

# EMSMN Lab. 4 – report

## IEEE 802.11 Network (WiFi)

Student 1: Abel Niwiński Date: 07.06.2022

Student 2: Sławomir Batruch

Student 3: Bryan Duque

### Spectrum Monitoring

Is 2.4 GHz frequency band crowded? Please justify:

TP-LINK\_AP\_4FB019, pass: zabazaba ; Yes it is, because there 13 channels, and maximum of 4 devices can use bandwidth without interfering with each other.

Wifi manager shows that are at least 6 different devices on 2.4 GHz bandwidth

### Investigation of wireless connection to the Internet

Standard	Channel number	Centre frequency (MHz)	Channel width (MHz)	Theoretical data rate		Measured data rate	
				TX (Mb/s)	RX (Mb/s)	DL (Mb/s)	UL (Mb/s)
802.11b	8	2447	20	11	11	3.49	4.75
802.11g	8	2447	20	54	54	16.34	18.43
802.11n	8	2447	20	144.5	144.5	80.56	28.94
802.11n	8	2447	40	300	300	92.54	25.15

The main features applied in PHY layer to increase throughput are:

802.11b HR/DSSS which uses complementary code keying

802.11g ERP-OFDM – 64-QAM modulation

802.11n HT-OFDM – Using MIMO

### Investigation of wireless connection between devices in a local network

Standard	Channel number	Frequency (MHz)	Channel width (MHz)	Measured data rate	
				Location 1 [1 m] (Mb/s)	Location 2 [3m] (Mb/s)
802.11b	8	2447	20	3.1	3.1
802.11g	8	2447	20	5.25	5.25
802.11n	8	2447	20	23.1	24.2
802.11n	8	2447	40	32.1	33.6

#### Conclusions:

Slower standards are more stable. There is no difference between data rate when the distance is changed. For faster standards it would appear that the farther is better. However the truth is that being very close to the router lowers the data transfer rate.

---

Standards 802.11b and 802.11g appear to have higher UL speed than DL speed. Although the difference is small, this result was unexpected. However our expectations were met with the examination of standard 802.11n in which DL was more than 3 times faster than UL.

---

Even though the used bandwidth in 802.11n can be either 20MHz or 40MHz, the throughput is similar because of the Shanon's formula.  $C = B \cdot \log_2(1 + S/N)$  where  $N = 10 \log(kTB)$ , the noise is increasing, therefore the SNR is decreasing.

---