LICENSE AGREEMENT

THIS LICENSE AGREEMENT ("Agreement") is made, effective as of the date set forth in section 2.01(a) below ("Effective Date"), by and between the **CITY AND COUNTY OF DENVER, a municipal corporation** ("City"), and **DISH WIRELESS HOLDING L.L.C.,** a Colorado limited liability company authorized to conduct business in Colorado, whose principal office is located at 9601 S. Meridian Blvd, Englewood CO 80112 ("Licensee").

DEFINITIONS

All capitalized terms or phrases in this Agreement, except for proper names, shall have the meanings as set forth below:

A. Agreement means this License Agreement during the Term or Term Extension of the Agreement.

B. ADA means federal Americans with Disabilities Act and any other federal or state laws requiring access for the disabled to public accommodations.

C. Applicable Law means all federal, state, and local laws applicable in the context of the specific matter addressed in this Agreement, including but not limited to: 1) the constitutions, laws, and rules and regulations of the United States of America and the State of Colorado; 2) the City Charter, the Denver Revised Municipal Code, and building, fire, electrical, plumbing and other applicable codes, as they may be amended from time to time; 3) rules and regulations, including any standards and specifications, promulgated or amended by the Denver Department of Safety and the Denver Fire Department; 4) any rules and regulations promulgated or amended by other City departments and agencies applicable to this Agreement; 5) executive orders issued by the Mayor; 6) any court order, judgment, or decree or any appellate decision applicable to this Agreement; 7) any federal, state, or local administrative decision or order applicable to this Agreement; 8) any anti-discrimination laws; and 9) the requirements of the ADA.

D. Cancellation means the revocation of the License and the termination or cancellation of the Agreement, including mutual termination by the parties, in the manner specified in this Agreement.

E. City means the City and County of Denver as represented by the Denver Fire Department and its Fire Chief.

F. City Representative means the Fire Chief's designee(s) who will oversee and direct all activities of Licensee under this Agreement. The City Representative(s) may be employees or contractors of the Denver Fire Department, Denver's Technology Services, the Electronic Engineering Bureau of the Department of Safety, and/or Denver's Division of Real Estate. Contact information for the City Representative and the assigned responsibilities, if there is more than one City Representative, shall be provided to Licensee upon execution of this Agreement. The City may identify, change, add or delete City Representative(s) by written notice to Licensee.

G. City System means all existing and future communication and other electronic facilities,

equipment and instrumentation and related infrastructure and utility connections that the City requires for the operation of the Fire Station or the provision of emergency services from the Fire Station, including, but not limited to, public safety channels, radio system or other electronic means of sending, receiving, processing and recording information and data for public safety purposes.

H. DRMC means the Denver Revised Municipal Code as it may be amended from time to time.

I. Effective Date means the date this Agreement goes into effect, as specified in section 2.01(a) below.

J. Emergency means an occurrence or incident that presents an imminent threat of widespread or severe damage, injury, or loss of life or property resulting from any natural cause or cause of human origin, including but not limited to fire, explosion, flood, earthquake, wind, storm, structural failure, hazardous substance, environmental contamination, civil disturbance, vandalism, or breach of security.

K. FCC means the Federal Communications Commission.

L. Fire Chief means the head of the Denver Fire Department.

M. Fire Station means the specific fire station operated by the Denver Fire Department to which this Agreement applies, as specified in section 1.01(a).

N. Interference Study means a site and technical interference study, **Exhibit B**, field tests or other activities or investigations related to the resolution of RF Interference that may be associated with the Licensed System as specified in section 5.02.

O. License means the license granted as specified in section 1.01(a) which is exclusive only to the extent specified in this Agreement and which is restricted and revocable as specified in this Agreement. No property or leasehold interest or right is granted by the License.

P. Licensed Premises means the location at the Fire Station where Licensee is authorized to install and operate the Licensed System, as specified in section 1.01(a).

Q. Licensed System means the radio frequency equipment and wireless communication facility, and related equipment, infrastructure and utility communications authorized by the City and installed and operated by Licensee within the Licensed Premises of the Fire Station, as specified in section 1.01(a).

R. Licensee means the legal entity to which the License is granted under and in accordance with this Agreement, as identified in opening paragraph of this Agreement. To the extent that Licensee retains contractors or consultants to perform any of Licensee's rights and obligations under the Agreement, Licensee shall also mean those contractors and consultants.

S. License Fee means the compensation to be paid by Licensee to the City for the use of the Licensed Premises and the operation of the Licensed System at the Fire Station as specified in section

3.01.

T. Minimum Technical Standards mean those standards set forth in **Exhibit C** as these Minimum Technical Standards may be updated from time-to-time, as needed, to address the state-of-the-art.

U. Party means either the City or Licensee, as appropriate in the context, and Parties means both the City and Licensee.

V. Permitted Use means the uses (subject to restrictions) as specified in section 1.02, which Licensee may make of the Licensed Premises in the installation and operation of the Licensed System.

W. RF (Radio Frequency) Interference means any emission, radiation or induction from or associated with the Licensed System that affects the functioning of or degrades, obstructs, or interrupts radio or other wireless communications being made by the City or other authorized parties to or from the Fire Station or the operation of any communication system located at the Fire Station.

X. Point of Contact means the Chief Deputy for the Technical Services Division of the Denver Fire Department, or the Chief Deputy's designated representative, during regular business hours of the Denver Fire Department and the Denver Fire Department's non-emergency Dispatch for Licensee's urgent need for access after regular business hours of the Denver Fire Department.

Y. Term means the duration of the Agreement running from the Effective Date of the Agreement, as specified in section 2.01(a).

Z. Term Extension means any approved amendment to the Agreement allowing the duration of the Agreement for another five-year period subject to any new or changed terms or conditions, as specified in section 2.02.

AA. Tower means the communication structure or structures authorized by the City on which the Licensed System and the City System are located, as specified in 1.01(b).

SECTION 1
LICENSE; PERMITTED USE; and ACCESS

1.01 Grant of License.

(a) City owns property located within the City and County of Denver, State of Colorado, known as Fire Station #29, which is located at 4800 N Himalaya Rd, Denver CO ("Fire Station"). City hereby grants a License to Licensee for the use of certain designated areas at the Fire Station as depicted on **Exhibit A** (the "Licensed Premises") for the installation and operation by Licensee of the Licensed System, as the Licensed System is technically described in **Exhibit A** The Licensed System shall be situated within the Licensed Premises and shall be located in relation to the City System, if any, as depicted in **Exhibit A**. The Licensed Premises shall not include the City System. Any proposed change to the Licensed Premises depicted in **Exhibit A** shall require an amendment to this Agreement.

(b) As a condition of the grant of the License, Licensee shall construct and install, at its sole cost and expense, the Licensed System, as described in the attached **Exhibit A** and at the location specified in **Exhibit A**, for shared use by the City and Licensee. The Licensed Premises shall not include the City System.

1.02 Permitted Use/Restrictions.

(a) The Licensed Premises at the Fire Station shall be used for the installation, maintenance, alteration, repair, replacement, operation, and removal of the Licensed System within the Licensed Premises, in accordance with this Agreement ("Permitted Use"). The Licensed System shall be owned by Licensee. Except as expressly provided in this Agreement, the City may not disturb or modify the Licensed System without the prior written permission of Licensee.

(b) Licensee may access the Fire Station site, use the Licensed Premises, and install and operate the Licensed System only as set forth in this Agreement. The Permitted Use does not authorize any activity that would conflict or interfere with the public health, safety or welfare purpose or operation of the Fire Station or City System. Such prohibited conflict or interference includes RF Interference as set forth in this Agreement and **Exhibit B.** Licensee shall likewise take every reasonable measure to promptly and effectively avoid or remedy any emergency situation within its control that could adversely impact the Fire Station, the City System, the Licensed Premises, or the Licensed System. Licensee must also coordinate with the Denver Fire Department and gain Denver Fire Department approval prior to all concrete cuts.

(c) Licensee must acquire City Approval, prior to making any change to the Licensed System as shown in **Exhibit A** and may trigger a change in license fee and a license amendment. Notwithstanding the foregoing, Licensee may add base station equipment to the Licensed System within the Licensed Premises and may also repair or replace any other equipment comprising the Licensed System with "like-for-like" equipment upon notice to Licensor.

1.03 Access.

(a) Provided that Licensee gives at least forty-eight (48) hours prior notice to the Point of Contact, Licensee has the reasonable right of access, ingress to and egress from the Licensed Premises during regular business hours for Licensee's employees, contractors and agents, including suppliers of materials and furnishers of service (collectively "Licensee's Personnel").

(b) In the event of an urgent situation where Licensee needs prompt access to the Licensed System during or outside of regular business hours, which shall be deemed to include any failure of Licensed System or any portion thereof, Licensee shall communicate with the Point of Contact to arrange for access by Licensee's Personnel.

(c) With respect to all access to the Fire Station, Licensee's Personnel must present legally sufficient identification, preferably in the form of a badge with picture ID issued by Licensee; will be subject to escort by Fire Department staff and search and inspection of items brought onto the Fire

Station site; and will comply with all restrictions and security protocols set by the Fire Chief and the direction of the City Representative. All equipment, vehicles, machinery and other materials brought onto the Fire Station site must be necessary for the work authorized to be performed.

(d) Should Licensee require access into a secure area of the Fire Station which may require prior approval or escort, then the permission of the City Representative must be obtained and any security protocols must be strictly observed by Licensee.

(e) The exercise of access by Licensee or Licensee's personnel shall not conflict or interfere with the operations of the Fire Station or the City System and may not block access at or the use of the Fire Station nor be in violation of the ADA. In addition, the exercise of access shall not conflict or interfere with the City System unless prior written permission is obtained from the City Representative.

(f) Any particular access on the Fire Station site may, at any time, temporarily or permanently, be closed, so long as an alternative means of access is made available to Licensee within a reasonable time. During the duration of any state of Emergency declared by the President of the United States, the Governor of the State of Colorado, or the Mayor of the City and County of Denver, access may be denied for security and public safety reasons. Licensee hereby releases and discharges the City from any and all claims, demands or causes of action which Licensee may now, or at any time hereafter, have against the City, arising or alleged to arise out of the closing of any point of access on the Fire Station site or the temporary unavailability of access to a Fire Station site.

SECTION 2
TERM and TERM EXTENSION

2.01 Term.

The Term of this Agreement shall be effective as of the date that the City delivers a fully-executed license contract to Licensee ("Effective Date"). If the Term commences on any day other than the first (1st) or ends on any day other than the last of a calendar month, rent for the fraction of a month at the commencement and at the end of the Term shall be prorated at a rate per day equal to 1 divided by the number of days in the month for which rent is being prorated. The Term of this Agreement shall expire ten years from the Effective date, unless Licensee terminates the Agreement upon sixty (60) days written notice.

2.02 Term Extension.

Licensee may exercise one (1) options to renew the License for one additional ten-year period at the end of the term. Licensee shall provide written notice to the City of its intent to exercise the renewal option by no sooner than one hundred and eighty (180) days and no later than sixty (60) days before the end of the Term. All terms and conditions shall remain in effect in accordance with this Agreement during the renewal period, including the percentage fee increase under Section 3.01, unless otherwise modified by mutual written agreement. Modifications, if any, must be set forth in an amendment to this Agreement and processed for approval in the same manner as the Agreement

SECTION 3
LICENSE FEE

3.01 License Fee.

(a) Licensee agrees to pay City a monthly Base Rent of payable in monthly installments by the fifth day of each month thereafter for the Term of the Agreement and any Term renewal. Licensee and City agree that the first Base Rent payment shall be made within thirty (30) days of the Effective Date, with subsequent rent payable by the fifth day of each month. The Monthly Base Rent shall follow this schedule:

Period	Monthly Base Rent
Yr 1	$3,400.00
Yr 2	$3,502.00
Yr 3	$3,607.06
Yr 4	$3,715.27
Yr 5	$3,826.73
Yr 6	$3,941.53
Yr 7	$4,059.78
Yr 8	$4,181.57
Yr 9	$4,307.02
Yr 10	$4,436.23
Yr 11 (if renewal is exercised)	$4,569.32
Yr 12	$4,706.40
Yr 13	$4,847.59
Yr 14	$4,993.02
Yr 15	$5,142.81
Yr 16	$5,297.09
Yr 17	$5,456.00
Yr 18	$5,619.68
Yr 19	$5,788.27
Yr 20	$5,961.92

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(b) Any Monthly Base Rent paid to the City shall not be refundable in the event of Cancellation, as provided in this Agreement.

3.02 Place and Manner of Payments.

All sums payable to City, including the License Fee and other costs and expenses incurred by

the City and reimbursable by Licensee under this Agreement, shall be made payable, without notice, to the "Manager of Finance for the City and County of Denver" and delivered to:

City and County of Denver
Division of Real Estate
201 West Colfax Avenue, Dept. 1010
Denver, Colorado 80202

All payments shall be made in legal tender of the United States. Any payment not made to City accrues interest at the lesser of (i) 18% per annum, or (ii) the maximum interest rate allowed under law, commencing on the fifth (5^{th}) calendar day after the date such amount is due and owing until paid to City. Licensee agrees to pay any charges, fees, or costs incurred by the City for collection of unpaid License Fees or other unpaid costs and expenses of Licensee specified in this Agreement, including reasonable attorney's fees.

SECTION 4
DESIGN, CONSTRUCTION AND INSTALLATION

4.01 General.

(a) On or after the Effective Date of this Agreement, Licensee shall, at its sole cost and expense, install within the Licensed Premises, the Licensed System in accordance with **Exhibit A** (unless changes are authorized under section 4.02)**,** and in accordance with the terms and conditions of this Agreement.

(b) The Licensed System shall in all respects be designed and installed in accordance with Applicable Law, and pursuant to any required building permit and zoning permit to be obtained by Licensee from the City, and according to requirements or design guidelines of the Denver's Technology Services division, the Denver Department of Safety and the Denver Fire Department.

(c) The implementation of the design and installation of the Licensed System, as described and depicted in **Exhibit A**, as well as any changes, elaborations or additions to the design, construction and installation of the Licensed System beyond those described and depicted in **Exhibit A** shall be subject to the oversight and approval of the City Representative as well as any other approvals required in this Agreement.

4.02 Plans and Specifications.

(a) Prior to any installation of any portion of the Licensed System, four (4) copies of complete and accurate plans and specifications for the Licensed System must be submitted to the City Representative for review. These plans and specifications must include complete specifications of transmitter power, operating frequencies, filter passband and rejection characteristics, antenna model numbers and radiation patterns (both horizontal and vertical plane patterns), antenna height and location, and placement of utilities servicing the Licensed System.

(b) Licensee shall cooperate with the City Representative in the review of the plans and specifications and shall make any reasonable modifications required by the City Representative. Upon

completion of the review and any required modifications, the City Representative, in consultation with the Fire Chief, will approve the plans and specifications.

(c) To the extent that the approved plans and specifications are different from the information contained in **Exhibit A**, Licensee shall prepare, to the reasonable satisfaction of the City Representative, new exhibits reflecting such changes, and the changed exhibits will replace and supersede the corresponding exhibits attached to this Agreement.

(d) Installation work shall not commence, nor shall continue, until Licensee has established to the City Representative's reasonable satisfaction that the work will proceed in conformance with the approved plans and specifications and that all Applicable Law has been or will be fully and appropriately satisfied. Licensee also cannot commence any cutting of concrete without the express written permission from the Denver Fire Department.

4.03 Installation.

(a) Licensee is responsible for undertaking all measures necessary and appropriate under Applicable Law to protect the health and safety of the public, City employees, and Licensee's employees and contractors and to lawfully conduct the work associated with the installation. Prior to the commencement of installation, Licensee or its contractor shall obtain and pay for all required permits, licenses and approvals. Good and workmanlike standards of design, construction and installation shall be required in connection with all such work.

(b) To the extent that building codes or other City requirements mandate that modifications be made to the roof or other infrastructure of the Fire Station as part of the installation, Licensee shall be required to include those modifications in its **Exhibit A** plans (unless changes are authorized under section 4.02) and to make such modifications, at its sole cost and expense and subject to prior written approval of such modifications by the City Representative and the City Representative's oversight of the modifications as they are being made. The City is not obligated to make any modifications to the Fire Station, including the Licensed Premises, to support the installation.

(c) Licensee shall include in Licensee's contract(s) with its consultants and contractors provisions whereby such consultants and contractors shall defend and hold harmless the City from all costs, liens, damages and expenses related to the design, construction and installation work.

(d) Licensee shall be responsible for obtaining utility locates prior to starting any authorized digging on City property. If damage should occur to any existing underground utilities or other underground facilities on City property, whether or not a utility locate was obtained, Licensee shall immediately report the damage to the City Representative and shall take all actions and incur all costs and expenses necessary to repair the damage in a manner satisfactory to the City Representative.

(e) Upon completion of the installation, Licensee shall timely furnish to the City Representative with documented evidence of payment, contractor's affidavits and full and final waivers of all liens for labor, services, or materials.

(f) Equipment shall be located in designated locations as depicted on **Exhibit A** within the Licensed Premises. The temporary placement of any equipment or materials outside of the Licensed Premises shall require the prior written approval of the City Representative. No equipment or materials shall be placed so as to block access at or use of the Fire Station or in violation of the ADA.

(g) Licensee is responsible for acquiring land lines required for the installation and operation of the Licensed System. The installation of land lines at the Fire Station shall be subject to the prior written approval of the City Representative. Licensee shall be solely responsible for paying any fees, charges, surcharges, taxes, assessments, and similar costs and expenses associated with the land lines.

(h) With respect to utilities, Licensee shall comply with section 5.07 and the installation requirements of this section 4.03.

(i) The City is not responsible for the Licensed System or Licensee's other authorized installations. Licensee shall be responsible for securing the Licensed System and Licensee's other authorized installations and keeping them in good working order.

SECTION 5
USE AND OPERATION

5.01 Authorized Frequencies.

In the operation of the Licensed System, Licensee is authorized to operate in the FCC-licensed radio bands and frequencies set forth in **Exhibit B.** Operation in any unlicensed radio band (as defined by the FCC) or any radio band used by a City System is prohibited.

5.02 RF (Radio Frequency) Interference.

(a) Licensee acknowledges that City's unimpeded use and operation of the Fire Station is critical to the health, safety and welfare of the City and County of Denver and its inhabitants. Licensee shall use its best efforts, at all times, to avoid any RF Interference or interference of any kind with the operation or use of the Fire Station and the City System as set forth in this Agreement and **Exhibit C**. Licensee shall diligently work to prevent and, in the event of failure to do so, immediately correct radio frequency interference to the City System and any component elements, including the City's WiFi system, and to cooperate with, and comply with the directions from, the City Representative assigned to deal with RF Interference matters. To help achieve this goal, Licensee shall comply with the following:

(a) Licensee agrees to comply with all federal, state, local, or other government regulations applicable to Licensee and its activities operating or using the Licensed System, including, but not limited to, regulations and standards published by the FCC.

(b) Upon written request by the City Representative, not to exceed once per five (5) year period, Licensee agrees to conduct an Interference Study prior to commencing operations and/or during the entire Term or Term Extension of this Agreement, and to furnish the City Representative

with the results of the Site Study and to include it as part of Licensee's System Plans and Specifications. If Licensee should fail within a period specified by the City Representative to undertake or complete an Interference Study, the City may arrange for such an Interference Study and Licensee shall reimburse the City for the cost and expense of conducting and preparing the Interference Study. Notwithstanding any provision of this section, if Licensee requests equipment modification, the City may request a new interference study.

(c) Licensee agrees to comply with the most recent edition of the Minimum Technical Standards, with the current Minimum Technical Standards attached hereto as **Exhibit C**

(d) In order to prevent interference, Licensee shall maintain and repair, at no cost to the City, the Licensed System, in order to comply with FCC rules and the reasonable requirements of the City Representative. If this maintenance should necessitate changing out or replacing existing antennas, the requirements of section 5.04 shall be applicable.

(e) If authorized to make changes, Licensee shall notify the City Representative of the specific changes to associated RF equipment, transmit and receive frequencies, transmitter output power, antenna configurations, and effective radiated power before making the changes. An Interference Study shall be conducted by Licensee, as directed by the City Representative and at Licensee's sole cost and expense, prior to any proposed frequency changes. The requirements of section 5.04 shall be applicable to the changes addressed herein.

(f) To extent there are more than one licensee operating at the Fire Station, Licensees are encouraged to resolve potential or real interference problems amongst themselves. Licensee agrees to cooperate fully with City and other licensees to diagnose and correct interference problems. Such cooperation may require Licensee to temporarily reduce or shut down transmit power to help diagnose problems.

(g) When the City Representative, based on inquiry and evaluation, becomes aware of a potential or existing interference problem caused directly or indirectly, wholly or partially, by the Licensed System, the City may require Licensee to reimburse City for the cost of an Interference Study to include radio frequency measurements. The purpose of this Interference Study is to identify the problem and determine if the problem is caused directly or indirectly, wholly or partially, by the Licensed System. This Interference Study shall be conducted by a consulting engineer selected by the Fire Chief after consultation with Licensee and the City Representative. In the event there are additional licensees operating at the Fire Station, Licensee shall pay for a pro rata share of the costs of the Interference Study, unless Licensee is determined to be solely responsible for the interference, in which case Licensee shall pay all costs and expenses. Pro rata share shall be determined by dividing the costs by the number of non-City licensees operating at the Fire Station.

(h) When necessary to correct interference problems, as determined by the Chief in the Chief's reasonable discretion, Licensee agrees, at its sole cost and expense, to install cavity-type bandpass filters, notch filters, isolators, or other state-of-the-art equipment. These equipment items are in addition to the minimum equipment of the Minimum Technical Standards. The minimum equipment items shall be installed regardless.

(i) Licensee shall ensure that its frequencies used for the operation of the Licensed System do not interfere with any operation of the Fire Station, including without limitation interference with public safety or the City System. Licensee shall provide documentation of the frequencies that it is authorized to use and is using for the Licensed System. Licensee shall not occupy any frequencies that they are not using for the purposes of blocking other licensees from operating. Licensee shall be responsible for conducting an RF scan to verify there will be no interference with other systems. This shall occur prior to Licensee turning on the Licensed System and shall be documented by a third-party vendor and submitted to the City Representative. Once City Representative has reviewed this documentation, the City Representative will give notice to Licensee that it can turn on its Licensed System. If the City Representative is not satisfied with the details of the study, the City Representative will give notification to Licensee as to what needs to be remedied before notice to proceed will be given.

(j) If Licensee's equipment or operations cause RF Interference, as determined by the Fire Chief in the Fire Chief's reasonable discretion, including without limitation interference with the City System, and if the interference is not eliminated within ten (10) days after written notice from the Fire Chief, then City may, at Licensee's sole cost and expense, temporarily turn off the power to the Licensed System. The City Representative shall contact Licensee at the time the Licensed System needs to be deactivated so Licensee can facilitate the effort to deactivate the Licensed System, isolate any interference, and turn the Licensed System back on with minimal interruption. Licensee, at its sole cost and expense and subject to the requirements of section 5.06, shall (i) have the right to make such repairs, maintenance, replacements or adjustments to the Licensed System as may be reasonably necessary to prevent such interference, and (ii) have the right to conduct intermittent tests of the Licensed System at times mutually agreeable to the City Representative to determine if the Licensed System will continue to cause such interference.

(k) The City requires that Licensee operate its Licensed System with no interference to other licensees' systems. Any unresolved disputes regarding the cause or resolution of specific interference problems or complaints must be evaluated by an independent third party selected by the Fire Chief who is competent to evaluate the potential causes of the interference and the measures required for its resolution. If it is determined that interference to the equipment, frequencies or channels of Licensee or other licensees operating at the Fire Station is a result of the non-compliance of those facilities with the Minimum Technical Standards, it shall be the responsibility of Licensee or other licensees to resolve the interference in accordance with the Minimum Technical Standards. If the interference continues when these facilities are brought into compliance with the Minimum Technical Standards, then it shall be Licensee's responsibility to take whatever measures are necessary to resolve the interference promptly and effectively or disengage the operation of the Licensed System until the interference is resolved to the satisfaction of the City Representative.

5.03 Operational Test Procedures.

The following test procedures shall be approved by City prior to or during, whichever is applicable, Licensee's operation of the Licensed System.

(a) Perform a desktop interference study to include all frequencies to be used by Licensee to ensure no interference is likely from intermodulation products or out-of-band emissions.

(b) Verify the results of the Interference Study by conducting appropriate measurements of the installed systems.

(c) If problems are found, make recommendations for additional filtering, channel changes, greater antenna separation, or other fixes, as necessary.

5.04 Changes to Licensed System.

(a) Licensee shall provide prior written notice to the Fire Chief of any proposed change that would require cutting through existing concrete. All reviews of proposed changes shall be subject to such process as prescribed by the Fire Chief and undertaken by the City Representative.

(b) Any proposed changes which are significant (as reasonably determined by the Fire Chief) will require a review of the current lease rate and may result in an additional License Fee being charged to Licensee and possible other changes to the terms and conditions of the Agreement. These changes, along with any addition, relocation or replacement of antennae or other equipment outside the Licensed Property, shall require an amendment to the Agreement which must be approved in the same manner as this Agreement. Notwithstanding the foregoing, Licensee's addition of ground/base station equipment to the Licensed System within the Licensed Premises as well as any maintenance actions, repair or replacement any other equipment comprising the Licensed System with "like-for-like" equipment shall not be considered significant and thus requiring an amendment to this Agreement Changes or occupation or use of areas outside of the Licensed Property which are not authorized as provided herein will be considered to be in breach of this Agreement.

(c) All such changes shall be subject to the Minimum Technical Standards and the installation and operational conditions set forth in this Agreement. The approval form must be attached to the scope of work and stamped structural drawings sheets (not separate). All contractors, subcontractors and vendors must have a copy of the signed approval sheets to present to the officer in charge of the Fire Station, before any work may begin.

5.05 Repairs and Maintenance; Removal.

(a) The maintenance, care, repair, alteration, enhancement or replacement of the Licensed System or infrastructure within the Licensed Premises shall be made by Licensee at its sole cost and expense. Licensee covenants and agrees during the Term or Term Extension of this Agreement, after the installation of the Licensed System and occupancy of the Licensed Premises, that Licensee:

(1) shall keep the System in good order and condition, and will make all necessary and appropriate repairs or changes thereof if approved as required in section 5.04 above;

(2) shall not permit rubbish, debris, waste materials or anything unsightly or detrimental to health, or likely to create a fire or explosion hazard, or conducive to deterioration, to remain in any part of the Licensed Premises or the Fire Station or to be disposed of improperly;

(3) shall at all times maintain the Licensed System in accordance with Applicable

Law, the Minimum Technical Standards, FCC requirements, and manufacturer's specifications;

(4) shall promptly repair any and all damage to, among other things, the structures, equipment and surrounding property at the Fire Station which result from Licensee's installation and operation of its Licensed System including, but not limited to, any leaks or physical damage as a result of roof penetrations or other physical penetrations or structural damage to the building or structures, including the significant reduction in the useful life of buildings or structures or any parts thereof, caused by the Licensed System or its operation and/or other workmen and maintenance and repair activities involving the Licensed System;

(5) shall store tools, test equipment and work materials only in areas at the Fire Station approved by the City Representative; and

(6) shall restore any damage resulting from roof or other building penetrations and actions or omissions of the License in the Licensed Premises or at the Fire Station so that the damaged property is restored to original condition.

(b) Removal of the Licensed System by Licensee may only occur only upon expiration of the Agreement or Cancellation, as provided by this Agreement or as part of the process of a replacement of the Licensed System as authorized under this Agreement.

(c) If Licensee should be of the opinion that repair, alteration or replacement of the tower is needed ("Alteration"), Licensee shall submit in writing a request to the Fire Chief explaining the perceived need for the Alteration. The Fire Chief shall determine whether such Alteration is warranted and, if so, who should make and pay for or the Alteration or how the cost of the Alteration is to be shared. Any obligation of the City to perform the work shall be strictly contingent upon approvals, including contracts, required by Applicable Law and obtaining all funding needed for the Alteration. If Licensee proposes to make and pay for the Alterations, it should provide plans and a budget with the request submitted to the Fire Chief.

5.06 Right to Enter, Inspect and Make Repairs and Improvements.

(a) The City and its authorized officers, employees, agents, contractors, subcontractors and other representatives shall have the right (at such times as may be reasonable under the circumstances and with as little interruption of Licensee's operations as is reasonably practicable) to access Licensee's equipment for the following purposes:

(1) to inspect such equipment at reasonable intervals during regular business hours (or at any time in case of Emergency or urgent need to protect the City System) to determine whether Licensee has complied and is complying with the terms and conditions of this Agreement;

(2) to perform maintenance and make repairs and replacements in cases where Licensee is obligated but has failed to do so, after the City has given Licensee reasonable notice so to do and an opportunity to cure. In the event that Licensee fails to cure within thirty (30) days of receipt of such notice (unless the nature of the cure is such that an extension of said period is necessary beyond thirty (30) days is necessary this period may be extended if Licensee diligently pursues completion of said cure) then City can proceed with repairs. In such event, event Licensee shall

reimburse the City for the reasonable cost thereof within thirty (30) days of Licensee's receipt of City's invoice accompanied by reasonable substantiation of the costs incurred. The City shall have the right to seek recovery of the cost of the maintenance or repair by any judicial remedy available should Licensee fail to pay the cost of the repair. Under no circumstances will City attempt to repair or alter in any way Licensee's operational equipment such as base station radios, other electronic equipment, alarm systems, antennas, coaxial cable, DAS, UPS, etc.; however, this restriction shall not limit the City in performing inspections and repairs and protecting the City System and the Fire Station as provided in this Agreement.

(b) The City reserves the right at all times to take any action it deems necessary, in its sole discretion, to repair, maintain, alter, expand, or improve the City System and the Fire Station and the improvements thereon in connection with their use and operation. The City agrees to give reasonable advance notice of any such activities to Licensee and to reasonably cooperate with Licensee to carry out such activities with a minimum amount of interference to Licensee's use of the Licensed Premises. Licensee agrees to cooperate with the City respect to such repairs, maintenance, alterations, expansions, or improvements and to accommodate such work to the extent the City deems necessary and at Licensee's sole expense.

5.07 Utilities.

(a) Licensee shall be responsible for arranging for all utility services needed for the Licensed System, including separately metered electrical service, and for paying for all service, connection, taxes, fees, surcharges and other charges associated with or resulting from the utility services for the Licensed System. Licensee shall be responsible to install all utility service locations in compliance with all applicable laws, codes and regulations and subject to the requirements of section 5.04 above and the installation requirements of section 4.03 above.

(b) Licensee shall be responsible for providing and properly maintaining and replacing, subject to the requirements of section 5.04 above and the installation requirements of section 4.03 above, an independent ventilation, heating and air conditioning system for those portions of the Licensed System, if any, that are expressly required by the manufacturer of the System to maintain manufacturer's warranties based upon Licensee's installation of the Licensed System at the Fire Station.

5.08 Interruption of Utility Services.

(a) Licensee agrees that City shall not be liable for failure of any utility services to be supplied to the Licensed System or for any interruption of utility services to the Licensed System caused by third parties.

(b) The City reserves the right to temporarily interrupt utility services at such time as may be necessary by reason of accident, unavailability of employees, repairs, alterations or improvements or whenever by reason of *force majeure*, including any state of Emergency declared by the President of the United States, the Governor of the State of Colorado, or the Mayor of the City and County of Denver for which such interruption is reasonable for security and public safety reasons. The City shall not be liable for operational or business losses or for damages to persons or property due to such interruptions. Nor shall such interruptions in any way be construed as

cause for abatement of the License Fee, unless caused by the demonstrated gross negligence or intentional misconduct of the City or its agents, contractors or employees.

(c) No backup power supplies shall be placed within the Licensed Premises or elsewhere on City property without the prior, written approval of the City Representative and after obtaining any required permits, licenses or approvals for such backup power supplies.

SECTION 6
INSURANCE; INDEMNITY and DEFENSE; GOVERNMENTAL IMMUNITY; LIMITS ON LIABILITY; and TAXES, LICENSES, LIENS AND FEES

6.01 Insurance.

(a) General Conditions: Licensee agrees to secure, at or before the time of execution of this Agreement, the following insurance covering all operations, goods or services provided pursuant to this Agreement. Licensee shall keep the required insurance coverage in force at all times during the term of the Agreement, including any extension thereof, and during any warranty period. The required insurance shall be underwritten by an insurer licensed or authorized to do business in Colorado and rated by A.M. Best Company as "A-VIII" or better. Each policy shall require notification to the City in the event any of the required policies be canceled before the expiration date thereof. Such written notice shall be sent to the parties identified as additional insureds on the certificate of insurance. Said notice shall be sent thirty (30) days prior to such cancellation. Licensee shall be responsible for the payment of any deductible or self-insured retention. The insurance coverages specified in this Agreement are the minimum requirements, and these requirements do not lessen or limit the liability of the Licensee. The Licensee shall maintain, at its own expense, any additional kinds or amounts of insurance that it may deem necessary to cover its obligations and liabilities under this Agreement.

(b) Proof of Insurance: Licensee may not commence services or work relating to this Agreement prior to placement of coverages required under this Agreement. Licensee certifies that the certificate of insurance attached as **Exhibit D**, preferably an ACORD form, complies with all insurance requirements of this Agreement. The City requests that the City's contract number be referenced on the certificate of insurance. The City's acceptance of a certificate of insurance or other proof of insurance that does not comply with all insurance requirements set forth in this Agreement shall not act as a waiver of Licensee's breach of this Agreement or of any of the City's rights or remedies under this Agreement. The City's Risk Management Office may require additional proof of insurance, including but not limited to endorsements.

(c) Additional Insureds: For Commercial General Liability, Auto Liability and Excess Liability/Umbrella (if required), Licensee and subLicensee's insurer(s) shall include the City and County of Denver, its elected and appointed officials, employees and volunteers as additional insured.

(d) Waiver of Subrogation: For all coverages required under this Agreement, Licensee's insurer shall waive subrogation rights against the City.

(e) Subcontractors and Subconsultants: Licensee shall confirm and document that all subcontractors and subconsultants (including independent contractors, suppliers or other entities providing goods or services required by this Agreement) procure and maintain coverage as approved by the Licensee and appropriate to their respective primary business risks considering the nature and scope of services provided.

(f) Workers' Compensation and Employer's Liability Insurance: Licensee shall maintain the coverage as required by statute for each work location and shall maintain Employer's Liability insurance with limits of $100,000 per occurrence for each bodily injury claim, $100,000 per occurrence for each bodily injury caused by disease claim, and $500,000 aggregate for all bodily injuries caused by disease claims.

(g) Commercial General Liability: Licensee shall maintain a Commercial General Liability insurance policy with minimum limits of $1,000,000 for each bodily injury and property damage occurrence, $2,000,000 products and completed operations aggregate (if applicable), and $2,000,000 policy aggregate.

(h) Automobile Liability: Licensee shall maintain Automobile Liability with minimum limits of $1,000,000 combined single limit applicable to all owned, hired and non-owned vehicles used at the Leased Premises.

(i) Property Insurance: Licensee shall provide 100% replacement cost for Licensee's tenant improvements and personal property. Licensee understands and acknowledges that the City does not provide any insurance coverage for any property of the Licensee, its agents, employees or assignees located in the Leased Premises and Licensee acknowledges and agrees that the Licensee, its agents, employees and assignees have no claim against the City for any damage or loss of personal property and belongings of Licensee, its agents, employees or assignees in the Leased Premises.

(j) Failure to comply with the requirements of this section 6.01 shall be legal grounds under this Agreement for work by Licensee at the Fire Station to be ordered to cease or to be restricted, as deemed appropriate by the Fire Chief or the Denver Risk Management Office, until compliance is achieved and any unpaid claims are resolved to the reasonable satisfaction of the City Representative and the Denver Risk Management Office. These insurance obligations shall survive the expiration of the Agreement and Cancellation.

6.02 Indemnification & Defense.

(a) Licensee hereby agrees to defend, indemnify, and hold harmless City, its appointed and elected officials, agents and employees against all liabilities, claims, judgments, suits or demands for damages to persons or property arising out of, resulting from, or relating to regarding the use and occupancy of, and activities and operations on, the Fire Station site by Licensee (including its officers, employees, representatives, suppliers, contractors, subcontractors and agents) under this Agreement ("Claims"), unless such Claims have been specifically determined by the trier of fact to be the sole negligence or willful misconduct of City. This indemnity shall be interpreted in the broadest possible manner to indemnify City for any acts or omissions of Licensee (including its officers, employees, representatives, suppliers, contractors, subcontractors and agents) either passive or active, irrespective

of fault, including City's concurrent negligence whether active or passive, except for the sole negligence or willful misconduct of City.

(b) Licensee's duty to defend and indemnify City shall arise at the time written notice of the Claim is first provided to City regardless of whether an action has been filed in court on the Claim. Licensee's duty to defend and indemnify the City shall arise even if City is the only party sued and/or it is alleged that City's negligence or willful misconduct was the sole cause of the alleged damages.

(c) Licensee will defend any and all Claims which may be brought or threatened against City and will pay on behalf of City any expenses incurred by reason of such Claims including, but not limited to, court costs and attorney fees incurred in defending and investigating such Claims or seeking to enforce this indemnity obligation. Such payments on behalf of City shall be in addition to any other legal remedies available to City and shall not be considered City's exclusive remedy.

(d) Insurance coverage requirements specified in this Agreement shall in no way lessen or limit the liability of Licensee under the terms of this indemnification obligation. Licensee shall obtain, at its own expense, any additional insurance that it deems necessary for City's protection.

(e) This indemnification and defense obligation shall survive the expiration of this Agreement and Cancellation.

6.03 Colorado Governmental Immunity Act.

Licensee understands and agrees that City is relying upon, and has not waived, the monetary limitations and all other rights, immunities and protection provided by the Colorado Governmental Act, § 24-10-101 *et seq*., C.R.S., and any related statutory protections against liability.

6.04 Limitation on Liability.

Licensee agrees that no liability shall attach to the City for any damages or losses incurred or claimed by Licensee or any other person or party on account of the installation, construction or operation of the Licensed System by Licensee. Licensee agrees that it shall not in any way seek damages or make any claims against the City for any interference or delay caused by construction in adjacent areas, other businesses or operations, including without limitation damages or losses in the nature of delay damages, lost labor productivity, and impact damages.

6.05 Environmental Requirements.

(a) Licensee and its contractor(s) and subcontractor(s) shall obtain all federal, state, and local environmental permits necessary for the work to be performed and shall comply with all applicable federal, state, and local environmental permit requirements applicable to the work. Licensee and its contractor(s) and subcontractor(s) shall comply with all applicable local, state, and federal environmental guidelines, rules, regulations, statutes, laws, and orders applicable to the work (collectively, "Environmental Requirements"), including but not limited to Environmental Requirements regarding the storage, use, transportation, and disposal of Hazardous Materials and regarding releases or threatened releases of Hazardous Materials to the environment.

(b) The term "Hazardous Materials" shall mean asbestos, asbestos-contaminated soils, and asbestos-containing materials, special wastes, polychlorinated biphenyls (PCBs), any petroleum products, natural gas, radioactive source material, pesticides, any hazardous waste as defined at 42 U.S.C. § 6903(5) of the Solid Waste Disposal Act, any hazardous substance as defined at 42 U.S.C. § 9601(14) of the Comprehensive Environmental Response, Compensation and Liability Act, and chemical substance as defined at 15 U.S.C.§ 2602(2) of the Toxic Substances Control Act, and any guidelines issued and rules or regulations promulgated pursuant to such statutes, or any other applicable federal or state statute.

(c) No Hazardous Materials shall be brought onto, or stored on, the Fire Station site without the prior, written approval of the City Representative and, if required by the City Representative, the prior, written approval of the Denver Department of Environmental Health and/or the Colorado Department of Public Health and Environment.

(d) The obligations of Licensee set out in this section 6.04 shall survive the expiration of the Agreement and Cancellation. Licensor represents, warrants and agrees that Licensor will not, and will not permit any third party to use, generate, store or dispose of any Hazardous Material on, under, about or within the Fire Station in violation of any law or regulation.

6.05 Taxes, Licenses, Liens and Fees.

(a) Licensee agrees to promptly pay all taxes, possessory interest taxes, excises, license fees and permit fees of whatever nature applicable to its operations hereunder and to take out and keep current all municipal, state or federal licenses required for the conduct of its business or operations under this Agreement and further agrees not to permit any of said taxes, excises, license fees or permit fees to become delinquent.

(b) Licensee also agrees not to permit any mechanic's or materialman's or any other lien to become attached or be foreclosed upon the Fire Station or the tower, or improvements thereto, or any part or parcel thereof, by reason of any work or labor performed or materials furnished by any mechanic or materialman for Licensee, as contractors or subcontractors.

(c) Licensee further agrees to promptly pay when due all bills, debts and obligations incurred by it in connection with its operations hereunder, and not to permit the same to become delinquent and to suffer no lien, mortgage, judgment or execution to be filed against the Fire Station, the tower, the City System, the Licensed System, or related improvements, which may in any way impair the rights of the City under this Agreement or to the City's property.

(d) The obligations of Licensee set out in this section 6.05 shall survive the expiration of the Agreement and Cancellation.

6.06 No Waiver.

No failure of the City to insist upon the strict performance of a term, covenant or agreement contained in this Agreement shall be deemed or taken to be a waiver by the City of any succeeding failure to perform or any breach or default.

SECTION 7
CITY RIGHTS

7.01 City's Rights.

(a) City shall retain all the rights to the use, occupancy and ownership of the tower; and such use, occupancy and ownership by the City shall be the primary use of the Fire Station and shall not be interfered with by the exercise of the rights granted hereunder during the Term or Term Extension of the Agreement, except to the extent interference shall be a result of Licensee's reasonable uses and actions in the installation, inspection, maintenance, alteration, repair, replacement, operation and removal of the Licensed System as authorized under this Agreement; provided, however, that Licensee shall be liable to the City for any damage to improvements that may result from such installation, inspection, maintenance, alteration, repair, replacement, operation and removal.

(b) If the City desires Licensee to leave in place any modifications made by Licensee to the tower and so states in a written notice to Licensee, then Licensee shall leave such modifications in place without compensation from or to the City. If Licensee is required to remove the modifications and does not restore damage resulting from said removal and thereby causing the City to have to undertake the restoration, then Licensee shall promptly reimburse the City for the work.

(c) The City specifically reserves for itself, other lessees, licensees and assignees of City, all rights which do not materially and adversely interfere with Licensee's exercise of its License under this Agreement; provided, however, the City will not materially and adversely interfere with, and will not knowingly permit or allow other licensees to materially and adversely interfere with, the rights of Licensee under the terms of this Agreement except to the extent expressly provided in this Agreement.

(d) Upon expiration of the Agreement or Cancellation or on the date specified in any demand for possession by the City after any default by Licensee (after any applicable notice and cure periods), Licensee covenants and agrees to surrender possession of the Licensed Premises and all other parts of the Fire Station site to the City in the same condition as when first occupied, ordinary wear and tear excepted but subject to the repair and restoration requirements provided in this Agreement.

(e) Licensee shall remove, at its sole cost, upon expiration of the Agreement or Cancellation, the Licensed System and all of Licensee's personal property within thirty (30) calendar days after expiration or Cancellation, as applicable. If such removal should damage the or Tower, Licensee agrees, at its sole cost, to immediately repair such damage in a good and workmanlike manner and to put the property in the same condition as it would have been if the Licensed System had not been installed, reasonable wear and tear excepted but subject to the repair and restoration requirements provided in this Agreement. If Licensee fails to remove the Licensed System and Licensee's personal property within thirty (30) calendar days after the expiration of this Agreement

or Cancellation, as applicable, the City, at its option, may remove, store and/or dispose of same and retain any proceeds therefrom, and further is entitled to recover any cost incurred by the City in removing same and in restoring the Tower.

(f) If Licensee holds over after the expiration of this Agreement or Cancellation, and so long as the Licensed System is still situated on the Fire Station site (even if it has been disconnected), Licensee shall pay to City a holdover fee equal to 200% of the then total License Fee prorated from the effective expiration or Cancellation date, whichever is applicable, to the date the Licensed System is properly and completely removed from the property. Nothing herein shall be construed to give Licensee the right to hold over at any time, and the City may exercise any and all remedies at law or in equity to recover possession of the Property, as well as any damages caused by Licensee.

SECTION 8
LOSS OF AND LIABILITIES
PERTAINING TO THE LICENSED SYSTEM

8.01 Damage or Destruction and Restoration.

In case of damage or loss of all or any portion of the Licensed System or the Tower, Licensee will give prompt notice thereof to the City; and, except as otherwise provided herein, Licensee shall promptly commence and complete with due diligence (subject to delays beyond its control), the restoration of the Licensed System or the Tower as nearly as reasonably practicable to the value and condition thereof immediately prior to such damage or destruction. In the event of such damage or destruction, Licensee shall be entitled to use or receive reimbursement from the proceeds of all property insurance policy or policies held by Licensee for the Licensed System or by the City for the Tower and shall be obligated to provide any additional moneys necessary for such restoration. The License Fee payable under section 3.01 shall continue to be due and owing.

8.02 Licensee's Election Not to Restore Damaged Licensed System.

In case of the damage or destruction of all or any part of the Licensed System, Licensee, within ninety (90) days thereafter, may elect not to restore or replace the Licensed System, and this Agreement shall be terminated. Licensee must notify the City within said 90 days of the damage or destruction to all or any part of the Licensed System of its intentions not to restore or replace the Licensed System and shall pay the City, in full, six (6) months of payments for the License Fee under section 3.01 from the date that the notice not to restore or replace is provided to the City. Licensee shall promptly proceed to remove the Licensed System from the Licensed Property and to repair and restore the Tower in accordance with Section 4 and section 7.01 and as otherwise provided in this Agreement within thirty (30) days after Licensee elects not to restore or replace the Licensed System. If Licensee should fail to repair or restore the Tower as required, the City may restore the Tower, at Licensee's cost and expense, as nearly as reasonably practicable to the value and condition thereof prior to the damage or destruction, and Licensee shall be obligated to timely and fully reimburse the City for the costs and expenses of such repairs and restoration. The obligations of Licensee under this section 8.02 shall survive the expiration of this Agreement and Cancellation.

SECTION 9
DEFAULT; REMEDIES; and DISPUTES

9.01 Default.

Licensee shall be in substantial default under this Agreement if Licensee:

(a) Fails to timely pay to the City on the fifth (5th) calendar day after the date License Fee or any other payments are due and owing under this Agreement; provided, however, default shall not occur until the tenth (10th) calendar day after written notice is provided by the City to Licensee; or

(b) Becomes insolvent, or takes the benefit of any present or future insolvency or bankruptcy statute, or makes a general assignment for the benefit of creditors, or consents to the appointment of a receiver, trustee or liquidator of any or substantially all of its property; or

(c) Transfers its interest under this Agreement, unless such transfer is specifically authorized pursuant to section 10.01; or

(d) Fails to submit or fails to timely submit complete and accurate plans and specifications, bonds, proof of insurance and other submittals as required by the express terms of this Agreement, and such failure continues for a period of fifteen (15) calendar days after Licensee has received written notice from the City of such failure; or

(e) Abandons, deserts or vacates the Licensed System or Licensed Premises; or

(f) Suffers any materialmen's or mechanic's lien or attachment to be filed against the Licensed System, the City System, the Tower, or the Fire Station because of any act or omission of Licensee, and such lien or attachment is not discharged or contested by Licensee in good faith by proper legal proceedings within thirty (30) calendar days after Licensee's receipt of written notice thereof from City; or

(g) Fails to keep, perform and observe any other promise, covenant or agreement set forth in this Agreement and such failure continues for a period of more than thirty (30) calendar days after delivery by City of a written notice of such breach or default, except where a shorter period is specified herein, or where fulfillment of its obligation requires activity over a period of time and Licensee within thirty (30) days of Licensee notice Licensee commences in good faith to perform whatever may be required to correct its failure to perform and continues such performance without interruption except for causes beyond its control (which must be documented in a written notice to the City); or

(h) Gives its permission to any person to use for any illegal or unauthorized purpose any portion of the City's property made available to Licensee for its use under this Agreement.

(i) Or any of its officers or employees are convicted, plead nolo contendere, enter into a formal agreement in which they admit guilt, enter a plea of guilty, or otherwise admit culpability to criminal offenses of bribery, kickbacks, collusive bidding, bid-rigging, antitrust, fraud, undue

influence, theft, racketeering, extortion or any offense of a similar nature, in connection with the Licensee's business or operations in the State of Colorado.

City shall be in substantial default under this Agreement if Licensor fails to keep, perform and observe any other promise, covenant or agreement set forth in this Agreement and such failure continues for a period of more than thirty (30) calendar days after delivery by Licensee of a written notice of such breach or default, except where a shorter period is specified herein, or where fulfillment of its obligation requires activity over a period of time and City within thirty (30) days of City's notice City commences in good faith to perform whatever may be required to correct its failure to perform and continues such performance without interruption except for causes beyond its control (which must be documented in a written notice to the Licensee).

9.02 Remedies.

If Licensee substantially defaults in any of the covenants, terms and conditions herein and such default is not cured within any applicable notice and cure periods, the City may exercise any one or more of the following remedies:

(a) The City may elect to allow this Agreement to continue in full force and effect and to enforce all of City's rights and remedies hereunder, including without limitation the right to collect compensation as it becomes due together with interest or recover any damages or losses resulting from the action or inaction of Licensee.

(b) The City may engage in Cancellation and repossess the Licensed Premises, without liability for so doing and without having to comply with any eviction process under state law, upon giving thirty (30) calendar days written notice to Licensee of the intended Cancellation, at the end of which time all the rights hereunder of Licensee shall terminate, unless the default shall have been cured as prescribed in section 9.01 or elsewhere in this Agreement. Licensee shall be liable to the City for all amounts owing to the City or any other party with respect to Licensee's operations at the Fire Station or under this Agreement.

(c) The remedies provided in this Agreement shall be cumulative and shall in no way affect any other remedy available to the City under law or equity. The obligations of Licensee under this section 9.02 shall survive the expiration of the Agreement and Cancellation.

(d) In the event of a Licensor default, Licensee may terminate the Agreement and/or pursue any remedy now or hereafter available to the it under the 1aws or judicial decisions of the state in which the Licensed Premises is located.

9.03 Dispute Resolution.

The Parties agree to work diligently together and in good faith, using reasonable efforts to resolve any unforeseen issues and disputes and to expeditiously take such actions as are necessary and appropriate to perform the duties and obligations of this Agreement. Any dispute between the City and Licensee, including whether a default by Licensee is substantial or has been timely and effectively cured, shall be taken to administrative hearing, pursuant to the procedure established

by Section 56-106, DRMC. For the purpose of that procedure, the City official rendering a final determination shall be the Executive Director of the Denver Department of Safety.

SECTION 10
MISCELLANEOUS PROVISIONS

10.01 Assignments.

(a) Licensee shall not assign or otherwise transfer its interest in this Agreement, in whole or in part, or otherwise transfer any rights or interest in or to the License granted under this Agreement, without the prior written consent of the Fire Chief, which consent can be given or denied in Fire Chief's sole discretion, and subject to approval, under section 10.16 below, of an amendment to this Agreement authorizing the assignment. The Fire Chief may require any proposed assignee to demonstrate that it is appropriately licensed and authorized to provide the same services as Licensee and has the ability to perform the terms and conditions of this Agreement including any financial obligations under this Agreement.

(b) Notwithstanding the foregoing, Licensee may assign this Agreement, and the License granted herein, in whole, to any business entity which is parent, subsidiary, affiliate of Licensee, or to any party that acquires all or substantially all of Licensee's radio spectrum assets in the Denver market area, by reason of a merger, acquisition or other business reorganization. The burden shall be on Licensee to demonstrate, to the satisfaction of the Fire Chief, that any proposed assignment qualifies under this sub-section 10.01(b).

(c) The License granted under this Agreement may not be sold under any circumstances. Any contract entered by Licensee to sell or convey the License granted herein shall not be binding on the City and shall be grounds for terminating the Agreement, at the discretion of the Fire Chief.

(d) Under no circumstances shall Licensee be authorized to allow any other licensee or sub-licensee to co-locate or operate any system at the Fire Station or the Tower.

10.02 Fair Dealing; Further Assurances.

(a) In all cases where the consent or approval of one Party is required before the other may act, or where the agreement or cooperation of the Parties is separately or mutually required as a legal or practical matter, then in that event the Parties agree that each will act in a fair and reasonable manner with a view to carrying out the intents and goals of this Agreement as the same are set forth herein, subject to the terms hereof.

(b) From time to time, upon the request of a Party, the other Party agrees to make, execute and deliver or cause to be made, executed and delivered to the requesting Party any and all further instruments, certificates and documents consistent with the provisions of this Agreement as may, in the reasonable opinion of the requesting Party, be necessary or desirable in order to effectuate, complete or perfect the rights of said Party under this Agreement, provided said requesting Party is currently in full compliance with the provisions of this Agreement and has tendered or offered to tender any reciprocal instruments, certificates and documents to which the other Party is entitled under

the Agreement.

10.03 Bond Ordinance.

The Premises' use is subject to regulation under the Internal Revenue Code. The parties agree therefore that this License Agreement must be and has been approved by Bond Counsel for the Bond and by Special Counsel for the COPs as a condition precedent to this License become effective. It is understood that the use of Premises is restricted by the Bond and COP Ordinances, existing zoning code designation of the City, and existing or future City cell tower agreements, and by all applicable rules, regulations, statutes or ordinances promulgated by any federal, state or municipal agency having jurisdiction over the Premises. Licensee shall comply with all IRS regulations and the Bond and COP Ordinances.

This License has been approved by Bond Counsel or by Special Counsel, attached hereto as **Exhibit E**. Licensee hereby acknowledges receipt of a copy of the Bond and COP ordinances. The Licensee agrees that in its activities and occupancy hereunder it will comply with all of the terms and conditions of the Bond and COP ordinances and that it will take no action, nor omit to act in any manner, which would cause the City to breach or be in default under the Bond and COP ordinances. The term and the rent if any may not be changed without Bond Counsel or Special Counsel approval.

10.04 Financial Interests.

Except for financial interests authorized by the City in accordance with the City Charter and ordinances, any financial interests created in, or used to secure financing and payment for the costs of, any work performed or improvements made under this Agreement, including but not limited to any bonds, certificates of participation, purchase agreements, and Uniform Commercial Code filings, shall expressly exclude from such debt or financial security contained in such financial instrument(s) any title, rights and interests held by the City in the property subject to this Agreement. The terms and conditions of this Agreement must be expressly recognized in any such financial instrument(s) created or entered by or on behalf of Licensee, which must specifically acknowledge and affirm that any financial interests created by the financial instrument(s) are subordinate to this Agreement and may not encumber the City's title, rights and interests in the subject property or under this Agreement.

10.05 Appropriation.

Notwithstanding any provision of this Agreement to the contrary, the rights and obligations of the City under this Agreement are contingent upon all funds necessary for work or expenditures contemplated under this Agreement being budgeted, appropriated and otherwise made available by the City. The Parties acknowledge that this Agreement is not intended to create a multiple-fiscal year direct or indirect debt or financial obligation of the City, except to the extent that capital improvement funds that are lawfully appropriated can be lawfully carried over to subsequent years.

10.06 Contracting or Subcontracting.

Any work that is allowed to be contracted or subcontracted under this Agreement shall be

subject, by the terms of the contract or subcontract, to every provision of this Agreement. Compliance with this provision shall be the responsibility of the Party who arranged the contract or authorized the subcontract. Except as otherwise expressly stated in this Agreement, no Party shall be liable or have a financial obligation to or for any contractor, subcontractor, supplier, or other person or entity with which the other Party contracts or has a contractual arrangement.

10.07 Third Parties.

This Agreement does not, and shall not be deemed or construed to, confer upon or grant to any third party or parties any right to claim damages or to bring any suit, action or other proceeding against either the City or Licensee because of any breach hereof or because of any of the terms, covenants, agreements and conditions herein.

10.08 Force Majeure.

Neither Party hereto shall be liable to the other for any failure, delay or interruption in the performance of any of the terms, covenants or conditions of this Agreement due to causes beyond the reasonable control of that Party, including without limitation strikes, boycotts, labor disputes, embargoes, shortages of materials, acts of God, acts of the public enemy, acts of superior governmental authority, severe weather conditions, fire, floods, riots, rebellion, sabotage or any other circumstance for which such Party is not responsible or which is not in its power to control, but in no event shall this section be construed so as to allow Licensee to reduce or abate its obligation to pay the License Fee prescribed in this Agreement.

10.09 No Discrimination in Employment.

In connection with the performance of work under the Agreement, the Licensee may not refuse to hire, discharge, promote, demote, or discriminate in matters of compensation against any person otherwise qualified, solely because of race, color, religion, national origin, ethnicity, citizenship, immigration status, gender, age, sexual orientation, gender identity, gender expression, marital status, source of income, military status, protective hairstyle, or disability. The Licensee shall insert the foregoing provision in all subcontracts.

10.10 Conflict of Interest.

The Parties agree that no official, officer or employee of the City shall have any personal or beneficial interest whatsoever in the services or property described herein, and Licensee further agrees not to hire or contract for services any official, officer or employee of the City or any other person which would be in violation of the Denver Revised Municipal Code Chapter 2, Article IV, Code of Ethics, or Denver City Charter provisions 1.2.9 and 1.2.12.

10.11 Applicable Law; Authority; Venue; Enforcement; and Claims.

(a) The Parties agree to comply with all Applicable Law in existence as of the Effective Date of this Agreement or as may be subsequently enacted or adopted and become applicable.

(b) This Agreement shall be construed and enforced in accordance with the laws of the United States, the State of Colorado, and the applicable provisions of the Charter and Revised Municipal Code of the City and County of Denver.

(c) Venue for any legal action relating to this Agreement shall lie in the District Court in and for the City and County of Denver.

(d) The Parties agree that this Agreement may be enforced in law or in equity for specific performance, injunctive, or other appropriate relief, including actual damages (notwithstanding Cancellation), as may be available according to the laws and statutes of the State of Colorado; provided, however, the Parties agree to and hereby release any claims for incidental, consequential, or punitive damages; provided, further, no provision of this Agreement may be enforced by the creation or recording of any type of lien against real property owned by the City, nor may any foreclosure process be utilized to recover any moneys owed by the City to Licensee. It is specifically understood that, by executing this Agreement, each Party commits itself to perform pursuant to these terms and conditions contained in this Agreement, and that any failure to comply which results in any recoverable damages shall not cause, by itself, the revocation or termination of any rights or obligations under this Agreement.

(e) Nothing in this section 10.11 shall be construed as a waiver, release, reduction or modification of any insurance, bond, indemnification or other liability obligations of Licensee or Licensee's design professional, contractor or sub-contractor expressly provided for in this Agreement.

(f) No official, officer, director, agent, or employee of either Party shall be charged personally or held contractually liable to the other Party or its officials, officers, directors, agents, or employees under any term or condition of this Agreement or for any breach, default, or violation under this Agreement.

(g) In the event that any claim, demand, suit, or action is made or brought in writing by any person or entity against one of the Parties related in any way to this Agreement, the Party in receipt of same shall promptly notify and provide a copy of said claim, demand, suit, or action to the other Party.

10.12 Use, Possession or Sale of Alcohol or Drugs; Smoking Policy.

(a) Licensee and its officers, agents, employees, and contractors shall cooperate and comply with the provisions of the City and County of Denver's policy or order or any successor policy or order concerning the use, possession or sale of alcohol or drugs on City property.

(b) Licensee and its officers, agents, employees, and contractors shall cooperate and comply with the provisions of the City's policy or order prohibiting smoking in buildings and certain facilities, and Licensee agrees it will take reasonable action to prohibit smoking by its employees in the public areas of the Fire Station.

10.13 Notices.

All notices hereunder must be in writing and shall be deemed validly given if sent by certified mail, return receipt requested or by commercial courier, provided the courier's regular business is delivery service and provided further that it guarantees delivery to the addressee by the end of the next business day following the courier's receipt from the sender, addressed as follows (or any other address that the Party to be notified may have designated to the sender by like notice):

To the City:

Fire Chief of the Denver Fire Department
City and County of Denver
745 West Colfax Avenue
Denver, CO 80204

City Attorney's Office
City and County of Denver
1437 Bannock Street, Room 353
Denver, Colorado 80202

To Licensee:

Dish Wireless Holding L.L.C.
9601 S Meridian Blvd
Englewood CO 80112

Notice shall be effective upon actual receipt or refusal as shown on the receipt obtained pursuant to the foregoing. All proposed amendments to the Agreement, letter approvals for proposed actions by Licensee, proposed changes to the exhibits, and any document or affidavit seeking the signature of the Fire Chief or the Executive Director of Safety, shall be provided to both the Fire Chief and the City Attorney's Office. Licensee and City shall designate local contact personnel for operational and otherwise day-to-day business communications which may be made by telephone or email. Any changes to this contact information shall be provided immediately once known.

10.14 Examination of Records.

Licensee agrees that any duly authorized representative of the City, including the City Auditor or his representative, until the expiration of three (3) years after expiration of this Agreement or Cancellation, shall have access to and the right to examine any directly pertinent books, documents, papers and records of Licensee related to this Agreement, excluding Licensor's technical and proprietary information.

10.15 Parties' Obligation Regarding Confidential Information.

The Parties agree that issues governing the use and disclosure of Confidential Information, as defined below, provided to or made available to the City by Licensee will be governed by the following provisions:

(a) As used herein, the term "Confidential Information" means all information, of any nature and in any form, regardless of when given, that (i) is disclosed or provided by or through Licensee to the City pursuant to performance of this Agreement; and (ii) has been clearly marked or indicated in writing as being confidential by Licensee; provided, that no part of this Agreement or the exhibits attached to this Agreement shall be deemed to contain Confidential Information. Information falling within this definition shall be treated by the City as confidential proprietary information of Licensee pursuant to the provisions of the Colorado Open Records Act and under any rule of court. Information not so marked or indicated will not be so considered.

(b) Except as expressly provided in this Agreement or as otherwise mandated by the Colorado Open Records Act or other applicable law, the City will not disclose Confidential Information to anyone other than individuals designated by the Fire Chief, including the City Representative, without the prior written consent of Licensee. The City will not use, or permit others to use, Confidential Information for any purpose other than actions incidental to the performance and enforcement of this Agreement between the City and Licensee, including but not limited to auditing of records of Licensee by the City Auditor and/or other representatives of the City. The City will take all reasonable measures to avoid disclosure, dissemination or unauthorized use of Confidential Information, including, at a minimum, those measures that it takes to protect its own Confidential Information of a similar nature.

(c) The Parties recognize that the mere marking of a document as "Confidential" does not render it conclusively confidential under the Colorado Open Records Act. Consequently, in the event that the City is served with an Open Records Request or subpoena from any third party requesting all or part of any Confidential Information as defined herein, the City shall give timely notice to Licensee of such request or subpoena within the time parameters of the Colorado Open Records Act or of any applicable court rule. In that event, Licensee agrees upon receipt of actual notice from the City of such Open Records Request or subpoena to immediately undertake, at its own cost and expense, to defend such Confidential Information from disclosure pursuant to the Colorado Open Records Act or applicable court rule and shall defend, save and hold harmless and indemnify the City and its agents and employees with respect to such issues.

(d) Licensee shall not at any time or in any manner, either directly or indirectly, divulge, disclose or communicate to any person, firm or corporation in any manner whatsoever any information concerning any matters which are not subject to public disclosure, including without limitation the trade secrets of businesses or entities doing business with the City, security measures utilized by the City, and other privileged or confidential information.

10.16 Entire Agreement; Amendment.

The Parties acknowledge and agree that the provisions contained herein, including all exhibits attached hereto, constitute the entire agreement and that all representations made by any officer, agent

or employee of the respective Parties unless included herein are null and void and of no effect. No alterations, amendments, changes or modifications, unless expressly reserved to the City herein, shall be valid unless executed by an instrument in writing by all the Parties with the same formality as this Agreement. The Director of Real Estate shall have the authority to execute agreements which make technical, minor, or non-substantive changes to this Agreement.

10.17 Severability.

If any term or provision of this Agreement is held by a court of law (following all legal rights of appeal or the expiration of time therefore) to be illegal or unenforceable or in conflict with any law of the State of Colorado or the City Charter or City ordinance, the validity of the remaining portions or provisions shall not be affected, and the rights and obligations of the Parties shall be construed and enforced as if the Agreement did not contain the particular term or provision held to be invalid; provided, however, if the invalidated term or provision was a critical or material consideration of either Party in entering this Agreement, the Parties shall work together, in good faith, to come up with an amendment to this Agreement that substantially satisfies the previously intended consideration while being in compliance with Applicable Law and the judgment of the court. Judicial invalidation of the License Fee, in whole or part, shall result in a failure of consideration and termination of this Agreement.

10.18 Time of Essence.

The Parties agree that in the performance of the terms and requirements of this Agreement by Licensee and the City, time is of the essence.

10.19 Section Headings.

The section headings herein are for convenience in reference only and are not intended to define or limit the scope of any provision of this Agreement.

10.20 Approval and Execution of Agreement.

This Agreement is expressly subject to and shall not be or become effective or binding on the City until City Council approval, if required by Charter, is obtained and the Agreement is fully executed by all required City signatories and all required Licensee signatories.

10.21 Authority.

Each Party represents and warrants that it has taken all actions that are necessary or that are required by its applicable law to legally authorize the undersigned signatories to execute this Agreement on behalf of the Party and to bind the Party to its terms. The person(s) executing this Agreement on behalf of each Party warrants that he/she/they have full authorization to execute this Agreement. The City shall have the right, in its discretion, to either temporarily suspend or permanently terminate the Agreement if there is any valid dispute as to the legal authority of Licensee or the person signing this Agreement on behalf of Licensee to enter into this Agreement.

10.22 Electronic Signatures and Electronic Records.

Licensee consents to the use of electronic signatures by the City. The Agreement, and any other documents requiring a signature hereunder, may be signed electronically by the City in the manner specified by the City. The Parties agree not to deny the legal effect or enforceability of the Agreement solely because it is in electronic form or because an electronic record was used in its formation. The Parties agree not to object to the admissibility of the Agreement in the form of an electronic record, or a paper copy of an electronic document, or a paper copy of a document bearing an electronic signature, on the ground that it is an electronic record or electronic signature or that it is not in its original form or is not an original.

Contract Control Number: FINAN-202367429-00
Contractor Name: DISH WIRELESS HOLDING L.L.C.

IN WITNESS WHEREOF, the parties have set their hands and affixed their seals at Denver, Colorado as of:

SEAL

CITY AND COUNTY OF DENVER:

ATTEST:

By: _____

_____

APPROVED AS TO FORM:

Attorney for the City and County of Denver

By: _____

REGISTERED AND COUNTERSIGNED:

By: _____

By: _____

Contract Control Number: FINAN-202367429-00
Contractor Name: DISH WIRELESS HOLDING L.L.C.

By: DocuSigned by: Dave Mayo F0DA1A105A684B7...
Dave Mayo

Title: EVP

By: DocuSigned by: lease admin 3C5E2ED8EA26474...
(Lease Admin)

Title: Sr. Operations Analyst - Lease Administration

By: DocuSigned by: Marco Santi 35510DE4E8524DE...
Marco Santi

Title: Market General Manager- Denver

By: DocuSigned by: John Stout B93A20085FB6424...
John Stout

Title: DISH Legal Approver

By: DocuSigned by: Paul Battaglia 1AE44C3E1ED4498...
Paul Battaglia

Title: SDM

EXHIBIT A

DISH Wireless L.L.C. SITE ID:

DNDEN00104C

DISH Wireless L.L.C. SITE ADDRESS:

4800 N HIMALAYA RD UNIT DISH
DENVER, CO 80249

SCOPE OF WORK

THIS IS NOT AN ALL INCLUSIVE LIST. CONTRACTOR SHALL UTILIZE SPECIFIED EQUIPMENT PART OR ENGINEER APPROVED EQUIVALENT. CONTRACTOR SHALL VERIFY ALL NEEDED EQUIPMENT TO PROVIDE A FUNCTIONAL SITE. THE PROJECT GENERALLY CONSISTS OF THE FOLLOWING:

TOWER SCOPE OF WORK:
- INSTALL (3) PROPOSED PANEL ANTENNAS (1 PER SECTOR)
- INSTALL PROPOSED JUMPERS
- INSTALL (6) PROPOSED RRUs (2 PER SECTOR)
- INSTALL (1) PROPOSED OVER VOLTAGE PROTECTION DEVICE (OVP)
- INSTALL (1) PROPOSED HYBRID CABLE

GROUND SCOPE OF WORK:
- INSTALL (1) PROPOSED CABLE TRAY
- INSTALL (1) PROPOSED PPC CABINET
- INSTALL (1) PROPOSED EQUIPMENT CABINET
- INSTALL (1) PROPOSED POWER CONDUIT
- INSTALL (1) PROPOSED TELCO CONDUIT
- INSTALL (1) PROPOSED TELCO-FIBER BOX
- INSTALL (1) PROPOSED GPS UNIT
- INSTALL (1) PROPOSED SAFETY SWITCH (IF REQUIRED)
- INSTALL (1) PROPOSED FIBER NID (IF REQUIRED)
- INSTALL (1) PROPOSED METER SOCKET

MOUNT UTILIZED FOR THIS PROJECT HAS BEEN PICKED FOR USE BY DISH WIRELESS LLC BASED ON PROVISIONS IN TIA-TSB-5053. WYCO HAS NOT ANALYZED OR ENGINEERED THE MOUNT FOR ANY SITE SPECIFIC CONDITIONS. SEAL AND SIGNATURE BY WYCO OR WYCO'S SUBCONTRACTED ENGINEER DOES NOT COVER THE MOUNT.

SITE INFORMATION

PROPERTY OWNER:	CITY & COUNTY OF DENVER
ADDRESS:	201 W. COLFAX AVE. 401 DENVER, CO 80202
TOWER TYPE:	SELF-SUPPORT TOWER
TOWER CO SITE ID:	DENVER FIRE #29
TOWER APP NUMBER:	855736
COUNTY:	DENVER
LATITUDE (NAD 83):	39° 46' 59.2" N 39.783111°
LONGITUDE (NAD 83):	104° 45' 16.4" W -104.754554
ZONING JURISDICTION:	CITY AND COUNTY OF DENVER
ZONING DISTRICT:	CITY AND COUNTY OF DENVER
PARCEL NUMBER:	0022100021000
OCCUPANCY GROUP:	U
CONSTRUCTION TYPE:	II-B
POWER COMPANY:	XCEL ENERGY
TELEPHONE COMPANY:	TBD

PROJECT DIRECTORY

APPLICANT:	DISH Wireless L.L.C. 5701 SOUTH SANTA FE DRIVE LITTLETON, CO 80120
TOWER OWNER:	CITY & COUNTY OF DENVER 201 W. COLFAX AVE. 401 DENVER, CO 80202
SITE DESIGNER:	WYCO FIELD SERVICES 6335 DOWNING ST DENVER, CO 80216 603.954.0284
PROJECT MANAGER:	MICHAEL LASITER 941.274.6002
SITE ACQUISITION:	KENNETH TRUJILLO 719.205.9370
CONSTRUCTION MANAGER:	SCOTT TOMLINSON 720.788.6655
RF ENGINEER:	ROBERT CARISTAN 720.277.2221

CODE OF COMPLIANCE

ALL WORK SHALL BE PERFORMED AND MATERIALS INSTALLED IN ACCORDANCE WITH THE CURRENT EDITIONS OF THE FOLLOWING CODES AS ADOPTED BY THE LOCAL GOVERNING AUTHORITIES. NOTHING IN THESE PLANS IS TO BE CONSTRUED TO PERMIT WORK NOT CONFORMING TO THESE CODES

CODE TYPE	CODE
BUILDING	2021 IBC
MECHANICAL	2018 IMC
ELECTRICAL	2020 NEC

SITE PHOTO

DIRECTIONS

DIRECTIONS FROM DISH WIRELESS L.L.C. OFFICE: 5701 S SANTA FE DR. LITTLETON, CO 80120, USA.

GET ON I-225 N IN DENVER FROM S SANTA FE DR AND W BELLEVIEW AVE. CONTINUE ON I-225 N TO GREEN VALLEY RANCH BLVD. TAKE THE GREEN VALLEY RANCH BLVD EXIT FROM PEÑA BLVD. FOLLOW GREEN VALLEY RANCH BLVD TO YOUR DESTINATION. 4800 HIMALAYA RD. DENVER, CO 80249, USA

SHEET INDEX

SHEET NO.	SHEET TITLE
T-1	TITLE SHEET
LS1	SURVEY
LS2	SURVEY
LS3	SURVEY
LS4	SURVEY
A-1	OVERALL AND ENLARGED SITE PLAN
A-2	ELEVATION, ANTENNA LAYOUT AND SCHEDULE
A-3	EQUIPMENT PLATFORM AND H-FRAME DETAILS
A-4	EQUIPMENT DETAILS
A-5	EQUIPMENT DETAILS
A-5.1	EQUIPMENT DETAILS
E-1	OVERALL SITE PLAN
E-1.1	ENLARGED SITE PLAN AND EQUIPMENT LAYOUT
E-2	ELECTRICAL NOTES AND DETAILS
E-3	ELECTRICAL ONE-LINE AND FAULT CALCS
E-3.1	PANEL SCHEDULE AND FAULT CALCS
E-3.2	SERIES RATING SPECIFICATIONS
E-3.3	SITE PHOTOS
G-1	GROUNDING PLANS AND NOTES
G-2	GROUNDING DETAILS
G-3	GROUNDING DETAILS
RF-1	RF CABLE COLOR CODE
GN-1	LEGEND AND ABBREVIATIONS
GN-2	RF SIGNAGE
GN-3	GENERAL NOTES
GN-4	GENERAL NOTES
GN-5	GENERAL NOTES

UNDERGROUND SERVICE ALERT
UTILITY NOTIFICATION CENTER OF COLORADO
(800) 922-1987
WWW.COLORADO811.ORG

CALL 2 WORKING DAYS UTILITY NOTIFICATION PRIOR TO CONSTRUCTION

GENERAL NOTES

THE FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. A TECHNICIAN WILL VISIT THE SITE AS REQUIRED FOR ROUTINE MAINTENANCE. THE PROJECT WILL NOT RESULT IN ANY SIGNIFICANT DISTURBANCE OR EFFECT ON DRAINAGE. NO SANITARY SEWER SERVICE, POTABLE WATER, OR TRASH DISPOSAL IS REQUIRED AND NO COMMERCIAL SIGNAGE IS PROPOSED.

11"x17" PLOT WILL BE HALF SCALE UNLESS OTHERWISE NOTED

CONTRACTOR SHALL VERIFY ALL PLANS, EXISTING DIMENSIONS, AND CONDITIONS ON THE JOB SITE, AND SHALL IMMEDIATELY NOTIFY THE ENGINEER IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.

VICINITY MAP

dish wireless.
5701 SOUTH SANTA FE DRIVE
LITTLETON, CO 80120

WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING ST.
DENVER, CO 80216
WYCOFS.COM

Tim Alexander, PE
Digitally signed by Tim Alexander, PE
DN: cn=Tim Alexander, PE, o, ou, email=tim.alexander@outlook.com, c=US
Date: 2022.12.15 09:38:06 -07'00'

COLORADO LICENSED
TIM ALEXANDER
44563
PROFESSIONAL ENGINEER
EXP 10/31/2023
SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT DISH
DENVER, CO 80249

SHEET TITLE

TITLE SHEET

SHEET NUMBER

T-1

TOPOGRAPHIC SURVEY
DISH WIRELESS SITE DNDEN00104C
SITUATED IN THE NORTHEAST QUARTER OF SECTION 22, TOWNSHIP 3 SOUTH, RANGE 66 WEST OF THE 6TH P.M.
COUNTY OF DENVER, STATE OF COLORADO

SURVEYOR'S CERTIFICATE

I, Robert Daley, do hereby certify only to WYCO, that on December 1, 2022 a topographic survey was conducted under my supervision using the normal standard of care of Professional Land Surveyors and the map hereon accurately represents said survey, to the best of my knowledge.

This drawing does not represent a Land Survey, Land Survey Plat, Improvement Land Survey Plat or Improvement Location Certificate and any monuments or boundary lines shown are for information only and are not to be relied on.

This survey relied on a Title Report by Purple Land Management, Client's File Number DNDEN00104C for legal descriptions and easements.

This survey does not constitute a title search by this surveyor or Daley Land Surveying, Inc. of the property shown and described hereon to determine:
1. *Ownership of this tract of land.*
2. *Rights-of-way, easements and encumbrances recorded or unrecorded affecting this tract of land.*
3. *Compatibility of this description with those of adjacent tracts of land*

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR
ROBERT DALEY
12-13-22
35597

Job No. 1806-133
For and on behalf of
Daley Land Surveying, Inc.
17011 Lincoln Ave., #361
Parker CO. 80134
303 953 9841
Robert Daley, PLS 35597

BASIS OF BEARINGS:
The bearings shown on this survey are referenced to the north line of the Northeast Quarter of Section 22, Township 3 South, Range 66 West of the 6th P.M., assumed to bear South 89°41'39" West, 2641.15 feet (South 89°41'39" West, 2641.03 feet per Green Valley Ranch Filing No. 32). No bearings shown on the plat of Green Valley Ranch Filing No. 9 or in parcel deed.

COORDINATE SYSTEM AND DATUM;
Horizontal coordinates are referenced to NAD83, Vertical datum is NAVD88 and originates from City and County of Denver (CCD) Benchmark 584, a CCD brass cap in median curb, Elevation 5417.64 feet NAVD88, utilizing the Geoid12A model.

UTILITIES:
The utilities which are readily visible upon the ground, such as manholes, power and light poles, inlets, etc. were located by field surveys and shown hereon. Sub-surface utilities, if shown, are the result of field surveys of utility location marks provided by others.

NOTICE: According to Colorado law you must commence any legal action based upon any defect in this survey within three years after you first discover such defect. In no event, may any action based upon any defect in this survey be commenced more than ten years from the date of the certification shown hereon.

TITLE REPORT BY PURPLE LAND MANAGEMENT

PLM Corporate
210 East 8th Street Fort Worth, Texas 76102 t 817.717.3835 f 817.717.3836 purplelandmgmt.com

TITLE REPORT
Client's File Number: DNDEN00104C
Original Request Date: 9/30/2022
Effective Date: 11/8/2022
Records reviewed: From June 28, 1984 through November 8, 2022

Customer Information
Customer Name: Dish Network L.L.C.
Property Address: 4800 N Himalaya Rd, Denver, CO 80249
COUNTY: Denver
STATE: CO

Current Ownership
Owner Name: City and County of Denver, a municipal corporation, Source Instrument Deed 1984082554, Parcel ID 00221-00-021-000

Full Legal Description from Source Deed 1984082554:
A parcel of land located in the Northeast quarter of Section 22, Township 3 South, Range 66 West of the Sixth Principal Meridian, City and County of Denver, State of Colorado, more particularly described as follows: Commencing at the Northeast corner of said Section 22: thence Westerly along the North line of said Section 22 a distance of 441.08 feet; thence on a deflection angle to the left of 90 degrees 00 minutes 00 seconds a distance of 137.55 feet to the point of beginning said point being on the proposed east right-of-way of Himalaya Road; thence on a deflection angle to the left of 65 degrees 49 minutes 14 seconds a distance of 140.00 feet; thence on a deflection angle to the right of 90 degrees 00 minutes 00 seconds a distance of 150.00 feet to a point on the North right-of-way of 48th Ave.; thence Westerly along said right-of-way on a deflection angle to the right of 90 degrees 00 minutes 00 seconds a distance of 140.00 feet to a point on the proposed East right-of-way of Himalaya Road; thence Northerly along said right-of-way on a deflection angle to the right of 90 degrees 00 minutes 00 seconds a distance of 150.00 feet to the point of beginning.

Mortgages and Deeds of Trust
None of Record

Special Notes & General Comments
General Comments:
1. Title research was limited to the following: Entities City & County, City County, City and County, Party Grantor, Document Types Memorandum, Deed, Right of Way, Lease, Mortgage, Deed of Trust.

Denver County online recorder does not allow for legal searches, nor does it return legal information in its search results. This, with the fact that the site owner is the 'City & County of Denver' makes for a very challenging search. There are over 20,000 documents recorded against this owner. When limiting the search to deeds conveyed to said owner, the amount drops to 7,500 documents.

2. The Legal Descriptions above differ slightly. It appears that the legal description from the County Tax Assessor site does not include a portion of the lands conveyed in Source Deed 1984082554, being the lands bordering Himalaya Rd and Green Valley Ranch Blvd, more specifically located at the intersection of said roads. It is possible that The City & County of Denver may have conveyed or granted the intersection lands, but due to the search limitations referenced in Comment No. 1, this instrument was not located.
This Title Report is based upon a 20-year title check in the Denver County Register of Deeds for the purpose of securing information regarding the current surface owner for the above-mentioned parcel. The information included and the associated documents provided reflect only those documents found directly affecting the interests of the current surface owner.
Jarred Cross Landman PLM, L.L.C. 210 East 8th Street Fort Worth, Texas 76102

dish WIRELESS
5701 SOUTH SANTA FE DRIVE
LITTLETON, CO 80120

WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING STREET
DENVER, CO 80216

DALEY LAND SURVEYING, INC.
17011 LINCOLN AVE #361
PARKER, CO 80134

DRAWN BY:	CHECKED BY:	APPROVED BY:
AV	RD	RD

RFDS REV #: ---

SUBMITTALS

REV	DATE	DESCRIPTION
1	12/07/22	SURVEY
2	12/13/22	LICENSE

(VENDOR) PROJECT NUMBER

DISH WIRELESS PROJECT NUMBER
DNDEN00104C

4800 N. HIMILAYA ROAD
DENVER, COLORADO 80249

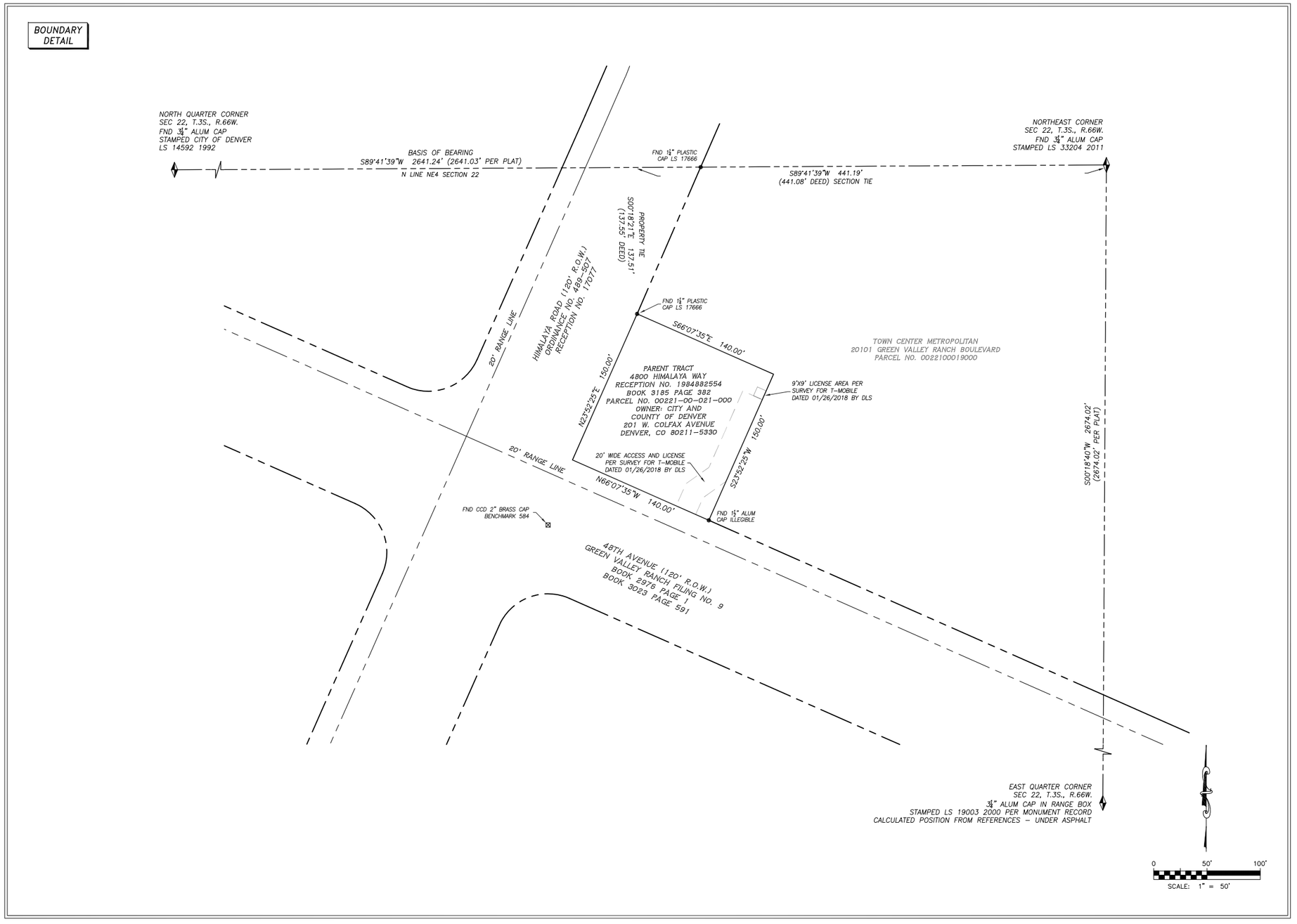
DENVER COUNTY

SHEET TITLE
TOPOGRAPHIC SURVEY

SHEET NUMBER
LS1

TOPOGRAPHIC SURVEY
DISH WIRELESS SITE DNDEN00104C
SITUATED IN THE NORTHEAST QUARTER OF SECTION 22, TOWNSHIP 3 SOUTH, RANGE 66 WEST OF THE 6TH P.M.
COUNTY OF DENVER, STATE OF COLORADO

BOUNDARY DETAIL



dish WIRELESS
5701 SOUTH SANTA FE DRIVE
LITTLETON, CO 80120

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DENVER, CO 80216

DALEY LAND SURVEYING, INC.
17011 LINCOLN AVE #361
PARKER, CO 80134

DRAWN BY:	CHECKED BY:	APPROVED BY:
AV	RD	RD

RFDS REV #: ---

SUBMITTALS		
REV	DATE	DESCRIPTION
1	12/07/22	SURVEY
2	12/13/22	LICENSE

(VENDOR) PROJECT NUMBER

DISH WIRELESS PROJECT NUMBER
DNDEN00104C

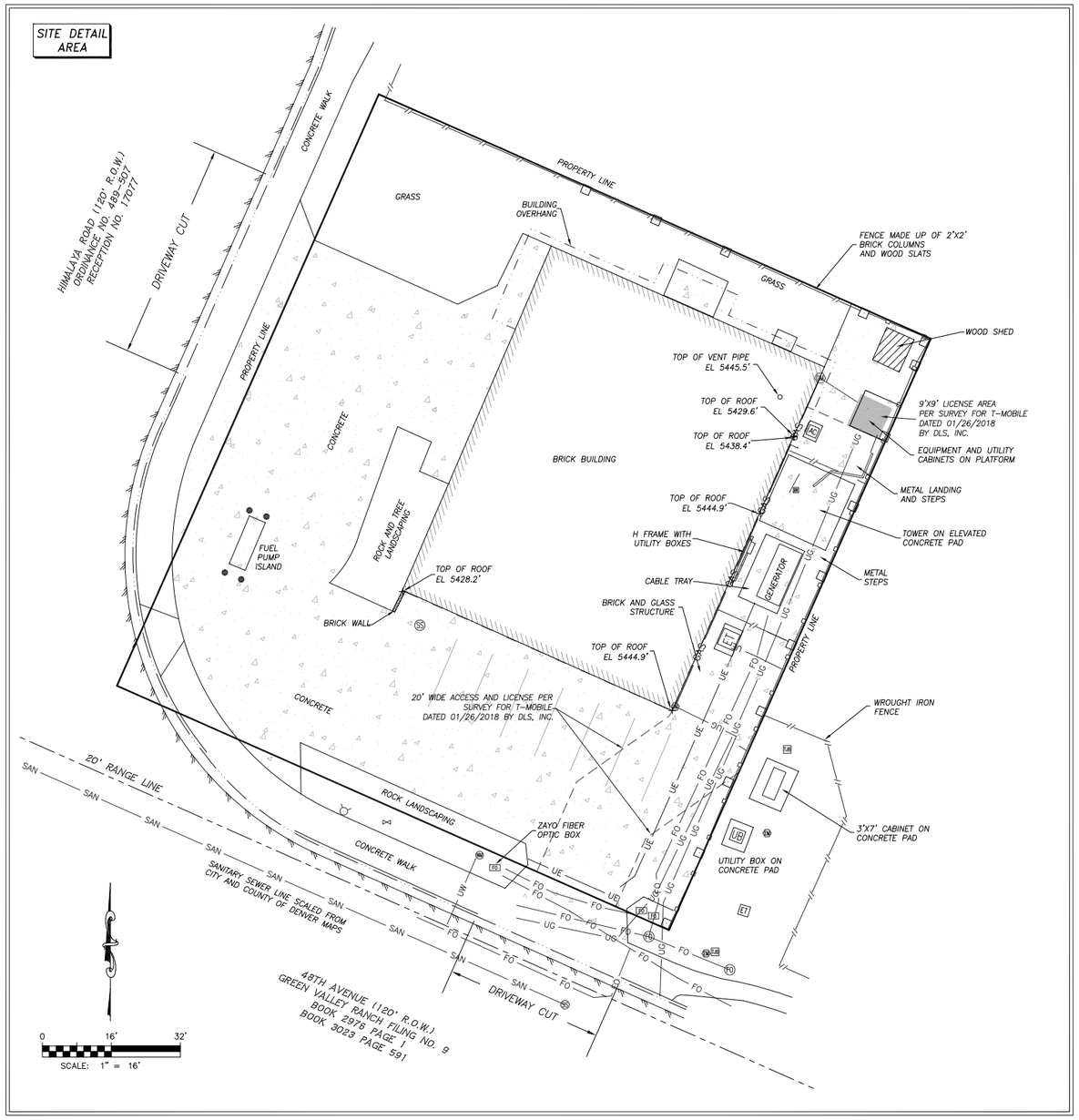
4800 N. HIMILAYA ROAD
DENVER, COLORADO 80249

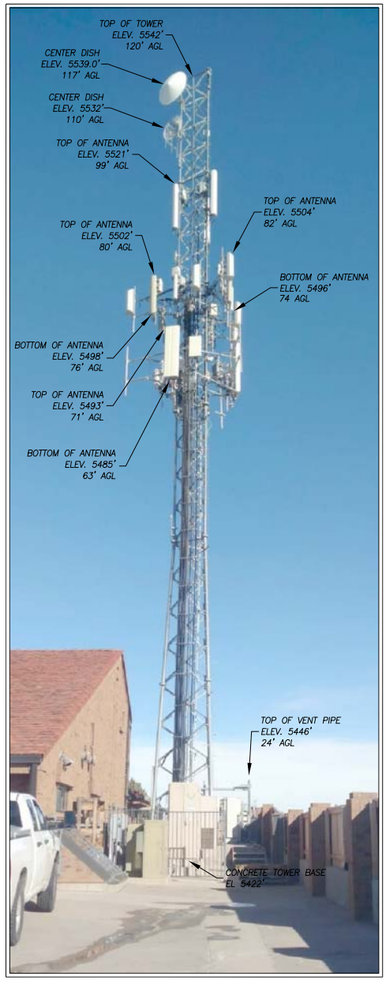
DENVER COUNTY

SHEET TITLE
TOPOGRAPHIC SURVEY

SHEET NUMBER
LS2

TOPOGRAPHIC SURVEY
DISH WIRELESS SITE DNDEN00104C
SITUATED IN THE NORTHEAST QUARTER OF SECTION 22, TOWNSHIP 3 SOUTH, RANGE 66 WEST OF THE 6TH P.M.
COUNTY OF DENVER, STATE OF COLORADO





LEGEND

CTV Cable TV Box	Street Light	Building
EB Electric Box	Sign	Edge of Asphalt
EM Electric Meter	Sanitary Manhole	Edge of Concrete
ET Electric Transformer	SD Storm Manhole	Flowline
Fire Hydrant	TJB Telephone Junction Box	OE OE Overhead Electric
FO Fiber Optic Manhole	TP Telephone Pedestal	UE UE Underground Electric
FO Fiber Optic Box	W Water Manhole	UG UG Underground Gas
GM Gas Meter	WM Water Meter	FO FO Fiber Optic Line
Light Pole	Water Valve	UW UW Underground Water
Power Pole	Coniferous Tree	Right of Way Line
RD Roof Drain Inlet	Deciduous Tree	Lot Line
RS Roof Downspout		Easement Line

dish WIRELESS
5701 SOUTH SANTA FE DRIVE
LITTLETON, CO 80120

WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING STREET
DENVER, CO 80216

DALEY LAND SURVEYING, INC.
17011 LINCOLN AVE #361
PARKER, CO 80134

DRAWN BY:	CHECKED BY:	APPROVED BY:
AV	RD	RD

RFDS REV #: ---

SUBMITTALS		
REV	DATE	DESCRIPTION
1	12/07/22	SURVEY
2	12/13/22	LICENSE

(VENDOR) PROJECT NUMBER

DISH WIRELESS PROJECT NUMBER
DNDEN00104C

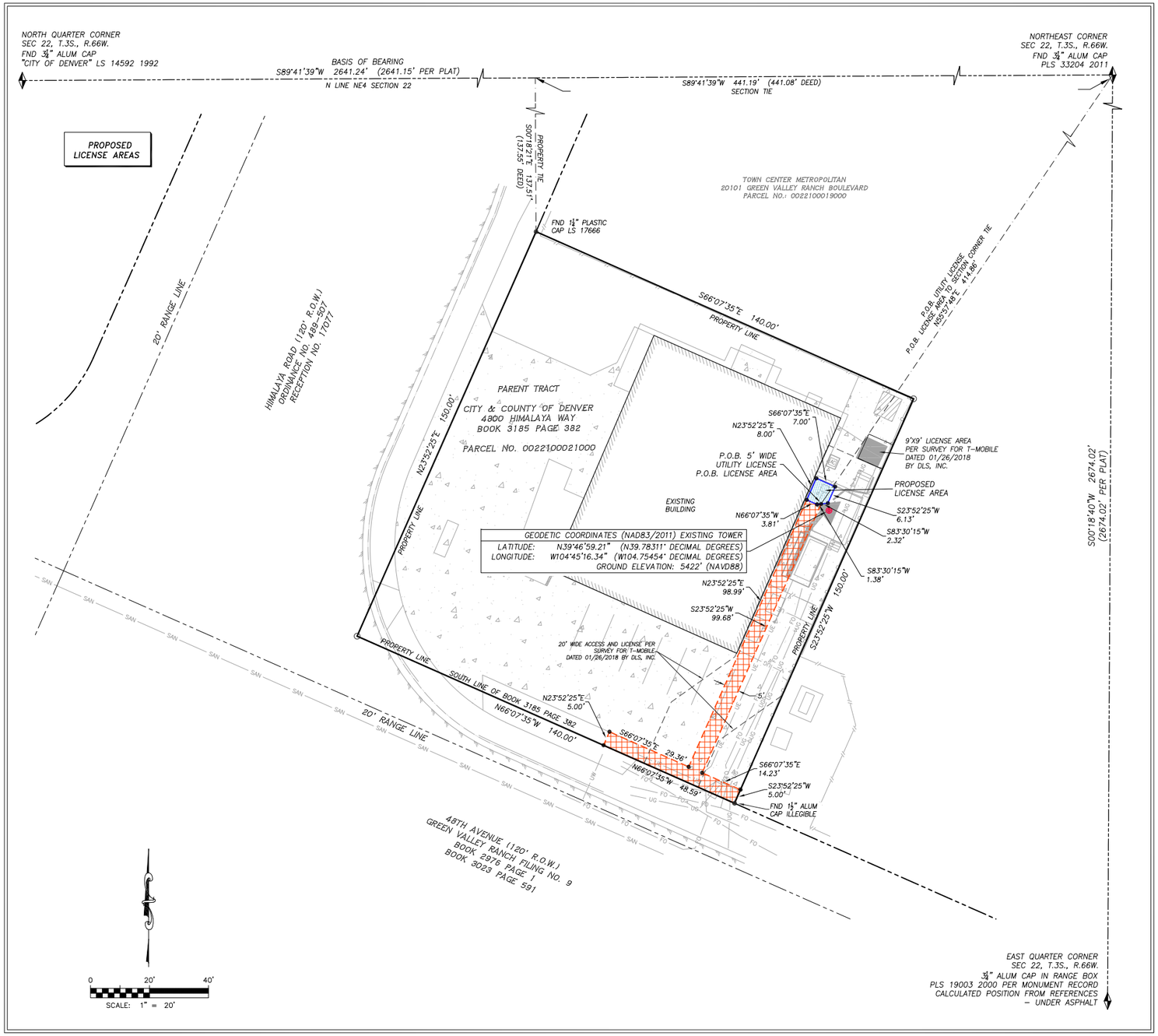
4800 N. HIMILAYA ROAD
DENVER, COLORADO 80249

DENVER COUNTY

SHEET TITLE
TOPOGRAPHIC SURVEY

SHEET NUMBER
LS3

TOPOGRAPHIC SURVEY
DISH WIRELESS SITE DNDEN00104C
SITUATED IN THE NORTHEAST QUARTER OF SECTION 22, TOWNSHIP 3 SOUTH, RANGE 66 WEST OF THE 6TH P.M.
COUNTY OF DENVER, STATE OF COLORADO



LICENSE AREA LEGAL DESCRIPTION – PROPOSED:

A parcel of land within that parcel of land described in Book 3185 at Page 382 of the Public Records of the City and County of Denver, located in the Northeast Quarter of Section 22, Township 3 South, Range 66 West, of the Sixth Principal Meridian, City and County of Denver, State of Colorado, more particularly described as follows:

For the purposes of this description the bearings are referenced to the north line of said Northeast Quarter of Section 22, T.3S., R.66W., assumed to bear S89°41'39"W, a distance of 2641.24 feet, monumented by a ¾" aluminum cap marked PLS 33204 2011 at the Northeast Corner and by a ¾" aluminum cap marked PLS 14592 1992 at the North Quarter Corner of said Section 22.

Beginning at a point on the southeasterly line of the License Area, also being the Point of Beginning of the hereinafter described 5' Wide Utility License, whence the Northeast Corner of said Section 22, bears North 55°57'48" East, a distance of 414.86 feet;

THENCE South 83°30'15" West, a distance of 1.38 feet;
THENCE North 66°07'33" West, a distance of 3.81 feet;
THENCE North 23°52'25" East, a distance of 8.00 feet;
THENCE South 66°07'35" East, a distance of 7.00 feet;
THENCE South 23°52'25" West, a distance of 6.13 feet;
THENCE South 83°30'15" West, a distance of 2.32 feet to the Point of Beginning.

Containing 53 Square Feet, or 0.001 Acres, more or less.

5' WIDE UTILITY LICENSE – PROPOSED:

A parcel of land within that parcel of land described in Book 3185 at Page 382 of the Public Records of the City and County of Denver, located in the Northeast Quarter of Section 22, Township 3 South, Range 66 West, of the Sixth Principal Meridian, City and County of Denver, State of Colorado, more particularly described as follows:

For the purposes of this description the bearings are referenced to the north line of said Northeast Quarter of Section 22, T.3S., R.66W., assumed to bear S89°41'39"W, a distance of 2641.24 feet, monumented by a ¾" aluminum cap marked PLS 33204 2011 at the Northeast Corner and by a ¾" aluminum cap marked PLS 14592 1992 at the North Quarter Corner of said Section 22.

Beginning at a point on the southeasterly line of the hereinbefore described License Area, whence the Northeast Corner of said Section 22, bears North 55°57'48" East, a distance of 414.86 feet;

THENCE North 83°30'15" East, a distance of 2.32 feet;
THENCE South 23°52'25" West, a distance of 99.68 feet;
THENCE South 66°07'35" East, a distance of 14.23 feet to the easterly line of that parcel of land described in Book 3185 at Page 382 of the Public Records of the City and County of Denver;
THENCE South 23°52'25" West, along said easterly line, a distance of 5.00 feet to the southeast corner of said parcel;
THENCE North 66°07'35" West, along the southwesterly line of said parcel and the northeasterly right of way line of 48th Avenue, a distance of 48.59 feet;
THENCE North 23°52'25" East, a distance of 5.00 feet;
THENCE South 66°07'35" East, a distance of 29.36 feet;
THENCE North 23°52'25" East, a distance of 98.99 feet to the southwest corner of said hereinbefore described License Area;
THENCE South 66°07'35" East, a distance of 3.81 feet to the most southerly corner of said hereinbefore described License Area;
THENCE North 83°30'15" East, a distance of 1.38 feet to the Point of Beginning.

Containing 738 Square Feet, or 0.017 Acres, more or less.

dish WIRELESS
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6335 DOWNING STREET
DENVER, CO 80216

DALEY LAND SURVEYING, INC.
17011 LINCOLN AVE #361
PARKER, CO 80134

DRAWN BY:	CHECKED BY:	APPROVED BY:
AV	RD	RD
RFDS REV #:		---

SUBMITTALS		
REV	DATE	DESCRIPTION
1	12/07/22	SURVEY
2	12/13/22	LICENSE

(VENDOR) PROJECT NUMBER

DISH WIRELESS PROJECT NUMBER
DNDEN00104C

4800 N. HIMILAYA ROAD
DENVER, COLORADO 80249

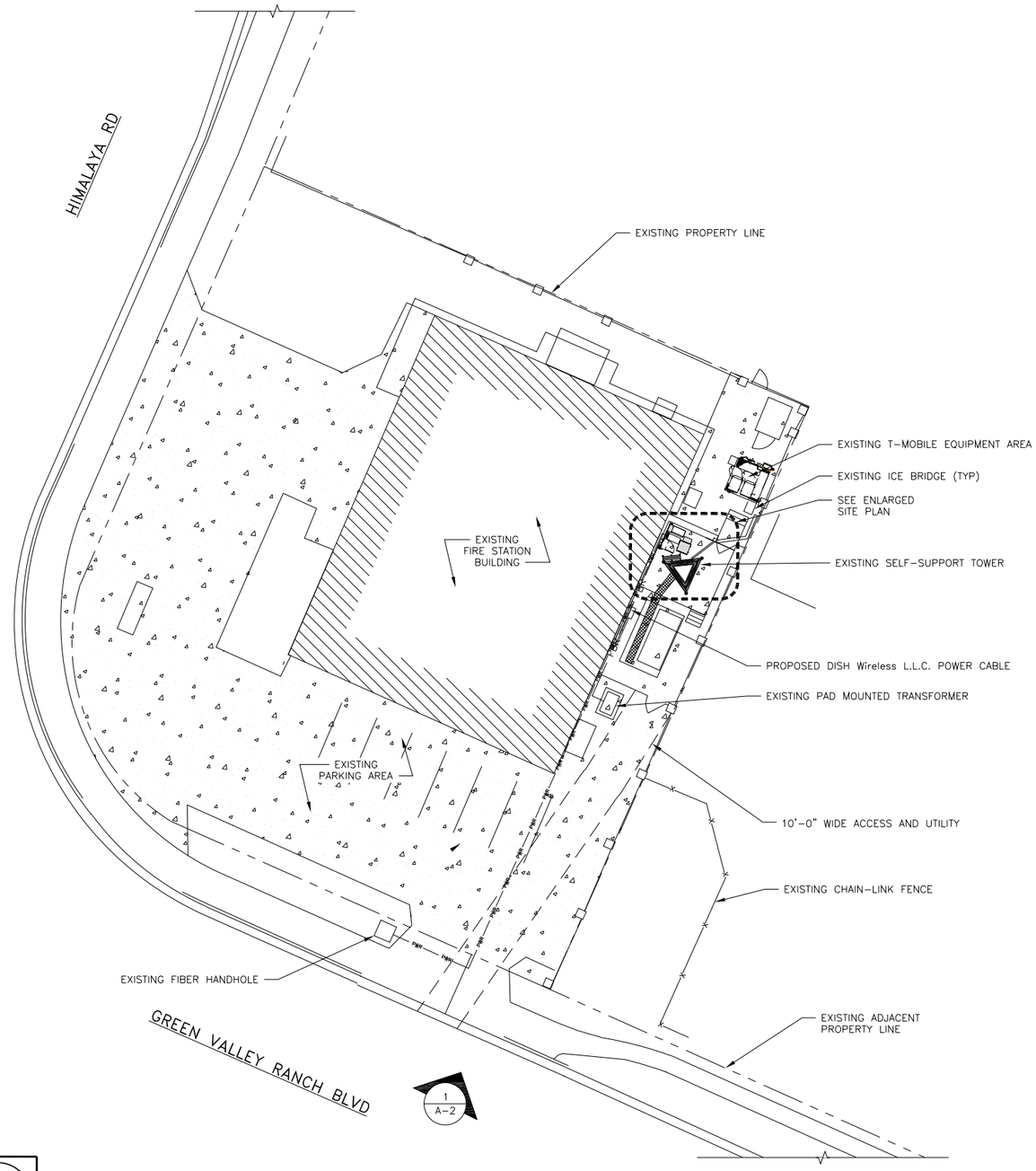
DENVER COUNTY

SHEET TITLE
TOPOGRAPHIC SURVEY

SHEET NUMBER
LS4

NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. ANTENNAS AND MOUNTS OMITTED FOR CLARITY.



OVERALL SITE PLAN

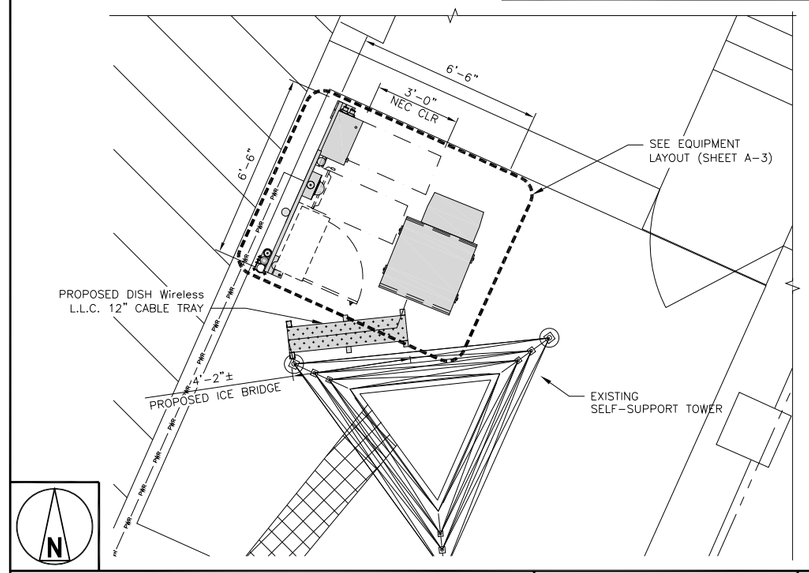
16' 12' 8' 4' 0 16' 32'
1/16"=1'-0"

1

DISH Wireless L.L.C. TEMPLATE VERSION 49 – 5/05/2022 80'-0"

NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. CONTRACTOR SHALL MAINTAIN A 10'-0" MINIMUM SEPARATION BETWEEN THE PROPOSED GPS UNIT, TRANSMITTING ANTENNAS AND EXISTING GPS UNITS.
3. ANTENNAS AND MOUNTS OMITTED FOR CLARITY.



ENLARGED SITE PLAN

12" 6" 0 1' 2' 3' 4' 5' 6' 7"
3/8"=1'-0"

2

SITE PHOTO

NO SCALE

3

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WYCOFS.COM

COLORADO LICENSED
TIM ALEXANDER
44563
PROFESSIONAL ENGINEER
EXP 10/31/2023

SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
OVERALL AND ENLARGED SITE PLAN

SHEET NUMBER
A-1

NOTES

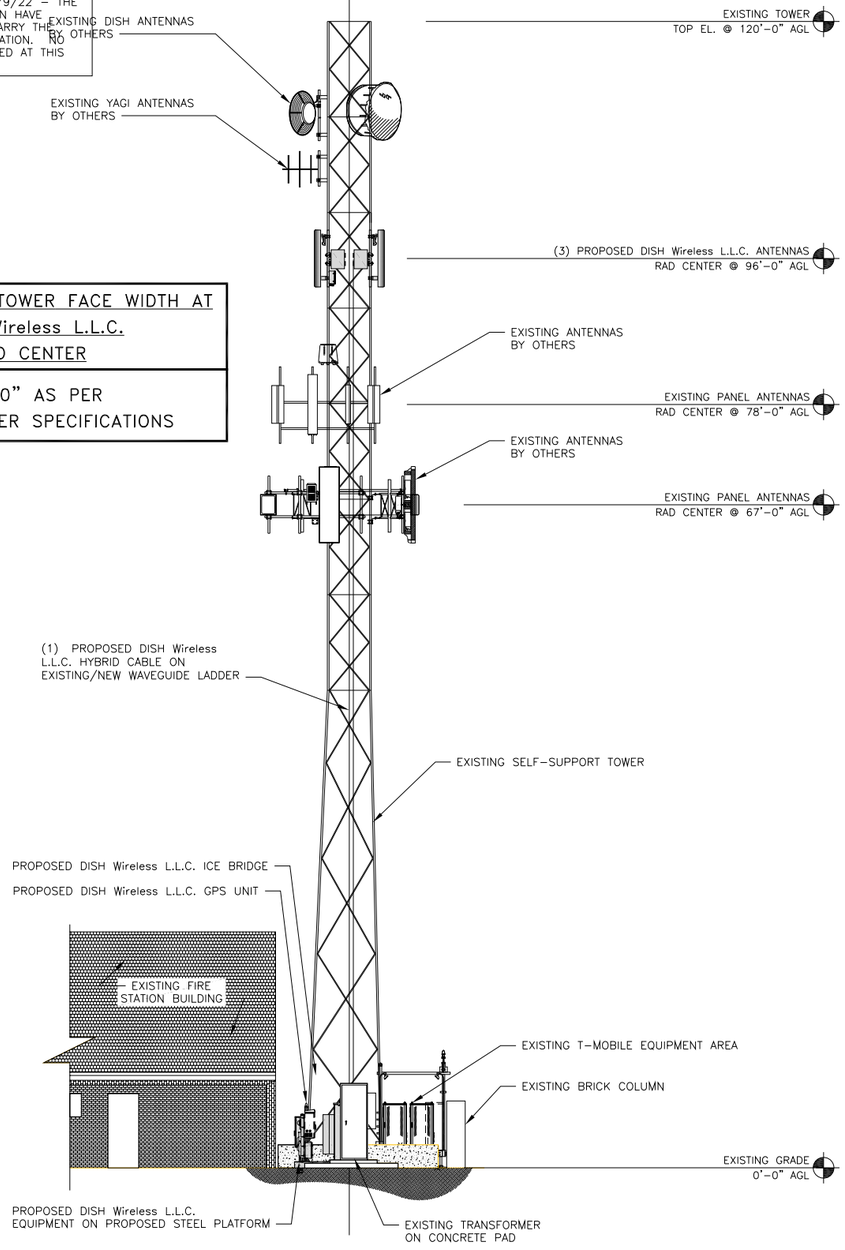
1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. ANTENNA AND MW DISH SPECIFICATIONS REFER TO ANTENNA SCHEDULE AND TO FINAL CONSTRUCTION RFDS FOR ALL RF DETAILS
3. EXISTING EQUIPMENT AND FENCE OMITTED FOR CLARITY.

STRUCTURAL NOTE:

PER STRUCTURAL ANALYSIS OF TOWER BY WYCO/COLLIERS DATED 11/9/22 – THE TOWER AND ITS FOUNDATION HAVE SUFFICIENT CAPACITY TO CARRY THE PROPOSED LOAD CONFIGURATION. NO MODIFICATIONS ARE REQUIRED AT THIS TIME.

SELF–SUPPORT TOWER FACE WIDTH AT DISH Wireless L.L.C. RAD CENTER

96'–0" AS PER TOWER OWNER SPECIFICATIONS



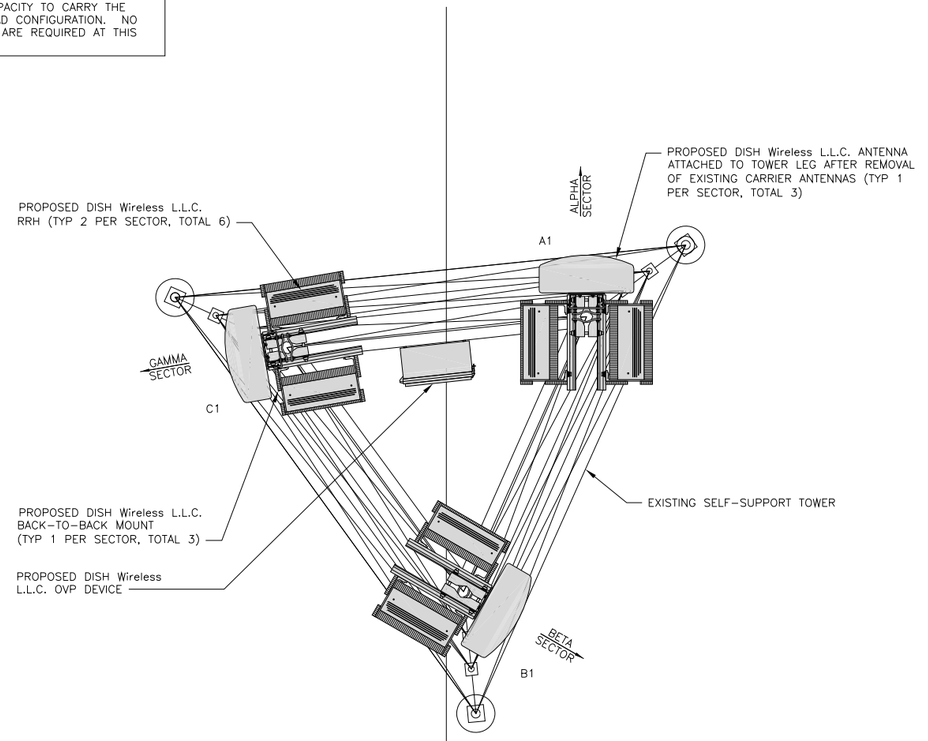
PROPOSED SOUTH ELEVATION

8' 4' 0 8' 16'
1/8"=1'–0"

1

STRUCTURAL NOTE:

PER STRUCTURAL ANALYSIS OF TOWER BY WYCO/COLLIERS DATED 11/9/22 – THE TOWER AND ITS FOUNDATION HAVE SUFFICIENT CAPACITY TO CARRY THE PROPOSED LOAD CONFIGURATION. NO MODIFICATIONS ARE REQUIRED AT THIS TIME.



ANTENNA LAYOUT

12" 6" 0 1' 2' 3'
3/4"=1'–0"

2

SECTOR POS.	ANTENNA					TRANSMISSION CABLE	RRH			OVP
	EXISTING OR PROPOSED	MANUFACTURER – MODEL NUMBER	TECH	AZIMUTH	RAD CENTER	FEED LINE TYPE AND LENGTH	MANUFACTURER – MODEL NUMBER	TECH	POS.	MANUFACTURER MODEL
A1	PROPOSED	JMA MX08FRO665–21	5G	REF:NOTE 1	96'–0"	(1) HIGH–CAPACITY HYBRID CABLE (110' LONG)	FUJITSU–TA8025–B604	5G	A1	RAYCAP RDIDC–9181–PF–48
							FUJITSU–TA8025–B605	5G	A1	
B1	PROPOSED	JMA MX08FRO665–21	5G	REF:NOTE 1	96'–0"	SHARED W/ALPHA	FUJITSU–TA8025–B604	5G	B2	SHARED W/ALPHA
							FUJITSU–TA8025–B605	5G	B2	
C1	PROPOSED	JMA MX08FRO665–21	5G	REF:NOTE 1	96'–0"	SHARED W/ALPHA	FUJITSU–TA8025–B604	5G	B2	SHARED W/ALPHA
							FUJITSU–TA8025–B605	5G	B2	

NOTES

1. CONTRACTOR TO REFER TO FINAL CONSTRUCTION RFDS FOR ALL RF DETAILS.
2. ANTENNA AND RRH MODELS MAY CHANGE DUE TO EQUIPMENT AVAILABILITY. ALL EQUIPMENT CHANGES MUST BE APPROVED AND REMAIN IN COMPLIANCE WITH THE PROPOSED DESIGN AND STRUCTURAL ANALYSES.

ANTENNA SCHEDULE

NO SCALE

3

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TIM ALEXANDER
44563
EXP 10/31/2023
PROFESSIONAL ENGINEER

SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

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A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

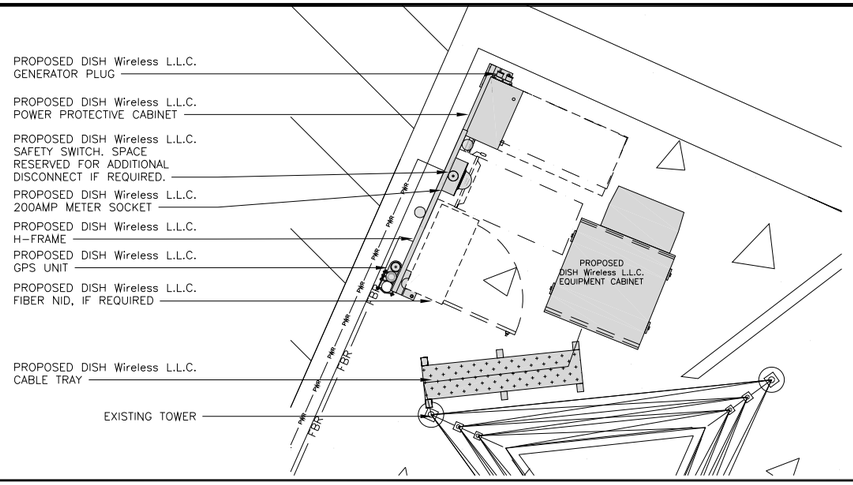
DNDEN00104C
4800 N HIMALAYA RD UNIT DISH
DENVER, CO 80249

SHEET TITLE

ELEVATION, ANTENNA LAYOUT AND SCHEDULE

SHEET NUMBER

A-2



PLATFORM EQUIPMENT PLAN

12" 9" 6" 3" 0 1' 2'
1"=1'-0"

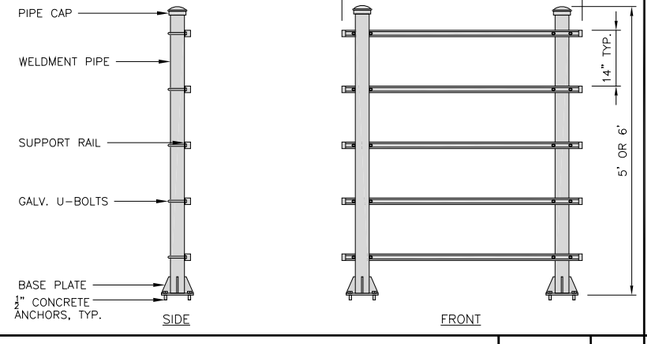
1

NOT USED

NO SCALE

2

COMMSCOPE MTC4045HFLD H-FRAME	
UNISTRUT/SUPPORT RAILS QTY	5
WEIGHT	59.74 lbs



H-FRAME DETAIL

NO SCALE

3

NOT USED

NO SCALE

4

NOT USED

12" 9" 6" 3" 0 1' 2'
1"=1'-0"

5

NOTES

1. CONTRACTOR TO BURY PLATFORM FEET WITH A MINIMUM OF 2" OF FILL PER EXISTING SITE SURFACE
2. WEED BARRIER FABRIC TO BE ADDED AT DISCRETION OF DISH Wireless L.L.C. CONSTRUCTION MANAGER AT TIME OF CONSTRUCTION. ONE SHEET 8'x8' INSTALLED UNDER ALL FOUR FEET OF THE PLATFORM (4 MIL BLACK PLASTIC)
3. EQUIPMENT CABINET OMITTED FOR CLARITY

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Tim Alexander
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10/31/2023
PROFESSIONAL ENGINEER

SIGNED, 15 DEC 2022

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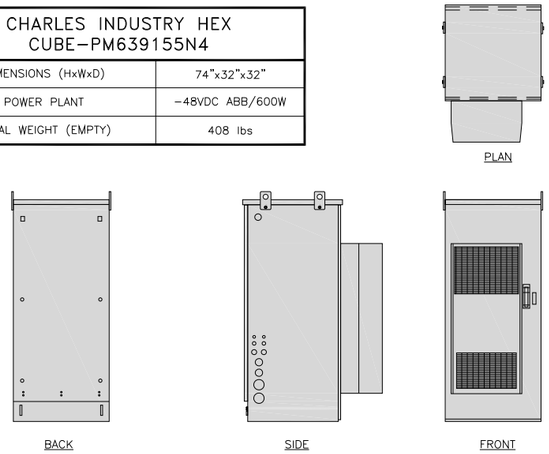
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DENVER, CO 80249
DISH

SHEET TITLE
EQUIPMENT PLATFORM AND H-FRAME DETAILS

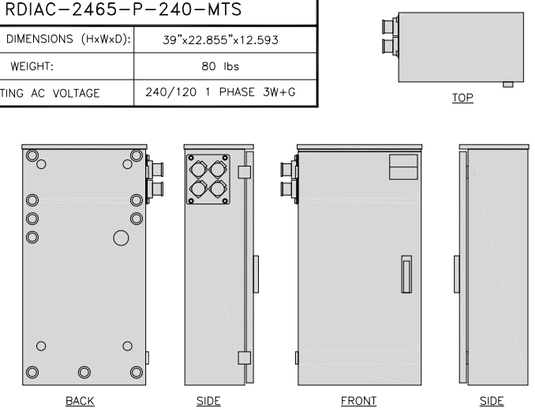
SHEET NUMBER
A-3

CHARLES INDUSTRY HEX CUBE–PM639155N4	
DIMENSIONS (HxWxD)	74"x32"x32"
POWER PLANT	–48VDC ABB/600W
TOTAL WEIGHT (EMPTY)	408 lbs



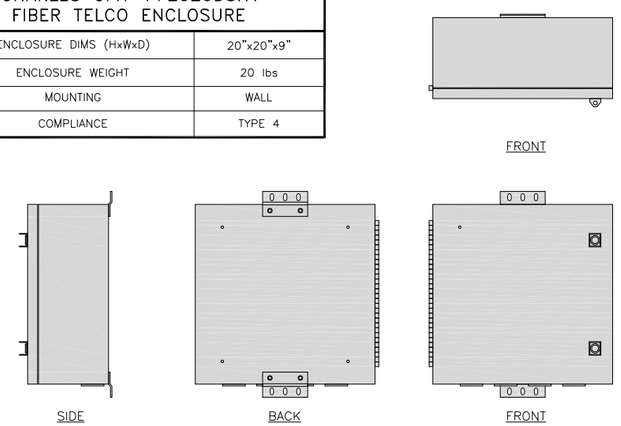
CABINET DETAIL | NO SCALE | 1

RAYCAP PPC RDIAC–2465–P–240–MTS	
ENCLOSURE DIMENSIONS (HxWxD):	39"x22.855"x12.593
WEIGHT:	80 lbs
OPERATING AC VOLTAGE	240/120 1 PHASE 3W+G



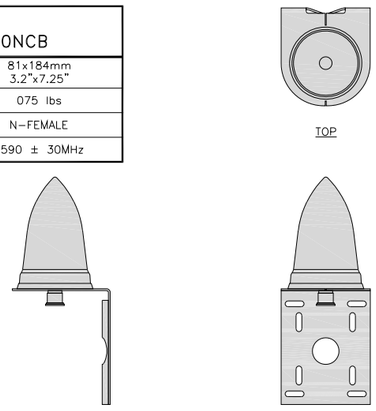
POWER PROTECTION CABINET (PPC) DETAIL | NO SCALE | 2

CHARLES CFIT–PF2020DSH1 FIBER TELCO ENCLOSURE	
ENCLOSURE DIMS (HxWxD)	20"x20"x9"
ENCLOSURE WEIGHT	20 lbs
MOUNTING	WALL
COMPLIANCE	TYPE 4

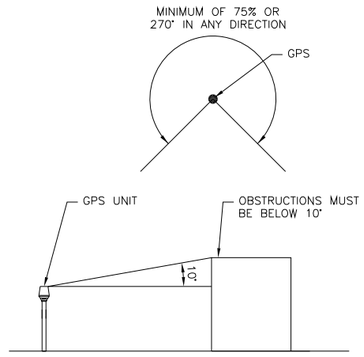


FIBER TELCO ENCLOSURE DETAIL | NO SCALE | 3

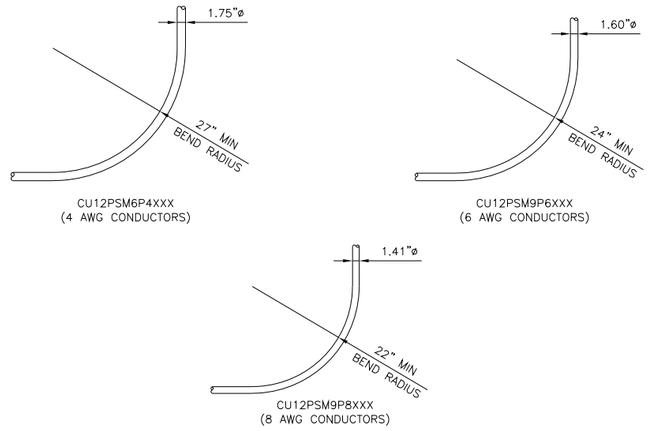
PCTEL GPSGL–TMG–SPI–40NCB	
DIMENSIONS (DIAxH) MM/INCH	81x184mm 3.2"x7.25"
WEIGHT W/ACCESSORIES	075 lbs
CONNECTOR	N–FEMALE
FREQUENCY RANGE	1590 ± 30MHz



GPS DETAIL | NO SCALE | 4

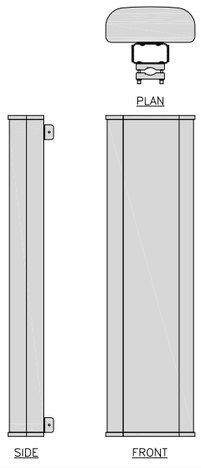


GPS MINIMUM SKY VIEW REQUIREMENTS | NO SCALE | 5



CABLES UNLIMITED HYBRID CABLE
MINIMUM BEND RADIUSES | NO SCALE | 6

JMA MX08FRO665–21	
DIMENSIONS (HxWxD)	72"x20.0"x8.0"
RF PORTS, CONNECTOR TYPE	8 x 4.3–10 FEMALE
WEIGHT	64.5 lbs
WEIGHT WITH BRACKETS	82.5 lbs



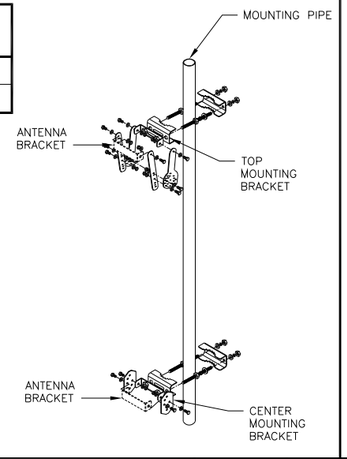
ANTENNA DETAIL | NO SCALE | 7

JMA ANTENNA MOUNT BRACKET #91900318	
TOTAL WEIGHT (WITH BRACKETS)	18 lbs (8.18 Kg)
POLE DIAMETER RANGE	2.5" TO 4.5"

NOTE:
KIT #91900318: TOP AND BOTTOM BRACKETS FOR 4–,6–, AND 8–FOOT ANTENNAS

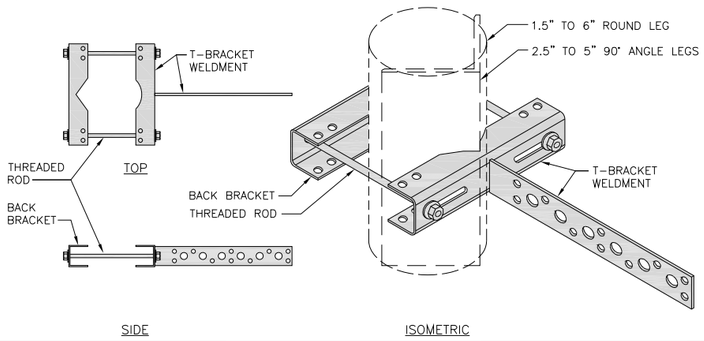
ANTENNA BRACKET NOT PART OF KIT

NOTE:
OR DISH Wireless L.L.C. APPROVED EQUIVALENT



ANTENNA BRACKET DETAIL | NO SCALE | 8

SITEPRO1 T600 UNIVERSAL T–BRACKET	
DIMENSIONS (HxWxL)	2.25"x10.0"x15.25"
WEIGHT/ VOLUME	5.60 LBS



VERTICAL CABLE SUPPORT DETAIL | NO SCALE | 9

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PROFESSIONAL ENGINEER
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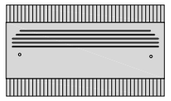
A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT DISH
DENVER, CO 80249

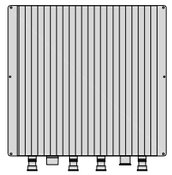
SHEET TITLE
EQUIPMENT DETAILS

SHEET NUMBER
A-4

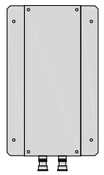
FUJITSU TRIPLE BAND TA08025-B605	
DIMENSIONS (HxWxD)	14.9"x15.7"x9"
WEIGHT	74.95 lbs
CONNECTOR TYPE	4.3-10 RF CONNECTOR
POWER SUPPLY	DC -58~-36V



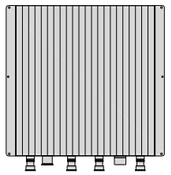
PLAN



BACK



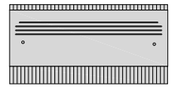
SIDE



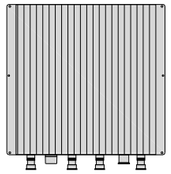
FRONT

RRH DETAIL | NO SCALE | 1

FUJITSU DUAL BAND TA08025-B604	
DIMENSIONS (HxWxD)	14.9"x15.7"x7.8"
WEIGHT	63.9 lbs
CONNECTOR TYPE	4.3-10 RF CONNECTOR
POWER SUPPLY	DC -58~-36V



PLAN



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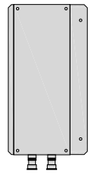
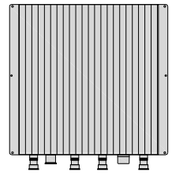


SIDE

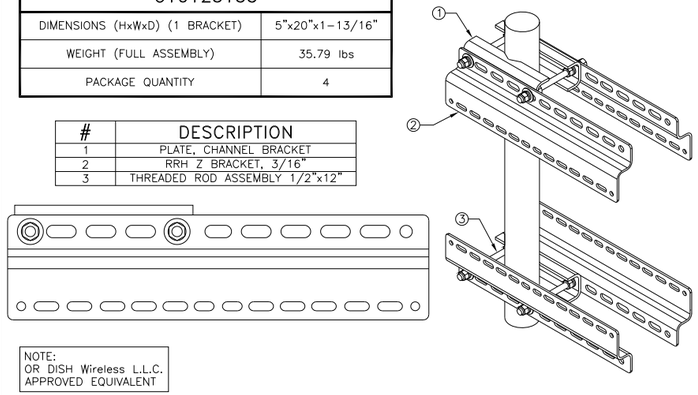


FRONT

RRH DETAIL | NO SCALE | 2

SABRE DOUBLE Z-BRACKET C10123155	
DIMENSIONS (HxWxD) (1 BRACKET)	5"x20"x1-13/16"
WEIGHT (FULL ASSEMBLY)	35.79 lbs
PACKAGE QUANTITY	4

#	DESCRIPTION
1	PLATE, CHANNEL BRACKET
2	RRH Z BRACKET, 3/16"
3	THREADED ROD ASSEMBLY 1/2"x12"

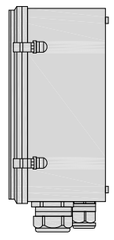


NOTE:
OR DISH Wireless L.L.C.
APPROVED EQUIVALENT

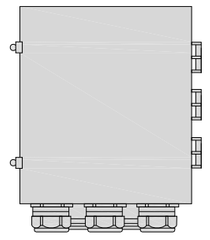
RRH MOUNT DETAIL | NO SCALE | 3

RAYCAP RDIDC-9181-PF-48 DC SURGE PROTECTION (OVP)	
DIMENSIONS (HxWxD)	18.98"x14.39"x8.15"
WEIGHT	21.82 LBS

PLAN



SIDE



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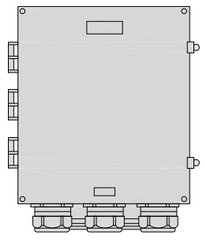
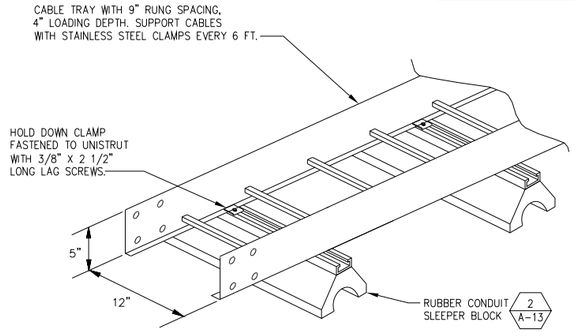


FRONT

SURGE SUPPRESSION DETAIL (OVP) | NO SCALE | 4

NOTE:
CONTRACTOR TO INSTALL PVC SLEEPERS TO A MINIMUM LENGTH OF 18" TO REDUCE THE POINT LOADS ON THE ROOF.

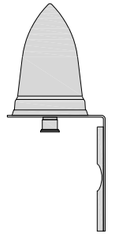


CABLE TRAY DETAIL | NO SCALE | 5

NOT USED | NO SCALE | 6

PCTEL GPSGL-TMG-SPI-40NCB	
DIMENSIONS (DIAxH) MM/INCH	81x184mm 3.2"x7.25"
WEIGHT W/ACCESSORIES	075 lbs
CONNECTOR	N-FEMALE
FREQUENCY RANGE	1590 ± 30MHz

TOP



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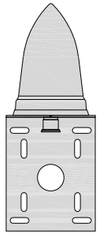
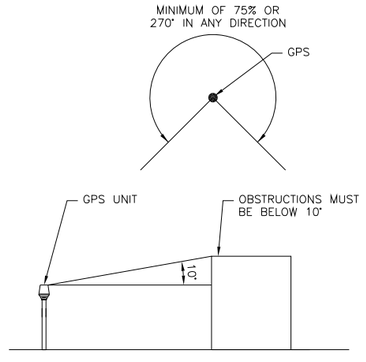
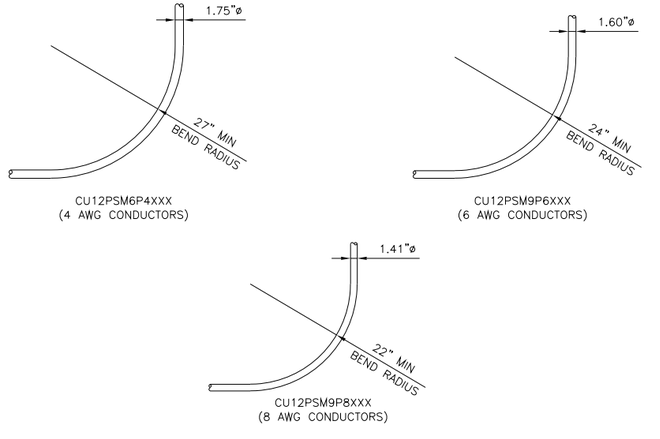


SIDE

GPS DETAIL | NO SCALE | 7



GPS MINIMUM SKY VIEW REQUIREMENTS | NO SCALE | 8



CABLES UNLIMITED HYBRID CABLE MINIMUM BEND RADIUSES | NO SCALE | 9

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COLORADO LICENSED
TIM ALEXANDER
44563
Tim Alexander
EXP
10/31/2023
PROFESSIONAL ENGINEER

SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER
DNDEN00104C

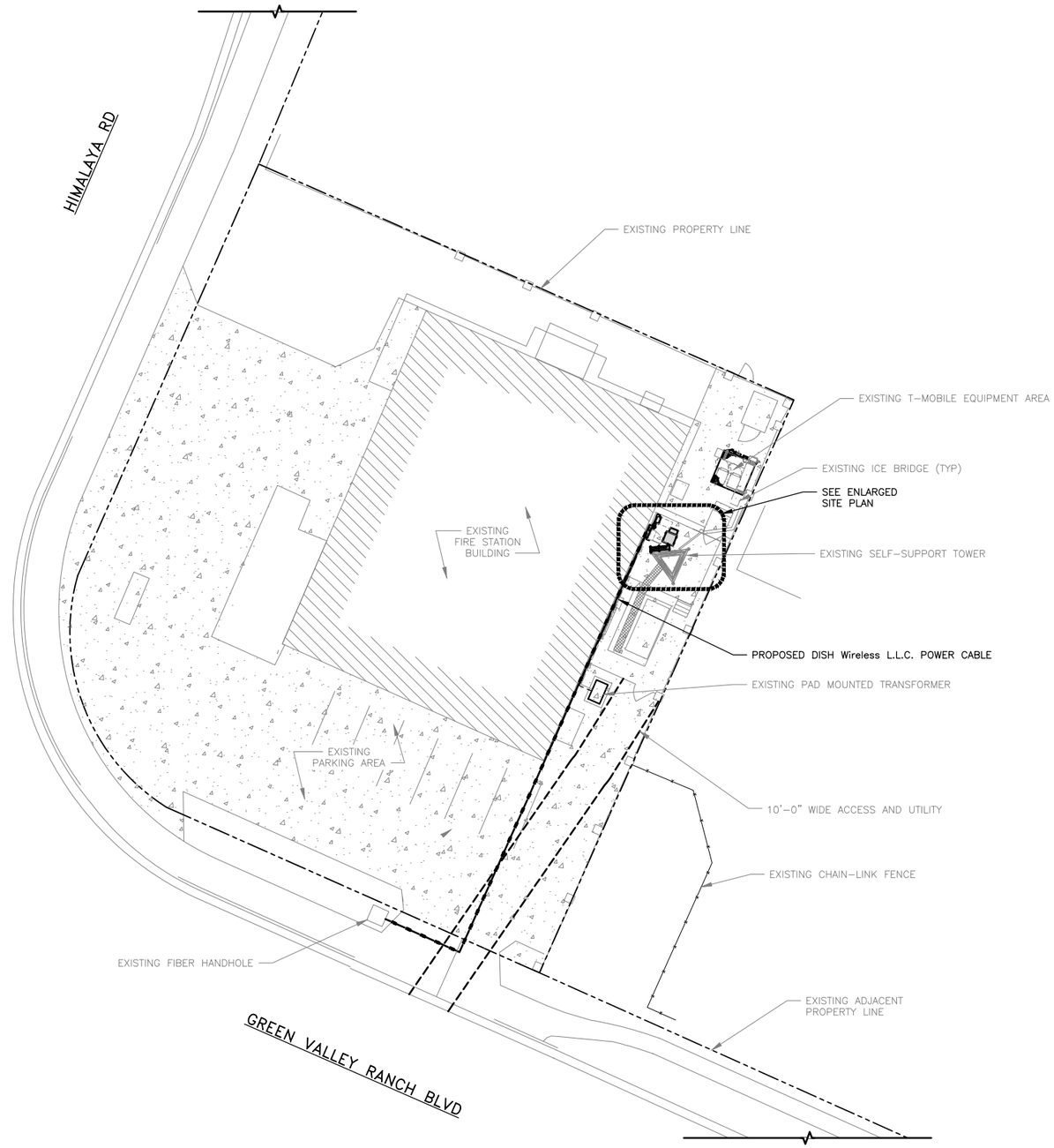
DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DENVER, CO 80249
DISH

SHEET TITLE
EQUIPMENT DETAILS

SHEET NUMBER
A-6

NOTES

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS.
2. CONTRACTOR SHALL MAINTAIN A 10'-0" MINIMUM SEPARATION BETWEEN THE PROPOSED GPS UNIT, TRANSMITTING ANTENNAS AND EXISTING GPS UNITS.
3. ANTENNAS AND MOUNTS OMITTED FOR CLARITY.



N

OVERALL SITE PLAN

16' 12' 8' 4' 0 16' 32'
1/16"=1'-0"

1

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DRAWN BY:	CHECKED BY:	APPROVED BY:
VW	AA	CS

RFDS REV #: 09/15/2022

PRELIMINARY DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
0	11/09/22	PRELIMINARY
1	12/08/22	PRELIMINARY
2	12/08/22	FINAL CONST.

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

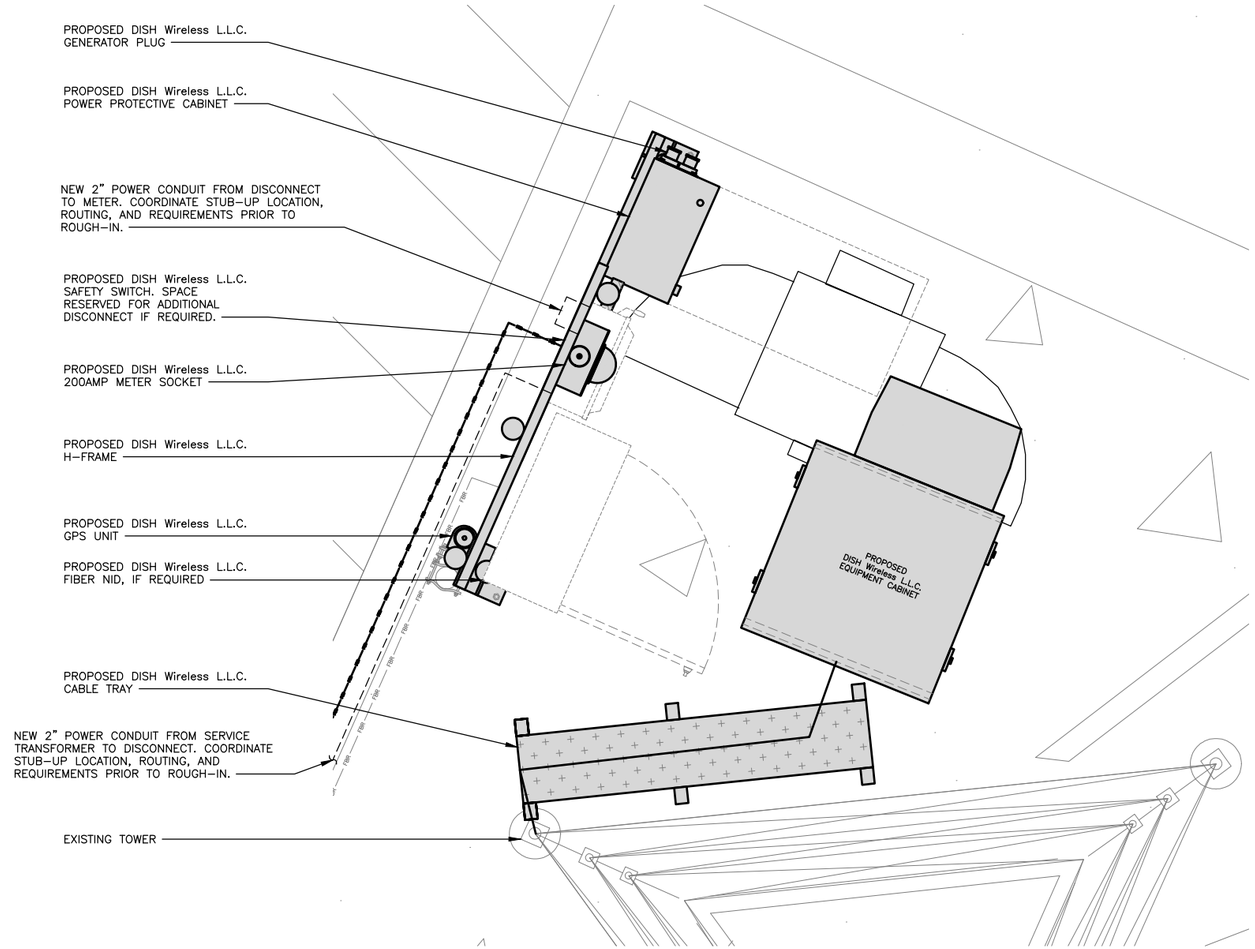
OVERALL SITE PLAN

SHEET NUMBER

E-1

for questions or comments contact number below:
phone: 602.287.0300
fax: 602.287.0600

DFT: VW
DSN: CM
CHK: CS



EQUIPMENT LAYOUT

12" 9" 6" 3" 0 1' 2'
1"=1'-0"

1

for questions or comments contact number below:
phone: 602.287.0300
fax: 602.287.0600

DFT: VW
DSN: CM
CHK: CS

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DRAWN BY:	CHECKED BY:	APPROVED BY:
VW	AA	CS

RFDS REV #: 09/15/2022

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DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

EQUIPMENT LAYOUT

SHEET NUMBER

E-1.1

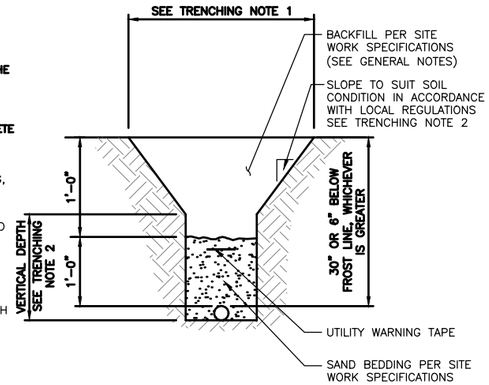
DC POWER WIRING SHALL BE COLOR CODED AT EACH END FOR IDENTIFYING +24V AND −48V CONDUCTORS. RED MARKINGS SHALL IDENTIFY +24V AND BLUE MARKINGS SHALL IDENTIFY −48V.

1. CONTRACTOR SHALL INSPECT THE EXISTING CONDITIONS PRIOR TO SUBMITTING A BID. ANY QUESTIONS ARISING DURING THE BID PERIOD IN REGARDS TO THE CONTRACTOR'S FUNCTIONS, THE SCOPE OF WORK, OR ANY OTHER ISSUE RELATED TO THIS PROJECT SHALL BE BROUGHT UP DURING THE BID PERIOD WITH THE PROJECT MANAGER FOR CLARIFICATION, NOT AFTER THE CONTRACT HAS BEEN AWARDED.
2. ALL ELECTRICAL WORK SHALL BE DONE IN ACCORDANCE WITH CURRENT NATIONAL ELECTRICAL CODES AND ALL STATE AND LOCAL CODES, LAWS, AND ORDINANCES. PROVIDE ALL COMPONENTS AND WIRING SIZES AS REQUIRED TO MEET NEC STANDARDS.
3. LOCATION OF EQUIPMENT, CONDUIT AND DEVICES SHOWN ON THE DRAWINGS ARE APPROXIMATE AND SHALL BE COORDINATED WITH FIELD CONDITIONS PRIOR TO CONSTRUCTION.
4. CONDUIT ROUGH−IN SHALL BE COORDINATED WITH THE MECHANICAL EQUIPMENT TO AVOID LOCATION CONFLICTS. VERIFY WITH THE MECHANICAL EQUIPMENT CONTRACTOR AND COMPLY AS REQUIRED.
5. CONTRACTOR SHALL PROVIDE ALL BREAKERS, CONDUITS AND CIRCUITS AS REQUIRED FOR A COMPLETE SYSTEM.
6. CONTRACTOR SHALL PROVIDE PULL BOXES AND JUNCTION BOXES AS REQUIRED BY THE NEC ARTICLE 314.
7. CONTRACTOR SHALL PROVIDE ALL STRAIN RELIEF AND CABLE SUPPORTS FOR ALL CABLE ASSEMBLIES. INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.
8. ALL DISCONNECTS AND CONTROLLING DEVICES SHALL BE PROVIDED WITH ENGRAVED PHENOLIC NAMEPLATES INDICATING EQUIPMENT CONTROLLED, BRANCH CIRCUITS INSTALLED ON, AND PANEL FIELD LOCATIONS FED FROM.
9. INSTALL AN EQUIPMENT GROUNDING CONDUCTOR IN ALL CONDUITS PER THE SPECIFICATIONS AND NEC 250. THE EQUIPMENT GROUNDING CONDUCTORS SHALL BE BONDED AT ALL JUNCTION BOXES, PULL BOXES, AND ALL DISCONNECT SWITCHES, AND EQUIPMENT CABINETS.
10. ALL NEW MATERIAL SHALL HAVE A U.L. LABEL.
11. PANEL SCHEDULE LOADING AND CIRCUIT ARRANGEMENTS REFLECT POST−CONSTRUCTION EQUIPMENT.
12. CONTRACTOR SHALL BE RESPONSIBLE FOR AS−BUILT PANEL SCHEDULE AND SITE DRAWINGS.
13. ALL TRENCHES IN COMPOUND TO BE HAND DUG

ELECTRICAL NOTES — NO SCALE — 1

TRENCHING NOTES

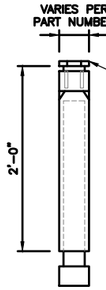
1. **CONTRACTOR SHALL RESTORE THE TRENCH TO ITS ORIGINAL CONDITIONS BY EITHER SEEDING OR SODDING GRASS AREAS, OR REPLACING ASPHALT OR CONCRETE AREAS TO ITS ORIGINAL CROSS SECTION.**
2. TRENCHING SAFETY; INCLUDING, BUT NOT LIMITED TO SOIL CLASSIFICATION, SLOPING, AND SHORING, SHALL BE GOVERNED BY THE CURRENT OSHA TRENCHING AND EXCAVATION SAFETY STANDARDS.
3. ALL CONDUITS SHALL BE INSTALLED IN COMPLIANCE WITH THE CURRENT NATIONAL ELECTRIC CODE (NEC) OR AS REQUIRED BY THE LOCAL JURISDICTION, WHICHEVER IS THE MOST STRINGENT.



TYPICAL UNDERGROUND TRENCH DETAIL — NO SCALE — 2

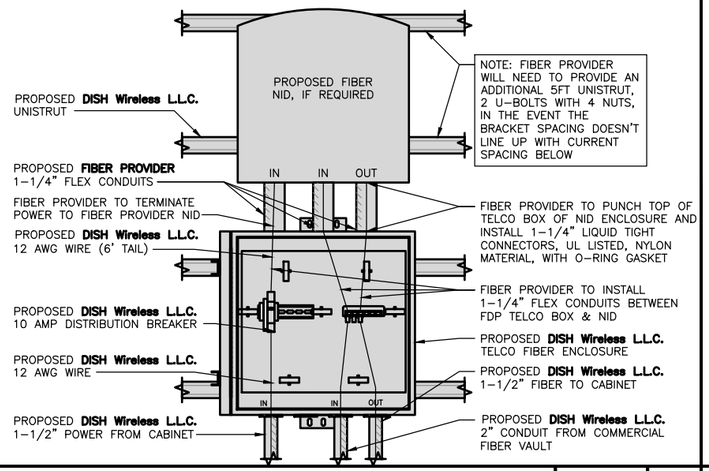
CARLON EXPANSION FITTINGS

COUPLING END PART#	MALE TERMINAL ADAPTER END PART#	SIZE	STD CTN QTY.	TRAVEL LENGTH
E945D	E945DX	1/2"	20	4"
E945E	E945EX	3/4"	15	4"
E945F	E945FX	1"	10	4"
E945G	E945GX	1 1/4"	5	4"
E945H	E945HX	1 1/2"	5	4"
E945J	E945JX	2"	15	8"
E945K	E945KX	2 1/2"	10	8"
E945L	E945LX	3"	10	8"
E945M	E945MX	3 1/2"	5	8"
E945N	E945NX	4"	5	8"
E945P	E945PX	5"	1	8"
E945R	E945RX	6"	1	8"

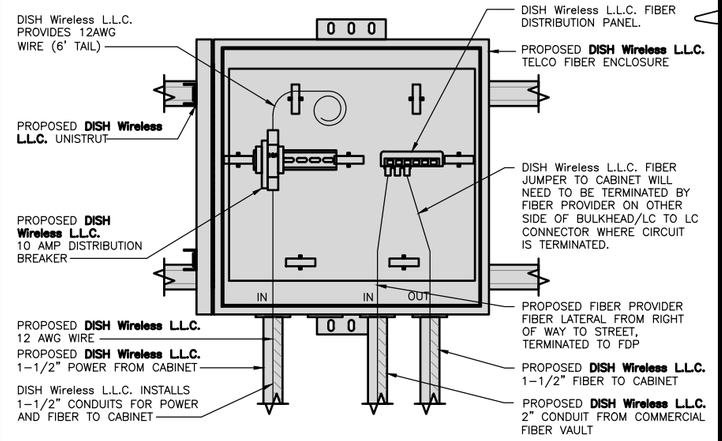


NOTE:
CONTRACTOR TO INSTALL EXPANSION FITTING SLIP JOINT AT METER CENTER CONDUIT TERMINATION, AS PER LOCAL UTILITY POLICY, ORDINANCE AND/OR SPECIFIED REQUIREMENT.

EXPANSION JOINT DETAIL — NO SCALE — 3



LIT TELCO BOX − INTERIOR WIRING LAYOUT (OPTIONAL) — NO SCALE — 4



DARK TELCO BOX − INTERIOR WIRING LAYOUT — NO SCALE — 5

NOT USED — NO SCALE — 6

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12/08/22
PROFESSIONAL ENGINEER
EXPIRES 10/31/2023

DRAWN BY:	CHECKED BY:	APPROVED BY:
VW	AA	CS

RFDS REV #: 09/15/2022

PRELIMINARY DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
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1	12/08/22	PRELIMINARY
2	12/08/22	FINAL CONST.

A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
ELECTRICAL DETAILS

SHEET NUMBER
E-2

PROVIDE APPROVED ARC-FLASH HAZARD WARNING ON ALL REQUIRED ELECTRICAL EQUIPMENT PER NEC 110.16

⚠ WARNING

Electric Arc Flash Hazard

Will cause severe injury or death

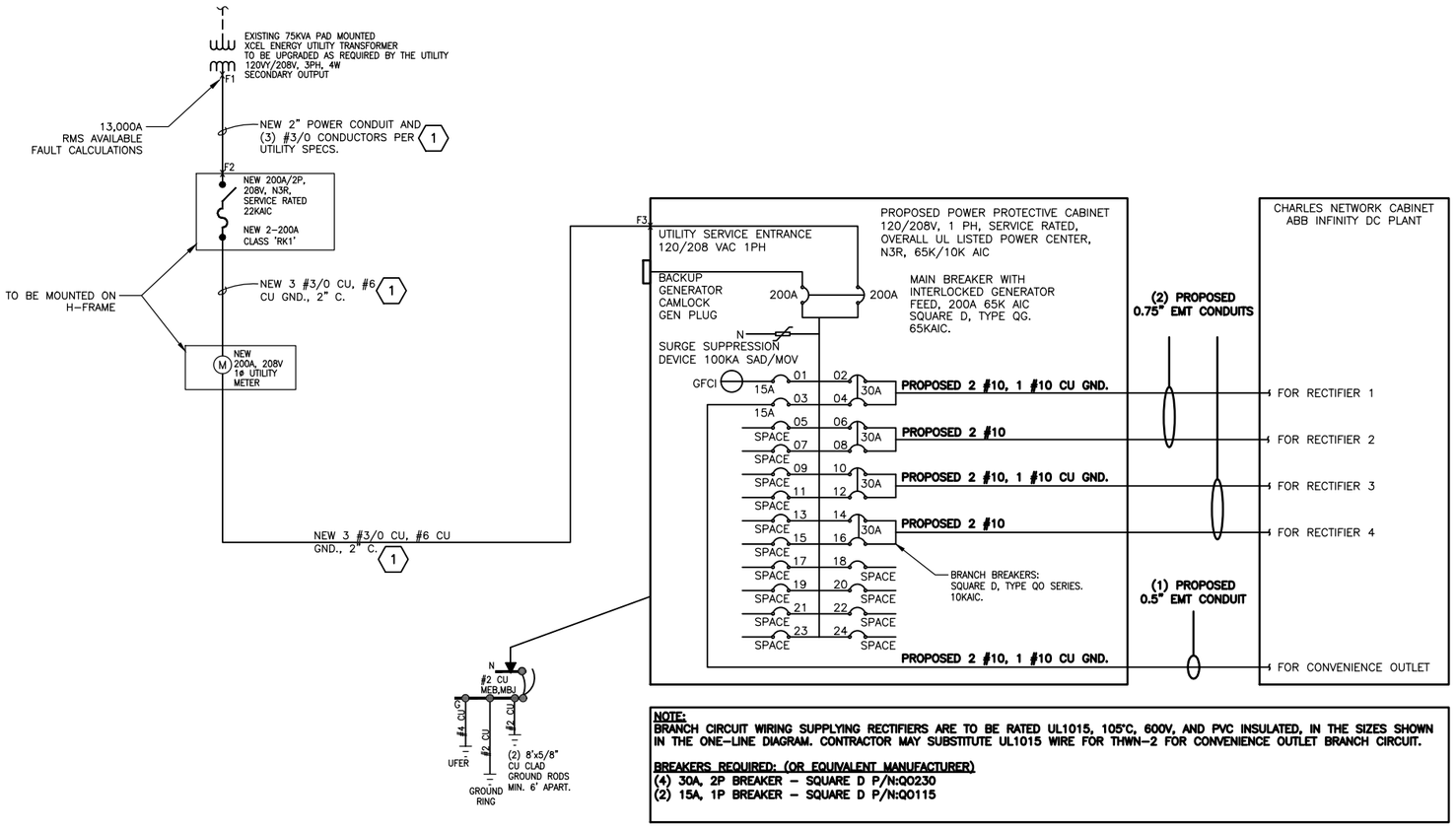
Wear proper protective equipment before opening or performing diagnostic measurements while energized. (See NFPA 70E)

ELECTRICAL CONTRACTOR SHALL PROVIDE LABELING OF THE AVAILABLE FAULT CURRENT FOR EACH PANEL AS NOTED, PER NEC 110.24.

SERVICE/FEEDER CONDUCTOR LENGTH TABLE
(BASED ON INDUSTRY STANDARD 3% VOLTAGE DROP AND 5% NEC ALLOWABLE LIMIT)

	CONDUCTOR SIZES					
DESIGN LOADS	250 kcmil AL	300 kcmil AL	3/0 CU	4/0 CU	250 kcmil CU	300 kcmil CU
DISH Wireless L.L.C. MAXIMUM CONTINUOUS LOAD (160A) (NEC ARTICLE 220 & 230 3% VOLTAGE DROP)	130'	155'	145'	180'	215'	255'
DISH Wireless L.L.C. MAXIMUM CONTINUOUS LOAD (160A) (NEC ARTICLE 220 & 230 5% VOLTAGE DROP)	220'	260'	240'	300'	360'	425'

NOTES:
1. 250 MCM/KCMIL AL + #2 AL GRD MAY BE USED AS A REPLACEMENT FOR 3/0 CU + #6 CU GRD SERVICE CONDUCTOR FROM THE DISH Wireless L.L.C. FIRST MEANS OF DISCONNECT/UTILITY COMPANY MEET-ME POINT. REFER TO VALUES ABOVE TO LIMIT VOLTAGE DROP TO 3%.
2. ALUMINUM/COPPER CONDUCTORS MUST BE RATED 75°C.
3. ALUMINUM TO COPPER BUSS CONNECTIONS MUST MEET AND CONFORM TO ANSI AND BE UL LISTED. USE ANTI CORROSION CONDUCTIVE LUBRICANT ON CONNECTIONS
4. PPC MAIN DISCONNECT CIRCUIT BREAKERS ACCEPT #4 – 300KCMIL AL OR CU CONDUCTORS.
5. VOLTAGE DROP FOR SINGLE METER ENCLOSURE FED FROM TRANSFORMER WITH MULTIPLE CUSTOMERS IS CALCULATED FROM THE TRANSFORMER TO PPC. (SERVICE AND FEEDER CONDUCTOR LENGTH)
6. VOLTAGE DROP FOR MULTI-METER ENCLOSURE IS CALCULATED FROM THE METER TO PPC. (FEEDER CONDUCTOR LENGTH)
7. VOLTAGE DROP CALCULATIONS ARE BASED ON A POWER FACTOR OF 1, A LINE TO GROUND VOLTAGE PER CONDUCTOR OF 120V, NO CORRECTION FACTOR FOR AMBIENT TEMPERATURE OR ADJUSTMENT FACTOR FOR MORE THAN THREE CURRENT-CARRYING CONDUCTORS IN A SINGLE CONDUCT OR RACEWAY. A POWER FACTOR LESS THAN 1 OR VOLTAGE LESS THAN 120 WILL RESULT IN SHORTER DISTANCES THAN SHOWN IN TABLE.



NOTE:
BRANCH CIRCUIT WIRING SUPPLYING RECTIFIERS ARE TO BE RATED UL1015, 105°C, 600V, AND PVC INSULATED, IN THE SIZES SHOWN IN THE ONE-LINE DIAGRAM. CONTRACTOR MAY SUBSTITUTE UL1015 WIRE FOR THWN-2 FOR CONVENIENCE OUTLET BRANCH CIRCUIT.

BREAKERS REQUIRED: (OR EQUIVALENT MANUFACTURER)
(4) 30A, 2P BREAKER – SQUARE D P/N:QO230
(2) 15A, 1P BREAKER – SQUARE D P/N:QO115

THE ENGINEER OF RECORD HAS PERFORMED ALL REQUIRED SHORT CIRCUIT CALCULATIONS AND THE AIC RATINGS FOR EACH DEVICE IS ADEQUATE TO PROTECT THE EQUIPMENT AND THE ELECTRICAL SYSTEM.

THE ENGINEER OF RECORD HAS PERFORMED ALL REQUIRED VOLTAGE DROP CALCULATIONS AND ALL BRANCH CIRCUIT AND FEEDERS COMPLY WITH THE NEC (LISTED ON T-1) ARTICLE 210.19(A)(1) FPN NO. 4.

THE (2) CONDUITS WITH (4) CURRENT CARRYING CONDUCTORS EACH, SHALL APPLY THE ADJUSTMENT FACTOR OF 80% PER 2014/17 NEC TABLE 310.15(B)(3)(a) OR 2020 NEC TABLE 310.15(C)(1) FOR UL1015 WIRE.

#12 FOR 15A-20A/1P BREAKER: 0.8 x 30A = 24.0A
#10 FOR 25A-30A/2P BREAKER: 0.8 x 40A = 32.0A
#8 FOR 35A-40A/2P BREAKER: 0.8 x 55A = 44.0A
#6 FOR 45A-60A/2P BREAKER: 0.8 x 75A = 60.0A

CONDUIT SIZING: AT 40% FILL PER NEC CHAPTER 9, TABLE 4, ARTICLE 358.
0.5" CONDUIT – 0.122 SQ. IN AREA
0.75" CONDUIT – 0.213 SQ. IN AREA
2.0" CONDUIT – 1.316 SQ. IN AREA
3.0" CONDUIT – 2.907 SQ. IN AREA

CABINET CONVENIENCE OUTLET CONDUCTORS (1 CONDUIT): USING THWN-2, CU.

#10 – 0.0211 SQ. IN X 2 = 0.0422 SQ. IN
#10 – 0.0211 SQ. IN X 1 = 0.0211 SQ. IN <GROUND
TOTAL = 0.0633 SQ. IN

0.5" EMT CONDUIT IS ADEQUATE TO HANDLE THE TOTAL OF (3) WIRES, INCLUDING GROUND WIRE, AS INDICATED ABOVE.

RECTIFIER CONDUCTORS (2 CONDUITS): USING UL1015, CU.

#10 – 0.0266 SQ. IN X 4 = 0.1064 SQ. IN
#10 – 0.0082 SQ. IN X 1 = 0.0082 SQ. IN <BARE GROUND
TOTAL = 0.1146 SQ. IN

0.75" EMT CONDUIT IS ADEQUATE TO HANDLE THE TOTAL OF (5) WIRES, INCLUDING GROUND WIRE, AS INDICATED ABOVE.

PPC FEED CONDUCTORS (1 CONDUIT): USING THHW, CU.

#3/0 – 0.3117 SQ. IN X 3 = 0.9351 SQ. IN
#6 – 0.0726 SQ. IN X 1 = 0.0726 SQ. IN <GROUND
TOTAL = 1.0077 SQ. IN

2.0" EMT CONDUIT IS ADEQUATE TO HANDLE THE TOTAL OF (4) WIRES, INCLUDING GROUND WIRE, AS INDICATED ABOVE.

1 PPC FEED CONDUCTORS (1 CONDUIT): USING THWN, AL.

250kcmil AL – 0.3970 SQ. IN X 3 = 1.191 SQ. IN
#4 AL – 0.0824 SQ. IN X 1 = 0.0824 SQ.IN <GROUND
TOTAL = 1.2734 SQ. IN

3.0" SCH 40 PVC CONDUIT IS ADEQUATE TO HANDLE THE TOTAL OF (4) WIRES, INCLUDING GROUND WIRE, AS INDICATED ABOVE.

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DRAWN BY:	CHECKED BY:	APPROVED BY:
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RFDS REV #: 09/15/2022

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A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
ELECTRICAL ONE-LINE & CALCULATIONS

SHEET NUMBER
E-3

for questions or comments contact number below:
phone: 602.287.0300
fax: 602.287.0600

DFT: VW
DSN: CM
CHK: CS

PPC ONE-LINE DIAGRAM

NO SCALE

1

PROPOSED CHARLES PANEL SCHEDULE

LOAD SERVED	VOLT AMPS (WATTS) L1	VOLT AMPS (WATTS) L2	TRIP	CKT #	PHASE	CKT #	TRIP	VOLT AMPS (WATTS) L1	VOLT AMPS (WATTS) L2	LOAD SERVED
PPC GFCI OUTLET	180		15A	1	A	2	30A	2880		ABB/GE INFINITY RECTIFIER 1
CHARLES GFCI OUTLET		180	15A	3	B	4			2880	
-SPACE-				5	A	6	30A	2880		ABB/GE INFINITY RECTIFIER 2
-SPACE-				7	B	8			2880	
-SPACE-				9	A	10	30A	2880		ABB/GE INFINITY RECTIFIER 3
-SPACE-				11	B	12			2880	
-SPACE-				13	A	14	30A	2880		ABB/GE INFINITY RECTIFIER 4
-SPACE-				15	B	16			2880	
-SPACE-				17	A	18				-SPACE-
-SPACE-				19	B	20				-SPACE-
-SPACE-				21	A	22				-SPACE-
-SPACE-				23	B	24				-SPACE-
VOLTAGE AMPS	180	180						11520	11520	

200A MCB, 1ϕ, 24 SPACE, 120/208V	L1	L2	
MB RATING: 65,000 AIC	11700	11700	VOLTAGE AMPS
	98	98	AMPS
	113		MAX AMPS
	141		MAX 125%

PANEL SCHEDULE/FUSE CHART | NO SCALE | 1

3-PHASE SHORT CIRCUIT CALCULATIONS BASED ON THE "POINT-BY-POINT" METHOD

I sca = Isc x M M = 1/(1 + f) Cable: f = 1.73 x L x I x C x E / 10000 x KVA

Xfmr: E = Ip sc x Vp x 1.73(%Z)/100000 x KVA

Is (sca) = Vp/Vs x M x Is

where:

I sc = the available short-circuit current, in amperes, at the beginning of the circuit.
L = the length of circuit to the fault, in feet.
C = the constant from Table C for the type of conductors and circuit arrangement. For parallel runs, multiply "C" value by the number of conductors per phase.
E = line-to-line voltage
Ip = primary current, in amperes.
Vp = primary line-to-line voltage of transformer, in volts.
Vs = secondary line-to-line voltage of transformer, in volts.
%Z = impedance of transformer.
* Use row 'ca' for feeder cables; and row 'xf' for transformers.

Fault Point	*	Description	Source Isc (amps)	Wire / Cable Size	No. of cond. per phase	Type of conduit	"C" value	E (volts)	L (length) in feet	XFMR. KVA	XFMR. %Z	Vp (volts)	Vs (volts)	f	M	Motor Contr. (A)	I sca (amps)
F1	ca	SERVICE TRANSFORMER	13000.00											0.00	1.00		13000.00
	xf	(PER XCEL CHARTS)												0.00	1.00		0.00

Note: The above calculations neglected motor short-circuit contributions. If significant, motor short-circuit contribution may be added to the transformer secondary short-circuit current value. A practical estimate of motor contribution is to multiply the total motor load in amperes by 6. Lengths are for calculations only. DO NOT USE for estimating or take-off purposes.

1-PHASE, LINE-TO-LINE SHORT CIRCUIT CALCULATIONS BASED ON THE "POINT-BY-POINT" METHOD

I sca = Isc x M M = 1/(1 + f) Cable: f = 2 x L x I / C x E

Xfmr: f = Ip sc x Vp x %Z/100000 x KVA

Is (sca) = Vp/Vs x M x Is

where:

I sc = the available short-circuit current, in amperes, at the beginning of the circuit.
L = the length of circuit to the fault, in feet.
C = the constant from Table C for the type of conductors and circuit arrangement. For parallel runs, multiply "C" value by the number of conductors per phase.
E = Line-to-line voltage or Line-to-ground voltage, where applicable.
Ip = primary current, in amperes.
Vp = primary line-to-line voltage of transformer, in volts.
Vs = secondary line-to-line voltage of transformer, in volts.
%Z = impedance of transformer.
* Use row 'ca' for feeder cables; and row 'xf' for transformers.

Fault Point	*	Description	Source Isc (amps)	Wire / Cable Size	No. of cond. per phase	Type of conduit	"C" value	E (volts)	L (length) in feet	XFMR. KVA	XFMR. %Z	Vp (volts)	Vs (volts)	f	M	I sca (amps)
F2	ca	COLD SEQUENCE DISCONNECT	13000.00	#3/0 CU	1	MAG	12844	208	47					0.46	0.69	8919.92
	xf													0.00	1.00	0.00
F3	ca	PPC	8919.92	#3/0 CU	1	MAG	12844	208	5					0.03	0.97	8631.72
	xf													0.00	1.00	0.00

Note: The above calculations neglected motor short-circuit contributions. If significant, motor short-circuit contribution may be added to the transformer secondary short-circuit current value. A practical estimate of motor contribution is to multiply the total motor load in amperes by 4. Lengths are for calculations only. DO NOT USE for cost estimating or take-off purposes.

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FAULT CALCULATIONS | NO SCALE | 2

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A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
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DISH
DENVER, CO 80249

SHEET TITLE
PANEL SCHEDULES & FAULT CALCS

SHEET NUMBER
E-3.1

Figure 4: UL Recognized Circuit Breaker/Circuit Breaker Series-Connected Rating

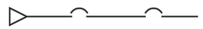

Figure 4 at left and Table 9 below show the arrangement and ratings of 240 or 277 Vac (maximum) systems with line side circuit breakers in series with load side circuit breakers for I-Line switchboards and panelboards.

NOTE: The line side circuit breaker may be in a separate enclosure or in the same enclosure as the load side circuit breaker. A line side circuit breaker may be integral or remote. A load side circuit breaker may be a branch or feeder. The series-connected SCCR must not exceed that of the line side circuit breaker. The tables apply to Square D brand, load side circuit breakers only. UL circuit breaker/circuit breaker series ratings are not applicable to corner-grounded systems.

Table 9: I-Line 240 Vac and 277 Vac Series Ratings—Switchboards/Panelboards

Maximum System Voltage AC	Maximum SCCR	Line Side		Load Side		
		Main Circuit Breaker	Maximum Circuit Breaker	Circuit Breakers [1]	Current Rating (A)	Poles
120	100 kA	FJ	100	FD	15–70	1
		QJ	225	FD	15–70	
		QJ	225	FA	15–100	
	65 kA	QG	225	FA	15–100	
				FD	15–70	
208Y/120	100 kA	QJ	225	FA, FD	15–100	2, 3
		QJ	225	QD, QG	70–225	2, 3
		PH	1600			
		PJ	1200			
		RJ	2000			
240	42 kA	KA	250	FD	15–100	1, 2, 3
		LA	400	QD	70–225	2, 3
		MA	1200			
	65 kA	FG, FH	100	FD	15–100	1, 2, 3
		MX	800			
		MH	1000			
		PJ	1200			
		FC	100	FD, FG		
		KC, KH	250			
		LH	400			
		LC	600			
		QG	225	FA, FD	15–100	2, 3
				QD	70–225	
		LH	400	QD	70–225	
		MH	1200			
		PA	1600			
		PG	1200			
		RG	2000			
	85 kA	RL	2500	FH	15–100	2, 3
			2500	KH	70–250	

Continued on next page

[1] FD, FG, and FJ circuit breaker ratings apply to both switchboards and panelboards. Ratings for all other circuit breakers apply only to switchboards.

Table 11: NQ 240 Vac Series Short-Circuit Current Ratings—Panelboards *(continued)*

Maximum System Voltage AC [1]	Maximum Short Circuit Current Rating (RMS Symmetrical)	Integral or Remote Main Circuit Breakers and Remote Main Fuses	Branch Circuit Breaker Designations and Allowable Ampere Ranges [2] [3] [4]			
			Type	1-pole	2-pole	3-pole
240	42k	LA, MA	Q2L-H QDL	— —	110–225 A 70–225 A	110–225 A 70–225 A
		LC 400 A	QO (B) QO (B) VH QOBVH QO (B) GFI QO (B) AFI	15–70 A 15–30 A — 15–30 A 15–20 A	— 15–125 A 150 A 15–60 A —	— 15–100 A — — —
		LC 600 A	QO (B) VH QOBVH QO (B) GFI QO (B) AFI	15–30 A — — 15–20 A	15–125 A 150 A 15–60 A —	15–100 A — — —
		MG	QO (B) VH	15–30 A	15–30 A	15–30 A
		HD, JD	QO (B) PL	15–30 A	15–60 A	15–30 A
	65k	LC 400 A	QO (B) QO (B) VH QOBVH QO (B) GFI QO (B) AFI	15–30 A 15–30 A — 15–30 A 15–20 A	— 15–125 A 150 A — —	— 15–100 A — — —
		LC 600 A	QO (B) VH QOBVH QO (B) GFI QO (B) AFI	15–30 A — — 15–20 A	15–125 A 150 A — —	35–100 A (3P 208 V Max.) 15–30 A (3P 240 V Max.) — — —
		DJ 400 A	QO (B) QO (B) VH QO (B) H	15–70 A — —	15–125 A 150 A 15–100 A	— 15–150 A —
		EG, FG, KG	QO (B) QO (B) GFI QO (B) AFI	15–70 A 15–30 A 15–20 A	15–125 A 15–60 A —	15–100 A — —
		QG	QO (B) QO (B) AS QO (B) VH	15–70 A 15–30 A —	15–125 A 15–30 A 150 A	15–30 A 15–30 A 35–150 A
		QG, HG, JG	QO (B) GFI QO (B) PL QO (B) AFI	15–30 A 15–30 A 15–20 A	15–60 A 15–60 A —	— 15–30 A —
		HG, JG	QO (B) QO (B) VH QO (B) H QOB2150VH	15–70 A — — —	15–125 A — 15–100 A 150 A	15–100 A 35–150 A — —
		FC22__ KC22__ FC32__ KC32__	QO (B) QO (B) AS QO (B) GFI QO (B) AFI	15–70 A 15–30 A 15–30 A 15–20 A	15–100 A 15–30 A 15–30 A —	15–100 A 15–30 A — —
		400 A Max. Class J or T6 Fuses	QO (B) VH QOB-VH QO (B) AFI	15–30 A — 15–20 A	15–125 A 150 A —	15–100 A — —

Continued on next page

[1] For shown circuit breakers rated less than this maximum voltage, the indicated short circuit current rating also applies, but at the voltage rating of the circuit breaker.

[2] Suffixes HID, SWD and SWN may also be applied to the applicable branch circuit breakers shown above, with one exception: suffix SWN may not be applied in combination with LC main circuit breakers.

[3] Where QO (B) circuit breakers are shown above, QO (B) H, QO (B) VH, and QH (B) circuit breakers may also be used.

[4] Where QO(B) GFI circuit breakers are shown above, QO (B) EPD circuit breakers may also be used.

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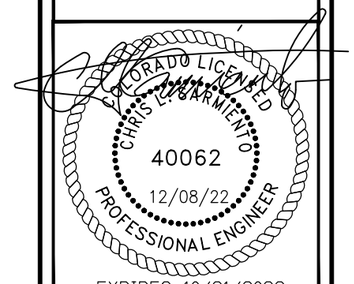

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A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
SERIES RATING SPECIFICATIONS

SHEET NUMBER
E-3.2

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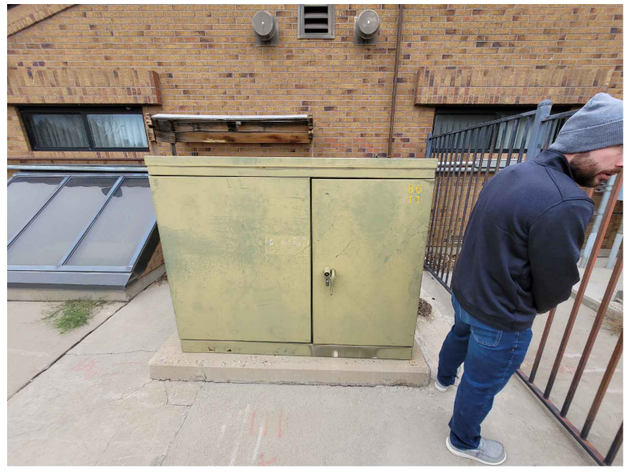

IMAGE 1: EXISTING SERVICE UTILITY TRANSFORMER

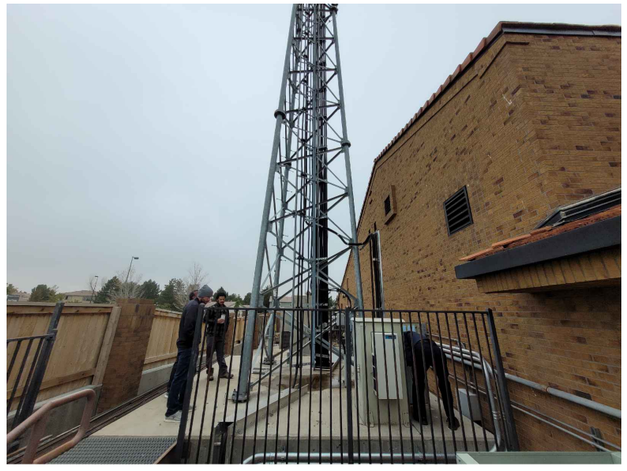

IMAGE 2: APPROXIMATE LOCATION OF PROPOSED EQUIPMENT PLATFORM

IMAGE 3: APPROXIMATE LOCATION OF PROPOSED DISH ANTENNAS WILL BE INSTALLED.

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DISH
DENVER, CO 80249

SHEET TITLE

SITE PHOTOS

SHEET NUMBER

E-3.3

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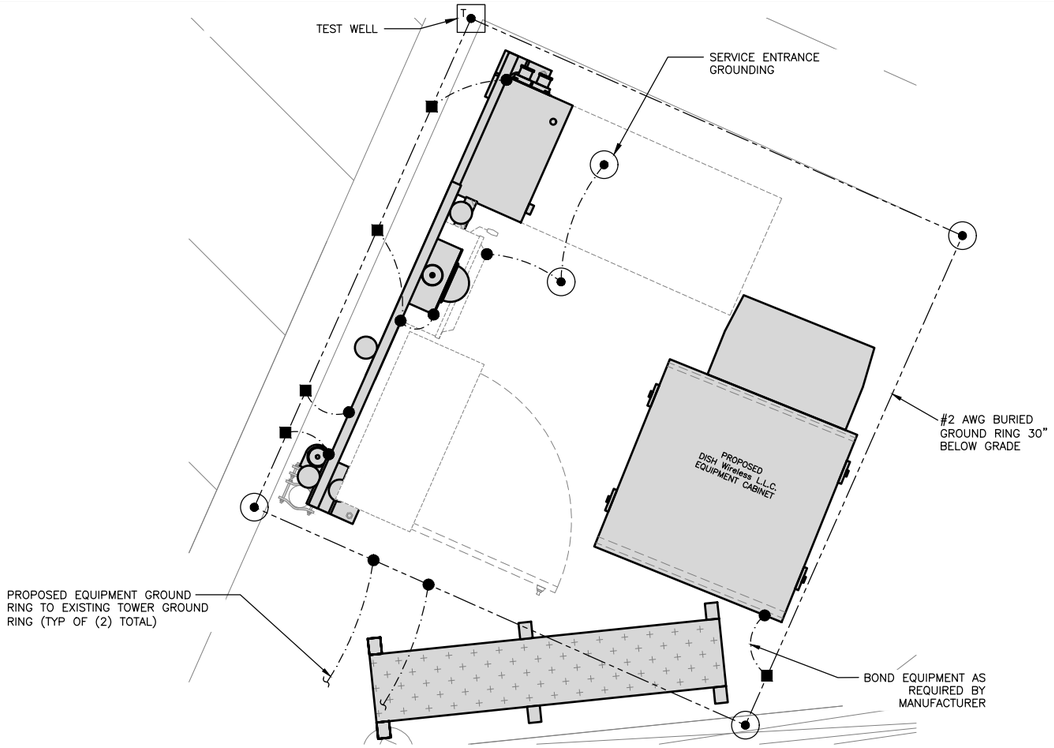
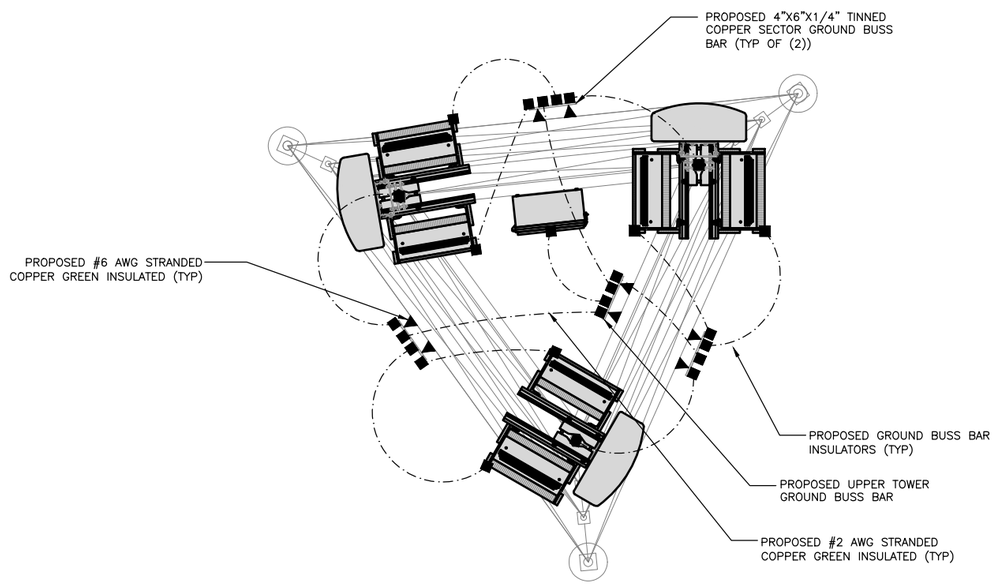


TYPICAL EQUIPMENT GROUNDING PLAN

12" 9" 6" 3" 0 1' 2'
1"=1'-0"

1



TYPICAL ANTENNA GROUNDING PLAN

12" 6" 0 1' 2' 3'
3/4"=1'-0"

2

EXOTHERMIC CONNECTION
MECHANICAL CONNECTION
GROUND BUS BAR
GROUND ROD
TEST GROUND ROD WITH INSPECTION SLEEVE
#6 AWG STRANDED & INSULATED
#2 AWG SOLID COPPER TINNED
#2 AWG STRANDED & INSULATED
BUSS BAR INSULATOR

GROUNDING LEGEND

1. **GROUNDING IS SHOWN DIAGRAMMATICALLY ONLY.**
2. **CONTRACTOR SHALL GROUND ALL EQUIPMENT AS A COMPLETE SYSTEM. GROUNDING SHALL BE IN COMPLIANCE WITH NEC SECTION 250 AND DISH Wireless L.L.C. GROUNDING AND BONDING REQUIREMENTS AND MANUFACTURER'S SPECIFICATIONS.**
3. **ALL GROUND CONDUCTORS SHALL BE COPPER; NO ALUMINUM CONDUCTORS SHALL BE USED.**

GROUNDING KEY NOTES

(A) EXTERIOR GROUND RING: #2 AWG SOLID COPPER, BURIED AT A DEPTH OF AT LEAST 30 INCHES BELOW GRADE, OR 6 INCHES BELOW THE FROST LINE AND APPROXIMATELY 24 INCHES FROM THE EXTERIOR WALL OR FOOTING.

(B) TOWER GROUND RING: THE GROUND RING SYSTEM SHALL BE INSTALLED AROUND AN ANTENNA TOWER'S LEGS, AND/OR GUY ANCHORS. WHERE SEPARATE SYSTEMS HAVE BEEN PROVIDED FOR THE TOWER AND THE BUILDING, AT LEAST TWO BONDS SHALL BE MADE BETWEEN THE TOWER RING GROUND SYSTEM AND THE BUILDING RING GROUND SYSTEM USING MINIMUM #2 AWG SOLID COPPER CONDUCTORS.

(C) INTERIOR GROUND RING: #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTOR EXTENDED AROUND THE PERIMETER OF THE EQUIPMENT AREA. ALL NON-TELECOMMUNICATIONS RELATED METALLIC OBJECTS FOUND WITHIN A SITE SHALL BE GROUNDED TO THE INTERIOR GROUND RING WITH #6 AWG STRANDED GREEN INSULATED CONDUCTOR.

(D) BOND TO INTERIOR GROUND RING: #2 AWG SOLID TINNED COPPER WIRE PRIMARY BONDS SHALL BE PROVIDED AT LEAST AT FOUR POINTS ON THE INTERIOR GROUND RING, LOCATED AT THE CORNERS OF THE BUILDING.

(E) GROUND ROD: UL LISTED COPPER CLAD STEEL. MINIMUM 1/2" DIAMETER BY EIGHT FEET LONG. GROUND RODS SHALL BE INSTALLED WITH INSPECTION SLEEVES. GROUND RODS SHALL BE DRIVEN TO THE DEPTH OF GROUND RING CONDUCTOR.

(F) CELL REFERENCE GROUND BAR: POINT OF GROUND REFERENCE FOR ALL COMMUNICATIONS EQUIPMENT FRAMES. ALL BONDS ARE MADE WITH #2 AWG UNLESS NOTED OTHERWISE STRANDED GREEN INSULATED COPPER CONDUCTORS. BOND TO GROUND RING WITH (2) #2 SOLID TINNED COPPER CONDUCTORS.

(G) HATCH PLATE GROUND BAR: BOND TO THE INTERIOR GROUND RING WITH TWO #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTORS. WHEN A HATCH-PLATE AND A CELL REFERENCE GROUND BAR ARE BOTH PRESENT, THE CRGB MUST BE CONNECTED TO THE HATCH-PLATE AND TO THE INTERIOR GROUND RING USING (2) TWO #2 AWG STRANDED GREEN INSULATED COPPER CONDUCTORS EACH.

(H) EXTERIOR CABLE ENTRY PORT GROUND BARS: LOCATED AT THE ENTRANCE TO THE CELL SITE BUILDING. BOND TO GROUND RING WITH A #2 AWG SOLID TINNED COPPER CONDUCTORS WITH AN EXOTHERMIC WELD AND INSPECTION SLEEVE.

(I) TELCO GROUND BAR: BOND TO BOTH CELL REFERENCE GROUND BAR OR EXTERIOR GROUND RING.

(J) FRAME BONDING: THE BONDING POINT FOR TELECOM EQUIPMENT FRAMES SHALL BE THE GROUND BUS THAT IS NOT ISOLATED FROM THE EQUIPMENTS METAL FRAMEWORK.

(K) INTERIOR UNIT BONDS: METAL FRAMES, CABINETS AND INDIVIDUAL METALLIC UNITS LOCATED WITH THE AREA OF THE INTERIOR GROUND RING REQUIRE A #6 AWG STRANDED GREEN INSULATED COPPER BOND TO THE INTERIOR GROUND RING.

(L) FENCE AND GATE GROUNDING: METAL FENCES WITHIN 7 FEET OF THE EXTERIOR GROUND RING OR OBJECTS BONDED TO THE EXTERIOR GROUND RING SHALL BE BONDED TO THE GROUND RING WITH A #2 AWG SOLID TINNED COPPER CONDUCTOR AT AN INTERVAL NOT EXCEEDING 25 FEET. BONDS SHALL BE MADE AT EACH GATE POST AND ACROSS GATE OPENINGS.

(M) EXTERIOR UNIT BONDS: METALLIC OBJECTS, EXTERNAL TO OR MOUNTED TO THE BUILDING, SHALL BE BONDED TO THE EXTERIOR GROUND RING. USING #2 TINNED SOLID COPPER WIRE

(N) ICE BRIDGE SUPPORTS: EACH ICE BRIDGE LEG SHALL BE BONDED TO THE GROUND RING WITH #2 AWG BARE TINNED COPPER CONDUCTOR. PROVIDE EXOTHERMIC WELDS AT BOTH THE ICE BRIDGE LEG AND BURIED GROUND RING.

(O) DURING ALL DC POWER SYSTEM CHANGES INCLUDING DC SYSTEM CHANGE OUTS, RECTIFIER REPLACEMENTS OR ADDITIONS, BREAKER DISTRIBUTION CHANGES, BATTERY ADDITIONS, BATTERY REPLACEMENTS AND INSTALLATIONS OR CHANGES TO DC CONVERTER SYSTEMS IT SHALL BE REQUIRED THAT SERVICE CONTRACTORS VERIFY ALL DC POWER SYSTEMS ARE EQUIPPED WITH A MASTER DC SYSTEM RETURN GROUND CONDUCTOR FROM THE DC POWER SYSTEM COMMON RETURN BUS DIRECTLY CONNECTED TO THE CELL SITE REFERENCE GROUND BAR

(P) TOWER TOP COLLECTOR BUSS BAR IS TO BE MECHANICALLY BONDED TO TOWER STEEL.

REFER TO DISH Wireless L.L.C. GROUNDING NOTES.

GROUNDING NOTES

3

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A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
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DISH
DENVER, CO 80249

SHEET TITLE

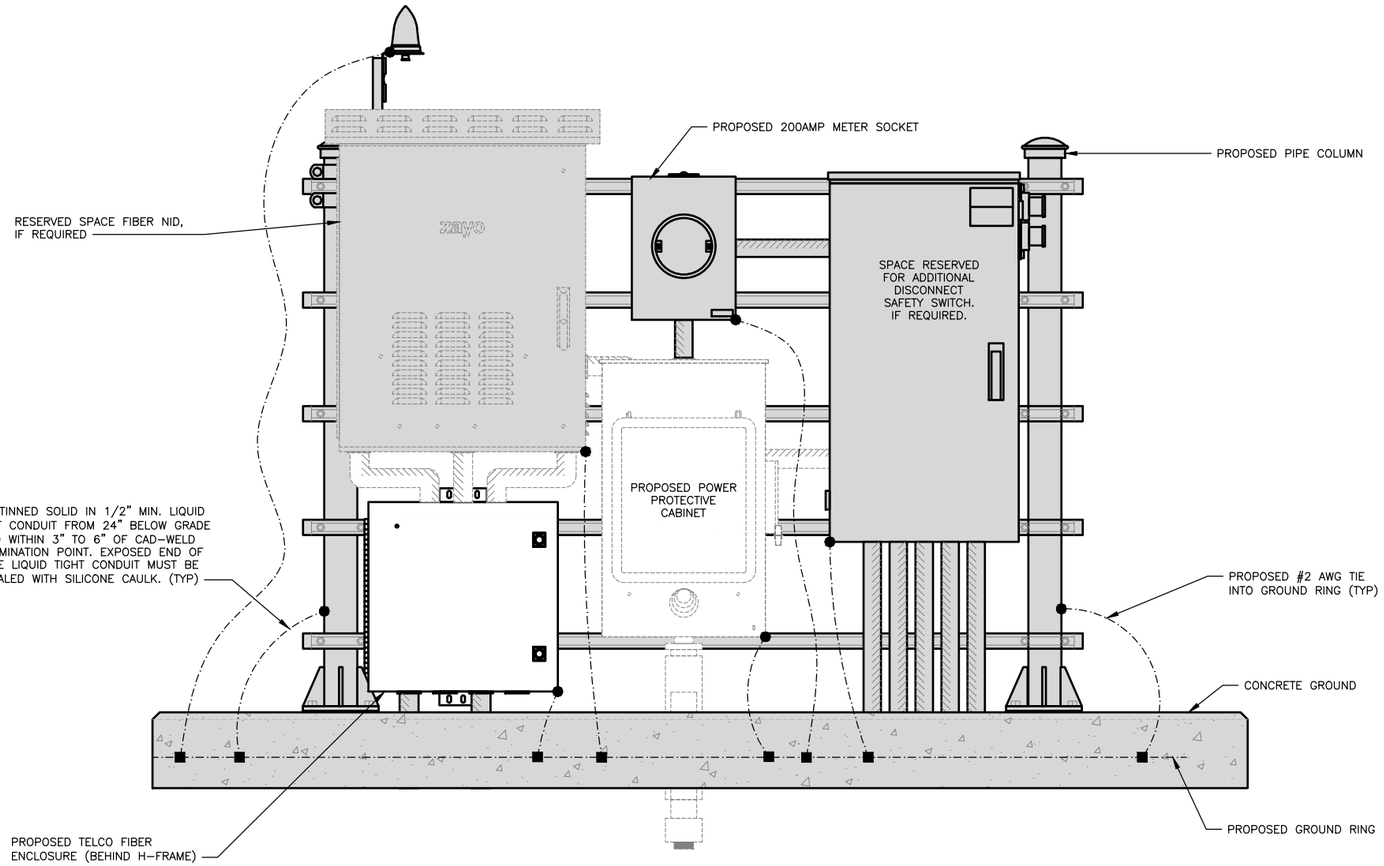
GROUNDING PLANS

SHEET NUMBER

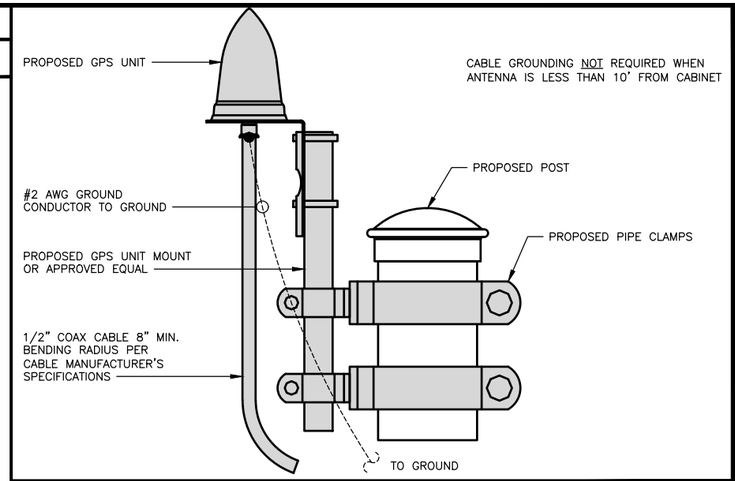
G-1

NOTES

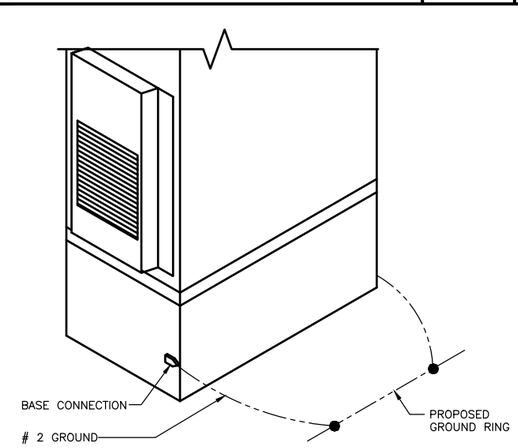
EQUIPMENT CABINET OMITTED FOR CLARITY



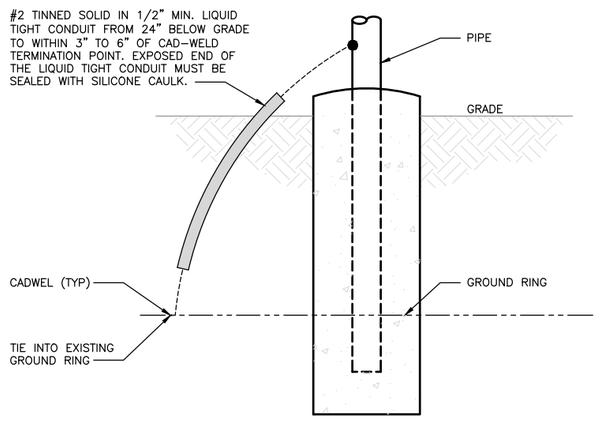
H-FRAME GROUNDING DETAIL | NO SCALE | 1



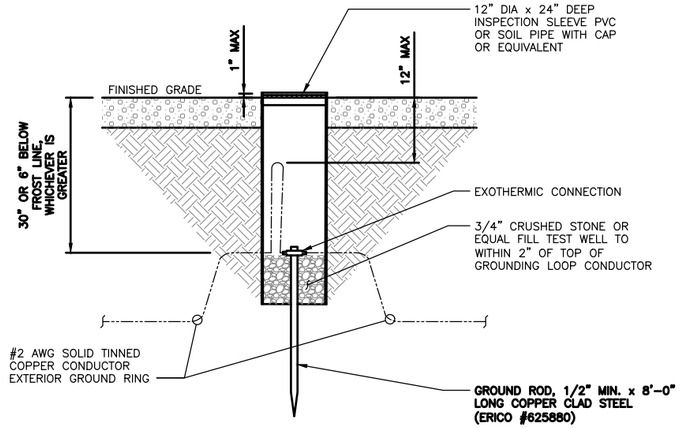
TYPICAL GPS UNIT GROUNDING | NO SCALE | 2



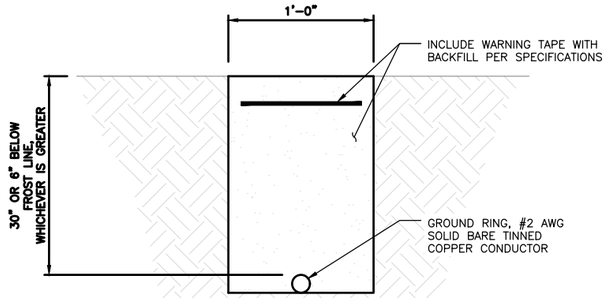
OUTDOOR CABINET GROUNDING | NO SCALE | 3



TRANSITIONING GROUND DETAIL | NO SCALE | 4



TYPICAL TEST GROUND ROD WITH INSPECTION SLEEVE | NO SCALE | 5



TYPICAL GROUND RING TRENCH | NO SCALE | 6

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A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

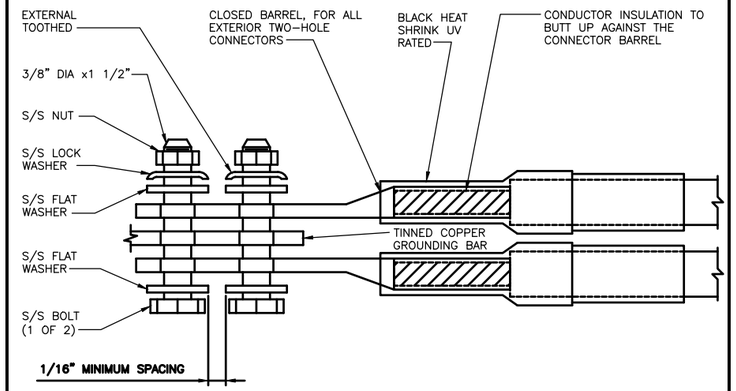
GROUNDING DETAILS

SHEET NUMBER

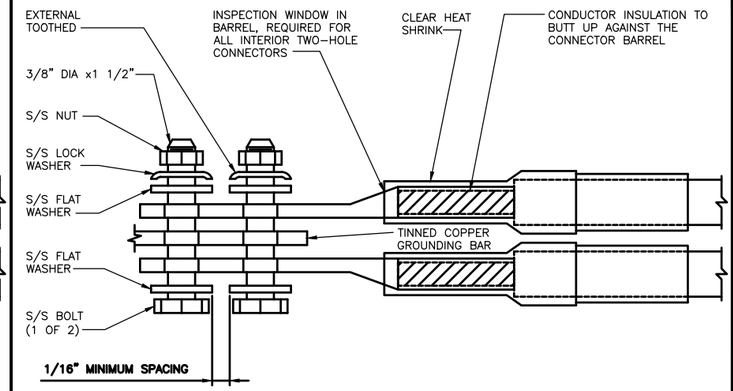
G-2

1. EXOTHERMIC WELD (2) TWO, #2 AWG BARE TINNED SOLID COPPER CONDUCTORS TO GROUND BAR. ROUTE CONDUCTORS TO BURIED GROUND RING AND PROVIDE PARALLEL EXOTHERMIC WELD.
2. ALL EXTERIOR GROUNDING HARDWARE SHALL BE STAINLESS STEEL 3/8" DIAMETER OR LARGER. ALL HARDWARE 18-8 STAINLESS STEEL INCLUDING LOCK WASHERS, COAT ALL SURFACES WITH AN ANTI-OXIDANT COMPOUND BEFORE MATING.
3. FOR GROUND BOND TO STEEL ONLY: COAT ALL SURFACES WITH AN ANTI-OXIDANT COMPOUND BEFORE MATING.
4. DO NOT INSTALL CABLE GROUNDING KIT AT A BEND AND ALWAYS DIRECT GROUND CONDUCTOR DOWN TO GROUNDING BUS.
5. NUT & WASHER SHALL BE PLACED ON THE FRONT SIDE OF THE GROUND BAR AND BOLTED ON THE BACK SIDE.
6. ALL GROUNDING PARTS AND EQUIPMENT TO BE SUPPLIED AND INSTALLED BY CONTRACTOR.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL GROUND BAR AS REQUIRED.
8. ENSURE THE WIRE INSULATION TERMINATION IS WITHIN 1/8" OF THE BARREL (NO SHINERS).

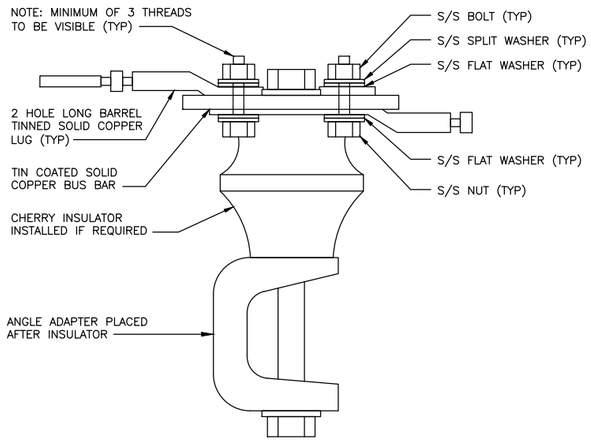
TYPICAL GROUNDING NOTES | NO SCALE | 1



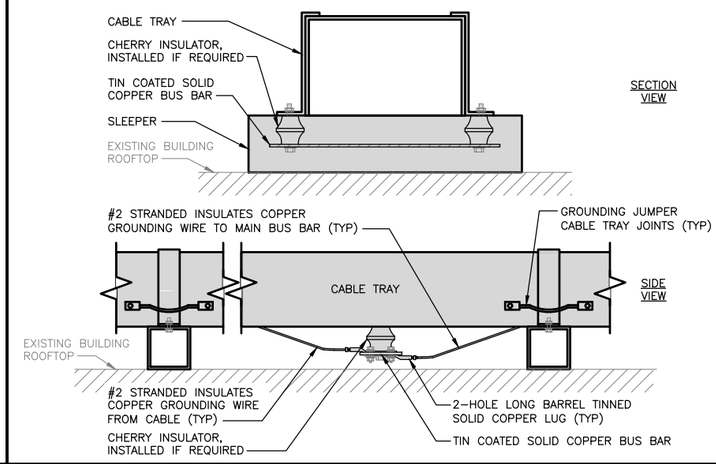
TYPICAL EXTERIOR TWO HOLE LUG | NO SCALE | 2



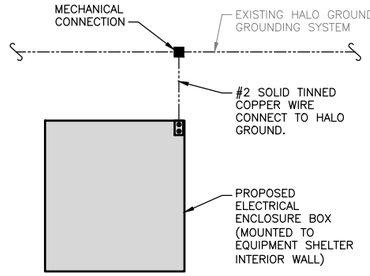
TYPICAL INTERIOR TWO HOLE LUG | NO SCALE | 3



LUG DETAIL | NO SCALE | 4



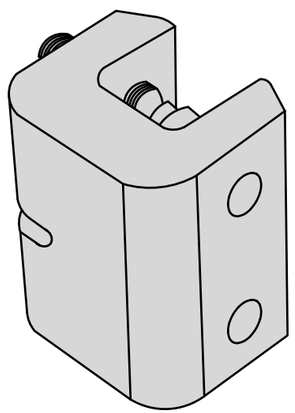
TYPICAL CABLE TRAY GROUND BUSS BAR | NO SCALE | 5



TYPICAL INDOOR ELECTRICAL ENCLOSURE BOX GROUNDING DETAIL | NO SCALE | 6

PANDUIT GUBC500-6 UNIVERSAL BEAM GROUNDING, CLAMP	
COPPER CONDUCTOR SIZE RANGE AWG	#6-500
FLANGE THICKNESS INCHES	0.250-0.675
STUD SIZE INCHES	1/2"
THREAD SIZE	1/2"-13
DIMENSIONS (LxWxH)	3.15"x 2.13"x 2.50"

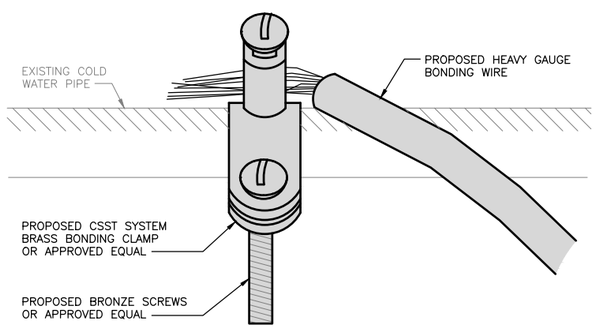
NOTE:
1. UNIVERSAL, FITS ON A WIDE RANGE OF STANDARD (ANGLED) AND WIDE FLANGE (PARALLEL) STRUCTURAL STEEL BEAMS.
2. UL 467 LISTED FOR GROUNDING AND BONDING ONLY



BUILDING STEEL GROUNDING DETAIL | NO SCALE | 7

NOTE

REMOVE ANY PAINT ON PIPE OR FITTING SURFACE UNDER BONDING CLAMP.



TYPICAL COLD WATER CONDUIT GROUNDING DETAIL | NO SCALE | 8

NOT USED | NO SCALE | 9

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LITTLETON, CO 80120

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Where quality still counts.
6335 DOWNING ST.
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40062
12/08/22
PROFESSIONAL ENGINEER
EXPIRES 10/31/2023

DRAWN BY:	CHECKED BY:	APPROVED BY:
VW	AA	CS

RFDS REV #: 09/15/2022

PRELIMINARY DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
0	11/09/22	PRELIMINARY
1	12/08/22	PRELIMINARY
2	12/08/22	FINAL CONST.

A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

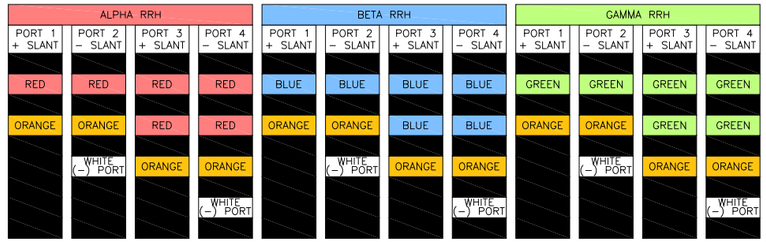
SHEET TITLE
GROUNDING DETAILS

SHEET NUMBER
G-3

HYBRID/DISCREET CABLES — 3/4" TAPE WIDTHS WITH 3/4" SPACING

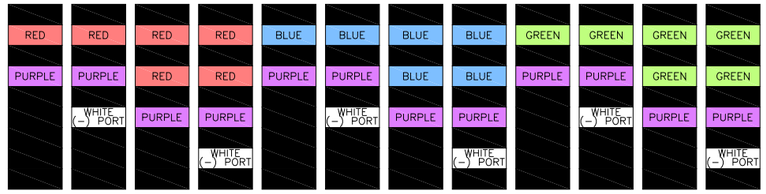
LOW-BAND RRH
(600 MHz N71 BASEBAND) +
(850 MHz N26 BAND) +
(700 MHz N29 BAND) – OPTIONAL PER MARKET

ADD FREQUENCY COLOR TO SECTOR BAND
(CBRS WILL USE YELLOW BAND)



MID-BAND RRH
(AWS BANDS N66+N70)

ADD FREQUENCY COLOR TO SECTOR BAND
(CBRS WILL USE YELLOW BANDS)



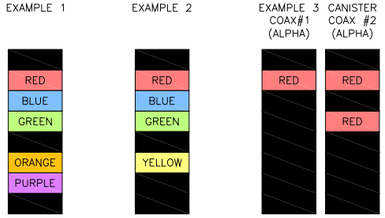
HYBRID/DISCREET CABLES

INCLUDE SECTOR BANDS BEING SUPPORTED ALONG WITH FREQUENCY BANDS.

EXAMPLE 1 – HYBRID, OR DISCREET, SUPPORTS ALL SECTORS, BOTH LOW-BANDS AND MID-BANDS.

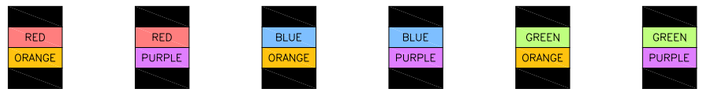
EXAMPLE 2 – HYBRID, OR DISCREET, SUPPORTS CBRS ONLY, ALL SECTORS.

EXAMPLE 3 – MAIN COAX WITH GROUND MOUNTED RRHs.



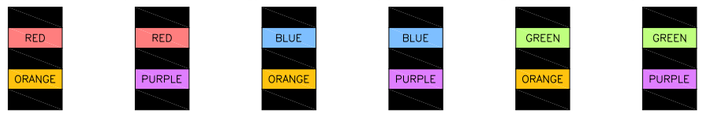
FIBER JUMPERS TO RRHs

LOW-BAND HHR FIBER CABLES HAVE SECTOR STRIPE ONLY.



POWER CABLES TO RRHs

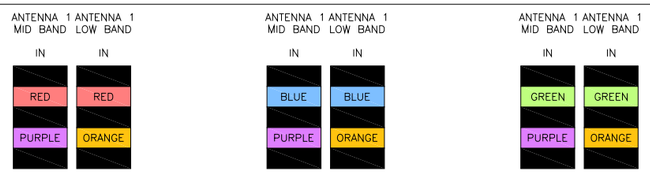
LOW-BAND RRH POWER CABLES HAVE SECTOR STRIPE ONLY



RET MOTORS AT ANTENNAS

RET CONTROL IS HANDLED BY THE MID-BAND RRH WHEN ONE SET OF RET PORTS EXIST ON ANTENNA.

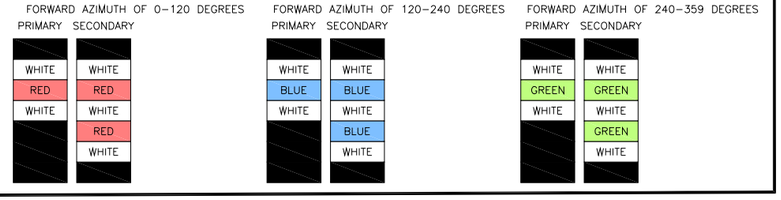
SEPARATE RET CABLES ARE USED WHEN ANTENNA PORTS PROVIDE INPUTS FOR BOTH LOW AND MID BANDS.



MICROWAVE RADIO LINKS

LINKS WILL HAVE A 1.5–2 INCH WHITE WRAP WITH THE AZIMUTH COLOR OVERLAPPING IN THE MIDDLE.
ADD ADDITIONAL SECTOR COLOR BANDS FOR EACH ADDITIONAL MW RADIO.

MICROWAVE CABLES WILL REQUIRE P-TOUCH LABELS INSIDE THE CABINET TO IDENTIFY THE LOCAL AND REMOTE SITE ID's.



RF CABLE COLOR CODES | NO SCALE | 1

LOW BANDS (N71+N26) OPTIONAL – (N29): ORANGE

AWS (N66+N70+H-BLOCK): PURPLE

CBRS TECH (3 GHz): YELLOW

NEGATIVE SLANT PORT ON ANT/RRH: WHITE

ALPHA SECTOR: RED | BETA SECTOR: BLUE | GAMMA SECTOR: GREEN

COLOR IDENTIFIER | NO SCALE | 2

NOT USED | NO SCALE | 3

NOT USED | NO SCALE | 4

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PROFESSIONAL ENGINEER
EXP 10/31/2023
SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
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A&E PROJECT NUMBER
DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION
DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
RF
CABLE COLOR CODE

SHEET NUMBER
RF-1

LEGEND

EXOTHERMIC CONNECTION

MECHANICAL CONNECTION

BUSS BAR INSULATOR

CHEMICAL ELECTROLYTIC GROUNDING SYSTEM

TEST CHEMICAL ELECTROLYTIC GROUNDING SYSTEM — T

EXOTHERMIC WITH INSPECTION SLEEVE

GROUNDING BAR

GROUND ROD

TEST GROUND ROD WITH INSPECTION SLEEVE — T

SINGLE POLE SWITCH

DUPLEX RECEPTACLE

DUPLEX GFCI RECEPTACLE — GFCI

FLUORESCENT LIGHTING FIXTURE (2) TWO LAMPS 48-T8 — F

SMOKE DETECTION (DC) — SD

EMERGENCY LIGHTING (DC)

SECURITY LIGHT W/PHOTOCELL LITHONIA ALXW LED-1-25A400/51K-SR4-120-PE-DDBTXD

CHAIN LINK FENCE — x x x x

WOOD/WROUGHT IRON FENCE

WALL STRUCTURE

LEASE AREA

PROPERTY LINE (PL)

SETBACKS

ICE BRIDGE

CABLE TRAY

WATER LINE — W W W W W

UNDERGROUND POWER — UGP UGP UGP UGP UGP

UNDERGROUND TELCO — UGT UGT UGT UGT UGT

OVERHEAD POWER — OHP OHP OHP OHP

OVERHEAD TELCO — OHT OHT OHT OHT

UNDERGROUND TELCO/POWER — UGT/P UGT/P UGT/P UGT/P

ABOVE GROUND POWER — AGP AGP AGP AGP AGP

ABOVE GROUND TELCO — AGT AGT AGT AGT AGT

ABOVE GROUND TELCO/POWER — AGT/P AGT/P AGT/P AGT/P

WORKPOINT — W.P.

SECTION REFERENCE — XX / X-X

DETAIL REFERENCE — XX / X-X

ABBREVIATIONS

AB	ANCHOR BOLT
ABV	ABOVE
AC	ALTERNATING CURRENT
ADDL	ADDITIONAL
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AGL	ABOVE GROUND LEVEL
AIC	AMPERAGE INTERRUPTION CAPACITY
ALUM	ALUMINUM
ALT	ALTERNATE
ANT	ANTENNA
APPROX	APPROXIMATE
ARCH	ARCHITECTURAL
ATS	AUTOMATIC TRANSFER SWITCH
AWG	AMERICAN WIRE GAUGE
BATT	BATTERY
BLDG	BUILDING
BLK	BLOCK
BLKG	BLOCKING
BM	BEAM
BTC	BARE TINNED COPPER CONDUCTOR
BOF	BOTTOM OF FOOTING
CAB	CABINET
CANT	CANTILEVERED
CHG	CHARGING
CLG	CEILING
CLR	CLEAR
COL	COLUMN
COMM	COMMON
CONC	CONCRETE
CONSTR	CONSTRUCTION
DBL	DOUBLE
DC	DIRECT CURRENT
DEPT	DEPARTMENT
DF	DOUGLAS FIR
DIA	DIAMETER
DIAG	DIAGONAL
DIM	DIMENSION
DWG	DRAWING
DWL	DOWEL
EA	EACH
EC	ELECTRICAL CONDUCTOR
EL.	ELEVATION
ELEC	ELECTRICAL
EMT	ELECTRICAL METALLIC TUBING
ENG	ENGINEER
EQ	EQUAL
EXP	EXPANSION
EXT	EXTERIOR
EW	EACH WAY
FAB	FABRICATION
FF	FINISH FLOOR
FG	FINISH GRADE
FIF	FACILITY INTERFACE FRAME
FIN	FINISH(ED)
FLR	FLOOR
FDN	FOUNDATION
FOC	FACE OF CONCRETE
FOM	FACE OF MASONRY
FOS	FACE OF STUD
FOW	FACE OF WALL
FS	FINISH SURFACE
FT	FOOT
FTG	FOOTING
GA	GAUGE
GEN	GENERATOR
GFCI	GROUND FAULT CIRCUIT INTERRUPTER
GLB	GLUE LAMINATED BEAM
GLV	GALVANIZED
GPS	GLOBAL POSITIONING SYSTEM
GND	GROUND
GSM	GLOBAL SYSTEM FOR MOBILE
HDG	HOT DIPPED GALVANIZED
HDR	HEADER
HGR	HANGER
HVAC	HEAT/VENTILATION/AIR CONDITIONING
HT	HEIGHT
IGR	INTERIOR GROUND RING
IN	INCH
INT	INTERIOR
LB(S)	POUND(S)
LF	LINEAR FEET
LTE	LONG TERM EVOLUTION
MAS	MASONRY
MAX	MAXIMUM
MB	MACHINE BOLT
MECH	MECHANICAL
MFR	MANUFACTURER
MGB	MASTER GROUND BAR
MIN	MINIMUM
MISC	MISCELLANEOUS
MTL	METAL
MTS	MANUAL TRANSFER SWITCH
MW	MICROWAVE
NEC	NATIONAL ELECTRIC CODE
NM	NEWTON METERS
NO.	NUMBER
#	NUMBER
NTS	NOT TO SCALE
OC	ON-CENTER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
OPNG	OPENING
P/C	PRECAST CONCRETE
PCS	PERSONAL COMMUNICATION SERVICES
PCU	PRIMARY CONTROL UNIT
PRC	PRIMARY RADIO CABINET
PP	POLARIZING PRESERVING
PSF	POUNDS PER SQUARE FOOT
PSI	POUNDS PER SQUARE INCH
PT	PRESSURE TREATED
PWR	POWER CABINET
QTY	QUANTITY
RAD	RADIUS
RECT	RECTIFIER
REF	REFERENCE
REINF	REINFORCEMENT
REQ'D	REQUIRED
RET	REMOTE ELECTRIC TILT
RF	RADIO FREQUENCY
RMC	RIGID METALLIC CONDUIT
RRH	REMOTE RADIO HEAD
RRU	REMOTE RADIO UNIT
RWY	RACEWAY
SCH	SCHEDULE
SHT	SHEET
SIAD	SMART INTEGRATED ACCESS DEVICE
SIM	SIMILAR
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
STL	STEEL
TEMP	TEMPORARY
THK	THICKNESS
TMA	TOWER MOUNTED AMPLIFIER
TN	TOE NAIL
TOA	TOP OF ANTENNA
TOC	TOP OF CURB
TOF	TOP OF FOUNDATION
TOP	TOP OF PLATE (PARAPET)
TOS	TOP OF STEEL
TOW	TOP OF WALL
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSION
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORY
UNO	UNLESS NOTED OTHERWISE
UMTS	UNIVERSAL MOBILE TELECOMMUNICATIONS SYSTEM
UPS	UNITERRUPTIBLE POWER SYSTEM (DC POWER PLANT)
VIF	VERIFIED IN FIELD
W	WIDE
W/	WITH
WD	WOOD
WP	WEATHERPROOF
WT	WEIGHT

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PROFESSIONAL ENGINEER
SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

LEGEND AND ABBREVIATIONS

SHEET NUMBER

GN-1

SIGN TYPES		
TYPE	COLOR	COLOR CODE PURPOSE
INFORMATION	GREEN	**"INFORMATIONAL SIGN"** TO NOTIFY OTHERS OF SITE OWNERSHIP & CONTACT NUMBER AND POTENTIAL RF EXPOSURE.
NOTICE	BLUE	**"NOTICE BEYOND THIS POINT"** RF FIELDS BEYOND THIS POINT MAY EXCEED THE FCC GENERAL PUBLIC EXPOSURE LIMIT. OBEY ALL POSTED SIGNS AND SITE GUIDELINES FOR WORKING IN RF ENVIRONMENTS. IN ACCORDANCE WITH FEDERAL COMMUNICATIONS COMMISSION RULES ON RADIO FREQUENCY EMISSIONS 47 CFR-1.1307(b)
CAUTION	YELLOW	**"CAUTION BEYOND THIS POINT"** RF FIELDS BEYOND THIS POINT MAY EXCEED THE FCC GENERAL PUBLIC EXPOSURE LIMIT. OBEY ALL POSTED SIGNS AND SITE GUIDELINES FOR WORKING IN RF ENVIRONMENTS. IN ACCORDANCE WITH FEDERAL COMMUNICATIONS COMMISSION RULES ON RADIO FREQUENCY EMISSIONS 47 CFR-1.1307(b)
WARNING	ORANGE/RED	**"WARNING BEYOND THIS POINT"** RF FIELDS AT THIS SITE EXCEED FCC RULES FOR HUMAN EXPOSURE. FAILURE TO OBEY ALL POSTED SIGNS AND SITE GUIDELINES FOR WORKING IN RF ENVIRONMENTS COULD RESULT IN SERIOUS INJURY. IN ACCORDANCE WITH FEDERAL COMMUNICATIONS COMMISSION RULES ON RADIO FREQUENCY EMISSIONS 47 CFR-1.1307(b)

SIGN PLACEMENT:

- RF SIGNAGE PLACEMENT SHALL FOLLOW THE RECOMMENDATIONS OF AN EXISTING EME REPORT, CREATED BY A THIRD PARTY PREVIOUSLY AUTHORIZED BY DISH Wireless L.L.C.
- INFORMATION SIGN (GREEN) SHALL BE LOCATED ON EXISTING DISH Wireless L.L.C EQUIPMENT.
  A) IF THE INFORMATION SIGN IS A STICKER, IT SHALL BE PLACED ON EXISTING DISH Wireless L.L.C EQUIPMENT CABINET.
  B) IF THE INFORMATION SIGH IS A METAL SIGN IT SHALL BE PLACED ON EXISTING DISH Wireless L.L.C H-FRAME WITH A SECURE ATTACH METHOD.
- IF EME REPORT IS NOT AVAILABLE AT THE TIME OF CREATION OF CONSTRUCTION DOCUMENTS; PLEASE CONTACT DISH Wireless L.L.C. CONSTRUCTION MANAGER FOR FURTHER INSTRUCTION ON HOW TO PROCEED.

NOTES:

1. FOR DISH Wireless L.L.C. LOGO, SEE DISH Wireless L.L.C. DESIGN SPECIFICATIONS (PROVIDED BY DISH Wireless L.L.C.)
2. SITE ID SHALL BE APPLIED TO SIGNS USING "LASER ENGRAVING" OR ANY OTHER WEATHER RESISTANT METHOD (DISH Wireless L.L.C. APPROVAL REQUIRED)
3. TEXT FOR SIGNAGE SHALL INDICATE CORRECT SITE NAME AND NUMBER AS PER DISH Wireless L.L.C. CONSTRUCTION MANAGER RECOMMENDATIONS.
4. CABINET/SHELTER MOUNTING APPLICATION REQUIRES ANOTHER PLATE APPLIED TO THE FACE OF THE CABINET WITH WATER PROOF POLYURETHANE ADHESIVE
5. ALL SIGNS WILL BE SECURED WITH EITHER STAINLESS STEEL ZIP TIES OR STAINLESS STEEL TECH SCREWS
6. ALL SIGNS TO BE 8.5"x11" AND MADE WITH 0.04" OF ALUMINUM MATERIAL

INFORMATION

This is an access point to an area with transmitting antennas.

Obey all signs and barriers beyond this point.
Call the DISH Wireless L.L.C. NOC at 1-866-624-6874

Site ID: _____

THIS SIGN IS FOR REFERENCE PURPOSES ONLY

NOTICE

Transmitting Antenna(s)

Radio frequency fields beyond this point MAY *EXCEED* the FCC Occupational exposure limit.

Obey all posted signs and site guidelines for working in radio frequency environments.

Call the DISH Wireless L.L.C. NOC at 1-866-624-6874 prior to working beyond this point.

Site ID: _____

dish

THIS SIGN IS FOR REFERENCE PURPOSES ONLY

CAUTION

Transmitting Antenna(s)

Radio frequency fields beyond this point MAY *EXCEED* the FCC Occupational exposure limit.

Obey all posted signs and site guidelines for working in radio frequency environments.

Call the DISH Wireless L.L.C. NOC at 1-866-624-6874 prior to working beyond this point.

Site ID: _____

dish

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WARNING

Transmitting Antenna(s)

Radio frequency fields beyond this point *EXCEED* the FCC Occupational exposure limit.

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Call the DISH Wireless L.L.C. NOC at 1-866-624-6874 prior to working beyond this point.

Site ID: _____

dish

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RF SIGNAGE

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5701 SOUTH SANTA FE DRIVE
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DISH Wireless L.L.C.
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4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE
RF
SIGNAGE

SHEET NUMBER
GN-2

SITE ACTIVITY REQUIREMENTS:

1. NOTICE TO PROCEED – NO WORK SHALL COMMENCE PRIOR TO CONTRACTOR RECEIVING A WRITTEN NOTICE TO PROCEED (NTP) AND THE ISSUANCE OF A PURCHASE ORDER. PRIOR TO ACCESSING/ENTERING THE SITE YOU MUST CONTACT THE DISH Wireless L.L.C. AND TOWER OWNER NOC & THE DISH Wireless L.L.C. AND TOWER OWNER CONSTRUCTION MANAGER.

2. "LOOK UP" – DISH Wireless L.L.C. AND TOWER OWNER SAFETY CLIMB REQUIREMENT:

THE INTEGRITY OF THE SAFETY CLIMB AND ALL COMPONENTS OF THE CLIMBING FACILITY SHALL BE CONSIDERED DURING ALL STAGES OF DESIGN, INSTALLATION, AND INSPECTION. TOWER MODIFICATION, MOUNT REINFORCEMENTS, AND/OR EQUIPMENT INSTALLATIONS SHALL NOT COMPROMISE THE INTEGRITY OR FUNCTIONAL USE OF THE SAFETY CLIMB OR ANY COMPONENTS OF THE CLIMBING FACILITY ON THE STRUCTURE. THIS SHALL INCLUDE, BUT NOT BE LIMITED TO: PINCHING OF THE WIRE ROPE, BENDING OF THE WIRE ROPE FROM ITS SUPPORTS, DIRECT CONTACT OR CLOSE PROXIMITY TO THE WIRE ROPE WHICH MAY CAUSE FRICTIONAL WEAR, IMPACT TO THE ANCHORAGE POINTS IN ANY WAY, OR TO IMPEDE/BLOCK ITS INTENDED USE. ANY COMPROMISED SAFETY CLIMB, INCLUDING EXISTING CONDITIONS MUST BE TAGGED OUT AND REPORTED TO YOUR DISH Wireless L.L.C. AND DISH Wireless L.L.C. AND TOWER OWNER POC OR CALL THE NOC TO GENERATE A SAFETY CLIMB MAINTENANCE AND CONTRACTOR NOTICE TICKET.

3. PRIOR TO THE START OF CONSTRUCTION, ALL REQUIRED JURISDICTIONAL PERMITS SHALL BE OBTAINED. THIS INCLUDES, BUT IS NOT LIMITED TO, BUILDING, ELECTRICAL, MECHANICAL, FIRE, FLOOD ZONE, ENVIRONMENTAL, AND ZONING. AFTER ONSITE ACTIVITIES AND CONSTRUCTION ARE COMPLETED, ALL REQUIRED PERMITS SHALL BE SATISFIED AND CLOSED OUT ACCORDING TO LOCAL JURISDICTIONAL REQUIREMENTS.

4. ALL CONSTRUCTION MEANS AND METHODS; INCLUDING BUT NOT LIMITED TO, ERECTION PLANS, RIGGING PLANS, CLIMBING PLANS, AND RESCUE PLANS SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR RESPONSIBLE FOR THE EXECUTION OF THE WORK CONTAINED HEREIN, AND SHALL MEET ANSI/ASSE A10.48 (LATEST EDITION); FEDERAL, STATE, AND LOCAL REGULATIONS; AND ANY APPLICABLE INDUSTRY CONSENSUS STANDARDS RELATED TO THE CONSTRUCTION ACTIVITIES BEING PERFORMED. ALL RIGGING PLANS SHALL ADHERE TO ANSI/ASSE A10.48 (LATEST EDITION) AND DISH Wireless L.L.C. AND TOWER OWNER STANDARDS, INCLUDING THE REQUIRED INVOLVEMENT OF A QUALIFIED ENGINEER FOR CLASS IV CONSTRUCTION, TO CERTIFY THE SUPPORTING STRUCTURE(S) IN ACCORDANCE WITH ANSI/TIA-322 (LATEST EDITION).

5. ALL SITE WORK TO COMPLY WITH DISH Wireless L.L.C. AND TOWER OWNER INSTALLATION STANDARDS FOR CONSTRUCTION ACTIVITIES ON DISH Wireless L.L.C. AND TOWER OWNER TOWER SITE AND LATEST VERSION OF ANSI/TIA-1019-A-2012 "STANDARD FOR INSTALLATION, ALTERATION, AND MAINTENANCE OF ANTENNA SUPPORTING STRUCTURES AND ANTENNAS."

6. IF THE SPECIFIED EQUIPMENT CAN NOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION FOR APPROVAL BY DISH Wireless L.L.C. AND TOWER OWNER PRIOR TO PROCEEDING WITH ANY SUCH CHANGE OF INSTALLATION.

7. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES. CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.

8. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.

9. THE CONTRACTOR SHALL CONTACT UTILITY LOCATING SERVICES INCLUDING PRIVATE LOCATES SERVICES PRIOR TO THE START OF CONSTRUCTION.

10. ALL EXISTING ACTIVE SEWER, WATER, GAS, ELECTRIC AND OTHER UTILITIES WHERE ENCOUNTERED IN THE WORK, SHALL BE PROTECTED AT ALL TIMES AND WHERE REQUIRED FOR THE PROPER EXECUTION OF THE WORK, SHALL BE RELOCATED AS DIRECTED BY CONTRACTOR. EXTREME CAUTION SHOULD BE USED BY THE CONTRACTOR WHEN EXCAVATING OR DRILLING PIERS AROUND OR NEAR UTILITIES. CONTRACTOR SHALL PROVIDE SAFETY TRAINING FOR THE WORKING CREW. THIS WILL INCLUDE BUT NOT BE LIMITED TO A) FALL PROTECTION B) CONFINED SPACE C) ELECTRICAL SAFETY D) TRENCHING AND EXCAVATION E) CONSTRUCTION SAFETY PROCEDURES.

11. ALL SITE WORK SHALL BE AS INDICATED ON THE STAMPED CONSTRUCTION DRAWINGS AND DISH PROJECT SPECIFICATIONS, LATEST APPROVED REVISION.

12. CONTRACTOR SHALL KEEP THE SITE FREE FROM ACCUMULATING WASTE MATERIAL, DEBRIS, AND TRASH AT THE COMPLETION OF THE WORK. IF NECESSARY, RUBBISH, STUMPS, DEBRIS, STICKS, STONES AND OTHER REFUSE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF LEGALLY.

13. ALL EXISTING INACTIVE SEWER, WATER, GAS, ELECTRIC AND OTHER UTILITIES, WHICH INTERFERE WITH THE EXECUTION OF THE WORK, SHALL BE REMOVED AND/OR CAPPED, PLUGGED OR OTHERWISE DISCONTINUED AT POINTS WHICH WILL NOT INTERFERE WITH THE EXECUTION OF THE WORK, SUBJECT TO THE APPROVAL OF DISH Wireless L.L.C. AND TOWER OWNER, AND/OR LOCAL UTILITIES.

14. THE CONTRACTOR SHALL PROVIDE SITE SIGNAGE IN ACCORDANCE WITH THE TECHNICAL SPECIFICATION FOR SITE SIGNAGE REQUIRED BY LOCAL JURISDICTION AND SIGNAGE REQUIRED ON INDIVIDUAL PIECES OF EQUIPMENT, ROOMS, AND SHELTERS.

15. THE SITE SHALL BE GRADED TO CAUSE SURFACE WATER TO FLOW AWAY FROM THE CARRIER'S EQUIPMENT AND TOWER AREAS.

16. THE SUB GRADE SHALL BE COMPACTED AND BROUGHT TO A SMOOTH UNIFORM GRADE PRIOR TO FINISHED SURFACE APPLICATION.

17. THE AREAS OF THE OWNERS PROPERTY DISTURBED BY THE WORK AND NOT COVERED BY THE TOWER, EQUIPMENT OR DRIVEWAY, SHALL BE GRADED TO A UNIFORM SLOPE, AND STABILIZED TO PREVENT EROSION AS SPECIFIED ON THE CONSTRUCTION DRAWINGS AND/OR PROJECT SPECIFICATIONS.

18. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING SITE DURING CONSTRUCTION. EROSION CONTROL MEASURES, IF REQUIRED DURING CONSTRUCTION, SHALL BE IN CONFORMANCE WITH THE LOCAL GUIDELINES FOR EROSION AND SEDIMENT CONTROL.

19. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF OWNER.

20. CONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS AND RADIOS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.

21. CONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION. TRASH AND DEBRIS SHOULD BE REMOVED FROM SITE ON A DAILY BASIS.

22. NO FILL OR EMBANKMENT MATERIAL SHALL BE PLACED ON FROZEN GROUND. FROZEN MATERIALS, SNOW OR ICE SHALL NOT BE PLACED IN ANY FILL OR EMBANKMENT.

GENERAL NOTES:

1.FOR THE PURPOSE OF CONSTRUCTION DRAWING, THE FOLLOWING DEFINITIONS SHALL APPLY:

CONTRACTOR:GENERAL CONTRACTOR RESPONSIBLE FOR CONSTRUCTION

CARRIER:DISH Wireless L.L.C.

TOWER OWNER:TOWER OWNER

2. THESE DRAWINGS HAVE BEEN PREPARED USING STANDARDS OF PROFESSIONAL CARE AND COMPLETENESS NORMALLY EXERCISED UNDER SIMILAR CIRCUMSTANCES BY REPUTABLE ENGINEERS IN THIS OR SIMILAR LOCALITIES. IT IS ASSUMED THAT THE WORK DEPICTED WILL BE PERFORMED BY AN EXPERIENCED CONTRACTOR AND/OR WORKPEOPLE WHO HAVE A WORKING KNOWLEDGE OF THE APPLICABLE CODE STANDARDS AND REQUIREMENTS AND OF INDUSTRY ACCEPTED STANDARD GOOD PRACTICE. AS NOT EVERY CONDITION OR ELEMENT IS (OR CAN BE) EXPLICITLY SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL USE INDUSTRY ACCEPTED STANDARD GOOD PRACTICE FOR MISCELLANEOUS WORK NOT EXPLICITLY SHOWN.

3. THESE DRAWINGS REPRESENT THE FINISHED STRUCTURE. THEY DO NOT INDICATE THE MEANS OR METHODS OF CONSTRUCTION. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR THE CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, AND PROCEDURES. THE CONTRACTOR SHALL PROVIDE ALL MEASURES NECESSARY FOR PROTECTION OF LIFE AND PROPERTY DURING CONSTRUCTION. SUCH MEASURES SHALL INCLUDE, BUT NOT BE LIMITED TO, BRACING, FORMWORK, SHORING, ETC. SITE VISITS BY THE ENGINEER OR HIS REPRESENTATIVE WILL NOT INCLUDE INSPECTION OF THESE ITEMS AND IS FOR STRUCTURAL OBSERVATION OF THE FINISHED STRUCTURE ONLY.

4. NOTES AND DETAILS IN THE CONSTRUCTION DRAWINGS SHALL TAKE PRECEDENCE OVER GENERAL NOTES AND TYPICAL DETAILS. WHERE NO DETAILS ARE SHOWN, CONSTRUCTION SHALL CONFORM TO SIMILAR WORK ON THE PROJECT, AND/OR AS PROVIDED FOR IN THE CONTRACT DOCUMENTS. WHERE DISCREPANCIES OCCUR BETWEEN PLANS, DETAILS, GENERAL NOTES, AND SPECIFICATIONS, THE GREATER, MORE STRICT REQUIREMENTS, SHALL GOVERN. IF FURTHER CLARIFICATION IS REQUIRED CONTACT THE ENGINEER OF RECORD.

5. SUBSTANTIAL EFFORT HAS BEEN MADE TO PROVIDE ACCURATE DIMENSIONS AND MEASUREMENTS ON THE DRAWINGS TO ASSIST IN THE FABRICATION AND/OR PLACEMENT OF CONSTRUCTION ELEMENTS BUT IT IS THE SOLE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY THE DIMENSIONS, MEASUREMENTS, AND/OR CLEARANCES SHOWN IN THE CONSTRUCTION DRAWINGS PRIOR TO FABRICATION OR CUTTING OF ANY NEW OR EXISTING CONSTRUCTION ELEMENTS. IF IT IS DETERMINED THAT THERE ARE DISCREPANCIES AND/OR CONFLICTS WITH THE CONSTRUCTION DRAWINGS THE ENGINEER OF RECORD IS TO BE NOTIFIED AS SOON AS POSSIBLE.

6. PRIOR TO THE SUBMISSION OF BIDS, THE BIDDING CONTRACTOR SHALL VISIT THE CELL SITE TO FAMILIARIZE WITH THE EXISTING CONDITIONS AND TO CONFIRM THAT THE WORK CAN BE ACCOMPLISHED AS SHOWN ON THE CONSTRUCTION DRAWINGS. ANY DISCREPANCY FOUND SHALL BE BROUGHT TO THE ATTENTION OF CARRIER POC AND TOWER OWNER.

7. ALL MATERIALS FURNISHED AND INSTALLED SHALL BE IN STRICT ACCORDANCE WITH ALL APPLICABLE CODES, REGULATIONS AND ORDINANCES. CONTRACTOR SHALL ISSUE ALL APPROPRIATE NOTICES AND COMPLY WITH ALL LAWS, ORDINANCES, RULES, REGULATIONS AND LAWFUL ORDERS OF ANY PUBLIC AUTHORITY REGARDING THE PERFORMANCE OF THE WORK. ALL WORK CARRIED OUT SHALL COMPLY WITH ALL APPLICABLE MUNICIPAL AND UTILITY COMPANY SPECIFICATIONS AND LOCAL JURISDICTIONAL CODES, ORDINANCES AND APPLICABLE REGULATIONS.

8. UNLESS NOTED OTHERWISE, THE WORK SHALL INCLUDE FURNISHING MATERIALS, EQUIPMENT, APPURTENANCES AND LABOR NECESSARY TO COMPLETE ALL INSTALLATIONS AS INDICATED ON THE DRAWINGS.

9. THE CONTRACTOR SHALL INSTALL ALL EQUIPMENT AND MATERIALS IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS UNLESS SPECIFICALLY STATED OTHERWISE.

10. IF THE SPECIFIED EQUIPMENT CAN NOT BE INSTALLED AS SHOWN ON THESE DRAWINGS, THE CONTRACTOR SHALL PROPOSE AN ALTERNATIVE INSTALLATION FOR APPROVAL BY THE CARRIER AND TOWER OWNER PRIOR TO PROCEEDING WITH ANY SUCH CHANGE OF INSTALLATION.

11. CONTRACTOR IS TO PERFORM A SITE INVESTIGATION, BEFORE SUBMITTING BIDS, TO DETERMINE THE BEST ROUTING OF ALL CONDUITS FOR POWER, AND TELCO AND FOR GROUNDING CABLES AS SHOWN IN THE POWER, TELCO, AND GROUNDING PLAN DRAWINGS.

12. THE CONTRACTOR SHALL PROTECT EXISTING IMPROVEMENTS, PAVEMENTS, CURBS, LANDSCAPING AND STRUCTURES. ANY DAMAGED PART SHALL BE REPAIRED AT CONTRACTOR'S EXPENSE TO THE SATISFACTION OF DISH Wireless L.L.C. AND TOWER OWNER

13. CONTRACTOR SHALL LEGALLY AND PROPERLY DISPOSE OF ALL SCRAP MATERIALS SUCH AS COAXIAL CABLES AND OTHER ITEMS REMOVED FROM THE EXISTING FACILITY. ANTENNAS REMOVED SHALL BE RETURNED TO THE OWNER'S DESIGNATED LOCATION.

14. CONTRACTOR SHALL LEAVE PREMISES IN CLEAN CONDITION. TRASH AND DEBRIS SHOULD BE REMOVED FROM SITE ON A DAILY BASIS.

dish wireless.

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Where quality still counts.

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TIM ALEXANDER
44563
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10/31/2023
PROFESSIONAL ENGINEER

SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

GN-3

CONCRETE, FOUNDATIONS, AND REINFORCING STEEL:

1. ALL CONCRETE WORK SHALL BE IN ACCORDANCE WITH THE ACI 301, ACI 318, ACI 336, ASTM A184, ASTM A185 AND THE DESIGN AND CONSTRUCTION SPECIFICATION FOR CAST-IN-PLACE CONCRETE.

2. UNLESS NOTED OTHERWISE, SOIL BEARING PRESSURE USED FOR DESIGN OF SLABS AND FOUNDATIONS IS ASSUMED TO BE 1000 psf.

3. ALL CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH (f'c) OF 3000 psi AT 28 DAYS, UNLESS NOTED OTHERWISE. NO MORE THAN 90 MINUTES SHALL ELAPSE FROM BATCH TIME TO TIME OF PLACEMENT UNLESS APPROVED BY THE ENGINEER OF RECORD. TEMPERATURE OF CONCRETE SHALL NOT EXCEED 90°f AT TIME OF PLACEMENT.

4. CONCRETE EXPOSED TO FREEZE-THAW CYCLES SHALL CONTAIN AIR ENTRAINING ADMIXTURES. AMOUNT OF AIR ENTRAINMENT TO BE BASED ON SIZE OF AGGREGATE AND F3 CLASS EXPOSURE (VERY SEVERE). CEMENT USED TO BE TYPE II PORTLAND CEMENT WITH A MAXIMUM WATER-TO-CEMENT RATIO (W/C) OF 0.45.

5. ALL STEEL REINFORCING SHALL CONFORM TO ASTM A615. ALL WELDED WIRE FABRIC (WWF) SHALL CONFORM TO ASTM A185. ALL SPLICES SHALL BE CLASS "B" TENSION SPLICES, UNLESS NOTED OTHERWISE. ALL HOOKS SHALL BE STANDARD 90 DEGREE HOOKS, UNLESS NOTED OTHERWISE. YIELD STRENGTH (Fy) OF STANDARD DEFORMED BARS ARE AS FOLLOWS:

#4 BARS AND SMALLER 40 ksi

#5 BARS AND LARGER 60 ksi

6. THE FOLLOWING MINIMUM CONCRETE COVER SHALL BE PROVIDED FOR REINFORCING STEEL UNLESS SHOWN OTHERWISE ON DRAWINGS:

- CONCRETE CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH 3"
- CONCRETE EXPOSED TO EARTH OR WEATHER:
- #6 BARS AND LARGER 2"
- #5 BARS AND SMALLER 1-1/2"
- CONCRETE NOT EXPOSED TO EARTH OR WEATHER:
- SLAB AND WALLS 3/4"
- BEAMS AND COLUMNS 1-1/2"

7. A TOOLED EDGE OR A 3/4" CHAMFER SHALL BE PROVIDED AT ALL EXPOSED EDGES OF CONCRETE, UNLESS NOTED OTHERWISE, IN ACCORDANCE WITH ACI 301 SECTION 4.2.4.

ELECTRICAL INSTALLATION NOTES:

1. ALL ELECTRICAL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS, NEC AND ALL APPLICABLE FEDERAL, STATE, AND LOCAL CODES/ORDINANCES.

2. CONDUIT ROUTINGS ARE SCHEMATIC. CONTRACTOR SHALL INSTALL CONDUITS SO THAT ACCESS TO EQUIPMENT IS NOT BLOCKED AND TRIP HAZARDS ARE ELIMINATED.

3. WIRING, RACEWAY AND SUPPORT METHODS AND MATERIALS SHALL COMPLY WITH THE REQUIREMENTS OF THE NEC.

4. ALL CIRCUITS SHALL BE SEGREGATED AND MAINTAIN MINIMUM CABLE SEPARATION AS REQUIRED BY THE NEC.

4.1. ALL EQUIPMENT SHALL BEAR THE UNDERWRITERS LABORATORIES LABEL OF APPROVAL, AND SHALL CONFORM TO REQUIREMENT OF THE NATIONAL ELECTRICAL CODE.

4.2. ALL OVERCURRENT DEVICES SHALL HAVE AN INTERRUPTING CURRENT RATING THAT SHALL BE GREATER THAN THE SHORT CIRCUIT CURRENT TO WHICH THEY ARE SUBJECTED, 22,000 AIC MINIMUM. VERIFY AVAILABLE SHORT CIRCUIT CURRENT DOES NOT EXCEED THE RATING OF ELECTRICAL EQUIPMENT IN ACCORDANCE WITH ARTICLE 110.24 NEC OR THE MOST CURRENT ADOPTED CODE PRE THE GOVERNING JURISDICTION.

5. EACH END OF EVERY POWER PHASE CONDUCTOR, GROUNDING CONDUCTOR, AND TELCO CONDUCTOR OR CABLE SHALL BE LABELED WITH COLOR-CODED INSULATION OR ELECTRICAL TAPE (3M BRAND, 1/2" PLASTIC ELECTRICAL TAPE WITH UV PROTECTION, OR EQUAL). THE IDENTIFICATION METHOD SHALL CONFORM WITH NEC AND OSHA.

6. ALL ELECTRICAL COMPONENTS SHALL BE CLEARLY LABELED WITH LAMICOID TAGS SHOWING THEIR RATED VOLTAGE, PHASE CONFIGURATION, WIRE CONFIGURATION, POWER OR AMPACITY RATING AND BRANCH CIRCUIT ID NUMBERS (i.e. PANEL BOARD AND CIRCUIT ID'S).

7. PANEL BOARDS (ID NUMBERS) SHALL BE CLEARLY LABELED WITH PLASTIC LABELS.

8. TIE WRAPS ARE NOT ALLOWED.

9. ALL POWER AND EQUIPMENT GROUND WIRING IN TUBING OR CONDUIT SHALL BE SINGLE COPPER CONDUCTOR (#14 OR LARGER) WITH TYPE THHW, THWN, THWN-2, XHHW, XHHW-2, THW, THW-2, RHW, OR RHW-2 INSULATION UNLESS OTHERWISE SPECIFIED.

10. SUPPLEMENTAL EQUIPMENT GROUND WIRING LOCATED INDOORS SHALL BE SINGLE COPPER CONDUCTOR (#6 OR LARGER) WITH TYPE THHW, THWN, THWN-2, XHHW, XHHW-2, THW, THW-2, RHW, OR RHW-2 INSULATION UNLESS OTHERWISE SPECIFIED.

11. POWER AND CONTROL WIRING IN FLEXIBLE CORD SHALL BE MULTI-CONDUCTOR, TYPE SOOW CORD (#14 OR LARGER) UNLESS OTHERWISE SPECIFIED.

12. POWER AND CONTROL WIRING FOR USE IN CABLE TRAY SHALL BE MULTI-CONDUCTOR, TYPE TC CABLE (#14 OR LARGER), WITH TYPE THHW, THWN, THWN-2, XHHW, XHHW-2, THW, THW-2, RHW, OR RHW-2 INSULATION UNLESS OTHERWISE SPECIFIED.

13. ALL POWER AND GROUNDING CONNECTIONS SHALL BE CRIMP-STYLE, COMPRESSION WIRE LUGS AND WIRE NUTS BY THOMAS AND BETTS (OR EQUAL). LUGS AND WIRE NUTS SHALL BE RATED FOR OPERATION NOT LESS THAN 75° C (90° C IF AVAILABLE).

14. RACEWAY AND CABLE TRAY SHALL BE LISTED OR LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE AND NEC.

15. ELECTRICAL METALLIC TUBING (EMT), INTERMEDIATE METAL CONDUIT (IMC), OR RIGID METAL CONDUIT (RMC) SHALL BE USED FOR EXPOSED INDOOR LOCATIONS.

16. ELECTRICAL METALLIC TUBING (EMT) OR METAL-CLAD CABLE (MC) SHALL BE USED FOR CONCEALED INDOOR LOCATIONS.

17. SCHEDULE 40 PVC UNDERGROUND ON STRAIGHTS AND SCHEDULE 80 PVC FOR ALL ELBOWS/90s AND ALL APPROVED ABOVE GRADE PVC CONDUIT.

18. LIQUID-TIGHT FLEXIBLE METALLIC CONDUIT (LIQUID-TITE FLEX) SHALL BE USED INDOORS AND OUTDOORS, WHERE VIBRATION OCCURS OR FLEXIBILITY IS NEEDED.

19. CONDUIT AND TUBING FITTINGS SHALL BE THREADED OR COMPRESSION-TYPE AND APPROVED FOR THE LOCATION USED. SET SCREW FITTINGS ARE NOT ACCEPTABLE.

20. CABINETS, BOXES AND WIRE WAYS SHALL BE LABELED FOR ELECTRICAL USE IN ACCORDANCE WITH NEMA, UL, ANSI/IEEE AND THE NEC.

21. WIREWAYS SHALL BE METAL WITH AN ENAMEL FINISH AND INCLUDE A HINGED COVER, DESIGNED TO SWING OPEN DOWNWARDS (WIREMOLD SPECMATE WIREWAY).

22. SLOTTED WIRING DUCT SHALL BE PVC AND INCLUDE COVER (PANDUIT TYPE E OR EQUAL).

23. CONDUITS SHALL BE FASTENED SECURELY IN PLACE WITH APPROVED NON-PERFORATED STRAPS AND HANGERS. EXPLOSIVE DEVICES (i.e. POWDER-ACTUATED) FOR ATTACHING HANGERS TO STRUCTURE WILL NOT BE PERMITTED. CLOSELY FOLLOW THE LINES OF THE STRUCTURE, MAINTAIN CLOSE PROXIMITY TO THE STRUCTURE AND KEEP CONDUITS IN TIGHT ENVELOPES. CHANGES IN DIRECTION TO ROUTE AROUND OBSTACLES SHALL BE MADE WITH CONDUIT OUTLET BODIES. CONDUIT SHALL BE INSTALLED IN A NEAT AND WORKMANLIKE MANNER. PARALLEL AND PERPENDICULAR TO STRUCTURE WALL AND CEILING LINES. ALL CONDUIT SHALL BE FISHED TO CLEAR OBSTRUCTIONS. ENDS OF CONDUITS SHALL BE TEMPORARILY CAPPED FLUSH TO FINISH GRADE TO PREVENT CONCRETE, PLASTER OR DIRT FROM ENTERING. CONDUITS SHALL BE RIGIDLY CLAMPED TO BOXES BY GALVANIZED MALLEABLE IRON BUSHING ON INSIDE AND GALVANIZED MALLEABLE IRON LOCKNUT ON OUTSIDE AND INSIDE.

24. EQUIPMENT CABINETS, TERMINAL BOXES, JUNCTION BOXES AND PULL BOXES SHALL BE GALVANIZED OR EPOXY-COATED SHEET STEEL. SHALL MEET OR EXCEED UL 50 AND BE RATED NEMA 1 (OR BETTER) FOR INTERIOR LOCATIONS AND NEMA 3 (OR BETTER) FOR EXTERIOR LOCATIONS.

25. METAL RECEPTACLE, SWITCH AND DEVICE BOXES SHALL BE GALVANIZED, EPOXY-COATED OR NON-CORRODING; SHALL MEET OR EXCEED UL 514A AND NEMA OS 1 AND BE RATED NEMA 1 (OR BETTER) FOR INTERIOR LOCATIONS AND WEATHER PROTECTED (WP OR BETTER) FOR EXTERIOR LOCATIONS.

26. NONMETALLIC RECEPTACLE, SWITCH AND DEVICE BOXES SHALL MEET OR EXCEED NEMA OS 2 (NEWEST REVISION) AND BE RATED NEMA 1 (OR BETTER) FOR INTERIOR LOCATIONS AND WEATHER PROTECTED (WP OR BETTER) FOR EXTERIOR LOCATIONS.

27. THE CONTRACTOR SHALL NOTIFY AND OBTAIN NECESSARY AUTHORIZATION FROM THE CARRIER AND/OR DISH Wireless L.L.C. AND TOWER OWNER BEFORE COMMENCING WORK ON THE AC POWER DISTRIBUTION PANELS.

28. THE CONTRACTOR SHALL PROVIDE NECESSARY TAGGING ON THE BREAKERS, CABLES AND DISTRIBUTION PANELS IN ACCORDANCE WITH THE APPLICABLE CODES AND STANDARDS TO SAFEGUARD LIFE AND PROPERTY.

29. INSTALL LAMICOID LABEL ON THE METER CENTER TO SHOW "DISH Wireless L.L.C.".

30. ALL EMPTY/SPARE CONDUITS THAT ARE INSTALLED ARE TO HAVE A METERED MULE TAPE PULL CORD INSTALLED.

dish wireless.

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Where quality still counts.
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PROFESSIONAL ENGINEER

SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

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C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
4800 N HIMALAYA RD UNIT
DISH
DENVER, CO 80249

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

GN-4

GROUNDING NOTES:

1. ALL GROUND ELECTRODE SYSTEMS (INCLUDING TELECOMMUNICATION, RADIO, LIGHTNING PROTECTION AND AC POWER GES'S) SHALL BE BONDED TOGETHER AT OR BELOW GRADE, BY TWO OR MORE COPPER BONDING CONDUCTORS IN ACCORDANCE WITH THE NEC.

2. THE CONTRACTOR SHALL PERFORM IEEE FALL-OF-POTENTIAL RESISTANCE TO EARTH TESTING (PER IEEE 1100 AND 81) FOR GROUND ELECTRODE SYSTEMS, THE CONTRACTOR SHALL FURNISH AND INSTALL SUPPLEMENTAL GROUND ELECTRODES AS NEEDED TO ACHIEVE A TEST RESULT OF 5 OHMS OR LESS.

3. THE CONTRACTOR IS RESPONSIBLE FOR PROPERLY SEQUENCING GROUNDING AND UNDERGROUND CONDUIT INSTALLATION AS TO PREVENT ANY LOSS OF CONTINUITY IN THE GROUNDING SYSTEM OR DAMAGE TO THE CONDUIT AND PROVIDE TESTING RESULTS.

4. METAL CONDUIT AND TRAY SHALL BE GROUNDED AND MADE ELECTRICALLY CONTINUOUS WITH LISTED BONDING FITTINGS OR BY BONDING ACROSS THE DISCONTINUITY WITH #6 COPPER WIRE UL APPROVED GROUNDING TYPE CONDUIT CLAMPS.

5. METAL RACEWAY SHALL NOT BE USED AS THE NEC REQUIRED EQUIPMENT GROUND CONDUCTOR. STRANDED COPPER CONDUCTORS WITH GREEN INSULATION, SIZED IN ACCORDANCE WITH THE NEC, SHALL BE FURNISHED AND INSTALLED WITH THE POWER CIRCUITS TO BTS EQUIPMENT.

6. EACH CABINET FRAME SHALL BE DIRECTLY CONNECTED TO THE MASTER GROUND BAR WITH GREEN INSULATED SUPPLEMENTAL EQUIPMENT GROUND WIRES, #6 STRANDED COPPER OR LARGER FOR INDOOR BTS; #2 BARE SOLID TINNED COPPER FOR OUTDOOR BTS.

7. CONNECTIONS TO THE GROUND BUS SHALL NOT BE DOUBLED UP OR STACKED BACK TO BACK CONNECTIONS ON OPPOSITE SIDE OF THE GROUND BUS ARE PERMITTED.

8. ALL EXTERIOR GROUND CONDUCTORS BETWEEN EQUIPMENT/GROUND BARS AND THE GROUND RING SHALL BE #2 SOLID TINNED COPPER UNLESS OTHERWISE INDICATED.

9. ALUMINUM CONDUCTOR OR COPPER CLAD STEEL CONDUCTOR SHALL NOT BE USED FOR GROUNDING CONNECTIONS.

10. USE OF 90° BENDS IN THE PROTECTION GROUNDING CONDUCTORS SHALL BE AVOIDED WHEN 45° BENDS CAN BE ADEQUATELY SUPPORTED.

11. EXOTHERMIC WELDS SHALL BE USED FOR ALL GROUNDING CONNECTIONS BELOW GRADE.

12. ALL GROUND CONNECTIONS ABOVE GRADE (INTERIOR AND EXTERIOR) SHALL BE FORMED USING HIGH PRESS CRIMPS.

13. COMPRESSION GROUND CONNECTIONS MAY BE REPLACED BY EXOTHERMIC WELD CONNECTIONS.

14. ICE BRIDGE BONDING CONDUCTORS SHALL BE EXOTHERMICALLY BONDED OR BOLTED TO THE BRIDGE AND THE TOWER GROUND BAR.

15. APPROVED ANTIOXIDANT COATINGS (i.e. CONDUCTIVE GEL OR PASTE) SHALL BE USED ON ALL COMPRESSION AND BOLTED GROUND CONNECTIONS.

16. ALL EXTERIOR GROUND CONNECTIONS SHALL BE COATED WITH A CORROSION RESISTANT MATERIAL.

17. MISCELLANEOUS ELECTRICAL AND NON-ELECTRICAL METAL BOXES, FRAMES AND SUPPORTS SHALL BE BONDED TO THE GROUND RING, IN ACCORDANCE WITH THE NEC.

18. BOND ALL METALLIC OBJECTS WITHIN 6 ft OF MAIN GROUND RING WITH (1) #2 BARE SOLID TINNED COPPER GROUND CONDUCTOR.

19. GROUND CONDUCTORS USED FOR THE FACILITY GROUNDING AND LIGHTNING PROTECTION SYSTEMS SHALL NOT BE ROUTED THROUGH METALLIC OBJECTS THAT FORM A RING AROUND THE CONDUCTOR, SUCH AS METALLIC CONDUITS, METAL SUPPORT CLIPS OR SLEEVES THROUGH WALLS OR FLOORS. WHEN IT IS REQUIRED TO BE HOUSED IN CONDUIT TO MEET CODE REQUIREMENTS OR LOCAL CONDITIONS, NON-METALLIC MATERIAL SUCH AS PVC CONDUIT SHALL BE USED. WHERE USE OF METAL CONDUIT IS UNAVOIDABLE (i.e., NONMETALLIC CONDUIT PROHIBITED BY LOCAL CODE) THE GROUND CONDUCTOR SHALL BE BONDED TO EACH END OF THE METAL CONDUIT.

20. ALL GROUNDS THAT TRANSITION FROM BELOW GRADE TO ABOVE GRADE MUST BE #2 BARE SOLID TINNED COPPER IN 3/4" NON-METALLIC, FLEXIBLE CONDUIT FROM 24" BELOW GRADE TO WITHIN 3" TO 6" OF CAD-WELD TERMINATION POINT. THE EXPOSED END OF THE CONDUIT MUST BE SEALED WITH SILICONE CAULK. (ADD TRANSITIONING GROUND STANDARD DETAIL AS WELL).

21. BUILDINGS WHERE THE MAIN GROUNDING CONDUCTORS ARE REQUIRED TO BE ROUTED TO GRADE, THE CONTRACTOR SHALL ROUTE TWO GROUNDING CONDUCTORS FROM THE ROOFTOP, TOWERS, AND WATER TOWERS GROUNDING RING, TO THE EXISTING GROUNDING SYSTEM, THE GROUNDING CONDUCTORS SHALL NOT BE SMALLER THAN 2/0 COPPER. ROOFTOP GROUNDING RING SHALL BE BONDED TO THE EXISTING GROUNDING SYSTEM, THE BUILDING STEEL COLUMNS, LIGHTNING PROTECTION SYSTEM, AND BUILDING MAIN WATER LINE (FERROUS OR NONFERROUS METAL PIPING ONLY). DO NOT ATTACH GROUNDING TO FIRE SPRINKLER SYSTEM PIPES.

dish wireless.
5701 SOUTH SANTA FE DRIVE
LITTLETON, CO 80120

WYCO FIELD SERVICES
Where quality still counts.
6335 DOWNING ST.
DENVER, CO 80216
WYCOFS.COM

COLORADO LICENSED
TIM ALEXANDER
44563
Tim Alexander
EXP
10/31/2023
PROFESSIONAL ENGINEER
SIGNED, 15 DEC 2022

DRAWN BY:	CHECKED BY:	APPROVED BY:
AS	ML	TA

RFDS REV #: 09/15/2022

CONSTRUCTION DOCUMENTS

SUBMITTALS

REV	DATE	DESCRIPTION
A	10/18/22	ISSUED FOR REVIEW
B	12/05/22	ISSUED FOR CONSTRUCTION
C	12/06/22	ISSUED FOR CONSTRUCTION

A&E PROJECT NUMBER

DNDEN00104C

DISH Wireless L.L.C.
PROJECT INFORMATION

DNDEN00104C
DISH
4800 N HIMALAYA RD UNIT
DENVER, CO 80249

SHEET TITLE

GENERAL NOTES

SHEET NUMBER

GN-5

Colliers
Engineering
& Design

120’ Self-Support
Comprehensive Structural Analysis

FOR
DEN00104C
4800 Himalaya Rd.
Denver, CO 80249
Denver County
Lat/Long: 39.783111°, -104.754554°

Tower Utilization: 93.3%
Foundation Utilization: 62.5%

November 9, 2022

Partha Ramakrishnan, PE
Geographic Discipline Leader

COLORADO LICENSED
PARTHA RAMAKRISHNAN
52228
PROFESSIONAL ENGINEER
11/09/2022

Partha Ramakrishnan

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Location: Denver, Colorado
Reason: I have reviewed this document
Date: 2022.11.09 11:51:20-07'00'

Prepared for:

Wyco Field Services
6335 Downing Street
Denver, CO 80216

Prepared by:

Colliers Engineering & Design
7110 W Jefferson Ave, Suite 100
Lakewood, CO 80235
Main: 856-797-0412
Colliersengineering.com

CED Project No. 22964050A Rev. 0

Colliers Engineering & Design

Objective:

The objective of this report is to determine the structural capacity of the existing 120' self-support tower and foundation at the subject facility for the final wireless telecommunications configuration, per the applicable codes and standards.

Introduction:

Colliers Engineering & Design has reviewed the following documents in completing this report:

Document Type	Remarks	Source
Radio Frequency Data Sheet (RFDS)	*RFDS Site Number: DNDEN000104C, Rev. 0 dated September 15, 2022*	*Dish Wireless*
Construction Drawings	*Wyco Field Services Project #; DNDEN00104C, dated October 18, 2022*	*Wyco Field Services*
Previous Mount Analysis	*Colliers Engineering & Design Project # 21779089A, Dated May 23, 2022*	*Colliers Engineering & Design*
Previous Structural Analysis	*Otegui Structural Services, LLC Site ID: DEN Gibraltar-Existing Tower, dated March 31, 2022*	*Wyco Field Services*

Codes and Standards:

Jurisdictional adopted codes and standards:

- 2018 International Building Code

Colliers Engineering & Design utilized the following codes and standards:

- Structural Standards for Antenna Supporting Structures and Antennas ANSI/TIA-222-H
    - Ultimate Wind Speed – 120 mph (3-Second Gust)
    - Exposure Category – C
    - Risk Category – III
    - Topographic Factor, Kzt – 1.0
    - Ice Wind Speed – 50 mph (3-Second Gust)
    - Design Ice Thickness – 0.25"
    - Mean Base Elevation (AMSL) – 5419.62 ft.
    - Service Wind Speed – 60 mph (3-Second Gust)
    - Seismic Parameters (Assuming Site Class D)
        - Short Term MCER ground motion (period=0.2s), Ss – 0.187
        - Long Term MCER ground motion (period=1.0s), S1 – 0.054

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Loading Consideration:

Table 1 – Proposed Equipment Configuration

Antenna Elevation (ft)	Quantity	Antenna Manufacturer	Antenna Model	Feed Lines	Status
96.0	3	JMA	MX08FRO665-21	(1) Hybrid Cable	Proposed
	3	Fujitsu	TA80255-B605		
	3	Fujitsu	TA08025-B604		
	1	Raycap	RDIDC-9181-PF-48		

Table 2 – Other Considered Equipment

Antenna Elevation (ft)	Quantity	Antenna Manufacturer	Antenna Model	Feed Lines	Status
117.0	1	-	6' Dish	(1) 5/16"	Existing
112.0	1	-	12' Panel	(1) 7/8"	
110.0	1	-	4' Grid Dish	(1) 3/8"	
105.0	1	-	3' Yagi Antenna	(1) 5/16"	
86.0	1	-	18" Panel	(1) 5/16"	
82.0	1	RFS	DB-B1-6C-12AB-0Z	-	
	1	Raycap	BRODC		
80.2	3	Ericsson	AIR 6449	(3) Hybrid Cable	
77.5	6	CommScope	NHHSS-65C-R2B		
	3	Raycap	RRODC-6627-PF-48		
	3	Ericsson	4408 B48		
	3	Ericsson	8843		
	3	Ericsson	4449		
77.3	3	Antel	CWX063X19X00-T05		
76.5	3	Ericsson	VZ-SM67015		
67.0	3	-	27"x20"x6" Panel	(2) 1 1/2"	
	3	CommScope	FFV4-65C-R3-V1		
	6	Nokia	AHLOA		
	3	-	T-Arm Mounts		
61.0	2	Raycap	RTMDC	(2) 1/4"	
	1	Airmux	AM-5G16		
	1	Ubiquiti Networks	Loco M5		
41.0	1	-	GPS	(1) 1/2"	

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Analysis Approach:

A three-dimensional model was created using tnxTower (version 8.1.1.0), a commercially available analysis software package. This model was used to calculate member stresses for dead, wind, ice, seismic and temperature load cases. Selected output from the analysis can be found in Appendix A.

General Assumptions:

1. The tower was constructed in accordance with its original design and maintained per the manufacturer's specifications.
2. The configuration of antennas, transmission cables, mounts and other appurtenances are as specified in the above tables and the referenced drawings.
3. Mount sizes, weights, and manufacturers are best estimates based on photos provided and determined without the benefit of a site visit by Colliers Engineering & Design.
4. Coax mounting equipment (feedline ladders, T-brackets, etc.) is removed when all coax attached to the equipment is removed from the tower unless noted otherwise by client/owner.
5. All welds and member connections are assumed to have been designed to meet or exceed the load carrying capacity of the connected member unless otherwise specified in this report.
6. All foundation steel reinforcing is assumed to have been designed to meet or exceed the load carrying capacity of the surrounding soils unless otherwise specified in this report.
7. Tower Leg A is assumed to be at azimuth 30°

Site Specific Assumptions and Design Parameters:

1. Structural Steel Grades have been assumed as follows, unless otherwise noted in this analysis:
    - Base/Flange Plate — ASTM A871 (Gr. 60)
    - Anchor Bolts — ASTM A325
    - Tower Legs — ASTM A572 (Gr.50)
    - Tower Bracing — ASTM A36
    - Member Bolts — ASTM A325
2. All other carrier loading other than Verizon Wireless has been assumed to be the loading found in the above referenced structural analysis report and design visit photos.
3. The existing tower and foundations have been designed as intended in the original tower design drawings.

Discrepancies between in-field conditions and the assumptions listed above may render this analysis invalid unless explicitly approved by Colliers Engineering & Design.

Calculations:

Selected analysis and calculations output can be found in the **Appendix Section** of this report.

Analysis Results and Conclusion:

Self-Support Foundation:

	Colliers Engineering & Design	Sabre Foundation Design Reactions	Capacity
Maximum Moment (Kip-ft)	1,212 kip-ft	1,939 kip-ft	62.5%

Self-Support Foundation Rating	62.5%

Component	Utilization %	Pass/Fail
Tower Legs	*91.0*	*Pass*
Diagonal Bracing	*93.3*	*Pass*
Top Girt	*56.9*	*Pass*
Bracing Bolts	*93.3*	*Pass*
Anchor Bolts	*41.7*	*Pass*

Structure Rating – *(Controlling Utilization of all Components)*	93.3%

Recommendation:

The tower and its foundation have sufficient capacity to carry the proposed load configuration. No modifications are required at this time.

The proposed (1) hybrid line shall be installed alongside the existing feedlines/waveguide.

Attachments

- Tnx Output
- Calculations

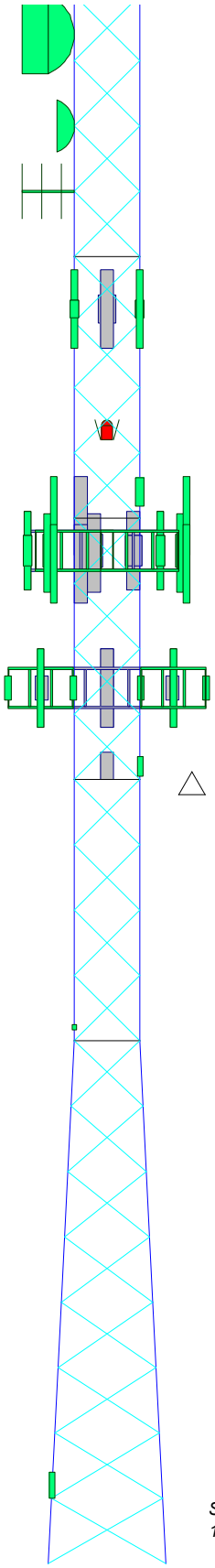
Disclaimer of Warranties:

Colliers Engineering & Design has not performed a site visit to the tower to verify member sizes or antenna/coax loading. Colliers Engineering & Design shall be contacted immediately if the existing conditions are not as represented on the tower elevation contained in this report in order to evaluate the significance of the discrepancy. Colliers Engineering & Design has not performed a condition assessment of the tower foundation. This report does not replace a full tower inspection.

The engineering services rendered by Colliers Engineering & Design in connection with this structural analysis are limited to an analysis of the tower structure and theoretical capacity of its main structural members. Miscellaneous items such as antenna mounts, etc., have not been designed or detailed as part of our work. We recommend that material of suitable size and strength be purchased from a reputable tower manufacturer.

Colliers Engineering & Design makes no warranties, expressed and/or implied, in connection with this report and disclaims any liability arising from material, fabrication, and erection of this tower. Colliers Engineering & Design will not be responsible whatsoever for, or on account of, consequential or incidental damages sustained by any person, firm, or organization as a result of any data contained in this report.

Section	T1	T2	T3	T4	T5	T6
Legs	Sabre 2.375 x 0.154		Sabre 2.875 x 0.276	Sabre 4.500 x 0.3370		Sabre 5.5625 x .375
Leg Grade	A572-50					
Diagonals	L2x2x1/8		L2x2x3/16	L2x2x1/4		L2x2x1/8
Diagonal Grade	A36					
Top Girts	L2x2x1/8		L2x2x3/16	L2x2x1/4	L2x2x1/8	N.A.
Face Width (ft)	9					7
# Panels @ (ft)	24 @ 5					
Weight (K)	0.6	0.8	1.0	1.6	1.7	1.7



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
6' HP Dish	117	VZ-SM67015	77.5
4' Grid Dish	110	Sabre V-Boom	77.5
3' Yagi	105	AIR6449 B41 w/ Mount Pipe	77.5
TA08025-B605	96	(2) NHHSS-65C-R2B w/ Pipe	77.5
RRFDC-4750-PF-48	96	RRODC-6627-PF-48	77.5
MX08FRO665-20	96	4408 B48 w/ Pipe	77.5
TA08025-B604	96	RADIO 8843	77.5
TA08025-B605	96	RADIO 4449	77.5
MX08FRO665-20	96	CWX063X19X00-T05 w/ Pipe	77.5
TA08025-B604	96	VZ-SM67015	77.5
TA08025-B605	96	Sabre V-Boom	77.5
TA08025-B604	96	AIR6449 B41 w/ Mount Pipe	77.5
MX08FRO665-20	96	(2) NHHSS-65C-R2B w/ Pipe	77.5
1.5'x4"x3" Panel	86	(2) AHLOA	67
BRODC	82	Sabre V-Boom	67
DB-B1-6C-12AB-0Z	82	27"x20"x6" Panel	67
RRODC-6627-PF-48	77.5	FFV4-65C-R3-V1 w/ Pipe	67
4408 B48 w/ Pipe	77.5	(2) AHLOA	67
RADIO 8843	77.5	Sabre V-Boom	67
RADIO 4449	77.5	27"x20"x6" Panel	67
CWX063X19X00-T05 w/ Pipe	77.5	FFV4-65C-R3-V1 w/ Pipe	67
VZ-SM67015	77.5	(2) AHLOA	67
Sabre V-Boom	77.5	Sabre V-Boom	67
AIR6449 B41 w/ Mount Pipe	77.5	27"x20"x6" Panel	67
(2) NHHSS-65C-R2B w/ Pipe	77.5	FFV4-65C-R3-V1 w/ Pipe	67
RRODC-6627-PF-48	77.5	RMTDC	61
4408 B48 w/ Pipe	77.5	AM-5G16	61
RADIO 8843	77.5	GPS	41
RADIO 4449	77.5	Loco M5	6
CWX063X19X00-T05 w/ Pipe	77.5		

MATERIAL STRENGTH

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

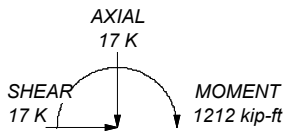
TOWER DESIGN NOTES

1. Tower is located in Denver County, Colorado.
2. Tower designed for Exposure C to the TIA-222-H Standard.
3. Tower designed for a 120 mph basic wind in accordance with the TIA-222-H Standard.
4. Deflections are based upon a 0 mph wind.
5. Tower Risk Category III.
6. Topographic Category 1 with Crest Height of 0.00 ft
7. TOWER RATING: 93.3%

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 161 K
SHEAR: 12 K

UPLIFT: -141 K
SHEAR: 10 K



TORQUE 5 kip-ft
REACTIONS - 120 mph WIND

Colliers Engineering & Design
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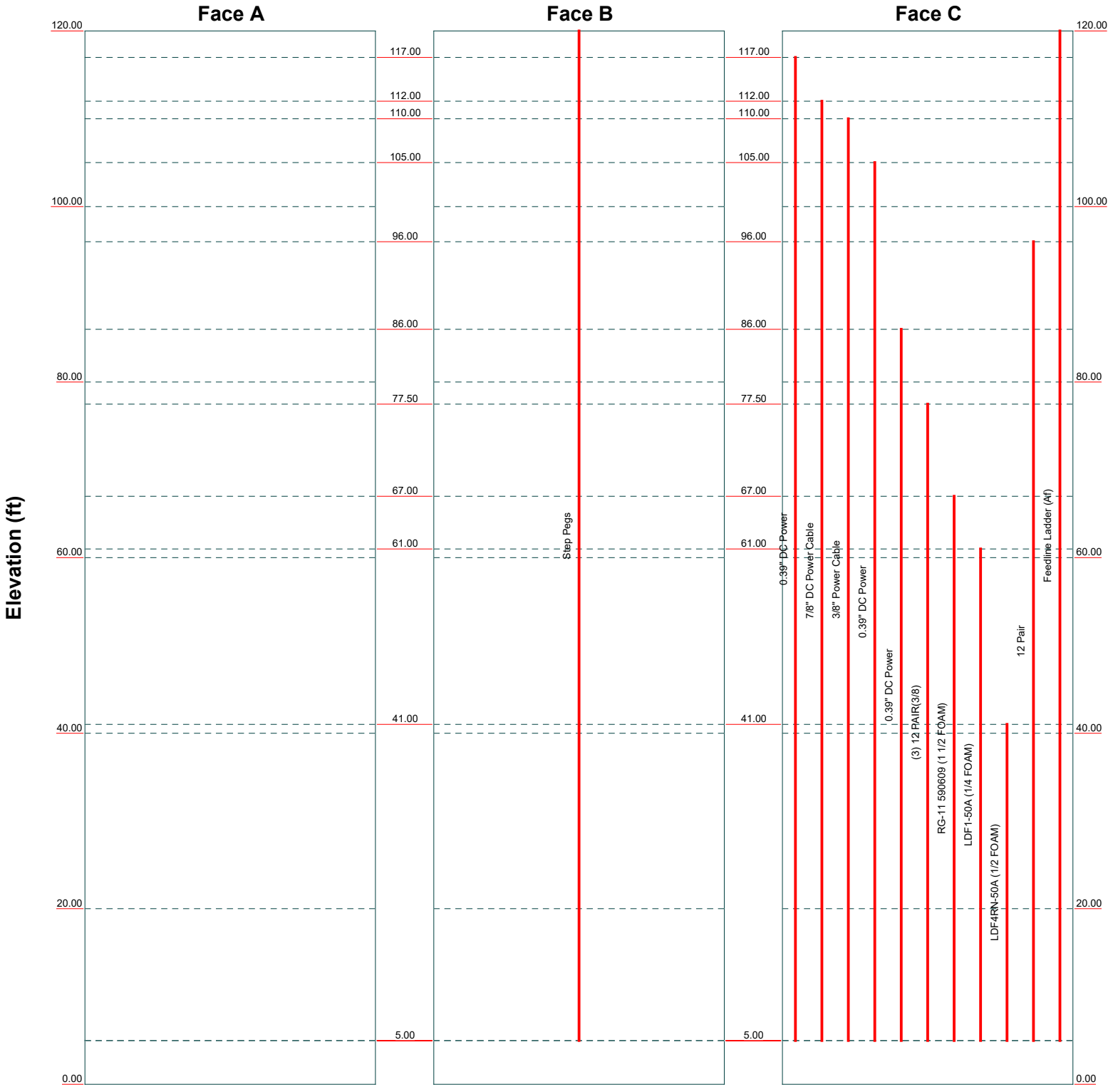
Phone: 856.797.0412
FAX:

Job: DNDEN00104C			
Project: 22964050A			
Client: Wyco Field Services	Drawn by: nlaporte	App'd:	
Code: TIA-222-H	Date: 11/09/22	Scale: NTS	
Path: C:\Users\nlaporte\OneDrive - Colliers Engineering & Design\Desktop\Misc\Tower Analysis\DNDEN00104C.eri		Dwg No. E-1	

Feed Line Distribution Chart
0' - 120'

Round | Flat | App In Face | App Out Face | Truss Leg



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Mt. Laurel, NJ 08054
Phone: 856.797.0412
FAX:

Job: DNDEN00104C			
Project: 22964050A			
Client: Wyco Field Services	Drawn by: nlaporte	App'd:	
Code: TIA-222-H	Date: 11/09/22	Scale: NTS	
Path: C:\Users\nlaporte\OneDrive - Colliers Engineering & Design\Desktop\Misc\Tower Analysis\DNDEN00104C.eri		Dwg No. E-7	

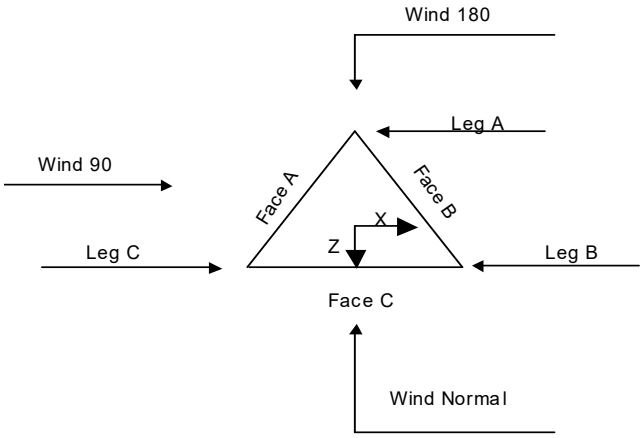
Tower Input Data

The main tower is a 3x free standing tower with an overall height of 120.00 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 9.00 ft at the base.
This tower is designed using the TIA-222-H standard.
The following design criteria apply:

Tower is located in Denver County, Colorado.
Tower base elevation above sea level: 5419.62 ft.
Basic wind speed of 120 mph.
Risk Category III.
Exposure Category C.
Simplified Topographic Factor Procedure for wind speed-up calculations is used.
Topographic Category: 1.
Crest Height: 0.00 ft.
Deflections calculated using a wind speed of 0 mph.
A non-linear (P-delta) analysis was used.
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.

Options

Consider Moments - Legs	Distribute Leg Loads As Uniform	Use ASCE 10 X-Brace Ly Rules
Consider Moments - Horizontals	Assume Legs Pinned	√ Calculate Redundant Bracing Forces
Consider Moments - Diagonals	√ Assume Rigid Index Plate	Ignore Redundant Members in FEA
Use Moment Magnification	√ Use Clear Spans For Wind Area	SR Leg Bolts Resist Compression
√ Use Code Stress Ratios	√ Use Clear Spans For KL/r	All Leg Panels Have Same Allowable
√ Use Code Safety Factors - Guys	Retension Guys To Initial Tension	Offset Girt At Foundation
Escalate Ice	√ Bypass Mast Stability Checks	√ Consider Feed Line Torque
Always Use Max Kz	√ Use Azimuth Dish Coefficients	√ Include Angle Block Shear Check
Use Special Wind Profile	√ Project Wind Area of Appurt.	Use TIA-222-H Bracing Resist. Exemption
√ Include Bolts In Member Capacity	Autocalc Torque Arm Areas	Use TIA-222-H Tension Splice Exemption
Leg Bolts Are At Top Of Section	Add IBC .6D+W Combination	Poles
√ Secondary Horizontal Braces Leg	√ Sort Capacity Reports By Component	Include Shear-Torsion Interaction
Use Diamond Inner Bracing (4 Sided)	Triangulate Diamond Inner Bracing	Always Use Sub-Critical Flow
SR Members Have Cut Ends	Treat Feed Line Bundles As Cylinder	Use Top Mounted Sockets
SR Members Are Concentric	Ignore KL/ry For 60 Deg. Angle Legs	Pole Without Linear Attachments
		Pole With Shroud Or No Appurtenances
		Outside and Inside Corner Radii Are Known



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	120.00-100.00			5.00	1	20.00
T2	100.00-80.00			5.00	1	20.00
T3	80.00-60.00			5.00	1	20.00
T4	60.00-40.00			5.00	1	20.00
T5	40.00-20.00			5.00	1	20.00
T6	20.00-0.00			7.00	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	120.00-100.00	5.00	X Brace	No	No	0.00	0.00
T2	100.00-80.00	5.00	X Brace	No	No	0.00	0.00
T3	80.00-60.00	5.00	X Brace	No	No	0.00	0.00
T4	60.00-40.00	5.00	X Brace	No	No	0.00	0.00
T5	40.00-20.00	5.00	X Brace	No	No	0.00	0.00
T6	20.00-0.00	5.00	X Brace	No	No	0.00	0.00

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Leg Type*	*Leg Size*	*Leg Grade*	*Diagonal Type*	*Diagonal Size*	*Diagonal Grade*
T1 120.00-100.00	Pipe	Sabre 2.375 x 0.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T2 100.00-80.00	Pipe	Sabre 2.375 x 0.154	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T3 80.00-60.00	Pipe	Sabre 2.875 x 0.276	A572-50 (50 ksi)	Equal Angle	L2x2x3/16	A36 (36 ksi)
T4 60.00-40.00	Pipe	Sabre 4.500 x 0.3370	A572-50 (50 ksi)	Equal Angle	L2x2x1/4	A36 (36 ksi)
T5 40.00-20.00	Pipe	Sabre 5.5625 x .375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	A36 (36 ksi)
T6 20.00-0.00	Pipe	Sabre 5.5625 x .375	A572-50 (50 ksi)	Equal Angle	L2x2x1/8	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 120.00-100.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T2 100.00-80.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T3 80.00-60.00	Equal Angle	L2x2x3/16	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T4 60.00-40.00	Equal Angle	L2x2x1/4	A36 (36 ksi)	Flat Bar		A36 (36 ksi)
T5 40.00-20.00	Equal Angle	L2x2x1/8	A36 (36 ksi)	Flat Bar		A36 (36 ksi)

Tower Section Geometry *(cont'd)*

Tower Elevation ft	*Gusset Area (per face) ft²*	*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 120.00-100.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00
T2 100.00-80.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00
T3 80.00-60.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00
T4 60.00-40.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00
T5 40.00-20.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00
T6 20.00-0.00	0.00	0.00	A36 (36 ksi)	1	1	1.05	36.00	36.00	36.00

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	Yes	Yes	1	0.9	1	1	1	1	1	1
120.00-100.00				0.9	1	1	1	1	1	1
T2	Yes	Yes	1	0.9	1	1	1	1	1	1
100.00-80.00				0.9	1	1	1	1	1	1
T3	Yes	Yes	1	0.9	1	1	1	1	1	1
80.00-60.00				0.9	1	1	1	1	1	1
T4	Yes	Yes	1	0.9	1	1	1	1	1	1
60.00-40.00				0.9	1	1	1	1	1	1
T5	Yes	Yes	1	0.9	1	1	1	1	1	1
40.00-20.00				0.9	1	1	1	1	1	1
T6 20.00-0.00	Yes	Yes	1	0.9	1	1	1	1	1	1
				0.9	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	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
120.00-100.00														
T2	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
100.00-80.00														
T3 80.00-60.00	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T4 60.00-40.00	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T5 40.00-20.00	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T6 20.00-0.00	0.00	1	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75

Tower Elevation ft	Redundant Horizontal		Redundant Diagonal		Redundant Sub-Diagonal		Redundant Sub-Horizontal		Redundant Vertical		Redundant Hip		Redundant Hip Diagonal	
	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	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
120.00-100.00														
T2	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
100.00-80.00														
T3 80.00-60.00	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T4 60.00-40.00	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75

Tower Elevation ft	Redundant Horizontal		Redundant Diagonal		Redundant Sub-Diagonal		Redundant Sub-Horizontal		Redundant Vertical		Redundant Hip		Redundant Hip Diagonal	
	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
T5 40.00-20.00	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75
T6 20.00-0.00	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	0.75	0.00	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 120.00-100.00	Flange	0.75 A325N	4	0.63 A325N	1	0.63 A325N	1	0.63 A325N	0	0.63 A325N	0	0.50 A325N	0	0.63 A325N	0
T2 100.00-80.00	Flange	0.75 A325N	4	0.63 A325N	1	0.63 A325N	1	0.63 A325N	0	0.63 A325N	0	0.50 A325N	0	0.63 A325N	0
T3 80.00-60.00	Flange	0.75 A325N	4	0.63 A325N	1	0.63 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T4 60.00-40.00	Flange	1.00 A325N	4	0.63 A325N	1	0.63 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T5 40.00-20.00	Flange	1.00 A325N	4	0.63 A325N	1	0.63 A325N	1	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0
T6 20.00-0.00	Flange	1.00 A325N	0	0.63 A325N	1	0.50 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0	0.63 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight klf
0.39" DC Power	C	No	No	Ar (CaAa)	117.00 - 5.00	0.00	0	1	1	0.39	0.39		0.00
7/8" DC Power Cable	C	No	No	Ar (CaAa)	112.00 - 5.00	0.00	-0.01	1	1	0.88	0.88		0.00
3/8" Power Cable	C	No	No	Ar (CaAa)	110.00 - 5.00	0.00	-0.02	1	1	0.38	0.38		0.00
0.39" DC Power	C	No	No	Ar (CaAa)	105.00 - 5.00	0.00	-0.03	1	1	0.39	0.39		0.00
0.39" DC Power	C	No	No	Ar (CaAa)	86.00 - 5.00	0.00	-0.04	1	1	0.39	0.39		0.00
12 PAIR(3/8)	C	No	No	Ar (CaAa)	77.50 - 5.00	0.00	-0.05	3	3	0.40	0.40		0.00
RG-11 590609 (1 1/2 FOAM)	C	No	No	Ar (CaAa)	67.00 - 5.00	0.00	-0.06	1	1	1.59	1.59		0.00
LDF1-50A (1/4 FOAM)	C	No	No	Ar (CaAa)	61.00 - 5.00	0.00	-0.07	1	1	0.35	0.35		0.00
LDF4RN-50A (1/2 FOAM)	C	No	No	Ar (CaAa)	41.00 - 5.00	0.00	-0.08	1	1	0.63	0.63		0.00
12 Pair	C	No	No	Ar (CaAa)	96.00 - 5.00	0.00	0.01	1	1	0.40	0.40		0.00
Step Pegs	B	No	No	Ar (CaAa)	120.00 -	0.00	0.5	1	1	0.80	0.80		0.00

Description	Face or Leg	Allow Shield	Exclude From Torque Calculation	Component Type	Placement ft	Face Offset in	Lateral Offset (Frac FW)	#	# Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight klf
Feedline Ladder (Af)	C	No	No	Af (CaAa)	5.00 120.00 - 5.00	0.00	-0.04	1	1	3.00	3.00		0.01

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	120.00-100.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.600	0.000	0.05
		C	0.000	0.000	12.283	0.000	0.18
T2	100.00-80.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.600	0.000	0.05
		C	0.000	0.000	14.934	0.000	0.19
T3	80.00-60.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.600	0.000	0.05
		C	0.000	0.000	18.888	0.000	0.20
T4	60.00-40.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.600	0.000	0.05
		C	0.000	0.000	21.983	0.000	0.22
T5	40.00-20.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.600	0.000	0.05
		C	0.000	0.000	23.180	0.000	0.22
T6	20.00-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	1.200	0.000	0.04
		C	0.000	0.000	17.385	0.000	0.17

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	120.00-100.00	1.37	4.26	1.37	4.26
T2	100.00-80.00	1.35	4.71	1.35	4.71
T3	80.00-60.00	1.38	4.97	1.38	4.97
T4	60.00-40.00	1.34	4.93	1.33	4.89
T5	40.00-20.00	1.50	5.48	1.47	5.34
T6	20.00-0.00	1.40	5.09	1.37	4.99

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	0.39" DC Power	100.00 - 117.00	0.6000	0.6000
T1	2	7/8" DC Power Cable	100.00 -	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	3	3/8" Power Cable	100.00 - 112.00	0.6000	0.6000
T1	4	0.39" DC Power	100.00 - 110.00	0.6000	0.6000
T1	16	Step Pegs	100.00 - 105.00	1.0000	1.0000
T1	17	Feedline Ladder (Af)	100.00 - 120.00	1.0000	1.0000
T2	1	0.39" DC Power	80.00 - 100.00	0.6000	0.6000
T2	2	7/8" DC Power Cable	80.00 - 100.00	0.6000	0.6000
T2	3	3/8" Power Cable	80.00 - 100.00	0.6000	0.6000
T2	4	0.39" DC Power	80.00 - 100.00	0.6000	0.6000
T2	5	0.39" DC Power	80.00 - 86.00	0.6000	0.6000
T2	13	12 Pair	80.00 - 96.00	0.6000	0.6000
T2	16	Step Pegs	80.00 - 100.00	1.0000	1.0000
T2	17	Feedline Ladder (Af)	80.00 - 100.00	1.0000	1.0000
T3	1	0.39" DC Power	60.00 - 80.00	0.6000	0.6000
T3	2	7/8" DC Power Cable	60.00 - 80.00	0.6000	0.6000
T3	3	3/8" Power Cable	60.00 - 80.00	0.6000	0.6000
T3	4	0.39" DC Power	60.00 - 80.00	0.6000	0.6000
T3	5	0.39" DC Power	60.00 - 80.00	0.6000	0.6000
T3	6	12 PAIR(3/8)	60.00 - 77.50	0.6000	0.6000
T3	7	RG-11 590609 (1 1/2 FOAM)	60.00 - 67.00	0.6000	0.6000
T3	8	LDF1-50A (1/4 FOAM)	60.00 - 61.00	0.6000	0.6000
T3	13	12 Pair	60.00 - 80.00	0.6000	0.6000
T3	16	Step Pegs	60.00 - 80.00	1.0000	1.0000
T3	17	Feedline Ladder (Af)	60.00 - 80.00	1.0000	1.0000
T4	1	0.39" DC Power	40.00 - 60.00	0.6000	0.6000
T4	2	7/8" DC Power Cable	40.00 - 60.00	0.6000	0.6000
T4	3	3/8" Power Cable	40.00 - 60.00	0.6000	0.6000
T4	4	0.39" DC Power	40.00 - 60.00	0.6000	0.6000
T4	5	0.39" DC Power	40.00 - 60.00	0.6000	0.6000
T4	6	12 PAIR(3/8)	40.00 - 60.00	0.6000	0.6000
T4	7	RG-11 590609 (1 1/2 FOAM)	40.00 - 60.00	0.6000	0.6000
T4	8	LDF1-50A (1/4 FOAM)	40.00 - 60.00	0.6000	0.6000
T4	9	LDF4RN-50A (1/2 FOAM)	40.00 - 41.00	0.6000	0.6000
T4	13	12 Pair	40.00 - 60.00	0.6000	0.6000
T4	16	Step Pegs	40.00 - 60.00	1.0000	1.0000
T4	17	Feedline Ladder (Af)	40.00 - 60.00	1.0000	1.0000
T5	1	0.39" DC Power	20.00 - 40.00	0.6000	0.6000
T5	2	7/8" DC Power Cable	20.00 - 40.00	0.6000	0.6000
T5	3	3/8" Power Cable	20.00 - 40.00	0.6000	0.6000
T5	4	0.39" DC Power	20.00 - 40.00	0.6000	0.6000
T5	5	0.39" DC Power	20.00 - 40.00	0.6000	0.6000
T5	6	12 PAIR(3/8)	20.00 - 40.00	0.6000	0.6000
T5	7	RG-11 590609 (1 1/2 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	8	LDF1-50A (1/4 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	9	LDF4RN-50A (1/2 FOAM)	20.00 - 40.00	0.6000	0.6000
T5	13	12 Pair	20.00 - 40.00	0.6000	0.6000
T5	16	Step Pegs	20.00 - 40.00	1.0000	1.0000
T5	17	Feedline Ladder (Af)	20.00 - 40.00	1.0000	1.0000
T6	1	0.39" DC Power	5.00 - 20.00	0.6000	0.6000
T6	2	7/8" DC Power Cable	5.00 - 20.00	0.6000	0.6000
T6	3	3/8" Power Cable	5.00 - 20.00	0.6000	0.6000
T6	4	0.39" DC Power	5.00 - 20.00	0.6000	0.6000
T6	5	0.39" DC Power	5.00 - 20.00	0.6000	0.6000
T6	6	12 PAIR(3/8)	5.00 - 20.00	0.6000	0.6000
T6	7	RG-11 590609 (1 1/2 FOAM)	5.00 - 20.00	0.6000	0.6000
T6	8	LDF1-50A (1/4 FOAM)	5.00 - 20.00	0.6000	0.6000
T6	9	LDF4RN-50A (1/2 FOAM)	5.00 - 20.00	0.6000	0.6000
T6	13	12 Pair	5.00 - 20.00	0.6000	0.6000

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T6	16	Step Pegs	5.00 - 20.00	1.0000	1.0000
T6	17	Feedline Ladder (Af)	5.00 - 20.00	1.0000	1.0000

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
3' Yagi	C	From Leg	0.00 0.00 0.00	0.00	105.00	No Ice	0.52	0.52	0.02
MX08FRO665-20	A	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	12.49	5.87	0.05
TA08025-B604	A	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.03	0.06
TA08025-B605	A	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.19	0.07
RRFDC-4750-PF-48	A	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	3.37	2.19	0.02
MX08FRO665-20	B	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	12.49	5.87	0.05
TA08025-B604	B	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.03	0.06
TA08025-B605	B	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.19	0.07
MX08FRO665-20	C	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	12.49	5.87	0.05
TA08025-B604	C	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.03	0.06
TA08025-B605	C	From Leg	0.00 0.00 0.00	0.00	96.00	No Ice	1.96	1.19	0.07
1.5'x4"x3" Panel	A	From Leg	0.00 0.00 0.00	0.00	86.00	No Ice	0.64	0.51	0.01
DB-B1-6C-12AB-0Z	B	From Leg	0.00 0.00 0.00	0.00	82.00	No Ice	3.36	2.19	0.02
BRODC	B	From Leg	0.00 0.00 0.00	0.00	82.00	No Ice	2.51	1.65	0.03
AIR6449 B41 w/ Mount Pipe	A	From Leg	3.00	45.00	77.50	No Ice	6.93	25.62	0.13

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
(2) NHHSS-65C-R2B w/ Pipe	A	From Leg	-2.00 2.70 3.00	45.00	77.50	No Ice	11.39	7.14	0.11
RRODC-6627-PF-48	A	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	4.06	2.05	0.05
4408 B48 w/ Pipe	A	From Leg	-1.00 0.00 3.00	45.00	77.50	No Ice	2.29	2.11	0.04
RADIO 8843	A	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	3.50	2.36	0.09
RADIO 4449	A	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	3.50	2.36	0.09
CWX063X19X00-T05 w/ Pipe	A	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	9.01	6.24	0.09
VZ-SM67015	A	From Leg	-1.00 -0.20 3.00	45.00	77.50	No Ice	1.35	0.75	0.06
Sabre V-Boom	A	From Leg	-2.00 -1.00 0.00	45.00	77.50	No Ice	13.07	9.57	0.15
AIR6449 B41 w/ Mount Pipe	B	From Leg	0.00 0.00 3.00	45.00	77.50	No Ice	6.93	25.62	0.13
(2) NHHSS-65C-R2B w/ Pipe	B	From Leg	-2.00 2.70 3.00	45.00	77.50	No Ice	11.39	7.14	0.11
RRODC-6627-PF-48	B	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	4.06	2.05	0.05
4408 B48 w/ Pipe	B	From Leg	-1.00 0.00 3.00	45.00	77.50	No Ice	2.29	2.11	0.04
RADIO 8843	B	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	3.50	2.36	0.09
RADIO 4449	B	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	3.50	2.36	0.09
CWX063X19X00-T05 w/ Pipe	B	From Leg	2.00 0.00 3.00	45.00	77.50	No Ice	9.01	6.24	0.09
VZ-SM67015	B	From Leg	-1.00 -0.20 3.00	45.00	77.50	No Ice	1.35	0.75	0.06
Sabre V-Boom	B	From Leg	-2.00 -1.00 0.00	45.00	77.50	No Ice	13.07	9.57	0.15
AIR6449 B41 w/ Mount Pipe	C	From Leg	0.00 0.00 3.00	45.00	77.50	No Ice	6.93	25.62	0.13
(2) NHHSS-65C-R2B w/ Pipe	C	From Leg	-2.00 2.70 3.00	45.00	77.50	No Ice	11.39	7.14	0.11

Description	Face or Leg	Offset Type	Offsets: Horz Lateral ft / Vert ft / ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight K
RRODC-6627-PF-48	C	From Leg	2.00 0.00 3.00 -1.00 0.00	45.00	77.50	No Ice	4.06	2.05	0.05
4408 B48 w/ Pipe	C	From Leg	3.00 2.00 0.00	45.00	77.50	No Ice	2.29	2.11	0.04
RADIO 8843	C	From Leg	3.00 2.00 0.00	45.00	77.50	No Ice	3.50	2.36	0.09
RADIO 4449	C	From Leg	3.00 2.00 0.00	45.00	77.50	No Ice	3.50	2.36	0.09
CWX063X19X00-T05 w/ Pipe	C	From Leg	3.00 -1.00 -0.20	45.00	77.50	No Ice	9.01	6.24	0.09
VZ-SM67015	C	From Leg	3.00 -2.00 -1.00	45.00	77.50	No Ice	1.35	0.75	0.06
Sabre V-Boom	C	From Leg	0.00 0.00 0.00	45.00	77.50	No Ice	13.07	9.57	0.15
27"x20"x6" Panel	A	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	4.50	1.45	0.04
FFV4-65C-R3-V1 w/ Pipe	A	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	20.97	11.25	0.16
(2) AHLOA	A	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	2.23	1.39	0.08
Sabre V-Boom	A	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	13.07	9.57	0.15
27"x20"x6" Panel	B	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	4.50	1.45	0.04
FFV4-65C-R3-V1 w/ Pipe	B	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	20.97	11.25	0.16
(2) AHLOA	B	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	2.23	1.39	0.08
Sabre V-Boom	B	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	13.07	9.57	0.15
27"x20"x6" Panel	C	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	4.50	1.45	0.04
FFV4-65C-R3-V1 w/ Pipe	C	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	20.97	11.25	0.16
(2) AHLOA	C	From Leg	3.00 0.00 0.00	45.00	67.00	No Ice	2.23	1.39	0.08
Sabre V-Boom	C	From Leg	3.00	45.00	67.00	No Ice	13.07	9.57	0.15

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
			0.00 0.00						
RMTDC	A	From Leg	0.00 0.00 0.00	0.00	61.00	No Ice	2.50	0.75	0.04
AM-5G16	B	From Leg	0.00 0.00 0.00	0.00	61.00	No Ice	1.50	0.64	0.02
Loco M5	C	From Leg	0.00 0.00 0.00	0.00	6.00	No Ice	2.00	0.72	0.04
GPS	C	From Leg	0.00 0.00 0.00	0.00	41.00	No Ice	0.12	0.12	0.00

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
6' HP Dish	C	Paraboloid w/Shroud (HP)	From Leg	0.00 0.00 0.00	45.00		117.00	6.00	No Ice	28.27	0.38
4' Grid Dish	C	Grid	From Leg	0.00 0.00 0.00	45.00		110.00	4.00	No Ice	8.80	0.08

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.0 Wind 0 deg - No Ice
3	1.2D+1.0W (pattern 1) 0 deg - No Ice
4	1.2D+1.0W (pattern 2) 0 deg - No Ice
5	0.9 Dead+1.0 Wind 0 deg - No Ice
6	1.2 Dead+1.0 Wind 30 deg - No Ice
7	1.2D+1.0W (pattern 1) 30 deg - No Ice
8	1.2D+1.0W (pattern 2) 30 deg - No Ice
9	0.9 Dead+1.0 Wind 30 deg - No Ice
10	1.2 Dead+1.0 Wind 60 deg - No Ice
11	1.2D+1.0W (pattern 1) 60 deg - No Ice
12	1.2D+1.0W (pattern 2) 60 deg - No Ice
13	0.9 Dead+1.0 Wind 60 deg - No Ice
14	1.2 Dead+1.0 Wind 90 deg - No Ice
15	1.2D+1.0W (pattern 1) 90 deg - No Ice

Comb. No.	Description
16	1.2D+1.0W (pattern 2) 90 deg - No Ice
17	0.9 Dead+1.0 Wind 90 deg - No Ice
18	1.2 Dead+1.0 Wind 120 deg - No Ice
19	1.2D+1.0W (pattern 1) 120 deg - No Ice
20	1.2D+1.0W (pattern 2) 120 deg - No Ice
21	0.9 Dead+1.0 Wind 120 deg - No Ice
22	1.2 Dead+1.0 Wind 150 deg - No Ice
23	1.2D+1.0W (pattern 1) 150 deg - No Ice
24	1.2D+1.0W (pattern 2) 150 deg - No Ice
25	0.9 Dead+1.0 Wind 150 deg - No Ice
26	1.2 Dead+1.0 Wind 180 deg - No Ice
27	1.2D+1.0W (pattern 1) 180 deg - No Ice
28	1.2D+1.0W (pattern 2) 180 deg - No Ice
29	0.9 Dead+1.0 Wind 180 deg - No Ice
30	1.2 Dead+1.0 Wind 210 deg - No Ice
31	1.2D+1.0W (pattern 1) 210 deg - No Ice
32	1.2D+1.0W (pattern 2) 210 deg - No Ice
33	0.9 Dead+1.0 Wind 210 deg - No Ice
34	1.2 Dead+1.0 Wind 240 deg - No Ice
35	1.2D+1.0W (pattern 1) 240 deg - No Ice
36	1.2D+1.0W (pattern 2) 240 deg - No Ice
37	0.9 Dead+1.0 Wind 240 deg - No Ice
38	1.2 Dead+1.0 Wind 270 deg - No Ice
39	1.2D+1.0W (pattern 1) 270 deg - No Ice
40	1.2D+1.0W (pattern 2) 270 deg - No Ice
41	0.9 Dead+1.0 Wind 270 deg - No Ice
42	1.2 Dead+1.0 Wind 300 deg - No Ice
43	1.2D+1.0W (pattern 1) 300 deg - No Ice
44	1.2D+1.0W (pattern 2) 300 deg - No Ice
45	0.9 Dead+1.0 Wind 300 deg - No Ice
46	1.2 Dead+1.0 Wind 330 deg - No Ice
47	1.2D+1.0W (pattern 1) 330 deg - No Ice
48	1.2D+1.0W (pattern 2) 330 deg - No Ice
49	0.9 Dead+1.0 Wind 330 deg - No Ice
50	Dead+Wind 0 deg - Service
51	Dead+Wind 30 deg - Service
52	Dead+Wind 60 deg - Service
53	Dead+Wind 90 deg - Service
54	Dead+Wind 120 deg - Service
55	Dead+Wind 150 deg - Service
56	Dead+Wind 180 deg - Service
57	Dead+Wind 210 deg - Service
58	Dead+Wind 240 deg - Service
59	Dead+Wind 270 deg - Service
60	Dead+Wind 300 deg - Service
61	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	120 - 100	Leg	Max Tension	45	4.83	0.02	-0.01
			Max. Compression	18	-6.36	-0.07	-0.04
			Max. Mx	14	-0.38	0.43	-0.13
			Max. My	2	-0.47	0.10	-0.38
			Max. Vy	14	0.35	-0.25	-0.13
			Max. Vx	2	-0.31	0.10	0.22
		Diagonal	Max Tension	14	1.48	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Compression	18	-1.59	0.00	0.00
			Max. Mx	20	1.36	0.01	-0.00
			Max. My	18	-0.61	-0.00	-0.00
			Max. Vy	20	-0.01	0.01	-0.00
			Max. Vx	18	0.00	0.00	0.00
		Top Girt	Max Tension	25	0.01	0.00	0.00
			Max. Compression	12	-0.03	0.00	0.00
			Max. Mx	19	-0.02	-0.01	0.00
			Max. My	14	-0.01	0.00	-0.00
			Max. Vy	19	-0.01	0.00	0.00
			Max. Vx	14	0.00	0.00	0.00
T2	100 - 80	Leg	Max Tension	45	19.15	-0.03	-0.02
			Max. Compression	18	-23.71	-0.36	-0.20
			Max. Mx	14	-20.52	-0.39	-0.04
			Max. My	2	-19.23	0.02	0.39
			Max. Vy	14	0.26	-0.15	-0.00
			Max. Vx	2	-0.26	-0.01	0.13
		Diagonal	Max Tension	16	2.47	0.00	0.00
			Max. Compression	20	-2.64	0.00	0.00
			Max. Mx	20	1.08	0.03	-0.01
			Max. My	14	-2.37	-0.01	-0.01
			Max. Vy	20	-0.01	0.03	-0.01
			Max. Vx	14	0.00	-0.01	-0.01
		Top Girt	Max Tension	44	0.10	0.00	0.00
			Max. Compression	20	-0.12	0.00	0.00
			Max. Mx	19	-0.06	-0.01	0.00
			Max. My	14	0.03	0.00	-0.00
			Max. Vy	19	-0.01	0.00	0.00
			Max. Vx	14	0.00	0.00	0.00
T3	80 - 60	Leg	Max Tension	45	56.79	0.36	0.19
			Max. Compression	18	-67.83	-0.20	-0.11
			Max. Mx	39	-16.79	-1.30	0.04
			Max. My	3	-17.56	0.01	-1.31
			Max. Vy	14	0.80	-0.72	-0.01
			Max. Vx	2	-0.79	0.04	0.68
		Diagonal	Max Tension	14	6.37	0.00	0.00
			Max. Compression	14	-6.68	0.00	0.00
			Max. Mx	18	3.98	0.06	-0.01
			Max. My	22	-5.54	-0.03	-0.02
			Max. Vy	18	-0.02	0.06	-0.01
			Max. Vx	22	0.00	-0.03	-0.02
		Top Girt	Max Tension	44	0.23	0.00	0.00
			Max. Compression	20	-0.32	0.00	0.00
			Max. Mx	19	-0.06	-0.01	0.00
			Max. My	14	0.04	0.00	-0.00
			Max. Vy	19	0.01	0.00	0.00
			Max. Vx	14	0.00	0.00	0.00
T4	60 - 40	Leg	Max Tension	45	113.77	0.19	0.07
			Max. Compression	18	-129.33	-1.43	-0.82
			Max. Mx	14	-0.17	-1.45	-0.07
			Max. My	2	-119.53	0.01	1.52
			Max. Vy	14	0.33	-1.45	-0.07
			Max. Vx	10	0.32	-0.61	1.01
		Diagonal	Max Tension	14	6.87	0.00	0.00
			Max. Compression	18	-7.45	0.00	0.00
			Max. Mx	18	4.07	0.07	-0.01
			Max. My	22	-6.15	-0.04	-0.02
			Max. Vy	18	-0.03	0.07	-0.01
			Max. Vx	22	0.01	-0.04	-0.02
		Top Girt	Max Tension	42	1.58	0.00	0.00
			Max. Compression	21	-1.65	0.00	0.00

Section No.	Elevation ft	Component Type	Condition	Gov. Load Comb.	Axial K	Major Axis Moment kip-ft	Minor Axis Moment kip-ft
			Max. Mx	19	-1.25	-0.01	0.00
			Max. My	14	0.13	0.00	-0.00
			Max. Vy	19	0.01	0.00	0.00
			Max. Vx	14	0.00	0.00	0.00
T5	40 - 20	Leg	Max Tension	45	131.46	-0.86	0.01
			Max. Compression	18	-149.31	0.84	-0.01
			Max. Mx	18	-139.59	1.65	-0.00
			Max. My	14	-0.35	-0.07	1.68
			Max. Vy	18	0.23	1.65	-0.00
			Max. Vx	22	0.36	-0.09	-1.66
		Diagonal	Max Tension	25	1.98	0.00	0.00
			Max. Compression	18	-2.18	0.00	0.00
			Max. Mx	18	0.62	0.02	-0.00
			Max. My	14	-1.85	-0.02	-0.01
			Max. Vy	18	-0.01	0.02	-0.00
			Max. Vx	14	0.00	0.00	0.00
		Top Girt	Max Tension	45	0.40	0.00	0.00
			Max. Compression	18	-0.50	0.00	0.00
			Max. Mx	19	-0.40	-0.01	0.00
			Max. My	18	0.17	0.00	0.00
			Max. Vy	19	0.01	0.00	0.00
			Max. Vx	18	0.00	0.00	0.00
T6	20 - 0	Leg	Max Tension	45	140.07	-0.69	0.01
			Max. Compression	18	-159.63	0.00	-0.00
			Max. Mx	18	-151.91	0.84	-0.01
			Max. My	14	-2.15	-0.05	1.23
			Max. Vy	42	-0.17	-0.70	0.02
			Max. Vx	22	-0.27	-0.07	-1.21
		Diagonal	Max Tension	15	1.84	0.00	0.00
			Max. Compression	18	-2.06	0.00	0.00
			Max. Mx	18	0.59	0.02	-0.00
			Max. My	14	-1.63	-0.00	-0.00
			Max. Vy	18	-0.01	0.02	-0.00
			Max. Vx	14	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	34	155.09	9.86	-5.44
	Max. H_x	34	155.09	9.86	-5.44
	Max. H_z	13	-140.45	-9.04	4.90
	Min. Vert	13	-140.45	-9.04	4.90
	Min. H_x	13	-140.45	-9.04	4.90
	Min. H_z	34	155.09	9.86	-5.44
Leg B	Max. Vert	18	161.08	-10.16	-5.54
	Max. H_x	45	-141.18	9.09	4.91
	Max. H_z	45	-141.18	9.09	4.91
	Min. Vert	45	-141.18	9.09	4.91
	Min. H_x	18	161.08	-10.16	-5.54
	Min. H_z	18	161.08	-10.16	-5.54
Leg A	Max. Vert	2	152.43	-0.11	11.16
	Max. H_x	16	2.56	0.46	0.25
	Max. H_z	2	152.43	-0.11	11.16
	Min. Vert	29	-136.48	0.09	-10.07
	Min. H_x	40	7.03	-0.39	0.47

Location	Condition	Gov. Load Comb.	Vertical K	Horizontal, X K	Horizontal, Z K
	Min. H_z	29	-136.48	0.09	-10.07

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	13.97	0.00	0.00	3.22	0.07	0.00
1.2 Dead+1.0 Wind 0 deg - No Ice	16.76	-0.27	-16.41	-1144.55	31.14	-1.34
1.2D+1.0W (pattern 1) 0 deg - No Ice	16.76	-0.17	-14.72	-971.51	19.59	-0.33
1.2D+1.0W (pattern 2) 0 deg - No Ice	16.76	-0.26	-11.53	-858.24	30.26	-1.43
0.9 Dead+1.0 Wind 0 deg - No Ice	12.57	-0.27	-16.41	-1143.49	31.04	-1.34
1.2 Dead+1.0 Wind 30 deg - No Ice	16.76	8.10	-13.54	-938.92	-577.53	2.21
1.2D+1.0W (pattern 1) 30 deg - No Ice	16.76	7.22	-12.22	-804.23	-485.94	2.42
1.2D+1.0W (pattern 2) 30 deg - No Ice	16.76	5.74	-9.45	-696.52	-438.08	2.11
0.9 Dead+1.0 Wind 30 deg - No Ice	12.57	8.10	-13.54	-938.24	-576.51	2.21
1.2 Dead+1.0 Wind 60 deg - No Ice	16.76	14.01	-7.52	-511.16	-1008.43	5.01
1.2D+1.0W (pattern 1) 60 deg - No Ice	16.76	12.45	-6.84	-443.45	-845.45	4.42
1.2D+1.0W (pattern 2) 60 deg - No Ice	16.76	9.96	-5.19	-372.87	-768.02	4.93
0.9 Dead+1.0 Wind 60 deg - No Ice	12.57	14.01	-7.52	-511.24	-1006.61	5.00
1.2 Dead+1.0 Wind 90 deg - No Ice	16.76	16.27	0.18	24.52	-1168.33	5.43
1.2D+1.0W (pattern 1) 90 deg - No Ice	16.76	14.47	0.11	17.14	-980.20	4.58
1.2D+1.0W (pattern 2) 90 deg - No Ice	16.76	11.56	0.17	23.64	-889.13	5.38
0.9 Dead+1.0 Wind 90 deg - No Ice	12.57	16.27	0.18	23.49	-1166.23	5.41
1.2 Dead+1.0 Wind 120 deg - No Ice	16.76	14.72	8.34	594.87	-1055.98	4.79
1.2D+1.0W (pattern 1) 120 deg - No Ice	16.76	13.05	7.45	502.24	-881.67	3.82
1.2D+1.0W (pattern 2) 120 deg - No Ice	16.76	10.50	5.90	451.13	-807.91	4.79
0.9 Dead+1.0 Wind 120 deg - No Ice	12.57	14.72	8.34	592.83	-1054.09	4.78
1.2 Dead+1.0 Wind 150 deg - No Ice	16.76	8.50	13.74	969.98	-624.82	3.21
1.2D+1.0W (pattern 1) 150 deg - No Ice	16.76	7.48	12.35	826.86	-515.84	2.20
1.2D+1.0W (pattern 2) 150 deg - No Ice	16.76	6.13	9.64	726.69	-483.87	3.26
0.9 Dead+1.0 Wind 150 deg - No Ice	12.57	8.50	13.74	967.28	-623.69	3.20
1.2 Dead+1.0 Wind 180 deg -	16.76	0.28	15.61	1099.36	-33.03	0.97

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						
1.2D+1.0W (pattern 1) 180 deg - No Ice	16.76	0.18	14.05	939.66	-20.66	0.11
1.2D+1.0W (pattern 2) 180 deg - No Ice	16.76	0.27	10.92	820.90	-32.15	1.05
0.9 Dead+1.0 Wind 180 deg - No Ice	12.57	0.28	15.61	1096.43	-32.97	0.97
1.2 Dead+1.0 Wind 210 deg - No Ice	16.76	-8.10	13.58	950.90	577.67	-1.80
1.2D+1.0W (pattern 1) 210 deg - No Ice	16.76	-7.22	12.24	814.53	486.10	-2.18
1.2D+1.0W (pattern 2) 210 deg - No Ice	16.76	-5.74	9.48	708.49	438.23	-1.70
0.9 Dead+1.0 Wind 210 deg - No Ice	12.57	-8.10	13.58	948.24	576.61	-1.80
1.2 Dead+1.0 Wind 240 deg - No Ice	16.76	-14.50	7.93	546.76	1029.81	-4.08
1.2D+1.0W (pattern 1) 240 deg - No Ice	16.76	-12.91	7.19	471.85	865.16	-3.86
1.2D+1.0W (pattern 2) 240 deg - No Ice	16.76	-10.28	5.50	404.53	782.62	-4.00
0.9 Dead+1.0 Wind 240 deg - No Ice	12.57	-14.50	7.93	544.83	1027.93	-4.07
1.2 Dead+1.0 Wind 270 deg - No Ice	16.76	-16.07	-0.14	-12.10	1144.31	-4.70
1.2D+1.0W (pattern 1) 270 deg - No Ice	16.76	-14.34	-0.09	-6.58	965.87	-4.15
1.2D+1.0W (pattern 2) 270 deg - No Ice	16.76	-11.36	-0.13	-11.22	865.11	-4.65
0.9 Dead+1.0 Wind 270 deg - No Ice	12.57	-16.07	-0.14	-13.04	1142.23	-4.69
1.2 Dead+1.0 Wind 300 deg - No Ice	16.76	-13.86	-7.89	-554.21	990.21	-4.67
1.2D+1.0W (pattern 1) 300 deg - No Ice	16.76	-12.37	-7.08	-470.80	835.47	-3.74
1.2D+1.0W (pattern 2) 300 deg - No Ice	16.76	-9.80	-5.54	-414.40	748.93	-4.67
0.9 Dead+1.0 Wind 300 deg - No Ice	12.57	-13.86	-7.89	-554.19	988.40	-4.66
1.2 Dead+1.0 Wind 330 deg - No Ice	16.76	-8.33	-13.67	-954.07	604.88	-3.40
1.2D+1.0W (pattern 1) 330 deg - No Ice	16.76	-7.37	-12.31	-814.20	503.95	-2.31
1.2D+1.0W (pattern 2) 330 deg - No Ice	16.76	-5.96	-9.57	-710.79	463.92	-3.44
0.9 Dead+1.0 Wind 330 deg - No Ice	12.57	-8.33	-13.67	-953.35	603.75	-3.39
Dead+Wind 0 deg - Service	13.97	-0.00	-0.00	3.22	0.07	-0.00
Dead+Wind 30 deg - Service	13.97	0.00	-0.00	3.22	0.07	0.00
Dead+Wind 60 deg - Service	13.97	0.00	-0.00	3.22	0.07	0.00
Dead+Wind 90 deg - Service	13.97	0.00	0.00	3.22	0.07	0.00
Dead+Wind 120 deg - Service	13.97	0.00	0.00	3.22	0.07	0.00
Dead+Wind 150 deg - Service	13.97	0.00	0.00	3.22	0.07	0.00
Dead+Wind 180 deg - Service	13.97	0.00	0.00	3.22	0.07	0.00
Dead+Wind 210 deg - Service	13.97	-0.00	0.00	3.22	0.08	0.00
Dead+Wind 240 deg - Service	13.97	-0.00	0.00	3.22	0.08	0.00
Dead+Wind 270 deg - Service	13.97	-0.00	-0.00	3.22	0.08	0.00
Dead+Wind 300 deg - Service	13.97	-0.00	-0.00	3.22	0.08	-0.00
Dead+Wind 330 deg - Service	13.97	-0.00	-0.00	3.22	0.08	-0.00

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	-13.97	0.00	0.00	13.97	0.00	0.000%
2	-0.27	-16.76	-16.41	0.27	16.76	16.41	0.000%
3	-0.17	-16.76	-14.72	0.17	16.76	14.72	0.000%
4	-0.26	-16.76	-11.53	0.26	16.76	11.53	0.000%
5	-0.27	-12.57	-16.41	0.27	12.57	16.41	0.000%
6	8.10	-16.76	-13.54	-8.10	16.76	13.54	0.000%
7	7.22	-16.76	-12.22	-7.22	16.76	12.22	0.000%
8	5.74	-16.76	-9.45	-5.74	16.76	9.45	0.000%
9	8.10	-12.57	-13.54	-8.10	12.57	13.54	0.000%
10	14.01	-16.76	-7.52	-14.01	16.76	7.52	0.000%
11	12.45	-16.76	-6.84	-12.45	16.76	6.84	0.000%
12	9.96	-16.76	-5.19	-9.96	16.76	5.19	0.000%
13	14.01	-12.57	-7.52	-14.01	12.57	7.52	0.000%
14	16.27	-16.76	0.18	-16.27	16.76	-0.18	0.000%
15	14.47	-16.76	0.11	-14.47	16.76	-0.11	0.000%
16	11.56	-16.76	0.17	-11.56	16.76	-0.17	0.000%
17	16.27	-12.57	0.18	-16.27	12.57	-0.18	0.000%
18	14.72	-16.76	8.34	-14.72	16.76	-8.34	0.000%
19	13.05	-16.76	7.45	-13.05	16.76	-7.45	0.000%
20	10.50	-16.76	5.90	-10.50	16.76	-5.90	0.000%
21	14.72	-12.57	8.34	-14.72	12.57	-8.34	0.000%
22	8.50	-16.76	13.74	-8.50	16.76	-13.74	0.000%
23	7.48	-16.76	12.35	-7.48	16.76	-12.35	0.000%
24	6.13	-16.76	9.64	-6.13	16.76	-9.64	0.000%
25	8.50	-12.57	13.74	-8.50	12.57	-13.74	0.000%
26	0.28	-16.76	15.61	-0.28	16.76	-15.61	0.000%
27	0.18	-16.76	14.05	-0.18	16.76	-14.05	0.000%
28	0.27	-16.76	10.92	-0.27	16.76	-10.92	0.000%
29	0.28	-12.57	15.61	-0.28	12.57	-15.61	0.000%
30	-8.10	-16.76	13.58	8.10	16.76	-13.58	0.000%
31	-7.22	-16.76	12.24	7.22	16.76	-12.24	0.000%
32	-5.74	-16.76	9.48	5.74	16.76	-9.48	0.000%
33	-8.10	-12.57	13.58	8.10	12.57	-13.58	0.000%
34	-14.50	-16.76	7.93	14.50	16.76	-7.93	0.000%
35	-12.91	-16.76	7.19	12.91	16.76	-7.19	0.000%
36	-10.28	-16.76	5.50	10.28	16.76	-5.50	0.000%
37	-14.50	-12.57	7.93	14.50	12.57	-7.93	0.000%
38	-16.07	-16.76	-0.14	16.07	16.76	0.14	0.000%
39	-14.34	-16.76	-0.09	14.34	16.76	0.09	0.000%
40	-11.36	-16.76	-0.13	11.36	16.76	0.13	0.000%
41	-16.07	-12.57	-0.14	16.07	12.57	0.14	0.000%
42	-13.86	-16.76	-7.89	13.86	16.76	7.89	0.000%
43	-12.37	-16.76	-7.08	12.37	16.76	7.08	0.000%
44	-9.80	-16.76	-5.54	9.80	16.76	5.54	0.000%
45	-13.86	-12.57	-7.89	13.86	12.57	7.89	0.000%
46	-8.33	-16.76	-13.67	8.33	16.76	13.67	0.000%
47	-7.37	-16.76	-12.31	7.37	16.76	12.31	0.000%
48	-5.96	-16.76	-9.57	5.96	16.76	9.57	0.000%
49	-8.33	-12.57	-13.67	8.33	12.57	13.67	0.000%
50	-0.00	-13.97	-0.00	0.00	13.97	0.00	0.000%
51	0.00	-13.97	-0.00	-0.00	13.97	0.00	0.000%
52	0.00	-13.97	-0.00	-0.00	13.97	0.00	0.000%
53	0.00	-13.97	0.00	-0.00	13.97	-0.00	0.000%
54	0.00	-13.97	0.00	-0.00	13.97	-0.00	0.000%
55	0.00	-13.97	0.00	-0.00	13.97	-0.00	0.000%
56	0.00	-13.97	0.00	-0.00	13.97	-0.00	0.000%

Load Comb.	Sum of Applied Forces PX K	PY K	PZ K	Sum of Reactions PX K	PY K	PZ K	% Error
57	-0.00	-13.97	0.00	0.00	13.97	-0.00	0.000%
58	-0.00	-13.97	0.00	0.00	13.97	-0.00	0.000%
59	-0.00	-13.97	-0.00	0.00	13.97	0.00	0.000%
60	-0.00	-13.97	-0.00	0.00	13.97	0.00	0.000%
61	-0.00	-13.97	-0.00	0.00	13.97	0.00	0.000%

Non-Linear Convergence Results

Load Combination	Converged?	Number of Cycles	Displacement Tolerance	Force Tolerance
1	Yes	4	0.00000001	0.00000001
2	Yes	4	0.00000001	0.00000001
3	Yes	4	0.00000001	0.00000001
4	Yes	4	0.00000001	0.00000001
5	Yes	4	0.00000001	0.00000001
6	Yes	4	0.00000001	0.00000214
7	Yes	4	0.00000001	0.00000001
8	Yes	4	0.00000001	0.00000001
9	Yes	4	0.00000001	0.00000187
10	Yes	4	0.00000001	0.00000001
11	Yes	4	0.00000001	0.00000001
12	Yes	4	0.00000001	0.00000001
13	Yes	4	0.00000001	0.00000001
14	Yes	4	0.00000001	0.00000186
15	Yes	4	0.00000001	0.00000001
16	Yes	4	0.00000001	0.00000001
17	Yes	4	0.00000001	0.00000179
18	Yes	4	0.00000001	0.00000001
19	Yes	4	0.00000001	0.00000001
20	Yes	4	0.00000001	0.00000001
21	Yes	4	0.00000001	0.00000001
22	Yes	4	0.00000001	0.00000278
23	Yes	4	0.00000001	0.00000165
24	Yes	4	0.00000001	0.00000190
25	Yes	4	0.00000001	0.00000245
26	Yes	4	0.00000001	0.00000001
27	Yes	4	0.00000001	0.00000001
28	Yes	4	0.00000001	0.00000001
29	Yes	4	0.00000001	0.00000001
30	Yes	4	0.00000001	0.00000218
31	Yes	4	0.00000001	0.00000001
32	Yes	4	0.00000001	0.00000001
33	Yes	4	0.00000001	0.00000192
34	Yes	4	0.00000001	0.00000001
35	Yes	4	0.00000001	0.00000001
36	Yes	4	0.00000001	0.00000001
37	Yes	4	0.00000001	0.00000001
38	Yes	4	0.00000001	0.00000178
39	Yes	4	0.00000001	0.00000001
40	Yes	4	0.00000001	0.00000001
41	Yes	4	0.00000001	0.00000166
42	Yes	4	0.00000001	0.00000140
43	Yes	4	0.00000001	0.00000001
44	Yes	4	0.00000001	0.00000001
45	Yes	4	0.00000001	0.00000001
46	Yes	4	0.00000001	0.00000258

47	Yes	4	0.00000001	0.00000001
48	Yes	4	0.00000001	0.00000178
49	Yes	4	0.00000001	0.00000225
50	Yes	4	0.00000001	0.00000001
51	Yes	4	0.00000001	0.00000001
52	Yes	4	0.00000001	0.00000001
53	Yes	4	0.00000001	0.00000001
54	Yes	4	0.00000001	0.00000001
55	Yes	4	0.00000001	0.00000001
56	Yes	4	0.00000001	0.00000001
57	Yes	4	0.00000001	0.00000001
58	Yes	4	0.00000001	0.00000001
59	Yes	4	0.00000001	0.00000001
60	Yes	4	0.00000001	0.00000001
61	Yes	4	0.00000001	0.00000001

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt K	Allowable Load per Bolt K	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	120	Leg	A325N	0.75	4	1.21	30.10	0.040	1	Bolt Tension
		Diagonal	A325N	0.63	1	1.48	4.55	0.325	1	Member Block Shear
		Top Girt	A325N	0.63	1	0.03	8.70	0.003	1	Member Bearing
T2	100	Leg	A325N	0.75	4	4.79	30.10	0.159	1	Bolt Tension
		Diagonal	A325N	0.63	1	2.47	4.55	0.543	1	Member Block Shear
		Top Girt	A325N	0.63	1	0.41	4.55	0.090	1	Member Block Shear
T3	80	Leg	A325N	0.75	4	14.20	30.10	0.472	1	Bolt Tension
		Diagonal	A325N	0.63	1	6.37	6.83	0.933	1	Member Block Shear
		Top Girt	A325N	0.63	1	1.17	6.83	0.172	1	Member Block Shear
T4	60	Leg	A325N	1.00	4	28.44	54.52	0.522	1	Bolt Tension
		Diagonal	A325N	0.63	1	6.87	9.11	0.755	1	Member Block Shear
		Top Girt	A325N	0.63	1	2.24	9.11	0.246	1	Member Block Shear
T5	40	Leg	A325N	1.00	4	32.87	54.52	0.603	1	Bolt Tension
		Diagonal	A325N	0.63	1	1.98	4.55	0.435	1	Member Block Shear
		Top Girt	A325N	0.63	1	2.59	4.55	0.569	1	Member Block Shear
T6	20	Diagonal	A325N	0.63	1	1.84	4.55	0.404	1	Member Block Shear

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	120 - 100	Sabre 2.375 x 0.154	20.00	5.00	76.2 K=1.00	1.07	-6.36	31.62	0.201 [1]
T2	100 - 80	Sabre 2.375 x 0.154	20.00	5.00	76.2 K=1.00	1.07	-23.71	31.62	0.750 [1]
T3	80 - 60	Sabre 2.875 x 0.276	20.00	5.00	64.9 K=1.00	2.25	-67.83	74.51	0.910 [1]
T4	60 - 40	Sabre 4.500 x 0.3370	20.00	5.00	40.6 K=1.00	4.41	-129.32	175.78	0.736 [1]
T5	40 - 20	Sabre 5.5625 x .375	20.03	5.01	32.7 K=1.00	6.11	-149.31	254.35	0.587 [1]
T6	20 - 0	Sabre 5.5625 x .375	20.03	5.01	32.7 K=1.00	6.11	-159.63	254.35	0.628 [1]

[1] $P_u / \phi P_n$ 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	120 - 100	L2x2x1/8	7.07	3.40	99.2 K=0.97	0.48	-1.59	11.81	0.135 [1]
T2	100 - 80	L2x2x1/8	7.07	3.40	99.2 K=0.97	0.48	-2.64	11.81	0.224 [1]
T3	80 - 60	L2x2x3/16	7.07	3.37	99.2 K=0.97	0.71	-6.68	17.77	0.376 [1]
T4	60 - 40	L2x2x1/4	7.07	3.27	97.7 K=0.97	0.94	-7.45	23.62	0.315 [1]
T5	40 - 20	L2x2x1/8	7.25	3.51	101.5 K=0.96	0.48	-2.18	11.57	0.188 [1]
T6	20 - 0	L2x2x1/8	10.08	4.92	133.6 K=0.90	0.48	-2.06	7.77	0.265 [1]

[1] $P_u / \phi P_n$ 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	120 - 100	L2x2x1/8	5.00	4.56	137.7 K=1.00	0.48	-0.03	7.31	0.004 [1]
T2	100 - 80	L2x2x1/8	5.00	4.56	137.7 K=1.00	0.48	-0.41	7.31	0.056 [1]
T3	80 - 60	L2x2x3/16	5.00	4.52	137.7 K=1.00	0.71	-1.17	10.79	0.109 [1]
T4	60 - 40	L2x2x1/4	5.00	4.39	134.6 K=1.00	0.94	-2.24	14.82	0.151 [1]
T5	40 - 20	L2x2x1/8	5.00	4.30	129.7 K=1.00	0.48	-2.59	8.24	0.314 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u K	ϕP_n K	Ratio $\frac{P_u}{\phi P_n}$

[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	120 - 100	Sabre 2.375 x 0.154	20.00	5.00	76.2	1.07	4.83	48.35	0.100 [1]
T2	100 - 80	Sabre 2.375 x 0.154	20.00	5.00	76.2	1.07	19.15	48.35	0.396 [1]
T3	80 - 60	Sabre 2.875 x 0.276	20.00	5.00	64.9	2.25	56.79	101.41	0.560 [1]
T4	60 - 40	Sabre 4.500 x 0.3370	20.00	5.00	40.6	4.41	113.77	198.34	0.574 [1]
T5	40 - 20	Sabre 5.5625 x .375	20.03	5.01	32.7	6.11	131.46	275.01	0.478 [1]
T6	20 - 0	Sabre 5.5625 x .375	20.03	5.01	32.7	6.11	140.07	275.01	0.509 [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	120 - 100	L2x2x1/8	7.07	3.40	65.1	0.29	1.48	12.74	0.116 [1]
T2	100 - 80	L2x2x1/8	7.07	3.40	65.1	0.29	2.47	12.74	0.194 [1]
T3	80 - 60	L2x2x3/16	7.07	3.37	65.5	0.43	6.37	18.74	0.340 [1]
T4	60 - 40	L2x2x1/4	7.07	3.27	64.4	0.56	6.87	24.49	0.281 [1]
T5	40 - 20	L2x2x1/8	7.25	3.51	67.3	0.29	1.98	12.74	0.156 [1]
T6	20 - 0	L2x2x1/8	10.08	4.92	94.2	0.29	1.84	12.74	0.144 [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	120 - 100	L2x2x1/8	5.00	4.56	92.0	0.29	0.01	12.74	0.001 [1]
T2	100 - 80	L2x2x1/8	5.00	4.56	92.0	0.29	0.41	12.74	0.032 [1]
T3	80 - 60	L2x2x3/16	5.00	4.52	92.6	0.43	1.17	18.74	0.063 [1]
T4	60 - 40	L2x2x1/4	5.00	4.39	91.1	0.56	2.24	24.49	0.091 [1]
T5	40 - 20	L2x2x1/8	5.00	4.30	86.9	0.29	2.59	12.74	0.203 [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	120 - 100	Leg	Sabre 2.375 x 0.154	2	-6.36	31.62	20.1	Pass
T2	100 - 80	Leg	Sabre 2.375 x 0.154	32	-23.71	31.62	75.0	Pass
T3	80 - 60	Leg	Sabre 2.875 x 0.276	62	-67.83	74.51	91.0	Pass
T4	60 - 40	Leg	Sabre 4.500 x 0.3370	92	-129.32	175.78	73.6	Pass
T5	40 - 20	Leg	Sabre 5.5625 x .375	122	-149.31	254.35	58.7 60.3 (b)	Pass
T6	20 - 0	Leg	Sabre 5.5625 x .375	152	-159.63	254.35	62.8	Pass
T1	120 - 100	Diagonal	L2x2x1/8	8	-1.59	11.81	13.5 32.5 (b)	Pass
T2	100 - 80	Diagonal	L2x2x1/8	38	-2.64	11.81	22.4 54.3 (b)	Pass
T3	80 - 60	Diagonal	L2x2x3/16	68	-6.68	17.77	37.6 93.3 (b)	Pass
T4	60 - 40	Diagonal	L2x2x1/4	98	-7.45	23.62	31.5 75.5 (b)	Pass
T5	40 - 20	Diagonal	L2x2x1/8	146	-2.18	11.57	18.8 43.5 (b)	Pass
T6	20 - 0	Diagonal	L2x2x1/8	155	-2.06	7.77	26.5 40.4 (b)	Pass
T1	120 - 100	Top Girt	L2x2x1/8	6	-0.03	7.31	0.4	Pass
T2	100 - 80	Top Girt	L2x2x1/8	34	-0.41	7.31	5.6 9.0 (b)	Pass
T3	80 - 60	Top Girt	L2x2x3/16	64	-1.17	10.79	10.9 17.2 (b)	Pass
T4	60 - 40	Top Girt	L2x2x1/4	94	-2.24	14.82	15.1 24.6 (b)	Pass
T5	40 - 20	Top Girt	L2x2x1/8	124	-2.59	8.24	31.4 56.9 (b)	Pass

Summary	ELC:	Existing/Proposed (LC5)
Leg (T3)	91.0	Pass
Diagonal (T3)	93.3	Pass
Top Girt (T5)	56.9	Pass
Bolt Checks	93.3	Pass
Rating =	93.3	Pass

CCIplate

Project Information

Site #	DNDEN00104C
Project #	22964050A

Tower Information

Tower Type	Self Support
TIA-222 Rev	H

☐ Apply TIA-222-H Section 15.5

Applied Loads

	Comp.	Uplift
Axial (k)	161.00	141.00
Shear (k)	12.00	10.00

Anchor Rod Data

Quantity:	6
Diameter (in):	1
Material Grade:	A325
Grout Considered:	No
l_{ar} (in):	0.25
Eta Factor, η:	
Thread Type:	N-Included
Configuration:	Symmetrical

Fy=92 ksi Fu=120 ksi

Not Considered, lar<=1(d)

Anchor Rod Results

Axial, Pu_c (kips)	26.83
Shear, Vu (kips)	2.00
Moment, Mu (kip-in)	-
Axial Cap., φPn_c (kips)	65.03
Shear Cap., ϕVn (kips)	29.26
Moment Cap., ϕMn (kip-in)	-
Stress Rating	41.7%

Pass

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EXHIBIT B

EBI Consulting
environmental | engineering | due diligence

CO-LOCATION INTERFERENCE ANALYSIS REPORT

Dish Wireless
DNDEN00104C
4800 N. Himalaya Road
Denver, CO 80249

Delivered: February 15, 2023

EBI Project Number: 6222007193

Prepared by:
EBI Consulting
21 B Street
Burlington, MA 01803

Table of Contents

1.0 Executive Summary

This report presents a radio frequency interference (RFI) analysis which was performed on the **Dish Wireless - DNDEN00104C (Denver CO)** site. The RFI analysis consists of transmitter noise, receiver desensitization, intermodulation, harmonic and transmitter spurious output interference. The report consists of Sections that provide details of the communications site, antenna systems, operational frequencies and each interference analysis mode.

A summary of the interference analysis results is depicted in the following Table.

Interference Analysis Mode	Type Mix	Status	Summary	Worst-Case Margin (dB)
Transmitter Noise	N/A	Passed	No Interference was predicted	**22.2**
Receiver Desensitization	N/A	Passed	No Interference was predicted	**29.8**
Transmitter Intermodulation	1 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	2 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	3 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	4 Tx	Passed	No Interference was predicted	N/A
Transmitter Intermodulation	5 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	1 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	2 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	3 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	4 Tx	Passed	No Interference was predicted	N/A
Receiver Intermodulation	5 Tx	Passed	No Interference was predicted	N/A
Transmitter Harmonics	N/A	Passed	No Interference was predicted	N/A
Transmitter Spurious Output	N/A	Passed	No Interference was predicted	N/A

The analysis was performed with the setup options depicted in the Table below.

Analysis	Description
Receiver Performance	Receiver Sensitivity Threshold
Receiver Bandwidth	Receiver Dependent
Antenna Patterns Considered	Yes
Measured Antenna Isolation Data	No
Filters/Multicouplers Considered	Yes
Number of Simultaneous Transmitters Mixed	5
Highest Intermodulation Order Tested	7
Condense Intermodulation Hit Quantity	Yes - 1000/Order
TX IM Bandwidth Multiplication	No
Tx/Rx Systems Excluded	None
Site File Name	Dish Wireless - DNDEN00104C (Denver CO).dta
Report File Name	Dish Wireless - DNDEN00104C (Denver CO).docx
WirelessSiteRFI Software Version	10.1.19

2.0 Site Description

The communication systems located at this site are described in this section as well as the configuration of the antenna systems.

The site parameters are:

Site Name:	**Dish Wireless - DNDEN00104C (Denver CO)**
Owner:	City & County of Denver
Site Description:	Self-Support Tower
Address:	4800 N. Himalaya Road, Denver CO 80249
Latitude:	39.783111 N
Longitude:	-104.754554 W
Elevation:	5426 feet AMSL

Notes: This analysis was performed between the proposed **Dish Wireless** radio systems and the existing radio systems for **Verizon Wireless**, **T-Mobile** and the **City and County of Denver**. Since specific locations were not provided for the radio systems of the City and County of Denver, all detailed City and County radios and antennas were analyzed as if they were all located on this tower to produce a worst case scenario.

2.1 Communications Systems

System	Provider	Technology	Frequency Band
1	Dish Wireless	5G	N29 - 700 MHz
2	Dish Wireless	5G	N66_2100 MHz
3	Dish Wireless	5G	N70_2100 MHz
4	Dish Wireless	5G	N71_600 MHz
5	Verizon Wireless	LTE	700 MHz Band
6	Verizon Wireless	LTE / 5G NR	850 MHz - Cellular Band
7	Verizon Wireless	LTE	1900 MHz PCS Band
8	Verizon Wireless	LTE	2100 MHz AWS Band
9	Verizon Wireless	5G	C Band
10	T-Mobile	LTE / 5G NR	600 MHz Band
11	T-Mobile	LTE	700 MHz Band
12	T-Mobile	LTE	1900 MHz PCS Band
13	T-Mobile	LTE	2100 MHz AWS Band
14	T-Mobile	LTE / 5G NR	2500 MHz BRS Band
15	City and County of Denver	Microwave	5 GHz Broadband
16	Denver - P25 MM Harris	800 MHz Trunking	800 MHz - Land Mobile
17	Denver - ASR	800 MHz Trunking	800 MHz - Land Mobile
18	Denver - RMRS	800 MHz Trunking	800 MHz - Land Mobile
19	Denver - Repeater	800 MHz Trunking	800 MHz - Land Mobile
20	Denver - Simulcast	800 MHz Trunking	800 MHz - Land Mobile
21	Denver - FD	700 / 800 MHz Trunking	700 MHz / 800 MHz - Land Mobile
22	Denver - Data	800 MHz Trunking	800 MHz - Land Mobile
23	Denver Conventional 800 MHz	800 MHz Trunking	800 MHz - Land Mobile
24	Denver - Conventional UHF	FM Land Mobile	800 MHz - Land Mobile
25	Denver - Conventional VHF	FM Land Mobile	800 MHz - Land Mobile

2.2 Antenna Systems

Ant #	Mfg	Antenna Model	Gain (dBd)	Hgt (ft)	Orient (deg)	Sector	Ant Use	Transmission Line Type	Line Loss (/100')	Line Length (ft)
1	Commscope	MX08FRO665-21	16	96	0	A	Tx	1/2 in. Foam	0.5	10
2	Commscope	MX08FRO665-21	16	96	120	B	Tx	1/2 in. Foam	0.5	10
3	Commscope	MX08FRO665-21	16	96	260	C	Tx	1/2 in. Foam	0.5	10
4	Commscope	NHHSS-65C-R2B	13.67	77	0	A	Dplx	1/2 in. Foam	0.5	10
5	Commscope	NHHSS-65C-R2B	13.67	77	120	B	Dplx	1/2 in. Foam	0.5	10
6	Commscope	NHHSS-65C-R2B	13.67	77	240	C	Dplx	1/2 in. Foam	0.5	10
7	Commscope	NHHSS-65C-R2B	15.83	77	0	A	Dplx	1/2 in. Foam	0.5	10
8	Commscope	NHHSS-65C-R2B	15.83	77	120	B	Dplx	1/2 in. Foam	0.5	10
9	Commscope	NHHSS-65C-R2B	15.83	77	240	C	Dplx	1/2 in. Foam	0.5	10
10	Samsung	MT6407-77A	23.15	77	0	A	Dplx	NA	NA	NA
11	Samsung	MT6407-77A	23.15	77	120	B	Dplx	NA	NA	NA
12	Samsung	MT6407-77A	23.15	77	240	C	Dplx	NA	NA	NA
13	RFS	FFV4-65C-R3-V1	15.83	77	0	B	Dplx	1/2 in. Foam	0.5	10
14	RFS	FFV4-65C-R3-V1	15.83	77	120	C	Dplx	1/2 in. Foam	0.5	10
15	RFS	FFV4-65C-R3-V1	15.83	77	240	A	Dplx	1/2 in. Foam	0.5	10
16	Commscope	NHHSS-65C-R2B	14.27	112	0	A	Tx/Rx	1/2 in. Foam	0.5	10
17	Decibel	DB806	6	110	0		Dplx	1-5/8 in. Foam	0.72	140
18	Decibel	DB806	6	110	0		Dplx	1-5/8 in. Foam	0.72	140
19	Decibel	DB806	6	110	0		Dplx	1-5/8 in. Foam	0.72	140
20	Decibel	DB806	6	120	0		Dplx	1-5/8 in. Foam	0.72	150
21	Decibel	DB806	6	120	0		Dplx	1-5/8 in. Foam	0.72	150
22	Decibel	DB806	6	120	0		Dplx	1-5/8 in. Foam	0.72	150
23	Decibel	DB806	6	105	0		Dplx	1-5/8 in. Foam	0.72	135
24	Decibel	DB806	6	105	0		Dplx	1-5/8 in. Foam	0.72	135
25	Celwave	PD201-1	5.53	110	0		Dplx	1-5/8 in. Foam	0.54	140
26	Celwave	PD200	5.6	110	0		Tx/Rx	1-5/8 in. Foam	0.28	140

3.0 Transmitter Frequencies

Freq #	Ant #	Provider	Model	Technology	Channel Label	ID	Frequency (MHz)	Power (Watts)	BW (KHz)
1	1	Dish Wireless	Fujitsu	5G	N29_1	A	725.000000	60	5000
2	2	Dish Wireless	Fujitsu	5G	N29_2	B	725.000000	60	5000
3	3	Dish Wireless	Fujitsu	5G	N29_3	C	725.000000	60	5000
4	1	Dish Wireless	Fujitsu	5G	N66_1	D	2190.000000	160	20000
5	2	Dish Wireless	Fujitsu	5G	N66_2	E	2190.000000	160	20000
6	3	Dish Wireless	Fujitsu	5G	N66_3	F	2190.000000	160	20000
7	1	Dish Wireless	Fujitsu	5G	N70_1	G	2007.500000	160	25000
8	2	Dish Wireless	Fujitsu	5G	N70_2	H	2007.500000	160	25000
9	3	Dish Wireless	Fujitsu	5G	N70_3	I	2007.500000	160	25000
10	1	Dish Wireless	Fujitsu	5G	N71_1	J	647.000000	250	10000
11	2	Dish Wireless	Fujitsu	5G	N71_2	K	647.000000	250	10000
12	3	Dish Wireless	Fujitsu	5G	N71_3	L	647.000000	250	10000
13	4	Verizon Wireless	Ericsson	LTE	1	M	781.500000	160	10000
14	5	Verizon Wireless	Ericsson	LTE	1	N	781.500000	160	10000
15	6	Verizon Wireless	Ericsson	LTE	1	O	781.500000	160	10000
16	4	Verizon Wireless	Ericsson	LTE / 5G	2	P	885.000000	160	10000
17	5	Verizon Wireless	Ericsson	LTE / 5G	2	Q	885.000000	160	10000
18	6	Verizon Wireless	Ericsson	LTE / 5G	2	R	885.000000	160	10000
19	7	Verizon Wireless	Ericsson	LTE	4	S	1982.500000	160	15000
20	8	Verizon Wireless	Ericsson	LTE	4	T	1982.500000	160	15000
21	9	Verizon Wireless	Ericsson	LTE	4	U	1982.500000	160	15000
22	7	Verizon Wireless	Ericsson	LTE	1	V	2125.000000	160	10000
23	8	Verizon Wireless	Ericsson	LTE	1	W	2125.000000	160	10000
24	9	Verizon Wireless	Ericsson	LTE	1	X	2125.000000	160	10000
25	10	Verizon Wireless	Ericsson	5G	C1	Y	3710.000000	20	20000
26	11	Verizon Wireless	Ericsson	5G	C1	Z	3710.000000	20	20000
27	12	Verizon Wireless	Ericsson	5G	C1	AA	3710.000000	20	20000
28	10	Verizon Wireless	Ericsson	5G	C2	AB	3730.000000	20	20000
29	11	Verizon Wireless	Ericsson	5G	C2	AC	3730.000000	20	20000
30	12	Verizon Wireless	Ericsson	5G	C2	AD	3730.000000	20	20000
31	10	Verizon Wireless	Ericsson	5G	C3	AE	3750.000000	20	20000
32	11	Verizon Wireless	Ericsson	5G	C3	AF	3750.000000	20	20000
33	12	Verizon Wireless	Ericsson	5G	C3	AG	3750.000000	20	20000
34	10	Verizon Wireless	Ericsson	5G	C4	AH	3770.000000	20	20000
35	11	Verizon Wireless	Ericsson	5G	C4	AI	3770.000000	20	20000
36	12	Verizon Wireless	Ericsson	5G	C4	AJ	3770.000000	20	20000
37	10	Verizon Wireless	Ericsson	5G	C5	AK	3790.000000	20	20000
38	11	Verizon Wireless	Ericsson	5G	C5	AL	3790.000000	20	20000
39	12	Verizon Wireless	Ericsson	5G	C5	AM	3790.000000	20	20000
40	10	Verizon Wireless	Ericsson	5G	C6	AN	3810.000000	20	20000
41	11	Verizon Wireless	Ericsson	5G	C6	AO	3810.000000	20	20000
42	12	Verizon Wireless	Ericsson	5G	C6	AP	3810.000000	20	20000
43	10	Verizon Wireless	Ericsson	5G	C7	AQ	3830.000000	20	20000
44	11	Verizon Wireless	Ericsson	5G	C7	AR	3830.000000	20	20000
45	12	Verizon Wireless	Ericsson	5G	C7	AS	3830.000000	20	20000
46	10	Verizon Wireless	Ericsson	5G	C8	AT	3850.000000	20	20000
47	11	Verizon Wireless	Ericsson	5G	C8	AU	3850.000000	20	20000
48	12	Verizon Wireless	Ericsson	5G	C8	AV	3850.000000	20	20000
49	13	T-Mobile	Ericsson	LTE / 5G	1	AW	627.000000	120	10000
50	14	T-Mobile	Ericsson	LTE / 5G	1	AX	627.000000	120	10000
51	15	T-Mobile	Ericsson	LTE / 5G	1	AY	627.000000	120	10000
52	13	T-Mobile	Ericsson	LTE	1	AZ	731.000000	80	5000
53	14	T-Mobile	Ericsson	LTE	1	BA	731.000000	80	5000
54	15	T-Mobile	Ericsson	LTE	1	BB	731.000000	80	5000
55	13	T-Mobile	Ericsson	LTE	1	BC	1957.500000	160	15000
56	14	T-Mobile	Ericsson	LTE	1	BD	1957.500000	160	15000
57	15	T-Mobile	Ericsson	LTE	1	BE	1957.500000	160	15000
58	13	T-Mobile	Ericsson	LTE	1	BF	2115.000000	160	10000

59	14	T-Mobile	Ericsson	LTE	1	BG	2115.000000	160	10000
60	15	T-Mobile	Ericsson	LTE	1	BH	2115.000000	160	10000
61	13	T-Mobile	Ericsson	LTE	1	BI	2150.000000	160	10000
62	14	T-Mobile	Ericsson	LTE	1	BJ	2150.000000	160	10000
63	15	T-Mobile	Ericsson	LTE	1	BK	2150.000000	160	10000
64	13	T-Mobile	Ericsson	LTE / 5G	1	CJ	2518.400000	60	20000
65	14	T-Mobile	Ericsson	LTE / 5G	1	CK	2518.400000	60	20000
66	15	T-Mobile	Ericsson	LTE / 5G	1	CL	2518.400000	60	20000
67	13	T-Mobile	Ericsson	LTE / 5G	2	CM	2538.200000	60	20000
68	14	T-Mobile	Ericsson	LTE / 5G	2	CN	2538.200000	60	20000
69	15	T-Mobile	Ericsson	LTE / 5G	2	CO	2538.200000	60	20000
70	13	T-Mobile	Ericsson	LTE / 5G	3	CP	2558.000000	60	20000
71	14	T-Mobile	Ericsson	LTE / 5G	3	CQ	2558.000000	60	20000
72	15	T-Mobile	Ericsson	LTE / 5G	3	CR	2558.000000	60	20000
73	16	City and County of Denver	Other	5 GHz Broadband	1	CS	4950.000000	5	20000
74	16	City and County of Denver	Other	5 GHz Broadband	2	CT	4980.000000	5	20000
75	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	1	CU	852.375000	100	25
76	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	2	CV	852.650000	100	25
77	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	3	CW	853.275000	100	25
78	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	4	CX	853.725000	100	25
79	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	5	CY	851.562500	100	25
80	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	6	CZ	853.150000	100	25
81	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	7	DA	853.425000	100	25
82	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	8	DB	854.587500	100	25
83	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	9	DC	856.487500	100	25
84	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	10	DD	857.237500	100	25
85	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	11	DE	858.237500	100	25
86	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	12	DF	852.125000	100	25
87	18	Denver - ASR	Motorola	800 MHz Trunking	1	DG	859.262500	100	20
88	18	Denver - ASR	Motorola	800 MHz Trunking	2	DH	858.712500	100	20
89	18	Denver - ASR	Motorola	800 MHz Trunking	3	DI	857.137500	100	20
90	18	Denver - ASR	Motorola	800 MHz Trunking	4	DJ	856.767500	100	20
91	18	Denver - ASR	Motorola	800 MHz Trunking	5	DK	856.212500	100	20
92	18	Denver - ASR	Motorola	800 MHz Trunking	6	DL	855.987500	100	20
93	18	Denver - ASR	Motorola	800 MHz Trunking	7	DM	855.487500	100	20
94	18	Denver - ASR	Motorola	800 MHz Trunking	8	DN	855.237500	100	20
95	18	Denver - ASR	Motorola	800 MHz Trunking	9	DO	854.437500	100	20
96	18	Denver - ASR	Motorola	800 MHz Trunking	10	DP	853.862500	100	20
97	18	Denver - ASR	Motorola	800 MHz Trunking	11	DQ	853.325000	100	20
98	18	Denver - ASR	Motorola	800 MHz Trunking	12	DR	852.775000	100	20
99	19	Denver - RMRS	Motorola	800 MHz Trunking	1	DS	858.087500	100	20
100	19	Denver - RMRS	Motorola	800 MHz Trunking	2	DT	858.337500	100	20
101	19	Denver - RMRS	Motorola	800 MHz Trunking	3	DU	859.087500	100	20
102	19	Denver - RMRS	Motorola	800 MHz Trunking	4	DV	859.637500	100	20
103	20	Denver - Repeater	Motorola	800 MHz Trunking	1	DW	851.587500	100	20
104	20	Denver - Repeater	Motorola	800 MHz Trunking	2	DX	851.887500	100	20
105	20	Denver - Repeater	Motorola	800 MHz Trunking	3	DY	852.862500	100	20
106	20	Denver - Repeater	Motorola	800 MHz Trunking	4	DZ	853.087500	100	20
107	20	Denver - Repeater	Motorola	800 MHz Trunking	5	EA	854.987500	100	20
108	20	Denver - Repeater	Motorola	800 MHz Trunking	6	EB	855.062500	100	20
109	20	Denver - Repeater	Motorola	800 MHz Trunking	7	EC	855.537500	100	20
110	20	Denver - Repeater	Motorola	800 MHz Trunking	8	ED	857.487500	100	20
111	20	Denver - Repeater	Motorola	800 MHz Trunking	9	EE	858.462500	100	20

112	20	Denver - Repeater	Motorola	800 MHz Trunking	10	EF	858.487500	100	20
113	20	Denver - Repeater	Motorola	800 MHz Trunking	11	EG	859.237500	100	20
114	20	Denver - Repeater	Motorola	800 MHz Trunking	12	EH	859.462500	100	20
115	20	Denver - Repeater	Motorola	800 MHz Trunking	13	EI	859.487500	100	20
116	20	Denver - Repeater	Motorola	800 MHz Trunking	14	EJ	859.587500	100	20
117	20	Denver - Repeater	Motorola	800 MHz Trunking	15	EK	859.737500	100	20
118	21	Denver - Simulcast	Motorola	800 MHz Trunking	1	EL	859.712500	100	20
119	21	Denver - Simulcast	Motorola	800 MHz Trunking	2	EM	859.612500	100	20
120	21	Denver - Simulcast	Motorola	800 MHz Trunking	3	EN	859.212500	100	20
121	21	Denver - Simulcast	Motorola	800 MHz Trunking	4	EO	856.137500	100	20
122	21	Denver - Simulcast	Motorola	800 MHz Trunking	5	EP	858.212500	100	20
123	21	Denver - Simulcast	Motorola	800 MHz Trunking	6	EQ	857.737500	100	20
124	21	Denver - Simulcast	Motorola	800 MHz Trunking	7	ER	858.137500	100	20
125	21	Denver - Simulcast	Motorola	800 MHz Trunking	8	ES	857.462500	100	20
126	21	Denver - Simulcast	Motorola	800 MHz Trunking	9	ET	857.062500	100	20
127	21	Denver - Simulcast	Motorola	800 MHz Trunking	10	EU	856.712500	100	20
128	21	Denver - Simulcast	Motorola	800 MHz Trunking	11	EV	856.637500	100	20
129	21	Denver - Simulcast	Motorola	800 MHz Trunking	12	EW	856.237500	100	20
130	21	Denver - Simulcast	Motorola	800 MHz Trunking	13	EX	858.737500	100	20
131	21	Denver - Simulcast	Motorola	800 MHz Trunking	14	EY	855.737500	100	20
132	21	Denver - Simulcast	Motorola	800 MHz Trunking	15	EZ	855.462500	100	20
133	21	Denver - Simulcast	Motorola	800 MHz Trunking	16	FA	854.562500	100	20
134	21	Denver - Simulcast	Motorola	800 MHz Trunking	17	FB	854.062500	100	20
135	22	Denver - FD	Motorola	800 MHz Trunking	1	FC	799.318750	100	20
136	22	Denver - FD	Motorola	800 MHz Trunking	2	FD	799.856250	100	20
137	22	Denver - FD	Motorola	800 MHz Trunking	3	FE	800.506250	100	20
138	22	Denver - FD	Motorola	800 MHz Trunking	4	FF	800.756250	100	20
139	22	Denver - FD	Motorola	800 MHz Trunking	5	FG	801.181250	100	20
140	22	Denver - FD	Motorola	800 MHz Trunking	6	FH	801.431250	100	20
141	22	Denver - FD	Motorola	800 MHz Trunking	7	FI	802.431250	100	20
142	22	Denver - FD	Motorola	800 MHz Trunking	8	FJ	802.681250	100	20
143	23	Denver - Data	Motorola	800 MHz Trunking	1	FK	855.912500	100	20
144	23	Denver - Data	Motorola	800 MHz Trunking	2	FL	856.787500	100	20
145	23	Denver - Data	Motorola	800 MHz Trunking	3	FM	855.687500	100	20
146	23	Denver - Data	Motorola	800 MHz Trunking	4	FN	854.237500	100	20
147	23	Denver - Data	Motorola	800 MHz Trunking	5	FO	851.187500	100	20
148	23	Denver - Data	Motorola	800 MHz Trunking	6	FP	852.125000	100	20
149	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8CALL90	FQ	851.012500	100	20
150	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC91	FR	851.512500	100	20
151	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC92	FS	852.012500	100	20
152	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC93	FT	852.512500	100	20
153	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC94	FU	853.012500	100	20
154	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	STAC	FV	853.787500	100	20
155	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	Metro	FW	851.887500	100	20
156	25	Denver - Conventional UHF	Motorola	FM Land Mobile	1	FX	460.425000	100	12.5
157	26	Denver - Conventional VHF	Motorola	FM Land Mobile	1	FY	155.475000	100	11.2
158	26	Denver - Conventional VHF	Motorola	FM Land Mobile	2	FZ	155.340000	100	11.2

4.0 Receiver Frequencies

Freq #	Ant #	Provider	Model	Technology	Channel Label	ID	Frequency (MHz)	Sen (dBm)	BW (KHz)
1	1	Dish Wireless	Fujitsu	LTE	N70_1	G	1917.500000	-110	5000
2	2	Dish Wireless	Fujitsu	LTE	N70_2	H	1917.500000	-110	5000
3	3	Dish Wireless	Fujitsu	LTE	N70_3	I	1917.500000	-110	5000
4	1	Dish Wireless	Fujitsu	LTE	N71_1	J	693.000000	-110	10000
5	2	Dish Wireless	Fujitsu	LTE	N71_2	K	693.000000	-110	10000
6	3	Dish Wireless	Fujitsu	LTE	N71_3	L	693.000000	-110	10000
7	4	Verizon Wireless	Ericsson	LTE	1	M	751.500000	-110	10000
8	5	Verizon Wireless	Ericsson	LTE	1	N	751.500000	-110	10000
9	6	Verizon Wireless	Ericsson	LTE	1	O	751.500000	-110	10000
10	4	Verizon Wireless	Ericsson	LTE / 5G	2	P	840.000000	-110	10000
11	5	Verizon Wireless	Ericsson	LTE / 5G	2	Q	840.000000	-110	10000
12	6	Verizon Wireless	Ericsson	LTE / 5G	2	R	840.000000	-110	10000
13	7	Verizon Wireless	Ericsson	LTE	4	S	1902.500000	-110	15000
14	8	Verizon Wireless	Ericsson	LTE	4	T	1902.500000	-110	15000
15	9	Verizon Wireless	Ericsson	LTE	4	U	1902.500000	-110	15000
16	7	Verizon Wireless	Ericsson	LTE	1	V	1725.000000	-110	10000
17	8	Verizon Wireless	Ericsson	LTE	1	W	1725.000000	-110	10000
18	9	Verizon Wireless	Ericsson	LTE	1	X	1725.000000	-110	10000
19	10	Verizon Wireless	Ericsson	5G	C1	Y	3710.000000	-110	20000
20	11	Verizon Wireless	Ericsson	5G	C1	Z	3710.000000	-110	20000
21	12	Verizon Wireless	Ericsson	5G	C1	AA	3710.000000	-110	20000
22	10	Verizon Wireless	Ericsson	5G	C2	AB	3730.000000	-110	20000
23	11	Verizon Wireless	Ericsson	5G	C2	AC	3730.000000	-110	20000
24	12	Verizon Wireless	Ericsson	5G	C2	AD	3730.000000	-110	20000
25	10	Verizon Wireless	Ericsson	5G	C3	AE	3750.000000	-110	20000
26	11	Verizon Wireless	Ericsson	5G	C3	AF	3750.000000	-110	20000
27	12	Verizon Wireless	Ericsson	5G	C3	AG	3750.000000	-110	20000
28	10	Verizon Wireless	Ericsson	5G	C4	AH	3770.000000	-110	20000
29	11	Verizon Wireless	Ericsson	5G	C4	AI	3770.000000	-110	20000
30	12	Verizon Wireless	Ericsson	5G	C4	AJ	3770.000000	-110	20000
31	10	Verizon Wireless	Ericsson	5G	C5	AK	3790.000000	-110	20000
32	11	Verizon Wireless	Ericsson	5G	C5	AL	3790.000000	-110	20000
33	12	Verizon Wireless	Ericsson	5G	C5	AM	3790.000000	-110	20000
34	10	Verizon Wireless	Ericsson	5G	C6	AN	3810.000000	-110	20000
35	11	Verizon Wireless	Ericsson	5G	C6	AO	3810.000000	-110	20000
36	12	Verizon Wireless	Ericsson	5G	C6	AP	3810.000000	-110	20000
37	10	Verizon Wireless	Ericsson	5G	C7	AQ	3830.000000	-110	20000
38	11	Verizon Wireless	Ericsson	5G	C7	AR	3830.000000	-110	20000
39	12	Verizon Wireless	Ericsson	5G	C7	AS	3830.000000	-110	20000
40	10	Verizon Wireless	Ericsson	5G	C8	AT	3850.000000	-110	20000
41	11	Verizon Wireless	Ericsson	5G	C8	AU	3850.000000	-110	20000
42	12	Verizon Wireless	Ericsson	5G	C8	AV	3850.000000	-110	20000
43	13	T-Mobile	Ericsson	LTE / 5G	1	AW	673.000000	-110	10000
44	14	T-Mobile	Ericsson	LTE / 5G	1	AX	673.000000	-110	10000
45	15	T-Mobile	Ericsson	LTE / 5G	1	AY	673.000000	-110	10000
46	13	T-Mobile	Ericsson	LTE	1	AZ	701.000000	-110	5000
47	14	T-Mobile	Ericsson	LTE	1	BA	701.000000	-110	5000
48	15	T-Mobile	Ericsson	LTE	1	BB	701.000000	-110	5000
49	13	T-Mobile	Ericsson	LTE	1	BC	1875.000000	-110	15000
50	14	T-Mobile	Ericsson	LTE	1	BD	1875.000000	-110	15000
51	15	T-Mobile	Ericsson	LTE	1	BE	1875.000000	-110	15000
52	13	T-Mobile	Ericsson	LTE	1	BF	1715.000000	-110	10000
53	14	T-Mobile	Ericsson	LTE	1	BG	1715.000000	-110	10000
54	15	T-Mobile	Ericsson	LTE	1	BH	1715.000000	-110	10000
55	13	T-Mobile	Ericsson	LTE	1	BI	1750.000000	-110	10000
56	14	T-Mobile	Ericsson	LTE	1	BJ	1750.000000	-110	10000
57	15	T-Mobile	Ericsson	LTE	1	BK	1750.000000	-110	10000
58	13	T-Mobile	Ericsson	LTE / 5G	1	CJ	2518.400000	-110	20000
59	14	T-Mobile	Ericsson	LTE / 5G	2	CK	2518.400000	-110	20000
60	15	T-Mobile	Ericsson	LTE / 5G	3	CL	2518.400000	-110	20000

61	13	T-Mobile	Ericsson	LTE / 5G	1	CM	2538.200000	-110	20000
62	14	T-Mobile	Ericsson	LTE / 5G	2	CN	2538.200000	-110	20000
63	15	T-Mobile	Ericsson	LTE / 5G	3	CO	2538.200000	-110	20000
64	13	T-Mobile	Ericsson	LTE / 5G	1	CP	2558.000000	-110	20000
65	14	T-Mobile	Ericsson	LTE / 5G	2	CQ	2558.000000	-110	20000
66	15	T-Mobile	Ericsson	LTE / 5G	3	CR	2558.000000	-110	20000
67	16	City and County of Denver	Other	5 GHz Broadband	1	CS	4950.000000	-72	20000
68	16	City and County of Denver	Other	5 GHz Broadband	2	CT	4980.000000	-72	20000
69	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	1	CU	807.375000	-116	25
70	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	2	CV	807.650000	-116	25
71	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	3	CW	808.275000	-116	25
72	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	4	CX	808.725000	-116	25
73	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	5	CY	806.562500	-116	25
74	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	6	CZ	808.150000	-116	25
75	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	7	DA	808.425000	-116	25
76	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	8	DB	809.587500	-116	25
77	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	9	DC	811.487500	-116	25
78	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	10	DD	812.237500	-116	25
79	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	11	DE	813.237500	-116	25
80	17	Denver - P25 MM Harris	Motorola	800 MHz Trunking	12	DF	807.125000	-116	25
81	18	Denver - ASR	Motorola	800 MHz Trunking	1	DG	814.262500	-116	25
82	18	Denver - ASR	Motorola	800 MHz Trunking	2	DH	813.712500	-116	25
83	18	Denver - ASR	Motorola	800 MHz Trunking	3	DI	812.137500	-116	25
84	18	Denver - ASR	Motorola	800 MHz Trunking	4	DJ	811.767500	-116	25
85	18	Denver - ASR	Motorola	800 MHz Trunking	5	DK	811.212500	-116	25
86	18	Denver - ASR	Motorola	800 MHz Trunking	6	DL	810.987500	-116	25
87	18	Denver - ASR	Motorola	800 MHz Trunking	7	DM	810.487500	-116	25
88	18	Denver - ASR	Motorola	800 MHz Trunking	8	DN	810.237500	-116	25
89	18	Denver - ASR	Motorola	800 MHz Trunking	9	DO	809.437500	-116	25
90	18	Denver - ASR	Motorola	800 MHz Trunking	10	DP	808.862500	-116	25
91	18	Denver - ASR	Motorola	800 MHz Trunking	11	DQ	808.325000	-116	25
92	18	Denver - ASR	Motorola	800 MHz Trunking	12	DR	807.775000	-116	25
93	19	Denver - RMRS	Motorola	800 MHz Trunking	1	DS	813.087500	-116	25
94	19	Denver - RMRS	Motorola	800 MHz Trunking	2	DT	813.337500	-116	25
95	19	Denver - RMRS	Motorola	800 MHz Trunking	3	DU	814.087500	-116	25
96	19	Denver - RMRS	Motorola	800 MHz Trunking	4	DV	814.637500	-116	25
97	20	Denver - Repeater	Motorola	800 MHz Trunking	1	DW	806.587500	-116	25
98	20	Denver - Repeater	Motorola	800 MHz Trunking	2	DX	806.887500	-116	25
99	20	Denver - Repeater	Motorola	800 MHz Trunking	3	DY	807.862500	-116	25
100	20	Denver - Repeater	Motorola	800 MHz Trunking	4	DZ	808.087500	-116	25
101	20	Denver - Repeater	Motorola	800 MHz Trunking	5	EA	809.987500	-116	25
102	20	Denver - Repeater	Motorola	800 MHz Trunking	6	EB	810.062500	-116	25
103	20	Denver - Repeater	Motorola	800 MHz Trunking	7	EC	810.537500	-116	25
104	20	Denver - Repeater	Motorola	800 MHz Trunking	8	ED	812.487500	-116	25
105	20	Denver - Repeater	Motorola	800 MHz Trunking	9	EE	413.462500	-116	25
106	20	Denver - Repeater	Motorola	800 MHz Trunking	10	EF	813.487500	-116	25
107	20	Denver - Repeater	Motorola	800 MHz Trunking	11	EG	814.237500	-116	25
108	20	Denver - Repeater	Motorola	800 MHz Trunking	12	EH	814.462500	-116	25
109	20	Denver - Repeater	Motorola	800 MHz Trunking	13	EI	814.487500	-116	25
110	20	Denver - Repeater	Motorola	800 MHz Trunking	14	EJ	814.587500	-116	25
111	20	Denver - Repeater	Motorola	800 MHz Trunking	15	EK	814.737500	-116	25
112	21	Denver - Simulcast	Motorola	800 MHz Trunking	1	EL	814.712500	-116	25
113	21	Denver - Simulcast	Motorola	800 MHz Trunking	2	EM	814.612500	-116	25

114	21	Denver - Simulcast	Motorola	800 MHz Trunking	3	EN	814.212500	-116	25
115	21	Denver - Simulcast	Motorola	800 MHz Trunking	4	EO	811.137500	-116	25
116	21	Denver - Simulcast	Motorola	800 MHz Trunking	5	EP	813.212500	-116	25
117	21	Denver - Simulcast	Motorola	800 MHz Trunking	6	EQ	812.737500	-116	25
118	21	Denver - Simulcast	Motorola	800 MHz Trunking	7	ER	813.137500	-116	25
119	21	Denver - Simulcast	Motorola	800 MHz Trunking	8	ES	812.462500	-116	25
120	21	Denver - Simulcast	Motorola	800 MHz Trunking	9	ET	812.062500	-116	25
121	21	Denver - Simulcast	Motorola	800 MHz Trunking	10	EU	811.712500	-116	25
122	21	Denver - Simulcast	Motorola	800 MHz Trunking	11	EV	811.637500	-116	25
123	21	Denver - Simulcast	Motorola	800 MHz Trunking	12	EW	811.237500	-116	25
124	21	Denver - Simulcast	Motorola	800 MHz Trunking	13	EX	813.737500	-116	25
125	21	Denver - Simulcast	Motorola	800 MHz Trunking	14	EY	810.737500	-116	25
126	21	Denver - Simulcast	Motorola	800 MHz Trunking	15	EZ	810.462500	-116	25
127	21	Denver - Simulcast	Motorola	800 MHz Trunking	16	FA	809.562500	-116	25
128	21	Denver - Simulcast	Motorola	800 MHz Trunking	17	FB	809.062500	-116	25
129	22	Denver - FD	Motorola	800 MHz Trunking	1	FC	769.31875	-116	25
130	22	Denver - FD	Motorola	800 MHz Trunking	2	FD	769.85625	-116	25
131	22	Denver - FD	Motorola	800 MHz Trunking	3	FE	770.50625	-116	25
132	22	Denver - FD	Motorola	800 MHz Trunking	4	FF	770.75625	-116	25
133	22	Denver - FD	Motorola	800 MHz Trunking	5	FG	771.18125	-116	25
134	22	Denver - FD	Motorola	800 MHz Trunking	6	FH	771.43125	-116	25
135	22	Denver - FD	Motorola	800 MHz Trunking	7	FI	772.43125	-116	25
136	22	Denver - FD	Motorola	800 MHz Trunking	8	FJ	772.68125	-116	25
137	23	Denver - Data	Motorola	800 MHz Trunking	1	FK	810.9125	-116	25
138	23	Denver - Data	Motorola	800 MHz Trunking	2	FL	811.7875	-116	25
139	23	Denver - Data	Motorola	800 MHz Trunking	3	FM	810.6875	-116	25
140	23	Denver - Data	Motorola	800 MHz Trunking	4	FN	809.2375	-116	25
141	23	Denver - Data	Motorola	800 MHz Trunking	5	FO	806.1875	-116	25
142	23	Denver - Data	Motorola	800 MHz Trunking	6	FP	807.125	-116	25
143	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8CALL90	FQ	806.012500	-116	25
144	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC91	FR	806.512500	-116	25
145	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC92	FS	807.012500	-116	25
146	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC93	FT	807.512500	-116	25
147	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	8TAC94	FU	808.012500	-116	25
148	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	STAC	FV	808.787500	-116	25
149	24	Denver Conventional 800 MHz	Motorola	800 MHz Trunking	Metro	FW	806.887500	-116	25
150	25	Denver - Conventional UHF	Motorola	FM Land Mobile	1	FX	465.425000	-116	12.5
151	26	Denver - Conventional VHF	Motorola	FM Land Mobile	1	FY	155.475000	-116	11.2
152	26	Denver - Conventional VHF	Motorola	FM Land Mobile	2	FZ	155.340000	-116	11.2

5.0 Transmitter Noise Analysis

Transmitter noise interference occurs because a transmitter radiates energy on its operating frequency as well as frequencies above and below the assigned frequency. The energy that is radiated above and below the assigned frequency is known as sideband noise energy and extends for several megahertz on either side of the operating frequency. This undesired noise energy can fall within the passband of a nearby receiver even if the receiver's operating frequency is several megahertz away. The transmitter noise appears as "on-channel" noise interference and cannot be filtered out at the receiver. It is on the receiver's operating frequency and competes with the desired signal, which in effect, degrades the operational performance.

The analysis predicts each transmitter's noise signal level present at the input of each receiver. It takes into account the transmitter's noise characteristics, frequency separation, power output, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in both systems. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required, if any, to prevent receiver performance degradation caused by transmitter noise interference. The Table below depicts the results of this analysis. For each receiver, the transmitter that has the worst-case impact is displayed. The Signal Margin represents the margin in dB, before the receiver's performance is degraded. A negative number indicates that the performance is degraded and the value indicates how much additional isolation is required to prevent receiver performance degradation.

Receiver Provider	Receive Channel	Receive Frequency (MHz)	Transmitter Provider	Transmit Channel	Transmit Frequency (MHz)	Attn Required (dB)	Attn Provided (dB)	Signal Margin (dB)
Dish Wireless	N70_1	1917.500000	Dish Wireless	N70_1	2007.500000	54.6	91.6	37
Dish Wireless	N70_2	1917.500000	Dish Wireless	N70_1	2007.500000	54.6	91.6	37
Dish Wireless	N70_3	1917.500000	Dish Wireless	N70_1	2007.500000	54.6	91.6	37
Dish Wireless	N71_1	693.000000	Dish Wireless	N71_1	647.000000	50	72.6	22.6
Dish Wireless	N71_2	693.000000	Dish Wireless	N71_1	647.000000	50	72.6	22.6
Dish Wireless	N71_3	693.000000	Dish Wireless	N71_1	647.000000	50	72.6	22.6
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	58.3	80.5	22.2
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	58.3	80.5	22.2
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	58.3	80.5	22.2
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	51.6	79.5	27.9
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	51.6	79.5	27.9
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	51.6	79.5	27.9
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	54.6	91.6	37
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	54.6	91.6	37
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	54.6	91.6	37
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	54.6	132.5	77.9
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	54.6	132.5	77.9
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	54.6	131.7	77.1
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	56.6	101.6	45
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	54.4	102.5	48.1
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	56.6	110.9	54.3
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	56.6	101.6	45
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	54.4	102.5	48.1

Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	56.6	110.1	53.5
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	56.6	101.6	45
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	54.4	102.5	48.1
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	54.4	100.9	46.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	56.6	101.6	45
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	54.4	100.9	46.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	56.6	101.6	45
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	54.4	100.9	46.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	56.6	101.6	45
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	54.4	100.9	46.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	56.6	101.6	45
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	54.4	100.9	46.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	56.6	101.6	45
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	54.4	100.9	46.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	56.6	101.6	45
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	54.4	100.9	46.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	56.6	101.6	45
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	54.4	100.9	46.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	56.6	101.6	45
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	54.4	100.9	46.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	56.6	101.6	45
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	54.4	100.9	46.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	56.6	101.6	45
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	54.4	100.9	46.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	56.6	101.6	45
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	54.4	100.9	46.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	56.6	101.6	45
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	54.4	100.9	46.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	56.6	101.6	45
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	54.4	100.9	46.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	56.6	101.6	45
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	54.4	100.9	46.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	56.6	101.6	45
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	54.4	100.9	46.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	56.6	101.6	45
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	54.4	100.9	46.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	56.6	101.6	45
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	54.4	100.9	46.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	56.6	101.6	45
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	54.4	100.9	46.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	56.6	101.6	45
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	54.4	100.9	46.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	56.6	101.6	45
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	54.4	100.9	46.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	56.6	101.6	45
T-Mobile	1	673.000000	T-Mobile	1	627.000000	46.8	73.6	26.8
T-Mobile	1	673.000000	T-Mobile	1	627.000000	46.8	73.6	26.8
T-Mobile	1	673.000000	T-Mobile	1	627.000000	46.8	73.6	26.8
T-Mobile	1	701.000000	T-Mobile	1	731.000000	45	79.5	34.5
T-Mobile	1	701.000000	T-Mobile	1	731.000000	45	79.5	34.5
T-Mobile	1	701.000000	T-Mobile	1	731.000000	45	79.5	34.5
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	54.6	91.6	37
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	54.6	91.6	37
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	54.6	91.6	37
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	54.6	131.7	77.1
T-Mobile	1	2518.400000	T-Mobile	2	2538.200000	59.3	102.1	42.8
T-Mobile	2	2518.400000	T-Mobile	2	2538.200000	59.3	102.1	42.8
T-Mobile	3	2518.400000	T-Mobile	2	2538.200000	59.3	102.1	42.8
T-Mobile	1	2538.200000	T-Mobile	1	2518.400000	59.3	100.5	41.2
T-Mobile	2	2538.200000	T-Mobile	1	2518.400000	59.3	100.5	41.2
T-Mobile	3	2538.200000	T-Mobile	1	2518.400000	59.3	100.5	41.2

T-Mobile	1	2558.000000	T-Mobile	2	2538.200000	59.3	100.5	41.2
T-Mobile	2	2558.000000	T-Mobile	2	2538.200000	59.3	100.5	41.2
T-Mobile	3	2558.000000	T-Mobile	2	2538.200000	59.3	100.5	41.2
City and County of Denver	1	4950.000000	City and County of Denver	2	4980.000000	5.2	60.5	55.3
City and County of Denver	2	4980.000000	City and County of Denver	1	4950.000000	5.2	60.5	55.3
Denver - P25 MM Harris	1	807.375000	Verizon Wireless	2	885.000000	57.6	148.5	90.9
Denver - P25 MM Harris	2	807.650000	Verizon Wireless	2	885.000000	57.6	148.4	90.8
Denver - P25 MM Harris	3	808.275000	Verizon Wireless	2	885.000000	57.6	148.4	90.7
Denver - P25 MM Harris	4	808.725000	Verizon Wireless	2	885.000000	57.6	148.5	90.9
Denver - P25 MM Harris	5	806.562500	Verizon Wireless	2	885.000000	57.6	149.7	92
Denver - P25 MM Harris	6	808.150000	Verizon Wireless	2	885.000000	57.6	148.3	90.7
Denver - P25 MM Harris	7	808.425000	Verizon Wireless	2	885.000000	57.6	148.4	90.8
Denver - P25 MM Harris	8	809.587500	Verizon Wireless	2	885.000000	57.6	149	91.3
Denver - P25 MM Harris	9	811.487500	Verizon Wireless	2	885.000000	57.6	149.4	91.8
Denver - P25 MM Harris	10	812.237500	Verizon Wireless	2	885.000000	57.6	149.4	91.8
Denver - P25 MM Harris	11	813.237500	Verizon Wireless	2	885.000000	57.6	149.3	91.7
Denver - P25 MM Harris	12	807.125000	Verizon Wireless	2	885.000000	57.6	148.8	91.1
Denver - ASR	1	814.262500	Verizon Wireless	2	885.000000	57.6	146.2	88.5
Denver - ASR	2	813.712500	Verizon Wireless	2	885.000000	57.6	146.3	88.7
Denver - ASR	3	812.137500	Verizon Wireless	2	885.000000	57.6	146.5	88.9
Denver - ASR	4	811.767500	Verizon Wireless	2	885.000000	57.6	146.5	88.9
Denver - ASR	5	811.212500	Verizon Wireless	2	885.000000	57.6	146.5	88.8
Denver - ASR	6	810.987500	Verizon Wireless	2	885.000000	57.6	146.4	88.8
Denver - ASR	7	810.487500	Verizon Wireless	2	885.000000	57.6	146.3	88.7
Denver - ASR	8	810.237500	Verizon Wireless	2	885.000000	57.6	146.3	88.6
Denver - ASR	9	809.437500	Verizon Wireless	2	885.000000	57.6	145.9	88.3
Denver - ASR	10	808.862500	Verizon Wireless	2	885.000000	57.6	145.7	88
Denver - ASR	11	808.325000	Verizon Wireless	2	885.000000	57.6	145.4	87.8
Denver - ASR	12	807.775000	Verizon Wireless	2	885.000000	57.6	145.4	87.8
Denver - RMRS	1	813.087500	Denver - RMRS	1	858.087500	55.6	154.2	98.6
Denver - RMRS	2	813.337500	Denver - RMRS	1	858.087500	55.6	153.6	97.9
Denver - RMRS	3	814.087500	Denver - RMRS	1	858.087500	55.9	151.7	95.8
Denver - RMRS	4	814.637500	Denver - RMRS	1	858.087500	56	150.4	94.4
Denver - Repeater	1	806.587500	Verizon Wireless	2	885.000000	57.6	146	88.4
Denver - Repeater	2	806.887500	Verizon Wireless	2	885.000000	57.6	145.5	87.9
Denver - Repeater	3	807.862500	Verizon Wireless	2	885.000000	57.6	144.8	87.1
Denver - Repeater	4	808.087500	Verizon Wireless	2	885.000000	57.6	144.8	87.1
Denver - Repeater	5	809.987500	Verizon Wireless	2	885.000000	57.6	145.5	87.9
Denver - Repeater	6	810.062500	Verizon Wireless	2	885.000000	57.6	145.6	87.9
Denver - Repeater	7	810.537500	Verizon Wireless	2	885.000000	57.6	145.7	88.1
Denver - Repeater	8	812.487500	Verizon Wireless	2	885.000000	57.6	145.9	88.2
Denver - Repeater	9	413.462500	Denver - Conventional UHF	1	460.425000	52	139.7	87.7
Denver - Repeater	10	813.487500	Verizon Wireless	2	885.000000	57.6	145.7	88.1

Denver - Repeater	11	814.237500	Verizon Wireless	2	885.000000	57.6	145.5	87.9
Denver - Repeater	12	814.462500	Verizon Wireless	2	885.000000	57.6	145.5	87.8
Denver - Repeater	13	814.487500	Verizon Wireless	2	885.000000	57.6	145.5	87.8
Denver - Repeater	14	814.587500	Verizon Wireless	2	885.000000	57.6	145.5	87.8
Denver - Repeater	15	814.737500	Verizon Wireless	2	885.000000	57.6	145.4	87.8
Denver - Simulcast	1	814.712500	Denver - Simulcast	17	854.062500	56.5	149	92.5
Denver - Simulcast	2	814.612500	Denver - Simulcast	17	854.062500	56.5	149.2	92.7
Denver - Simulcast	3	814.212500	Denver - Simulcast	17	854.062500	56.5	150.2	93.7
Denver - Simulcast	4	811.137500	Denver - Simulcast	17	854.062500	56.1	156.5	100.4
Denver - Simulcast	5	813.212500	Denver - Simulcast	17	854.062500	56.4	152.6	96.2
Denver - Simulcast	6	812.737500	Denver - Simulcast	17	854.062500	56.3	153.7	97.3
Denver - Simulcast	7	813.137500	Denver - Simulcast	17	854.062500	56.4	152.8	96.4
Denver - Simulcast	8	812.462500	Denver - Simulcast	17	854.062500	56.3	154.3	98
Denver - Simulcast	9	812.062500	Denver - Simulcast	17	854.062500	56.3	155.1	98.8
Denver - Simulcast	10	811.712500	Denver - Simulcast	17	854.062500	56.2	155.7	99.5
Denver - Simulcast	11	811.637500	Denver - Simulcast	17	854.062500	56.2	155.8	99.6
Denver - Simulcast	12	811.237500	Denver - Simulcast	17	854.062500	56.1	156.4	100.3
Denver - Simulcast	13	813.737500	Denver - Simulcast	17	854.062500	56.4	151.3	94.9
Denver - Simulcast	14	810.737500	Denver - Simulcast	17	854.062500	56.1	156.8	100.8
Denver - Simulcast	15	810.462500	Denver - Simulcast	17	854.062500	56	156.9	100.9
Denver - Simulcast	16	809.562500	Denver - Simulcast	17	854.062500	55.7	156.8	101.1
Denver - Simulcast	17	809.062500	Denver - Simulcast	17	854.062500	55.6	156.5	100.9
Denver - FD	1	769.31875	Verizon Wireless	1	781.500000	71.6	203.8	132.2
Denver - FD	2	769.85625	Verizon Wireless	1	781.500000	71.6	206.1	134.5
Denver - FD	3	770.50625	Verizon Wireless	1	781.500000	71.6	193.6	122
Denver - FD	4	770.75625	Verizon Wireless	1	781.500000	71.6	190.5	118.8
Denver - FD	5	771.18125	Verizon Wireless	1	781.500000	71.6	189.6	118
Denver - FD	6	771.43125	Verizon Wireless	1	781.500000	71.6	192.6	121
Denver - FD	7	772.43125	Verizon Wireless	1	781.500000	71.6	200.1	128.4
Denver - FD	8	772.68125	Verizon Wireless	1	781.500000	71.6	188.6	117
Denver - Data	1	810.9125	Verizon Wireless	2	885.000000	57.6	149.3	91.7
Denver - Data	2	811.7875	Verizon Wireless	2	885.000000	57.6	149.4	91.8
Denver - Data	3	810.6875	Verizon Wireless	2	885.000000	57.6	149.3	91.7
Denver - Data	4	809.2375	Verizon Wireless	2	885.000000	57.6	148.7	91.1
Denver - Data	5	806.1875	Verizon Wireless	2	885.000000	57.6	150.6	92.9
Denver - Data	6	807.125	Verizon Wireless	2	885.000000	57.6	148.7	91.1
Denver Conventional 800 MHz	8CALL90	806.012500	Verizon Wireless	2	885.000000	57.6	147.7	90.1
Denver Conventional 800 MHz	8TAC91	806.512500	Verizon Wireless	2	885.000000	57.6	146.3	88.6
Denver Conventional 800 MHz	8TAC92	807.012500	Verizon Wireless	2	885.000000	57.6	145.4	87.8

Denver Conventional 800 MHz	8TAC93	807.512500	Verizon Wireless	2	885.000000	57.6	145	87.3
Denver Conventional 800 MHz	8TAC94	808.012500	Verizon Wireless	2	885.000000	57.6	144.8	87.2
Denver Conventional 800 MHz	STAC	808.787500	Verizon Wireless	2	885.000000	57.6	145.1	87.4
Denver Conventional 800 MHz	Metro	806.887500	Verizon Wireless	2	885.000000	57.6	145.6	87.9
Denver - Conventional UHF	1	465.425000	Denver - Conventional UHF	1	460.425000	57.4	102.2	44.8
Denver - Conventional VHF	1	155.475000	Denver - Conventional VHF	2	155.340000	85.4	125.3	39.9
Denver - Conventional VHF	2	155.340000	Denver - Conventional VHF	1	155.475000	85.4	125.3	39.9

Analysis Results: No transmitter noise interference problems were predicted that were determined to be system performance limiting to any operators analyzed in this report. All calculations yielded results that determined, based upon the listed configurations, that there was adequate isolation between all analyzed transmitters and receivers either through physical separation, antenna broadcast pattern gain roll off or filtering and isolation devices considered to be part of the standard transmitter / receiver configuration deployed by the equipment manufacturers listed as part of this analysis.

6.0 Receiver Desensitization Analysis

Receiver desensitization interference occurs when an undesired signal from a nearby "off-frequency" transmitter is sufficiently close to a receiver's operating frequency. The signal may get through the RF selectivity of the receiver. If this undesired signal is of sufficient amplitude, the receiver's critical voltage and current levels are altered and the performance of the receiver is degraded at its operating frequency. The gain of the receiver is reduced, thereby reducing the performance of the receiver.

A transmitter can be operating several megahertz away from the receiver frequency and/or its antenna can be located several thousand feet from the receiver's antenna and still cause interference.

The analysis predicts each transmitter's signal level present at the input of each receiver. It takes into account the transmitter's power output, frequency separation, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in both systems. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required, if any, to prevent receiver performance degradation caused by receiver desensitization interference. The Table below depicts the results of this analysis. For each receiver, the transmitter that has the worst-case impact is displayed. The Signal Margin represents the margin in dB, before the receiver's performance is degraded. A negative number indicates that the performance is degraded and the value indicates how much additional isolation is required to prevent receiver performance degradation.

Receiver Provider	Receive Channel	Receive Frequency (MHz)	Transmitter Provider	Transmit Channel	Transmit Frequency (MHz)	Attn Required (dB)	Attn Provided (dB)	Signal Margin (dB)
Dish Wireless	N70_1	1917.500000	Dish Wireless	N70_1	2007.500000	19	89.2	70.2
Dish Wireless	N70_2	1917.500000	Dish Wireless	N70_1	2007.500000	19	89.2	70.2
Dish Wireless	N70_3	1917.500000	Dish Wireless	N70_1	2007.500000	19	89.2	70.2
Dish Wireless	N71_1	693.000000	Dish Wireless	N71_1	647.000000	18	79.5	61.5
Dish Wireless	N71_2	693.000000	Dish Wireless	N71_1	647.000000	18	79.5	61.5
Dish Wireless	N71_3	693.000000	Dish Wireless	N71_1	647.000000	18	79.5	61.5
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	22.3	73.6	51.3
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	22.3	73.6	51.3
Verizon Wireless	1	751.500000	Verizon Wireless	1	781.500000	22.3	73.6	51.3
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	23.6	72.6	49
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	23.6	72.6	49
Verizon Wireless	2	840.000000	Verizon Wireless	2	885.000000	23.6	72.6	49
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	19	89.2	70.2
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	19	89.2	70.2
Verizon Wireless	4	1902.500000	Verizon Wireless	4	1982.500000	19	89.2	70.2
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	19	217.7	198.7
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	19	217.7	198.7
Verizon Wireless	1	1725.000000	Verizon Wireless	4	1982.500000	19	129.3	110.3
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	24	101.6	77.6
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	19	100.9	81.9
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	24	110.9	86.9
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	24	101.6	77.6
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	19	100.9	81.9

Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	24	110.1	86.1
Verizon Wireless	C1	3710.000000	Verizon Wireless	C1	3710.000000	24	101.6	77.6
Verizon Wireless	C1	3710.000000	Verizon Wireless	C2	3730.000000	19	100.9	81.9
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	19	102.5	83.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	24	101.6	77.6
Verizon Wireless	C2	3730.000000	Verizon Wireless	C3	3750.000000	19	100.9	81.9
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	19	102.5	83.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	24	101.6	77.6
Verizon Wireless	C2	3730.000000	Verizon Wireless	C3	3750.000000	19	100.9	81.9
Verizon Wireless	C2	3730.000000	Verizon Wireless	C1	3710.000000	19	102.5	83.5
Verizon Wireless	C2	3730.000000	Verizon Wireless	C2	3730.000000	24	101.6	77.6
Verizon Wireless	C2	3730.000000	Verizon Wireless	C3	3750.000000	19	100.9	81.9
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	19	102.5	83.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	24	101.6	77.6
Verizon Wireless	C3	3750.000000	Verizon Wireless	C4	3770.000000	19	100.9	81.9
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	19	102.5	83.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	24	101.6	77.6
Verizon Wireless	C3	3750.000000	Verizon Wireless	C4	3770.000000	19	100.9	81.9
Verizon Wireless	C3	3750.000000	Verizon Wireless	C2	3730.000000	19	102.5	83.5
Verizon Wireless	C3	3750.000000	Verizon Wireless	C3	3750.000000	24	101.6	77.6
Verizon Wireless	C3	3750.000000	Verizon Wireless	C4	3770.000000	19	100.9	81.9
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	19	102.5	83.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	24	101.6	77.6
Verizon Wireless	C4	3770.000000	Verizon Wireless	C5	3790.000000	19	100.9	81.9
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	19	102.5	83.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	24	101.6	77.6
Verizon Wireless	C4	3770.000000	Verizon Wireless	C5	3790.000000	19	100.9	81.9
Verizon Wireless	C4	3770.000000	Verizon Wireless	C3	3750.000000	19	102.5	83.5
Verizon Wireless	C4	3770.000000	Verizon Wireless	C4	3770.000000	24	101.6	77.6
Verizon Wireless	C4	3770.000000	Verizon Wireless	C5	3790.000000	19	100.9	81.9
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	19	102.5	83.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	24	101.6	77.6
Verizon Wireless	C5	3790.000000	Verizon Wireless	C6	3810.000000	19	100.9	81.9
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	19	102.5	83.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	24	101.6	77.6
Verizon Wireless	C5	3790.000000	Verizon Wireless	C6	3810.000000	19	100.9	81.9
Verizon Wireless	C5	3790.000000	Verizon Wireless	C4	3770.000000	19	102.5	83.5
Verizon Wireless	C5	3790.000000	Verizon Wireless	C5	3790.000000	24	101.6	77.6
Verizon Wireless	C5	3790.000000	Verizon Wireless	C6	3810.000000	19	100.9	81.9
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	19	102.5	83.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	24	101.6	77.6
Verizon Wireless	C6	3810.000000	Verizon Wireless	C7	3830.000000	19	100.9	81.9
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	19	102.5	83.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	24	101.6	77.6
Verizon Wireless	C6	3810.000000	Verizon Wireless	C7	3830.000000	19	100.9	81.9
Verizon Wireless	C6	3810.000000	Verizon Wireless	C5	3790.000000	19	102.5	83.5
Verizon Wireless	C6	3810.000000	Verizon Wireless	C6	3810.000000	24	101.6	77.6
Verizon Wireless	C6	3810.000000	Verizon Wireless	C7	3830.000000	19	100.9	81.9
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	19	102.5	83.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	24	101.6	77.6
Verizon Wireless	C7	3830.000000	Verizon Wireless	C8	3850.000000	19	100.9	81.9
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	19	102.5	83.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	24	101.6	77.6
Verizon Wireless	C7	3830.000000	Verizon Wireless	C8	3850.000000	19	100.9	81.9
Verizon Wireless	C7	3830.000000	Verizon Wireless	C6	3810.000000	19	102.5	83.5
Verizon Wireless	C7	3830.000000	Verizon Wireless	C7	3830.000000	24	101.6	77.6
Verizon Wireless	C7	3830.000000	Verizon Wireless	C8	3850.000000	19	100.9	81.9
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	19	102.5	83.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	24	101.6	77.6
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	19	102.5	83.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	24	101.6	77.6
Verizon Wireless	C8	3850.000000	Verizon Wireless	C7	3830.000000	19	102.5	83.5
Verizon Wireless	C8	3850.000000	Verizon Wireless	C8	3850.000000	24	101.6	77.6
T-Mobile	1	673.000000	T-Mobile	1	627.000000	14.8	80.5	65.7
T-Mobile	1	673.000000	T-Mobile	1	627.000000	14.8	80.5	65.7
T-Mobile	1	673.000000	T-Mobile	1	627.000000	14.8	80.5	65.7

T-Mobile	1	701.000000	T-Mobile	1	731.000000	13	72.6	59.6
T-Mobile	1	701.000000	T-Mobile	1	731.000000	13	72.6	59.6
T-Mobile	1	701.000000	T-Mobile	1	731.000000	13	72.6	59.6
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	19	89.2	70.2
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	19	89.2	70.2
T-Mobile	1	1875.000000	T-Mobile	1	1957.500000	19	89.2	70.2
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	1715.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	1750.000000	T-Mobile	1	1957.500000	19	129.3	110.3
T-Mobile	1	2518.400000	T-Mobile	2	2538.200000	24	100.5	76.5
T-Mobile	2	2518.400000	T-Mobile	2	2538.200000	24	100.5	76.5
T-Mobile	3	2518.400000	T-Mobile	2	2538.200000	24	100.5	76.5
T-Mobile	1	2538.200000	T-Mobile	3	2558.000000	24	100.5	76.5
T-Mobile	2	2538.200000	T-Mobile	3	2558.000000	24	100.5	76.5
T-Mobile	3	2538.200000	T-Mobile	3	2558.000000	24	100.5	76.5
T-Mobile	1	2558.000000	T-Mobile	2	2538.200000	24	102.1	78.1
T-Mobile	2	2558.000000	T-Mobile	2	2538.200000	24	102.1	78.1
T-Mobile	3	2558.000000	T-Mobile	2	2538.200000	24	102.1	78.1
City and County of Denver	1	4950.000000	City and County of Denver	2	4980.000000	30.7	60.5	29.8
City and County of Denver	2	4980.000000	City and County of Denver	1	4950.000000	30.7	60.5	29.8
Denver - P25 MM Harris	1	807.375000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	2	807.650000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	3	808.275000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	4	808.725000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	5	806.562500	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	6	808.150000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	7	808.425000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	8	809.587500	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - P25 MM Harris	9	811.487500	Denver - P25 MM Harris	4	853.725000	27.9	145.4	117.5
Denver - P25 MM Harris	10	812.237500	Denver - P25 MM Harris	8	854.587500	27.8	145.2	117.4
Denver - P25 MM Harris	11	813.237500	Denver - P25 MM Harris	8	854.587500	27.9	145.2	117.3
Denver - P25 MM Harris	12	807.125000	Denver - P25 MM Harris	8	854.587500	27.6	145.2	117.6
Denver - ASR	1	814.262500	Denver - ASR	9	854.437500	28.1	145	117
Denver - ASR	2	813.712500	Denver - ASR	9	854.437500	28	145	117
Denver - ASR	3	812.137500	Denver - ASR	9	854.437500	27.8	145	117.2
Denver - ASR	4	811.767500	Denver - ASR	9	854.437500	27.8	145	117.2
Denver - ASR	5	811.212500	Denver - ASR	9	854.437500	27.8	145	117.2
Denver - ASR	6	810.987500	Denver - ASR	9	854.437500	27.8	145	117.2
Denver - ASR	7	810.487500	Denver - ASR	9	854.437500	27.7	145	117.3
Denver - ASR	8	810.237500	Denver - ASR	9	854.437500	27.7	145	117.3
Denver - ASR	9	809.437500	Denver - ASR	9	854.437500	27.6	145	117.4
Denver - ASR	10	808.862500	Denver - ASR	9	854.437500	27.6	145	117.4
Denver - ASR	11	808.325000	Denver - ASR	9	854.437500	27.6	145	117.4
Denver - ASR	12	807.775000	Denver - ASR	9	854.437500	27.6	145	117.4
Denver - RMRS	1	813.087500	Denver - RMRS	1	858.087500	27.6	151.7	124.1
Denver - RMRS	2	813.337500	Denver - RMRS	1	858.087500	27.6	151.7	124.1
Denver - RMRS	3	814.087500	Denver - RMRS	1	858.087500	27.7	151.7	124
Denver - RMRS	4	814.637500	Denver - RMRS	1	858.087500	27.8	151.7	124
Denver - Repeater	1	806.587500	Denver - Repeater	5	854.987500	27.6	145.3	117.7

Denver - Repeater	2	806.887500	Denver - Repeater	5	854.987500	27.6	145.3	117.7
Denver - Repeater	3	807.862500	Denver - Repeater	5	854.987500	27.6	145.3	117.7
Denver - Repeater	4	808.087500	Denver - Repeater	5	854.987500	27.6	145.3	117.7
Denver - Repeater	5	809.987500	Denver - Repeater	5	854.987500	27.6	145.3	117.7
Denver - Repeater	6	810.062500	Denver - Repeater	5	854.987500	27.6	145.3	117.7
Denver - Repeater	7	810.537500	Denver - Repeater	5	854.987500	27.7	145.3	117.6
Denver - Repeater	8	812.487500	Denver - Repeater	5	854.987500	27.8	145.3	117.4
Denver - Repeater	9	413.462500	Denver - Conventional UHF	1	460.425000	20	158.9	138.9
Denver - Repeater	10	813.487500	Denver - Repeater	5	854.987500	27.9	145.3	117.4
Denver - Repeater	11	814.237500	Denver - Repeater	5	854.987500	28	145.3	117.3
Denver - Repeater	12	814.462500	Denver - Repeater	5	854.987500	28	145.3	117.3
Denver - Repeater	13	814.487500	Denver - Repeater	5	854.987500	28	145.3	117.3
Denver - Repeater	14	814.587500	Denver - Repeater	5	854.987500	28	145.3	117.2
Denver - Repeater	15	814.737500	Denver - Repeater	5	854.987500	28	145.3	117.2
Denver - Simulcast	1	814.712500	Denver - Simulcast	17	854.062500	28.1	145	116.9
Denver - Simulcast	2	814.612500	Denver - Simulcast	17	854.062500	28.1	145	116.9
Denver - Simulcast	3	814.212500	Denver - Simulcast	17	854.062500	28.1	145	116.9
Denver - Simulcast	4	811.137500	Denver - Simulcast	17	854.062500	27.8	145	117.2
Denver - Simulcast	5	813.212500	Denver - Simulcast	17	854.062500	28	145	117
Denver - Simulcast	6	812.737500	Denver - Simulcast	16	854.562500	27.9	145	117.1
Denver - Simulcast	7	813.137500	Denver - Simulcast	17	854.062500	28	145	117
Denver - Simulcast	8	812.462500	Denver - Simulcast	17	854.062500	27.9	145	117.1
Denver - Simulcast	9	812.062500	Denver - Simulcast	17	854.062500	27.9	145	117.1
Denver - Simulcast	10	811.712500	Denver - Simulcast	16	854.562500	27.8	145	117.2
Denver - Simulcast	11	811.637500	Denver - Simulcast	16	854.562500	27.8	145	117.2
Denver - Simulcast	12	811.237500	Denver - Simulcast	17	854.062500	27.8	145	117.2
Denver - Simulcast	13	813.737500	Denver - Simulcast	17	854.062500	28	145	117
Denver - Simulcast	14	810.737500	Denver - Simulcast	17	854.062500	27.8	145	117.2
Denver - Simulcast	15	810.462500	Denver - Simulcast	16	854.562500	27.7	145	117.3
Denver - Simulcast	16	809.562500	Denver - Simulcast	16	854.562500	27.6	145	117.4
Denver - Simulcast	17	809.062500	Denver - Simulcast	16	854.562500	27.6	145	117.4
Denver - FD	1	769.31875	Denver - FD	8	802.68125	24.1	166.4	142.3
Denver - FD	2	769.85625	Denver - FD	8	802.68125	24.5	166.4	141.9
Denver - FD	3	770.50625	Denver - FD	8	802.68125	25.1	166.4	141.3
Denver - FD	4	770.75625	Denver - FD	8	802.68125	25.2	166.4	141.2
Denver - FD	5	771.18125	Denver - FD	8	802.68125	25.4	166.4	141

Denver - FD	6	771.43125	Denver - FD	8	802.68125	25.5	166.4	140.9
Denver - FD	7	772.43125	Denver - FD	8	802.68125	26	166.4	140.4
Denver - FD	8	772.68125	Denver - FD	8	802.68125	26.3	166.4	140.2
Denver - Data	1	810.9125	Denver - Data	4	854.2375	27.8	145	117.2
Denver - Data	2	811.7875	Denver - Data	4	854.2375	27.8	145	117.2
Denver - Data	3	810.6875	Denver - Data	4	854.2375	27.8	145	117.2
Denver - Data	4	809.2375	Denver - Data	4	854.2375	27.6	145	117.4
Denver - Data	5	806.1875	Denver - Data	4	854.2375	27.6	145	117.4
Denver - Data	6	807.125	Denver - Data	4	854.2375	27.6	145	117.4
Denver Conventional 800 MHz	8CALL90	806.012500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	8TAC91	806.512500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	8TAC92	807.012500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	8TAC93	807.512500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	8TAC94	808.012500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	STAC	808.787500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver Conventional 800 MHz	Metro	806.887500	Denver Conventional 800 MHz	STAC	853.787500	27.6	145.1	117.5
Denver - Conventional UHF	1	465.425000	Dish Wireless	N71_1	647.000000	24	81.5	57.5
Denver - Conventional VHF	1	155.475000	Denver - Conventional VHF	2	155.340000	69.8	110.8	41
Denver - Conventional VHF	2	155.340000	Denver - Conventional VHF	1	155.475000	69.8	110.8	41

Analysis Results: No receiver desensitization interference problems were predicted that were determined to be system performance limiting to any operators analyzed in this report. All calculations yielded results that determined, based upon the listed configurations, that there was adequate isolation between all analyzed transmitters and receivers either through physical separation, antenna broadcast pattern gain roll off or filtering and isolation devices considered to be part of the standard transmitter / receiver configuration deployed by the equipment manufacturers listed as part of this analysis.

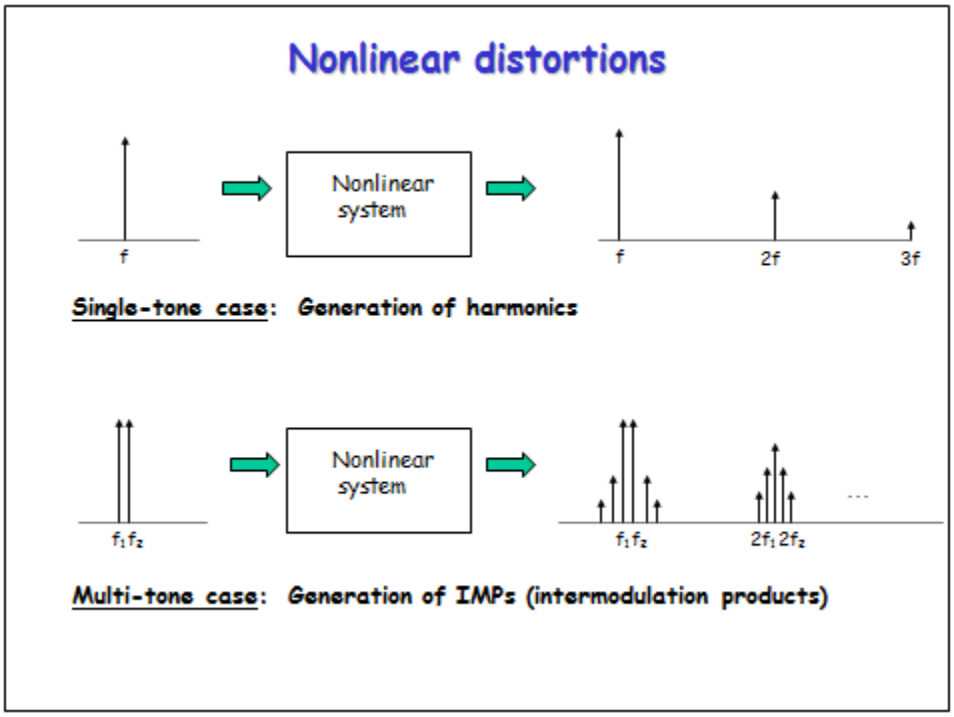
7.0 Intermodulation Interference Analysis

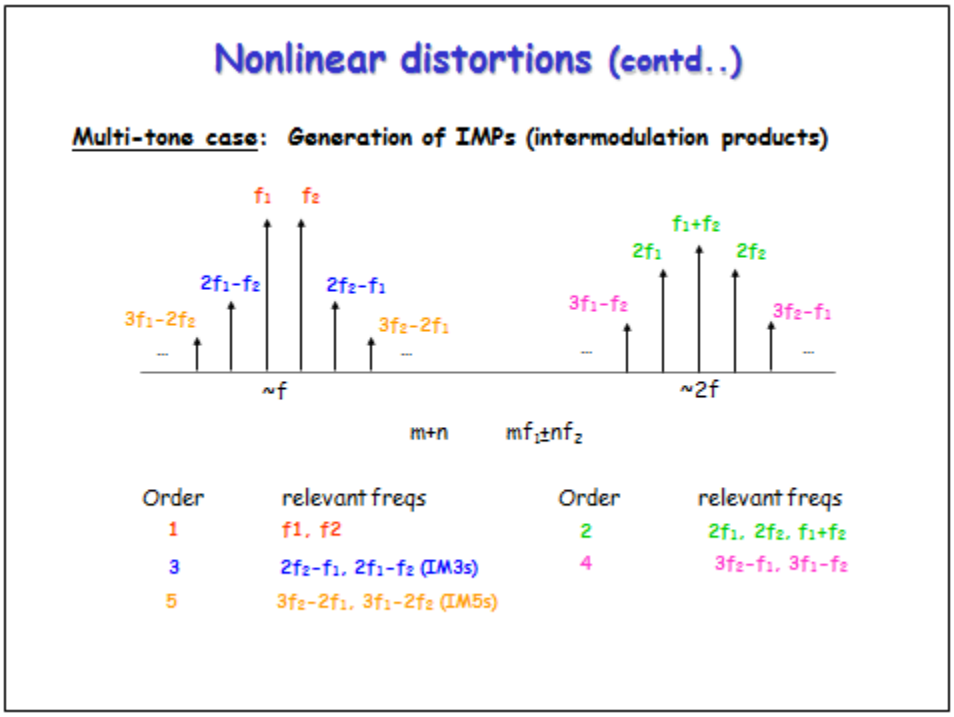
There are three basic categories of Intermodulation (IM) interference. They are receiver produced, transmitter produced, and "other" radiated IM. Transmitter produced IM is the result of one or more transmitters impressing a signal in the non-linear final output stage circuitry of another transmitter, usually via antenna coupling. The IM product frequency is then re-radiated from the transmitter's antenna. Receiver produced IM is the result of two or more transmitter signals mixing in a receiver RF amplifier or mixer stage when operating in a non-linear range.

"Other" radiated IM is the result of transmitter signals mixing in other non-linear junctions. These junctions are usually metallic, such as rusty bolts on a tower, dissimilar metallic junctions, or other non-linear metallic junctions in the area. IM products can also be caused by non-linearity in the transmission system such as antenna, transmission line, or connectors.

Communication sites with co-located transmitters, usually have RF coupling between each transmitter and antenna system. This results in the signals of each transmitter entering the nonlinear final output (PA) circuitry of the other transmitters. When intermodulation (IM) products are created in the output circuitry and they fall within the passband of the final amplifier, the IM products are re-radiated and may interfere with receivers at the same site or at other nearby sites. Additionally, these strong transmitter signals may directly enter a receiver and drive the RF amplifier into a nonlinear operation, or if not filtered effectively by the receiver input circuitry, these signals could mix in the nonlinear circuitry of the receiver front-end or mixer, creating IM products directly in the receiver.

The frequencies of IM mixing are known as nonlinear distortions. The images below depict how these IM products are derived when passing through a nonlinear junction/system.





Below are the mathematical formulae for common IM products. IM products are classified by their "order" (2nd, 3rd, 4th, ...Nth). Some of the more common forms of mixing are illustrated in the following examples. Note that the "A", "B", and "C" designations are the mixing frequencies. The numerical number assigned to the letter designation indicates the harmonic relationship of the frequency. Thus, 2A means the 2nd harmonic of frequency A.

Order	Mixing Formulae
First	A=B, A=C, etc.
Second	A ± B, A ± C, etc.
Third	A + B - C, A ± 2B, 2A ± B, etc.
Fourth	A ± 3B, 2A ± 2B, 3A ± B, etc.
Fifth	A ± 4B, 2A ± 3B, 3A ± 2B, 4A ± B, etc.
Sixth	A ± 3B ± 2C, 2A ± 2B ± 2C, 3A ± 2B ± C, etc.
Seventh	A ± 6B, 2A ± 5B, 3A ± 4B, 4A ± 3B, 5A ± 2B, etc.
Eighth	A ± 7B, 2A ± 6B, 3A ± 5B, 4A ± 4B, 5A ± 3B, 6A ± 2B, etc.
Ninth	A ± 8B, 2A ± 7B, 3A ± 6B, 4A ± 5B, 5A ± 4B, 6A ± 3B, etc.

The above IM product formulae are just a few of the many possible combinations. When there are four frequencies involved at one time, the mixing possibilities increase tremendously. Not all of the mixing possibilities are significant in creating interference signals. Some fall “out-of-band” of the receiver and the higher order IM products are usually weaker in signal strength.

7.1 Transmitter Generated Intermodulation Analysis

Intermodulation in transmitters occurs when a signal from another transmitter is impressed on the nonlinear final output stage circuitry, usually via antenna coupling. The power level of the IM product is determined by the power level of the incoming extraneous signal from another transmitter and by a conversion loss factor. The conversion loss factor takes into account the mixing efficiency of the transmitter's final output stage. Conversion loss differs with transmitter design, adjustment, frequency separation of the source signals, and with the order of the IM product.

The analysis calculates all possible IM product frequencies that could potentially interfere with receivers at the communications site based on each receiver's individual bandwidth. It then predicts each IM signal level present at the input of each affected receiver. For each IM frequency, the analysis considers all possible sources of IM generation in the transmitters. For example, if there are four transmitters involve, the analysis will calculate the IM signal level that would be generated in each transmitter. For this example, that would be four possible mixing conditions.

The analysis takes into account the transmitter's power output, modulation bandwidth, conversion losses, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for each IM interference signal that occurs. Receivers experiencing transmitter generated intermodulation interference are depicted in the following Table.

Tx 1 Source Mix Tx		Tx 2 Source		TX 3 Source		Tx 4 Source		Tx 5 Source		Intermod Hit		Affected Receiver		Attn Need (dB)
ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	Freq (MHz)	Ord	ID	Freq (MHz)	
None														

Analysis Results: The above table lists any transmitter generated IM product that is determined to have potential to noticeably degrade the system performance to any receive systems analyzed as part of this study. Based upon the listed configurations for transmitters, receivers, antenna models, antenna patterns and equipment filtering and isolation specifications it has been determined that no transmitter generated intermodulation interference problems were predicted that have the potential to be system performance limiting to any receivers analyzed in this report. While there are thousands of potential IM product combinations based upon the large number of transmitters located at this facility, all potential products produced yielded values that were below the limit where any noticeable degradation to system performance would be experienced.

7.2 Receiver Generated Intermodulation Analysis

Within a receiver, when two or more strong off-channel signals enter and mix in the receiver and one of the IM product frequencies created coincides with the receiver operating frequency, potential interference results. This internal IM mixing process takes place in the receiver's RF amplifier when it operates in a nonlinear range and/or in the first mixer, which, of course, has been designed to operate as a nonlinear device.

Receivers have a similar conversion loss type factor and receiver performance is commonly described in terms of conversion loss with respect to the 2A - B type products. Here, conversion loss is the ratio of a specified level of A and B to the level of the resulting IM product, when the product is viewed as an equivalent on-channel signal. Receiver conversion loss varies with input levels, AGC action, and product order.

The analysis calculates all possible IM product frequencies that could potentially interfere with receivers at the communications site based on each receiver's individual bandwidth. It then predicts each IM signal level present at the input of each affected receiver. For each IM frequency, the analysis considers that the IM signal is generated directly in the receiver.

The analysis takes into account the transmitter's power output, modulation bandwidth, conversion losses, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for each IM interference signal that occurs. Receivers experiencing receiver generated intermodulation interference are depicted in the following Table.

Tx 1 Source		Tx 2 Source		TX 3 Source		Tx 4 Source		Tx 5 Source		Intermod Hit		Affected Receiver		Attn Need (dB)
ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	ID	Freq (MHz)	Freq (MHz)	Ord	ID	Freq (MHz)	
None														

Analysis Results: The above table lists any receiver generated IM product that is determined to have potential to noticeably degrade the system performance to any receive systems analyzed as part of this study. Based upon the listed configurations for transmitters, receivers, antenna models, antenna patterns and equipment filtering and isolation specifications it has been determined that no receiver generated intermodulation interference problems were predicted that have the potential to be system performance limiting to any operators analyzed in this report.

8.0 Transmitter Harmonic Output Interference Analysis

Transmitter harmonic interference is due to non-linear characteristics in a transmitter. The harmonics are typically created due to frequency multipliers and the non-linear design of the final output stage of the transmitter. If the harmonic signal falls within the passband of a nearby receiver and the signal level is of sufficient amplitude, it can degrade the performance of the receiver.

The analysis takes into account the transmitter's harmonic characteristics, output level, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for any harmonics that fall within a receiver's passband. Receivers experiencing transmitter harmonic interference are depicted in the following Table.

Transmitter		Harmonic		Affected Receiver		Attn Needed (dB)
ID	Frequency (MHz)	Frequency (MHz)	Order	ID	Frequency (MHz)	
None						

Analysis Results: No transmitter generated harmonic interference problems were predicted that have the potential to be system performance limiting to any operators analyzed in this report. The calculations to determine harmful out of band harmonics assumed that proper bandpass filtering was utilized to severely reduce these harmonics to levels below those that could be system performance limiting to any receivers analyzed as part of this analysis.

9.0 Transmitter Spurious Output Interference Analysis

Transmitter spurious output interference can be attributed to many different factors in a transmitter. The generation of spurious frequencies could be due to non-linear characteristics in a transmitter or possibly the physical placement of components and unwanted coupling. If a spurious signal falls within the passband of a nearby receiver and the signal level is of sufficient amplitude, it can degrade the performance of the receiver.

The analysis takes into account a transmitter's spurious output specification, output levels, transmission line losses, filters, duplexers, combiners, isolators, multi-couplers and other RF devices that are present in each system. Additionally, the analysis considers the antenna separation space loss, horizontal and vertical gain components of the antennas as well as how they are mounted on the structure. The gain components are derived from antenna pattern data published by each manufacturer.

The analysis determines how much isolation is required to prevent receiver performance degradation for any transmitter spurious signals that fall within a receiver's passband. Receivers experiencing transmitter spurious output interference are depicted in the following Table.

Transmitter		Affected Receiver		Attn Needed (dB)
ID	Frequency (MHz)	ID	Frequency (MHz)	
None				

Analysis Results: No transmitter generated spurious emission interference problems were predicted that have the potential to be system performance limiting to any operators analyzed in this report. The calculations to determine harmful off channel emissions assumed that proper bandpass filtering was utilized to severely reduce these products to levels below those that could be system performance limiting to any receivers analyzed as part of this analysis.

10.0 Summary & Limitations

Based upon the data received regarding the proposed radio equipment to be utilized by **Dish Wireless** and the existing radio systems utilized by **Verizon Wireless**, **T-Mobile** and the **City and County of Denver**, there should not be any negative impact to the performance of any radio systems proposed or existing identified in this report from the proposed **Dish Wireless** installation based upon calculations performed utilizing the radio configurations described in this report.

This analysis was performed solely based upon radio configuration data provided by **Dish Wireless** and **SBA Communications**. In certain instances, where assumptions were required, industry standard values were utilized for variables such as transmission power levels, filter response curves, combining schemes and other configuration variables if not provided by the parties listed above. The scope of this study was limited to radio systems identified in this report exclusively. It does not take into account emissions from surrounding radio sources.

As identified in the various sections of this report, the potential is present for certain forms of interference to exist. However, based upon the supplied and assumed radio system configurations, the isolation provided by physical separation, Antenna pattern gain roll off, filtering variables and isolation devices appears adequate to allow these radio systems to co-exist as outlined in the drawings and configuration documents provided by **Dish Wireless** and SBA Communications.

This analysis was also performed assuming that all radio equipment including lines and antennas are performing to manufacturers specifications. Each system was analyzed assuming proper filtering was used to maintain compliance with all FCC licenses and reduce out of band emissions.

Exhibit C — City's Minimum Technical Standards

Note: Some standards may not apply to your facility due to frequency of operation or type of service.

1.0 General

1.1 Posting of Information. The following information shall be posted on or near your cabinet:

Copy of FCC license (if applicable)
Equipment Identification Card with the following information:

Transmit and receive frequencies (or frequency bands in case of wireless operators)
Type of service
Authorized output power & ERP
Antenna model number
Transmission line model number and type
Name of licensee
Contact information for responsible person (name, phone, email)

Unidentified equipment shall be considered unauthorized and may be red tagged and removed after 30 days.

1.2 Installations at City Fire Stations. The City may require that the Tenant (Licensee) upgrade City radio equipment to ensure interference-free coexistence. Specifically, there is a problem with installing an isolator on the existing 900 MHz Alligator Model 1888 MAS transceiver used at most City fire stations. The isolator must be installed only on the transmit line, but the transceiver uses a duplexed (switched) output whereby both the transmitter and the receiver share the same antenna line. Similarly, separate cavity filters are required for the receiver and transmitter, but it is not possible to install both on a single duplexed line. For this reason, the City usually directs that the Alligator Model 1888 be replaced with a Model 1800 Master unit with separate transmit and receive antenna ports. A duplexer cavity filter should be used to combine transmit and receive into the existing antenna. Contact the City's Technical Representative for recommended vendors for these components.

1.3 Changes. Notify the City's Technical Representative immediately of any changes to frequencies, antennas or other equipment configuration. Obtain City's approval prior to making those changes as required by the Lease (License). Approved changes shall be shown on an updated Equipment ID Card.

2.0 Mobile Wireless Services

2.1 Land Mobile Radio Filter and Isolator Requirements. For land mobile radio (LMR), as a minimum, each transmitter shall employ a dual stage isolator followed by a single cavity

bandpass filter. All transmitters shall have built-in or external harmonic (low pass) filters. The low pass filter must be a true low pass filter, not a notch filter tuned to just one or two harmonic frequencies. Harmonic rejection shall be at least 60 dB at the second harmonic and at least 50 dB at the third harmonic. The following minimum isolator and bandpass cavity filter specifications apply:

30-50 MHz
Isolators - None required.
TX cavity - minimum of 20 dB rejection at + 0.5 MHz

72-76 MHz
Isolators - Minimum of 25 dB
TX cavity - minimum of 20 dB rejection at + 0.5 MHz

138-174, 216-222 MHz
Dual Stage Isolators - minimum of 60 dB
TX cavity - minimum of 20 dB rejection at + 1.5 MHz

406-512 MHz
Dual Stage Isolators - minimum of 60 dB
TX cavity - minimum of 20 dB rejection at + 3.5 MHz

698-941 MHz (excluding airphone)
Dual Stage Isolators - minimum of 60 dB
Tx cavity - minimum of 20 dB rejection at + 6 MHz

Explanation. The bandpass filter and lowpass filter must follow the isolator because ferrite isolators are nonlinear and can create harmonics. Please note that most bandpass cavity filters will pass odd harmonics of the tuned frequency, so an external lowpass filter following the isolator is also required. Transmitter combiners will be considered on a case-by-case basis. Please provide all combiner technical information to the City's Technical Representative.

2.2 Airphone (849-851 MHz transmit, 894-896 MHz receive)
Transmitter out-of-band emissions shall not cause harmful interference to cellular base station receivers (824-849 MHz). Tenant (Licensee) shall submit plans, including bandpass filter response curves, to the City's Technical Representative for approval prior to installation. Tenant (Licensee) shall install adequate receiver bandpass filtering to preclude receiver desensitization or receiver intermodulation caused indirectly by cellular base stations on the site.

2.3 LMR Duplexers. Notch duplexers are not adequate. The duplexer must also have a bandpass characteristic to ensure other transmit signals do not enter the transmitter or over drive the receiver This is especially important for VHF repeaters which are vulnerable to FM broadcast signals and other closely-spaced VHF transmitters.

2.4 Personal Wireless Services. These services include, but are not limited to the 698-806, 806-

869, 1710-1755, 1850-2000, 2110-2155, 2500-2600 MHz bands (excluding 700 and 800 MHz public safety bands). Because the wireless provider is assumed to have exclusive use of a band of frequencies, out-of-band emissions are expected to be attenuated significantly by the manufacturer's standard combiners, duplexers and cross-band couplers. Ferrite isolators may not be required. Submit your plans to the City's Technical Representative for approval.

2.5 Unlicensed Band (License-Free) Radios. Unlicensed band radios and shared-band services, including, but not limited to those operating in the 902-928 MHz, 2.4-2.4835 GHz, 3.5 GHz, 4.9 GHz (public safety only) and 5 GHz bands are not allowed unless specifically authorized in the Tenant's (Licensee's) Lease (License). When authorized, Tenant (Licensee) shall not change operating frequencies without first getting approval from City. License-free radios are notorious for their poor quality in a harsh RF environment and specific make, model and technical specifications must be provided to the City's Technical Representative for approval. Additional protective devices, shielded CAT 6 cable and shielded NEMA cases may be required before such devices can be installed on the tower.

2.6 Receivers. The site may have relatively high radio frequency (RF) levels in all mobile radio bands. Your receiver amplifier must be robust to work in this environment. Ensure the receiver has good intermodulation (IM) rejection and high 1 dB compression point. If interference is encountered and we find the receiver is not performing up to the standards exhibited by state-of-the-art equipment, the City may require receiver improvements or upgrades before requiring changes to other tenant (licensee) equipment or configurations. This requirement applies to both new and existing tenants (licensees).

Filters are required for mobile radio receivers. Single receivers must employ a minimum of a single 7" diameter (or equivalent) cavity bandpass filter with a rejection curve corresponding to 1 dB insertion loss or better. Additional filter isolation may be required in special cases. Receiver multicouplers must use a bandpass filter (preselector) prior to the multicoupler amplifier.

2.7 Antennas. Select antennas designed to minimize passive intermodulation generation. Note that antennas that pass intermodulation tests at the factory may not provide good intermodulation rejection after years of exposure to heat, cold, vibration from wind, and humidity. Only new antennas are allowed for new installations. Select antennas specifically designed to reject intermodulation over the life of the antenna. Unless the antenna is a duplex configuration, transmit and receive antennas should be separated vertically on the tower. If the tower is owned by the City, the City will designate antenna locations. Antennas must be DC grounded to the tower for lightning protection.

2.8 Transmission Lines. Coaxial cable should be grounded at the top and the bottom of the run with an Andrew ground kit or equivalent. Ensure that ground conductors run straight down with no sharp bends because bends will increase the impedance of the grounding conductor. We also require that the line be marked so we can identify it later. We suggest bands of colored electrical tape at the bottom, middle and top of the run (similar to a resistor color code). Install a Huber-Suhner (or equivalent) coaxial surge arrestor at the bulkhead. All exterior transmission lines must be solid outer conductors. If possible, receive and transmit lines should be separated by at

least one foot from cabinet to antenna.

2.9 Connectors. Connectors are often sources of RF leakage and passive intermodulation. UHF connectors (PL259) are not allowed on connections external to the radio cabinet. Type "N" connectors are allowed below 512 MHz. 7/16 DIN connectors should be used at 698 MHz and above and are required above 1.7 GHz. Connectors using dissimilar metal contacts or ferrous materials (e.g., nickel plating) are not allowed. The preferred connector uses a silver plated body with gold plated inner conductor. Brass bodies and silver or brass inner conductors are also allowed.

2.10 Additional Protective Devices May Be Required. The specifications above are minimum requirements. Additional protective devices may be required based upon evaluation of the following information:

Theoretical TX mixes, particularly second and third order
Antenna location and type
Combiner/multicoupler configurations
Transmitter specifications
Receiver specifications
Historical problems
Transmitter to transmitter isolation
Transmitter to antenna isolation
Transmitter to receiver isolation
Calculated and measured level of IM products
Transmitter output power
Transmitter ERP
Spectrum analyzer measurements
VSWR measurements
Existing cavity selectivity
Antenna to antenna proximity

3.0 FM & IBOC Broadcast (Part 73, ERP > 1 kW)

3.1 FM Broadcast Transmitters. FM and IBOC Broadcast transmitters will be either combined with other stations into a common antenna or stand-alone. If combined, the combiner design shall be approved by the City's Technical Representative. If stand-alone, the transmitter shall employ a bandpass cavity filter with the following minimum performance specifications:

3.1.1. Rejection. The bandpass filter shall provide the following minimum rejection for Class C, C0 and C1 stations:

From Center +/-	Minimum Rejection
800 kHz	22 dB
1 MHz	28 dB
1.2 MHz	32 dB

1.4 MHz 38 dB
1.6 MHz 43 dB

Note that four cavities are required to meet this specification. Class C2 and C3 stations may use three-cavity filters. These filter requirements also apply to stations with FM & IBOC combined outputs. A stand alone IBOC transmitter and antenna shall comply with the following requirements: IBOC ERP greater than 5,000 Watts: 4 cavity filter (see rejection above), IBOC ERP less than or equal to 5,000 Watts: 3 cavity filter.

3.1.2 Gain Flatness. +/-0.5 dB from +/-200 kHz from center frequency.

3.1.3. Group Delay Flatness. No greater than +/- 150 nanoseconds (symmetrical) in +/- 200 kHz (I.e., minimum to maximum delay difference shall be no greater than 300 nanoseconds in the band f_c - 200 kHz to f_c + 200 kHz.

3.1.4. VSWR. No greater than 1.1:1 in +/- 200 kHz (assuming filter is terminated in perfect 50 ohm load).

3.1.5. Insertion Loss. No greater than 0.3 dB in +/- 200 kHz.

The transmitter should comply with current FCC rules regarding out-of-band emissions at transmitter output (before the bandpass cavity filter). The external filter is required to provide further rejection of out-of-band emissions to ensure electromagnetic compatibility with other users on the site.

3.2 FM Broadcast Antennas. FM Broadcast antennas mounted below 250' AGL (center of radiation) shall employ short element spacing to reduce downward radiation and ensure compliance with CFR 47, Parts 1.1307-1.1310. This requirement does not apply to stations that employ a single element antenna. Examples of short element spacing are a 6 bay antenna with half-wavelength spacing or an 8 bay antenna with 3/4 wavelength spacing. Submit a plot of predicted power density versus distance at ground level for City's Technical Representative approval.

4.0 Full-Power Television

4.1 Full-power television transmitters shall include band pass and low pass filters.

4.2 For television transmitters, measured out-of-band emissions (including harmonics) greater than 3 MHz from the respective channel edge shall be more than 80 dB below the measured power over the entire channel. Both measurements shall use a 6 MHz measurement bandwidth.

5.0 Low Power Television (analog and digital)

5.1 Low Power Television (LPTV) transmitters and television translators must have low pass filters that attenuate all harmonics and spurious products at least 80 dB below the power

measured at the carrier frequency. To facilitate measurements of spurious products, each LPTV and translator transmitter shall have installed a line section and appropriate directional coupler element. For routine use, the line section may employ a standard DC element and be connected to a wattmeter capable of measuring forward and reflected power. In addition, the Tenant (Licensee) shall own or have access to an RF load capable of dissipating the full power of the transmitter for troubleshooting purposes.

6.0 Grounding, Bonding and Shielding

6.1 Shielding. RF interference can get directly into the electronics of a receiver or transmitter. Cabinet shielding must be in place and maintained to the manufacturer's specifications. Do not leave cabinet doors open because open cabinet doors defeat the shielding.

6.2 Grounding. Equipment grounding and bonding should be accomplished in accordance with Mil Std 188-124, Military Handbook 419 and Motorola R56. Contact the City's Technical Representative for guidance on grounding and bonding at your particular facility.

7.0 Site Work

7.1 Tower Work Insurance and Experience Requirements. All tower riggers or installers of antennas, transmission lines, cabinets, wiring or similar hardware or apparatus must meet the minimum basic requirements of the City. These will include, but not be limited to, the following:

- The rigging company must have a current Certificate of Insurance on file with the City. The certificate will include, but not be limited to the following:

    1. General Comprehensive & Liability: $5,000,000
    2. Vehicle Liability: $1,000,000
    3. Workman's Compensation Insurance (By Statute)

- Demonstrated experience on similar tower types and similar work activity on similar towers within the past two years with a list of at least two recent clients or professional references with actual knowledge of experience and necessary qualifications, or in lieu thereof; previous working relationship with the City and known by the City's personnel.

City reserves the right, at its sole discretion, to reject the use of any person or tower rigging company on City-owned towers or properties.

7.2 Work Standards. The installation of any and all materials on the tower and in the accompanying shelter must be pre-authorized and approved by the City's Technical Representative. The following guidelines will be strictly enforced:

7.2.1 Equipment or cabinets mounted on platforms will be constructed of galvanized or stainless steel and will be securely attached to the tower members or platforms with J-bolts, U-

bolts or similar clamping devices which do not penetrate tower members or any part of the galvanized coating. All mounting hardware must be hot-dipped galvanized or stainless steel (NOT PLATED). All mounting nuts, bolts, washers or similar must be Grade 5 or better.

7.2.2 Antennas and the mounting thereof must be approved in advance of installation. Data in reference to antenna type, weight, wind loading, gain, bandwidth and mounting details must be provided to the City's Technical Representative and may not be modified or replaced without expressed written permission of City. Installation of antennas on City-owned towers may require a new structural study at the Tenant (Licensee)‘s expense.

7.2.3 Transmission lines and hardware must be approved in advance of installation by the City's Technical Representative and must be specified as to manufacturer, size and type and shown on the City’s New Tenant Questionnaire. All the mounting hardware must be of appropriate type and design to support the transmission lines with strain-reliefs installed at the manufacturer’s recommended intervals. Under no circumstances will stainless steel automotive-type hose clamps be used to secure transmission lines or cables to tower members. Where not previously designated, all lines will be positioned on the tower to minimize wind loading and provide a minimum of obstruction to climbing or removal/replacement of other lines. Each line will be mounted independently of other lines on the tower. Cable trays, waveguide entrances, tower ladders, elevator rails and other similar members are to be kept clear of all cables on the tower. Stainless steel lashing ties are acceptable for use on the tower but are not to be used as strain reliefs.

7.2.4 Antenna jumper cables or cables to/from crossband couplers or similar devices on the tower will be kept to minimum required lengths and will be made of solid shield outer conductor cables with outer jackets capable of withstanding severe weather and ultraviolet rays. All such cable types must be pre-approved by the City.

7.2.5 UNDER NO CIRCUMSTANCES –

- will welding or drilling of tower members be allowed;
- will modifications to the tower, bridge, building entrance fittings or similar be permitted;
- will transmission line splices (a pair of connectors at other than the top or bottom of the run on the tower) be permitted except by prior approval or necessitated by damage only repairable by splicing;
- will any tampering, retuning, rerouting or other modifications be permitted to equipment owned by City or other tenants.

7.2.6 All installations will be performed in accordance with good engineering practice and within the guidelines of this document. Any deviation from these minimum requirements and technical standards must be approved in writing prior to installation or modification.

7.3 Removal of Unused Antennas and Lines. Tenant (Licensee) shall remove all unused antennas, transmission lines and associated mounting hardware from City's tower within 90 days of the date an antenna is no longer in service.

7.4 NO PRESENT INSTALLATION WILL BE "GRANDFATHERED" and must conform to these work standards within a reasonable time period to be determined by the City's Technical Representative. Periodic inspections may be performed to ensure that all installations meet technical standards.

8.0 Shelters

8.1 Cable Dressing Inside Building or Shelter. All wiring and cables within a given rack will be properly dressed and/or bundled with cable ties with excess cut close to the barbs. Twisted wire, tape, rope, twine, phone wire and similar bits of debris usually available on site ARE NOT ACCEPTABLE substitutes for proper securing hardware. All inter-rack cables and wiring must be properly routed and utilize the cable trays provided even if between adjacent racks. Overhead cables and RF lines must be easily removed or reworked within the cable trays. Proper care must be taken to ensure that new cables added to the trays are not stressed or intertwined with existing cables. OVERHEAD CABLES MAY NOT CROSS PERPENDICULARS OR BE SUSPENDED IN MID AIR WITHOUT SUPPORTS. NO SUPPORTS MAY BE INSTALLED WITHOUT PRIOR APPROVAL. All long cable runs must be properly identified at each end indicating the opposite cable end address. All cabling within the building must be cut to proper length except phasing harnesses, where required.

9.0 Towers

9.1 Tenant (Licensee) may not erect new towers without the City's prior written consent, which may be granted or denied in City's sole discretion, and towers that are approved may only be constructed after plans for the tower have been approved by the City and by the zoning authority.

9.2 New towers shall comply with TIA-222-G or the most recent edition adopted by the local zoning authority. Changes to an existing tower, including addition or replacement of antennas requires that TIA-222-G or the most recent edition be used. Tenant (Licensee)-owned towers that present an immediate safety hazard shall be corrected by Tenant (Licensee) regardless of the status of the current lease or the particular edition of TIA-222 in use at the time of tower construction. Installation of antennas on City-owned towers may require a new structural study at the Tenant (Licensee)'s expense.

10.0 Permits

10.1 Tenant (Licensee) shall comply with all local and Federal regulations. Tenant (Licensee) is responsible for acquiring all applicable permits, including, but not limited to FCC construction permits and building permits. Tenant (Licensee) is also responsible for performing any required studies, including RF exposure and RF interference studies required by the FCC, local government, and City. Tenant (Licensee) shall furnish all applicable permits, studies, and

approvals to the City for approval before starting any construction, including antenna installation.

11.0 Radio Frequency Safety

11.1 The engineering, design, configuration, installation, and maintenance of high power (> 1 kW ERP) radio facilities on the site shall be accomplished in a manner that minimizes downward radiation. Changes to proposed systems may be directed by City to comply with this objective.

11.2 Everyone on the site shall follow these guidelines:

- All personnel entering the site must be authorized
- Obey all posted signs
- Assume all antennas are active unless proven otherwise
- Before working on an antenna, notify the owner and disable the transmitter
- Use a radio frequency (RF) personal monitor when working near antennas
- Never operate transmitters without shields

11.3 Power densities on towers can be much higher than at ground level. For this reason, tower climbers should request power reductions from high-power tenants and carry RF personal monitors when climbing towers. The City's Technical Representative can tell you which transmitters should be turned down before climbing the tower.

11.4 Federal Government guidelines regarding human exposure to radio frequency energy are found in the Code of Federal Regulations (CFR) Title 47, Parts 1.1307-1.1310.

Figure 1 - Warning Sign to be Posted at Base of Tower
(Available from Tessco, Holaday, Narda and other Sources)

EXHIBIT D

CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY): 8/1/2023 | 2/28/2023

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS CERTIFICATE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE CERTIFICATE HOLDER.

IMPORTANT: If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must have ADDITIONAL INSURED provisions or be endorsed. If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

PRODUCER Lockton Companies 8110 E Union Avenue Suite 100 Denver CO 80237 (303) 414-6000	**CONTACT NAME:** **PHONE (A/C, No, Ext):** **FAX (A/C, No):** **E-MAIL ADDRESS:**
INSURED 1033160 DISH Network Corporation DISH Network LLC 9601 S. Meridian Blvd. Englewood, CO 80112	**INSURER(S) AFFORDING COVERAGE** — **NAIC #** **INSURER A :** XL Insurance America, Inc. — 24554 **INSURER B :** ACE American Insurance Company — 22667 **INSURER C :** Indemnity Insurance Co of North America — 43575 **INSURER D :** ACE Fire Underwriters Insurance Company — 20702 **INSURER E :** **INSURER F :**

COVERAGES **CERTIFICATE NUMBER:** 19372788 **REVISION NUMBER:** XXXXXXX

THIS IS TO CERTIFY THAT THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	TYPE OF INSURANCE	ADDL INSD	SUBR WVD	POLICY NUMBER	POLICY EFF (MM/DD/YYYY)	POLICY EXP (MM/DD/YYYY)	LIMITS	
B	X **COMMERCIAL GENERAL LIABILITY** [ ] CLAIMS-MADE [X] OCCUR X Standard [ ] Contractual Liab. GEN'L AGGREGATE LIMIT APPLIES PER: X POLICY [ ] PRO-JECT [ ] LOC X OTHER: SIR $500,000	Y	Y	XSL G47332175	8/1/2022	8/1/2023	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG $	$ 2,000,000 $ 300,000 $ XXXXXXX $ 2,000,000 $ 4,000,000 $ 4,000,000 $
B	**AUTOMOBILE LIABILITY** X ANY AUTO [ ] OWNED AUTOS ONLY [ ] SCHEDULED AUTOS X HIRED AUTOS ONLY [X] NON-OWNED AUTOS ONLY	N	N	ISA H10733479	8/1/2022	8/1/2023	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident) $	$ 5,000,000 $ XXXXXXX $ XXXXXXX $ XXXXXXX $ XXXXXXX
A	X **UMBRELLA LIAB** [X] OCCUR **EXCESS LIAB** [ ] CLAIMS-MADE [ ] DED [X] RETENTION $ 10,000	N	N	US00072327LI22A	8/1/2022	8/1/2023	EACH OCCURRENCE AGGREGATE $	$ 10,000,000 $ 10,000,000 $ XXXXXXX
C D B	**WORKERS COMPENSATION AND EMPLOYERS' LIABILITY** ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? **Y / N** N **(Mandatory in NH)** If yes, describe under DESCRIPTION OF OPERATIONS below	N / A	N	WLR C50703733 (AOS) SCF C50703794 (WI) WLR C50703691 (AZ, CA, MA)	8/1/2022 8/1/2022 8/1/2022	8/1/2023 8/1/2023 8/1/2023	X PER STATUTE [ ] OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	$ 1,000,000 $ 1,000,000 $ 1,000,000

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

Dish Site ID DNDEN00104C - 4800 Himalaya Rd., Denver, CO 80249. City and County of Denver, its elected and appointed officials, employees and volunteers are included as Additional Insured as respects General Liability if required by written contract. Waiver of Subrogation applies in favor of the Additional Insured as respects General Liability if required by written contract, where permissible by law.

CERTIFICATE HOLDER

19372788
City and County of Denver
and its elected/ appointed officials,
employees, and volunteers
201 W. Colfax Ave.
Denver, CO 80202

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

AUTHORIZED REPRESENTATIVE

EVIDENCE OF COMMERCIAL PROPERTY INSURANCE

DATE (MM/DD/YYYY): 3/1/2023

THIS EVIDENCE OF COMMERCIAL PROPERTY INSURANCE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE ADDITIONAL INTEREST NAMED BELOW. THIS EVIDENCE DOES NOT AFFIRMATIVELY OR NEGATIVELY AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW. THIS EVIDENCE OF INSURANCE DOES NOT CONSTITUTE A CONTRACT BETWEEN THE ISSUING INSURER(S), AUTHORIZED REPRESENTATIVE OR PRODUCER, AND THE ADDITIONAL INTEREST.

PRODUCER NAME, CONTACT PERSON AND ADDRESS / **PHONE (A/C, No, Ext):** (303) 414-6000 Lockton Companies 8110 E Union Avenue Suite 100 Denver CO 80237	**COMPANY NAME AND ADDRESS** / **NAIC NO:** 26247 American Guarantee and Liab. Ins. Co.
FAX (A/C, No): (303) 865-6000 / **E-MAIL ADDRESS:**	**IF MULTIPLE COMPANIES, COMPLETE SEPARATE FORM FOR EACH**
CODE: / **SUB CODE:**	**POLICY TYPE** Property
AGENCY CUSTOMER ID #:	
NAMED INSURED AND ADDRESS 1126504 DISH Network Corporation DISH Network LLC 9601 S. Meridian Blvd. Englewood, CO 80112	**LOAN NUMBER** / **POLICY NUMBER** ERP 6724301-12
	EFFECTIVE DATE: 9/1/2022 / **EXPIRATION DATE**: 9/1/2023 / ☐ CONTINUED UNTIL TERMINATED IF CHECKED
ADDITIONAL NAMED INSURED(S)	**THIS REPLACES PRIOR EVIDENCE DATED:**

PROPERTY INFORMATION (ACORD 101 may be attached if more space is required) ☐ BUILDING OR ☒ BUSINESS PERSONAL PROPERTY

LOCATION / DESCRIPTION

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS EVIDENCE OF PROPERTY INSURANCE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

COVERAGE INFORMATION

PERILS INSURED: ☐ BASIC ☐ BROAD ☒ SPECIAL ☐

COMMERCIAL PROPERTY COVERAGE AMOUNT OF INSURANCE: $ 5,000,000 DED:

	YES	NO	N/A	
☐ BUSINESS INCOME ☐ RENTAL VALUE			X	If YES, LIMIT: ☐ Actual Loss Sustained; # of months:
BLANKET COVERAGE			X	If YES, indicate value(s) reported on property identified above: $
TERRORISM COVERAGE		X		Attach Disclosure Notice / DEC
IS THERE A TERRORISM-SPECIFIC EXCLUSION?	X			
IS DOMESTIC TERRORISM EXCLUDED?	X			
LIMITED FUNGUS COVERAGE	X			If YES, LIMIT: DED:
FUNGUS EXCLUSION (If "YES", specify organization's form used)		X		
REPLACEMENT COST	X			
AGREED VALUE			X	
COINSURANCE			X	If YES, %
EQUIPMENT BREAKDOWN (If Applicable)			X	If YES, LIMIT: DED:
ORDINANCE OR LAW - Coverage for loss to undamaged portion of bldg			X	If YES, LIMIT: DED:
- Demolition Costs			X	If YES, LIMIT: DED:
- Incr. Cost of Construction			X	If YES, LIMIT: DED:
EARTH MOVEMENT (If Applicable)			X	If YES, LIMIT: DED:
FLOOD (If Applicable)			X	If YES, LIMIT: DED:
WIND / HAIL INCL ☐ YES ☒ NO Subject to Different Provisions:			X	If YES, LIMIT: DED:
NAMED STORM INCL ☐ YES ☒ NO Subject to Different Provisions:			X	If YES, LIMIT: DED:
PERMISSION TO WAIVE SUBROGATION IN FAVOR OF MORTGAGE HOLDER PRIOR TO LOSS			X	

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, NOTICE WILL BE DELIVERED IN ACCORDANCE WITH THE POLICY PROVISIONS.

ADDITIONAL INTEREST

☐ CONTRACT OF SALE ☐ LENDER'S LOSS PAYABLE ☐ LOSS PAYEE
☐ MORTGAGEE

NAME AND ADDRESS

820085 City and County of Denver
and its elected/ appointed officials,
employees, and volunteers
201 W. Colfax Ave.
Denver, CO 80202

LENDER SERVICING AGENT NAME AND ADDRESS

AUTHORIZED REPRESENTATIVE

EVIDENCE OF COMMERCIAL PROPERTY INSURANCE-Including Special Conditions (Use only if more space is required)

Dish Site ID DNDEN00104C - 4800 Himalaya Rd., Denver, CO 80249.

EXHIBIT E

KUTAKROCK

Kutak Rock LLP
1801 California Street, Suite 3000, Denver, CO 80202-2652
office 303.297.2400

March 3, 2023

City and County of Denver
c/o Denver City Attorney's Office
1437 Bannock, Room 353
Denver, Colorado 80202

Re: Private Business Use Review: License Agreement between the City and County of Denver and DISH Wireless Holding L.L.C. relating to Fire Station #29

Ladies and Gentlemen:

We have been advised that the City and County of Denver (the "City") intends to enter into a License Agreement (the "Agreement") with DISH Wireless Holding L.L.C. (the "Licensee"). The City has requested that we advise whether the Agreement will generate private business use under Section 141 of the Internal Revenue Code of 1986 (the "Code") with respect to any federally tax-exempt bond or lease obligations of the City ("Obligations").

The Agreement grants a limited license to the Licensee for the use of certain telecommunications equipment owned by the City (the "Equipment") and installed at the City's Fire Station #29, located at 4800 Himalaya Road within the City (the "Fire Station"). The City has indicated that certain building spaces within the Fire Station, including kitchen space, have been financed or refinanced in whole or in part with Obligations, which may include the following: General Obligation Elevate Denver Bonds, Series 2018A; General Obligation Elevate Denver Bonds, Series 2019C; and General Obligation Elevate Denver Bonds, Series 2020A. The City has also indicated that no portion of the Equipment and no portion of the limited premises on which the Equipment is located has been financed or refinanced by Obligations.

The City has provided to us a draft copy of the Agreement and information regarding use of Obligation proceeds with respect to the Fire Station. Based on the draft Agreement and such information, we are of the opinion that the use contemplated by the Agreement will not generate private business use under Section 141 of the Code with respect to any Obligations. The opinion set forth in this paragraph assumes that (a) the execution version of the Agreement will not differ from the draft version of the Agreement provided to us and (b) the information regarding use of Obligation proceeds accurately reflects the City's final allocation of all such proceeds to expenditures. Furthermore, such opinion is based on existing laws on the date hereof, and we express no opinion as of any subsequent date or with respect to any pending or future proposed or final Treasury Regulations and legislation. This letter has been prepared solely for your use and may not be relied on by any other person without our prior written consent.

Very truly yours,

Kutak Rock LLP

MME

Kutak Rock LLP