



39GHz VectaStar NR Access Point Operational Description



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Version History

Issue Number	Author(s)	Version Date	Summary & Comments
1	Justin Clark	4 th February 2025	1 st version
1_1	Justin Clark	5 th February 2025	Added FCC wording references
1_2	Justin Clark	11 th February 2025	Removed 2CC reference

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1 Introduction

This Operational Description document is for the VectaStar NR 39GHz n260 3GPP Access Point (AP) forming the donor end point for a 5G NR Point to Multi-Point Fixed Wireless Access system. The AP is designed and manufactured by Delta Electronics to CBNG's requirements and is based on a NXP Layerscape® LX2160 Host processor and LS1235 programmable modem.

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

2 Product Specification

The following table defines the key product specifications for the VectaStar NR AP.

Description	Specification	Notes
RF Performance		
Frequency Range 1	37 - 40 GHz	n260 FR2 Band
EIRP	+58dBm $\pm$ 3dB	
Antenna Type	Phased array	
Antenna Beam Width	>4.5°	Half Power Beam width
Antenna Scan Range	Azimuth $\pm$ 45°, Elevation $\pm$ 10°	
Antenna Scan Loss	3dB max @ $\pm$ 45°	
Main Beam Sidelobes	20dBc min	
Phased Array Antenna Gain		
Peak	28.3dBi	Simulated
Nominal	25dBi	Measured
Features		
Channel Bandwidths	100, 200, 400 MHz	
# of Layers	2	Horizontal & Vertical Antenna Polarization, 2x2 MIMO
Carrier Aggregation	1CC, 4CC, 8CC	800MHz aggregated BW per layer
Maximum Contiguous Bandwidth	Downlink 800MHz Uplink 400MHz	
Supported Modulations	Downlink QPSK, 16QAM, 64QAM, 256QAM Uplink QPSK, 16QAM, 64QAM	
Duplex Mode	TDD	
Time Sync	IEEE 1588 PTP v2 GPS with External Antenna Holdover - 4hrs	Holdover occurs when IEEE 1588 Grandmaster and GPS unavailable



MIMO	2T2R	
Interfaces		
Back Haul	2x 10GbE SM Fiber (SFP+) 1x 1GbE RJ45 as LMT (Local Management)	
Supply Voltage	-48V DC Nominal -40V to -60V Input Range	
Peak Power consumption	223.2W, -48V Nominal DC @ 4.65A	
LED Indicators	System & Front Haul	
Environmental/Certification		
Operating Temperature Range	-40 °C to +55 °C	
Operating Humidity Range	5% to 95% RH	
IP Rating	IP67	
Certification	UL, FCC 3GPP compliant RoSH and WEEE	
Weight	Access Point 18kg Mounting Bracket 2.6kg	
Size	466.7mm (height) x 400mm (width) x 205.6mm (depth)	
Software		
Management	HTTPS / Netconf	
Firmware Upgrade	FOTA & Local (via Ethernet)	
LAN	IEEE 802.1Q-1998 / IEEE 802.1AD (VLAN, QinQ) IEEE 802.1P (DSCP QoS) IPv4/IPv6 Dual-Stack NAPT, DNS Proxy, Port Forwarding, VPN Pass-through, DHCP Server/Client MAC/IP Packet Filtering, Stateless Firewall	Ethernet PDU, IP PDU and Dual Ethernet & IP PDU Types supported
Miscellaneous		
Product Ordering Code	CB-GN-HB-2x2M-2B	

2.1 VectaStar NR AP Physical Connections

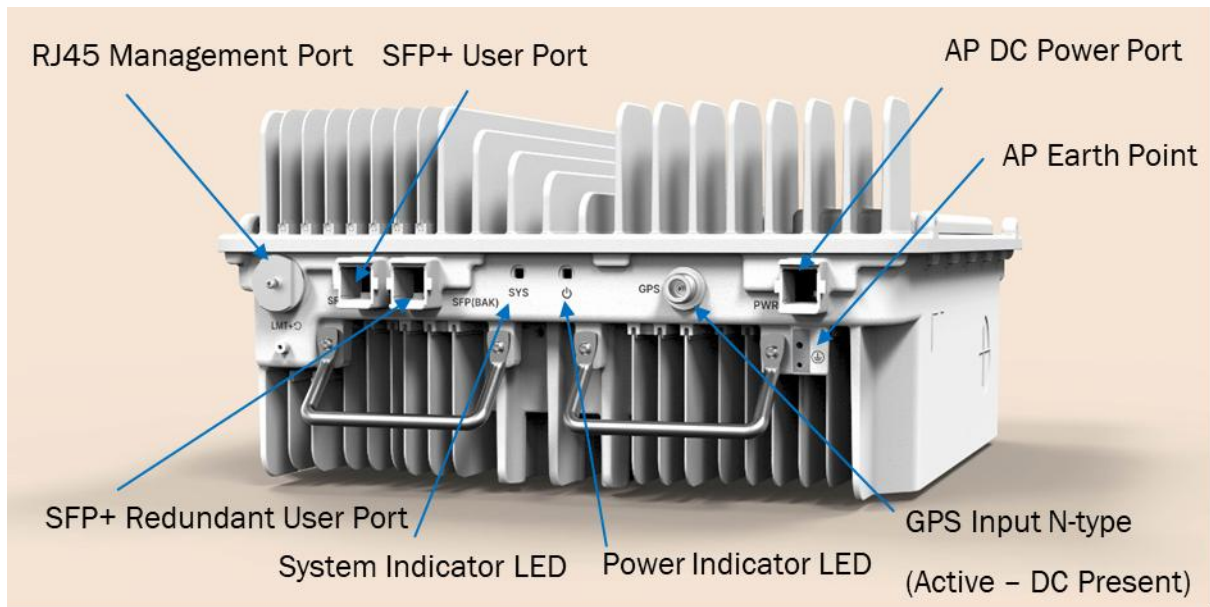


Figure 1: VectaStar NR AP External Connections and Indicators



2.2 Ethernet Ports

2.2.1 User Data Ports

The AP supports two 10Gbps capable ethernet ports for transferring user data to the network using an SFP+ format to support Lucent Connector (LC) Single Mode (SM) fibre cable connections to the Cell Site Router (CSR). On the AP these are marked as 'SFP' and 'SFP(BAK)' shown in Figure 2: VectaStar NR AP External Ports.

The SFP port carries data and control plane traffic to and from the CSR over the SM fibre interface. An SFP+ Fibre transceiver supplied by CBNG is installed within the Radiall® OCTIS™ SFP+ Interface connector and connected to the SFP port during installation, the other (spare) port marked 'SFP(BAK)' is blanked off with an IP67 blanking plug. Refer to the *VectaStar NR AP Installation and Commissioning Guide* for details.

2.2.2 Management Port

An RJ45 management port marked 'LMT+' supports 10/100/1000Mbps Base-T in an RJ45 format and is provided for local 'Out of Band' management of the AP, for SW install and debug during development. This port will be capped off with an IP67 blanking plug and will not be used once in band management feature is validated and released.

Notes:

- Early Trial installations in Richardson, Texas; Temple Terrace, Tampa; and Dallas will require the RJ45 management port to be connected to the external 5G Core Network Server, until the In Band management feature is validated, released and the 5G Radio Controller is integrated into the AP.
- Early launch installations supporting the integrated Radio Controller will require the RJ45 management port to be connected to the Cell Site Router until the In Band management feature is validated and released.

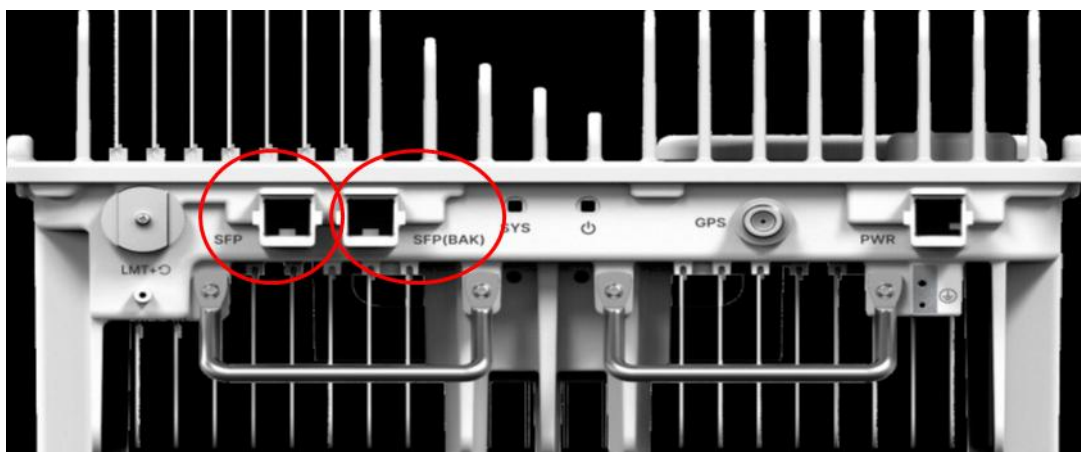


Figure 2: VectaStar NR AP External Ports

2.3 DC Power Port

The AP is powered by a nominal -48V DC input voltage, designed for NEBS (Network Equipment-Building System) installations, the AP accommodates an input range from -40V to -60V. Refer to the *VectaStar NR AP Installation and Commissioning Guide* for details of wiring the DC Power connector to support -48V DC sources.

The DC Input connector is a Radiall® OCTIS™ Series Twin core connector type.

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2.4 GNSS Antenna Port

The device integrates a Global Navigation Satellite System (GNSS) receiver (No Transmitter) for location and timing-based services. The features it supports are:

- Operating in the L1 Band (Frequency Range: 1575.42 MHz / 1602 MHz)
- GPS Receiver only (No Transmitter)
- Supports standards:
 - GPS (North America)
 - Galileo (Europe)
 - GLONASS (Russia)
 - QZSS (Japan)

The GPS signal is fed via an external antenna which is an active type, a 3.3V DC voltage is present on the GPS input port to power the antenna, the antenna requires mounting onto the AP prior to installation and is connected to the GNSS input port using a standard RF N-type connector. Refer to the *VectaStar NR AP Installation and Commissioning Guide* for details of mounting and connecting the GNSS Antenna to the AP.

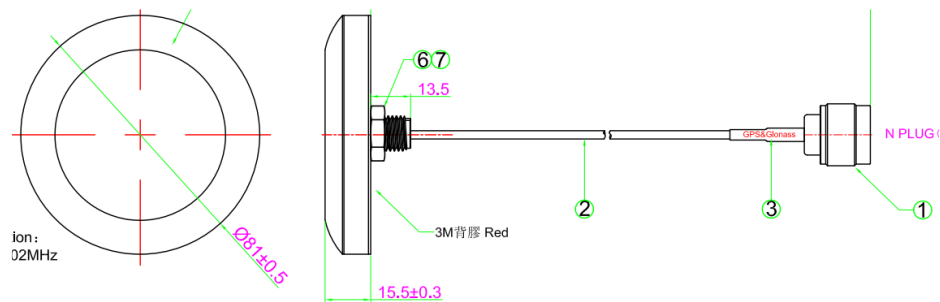


Figure 3: VectaStar NR AP GNSS Antenna Assembly

2.5 Earthing Point

The AP has an external earthing point located under the DC Power Input point, it consists of a rectangular area of metal cleared of paint with two pre-tapped fixing holes, to attach an earthing lug or lead. The M3 & M4 holes are spaced 10mm apart (centre to centre).

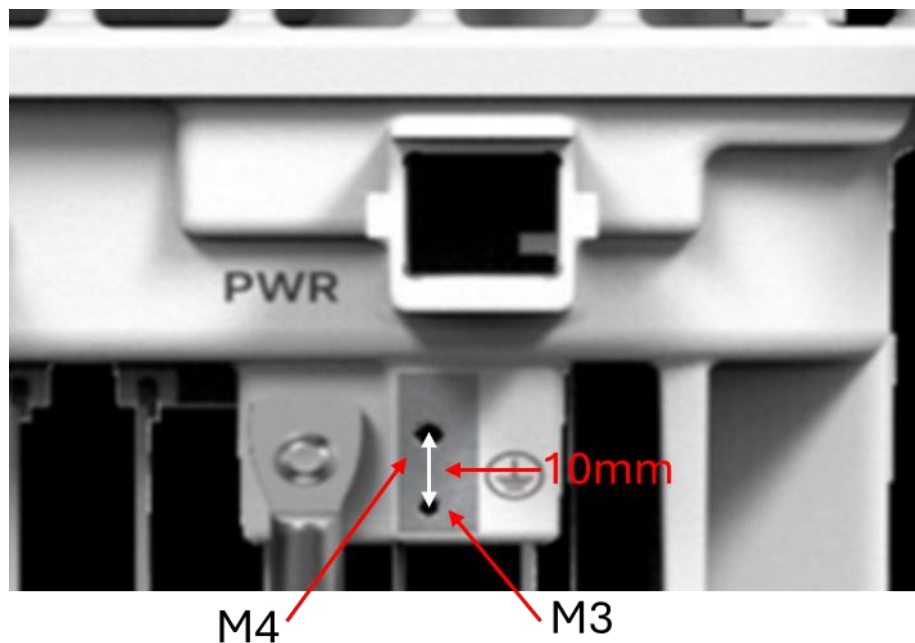
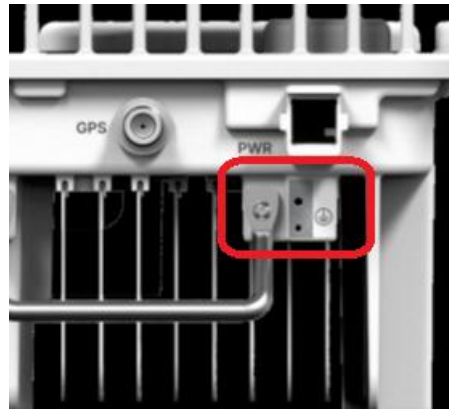


Figure 4: AP Earth Mounting Point

A fixing kit is provided to connect an earth grounding cable to the AP, the current fixing kit consists of the following:

- An M4 Shakeproof washer
- An M4x12mm Screw
- An M4 Flat Washer
- An M4 Crimp Lug

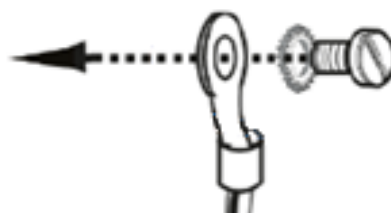


Figure 5: AP Earth Mounting Fixing Kit Concept



The M4 Crimp lug can support up to and including 6 AWG wire gauge wire (Ø 0.162in) with a maximum current carrying capacity of 95A.

The M4 earth fixing kit screws into the M4 hole on the AP.

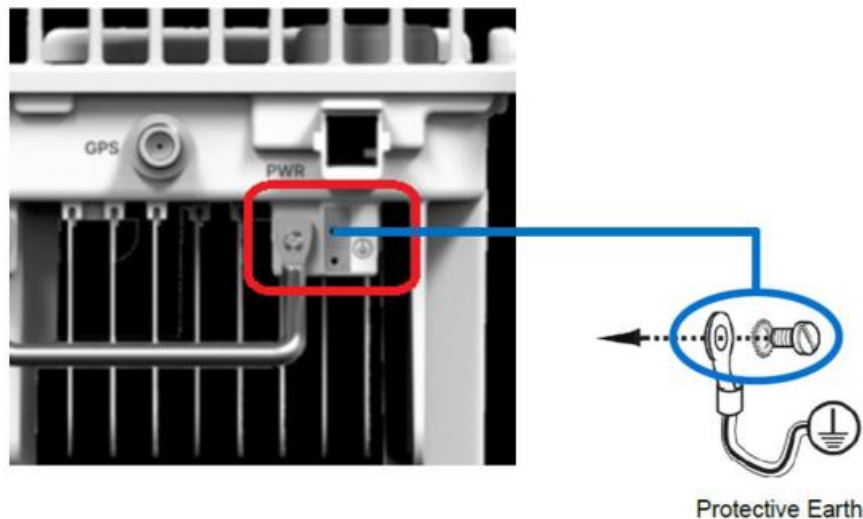


Figure 6: AP Earth Mounting Fixing Kit Connection Concept

CBNG are working on an alternative fixing solution which uses a crimped metal bar, which is affixed to the AP using both screw holes to reduce the variance in the fixing position that a single point contact creates.



Figure 7: AP Earth Mounting Fixing Kit Crimped Bar Concept in Development

3 Product Features

The VectaStar NR Access Point (AP) is a 3GPP 5G NR Radio operating in the n260 37-40GHz Band. The AP along with the associated CBNG Remote Terminal (RT) and Network Management System (NMS) forms a front haul Wireless Access system providing internet connectivity to end users over a 5km radius in a 90° sector. Capable of Gigabit access speeds the VectaStar NR AP forms an Ethernet bridge with the RT to pass ethernet traffic over a 3GPP 5G NR Release 16 airlink.

3.1 Status & Signal Strength LED Functionality

The device has two externally visible LEDs whose functionality is described in the following tables.



Feature	Detailed Description
System LED	• Off – The system is power off. • Solid Green – The system is in normal operation mode. • Blinking Red 4Hz – There is a hardware failure, such as high device temperature. • Blinking Red 2Hz – The system is w/o DPLL and Jitter Attenuator Lock. • Solid Red – The system w/o plug in RF card.

Feature	Detailed Description
Power LED	• Off – The system is power off. • Blinking Green 4Hz – TBC. • Blinking Green 2Hz – TBC. • Solid Green – The system is in normal operation mode. • Solid Red – TBC.

Figure 8: AP LED Indicator Functionality

3.2 Radio Link Features

The VectaStar NR AP is a Point to Multipoint Radio providing coverage over a 90° ($\pm 45^\circ$) sector out to 5km forming 3GPP 5G NR Release 16 compliant airlinks with CBNG Remote Terminals. The AP requires Line of Sight (LOS) with the RT to form a link that can support variable modulation rates and bandwidths to maximise the data throughput over the link.

3.2.1 Phased Array Antenna

A High Power Phased Array Antenna generating up to 164dBm Effective Isotropic Radiated Power (EIRP), can steer the signal beams across the sector towards each RT, multiplexing the dual layer data stream at bandwidths of up to 800MHz across several RTs in the sector in a Time Domain Division (TDD) format.

¹ Current AP supports a nominal 58dBm EIRP, 64dBm support will be available in Revision 2 hardware

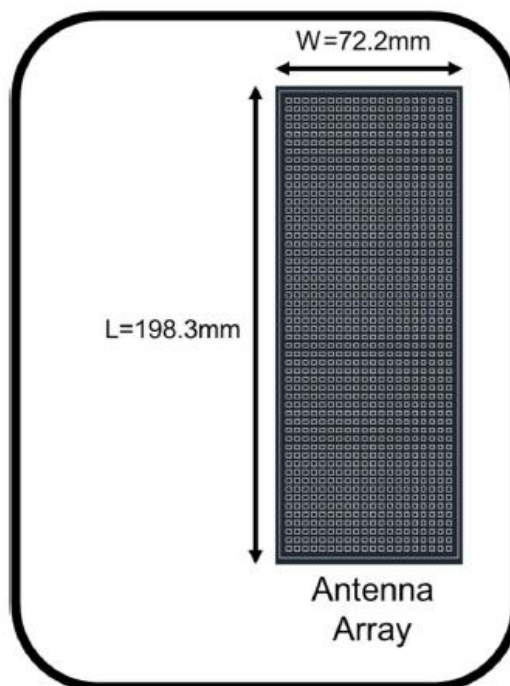




Figure 9: AP Antenna Array

The phased array antenna consists of two sub arrays of 192 patches one for vertical polarisation and one for horizontal polarisation these are fed by 12 Beamformers each supporting 8 physical RF paths for TX & RX. Each antenna path is split with a Wilkinson divider in doublet format, $8 \times 12 \times 2 = 192$ patches.

The outer two columns and rows of the array are passive for managing the sidelobes and grating lobes at the edges of the array scan range.

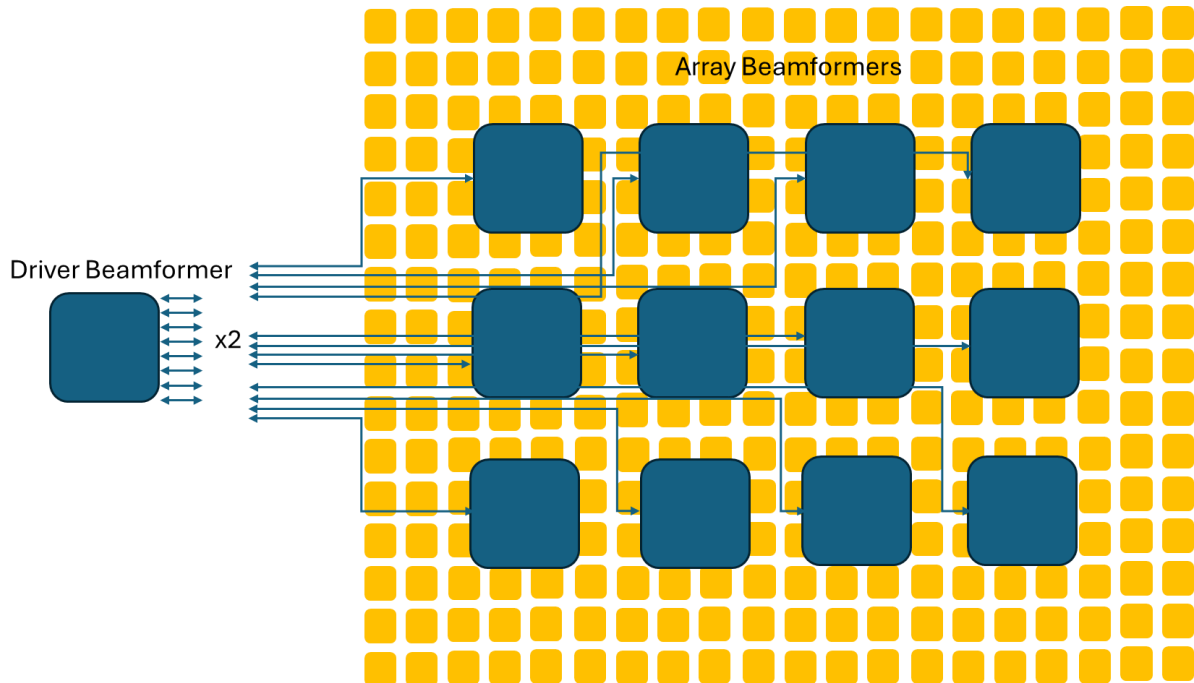


Figure 10: AP Antenna Front End

3.2.2 Dual Layer MIMO

Two Transmit and Two Receive (2T2R) spatially diverse independent data streams are carried over Horizontal and Vertical (H&V) polarized beams formed by the antenna array to the RT. The sector volume is covered by 80 horizontal and 80 vertical high power service beams each of around 6.5° in beam width and an additional 16 horizontal and 16 vertical broadcast beams used for RT registration and attach procedures defined by the 3GPP 5G standard. Each RT in the sector is mapped to a specific beam based on the signal strength of the serving beam determined during the cell search and synchronisation process.

3.2.3 Slot Formats & Sector Capacity

The AP uses a DDSU slot format that provides a 3:2 variable to 4:1 Downlink to Uplink traffic ratio depending on the configuration of the S slot. Limited formats are available. With bandwidths of up to 800MHz, and a modulation and coding scheme supporting 8 bits per symbol sector capacities of up to 8.5Gbps can be theoretically achieved in ideal



conditions. With overheads in data processing and data security in the upper layers and non-ideal radio link conditions typical sector capacities of 4.5Gbps are to be expected.

3.2.4 Carrier Aggregation & Supported Bandwidths

The AP supports Carrier Aggregation of 1, 2, 4 or 8 Component Carriers (CCs) with a maximum aggregated bandwidth of 800MHz, carriers with bandwidths of 100, 200, 400MHz are supported.

3.2.5 Uplink Power Control

Basic Uplink Power control minimises sector interference by optimising the RT power based on distance to the AP, this equalises the majority of uplink signal powers at the AP receiver. At distances >2.5km the RTs will operate at maximum power +48dBm.

3.2.6 Adaptive Modulation

The AP supports adaptive modulation automatically selecting the best modulation for sector conditions based on range, received SNR and reported received SNR from each RT in the sector, which can vary over time due to atmospheric conditions. The adaptive modulation scheme compensates for reduction in airlink signal to noise ratio, maintaining the radio link at the expense of reduced sector capacity, providing an element of robustness to changing weather conditions.

5G NR supports different modulation and coding schemes depending on the class of Base Station (gNB) or User Equipment (UE), each MCS supports either QPSK, 16QAM, 64QAM or 256QAM, a variable coding rate offers 28 different schemes (MCS0 to MCS27) that balances Signal to Noise Ratio (SNR) and throughput to maintain a robust link for data transfer.

3.2.7 Beam Management

The AP supports Beam Management, the scan volume of the antenna array ($\pm 45^\circ$ Azimuth, $\pm 15^\circ$ Elevation nominal) is divided into sixteen beams in azimuth of roughly 6° width (3dB Beamwidth) covering the sector, $6^\circ \times 16 = 96^\circ$ and five beams in elevation, $5 \times 6^\circ = 30^\circ$ giving a total of eighty horizontal and eighty vertical narrow beams.

In addition, there are sixteen broadcast beams also nominally 6° width which have lower gain ~ 6 dB than the narrow beams. The Beam IDs are mapped out in the images below.



TX Wide Beam (V)																	
Beam ID		Azimuth (X)															
		Null	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°
Tilt angle (Y)	0°	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15

TX Narrow Beam (V)																
Beam ID	Azimuth (X)															
	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°	
Tilt angle (Y)	-10°	16	21	26	31	36	41	46	51	56	61	66	71	76	81	86
	-5°	17	22	27	32	37	42	47	52	57	62	67	72	77	82	87
	0°	18	23	28	33	38	43	48	53	58	63	68	73	78	83	88
	5°	19	24	29	34	39	44	49	54	59	64	69	74	79	84	89
	10°	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90

TX Wide Beam (H)																	
Beam ID		Azimuth (X)															
		Null	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°
Tilt angle (Y)	0°	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106



TX Narrow Beam (H)																
Beam ID		Azimuth (X)														
		-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°
Tilt angle (Y)	-10°	107	112	117	122	127	132	137	142	147	152	157	162	167	172	177
	-5°	108	113	118	123	128	133	138	143	148	153	158	163	168	173	178
	0°	109	114	119	124	129	134	139	144	149	154	159	164	169	174	179
	5°	110	115	120	125	130	135	140	145	150	155	160	165	170	175	180
	10°	111	116	121	126	131	136	141	146	151	156	161	166	171	176	181

RX Wide Beam (V)																	
Beam ID		Azimuth (X)															
		Null	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°
Tilt angle (Y)	0°	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197

RX Narrow Beam (V)																
Beam ID		Azimuth (X)														
		-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°
Tilt angle (Y)	-10°	198	203	208	213	218	223	228	233	238	243	248	253	258	263	268
	-5°	199	204	209	214	219	224	229	234	239	244	249	254	259	264	269
	0°	200	205	210	215	220	225	230	235	240	245	250	255	260	265	270
	5°	201	206	211	216	221	226	231	236	241	246	251	256	261	266	271
	10°	202	207	212	217	222	227	232	237	242	247	252	257	262	267	272



RX Wide Beam (H)																	
Beam ID	Azimuth (X)																
	Null	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°	
Tilt angle (Y)	0°	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288

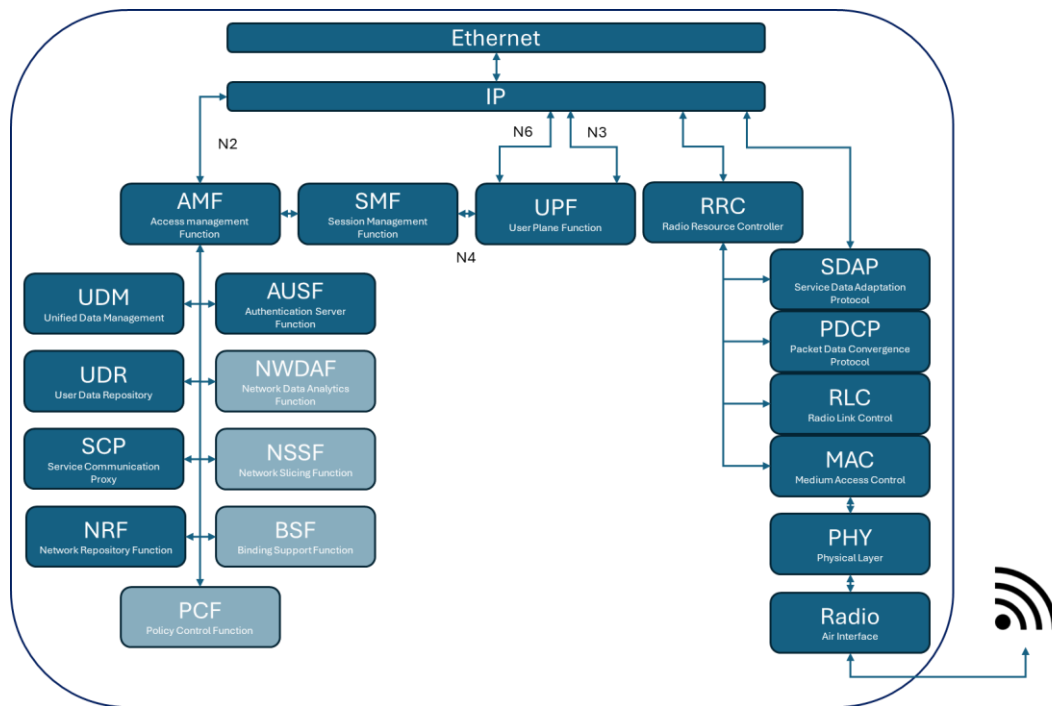
RX Narrow Beam (H)																	
Beam ID	Azimuth (X)																
	-42°	-36°	-30°	-24°	-18°	-12°	-6°	0°	6°	12°	18°	24°	30°	36°	42°		
Tilt angle (Y)	-10°	289	294	299	304	309	314	319	324	329	334	339	344	349	354	359	
	-5°	290	295	300	305	310	315	320	325	330	335	340	345	350	355	360	
	0°	291	296	301	306	311	316	321	326	331	336	341	346	351	356	361	
	5°	292	297	302	307	312	317	322	327	332	337	342	347	352	357	362	
	10°	293	298	303	308	313	318	323	328	333	338	343	348	353	358	363	

Figure 11: Antenna Beam IDs

3.8 Networking Features

3.8.1 5G NR Stack

At its heart the VectaStar NR AP is a 3GPP 5G NR Release 16 gNB, a point to multi-point base station connecting remote terminals (RTs) within a sector volume to a core network interface, providing wireless communications across the sector. The 5G software running on the AP hardware platform provides Layer 1: Physical Access functionality; Layer 2 Distributed Unit (DU) functionality and Layer 3 Central Unit (CU) functionality compliant to the 3GPP 5G NR Release 16 specification. Coupled with the embedded 5G Core Network (CN) the VectaStar NR AP performs the function of a Wireless Network In a Box (NIB).



3.8.2 Wireless Ethernet Bridge

The AP uses VLAN tags and IPv6 ethernet source and destination addresses coming to and from the network source in the sector to route traffic accordingly to each RT in the sector and back to the network source. The AP acting as a wireless ethernet bridge supports the following networking features.

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3.8.3 VLAN Management

The VLAN Management feature interrogates the incoming traffic from the Northbound interface on the SM Fibre port and based on the VLAN tags and destination addresses of the packets routes the traffic over virtual interfaces accordingly.

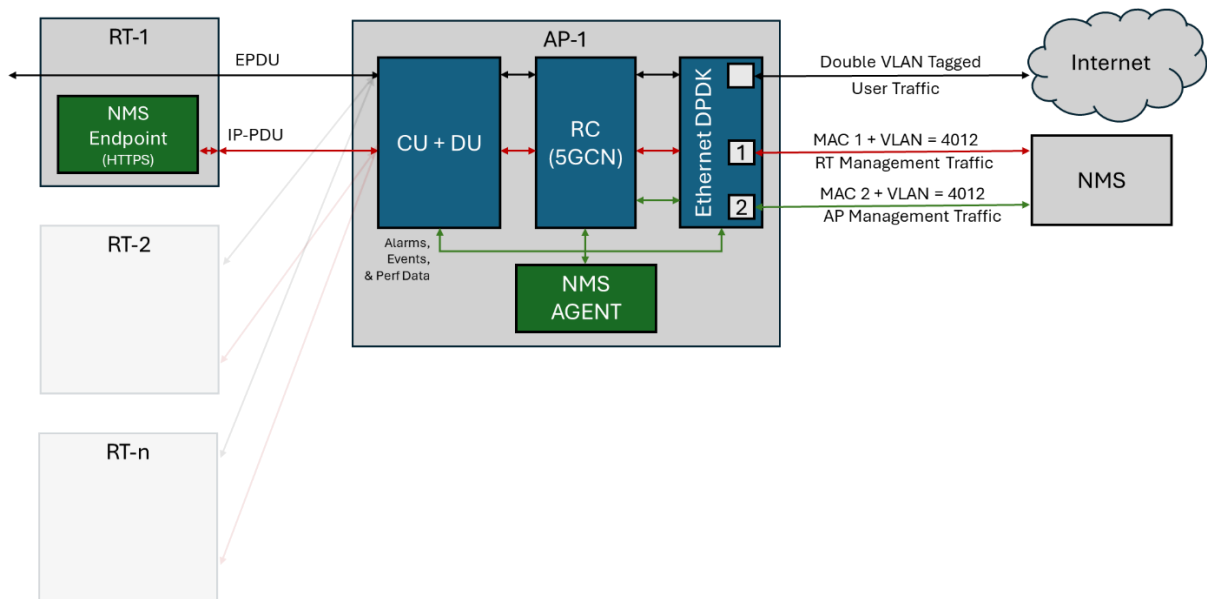


Figure 13: VectaStar NR AP Traffic Management

- Double tagged traffic indicates user traffic to be sent over the EPDU session to the appropriate RT.
- Single tagged management traffic (VLAN=4012) with the AP MAC address is routed internally, to the RC, CU or NMS Agent.
- Single tagged management traffic (VLAN=4012) with the RT MAC address is routed over the IP-PDU session to the appropriate RT.

3.8.4 Embedded Radio Controller

The Vectastar NR AP embeds the 3GPP 5G NR Core networking functions, termed the Radio Controller (RC) the embedded software controls the core 5G networking functions of:

- Access and Mobility Management (AMF): Termination of NAS signalling, NAS ciphering & integrity protection, registration management, connection management, access authentication and authorization, security context management.
- Session Management (SMF): session management (session establishment, modification, release), RT IP address allocation & management, DHCP functions, termination of NAS signalling related to session management, DL data notification, traffic steering configuration for UPF for proper traffic routing.
- User Plane (UPF): packet routing & forwarding, packet inspection, QoS handling, acts as external PDU session point of interconnect to Data Network (DN)
- Authentication Server (AUSF) acts as an authentication server.



- Unified Data Management (UDM): generation of Authentication and Key Agreement (AKA) credentials, user identification handling, access authorization, subscription management.
- User Data Repository (UDR): an in-memory database that stores 5G core subscription and policy data
- Service Communications Proxy (SCP): a HTTP/2 based network function enabling dynamic scaling and management of communication and services in the 5G network
- Network Repository Function (NRF): service discovery function, maintains NF profile and available NF instances.

3.8.5 NMS Agent

Embedded within the AP is an NMS Agent application, which communicates with the cloud NMS and performs several functions as described below:

- Runs a simple web server to allow the installer to configure the gNB:
 - Assign domain names: eg “ap1.ds1000.fwa.Verizon”
 - Gets certificate for domain name
 - Configures EMS/NMS details (domain names)
 - Pairs the unit with EMS/NMS
 - Verifies the unit is connected to the EMS/NMS (verify alarms / data push is working)
- Send heartbeats to CBNG EMS: Heartbeats are the status messages sent from the AP and proxied from the RT that allow the NMS to determine the status of the sector.
- Send alarms / performance data to CBNG EMS: The NMS Agent handles the sending of alarms and performance metrics to the NMS, the Agent uses a gRPC protocol a high-performance Remote Procedure Call (RPC) framework.
- Manage configuration: The NMS Agent interprets the simplified configuration data from the NMS and creates the full configuration file from a template stored on the AP, for AP configuration using a simplified NETCONF protocol
- Manage software updates from the NMS: The Agent receives SW Update messages from the NMS and handles them appropriately to update the software on the AP or pass SW updates to the RT over the airlink.
- Handle certificate updates (X.509 / SSL): The Agent handles authorisation of the AP with the NMS handling the processing of authentication via X.509 certificates using a proprietary API.

3.8.6 Internal Web Application

The internal web application supports device commissioning and configuration as well as status indication. Accessed via the management ethernet port (eth0) the internal web application contains a set-up wizard that allows a user to login into the AP, set its configuration parameters and test the connection to the NMS.

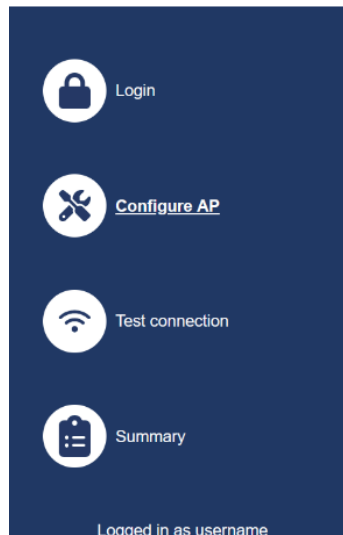


Figure 14: CBNG Web Server Setup Wizard



4 Product Conformity

The VectaStar NR AP (Access Point) is designed to conform to the following regulatory, qualification and certification standards.

1. US UL
 - a. CFR 29 - Part 1910,
 - b. EN 62368-1
2. US FCC
 - a. CFR 47 - Parts 15B, 18, & 30
 - b. CFR 47 - Part 1 §1310
 - c. CFR 47 - Part 2 §1091
 - d. CFR 21 - §1040.10
 - e. CFR 21 - §1040.11
3. ETSI
 - a. EN 300 132-2
 - b. EN 300-019-1-4 classes 4.1E and 4.2H
4. CENELEC
 - a. EN 55032
5. IEC
 - a. IEC/EN 60825-1: 2014
 - b. IEC/EN 60825-2: 2021
6. 3GPP Rel 16
 - a. TS 38.104,
 - b. TS 38.113,
 - c. TS 38.141-1,
 - d. TS 38.141-2
7. Customer Compliance Requirements
 - a. TL 9000 Quality Management System - Requirements Handbook,
 - b. TL 9000 Quality Management System - Measurements Handbook,
 - c. GR-63 Network Equipment - Building System (NEBS) Requirements: Physical Protection
 - d. GR-78 Generic Requirements for the Physical Design and Manufacture of Telecommunications Products and Equipment
 - e. GR-282 Software Reliability and Quality Acceptance Criteria (SRQAC), A Module Of RQGR, FR-796 Issue 4
 - f. GR-383 COMMON LANGUAGE® Equipment Codes (CLEITM Codes) - Generic Requirements for Bar Code Labels Issue 3
 - g. GR-485 Common Language® Equipment Codes (CLEITM Codes)- Generic Requirements for Processes and Guidelines Issue 5



- h. GR-929 Reliability and Quality Measurements for Telecommunications Systems RQMS-Wire line), A Module of RQMS, FR-929 and RQGR, FR-796 Issue 8
- i. GR-1089 Electromagnetic Compatibility and Electrical Safety Generic Criteria for Network Telecommunications Equipment Issue 4
- j. GR-1315 In-Process Quality Metrics (IPQM)
- k. GR-1421 Generic Requirements for ESD Protective Circuit Packet Containers
- l. SR-NWT-2759 A View of Packaging, Palletization and Marking Requirements
- m. SR-332 Reliability Prediction Procedure for Electronic Equipment
- n. TR-NWT-000357 Generic Requirements for Assuring Reliability of Components Used in Telecommunications Equipment
- o. GR-418 Generic Reliability Assurance Requirements for Fiber Optic Transport Systems A Module Of RQGR, FR-796 Issue 2
- p. GR-840 Supplier Support Generic Requirements (SSGR), A Module of LSSGR, FR-64; OTGR, FR-439; and TSGR, FR-440 Issue 1
- q. TR-NWT-000870 Electrostatic Discharge Control in the Manufacture of Telecommunications Equipment

3.9 Safety Notices

3.9.1 Working Safely at Height

All health and safety regulations must be adhered to when operating at heights. This includes, but is not limited to:

- Where it is necessary to prevent injury, you must do all that is reasonably practicable to prevent anything falling.
- If it is not reasonably practicable, you must ensure that no one is injured by anything falling.
- You must ensure that nothing is:
 - thrown or tipped from height if it is likely to injure anyone;
 - stored in such a way that its movement is likely to injure anyone.
- If the workplace contains an area in which there is a risk of someone being struck by a falling object or person, you must ensure that the area is clearly indicated, and that (as far as reasonably practicable) unauthorised people are unable to reach it.
 - Ensure that no work is done at height if it is safe and reasonably practicable to do it other than at height
 - Ensure that the work is properly planned, appropriately supervised, and carried out in as safe a way as is reasonably practicable
 - Ensure that the work complies with any local health and safety regulations



- Take any necessary precautions with equipment used, to ensure that the work at height is safe and that there is no risk of the equipment falling
- Ensure that people cannot pass under the area of work, while work is taking place.

3.9.2 General and electrical safety notices

Warnings



- All installations must be carried out by fully competent and trained personnel, in accordance with the instructions given in this document. If working at height, proper safety procedures must be adhered to, and the relevant safety equipment must be used.



- The outdoor unit must be mounted so that contact by a member of the public is impossible. For example, the unit should be positioned on a roof or mast with no public access and where access to service personnel is restricted. Where possible the unit shall be positioned at a minimum height of 3m above the ground to ensure that access to the unit is restricted. The equipment is intended to be installed in a restricted access location. The equipment should be accessed only when it is powered off and has been allowed to cool down.



- Hot surface temperature: Vectastar NR AP may become very warm during normal use. It complies with the user-accessible surface temperature limits defined by the International Standards for Safety (EN / UL 62368-1)



- According to CFR 47 1.1310, (Title 47, Chapter I, Subchapter A, Part 1, Subpart I, § 1.1310) and CFR 47 2.1091, (Title 47, Chapter I, Subchapter A, Part 2, Subpart J, Radiofrequency Radiation Exposure, § 2.1091) an AP (mobile device) should be installed in a location such that it is not possible for a member of the public, in the normal course of their work or everyday activities, to gain access closer than distances specified in *RF Safety Notices*.



- On the front of all units requiring a –48V DC supply a user-supplied frame chassis earthing conductor, 1.5 mm² cross-sectional area (or 16AWG) or larger, must be permanently connected from the frame/chassis earth bolt (identified by the graphic symbol 60417-IEC-5020) to an earth point in the building installation.



- All units are powered from a nominal –48V DC supply. The supply used for these units shall be in accordance with ETSI EN 300 132-2.



- The VectaStar NR AP CB-GN-HB-2x2M-2B is a “Class 1 Laser Product”.



Cautions



- All VectaStar NR equipment should be installed within a lightning protection zone.
- Units have anti-tamper seals fitted. Breaking such seals will invalidate any existing product warranty.
- With connections to centralized DC power, install only in dedicated equipment rooms or the equivalent.
- An AP weighs up to 22kg (including the rear bracket). Be prepared for this when installing. The installation will be easier if performed by two people.
- The AP Pole Mounting Brackets are designed to support pole sizes between 1.5" (35mm) and 3" (80mm).
- All connections at the AP are rated to IP67. As an additional safeguard against water ingress over time, CBNG recommends the use of self-amalgamating tape in line with local practice, on all external cable connectors and joiners. Suitable tape is available from most suppliers of installation components.
- Where extreme climatic conditions are found, CBNG recommends the use of a flexible cable protection conduit for the external cabling to the AP.
- Be sure that you are aware of any local building regulations and standards and adhere to those that are relevant.

3.9.3 RF safety notices

Warnings



- NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.
- Locally applicable national and international RF safety requirements must be adhered to when installing the Access Point. Please refer to CBNG Customer Support and local regulatory authorities for advice on compliance.

As guidance, for a VectaStar NR Access Point:

The AP should be installed in a location such that it is not possible for workers or members of the public, in the normal course of their work or everyday activities,



to gain access closer in front of the unit than the specified distances in the table below. The maximum EIRP is also given.

MPE Distance

Product	MPE Distance
Access Point @ 62dBm	3.49m

Areas where the AP are installed should have warning notices suitably displayed on all approaches to the equipment and again at 3.49m from the AP. Access to the AP should be restricted from the general population and any uncontrolled exposure and all ingress sites should be appropriately signed. Typical warning sign examples are as below:



Figure 15: Example RF Safety Notices

3.9.4 Laser safety notices

VectaStar NR products have the facility for an interface to contain a Class 1 laser transceiver to enable Fibre Optic data transmission up to 10 km.



- **WARNING:** VectaStar NR products must only be used with Class 1 small form-factor pluggable laser transceivers which comply with IEC/EN 60825-1: 2014, IEC/EN 60825-2: 2021.



- **WARNING:** Class 1 Laser devices are not considered to be hazardous when used for their intended purpose. Do not look at the laser beam projection area (e.g. end of optical connector) with naked eyes or through optical equipment while the power is supplied to this product. Otherwise, your eyes may be injured.



- **WARNING:** Only trained and qualified personnel who are familiar with the safety aspects of laser radiation should be allowed to install, service or maintain this equipment.



- **WARNING:** No service personnel shall attempt to replace the laser transceiver, and the faulty ODU should be sent to one of CBNG's authorised Repair Centres.



- **WARNING:** Do not under any circumstances use a higher-class laser transceiver as this will pose a risk of eye injury.

CBNG ODU Optical Standard (OS) fibre optic products contain Class 1 laser transceivers which comply with IEC/EN 60825-1: 2014, IEC/EN 60825-2: 2021 and 21CFR 1040.10 & 1040.11 Subchapter J except for deviations pursuant to Laser Notice No. 56, dated May 2019. The Class 1 small form-factor pluggable laser transceivers designed to operate with VectaStar NR products are specified as follows:

- Emitted wavelength: 1310 nm
- Maximum average radiant power: 0.5 mW



- **WARNING:** Use of controls or adjustments or performance of procedures other than those specified herein or in the laser product's installation guide may result in hazardous radiation exposure.

To reduce the risk of exposure to hazardous radiation:

- Do not try to open the module enclosure. There are no user-serviceable components inside.
- Do not operate controls, adjust, or perform procedures to the laser device other than those specified herein.
- Do not stare into open optical ports.



VectaStar NR ODUs contain an eye-safe class 1 laser product. Invisible laser radiation is emitted from (and received into) the front apertures of the laser. Although Class 1 lasers are considered to be eye-safe, avoid staring into the transmitter or fibre-end infrared radiation.



CAUTION: Observe electrostatic discharge (ESD) precautions when handling SFP transceiver modules. Always wear a wrist strap that connects to an approved grounding source when installing or handling the modules.



CAUTION: To prevent damage to an SFP module and to any connected cables, disconnect all cables before installing or removing a module.

NOTE: Since the presence of an SFP module is only detected on restarting VectaStar, you must power down the appliance when installing or removing a module.

Failure to use a Class 1 small form-factor pluggable laser transceiver as specified can lead to damage to the equipment and risk of serious injury.

3.9.5 Outdoor Equipment Requirements



The VectaStar NR Access Points (AP) and Remote Terminals (RT) meet the requirements of ETSI EN 300-019-1-4 classes 4.1E and 4.2H for stationary use at non-weather-protected locations. This class applies to locations:

- Which are directly exposed to an open-air climate, including solar radiation, movement of the surrounding air, precipitation, and water jets; splashing; water
- Where mould growth, or attacks by animals but excluding termites, may occur
- With normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic. It also applies to coastal areas
- In areas with sand or dust sources, including urban areas*
- Where transmitted vibrations are experienced from machines or passing vehicles. Higher level shocks may be experienced e.g. from adjacent machines

* At locations in geographical areas with wind-driven sand or dust in air, special precautions must be taken.

Note: *In extreme environmental conditions, or for additional protection, installers may wish to consider placing VectaStar NR cabling in a suitable outdoor duct.*

3.9.6 Electromagnetic Capability



WARNING: *VectaStar NR Access Points (AP) and Remote Terminals (RT) are class A (EN 55032) products. In a residential / domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.*