

ETSI TR 101 534 V1.1.1 (2012-03)



**Broadband Radio Access Networks (BRAN);
Very high capacity density BWA networks;
System architecture, economic model and
derivation of technical requirements**

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Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Broadband Radio Access Networks (BRAN).

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1 Scope

The present document addresses the architecture, the economic model and the derivation of technical requirements for a BWA system, providing 1 Gbit/s/km², using 40 MHz of licensed spectrum and including self-backhauling in both licensed and un-licensed bands, network MIMO, cognitive-radio based self-organization, etc.

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.

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2.1 Normative references

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

Not applicable.

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] ETSI TR 125 942 (2009): "Universal Mobile Telecommunications System (UMTS); Radio Frequency (RF) system scenarios (3GPP TR 25.942 version 9.0.0)".
- [i.2] A. Papadogiannis and A. G. Burr: "Multi-beam Assisted MIMO - A Novel Approach to Fixed Beamforming", Future Network and Mobile Summit (FNMS 2011), Warsaw, Poland, June 2011.
- [i.3] UMTS Forum: "Mobile Broadband Evolution: the roadmap from HSPA to LTE", Feb., 2009.
- [i.4] FCC: "Notice of Proposed Rule Making and Order," ET Docket No 03-222, 2003.
- [i.5] F. Akyildiz, et al.: "Next generation/dynamic spectrum access/cognitive radio wireless networks: A survey", Computer Networks, vol. 50, pp. 2127-2159, Sep, 2006.
- [i.6] J. Mitola: "Cognitive Radio Architecture: The Engineering Foundations of Radio XML", 2006.
- [i.7] J. Mitola and G. Maguire: "Cognitive radio: making software radios more personal", IEEE Personal Communication, vol. 6, pp. 13-18, Aug, 1999.
- [i.8] R. S. Sutton and A. G. Barto: "Reinforcement learning : An Introduction: The MIT Press", 1998.
- [i.9] Farahmand, A.-M.: "Interaction of culture-based learning and cooperative co-evolution and its application to automatic behavior-based system design", Evolutionary Computation, IEEE Transactions on, vol. 14, pp. 23 -57, Feb. 2010.
- [i.10] Ahmadabadi, M.N., et al: "Expertness measuring in cooperative learning", vol. 3, pp. 2261 -2267 vol.3, 2000.
- [i.11] Mischa Dohler: "Docitive Radios - Centroid of Cognition and Cooperation", Keynote, WWRF23, October 2009, Beijing, China.

- [i.12] Mischa Dohler: "Docitive Networks - A Step Beyond Cognition", Keynote, ISABEL 2009, November 2009, Bratislava, Slovakia.
- [i.13] Mischa Dohler, L. Giupponi, A. Galindo-Serrano, P. Blasco: "Docitive Networks: A Novel Framework Beyond Cognition", IEEE Communications Society, Multimedia Communications TC, E-Letter, January 2010.
- [i.14] ITU-R Recommendation P.530-12: "Propagation data and prediction methods required for the design of terrestrial line-of-sight systems".
- [i.15] P. Blasco, L. Giupponi, A. Galindo, M. Dohler: "Aggressive Joint Access & Backhaul Design For Distributed-Cognition 1Gbps/km2 System Architecture", in Proceedings of 8th International Conference on Wired/Wireless Internet Communications (WWIC 2010), 1-3 June, 2010, Lulea (Sweden).
- [i.16] BuNGee deliverable D3.1: "Baseline RRM & Joint Access/Self-Backhaul Protocols".

3 Definitions and abbreviations

3.1 Definitions

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

Adaptive Antenna System (AAS): system adaptively exploiting more than one antenna to improve the coverage and the system capacity

self-backhauling: wireless links between HBS and ABS, which may share a frequency channel with the access operation (in-band) and use in addition license-exempt spectrum, as 5 GHz or 60 GHz bands (out-of-band)

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

4G	4th Generation
AAA	Authentication, Authorization, and Accounting
ABS	Access BS
ACK	Acknowledge
ADC	Analogue To Digital Converter
AP	Access Point
ART	Above Roof Top
ASN	Access Service Network
BCC	BWA Control Channel
BER	Bit Error Rate
BF	Beam Forming
BM	Buttler Matrix
BRT	Below Roof Top
BS	Base Station
BS-BS	Base Station to Base Station
BW	Bandwidth
BWA user	Fixed, Nomadic or Mobile user
BWA	Broadband Wireless Access
CAPEX	Capital Expenditure
CAPEX	Capital Expenditure
CINR	Carrier to Interference and Noise Ratio
CQI	Channel Quality Indicator
CR	Cognitive Radio
CSI	Channel State Information
CTC	Clear Timer on Compare
DCO	Direct Communication Operation