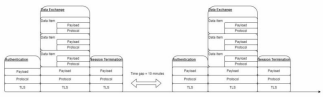

SuperCom PureOne Device Analysis and Design of Cellular/BLE Duty Cycle Owner's Manual

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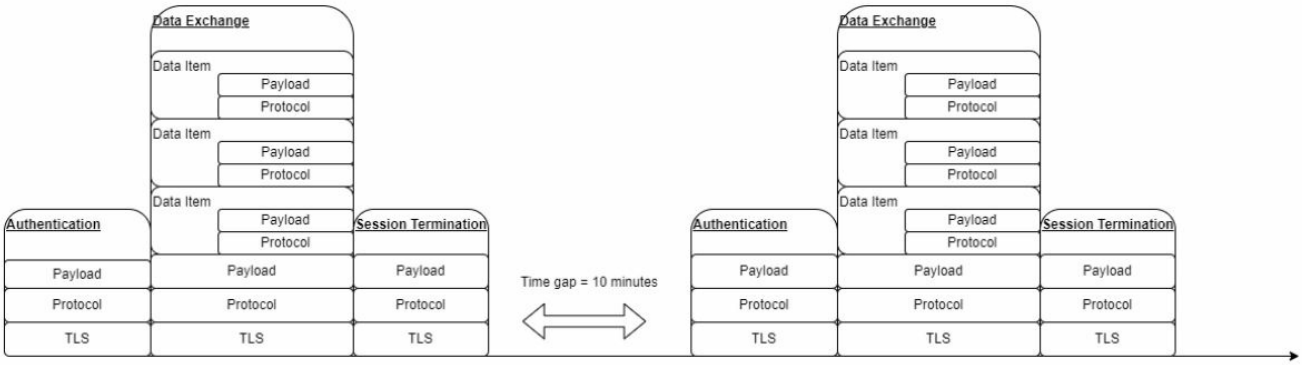
SuperCom PureOne Device Analysis and Design of Cellular/BLE Duty Cycle



Product Information

Specifications

- Product: PureOne
- Manufacturer: SuperCom LTD
- Model: PureOne 3.0
- Hardware Version: 3.0
- FCC ID: 2BAX3PRFPUREONE3

Device Tx Data Analysis

The PureOne device is designed to analyze and demonstrate the cellular and BLE Tx duty factor. It is capable of performing various use cases and provides protection against alterations of the maximum duty factor for compliance purposes.

Cellular Data Tx Flow

- **Communication interval:** Infrequent (every 60 minutes, usually when at home) and Frequent (every 10 minutes, usually when outside home)
- **Communication session flow:** Authentication and security, Data exchange, Session termination

Data payload analysis:

The data payload for each session can be up to 2060 bytes. Assuming a data rate of 5 Mbps using an LTE network connection, the active transmission time is calculated as follows:

```
2060 bytes * 8 = 16,480 bits
16,480 bits / 5 Mbps = 3.296 milliseconds
Duty Cycle = (3.296 milliseconds / 600,000 milliseconds) * 100 = 0.05493%
```

Description of reasonable and infrequent cases – Cellular

- Daily payload: 1440 minutes / 10 minutes * 2060 bytes = 296,640 bytes
- Device triggers 20 alarms per day, each with a payload of 2060 bytes
- Daily alarms payload: 2060 bytes * 20 = 41,200 bytes
- Total daily payload: 296,640 bytes + 41,200 bytes = 337,840 bytes
- Daily Payload in bits: 337,840 bytes * 8 = 2,702,720 bits
- Tx time, assuming data rate of 5 Mbps: 2,702,720 bits / 5 Mbps = 540,544 milliseconds
- Daily Duty Cycle = (540,544 milliseconds / 86,400,000 daily milliseconds) * 100 = 0.6267%

Bluetooth Duty Cycle Analysis

The PureOne device utilizes a Bluetooth low energy certified module. It transmits status data every 5 seconds using the Advertising (broadcast) protocol under the GAP profile.

Protocol characteristics:

- Data rate: 1 Mbps
- Interval: 5 seconds
- Channels: All 3 channels used (channels: 37, 38, 39)
- Payload: 39 bytes

Standard Active Transmission Time:

```
Payload in bits: 39 bytes * 8 = 312 bits
Daily packets: 86400 seconds / 5 seconds = 17,280
All 3 BLE channels: 17,280 * 3 = 51,840
51,840 bits / 1 Mbps = 51.88 milliseconds
Duty cycle: 51.88 milliseconds / 86,400,000 milliseconds = 0.00006%
```

Description of reasonable and infrequent cases – BLE

The BLE advertising protocol uses a random time before/after each 5 seconds transmission interval, but the average interval of 5 seconds is still maintained.

System Design to Protect from Duty Cycle Alterations

The PureOne device is a hardware-based device designed, reviewed, implemented, and manufactured using standard design tools and professional engineers. Each device undergoes testing and documentation for quality control during manufacturing. The radio hardware components are certified, and intensive QA and external Labs are employed during the development process for verifications.

FAQ

- Q: What is the maximum daily Tx duty cycle for the PureOne device?
  A: The maximum daily Tx duty cycle for the PureOne device is 0.6267%.
- Q: What is the BLE duty cycle for the PureOne device?
  A: The BLE duty cycle for the PureOne device is 0.00006%.

Purpose

- Analyze and demonstrate the cellular and BLE Tx duty factor.
- Describe all reasonable and infrequent use cases.
- Show how the design inherently provides protection from alterations of the maximum duty factor that was considered for compliance purposes.

Device details

- Product: PureOne
- Manufacturer: SuperCom LTD
- Model: PureOne
- Hardware Version: 3.0

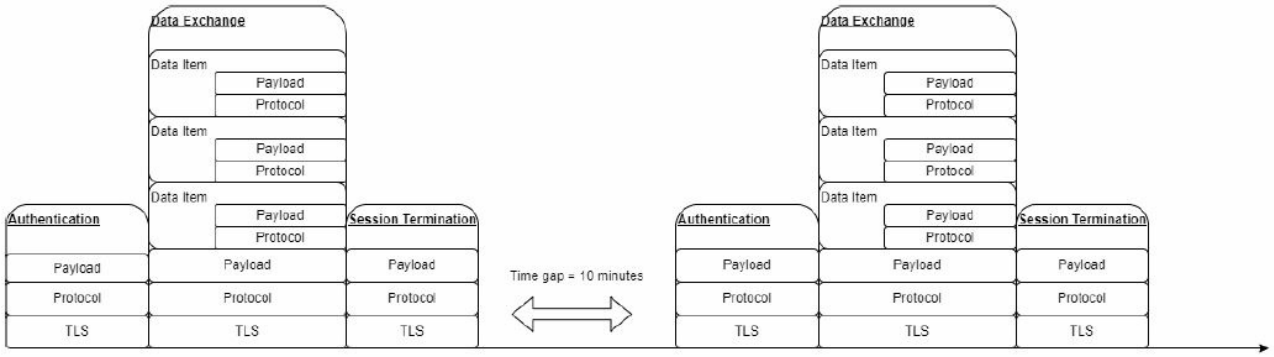
- FCC ID: 2BAX3PRFPUREONE3

Device Tx Data Analysis

Cellular Data Tx Flow

- Communication interval
  - Infrequent: every 60 minutes, usually when at home.
  - Frequent: every 10 minutes, usually when outside home.
- Communication session flow:
  - Authentication and security
  - Data exchange
  - Session termination

Data payload analysis:

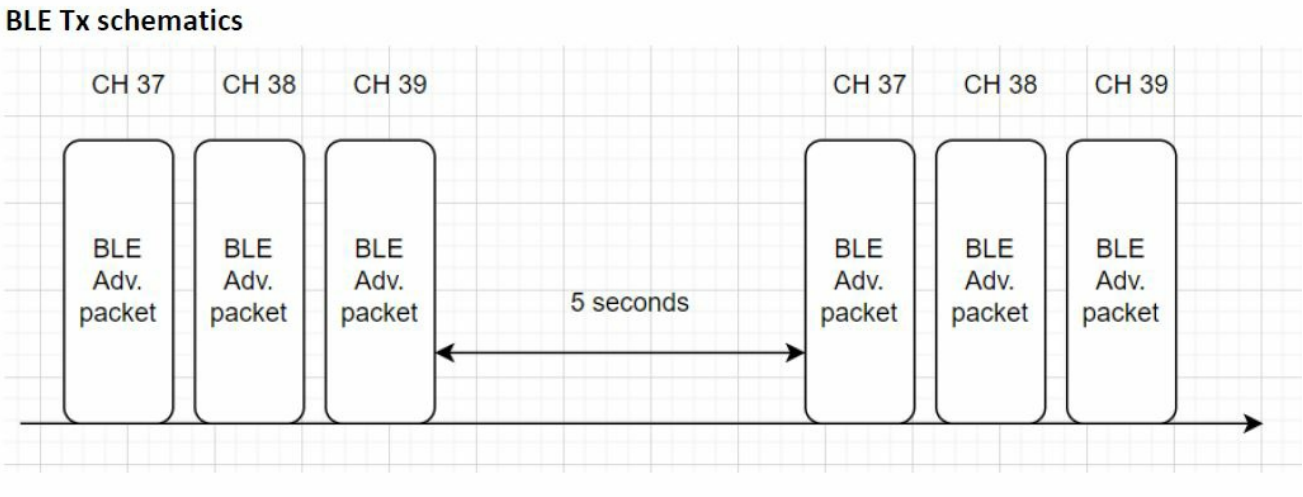


Data payload is up to 2060 bytes per session, according to the following analysis:

- Authentication and security – 600 bytes
  - TLS/SSL negotiation: 200 bytes
  - HTTP headers and structure: 180 bytes
  - Protocol overhead data: 100 bytes
  - Authentication net payload: 120 bytes
- Data exchange – 1100 bytes
  - Security overhead – 80 bytes
  - HTTP headers and structure: 180 bytes
  - Other overhead data: 100 bytes
  - Data items size: 640 byes
  - Single data item size: 32 bytes
  - Protocol overhead data: 32 bytes
  - Number of data items: 10
- Session termination– 360 bytes
  - Security overhead – 80 bytes
  - HTTP headers and structure: 180 bytes
  - Protocol overhead data: 40 bytes

- Termination net payload: 60 bytes

Standard Active Transmission Time



- 2060 bytes payload in bits
  - 2060 X 8 = 16,480
- Data rate: assuming 5 Mbps (using LTE network connection)
- Calculation:
  - 16,480 / 5 = 3.296 milliseconds
- The active transmission time is a time slot of 10 minutes is 3.296 milliseconds.
  Duty Cycle = (3.296 milliseconds / 600,000 milliseconds) * 100 = 0.05493%
  The standard typical duty cycle is: 0.05493%

Description of reasonable and infrequent cases Cellular

There are 3 use cases

1. Standard reporting.
   1. Device is active, not at home, communications is every 10 minutes.
   2. Duty cycle is 0.05493%
2. Infrequent reporting.
   1. Device is active, at home or static position/location, communications is every 60 minutes.
   2. Duty cycle is 0.00915%
3. Alarm reporting.
   1. A special case where a single alarm/data should be immediately sent.
   2. Maximum allowed alarms per day: 20 alarms

Duty cycle at worst case scenario:
Assumptions:

- Standard reporting mode is active all the time.
  - Communication is every 10 minutes.
  - Payload per session: 2060 bytes
- Daily payload:

    - 1440 minutes / 10 minutes X 2060 bytes
    - Daily payload: 296,640 bytes
- Device is triggering 20 alarms per day.
    - Each alarm payload: 2060 bytes
    - Daily alarms payload: 2060 * 20 = 41,200 bytes
- Total daily payload: 296,640 + 41,200 = 337,840 bytes

Daily Payload in bits: 337,840 * 8 = 2,702,720 bits
Tx time, assuming data rate of 5Mbps: 2,702,720 / 5 = 540,544 milliseconds Daily Duty Cycle = (540,544 milliseconds / 86,400,000 daily milliseconds) * 100 = 0.6267%
The maximum daily Tx duty cycle is 0.6267%.

Bluetooth duty cycle analysis

The PureOne device uses a “Bluetooth low energy” certified module.
The device is set up to transmit status data every 5 seconds.
The protocol is “Advertising” (broadcast) under GAP profile.

Protocol characteristics:

- Data rate: 1 Mbps
- Interval: 5 seconds
- Channels: All 3 channels used (channels: 37,38,39)
- Payload: 39 bytes

Standard Active Transmission Time

- Payload in bits: 39 (bytes) * 8 = 312 bits
- Daily packets: 86400 / 5 = 17,280
- All 3 BLE channels: 17,280 * 3 = 51,840
- 51,880 / 1 (Mbps) = 51.88 milliseconds
- Duty cycle: 51.88 / 86,400,000 = 0.00006 %
- The BLE duty cycle is 0.00006 %

Description of reasonable and infrequent cases

The BLE advertising protocol uses a random time before/after each 5 seconds Tx interval. The average of 5 seconds interval is still being kept

System design to protect from duty cycle alterations

Standard design

- The PureOne device is a hardware-based device. The hardware was designed, reviewed, implemented, and manufactured using standard design tool and by professional engineers.
- During manufacturing, each single device is being tested and documented for quality control.

- The radio hardware component are certified.
- During development process, intensive QA and external Labs are used for verifications.

Design to meet and keep requirements:

To meet duty cycle requirements, and keep up with them:

- Device has a precise real time clock for timing.
    - Time is constantly being verified against a server to avoid any drift.
- Device has flash and eeprom memory to keep track of all communication intervals and data payload history.
- RF modules are certified and by know vendors.
- Product is being tested at RF labs.
- Product is reporting its Tx statistics for analysis and record keeping.

Documents / Resources

	SuperCom PureOne Device Analysis and Design of Cellular/BLE Duty Cycle [pdf] Owner's Manual PRFPUREONE3, PureOne Device Analysis and Design of Cellular BLE Duty Cycle, PureOne, Device Analysis and Design of Cellular BLE Duty Cycle, Analysis and Design of Cellular BLE Duty Cycle, Design of Cellular BLE Duty Cycle, Cellular BLE Duty Cycle, BLE Duty Cycle, Duty Cycle, Cycle

References

- User Manual