

ONT Power Saving Proposal

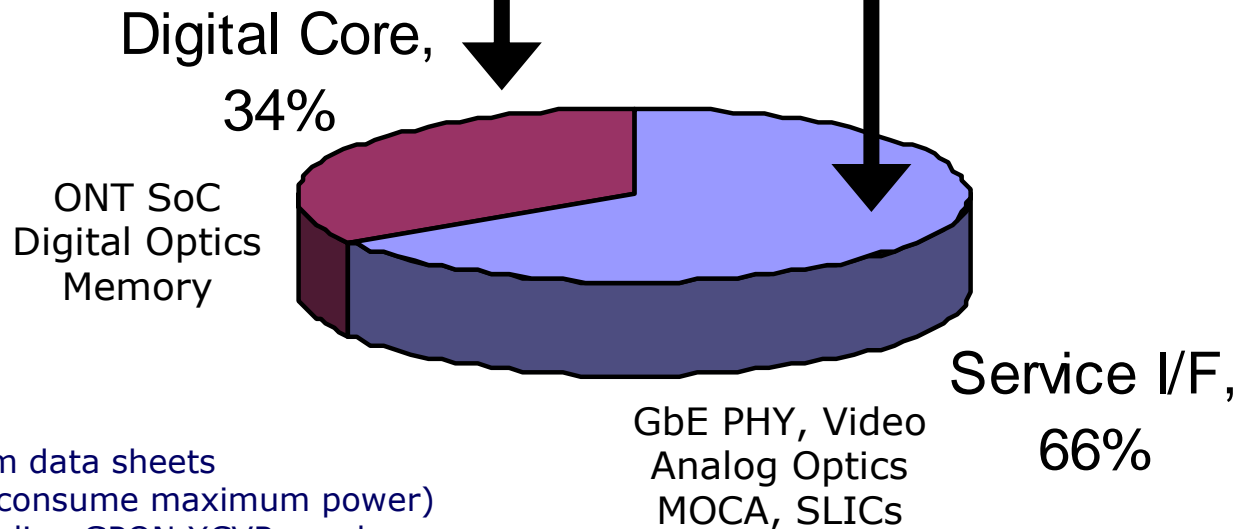
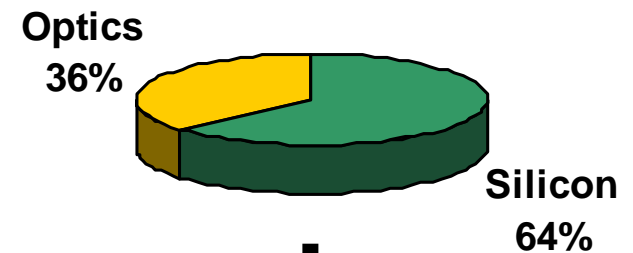
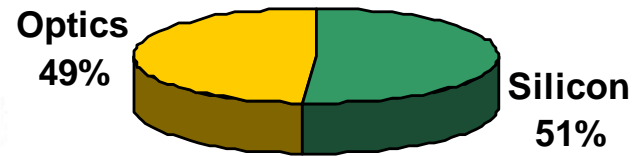
**Dave Hood – Ericsson
Denis Khotimsky - Motorola
Frank Effenberger - Huawei
Dan Parsons – BroadLight
Eli Elmoalem - BroadLight**

**ITU Q2/SG15
Stockholm, June 2008**

Purpose

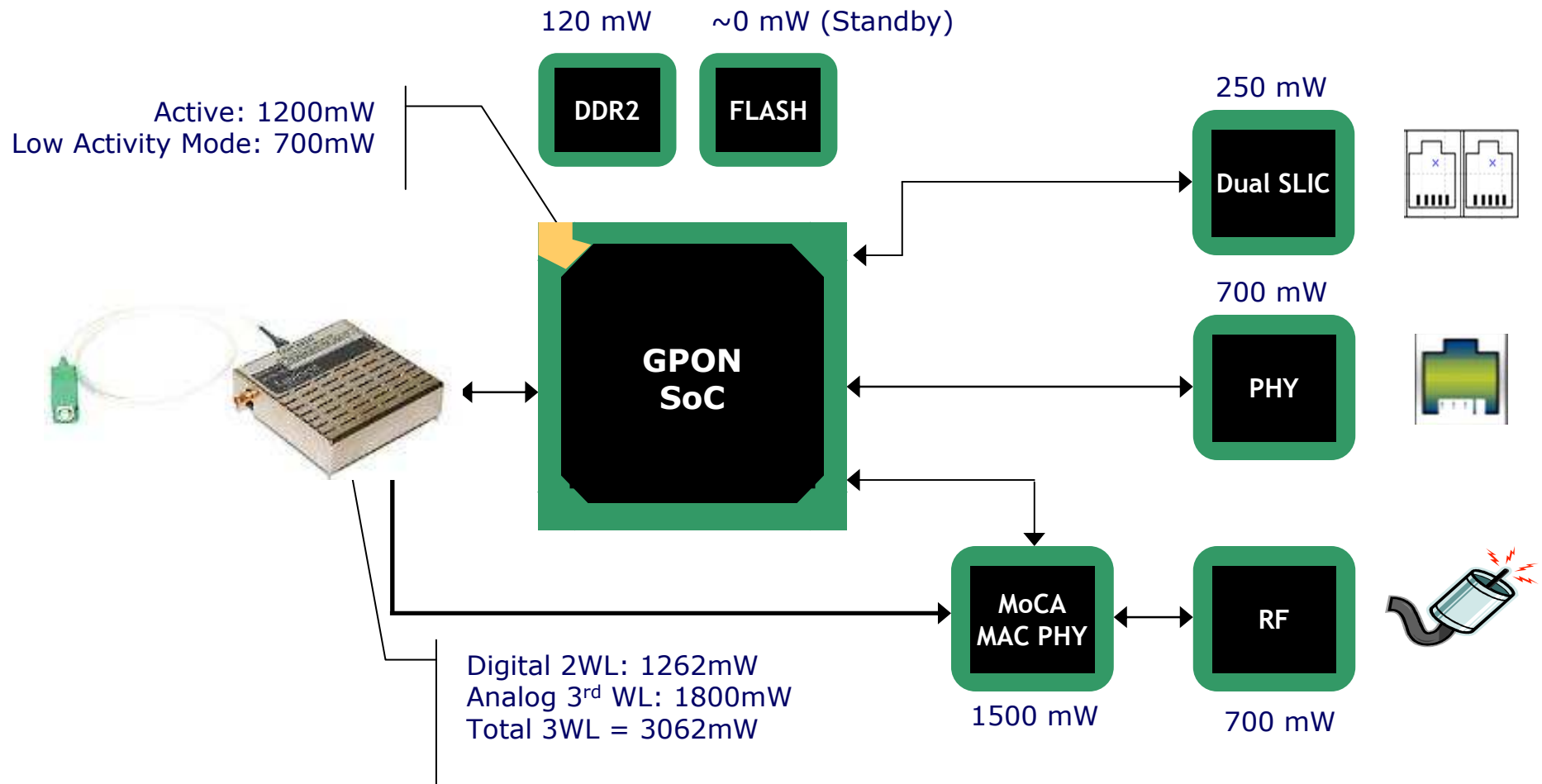
- Quantify power shedding using current technology for NA ONT application
- Quantify ONT battery requirements using power shedding
- Identify impact to G.984.x
- Outline power saving technology trends

NA ONT Power Consumption Profile



Maximum power consumption from data sheets
 (Unlikely that all components will consume maximum power)
 Average of Max powers from 3 leading GPON XCVR vendor

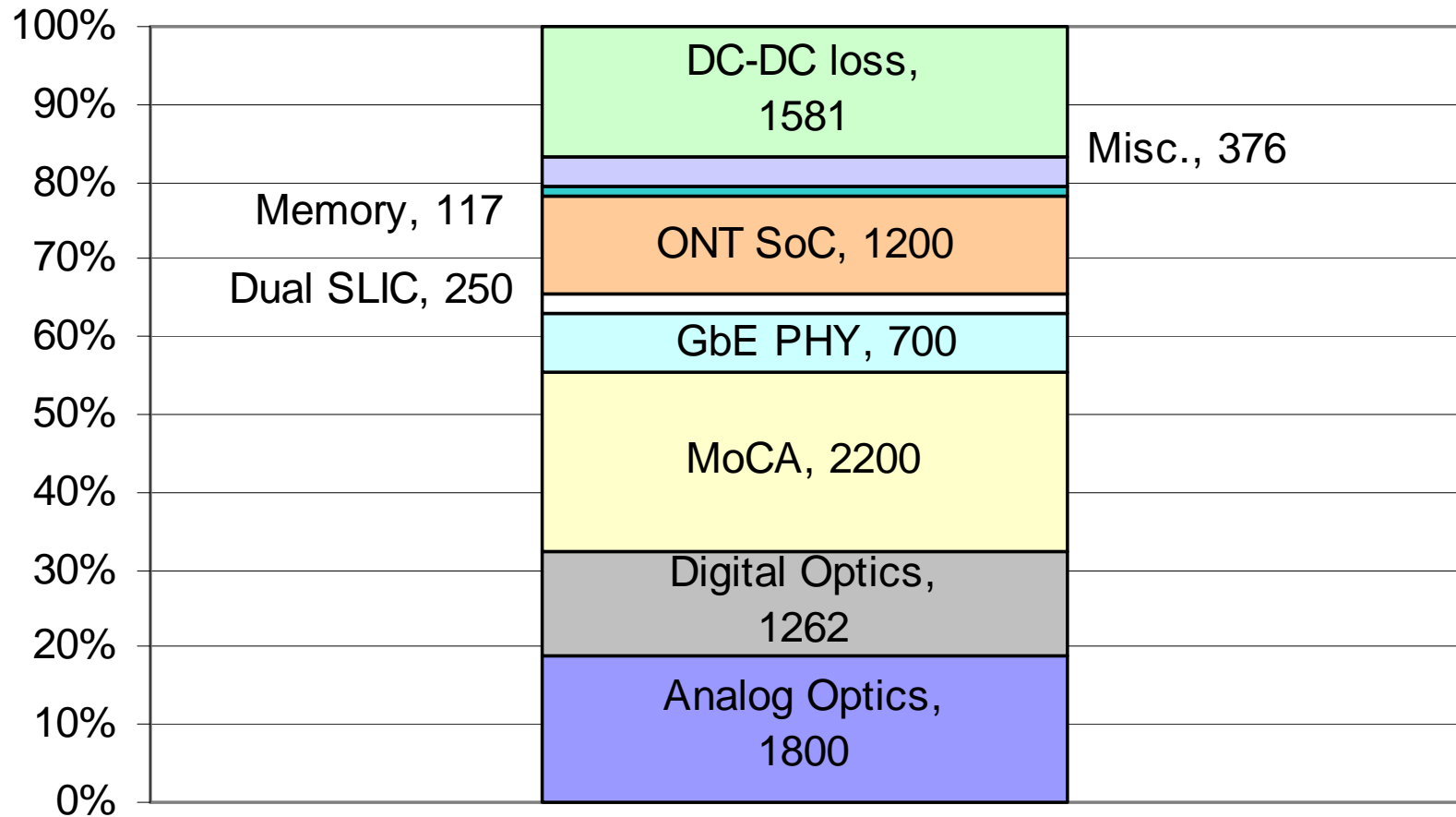
NA ONT Key Components



Maximum power consumption from data sheets.

Power Profile of Key Components

Active NA ONT Total = 9487mW



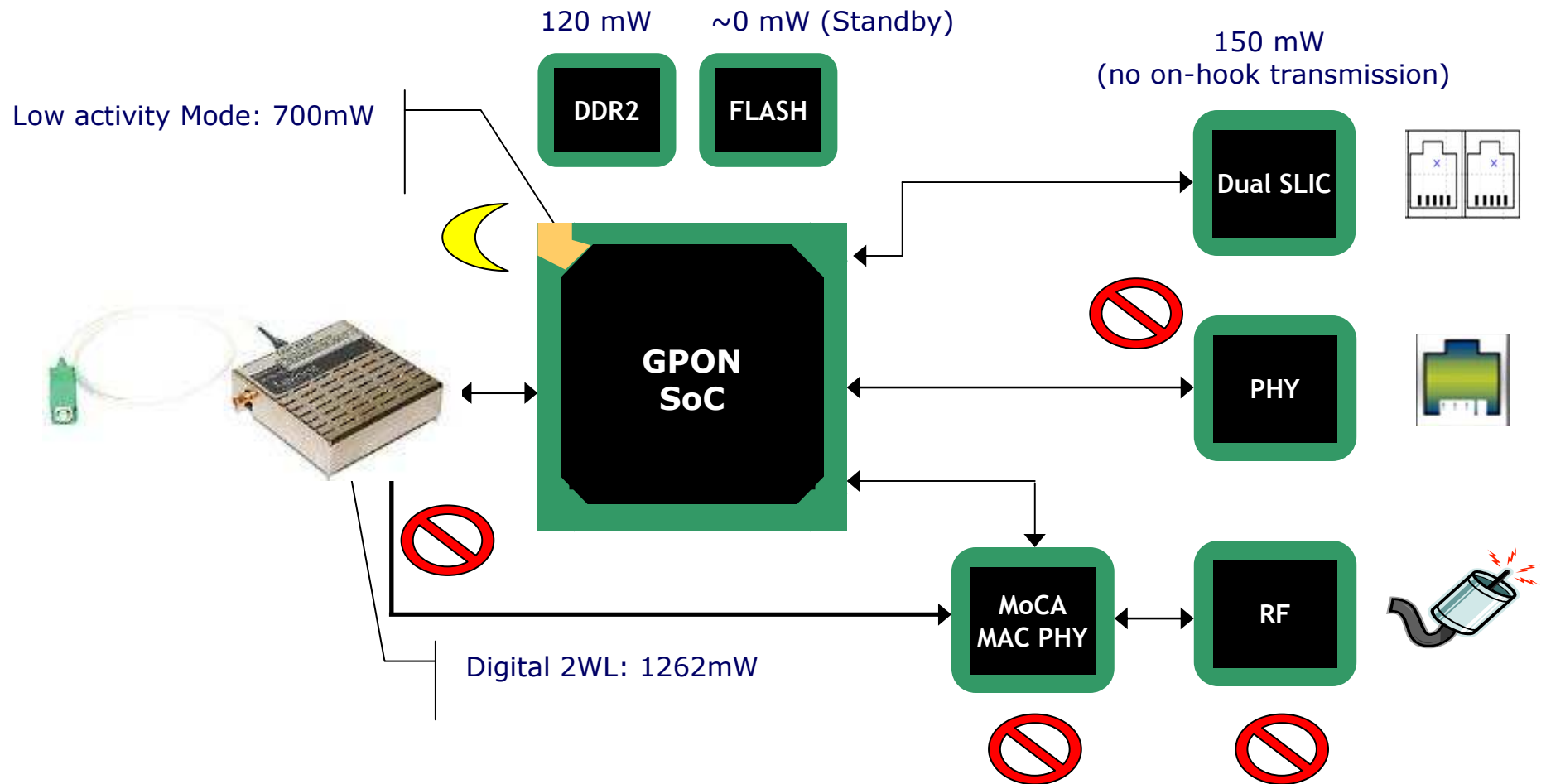
Maximum power consumption from data sheets

Unlikely that all components will exhibit maximum power in one ONT

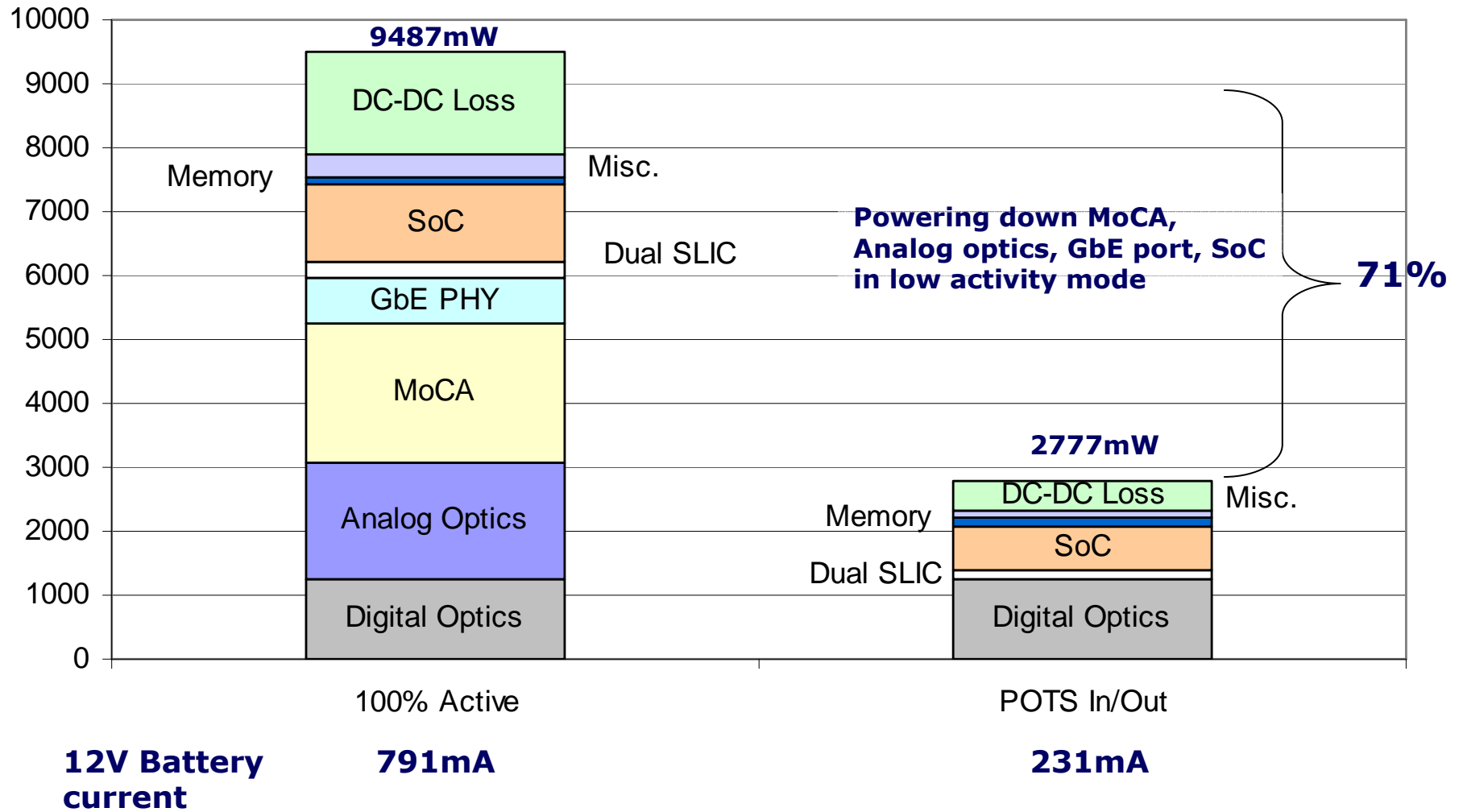
Average of Max powers from 3 leading GPON XCVR vendor

DC-DC efficiency 80%

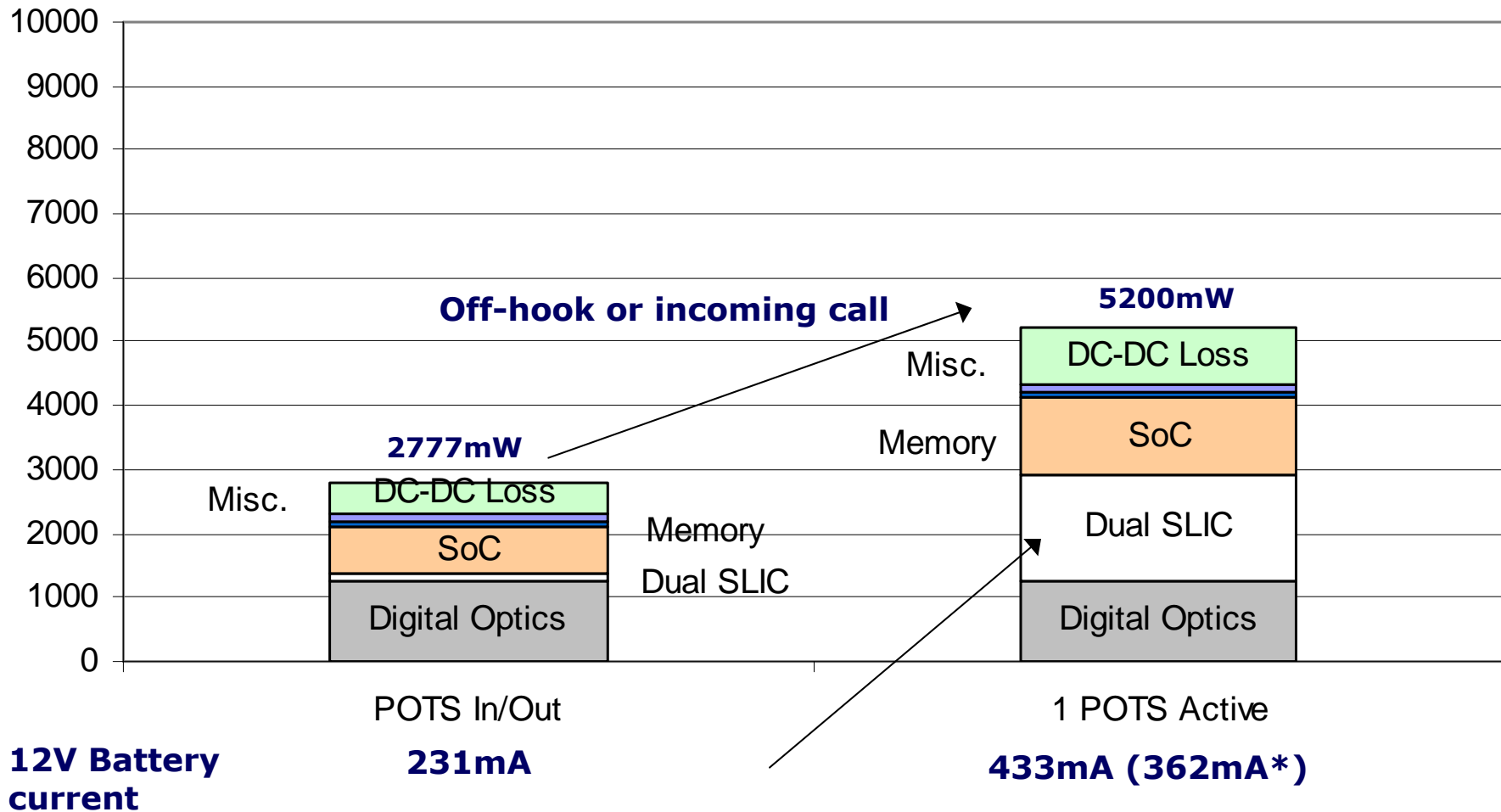
NA ONT Power Shedding for Lifeline POTS



Power Saving Options Summary



Low-Activity to One Active POTS Profile



One port of Dual SLIC active. Includes 25mA loop current from internally generated 48V into 600 ohm load

*** Current for 24V battery feed and 20mA loop current.**

ONT Battery Conservation

Battery size for 8 hrs operation considering:

Talk time with 48Vbat and 25mA loop current

No Delay in implementing power shedding

Talk min/hr	6	15	30	45
Power Shed	0	0	0	0
Delay (min)	0	0	0	0
Battery (Ah)	2.02	2.26	2.67	3.07

Phone @ 24Vbat, 20mA loop current	1.96	2.12	2.38	2.64
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Fixed battery size of 3.6Ah for 8 hrs operation considering:

Talk time with 48Vbat and 25mA loop current

Delay in implementing power shedding

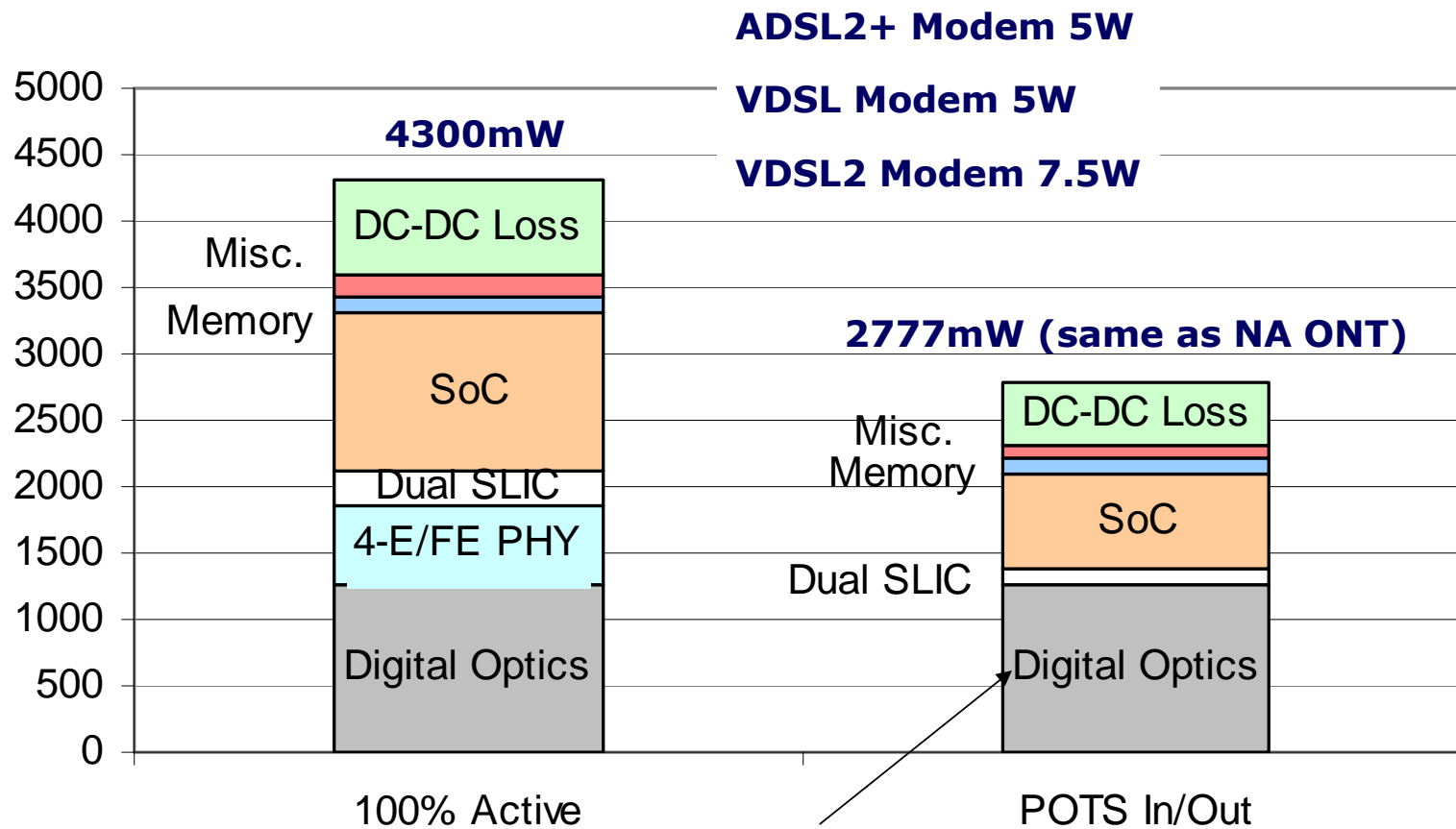
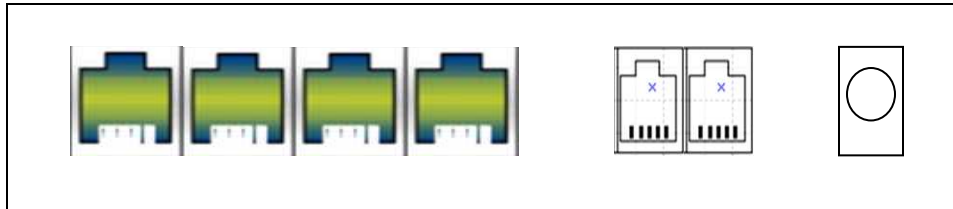
Talk min/hr	6	15	30	45
Power Shed	15	12 /14*	8/11*	5 /9*
Delay (min)	15	12 /14*	8/11*	5 /9*
Battery (Ah)	3.6	3.53	3.51	3.6

* Phone @24Vbat, 20mA loop current

EU Style ONT Power Comparison

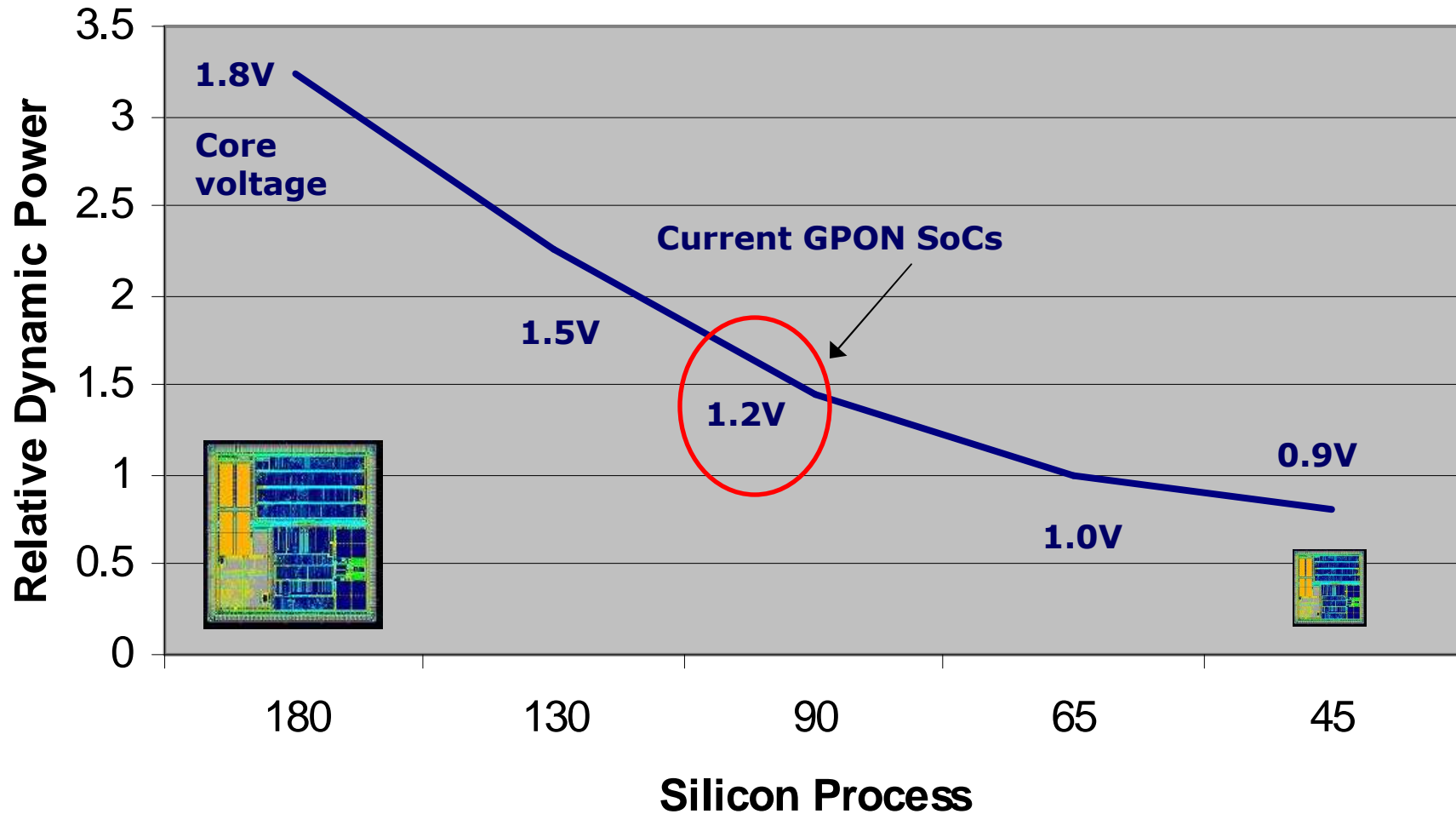
4 E/FE

2 POTS



PX-10 EPON, Class A/B and Class B+ have same power consumption

Silicon Process Power Impact



Dynamic power \sim freq x capacitance x voltage²

GPON ONT SoC Power Reduction Options

- o Powering down sections of chip not in use
 - o Maintain GPON TC layer operation
- o Reducing clock speed during low-activity
 - o Dynamic power $\sim \text{freq} \times \text{capacitance} \times \text{voltage}^2$
 - o Can reduce power by 50% of digital sub-units
 - o Processing speed not necessary during low-activity
- o Further integration may reduce overhead circuitry otherwise require in separate chips
 - o Common memory usage, power converters, I/O lines, etc.

Voice - Real Power-Savings Opportunity

- o Traditional POTS phone - 100 yr old legacy
 - o On-hook voltage $>24V^*$
 - o Off-hook current $>20mA \sim >0.5W(1.2W, 48V@25mA)$
 - o High voltage ringing ($>40V_{rms}$) into 5 REN load
 - o Backup battery typically 3.6 or 7.2 Ah, with corresponding charging capacity and wiring
- o Compare cell phone power consumption
 - o 3.7W, 900mAh battery
 - o On-hook/standby – 10mW (3mA) draw, 300h standby
 - o Off-hook/talk – 800mW (225mA) draw, 4h talk time

* Typical numbers, may vary from one operator to another

Lifeline POTS Possibilities

- o We are in the process of obsoleting millions (billions?) of analog television sets
- o Could we obsolete legacy telephone sets?
- o Offer “free” replacement phones as part of a green FITL upgrade?
 - o DECT 6.0 phone base station in the ONT
 - o Commercially available DECT 6.0 handsets
 - o 9h talk time (16 day standby)
 - o Commercially available DECT base station single chip ICs
 - o Or, a little adapter kit that translates energy-efficient FITL telephony to old-style POTS?

Tele - (word root: remote)

- o Telecommuting

- o Per week: one tank of petrol for commuting vs ONT power + PC power (even 24x7)

- o Teleconferencing

- o Compare travel to FSAN-ITU meetings to potential teleconference energy use

- o Our companies are doing it – why not ourselves?

Summary

- o No impact to G.984.x
- o Power shedding can save >70% of active ONT power
 - o Technique commonly used throughout industries – laptop PCs, PC monitors, cell phones
- o North American ONT battery size can be reduced by >50% with currently available technology
- o Future SoC semiconductor technology and low-activity functions will reduce power even further
- o Options available for lower power voice service