

FCC FACT SHEET*

Updating FM Broadcast Radio Service—Directional Antenna Performance Verification
Notice of Proposed Rulemaking – MB Docket No. 21-422

Background: Directional antennas radiate more energy in some directions than in others, in order to prevent interference to other stations or to keep the signal from radiating outside the station's authorized service area. FM radio is the only broadcast service that requires stations using directional antennas, when applying for license, to provide physical measurements to verify the directional pattern. To provide the required physical measurements, stations must either build a full-size mockup of the antenna and supporting structures to measure the pattern generated or must build a scale model of the antenna and structures for measurement in a laboratory. Both approaches increase costs, are time consuming, and raise a number of difficulties such as accurately replicating the installed antenna environment. Four manufacturers of FM broadcast radio antennas and one licensee of FM broadcast stations (Joint Petitioners) seek an amendment to our rules to allow applicants proposing directional FM antennas the option of verifying the directional antenna pattern through computer modeling, rather than by physical measurements as is required by the current rules.

What the Notice of Proposed Rulemaking Would Do:

- Tentatively conclude that requiring FM and LPFM applicants to provide physical measurements as the only means to verify directional antenna patterns is outdated.
- Seek comment as to whether the Commission's rules should provide the option for verifying FM directional patterns through computer modeling. The Joint Petitioners' proposed rule changes would apply not only to applicants for new FM and LPFM facilities, but to FM and LPFM broadcast station licensees applying for facility modifications.
- Seek comment as to whether there is a voluntary consensus standard as to modeling software, or alternatively a common computer model that antenna manufacturers and/or broadcast engineers agree provides the greatest accuracy, or ask in the alternative whether the most commonly used directional FM antenna modeling software has a common theoretical basis that would allow Commission staff to evaluate the results generated by other software programs sharing the same theoretical basis.
- Seek comment on whether our existing policies are sufficient to resolve any interference complaints or disputes pertaining to the directional FM antennas.

* This document is being released as part of a "permit-but-disclose" proceeding. Any presentations or views on the subject expressed to the Commission or its staff, including by email, must be filed in MB Docket No. 21-422, which may be accessed via the Electronic Comment Filing System (<https://www.fcc.gov/ecfs/>). Before filing, participants should familiarize themselves with the Commission's *ex parte* rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. *See* 47 CFR § 1.1200 *et seq.*

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of
Updating FM Broadcast Radio Service Directional
Antenna Performance Verification
MB Docket No. 21-422

NOTICE OF PROPOSED RULE MAKING*

Adopted: []

Released: []

Comment Date: [30 days after date of publication in the Federal Register]
Reply Comment Date: [45 days after date of publication in the Federal Register]

By the Commission:

I. INTRODUCTION

1. In this Notice of Proposed Rule Making (NPRM) we propose to allow FM broadcasters using directional antennas to verify the antennas' directional patterns through use of computer modeling rather than the physical modeling and measurement required under our current rules. This NPRM will provide regulatory parity across all broadcast applicants and licensees.

2. This proceeding is based on a Joint Petition for Rulemaking (Joint Petition) filed by four manufacturers of FM antennas and one broadcast licensee. The parties that filed the Joint Petition (Joint Petitioners) note that, among the broadcast services (AM and FM radio and television/DTV), only FM

* This document has been circulated for tentative consideration by the Commission at its November 18, 2021 open meeting. The issues referenced in this document and the Commission's ultimate resolutions of those issues remain under consideration and subject to change. This document does not constitute any official action by the Commission. However, the Chairwoman has determined that, in the interest of promoting the public's ability to understand the nature and scope of issues under consideration, the public interest would be served by making this document publicly available. The Commission's ex parte rules apply, and presentations are subject to "permit-but-disclose" ex parte rules. See, e.g., 47 CFR §§ 1.1206, 1.1200(a). Participants in this proceeding should familiarize themselves with the Commission's ex parte rules, including the general prohibition on presentations (written and oral) on matters listed on the Sunshine Agenda, which is typically released a week prior to the Commission's meeting. See 47 CFR §§ 1.1200(a), 1.1203.

1 In this NPRM, the proposed rule change would apply not only to applicants for new FM facilities, but to FM broadcast station licensees applying for facility modifications. Thus, the term "applicants" when used herein refers to applicants for both new FM stations and FM facility modifications.

2 Joint Petition for Rulemaking, filed by Dielectric, LLC; Educational Media Foundation; Jampro Antennas, Inc.; Radio Frequency Systems; and Shively Labs (June 15, 2021). Because verification of antennas' directional patterns through use of computer modeling is permitted for both AM radio and TV/DTV and is well-known to both the Commission and the industry, we find good cause to waive the public notice and comment period provided in sections 1.403 and 1.405 of the Commission's rules for the Joint Petition and instead proceed directly to an NPRM. In addition, we note there will be a full opportunity for comments and replies in the context of this NPRM.

radio specifically requires physical measurements, thereby preventing manufacturers and broadcasters from relying on computer modeling to verify directional antenna patterns.³ We seek comment on whether the rule changes they propose would serve the public interest by providing FM and Low Power FM (LPFM) applicants the same flexibility currently afforded AM and DTV applicants in verifying directional antenna patterns, thereby potentially offering significant cost savings when installing directional FM antennas, without increasing the potential for interference.⁴ Accordingly, we seek comment on whether, and how, computer modeling of FM directional antennas may be used to verify directional pattern performance, in lieu of the physical testing currently required by our rules, and whether the public interest would be served by Joint Petitioners' proposed rule amendments. We believe that giving license applicants the option of submitting computer models could provide meaningful relief to many FM broadcasters without jeopardizing technical standards or service to the public. At the same time, we seek comment from engineers, broadcasters, antenna manufacturers, and other interested parties to help us clarify some of the issues raised by the proposed rule changes and to assess their relative costs and benefits.

II. BACKGROUND

3. Some broadcast stations use antennas that suppress the radiated field in certain directions and enhance it in others, known as directional antennas. For FM (and television) broadcasts, which typically use an integrated antenna system consisting of a single antenna unit that is mounted on a tower or pole, antenna manufacturers achieve directionality by shaping the reflective surfaces and elements of the antenna. In the AM service, a directional antenna system consists of two or more radiators (towers) and associated ground systems in order to create the directional radiation pattern. In both cases, however, the goal is the same: to radiate more radiofrequency energy in some directions than others, in order to prevent interference to other broadcast stations, or to prevent the signal from radiating outside the station's authorized service area.

4. The Commission's rules require that upon completion of the construction of a broadcast antenna system, a showing is required to demonstrate that the facility is operating in compliance with its construction permit in order to be licensed. Joint Petitioners cite specifically to the Commission's rules regarding FM and TV directional station licensing, particularly sections 73.316 and 73.685, respectively.⁵ They note that since the Commission adopted these rules in 1963,⁶ and continuing through almost 60 years' worth of amendments, the major difference between the FM and TV rules is that section 73.316 requires an applicant for a license to cover a construction permit specifying an FM directional antenna system to provide a "tabulation of the *measured* relative field pattern" set forth in the construction

³ 47 CFR § 73.316(c)(2)(iii).

⁴ Some LPFM stations that use directional antennas must also provide physical measurements to verify their antenna pattern. 47 CFR §73.816(d). Because section 73.816(d) cross references section 73.316(c) of our rules, any modification to section 73.316(c) adopted in this proceeding for full service FM stations would automatically apply to LPFM stations as well.

⁵ 47 CFR §§ 73.316, 73.685. See Joint Petition at 8-9.

⁶ Sections 73.316 and 73.685 first appear at 28 Fed. Reg. 13572, 13645, 13679 (Dec. 14, 1963). For the FM service, measurement requirements have been a key element in subsequent rulemakings concerning directional antennas and amendments to section 73.316. See, e.g., *Amendment of Part 73 of the Commission's Rules to Permit Short-Spaced FM Station Assignments by Using Directional Antennas*, MM Docket No. 87-121, Report and Order, FCC 88-406, 4 FCC Rcd 1681, 1686-87 (1989) (affirming that the Commission will continue to require proofs of performance to establish that directional antennas have the appropriate measured patterns); *1998 Biennial Regulatory Review—Streamlining of Mass Media Applications, Rules, and Processes—Policies and Rules Regarding Minority Female Ownership of Mass Media Facilities*, MM Docket Nos. 94-149, 98-43, Report and Order, FCC 98-281, 13 FCC Rcd 23056 (1998) (modifying 73.316(c), shifting the filing requirement for certain directional antenna measurement information to the license application stage of the FM authorization process).

permit,⁷ while section 73.685 requires only a “tabulation of the relative field pattern” of a TV directional antenna without requiring that the pattern be “measured.”⁸

5. In order to provide permittees with the measurements section 73.316(c)(2)(iii) requires to verify the performance of a directional FM broadcast antenna, directional antenna manufacturers will typically employ one of two methods. The first is to mount a full-scale model of the antenna or some elements of it on a test range, which is a large open area maintained by the antenna manufacturer (in most cases) for such testing, with pre-positioned testing probes for measuring signal strength in the far field of the antenna pattern. Such a re-creation of the antenna includes replicating the tower or pole on which the antenna is to be mounted, as such structures can affect the antenna’s radiation pattern in specific ways. It may also include replicating any structures on or near the ultimate site of the antenna that could affect the directional pattern or re-radiate the antenna’s energy.⁹ The second common method is to construct a smaller, scale model of the antenna, mounting structure, and nearby structures, and to take measurements of the signal generated by the scale model in an indoor anechoic (non-reflecting) chamber. Because the model is smaller than the antenna to be constructed (commonly 4.4:1 or 4.5:1), the frequency of the signal must be increased to approximately four and one-half times the FM frequency of the full-size antenna, to account for the shorter wavelength of the signals generated by the scale model.¹⁰

6. Joint Petitioners point out these methods for measuring FM directional antenna patterns greatly increase expenses for broadcasters and potentially lead to inaccurate results. Broadcasters bear the expense of physically re-creating the environment in which the directional FM antenna is to be installed, including occasionally needing to create single-use components to duplicate non-standard mounting structures.¹¹ The Joint Petitioners additionally note it is difficult to produce accurate mechanical and, thus, electrical alignment of the test range.¹² Any mis-alignments can cause deviations of the test range from the idealized perfectly aligned range, and can lead to inaccurate test results.¹³ According to Joint Petitioners, computerized models can reduce or eliminate these mechanical errors.¹⁴ Also, Joint Petitioners point out that measuring the horizontally and vertically polarized components of an antenna’s signal is difficult to perform on a test range, where reflections or imperfections in the test antenna can lead to inaccuracies, whereas a computer model can create an environment in which the theoretical antenna being modeled can be optimized.¹⁵

7. Joint Petitioners note other instances in which the Commission has allowed the use of computer modeling to demonstrate compliance with the rules. For example, the Commission in 2008 allowed AM broadcasters using series-fed radiators in their directional antenna arrays to replace measured proofs of performance of their directional antenna systems with computer models using the “method of

⁷ 47 CFR § 73.316(c)(2)(iii).

⁸ 47 CFR § 73.685(f)(3).

⁹ Such structures can include transmission lines, ladders, conduits, other antennas on the tower near the antenna being modeled, and any other installations that could affect the measured directional pattern. *See* 47 CFR § 73.1690(c)(2)(iii).

¹⁰ Joint Petition at 4 n.6.

¹¹ *Id.* at 3-4.

¹² *Id.* at 13-14.

¹³ *Id.* Deviations can be the result of “reflections from the range surface(s), unaccounted-for surrounding objects, positioner errors, and cables used to feed the antennas,” as well as signals from external sources that might not be present at the actual antenna installation.

¹⁴ *Id.* at 14-15.

¹⁵ *Id.* at 16.

moments” system.¹⁶ In these proceedings,¹⁷ the Commission allowed applicants for certain AM directional stations to use method of moments computer modeling to demonstrate the performance of their directional antenna arrays.¹⁸

8. Joint Commenters thus argue that the time is ripe for the Commission to update its rules to allow computer modeling, at the applicant’s option, in lieu of physical modeling and measurement when verifying FM directional antenna performance. In further support of their argument, Joint Commenters include results of a sample study of an actual directional FM station (WHEM(FM) Eau Claire, Wisconsin). The study compares results of a computer-modeled directional pattern proof to a previous scale-model physical measurement of performance of that station’s directional antenna.¹⁹ The comparison showed close correlation between the results of the physical model measurements and those predicted by the computer model.

9. Although they further maintain that there should be no need, based on current rules, to establish the qualifications of the antenna design engineer(s) (as opposed to the engineer(s) supervising antenna installation, as required in the current rules),²⁰ Joint Commenters’ proposed amendment to section 73.316 includes a requirement identifying and describing the software tools and procedures used in designing the antenna, and setting forth the qualifications of the engineer(s) who designed the antenna, who performed the modeling, and who prepared the instructions for mounting of the antenna at the site. By including this information, Commission staff would be able to evaluate the methods used and, presumably, the accuracy of the computer-modeled verification of the directional pattern.

¹⁶ The “method of moments” system is based on the National Electrical Code (NEC) moment method of analysis developed at the Lawrence Livermore Laboratory, Livermore, California. *See An Inquiry Into the Commission’s Policies and Rules Regarding AM Broadcast Radio Service Directional Antenna Performance Verification*, MB Docket No. 93-177, Second Report and Order and Second Further Notice of Proposed Rulemaking, 23 FCC Rcd 14267, 14268 n.2 (2008) (*AM Directional Second R&O*). *See also Revitalization of the AM Radio Service*, MB Docket No. 13-249, Third Report and Order, 32 FCC Rcd 7736 (2017) (*AMR Third R&O*); 47 CFR § 73.151 (reducing the number of field strength measurements needed to verify the performance of AM directional antenna arrays).

¹⁷ *See AM Directional Second R&O, supra; Media Bureau Clarifies Procedures for AM Directional Antenna Performance Verification Using Moment Method Modeling*, Public Notice, 24 FCC Rcd 13398 (MB 2009); *AMR Third R&O*, 32 FCC Rcd at 7739-46, paras. 6-26 (modifying certain aspects of method of moments modeling for AM directional arrays).

¹⁸ Joint Commenters also reference the Commission’s rules on evaluating RF radiation exposure as applied to portable devices. Joint Petition at 11-12, citing 47 CFR § 2.1093(d)(2). Those rules allow for computer modeling as long as it is “supported by adequate documentation showing that the numerical method as implemented in the computational software has been fully validated,” and that “the equipment under test and exposure conditions must be modeled according to protocols established by FCC-accepted numerical computation standards or available FCC procedures for the specific computational method.” 47 CFR § 2.1093(d)(2). The proceeding in which the current version of section 2.1093(d)(2) was adopted has been remanded to the Commission by the United States Court of Appeals for the District of Columbia Circuit. *See Environmental Health Trust v. FCC*, No. 20-1025, 2021 WL 3573769 (D.C. Cir. Aug. 13, 2021). We note that similar, though not identical, language was included in the prior version of section 2.1093. *See* 47 CFR § 2.1093(d)(3) (2019) (“Compliance with SAR limits can be demonstrated by either laboratory measurement techniques or by computational modeling. The latter must be supported by adequate documentation showing that the test device and exposure conditions have been correctly modeled in accordance with the operating configurations for normal use. Guidance regarding SAR measurement techniques can be found in the Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB). The staff guidance provided in the KDB does not necessarily represent the only acceptable methods for measuring RF exposure or emissions, and is not binding on the Commission or any interested party.”).

¹⁹ Joint Petition at 17-23.

²⁰ 47 CFR § 73.316(c)(2)(vii).

III. DISCUSSION

10. We tentatively conclude that requiring FM and LPFM applicants to provide physical measurements as the only means to verify directional antenna patterns is outdated. This restriction places such applicants on an unequal footing with their AM and DTV counterparts. We therefore seek comment on whether we should adopt Joint Petitioners' proposed rule amendments, attached hereto as Appendix A, to give applicants proposing directional FM and LPFM facilities the option of using computer modeling for pattern verification. As discussed below, we solicit commenter input on Joint Petitioners' proposed rule amendments, as well as any concerns about whether computer modeling, without any physical confirmation, will provide sufficient assurance that an applicant's FM directional antenna will perform in the field as predicted in the model.

11. We believe that the proposed rule change would provide regulatory parity and ongoing relief for both antenna manufacturers and FM broadcasters while maintaining the integrity of our licensing requirements. Commission records indicate that over 2,000 full-service FM broadcast stations, 21.5% of such stations, use directional antennas. Our records also indicate that 10 LPFM stations, 0.5% of the total, use directional antennas. The proposed rule change would allow any of those stations that replace existing antennas to avoid the expense of field measurements. Additionally, given the ongoing demand for FM spectrum and the need for new stations to avoid interference to existing broadcasters, we anticipate an increase in the use of directional antennas. We believe those future broadcast applicants would benefit from this proposal. Petitioners assert that the requirements of section 73.316(c)(2) can require sometimes substantial expenditures of time and money to such applicants.²¹ We agree with the Joint Petitioners that when section 73.316 was first added to the rules over five decades ago, the computer tools enabling design and modeling of directional antennas did not exist.²² As the Joint Petitioners point out, we now can take advantage of the newly developed modeling tools. We seek comment on whether use of these tools will increase the risk of interference to adjacent stations. Finally, adopting the proposed rule change would align section 73.316 with the rules regarding AM and TV directional station licensing. We seek comment on these issues.

12. *Correlating physical measurements.* We seek comment on whether we should require any physical measurement in addition to computer modeling. We note that historically it has been rare for the Media Bureau to receive complaints from stations about interference attributable to directional FM broadcast stations. Is this because manufacturing standards are so high that the risk of incorrect directional patterns is minimized? Or has section 73.316 forced manufacturers and broadcasters to take extra and necessary steps to minimize risk? We seek input on whether computer modeling by itself is sufficient or whether some reduced level of field measurement is still necessary. Is there a less resource intensive and costly level of field verification that would enhance the reliability of computer modeling? We note that although Joint Petitioners point to the method of moments modeling of AM directional systems in support of their proposal, the AM directional procedures do not rely solely on computer modeling, but rather such modeling must be verified by correlation with monitored antenna sample indications.²³ Thus, in the case of AM directional arrays, proper adjustment of the antenna pattern is determined by comparing the method of moments computer model with measurements taken of the

²¹ Joint Petition at 2-4 (describing the expenses involved in maintaining full scale test ranges for measurement of antenna patterns, including "tens of acres" of land, inventories of tower sections on which to mount antenna elements, and occasional fabrication of specialized tower sections and appurtenances to match a customer's unique antenna mounting site).

²² Joint Petition at 25-26.

²³ 47 CFR § 73.151(c)(1) (requiring a "matrix of impedance measurements at the base and/or feed point of each element in the array, with all other elements shorted and/or open circuited at their respective measurement locations.").

antenna array.²⁴ Joint Petitioners' proposed rule changes do not propose any such measured parameters for pattern verification. We seek comment as to whether there are physical measurements that should be taken from an installed FM directional antenna that can similarly be correlated with the computer model of that antenna, in order to verify adjustment of the antenna pattern.

13. *Directional FM antenna modeling software.* We also seek input on whether we should adopt a specific computer program or underlying model for directional FM antenna verification. Joint Petitioners state that there currently exist "several software programs that can be used for modeling antennas as well as environmental objects in proximity to the antennas, plus filters, transmission lines, hybrids, lumped constant RF components, and so on."²⁵ Is there a common program or model that antenna manufacturers and/or broadcast engineers agree provides the greatest accuracy? For example, the method of moments is the accepted method for modeling AM directional antenna arrays. Is there a similarly accepted method for modeling directional FM antennas? Is any other local, state, or federal government agency currently using a model that would be suitable for this purpose? Similarly, are there suitable models currently in use outside the United States? Is there a voluntary consensus standard for modeling directional FM antennas and, if so, is there any reason use of such a standard would be impractical or otherwise unsuitable?²⁶ Additionally, as discussed above, section 2.1093(d)(2) of our rules by its terms requires "adequate documentation" demonstrating full validation of the numerical method used in the computer software for evaluating compliance with limits on specific absorption rates of radiofrequency energy, and further requires that the equipment used must be modeled under FCC-accepted standards or procedures.²⁷ Should a similar provision be included in any amendment to section 73.316? Commenters should discuss the extent to which any amendment of our rules based on computer models would establish performance rather than design criteria, as well as the ability of small and medium-size enterprises to use and benefit from using an approved or designated computer model.

14. Assuming that there is no single voluntary consensus standard as to FM directional modeling software, we invite comment on what propagation software we should accept from applicants to verify FM directional antenna patterns. We ask, for example, whether verification should be limited to the propagation software used by the various antenna manufacturers in evaluating their products. Do these programs have a common theoretical basis, such that results generated by manufacturers' in-house software programs should be accepted as accurate? Alternatively, should we accept results from other software products created by engineering consultants or other third-party vendors that are commonly used in the industry to verify FM directional antenna patterns? Do such third-party software products also share a common theoretical basis with each other and with antenna manufacturers' software, such that all may be relied upon to the same degree? Are commenters aware of significant differences among the results of the prediction models generated by the "several software programs"²⁸ available, indicating that some are more accurate than others? Commenters are also asked to address whether we should accept results from modeling software written by an individual engineer or broadcaster for a specific antenna,

²⁴ *Id.* § 73.151(c)(2)(ii) ("Proper adjustment of an antenna pattern shall be determined by correlation between the measured antenna monitor sample indications and the parameters calculated by the method of moments program, and by correlation between the measured matrix impedances for each tower and those calculated by the method of moments program.").

²⁵ Joint Petition at 13.

²⁶ If there is a voluntary consensus standard for directional FM antennal verification, commenters should discuss the process by which the standard was developed with reference to openness of the process to a broad and balanced range of stakeholders, transparency of the process, due process considerations (e.g., notice of meetings), any appeals process, and consensus procedures. Commenters should also state whether any voluntary consensus standard is an international standard.

²⁷ 47 CFR § 2.1093(d)(2).

²⁸ Joint Petition at 13.

and if so what showings, if any, must be made to vouch for the accuracy of such software?

15. In the event that commenters believe we should accept computer-modeled FM pattern verifications, no matter what models or software are used, we ask that they address how the staff should evaluate the directional antenna models used and how any model will incorporate advances in technology. While the Joint Petitioners' proposed rules require submission of a detailed description of the software tools and procedures being used and the qualifications of the engineer(s) constructing the computer models, given the number of such software programs, we ask commenters to discuss how Commission staff should accept or confirm the accuracy of such models. Are there specific types of antenna installations where measurements should still be required (for example, installations on the sides of buildings)? What information regarding submitted computer models should be provided in license applications? Should that information be greater or less than that proposed by Joint Petitioners? To what extent will the Commission staff be able to use any recommended computer model to confirm or replicate the results submitted by applicants?

16. Additionally, in discussing the software proposed to be used in modeling FM directional antenna patterns, we ask commenters specifically to enumerate the costs and benefits of the proposed software and any alternatives proposed by commenters. This should include the costs to license any software needed to run an approved or designated computer model, and the distribution of costs and benefits among stakeholders. To the extent possible, commenters should also quantify projected costs and benefits, identify supporting evidence and any underlying assumptions, and explain any difficulties faced in trying to quantify benefits and costs of the proposals and how the Commission might nonetheless evaluate them.

17. *Interference complaints.* We seek comment on whether our existing policies are sufficient to resolve any interference complaints or disputes pertaining to the directional FM antennas.²⁹ Are new or modified rules necessary to address such complaints or disputes? Should the burden of proof fall on the applicant providing verification of antenna pattern performance via computer modeling, or on the complaining party? Should the burden shift if the operator of the FM directional station provided measurements as opposed to solely computer model data? What level of proof is needed to overcome a complaint that a directional FM antenna is not performing as predicted? We note that duplication or scale modeling of the installed antenna for purposes of measurement to overcome an accusation of faulty pattern performance would involve considerable expense. What safeguards, if any, are needed to prevent frivolous complaints of inaccurate FM directional pattern performance?

18. *Experience with computer modeling of directional FM antennas.* Perhaps most importantly, we are interested in comments from broadcasters, engineers, and manufacturers who have used both computer modeling of FM directional antennas and physical models of the same, and who can discuss their experience regarding the accuracy of computer-modeled antennas vis-à-vis the performance of such antennas as installed. Based on such experience, are commenters confident that computer modeling can take the place of physical measurements of FM directional antennas or scale models of such antennas? Are there specific procedures that in commenters' experience would affect the accuracy of such computer models, in either a positive or negative manner? Are there particular difficulties in simulating certain environments in which a computer-modeled FM directional antenna is to be installed that would argue against use of computer modeling in those situations, and are there ways in which those difficulties can be minimized or overcome? Again, are there measurable attributes of an installed FM directional antenna that can be used to confirm the accuracy of a computer-generated model of the antenna's pattern without

²⁹ See 47 CFR §§ 73.209, 73.211. See also, e.g., *Involuntary Modification of License of Station KFWR(FM), Jacksboro, Texas*, Order to Show Cause, 30 FCC Rcd 2625 (MB), *modification ordered*, 30 FCC Rcd 8235 (MB 2015) (finding that pattern of allegedly non-directional "pattern optimized" FM station radiated 2.75 times the maximum power allowed under 47 CFR § 73.211(b) toward a co-channel station, and that maximum-to-minimum ratio of antenna exceeded that allowed for directional antennas, citing *Ettlinger Broad. Corp.*, Memorandum Opinion and Order, 53 R.R.2d 635 (1983)).

performing field measurements? We invite comment on these and any other issues relevant to this proposal to update the Commission's FM directional antenna rules.

19. *Digital Equity and Inclusion*. Finally, the Commission, as part of its continuing effort to advance digital equity for all,³⁰ including people of color, persons with disabilities, persons who live in rural or Tribal areas, and others who are or have been historically underserved, marginalized, or adversely affected by persistent poverty or inequality, invites comment on any equity-related considerations³¹ and benefits (if any) that may be associated with the proposals and issues discussed herein. Specifically, we seek comment on how our proposals may promote or inhibit advances in diversity, equity, inclusion, and accessibility, as well the scope of the Commission's relevant legal authority.

IV. PROCEDURAL MATTERS

A. *Ex Parte* Rules

20. The proceeding this *NPRM* initiates shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules.³² Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made, and (2) summarize all data presented and arguments made during the presentation. Memoranda must contain a summary of the substance of the *ex parte* presentation and not merely a listing of the subjects discussed. More than a one or two sentence description of the views and arguments presented is generally required. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda or other filings in the proceeding, the presenter may provide citations to such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with section 1.1206(b) of the rules.³³ In proceedings governed by section 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding, and must be filed in their native format (*e.g.*, .doc, .xml, .ppt, searchable.pdf).³⁴ Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

³⁰ Section 1 of the Communications Act of 1934 as amended provides that the FCC "regulat[es] interstate and foreign commerce in communication by wire and radio so as to make [such service] available, so far as possible, to all the people of the United States, without discrimination on the basis of race, color, religion, national origin, or sex." 47 U.S.C. § 151.

³¹ The term "equity" is used here consistent with Executive Order 13985 as the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality. *See* Exec. Order No. 13985, 86 Fed. Reg. 7009, Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government (January 20, 2021).

³² 47 CFR §§ 1.1200 *et seq.*

³³ 47 CFR § 1.1206(b).

³⁴ 47 CFR § 1.49(f).

B. Comment Filing Procedures

21. Pursuant to sections 1.415 and 1.419 of the Commission's rules,³⁵ interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS).³⁶

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://apps.fcc.gov/ecfs/>.
- Paper Filers: Parties who choose to file by paper must file an original and one copy of each filing.
- Filings can be sent by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
 - Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9050 Junction Drive, Annapolis Junction, MD 20701.
 - U.S. Postal Service first-class, Express, and Priority mail must be addressed to 45 L Street, NE, Washington D.C. 20554.
 - Effective March 19, 2020, and until further notice, the Commission no longer accepts any hand or messenger delivered filings. This is a temporary measure taken to help protect the health and safety of individuals, and to mitigate the transmission of COVID-19.³⁷

22. *Initial Regulatory Flexibility Act Analysis.* As required by the Regulatory Flexibility Act of 1980 (RFA),³⁸ the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA). The IRFA is attached as Appendix B. Written public comments are requested on the IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the first page of this document. The Commission will send a copy of this document, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).

23. *Initial Paperwork Reduction Act Analysis.* This document contains new or modified information collection requirements. The Commission, as part of its continuing effort to reduce paperwork burdens, invites the general public and the Office of Management and Budget (OMB) to comment on the information collection requirements contained in this document, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. In addition, pursuant to the Small Business Paperwork Relief Act of 2002,³⁹ we seek specific comment on how we might "further reduce the information collection burden for small business concerns with fewer than 25 employees."⁴⁰

24. *People with Disabilities:* To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to fcc504@fcc.gov or call

³⁵ See 47 CFR §§ 1.415, 1.419.

³⁶ See *Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

³⁷ *FCC Announces Closure of FCC Headquarters Open Window and Change in Hand-Delivery Policy*, Public Notice, 35 FCC Rcd 2788 (2020).

³⁸ See 5 U.S.C. § 603. The RFA, see 5 U.S.C. § 601, *et seq.*, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 847 (1996). The SBREFA was enacted as Title II of the Contract with America Advancement Act of 1996 (CWAAA).

³⁹ Pub. L. No. 107-198.

⁴⁰ 44 U.S.C. § 3506(c)(4).

the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

25. *Availability of Documents.* Commission headquarters remains closed due to the COVID-19 pandemic.⁴¹ When it is open to the public, the comments and reply comments will be available for public inspection and copying during regular business hours at the FCC Reference Information Center, 45 L Street, NE, Washington, DC 20554. These filings may also be viewed in the Commission's Electronic Comment Filing System (ECFS) at <https://www.fcc.gov/ecfs/>.

26. *Additional Information.* For additional information on this proceeding, contact Thomas Nessinger, Thomas.Nessinger@fcc.gov, of the Media Bureau, Audio Division, at (202) 418-2709, or James Bradshaw, James.Bradshaw@fcc.gov of the Media Bureau, Audio Division, at (202) 418-2739.

V. ORDERING CLAUSES

27. Accordingly, **IT IS ORDERED** that, pursuant to the authority contained in sections 1, 4(i), 4(j), 301, 303, 307, 308, 309, 316, and 319 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 303, 307, 308, 309, 316, and 319, this Notice of Proposed Rulemaking **IS ADOPTED**.

28. **IT IS FURTHER ORDERED** that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, **SHALL SEND** a copy of this Notice of Proposed Rulemaking, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

⁴¹ See *FCC Announces Updated Restrictions on Visitors to its Facilities*, Public Notice (Mar. 12, 2020).

APPENDIX A
Proposed Rule Changes
NEW LANGUAGE IN BOLD

The Federal Communications Commission proposes to amend Part 73 of Chapter 5 of Title 47 of the Code of Federal Regulations (CFR) as follows:

1. The authority citation for part 73 continues to read as follows:

Authority: 47 U.S.C. 154, 155, 301, 303, 307, 309, 310, 334, 336, 339.

2. Amend § 73.316 to revise paragraph (c)(2) to read as follows:

§ 73.316 FM antenna systems.

* * * * *

(c) * * *

(2) * * *

(iii) A tabulation of the measured **or computer modeled** relative field pattern required in paragraph (c)(1) of this section. The tabulation must use the same zero degree reference as the plotted pattern, and must contain values for at least every 10 degrees. Sufficient vertical patterns to indicate clearly the radiation characteristics of the antenna above and below the horizontal plane. Complete information and patterns must be provided for angles of -10 deg. from the horizontal plane and sufficient additional information must be included on that portion of the pattern lying between + 10 deg. and the zenith and -10 deg. and the nadir, to conclusively demonstrate the absence of undesirable lobes in these areas. The vertical plane pattern must be plotted on rectangular coordinate paper with reference to the horizontal plane. In the case of a composite antenna composed of two or more individual antennas, the composite antenna pattern should be used, and not the pattern for each of the individual antennas.

(iv) **When a directional antenna is computer modeled, as permitted in paragraphs (c)(2)(iii) and (c)(2)(x) of this section and in §73.1690(c)(2), a statement from the engineer(s) responsible for designing the antenna, performing the modeling, and preparing the manufacturer's instructions for installation of the antenna, that identifies and describes the software tool(s) used in the modeling, the procedures applied in using the software, and lists such engineers' qualifications. Such computer modeling shall include modeling of the antenna mounted on a tower or tower section, and the tower or tower section model must include transmission lines, ladders, conduits, other antennas, and any other installations that may affect the computer modeled directional pattern.**

(v) A statement that the antenna is mounted on the top of an antenna tower recommended by the antenna manufacturer, or is side-mounted on a particular type of antenna tower in accordance with specific instructions provided by the antenna manufacturer.

(vi) A statement that the directional antenna is not mounted on the top of an antenna tower which includes a top-mounted platform larger than the nominal cross-sectional area of the tower in the horizontal plane.

(vii) A statement that no other antenna of any type is mounted on the same tower level as a directional antenna, and that no antenna of any type is mounted within any horizontal or vertical distance specified by the antenna manufacturer as being necessary for proper directional operation.

(viii) A statement from an engineer listing such individual engineer's qualifications and certifying that the antenna has been installed pursuant to the manufacturer's instructions.

(ix) A statement from a licensed surveyor that the installed antenna is properly oriented.

(x) (A) For a station authorized pursuant to §73.215 or Sec. §73.509, a showing that the root mean square (RMS) of the measured **or computer modeled** composite antenna pattern (encompassing both the horizontally and vertically polarized radiation components (in relative field)) is at least 85 percent of the RMS of the authorized composite directional antenna pattern (in relative field). The RMS value, for a composite antenna pattern specified in relative field values, may be determined from the following formula:

RMS = the square root of:

$$[(\text{relative field value } 1)^2 + (\text{relative field value } 2)^2 + \dots + (\text{last relative field value})^2]$$

total number of relative field values

(B) where the relative field values are taken from at least 36 evenly spaced radials for the entire 360 degrees of azimuth. The application for license must also demonstrate that coverage of the community of license by the 70 dBu contour is maintained for stations authorized pursuant to §73.215 on Channels 221 through 300, as required by §73.315(a), while noncommercial educational stations operating on Channels 201 through 220 must show that the 60 dBu contour covers at least a portion of the community of license.

* * * * *

3. Amend § 73.1620 to revise paragraph (a)(3) to read as follows:

§ 73.1620 Program tests.

(a) * * *

(3) FM licensees replacing a directional antenna pursuant to §73.1690 (c)(2) without changes which require a construction permit (*see* §73.1690(b)) may immediately commence program test operations with the new antenna at one half (50%) of the authorized ERP upon installation. If the directional antenna replacement is an EXACT duplicate of the antenna being replaced (*i.e.*, same manufacturer, antenna model number, and measured **or computer modeled** composite pattern), program tests may commence with the new antenna at the full authorized power upon installation. The licensee must file a modification of license application on FCC Form 302-FM within 10 days of commencing operations with the newly installed antenna, and the license application must contain all of the exhibits required by §73.1690(c)(2). After review of the modification-of-license application to cover the antenna change, the Commission will issue a letter notifying the applicant whether program test operation at the full authorized power has been approved for the replacement directional antenna.

* * * * *

4. Amend § 73.1690 to revise paragraph (c)(2) to read as follows:

§ 73.1690 Modification of transmission systems.

* * * * *

(c) * * *

(2) Replacement of a directional FM antenna, where the measured **or computer modeled** composite directional antenna pattern does not exceed the licensed composite directional pattern at any azimuth, where no change in effective radiated power will result, and where compliance with the principal coverage requirements of §73.315(a) will be maintained by the measured **or computer modeled** directional pattern. The antenna must be mounted not more than 2 meters above or 4 meters below the authorized values. The modification of license application on Form 302-FM to cover the antenna replacement must contain all of the data in the following sections (i)

through (v). Program test operations at one half (50%) power may commence immediately upon installation pursuant to §73.1620(a)(3). However, if the replacement directional antenna is an exact replacement (*i.e.*, no change in manufacturer, antenna model number, AND measured **or computer modeled** composite antenna pattern), program test operations may commence immediately upon installation at the full authorized power.

(i) A measured **or computer modeled** directional antenna pattern and tabulation on the antenna manufacturer's letterhead showing both the horizontally and vertically polarized radiation components and demonstrating that neither of the components exceeds the authorized composite antenna pattern along any azimuth.

(ii) Contour protection stations authorized pursuant to §73.215 or §73.509 must attach a showing that the RMS (root mean square) of the composite measured **or computer modeled** directional antenna pattern is 85% or more of the RMS of the authorized composite antenna pattern. *See* §73.316(c)(9). If this requirement cannot be met, the licensee may include new relative field values with the license application to reduce the authorized composite antenna pattern so as to bring the measured **or computer modeled** composite antenna pattern into compliance with the 85 percent requirement.

(iii) A description from the manufacturer as to the procedures used to measure **or computer model** the directional antenna pattern. The antenna measurements **or computer modeling** must be performed with the antenna mounted on a tower, tower section, or scale model equivalent to that on which the antenna will be permanently mounted, and the tower or tower section must include transmission lines, ladders, conduits, other antennas, and any other installations which may affect the measured **or computer modeled** directional pattern. **See §73.316(c)(2)(iv) for details of the showings required in connection with an application filed for a station utilizing an FM directional antenna.**

* * * * *

APPENDIX B**Initial Regulatory Flexibility Act Analysis**

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),⁴² the Commission has prepared this Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities by the policies proposed in the *Notice of Proposed Rulemaking (NPRM)*. Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the *NPRM* provided on the first page of the *NPRM*. The Commission will send a copy of this entire *NPRM*, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).⁴³ In addition, the *NPRM* and the IRFA (or summaries thereof) will be published in the Federal Register.⁴⁴

A. Need for, and Objectives of, the Proposed Rule Changes.

2. The Commission initiates this rulemaking proceeding to obtain comments regarding its proposal to allow an applicant for an FM broadcast station utilizing a directional antenna to verify the antenna's directional pattern through the use of computer modeling, rather than physical modeling and measurements. An applicant for a directional FM station currently must verify the accuracy of the directional pattern by way of measurements, which are made either on a full-scale replica of the antenna on a test range, or on a scale model of the antenna in an anechoic chamber. In either case the model must include elements replicating the environment of the antenna as it is to be installed, including the support structure, transmission lines, other nearby antennas, or other structures that could affect the directional pattern. The *NPRM* proposes to give applicants proposing directional FM facilities the option, in lieu of such physical models and measurements, to verify antenna pattern performance via computer modeling, which is less expensive and able to be adjusted to account for conditions in the installed environment.

B. Legal Basis.

3. The proposed action is authorized pursuant to sections 1, 4(i), 4(j), 301, 303, 307, 308, 309, 316, and 319 of the Communications Act, 47 U.S.C. §§ 151, 154(i), 154(j), 301, 303, 307, 308, 309, 316, 319.

C. Description and Estimate of the Number of Small Entities to Which the Proposed Rules Will Apply.

4. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.⁴⁵ The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."⁴⁶ In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.⁴⁷ A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of

⁴² See 5 U.S.C. § 603. The RFA, see 5 U.S.C. §§ 601-612, was amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

⁴³ See 5 U.S.C. § 603(a).

⁴⁴ See *id.*

⁴⁵ 5 U.S.C. § 603(b)(3).

⁴⁶ *Id.* § 601(6).

⁴⁷ *Id.* § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." *Id.* § 601(3).

operation; and (3) satisfies any additional criteria established by the SBA.⁴⁸ The rules proposed herein will directly affect small television and radio broadcast stations. Below, we provide a description of these small entities, as well as an estimate of the number of such small entities, where feasible.

5. *Radio Stations.* This Economic Census category “comprises establishments primarily engaged in broadcasting aural programs by radio to the public.”⁴⁹ The SBA has created the following small business size standard for this category: those having \$41.5 million or less in annual receipts.⁵⁰ Census data for 2012 show that 2,849 firms in this category operated in that year.⁵¹ Of this number, 2,806 firms had annual receipts of less than \$25 million, and 43 firms had annual receipts of \$25 million or more.⁵² Because the Census has no additional classifications that could serve as a basis for determining the number of stations whose receipts exceeded \$41.5 million in that year, we conclude that the majority of radio broadcast stations were small entities under the applicable SBA size standard.

6. Apart from the U.S. Census, the Commission has estimated the number of licensed commercial FM radio stations to be 6,682, the number of licensed FM translator and booster stations to be 8,771, and the number of licensed LPFM stations to be 2,081, for a total number of 17,534.⁵³ As of July 2021, 6,676 of 6,677 FM stations had revenues of \$41.5 million or less, according to Commission staff review of the BIA Kelsey Inc. Media Access Pro Database (BIA). In addition, the Commission has estimated the number of noncommercial educational (NCE) FM radio stations to be 4,214. NCE stations are non-profit, and therefore considered to be small entities.⁵⁴ Therefore, we estimate that the majority of full-service FM broadcast stations are small entities.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements.

7. The *NPRM* proposes to amend existing rules to provide more flexibility and reduce expenses to applicants for FM broadcast stations proposing directional antenna patterns. The proposed revisions require additional paperwork obligations for those applicants opting to use computer modeling rather than the currently accepted physical measurements to verify FM directional patterns.

⁴⁸ *Id.* § 632. Application of the statutory criteria of dominance in its field of operation and independence are sometimes difficult to apply in the context of broadcast television. Accordingly, the Commission’s statistical account of television stations may be over-inclusive.

⁴⁹ U.S. Census Bureau, 2012 NAICS Definitions, “515112 Radio Stations,” at <http://www.census.gov/cgi-bin/sssd/naics/naicsrch>. This category description continues: “Programming may originate in their own studio, from an affiliated network, or from external sources.”

⁵⁰ 13 CFR § 121.201; NAICS code 515112.

⁵¹ U.S. Census Bureau, Table No. EC0751SSSZ4, *Information: Subject Series – Establishment and Firm Size: Receipts Size of Firms for the United States: 2012* (515112), http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ4&prodType=table.

⁵² *Id.*

⁵³ See *Broadcast Station Totals as of September 30, 2021*, available online at <https://docs.fcc.gov/public/attachments/DOC-376230A1.pdf>.

⁵⁴ 5 U.S.C. § 601(4), (6).

E. Steps Taken to Minimize Significant Impact on Small Entities and Significant Alternatives Considered

8. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.⁵⁵

9. In the *NPRM*, the Commission proposes to amend existing rules to allow the same computer modeling for proposed FM directional antennas that is allowed for verifying directional antenna patterns in the AM and TV/DTV services. The proposed rules will eliminate the requirement that applicants provide measured tabulations of FM directional antenna patterns, and allow them to verify FM directional antenna patterns by use of computer models. These revisions will reduce the expense to station applicants of having to create physical models of FM directional antennas and their environs in order to make the measurements required by the current rules. The proposed rule amendments will therefore reduce costs to these FM applicants and will reduce the amount of time needed to construct and install directional FM antennas.

10. Alternatives considered by the Commission include retaining the existing rules, and requiring measurement of certain antenna parameters to assist in verification of FM directional antenna coverage patterns if the applicant uses computer modeling. The Commission seeks comment on the effect of the proposed rule changes on all affected entities. The Commission is open to consideration of alternatives to the proposals under consideration, including but not limited to alternatives that will minimize the burden on broadcasters, most of which are small businesses.

F. Federal Rules that May Duplicate, Overlap, or Conflict with the Proposed Rule

11. None.

⁵⁵ 5 U.S.C. § 603(c).