97	23.97			Channel		
20	QPSK	3	3760	23.97	23.98	23.98			Channel		
20	QPSK	3	3800	23.98	23.99	23.99			Channel		
20	QPSK	3	3840	23.99	24.00	24.00			Channel		
20	QPSK	3	3880	24.00	24.01	24.01			Channel		
20	QPSK	3	3920	24.01	24.02	24.02			Channel		
20	QPSK	3	3960	24.02	24.03	24.03			Channel		
20	QPSK	3	4000	24.03	24.04	24.04			Channel		
20	QPSK	3	4040	24.04	24.05	24.05			Channel		
20	QPSK	3	4080	24.05	24.06	24.06			Channel		
20	QPSK	3	4120	24.06	24.07	24.07			Channel		
20	QPSK	3	4160	24.07	24.08	24.08			Channel		
20	QPSK	3	4200	24.08	24.09	24.09			Channel		
20	QPSK	3	4240	24.09	24.10	24.10			Channel		
20	QPSK	3	4280	24.10	24.11	24.11			Channel		
20	QPSK	3	4320	24.11	24.12	24.12			Channel		
20	QPSK	3	4360	24.12	24.13	24.13			Channel		
20	QPSK	3	4400	24.13	24.14	24.14			Channel		
20	QPSK	3	4440	24.14	24.15	24.15			Channel		
20	QPSK	3	4480	24.15	24.16	24.16			Channel		
20	QPSK	3	4520	24.16	24.17	24.17			Channel		
20	QPSK	3	4560	24.17	24.18	24.18			Channel		
20	QPSK	3	4600	24.18	24.19	24.19			Channel		
20	QPSK	3	4640	24.19	24.20	24.20			Channel		
20	QPSK	3	4680	24.20	24.21	24.21			Channel		
20	QPSK	3	4720	24.21	24.22	24.22			Channel		
20	QPSK	3	4760	24.22	24.23	24.23			Channel		
20	QPSK	3	4800	24.23	24.24	24.24			Channel		
20	QPSK	3	4840	24.24	24.25	24.25			Channel		
20	QPSK	3	4880	24.25	24.26	24.26			Channel		
20	QPSK	3	4920	24.26	24.27	24.27			Channel		
20	QPSK	3	4960	24.27	24.28	24.28			Channel		
20	QPSK	3	5000	24.28	24.29	24.29					



L1E Band 36

SW (MHz)	Modulation	RB Size	RB Offset	Power Low Ch. (Freq.)	Power Max Ch. (Freq.)	Power High Ch. (Freq.)	Time-up time (dBm)	MPE (dB)
Channel								
Frequency (MHz)								
10	QPSK	1	0	23.25			24	0
10	QPSK	1	24	23.12				
10	QPSK	25	0	23.25				
10	QPSK	25	12	22.48			23	1
10	QPSK	25	24	22.47				
10	QPSK	50	0	22.46				
10	16QAM	1	0	22.87			23	1
10	16QAM	1	24	22.88				
10	16QAM	1	48	22.85				
10	16QAM	25	0	21.28			22	2
10	16QAM	25	12	21.61				
10	16QAM	25	24	21.50				
10	16QAM	50	0	21.28			21	3
10	16QAM	50	24	21.25				
10	16QAM	50	48	21.51				
10	64QAM	1	0	21.52			22	2
10	64QAM	1	48	21.52				
10	64QAM	25	12	19.93				
10	64QAM	25	24	19.87			21	3
10	64QAM	50	0	19.88				
10	64QAM	50	48	19.88				
Channel								
Frequency (MHz)								
5	QPSK	1	0	23.17	23.10	23.03	24	0
5	QPSK	1	12	23.11	23.05	23.04		
5	QPSK	1	24	23.02	23.10	23.04		
5	QPSK	12	0	22.61	22.58	22.48	23	1
5	QPSK	12	7	22.53	22.51	22.59		
5	QPSK	12	14	22.51	22.49	22.54		
5	QPSK	25	0	22.46	22.50	22.58	23	1
5	16QAM	1	0	22.96	22.79	22.77		
5	16QAM	1	12	22.92	22.71	22.72		
5	16QAM	1	24	22.76	22.82	22.74	22	2
5	16QAM	12	0	21.82	21.60	21.50		
5	16QAM	12	7	21.62	21.59	21.83		
5	16QAM	12	14	21.61	21.50	21.52	21	3
5	16QAM	25	0	21.59	21.54	21.57		
5	64QAM	1	0	21.46	21.33	21.23		
5	64QAM	1	12	21.38	21.25	21.26	22	2
5	64QAM	1	24	21.65	21.25	21.23		
5	64QAM	12	0	20.75	20.70	20.78		
5	64QAM	12	7	20.71	20.54	20.56	21	3
5	64QAM	12	14	20.56	20.50	20.56		
5	64QAM	25	0	20.12	20.05	20.14		

L1E Band 66

SW (MHz)	Modulation	RB Size	RB Offset	Power Low Ch. (Freq.)	Power Max Ch. (Freq.)	Power High Ch. (Freq.)	Time-up time (dBm)	MPE (dB)
Channel								
Frequency (MHz)								
20	QPSK	1	0	23.25	23.24	23.23	24	0
20	QPSK	1	48	23.07	23.09	23.11		
20	QPSK	1	96	23.12	23.24	23.30		
20	QPSK	50	0	22.50	22.58	22.28	23	1
20	QPSK	50	24	22.25	22.19	22.21		
20	QPSK	50	48	22.28	22.27	22.23		
20	QPSK	100	0	22.50	22.58	22.28	23	1
20	16QAM	1	0	22.87	22.70	22.64		
20	16QAM	1	48	22.46	22.52	22.49		
20	16QAM	1	96	22.20	22.24	22.23	22	2
20	16QAM	50	0	21.17	21.28	21.23		
20	16QAM	50	24	21.22	21.17	21.21		
20	16QAM	50	48	21.26	21.28	21.24	21	3
20	64QAM	1	0	21.46	21.28	21.59		
20	64QAM	1	48	21.46	21.38	21.51		
20	64QAM	1	96	21.37	21.36	21.33	22	2
20	64QAM	50	0	20.90	20.87	20.92		
20	64QAM	50	24	20.58	20.54	20.49		
20	64QAM	50	48	20.45	20.75	20.55	21	3
20	64QAM	100	0	20.44	20.48	20.46		
20	64QAM	100	48	20.50	20.58	20.57		
Channel								
Frequency (MHz)								
15	QPSK	1	0	23.31	23.38	23.12	24	0
15	QPSK	1	37	23.11	23.29	23.30		
15	QPSK	1	74	23.12	23.19	23.21		
15	QPSK	36	0	22.24	22.32	22.33	23	1
15	QPSK	36	20	22.20	22.13	22.17		
15	QPSK	36	40	22.19	22.16	22.24		
15	QPSK	75	0	22.27	22.18	22.22	22	2
15	16QAM	1	0	22.78	22.74	22.82		
15	16QAM	1	37	22.72	22.49	22.48		
15	16QAM	1	74	22.77	22.81	22.75	21	3
15	16QAM	36	0	21.24	21.31	21.31		
15	16QAM	36	20	21.29	21.16	21.15		
15	16QAM	36	40	21.16	21.17	21.28	22	2
15	16QAM	75	0	21.24	21.19	21.20		
15	64QAM	1	0	21.02	21.13	21.07		
15	64QAM	1	37	21.08	20.80	21.08	21	3
15	64QAM	1	74	21.13	21.03	21.23		
15	64QAM	36	0	19.93	20.03	20.16		
15	64QAM	36	20	20.02	19.83	20.01	22	2
15	64QAM	36	40	19.97	19.98	20.06		
15	64QAM	75	0	19.98	19.94	20.04		
Channel								
Frequency (MHz)								
10	QPSK	1	0	23.13	23.10	23.11	24	0
10	QPSK	1	24	22.97	22.91	23.15		
10	QPSK	1	48	23.33	23.29	23.30		
10	QPSK	25	0	22.06	22.11	22.09	23	1
10	QPSK	25	12	22.12	22.10	22.18		
10	QPSK	25	24	22.28	22.29	22.30		
10	QPSK	50	0	22.09	22.24	22.25	23	1
10	16QAM	1	0	22.60	22.76	22.83		
10	16QAM	1	24	22.32	22.38	22.41		
10	16QAM	1	48	22.46	22.50	22.47	22	2
10	16QAM	25	0	21.05	21.09	21.10		
10	16QAM	25	12	21.10	21.10	21.08		
10	16QAM	25	24	21.28	21.24	21.27	21	3
10	16QAM	50	0	21.11	21.12	21.23		
10	64QAM	1	0	21.22	21.28	21.12		
10	64QAM	1	24	21.39	21.45	21.49	22	2
10	64QAM	1	48	21.36	21.50	21.50		
10	64QAM	25	0	19.75	19.84	19.83		
10	64QAM	25	12	19.88	19.86	20.03	21	3
10	64QAM	25	24	19.97	20.11	20.10		
10	64QAM	50	0	19.90	19.88	20.12		
Channel								
Frequency (MHz)								
5	QPSK	1	0	23.12	23.16	23.20	24	0
5	QPSK	1	12	23.07	22.95	23.11		
5	QPSK	1	24	22.99	22.99	23.12		
5	QPSK	12	0	22.10	22.11	22.16	23	1
5	QPSK	12	13	22.07	22.10	22.15		
5	QPSK	25	0	22.09	22.06	22.01		
5	16QAM	1	0	22.47	22.25	22.68	23	1
5	16QAM	1	12	22.30	22.34	22.36		
5	16QAM	1	24	22.32	22.40	22.42		
5	16QAM	12	0	21.16	21.16	21.25	22	2
5	16QAM	12	7	21.11	21.11	21.23		
5	16QAM	12	13	21.05	21.20	21.15		
5	16QAM	25	0	21.08	21.07	21.08	21	3
5	64QAM	1	0	21.02	21.48	21.34		
5	64QAM	1	12	21.20	21.19	21.26		
5	64QAM	1	24	21.30	21.16	21.15	22	2
5	64QAM	12	0	19.84	19.80	20.12		
5	64QAM	12	7	19.82	19.85	20.00		
5	64QAM	12	13	19.87	19.85	20.00	21	3
5	64QAM	25	0	19.87	19.80	20.02		
5	64QAM	25	12	19.87	19.86	20.02		
Channel								
Frequency (MHz)								
3	QPSK	1	0	23.10	23.20	23.20	24	0
3	QPSK	1	9	23.00	23.19	23.16		
3	QPSK	1	18	23.00	23.11	23.09		
3	QPSK	8	0	22.08	22.14	22.20	23	1
3	QPSK	8	4	22.08	22.12	22.20		
3	QPSK	8	7	22.00	22.14	22.15		
3	QPSK	15	0	22.08	22.13	22.17	23	1
3	16QAM	1	0	22.37	22.41	22.53		
3	16QAM	1	9	22.20	22.20	22.48		
3	16QAM	1	18	22.01	22.06	22.05	22	2
3	16QAM	8	0	21.16	21.17	21.42		
3	16QAM	8	4	21.15	21.18	21.23		
3	16QAM	8	7	21.10	21.26	21.23	21	3
3	16QAM	15	0	21.07	21.12	21.19		
3	64QAM	1	0	21.40	21.28	21.31		
3	64QAM	1	9	21.21	21.37	21.28	22	2
3	64QAM	1	18	21.32	21.16	21.23		
3	64QAM	8	0	19.87	19.80	20.04		
3	64QAM	8	4	19.88	19.88	20.05	21	3
3	64QAM	8	7	19.88	19.88	19.91		
3	64QAM	15	0	19.91	20.08	20.01		
Channel								
Frequency (MHz)								
1.4	QPSK	1	0	23.19	23.07	23.24	24	0
1.4	QPSK	1	3	23.05	23.11	23.16		
1.4	QPSK	1	6	23.00	23.14	23.10		
1.4	Q							



Reduced Power Mode for P-Sensor On

GSM1900 TX Channel	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512	661	810		512	661	810	
Frequency (MHz)	152.2	180	152.3		152.2	180	152.3	
GSM 1 Tx slot	26.12	26.08	26.15	27.00	17.12	17.08	17.15	18.00
GPRS 1 Tx slot	26.15	26.06	26.14	27.00	17.15	17.06	17.14	18.00
GPRS 2 Tx slots	22.41	22.43	22.36	24.00	16.41	16.43	16.36	18.00
GPRS 3 Tx slots	20.97	20.84	20.90	22.00	16.71	16.58	16.64	17.74
GPRS 4 Tx slots	19.60	19.62	19.63	20.50	16.60	16.62	16.63	17.50
EDGE 1 Tx slot	21.95	22.02	21.89	22.50	12.95	13.02	12.89	13.50
EDGE 2 Tx slots	21.81	21.92	21.71	22.50	15.81	15.92	15.71	16.50
EDGE 3 Tx slots	19.82	20.12	19.72	20.50	15.56	15.86	15.46	16.24
EDGE 4 Tx slots	18.71	18.84	18.69	19.50	15.71	15.84	15.59	16.50



Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
TX Channel		9502	9400	9538		1312	1113	1513		4132	4132	4233	
Rx Channel		9652	9400	9938	1537	1639	1738	4357	4407	4458			
Frequency (MHz)		1852.4	1680	1907.6	1712.4	1732.6	1752.6	826.4	836.4	846.6			
3GPP Rel 99	AMR 12.2kops	14.22	14.26	14.20	15.50	15.28	15.22	15.13	16.00	20.87	21.13	21.07	22.00
3GPP Rel 99	RMC 12.2kops	14.21	14.28	14.22	15.50	15.22	15.27	15.18	16.00	20.86	21.16	21.11	22.00
3GPP Rel 6	HSDPA Subtest-1	13.64	13.54	13.68	14.50	14.18	14.05	14.14	15.00	20.17	20.36	20.41	21.00
3GPP Rel 6	HSDPA Subtest-2	13.63	13.76	13.65	14.50	14.15	14.12	14.07	15.00	20.19	20.35	20.32	21.00
3GPP Rel 6	HSDPA Subtest-3	12.97	12.98	13.10	14.00	13.63	13.54	13.67	14.50	19.68	19.56	19.90	20.50
3GPP Rel 6	HSDPA Subtest-4	13.08	13.10	12.98	14.00	13.68	13.65	13.63	14.50	19.67	19.67	19.67	20.50
3GPP Rel 8	DC-HSDPA Subtest-1	13.65	13.62	13.66	14.50	14.16	14.06	14.11	15.00	20.18	20.02	20.41	21.00
3GPP Rel 8	DC-HSDPA Subtest-2	13.62	13.87	13.54	14.50	14.13	14.07	14.14	15.00	20.18	20.01	20.38	21.00
3GPP Rel 8	DC-HSDPA Subtest-3	12.97	13.43	12.99	14.00	13.61	13.65	13.60	14.50	19.67	19.55	19.68	20.50
3GPP Rel 8	DC-HSDPA Subtest-4	12.96	12.96	12.98	14.00	13.60	13.70	13.54	14.50	19.63	19.51	19.79	20.50
3GPP Rel 6	HSUPA Subtest-1	13.65	13.65	13.66	14.50	14.28	14.32	14.13	15.00	20.17	20.12	20.46	21.00
3GPP Rel 6	HSUPA Subtest-2	11.82	11.76	11.88	12.50	12.16	12.24	12.21	13.00	18.21	18.22	18.37	19.00
3GPP Rel 6	HSUPA Subtest-3	12.74	12.74	12.87	13.50	13.06	13.08	12.97	14.00	19.13	19.18	19.35	20.00
3GPP Rel 6	HSUPA Subtest-4	11.64	11.76	11.88	12.50	12.07	12.15	11.97	13.00	18.06	18.24	18.35	19.00
3GPP Rel 6	HSUPA Subtest-5	13.90	13.66	13.97	14.50	14.26	14.22	14.16	15.00	20.03	20.25	20.34	21.00



LTE Band 2

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								
Frequency (MHz)								
20	QPSK	1	0	15.94	15.07	15.83	16.5	0
20	QPSK	1	49	15.71	16.04	16.03		
20	QPSK	1	99	15.67	15.91	15.99		
20	QPSK	50	0	15.89	15.96	15.81		
20	QPSK	50	24	15.95	15.81	15.77		
20	QPSK	50	50	15.77	15.68	15.75		
20	QPSK	100	0	15.91	15.91	15.79		
20	16QAM	1	0	15.94	15.98	15.85		
20	16QAM	1	49	15.86	15.86	15.73		
20	16QAM	1	99	15.83	15.96	15.85		
20	16QAM	50	0	15.99	15.84	15.75		
20	16QAM	50	24	15.83	15.84	15.72		
20	16QAM	50	50	15.68	15.68	15.71		
20	16QAM	100	0	15.92	15.79	15.89		
20	64QAM	1	0	15.86	15.76	15.84		
20	64QAM	1	49	15.73	15.65	15.82		
20	64QAM	1	99	15.73	15.96	15.96		
20	64QAM	50	0	16.01	15.87	15.78		
20	64QAM	50	24	15.93	15.77	15.73		
20	64QAM	50	50	15.81	15.59	15.74		
20	64QAM	100	0	15.87	15.80	15.75		
Channel								
Frequency (MHz)								
15	QPSK	1	0	15.77	15.77	15.86	16.5	0
15	QPSK	1	37	15.57	15.98	15.71		
15	QPSK	1	74	15.79	15.87	15.77		
15	QPSK	36	0	15.93	15.96	15.83		
15	QPSK	36	20	16.00	15.93	15.89		
15	QPSK	36	39	15.87	15.81	15.87		
15	QPSK	75	0	15.95	15.85	15.95		
15	16QAM	1	0	15.88	15.81	16.00		
15	16QAM	1	37	16.05	16.04	15.84		
15	16QAM	1	74	15.78	15.76	15.71		
15	16QAM	36	0	15.91	15.96	15.78		
15	16QAM	36	20	15.86	15.86	15.90		
15	16QAM	36	39	16.03	15.81	15.93		
15	16QAM	75	0	16.00	16.02	15.85		
15	64QAM	1	0	15.97	16.03	15.71		
15	64QAM	1	37	15.79	15.80	15.72		
15	64QAM	1	74	15.99	15.71	15.81		
15	64QAM	36	0	16.06	15.84	15.79		
15	64QAM	36	20	15.86	15.87	15.81		
15	64QAM	36	39	15.92	15.80	15.85		
15	64QAM	75	0	15.85	15.92	15.82		
Channel								
Frequency (MHz)								
10	QPSK	1	0	15.76	15.77	15.74	16.5	0
10	QPSK	1	25	15.71	15.91	15.96		
10	QPSK	1	49	15.84	15.78	15.73		
10	QPSK	25	0	15.85	15.88	15.91		
10	QPSK	25	12	15.91	15.83	15.87		
10	QPSK	25	25	15.82	15.92	15.79		
10	QPSK	50	0	15.90	15.92	15.81		
10	16QAM	1	0	16.01	15.99	15.88		
10	16QAM	1	25	15.85	15.91	16.04		
10	16QAM	1	49	16.02	15.99	16.03		
10	16QAM	25	0	15.90	15.90	15.91		
10	16QAM	25	12	15.91	15.78	15.77		
10	16QAM	25	25	15.85	15.70	15.72		
10	16QAM	50	0	15.92	15.96	15.82		
10	64QAM	1	0	15.92	15.96	15.83		
10	64QAM	1	25	15.86	15.99	15.80		
10	64QAM	1	49	15.85	15.84	15.78		
10	64QAM	25	0	15.87	15.88	15.87		
10	64QAM	25	12	15.78	15.88	15.82		
10	64QAM	25	25	15.85	15.92	15.77		
10	64QAM	50	0	15.78	15.86	15.85		
Channel								
Frequency (MHz)								
5	QPSK	1	0	15.88	15.76	15.76	16.5	0
5	QPSK	1	12	15.82	15.68	15.68		
5	QPSK	1	24	15.71	15.95	15.60		
5	QPSK	12	0	15.95	15.94	15.99		
5	QPSK	12	7	15.92	15.84	15.79		
5	QPSK	12	13	15.83	15.90	15.75		
5	QPSK	25	0	15.95	15.88	15.82		
5	16QAM	1	0	15.93	15.74	15.95		
5	16QAM	1	12	15.96	15.99	15.82		
5	16QAM	1	24	15.98	15.91	15.99		
5	16QAM	12	0	16.03	15.85	15.89		
5	16QAM	12	7	15.90	15.90	15.75		
5	16QAM	12	13	15.85	15.79	15.73		
5	16QAM	25	0	15.96	15.80	15.74		
5	64QAM	1	0	15.98	16.01	15.89		
5	64QAM	1	12	16.05	15.84	16.02		
5	64QAM	1	24	15.91	15.94	15.85		
5	64QAM	12	0	15.93	15.79	15.89		
5	64QAM	12	7	15.85	15.07	15.78		
5	64QAM	12	13	15.99	15.95	15.78		
5	64QAM	25	0	15.94	15.94	15.79		
Channel								
Frequency (MHz)								
3	QPSK	1	0	16.04	15.89	15.75	16.5	0
3	QPSK	1	8	16.04	16.00	15.87		
3	QPSK	1	14	16.06	15.72	15.84		
3	QPSK	8	0	15.87	15.76	15.84		
3	QPSK	8	4	15.90	15.88	15.91		
3	QPSK	8	7	15.82	15.87	15.79		
3	QPSK	15	0	15.85	15.83	15.71		
3	16QAM	1	0	16.03	15.70	15.81		
3	16QAM	1	8	15.99	15.97	15.96		
3	16QAM	1	14	15.75	16.01	15.97		
3	16QAM	8	0	15.88	15.66	15.70		
3	16QAM	8	4	15.99	15.92	15.95		
3	16QAM	8	7	15.70	15.74	15.65		
3	16QAM	15	0	15.72	15.83	15.72		
3	64QAM	1	0	15.81	16.01	15.87		
3	64QAM	1	8	15.92	15.88	15.75		
3	64QAM	1	14	15.83	16.01	15.94		
3	64QAM	8	0	15.82	15.98	15.97		
3	64QAM	8	4	15.87	16.03	16.00		
3	64QAM	8	7	15.93	16.00	15.97		
3	64QAM	15	0	15.90	15.96	15.92		
Channel								
Frequency (MHz)								
1.4	QPSK	1	0	15.55	15.77	15.73	16.5	0
1.4	QPSK	1	3	16.00	16.01	15.82		
1.4	QPSK	1	5	15.69	15.94	15.76		
1.4	QPSK	3	0	15.99	15.92	15.87		
1.4	QPSK	3	1	16.01	15.97	15.94		
1.4	QPSK	3	3	15.91	16.00	15.81		
1.4	QPSK	6	0	15.76	15.79	15.86		
1.4	16QAM	1	0	15.99	15.73	16.00		
1.4	16QAM	1	3	16.04	15.98	16.00		
1.4	16QAM	1	5	15.89	15.86	15.84		
1.4	16QAM	3	0	16.02	15.74	15.74		
1.4	16QAM	3	1	16.00	16.02	16.04		
1.4	16QAM	3	3	15.82	15.96	15.86		
1.4	16QAM	6	0	15.70	15.76	15.64		
1.4	64QAM	1	0	15.71	16.03	16.00		
1.4	64QAM	1	3	15.96	15.97	16.00		
1.4	64QAM	1	5	16.01	15.86	15.99		
1.4	64QAM	3	0	15.92	15.91	15.86		
1.4	64QAM	3	1	16.04	15.97	15.91		
1.4	64QAM	3	3	16.01	15.75	15.81		
1.4	64QAM	6	0	16.01	16.04	15.83		

LTE Band 4

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								
Frequency (MHz)								
20	QPSK	1	0	15.78	15.02	15.97	16.5	0
20	QPSK	1	49	15.80	15.88	15.79		
20	QPSK	1	99	15.73	15.87	15.72		
20	QPSK	50	0	15.85	15.84	15.79		
20	QPSK	50	24	15.88	15.72	15.75		
20	QPSK	50	50	15.77	15.81	15.86		
20	QPSK	100	0	15.74	15.88	15.80		
20	16QAM	1	0	15.71	15.76	15.74		
20	16QAM	1	49	15.99	15.88	15.74		
20	16QAM	1	99	15.69	15.86	15.75		
20	16QAM	50	0	15.76	15.84	15.74		
20	16QAM	50	24	15.92	15.76	15.73		
20	16QAM	50	50	15.79	15.87	15.82		
20	16QAM	100	0	15.74	15.73	15.73		
20	64QAM	1	0	15.88	15.74	15.73		
20	64QAM	1	49	15.74	15.75	15.73		
20	64QAM	1	99	15.84	15.83	15.74		
20	64QAM	50	0	16.01	15.85	15.77		
20	64QAM	50	24	15.87	15.77	15.72		
20	64QAM	50	50	15.84	15.78	15.66		
20	64QAM	100	0	15.88	15.73	15.81		
Channel								
Frequency (MHz)								
15	QPSK	1	0	15.45	15.70	15.71	16.5	0
15	QPSK	1	37	15.87	15.88	15.88		
15	QPSK	1	74	15.99	15.72	15.80		
15	QPSK	36	0	15.73	15.80	15.80		
15	QPSK	36	20	15.79	15.71	15.66		
15	QPSK	36	39	15.82	15.76	15.66		
15	QPSK	75	0	15.77	15.89	15.74		
15	16QAM	1	0	15.71	15.85	15.75		
15	16QAM	1	37	15.74	15.99	15.84		
15	16QAM	1	74	15.72	15.74	15.82		
15	16QAM	36	0	15.73	15.78	15.78		
15	16QAM	36	20	15.77	15.79	15.6		



LTE Band 30

BW (MHz)	Modulation	RB Size	RB Offset	Channel			Tune-up limit (dBm)	MPR (dB)
				Power Low Ch / Freq	Power Middle Ch / Freq	Power High Ch / Freq		
Channel 2310							21	0
Frequency (MHz)								
10	QPSK	1	0	20.15	20.15	20.15		
10	QPSK	1	25	20.03	20.03	20.03		
10	QPSK	1	49	19.99	19.99	19.99		
10	QPSK	25	0	20.11	20.11	20.11		
10	QPSK	25	12	19.76	19.76	19.76		
10	QPSK	25	25	19.78	19.78	19.78		
10	QPSK	125	0	20.05	20.05	20.05		
10	16QAM	1	0	19.82	19.82	19.82		
10	16QAM	1	25	19.69	19.69	19.69		
10	16QAM	1	49	19.66	19.66	19.66		
10	16QAM	25	0	19.41	19.41	19.41		
10	16QAM	25	12	19.44	19.44	19.44		
10	16QAM	25	25	19.33	19.33	19.33		
10	16QAM	50	0	19.36	19.36	19.36		
10	16QAM	1	0	19.89	19.89	19.89		
10	16QAM	1	25	19.83	19.83	19.83		
10	16QAM	1	49	19.78	19.78	19.78		
10	16QAM	25	0	19.86	19.86	19.86		
10	16QAM	25	12	19.76	19.76	19.76		
10	16QAM	25	25	19.70	19.70	19.70		
10	16QAM	50	0	19.71	19.71	19.71		
Channel 2765							21	0
Frequency (MHz)								
5	QPSK	1	0	20.04	20.13	20.12		
5	QPSK	1	12	20.08	20.01	20.05		
5	QPSK	1	24	19.99	20.13	19.98		
5	QPSK	12	0	20.11	20.03	20.05		
5	QPSK	12	7	20.03	19.98	20.01		
5	QPSK	12	13	20.03	20.00	19.92		
5	QPSK	25	0	20.09	20.04	20.08		
5	16QAM	1	0	19.97	20.02	20.00		
5	16QAM	1	12	19.85	20.14	20.00		
5	16QAM	1	24	19.85	20.12	20.01		
5	16QAM	12	0	20.02	20.10	20.00		
5	16QAM	12	7	20.03	20.02	19.93		
5	16QAM	12	13	20.05	19.93	20.08		
5	16QAM	25	0	20.00	19.99	19.99		
5	16QAM	1	0	20.12	20.00	19.95		
5	16QAM	1	12	20.00	20.01	19.99		
5	16QAM	1	24	20.10	20.08	20.00		
5	16QAM	12	0	20.12	20.11	20.03		
5	16QAM	12	7	20.13	20.03	19.98		
5	16QAM	12	13	20.10	20.04	19.92		
5	16QAM	25	0	20.14	19.99	20.07		

LTE Band 66

BW (MHz)	Modulation	RB Size	RB Offset	Channel			Tune-up limit (dBm)	MPR (dB)
				Power Low Ch / Freq	Power Middle Ch / Freq	Power High Ch / Freq		
Channel 1720							16.5	0
Frequency (MHz)								
20	QPSK	1	0	16.01	16.06	16.08		
20	QPSK	1	49	16.00	16.09	16.06		
20	QPSK	1	99	16.06	16.07	16.06		
20	QPSK	50	0	16.82	16.86	16.75		
20	QPSK	50	24	16.57	16.58	16.61		
20	QPSK	50	50	16.50	16.56	16.56		
20	QPSK	100	0	16.52	16.51	16.54		
20	16QAM	1	0	16.57	16.57	16.54		
20	16QAM	1	49	16.97	16.49	16.47		
20	16QAM	1	99	16.80	16.90	16.94		
20	16QAM	50	0	16.43	16.90	16.52		
20	16QAM	50	24	16.50	16.62	16.61		
20	16QAM	50	50	16.53	16.52	16.57		
20	16QAM	100	0	16.54	16.55	16.59		
20	64QAM	1	0	16.88	16.73	16.84		
20	64QAM	1	49	16.73	16.74	16.80		
20	64QAM	1	99	16.84	16.58	16.66		
20	64QAM	50	0	16.42	16.47	16.50		
20	64QAM	50	24	16.49	16.59	16.57		
20	64QAM	50	50	16.51	16.53	16.53		
20	64QAM	100	0	16.51	16.58	16.59		
Channel 13047							16.5	0
Frequency (MHz)								
15	QPSK	1	0	16.59	16.53	16.70		
15	QPSK	1	37	16.90	16.45	16.75		
15	QPSK	1	74	16.81	16.63	16.71		
15	QPSK	36	0	16.93	16.81	16.66		
15	QPSK	36	20	16.46	16.60	16.57		
15	QPSK	36	39	16.47	16.53	16.54		
15	QPSK	75	0	16.47	16.52	16.58		
15	16QAM	1	0	16.75	16.79	16.80		
15	16QAM	1	37	16.99	16.51	16.38		
15	16QAM	1	74	16.81	16.98	16.99		
15	16QAM	36	0	16.54	16.59	16.68		
15	16QAM	36	20	16.42	16.52	16.55		
15	16QAM	36	39	16.49	16.48	16.53		
15	16QAM	75	0	16.45	16.60	16.68		
15	64QAM	1	0	16.56	16.60	16.65		
15	64QAM	1	37	16.29	16.35	16.32		
15	64QAM	1	74	16.45	16.42	16.50		
15	64QAM	36	0	16.54	16.81	16.86		
15	64QAM	36	20	16.42	16.60	16.51		
15	64QAM	36	39	16.47	16.49	16.51		
15	64QAM	75	0	16.42	16.63	16.65		
Channel 13202							16.5	0
Frequency (MHz)								
10	QPSK	1	0	16.21	16.22	16.27		
10	QPSK	1	25	16.22	16.33	16.33		
10	QPSK	1	49	16.31	16.36	16.37		
10	QPSK	25	0	16.22	16.39	16.45		
10	QPSK	25	12	16.29	16.51	16.52		
10	QPSK	25	25	16.34	16.57	16.66		
10	QPSK	50	0	16.55	16.48	16.48		
10	16QAM	1	0	16.36	16.28	16.30		
10	16QAM	1	25	16.62	16.25	16.33		
10	16QAM	1	49	16.29	16.32	16.23		
10	16QAM	25	0	16.50	16.41	16.40		
10	16QAM	25	12	16.54	16.54	16.49		
10	16QAM	25	25	16.55	16.53	16.59		
10	16QAM	50	0	16.55	16.49	16.47		
10	16QAM	1	0	16.26	16.48	16.28		
10	64QAM	1	25	16.73	16.69	16.67		
10	64QAM	1	49	16.29	16.32	16.24		
10	64QAM	25	0	16.46	16.39	16.43		
10	64QAM	25	12	16.52	16.55	16.49		
10	64QAM	25	25	16.57	16.53	16.58		
10	64QAM	50	0	16.48	16.50	16.47		
Channel 13097							16.5	0
Frequency (MHz)								
5	QPSK	1	0	16.59	16.34	16.17		
5	QPSK	1	12	16.42	16.37	16.63		
5	QPSK	1	24	16.42	16.41	16.41		
5	QPSK	12	0	16.60	16.49	16.61		
5	QPSK	12	7	16.55	16.49	16.56		
5	QPSK	12	13	16.49	16.49	16.49		
5	QPSK	25	0	16.56	16.50	16.60		
5	16QAM	1	0	16.45	16.36	16.41		
5	16QAM	1	12	16.40	16.29	16.33		
5	16QAM	1	24	16.34	16.26	16.29		
5	16QAM	12	0	16.82	16.51	16.61		
5	16QAM	12	7	16.54	16.55	16.58		
5	16QAM	12	13	16.54	16.51	16.54		
5	16QAM	25	0	16.55	16.52	16.53		
5	64QAM	1	0	16.86	16.72	16.82		
5	64QAM	1	12	16.74	16.71	16.68		
5	64QAM	1	24	16.69	16.59	16.65		
5	64QAM	12	0	16.58	16.45	16.59		
5	64QAM	12	7	16.52	16.50	16.52		
5	64QAM	12	13	16.50	16.45	16.47		
5	64QAM	25	0	16.53	16.55	16.53		
Channel 13187							16.5	0
Frequency (MHz)								
3	QPSK	1	0	16.25	16.43	16.58		
3	QPSK	1	8	16.45	16.71	16.55		
3	QPSK	1	14	16.67	16.54	16.48		
3	QPSK	8	0	16.56	16.46	16.59		
3	QPSK	8	4	16.52	16.69	16.52		
3	QPSK	8	7	16.49	16.47	16.81		
3	QPSK	15	0	16.55	16.47	16.80		
3	16QAM	1	0	16.93	16.49	16.69		
3	16QAM	1	8	16.76	16.40	16.71		
3	16QAM	1	14	16.67	16.86	16.55		
3	16QAM	8	0	16.72	16.81	16.58		
3	16QAM	8	4	16.53	16.76	16.83		
3	16QAM	8	7	16.61	16.45	16.78		
3	16QAM	15	0	16.27	16.50	16.51		
3	64QAM	1	0	16.43	16.42	16.69		
3	64QAM	1	8	16.34	16.53	16.51		
3	64QAM	1	14	16.26	16.72	16.52		
3	64QAM	8	0	16.60	16.71	16.73		
3	64QAM	8	4	16.34	16.49	16.52		
3	64QAM	8	7	16.74	16.52	16.75		
3	64QAM	15	0	16.36	16.39	16.59		
Channel 13177							16.5	0
Frequency (MHz)								
1.4	QPSK	1	0	16.34	16.34	16.43		
1.4	QPSK	1	3	16.40	16.33	16.32		
1.4	QPSK	1	5	16.51	16.78	16.71		
1.4	QPSK	3	0	16.57	16.39	16.66		
1.4	QPSK	3	1	16.60	16.51	16.82		
1.4	QPSK	3	3	16.36	16.57	16.54		
1.4	QPSK	8	0	16.52	16.46	16.59		
1.4	16QAM	1	0	16.37	16.36	16.71		
1.4	16QAM	1	3	16.57	16.59	16.47		
1.4	16QAM	1	5	16.37	16.46	16.65		
1.4	16QAM	3</						

Reduced Power Mode for Hotspot On

GSM1900 TX Channel Frequency (MHz)	Burst Average Power (dBm)			Tune-up Limit (dBm)	Frame-Average Power (dBm)			Tune-up Limit (dBm)
	512 1850.2	661 1880	810 1909.8		512 1850.2	661 1880	810 1909.8	
GSM 1 Tx slot	23.45	23.57	23.47	24.50	14.45	14.57	14.47	15.50
GPRS 1 Tx slot	23.44	23.45	23.45	24.50	14.44	14.45	14.45	15.50
GPRS 2 Tx slots	20.05	20.21	20.11	21.50	14.05	14.21	14.11	15.50
GPRS 3 Tx slots	17.78	18.10	17.82	19.50	13.52	13.84	13.56	15.24
GPRS 4 Tx slots	16.70	16.96	16.86	18.00	13.70	13.98	13.66	15.00
EDGE 1 Tx slot	19.58	19.53	19.43	20.00	10.56	10.53	10.43	11.00
EDGE 2 Tx slots	19.66	19.51	19.45	20.00	13.66	13.51	13.45	14.00
EDGE 3 Tx slots	17.74	17.69	17.84	18.00	13.48	13.43	13.58	13.74
EDGE 4 Tx slots	16.05	16.15	16.05	17.00	13.05	13.15	13.05	14.00



Band		WCDMA II			Tune-up Limit (dBm)	WCDMA IV			Tune-up Limit (dBm)	WCDMA V			Tune-up Limit (dBm)
Tx Channel		9202	9400	9538		1312	1313	1513		4132	4132	4233	
Rx Channel		9652	9800	9938	1537	1539	1738	4357	4407	4458			
Frequency (MHz)		1852.4	1980	1907.6	1712.4	1732.6	1752.6	826.4	836.4	846.6			
3GPP Rel 99	AMR 12.2kops	11.71	11.76	11.48	13.00	13.18	13.21	13.18	14.00	20.87	21.13	21.07	22.00
3GPP Rel 99	RMC 12.2kops	11.70	11.79	11.52	13.00	13.20	13.23	13.21	14.00	20.86	21.16	21.11	22.00
3GPP Rel 6	HSDPA Subtest1	11.07	10.97	11.12	12.00	12.02	11.84	11.85	13.00	20.17	20.36	20.41	21.00
3GPP Rel 6	HSDPA Subtest2	11.08	11.30	11.00	12.00	11.97	11.87	11.82	13.00	20.19	20.35	20.32	21.00
3GPP Rel 6	HSDPA Subtest3	10.53	10.42	10.59	11.50	11.47	11.36	11.38	12.50	19.68	19.56	19.90	20.50
3GPP Rel 6	HSDPA Subtest4	10.54	10.74	10.60	11.50	11.50	11.42	11.35	12.50	19.67	19.67	19.67	20.50
3GPP Rel 8	DC-HSDPA Subtest1	11.07	11.05	11.13	12.00	11.92	11.84	11.82	13.00	20.18	20.02	20.41	21.00
3GPP Rel 8	DC-HSDPA Subtest2	11.05	11.28	11.07	12.00	11.95	11.86	11.84	13.00	20.18	20.01	20.38	21.00
3GPP Rel 8	DC-HSDPA Subtest3	10.47	10.76	10.58	11.50	11.45	11.41	11.33	12.50	19.67	19.55	19.88	20.50
3GPP Rel 8	DC-HSDPA Subtest4	10.48	10.75	10.56	11.50	11.45	11.44	11.29	12.50	19.63	19.51	19.79	20.50
3GPP Rel 6	HSUPA Subtest1	11.19	11.12	11.21	12.00	12.11	12.09	11.84	13.00	20.17	20.12	20.46	21.00
3GPP Rel 6	HSUPA Subtest2	9.14	9.19	9.25	10.00	10.04	9.99	9.98	11.00	18.21	18.22	18.37	19.00
3GPP Rel 6	HSUPA Subtest3	10.20	10.16	10.27	11.00	10.89	10.85	10.71	12.00	19.13	19.18	19.35	20.00
3GPP Rel 6	HSUPA Subtest4	9.13	9.22	9.19	10.00	9.95	9.89	9.75	11.00	18.06	18.24	18.35	19.00
3GPP Rel 6	HSUPA Subtest5	11.17	11.22	11.35	12.00	12.10	11.99	11.90	13.00	20.03	20.25	20.34	21.00



LTE Band 2

Table with columns: 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). Includes sub-headers for Channel and Frequency (MHz) with various modulation schemes like QPSK and 16QAM.

LTE Band 4

Table with columns: 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). Includes sub-headers for Channel and Frequency (MHz) with various modulation schemes like QPSK and 16QAM.

LTE Band 5

Table with columns: 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). Includes sub-headers for Channel and Frequency (MHz) with various modulation schemes like QPSK and 16QAM.



LTE Band 20

Channel	Frequency (MHz)	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up Int. (dBm)	MPR (dB)
Channel 2310						
10	QPSK	1	0	20.15	21	0
10	QPSK	1	25	20.03		
10	QPSK	1	40	19.89		
10	QPSK	25	0	20.11		
10	QPSK	25	12	19.76		
10	QPSK	25	25	19.78		
10	QPSK	50	0	20.03		
10	16QAM	1	0	19.80		
10	16QAM	1	25	19.59		
10	16QAM	1	49	19.66		
10	16QAM	25	0	19.41		
10	16QAM	25	12	19.44		
10	16QAM	25	25	19.33		
10	16QAM	50	0	19.59		
10	64QAM	1	0	19.89		
10	64QAM	1	25	19.93		
10	64QAM	1	49	19.78		
10	64QAM	25	0	19.86		
10	64QAM	25	12	19.76		
10	64QAM	25	25	19.70		
10	64QAM	50	0	19.71		
Channel 2765						
Frequency (MHz)						
5	QPSK	1	0	20.04	21	0
5	QPSK	1	12	20.06		
5	QPSK	1	24	19.99		
5	QPSK	12	0	20.11		
5	QPSK	12	7	20.03		
5	QPSK	12	13	20.03		
5	QPSK	25	0	20.00		
5	16QAM	1	0	19.97		
5	16QAM	1	12	19.95		
5	16QAM	1	24	19.86		
5	16QAM	12	0	20.02		
5	16QAM	12	7	20.03		
5	16QAM	12	13	20.05		
5	16QAM	25	0	20.00		
5	16QAM	25	12	19.99		
5	16QAM	25	25	19.92		
5	64QAM	1	0	20.12		
5	64QAM	1	12	20.00		
5	64QAM	1	24	20.00		
5	64QAM	12	0	20.12		
5	64QAM	12	7	20.13		
5	64QAM	12	13	20.10		
5	64QAM	25	0	20.14		

LTE Band 66

Channel	Frequency (MHz)	Power Low Ch. / Freq.	Power Middle Ch. / Freq.	Power High Ch. / Freq.	Tune-up Int. (dBm)	MPR (dB)
Channel 1720						
20	QPSK	1	0	13.77	14.5	0
20	QPSK	1	49	13.41		
20	QPSK	1	99	13.70		
20	QPSK	50	0	13.75		
20	QPSK	50	24	13.61		
20	QPSK	50	50	13.66		
20	QPSK	100	0	13.67		
20	16QAM	1	0	13.33		
20	16QAM	1	49	13.36		
20	16QAM	1	99	13.69		
20	16QAM	50	0	13.30		
20	16QAM	50	24	13.38		
20	16QAM	50	50	13.40		
20	16QAM	100	0	13.40		
20	64QAM	1	0	13.52		
20	64QAM	1	49	13.57		
20	64QAM	1	99	13.54		
20	64QAM	50	0	13.27		
20	64QAM	50	24	13.35		
20	64QAM	50	50	13.36		
20	64QAM	100	0	13.37		
Channel 15047						
Frequency (MHz)						
15	QPSK	1	0	13.53	14.5	0
15	QPSK	1	37	13.36		
15	QPSK	1	74	13.69		
15	QPSK	36	0	13.77		
15	QPSK	36	20	13.54		
15	QPSK	36	30	13.51		
15	QPSK	75	0	13.57		
15	16QAM	1	0	13.54		
15	16QAM	1	37	13.61		
15	16QAM	1	74	13.74		
15	16QAM	36	0	13.23		
15	16QAM	36	20	13.11		
15	16QAM	36	30	13.17		
15	16QAM	75	0	13.52		
15	64QAM	1	0	13.69		
15	64QAM	1	37	13.41		
15	64QAM	1	74	13.68		
15	64QAM	36	0	13.24		
15	64QAM	36	20	13.13		
15	64QAM	36	30	13.16		
15	64QAM	75	0	13.11		
Channel 15052						
Frequency (MHz)						
10	QPSK	1	0	13.42	14.5	0
10	QPSK	1	25	13.36		
10	QPSK	1	49	13.67		
10	QPSK	25	0	13.57		
10	QPSK	25	12	13.65		
10	QPSK	25	25	13.67		
10	QPSK	50	0	13.66		
10	16QAM	1	0	13.76		
10	16QAM	1	25	13.61		
10	16QAM	1	49	13.66		
10	16QAM	25	0	13.15		
10	16QAM	25	12	13.20		
10	16QAM	25	25	13.25		
10	16QAM	50	0	13.21		
10	64QAM	1	0	13.65		
10	64QAM	1	25	13.59		
10	64QAM	1	49	13.44		
10	64QAM	25	0	13.16		
10	64QAM	25	12	13.21		
10	64QAM	25	25	13.24		
10	64QAM	50	0	13.15		
Channel 13197						
Frequency (MHz)						
5	QPSK	1	0	13.63	14.5	0
5	QPSK	1	12	13.49		
5	QPSK	1	24	13.49		
5	QPSK	12	0	13.67		
5	QPSK	12	7	13.64		
5	QPSK	12	13	13.58		
5	QPSK	25	0	13.62		
5	16QAM	1	0	13.56		
5	16QAM	1	12	13.61		
5	16QAM	1	24	13.42		
5	16QAM	12	0	13.25		
5	16QAM	12	7	13.17		
5	16QAM	12	13	13.16		
5	16QAM	25	0	13.21		
5	64QAM	1	0	13.37		
5	64QAM	1	12	13.34		
5	64QAM	1	24	13.30		
5	64QAM	12	0	13.34		
5	64QAM	12	7	13.33		
5	64QAM	12	13	13.33		
5	64QAM	25	0	13.14		
Channel 13197						
Frequency (MHz)						
3	QPSK	1	0	13.61	14.5	0
3	QPSK	1	8	13.56		
3	QPSK	1	14	13.55		
3	QPSK	8	0	13.65		
3	QPSK	8	4	13.63		
3	QPSK	8	7	13.67		
3	QPSK	15	0	13.63		
3	16QAM	1	0	13.46		
3	16QAM	1	8	13.54		
3	16QAM	1	14	13.43		
3	16QAM	8	0	13.28		
3	16QAM	8	4	13.27		
3	16QAM	8	7	13.26		
3	16QAM	15	0	13.29		
3	64QAM	1	0	13.35		
3	64QAM	1	8	13.29		
3	64QAM	1	14	13.24		
3	64QAM	8	0	13.22		
3	64QAM	8	4	13.18		
3	64QAM	8	7	13.11		
3	64QAM	15	0	13.13		
3	64QAM	15	7	13.15		
3	64QAM	15	15	13.15		
Channel 13197						
Frequency (MHz)						
1.4	QPSK	1	0	13.43	14.5	0
1.4	QPSK	1	3	13.64		
1.4	QPSK	1	5	13.65		
1.4	QPSK	3	0	13.51		
1.4	QPSK	3	1	13.57		
1.4	QPSK	3	3	13.47		
1.4	QPSK	6	0	13.54		
1.4	16QAM	1	0	13.31		
1.4	16QAM	1	3	13.44		
1.4	16QAM	1	5	13.37		
1.4	16QAM	3	0	13.15		
1.4	16QAM	3	1	13.16		
1.4	16QAM	3	3	13.10		
1.4	16QAM	6	0	13.14		
1.4	64QAM	1	0	13.14		
1.4	64QAM	1	3	13.16		
1.4	64QAM	1	5	13.17		
1.4	64QAM	3	0	13.18		
1.4	64QAM	3	1	13.20		
1.4	64QAM	3	3	13.12		
1.4	64QAM	6	0	13.09		



Reduced Power Mode for Handheld On

Band	TX Channel	WCDMA II			Turn-up Limit (dBm)	WCDMA IV			Turn-up Limit (dBm)
		5262	9400	9538		1312	1413	1513	
Rx Channel		9662	9600	9938	1537	1638	1738		
Frequency (MHz)		1922.4	1800	1873.3	1722.4	1722.3	1722.6		
3GPP Rel 99	AMR 12.2Kbps	17.55	17.58	17.17	19.00	19.75	19.81	19.53	20.50
3GPP Rel 99	AMR 12.2Kbps	17.58	17.59	17.23	19.00	19.77	19.82	19.60	20.50
3GPP Rel 6	HSDPA Subtest-1	16.96	16.82	16.91	18.00	18.12	17.98	18.02	19.50
3GPP Rel 6	HSDPA Subtest-2	16.91	17.13	16.81	18.00	18.07	18.03	17.99	19.50
3GPP Rel 6	HSDPA Subtest-3	16.34	16.28	16.38	17.50	17.57	17.50	17.55	19.00
3GPP Rel 6	HSDPA Subtest-4	16.45	16.57	16.45	17.50	17.60	17.56	17.52	19.00
3GPP Rel 8	DC-HSDPA Subtest-1	17.00	16.87	16.94	18.00	18.10	17.98	17.99	19.50
3GPP Rel 8	DC-HSDPA Subtest-2	16.94	17.10	16.86	18.00	18.05	18.00	18.01	19.50
3GPP Rel 8	DC-HSDPA Subtest-3	16.36	16.80	16.37	17.50	17.55	17.55	17.50	19.00
3GPP Rel 8	DC-HSDPA Subtest-4	16.40	16.59	16.43	17.50	17.55	17.58	17.46	19.00
3GPP Rel 6	HSUPA Subtest-1	17.07	16.99	17.02	18.00	18.21	18.23	18.01	19.50
3GPP Rel 6	HSUPA Subtest-2	15.06	15.04	15.09	16.00	16.14	16.13	16.13	17.50
3GPP Rel 6	HSUPA Subtest-3	15.09	15.04	15.09	17.00	16.99	16.99	16.98	16.50
3GPP Rel 6	HSUPA Subtest-4	15.09	15.09	15.03	16.00	16.05	16.03	15.92	17.50
3GPP Rel 6	HSUPA Subtest-5	17.10	17.06	17.20	18.00	18.20	18.13	18.07	19.50



LTE Band 2

BW (MHz)	Modulation	RB Size	RB Offset	Power			Turn-up limit (dBm)	MPR (dB)
				Low Ch / Freq	Middle Ch / Freq	High Ch / Freq		
Channel								
Frequency (MHz)								
20	QPSK	1	0	19.23	19.32	19.17	20	0
20	QPSK	1	49	19.10	19.01	19.02		
20	QPSK	1	99	19.03	19.03	19.01		
20	QPSK	50	0	19.14	19.14	19.07		
20	QPSK	50	24	19.08	19.00	19.05		
20	QPSK	50	50	19.00	19.05	19.04		
20	QPSK	100	0	19.10	19.08	19.07		
20	16QAM	1	0	19.06	19.00	19.05		
20	16QAM	1	49	19.06	19.08	19.01		
20	16QAM	1	99	19.03	19.03	19.01		
20	16QAM	50	0	19.03	19.00	19.08		
20	16QAM	50	24	19.07	19.07	19.04		
20	16QAM	50	50	19.06	19.00	19.05		
20	16QAM	100	0	19.03	19.06	19.00		
20	64QAM	1	0	19.08	19.01	19.11		
20	64QAM	1	49	19.07	19.07	19.12		
20	64QAM	1	99	19.01	19.08	19.04		
20	64QAM	50	0	19.04	19.02	19.07		
20	64QAM	50	24	19.08	19.09	19.03		
20	64QAM	50	50	19.06	19.07	19.07		
20	64QAM	100	0	19.01	19.03	19.07		
Channel								
Frequency (MHz)								
15	QPSK	1	0	19.79	19.85	19.84	20	0
15	QPSK	1	37	19.83	19.70	19.76		
15	QPSK	1	74	19.12	19.11	19.11		
15	QPSK	36	0	19.00	19.03	19.01		
15	QPSK	36	20	19.02	19.01	19.08		
15	QPSK	36	39	19.03	19.06	19.08		
15	QPSK	75	0	19.06	19.03	19.05		
15	16QAM	1	0	19.00	19.03	19.03		
15	16QAM	1	37	19.04	19.07	19.01		
15	16QAM	1	74	19.07	19.03	19.10		
15	16QAM	36	0	19.06	19.02	19.01		
15	16QAM	36	20	19.06	19.02	19.00		
15	16QAM	36	39	19.02	19.06	19.04		
15	16QAM	75	0	19.01	19.00	19.04		
15	64QAM	1	0	19.03	19.02	19.01		
15	64QAM	1	37	19.03	19.03	19.01		
15	64QAM	1	74	19.02	19.08	19.01		
15	64QAM	36	0	19.02	19.08	19.01		
15	64QAM	36	20	19.07	19.06	19.06		
15	64QAM	36	39	19.06	19.01	19.08		
15	64QAM	75	0	19.00	19.02	19.06		
Channel								
Frequency (MHz)								
10	QPSK	1	0	19.79	19.88	19.84	20	0
10	QPSK	1	25	19.89	19.97	19.82		
10	QPSK	1	49	19.06	19.05	19.07		
10	QPSK	25	0	19.08	19.05	19.01		
10	QPSK	25	12	19.02	19.00	19.07		
10	QPSK	25	25	19.03	19.05	19.04		
10	QPSK	50	0	19.02	19.08	19.03		
10	16QAM	1	0	19.00	19.03	19.01		
10	16QAM	1	25	19.14	19.14	19.00		
10	16QAM	1	49	19.09	19.02	19.07		
10	16QAM	25	0	19.07	19.03	19.02		
10	16QAM	25	12	19.07	19.00	19.08		
10	16QAM	25	25	19.04	19.05	19.06		
10	16QAM	50	0	19.00	19.08	19.04		
10	64QAM	1	0	19.01	19.00	19.06		
10	64QAM	1	25	19.03	19.05	19.04		
10	64QAM	1	49	19.12	19.03	19.00		
10	64QAM	25	0	19.04	19.05	19.00		
10	64QAM	25	12	19.05	19.01	19.07		
10	64QAM	25	25	19.02	19.02	19.06		
10	64QAM	50	0	19.03	19.06	19.00		
Channel								
Frequency (MHz)								
5	QPSK	1	0	19.01	19.72	19.75	20	0
5	QPSK	1	12	19.83	19.72	19.64		
5	QPSK	1	24	19.62	19.70	19.73		
5	QPSK	12	0	19.05	19.05	19.00		
5	QPSK	12	7	19.07	19.06	19.07		
5	QPSK	12	13	19.06	19.01	19.04		
5	QPSK	25	0	19.00	19.01	19.02		
5	16QAM	1	0	19.04	19.07	19.04		
5	16QAM	1	12	19.08	19.01	19.02		
5	16QAM	1	24	19.00	19.07	19.04		
5	16QAM	12	0	19.02	19.00	19.07		
5	16QAM	12	7	19.07	19.04	19.06		
5	16QAM	12	13	19.02	19.03	19.05		
5	16QAM	25	0	19.04	19.00	19.01		
5	64QAM	1	0	19.03	19.07	19.03		
5	64QAM	1	12	19.06	19.01	19.05		
5	64QAM	1	24	19.04	19.07	19.04		
5	64QAM	12	0	19.02	19.00	19.07		
5	64QAM	12	7	19.06	19.00	19.06		
5	64QAM	12	13	19.03	19.03	19.06		
5	64QAM	25	0	19.07	19.05	19.06		
Channel								
Frequency (MHz)								
3	QPSK	1	0	19.65	19.68	19.78	20	0
3	QPSK	1	8	19.83	19.86	19.77		
3	QPSK	1	14	19.99	19.86	19.72		
3	QPSK	8	0	19.80	19.80	19.70		
3	QPSK	8	4	19.89	19.91	19.72		
3	QPSK	8	7	19.79	19.89	19.72		
3	QPSK	15	0	19.89	19.86	19.76		
3	16QAM	1	0	19.87	19.93	19.86		
3	16QAM	1	8	19.02	19.14	19.71		
3	16QAM	1	14	19.07	19.05	19.82		
3	16QAM	8	0	19.87	19.82	19.88		
3	16QAM	8	4	19.06	19.06	19.84		
3	16QAM	8	7	19.02	19.07	19.88		
3	16QAM	15	0	19.05	19.79	19.67		
3	64QAM	1	0	19.01	19.12	19.98		
3	64QAM	1	8	19.02	19.01	19.93		
3	64QAM	1	14	19.02	19.00	19.01		
3	64QAM	8	0	19.87	19.87	19.72		
3	64QAM	8	4	19.06	19.06	19.86		
3	64QAM	8	7	19.83	19.83	19.84		
3	64QAM	15	0	19.88	19.83	19.77		
Channel								
Frequency (MHz)								
1.4	QPSK	1	0	19.93	19.91	19.84	20	0
1.4	QPSK	1	3	19.80	19.96	19.86		
1.4	QPSK	1	5	19.84	19.88	19.80		
1.4	QPSK	3	0	19.79	19.75	19.80		
1.4	QPSK	3	1	19.88	19.82	19.73		
1.4	QPSK	3	3	19.77	19.77	19.85		
1.4	QPSK	6	0	19.79	19.76	19.87		
1.4	16QAM	1	0	19.89	19.92	19.14		
1.4	16QAM	1	3	19.02	19.90	19.00		
1.4	16QAM	1	5	19.99	19.82	19.00		
1.4	16QAM	3	0	19.84	19.81	19.89		
1.4	16QAM	3	1	19.86	19.93	19.80		
1.4	16QAM	3	3	19.77	19.93	19.72		
1.4	16QAM	6	0	19.83	19.79	19.83		
1.4	64QAM	1	0	19.01	19.05	19.96		
1.4	64QAM	1	3	19.01	19.03	19.06		
1.4	64QAM	1	5	19.01	19.91	19.98		
1.4	64QAM	3	0	19.86	19.80	19.80		
1.4	64QAM	3	1	19.88	19.00	19.94		
1.4	64QAM	3	3	19.86	19.92	19.70		
1.4	64QAM	6	0	19.84	19.87	19.72		

LTE Band 4

BW (MHz)	Modulation	RB Size	RB Offset	Power			Turn-up limit (dBm)	MPR (dB)
				Low Ch / Freq	Middle Ch / Freq	High Ch / Freq		
Channel								
Frequency (MHz)								
20	QPSK	1	0	19.65	19.66	19.49	20	0
20	QPSK	1	49	19.33	19.30	19.35		
20	QPSK	1	99	19.30	19.36	19.23		
20	QPSK	50	0	19.33	19.42	19.34		
20	QPSK	50	24	19.30	19.22	19.39		
20	QPSK	50	50	19.16	19.23	19.17		
20	QPSK	100	0	19.19	19.32	19.33		
20	16QAM	1	0	19.28	19.35	19.31		
20	16QAM	1	49	19.32	19.26	19.47		
20	16QAM	1	99	19.45	19.29	19.48		
20	16QAM	50	0	19.27	19.20	19.16		
20	16QAM	50	24	19.08	19.08	19.15		
20	16QAM	50	50	19.01	19.24	19.27		
20	16QAM	100	0	19.22	19.12	19.11		
20	64QAM	1	0	19.07	19.02	19.27		
20	64QAM	1	49	19.94	19.26	19.02		
20	64QAM	1	99	19.12	19.02	19.14		
20	64QAM	50	0	19.12	19.16	19.12		
20	64QAM	50	24	19.33	19.23	19.29		
20	64QAM	50	50	19.37	19.01	19.02		
20	64QAM	100	0	19.06	19.11	19.07		
Channel								
Frequency (MHz)								
15	QPSK	1	0	19.30	19.19	19.51	20	0
15	QPSK	1	37	19.21	19.52	19.44		
15	QPSK	1	74	19.49	19.43	19.63		
15	QPSK	36	0	19.53	19.47	19.61		
15	QPSK	36	20	19.32	19.49	19.41		
15	QPSK	36	39	19.28	19.54	19.31		
15	QPSK	75	0	19.30	19.28	19.42		
15	16QAM	1	0	19.62	19.54	19.62		
15	16QAM	1	37	19.53	19.56	19.51		
15	16QAM	1	74	19.49	19.41	19.41		
15	16QAM	36	0	19.40	19.51	19.50		



LTE Band 30

BW [MHz]	Modulation	RB Size	RB Offset	Power Low Ch / Freq	Power Middle Ch / Freq	Power High Ch / Freq	Tune-up limit (dBm)	MFR (dB)		
Channel										
Frequency (MHz)										
10	QPSK	1	0		21.83		22.5	0		
10	QPSK	1	25		21.71					
10	QPSK	1	49		21.67					
10	QPSK	25	0		21.47					
10	QPSK	25	12		21.44					
10	QPSK	25	25		21.41		22.5	0		
10	QPSK	50	0		21.61					
10	16QAM	1	0		21.48					
10	16QAM	1	25		21.37					
10	16QAM	1	49		21.34					
10	16QAM	25	0		20.59		22	0.5		
10	16QAM	25	12		20.62					
10	16QAM	25	25		20.51					
10	16QAM	50	0		20.54					
10	16QAM	50	0		21.07					
10	64QAM	1	25		21.11		22	0.5		
10	64QAM	1	49		20.96					
10	64QAM	25	0		20.04					
10	64QAM	25	12		19.94					
10	64QAM	25	25		19.88					
10	64QAM	50	0		19.89		21	1.5		
Channel										
Frequency (MHz)										
5	QPSK	1	0	21.61	21.74	21.70			22.5	0
5	QPSK	1	12	21.67	21.60	21.65				
5	QPSK	1	24	21.56	21.74	21.56				
5	QPSK	12	0	21.72	21.60	21.66				
5	QPSK	12	7	21.60	21.59	21.60				
5	QPSK	12	13	21.60	21.54	21.53	22.5	0		
5	QPSK	25	0	21.61	21.63	21.67				
5	16QAM	1	0	21.54	21.63	21.60				
5	16QAM	1	12	21.46	21.73	21.58				
5	16QAM	1	24	21.54	21.71	21.61				
5	16QAM	12	0	21.13	21.20	21.08	22	0.5		
5	16QAM	12	7	21.12	21.10	21.09				
5	16QAM	12	13	21.10	21.03	21.18				
5	16QAM	25	0	21.11	21.07	21.09				
5	64QAM	1	0	21.23	21.08	21.07				
5	64QAM	1	12	21.09	21.11	21.09	22	0.5		
5	64QAM	1	24	21.17	21.20	21.08				
5	64QAM	12	0	20.28	20.20	20.13				
5	64QAM	12	7	20.24	20.14	20.08				
5	64QAM	12	13	20.21	20.15	20.07				
5	64QAM	25	0	20.21	20.10	20.15	21	1.5		

LTE 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)	MFR (dB)		
Channel										
Frequency (MHz)										
20	QPSK	1	0	19.26	19.33	19.27	20	0		
20	QPSK	1	49	19.13	19.20	19.16				
20	QPSK	1	99	18.99	19.01	19.14				
20	QPSK	50	0	19.14	19.22	19.11				
20	QPSK	50	24	18.93	18.96	19.01				
20	QPSK	50	50	19.02	19.90	18.99	20	0		
20	QPSK	100	0	19.14	19.32	19.12				
20	16QAM	1	0	18.87	18.87	18.88				
20	16QAM	1	49	18.96	18.95	19.00				
20	16QAM	1	99	19.17	19.26	19.11				
20	16QAM	50	0	18.67	18.80	18.95	20	0		
20	16QAM	50	24	18.77	18.83	19.00				
20	16QAM	50	50	18.91	18.94	18.97				
20	16QAM	100	0	18.80	18.76	18.88				
20	64QAM	1	0	19.12	19.13	19.15				
20	64QAM	1	49	19.02	19.10	19.02	20	0		
20	64QAM	1	99	19.05	18.99	19.06				
20	64QAM	50	0	18.69	18.76	18.79				
20	64QAM	50	24	18.81	18.92	18.90				
20	64QAM	50	50	18.81	18.87	18.92				
20	64QAM	100	0	18.82	18.91	18.78	20	0		
Channel										
Frequency (MHz)										
15	QPSK	1	0	18.93	19.18	18.95			20	0
15	QPSK	1	37	18.93	18.96	18.94				
15	QPSK	1	74	18.90	18.99	19.01				
15	QPSK	36	0	18.81	18.89	18.99				
15	QPSK	36	39	19.06	19.83	19.96				
15	QPSK	36	70	18.69	18.78	18.83	20	0		
15	QPSK	75	0	18.76	18.88	18.83				
15	16QAM	1	0	19.12	19.03	19.23				
15	16QAM	1	37	19.03	19.05	19.93				
15	16QAM	1	74	19.01	19.17	19.01				
15	16QAM	36	0	18.73	18.85	18.97	20	0		
15	16QAM	36	20	18.72	19.90	19.81				
15	16QAM	36	59	19.71	19.75	19.90				
15	16QAM	75	0	18.81	18.85	18.90				
15	64QAM	1	0	19.11	18.99	19.25				
15	64QAM	1	37	19.14	19.10	19.09	20	0		
15	64QAM	1	74	19.15	19.29	19.16				
15	64QAM	36	0	18.83	18.91	19.05				
15	64QAM	36	20	18.82	18.96	18.97				
15	64QAM	36	39	19.04	19.75	19.86				
15	64QAM	75	0	18.78	18.83	18.87	20	0		
Channel										
Frequency (MHz)										
10	QPSK	1	0	18.10	18.15	18.34			20	0
10	QPSK	1	25	18.39	18.42	18.45				
10	QPSK	1	49	18.40	18.44	18.44				
10	QPSK	25	0	18.85	18.56	18.72				
10	QPSK	25	12	18.84	18.82	18.88				
10	QPSK	25	25	18.74	18.82	19.04	20	0		
10	QPSK	50	0	18.66	18.62	18.71				
10	16QAM	1	0	18.67	18.66	18.75				
10	16QAM	1	25	18.81	18.58	18.64				
10	16QAM	1	49	19.02	18.95	18.66				
10	16QAM	25	0	18.85	18.87	18.59	20	0		
10	16QAM	25	12	18.74	18.99	18.72				
10	16QAM	25	25	18.67	18.72	18.83				
10	16QAM	50	0	18.76	18.77	18.72				
10	64QAM	1	0	19.01	19.02	18.84				
10	64QAM	1	25	18.99	18.93	18.93	20	0		
10	64QAM	1	49	19.24	19.12	18.90				
10	64QAM	25	0	18.83	18.58	18.80				
10	64QAM	25	12	18.71	18.94	18.86				
10	64QAM	25	25	18.76	18.60	18.76				
10	64QAM	50	0	18.67	18.73	18.71	20	0		
Channel										
Frequency (MHz)										
5	QPSK	1	0	18.85	18.88	18.94			20	0
5	QPSK	1	12	18.73	18.75	18.85				
5	QPSK	1	24	18.95	18.98	18.85				
5	QPSK	12	0	19.12	18.92	18.96				
5	QPSK	12	7	19.06	18.94	18.95				
5	QPSK	12	13	19.01	18.98	18.83	20	0		
5	QPSK	25	0	19.04	18.95	18.93				
5	16QAM	1	0	19.01	19.05	18.89				
5	16QAM	1	12	18.85	18.89	18.83				
5	16QAM	1	24	18.99	18.64	18.91				
5	16QAM	12	0	19.03	19.11	19.00	20	0		
5	16QAM	12	7	18.96	19.11	18.99				
5	16QAM	12	13	18.95	19.07	18.92				
5	16QAM	25	0	19.08	18.99	18.90				
5	64QAM	1	0	19.16	19.28	19.13				
5	64QAM	1	12	19.15	18.97	19.15	20	0		
5	64QAM	1	24	19.21	18.98	19.16				
5	64QAM	12	0	18.97	18.88	19.02				
5	64QAM	12	7	18.99	18.94	18.92				
5	64QAM	12	13	18.93	18.94	18.91				
5	64QAM	25	0	19.00	18.98	18.93	20	0		
Channel										
Frequency (MHz)										
3	QPSK	1	0	18.98	18.83	18.86			20	0
3	QPSK	1	8	18.92	19.02	19.06				
3	QPSK	1	14	19.08	18.88	18.89				
3	QPSK	8	0	19.07	19.02	19.02				
3	QPSK	8	4	19.02	18.98	19.06				
3	QPSK	8	7	18.96	18.95	19.00	20	0		
3	QPSK	15	0	19.02	18.92	19.04				
3	16QAM	1	0	18.98	19.03	19.01				
3	16QAM	1	8	19.10	19.10	19.08				
3	16QAM	1	14	18.79	18.84	19.02				
3	16QAM	8	0	19.05	19.10	19.02	20	0		
3	16QAM	8	4	18.99	18.92	19.04				
3	16QAM	8	7	19.10	18.95	18.97				
3	16QAM	15	0	18.99	18.90	18.93				
3	64QAM	1	0	18.94	18.96	19.32				
3	64QAM	1	8	19.02	19.15	19.19	20	0		
3	64QAM	1	14	19.19	19.02	19.02				
3	64QAM	8	0	19.05	19.02	19.06				
3	64QAM	8	4	19.04	19.04	19.06				
3	64QAM	8	7	19.04	19.00	19.02				
3	64QAM	15	0	18.99	18.97	18.97	20	0		
Channel										
Frequency (MHz)										
1.4	QPSK	1	0	18.79	18.82	18.90			20	0
1.4	QPSK	1	3	18.93	18.71	18.99				
1.4	QPSK	1	5	18.88	18.72	18.89				
1.4	QPSK	3	0	19.05	18.95	19.09				
1.4	QPSK	3	1	18.98	18.80	19.02				
1.4	QPSK	3	3	18.81	18.77	18.86	20	0		
1.4	QPSK	6	0	19.01	18.82	18.97				



2.4GHz WLAN					
Full power					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11b 1Mbps	1	2412	18.30	20.00	98.28
	6	2437	18.30	20.00	
	11	2462	18.30	20.00	
802.11g 6Mbps	1	2412	15.70	18.00	98.28
	6	2437	15.80	19.00	
	11	2462	15.40	18.00	
802.11n HT20 MCS0	1	2412	15.20	18.00	98.16
	6	2437	17.50	19.00	
	11	2462	15.00	18.00	

2.4GHz WLAN					
Reduced Power Mode for Head					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11b 1Mbps	1	2412	15.30	18.00	98.28
	6	2437	14.70	18.00	
	11	2462	15.20	18.00	
802.11g 6Mbps	1	2412	15.00	18.00	98.28
	6	2437	16.00	19.00	
	11	2462	15.00	18.00	
802.11n HT20 MCS0	1	2412	15.00	18.00	98.16
	6	2437	17.00	19.00	
	11	2462	15.00	18.00	

5GHz WLAN					
Full power					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	36	5180	14.60	15.50	97.93
	40	5200	14.72	15.50	
	44	5220	14.91	15.50	
802.11n HT20 MCS0	36	5180	13.87	14.00	97.79
	40	5200	14.75	15.50	
	44	5220	14.97	15.50	
802.11n HT40 MCS0	36	5180	14.00	15.00	98.03
	40	5200	14.00	15.00	
	44	5220	15.01	15.50	
802.11ac VHT20 MCS0	36	5180	13.42	13.50	97.40
	40	5200	14.66	15.50	
	44	5220	14.87	15.50	
802.11ac VHT40 MCS0	36	5180	14.29	15.50	98.04
	40	5200	13.98	13.50	
	44	5220	14.97	15.50	
802.11ac VHT80 MCS0	42	5210	11.20	12.00	92.61

5GHz WLAN					
Reduced Power Mode for Body-worn & Hotspot					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	36	5180	8.50	8.50	97.93
	40	5200	8.50	8.50	
	44	5220	8.50	8.50	
802.11n HT20 MCS0	36	5180	8.50	8.50	97.79
	40	5200	8.50	8.50	
	44	5220	8.50	8.50	
802.11n HT40 MCS0	36	5180	8.05	8.50	96.03
	40	5200	7.92	8.50	
	44	5220	8.50	8.50	
802.11ac VHT20 MCS0	36	5180	8.50	8.50	97.40
	40	5200	8.50	8.50	
	44	5220	8.50	8.50	
802.11ac VHT40 MCS0	36	5180	8.50	8.50	96.04
	40	5200	8.50	8.50	
	44	5220	8.50	8.50	
802.11ac VHT80 MCS0	42	5210	8.00	8.00	92.61

5GHz WLAN					
Reduced Power Mode for Simultaneous-0mm					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	36	5180	14.50	14.50	97.93
	40	5200	14.50	14.50	
	44	5220	14.50	14.50	
802.11n HT20 MCS0	36	5180	14.00	14.00	97.79
	40	5200	14.50	14.50	
	44	5220	14.50	14.50	
802.11n HT40 MCS0	36	5180	13.79	13.79	96.03
	40	5200	14.12	14.50	
	44	5220	14.12	14.50	
802.11ac VHT20 MCS0	36	5180	13.00	13.00	97.40
	40	5200	14.50	14.50	
	44	5220	14.50	14.50	
802.11ac VHT40 MCS0	36	5180	13.90	14.50	96.04
	40	5200	13.90	13.50	
	44	5220	14.50	14.50	
802.11ac VHT80 MCS0	42	5210	12.00	12.00	92.61

5GHz WLAN					
Full power					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	52	5260	16.27	17.00	97.93
	56	5280	16.31	17.00	
	60	5300	16.42	17.00	
	64	5320	16.21	17.00	
802.11n HT20 MCS0	52	5260	16.32	17.00	97.79
	56	5280	16.19	17.00	
	60	5300	16.28	17.00	
	64	5320	15.99	17.00	
802.11n HT40 MCS0	54	5270	16.47	17.00	98.03
	62	5310	12.90	13.00	
	54	5270	16.02	17.00	
	58	5290	16.04	17.00	
802.11ac VHT20 MCS0	60	5300	16.06	17.00	97.40
	64	5320	15.84	17.00	
	54	5270	16.43	17.00	
	62	5310	12.97	13.00	
802.11ac VHT80 MCS0	58	5290	12.33	12.50	92.61

5GHz WLAN					
Reduced Power Mode for Body-worn					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	52	5260	8.50	8.50	97.93
	56	5280	8.50	8.50	
	60	5300	8.50	8.50	
	64	5320	8.50	8.50	
802.11n HT20 MCS0	52	5260	8.50	8.50	97.79
	56	5280	8.50	8.50	
	60	5300	8.50	8.50	
	64	5320	8.50	8.50	
802.11n HT40 MCS0	54	5270	7.70	8.50	96.03
	62	5310	7.89	8.50	
	52	5260	8.50	8.50	
	56	5280	8.50	8.50	
802.11ac VHT20 MCS0	60	5300	8.50	8.50	97.40
	64	5320	8.50	8.50	
	54	5270	8.50	8.50	
	62	5310	8.50	8.50	
802.11ac VHT80 MCS0	58	5290	8.00	8.00	92.61

5GHz WLAN					
Reduced Power Mode for Simultaneous-0mm					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	52	5260	16.00	16.00	97.93
	56	5280	16.00	16.00	
	60	5300	16.00	16.00	
	64	5320	16.00	16.00	
802.11n HT20 MCS0	52	5260	16.00	16.00	97.79
	56	5280	16.00	16.00	
	60	5300	16.00	16.00	
	64	5320	16.00	16.00	
802.11n HT40 MCS0	54	5270	14.92	16.00	96.03
	62	5310	12.99	13.00	
	52	5260	16.00	16.00	
	56	5280	16.00	16.00	
802.11ac VHT20 MCS0	60	5300	16.00	16.00	97.40
	64	5320	16.00	16.00	
	54	5270	16.00	16.00	
	62	5310	13.00	13.00	
802.11ac VHT80 MCS0	58	5290	12.50	12.50	92.61

5GHz WLAN					
Full power					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	100	5500	17.45	18.50	97.93
	116	5520	17.85	18.50	
	124	5520	17.43	18.50	
	132	5560	17.55	18.50	
	140	5700	15.36	18.00	
	144	5720	17.38	18.50	
	100	5500	17.74	18.50	
802.11n HT20 MCS0	116	5520	17.82	18.50	97.79
	124	5520	17.43	18.50	
	132	5560	17.34	18.50	
	140	5700	13.40	14.00	
	144	5720	17.25	18.50	
	102	5510	15.24	16.00	
	110	5550	17.82	18.50	
802.11n HT40 MCS0	126	5530	17.19	18.50	98.03
	134	5570	17.28	18.50	
	142	5710	17.58	18.50	
	100	5500	17.64	18.50	
	116	5580	17.42	18.50	
	124	5520	17.39	18.50	
	132	5560	17.28	18.50	
802.11ac VHT20 MCS0	140	5700	13.16	14.00	97.40
	144	5720	17.19	18.50	
	102	5510	14.83	15.00	
	110	5550	17.79	18.50	
	126	5530	17.81	18.50	
	134	5570	16.95	18.50	
	142	5710	17.51	18.50	
802.11ac VHT40 MCS0	108	5530	13.09	14.00	96.04
	122	5610	16.73	17.00	
	138	5690	16.14	17.00	
	100	5500	17.42	18.50	
	116	5580	17.42	18.50	
	124	5520	17.39	18.50	
	132	5560	17.28	18.50	
802.11ac VHT80 MCS0	140	5700	13.16	14.00	92.61
	144	5720	17.19	18.50	
	102	5510	14.83	15.00	
	110	5550	17.82	18.50	
	126	5530	17.81	18.50	
	134	5570	16.95	18.50	
	142	5710	17.51	18.50	

5GHz WLAN					
Reduced Power Mode for Body-worn					
Mode	Channel	Frequency (MHz)	Average power (dBm)	Turn-Up Limit	Duty Cycle %
802.11a 6Mbps	100	5500	13.00	13.00	97.93
	116	5520	13.00	13.00	
	124	5520	13.00	13.00	
	132	5560	13.00	13.00	
	140	5700	13.00	13.00	
	144	5720	13.00	13.00	
	100	5500	13.00	13.00	
802.11n HT20 MCS0	116	5520	13.00	13.00	97.79
	124	5520	13.00	13.00	
	132	5560	13.00	13.00	
	140	5700	13.00	13.00	
	144	5720	13.00	13.00	
	102	5510	12.01	13.00	
	110	5550	12.96	13.00	
802.11n HT40 MCS0	126	5530	11.98	13.00	96.03
	134	5570	11.75	13.00	
	142	5710	11.81	13.00	
	100	5500	13.00	13.00	
	116	5580	13.00	13.00	
	124	5520	13.00	13.00	
	132	5560	13.00	13.00	
802.11ac VHT20 MCS0	140	5700	13.00	13.00	97.40
	144	5720	13.00	13.00	
	102	5510	13.00	13.00	
	110	5550	13.00	13.00	
	126	5530	13.00	13.00	
	134	5570	13.00	13.00	
	142	5710	13.00	13.00	
802.11ac VHT40 MCS0	108	5530	12.00	12.00	96.04
	122	5610	12.00	12.00	
	138	5690	12.00	12.00	
	100	5500	13.00	13.00	
	116	5580	13.00	13.00	
	124	5520	13.00	13.00	
	132				



Appendix F. Supplemental Tuner Head & Body SAR Results

The results are shown as follows.



Head

Mode	Service/Modulation	Channel	Frequency (MHz)	BS Size	BS Offset	Test Position	Spacing	Measurement Log SSB (dBm)	Average Value of Time Series (dBm)																																				
									Auto- Time	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140
WCDMA V	RM-C 12.2Mbps	4182	836.4	—	—	Right Chalk	0mm	0.546	0.465	0.504	0.539	0.527	0.555	0.613	0.617	0.779	0.214	0.185	0.206	0.195	0.183	0.112	0.110	0.113	0.140	0.051	0.053	0.011	0.139	0.104	0.237	0.051	0.063	0.065	0.028	0.163	0.004	0.234	0.165	0.146	0.107	0.139	0.487	0.009	0.454
Mode	Service/Modulation	Channel	Frequency (MHz)	BS Size	BS Offset	Test Position	Spacing	Measurement Log SSB (dBm)	Average Value of Time Series (dBm)																																				
LTE Band 6	QPSK	2620	836.2	1	0	Right Chalk	0mm	0.341	0.307	0.256	0.139	0.408	0.437	0.562	0.734	0.206	0.109	0.408	0.433	0.361	0.034	0.386	0.161	0.114	0.422	0.462	0.006	0.166	0.403	0.118	0.141	0.746	0.406	0.092	0.432	0.411	0.261	0.006	0.241	0.467	0.116	0.462	0.400	0.426	
Mode	Service/Modulation	Channel	Frequency (MHz)	BS Size	BS Offset	Test Position	Spacing	Measurement Log SSB (dBm)	Average Value of Time Series (dBm)																																				
LTE Band 12	QPSK	2486	101.2	1	0	Right Chalk	0mm	0.351	0.423	0.419	0.191	0.018	0.156	0.002	0.046	0.039	0.019	0.039	0.104	0.062	0.006	0.106	0.001	0.084	0.019	0.014	0.035	0.139	0.061	0.004	0.161	0.000	0.106	0.017	0.015	0.037	0.205	0.001	0.001	0.079	0.001	0.034	0.001	0.006	0.001
Mode	Service/Modulation	Channel	Frequency (MHz)	BS Size	BS Offset	Test Position	Spacing	Measurement Log SSB (dBm)	Average Value of Time Series (dBm)																																				
LTE Band 14	QPSK	2332	751	1	0	Right Chalk	0mm	0.400	0.154	0.248	0.362	0.499	0.567	0.104	0.146	0.024	0.106	0.105	0.201	0.131	0.303	0.211	0.068	0.224	0.006	0.224	0.072	0.112	0.255	0.105	0.194	0.029	0.200	0.001	0.266	0.061	0.049	0.087	0.082	0.001	0.006	0.112	0.001	0.254	0.037



Body

Mode	Service/Modulation	Frequency (MHz)	Channel	RB Size	RB Offset	Test Position	Spacing	Measurement Spacing (W/kg)	Average Value of Time Sweep (W/kg)																																							
									Auto-Tune	0	4	8	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84	88	92	96	100	104	108	112	116	120	124	128	132	136	140			
WCDMA V	RNC 12 20bps	4233	836.6			Front	5mm	0.888	1.662	0.524	0.811	1.407	0.660	1.349	0.251	1.167	0.181	1.132	0.070	1.221	1.239	0.716	1.586	0.211	1.458	0.070	1.425	0.043	1.112	1.020	0.662	1.551	0.211	1.389	0.064	1.321	0.020	1.020	1.044	0.561	1.480	0.221	1.274	0.032	1.220			
LTE Band 5	QPSK	20525	836.5	1	0	Front	5mm	1.120	1.902	0.251	1.134	1.632	1.341	1.624	0.895	1.830	0.556	1.521	0.334	1.627	0.000	1.606	1.734	1.020	1.800	0.883	1.807	0.214	1.634	0.055	1.600	1.626	0.028	1.902	0.257	1.809	0.054	1.262	0.021	1.048	1.705	0.617	1.578	0.101	1.901			
LTE Band 14	QPSK	23330	793	1	0	Back	5mm	1.210	1.807	0.576	1.556	0.840	1.886	0.564	1.634	1.790	1.427	1.828	0.521	1.488	0.758	1.487	0.186	1.580	1.008	1.015	1.025	0.945	1.048	0.089	1.028	0.111	1.021	1.051	1.509	0.030	0.149	0.224	0.034	1.742	0.024	1.346	0.560	0.528	0.628			
LTE Band 12	QPSK	23005	707.5	1	0	Front	5mm	0.891	1.533	1.124	1.102	0.541	0.332	0.336	0.708	0.693	0.654	0.659	1.163	0.432	1.217	0.882	0.687	1.133	1.097	1.047	1.026	1.110	1.116	1.047	1.169	1.026	1.107	1.172	0.998	0.626	0.645	0.648	0.844	0.648	0.646	0.807	0.628	0.655	0.668			



verified for SAR higher than 1.2W/Kg
(Antenna #0, Slave ID=6)

Mode	Service/Modulation	Channel	Frequency (MHz)	RB Size	RB Offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Auto-Tune	Average Value of Time Sweep (W/kg)																				
										0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
WCDMA V	RMC 12.2Kbps	4233	836.6			Front	5mm	0.988	1.662	0.524	0.499	0.325	0.526	0.813	1.080	1.214	1.330	1.407	1.400	0.135	0.387	0.660	0.892	1.133	1.231	1.349	1.241	0.079	0.183	0.251
										21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
										0.631	0.897	1.080	1.167	1.210	1.280	1.184	0.131	0.348	0.624	0.891	1.122	1.283	1.401	1.284	0.076	0.137	0.231	0.921	1.271	1.381
										42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
										1.589	1.324	1.239	1.131	0.104	0.486	0.716	1.342	1.430	1.492	1.586	1.421	0.043	0.126	0.211	0.834	1.211	1.348	1.458	1.225	1.035
										63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
										0.521	0.070	0.493	0.721	1.228	1.425	1.458	1.562	1.411	0.043	0.138	0.214	0.835	1.112	1.283	1.421	1.210	1.020	0.981	0.063	0.387
										84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
										0.662	1.020	1.423	1.482	1.551	1.394	0.042	0.125	0.213	0.837	1.102	1.285	1.389	1.248	1.110	1.020	0.064	0.384	0.533	0.827	1.321
										105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
										1.384	1.418	1.284	0.020	0.134	0.184	0.864	1.020	1.134	1.284	1.135	1.044	1.034	0.032	0.384	0.563	0.831	1.356	1.421	1.480	1.260
										126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143			
										0.021	0.184	0.221	0.634	0.913	1.199	1.274	1.183	1.022	0.547	0.024	0.213	0.372	0.862	1.220	1.284	1.361	1.240			

(Antenna #0, Slave ID=6)

Mode	Service/Modulation	Channel	Frequency (MHz)	RB Size	RB Offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Auto-Tune	Average Value of Time Sweep (W/kg)																				
										0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
LTE Band 5	QPSK	20525	836.5	1	0	Front	5mm	1.12	1.902	0.113	0.251	0.384	0.834	1.211	1.534	1.818	1.821	1.890	1.632	0.234	0.483	0.662	1.341	1.727	1.821	1.891	1.624	0.155	0.321	0.493
										21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
										0.895	1.413	1.634	1.810	1.850	1.901	1.789	0.301	0.556	0.821	1.120	1.354	1.521	1.899	1.685	0.156	0.334	0.521	0.912	1.398	1.622
										42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
										1.892	1.884	1.901	0.002	0.217	0.374	0.931	1.606	1.821	1.900	1.899	1.734	0.092	0.214	0.379	1.020	1.870	1.881	1.891	1.802	1.735
										63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
										0.082	0.218	0.383	1.130	1.789	1.821	1.897	1.845	1.789	0.076	0.214	0.356	0.744	1.367	1.634	1.879	1.901	1.874	0.055	0.109	0.285
										84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
										0.935	1.609	1.878	1.901	1.900	1.826	0.041	0.089	0.263	0.928	1.626	1.843	1.901	1.902	1.850	0.033	0.002	0.257	1.006	1.715	1.880
										105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
										1.899	1.901	1.810	0.028	0.054	0.130	0.445	0.956	1.262	1.546	1.861	1.878	0.023	0.053	0.146	0.526	1.048	1.345	1.760	1.762	1.765
										126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143			
										0.034	0.067	0.221	0.617	1.234	1.633	1.624	1.578	1.513	0.034	0.045	0.103	0.685	1.173	1.487	1.901	1.876	1.450			

(Antenna #0, Slave ID=6)

Mode	Service/Modulation	Channel	Frequency (MHz)	RB Size	RB Offset	Test Position	Spacing	Measured 1g SAR (W/kg)	Auto-Tune	Average Value of Time Sweep (W/kg)																				
										0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
LTE Band 14	QPSK	23330	793	1	1	Back	5mm	1.121	1.907	0.227	0.378	0.575	1.030	1.245	1.378	1.556	1.689	1.905	0.566	0.840	1.456	1.810	1.824	1.886	1.888	1.906	1.905	0.364	0.847	1.197
										21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
										1.345	1.634	1.901	1.837	1.824	1.797	0.181	0.924	1.234	1.427	1.521	1.608	1.670	1.824	1.358	0.141	0.284	0.521	1.080	1.184	1.361
										42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62
										1.488	1.884	1.902	0.327	0.758	1.080	1.294	1.345	1.487	1.594	1.568	1.577	0.186	0.457	0.976	1.324	1.389	1.421	1.460	1.524	1.058
										63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83
										0.081	0.324	0.571	1.215	1.720	1.624	1.243	1.325	0.736	0.016	0.159	0.345	0.672	0.874	1.072	1.348	1.441	1.521	0.186	0.389	0.666
										84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104
										1.080	1.310	1.358	1.417	1.398	1.328	0.111	0.190	1.315	1.652	1.621	1.516	1.434	1.277	1.261	0.034	0.077	1.345	1.569	1.533	1.523
										105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125
										1.203	1.030	0.024	0.041	0.111	0.149	0.534	0.923	1.234	1.523	1.734	1.621	0.034	0.034	0.115	0.894	1.325	1.742	1.724	1.687	1.621
										126	127	128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143			
										0.021	0.134	0.678	1.070	1.345	1.234	0.892	0.734	0.569	0.006	0.078	0.245	0.524	0.634	0.721	0.872	0.634	0.407			