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	33.9 ± 6 %	5.10 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	8.18 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.0 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	**22.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.8 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 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 5200 MHz

Impedance, transformed to feed point	47.6 Ω - 6.2 jΩ
Return Loss	- 23.3 dB

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	46.9 Ω - 4.8 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	46.2 Ω - 3.3 jΩ
Return Loss	- 25.6 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	49.1 Ω - 4.2 jΩ
Return Loss	- 27.3 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.9 Ω + 0.4 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	51.8 Ω - 0.8 jΩ
Return Loss	- 34.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	50.9 Ω - 2.7 jΩ
Return Loss	- 31.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.201 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 22.06.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1060

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5250 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.54 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5250 MHz; σ = 4.59 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5300 MHz; σ = 4.64 S/m; ε_r = 34.6; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5500 MHz; σ = 4.85 S/m; ε_r = 34.3; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5600 MHz; σ = 4.95 S/m; ε_r = 34.1; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5750 MHz; σ = 5.1 S/m; ε_r = 33.9; ρ = 1000 kg/m^3 ,
Medium parameters used: f = 5800 MHz; σ = 5.15 S/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.5, 5.5, 5.5) @ 5250 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.25, 5.25, 5.25) @ 5500 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.08, 5.08, 5.08) @ 5750 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.84 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.1%
Maximum value of SAR (measured) = 18.5 W/kg

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 = 80.04 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.2 W/kg
SAR(1 g) = 8.01 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70.3%
Maximum value of SAR (measured) = 18.2 W/kg

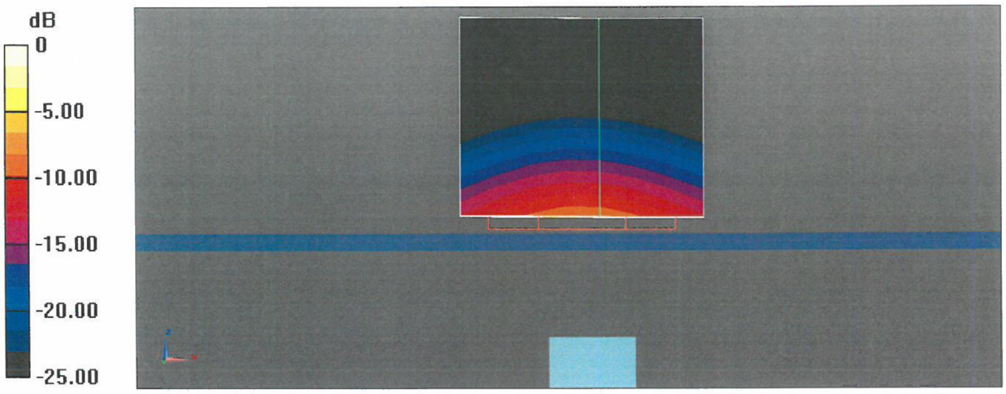
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.15 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 28.9 W/kg
SAR(1 g) = 8.25 W/kg; SAR(10 g) = 2.35 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 69.1%
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 80.07 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 33.6 W/kg
SAR(1 g) = 8.80 W/kg; SAR(10 g) = 2.47 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 66.4%
Maximum value of SAR (measured) = 20.9 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 = 80.82 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 30.8 W/kg
SAR(1 g) = 8.45 W/kg; SAR(10 g) = 2.40 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 67.5%
Maximum value of SAR (measured) = 19.9 W/kg

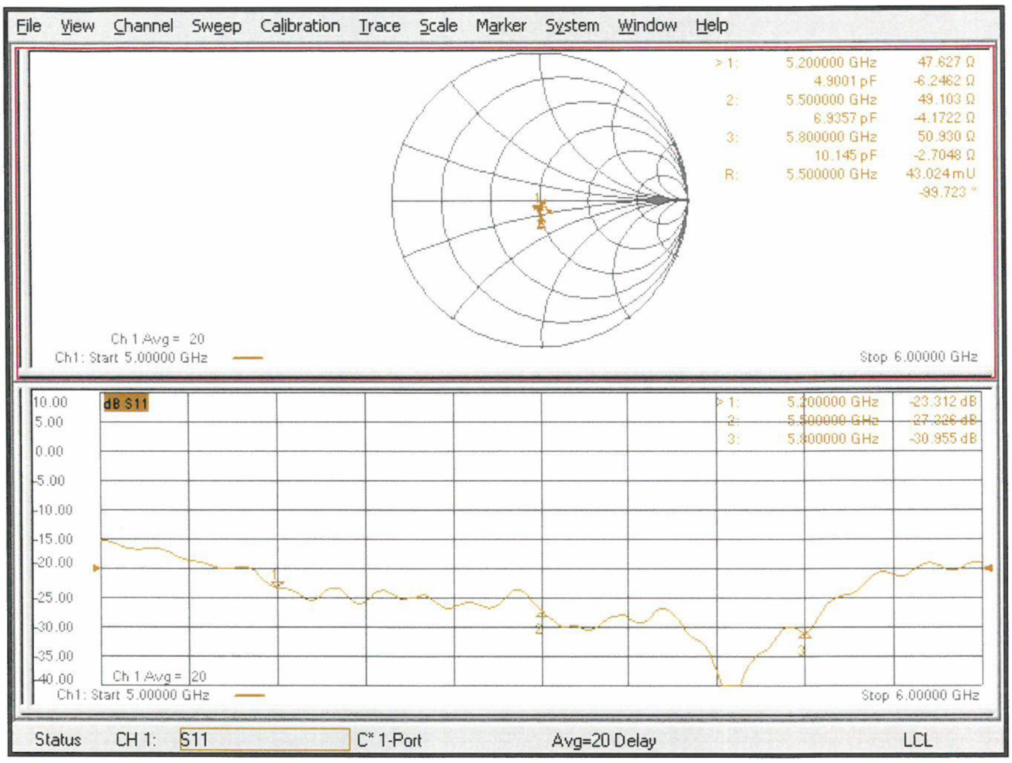
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.22 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 8.18 W/kg; SAR(10 g) = 2.30 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.8%
Maximum value of SAR (measured) = 19.5 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.53 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 8.19 W/kg; SAR(10 g) = 2.31 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 65.4%
Maximum value of SAR (measured) = 19.2 W/kg

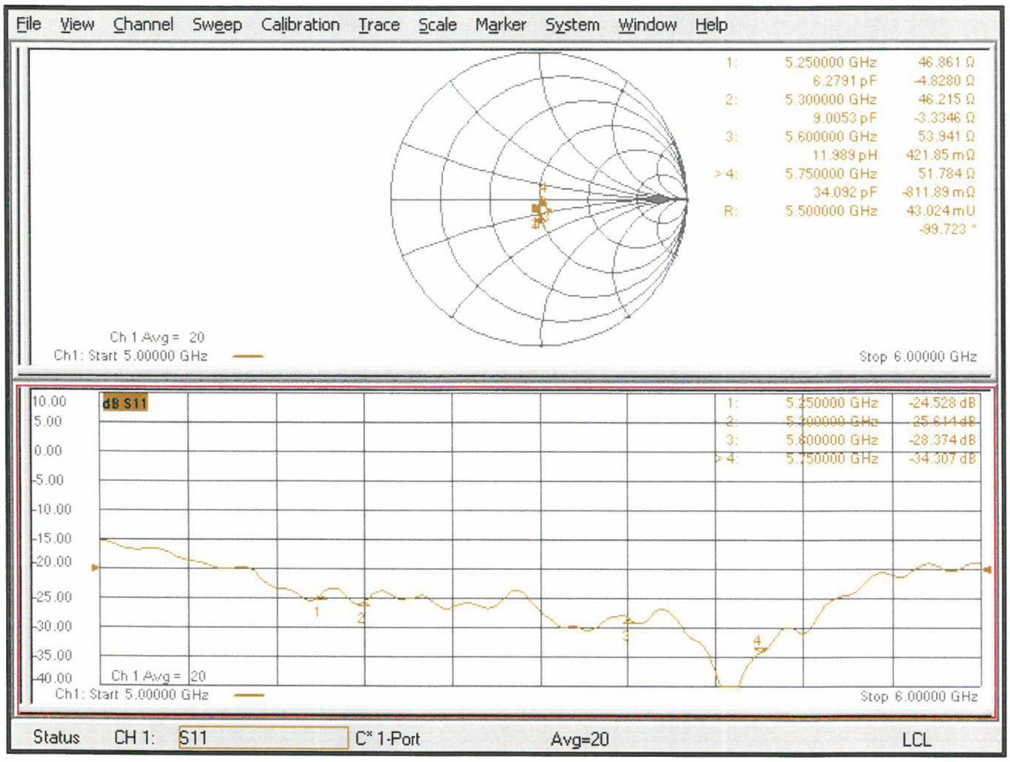


0 dB = 20.9 W/kg = 13.20 dBW/kg

Impedance Measurement Plot for Head TSL (5200, 5500, 5800 MHz)

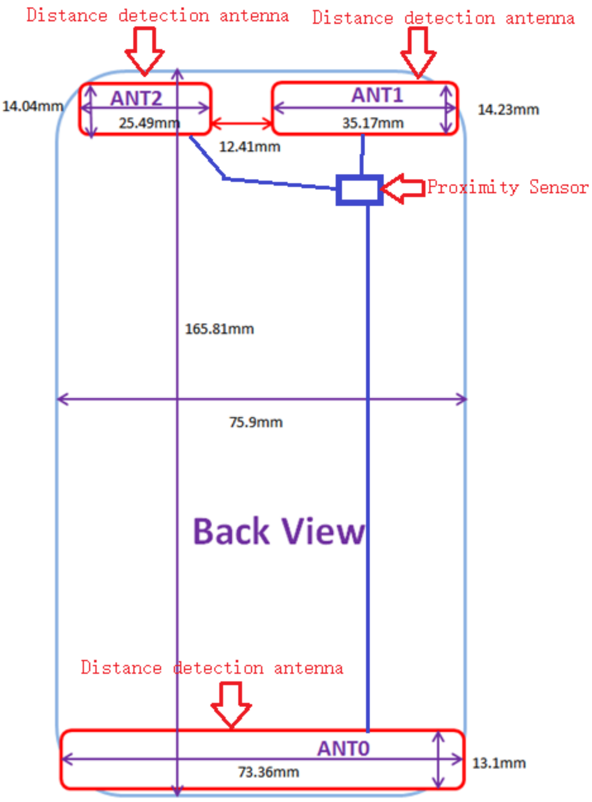


Impedance Measurement Plot for Head TSL (5250, 5300, 5600, 5750 MHz)



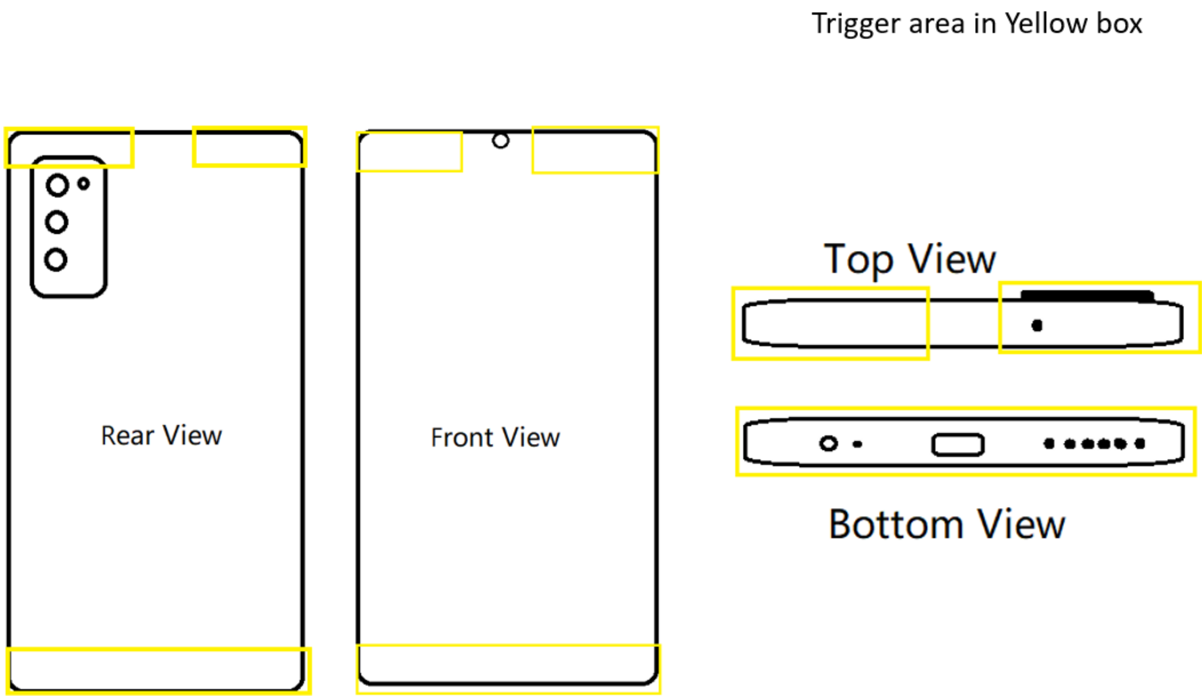
ANNEX I Sensor Triggering Data Summary

The DUT has the proximity sensors to reduce the output power. The position of the sensor and antenna are as shown in the graphic.



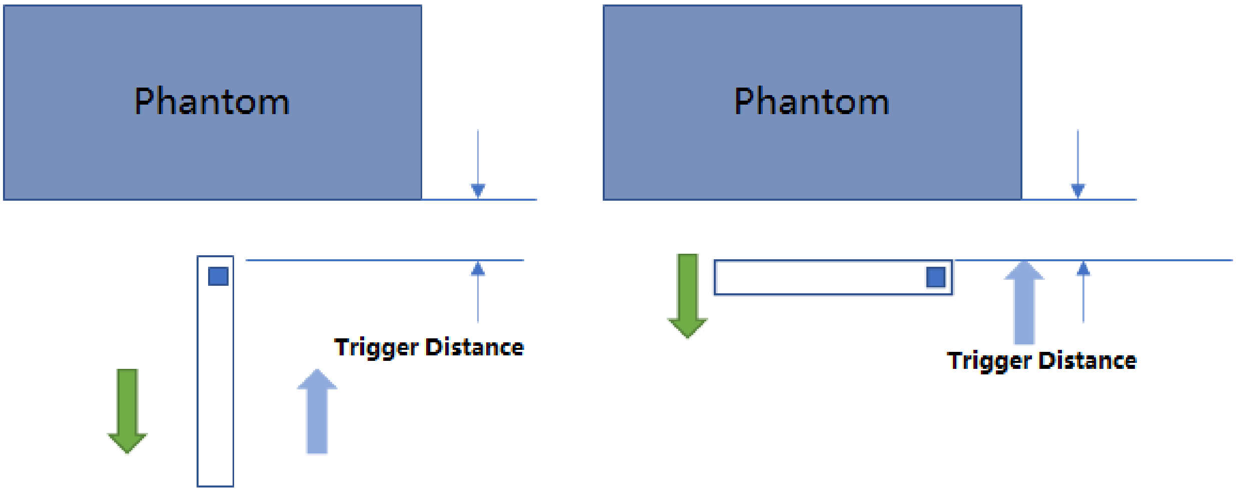
Antenna	Trigger Position	Trigger Distance (mm)
ANT0	Rear	6
	Bottom	6
	Front	4
ANT1	Rear	6
	Top	6
	Front	4
ANT2 WIFI Antenna	Rear	21
	Top	16
	Front	14

SAR Sensor Trigger region



Rear, Front, Bottom and Top of the DUT was placed directly below the flat phantom. The DUT was moved toward the phantom in accordance with the steps outlined in KDB 616217 to determine the trigger distance for enabling power reduction. The DUT was moved away from the phantom to determine the trigger distance for resuming full power.

The DUT featured a visual indicator on its display that showed the status of the proximity sensor (Triggered or not triggered). This was used to determine the status of the sensor during the proximity sensor assessment as monitoring the output power directly was not practical without affecting the measurement. It was confirmed separately that the output power according to locking the proximity sensor status. Section 11 contains both the full and reduced conducted power measurements.



Blue arrow : Direction of DUT travel for determination of power reduction triggering point.

Green arrow: Direction of DUT travel for determination of normal power triggering point

When the visual indicator display is “Nearly”, indicates that the status of the proximity sensor is triggered (see the figure below)

AW9610X Grip sensor for wifi: Nearly
AW9610X Grip sensor for sub: Nearly

ch1_background_cap = 71.6
ch1_refer_channel_cap = 43.759
ch2_background_cap = 80.97
ch2_refer_channel_cap = 43.759

-999999.0 < ch1 < 999999.0
-999999.0 < rf1 < 999999.0
-999999.0 < ch2 < 999999.0
-999999.0 < rf2 < 999999.0

ch1_diff = 916714
ch2_diff = 465653

Fig1.ANT1/ANT2

AW9610X Grip sensor: Nearly

ch0_background_cap = 143.815
ch0_refer_channel_cap = 76.51

-999999.0 < ch0 < 999999.0
-999999.0 < rf0 < 999999.0

ch0_diff = 759367

Fig2.ANT0

When the visual indicator display is “Far away”, indicates that the status of the proximity sensor is not triggered

AW9610X Grip sensor for wifi: Far away
AW9610X Grip sensor for sub: Far away

ch1_background_cap = 71.6
ch1_refer_channel_cap = 43.759
ch2_background_cap = 80.97
ch2_refer_channel_cap = 43.759

-999999.0 < ch1 < 999999.0
-999999.0 < rf1 < 999999.0
-999999.0 < ch2 < 999999.0
-999999.0 < rf2 < 999999.0

ch1_diff = 169
ch2_diff = 334

Fig3.ANT1/ANT2

AW9610X Grip sensor: Far away

ch0_background_cap = 143.776
ch0_refer_channel_cap = 76.471

-999999.0 < ch0 < 999999.0
-999999.0 < rf0 < 999999.0

ch0_diff = 150

Fig4.ANT0

ANT0

Front Edge

Moving device toward the phantom:

sensor near or far										
Distance [mm]	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Main antenna	Far away	Far away	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far										
Distance [mm]	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Main antenna	Far away	Far away	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Rear Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Bottom Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

ANT1

Front Edge

Moving device toward the phantom:

sensor near or far										
Distance [mm]	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Main antenna	Far away	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far										
Distance [mm]	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
Main antenna	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Rear Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Top Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**
Main antenna	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

ANT2

Front Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**
Main antenna	Far away	Far away	Far away	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**	**11**	**10**	**9**
Main antenna	Far away	Far away	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	

Rear Edge

Moving device toward the phantom:

sensor near or far											
Distance [mm]	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Moving device away from the phantom:

sensor near or far											
Distance [mm]	**30**	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**21**	**20**
Main antenna	Far away	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

Top Edge

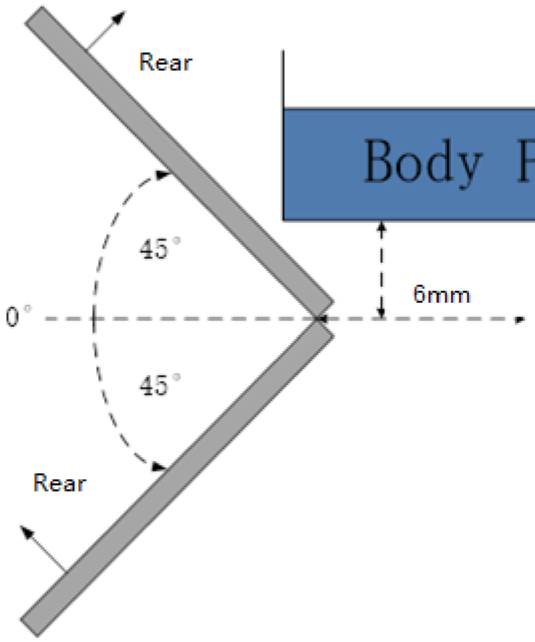
Moving device toward the phantom:

sensor near or far											
Distance [mm]	**22**	**21**	**20**	**19**	**18**	**17**	**16**	**15**	**14**	**13**	**12**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

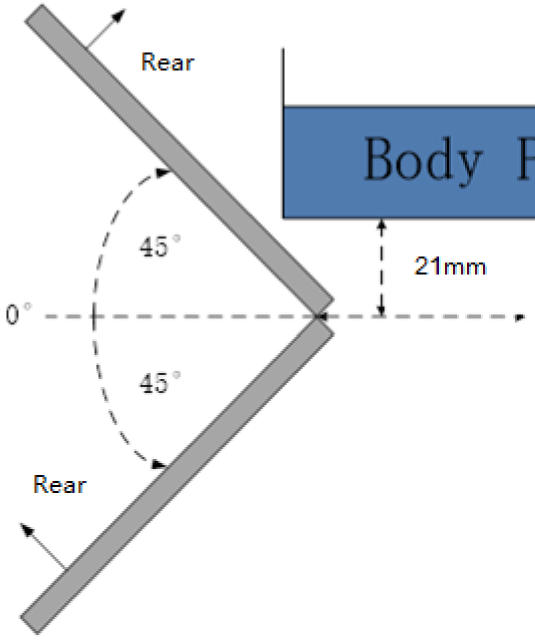
Moving device away from the phantom:

sensor near or far											
Distance [mm]	**26**	**25**	**24**	**23**	**22**	**21**	**20**	**19**	**18**	**17**	**16**
Main antenna	Far away	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly	Nearly

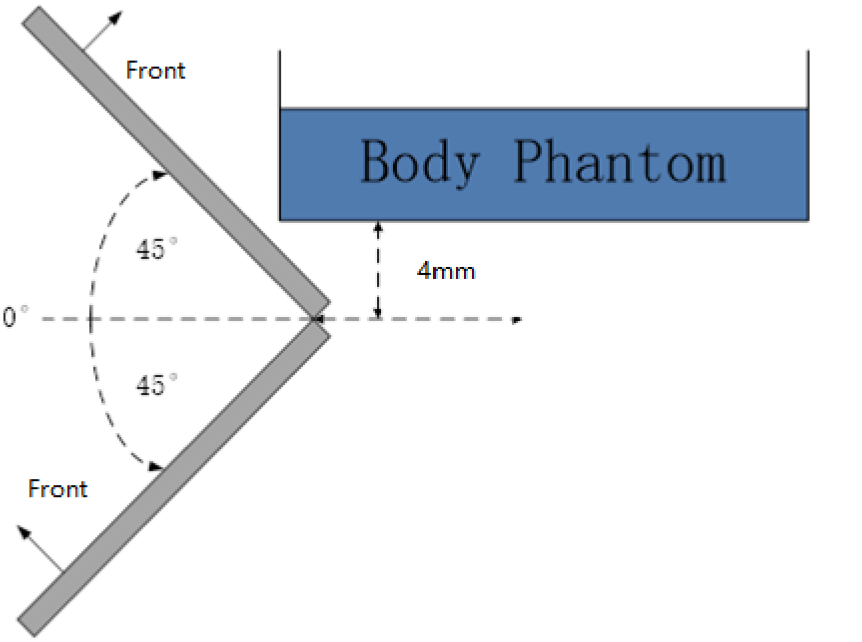
Per FCC KDB Publication 616217 D04v01r02, the influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distanceby rotating the device around the edge next to the phantom in ≤ 10° increments until the tablet is ±45° or more from the vertical position at 0°.



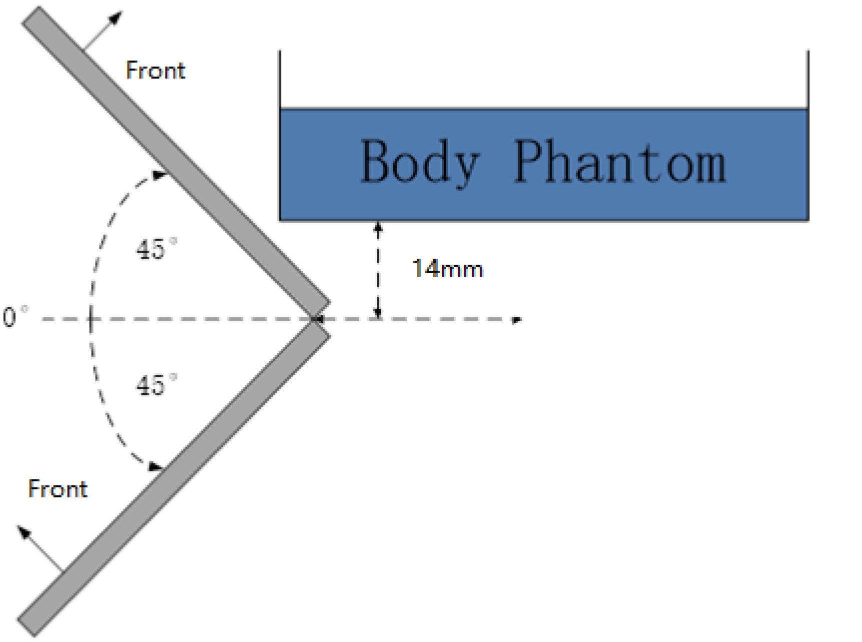
The Rear evaluation



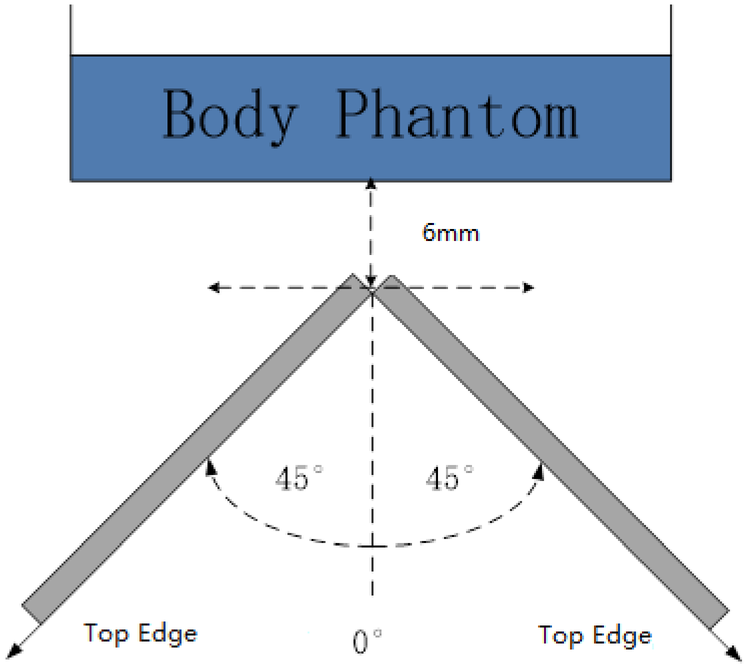
The Rear evaluation



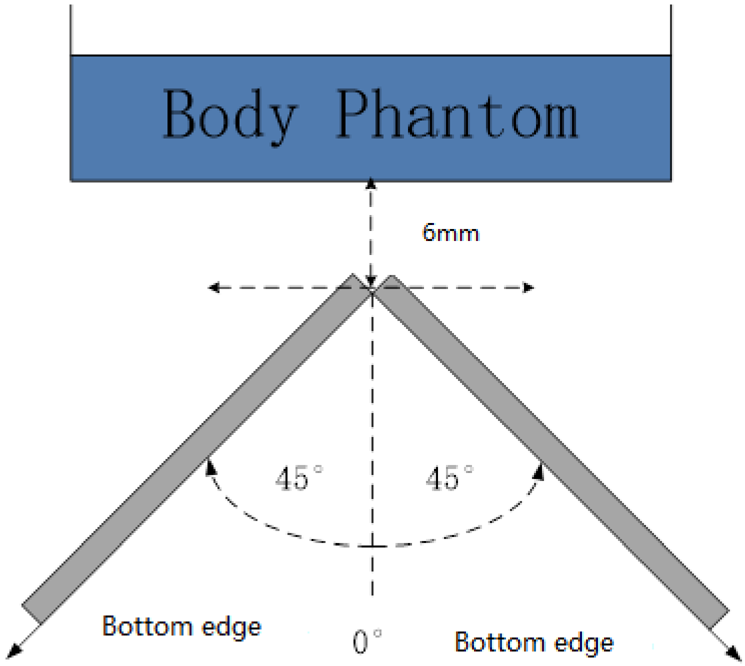
The Front edge evaluation



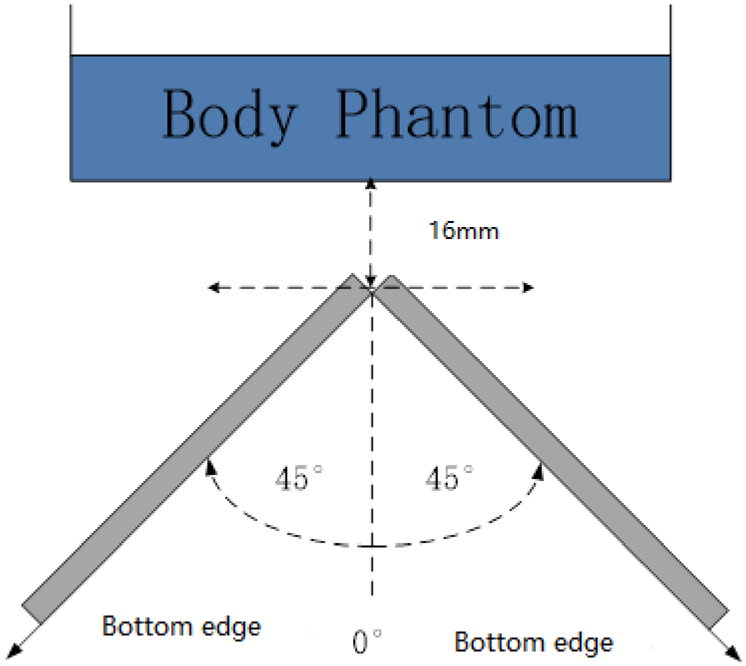
The Front edge evaluation



The Bottom edge evaluation



The Top edge evaluation



The Top edge evaluation

Based on the above evaluation, we come to the conclusion that the sensor triggering is not released and normal maximum output power is not restored within the ±45° range at the smallest sensor triggering test distance declared by manufacturer.

ANNEX J Accreditation Certificate

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ilac-MRA

Certificate of Accreditation to ISO/IEC 17025:2017

NVLAP LAB CODE: 600118-0

Telecommunication Technology Labs, CAICT
Beijing
China

is accredited by the National Voluntary Laboratory Accreditation Program for specific services, listed on the Scope of Accreditation, for:

Electromagnetic Compatibility & Telecommunications

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communique dated January 2009).

DEPARTMENT OF COMMERCE • UNITED STATES OF AMERICA

2020-09-29 through 2021-09-30
Effective Dates

For the National Voluntary Laboratory Accreditation Program