Core, edge and access IP routers are the main focus of the current activity. All the three global standards of energy efficiency for IP equipments from ETSI/ITU/ATIS [1, 2, and 3] and the ECR Initiative document [5] are applicable to this class of equipments. They agree to the general definition of energy efficiency of telecommunication equipments that is the aggregate throughput achieved per unit power consumed (ECR initiative uses the inverse metric i.e., energy consumed per bit). However, the formulation of metric, specifics of the measurement method and reporting format are the areas where these standards diverge. In particular, for the following reasons, the ITU specification L.1310 “Energy efficiency metrics and measurement for telecommunication equipment” [2] may be considered most appropriate for the current requirement of defining technical specification for energy efficiency of IP router equipments.

1. Metric Definition

All the three energy efficiency standards [1, 2 and 3] detail the weight multipliers to variable throughput levels required to compute the energy efficiency ratio as per defined formulae. However, the ECR document does not specify the weight multipliers within the document and leaves it open for vendors to choose.

Only ITU specification considers routers and switches supporting sleep (stand by) mode in its proposed EER metric. The specification also provides weight multipliers proportional to the utilization of the equipments in these sleep (stand by) modes. Other metrics (ATIS-TEER, ETSI-EEER and ECR Initiative) do not consider these low power sleep modes.

Another difference is the recognition of the fact that advances in hardware and system software of routers now allows them to dynamically switch their power states. Power state is a mode of operation with reduced performance and reduced energy consumption. Power state is a static, not a traffic dependent, mode of operation. Transition between power states is not instant and may incur a delay, during which excess traffic might be lost. The ITU specification defines method to compute energy efficiency of the equipment at different power states.

2. Metrics and equipment modularity

All the four specifications [1, 2, 3 and 5] address equipment modularity. In case of modular equipments, the metrics shall be reported along with the configuration used. For comparison
purposes, equipments with similar configurations need to be considered. However, all the three specifications [1, 2 and 3] agree that EER determined by a real measure on a defined equipment configuration takes precedence over the EER calculated with the modular/alternative method. The modular/alternative measurement method can only help the vendor reduce the number of traffic generators and service boards required and can extrapolate the power consumption of any configuration. Hence, it is recommended that the metrics for modular telecommunication systems shall be obtained using the most usual set-up and pre-defined configurations. The ITU specification does refer to the modular method defined in ATIS [3] and ETSI [1] in case such a measurement is essential.

3. Measurement procedure
The ECR document [5] specifies that prior to the actual test; the System Under Test (SUT) has to be exposed to environmental conditions for at least four hours to settle the potential temperature difference. System stabilization time of 4 hrs is too long as compared to other standards [1, 2, 3] that specify a short period of up to 20 minutes.

4. Traffic Profile
The ECR document [5] specifies a common test traffic model of Simple IMIX average of 340 Bytes size packets considered for all equipments and all states. This is too simplistic model. The ETSI and ATIS [1, 3] standards specify the detailed Simple IMIX model along with the packet sizes and their proportion of total traffic. Also, the ITU specification [2] endorses the ATIS standard for Simple IMIX test traffic model.

5. Reporting Format
ITU specification recommends ISO/IEC 17025 General requirements for the competence of testing and calibration laboratories [4] as a general basis for reports along with minimum requirement for content of the test reports. However, this recommendation as well as the ECR document [5] does not endorse a specific reporting format. The ATIS [3] lists out a similar list of minimum requirements, but the ETSI specification [1] does not contain any section on reports.

Reference:
1. ETSI ES 203 136 V1.0.0 (2013-03) Environmental Engineering (EE); Measurement methods for energy efficiency of router and switch equipment
2. ITU recommendation: L.1310; (11/2012); Energy efficiency metrics and measurement for telecommunication equipment
3. ATIS-0600015.03.2009; (07/2009); Energy efficiency for telecommunication equipment: Methodology for measurement and reporting for router and Ethernet switch products
4. ISO/IEC 17025:2005, General requirements for the competence of testing and calibration laboratories