

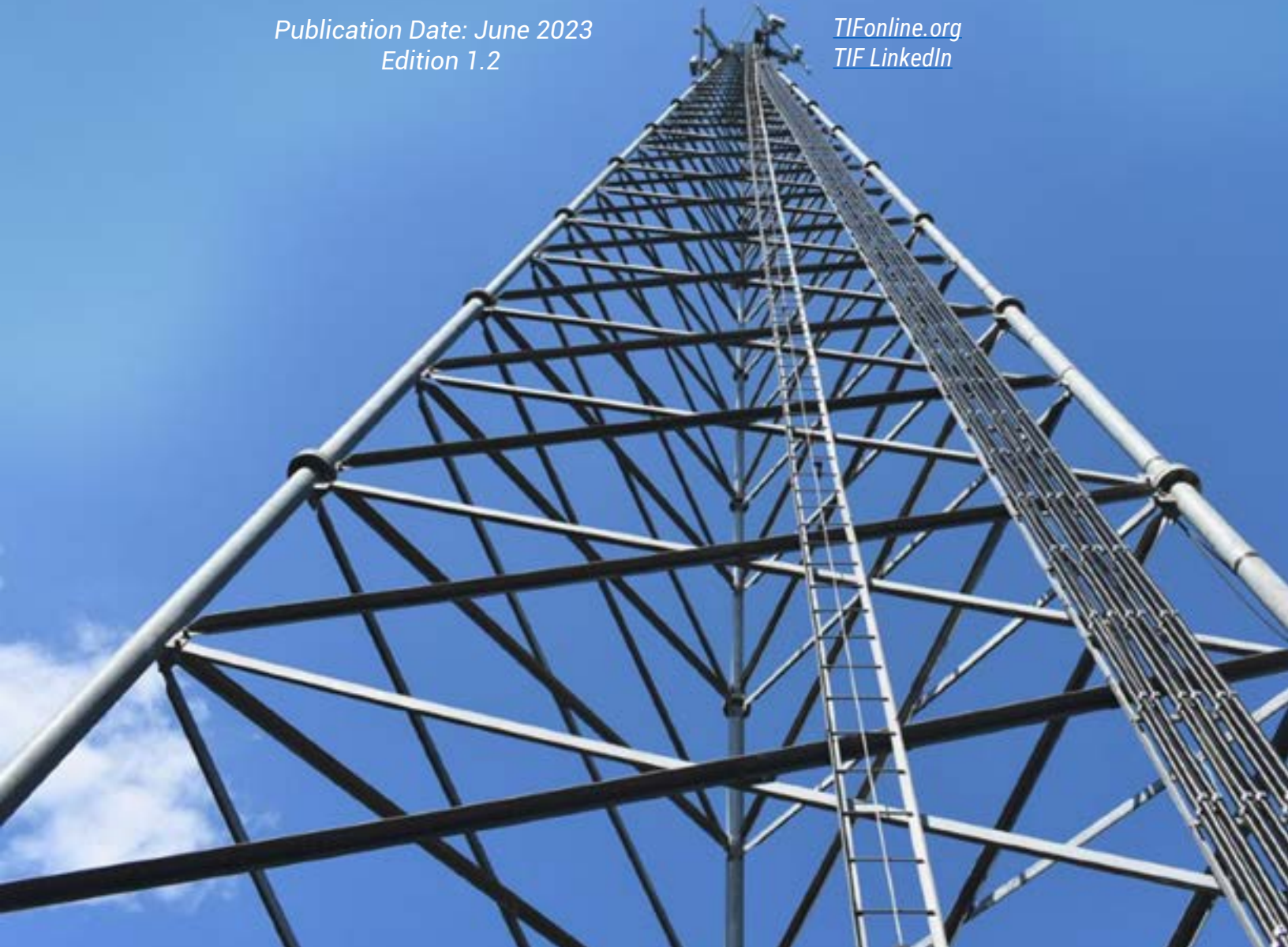


The Telecommunications Industry Foundation is pleased to announce
publication of the following TIF White Paper:

U.S. REGULATORY COMPLIANCE AND AIR NAVIGATION SAFETY

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INTRODUCTION

This TIF white paper (“**White Paper**”) provides guidance for industry Stakeholders concerning air navigation safety, reliable lighting operations, and regulatory compliance when installing, maintaining, or replacing lighting and markings upon antenna supporting structures. Specifically, this White Paper will focus on a review of US Federal regulatory oversight, the Federal Aviation Administration (“**FAA**”) determination process, regulatory requirements of the FAA and Federal Communications Commission (“**FCC**”), as well as best practices for key Stakeholders as it relates to marking and lighting antenna supporting structures.

Antenna supporting structures and other structures that are constructed or used to transmit or receive radio energy (“**Antenna Structures**”) are ubiquitous throughout the US. The structural design for Antenna Structures is the ANSI/TIA 222 standard which has been adopted by the International Building Code (“**IBC**”). ANSI/TIA 222 Rev. H points directly to the FAA for the marking and lightning of Antenna Structures¹ (this is the shortest section of the ANSI/TIA 222 standard as it points directly to the regulatory authority for marking and lighting). These Antenna Structures are enabling the United States to compete with the rest of the world because of the advances that have been made in the telecommunications industry. All parts of our society benefit from the technology that supports telecommunications infrastructure; from cell phones to first responders’ networks to military communications. In order to support these endeavors, the telecommunications infrastructure must be properly designed, installed, and maintained to promote reliability and not negatively impact navigable air space. This is where the proper marking and lighting is so very critical. As a primer to this White Paper, it is important to review the key Stakeholders involved in ensuring successful installations, safe air navigation, and regulatory compliance on Antenna Structures.

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| <ol style="list-style-type: none"> 1. Regulatory Agencies providing compliance standards and enforcement <ol style="list-style-type: none"> i. Federal Communications Commission – the federal agency responsible for promulgating and enforcing rules on Antenna Structures’ air navigation safety markings and lighting. ii. Federal Aviation Administration – the federal advisory agency that proposes standards for air navigation safety. iii. State and Local Government – state and local government agencies often provide additional conditions for the approval and marking of Antenna Structures. These requirements cannot alter or supersede FCC or FAA marking and monitoring requirement. iv. Occupational Safety and Health Administration (“OSHA”) – the federal agency responsible for ensuring health and safety at the workplace. | <ol style="list-style-type: none"> 2. Structure Owners – Owners of Antenna Structures are responsible for compliance with FCC lighting, painting, and monitoring requirements at Antenna Structure sites; Structure Owners also mitigate regulatory and liability risk by ensuring safe air navigation. 3. Engineers – Engineers represent Structure Owners by providing specification, design, and construction engineering services to develop engineering drawings. These engineering drawings should include any applicable Antenna Structure painting and lighting measures required by FAA during the determination process (discussed in Chapter 2). 4. Contractors – the companies that provide installation and repair services at Antenna Structure sites. 5. Manufacturers or OEM (Original Equipment Manufacturer) – the companies that manufacture and warranty obstruction lighting systems, and in some cases, provide additional services such as 24/7 monitoring and installation and repair services. |
|---|---|

¹See ANSI/TIA-222-H, Section 11 Obstruction Marking (“Structures shall be marked in accordance with Federal Communications Commission (FCC), Federal Aviation Authority (FAA), and/or the local aviation authority requirements”)

It is important that these parties communicate effectively and coordinate to address issues that affect safe navigation, successful installations, and regulatory compliance. Common errors that arise from ineffective communication and a lack of regulatory understanding include: (i) incorrect or incomplete painting and/or lighting requirements for Antenna Structures; (ii) installation errors; (iii) post installation service errors; and (iv) other non-compliance with regulatory requirements and FAA determinations. The ultimate goal is to ensure Structure Owner's regulatory compliance and provide for the successful and safe operations of Antenna Structures. In an effort to minimize regulatory noncompliance, Chapter 4 details best practices that Stakeholders should consider utilizing in their air navigation safety programs.

CHAPTER 1: US FEDERAL REGULATORY OVERSIGHT

In the United States, the FCC has authority granted by Congress to require the painting and/or illumination of Antenna Structures, when it determines that such structures may otherwise constitute a menace to air navigation². FCC rules governing Antenna Structure lighting and painting requirements are based on advisory recommendations of the FAA, which are found in FAA Advisory Circulars codified at 47 CFR 17.21 through 17.58³, and made mandatory by the FCC through incorporation by reference into the FCC rules. When constructing new Antenna Structures, there are several options for painting and lighting Antenna Structures (the painting and lighting of Antenna Structures are commonly referred to collectively as “marking” of Antenna Structures), including the following⁴:

- Daytime – paint (alternating white and orange bands) or white flashing lights.
- Nighttime – red flashing lights, steady burning (non-flashing) lights or some combination of the two.
 - ◊ The intensity of the various light sources, and number of light sources depend upon the height of the structure, including appurtenances at the top of the tower. Current regulations on Obstruction Marking and Lighting can be found in FAA Advisory Circular [AC 70/7460-1M](#).

While it is the responsibility of the FAA to develop standards for the marking of Antenna Structures, the FCC is the agency responsible for promulgating and enforcing rules on Antenna Structures' air navigation safety markings and lighting. The FCC, under authority granted by Congress, can assess fines on Antenna Structures that are not in compliance with FAA marking and monitoring compliance requirements via the FCC Enforcement Bureau. The Enforcement Bureau is the primary FCC department tasked with enforcing the Communications Act⁵ and FCC rules, regulations, and orders. The Enforcement Bureau's mission is to ensure consumer protection, robust competition, the efficient and responsible use of public airwaves, and strict compliance with public safety rules. If a violation of the Communications Act or FCC rules is observed, the FCC is empowered to issue a wide range of penalties such as citations, cease-and-desist letters, and notices of apparent liability, or “**NAL**”, which could result in hearings and monetary forfeitures.

In addition to complying with FAA marking standards, the FCC requires in 47 CFR Part 17 that structure owners put in place monitoring procedures to ensure the functioning of obstruction lighting used for air navigation safety.⁶

²47 U.S.C. §303 (“Except as otherwise provide in this chapter, the Commission from time to time, as public convenience, interest, or necessity requires, shall (q) Have authority to require the painting and/or illumination of radio towers if and when in its judgment such towers constitute, or there is a reasonable possibility that they may constitute, a menace to air navigation. The permittee or licensee, and the tower owner in any case in which the owner is not the permittee or licensee, shall maintain the painting and/or illumination of the tower as prescribed by the Commission pursuant to this section. In the event that the tower ceases to be licensed by the Commission for the transmission of radio energy, the owner of the tower shall maintain the prescribed painting and/or illumination of such tower until it is dismantled, and the Commission may require the owner to dismantle and remove the tower when the Administrator of the Federal Aviation Agency determines that there is a reasonable possibility that it may constitute a menace to air navigation.”).

³[47 CFR §§17.21 - 58](#)

⁴A comprehensive list of FAA Advisory Circulars is available to review here: [FAA Advisory Circulars](#)

⁵“Communications Act” refers to the Communications Act of 1934, as amended by the Telecommunications Act of 1996 and subsequent legislation. The FCC maintains the updated Communications Act of 1934, as amended, which can be found [here](#).

⁶See [14 CFR Part 17](#).

These responsibilities include:

- Observation of the Antenna Structure's lights at least once every 24 hours, either visually or by observing an automatic properly maintained indicator designed to register the failure of such lights, to ensure that all such lights are functioning properly as required.
- Any observed or otherwise known extinguishment or improper functioning of any top steady burning light or any flashing obstruction light, regardless of its position on the antenna structure, that is not corrected within 30 minutes must be reported to the FAA.
 - ◊ This reporting creates a Notice to Air Missions or "**NOTAM**". This NOTAM is a record within the FAA database that provides information on light outages on Antenna Structures. It is then available for flight planning, to alert airmen of Antenna Structure obstructions without proper marking. The NOTAM must stay in place on the FAA database until the issue is resolved. The reasons for a NOTAM may include any top light not in operation, a system in the wrong intensity mode, or site telemetry not communicating with a remote network operation center ("**NOC**").
- The owner of each Antenna Structure must maintain a record of any observed or otherwise known extinguishing or improper functioning structure lights. This record shall be retained for a period of two (2) years and provided to the FCC or its agents upon request.

These monitoring requirements are generally performed by one of the following: (i) a party located around the Antenna Tower (which has record and reporting responsibilities); (ii) the Antenna Tower owner's network operations center ("**NOC**"); or (iii) provided by a third party (such as an OEM) with its own NOC.

CHAPTER 2: THE FAA DETERMINATION PROCESS

Under 14 CFR Part 77 provides regulation for the safe, efficient use, and preservation of navigable airspace⁷. Pursuant to Part 77, owners planning construction or alterations of Antenna Structures may be required to notify FAA to determine potential hazards to air navigation. If notification to the FAA is required, the FAA will perform an aeronautical study called a "determination". The determination process allows the FAA to assess an Antenna Structure as being either a hazard, or non-hazard, to air navigation. Owners of Antenna Structures are required to file for an FAA Determination in the following cases:

1. Any construction or alteration exceeding 200 ft. above ground level ("**AGL**"), regardless of location.
2. Any construction or alteration:
 - within 20,000 ft. of a public use or military airport which exceeds a 100:1 surface from any point on the runway of each airport with at least one runway more than 3,200 ft (excluding heliports).
 - within 10,000 ft. of a public use or military airport which exceeds a 50:1 surface from any point on the runway of each airport with its longest runway no more than 3,200 ft (excluding heliports).
 - within 5,000 ft. of a public use heliport which exceeds a 25:1 surface
3. Any highway, railroad, or other traverse way whose prescribed adjusted height would exceed the above noted standards (see full text of regulation for guidelines).
4. Any construction or alteration located on the following airports and heliports:
 - public use airports.
 - military or public use airports under construction.
 - airports operated by a Federal agency or the Department of Defense.
 - airports and heliports with at least one FAA-approved instrument approach procedure.
5. When a filing is requested by the FAA.

Persons failing to comply with the provisions of Part 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended, and pursuant to 49 U.S.C. § 46301(a). When calculating the AGL for Antenna Structures, any appurtenances such as lightning rods or antennas must be included. If the Antenna Structure is determined to be a hazard, FAA may either reject the project by issuing a Determination of Hazard or provide a marking solution that is within its FAA Advisory Circular AC 70/7460-1M.

⁷See [14 CFR Part 77](#).

To begin the FAA determination process, Form 7460-1, Notice of Proposed Construction or Alteration must be filed. The forms should be filed electronically at <https://oeaaa.faa.gov>. Owners of Antenna Structures (or their proponent) have 3 notification steps in the FAA determination process. These forms are found on the FAA website <https://www.faa.gov/forms>.

1. **FAA Form 7460-1** provides a preconstruction notice. It is filed at least forty-five (45) days prior to the date proposed construction or alteration begins, but it is optimal to provide this information to FAA as soon as feasible. This form starts the FAA determination process. The FAA will provide a determination with one of three responses to the owner or project sponsor. The determinations are valid for eighteen (18) months (the maximum time as specified by Part 77).
 1. **Determination of No Hazard** – The subject construction did not exceed obstruction standards, marking and/or lighting is not required.
 2. **Determination of No Hazard with Conditions, or Notice of Presumed Hazard** – The proposed construction or alteration would be acceptable contingent upon implementing proposed mitigating measures such as marking and lighting the structure. The determination will reference FAA's direction and requirements for marking of the Antenna Structure, by referencing specific Chapters within the Advisory Circular AC 70/7460-1M.
 3. **Determination of Hazard** – The proposed construction or alteration is determined to be a hazard to air navigation.
2. **FAA Form 7460-2, Part 1** is to be submitted to FAA at least ten (10) days prior to starting the actual construction or alteration of the Antenna Structure.
3. **FAA Form 7460-2, Part 2** is to be completed within five (5) days after the Antenna Structure has reached its greatest height.⁸

Due to the high volume of studies the FAA is requested to perform each year, often times the Notice of Presumed Hazard will only evaluate the coordinates and heights submitted on Form 7460-1 and their relation to nearby airports. When received, the proponent may request the FAA to conduct further study; typically, a request must be made within sixty (60) days of receipt of the Notice of Presumed Hazard. **When submitting a request for further study best practice is to provide pertinent mitigation information to the FAA reviewer** (e.g., if there is a constructed Antenna Structure that is taller than the proposed Antenna Structure that is also closer to the nearby airport (and on the same flight path), then the proponent should submit aerial views plotting both Antenna Structures and the ASR information for the constructed Antenna Structure).

As discussed earlier, it is important to follow the tower marking direction, based on the FAA Determination Letter. Any changes to the manner in which the Antenna Structure is marked or lighted that deviates from the FAA Determination Letter requires an updated Form 7460-1 filing, to ensure regulatory compliance and approval. The FCC, under authority granted by Congress, can assess fines on Antenna Structure owners that are not in compliance with the guidance and determination of FAA marking direction. These civil fines can be from to \$1,000 per day for individuals to millions of dollars for corporations. (NOTE: maintenance activities regarding marking or lighting often occurs without review of the Antenna Structure's FAA Determination Letter; this can and has led to sites being non-compliant with the FAA Determination Letter, as filed, even though the intent was to correct an issue).

CHAPTER 3: REGULATORY REQUIREMENTS FOR OEM'S OF OBSTRUCTION LIGHTING ON ANTENNA TOWERS

FAA also sets specific performance standards for the OEMs that provide obstruction lighting solutions in the US domestic market. These standards cover electrical, environmental, photometric, and operational performance specifications for various lighting technologies. These standards are provided under [Advisory Circular, AC 150/5345-43 \(Specifications for Obstruction Lighting Equipment\)](#).⁹ For an OEM to meet the FAA standards, its lighting products must be submitted to an approved third party testing company. Upon successful testing and

⁸[FAA AC 70/7460-1M](#)

⁹See [AC No.: 150/5345-43J](#)

approval by the third-party testing company, the OEM obtains a certificate of conformance with FAA AC 50/150-5345. Shortly afterward, the OEM and its specific lighting technologies are listed in FAA's [Advisory Circular AC 150/5345-53D addendum \(Airport Lighting Equipment Certification Program\)](#).¹⁰ This Advisory Circular is published on the FAA website and is updated quarterly. OEMs listed are required to allow unscheduled onsite audits periodically by FAA approved third party testing companies, in order to maintain certificates of conformance. This protects antenna tower owners, by providing assurance that the OEM lighting products continue meeting FAA lighting specifications.

CHAPTER 4: BEST PRACTICES TO COMPLY WITH AIR NAVIGATION REGULATIONS

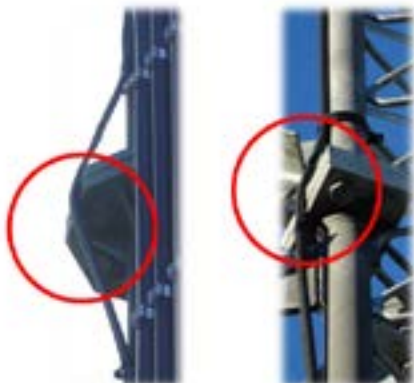
OEMs of obstruction lighting provide value to owners, engineering firms, and third-party service companies by assisting with safety procedures and implementation, optimum lighting system performance, and regulatory compliance. These support activities also apply to other types of structures that are required by FAA guidance for marking, including rooftops, water tanks, and utility and lighting poles. Regulatory compliance, aviation navigation safety, and liability risk management are critical for these applications, just as with Antenna Structures.

OEMs with obstruction products compliant and listed in FAA Advisory Circulars are essential to maintain regulatory compliance and limit liability risk. When marking and/or lighting of an Antenna Structure is required, OEMs should be consulted to ensure that the correct system selections and equipment designs are selected. Involving the OEM ensures that proper lighting configuration and technology, based on the specific FAA determination, is installed. As an example, in November 2020, FAA Advisory Circular AC 70/7460-1M mandated that all red lighting sources used at night must be infrared capable, for recognition with night vision goggles and systems; requirements such as this illustrates the importance of consulting OEMs.

OEMs can often assist the owner economically as well, through the use of fewer light fixtures. For instance, in an effort to promote bird safety, FAA made revisions in 2018 to their marking configurations with [AC 70/7460-1L](#). This allowed Antenna Structures above 350 ft. to eliminate L 810 marker fixtures for night marking. The OEM can advise the owner of a simplified FAA refiling process, potentially allowing fewer light fixtures needed on the Antenna Structure and providing economic savings, as well as possible protection for birds.

The OEM, as an advisor for regulatory and optimum lighting system performance, should provide best practices for installations and repairs in order to promote safety, quality, and optimal system performance. Key areas to promote a safe and optimum longevity of the systems include the following:

1. Ensuring the lighting system being offered meets the requirements established in the site-specific FAA Determination Letter.
2. Proper routing, securing, and length calculations for cables to avoid remobilization for future repairs. Installation issues can include insufficient cable length with the lighting kit (due to ice bridges, underground conduit, and service loops) and cable cutting / wear and tear due to rubbing against structure flanges and sharp metal edges.



Cable rubbing against sharp edges, without proper spacing. (Cable damage due to rubbing across bolt and other sharp edges)

¹⁰See [AC No.: 150/5345-53D](#); See also January 2022 Addendum to [AC No.: 150/5345-53D](#)

- Bringing awareness to issues affecting lighting visibility which could raise potential compliance issues. These include beacon or flash head leveling, crazing of fixture lenses due to UV exposure and xenon gas tube operation, obstructions at the top of the antenna tower greater than 7/8" in diameter, and the "nesting" of the top light fixture(s) within large antennas around the tower perimeter. Nesting caused by obstructions such as antennas can block 360-degree visibility of the lighting source's beam pattern (which is required). These type of issues place the Antenna Structure at risk of being out of compliance with FCC regulations.



(Nesting of flash head within a several appurtenances at top of tower)

- Proper photodiode/photocell installation directed to the northern sky (in the US) and avoiding artificial light sources which can put the lighting system in the wrong intensity state during the evening. Also, providing guidance of proper installation of the photodiode/photocell to eliminate water intrusion inside the receptacle.



(Crazing of flash head, affecting FAA intensity requirements, needing a replacement)



(Proper installation of photodiode/photocell at tower site)



(Flash head leveling using washers as a spacer)



*Photodiode sealed from water intrusion facing northern sky
(in Northern Hemisphere)*

5. Remote technical support for service companies during installation or repair work. OEM's technical support should be able to assist installers on performance issues, diagnostics, completing final lighting inspection to ensure no alarming is occurring. Alarms that extend beyond thirty (30) minutes shall be reported to FAA.
6. Support third-party service companies and owners by providing training which equips contractor field staff with expertise in system design, installation best practices, and troubleshooting.
7. Monitoring support 24/7/365 to meet FCC monitoring compliance and record keeping (see Chapter 1). Especially helpful for companies that want to maintain lower overhead and internal staffing.

CONCLUSION

Achieving regulatory compliance and optimum obstruction lighting performance begins with a clear understanding FAA and FCC regulatory standards & processes. Of paramount importance is the understanding of both when an FAA Determination Letter is required and the process for submitting Form 7460. Owners of Antenna Structures and other obstructions in airspace can achieve regulatory compliance and liability management goals by consulting OEMs and utilizing products tested and listed in FAA Advisory Circulars. An experienced and proven OEM with resources to partner with owners, engineering firms, and service providers, can help achieve maximum regulatory compliance and minimize liability risk; the achieved goal being the protection of Antenna Structure owners, and keeping air navigation safe for all.

AUTHORSHIP CONTRIBUTIONS

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