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CAICT

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250MHz

Impedance, transformed to feed point	48.4Ω- 3.36jΩ
Return Loss	- 28.5dB

Antenna Parameters with Head TSL at 5600MHz

Impedance, transformed to feed point	50.8Ω+ 2.69jΩ
Return Loss	- 31.1dB

Antenna Parameters with Head TSL at 5750MHz

Impedance, transformed to feed point	53.5Ω+ 2.34jΩ
Return Loss	- 27.9dB

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 feed-point 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 feed-point may be damaged.

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Date: 2022-08-17

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1238

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz Duty Cycle: 1:1

Medium parameters used: f = 5250 MHz; σ = 4.643 S/m; ε_r = 36.34; ρ = 1000 kg/m^3

Medium parameters used: f = 5600 MHz; σ = 5.006 S/m; ε_r = 35.17; ρ = 1000 kg/m^3

Medium parameters used: f = 5750 MHz; σ = 5.18 S/m; ε_r = 34.96; ρ = 1000 kg/m^3

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(5.43, 5.43, 5.43) @ 5250 MHz; ConvF(4.91, 4.91, 4.91) @ 5600 MHz; ConvF(4.85, 4.85, 4.85) @ 5750 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 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 = 67.66 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.1%
Maximum value of SAR (measured) = 18.8 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 = 68.44 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 35.2 W/kg
SAR(1 g) = 8.28 W/kg; SAR(10 g) = 2.37 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 63.5%
Maximum value of SAR (measured) = 20.1 W/kg

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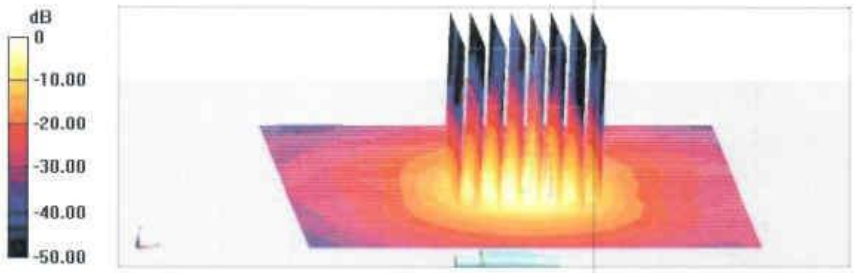
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 65.17 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.22 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 61.3%
Maximum value of SAR (measured) = 19.4 W/kg



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

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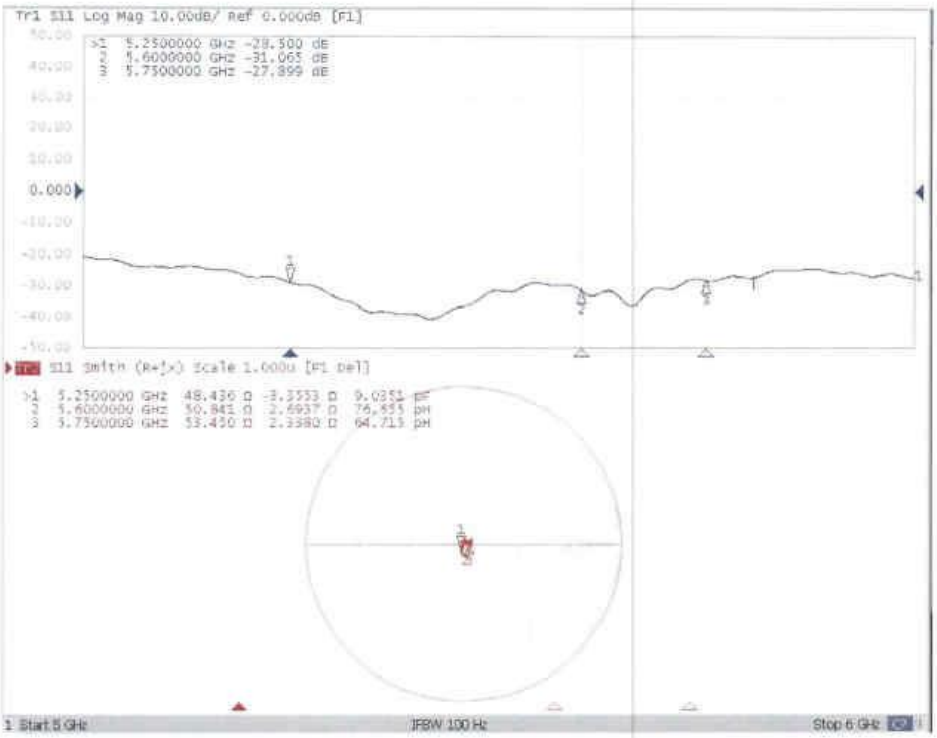
Impedance Measurement Plot for Head TSL



ANNEX J: Extended Calibration SAR Dipole

Referring to KDB865664 D01, if dipoles are verified in return loss (<-20dBm, 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.

Justification of Extended Calibration SAR Dipole D750V3 - SN: 1163

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2022/8/22	-27.8	/	50.0	/	-4.06	/
2023/8/22	-27.0	2.9	51.3	1.3	-3.83	0.23
2024/8/22	-26.5	4.7	51.6	1.6	-3.67	0.39

Justification of Extended Calibration SAR Dipole D1750V2 - SN: 1152

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2022/8/22	-32.8	/	47.9	/	-0.71	/
2023/8/22	-33.7	2.7	49.6	1.7	-0.55	0.16
2024/8/22	-34.3	4.6	50.4	2.5	-0.42	0.29

Justification of Extended Calibration SAR Dipole D2550V2 - serial no. 1010

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2024/4/23	-27.4	/	53.3	/	-2.90	/
2025/4/22	-26.6	2.9	54.2	0.9	-2.73	0.17

Justification of Extended Calibration SAR Dipole D3500V2 - serial no.1084

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2022/9/19	-27.1	/	49.5	/	4.36	/
2023/9/19	-26.3	3.0	51.2	1.7	4.88	0.52
2024/9/19	-25.5	5.9	53.4	3.9	4.97	0.61

Justification of Extended Calibration SAR Dipole D3700V2 - serial no.1049

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2022/9/22	-30.7	/	48.7	/	-2.53	/
2023/9/19	-28.9	5.9	50.8	2.1	-1.95	0.58
2024/9/19	-28.2	8.1	51.3	2.6	-1.74	0.79

Justification of Extended Calibration SAR Dipole D3900V2 - serial no.1028

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
2022/9/22	-24.3	/	47.7	/	-5.54	/
2023/9/19	-23.2	4.5	49.8	2.1	-5.22	0.32
2024/9/19	-22.5	7.4	51.6	3.9	-4.95	0.59

Justification of Extended Calibration SAR Dipole D5GHzV2 - SN: 1238

Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (johm)	Delta (johm)
5250MHz						
2022/8/17	-28.5	/	48.4	/	-3.36	/
2023/8/17	-27.6	3.2	49.5	1.1	-3.18	0.18
2024/8/17	-26.9	5.6	50.1	1.7	-2.94	0.42
5600MHz						
2022/8/17	-31.1		50.8		2.69	/
2023/8/17	-30.3	2.6	52.2	1.4	2.88	0.19
2024/8/17	-29.5	5.1	53.6	2.8	3.03	0.34
5750MHz						
2022/8/17	-27.9		53.5		2.34	/
2023/8/17	-27.1	2.9	55.1	1.6	2.45	0.11
2024/8/17	-26.2	6.1	56.8	3.3	2.69	0.35

The Return-Loss is <-20dB, and within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the value result should support extended cabration.

ANNEX K: LTE Band 41 Power Class 2 and Power Class 3 Linearity

This device supports Power Class 2 and Power Class 3 operations for LTE Band 41. The highest available duty cycle for Power Class 2 operations is 43.3 % using UL-DL configuration 1. Per May 2017 TCB Workshop Notes based on the device behavior, all SAR tests were performed using Power Class 3. SAR with Power Class 2 at the highest power and available duty factor was additionally performed for the Power Class 3 configuration with the highest SAR for each exposure condition. The linearity between the Power Class 2 and Power Class 3 SAR results and the respective frame averaged powers was calculated to determine that the results were linear. When ULCA is active, the linearity between the Power Class 2 with ULCA active and Power Class 3 with ULCA active SAR results and the respective frame averaged powers was calculated to determine that the results were linear. Per May 2017 TCB Workshop, no additional SAR measurements were required since the linearity between power classes was < 10% and all reported SAR values were < 1.4 W/kg for 1g and < 3.5 W/kg for 10g.

LTE Band 41 SAR testing with power class 2 at the highest power and available duty factor was additionally performed for the power class 3 configuration with the highest SAR for each exposure condition.

Table K.1: LTE Band 41 Head Power Level B1 Linearity Data

/	**LTE Band 41 (Power Class 3)**	**LTE Band 41 (Power Class 2)**
Maximum Tune up Power (dBm)	21.0	21.0
Reported 1g SAR (W/kg)	0.70	0.47
Duty Cycle	63.30%	43.30%
Frame Averaged (mW)	79.69	54.51
Linearity SAR (W/kg)	0.479	/
% deviation from expected linearity	/	-1.84%

Table K.2: LTE Band 41 Hotspot Power Level B1 Linearity Data

/	**LTE Band 41 (Power Class 3)**	**LTE Band 41 (Power Class 2)**
Maximum Tune up Power (dBm)	21.0	21.0
Reported 1g SAR (W/kg)	0.23	0.16
Duty Cycle	63.30%	43.30%
Frame Averaged (mW)	79.69	54.51
Linearity SAR (W/kg)	0.157	/
% deviation from expected linearity	/	1.70%

Table K.3: LTE Band 41 Hotspot Power Level A1 Linearity Data

/	LTE Band 41 (Power Class 3)	LTE Band 41 (Power Class 2)
Maximum Tune up Power (dBm)	23.5	26.5
Reported 1g SAR (W/kg)	0.16	0.22
Duty Cycle	63.30%	43.30%
Frame Averaged (mW)	141.71	193.41
Linearity SAR (W/kg)	0.218	/
% deviation from expected linearity	/	0.74%

Table K.4: LTE Band 41 Body-Worn Power Level B1 Linearity Data

/	LTE Band 41 (Power Class 3)	LTE Band 41 (Power Class 2)
Maximum Tune up Power (dBm)	21.0	21.0
Reported 1g SAR (W/kg)	0.18	0.13
Duty Cycle	63.30%	43.30%
Frame Averaged (mW)	79.69	54.51
Linearity SAR (W/kg)	0.123	/
% deviation from expected linearity	/	5.58%

Table K.5: LTE Band 41 Body-Worn Power Level A1 Linearity Data

/	LTE Band 41 (Power Class 3)	LTE Band 41 (Power Class 2)
Maximum Tune up Power (dBm)	23.3	26.5
Reported 1g SAR (W/kg)	0.14	0.19
Duty Cycle	63.30%	43.30%
Frame Averaged (mW)	135.33	193.41
Linearity SAR (W/kg)	0.200	/
% deviation from expected linearity	/	-5.04%

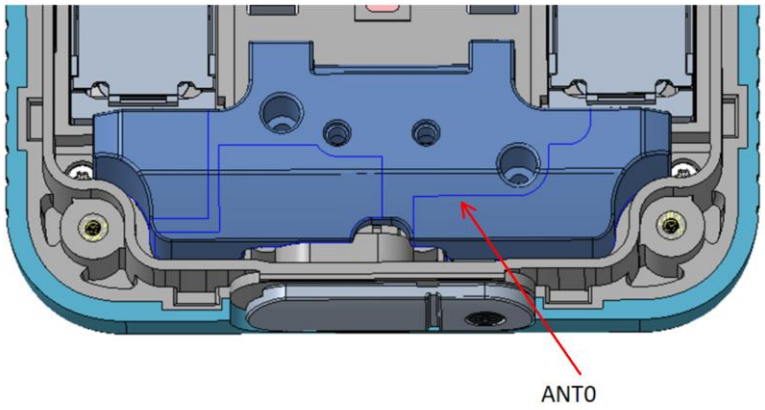
ANNEX L: Sensor Triggering Data Summary

Per FCC KDB Publication 616217 D04, this device was tested by the manufacturer to determine the proximity sensor triggering distances for all applicable sides and edges of the device. The measured output power at distances within ± 5 mm of the triggering points (or until touching the phantom) is included for back side and each applicable edge per Step i) in Section 6.2 of the KDB. The technical descriptions in the filing contain the complete set of triggering data required by Section 6 of FCC KDB Publication 616217 D04.

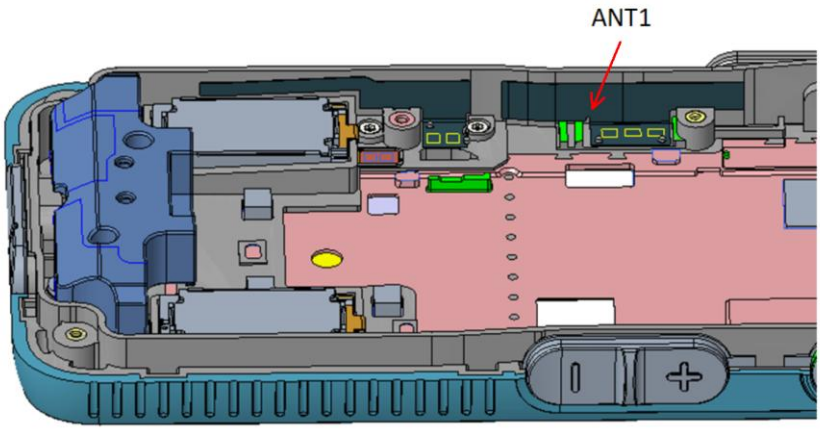
To ensure all production units are compliant, it is necessary to test SAR at a distance 1 mm less than the smallest distance between the device and SAR phantom with the device at the maximum output power (without power reduction). These SAR tests are included in addition to the SAR tests for the device touching the SAR phantom (at the reduced output power level).

The operational description contains information explaining how this device remains compliant in the event of a sensor malfunction.

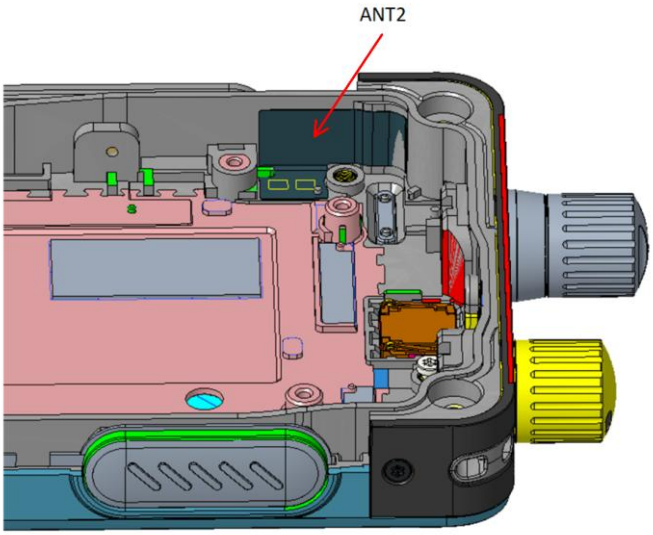
P-sensor IC have three separator channels connected to Cellular antenna show as below.



P-sensor coexisted with Cellular antennae



P-sensor coexisted with Cellular antennae



P-sensor coexisted with Cellular antennae

WWAN Antenna:

Front Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 0	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 0	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the front side.

Rear Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 0	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 0	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the rear side.

Bottom Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 0	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 0	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the bottom side.

WWAN Antenna:

Front Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 1	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 1	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the front side.

Rear Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 1	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 1	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the rear side.

Right Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	31	30	29	28	27	26	25	24	23	22	21
Ant. 1	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	21	22	23	24	25	26	27	28	29	30	31
Ant. 1	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 26 mm, additional SAR measurements were required at 25 mm in the right side.

WWAN Antenna:

Front Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 2	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the front side.

Rear Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	25	24	23	22	21	20	19	18	17	16	15
Ant. 2	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	15	16	17	18	19	20	21	22	23	24	25
Ant. 2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 20 mm, additional SAR measurements were required at 19 mm in the rear side.

Right Side

Moving device toward the phantom:

sensor triggered (Yes or No)											
Distance(mm)	31	30	29	28	27	26	25	24	23	22	21
Ant. 2	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

sensor triggered (Yes or No)											
Distance(mm)	21	22	23	24	25	26	27	28	29	30	31
Ant. 2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 26 mm, additional SAR measurements were required at 25 mm in the right side.

Top Side

Moving device toward the phantom:

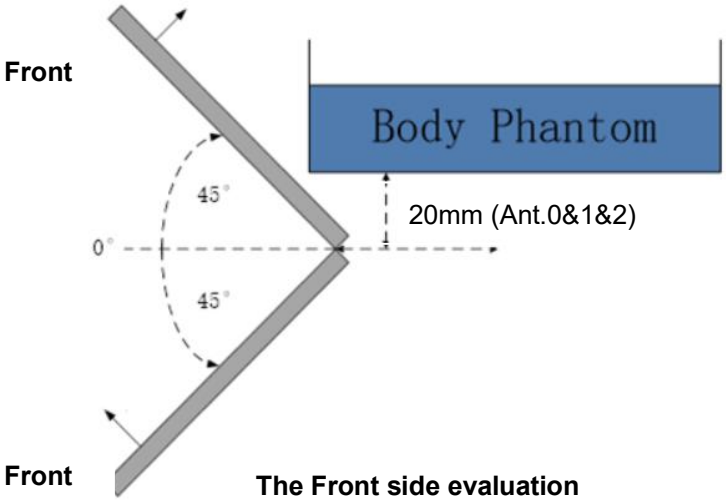
sensor triggered (Yes or No)											
Distance(mm)	31	30	29	28	27	26	25	24	23	22	21
Ant. 2	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Moving device away from the phantom:

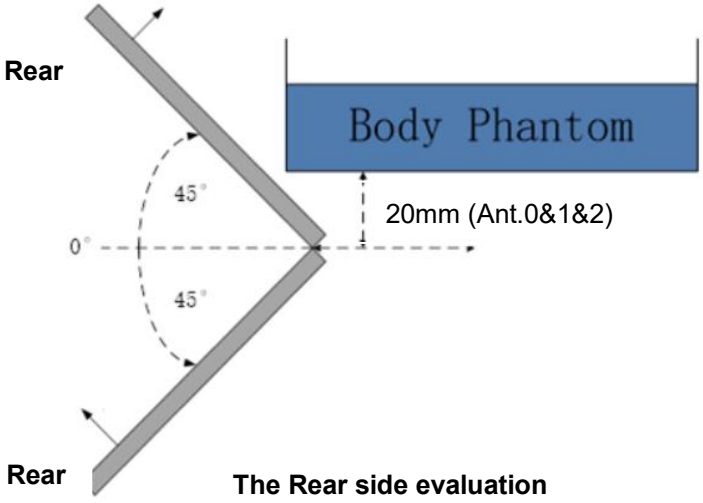
sensor triggered (Yes or No)											
Distance(mm)	21	22	23	24	25	26	27	28	29	30	31
Ant. 2	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No

Based on the most conservative measured triggering distance of 26 mm, additional SAR measurements were required at 25 mm in the top side.

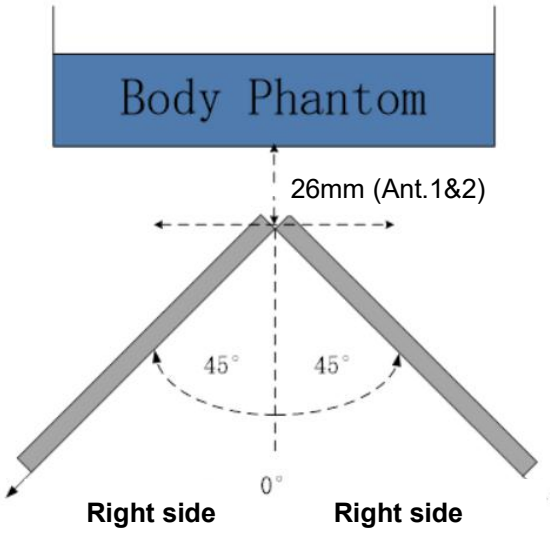
The influence of table tilt angles to proximity sensor triggering is determined by positioning each edge that contains a transmitting antenna, perpendicular to the flat phantom, at the smallest sensor triggering test distance by rotating the device around the edge next to the phantom in ≤ 10° increments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



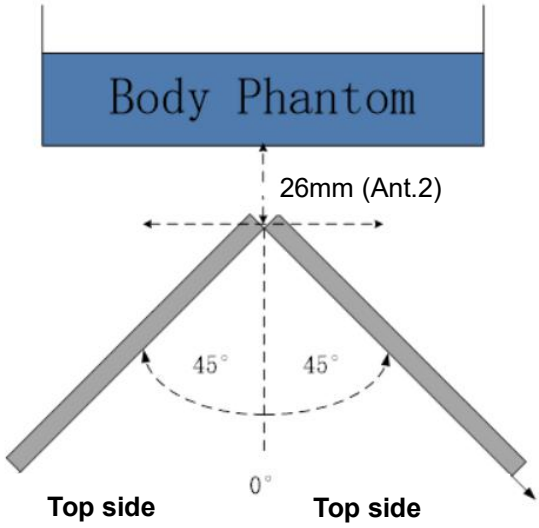
The Front side evaluation



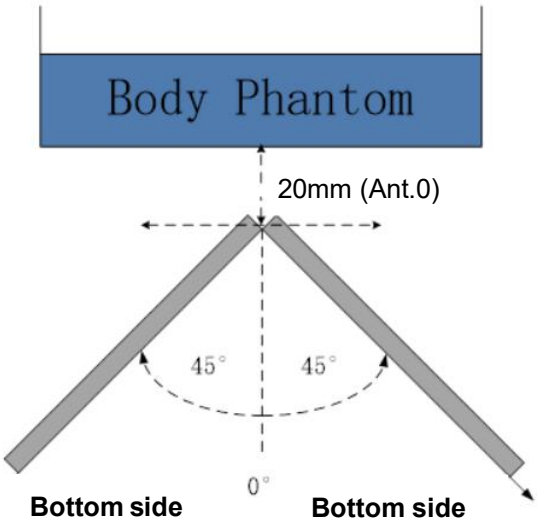
The Rear side evaluation



The Right side evaluation



The Top side evaluation



The Bottom side 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.

*****END OF REPORT*****