

HARPER ENGINEERING, Inc.

815 Superior Ave.
Suite 1514
Cleveland, OH 44114
Ph: 216.344.3855
Email: dwharper@harperengineering.org

STRUCTURAL EVALUATION LETTER

SITE INFORMATION

Site Name: South Dublin
Site Type: Rooftop
Site Address: 5127 Post Road, Dublin, Ohio 43017
Verizon Site No.: CLMB037
HPE Site No.: 9-151-408 (Rev.2)

CURRENT WIND CRITERIA

1. Meets Ohio Building Code 2011/IBC 2009.
2. ANSI/TIA/EIA-222-G - Code.

DATA SOURCES

1. Verizon RF information sheet dated 03/24/2015.
2. Site photos and measurements dated 05/03/2013.

PROPOSED MODIFICATIONS

1. Remove twelve (12) existing panel antennas and install twelve (12) SBNHH-1D65A new panel antennas on existing pipe mounts at 47'5" elevation. (Antennas should not be visible above the screen wall).
2. Install six (6) RRHs on existing pipe of the roof sector mounts, two (2) per sector at 47'5" elevation.
3. Install one (1) PM-RU3 on existing pipe mounts in Beta/Gamma at 45' elevation.
4. Move one (1) existing OVP distribution box on roof sector mount in Beta/Gamma to new PM-RU3 at 45 ft. elevation.
5. Install one (1) OVP distribution box on PM-RU3 in Beta/Gamma at 45 ft. elevation.
6. Remove one (1) sector OVP distribution box and install one (1) standard OVP distribution box on roof sector mount Alpha at 45 ft. elevation.
7. Install one (1) 1-5/8" dia. Hybrid cable to new OVP distribution box in Beta/Gamma at 45 ft. elevation.
8. Remove one (1) 7/8" dia. Hybrid jumper from OVP in Alpha sector and install one (1) 1-5/8" Hybrid cable in Alpha sector at 45 ft. elevation.
9. Upgrade three (3) existing RRHs to new 60-WATT model.

ASSUMPTIONS

1. Existing structure is in good condition and without any structural defects.
2. The original structural design was performed in accordance with the Telecommunication Industry Association standard TIA/EIA 222 and governing building code.

VERIZON LOADING

Location	Elev./Antenna and Equipment info.:	Coax
The existing steel frames, on the existing pipe mounts	47'5" ft.: (12) SBNHH-1D65A panel antennas (9) RRHs 45 ft.: (3) OVP boxes	(12) AVA7 (3) 1-5/8" Hybrid cables



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CONCLUSION

Harper Engineering, Inc. performed structural analysis of existing antenna and equipment support for the above loading. Our results show:

- Existing antenna mounts are adequate to support proposed antenna load.
- By observation, the increase in the load on building structure due to the new equipment load is not structurally significant. Based on above, Harper Engineering can conclude that the existing antenna mounts and building structure meet the design criteria listed above and are structurally adequate to support the proposed Verizon modifications

ATTACHMENTS

1. Harper Engineering structural analysis.

Wind pressure calculation

The wind load calculations are based on the ANSI/TIA-222-G-2005 Structural Standard for Antenna Supporting Structures and Antennas. Specific equation numbers and/or tables and table values have been listed in the equations listed below.

Velocity pressure	$q_z = 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot V^2 \cdot I$	Eq. 2.6.9.6.
Height above ground level	$z = 48 \text{ ft}$	
	$a = 7$	Table 2-4
	$z_g = 1200 \text{ ft}$	Table 2-4
Velocity pressure coefficient	$K_z = 2.01 \cdot \left(\frac{z}{z_g} \right)^{\frac{2}{a}}$	Eq. 2.6.5.2.
Topographic factor	$K_{zt} = 1$	Eq. 2.6.6.4.
Wind direction probability factor	$K_d = 0.95$	Table 2-2
Basic wind speed	$V = 90 \text{ mph}$	
Importance factor	$I = 1$	Table 2-3
	$q_z = 15.78 \text{ psf}$	
Wind pressure	$q_p = q_z \cdot G_h$	
Gust effect factor	$G_h = 0.85$	
	$q_p = 13.42 \text{ psf}$	

Existing antenna wind load (ant. model nr. X7CAP-465-62ip)

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 81.73 \text{ lbs}$
Antenna area	$A_a = 4.35 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

Proposed antenna wind load (ant.
model nr.SBNHH-1D65A)

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 119.87 \text{ lbs}$
Antenna area	$A_a = 6.38 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

Existing antenna wind load (ant.
model nr. APL866513-42T6)

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 57.68 \text{ lbs}$
Antenna area	$A_a = 3.07 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

Existing antenna wind load (ant.
model nr.APX18-60-2)

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 41.9 \text{ lbs}$
Antenna area	$A_a = 2.23 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

The result shows the wind force increase significantly on existing mounts. Existing antenna mounts are O.K.

Existing small OVP wind load

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 15.03 \text{ lbs}$
Antenna area	$A_a = 0.8 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

Proposed OVP (RCMD-3315V-PF-48) wind load

Antenna wind force	$F_a = q_p \cdot [C_{df} \cdot A_a]$	$F_a = 58.24 \text{ lbs}$
Antenna area	$A_a = 3.1 \text{ sqft}$	
Force coefficient for flat members	$C_{df} = 1.4$	
Wind pressure	$q_p = 13.42 \text{ psf}$	

The RRH's are mounted behind the antennas, for the reason of shielding there is no wind load increase.

The OVP wind load shows minimal wind force increase on existing frames (compare to the total wind load from antennas and the steel frames) therefore existing antenna mounts and steel frames will be O.K.

Total increase on antenna and equipment weight is 298 lbs. This is a negligible increase compare to the total weight of the steel frames; therefore frames and building structure will be O.K.



VERIZON SITE NUMBER:
CLMB037
 SITE NAME:
SOUTH DUBLIN
ANTENNA CHANGE OUT



HARPER
ENGINEERING, INC.
 TELECOM GROUP
 815 Superior Ave. Suite 1514
 Cleveland, OH. 44114
 Phone: (216)344-3855
 Fax: (216)344-3856

PROJECT TEAM	SITE INFORMATION	APPROVALS	SHEET INDEX		
ENGINEER: HARPER ENGINEERING, INC. 815 SUPERIOR AVE. SUITE 1514 CLEVELAND, OH. 44114 (216) 344-3855 CONTACT PERSON: DAVID W. HARPER (216) 344-3855	PROJECT DATA: FACILITY OCCUPANT: VERIZON WIRELESS LEASE AREA: EXISTING EQUIPMENT ENCLOSURE: EXISTING ZONING JURISDICTION: CITY OF DUBLIN TAX ID. NO. 273-001976 CONSTRUCTION TYPE: NONCOMBUSTIBLE, IB \ USE GROUP "U" GOVERNING CODE: OBC 2011/IBC 2009 SITE ADDRESS: 5127 POST ROAD DUBLIN, OHIO 43107 PROPERTY OWNER: SLMG LTD 5131 POST ROAD, STE 235 DUBLIN, OH 43017 PROPERTY OWNER CONTACT: DOUG SLADOJE (614) 228-2388 APPLICANT: VERIZON WIRELESS DENA FARMER 7575 COMMERCE COURT LEWIS CENTER, OH 43035 OFFICE (614) 307-1056 POWER PROVIDER: N/A PHONE PROVIDER: N/A	_____ DATE _____ SITE ACQUISITION _____ DATE _____ ZONING MANAGER _____ DATE _____ CONSTRUCTION MANAGER _____ DATE _____ RF ENGINEER _____ DATE _____ FIELD INSPECTOR _____ DATE _____ OWNER	SHEET	DESCRIPTION	REV.
			T-1	TITLE SHEET	1
			A-1	OVERALL ROOF/SITE PLAN	1
			A-2	DEMOLITION & PROPOSED ROOF PLANS	1
			A-3	BUILDING ELEVATIONS	1
			RF-1	ANTENNA DETAILS	1

DRAWING REVISIONS

Rev.	Description	Date	Mgr.
A	For Approval	08/28/13	DWH
O	For Construction	02/27/14	DWH
B	For Approval	03/25/15	DWH
1	For Construction	03/26/15	DWH

DO NOT SCALE DRAWINGS

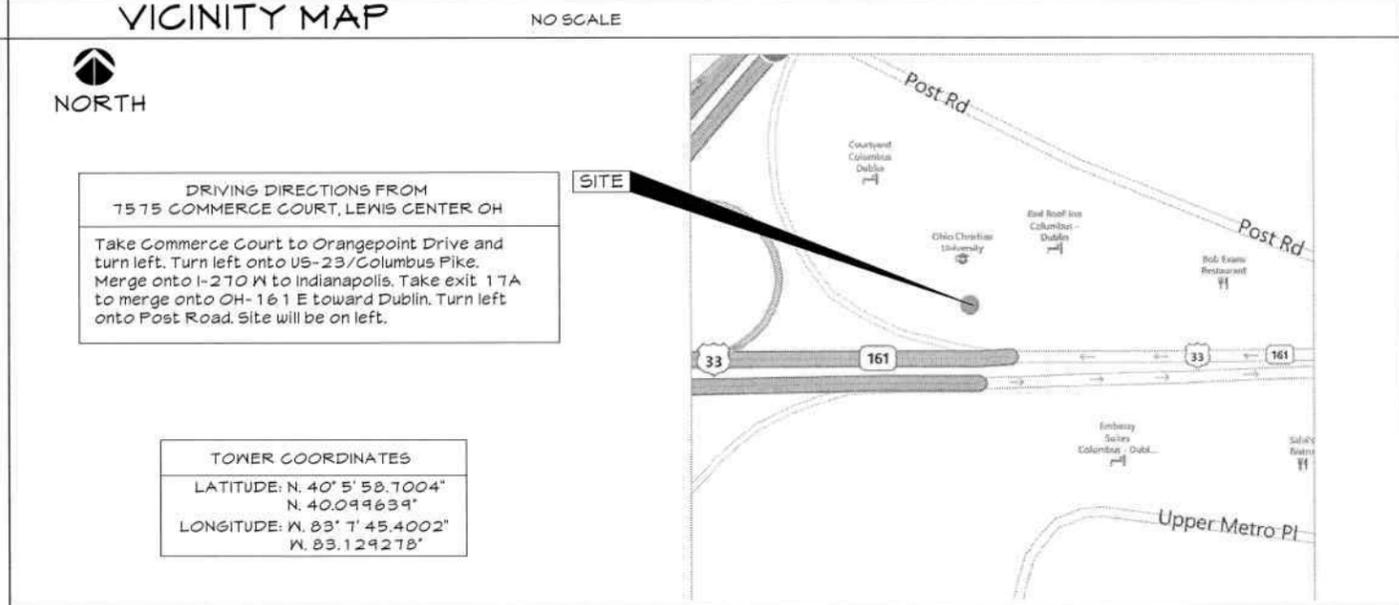
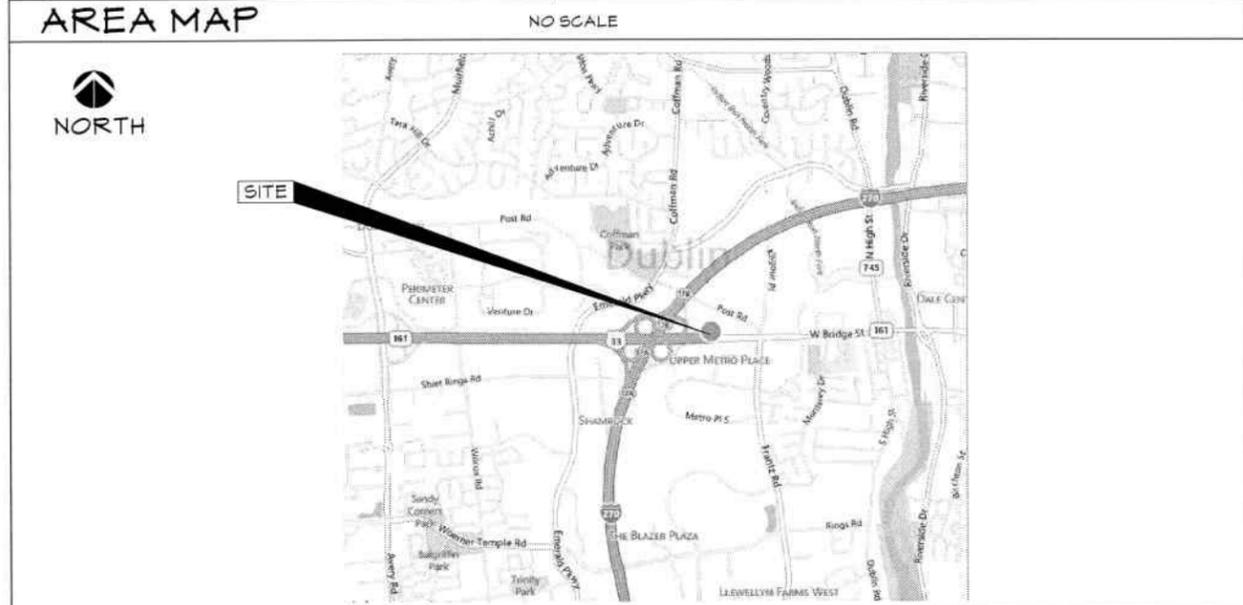
CONTRACTOR SHALL VERIFY ALL PLANS & EXISTING DIMENSIONS & CONDITIONS ON THE JOB SITE & SHALL IMMEDIATELY NOTIFY THE ARCHITECT IN WRITING OF ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK OR BE RESPONSIBLE FOR SAME

HANDICAP REQUIREMENTS

FACILITY IS UNMANNED AND NOT FOR HUMAN HABITATION. HANDICAP ACCESS IS NOT REQUIRED

OTHER REQUIREMENTS

- FACILITY HAS NO PLUMBING OR PARKING
 - NO GRADING WILL BE REQUIRED FOR THIS SITE.



VERIZON
 SITE NUMBER:
CLMB037
 SITE NAME:
SOUTH DUBLIN
 5127 POST ROAD
 DUBLIN, OHIO 43017

SHEET NAME:
TITLE SHEET

SHEET NO./REV.:
T-1/1

SCALE: AS NOTED
 DRWN BY: NAA
 CHK'D BY: DLW
 DATE: 07/01/13
 FILE: 9-151-408

NOTES

1. FOR DEMOLITION GENERAL NOTES, NOTES AND ANTENNA REPLACEMENT NOTES SEE DRAWING A-2.



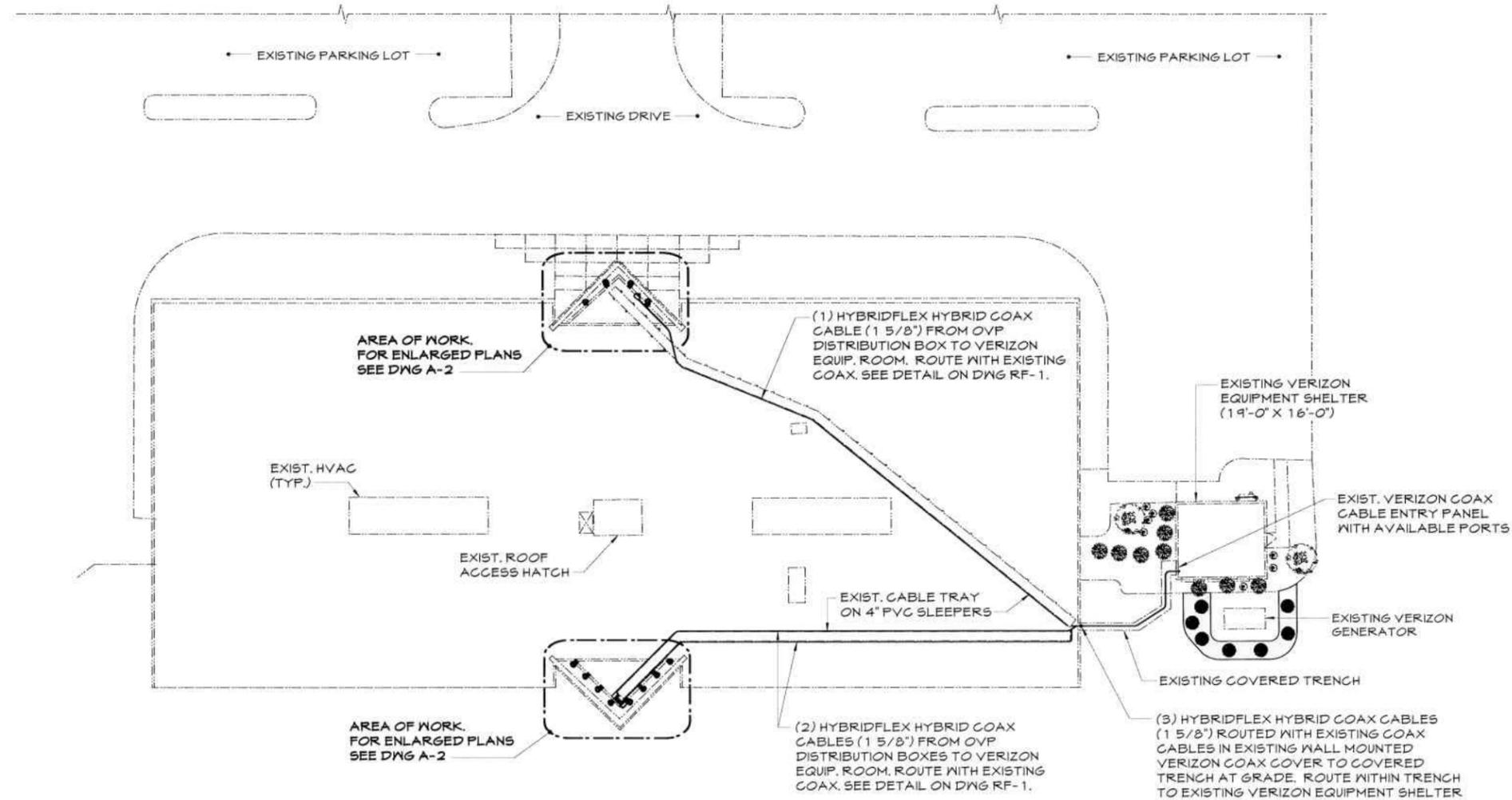
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OVERALL ROOF/SITE PLAN

SCALE: 1/16"=1'-0"
0 10 20 30



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SITE NUMBER:
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SHEET NAME:

OVERALL
ROOF/SITE
PLAN

SHEET No./Rev.:	SCALE: AS NOTED
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SHEET NAME:

DEMOLITION & PROPOSED ROOF PLANS

SHEET No./Rev.:	SCALE: AS NOTED
A-2/1	DRAWN BY: NAA
	CHK'D BY: DLN
	DATE: 07/01/13
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DEMOLITION GENERAL NOTES

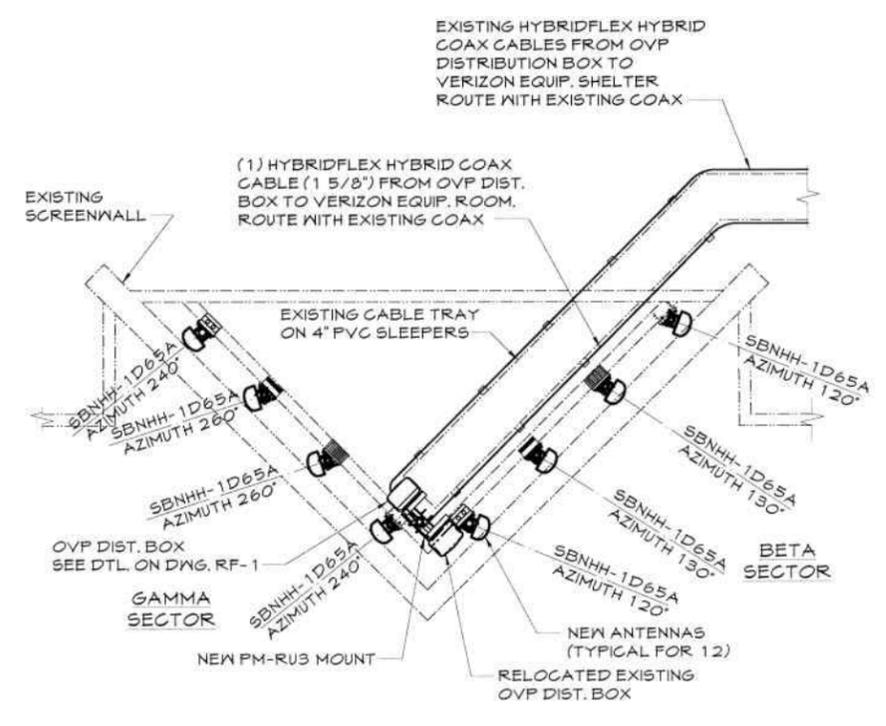
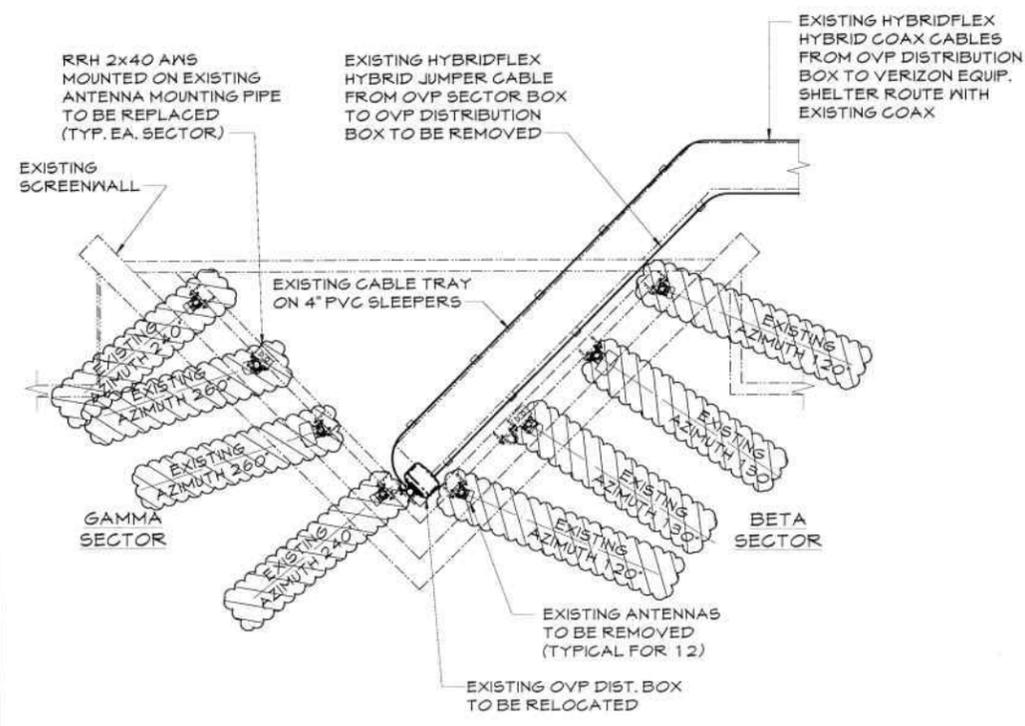
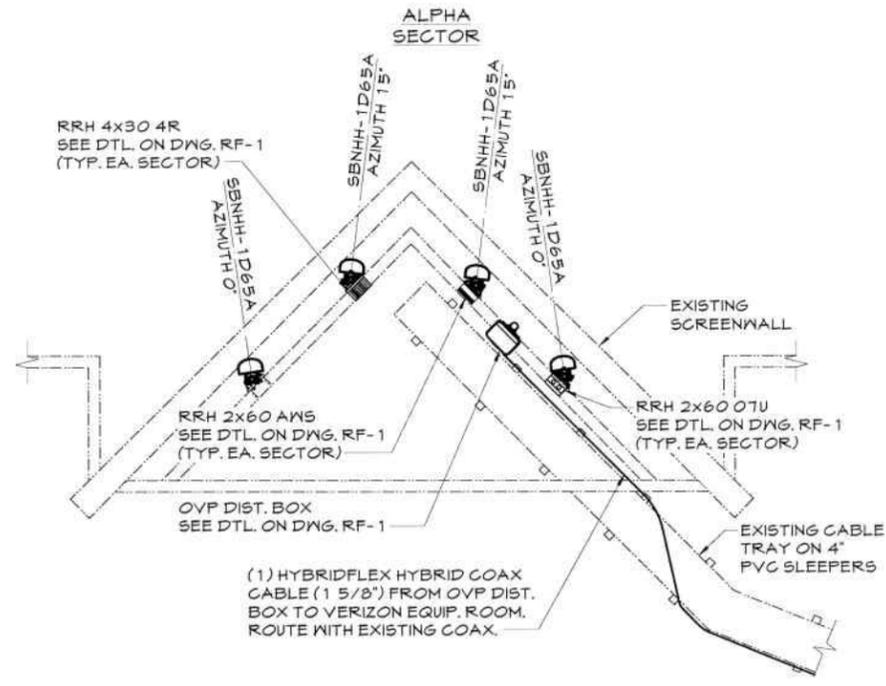
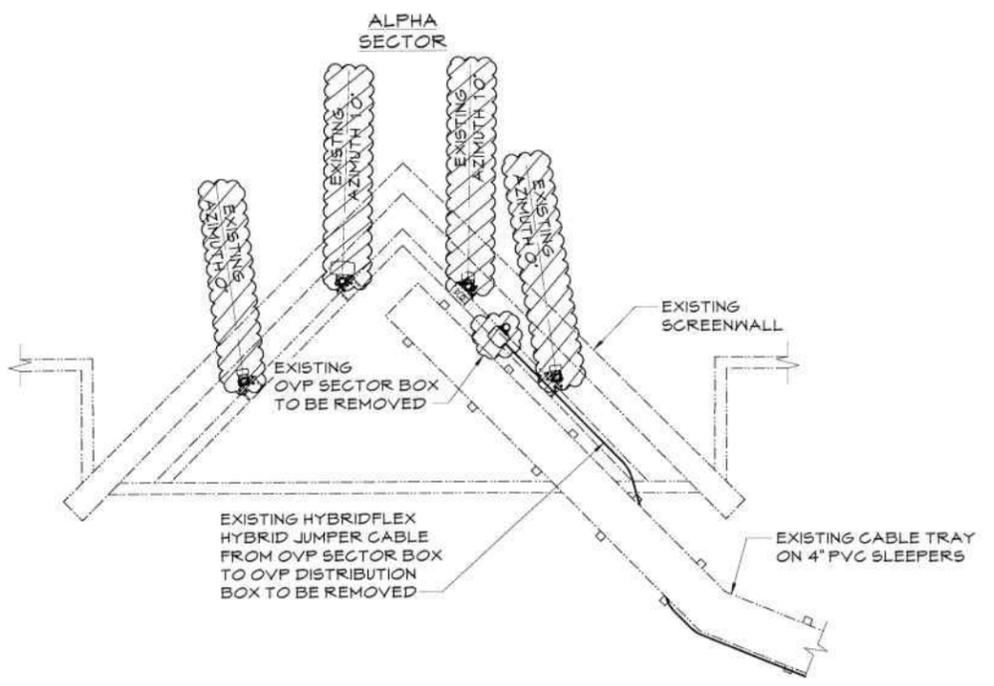
- ALL DEMOLITION ACTIVITIES MUST BE COORDINATED / SCHEDULED WITH BUILDING MAINTENANCE SUPERVISOR TO AVOID OR MINIMIZE DISRUPTION OF BUILDING SERVICES.
- CONTRACTOR SHALL PROTECT ALL EXISTING PORTIONS OF THE EXISTING BUILDING DURING DEMOLITION / CONSTRUCTION. THE GENERAL CONTRACTOR IS RESPONSIBLE FOR ANY / ALL DAMAGES CAUSED BY HIMSELF OR SUB-CONTRACTORS.
- KEEP CLEAN ALL EXISTING SPACES AND PROPERTIES ADJACENT TO DEMOLITION / CONSTRUCTION AREAS. ANY DEBRIS SHALL BE REMOVED FROM WORK AREAS DAILY. IF REQUIRED, CLOSE OFF EXISTING SUPPLY AIR VENTS TO AVOID FEEDING EXISTING ROOMS TO PREVENT DUST / DEBRIS ENTRY. (COORDINATE WITH BUILDING MAINTENANCE SUPERVISOR).
- CONTRACTOR SHALL NOTIFY VERIZON REPRESENTATIVE REGARDING METHOD AND PROCEDURE FOR DEMOLITION TWO WEEKS PRIOR TO COMMENCING WORK.
- HATCHING INDICATES EXISTING ANTENNAS AND ASSOCIATED MOUNTING HARDWARE TO BE REMOVED.
- ALL EXISTING ANTENNAS, ETC. THAT ARE REMOVED SHALL BE RETURNED TO VERIZON.

NOTES:

- REMOVE (12) EXISTING ANTENNAS AND MOUNTING HARDWARE AT ELEV. 47'-5".
- INSTALL (12) NEW ANTENNAS AND MOUNTING HARDWARE AT ELEV. 47'-0".
- INSTALL (6) RRH ON NEW ANTENNA MOUNTING PIPES ON EXISTING MOUNTING FRAMES AT ELEV. 49'-0" (2 PER SECTOR). REMOVE (3) EXISTING RRH 2X40 AWS AND INSTALL (3) RRH 2X60 AWS.
- REMOVE (1) OVP SECTOR BOX AT ELEV. 45'-0" (ALPHA SECTOR).
- INSTALL (1) OVP DISTRIBUTION BOX ON NEW ANTENNA MOUNTING PIPE AT ELEV. 45'-0" (ALPHA SECTOR).
- INSTALL (1) NEW RRU UNIVERSAL PM-RU3 MOUNT ON NEW MOUNTING PIPE AT ELEV. 45'-0" (BETA & GAMMA SECTORS).
- INSTALL (1) OVP DISTRIBUTION BOX & RELOCATE (1) OVP DIST. BOX ON NEW PM-RU3 MOUNT AT ELEV. 45'-0" (BETA & GAMMA SECTORS)
- REMOVE (1) HYBRIDFLEX HYBRID CABLE FROM OVP SECTOR BOX TO OVP DIST. BOX.
- INSTALL (2) HYBRIDFLEX HYBRID (1 5/8") COAX CABLE FROM OVP DIST. BOXES TO VERIZON SHELTER.
- INSTALL APPROPRIATE COAX CABLE BOOT(S) IN EXISTING SHELTER FOR NEW (1 5/8") COAX CABLES IN AVAILABLE PORT(S).
- NO ELECTRICAL WORK REQUIRED FOR THIS INSTALLATION. NO NEW VOLTAGE REQUIRED.

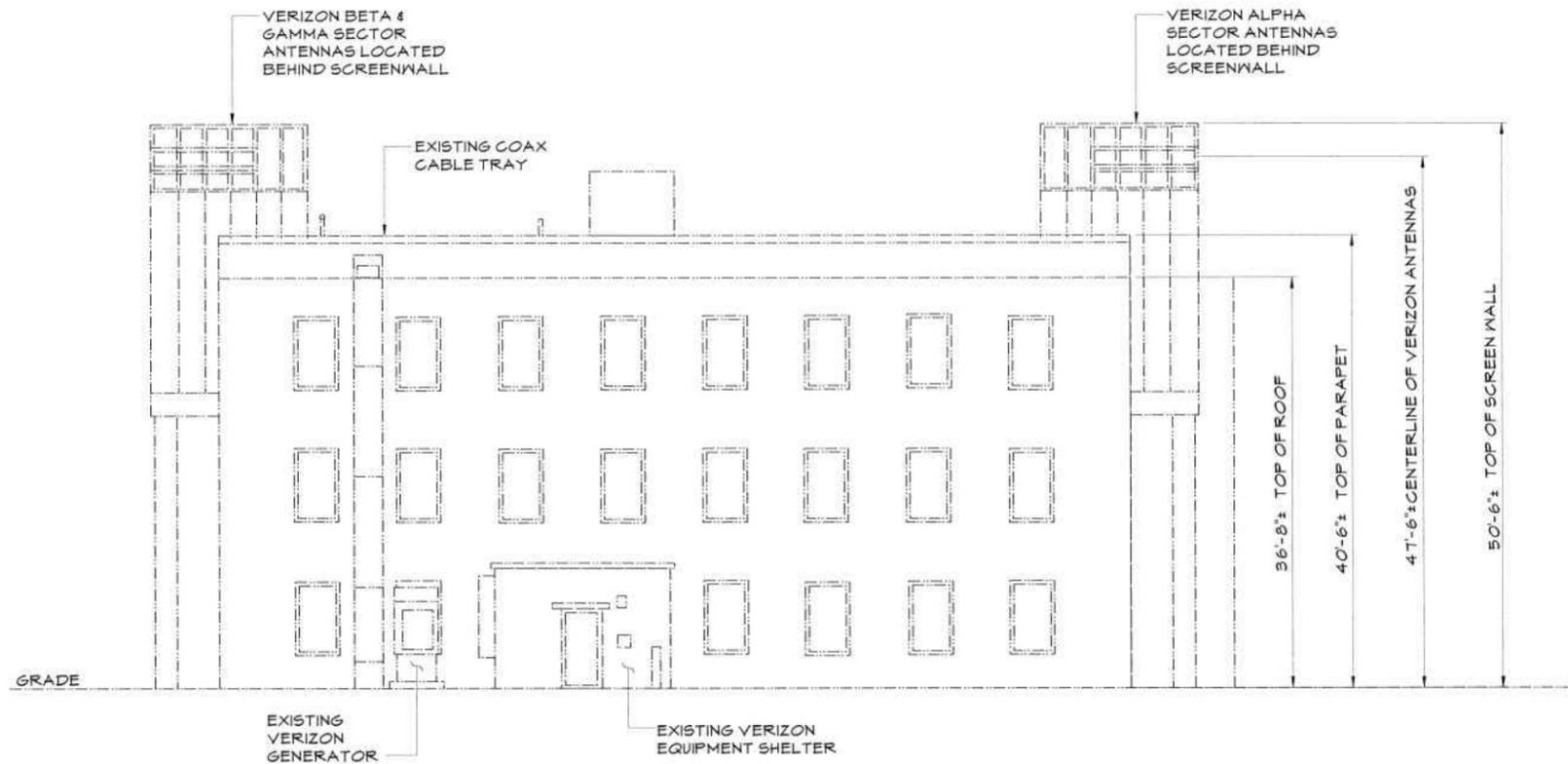
ANTENNA REPLACEMENT NOTES:

- CONTRACTOR TO INSPECT THE CONDITION OF EXISTING MOUNTING PIPES. CONFIRM THE FOLLOWING:
 - CORROSION; IF MOUNTS ARE FOUND TO BE CORRODED, CONTACT VERIZON REP. FOR DIRECTION.
 - CHECK CONDITION OF ATTACHMENT BOLTS. IF FOUND LOOSE, TIGHTEN TO ORIGINAL SPECIFICATIONS (AISC; TURN OF THE NUT METHOD).
 - IF BOLTS ARE MISSING, REPLAGE TO SUITE.
 - CONFIRM MOUNTING PIPE IS ADEQUATELY SIZED TO ACCOMMODATE PROPOSED ANTENNA INSTALL.
- ALL WORK DEPICTED ON THIS DRAWING DESIGNED IN ACCORDANCE WITH OBC 2011 AND AMENDMENTS.



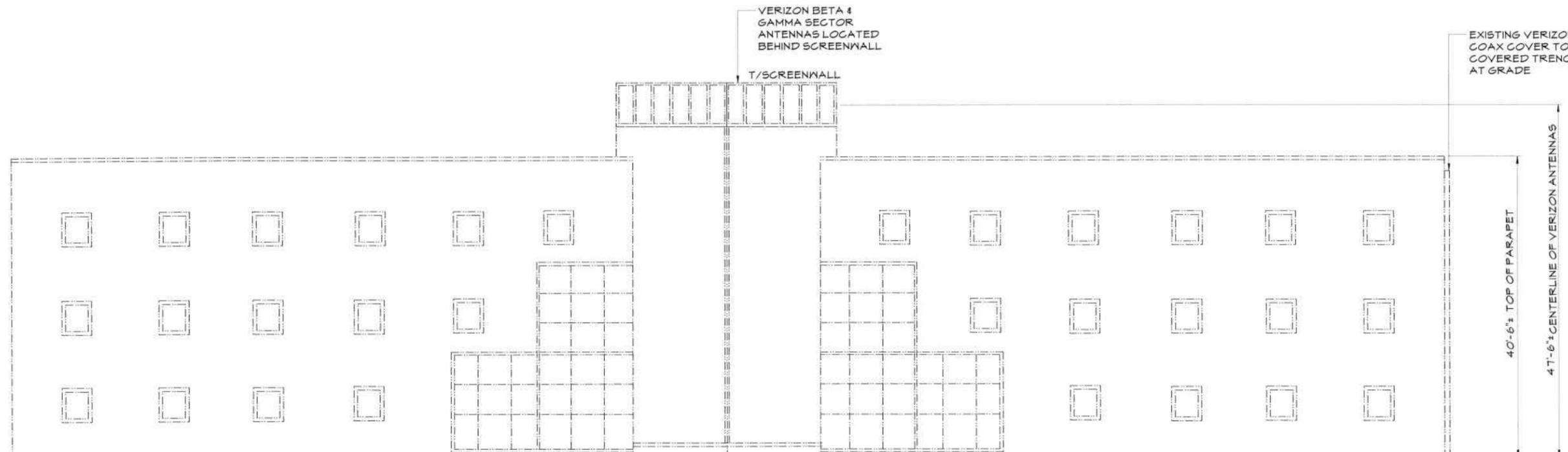
PARTIAL DEMOLITION ROOF PLAN
SCALE: 1/4"=1'-0"
0 1 2 3 4 5

PARTIAL PROPOSED ROOF PLAN
SCALE: 1/4"=1'-0"
0 1 2 3 4 5



EAST ELEVATION

SCALE: 1/8"=1'-0"



SOUTH ELEVATION

SCALE: 1/8"=1'-0"



GENERAL NOTES
1. FOR ANTENNA CHANGES AND DEMOLITION NOTES SEE DRAWING A-2.



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SHEET NAME:

BUILDING ELEVATIONS

SHEET No./Rev.:	SCALE: AS NOTED
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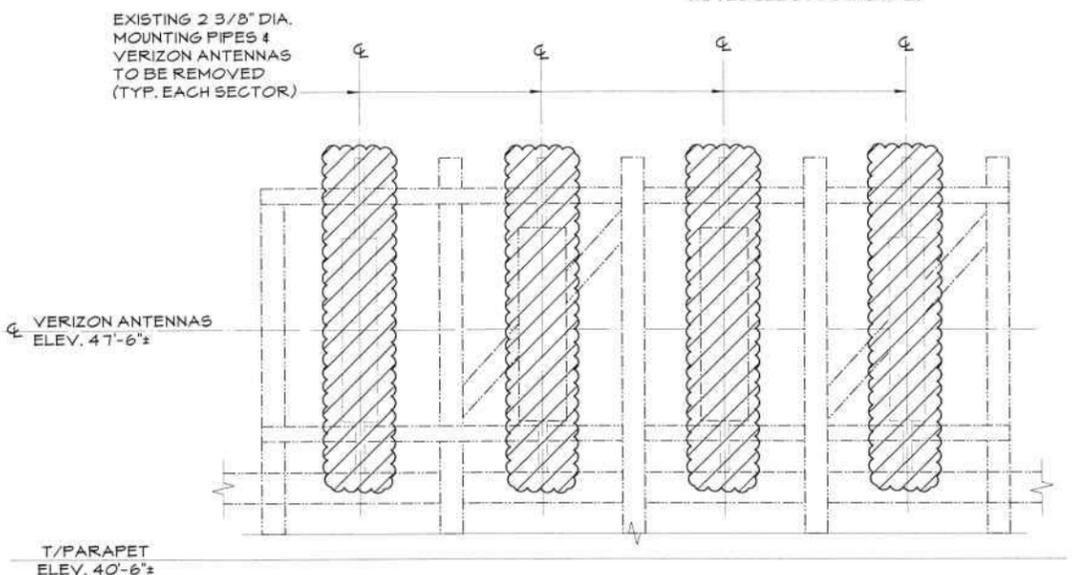
SHEET NAME:

ANTENNA DETAILS

SHEET No./Rev.:	SCALE: AS NOTED
RF-1/1	DRWN BY: NAA
	CHK'D BY: DLW
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	FILE: 9-15-408

GENERAL NOTES
1. FOR ANTENNA CHANGES AND DEMOLITION NOTES SEE DRAWING A-2.

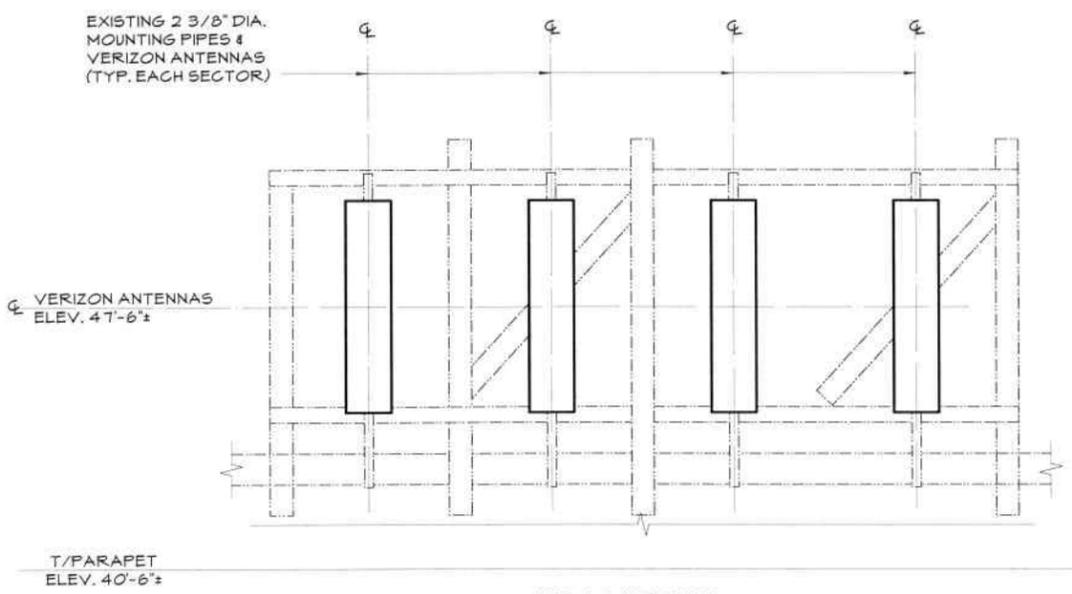
EXISTING 2 3/8" DIA. MOUNTING PIPES & VERIZON ANTENNAS TO BE REMOVED (TYP. EACH SECTOR)



EXISTING ANTENNA LAYOUT SECTION (BETA & GAMMA SECTOR) (ALPHA SECTOR SIMILAR)

SCALE: 1/2"=1'-0"
0 1 2 3

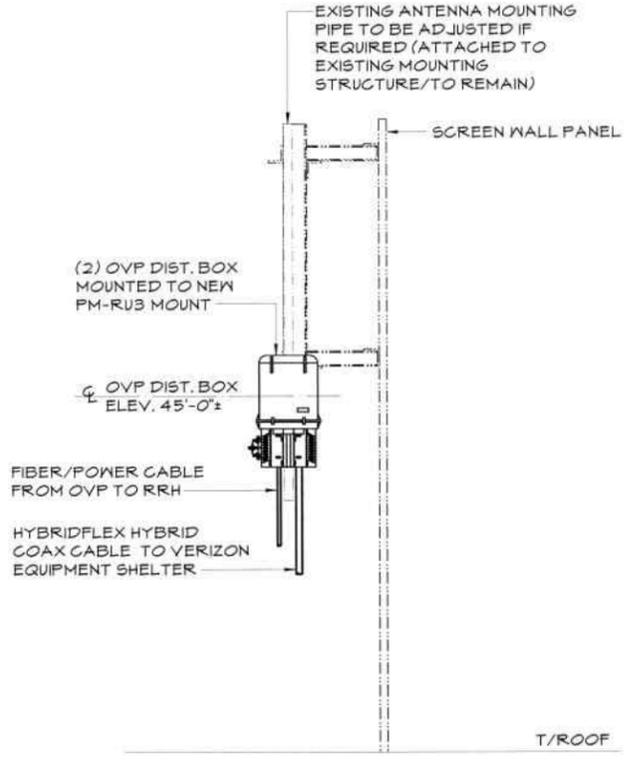
EXISTING 2 3/8" DIA. MOUNTING PIPES & VERIZON ANTENNAS (TYP. EACH SECTOR)



NEW ANTENNA LAYOUT SECTION (BETA & GAMMA SECTOR) (ALPHA SECTOR SIMILAR)

SCALE: 1/2"=1'-0"
0 1 2 3

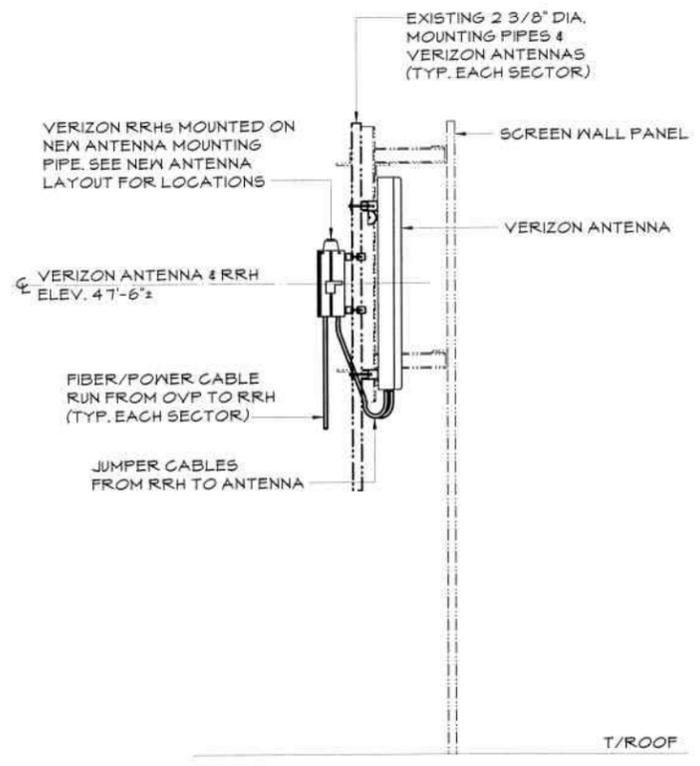
EXISTING ANTENNA MOUNTING PIPE TO BE ADJUSTED IF REQUIRED (ATTACHED TO EXISTING MOUNTING STRUCTURE/TO REMAIN)



OVP DETAIL

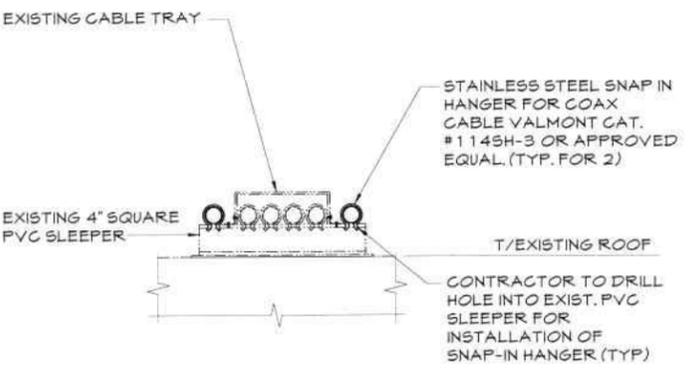
SCALE: 1/2"=1'-0"
0 1 2 3

EXISTING 2 3/8" DIA. MOUNTING PIPES & VERIZON ANTENNAS (TYP. EACH SECTOR)



ANTENNA/RRH DETAIL

SCALE: 1/2"=1'-0"
0 1 2 3



COAX CABLE MOUNTING DETAIL

SCALE: 1/16"=1'-0"
0 10 20 30



Rachel Ray
City of Dublin - Planning
406 Justice Drive – Room 167
Lebanon, OH 45036

May 7, 2015

Re: CLMB037 South Dublin (700-1900-RRH) (RT) - Verizon Modification Project

Dear Sir or Madam:

As one of the major leaders in the Wireless industry, Verizon Wireless (VZW) must work diligently to improve their network and keep up with the ever changing technologies in order to compete with other Wireless providers.

In this specific instance, Verizon Wireless proposes to upgrade their existing equipment atop the roof of the office building located at 5127 Post Road, Dublin, OH 43017. Specifically, Verizon Wireless proposes to swap (12) existing antennas for (12) new antennas, upgrade (3) existing RRHs to new 60 watt models, add (6) RRHs, swap (1) sector OVP box for (1) standard OVP box, install (1) PM-RU3 universal mount, add (1) standard OVP box, relocate (1) existing OVP box, remove (1) 7/8" hybrid jumper and add (2) new 1-5/8" hybrid cables.

No ground work is proposed either inside or outside the existing compound. No electrical work is proposed. No equipment will exceed over the existing screen walls.

Per conversation, it is my understanding that the City of Dublin requires (1) notarized hard copy of the ART application, (1) structural analysis report and (1) sealed construction drawing. All are enclosed. According to the structural evaluation, the building and foundation will adequately support the antenna alterations and additional coax lines. Also, an electronic submittal of all documents will be sent as well.

The construction contractor will be named at a later date by Verizon Wireless. In addition, the commencement date of construction has yet to be determined. The commencement date will only occur following the issuance of the proper permit(s) by the City of Dublin. Generally, the timeline for the construction is three weeks from start to finish.

I hope this outline helps to define exactly what is going on with the project. As you have noticed, this installation is very small, often described as maintenance. It has been performed numerous times by Verizon Wireless and all other carriers of the Wireless community. Verizon strives to be the best wireless provider out there and this upgrade is a perfect example why they are known as one of the best. Please don't hesitate to contact me with any questions or concerns.

Thanks again and I'm looking forward to working with the City of Dublin in order to obtain the proper permit(s).

Sincerely,

A handwritten signature in black ink, appearing to read "Rodney Lafferty".

Rodney Lafferty
Representative for Verizon Wireless
SBA Network Services
rlafferty@sbsite.com
(740) 252-7410



SBNHH-1D65A

Andrew® Tri-band Antenna, 698–896 and 2x 1695–2360 MHz, 65° horizontal beamwidth, internal RET. Both high bands share the same electrical tilt.

- Interleaved dipole technology providing for attractive, low wind load mechanical package

Electrical Specifications

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain, dBi	13.6	13.7	16.5	16.9	17.1	17.6
Beamwidth, Horizontal, degrees	66	61	70	65	62	61
Beamwidth, Vertical, degrees	17.6	15.9	7.1	6.6	6.2	5.5
Beam Tilt, degrees	0–18	0–18	0–10	0–10	0–10	0–10
USLS, dB	16	13	13	13	12	12
Front-to-Back Ratio at 180°, dB	25	27	28	28	27	29
CPR at Boresight, dB	20	16	20	23	17	20
CPR at Sector, dB	10	5	11	6	1	4
Isolation, dB	25	25	25	25	25	25
Isolation, Intersystem, dB	30	30	30	30	30	30
VSWR Return Loss, dB	1.5 14.0	1.5 14.0	1.5 14.0	1.5 14.0	1.5 14.0	1.5 14.0
PIM, 3rd Order, 2 x 20 W, dBc	-153	-153	-153	-153	-153	-153
Input Power per Port, maximum, watts	350	350	350	350	350	300
Polarization	±45°	±45°	±45°	±45°	±45°	±45°
Impedance	50 ohm					

Electrical Specifications, BASTA*

Frequency Band, MHz	698–806	806–896	1695–1880	1850–1990	1920–2180	2300–2360
Gain by all Beam Tilts, average, dBi	13.1	13.1	16.1	16.5	16.7	17.2
Gain by all Beam Tilts Tolerance, dB	±0.5	±0.5	±0.5	±0.3	±0.5	±0.4
	0° 13.4	0° 13.4	0° 16.0	0° 16.3	0° 16.5	0° 17.0
Gain by Beam Tilt, average, dBi	9° 13.1	9° 13.1	5° 16.2	5° 16.5	5° 16.8	5° 17.3
	18° 12.7	18° 12.7	10° 16.1	10° 16.5	10° 16.6	10° 16.9
Beamwidth, Horizontal Tolerance, degrees	±3.1	±5.4	±2.8	±4	±6.6	±4.6
Beamwidth, Vertical Tolerance, degrees	±1.8	±1.4	±0.3	±0.4	±0.5	±0.3
USLS, dB	15	14	15	15	15	14
Front-to-Back Total Power at 180° ± 30°, dB	22	21	26	26	24	25
CPR at Boresight, dB	22	16	22	25	21	22
CPR at Sector, dB	10	6	12	8	5	4

* CommScope® supports NGMN recommendations on Base Station Antenna Standards (BASTA). To learn more about the benefits of BASTA, [download the whitepaper Time to Raise the Bar on BSAs.](#)

General Specifications

Antenna Brand	Andrew®
Antenna Type	DualPol® multiband with internal RET
Band	Multiband
Brand	DualPol® Teletilt®
Operating Frequency Band	1695 – 2360 MHz 698 – 896 MHz

SBNHH-1D65A

POWERED BY



Mechanical Specifications

Color	Light gray
Lightning Protection	dc Ground
Radiator Material	Aluminum Low loss circuit board
Radome Material	Fiberglass, UV resistant
RF Connector Interface	7-16 DIN Female
RF Connector Location	Bottom
RF Connector Quantity, total	6
Wind Loading, maximum	445.0 N @ 150 km/h 100.0 lbf @ 150 km/h
Wind Speed, maximum	241.4 km/h 150.0 mph

Dimensions

Depth	180.0 mm 7.1 in
Length	1409.0 mm 55.5 in
Width	301.0 mm 11.9 in
Net Weight	15.2 kg 33.5 lb

Remote Electrical Tilt (RET) Information

Input Voltage	10–30 Vdc
Power Consumption, idle state, maximum	2.0 W
Power Consumption, normal conditions, maximum	13.0 W
Protocol	3GPP/AISG 2.0 (Multi-RET)
RET Interface	8-pin DIN Female 8-pin DIN Male
RET Interface, quantity	1 female 1 male
RET System	Teletilt®

Regulatory Compliance/Certifications

Agency

RoHS 2011/65/EU
China RoHS SJ/T 11364-2006
ISO 9001:2008

Classification

Compliant by Exemption
Above Maximum Concentration Value (MCV)
Designed, manufactured and/or distributed under this quality management system

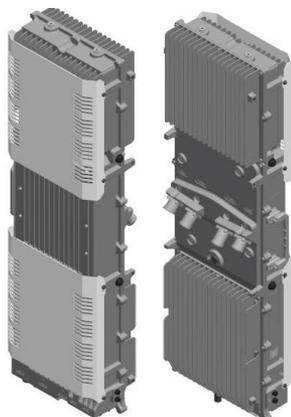


Included Products

BSAMNT-1 — Wide Profile Antenna Downtilt Mounting Kit for 2.4 - 4.5 in (60 - 115 mm) OD round members. Kit contains one scissor top bracket set and one bottom bracket set.

ALCATEL-LUCENT WIRELESS PRODUCT DATASHEET RRH2X60-AWS FOR BAND 4 APPLICATIONS

The Alcatel-Lucent RRH2x60-AWS is a high power, small form factor Remote Radio Head operating in the AWS frequency band (3GPP Band 4) for LTE technology. It is designed with an eco-efficient approach, providing operators with the means to achieve high quality and high capacity coverage with minimum site requirements and efficient operation.



A distributed Node B expands the deployment options by using two components, a Base Band Unit (BBU) containing the digital assets and a separate RRH containing the radio-frequency (RF) elements. This modular design optimizes available space and allows the main components of a Node B to be installed separately, within the same site or several kilometers apart.

The Alcatel-Lucent RRH2x60-AWS is linked to the BBU by an optical-fiber connection carrying downlink and uplink digital radio signals along with operations, administration and maintenance (OA&M) information.

SUPERIOR RF PERFORMANCE

The Alcatel-Lucent RRH2x60-AWS integrates all the latest

technologies. This allows to offer best-in-class characteristics.

It delivers an outstanding 120 watts of total RF power thanks to its two transmit RF paths of 60 W each.

It is ideally suited to support multiple-input multiple-output (MIMO) 2x2 operation.

It includes four RF receivers to natively support 4-way uplink reception diversity. This improves the radio uplink coverage and this can be used to extend the cell radius commensurate with 2x2MIMO 2x60 W for the downlink.

It supports multiple discontinuous LTE carriers within an instantaneous bandwidth of 45 MHz corresponding to the entire AWS B4 spectrum.

The latest generation power amplifiers (PA) used in this product achieve high efficiency (>40%), resulting in improved power consumption figures.

OPTIMIZED TCO

The Alcatel-Lucent RRH2x60-AWS is designed to make available all the benefits of a distributed Node B, with excellent RF characteristics, with low capital expenditures (CAPEX) and low operating expenditures (OPEX).

The Alcatel-Lucent RRH2x60-AWS is a very cost-effective solution to deploy LTE MIMO.

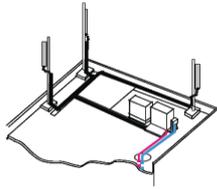
EASY INSTALLATION

The RRH2x60-AWS includes a reversible mounting bracket which allows for ease of installation behind an antenna, or on a rooftop knee wall while providing easy access to the mid body RF connectors.

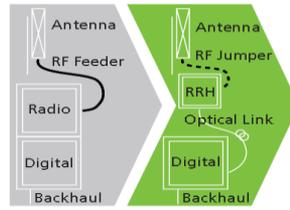
The limited space available in some sites may prevent the installation of traditional single-cabinet BTS equipment. However, many of these sites can host an Alcatel-Lucent RRH2x60-AWS installation, providing more flexible site selection and improved network quality along with greatly reduced installation time and costs.

The Alcatel-Lucent RRH2x60-AWS is a zero-footprint solution and is convection cooled without fans for silent operation, simplifying negotiations with site property owners and minimizing environmental impacts.

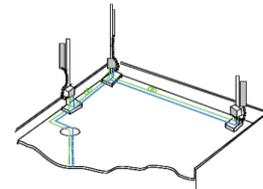
Installation can easily be done by a single person as the Alcatel-Lucent RRH2x60-AWS is compact and weighs about 25 kg, eliminating the need for a crane to hoist the BTS cabinet to the rooftop. A site can be in operation in less than one day.



Macro



RRH for space-constrained cell sites



Distributed

FEATURES

- RRH2x60-AWS integrates two power amplifiers of 60W rating (at each antenna connector)
- Support multiple carriers over the entire 3GPP band 4
- RRH2x60-AWS is optimized for LTE operation
- RRH2x60-AWS is a very compact and lightweight product
- Advanced power management techniques are embedded to provide power savings, such as PA bias control

BENEFITS

- MIMO LTE operation with only one single unit per sector
- Improved uplink coverage with built-in 4-way receive diversity capability
- RRH can be mounted close to the antenna, eliminating nearly all losses in RF cables and thus reducing power consumption by 50% compared to conventional solutions
- Distributed configurations provide easily deployable and cost-effective solutions, near zero footprint and

silent solutions, with minimum impact on the neighborhood, which ease the deployment

- RETA and TMA support without additional hardware thanks to the AISG v2.0 port and the integrated Bias-Tees. Bias-Tees support AISG DC supply and signaling.

TECHNICAL SPECIFICATIONS

Specifications listed are hardware capabilities. Some capabilities depend on support in a specific software release or future release.

Dimensions and weights

- HxWxD : 930x270x146 mm (with solar shield)
- Weight : 25 kg (55 lbs) (with solar shield)

Electrical Data

- Power Supply : -48V DC (-40.5 to -57V)
- Power Consumption (ETSI average traffic load reference) : 250W @2x60W

RF Characteristics

- Frequency band: 1710-1755, UL / 2110-2155 MHz, DL (3GPP band 4)
- Output power: 2x60W at antenna connectors
- Technology supported: LTE
- Instantaneous bandwidth: 45 MHz
- Rx diversity: 2-way and 4-way uplink reception
- Typical sensitivity without Rx diversity: -105 dBm for LTE

Connectivity

- Two CPRI (3-6) optical ports for daisy chaining and up to six RRHs per fiber
- Type of optical fiber: Single-Mode (SM) and Multi-Mode (MM) SFPs
- Optical fiber length: up to 300m using MM fiber, up to 15km using SM fiber
- TMA/RETA : AISG 2.0 (RS485 connector and internal Bias-Tee)
- Four external alarms
- Surge protection for all external ports (DC and RF)

Environmental specifications

- Operating temperature: -40°C to 55°C including solar load
- Operating relative humidity: 8% to 100%
- Environmental Conditions : ETS 300 019-1-4 class 4.1E
- Ingress Protection : IEC 60529 IP65
- Acoustic Noise : Noiseless (natural convection cooling)

Safety and Regulatory Data

- EMC : 3GPP 25113, EN 301 489-1, EN 301 489-23, GR 1089, GR 3108, OET-65
- Safety : IEC60950-1, EN 60825-1, UL, ANSI/NFPA 70, CAN/CSA-C22.2
- Regulatory : FCC Part 15 Class B, CE Mark – European Directive : 2002/95/EC (ROHS); 2002/96/EC (WEEE); 1999/5/EC (R&TTE)
- Health : EN 50385

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AT THE SPEED OF IDEAS™

ALCATEL-LUCENT B13 RRH4X30-4R

Alcatel-Lucent B13 Remote Radio Head 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B13 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the 700U band (700 MHz, 3GPP band 13), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B13 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity and up to 10MHz instantaneous bandwidth.

The Alcatel-Lucent B13 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

Its compactness and slim design makes the Alcatel-Lucent B13 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

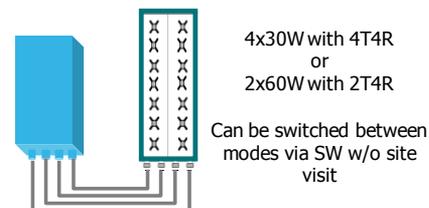


FEATURES

- Supporting LTE in 700 MHz band (700U, 3GPP band 13)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 10MHz LTE carrier with 4Rx Diversity
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in 700U band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



TECHNICAL SPECIFICATIONS

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	U700 (C) (3GPP bands 13): DL: 746 - 756 MHz / UL: 777 - 787 MHz
Instantaneous bandwidth - #carriers	10MHz – 1 LTE carrier (in 10MHz occupied bandwidth)
LTE carrier bandwidth	10 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2 dB typ. (<2.5 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.)	550 x 305 x 230 (21.6" x 12.0" x 9") (with solar shield)
Volume in L	38 (with solar shield)
Weight in kg (lb) (w/o mounting HW)	26 (57.2) (with solar shield)
DC voltage range	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption
DC power consumption	550W typical @100% RF load (in 2Tx or 4TX mode)
Environmental conditions	-40°C (-40°F) /+55°C (+131°F) IP65
Wind load (@150km/h or 93mph)	Frontal:<200N / Lateral :<150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

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Alcatel-Lucent Remote Radio Head B25 RRH 4x30-4R is the newest addition of Remote Radio Head to the extended product line of Alcatel-Lucent's distributed Base Station solutions, aimed at facilitating smooth RF site acquisition and related civil engineering.

Supporting 2Tx/4Tx MIMO and 4-way Rx diversity, Alcatel-Lucent B25 RRH4x30-4R allows operators to have a compact radio solution to deploy LTE in the PCS band (1.9 GHz, 3GPP band 25), providing them with the means to achieve high capacity, high quality and high coverage with minimum site requirements.

The Alcatel-Lucent B25 RRH4x30-4R product has four transmit RF paths, offering the possibility to **select, via software only, 2Tx or 4Tx MIMO configurations** with either 2x60 W or 4x30 W RF output power. It supports also 4-way Rx diversity, LTE carriers from 3MHz up to 20MHz and up to 65MHz instantaneous bandwidth.

The Alcatel-Lucent B25 RRH4x30-4R is a near zero-footprint solution and operates noise free, simplifying negotiations with site property owners and minimizing environmental impacts.

Its compactness and slim design makes the Alcatel-Lucent B25 RRH4x30-4R easy to install close to the antenna: operators can therefore locate this Remote Radio Head where RF design conditions are deemed ideal, minimizing trade-offs between available sites and RF optimum sites, together with reducing the RF feeder needs and installation costs.

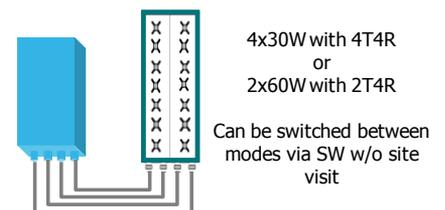


FEATURES

- Supporting LTE in 1.9 GHz band (PCS, 3GPP band 2 & 25)
- LTE 2Tx or 4Tx MIMO (SW switchable)
- Output power: Up to 2x60W or 4x30W
- 3, 5, 10, 15 or 20MHz LTE carrier with 4Rx Diversity
- Up to 4 carriers anywhere in 65MHz instantaneous bandwidth
- Convection-cooled (fan-less)
- Supports AISG 2.0 ALD devices (RET, TMA) through RS485 or RF ports

BENEFITS

- Compact to reduce additional footprint when adding LTE in PCS band
- MIMO scheme operation selection (2Tx or 4Tx) by software only
- Full flexibility for multiple carriers operation over entire PCS spectrum
- Improves downlink spectral efficiency through MIMO4
- Increases LTE coverage thanks to 4Rx diversity capability and best in class Rx sensitivity
- Flexible mounting options: Pole or Wall



TECHNICAL SPECIFICATIONS

Features & performance	
Number of TX/RX paths	4 duplexed (either 4T4R or 2T4R by SW)
Frequency band	PCS-G (3GPP bands 2 & 25): DL: 1930 - 1995 MHz / UL: 1850 - 1915 MHz
Instantaneous bandwidth - #carriers	65MHz – Up to 4 LTE carriers (in 40MHz occupied bandwidth)
LTE carrier bandwidth	3, 5, 10, 15 or 20 MHz
RF output power	2x60W or 4x30W (by SW)
Noise figure – RX Diversity scheme	2.5 dB typ. (<3 dB max) – 2 or 4 way Rx diversity
Sizes (HxWxD) in mm (in.)	544 x 305 x 184 (21.4" x 12.0" x 7.2") (with solar shield)
Volume in L	30.5 (with solar shield)
Weight in kg (lb) (w/o mounting HW)	23 (51) (with solar shield)
DC voltage range	-40.5 to -57V at full performance, -38 to -57V with relaxation on power consumption
DC power consumption	520W typical @100% RF load
Environmental conditions	-40°C (-40°F) / +55°C (+131°F) IP65
Wind load (@150km/h or 93mph)	Frontal:<200N / Lateral :<150N
Antenna ports	4 ports 7/16 DIN female (50 ohms) VSWR < 1.5
CPRI ports	2 CPRI ports (HW ready for Rate7, 9.8 Gbps) SFP single mode dual fiber
AISG interfaces	1 AISG2.0 output (RS485) Integrated Smart Bias Tees (x2)
Misc. Interfaces	4 external alarms (1 connector) – 4 RF Tx & 4 RF Rx monitor ports - 1 DC connector (2 pins)
Installation conditions	Pole and wall mounting
Regulatory compliance	3GPP 36.141 / 3GPP 36.113 / GR-1089-CORE / GR-3108-CORE / UL 60950-1 / FCC Part 27

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**DC Surge Protection for RRH/Integrated Antenna Radio Head
RxxDC-4750-PF-48 • RxxDC-3315-PF-48**

Tower / Base / Rooftop / Rooftop Distribution Models

Raycap's flexible Tower, Base Stations and Rooftop protection and Distribution products provide protection for up to 6 Remote Radio Heads/Integrated Antennas. The solutions mitigate the risk of damage due to lightning and provide high levels of availability and reliability to radio equipment.



Shown with optional 90° elbow for side entry. Can be installed on left or right side of unit.

Mounting Bracket Included

Features

- Employs the Strikesorb® 30-V1-HV Surge Protective Device (SPD) specifically designed for the Remote Radio Head (RRH) installation environment and certified for use in DC applications and at low DC operating voltages (48V).
- The Strikesorb 30-V1-HV is a Class I SPD, certified by VDE per the IEC 61643-1 standard as suitable for installation in areas where direct lightning exposure is expected. Strikesorb 30-V1-HV is able to withstand direct lightning currents of up to 5kA (10/350) and induced surge currents of up to 60kA (8/20).
- Provides very low let through / clamping voltage - unique for a Class I product - as it does not employ spark gaps or other switching elements. Strikesorb offers unique protection levels to the RRH equipment as well as the Base Band Units.
- Alarms for SPD sacrifice, Moisture detection and Intrusion.
- Fully recognized to the UL 1449 3rd Edition Safety Standard.
- Patent pending design

Benefits

- Offers unique maintenance-free protection against direct lightning currents.
- Protects up to 6 Remote Radio Heads and connects up to 12 fiber pairs.
- Utilizes an IP 67 rated enclosure, allowing for indoor or outdoor installation on a roof or tower top.
- Configurable cable ports are designed to accommodate varying diameters of hybrid (combined power and fiber optic) or standard cables with diameters up to 2" (will fit most standard 1 5/8" coax class cables) depending upon port configuration.
- Lightweight aerodynamic design provides maximum flexibility for tower top installation.
- Companion to the RxxDC-1064-PF-48 (Sector) model.



DC1-48-60-18U

Tower / Base / Rooftop / Rooftop Distribution Models:
RxxDC-4750-PF-48
RxxDC-3315-PF-48

Companion Sector Model:
RxxDC-1064-PF-48

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G02-00-236 130129

SPECIFICATIONS

DC Surge Protection for RRH/Integrated Antenna Radio Head RxxDC-4750-PF-48 • RxxDC-3315-PF-48

Tower / Base / Rooftop / Rooftop Distribution Models

Electrical

Model Numbers	RxxDC-4750-PF-48	RxxDC-3315-PF-48
Nominal Operating Voltage	48 VDC	48 VDC
Nominal Discharge Current [I_n]	n/a	20 kA 8/20 μ s
Maximum Surge Current [I_{max}]	n/a	60 kA 8/20 μ s
Maximum Impulse (Lightning) Current per IEC 61643-1	n/a	5 kA 10/350 μ s
Maximum Continuous Operating Voltage [U_c]	n/a	75 VDC
Voltage Protection Rating (VPR) per UL 1449 3rd Edition	n/a	400V
Protection Class as per IEC 61643-1	n/a	Class I
SPD Alarm	n/a	upon sacrifice
Intrusion Sensor	microswitch	microswitch
Moisture Sensor	infrared moisture detector	infrared moisture detector
Strikesorb Module Type		30-V1-HV
	No Strikesorb modules installed (used as Distribution Unit only)	Strikesorb modules installed to protect 6 Remote Radio Heads

Mechanical

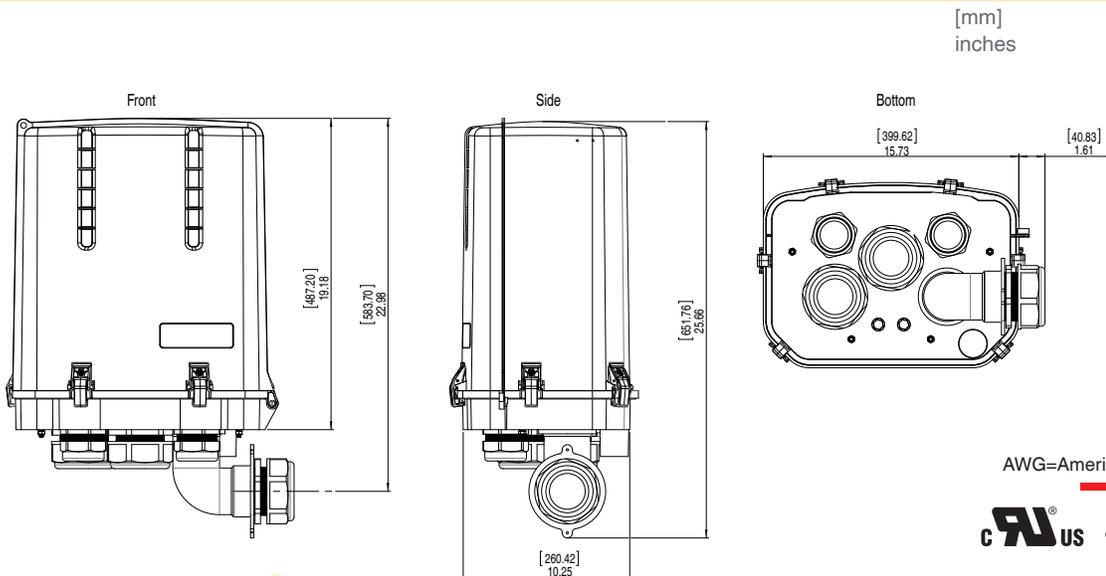
Suppression Connection Method	Compression lug, #20 - #6 AWG (0.5 mm ² - 16 mm ²)	
Fiber Connection Method	LC-LC Single mode	
Pressure Equalizing Vent	Gore™ Vent	
Environmental Rating	IP 67	
Operating Temperature	-40° C to +80° C	
UV Resistant	Yes	
Weight	System: 26 lbs (11.80 kg)	System: 32 lbs (14.51 kg)
Combined Wind Loading	150mph (sustained): 185 lbs (823 N)	

Standards Compliance

Strikesorb modules are compliant to the following Surge Protective Device (SPD) Standards

Standards	ANSI/UL 1449 3rd Edition
	IEEE C62.41
	NEMA LS-1, IEC 61643-1:2005 2nd Edition (Class I Protection)
	IEC 61643-12
	EN 61643-11:2002 (including A11:2007)

Product Diagram



AWG=American Wire Gauge



Raycap

www.raycapsurgeprotection.com

G02-00-236 130129



Andrew Solutions
RFA1206-24S26-300

HELIAX® FiberFeed Hybrid Cable Assembly, 12 power conductors 6 AWG, 24-fiber, black jacket, aluminum armor, 300 ft

Construction Materials

Fiber Type	TeraSPEED®, zero water peak singlemode fiber (G.652.D or G.652.D OS2)
Total Fibers, quantity	24
Jacket Color	Black

Dimensions

Cord Length	91.4 m 300.0 ft
Breakout Length, Fiber, end 1	813 mm 32 in
Breakout Length, Power, end 1	737 mm 29 in
Breakout Length, Fiber, end 2	813 mm 32 in
Breakout Length, Power, end 2	737 mm 29 in

Environmental Specifications

Environmental Space	Wireless installation
Operating Temperature	-40 °C to +80 °C (-40 °F to +176 °F)

General Specifications

Conductors, quantity	12
Construction Type	Breakout, armored
Alarm Wire Gauge	18 AWG
Alarm Wire, quantity	6
Cable Glands	No glands
Color, connector A	Blue
Color, connector B	Blue
Interface Feature, connector A	Standard
Interface Feature, connector B	Standard
Interface, connector A	LC
Interface, connector B	LC
Minimum Bend Radius, furcation	30.0 mm 1.2 in
Pulling Grips, quantity	0

Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system



Included Products

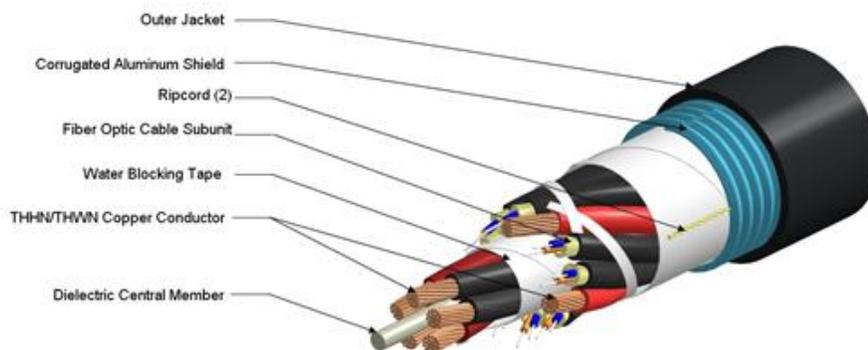
760177543 | RFF-24SM-1206-618-APE (Product Component—not orderable) — HELIAX® FiberFeed Hybrid Cable with aluminum armor

- CS-8F-MP (Product Component—not orderable) — Low Macrobending, Zero Water Peak, Dispersion-Unshifted Singlemode Fiber

Andrew Solutions
 760177543 | RFF-24SM-1206-618-APE
HELIAX® FiberFeed Hybrid Cable with aluminum armor



Representative Image



General Specifications

Cable Type	Wireless feeder
Center Conductor Gauge	6 AWG
Conductors, quantity	12
Construction Type	Armored
Alarm Wire Gauge	18 AWG
Alarm Wire, quantity	6
Application	Remote radio head
Brand	HELIAX® FiberFeed
Corrosion Protection	Water blocking tape
Inner Shield (Tape) Material	Corrugated aluminum
Outer Shield (Tape) Material	PE
Ripcord Material	Para-aramid synthetic fiber
Strength Member	Glass reinforced plastic rod

Construction Materials

Fiber Type Solution	Bend insensitive singlemode fiber (G.657.A1)
Total Fiber Count	24
Armor Type	Corrugated aluminum
Fiber Type	Bend insensitive singlemode fiber (G.657.A1)
Fiber Type, quantity	24
Fibers per Subunit, quantity	12

760177543 | RFF-24SM-1206-618-APE



Jacket Color Black

Electrical Specifications

dc Resistance, maximum	0.412 ohms/kft 1.348 ohms/km
dc Resistance Note	Maximum value based on a standard condition of 20 °C (68 °F)

Dimensions

Buffer Tube/Subunit Diameter	6.00 mm 0.24 in
Cable Weight	2198.0 kg/km 1477.0 lb/kft
Diameter Over Jacket	33.27 mm 1.31 in
Subunit, quantity	2

Physical Specifications

Minimum Bend Radius, multiple bends, loaded	662.9 mm 26.1 in
Minimum Bend Radius, multiple bends, unloaded	332.7 mm 13.1 in
Minimum Bend Radius, single bend, unloaded	231.1 mm 9.1 in
Tensile Load, long term, maximum	1068 N 240 lbf
Tensile Load, short term, maximum	3559 N 800 lbf

Environmental Specifications

Environmental Space	Wireless installation
Installation Temperature	-30 °C to +70 °C (-22 °F to +158 °F)
Operating Temperature	-40 °C to +80 °C (-40 °F to +176 °F)
Storage Temperature	-40 °C to +80 °C (-40 °F to +176 °F)

Mechanical Test Specifications

Compression	22 N/mm 126 lb/in
Compression Test Method	FOTP-41
Flex Test Method	FOTP-104
Impact	2.94 N-m 2.17 ft lb
Impact Test Method	FOTP-25
Twist	10 cycles
Twist Test Method	FOTP-85

Qualification Specifications

Cable Qualification Standards	Telcordia GR-20-CORE Issue 3 Telcordia GR-409-CORE Issue 2
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Regulatory Compliance/Certifications

Agency	Classification
RoHS 2011/65/EU	Compliant
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system



Included Products

CS-8F-MP (Product Component—not orderable) — Low Macrobending, Zero Water Peak, Dispersion-Unshifted Singlemode Fiber

Andrew Solutions

CS-8F-MP

Low Macrobending, Zero Water Peak, Dispersion-Unshifted Singlemode Fiber

Optical Specifications, Wavelength Specific

Standards Compliance	ITU-T G.657.A1 TIA-492CAAB (OS2)
Attenuation, maximum	0.50 db/m @ 1310 nm 0.50 db/km @ 1385 nm 0.50 db/km @ 1490 nm 0.50 db/km @ 1550 nm
Dispersion, maximum	18 ps(nm-km) at 1550 nm 3.5 ps(nm-km) from 1285 nm to 1330 nm at 1310 nm
Mode Field Diameter	8.9 μm @ 1310 nm 10.4 μm @ 1550 nm
Mode Field Diameter Tolerance	$\pm 0.4 \mu\text{m}$ @ 1310 nm $\pm 0.5 \mu\text{m}$ @ 1550 nm
Index of Refraction	1.467 @ 1310 nm 1.467 @ 1385 nm 1.468 @ 1550 nm
Polarization Mode Dispersion Link Design Value, maximum	0.06 ps/sqrt(km)

Physical Specifications

Cladding Diameter	125.0 μm
Cladding Diameter Tolerance	$\pm 0.7 \mu\text{m}$
Cladding Non-Circularity, maximum	1 %
Coating Diameter (Colored)	254 μm
Coating Diameter (Uncolored)	245 μm
Coating Diameter Tolerance (Colored)	$\pm 7 \mu\text{m}$
Coating Diameter Tolerance (Uncolored)	$\pm 10 \mu\text{m}$
Coating/Cladding Concentricity Error, maximum	12 μm
Core/Clad Offset, maximum	0.5 μm

Optical Specifications, General

Cabled Cutoff Wavelength, maximum	1260 nm
Point Defects, maximum	0.10 dB
Zero Dispersion Slope, maximum	0.092 ps/[km-nm-nm]
Zero Dispersion Wavelength, maximum	1322 nm
Zero Dispersion Wavelength, minimum	1302 nm

Mechanical Specifications

Coating Strip Force, maximum	8.9 N 2.0 lbf
Coating Strip Force, minimum	1.3 N 0.3 lbf
Dynamic Fatigue Parameter, minimum	18 nd
Fiber Curl, minimum	4.0 m 13.1 ft
Macrobending, 20 mm mandrel, 1 turn	0.20 dB @ 1550 nm
Macrobending, 30 mm mandrel, 1 turn	0.02 dB @ 1550 nm
Macrobending, 30 mm mandrel, 10 turns	0.20 dB @ 1550 nm 0.50 dB @ 1625 nm

CS-8F-MP



Macrobending, 50 mm mandrel, 100 turns	0.01 dB @ 1550 nm 0.05 dB @ 1625 nm
Proof Test	0.69 N/mm ² 100.00 psi

Environmental Specifications

Heat Aging, maximum	0.05 dB @ 85 °C
Temperature Dependence, maximum	0.05 dB
Temperature Humidity Cycling, maximum	0.05 dB
Water Immersion, maximum	0.05 dB @ 23 °C

Regulatory Compliance/Certifications

Agency	Classification
ISO 9001:2008	Designed, manufactured and/or distributed under this quality management system

* Footnotes

Temperature Dependence, maximum	Temperature dependence is conducted at -60 °C to +85 °C (-76 °F to +185 °F)
Temperature Humidity Cycling, maximum	Temperature humidity cycling is conducted at -10 °C to +85 °C (+14 °F to +185 °F) up to 95% relative humidity