

Modern Wireless Network Technologies

Necessary knowledge:

1. Circuits and Signals
2. Principles of Telecommunication
3. Signal Processing
4. Telecommunication Nets and Systems
5. Theory of Electromagnetic Field
6. Coding and Transmission of Signals
7. High Frequency Technique

Outline

- An introduction. The classification of wireless networks (WWAN, WMAN, WLAN, WPAN). The model of the wireless data transfer system.
- Propagation of the electromagnetic waves. Bands of radio frequency.
- The models of the propagation. Attenuation and disappearances of the signals and the methods of minimizing their effect.
- Principle of operation and basic parameters of the antennas.
- Techniques of transmitting and receiving.
- Spread Spectrum techniques (FHSS, DSSS) and CDMA.
- OFDM wireless systems.
- MIMO wireless systems.
- WPAN (Bluetooth, ZigBee, Ultra Wideband)
- WLAN (IEEE 802.11a,b,e,g,n)
- WMAN (WiMAX)
- WWAN (GPRS, UMTS, EDGE, GSM, LTE, 4G)
- The future of wireless data transfer systems (5G)

References

1. J. L. Brubank, J. Andrusenko, J. S. Everett, W. T. M. Katsch – *Wireless Networking. Understanding Internetworking Challenges*. IEEE Press 2013.
2. E. Dahlman, S. Parkval, J. Sköld - *5G NR: The Next Generation Access Technology*. Elsevier, 2018.
3. C. Cox – *An Introduction to LTE. LTE, LTE Advanced, SAE, VoLTE, and 4G Mobile Communications*. 2nd Ed. Wiley, 2014.
4. S. Ahmadi – *LTE Advanced. A Practical Systems Approach to Understanding the 3GPP LTE Releases 10 And 11 Radio Access Technologies*. Elsevier 2014.
5. S. Gligic, B. Lorenzo – *Advanced Wireless Networks. Cognitive, Cooperative and Opportunistic 4G Technology*. Wiley & Sons, 2014.
6. H. Holma, A. Toskala – *LTE For UMTS, OFDMA and SC-FDMA Based Radio Access*. Wiley, 2009.

Features of wireless networks:

- Mobility
- Ability to quickly create ad hoc
- Quickly implementation of the network
- Possibility of installation in parks, airports, etc.
- Any network architecture

Disadvantages :

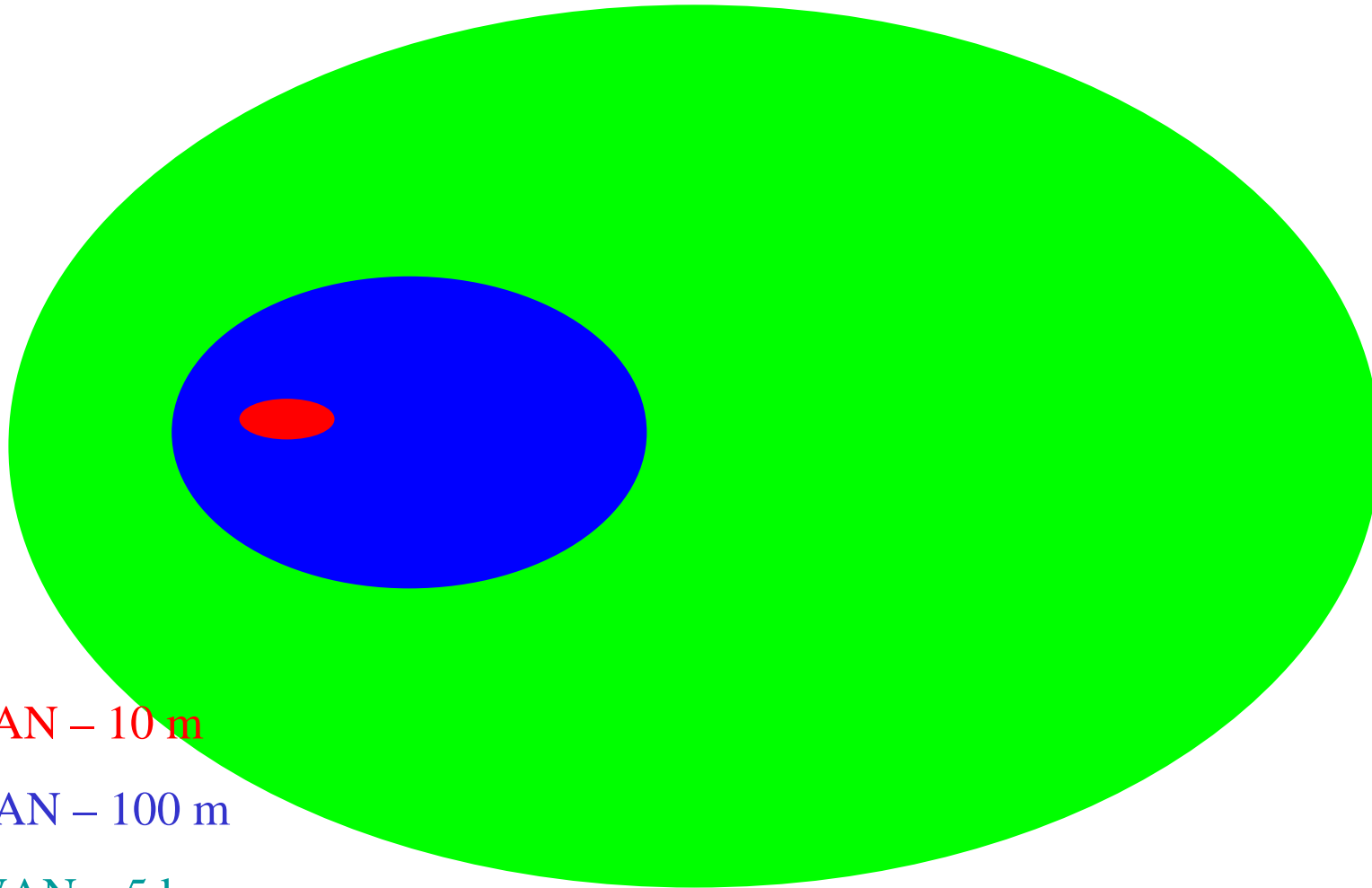
- Less transfer data rate
- Less security (additional protections decreasing data transfer rate)
- Limited number of networks inside the given area
- More expensive devices in comparison to wire networks
- Less noise immunity
- Transfer data rate depends on the distance between transmitting devices

Future :

- Security
- QoS
- mobility

Technologies of wireless networks

WWAN	WMAN	WPAN	WWAN/ WMAN
GSM/GPRS EDGE UMTS → HSPA → HSPA+ LTE, LTE-A	802.16 (FWA- Fixed Wireless Access) – WiMax 802.20 (Mobile Broadband WA – MBWA)	IEEE 802.11 (WiFi) HIPERLAN	IEEE 802.15 Bluetooth HIPERPAN



WPAN – 10 m

WLAN – 100 m

WWAN – 5 km

Scheme of digital telecommunication system

