

SumoBots Frequency Facts

There are four (4) frequencies that may be used by robots in this competition: the three major frequencies that have been designated by law for use with radio controlled cars (27 MHz, 49 MHz, and 75 MHz) and 2.4 GHz. Each of these frequencies has a set of *sub-frequencies*, sometimes referred to as channels (this should not be confused with the number of channels a remote control has, which refers to the number of different motors the remote can operate). ***Please note that 72 MHz has been designated by the Federal Government for use by model airplanes and helicopters only, and it is against Federal law to allow that frequency to be used to control a land vehicle such as the Sumo Bot.***

27 MHz has 6 major sub-frequencies. There are two standard ways to refer to these sub-frequencies: either by their frequency number or by their channel number. The subfrequencies for 27 MHz are Channel 1 (26.995 MHz), Channel 2 (27.045 MHz), Channel 3 (27.095 MHz), Channel 4 (27.145 MHz), Channel 5 (27.195 MHz), and Channel 6 (27.255 MHz). The FCC has recently added an additional 6 sub-frequencies (channels 7 - 12). Channels 7 to 12 are really intermediate channels between 1 - 6 (for example, channel 7 uses a frequency between the frequencies of channels 1 and 2). Only the most modern transmitters/receivers can use those channels without causing interference - for example, if you are using channel 7 for your bot, you could cause interference for a competitor using channel 1 or channel 2 if they had an older transmitter/receiver. Therefore, the sub-frequencies of 27 MHz that will be allowed at a Sumo Bots competition are those designated as channels 1 - 6.

49 MHz has 5 sub-frequencies: Channel 1 (49.830), Channel 2 (49.845), Channel 3 (49.860), Channel 4 (49.875), and Channel 5 (49.890). Students should be aware that 49 MHz seems to have fallen out of favor with remote control enthusiasts. While crystals to change channels were as easy to obtain as the other frequencies several years ago, it has become almost impossible to find additional crystals for 49 MHz. It is recommended that you only consider using 49 MHz if you already have a transmitter and receiver that operate on 49 MHz that allows crystals to be changed and you currently have additional 49 MHz crystals.

75 MHz has 30 sub-frequencies: from Channel 61 - Channel 90, with frequencies that start at 75.41 for Channel 61 and rise by .02 MHz until you reach Channel 90, which is 75.99 MHz.

The number of channels available for 2.4 GHz depends on the manufacturer of the transmitter and receiver. Spektrum and other DSSS or DSM models divide the 2.4 GHz frequency into 80 channels. Other manufacturers may divide the frequency into more or fewer channels. The advantage of the 2.4 GHz frequency is that no crystals are required to change the channel - the transmitter searches for an unused frequency and locks the receiver to that frequency (some 2.4 GHz transmitters and receivers must

be paired together to work correctly. A transmitter cannot connect with a receiver unless it has been paired with it. If you are using 2.4 GHz, it is strongly recommended that you use a transmitter and receiver that are paired). The disadvantage is either cost or time: transmitters and receivers designed to control R/C cars using the 2.4 GHz frequency can be expensive (\$500 or more). If you wish to use a transmitter and receiver that is not specifically designed for controlling an R/C car (for example a bluetooth device, transmitting from either a computer or a cell phone), then you will need to program the receiver to operate your bot based on the signals it receives from the transmitter. If you use a 2.4 GHz transmitter/receiver that don't get paired, please be aware that some 802.11g wireless systems operate on 2.4 GHz.

Sumo Bots are required to be designed so they can be operated on three different frequencies. This can be three sub-frequencies of one frequency (for example, 27 MHz, channels 1, 3, and 5) or a combination of different major frequencies (example: 49 MHz, Channel 2 and 75 MHz, Channels 63 and 72). As long as you can change the frequency your bot operates under among three different frequencies (or sub-frequencies), you have met the rules. If you are using the 2.4 GHz frequency, then your bot will automatically switch to an unused frequency, so there is no need to worry about the three frequency requirement. However, you need to be aware that if your transmitter cannot find an available channel (for example, if 80 people in the crowd have bluetooth enabled cell phones turned on) then it simply will not transmit until a channel becomes available.

Remote control Transmitter/Receiver pairs that can operate on more than one frequency come with one *crystal* installed (the crystal is a chip that determines which frequency (or channel) the transmitter is sending out and the receiver is accepting). In the 27 MHz and 75 MHz range, additional crystals are sold in pairs (one for the transmitter and one for the receiver). As stated above, crystals for 49 MHz are extremely difficult to find. ***If your transmitter/receiver is either 27 MHz, 49 MHz, or 75 MHz and does not have interchangeable crystals, there are only two other ways you can change the frequency: if you have a digital transmitter and receiver, you can dial a new frequency on the transmitter's readout screen and turn a setting wheel on the receiver to the same frequency; and if you have a transmitter and receiver pair that has a switch that can be set for three different frequencies (usually designated as 27 MHz, channel A, B, and C). If your transmitter/receiver pair does not have any of these three features, then you cannot switch the frequencies on your bot and it does not meet the construction requirements.***

Please keep in mind that some of the cheaper r/c models available that operate on more than one frequency utilize a non-standard method of designating their frequencies (ie: 27 MHz, Channel A and Channel B). To insure that there is no interference between robots, the event supervisor **MUST** know what frequency your robot can operate on, and **MUST** be able to tell you to switch to a frequency that he/she knows is not being used by anyone else. It is not the Event Supervisor's job to determine what frequencies are represented by non-standard designations - it is the responsibility of the team. If students cannot tell the Event Supervisor what frequencies their robot uses (in standard format), they will not be allowed to compete in the tournament.

Finally, some students (and coaches) have contacted us in the past to complain that their local hobby shop has informed them that it is illegal for anyone except a certified repair person to change the

frequency on an r/c transmitter or receiver. These hobby shop owners are speaking of changing the frequency on a transmitter or receiver that came set for one frequency and does not have interchangeable crystals. If you are purchasing a new transmitter/receiver pair, it is recommended that you speak with a sales person rather than just ordering from the internet. Explain that you need a transmitter/receiver pair that allow you to change the crystals, and order the additional crystals when you order the parts. You should also ask if there are instructions that explain how to change the crystals.

Last updated 6/1/10

© New York State Science Olympiad (www.newyorkscioly.org)