# Upper Bound Transmission Duty Factor Analysis for FCC: S5ESTPXS8

SoberTrack is primarily a handheld alcohol detection device used to perform several regularly scheduled or random sobriety tests on the user. The device includes a camera which is used to take still and/or video images of the user whilst performing the sobriety test. The pictures and test results are sent back to a central gateway using GSM / CDMA wireless networks once the tests have been completed. Additionally, video may be saved to an SD card.  Voice operations are not supported.

The Device uses the PXS8 multimode cellular module, FCC ID S5ESTPXS8, to transmit data or alarms via the cellular wireless network. The device also supports a 915 low power (<10mW, FCC Part 15C) transmitter, a GPS receiver and a Murata WiFi module that is used in a receive-only mode and does not transmit. The device firmware ensures that the cellular module and the 915 MHZ transmitter will never transmit simultaneously.

The SoberTrack will be certified under FCC ID **S5EST10417** to cover the 915 MHz transceiver.  FCC approvals for the cellular operations will be covered by the modular approval for FCC ID S5ESTPXS8.  As the full modular approval is limited to mobile devices a Class II Permissive Change will be submitted to cover use of the module in a portable rf exposure condition in the SoberTrack.  Based on the duty cycle analysis in this document, the time-averaged output power levels for the module are below the thresholds that would require SAR testing for a portable device used within 5mm of the body or head.

The main SoberTrack application processor controls the operation of the modem. In the event of a connection not being established the SoberTrack device will store the data and retry at 5 minute intervals.

The SoberTrack is by default programmed to transmit sobriety results via cellular data message every 300 seconds lasting typically 2-3 seconds. In a worst-case scenario with latency this could be increased to a maximum transmission lasting 6 seconds every 300 seconds. In the event of latency exceeding 6s the device will terminate the call and retry in the next 5-minute cycle.

The correction of average output power for duty cycle is thus 6/300*maximum power. The tables in the following section show the maximum rated power, including tune up tolerance for each of the technologies and operating bands supported in the USA by the module.  Those power values are corrected for source based duty cycle (i.e. GSM frame power) and then corrected for the 6/300 operational duty cycle and the resulting power levels are used to determine the SAR exclusion requirements based on KDB 447498.

**Supported Cellular technologies and maximum power including tune-up tolerance.**

| Technology/Band | Maximum Power (dBm) | Maximum Power (mW) |
|---|---|---|
| W-CDMA II | 24.5 | 282 |
| W-CDMA V | 24.5 | 282 |
| CDMA BC0 | 24.5 | 282 |
| CDMA BC1 | 24.5 | 282 |

| RF Air Interface | GPRS/EGPRS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Tx 1 Slot | | Tx 2 Slots | | Tx 3 Slots | | Tx 4 Slots | |
| | Maximum Power (dBm) | Maximum Power (mW) | Maximum Power (dBm) | Maximum Power (mW) | Maximum Power (dBm) | Maximum Power (mW) | Maximum Power (dBm) | Maximum Power (mW) |
| GSM 850 | 33.5 | 2239 | 30.5 | 1122 | 28.7 | 741 | 27.5 | 562 |
| GSM 1900 | 30.5 | 1122 | 27.5 | 562 | 25.7 | 372 | 24.5 | 282 |

| RF Air Interface | Tx 1 Slot | | Tx 2 Slots | | Tx 3 Slots | | Tx 4 Slots | |
|---|---|---|---|---|---|---|---|---|
| | Maximum Burst Power (mW) | Maximum Frame power (mW) | Maximum Burst Power (mW) | Maximum Frame power (mW) | Maximum Burst Power (mW) | Maximum Frame power (mW) | Maximum Burst Power (mW) | Maximum Frame power (mW) |
| GSM 850 | 2239 | 282 | 1122 | 282 | 741 | 278 | 562 | 281 |
| GSM 1900 | 1122 | 141 | 562 | 141 | 372 | 140 | 282 | 141 |

**Duty Cycle correction**

| Technology/Band | Upper Frequency (MHz) | Maximum Power (mW) without duty factor correction (mW) | Maximum Power (mW) with duty factor correction (mW) |
|---|---|---|---|
| W-CDMA II | 1907.6 | 282 | 5.6 |
| W-CDMA V | 846.6 | 282 | 5.6 |
| CDMA BC0 | 849 | 282 | 5.6 |
| CDMA BC1 | 1910 | 282 | 5.6 |
| GSM850 | 849 | 282 | 5.6 |
| GSM1900 | 1910 | 141 | 2.8 |

## SAR Exclusion Calculations

From KDB 447498, for transmission frequencies 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g SAR test exclusion thresholds are determined by the following:

[(max. power of channel, including tune-up tolerance, mW) / (min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 where:

- f(GHz) is the RF channel transmit frequency in GHz;
- Power and distance are rounded to the nearest mW and mm before calculation;
- For a separation distance of less than 5mm, 5mm is used.

The result is rounded to one decimal place for comparison with the 3.0 threshold.

The table below shows that at the maximum power for all bands and technologies, after accounting for source-based and operational duty cycles, and for a separation distance of 5mm or less, SAR test exclusion applies.

| RF Air interface | RF Exposure Conditions | Frequency (GHz) | Max. tune-up tolerance (mW) | Min. test separation distance (mm) | SAR test exclusion Result* |
|---|---|---|---|---|---|
| W-CDMA II | Body-worn | 0.191 | 6 | 5 | 0.5 |
| W-CDMA V | Body-worn | 0.847 | 6 | 5 | 1.1 |
| CDMA BC0, BC10 | Body-worn | 0.855 | 6 | 5 | 1.1 |
| CDMA BC1 | Body-worn | 0.191 | 6 | 5 | 0.5 |
| GSM850 | Body-worn | 0.849 | 6 | 5 | 1.1 |
| GSM1900 | Body-worn | 0.191 | 3 | 5 | 0.3 |

**Conclusion:**

*: The computed value is ≤ 3; therefore, this qualifies for SAR test exclusion.