Vivid-Hosting, LLC
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02/25/2024

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

RE: Part 15 Supporting Information (FIRST Robotics Competition Usage Guidance)

To whom it may concern:

We, Vivid-Hosting, LLC., would like to provide photos for the proposed usage guidance for device under FCC ID: **2BBOU10923**.

The noted FCC ID above is otherwise known as the VH-109 device.

Please see the attached pages with photos inserted. Recommended mounting instructions are also included

Sincerely,

Kiet Chau
Chief Executive Officer
Vivid-Hosting, LLC.
02/25/2024

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Exhibit #1: Multiple Robots using the VH-109 devices on the protected field environment

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Exhibit #2: Robot with the VH-109 Device installed, device circled

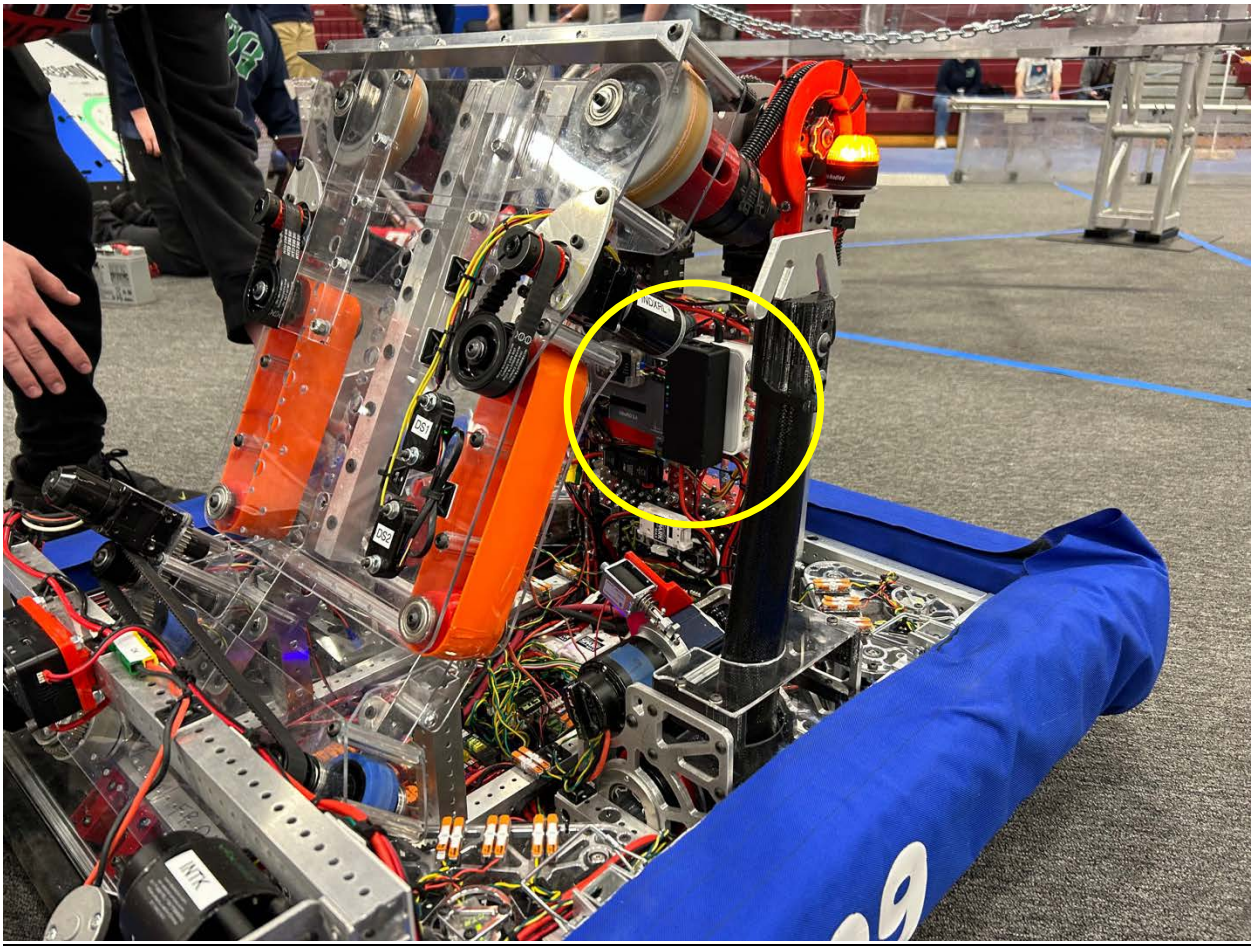

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Exhibit #3: VH-109 Device configured in 6ID mode, powered using AC Source

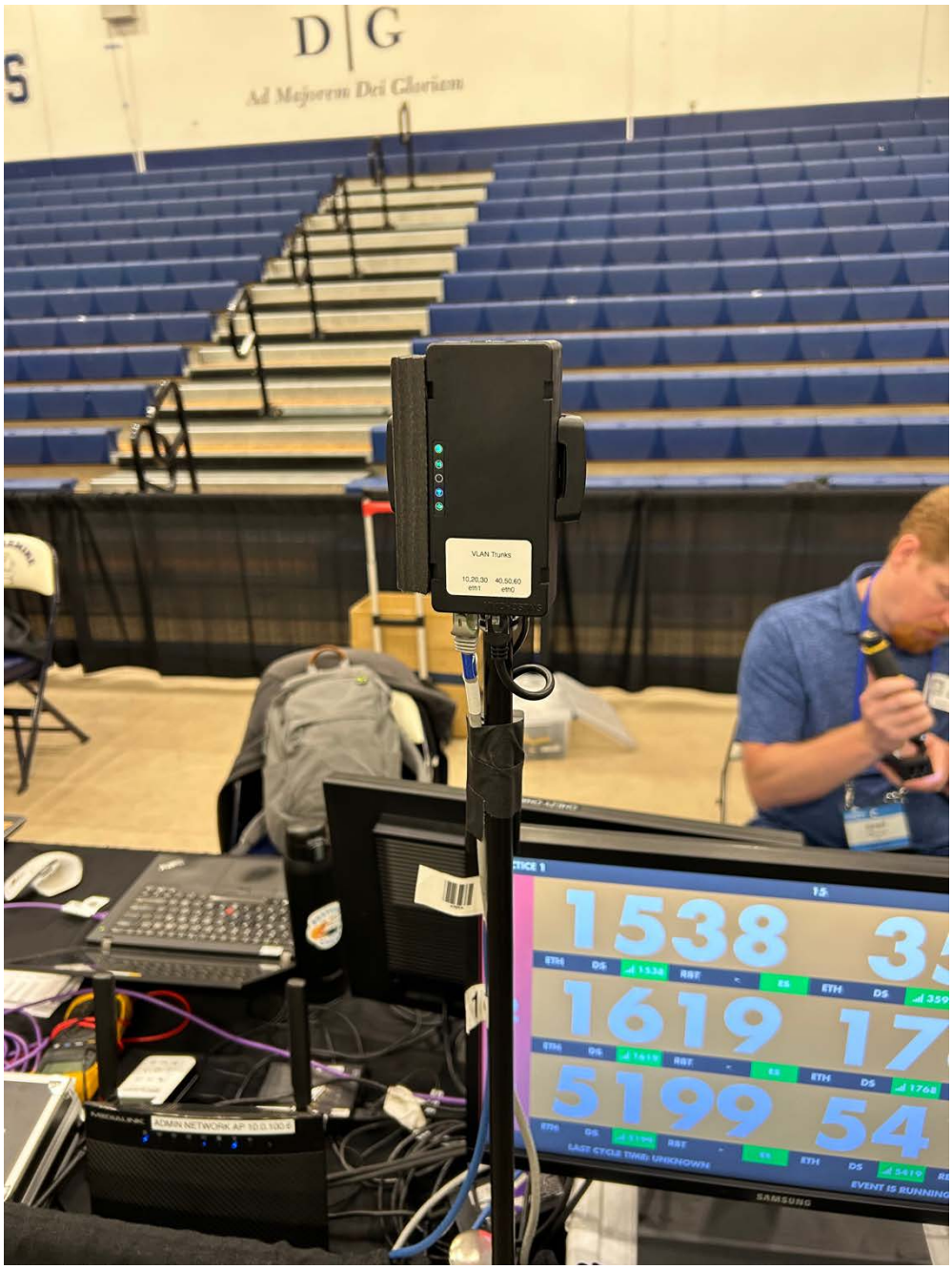

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Exhibit #3: Multiple Robots with the VH-109 Device installed, device circled

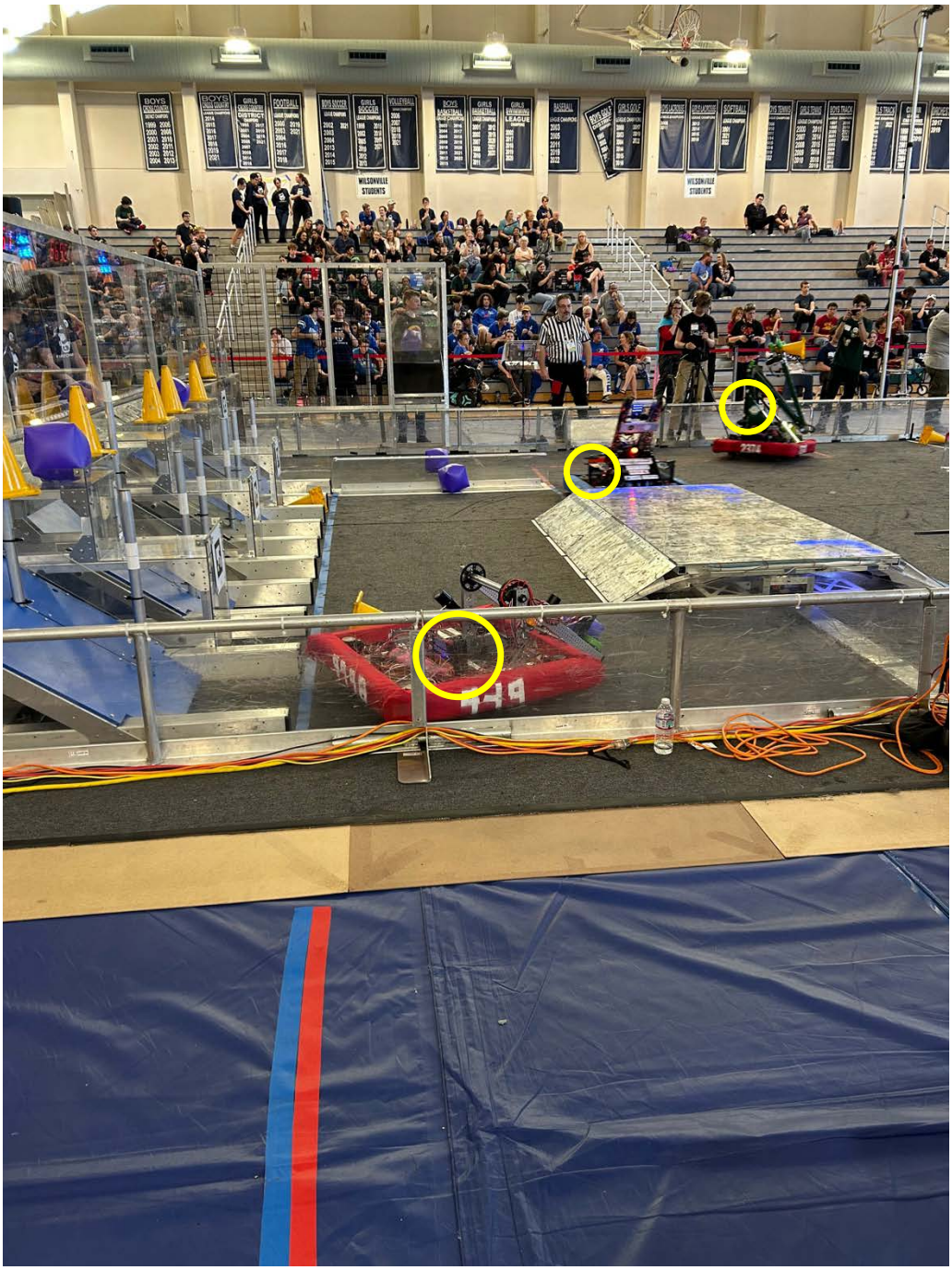

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Exhibit #4: Mounting instructions for 6XD Use Case (Mounting to a Robot)

Mounting Your Radio

Overview

Properly mounting your radio is an important first step to making sure your robot connects to the field and remains connected throughout a match.

Here are some initial considerations when thinking about where to mount the radio on your robot:

Consideration	Reason
The radio should be mounted against a metal tube or plate.	Heat can build up inside the radio. By mounting the radio against a metal surface, you can conduct heat away.
Do not block the visibility of the status LEDs.	These LEDs are used by field staff to diagnose connectivity problems. Without these LEDs it becomes much harder to troubleshoot why your robot may be having connection issues.
Avoid having objects within 12" of the radio (Not including the back of the radio, opposite the status LEDs).	The antennas inside the radio have a radiation pattern. Having objects pass too close the radio can alter this radiation pattern, and adversely affect how well the radio is able to communicate with the field.

It is recommended that teams mount against a metal tube/plate to act as a heatsink for the radio during extended operation.

Mounting Examples

Here are some examples of ways you can mount the radio to your robot. In each of these examples we'll discuss why it's good or bad.

The radiation patterns shown in the renders below are meant to be representative of the affect different mounting locations have on radio performance.

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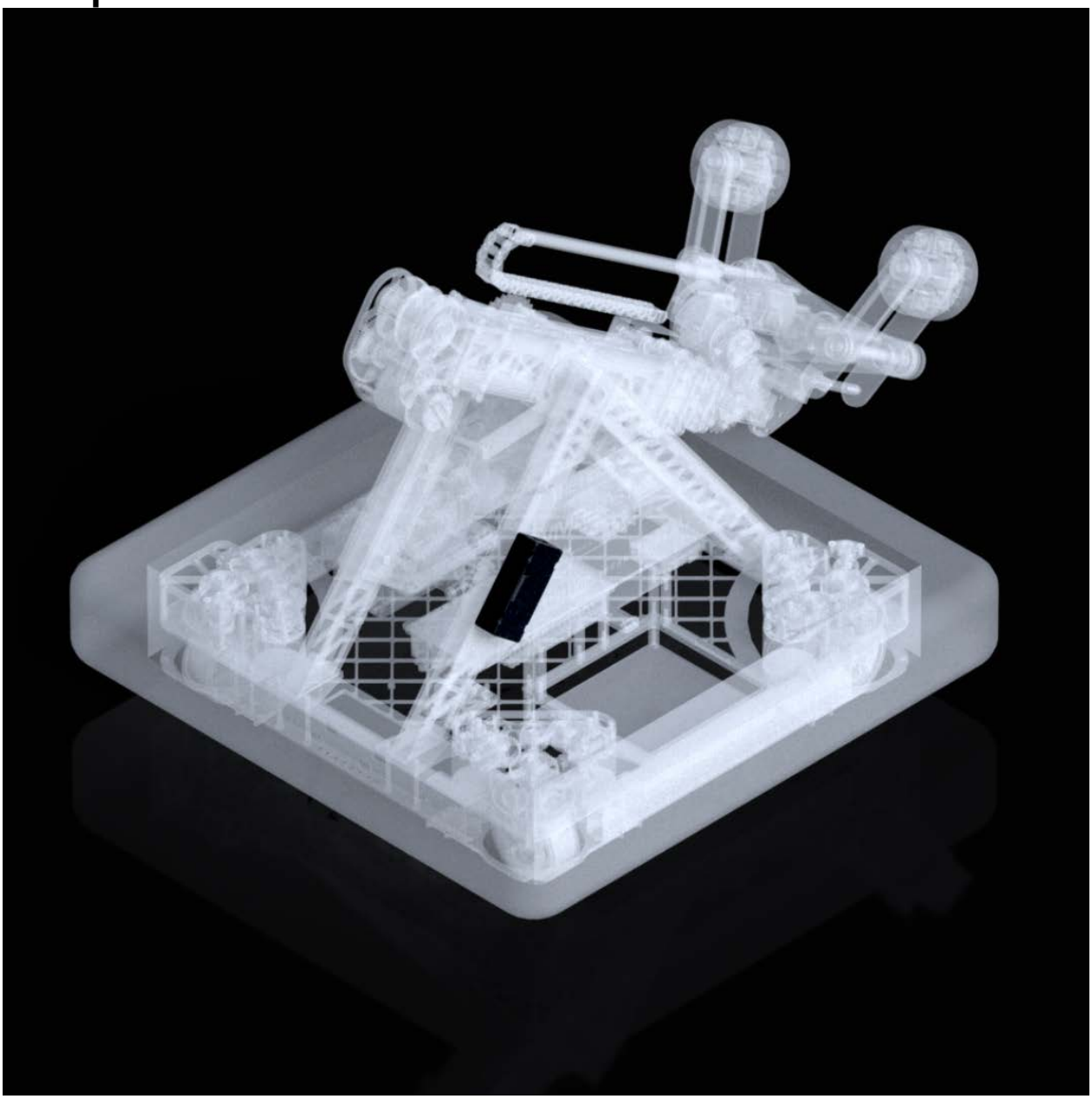
Example #1



In this configuration the radio is mounted on the outside of the robot's structure, with the status LEDs pointed towards the outside of the robot.

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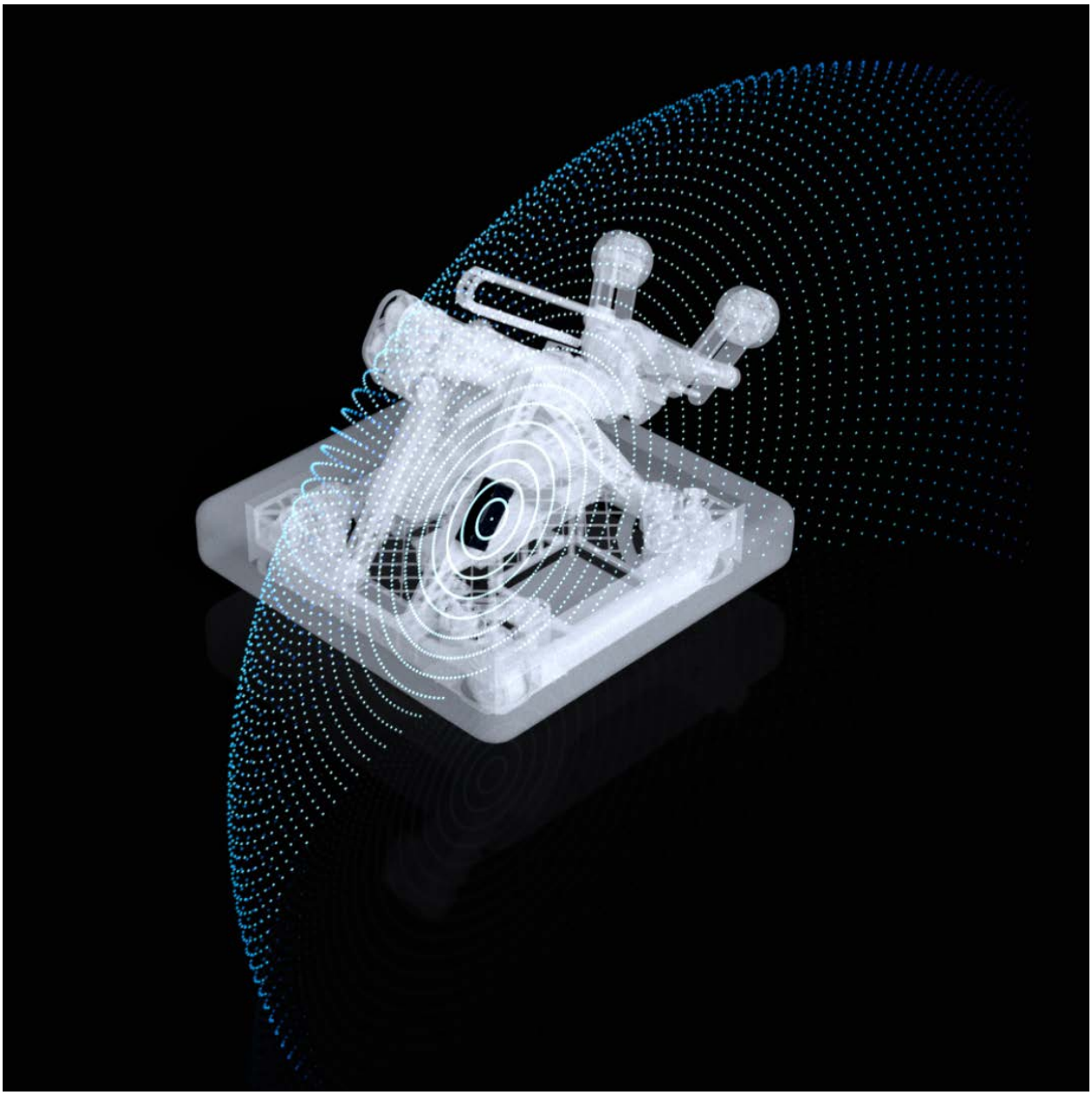

Isometric view of the VH-109's radiation pattern in this mounting configuration

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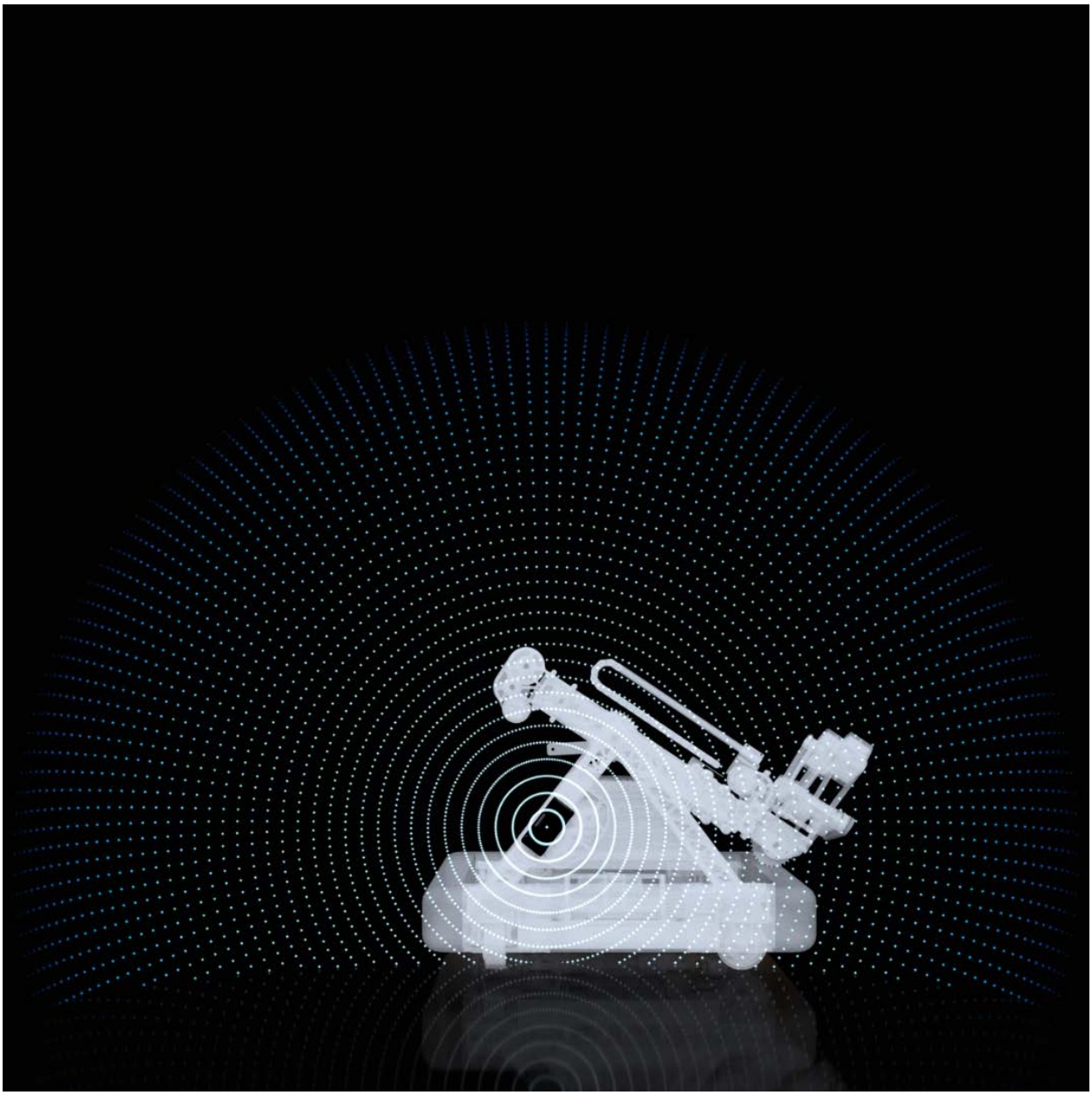

Side view of the VH-109's radiation pattern in this mounting configuration

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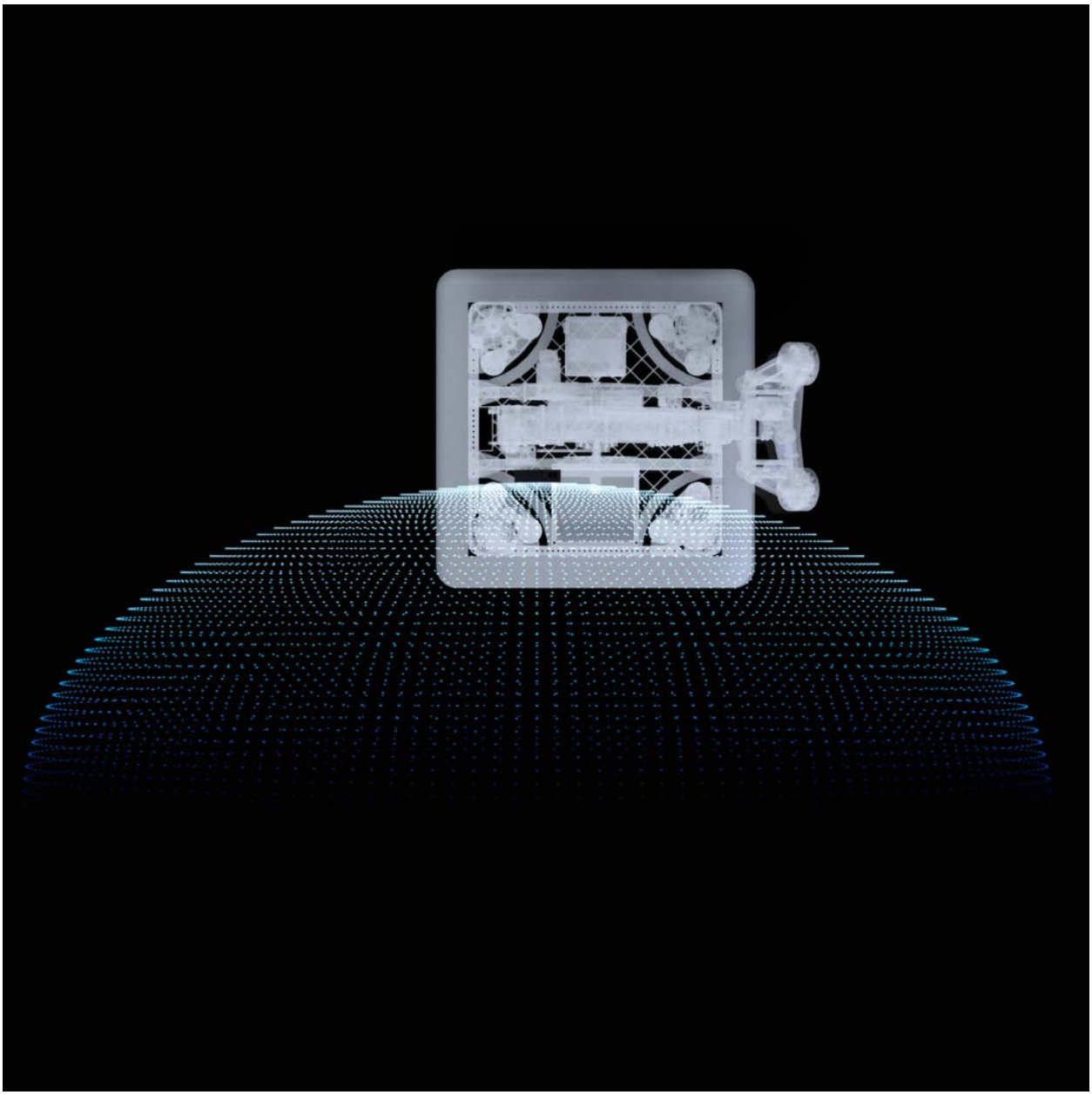

Top view of the VH-109's radiation pattern in this mounting configuration

This is the best configuration because it creates the least amount of interference for the radio's antennas. The status LEDs are visible and make it easy for field staff to read them. The radio is mounted relatively high on the robot. There are very few metal obstructions around the antenna.

Final Verdict: ***Best***

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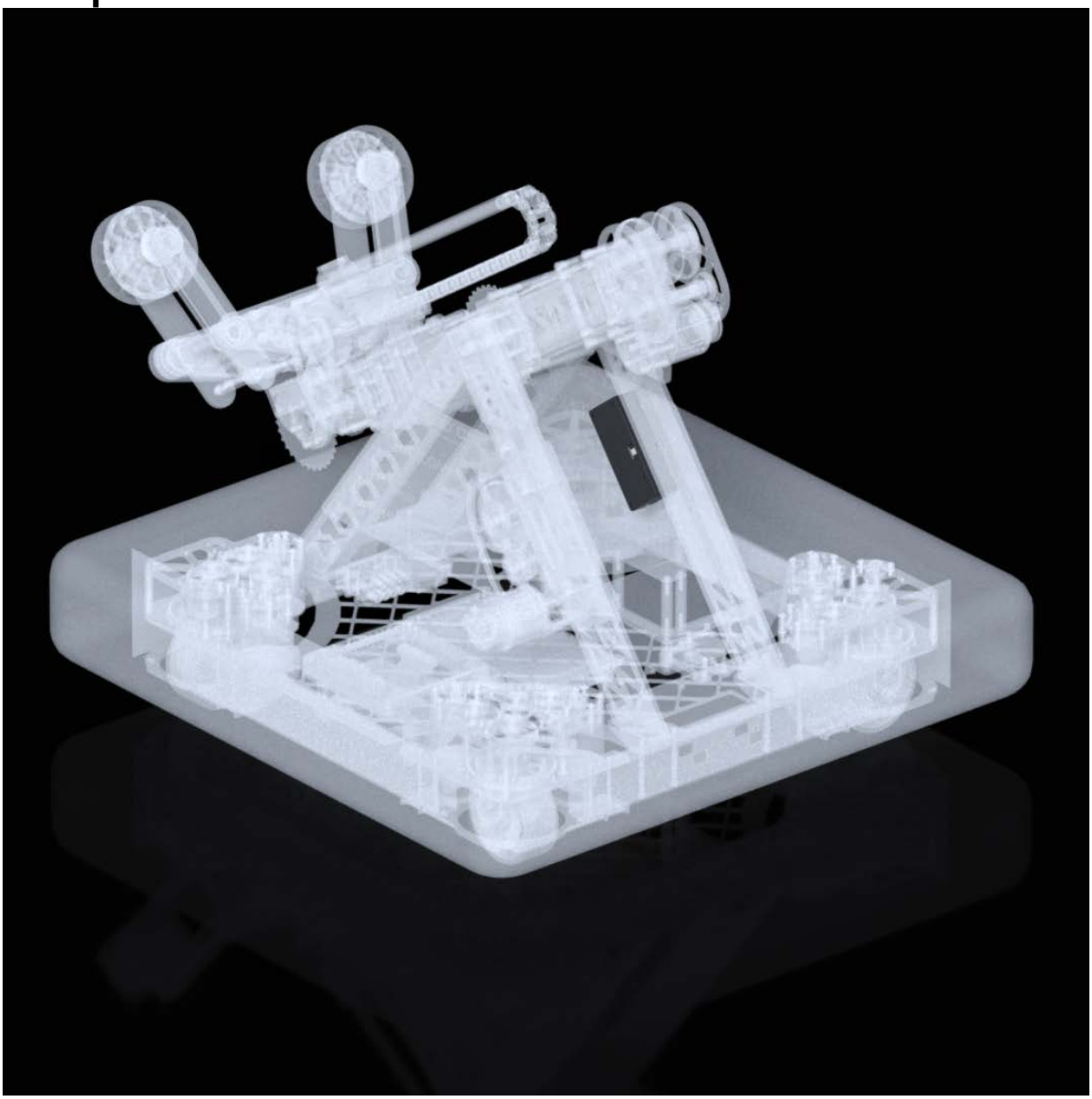
Example #2



In this configuration the radio is mounted between the robot's a-frame, with the status LEDs pointed towards the outside of the robot. However, there is a transparent plastic panel covering the status LEDs.

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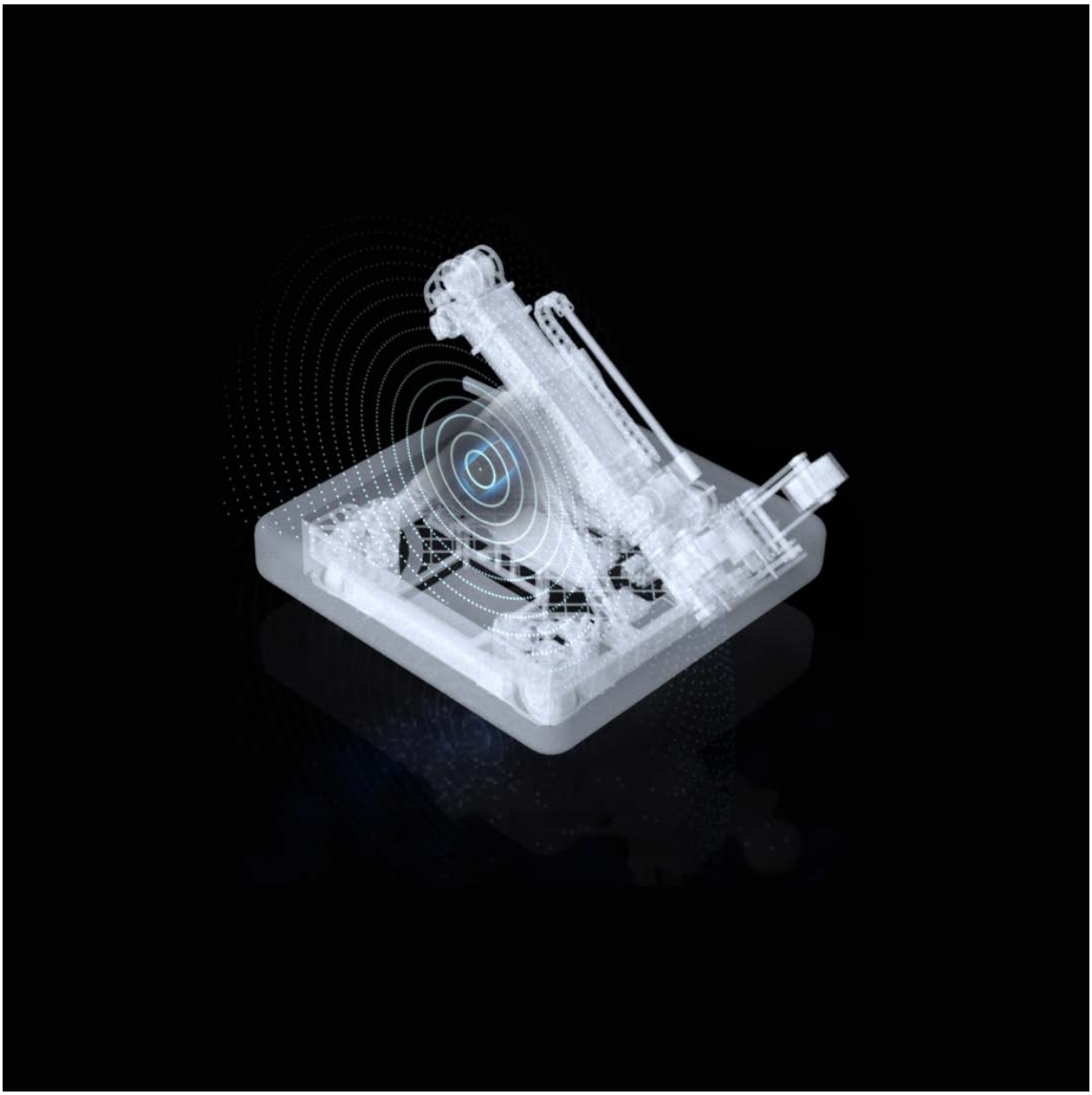

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Side view of the VH-109's radiation pattern in this mounting configuration

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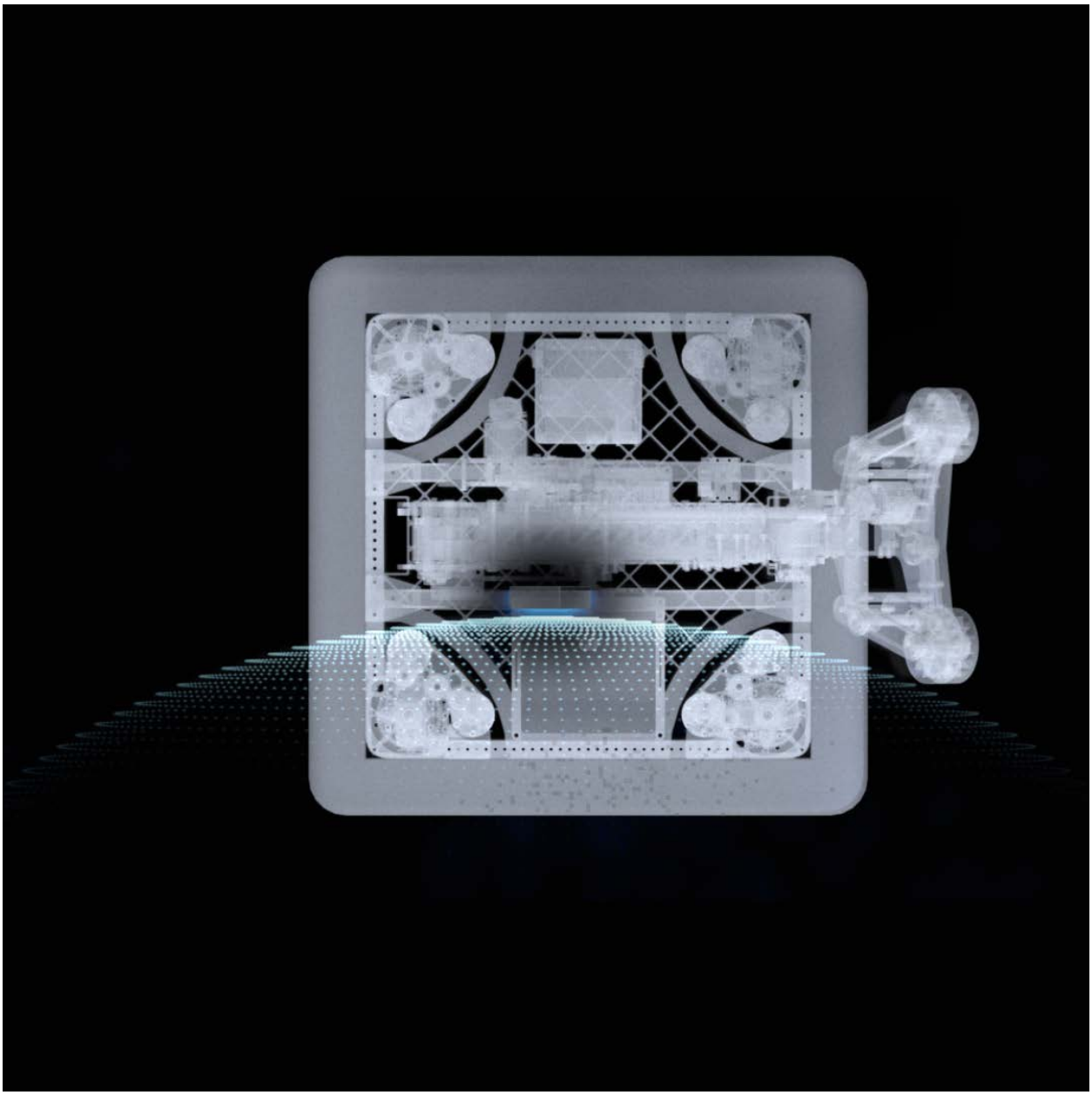

Top view of the VH-109's radiation pattern in this mounting configuration

This configuration is not the best but is still acceptable. The robot's a-frame is surrounding the sides of the radio, which will affect antenna performance. However, the plastic panel doesn't impact antenna performance, which allows the radio to create a good link with the field access point (AP).

Final Verdict: ***Acceptable***

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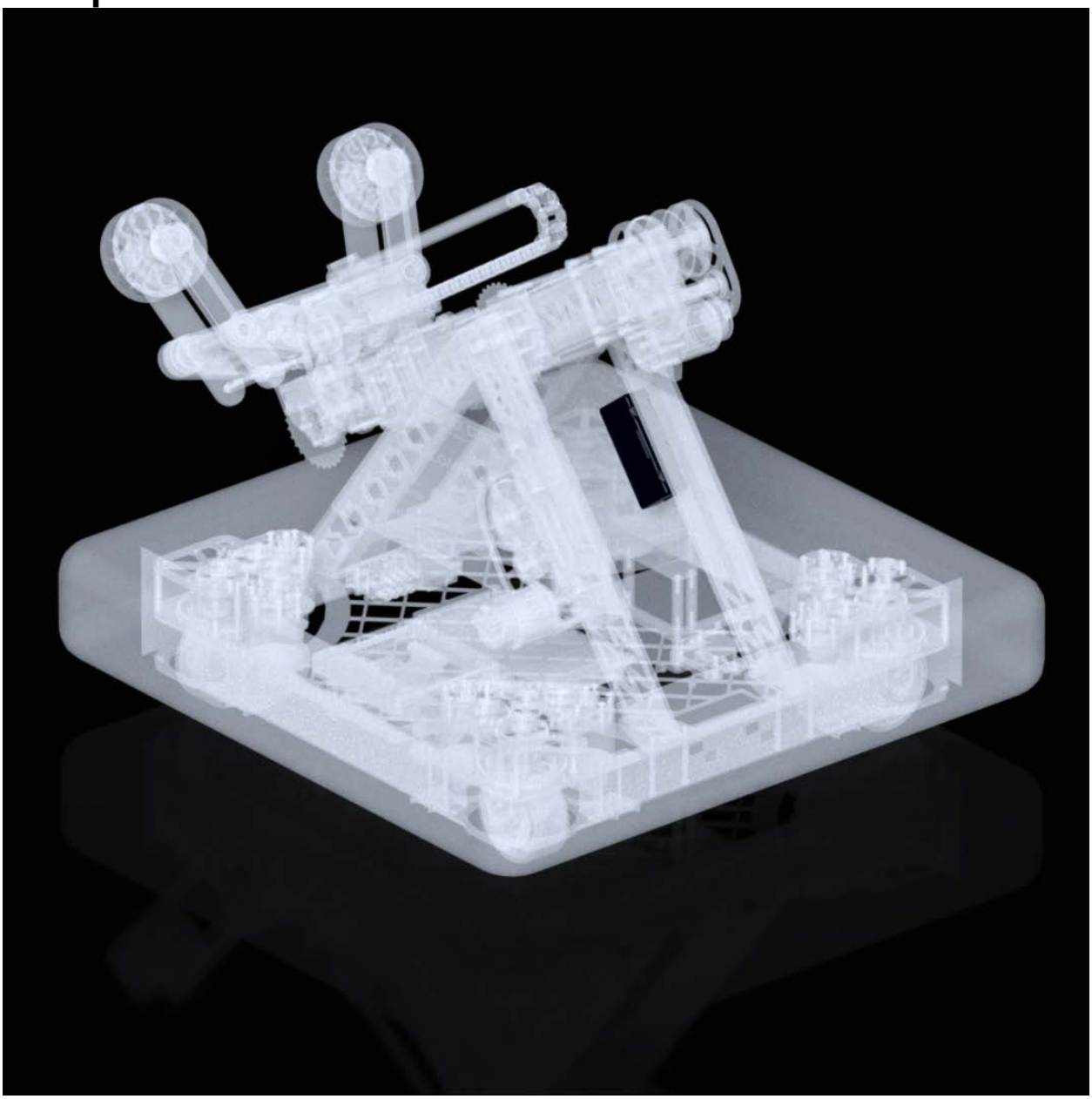
Example #3



In this configuration the radio is mounted between the robot's a-frame, with the status LEDs pointed towards the centerline of the robot.

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Isometric view of the VH-109's radiation pattern in this mounting configuration

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Side view of the VH-109's radiation pattern in this mounting configuration

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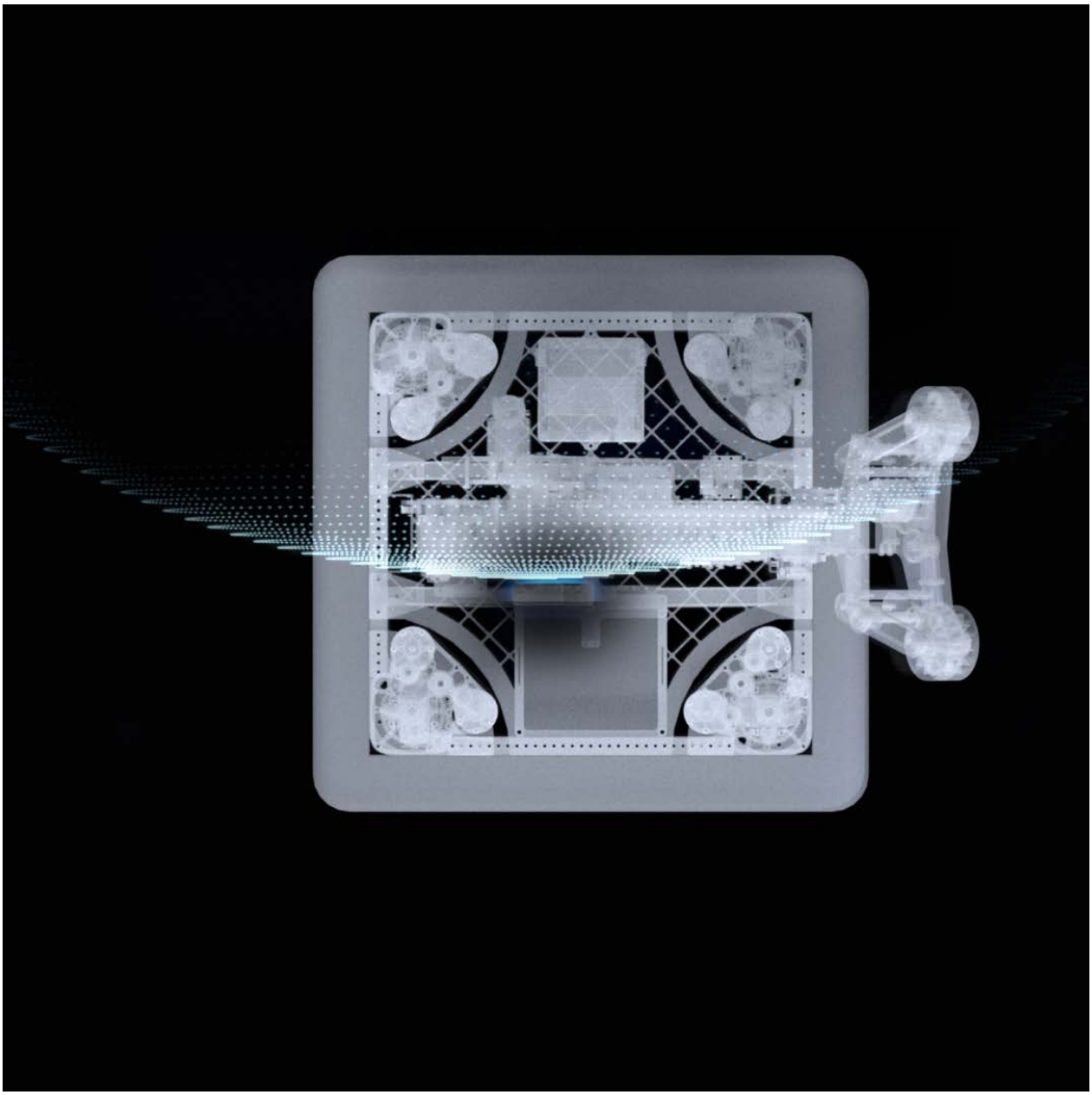

Top view of the VH-109's radiation pattern in this mounting configuration

This is not a good mounting location for the radio. First, field staff will have a harder time seeing the status LEDs, which will make it harder for them to help you troubleshoot your robot. More importantly, the radio is broadcasting its signal into the rest of the robot's structure. This configuration has a greater impact on antenna performance, and likely cause the robot to have communication problems with the field access point (AP).

Final Verdict: ***Not Recommended***

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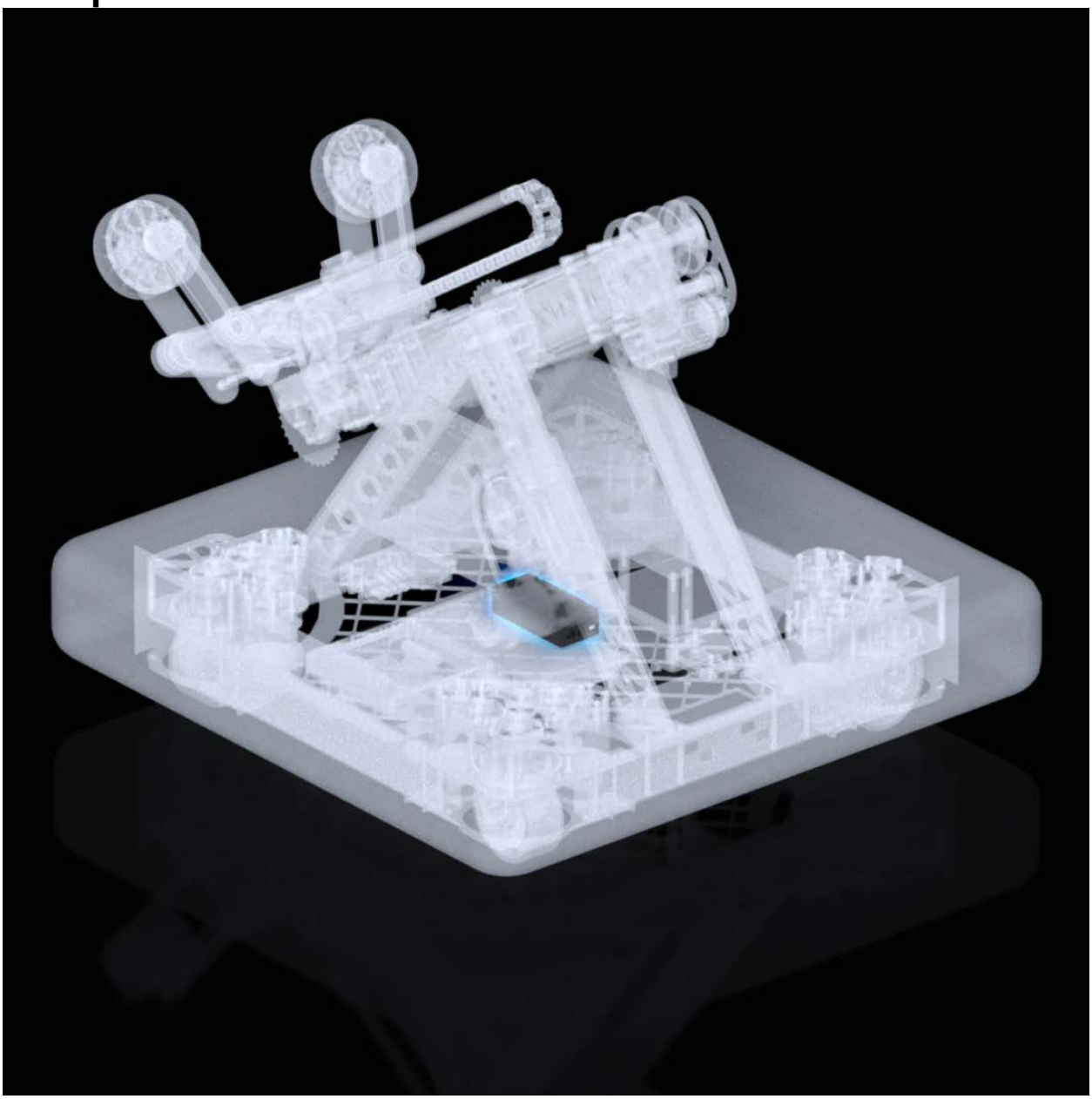
Example #4



In this configuration the radio is mounted on a plate with the rest of the robot's electronics. The status LEDs are pointing upwards.

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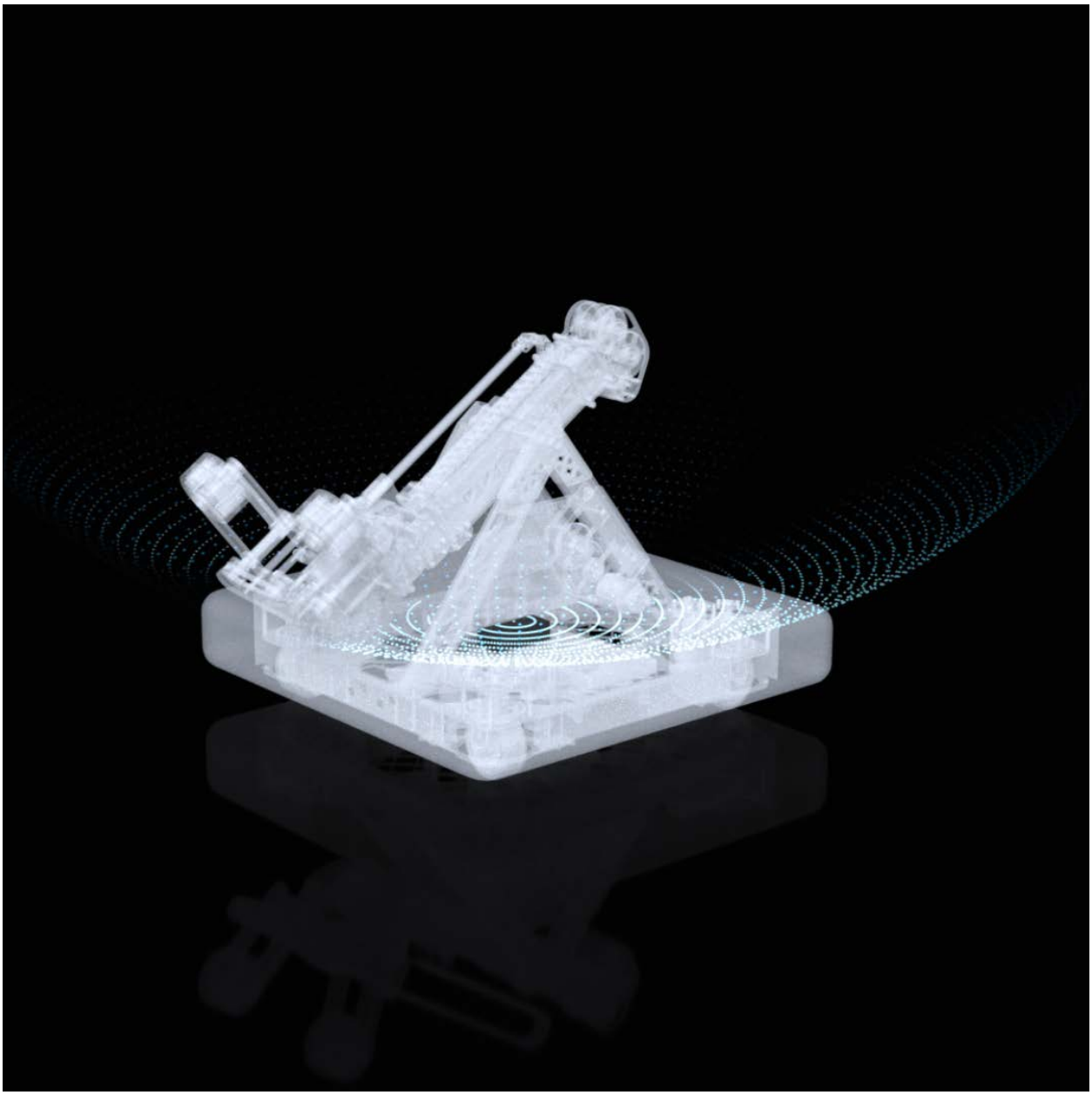

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Side view of the VH-109's radiation pattern in this mounting configuration

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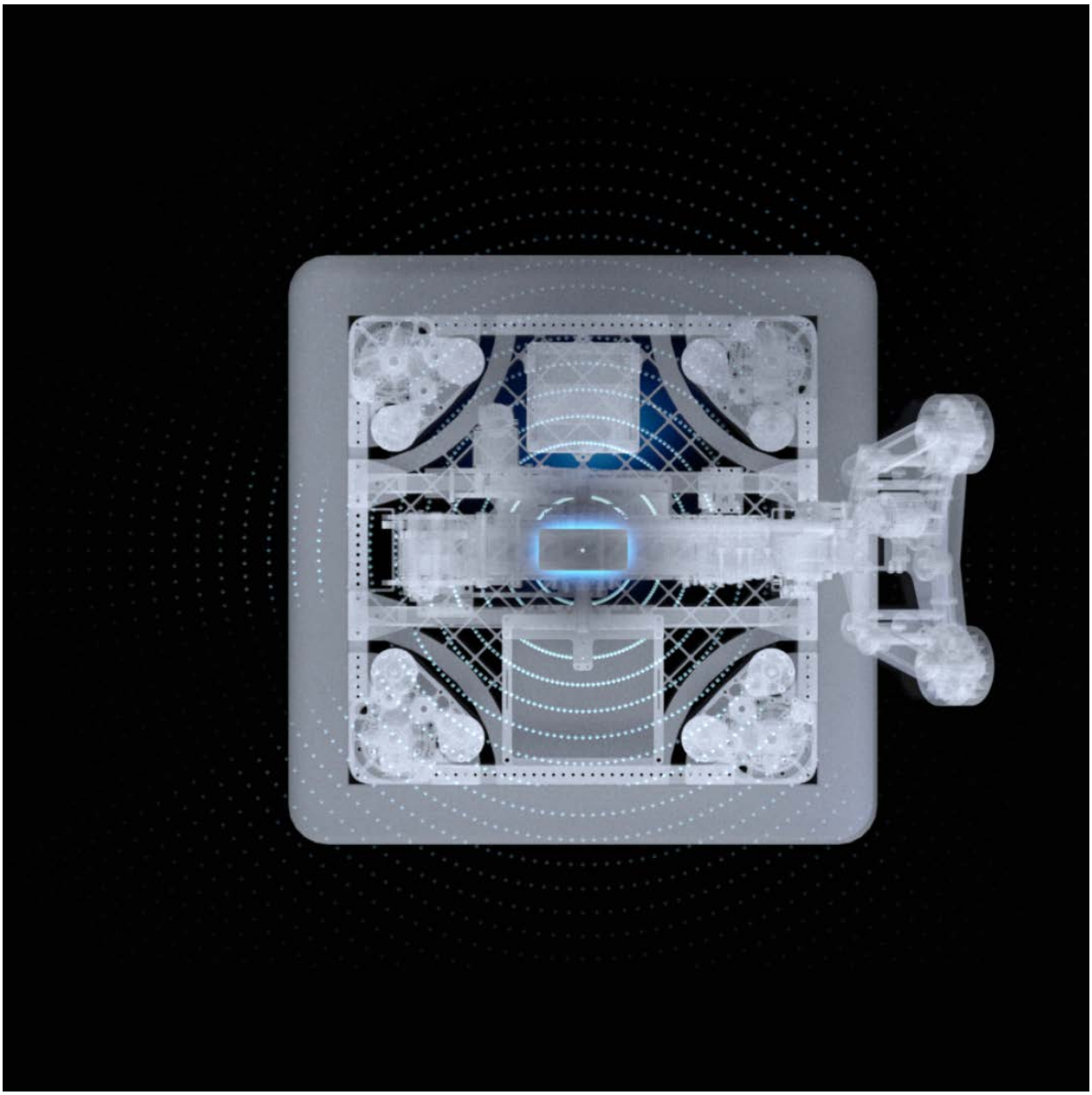

Top view of the VH-109's radiation pattern in this mounting configuration

This scenario depends on other factors to determine if it could be satisfactory. In this specific example, the radio is broadcasting into an arm, which is going to negatively impact performance. If there were no obstructions above the radio, then this would be an acceptable configuration.

Final Verdict: ***Depends***

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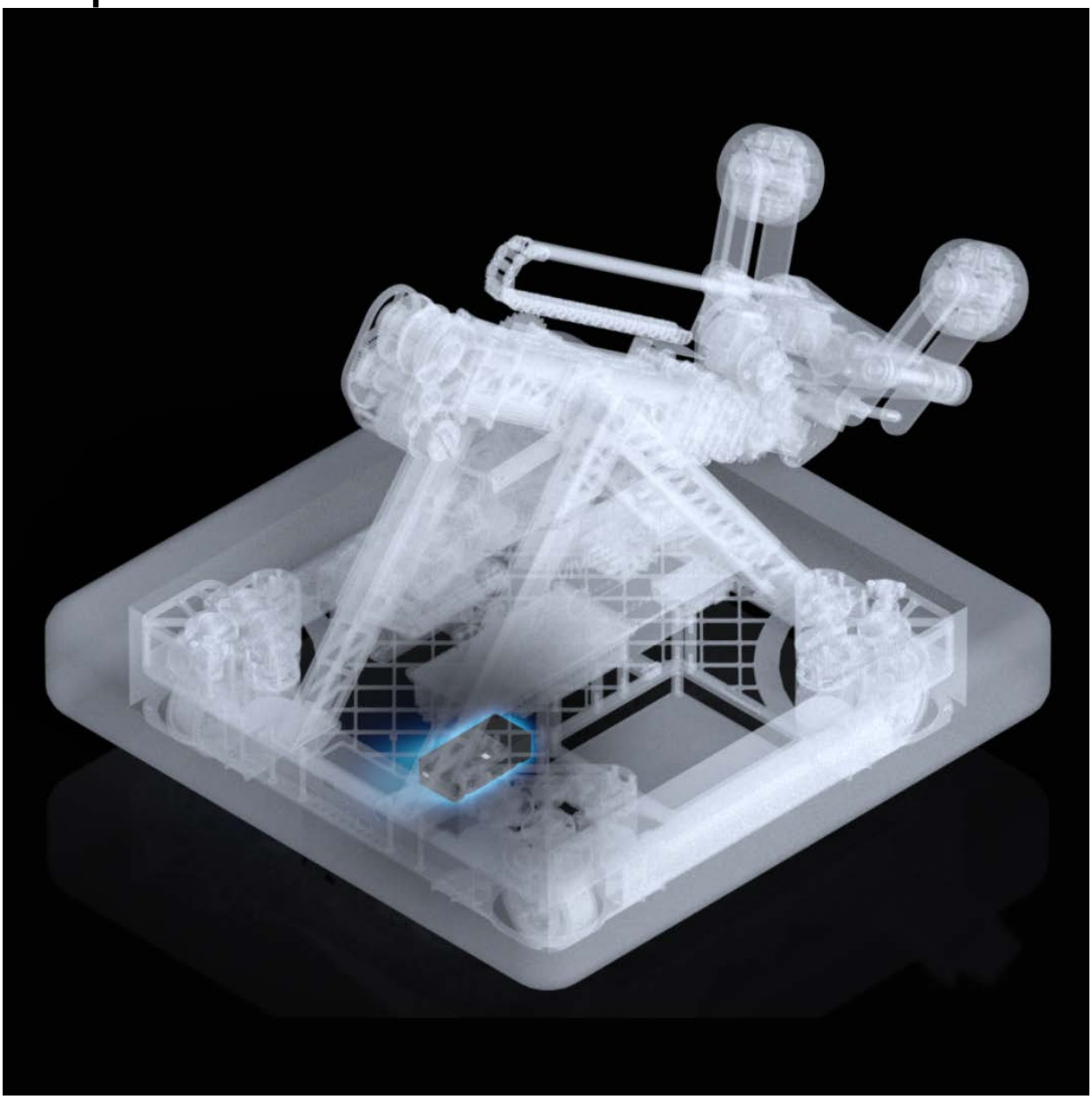
Example #5



In this configuration the radio is mounted on a plate with the rest of the robot's electronics. The status LEDs are pointing downward (towards the ground).

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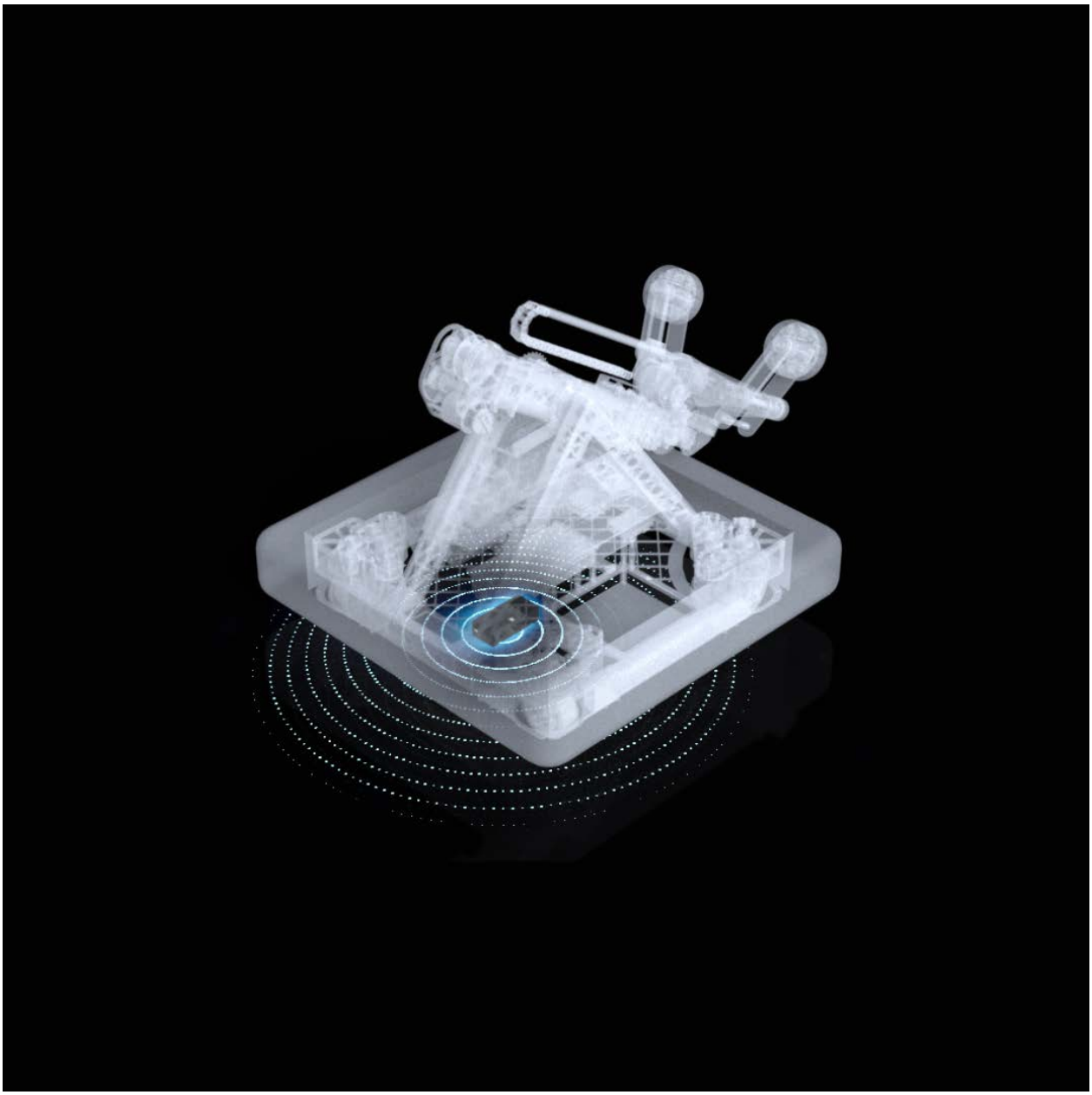

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Side view of the VH-109's radiation pattern in this mounting configuration

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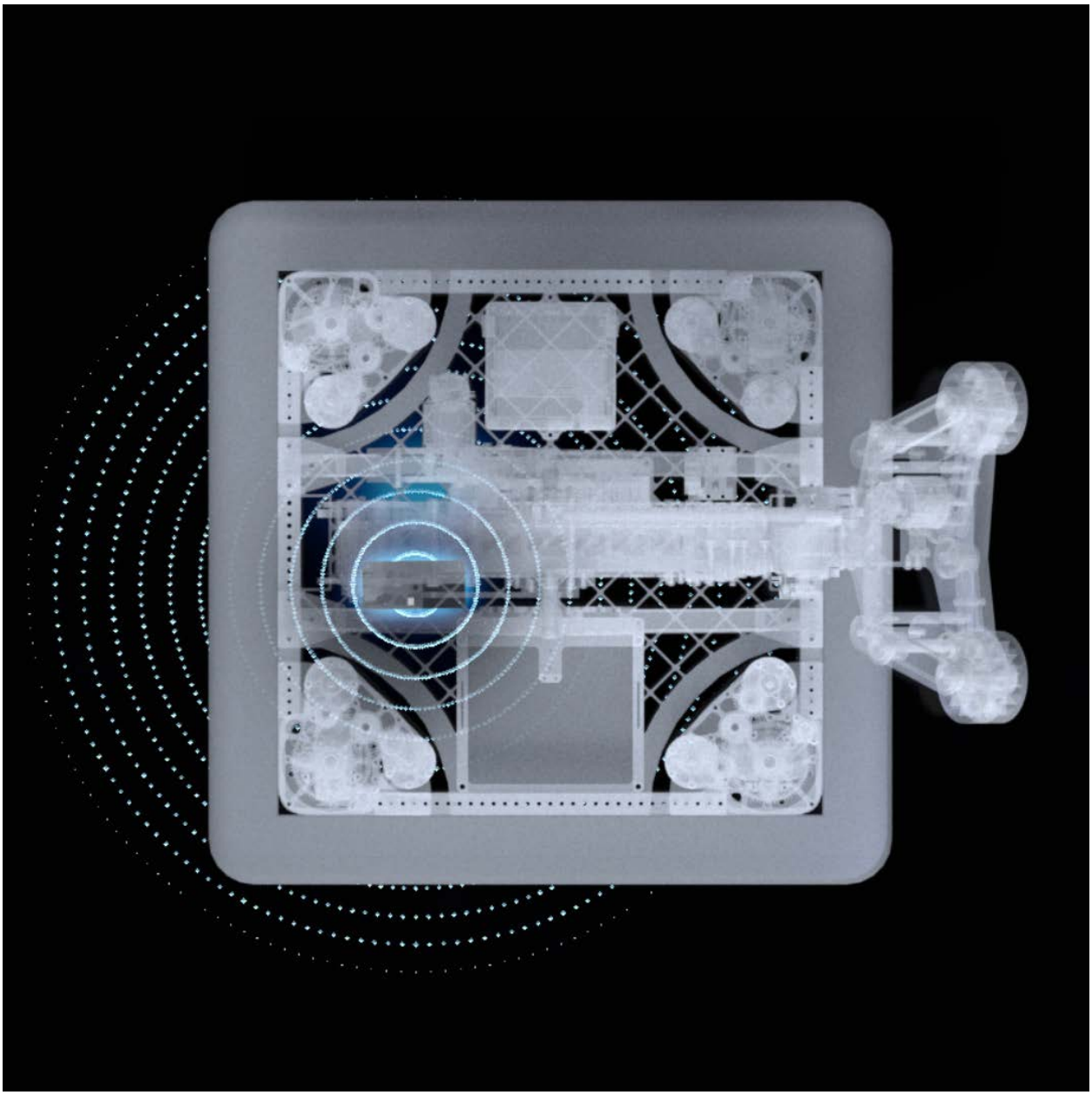

Top view of the VH-109's radiation pattern in this mounting configuration

This is one of the worst ways you can mount your radio. In this scenario the radio is broadcasting into the ground, which has a significant impact on performance. In this scenario the field access point (AP) will likely have a hard time maintaining a good connection to the radio throughout the match.

Final Verdict: ***Not Acceptable***

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How To Mount Your Radio

There are two recommended methods to mount your radio.

Zip Ties

The radio housing has two notches on either side. These notches are sized to fit a 1/4" wide zip tie (McMaster-Carr P/N 70215K57). When zip ties can be run through these notches and around a part of your robot's structure to rigidly mount the radio to the robot.

Removing the radio is easy, just cut the zip ties and unplug the cables.

VHB Tape

Another recommended solution is to use VHB tape. This is a high strength foam tape that can create a rigid mechanical connection between your robot and the radio.

Here are some examples of recommended VHB tape:

Thickness x Width	Supplier / Part Number
0.045" x 0.500"	McMaster-Carr / 8127A51
0.045" x 1"	McMaster-Carr / 8127A53
0.045" x 2"	McMaster-Carr / 8127A61

It's possible to remove the radio when using VHB, but keep in mind that VHB creates a more permanent bond than zip ties. Removing a radio mounted with VHB will require some force. Be careful not to damage your radio in the process of removing it.

Zip tie notches are included in the event that teams opt out of using VHB or another adhesive to attach the radio to their robots.