YesDR Technical Specification

YesDR TS 02.010

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Release 1

YesDR Spectrum Monitor (YSM)

Developed by
Chandhar Research Labs Pvt Ltd
BaSig Wireless Laboratories Pvt Ltd

Contents

1 Scope

This Technical Specification defines the YesDR Spectrum Monitor (YSM).

YSM is responsible for wideband spectrum sensing, signal power measurement, segment-wise occupancy estimation, AI-assisted inference, and reporting of spectrum usage to YesDR control-plane entities.

YSM interacts with the YesDR Access Management Function (YAMF) via YSMP and reports spectrum intelligence using YSMP-aligned messages.

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2 References

2.1 Normative References

- YesDR TS 01.001: YesDR Overall Architecture
- YesDR TS 04.002: YesDR Spectrum Management Protocol (YSMP)

2.2 Informative References

- 3GPP TR 38.843: AI/ML for NR Air Interface
- GNU Radio and RTL-SDR Documentation

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3 Definitions, Symbols, and Abbreviations

Abbreviation	Description
YSM	YesDR Spectrum Monitor
YPHY	YesDR Physical Layer (Spectrum Capture)
YSS	YesDR Spectrum Segmentation
YDAG	YesDR Data Aggregation
YAIF	YesDR AI Inference Function
YAP	YesDR Analytics and Presentation
YSMP	YesDR Spectrum Management Protocol
FFT	Fast Fourier Transform

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4 Functional Overview

YSM performs the following functions:

- Wideband spectrum scanning using SDR devices
- Segmentation of spectrum into fixed-width frequency blocks
- Power-based occupancy estimation
- AI-assisted band classification (Idle / Busy)
- Periodic reporting of spectrum intelligence

YSM SHALL operate autonomously and periodically report results to YesDR control-plane entities.

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5 YSM Architecture

YSM consists of the following layered architecture:

5.1 Physical Capture Layer (YPHY)

Responsible for spectrum scanning using external tools (e.g., `rtl_power`) and SDR hardware.

5.2 Spectrum Segmentation Layer (YSS)

Extracts frequency bins and segments spectrum data into configurable frequency blocks.

5.3 Data Aggregation Layer (YDAG)

Computes occupancy metrics based on power thresholds and time-domain aggregation.

5.4 AI Inference Layer (YAIF)

Performs rule-based or AI-assisted classification of spectrum segments.

5.5 Analytics and Presentation Layer (YAP)

Logs spectrum decisions, generates CSV reports, and prepares reporting messages.

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6 Spectrum Sensing Procedures

YSM perform spectrum sensing as follows:

1. Capture wideband spectrum samples
2. Divide spectrum into fixed-width segments
3. Compute occupancy per segment
4. Classify segments as Idle or Busy

Occupancy shall be computed as the ratio of power measurements exceeding a configured threshold.

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7 YSM Setup Procedure

YSM initiate operation by sending a `YSMSetupRequest` message to YAMF.

7.1 YSMSetupRequest

The message SHALL include:

- YSM identifier
- Deployment location
- Sensing capabilities
- Supported scan bands
- FFT size

- Maximum transmit power

The message SHALL be encoded using TLV format and transported over UDP :contentReference[oaicite:1]index=1.

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8 Spectrum Reporting

YSM SHALL periodically send spectrum reports using `YSMReporting` messages.

8.1 Reported Information

Each report SHALL include:

- Timestamp
- Start and end frequency (MHz)
- Occupancy value
- Number of measurements
- Decision (Idle / Busy)

Reports MAY be filtered to specific frequency ranges based on deployment policy :contentReference[oaicite:2]index=2.

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9 Logging and Telemetry

YSM SHALL support:

- CSV-based local logging
- UDP-based centralized logging
- Exception capture and reporting

Logged events SHALL include sensing activity, decisions, and error conditions.

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10 Error Handling

YSM SHALL handle:

- SDR capture failures
- Invalid spectrum data
- Reporting transmission failures

Errors SHALL be logged and SHALL NOT cause unexpected process termination.

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11 Security Considerations

YSM SHALL:

- Restrict access to reporting interfaces
- Avoid transmission of raw I/Q samples
- Validate configuration parameters

Spectrum reports SHALL contain only processed and aggregated information.
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12 Relationship to Cognitive Radio Systems

YSM aligns with cognitive radio sensing principles while:

- Supporting SDR-based wideband sensing
- Enabling AI-assisted spectrum classification
- Feeding centralized cognitive intelligence (YCRF)

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