

Santo Domingo, D.N.
12 Mayo 2020**A:** Departamento de Licitaciones, Junta Central Electoral**Asunto:** PROPUESTAS DE PROCESO JCE-CCC-PU-03-03-2020 (ITEMS Y/O PROYECTOS)

Estimados luego de saludarles pasamos a realizar breves comentarios sobre las propuestas contenidas en el proceso JCE-CCC-PU-03-03-2020.

Como expresamos en comunicación remitida a esta Dirección de que al ser la naturaleza de tres proyectos diferentes (por las características de cada uno) y a los puntos que dejábamos a su consideración. Pues presentamos en efecto 3 propuestas

NUMERACIONES :

- 1- 0169 -ENLACE FIBRA OPTICA -SALA DE MAQUINA A PARTIDOS POLITICOS
- 2- 0170 -ENLACE FIBRA OPTICA -SALA DE MAQUINA A SALON MULTIUSOS
- 3- 0171 -ENLACE DE MICROONDAS -SEDE PRINCIPAL A NAVE LAS COLINAS

En estas tres propuestas contenidas en este mismo ANEXO a consecución de esta comunicación hemos para mayor facilidad de ustedes (los equipos de trabajo y evaluación) que en la misma página de las propuestas económicas encuentren todos los detalles relevantes de la propuesta, sus características generales, garantías, tiempos de entrega, tiempos de ejecución, condiciones de pago y detalles técnicos complementarios.

1- 0169 -ENLACE FIBRA OPTICA -SALA DE MAQUINA A PARTIDOS POLITICOS

Este enlace de 180 mts + 10 mts (flojo por regulación) =190 mts, como indicado en la propuesta se basa en un cable armado (doble jacket de protección) para garantizar su integridad a lo largo de la ruta y donde todas las terminaciones para que puedan realizar las interconexiones de equipos de Data y Transmisión cuenten con el 100% de capacidad del enlace serán en ese sentido todas las cros-conexiones empaladas por termofusión.

2- 0170 -ENLACE FIBRA OPTICA -SALA DE MAQUINA A SALON MULTIUSOS

Este enlace de 300 mts + 15 mts (flojo por regulación en dicha distancia) = 315 mts , como indicado en la propuesta constará con el uso de un cable armado (doble jacket de protección) para garantizar su integridad. En este caso la ruta implica un tramo de tuberías rígidas en el techo de la sede principal y tuberías flexibles para mayor protección a la entrada del edificio en que se encuentra el SALON MULTIUSO. De igual manera todas las terminaciones serán termofundidas.

*** PARA AMBOS ENLACES PROVEEREMOS las mediciones de los hilos y su status, así como también las pruebas de certificación del enlace de manera que quede establecida la efectividad de los enlaces.

3- 0171 -ENLACE DE MICROONDAS -SEDE PRINCIPAL A NAVE LAS COLINAS

En este enlace tenemos varios puntos a resaltar y que para más facilidad los citaremos en bullets.

- Ofertamos una torre de 10 mts Certificada en la sede principal. Luego de realizar varios modelos (path profiles) para obtener las alturas y rendimientos del enlace destacamos los siguientes aspectos por su validez técnica.
 - La distancia del cable desde el cuarto de equipo (sala de máquina) al techo obliga a una ubicación próxima a la esquina superior y hasta la entrada de las escaleras al techo preferiblemente para poder garantizar una ubicación cercana al punto de subida se hace imperativo la elevación en este punto tomando en cuenta la línea de vista hacia la NAVE LAS COLINAS y el MODELO DE RADIO SELECCIONADO POR USTEDES
 - Las opciones de mástil en la sede principal (soló serían factibles para puntos donde un 50% a 60% del mástil este con puntos de apoyo laterales en adición a la base y garanticé al menos 50% de la capacidad del enlace lo cual no se cumplía.
 - La opción de 10 mts en esta torre (amerita el caso por el MODLEO DE RADIO solicitado y la seguridad del mismo).
 - Nuestra torres cuenta con la CERIFICACION PJFORD. Y la misma pudiéramos de requerir agregar sección de 5 metros y mantendríamos la garantía que inicial fue dada. (Carta de certificación PJFORD anexa en el MODELO DE 15mts para que tengan referencia futura) que en nuestro caso pudiera ser opción a ustedes y no encarecer el costo al momento ya que con la sección hasta los 10 Mts obteníamos el mayor rendimiento del enlace.
 - En la NAVE LAS COLINAS: Si pudimos determinar un punto en el que con un MASTIL DE 6 METROS poder colocar el Radio (pareja) del que estará en la sede principal. Puesto que en este caso si obtuvimos un punto para la instalación apropiada sin riesgo de ser afectado.
 - Luego de modelar (el enlace) para que se obtenga con respecto a la distancia (línea de vista) el ancho de banda esperado, se concluyó las alturas en los puntos A (sede principal) y B (nave las colinas), el escenario ideal lo arroja esta configuración.
 - **NOTA:** Las opciones disponibles para mástiles telescópicos no son recomendados para la instalación de estos radios por las dimensiones y peso de los mismos por la cual en la SEDE reforzamos el análisis hecho.
 - Como práctica sana en este tiempo (inicios de temporada ciclónica), se pueden tomar previsiones al respecto y entendemos prudente ofertar póliza de seguros para casos de fenómenos naturales. (como trabajamos estos temas, al concluir y recibir el pago total, es el momento en que el Asegurador nos permite emitir pues se toman todos los elementos. **COMO MANEJAMOS ESTOS TEMAS, LE OTORGAREMOS EL 1ER AÑO GRATIS** (ya luego de decidir podemos fungir como mediadores para ofertas ajustadas año tras año o ustedes decidir dejarla).

Sin más por el momento y atento a sus retroalimentaciones sobre el proceso les saluda atentamente.



Ing. Jorge Luis Pimentel, MBA & Operations
Presidente CariTec –Consultores & Asesores Tecnológicos.



PROPUESTA ECONOMICA (ENLACE DE F.O)

ENLACE FIBRA OPTICA -SEDE PRINCIPAL (SALA DE MAQUINAS A PARTIDOS POLITICOS)

CLIENTE: JUNTA CENTRAL ELECTORAL FECHA: 11-May-20
DIRECCION: AVE. 27 DE FEBRERO ESQ. AVE. GREGORIO LUPERON, SANTO DOMINGO. D.N./R.D
CONDICIONES: 50% CON ORDEN DE COMPRA & 50% (DE 15 A 30 DIAS DE ENTREGA) TEL: (809) 539-5419
SOLICITUD ASOCIADA: PROCEDIMIENTO DE URGENCIA JCF-CCC-PU-03-03-2020 (1 DE 3 PROPUESTAS SOLICITADAS)

NO.	DESCRIPCION (CONCEPTOS)	CANT.	UND.	RDS	ITBIS	TOTAL RDS
FIBRA OPTICA + PERIFERICOS (ENLACE + FLOJO EN CBL)						
1	Cable Fibra Optica MM 6h/DOUBLE JACKET /ARMORED - (15% DESC.) ***	190	MTS	109.45	3,181.71	17,676.18
2	F.O Coupling Plate	2	UD	2,069.50	745.02	4,139.00
3	Pig Tail LC (performed coated fusion -th-fusion) - (20% DESC.) ***	12	UD	1,988.75	3,436.56	19,092.00
4	Sleeves (Thermo empalme -fusión)	12	UD	1,195.00	2,581.20	14,340.00
5	Fiber Distribution Pannel 6H/W/M	2	UD	9,218.50	3,318.66	18,437.00
6	Manga f.o. preformed 1/4 -splice tray	2	UD	3,488.50	1,255.86	6,977.00
7	Patch cord F.O. coated/protected LC-LC - (20% DESC.) ***	4	UD	2,497.95	1,438.82	7,993.44
8	Materiales miscelaneos de instalación (Sujetadores de cables, tuercas, tornillos, cemento/yeso, reposiciones de perforaciones).	1	UD	3,500.00	630.00	3,500.00
				SUBTOTAL	16,587.83	92,154.62
LABOR TECNICA ASOCIADA						
1	Instalación de cable fibra optica MM 6H	190	MTS	95.50	3,266.10	18,145.00
2	Preparación de flojos (Por NORMA standard -comunicaciones)	2	UD	950.00	342.00	1,900.00
3	Instalación & Preparación FDP (Fiber Distribution Panel)	2	UD	2,975.00	1,071.00	5,950.00
5	Vaciado de Hilos en PANEL -CADA EXTREMO	12	HILOS	365.00	788.40	4,380.00
6	Empalmes Termo fundido en cable (en cada extremo) (10% DESC.) ***	12	HILOS	1,825.00	3,547.80	19,710.00
7	Prueba de Enlaces - (30% DESC.) ***	1	UD	12,500.00	1,575.00	8,750.00
8	Certificación de hilos -ENLACE - (35% DESC.) ***	1	UD	17,500.00	2,047.50	11,375.00
				SUBTOTAL	12,637.80	70,210.00
1	GASTOS ADM, DISEÑO & SUPERVISION - (20% DESC.)	***		25,000.00	3,600.00	20,000.00
2	TRANSPORTE & ACARREO (GRATIS)	***		7,500.00		GRATIS
SUB-TOTAL						182,364.62
					ITBIS (18%)	32,825.63
					T.GENERAL	RD\$ 215,190.25

****ESTA PROPUESTA INCLUYE 1 ENLACE DE FIBRA OPTICA PARA CONECTAR LAS AREAS EN LA SEDE PRINCIPAL (DESDE SALA DE MAQUINAS A PARTIDOS POLITICOS) ****

(TERMINACION EN THERMOFUSION EN TODOS LOS HILOS DEL ENLACE)

- 1-) Enlaces Pto-Pto (180 MTS + 10 MTS FLOJO POR NORMA STANDARD CONSTRUCCION ENLACE)
- 2-) Entrega Certificación hilos de enlace y de las Terminaciones conectorizadas
- 3-) Se seleccionó cable armado para aportar extra de protección del enlace y la integridad de los hilos de Fibra del mismo.
- 4-) No señalado en propuesta pero en puntos de cruce de cable en el recorrido se usará porciones de tubería flexible con recubrimiento interno. en áreas sensible de accesos a las terminaciones como validado por nosotros en el levantamiento.

INICIO: CON 1ER PAGO INICIAMOS Y CONCLUIMOS EL TRABAJO.

GARANTIA:

- 4-) GARANTIA DE POR VIDA EN TERMINACION "Thermo-fusión" de los terminales en hilos instalados.
 - 4.1-) CABLE FIBRA OPTICA: 15 AÑOS / MATERIALES DE INSTALACION: 10 AÑOS (NO CUBRE INCENDIOS)

TIEMPO:

- 5-) A REALIZARSE en 2.5 DIAS -se tomará/acordará MEDIO DIA PARA PRUEBAS Y ENTREGA FINAL (DEPENDE DE LOS PERMISOS PARA TRANSITAR EN LAS AREAS DISPUESTAS y/o el horario que su personal nos indique)

- *** Nuestro equipo por la actual situación trabajará con las medidas de seguridad personal y el distanciamiento social
- *** Podemos proveer al personal de turno de mascarilla y guantes de necesitar.
- *** Disponibilidad de trabajos en horarios de fines de semana de ser requerido.
- *** Tomamos en el diseño previsión para expansión de requerir en el futuro y poder intersectar ducto y/o cable para op
- *** Ofertamos servicios de mantenimiento/ reemplazos y soporte para estos trabajos a su solicitud.

*** Descuentos de 10, 20 & 30% en las siguientes partidas :

- 1- Administrativa (20%)
- 2- En pruebas de enlace (30%)
- 3- En certificación -(35%) (mediante equipo para dicho propósito) & TRANSPORTE & ACARREO -(GRATIS)
- 4- Cable Fibra Optica MM 6h/DOUBLE JACKET /ARMORED (15%) & Empalmes Thermo fundidos (10%)
- 5- En Pigtails & Patch cords (20%)

Jorge L. Pimentel
ING. JORGE LUIS PIMENTEL

AUTORIZADO

RECIBIDO POR

*** PROPUESTA VALIDA POR 15 DIAS A PARTIR DE FECHA EMISION



PROPUESTA ECONOMICA

(ENLACE DE F.O)

ENLACE FIBRA OPTICA -SEDE PRINCIPAL (SALA DE MAQUINAS A SALON MULTIUSOS)

CLIENTE: JUNTA CENTRAL ELECTORAL

FECHA: 11-May-20

DIRECCION: AVE. 27 DE FEBRERO ESQ. AVE. GREGORIO LUPERON, SANTO DOMINGO. D.N./R.D

CONDICIONES: 50% CON ORDEN DE COMPRA & 50% (DE 15 A 30 DIAS DE ENTREGA) TEL.: (809) 539-5419

SOLICITUD ASOCIADA: PROCEDIMIENTO DE URGENCIA JCE-CCC-PU-03-03-2020 (2 DE 3 PROPUESTAS SOLICITADAS)

NO.	DESCRIPCION (CONCEPTOS)	CANT.	UND.	RDS	ITBIS	TOTAL RDS
FIBRA OPTICA + PERIFERICOS (ENLACE + FLOJO EN CBL)						
1	Cable Fibra Optica MM 6h/DOUBLE JACKET /ARMORED - (15% DESC.) ***	315	MTS	109.45	5,274.94	29,305.24
2	Registro 10x10x4 Nema III	2	UD	587.00	211.32	1,174.00
3	Tubos EMT 1 1/2"	9		712.50	1,154.25	6,412.50
4	Tuberia Liquitype 1 1/2"	3	MTS	195.55	105.60	586.65
5	Abrazaderas Tipo U 1 1/2"	8	UD	23.00	33.12	184.00
6	Tornillos 1x5/8 x 3/8	30	UD	5.65	30.51	169.50
7	Tarugos 1x5/8x 3/8	30	UD	12.87	69.50	386.10
8	Abrazaderas Untru 1 1/2"	25	UD	49.50	222.75	1,237.50
9	Conector Liquitype 1 1/2"	4	UD	122.75	88.38	491.00
10	Coupling IMC 1 1/2"	2	UD	85.00	30.60	170.00
11	Bloques plasticos para sujeción de tuberías	10	UD	789.00	1,420.20	7,890.00
12	Coupling EMT 1 1/2	14	UD	94.00	236.88	1,316.00
13	Conector Recto 1 1/2"	14	UD	76.00	191.52	1,064.00
14	Sleeves (Thermo empalme -fusión)	12	UD	1,195.00	2,581.20	14,340.00
15	F.O Coupling Plate	2	UD	2,069.50	745.02	4,139.00
16	Pig Tail LC (performed coated fusion -th-fusion) - (20% DESC.) ***	12	UD	1,988.75	3,436.56	19,092.00
17	Fiber Distribution Pannel 6H/W/M	2	UD	9,218.50	3,318.66	18,437.00
18	Manga f.o. preformed 1/4 -splice tray	4	UD	3,488.50	2,511.72	13,954.00
19	Patch cord F.O. coated/protected LC-LC - (20% DESC.) ***	6	UD	2,497.95	2,158.23	11,990.16
20	Materiales miscelaneos de instalación (Sujetadores de cables, tuercas, tornillos, cemento/yeso, reposiciones de perforaciones).	1	UD	7,500.00	1,350.00	7,500.00
				SUBTOTAL	25,170.96	139,838.65
LABOR TECNICA ASOCIADA						
1	Instalación de cable fibra optica MM 6H	315	MTS	85.50	4,847.85	26,932.50
2	Preparación de flojos (Por NORMA standard -comunicaciones)	3	UD	950.00	513.00	2,850.00
3	Instalación & Preparación FDP (Fiber Distribution Panel)	2	UD	2,975.00	1,071.00	5,950.00
4	Vaciado de Hilos en PANEL -CADA EXTREMO	12	HILOS	365.00	788.40	4,380.00
5	Empalmes Termo fundido en cable (en cada extremo) (10% DESC.) ***	12	HILOS	1,825.00	3,547.80	19,710.00
6	Prueba de Enlaces - (30% DESC.) ***	1	UD	12,500.00	1,575.00	8,750.00
7	Certificación de hilos -ENLACE - (35% DESC.) ***	1	UD	17,500.00	2,047.50	11,375.00
				SUBTOTAL	14,390.55	79,947.50
1	GASTOS ADM, DISEÑO & SUPERVISION - (20% DESC.)	***		35,750.00	5,148.00	28,600.00
2	TRANSPORTE & ACARREO (GRATIS)	***		7,500.00		GRATIS

SUB-TOTAL	248,386.15
ITBIS (18%)	44,709.51
T.GENERAL	RD\$ 293,095.65

****ESTA PROPUESTA INCLUYE 1 ENLACE DE FIBRA OPTICA PARA CONECTAR LAS AREAS EN LA SEDE PRINCIPAL (DESDE SALA DE MAQUINAS A SALON MULTIUSOS) ****

(TERMINACION EN THERMOFUSION EN TODOS LOS HILOS DEL ENLACE)

- 1-) Enlaces Pto-Pto (300 MTS + 15 MTS FLOJO POR NORMA STANDARD CONSTRUCCION ENLACE)
- 2-) Entrega Certificación hilos de enlace y de las Terminaciones conectorizadas
- 3-) Se seleccionó cable armado para aportar extra de protección del enlace y la integridad de los hilos de Fibra del mismo.
- 4-) No señalado en propuesta pero en puntos de cruce de cable en el recorrido se usará porciones de tubería flexible con recubrimiento interno. en areas sensible de accesos a las terminaciones como validado por nosotros en el levantamiento.

INICIO: CON 1ER PAGO INICIAMOS Y CONCLUIMOS. /POR LOS HORARIOS COLOCAREMOS 2 BRIGADAS (COMENTARIO EN NOTAS DEL PROYECTO)

GARANTIA:

4-) **GARANTIA DE POR VIDA EN TERMINACION "Thermo-fusión" de los terminales en hilos instalados.**

4.1-) CABLE FIBRA OPTICA: 15 AÑOS / MATERIALES DE INSTALACION: 10 AÑOS (NO CUBRE INCENDIOS)

TIEMPO:

5-) **A REALIZARSE en 2.5 DIAS -se tomará/acordará MEDIO DIA ES PARA PRUEBAS Y ENTREGA FINAL.**

(DEPENDIENDO DE LOS PERMISOS PARA TRANSITAR EN LAS AREAS DISPUESTAS y/o el horario que su personal nos indique)

*** Nuestro equipo por la actual situación trabajará con las medidas de seguridad personal y el distanciamiento social

*** Podemos proveer al personal de turno de mascarilla y guantes de necesitar.

*** Disponibilidad de trabajos en horarios de fines de semana de ser requerido.

*** Tomamos en el diseño previsión para expansión de requerir en el futuro y poder intersectar ducto y/o cable para optimizar sus recursos.

*** Ofertamos servicios de mantenimiento/ reemplazos y soporte para estos trabajos a su solicitud.

*** Descuentos de 10, 20 & 30% en las siguientes partidas :

- 1- Administrativa (20%)
- 2- En pruebas de enlace (30%)
- 3- En certificación -(35%) (mediante equipo para dicho propósito) & TRANSPORTE & ACARREO -(GRATIS)
- 4- Cable Fibra Optica MM 6h/DOUBLE JACKET /ARMORED (15%) & Empalmes Thermo fundidos (10%)
- 5- En Pigtailes & Patch cords (20%)

Jorge L. Pimentel
ING. JORGE LUIS PIMENTEL

AUTORIZADO

RECIBIDO POR

*** PROPUESTA VALIDA POR 15 DIAS A PARTIR DE FECHA EMISION



PROPUESTA ECONOMICA

(ENLACE DE MICROONDAS)

ENLACE MICROONDAS -SEDE PRINCIPAL A NAVE LAS COLINAS

CLIENTE: JUNTA CENTRAL ELECTORAL

FECHA: 11-May-20

DIRECCION: AVE. 27 DE FEBRERO ESQ. AVE. GREGORIO LUPERON, SANTO DOMINGO. D.N./R.D

CONDICIONES: 50% CON ORDEN DE COMPRA & 50% (DE 15 A 30 DIAS DE ENTREGA) TEL: (809) 539-5419

SOLICITUD ASOCIADA: PROCEDIMIENTO DE URGENCIA JCE-CCC-PU-03-03-2020 (3 DE 3 PROPUESTAS SOLICITADAS)

NO.	DESCRIPCION (CONCEPTOS)	CANT.	UND.	RDS	ITBIS	TOTAL RDS
TORRE & ENLACE RADIO MW						
1	Suministro Torre Venteada 10 metros -Standard TIA 222-G -Certificada PJFORD -Estructura Galvanizada en Caliente (Luego de Fabricación) -Soporte metálico para Antenas de Microondas - Kit de Puestas a tierra bajo estandar EIA -Garantía: 7 años -Tiempo de Entrega: Inmediata +4 días instalación	1	UD	1,017,900.00	183,222.00	1,017,900.00
2	Suministro de Mastil 6 metros / 114 mm / Galvanizado con fijaciones y soportes de base de acero inoxidable -Garantía: 10 años -Tiempo de Entrega: Inmediata + 1 día de instalación	1	UD	53,284.50	9,591.21	53,284.50
3	Radio UBIQUITI Airfiber AF5U -1.2G full duplex /5ghz /pt2pt -Garantía: 1.5 años -Tiempo de Entrega: 2 Semanas	1	UD	291,749.00	52,514.82	291,749.00
4	Instalación de Torre, Mastil & Antena (Radios-la pareja), Los cableados en torre, anclajes y soportes -Tiempo de Ejecución: 3 días (Se refierte al radio)	1	UD	295,855.35	53,253.96	295,855.35
5	Comisionamiento y puesta en servicio	1	UD	56,100.00	10,098.00	56,100.00
6	Pruebas de throughput (TX & RX)	1	UD	17,500.00	3,150.00	17,500.00
	*** Punto 5 & 6 (en la etapa final del 3er día de Instalación radios) -0.5 días					
7	Polizas de seguros para el proyecto	1	UD	GRATIS	0.00	GRATIS
SUBTOTAL				1,732,388.85	311,829.99	1,732,388.85
1	GASTOS ADM, DISEÑO & SUPERVISION - (20% DESC.)			100,000.00	14,400.00	80,000.00
2	TRANSPORTE & ACARREO (GRATIS)			20,000.00	0.00	GRATIS

*** ENLACE DE MICROONDAS PARA INTERCONECTAR LA SEDE PRINCIPAL CON LA NAVE LAS COLINAS				SUB-TOTAL	1,812,388.85
				ITBIS (18%)	326,229.99
				T.GENERAL	RD\$ 2,138,618.84

OBSERVACIONES GENERALES DE PROPUESTA:

1- TIEMPO DE ENTREGA EN TORRE & MASTIL : INMEDIATA CON PRIMER PAGO (DISPONEMOS DE STOCK EN EL PAIS POR LOS

TRABAJOS QUE MANTENEMOS CON LAS PRESTADORAS DE TELECOMUNICACIONES & OTROS CLIENTES

2- TIEMPO DE ENTREGA EN RADIO MW : 2 SEMANAS

*** PUEDE SER MENOS PERO TOMAMOS LA PREVISION DEL ACTUAL ESTADO CON ALGUNAS LIMITACIONES DE TRANSPORTES INTERNACIONALES

3- TIEMPO DE EJECUCION: DETALLADO ARRIBA (TORRE 10 MTS 4 DIAS / MASTIL Y BASE Y SOPORTE 1 DIA)

3- CONDICIONES DE PAGO: 50% ORDEN DE COMPRA - 50% CONTRA ENTREGA & ACEPTACION

4- PODEMOS ACEPTAR PAGOS EN USDS O PESOS DOMINICANOS RD\$ (A LA TASA DEL MOMENTO DE ADJUDICACION)

5- GARANTIAS EXPRESADAS EN RENGLONES SEGUN APLICA

TIEMPO TOTAL: (EN EL TRANCURSO DE LAS DOS SEMANAS DE ESPERA DEL RADIO YA ESTARA COMPLETO TODO EL TRABAJO Y EN TRES DIAS ADICIONALES EL RADIO Y LAS PRUEBAS DE COMISIONAMIENTO Y FINALES DE AJUSTE PARA -2 SEMANAS Y TRES DIAS CON PRIMER PAGO Y ADJUDICACION CORRESPONDIENTE.

NOTAS RESUMIDAS: SOBRE PROPUESTA:

*** En la sede principal proponemos una torre venteada de 10 Metros que permita la instalación apropiada del RADIO MW (por el peso del equipo y la Altura a colocar el enlace para mayor capacidad del throughput de TX (ancho de banda) / La colocación de un MASTIL para esta facilidad no es satisfactoria Y las modelaciones del ENLACE lo colocarían en alto riesgo (tanto la integridad del equipo/seguridad) como el desempeño del mismo.

*** En la Nave las colinas Si pudimos realizar el análisis para no necesitar torre venteada en este punto y poder instalar MASTIL DE 6 Metros pueto que allí se podrá fijar y recibir la alineación correcta del radio de la sede principal.

*** En casos futuros de requerir mover la torre en caso de decidir hacer una instalación para MULTIPLES RADIOS y mayor altura mantenemos la garantía de ser contratados para cualquier movilización la mantenemos. Hasta la vida útil otorgada.

NOTAS FINALES:

*** Nuestro equipo por la actual situación trabajará con las medidas de seguridad personal y el distanciamiento social

*** Podemos proveer al personal de turno de mascarilla y guantes de necesitar.

*** Disponibilidad de trabajos en horarios de fines de semana de ser requerido.

*** Ofertamos servicios de mantenimiento y soporte para estos trabajos a su solicitud.

*** Podemos ofertar de cara al proceso electoral del año entrante y sirva de beneficio una POLIZA DE SEGURO PARA SINIESTROS

NATURALES a partir deL mes de Julio para que ante cualquier suceso pueda ser repuesto por el costo de poliza y no así por eventos

o siniestros de la naturaleza (OFERTARIAMOS gratis el 1er año de protección de la misma (polizas), otorgandoles mas garantías a su inversión).



Jorge L. Pimentel
ING. JORGE LUIS PIMENTEL

AUTORIZADO

RECIBIDO POR

*** PROPUESTA VALIDA POR 15 DIAS A PARTIR DE FECHA EMISION



airFiber[®]

Full-Duplex, Point-to-Point
Gigabit Radio

Models: AF-24, AF-24HD, AF-5, AF-5U

High Performance Wireless Backhaul

Extreme, Long-Range Links

Worldwide License-Free Operation



Revolutionary Wireless Technology

Introducing airFiber®, a truly revolutionary Point-to-Point wireless platform from Ubiquiti Networks. Housed in a compact, highly efficient form factor, airFiber delivers amazing wireless gigabit+ performance, low latency, and long range. airFiber ushers in a new era in price-disruptive wireless technology ideal for carrier backhaul, building-to-building enterprise use, or public safety applications.

Efficient by Design

Every detail of airFiber was designed and engineered by the Ubiquiti R&D Team. From the silicon chip up to the innovative split-antenna architecture, the Ubiquiti R&D Team created airFiber to deliver superior throughput with efficiency. airFiber was purpose-built to create a high performance backhaul.

Plug and Play Deployment

Based on Ubiquiti's innovative and intuitive airOS®, the airFiber Configuration Interface enables quick deployment. With installation efficiency in mind, the mechanical design allows easy installation by one person. A two-person installation crew can effectively install and align an airFiber link.

To fine-tune the alignment, the received signal levels can be conveniently accessed via any of these methods:

- airFiber LED display
- airFiber Configuration Interface
- Audio tone feature

Designed for Freedom

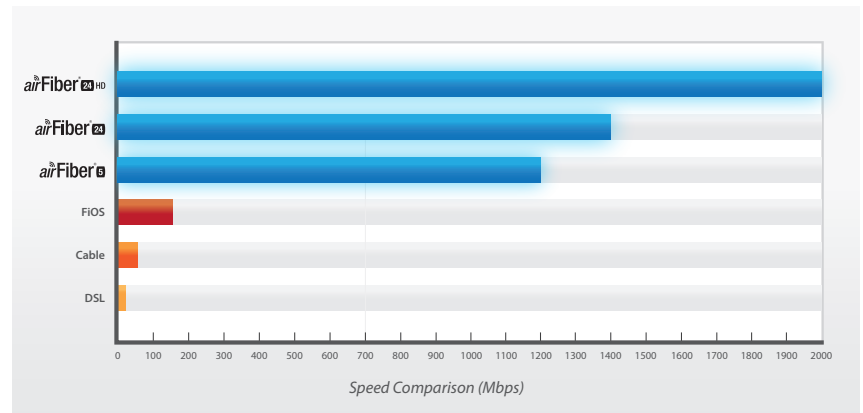
airFiber operates in worldwide, **license-free**, 24 or 5 GHz frequencies. Anyone around the world can purchase and operate airFiber without any special permits, paperwork, or added licensing costs. Users are free to locate, deploy, and operate airFiber practically anywhere they choose (subject to local country regulations).

Model	Description	Operating Frequency*
AF-5	Mid-band 5 GHz frequencies	5470 - 5950 MHz
AF-5U	High-band 5 GHz frequencies	5725 - 6200 MHz
AF-24/AF-24HD	24 GHz frequencies	24.05 - 24.25 GHz

* Refer to the *Specifications* section for more information.

Built for Speed and Range

airFiber delivers gigabit performance at 1.2+ Gbps for airFiber AF-5/AF-5U, 1.5+ Gbps for airFiber AF-24, and 2 Gbps for airFiber AF-24HD. To put this in perspective, airFiber can transmit a 100 MB file in less than a second. Rivaling common broadband providers, airFiber download speed is up to 100x faster. With speed and throughput surpassing conventional wired backhails, airFiber prevails over expensive and labor-intensive wired infrastructures.



airFiber is built for long-range use: up to 13+ km for airFiber AF-24, up to 20+ km for airFiber AF-24HD, and up to 100+ km for airFiber AF-5/AF-5U, which launches the innovative xtreme Range Technology (xRT™) feature.



airFiber backhails do not share the security risks associated with wired backhails. The long distances of wired backhails are vulnerable to copper theft, fiber optic damage, vandalism, and accidental breakage. With airFiber, only the installation points of the airFiber links need to be secured.

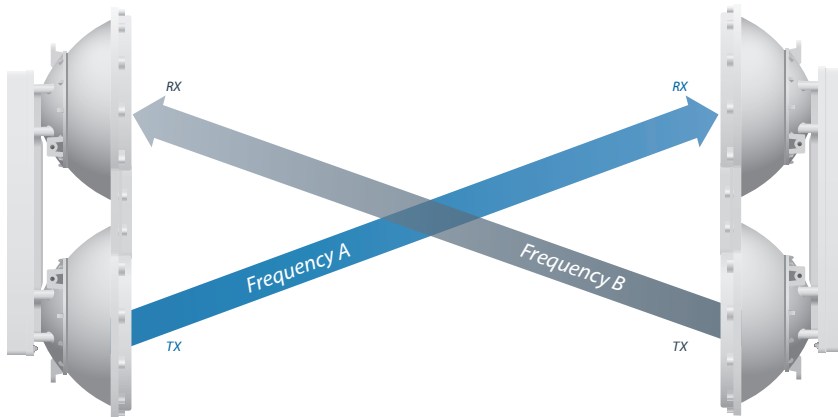
Innovative Proprietary Modem Technology

Ubiquiti's innovative proprietary modem technology was purpose-built to address the specific challenges of outdoor, PtP (Point-to-Point) bridging and high-performance network backhauls. Every aspect of the radio has been carefully simulated and designed to optimize range, speed, and latency performance in the harshest RF noise environments.

Synchronous Data Transmission and Reception

Conventional wireless standards impose a latency by having to receive a packet before a packet is transmitted. airFiber can transmit data synchronously without any wait time. airFiber features traditional TDD and FDD modes of operation in addition to the proprietary Hybrid Division Duplexing (HDD) mode, which provides a breakthrough in range and spectral efficiency performance.

Based on the ranging algorithm built into the air protocol, the airFiber radios use patent-pending HDD technology to calculate the propagation delay and know when each radio can transmit and receive, so they send packets in precise synchronization. Packet transmission latency is virtually eliminated.



airFiber AF-5/AF-5U Radios in Full-Duplex Mode



airFiber AF-5/AF-5U

Innovative Dual-Antenna Architecture

airFiber features a dual-independent, 2x2 MIMO, high-gain reflector antenna system. Separate yet integrated transmit (TX) and receive (RX) antennas help extend link budgets by eliminating the extra RF losses caused by the switches or duplexers required in systems with common TX/RX antennas.

Network Management

airFiber supports a variety of features to help you manage your network:

- **Network management options** A choice between the greater security of out-of-band management and the convenience of in-band management.
- **SNMP support** Full SNMP support to aid in network management.
- **Local and remote airFiber status information** Available on the Main tab of the airFiber Configuration Interface.



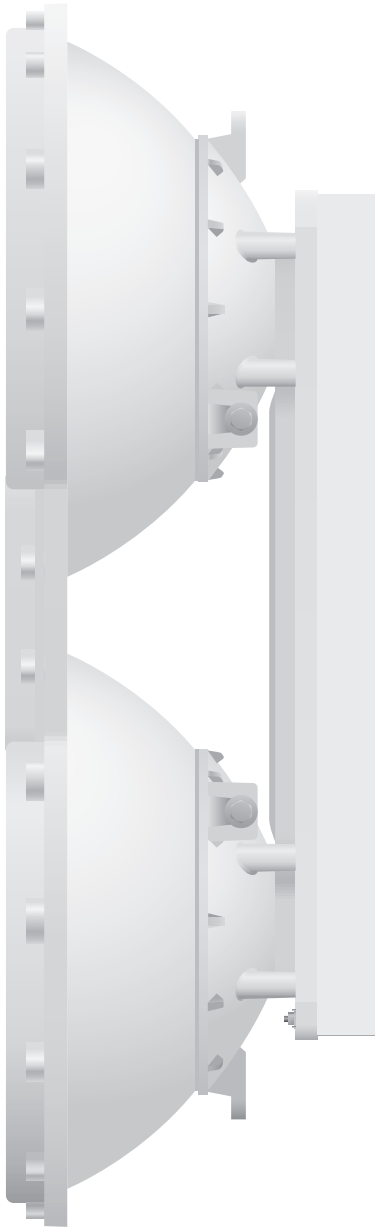
airFiber AF-24 shown without radome

airFiber® 5

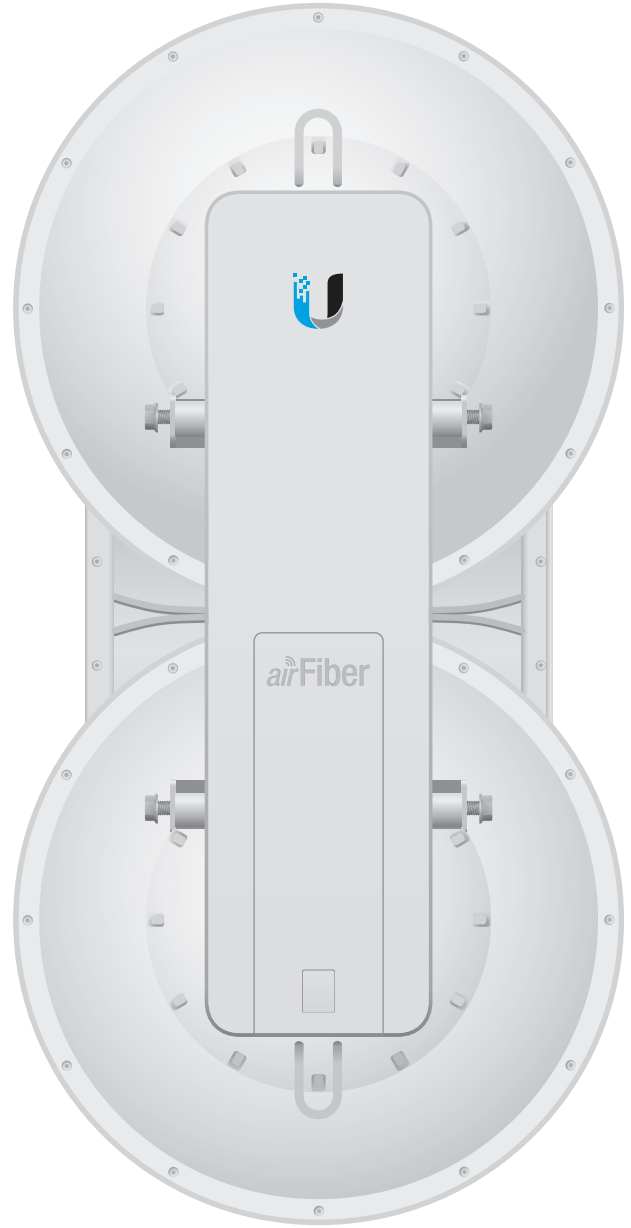
airFiber® 5U

There are two airFiber models available for the 5 GHz spectrum. The mid-band model, AF-5, features the popular mid-band frequencies, which are freely used in many parts of the world.

The high-band (5.7 - 6.2 GHz) model, AF-5U, has robust filtering to enable co-location with devices operating in the lower 5 GHz bands while allowing operation at a higher output power in many areas of the world.



Side



Back

1.2+ Gbps
Real Data Throughput

(((5 GHz)))

100+ km
← xRT →
xtreme Range Technology

HDD
TDD FDD

Superior Processing

Ubiquiti Networks introduces our proprietary INVICTUS™ core communications processing engine. The speed, power, and efficiency of this integrated circuit enhances the performance of the airFiber AF-5/AF-5U.

Efficient Use of 5 GHz Band

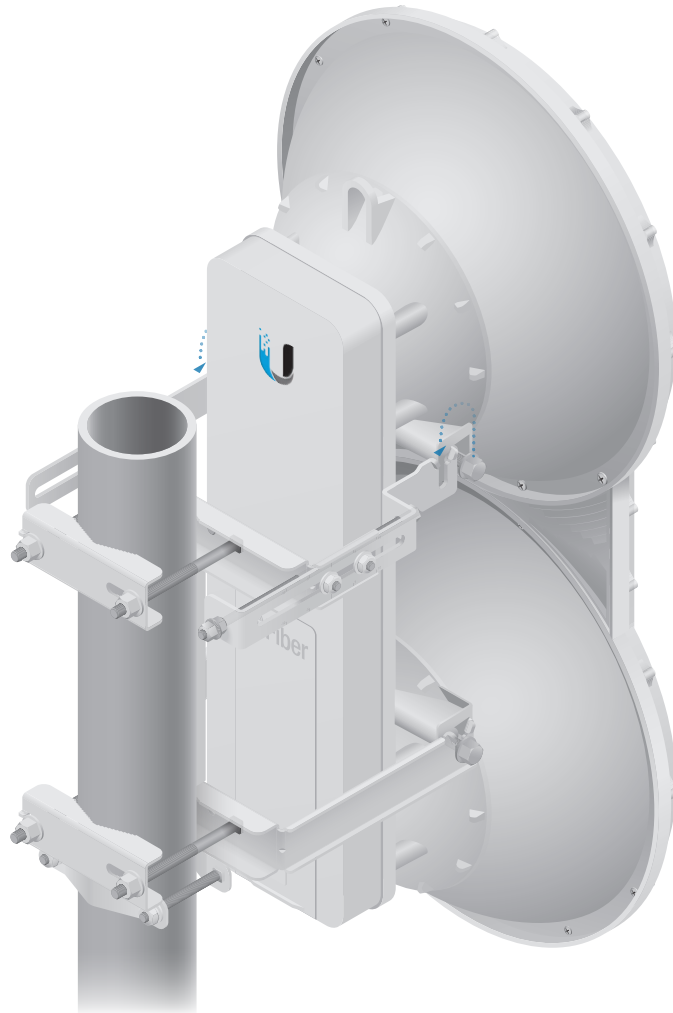
airFiber AF-5/AF-5U features 1 MHz center channel resolution with market-leading Power Envelope Tracking technology. The airFiber AF-5/AF-5U accurately and continuously controls transmit power relative to the band edge. The power level automatically tracks to optimize performance near band edges, allowing you to choose the part of the band with the least interference.

Long-Range Links

Newly developed for the airFiber AF-5/AF-5U, the patent-pending xRT feature uses an innovative, adaptive multi-channel coding scheme to enhance radio transceiver performance, thereby maximizing your link budget and spectrum utilization – while still maintaining regulatory compliance. This results in links that can span distances from 10 m up to 100+ km.

Quick and Easy Installation

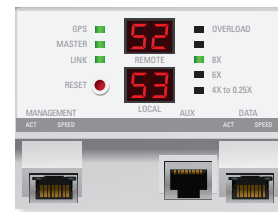
The unique sliding-clamp design of the airFiber AF-5/AF-5U allows mounting hardware to be pre-assembled prior to installation – no more dropped screws at the top of the tower. As an added convenience, the drop-in cradle mount design allows the installer to attach mounting hardware to the pole without having to support the weight of the airFiber radio during installation.



Radio Alignment Display

Newly designed for the airFiber AF-5/AF-5U, the Radio Alignment Display (RAD) makes aiming quicker and easier. The dual, calibrated signal strength indicators display the actual signal strength on the local and remote airFiber radios in real time. The comprehensive array of radio status indicators display the following:

- GPS synchronization status
- Master/slave mode
- RF link status
- RF overload warning
- Current modulation mode
- Link activity and speed for wired management and data ports



Specifications

airFiber AF-5/AF-5U	
Dimensions	
Radio	938.4 x 468.4 x 281.4 mm (36.94 x 18.44 x 11.08")
Box	1042 x 573 x 502 mm (41.02 x 22.56 x 19.76")
Weight	
Radio (Mount Included)	16 kg (35.27 lb)
Box	26.5 kg (58.42 lb)
Max. Power Consumption	40W
Power Supply	50V, 1.2A PoE GigE Adapter (Included)
Power Method	Passive Power over Ethernet
Supported Voltage Range	+42 to +58VDC, -48VDC
Automatic Transmit Power Control (ATPC)	Yes
Certifications	CE, FCC, IC
Mounting	Pole Mount Kit (Included)
Wind Loading	863 N @ 200 km/hr (194 lbf @ 125 mph)
Wind Survivability	200 km/hr (125 mph)
Operating Temperature	-40 to 55° C (-40 to 131°F)
LEDs	(12) Status LEDs: Data Port Link/Activity Data Port Speed Management Port Link/Activity Management Port Speed GPS Synchronization Master/Slave Link Status Modulation Mode 0.25x to 4x, 6x, 8x, 10x (Unlabeled), Overload Remote and Local Displays (Calibrated Signal Strength)
Operating Frequency	
AF-5	
FCC 15.247, 15.407, IC RSS-210	5470 - 5600 MHz, 5650 - 5850 MHz
ETSI EN 301 893, EN 302 502	5470 - 5875 MHz
Other Regions	5470 - 5950 MHz
AF-5U	
FCC 15.247, IC RSS-210	5725 - 5850 MHz
ETSI EN 302 502	5725 - 5875 MHz
Other Regions	5725 - 6200 MHz
Interface	
Data Port	(1) 10/100/1000 Ethernet Port
Management Port	(1) 10/100 Ethernet Port
Auxiliary Port	(1) RJ-12, Alignment Tone Port
System	
Maximum Throughput	1.2+ Gbps
Maximum Range	100+ km (Dependent on Regulatory Region)
Packets per Second	1+ Million
Encryption	128-Bit AES
Uplink/Downlink Ratio	50% Fixed
Latency	
Full Duplex Mode	< 200 µs at Full Throughput
Half Duplex Mode	< 2 ms at Full Throughput
Radio Frame Synchronization	GPS
Dynamic Frequency Selection	
AF-5	CE, FCC/IC
AF-5U	CE (FCC/IC Not Applicable)
MTU (Maximum Transmission Unit)	Up to 9600

airFiber AF-5/AF-5U Suggested Max. TX Power	
10x	39 dBm
8x	43 dBm
6x	45 dBm
4x and below	47 dBm

airFiber AF-5/AF-5U Receive Sensitivity								
Rate	Modulation	Sensitivity (10 MHz)	Sensitivity (20 MHz)	Sensitivity (30 MHz)	Sensitivity (40 MHz)	Sensitivity (50 MHz)	FDD Capacity*	TDD Capacity*
10x	1024QAM	-63 dBm	-60 dBm	-59 dBm	-58 dBm	-57 dBm	1280 Mbps	640 Mbps
8x	256QAM	-70 dBm	-67 dBm	-66 dBm	-65 dBm	-64 dBm	1024 Mbps	512 Mbps
6x	64QAM	-77 dBm	-74 dBm	-73 dBm	-72 dBm	-71 dBm	768 Mbps	384 Mbps
4x	16QAM MIMO	-84 dBm	-81 dBm	-80 dBm	-79 dBm	-78 dBm	512 Mbps	256 Mbps
2x	QPSK MIMO	-90 dBm	-87 dBm	-86 dBm	-85 dBm	-84 dBm	256 Mbps	128 Mbps
1x	½ Rate QPSK xRT	-93 dBm	-90 dBm	-89 dBm	-88 dBm	-87 dBm	128 Mbps	64 Mbps
¼x	¼x QPSK xRT	-95 dBm	-93 dBm	-93 dBm	-92 dBm	-91 dBm	32 Mbps	16 Mbps

* FDD = (2) 50 MHz channels and TDD = (1) 50 MHz channel

airFiber AF-5/AF-5U Radio Frequency	
GPS	GPS Clock Synchronization
Transceiver	
EIRP	~50 dBm (Dependent on Regulatory Region and Frequency Band)
Frequency Accuracy	±2.5 ppm without GPS Synchronization ±0.2 ppm with GPS Synchronization
Channel Bandwidth	10/20/30/40/50 MHz
Modulation	1024QAM MIMO 256QAM MIMO 64QAM MIMO 16QAM MIMO QPSK MIMO ½ Rate QPSK xRT ¼ Rate QPSK xRT
Integrated Split Antenna	
TX Gain	23 dBi
RX Gain	23 dBi
Beamwidth	6°
Front-to-Back Ratio	70 dB
Polarity	Dual-Slant Polarization
Cross-Polarity Isolation	> 28 dB

airFiber AF-5/AF-5U Capacity (Mbps)						
Rate	Modulation	Channel Width (MHz)				
		10	20	30	40	50
10x	1024 QAM MIMO	256.0	512.0	768.0	1024.0	1280.0
8x	256 QAM MIMO	204.8	409.6	614.4	819.2	1024.0
6x	64 QAM MIMO	153.6	307.2	460.8	614.4	768.0
4x	16 QAM MIMO	102.4	204.8	307.2	409.6	512.0
2x	QPSK MIMO	51.2	102.4	153.6	204.8	256.0
1x	½ Rate QPSK xRT	25.6	51.2	76.8	102.4	128.0
¼ x	¼ Rate QPSK xRT	6.4	12.8	19.2	25.6	32.0



Superior 24 GHz Performance

airFiber AF-24/AF-24HD provides a breakthrough in 24 GHz backhaul performance.

Systems for millimeter-wave frequencies typically experience RF losses when part of the RF is lost in the switches and filters.

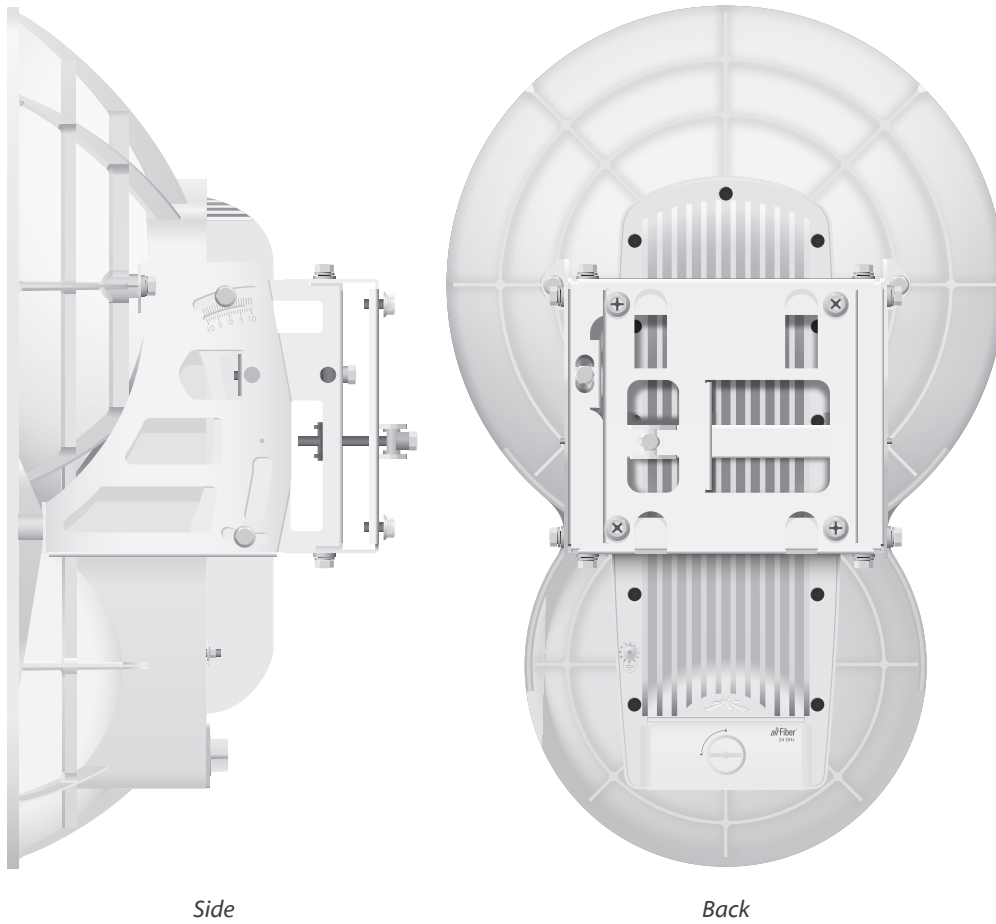
The Ubiquiti R&D team eliminated such RF losses with separate yet integrated TX and RX antennas, so the link budget is robust and the airFiber AF-24/AF-24HD has better noise figure and higher transmit power efficiency.

Two airFiber 24 GHz Models

Two models deliver superior speed with spectral efficiency in the worldwide, license-free, 24 GHz radio band.

The standard model, AF-24, delivers up to 1.5+ Gbps throughput at a range of up to 13+ km.

The heavy-duty model, AF-24HD, provides more throughput at up to 2 Gbps and increased range of up to 20+ km. It also includes a more rugged exterior with a metal reflector, to protect against nature's harshest elements.



1.5+ Gbps
Real Data Throughput

((24 GHz))
License-Free

13+ km
Extreme Range

HDD
TDD FDD

Specifications

airFiber AF-24	
Operating Frequency	24.05 – 24.25 GHz*
Dimensions	
Radio	649 x 426 x 303 mm (25.55 x 16.77 x 11.93")
Box	725 x 520 x 410 mm (28.54 x 20.47 x 16.14")
Weight	
Radio (Mount Included)	10.5 kg (23.15 lb)
Box	17 kg (37.48 lb)
Max. Power Consumption	50W
Power Supply	50V, 1.2A PoE GigE Adapter (Included)
Power Method	Passive Power over Ethernet
Supported Voltage Range	+42 to +58VDC, -48VDC
Certifications	CE, FCC, IC
Wind Loading	480 N @ 200 km/hr (108 lbf @ 125 mph)
Wind Survivability	200 km/hr (125 mph)
Mounting	Pole Mount Kit (Included)
Operating Temperature	-40 to 55° C (-40 to 131° F)
LEDs	(8) Status LEDs: Data Port Speed Data Port Link/Activity Configuration Port Speed Configuration Port Link/Activity GPS Synchronization Modulation Mode Master/Slave RF Status (1) Two-Digit LED Display Calibrated in dBm
Interface	
Data Port	(1) 10/100/1000 Ethernet Port
Configuration Port	(1) 10/100 Ethernet Port
Auxiliary Port	(1) RJ-12, Alignment Tone Port
System	
Maximum Throughput	1.5+ Gbps
Maximum Range	13+ km
Packets per Second	> 1 Million
Encryption	128-Bit AES
Uplink/Downlink Ratio	50% Fixed
Latency	
Full Duplex Mode	< 200 μ s at Full Throughput
Half Duplex Mode	< 2 ms at Full Throughput
MTU (Maximum Transmission Unit)	Up to 9600

* Two 100 MHz channels are available: 24.1 GHz (24.05-24.15 GHz) and 24.2 GHz (24.15-24.25 GHz)

airFiber AF-24 Receive Sensitivity			
Modulation	Sensitivity	FDD Capacity*	TDD Capacity*
64QAM	-66 dBm	1500 Mbps	760 Mbps
16QAM	-72 dBm	1000 Mbps	507 Mbps
QPSK MIMO	-78 dBm	500 Mbps	253 Mbps
QPSK SISO	-80 dBm	250 Mbps	127 Mbps
¼x QPSK SISO	-87 dBm	62.5 Mbps	31.7 Mbps

* FDD = (2) 100 MHz channels and TDD = (1) 100 MHz channel

airFiber AF-24 Radio Frequency	
GPS	GPS Clock Synchronization
Transceiver	
EIRP	~33 dBm (FCC/IC), ~20 dBm (CE), ~40 dBm (Other Regions)
Frequency Accuracy	±2.5 ppm without GPS Synchronization ±0.2 ppm with GPS Synchronization
Channel Bandwidth	100 MHz
Operating Channels	24.1 GHz, 24.2 GHz
Modulation	64QAM MIMO 16QAM MIMO QPSK MIMO QPSK SISO ¼x QPSK SISO
Integrated Split Antenna	
TX Gain	33 dBi
RX Gain	38 dBi
Beamwidth	< 3.5°
Front-to-Back Ratio	70 dB
Polarity	Dual-Slant Polarization
Cross-Polarity Isolation	> 28 dB

airFiber AF-24 Capacity (Mbps)		
Rate	Modulation	100 MHz Channel Width*
6x	64 QAM MIMO	1500.0
4x	16 QAM MIMO	1000.0
2x	QPSK MIMO	500.0
1x	QPSK SISO	250.0
¼x	¼ QPSK SISO	62.5

* Aggregated capacity in Full-Duplex mode



airFiber® 24 HD

Best-in-Class Performance and Range

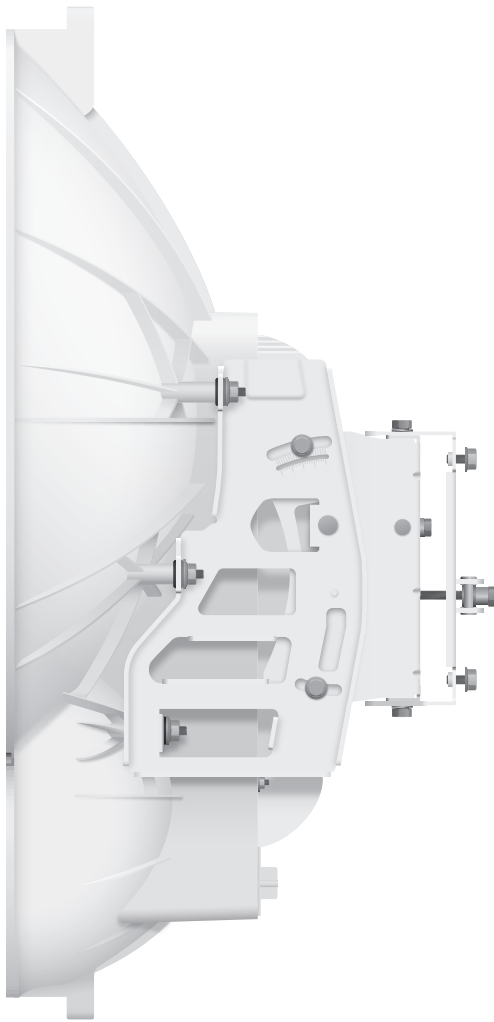
Our INVICTUS custom silicon dramatically improves wireless performance. The AF-24HD model supports the dense modulation rates, up to 256QAM, that are required for high data rates, up to 2 Gbps.

The airFiber AF-24/AF-24HD features the most powerful automatic compensation for path loss degradation due to rain fade, so it provides the best range among 24 GHz products and allows for constellation threshold extension.

Robust Mechanical Assembly

An independent lab has tested the airFiber mechanical assembly to meet MIL-STD-810G, a rigorous United States MIL-STD (Military Standard) that defines a variety of challenging environmental conditions.

The mechanical assembly has also undergone vibration testing using an extended version of IEC 60068-2-6, an environmental standard of the IEC (International Electrotechnical Commission).



Side



Back

2 Gbps
Real Data Throughput

24 GHz
License-Free

20+ km
Extreme Range

HDD
TDD FDD

Specifications

airFiber AF-24HD	
Operating Frequency	24.05 – 24.25 GHz
Dimensions	
Radio	593 x 768 x 370 mm (23.35 x 30.24 x 14.57")
Box	796 x 696 x 49.5 mm (31.34 x 27.40 x 1.95")
Weight	
Radio (Mount Included)	17.3 kg (38.14 lb)
Box	25.5 kg (56.22 lb)
Max. Power Consumption	50W
Power Supply	50V, 1.2A PoE GigE Adapter (Included)
Power Method	Passive Power over Ethernet
Supported Voltage Range	+42 to +58VDC, -48VDC
Certifications	CE, FCC, IC
Wind Loading	770 N @ 200 km/hr (170 lbf @ 125 mph)
Wind Survivability	200 km/hr (125 mph)
Mounting	Pole Mount Kit (Included)
Operating Temperature	-40 to 55° C (-40 to 131° F)
LEDs	(8) Status LEDs: Data Port Speed Data Port Link/Activity Configuration Port Speed Configuration Port Link/Activity GPS Synchronization Modulation Mode Master/Slave RF Status (1) Two-Digit LED Display Calibrated in dBm
Interface	
Data Port	(1) 10/100/1000 Ethernet Port
Configuration Port	(1) 10/100 Ethernet Port
Auxiliary Port	(1) RJ-12, Alignment Tone Port
System	
Maximum Throughput	2 Gbps
Maximum Range	20+ km
Packets per Second	1+ Million
Packets per Second	> 1 Million
Encryption	128-Bit AES
Uplink/Downlink Ratio	50% Fixed
Latency	
Full Duplex Mode	< 200 μ s at Full Throughput
Half Duplex Mode	< 2 ms at Full Throughput
MTU (Maximum Transmission Unit)	Up to 9600

airFiber AF-24HD Receive Sensitivity			
Modulation	Sensitivity	FDD Capacity*	TDD Capacity*
256QAM	-60 dBm	2000 Mbps	1024 Mbps
64QAM	-66 dBm	1500 Mbps	760 Mbps
16QAM	-72 dBm	1000 Mbps	507 Mbps
QPSK MIMO	-78 dBm	500 Mbps	253 Mbps
QPSK SISO	-80 dBm	250 Mbps	127 Mbps
1/4x QPSK SISO	-87 dBm	62.5 Mbps	31.7 Mbps

* FDD = (2) 100 MHz channels and TDD = (1) 100 MHz channel

airFiber AF-24HD Radio Frequency	
GPS	GPS Clock Synchronization
Transceiver	
EIRP	~33 dBm (FCC/IC), ~20 dBm (CE), ~40 dBm (Other Regions)
Frequency Accuracy	±2.5 ppm without GPS Synchronization ±0.2 ppm with GPS Synchronization
Channel Bandwidth	100 MHz
Operating Channels	24.1 GHz, 24.2 GHz
Modulation	256QAM MIMO 64QAM MIMO 16QAM MIMO QPSK MIMO QPSK SISO ¼x QPSK SISO
Integrated Split Antenna	
TX Gain	33 dBi
RX Gain	40 dBi
Beamwidth	< 3.5°
Front-to-Back Ratio	70 dB
Polarity	Dual-Slant Polarization
Cross-Polarity Isolation	> 28 dB

airFiber AF-24HD Capacity (Mbps)		
Rate	Modulation	100 MHz Channel Width*
8x	256 QAM MIMO	2000.0
6x	64 QAM MIMO	1500.0
4x	16 QAM MIMO	1000.0
2x	QPSK MIMO	500.0
1x	QPSK SISO	250.0
¼x	¼ QPSK SISO	62.5

* Aggregated capacity in Full-Duplex mode



Specifications are subject to change. Ubiquiti products are sold with a limited warranty described at: www.ubnt.com/support/warranty
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www.ubnt.com

Fecha: 23 de agosto de 2018

Cliente: Constructora Javier Cruz De PR Inc. (CJC)
8374 NW 64th St
Miami, 33166
Attn: Joan Javier
joanjavier@grupocjc.com

País: Republica Dominicana

Estructura: 15m Torre
Fabricante: CJC
Nombre del Sitio: N/A
Referencia del Sitio: N/A
Latitud, Longitud: N/A

PJF Proyecto: A00018-0473.001.8700

Paul J. Ford and Company se complace en presentar este "**Informe de Análisis Estructural**" para determinar el nivel de estrés de la torre.

Criterios de Análisis:

Norma de Diseño: ANSI/TIA-222-G-2-2009
Velocidad Básica del Viento: 193 kph (120 mph) ráfaga de viento durante 3 segundos sin hielo
Velocidad del Viento (Servicio): 97 kph (Servicio) sin hielo
TIA-222 Criterios: Clase de Estructura II; Categoría Topográfica 1; Categoría de Exposición C

Cargas de Los Accesorios Propuestos:

La Estructura se analizó con las cargas propuestas mostradas en la Tabla 1 de este informe.

Resumen de Los Resultados del Análisis:

Estructura Propuesta: Pasa
Fundación Propuesta: N/A

Nosotros en Paul J. Ford and Company apreciamos la oportunidad de ofrecer nuestros servicios profesionales a usted y Constructora Javier Cruz De PR Inc. (CJC). Si usted tiene alguna pregunta o necesita ayuda adicional sobre este o cualquier otro proyecto por favor llámenos.

Atentamente:



Michael Lenk, El
Structural Designer
mlenk@pauljford.com *MLK*

Columbus
250 E Broad St, Suite 600
Columbus, OH 43215
Phone 614.221.6679

Orlando
1801 Lee Rd, Suite 230
Winter Park, FL 32789
Phone 407.898.9039

Report Date: August 23, 2018

Client: Constructora Javier Cruz De PR Inc. (CJC)
8374 NW 64th St
Miami, 33166
Attn: Joan Javier
joanjavier@grupocjc.com

Country: Dominican Republic

Structure: 15m Tower
Manufacturer: CJC
Site Name: N/A
Site Reference: N/A
Latitude, Longitude: N/A

PJF Project: A00018-0473.001.8700

Paul J. Ford and Company is pleased to submit this “**Structural Analysis Report**” to determine the tower stress level.

Analysis Criteria:

Reference Standard: ANSI/TIA-222-G-2-2009
Basic Wind Speed: 193 kph (120 mph) 3-second gust wind speed without ice
Service Wind Speed: 97 kph (Serviceability) without ice
TIA-222 Criteria: Structure Class II; Topographic Category 1; Exposure Category C

Proposed Appurtenance Loads:

The structure was analyzed with the addition of the proposed appurtenance loads shown in Table 1 of this report.

Summary of Analysis Results:

Proposed Structure: Pass
Proposed Foundation: N/A

We at Paul J. Ford and Company appreciate the opportunity of providing our continuing professional services to you and Constructora Javier Cruz De PR Inc. (CJC). If you have any questions or need further assistance on this or any other projects please give us a call.

Respectfully submitted by:

Michael Lenk, EI
Structural Designer
mlenk@pauljford.com

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1) INTRODUCTION

This tower is a 15m guyed tower.

2) ANALYSIS CRITERIA

The structural analysis was performed for this tower in accordance with the requirements of TIA-222-G Structural Standards for Steel Antenna Towers and Antenna Supporting Structures using a 3-second gust wind speed of 193 kph with no ice and 97 kph under service loads, exposure category C with topographic category 1 and crest height of 0 meters.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (m)	Center Line Elevation (m)	Number of Antennas	Antenna Manufacturer	Antenna Model	Number of Feed Lines	Feed Line Size (in)	Note
15.0	15.0	1	generic	6m ² AEV	18	1/2	-
13.0	13.0	1	generic	6m ² AEV	18	1/2	
7.5	7.5	1	generic	1m ² AEV	1	1/2	-

3) ANALYSIS PROCEDURE

Table 2 - Documents Provided

Document	Date	Reference	Source
Tower Drawings and Calculations	7/18/2018	G1501C	CJC
Tower Drawings and Calculations	7/25/2018	19840	Guillermo Sanchez
Additional tower drawings	8/15/2018	-	Guillermo Sanchez

3.1) Analysis Method

tnxTower (version 8.0.4.0), a commercially available analysis software package, was used to create a three-dimensional model of the tower and calculate member stresses for various loading cases. Selected output from the analysis is included in Appendix A.

3.2) Assumptions

- 1) Tower and structures were built in accordance with the manufacturer's specifications.
- 2) The tower and structures have been maintained in accordance with the manufacturer's specification.
- 3) The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in Tables 1 and 2 and the referenced drawings.
- 4) The connections to the for the guy cables are welded to the tower legs.

This analysis may be affected if any assumptions are not valid or have been made in error. Paul J Ford and Company should be notified to determine the effect on the structural integrity of the tower.

4) ANALYSIS RESULTS

Table 3 - Section Capacity (Summary)

Section No.	Elevation (m)	Component Type	Size	Critical Element	P (kN)	SF*P_allow (kN)	% Capacity	Pass / Fail
T1	30 - 27	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	2	-113.31	177.25	63.9	Pass
T2	27 - 21	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	29	-175.68	177.25	99.1	Pass
T3	21 - 15	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	80	-163.09	177.25	92.0	Pass
T1	30 - 27	Diagonal	2L 40 x 40 x 4 (5)	14	-26.34	97.28	27.1 70.3 (b)	Pass
T2	27 - 21	Diagonal	2L 40 x 40 x 4 (5)	77	-24.87	97.28	25.6 63.9 (b)	Pass
T3	21 - 15	Diagonal	2L 40 x 40 x 4 (5)	122	-14.05	97.28	14.4 33.4 (b)	Pass
T1	30 - 27	Horizontal	2L 40 x 40 x 4 (5)	12	8.25	102.48	8.0 22.8 (b)	Pass
T2	27 - 21	Horizontal	2L 40 x 40 x 4 (5)	75	24.38	102.48	23.8 67.3 (b)	Pass
T3	21 - 15	Horizontal	2L 40 x 40 x 4 (5)	113	1.66	102.48	1.6 4.6 (b)	Pass
T1	30 - 27	Top Girt	2L 40 x 40 x 4 (5)	5	8.01	102.48	7.8 22.1 (b)	Pass
T2	27 - 21	Guy A@26.25	5/8	143	67.15	113.16	59.3	Pass
		Guy A@21.75	5/8	150	34.54	113.16	30.5	Pass

Section No.	Elevation (m)	Component Type	Size	Critical Element	P (kN)	SF*P_allow (kN)	% Capacity	Pass / Fail	
T2	27 - 21	Guy B@26.25	5/8	137	67.87	113.16	60.0	Pass	
		Guy B@21.75	5/8	149	35.63	113.16	31.5	Pass	
T2	27 - 21	Guy C@26.25	5/8	130	67.20	113.16	59.4	Pass	
		Guy C@21.75	5/8	148	35.74	113.16	31.6	Pass	
T2	27 - 21	Torque Arm Top@26.25	2L2x2x3/8x1/2	133	57.41	391.83	14.7 57.5 (b)	Pass	
T2	27 - 21	Torque Arm Bottom@26.25	2L2x2x3/8x1/2	146	-36.87	354.76	10.4 30.2 (b)	Pass	
							Summary		
							Leg (T2)	99.1	Pass
							Diagonal (T1)	70.3	Pass
							Horizontal (T2)	67.3	Pass
							Top Girt (T1)	22.1	Pass
							Guy A (T2)	59.3	Pass
							Guy B (T2)	60.0	Pass
							Guy C (T2)	59.4	Pass
							Torque Arm Top (T2)	57.5	Pass
							Torque Arm Bottom (T2)	30.2	Pass
							Bolt Checks	70.3	Pass
							Rating =	99.1	Pass

Table 4 - Tower Component Stresses vs. Capacity

Notes	Component	Elevation (m)	% Capacity	Pass / Fail
-	Base Foundation	0	-	-
Structure Rating (max from all components) =				99.1%

4.1) Recommendations

The tower will have capacity to carry the proposed load configuration.

APPENDIX A
TNXTOWER OUTPUT

Tower Input Data

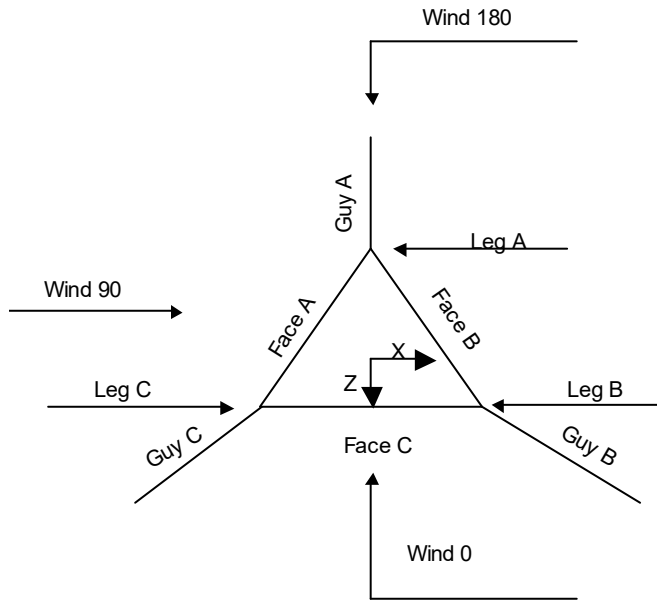
The main tower is a 3x guyed tower with an overall height of 30.00 m above the ground line.
The base of the tower is set at an elevation of 15.00 m above the ground line.
The face width of the tower is 0.80 m at the top and 0.80 m at the base.
This tower is designed using the TIA-222-G standard.

The following design criteria apply:

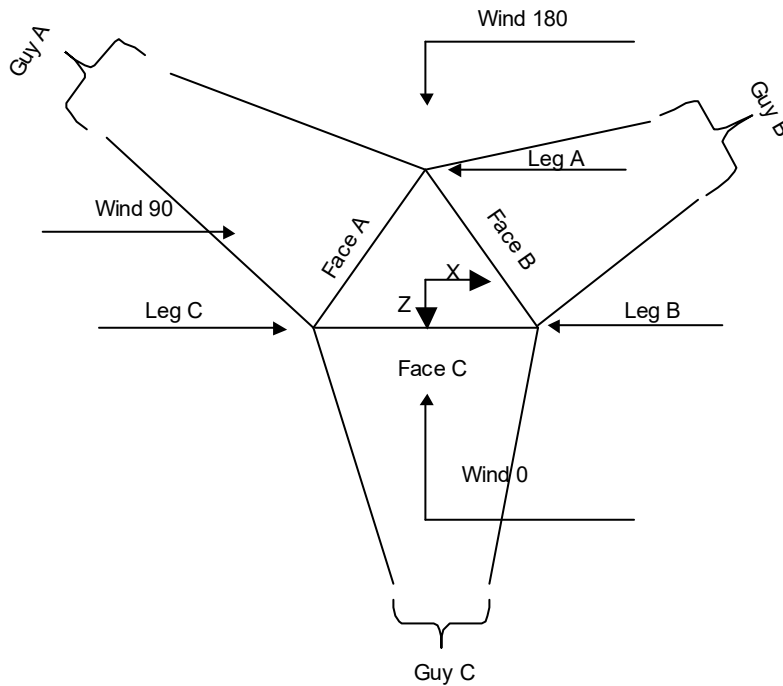
- 1) Basic wind speed of 193 kph.
- 2) Structure Class II.
- 3) Exposure Category C.
- 4) Topographic Category 1.
- 5) Crest Height 0.00 m.
- 6) Deflections calculated using a wind speed of 97 kph.
- 7) Pressures are calculated at each section.
- 8) Safety factor used in guy design is 1.
- 9) Stress ratio used in tower member design is 1.

Options

- | | | |
|--|---|--|
| <ul style="list-style-type: none"> Consider Moments - Legs Consider Moments - Horizontals Consider Moments - Diagonals Use Moment Magnification √ Use Code Stress Ratios √ Use Code Safety Factors - Guys Escalate Ice Always Use Max Kz Use Special Wind Profile √ Include Bolts In Member Capacity Leg Bolts Are At Top Of Section Secondary Horizontal Braces Leg Use Diamond Inner Bracing (4 Sided) √ SR Members Have Cut Ends SR Members Are Concentric | <ul style="list-style-type: none"> Distribute Leg Loads As Uniform Assume Legs Pinned Assume Rigid Index Plate Use Clear Spans For Wind Area √ Use Clear Spans For KL/r √ Retension Guys To Initial Tension Bypass Mast Stability Checks Use Azimuth Dish Coefficients √ Project Wind Area of Appurt. √ Autocalc Torque Arm Areas Add IBC .6D+W Combination √ Sort Capacity Reports By Component Triangulate Diamond Inner Bracing Treat Feed Line Bundles As Cylinder Ignore KL/ry For 60 Deg. Angle Legs | <ul style="list-style-type: none"> Use ASCE 10 X-Brace Ly Rules Calculate Redundant Bracing Forces Ignore Redundant Members in FEA SR Leg Bolts Resist Compression All Leg Panels Have Same Allowable Offset Girt At Foundation √ Consider Feed Line Torque √ Include Angle Block Shear Check Use TIA-222-G Bracing Resist. Exemption Use TIA-222-G Tension Splice Exemption |
| <div style="display: inline-block; background-color: #e0e0e0; padding: 2px 10px; border: 1px solid black;">Poles</div> | | |
| <ul style="list-style-type: none"> Include Shear-Torsion Interaction Always Use Sub-Critical Flow Use Top Mounted Sockets Pole Without Linear Attachments Pole With Shroud Or No Appurtenances Outside and Inside Corner Radii Are Known | | |



Corner & Starmount Guyed Tower



Face Guyed

Tower Section Geometry

Tower Section	Tower Elevation	Assembly Database	Description	Section Width	Number of Sections	Section Length
	<i>m</i>			<i>m</i>		<i>m</i>
T1	30.00-27.00			0.80	1	3.00
T2	27.00-21.00			0.80	1	6.00
T3	21.00-15.00			0.80	1	6.00

Tower Section Geometry (cont'd)

Tower Section	Tower Elevation	Diagonal Spacing	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset	Bottom Girt Offset
	<i>m</i>	<i>m</i>				<i>mm</i>	<i>mm</i>
T1	30.00-27.00	0.75	K Brace Left	No	Yes	0.000	0.000
T2	27.00-21.00	0.75	K Brace Left	No	Yes	0.000	0.000
T3	21.00-15.00	0.75	K Brace Left	No	Yes	0.000	0.000

Tower Section Geometry (cont'd)

Tower Elevation m	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 30.00-27.00	Pipe	Pipe 1.9"x 0.197" (1.5"x5mm)	A572-50 (345 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)
T2 27.00-21.00	Pipe	Pipe 1.9"x 0.197" (1.5"x5mm)	A572-50 (345 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)
T3 21.00-15.00	Pipe	Pipe 1.9"x 0.197" (1.5"x5mm)	A572-50 (345 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)

Tower Section Geometry (cont'd)

Tower Elevation m	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 30.00-27.00	None	Equal Angle		A36 (248 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)
T2 27.00-21.00	None	Equal Angle		A36 (248 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)
T3 21.00-15.00	None	Equal Angle		A36 (248 MPa)	Double Equal Angle	2L 40 x 40 x 4 (5)	A36 (248 MPa)

Tower Section Geometry (cont'd)

Tower Elevation m	Gusset Area (per face) m ²	Gusset Thickness mm	Gusset Grade	Adjust. Factor A _r	Adjust. Factor A _r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals mm	Double Angle Stitch Bolt Spacing Horizontals mm	Double Angle Stitch Bolt Spacing Redundants mm
T1 30.00-27.00	0.00	5.000	A36 (248 MPa)	1	1	1.1	Mid-Pt	Mid-Pt	Mid-Pt
T2 27.00-21.00	0.00	5.000	A36 (248 MPa)	1	1	1.1	Mid-Pt	Mid-Pt	Mid-Pt
T3 21.00-15.00	0.00	5.000	A36 (248 MPa)	1	1	1.1	Mid-Pt	Mid-Pt	Mid-Pt

Tower Section Geometry (cont'd)

Tower Elevation m	Calc K Single Angles	Calc K Solid Rounds	Legs	K Factors ¹						
				X Brace Diags	X Brace Diags	Single Diags	Girts	Horiz.	Sec. Horiz.	Inner Brace
T1 30.00-27.00	Yes	No	1	1	1	1	1	1	1	1
T2 27.00-21.00	Yes	No	1	1	1	1	1	1	1	1
T3 21.00-15.00	Yes	No	1	1	1	1	1	1	1	1

¹Note: K factors are applied to member segment lengths. K-braces without inner supporting members will have the K factor in the out-of-plane direction applied to the overall length.

Tower Section Geometry (cont'd)

Tower Elevation m	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct mm	U	Net Width Deduct mm	U	Net Width Deduct mm	U	Net Width Deduct mm	U	Net Width Deduct mm	U	Net Width Deduct mm	U	Net Width Deduct mm	U
T1 30.00- 27.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T2 27.00- 21.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75
T3 21.00- 15.00	0.000	1	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75	0.000	0.75

Tower Section Geometry (cont'd)

Tower Elevation m	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size mm	No.	Bolt Size mm	No.	Bolt Size mm	No.	Bolt Size mm	No.	Bolt Size mm	No.	Bolt Size mm	No.	Bolt Size mm	No.
T1 30.00- 27.00	Flange	16.000 ISO 8.8 (N)	6	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 ISO 8.8 (N)	0
T2 27.00- 21.00	Flange	16.000 ISO 8.8 (N)	6	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 ISO 8.8 (N)	0
T3 21.00- 15.00	Flange	16.000 ISO 8.8 (N)	6	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 A325N	1	15.875 ISO 8.8 (N)	0

Guy Data

Guy Elevation m	Guy Grade	Guy Size	Initial Tension kN	%	Guy Modulus MPa	Guy Weight kg/m	L_u m	Anchor Radius m	Anchor Azimuth Adj. °	Anchor Elevation m	End Fitting Efficiency %	
26.25	EHS	A	5/8	18.86	10%	158579	1.21	13.55	8.00	0.0000	15.00	100%
		B	5/8	18.86	10%	158579	1.21	13.55	8.00	0.0000	15.00	100%
		C	5/8	18.86	10%	158579	1.21	13.55	8.00	0.0000	15.00	100%
21.75	EHS	A	5/8	18.86	10%	158579	1.21	10.11	8.00	0.0000	15.00	100%
		B	5/8	18.86	10%	158579	1.21	10.11	8.00	0.0000	15.00	100%
		C	5/8	18.86	10%	158579	1.21	10.11	8.00	0.0000	15.00	100%

Guy Data(cont'd)

Guy Elevation m	Mount Type	Torque-Arm Spread m	Torque-Arm Leg Angle °	Torque-Arm Style	Torque-Arm Grade	Torque-Arm Type	Torque-Arm Size
26.25	Torque Arm	1.60	60.0000	Dog Ear	A36 (248 MPa)	Double Equal Angle	2L2x2x3/8x1/2
21.75	Corner						

Guy Data (cont'd)

Guy Elevation m	Diagonal Grade	Diagonal Type	Upper Diagonal Size	Lower Diagonal Size	Is Strap.	Pull-Off Grade	Pull-Off Type	Pull-Off Size
26.25	A572-50 (345 MPa)	Solid Round				A36 (248 MPa)	Equal Angle	
21.75	A572-50 (345 MPa)	Solid Round				A36 (248 MPa)	Equal Angle	

Guy Data (cont'd)

Guy Elevation m	Cable Weight A kN	Cable Weight B kN	Cable Weight C kN	Cable Weight D kN	Tower Intercept A m	Tower Intercept B m	Tower Intercept C m	Tower Intercept D m
26.25	0.16	0.16	0.16		0.06 0.8 sec/pulse	0.06 0.8 sec/pulse	0.06 0.8 sec/pulse	
21.75	0.12	0.12	0.12		0.03 0.6 sec/pulse	0.03 0.6 sec/pulse	0.03 0.6 sec/pulse	

Guy Data (cont'd)

Guy Elevation m	Calc K Single Angles	Calc K Solid Rounds	Torque Arm		Pull Off		Diagonal	
			K _x	K _y	K _x	K _y	K _x	K _y
26.25	Yes	No	1	1	1	1	1	1
21.75	No	No			1	1	1	1

Guy Data (cont'd)

Guy Elevation m	Torque-Arm				Pull Off				Diagonal			
	Bolt Size mm	Number	Net Width Deduct mm	U	Bolt Size mm	Number	Net Width Deduct mm	U	Bolt Size mm	Number	Net Width Deduct mm	U
26.25	15.875 ISO 8.8 (N)	2	0.000	1	15.875 A325N	1	0.000	0.75	15.875 A325N	0	0.000	0.75
21.75	15.875 ISO 8.8 (N)	0	0.000	0.75	15.875 A325N	1	0.000	0.75	15.875 A325N	0	0.000	0.75

Guy Pressures

Guy Elevation m	Guy Location	z m	q _z kPa	q _z Ice kPa	Ice Thickness mm
26.25	A	20.63	1.75		
	B	20.63	1.75		

Guy Elevation m	Guy Location	z m	q _z kPa	q _z Ice kPa	Ice Thickness mm
21.75	C	20.63	1.75		
	A	18.38	1.71		
	B	18.38	1.71		
	C	18.38	1.71		

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement m	Face Offset mm	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing mm	Width or Diameter mm	Perimeter mm	Weight kg/m
L40mm Ladder Rail	A	No	No	Af (CaAa)	30.00 - 15.00	0.000	0	2	2	300.00 0 38.100	40.000		2.68
LDF4-50A (1/2" foam) ****	A	No	No	Ar (CaAa)	30.00 - 15.00	0.000	0	18	9	12.000 10.000	16.002		0.22
L40mm Ladder Rail	B	No	No	Af (CaAa)	24.86 - 15.00	0.000	0	2	2	300.00 0 38.100	40.000		2.68
LDF4-50A (1/2" foam)	B	No	No	Ar (CaAa)	22.50 - 15.00	0.000	0	19	9	12.000 10.000	16.002		0.22
LDF4-50A (1/2" foam) ****	B	No	No	Ar (CaAa)	28.00 - 22.50	0.000	0	18	9	12.000 10.000	16.002		0.22
L40mm Climb Ladder Rail	C	No	No	Af (CaAa)	30.00 - 15.00	0.000	0	2	2	300.00 0 38.100	40.000		2.68
5/8" ladder rung (12" long 12" oc)	C	No	No	Ar (CaAa)	30.00 - 15.00	0.000	0	1	1	15.875	15.875		1.55
Safety Line 3/8 ****	C	No	No	Ar (CaAa)	30.00 - 15.00	0.000	0.05	1	1	9.525	9.525		0.33

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert m m m	Azimuth Adjustment t	Placement m	CAAA Front m ²	CAAA Side m ²	Weight kN	
5/8" X 6' Lightning Rod **** **** ****	A	From Leg	0.00 0.00 1.00	0.0000	30.00	No Ice	0.03	0.03	0.03
6m2 AEV (Incl. Antennas, RRUs, and Sidearms) ****	C	None		0.0000	30.00	No Ice	7.64	7.64	6.62
6m2 AEV (Incl. Antennas, RRUs, and Sidearms) ****	C	None		0.0000	28.00	No Ice	6.87	6.87	6.62
1m2 AEV (Incl. MW and pipe mount) ****	B	None		0.0000	22.50	No Ice	1.35	1.35	0.63

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice+1.0 Guy
3	1.2 Dead+1.6 Wind 30 deg - No Ice+1.0 Guy
4	1.2 Dead+1.6 Wind 60 deg - No Ice+1.0 Guy
5	1.2 Dead+1.6 Wind 90 deg - No Ice+1.0 Guy
6	1.2 Dead+1.6 Wind 120 deg - No Ice+1.0 Guy
7	1.2 Dead+1.6 Wind 150 deg - No Ice+1.0 Guy
8	1.2 Dead+1.6 Wind 180 deg - No Ice+1.0 Guy
9	1.2 Dead+1.6 Wind 210 deg - No Ice+1.0 Guy
10	1.2 Dead+1.6 Wind 240 deg - No Ice+1.0 Guy
11	1.2 Dead+1.6 Wind 270 deg - No Ice+1.0 Guy
12	1.2 Dead+1.6 Wind 300 deg - No Ice+1.0 Guy
13	1.2 Dead+1.6 Wind 330 deg - No Ice+1.0 Guy
14	Dead+Wind 0 deg - Service+Guy
15	Dead+Wind 30 deg - Service+Guy
16	Dead+Wind 60 deg - Service+Guy
17	Dead+Wind 90 deg - Service+Guy
18	Dead+Wind 120 deg - Service+Guy
19	Dead+Wind 150 deg - Service+Guy
20	Dead+Wind 180 deg - Service+Guy
21	Dead+Wind 210 deg - Service+Guy
22	Dead+Wind 240 deg - Service+Guy
23	Dead+Wind 270 deg - Service+Guy
24	Dead+Wind 300 deg - Service+Guy
25	Dead+Wind 330 deg - Service+Guy

Maximum Tower Deflections - Service Wind

Section No.	Elevation <i>m</i>	Horz. Deflection <i>mm</i>	Gov. Load Comb.	Tilt <i>°</i>	Twist <i>°</i>
T1	30 - 27	10.90	18	0.0989	0.0118
T2	27 - 21	5.90	18	0.0818	0.0371
T3	21 - 15	0.81	18	0.0203	0.0302

Critical Deflections and Radius of Curvature - Service Wind

Elevation <i>m</i>	Appurtenance	Gov. Load Comb.	Deflection <i>mm</i>	Tilt <i>°</i>	Twist <i>°</i>	Radius of Curvature <i>m</i>
30.00	5/8" X 6' Lightning Rod	18	10.90	0.0989	0.0118	8387
28.00	6m2 AEV (Incl. Antennas, RRUs, and Sidearms)	18	7.44	0.0888	0.0284	6432
26.25	Guy	18	4.89	0.0752	0.0413	4603
22.50	1m2 AEV (Incl. MW and pipe mount)	18	1.52	0.0343	0.0376	6651
21.75	Guy	18	1.13	0.0268	0.0340	7336

Maximum Tower Deflections - Design Wind

Section No.	Elevation m	Horz. Deflection mm	Gov. Load Comb.	Tilt °	Twist °
T1	30 - 27	120.52	6	0.9234	0.1618
T2	27 - 21	73.17	6	0.8161	0.1864
T3	21 - 15	13.07	6	0.3017	0.1273

Critical Deflections and Radius of Curvature - Design Wind

Elevation m	Appurtenance	Gov. Load Comb.	Deflection mm	Tilt °	Twist °	Radius of Curvature m
30.00	5/8" X 6' Lightning Rod	6	120.52	0.9234	0.1618	1166
28.00	6m2 AEV (Incl. Antennas, RRUs, and Sidearms)	6	88.18	0.8638	0.1712	894
26.25	Guy	6	62.76	0.7676	0.1917	635
22.50	1m2 AEV (Incl. MW and pipe mount)	6	22.97	0.4324	0.1569	643
21.75	Guy	6	17.57	0.3643	0.1425	635

Bolt Design Data

Section No.	Elevation m	Component Type	Bolt Grade	Bolt Size mm	Number Of Bolts	Maximum Load per Bolt kN	Allowable Load per Bolt kN	Ratio		Allowable Ratio	Criteria
								Load	Allowable		
T1	30	Leg	ISO 8.8 (N)	16.000	6	6.29	90.48	0.070	✓	1	Bolt Tension
		Diagonal	A325N	15.875	1	25.47	36.23	0.703	✓	1	Member Block Shear
		Horizontal	A325N	15.875	1	8.25	36.23	0.228	✓	1	Member Block Shear
		Top Girt	A325N	15.875	1	8.01	36.23	0.221	✓	1	Member Block Shear
T2	27	Leg	ISO 8.8 (N)	16.000	6	9.65	90.48	0.107	✓	1	Bolt Tension
		Diagonal	A325N	15.875	1	23.15	36.23	0.639	✓	1	Member Block Shear
		Horizontal	A325N	15.875	1	24.38	36.23	0.673	✓	1	Member Block Shear
		Torque Arm Top@26.25	ISO 8.8 (N)	15.875	2	28.71	49.89	0.575	✓	1	Gusset Bearing
T3	21	Torque Arm Bottom@26.25	ISO 8.8 (N)	15.875	2	18.44	60.94	0.302	✓	1	Gusset Bearing
		Leg	ISO 8.8 (N)	16.000	6	6.82	90.48	0.075	✓	1	Bolt Tension
		Diagonal	A325N	15.875	1	12.09	36.23	0.334	✓	1	Member Block Shear
		Horizontal	A325N	15.875	1	1.66	36.23	0.046	✓	1	Member Block Shear

Guy Design Data

Section No.	Elevation m	Size	Initial Tension kN	Breaking Load kN	Actual T_u kN	Allowable ϕT_n kN	Required S.F.	Actual S.F.
T2	26.25 (A)	5/8 EHS	18.86	188.60	64.93	113.16	1.000	1.743 ✓

Section No.	Elevation m	Size	Initial Tension kN	Breaking Load kN	Actual T_u kN	Allowable ϕT_n kN	Required S.F.	Actual S.F.
	(142)							
	26.25 (A)	5/8 EHS	18.86	188.60	67.15	113.16	1.000	1.685 ✓
	(143)							
	26.25 (B)	5/8 EHS	18.86	188.60	66.53	113.16	1.000	1.701 ✓
	(136)							
	26.25 (B)	5/8 EHS	18.86	188.60	67.87	113.16	1.000	1.667 ✓
	(137)							
	26.25 (C)	5/8 EHS	18.86	188.60	67.20	113.16	1.000	1.684 ✓
	(130)							
	26.25 (C)	5/8 EHS	18.86	188.60	65.55	113.16	1.000	1.726 ✓
	(131)							
	21.75 (A)	5/8 EHS	18.86	188.60	34.54	113.16	1.000	3.276 ✓
	(150)							
	21.75 (B)	5/8 EHS	18.86	188.60	35.63	113.16	1.000	3.176 ✓
	(149)							
	21.75 (C)	5/8 EHS	18.86	188.60	35.74	113.16	1.000	3.166 ✓
	(148)							

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation m	Size	L m	L_u m	Kl/r	A mm ²	Mast Stability Index	P_u kN	ϕP_n kN	Ratio $\frac{P_u}{\phi P_n}$
T1	30 - 27	Pipe 1.9"x 0.197" (1.5"x5mm)	3.00	0.75	48.7 K=1.00	679.52 8	1.00	-113.31	177.25	0.639 ¹ ✓
T2	27 - 21	Pipe 1.9"x 0.197" (1.5"x5mm)	6.00	0.75	48.7 K=1.00	679.52 8	1.00	-175.68	177.25	0.991 ¹ ✓
T3	21 - 15	Pipe 1.9"x 0.197" (1.5"x5mm)	6.00	0.75	48.7 K=1.00	679.52 8	1.00	-163.09	177.25	0.920 ¹ ✓

¹ $P_u / \phi P_n$ controls

Diagonal Design Data (Compression)

Section No.	Elevation m	Size	L m	L_u m	Kl/r	A mm ²	P_u kN	ϕP_n kN	Ratio $\frac{P_u}{\phi P_n}$
T1	30 - 27	2L 40 x 40 x 4 (5)	1.10	0.96	79.6 K=1.00	608.00 0	-26.34	97.28	0.271 ¹ ✓
T2	27 - 21	2L 'a' > 458.284 mm - 14 2L 40 x 40 x 4 (5)	1.10	0.96	79.6 K=1.00	608.00 0	-24.87	97.28	0.256 ¹ ✓
T3	21 - 15	2L 'a' > 458.284 mm - 77 2L 40 x 40 x 4 (5)	1.10	0.96	79.6 K=1.00	608.00 0	-14.05	97.28	0.144 ¹ ✓
		2L 'a' > 458.284 mm - 122							

¹ $P_u / \phi P_n$ controls

Horizontal Design Data (Compression)

Section No.	Elevation <i>m</i>	Size	<i>L</i> <i>m</i>	<i>L_u</i> <i>m</i>	<i>Kl/r</i>	<i>A</i> <i>mm</i> ²	<i>P_u</i> <i>kN</i>	ϕP_n <i>kN</i>	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	2L 40 x 40 x 4 (5)	0.80	0.68	56.4 K=1.00	608.00 0	-8.68	114.86	0.076 ¹ ✓
T2	27 - 21	2L 'a' > 324.787 mm - 12 2L 40 x 40 x 4 (5) 2L 'a' > 324.787 mm - 73	0.80	0.68	56.4 K=1.00	608.00 0	-21.41	114.86	0.186 ¹ ✓

¹ $P_u / \phi P_n$ controls

Top Girt Design Data (Compression)

Section No.	Elevation <i>m</i>	Size	<i>L</i> <i>m</i>	<i>L_u</i> <i>m</i>	<i>Kl/r</i>	<i>A</i> <i>mm</i> ²	<i>P_u</i> <i>kN</i>	ϕP_n <i>kN</i>	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	2L 40 x 40 x 4 (5) 2L 'a' > 324.787 mm - 5	0.80	0.68	56.4 K=1.00	608.00 0	-8.00	114.86	0.070 ¹ ✓

¹ $P_u / \phi P_n$ controls

Torque-Arm Bottom Design Data

Section No.	Elevation <i>m</i>	Size	<i>L</i> <i>m</i>	<i>L_u</i> <i>m</i>	<i>Kl/r</i>	<i>A</i> <i>mm</i> ²	<i>P_u</i> <i>kN</i>	ϕP_n <i>kN</i>	Ratio $\frac{P_u}{\phi P_n}$ ¹
T2	27 - 21 (134)	2L2x2x3/8x1/2	0.80	0.66	43.5 K=1.00	1754.0 29	-35.83	354.76	0.101 ¹ ✓
T2	27 - 21 (135)	2L 'a' > 322.175 mm - 134 2L2x2x3/8x1/2	0.80	0.66	43.5 K=1.00	1754.0 29	-36.18	354.76	0.102 ¹ ✓
T2	27 - 21 (140)	2L 'a' > 322.175 mm - 135 2L2x2x3/8x1/2	0.80	0.66	43.5 K=1.00	1754.0 29	-36.47	354.76	0.103 ¹ ✓
T2	27 - 21 (141)	2L 'a' > 322.175 mm - 140 2L2x2x3/8x1/2	0.80	0.66	43.5 K=1.00	1754.0 29	-36.31	354.76	0.102 ¹ ✓
T2	27 - 21 (146)	2L 'a' > 322.175 mm - 141 2L2x2x3/8x1/2	0.80	0.66	43.5 K=1.00	1754.0 29	-36.87	354.76	0.104 ¹ ✓
T2	27 - 21 (147)	2L 'a' > 322.175 mm - 146 2L2x2x3/8x1/2 2L 'a' > 322.175 mm - 147	0.80	0.66	43.5 K=1.00	1754.0 29	-35.44	354.76	0.100 ¹ ✓

¹ $P_u / \phi P_n$ controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation m	Size	L m	L _u m	Kl/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	Pipe 1.9"x 0.197" (1.5"x5mm)	3.00	0.75	48.7	679.52 8	57.90	210.83	0.275 ¹ ✓
T2	27 - 21	Pipe 1.9"x 0.197" (1.5"x5mm)	6.00	0.75	48.7	679.52 8	56.78	210.83	0.269 ¹ ✓

¹ P_u / φP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation m	Size	L m	L _u m	Kl/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	2L 40 x 40 x 4 (5)	1.10	0.96	83.7	341.70 0	25.47	102.48	0.249 ¹ ✓
T2	27 - 21	2L 'a' > 458.284 mm - 14 2L 40 x 40 x 4 (5)	1.10	0.96	83.7	341.70 0	23.15	102.48	0.226 ¹ ✓
T3	21 - 15	2L 'a' > 458.284 mm - 77 2L 40 x 40 x 4 (5) 2L 'a' > 458.284 mm - 128	1.10	0.96	83.7	341.70 0	12.09	102.48	0.118 ¹ ✓

¹ P_u / φP_n controls

Horizontal Design Data (Tension)

Section No.	Elevation m	Size	L m	L _u m	Kl/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	2L 40 x 40 x 4 (5)	0.80	0.68	61.1	341.70 0	8.25	102.48	0.080 ¹ ✓
T2	27 - 21	2L 'a' > 324.787 mm - 12 2L 40 x 40 x 4 (5)	0.80	0.68	61.1	341.70 0	24.38	102.48	0.238 ¹ ✓
T3	21 - 15	2L 'a' > 324.787 mm - 75 2L 40 x 40 x 4 (5) 2L 'a' > 324.787 mm - 113	0.80	0.68	61.1	341.70 0	1.66	102.48	0.016 ¹ ✓

¹ P_u / φP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation m	Size	L m	L _u m	Kl/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$ ¹
T1	30 - 27	2L 40 x 40 x 4 (5)	0.80	0.68	61.1	341.70	8.01	102.48	0.078 ¹

Section No.	Elevation m	Size	L m	L _u m	KI/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$
		2L 'a' > 324.787 mm - 5				0			✓

¹ P_u / φP_n controls

Torque-Arm Top Design Data

Section No.	Elevation m	Size	L m	L _u m	KI/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$
T2	27 - 21 (132)	2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	56.51	391.83	0.144 ¹ ✓
T2	27 - 21 (133)	2L 'a' > 751.361 mm - 132 2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	57.41	391.83	0.147 ¹ ✓
T2	27 - 21 (138)	2L 'a' > 751.361 mm - 133 2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	55.60	391.83	0.142 ¹ ✓
T2	27 - 21 (139)	2L 'a' > 751.361 mm - 138 2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	55.15	391.83	0.141 ¹ ✓
T2	27 - 21 (144)	2L 'a' > 751.361 mm - 139 2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	55.85	391.83	0.143 ¹ ✓
T2	27 - 21 (145)	2L 'a' > 751.361 mm - 144 2L2x2x3/8x1/2	1.70	1.53	109.3	1754.0 29	56.85	391.83	0.145 ¹ ✓
		2L 'a' > 751.361 mm - 145							✓

¹ P_u / φP_n controls

Torque-Arm Bottom Design Data

Section No.	Elevation m	Size	L m	L _u m	KI/r	A mm ²	P _u kN	φP _n kN	Ratio $\frac{P_u}{\phi P_n}$
T2	27 - 21 (134)	2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	24.33	391.83	0.062 ¹ ✓
T2	27 - 21 (135)	2L 'a' > 322.175 mm - 134 2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	24.55	391.83	0.063 ¹ ✓
T2	27 - 21 (140)	2L 'a' > 322.175 mm - 135 2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	25.32	391.83	0.065 ¹ ✓
T2	27 - 21 (141)	2L 'a' > 322.175 mm - 140 2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	25.14	391.83	0.064 ¹ ✓
T2	27 - 21 (146)	2L 'a' > 322.175 mm - 141 2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	24.90	391.83	0.064 ¹ ✓
T2	27 - 21 (147)	2L 'a' > 322.175 mm - 146 2L2x2x3/8x1/2	0.80	0.66	51.5	1754.0 29	25.13	391.83	0.064 ¹ ✓
		2L 'a' > 322.175 mm - 147							✓

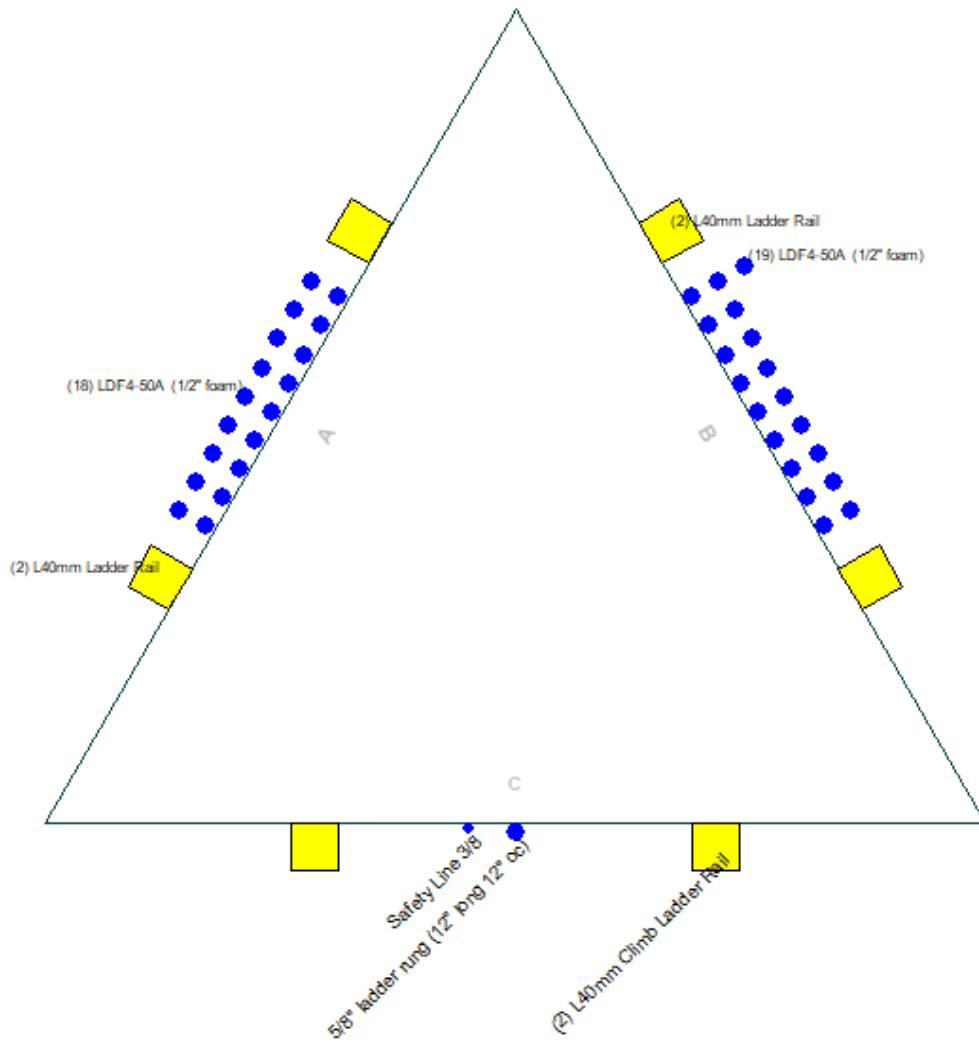
Section No.	Elevation m	Size	L m	L_u m	Kl/r	A mm^2	P_u kN	ϕP_n kN	Ratio $\frac{P_u}{\phi P_n}$
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¹ $P_u / \phi P_n$ controls

Section Capacity Table

Section No.	Elevation m	Component Type	Size	Critical Element	P kN	ϕP_{allow} kN	% Capacity	Pass Fail	
T1	30 - 27	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	2	-113.31	177.25	63.9	Pass	
T2	27 - 21	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	29	-175.68	177.25	99.1	Pass	
T3	21 - 15	Leg	Pipe 1.9"x 0.197" (1.5"x5mm)	80	-163.09	177.25	92.0	Pass	
T1	30 - 27	Diagonal	2L 40 x 40 x 4 (5)	14	-26.34	97.28	27.1	Pass	
							70.3 (b)		
T2	27 - 21	Diagonal	2L 40 x 40 x 4 (5)	77	-24.87	97.28	25.6	Pass	
							63.9 (b)		
T3	21 - 15	Diagonal	2L 40 x 40 x 4 (5)	122	-14.05	97.28	14.4	Pass	
							33.4 (b)		
T1	30 - 27	Horizontal	2L 40 x 40 x 4 (5)	12	8.25	102.48	8.0	Pass	
							22.8 (b)		
T2	27 - 21	Horizontal	2L 40 x 40 x 4 (5)	75	24.38	102.48	23.8	Pass	
							67.3 (b)		
T3	21 - 15	Horizontal	2L 40 x 40 x 4 (5)	113	1.66	102.48	1.6	Pass	
							4.6 (b)		
T1	30 - 27	Top Girt	2L 40 x 40 x 4 (5)	5	8.01	102.48	7.8	Pass	
							22.1 (b)		
T2	27 - 21	Guy A@26.25	5/8	143	67.15	113.16	59.3	Pass	
		Guy A@21.75	5/8	150	34.54	113.16	30.5	Pass	
T2	27 - 21	Guy B@26.25	5/8	137	67.87	113.16	60.0	Pass	
		Guy B@21.75	5/8	149	35.63	113.16	31.5	Pass	
T2	27 - 21	Guy C@26.25	5/8	130	67.20	113.16	59.4	Pass	
		Guy C@21.75	5/8	148	35.74	113.16	31.6	Pass	
T2	27 - 21	Torque Arm Top@26.25	2L2x2x3/8x1/2	133	57.41	391.83	14.7	Pass	
							57.5 (b)		
T2	27 - 21	Torque Arm Bottom@26.25	2L2x2x3/8x1/2	146	-36.87	354.76	10.4	Pass	
							30.2 (b)		
							Summary		
							Leg (T2)	99.1	Pass
							Diagonal (T1)	70.3	Pass
							Horizontal (T2)	67.3	Pass
							Top Girt (T1)	22.1	Pass
							Guy A (T2)	59.3	Pass
							Guy B (T2)	60.0	Pass
							Guy C (T2)	59.4	Pass
							Torque Arm Top (T2)	57.5	Pass
							Torque Arm Bottom (T2)	30.2	Pass
							Bolt Checks	70.3	Pass
							RATING =	99.1	Pass

APPENDIX B BASE LEVEL DRAWING

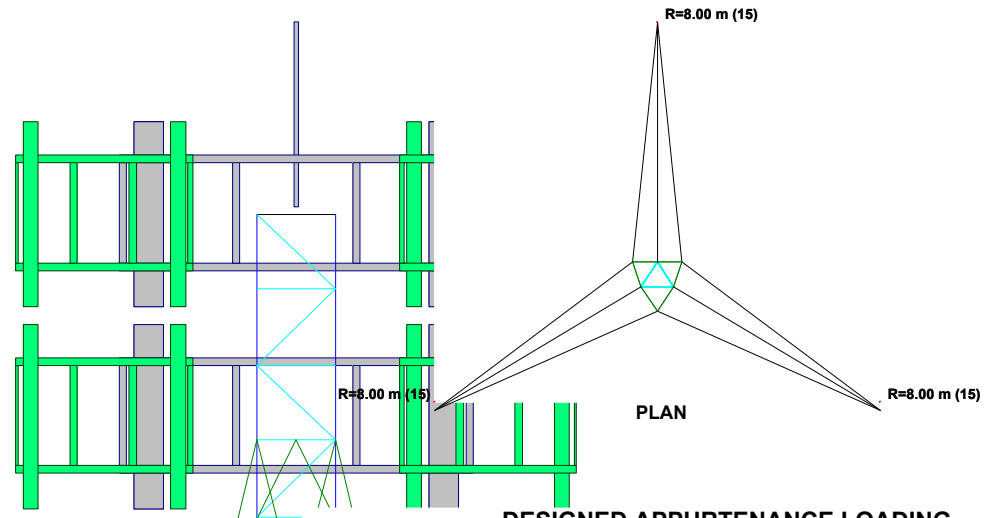


STANDARD CONDITIONS FOR FURNISHING OF PROFESSIONAL ENGINEERING SERVICES ON EXISTING STRUCTURES BY PAUL J. FORD AND COMPANY

- 1) Paul J. Ford and Company has not performed a site visit to verify the tower member sizes or the antenna/coax loading. If the existing conditions are not as represented on these drawings, we should be contacted immediately to evaluate the significance of the deviation.
- 2) No allowance was made for any damaged, missing, or rusted members. The analysis of this tower assumes that no physical deterioration has occurred in any of the structural components of the tower and that all the tower members have the same load carrying capacity as the day the tower was erected.
- 3) It is not possible to have all the very detailed information to perform a very thorough analysis of every structural sub-component of an existing tower. The structural analysis by Paul J. Ford and Company verifies the adequacy of the main structural members of the tower. Paul J. Ford and Company provides a limited scope of service in that we cannot verify the adequacy of every weld, plate connection detail, etc.
- 4) The structural integrity of the existing tower foundation can only be verified if exact foundation conditions are known. Paul J. Ford and Company will not accept any responsibility for the adequacy of the existing foundations unless the foundation conditions are provided.
- 5) This tower has been analyzed according to the minimum design wind loads recommended by the Telecommunications Industry Association Standard ANSI/TIA-222-G. If the owner or local or state agencies require a higher design wind load, Paul J. Ford and Company should be made aware of this requirement.
- 6) The attached sketches are a schematic representation of the tower that we have analyzed. If any material is fabricated from these sketches, the contractor shall be responsible for field verifying the existing conditions and for the proper fit and clearance in the field.
- 7) Miscellaneous items such as antenna mounts etc. have not been designed or detailed as a part of our work. We recommend that material of adequate size and strength be purchased from a reputable tower manufacturer.

APPENDIX C
ADDITIONAL CALCULATIONS

Section	T1		1.7
Legs	Pipe 1.9" x 0.197" (1.5"x5mm)		
Leg Grade	A572-50		
Diagonals	2L 40 x 40 x 4 (5)		
Diagonal Grade	A36		
Top Girts	N.A.		
Horizontals	2L 40 x 40 x 4 (5)		5.6
Face Width (m)	0.8		
# Panels @ (m)	20 @ 0.75		21.8 m
Weight (kN)	10.7		3.4
			21.0 m
			26.3 m
			27.0 m
			30.0 m



DESIGNED APPURTENANCE LOADING

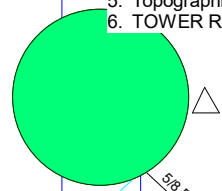
TYPE	ELEVATION	TYPE	ELEVATION
5/8" X 6' Lightning Rod	30	6m2 AEV (Incl. Antennas, RRUs, and Sidearms)	28
6m2 AEV (Incl. Antennas, RRUs, and Sidearms)	30	1m2 AEV (Incl. MW and pipe mount)	22.5

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	345 MPa	448 MPa	A36	248 MPa	400 MPa

TOWER DESIGN NOTES

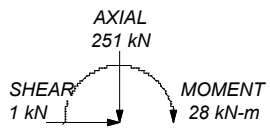
1. Tower designed for Exposure C to the TIA-222-G Standard.
2. Tower designed for a 193 kph basic wind in accordance with the TIA-222-G Standard.
3. Deflections are based upon a 97 kph wind.
4. Tower Structure Class II.
5. Topographic Category 1 with Crest Height of 0.00 m
6. TOWER RATING: 99.1%



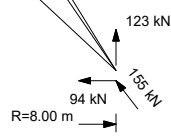
ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
 DOWN: 124 kN
 SHEAR: 2 kN

UPLIFT: 0 kN
 SHEAR: 0 kN

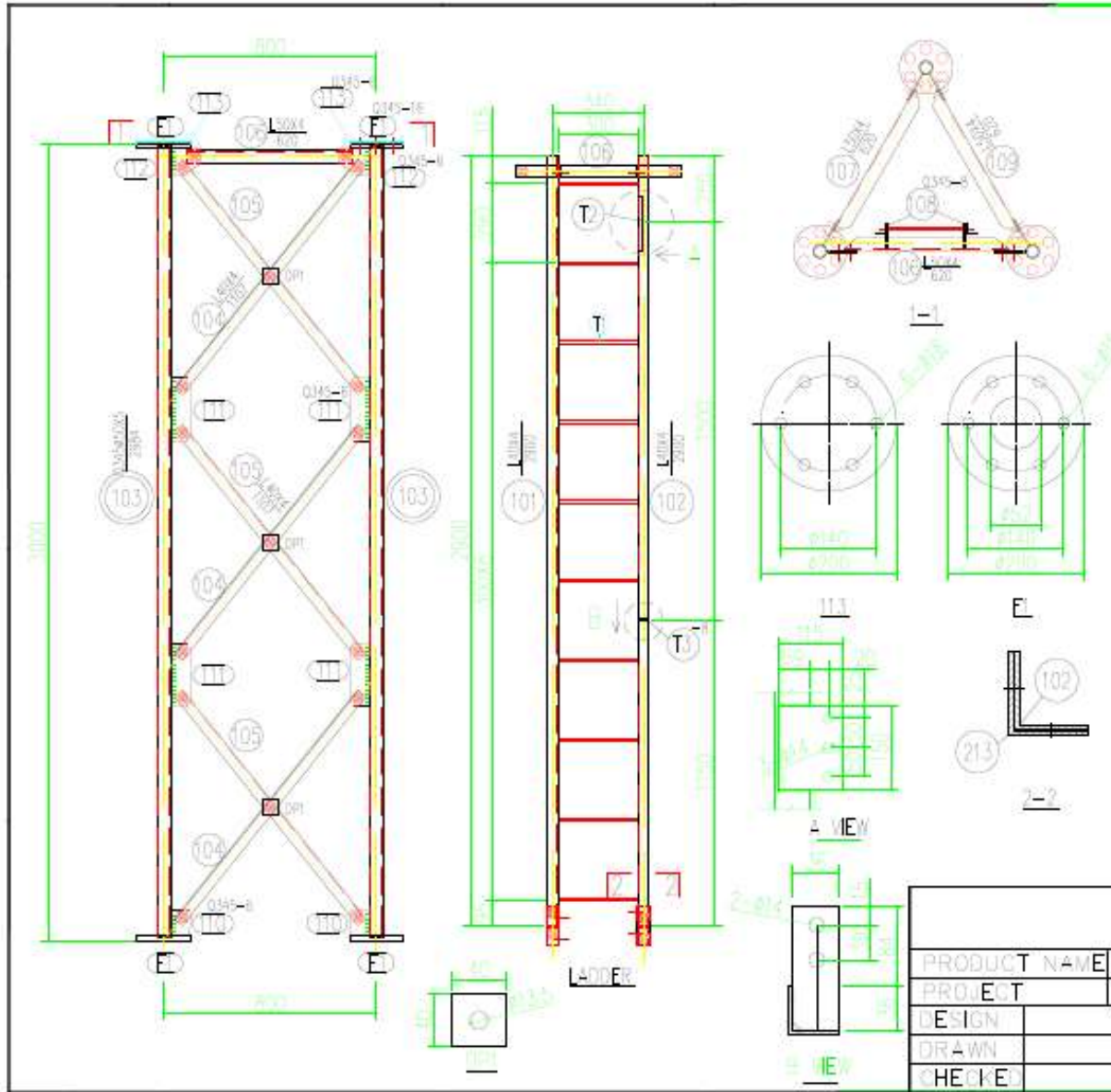


TORQUE 2 kN-m
 REACTIONS - 193 kph WIND



ALL REACTIONS ARE FACTORED

Paul J. Ford and Company 250 East Broad St., Suite 600 Columbus, OH 43215 Phone: (614) 221-6679 FAX:	Job: 15m Rooftop Tower - Dominican Republic		
	Project: PJF 00018-0473.001.8700		
	Client: CJC	Drawn by: mlenk	App'd:
	Code: TIA-222-G	Date: 08/23/18	Scale: NTS
	Path:	Dwg No. E-1	



BILL OF MATERIAL

NO.	DESCRIPTION	LENGTH (M)	QTY	WEIGHT (KG)		REMARKS
				NET	TOTAL	
F1	2040-1000	200	4	5.20	20.80	B
F2	L40x4	2050	1	7.00	7.00	
F3	L50x4	2000	1	7.00	7.00	
F4	F50x5	2004	3	18.00	54.00	
F5	L40x4	1100	8	3.48	27.84	
F6	L50x4	1100	8	3.48	27.84	C,T
F7	L50x4	600	1	1.90	1.90	C,T
F8	L50x4	620	1	1.90	1.90	C,T
F9	2040-1000	100	2	0.00	0.00	B
F10	L50x4	620	1	1.90	1.90	C,T
F11	2040-1000	95	4	0.31	1.24	B
F12	2040-1000	130	12	0.66	7.92	B
F13	2040-1000	110	8	0.58	4.64	B
F14	2040-1000	200	3	1.66	4.98	
T	#10	320	10	0.5	5.00	B
T	#12	115	1	0.1	0.10	B
T	#12	40	1	0.3	0.30	B
DPT	#3/4"	40	12	0.50	6.00	
TOTAL WEIGHT					162.14	

BOLT LIST

SIZE	GRADE	DESCRIPTION	QTY	UNIT	WEIGHT (KG)	REMARKS	
BOLT	8.8	W8x80	18	KG	144.00	T, B, HE	
		M12x50	55	KG	660.00		
TOTAL WEIGHT					804.00		

PRODUCT NAME		15M/18M/21M CUY TYPE - E.T.M.C	
PROJECT			
DESIGN		APPROVED	
DRAWN		DRAWING NO	
CHECKED		REVISION / DATE	