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IT and communications solutions



*Service Assurance
for Telecommunications and Network Services*

NETvisor

iTVSense Probes Technologies

| telecommunication networks | it networks | research and development | cost effective operation

iTVSense Probe Technologies

iTVSense MiniProbes and **RackProbes** are compact and feature-full devices for monitoring and diagnosing IP networks and digital media services, including IP transport over L3 or MPLS networks, Internet / Intranet connectivity and services, IPTV/DVB/OTT streams or SIP/VoIP communication.

The various models of the iTVSense Probe product line share a unified and proven architecture, with distinct advantages: the **MiniProbes** (above) combine this versatility with small size, portability and low power requirements, while the powerful

RackProbes (below) offer 10 Gbps analysis for network hubs and datacenters.



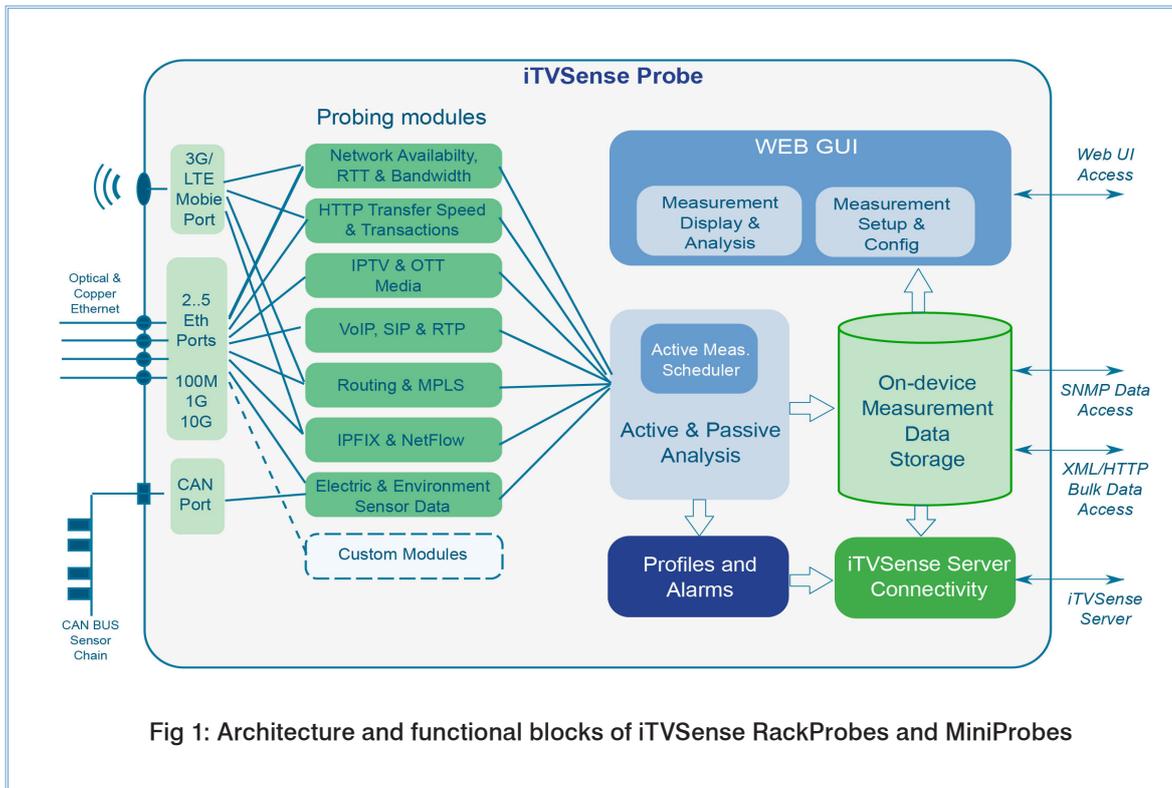
Benefits

With measurement capacities of up to 10Gbits/sec (i.e. thousands of network connections, OTT/IPTV media streams or up to 10 thousand of simultaneous VoIP calls (see Table 1 and 2) the RackProbes and MiniProbes are versatile measurement analysis and monitoring devices for multiple application scenarios, e.g.

- In network hubs and aggregation points, i.e. on switch/router ports for active testing or passive monitoring of backbone and aggregation routing, switching and auxiliary services like DNS, DHCP, etc.
- In data centers, monitoring the availability, performance and resource status of servers (Web, Mail, DB etc.) and services.
- On network access devices (xDSL, GPON, Cable), analyzing access concentration operation and performance.
- iTVSense Probes support all testing and monitoring functions in a single device, offering exceptional versatility and top price/performance.
- RackProbes are capable to provide a combination of most tests with up to 2x10Gbps aggregate speed.
- The MiniProbes, with their small size, robust construction and friendly price tag are also excellent portable tools for field technicians or for temporary, on-demand deployments at customer premises, like for 72-hour service qualification or diagnosis sessions.
- MiniProbes with 'R' ("Rugged") designation are also operable outdoors in street cabinets, manholes, or overhead cabling enclosures [figure 6].



Architecture



iTVSense probes are based on an innovative architecture, where measurements of different types are processed through a unified workflow of data acquisition, analysis, storage, presentation and export. This not only results in high performance and resource efficient processing for the standard measurement technologies, but also supports custom extensions on specific customer needs.

- **Probing modules** are responsible for executing active measurements and collecting measurement data. Technologies supported through probing modules are described later.
- The **Measurement analysis module** is responsible for the initial analysis and basic conversion of results from various technologies. Active measurements – like OTT/HTTP transactions, VoIP calls, etc.- are also scheduled through this module.
- The **Measurement Data Store** provides high performance, compressing storage for measurements and alarms. Data is saved in the probe's persistent memory, and can be accessed over the SNMP or a HTTP/XML data access interface by NETvisor's PerformanceVisor or by 3rd party collection systems.
- **Profiles and Alarms Processor** validates incoming metrics against user-defined alarm criteria and records alarms if those are violated.
- The **Web UI** is the primary interface to control measurements and access to results on the probes (see 'Standalone mode' on p. 3)
- **iTVSense Connectivity** makes it possible to operate multiple probes from an iTVSense Server (see 'Centralized Operation' on p. 4)



Operation modes

iTVSense probes may be operated in stand-alone mode -controlled from the Web GUI-, or under the central control of an iTVSense server.

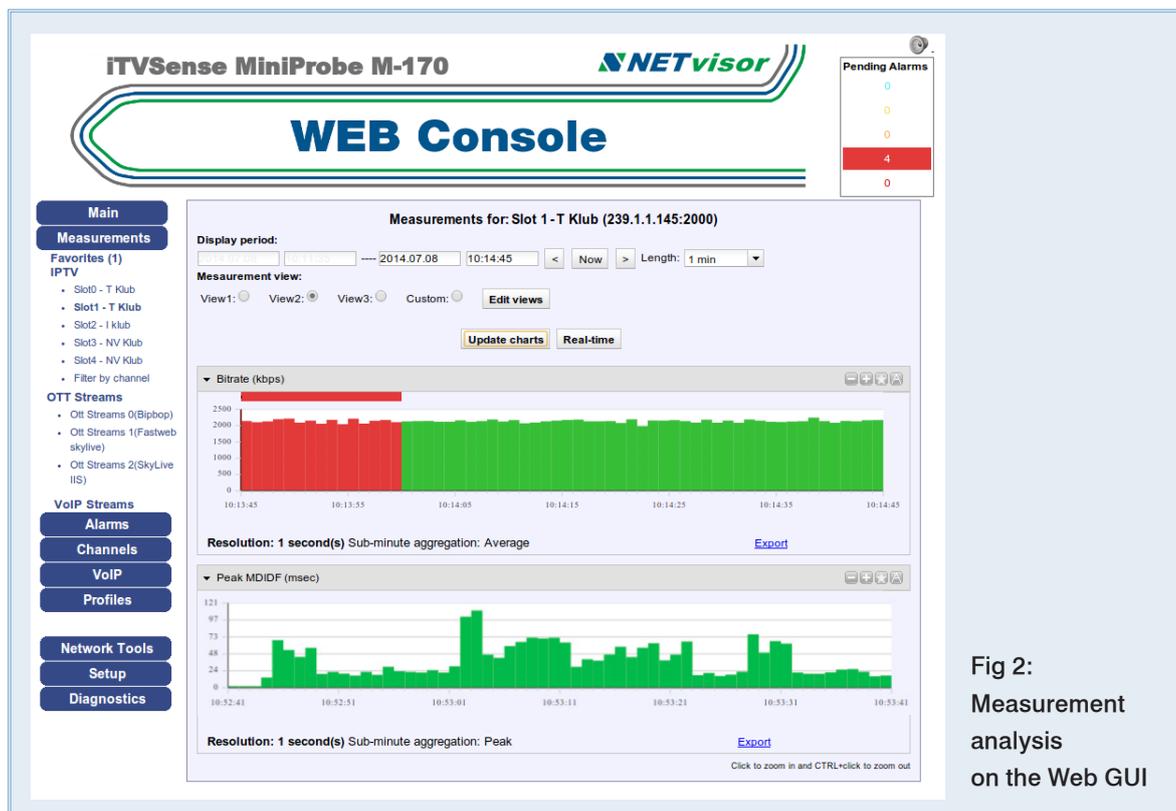


Fig 2:
Measurement
analysis
on the Web GUI

Standalone Mode and Web GUI

Probes in stand-alone mode are operated using the MiniProbe Web GUI, a sophisticated, dynamic and bandwidth-economic web application with the following main functions:

- Probe status overview: identification, system and network status, probe alarms, and measurements overview.
- Detailed measurement charts with
 - Selectable measurements and metrics
 - Selectable time resolution (1 secs - 4 hours)
 - Interactive zoom functions
 - Related alarms indicated on measurement charts.
- Setup screens for
 - Boot and network settings, including VPN interfaces to make probe accessible from external networks.
 - Measurement settings
 - Alarm thresholds defined through profiles.
 - Well-known IP hosts, IPTV channel definitions, Internet test server lists and/or VoIP peer lists.



- Additional Network and Diagnostic tools like
 - Selective or generic mode packet capture: captured data can be uploaded to a different host in tcpdump format for further analysis. Selective captures only include single channels or directions, while generic mode includes all network data, with custom filter definitions supported.
 - DNS, NTP, Ping, HTTP, traceroute, FTTP availability tests

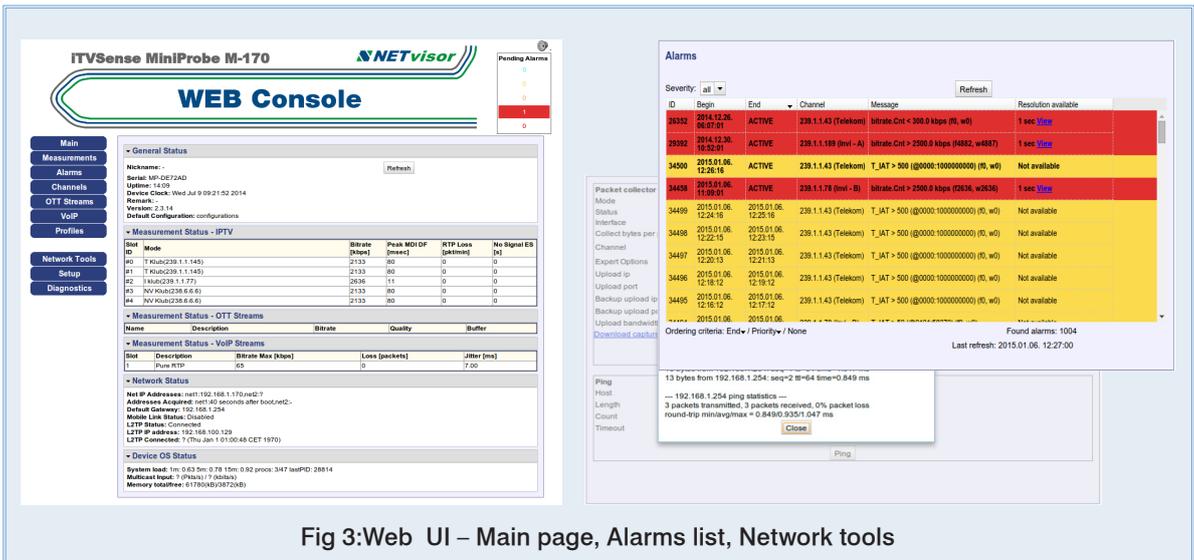


Fig 3: Web UI – Main page, Alarms list, Network tools

Centralized Operation

Operated under central control, the probe communicates with the iTVSense/PVSR server environment for:

- Downloading measurement configuration from a central repository.
- Serving the iTVSense performance monitoring server with periodic minute-resolution measurement readings.
- Propagating locally evaluated alarms to higher-level services for further processing
- Serving the iTVSense GUI charts with sub-minute resolution measurement results for on-demand queries.
- Uploading network data, captured by the probe to the iTVSense server.
- In addition to configuration data, centralized operation also allows probe firmware to be downloaded from the central iTVSense system, offering fully automated upgrade management for all probes from a single central location.

In order to enable centralized operation and control in different deployments, probes support several options to provide firewall-transparent access from the management server. These include VPN solutions like L2TP, CiscoVPN, asymmetric multicast/unicast data exchange, or a TR-069 style notification based access from the central server.



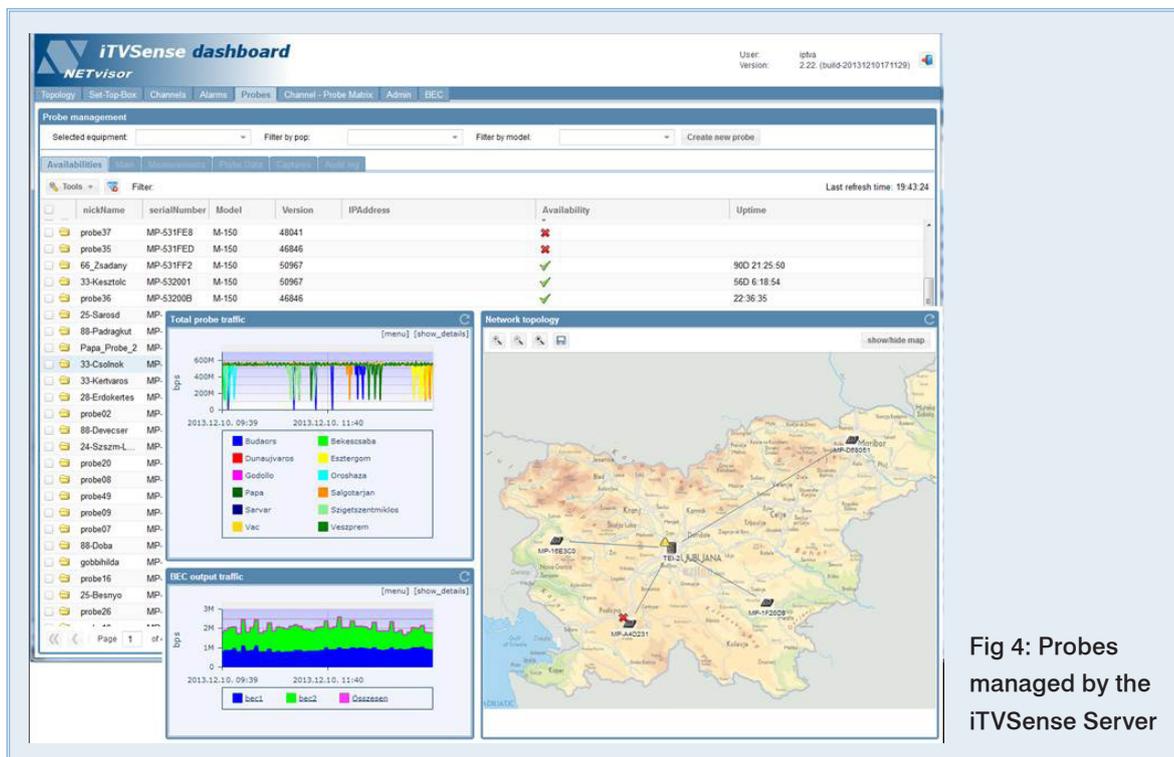


Fig 4: Probes managed by the iTVSense Server

Technology Specific Features and Usage

Availability and RTT/bandwidth assurance

Thanks to the small size and to the good environmental and power tolerance of iTVSense Probes they are ideal devices for monitoring the availability of telecommunication and network connections, or services provided over those networks. By deploying multiple probes to multiple points in the network, service assurance can be based on a mesh of measurements, increasing monitoring reliability and facilitating root cause analysis.

Features of the probing module for availability and RTT/bandwidth measurement:

- Selectable test protocols: ICMP ECHO (ping), DNS, DHCP, HTTP, and RTP mirror and Cisco IOS responder protocols
- User configurable test repetition rates between 0.1-10000 seconds.
- User configurable test packet counts lengths and frequencies.
- Milliseconds-accurate RTT measurements for all protocols.
- Multiple bandwidth estimation algorithms available: Path-load, Packet Pair, Packet Train and PTR.
- Additional initiator packet may be configured to initialize dynamically allocated channels for test packets (e.g. in case of VSAT links).
- Support for dynamically generated or dictionary-loaded test URL-s and host names to disable HTTP and DNS caching.



iTVSense Probes Used for Internet Services

- Internet access measurements: availability, utilization, average/maximum RTT
- Basic internet service availability tests for for HTTP/HTTPS, SMTP, POP3/IMAP, DHCP, DNS, NTP, etc
- Website and online service availability tests, including replays of simulated or recorded **multi-step HTTP/HTTPS transactions** (like online shopping sessions including catalog, registration/login/logout shopping cart, ordering, payment, etc.)
- Scheduled, periodic download/upload rate tests for selected servers

IPTV and OTT monitoring

In IPTV and OTT service environments, iTVSense Probes provide the following main monitoring features:

- Measurement of up to 1000 IPTV channels or VoD streams (SD, HD or mixed SD/HD channels) simultaneously
- Support for OTT streams delivered using HLS, MS Smooth streaming or MPEG Dash protocols
- Seconds-resolution metrics and minute-based aggregates of standard and custom metrics:
 - average and maximum bitrate,
 - packet loss, burst packet loss
 - RFC 4445 MDI DF (delay factor), and MLR (media loss rate, a.k.a. „CC error“),
 - PCR jitters and errors
 - RTP errors (loss, duplicates and out-of-order packets),
 - no signal conditions
 - IGMP / RTSP response time to first packet and to first iFrame, including monitoring of fast channel change (FCC) transactions
 - Elementary Streams presence and bandwidth
 - Monitoring of FEC and BEC effectiveness
- PID level analysis and monitoring of compliance to user-defined PID signature criteria.
- Measurements on external/unrelated multicast and unicast bandwidth
- Measurement results stored in non-volatile memory: minute-resolution data stored for up to 168 hours and seconds-level data stored for up to 24 hours.
- Alarm definitions based on measured values. In addition to being displayed on the probe Web GUI, alarms may trigger
- syslog/SNMP alerts sent to external devices
- automatic data capture enabled for the alarm period

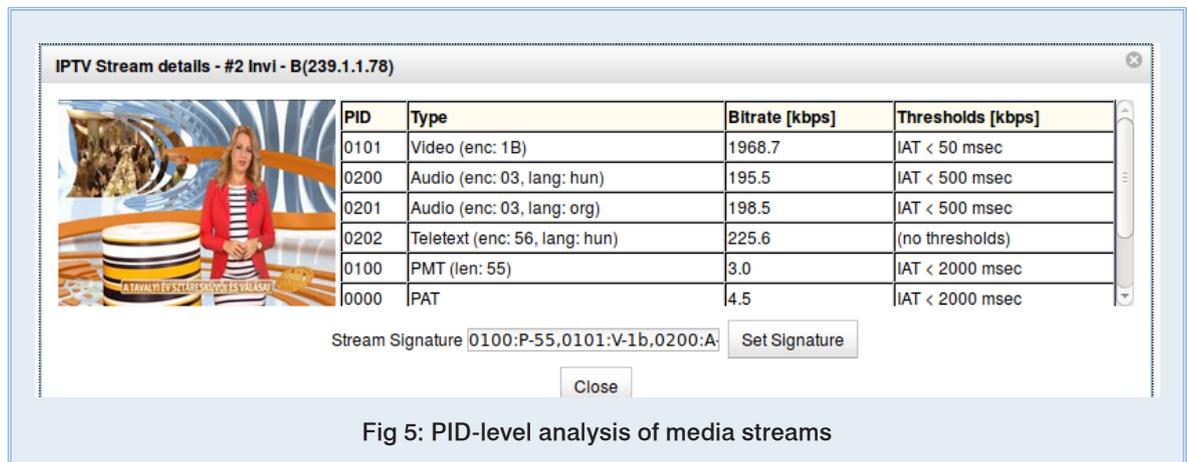
Miniprobes also support the measurement of access to **live or pre-recorded OTT content, including Youtube downloads**, or services running the HLS, MSS or (starting in Q1 2014) MPEG-DASH adaptive streaming formats.



VoIP and RTP transmissions

VoIP measurement functions include:

- SIP-based VoIP call initiation and termination over different transport protocols.
- Generated, or user-defined content transmitted
- Measurement of success rate, and call quality
- Measurements provide objective, QoS metrics (RTT, loss, jitter, data and encoding errors, etc.) and subjective, QoE or Mean Opinion based scores (MOS)



Monitoring IP Routing and MPLS

Probes support monitoring of BGP routing advertisements through the following techniques:

- Advertisement frequency and consistency
- Prefix source/content mismatches (local and external)
- Policy compliance and ROA validation
- AS domain reachability from external test points (e.g. using PlanetLab TopHat hosts).

Used with MPLS networks, the probing module provides:

- MPLS network device discovery and availability tests
- Monitoring of network traffic volumes by QoS classes
- Label verification, fault detection and management
- Recording and validation (passive monitoring) of mirrored MPLS LDP & RSVP-TE/RSVP provisioning communication.
- Active execution of MPLS provisioning sessions i.e. creating, validation and destroying of temporary different MPLS paths using CR-LDP and RSVP-TE.
- QoS testing on configured MPLS networks and services.



IPFIX / NetFlow analysis with iTVSense Probes

Probes deployed to receive and analyze flow information from routers

- Receive flow records from up to 50 devices simultaneously. Records from different sources are processed with virtually isolated flow analysis modules but it is possible to group several sources into a virtual sender group.
- Automatically clusters flow information to identify top-10 sources, destinations and protocols/ports
- Manual configuration of groups by criteria (source destination, protocol/ports), is also possible. Bandwidth and packet count for these criteria-based groups is also possible.

Probe-generated extended flow records

- Besides processing IPFIX/Netflow data received from routers, iTVSense probes can also act as stand-alone flow analyzers for streams seen on its interfaces (i.e. packets received through port mirroring or via network taps).
- In addition to the standard, IANA assigned flow record fields supported by IPFIX (19 parameters in case of NetFlow V5, configurable using NetFlow V9), the probe provides additional custom flow record fields with information on protocol- and technology-specific aspects like packet jitters and losses (for digital video and audio) and TCP retransmissions and TCP window control events.

Specifications

Supported Standards and RFC

- Network UDP stream packet rate, byte rate, packet loss rate and several jitter metrics
- MPEG Transport Stream packet rates, jitter, packet loss, counter and encapsulation errors. Metrics are provided both as an aggregate and also by individual Mpeg streams (video, audio, control).
- RFC 4445 Media Delivery Index (MDI).
- Multicast join times and zapping time.
- Encoder alarm events
- IPTV server operation, network traffic and stream processing (via SNMP)
- VCAS Server network traffic and stream processing (via SNMP)
- Middleware and VoD service operation, resources and response time, server/OS/Database health.
- DHCP and Boot Image server availability and events
- STB CPU load, memory used and available, network traffic, process count, reboot events and uptimes, process monitoring, STB agent footprint



Probe Models and Options

A./ MiniProbes

Model	Ethernet Speed	Monitoring Bandwidth	IPTV Channel Capacity	USB 2.0 Port	NVCan Port
M-152	100baseT	30 Mbps	4 (2xSD + 2xHD max)	-	-
M-170	100baseT	80 Mbps	10 (6xSD + 4xHD)	-	-
M-175	100baseT	80 Mbps	10 (6xSD + 4xHD)	1	-
M-180	100baseT	80 Mbps	10 (6xSD + 4xHD)	1	1
M-190	1000baseT	500 Mbps	50 (35xSD + 15xHD)	-	-
M-195	1000baseT	500 Mbps	50 (35xSD + 15xHD)	1	1

Remarks

- Internal persistent memory available for data storage is generally 48 Mbytes. M-152 internal memory is 12 Mbytes. For the M-19x models this can be internally extended to 4GBytes. Models with USB ports also support external memory sticks for data storage.
- The USB port can also be used for connectivity through 3G/LTE mobile network dongles
- DVB-T / DVB-C monitoring is provided through DVB dongles attached through the USB port.
- The NVCAN interface allows the connection of NETvisor sensors and other CANBUS devices



Fig 6: iTVsense MiniProbe M170R with IP54 sealing is designed for outdoor deployments

Physical and Environmental Characteristics

- dimensions: 170 x 106 x 31 mm, (M-151: 100x115x30mm-s)
- weight 480 grams (M-151: 350 grams)
- power: 6 Watts (typ.)
- supply: 12-24 VDC (1 Amps max.)
 - 48 VDC available as an option
- temperature:
 - -10 - +60 degrees Celsius
- humidity: 80% max.
- "R" model options with rugged cases are available with increased environmental tolerance



B./ RackProbes

Model	Ethernet Speed	Monitoring Bandwidth	IPTV Channel Capacity	USB 2.0 Port	NVCan Port
M-201	2x 1000baseT	up to 2 Gbps	200 (150xSD + 50xHD max)	3	-
M-301	2x 10Gbps SFP+ 2x 1000baseT	up to 18 Gbps	1000 (800xSD + 200xHD)	-3	-

Physical and Environmental Characteristics

- dimensions: 383 D x 436 W x 43 H mm
- weight 7200 grams
- power: 85 Watts (typ.)
- supply: 110/230VAC (6 Amps max.)
- operating temperature: +10 - +35 degrees Celsius
- humidity: 90% max.



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