Macrofab TotTag Testing Procedure

Supplies

For automated testing of the TotTag devices, the following supplies are required:

- Pre-programmed TotTag testing “master device” (provided by us)
- J-Link Programmer (provided by us)
- PC<>J-Link connector board and cables (provided by us)
- TotTag device-under-test (provided by Macrofab)
- 3.7V LiPo battery for the device-under-test

Setup

1. Ensure that the SEGGER J-Link Software and Documentation Pack has been downloaded, installed, and added to the PATH on the test computer, and that it is runnable from the command line (e.g., entering `JLink` on Windows or `JLinkExe` on another OS starts the J-Link Commander program).
2. Open up the case of the master TotTag testing device, remove the cover, and switch the device ON using the on-board power switch. (The green LED should illuminate to indicate that the board is on. If it does not, the battery may need to be replaced.)
3. Lay the master testing device LED-side-up on a tabletop.
4. Connect a battery to the device-under-test, and switch the device ON using the on-board power switch.
5. Connect the Tag-Connect adapter and cable to the J-Link Programmer.
6. Connect one end of the J-Link Programmer to your computer via USB.
7. Connect the other end of the J-Link Programmer to the TotTag device-under-test by inserting the Tag-Connect cable into the set of holes on the TotTag board labeled “SWD”.
8. On the test computer, navigate to the root of the TotTag testing directory, and enter either `test_tottag.bat` on Windows or `sh test_tottag.sh` on any other OS to flash the testing firmware onto the target device. This will take about 10 seconds, and **the terminal will appear to freeze** during this time. **Do not proceed until the script has fully finished processing! You should hear a “happy” buzzer sound when this occurs.**
9. Remove all cabling, **switch off** the device-under-test, lay the device-under-test on the tabletop about 8” away from the master testing device, and manually power cycle the device-under-test using the on-board switch. Testing will begin immediately.
10. Validate successful results using the details in the following section.
11. Power down the device-under-test using the on-board power switch, and remove the battery for use in the next device.
12. Repeat for all devices under test, **ensuring that ONLY one device-under-test is powered on at any given time!**
13. Ensure that the power to the master testing device is switched off after all testing is complete, and replace the cover and screws for storage.

Results

Testing results will be reported both visually using colored LEDs and auditorially using a buzzer. The expected sequence of events is as follows:

1. All LEDs (red, orange, and green) will blink simultaneously 3 times.
2. The buzzer will make a “happy” sound (4 quick tones of increasing pitch).
3. The green LED will illuminate for 1 second while the buzzer sounds a single pulse.
4. After ~1 second, the green LED will illuminate while the buzzer sounds 2 pulses.
5. After ~1 second, the green LED will illuminate while the buzzer sounds 3 pulses.
6. Items 3-5 repeat forever.

The number of buzzer pulses in items 3-5 above indicate which UWB antenna is currently being tested. If the above sequence of events does not occur, the following table outlines the meaning of the various possible error indications:

Error Indication	Meaning
LEDs never illuminate at all	MCU cannot be accessed by the debugger
Buzzer never emits a sound	Buzzer connection to the MCU is faulty
Buzzer continuously plays a quick 4-tone sequence every 2 seconds while the **red** LED is **continuously** illuminated	Cannot communicate with the external flash storage chip
Buzzer continuously plays a quick 4-tone sequence every 2 seconds while the **orange** LED is **continuously** illuminated	Cannot communicate with the IMU chip
Buzzer continuously plays a slow 2-tone sequence every 3 seconds while **both** the red and orange LEDs are **continuously** illuminated	BLE stack cannot initialize successfully, indicating an issue with the MCU itself
Orange and red LEDs blink continuously once per second	Cannot communicate with the DW3000 ranging radio
LEDs never illuminate again after the initial blinking and happy sound	No UWB data is being received, indicating an issue with the DW3000 module or one or more of the UWB antennas
Red LED illuminates for 1 second, coupled with 1-3 buzzer pulses	UWB data was detected but was too weak to be received, indicating an issue with the UWB antenna number indicated by the number of buzzer pulses
Orange LED illuminates for 1 second, coupled with 1-3 buzzer pulses	UWB data was successfully received on the antenna number indicated by the number of buzzer pulses, but the signal was weaker than expected