United States Court of Appeals

FOR THE DISTRICT OF COLUMBIA CIRCUIT

Argued September 17, 2021 Decided December 28, 2021

No. 20-1190

AT&T SERVICES, INC.,
PETITIONER

v.

FEDERAL COMMUNICATIONS COMMISSION AND UNITED STATES OF AMERICA,
RESPONDENTS

APPLE INC., ET AL.,
INTERVENORS

Consolidated with 20-1216, 20-1272, 20-1274, 20-1281, 20-1284

On Petitions for Review of an Order
of the Federal Communications Commission

Jonathan E. Nuechterlein argued the causes for petitioners Joint Issues. *Mark Reddish* argued the causes for petitioner APCO. With them on the joint briefs were *Jeffrey S. Cohen*, *C. Frederick Beckner III*, *Rick Kaplan*, *Jerianne Timmerman*, *Craig A. Gilley*, *Mitchell Y. Mirviss*, *Elizabeth C. Rinehart*, and *Russell P. Hanser*. *Michele Farquhar*, *Brett Kilbourne*, *Jay*

Morrison, *Brian W. Murray*, *Delia D. Patterson*, *Christopher T. Shenk*, and *Ian D. Volner* entered appearances.

Trey Hanbury and *Jessica L. Ellsworth* were on the brief for *amicus curiae* Southern Company Services, Inc. in support of petitioners.

James M. Carr, Counsel, Federal Communications Commission, argued the cause for respondents. With him on the brief were *Daniel E. Haar* and *Robert J. Wiggers*, Attorneys, U.S. Department of Justice, *Jacob M. Lewis*, Associate General Counsel, Federal Communications Commission, and *Thaila K. Sundaresan*, Counsel. *Richard K. Welch*, Deputy Associate General Counsel, and *Adam Crews*, Counsel, entered appearances.

Christopher J. Wright argued the cause for intervenors. With him on the joint brief were *David Paul Murray*, *Russell H. Fox*, *Robert G. Kidwell*, *Paul J. Caritj*, and *Jason Neal* in support of respondents. *Rick C. Chessen* and *Neal M. Goldberg* entered appearances.

Matthew A. Brill and *Matthew T. Murchison* were on the brief for *amicus curiae* Cable Television Laboratories, Inc. in support of respondents.

Andrew Jay Schwartzman and *Harold Feld* were on the brief for *amici curiae* Public Knowledge, et al. in support of respondents.

Before: TATEL, MILLETT, and WALKER, *Circuit Judges*.

Opinion for the Court filed by *Circuit Judge* TATEL.

TATEL, *Circuit Judge*: By order dated April 24, 2020, the Federal Communications Commission opened the 6 gigahertz (GHz) band of radiofrequency spectrum to unlicensed devices—routers and the devices they connect to, such as smartphones, laptops, and tablets. In doing so, the Commission required that such unlicensed devices be designed and operated to prevent harmful interference with licensees now using the 6 GHz band, i.e., commercial communications providers, electric utilities, public safety services, and network broadcasters. Those licensees, emphasizing that existing uses of the band involve vital public safety and critical infrastructure, argue that harmful interference could nonetheless occur and that the Order therefore runs afoul of both the Communications Act of 1934 and the Administrative Procedure Act. But as explained in this opinion, petitioners have failed to provide a basis for questioning the Commission's conclusion that the Order will protect against a significant risk of harmful interference, just the kind of highly technical determination to which we owe considerable deference. We therefore deny the petitions for review in all respects save one. The exception relates to the petition brought by licensed radio and television broadcasters using the 6 GHz band. Because the Commission failed adequately to respond to their request that it reserve a sliver of that band exclusively for mobile licensees, we remand to the Commission for further explanation on that point.

I.

Many users of the radiofrequency spectrum operate by transmitting information through microwaves—short waves of 890 megahertz (MHz) or higher. *See* 47 C.F.R. § 101.3

(defining microwave frequencies). To prevent such users from interfering with one another, the Federal Communications Commission, pursuant to its authority under the Communications Act of 1934, 47 U.S.C. § 151 et seq. ("Communications Act"), awards licenses to operate in specific frequency ranges, or "bands." *See id.* §§ 151, 301 (creating the Commission to carry out the Act's provisions and providing for licensing).

Historically, the 6 GHz band, comprising frequencies between 5.925 and 7.125 GHz, has been reserved for licensed users that "support a variety of critical services provided by utilities, commercial and private entities, and public safety agencies." Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz, 35 FCC Rcd. 3852, 3855 ¶ 7 (2020) ("Order"). Some of these licensees transmit signals through a "fixed-microwave system," in which "a transmitter on one tower beams 6 GHz signals to a receiver on another tower within its line of sight." Pet'rs' Br. 3. Fixed microwave systems support "emergency 911 dispatch and other public safety operations," *id.*; "commercial wireless providers," Order ¶ 7; and "links for coordination of railroad train movements, control of natural gas and oil pipelines, management of electric grids, and long-distance telephone service," *id.* In addition to fixed microwave users, other 6 GHz band licensees operate on a mobile basis. They employ transmitters and receivers affixed to portable bases, like news vans and broadcasting cameras, and send programing from remote locations back to studios. Still others employ mobile transmitters to support wireless microphones and backstage communications.

Several decades ago, the Commission, charged by Congress to "generally encourage the larger and more effective use of" the spectrum, 47 U.S.C. § 303(g), opened the 2.4 GHz

and certain other bands to unlicensed radiofrequency transmitters. Today, these devices include routers and the smartphones, laptops, and tablets they support. Such devices, however, must refrain from causing "harmful interference" with licensed users. 47 C.F.R. § 15.5(b)–(c); *see also* Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band, No. 02-380, FCC-02-328 ¶¶ 3–4 (Dec. 11, 2002) (describing the history of unlicensed operation). Commission regulations define "harmful interference" as interference that "endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs or repeatedly interrupts a radiocommunications service." 47 C.F.R. § 15.3(m). If harmful interference occurs, the Commission may order the interfering user to cease operations. *Id.* § 15.5(c) ("The operator of a radio frequency device shall be required to cease operating the device upon notification by a Commission representative that the device is causing harmful interference."); *see also id.* § 15.15(c) ("[O]perators [of unlicensed devices] are required to cease operation should harmful interference occur to authorized users.").

The Commission's opening of the radiofrequency spectrum for unlicensed uses has taken on new import in recent years because of a boom in unlicensed devices that use Wi-Fi and Bluetooth technology. *See* Order ¶ 1. Such devices include internet "access points" (e.g., routers) and the myriad "client devices" that connect to them, like smartphones, tablets, and laptops. *Id.* ¶¶ 3, 12. Because these devices transmit large amounts of data, they require access to wide bands of the spectrum. "The demand for wireless broadband," according to the Commission, "continues to grow at a phenomenal pace;" by 2024, a smartphone's average data use is projected to grow almost sixfold relative to 2018 data levels. *Id.* ¶ 2.

In 2017, responding to this growing demand, the Commission announced that it was considering opening a portion of spectrum between 3.7 and 24 GHz to unlicensed use and sought public comment. Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz, 32 FCC Rcd. 6373 (2017). The following year, the Commission proposed a rule that would open the 6 GHz band to unlicensed devices, again seeking public comment. Unlicensed Use of the 6 GHz Band; Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz, 33 FCC Rcd. 10496 (2018). The Commission chose the 6 GHz band in part because of its proximity and similarity to the 5 GHz band, portions of which already allowed unlicensed use. Opening the adjacent 6 GHz band would allow unlicensed devices to "operate with wider channel bandwidths and higher data rates with increased flexibility." *Id.* ¶ 14; *see also id.* ¶ 19. After considering comments, the Commission, at an open meeting on April 23, 2020, adopted the Order now before us. *See generally* Order, 35 FCC Rcd. 3852.

The Order allows unlicensed devices to operate in the 6 GHz band. Because the extent to which a signal may cause interference depends in part on the signal's power, the Order distinguishes between internet access points that use standard power (like the devices that provide internet to stadiums, concert halls, and other large areas) and access points that use low power (like typical residential or office routers).

The Order requires all standard-power access points to use an automated frequency coordination (AFC) system, a technology designed to ensure that unlicensed devices do not cause harmful interference with licensed devices. *Id.* ¶ 17. But because the AFC system requires knowing the "exact operating locations and times" of licensed uses, it offers little protection to licensed mobile operators, whose location "can change frequently." *Id.* ¶ 93. For that reason, the Order prohibits

unlicensed standard-power access points from using those 6 GHz sub-bands in which mobile licensees operate.

By contrast, the Order allows unlicensed low-power access points to operate across the 6 GHz band. But to protect licensed users from harmful interference, the Order requires that routers (1) operate below specified maximum power levels—as relevant here, 5 decibel milliwatts per megahertz (5 dBm/MHz); (2) use a "contention-based protocol," through which a device "listens" to a channel to ensure it is free before transmitting a signal over it; and (3) remain indoors, thus decreasing the likelihood of interference with licensed outdoor users. Smartphones, laptops, and other client devices using these low-power access points must observe an even lower maximum power limit and employ contention-based protocol technology. To discourage the outdoor use of low-power routers, the Order (1) prohibits making them weather-resistant, (2) requires that they have integrated antennas, and (3) forbids equipping them with batteries. These multifaceted protections, the Commission concluded, "eliminate[] any significant risk of causing harmful interference" with licensed users. *Id.* ¶ 146.

Petitioners either hold licenses to operate in the 6 GHz band or represent entities that do. Specifically, petitioners are commercial communications providers AT&T Services and Lumen Technologies, electric utilities, the Association of Public-Safety Communications Officials International (APCO), and the National Association of Broadcasters. Petitioners contend that the Order fails to protect licensees from harmful interference and therefore runs afoul of both the Communications Act and the Administrative Procedure Act (APA), 5 U.S.C. § 706(2)(A). They urge us to vacate the Order and remand to the Commission to implement further safeguards. Several industry groups and companies, including Apple, Broadcom, and Cisco Systems, which manufacture

devices or provide services that rely on unlicensed spectrum, have intervened to defend the Order.

II.

Fundamental and longstanding principles of administrative law guide our review of petitioners' challenges to the Commission's order. To demonstrate that a regulation is arbitrary and capricious, a challenger must show that the agency "relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Motor Vehicle Manufacturers Ass'n v. State Farm Mutual Automobile Insurance Co.*, 463 U.S. 29, 43 (1983). Where, as here, the Commission "'foster[s] innovative methods of exploiting the spectrum,' it 'functions as a policymaker' and is 'accorded the greatest deference by a reviewing court.'" *Mobile Relay Associates v. FCC*, 457 F.3d 1, 8 (D.C. Cir. 2006) (quoting *Teledesic LLC v FCC*, 275 F.3d 75, 84 (D.C. Cir. 2001)). Of course, "we do not hear cases merely to rubber stamp agency actions." *Natural Resources Defense Council, Inc. v. Daley*, 209 F.3d 747, 755 (D.C. Cir. 2000). But to survive judicial review, the Commission's technical judgments need rest upon only "'a modicum of reasoned analysis,' 'absent highly persuasive evidence to the contrary.'" *Mobile Relay Associates*, 457 F.3d at 8 (quoting *Hispanic Information & Telecommunications Network, Inc. v. FCC*, 865 F.2d 1289, 1297–98 (D.C. Cir. 1989)). Moreover, the Commission's "'predictive judgments about areas'" within its "'discretion and expertise are entitled to particularly deferential review, as long as they are reasonable.'" *EarthLink, Inc. v. FCC*, 462 F.3d 1, 12 (D.C. Cir. 2006) (emphasis omitted) (quoting *In re Core Communications, Inc.*, 455 F.3d 267, 282 (D.C. Cir. 2006)).

A.

All petitioners argue that the Commission has understated the risk of harmful interference. Central to this argument, petitioners claim that the Commission intended the Order to eliminate all risk of harmful interference. "[I]n the [Commission's] view," petitioners assert, the Order "eliminate[s] any 'significant risk' that *any* of the hundreds of millions of unlicensed 6 GHz devices will cause harmful interference to *any* of the nation's nearly 100,000 licensed microwave links, at *any* point in the foreseeable future." Pet'rs' Br. 21. Dissecting the studies upon which the Commission relied and critiquing the Order's safeguards for licensed users, petitioners argue that some harmful interference will occur at some point, thus rendering the Order arbitrary and capricious.

Petitioners mischaracterize the Commission's goal. It never claimed that the Order would reduce the risk of harmful interference to zero. To the contrary, the Commission repeatedly explained that the Order makes the "potential for harmful interference to incumbent services operating in the 6 GHz band . . . *insignificant*." Order ¶ 104 (emphasis added); *see also id.* ¶¶ 110, 122 n.317, 145–46, 245 (repeatedly characterizing such risk as low or insignificant, not zero). The Commission acknowledged that it had to "balance unlicensed device access and incumbent protection," *id.* ¶ 63, and explained that "in the unlikely event that harmful interference does occur," "the Commission's Enforcement Bureau has the ability to investigate reports of such interference and take appropriate enforcement action as necessary," *id.* ¶ 149. This aligns perfectly with existing Commission regulations, which (1) acknowledge that full compliance "will not prevent harmful interference under all circumstances" and (2) authorize the Commission to order interfering users to cease operations. 47 C.F.R. § 15.15(c); *see also supra* at 5.

B.

Petitioners argue that the Order falls short in other ways.

We start with petitioners' contention that the Commission should have estimated the frequency and cost of harmful interference. In support, they cite *Competitive Enterprise Institute v. National Highway Traffic Safety Administration*, in which our court remanded a fuel efficiency rule to the agency for failing to consider the standard's impact upon car size and safety. 956 F.2d 321 (D.C. Cir. 1992). But unlike the agency in *Competitive Enterprise*, the Commission "conduct[ed] a serious analysis of the data," revealing the likelihood of harm to be vanishingly low. *Id.* at 327. Moreover, even if harmful interference does occur, its victims may petition the Commission for relief. *See* Order ¶ 149 & n.397 (discussing the Commission's ability to respond to complaints); *see also supra* at 5.

Accusing the Commission of a "textbook APA violation," petitioners argue that the agency failed to explain why it did not require low-power devices to use an AFC system, as must standard-power devices. Pet'rs' Reply Br. 6–7. Oral Arg. Tr. 4–5. We disagree. In the Order, the Commission explained that the requirements for low-power devices (power limits, contention-based protocol, and indoor operation), together with Commission enforcement authority, "reduce[] the possibility of harmful interference to the minimum that the public interest requires." Order ¶ 146; *see also id.* ¶¶ 147–50 (acknowledging comments seeking an AFC system and explaining why the Order's other requirements reduce the risk of harmful interference to an acceptably low level). Put differently, the Commission concluded that even without an AFC system, "the restrictions and requirements . . . establish[ed] for indoor use of low-power access points

eliminates any significant risk of harmful interference." *Id.* ¶ 146; *see also id.* ¶¶ 147–50.

Petitioners also raise several technical objections to the principal study on which the Commission relied. A simulation submitted by Cable Television Laboratories ("CableLabs"), a nonprofit supporting broadband providers, the study models the likelihood that hypothetical unlicensed 6 GHz devices scattered across New York City will interfere with transmission from a local microwave tower. To simulate a city filled with unlicensed routers, the study uses what is known as Monte Carlo analysis. *Id.* ¶ 117. Developed by scientists working on the Manhattan Project, Monte Carlo analysis differs from more traditional mathematical models in how it accounts for variables. Nick T. Thomopoulos, *Essentials of Monte Carlo Simulation: Statistical Methods for Building Simulation Models* 1 (2013). Here the variables are those factors that affect a router's transmission, such as its power, location, and frequency range. While traditional models select a single value (e.g., an average) for each variable, Monte Carlo analysis uses a range of possible values for each variable, runs hundreds of simulations, and produces a range of possible outcomes. In situations where "interactions between the possible outcomes become [exceptionally] complex," Monte Carlo analysis can provide a "more complete view of potential outcomes and their associated likelihoods." Federal Judicial Center & National Research Council, *Reference Manual on Scientific Evidence* 469 (3d ed. 2011) (first quote); CableLabs Amicus Br. 7–8 (second quote).

The CableLabs study uses sales projections and statistical distributions drawn from real-world data and industry standards to analyze the effect of approximately 800,000 hypothetical routers on a microwave tower in New York City. CableLabs ran 1,500 simulations, generating data on more than

1.2 billion hypothetical routers. Not one of the hypothetical routers caused harmful interference.

Calling the study a "black box," petitioners argue that the Commission should have made available "spreadsheets, formulas, detailed datasets, and transparent explanations of how those datasets were obtained." Pet'rs' Br. 14. In support, they cite *American Radio Relay League, Inc. v. FCC*, in which we faulted the Commission for cherry-picking the data it disclosed. 524 F.3d 227, 237 (D.C. Cir. 2008). Here, by contrast, the Commission disclosed all data in its possession. The Commission, moreover, emphasizes that CableLabs's submission was "typical [of] FCC proceedings"—that is, it "presented the results of its study by describing the sample size, simulation parameters, methodology, and results." Commission Br. 46. According to the Commission, such information, not raw data, "allows parties to meaningfully comment." *Id.* at 46–47. Indeed, our court has explained that "requiring agencies to obtain and publicize the data underlying all studies on which they rely would be impractical and unnecessary." *American Trucking Ass'ns, Inc. v. EPA*, 283 F.3d 355, 372 (D.C. Cir. 2002) (internal quotation marks omitted).

Petitioners also criticize the CableLabs study for ignoring those rare cases when a router's signal might experience zero "building loss," a variable that measures the extent to which a building's characteristics, such as insulation and wall thickness, weaken router signals. Pet'rs' Br. 45–48. Although the Commission acknowledged that "it would be more appropriate for CableLabs to have used the full statistical distribution" of building loss values, it nonetheless concluded that the range used in the CableLabs study was "not different enough from the [full] statistical distribution to materially alter the likelihood of harmful interference occurring." Order ¶ 122.

Petitioners have offered no reason for us to depart from our court's longstanding practice of according "considerable deference" to the Commission's expertise on such a "highly technical question." *American Radio Relay*, 524 F.3d at 233 (internal quotation marks omitted).

Petitioners next criticize the CableLabs study for assuming an "average activity factor of 0.4%," meaning that routers "transmit only one minute out of every 250." Pet'rs' Br. 43 (internal quotation marks omitted). "Where," they ask, "does that strikingly low figure come from?" *Id.* Answering that question in the Order, the Commission explained that the CableLabs study uses "a distribution of airtime utilization based on data taken from 500,000 Wi-Fi access points to model how often each access point in the simulation transmits"—the average activity factor was 0.4%. Order ¶ 117; *see also* CableLabs Ex Parte Letter on AT&T's Comment Letter (Feb. 14, 2020), at 1–2 (explaining the source of this figure). True, this does seem low, but as intervenors explained at oral argument, routers, especially those operating in the 6 GHz band, transmit huge amounts of data in "really tiny burst[s]." Oral Arg Tr. 52. For example, counsel explained, in "a matter of seconds or less," a router can receive the data necessary to enable "watching [a video] for two hours." *Id.* Determining a router's activity factor "is precisely the type of technical issue on which we defer to the Commission's expertise," *Keller Communications, Inc. v. FCC*, 130 F.3d 1073, 1077 (D.C. Cir. 1997), especially "absent highly persuasive evidence" from petitioners that routers have a higher activity factor than the one used by CableLabs, *Mobile Relay Associates*, 457 F.3d at 8 (internal quotation marks omitted).

Last, petitioners fault the CableLabs study for assuming that "1500 snapshots in time provide[] a sample sufficient for drawing a statistically sound conclusion that harmful

interference will *never* occur." Pet'rs' Br. 48. But as explained above, the Commission never said that no harmful interference would occur; it concluded only that, given the Order's safeguards, "the potential for harmful interference to incumbent services operating in the 6 GHz band is *insignificant*." Order ¶ 104 (emphasis added).

Petitioners' next set of challenges centers on the Commission's rerun of a study prepared and submitted by petitioner AT&T. That study identifies several buildings with direct lines of sight to various microwave towers and assumes that the buildings contain 6 GHz routers that might interfere with the towers' signals. Unlike the Monte Carlo analysis used in the CableLabs study, the AT&T study, as originally designed and submitted to the Commission, selects single, worst-case values for all but one variable—that is, values likely to cause harmful interference. The AT&T study concludes that hypothetical routers could interfere with a microwave tower in every case.

The Commission discounted that conclusion because the AT&T study uses worst-case scenarios and so does not "rebut the persuasive showing by CableLabs based on a reliable probabilistic assessment derived from measurements associated with hundreds of thousands of actual Wi-Fi [access points]." *Id.* ¶ 130. Notwithstanding the Commission's preference for Monte Carlo analyses, it reran the AT&T study "to show that even under AT&T's preferred mode of analysis . . . the likelihood of harmful interference [is] insignificant." *Id.* ¶ 127 n.331. To accomplish this, the Commission revised the AT&T study in several respects, two of which are relevant here. First, it modified how the AT&T study deals with building loss, the one variable for which that study uses a range of values. Because the Commission believed that treating building loss differently from all other variables undermined

the study's accuracy, it replaced the range with a single, average value. Second, for two of the six scenarios, the Commission substituted what it believed to be more reasonable values for "clutter loss," signal attenuation caused by terrain, trees, and other structures. *Id.* ¶ 124. Thus modified, the AT&T study demonstrates that only one of the six scenarios could result in "a nontrivial possibility of harmful interference," and the Commission discounted even that because it did "not believe this one case poses a significant potential for actual harmful interference." *Id.* ¶ 131.

Petitioners criticize the Commission for using an average value instead of a statistical distribution for building loss and for failing to respond to comments on this subject. But the Commission did respond, explaining that treating only building loss "as a probabilistic quantity while not considering all the other [relevant] statistical quantities" exaggerated the likelihood of interference. Order ¶ 127. Petitioners quibble with this conclusion, but they have given us no real basis for second-guessing the Commission's analysis, which, as in much of this case, "requires a high level of technical expertise" meriting deference to the Commission's "informed discretion." *Marsh v. Oregon Natural Resources Council*, 490 U.S. 360, 377 (1989) (internal quotation marks omitted).

Next, petitioners fault the adjustments the Commission made for clutter loss. According to AT&T, it selected the six case studies precisely because the towers all had a direct line of sight to at least one building assumed to have one or more routers, which meant that "clutter loss approached zero." Pet'rs' Br. 34. The Commission, however, explained that it found the assumption of zero clutter loss unrealistic for the two scenarios in which the tower and the router were more than one kilometer apart. "Based on [its] experience," the Commission explained, AT&T's model "drastically underpredicts [clutter]

loss for longer distances because, as a practical matter, there is almost always interaction with the environment that reduces the signal level." Order ¶ 67. Besides, as noted above, the Commission explained that because the AT&T study uses worst-case scenarios, it does not "rebut the persuasive showing by CableLabs" that the likelihood of harmful interference is insignificant. *Id.* ¶ 130.

C.

In addition to challenging the CableLabs study and the Commission's rerun of the AT&T study, petitioners challenge the Order's requirements for low-power access points—that they not exceed a power limit of 5 dBm/MHz, that they be equipped with contention-based protocol technology, and that they operate only indoors.

We begin with power limits, which the Order sets at 5 dBm/MHz. According to petitioners, the Commission "plucked [that figure] out of thin air" and failed to "cite evidence . . . [for] pegging the power level to 5, rather than (say) 3 or 1." Pet'rs' Br. 51. Quite to the contrary, the Commission chose 5 dBm/MHz "[b]ased on [its] experience with unlicensed operations and interference analyses," including using that precise power limit when it reran the AT&T study and found an insignificant risk of harmful interference. Order ¶ 110. Relying on its "engineering judgment," the Commission concluded that 5 dBm/MHz "will both adequately protect all incumbents in the band from harmful interference as well as offer enough power to unlicensed devices, commensurate with the levels in . . . other . . . bands." *Id.*

Petitioners claim that contention-based protocol technology allows low-power devices to detect only devices like themselves that "transmit in all directions at once" and thus

offers no protection to licensed fixed microwave users that send "focused point-to-point beam[s]." Pet'rs' Reply Br. 27. But the Commission never claimed that contention-based protocol would directly protect microwave towers from interference. Instead, it explained, "our rule requiring that low-power indoor access points employ a contention-based protocol ensures that none of these unlicensed devices will employ continuous transmissions," thus making the occurrence of harmful interference "even less likely." Order ¶ 141; *see also id.* n.374.

Petitioners contend that even if power limits and contention-based protocol technology could protect licensees from indoor low-power devices, these precautions will fall short when such devices inevitably operate outdoors—for example, when people take their routers outside to conduct Zoom calls on their balconies. Fully aware of that risk, the Commission imposed several requirements to make outdoor use "impractical and unsuitable." *Id.* ¶ 108. Specifically, it required that routers have incorporated antennas, no batteries, and no weather-resistant capability. Petitioners insist that "[a]lthough these measures might help discourage outdoor use . . . they cannot possibly prevent it." Pet'rs' Br. 53. But again, petitioners are measuring the Order against a standard the Commission never embraced; as explained above, the Order does not seek to reduce the risk of harmful interference to zero. Rendering outdoor router use impractical, as petitioners concede the Order does, rather than impossible, promotes the Commission's goal of making the risk of harmful interference "insignificant." Order ¶ 104.

Petitioners argue that client devices, like smartphones and laptops, will interfere with licensed users when operating outdoors. Equally aware of this risk, the Commission imposed power limits on client devices to "ensure that [they] remain in

close proximity to the indoor access points." *Id.* ¶ 103. By doing so, the Commission "authorize[d] indoor unlicensed devices with adequate power to be useful to the public while also protecting the licensed services in the 6 GHz band from harmful interference." *Id.*

D.

Petitioners' remaining arguments are equally without merit. They contend that the Commission arbitrarily rejected two studies that analyze situations with low clutter loss. The Commission, however, offered perfectly reasonable explanations for rejecting each. *See id.* ¶ 133 ("We have conducted a similar analysis of the [Cellular Telecommunications Industry Association] study as we did with AT&T's study and arrived at similar results."); *id.* ¶ 154 (disagreeing with assumptions in the National Association of Broadcasters' study, including that devices will have direct lines of sight to news gathering receivers and that the threshold for harmful interference is -10 dB). Petitioners disagree with the Commission's view of worst-case assumptions in these and other studies, but disagreement by itself is insufficient to demonstrate that the Commission failed to "examine the relevant data and articulate a satisfactory explanation for its action including a 'rational connection between the facts found and the choice made.'" *State Farm*, 463 U.S. at 43 (quoting *Burlington Truck Lines v. United States*, 371 U.S. 156, 168 (1962)).

Petitioners criticize the Commission for declining to impose a mandatory maximum activity factor for unlicensed devices. As indicated above, however, the Commission explained that "requiring [such] devices to use a contention-based protocol . . . will prevent [them] from transmitting" continuously, even though "the adopted rules do not [directly] limit the activity factor." Order ¶ 120.

Finally, petitioners argue that the Order fails to "create[] an effective mechanism for immediately detecting, identifying, and turning off any device that . . . cause[s] harmful interference to licensed operations." Pet'rs' Br. 74. According to petitioners, the Commission's "post-hoc enforcement mechanisms are designed to locate interference caused by pirate radio transmitters or enterprise-grade machinery, not the types of portable, sporadically transmitting consumer devices bought by hundreds of millions of" people and kept on private property. *Id.* at 75. The Commission disagreed, assuring licensed users that its "Enforcement Bureau has the ability to investigate reports of such interference and take appropriate enforcement action." Order ¶ 149. To accomplish this, the Commission will rely on field agents with "fixed, vehicular-mounted, and portable commercial and specialized spectrum equipment to conduct investigations" and "work[] with entities at the federal, state, county, and local levels of government" to stop interference. Order ¶ 149 n.397. Petitioners have given us no basis for second-guessing this "predictive judgment[]. . . within the agency's field of discretion and expertise." *EarthLink*, 462 F.3d at 12 (internal quotation marks omitted). Should it turn out that the Enforcement Bureau is not up to the task, petitioners can return to the Commission for relief.

III.

In addition to petitioners' shared challenges to the adequacy of the Order's safeguards against harmful interference, three groups of petitioners bring individual claims.

A.

APCO, representing public safety operators, argues that the Commission failed to consider the Order's impact on 911 dispatch and other public safety services. In support, it cites our

court's recent decision in *Mozilla Corporation v. FCC*, where we faulted the Commission for its "failure to consider the implications for public safety of its changed regulatory posture in [a] 2018 Order." 940 F.3d 1, 59 (D.C. Cir. 2019). There, however, the Commission failed entirely to consider public safety. Here, the Commission expressly acknowledged that public safety services use the 6 GHz band and adopted many of the very safeguards APCO sought. *See* Order ¶ 7 (noting that public safety services operate in the 6 GHz band); *see also id.* ¶¶ 30, 39–40, 46, 81–83, 187–88 (adopting various safeguards that APCO suggested). APCO insists that the Commission could have done more, but it identifies no "'fail[ure] to consider an important aspect of the problem.'" *Mozilla*, 940 F.3d at 59 (quoting *State Farm*, 463 U.S. at 43).

APCO also challenges the Order's approach to unlicensed standard-power devices—access points that provide broadband to large areas like stadiums, concert halls, and shopping malls. The Order requires that such devices, prior to transmitting, consult a centralized AFC system to determine available frequencies and maximum permissible power levels. APCO complains that this system will be effective only 95% of the time. The Commission, however, determined that based on its experience with other devices, an AFC system with a 95% confidence level will sufficiently protect licensees. "Our experience with this rule," the Commission explained, "confirms that [such a confidence level] reliably ensures protection against harmful interference, at reasonable cost." Order ¶ 41. This is just the kind of "predictive judgment[] about areas . . . within the agency's field of discretion and expertise . . . entitled to particularly deferential review." *EarthLink*, 462 F.3d at 12 (internal quotation marks and emphasis omitted).

APCO next argues that AFC systems are unable to protect public safety services that operate on a temporary emergency basis in the wake of hurricanes and other major disasters. The Order, however, contains provisions designed to protect against that very possibility. Specifically, it instructs such licensees to "register the details of their [temporary] operation," including temporary "transmitter and receiver location," so that the AFC system can "protect [such licensees] from harmful interference." Order ¶ 32. "Because temporary fixed links are not mobile and intended to operate at a specified location for up to a year," the Commission explained, "we do not believe this registration requirement poses a significant burden on licensees." *Id.*

Finally, APCO doubts that the Commission's enforcement authority is adequate to protect licensees from interference from standard-power access points. But the Order includes several measures designed to ensure that the Commission can detect and end just such interference. *See* Order ¶ 83 (listing requirements for AFC operators to facilitate enforcement). We have no more basis for questioning the Commission's judgment about its ability to stop harmful interference from standard-power access points than we did with respect to its ability to stop interference from low-power devices. *See supra* at 19.

B.

Electric utility petitioners argue that the Commission unreasonably dismissed two studies on which they relied to show that unlicensed low-power devices will interfere with licensed users. With respect to one of the studies, submitted by Southern Company Services, we agree with petitioners that the Commission seems to have mischaracterized the study's treatment of clutter loss and ignored their clarifying comments. The Order, however, cites other perfectly sound reasons for

rejecting the study—in particular, the Commission's preference for Monte Carlo analyses. Order ¶ 135 & n.345. The other study, a Critical Infrastructure Industry analysis, does employ Monte Carlo methodology, but, as the Commission explained, it relied on several unreasonable assumptions about the demand unlicensed devices place on the 6 GHz band. *See id.* ¶ 138 (listing unreliable assumptions, including that "every man, woman, and child living in the Houston area" would be using their own access points at the same time for a 4K video streaming service).

Petitioners next argue that the Commission failed to respond to comments about the Southern and Critical Infrastructure Industry studies that they submitted in response to a draft order that the Commission circulated three weeks before its April 23, 2020 open meeting. *See supra* at 6. As for the Southern Study, the Commission acknowledged petitioners' comments and explained why it nonetheless found the study less reliable than Monte Carlo simulations. Order ¶ 135 n.345. As for the Critical Infrastructure Industry study, the Commission explains in its brief that the utilities' April comments "merely repeated arguments [they] had made in 'technical submissions' that were previously placed in the record" and to which the Commission had already responded. Commission Br. 70–71; *see also* Order ¶ 138 n.364 (responding to utilities' earlier submission); *Thompson v. Clark*, 741 F.2d 401, 408 (D.C. Cir. 1984) ("The failure to respond to comments is significant only insofar as it demonstrates that the agency's decision was not based on a consideration of the relevant factors." (internal quotation marks omitted)).

C.

The National Association of Broadcasters argues that because mobile operators frequently work indoors, the

provisions of the Order designed to restrict low-power routers to indoor operation offer mobile licensees little protection. Moreover, the Association informs us, after the Commission allowed unlicensed access in the 2.4 GHz band, "a contention-based protocol . . . failed to protect . . . licensed users[,] . . . rendering that band partially unusable." Pet'rs' Br. 71.

The Association and others raised these concerns in comments to the Commission and requested that it reserve a sliver of 6 GHz band for licensed mobile operation. The Commission, however, never responded to their complaints about interference in the 2.4 GHz band. Although the Commission cited a study to support its conclusion that the Order sufficiently protects mobile operators, that study does not rebut the Association's claims about interference in the 2.4 GHz band. As we have explained, "the opportunity to comment is meaningless unless the agency responds to significant points raised by the public." *Sherley v. Sebelius*, 689 F.3d 776, 784 (D.C. Cir. 2012) (quoting *Home Box Office, Inc. v. FCC*, 567 F.2d 9, 35–36 (D.C. Cir. 1977)). We shall thus grant the Association's petition for review on this point and remand to the Commission for it to respond to the Association's concerns about interference in the 2.4 GHz band.

The Association urges us to go further and vacate the Order. "The decision whether to vacate depends on [(1)] the seriousness of the order's deficiencies (and thus the extent of doubt whether the agency chose correctly) and [(2)] the disruptive consequences of an interim change that may itself be changed." *Allied-Signal, Inc. v. Nuclear Regulatory Commission*, 988 F.2d 146, 150–51 (D.C. Cir. 1993) (internal quotation marks omitted). Here both factors favor remand without vacatur. "It is conceivable that the Commission may be able to explain" why its experience in the 2.4 GHz band supports its ability to protect licensed mobile operators from

harmful interference. *Id.* at 151. "At the same time, the consequences of vacating may be quite disruptive." *Id.* At oral argument, Commission counsel explained that "vacating this order would be incredibly disruptive given the fact that devices have already started to be deployed" and assured us that "it's well within the Commission's power to provide [more] explanation" if needed. Oral Arg. Tr. 44. Given the Commission's failure to respond to the Association's concerns about harmful interference in the 2.4 GHz band, further explanation is called for.

IV.

We end where we began, with the principles that guide our review of petitioners' challenges. As explained in the foregoing pages, petitioners commercial communications providers, electric utilities, and APCO have failed to demonstrate that the Commission "relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the [Commission], or is so implausible that it could not be ascribed to a difference in view or the product of [Commission] expertise." *State Farm*, 463 U.S. at 43. This failure is especially significant because in issuing the Order, the Commission was acting to "foster[] innovative methods of exploiting the spectrum," thus requiring our "greatest deference." *Mobile Relay Associates*, 457 F.3d at 8 (internal quotation marks omitted). We therefore deny their petitions for review. But for the reasons set forth above, we grant the National Association of Broadcasters' petition in part and remand for further proceedings consistent with this opinion.

So ordered.