5G IoT Strategy Group

Improving Energy Efficiency for Mobile IoT

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Introduction

Director of Product Marketing at Sony Semiconductor Israel.

- Sony Semiconductor Israel is a leading provider of Cellular IoT chipsets
- Ultra-low-power and ultra-small chipset solutions for 5G
- Millions of Sony chipsets connecting cellular IoT devices around the world.
- Sony’s Altair chipsets can be found in wearables, vehicle telematics, smart utility meters, personal & logistics trackers, consumer electronics, and many other IoT devices.

Vice-Chair at the GSMA 5G IoT Strategy Group

- Heading the energy efficiency subgroup
- Industry Experts:
  MNOs, Chipset vendors, Module Makers, Infrastructure vendors
Cellular IoT Use Cases

- mHealth
- Smart Cities
- Agriculture
- Point Of Sale
- Logistics
- Telematics
- Consumer Electronics
- Smart Metering
Mobile IoT - Energy Efficiency White Paper

Baseline guide document for application developers building low energy cellular IoT solutions

- Introduces energy efficiency capabilities of 5G Mobile IoT technologies
- Key energy efficiency features available for LTE-M and NB-IoT devices compared to 2G
- Power optimization techniques in R13, R14 and later in R15
- Power class specifications and energy consumption impact
- Power efficient LTE-M/NB-IoT vs ~x6 higher current at 2G
- Application protocol selection
- Preferred operation modes - PSM/eDRX vs Device Shut down
- Reference Test Setup – Conducted/Radiated in a Lab and Live NW
- Measurement procedures and Reference test results
Typical Use Cases

**Smart Meters**

Gas, Electricity, Water meters

Power consumption and service longevity

PSM vs eDRX - Data logging and upload cycles

FOTA – Firmware Over The Air

**Trackers**

Telematics, Asset and Pet Trackers

Continues/Periodic tracking

Geofencing

eDRX and PSM combination
Device Power efficiency is directly affected by both Network & Device configurations

Device States:
- Off
- Connected
- Idle
- Power save

- TAU - Tracking Area Update
- DRX - Discontinuous Reception
- C-DRX - Connected DRX
- Inactivity Timer
- RAI - Release Assistance Indication
- RRC - Radio Resource Control
- PTW - Paging Time Window
- PSM - Power Saving Mode
- eDRX - Extended Discontinuous Reception
- T3412 and T3324 timers
Release Assistance Indication (RAI) helps further reduce device power

- RAI allowing the IoT device to prematurely tear down the Resource Control (RRC) bearer
- RAI informs the network that no subsequent UL/DL transmission is expected.
- Without RAI the IoT device is forced to remain in RRC_CONNECTED mode until the expiration of the eNodeB’s RRC inactivity timer that could be as long as 20 to 30 seconds.
Selecting Power Efficient Application Protocol

HTTPs vs CoAP

![Bar chart comparing HTTP and CoAP protocols](image)
Lab tests proposal to predict devices performance in common use cases

**Measurement Scenarios**

<table>
<thead>
<tr>
<th>Test Profiles:</th>
<th>RT1: LTE-M</th>
<th>RT2: NB-IoT</th>
<th>RT3: GPRS</th>
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</thead>
<tbody>
<tr>
<td>1. PSM and TAU</td>
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<td>2. Data transmission to/from PSM</td>
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<td>3. Reception in eDRX</td>
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<td>4. Connection to network and change to PSM</td>
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<td>5. Always on transmission</td>
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<tr>
<td>6. eSIM Profile swap</td>
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RT – Recommended Test

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**Test Profiles:**

1. PSM and TAU
2. Data transmission to/from PSM
3. Reception in eDRX
4. Connection to network and change to PSM
5. Always on transmission
6. eSIM Profile swap

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![Graph showing measurement scenarios](image-url)
Four Step Procedure

- Profile
- Procedure
- Environment
- Test Result
Multiple factors affect battery life of a mobile IoT device:

- Network parameters, messaging period, application protocol, cloud latency and more

- Minimise the number of power On/Offs and Registrations → Use PSM

- Reduce Connected Mode consumption → Use Release Assistance Indication (RAI)

- Reduce Idle Mode consumption → Use eDRX

- Avoid chatty protocols.

- Proper RAT selection: LTE-M/NB-IoT enables significantly longer battery life vs 2G

Download your free copy of energy efficiency white paper here: https://www.gsma.com/iot/resources/energy-efficiency-mobile-iot/