वर्गीय आवश्यकताओं के लिए मानक

टीईसी <दस्तावेज़ सं: नई नंबररंग स्कीम के अनुसार>

(पूर्व सं: टीईसी/जीआर/...)/ (सं: टीईसी....को अधिक्रमित करता है)

STANDARD FOR GENERIC REQUIREMENTS

TEC <document no. TEC 35XXX:2026]

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सक्रिय वितरित एंटीना प्रणाली

Active Distributed Antenna System

ISO 9001:2015

Release __: Month, 2026

FOREWORD

Telecommunication Engineering Centre (TEC) is the technical arm of Department of Telecommunications (DOT), Government of India. Its activities include:

- Framing of TEC Standards for Generic Requirements for a Product/Equipment, Standards for Interface Requirements for a Product/Equipment, Standards for Service Requirements & Standard document of TEC for Telecom Products and Services
- Formulation of Essential Requirements (ERs) under Mandatory Testing and Certification of Telecom Equipment (MTCTE)
- Field evaluation of Telecom Products and Systems
- Designation of Conformity Assessment Bodies (CABs)/Testing facilities
- Testing & Certification of Telecom products
- Adoption of Standards
- Support to DOT on technical/technology issues

For the purpose of testing, four Regional Telecom Engineering Centers (RTECs) have been established which are located at New Delhi, Bangalore, Mumbai, and Kolkata.

ABSTRACT

This Standard for Generic Requirements (GR) for a Product/Equipment pertains to Active Distributed Antenna Systems (ADAS) deployed for indoor and in-building mobile network coverage. This GR defines the reference architecture and generic technical requirements applicable to ADAS installations. It defines the functional scope of centralized signal source equipment, Point of Interconnect (POI), digital or optical distribution network, and Active Remote Antenna Units (RAUs), interconnected through optical fiber or Ethernet transmission media and service antennas, to enable multi-operator, multi-band, and multi-technology wireless coverage within indoor environments.

Note-This GR does not cover the deployment of Active DAS implemented using Small Cells.

CONTENTS

HISTORY SHEET

Sl. No.	Standard/document No.	Title	Remarks
1.	TEC 35XXX:2026	ACTIVE DISTRIBUTED ANTENNA SYSTEM (ADAS)	First Issue

REFERENCES

S.No.	Document No.	Title/ Document Name
[1]	ISO 9001:2015	Quality management systems — Requirements
[2]	TEC 10009:2024	Safety Requirements of Telecommunication Equipment
[3]	TEC 14016:2010 (Old No. QM-333)	Standard for Environmental testing of Telecommunication equipment
[4]	TEC 11016:2016, (Old Document No.: TEC/SD/DD/EMC-221/05/OCT-16).	Standard for Electromagnetic Compatibility Standard for Telecommunication Equipment",
[5]	TEC 66130:2025.	Standard for Lightning for surge protection of telecom site.

Note:

Unless otherwise explicitly stated, the latest approved issue of the standard/GR/IR, with all amendments in force, listed in references, on the issuance date of this GR/IR are applicable.

CHAPTER-1

1.0   Introduction

1.1   Mobile networks supporting multiple frequency bands and radio access technologies (2G/3G/4G/5G) require dedicated indoor solutions to address signal attenuation caused by indoor/outdoor and semi-enclosed environments.

1.2   An Active Distributed Antenna System (Active DAS) is an electronically amplified indoor coverage solution that distributes RF signals from one or more mobile network operators through a centralized Headend and Active Point of Interface to multiple service antennas via Remote Antenna Units using optical fiber or Ethernet links. The system enables controlled RF power distribution, centralized monitoring, and scalable multi-operator, multi-band coverage across licensed mobile frequency bands.

1.3   This Generic Requirement (GR) specifies the functional, technical, operational, quality, interoperability, environmental and interface requirements for Active DAS deployment in commercial buildings, public venues, transportation hubs, campuses, residential complexes, and similar environments.

2.0   Description

An Active DAS (ADAS) is a centrally managed, electronically controlled antenna distribution system. RF signals from multiple operators are aggregated at the Headend, conditioned, amplified, and actively transported to distributed service antennas via optical fiber, or digital links.

The Headend handles major functional segregation, including signal aggregation, RF conditioning, operator interfacing, connection to Expansion Units, and distribution to POIs for routing to Remote Units (RUs). RUs convert signals back to RF, applying active amplification and processing to ensure consistent coverage and signal quality.

ADAS supports multiple operators, frequency bands, and technologies (2G/3G/4G/5G) with centralized monitoring, fault management, and scalable network expansion. By controlling RF distribution, ADAS improves coverage, reduces interference, enhances handover performance, and ensures interoperability and regulatory compliance.

2.1 Architecture of Active Distributed Antenna System
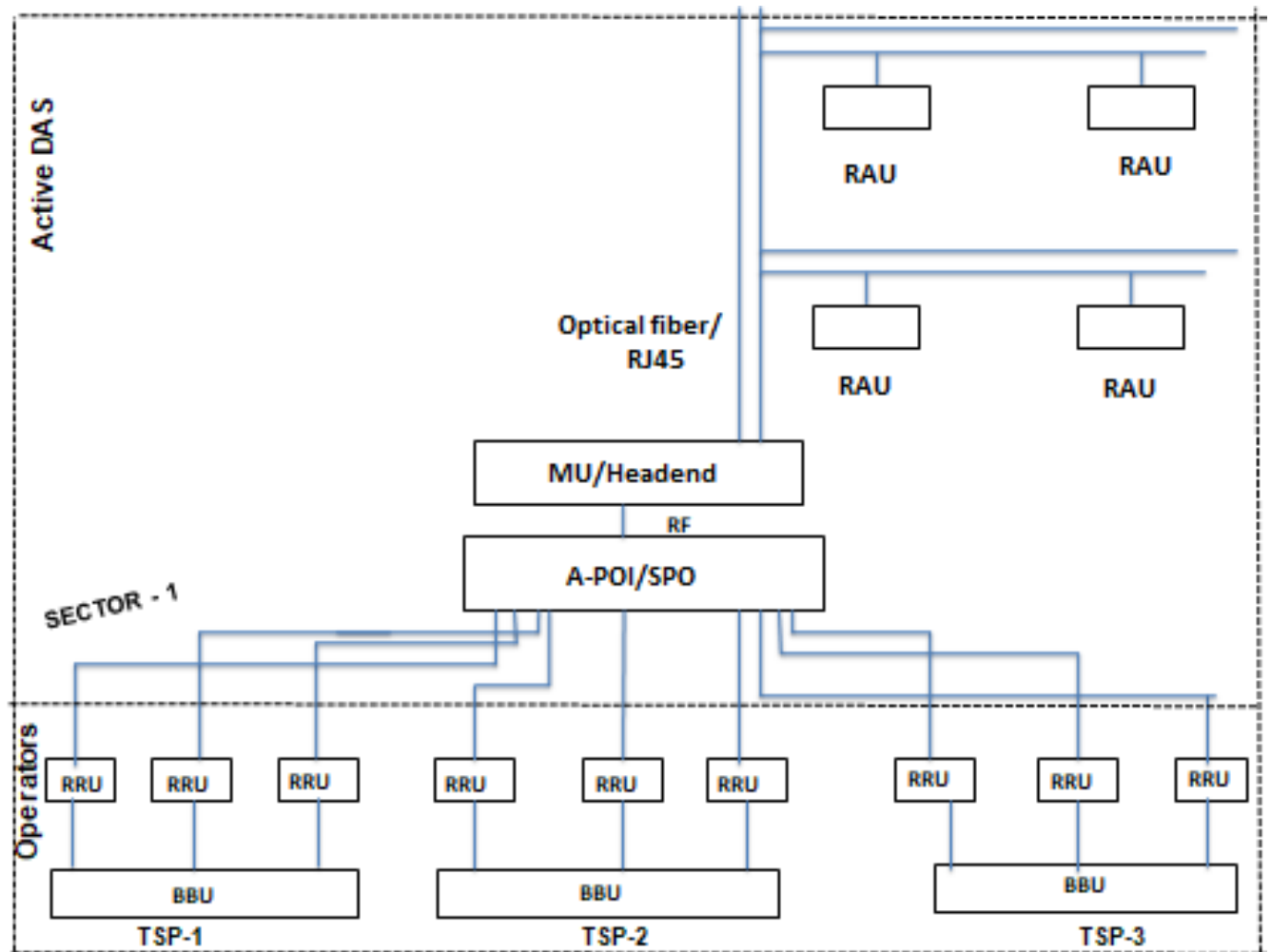
Figure 1: Architecture of Active DAS

2.2 Network Elements of the Active Distributed Antenna System (Active DAS)

A. The Active DAS shall consist of the following major network elements required to support end-to-end RF signal reception, processing, conversion, transport, and distribution within the intended coverage area.

The Active DAS may have the following network elements:-

(a) Headend/Master Unit

(b) Expansion Unit

(c) Remote Antenna Unit

(d) Point of Interconnect

(e) Accessories as per requirement (Fibre patch cord, RF cable, Connectors etc)

B. **Operating Frequency Range**- The system shall operate over a frequency range of 600 MHz to 4 GHz, and this range shall be supported and compatible across all network elements of the Active DAS. The commercial use of frequency and power limits shall be governed as per NFAP 2025 and its amendments from time to time

2.2.1 Head-end Unit / Master Unit (MU)

The Head-end Unit shall function as the centralized signal processing, aggregation, and control entity of the Active DAS. It shall interface with operator Radio Access Network elements such as BTS, NodeB, eNodeB, or gNodeB through RF, optical, or digital interfaces. The MU shall perform signal conditioning, amplification (as applicable), frequency management, and conversion between RF, optical, and IP domains. It shall distribute the processed signals to Expansion Units, POIs, or directly to Remote Units while supporting centralized monitoring, alarm handling, and configuration via the Network Management System.

2.2.1.1 Technical Specifications

S. No.	Technical Parameter	Typical Requirement / Value
1	SISO/MIMO Capability	Supports SISO and MIMO configurations; 2×2 or 4×4, based on band configuration
2	VSWR	≤2.0±0.2
3	RF Combiner Modules	The number of RF combiner modules per MU chassis shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations.
4	Sector Mapping / Routing	Supports multiple sector mapping and routing
5	Instantaneous Bandwidth (IBW)	Supports up to 200 MHz IBW per RF combiner module
6	Integrated POI	Duplex ports per RF combiner with Integrated Point of Interconnect (POI), shall align with the OEM/manufacturer's

		design requirements, taking into account the procurer's deployment considerations
7	Band Aggregation over Fiber	Supports transmission of up to twelve (12) or more 3GPP frequency bands over a single core fiber using two (2) or more slave modules, aligned with the OEM/manufacturer's design and the procurer's deployment considerations.
8	Optical Interface	2 nos of 10Gbps and additional as per purchaser requirements
9	Optical Connectivity to EU/RU	The number of optical connections to Expansion Units (EU) / Remote Units (RU) shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
10	RF–Optical Conversion	Converts analog RF signals to digital optical signals and vice versa
11	Local Monitoring Interface	Integrated OMT and RJ45 interface for local monitoring
12	External Alarm / NMS Interface	RJ45 interface for external alarm and Network Management System (NMS)
13	Mechanical Design	Rack-mounted design
14	Cooling Mechanism	Integrated fan with cooling support
15	Ingress Protection	IP30

2.2.2 Expansion Unit (EU)

Expansion Units shall extend the capacity and coverage of the Active DAS by providing additional ports and signal paths. The EU shall interface with the Head-end and distribute signals to multiple RUs while maintaining synchronization, signal quality, and scalability.

2.2.2.1 Technical Specifications

S. No.	Technical Parameter	Typical Requirement / Value
1	VSWR	≤2.0±0.2
2	Optical Interface	2 nos of 10Gbps and additional as per purchaser requirements
3	Optical Connectivity to RU	The number of optical connections to / Remote Units (RU) shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
4	Optical Connectivity to MU	The number of optical connections to Master Unit (MU) shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
5	Optical Connectivity for EU Cascade	The number of optical connections to Expansion Units (EU) shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
6	EU Cascading Capability	Per optical connection cascading support to Expansion Units (EU) shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
7	Status and Alarm Indication	LED indicators for status and alarm monitoring
8	Local Monitoring Interface	Integrated OMT and RJ45 interface for local monitoring
9	External Alarm Interface	RJ45 interface for external alarm
10	Optical Path Redundancy	Supports fiber loop back for optical path redundancy
11	Supported Bandwidth	Supports 800 MHz bandwidth with single-

	over Fiber	core fiber and 1600 MHz bandwidth with dual-core fiber
12	Mechanical Design	Rack-mounted design
13	Ingress Protection	IP30

2.2.3 Remote Antenna Unit (RAU)

The Remote Antenna Unit (RAU) is the distributed radio interface element of the Active DAS deployed within the coverage area. Radio Access Unit(RAU) /Low Power Radio Unit(LPRU) receives processed RF or digitized signals from the Master Unit (MU) over optical fiber or Ethernet links and converts them into RF signals for radiation through integrated or connected antennas.

In the uplink direction, the RAU receives signals from user equipment via the antenna, conditions them, and forwards the signals back to the centralized unit for further processing. The RAU enables localized signal distribution, ensures uniform indoor coverage, and supports flexible deployment in areas such as floors, corridors, and zones within buildings.

2.2.3.1 Technical Specifications

S. No.	Technical Parameter	Typical Requirement / Value
1	Output Power	Better than +20dBm per port
2	SISO/MIMO Capability	Supports SISO and MIMO operation; 2×2 or 4×4 MIMO based on band configuration
3	VSWR	≤1.5±0.2
4	RF Modules	The no. of RF modules per Remote Unit (RU), shall align with the OEM/manufacturer's design requirements, taking into account the procurer's deployment considerations
5	Bandwidth per RF Module	Supports up to 200 MHz bandwidth per RF module
6	Optical Interface	2 nos of 10Gbps and additional as per purchaser requirements
7	Optical Cascading Capability	Supports cascading using two or more optical modules

8	Antenna Configuration	Supports integrated or external antenna options
9	Antenna Gain	2 dBi or 4 dBi antenna gain
10	Mechanical Installation	Ceiling-mounted design
11	Noise Figure	< 3 dB at at maximum rated gain.
12	Power Consumption	Up to 100 W fully loaded operating conditions
13	System impedance	50 Ω

2.2.4 Point of Interconnect (POI)

The POI acts a bridge between head-end and the RRU(Remote Radio Unit) of the operators.The POI shall serve as the standardized RF interface between each Radio Access Network (RAN) output of the mobile service provider and the Distributed Antenna System (DAS) infrastructure. It shall ensure controlled RF signal injection and extraction while maintaining signal integrity, operator isolation, and linearity. The POI shall incorporate band-specific RF conditioning components such as filters, duplexers, combiners, attenuators, and isolators. The POI shall be modular and scalable to support future operators and technologies up to 5G new radio.

2.2.5 Active DAS Accessories

Following accessories may be deployed with network elements of active DAS as per requirement such that the above-stated technical/operational performance requirements are complied:

2.2.5.1 Fiber Patch Cord

2.2.5.2 RF Cable (½″ Low Loss Corrugated RF Cable and ⅞″ Low Loss Corrugated RF Cable)

2.2.5.3 Connector (N-Male Straight Connector for 7/8″ RF Cable / 1-1/4″ RF Cable / ½″ RF Cable)

Note- This list is illustrative not exhaustive

3.0   Quality Requirements

The manufacturer of the DAS equipment (Head-end, Remote Units, Distribution Units, Power Modules, and associated components) shall have a valid ISO 9001:2015 quality management certification or any equivalent international quality standard.

3.1.1   For coverage, the target RSRP shall be better than –110 dBm for all technology. However, this may be reviewed in tender requirements.

3.1.2   The equipment shall meet the environmental requirements as per Category B of the TEC Standard for "Environmental Testing of Telecommunication Equipment", TEC14016:2010 (old no. QM-333 Issue March 2010

3.1.2   The DAS shall meet the minimum radio service quality requirements, including RSRP, SINR, and RSRQ performance for 2G, 3G, 4G, and 5G services at the user equipment level across the declared coverage area. Compliance shall be verified during acceptance and performance testing. However, these quality requirements may be further improved as per the mutual requirements of the purchaser/procurer and the mobile service operator.

3.1.3   The supplier shall ensure availability of maintenance support, spare modules, and software updates for the declared product life cycle.

4.0   EMI/EMC Requirements

The equipment in the Distributed Antenna System (DAS) shall conform to the TEC Standards on EMI/EMC as applicable for telecommunication equipment, as prescribed in the relevant TEC document "Electromagnetic Compatibility Standard for Telecommunication Equipment", TEC 11016:2016, (Old Document No.: TEC/SD/DD/EMC-221/05/OCT-16).

5.0   Safety Requirements

5.1   The equipment in the Distributed Antenna System (DAS) shall conform to the TEC standards on safety requirements applicable to relevant telecommunication equipment, as prescribed in the relevant TEC document "Safety Requirements of Telecommunication Equipment", TEC 10009:2024.

5.2   The equipment in the Distributed Antenna System (DAS) shall conform to the TEC standards on safety requirements as applicable(stage-II) to telecommunication equipment, as prescribed in the relevant TEC document

"Lightning for surge protection of telecom site.", TEC 66130:2025.

6.0 Environmental Requirements

The Active DAS equipment shall meet the following environmental specifications to ensure reliable operation under defined conditions:

6.1.1 The equipment shall operate within a temperature range of −10°C to +55°C.

6.1.2 The equipment shall be capable of storage within a temperature range of −25°C to +85°C.

6.1.3 The equipment shall operate reliably at relative humidity levels up to 95%.

6.1.4 The equipment shall have a water-proofing rating of IP65.

6.1.5 The equipment shall be suitable for both indoor and outdoor applications.

7.0 Interoperability Requirements

The Distributed Antenna System (DAS) shall meet the following interoperability requirements to support multi-operator, multi-band, multi-technology, and multi-vendor deployments:

7.1.1 The system shall support MOCN (Multi-Operator Core Network) and MORAN (Multi-Operator Radio Access Network) architectures.

7.1.2 Operator signals shall remain logically separated across the DAS, ensuring independent and interference-free operation.

7.1.3 The Head-end, DUs, CUs, RUs, and antennas shall be interoperable with equipment from multiple vendors without functional limitations.

Note-The system shall support per-operator power control, including an output power of 20 Watt per RRU per operator, configurable attenuation settings, and resource allocation for efficient multi-operator performance. *The installation site shall have sufficient and reliable electrical power to support continuous operation of the RRU(s), including peak power consumption, with provision for redundancy where applicable*

CHAPTER 2

8.0   GUIDELINE FOR THE PUCHASER /USER

This chapter describes the requirements that may be included in the tender document by the Purchaser / Procurer based on the intended application, deployment environment, and operational needs of the Active Distributed Antenna System (ADAS). The following aspects shall be specified by the Ordering Authority as per actual site and network requirements.

8.1   The Purchaser / Procurer shall specify the intended deployment scenario of the Active DAS such as building type, coverage objective, and general installation environment (indoor / in-building).

8.3   The Purchaser / Procurer may specify   compliance of the respective network element as per the technical specification mentioned in para 2 of this GR.

8.3   The Purchaser may specify any requirement for field trials, system validation, or acceptance testing prior to final deployment. Feedback, if any, may be furnished to TEC for future improvement of this GR.

9.0   ORDERING INFORMATION

The following information shall be specified by the Tendering / Ordering Authority while placing orders, depending upon operational requirements:

9.1   Intended frequency band(s) radio access technologies, and services to be supported by the Active DAS.

9.2   General system architecture, including centralized unit configuration, number and type of remote units, and coverage area requirements.

9.3   Quantity and deployment scale, and expansion capability of the Active DAS network.

10.0   SPECIFIC ITEMS TO BE MENTIONED IN THE CERTIFICATE

Make and Model number of the component/network element of the Active Distributed Antenna System (ADAS), including centralized unit(s) and remote unit(s), as declared by the manufacturer.

ABBREVIATIONS

For the purpose of this document the following abbreviations apply:

3GPP	:	3rd Generation Partnership Project
ADAS	:	Active Distributed Antenna System
BTS	:	Base Transceiver Station
DAS	:	Distributed Antenna System
EMC	:	Electromagnetic Compatibility
EMI	:	Electromagnetic Interference
EU	:	Expansion Unit
eNodeB	:	Evolved NodeB (4G)
gNodeB	:	Next Generation NodeB (5G)
IP	:	Ingress Protection
LPRU	:	Low Power Remote Unit
MOCN	:	Multi-Operator Core Network
MORAN	:	Multi-Operator Radio Access Network
MU	:	Master Unit
NFAP	:	National Frequency Allocation Plan
PIM	:	Passive Intermodulation
POI	:	Point of Interconnect
RAN	:	Radio Access Network
RAU	:	Remote Antenna Unit
RSRP	:	Reference Signal Received Power
RSRQ	:	Reference Signal Received Quality
RU	:	Remote Unit
SINR	:	Signal-to-Interference-plus-Noise Ratio
VSWR	:	Voltage Standing Wave Ratio

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