In Collaboration with
s p e a g
CALIBRATION LABORATORY
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	52.3Ω - 9.30jΩ
Return Loss	- 20.6dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	52.9Ω - 1.49jΩ
Return Loss	- 29.9dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	54.4Ω - 3.77jΩ
Return Loss	- 25.2dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	53.4Ω +3.99jΩ
Return Loss	- 25.9dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	51.3Ω - 8.42jΩ
Return Loss	- 21.5dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.8Ω + 1.03jΩ
Return Loss	- 33.7dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	54.6Ω - 2.05jΩ
Return Loss	- 26.4dB

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	53.0Ω + 4.83jΩ
Return Loss	- 25.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.054 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

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL Date: 09.27.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1221

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz,

Medium parameters used: f = 5200 MHz; σ = 4.748 S/m; ε_r = 35.09; ρ = 1000 kg/m3, Medium parameters used: f = 5300 MHz; σ = 4.864 S/m; ε_r = 34.85; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.193 S/m; ε_r = 34.51; ρ = 1000 kg/m3, Medium parameters used: f = 5800 MHz; σ = 5.411 S/m; ε_r = 34.3; ρ = 1000 kg/m3,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(5.05, 5.05, 5.05) @ 5200 MHz; Calibrated: 8/27/2018, ConvF(4.99, 4.99, 4.99) @ 5300 MHz; Calibrated: 8/27/2018, ConvF(4.41, 4.41, 4.41) @ 5600 MHz; Calibrated: 8/27/2018, ConvF(4.42, 4.42, 4.42) @ 5800 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 /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.34 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 18.5 W/kg

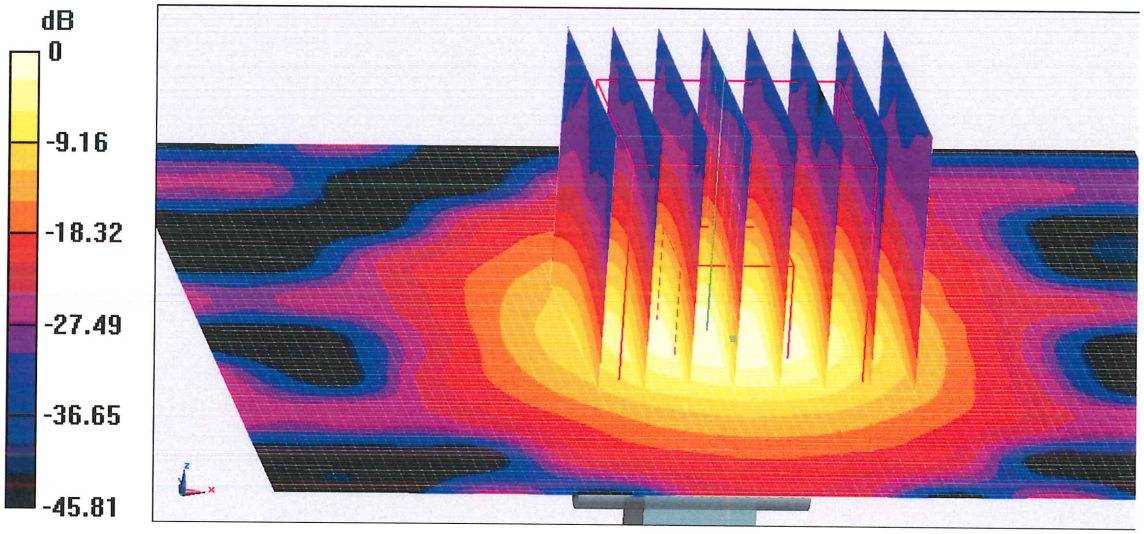
Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 67.74 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 34.7 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.27 W/kg
Maximum value of SAR (measured) = 19.4 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 = 66.14 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 37.5 W/kg
SAR(1 g) = 8.07 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 19.8 W/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.94 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 37.4 W/kg
SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 19.3 W/kg

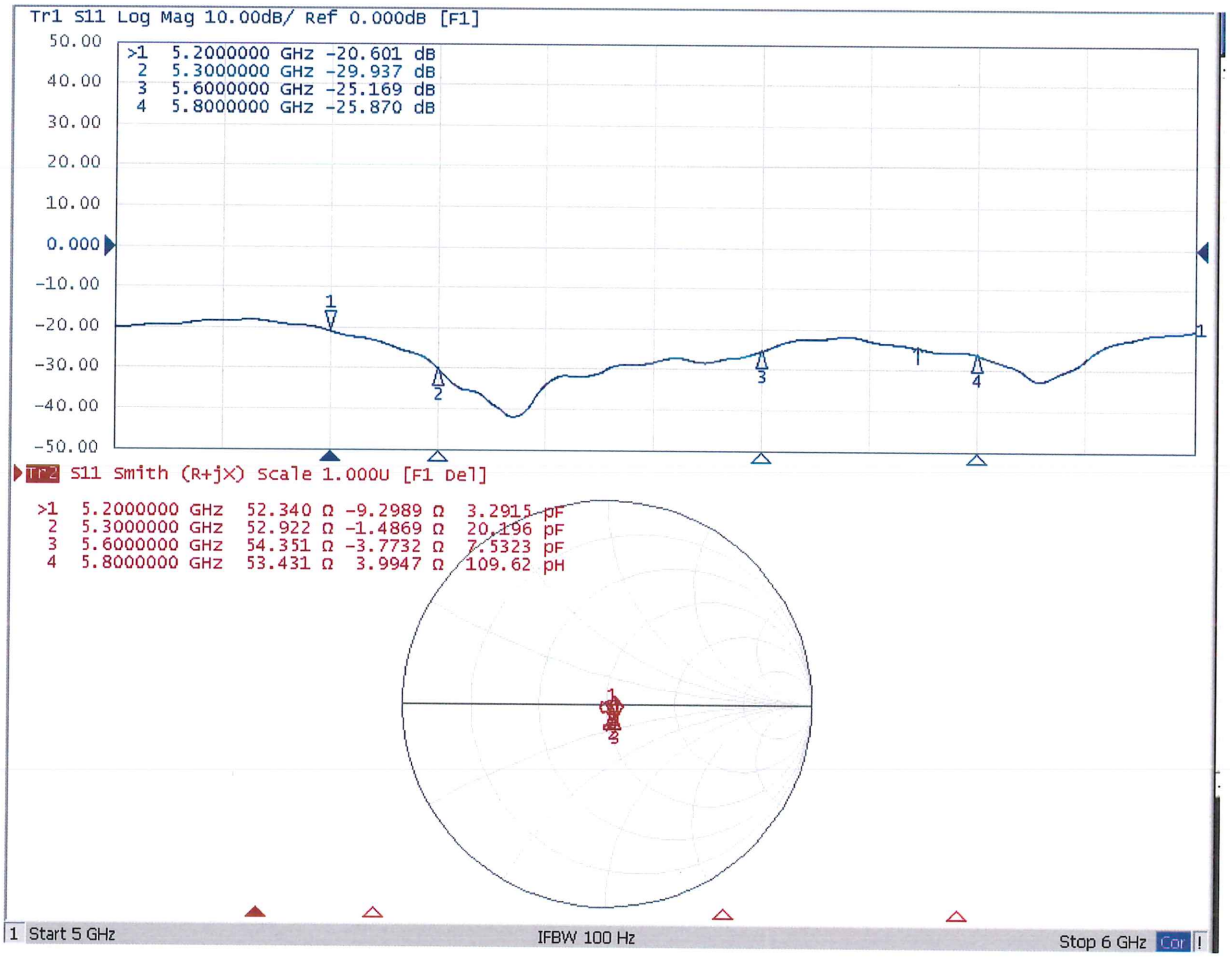


0 dB = 19.3 W/kg = 12.86 dBW/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Head TSL



Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Body TSL Date: 09.25.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1221

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz,

Medium parameters used: f = 5200 MHz; σ = 5.344 S/m; ε_r = 48.26; ρ = 1000 kg/m3, Medium parameters used: f = 5300 MHz; σ = 5.475 S/m; ε_r = 48.09; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.88 S/m; ε_r = 47.47; ρ = 1000 kg/m3, Medium parameters used: f = 5800 MHz; σ = 6.175 S/m; ε_r = 46.98; ρ = 1000 kg/m3,

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(4.59, 4.59, 4.59) @ 5200 MHz; Calibrated: 8/27/2018, ConvF(4.49, 4.49, 4.49) @ 5300 MHz; Calibrated: 8/27/2018, ConvF(4, 4, 4) @ 5600 MHz; Calibrated: 8/27/2018, ConvF(3.94, 3.94, 3.94) @ 5800 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 /Pin=100mW, d=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.19 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 28.0 W/kg
SAR(1 g) = 7.22 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 17.1 W/kg

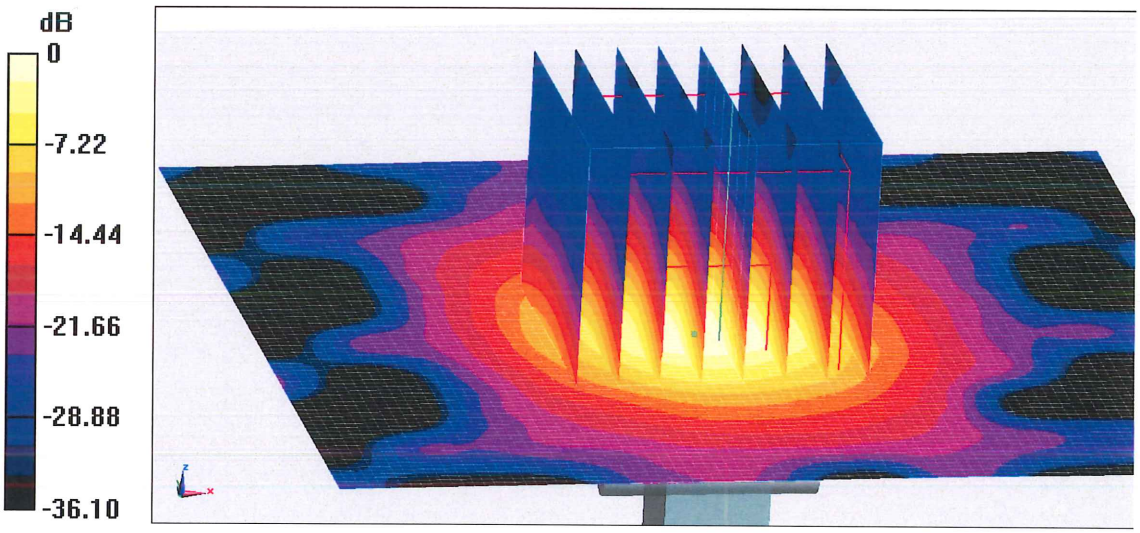
Dipole Calibration /Pin=100mW, d=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 61.08 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 7.56 W/kg; SAR(10 g) = 2.15 W/kg
Maximum value of SAR (measured) = 18.4 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.98 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 35.3 W/kg
SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 19.7 W/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Dipole Calibration /Pin=100mW, d=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.20 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.7 W/kg
SAR(1 g) = 7.51 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

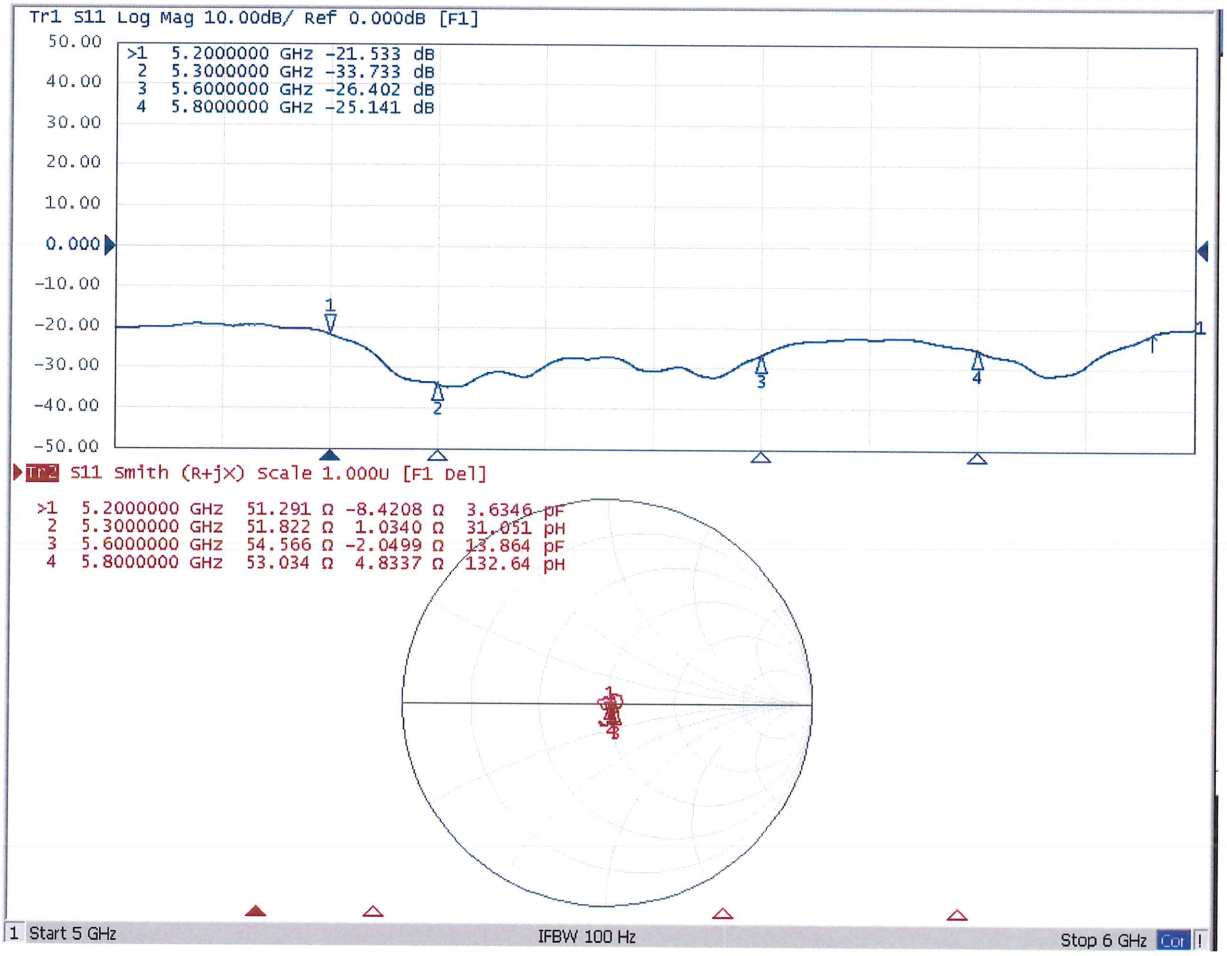


0 dB = 19.0 W/kg = 12.79 dBW/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com http://www.chinattl.cn

Impedance Measurement Plot for Body TSL



Dipole Internal Calibration Record

Asset No. :	E-436	Model No. :	D5GHzV2	Serial No. :	1160
Environmental	22.3℃, 55 %	Original Cal. Date :	June 20, 2018	Next Cal. Date :	June 20, 2021

Standard List		
1	IEEE Std 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorpiton Rate(SAR) in the Human Head from Wireless Communication Devices: Measurement Texhniques, June 2013
2	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
3	KDB865664	SAR Measurement Requirements for 100 MHz to 6 GHz

Equipment Information					
Equipment :	Manufacturer :	Model No. :	Serial No. :	Cal.Organization :	Cal. Date :
Power Amplifier	Mini-Circuits	ZVE-8G+	520701341	NA	March 9, 2018
DC Source	Iteck	OT6154	M00157	NA	October 12, 2018
P-series power meter	Agilent	N1911A	MY45100473	NA	August 11, 2018
wideband power sensor	Agilent	N1921A	MY51100041	NA	August 11, 2018
power Meter	Anritsu	ML2495A	1128009	NA	Mar. 11, 2018
Pulse Power Sensor	Anritsu	MA 2411B	1027500	NA	Mar. 11, 2018
Dual directional coupler	Woken	TS-PCC0M-05	107090019	NA	Mar. 11, 2018
MXG Analog Signal Generator	Agilent	N5181A	MY49060710	NA	August 11, 2018
ENA Network Analyzer	Agilent	E5071C	MY46102965	NA	March 11, 2018

Model No	For Head Tissue				
	Item	Originak Cal. Result	Verified on 2018/12/25	Deviation	Result
D5GHzV2(5.2GHz)	Impedance, transformed to feed point	53.5Ω-8.96jΩ	56.5Ω-6.47jΩ	<5Ω	Pass
	Return Loss(dB)	-20.7	-24.8	19.8%	Pass
	SAR Value for 1g(mW/g)	7.5	7.27	-3.1%	Pass
	SAR Value for 10g(mW/g)	2.16	2.07	-4.2%	Pass
D5GHzV2(5.3GHz)	Impedance, transformed to feed point	50.1Ω-3jΩ	49.6Ω-2.8jΩ	<5Ω	Pass
	Return Loss(dB)	-30.5	-30.7	0.7%	Pass
	SAR Value for 1g(mW/g)	7.66	7.34	-4.2%	Pass
	SAR Value for 10g(mW/g)	2.2	2.07	-5.9%	Pass
D5GHzV2(5.5GHz)	Impedance, transformed to feed point	51.4Ω-5.39jΩ	50.2Ω-3.01jΩ	<5Ω	Pass
	Return Loss(dB)	-25.2	-28.8	14.3%	Pass
	SAR Value for 1g(mW/g)	8.08	8.32	3.0%	Pass
	SAR Value for 10g(mW/g)	2.3	2.33	1.3%	Pass
D5GHzV2(5.6GHz)	Impedance, transformed to feed point	57.5Ω-2.95jΩ	54.9Ω-1.65jΩ	<5Ω	Pass
	Return Loss(dB)	-22.5	-25.8	14.7%	Pass
	SAR Value for 1g(mW/g)	7.85	7.84	-0.1%	Pass
	SAR Value for 10g(mW/g)	2.25	2.2	-2.2%	Pass
D5GHzV2(5.8GHz)	Impedance, transformed to feed point	54.5Ω-1.38jΩ	55.2Ω+1.97jΩ	<5Ω	Pass
	Return Loss(dB)	-26.9	-26.1	-3.0%	Pass
	SAR Value for 1g(mW/g)	7.78	7.89	1.4%	Pass
	SAR Value for 10g(mW/g)	2.21	2.21	0.0%	Pass

Model No	For Body Tissue				
	Item	Originak Cal. Result	Verified on 2018/12/25	Deviation	Result
D5GHzV2(5.2GHz)	Impedance, transformed to feed point	53.1Ω-7.52jΩ	55.1Ω-7.96jΩ	<5Ω	Pass
	Return Loss(dB)	-22.1	-26.1	18.1%	Pass
	SAR Value for 1g(mW/g)	6.99	7.28	4.1%	Pass
	SAR Value for 10g(mW/g)	1.92	2.06	7.3%	Pass
D5GHzV2(5.3GHz)	Impedance, transformed to feed point	49.3Ω-2.06jΩ	52.7Ω-1.73jΩ	<5Ω	Pass
	Return Loss(dB)	-33.1	-30.3	-8.5%	Pass
	SAR Value for 1g(mW/g)	7.25	7.16	-1.2%	Pass
	SAR Value for 10g(mW/g)	2.04	2	-2.0%	Pass
D5GHzV2(5.5GHz)	Impedance, transformed to feed point	50.9Ω-4.94jΩ	48.2Ω-3.03jΩ	<5Ω	Pass
	Return Loss(dB)	-26.1	-24.8	-5.0%	Pass
	SAR Value for 1g(mW/g)	7.63	7.72	1.2%	Pass
	SAR Value for 10g(mW/g)	2.13	2.16	1.4%	Pass
D5GHzV2(5.6GHz)	Impedance, transformed to feed point	58.5Ω-0.79jΩ	57.6Ω-0.43jΩ	<5Ω	Pass
	Return Loss(dB)	-22.1	-23.2	5.0%	Pass
	SAR Value for 1g(mW/g)	7.78	7.92	1.8%	Pass
	SAR Value for 10g(mW/g)	2.14	2.2	2.8%	Pass
D5GHzV2(5.8GHz)	Impedance, transformed to feed point	54.3Ω+0.12jΩ	52.2Ω+0.43jΩ	<5Ω	Pass
	Return Loss(dB)	-27.6	-24.1	-12.7%	Pass
	SAR Value for 1g(mW/g)	7.66	7.79	1.7%	Pass
	SAR Value for 10g(mW/g)	2.15	2.16	0.5%	Pass

Impedance Test-Head	Return Loss-Head