Oculus Z

Automated wideband COMINT & spectrum analysis platform

Traditional spectrum monitoring forces operators to draw static frequency masks and manually assign limited receiver channels. Oculus Z runs collection as an automated session: operators define target signal rules by frequency band, SNR, bandwidth, duration and protocol (such as DMR, TETRA or APCO P25). The server continuously estimates the regional noise floor, detects every transmission rising above a noise-riding threshold, measures centre frequency and bandwidth, and dynamically allocates a 32-bit GPGPU digital down-converter (DDC) channel to demodulate, decode and log the emission.



Figure 1. Rule-based task configuration pairing target protocols (DMR, TETRA, APCO P25, NXDN) with automated demodulation and IQ recording actions

Key Features

- Noise-riding detection & parameter estimation
- Scalable 32-bit GPGPU DDC channelizer
- Feature-based classification, vocoders & privacy analysis
- Rule-based prioritisation & session management
- Time-travel wideband replay, TDOA & open APIs
- Air-traffic band monitoring

AT A GLANCE

CHANNELIZER ARCHITECTURE
GPGPU multi-channel DDC; 128 channels standard, scalable to 2,048 channels (4 × 512 ch @ 125 Msps on a single NVIDIA RTX A5000)

DDC INPUT / OUTPUT SAMPLE RATE
125 Msps typical (16-bit Complex IQ input) → 3 to 300 ksps configurable (32-bit floating-point Complex IQ output)

CENTER TUNING RESOLUTION
32-bit floating-point resolution

PROTOCOL DETECTION & DECODING
APCO P25 (Phase I, II), DMR (Base, Terminal), TETRA (Base, Terminal, Direct), NXDN (2400, 4800 bd), dPMR (Base, Terminal), D-STAR, Yaesu Fusion, DTMF, Analogue Voice (FM, AM, LSB, USB, CW)

DIGITAL MODULATION CLASSIFICATION
PSK2, DPSK2, PSK4, DPSK4, PSK8, FSK (2/4/8), CPFSK (2/4/8), OQPSK, GMSK, QAMP, AFSK

APPLICATIONS

- Automated wideband COMINT collection and protocol decoding across HF, V/UHF and microwave bands
- Networked fixed and tactical monitoring stations sharing a unified session and synchronised cryptographic/emitter databases
- Low-bandwidth TDOA emitter geolocation and VITA-49 baseband hand-off

to specialised signal analysis suites
- Automated regulatory spectrum occupancy auditing and unlicensed transmitter detection
- Retrospective interference investigation around airports, ports and critical infrastructure using wideband IF replay
- Long-duration unattended band monitoring with rule-based alarming
- Monitoring of air-ground communications in the 118–137 MHz band

Capabilities

Noise-riding detection & parameter estimation

Frequency-region-specific algorithms track the live noise floor and apply a noise-riding SNR threshold to isolate transient and continuous transmissions, automatically estimating centre frequency and occupied bandwidth without operator tuning.

Scalable 32-bit GPGPU DDC channelizer

A GPGPU multi-channel digital down-converter filters each detected emission to its measured bandwidth with 32-bit floating-point tuning and sample resolution. Scales from 128 standard channels to 2,048 real-time channels (4 × 512 channels across four 125 Msps VITA-49 streams on a single NVIDIA RTX A5000).

Feature-based classification, vocoders & privacy analysis

Classifies signals by physical and protocol features rather than modulation alone: APCO P25 (Phase I/II), DMR, TETRA, NXDN, dPMR, D-STAR, Yaesu Fusion, DTMF and analogue voice, plus PSK, DPSK, FSK, CPFSK, OQPSK, GMSK, QAM and AFSK. Supports custom DMR vocoders and key recovery/database synchronisation across stations for TETRA TEA1, DMR Basic/Enhanced Privacy, DMR RC, APCO ADP and NXDN scramblers.

Rule-based prioritisation & session management

Operators define priority and ignore lists by frequency band, bandwidth, duration and signal type so critical emitters receive DDC and decoder resources first. When no rule is specified, resources are allocated dynamically by highest SNR.

Time-travel wideband replay, TDOA & open APIs

Stores timestamped detections, decoded audio/data, vocoder metadata and narrowband files in PostgreSQL or MS SQL, alongside optional full-band IF recording for retrospective reanalysis with new parameters. Supports compressed narrowband TDOA geolocation, VITA-49 baseband socket output to third-party tools, and REST/Java APIs.

Air-traffic band monitoring

In the 118–137 MHz air-ground communications band, transmissions are detected automatically, their parameters measured and classified, and recorded as narrowband files.



Figure 2. Live wideband spectrum (416–429 MHz) with dynamic noise-riding threshold and active session controls

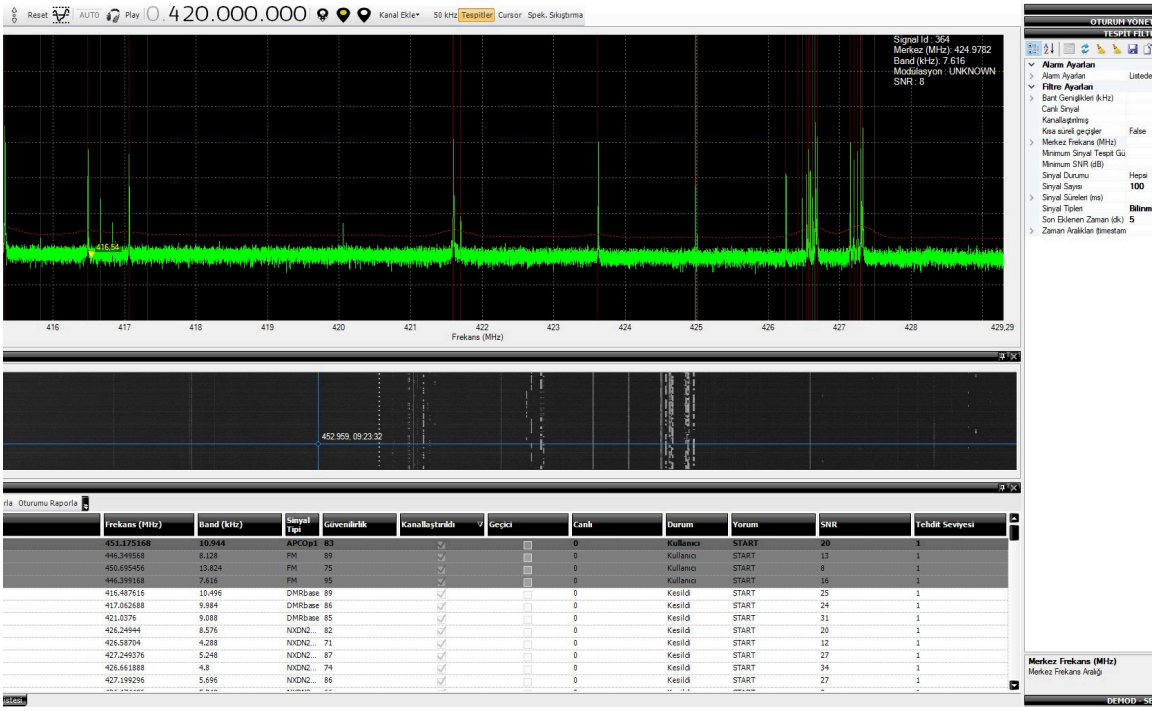


Figure 3. Automated signal detection and filter rules across a dense V/UHF band

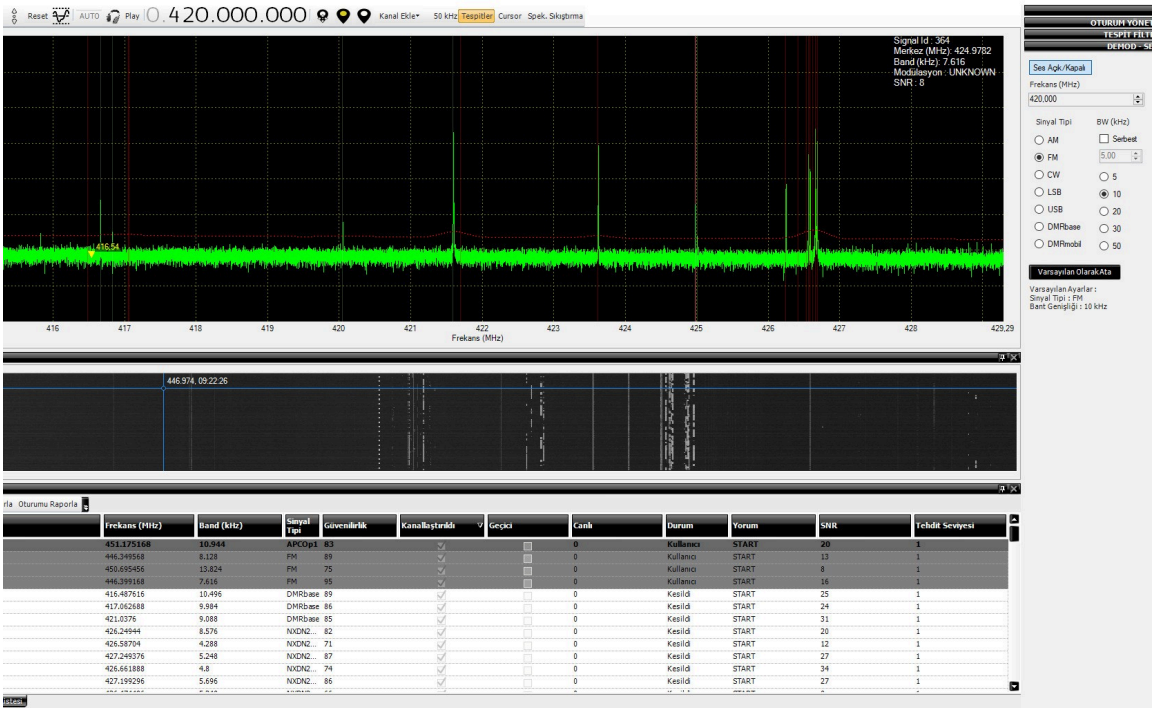


Figure 4. Narrowband demodulation controls and live emitter table with SNR, bandwidth and protocol confidence

Specifications

General	
Channelizer architecture	GPGPU multi-channel DDC; 128 channels standard, scalable to 2,048 channels (4 × 512 ch @ 125 Msps on a single NVIDIA RTX A5000)
DDC input / output sample rate	125 Msps typical (16-bit Complex IQ input) → 3 to 300 ksps configurable (32-bit floating-point Complex IQ output)
Center tuning resolution	32-bit floating-point resolution
Protocol detection & decoding	APCO P25 (Phase I, II), DMR (Base, Terminal), TETRA (Base, Terminal, Direct), NXDN (2400, 4800 bd), dPMR (Base, Terminal), D-STAR, Yaesu Fusion, DTMF, Analogue Voice (FM, AM, LSB, USB, CW)
Digital modulation classification	PSK2, DPSK2, PSK4, DPSK4, PSK8, FSK (2/4/8), CPFSK (2/4/8), OQPSK, GMSK, QAMP, AFSK
Vocoders & privacy analysis (optional)	Custom DMR vocoders; TETRA TEA1, DMR Basic Privacy (16/40/128/256-bit), DMR Enhanced Privacy (40-bit), DMR RC (40-bit), APCO ADP (40-bit), NXDN scrambler (15-bit) with multi-station key DB sync
Supported receivers & IQ sources	VITA-49 sources; ZETA OCR-1911 (9 kHz–32 MHz HF, 20 MHz–6 GHz V/UHF, 100 MHz IFBW); CommsAudit 7851, 7852, 7814; Signal Hound BB60C; DRS Vesper; Ettus USRP series; wideband IQ files
Client network bandwidth	~300 kbps typical per 125 Msps (100 MHz IFBW) receiver for 16 fps spectrum/spectrogram, detections and C2
External interfaces & integration	VITA-49 baseband output sockets; REST and Java control APIs; PostgreSQL and Microsoft SQL Server session databases; TDOA geolocation option
Air-traffic band	118–137 MHz

Warranty

All hardware and software procured from Zeta is under warranty against manufacturing or design failures for 2 years. Customer-specific warranty terms may be arranged.

Disclaimer

Due to ongoing research and development, Zeta reserves the right to change product specifications without notice.

About Zeta

Zeta Defence develops electronic intelligence (ELINT) and communication intelligence (COMINT) equipment and radar / electronic warfare simulators. Its capabilities include RF transceiver system design, digital design and large-scale software development.

Contact

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