

Power reduction mechanism verification

According to the May 2017 TCBC Workshop, Demonstration of proper functioning of the detection and triggering mechanisms is required 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

The power verification was performed according to the following procedure:

1. A base station simulator was used to establish a conducted RF connection and the output power was monitored. The power measurements were confirmed to be within expected tolerances for all states before and after a power reduction mechanism was triggered.
2. Step 1 was repeated for all relevant modes and frequency bands for the mechanism being investigated.
3. Steps 1 and 2 were repeated for all individual power reduction mechanisms and combinations thereof. For the combination cases, one mechanism was switched to a 'triggered' state at a time; powers were confirmed to be within tolerances after each additional mechanism was activated.

General Note:

1. This device uses different Device State Indices (DSI) to configure different time averaged power levels based on certain exposure scenarios, as the following table:

Exposure Condition	DSI	EUT Flip State	Trigger conditions
Head	DSI 2	Flip Close	Earpiece On
Body worn	DSI 3	Flip Close	Sensor On
Body	DSI 12	Flip Open	Sensor On
Extremity	DSI 6	Flip Close	Sensor On
Hotspot	DSI 7	Flip Close	Hotspot on
Body/ Body Worn / Extremity / Sensor Off	DSI 4	Flip Open/Flip Close	Sensor Off

2. Select the bands with the largest power reduction for power verification:
 - a. Establish voice call and audio routed through the earpiece to monitor output power under head power states.
 - Tradition voice call for WCDMA, voice over IP CMRS operations for LTE
 - LTE Band 7 is set at 'highest BW, 1RB, RB Offset = 0, QPSK', WCDMA II is set AMR 12.2Kbps.
 - b. Establish data connection monitor hotspot power state.
 - GSM1900 is set to GPRS 4TX slot, LTE Band 25/2 is set at 'highest BW, 1RB, RB Offset = 0, QPSK', WCDMA II is set RMC 12.2Kbps.
 - c. Establish data connection monitor body worn power state.
 - GSM850 is set to GPRS 4TX slot, LTE Band 7 is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA II is set RMC 12.2Kbps.
 - Body Detect mechanism was performed for the in-hand and on a stationary object (placed on a table)
 - d. Establish data connection monitor extremity power state.
 - GSM850 is set to GPRS 4TX slot, LTE Band 2/25 is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA IV is set RMC 12.2Kbps.
 - Body Detect mechanism was performed for the in-hand and on a stationary object (placed on a table).
 - e. Establish data connection monitor body (open) power state.
 - LTE Band 7 is set at 'highest BW, 1RB, RB Offset = 0, QPSK' WCDMA II is set RMC 12.2Kbps.
 - Body Detect mechanism was performed for the in-hand and on a stationary object (placed on a table)
3. In this power validation purpose is to demonstrate of proper functioning of the detection and triggering mechanisms to support the corresponding RF exposure conditions.
4. Verification performed for one technology/Band to demonstrate that the power reduction applies for same technology/band and call origination.

2. Verification output Power Results

Head exposure conditions

Head Exposure condition		Output Power for Voice Call			
Ear acoustic output Status:		ON		OFF	
Power state		WWAN Receiver on		WWAN Receiver off	
Wireless technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
WCDMA II	Ant 3	20.92	21.8	23.25	24.0
LTE Band 7	Ant 3	14.68	15.4	23.14	24.0

Hotspot exposure condition

Hotspot Status		ON		OFF	
Power state		WWAN Hotspot on		WWAN Hotspot off	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
GSM1900 (GPRS 4 Tx slots)	Ant 3	21.09	22.1	24.09	25.0
WCDMA II	Ant 3	17.45	18.6	23.11	24.0
LTE Band 25(2)	Ant 1	18.42	19.1	23.15	24.0

Body worn exposure condition

Body Worn exposure condition		Output Power (data connection)			
Power state		WWAN Sensor on		WWAN Sensor off	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
GSM850 (GPRS 4 Tx slots)	Ant 1	24.89	25.6	27.45	28.5
WCDMA II	Ant 3	17.45	18.6	23.04	24.0
LTE Band 7	Ant 3	16.34	17.1	23.34	24.0

Extremity exposure condition

Extremity exposure condition		Output Power (data connection)			
Power state		WWAN Sensor on		WWAN Sensor off	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
GSM850 (GPRS 4 Tx slots)	Ant 1	24.78	25.6	27.83	28.5
WCDMA IV	Ant 3	21.35	22.2	23.11	24.0
LTE Band 25(2)	Ant 3	21.73	22.5	23.17	24.0

Body (open) exposure condition

Body exposure condition		Output Power (data connection)			
Power state		WWAN Sensor on		WWAN Sensor off	
Wireless Technology	Antenna	Measured (dBm)	Max. Tune-up (dBm)	Measured (dBm)	Max. Tune-up (dBm)
WCDMA II	Ant 4	14.45	15.6	23.14	24.0
LTE Band 7	Ant 3	12.01	12.9	22.89	24.0

3. Angle Verification Results

The angle verification procedure was performed according to the following procedure:

- For licensed modes, the device state index on the device UI was monitored to determine the triggering state.
- The device was opened and closed to determine the angle at which the Hall sensor mechanism triggers, per the FCC TCB Workshop Slides from November 2019. The triggering conditions of the angles were sufficient such that all possible user scenarios with the device in open/closed condition are in the different power state, the angle Verification data as following tables.

Flip from closed state to open state														
Degree steps	0 Degrees	1 Degrees	2 Degrees	3 Degrees	4 Degrees	5 Degrees	6 Degrees	7 Degrees	8 Degrees	9 Degrees	10 Degrees	20 Degrees	30 Degrees	40 Degrees
State	1	1	1	1	1	1	0	0	0	0	0	0	0	0
Degree steps	50 Degrees	60 Degrees	70 Degrees	80 Degrees	90 Degrees	100 Degrees	110 Degrees	120 Degrees	130 Degrees	140 Degrees	150 Degrees	160 Degrees	170 Degrees	180 Degrees
State	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Flip from open state to closed state														
Degree steps	180 Degrees	170 Degrees	160 Degrees	150 Degrees	140 Degrees	130 Degrees	120 Degrees	110 Degrees	100 Degrees	90 Degrees	80 Degrees	70 Degrees	60 Degrees	50 Degrees
State	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Degree steps	40 Degrees	30 Degrees	20 Degrees	10 Degrees	9 Degrees	8 Degrees	7 Degrees	6 Degrees	5 Degrees	4 Degrees	3 Degrees	2 Degrees	1 Degrees	0 Degrees
State	0	0	0	0	0	0	0	0	1	1	1	1	1	1