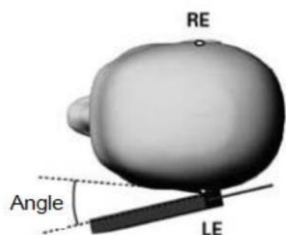


Appendix F. P-light sensor validation

Since proximity sensor validation procedure in KDB 616217 section 6.2/6.3/6.4 are for body exposure condition, therefore that procedure is not full applicable proximity sensor detection verification for the head exposure condition, following sensor validation procedure will be applied for head and near the front of face exposure condition

11.1 Proximity sensor validation procedure for Head exposure condition



The following guidance only for the device integrated proximity sensor to reduce power or disable RFID transmit and applies head exposure condition.

The earpiece of device positioned on the left and right ERP (ear reference point) location of head phantom defined in IEEE Std 1528-2013 and rotates the device along one axis, from 0 degrees to 90 degrees and then reverse the procedure to go from 90 degrees to 0 degrees.

Establish OTT VoIP call (through WIFI data) and audio is actively routed through the earpiece receiver (earpiece is ON).

This process is to determine the angle where a power reduction occurs, by taking power measurements at each step, as indicated in the step listed here below:

- i. From the device in 0 degrees, rotate in 10 degrees steps until proximity sensor is release
- ii. Lower the device rotate by 5 degrees increments to verify that the "proximity sensor" is triggered
- iii. From the position of the previous step, rotate the device in 1 degree increments until proximity sensor is Triggered again
- iv. Continue rotate the device in 1 degree increments until at least 5 degrees past where proximity sensor is release was obtained, then continue rotate device in 10 degrees steps until the device opened to 90 degrees with proximity sensor is release.
- v. Reverse the previous procedure to go from device 90 degrees back down to 0 degrees

Rotate the device from 0 degree to 90 degree _Right_ Head		
Device angle (degree)	Angle	Proximity sensor
	0	On
	10	On
	20	On
	30	On
	40	On
	50	On
	60	On
	70	On
	80	On
	81	On
	82	On
	83	On
	84	On
	85	On
	86	On
	87	Off
	88	Off
	89	Off
	90	Off

Rotate the device from 90 degree to 0 degree _Right_ Head		
Device angle (degree)	Angle	Proximity sensor
	90	Off
	89	Off
	88	Off
	87	Off
	86	Off
	85	Off
	84	Off
	83	On
	82	On
	81	On
	80	On
	79	On
	70	On
	60	On
	50	On
	40	On
	30	On
	20	On
	10	On
	0	On

Rotate the device from 0 degree to 90 degree_Left Head		
Device angle (degree)	Angle	Proximity sensor
	0	On
	10	On
	20	On
	30	On
	40	On
	50	On
	60	On
	70	On
	80	On
	81	On
	82	On
	83	On
	84	On
	85	On
	86	On
	87	On
	88	Off
	89	Off
	90	Off

Rotate the device from 90 degree to 0 degree_Left Head		
Device angle (degree)	Angle	Proximity sensor
	90	Off
	89	Off
	88	Off
	87	Off
	86	Off
	85	Off
	84	On
	83	On
	82	On
	81	On
	80	On
	70	On
	60	On
	50	On
	40	On
	30	On
	20	On
	10	On
	0	On

11.2 Proximity sensor validation procedure for near the front of the face

In order to consider front of device near the front of the face during VOIP call, hereunder is for proximity sensor validation procedure and results for determining proximity sensor triggering distance and ensure the trigger distance is larger than front of device test at 10 mm distance.

- The entire front surface of the device is positioned below a flat phantom filled with the required tissue-equivalent medium, and positioned at least 20 mm further than the distance that triggers power reduction
- The front surface is moved toward the phantom in 3 mm steps until the sensor triggers.
- The front surface is then moved back (further away) from the phantom by at least 5 mm or until maximum output power is returned to the normal maximum level.
- The front surface is again moved toward the phantom, but in 1 mm steps, until it is at least 5 mm past the triggering point or touching the phantom.
- If the device is not touching the phantom, it is moved in 3 mm steps until it touches the phantom to confirm that the sensor remains triggered and the maximum power stays reduced.
- The process is then reversed by moving the device away from the phantom according to steps b) to e), to determine triggering release, until it is at least 10 mm beyond the point that triggers the return of normal maximum power.
- The measured output power within +/- 5 mm of the triggering points, or until the device is touching the phantom, for movements to and from the phantom should be tabulated in the SAR report.

Front of device moved toward the phantom		
Device Trigger distance	Distance (mm)	Proximity sensor
	60	Off
	57	Off
	54	Off
	51	Off
	48	Off
	45	Off
	42	Off
	39	Off
	36	Off
	33	Off
	30	Off
	29	Off
	28	Off
	27	Off
	26	Off
	25	ON
	24	ON
	23	ON
	22	ON
	21	ON
	18	ON
	15	ON
	12	ON
	9	ON
	6	ON
	3	ON
	0	ON

Front of device moved back (further away) from the phantom		
Device Trigger distance	Distance (mm)	Proximity sensor
	0	ON
	3	ON
	6	ON
	9	ON
	12	ON
	15	ON
	18	ON
	21	ON
	24	ON
	27	ON
	30	ON
	31	ON
	32	ON
	33	ON
	34	ON
	35	off
	36	off
	37	off
	38	off
	39	off
	42	off
	45	off
	48	off
	51	off
	54	off
	57	off
	60	off

11.2.1 Proximity sensor validation on head-shaped phantom

The proximity sensor validation is to verify sensor trigger distance on head-shaped phantom to ensure the trigger distance is determined via 11.2 section is valid and workable on head-shaped phantom.

- The entire front surface of the device is positioned below a head-shaped phantom filled with the required tissue-equivalent medium.
- According to section 11.2 identified trigger distance, the front surface is then moved back (further away) from the phantom by at least 5 mm or until maximum output power is returned to the normal maximum level.
- The front surface is again moved toward the phantom, but in 1 mm steps, until it is at least 5 mm past the triggering point or touching the phantom.
- The process is then reversed by moving the device away from the phantom according to steps b) to c), to determine triggering release, until it is at least 10 mm beyond the point that triggers the return of normal maximum power.
- The measured output power within +/- 5 mm of the triggering points, or until the device is touching the phantom, for movements to and from the phantom should be tabulated in the SAR report.

Front of device moved toward the phantom		
Device Trigger distance	Distance (mm)	Proximity sensor
	31	Off
	30	Off
	29	Off
	28	Off
	27	Off
	26	ON
	25	ON
	24	ON
	23	ON
	22	ON

Remark: Since device currently still in design and development stage, the SW have not ready to combine RFID power and proximity sensor detection, therefore above proximity sensor validation results just monitors the screen changes corresponding to proximity sensor detection.

Proximity sensor on	LCD backlight off
Proximity sensor off	LCD backlight on

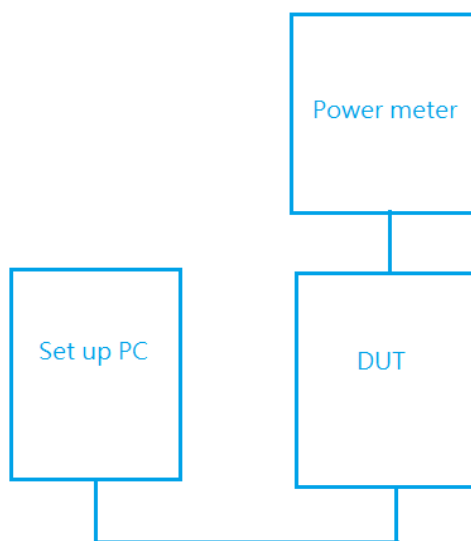
Conclusion:

The minimum trigger angle of the proximity sensor between the left and right sides of the head was measured at 83°, covering normal RF exposure conditions for cheek (0°) and tilted (15°) positions. Therefore, RFID head mode testing is not required.

In addition, the minimum trigger distance of the proximity sensor was measured at 26 mm; accordingly, RFID SAR for the front face will be evaluated at a 25 mm test separation (trigger distance minus 1 mm). Simultaneous transmission with BT, and WLAN will also be assessed to ensure compliance with RF exposure requirements.

RFID conducted power verification:

- Establish VOIP call over WIFI and audio routed through the earpiece to monitor output power under head exposure condition.
- To use FTM (Factory Test Model) mode TX tool to configure RFID TX transmission.
- Monitor the RFID output power based on the P-light sensor detection mechanism to trigger disabling RFID Tx transmission under head exposure conditions.
- According to the proximity sensor validation results which the minimum triggering distance is 27 mm determined by front of device moved toward to the phantom, therefore select the condition of front of device moved toward the phantom from 26 mm sensor off to 27 mm sensor on and then monitor RFID output power.
- When RFID Tx off by FTM mode, observed the out power by power meter is -50~-60 dBm, the output power is noise floor power level.
- Test setup for measuring power



- Verification output power results

Front of device moved toward the phantom			
Device Trigger distance	Distance (mm)	Proximity sensor	RFID power
	27	Off	24.83
	26	ON	-52

Appendix F. Power reduction mechanism verification

Demonstration of proper functioning of the detection and triggering mechanisms to support the corresponding RF exposure conditions. The verification is through a base station simulator is used to establish a conducted RF connection and monitor output power under different operating conditions related to the power reduction mechanisms. Detail of power reduction mechanisms referring to Operational Description

1. Power verification procedure

- Establish voice call and audio routed through the earpiece to monitor output power under head exposure condition
- Establish data connection monitor body worn power state.
 - Body Detect mechanism was performed for the in-hand and on a stationary object (placed on a table)
- In this power validation purpose is to demonstrate of proper functioning of the detection and triggering mechanisms to support the corresponding RF exposure conditions.
- Verification performed for each technology to demonstrate that the power reduction applies for both technology and call origination.

2. Test setup for measuring power



Figure 1

3. Verification output Power Results

Head exposure condition

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11a 6Mbps CH149	(Ant6+7)Ant 6	19.3	20 ±1.5
	(Ant6+7)Ant 7	19.4	20 ±1.5

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11ax-HE160 MCS0 CH15	(Ant6+7)Ant 6	16.16	15±1.5
	(Ant6+7)Ant 7	16.2	15±1.5

Hotspot exposure condition

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11a 6Mbps CH149	(Ant6+7)Ant 6	13.5	14.9 ±1.5
	(Ant6+7)Ant 7	13.6	14.9 ±1.5

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11ax-HE160 MCS0 CH15	(Ant6+7)Ant 6	5.22	6.5±1.5
	(Ant6+7)Ant 7	5.21	6.5±1.5

Extremity exposure condition -RFID trigger hold:

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11a 6Mbps CH149	(Ant6+7)Ant 6	18.8	19 ±1.5
	(Ant6+7)Ant 7	18.7	19 ±1.5

Head exposure condition		Output Power	
Wireless technology	Antenna	Measured	Target power(dBm)
		(dBm)	
802.11ax-HE160 MCS0 CH15	(Ant6+7)Ant 6	10.26	9.5±1.5
	(Ant6+7)Ant 7	10.18	9.5±1.5

Body worn exposure condition
Display on:

Body exposure condition		Output Power (data connection)			
		G-Sensor status			
Power state		Sensor Off		Sensor On	
Wireless technology	Antenna	Measured	Target power(dBm)	Measured	Target power(dBm)
		(dBm)		(dBm)	
802.11a 6Mbps CH149	(Ant6+7)Ant 6	19.4	20 ±1.5	15.7	16.2 ±1.5
	(Ant6+7)Ant 7	19.3	20 ±1.5	15.7	16.2 ±1.5

Body exposure condition		Output Power (data connection)			
		G-Sensor status			
Power state		Sensor Off		Sensor On	
Wireless technology	Antenna	Measured	Target power(dBm)	Measured	Target power(dBm)
		(dBm)		(dBm)	
802.11ax-HE160 MCS0 CH15	(Ant6+7)Ant 6	16.08	15 ±1.5	10.16	9.5±1.5
	(Ant6+7)Ant 7	16.115	15 ±1.5	10.13	9.5±1.5

Display on to off:

Body exposure condition		Output Power (data connection) (dBm)			
		Display on Stationary Placed on a table		Display off Stationary Placed on a table	
Power state		Full Power		Low Power	
Wireless technology	Antenna	Measured	Max. Tune-up	Measured	Max. Tune-up
802.11a 6Mbps CH149	(Ant6+7)Ant 6	19.4	20 ±1.5	15.5	16.2 ±1.5
	(Ant6+7)Ant 7	19.2	20 ±1.5	15.4	16.2 ±1.5

Body exposure condition		Output Power (data connection) (dBm)			
		Display on Stationary Placed on a table		Display off Stationary Placed on a table	
Power state		Full Power		Low Power	
Wireless technology	Antenna	Measured	Max. Tune-up	Measured	Max. Tune-up
802.11ax-HE160 MCS0 CH15	(Ant6+7)Ant 6	10.12	9.5±1.5	10.14	9.5±1.5
	(Ant6+7)Ant 7	10.13	9.5±1.5	10.12	9.5±1.5

Note: When the Display is off, the power will remain at the reduce power level.

Body detect validation

- a) Body Detect mechanism will be performed for the in-hand and on a stationary object (placed on a table).
- b) Verify the functionality of the motion sensor by measuring the output power in the following steps.

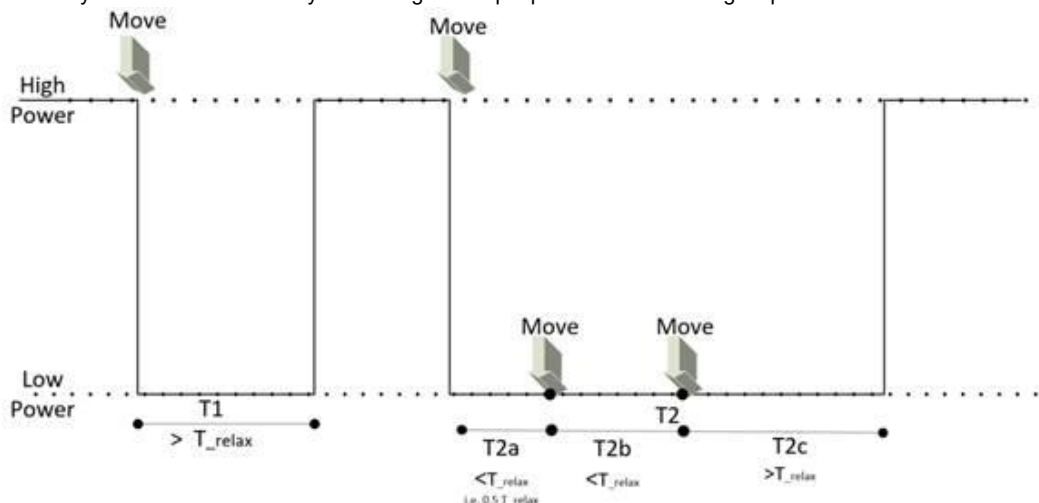


Figure 1 Illustration of the procedure for the validation of the power reduction

1. **Placed on a table:** Make the DUT transmit with the maximum output power by using a base station simulator.
 - a) Confirm that motion sensor is not triggered by letting the DUT remain stationary with no movements for the period T_{relax} for the motion sensor to reach stationary state.
 - b) Record P_{step1} (high power)
2. **In-hand:** Move the DUT to trigger the motion sensor. Apply the motion of the DUT with respect to movements in intended and reasonably foreseeable use conditions of the DUT.
 - c) Record P_{step2} (low power)
3. For the validation of T_{relax} , wait a time period $T_1 > T_{relax}$ and confirm DUT restores to high power (P_{step1}).
4. Move the DUT to trigger the motion sensor.
5. Move DUT within T_{relax} to ensure T_{relax} resets when DUT is in motion.
 DUT can be moved once or twice within T_{relax} , (after time periods T_{2a} and T_{2b} in Figure 1.) followed by waiting for a time period greater than T_{relax} (time period T_{2c} in Figure 1.) for DUT to restore high power. The total time duration of this step is T_2 , and the power during the whole period T_2 shall be reduced (low power – P_{step2}).
 T_{relax} : 60 sec
 Monitor period, T_1 : 70 sec, T_{2a} : 30 sec, T_{2b} : 30 sec, T_{2c} : 70 sec

Exposure Condition		Output Power (data connection) (dBm)											
		Stationary Placed on a table		In hand		Stationary Placed on a table		In hand				Stationary Placed on a table	
Power state		Full Power P_{step1}		Low Power P_{step2}		Full Power $P_{\text{step1}} \ \& \ T_1 > T_{\text{relax}}$		Low Power $P_{\text{step2}} \ \& \ T_{2a} < T_{\text{relax}}$		Low Power $P_{\text{step2}} \ \& \ T_{2b} < T_{\text{relax}}$		Full Power $P_{\text{step1}} \ \& \ T_{2c} > T_{\text{relax}}$	
Wireless technology	Antenna	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up
802.11a 6Mbps CH149	(Ant6+7) Ant 6	19.4	20 ±1.5	15.5	16.2±1.5	19.3	20 ±1.5	15.5	16.2±1.5	15.2	16.2±1.5	19.5	20 ±1.5
	(Ant6+7) Ant 7	19.3	20 ±1.5	15.4	16.2±1.5	19.3	20 ±1.5	15.4	16.2±1.5	15.3	16.2±1.5	19.4	20 ±1.5

Exposure Condition		Output Power (data connection) (dBm)											
		Stationary Placed on a table		In hand		Stationary Placed on a table		In hand				Stationary Placed on a table	
Power state		Full Power P_{step1}		Low Power P_{step2}		Full Power $P_{\text{step1}} \ \& \ T_1 > T_{\text{relax}}$		Low Power $P_{\text{step2}} \ \& \ T_{2a} < T_{\text{relax}}$		Low Power $P_{\text{step2}} \ \& \ T_{2b} < T_{\text{relax}}$		Full Power $P_{\text{step1}} \ \& \ T_{2c} > T_{\text{relax}}$	
Wireless technology	Antenna	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up	Measured	Max. Tune-up
802.11ax-HE160 MCS0 CH15	(Ant6+7) Ant 6	16.15	15 ±1.5	10.13	9.5±1.5	16.13	15 ±1.5	10.12	9.5±1.5	10.21	9.5±1.5	16.12	15 ±1.5
	(Ant6+7) Ant 7	16.14	15 ±1.5	10.14	9.5±1.5	16.14	15 ±1.5	10.12	9.5±1.5	10.2	9.5±1.5	16.13	15 ±1.5

Appendix F. Supplemental SAR Tests Results

SAR test result

1. The test data is selected according to the worst case SAR configuration per each technology.
2. The test data is to demonstrate the device is in compliance with FCC requirements at 25mm when all power reduction mechanisms are OFF. The worst case body SAR at 10mm was used for simultaneous transmission SAR analysis since they are more conservative than the 25mm SAR.

Band	Mode	Test Position	Gap (mm)	Antenna	Power State	Ch.	Freq. (MHz)	Sample	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-Up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
WLAN2.4GHz	802.11b 1Mbps	Back	25mm	Ant 7+6(6)	DSI 0	1	2412	Sample 2	20.60	21.50	1.23	85.87	1.165	0.09	0.163	0.234
WLAN2.4GHz	802.11b 1Mbps	Back	25mm	Ant 7+6(6)	DSI 0	1	2412	Sample 7	20.60	21.50	1.23	85.87	1.165	-0.10	0.138	0.198
WLAN5GHz	802.11ax-HE40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	46	5230	Sample 3	19.90	20.50	1.148	85.91	1.164	0.11	0.580	0.775
WLAN5GHz	802.11ax-HE40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	54	5270	Sample 3	20.60	21.00	1.096	85.91	1.164	0.09	0.667	0.851
WLAN5GHz	802.11ac-VHT20 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	52	5260	Sample 3	20.40	20.50	1.023	86.02	1.163	0.04	0.519	0.617
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	110	5550	Sample 3	19.90	21.00	1.288	85.91	1.164	-0.01	0.753	1.129
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	102	5510	Sample 3	20.00	21.00	1.259	85.91	1.164	0.08	0.801	1.174
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	126	5630	Sample 3	19.80	21.00	1.318	85.91	1.164	0.01	0.747	1.146
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	134	5670	Sample 3	19.80	21.00	1.318	85.91	1.164	0.06	0.748	1.148
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	142	5710	Sample 3	19.70	21.00	1.349	85.91	1.164	0.04	0.741	1.164
WLAN5GHz	802.11a 6Mbps	Back	25mm	Ant 7+6(7)	DSI 0	149	5745	Sample 3	20.80	21.50	1.175	85.79	1.166	-0.18	0.621	0.851
WLAN5GHz	802.11a 6Mbps	Back	25mm	Ant 7+6(7)	DSI 0	157	5785	Sample 3	20.50	21.50	1.259	85.79	1.166	0.01	0.583	0.856
WLAN5GHz	802.11a 6Mbps	Back	25mm	Ant 7+6(7)	DSI 0	165	5825	Sample 3	20.60	21.50	1.23	85.79	1.166	-0.00	0.508	0.729
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	110	5550	Sample 8	19.90	21.00	1.288	85.91	1.164	-0.04	0.718	1.076
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	102	5510	Sample 8	20.00	21.00	1.259	85.91	1.164	0.01	0.764	1.120
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	126	5630	Sample 8	19.80	21.00	1.318	85.91	1.164	-0.02	0.712	1.092
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	134	5670	Sample 8	19.80	21.00	1.318	85.91	1.164	-0.04	0.713	1.094
WLAN5GHz	802.11ax-HT40 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	142	5710	Sample 8	19.70	21.00	1.349	85.91	1.164	0.08	0.707	1.110
WLAN5GHz	802.11a 6Mbps	Back	25mm	Ant 7+6(7)	DSI 0	149	5745	Sample 8	20.80	21.50	1.175	85.79	1.166	-0.17	0.580	0.795
WLAN6GHz	802.11be-EHT320 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	31	6105	Sample 1	16.20	16.50	1.072	85.59	1.168	0.11	0.258	0.323
WLAN6GHz	802.11be-EHT320 MCS0	Back	25mm	Ant 7+6(7)	DSI 0	31	6105	Sample 6	16.20	16.50	1.072	85.59	1.168	-0.15	0.245	0.307
Bluetooth	LE 1Mbps	Back	25mm	Ant 7+6(7)	DSI 0	19	2440	Sample 2	14.90	16.00	1.288	68.52	1.216	-0.10	0.048	0.074