The **Citizens Band Radio Service (CB)** is a private, two-way, short-distance voice communications service for personal or business activities of the general public, and for voice paging. It has 40 channels between 26.965 MHz and 27.405 MHz and a power output of 4 watts using Amplitude Modulation (AM) or 12 watts using Single Side Band (SSB). You are not supposed to talk with another station for more than 5 minutes continuously and then you must wait at least one minute before starting another communication. A CB transmitter must be type certified by the FCC and may not use an external amplifier nor have an antenna higher than 60 feet above the ground.

CB radio service was established by law in the U.S. in 1949. Then came popular during the oil crisis of 1973, when the U.S faced fuel shortages, gas station closures, and reduced speed limits nationwide. Commercial semi drivers began using CB radios to communicate which gas stations were open, where to avoid traffic jams and accidents, and how to avoid speed traps set up by local police.

Each CB channel is 10 kHz. *Channel 9 is reserved for emergency communications or for traveler assistance.

1) 26.965 2) 26.975 3) 26.985 4) 27.005 5) 27.015 6) 27.025 7) 27.035 8) 27.055 9) 27.065*
10) 27.075 11) 27.085 12) 27.105 13) 27.115 14) 27.125 15) 27.135 16) 27.155 17) 27.165 18) 27.175
19) 27.185 20) 27.205 21) 27.215 22) 27.225 23) 27.255 24) 27.235 25) 27.245 26) 27.265 27) 27.275
28) 27.285 29) 27.295 30) 27.305 31) 27.315 32) 27.325 33) 27.335 34) 27.345 35) 27.355 36) 27.365
37) 27.375 38) 27.385 39) 27.395 40) 27.405 Rule Part: 47 C.F.R, Part 95

The **Family Radio Service (FRS)** is a private, two-way, short-distance voice and data communications service for facilitating family and group activities. The most common use for FRS channels is short-distance, two-way voice communications using small hand-held radios that are similar to walkie-talkies. Established as the improved walkie-talkie radio system authorized in the United States since 1996. The service is licensed-by-rule so the general public can use the devices without having to obtain a license and channel sharing is achieved through a listen-before-talk etiquette. (The rule being they can't modify or change the device.)

The FRS is authorized 22 channels in the 462 MHz and 467 MHz range, all of which are shared with General Mobile Radio Service (GMRS) which requires an individual license for use. Each channel has a bandwidth of 12.5 kHz, but the power of each channel may vary.

Rule Part 47 C.F.R, Part 95

Channel No.	Frequency	Power (ERP in Watts)
1	462.5625	2 W
2	462.5875	2 W
3	462.6125	2 W
4	462.6375	2 W
5	462.6625	2 W
6	462.6875	2 W
7	462.7125	2 W
8	467.5625	0.5 W
9	467.5875	0.5 W
10	467.6125	0.5 W
11	467.6375	0.5 W

Channel No.	Frequency	Power (ERP in Watts)
12	467.6625	0.5 W
13	467.6875	0.5 W
14	467.7125	0.5 W
15	462.5500	2 W
16	462.5750	2 W
17	462.6000	2 W
18	462.6250	2 W
19	462.6500	2 W
20	462.6750	2 W
21	462.7000	2 W
22	462.7250	2 W

The **General Mobile Radio Service (GMRS)** is a licensed radio service that uses channels around 462 MHz and 467 MHz. The current GMRS service was established in 1987. The most common use of GMRS channels is for short-distance, two-way voice communications using hand-held radios, mobile radios and repeater systems. The FCC expanded GMRS to also allow short data messaging applications including text messaging and GPS location information. License cost is $35, no testing and lasts 10 years. There are 30 GMRS channels with a bandwidth of 25 kHz (20 KHz authorized bandwidth) or 12.5 kHz as outlined below: Rule Part 47 C.F.R, Part 95 Subpart E

Channel		Authorized Bandwidth
15	462.5500	20 kHz
1	462.5625	20 kHz
16	462.5750	20 kHz
2	462.5875	20 kHz
17	462.6000	20 kHz
3	462.6125	20 kHz
18	462.6250	20 kHz
4	462.6375	20 kHz
19	462.6500	20 kHz
5	462.6625	20 kHz
20	462.6750	20 kHz
6	462.6875	20 kHz
21	462.7000	20 kHz
7	462.7125	20 kHz
22	462.7250	20 kHz

Channel		Authorized Bandwidth
R15	467.5500	20 kHz
8	467.5625	12.5 kHz
R16	467.5750	20 kHz
10	467.6125	12.5 kHz
R17	467.6000	20 kHz
12	467.6625	12.5 kHz
R18	467.6250	20 kHz
14	467.7125	12.5 kHz
R19	467.6500	20 kHz
9	467.5875	12.5 kHz
R20	467.6750	20 kHz
11	467.6375	12.5 kHz
R21	467.7000	20 kHz
13	467.6875	12.5 kHz
R22	467.7250	20 kHz

The 800 MHz **Cellular Radiotelephone (Cellular)** Service is in the 824–849 and 869–894 MHz spectrum range. The most common use of Cellular Service spectrum is mobile voice and data services, including cell phone, text messaging, and Internet.

The Cellular Service helped transform the communications landscape by making mobile wireless telephone services broadly available to the American public. Today, Cellular Service is available nationwide, including parts of Alaska, reaching more than 99% of the U.S. population and leaving little area still unlicensed (Unserved Area).

The Broadband Personal Communications Service (PCS) is in the 1850 – 1990 MHz spectrum range. The most common use of Broadband PCS spectrum is mobile voice and data services, including cell phone, text messaging, and Internet.
1G & 2G: 850/1900, 900/1800 MHz
3G: 850/2100, 850/900/1800/1900 MHz
4G: 600 MHz, 700 MHz, 1.7/2.1 GHz, 2.3 GHz, and 2.5 GHz
5G: 600/700, 1800/1900, 1.7-2.5/4GHz, 24GHz–40GHz

The **Maritime Mobile Service** is an internationally-allocated radio service providing for safety of life and property at sea and on inland waterways. It includes the Maritime Mobile Service, the Maritime Mobile-Satellite Service, the Port Operations Service, the Ship Movement Service, the Maritime Fixed Service, and the Maritime Radiodetermination Service.
Freq: 156 and 174 MHz

Marine VHF radio equipment is installed on all large ships and most seagoing small craft. It is also used, with slightly different regulation, on rivers and lakes. It is used for a wide variety of purposes, including marine navigation and traffic control, summoning rescue services and communicating with harbors, locks, bridges and marinas.

The FM broadcast band (**FM Radio**) is a range of 88-108 MHz, where audio is broadcast for music and talk radio. Under the call sign KDKA, Pittsburgh's Westinghouse Electric and Manufacturing Company transmitted the first scheduled broadcast on Nov. 2, 1920. The band is divided into 100 channels, each 200 kHz (0.2 MHz) wide. The center frequency is located at 1/2 the bandwidth of the FM Channel, or 100 kHz (0.1 MHz) up from the lower end of the channel.

The future is digital but in different methods around the world. HD versus DAB
Some countries have implemented Eureka-147 Digital Audio Broadcasting (DAB) or the newer DAB+ version. DAB broadcasts a single multiplex that is approximately 1.5 megahertz wide (≈1 megabit per second). That multiplex is then subdivided into multiple digital streams of between 9~12 programs (or stations). In contrast, HD FM requires 400 kHz bandwidth – compatible with the 200 kHz channel spacing traditionally used in the United States – with capability of 300 kbit/s in digital-only mode.

HDradio is designed to co-exist with current broadcasts offer 3 additional digital channels to the stations current analog broadcast.

The VHF **airband** uses the frequencies between 108 and 137 MHz. The lowest 10 MHz of the band, from 108 to 117.95 MHz, is split into 200 narrow-band channels of 50 kHz. These are reserved for navigational aids such as VOR beacons, and precision approach systems such as ILS localizers.

As of 2012, most countries divide the upper 19 MHz into 760 channels for **amplitude modulation** voice transmissions, on frequencies from 118 to 136.975 MHz, in steps of 25 kHz. In Europe, it is becoming common to further divide those channels into three (8.33 kHz channel spacing), potentially permitting 2,280 channels.

Some channels between 123.100 and 135.950 are available in the US to other users such as government agencies, commercial company advisory, search and rescue, military aircraft, glider and ballooning air-to-ground, flight test and national aviation authority use. A typical transmission range of an aircraft flying at cruise altitude (35,000 ft), is about 200 miles in good weather conditions. AM and SSB permit stronger stations to override weaker or interfering stations.

NOAA Weather Radio (NWR), also known as NOAA Weather Radio All Hazards, is an automated 24-hour network of VHF FM weather radio stations in the United States that broadcast weather information directly from a nearby National Weather Service office. The routine programming cycle includes local or regional weather forecasts, synopsis, climate summaries or zone/lake/coastal waters forecasts. During severe conditions the cycle is shortened into: hazardous weather outlooks, short-term forecasts, special weather statements or tropical weather summaries (the first two are not normally broadcast in most offices). It occasionally broadcasts other non-weather related events such as national security statements, natural disaster information, environmental and public safety statements (such as an AMBER Alert), civil emergencies, fires, evacuation orders, and other hazards sourced from the Federal Communications Commission's (FCC) Emergency Alert System.

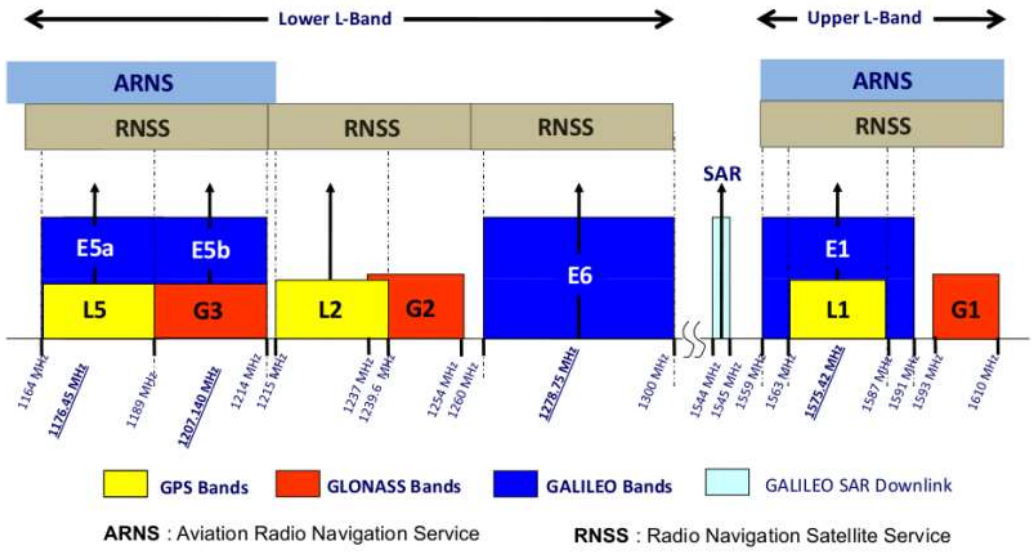
162.400 MHz	162.425 MHz	162.450 MHz	162.475 MHz	162.500 MHz	162.525 MHz	162.550 MHz

Wi-Fi (IEEE 802.11) is used in a number of bands but 2.4 GHz and 5 GHz being the most widely used, but other bands are available in some countries at 934 MHz, 3.6 GHz, & 6 GHz.

The origins of WiFi pre-date the arrival of the World Wide Web in 1989, it was born amid the tropical climes of Hawaii as ALOHANET in 1971, creating the very first wireless data packet transfer - a technique for sharing information completely free from connecting cables or satellite transmissions - the small team was able to communicate across seven Hawaiian islands in a way never achieved before. At the time of those early ALOHANET experiments, almost all telecommunications channels were regulated by the government.

In 1999 Victor Hayes introduced a brand new concept into the world of wireless networking, an international standard set for globe-crossing success, which he snappily named the IEEE 802.11 standard. The new standardized networking opened the floodgates of possibility, allowing for bigger, bolder, and more intricate networks without the need for tangles of cables… or the infamous dial-up tone, that those of us old enough to remember still occasionally hear in our dreams. The Wi-Fi Alliance was established later the same year.

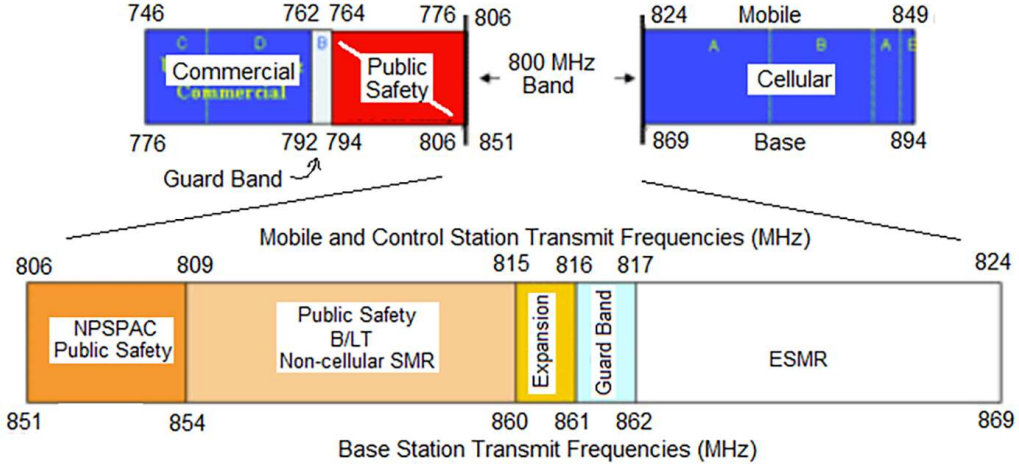
All **GPS** satellites broadcast on at least two carrier frequencies. They broadcast their position and the exact time, letting receiving devices derive their location from multiple satellites.



GPS Technology operates in the following frequency bands:

GPS L1 Band: 1575.42 MHz with a bandwidth of 15.345 MHz
GPS L2 Band: 1227.6 MHz with a bandwidth of 11 MHz
GPS L5 Band: 1176.45 MHz with a bandwidth of 12.5 MHz
GPS is the most widely used GNSS (Global Navigation Satellite System).
Other GNSS options include BeiDou (China), GLONASS (Russia) and Galileo (Europe).

Public safety radio systems (such as those used by police, firefighters and emergency medical technicians) operate in bands including the 700 MHz and the 800 MHz bands.



Starting in 1987, the Commission set aside spectrum in the 800 MHz band for exclusive use by local, regional and state public safety agencies. The 800 MHz NPSPAC spectrum is administered on a regional basis by 55 regional public safety planning committees.

In 2023 the Commission has allocated fifty megahertz of spectrum in the 4940-4990 MHz band (4.9 GHz band) for fixed and mobile services (except aeronautical mobile service) and designated this band for use in support of public safety. (voip, wifi, backhaul)

In the United States, **ADS-B** equipped aircraft and vehicles exchange information on one of two frequencies: 978 MHz or 1090 MHz.

Countries around the world are implementing a more accurate way of tracking aircraft. Called Automatic Dependent Surveillance–Broadcast (ADS-B), the technology will eventually replace radar as the primary surveillance method for Air Traffic Control (ATC) monitoring and separation of aircraft worldwide.

ADS-B allows equipped aircraft and ground vehicles to broadcast their identification, position, altitude and velocity to other aircraft and ATC. This is called ADS-B Out. Being able to receive this information is known as ADS-B In.

This tech is built in to all new transponders, as well as Traffic Collision and Avoidance Systems (TCAS), and uses 1090 MHz globally.

A new technology called Universal Access Transceiver (UAT), operate on 978 MHz providing graphical weather and traffic information.

Prior to the HD transition of 2009,
Television was broadcast on VHF (54-88 MHz & 174-216 MHz)
and UHF (470-890 MHz)… After the repack much of the spectrum was sold for 5G cellular and expanded public safety uses.

In 2009, all US TV stations transitioned to the ATSC 8VSB (digital) signal.
Operating on VHF (54-72) (76-78) (174-216 MHz)
and UHF (470-698 MHz)

The first American TV station began broadcasting on July 2, 1928. W3XK was the first commercially licensed television station in the US, owned by inventor Charles Francis Jenkins. Television replaced radio as the dominant broadcast medium by the 1950s and took over home entertainment. Approximately 8,000 U.S. households had television sets in 1946 (1%); and 45.7 million had them by 1960 (90%).