

ETSI TS 102 706 V1.2.1 (2011-10)



Environmental Engineering (EE) Measurement Method for Energy Efficiency of Wireless Access Network Equipment

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Reference

RTS/EE-00022

Keywords

radio, network, GSM, LTE, WCDMA

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Foreword

This Technical Specification (TS) has been produced by ETSI Technical Committee Environmental Engineering (EE).

Introduction

Energy efficiency is one critical factor of modern telecommunication systems. The energy consumption of the access network is the dominating part of the wireless telecom network energy consumption. Hence the Core Network and Service Networks are not considered in the first version of the present document. In the Access Network, the power consumption of the Radio Base Station node sites (later referred as RBS sites) is dominating and the power consumption of Radio Network Control nodes (RNC or BSC) are not considered in the present document.

The present document defines harmonized methods to evaluate the energy efficiency of wireless access networks. In order to do that, the present document provides definitions for the following indicators:

- Average power consumption of RBS equipment in clause 5.1: The RBS average power consumption is based on measured RBS power consumption under reference configuration, reference environment and under reference load levels.
- Average power consumption of RBS site in clause 5.2: The RBS site level power consumption is calculated based on RBS equipment power consumption for reference RBS site configuration using correction factors for different power supply, cooling and site solutions.
- Performance indicators for network level energy efficiency for wireless systems in clause 5.3: The network level performance indicators are calculated based on RBS site level reference power consumption as well as based on RBS coverage area for rural area and RBS capacity for urban area.

1 Scope

The present document defines a method to analyse the energy efficiency of wireless access network equipment.

The present document version covers following radio access technologies:

- GSM
- LTE
- WCDMA
- WiMAX™

As the RBS power consumption is the dominant part of total power consumption of wireless access network, the present document covers methods which takes into account only the RBS site power consumption when defining the total power consumption of wireless access networks. In the dynamic measurement, functionalities located in RNC or BSC node, which may have a significant impact on power consumption of base station nodes, are also considered.

The methodology described in the present document to measure energy efficiency consists of two parts. Within the present document they are referred to as static and dynamic measurements.

The results based on "static" measurements of the RBS power consumption provide a power consumption figure for RBS under static load and without radio network features activated. The results based on "dynamic" measurements of the RBS power consumption provide a power consumption figure for RBS with dynamic load and with radio network features activated, i.e. including the functionalities located in the radio network controller e.g. BSC/RNC.

Energy consumption of terminal (end-user) equipment is outside the scope of the present document.

The scope of the present document is not to define target limits for the energy efficiency of equipment or networks.

The results should only be used to assess and compare the efficiency of mobile radio network equipment from different vendors featuring the same mobile radio standard and frequency band.

The present document does not cover multi RAT. Only Wide Area Base Stations are covered in this version. Other type of RBS will be considered in a future version of the present document.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

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2.1 Normative references

The following referenced documents are necessary for the application of the present document.

- [1] ETSI TS 145 005: "Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (3GPP TS 45.005 Release 8)".
- [2] ETSI TS 125 104: "Universal Mobile Telecommunications System (UMTS); Base Station (BS) radio transmission and reception (FDD) (3GPP TS 25.104 Release 8)".

- [3] CENELEC EN 50160: "Voltage characteristics of electricity supplied by public electricity networks".
- [4] ETSI EN 300 132-2: "Environmental Engineering (EE); Power supply interface at the input to telecommunications and datacom (ICT) equipment; Part 2: Operated by -48 V direct current (dc)".
- [5] ISO/IEC 17025: "General requirements for the competence of testing and calibration laboratories".
- [6] ETSI TS 151 021: "Digital cellular telecommunications system (Phase 2+); Base Station System (BSS) equipment specification; Radio aspects (3GPP TS 51.021 Release 8)".
- [7] ETSI TS 125 141 (V8.3.0): "Universal Mobile Telecommunications System (UMTS); Base Station (BS) conformance testing (FDD) (3GPP TS 25.141 version 8.3.0 Release 8)".
- [8] ETSI TS 125 101: "Universal Mobile Telecommunications System (UMTS); User Equipment (UE) radio transmission and reception (FDD) (3GPP TS 25.101)".
- [9] ETSI TS 136 101: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); User Equipment (UE) radio transmission and reception (3GPP TS 36.101)".
- [10] ETSI TS 136 211: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Physical channels and modulation (3GPP TS 36.211)".
- [11] ETSI TS 136 141 (V8.6.0): "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing (3GPP TS 36.141 version 8.6.0 Release 8)".
- [12] ETSI TS 136 104: "LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) radio transmission and reception (3GPP TS 36.104)".
- [13] IEEE 802.16e: "IEEE Standard for Local and metropolitan area networks Part 16: Air Interface for Fixed and Mobile Broadband Wireless Access Systems Amendment for Physical and Medium Access Control Layers for Combined Fixed and Mobile Operation in Licensed Bands".

NOTE: WiMAX Technologies and Standards.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

- [i.1] NIST Technical Note 1297: "Guidance for evaluating and expressing the uncertainty of NIST measurement results".
- [i.2] ISO/IEC Guide 98: 1995: "Guide to the expression of uncertainty in measurement (GUM)".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

activity level: traffic model in dynamic measurement is divided into three activity levels corresponding to low-, medium- and busy hour traffic

activity time: time to generate data from the server to at least one UE (in the scenario for dynamic measurement this corresponds to the transmission time for the UE group with highest path loss)

busy hour: period during which occurs the maximum total load in a given 24-hour period

busy hour load: in static measurement it is the highest measurement level of radio resource configuration and in dynamic measurement is the highest activity level