

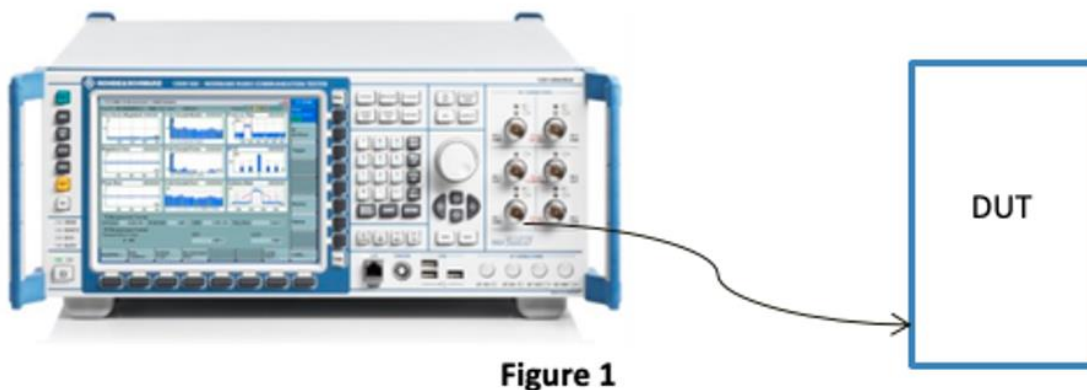
## **Appendix E. Power reduction mechanism verification**

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 data connection monitor hotspot power state.
  - UMTS CMRS Voice, 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.
  - 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**



### 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<br>WIFI status 1      |                    |
| Wireless Technology        | Antenna | Measured (dBm)                   | Max. Tune-up (dBm) |
| UMTS Band 2                | Ant 1   | 22.8                             | 24                 |
| LTE Band 7                 | Ant 5   | 21.7                             | 22                 |
| NR SA n77                  | Ant 8   | 18.3                             | 19.5               |
|                            | Ant 9   | 15.3                             | 16.5               |

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               | (Ant6+7)Ant 6 | 16.3                           | 16.5 ±1.5db       | 16.1           | 15.5 ±1.5db       |
| UNII ,CH157                | (Ant6+7)Ant 7 | 15.7                           | 16.5 ±1.5db       | 15.8           | 15.5 ±1.5db       |

#### Body worn exposure condition

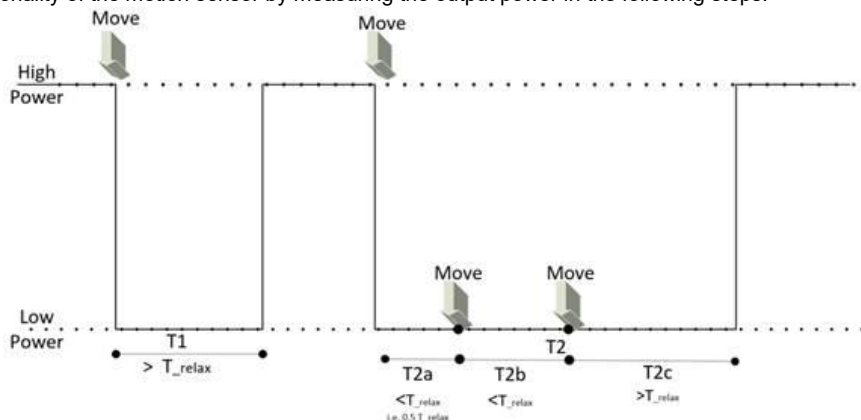
| Body Worn exposure condition |         | Output Power (data connection) |                    |                             |                    |
|------------------------------|---------|--------------------------------|--------------------|-----------------------------|--------------------|
|                              |         | Body Worn (In hand)            |                    |                             |                    |
| WIFI/BT Status               |         | OFF                            |                    | ON                          |                    |
| Power state                  |         | WWAN DSI 1<br>WIFI status 0    |                    | WWAN DSI 1<br>WIFI status 1 |                    |
| Wireless Technology          | Antenna | Measured (dBm)                 | Max. Tune-up (dBm) | Measured (dBm)              | Max. Tune-up (dBm) |
| NR SA n77                    | Ant 8   | 21.8                           | 23                 | 18.2                        | 19.5               |
| NR SA n77                    | Ant 9   | 21.8                           | 22                 | 16.7                        | 18                 |

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            | (Ant4+3)Ant 4 | 16.2                           | 16.5 ±1.5db       | 16.0           | 15.5 ±1.5db       |
| UNII ,CH157             | (Ant4+3)Ant 3 | 15.8                           | 16.5 ±1.5db       | 15.7           | 15.5 ±1.5db       |

## 1. Conducted Power verification Plan:

- 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.
- Body Detect mechanism will be performed for the in-hand and on a stationary object (placed on a table).
- 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.

- Placed on a table:** Make the DUT transmit with the maximum output power by using a base station simulator.
  - 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.
  - Record  $P_{step1}$  (high power)
- 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.
  - Record  $P_{step2}$  (low power)
- For the validation of  $T_{relax}$ , wait a time period  $T1 > T_{relax}$  and confirm DUT restores to high power ( $P_{step1}$ ).
- Move the DUT to trigger the motion sensor.
- 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  $T2a$  and  $T2b$  in Figure 1.) followed by waiting for a time period greater than  $T_{relax}$  (time period  $T2c$  in Figure 1.) for DUT to restore high power. The total time duration of this step is  $T2$ , and the power during the whole period  $T2$  shall be reduced (low power –  $P_{step2}$ ).

### WLAN OFF

| Exposure Condition  |         | Output Power (data connection)<br>(dBm) |              |                          |              |                                              |              |                                                |              |                                                |              |                                                 |              |
|---------------------|---------|-----------------------------------------|--------------|--------------------------|--------------|----------------------------------------------|--------------|------------------------------------------------|--------------|------------------------------------------------|--------------|-------------------------------------------------|--------------|
|                     |         | Stationary<br>Placed on a table         |              | In hand                  |              | Stationary<br>Placed on a table              |              | In hand                                        |              | In hand                                        |              | Stationary<br>Placed on a table                 |              |
| Power state         |         | Full Power<br>$P_{step1}$               |              | Low Power<br>$P_{step2}$ |              | Full Power<br>$P_{step1} \& T_1 > T_{relax}$ |              | Low Power<br>$P_{step2} \& T_{2a} < T_{relax}$ |              | Low Power<br>$P_{step2} \& T_{2b} < T_{relax}$ |              | Full Power<br>$P_{step1} \& T_{2c} > T_{relax}$ |              |
| 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   | 24.5                                    | 25.0         | 21.7                     | 23.0         | 24.7                                         | 25.0         | 21.8                                           | 23.0         | 21.7                                           | 23.0         | 24.5                                            | 25.0         |

### WLAN ON

| Exposure Condition  |         | Output Power (data connection)<br>(dBm) |              |                          |              |                                              |              |                                                |              |                                                |              |                                                 |              |
|---------------------|---------|-----------------------------------------|--------------|--------------------------|--------------|----------------------------------------------|--------------|------------------------------------------------|--------------|------------------------------------------------|--------------|-------------------------------------------------|--------------|
|                     |         | Stationary<br>Placed on a table         |              | In hand                  |              | Stationary<br>Placed on a table              |              | In hand                                        |              | In hand                                        |              | Stationary<br>Placed on a table                 |              |
| Power state         |         | Full Power<br>$P_{step1}$               |              | Low Power<br>$P_{step2}$ |              | Full Power<br>$P_{step1} \& T_1 > T_{relax}$ |              | Low Power<br>$P_{step2} \& T_{2a} < T_{relax}$ |              | Low Power<br>$P_{step2} \& T_{2b} < T_{relax}$ |              | Full Power<br>$P_{step1} \& T_{2c} > T_{relax}$ |              |
| 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   | 24.5                                    | 25.0         | 18.0                     | 19.5         | 24.7                                         | 25.0         | 18.2                                           | 19.5         | 18.0                                           | 19.5         | 24.5                                            | 25.0         |