

# GETTING READY TO DEPLOY 6 GHz



With regulatory approval for commercial 6 GHz operation available soon, now is the time to make sure your 6 GHz planning and deployment activity is optimized to get the most out of the spectrum. This document provides background on 6 GHz, as well as specific enhancements available with the Tarana Gigabit 1 (G1) next-generation fixed wireless (ngFWA) platform.

## What is 6 GHz?

In 2020, the FCC adopted the proposal to open 1200 MHz of spectrum in the 6 GHz band, from 5925–7125 MHz or UNII-5 through UNII-8 bands. For comparison, the original 2.4 GHz unlicensed band encompasses 72 MHz of spectrum. The 5 GHz band is a total of 515 MHz, including DFS channels. With 6 GHz, the FCC is opening up over twice as much spectrum as both 2.4 GHz and 5 GHz combined. Canada is expected to open an additional 100 MHz of spectrum (total of 950 MHz) with rules similar to the FCC.

## Who and What Can Use 6 GHz?

It's important to note that the entire 1200 MHz of spectrum is not treated equally. Use of each UNII band will depend on the type of device. Indoor devices (low power) can use the entire 1200 MHz. Outdoor operations are restricted to the UNII-5 and UNII-7 bands — a total of 850 MHz.

### Benefits of 6 GHz

- › 850 MHz of relatively unused spectrum
- › Commercial deployment expected by Q1 2024
- › Automated Frequency Coordination (AFC) is simpler than CBRS SAS
- › Similar propagation to 5 GHz, with less interference

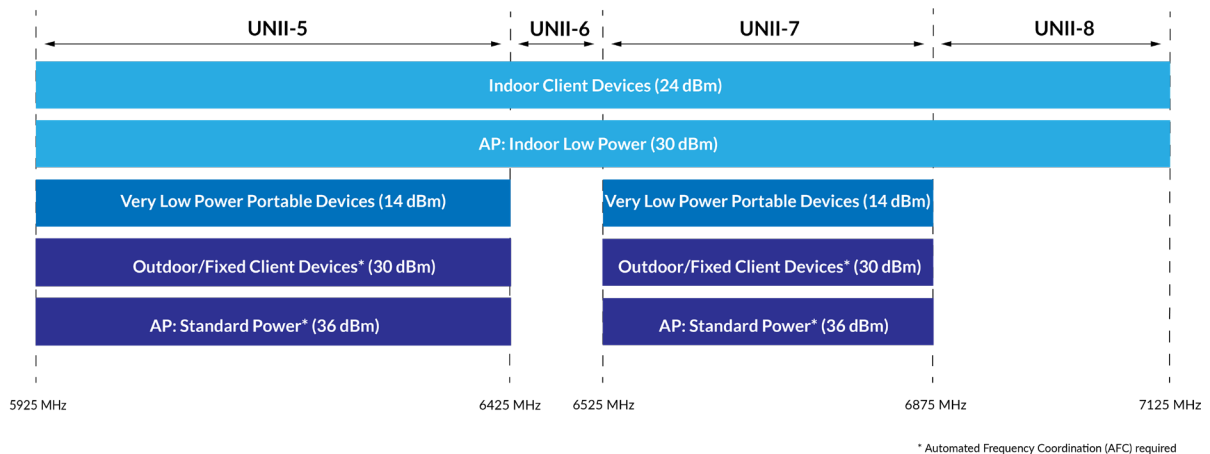


Figure 1: Allowed 6 GHz spectrum and power levels (FCC)

The discrepancy is because incumbents are already using the 6 GHz band and their operations may be interfered with by newcomers. This includes microwave and fixed satellite services and radio astronomy. To limit the potential for interference, the FCC has introduced power limits for standard power devices which includes any outdoor device, both base stations and fixed clients.

## Standard Power Requirements

In addition to the reduced number of allowed bands, standard power devices must use an Automated Frequency Coordination (AFC) server. This is similar to the Spectrum Access System (SAS) used by Citizens Band Radio Service (CBRS). The idea is that, whenever a standard power device powers up, it must contact an AFC and provide information such as antenna height and geolocation coordinates. The AFC will compare this to a list of incumbents and their locations provided by the FCC (via the Universal Licensing System or ULS) and send the device a list of permitted frequencies and power levels. The AFC syncs with the FCC's database of incumbents on a daily basis to maintain accurate information. All standard power devices must, therefore, check with the AFC on a daily basis to ensure they are not causing harmful interference to protected incumbents.

**Note:** This protection is only for incumbents, such as licensed point-to-point links. The AFC does not protect other unlicensed 6 GHz devices from each other. The AFC does not explicitly assign channels or offer any type of prioritization for unlicensed users over other unlicensed users.

The following table outlines the differences between the 6 GHz AFC and the CBRS SAS.

	CBRS	6 GHz
Spectrum Access	3550–3700 MHz	5925–6425 MHz 6525–6825 MHz
Countries	USA	Worldwide
Coordinator	Spectrum Access System (SAS)	Automatic Frequency Coordination (AFC) System
Certified Installer Needed	Yes	No
Power Levels	Max EIRP 53 dBm (40 MHz carrier)	Max EIRP 36 dBm across band
Tarana-supported Carrier Widths	10, 20, 30, 40 MHz	40 MHz

Table 1: CBRS SAS vs. 6 GHz AFC operation

When a device needs to contact the AFC, it can use an AFC domain proxy (similar to what happens with a SAS). In the case of Tarana devices, Tarana Cloud Suite (TCS) acts as the domain proxy and works with the ComSearch AFC. A single request and response called AvailableSpectrumInquiry (ASI) is sent between the 6 GHz device and the AFC system every 24 hours. The client device (or its proxy) sends certification details and a list of preferred frequencies. The AFC responds with the maximum power values for each of the preferred channels. By default, TCS requests power levels for all available channels in order to make the best decision.

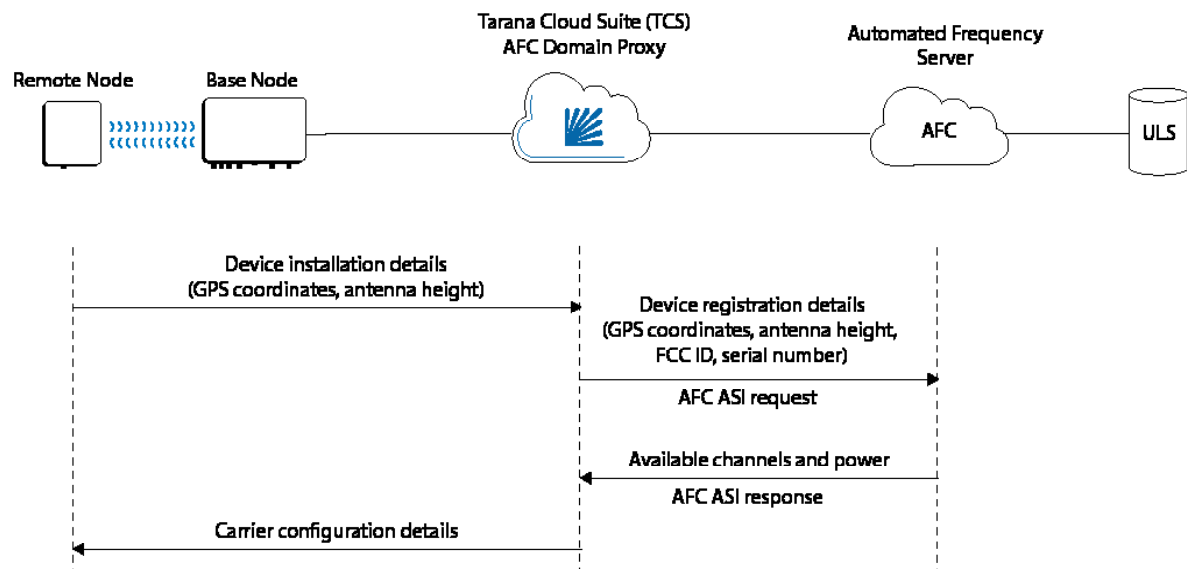


Figure 2: TCS acts as a proxy for Tarana devices to the AFC

## When Will AFC Be Available?

At the time of this writing, commercial AFC availability is expected to happen in Q4 2023 or Q1 2024. Until there are approved AFCs, any usage of the 6 GHz spectrum today must stay within the low power requirements or use a [special temporary authority \(STA\) license](#). Download Tarana’s OET experimental license (STA) filing guide [here](#).

## How Much Interference Should I Expect?

One thing to understand about standard power 6 GHz operation: anyone can use the spectrum, assuming there is no conflict with an incumbent. AFCs exist to prevent interference with protected incumbents but will do nothing to prevent unlicensed users from interfering with each other. Just like with 2.4 and 5 GHz, interference can and will be a concern for operators. The expectation is that the spectrum will be relatively clean to begin with and become more crowded and noisier, as time goes on.

At Tarana, we believe 6 GHz is an important tool for operators; G1 will leverage field-proven innovations like interference cancelation to help make the most of this valuable resource. As the popularity of 6 GHz grows, the need to manage and eliminate harmful interference will only become more important.

## 6 GHz Channel Planning

The 6 GHz band is structured by operating classes that correspond to channel width. Channel numbers range from 0–233, and represent 5 MHz increments along the spectrum. Tarana devices use operating classes 131 (2 x 20 MHz) or 132 (1 x 40 MHz) for each carrier. It’s important to note there could be different allowed power permitted for different channels.

For class 131 operations, in which two 20 MHz channels are combined, TCS will always select the highest power combination of two contiguous channels for each carrier. In the example shown in figure 3, TCS received the given power values from the AFC. In this case, channels 13 and 17 would be selected since they offer full power (36 dBm).

	UNII-5						UNII-6						UNII-7					
Channel	1	5	9	13	17	...	93	97	101	105	109	113	117	121	125	129	...	181
Max EIRP	33.6	36	29	36	36		36	N/A	N/A	N/A	N/A	N/A	36	36	36	36		35

Figure 3: For class 131 operation, TCS selects the 2 lowest contiguous frequencies with the highest power

If two combinations have the same power, the lower frequency combination will be selected. In the example above, if channel 1 was available at 36 dBm power, channels 1 and 5 would have been selected instead, since they are lower frequencies than 13 and 17. Channels in the UNII-7 band will be used if there is no combination in UNII-5 that offers the same or higher power.

For 40 MHz (class 132) operation, TCS will assign the channel with the highest power. In cases of a tie, the lowest frequency channel will be selected. In figure 4, channel 35 is the lowest frequency with the highest power.

	UNII-5					UNII-6				UNII-7								
<b>Channel</b>	3	11	19	27	35	...	91	99	107	115	123	131	139	147	155	163	171	179
<b>Max EIRP</b>	33.3	34.5	28	23.5	36		36	N/A	N/A	N/A	36	36	36	36	36	36	35	35

Figure 4: For class 132 operation, TCS selects the lowest frequency with the highest power

## Tarana G1 Updates

Tarana's G1 6 GHz base node and remote node models include several enhancements to streamline the deployment process and take full advantage of the spectrum.

### Backward Compatibility

6 GHz base nodes (BNs) and remote nodes (RNs) are backward compatible with 5 GHz models in the UNII-3 band. Thus, a 5 GHz remote node can connect to a 6 GHz base node, and vice versa. This ensures equipment already in place will continue to function as newer hardware is introduced into the network.

### New Remote Node Features

#### GPS Module

The 6 GHz remote node includes an integrated GPS module. This is used to determine installation parameters and has an accuracy of 2.5 meters. GPS-determined installation parameters allow the remote node to operate at a higher maximum power, 36 dBm, when the GPS is locked. In cases where there is no GPS lock, the remote node will function at reduced power (maximum of 30 dBm) to comply with FCC regulations for non-GPS-enabled devices.

## Alignment LEDs

The 6 GHz remote node also features alignment metric LEDs on the exterior of the node. These LEDs aid in determining the optimal alignment without need for the web UI.

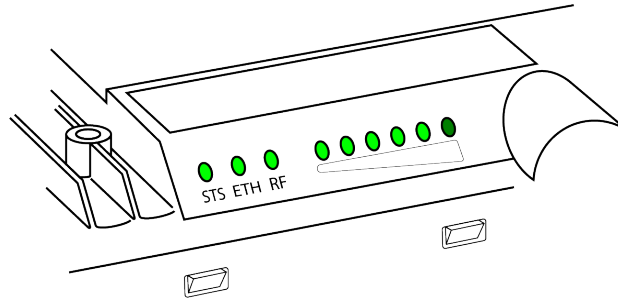


Figure 5: 6 GHz remote nodes include exterior alignment LEDs

## Priority Search List

Scanning the entire allowed 6 GHz spectrum could be a lengthy process. The remote node web UI includes an option to select preferred frequencies at installation time. This reduces the amount of spectrum the remote node must scan while searching for base nodes and speeds up overall installation time. It is best practice to select the frequencies for the nearest base nodes, as they will typically be the best serving.

## Air Interface Protocol (AIP)

Base nodes and remote nodes use the Tarana air interface protocol (AIP) to communicate. Current 5 GHz models use AIP version 0. The 6 GHz models introduce a new AIP version 1. The new AIP version offers improved control channel communications to reliably deliver commands and avoid truck rolls. This includes:

- › Trigger full search on remote node
- › Reboot the remote node
- › Reset saved base node state or other persistent state on the remote node

The AIP version is set at the sector level. Remote nodes must use firmware that supports the desired version of AIP.

**Note:** In cases where a mixture of models (5 GHz and 6 GHz) will be deployed, it's important to ensure the correct version of AIP is used. A 6 GHz remote node using AIP version 1 will require a base node that is also using AIP version 1. A 5 GHz remote node using AIP version 1 can connect to a base node that is using AIP version 0 or version 1.

All software versions of 1.2 or greater support AIP version 0 and 1 for base nodes, while remote nodes will have different requirements depending on the model. The following compatibility matrix shows how this works.

AIP Version	5 GHz Base & Remote Nodes	6 GHz Base & Remote Nodes
Version 0	Default (all software releases)	Supported on base node only
Version 1	Available with 1.2+ software	Default (all software releases)

5 GHz base nodes default to AIP version 0, while 6 GHz base nodes default to AIP version 1. It is important to ensure the correct version of AIP is used during deployment. When upgrading from AIP version 0 to AIP version 1, 5 GHz remote nodes running 0.9xx firmware should always be upgraded before the base node to avoid stranding the remote node. Figure 6 shows the 3-step process necessary to upgrade a 5 GHz remote node to AIP version 1.

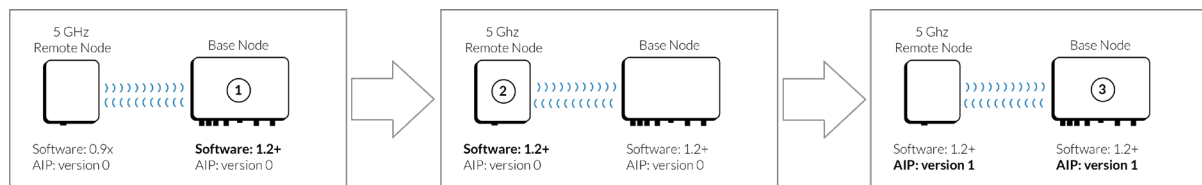


Figure 6: 3-step procedure to upgrade 5 GHz remote node to AIP version 1

If 6 GHz remote nodes are already field deployed, the remote nodes in step 1 of Figure 7 should be upgraded from 0.9xx to 1.2+ software and use AIP version 0 to connect to their base node (5 GHz or 6 GHz). If the remote node is offline, it should be upgraded when it is online again. As shown in step 2, the base node must stay configured to AIP version 0 to avoid a truck roll. Once all remote nodes have been upgraded, the base node can be changed to AIP version 1 (step 3). This allows all remote nodes to connect using AIP version 1.

**Note:** Changing the AIP version on the base node will disconnect all remote nodes, and require that they reconnect with the new AIP version.

## x2 Mode

x2 (or 4-carrier) mode, which enables 4 x 40 MHz carriers on the base node and remote node, will be available as a software upgrade in early 2024. With x2 mode, the RF chains and antennas are split in half, allowing for 4 x 40 MHz operation. For the base node, this means dual 2 x 40 MHz carriers with 8 antennas each. The remote node configuration will consist of dual 2 x 40 MHz carriers with four antennas each. Using this configuration, the maximum performance of a link increases from 800 Mbps of aggregate throughput to 1.6 Gbps.

## Appendix A: G1 Supported Frequencies

Tarana 6 GHz devices support UNII-3, -4, -5, and -7 channels. For 6 GHz operation (UNII-5 and UNII-7), class 131 and 132 channels are supported. The following table shows the supported center frequencies in Hertz for each band.

UNII-3	UNII-4	UNII-5	UNII-7
5750	5845	5965	6545
5755	5855	5985	6565
5765	5865	6005	6585
5775		6025	6605
5785		6045	6625
5795		6065	6645
5805		6085	6665
5815		6105	6685
5825		6125	6705
5835		6145	6725
5845		6165	6745
5855		6185	6765
5865		6205	6785
		6225	6805
		6245	6825
		6265	6845
		6285	
		6305	
		6325	
		6345	
		6365	
		6385	
		6405	

\*UNII-4 frequencies require a special temporary authority (STA) license from the FCC.

Tarana's mission is to accelerate the deployment of fast, affordable internet access around the world. Through a decade of R&D and more than \$400M of investment, the Tarana team has created a unique next-generation fixed wireless access (ngFWA) technology instantiated in its first commercial platform, Gigabit 1 (G1). It delivers a game-changing advance in broadband economics in both mainstream and underserved markets, using either licensed or unlicensed spectrum. G1 started production in mid-2021 and has been embraced by more than 200 service providers globally. Tarana is headquartered in Milpitas, California, with additional research and development in Pune, India.