

Next Generation Warning System Grant Program (NGWSGP) Equipment List

This is a list of allowable equipment to purchase under the NGWSGP. The Corporation for Public Broadcasting can request to add equipment to this list, which will be reviewed by the Federal Emergency Management Agency (FEMA), Integrated Public Alert and Warning System (IPAWS) Program. FEMA does not endorse, approve, or recommend any specific contractors or manufacturers' product.

ATSC 3.0 Equipment

The following equipment may be necessary for a station to upgrade to ATSC 3.0¹. This list was last updated November 3, 2023.

Item	Category/Type	Description	Notes
Exciter	Labor and Equipment	ATSC 3.0 capable	
Studio Transmitter Link (STL) Transmitter/ Receiver	Labor and Equipment	Change to IP-based system	This could require an upgraded STL microwave/fiber link. Can include Fiber and Microwave links and associated support equipment
Scheduler/ Broadcast Gateway	Equipment	Converts to ATSC 3.0 standard	Encapsulates data and works with ATSC 3.0 exciter
ROUTE Packetizer/ Signaling Device	Equipment	Implements transport for delivery of data from the broadcast	Feeds the Scheduler and can be combined with the Broadcast Gateway
Program Guide Generator	Equipment	Program schedule insertion	Provides electronic service guide data in XML, PSIP, etc.
Live Content Encoders, Packagers, and Encryption	Equipment	HEVC/AC-4 standard for each program stream, can be combined with Packagers and CENC for encryption.	Some existing encoders may be upgradable to HEVC/AC-4. Includes servers for transcoding and mezzanine content delivery

¹ Sources for the information include: 1) [PearlTV Host Station Manual v12](#); 2) [NAB-ATSC-3.0-Guide_Final.pdf](#); and 3) [Incentive Auction Task Force and Media Bureau Update Price Ranges In Catalog of Reimbursement Expenses for Full Power and Class A TV Stations and Multichannel Video Programming Distributors](#)

Item	Category/Type	Description	Notes
Broadband Services	Equipment	Broadband connectivity, VPNs, Firewalls, Anti-virus, etc.	Dependent on station requirements for size and reach.
Support Equipment including IP Network equipment, interface equipment, SDI, IP, Uninterruptable Power Supply (UPS)s, batteries, cables, and accessories	Equipment	Glue to connect everything, e.g., switches, routers, racks, power, UPSs, cables, KVMs, etc. Includes interfaces for stream transport, multicast, SDI, IP, NIC, legacy connectivity, cross-conversion, NTP, PTP, or GPS time source, etc.	Specified for applicable protocols and speed.
Broadcaster Application	Labor and Equipment	ATSC 3.0 requires an application to "Watch TV"	Development of a branded application with features including support for advanced emergency alerting
System Integration	Labor	Contractor to install, configure and test	Putting all the pieces together
Test & Measurement	Equipment	Validation and troubleshooting for ATSC 3.0 broadcasts	Verification and validation of broadcast quality signal
RF Engineering	Labor	Expertise required for measuring RF contours	Required by FCC to show actual contours of RF reach.
FCC and Legal	Labor	Filing fees, consultant, etc.	Permitting for construction, FCC filings, etc.
Tower Structural Study	Labor	Tower integrity	Needed if any antenna or line modifications are required
Environmental Impact Study	Labor	Environmental Impact	Needed if any tower structural modifications are required
Tower Upgrade	Labor and Equipment	Structural work (includes rigging)	If needed based on antenna changes
Transmission Line Upgrade	Labor and Equipment	Handle increased power (based on 1,000')	Only if V-pol is added
Mask Filter	Labor and Equipment	Handle increased bandwidth	Only if sharp tuned filter
Transmitter	Labor and Equipment	Handle increased power (Solid State)	Depends on existing transmitter power rating and licensed ERP (50 kilowatts to 5 megawatts)

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HVAC System	Labor and Equipment	Handle increased power	Depends on if transmitter power changes
Transmitter Building Addition	Labor and Equipment	In limited situations, expansion of the transmitter building may be required to accommodate new equipment.	Approx. 600-1500 square foot addition (costs vary with location, site access, and construction type)
Interim Facilities	Equipment	To maintain new and existing broadcasts during build-up/ switchover period	Required to maintain service if flash-cutting to ATSC 3.0
MVPD (Multi-channel Video Programming Distributor)	Equipment	Provide reception for redistribution	Consumer antenna and receivers for ATSC 3.0 broadcasts for those MVPDs who need it. In general, MVPDs or cable operators receive content via direct IP connection. Required if flash-cutting to ATSC 3.0
UHD Net Pass-Thru	Equipment	Gear to pass-thru UHD	Depends on how network delivers UHD material, required if Master Control has not been upgraded to manage UHD
System Manager Software, Systems, and Services	Equipment	Handles setup and monitoring of system equipment	Automation and Orchestration Solutions for ATSC 3.0
Non-Real-Time Encoders	Equipment	For optional second screen and apps	On-demand content, ad insertion, second screen
Support Equipment including servers, racks, and virtualization software	Equipment	Equipment to support required function that may be virtualized	Some ATSC 3.0 function may involve physical equipment or may be virtualized
Emergency Alerting	Equipment	EAS Encoder/Decoder	Stations should already have this, extra expense only if existing needs replacement or upgrade
Advanced Emergency Alerting	Equipment	ATSC 3.0 Standard firmware upgrade to existing EAS gear	Opportunities for picture in picture, device wake up, extended imagery, etc.
Watermarking	Equipment	ATSC 3.0 Watermarks	Audio and Video Watermarks are useful for broadcasters to deliver data

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A3SA Certificates	Licensing/ Subscription	ATSC 3.0 Security Authority	Signal and Application signing are part of the ATSC 3.0 standards
Monitoring	Equipment	ATSC 3.0 specific notifications for issues affecting consumer reception, including OTA receivers, computers, servers, software, dedicated monitoring devices, etc.	Monitor for SNMP Traps, PCAP, stream verification, deliver email notifications, etc.
Resiliency and Redundancy	Equipment	Equipment to support better resiliency	Improve the overall resiliency (uptime) of broadcasts
Antenna Change	Labor and Equipment	Addition of vertical polarity antenna to increase coverage	Provides better support for indoor and mobile reception of ATSC 3 NextGen TV
Connectivity to Broadcast Partners	Equipment and Services	Fiber, Microwave, or Internet connectivity between partner stations	Encoders, decoders, interfaces, tunnels, and services, e.g. SRT, RIST, etc.
Backup power supply such as emergency generators and / or electrical panel for resiliency generator, includes surge protectors and Automatic Voltage Regulators (AVR)	Equipment	Control panel for generator can include the ability to remotely control two power feeds: 1) Commercial power from local utility company, 2) Backup generator typically gas or propane powered.	480 volts is the typical power output and the AVR ensures steady power. The control panel acts as a transfer switch and can be used remotely in the event the TV station is not manned and remote control is necessary.
Remote Monitoring System of the Studio Transmitter Link Transport Protocol (STLTP) and / or STLTP over Secure Reliable Transport (SRT)	Equipment and Software	Remotely manage and monitor transmission systems for multiple purposes including validation of broadcast quality signal, verification of certificates, broadcast configuration and checking on-air status	Utilize Internet connectivity with off-the-shelf PC and certified software to monitor and manage transmitter(s). This system may be setup at any location. Transport can include any approved transport protocol, e.g. Secure Reliable Transport (SRT), Reliable Internet Stream Transport (RIST), etc.

Radio Equipment

The following equipment may be necessary for radio stations desiring to upgrade existing or build-out new facilities for AM/FM, and/or HD Radio technologies². This list was last updated November 3, 2023.

Item	Category/Type	Description	Notes
Air Cooled Solid State FM Transmitter	Labor and Equipment	10 Watts - 40 kW Analog	For upgrading or replacing analog FM Transmitters, dependent on transmitter wattage consumption for desired station spectrum contours (smallest = 10 Watts)
Air Cooled Solid State FM Transmitter	Labor and Equipment	10 Watts - 40 kW Hybrid	For upgrading or replacing hybrid (analog and digital) FM Transmitters, dependent on transmitter wattage consumption for desired station spectrum contours
Air Cooled Solid State FM Transmitter	Labor and Equipment	More than 40 kW Analog or Hybrid	For the largest stations to increase spectrum contours.
Liquid Cooled Solid State FM Transmitter	Labor and Equipment	10 kW - 40 kW Analog	For larger stations upgrading or replacing analog FM Transmitters, dependent on transmitter wattage consumption for desired station spectrum contours (smallest = 10 kilowatts)
Liquid Cooled Solid State FM Transmitter	Labor and Equipment	10 kW - 40 kW Hybrid	For larger stations upgrading or replacing hybrid (analog and digital) FM Transmitters, dependent on transmitter wattage consumption for desired station spectrum contours
Liquid Cooled Solid State FM Transmitter	Labor and Equipment	More than 40 kW Analog or Hybrid	For the largest stations to increase spectrum contours.
Low-loss Combining Transmitter	Labor and Equipment	Increase IBOC Digital Sidebands	Combining separate analog and HD Radio transmitters
Transmitter Remote System	Equipment	Remotely manage and monitor transmission systems	Utilize Internet connectivity with web browser interface to monitor and manage transmitter(s), translators, boosters, Studio-Transmitter Links, Inter-city relays, and other transmission-related systems.

² Sources for the information include: 1) Radio Station Construction Costs (doc.gov) https://www.ntia.doc.gov/legacy/otiahome/ptfp/application/equipcost_Radio.html; 2) Widelity Catalog of Potential Expenses and Estimated Costs for LPTV Stations, FM Stations, and Translators: <https://docs.fcc.gov/public/attachments/DA-19-176A2.pdf>; and (3) Broadcast Radio Links: <https://www.fcc.gov/media/radio/broadcast-radio-links#AM>

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HD Importer	Labor and Equipment	Manage Diversity Delay in HD Radio implementations	Importer and Exporter can be combined where feasible to manage Radio buffer delays between analog and digital. Cost is dependent on multiple factors, including the manufacturer, the amount of buffering, and external clocking (e.g., 10 MHz GPS disciplined clock source) required to synchronize the analog and digital signals for HD Radio.
HD Exporter	Labor and Equipment	Manage Diversity Delay in HD Radio implementations	Importer and Exporter can be combined where feasible to manage Radio buffer delays between analog and digital
Combined HD Importer/Exporter	Labor and Equipment	Manage Diversity Delay in HD Radio implementations	Combined Importer/Exporter for HD Radio
Additional Exciter	Labor and Equipment	Prepare the audio signal for transmission by boosting the power, amplitude and frequency modulation	If required for redundancy; most transmitters are shipped with one exciter.
Transmitter Installation	Labor	Includes daily rates and expenses	Varies depending upon geographic areas, transmitter sizes, and cooling requirements
Transmitter Building Site Survey	Labor	Includes daily rates and expenses	Varies dependent upon geographic areas, transmitter sizes
Service Entrance 3 Phase/800 amp/208 volt	Labor	Labor for transmitter modifications	A station replacing transmitter equipment may have to increase the power supply to the transmitter or perform other electrical work. Generally contracted at a fixed price.
Switchgear - industrial 800 amp	Labor	Labor for transmitter modifications	A station replacing transmitter equipment may have to increase the power supply to the transmitter or perform other electrical work. Generally contracted at a fixed price.
Transformer 3 phase	Labor and Equipment		A station replacing transmitter equipment may have to increase the power supply to the transmitter or perform other electrical work. Generally contracted at a fixed price per transformer size
Rigid Conduit and Wiring at 2", 3", 4" widths	Labor and Equipment		A station replacing transmitter equipment may have to increase the power supply to the transmitter or perform other electrical

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			work. Generally contracted at a fixed price per foot for conduit width and length.
HVAC Service - Cooling Only	Labor and Equipment		A station installing replacement transmitter equipment may need additional cooling capability. Generally contracted at a fixed price per HVAC tonnage.
HVAC Service - Heating and Cooling	Labor and Equipment		A station installing replacement transmitter equipment may need addition air-handling capacity that includes both heating and cooling. In limited situations, expansions of the transmitter building may require accommodating new equipment (costs vary with location, site access, and construction type). Pricing includes labor and installation
Transmitter Building Modification	Labor and Equipment	Expansion of existing buildings to house new equipment. Variable costs are per ft ²	In limited situations, expansions of the transmitter building may require accommodating new equipment (costs vary with location, site access, and construction type). Pricing is per square foot.
Remote Control	Labor and Equipment	Remote site management and tower control for lighting and positioning	For stations that must rebuild permanent facilities only
RDS Encoder	Labor and Equipment	Radio Data System encoders send broadcast data at 1187.5bps over the FM subcarrier at 57KHz	For stations needing a replacement or redundant RDS encoder. The RDS encoder can also deliver emergency alerts when connected to EAS Systems
Monitoring, FM/RDS Monitor/Receiver, EAS Monitor/Receiver	Labor, Equipment, and Services	Monitoring equipment for radio station facilities including modulation monitors, OTA reception, stream analyzers, and field monitors/receivers	Can also cover monitoring services from 3 rd party suppliers and/or service providers.
Audio Processing	Labor and Equipment	Analog Basic Analog/HD Basic Analog/HD Upgraded	For stations that must rebuild permanent facilities only. Pricing varies based on the type of audio being processed. Audio processing includes compression and limiting, exciters, and pre-emphasis which should be disabled for HD Radio

Item	Category/Type	Description	Notes
AM Antennas	Labor and Equipment	Refer to Existing Tower Reinforcement and New Tower Costs	AM antenna is the tower itself to allow for proper ground radiation of AM signals. Directional AM stations require 2 or more antenna towers, plus lightning protection, and directional sampling loops. Variable costs (requires a quote) dependent on FCC approved class of station and contours (power and size) and tower(s) locations.
FM Low-Power Antennas	Labor and Equipment	200 Watt to 1 kW Log-Periodic 200 Watt to 1 kW Yagi 200 Watt to 5 kW Vertical, Horizontal or Circularly Polarized	Most FM stations building a separate facility will require a new antenna. The price of an antenna does not include installation or removal of existing antennas, radomes, or de-icing equipment (separate covered expenses). All antennas are rated based on input power and priced per bay.
FM High-Power Antennas - Circularly Polarized	Labor and Equipment	6 kW to 10 kW 11 kW to 25 kW 26 kW to 50 kW 51 kW to 100 kW 26kW to 50 kW Panel (3 panels per bay)	Most FM stations building a separate facility will require a new antenna. The price of an antenna does not include installation or removal of existing antennas, radomes, or de-icing equipment (separate covered expenses). All antennas are rated based on input power and priced per bay. All High-Power Antennas are Circularly Polarized
Translators/Boosters - 51 to 100 kW Panel (3 panels per bay)	Labor and Equipment	Low-powered FM retransmission complements primary FM service	Extends the coverage of the primary FM station. Boosters are low-powered translators which fill gaps in the station service contours for the same frequency. Translators simulcast to a different frequency.
Translators/Boosters - more than 100 kW	Labor and Equipment	Complements the primary FM service	Extends the coverage of the primary FM station. Variable costs (requires a quote) dependent on size and location of translator station
Translators/Boosters - Directional antenna fabrication and testing	Labor and Equipment	Complements the primary FM service	Extends the coverage of the primary FM station. Variable costs (requires a quote) dependent on size and location of translator station
Translators/Boosters - Dual polarization antennas, H-only or V-only antennas more than 2 kW	Labor and Equipment	Complements the primary FM service	Extends the coverage of the primary FM station. Variable costs (requires a quote) dependent on size and location of translator station

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Translators/Boosters - Broadband (community or combined) antennas	Labor and Equipment	Complements the primary FM service	Extends the coverage of the primary FM station. Variable costs (requires a quote) dependent on size and location of translator station
Other Antenna-Related Items - Antenna Sweep	Labor and Equipment	Calculate the response of the antenna across frequencies	Dependent on antenna type and polarization
Other Antenna-Related Items - New FM Combiner	Labor and Equipment	Combine signals of several transmitters and translators into one antenna system	Depends on power input and minimum frequency separation. Cost is per channel.
Other Antenna-Related Items - FM Band Pass Filter	Labor and Equipment	Reject frequencies outside of the FM range 87.5 to 108 MHz	Depends on power input and number of sections.
Other Antenna-Related Items - Notch Filter	Labor and Equipment	Stop frequency interference within the narrow FM channel range	Depends on power input and number of sections.
Other Antenna-Related Items - Mounting Brackets	Labor and Equipment		Variable costs (requires a quote) depend on number and types of brackets.
Other Antenna-Related Items - De-Icers	Labor and Equipment		Pricing per bay
Other Antenna-Related Items - Radomes	Labor and Equipment	Weatherproof Antenna enclosures	Pricing per bay
Flexible or Rigid Transmission Line	Labor and Equipment	Flexible transmission line foam dielectric - 1/2" to 1-5/8" Flexible transmission line air dielectric - 1-5/8" to 4" Rigid transmission line - 7/8" to 4-1/6"	RF plumbing for inside the transmitter building between transmitter and transmission line leaving the building. Prices generally include elbows and hangers. Cost is per foot. New transmission line, if needed, is priced per foot based on a length of 1,000 ft
Existing Tower Reinforcement - tower mapping and	Labor	Towers without sufficient documentation of tower specifications	FM Broadcasters replacing or adding an antenna may incur rigging, installation, and removal costs. In addition to these expenses, it may be necessary to modify the

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report for structural engineer		may need to be mapped prior to completion of a tower load study.	existing tower or construct a new tower to accommodate the additional antennas.
Existing Tower Reinforcement - structural engineering study for guyed or free-standing tower	Labor	Towers without sufficient documentation of tower specifications may need to be mapped prior to completion of a tower load study.	FM Broadcasters replacing or adding an antenna may incur rigging, installation, and removal costs. In addition to these expenses, it may be necessary to modify the existing tower or construct a new tower to accommodate the additional antennas.
Existing Tower Reinforcement - structural engineering study for candelabra tower	Labor	Towers without sufficient documentation of tower specifications may need to be mapped prior to completion of a tower load study.	FM Broadcasters replacing or adding an antenna may incur rigging, installation, and removal costs. In addition to these expenses, it may be necessary to modify the existing tower or construct a new tower to accommodate the additional antennas.
Existing Tower Reinforcement - tower reinforcement	Labor and Equipment	Towers without sufficient documentation of tower specifications may need to be mapped prior to completion of a tower load study.	Variable costs (requires a quote) dependent on location, size, and power requirements. FM Broadcasters replacing or adding an antenna may incur rigging, installation, and removal costs. In addition to these expenses, it may be necessary to modify the existing tower or construct a new tower to accommodate the additional antennas.
New Tower Construction	Labor and Equipment	towers shorter than 500' towers between 500' and 1000' towers over 1000'	Costs includes constructing a new tower, per foot; costs may be higher for tower sites with difficult soil conditions. Footings, piers and foundations, and guy anchors may not be included in price
Rigging and Antenna Installation/Removal	Labor and Equipment	towers shorter than 500' towers between 500' and 1000' towers over 1000' Complex tower (candelabras, stacked antennas, terrain-constrained)	Fees paid to tower crews to install/remove antennas and/or transmission line
Rigging and Antenna Installation/Removal	Labor and Equipment	Helicopter installation/removal	Variable costs (requires a quote) dependent on location, size, power. Fees paid to tower

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		(for antennas on top of high-rise buildings, a complex tower, or tower that is terrain-constrained so that antennas cannot be lifted using a gin pole or winches)	crews to install/remove antennas and/or transmission line.
Temporary Tower Rent	Licensing		Variable costs (requires a quote) dependent on location, size, power requirements.
RF Consulting Engineer Fees	Labor, Licensing	Prepare Engineering Section of Construction Permit	Stations without sufficient internal resources, either at the station itself or at an affiliated station or company, may have to obtain professional services from an outside vendor to complete the various aspects of the station's channel relocation
RF Consulting Engineer Fees	Labor, Licensing	Prepare Engineering Section of License to Cover	
RF Consulting Engineer Fees	Labor, Licensing	Prepare Engineer STA	
RF Consulting Engineer Fees	Labor, Licensing	Prepare Form 601	
Attorney Fees	Labor, Licensing	Prepare and file Construction Permit	
Attorney Fees	Labor, Licensing	Prepare and file License to Cover	
Attorney Fees	Labor, Licensing	Prepare and file STA	
Attorney Fees	Labor, Licensing	Lease negotiations or other legal matters	
Other Professional Fees	Labor	Project Management, if needed	Costs per hour
Other Professional Fees	Labor	Prepare and/or review reimbursement forms	
Other Professional Fees	Labor	Form 399 assistance or other Program Management Costs	Variable costs (requires a quote) depend on assistance needed

Item	Category/Type	Description	Notes
Field Engineering	Labor	Outside engineering assistance	Cost per day
Field Engineering	Labor	Coverage verification of new primary facility	
Field Engineering	Labor	AM Pattern disturbance study/remediation	
Field Engineering	Labor	RF Exposure Measurements	
FCC Filing Fees	Labor, Licensing	FCC Form 301/340 Minor/ Major Change Construction Permit	From 2018 Filing Fee Guide.
FCC Filing Fees	Labor, Licensing	FCC Form 302 or 350 FM License to Cover (non-directional or directional antenna)	From 2018 Filing Fee Guide.
FCC Filing Fees	Labor, Licensing	- FCC Form 359 FM Translator Major Change Construction Permit	From 2018 Filing Fee Guide
Equipment Disposal, Storage, Delivery and Handling	Labor and Equipment		Variable costs (requires a quote) dependent on location and amount, types, and sizes of equipment
Point to Point Microwave (STL/ICR) - Frequency Coordination	Labor and Equipment	Microwave Studio to Transmitter Link	Per license - 2 needed for bi-directional link Studio Transmitter Link (STL) and Inter-City Relay (ICR)
Point to Point Microwave (STL/ICR) - Unlicensed systems	Labor and Equipment	Microwave Studio to Transmitter Link	Includes antennas attached to radios for Studio Transmitter Link (STL) and Inter-City Relay (ICR). Larger antennas are additional.
6/11 GHz Licensed Part 101 Systems	Labor and Equipment	Microwave Studio to Transmitter Link	Price includes 6-foot antennas. Single link and redundant systems are included in this price range
950 MHz Licensed Part 74 Systems	Labor and Equipment	Microwave Studio to Transmitter Link	Price includes 6-foot antennas. Single link and redundant systems are included in this price range

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1 pair IP-only Codecs for fiber, internet, or IP microwave systems	Labor and Equipment	Microwave Studio to Transmitter Link	System to support IP-based streaming for STL, digital audio transport, transport circuitry, etc.
Ibiquity HD Radio Software License	Licensing	HD Radio License	Required by Xperi, Inc. to be able to broadcast HD Radio signals
Metadata Publishing Software	Licensing	Metadata Publishing	Include metadata in the HD Radio and/or RDS transmissions
Backup power supply such as emergency generators / or electrical panel for resiliency generator, includes surge protectors and Automatic Voltage Regulators (AVR)	Labor and Equipment	Control panel for generator can include the ability to remotely control two power feeds: 1) Commercial power from local utility company, 2) Backup generator typically gas or propane powered.	480 volts is the typical power output and the AVR ensures steady power. The control panel acts as a transfer switch and can be used remotely in the event the radio station is not manned and remote control is necessary.
Uninterruptable Power Supply (UPS), batteries, cables, and accessories	Equipment	Power supply backup for computer systems, audio consoles, and other powered and IP-connected devices.	Variable costs dependent on UPS sizing and requirements.