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CNAS L0570

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Client **7layers**

Certificate No: **Z21-60425**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 1048**

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

Calibration date: **October 21, 2021**

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	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

	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: October 27, 2021

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%.



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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
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 \pm 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 \pm 0.2) °C	39.5 \pm 6 %	1.81 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.8 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.2 W/kg \pm 18.7 % (k=2)



Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.6Ω+ 8.39jΩ
Return Loss	- 21.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.057 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: 10.21.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 1048

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.809$ S/m; $\epsilon_r = 39.51$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(7.34, 7.34, 7.34) @ 2450 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

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

Reference Value = 108.6 V/m; Power Drift = -0.02 dB

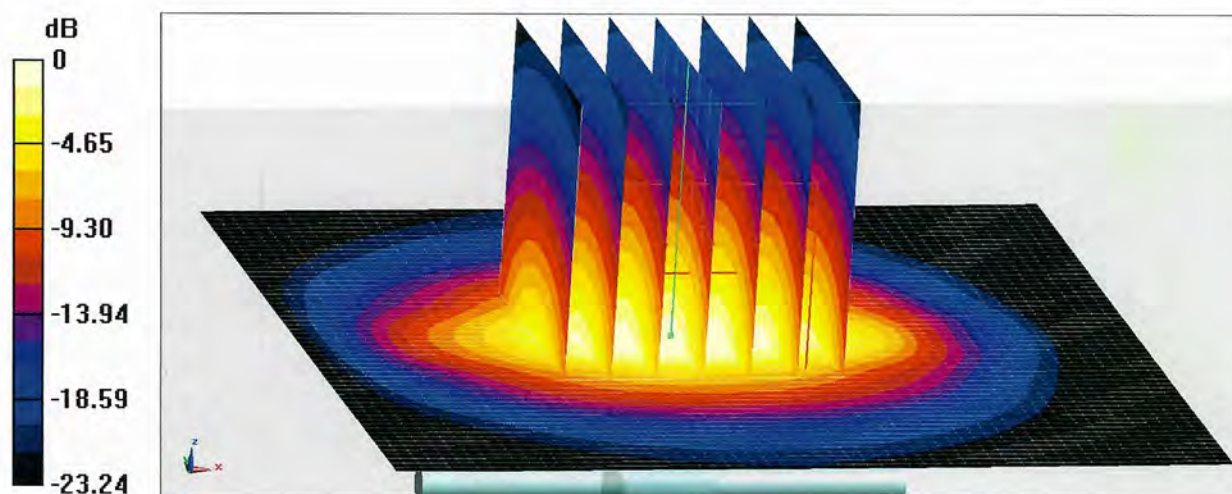
Peak SAR (extrapolated) = 28.0 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.05 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 47.1%

Maximum value of SAR (measured) = 22.5 W/kg



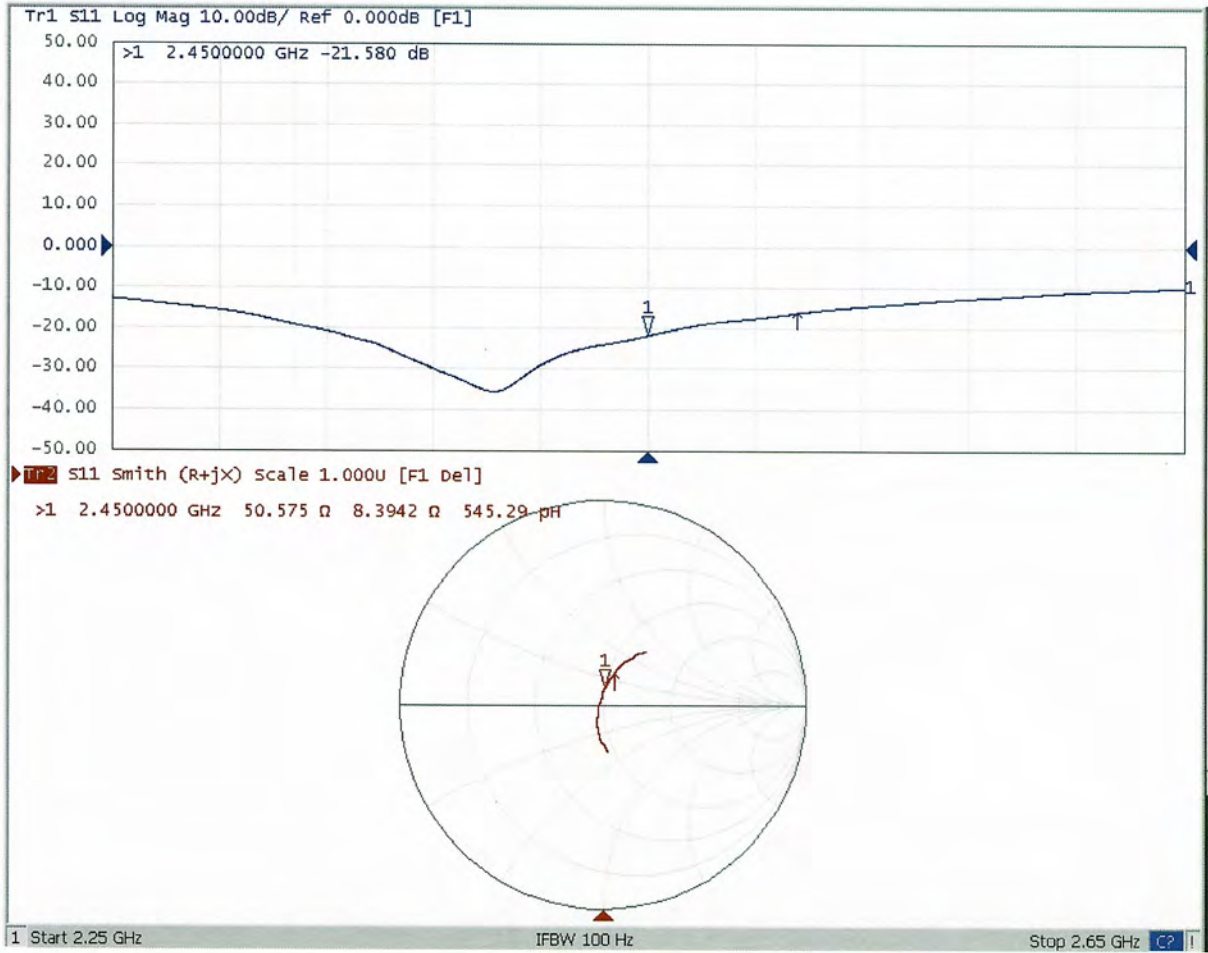
0 dB = 22.5 W/kg = 13.52 dBW/kg



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Impedance Measurement Plot for Head TSL



D2450V2 - SN: 1048 Extended Dipole Calibrations

Referring to KDB 865664 D01, 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.

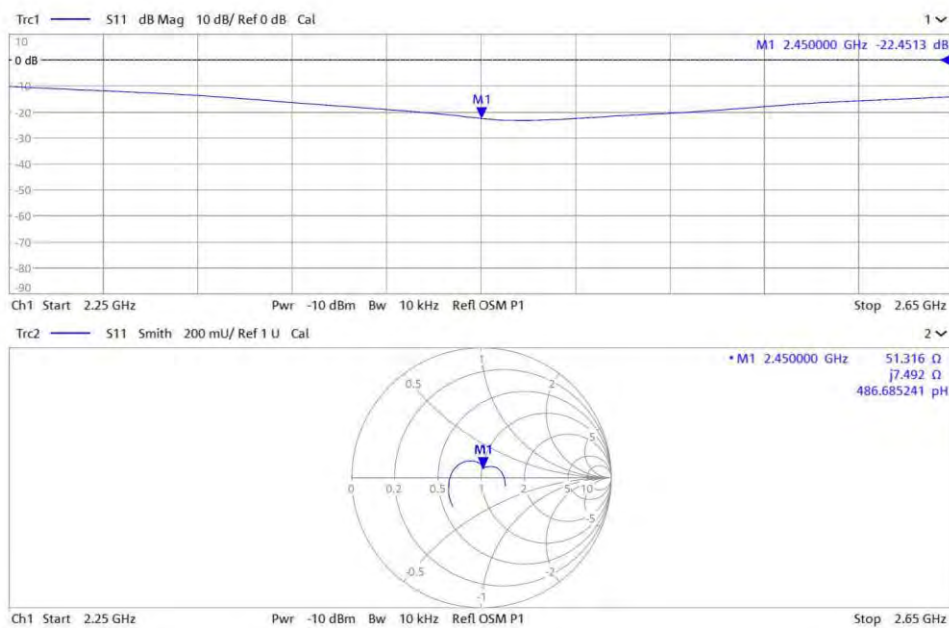
D2450V2 - SN: 1048						
2450MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
10.21.2021	-21.6		50.6		8.39	
10.20.2022	-22.5	3.94	51.3	0.72	7.5	-0.90

<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>

Head 2450MHz _2022.10.20





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Client

B.V.ADT

Certificate No:

Z21-60339

CALIBRATION CERTIFICATE

Object

D2600V2 - SN: 1110

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

September 16, 2021

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	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Power sensor NRP8S	104291	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Reference Probe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
Network Analyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

	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 21, 2021

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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	V52.10.4
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	2600 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.95 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	55.8 W/kg ± 18.8 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.13 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.6 W/kg ± 18.7 % (k=2)



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Appendix(Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.1 Ω - 5.12j Ω
Return Loss	- 25.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.058 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: 09.16.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1110

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.949$ S/m; $\epsilon_r = 39.04$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(7.1, 7.1, 7.1) @ 2600 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 105.3 V/m; Power Drift = 0.01 dB

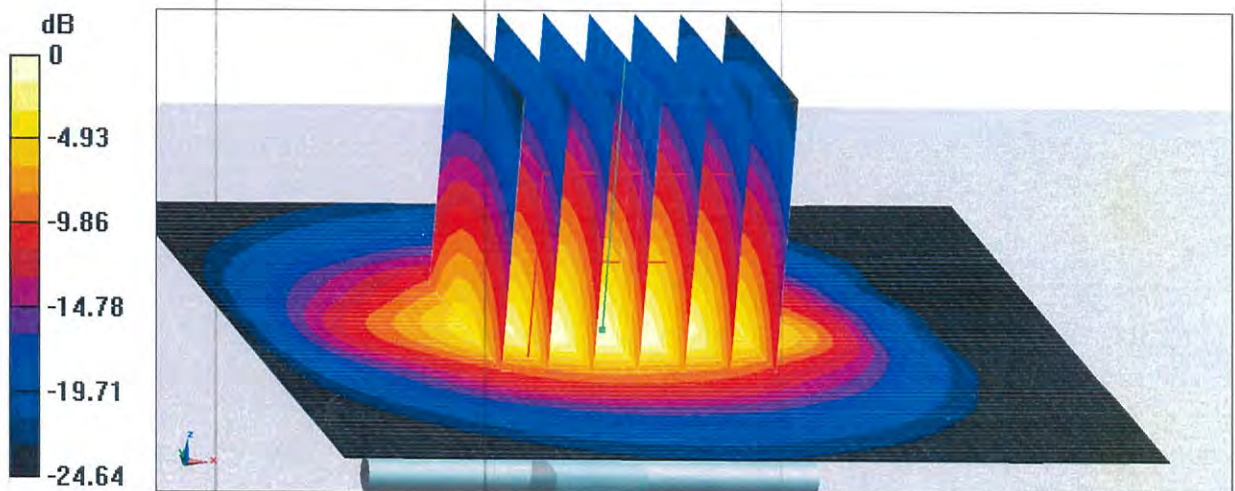
Peak SAR (extrapolated) = 30.6 W/kg

SAR(1 g) = 13.9 W/kg; SAR(10 g) = 6.13 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 45.2%

Maximum value of SAR (measured) = 24.1 W/kg



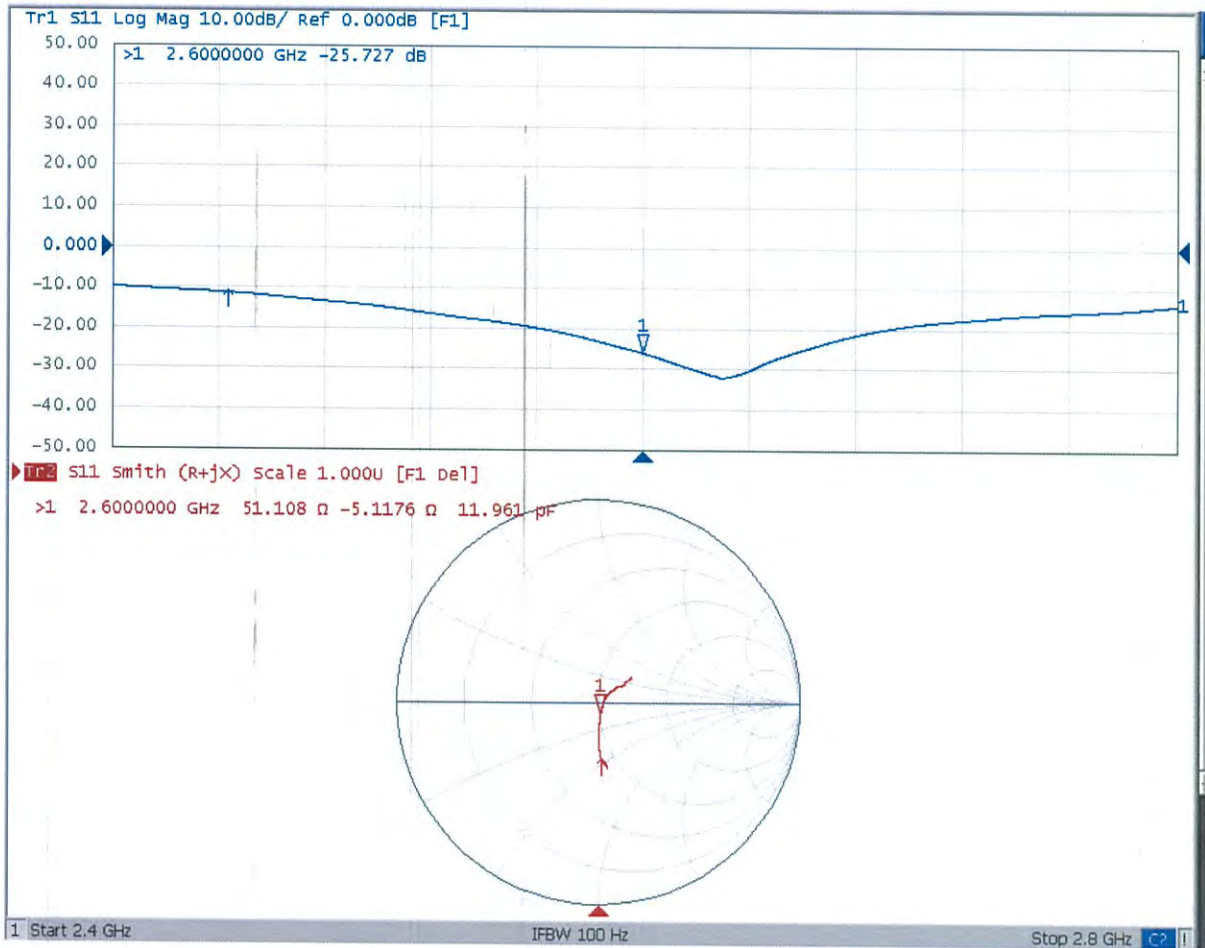
0 dB = 24.1 W/kg = 13.82 dBW/kg



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Impedance Measurement Plot for Head TSL



D2600V2 - SN: 1110 Extended Dipole Calibrations

Referring to KDB 865664 D01, 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.

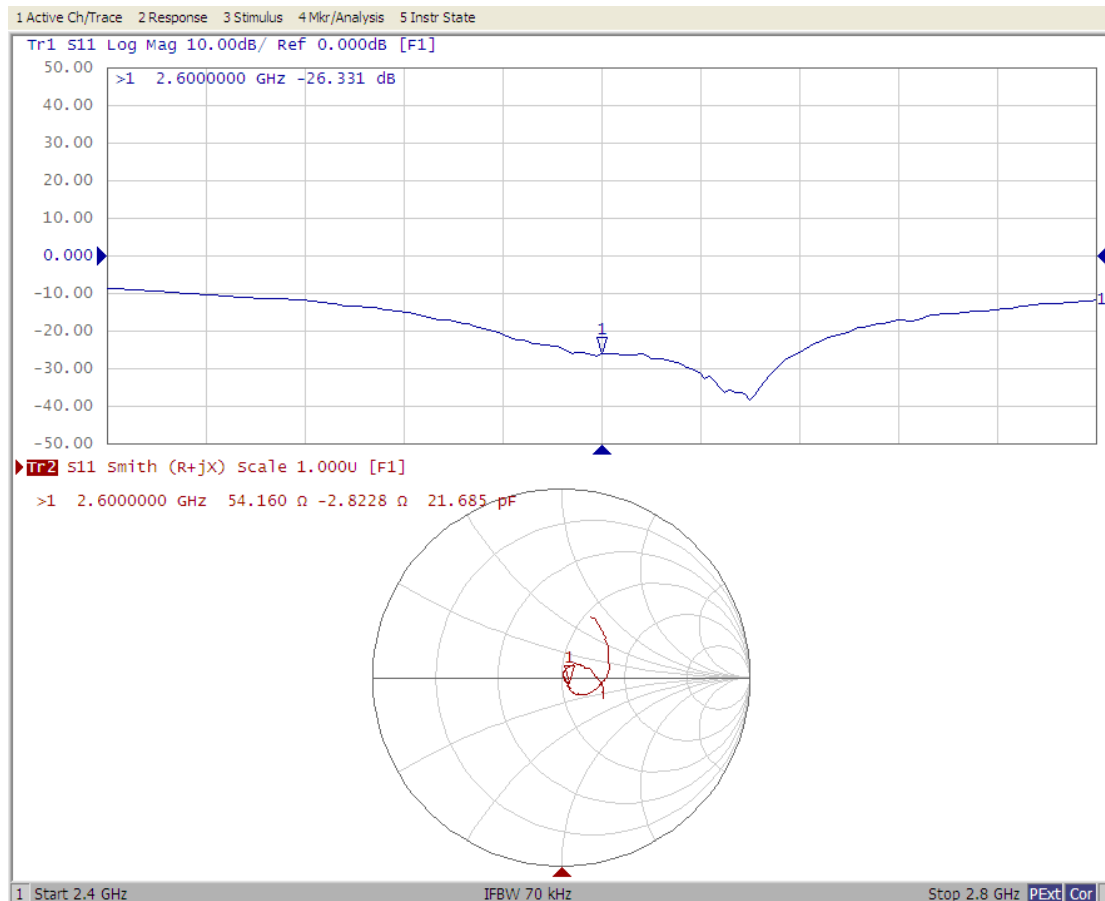
D2600V2 - SN: 1110						
2600 Head						
Date of Measurement	Return-loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2021.09.16	-25.7		51.1		-5.1	
2022.09.16	-26.3	2.7	54.2	3.1	-2.8	2.3

<Justification of the extended calibration>

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

<Dipole Verification Data>

Head 2600MHz _2022.09.16





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Client

7layers

Certificate No: Z21-60431

CALIBRATION CERTIFICATE

Object D5GHzV2 - SN: 1315

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

Calibration date: October 22, 2021

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	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
ReferenceProbe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE4	SN 1556	15-Jan-21(SPEAG,No.DAE4-1556_Jan21)	Jan-22
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzerE5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

	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: October 27, 2021

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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:

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

Additional Documentation:

- e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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



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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.6 ± 6 %	4.70 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.66 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	22.1 W/kg ± 24.2 % (k=2)



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

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	36.0 ± 6 %	5.08 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	81.9 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	23.5 W/kg ± 24.2 % (k=2)

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.8 ± 6 %	5.25 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.59 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	76.1 W/kg ± 24.4 % (k=2)
SAR averaged over 10 cm³ (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.7 W/kg ± 24.2 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	50.5Ω - 3.27jΩ
Return Loss	- 29.7dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.2Ω + 0.81jΩ
Return Loss	- 27.8dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	49.4Ω + 1.99jΩ
Return Loss	- 33.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.098 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: 10.22.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1315

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

Medium parameters used: $f = 5250$ MHz; $\sigma = 4.704$ S/m; $\epsilon_r = 36.62$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5600$ MHz; $\sigma = 5.084$ S/m; $\epsilon_r = 36$; $\rho = 1000$ kg/m³,
Medium parameters used: $f = 5750$ MHz; $\sigma = 5.248$ S/m; $\epsilon_r = 35.78$; $\rho = 1000$ kg/m³,

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(5.42, 5.42, 5.42) @ 5250 MHz; ConvF(4.75, 4.75, 4.75) @ 5600 MHz; ConvF(4.82, 4.82, 4.82) @ 5750 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2021-01-15
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7501)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan,

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

Reference Value = 70.32 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 65%

Maximum value of SAR (measured) = 18.2 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan,

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

Reference Value = 71.09 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 34.9 W/kg

SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.34 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

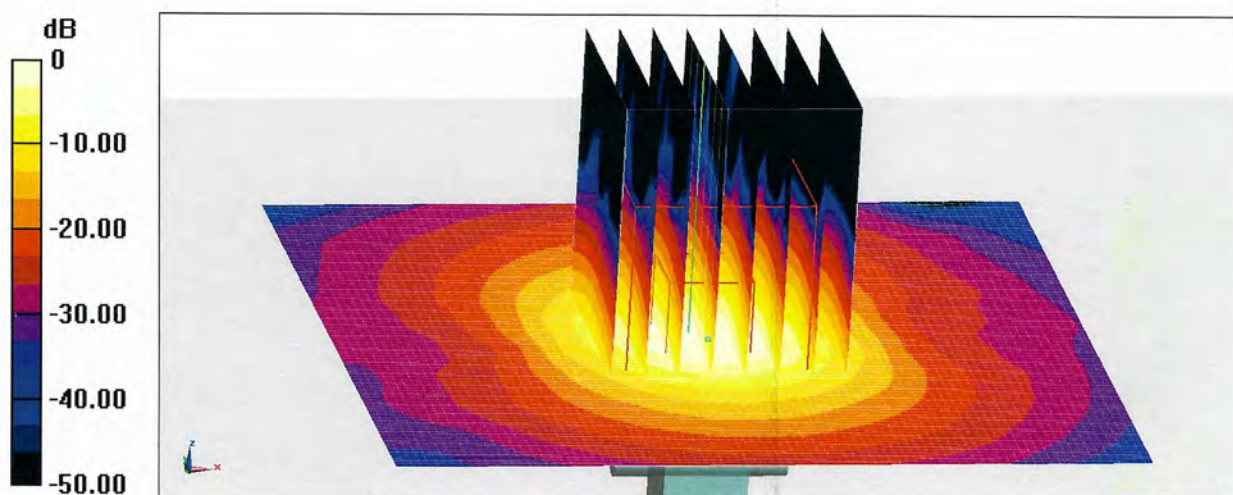
Ratio of SAR at M2 to SAR at M1 = 63.3%

Maximum value of SAR (measured) = 19.9 W/kg



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Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan,
dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.72 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 33.5 W/kg
SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.16 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.4%
Maximum value of SAR (measured) = 18.6 W/kg

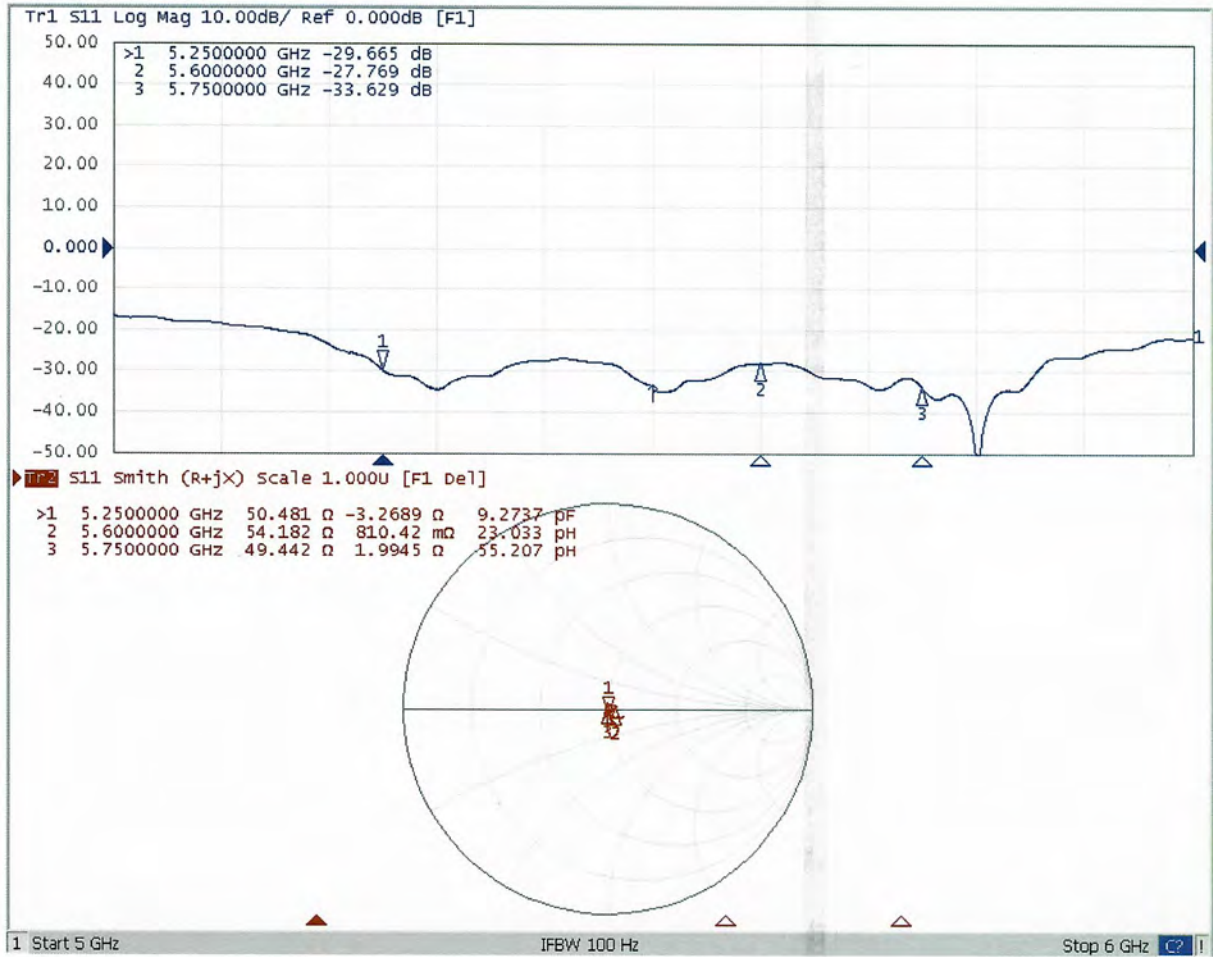


0 dB = 18.6 W/kg = 12.70 dBW/kg



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Impedance Measurement Plot for Head TSL



D5GHzV2 - SN: 1315 Extended Dipole Calibrations

Referring to KDB 865664 D01, 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.

D5GHzV2 - SN: 1315						
5250MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
10.22.2021	-29.7		50.5		-3.27	
10.21.2022	-34.5	16.26	51.2	0.66	1.6	4.83

D5GHzV2 - SN: 1315						
5600MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
10.22.2021	-27.8		54.2		0.81	
10.21.2022	-31.0	11.63	49.6	-4.61	-2.8	-3.60

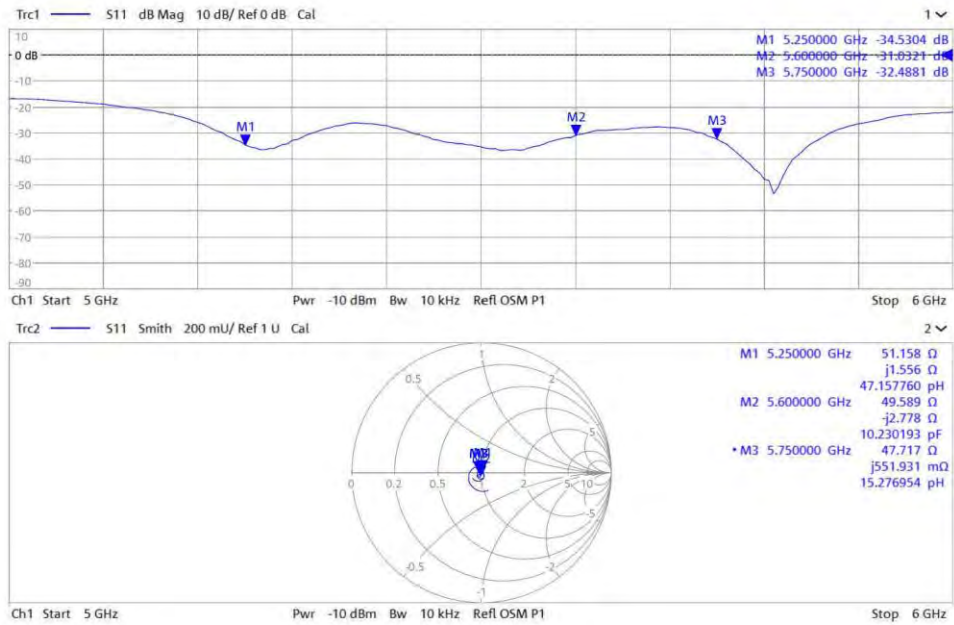
D5GHzV2 - SN: 1315						
5750MHz Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
10.22.2021	-33.6		49.4		1.99	
10.21.2022	-32.5	-3.31	47.7	-1.68	0.6	-1.44

<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>

Head 5250-5750MHz _2022.10.21





Appendix D. Conducted Power Result

Full Power

Band	GSM850				GSM1900			
Channel	128	189	251	Max. Tune-up Power	512	661	810	Max. Tune-up Power
Frequency	824.2	836.4	848.8		1850.2	1880	1909.8	
GSM	32.58	32.62	32.63	34.00	29.81	29.97	29.99	31.50
GPRS 1Tx Slot	32.46	32.51	32.46	34.00	29.61	29.81	29.84	31.50
GPRS 2Tx Slot	30.27	30.05	30.07	31.50	27.26	27.45	27.47	28.50
GPRS 3Tx Slot	28.68	28.94	28.83	30.00	25.93	26.14	26.10	27.00
GPRS 4Tx Slot	27.38	27.53	27.48	28.50	24.39	24.58	24.61	25.50
EDGE 1Tx Slot	27.54	27.55	27.63	29.00	25.54	25.76	25.47	28.00
EDGE 2Tx Slot	24.32	24.16	24.21	26.00	23.71	23.78	23.56	25.00
EDGE 3Tx Slot	22.49	22.51	22.37	24.50	22.07	22.05	22.02	23.50
EDGE 4Tx Slot	21.14	21.33	21.12	23.00	20.18	20.23	20.17	22.00

Source-Based Time-Averaged Power								
Band	GSM850			Max. Tune-up Power	GSM1900			Max. Tune-up Power
Channel	128	189	251		512	661	810	
GSM	23.58	23.62	23.63	25.00	20.81	20.97	20.99	22.50
GPRS 1Tx Slot	23.46	23.51	23.46	25.00	20.61	20.81	20.84	22.50
GPRS 2Tx Slot	24.27	24.05	24.07	25.50	21.26	21.45	21.47	22.50
GPRS 3Tx Slot	24.42	24.68	24.57	25.74	21.67	21.88	21.84	22.74
GPRS 4Tx Slot	24.38	24.53	24.48	25.50	21.39	21.58	21.61	22.50
EDGE 1Tx Slot	18.54	18.55	18.63	20.00	16.54	16.76	16.47	19.00
EDGE 2Tx Slot	18.32	18.16	18.21	20.00	17.71	17.78	17.56	19.00
EDGE 3Tx Slot	18.23	18.25	18.11	20.24	17.81	17.79	17.76	19.24
EDGE 4Tx Slot	18.14	18.33	18.12	20.00	17.18	17.23	17.17	19.00

Band	WCDMA II			WCDMA II	WCDMA V			WCDMA V	WCDMA IV			WCDMA IV	
Tx Channel	9262	9400	9538	Max. Tune-up Power	4132	4182	4233	Max. Tune-up Power	1312	1413	1513	Max. Tune-up Power	
Rx Channel	9662	9800	9938		4357	4407	4458		4357	4407	4458		
Frequency	1852.4	1880	1907.6		826.4	836.4	846.6		1712.4	1732.6	1752.6		
RMC 12.2K	23.45	23.39	23.23	24.50	24.58	24.52	24.62	25.50	24.47	24.46	24.44	25.50	Proposal
HSDPA Subtest-1	22.55	22.47	22.35	23.50	24.03	23.94	24.04	24.50	23.79	23.88	23.86	24.50	0
HSDPA Subtest-2	22.54	22.46	22.34	23.50	23.99	23.93	24.03	24.50	23.88	23.87	23.85	24.50	0
HSDPA Subtest-3	22.03	21.95	21.83	23.00	23.48	23.37	23.52	24.00	23.37	23.46	23.42	24.00	0.5
HSDPA Subtest-4	22.02	21.94	21.82	23.00	23.47	23.41	23.51	24.00	23.36	23.35	23.33	24.00	0.5
DC-HSDPA Subtest-1	22.47	22.41	22.27	23.50	23.85	23.88	23.96	24.50	23.81	23.82	23.78	24.50	0
DC-HSDPA Subtest-2	22.46	22.40	22.26	23.00	23.91	23.87	23.95	24.00	23.82	23.81	23.77	24.00	0
DC-HSDPA Subtest-3	22.04	21.89	21.77	23.00	23.49	23.29	23.46	24.00	23.34	23.30	23.33	24.00	0.5
DC-HSDPA Subtest-4	22.03	21.88	21.76	23.00	23.48	23.35	23.45	24.00	23.37	23.29	23.27	24.00	0.5
HSUPA Subtest-1	22.51	22.43	22.31	23.50	23.96	23.90	24.00	24.50	23.85	23.84	23.82	24.50	0
HSUPA Subtest-2	20.50	20.42	20.30	21.50	21.95	21.89	21.99	22.50	22.08	22.07	22.03	22.50	2
HSUPA Subtest-3	21.98	21.91	21.79	22.50	23.43	23.38	23.45	23.50	23.32	23.32	23.30	23.50	1
HSUPA Subtest-4	20.34	20.25	20.15	21.50	21.69	21.63	21.71	22.50	21.92	21.87	21.85	22.50	2
HSUPA Subtest-5	22.46	22.39	22.27	23.50	23.91	23.86	23.96	24.50	23.80	23.80	23.78	24.50	0

LTE Band 41 (2496 ~ 2690MHz)											
BW	MCS Index	RB Size	RB Offset	Low	Low Mid	Mid	High Mid	High	3GPP MPR (dB)	Max. Tune-up (dBm)	
		Channel		39750	40185	40620	41055	41490			
		Frequency (MHz)		2506	2549.5	2593	2636.5	2680			
20M	QPSK	1	0	23.65	23.45	23.42	23.68	22.91	0	24.50	
		1	50	23.17	23.35	23.19	23.39	22.73	0	24.50	
		1	99	22.74	23.09	23.07	23.11	22.85	0	24.50	
		50	0	22.48	22.43	22.29	22.49	21.89	1	23.50	
		50	25	22.30	22.42	22.26	22.48	21.88	1	23.50	
		50	50	22.06	22.21	22.09	22.25	21.86	1	23.50	
	100	0	22.21	22.32	22.16	22.33	21.91	1	23.50		
	16QAM	1	0	22.57	22.49	22.40	22.72	21.92	1	23.50	
		1	50	22.13	22.40	22.17	22.32	21.77	1	23.50	
		1	99	21.71	22.11	22.06	22.09	21.93	1	23.50	
		50	0	21.51	21.46	21.26	21.53	20.84	2	22.50	
		50	25	21.33	21.48	21.33	21.52	20.97	2	22.50	
		50	50	21.12	21.29	21.12	21.24	20.94	2	22.50	
	64QAM	100	0	21.27	21.41	21.21	21.37	20.97	2	22.50	
		1	0	21.63	21.74	21.68	21.85	21.76	2	22.50	
		1	50	21.36	21.73	21.45	21.49	21.63	2	22.50	
		1	99	20.92	21.50	21.31	21.24	21.77	2	22.50	
		50	0	20.88	20.76	20.89	20.63	20.84	3	21.50	
		50	25	20.93	20.77	20.95	20.64	20.90	3	21.50	
	20M	64QAM	50	50	20.70	20.94	20.71	20.35	20.85	3	21.50
			100	0	20.84	20.98	20.79	20.42	20.82	3	21.50
			100	0	20.84	20.98	20.79	20.42	20.82	3	21.50

(HPUE) LTE Band 41 (2496 ~ 2690MHz)											
BW	MCS Index	RB Size	RB Offset	Low	Low Mid	Mid	High Mid	High	3GPP MPR (dB)	Max. Tune-up (dBm)	
		Channel		39750	40185	40620	41055	41490			
		Frequency (MHz)		2506	2549.5	2593	2636.5	2680			
20M	QPSK	1	0	26.47	26.47	26.60	26.66	25.71	0	27.50	
		1	50	26.06	26.31	26.19	26.34	25.58	0	27.50	
		1	99	25.72	26.20	26.13	25.88	25.69	0	27.50	
		50	0	25.63	25.62	25.45	25.74	24.99	1	26.50	
		50	25	25.30	25.52	25.40	25.54	24.81	1	26.50	
		50	50	25.24	25.41	25.32	25.45	24.93	1	26.50	
	100	0	25.39	25.56	25.38	25.58	25.01	1	26.50		
	16QAM	1	0	25.85	25.78	25.89	25.91	25.00	1	26.50	
		1	50	25.43	25.64	25.49	25.52	24.88	1	26.50	
		1	99	25.10	25.49	25.44	25.20	24.99	1	26.50	
		50	0	24.73	24.70	24.51	24.86	24.01	2	25.50	
		50	25	24.40	24.63	24.49	24.53	23.89	2	25.50	
		50	50	24.34	24.68	24.40	24.55	24.08	2	25.50	
	64QAM	100	0	24.52	24.66	24.48	24.68	24.11	2	25.50	
		1	0	25.30	25.26	25.36	25.30	24.47	2	25.50	
		1	50	24.86	25.16	24.91	24.92	24.40	2	25.50	
		1	99	24.51	25.06	24.83	24.63	24.56	2	25.50	
		50	0	24.35	24.38	24.14	24.40	23.65	3	24.50	
		50	25	24.01	24.34	24.10	24.11	23.54	3	24.50	
	20M	64QAM	50	50	23.93	24.27	23.98	24.15	23.78	3	24.50
			100	0	24.11	24.33	24.07	24.27	23.77	3	24.50
			100	0	24.11	24.33	24.07	24.27	23.77	3	24.50

Full Power CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	Measured Power (dBm)	Max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	23.99	24.50
		16QAM	1	0	0	0	1	23.01	23.50
		64QAM	1	0	0	0	1	22.02	22.50
40521	40719	QPSK	1	0	0	0	1	24.08	24.50
		16QAM	1	0	0	0	1	23.04	23.50
		64QAM	1	0	0	0	1	21.99	22.50
41292	41490	QPSK	1	0	0	0	1	23.65	24.50
		16QAM	1	0	0	0	1	22.67	23.50
		64QAM	1	0	0	0	1	21.71	22.50

2.4GHz WLAN

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
2.4GHz WLAN	802.11b 1Mbps	1	2412	17.61	18.00
		6	2437	17.41	18.00
		11	2462	17.52	18.00
	802.11g 6Mbps	1	2412	14.60	16.00
		6	2437	15.53	16.00
		11	2462	14.79	16.00
	802.11n- HT20 MCS0	1	2412	14.43	16.00
		6	2437	15.36	16.00
		11	2462	14.60	16.00
		3	2422	13.55	15.00
		6	2437	13.80	15.00
		9	2452	13.97	15.00

5.2GHz WLAN

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.2GHz WLAN	802.11a 6Mbps	36	5180	16.99	17.50
		40	5200	16.62	17.50
		44	5220	16.61	17.50
		48	5240	16.88	17.50
	802.11n- HT20 MCS0	36	5180	16.88	17.50
		40	5200	16.50	17.50
		44	5220	16.43	17.50
	802.11n- HT40 MCS0	48	5240	16.76	17.50
		38	5190	15.29	16.50
	802.11ac- VHT20 MCS0	46	5230	15.28	16.50
		36	5180	15.82	16.50
	802.11ac- VHT40 MCS0	40	5200	15.45	16.50
		44	5220	15.42	16.50
		48	5240	15.67	16.50
	802.11ac- VHT80 MCS0	38	5190	15.44	16.50
		46	5230	15.43	16.50
	42	5210	14.37	15.50	

5.3GHz WLAN

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.3GHz WLAN	802.11a 6Mbps	52	5260	17.05	17.50
		56	5280	16.62	17.50
		60	5300	16.65	17.50
		64	5320	16.98	17.50
	802.11n- HT20 MCS0	52	5260	16.93	17.50
		56	5280	16.43	17.50
		60	5300	16.48	17.50
	802.11n- HT40 MCS0	64	5320	16.81	17.50
		54	5270	15.72	16.50
	802.11ac- VHT20 MCS0	62	5310	15.74	16.50
		52	5260	15.84	16.50
		56	5280	15.39	16.50
	802.11ac- VHT40 MCS0	60	5300	15.42	16.50
		64	5320	15.74	16.50
		54	5270	15.72	16.50
	802.11ac- VHT80 MCS0	62	5310	15.75	16.50
		58	5290	14.25	15.50

5.5GHz WLAN

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.5GHz WLAN	802.11a 6Mbps	100	5500	16.35	17.50
		116	5580	16.62	17.50
		124	5620	16.58	17.50
		132	5660	16.52	17.50
		140	5700	16.70	17.50
		144	5720	16.67	17.50
	802.11n- HT20 MCS0	100	5500	16.52	17.50
		116	5580	16.45	17.50
		124	5620	16.41	17.50
		132	5660	16.43	17.50
		140	5700	16.51	17.50
		144	5720	16.47	17.50
	802.11n- HT40 MCS0	102	5510	15.85	17.00
		110	5550	15.54	17.00
		126	5630	15.86	17.00
	802.11ac- VHT20 MCS0	134	5670	16.06	17.00
		142	5710	15.89	17.00
		100	5500	15.98	17.00
		116	5580	15.98	17.00
		124	5620	15.93	17.00
		132	5660	15.96	17.00
	802.11ac- VHT40 MCS0	140	5700	16.03	17.00
		144	5720	16.00	17.00
		102	5510	15.86	17.00
		110	5550	15.54	17.00
		126	5630	15.73	17.00
		134	5670	16.07	17.00
	802.11ac- VHT80 MCS0	142	5710	15.91	17.00
		106	5530	14.75	16.00
		122	5610	14.49	16.00
		138	5690	15.09	16.00

5.8GHz WLAN

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.8GHz WLAN	802.11a 6Mbps	149	5745	16.58	17.50
		157	5785	16.95	17.50
		165	5825	16.74	17.50
	802.11n- HT20 MCS0	149	5745	16.42	17.50
		157	5785	16.79	17.50
		165	5825	16.55	17.50
	802.11n- HT40 MCS0	151	5755	15.87	17.00
		159	5795	16.13	17.00
	802.11ac- VHT20 MCS0	149	5745	15.98	17.00
		157	5785	16.25	17.00
		165	5825	16.23	17.00
	802.11ac- VHT40 MCS0	151	5765	15.86	17.00
		159	5795	16.15	17.00
		155	5775	14.97	16.00

Bluetooth

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
BR / EDR	GFSK	CH 0	2402	10.46	11.00
		CH 39	2441	10.21	11.00
		CH 78	2480	8.47	10.00
	DQPSK	CH 0	2402	7.78	9.00
		CH 39	2441	7.42	9.00
		CH 78	2480	7.39	9.00
	8DPSK	CH 0	2402	7.78	9.00
		CH 39	2441	7.41	9.00
		CH 78	2480	6.71	8.00
BLE	1M	CH 0	2402	6.36	8.00
		CH 19	2440	6.29	8.00
		CH 39	2480	5.21	7.00

Reduced Power

DSI-7									
Band	WCDMA II			WCDMA II	WCDMA IV			WCDMA IV	
TX Channel	9262	9400	9538	Max. Tune-up Power	1312	1413	1513	Max. Tune-up Power	
Rx Channel	9662	9800	9938		4357	4407	4458		
Frequency	1852.4	1880	1907.6		1712.4	1732.6	1752.6		
RMC 12.2K	20.74	20.70	20.63	22.00	22.98	22.93	22.91	23.50	Proposal
HSDPA Subtest-1	19.84	19.78	19.75	21.00	21.98	21.92	21.90	22.50	0
HSDPA Subtest-2	19.83	19.77	19.74	21.00	21.97	21.91	21.89	22.50	0
HSDPA Subtest-3	19.32	19.26	19.23	20.50	21.46	21.40	21.38	22.00	0.5
HSDPA Subtest-4	19.31	19.25	19.22	20.50	21.45	21.39	21.37	22.00	0.5
DC-HSDPA Subtest-1	19.76	19.72	19.67	21.00	21.80	21.77	21.69	22.50	0
DC-HSDPA Subtest-2	19.75	19.71	19.66	20.50	21.79	21.76	21.68	22.00	0
DC-HSDPA Subtest-3	19.33	19.20	19.17	20.50	21.37	21.25	21.19	22.00	0.5
DC-HSDPA Subtest-4	19.32	19.19	19.16	20.50	21.36	21.24	21.18	22.00	0.5
HSUPA Subtest-1	19.96	19.91	19.86	21.00	21.84	21.79	21.73	22.50	0
HSUPA Subtest-2	17.99	17.93	17.90	19.00	19.50	19.45	19.43	20.50	2
HSUPA Subtest-3	18.92	18.88	18.83	20.00	20.80	20.76	20.70	21.50	1
HSUPA Subtest-4	17.83	17.73	17.74	19.00	19.62	19.59	19.64	20.50	2
HSUPA Subtest-5	19.91	19.87	19.82	21.00	21.31	21.27	21.21	22.50	0

Table 1: LTE Band 41 (2496 - 2600MHz) DSF-6. This table contains frequency allocation data for various channel widths (1.4, 3, 5, 10, 15, 20 MHz) and bandwidths (10, 15, 20 MHz). It includes columns for channel frequency, low and high MHz, and maximum transmit power.

Table 2: (N)PUE LTE Band 41 (2496 - 2600MHz) DSF-6. This table provides similar frequency allocation data as Table 1 but includes an additional column for the Maximum Power Spectral Density (MPSD) in dBm/Hz.

Table 3: LTE Band 41 (2496 - 2600MHz) DSF-7. This table contains frequency allocation data for various channel widths and bandwidths, similar to Table 1.

Table 4: (N)PUE LTE Band 41 (2496 - 2600MHz) DSF-7. This table provides similar frequency allocation data as Table 3 but includes an additional column for the Maximum Power Spectral Density (MPSD) in dBm/Hz.

LTE Band 2 DS17 Table with columns for BW, MCS Index, RB Size, RB Offset, Low, Mid, High, SPP MPR, Max. Turn-up, Channel, Frequency (MHz), and various channel configurations for QPSK, 16QAM, and 64QAM modulation schemes across different bandwidths.

LTE Band 4 DS17 Table with columns for BW, MCS Index, RB Size, RB Offset, Low, Mid, High, SPP MPR, Max. Turn-up, Channel, Frequency (MHz), and various channel configurations for QPSK, 16QAM, and 64QAM modulation schemes across different bandwidths.

LTE Band 25 DS17 Table with columns for BW, MCS Index, RB Size, RB Offset, Low, Mid, High, SPP MPR, Max. Turn-up, Channel, Frequency (MHz), and various channel configurations for QPSK, 16QAM, and 64QAM modulation schemes across different bandwidths.

LTE Band 66 DSI-7									
BW	MCS Index	Channel		Low	Mid	High	3GPP MPR (dB)	Max. Tune-up (dBm)	
		RB Size	RB Offset	132072	133222	132572			
20M	QPSK	Frequency (MHz)		1720	1745	1770			
		1	0	22.42	22.59	22.14	0	23.50	
		1	50	22.34	22.61	21.98	0	23.50	
		1	99	23.06	22.87	22.59	0	23.50	
		50	0	22.05	22.16	21.96	1	23.00	
		50	25	22.13	22.16	22.01	1	23.00	
		50	50	22.35	22.19	22.04	1	23.00	
		100	0	22.26	22.11	21.94	1	23.00	
		1	0	22.09	22.04	22.43	1	23.50	
		1	50	22.59	22.51	22.54	1	23.50	
		1	99	22.68	22.72	22.84	1	23.50	
		50	0	21.66	21.69	21.58	2	23.00	
	50	25	21.69	21.68	21.54	2	23.00		
	50	50	21.79	21.72	21.64	2	23.00		
	100	0	21.77	21.61	21.58	2	23.00		
	1	0	22.04	22.20	21.93	2	23.50		
	1	50	21.95	21.94	21.97	2	23.50		
	1	99	22.58	22.65	22.40	2	23.50		
	50	0	21.53	21.62	21.53	3	23.00		
	50	25	21.58	21.63	21.55	3	23.00		
	50	50	21.83	21.61	21.68	3	23.00		
	100	0	21.72	21.67	21.49	3	23.00		
	15M	QPSK	Channel		132622	133222	132572	3GPP MPR	Max. Tune-up
			Frequency (MHz)		1720	1745	1770		
			1	0	22.34	22.55	22.09	0	23.50
			1	37	22.32	22.53	21.97	0	23.50
			1	74	22.98	22.83	22.54	0	23.50
			36	0	22.02	22.10	21.94	1	23.00
			36	19	22.11	22.09	21.96	1	23.00
			36	39	22.29	22.11	22.02	1	23.00
			75	0	22.35	22.09	21.86	1	23.00
			1	0	22.02	21.96	22.37	1	23.50
			1	37	22.86	22.45	22.52	1	23.50
			1	74	22.86	22.65	22.79	1	23.50
		36	0	21.60	21.61	21.56	2	23.00	
		36	19	21.67	21.60	21.53	2	23.00	
36		39	21.71	21.68	21.59	2	23.00		
75		0	21.75	21.53	21.57	2	23.00		
1		0	21.96	22.16	21.88	2	23.50		
1		37	21.92	21.86	21.95	2	23.50		
1		74	22.56	22.58	22.35	2	23.50		
36		0	21.47	21.54	21.51	3	23.00		
36		19	21.57	21.61	21.47	3	23.00		
36		39	21.78	21.53	21.62	3	23.00		
75		0	21.71	21.61	21.47	3	23.00		
10M		QPSK	Channel		132622	133222	132622	3GPP MPR	Max. Tune-up
			Frequency (MHz)		1715	1745	1775		
			1	0	22.41	22.55	22.06	0	23.50
			1	24	22.30	22.58	21.92	0	23.50
			1	49	23.04	22.86	22.55	0	23.50
			25	0	21.99	22.11	21.95	1	23.00
			25	12	22.12	22.14	21.96	1	23.00
			25	25	22.27	22.12	22.02	1	23.00
			50	0	22.35	22.07	21.91	1	23.00
			1	0	22.06	22.03	22.37	1	23.50
			1	24	22.85	22.46	22.52	1	23.50
			1	49	22.82	22.70	22.81	1	23.50
		25	0	21.64	21.61	21.57	2	23.00	
	25	12	21.61	21.64	21.49	2	23.00		
	25	25	21.76	21.66	21.62	2	23.00		
	50	0	21.76	21.56	21.50	2	23.00		
	1	0	21.98	22.17	21.89	2	23.50		
	1	24	21.93	21.87	21.92	2	23.50		
	1	49	22.52	22.57	22.38	2	23.50		
	25	0	21.52	21.60	21.45	3	23.00		
	25	12	21.51	21.55	21.49	3	23.00		
	25	25	21.81	21.60	21.64	3	23.00		
	50	0	21.70	21.59	21.48	3	23.00		
	5M	QPSK	Channel		131997	132322	132647	3GPP MPR	Max. Tune-up
			Frequency (MHz)		1715.5	1745	1775.5		
			1	0	22.37	22.52	22.09	0	23.50
			1	12	22.32	22.53	21.98	0	23.50
			1	24	23.01	22.79	22.58	0	23.50
			12	0	22.01	22.11	21.91	1	23.00
			12	6	22.05	22.15	21.96	1	23.00
			12	13	22.31	22.14	22.03	1	23.00
			25	0	22.30	22.09	21.89	1	23.00
			1	0	22.02	21.99	22.41	1	23.50
			1	12	22.81	22.49	22.49	1	23.50
			1	24	22.86	22.64	22.82	1	23.50
		12	0	21.58	21.63	21.50	2	23.00	
12		6	21.63	21.66	21.48	2	23.00		
12		13	21.72	21.67	21.62	2	23.00		
25		0	21.71	21.54	21.53	2	23.00		
1		0	21.97	22.15	21.91	2	23.50		
1		12	21.67	21.92	21.91	2	23.50		
1		24	22.50	22.64	22.38	2	23.50		
12		0	21.49	21.57	21.45	3	23.00		
12		6	21.50	21.62	21.53	3	23.00		
12		13	21.79	21.56	21.60	3	23.00		
25		0	21.66	21.65	21.46	3	23.00		
3M		QPSK	Channel		131997	132322	132647	3GPP MPR	Max. Tune-up
			Frequency (MHz)		1716.7	1745	1773.3		
			1	0	22.28	22.53	22.03	0	23.50
			1	2	22.25	22.48	21.95	0	23.50
			1	5	22.92	22.76	22.49	0	23.50
			3	0	21.95	22.05	21.92	0	23.50
			3	1	22.03	22.07	21.90	0	23.50
			3	3	22.21	22.10	22.00	0	23.50
			6	0	22.31	22.04	21.78	1	23.00
			1	0	21.94	21.95	22.35	1	23.50
			1	2	22.81	22.40	22.48	1	23.50
			1	5	22.84	22.57	22.78	1	23.50
		3	0	21.52	21.57	21.51	1	23.50	
	3	1	21.64	21.54	21.51	1	23.50		
	3	3	21.69	21.61	21.54	1	23.50		
	6	0	21.69	21.45	21.55	2	23.00		
	1	0	21.95	22.14	21.80	2	23.50		
	1	2	21.87	21.80	21.89	2	23.50		
	1	5	22.55	22.52	22.33	2	23.50		
	3	0	21.42	21.52	21.44	2	23.50		
	3	1	21.55	21.53	21.46	2	23.50		
	3	3	21.70	21.49	21.57	2	23.50		
	6	0	21.69	21.53	21.46	3	23.00		

DSI-2									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	21.74	22.00
		16QAM	1	0	0	0	1	21.71	22.00
		64QAM	1	0	0	0	1	21.43	22.00
40521	40719	QPSK	1	0	0	0	1	21.79	22.00
		16QAM	1	0	0	0	1	21.62	22.00
		64QAM	1	0	0	0	1	20.93	22.00
41292	41490	QPSK	1	0	0	0	1	21.47	22.00
		16QAM	1	0	0	0	1	21.32	22.00
		64QAM	1	0	0	0	1	20.62	22.00

DSI-3									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	19.21	20.00
		16QAM	1	0	0	0	1	18.95	20.00
		64QAM	1	0	0	0	1	18.67	20.00
40521	40719	QPSK	1	0	0	0	1	19.05	20.00
		16QAM	1	0	0	0	1	18.96	20.00
		64QAM	1	0	0	0	1	18.37	20.00
41292	41490	QPSK	1	0	0	0	1	18.62	20.00
		16QAM	1	0	0	0	1	18.59	20.00
		64QAM	1	0	0	0	1	18.06	20.00

DSI-4									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	19.66	20.50
		16QAM	1	0	0	0	1	19.62	20.50
		64QAM	1	0	0	0	1	19.59	20.50
40521	40719	QPSK	1	0	0	0	1	19.73	20.50
		16QAM	1	0	0	0	1	19.48	20.50
		64QAM	1	0	0	0	1	19.13	20.50
41292	41490	QPSK	1	0	0	0	1	18.95	20.50
		16QAM	1	0	0	0	1	18.91	20.50
		64QAM	1	0	0	0	1	18.42	20.50

DSI-5									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	20.04	20.50
		16QAM	1	0	0	0	1	20.02	20.50
		64QAM	1	0	0	0	1	19.69	20.50
40521	40719	QPSK	1	0	0	0	1	20.07	20.50
		16QAM	1	0	0	0	1	19.85	20.50
		64QAM	1	0	0	0	1	19.44	20.50
41292	41490	QPSK	1	0	0	0	1	19.45	20.50
		16QAM	1	0	0	0	1	19.41	20.50
		64QAM	1	0	0	0	1	18.88	20.50

DSI-6									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	18.09	19.00
		16QAM	1	0	0	0	1	18.08	19.00
		64QAM	1	0	0	0	1	17.74	19.00
40521	40719	QPSK	1	0	0	0	1	18.15	19.00
		16QAM	1	0	0	0	1	18.14	19.00
		64QAM	1	0	0	0	1	17.62	19.00
41292	41490	QPSK	1	0	0	0	1	17.52	19.00
		16QAM	1	0	0	0	1	17.49	19.00
		64QAM	1	0	0	0	1	17.03	19.00

DSI-7									
CA_41C									
Combination 20MHz+20MHz (100RB+100RB)									
PCC Channel	SCC Channel	Modulation	PCC		SCC		Total RB Size	measured Power (dBm)	max. Tune-up (dBm)
			RB Size	RB offset	RB Size	RB offset			
39750	39948	QPSK	1	0	0	0	1	18.94	20.00
		16QAM	1	0	0	0	1	18.85	20.00
		64QAM	1	0	0	0	1	18.38	20.00
40521	40719	QPSK	1	0	0	0	1	18.97	20.00
		16QAM	1	0	0	0	1	18.91	20.00
		64QAM	1	0	0	0	1	18.29	20.00
41292	41490	QPSK	1	0	0	0	1	18.35	20.00
		16QAM	1	0	0	0	1	18.31	20.00
		64QAM	1	0	0	0	1	18.02	20.00

2.4GHz WLAN DSI-6

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
2.4GHz WLAN	802.11b 1Mbps	1	2412	16.74	17.50
		6	2437	16.70	17.50
		11	2462	16.66	17.50
	802.11g 6Mbps	1	2412	14.60	16.00
		6	2437	15.53	16.00
		11	2462	14.79	16.00
	802.11n- HT20 MCS0	1	2412	14.43	16.00
		6	2437	15.36	16.00
		11	2462	14.60	16.00
	802.11n- HT40 MCS0	3	2422	13.55	15.00
		6	2437	13.80	15.00
		9	2452	13.97	15.00

5.2GHz WLAN DSI-6

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.2GHz WLAN	802.11a 6Mbps	36	5180	14.66	15.00
		40	5200	14.59	15.00
		44	5220	14.35	15.00
		48	5240	14.00	15.00
	802.11n- HT20 MCS0	36	5180	14.00	15.00
		40	5200	14.50	15.00
		44	5220	14.16	15.00
		48	5240	13.83	15.00
	802.11n- HT40 MCS0	38	5190	13.73	14.00
		46	5230	13.52	14.00
		36	5180	14.03	15.00
	802.11ac- VHT20 MCS0	40	5200	14.52	15.00
		44	5220	14.20	15.00
		48	5240	13.85	15.00
	802.11ac- VHT40 MCS0	38	5190	13.76	14.00
		46	5230	13.53	14.00
	802.11ac- VHT80 MCS0	42	5210	12.94	14.00

5.3GHz WLAN DSI-6

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.3GHz WLAN	802.11a 6Mbps	52	5280	14.69	15.00
		56	5280	14.62	15.00
		60	5300	14.67	15.00
		64	5320	14.31	15.00
	802.11n- HT20 MCS0	52	5280	14.14	15.00
		56	5280	14.63	15.00
		60	5300	14.50	15.00
	802.11n- HT40 MCS0	64	5320	14.14	15.00
		54	5270	13.83	14.00
	802.11ac- VHT20 MCS0	62	5310	13.81	14.00
		52	5280	14.15	15.00
		56	5280	14.66	15.00
	802.11ac- VHT40 MCS0	60	5300	14.53	15.00
		64	5320	14.16	15.00
	802.11ac- VHT80 MCS0	54	5270	13.83	14.00
	62	5310	13.80	14.00	
	58	5290	13.15	14.00	

5.5GHz WLAN DSI-6

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.5GHz WLAN	802.11a 6Mbps	100	5500	12.44	13.50
		116	5580	12.64	13.50
		124	5620	12.96	13.50
		132	5660	13.02	13.50
		140	5700	13.05	13.50
		144	5720	12.99	13.50
	802.11n- HT20 MCS0	100	5500	12.27	13.50
		116	5580	12.46	13.50
		124	5620	12.83	13.50
		132	5660	12.91	13.50
		140	5700	12.70	13.50
		144	5720	12.82	13.50
	802.11n- HT40 MCS0	102	5510	11.61	12.50
		110	5550	11.56	12.50
		126	5630	11.68	12.50
		134	5670	11.73	12.50
		142	5710	11.33	12.50
		100	5500	12.29	13.50
	802.11ac- VHT20 MCS0	116	5580	12.47	13.50
		124	5620	12.85	13.50
		132	5660	12.93	13.50
		140	5700	12.71	13.50
		144	5720	12.85	13.50
		102	5510	11.59	12.50
	802.11ac- VHT40 MCS0	110	5550	11.58	12.50
		126	5630	11.69	12.50
		134	5670	11.74	12.50
		142	5710	11.31	12.50
	802.11ac- VHT80 MCS0	106	5530	10.96	12.50
		122	5610	10.72	12.50
	138	5690	10.97	12.50	

5.8GHz WLAN DSI-6

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit
5.8GHz WLAN	802.11a 6Mbps	149	5745	13.61	14.00
		157	5785	13.64	14.00
		165	5825	13.20	14.00
	802.11n- HT20 MCS0	149	5745	13.47	14.00
		157	5785	13.44	14.00
		165	5825	13.03	14.00
	802.11n- HT40 MCS0	151	5755	11.44	13.00
		159	5795	12.44	13.00
	802.11ac- VHT20 MCS0	149	5745	13.49	14.00
		157	5785	13.45	14.00
		165	5825	13.03	14.00
	802.11ac- VHT40 MCS0	151	5755	12.42	13.00
		159	5795	12.44	13.00
	802.11ac- VHT80 MCS0	155	5775	11.52	13.00

5.5GHz WLAN DSI-3

	Mode	Channel	Frequency (MHz)	Average power (dBm)	Tune-Up Limit	Power Setting
5.5GHz WLAN	802.11a 6Mbps	100	5500	15.28	16.50	15.00
		116	5580	15.44	16.50	15.00
		124	5620	15.76	16.50	15.00
		132	5660	15.77	16.50	15.00
		140	5700	15.84	16.50	15.00
		144	5720	15.79	16.50	15.00
	802.11n- HT20 MCS0	100	5500	15.12	16.50	15.00
		116	5580	15.29	16.50	15.00
		124	5620	15.60	16.50	15.00
		132	5660	15.61	16.50	15.00
		140	5700	15.54	16.50	15.00
		144	5720	15.66	16.50	15.00
	802.11n- HT40 MCS0	102	5510	14.82	15.50	14.00
		110	5550	14.82	15.50	14.00
		126	5630	15.02	15.50	14.00
		134	5670	15.06	15.50	14.00
		142	5710	14.96	15.50	14.00
		100	5500	15.98	16.50	15.00
	802.11ac- VHT20 MCS0	116	5580	15.98	16.50	15.00
		124	5620	15.93	16.50	15.00
		132	5660	15.96	16.50	15.00
		140	5700	16.03	16.50	15.00
		144	5720	16.00	16.50	15.00
		102	5510	14.82	15.50	14.00
	802.11ac- VHT40 MCS0	110	5550	14.82	15.50	14.00
		126	5630	14.97	15.50	14.00
		134	5670	15.03	15.50	14.00
		142	5710	15.00	15.50	14.00
	802.11ac- VHT80 MCS0	106	5530	14.75	16.00	14.00
		122	5610	14.49	16.00	14.00
	138	5690	15.09	16.00	14.00	