**Scope of Work:**

The scope of work requires the Contractor to provide all equipment specified for the **Television Transmission System** described herein and the supervision, installation and other technical services specified. Hence, the Contractor shall supply and install every component necessary for an operable system, whether or not specified herein.

* 1. **The Contractor shall perform the following services**:
		1. Installation of the channel 13, 15kW ATSC/ 14kW OFDM compliant digital transmitter, and related ancillary equipment.
		2. Initial turn-on and tuning of the transmitter and related ancillary equipment.
		3. Perform all test procedures necessary to demonstrate compliance with these specifications and shall certify thereto.
		4. Perform FCC proof of performance for operation.
		5. Two copies of the detailed proof of performance report for FCC filing.
		6. Remove from the premises all debris resulting from work performed.
		7. Installation of AC power and breaker panels suitable for proper operation of equipment.
		8. Wiring from the site's AC distribution panels to the transmitter cabinets for all necessary single and three phase service.
		9. Removal of existing Harris Platinum VHF transmitter.
		10. Provide a new channel 13 VHF antenna.
		11. Remove the existing channel 13 VHF traveling wave antenna.
		12. Supply Drawings and a clear scope of work to be undertaken.

**1.2** **Facilities and services to be provided by Louisiana Educational Television Authority**:

1.2.1 All required licenses, FCC construction permits and certificates of inspection.

1.2.2 Roadways adequate for delivery of equipment

1.2.3 Area illumination

1.2.4 Proper operation of any other unspecified equipment required to supply an ASI and multi-cast IP stream signal to the transmitting equipment for conduct of FCC Proof of Performance tests.

**1.3 Contacts:**

1.3.1 Purchaser: Louisiana Educational Television Authority (LETA), an instrumentality of the State of Louisiana, Clarence Copeland, Executive Director, 7733 Perkins Road, Baton Rouge, Louisiana 70810, Telephone (225)-767-4446.

1.3.2 Director of Engineering, Frank Hillyard, telephone (225) 767-4430, email: fhillyard@lpb.org.

1.3.3 Transmitter Supervisor Steve Ringo, telephone (225) 252-7886, email: sringo@lpb.org

**1.4 Site Location:**

1.4.1 The Channel 13 transmitter site is located at **232 KNOE Tower Rd. Columbia, LA 71418.**

**1.5 Delivery:**

All items described herein shall be delivered F.O.B., to the transmitter site. All items described herein shall be delivered and installed within 120 calendar days following the award of contract.

**1.6 Substitution of Materials or Equipment:**

Where materials or equipment are specified herein by a manufacturer’s name and/or type number, such a designation is intended to establish the desired level of quality and/or performance. The Contractor may propose substitute materials or equipment, which they believe equivalent to items specified, provided that documentation necessary to establish equivalency is supplied with bid. The burden of establishing equivalency shall rest with the Contractor, and the Purchaser shall be the final judge of the acceptability of equipment or materials submitted as equivalents.

**1.7 Terms, Conditions, and Warranties:**

1.7.1. The warranties covering the transmitter and all vendor items contained within and thereon shall be for at least 4 years (48 months) following the successful completion of proof of performance tests.

1.7.2. Warranties covering all other vendor items shall be those of the manufacturers. Successful Contractor shall assure Purchaser that vendor’s warranty shall begin with the successful completion of proof of performance tests, the same as the warranty for items provided by the Contractor.

**1.8 Codes, Permits, Taxes, and Certifications of Inspection and Approval:**

The digital transmitting facility shall be installed in accordance with all national, state, and local codes and regulations, and in strict conformity to the Rules and Regulations of the Federal Communications Commission. Purchaser will secure and pay for all permits, licenses, and certificates of inspection. The Contractor shall pay all taxes applicable to this project.

**1.9 Decision of Purchaser:**

Purchaser shall be the sole judge of acceptability of technical equipment, materials, design, and workmanship.

**1.10 Consideration of Bids:**

All bids submitted should contain the following information. Omission of any of the following items may result in the bid being rejected as non-responsive.

1.10.1 A complete bill of materials which shall include quantity, manufacturer, model number and description of every item of equipment to be supplied within the bid. Contractors must state overall bid cost both in writing and in figures. Any bid which fails to state a price in both figures and writing may be deemed non-responsive and rejected. In the event of any discrepancy between written and numerical prices, the written price will be considered to the bid. All equipment bid shall be new and not previously sold or delivered.

1.10.2 A manufacturer’s specification sheet, drawing, or other information for each major item of equipment proposed, to permit a determination as to whether the equipment proposed meets the requirements of these specifications.

1.10.3 A complete list of the Digital VHF broadcast stations to which the transmitter manufacture has furnished transmitters. Such list should include call signs, engineering contacts and addresses of stations. (Please list on separate page)

1.10.4 A complete listing of any and all exceptions to these specifications and/or requirements of this bid document.

1.10.5 Each individual item of optional equipment: (Please list on separate page)

 A floor plan, showing sizes and recommended locations of items of equipment to be supplied

a) Proposed functional diagrams of signal path.

c) Proposed rack layouts of equipment to be supplied.

d) A statement as to the availability of replacement parts.

e) The current list prices of the type and model transistors used.

**Broadcast Transmitter Equipment**

# **Manufacturer’s Requirements:**

* 1. All major components of the transmitter system shall be warranted by one single manufacturer.

#  1.2 The manufacturer shall have been continuously engaged in the manufacture of TV broadcast transmitters for a minimum of 5 years.

1.3 All equipment offered shall be the latest design of its type by the manufacturer. Its construction shall conform to the best prevailing engineering practice and applicable industry standards to assure a high degree of quality, performance, reliability, and maintainability.

1.4 The manufacturer shall warrant the transmitter to be free from defects in material and workmanship for a period of not less than 4 years. Under the terms of this warranty, the manufacturer shall either provide free exchange replacements for products determined to be defective or repair the defective products without charge for parts and labor.

1.5 The transmitter manufacturer shall have a service department that is accessible 24 hours a day, 7 days a week, 365 days a year, and shall employ a staff of full‑time customer service engineers available for telephone consultation or on‑site service.

1.6 Parts and service support shall be provided for a minimum of 10 years after the sale of the equipment.

1.7 To provide transmitter owners with the latest improvements, the transmitter manufacturer shall provide up‑date kits and software upgrades whenever applicable. Any tools (including software) required for periodic maintenance and tuning shall be included.

1.8 All electrical components shall be standard catalog items of U.S. manufacturers and/or shall be readily available in North America through normal distribution channels.

1.9 The manufacturer shall regularly conduct technical maintenance training seminars at its facilities on the transmitter system supplied. This training shall be provided for up to four members of the engineering staff**.**

**2.0 General Antenna Requirements:**

 2.1. The transmitter shall consist of the following major components:

2.1.1 Transmitter System control, all components and licenses necessary to fully operate in ATSC 1.0 and ATSC 3.0 modulation mode.

 2.1.2 Solid state power amplifier cabinets (quantity dependent upon total transmitter output)

 2.1.3 RF system, including FCC mask filter, Dielectric RF Scout with air pressure and temperature sensors, a RF Hawkeye, Hawkeye 6 1/8” line section, four port 6 1/8” motorized RF switch, Controller for the motorized four port switch, A RF test load, and interconnecting RF line.

2.1.4 If the transmitter cooling design requires a unitized blower or water-cooled heat exchanger assembly it shall be equipped with a local disconnect, and motor protection.

2.1.5 If the transmitter cooling design is water cooled it shall be a sealed and pressurized system to eliminate atmospheric contamination. All pumps and heat exchanger fans shall be flow and temperature tracking for maximum efficiency and minimum power consumption.

 2.2 The transmitter shall be designed to generate high quality signals in accordance with all applicable FCC regulations ATSC 1.0, ATSC 3.0, and EIA standards.

 2.3 The transmitter cabinet(s) shall be assembled, wired and tested in the manufacturer's plant to minimize assembly required during installation.

 2.4 The transmitter model shall be documented in accordance with current FCC regulations for the appropriate operating power.

 2.5 The transmitter shall be supplied with two sets of documentation. The basic transmitter manuals shall include installation, operating, and trouble‑shooting procedures. Additionally, the manuals shall include schematic wiring diagrams with component designators and values, a manufacturer’s parts list that documents replaceable assembly part numbers as well as assembly component breakdowns, component circuit designators, industry standard descriptions and the vendor’s generic number when possible.

 2.6 The transmitter shall be supplied with installation materials for interconnecting major transmitter components as diagramed within typical installation drawing requirements at the designated location within the KNOE transmitter building. The Bidder shall be responsible for all requirements to facilitate the installation of the transmitter to where KNOE designates.

 2.7 The transmitter shall be supplied with surge suppression system, Exciter/controller UPS, bonded and grounded with a minimum of 4” copper strap at all locations including cabinets, filters, transformers, pumps, heat exchangers, system and hybrid reject loads.

**3.0 DTV Exciter**

3.1 The exciter section of the transmitter shall be warranted by the transmitter manufacturer for a period of 4 years.

3.2 The exciter shall generate a high-quality digital television signal according to FCC Regulations, ATSC 1.0 standard and ATSC 3.0 standard.

3.3 The ATSC 1.0 input data format shall be a 19.39Mb/s serial bit stream with embedded clock. Input data level, timing stability and impedance shall comply with the Asynchronous Serial Interface standard.

3.4 Printed circuit boards shall be used wherever practical for maximum uniformity and stability. All I.F. and R.F. signal connections between printed circuit boards shall be via industry standard shielded coaxial cables and printed wiring board connector when and if applicable .

3.5 ALC circuitry shall be provided to maintain a constant signal level.

3.6 Dual Exciter configuration is required.

3.7 The Contractor shall conduct and provide FCC proof of performance for both ATSC 1.0 and ATSC 3.0 modulation mode based on user selection.

3.8 Exciter shall be software based for quick adoption of software updates related to standard updates, security, features an on ongoing development within the ATSC 3.0 standard. FPGA exciters may be accepted.

**4.0 RF Power Amplifiers**

 4.1 The RF amplifiers shall be 100% solid state.

 4.2 Each RF amplifier shall operate independently allowing easy removal and replacement while the transmitter is on the air. It shall not be necessary to shut the transmitter off, reduce RF drive, remove cabinet AC power, or make any adjustments when replacing amplifier modules. The system shall be designed to operate for an indefinite period with any number of modules removed. Manual coolant shutoff valves and AC main breakers shall be present for each individual amplifier.

 4.3 Each RF amplifier must have its own monitoring for at least the following parameters:

4.3.1 Driver amplifier temperature

4.3.2 Final amplifier temperature

4.3.3 Final amplifier output power

4.3.4 Final amplifier VSWR

 4.4 Each RF amplifier shall have onboard overload protection for the following conditions:

4.4.1 DC over-current in each amplifier sub-module

4.4.2 Over temperature

4.4.3 Excessive VSWR

4.5 A complete spare RF amplifier shall be supplied.

**5.0 RF Module DC Power Supply**

5.1 All DC power supplies shall be fully redundant regulated. To ensure stable performance over a wide range of conditions, the output voltage shall be regulated from zero to full rated load current and for AC line voltage fluctuations of up to -15/+10% from nominal.

5.2 If multiple power supplies are part of the amplifier assembly, a separate, in cabinet, disconnect shall be provided for each amplifier.

5.3 Faults pertaining to the power supply shallbeclearly displayed on the control/monitor system of the transmitter.

5.4 The transmitter and power supplies shall be capable of surviving, without damage; AC line voltage transients meeting the criteria of industry standard test ANSI C62.41 (formerly IEEE-587). External transient surge suppression shall be supplied.

5.5 All DC power supplies shall ramp up to full voltage, soft start, to reduce stress and limit inrush current.

5.6 A complete spare DC power supply shallbe provided. It may be as part of the spare RF amplifier module.

 **6.0 RF Dividers and Combiners**

6.1 The RF amplifier cabinet shall utilize low loss combiners and dividers to allow the parallel operation of the solid-state amplifier modules.

6.2 The RF amplifiers and RF output combiners shall be designed and operated such that each amplifier module is protected from damaging mismatch conditions due to improper connection to load or antenna, or other faults that may create high return loss.

6.3 Reject load resistors for the combiners shall be large enough to permit continuous on‑air operation with any combination of operative and inoperative modules.

**7.0 Transmitter Control and Monitoring System**

7.1 The transmitter shall be designed for unattended remote control.

7.1.1 Connection to remote control equipment for control, status, and metering shall be provided within the transmitter cabinets.

7.1.2 Sensors providing metering samples for remote control shall be included in the transmitter.

7.1.3 The remote-control circuitry of the transmitter shall be directly compatible with the Burk Arc Touch Plus system.

7.1.4 The remote control shall have the ability to communicate by SNMP and hard wired configuration.

7.2 As a minimum, the following parameters shall be monitored and be available for display(s) on the transmitter control/monitoring system:

7.2.1 Transmitter output power (average) and (percent)

7.2.2 Transmitter VSWR / reflected power return loss

7.2.3 RF drive power

7.2.4 Reject load power

7.2.5 System interlock status

7.2.6 All system overloads

7.2.7 Each RF module output power

7.2.8 Each RF module input power

7.2.9 Each RF module fault status to include: VSWR, overcorrect, heat sink temp, FET failure

7.2.10 Cabinet combiner reject load power levels

7.2.11 All amplifier DC power supply voltages and currents

7.2.12 AC line voltage tolerance

7.3 As a diagnostic aid, a summary of active and inactive fault conditions shall be stored and available for viewing on the transmitter control panel. Fault summary to include fault description and number of occurrences.

7.4 The transmitter system shall be capable of automatically optimizing efficiency while maintaining FCC specifications.

**8.0 Cooling System**

8.1 The transmitter shall be liquid cooled.

8.2 To prevent dust build up and thereby reduce routine maintenance requirements, a positive cabinet air pressure shall exist with respect to room pressure.

8.3 Removal of any module or combination of modules shall not adversely affect the cooling of the remaining modules, which may be operated indefinitely. Cooling of the combiners, reject loads and power supplies shall not be affected by module removal.

8.4 Typical building heat loads for the transmitter shall be provided upon request.

8.5 The cooling pumps shall be of an N+1 design**.** The pumps shall have the capability to run on one pump during a failed pump event without having to reduce power. The pumps may be either in parallel configuration or series configuration operating in a logic OR configuration. Reduction or loss of power to change a failed pump is not acceptable.

8.6 The cooling pumps shall have the capability to be changed out while still operating at full power on the air. No reduction of RF power or removal of RF power is acceptable.

8.7 The cooling system shall be of a sealed and pressurized design to eliminate any atmospheric contamination into the coolant system.

8.8 Pump flow rates, coolant temperatures, and Heat exchanger fan speeds shall be monitored and measured from transmitter controller.

8.9 All exterior heat exchanger cooling hoses shall utilize industry standard connections to eliminate the risk of hose separation and coolant leaks.

8.10 All cooling hose exterior penetrations shall be sealed with metal plate and waterproof boot on both sides of wall penetration to eliminate water ingress.

8.11 All heat exchangers shall be installed with risers to keep them off the ground. Vertical models shall be on no less than 1’risers while horizontal models shall be on no less than 3’ risers. The Bidder shall determine the final height of the risers with Gray Communications. Riser shall be constructed of Aluminum, Stainless Steel, or hot dipped galvanized to prevent corrosion.

8.12 The heat exchanger shall have an ice protective structure.

**9.0 Filter and RF System**

9.1 The RF system shall be supplied with precision RF directional couplers mounted before and after the filter oriented to monitor forward and reflected power, a Dielectric RF Hawkeye, Dielectric RF Scout and all necessary transmission line, hangers, RF line to adapt and interconnect transmitter, filter, to existing transmission line.

 9.2 The RF system supplied shall be rated to safely handle at least 110% of 15kW digital television transmitter average and peak power levels using standard EIA transmission line. EHT line is prohibited.

9.3 The RF system shall have spare RF directional couplers before and after the filter for forward and reflected power to be used by staff for trouble shooting purposes.

9.4 The RF Mask filter shall make the FCC mask as required by the FCC. It shall be a constant impedance style filter. It shall have at least six poles but may have more poles if the manufacturer feels it is necessary to make the FCC mask. The filter shall be capable of meeting the maximum TPO power requirements of 41.2KW ERP with excess capacity to handle the transmitters’ maximum output power.

9.5 Mask filter shall be measured upon delivery to verify FCC mask compliance for both insertion loss and tuning prior to operation due to sensitivity of tuning during transportation.

9.6 All non-pressurized interior RF outboard of the transmitter shall use soldered EIA flanges.

9.7 All installers shall be factory trained by the transmitter manufacture.

9.8 All shipping, receipt, offload, unpacking, required rental equipment used for offload or equipment placement, disposal of materials shall be the responsibility of the installer.

**10.0 Electrical and Installation**

10.1 If required electrical transformers shall be supplied one per transmitter cabinet with both primary and secondary circuit protection. Transformers shall be bonded to facility reference ground by 4” copper straps with floor fasteners spaced 6” apart. Folded turns must be securely anchored to the floor.

 10.2 All cabinets, pumps, transformers, filters, and loads shall be securely bolted to the concrete slab.

 10.3 All mechanical support for cooling systems shall be 24” x 4” aluminum tray. Exterior tray shall be supported by aluminum mechanical frames properly secured for hurricane force winds. All hardware shall be stainless steel. Ferrous hardware subject to rust and corrosion shall not be used for any exterior or interior mounting, support, or mechanical structure. Cooling hoses shall be protected from ice where they are not shielded by the required heat exchanger ice protection structure.

 10.4 Installer shall supply as built documentation for both interior and exterior installation of the entire building.

 10.5 Installation must include all safety interlocks. Interlocks and safety systems shall be calibrated, and tested, including RF Scout, RF Hawkeye, internal, and external equipment.

 10.6 A three phase surge suppressor shall be installed on transmitter primary power bus.

 10.7 All ceiling hung RF components shall be supported at a minimum of two locations, with hangers spacing no greater than 5’spacing. Supports shall be secured to ceiling by threaded rod and Unistrut strut slings for rigid support of all overhead components and equipment.

 10.8 Any required building penetrations shall have feed through covers on each opening to prevent the outside elements from coming inside the building.

 10.9 The transmitter electrical distribution interconnections shall be accessible from the outside of the transmitter cabinet.

 **11.0 Antenna Specifications**

 **11.1** The Contractor shall perform the following services:

11.1.1 Provide a VHF side mount antenna tuned for broadcast channel 13 that is capable of 15 kilowatts of radio frequency input power.

11.1.2 Provide the required hardware to mount the antenna on the side of an existing guyed wired tower.

 11.1.3 Provide a fine matcher.

11.1.4 Provide any required adapters to connect the provided antenna to the existing 6 1/8” 75-ohm transmission line.

 11.1.5 Provide a radio frequency line sweep of the transmission system.

 11.1.6 Remove the existing channel 13 traveling wave very high frequency antenna. A site visit is required to verify that no special equipment is required. If special equipment is required, the Bidder shall include all associated costs to needed equipment and/or tools.

11.1.7 New 6-1/8” 75-ohm line shall be required to make up for the size difference between the existing antenna and the new antenna. The vendor is required to make a site visit to verify the length needed to be successful.

 11.1.8 A structural analysis shall be performed by the vendor to verify the antenna structure is within tolerance of the work to be performed.

**VHF Digital Antenna**

**12.0 Manufacturer’s Requirements**

 12.1 All major components of the antenna shall be warranted by one single manufacturer.

 12.2 The manufacturer shall have been continuously engaged in the manufacture of VHF television antenna for a minimum of 10 years.

 12.3 All components offered shall be the latest design of its type by the manufacturer. Its construction shall conform to the best prevailing engineering practice and applicable industry standards to assure a high degree of quality, performance, reliability, and maintainability.

 12.4 The manufacturer shall warrant the antenna to be free from defects in material and workmanship for a period of not less than 4 years. Under the terms of this warranty, the manufacturer shall either provide free exchange replacements for products determined to be defective or repair the defective products without charge for parts and labor.

 12.5 The antenna manufacturer shall have a service department that is accessible 24 hours a day, 7 days a week, 365 days a year, and shall employ a staff of full-time customer service engineers available for telephone consultation or on-site service.

 12.6 Parts and service support shall be provided for a minimum of 10 years after the sale of the equipment.

**13.0 General Antenna Requirements**

 13.1 The antenna shall be constructed to meet the following technical requirements:

13.1.1 The antenna shall be a side mounted slot cylinder-based design that operates efficiently on VHF channel 13. The maximum VSWR across channel 13 shall be no more than 1.08:1. Field tuning of the antenna shall not be allowed.

13.1.2 The antenna shall be elliptically polarized with a minimum 30% vertical polarization with respect to the total effective radiated power.

13.1.3 There shall be no external radiating or pattern shaping elements. All pattern shaping elements shall be enclosed within A cylinder radome that is FAA orange in color.

13.1.4 The antenna shall be designed to structural code RS-222G or higher.

13.1.5 The antenna shall mount directly to the side of the existing tower. LETA shall supply whatever information they have about the tower, but it shall be the responsibility of the bidder to obtain or confirm the information needed regarding the tower top. The antenna shall include all required mounting hardware.

13.1.6 The antenna shall have a minimum horizontal gain of 6.87 (8.37 dBd). The vertical gain shall be 2.09 (3.21 dBd) or greater as long as the vertical is within FCC regulations. The pattern shall meet the requirement of KLTM FCC License. The license file number is 00002625744.

13.1.7 The antenna shall achieve a horizontal polarization effective radiated power of 41.2 kilowatts (16.15dBk) and a minimum vertical polarization effective radiated power of 16.34 kilowatts (12.14dBk) or greater as long as the vertical is within FCC regulations, using 1,890 feet of 6 1/8” 75ohm transmission line with 7.971 kilowatts on the input of the transmission line.

13.1.8 The antenna beam tilt shall be 0.75 degrees.

13.1.9 The antenna input power rating shall be rated at a minimum of 10 kilowatts average digital television power operating on the “Nextgen” ATSC 3.0 modulation standard.

 13.1.10 The antenna shall be tested and fully certified at the factory prior to shipping. The antenna shall be shipped fully assembled. On-site antenna assembly shall not be allowed.

 13.1.11 A formal antenna input elbow complex shall be supplied to allow easy changing of antenna from the existing 6 1/8” 75-ohm transmission line. LETA shall provide any existing tower drawings to assist with the design of the input complex. However, final “fit” will be the responsibility of the bidder. Any cut sections to connect to the existing 6 1/8” 75- ohm transmission line to the elbow complex input shall be factory welded and shipped overnight.

 13.1.12 The existing Dielectric 6 1/8” 75-ohm transmission line will need to be extended with the same size and type line due to Dielectric’s use of the thin wall inside conductor from the point the old antenna connected to where the new antenna will be connected. It is up to the Bidder to calculate the line section needed and an inspection is required. It is up to the Bidder to supply the additional ridged and spring hangers plus any other hardware required.



