SUBMITTAL TO THE BOARD OF SUPERVISORS
COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

ITEM
3.8
(ID # 6529)

MEETING DATE:
Tuesday, March 20, 2018

FROM : RIVERSIDE COUNTY INFORMATION TECHNOLOGY:

SUBJECT: RIVERSIDE COUNTY INFORMATION TECHNOLOGY - PSEC: Approval of the Service Agreement with JTD Consulting, Inc., for Tower Inspections, and Transmission Line Sweep Services from March 20, 2018 to June 30, 2019. [All Districts]; [Total cost $300,000 aggregate [RCIT/PSEC operating budgets - 100%].

RECOMMENDED MOTION: That the Board of Supervisors:

1. Approve the Service Agreement for Tower Inspections and Transmission Lines Sweep Services with JTD Consulting, Inc. dba Wireless Infrastructure Services, for $300,000 aggregate total from March 20, 2018 to June 30, 2019, and authorize the Chairman of the Board to execute the same on behalf of the County; and
2. Authorize the Purchasing Agent, in accordance with Ordinance No. 459, based on the availability of funding and as approved by County Counsel, to sign amendments that do not change the substantive terms of the agreement.

ACTION: Policy

Dave Rogers, Chief Information Officer 3/8/2018

MINUTES OF THE BOARD OF SUPERVISORS

On motion of Supervisor Tavaglione, seconded by Supervisor Perez and duly carried by unanimous vote, IT WAS ORDERED that the above matter is approved as recommended.

Ayes:	Jeffries, Tavaglione, Washington, Perez and Ashley
Nays:	None
Absent:	None
Date:	March 20, 2018
xc:	RCIT, Purchasing

Kecia Harper-Ihem
Clerk of the Board
By: _____ Deputy

SUBMITTAL TO THE BOARD OF SUPERVISORS COUNTY OF RIVERSIDE, STATE OF CALIFORNIA

FINANCIAL DATA	Current Fiscal Year:	Next Fiscal Year:	Total Cost:	Ongoing Cost
COST	$ 150,000	$ 150,000	$300,000	$
NET COUNTY COST	$ 150,000	$	$	$

SOURCE OF FUNDS: PSEC operating budget (45520 – 100%	**Budget Adjustment:** No
	For Fiscal Year: 17/18 18/19

C.E.O. RECOMMENDATION: [CEO use]

BACKGROUND:

Summary

PSEC tower inspections and antenna sweeps are required to keep the Public Safety radio system compliant with industry standards. The inspections and antenna sweeps ensure the proper operation and viability of the Public Safety Radio system serving first responders across the County of Riverside

BACKGROUND:

Summary (continued)

The tower inspections and antenna system sweeps shall be inclusive of all seventy-two PSEC sites providing public safety coverage to approximately 5500 users over the County of Riverside, covering 7280 square miles, and serving the 2.3 million plus resident population and visitors. Tower Inspections and antenna sweeps are required every five years at a minimum so that towers, antennas, and equipment continue in compliance with industry and County standards. The inspections and antenna system sweeps will be done in two phases by the County and Contractor to meet these requirements and identify any issues to remediate.

Impact on Residents and Businesses

Public Safety Radio traffic audio quality affects everyone in Riverside County. All of us depend on the Public Safety Infrastructure to keep us safe and deliver essential life-saving security and medical services to our communities.

Additional Fiscal Information

There are no net county costs and no budget adjustment is required.

Contract History and Price Reasonableness

The Purchasing Department, on behalf of PSEC, issued a bid, Request for Quote (RFQ) PEARC-034, for Tower Inspections, Transmission Line Sweep, and Mapping (optional) Services. The bid was posted publicly on PublicPurchase.com website to over one hundred firms with six companies attending the mandatory pre-bid meeting and four companies

responded to the RFQ. Prices ranged from $300,000 to $766,500 aggregate for Tower Inspection and Transmission Line Sweeps. PSEC Project Managers reviewed the pricing and the information provided by all bidders in response to the RFQ and determined JTD Infrastructure, Inc., to be the lowest responsive responsible bidder for an inclusive award for services needed at the PSEC tower locations.
The contract is being awarded to the lowest responsive and responsible bidder out of four responses. The contract is within the FY17\18 and FY18\19 internal budget for the RCIT\PSEC Public Safety radio division.

ATTACHMENTS:
Service Agreement – JTD Consulting, Inc.
Attachment B- Tower Site List and Inspection FY 17/18
Exhibit C - Site Check List – Maintenance and Condition Assessment
Exhibit D - PSEC RF Parameters System Manual
Exhibit E - County of Riverside Installation Standards
Exhibit F - PSEC 700 Voice Antenna System Commissioning Guide
Exhibit G - Example Structural Analysis Report)
Exhibit H - Example Site Pictures

Chet Ashbaugh, Chairman of the PSEC Steering Committee 3/12/2018

Teresa Summers, Director of Purchasing 3/9/2018

Gregory P. Priamos, Director County Counsel 3/12/2018

SERVICE AGREEMENT

for

TOWER INSPECTIONS AND TRANSMISSION LINES SWEEP SERVICES

between

COUNTY OF RIVERSIDE

and

JTD CONSULTING INC., DBA WIRELESS INFRASTRUCTURE SERVICES

MAR 2 0 2018 3.8

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This Agreement, made and entered into this 13th day of March 2018, by and between JTD Consulting, Inc., dba Wireless Infrastructure Services, a California corporation, (herein referred to as "CONTRACTOR"), and the COUNTY OF RIVERSIDE, a political subdivision of the State of California, (herein referred to as "COUNTY"). The parties agree as follows:

1. Description of Services

1.1 CONTRACTOR shall provide all services as outlined and specified in Exhibit A, Scope of Services, and Attachment A, General Requirements, at the prices stated in Exhibit B, Cost Sheet.

1.2 CONTRACTOR represents that it has the skills, experience, and knowledge necessary to perform under this Agreement and the COUNTY relies upon this representation. CONTRACTOR shall perform to the satisfaction of the COUNTY and in conformance to and consistent with the highest standards of firms/professionals in the same discipline in the State of California.

1.3 CONTRACTOR affirms this it is fully apprised of all of the work to be performed under this Agreement; and the CONTRACTOR agrees it can properly perform this work at the prices stated in Exhibit B. CONTRACTOR is not to perform services or provide products outside of the Agreement.

1.4 Acceptance by the COUNTY of the CONTRACTOR's performance under this Agreement does not operate as a release of CONTRACTOR's responsibility for full compliance with the terms of this Agreement.

2. Period of Performance

2.1 This Agreement shall be effective upon signature of this Agreement by both parties and continues in effect through June 30, 2019, unless terminated earlier. CONTRACTOR shall commence performance upon signature of this Agreement by both parties and shall diligently and continuously perform thereafter. The Riverside County Board of Supervisors is the only authority that may obligate the County for a non-cancelable multi-year agreement.

3. Compensation

3.1 The COUNTY shall pay the CONTRACTOR for services performed, products provided and expenses incurred in accordance with the terms of Exhibit B, Payment Provisions. Maximum payments by COUNTY to CONTRACTOR shall not exceed three hundred thousand dollars ($300,000) aggregate, including all expenses. The COUNTY is not responsible for any fees or costs incurred above or beyond the contracted amount and shall have no obligation to purchase any specified amount of services or products. Unless otherwise specifically stated in Exhibit B, COUNTY shall not be responsible for payment of any of CONTRACTOR's expenses related to this Agreement.

3.2 No price increases will be permitted during the first year of this Agreement (If applicable). All price decreases (for example, if CONTRACTOR offers lower prices to another governmental entity) will automatically be extended to the COUNTY. The COUNTY requires written proof satisfactory to COUNTY of cost increases prior to any approved price adjustment. After the first year of the award, a minimum of 30-days advance notice in writing is required to be considered and approved by COUNTY. No retroactive price adjustments will be considered. Any price increases must be stated in a written amendment to this Agreement. The net dollar amount of profit will remain firm during the period of the Agreement. Annual increases shall not exceed the Consumer Price Index- All Consumers, All Items - Greater Los Angeles, Riverside and Orange County areas and be subject to satisfactory performance review by the COUNTY and approved (if needed) for budget funding by the Board of Supervisors.

3.3 CONTRACTOR shall be paid only in accordance with an invoice submitted to COUNTY by CONTRACTOR and COUNTY shall pay the acceptable invoice within **thirty (30) working days** from the date of receipt of the invoice. Payment shall be made to CONTRACTOR only after services have been rendered or delivery of materials or products, and acceptance has been made by COUNTY. Prepare invoices in duplicate. For this Agreement, send the original invoice to:

Riverside County Information Technology
Attn: Accounts Payable
3450 14th Street, Fourth Floor
Riverside, CA 92501

a) Invoice shall contain a minimum of the following information: invoice number and date; remittance address; bill-to and ship-to addresses of ordering department/division; Agreement number #PEARC-91365-001-03/19; quantities; item descriptions, unit prices, extensions, sales/use tax if applicable, and an invoice total.

b) Invoices shall be rendered monthly in arrears.

3.4 The COUNTY obligation for payment of this Agreement beyond the current fiscal year end is contingent upon and limited by the availability of COUNTY funding from which payment can be made, and invoices shall be rendered "monthly" in arrears. In the State of California, Government agencies are not allowed to pay excess interest and late charges, per Government Codes, Section 926.10. No legal liability on the part of the COUNTY shall arise for payment beyond June 30 of each calendar year unless funds are made available for such payment. In the event that such funds are not forthcoming for any reason,

COUNTY shall immediately notify CONTRACTOR in writing; and this Agreement shall be deemed terminated, have no further force, and effect.

4. Alteration or Changes to the Agreement

4.1 The Board of Supervisors and the COUNTY Purchasing Agent and/or his designee is the only authorized COUNTY representatives who may at any time, by written order, alter this Agreement. If any such alteration causes an increase or decrease in the cost of, or the time required for the performance under this Agreement, an equitable adjustment shall be made in the Agreement price or delivery schedule, or both, and the Agreement shall be modified by written amendment accordingly.

4.2 Any claim by the CONTRACTOR for additional payment related to this Agreement shall be made in writing by the CONTRACTOR within 30 days of when the CONTRACTOR has or should have notice of any actual or claimed change in the work, which results in additional and unanticipated cost to the CONTRACTOR. If the COUNTY Purchasing Agent decides that the facts provide sufficient justification, he may authorize additional payment to the CONTRACTOR pursuant to the claim. Nothing in this section shall excuse the CONTRACTOR from proceeding with performance of the Agreement even if there has been a change.

5. Termination

5.1. COUNTY may terminate this Agreement without cause upon 30 days written notice served upon the CONTRACTOR stating the extent and effective date of termination.

5.2 COUNTY may, upon five (5) days written notice terminate this Agreement for CONTRACTOR's default, if CONTRACTOR refuses or fails to comply with the terms of this Agreement or fails to make progress that may endanger performance and does not immediately cure such failure. In the event of such termination, the COUNTY may proceed with the work in any manner deemed proper by COUNTY.

5.3 After receipt of the notice of termination, CONTRACTOR shall:

(a) Stop all work under this Agreement on the date specified in the notice of termination; and

(b) Transfer to COUNTY and deliver in the manner as directed by COUNTY any materials, reports or other products, which, if the Agreement had been completed or continued, would have been required to be furnished to COUNTY.

5.4 After termination, COUNTY shall make payment only for CONTRACTOR's performance up to the date of termination in accordance with this Agreement.

5.5 CONTRACTOR's rights under this Agreement shall terminate (except for fees accrued prior to the date of termination) upon dishonesty or a willful or material breach of this Agreement by CONTRACTOR; or in the event of CONTRACTOR's unwillingness or inability for any reason whatsoever to perform the terms of this Agreement. In such event, CONTRACTOR shall not be entitled to any further compensation under this Agreement.

5.6 If the Agreement is federally or State funded, CONTRACTOR cannot be debarred from the System for Award Management (SAM). CONTRACTOR must notify the COUNTY immediately of a debarment. Reference: System for Award Management (SAM) at https://www.sam.gov for Central Contractor Registry (CCR), Federal Agency Registration (Fedreg), Online Representations and Certifications Application, and Excluded Parties List System (EPLS)). Excluded Parties Listing System (EPLS) (http://www.epls.gov) (Executive Order 12549, 7 CFR Part 3017, 45 CFR Part 76, and 44 CFR Part 17). The System for Award Management (SAM) is the Official U.S. Government system that consolidated the capabilities of CCR/FedReg, ORCA, and EPLS.

5.7 The rights and remedies of COUNTY provided in this section shall not be exclusive and are in addition to any other rights and remedies provided by law or this Agreement.

6. Ownership/Use of Contract Materials and Products

The CONTRACTOR agrees that all materials, reports or products in any form, including electronic, created by CONTRACTOR for which CONTRACTOR has been compensated by COUNTY pursuant to this Agreement shall be the sole property of the COUNTY. The material, reports or products may be used by the COUNTY for any purpose that the COUNTY deems to be appropriate, including, but not limit to, duplication and/or distribution within the COUNTY or to third parties. CONTRACTOR agrees not to release or circulate in whole or part such materials, reports, or products without prior written authorization of the COUNTY.

7. Conduct of Contractor

7.1 The CONTRACTOR covenants that it presently has no interest, including, but not limited to, other projects or contracts, and shall not acquire any such interest, direct or indirect, which would conflict in any manner or degree with CONTRACTOR's performance under this Agreement. The CONTRACTOR further covenants that no person or subcontractor having any such interest shall be employed or retained by CONTRACTOR under this Agreement. The CONTRACTOR agrees to inform the COUNTY of all the CONTRACTOR's interests, if any, which are or may be perceived as incompatible with the COUNTY's interests.

7.2 The CONTRACTOR shall not, under circumstances which could be interpreted as an attempt to influence the recipient in the conduct of his/her duties, accept any gratuity or special favor from individuals or firms with whom the CONTRACTOR is doing business or proposing to do business, in accomplishing the work under this Agreement.

7.3 The CONTRACTOR or its employees shall not offer gifts, gratuity, favors, and entertainment directly or indirectly to COUNTY employees.

8. Inspection of Service; Quality Control/Assurance

8.1 All performance (which includes services, workmanship, materials, supplies and equipment furnished or utilized in the performance of this Agreement) shall be subject to inspection and test by the COUNTY or other regulatory agencies at all times. The CONTRACTOR shall provide adequate cooperation to any inspector or other COUNTY representative to permit him/her to determine the CONTRACTOR's conformity with the terms of this Agreement. If any services performed or products provided by CONTRACTOR are not in conformance with the terms of this Agreement, the COUNTY shall have the right to require the CONTRACTOR to perform the services or provide the products in conformance with the terms of the Agreement at no additional cost to the COUNTY. When the services to be performed or the products to be provided are of such nature that the difference cannot be corrected; the COUNTY shall have the right to: (1) require the CONTRACTOR immediately to take all necessary steps to ensure future performance in conformity with the terms of the Agreement; and/or (2) reduce the Agreement price to reflect the reduced value of the services performed or products provided. The COUNTY may also terminate this Agreement for default and charge to CONTRACTOR any costs incurred by the COUNTY because of the CONTRACTOR's failure to perform.

8.2 CONTRACTOR shall establish adequate procedures for self-monitoring and quality control and assurance to ensure proper performance under this Agreement; and shall permit a COUNTY representative or other regulatory official to monitor, assess, or evaluate CONTRACTOR's performance under this Agreement at any time, upon reasonable notice to the CONTRACTOR.

9. Independent Contractor/Employment Eligibility

9.1 The CONTRACTOR is, for purposes relating to this Agreement, an independent contractor and shall not be deemed an employee of the COUNTY. It is expressly understood and agreed that the CONTRACTOR (including its employees, agents, and subcontractors) shall in no event be entitled to any benefits to which COUNTY employees are entitled, including but not limited to overtime, any retirement benefits, worker's compensation benefits, and injury leave or other leave benefits. There shall be no

employer-employee relationship between the parties; and CONTRACTOR shall hold COUNTY harmless from any and all claims that may be made against COUNTY based upon any contention by a third party that an employer-employee relationship exists by reason of this Agreement. It is further understood and agreed by the parties that CONTRACTOR in the performance of this Agreement is subject to the control or direction of COUNTY merely as to the results to be accomplished and not as to the means and methods for accomplishing the results.

9.2 CONTRACTOR warrants that it shall make its best effort to fully comply with all federal and state statutes and regulations regarding the employment of aliens and others and to ensure that employees performing work under this Agreement meet the citizenship or alien status requirement set forth in federal statutes and regulations. CONTRACTOR shall obtain, from all employees performing work hereunder, all verification and other documentation of employment eligibility status required by federal or state statutes and regulations including, but not limited to, the Immigration Reform and Control Act of 1986, 8 U.S.C. §1324 et seq., as they currently exist and as they may be hereafter amended. CONTRACTOR shall retain all such documentation for all covered employees, for the period prescribed by the law.

10. Subcontract for Work or Services

No contract shall be made by the CONTRACTOR with any other party for furnishing any of the work or services under this Agreement without the prior written approval of the COUNTY; but this provision shall not require the approval of contracts of employment between the CONTRACTOR and personnel assigned under this Agreement, or for parties named in the proposal and agreed to under this Agreement.

11. Disputes

11.1 The parties shall attempt to resolve any disputes amicably at the working level. If that is not successful, the dispute shall be referred to the senior management of the parties. Any dispute relating to this Agreement, which is not resolved by the parties, shall be decided by the COUNTY's Purchasing Department's Compliance Contract Officer who shall furnish the decision in writing. The decision of the COUNTY's Compliance Contract Officer shall be final and conclusive unless determined by a court of competent jurisdiction to have been fraudulent, capricious, arbitrary, or so grossly erroneous to imply bad faith. The CONTRACTOR shall proceed diligently with the performance of this Agreement pending the resolution of a dispute.

11.2 Prior to the filing of any legal action related to this Agreement, the parties shall be obligated to attend a mediation session in Riverside County before a neutral third-party mediator. A second mediation

session shall be required if the first session is not successful. The parties shall share the cost of the mediations.

12. Licensing and Permits

CONTRACTOR shall comply with all State or other licensing requirements, including but not limited to the provisions of Chapter 9 of Division 3 of the Business and Professions Code. All licensing requirements shall be met at the time proposals are submitted to the COUNTY. CONTRACTOR warrants that it has all necessary permits, approvals, certificates, waivers and exemptions necessary for performance of this Agreement as required by the laws and regulations of the United States, the State of California, the County of Riverside and all other governmental agencies with jurisdiction, and shall maintain these throughout the term of this Agreement.

13. Use By Other Political Entities

The CONTRACTOR agrees to extend the same pricing, terms, and conditions as stated in this Agreement to each and every political entity, special district, and related non-profit entity in Riverside County. It is understood that other entities shall make purchases in their own name, make direct payment, and be liable directly to the CONTRACTOR; and COUNTY shall in no way be responsible to CONTRACTOR for other entities' purchases.

14. Non-Discrimination

CONTRACTOR shall not be discriminate in the provision of services, allocation of benefits, accommodation in facilities, or employment of personnel on the basis of ethnic group identification, race, religious creed, color, national origin, ancestry, physical handicap, medical condition, marital status or sex in the performance of this Agreement; and, to the extent they shall be found to be applicable hereto, shall comply with the provisions of the California Fair Employment and Housing Act (Gov. Code 12900 et. seq), the Federal Civil Rights Act of 1964 (P.L. 88-352), the Americans with Disabilities Act of 1990 (42 U.S.C. S1210 et seq.) and all other applicable laws or regulations.

15. Records and Documents

CONTRACTOR shall make available, upon written request by any duly authorized Federal, State, or COUNTY agency, a copy of this Agreement and such books, documents and records as are necessary to certify the nature and extent of the CONTRACTOR's costs related to this Agreement. All such books, documents and records shall be maintained by CONTRACTOR for at least five years following termination of this Agreement and be available for audit by the COUNTY. CONTRACTOR shall provide to the COUNTY reports and information related to this Agreement as requested by COUNTY.

16. Confidentiality

16.1 The CONTRACTOR shall not use for personal gain or make other improper use of privileged or confidential information which is acquired in connection with this Agreement. The term "privileged or confidential information" includes but is not limited to: unpublished or sensitive technological or scientific information; medical, personnel, or security records; anticipated material requirements or pricing/purchasing actions; COUNTY information or data which is not subject to public disclosure; COUNTY operational procedures; and knowledge of selection of contractors, subcontractors or suppliers in advance of official announcement.

16.2 The CONTRACTOR shall protect from unauthorized disclosure names and other identifying information concerning persons receiving services pursuant to this Agreement, except for general statistical information not identifying any person. The CONTRACTOR shall not use such information for any purpose other than carrying out the CONTRACTOR's obligations under this Agreement. The CONTRACTOR shall promptly transmit to the COUNTY all third party requests for disclosure of such information. The CONTRACTOR shall not disclose, except as otherwise specifically permitted by this Agreement or authorized in advance in writing by the COUNTY, any such information to anyone other than the COUNTY. For purposes of this paragraph, identity shall include, but not be limited to, name, identifying number, symbol, or other identifying particulars assigned to the individual, such as finger or voice print or a photograph.

17. Administration/Contract Liaison

The COUNTY Purchasing Agent, or designee, shall administer this Agreement on behalf of the COUNTY. The Purchasing Department is to serve as the liaison with CONTRACTOR in connection with this Agreement.

18. Notices

All correspondence and notices required or contemplated by this Agreement shall be delivered to the respective parties at the addresses set forth below and are deemed submitted two days after their deposit in the United States mail, postage prepaid:

COUNTY OF RIVERSIDE	**CONTRACTOR**
Purchasing and Fleet Services	JTD Consulting Inc.,
Riverside County Information Technology	1837 California Avenue
3450 14th Street, Fourth Floor	Travis Donahue
Riverside, CA 92501	President
Email: RCIT-AcctsPayable@rivco.org	Email: TDonahue@jtd-wis.com

19. Force Majeure

If either party is unable to comply with any provision of this Agreement due to causes beyond its reasonable control, and which could not have been reasonably anticipated, such as acts of God, acts of war, civil disorders, or other similar acts, such party shall not be held liable for such failure to comply.

20. EDD Reporting Requirements

In order to comply with child support enforcement requirements of the State of California, the COUNTY may be required to submit a Report of Independent Contractor(s) form **DE 542** to the Employment Development Department. The CONTRACTOR agrees to furnish the required data and certifications to the COUNTY within 10 days of notification of award of Agreement when required by the EDD. This data will be transmitted to governmental agencies charged with the establishment and enforcement of child support orders. Failure of the CONTRACTOR to timely submit the data and/or certificates required may result in the contract being awarded to another contractor. In the event a contract has been issued, failure of the CONTRACTOR to comply with all federal and state reporting requirements for child support enforcement or to comply with all lawfully served Wage and Earnings Assignments Orders and Notices of Assignment shall constitute a material breach of Agreement. If CONTRACTOR has any questions concerning this reporting requirement, please call (916) 657-0529. CONTRACTOR should also contact its local Employment Tax Customer Service Office listed in the telephone directory in the State Government section under "Employment Development Department" or access their Internet site at www.edd.ca.gov.

21. Hold Harmless/Indemnification

21.1 CONTRACTOR shall indemnify and hold harmless the County of Riverside, its Agencies, Districts, Special Districts and Departments, their respective directors, officers, Board of Supervisors, elected and appointed officials, employees, agents and representatives (individually and collectively hereinafter referred to as Indemnitees) from any liability, action, claim or damage whatsoever, based or

asserted upon any services of CONTRACTOR, its officers, employees, subcontractors, agents or representatives arising out of or in any way relating to this Agreement, including but not limited to property damage, bodily injury, or death or any other element of any kind or nature. CONTRACTOR shall defend the Indemnitees at its sole expense including all costs and fees (including, but not limited, to attorney fees, cost of investigation, defense and settlements or awards) in any claim or action based upon such acts, omissions or services.

21.2 With respect to any action or claim subject to indemnification herein by CONTRACTOR, CONTRACTOR shall, at their sole cost, have the right to use counsel of their own choice and shall have the right to adjust, settle, or compromise any such action or claim without the prior consent of COUNTY; provided, however, that any such adjustment, settlement or compromise in no manner whatsoever limits or circumscribes CONTRACTOR indemnification to Indemnitees as set forth herein.

21.3 CONTRACTOR'S obligation hereunder shall be satisfied when CONTRACTOR has provided to COUNTY the appropriate form of dismissal relieving COUNTY from any liability for the action or claim involved.

21.4 The specified insurance limits required in this Agreement shall in no way limit or circumscribe CONTRACTOR'S obligations to indemnify and hold harmless the Indemnitees herein from third party claims.

22. Insurance

22.1 Without limiting or diminishing the CONTRACTOR'S obligation to indemnify or hold the COUNTY harmless, CONTRACTOR shall procure and maintain or cause to be maintained, at its sole cost and expense, the following insurance coverage's during the term of this Agreement. As respects to the insurance section only, the COUNTY herein refers to the County of Riverside, its Agencies, Districts, Special Districts, and Departments, their respective directors, officers, Board of Supervisors, employees, elected or appointed officials, agents, or representatives as Additional Insureds.

A. Workers' Compensation:

If the CONTRACTOR has employees as defined by the State of California, the CONTRACTOR shall maintain statutory Workers' Compensation Insurance (Coverage A) as prescribed by the laws of the State of California. Policy shall include Employers' Liability (Coverage B) including Occupational Disease with limits not less than $1,000,000 per person per accident. The policy shall be endorsed to waive subrogation in favor of The County of Riverside.

B. Commercial General Liability:

Commercial General Liability insurance coverage, including but not limited to, premises liability, unmodified contractual liability, products and completed operations liability, personal and advertising injury, and cross liability coverage, covering claims which may arise from or out of CONTRACTOR'S performance of its obligations hereunder. Policy shall name the COUNTY as Additional Insured. Policy's limit of liability shall not be less than $1,000,000 per occurrence combined single limit. If such insurance contains a general aggregate limit, it shall apply separately to this agreement or be no less than two (2) times the occurrence limit.

C. Vehicle Liability:

If vehicles or mobile equipment is used in the performance of the obligations under this Agreement, then CONTRACTOR shall maintain liability insurance for all owned, non-owned, or hired vehicles so used in an amount not less than $1,000,000 per occurrence combined single limit. If such insurance contains a general aggregate limit, it shall apply separately to this agreement or be no less than two (2) times the occurrence limit. Policy shall name the COUNTY as Additional Insureds.

D. General Insurance Provisions - All lines:

1) Any insurance carrier providing insurance coverage hereunder shall be admitted to the State of California and have an A M BEST rating of not less than A: VIII (A:8) unless such requirements are waived, in writing, by the County Risk Manager. If the County's Risk Manager waives a requirement for a particular insurer such waiver is only valid for that specific insurer and only for one policy term.

2) The CONTRACTOR must declare its insurance self-insured retention for each coverage required herein. If any such self-insured retention exceeds $500,000 per occurrence each such retention shall have the prior written consent of the County Risk Manager before the commencement of operations under this Agreement. Upon notification of self-insured retention unacceptable to the COUNTY, and at the election of the Country's Risk Manager, CONTRACTOR'S carriers shall either; 1) reduce or eliminate such self-insured retention as respects this Agreement with the COUNTY, or 2) procure a bond which guarantees payment of losses and related investigations, claims administration, and defense costs and expenses.

3) CONTRACTOR shall cause CONTRACTOR'S insurance carrier(s) to furnish the County of Riverside with either 1) a properly executed original Certificate(s) of Insurance and certified original copies of Endorsements effecting coverage as required herein, and 2) if requested to do so orally or in writing by the County Risk Manager, provide original Certified copies of policies including all Endorsements and all attachments thereto, showing such insurance is in full force and effect. Further, said Certificate(s) and policies of insurance shall contain the covenant of the insurance carrier(s) that thirty (30) days written notice

shall be given to the County of Riverside prior to any material modification, cancellation, expiration or reduction in coverage of such insurance. In the event of a material modification, cancellation, expiration, or reduction in coverage, this Agreement shall terminate forthwith, unless the County of Riverside receives, prior to such effective date, another properly executed original Certificate of Insurance and original copies of endorsements or certified original policies, including all endorsements and attachments thereto evidencing coverage's set forth herein and the insurance required herein is in full force and effect. CONTRACTOR shall not commence operations until the COUNTY has been furnished original Certificate (s) of Insurance and certified original copies of endorsements and if requested, certified original policies of insurance including all endorsements and any and all other attachments as required in this Section. An individual authorized by the insurance carrier shall sign the original endorsements for each policy and the Certificate of Insurance.

4) It is understood and agreed to by the parties hereto that the CONTRACTOR'S insurance shall be construed as primary insurance, and the COUNTY'S insurance and/or deductibles and/or self-insured retention's or self-insured programs shall not be construed as contributory.

5) If, during the term of this Agreement or any extension thereof, there is a material change in the scope of services; or, there is a material change in the equipment to be used in the performance of the scope of work; or, the term of this Agreement, including any extensions thereof, exceeds five (5) years; the COUNTY reserves the right to adjust the types of insurance and the monetary limits of liability required under this Agreement, if in the County Risk Manager's reasonable judgment, the amount or type of insurance carried by the CONTRACTOR has become inadequate.

6) CONTRACTOR shall pass down the insurance obligations contained herein to all tiers of subcontractors working under this Agreement.

7) The insurance requirements contained in this Agreement may be met with a program(s) of self-insurance acceptable to the COUNTY.

8) CONTRACTOR agrees to notify COUNTY of any claim by a third party or any incident or event that may give rise to a claim arising from the performance of this Agreement.

23. General

23.1 CONTRACTOR shall not delegate or assign any interest in this Agreement, whether by operation of law or otherwise, without the prior written consent of COUNTY. Any attempt to delegate or assign any interest herein shall be deemed void and of no force or effect.

23.2 Any waiver by COUNTY of any breach of any one or more of the terms of this Agreement shall not be construed to be a waiver of any subsequent or other breach of the same or of any other term of this Agreement. Failure on the part of COUNTY to require exact, full, and complete compliance with any terms of this Agreement shall not be construed as in any manner changing the terms or preventing COUNTY from enforcement of the terms of this Agreement.

23.3 In the event the CONTRACTOR receives payment under this Agreement, which is later disallowed by COUNTY for nonconformance with the terms of the Agreement, the CONTRACTOR shall promptly refund the disallowed amount to the COUNTY on request; or at its option the COUNTY may offset the amount disallowed from any payment due to the CONTRACTOR.

23.4 CONTRACTOR shall not provide partial delivery or shipment of services or products unless specifically stated in the Agreement.

23.5 CONTRACTOR shall not provide any services or products subject to any chattel mortgage or under a conditional sales contract or other agreement by which an interest is retained by a third party. The CONTRACTOR warrants that it has good title to all materials or products used by CONTRACTOR or provided to COUNTY pursuant to this Agreement, free from all liens, claims, or encumbrances.

23.6 Nothing in this Agreement shall prohibit the COUNTY from acquiring the same type or equivalent equipment, products, materials or services from other sources, when deemed by the COUNTY to be in its best interest. The COUNTY reserves the right to purchase more or less than the quantities specified in this Agreement.

23.7 The COUNTY agrees to cooperate with the CONTRACTOR in the CONTRACTOR's performance under this Agreement, including, if stated in the Agreement, providing the CONTRACTOR with reasonable facilities and timely access to COUNTY data, information, and personnel.

23.8 CONTRACTOR shall comply with all applicable Federal, State and local laws and regulations. CONTRACTOR will comply with all applicable COUNTY policies and procedures. In the event that there is a conflict between the various laws or regulations that may apply, the CONTRACTOR shall comply with the more restrictive law or regulation.

23.9 CONTRACTOR shall comply with all air pollution control, water pollution, safety and health ordinances, statutes, or regulations, which apply to performance under this Agreement.

23.10 CONTRACTOR shall comply with all requirements of the Occupational Safety and Health Administration (OSHA) standards and codes as set forth by the U.S. Department of Labor and the State of California (Cal/OSHA).

23.11 This Agreement shall be governed by the laws of the State of California. Any legal action related to the performance or interpretation of this Agreement shall be filed only in the Superior Court of the State of California located in Riverside, California, and the parties waive any provision of law providing for a change of venue to another location. In the event any provision in this Agreement is held by a court of competent jurisdiction to be invalid, void, or unenforceable, the remaining provisions will nevertheless continue in full force without being impaired or invalidated in any way.

23.12 This Agreement, including any attachments or exhibits, constitutes the entire Agreement of the parties with respect to its subject matter and supersedes all prior and contemporaneous representations, proposals, discussions and communications, whether oral or in writing. This Agreement may be changed or modified only by a written amendment signed by authorized representatives of both parties.

IN WITNESS WHEREOF, the Parties hereto have caused their duly authorized representatives to execute this Agreement.

COUNTY OF RIVERSIDE, a political subdivision of the State of California

By: _____
Chuck Washington, Chairman
Board of Supervisors

Dated: MAR 20 2018

JTD Consulting Inc., a California corporation

By: _____
Travis Donahue
President

Dated: 3/7/18

ATTEST:
Kecia Harper-Ihem
Clerk of the Board

By: _____, Deputy

APPROVED AS TO FORM:
Gregory P. Priamos
County Counsel

By: _____
Thomas Oh
Deputy County Counsel

Exhibit A
Scope of Services

This Agreement is for tower inspections (assessments reports) and transmission line sweeps for the Public Safety Enterprise Communications (PSEC) Division and the radio system with towers for all Public Safety PSEC sites throughout Riverside County as detailed in the task below:

The PSEC radio system has 72 sites (1st Phase (38 sites) Fiscal 17/18) sites and (2nd Phase (34 sites) Fiscal 18/19) with towers, poles, and communication structures throughout the County of Riverside.

This project shall be in two (2) fiscal phases:

1. Phase 1: Start date upon award in March 2018 and a Completion Date of June 1, 2018.
2. Phase 2: Start date upon beginning of new Fiscal Year, July 1, 2018 with a Completion Date of June 30, 2019.

The tasks included as a part of this Agreement are:

1. tower/site inspections (assessment and condition reports) per TIA 222G, Industry standards.
2. tower sweeps per original equipment manufacturer (OEM) recommendations (ensuring proper electrical performance).

The purpose of this Scope of Services ("SOS") is to outline the tasks, methodology standards and provide a completion checklist. Below are the documents associated with and attached as separate documents to this Agreement and incorporated herein by reference:

1. Attachment B - Tower Site List
2. Exhibit C - Maintenance and Condition Checklist
3. Exhibit D - RF Parameters System Manual
4. Exhibit E - Installation Standards
5. Exhibit F - Antenna System Commissioning Guide
6. Exhibit G - Mapping and Structural Analysis (Example)
7. Exhibit H - Site Verification Pictures (Examples)

Task 1 – CONTRACTOR shall perform tower inspections (as noted in Task 1, Section 1, Items A through J below) on all 72 sites noted in **Attachment B - Tower and Inspection FY 17/18 Site List.**

CONTRACTOR shall provide a **Maintenance and Condition Assessment Checklist, Exhibit C** for each of the sites inspected, consistent with this Industry TIA-222G standard and note all deficiencies corrected during the inspection and outstanding due to being outside the scope of the Agreement (e.g. checking for a percentage (percentage can be included in value added section) of all main tower structure bolts and tightening as needed, missing hardware, antenna damage, etc.), Details of the inspection required of CONTRACTOR are described in section (A. through J.) below:

1. **Maintenance and Condition Assessment**

A. Structure Condition
   1. Damaged members (legs and bracing)
   2. Loose members
   3. Missing members
   4. Climbing facilities, platforms, catwalks – all secure
   5. Loose and/or missing bolts and/or nut locking devices
   6. Visible cracks in welded connections

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

C. Lighting
   1. Conduit, junction boxes, and fasteners (weather tight and secure)
   2. Drain and vent openings (unobstructed)
   3. Wiring condition
   4. Light lenses
   5. Bulb condition
   6. Controllers (functioning):
      a) Flasher
      b) Photo control
      c) Alarms

D. Grounding
   1. Connections
   2. Corrosion
   3. Lightning protection (secured to structure)

E. Antennas and Lines
   1. Antenna condition
   2. Mount and/or ice shield condition (bent, loose, and/or missing members)
   3. Feed line condition (flanges, seals, dents, jacket damage, grounding, etc.)
   4. Hanger condition (snap-ins, bolt on, kellum grips, etc.)
   5. Secured to structure

F. Other appurtenances (walkways, platforms, sensors, floodlights, etc.)
   1. Condition
   2. Secured to structure

G. Insulator Condition
   1. Cracking and chipping
   2. Cleanliness of insulators
   3. Spark gaps set properly
   4. Isolation transformer condition
   5. Bolts and connection secure

H. Guys
   1. Strand condition (corrosion, breaks, nicks, kinks, etc.)
   2. Guy Hardware Conditions:
      a) Turnbuckles or equivalent (secure and safety properly applied)
      b) Cable thimbles properly in place (if required)

c) Service sleeves properly in place (if required)
d) Cable connectors (end fittings):
   1) Cable clamps applied properly and bolts tight
   2) Wire serving properly applied
   3) No signs of slippage or damaged strands
   4) Preformed wraps – properly applied, fully wrapped, and sleeve in place
   5) Poured sockets secure and showing no separation
   6) Shackles, bolts, pins and cotter pins secure and in good condition

3. Guy Tensions
4. Measure guy tensions (refer to TIA 222G Annex K)
5. Record temperature, wind speed and wind direction

I. Concrete Foundations
1. Ground condition:
   a) Settlement, movement or earth cracks
   b) Erosion
   c) Site condition (standing water, drainage, trees, etc.)
2. Anchorage condition:
   a) Nuts and/or nut locking device (tightened)
   b) Grout condition
   c) Anchorages and/or anchor rod condition
3. Concrete condition:
   a) Cracking, spalling, or splitting
   b) Chipped or broken concrete
   c) Honeycombing
   d) Low spots to collect moisture

J. Guyed Mast Anchors
1. Settlement, movement or earth cracks
2. Backfill heaped over concrete for water shedding
3. Anchor rod condition below earth (Maintain required structural capacity of anchor during exploration. Attachment to temporary anchorage may be required)
4. Corrosion control measures (galvanizing, coating, concrete encasement, cathodic protection systems, etc.)
5. Anchor heads clear of earth

Task 2 – CONTRACTOR shall perform Tower Sweeps (Antenna and Transmission Line Sweeps). of all 72 sites noted in **Attachment B - Tower Site List Inspection FY 17/18**

Prior to starting work at any site, CONTRACTOR shall provide a five (5) day written notice to County Radio Engineer or designee prior to performing services in SOS.

CONTRACTOR shall perform Antenna and Transmission Line Sweeps as defined below:

1. **Maintenance and Condition Assessment**

Sweep designated antennas and inspect mounts (Sites numbered 1 through 37 in **Attachment B - Tower Site List Inspection FY 17/18** shall be performed during the Fiscal year of FY 17/18 the

remaining 35 sites to be performed in FY18/19). Note: tower drawings for all sites shall be provided to CONTRACTOR following the contract award.

2. RF Antenna Installation Inspection and Sweep

A. Sweep all site (Attachment B - Tower and Inspection FY 17/18 Site List) antennas and inspect mounts at County of Riverside tower locations designated by County provided tower drawing in accordance with the manufacturer's recommendations. Note: tower drawings for all sites will be provided to CONTRACTOR following the contract award.

B. If antenna is a directional/panel antenna, the antenna shall be checked to ensure correct directionality at the degrees designated in provided antenna spreadsheet attached hereto as Exhibit D. Note: degrees are true north.

C. Perform antenna and cable sweep tests at the completion of installation per the attached methodology attached hereto as Exhibit F. Testing should include tests 2, 8, 9, and 10 at a minimum. If there are issues with jumpers or arrestors they shall be reported to COUNTY by CONTRACTOR and sub tests are included for reference but are not considered needed as a deliverable for the County of Riverside's documentation.

D. CONTRACTOR shall perform the testing on antenna(s) and as described in Exhibit F.

E. Note: Weather proofing shall be removed prior to antenna and cable sweeping (by CONTRACTOR) and restored by CONTRACTOR. CONTRACTOR shall provide pictures of the final weatherproofing. (Refer to Exhibit H).

3. RF Cable Installation Inspection and Sweep

A. Inspect all Tower RF Cables and jumpers to antennas ensuring integrity in accordance with the manufacturer's recommendations.

B. When connectors are replaced, CONTRACTOR shall have the manufacturer recommended tools for AVA type cable connectors and use proper torqueing techniques as defined in Exhibit F, (Andrew Coupling Torque Recommendations). Note: individuals responsible for terminating cables should be Andrew certified (Certification) for AVA (coaxial cable) connector installations.

C. CONTRACTOR shall supply and repair any damaged install clamps, hangers, weather proofing kits, boots, and grounding kits for all antenna cable runs. The number of grounding kits required shall be in accordance to R56 standards and corrected on all runs if deficient.

D. CONTRACTOR shall ensure all RF cables are labeled with uniquely colored tape at the top, middle, entry port, and demarcation point. CONTRACTOR shall supply tape if missing and label as follows:

1. 700 MHz receive antennas shall be green; where there are multiple receive antennas, antenna 1 shall be one band, antenna 2 shall be two bands, etc.
2. 700 MHz transmit antennas shall be blue; where there are multiple transmit antennas, antenna 1 shall be one band, antenna 2 shall be two bands, etc.

3. VHF (very high frequency) transmit antennas shall be yellow
4. VHF receive antennas shall be orange
5. HPD (high performance data) transmit antennas shall be white
6. HPD receive antennas shall be red; where there are multiple receive antennas, antenna 1 shall be one band, antenna 2 shall be two bands, etc.
7. GPS (global position satellite) antennas shall be brown; where there are multiple GPS antennas, antenna 1 shall be one band, antenna 2 shall be two bands, etc.

4. Tower Top Amp Inspection and operational verification

A. Inspect and ensure integrity and proper operation of Tower Top Amps (TTA) for 700 MHz RF voice sites at County of Riverside tower locations in accordance with the manufacturer's recommendations. HPD sites and VHF sites shall not have a TTA.

5. GPS Antenna/Receiver Inspection

A. Inspect GPS Antenna and cabling at County site locations and ensure proper operation in accordance with the manufacturer's recommendations and in accordance to R56 standards at all simulcast sites. All GPS antennas should be installed on Ice Bridge (metal shield over transmission line for protection) unless indicated differently by the COUNTY. Sites co-located with HPD shall contain a total of 4 GPS antennas.

B. CONTRACTOR shall inspect and ensure proper operation of the GPS Antenna/Receiver to provided lightning arrestor as designated in accordance with the manufacturer's recommendations.

6. Lightning Arrestor Inspection

A. Inspect grounding trapeze at the entry port of the building in accordance to R56 standards.

B. Inspect and ensure proper operation of lightning arrestors on trapeze.

7. Verify Installation Guidelines have been followed

A. Coaxial cables shall be supported at the manufacturer's recommended intervals based on the cable type and a wind speed of one-hundred twenty (120) miles per hour. Coaxial cable supports used shall be those recommended by the manufacturer for that cable type under the specified conditions.

B. Tower coaxial cable transitions from vertical to horizontal for building entry shall incorporate a drip loop at the bottom of the vertical run to prevent water entry into the building.

C. Care shall be exercised in confirming the proper installation of all connectors. Loss in excess of connector manufacturer's specification per connector is not acceptable and such connectors will have to be identified by CONTRACTOR to the COUNTY. The connector manufacturer's specification(s) are contained in Exhibit F, Table 1A. In addition, connectors and ground kits used outdoors must be inspected and protected from corrosion and be fully weatherproof. All connectors shall be weatherproofed with the cable manufacturer's recommended

weatherproofing kit and then taped thoroughly with multiple layers of vinyl tape. Connectors shall be taped with one layer of vinyl tape prior to installation of weather proofing.

D. Coaxial cable outer conductors shall be connected to a suitable ground (5 Ohms or the lowest resistance achievable based on-site conditions), using the cable manufacturer's recommended grounding kit, at the following points:

1. Top of vertical run, within six (6) feet of the antenna
2. Outdoors, at the point that the cable enters the building or enclosure
3. If tower mounted, bottom of vertical run near the tower base at the point the cable leaves the tower.
4. At no greater than 100 foot intervals from the first ground point nearest the antenna
5. In all cases, the grounding cable shall be no smaller than #6 Gauge solid or stranded copper. The cable shall be run in the shortest, straightest manner possible. No sharp bends shall be permitted.
6. All installed grounding kits shall be weatherproofed.

E. Coaxial cable lightning suppression devices shall be installed indoors, at the point the coaxial cable enters the building, and connected to a suitable ground (5 Ohms or the lowest resistance achievable based on Site conditions) using #6 Gauge solid or stranded copper wire. The cable shall be run in the shortest, straightest manner possible. No sharp bends shall be permitted. The preference is for Coaxial cable lightning suppression devices to be mounted directly to a grounding panel wherever possible.

8. Acceptance Procedures

A. CONTRACTOR will notify County Radio Engineer or designee of work completion and installation ready for acceptance on a per site basis.

B. CONTRACTOR will submit a complete Maintenance and Condition Checklist (Exhibit C) and Sweep Results (Exhibit G – Mapping and Structural Analysis - Example) to County Radio Engineer or designee. A punch list of reasonable deficiencies will be prepared and agreed to by both the CONTRACTOR and County Radio Engineer or designee.

C. Within reasonable time frames if needed, CONTRACTOR will work to clear the punch list items.

D. A final walk through will be completed to verify completion of the punch list items.

E. Acceptance will occur on a per site basis.

F. CONTRACTOR will provide invoices upon acceptance for sites as work is completed.

9. Emergency Repairs

A. CONTRACTOR shall notify County Radio Engineer or designee if a transmission line or antenna is found defective while on-site. CONTRACTOR is encouraged to carry transmission line for sites to be able to perform replacements on-site while doing inspections by CONTRACTOR. Due to the County of Riverside's purchasing lead time, defective antennas shall have to be ordered and a return trip scheduled by CONTRACTOR so that CONTRACTOR

can install said antennas. Emergency repairs shall require a quote and remediation on a case by case basis. The County of Riverside would like to be able to facilitate repairs of this nature during the Site inspection process to save costs for re-deploying resources.

ATTACHMENT "A"
GENERAL REQUIREMENTS

1. **Certifications:**
   Tower Climbing Certification - All applicable certifications required for tower safety and climbing in the County of Riverside.
   All structural studies shall be stamped by a certified professional engineer from the State of California.

2. **Standards and Codes**
   a. CONTRACTOR shall be responsible for complete and fully operable inspection and recommendations for restoration of all items identified in accordance with the latest version of the TIA 222G, Motorola's R56 guideline, National Electrical Code, local building codes, environmental laws, zoning and planning regulations or ordinances, land use restrictions, OSHA and state safety requirements, Federal Aviation Administration rules and regulations, Department of Transportation regulations governing road access and entry, and all other local, state or Federal codes, regulations, laws and/or ordinances, as applicable. In the event there is a conflict between the referenced drawings, codes, specifications or standards, the most stringent will apply.

3. **Personnel**
   a. The personnel employed by the CONTRACTOR shall be working in and around public service and safety communications facilities. As such, security is paramount. All personnel shall be identifiable by uniform dress and/or identification card and escorted by County employee(s). In most cases, general access to the facilities shall be granted, with all personnel instructed, as to limiting their activities to the assigned areas.

4. **Electro Magnetic Exposure (EME) Awareness**
   a. CONTRACTOR shall have in place a documented EME exposure awareness/training program. Contractor shall carry EME measuring devices always.

5. **Working Hours**
   a. Generally, site access is from 7:00 AM to 4:30 PM Monday through Thursday and 8:00 AM to 3:30 P.M. Friday, although the project may be affected by some furlough days or adjustable work schedules due to the County budget. All after-hours and weekend access shall be arranged in advanced with the County Radio Engineer or designee and agency representative. A large number (90%) of sites may require an afterhours work schedule. Emergencies shall be handled on a case by case basis. The awarded contractor representative or superintendent shall notify the County Radio Engineer or designee when daily activities shall cease or re-commence (other than scheduled weekend breaks).

6. **Equipment, Tools, and Special Test Equipment**
   a. CONTRACTOR personnel shall be equipped with all tools, equipment, safety and rescue devices necessary to perform the work listed within this Agreement. All test equipment supplied and used by the CONTRACTOR technicians must be properly calibrated to ensure accurate test results.

   b. All tools, equipment, dies, gauges, models, software, drawings or other materials paid for or furnished by the County of Riverside for this Agreement shall be and remain the sole property of County of Riverside. CONTRACTOR personnel shall safeguard all such property while it is in their

custody or control, be liable for any loss or damage to such property, use it only for County of Riverside agreements, and return it to the County of Riverside upon request. Such property may be removed from premises of the CONTRACTOR by the County of Riverside without extra cost.

7. Materials and Workmanship

a. Materials and workmanship shall be the best of their respective kinds (as defined by industry standards), free of defects and all materials shall be new and unused in all cases, unless otherwise specified. CONTRACTOR shall promptly remove any part of the work declared to be non-conforming by the County of Riverside because of failure to conform to the specifications whether actually incorporated in the work or not, and CONTRACTOR shall, at their own expense, promptly replace such non-conforming work, with other work conforming to the requirements of the Agreement. CONTRACTOR agrees that the work shall be performed in a good workmanlike manner by competent and skilled workers.

8. Warranty for Work Performed

a. CONTRACTOR warrants to the County of Riverside that materials and services furnished to be of new, good quality and all work shall conform to the requirements of the Agreement. CONTRACTOR shall warranty the materials and services performed to support this project for a minimum of one (1) year. Materials and services not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.

9. Verification of Existing Conditions

a. Before starting any operation, CONTRACTOR shall examine existing work, or work performed by others, to which its work is to adjoin or be applied, and shall report to the County Radio Engineer or designee any conditions that prevent satisfactory accomplishment of the work. Failure to notify the County Radio Engineer or designee of the deficiencies, errors or faults prior to commencement of work shall constitute acceptance thereof and waiver of any claims of unsuitability, errors, omissions or inaccuracies.

10. Safety and Health

a. The County of Riverside holds safety as paramount, at no time shall any operation or task be undertaken or continued by CONTRACTOR if deemed hazardous to the personnel, equipment or community. All safety practices shall be put in place and compliance with all local, state and federal laws and regulations shall be maintained by CONTRACTOR. CONTRACTOR shall maintain a current OSHA policy and safety plan on file with the County of Riverside.

b. Work area shall be partitioned by barricades and safety tape by CONTRACTOR when required.

c. CONTRACTOR shall post signage in accordance with OSHA regulations (i.e. medical aid, hard hat, safety glasses) notifications.

d. All CONTRACTOR personnel shall be compliant with OSHA regulations, and fully trained for the type of work to be performed.

e. Prior to commencement of any hazardous operation, CONTRACTOR personnel shall conduct an on-site briefing for all persons in attendance.

f. Prior to any "Hot Work" (energized RF Equipment), the area shall be inspected for hazards and proper precautions shall be observed.

g. All CONTRACTOR team members shall ensure that the workplace is maintained clean and free of safety hazards.

h. All trash and debris shall be removed by CONTRACTOR daily.

i. A safety and security check shall be conducted by CONTRACTOR at the close of the workday.

j. All accidents are to be reported to the County of Riverside immediately upon occurrence. CONTRACTOR shall provide the County of Riverside a copy of all injury investigation reports and/or safety reports for all injuries that receive medical treatment within twenty-four (24) hours of the injury.

11. Workplace Environment

a. The County of Riverside is committed to providing a respectful and productive work environment and shall not tolerate verbal, visual, written or physical conduct that harasses, disrupts, or interferes with another's work performance or which creates an intimidating or hostile work environment.

b. All Riverside County employees and employees of its contractors shall contribute to a productive work environment that is free from harassing, violent, threatening or other disruptive activity.

c. The County of Riverside complies with the Drug-Free Workplace Act, and applicable regulations of government agencies (including regulations promulgated by the Department of Transportation), and other federal, state, and local laws and regulations. The County of Riverside supports a workforce that is drug free and free from illegal manufacture, distribution, possession and use of drugs, the abuse of alcohol and/or controlled substances. Alcohol is not permitted on the jobsite.

12. Site Cleanup

a. CONTRACTOR shall clean-up and remove from the work site daily (or sooner if directed by the County Radio Engineer or designee) all rubbish and construction debris, resulting from their own work. CONTRACTOR shall supply a dumpster or similar trash storage/removal device wherever a substantial amount of construction debris is generated. Upon completion of work, the entire job site areas shall be left clean and free of trash, debris, mud, dirt, dust, scrap materials, and excess materials. Upon completion of installation and construction work, the radio equipment shelters and rooms shall be thoroughly cleaned (including walls and floors) by CONTRACTOR to the satisfaction of the County Radio Engineer or designee.

13. Proprietary Information Confidentiality

a. All information or data in the form of specifications, drawings, reprints, technical information or otherwise furnished to CONTRACTOR under this Agreement shall remain the County of Riverside's property, shall be deemed proprietary, shall be kept confidential, and shall be promptly returned at the County of Riverside's request. CONTRACTOR shall not disclose, without the County of Riverside's written permission, any such information or data to any person, or use such information or data itself for any purpose other than performing this Agreement. The obligations under this paragraph will survive the cancellation, termination, or completion of this Agreement. Unless otherwise agreed in writing, no commercial, financial or technical information disclosed in any manner or at any time by CONTRACTOR to the County of Riverside shall be deemed secret or confidential.

EXHIBIT "B"

COST SHEET

TASK 1 – TOWER INSPECTIONS	
Phase One: Inspect first 38 sites (see Attachment B Site List) FY 17/18	***$82,000***
Phase Two: Inspect second 34 Sites (see Attachment B Site List) FY 18/19	***$82,000***
TASK 2 – TOWER SWEEPS	
Phase One: Inspect first 38 sites (see Attachment B Site List) FY 17/18	***$68,000***
Phase Two: Inspect second 34 Sites (see Attachment B Site List) FY 18/19	***$68,000***
Total Cost – Phase One FY 17/18	***$150,000***
Total Cost – Phase Two FY 18/19	***$150,000***
Project Cost Total FY 17/18 and 18/19	***$300,000***

Exhibit E

County of Riverside Site Installation Standards

Table of contents

County of Riverside Site Installation Standards

Overview

The County of Riverside has adopted the Motorola R-56 set standards and requirements for the installation of communications equipment, infrastructure and the way a communications site is managed, controlled, and operated. All tenants located in a communications site shall follow all requirements set forth in this document and the Motorola R-56 standard. All requirements are essential to protect personnel, minimize component failure, and optimize performance.

General Requirements

These general requirements have been put in place to improve personal safety and to prevent equipment damage. They establish minimum requirements for grounding, safety, equipment installation, conduct, maintenance, and all other requirements necessary for a successful installation. These procedures relate to safe operations that will be followed during installation and maintenance of communications equipment and antenna systems. The County of Riverside site procedures and standards shall prevail over contractor accepted practices and standards. Contractors must follow the standards and requirements for all sites accessed. The conduct of contractors will be controlled and coordinated by the County Site Manager. All contractors, whether County of Riverside controlled or contracted directly with the outside vendor, must follow specific procedures and coordinate all installations and approvals with the County of Riverside site manager.

Safety

All County employees, contractors, and other personnel working at a communications site shall be familiar with the information obtained in this document. The County of Riverside as a site owner/primary tenant, is responsible for compliance to Federal Communications Commission (FCC) regulation.

- All County employees, tenants, contractors, and other personnel shall be required to use an appropriate EME monitoring device when working in the vicinity of fixed transmission sources of RF energy.
- All County employees, tenants, contractors, and other personnel shall be required to provide certification that all field technicians have received RFR safety awareness training.
- All County employees, tenants, contractors, and other personnel shall be required to provide certification that field technicians have personal protection equipment (PPE) in the form of RF personal monitors.
- All tower work shall be performed with personnel trained in this practice and who possess the proper equipment and certifications.
- Fall protection measures shall be observed and implemented on all towers and structures, where climbing is required.
- All applicable regulations regarding tower climbing shall be observed.

County of Riverside Site Installation Standards

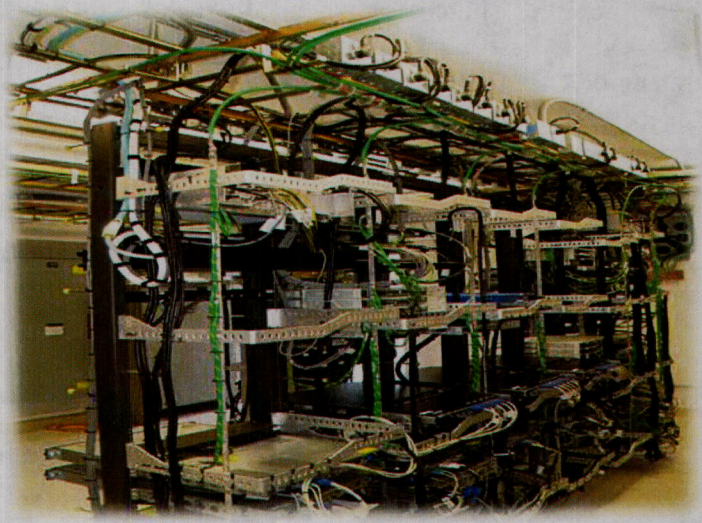
- Subcontractors shall be required to submit their written Safety Program to the Site Manager and obtain approval prior to commencing any work.
- All tower climbing shall be in accordance with the Fall Protection Program.

- OSHA or other applicable Occupational Safety and Health standards/regulations shall be observed and followed in all phases of tower construction and maintenance. Proper documentation must be on file with County.
- All tower climbing crews shall provide copies of tower climbing and safety certification to the county prior to climbing the tower.
- In case of a fire at the Communication Site, the fire department shall be notified as soon as a fire is discovered. Notification shall not be delayed in order to assess the results of firefighting effort using on-site fire extinguisher.

Cabinet and Equipment Rack Installation Standards

The County Communication facilities are designed to utilize both open and closed rack mounting for equipment installations. Floor spacing and electrical outlet spacing in cable trays follow this pattern, which is designed to maximize the amount of equipment within the available floor space. All approved racks, cabinets, electrical ("If Available") and cable tray for the specified communications site will be provided and installed by the County of Riverside per County standards unless otherwise specified or on a case by case basis. If tenant provides their own rack or cabinet it shall be installed per County standards, which include but are not limited to:

- Bonding to the MGB- (Master Ground Bar)
- Bonding to SSGB- (Sub System Ground Bus Bar)
- Bonding to RGB - (Rack Ground Bar)
- Bonding to ground bus conductor
- Bonding to communication bonding backbone conductors and grounding equalizer conductors.
- Approved welded rack or cabinet, based on the equipment specifications.
- Insulation pad/Isolated Grommets.
- Hilti Anchor-Specified for seismic (Zone 4) Part#HSL-3-B, M12
- A 36-inch side aisle shall be maintained around electrical panel boards (NFPA 70-2005, Article 110.26).
- A 36 to 48-inch front, side, and



(where applicable) rear aisles are required for servicing interior mounted air conditioners (NFPA 70-2005, Article 110.26, ASHRAE).

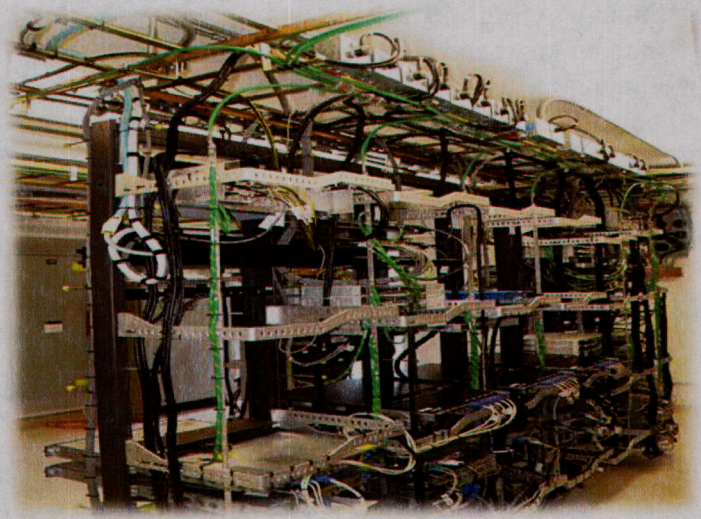
- A 36-inch aisle shall be maintained in front of all telephone switching equipment and/or demarcation cabling. A 36-inch aisle shall be maintained in situations where there is telephone switching equipment and/or demarcation cabling on both sides of the aisle (NFPA 70-2005, Article 110.72).
- A 36-inch minimum workspace shall be maintained on all non-egress or aisle ways without equipment described in this section.
- A 36-inch aisle shall be maintained between at least one end of an equipment row and building wall or other obstruction; longer aisles may require additional access breaks. Larger aisles and additional access breaks in a row may be required as the row becomes longer, such that a fire in the aisle does not prevent egress.

Equipment Installation within Racks or Cabinets

Prior to the installation of equipment in a communication site, the County shall perform a BTU and electrical load analysis making sure there is sufficient power and AC for the entire facility. If electrical or AC needs to be upgraded to support any additional equipment, the tenant will be responsible for all associated costs, tenant must provide the county all load, electrical and BTU requirements for each piece of equipment prior of installation.

- All cabling within racks and cabinets shall conform to the requirements of NFPA 70-2005, Article 300, Article 800, Article 810, Article 820, and Article 830.
- (See ANSI/TIA/EIA-568(c) and 569(b) and NECA/BICSI 568-2001 for additional information.)

Every transmitter on site shall be equipped with a dual-stage isolator with second harmonic filter or bandpass cavity on the isolator output. Strong IM can be generated from the transmitter power amplifier(PA). The dual-stage isolator greatly reduces the amount of external frequency energy entering a transmitter PA and consequently, the level of IM generated. Jacketed heliax transmission lines and type N connectors shall be used instead of RG-8 cable and UHF connectors. Where two or more transmit frequencies are combined to one antenna, connectors shall be 7/16 inch DIN connectors. Every receiver should have a band pass cavity to prevent strong transmitter signals from swamping the receiver, all transmitters onsite should have sufficient transmitter noise filtering to reduce harmful on-channel noise to all receivers on site. This is best achieved through a bandpass cavity(s) that reduces the on channel transmitter noise below the interference level. All receivers should have bandpass cavities to prevent receivers from being desensitized by nearby strong



transmit frequency carriers.

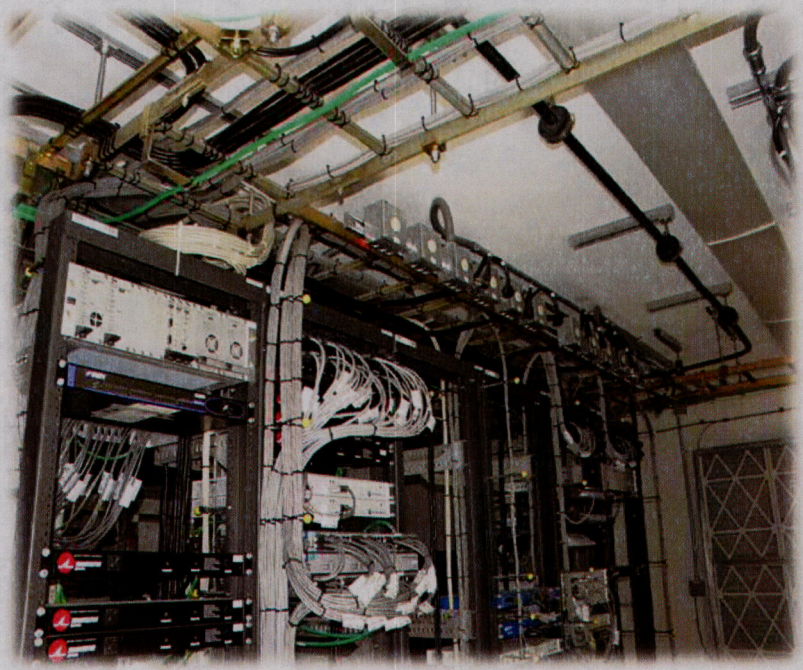
- Some radios, when manufactured, are designed to have the antenna connectors and control cables exit to the side. Side-mounted connectors require additional and odd spacing and disrupt designated floor plans. Mounting of this type of equipment, without modification, shall not be permitted in primary site radio facilities. It may however, be permitted with a single-station installation in County facilities other than specified locations and/or County radio facilities. Installation of this type of equipment shall require coordination for facilities under the jurisdiction of other agencies.
- Floor space assignments shall be made by Site Manager for locations under county control. Installations of equipment shall be well planned in order to provide a minimum of interference or downtime to system users. All installations or modifications that require the disabling of an operational system shall be coordinated with the proper jurisdiction. All equipment installations shall comply with all local building and electrical codes.
- 25-54 MHz - Transmitters in this range shall have an isolator with a minimum of 20dB reverse isolation followed by a low pass filter and a bandpass cavity setup, which provides a minimum of 20dB of attenuation at 1 MHz from the transmit frequency.
- 66-88 MHz - Transmitters in this range shall have an isolator with a minimum of 25dB reverse isolation followed by a low pass filter and bandpass cavity setup, which provides a minimum of 20dB of attenuation at 1 MHz from the transmit frequency.
- 130-225 MHz - Transmitters in this range shall have a set of isolators with a minimum of 50dB reverse isolation followed by a low pass filter and a bandpass cavity setup, which provides a minimum of 25dB of attenuation at 1 MHz from the transmit frequency.
- 276-284 MHz - Transmitters in this range shall have a set of isolators with a minimum of 50dB reverse isolation followed by a low pass filter and a bandpass cavity setup, which provides a minimum of 25dB of attenuation at 1 MHz from the transmit frequency.
- 400-512 MHz - Transmitters in this range shall have a set of isolators with a minimum of 50dB reverse isolation followed by a low pass filter and a bandpass cavity setup, which provides a minimum of 15dB of attenuation at 1 MHz from the transmit frequency.
- 764-960 MHz - Transmitters in this range shall have a set of isolators with a minimum of 50dB reverse isolation followed by a low pass filter and a bandpass cavity setup, which provides a minimum of 15dB of attenuation at 1 MHz from the transmit frequency.

County of Riverside Site Installation Standards

Cabling Requirements for Equipment in Racks and Cabinets

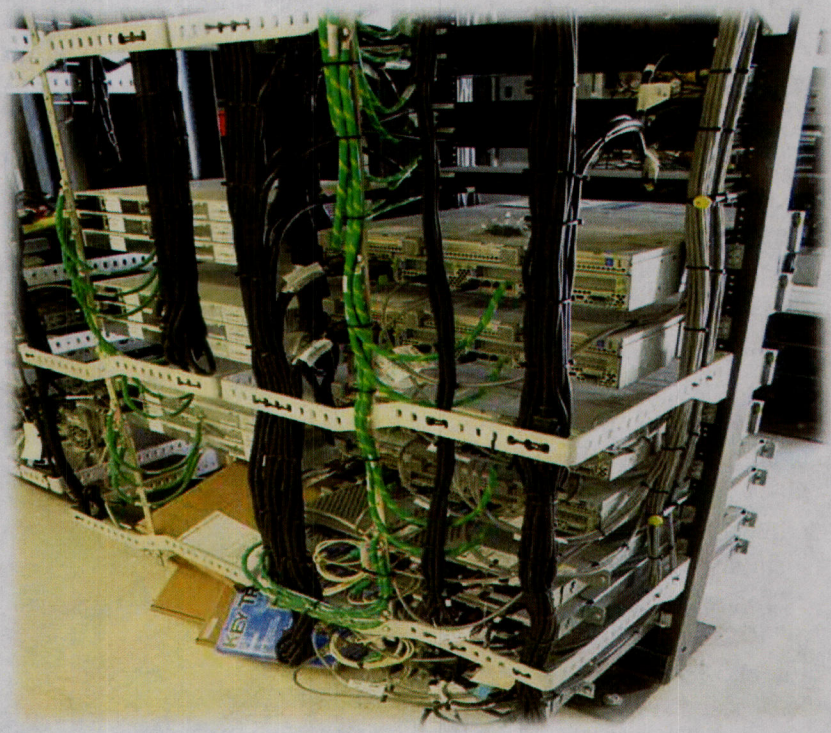
To help prevent damage or accidental disconnection, cables and conductors **shall** be secured at intervals of no more than 914 mm (3 ft.). Attachment **shall** be accomplished in a manner that does not restrict access to the equipment in the rack or cabinet.

- Insulated standoffs are recommended for use in racks or cabinets. The standoffs should be of sufficient length to maintain the proper cable separation.
- Nonmetallic cable ties shall be used to secure cables and conductors. Attachment shall be tight enough to secure cables without crushing or deforming them.
- Nonmetallic cable ties must be cut with flush cut side cuts directly adjacent to the locking tab to prevent sharp protrusions.
- When tenants install their own cabinet or rack all grounding conductors within racks or cabinets shall be routed toward the RGB, MGB, SSGB, or ground bus conductor. Connections to the RGB or ground bus conductor shall always be made with the equipment grounding or tap conductors being routed toward the MGB, SSGB, or RGB.
- Whenever possible, cable groups of different types should maintain 50.8 mm (2 in.) separation when passing through the cabinet housing. When the 50.8 mm (2 in.) separation cannot be maintained at the through the cabinet housing penetration, separation shall be maintained before and after the penetration point. Cables are to be run neatly. Cable management over relay racks and equipment cabinets is accomplished by utilizing cable tray systems. Cable trays provide proper support of cables between cabinets, relay racks and bays of equipment and help maintain adequate separation between the cable groups. The orderly separation and support of cable also simplifies maintenance. All cables installed in cable trays shall installed in a neatly secure fashion with all listed requirements met.



- Cables in racks or cabinets shall be sized to length, and shall be installed and routed neatly and in a workmanlike manner.
- AC power cords longer than necessary may be looped down and back up a rack or cabinet. Excess lengths of AC power cord shall not be coiled on top of racks or cabinets.
- Grounding conductors of all sizes shall maintain a minimum bending radius of 203 mm (8 in.). The angle of any bend shall be not less than 90 degrees.

- The bending radius of CAT-5e cables shall be not less than 10 times the outside diameter of the cable. Follow the cable manufacturer's recommendations and see ANSI/TIA/EIA-568(b) and CSAT529-1995 for additional information.



- All other cables shall not have sharp bends which will damage or degrade the performance of the cable. The cable manufacturer's specifications shall be followed.
- Cabling in racks or cabinets shall be grouped according to function. Groups are defined as:
  - AC power cords
  - DC power cables
  - Ground conductors
  - RF transmission cabling
  - Data, control, signal and timing reference cabling and telephone cabling
- Cable groups within racks and cabinets shall be separated by 50.8 mm (2 in.) from other cable groups. See ANSI/TIA/EIA-568(b) and -569(b); and NFPA 70-2005, Articles 800.133, 810.18,820.133 and 830.133 for additional information.
- When practical, cable groups at or in close proximity to equipment chassis should be separated by 50.8 mm (2 in.) or cross at a 90-degree angle.

Communication Cabling Requirements for Plenums and Other Air-Handling Spaces

- Non-plenum rated power cabling shall not be installed within plenums. Failure to use plenum-rated cables in these areas can result in generation of toxic fumes in the event of a fire. Wiring systems may be installed in ducts specifically constructed to transport environmental air only when such wiring consists exclusively of the following. See NFPA 70-2005, Article 300.22(B) for additional information:
- Type MI (mineral insulated) cable
- Type MC (metal-clad) cable employing a smooth or corrugated impervious metal sheath without an overall nonmetallic covering.
- Type CMP (communications plenum cable), electrical metallic tubing, flexible metal tubing, intermediate metal conduit, or rigid metal conduit. Flexible metal conduit and liquid-tight

flexible metal conduit shall only be permitted in lengths not exceeding 1.22 m (4 ft.), to connect physically adjustable equipment and devices permitted to be in the ducts. See NFPA 70-2005, Article 300.22(B) for additional information.

- Wiring installed in other spaces used for environmental air, such as the area above a suspended ceiling or as otherwise defined in NFPA 70-2005, Article 300.22(C), shall be installed in accordance with NFPA 70-2005, Article 300.22(C). Such wiring methods include using Type MI (mineral insulated) cable, Type MC (metal-clad) cable without an overall nonmetallic covering, and Type AC (armored cable) cable. See NFPA 70-2005, Article 300.22(C) for additional information.

Antenna-Installation Installation and Removal of Antennas and Cables

An interference analysis shall be performed to determine interference that may exist at the location. The EME study will be the responsibility of the party requesting the new equipment installation. The EME study will be made available to the County of Riverside Site Administrator for approval before site work is to proceed.

All antennas shall have a jumper constructed of Andrew LDF4-50A (not to exceed 50 inches). and Andrew LDF5-50A is recommended as the primary feed line. A "drip loop" shall be formed as the jumper or feed line is installed. The manufacturer-recommended bending radius specifications shall not be exceeded. Coaxial feed line connectors shall not fall within, or be obscured by, any antenna support pipe or conduit run when making antenna feed line installations inside of support pipes or conduit runs. Antenna feed line runs to be installed in conduit or pipes will require special consideration and the approval of the Site Manager.

All antenna feed line runs shall be secured to the existing Unistrut brackets with HOT-DIP GALVANIZED Unistrut clamps and STAINLESS STEEL hardware.

All antenna feed line runs to be installed on towers shall follow the appropriate antenna feed line ladder support. This is dependent upon which side of the tower the antenna is to be mounted. Accordingly, inside and outside positions on the cable ladder shall be evenly utilized when making antenna feed line installations. All antenna feed line runs shall be secured to the antenna feed line ladder and ice bridge.

- Transmission lines shall not be installed in a way that will impede climbing or safety devices.

County of Riverside Site Installation Standards

- Transmission lines shall not be mounted to climbing ladder rungs or climbing pegs.
- Transmission line installation should be planned with consideration for future expansion.
- Excess transmission line shall not be stored (coiled or looped) on the tower.
- Any unused or abandoned transmission line will be removed from tower.
- All transmission line connectors, splices, terminations, and jumpers shall be weatherproofed.

On towers where antenna feed line support systems have not been provided, antenna feed line runs may be secured by the utilization of stainless angle adapter clamps such as (Andrew part number 31768A) and the appropriate Andrew hanger kit number for size of cable) attached to the tower face cross angles. At other locations where galvanized pipe or electrical conduit has been utilized for mounting antennas, the vertical antenna feed line runs may be secured by the utilization of stainless steel wrap lock or stainless steel ties. When installing antenna feed line runs, no feed line shall be attached to or supported by any other individual antenna feed line run already installed. Attachment intervals shall follow that of the manufacturer recommendation as provided in the Andrew reference catalog.

The utilization of messenger cable for antenna feed line support shall be considered on an "as-needed" basis.

Antenna feed line entryways are provided for each individual equipment row. All antenna feed line runs entering or exiting these buildings shall utilize the appropriate entryway for the equipment row being utilized. Each entryway port shall be fully utilized prior to the use of another entryway. Microflect entryway boots shall be used for the appropriate remote sites.

All antenna feed line runs inside buildings (where cable trays are provided) may be secured by utilization of black nylon cable ties. Where cable trays are not provided, the use of jiffy clips, one-hole pipe straps, rigid conduit straps, Unistrut and Unistrut clamps or black nylon cable ties shall be permitted to secure antenna feed line runs. Utilization of ELECTRO-GALVANIZED or PLATED material inside of buildings is permitted.

When Andrew LDF5-50A antenna feed line is used for the primary run, it shall terminate (when cable trays are provided) approximately twelve inches prior to being centered over a radio rack or radio cabinet. A jumper cable utilizing Andrew LDF4-50A shall be constructed to connect the antenna feed line to a base station, duplexer, transmitter combiner or receiver combiner, etc. In some cases RG-214, RG-142, RG-400 or Andrew FSJ4-50B may be permitted

A coax protector is to be utilized for the installation, it shall be installed in the cable tray between the 7/8" run of antenna feed line and the jumper cable going to the equipment. The coax

protector shall be connected to the ground bus at this point. A SPD shall be used for single station installations and an IS-PT50HN-MA or similar shall be used for installations with combiners.

All antenna feed line runs shall have cable identification tags and shall denote antenna location on tower. An antenna location chart and antenna feed line run chart shall be provided by the RCIT Site Manager for each County-controlled site.

The antenna feed line point of connection to a vertical antenna (Stationmaster type) shall be sealed with electrical tape. A minimum of three wraps shall be utilized. All other types of antennas, with exposed connectors, shall be sealed with Andrew Type 34283 Connector Burial Kit. This shall consist of one wrap of electrical tape, one wrap of Type 34283 Connector Burial Kit and three additional wraps of electrical tape. All wraps shall be properly cut and sealed.

The point of connection of the jumper Andrew LDF4-50A and LDF5-50A (on the antenna end) shall be sealed. This shall consist of one wrap of electrical tape, one wrap of Andrew Type 34283 Connector Burial Kit and three additional wraps of electrical tape. All wraps shall be properly cut and sealed. All transmission lines shall be labeled per county guidelines. County guidelines will be provided from the Site Manager prior of installation.

RF Transmission Line and Preamplifier Grounding

All antenna feed line runs shall be grounded and **shall** comply with all applicable codes in use by the authority having jurisdiction. Grounding systems **shall** be installed in a neat and workmanlike manner (NFPA 70-2005, Article 110.12 and NFPA 780-2004, section 1.4). This will require the installation of a grounding kit similar to Andrew Type 204989-2 Strap Kit (for Andrew LDF5-50A) or appropriate kit number for the antenna feed line being used. All transmission lines **shall** be installed and bonded to the tower using ground kits as follows:

- Each transmission line run shall have entry port boots (inside and/or outside), lightning protectors and associated mounting brackets, and any additional jumpering required by the site specific RF configuration. Some manufacturers provide transmission line kits, which include the main line connectors, top and bottom jumpers, line grounding kits (typically three per line), hoist grips, and weatherproofing materials.
- Coaxial cable transmission lines shall be bonded and grounded in accordance with the installation practices listed below. To minimize the formation of condensation and ice on transmission lines, a drip loop should be created at the point where the direction of the

transmission lines changes from vertical to horizontal. To lessen the likelihood of moisture on the cables getting into the shelter, the cables should be installed with a slight upward incline as they approach the shelter.

- Transmission line ground kits shall be installed per manufacturer specifications.
- Transmission line ground kits shall be sealed from the weather to prevent water and corrosion damage to the transmission line (ANSI T1.313-2003, section 10.5).
- When a tower bus bar is not available the transmission line ground kits shall be attached to an effectively grounded vertical member of the tower, using tower manufacturer-approved methods (typically a type of mechanical clamp).
- Transmission line ground kits shall be attached to a tower bus bar if available.
- Transmission line ground kit grounding conductors shall be installed without drip loops, parallel to the transmission line, and pointed down towards the ground to provide a direct discharge path for lightning (ANSI T1.313-2003, section 10.5.1).
- Transmission line ground kits shall be installed at the first point of contact, near the antenna (ANSI T1.334-2002, section 6.6; ANSI T1.313-2003, section 10.5.1; and MIL-HDBK-419A).
- Transmission line ground kits shall be installed at the bottom of the tower near the vertical to horizontal transition point (ANSI T1.313-2003, section 10.5.1; ANSI T1.334-2002, section 6.6; and MIL-HDBK-419A). The ground kits shall be bonded to the tower or tower ground bus bar (TGB) if installed.
- If the tower is greater than 61 m (200 ft.) in height, an additional ground kit shall be installed at the tower midpoint (ANSI T1.334-2002, section 6.6 and MIL-HDBK-419A). Additional ground kits shall be installed as necessary to reduce the distance between ground kits to 61 m (200 ft.) or less.
- In high lightning prone geographical areas, additional ground kits should be installed at spacing between 15.2 to 22.9 m (50 to 75 ft.) (ANSI T1.313, section 10.5.1 and ANSI T1.334-2002, section 6.6). This is especially important on towers taller than 45.7 m (150 ft.).

All antennas and transmission lines supported by wooden poles, or installed on the side of a structure will be handled and designed on a case by case basis and approved by the Site Manager.

The use of Andrew FSJ4-50B SUPERFLEXIBLE cable shall be permitted only in those cases where the bending radius required cannot be achieved when using Andrew LDF4-50A. The use of Andrew FSJ1-50 or Andrew LDF2-50 shall not be permitted. Any variation from the above shall require the approval of the RCIT Site Manager for County-controlled facilities. Coordination and approval shall be required with other controlling agencies.

County of Riverside Site Installation Standards

Microwave Dish Installation

All microwave dish mounts shall be HOT-DIPPED GALVANIZED after fabrication. Each microwave dish leg mount shall be constructed and mounted so as to be plumb. All microwave dishes, after mounting, shall have a stabilizer arm attached and shall be properly anchored so as to prohibit the microwave dish from moving during high winds. Mounting of microwave dishes between tower legs shall be considered on an "as-needed" basis.

Elliptical waveguide shall be utilized for all microwave installations from 6 GHz through 18 GHz. When RF transmitters are installed they must be maintenance per manufacture guidelines and must be incompliance. This includes ensuring all shields are maintained properly and installed correctly, this includes but not limited to:

- Not allowing transmit antennas inside equipment rooms or near the ground level of sites.
- Ensuring all microwave dishes are directed away from facilities.
- Proper use and installation of transmission lines and connectors. When waveguide carrying high power is used, verification of fitting integrity must be performed to ensure there is no RF leakage.
- Each transmission line run shall have entry port boots (inside and/or outside), lightning protectors and associated mounting brackets, and any additional jumpering required by the site specific RF configuration. Some manufacturers provide transmission line kits, which include the main line connectors, top and bottom jumpers, line grounding kits (typically three per line), hoist grips, and weatherproofing materials.
- Strain relief devices shall be used a minimum of every 60.8 m (200 ft.) during transmission line installation and shall remain in place to support the cable after installation. A support cable should be used between the grips to prevent damage to the transmission line caused by lifting from only one point.
- Coaxial cable transmission lines shall be bonded and grounded in accordance with antenna installation grounding installation.
- To minimize the formation of condensation and ice on transmission lines, a drip loop should be created at the point where the direction of the transmission lines changes from vertical to

horizontal. To lessen the likelihood of moisture on the cables getting into the shelter, the cables should be installed with a slight upward incline as they approach the shelter.

All microwave waveguide shall be grounded by following the same procedure as that of antenna feed line grounding. The required grounding kit shall be obtained from the Andrew reference catalog for the type of waveguide being utilized. Special consideration shall be given to microwave waveguide installations and shall require contacting the RCIT Site Manger. All transmission lines shall be labeled per county guidelines. County guidelines will be provided from the Site Manager prior of installation.

When equipment/users vacate a communications building, the antenna(s), transmission line(s) along with all hardware and appurtenances are to be removed from the tower and inside the comm. building.

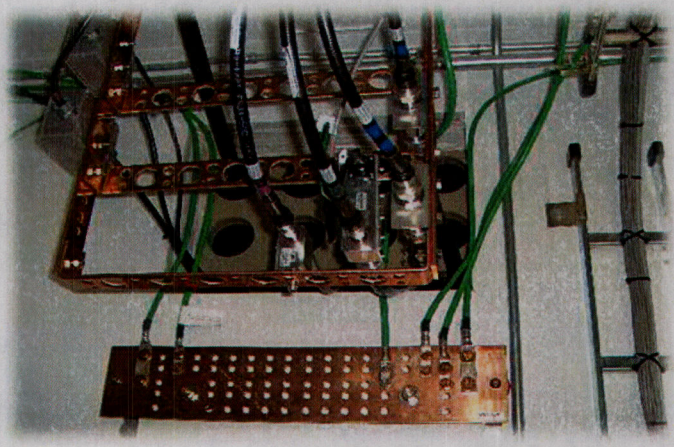
Documentation

All systems, when installed shall provide the following prior to acceptance:

- Transmitter frequency by antenna mount
- Power out of transmitter
- FCC License

Coordination with the RCIT Site Manager shall be required when multiplex channels are to be installed in the County Microwave System.

Surge Protection Devices (SPDS)



All surge protection devices and outside telecommunication cable metallic shields including, but not limited to, items listed below **shall** be effectively bonded back to the internal grounding (earthing) system with a 16 mm2 csa (#6 AWG) or coarser equipment grounding conductor by using the following requirements and connection methods described within this document:

- Individual RF Surge Protection Devices
- Primary Surge Protection Devices
- Secondary Surge Protection Devices
- Telecommunication Cable Metallic Shields
- GPS Cable Metallic Shields

RF Surge Protection Devices

RF transmission SPDs **shall** be bonded to the MGB within 610 mm (24 in.) of entry into the equipment shelter, equipment room or equipment area. A separate equipment grounding (earthing) conductor **shall** be used to bond each of these devices to the MGB or to a SSGB. RF

transmission line SPDs may also be bonded directly to a SSGB, MGB, or the copper integrated entry panel with the proper securing hardware.

AC/UPS Power Specifications

All tenant provided UPS's shall be rack mounted and approved by the Site Manager.

Grounding Installation check list

- All grounding conductors shall be installed and routed so that personal safety is not compromised and that all equipment is serviceable. The following requirements shall apply:
- Length: conductors shall be no longer than required to achieve their purpose and shall be installed and routed in a professional and workmanlike manner.
- Support: conductors shall be secured or attached to surfaces as required to ensure they do not become damaged or disconnected. Conductors shall be secured in a manner that permits associated equipment to be easily serviced. Conductors shall be secured at no greater than 3 foot intervals.
- Protection: conductors installed in areas where they may be subjected to damage shall be sleeved in electrical non-metallic tubing, or other conduit, that is securely attached to the surface over which it is routed.
- In locations where metallic tubing or conduit is required for adequate protection, the conductor(s) routed through the metallic tubing or conduct must be effectively bonded to each end of the conduit using suitable listed means and devices.
- When ground conductor tap joints are used, they shall be properly insulated as to prevent the bare conductor or connection device from making incidental contact with metallic surfaces.

Grounding Routing

- At points where conductors are routed through holes within metallic surfaces, the surfaces shall be suitably protected with grommets or other material to minimize damage to the conductor or insulation.
- Conductors shall be routed toward the MGB. Connections to bus conductors shall always be made with the tap conductors routed toward the MGB.
- At points where conductors must pass through a hole in a metallic surface and the hole is slightly larger than the conductor, the conductor shall be bonded to the metallic surface

through which it passes. If the hole or opening is much larger than the conductor and is intended to accommodate several conductors, the conductor is not required to be bonded.

- Ground bus conductors may be routed within cable trays, on the outside of cable trays where suitable support is provided, or along equipment platforms.
- Equipment grounding conductors shall be installed along the rack rail.
- Ground bus conductors shall be routed using the shortest possible routes.
- Bending radius: Ground bus conductors of all sizes shall maintain a minimum bending radius of 8 inches. The angle of any bend shall not be less than 90 degrees.

Tenant Communication

If there are situations in which one tenant needs to communicate with another tenant regarding equipment at the site, all communication will go through the Riverside County Site Manager. Unless directed by the Riverside County Site Manager, or a life and death emergency, tenants **shall not** contact other tenants regarding the site, equipment, interference, etc.

Check in - check out procedure

- Central call in number for site personnel
- Installers/techs to provide work authorization number provided by county prior to work performed.

Ingress Procedures

To enter County of Riverside Communications Center and Other Communications Facilities, contact the RCIT Radio Maintenance Group at 951-955-3580. This number is to be used during regular business hours and after hours. Our regular business hours are

Mon-Thurs 7:00 AM – 4:30 PM Fri 7:00 AM – 3:30 PM

Closed the Following Holidays: New Year's Day, Martin Luther King Day, Lincoln's Birthday, Washington's Birthday, Memorial Day, Independence Day, Labor Day, Columbus Day, Veterans' Day, Thanksgiving, Day After Thanksgiving, Christmas Day.

When Christmas or New Year's Day falls on a Tuesday, the County will be closed the day before the holiday. When Christmas or New Year's Day falls on a Thursday, the County will be closed the day after the holiday.

Ingress Procedures – Scheduled Maintenance, Regular Business Hours

Contact the RCIT Radio Maintenance Group (Radio Shop) three (3) business days prior to the scheduled work to be performed. Notify the Radio Shop of the estimated duration and nature of the scheduled work, the number of personnel to be on site, and the number of vehicles expected to be used.

Ingress Procedures – Scheduled Maintenance, After-Hours

Contact the Radio Shop three (3) business days prior to the maintenance work to notify them of the estimated time and nature of the scheduled work, the number of personnel to be on site, and the number of vehicles expected to be used.

Ingress Procedures – Scheduled System Outage, Regular Business Hours

Contact the Radio Shop five (5) business days prior to the outage. Notify them of the nature of the outage, the estimated time repair personnel will be on site, and the estimated number of staff and vehicles that will be required.

Ingress Procedures – Scheduled System Outage, After-Hours

Contact the Radio Shop five (5) business days prior to the outage. Notify them of the nature of the outage, the number of personnel and vehicles required to make the necessary repairs, and the estimated time and duration of the site visit.

Ingress Procedures – Unscheduled System Outage, Regular Business Hours

Contact the Radio Shop as soon as you are aware of the outage. Notify them of the nature of the outage, the estimated time repair personnel will be on site, and the estimated number of staff and vehicles that will be required.

Ingress Procedures – Unscheduled System Outage, After-Hours

Contact the Radio Shop as soon as you are aware of the outage. Notify them of the nature of the outage, the estimated time repair personnel will be on site, and the estimated number of staff and vehicles that will be required.

Site Logbook

All site work is to be recorded in the Site Logbook.

- All personnel entering a communications site are to record, in the Site Log Book, the date of their entry, a brief description of the work performed and the names of the personnel performing the work.
- Contact/User information listed in Site Log Book.
- A section of the Site Log Book will be set aside to record all pertinent contact information for the current site users. This information will include Name, Telephone and Email of the responsible person or department to contact in case of questions or emergency. It is the responsibility of each site user to keep the information current. If the information should change, the County of Riverside Site Administrator is to be notified.

Copy of valid FCC license(s) and COR Technical Data Form posted for location

A copy of the current FCC license must be posted in the Communications Site for the equipment installed.

- The equipment installation must meet with the license terms.

- A copy of the license must be provided to the County of Riverside Site Administrator before the transmitting equipment will be allowed to be placed in service.

A copy of the Riverside County Application and Technical Data Form as approved by Riverside County Facilities Management must be posted in the site.

Exhibit H

Example Site Pictures

Appendix F2 - Arlington Site Picture Examples

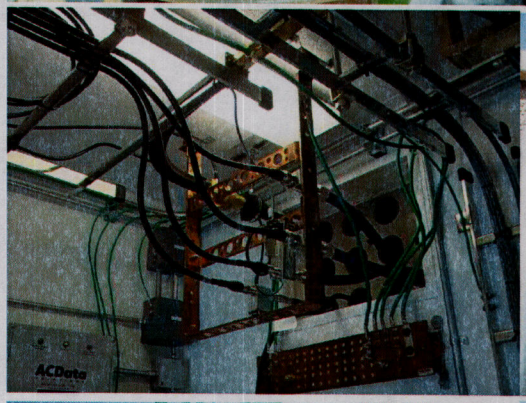
Contractor is required to take current pictures while performing inspections of all connections and antenna installations, checklist items verifying completion of inspection work.

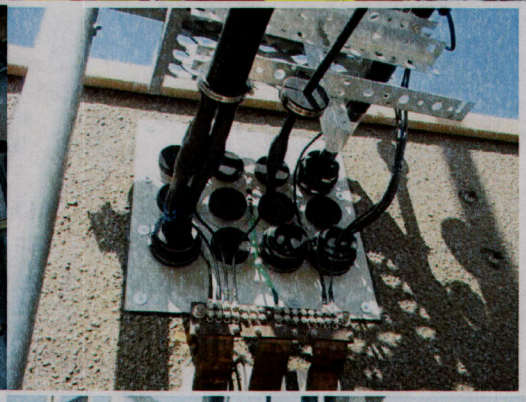

THIS END UP
DANGER
ARL TX2

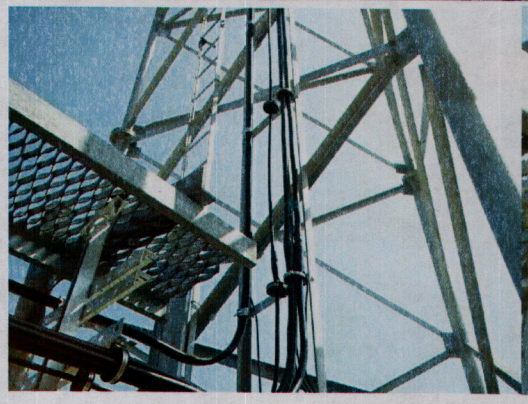

THIS END UP
DANGER
ARL TX1

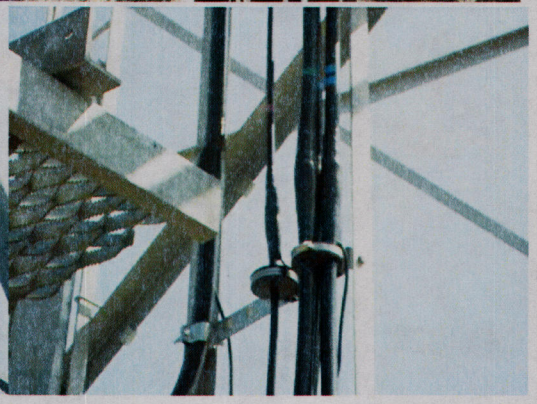

THIS END UP
DANGER
PENETRATOR
ARL TX1

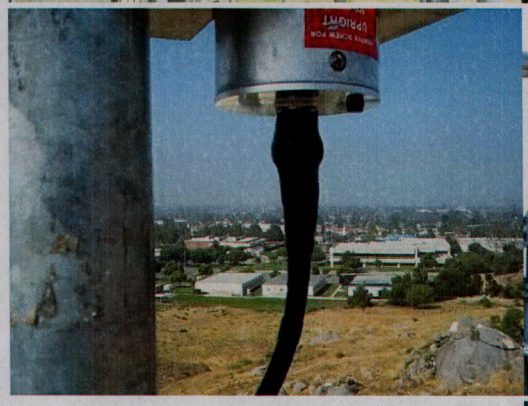

THIS END UP
DANGER
ARL TX1

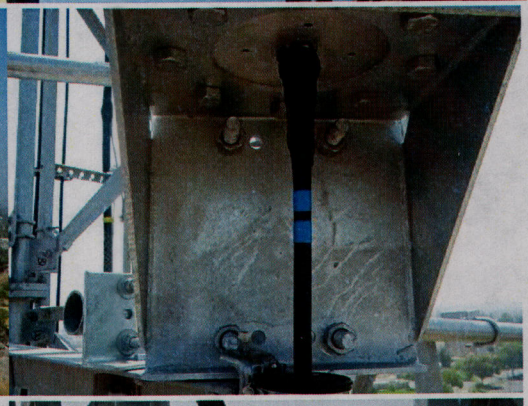

ACData











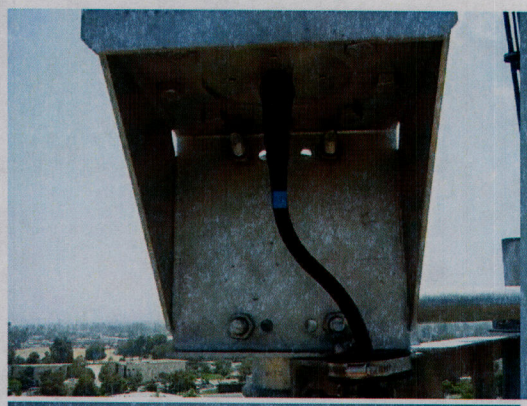


EXHIBIT F

ANTENNA SYSTEM COMMISSIONING GUIDE

METHOD OF PROCEDURE

Equipment List:

1. Bird Site Analyzer or Anritsu Site Master.
2. 1.5 Meter Armored Phase Stable cable Type N to Type N & Type N to DIN.
3. Precision Open/Short/Load combinations for type N and DIN connectors.
4. Site Analyzer to PC serial cable.
5. Computer to store traces.

The majority of the antenna system components will be tested with the Bird Site Analyzer. The final antenna Return Loss test after the antenna is mounted will be completed with the Anritsu Site Master. Final captured displays characteristics will differ slightly between the Anritsu & Bird but will contain accurate Return Loss measurements.

A phase stable cable is used in testing of all antenna system components and must be part of the calibration setup (follow manufactures instructions for calibration of equipment).

Test 1 - Antenna Jumper Testing – Return Loss Test Using a Precision Load & Insertion Loss Test (Cable Loss) Using a Precision Short.

The first test required for commissioning an antenna system is to test the antenna jumper. The jumper is tested for **Return Loss** and **Insertion Loss (Cable Loss).** Below are the steps necessary to test the antenna jumper:

1. Set Site Analyzer mode to **Return Loss** (dB).
2. Set the frequency range of the Site Analyzer. The frequency range is set to 744 MHz to 871 MHz (2 MHz above and below the antenna's operating frequency)
3. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
4. Connect the Site Analyzer phase stable cable directly to the antenna jumper.
5. Terminate antenna jumper with a precision load.
6. Perform a **Return Loss** test of the antenna jumper.
7. Save the **Return Loss** test results into the Site Analyzer memory or download the test results to a computer.
8. Verify the antenna jumper meets or exceeds **Return Loss** specifications throughout the test frequencies. Typical **Return Loss** values are -28dB or better.
9. Set analyzer mode to **Cable Loss**.
10. Set the frequency range of the Site Analyzer. The frequency range is set to 744 MHz to 871 MHz (2 MHz above and below antenna's operating frequency)
11. Calibrate the Site Analyzer as per the manufacture's instructions.
12. Connect the Site Analyzer phase stable cable directly to the antenna jumper.
13. Terminate the antenna jumper with a precision short.
14. Perform a **Cable Loss** test of the antenna jumper.
15. Save the **Cable Loss** test results into the Site Analyzer memory or download the test results to a computer.
16. Verify the antenna jumper and connectors meet or exceed the **Insertion Loss** specifications throughout the test frequencies, as specified by the manufacturer. See chart 1A.
17. The antenna jumper test will be performed prior to installation.
18. Repeat this test on the main transmission feed line after installation.

Test 2 - Antenna Testing – Return Loss

The second test required for commissioning an antenna system is to test the actual antenna. The antenna is tested for **Return Loss** across its specified bandwidth. Below are the steps necessary to test the antenna:

1. Set Site Analyzer test mode to **Return Loss** (dB).
2. Set the frequency range of the Site Analyzer. The frequency range set to 744 MHz to 871 MHz (2 MHz above and below antenna's operating frequency)
3. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
4. Connect the Site Analyzer directly to the antenna (no antenna jumper, if possible). Note: This test is performed prior to antenna installation and after antenna installation on the tower at the location where it will be used.
5. Perform a **Return Loss** test of the antenna.
6. Save the **Return Loss** test results into the Site Analyzer memory or download the test results to a computer.
7. Verify the antenna meets or exceeds its **Return Loss** specifications throughout its bandwidth, as specified by the antenna manufacturer. Typical value is -14dB.

TEST 3 - TRANSMISSION LINE DISTANCE-TO-FAULT TEST WITHOUT ANTENNA OR ANTENNA JUMPER, USING A PRECISION SHORT

The third test required for commissioning an antenna system is to perform a **Distance-To-Fault (DTF)** measurement of the transmission line system. The **Distance-To-Fault** measurement of the transmission line is performed with the cable terminated with a precision short. Below is a list of the required steps necessary to perform the transmission line system **Distance-To-Fault** measurement using a precision short:

1. Set Site Analyzer mode to **Distance-To-Fault.**
2. Set the frequency range of the Site Analyzer. The frequency range should be a wide range of frequencies (such as 500 MHz) centered on the antenna's specified center frequency of 807.500 MHz. Smoothing should be set to medium.
3. Select the appropriate cable type in the Site Analyzer DTF setup.
4. Set the distance range of the Site Analyzer. D1 should equal zero. D2 should be approximately 25% longer than the total cable distance.
5. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
6. Connect the Site Analyzer to the transmission line where it enters the building (i.e. **not** going through the lightning suppressor). Terminate the end of the cable with a precision short.
7. Perform a **Distance-To-Fault** measurement of the transmission line system.
8. Save the **Distance-To-Fault** measurement results into the Site Analyzer memory or download the test results to a computer.
9. Note the location of the precision short, as shown on the Site Analyzer display. This will be needed during the next test.
10. Verify all system components meet or exceed the manufacture's specifications. Typical values can be found in chart 1A.

TEST 4 - TRANSMISSION LINE DISTANCE-TO-FAULT TEST, WITHOUT ANTENNA OR ANTENNA JUMPER, USING A PRECISION LOAD.

The forth test required for commissioning an antenna system is to perform a **Distance-To-Fault** measurement of the transmission line system. The **Distance-To-Fault** measurement of the transmission line is performed with the cable terminated with a precision load. Below is a list of the required steps necessary to perform the transmission line system Distance-To-Fault measurement using a precision load:

1. Set Site Analyzer mode to **Distance-To-Fault**.
2. Set the frequency range of the Site Analyzer. The frequency range should be a wide range of frequencies (such as 500 MHz) centered on the antenna's specified center frequency of 807.500 MHz. Smoothing should be set to medium.
3. Select the appropriate cable type in the Site Analyzer DTF setup.
4. Set the distance range of the Site Analyzer. D1 should equal zero. D2 should equal approximately 25% longer than the total cable distance.
5. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
6. Connect the Site Analyzer to the transmission line where it enters the building (i.e. **not** going through the lightning suppressor). Terminate the end of the cable with a precision load.
7. Perform a **Distance-To-Fault** measurement of the transmission line system.
8. Save the **Distance-To-Fault** measurement results into the Site Analyzer memory or download the test results to a computer.
9. Note the location of the precision load, as shown on the Site Analyzer display. Compare this with the location of the precision short from step nine of test 3. The precision short and precision load should appear at the same distance. Record the main feedline length and calculate the **Insertion Loss** for main feedline. This calculated value will be needed for the feedline and feedline plus jumper **Insertion Loss** test.
10. Verify all system components meet or exceed the manufacture's specifications. Typical values can be found in chart 1A.

TEST 5- TRANSMISSION LINE DISTANCE-TO-FAULT TEST, WITH ANTENNA JUMPER, USING A PRECISION SHORT

The fifth test required for antenna system commissioning is to perform a **Distance-To-Fault (DTF)** measurement of the transmission line system using a precision short. The **Distance-To-Fault** measurement of the transmission line system is performed with the antenna jumper in place and terminated with a precision short. Below is a list of the required steps necessary to perform the transmission line system **Distance-To-Fault** measurement:

1. Set Site Analyzer mode to **Distance-To-Fault.**
2. Setup frequency range of the Site Analyzer. The frequency range should be a wide range of frequencies (such as 500 MHz) centered on the antenna's specified center frequency of 807.500 MHz. Smoothing should be set to medium.
3. Select the appropriate cable type in the Site Analyzer **DTF** setup.
4. Setup distance range of the Site Analyzer. D1 should equal zero. D2 should equal approximately 25% longer than the total cable distance.
5. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
6. Connect the Site Analyzer to the transmission line where it enters the building (i.e. **not** going through the lightning suppressor). Terminate the end of the cables with a precision short.
7. Perform a **Distance-To-Fault** measurement of the transmission line system.
8. Save the **Distance-To-Fault** measurement results into the Site Analyzer memory or download the test results to a computer.
9. Note the location of the precision short, as shown on the Site Analyzer display. This will be needed during the next test.
10. Verify all system components meet or exceed the manufacture's specifications. Typical values can be found in chart 1A.

TEST 6 - TRANSMISSION LINE DISTANCE-TO-FAULT TEST, WITH ANTENNA JUMPER, USING A PRECISION LOAD

The sixth test required for antenna system commissioning is to perform a **Distance-To-Fault** measurement of the transmission line system using a precision load. The **Distance-To-Fault** measurement of the transmission line system is performed with the antenna jumper in place and terminated with a precision load. Below is a list of the required steps necessary to perform the transmission line system **Distance-To-Fault** measurement:

1. Set Site Analyzer mode to **Distance-To-Fault.**
2. Setup frequency range of the Site Analyzer. The frequency range should be a wide range of frequencies (such as 500 MHz) centered on the antenna's specified center frequency of 807.500 MHz. Smoothing should be set to medium.
3. Select the appropriate cable type in the Site Analyzer **DTF** setup.
4. Setup the distance range of the Site Analyzer. D1 should equal zero. D2 should equal approximately 25% longer than the total cable distance.
5. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
6. Connect the Site Analyzer to the transmission line where it enters the building (i.e. **not** going through the lightning suppressor). Terminate the end of the cables with a precision load.
7. Perform a **Distance-To-Fault** measurement of the transmission line system.
8. Save the **Distance-To-Fault** measurement results into the Site Analyzer memory or download the test results to a computer.
9. Note the location of the precision load, as shown on the Site Analyzer display. Compare this with the location of the precision short from step nine of test 5. The precision short and precision load should appear at the same distance.
10. Verify all system components meet or exceed the manufacture's specifications. Typical values can be found in chart 1A.

TEST 7 - TRANSMISSION LINE RETURN LOSS TEST, WITH ANTENNA JUMPER, USING A PRECISION LOAD

The seventh test required for antenna system commissioning is to measure the **Return Loss** of the transmission line while it is terminated at the top of the tower with the antenna jumper and precision load. Below is a list of the required steps necessary to measure the transmission line **Return Loss**:

1. Set Site Analyzer mode to **Return Loss** (dB).
2. Set the frequency range of the Site Analyzer. The frequency range set to 744 MHz to 871 MHz (2 MHz above an below antenna's operating frequency)
3. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
4. Install a precision load on the far end of the transmission line system, including the antenna jumper.
5. Connect the Site Analyzer to the transmission line where it enters the building (i.e. **not** going through the lightning suppressor).
6. Perform a **Return Loss** test of the transmission line system.
7. Save the transmission line **Return Loss** test results into the Site Analyzer memory or download the test results to a computer.
8. Verify the measured **Return Loss** meets or exceeds the calculated system **Return Loss**. The typical **Return Loss** value would be the **Return Loss** of the first connector, approximately -22dB or better.

Test 8 - Antenna Cable System Insertion Loss Test, With Antenna Jumper And Lightning Suppressor, Using Precision Short.

The eighth test required for antenna system commissioning is to measure the **Insertion Loss** of the antenna system (i.e. main transmission line, antenna jumper, and lightning suppressor). Below is a list of the required steps necessary to measure the antenna system **Insertion Loss (Cable Loss):**

1. Set Site Analyzer mode to **Cable Loss**.
2. Set the frequency range of the Site Analyzer. The frequency range set to 744 MHz to 871 MHz (2 MHz above and below antenna's operating frequency).
3. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
4. Install a precision short on the far end of the transmission line system, including the antenna jumper.
5. Connect the Site Analyzer to the transmission line where it enters the building including the lightning suppressor. Perform a **Cable Loss (CL)** measurement of the antenna system.
6. Save the **Cable Loss** measurement results into the Site Analyzer memory or download the test results to a computer.
7. Verify the antenna system **Insertion Loss** meets the calculated system insertion loss. (i.e. cable loss + connector losses + jumper loss + lightning suppressor loss).

Test 9 - Complete Antenna System Return Loss Test, With Antenna And Lightning Suppressor

The ninth test required for antenna system commissioning is to test the complete antenna system. The antenna system is tested for **Return Loss**. Below is a list of the required steps necessary to test the antenna system for **Return Loss**:

1. Set Site Analyzer mode to **Return Loss (dB).**
2. Set the frequency range of the Site Analyzer. The frequency range set to 744 MHz to 871 MHz (2 MHz above and below antenna's operating frequency)
3. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
4. Connect the Site Analyzer to the transmission line where it enters the building at the polyphaser.
5. Perform a **Return Loss** test of the antenna system.
6. Save the **Return Loss** test results into the Site Analyzer memory or download the test results to a computer. This trace will serve as the antenna system signature for future reference.
7. The expected system **Return Loss** is a complex vector summing of all components while considering **Insertion Loss** and is beyond explanation in this document.

TEST 10 – COMPLETE ANTENNA SYSTEM DISTANCE-TO-FAULT TEST, WITH ANTENNA AND LIGHTNING SUPPRESSOR

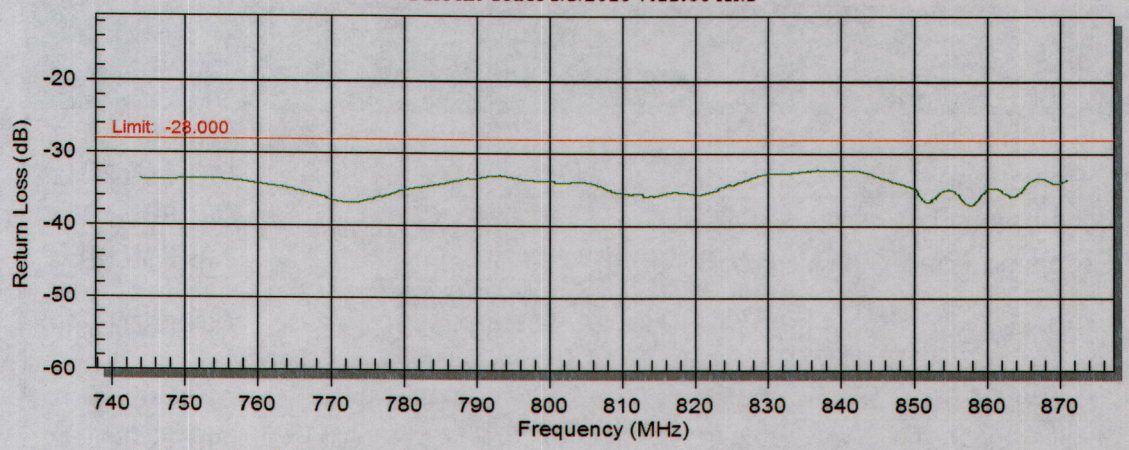
The tenth test required for antenna system commissioning is to perform a **Distance-To-Fault** measurement of the complete antenna system. The **Distance-To-Fault** measurement of the antenna system is performed with the lightning suppressor and antenna in place. Below is a list of the required steps necessary to perform the antenna system **Distance-To-Fault** measurement:

1. Set Site Analyzer mode to **Distance-To-Fault**.
2. Setup frequency range of the Site Analyzer. The frequency range should be a wide range of frequencies (such as 500 MHz) centered on the antenna's specified center frequency of 807.500 MHz. Smoothing should be set to medium.
3. Select the appropriate cable type in the Site Analyzer **DTF** setup.
4. Setup distance range of the Site Analyzer. D1 should equal zero. D2 should equal approximately 25% longer than the total cable distance.
5. Calibrate the Site Analyzer and phase stable cable as per the manufacturer's instructions.
6. Connect the Site Analyzer to the transmission line where it enters the building at the polyphaser. Perform a **Distance-To-Fault** measurement of the antenna system.
7. Save the **Distance-To-Fault** measurement results into the Site Analyzer memory or download the test results to a computer. This trace will serve as the antenna system signature for future reference
8. Verify all system components meet or exceed the manufacture's specifications. Typical values can be found in chart 1A.

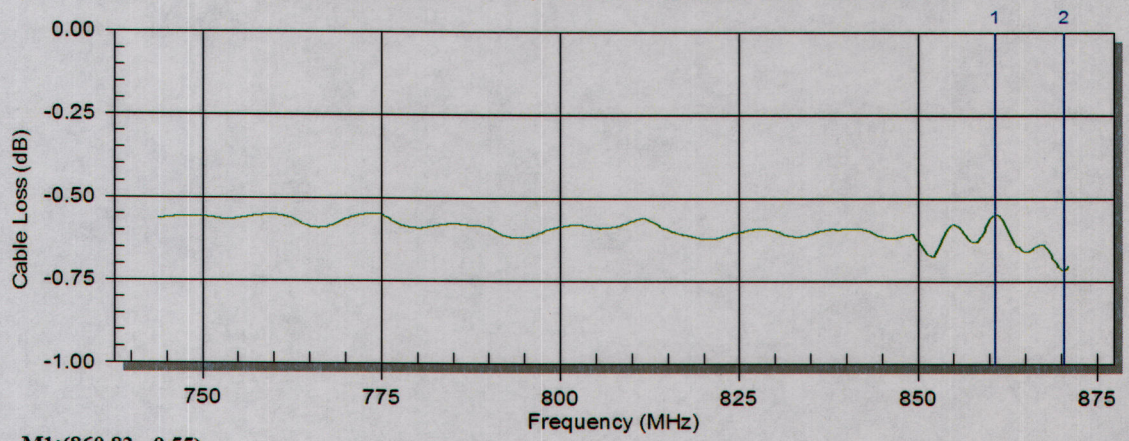
Table 1A

Component	Return Loss	Insertion Loss	Bandwidth
Antenna	≤ -14dB	n/a	746-869 MHz
Polyphaser	≤ -26dB	.1dB	746-869 MHz
Polyphaser- DC	≤ -21dB	.1dB	746-869 MHz
Precision Load	-42dB	n/a	746-869 MHz
7/8" AVA5-50	-24dB	.0101dB/foot @ 800MHz'	746-869 MHz
1/2" LDF50	-24dB	.0196dB/foot @ 800MHz'	746-869 MHz
1/2" FSJ4-50B	-24dB	.0317/foot @ 800MHz'	746-869 MHz
DIN for 1/2" LDF	-39dB	.044dB @ 800MHz'	746-869 MHz
DIN for 7/8" LDF	-39dB	.044dB @ 800MHz'	746-869 MHz
Type N for 7/8"	-39dB	.044dB @ 800MHz'	746-869 MHz
Type N for 1/2"	-39dB	.044dB @ 800MHz'	746-869 MHz
6' Jumper	-28dB	.237dB	746-869 MHz
10' Jumper	-28dB	.319dB	746-869 MHz

Return Loss. Site XYZ. 8' RG214 Antenna Jumper. Test 1
Frequency: 744 MHz - 871 MHz (Full Cal)
Current Trace 5/3/2010 7:11:00 AM

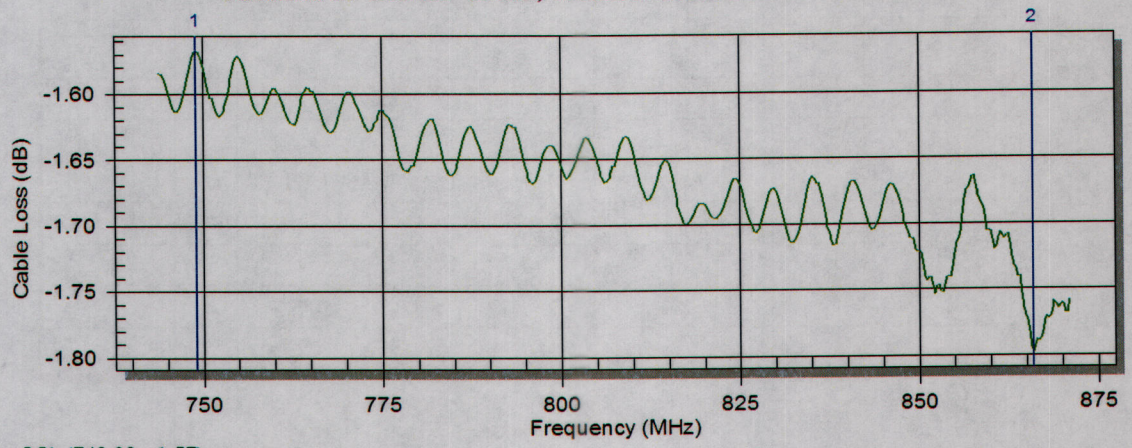


Cable Loss. Site XYZ. Tx1. 8' RG214 Jumper Test 1
Frequency: 744 MHz - 871 MHz (Full Cal)
Calculated IL .816dB (.576+.24). Measured .635dB 5/3/2010 7:37:00 PM



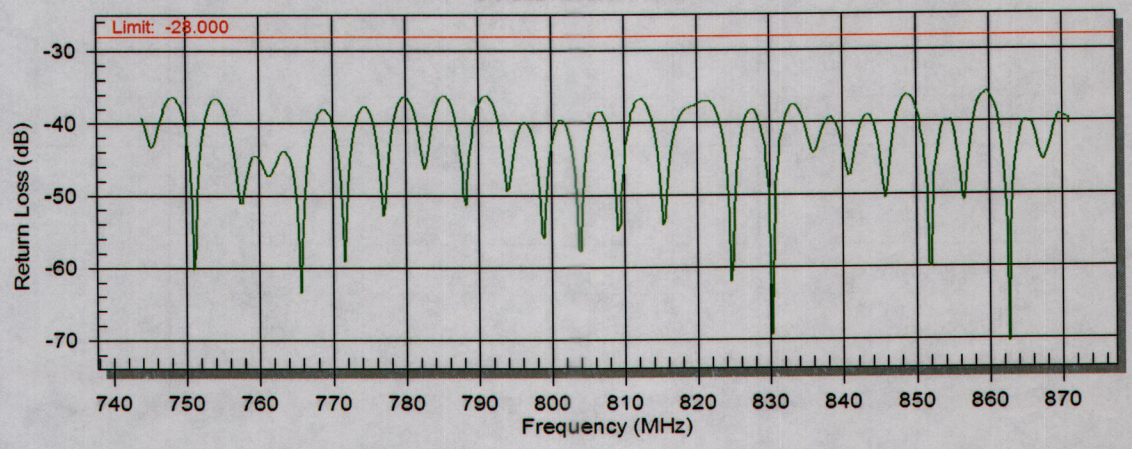
M1:(860.82, -0.55)
M2:(870.46, -0.72)

Cable Loss. Site XYZ Tx1. 81' LDF4. Feed Line. Test 1
Frequency: 744 MHz - 871 MHz (Full Cal)
Calculated IL- 1.61+.12= 1.73dB, Measured 1.68dB 5/3/2010 7:51:00 AM

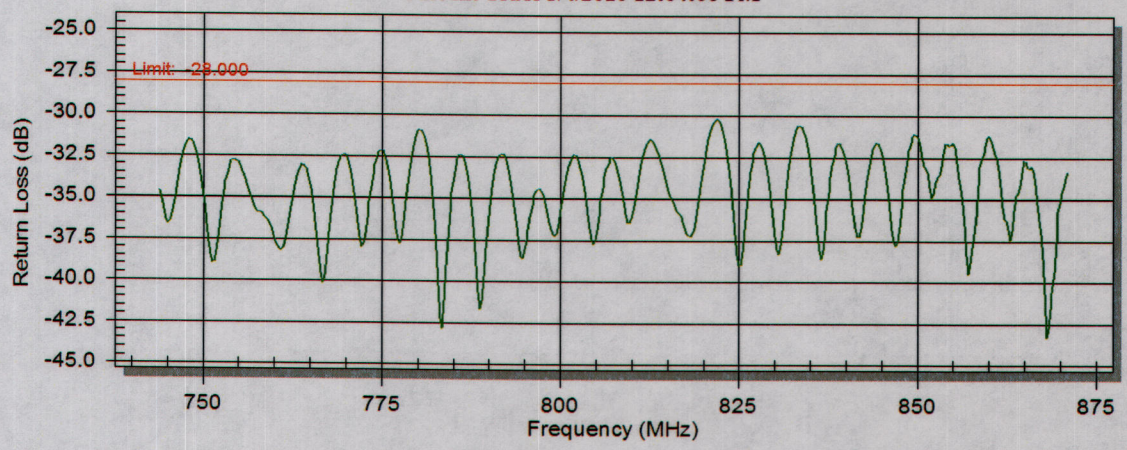


M1:(749.09, -1.57)
M2:(865.91, -1.80)

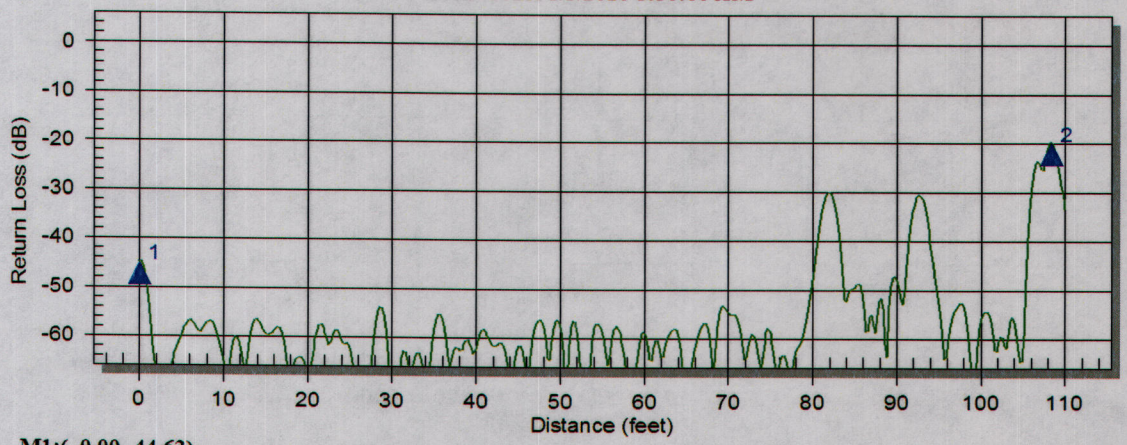
Return Loss. Site XYZ. Tx1. 81' LDF4 Feed Line. Test 1
Frequency: 744 MHz - 871 MHz (Full Cal)
5/3/2010 8:06:00 AM



Return Loss. Site XYZ. Tx1. 8' RG214 Jumper & 81' LDF4. Test 7
Frequency: 744 MHz - 871 MHz (Full Cal)
Current Trace 5/4/2010 12:04:00 PM



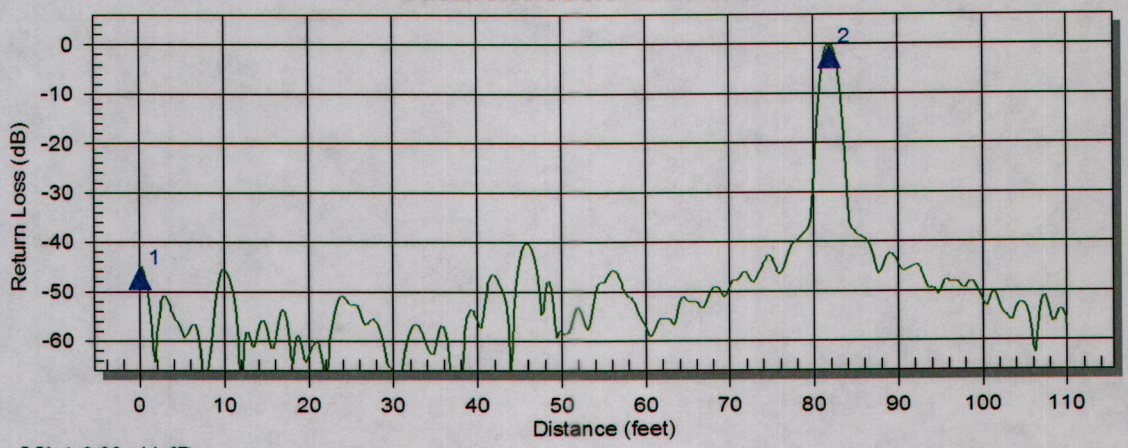
Distance To Fault. Site XYZ. Tx1. Antenna, 8' RG142 Jumper & 81' LDF4. Test 10
Distance: 0 feet - 110 feet (Full Cal)
Current Trace 5/3/2010 8:50:00 AM



M1:(0.00,-44.62)
M2:(108.38,-19.53)

Distance To Fault. Site XYZ. Tx1. 81' LDF4 Feed Line Short. Test 3

Distance: 0 feet - 110 feet (Full Cal)
Current Trace 5/3/2010 8:53:00 AM



M1:(0.00,-44.67)
M2:(81.92, -0.02)

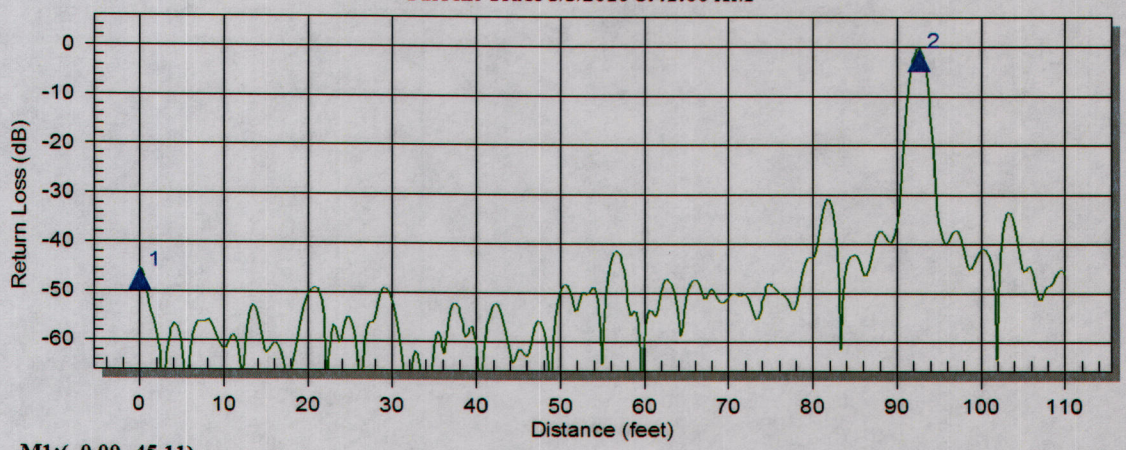
Distance To Fault.Site XYZ. Tx1. 81' LDF4. 50 ohm load Test 4

Distance: 0 feet - 110 feet (Full Cal)
Current Trace 5/3/2010 9:12:00 AM

M1:(0.00,-44.82)
M2:(81.69,-41.80)

Distance To Fault. Site XYZ. Tx1. 8' RG142 Jumper & 81' LDF4. Short. Test 5

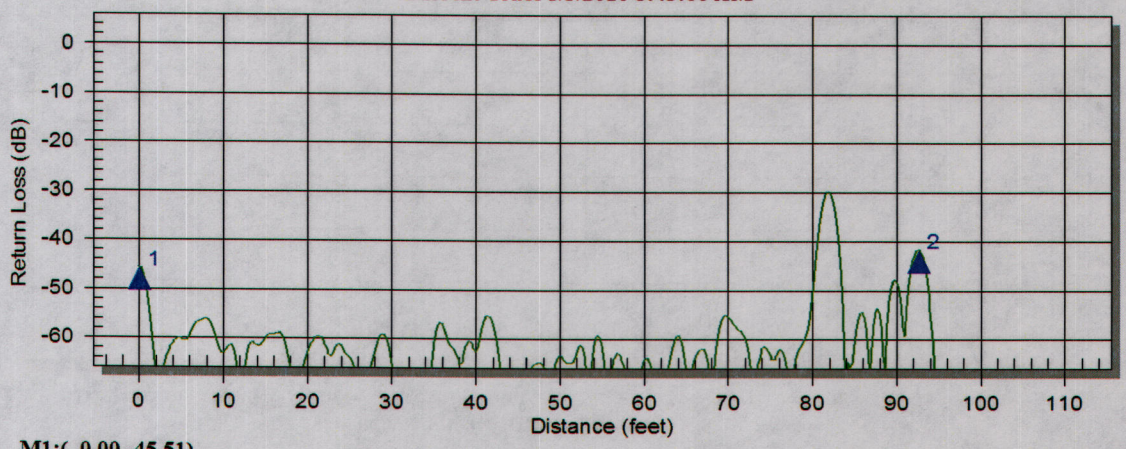
Distance: 0 feet - 110 feet (Full Cal)
Current Trace 5/3/2010 8:41:00 AM



M1:(0.00,-45.11)
M2:(92.59, -0.11)

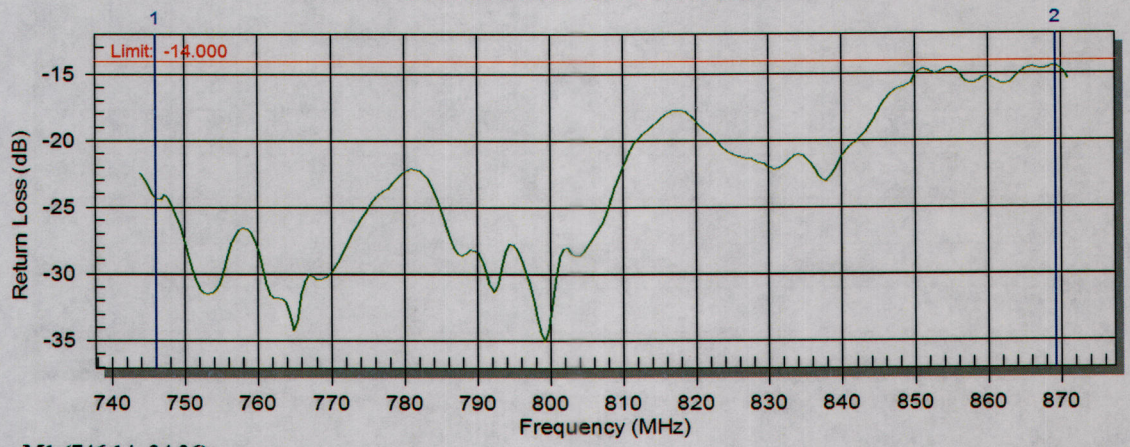
Distance To Fault. Site XYZ. Tx1. 8' RG214 Jumper & 81' LDF4. 50 Ohm Test 6

Distance: 0 feet - 110 feet (Full Cal)
Current Trace 5/3/2010 8:43:00 AM



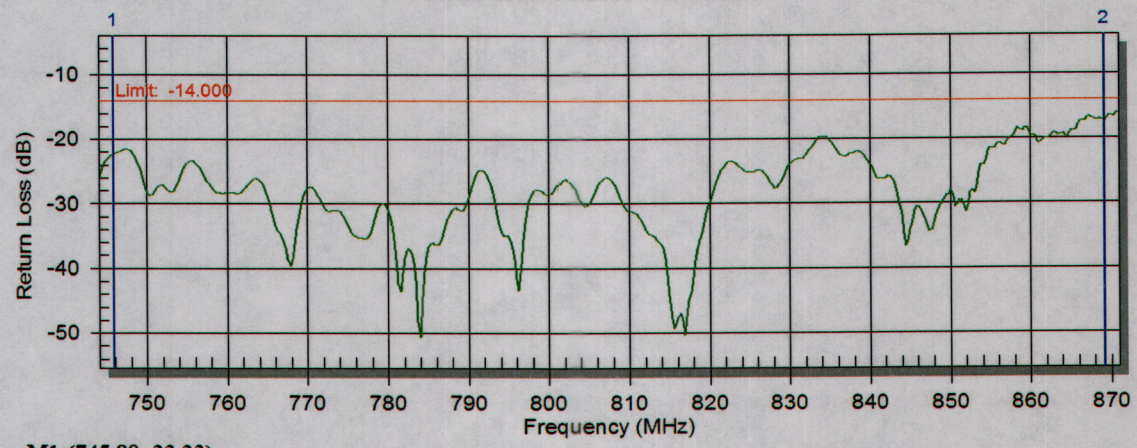
M1:(0.00,-45.51)
M2:(92.59,-41.48)

Return Loss. Site XYZ. Tx1 Antenna. Test 2
Frequency: 744 MHz - 871 MHz (Full Cal)
CC47983-1-1 4/15/2010 8:22:00 AM



M1:(746.14,-24.36)
M2:(869.39,-14.43)

Return Loss. Site XYZ. Tx1 Antenna, 8' RG214 Jumper, 81' LDF4. Test 9
Frequency: 744 MHz - 871 MHz (Full Cal)
Current Trace 5/3/2010 8:13:00 AM

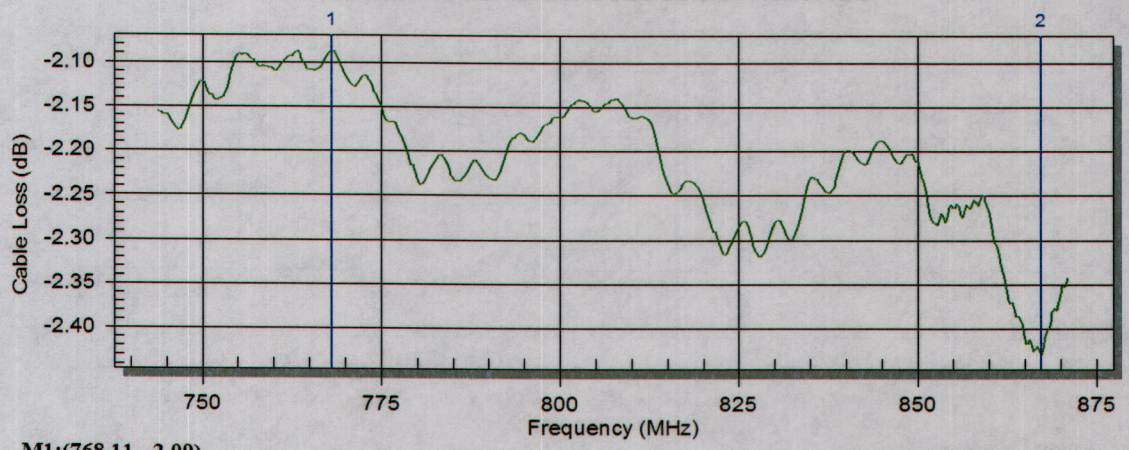


M1:(745.88,-22.23)
M2:(869.12,-17.22)

Cable Loss. XYZ. Tx1. 8' RG214 Jumper (.576+.24), 81' LDF4 (1.58+.12) Test 8

Frequency: 744 MHz - 871 MHz (Full Cal)

Calculated IL 2.51dB Measured 2.26 5/3/2010 9:47:00 AM



M1:(768.11, -2.09)
M2:(867.25, -2.43)

WIRELESS INFRASTRUCTURE SERVICES
BROADCAST MICROWAVE PUBLIC SAFETY
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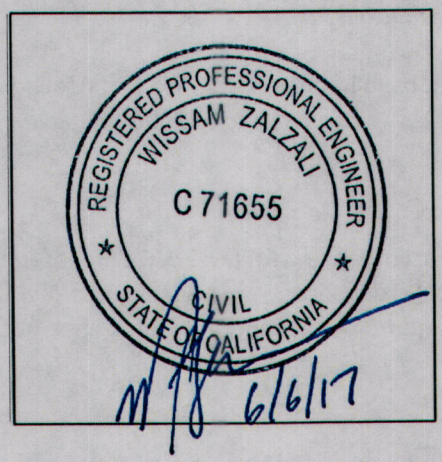
Wireless Infrastructure
Arlington

All States Engineering & Surveying
Project No: 171602 Arlington

Structural Analysis Report

Riverside County – Arlington F, CA
100' Self-Support Tower Model: *S3TL-HD1*



Rev. #	Reason for revision	Total # of Sheets	Prepared By	Checked By	Approved/ Accepted	Date
0	1st Submittal	34	LeT	BAW	WZ	6/6/2017

	Quantity / Shape	Strength (min.)	Dimensions	Thickness / Depth	Capacity Utilization	
Tower	3 sides Lattice Tower	50 ksi.	5' at top face 13' at bottom fa	-	**54.6%**	**PASS**
Foundation	*Round Caisson*	*4 ksi.*	*4'-6"Φ*	*14'-0" **	**48.7%**	**PASS**

* Total 14'-6" length of 4'-6"Φ Caisson – drilled pier foundation (Designed by Sabre Towers & Poles dated on 1/14/09, Job # 09-01056), with 14' embedment and 6" above the GL. This analysis was performed without a soil report, and minimum soil properties from IBC-12 were used. Required pole caisson embedment depth may change with a soil report from the proposed pole location.

100' Self-Support Tower Model: *S3TL-HD1*
Riverside, CA
171602 Arlington

ALL STATES ENGINEERING & SURVEYING
A ZALZALI & ASSOCIATES COMPANY

Project Description:

All States Engineering & Surveying (ASES) is pleased to submit this **"Structural Analysis Report"** to determine the structural integrity of the 100' self-supporting tower *(Model: S3TL – HD1)*.
The purpose of the analysis is to determine acceptability of the tower stress level. Based on our analysis we have determined the tower stress level for the structure and anchorage, under the following load case, to be:

LC1: Existing + Proposed Equipment
(Please see page 4 for details)

All modifications and equipment proposed in this report shall be installed in accordance with the provided drawings for the determined available structural capacity to be effective.

Structural Analysis Parameters:

This analysis has been performed in accordance with the 2016 CBC based upon an ultimate 3-second gust wind speed of 110 mph converted to a nominal 3-second gust wind speed of 85 mph per section 1609.3.1 as required for use in the TIA-222-G Standard per Exception #5 of Section 1609.1.1.

- Exposure Category C
- Risk Category III
- Topographical 1
- Crest Height = 0

DISCLAIMER:

ASES has NOT visited the site, and all information used in the preparation of this structural analysis was based 100% on information provided to us by the client. ASES does not guarantee the accuracy of the data provided. Any discrepancies of the in-field measurements can drastically affect the outcome of this report. We have enclosed the field verifier's data as a reference.

All corrosion and/or damaged members and connections should be treated, re-conditioned or replaced if needed to reassure the original "as-new" capacity.

We at *All States Engineering & Surveying* appreciate the opportunity of providing our continuing professional services to Wireless Infrastructure Services. If you have any questions or need further assistance on this or any other projects, please give us a call.

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100 Ft Self Support Tower Structural Analysis
171602 Arlington

June 06, 2017
100ft. MODEL S3TL-HD1

1) INTRODUCTION

This tower is a 100 ft Self Support tower designed by Sabre Towers & Poles in Riverside County -Arlington F, CA. The tower was originally designed for a wind speed of 120 mph with no ice per ANSI/TIA-222-G-2005, Structural Class III, Exposure Category C and Topographic Category 1.

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 85 mph with no ice, 30 mph with 0 inch ice thickness and 60 mph under service loads, exposure category C with topographic category 1 and crest height of 0 feet.

Table 1 - Proposed Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Model	Number of Feed Lines	Feed Line Size (in)
32.0	32.0	1	DB436-C w/ pipe mount	1	1/2"

Table 2 - Existing and Reserved Antenna and Cable Information

Mounting Level (ft)	Center Line Elevation (ft)	Number of Antennas	Antenna Model	Number of Feed Lines	Feed Line Size (in)
99.0	109.0	1	SC412-HF2LDF whip antenna	1	7/8"
	99.0	1	4' Side Mount Standoff (1)		
98.0	98.0	1	MW Leg Mounting w/ Pipe	1	E90
		1	SC2-W100B		
91.0	91.0	1	MW Face Mounting w/ Pipe	1	E65
		1	PAD6-65BC w/ Radome	1	
83.0	90.0	2	BPS10S-A-B1 Bogner Antenna	2	7/8"
	83.0	2	4' Side Mount Standoff (1)		

3) ANALYSIS PROCEDURE

3.1) Analysis Method

tnxTower (version 7.0.7.0), 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

This analysis may be affected if any assumptions are not valid or have been made in error. All States Eng. & Surveying 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 (ft)	Component Type	Size	Critical Element	P (K)	SF*P_allow (K)	% Capacity	Pass / Fail
T1	100 - 80	Leg	P2.5x.203	1	-11.29	57.33	19.7	Pass
		Diagonal	L2x2x1/4	11	-2.29	17.09	13.4 22.4 (b)	Pass
		Top Girt	L2x2x1/4	4	-0.15	11.01	1.3	Pass
T2	80 - 60	Leg	P3x.3	32	-24.03	110.99	21.7	Pass
		Diagonal	L2x2x3/16	56	-2.59	12.31	21.0 32.2 (b)	Pass
		Top Girt	L2x2x3/16	34	-0.03	8.92	0.4	Pass
T3	60 - 40	Leg	P3.5x.318	62	-37.28	142.17	26.2 26.5 (b)	Pass
		Diagonal	L2x2x3/16	69	-2.18	7.38	29.5	Pass
T4	40 - 20	Leg	P4x.337	89	-48.44	160.20	30.2 40.7 (b)	Pass
		Diagonal	L2 1/2x2 1/2x3/16	92	-2.60	9.20	28.2 32.4 (b)	Pass
T5	20 - 0	Leg	P5.5x.375	110	-62.11	235.95	26.3 54.6 (b)	Pass
		Diagonal	L2 1/2x2 1/2x3/16	113	-2.93	7.16	40.9	Pass
							Summary	
						Leg (T5)	54.6	Pass
						Diagonal (T5)	40.9	Pass
						Top Girt (T1)	1.3	Pass
						Bolt Checks	54.6	Pass
						Rating =	54.6	Pass

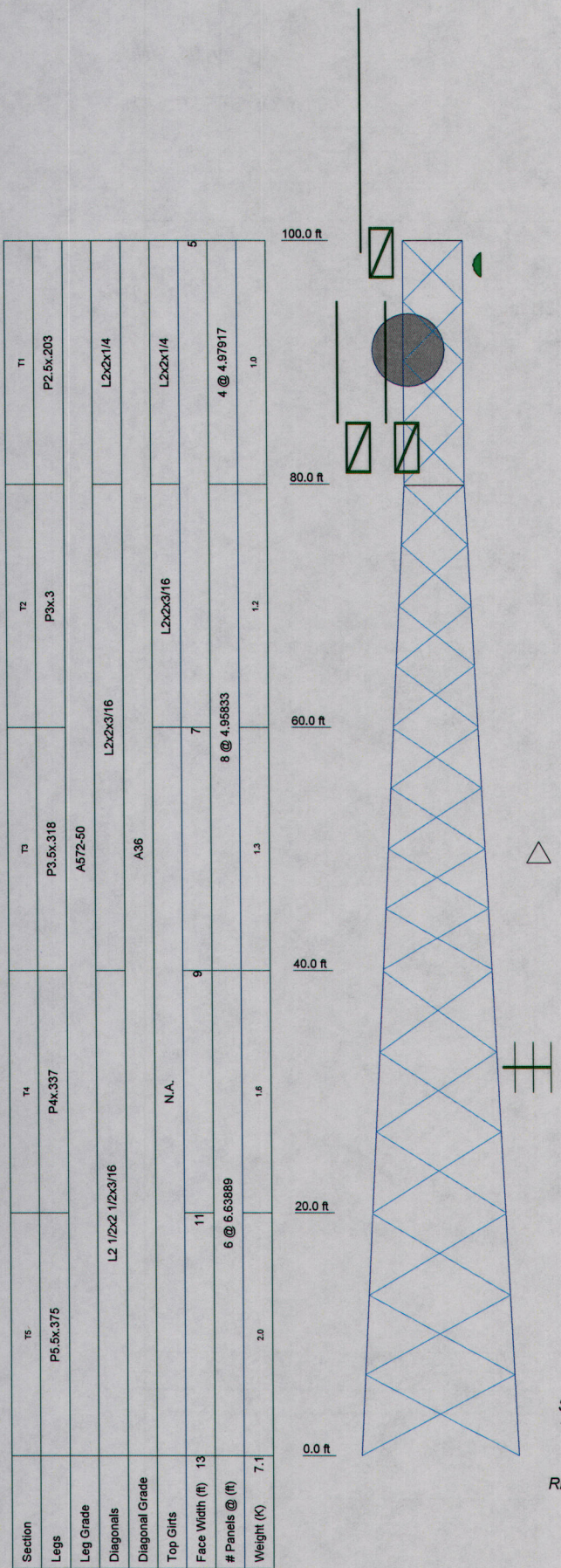
Table 4 - Tower Component Stresses vs. Capacity - **LC1/LC4**

Notes	Component	Elevation (ft)	% Capacity	Pass / Fail
	Base Foundation Soil Interaction		48.7	Pass

Structure Rating (max from all components) =	54.6%

APPENDIX A

TNXTOWER OUTPUT



Section	T5	T4	T3	T2	T1
Legs	P5.5x.375	P4x.337	P3.5x.318	P3x.3	P2.5x.203
Leg Grade	A572-50				
Diagonals	L2 1/2x2 1/2x3/16		L2x2x3/16		L2x2x1/4
Diagonal Grade	A36				
Top Girts	N.A.		L2x2x3/16		L2x2x1/4
Face Width (ft)	13	11	9	7	5
# Panels @ (ft)	6 @ 6.63889		8 @ 4.95833		4 @ 4.97917
Weight (K)	7.1	2.0	1.6	1.3	1.2	1.0

DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
SC412-HF2LDF whip antenna	99	BPS10S-A-B1 Bogner Antenna	83
4' Side Mount Standoff (1)	99	BPS10S-A-B1 Bogner Antenna	83
MW Leg Mounting w/ Pipe	98	4' Side Mount Standoff (1)	83
SC2-W100B	98	4' Side Mount Standoff (1)	83
MW Face Mounting w/ Pipe	91	DB436-C w/ pipe mount	32
PAD6-65BC w/ Radome	91		

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A572-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Riverside County, California.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 85 mph basic wind in accordance with the TIA-222-G Standard.
4. Deflections are based upon a 60 mph wind.
5. Tower Structure Class III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 54.6%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 64 K
SHEAR: 8 K

UPLIFT: -56 K
SHEAR: 7 K

AXIAL 12 K
SHEAR 12 K
MOMENT 687 kip-ft

TORQUE 9 kip-ft
REACTIONS - 85 mph WIND

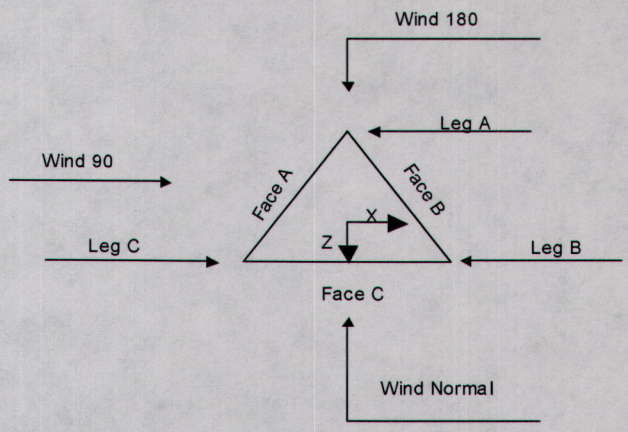
All States Eng. & Surveying
23675 Birtcher Drive
Lake Forest, CA 92630
Phone: (949) 273-0996
FAX: (949) 606-7222
ASES

Job:	*100' S3TL Series HD1 Self-Supporting Tower*
Project:	*Riverside County - Arlington F, CA*
Client:	Wireless Infrastructure Services
Drawn by:	LeT
App'd:	
Code:	TIA-222-G
Date:	06/06/17
Scale:	NTS
Path:	P:\16 - Wireless Infrastructure Services\2017\171602 Arlington - Renin SA\Calcs\Tower Analysis\3_sided_fpa_standing_tower.eri
Dwg No.	E-1

Tower Input Data

The main tower is a 3x free standing tower with an overall height of 100.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 5.00 ft at the top and 13.00 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Riverside County, California.
Basic wind speed of 85 mph.
Structure Class III.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Deflections calculated using a wind speed of 60 mph.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.



Triangular Tower

Tower Section Geometry

Tower Section	*Tower Elevation*	*Assembly Database*	*Description*	*Section Width*	*Number of Sections*	*Section Length*
	ft			*ft*		*ft*
T1	100.00-80.00			5.00	1	20.00
T2	80.00-60.00			5.00	1	20.00
T3	60.00-40.00			7.00	1	20.00
T4	40.00-20.00			9.00	1	20.00
T5	20.00-0.00			11.00	1	20.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T1	100.00-80.00	4.98	X Brace	No	No	0.0000	1.0000
T2	80.00-60.00	4.96	X Brace	No	No	1.0000	1.0000
T3	60.00-40.00	4.96	X Brace	No	No	1.0000	1.0000
T4	40.00-20.00	6.64	X Brace	No	No	1.0000	0.0000
T5	20.00-0.00	6.64	X Brace	No	No	1.0000	0.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 100.00-80.00	Pipe	P2.5x.203	A572-50 (50 ksi)	Single Angle	L2x2x1/4	A36 (36 ksi)
T2 80.00-60.00	Pipe	P3x.3	A572-50 (50 ksi)	Single Angle	L2x2x3/16	A36 (36 ksi)
T3 60.00-40.00	Pipe	P3.5x.318	A572-50 (50 ksi)	Single Angle	L2x2x3/16	A36 (36 ksi)
T4 40.00-20.00	Pipe	P4x.337	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)
T5 20.00-0.00	Pipe	P5.5x.375	A572-50 (50 ksi)	Single Angle	L2 1/2x2 1/2x3/16	A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 100.00-80.00	Single Angle	L2x2x1/4	A36 (36 ksi)	Pipe		A36 (36 ksi)
T2 80.00-60.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Pipe		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 100.00-80.00	1.00	0.3750	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T2 80.00-60.00	1.00	0.3750	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T3 60.00-40.00	1.00	0.3750	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T4 40.00-20.00	1.00	0.3750	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000
T5 20.00-0.00	1.00	0.3750	A36 (36 ksi)	1	1	1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Calc K Single Angles	Calc K Solid Rounds	K Factors[1] Legs	X Brace Diags X Y	K Brace Diags X Y	Single Diags X Y	Girts X Y	Horiz. X Y	Sec. Horiz. X Y	Inner Brace X Y
T1 100.00-80.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T2 80.00-60.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T3 60.00-40.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T4 40.00-20.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1
T5 20.00-0.00	Yes	No	1	1 1	1 1	1 1	1 1	1 1	1 1	1 1

[1]*Note: 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 ft	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U	Net Width Deduct in	U
T1 100.00-80.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T2 80.00-60.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T3 60.00-40.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T4 40.00-20.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75
T5 20.00-0.00	0.0000	1	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75	0.0000	0.75

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 100.00-80.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T2 80.00-60.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T3 60.00-40.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T4 40.00-20.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0
T5 20.00-0.00	Flange	0.6250 A325N	4	0.6250 A325N	1	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	Number Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight klf
1-5/8	C	No	Ar (CaAa)	80.50 - 0.00	3	3	0.0000	1.9800		0.00
1-5/8	C	No	Ar (CaAa)	85.67 - 0.00	1	1	0.0000	1.9800		0.00
1-5/8	C	No	Ar (CaAa)	76.00 - 0.00	1	1	0.0000	1.9800		0.00
EW63	C	No	Ar (CaAa)	76.00 - 0.00	1	1	0.0000	1.5742		0.00
EW63 **	C	No	Ar (CaAa)	68.00 - 0.00	1	1	0.0000	1.5742		0.00
E65	C	No	Ar (CaAa)	91.00 - 0.00	1	1	0.0000	1.5836		0.00
E90	C	No	Ar (CaAa)	98.00 - 0.00	1	1	0.8500	0.8500		0.00
7/8	C	No	Ar (CaAa)	99.00 - 0.00	1	1	1.0900	1.0900		0.00
7/8	C	No	Ar (CaAa)	83.00 - 0.00	1	1	1.0900	1.0900		0.00
7/8	C	No	Ar (CaAa)	83.00 - 0.00	1	1	1.0900	1.0900		0.00
LDF4-50A (1/2 FOAM)	C	No	Ar (CaAa)	32.00 - 0.00	1	1	0.6300	0.6300		0.00

Feed Line/Linear Appurtenances - Entered As Area

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number		C_AA_A ft^2/ft	Weight klf
Climbing Ladder	A	No	CaAa (In Face)	100.00 - 0.00	1	No Ice	0.29	0.00

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight K
T1	100.00-80.00	A	0.000	0.000	5.800	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	7.417	0.000	0.02
T2	80.00-60.00	A	0.000	0.000	5.800	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	34.193	0.000	0.13
T3	60.00-40.00	A	0.000	0.000	5.800	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	37.504	0.000	0.14
T4	40.00-20.00	A	0.000	0.000	5.800	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	38.260	0.000	0.14
T5	20.00-0.00	A	0.000	0.000	5.800	0.000	0.02
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	38.764	0.000	0.14

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	1-5/8	80.00 - 80.50	0.6000	0.6000
T1	2	1-5/8	80.00 - 85.67	0.6000	0.6000
T1	7	E65	80.00 - 91.00	0.6000	0.6000
T1	8	E90	80.00 - 98.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	9	7/8	80.00 - 99.00	0.6000	0.6000
T1	10	7/8	80.00 - 83.00	0.6000	0.6000
T1	11	7/8	80.00 - 83.00	0.6000	0.6000
T1	12	Climbing Ladder	80.00 - 100.00	0.6000	0.6000
T2	1	1-5/8	60.00 - 80.00	0.6000	0.6000
T2	2	1-5/8	60.00 - 80.00	0.6000	0.6000
T2	3	1-5/8	60.00 - 76.00	0.6000	0.6000
T2	4	EW63	60.00 - 76.00	0.6000	0.6000
T2	5	EW63	60.00 - 68.00	0.6000	0.6000
T2	7	E65	60.00 - 80.00	0.6000	0.6000
T2	8	E90	60.00 - 80.00	0.6000	0.6000
T2	9	7/8	60.00 - 80.00	0.6000	0.6000
T2	10	7/8	60.00 - 80.00	0.6000	0.6000
T2	11	7/8	60.00 - 80.00	0.6000	0.6000
T2	12	Climbing Ladder	60.00 - 80.00	0.6000	0.6000
T3	1	1-5/8	40.00 - 60.00	0.6000	0.6000
T3	2	1-5/8	40.00 - 60.00	0.6000	0.6000
T3	3	1-5/8	40.00 - 60.00	0.6000	0.6000
T3	4	EW63	40.00 - 60.00	0.6000	0.6000
T3	5	EW63	40.00 - 60.00	0.6000	0.6000
T3	7	E65	40.00 - 60.00	0.6000	0.6000
T3	8	E90	40.00 - 60.00	0.6000	0.6000
T3	9	7/8	40.00 - 60.00	0.6000	0.6000
T3	10	7/8	40.00 - 60.00	0.6000	0.6000
T3	11	7/8	40.00 - 60.00	0.6000	0.6000
T3	12	Climbing Ladder	40.00 - 60.00	0.6000	0.6000
T4	1	1-5/8	20.00 - 40.00	0.6000	0.6000
T4	2	1-5/8	20.00 - 40.00	0.6000	0.6000
T4	3	1-5/8	20.00 - 40.00	0.6000	0.6000
T4	4	EW63	20.00 - 40.00	0.6000	0.6000
T4	5	EW63	20.00 - 40.00	0.6000	0.6000
T4	7	E65	20.00 - 40.00	0.6000	0.6000
T4	8	E90	20.00 - 40.00	0.6000	0.6000
T4	9	7/8	20.00 - 40.00	0.6000	0.6000
T4	10	7/8	20.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T4	11	7/8	40.00 20.00 -	0.6000	0.6000
T4	12	Climbing Ladder	40.00 20.00 -	0.6000	0.6000
T4	13	LDF4-50A (1/2 FOAM)	40.00 20.00 -	0.6000	0.6000
T5	1	1-5/8	32.00 0.00 - 20.00	0.6000	0.6000
T5	2	1-5/8	0.00 - 20.00	0.6000	0.6000
T5	3	1-5/8	0.00 - 20.00	0.6000	0.6000
T5	4	EW63	0.00 - 20.00	0.6000	0.6000
T5	5	EW63	0.00 - 20.00	0.6000	0.6000
T5	7	E65	0.00 - 20.00	0.6000	0.6000
T5	8	E90	0.00 - 20.00	0.6000	0.6000
T5	9	7/8	0.00 - 20.00	0.6000	0.6000
T5	10	7/8	0.00 - 20.00	0.6000	0.6000
T5	11	7/8	0.00 - 20.00	0.6000	0.6000
T5	12	Climbing Ladder	0.00 - 20.00	0.6000	0.6000
T5	13	LDF4-50A (1/2 FOAM)	0.00 - 20.00	0.6000	0.6000

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz Lateral Vert ft ft ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
SC412-HF2LDF whip antenna	C	From Leg	4.00 0.00 10.00	0.0000	99.00	No Ice	7.86	7.86	0.11
4' Side Mount Standoff (1)	C	From Leg	2.00 0.00 0.00	0.0000	99.00	No Ice	2.72	2.72	0.05
BPS10S-A-B1 Bogner Antenna	C	From Leg	4.00 -4.00 7.00	0.0000	83.00	No Ice	9.80	9.80	0.06
4' Side Mount Standoff (1)	C	From Leg	2.00 -4.00 0.00	0.0000	83.00	No Ice	2.72	2.72	0.05
BPS10S-A-B1 Bogner Antenna	C	From Leg	4.00 4.00 7.00	0.0000	83.00	No Ice	9.80	9.80	0.06
4' Side Mount Standoff (1)	C	From Leg	2.00 4.00 0.00	0.0000	83.00	No Ice	2.72	2.72	0.05
***									
MW Leg Mounting w/ Pipe	B	None		0.0000	98.00	No Ice	2.45	2.45	0.85
MW Face Mounting w/ Pipe	A	None		0.0000	91.00	No Ice	3.97	3.97	0.97
DB436-C w/ pipe mount	B	From Leg	0.50 0.00 0.00	0.0000	32.00	No Ice	4.25	1.07	0.02

Dishes

Description	Face or Leg	Dish Type	Offset Type	Offsets: Horz Lateral Vert ft	Azimuth Adjustment °	3 dB Beam Width °	Elevation ft	Outside Diameter ft		Aperture Area ft^2	Weight K
PAD6-65BC w/ Radome	A	Paraboloid w/o Radome	From Face	1.00 0.00 0.00	51.0000		91.00	6.00	No Ice	28.27	0.24
SC2-W100B	B	Paraboloid w/o Radome	From Leg	1.00 0.00 0.00	79.0000		98.00	2.00	No Ice	3.14	0.06

Tower Pressures - No Ice

G_H = 0.850

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 100.00-80.00	90.00	1.238	22	104.792	A	10.751	9.583	9.583	47.13	5.800	0.000
					B	10.751	9.583		47.13	0.000	0.000
					C	10.751	9.583		47.13	7.417	0.000
T2 80.00-60.00	70.00	1.174	21	125.841	A	11.670	11.686	11.686	50.03	5.800	0.000
					B	11.670	11.686		50.03	0.000	0.000
					C	11.670	11.686		50.03	34.193	0.000
T3 60.00-40.00	50.00	1.094	20	166.675	A	13.033	13.356	13.356	50.61	5.800	0.000
					B	13.033	13.356		50.61	0.000	0.000
					C	13.033	13.356		50.61	37.504	0.000
T4 40.00-20.00	30.00	0.982	18	207.509	A	15.452	15.025	15.025	49.30	5.800	0.000
					B	15.452	15.025		49.30	0.000	0.000
					C	15.452	15.025		49.30	38.260	0.000
T5 20.00-0.00	10.00	0.85	15	249.178	A	17.497	18.364	18.364	51.21	5.800	0.000
					B	17.497	18.364		51.21	0.000	0.000
					C	17.497	18.364		51.21	38.764	0.000

Tower Pressure - Service

G_H = 0.850

Section Elevation ft	z ft	K_Z	q_z psf	A_G ft^2	Face	A_F ft^2	A_R ft^2	A_{leg} ft^2	Leg %	C_AA_A In Face ft^2	C_AA_A Out Face ft^2
T1 100.00-80.00	90.00	1.238	10	104.792	A	10.751	9.583	9.583	47.13	5.800	0.000
					B	10.751	9.583		47.13	0.000	0.000
					C	10.751	9.583		47.13	7.417	0.000
T2 80.00-60.00	70.00	1.174	9	125.841	A	11.670	11.686	11.686	50.03	5.800	0.000
					B	11.670	11.686		50.03	0.000	0.000
					C	11.670	11.686		50.03	34.193	0.000
T3 60.00-40.00	50.00	1.094	9	166.675	A	13.033	13.356	13.356	50.61	5.800	0.000
					B	13.033	13.356		50.61	0.000	0.000
					C	13.033	13.356		50.61	37.504	0.000
T4 40.00-20.00	30.00	0.982	8	207.509	A	15.452	15.025	15.025	49.30	5.800	0.000
					B	15.452	15.025		49.30	0.000	0.000
					C	15.452	15.025		49.30	38.260	0.000
T5 20.00-0.00	10.00	0.85	7	249.178	A	17.497	18.364	18.364	51.21	5.800	0.000
					B	17.497	18.364		51.21	0.000	0.000
					C	17.497	18.364		51.21	38.764	0.000

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	22	1	1	16.247	0.96	0.05	C
			B	0.194	2.616		1	1	16.247			
			C	0.194	2.616		1	1	16.247			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	21	1	1	18.356	1.31	0.07	C
			B	0.186	2.645		1	1	18.356			
			C	0.186	2.645		1	1	18.356			
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	20	1	1	20.625	1.39	0.07	C
			B	0.158	2.741		1	1	20.625			
			C	0.158	2.741		1	1	20.625			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	18	1	1	23.842	1.40	0.07	C
			B	0.147	2.783		1	1	23.842			
			C	0.147	2.783		1	1	23.842			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	15	1	1	27.342	1.35	0.07	C
			B	0.144	2.794		1	1	27.342			
			C	0.144	2.794		1	1	27.342			
Sum Weight:	0.87	7.13						OTM	302.81 kip-ft	6.40		

Tower Forces - No Ice - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	22	0.8	1	14.097	0.85	0.04	C
			B	0.194	2.616		0.8	1	14.097			
			C	0.194	2.616		0.8	1	14.097			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	21	0.8	1	16.022	1.20	0.06	C
			B	0.186	2.645		0.8	1	16.022			
			C	0.186	2.645		0.8	1	16.022			
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	20	0.8	1	18.018	1.27	0.06	C
			B	0.158	2.741		0.8	1	18.018			
			C	0.158	2.741		0.8	1	18.018			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	18	0.8	1	20.752	1.27	0.06	C
			B	0.147	2.783		0.8	1	20.752			
			C	0.147	2.783		0.8	1	20.752			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	15	0.8	1	23.843	1.22	0.06	C
			B	0.144	2.794		0.8	1	23.843			
			C	0.144	2.794		0.8	1	23.843			
Sum Weight:	0.87	7.13						OTM	274.20 kip-ft	5.81		

Tower Forces - No Ice - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	22	0.85	1	14.634	0.88	0.04	C
			B	0.194	2.616		0.85	1	14.634			
			C	0.194	2.616		0.85	1	14.634			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	21	0.85	1	16.605	1.23	0.06	C
			B	0.186	2.645		0.85	1	16.605			
			C	0.186	2.645		0.85	1	16.605			

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	20	0.85	1	18.670	1.30	0.06	C
			B	0.158	2.741		0.85	1	18.670			
			C	0.158	2.741		0.85	1	18.670			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	18	0.85	1	21.524	1.30	0.07	C
			B	0.147	2.783		0.85	1	21.524			
			C	0.147	2.783		0.85	1	21.524			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	15	0.85	1	24.718	1.25	0.06	C
			B	0.144	2.794		0.85	1	24.718			
			C	0.144	2.794		0.85	1	24.718			
Sum Weight:	0.87	7.13						OTM	281.36 kip-ft	5.96		

Tower Forces - Service - Wind Normal To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	10	1	1	16.247	0.42	0.02	C
			B	0.194	2.616		1	1	16.247			
			C	0.194	2.616		1	1	16.247			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	9	1	1	18.356	0.57	0.03	C
			B	0.186	2.645		1	1	18.356			
			C	0.186	2.645		1	1	18.356			
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	9	1	1	20.625	0.60	0.03	C
			B	0.158	2.741		1	1	20.625			
			C	0.158	2.741		1	1	20.625			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	8	1	1	23.842	0.61	0.03	C
			B	0.147	2.783		1	1	23.842			
			C	0.147	2.783		1	1	23.842			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	7	1	1	27.342	0.58	0.03	C
			B	0.144	2.794		1	1	27.342			
			C	0.144	2.794		1	1	27.342			
Sum Weight:	0.87	7.13						OTM	131.20 kip-ft	2.77		

Tower Forces - Service - Wind 60 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	10	0.8	1	14.097	0.37	0.02	C
			B	0.194	2.616		0.8	1	14.097			
			C	0.194	2.616		0.8	1	14.097			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	9	0.8	1	16.022	0.52	0.03	C
			B	0.186	2.645		0.8	1	16.022			
			C	0.186	2.645		0.8	1	16.022			
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	9	0.8	1	18.018	0.55	0.03	C
			B	0.158	2.741		0.8	1	18.018			
			C	0.158	2.741		0.8	1	18.018			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	8	0.8	1	20.752	0.55	0.03	C
			B	0.147	2.783		0.8	1	20.752			
			C	0.147	2.783		0.8	1	20.752			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	7	0.8	1	23.843	0.53	0.03	C
			B	0.144	2.794		0.8	1	23.843			
			C	0.144	2.794		0.8	1	23.843			

June 06, 2017

100 Ft Self Support Tower Structural Analysis

171602 Arlington

100ft. MODEL S3TL-HD1

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
Sum Weight:	0.87	7.13						OTM	118.81 kip-ft	2.52		

Tower Forces - Service - Wind 90 To Face

Section Elevation ft	Add Weight K	Self Weight K	Face	e	C_F	q_z psf	D_F	D_R	A_E ft²	F K	w klf	Ctrl. Face
T1 100.00-80.00	0.09	0.94	A	0.194	2.616	10	0.85	1	14.634	0.38	0.02	C
			B	0.194	2.616		0.85	1	14.634			
			C	0.194	2.616		0.85	1	14.634			
T2 80.00-60.00	0.19	1.11	A	0.186	2.645	9	0.85	1	16.605	0.53	0.03	C
			B	0.186	2.645		0.85	1	16.605			
			C	0.186	2.645		0.85	1	16.605			
T3 60.00-40.00	0.20	1.30	A	0.158	2.741	9	0.85	1	18.670	0.56	0.03	C
			B	0.158	2.741		0.85	1	18.670			
			C	0.158	2.741		0.85	1	18.670			
T4 40.00-20.00	0.20	1.56	A	0.147	2.783	8	0.85	1	21.524	0.56	0.03	C
			B	0.147	2.783		0.85	1	21.524			
			C	0.147	2.783		0.85	1	21.524			
T5 20.00-0.00	0.20	1.99	A	0.144	2.794	7	0.85	1	24.718	0.54	0.03	C
			B	0.144	2.794		0.85	1	24.718			
			C	0.144	2.794		0.85	1	24.718			
Sum Weight:	0.87	7.13						OTM	121.91 kip-ft	2.58		

Force Totals

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Leg Weight	3.85					
Bracing Weight	3.05					
Total Member Self-Weight	6.90			1.04	2.21	
Gusset Weight	0.23					
Total Weight	10.30			1.04	2.21	
Wind 0 deg - No Ice		0.00	-7.70	-421.04	0.56	-4.20
Wind 30 deg - No Ice		3.53	-6.19	-338.09	-189.43	-2.92
Wind 60 deg - No Ice		5.85	-3.60	-201.72	-310.34	-0.81
Wind 90 deg - No Ice		6.98	0.29	25.43	-371.69	2.39
Wind 120 deg - No Ice		6.38	4.47	267.43	-335.02	5.19
Wind 150 deg - No Ice		3.47	6.63	378.82	-182.22	5.57
Wind 180 deg - No Ice		0.17	7.37	418.35	-12.13	4.62
Wind 210 deg - No Ice		-3.21	6.64	381.28	165.08	3.11
Wind 240 deg - No Ice		-6.30	4.33	256.84	333.61	1.49
Wind 270 deg - No Ice		-6.93	-0.16	-12.49	371.94	-1.79
Wind 300 deg - No Ice		-5.95	-3.53	-192.70	322.25	-2.87
Wind 330 deg - No Ice		-3.56	-6.29	-346.50	193.92	-3.85
Total Weight	10.30			1.04	2.21	
Wind 0 deg - Service		0.00	-3.34	-181.84	1.49	-1.82
Wind 30 deg - Service		1.53	-2.68	-145.90	-80.83	-1.26
Wind 60 deg - Service		2.54	-1.56	-86.81	-133.21	-0.35
Wind 90 deg - Service		3.02	0.12	11.61	-159.79	1.04
Wind 120 deg - Service		2.76	1.94	116.46	-143.91	2.25

Load Case	Vertical Forces K	Sum of Forces X K	Sum of Forces Z K	Sum of Overturning Moments, M_x kip-ft	Sum of Overturning Moments, M_z kip-ft	Sum of Torques kip-ft
Wind 150 deg - Service		1.50	2.87	164.72	-77.70	2.41
Wind 180 deg - Service		0.07	3.19	181.85	-4.01	2.00
Wind 210 deg - Service		-1.39	2.88	165.79	72.78	1.35
Wind 240 deg - Service		-2.73	1.88	111.87	145.79	0.65
Wind 270 deg - Service		-3.00	-0.07	-4.82	162.40	-0.77
Wind 300 deg - Service		-2.58	-1.53	-82.90	140.88	-1.24
Wind 330 deg - Service		-1.54	-2.73	-149.54	85.27	-1.67

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	Dead+Wind 0 deg - Service
27	Dead+Wind 30 deg - Service
28	Dead+Wind 60 deg - Service
29	Dead+Wind 90 deg - Service
30	Dead+Wind 120 deg - Service
31	Dead+Wind 150 deg - Service
32	Dead+Wind 180 deg - Service
33	Dead+Wind 210 deg - Service
34	Dead+Wind 240 deg - Service
35	Dead+Wind 270 deg - Service
36	Dead+Wind 300 deg - Service
37	Dead+Wind 330 deg - Service

Maximum Member Forces

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
T1	100 - 80	Leg	Max Tension	15	9.35	0.18	-0.09
			Max. Compression	18	-11.29	0.21	-0.15
			Max. Mx	2	-8.71	0.39	0.10
			Max. My	12	-2.58	-0.18	0.56
			Max. Vy	10	2.04	-0.35	0.09

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Vx	15	1.92	0.25	-0.25
		Diagonal	Max Tension	15	2.33	0.00	0.00
			Max. Compression	2	-2.29	0.00	0.00
			Max. Mx	18	0.48	0.02	-0.00
			Max. My	13	-0.46	-0.00	-0.01
			Max. Vy	18	-0.01	0.02	-0.00
			Max. Vx	13	0.00	0.01	-0.01
		Top Girt	Max Tension	11	0.09	0.00	0.00
			Max. Compression	14	-0.15	0.00	0.00
			Max. Mx	2	-0.07	-0.01	0.00
			Max. Vy	2	0.01	0.00	0.00
T2	80 - 60	Leg	Max Tension	15	21.95	0.04	0.04
			Max. Compression	10	-24.03	0.11	-0.00
			Max. Mx	10	-10.65	0.37	-0.31
			Max. My	12	-3.60	0.05	-0.56
			Max. Vy	10	-1.90	0.11	-0.00
			Max. Vx	12	1.61	0.05	-0.56
		Diagonal	Max Tension	15	2.52	0.00	0.00
			Max. Compression	10	-2.59	0.00	0.00
			Max. Mx	18	0.88	0.01	-0.00
			Max. My	12	-2.24	0.00	-0.01
			Max. Vy	18	-0.01	0.01	-0.00
			Max. Vx	12	0.00	0.00	0.00
		Top Girt	Max Tension	18	0.05	0.00	0.00
			Max. Compression	11	-0.03	0.00	0.00
			Max. Mx	2	0.01	-0.01	0.00
			Max. My	2	-0.01	0.00	0.00
			Max. Vy	2	0.01	0.00	0.00
			Max. Vx	2	-0.00	0.00	0.00
T3	60 - 40	Leg	Max Tension	15	33.67	0.04	0.03
			Max. Compression	10	-37.28	0.15	0.01
			Max. Mx	10	-25.50	0.27	-0.05
			Max. My	12	-5.23	0.02	-0.21
			Max. Vy	10	-2.43	0.15	0.01
			Max. Vx	12	1.42	0.01	-0.17
		Diagonal	Max Tension	10	2.18	0.00	0.00
			Max. Compression	10	-2.18	0.00	0.00
			Max. Mx	14	0.98	0.01	-0.00
			Max. My	12	-1.73	0.00	-0.00
			Max. Vy	14	0.01	0.01	-0.00
			Max. Vx	12	0.00	0.00	0.00
T4	40 - 20	Leg	Max Tension	15	43.15	-0.18	0.00
			Max. Compression	10	-48.44	0.05	0.04
			Max. Mx	3	-36.56	0.35	0.05
			Max. My	13	-5.73	0.02	-0.29
			Max. Vy	10	-2.43	0.35	-0.03
			Max. Vx	12	1.42	0.02	-0.29
		Diagonal	Max Tension	16	2.54	0.00	0.00
			Max. Compression	10	-2.60	0.00	0.00
			Max. Mx	10	2.45	0.03	-0.00
			Max. My	12	-1.66	0.00	-0.01
			Max. Vy	14	0.01	0.03	-0.00
			Max. Vx	12	0.00	0.00	0.00
T5	20 - 0	Leg	Max Tension	15	54.44	-0.22	0.01
			Max. Compression	10	-62.11	0.00	0.00
			Max. Mx	14	46.22	-0.31	-0.01
			Max. My	13	-7.06	-0.01	-0.44
			Max. Vy	10	-3.13	0.31	0.01
			Max. Vx	12	1.43	0.00	-0.28
		Diagonal	Max Tension	16	2.81	0.00	0.00
			Max. Compression	10	-2.93	0.00	0.00
			Max. Mx	10	2.54	0.03	0.00
			Max. My	12	2.12	0.03	-0.01
			Max. Vy	12	0.02	0.03	-0.01
			Max. Vx	12	0.00	0.00	0.00

Maximum Reactions

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
Leg C	Max. Vert	18	63.34	6.40	-3.84
	Max. H_x	18	63.34	6.40	-3.84
	Max. H_z	5	-44.40	-4.44	3.34
	Min. Vert	7	-49.59	-5.32	3.14
	Min. H_x	7	-49.59	-5.32	3.14
	Min. H_z	18	63.34	6.40	-3.84
Leg B	Max. Vert	10	64.40	-6.74	-3.50
	Max. H_x	23	-50.17	5.49	2.94
	Max. H_z	25	-45.31	4.74	2.97
	Min. Vert	23	-50.17	5.49	2.94
	Min. H_x	10	64.40	-6.74	-3.50
	Min. H_z	10	64.40	-6.74	-3.50
Leg A	Max. Vert	2	63.99	-0.30	7.53
	Max. H_x	19	-33.34	0.96	-3.86
	Max. H_z	2	63.99	-0.30	7.53
	Min. Vert	15	-56.29	0.31	-6.69
	Min. H_x	6	32.82	-0.84	3.71
	Min. H_z	15	-56.29	0.31	-6.69

Tower Mast Reaction Summary

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
Dead Only	10.30	-0.00	0.00	1.04	2.21	0.00
1.2 Dead+1.6 Wind 0 deg - No Ice	12.36	0.01	-12.32	-674.00	0.02	-6.72
0.9 Dead+1.6 Wind 0 deg - No Ice	9.27	0.01	-12.32	-674.32	-0.64	-6.72
1.2 Dead+1.6 Wind 30 deg - No Ice	12.36	5.65	-9.90	-541.30	-303.94	-4.67
0.9 Dead+1.6 Wind 30 deg - No Ice	9.27	5.65	-9.90	-541.61	-304.60	-4.67
1.2 Dead+1.6 Wind 60 deg - No Ice	12.36	9.36	-5.77	-323.13	-497.37	-1.30
0.9 Dead+1.6 Wind 60 deg - No Ice	9.27	9.36	-5.77	-323.44	-498.03	-1.30
1.2 Dead+1.6 Wind 90 deg - No Ice	12.36	11.16	0.46	40.27	-595.51	3.83
0.9 Dead+1.6 Wind 90 deg - No Ice	9.27	11.16	0.46	39.96	-596.17	3.83
1.2 Dead+1.6 Wind 120 deg - No Ice	12.36	10.21	7.15	427.43	-536.85	8.31
0.9 Dead+1.6 Wind 120 deg - No Ice	9.27	10.21	7.15	427.11	-537.51	8.31
1.2 Dead+1.6 Wind 150 deg - No Ice	12.36	5.55	10.61	605.62	-292.40	8.91
0.9 Dead+1.6 Wind 150 deg - No Ice	9.27	5.55	10.61	605.31	-293.06	8.91
1.2 Dead+1.6 Wind 180 deg - No Ice	12.36	0.27	11.79	668.87	-20.29	7.39
0.9 Dead+1.6 Wind 180 deg - No Ice	9.27	0.27	11.79	668.55	-20.96	7.39
1.2 Dead+1.6 Wind 210 deg - No Ice	12.36	-5.14	10.63	609.56	263.21	4.97
0.9 Dead+1.6 Wind 210 deg - No Ice	9.27	-5.14	10.63	609.25	262.55	4.97
1.2 Dead+1.6 Wind 240 deg - No Ice	12.36	-10.08	6.93	410.49	532.82	2.39
0.9 Dead+1.6 Wind 240 deg - No Ice	9.27	-10.08	6.93	410.17	532.16	2.39
1.2 Dead+1.6 Wind 270 deg	12.36	-11.09	-0.26	-20.40	594.14	-2.86

Load Combination	Vertical K	$Shear_x$ K	$Shear_z$ K	Overturning Moment, M_x kip-ft	Overturning Moment, M_z kip-ft	Torque kip-ft
- No Ice 0.9 Dead+1.6 Wind 270 deg - No Ice	9.27	-11.09	-0.26	-20.71	593.48	-2.86
1.2 Dead+1.6 Wind 300 deg - No Ice	12.36	-9.52	-5.65	-308.70	514.66	-4.59
0.9 Dead+1.6 Wind 300 deg - No Ice	9.27	-9.52	-5.65	-309.01	514.00	-4.59
1.2 Dead+1.6 Wind 330 deg - No Ice	12.36	-5.69	-10.07	-554.76	309.35	-6.16
0.9 Dead+1.6 Wind 330 deg - No Ice	9.27	-5.69	-10.07	-555.07	308.68	-6.16
Dead+Wind 0 deg - Service	10.30	0.00	-3.34	-181.82	1.49	-1.82
Dead+Wind 30 deg - Service	10.30	1.53	-2.68	-145.88	-80.82	-1.26
Dead+Wind 60 deg - Service	10.30	2.54	-1.56	-86.80	-133.20	-0.35
Dead+Wind 90 deg - Service	10.30	3.02	0.12	11.61	-159.77	1.04
Dead+Wind 120 deg - Service	10.30	2.76	1.94	116.45	-143.89	2.25
Dead+Wind 150 deg - Service	10.30	1.50	2.87	164.71	-77.69	2.41
Dead+Wind 180 deg - Service	10.30	0.07	3.19	181.83	-4.01	2.00
Dead+Wind 210 deg - Service	10.30	-1.39	2.88	165.77	72.77	1.35
Dead+Wind 240 deg - Service	10.30	-2.73	1.88	111.86	145.78	0.65
Dead+Wind 270 deg - Service	10.30	-3.00	-0.07	-4.82	162.38	-0.77
Dead+Wind 300 deg - Service	10.30	-2.58	-1.53	-82.89	140.86	-1.24
Dead+Wind 330 deg - Service	10.30	-1.54	-2.73	-149.52	85.26	-1.67

Solution Summary

	Sum of Applied Forces			Sum of Reactions			
Load Comb.	PX K	PY K	PZ K	PX K	PY K	PZ K	% Error
1	0.00	-10.30	0.00	0.00	10.30	-0.00	0.000%
2	0.01	-12.36	-12.32	-0.01	12.36	12.32	0.000%
3	0.01	-9.27	-12.32	-0.01	9.27	12.32	0.000%
4	5.65	-12.36	-9.90	-5.65	12.36	9.90	0.000%
5	5.65	-9.27	-9.90	-5.65	9.27	9.90	0.000%
6	9.36	-12.36	-5.77	-9.36	12.36	5.77	0.000%
7	9.36	-9.27	-5.77	-9.36	9.27	5.77	0.000%
8	11.16	-12.36	0.46	-11.16	12.36	-0.46	0.000%
9	11.16	-9.27	0.46	-11.16	9.27	-0.46	0.000%
10	10.21	-12.36	7.15	-10.21	12.36	-7.15	0.000%
11	10.21	-9.27	7.15	-10.21	9.27	-7.15	0.000%
12	5.55	-12.36	10.61	-5.55	12.36	-10.61	0.000%
13	5.55	-9.27	10.61	-5.55	9.27	-10.61	0.000%
14	0.27	-12.36	11.79	-0.27	12.36	-11.79	0.000%
15	0.27	-9.27	11.79	-0.27	9.27	-11.79	0.000%
16	-5.14	-12.36	10.63	5.14	12.36	-10.63	0.000%
17	-5.14	-9.27	10.63	5.14	9.27	-10.63	0.000%
18	-10.08	-12.36	6.93	10.08	12.36	-6.93	0.000%
19	-10.08	-9.27	6.93	10.08	9.27	-6.93	0.000%
20	-11.09	-12.36	-0.26	11.09	12.36	0.26	0.000%
21	-11.09	-9.27	-0.26	11.09	9.27	0.26	0.000%
22	-9.52	-12.36	-5.65	9.52	12.36	5.65	0.000%
23	-9.52	-9.27	-5.65	9.52	9.27	5.65	0.000%
24	-5.69	-12.36	-10.07	5.69	12.36	10.07	0.000%
25	-5.69	-9.27	-10.07	5.69	9.27	10.07	0.000%
26	0.00	-10.30	-3.34	-0.00	10.30	3.34	0.000%
27	1.53	-10.30	-2.68	-1.53	10.30	2.68	0.000%
28	2.54	-10.30	-1.56	-2.54	10.30	1.56	0.000%
29	3.02	-10.30	0.12	-3.02	10.30	-0.12	0.000%

June 06, 2017

100 Ft Self Support Tower Structural Analysis

171602 Arlington

100ft. MODEL S3TL-HD1

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
30	2.76	-10.30	1.94	-2.76	10.30	-1.94	0.000%
31	1.50	-10.30	2.87	-1.50	10.30	-2.87	0.000%
32	0.07	-10.30	3.19	-0.07	10.30	-3.19	0.000%
33	-1.39	-10.30	2.88	1.39	10.30	-2.88	0.000%
34	-2.73	-10.30	1.88	2.73	10.30	-1.88	0.000%
35	-3.00	-10.30	-0.07	3.00	10.30	0.07	0.000%
36	-2.58	-10.30	-1.53	2.58	10.30	1.53	0.000%
37	-1.54	-10.30	-2.73	1.54	10.30	2.73	0.000%

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	100 - 80	0.874	34	0.0745	0.0520
T2	80 - 60	0.571	32	0.0654	0.0422
T3	60 - 40	0.322	30	0.0483	0.0209
T4	40 - 20	0.146	30	0.0303	0.0096
T5	20 - 0	0.042	30	0.0133	0.0040

Critical Deflections and Radius of Curvature - Service Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
99.00	SC412-HF2LDF whip antenna	34	0.858	0.0742	0.0517	296134
98.00	SC2-W100B	34	0.843	0.0738	0.0514	296134
91.00	PAD6-65BC w/ Radome	32	0.734	0.0711	0.0489	164519
83.00	BPS10S-A-B1 Bogner Antenna	32	0.614	0.0672	0.0446	87338
32.00	DB436-C w/ pipe mount	30	0.096	0.0232	0.0071	64614

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	100 - 80	3.193	14	0.2670	0.1920
T2	80 - 60	2.108	11	0.2382	0.1560
T3	60 - 40	1.197	11	0.1773	0.0772
T4	40 - 20	0.542	11	0.1123	0.0355
T5	20 - 0	0.157	11	0.0494	0.0147

Critical Deflections and Radius of Curvature - Design Wind

Elevation ft	Appurtenance	Gov. Load Comb.	Deflection in	Tilt °	Twist °	Radius of Curvature ft
99.00	SC412-HF2LDF whip antenna	14	3.136	0.2660	0.1909	91805
98.00	SC2-W100B	14	3.080	0.2649	0.1898	91805
91.00	PAD6-65BC w/ Radome	11	2.691	0.2570	0.1807	51003
83.00	BPS10S-A-B1 Bogner Antenna	11	2.263	0.2444	0.1646	27062
32.00	DB436-C w/ pipe mount	11	0.355	0.0861	0.0261	17627

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	100	Leg	A325N	0.6250	4	0.14	20.71	0.007 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.33	10.44	0.224 ✔	1	Member Bearing
		Top Girt	A325N	0.6250	1	0.15	12.43	0.012 ✔	1	Bolt Shear
T2	80	Leg	A325N	0.6250	4	2.36	20.71	0.114 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.52	7.83	0.322 ✔	1	Member Bearing
T3	60	Leg	A325N	0.6250	4	5.49	20.71	0.265 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.18	7.83	0.278 ✔	1	Member Bearing
T4	40	Leg	A325N	0.6250	4	8.42	20.71	0.407 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.54	7.83	0.324 ✔	1	Member Bearing
T5	20	Leg	A325N	0.6250	4	11.31	20.71	0.546 ✔	1	Bolt Tension
		Diagonal	A325N	0.6250	1	2.81	7.83	0.359 ✔	1	Member Bearing

Compression Checks

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	P2.5x.203	20.00	4.98	63.1 K=1.00	1.7040	-11.29	57.33	0.197 [1] ✔
T2	80 - 60	P3x.3	20.03	4.97	52.4 K=1.00	3.0159	-24.03	110.99	0.217 [1] ✔
T3	60 - 40	P3.5x.318	20.03	4.97	45.6 K=1.00	3.6784	-37.28	142.17	0.262 [1] ✔
T4	40 - 20	P4x.337	20.03	6.65	54.0 K=1.00	4.4074	-48.44	160.20	0.302 [1] ✔
T5	20 - 0	P5.5x.375	20.03	6.65	43.9 K=1.00	6.0377	-62.11	235.95	0.263 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	L2x2x1/4	7.06	3.24	104.6 K=1.05	0.9380	-2.29	17.09	0.134 [1] ✔

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	80 - 60	L2x2x3/16	7.23	3.48	109.6 K=1.03	0.7150	-2.59	12.31	0.210 [1] ✔
T3	60 - 40	L2x2x3/16	10.05	4.86	147.9 K=1.00	0.7150	-2.18	7.38	0.295 [1] ✔
T4	40 - 20	L2 1/2x2 1/2x3/16	12.57	6.14	148.8 K=1.00	0.9020	-2.60	9.20	0.282 [1] ✔
T5	20 - 0	L2 1/2x2 1/2x3/16	14.30	6.96	168.7 K=1.00	0.9020	-2.93	7.16	0.409 [1] ✔

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	L2x2x1/4	5.00	4.52	138.7 K=1.00	0.9380	-0.15	11.01	0.013 [1] ✔
T2	80 - 60	L2x2x3/16	5.01	4.72	134.5 K=0.94	0.7150	-0.03	8.92	0.004 [1] ✔

[1] P_u / ϕP_n controls

Tension Checks

Leg Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	P2.5x.203	20.00	4.98	63.1	1.7040	9.35	76.68	0.122 [1] ✔
T2	80 - 60	P3x.3	20.03	4.97	52.4	3.0159	21.95	135.72	0.162 [1] ✔
T3	60 - 40	P3.5x.318	20.03	4.97	45.6	3.6784	33.67	165.53	0.203 [1] ✔
T4	40 - 20	P4x.337	20.03	6.65	54.0	4.4074	43.15	198.34	0.218 [1] ✔
T5	20 - 0	P5.5x.375	20.03	6.65	43.9	6.0377	54.44	271.70	0.200 [1] ✔

[1] P_u / ϕP_n controls

Diagonal Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	L2x2x1/4	7.06	3.24	66.2	0.5629	2.33	24.49	0.095 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T2	80 - 60	L2x2x3/16	7.23	3.48	70.1	0.4308	2.52	18.74	0.135 [1]
T3	60 - 40	L2x2x3/16	10.05	4.86	96.8	0.4308	2.18	18.74	0.116 [1]
T4	40 - 20	L2 1/2x2 1/2x3/16	12.57	6.14	96.5	0.5710	2.54	24.84	0.102 [1]
T5	20 - 0	L2 1/2x2 1/2x3/16	14.30	6.96	109.2	0.5710	2.81	24.84	0.113 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Tension)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$
T1	100 - 80	L2x2x1/4	5.00	4.52	93.8	0.5629	0.09	24.49	0.004 [1]
T2	80 - 60	L2x2x3/16	5.01	4.72	91.7	0.7150	0.05	23.17	0.002 [1]

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
T1	100 - 80	Leg	P2.5x.203	1	-11.29	57.33	19.7	Pass
		Leg	P2.5x.203	2	-10.55	57.33	18.4	Pass
		Leg	P2.5x.203	3	-10.74	57.33	18.7	Pass
		Diagonal	L2x2x1/4	7	-1.53	17.09	8.9 19.4 (b)	Pass
		Diagonal	L2x2x1/4	8	-2.22	17.09	13.0 17.9 (b)	Pass
		Diagonal	L2x2x1/4	9	-0.66	17.09	3.9 6.9 (b)	Pass
		Diagonal	L2x2x1/4	10	-0.72	17.09	4.2 6.1 (b)	Pass
		Diagonal	L2x2x1/4	11	-2.29	17.09	13.4 22.4 (b)	Pass
		Diagonal	L2x2x1/4	12	-2.27	17.09	13.3 19.0 (b)	Pass
		Diagonal	L2x2x1/4	13	1.33	24.49	5.4 12.7 (b)	Pass
		Diagonal	L2x2x1/4	14	-1.40	17.09	8.2 11.3 (b)	Pass
		Diagonal	L2x2x1/4	15	-0.59	17.09	3.4 8.0 (b)	Pass
		Diagonal	L2x2x1/4	16	-0.78	17.09	4.6 6.3 (b)	Pass
		Diagonal	L2x2x1/4	17	-1.36	17.09	7.9 16.0 (b)	Pass
		Diagonal	L2x2x1/4	18	-1.52	17.09	8.9 13.3 (b)	Pass
		Diagonal	L2x2x1/4	19	-0.70	17.09	4.1 6.3 (b)	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	øP$_{allow}$ K	% Capacity	Pass Fail
		Diagonal	L2x2x1/4	20	-1.08	17.09	6.3 8.7 (b)	Pass
		Diagonal	L2x2x1/4	21	0.31	24.49	1.3 3.0 (b)	Pass
		Diagonal	L2x2x1/4	22	-0.42	17.09	2.5 3.4 (b)	Pass
		Diagonal	L2x2x1/4	23	-0.90	17.09	5.2 9.0 (b)	Pass
		Diagonal	L2x2x1/4	24	-0.59	17.09	3.5 6.1 (b)	Pass
		Diagonal	L2x2x1/4	25	-0.33	17.09	1.9 4.4 (b)	Pass
		Diagonal	L2x2x1/4	26	-0.26	17.09	1.5 3.2 (b)	Pass
		Diagonal	L2x2x1/4	27	0.10	24.49	0.4 1.0 (b)	Pass
		Diagonal	L2x2x1/4	28	-0.12	17.09	0.7 1.0 (b)	Pass
		Diagonal	L2x2x1/4	29	-0.27	17.09	1.6 2.5 (b)	Pass
		Diagonal	L2x2x1/4	30	-0.35	17.09	2.1 3.4 (b)	Pass
		Top Girt	L2x2x1/4	4	-0.15	11.01	1.3	Pass
		Top Girt	L2x2x1/4	5	-0.09	11.01	0.8	Pass
		Top Girt	L2x2x1/4	6	-0.10	11.01	0.9	Pass
T2	80 - 60	Leg	P3x.3	31	-24.01	110.99	21.6	Pass
		Leg	P3x.3	32	-24.03	110.99	21.7	Pass
		Leg	P3x.3	33	-24.02	110.99	21.6	Pass
		Diagonal	L2x2x3/16	37	-1.61	10.44	15.4 26.9 (b)	Pass
		Diagonal	L2x2x3/16	38	-2.14	10.44	20.5 21.2 (b)	Pass
		Diagonal	L2x2x3/16	39	-0.62	10.44	5.9 9.9 (b)	Pass
		Diagonal	L2x2x3/16	40	-0.77	10.44	7.4 7.5 (b)	Pass
		Diagonal	L2x2x3/16	41	-2.10	10.44	20.1 27.1 (b)	Pass
		Diagonal	L2x2x3/16	42	-2.08	10.44	19.9 26.4 (b)	Pass
		Diagonal	L2x2x3/16	43	-1.57	11.15	14.1 26.0 (b)	Pass
		Diagonal	L2x2x3/16	44	-2.19	11.15	19.7 20.9 (b)	Pass
		Diagonal	L2x2x3/16	45	-0.48	11.15	4.3 7.7 (b)	Pass
		Diagonal	L2x2x3/16	46	-0.63	11.15	5.7 5.8 (b)	Pass
		Diagonal	L2x2x3/16	47	-2.14	11.15	19.2 27.4 (b)	Pass
		Diagonal	L2x2x3/16	48	-2.07	11.15	18.6 25.6 (b)	Pass
		Diagonal	L2x2x3/16	49	-1.56	11.74	13.3 27.7 (b)	Pass
		Diagonal	L2x2x3/16	50	-2.09	11.74	17.8 20.3 (b)	Pass
		Diagonal	L2x2x3/16	51	0.50	18.74	2.7 6.4 (b)	Pass
		Diagonal	L2x2x3/16	52	-0.48	11.74	4.1	Pass
		Diagonal	L2x2x3/16	53	-2.07	11.74	17.6 27.4 (b)	Pass
		Diagonal	L2x2x3/16	54	-2.14	11.74	18.2 26.9 (b)	Pass
		Diagonal	L2x2x3/16	55	-1.74	12.31	14.1 28.9 (b)	Pass
		Diagonal	L2x2x3/16	56	-2.59	12.31	21.0 23.4 (b)	Pass
		Diagonal	L2x2x3/16	57	-0.32	12.31	2.6 4.2 (b)	Pass
		Diagonal	L2x2x3/16	58	-0.29	12.31	2.4	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
							3.2 (b)	
		Diagonal	L2x2x3/16	59	-2.49	12.31	20.2	Pass
							32.2 (b)	
		Diagonal	L2x2x3/16	60	-2.40	12.31	19.5	Pass
							28.7 (b)	
		Top Girt	L2x2x3/16	34	-0.03	8.92	0.4	Pass
		Top Girt	L2x2x3/16	35	-0.03	8.92	0.4	Pass
		Top Girt	L2x2x3/16	36	0.05	23.17	0.2	Pass
T3	60 - 40	Leg	P3.5x.318	61	-36.83	142.17	25.9	Pass
		Leg	P3.5x.318	62	-37.28	142.17	26.2	Pass
		Leg	P3.5x.318	63	-37.15	142.17	26.1	Pass
							26.5 (b)	
		Diagonal	L2x2x3/16	64	-1.87	7.38	25.3	Pass
							27.8 (b)	
		Diagonal	L2x2x3/16	65	-2.17	7.38	29.4	Pass
		Diagonal	L2x2x3/16	66	-1.14	7.38	15.4	Pass
							16.2 (b)	
		Diagonal	L2x2x3/16	67	-1.27	7.38	17.2	Pass
		Diagonal	L2x2x3/16	68	-2.15	7.38	29.2	Pass
		Diagonal	L2x2x3/16	69	-2.18	7.38	29.5	Pass
		Diagonal	L2x2x3/16	70	-1.78	8.07	22.1	Pass
							26.3 (b)	
		Diagonal	L2x2x3/16	71	-2.18	8.07	27.0	Pass
		Diagonal	L2x2x3/16	72	-1.01	8.07	12.5	Pass
							14.4 (b)	
		Diagonal	L2x2x3/16	73	-1.15	8.07	14.2	Pass
		Diagonal	L2x2x3/16	74	-2.14	8.07	26.6	Pass
							26.8 (b)	
		Diagonal	L2x2x3/16	75	-2.10	8.07	26.1	Pass
		Diagonal	L2x2x3/16	76	-1.70	8.84	19.2	Pass
							26.3 (b)	
		Diagonal	L2x2x3/16	77	-2.11	8.84	23.8	Pass
		Diagonal	L2x2x3/16	78	-0.86	8.84	9.8	Pass
							12.9 (b)	
		Diagonal	L2x2x3/16	79	-1.02	8.84	11.5	Pass
		Diagonal	L2x2x3/16	80	-2.08	8.84	23.5	Pass
							26.3 (b)	
		Diagonal	L2x2x3/16	81	-2.05	8.84	23.2	Pass
							25.9 (b)	
		Diagonal	L2x2x3/16	82	-1.69	9.65	17.5	Pass
							26.6 (b)	
		Diagonal	L2x2x3/16	83	-2.18	9.65	22.6	Pass
		Diagonal	L2x2x3/16	84	-0.77	9.65	7.9	Pass
							11.5 (b)	
		Diagonal	L2x2x3/16	85	-0.92	9.65	9.5	Pass
		Diagonal	L2x2x3/16	86	-2.14	9.65	22.2	Pass
							27.1 (b)	
		Diagonal	L2x2x3/16	87	-2.08	9.65	21.6	Pass
							26.2 (b)	
T4	40 - 20	Leg	P4x.337	88	-47.69	160.20	29.8	Pass
							33.9 (b)	
		Leg	P4x.337	89	-48.44	160.20	30.2	Pass
							34.5 (b)	
		Leg	P4x.337	90	-48.18	160.20	30.1	Pass
							40.7 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	91	-2.33	9.20	25.3	Pass
							31.4 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	92	-2.60	9.20	28.2	Pass
							29.5 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	93	-1.71	9.20	18.6	Pass
							23.1 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	94	-1.83	9.20	19.9	Pass
							21.8 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	95	-2.54	9.20	27.6	Pass
							32.4 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	96	-2.55	9.20	27.7	Pass
							31.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	97	-2.20	10.09	21.8	Pass
							31.0 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	98	-2.46	10.09	24.4	Pass

Section No.	Elevation ft	Component Type	Size	Critical Element	P K	ϕP_{allow} K	% Capacity	Pass Fail
							28.1 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	99	-1.56	10.09	15.4	Pass
							21.3 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	100	-1.67	10.09	16.5	Pass
							19.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	101	-2.42	10.09	24.0	Pass
							31.1 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	102	-2.46	10.09	24.4	Pass
							30.4 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	103	-2.13	11.08	19.3	Pass
							29.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	104	-2.52	11.08	22.8	Pass
							27.0 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	105	-1.40	11.08	12.6	Pass
							19.3 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	106	-1.53	11.08	13.8	Pass
							17.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	107	-2.49	11.08	22.4	Pass
							31.1 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	108	-2.44	11.08	22.0	Pass
							30.1 (b)	
T5	20 - 0	Leg	P5.5x.375	109	-61.09	235.95	25.9	Pass
							47.1 (b)	
		Leg	P5.5x.375	110	-62.11	235.95	26.3	Pass
							47.7 (b)	
		Leg	P5.5x.375	111	-61.72	235.95	26.2	Pass
							54.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	112	-2.65	7.16	37.0	Pass
		Diagonal	L2 1/2x2 1/2x3/16	113	-2.93	7.16	40.9	Pass
		Diagonal	L2 1/2x2 1/2x3/16	114	-2.15	7.16	30.0	Pass
		Diagonal	L2 1/2x2 1/2x3/16	115	-2.26	7.16	31.5	Pass
		Diagonal	L2 1/2x2 1/2x3/16	116	-2.86	7.16	40.0	Pass
		Diagonal	L2 1/2x2 1/2x3/16	117	-2.81	7.16	39.3	Pass
		Diagonal	L2 1/2x2 1/2x3/16	118	-2.46	7.79	31.6	Pass
							33.5 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	119	-2.58	7.79	33.2	Pass
		Diagonal	L2 1/2x2 1/2x3/16	120	-1.94	7.79	24.9	Pass
							26.0 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	121	-2.03	7.79	26.0	Pass
		Diagonal	L2 1/2x2 1/2x3/16	122	-2.60	7.79	33.3	Pass
							33.7 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	123	-2.66	7.79	34.1	Pass
		Diagonal	L2 1/2x2 1/2x3/16	124	-2.44	8.51	28.6	Pass
							32.5 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	125	-2.66	8.51	31.2	Pass
		Diagonal	L2 1/2x2 1/2x3/16	126	-1.87	8.51	22.0	Pass
							24.9 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	127	-1.97	8.51	23.2	Pass
							23.6 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	128	-2.61	8.51	30.7	Pass
							33.5 (b)	
		Diagonal	L2 1/2x2 1/2x3/16	129	-2.64	8.51	31.1	Pass
							32.8 (b)	
							Summary	
						Leg (T5)	54.6	Pass
						Diagonal (T5)	40.9	Pass
						Top Girt (T1)	1.3	Pass
						Bolt Checks	54.6	Pass
						RATING =	**54.6**	**Pass**

APPENDIX B

BASE LEVEL DRAWING

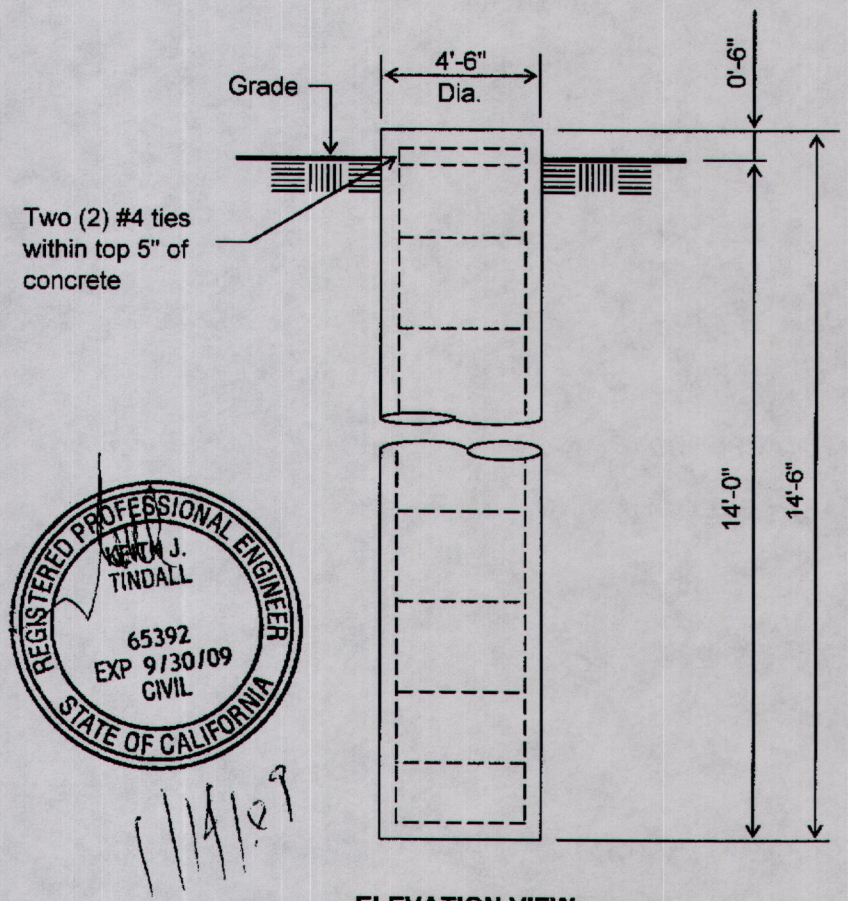
Sabre™ Towers & Poles

For Reference Only

No.: 09-01056
Page: 2
Date: 1/14/09
By: REB

Customer: MOTOROLA ISPO
Site: Riverside County - Arlington F, CA

80 ft. Model S3TL Series HD1 Self Supporting Tower At
120 mph Wind with no ice and 30 mph Wind with 0.5 in. Ice per ANSI/TIA-222-G-2005.
Antenna Loading per Page 1



REGISTERED PROFESSIONAL ENGINEER
KEVIN J. TINDALL
65392
EXP 9/30/09
CIVIL
STATE OF CALIFORNIA
1/14/09

ELEVATION VIEW
(8.54 Cu. Yds. each)
(3 REQUIRED; NOT TO SCALE)

Notes:

1). Concrete shall have a minimum 28-day compressive strength of 4000 PSI, in accordance with ACI 318-05.

2). Rebars to conform to ASTM specification A615 Grade 60.

3). All rebar to have a minimum of 3" concrete cover.

4). All exposed concrete corners to be chamfered 3/4".

5). The foundation design is based on the geotechnical report by Toro International project no. 08-115.33, dated: 12/26/08

6). See the geotechnical report for drilled pier installation requirements, if specified.

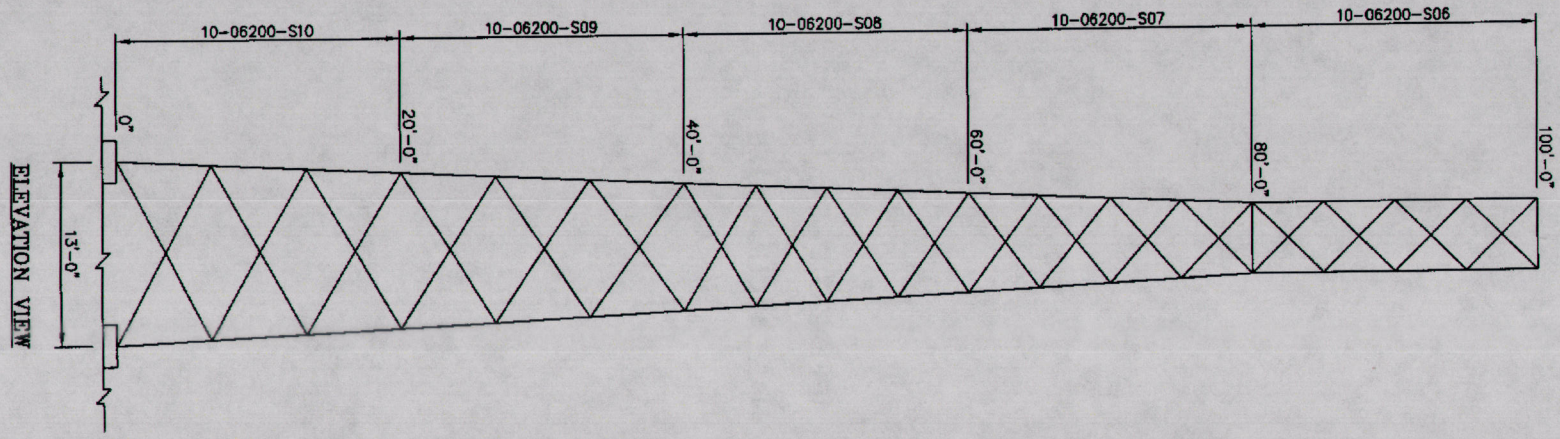
7). The foundation is based on the following factored loads:
Factored uplift (kips) = 137.88
Factored download (kips) = 142.87
Factored shear (kips) = 14.87

8). Use Type II Portland cement with a maximum water-cement ratio of 0.45 for concrete in contact with the on-site soils.

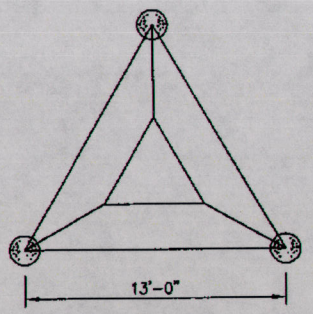
Rebar Schedule per Pier	
Pier	(20) #7 vertical rebar w/#4 ties, two (2) within top 5" of pier then 12" C/C

2101 Murray St - P.O. Box 658 - Sioux City, IA 51102-0658 - Phone 712.258.6690 - Fax 712.258.8250

LEGS	5.563 O.D. X .375	4.500 O.D. X .337	4.000 O.D. X .318	3.500 O.D. X .300	2.875 O.D. X .203
DIAGONALS	L 2 1/2 X 2 1/2 X 3/16		L 2 X 2 X 3/16		L 2 X 2 X 1/4
HORIZONTALS	NONE			L 2 X 2 X 3/16	L 2 X 2 X 1/4
BAYS/SECTION	3 BAYS		4 BAYS		
SECTION WEIGHT	2352 LBS.	1926 LBS.	1684 LBS.	1408 LBS.	1143 LBS.



ELEVATION VIEW



PLAN VIEW

UNLESS OTHERWISE SPECIFIED ALL DIMENSIONS INCLUDE FINISHES AND ARE IN INCHES

TOLERANCES: FRACTIONS ± 1/16" ANGLES ± 1/2 DEG. DECIMALS ± .010"

MATERIAL:

TOLERANCES DO NOT APPLY TO RAW MATERIAL

REV	DATE	DRW	CHK	DESCRIPTION
1	8/24/09	CE	TWM	REVISED FOUNDATION PER ANALYSIS REVISION "0"

Sabre Towers & Poles

MASTER: 100 FT. MODEL S3TL-HD1

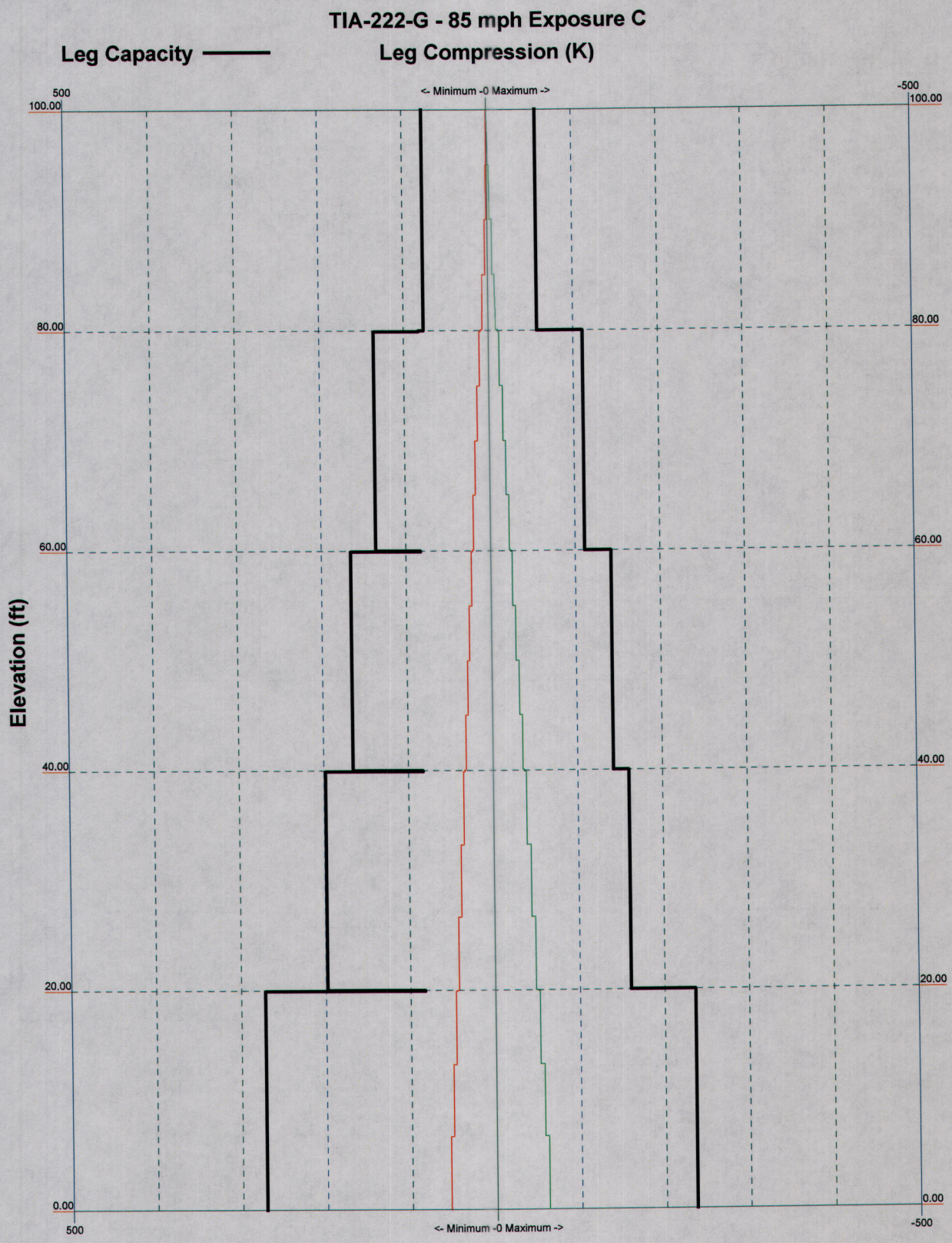
SITE: RIVERSIDE COUNTY-ARLINGTON F, CA

CUSTOMER: MOTOROLA IPSO

JOB NO. 10-06200		SIZE	DRAWING NO.	REV
DATE	08/04/09	B	10-06200-MS	1
DRAWN BY	DPJ			
CHECKED BY	ZAK		SCALE NONE	PAGE 1 OF 2

APPENDIX C

ADDITIONAL CALCULATIONS



All States Eng. & Surveying
23675 Birtcher Drive
Lake Forest, CA 92630
Phone: (949) 273-0996
FAX: (949) 606-7222
ASES

Job: 100' S3TL Series HD1 Self-Supporting Tower			
Project: Riverside County - Arlington F, CA			
Client: Wireless Infrastructure Services	Drawn by: LeT	App'd:	
Code: TIA-222-G	Date: 06/06/17	Scale: NTS	
Path: P116 - Wireless Infrastructure Services\2017\171602 Arlington - Repo SA\Calcs\Tower Analysis\3_sided_free_standing_tower.eri		Dwg No. E-3	

Date: 6/6/2017

Site Name:	5726P
By:	LeT
Checked:	WZ

ALL STATES ENGINEERING & SURVEYING
A ZALZALI & ASSOCIATES COMPANY

Self-Support Drilled Pier

Input

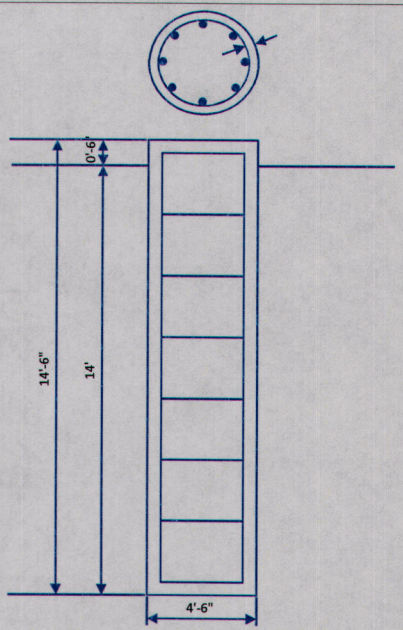
Criteria	
TIA Revision:	G
ACI 318 Revision:	2009
Seismic Category:	D

Forces	
Compression	64 kips
Compression Shear	8 kips
Uplift	56 kips
Uplift Shear	7 kips
Add'l Moment	709 k-ft
Swelling Force	0 kips

Foundation Dimensions	
Pier Diameter:	4.5 ft
Ext. above grade:	0.5 ft
Depth below grade:	14 ft
Bell Diameter:	ft
Bell Angle:	deg

Material Properties	
Number of Rebar:	20
Rebar Size:	7
Tie Size	4
Rebar tensile strength:	60 ksi
Concrete Strength:	4000 psi
Ultimate Concrete Strain	0.003 in/in
Clear Cover to Ties:	3 in

Soil Profile 816890



Layer	Thickness (ft)	From (ft)	To (ft)	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)	Ultimate Uplift Skin Friction (ksf)	Ultimate Comp. Skin Friction (ksf)	Ultimate Bearing Capacity (ksf)	SPT 'N' Counts
1	14	0	14	128	0	0	0.52	0.52	1.5	

Analysis Results

Soil Lateral Capacity	Uplift case		Comp. case	
Depth to Zero Shear:	21.6	ft	21.6	ft
Max Moment, Mu:	532.4	k-ft	612.2	k-ft
Soil Safety Factor:	38.6		33.6	
Safety Factor Req'd:	1.33		1.33	
RATING:	3.44%		3.96%	

Soil Axial Capacity	
Concrete Weight:	33.4 kips
Skin Friction:	102.9 kips
Soil Cone:	kips
Uplift Capacity (k), ϕTn:	102.9 kips
Uplift (k), Tu:	35.0 kips
RATING:	34.01%

Skin Friction (k):	102.9 kips
End Bearing (k):	47.7 kips
Comp. Capacity (k), ϕCn:	150.6 kips
Comp. (k), Cu:	73.4 kips
RATING:	48.73%

Concrete/Steel Check	Uplift Case		Comp case	
Mu (from soil analysis)	532.4	k-ft	612.2	k-ft
ϕMn	2810.2	k-ft	5111.1	k-ft
RATING:	18.94%		11.98%	

rho provided	0.75	
rho required	0.33	OK
Rebar Spacing	7.1	
Spacing required	20.3	OK
Dev. Length required	32.6	
Dev. Length provided	55.6	OK

Overall Foundation Rating: 48.73%