



---

Your Extensible Software Defined Radio

## **YesDR Technical Specification**

### **YesDR TS 02.020**

Version 1.0.0

Release 1

## **YesDR Base Station (YBS)**

### **Developed by**

Chandhar Research Labs Pvt Ltd

BaSig Wireless Laboratories Pvt Ltd

**Contents**

<b>1</b>	<b>Scope</b>	<b>2</b>
<b>2</b>	<b>References</b>	<b>2</b>
2.1	Normative . . . . .	2
2.2	Informative . . . . .	2
<b>3</b>	<b>Abbreviations</b>	<b>2</b>
<b>4</b>	<b>Functional Overview</b>	<b>2</b>
<b>5</b>	<b>YBS Architecture</b>	<b>3</b>
5.1	Control Plane Module . . . . .	3
5.2	NAS Relay Module . . . . .	3
5.3	Security Module . . . . .	3
5.4	Session Management Module . . . . .	3
5.5	User Plane Module . . . . .	3
5.6	PHY Interface Module . . . . .	3
<b>6</b>	<b>UE Context Management</b>	<b>3</b>
<b>7</b>	<b>Registration Procedure</b>	<b>3</b>
<b>8</b>	<b>Security Procedures</b>	<b>4</b>
<b>9</b>	<b>PDU Session Management</b>	<b>4</b>
<b>10</b>	<b>User Plane Forwarding</b>	<b>4</b>
<b>11</b>	<b>Error Handling</b>	<b>4</b>
<b>12</b>	<b>Security Considerations</b>	<b>5</b>

## 1 Scope

This specification defines the YesDR Base Station (YBS).

YBS provides radio access, access-stratum security handling, NAS forwarding, PDU session establishment, and user-plane tunnel mapping between YUE and YCore.

YBS is functionally aligned with the 3GPP gNB defined in TS 23.501 but is simplified for research, teaching, and rapid prototyping.

—

## 2 References

### 2.1 Normative

- YesDR TS 01.001: Overall Architecture
- YesDR TS 03.001: YesDR Access Control Protocol (YACP)
- YesDR TS 02.040: YesDR User Plane Function (YUPF)

### 2.2 Informative

- 3GPP TS 23.501
- 3GPP TS 38.401

—

## 3 Abbreviations

Term	Description
YBS	YesDR Base Station
YUE	YesDR User Equipment
YAMF	YesDR Access Management Function
YUPF	YesDR User Plane Function
YACP	YesDR Access Control Protocol
NAS	Non-Access Stratum
TEID	Tunnel Endpoint Identifier
PDU	Packet Data Unit

—

## 4 Functional Overview

YBS performs the following major functions:

- UE registration and identity handling
- NAS message forwarding between YUE and YAMF
- Access-stratum security setup
- PDU session establishment and management
- GTP-U tunnel mapping and forwarding
- PHY modulation and transmission coordination

—

## 5 YBS Architecture

### 5.1 Control Plane Module

Handles YACP messages, UE context management, and interaction with YAMF.

### 5.2 NAS Relay Module

Encapsulates and forwards NAS messages between YUE and YCore without modification.

### 5.3 Security Module

Derives access-stratum keys (KgNB, K\_RRC, K\_UP) and validates UE security capabilities.

### 5.4 Session Management Module

Maintains PDU session state, TEID allocation, and UPF tunnel parameters.

### 5.5 User Plane Module

Maps downlink and uplink packets using TEID-based lookup tables and forwards traffic accordingly.

### 5.6 PHY Interface Module

Interfaces with the PHY processing chain, including modulation, coding, and SDR transmission.

—

## 6 UE Context Management

YBS SHALL maintain a UE context identified by `gnb-ue-ngap-id`.

Each context SHALL contain:

- SUCI and/or GUTI
- Registration state
- Security keys
- Active PDU sessions
- TEID mappings

Contexts SHALL be updated dynamically based on YACP messages :contentReference[oaicite:1]index=1.

—

## 7 Registration Procedure

The registration procedure follows these steps:

1. UE sends Initial Registration to YBS
2. YBS assigns gNB-UE-NGAP-ID
3. NAS Registration Request forwarded to YAMF
4. Security Mode Command handled
5. Registration Accept forwarded to UE

YBS SHALL NOT store AMF-assigned UE identifiers as primary keys :contentReference[oaicite:2]index=2.

—

## 8 Security Procedures

YBS SHALL:

- Validate UE security capabilities
- Derive KgNB from Kamf
- Derive RRC and UP keys
- Protect access-stratum signaling

Security key derivation SHALL follow 3GPP-aligned KDF procedures.

—

## 9 PDU Session Management

YBS SHALL support:

- PDU Session Setup
- TEID generation
- UPF tunnel parameter storage
- Session state synchronization

Each PDU session SHALL include:

- Local (DL) TEID
- UPF (UL) TEID
- UPF IP and port
- UE IP address

—

## 10 User Plane Forwarding

Downlink packets SHALL be forwarded based on DL-TEID lookup tables.

Uplink packets SHALL be encapsulated using UPF-assigned TEID and forwarded to YUPF.

TEID mappings SHALL be dynamically updated upon session modification :contentReference[oaicite:3]index=3.

—

## 11 Error Handling

YBS SHALL handle:

- Invalid NAS messages
- Session setup failures
- TEID conflicts
- SDR transmission errors

Errors SHALL be logged and SHALL NOT cause unexpected service interruption.

—

## 12 Security Considerations

YBS SHALL:

- Avoid persistent storage of sensitive keys
- Restrict control-plane access
- Isolate UE contexts

—