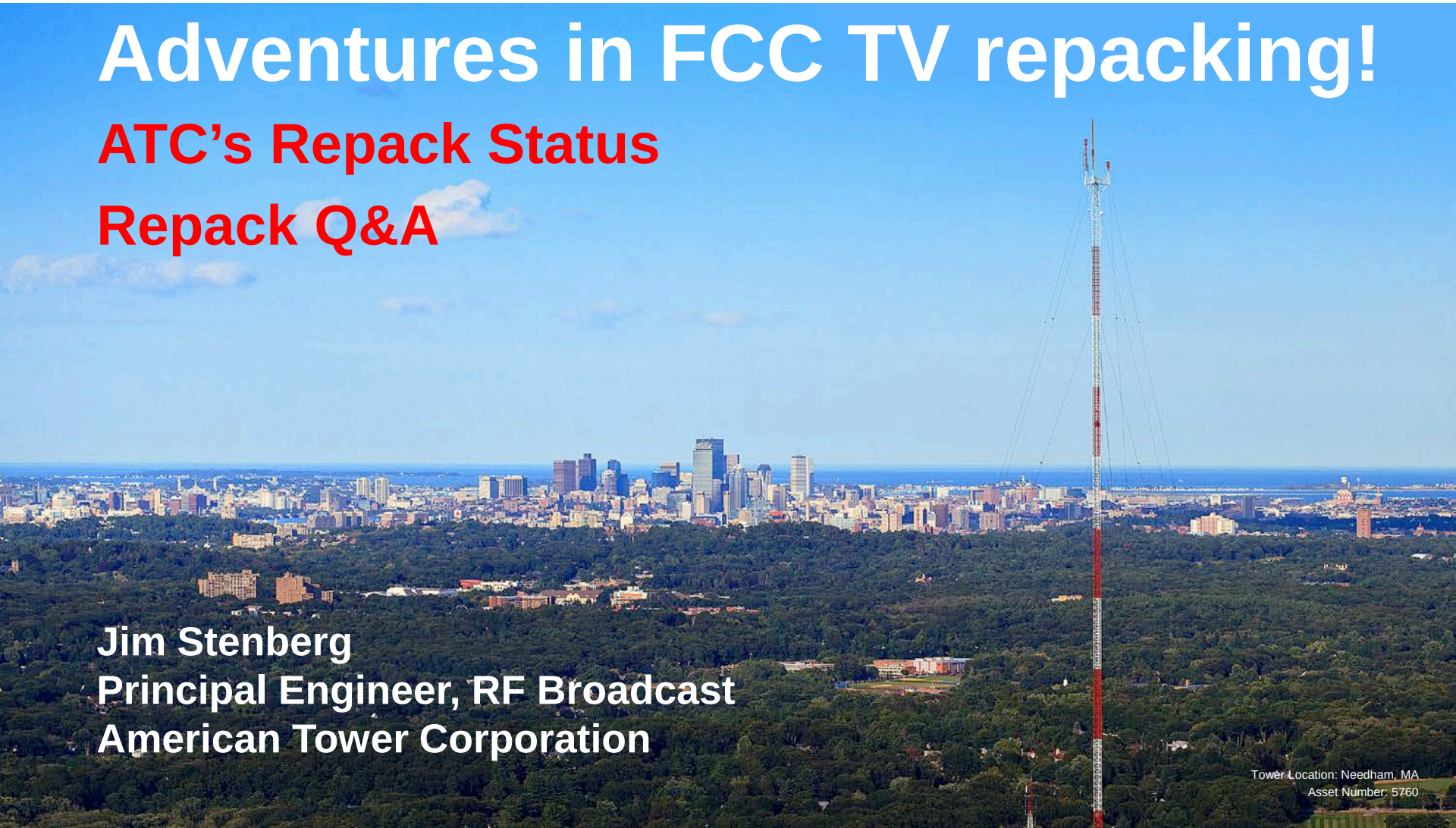
AMERICAN TOWER®

Adventures in FCC TV repacking!

ATC's Repack Status

Repack Q&A

Jim Stenberg
Principal Engineer, RF Broadcast
American Tower Corporation



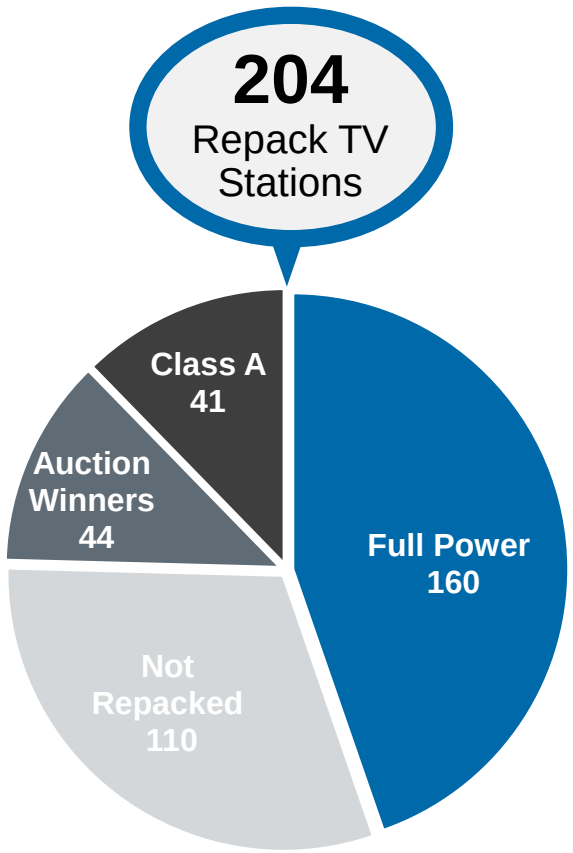
Repack is: TV's Gettysburg!

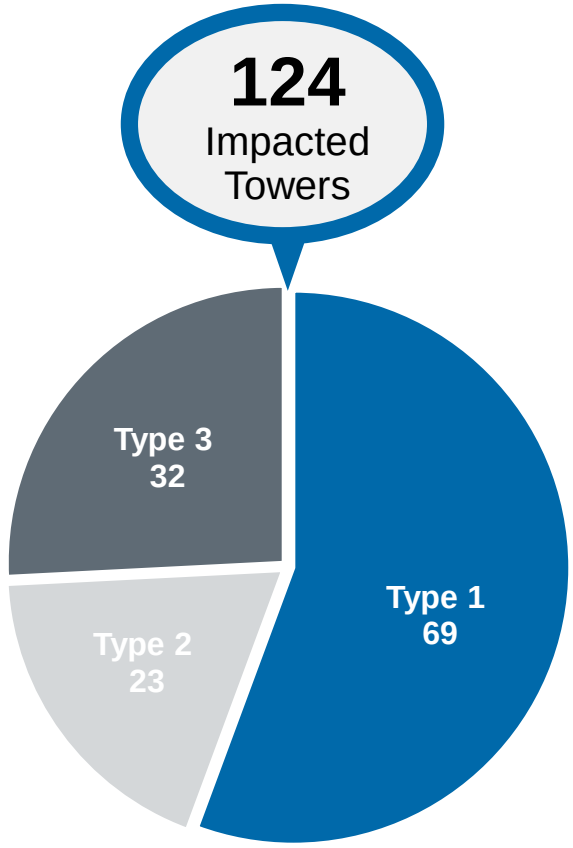
"It is rather for us, **the survivors of the incentive auction**, we here be dedicated to the great **repack** remaining before us — that, from these honored **auction winners** we take increased devotion to that cause for which they here, gave the last full measure of devotion — that we here highly resolve these **stations** shall not have died in vain ; that the **industry**, shall have a new birth of freedom, and that **television** of the people by the people for the people, shall not perish from the earth."

Incentive Spectrum Auction Results

- **175** Full power and Class A reverse auction “winners” surrendered their 6 MHz spectrum
  - Options:
    - Go off-air
    - Channel share
    - Move to VHF
- **987** Full power and Class A stations require new “repack” channels
  - Channels 14 to 36 available
  - Exploit adjacent channel spacing

ATC Repack Impact



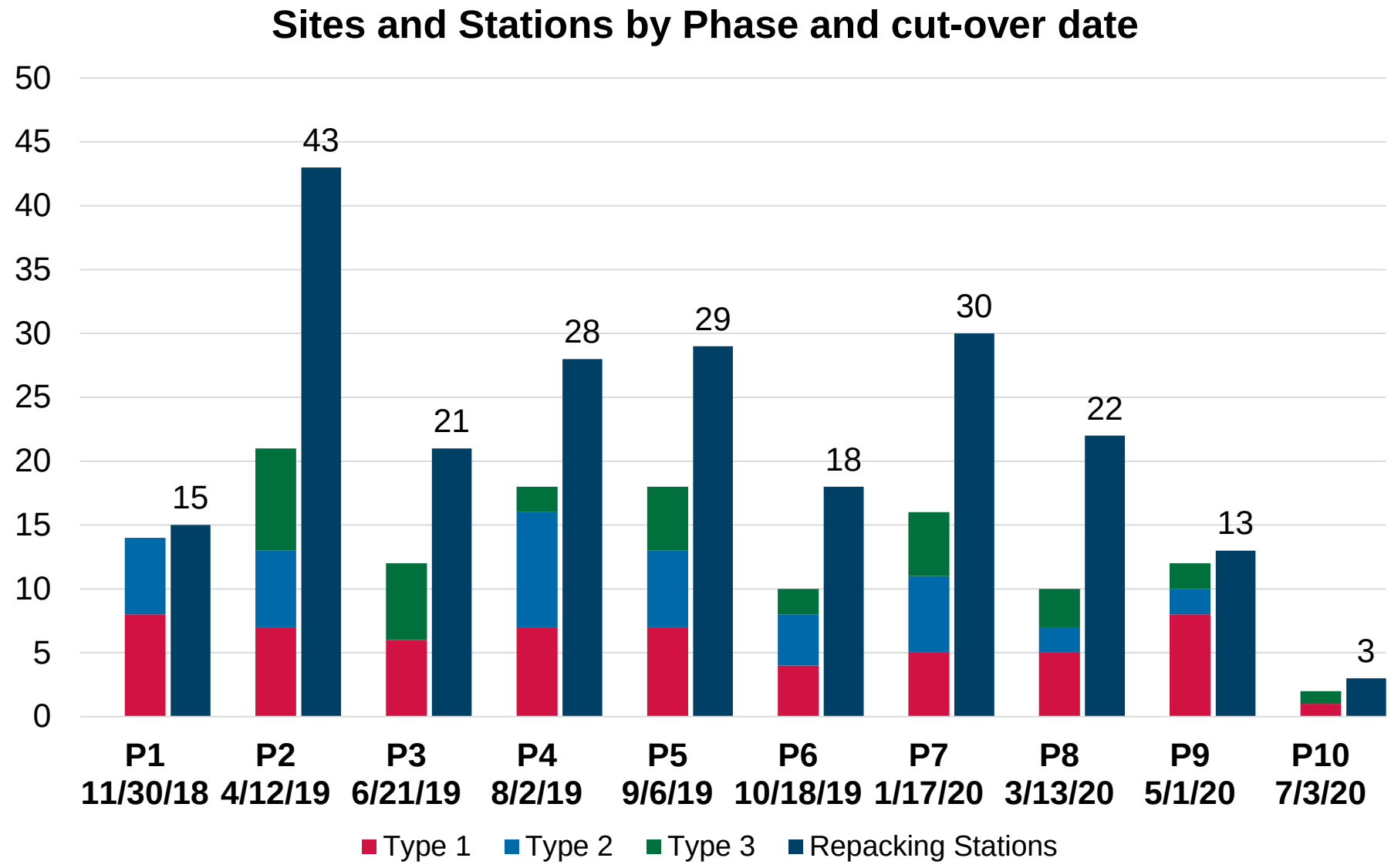


PROJECT TYPE:

- **Type 1 - No tower or site modifications**
- **Type 2 - Moderate tower and or site modifications**
- **Type 3 - Complex towers, New BBAs, major tower mods**

Approx. 20% of repacked stations are on ATC Assets

ATC Repack Impact



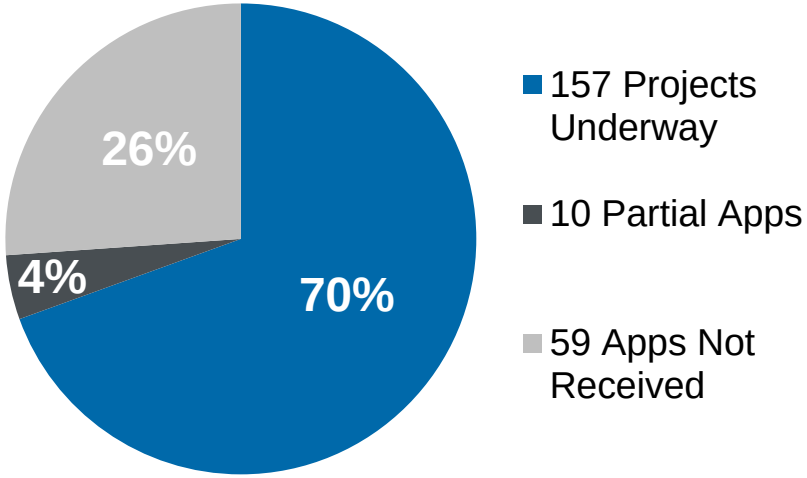
ATC Repack Project Status

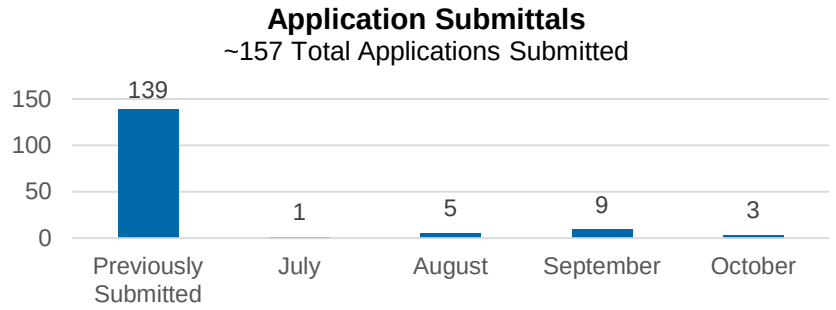
Application Detail by Phase

- **Phase 1:** All 15 applications received
- **Phase 2:** All 44 applications received
- **Phase 3:** 20 applications received, 2 remaining
- **Phase 4:** 24 applications received, 6 remaining
- **Phases 5-10:** 54 applications received, 61 remaining

Project Highlights

- Of the 13 new BBA projects:
  - 4 Complex BBA projects currently in construction to be completed in 2018
  - 4 additional complex BBA projects starting in November 2018
- 12 Phase 1 & 2 stations completed construction
- 7 Major tower modifications completed in 2018





Have not received repack plans from 29% of stations

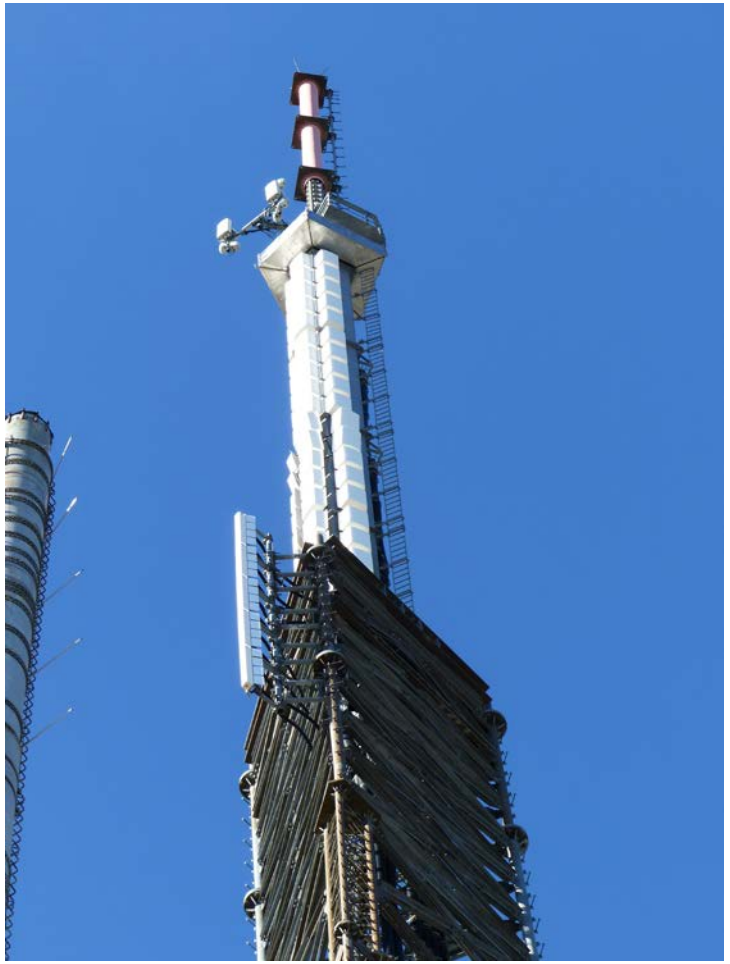
ATC Repack Project Summary

- Phases 1-3 repack projects on ATC towers well underway
- Processing all Phase 4-6 repack applications
- 13 new BBA projects underway – supporting ~36 stations
- 16 existing BBA channel reconfiguration designs completed
- 7 major tower modifications completed through October 2018
- Tower work for complex projects will challenge engineering, fabrication, and rigging resources in mid phases
- Hiring qualified transmitter and RF equipment installers has become an issue
- Safety remains our #1 priority

Existing ATC TV BBA fleet

BBA = Broadband Antenna = Multichannel system

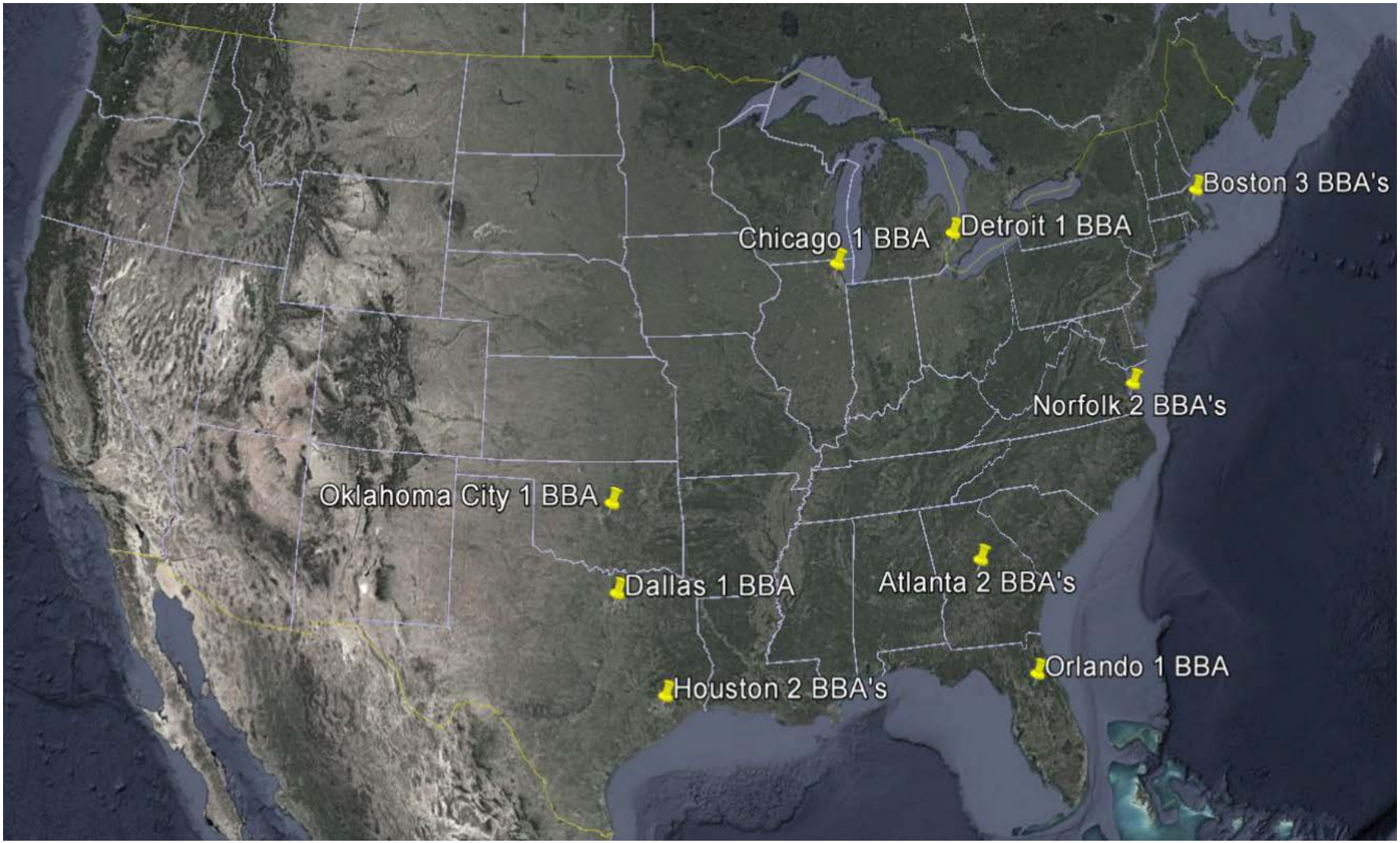
- 29 UHF systems
- 1 VHF system
- 23 Impacted by Repack w/ 1 or more changes
- All except 1 are horizontally polarized only
- Limitations to consider
  - VSWR bandwidth
  - Pattern bandwidth
  - Power input capacity
  - Number of feedlines



Goals of our repack BBA program

- Optimize repack changes
  - Locate where an antenna has to be changed out
  - Include as many stations as possible in design
- Minimize on air disruptions
  - Provide side mount interim antennas
- Reduce overall tower loading
  - Remove unused lines/antennas
  - Re-use lines wherever practical
- Meet aggressive FCC timelines
- Minimize overall economic impact to all parties
- Provide future proof systems

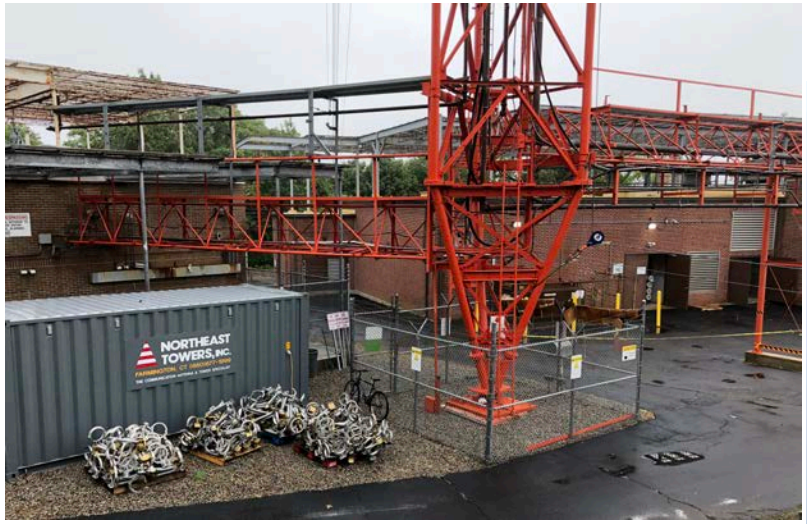
New Repack BBA Locations and Quantities



ATC Repack BBA Market Solution - Boston

Boston Needham

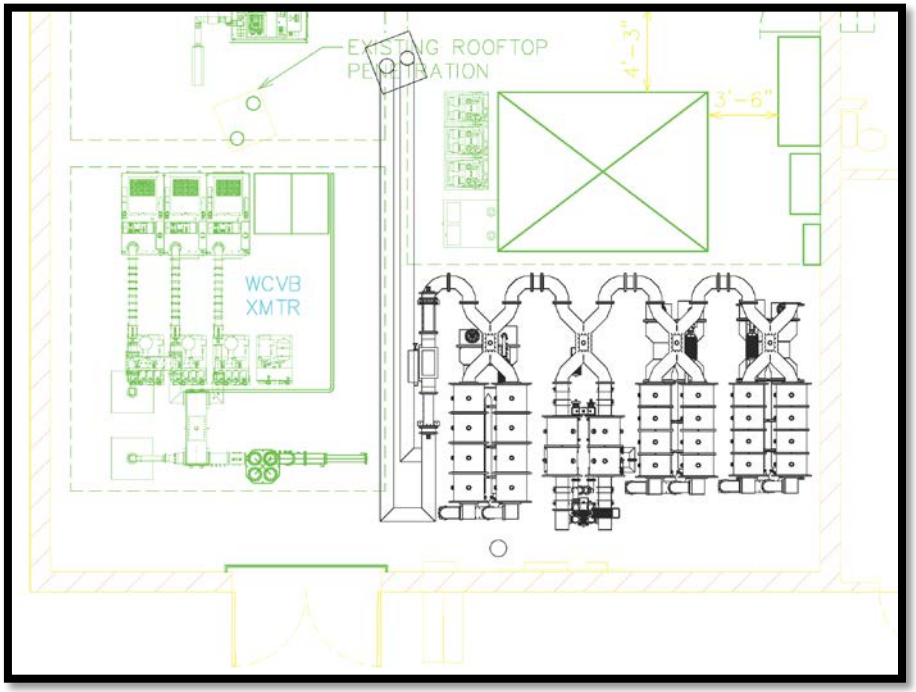
Develop interim main site which becomes off-site auxiliary.
Reconfigure top of candelabra tower for single VHF/UHF stack



ATC Repack BBA Market Solution - Boston

Boston Needham

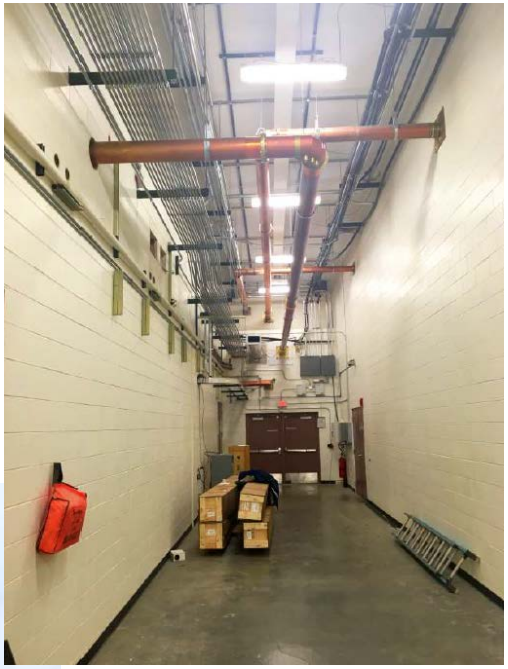
Dedicated common transmitter/combiner room. Five stations plus a dual chain combiner.



ATC Repack BBA Market Solution - Detroit

Detroit – Oak Park

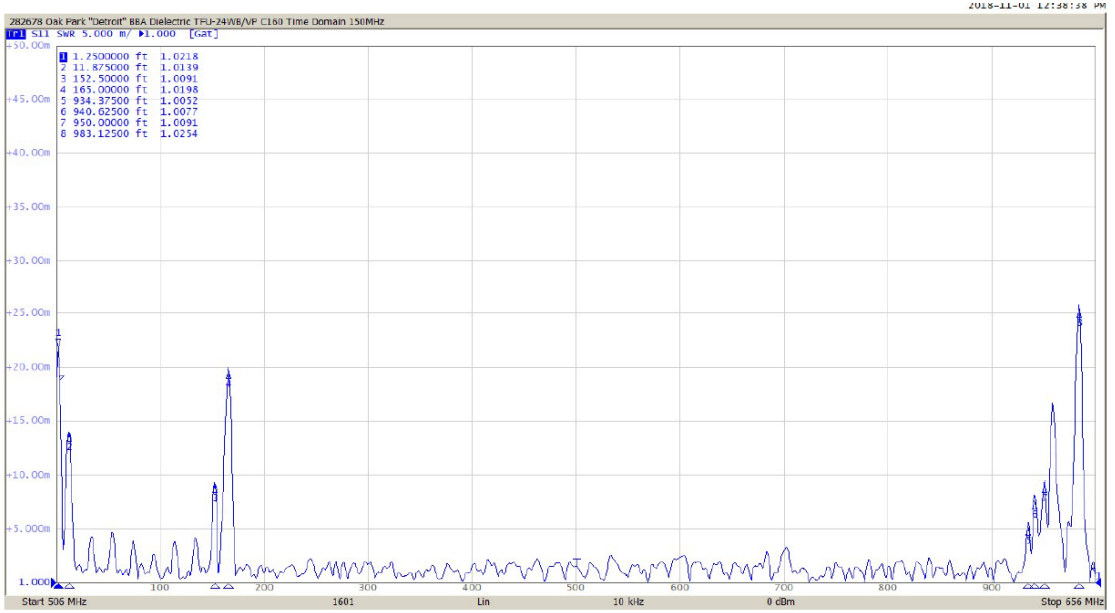
Install side mount interim for three stations. Replace single frequency antennas on candelabra and provide auxiliary antenna long term



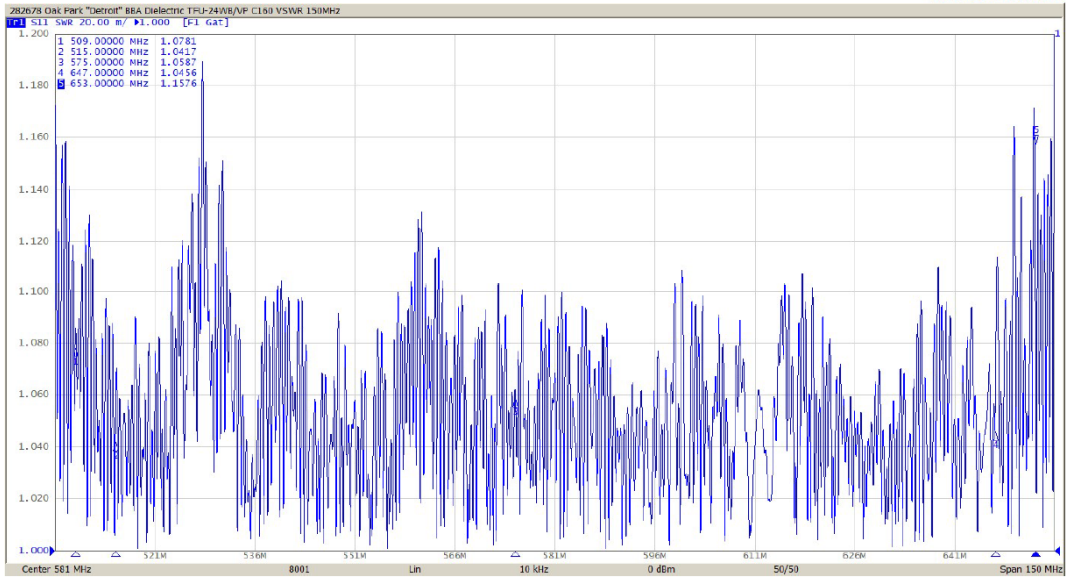
ATC Repack BBA Market Solution - Detroit

Detroit – Oak Park

Time domain and frequency domain measurements of 930 ft of 8” line and side mount antenna over 150 MHz



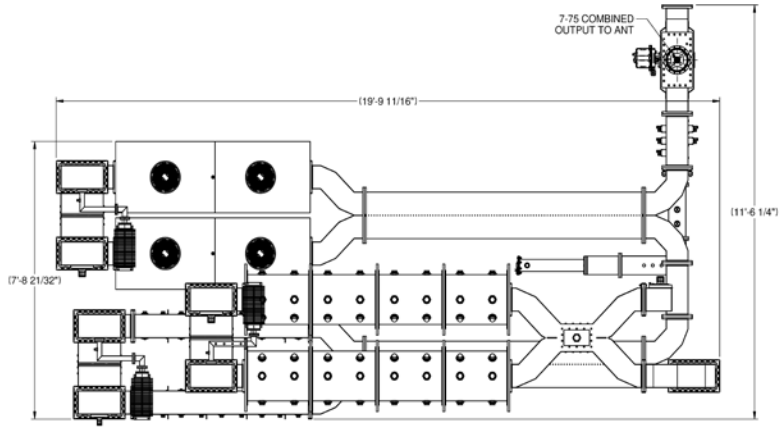
Scale 5m/div

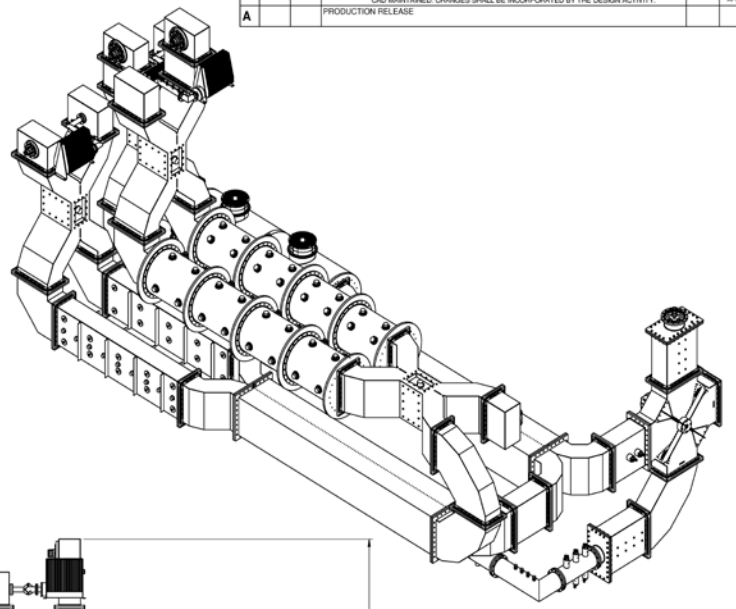


No individual response > 1.025

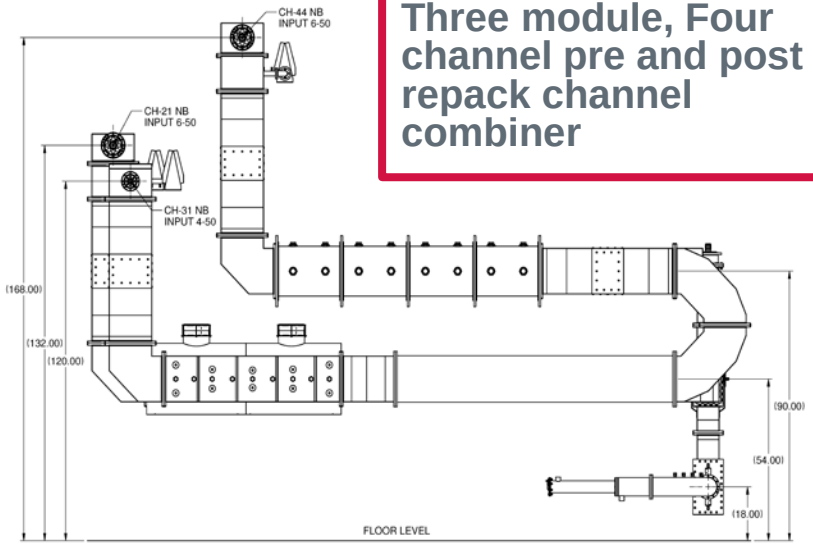
Input VSWR < 1.18

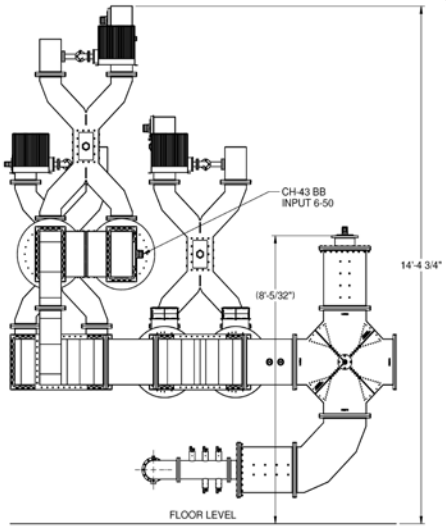
ATC Repack BBA Market Solution - Detroit





Three module, Four channel pre and post repack channel combiner





PRELIMINARY LAYOUT - ATC DETROIT COMBINER SYSTEM

LOOKING TOWARDS THE 22' SECTION OF THE FENCE

REV.	SHEET	ZONE	REVISION NOTE	ECO	DATE APPR.
A			CAD MAINTAINED. CHANGES SHALL BE INCORPORATED BY THE DESIGN ACTIVITY. PRODUCTION RELEASE		

STATUS: CONCEPTUAL

DIMENSIONAL TOLERANCES (UNLESS OTHERWISE NOTED)
DECIMAL DIMENSIONS
3 PLACE DIMENSIONS ±.005
2 PLACE DIMENSIONS ±.02
FRACTIONAL DIMENSIONS
0"-6" ±1/32"
ABOVE 6" UP TO 12" ±1/16"
ABOVE 12" UP TO 48" ±1/8"
ABOVE 48" ±1/4"
ANGULAR DIMENSIONS ±1/2°
REFERENCE DIMENSIONS ARE NOT FOR MANUFACTURING OR INSPECTION
ANGLE PROJECTION

PART NO./ MATERIAL NO.:
SAP DOCUMENT NO.:
MATERIAL:
FINISH: N/A

	NAME	DATE
DESIGNED BY	dfdotcom	10/24/2018
DETAIL BY	dfdotcom	10/25/2018
CHKD. BY		
ENG. T APPR.		
ENG. Z APPR.		
MANUFACT.		

Dielectric Raymond, ME

TITLE:

D | GAGE CODE 08441 | DRAWING NO.

7:55:16 AM | SHEET: 1 OF 1

REFER TO D8110 FOR PLATING
REFER TO D17800 FOR PAINT

UNLESS OTHERWISE SPECIFIED
MANUFACTURING TOLERANCE AND PROCEDURES MUST BE IN ACCORDANCE WITH D79001. ALL ALUMINUM, COPPER, AND BRASS WELDING MUST COMPLY WITH A-62700, SECT. XIV "PRODUCTION WELDING PROCEDURES". STRUCTURAL STEEL WELDING MUST COMPLY WITH "AWS 1.1 CURRENT REVISION".

ATC Repack BBA Market Solution – Houston

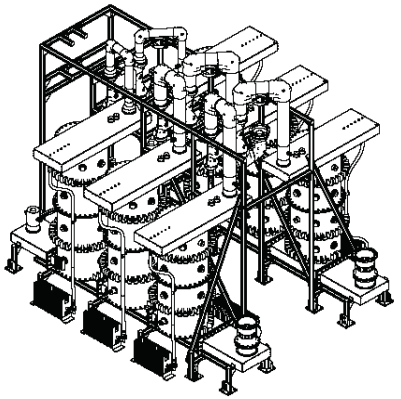
Missouri City RT

Develop side mount interim main and top mount variable polarization dual chain main system for three repack stations.

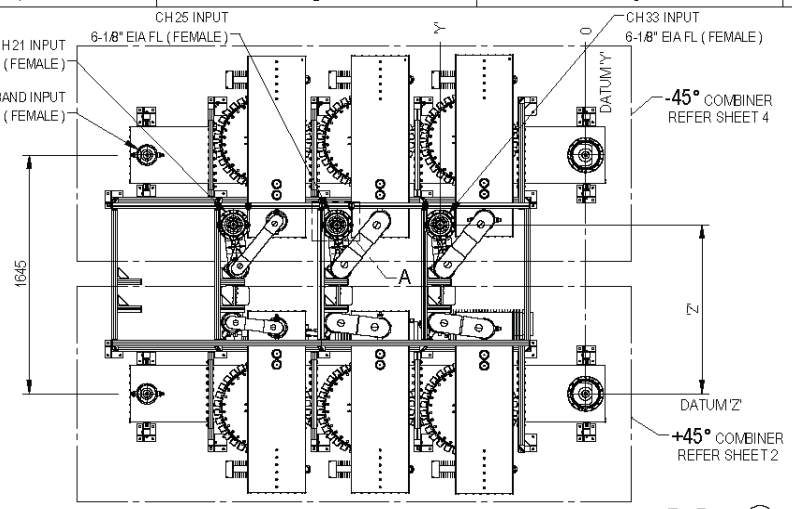
ATC Repack BBA Market Solution - Houston

CHANNEL	DIMN 'X'	DIMN 'Y'	DIMN 'Z'
WIDEBAND INPUT	589	2975	1645
CH21	2295	2392	1165
CH25	1983	1687	1165
CH33	1983	987	1165
COMBINED OUTPUT	708	0	1645

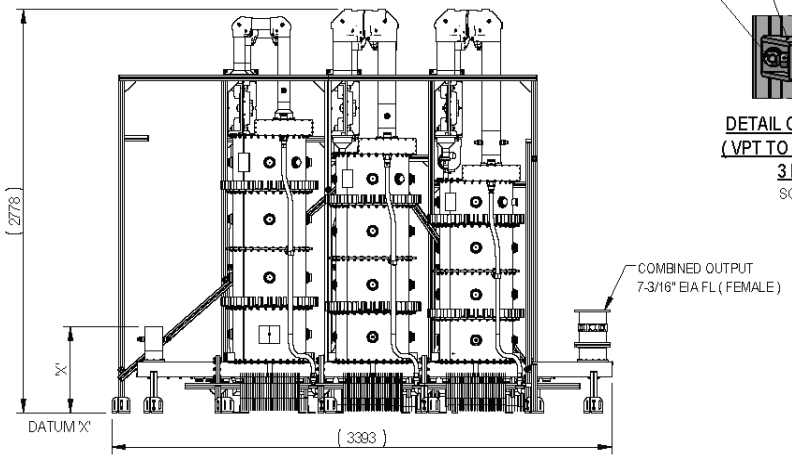
Three module dual chain VPT channel combiner



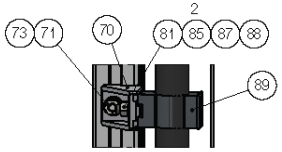
ISOMETRIC VIEW



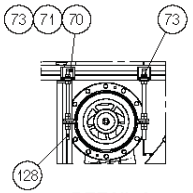
TOP VIEW



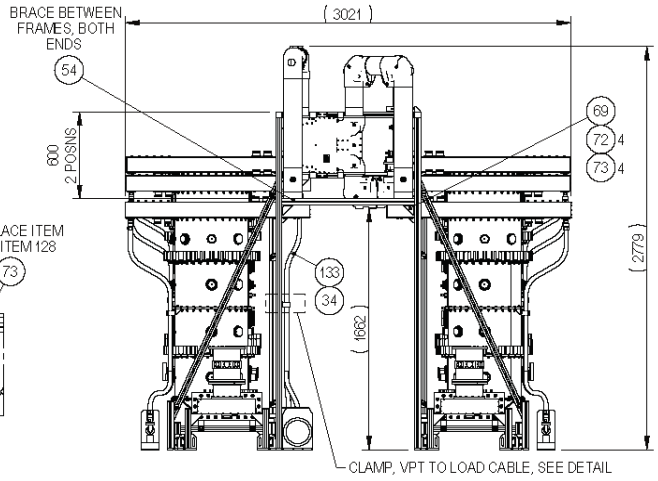
FRONT VIEW



DETAIL CABLE CLAMP
(VPT TO LOAD CABLE)
3 POSNS
SCALE 1:5



DETAIL A
3 POSNS
SCALE 1 : 12



SIDE VIEW

					TOLERANCE GROUP (UNLESS NOTED OTHERWISE)	
					LINEAR	ANGULAR
					X = ±2.0	X° = ±1°
					XX = ±1.0	XX° = ±0.5°
					XXX = ±0.5	XXX° = ±0.25°
01	DF130.019.00	KH	YP	17/09/2018	3RD ANGLE PROJECTION	
ISSUE	DESCRIPTION	DRAWN	APP.	DATE		

RFS RADIO FREQUENCY SYSTEMS
RFS Australia

DRAWN	KH
DATE	17/09/2018
DRG. CHECK	SP
MECH. CHECK	-
ELEC. CHECK	LJS
APPROVED	YP

- DIMENSIONS IN MILLIMETRES U.N.O.
- DRAWING PRACTICES TO AS1100
- DO NOT SCALE - IF IN DOUBT ASK

TITLE	CW4P-3 x2 VPT COMB HOUSTON MISSOURI CITY		
MATERIAL	AS LISTED	FINISH	CLEAN
SCALE	1:31	SHEET No.	1 OF 9
DRG No.	24.31070		A3

File Name:2431070

ATC Repack BBA Construction Underway

Atlanta Chester Avenue

Top mount interim main, permanent main, off-site auxiliary for four stations with single feedline variable polarization antenna fixed at top.

Completion 2/2019

Oklahoma City RT

Top mount interim main, permanent main, off-site auxiliary for three stations with single feedline variable polarization antenna fixed at top.

Completion 12/2018

Dallas Cedar Hill Milton

Top mount interim main, permanent main, off-site auxiliary for five stations with dual feedlines, adjustable polarization antenna part of two antenna stack, dual chain combiner. Extensive tower modification.

Completion 2/2019

Questions?

Please feel free to contact me with any questions.

Jim Stenberg

Principal Engineer, RF Broadcast

james.stenberg@americantower.com

office: 207-632-8973

mobile: 207-632-8973

www.americantower.com