Radio

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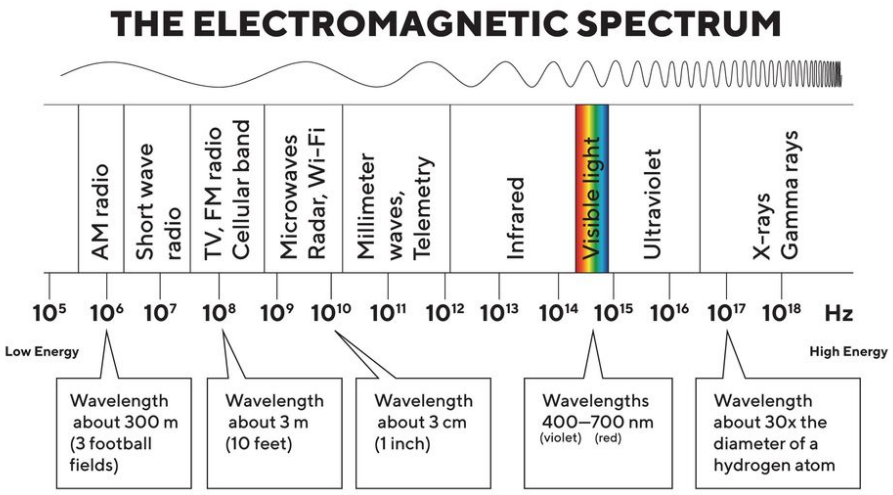
Contents

How is wireless communication done?

The terms “radio” and “radio waves” are mismatched these days; in the past a certain range of electromagnetic frequencies was used for radio transmission. In old mobile communication systems, the same frequencies where used. In modern mobile communications a much bigger range of frequencies is used; 5G uses microwaves and millimeter waves. In fact, it is anticipated that 6G will use infrared and visible waves.



The frequencies bands for 5G are listed below. Duplexing is the method of separating uplink and downlink data. For frequency division duplex (FDD) different frequencies are used for uplink and downlink, as you can see. This allows the same antenna to be a transmitter and a receiver. For time division duplexing, the antenna acts as a transmitter for a short period of time, then acts as a receiver for a short period of time. Some bands are designated as supplementary uplink or downlink (SUL, SDL).

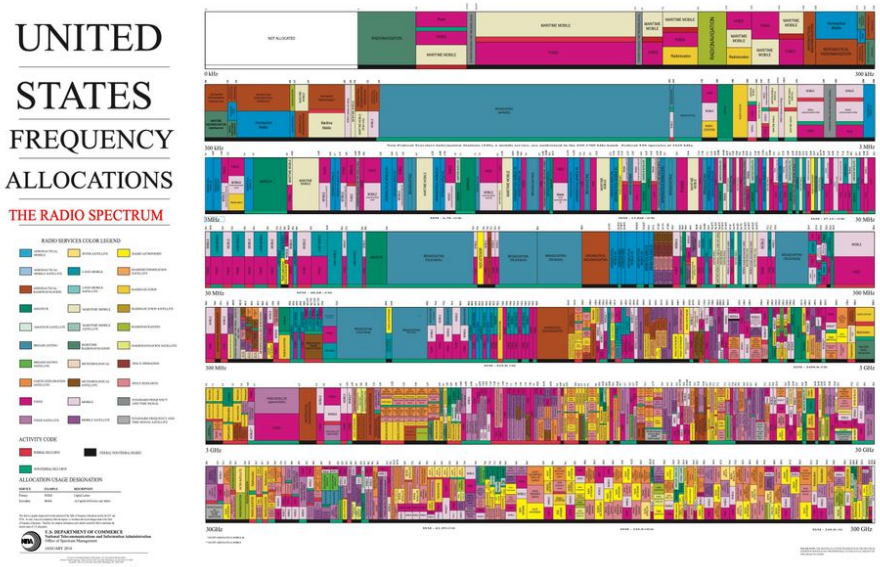
FREQUENCY BAND	UPLINK	DOWNLINK	DUPLEX MODE
n1	1920-1980 MHz	2110-2170 MHz	FDD
n2	1850-1910 MHz	1930-1990 MHz	FDD
n3	1710-1785 MHz	1805-1880 MHz	FDD
n5	824-849 MHz	869-894 MHz	FDD
n7	2500-2570 MHz	2620-2690 MHz	FDD
n8	880-915 MHz	925-960 MHz	FDD
n12	699-716 MHz	729-746 MHz	FDD
n20	832-862 MHz	791-821 MHz	FDD
n25	1850-1915 MHz	1930-1995 MHz	FDD
n28	703-748 MHz	758-803 MHz	FDD
n34	2010-2025 MHz	2010-2025 MHz	TDD
n38	2570-2620 MHz	2570-2620 MHz	TDD
n39	1880-1920 MHz	1880-1920 MHz	TDD
n40	2300-2400 MHz	2300-2400 MHz	TDD
n41	2496-2690 MHz	2496-2690 MHz	TDD
n50	1432-1517 MHz	1432-1517 MHz	TDD
n51	1427-1432 MHz	1427-1432 MHz	TDD
n66	1710-1780 MHz	2110-2200 MHz	FDD
n70	1695-1710 MHz	1995-2020 MHz	FDD
n71	663-698 MHz	617-652 MHz	FDD
n74	1427-1470 MHz	1475-1518 MHz	FDD
n75		1432-1517 MHz	SDL
n76		1427-1432 MHz	SDL
n77	3.3-4.2 GHz	3.3-4.2 GHz	TDD
n78	3.3-3.8 GHz	3.3-3.8 GHz	TDD
n79	4.4-5.0 GHz	4.4-5.0 GHz	TDD
n80	1710-1785 MHz		SUL
n81	880-915 MHz		SUL
n82	832-862 MHz		SUL
n83	703-748 MHz		SUL
n84	1920-1980 MHz		SUL
n86	1710-1780 MHz		SUL

Fig. 3.44 Supported NR frequency bands in frequency range 1.

FREQUENCY BAND	UPLINK	DOWNLINK	DUPLEX MODE
n257	26.5-29.5 GHz	26.5-29.5 GHz	TDD
n258	24.25-27.5 GHz	24.25-27.5 GHz	TDD
n260	37-40 GHz	37-40 GHz	TDD
n261	27.5-28.35 GHz	27.5-28.35 GHz	TDD

Fig. 3.45 Supported NR frequency bands in frequency range 2.

These bands are just some of the electromagnetic spectrum used for communication. The use of electromagnetic spectrum is regulated, as you see in the diagram below.



One very cool thing about the 4G to 5G transition is that 5G can use all of the frequencies that were set aside for 4G (and many others). This concept is called dynamic spectrum sharing (DSS).