

Technical Description of Power Reduction through Proximity Sensor

Equipment : Tablet Computer
Brand Name : Lenovo
Model Name : Lenovo TB-X6C6NBL
FCC ID : O57TBX6C6NBL
IC ID : 10407A-TBX6C6NBL

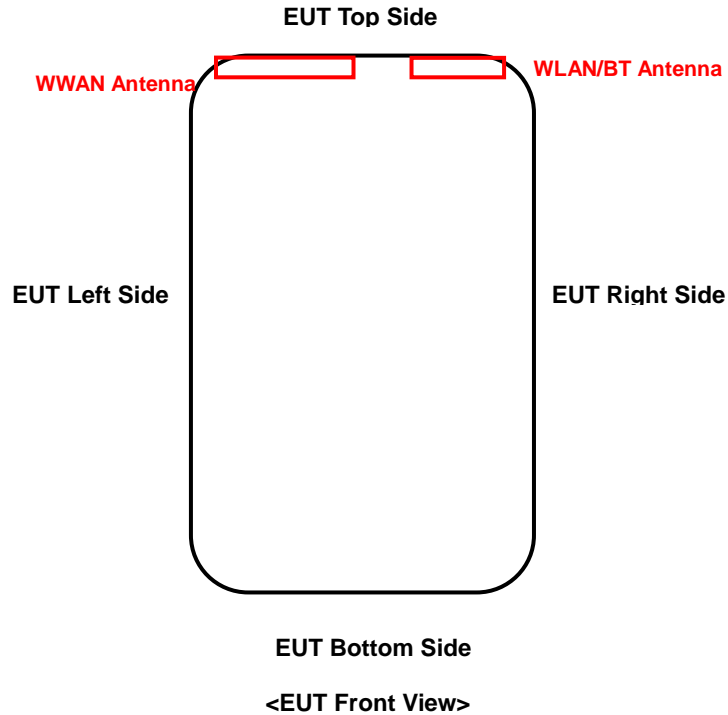
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1. EUT Antenna Placement

This is a Portable Tablet Computer, model name Lenovo TB-X6C6NBL
 The antenna location and the EUT dimension is shown in the following diagram.

<Antenna Location>



The separation distance for antenna to edge:

Antenna	Overall diagonal(mm)	Display diagonal(mm)	To Left Side (mm)	To Right Side (mm)	To Top Side (mm)	To Bottom Side (mm)
WWAN	283	262	4.78	94.17	0	237.41
WLAN / BT			103.26	4.69	0	237.41

2. Considerations Related to Proximity Sensor

The device supports WWAN/WLAN and Bluetooth capabilities. It is designed with two proximity sensor which can trigger/not trigger power reduction for GSM/WCMA/LTE and WLAN on Rear Face / Left Side / Right Side and Top Side of EUT for SAR compliance. Others RF capability (Bluetooth) have no power reduction. The power levels for all wireless technologies and the power reduction please refer to section 3 of this report.

Sensor: SX9338IULTRT

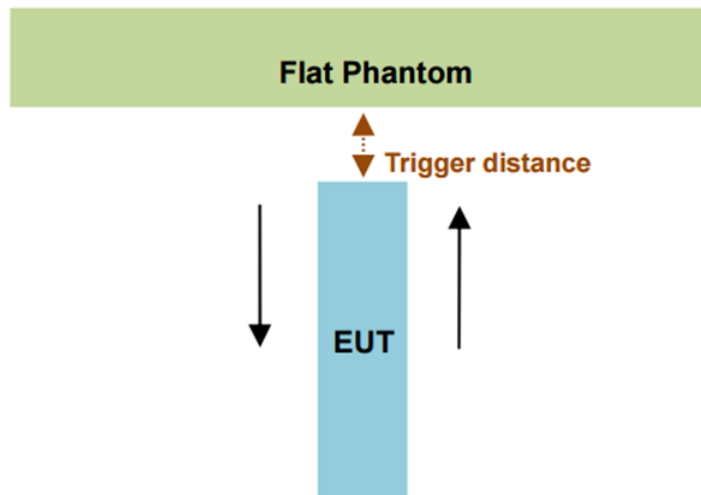
How it works: The Sar Sensor connects directly to antenna, creating a capacitance effect between the antenna and the surrounding space. When something (especially metal) comes close, the capacitance effect between the antenna and surrounding environment changes. At this point, the SAR sensor will pick up the capacitance change, and then issue a command to make an action according to the volume change.

Power reduction is the principle of scene recognition : when the hand or other parts of the body approach the antenna from any direction, the capacitance between the antenna and surrounding environment will change. When the value changes to a set threshold, the machine's SOC will recognize and issue an instruction to reduce power.

3. Proximity Sensor Triggering Distances (KDB 616217 D04 §6.2)

The proximity sensor triggering distance was determined per KDB 616217 section 6.2, and EUT moving further away from the flat phantom and EUT moving toward the flat phantom were both assessed.

In the preliminary triggering distance testing, the tissue-equivalent medium for different frequency bands were used for verification; no other frequency bands tissue-equivalent medium was found to result in shortest triggering than that for 5700MHz, and the tissue-equivalent medium for 5700MHz was used for formal proximity sensor triggering testing.



Summary for power verification per distance was tabulated in the below table.

WWAN

Output Power Verification in dBm for EUT Rear Face											
Distance (mm)	19	20	21	20	22	23	24	25	26	27	28
GSM850	24.5	24.5	24.5	24.5	24.5	30.5	30.5	30.5	30.5	30.5	30.5
GSM1900	20.0	20.0	20.0	20.0	20.0	27.5	27.5	27.5	27.5	27.5	27.5
WCDMA II	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA IV	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA V	17.5	17.5	17.5	17.5	17.5	24.5	24.5	24.5	24.5	24.5	24.5
LTE 2	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 4	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 5	17.5	17.5	17.5	17.5	17.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 12	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 13	19.0	19.0	19.0	19.0	19.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 14	19.5	19.5	19.5	19.5	19.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 17	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 25	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 30	13.5	13.5	13.5	13.5	13.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 66	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 71	20.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0

Output Power Verification in dBm for EUT Left Side											
Distance (mm)	5	6	7	8	9	10	11	12	13	14	15
GSM850	24.5	24.5	24.5	24.5	24.5	30.5	30.5	30.5	30.5	30.5	30.5
GSM1900	20.0	20.0	20.0	20.0	20.0	27.5	27.5	27.5	27.5	27.5	27.5
WCDMA II	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA IV	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA V	17.5	17.5	17.5	17.5	17.5	24.5	24.5	24.5	24.5	24.5	24.5
LTE 2	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 4	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 5	17.5	17.5	17.5	17.5	17.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 12	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 13	19.0	19.0	19.0	19.0	19.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 14	19.5	19.5	19.5	19.5	19.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 17	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 25	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 30	13.5	13.5	13.5	13.5	13.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 66	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 71	20.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0

Output Power Verification in dBm for EUT Top Side											
Distance (mm)	26	27	28	29	30	31	32	33	34	35	36
GSM850	24.5	24.5	24.5	24.5	24.5	30.5	30.5	30.5	30.5	30.5	30.5
GSM1900	20.0	20.0	20.0	20.0	20.0	27.5	27.5	27.5	27.5	27.5	27.5
WCDMA II	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA IV	14.0	14.0	14.0	14.0	14.0	24.5	24.5	24.5	24.5	24.5	24.5
WCDMA V	17.5	17.5	17.5	17.5	17.5	24.5	24.5	24.5	24.5	24.5	24.5
LTE 2	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 4	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 5	17.5	17.5	17.5	17.5	17.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 12	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 13	19.0	19.0	19.0	19.0	19.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 14	19.5	19.5	19.5	19.5	19.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 17	18.0	18.0	18.0	18.0	18.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 25	14.5	14.5	14.5	14.5	14.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 30	13.5	13.5	13.5	13.5	13.5	24.0	24.0	24.0	24.0	24.0	24.0
LTE 66	14.0	14.0	14.0	14.0	14.0	24.0	24.0	24.0	24.0	24.0	24.0
LTE 71	20.0	20.0	20.0	20.0	20.0	24.0	24.0	24.0	24.0	24.0	24.0

WLAN

Output Power Verification in dBm for EUT Rear Face											
Distance (mm)	5	6	7	8	9	10	11	12	13	14	15
WLAN2.4G	14.5	14.5	14.5	14.5	14.5	21.0	21.0	21.0	21.0	21.0	21.0
WLAN5.2G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.3G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.6G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.8G	11.0	11.0	11.0	11.0	11.0	20.0	20.0	20.0	20.0	20.0	20.0

Output Power Verification in dBm for EUT Right Side											
Distance (mm)	0	1	2	3	4	5	6	7	8	9	10
WLAN2.4G	14.5	14.5	14.5	14.5	14.5	21.0	21.0	21.0	21.0	21.0	21.0
WLAN5.2G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.3G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.6G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.8G	11.0	11.0	11.0	11.0	11.0	20.0	20.0	20.0	20.0	20.0	20.0

Output Power Verification in dBm for EUT Top Side											
Distance (mm)	11	12	13	14	15	16	17	18	19	20	21
WLAN2.4G	14.5	14.5	14.5	14.5	14.5	21.0	21.0	21.0	21.0	21.0	21.0
WLAN5.2G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.3G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.6G	10.0	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0
WLAN5.8G	11.0	11.0	11.0	11.0	11.0	20.0	20.0	20.0	20.0	20.0	20.0

WWAN Proximity Sensor Trigger Distance (mm)			
Position	Rear Face	Left Side	Top Side
Minimum	22	9	30

WLAN Proximity Sensor Trigger Distance (mm)			
Position	Rear Face	Right Side	Top Side
Minimum	9	4	15

4. Proximity Sensor Coverage (KDB 616217 D04 §6.3)

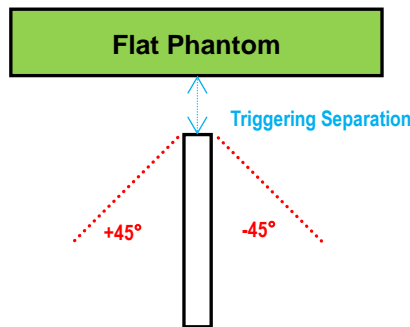
In KDB 616217 section 6.3, if a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For p-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”.

However, this device uses a capacitive proximity sensor that is same metallic component as the transmitting antenna to facilitate triggering in any condition the user may use the device in proximity of the antenna in the device.

Therefore, no further sensor coverage assessments were required.

5. Proximity Sensor Tilt Angle Influences (KDB 616217 D04 §6.4)

The proximity sensor tilt angle influence was determined per KDB 616217 for applicable edge. Summary for proximity sensor tilt angle influence is shown in below.



WWAN

Orientation	Separation Distance (mm)	Tilt Angle										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
Top Side	30	On	On	On	On	On	On	On	On	On	On	On
Left Side	9	On	On	On	On	On	On	On	On	On	On	On

WLAN

Orientation	Separation Distance (mm)	Tilt Angle										
		-45°	-40°	-30°	-20°	-10°	0°	10°	20°	30°	40°	45°
Top Side	15	On	On	On	On	On	On	On	On	On	On	On
Right Side	4	On	On	On	On	On	On	On	On	On	On	On

6. Summary for Proximity Sensor Triggering Test

According to the procedures noticed in KDB 616217 D04,

The WWAN for proximity sensor triggering distance is 22 mm for EUT Rear Face, 9 mm for EUT Left Side and 30 mm for Top Side. The separation distance of 30 mm / 9 mm determined by the smallest triggering distance on Top Side Left Side is used to access the tilt angle influence and the sensor does not release during ± 45 degree. Therefore, the smallest separation distance for tilt angle influence is 30 mm for the Top Side and 9 mm for the Left Side. The conservation triggering distances based on the separation distance for the sensor trigger / not triggered as EUT with power reduction at 0 mm, and EUT without power reduction at 15 mm for EUT Rear Face, 8 mm for EUT Left Side and 25 mm for Top Side were used to test SAR.

The WLAN for proximity sensor triggering distance is 9 mm for EUT Rear Face, 4 mm for EUT Right Side and 15 mm for Top Side. The separation distance of 15 mm / 4 mm determined by the smallest triggering distance on Top Side Right Side is used to access the tilt angle influence and the sensor does not release during ± 45 degree. Therefore, the smallest separation distance for tilt angle influence is 15 mm for the Top Side and 4 mm for the Right Side. The conservation triggering distances based on the separation distance for the sensor trigger / not triggered as EUT with power reduction at 0 mm, and EUT without power reduction at 8 mm for EUT Rear Face, 3 mm for EUT Right Side and 12 mm for Top Side were used to test SAR.

The power reduction is depends on the proximity sensor input. For a steady SAR test, the power reduction was enabled or disabled manually by engineering software during SAR testing.