

APPENDIX G: POWER REDUCTION VERIFICATION

Per the May 2017 TCBC Workshop Notes, demonstration of proper functioning of the power reduction mechanisms is required to support the corresponding SAR configurations. The verification process was divided into two parts: (1) evaluation of output power levels for individual or multiple triggering mechanisms and (2) evaluation of the triggering distances for proximity-based sensors.

G.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.

G.2 Distance Verification Procedure

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

1. A base station simulator was used to establish an RF connection and to monitor the power levels. The device being tested was placed below the relevant section of the phantom with the relevant side or edge of the device facing toward the phantom.
2. The device was moved toward and away from the phantom to determine the distance at which the mechanism triggers and the output power is reduced, per KDB Publication 616217 D04v01r02 and FCC Guidance. Each applicable test position was evaluated. The distances were confirmed to be the same or larger (more conservative) than the minimum distances provided by the manufacturer.
3. Steps 1 and 2 were repeated for low, mid, and high bands, as appropriate (see note below Table G-2 for more details).
4. Steps 1 through 3 were repeated for all distance-based power reduction mechanisms.

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| Test Dates: 11/01/21 - 12/13/21 | DUT Type: Portable Handset | | | APPENDIX G: Page 1 of 7 |

G.3 Main Antenna Verification Summary

**Table G-1
Power Measurement Verification for Licensed Modes**

| Mechanism(s) | | Mode/Band | Conducted Power (dBm) | | |
|--------------|-------------|-----------------------|-----------------------|------------------------|------------------------|
| 1st | 2nd | | Un-triggered (Max) | Mechanism #1 (Reduced) | Mechanism #2 (Reduced) |
| Grip | | GPRS 1900 1 Tx Slot | 29.11 | 26.63 | |
| Hotspot On | | GPRS 1900 1 Tx Slot | 29.06 | 26.17 | |
| Grip | Hotspot On | GPRS 1900 1 Tx Slot | 29.00 | 26.64 | 26.13 |
| Hotspot On | Grip | GPRS 1900 1 Tx Slot | 29.12 | 26.11 | 26.11 |
| Grip | | UMTS 1750 | 23.21 | 19.83 | |
| Hotspot On | | UMTS 1750 | 23.21 | 18.92 | |
| Grip | Hotspot On | UMTS 1750 | 23.21 | 19.88 | 18.17 |
| Hotspot On | Grip | UMTS 1750 | 23.20 | 18.13 | 18.24 |
| Grip | | UMTS 1900 | 23.02 | 19.56 | |
| Hotspot On | | UMTS 1900 | 23.01 | 18.32 | |
| Grip | Hotspot On | UMTS 1900 | 23.02 | 19.15 | 18.42 |
| Hotspot On | Grip | UMTS 1900 | 23.07 | 18.40 | 18.44 |
| Grip | | LTE Band 66 Ant A | 22.79 | 18.09 | |
| Hotspot On | | LTE Band 66 Ant A | 22.78 | 16.74 | |
| Grip | Hotspot On | LTE Band 66 Ant A | 22.80 | 18.12 | 16.77 |
| Hotspot On | Grip | LTE Band 66 Ant A | 22.79 | 16.72 | 16.72 |
| Grip | | LTE Band 4 Ant A | 22.39 | 18.89 | |
| Hotspot On | | LTE Band 4 Ant A | 22.34 | 17.12 | |
| Grip | Hotspot On | LTE Band 4 Ant A | 22.39 | 18.85 | 17.15 |
| Hotspot On | Grip | LTE Band 4 Ant A | 22.33 | 17.17 | 17.17 |
| Held-to-Ear | | LTE Band 4 Ant I | 20.00 | 15.32 | |
| Hotspot On | | LTE Band 4 Ant I | 19.98 | 15.89 | |
| Held-to-Ear | Hotspot On | LTE Band 4 Ant I | 19.92 | 15.28 | 15.88 |
| Hotspot On | Held-to-Ear | LTE Band 4 Ant I | 19.99 | 15.78 | 15.90 |
| Grip | | LTE Band 25 | 22.69 | 18.64 | |
| Hotspot On | | LTE Band 25 | 22.69 | 16.77 | |
| Grip | Hotspot On | LTE Band 25 | 22.69 | 18.52 | 16.78 |
| Hotspot On | Grip | LTE Band 25 | 22.69 | 16.89 | 16.72 |
| Grip | | LTE Band 2 | 22.33 | 18.32 | |
| Hotspot On | | LTE Band 2 | 22.34 | 17.12 | |
| Grip | Hotspot On | LTE Band 2 | 22.35 | 18.55 | 17.08 |
| Hotspot On | Grip | LTE Band 2 | 22.35 | 17.12 | 17.09 |
| Grip | | LTE Band 41 PC3 | 23.36 | 21.62 | |
| Hotspot On | | LTE Band 41 PC3 | 23.37 | 21.14 | |
| Grip | Hotspot On | LTE Band 41 PC3 | 23.34 | 21.88 | 21.02 |
| Hotspot On | Grip | LTE Band 41 PC3 | 23.32 | 21.04 | 21.04 |
| Grip | | LTE Band 41 PC2 | 24.67 | 22.17 | |
| Hotspot On | | LTE Band 41 PC2 | 24.66 | 21.31 | |
| Grip | Hotspot On | LTE Band 41 PC2 | 24.69 | 22.17 | 21.50 |
| Hotspot On | Grip | LTE Band 41 PC2 | 24.70 | 21.48 | 21.43 |
| Grip | | NR FDD Band n66 Ant A | 24.32 | 20.21 | |
| Hotspot On | | NR FDD Band n66 Ant A | 24.19 | 18.68 | |
| Grip | Hotspot On | NR FDD Band n66 Ant A | 24.33 | 20.24 | 18.70 |
| Hotspot On | Grip | NR FDD Band n66 Ant A | 24.28 | 18.66 | 18.60 |
| Held-to-Ear | | NR FDD Band n66 Ant I | 21.28 | 17.49 | |



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| Test Dates: 11/01/21 - 12/13/21 | DUT Type: Portable Handset | | | APPENDIX G: Page 2 of 7 |

Table G-2
Distance Measurement Verification for Main Antenna

| Mechanism(s) | Test Condition | Band | Distance Measurements (mm) | | Minimum Distance per Manufacturer (mm) |
|--------------|-----------------------|------|----------------------------|-------------|--|
| | | | Moving Toward | Moving Away | |
| Grip | Phablet - Back Side | Mid | 9 | 11 | 9 |
| Grip | Phablet - Back Side | High | 9 | 11 | 9 |
| Grip | Phablet - Front Side | Mid | 7 | 9 | 7 |
| Grip | Phablet - Front Side | High | 7 | 9 | 7 |
| Grip | Phablet - Bottom Edge | Mid | 12 | 14 | 12 |
| Grip | Phablet - Bottom Edge | High | 12 | 14 | 12 |



*Note: Mid band refers to: GSM1900, UMTS B2/4, LTE B2/4/25/66, and NR Band n66 antenna A. High band refers to: LTE B41.

G.4 WIFI Verification Summary

Table G-3
Power Measurement Verification WIFI – Antenna 1

| Mode/Band | Conducted Power (dBm) | |
|--------------------------|-----------------------|-----------------------------------|
| | Un-triggered (Max) | Mechanism #1 RCV Active (Reduced) |
| 802.11b | 17.97 | 16.61 |
| 802.11g | 17.02 | 15.96 |
| 802.11n (2.4GHz) | 17.00 | 16.02 |
| 802.11a | 15.93 | 13.17 |
| 802.11n (5GHz, 20MHz BW) | 15.91 | 13.06 |
| 802.11ac (20MHz BW) | 16.10 | 12.97 |
| 802.11n (5GHz, 40MHz BW) | 15.95 | 12.97 |
| 802.11ac (40MHz BW) | 16.00 | 12.85 |
| 802.11ac (80MHz BW) | 15.52 | 13.02 |
| 802.11ac (160MHz BW) | 14.98 | 13.07 |



*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions.

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| Test Dates: 11/01/21 - 12/13/21 | DUT Type: Portable Handset | | APPENDIX G: Page 3 of 7 | |

**Table G-4
Power Measurement Verification WIFI – Antenna 2**

| Mode/Band | Conducted Power (dBm) | |
|--------------------------|-----------------------|-----------------------------------|
| | Un-triggered (Max) | Mechanism #1 RCV Active (Reduced) |
| 802.11b | 19.25 | 16.96 |
| 802.11g | 17.15 | 15.71 |
| 802.11n (2.4GHz) | 17.30 | 15.69 |
| 802.11a | 16.13 | 12.85 |
| 802.11n (5GHz, 20MHz BW) | 16.00 | 12.99 |
| 802.11ac (20MHz BW) | 16.01 | 13.12 |
| 802.11n (5GHz, 40MHz BW) | 15.94 | 12.85 |
| 802.11ac (40MHz BW) | 16.10 | 12.88 |
| 802.11ac (80MHz BW) | 15.52 | 13.02 |
| 802.11ac (160MHz BW) | 15.02 | 13.00 |

*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions.

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| Test Dates: 11/01/21 - 12/13/21 | DUT Type: Portable Handset | | APPENDIX G: Page 4 of 7 | |

**Table G-5
Power Measurement Verification 2.4 GHz WIFI – Antenna 1 with NR Active**



| Mode/Band | Conducted Power (dBm) | | |
|------------------|-----------------------|----------------------------------|--|
| | Un-triggered (Max) | Mechanism #1 NR Active (Reduced) | Mechanism #2 RCV and NR Active (Reduced) |
| 802.11b | 18.01 | 15.92 | 16.01 |
| 802.11g | 16.98 | 16.00 | 15.89 |
| 802.11n (2.4GHz) | 17.05 | 15.99 | 15.93 |

*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions

**Table G-6
Power Measurement Verification 2.4 GHz WIFI – Antenna 2 with NR Active**

| Mode/Band | Conducted Power (dBm) | | |
|------------------|-----------------------|----------------------------------|--|
| | Un-triggered (Max) | Mechanism #1 NR Active (Reduced) | Mechanism #2 RCV and NR Active (Reduced) |
| 802.11b | 18.63 | 15.50 | 15.22 |
| 802.11g | 17.21 | 15.81 | 15.47 |
| 802.11n (2.4GHz) | 17.27 | 15.59 | 15.79 |

*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions

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| Test Dates: 11/01/21 - 12/13/21 | DUT Type: Portable Handset | | | APPENDIX G: Page 5 of 7 |

**Table G-7
Power Measurement Verification 5 GHz WIFI – Antenna 1 with NR Active**



| Mode/Band | Conducted Power (dBm) | | |
|--------------------------|-----------------------|----------------------------------|--|
| | Un-triggered (Max) | Mechanism #1 NR Active (Reduced) | Mechanism #2 RCV and NR Active (Reduced) |
| 802.11a | 16.01 | 12.98 | 13.22 |
| 802.11n (5GHz, 20MHz BW) | 15.98 | 13.01 | 13.21 |
| 802.11ac (20MHz BW) | 16.00 | 12.87 | 12.99 |
| 802.11n (5GHz, 40MHz BW) | 15.87 | 12.92 | 12.96 |
| 802.11ac (40MHz BW) | 15.93 | 12.97 | 13.01 |
| 802.11ac (80MHz BW) | 15.43 | 13.02 | 12.87 |
| 802.11ac (160MHz BW) | 15.01 | 12.99 | 13.12 |

*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions

**Table G-8
Power Measurement Verification 5 GHz WIFI – Antenna 2 with NR Active**

| Mode/Band | Conducted Power (dBm) | | |
|--------------------------|-----------------------|----------------------------------|--|
| | Un-triggered (Max) | Mechanism #1 NR Active (Reduced) | Mechanism #2 RCV and NR Active (Reduced) |
| 802.11a | 15.94 | 12.89 | 12.76 |
| 802.11n (5GHz, 20MHz BW) | 16.19 | 13.01 | 13.14 |
| 802.11ac (20MHz BW) | 15.98 | 12.98 | 13.03 |
| 802.11n (5GHz, 40MHz BW) | 15.89 | 12.85 | 13.01 |
| 802.11ac (40MHz BW) | 15.95 | 13.10 | 12.98 |
| 802.11ac (80MHz BW) | 15.42 | 12.98 | 13.13 |
| 802.11ac (160MHz BW) | 14.98 | 12.98 | 13.05 |

*Note: IEEE 802.11ax and MIMO WIFI modes were not evaluated due to equipment limitations. 802.11g, 802.11n, 802.11a, and 802.11ac WIFI only operate in MIMO, and these SISO powers were taken during MIMO conditions

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G.5 Bluetooth Verification Summary

Table G-9
Power Measurement Verification Bluetooth Antenna 1



| Mechanism(s) | Mode/Band | Conducted Power (dBm) | |
|--------------|-----------|-----------------------|------------------------|
| 1st | | Un-triggered (Max) | Mechanism #1 (Reduced) |
| Held-to-Ear | Bluetooth | 17.21 | 13.89 |

Note: Bluetooth Dual mode was not evaluated due to equipment limitations.

Table G-10
Power Measurement Verification Bluetooth Antenna 2

| Mechanism(s) | Mode/Band | Conducted Power (dBm) | |
|--------------|-----------|-----------------------|------------------------|
| 1st | | Un-triggered (Max) | Mechanism #1 (Reduced) |
| Held-to-Ear | Bluetooth | 16.05 | 13.98 |

Note: Bluetooth Dual mode was not evaluated due to equipment limitations.

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