Appendix E. Power reduction mechanism verification

According to the May 2017 TCBC Workshop, 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 with simultaneous transmitting power states.
  - Tradition voice call for GSM/WCDMA, voice over IP CMRS operations for LTE/WIFI/5G FR1
  - GSM is set to 1TX slot, LTE is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA is set AMR 12.2Kbps, 5G FR1 is set at highest BW MHz, 1RF, RB offset = 1

- Establish data connection monitor hotspot power state.
  - GSM is set to GPRS 4TX slot, LTE is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA is set RMC 12.2Kbps, 5G FR1 is set at highest BW MHz, 1RF, RB offset = 1

- Establish data connection monitor body worn power state.
  - GSM is set to GPRS 2TX slot, LTE is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA is set RMC 12.2Kbps, 5G FR1 is set at highest BW MHz, 1RF, RB offset = 1
  - Body Detect mechanism was performed for the in-hand and on a stationary object (placed on a table)

- This device incorporates the Qualcomm Smart Transmit algorithm feature and through under varying Tx power transmission scenarios in real-time to maintain the time-averaged Tx power compliant with FCC RF exposure requirement.
- In this power validation purpose is to demonstrate of proper functioning of the detection and triggering mechanisms to support the corresponding RF exposure conditions. In order to avoid real-time TX power varying may affect monitor output power related to the power reduction mechanisms, therefore power reduction verification would be disabled WWAN smart transmit feature.
- 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

Hotspot exposure condition

Hotspot exposure condition		Output Power for data connection	
Wifi Hotspot Status		ON	
Power state		WWAN DSI 3 WIFI status 1	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)
LTE Band 7	Ant 5	22.5	23.5
NR SA n77	Ant 8	18.5	19.8
	Ant 9	15.3	17

Note:N77 ANT9 :Only support UL MIMO, so MIMO per chain power = Total power-3db.

Hotspot exposure condition		Output Power (data connection)			
		In hand			
WWAN Status:		OFF		ON	
Power state		WIFI status 0		WIFI status 1	
Wireless technology	Antenna	Measured (dBm)	Target power(dBm)	Measured (dBm)	Target power(dBm)
WiFi 802.11a UNII ,CH44	(Ant6+7)Ant 6	18.2	17 ±1.5db	15.8	15.5 ±1.5db
	(Ant6+7)Ant 7	18.0	17 ±1.5db	15.6	15.5 ±1.5db

Body worn exposure condition

Body Worn exposure condition		Output Power (data connection)			
		Body Worn (In hand)			
WIFI/BT Status		OFF		ON	
Power state		WWAN DSI 1 WIFI status 0		WWAN DSI 1 WIFI status 1	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
NR SA n77	Ant 8	20.8	22	18.2	19.5
NR SA n77	Ant 9	20.5	21.4	15.7	16.5

Note:N77 ANT9 :Only support UL MIMO, so MIMO per chain power = Total power-3db.

Body exposure condition		Output Power (data connection)			
		In hand			
WWAN Status:		OFF		ON	
Power state		WIFI status 0		WIFI status 1	
Wireless technology	Antenna	Measured (dBm)	Target power(dBm)	Measured (dBm)	Target power(dBm)
WiFi 802.11a UNII ,CH157	(Ant6+7)Ant 6	18.3	17 ±1.5db	15.8	15.5 ±1.5db
	(Ant6+7)Ant 7	18.1	17 ±1.5db	15.7	15.5 ±1.5db

1. Conducted Power verification Plan:

a) According to the May 2017 TCBC Workshop, 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.
b) Body Detect mechanism will be performed for the in-hand and on a stationary object (placed on a table).
c) Verify the functionality of the motion sensor by measuring the output power in the following steps.

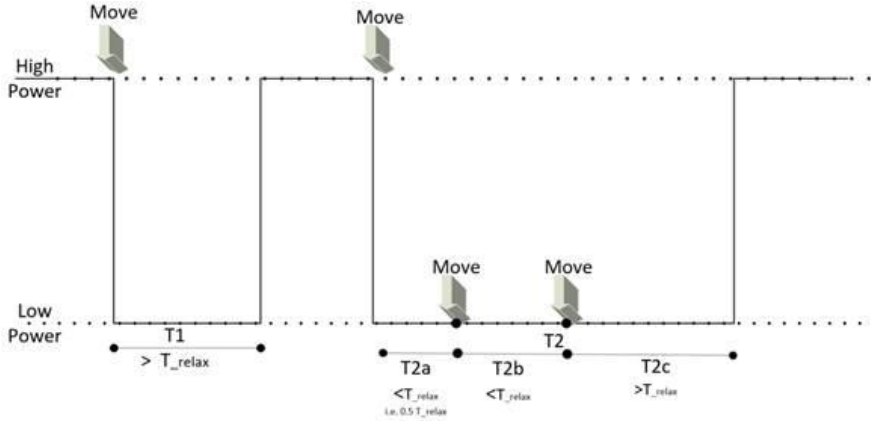

Figure 1 Illustration of the procedure for the validation of the power reduction

The device is embedded with motion sensors only, no proximity sensors are installed.

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.
   a) 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).

WLAN OFF

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_{step1} & T_1 > T_{relax}		Low Power P_{step2} & T_{2a} < T_{relax}		Low Power P_{step2} & T_{2b} < T_{relax}		Full Power P_{step1} & T_{2c} > T_{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
FR1 n77	Ant 8	24.2	25.0	20.8	22.0	24.5	25.0	20.9	22.0	20.8	22.0	24.6	25.0

WLAN ON

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_{step1} & T_1 > T_{relax}		Low Power P_{step2} & T_{2a} < T_{relax}		Low Power P_{step2} & T_{2b} < T_{relax}		Full Power P_{step1} & T_{2c} > T_{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
FR1 n77	Ant 8	24.2	25.0	18.5	19.5	24.5	25.0	18.4	19.5	18.5	19.5	24.6	25.0