SPECIFICATIONS FOR
FURNISHING AND ERECTING STEEL RADIO TOWER NEAR FLAT, MISSOURI

GENERAL:

Missouri Highways and Transportation Commission (hereafter "Commission") desires to purchase one (1) installed 300' guyed tower with specified antennas, feed lines, aviation lighting, ice bridge, waveguide ladder, climbing ladder with safety climb system and other related items in accordance with the TIA-222-G and other specifications as detailed below. In addition the Commission desires to replace the equipment shelter and fencing located at this tower site. This tower will replace an existing tower. The exact location of the existing tower is 37º 45' 24.0"N, 91º 58' 29.3"W in Phelps County, MO.

TOWER AND INSTALLATION REQUIRMENTS:

1. **Project Timelines**.
    a. This tower is located on United States Forest Service (USFS) property under a permit. Site plans will require approval by USFS before any work is started.
    b. Upon award of the contract, the contractor will be notified to develop tower drawings, foundation drawings, site plans and any other documents needed for Commission review and submittal to USFS. *No site work will be started at this time.*
    c. The Commission will review and approve the tower and foundation drawings or provide comments. Upon final approval, the contractor may begin fabrication of the tower and related items to allow for associated lead time.
    d. When the Commission has obtained all approvals from USFS, a notice to proceed will be issued to start site work. The exact time required for these approvals is unknown.
    e. It will be necessary to remove the existing tower and foundations before installing the new tower. The contractor shall develop a schedule that will minimize the time that the site is out of service. This schedule requires approval by the Commission before any work is started.

2. **Standards**. This project shall conform to the latest revisions of the following standards:
    a. American National Standards Institute (ANSI)/Telecommunications Industry Association (TIA) 222-G, *Structural Standard for Antenna Supporting Structures and Antennas*, hereafter referred to as TIA-222-G.
    b. Site Grounding and Other Items: Motorola Standards and Guidelines for Communications Sites R56, hereafter referred to as R56.
    c. Missouri Standard Specifications for Highway Construction, hereafter referred to as MoDOT Spec Book.
    d. National Electrical Code, hereafter referred to as NEC.
    e. Any applicable Federal Communications Commission standards hereafter referred to as FCC.
    f. Any applicable Federal Aviation Administration standards, hereafter referred to as FAA.

g. Any applicable Occupational Safety and Health Administration standard and practices, hereafter referred to as OSHA.
h. Any other standards specified in the above documents or this request for bid (RFB).
i. In the case of a conflict, the most stringent standard shall be used.
j. It is the responsibility of the contractor to obtain copies of any required standards. The MoDOT Spec Book can be found on the MoDOT web site at www.modot.org .

3. Design Requirements.

a. All structural elements shall conform to TIA-222-G and the following.
- The tower shall be triangular in cross section and of rigid frame construction. All vertical tower members shall be tubular round or solid round.
- Towers may be fabricated in sections of 10' or 20' (+/-) lengths.
- All parts of the tower structure shall be made of structural steel conforming to TIA-222-G. Bolts, other connecting devices and welding shall conform to TIA-222-G.
- The structural classification as defined in TIA-222-G shall be Class II.
- The exposure category as defined in TIA-222-G shall be Exposure B.
- The topographic category as defined in TIA-222-G shall be Category 1.
- Design loading shall include all current and future antennas as detailed below, all feed lines, mounting hardware, aviation lighting, climbing ladder, waveguide ladder, safety climb system, any other wiring, hardware and appurtenances as required for the final installation.
- Design criteria shall conform to TIA-222-G, Annex B for the county of the tower installation except for frost depth as defined below.

b. The steel structure and all steel items shall be hot dip galvanized and shall not require primer and/or paint. Hot dip galvanizing shall conform to TIA-222-G.
c. All steel items that are not part of the tower structure shall be designed to withstand the loading for the specified application and shall meet all applicable standards in this RFB and any industry standards.
d. Mat and pier type foundation or drilled shafts are the preferred designs for the tower foundation. No surface slab-type foundations will be allowed for any tower or guy anchor foundations. A design frost depth of at least 40" shall be used for all tower and guy anchor foundations regardless of location.
e. The tower shall include a fixed climbing ladder or step bolts and safety climb system the entire height of the tower in accordance with TIA-222-G, Class B.
f. Waveguide ladders shall be installed on the tower at a spacing of 5' or less increments the entire height of the tower and it is preferred that they are fabricated into the tower structure.
g. The replacement tower shall be located at the same location as the existing tower including the tower foundation and the outer guy anchor locations (the existing inner guy anchor locations may be eliminated).
h. The equipment shelter shall conform to drawings and specifications detailed in this RFB. The equipment shelter, fencing and appurtenances shall be as close as possible to the existing location and footprint.

i. Soil boring sample results are included in this RFB.

j. An approximate proposed site layout and existing tower information are included in this RFB.

4. **Initial Tower Submittals.** Submittals shall include but are not limited to the following and shall conform to all requirements in this RFB. All submittals shall be legible including all details and notes in the format provided. Structural plans, foundation plans and calculations shall be sealed by a Professional Engineer (PE) registered in the State of Missouri.
    a. Detailed structural/fabrication plans of the tower structure, guy wires (if applicable) and all related items. The plans shall show overall dimensions, sections, size and relative location of each member, guy anchors (if applicable), details of connection between tower sections, detail of base plates, climbing ladder and any and all other necessary structural details as required.
    b. Structural plans shall include installation requirements to assure that the tower will be installed to withstand all required loading.
    c. Detailed foundation plans for tower foundation, guy anchors and all related items.
    d. Stress calculation of the tower, guys, foundations in accordance with TIA-222-G and this RFB.
    e. Details of tower side and top mount antenna supports, coaxial cable supports, aviation lights, power wiring, conduit, and any other details as required.
    f. Detailed site grounding plan in accordance with R56 and this RFB.
    g. Site plans showing the exact locations of the entire installation including but not limited to the tower, guy wires, foundations, equipment shelter, fencing, ice bridge, etc.
    h. Project schedule as described above.
    i. Detailed equipment list of all brands and models of all manufactured and off the shelf items specified in this RFB.
    j. Any other submittals required in this RFB.

5. **Removal**.
    a. The existing 300’ guyed tower, guy cables and guy anchors that are on site shall be removed and disposed of. All concrete bases and guy anchors shall be removed a minimum of 1’ below grade. Any and all other debris shall be removed and disposed of. The tower base shall be removed from the ground in its entirety to allow for a new tower base at the same location. No portion of any anchor can be cut off at the ground level. Anchor and foundation design and other information for the existing tower are attached.
    b. The existing equipment shelter and associated concrete pad, fencing, fence post bases shall be removed and disposed of.
    c. Non-hazardous materials may be removed to:
        - MoDOT Edgar Springs Building, Rte. 63, 0.3 Mi. S. of Rte. H
    d. All radio and lighting equipment and other items in the shelter as specified by the Commission will be relocated by Commission staff prior to shelter demolition.
    e. *Preferred disposal*: deliver any recyclable materials to a scrap recycling facility rather than dumping in a landfill.

f. The existing propane tank and standby generator shall be preserved in working order so that they can be reused for this site. Commission staff will remove and store these items.
g. The existing tower aviation lighting system shall be removed and preserved in working order and shall remain property of the Commission. (A new lighting system shall be provided for this installation as specified below.)
h. Any other antennas, feed lines and mounting hardware that are still in useable condition after demolition shall remain property of the Commission.

6. **Tower Fabrication.** Upon notification by the Commission, the contractor may order the fabrication of the tower structure. The fabricated tower shall conform to TIA-222-G and the approved drawings and specifications detailed above. All manufacturing and fabrication shall conform to TIA-222-G.

7. **Clearing and Excavating.** The contractor shall furnish all equipment, labor, forms, all material, and the performing of all operations in connection with the excavation and installation of tower base foundations, guy anchors, shelter foundation, ground rings, fence post bases and any other underground items. All vegetation, roots brush, grass sod, decayed matter, rubbish, etc. shall be removed from the area and disposed of by the Contractor. Any removal of trees shall be approved by the Commission in coordination with USFS. All excavated waste shall be disposed of by the Contractor as directed by the Commission.

8. **Tower Installation.** The tower shall be installed following the approved contractor provided schedule. Tower installation shall conform to the manufacturer's plans and requirements as approved by the Commission and requirements below. The contractor shall follow applicable Occupational Safety and Health Administration (OSHA) and any other applicable safety requirements.
    a. **Equipment and Materials.** The contractor supplied equipment and materials shall be as specified in this RFB and shall be new and the manufacturer's latest current model.
    b. **Guy Wire Installation (If Applicable)**. Guy wires shall be tensioned as specified in the approved tower plans. The contractor shall document guy wire tension as built and provide reports to the Commission. The contractor shall demonstrate conformance if requested by the Commission.
    c. **Turnbuckles**. Turnbuckles shall be properly installed and allow capacity for future tensioning. Both sides of the jaw threads shall be equal in the turnbuckle and a minimum of ½" of inside threads shall be showing on each set of jaw threads. Each turnbuckle shall leave a minimum of 50% of the tensioning capacity (at least 50% of the space in the turnbuckle shall be open).
    d. **Guy Wire Safety Loops**. All guy wire installations shall include safety loops at the guy anchors. The safety loop shall be a minimum of 3/8" galvanized steel cable meeting the same requirements as the tower guy cables. The safety cable shall be installed in a figure eight pattern with one pass through all turnbuckle jaws at the anchor fan plate, 2 passes through the center of all turnbuckles and one pass through all the guy wire thimbles. The safety cable shall be secured with 2 – 3/8" galvanized wire rope clamps.

e. **Tower Plumb**. The entire tower shall be plumb from the top to the bottom. The contractor shall confirm that the tower is plumb with a transit after final guy wire tensioning and provide a certification. The contractor shall demonstrate conformance if requested by the Commission.
f. **Galvanizing Repair**. Any damage to galvanized surfaces shall be brought to the attention of the Commission. Major damage will be reviewed by the Commission to determine if a field repair may be made. Any field repairs shall follow ASTM Standard A780. Use of paints containing zinc dust is permitted. It understood that the cad welding process detailed below will require field galvanizing repair.

9. **Tower Concrete.** All concrete, reinforcing steel, any associated materials and installation practices shall conform to all concrete requirements in other sections of this RFB. Concrete shall have minimum design 28 day compressive strength of 4000 PSI. The contractor shall be responsible for field quality control as described in other sections of this RFB including but not limited to making and testing concrete test cylinders.

10. **Antennas.** The following antennas and feed lines shall be provided and installed according to manufacturer's specifications and this RFB. Also see antenna placement diagram below. No substitutions will be allowed unless otherwise noted.
    a. **Antennas.** Quantity 3 CommScope® DB224A VHF dipole antennas shall be provided and installed at heights shown below. Mounting leg and orientation shall be as directed by Commission staff.
    b. **Antenna Mounts.** Top mount kit shall be as provided with the DB224A antenna. Side mount kits with top sway brace shall be CommScope® Part # DB5001 or DB5001-SP5 depending on leg diameter.
    c. **Feed Line.** All feed line for DB224A antennas shall be provided and shall be 7/8" Heliax® – Part #AVA5-50FX. See below for installation requirements.
    d. **USFS Equipment**. *Telewave® ANT150F2 antenna, mount, feed line and accessories will be provided by USFS and installed by the contractor. Notice shall be provided to USFS of the install date 30 days prior so that materials will be on-site for installation.
    e. **Antenna Schedule.** These antennas shall be installed with this project.

Antenna Type	Base Height	Mount Type	Feed Line
CommScope DB224A	300'	Top Mount	7/8" Heliax
CommScope DB224A	260'	Side Mount	7/8" Heliax
CommScope DB224A	220'	Side Mount	7/8" Heliax
Telewave ANT150F2*	150'	Side Mount	½" Heliax

f. **Future Antennas**. The following future antennas and feed lines will not be installed at this time, but will be used for structural design purposes.

Antenna Type	Base Height	Mount Type	Feed Line
3' Round Dish – PCTEL MPRC3649	300'	Dish Mount	
3' Round Dish PCTEL MPRC3649	300'	Dish Mount	
15" Square "ODU" Airmux-400	300'	Leg Clamp	Outdoor CAT5
15" Square "ODU" Airmux-400	300'	Leg Clamp	Outdoor CAT5
CommScope DB224A	180'	Side Mount	7/8" Heliax

g. **Polyphaser® Coax Protectors**. The contractor shall provide and install quantity 3 Polyphaser® part # IS-50NX-C2-MA. Coax protectors shall be installed according to manufacturer specifications and grounded according to R56.

h. **Repeater Jumpers**. The contractor shall provide and install quantity 3 jumpers with Type N male connectors on both ends between the Polyphaser® and each MoDOT repeater. Any unused jumpers shall be neatly coiled and secured. Jumpers shall made from Times Microwave® LMR400 cable with properly installed connectors. The length of the jumpers will be as needed to span from the Polyphaser to each repeater duplexer in the final locations. Jumpers shall be one piece, splices will not be allowed. The total loss of each jumper with connectors installed shall not exceed the following at 155 MHz.
    - 0.3 dB up to 10'
    - 0.5 dB from 11' to 20'

i. **Testing.** The contractor shall test the transmission lines and antennas after installation. The contractor shall test the lines with appropriate calibrated test equipment for losses and for SWR. Any shorts or other issues discovered in the transmission lines, antennas or accessories shall be corrected by the contractor. All test results will be provided to MoDOT for approval before final acceptance. The contractor shall be responsible for making all final connections. The installed coax cable and connectors shall not exceed the following specifications.
    - The maximum Standing Wave Ratio (SWR) measured from the transmitter side of the Polyphaser shall not exceed 1.5 with the final antenna connection in place at 155 MHz.
    - The total loss from the transmitter side of the Polyphaser to the antenna connection, including the Polyphaser, and all installed connectors shall not exceed the following losses measured at 155 MHz. These losses shall be measured before the final antenna connection is made with the appropriate calibrated test equipment.

Coax Type	Length	Maximum dB Loss†
7/8" Heliax	<= 100'	0.8
7/8" Heliax	101' to <= 200'	1.3
7/8" Heliax	201' to <= 300'	1.8
7/8" Heliax	301' to <= 350'	2.0
½" Heliax	<= 100'	1.2
½" Heliax	101' to <= 150'	1.6
½" Heliax	151' to <= 200'	2.1

†Including Polyphaser and both end connectors.

11. Feed Line Installation and Grounding.

a. **Continuous Cables.** All coax cable runs shall be continuous from the antenna to the connection in the building to the Polyphaser. No splices will be allowed.

b. **Coax Ends**. All end connectors for 7/8" feed line shall be CommScope® 78EZNF and shall be installed according to manufacturer's recommendations. No substitutions will be allowed.

c. **Weather Sealing**. All outdoor coax ends shall be sealed as follows; 1 layer of "courtesy tape" (electrical tape), ample butyl Coax Seal® material around the connection on top of the courtesy tape and 3 to 4 layers of 3M Super 33+® tape on top of the coax seal. The connector shall be completely weatherproof.

d. **Installation.** Coax cables shall be installed so as not to exceed bend radius specifications. Coax cables shall be dressed so that there are no rub points with tower steel, hardware, other cables or antennas.

e. **Securing Cables.** Vertical cables shall be secured at a spacing of every 5' or less using the waveguide ladder system using appropriate hanger clips. All horizontal cable runs shall be secured at a spacing of every 3'or less. The contractor shall provide and install all hanger clips designed for the waveguide ladder system and specified cables. All cables shall be properly secured at the bottom of the tower and at antenna connections and other locations to prevent stress on the end connectors and prevent any rubbing.

f. **Hoisting Grips.** Stainless steel lace up style hoisting grips shall be provided and installed according to manufacturer's specifications. A minimum of 2 hoisting grips shall be installed for each coax cable over 200' (one at the top and one at the middle of the cable), a minimum of 1 hoisting grip is required on coax cable less than 200'. Hoisting grips for 7/8" feed line shall be CommScope® part # 19256B or equivalent.

g. **Coax Entry Port.** A 4 port (2 x 2) aluminum waveguide entry panel shall be provided and installed according to manufacturer's specifications. Applicable rubber boots shall be provided for all installed cable. Multiple cables should be routed through each port with maximum of 3 cables allowed per port. The entry port shall be Site Pro 1® part # E1199 or equivalent with matching rubber boots. All unused ports shall be covered with matching rubber sealing caps.

h. **Cable Tray**. A cable tray system shall be installed inside the shelter to support all tower cables from the entry ports. The cable trays shall be ladder style or mesh basket style and shall be constructed of aluminum or zinc coated steel. A minimum 24" wide cable tray shall span the full length of the building (16') from the entry ports to the opposite wall. A minimum 6" wide cable tray shall support

the aviation lighting cable. The cable tray system shall be installed and supported according to manufacturer's specifications. All cables shall be fully supported in a cable tray to just over the associated equipment. The 7/8" feed lines inside the shelter shall be continuous to just above the radio equipment to allow for minimum jumper length into the equipment cabinet.

i. **Grounding Kits**. Coax grounding kits shall be provided and installed according to R56 and the manufacturer's specifications. Grounding kits are required at the antenna, tower midpoint (towers over 200'), tower base and at the equipment shelter entrance for each coax (minimum of 4 ground kits per cable for cables that are 200' or greater, 3 grounding kits for cables less than 200'). Grounding kits shall be waterproofed according to R56 and the manufacturer's specifications. Grounding kits shall be CommScope® Part #220497, no substitutions will be accepted.
j. **USFS Cables.** USFS provided feed line, ends, grounding kits and hardware shall be installed according to these requirements. Contractor is not required to make the final connections to the USFS transmitters.
k. **Cable Marking.** All cables shall be marked with a system to identify each cable top and bottom. A cable marking guide shall be provided to the Commission by the contractor that identifies the antenna or device connected at the top.

12. **Waveguide Ice Bridge.** The contractor shall provide and install a minimum 24" wide hot dip galvanized steel waveguide ice bridge with supports of sufficient strength to protect the cables from falling ice. Sufficient length of ice bridge shall be installed to provide full coverage between the equipment shelter and the tower. The ice bridge shall include trapeze type waveguide supports of necessary size to support all power cables and transmission lines for current and future antennas listed. Trapeze supports shall be provided at a spacing of every 3'or less of horizontal cable run. Waveguide clips designed for both the trapeze support and the installed cable shall be provided and installed. The ice bridge kit(s) shall be Commscope® part # WB-K210-B or equivalent.

13. **Aviation Lighting**. The contractor shall supply and install Flash Technology® FTB 324 Medium Intensity Dual Xenon Lighting System aviation lighting and controller for FAA E-1 type tower at the direction of Commission personnel.

    a. The lighting system shall be a combination Xenon beacons and LED side-light lighting system. The system shall be configured for 120V, 60Hz power. No incandescent lighting will be allowed. Product information sheet is attached.
    b. The contractor shall also provide and install required type SO weatherproof power cables meeting the manufacturer's requirements and NEC. The power cables shall be continuous from the tower mounted lighting to the controller in the equipment shelter, no splices will be allowed.
    c. The power cable shall be supported at a spacing of every 5' or less vertically using the waveguide ladder system and appropriate hanger clips and at a spacing of every 3'or less on any horizontal runs.
    d. A separate 2-port entry panel shall be installed for the lighting power cable. This entry panel shall be as close as practical, but separated from the coax entry panel, and shall not conflict with the external ground bus bar. This entry port shall be Site Pro 1® part # E1448 or equivalent with matching rubber boots.

14. **Antenna Tower and Site Grounding Requirements.** Tower, building, fencing and ice shield bridge grounding must meet the latest revision of R56. The following highlights R56 items that apply to this project, but all applicable R56 standards shall be followed.
    a. **Materials.** All grounding materials including but not limited to ground rods, wire, bus bars, conduits, chemical grounding system (if used) shall conform to R56.
    b. **Ground Rod Spacing.** Ground rod spacing and quantity required shall be determined based on R56 requirements.
    c. **Cad Welding**. All primary connections shall be exothermically connected (cad welded) on all ends. At a minimum cad welding shall conform to "Installers and Inspectors Guide for CADWELD® Electrical Connectors" by Erico®. This requirement applies to but is not limited to the following:
        - All underground connections.
        - All tower and building ground ring connections and all connections to ground rods.
        - Connections from tower legs to the ground ring.
        - Connections from bus bars to ground rings.
        - All connections to fencing and gate jumpers.
        - Connections to ice bridge support posts and bonding jumpers.
    d. **Dissimilar Metals**. Dissimilar metals and corrosion control measures shall be employed as specified in R56.
    e. **Ground Bus Bars**. Bus bars are required at the tower base, outside and inside the equipment shelter (minimum of 3). Bus bars shall conform to R56.
    f. **Guy Anchor Grounding.** Guy anchor grounding shall conform to R56, including but not limited to the following.
        - If the steel guy anchor shaft is in contact with the soil, the ground wire shall be tinned copper and the ground rod shall be galvanized. In this case, the guy anchor shaft shall also be surrounded by 6" of gravel. This is to prevent galvanic corrosion between the copper ground rod and galvanized anchor shaft.
        - Ground rods shall be a minimum of 2' from the concrete foundation.
    g. **Waveguide Ice Bridge.** Waveguide ice bridge shall be grounded in accordance with R56 including all support posts, bonding jumpers between support posts and all ice bridge segments.
    h. **Fence Grounding**. Grounding shall be installed on all fence corner posts, gate posts, with flexible jumpers to gates. Fencing around guy anchors shall be grounded as specified in R56.
    i. **Aviation Lighting.** On structures provided with aviation lights, the power service to the aviation lights shall be protected with surge protection devices as specified in R56 and connected to the tower grounding ring. Where power to aviation lights is run underground, lighting protection shall be provided where electric service enters building.
    j. **Equipment Shelter and AC Service.** Inside the equipment shelter, a perimeter "halo" ground wire shall be installed as defined in R56. A master ground bus bar shall be installed inside the building within 24" of the coax entry port. All internal ground connections shall be as specified in R56. The AC service ground

and tower ground shall be connected as required in the NEC. Neutral-ground bonding shall be as specified in R56, "Location of Neutral-Ground Bond" section.

k. **System Resistance Requirements.** Grounding system resistance shall conform to R56 Type "B" Sites. The contractor shall test the ground resistance with appropriate test equipment and procedures and document test results. The contractor shall demonstrate conformance if requested by the Commission.

15. **Fencing and Compound.** Fencing shall conform to fencing requirements found in other sections of this RFB and the following. An approximate compound layout is included in this RFB with additional information.
    a. **Tower Base and Shelter Compound.** Fencing shall be a minimum 6' tall chain link fence with a minimum of 3-strands of barbed wire topping enclosing the tower, building, generator and propane fuel tank. Also see radio tower equipment shelter specification.
    b. **Gate.** A 10' two piece drive in gate shall be provided and installed at the tower compound. Also see radio tower equipment shelter specification and shelter compound general layout.
    c. Tower Guy Anchor Locations (if applicable). Fencing shall be a minimum 6' tall chain link fence with a minimum of 3-strands of barbed wire topping enclosing the guy anchor. The fenced area shall allow for a minimum 4' clearance from the above ground guy anchor components, shall extend underneath the guy cable to a minimum of 10' of clearance from the ground to the lowest cable and one 36" walk-in gate shall be provided and installed per guy anchor location. A protective fence section shall be extended in line and underneath the guy wires out to a guy wire clearance of at least 14 feet to prevent vehicles from hitting the guy wires.
    d. **Weed Barrier and Rock.** All fenced areas shall have heavy duty weed barrier cloth and 4" depth of 1" clean crushed limestone installed throughout the fenced area and 1' outside the fencing on all sides.

16. **Wind and Working Days**. A working day is as defined in this RFB and the following. For worker safety, during aerial tower stacking operations the contractor may suspend work if the wind is persistent at 15 MPH or above. During aerial antenna, feed line or accessory installation the contractor may stop work if the wind is persistent at 20 MPH or above.

17. **Digital Photograph Requirements**. The contractor shall provide to the Commission digital photographs to demonstrate conformance to this RFB and related requirements. Photographs shall be of sufficient quality, quantity and detail to clearly document the required items. At a minimum the following shall photographs shall be provided.
    a. Site grounding system installation before backfilling
    b. All foundation forms and re-bar cages before concrete is poured.
    c. Guy anchor locations showing installed grounding before backfilling.
    d. Tower section connection points and guy anchor connections after erection.
    e. Antenna installation showing mounts, properly dressed cables, etc.
    f. Feed line installation demonstrating proper cable supports, hoisting grips, weather sealed connections, ground kit installation, etc.

18. **Final Tower Documentation.** The following final documentation is required in addition to any other documents required in this RFB.

a. **As Built Drawings**. If any changes are made to the site layout, grounding plans, or other drawings, final as-built drawings shall be provided.
b. **Guy Wire Tensioning**. The final results of guy wire tensioning for all guy wires shall be provided.
c. **Tower Plumb Certification**. Certification that the entire tower is plumb shall be provided.
d. **Coax sweeps**. The results of coax cable SWR and loss testing shall be provided.
e. **Cable Marking Guide.** A guide to the cable marking shall be provided.
f. **Grounding Test Results.** A report of the grounding system resistance shall be provided.
g. **Concrete Cylinder Test Results.** Test reports of tower concrete breaking strength.
h. **Construction Photographs.** Digital photographs to demonstrate conformance to specifications and any other photographs taken to document the installation.

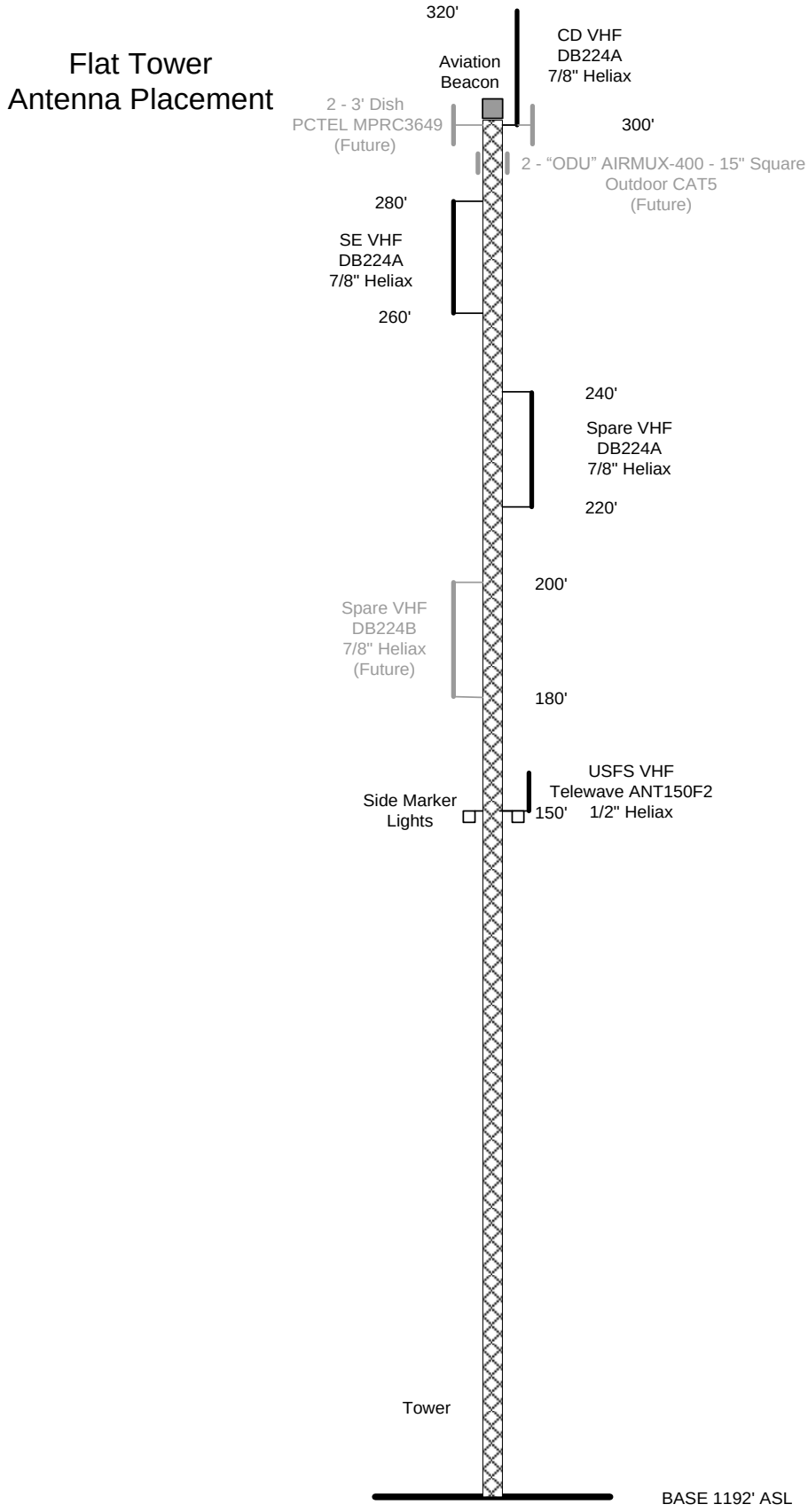
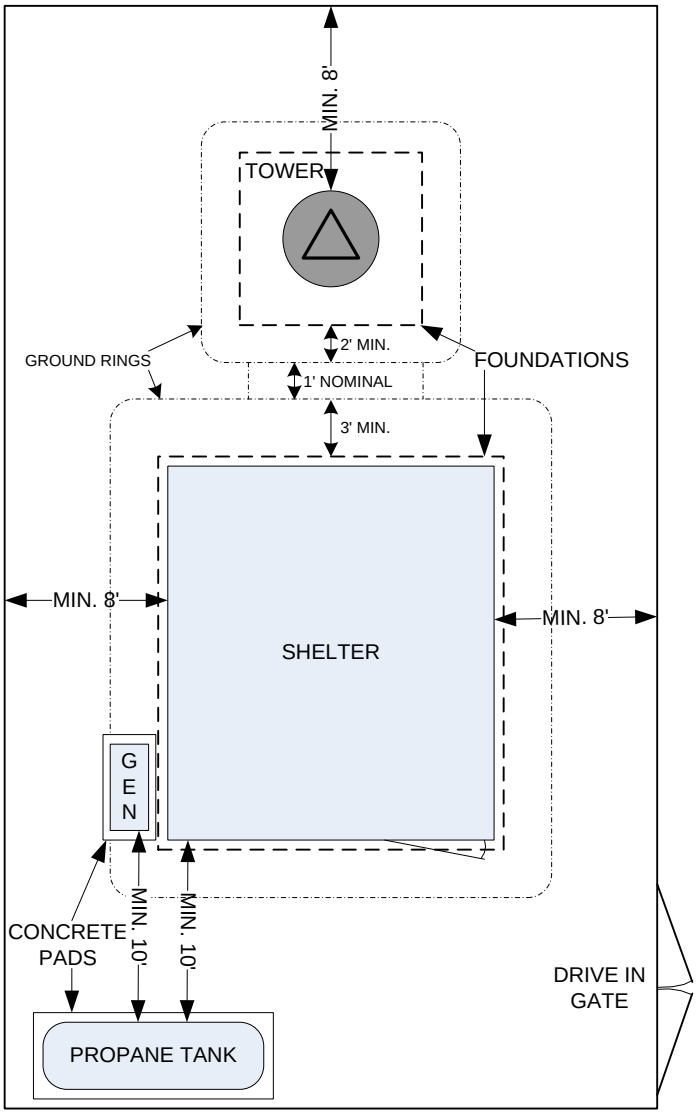


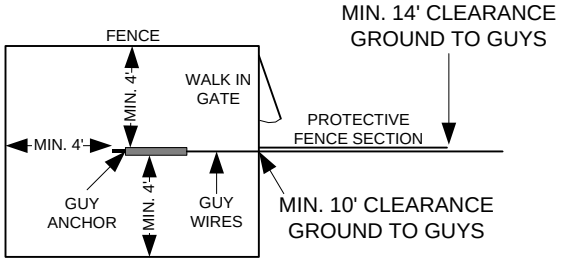
FIGURE 1. ANTENNA PLACEMENT DIAGRAM

TOWER SITE FENCED AREAS
TYPICAL DIMENSIONAL REQUIREMENTS

FENCED TOWER COMPOUND



TYPICAL GUY ANCHOR LOCATION



NOTE: Drawing is not to scale. All required items are not shown, this drawing is only to provide information on general dimensional requirements.

FIGURE 2. FENCED AREAS