PROVENTUS STRUCTURAL SERVICES LLC

PROVIDING THE TOWER DATA YOU NEED

Site Name:	Prospect Tower
Structure Type:	Guyed Tower
Structure Height:	220’
Make:	Rohn
Model:	80
Tower Owner:	Government of Bermuda
Address:	Fort Hill Road
Parish:	Devonshire
Latitude:	32.299186
Longitude:	-64.765877
Date of Visit:	6/3/2019
Employees on Site:	Angie Shyrigh
	Ben Shyrigh
	Brian Heiney

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Purpose of this Site Visit

To fulfill the inspection requirements set forth in the TIA/EIA222-G, Annex J.1 standard for Maintenance and Condition Assessment of communication structures.

General Information

If a manufacturer's plate is installed, record the information here:
A manufacturer's plate is not installed; however, the design details are congruent with Rohn model 80 tower.

Elevations
Ground to top of pier pad: 2"
Top of pier pad to top of base plate: 1"
Top of base plate to top of structure: 220'
Tip height of highest appurtenance: 230'
What is the highest appurtenance? Omni antenna

Leg Orientation
Legs are labeled in a clockwise fashion with "A leg" as the northernmost leg.
Azimuth of "A leg": 315°

Note: while recommendations for corrective actions regarding tower mounted equipment and the guying system are provided in this report, due to the quantity of irreparably rust-damaged members, the strongest recommendation is the tower be decommissioned at the earliest possible date.

Access and Compound

- Access road
- Compound gates & fencing
- Compound substrate
- Shelter exteriors

Observations
The access and compound are in fair condition with no deficiencies observed.

Concrete Foundations

- Ground condition
    - Settlement, movement, earth cracks
    - Erosion
    - Site condition (standing water, drainage, trees, etc.)
- Anchorage condition
    - Nuts and/or locking device (tightened)
    - Grout condition
    - Anchorage and/or anchor rod condition
- Concrete condition
    - Cracking, spalling, or splitting
    - Chipped or broken concrete
    - Honeycombing
    - Low spots to collect moisture

Observations

The tower foundation is in fair, functional condition with no deficiencies observed.

Structure Condition

- Damaged members (legs and bracing)
- Loose members
- Missing members
- Climbing facilities, platforms, catwalks – all secure
- Loose and/or missing bolts and/or locking devices
- Visible cracks in welded connections

Observations

Elevation	Location	Description	Recommendation	Priority
70’ 6”, 205’	Varies	Locking hardware is not installed on the torque arm connection bolt assemblies.	Install locking hardware on the bolt assemblies. (24) 5/8” Ø PAL nuts are required to correct.	To be scheduled within 12 months

Finish

- Paint and/or galvanizing condition
- Rust and/or corrosion condition including mounts and accessories
- FAA or ICAO color marking conditions
- Water collection in members (to be remedied, e. g. unplug drain holes, etc.)

Note: Corrosion Definitions
Category 1 rust: light discoloration of steel surface, galvanizing may be wearing thin however rust does not penetrate steel and there is no loss of material. Recommended action is generally to monitor and record condition to determine the advancement of the condition.
Category 2 rust: discoloration is heavy and light pitting may be present. Recommended action is generally to brush region and treat with zinc rich compound. After treatment, region should be monitored and condition recorded at regular intervals to determine advancement of condition.
Category 3 rust: heavy pitting, flaking and/or loss of material is present. Recommended action is generally to replace component. If component replacement is not feasible, a review of condition by a professional engineer is recommended to determine course of action.

Observations
Extreme and extensive rust related material loss was observed on the bracing members of the tower. Bracing members are tubular, pinched at each end to create a ply that may be drawn into firm contact with the gusset once bolted. Despite the presence of a weep hole at each pinched end, these members are prone to holding water, rusting and “blowing out”. The lowest “blow out” was observed at the 5’ elevation. The quantity of members with this condition increases at higher elevations with approximately 40% of the members “blown out” at 80’.

Following are areas of special concern:

- Scaling rust is present at the C Leg weld to the base plate. This region of rust has advanced rapidly since the 2017 inspection
- Antenna #9 is a 4’ microwave dish mounted to a 4’ long antenna mount. It has a stiff arm which is connected to a diagonal member. This member is rusted though at its lower connection with only an estimated 50% of original material remaining.

Each of these members presents a serious drop hazard which may then contribute to the failure of the structure.

Due to the location of this tower at a manned facility with cars, human & vehicular traffic all within the drop/fall radius of this tower, it should be considered imperative to completely remove the structure as soon as possible. In its current condition, the tower poses a significant hazard to property and life.

Lighting

- Conduit, junction boxes and fasteners (weather tight and secure)
- Drain and vent openings (unobstructed)
- Wiring condition
- Light lenses
- Photo cell facing north
- Bulb condition
- Controller function if accessible

Light Type	Elevation	Location
LED Sidelight	109’	A Leg
LED Sidelight	109’	B Leg
LED Sidelight	109’	C Leg
Dual Strobe	219’	C Leg
LED Sidelight	109’	A Leg

Observations

Elevation	Location	Description	Recommendation	Priority
109’	B Leg	The side light has no closure clips and is secured with a hose clamp.	It is recommended that replacement hose clamps from the manufacturer be installed.	To be scheduled

Grounding

- Connections
- Corrosion
- Lightning protection (secured to structure)

Observations

Elevation	Location	Description	Recommendation	Priority
220’	Tower top	A lightning rod is installed at the top of the tower however the highest appurtenance is a 20’ omni.	It is recommended an extension be installed for the lightning rod and the omni antenna elevation be lowered with the result that the tip of the lightning rod is at least 1’ higher than the tip of the omni antenna.	To be scheduled

Personnel Safety

- Presence and condition of safety cable system
- Integrity of climbing facilities
- Availability of adequate anchorage points throughout height of climb

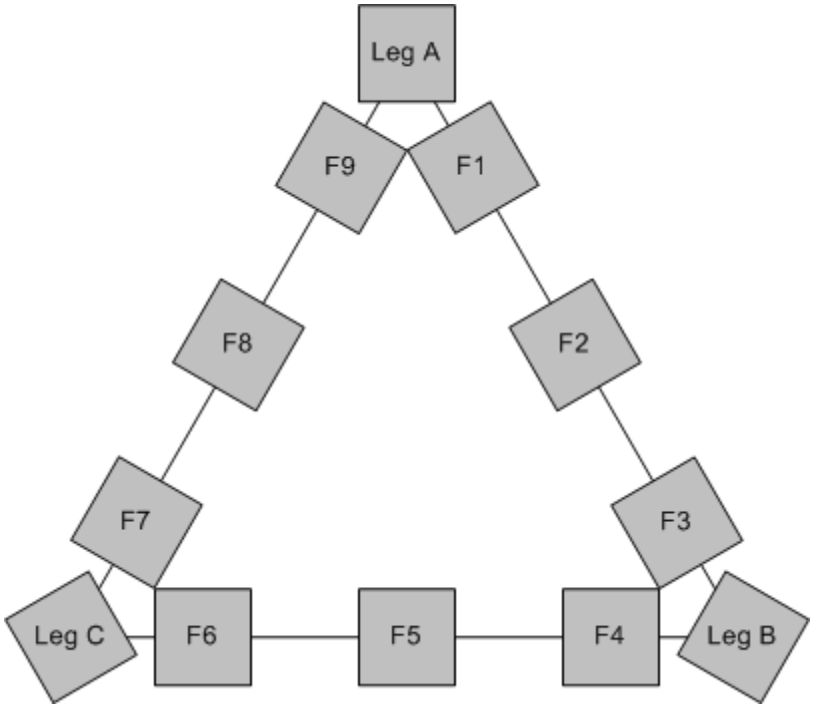
Observations and Issues Found

Elevation	Location	Description	Recommendation	Priority
Throughout height	C Leg	Category 3 rust is present on the safety cable.	It is recommended the safety cable system be replaced and that the safety cable kit be installed per manufacturer's specifications.	To be scheduled within 12 months

Antennas and Lines

- Antenna condition
- Mount and/or ice shield condition (bent, loose, and/or missing members)
- Feedline condition (flanges, seals, dents, jacket damage, grounding, etc.)
- Feedline hanger condition (snap-ins, bolt on, kellum grips, etc.)
- Secured to structure

Coax Position Diagram



Loading

Antennas							External Devices				Feedlines				Mounts				
#	Elev.	Location	Az.	Make	Model	Description	Quant.	Make	Model	Description	Quant.	Size	In/Out	Coax Position*	Elev.	Description	Height	Width	Offset
1	24'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	20' DIPOLE	NONE				1	7/8"	OUTSIDE	F2	24'	STANDOFF	1' 6"	2"	1'
2	46'	A LEG	235°	ANATEL	MINI-LINK ANT09.6HP	3' DISH	1	ERICSSON	RAU2 X 6U/A31	ODU	1	1/4"	OUTSIDE	A LEG	46'	CLAMPSET TO LEG	N/A	N/A	N/A
3	46'	B LEG	350°	ILLEGIBLE	ILLEGIBLE	1' SQUARE PANEL	NONE				1	CAT5	INSIDE	F7	46'	CLAMPSET TO LEG	N/A	N/A	N/A
4	48'	C LEG	N/A	COMMSCOPE	DB224-B	20' DIPOLE	NONE				1	7/8"	INSIDE	F8	48'	STANDOFF	1' 6"	2"	1'
5	48' 6"	B LEG	50°	ANATEL	MINI-LINK ANT09.6HP	3' DISH	1	ERICSSON	RAU2 X 6U/A31	ODU	1	1/4"	OUTSIDE	A LEG	48' 6"	CLAMPSET TO LEG	N/A	N/A	N/A
6	50'	A LEG	235°	ERICSSON	ANT2 0.6 13 HP	2' DISH	NONE				1	1/2"	OUTSIDE	F9	52'	PIPE MOUNT	5'	4"	1'
7	53'	A LEG	50°	ERICSSON	ANT2 0.6 13 HP	2' DISH	NONE				1	1/2"	OUTSIDE	F9					
8	58'	A LEG	235°	COMMSCOPE	VHLP4-6W-DW1C	4' DISH	2	DRAGONWAVE	RLHP15B1	ODU	2	3/8"	INSIDE	F6	58'	STANDOFF	4"	3-1/2"	4'
9	58'	B LEG	50°	COMMSCOPE	VHLP4-6W-DW1C	4' DISH	2	DRAGONWAVE	RLHP15B1	ODU	2	3/8"	INSIDE	F6	58'	STANDOFF	4"	3-1/2"	4'
10	63'	A LEG	315°	COMMSCOPE	VHLP3-6W-DW1	3' DISH	2	DRAGONWAVE	RLHP15B1	ODU	2	3/8"	INSIDE	F6	58'	STANDOFF	4"	3-1/2"	4'
11	63'	B LEG	50°	COMMSCOPE	VHLP4-6W-DW1C	4' DISH	2	DRAGONWAVE	RLHP15B1	ODU	2	3/8"	INSIDE	F6	58'	STANDOFF	4"	3-1/2"	4'
12	71'	A LEG	235°	RADIOWAVES	HPCPE-23DW2	1' DISH	1	DRAGONWAVE	PHHP23B3SXR1	ODU	1	3/8"	INSIDE	F6	71'	STANDOFF	5'	2-1/2"	1' 6"
13	73'	B LEG	50°	COBHAM	AFS-DBG-0360-01	2' PANEL	1	REDLINE	RDL-3000	ODU	1	3/8"	INSIDE	F6	73'	STANDOFF	6'	2 3/8"	1' 6"
14	76'	B LEG	195°	RADIOWAVES	ILLEGIBLE	2' DISH	1	REDLINE	RDL-3000	ODU	1	3/8"	INSIDE	F6			3'	2 3/8"	1' 6"
15	78'	AB FACE	N/A	NONE			NONE				3 1	7/8" 1/2"	INSIDE	AB FACE	NONE				
16	76'	A LEG	315°	COBHAM	AFS-DBG-0360-01	2' PANEL	1	REDLINE	RDL-3000	ODU	1	3/8"	INSIDE	F6	80'	STANDOFF	10'	2 3/8"	1' 6"
17	80'	A LEG	300°	RADIOWAVES	ILLEGIBLE	2' DISH	1	REDLINE	RDL-3000	ODU	1	3/8"	INSIDE	F6					
18	83'	A LEG	300°	RADIOWAVES	SPD2-5 2NS	2' DISH	1	REDLINE	RDL-3000	ODU	1	3/8"	INSIDE	F6					
19	83'	B LEG	15°	RADIOWAVES	HPCPE-23DW2	1' DISH	1	DRAGONWAVE	PHHP23B3SXR1	ODU	1	3/8"	INSIDE	F6	83'	STANDOFF	2'	2 7/8"	1' 6"
20	84'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	20' DIPOLE	NONE				1	7/8"	INSIDE	F8	84', 104'	STANDOFFS	2 3/8"	2 3/8"	6'
21	103'	C LEG	195°	RADIOWAVES	HPCPE-23DW2	1' DISH	1	DRAGONWAVE	PHHP23B3SXR1	ODU	1	3/8"	INSIDE	F6	103'	STANDOFF	2'	3 1/2"	1' 6"
22	111'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	20' OMNI	NONE				1	7/8"	INSIDE	F7	111'	STANDOFF	1'	2"	1' 6"
23	115' - 125'	B LEG	N/A	ILLEGIBLE	ILLEGIBLE	2 BAY FM: 2' T X 2' W X 2' L	NONE				1	7/8"	INSIDE	B LEG	115' - 125'	STANDOFF	1'	2"	1' 6"
24	131'	A LEG	275°	SCALA	ILLEGIBLE	PARAGRID: 18" T X 3' W	NONE				1	1/2"	INSIDE	F8	132'	PIPE MOUNT	2'	2 3/8"	6"
25	143'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	20' OMNI	NONE				1	7/8"	INSIDE	F8	142'	STANDOFF	2'	2 3/8"	4'
26	175' - 182'	C LEG	N/A	ILLEGIBLE	ILLEGIBLE	2 BAY FM: 3' T X 2" W X 2' L	NONE				1	1-5/8"	INSIDE	F4	175'	PIPE MOUNT	20'	4 1/2"	1'
27	190'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	2' DIAMETER FM ELEMENT	NONE				1	7/8"	INSIDE	F7	190'	CLAMPSET TO LEG	N/A	N/A	N/A
28	198'	B LEG	N/A	ILLEGIBLE	ILLEGIBLE	15' OMNI	NONE				1	7/8"	INSIDE	F8	195'	STANDOFF	2'	2"	6'
29	218'	B LEG	N/A	ILLEGIBLE	ILLEGIBLE	6' OMNI	NONE				1	7/8"	INSIDE	F7	217'	STANDOFF	2'	2"	4'
30	219'	A LEG	N/A	ILLEGIBLE	ILLEGIBLE	4' OMNI	NONE				1	7/8"	INSIDE	F7	219'	CLAMPSET TO LEG	N/A	N/A	N/A
31	223'	B LEG	N/A	ILLEGIBLE	ILLEGIBLE	6' OMNI	1	ILLEGIBLE	ILLEGIBLE	10" X 12" X 8"	1	7/8"	INSIDE	F7	222'	PIPE MOUNT	4'	2 3/8"	6"

Observations

Elevation	Location	Description	Recommendation	Priority
78'	AB face	Dead feedlines (loading item #15) were observed to be installed.	It is recommended out of service or otherwise abandoned equipment be completely removed from the structure in order to reduce the resources required to maintain safe connection to the structure as well as to maintain accurate loading records.	To be scheduled
Varies	Varies	The stiff-arm associated with each antenna # 8, #9, #10, #11 is connected to a tower bracing member.	In order to prevent damage to the already structurally compromised bracing members it is recommended the stiff-arm connection be relocated to a tower leg.	To be scheduled

Guy Wires and Associated Hardware

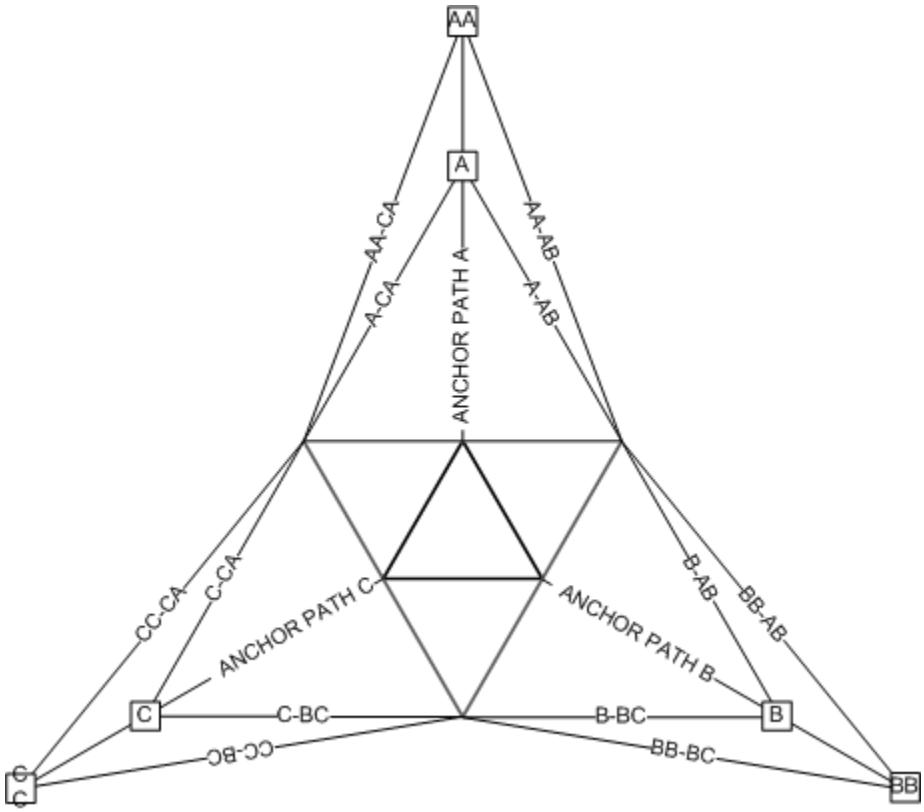
Items inspected include:

- Strand condition (corrosion, breaks, nicks, kinks, etc.)
- Guy hardware conditions
    - Turnbuckles or equivalent (secure and safety properly applied)
    - Cable thimbles properly in place (if required)
    - Service sleeves properly in place (if required)
    - Cable connectors (end fittings)
        - Cable clamps applied and bolts tight
        - Wire serving properly applied
        - No signs of slippage or damaged strands
        - Preformed wraps – properly applied, fully wrapped and sleeves in place
        - Poured sockets secure and showing no separation
        - Shackles, bolts, pins and cotter pins secure and in good condition
- Guy tensions

Note: 1) Minor variations in guy tensions are to be expected due to temperature and low wind speed conditions. The cause of significant changes should be determined immediately and proper remedial action taken. Possible cause may be initial construction loosening, previously experienced extreme wind or ice, anchor movements, base settlement, or connection slippage.
2) Tension variations at a single level are to be expected because of anchor elevation differences, construction deviations and wind effects.

Guy Anchor and Guy Wire Position Codes

- The northernmost anchor is designated “A” followed by “B” and “C” clockwise.
- Outer anchors are designated with a double letter.
- Torque arm guy wires are labeled according to the anchor plate to which it is attached followed by the two paths the guy wire is between.



Guy Tension Results

Note: the ideal initial tension range is 7% under or 15% over the engineered tension. In the absence of engineered tensions, ideal initial tension is considered to be 10% of the manufacturer's rated breaking strength.

Temperature	77°
Wind Speed	12MPH
Wind Direction	W

Guy Wire Position Code	Anchor Distance	Anchor Elevation	Guy Wire Attachment Elevation	Guy Wire Diameter	Guy Wire Type	Ideal Initial Tension Range			Measured Tension	Result
						Low	Target	High		
A-CA	131'	+5'	70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	2,400	9% UNDER TARGET TENSION
A-AB			70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	3,300	25% OVER TARGET TENSION
A			140'	3/4" X 19	EHS	5,422	5,830	6,705	6,300	ACCEPTABLE TENSION
A-CA			205'	9/16" X 7	EHS	3,255	3,500	4,025	4,600	31% OVER TARGET TENSION
A-AB			205'	9/16" X 7	EHS	3,255	3,500	4,025	3,900	ACCEPTABLE TENSION
B-AB	135'	+2'	70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	3,100	17% OVER TARGET TENSION
B-BC			70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	3,100	17% OVER TARGET TENSION
B			140'	3/4" X 19	EHS	5,422	5,830	6,705	5,800	ACCEPTABLE TENSION
B-AB			205'	9/16" X 7	EHS	3,255	3,500	4,025	4,100	17% OVER TARGET TENSION
B-BC			205'	9/16" X 7	EHS	3,255	3,500	4,025	4,500	29% OVER TARGET TENSION
C-BC	135'	+15'	70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	3,500	33% OVER TARGET TENSION
C-CA			70' 6"	1/2" X 7	EHS	2,455	2,640	3,036	3,000	ACCEPTABLE TENSION
C			140'	3/4" X 19	EHS	5,422	5,830	6,705	7,400	27% OVER TARGET TENSION
C-BC			205'	9/16" X 7	EHS	3,255	3,500	4,025	4,600	31% OVER TARGET TENSION
C-CA			205'	9/16" X 7	EHS	3,255	3,500	4,025	4,600	31% OVER TARGET TENSION

(4) of (15) guy wires are within the acceptable tension range.
(1) of (15) guy wires are under the acceptable tension range.
(10) of (15) guy wires are over the acceptable tension range.

It is recommended the guy wires be tensioned to bring them into the acceptable ranges.

Observations

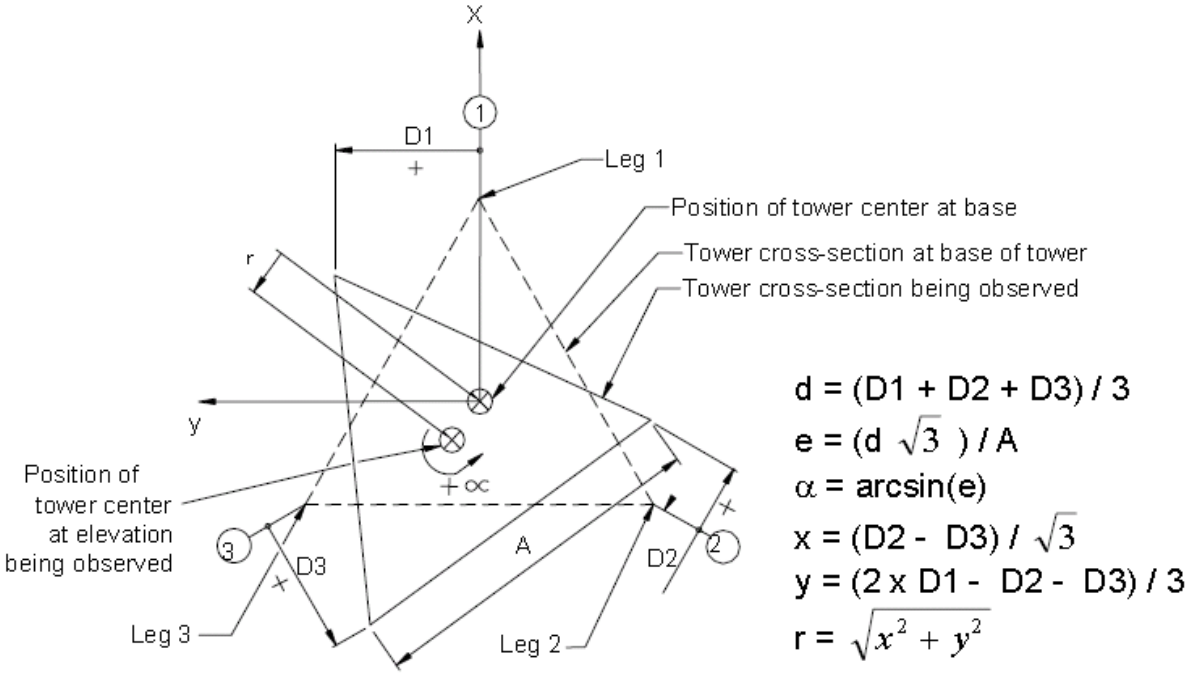
Elevation	Location	Description	Recommendation	Priority
Ground	Anchor A	Scaling rust is present and advancing at the base of the Anchor A elevation beam.	It is recommended the Engineer of Record be consulted to determine corrective action.	To be scheduled within 12 months
Ground	Anchor B	Scaling rust is present at the guy anchor rods and approximately 1/4” material from the diameter of each anchor rod is present.	It is recommended the Engineer of Record be consulted to determine corrective action.	To be scheduled within 12 months
Ground	Each anchor	End sleeves are not present on the guy grip ends.	In order to protect the guy grip ends, it is recommended that end sleeves be installed. (6) 1/2” end sleeves, (3) 3/4” end sleeves and (6) 9/16” end sleeves are required to correct.	To be scheduled within 12 months
Ground	Anchor A	The level 2 guy wire ground has become detached.	Reattach the guy wire ground for proper lightning protection.	To be scheduled within 12 months
Ground	Anchor B	What appears to be electrical feed is draped over the top two guy wires and is secured and cushioned by what appears to be rubber foam.	It is strongly recommended that this feed be relocated away from the tower. The potential for serious injury, death, and equipment damage is great should either the tower or the feed fails.	To be scheduled within 3 months

Tower Alignment

The tower twist and plumb are within acceptable limits.

Temperature	77°
Wind Speed	12MPH
Wind Direction	W

OBSERVED MAST DATA					CALCULATED TWIST			CALCULATED OUT-OF-PLUMB		
Mast Elevation in FT.	A IN.	D1 IN.	D2 IN.	D3 IN.	d IN.	e	a DEG.	x IN.	y IN.	r IN.
0.00	42.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
70.00	42.00	-0.40	0.10	-0.20	-0.17	-0.01	-0.39	0.17	-0.23	0.29
140.00	42.00	-0.40	-0.50	-0.60	-0.50	-0.02	-1.18	0.06	0.10	0.12
205.00	42.00	-1.70	-0.60	-1.30	-1.20	-0.05	-2.84	0.40	-0.50	0.64



$d = (D1 + D2 + D3) / 3$

$e = (d \sqrt{3}) / A$

$\alpha = \arcsin(e)$

$x = (D2 - D3) / \sqrt{3}$

$y = (2 \times D1 - D2 - D3) / 3$

$r = \sqrt{x^2 + y^2}$

Photos

Tower signage
File 001

Tower profile
File 002

Base of tower
File 003

A Leg
File 004

AB Face
File 005

Base of tower
File 006

B Leg
File 007

BC Face
File 008

Base of tower
File 009

C Leg
File 010

CA Face
File 011

Anchor A
File 012

Anchor A
File 013

Anchor A
File 014

Anchor A
File 015

Tower profile
File 016

Tower profile
File 017

Tower profile
File 018

Tower profile
File 019

Tower profile
File 020

Anchor B
File 021

Anchor B
File 022

Anchor B
File 023

Anchor B
File 024

Anchor B
File 025

Tower profile
File 026

Tower profile
File 027

Tower profile
File 028

Tower profile
File 029

Tower profile
File 030

Anchor C
File 031

Anchor C
File 032

Anchor C
File 033

Anchor C
File 034

Tower profile
File 035

Tower profile
File 036

Tower profile
File 037

Tower profile
File 038

Tower profile
File 039

Base of tower
File 040

Base plate
File 041

Base plate
File 042

Base plate
File 043

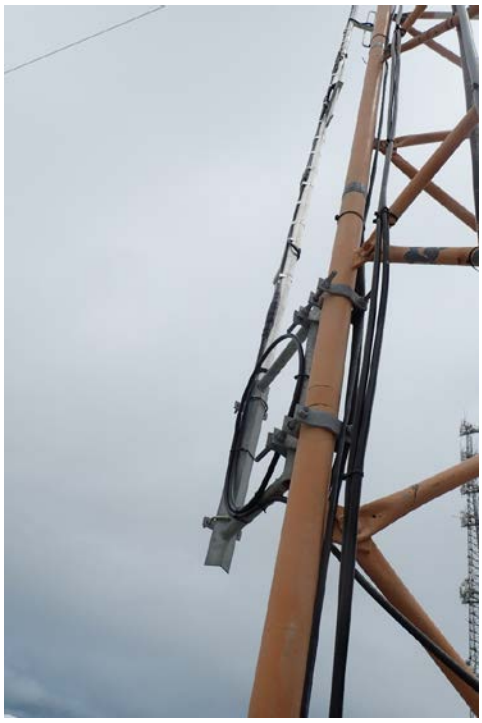
5' leg splice
File 044

30' leg splice
File 045

20' - 40' section
File 046

Hardware condition
File 047

Safety cable condition
File 048



Antenna #1
File 049

Tower surface condition
File 050

Hardware condition
File 051

Hardware condition
File 052

Hardware condition
File 053

40' leg splice
File 054

40' - 60' section
File 055

Tower surface condition
File 056

Tower surface condition
File 057

Tower surface condition
File 058

Tower surface condition
File 059

Tower surface condition
File 060

Tower surface condition
File 061

Antenna #2
File 062

Antenna #3
File 063

Antenna #5
File 064

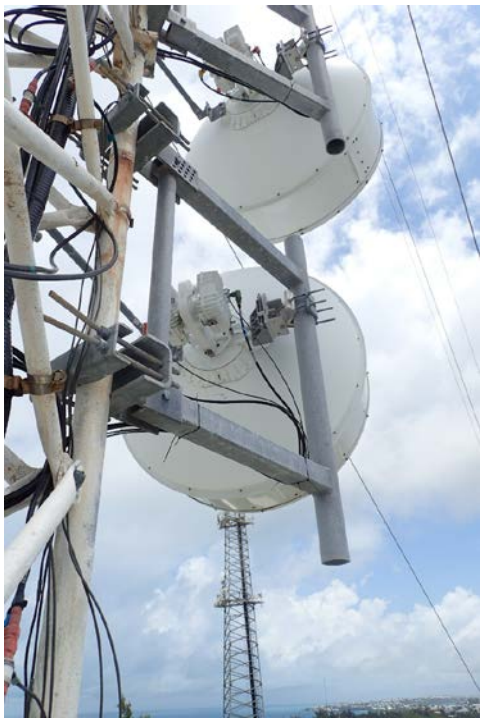
Antenna #4
File 065

Antenna #4 label
File 066

Antennas #6, #7
File 067

Tower surface condition
File 068

Antennas #8, #10
File 069



Antennas #9, #11
File 070

Stiff arm connections
File 071

60' leg splice
File 072

60' - 80' section
File 073

Antenna #10
File 074

Antenna #10 stiff arm connection
File 075

Antenna #11
File 076

Antenna #10 stiff arm connection to damaged diagonal
File 077

Antenna #10 stiff arm connection to damaged diagonal
File 078

Tower surface condition
File 079

Tower surface condition
File 080

Tower surface condition
File 081

Tower surface condition
File 082

Tower surface condition
File 083

Tower surface condition
File 084

Torque arm
File 085

Torque arm
File 086

Torque arm
File 087

Torque arm
File 088

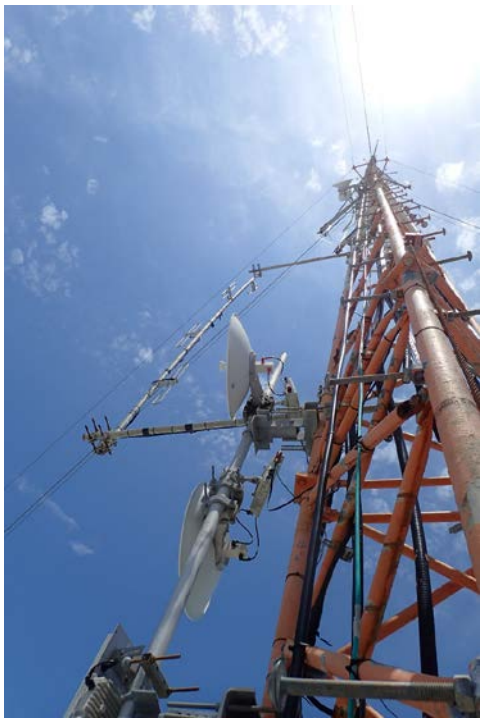
Guy path B
File 089

Guy path C
File 090

Antenna #12
File 091

Antennas #12, #13, #14
File 092

Antennas #16, #17, #18
File 093



Antennas #16, #17, #18, #20
File 094

Tower surface condition
File 095

Tower surface condition
File 096

Tower surface condition
File 097

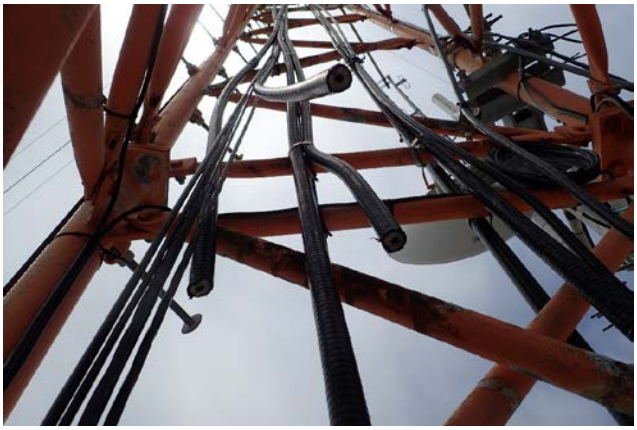
Antenna #20
File 098

Antenna #19
File 099

Tower surface condition
File 100

Tower surface condition
File 101

Tower surface condition
File 102

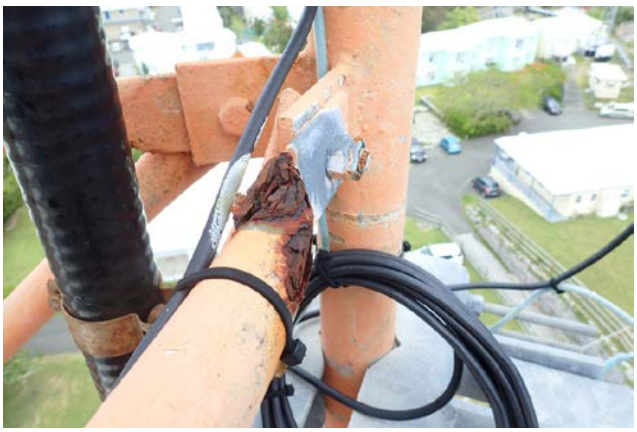


Dead feedlines
File 103

80' leg splice
File 104

80' - 100' section
File 105

Tower surface condition
File 106



Tower surface condition
File 107

Tower surface condition
File 108

100' leg splice
File 109

100' - 120' section
File 110

Antenna #21
File 111

Tower surface condition
File 112

Tower surface condition
File 113

Tower surface condition
File 114

Tower surface condition
File 115

Tower surface condition
File 116

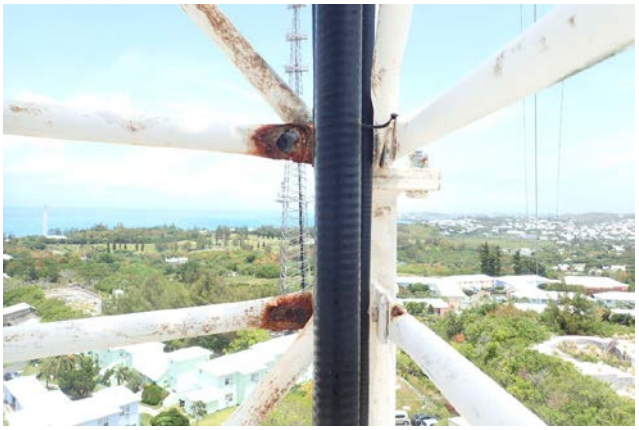
Tower surface condition
File 117

Tower surface condition
File 118

Tower surface condition
File 119

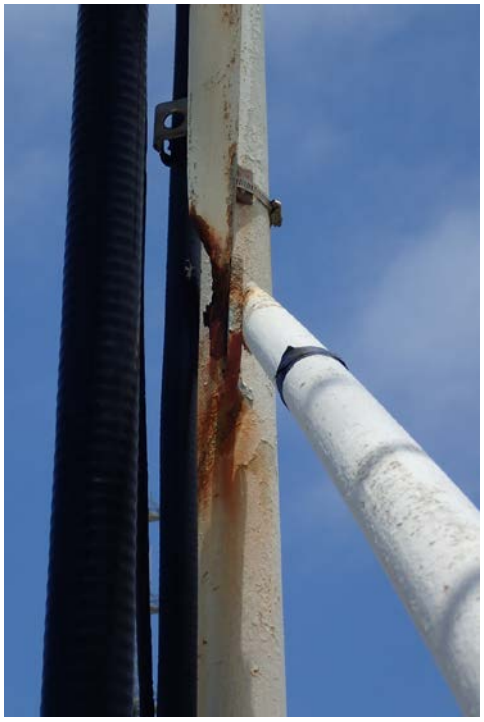
Tower surface condition
File 120

Tower surface condition
File 121



Tower surface condition
File 122

Tower surface condition
File 123



Tower surface condition
File 124

Torque arm hardware
File 125

Torque arm hardware
File 126

Guy attachment
File 127

Guy attchment
File 128

Tower surface condition
File 129