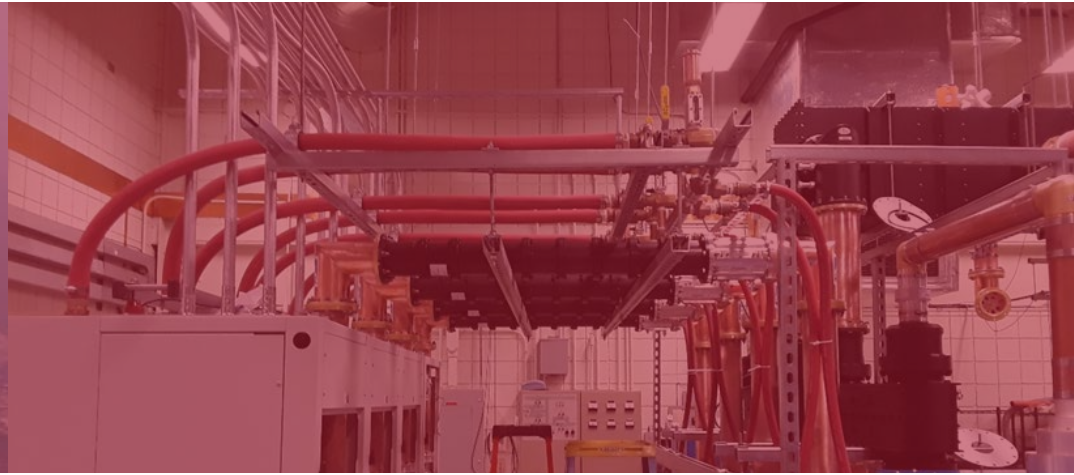


TV Repack:
What We Learned From the First Installations

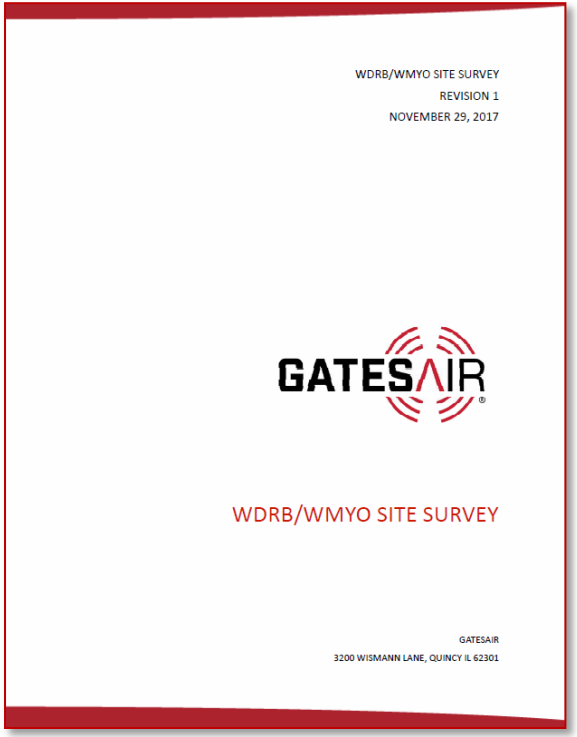
Martyn Horspool
Product Manager
TV Transmission
GatesAir

Planning Aspects

- Well executed Tx Repack installations include:
  - Detailed site survey – an absolute “MUST-HAVE”
  - Expert planning & preparation
  - Layout drawings (current / transition / final)
  - Project Management & coordination of:
    - Specifying & ordering equipment
    - Delivery schedule (including outside RF, antenna, etc.)
    - Interim configurations and final switchover planning
    - Lining up Civil Works, Electrical, HVAC, Plumbers and install crew
    - Final inspection / Testing / Proof

Surveying the Site

- Site location & access
- Current equipment
- Building layout drawings
- RF systems
- RF line
- Electrical
- Codes and regulations
- HVAC
- New tx placement and drawings
- Interim configurations
- Summary

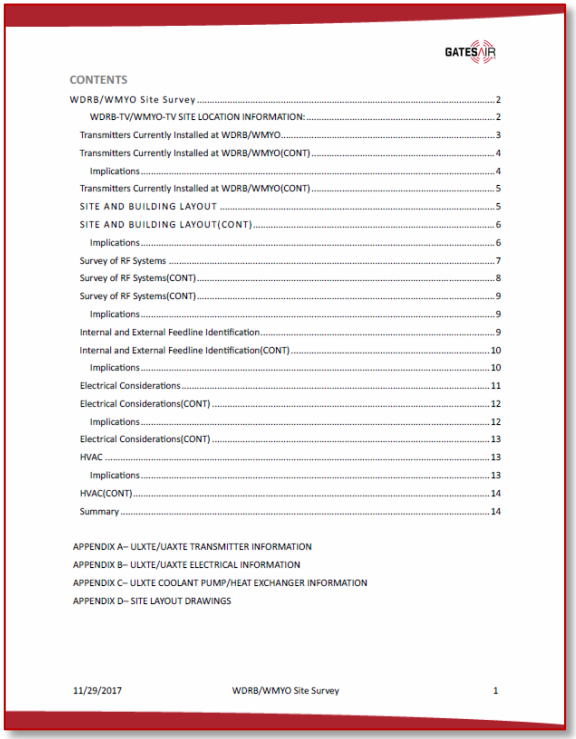


WDRB/WMYO SITE SURVEY
REVISION 1
NOVEMBER 29, 2017

GATESAIR

WDRB/WMYO SITE SURVEY

GATESAIR
3200 WISMANN LANE, QUINCY IL 62301



GATESAIR

CONTENTS

11/29/2017 WDRB/WMYO Site Survey 1

Site Survey Report Example – KIAH, June 2018

KIAH-TV SITE SURVEY
REVISION 1
JUNE 18, 2018

KIAH-TV SITE SURVEY

GATESAIR
3200 WISMANN LANE, QUINCY IL 62301

CONTENTS

Site Survey – KIAH - Houston, TX

KIAH-TV SITE SURVEY

This report is the findings of a site survey to prepare **KIAH-TV** for the Spectrum Repack, and/or for the replacement of the aging Sigma transmitter CD3260P2. The Spectrum Repack will affect this station. The current channel is Channel 38; and with the FCC mandated Spectrum Repack, the new channel will be Channel 34. The focus of this report is to gain a general, all-encompassing knowledge base that will allow GatesAir to provide strategic and targeted solutions for KIAH-TV. This report is divided into five key areas that are essential for GatesAir to understand so that we may identify potential opportunities and issues that will affect this future installation.

1. **Current Transmitters Installed at the Facility**
2. **Site and Building Layout**
3. **Survey of RF Systems (includes Feedlines to tower)**
4. **Electrical Considerations**
5. **HVAC Capabilities**

For comparative purposes of this report, we have designed our findings around installing a GatesAir ULXTE-120 transmitter system in place of the existing Harris/GatesAir Sigma transmitter, model CD3260P2. These assumptions are based on the current-power ratings and are subject to change.

KIAH-TV SITE SURVEY

KIAH-TV SITE LOCATION INFORMATION:

Site Address: 4130 McHard Road (FM2234)
Missouri City, Texas 77053

Site Longitude: **29° 34' 06.0" N**
Site Latitude: **95° 29' 57.0 " W**

STATION AND SITE CONTACT INFORMATION

Contact: Peggy Moore Phone: (713) 435-2863
Email: PNMoore@tribunemedia.com Mobile: (832) 25-1256

KIAH-TV REPACK INFORMATION:

Pre-Repack Channel: 38
Post-Repack Channel: 34
Post-Repack ERP: 992kW
Phase: 2 Completion Deadline: 4/12/2019

Site Survey – KIAH - Houston, TX

TRANSMITTERS CURRENTLY INSTALLED AT KIAH-TV

KIAH-TV is currently on the air and operating with a Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter: P/N 994-9649-143, SN: SPCD109-01. The transmitter was ready for shipment on December 5, 2001. Presently, KIAH-TV is operating on Channel 38. The main Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter is rated to put out approximately 54kW. Currently, the customer is running full power on both cabinets equaling the TPO of 54kW input to the existing antenna.

TRANSMITTERS CURRENTLY INSTALLED AT KIAH-TV (CONT)

Presently, KIAH-TV also has a GatesAir ULX-6300AT liquid-cooled backup transmitter system at the site. The Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter that currently resides in the KIAH-TV main-transmitter site room. The Harris/GatesAir Sigma transmitter, model CD3260P2 liquid-cooled transmitter consists of two IOT cabinets, so in an event of a cabinet or transmitter failure, the customer can continue to broadcast on the current channel. The site room has the space to support the installation of our GatesAir ULXTE-120 transmitter system without moving or de-installing the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter.

A control cabinet will need to be re-located to install the GatesAir ULXTE-120 transmitter system to ensure that there is enough floor space.

Site Survey – KIAH - Houston, TX

TRANSMITTERS CURRENTLY INSTALLED AT KIAH-TV (CONT)

The GatesAir ULX-6300AT liquid-cooled backup transmitter will be reconfigured for the new Channel 34. This transmitter will need to be drained and refilled with glycol antifreeze. The channel will change and the pump module that is currently in the cooling of the transmitter will be replaced with a newer HE-2 pump module. This pump will also cool the station load as well. The current-pump module is a re-purposed Sigma transmitter pump module that will be decommissioned during the upgrade process. This will make room for the installation of the new HE-2 pump module in same location of the existing pump module that is currently in a separate room from the transmitter.

IMPLICATIONS

Sigma series transmitters are not particularly classified as frequency-agile. Most frequency-change components are band-sensitive. The channels on the Sigma transmitter could be changed but it would take extensive on-site services and require major changes to the transmitter hardware provided by GatesAir personnel and at a major cost if all the frequency-change components are still available. Another consideration is the actual IOT cabinet tube. The price of a tube and the lead time to purchase one has dramatically increased over time which makes the newer ULXTE solid-state transmitter a better option. With the age of the current IOT's and the amount of other required hardware, attempting to change the channel of the Sigma is not practical. Any movement of the channels requires the RF-mask filter and most of the RF system to also be replaced.

Serviceability is a consideration. The Sigma series transmitter is approaching the end-of-its-life cycle within the next two years, as production of this model ceased in 2008.

In the case of a major-frequency change, some components will be difficult if not impossible to obtain. A major-frequency change should, for the above reasons, not be considered for the CD3200P2 Sigma transmitter.

TRANSMITTERS CURRENTLY INSTALLED AT KIAH-TV (CONT)

The GatesAir ULX-6300AT liquid-cooled backup transmitter system will also require a frequency change from Channel 38 to Channel 34. The GatesAir ULX-6300AT liquid-cooled backup transmitter system has a M2X exciter installed. The M2X exciter can be channel changed from Channel 38 to Channel 34 with some retuning of the current mask filter and setting changes in the M2X exciter. The GatesAir ULX-6300AT liquid cool backup transmitter system will need the current RF-line output installed into an RF switch that will make the RF-line output travel to the existing RF waveguide switch. This will allow the output to reach the antenna.

Removing the current GatesAir ULX-6300AT liquid-cooled backup transmitter system pump module and installing a HE-2 pump module will be considered into the installation time for the GatesAir ULXTE-120 transmitter system installation. The draining the GatesAir ULX-6300AT liquid-cooled backup transmitter system, flushing and refilling the system, will need to be taken into consideration for the installation.

SITE AND BUILDING LAYOUT

The **KIAH-TV** transmitter site is in a remote area off the Fort Bend Parkway (Toll Road). The studio location and the transmitter site are located separately with a microwave feed and a fiber-line backup. Both locations are surrounded by chain-link fencing. Access to the transmitter site is through a cow pasture. Delivery of the transmitter and other equipment will need to be scheduled with the customer to ensure access to the site.

Site Survey – KIAH - Houston, TX

SITE AND BUILDING LAYOUT(CONT)

The transmitter site building is in good shape. The building is of a cinderblock-design wall structure. The floor is a cement floor that is painted. The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter has ground strap running across the floor to the transmitter location that is connected to the transmitter grounding. The ceiling is a metal roof that can support the RF system for a ceiling-mounted installation for the RF system. The ceiling measures 20' from the floor to the roof of the building. The beams hang down 2'-6" from the ceiling in some parts of the room.

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter does take up a lot of space at the site. There still will be space to perform the installation of the GatesAir ULXTE-120 transmitter system without performing any de-installation work on the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter. The customer will be able to broadcast on the current Channel 38 until the FCC Spectrum Repack channel change date. A control cabinet will need to be relocated so the new GatesAir ULXTE-120 transmitter system is clear to be set in place.

SITE AND BUILDING LAYOUT(CONT)

The site-access road is a dirt road. There should not be any issues for a larger truck to access the site except during wet weather. For delivery, the truck should have a lift-gate that can lower the transmitter and equipment from the high-truck bed to the ground. There is not a loading dock present at the site. The access equipment door to the site room is the garage area. There is sufficient height and width on the door that he GatesAir ULXTE Transmitter cabinets can be shipped in a vertical or horizontal delivery. There is a lift at the site to bring the transmitter cabinets and associated equipment into the transmitter room. The truck will need a lift gate to get the transmitters off the truck and onto the ground. The control cabinetry for the current transmitter will need to be moved. This was discussed at the time of the site survey and the customer plans to move the one cabinet before the installation.

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter is floor mounted to the left side of the site room and the GatesAir ULX-6300AT liquid-cooled backup transmitter system is floor mounted towards the center of the room. The new ULXTE-120 transmitter will be installed on the right side of the room in front of the dock doors.

The outside pad for the transmitter currently has the older Harris/GatesAir heat exchangers mounted to the concrete which measures approximately 10-feet long and 12-feet wide. With the decommissioning

Site Survey – KIAH - Houston, TX

SITE AND BUILDING LAYOUT(CONT)

of the current ULX pump module, this will call for the removal of one heat exchanger also. This will make room for the newer-model heat exchangers to be stacked on the pad and installed on the outside of the wall for the plumbing from the pump modules. The fencing for the pad may need to be removed to get the exchangers onto the pad. The three-foot doors may not be enough room to move the crates onto the pad and past the current exchangers.

SITE AND BUILDING LAYOUT(CONT)

IMPLICATIONS

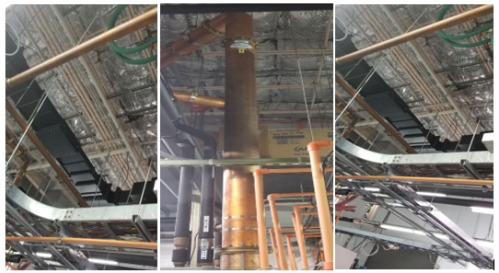
The site building is in good shape. There should be no issues delivering the equipment to the site except in the case of wet weather and the livestock. To be safe, a box truck should be used instead of a semi-trailer truck when delivering the transmitter system. The vehicle should also have a lift gate. The transmitter can be shipped in the standing upright position and delivered with little issues. The site room has plenty of space and high ceilings. The customer mentioned having a tower crew that can assist with the placement the transmitter cabinets before the installation begins. The site room is large enough for the GatesAir ULXTE-120 transmitter to be installed without doing anything to the existing Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter or the GatesAir ULX-6300AT liquid-cooled backup transmitter, except for the movement of the current-control cabinetry, which was discussed during the site-survey visit with the customer.

Site Survey – KIAH - Houston, TX

SURVEY OF RF SYSTEMS

KIAH-TV is moving from the current broadcasting Channel 38 to the assigned FCC Spectrum Repack Channel 34.

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter is configured as a dual-setup-combined transmitter. The transmitter has two IOT cabinets so each IOT cabinet RF output is adapted to 6" 50-Ohm line and combined into a Dielectric UHF switchless combiner with two inputs that are configurable for transmitter-A side and transmitter-B side to the antenna. The output of the design ensures that if one of the IOT cabinets go off-air, the customer is still running on half power. The Dielectric UHF switchless combiner feeds into a 90-degree waveguide elbow, and then into a waffle harmonic filter. The out of the harmonic filter runs into another 90-degree waveguide elbow, and then into a UHF channel filter/combiner. The output of the combiner travels into a waveguide RF 4-port motorized switch. The only output from the switch is the combined-transmitters output.

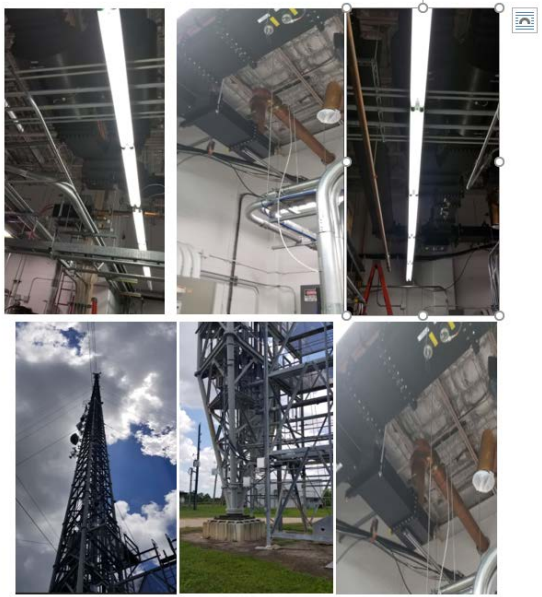


The distance for the RF transmission line for the input to the antenna switch is going to be about 60-feet. The RF transmission line output of the transmitter system travels to the RF combiners and into the transmitter RF waveguide switch. The run is about 10-feet. There needs to approximately 80-feet of RF line that will be needed for all the turns and bends to make it to the destination with 5 elbows needed to make all turns.

The RF output of the waveguide RF 4-port motorized switch travels to the tower and finally to the antenna. The secondary output feeds a water-cooled station dummy load. The waveguide RF 4-port motorized switch output transitions to a 6" 75-ohm rigid-copper line that hits the gas barrier. The gas barrier has a Dielectric dehumidifier, model 3200, connected to it. The RF line continues out of the building and turns

SURVEY OF RF SYSTEMS(CONT)

towards the tower at a 90-degree angle. The system is mounted under an ice-bridge all the way to the tower about one hundred feet.



Site Survey – KIAH - Houston, TX

SURVEY OF RF SYSTEMS (CONT)

The new GatesAir ULXTE-120 transmitter system uses a 4" RF-line output to a 90-degree elbow that runs into a low-pass filter and directional coupler. The output of the directional couplers runs into a band-pass filter. The output of the band-pass filter runs into a 3dB combiner. With four cabinets that make up the GatesAir ULXTE-120 transmitter system, the two 3dB combiners will both have their own respective reject loads. The outputs of each combiner will run into a bigger 3dB combiner which will have its own reject load. The current control cabinetry, that will need to be moved as mentioned previously, is where the GatesAir ULXTE-120 transmitter system will be placed.

The new GatesAir ULXTE-120 transmitter system RF-line will run into a new RF waveguide switch with a Dielectric switch controller. This switch needs to be mounted in the ceiling. The inputs coming to the switch will be coming from the GatesAir ULX-6300AT liquid-cooled, backup transmitter and the new GatesAir ULXTE-120 transmitter system. One of the waveguide switch outputs will be connected to a water-cooled station load. The last output will feed an older RF waveguide switch that currently feeds the antenna. The switch controller will need to control both RF waveguide switches.

A water-cooled, station-test load will be installed with a RF waveguide switch during the GatesAir ULXTE-120 transmitter system installation to be used for the testing, commissioning, and proof services for the transmitter. The dummy load and switch will be ceiling-mounted. The 6" RF-line going to the existing waveguide switch will need to be plumbed above the existing RF system. The reason for this is when dismantling the current RF system, no lines will need to be disconnected to prevent any on-air disruptions with the new system.

IMPLICATIONS

The existing RF system will need to be disconnected from the current RF waveguide switch to make room for the new GatesAir ULXTE-120 transmitter system. The new RF-line will be plumbed in over the top of the existing RF-system. This will ensure that when the dissembling of the original RF system takes place, there will be no interruption with the new GatesAir ULXTE-120 transmitter system's operation. This will

SURVEY OF RF SYSTEMS (CONT)

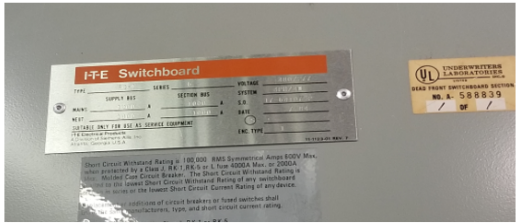
also allow for the decommissioning of current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system without taking the GatesAir ULXTE-120 transmitter system apart causing off-air time for the system. The customer will need to move the control cabinet prior to the arrival of GatesAir service personnel and the GatesAir transmitter equipment.

ELECTRICAL CONSIDERATIONS

The **KIAH-TV** site is fed with 1000A 480V/277V three-phase Wye four-wire service. The main disconnect runs into a Zenith 480V three-phase transfer switch. This transfer switch has the main power and the 750kW Spectrum Detroit Diesel generator power feed coming in to the same location. The generator is currently in good running condition and is regularly maintained for preventative care. The generator also has a block heater to keep the generator in a heated condition to run in the winter if needed.

The GatesAir ULXTE-120 transmitter system will require a 300KVA 480V to 208V step-down transformer to provide the correct power to the GatesAir ULXTE-120 transmitter system. The site currently has a spare 400A 480V disconnect that can be utilized to feed the step-down transformer. This will be used to turn off power to the step-down transformer if there is a need. The 208V output of the step-down transformer will run to a panel board that either will be an existing one or a new-panel board. The main breaker for the GatesAir ULXTE-120 transmitter system needs to be a 475A breaker to feed the rest of the power blocks with 80A and the rest of the equipment with their own individual breakers. Please look in the appendix at the end of the site survey report for the detailed information on the electrical requirements.

There should not be any issues as far as incoming power into the site with running the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter and the new GatesAir ULXTE-120 transmitter system, which will happen during the testing phase. The ULXTE-120 will be tested into the station load.



Site Survey – KIAH - Houston, TX

ELECTRICAL CONSIDERATIONS(CONT)

ELECTRICAL CONSIDERATIONS(CONT)

IMPLICATIONS

The **KIAH-TV** site has 1000A 480V/277v three-phase Wye four-wire service. The incoming power is adequate to provide the proper power to the GatesAir ULXTE-120 transmitter, pump modules, and heat exchangers. The site will use a spare breaker in an existing panel board to house the breaker for the incoming GatesAir ULXTE-120 transmitter system's 300kVA step-down transformer. A new panel board will be installed for the GatesAir ULXTE-120 transmitter system.

HVAC

The **KIAH-TV** site is cooled by two individual HVAC units. One unit is a 20-Rton roof-mounted condenser that runs most of the time. The other unit is a redundant 15-Rton unit that can cool the room on its own. Combined, there is a total of 35-Rtons available to cool the transmitter room that houses the Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter, the GatesAir ULX-6300AT liquid-cooled backup transmitter, and soon the new GatesAir ULXTE-120 transmitter system

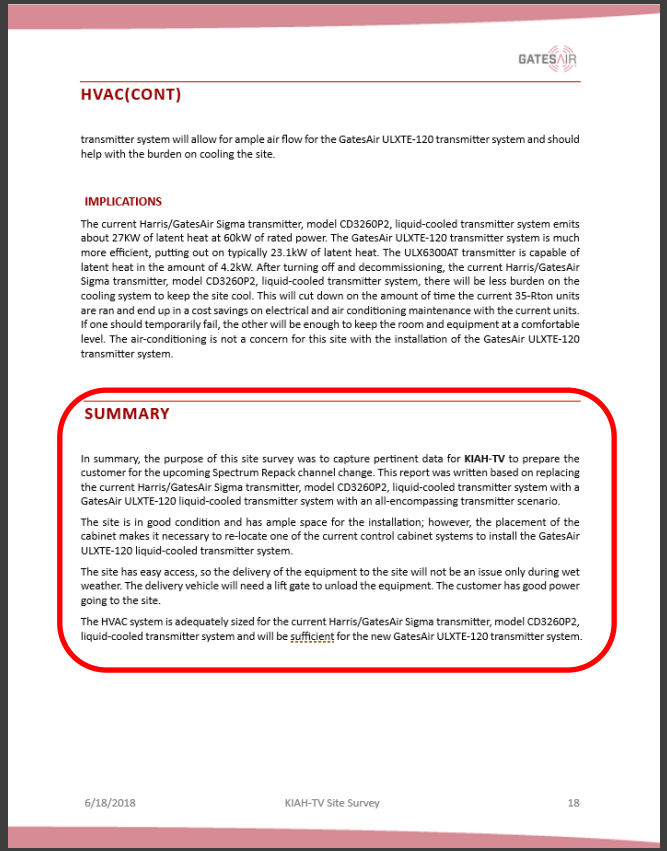
With the new channel testing that will need to occur prior to the decommissioning of the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system, the GatesAir ULXTE-120 transmitter system and the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system will need to be ran at the same time to accommodate the testing, commissioning, and proof services for the ULXTE-120 transmitter.

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system emits about 27KW of latent heat at 60kW of rated power. Since the customer is running the IOT cabinets at around 100%, the current latent heat is at the maximum for the current system. The GatesAir ULXTE-120 transmitter system typically emits about 23.1kW of latent heat. A 10-Rton cooling system can handle around 35kW of latent heat. The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system operating in its current configuration and having the GatesAir ULXTE-120 transmitter operating at rated power at the same time should not produce enough latent heat in the transmitter room to cause heat issues.

The current ULX6300AT transmitter emits about 4.2kW of latent heat into the room. This transmitter will be off during the testing and commissioning phase of the ULXTE-120 transmitter. However, there will also be a need to perform a channel change, test, and commission this transmitter. The Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system and the GatesAir ULXTE-120 transmitter system will be operational during the new channel testing, commissioning phase together at periods of time. Taking this into consideration, there will be no issues with cooling for this site given the 35-ton of cooling capable of cooling the room.

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system will be turned off and decommissioned once mandated FCC Spectrum Repack channel change has taken place. The decommissioning of current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled

Site Survey – KIAH - Houston, TX



GATESAIR

HVAC(CONT)

transmitter system will allow for ample air flow for the GatesAir ULXTE-120 transmitter system and should help with the burden on cooling the site.

IMPLICATIONS

The current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system emits about 27KW of latent heat at 60kW of rated power. The GatesAir ULXTE-120 transmitter system is much more efficient, putting out on typically 23.1kW of latent heat. The ULX6300AT transmitter is capable of latent heat in the amount of 4.2kW. After turning off and decommissioning, the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system, there will be less burden on the cooling system to keep the site cool. This will cut down on the amount of time the current 35-Rton units are ran and end up in a cost savings on electrical and air conditioning maintenance with the current units. If one should temporarily fail, the other will be enough to keep the room and equipment at a comfortable level. The air-conditioning is not a concern for this site with the installation of the GatesAir ULXTE-120 transmitter system.

SUMMARY

In summary, the purpose of this site survey was to capture pertinent data for **KIAH-TV** to prepare the customer for the upcoming Spectrum Repack channel change. This report was written based on replacing the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system with a GatesAir ULXTE-120 liquid-cooled transmitter system with an all-encompassing transmitter scenario.

The site is in good condition and has ample space for the installation; however, the placement of the cabinet makes it necessary to re-locate one of the current control cabinet systems to install the GatesAir ULXTE-120 liquid-cooled transmitter system.

The site has easy access, so the delivery of the equipment to the site will not be an issue only during wet weather. The delivery vehicle will need a lift gate to unload the equipment. The customer has good power going to the site.

The HVAC system is adequately sized for the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system and will be sufficient for the new GatesAir ULXTE-120 transmitter system.

6/18/2018 KIAH-TV Site Survey 18

SUMMARY:

In summary, the purpose of this site survey was to capture pertinent data for KIAH-TV to prepare the customer for the upcoming Spectrum Repack channel change. This report was written based on replacing the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system with a GatesAir ULXTE-120 liquid-cooled transmitter system with an all-encompassing transmitter scenario.

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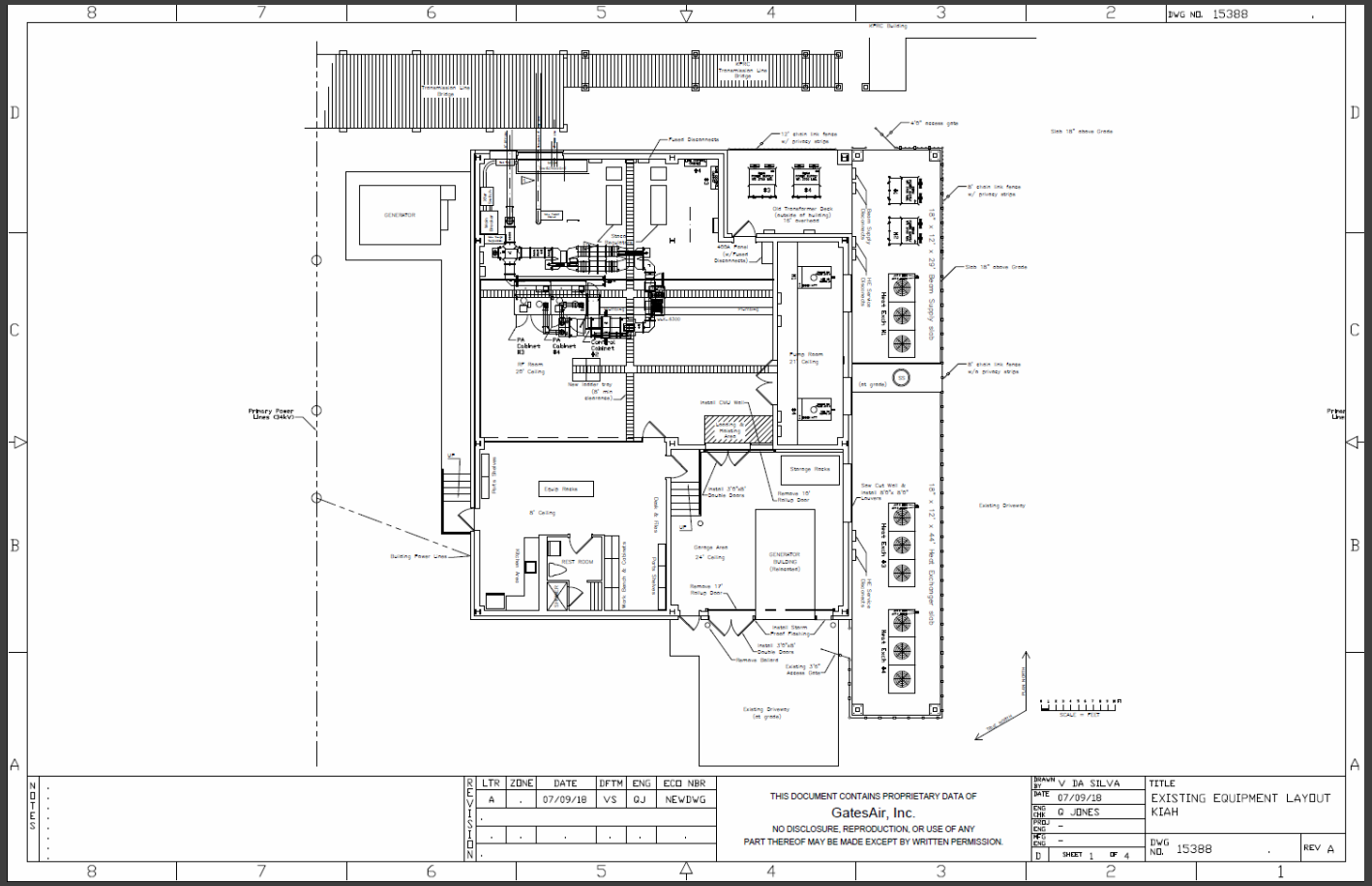
The site has easy access, so the delivery of the equipment to the site will not be an issue only during wet weather. The delivery vehicle will need a lift gate to unload the equipment. The customer has good power going to the site.

The HVAC system is adequately sized for the current Harris/GatesAir Sigma transmitter, model CD3260P2, liquid-cooled transmitter system and will be sufficient for the new GatesAir ULXTE-120 transmitter system.

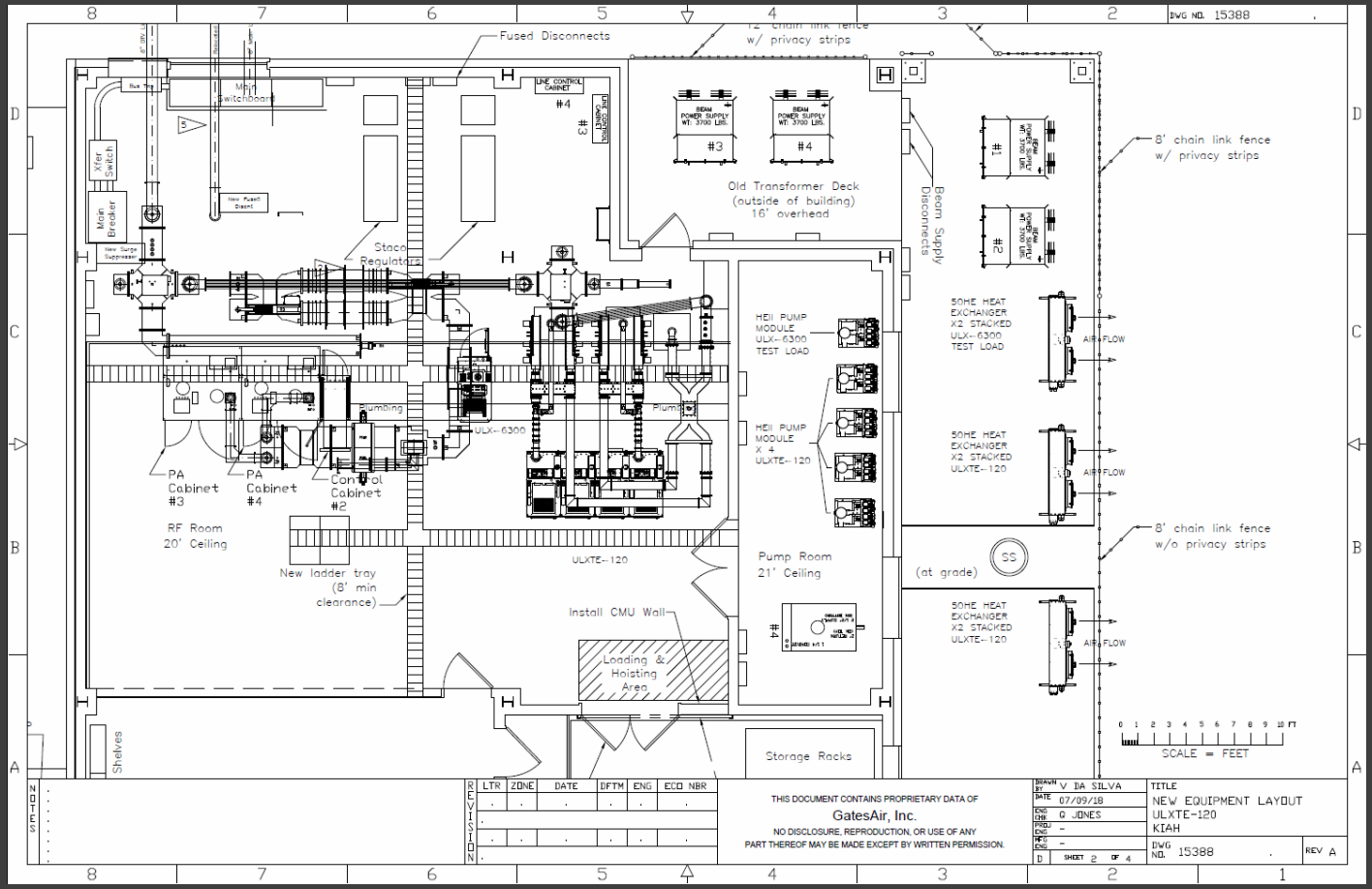
Site Survey – KIAH - Houston, TX

Existing Layout



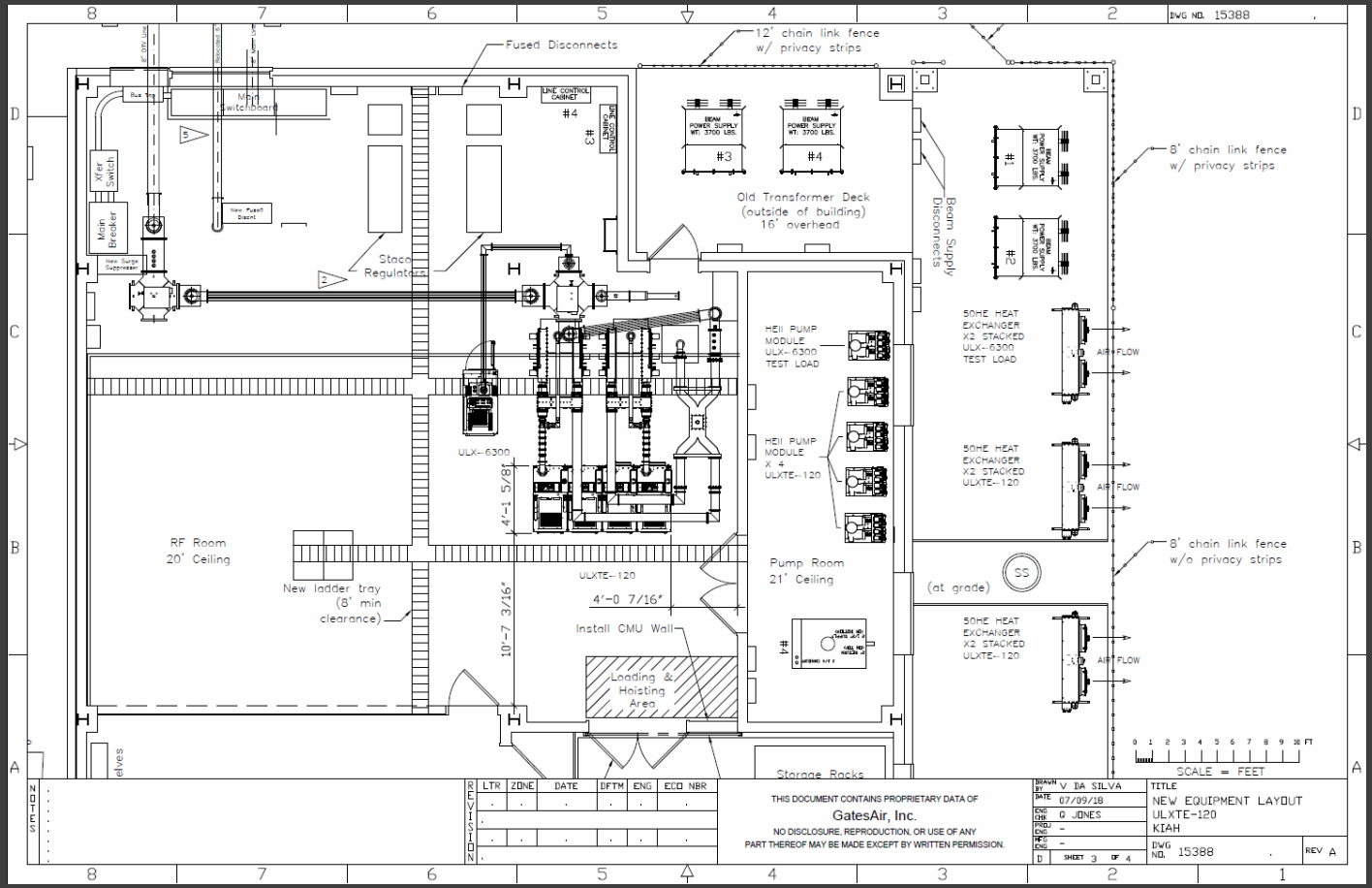
Site Survey – KIAH - Houston, TX

New Layout
ULXTE-120
Step 1



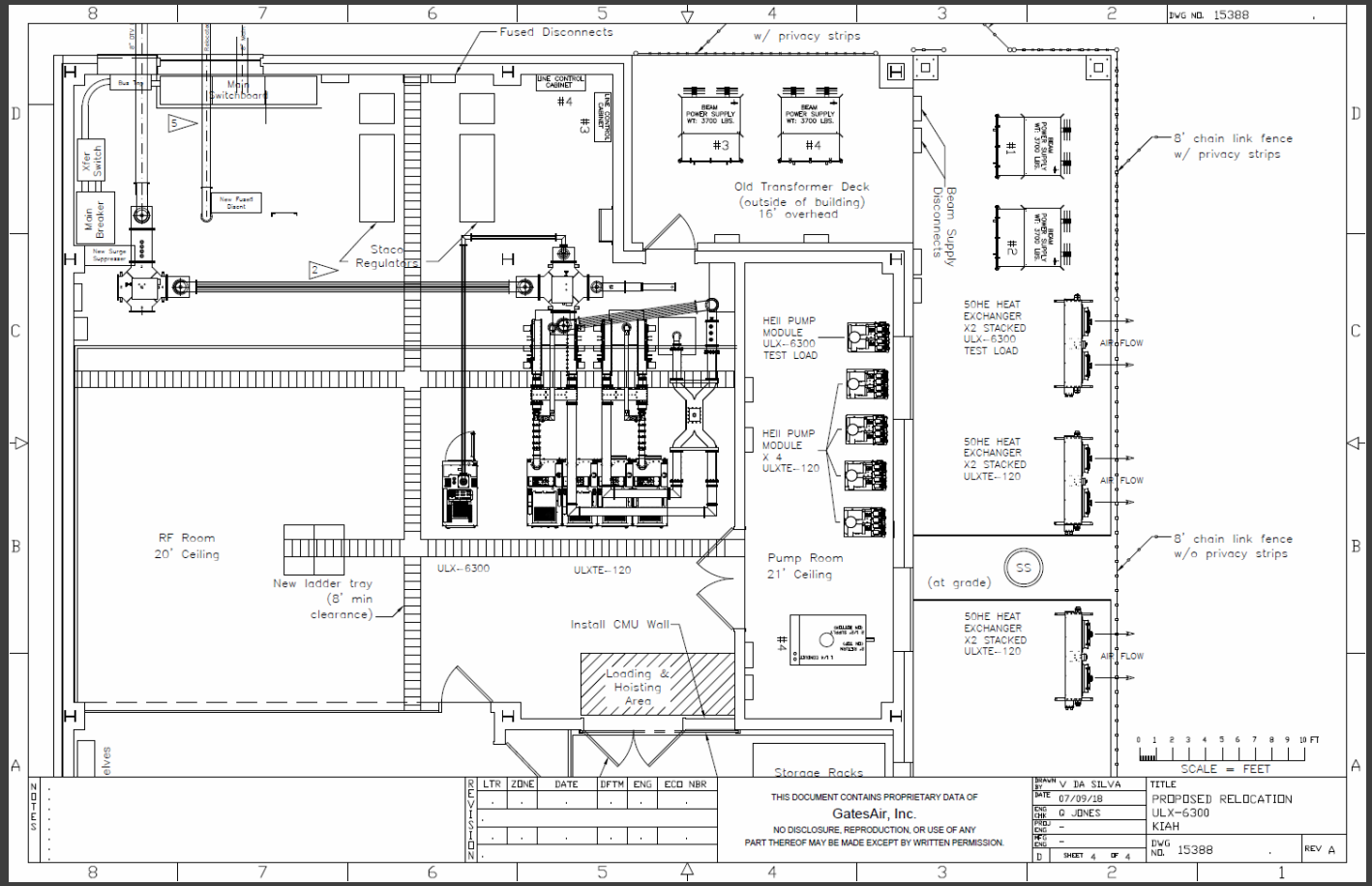
Site Survey – KIAH - Houston, TX

New Layout
ULXTE-120
Step 2



Site Survey – KIAH - Houston, TX

New Layout
ULXTE-120
Step
(relocated ULX tx)



Re-Pack Installation Example - WBTV

WBTV-TV
Charlotte, NC
Maxiva ULXTE-120

WBTV ULXTE-120 Installation Photo's

January 2, 2018
Interior of site prior
To installation of the
ULXTE-120

WBTV ULXTE-120 Installation Photo's

Delivery day at site
January 3, 2018

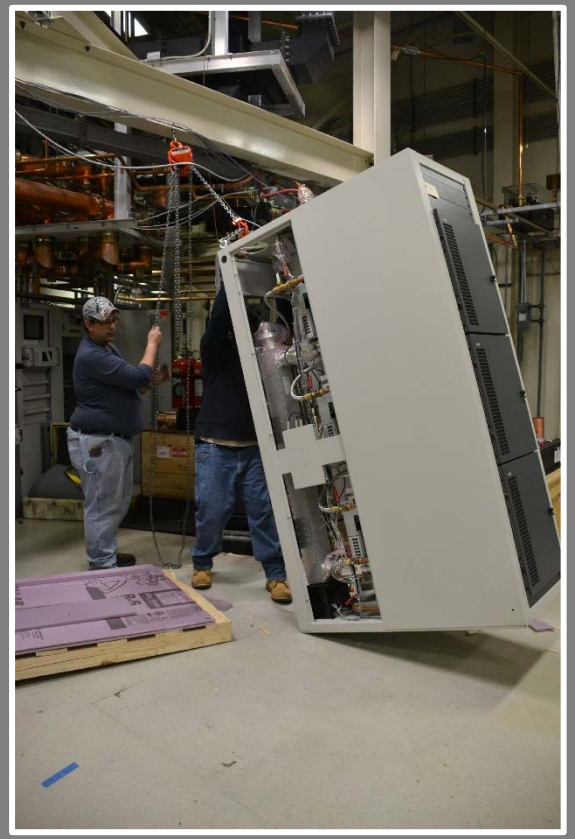
WBTV ULXTE-120 Installation Photo's

January 3, 2018
Unloading equipment & moving into the building

WBTV ULXTE-120 Installation Photo's

January 4, 2018
Photos of interior of site before installation

WBTV ULXTE-120 Installation Photo’s



January 4, 2018
Hoisting up Equipment

WBTV ULXTE-120 Installation Photo's

January 4, 2018
Cabinets in place – installation begins

WBTV ULXTE-120 Installation Photo's

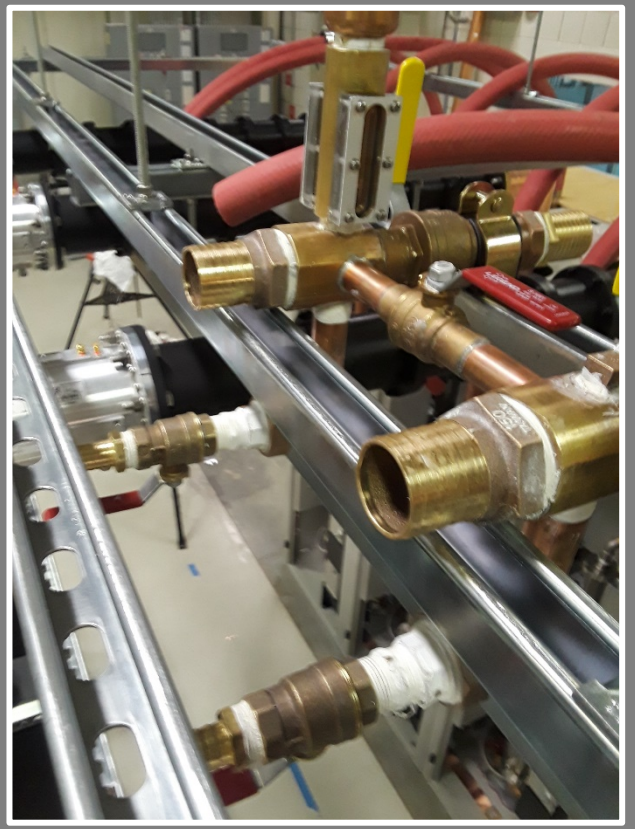
January 8th & 9th, 2018 Installation is underway

WBTV ULXTE-120 Installation Photo's

January 10th, 2018
Installation continues

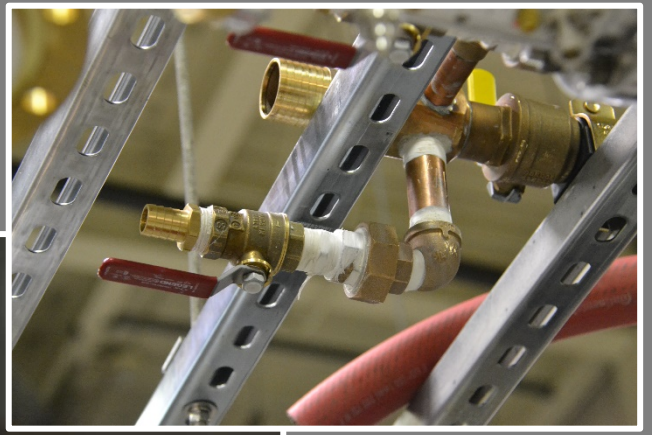
WBTV ULXTE-120 Installation Photo's

January 11th, 2018
Installation continues



WBTV ULXTE-120 Installation Photo’s

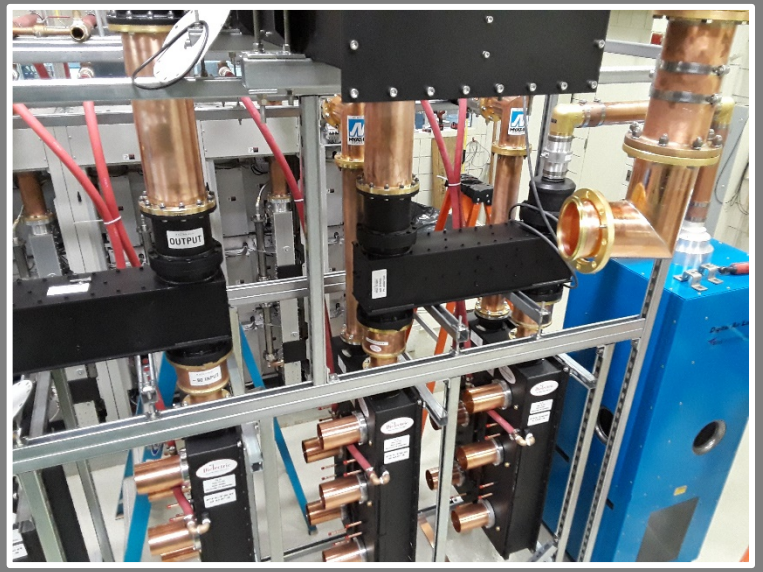
January 12th, 2018
Installation continues



WBTV ULXTE-120 Installation Photo's

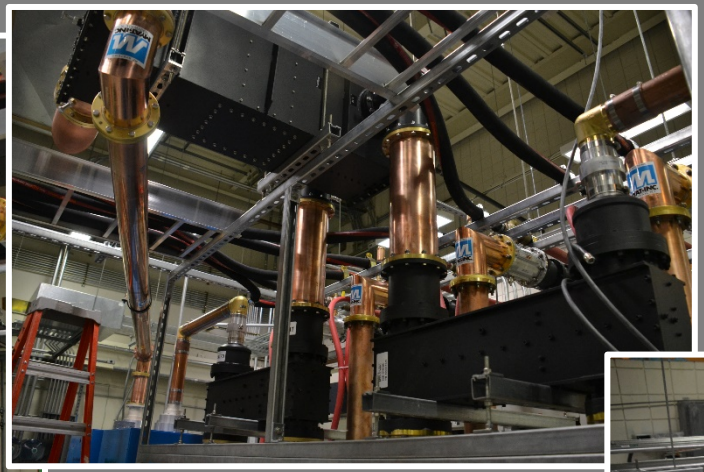
January 15th, 2018
Installation continues

WBTV ULXTE-120 Installation Photo's



January 17th, 2018
Installation continues

WBTV ULXTE-120 Installation Photo's



January 22nd, 2018
Installation continues

WBTV ULXTE-120 Installation Photo’s

January 29th, 2018
Installation Complete !

Transport

Transmit Television

Transmit Radio

How Well Did the System Perform?

- Location: Charlotte, NC
- Model: Maxiva ULXTE-120
- Tx Power rating 75.1kW
- On-air at 67kW

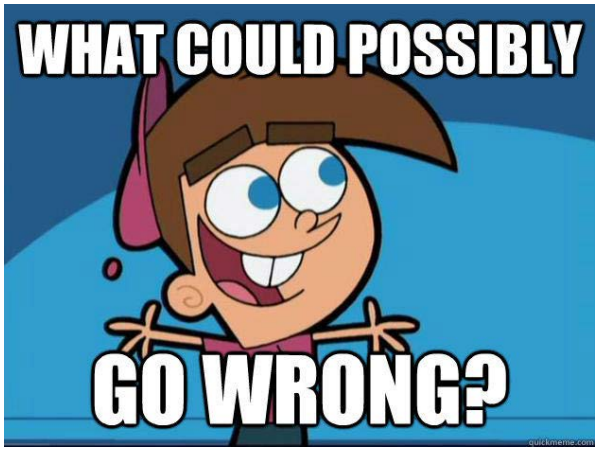
MER: 40.3dB

EVM: 0.63% (~ 43dB SNR)

ATSC Parameters					
Pass	Limit	<	Results	< Limit	Unit
Level	-60.0		-13.7	10.0	dBm
Constellation			8VSB / Normal		
MER (rms)	24.0		40.3	-----	dB
MER (peak)	10.0		13.9	-----	dB
EVM (rms)	-----		0.63	4.40	%
EVM (peak)	-----		13.28	22.00	%
BER before RS			0.0e-8(77%/1e9)	2.0e-4	
BER after RS			0.0e-7(45%/1e6)	1.0e-10	
Packet Error Ratio			0.0e-5(45%/1e6)	1.0e-8	
Packet Errors			0	1	/s
Carrier Freq Offset	-30000.0		-25.5	30000.0	Hz
Symbol Rate Offset	-10000.0		-0.4	10000.0	Symb/s
MPEG Ts Bitrate			19.392657		MBit/s
3.7dBm | BER 0.0e-8 | MER 40.3dB			DEMOD	MPEG	

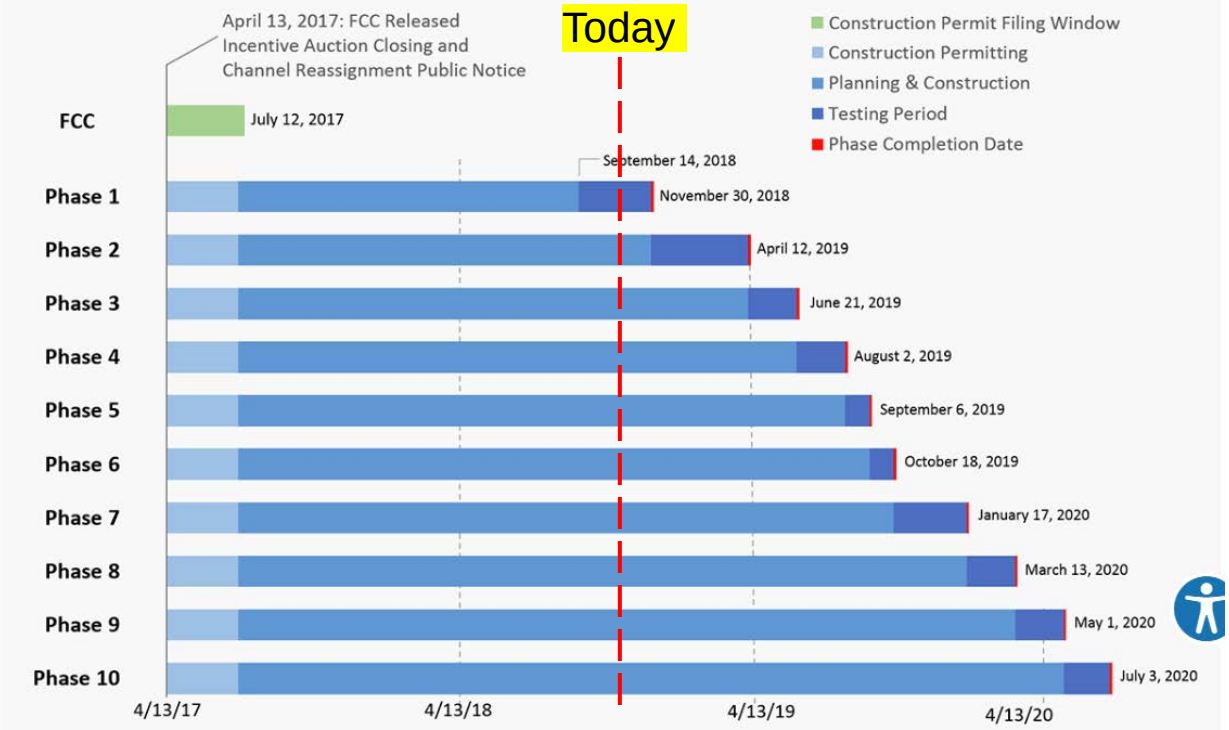
What Have We Learned So Far…

- Most re-pack tx installations so far have gone well, with only a few issues
- Nearly all issues were addressed ahead of time, because of these activities:
  - Conducted a detailed Site Survey
    - Find out as much as possible and create a plan
    - Make sure that all required items are on-hand or are ordered ahead of time
  - Proper coordination of all activities before and on-site
    - Delivery and off-loading, ship dates, rental equipment, etc.
    - GatesAir Service team
    - Making sure that sub-contractors, HVAC, Electrical trades, etc. are lined-up
    - Mapping out ahead of time with step-by-step plan, drawings
    - Coordination with outside RF suppliers and tower crews, if needed
- Great, so "**What Could Possibly Go Wrong**"?



Quick Review - Repack Transition Schedule

- Phase 1 is well underway
- Phase 2 nearing testing period



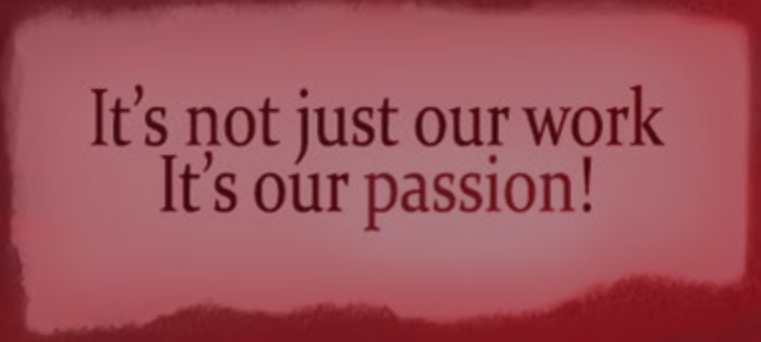
Repack Install Issues

- Issues that can occur:
  - Vendor supplied RF equipment not always on-site per original delivery schedule
  - Wrong equipment was ordered !?!?!?
  - Primary electrical work delayed, or incorrect
  - Incorrect AC power sizing for added equipment
  - Unpredictable delays due to weather:
    - Flooding/wind/hurricanes
    - Site access issues
    - Slows/stops outdoor tower work/rigging
    - Building modifications often delayed
  - Our biggest issue - Install crews having to re-schedule trips due to delays, which impacts next site, which impacts next site….. **The DOMINO EFFECT**

Avoiding Repack Issues (Transmitter Perspective)

- **Start early and plan ahead:**
  - A thorough **Site Survey** is essential (You do it, or pay to get done)
  - **Construction Permits** can take a while
  - Identify any issues, create a **plan**
  - Plan for **interim tx placement** if required
  - Make sure **delivery** aligns with planned dates
  - Make sure all **civil works**, building updates ready before install
  - **Electricians** and **HVAC** folks lined-up / scheduled
  - Ensure that all items required are ordered well in advance
  - Allow for **weather delays** and the unexpected

Questions?



Martyn Horspool
Product Manager, Television
GatesAir