



# AirPods Max Teardown

Physical teardown and X-rays of Apple's devastatingly overengineered over-ear headphones, the AirPods Max.

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# INTRODUCTION

The name “AirPods” can now refer to either [tiny little e-waste disasters](#) or cavernous, over-ear Max headphones. With a name like AirPods, we had to know: will the AirPods Max be serviceable to any degree? Or did Apple spend a good chunk of the \$550 price on over-engineering them into knots?

We wanted to do more than just strip these Pods down to their Digital Crown, truly odd Lightning Port, and micron-scale screws. With time to really explore the space, we enlisted the help of [Creative Electron](#) to work them over with X-rays. Not only that, but we also took apart some semi-comparable Sony and Bose headsets, to see just how different Apple’s (non-Beats) entry into the premium headphone market would be.

For reference (eh?), check out our [previous AirPods teardowns](#). To keep up on what’s happening around gadgets and repair, check out our [YouTube channel](#), our [Instagram](#), and our [Twitter](#). And to always hear first about our latest gadget investigations, subscribe to our [newsletter](#).



## TOOLS:

- [Heat Gun](#) (1)
- [Probe and Pick Set](#) (1)
- [P5 Pentalobe Screwdriver Retina MacBook Pro and Air](#) (1)
- [T1 Torx Screwdriver](#) (1)
- [T2 Torx Screwdriver](#) (1)
- [T3 Torx Screwdriver](#) (1)
- [T4 Torx Screwdriver](#) (1)
- [T5 Torx Screwdriver](#) (1)
- [Spudger](#) (1)
- [Tweezers](#) (1)
- [SIM Card Eject Tool](#) (1)
- [4mm Nut Driver](#) (1)
- [Soldering Iron](#) (1)
- [Phillips #00 Screwdriver](#) (1)
- [Isopropyl Alcohol](#) (1)

## Step 1 — AirPods Max Teardown



- AirPods Max will set you back a whopping 550 US dollars. What do you get for all that hard-earned cash?
  - Two 40 mm Apple-designed dynamic drivers
  - Two color-matched magnetic ear cushions
  - Two Apple H1 chips
  - Eight microphones for active noise cancellation
  - Bluetooth 5.0 with support for the Apple-friendly AAC codec
  - A soft-touch Smart Case and a Lightning-to-USB-C cable for charging
- ⓘ Notably absent from this list: any sort of auxiliary cable. You'll have to buy a [Lightning-to-3.5 mm audio cable](#) at additional cost if you want to do any wired listening.

## Step 2



- First order of business: unwrap our present.
- ☑ The Smart Case comes with its own little [protective paper wrapper](#), so it arrives nice and fresh.
  - The wrapper is a single-piece, precision-cut affair that looks like it probably cost millions to design and manufacture all by itself. Into the recycling bin it goes.
  - The Smart Case doesn't cover up as much as you might think. It's more like Smart Shorts, if you will.

## Step 3



- Before we go any further, it's time to blast these things with some X-rays (or, more accurately, it's time for our friends at [Creative Electron](#) to blast them with said X-rays).
- Even more than most X-rays, this image is rich with see-through detail! We spot:
  - Two battery cells, both in the same ear cup.
  - *i* Worryingly, there are some solder joints and wires near the batteries, but no obvious connectors. We're still holding out hope for an easy battery swap procedure, though—the connectors aren't always easy to spot from here.
  - You'll notice in the X-ray that the ear cup opposite the batteries doesn't seem to have any sort of counter-weight, just empty space. Maybe it's tucked away somewhere else? We'll be on the lookout.
- Huge dual-ring speaker driver magnets, and speaker units that appear to be secured with screws—a great sign!
- Lots of little alignment magnets, brackets for the various microphones, and some more friendly screws.

## Step 4



- If you want to not only look *through* but look *around*, Creative Electron has you covered there, too. Take this brief video orbit around the AirPods Max.
- In the movie version it's easier to catch all those screws (yay!), and get a feel for the depth and layers of each ear cup.

## Step 5



- Hold up a minute: is this an Apple Watch teardown or an AirPods teardown?
  - Like the Grinch's heart on Christmas, the Digital Crown has grown to three times its original size. Unlike the Grinch's heart, this Digital Crown handles the volume and playback controls for AirPods Max.
- Along the bottom edge of the AirPods you'll find a few holes, but none of them are the friendly round 3.5 mm kind.
  - Instead, wired listening is handled by the Lightning port, pulling double duty for listening and charging. Oh, but you'll need to buy an [extra cable](#) for the listening part. That's real ... [courageous](#), Apple.
- The first step in disassembly is removing these magnetic ear cushions. An openly user-replaceable part on an AirPods product? We must have made the Nice List this year.
- In case you were looking for the Apple logo on this pair of head speakers: [it's here, just tucked away](#).

## Step 6



- Underneath the ear cushions: holes! And wait a sec, are those screws? Computer, *enhance!*
- Well, the good news is that we aren't fighting glue yet. These are already looking like a promising departure from the the rest of the AirPods we've previously [scalpel-ed into submission](#).
- The less-than-good news is, they're Pentalobe screws. Luckily we're used to that, and came prepared for just about any kind of screw (15 kinds, to be exact) thanks to our [Marlin Screwdriver Set](#).

## Step 7



- This is where the fun stops and the work begins.
- Those screws got our hopes up, but they behave... strangely. They turn a little ways in each direction, and then stop.
- If you forcibly remove them like we did, you'll be rewarded with the sound of loose pieces rattling around inside the earcups... which remain sealed shut. Huh?
- It turns out, you're not supposed to *remove* the screws—just rotate them each a quarter turn or so, to release a locking wedge on the other side. Our pal Quinn over at Snazzy Labs has a lovely video of what that looks like, along with his review of the AirPods Max sound quality—[check it out!](#)
- The next round of frustration: adhesive. That's right, releasing the locks and/or removing the screws isn't enough. Out comes the heat gun, which must be wielded very carefully to avoid melting all this plastic.
- There's really no clearance at all for prying these things out by the edges—if you try, you're gonna do some damage. Since we've already removed the screws, we use a handy [dental pick](#) to hook under the screw holes and *pull*. Finally... we're in!

## Step 8



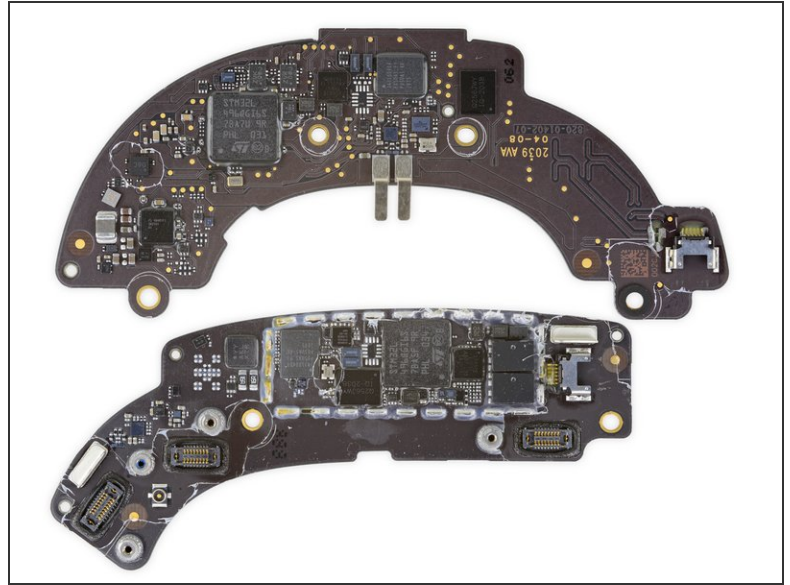
- Ear cup grilles away! Each one has a single microphone stowaway, here to hear what the wearer is listening to, probably to then report back to the H1 chip for EQ adjustments. Or go directly to Tim Cook's earpiece.
- Each 40 mm driver is held down by a few screws, one of them a gigantic standoff. We're momentarily stumped, and reach for our kitted-out [Mahi driver kit](#). A torq-set #6 bit is ... not a perfect fit, but gets the job done.

## Step 9



- With the screws removed, the drivers flip right out, revealing a pair of repair-friendly spring contacts directly underneath. Neat!
- That provides enough clearance to remove our next target: the battery. As shown in the X-ray, both battery cells live in the right ear cup, tethered together by a single cable.
- To our relief, both cells are fastened with screws, not adhesive. Even better, they provide power via a single, iPhone-style pop connector—no solder here.
- That was surprisingly painless, particularly for an [AirPods](#) product. Were it not for the glue-y opening procedure, you could almost say it was *easy*. Imagine that—easily replacing a consumable component, instead of throwing the whole device away.
- Made by Sunwoda, the two cells are wired in parallel, with a total capacity of 664 mAh and 2.53 Wh total energy at 4.35 V. Each cell measures approximately 5.7 x 20 x 28 mm.
- This is right in line with the 2.39 Wh cell in the Bose NC 700 wireless headphones, which also promise around 20 hours of listening time. Sony WH-1000XM4s offer a longer, 30 hour listening time, with a correspondingly larger 4.1 Wh battery driving them.

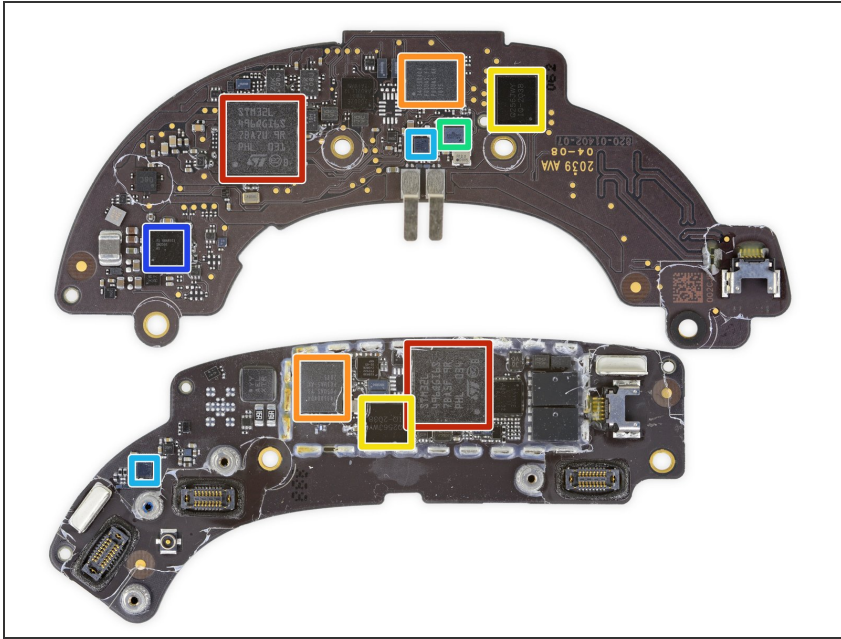
## Step 10



- Next target: the logic board. There's a unique board in each side—we extracted both, and called on our amazing community of fixers to help ID all the silicon. *Spoiler alert:* They did an amazing job.

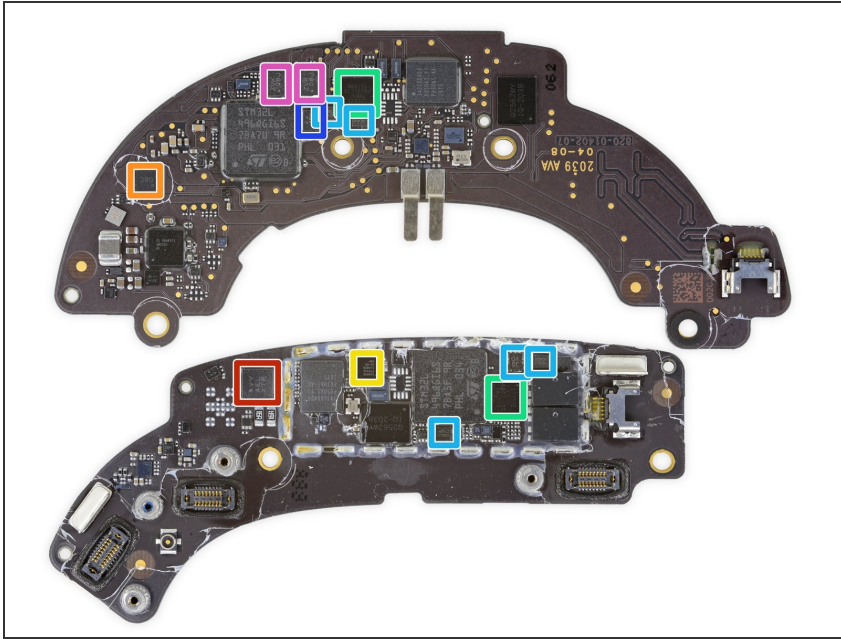
📌 For maximum resolution, you can find the original image files [here](#) and [here](#).

## Step 11



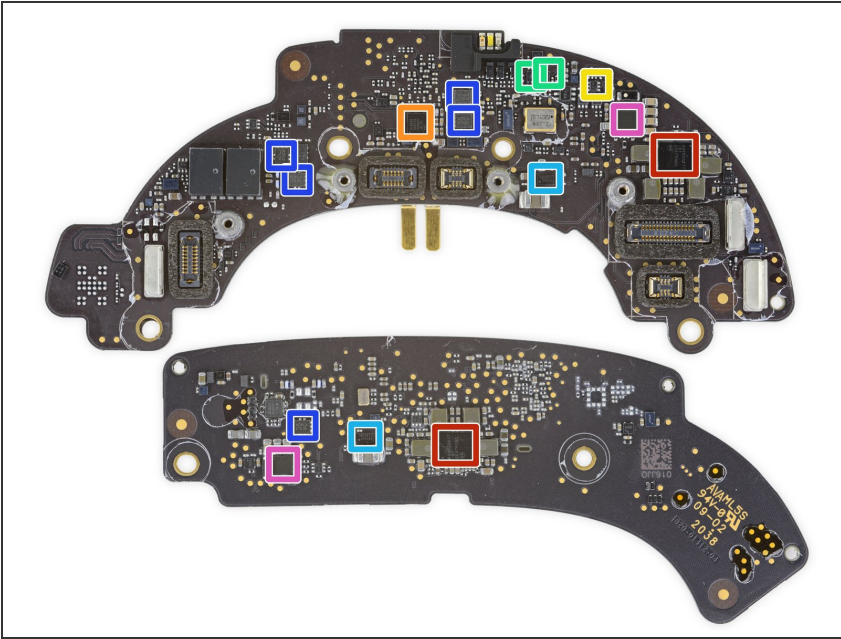
- Here are the chip ID submissions we've received to date. What else can you find?
  - STMicroelectronics [STM32L496QG](#) 32-bit Arm microcontroller
  - Apple 343S00404, likely a Bluetooth SoC
    - ⓘ This is probably the H1 chip rumored to be on each side of the headset.
  - Winbond [W25Q256JW](#) 256 Mb serial flash memory
  - Cirrus Logic CS46L10A0, likely an audio codec
  - Cirrus Logic CS44L22, likely a 1-Ch. audio amplifier
  - Texas Instruments SN2501, likely a battery charger IC

## Step 12



- Side A of IC ID, continued:
  - Bosch Sensortec, likely an inertial measurement unit
  - Bosch Sensortec [BMA456](#) 3-Axis accelerometer
  - NXP Semiconductor CBTL610A38, likely a display port multiplexer
  - Lattice Semiconductor [LCMXO2-2000ZE](#) MachXO2 field programmable gate array
  - Diodes Incorporated [PI3USB102E](#) 480 Mbps USB 2.0 switch
  - Texas Instruments [TMUX136](#) 2-Ch. 2:1 analog switch
  - Texas Instruments [SN74AVC4T774](#) 4-bit dual-supply bus transceiver

## Step 13



- Boards, side B. What do you see?
  - Apple 338S00517, likely a power management IC
  - NXP Semiconductor CBTL610A38, likely a display port multiplexer
  - Texas Instruments [TLV341](#) operational amplifier
  - Texas Instruments [TLV3691](#) comparator
  - Texas Instruments [TPS62743](#) 300 mA step down DC-DC converter
  - Diodes Incorporated [PI3USB102E](#) 480 Mbps USB 2.0 switch
  - Maxim Integrated [MAXM17552](#) 100 mA step-down power module

## Step 14



- Standing between us and the Lightning port are four Torx screws. Two of them are so hard to reach we have to daisy-chain a T2 Torx bit into a 4 mm nut driver—nothing else fits in this little space.
- While challenging to remove, this port's modularity is critical for repairs—without it, your AirPods will never charge again.
- Next up: Behind the two exterior slits on the lower corner of each can is this plastic air channel, which passes straight through to the cavity directly behind the driver. You might call it an *air port*.
- Presumably this is the ventilation system that gives those drivers their distortion-free *oomph* at higher volumes.

## Step 15



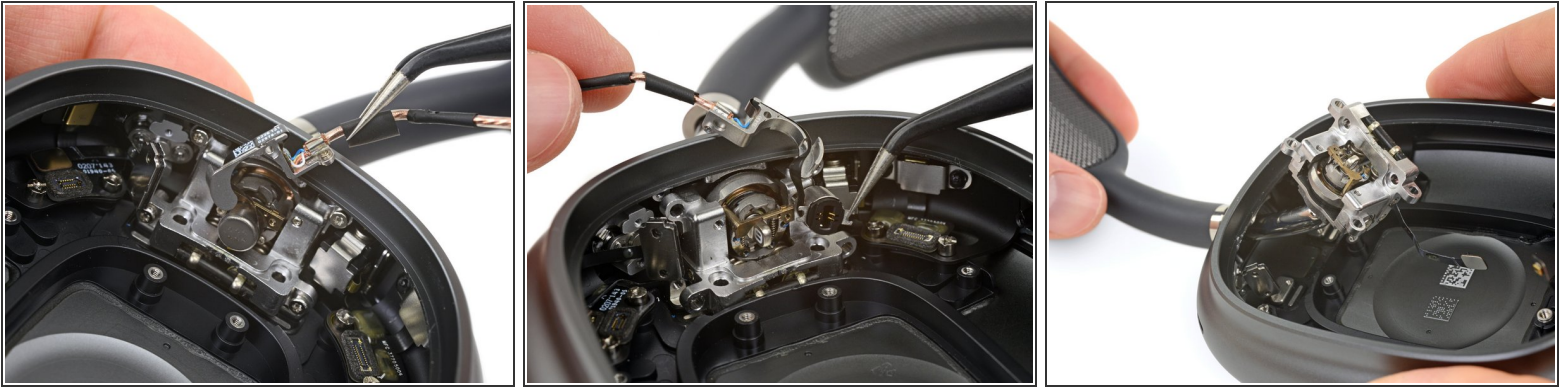
- Hiding beneath that antenna line on the left ear cup is... [a big antenna](#). We had a thought this might be some sort of counterweight, to offset the batteries in the opposite ear cup—but it weighs next to nothing.
  - [Here's an X-ray](#) if you'd like a deeper look.
- The upper microphones are secured with little metal brackets, screwed *and* plastic-riveted into place. Every turn of this teardown is just *riveting*.
  - A soldering iron makes quick work of these rivets by melting the top off. But this is not a very repair-friendly way to go.
- Right next door, we find some mechanical button hardware. The button and ribbon cable come free easily enough, but the rest is secured with two *tiny* hex nuts that are smaller than anything in our toolkit.
- ① That's thrice now we've had to reach beyond even our expansive toolkits for this one pair of headphones. Who says Apple [can't innovate](#)?

## Step 16



- You're now looking at perhaps the most elaborate part of the AirPods Max.
- Does this look scary to take apart?
  - *Nah.*

## Step 17



- Any capable headphone headband has to tilt, spin, and connect the ear cups together, but no other headphone does it quite like this.
- Apple's electromechanical hinge hardware is both intricate and overbuilt, and might make the AirPods Max's price tag a little easier to swallow.
  - This hinge needs to provide a sturdy but comfortable connection for the headband, while also reliably passing a power connection through from the battery.
  - Apple uses a wraparound flex cable in the rotating portion of the joint, with some clever routing and built-in strain relief—then switches over to spring contacts for the connection to the headband. What a flex.
- ❗ Hopefully, all that adds up to fewer failures from cable wear. Durability is hard to predict at times, but it's clear that a *lot* of thought went into this setup.
- With a bunch of Torx screws out of the way, the joint is ready for its closeup.

## Step 18



- Not merely T4, not only T3, not just T2, but even a few teeny-tiny **T1** Torx screws later, the joint comes apart and shows its springs, miniscule bearings, and precision-machined micro-housings.
- The two large springs provide that gentle clamping pressure on your skull, while the two smaller springs perform a neat trick that we'll reveal in a minute.
- Why did Apple go to such lengths to over-engineer these parts? Here are a few factors:
  - The two points in any headphone where the headband meets the ear cup are paramount for comfort. The joint needs to move with multiple degrees of freedom to sit comfortably on the wearer's head, and be sturdy enough to be yanked around a bit during the putting-on and resizing process.
  - Additionally, headphones are little pockets of pure vibration. Inside both ear cups, the drivers vibrate rapidly for extended periods of time to create sound for your ear holes. So any joint hardware *inside* the ear cup needs to be pretty robust.
  - It was rumored that Apple wanted to design the AirPods Max headband to be easily-swappable like its magnetic ear cups. That feature was [thought to be missing](#) from the final design, but this joint is so complex it just might have *one more thing* up its sleeve...

## Step 19



- Here's the trick, and the best part: despite the joint's complexity, you *can* detach the entire headband from AirPods Max with just a SIM card removal tool or paperclip, without even opening the ear cup.
  - ❗ When fully assembled, a little poke in [just the right place](#) compresses two tiny springs inside the joint, freeing the clamp that secures the headband.
- We were as shocked as you are. Did Apple put this tiny hole here with *repair* in mind? Portability? Both? Is \$550 starting to seem ... reasonable?

## Step 20



- That's a wrap on AirPods Max! What a delightfully perplexing pair of headphones.
- Despite the slightly confusing and over-complicated (read: sticky) opening process, these things are actually fairly serviceable. Not *fun* to service, but serviceable.
- As always, we have a love/hate relationship with Apple's use of screws: love the use of screws, but hate the screws they choose.
- Before we sign off and assign these headphones a score though, there's just one more thing... or two...

## Step 21



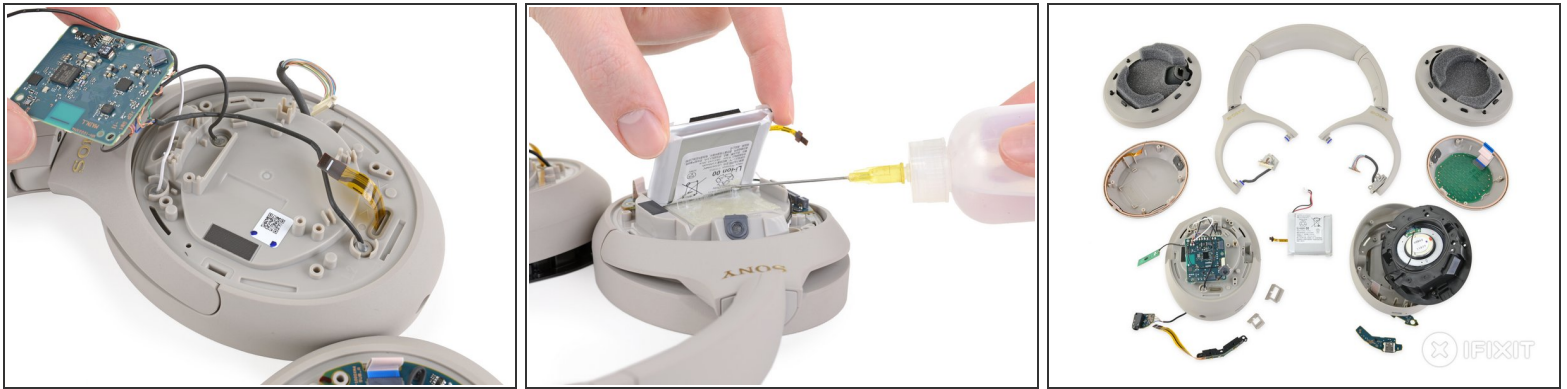
- To better gauge Apple's approach to big, pricey headphones, we also took apart a couple other pairs of cans—the kinds without Digital Crowns or Lightning ports.
- We'll start with Sony's ever-popular \$350 [WH-1000XM4s](#).
- This headset is plastic-clad, so the casing is significantly more transparent in Creative Electron's X-rays.

## Step 22



- Sony's ear cushions clip into (and out of) place—no fancy magnets here. We rather liked the magnets; clips can get brittle and break.
- Underneath, we find a free-floating foam liner. Under the foam liner, the drivers sit encased in plastic cages.
- The drivers will have to wait though. Four ( [marked and visually distinct](#)!) screws inside each ear cup hold down the *exterior* panels. So instead of digging deeper, we flip to side B.

## Step 23



- On the back of the left ear cup, this square circuit board is home to Sony's [QN1 processor](#) and a Mediatek bluetooth SoC, among some other ICs. Here are full-sized images of [both sides](#), for the curious.
- On the back of the right ear cup: the battery! The connector is easy to access, but the [4.1 Wh cell](#) rests on a tenacious adhesive pad. We used a little isopropyl alcohol to free it.
- In both ear cups, all wires that pass through the plastic housing are [hot glued in their holes](#). Because of this, moving components around on either side is tricky, and accessing the USB-C port or 3.5 mm jack underneath the driver housing is a pain.
- Overall, not too bad. A couple misses, but refreshingly simple after that very long and winding AirPods slog:
  - All screws are Phillips 00; ear cushions, headband, buttons, and ports are all modular and replaceable.
  - The battery is a gluey mess and the disassembly path is slightly wonky.
  - Lots of hot glue and no friendly connectors for the 3.5 mm aux jack or drivers.

## Step 24



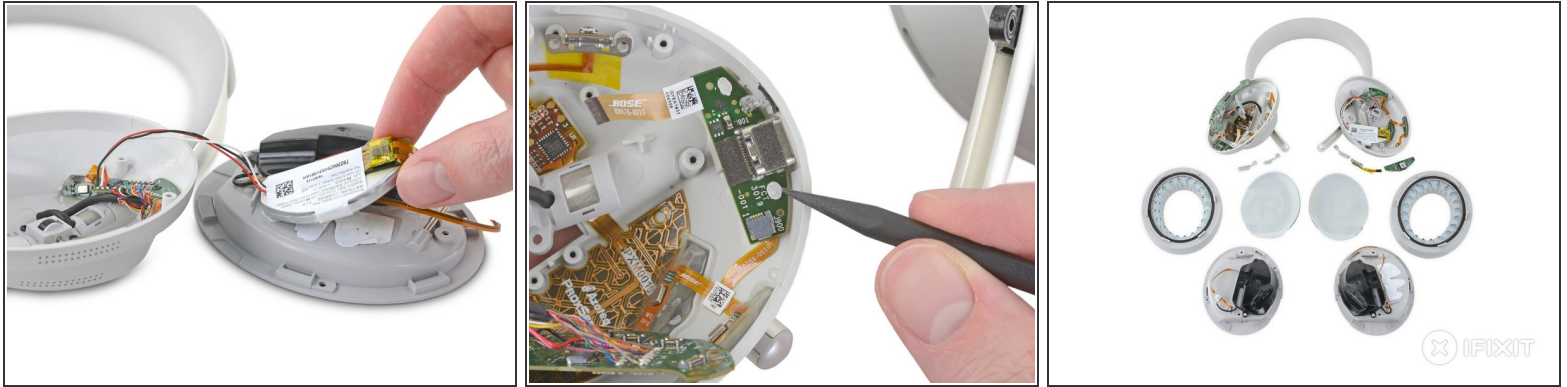
- Annnnnnd one more—Bose's \$380 [NC 700](#) have a little more metal in them, particularly in that shiny headband.

## Step 25



- Like on the Sonys, these ear cushions clip to their cup housing. With a little spudger persuasion, they are free—effective, if not as elegant as the AirPods.
- Unlike the Sonys and the AirPods, the cloth liner over each speaker grille doesn't come up with the ear cushion. The L and R marked liners are slightly glued down, making them annoying to peel off without ripping.
- Under the liner, Torx security screws guard the entrance to each ear cup.
- Both cups hold a mess of wires—but the right one, home to the main circuit board, is truly tangled.
- On that circuit board lives a Qualcomm [CSRA68105 Bluetooth audio SoC](#). Here are some full-res images of that board, if you want to do more sleuthing: [front](#), [back](#).

## Step 26



- The 2.39 Wh battery lives next to the driver on the backside. Long wires connect to a control board—but the connection is soldered.
- Mixed news: The headband has screws for removal, but doesn't fully detach without desoldering. Better news: the 2.5 mm aux jack is modular, held down with screws.
- Bad news: the microphones are embalmed in glue. Other bad news: the USB-C control board is modular, but held down with plastic rivets for some reason?
- To sum it all up:
  - Ear cushions, drivers, 2.5 mm aux jack, and buttons are accessible and replaceable.
  - The battery is easily accessible, but gluey—and its connection to the circuit board in the left ear cup is soldered.
  - Lots o' hot glue prevents microphones and some peripheral circuitry from being removed; the USB-C port is held down with single-use fasteners; the headband is a little confusing to disconnect and can't be fully removed without (extensive) soldering.

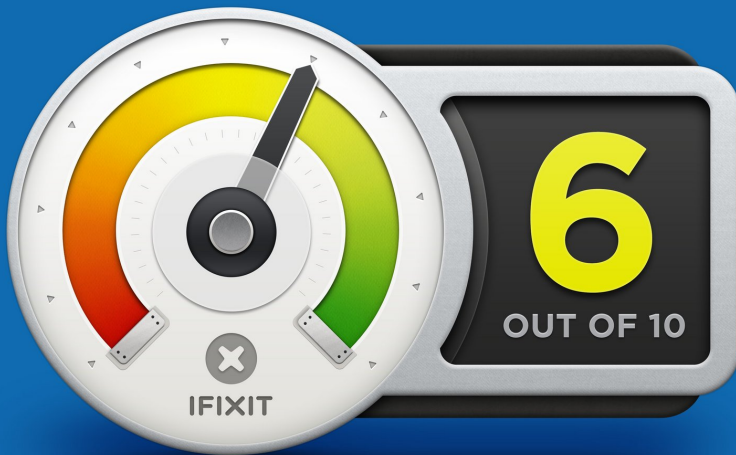
## Step 27



- With all their intricate, precision-engineered parts, AirPods Max remind us more of a mechanical watch than of any pair of headphones.
- Despite their complexity, and an earcup-opening procedure fraught with strange screws and adhesive, Apple's first over-ear headphones are actually quite serviceable—if you have all the tools and are willing to put in some work.
- We're thrilled to see DIY-friendly highlights like the easily-removable ear cushions and headband in an Apple product.
- And after tearing down some of the competition, we're more understanding of that \$550 price tag. Sony and Bose both charge less, but internally, the AirPods Max's obsessive craftsmanship makes those other extremely capable devices look like toys by comparison.
- All that said, we're excited to award the first-ever *non-zero* repair score to an AirPods device...

## Step 28 — Final Thoughts

### REPAIRABILITY SCORE:



- The AirPods Max earn a **6 out of 10** on our repairability scale (10 is the easiest to repair):
  - The ear cushions attach (and detach) magnetically—no tools required.
  - The headband detaches from both earcups with a simple poke from a paperclip or SIM card tool—no wires and no fuss.
  - Drivers and battery are secured with screws and use repair-friendly board connections.
  - While screws are almost always preferable to glue, the sheer number of screw types here is baffling—you'll need an *extensive* toolkit, even by our standards.
  - Pentalobe screws *and* adhesives guard the earcups, complicating internal repairs.