Datasheet

Dotouch 触点互动

XproUESimulator

High performance 5G simulation terminal test solution

Dotouch XproUESimulator can simulate up to 2000 5G UEs simultaneously testing the functionality, performance, and security of 5G base stations. Due to the innovative SDR (Software Defined Radio) architecture, XproUESimulator supports flexible configuration of wireless bandwidth from 10MHz to 100MHz, and supports any frequency point setting within the FR1 frequency band. In terms of media plane transmission performance, it supports up to 256QAM modulation and achieves a communication rate of 360Mbps at the layer 1 /layer 2 under a single antenna, approaching the theoretical transmission limit of 5G. In terms of key metrics such as the number of online users per second, XproUESimulator supports an online user rate of over 100 CAPS per second, allowing for high-performance large user access rate impact test of base stations.

XproUESimulator provides complete 5G NR UE side protocol stack simulation capabilities, including PHY, MAC, RLC, PDCP, RRC, NAS, SDAP protocol stack modules, supporting TDD/FDD mode, and has completed docking tests with over 20 brand base stations. XproUESimulator has achieved industry-leading protocol compatibility indicators, thanks to the flexible programming capability of software defined radio and the ability to complete functional integration testing with base stations within 3 days. Its compatibility adaptation speed exceeds that of similar products. XproUESimulator supports both cell level and UE level diagnostic logs in test result output, as well as real-time stream storage and offline graphical analysis of signaling streams, making it convenient for testers to diagnose. XproUESimulator also has the ability to capture real-time air interface data, which can capture the air interface data sent bidirectionally by UE and base station sides for storage and analysis.

XproUESimulator provides unique programmable protocol stack capabilities, allowing customers to edit the NAS layer and RRC layer signaling encoding and decoding formats and signaling processes of the UE on site, for systematic testing of base station protocol stack robustness and protocol vulnerability mining. This is the industry's first tool product that can perform base station vulnerability testing, with a globally leading level of innovation.

Test Scenarios

- **R&D testing for 5G equipment, including R&D testing, version testing during the product development stage of base stations, and regression testing for new versions**
- **Equipment procurement and network access testing for telecom operators**
- **Network deployment and operation & maintenance testing for telecom operators' existing networks**
- **Standard testing tools for large-scale user scenarios in telecom operators' emergency communication plans**
- **5G air interface security testing**
- **R&D testing and road testing for 5G V2X equipment / terminals**
- **Testing of other private network evolution services for 5G**

XproUESimulator: High-performance terminal simulation testing for 5G access networks

XproUESimulator is capable of simulating up to 2000 concurrent 5G devices for testing the functionality, performance, and security of 5G base stations. This capability is made possible through an innovative SDR (Software Defined Radio) architecture that allows for flexible configuration of wireless bandwidth between 10MHz and 100MHz, and supports any frequency point within the FR1 frequency band. In terms of media plane transmission performance, it supports up to 256QAM modulation, achieving a communication rate of 360Mbps at a single antenna, nearing the theoretical transmission limit of 5G. Furthermore, XproUESimulator supports over 100 CAPS (Connections per Second) per second, making it suitable for conducting large-scale performance stress tests on base stations.

XproUESimulator: A 5G terminal simulation and testing solution based on X86 and SDR technology

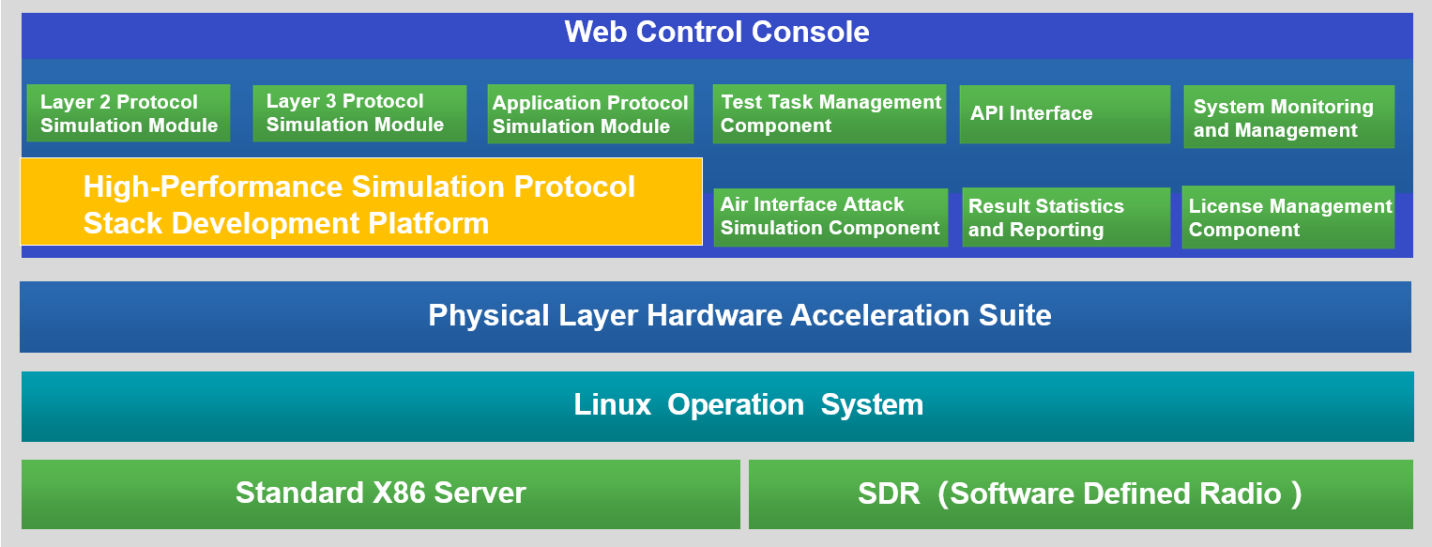
- The XproUESimulator utilizes a high-performance hardware platform based on the universal X86 architecture, combined with SDR technology and physical layer hardware acceleration functions. It realizes layers 2, 3, and application layers in software, providing a high-performance 5G terminal simulation testing solution specifically for 5G RAN.
- Offers comprehensive 5G UE-side protocol stack simulation capabilities, including PHY、MAC、RLC、PDCP、RRC、NAS、SDAP modules, supporting TDD and FDD.
- Features modular system design, allowing for rapid customization based on customer requirements.
- Supports quick adaptation of private protocols, as well as the development of test cases for special scenarios.
- Capable of real-time capture of air interface data, enabling the storage and analysis of bidirectional air interface data sent by both the UE and the base station.

XproUESimulator: A programmable protocol stack solution based on NAS and RRC

- The XproUESimulator offers unique programmable protocol stack capabilities, enabling the editing of signaling codec formats and signaling processes at the UE NAS and RRC layers, for the purpose of systematic robustness testing of base station protocol stacks and the identification of protocol vulnerabilities.
- The programmable protocol stack facilitates the development and validation of specific proprietary air interface protocols, as well as cutting-edge verification of air interface protocols.
- It generates a large volume of random or targeted messages that are sent to the base station, and monitors the base station's response, particularly in terms of crashes, abnormal returns, or security issues.
- By modifying message content or sequences within standard processes through the protocol stack tool, it simulates the behavior of malicious attackers to detect whether the base station can handle the scenarios properly or reveals any vulnerabilities.

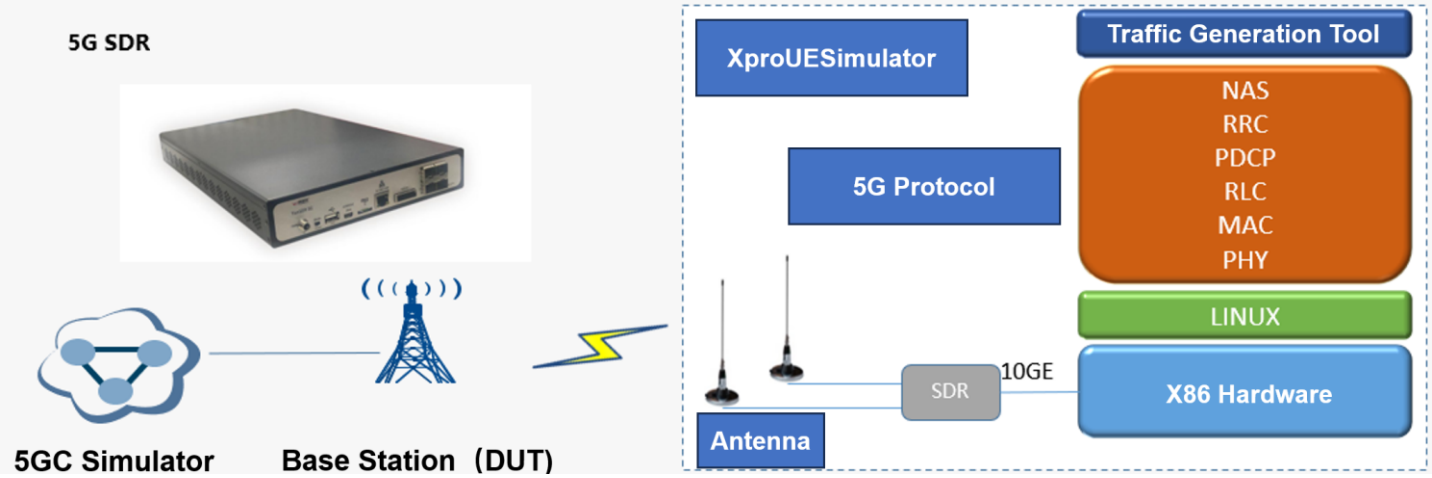
XproUESimulator: NTN Terminal Simulation and Testing Solution

- The XPRO UESimulator leverages a high-performance hardware platform based on a universal X86 architecture, integrated with SDR technology and physical layer hardware acceleration capabilities, to achieve NTN terminal simulation, covering the physical layer, L2, L3, and NAS layers.
- Compliant with 3GPP R17 specifications, it supports a frequency range of 300MHz to 6GHz, offering an RF bandwidth of 400MHz for both uplink and downlink. It supports 64QAM and 256QAM modulation for both directions and has extended capabilities for millimeter-wave options, including N257, N258, N260, and N261.



Product Testing Topology Diagram

5G Simulation Terminal System Integration and Wireless Access Testing Solution - OTA or SMA RF Feed Line Access Mode



Product Features and Value

- **Higher Cost-Performance Ratio**
  - XproUESimulator is based on the universal X86 architecture hardware platform and generic SDR technology, offers the most cost-effective solution in the industry that combines software and hardware for high-performance 5G terminal simulation testing. This significantly reduces the cost investment for customer testing tools.
- **Better Flexibility**
  - XproUESimulator is built on the universal X86 hardware platform and Linux operating system, boasts unparalleled flexibility compared to dedicated hardware architectures and closed system platforms. Through rapid customization services, it achieves a deep match between testing tools and requirements, fulfilling personalized testing needs.
  - It supports universal SDR with an even broader selectable frequency range.
- **Higher Performance**
  - Based on NVIDIA's high-performance GPU-accelerated physical layer solution, XproUESimulator can deliver a single-user, single-cell, single-antenna downlink simulation traffic output capability of 360Mbps. By enhancing server performance and SDR RF front-end specifications, it further increases system capacity to meet testing needs in multi-user, high-performance testing scenarios.
  - It supports flexible wireless bandwidth configurations from 10MHz to 100MHz and allows for the setting of any frequency point within the FR1 band.
  - In terms of media plane transmission performance, it supports up to 256QAM modulation.
  - It supports a rate of over 100 CAPS (Call Attempts Per Second), allowing for high-performance impact testing on base stations.
  - It supports up to 2000 users per cell.
- **More Extensive Functional Features**
  - XproUESimulator can simulate a large number of terminals sharing the same frequency and simulate IP traffic such as ping, UDP, HTTP, etc.
  - XproUESimulator offers a unique programmable protocol stack capability, allowing for the editing of UE NAS layer and RRC layer signaling encoding/decoding formats and signaling processes. This is used for systematic base station protocol stack robustness testing and protocol vulnerability mining. Additionally, the programmable protocol stack can facilitate the development and verification of specific proprietary air interface protocols, as well as cutting-edge validation work for air interface protocols.
  - Provides remote APIs based on WebSocket and JSON.
  - Supports an over-the-air security testing engine.
  - Supports all encryption modes and integrity protection algorithms including ZUC.
  - Features a web-based full graphical interface management approach and system status monitor.

Functional Features Supported

Features	Description
Frequency and Network Features	• Supports SA as defined by R16 • Supports both FDD and TDD • Supports all FR1 uplink, downlink, and SSB carrier intervals
Interface Supported	• OTA over-the-air interface • SMA RF line connection
Control Plane and User Plane Encryption and Integrity Protection Protocols	• Supports NEA0, 128-NEA1, 128-NEA2, 128-NEA3 • Supports NIA0, 128-NIA1, 128-NIA2, 128-NIA3
Network Behavior Simulation	• Supports packet rate control • Supports application layer service latency control • Supports new or concurrent connection control • Supports throughput control
Deployment Features	• Deployed on X86 servers
Security Features Supported	• Supports base station over-the-air security testing • Provides programmable protocol stack capabilities, allowing for editing of UE NAS layer and RRC layer signaling encoding/decoding formats and signaling processes, used for systematic base station protocol stack robustness testing and protocol vulnerability mining. Additionally, the programmable protocol stack can facilitate the development and verification of specific proprietary air interface protocols, as well as cutting-edge validation work for air interface protocols.
Data Analysis and Reporting	• Supports real-time graphical presentation of test data • Supports generation and export of test reports (PDF & CSV formats) • Supports cell-level and UE-level statistics • Fully localized Chinese interface
System Management	• Web-based fully graphical management interface • Real-time system status monitoring and alarming • Supports API for automated testing.

Parameter Features Supported

Features	Description
Communication standard	NR (FDD/TDD), NTN (FDD)
Number of UEs online	2,000 Units
UEs online speed	100 Units/second
Number of UEs with active services	200 units
Number of UEs scheduled per timeslot	40 units
Subcarrier spacing	• SSB: 15kHz / 30kHz / 120kHz • PDSCH/PUSCH: 15kHz / 30kHz / 120kHz • PDCCH/PUCCH: 15kHz / 30kHz / 120kHz • PRACH: 1.25kHz / 5kHz / 15kHz / 30kHz / 120kHz • Sounding RS: 15kHz / 30kHz / 120kHz • CSI-RS: 15kHz / 30kHz / 120kHz
TDD slot configuration	All formats
Cell bandwidth	10MHz / 20MHz / 30MHz / 40MHz / 100MHz / 200MHz / 400MHz
MIMO	1T1R / 1T2R / 2T4R
Transmission power	Maximum 15 dBm
Transmission frequency error	Frequency error: 1 ppm
Transmission EVM	Better than 1.2%
PRACH	Root sequence length: 139/839
PUCCH	• Formats: Format 0/1/2/3/4 • Frequency hopping: intra-Slot/inter-Slot • Bearer content: SR / HARQ-ACK / CRI / RI / PMI / CQI / RSRP • PDSCH-HARQ-ACK Codebook: semi-static/dynamic
PUSCH	• Signal waveform: CP-OFDM/DFT-S-OFDM • Maximum modulation level: 256QAM
PUSCH Time Domain Resource Allocation	• PUSCH starting OFDM symbol as the first symbol of the slot: type A • PUSCH starting OFDM symbol as the scheduling symbol: type B
PUSCH Frequency Domain Resource Allocation	Distributed / Centralized: resourceAllocationType0/Type1
PUSCH DMRS	• type 1/type 2 • DMRS symbol count: single symbol/double symbol/extra symbol
PUSCH Bearer Content	• UCI only: carries only non-periodic CSI and possible HARQ-ACK • UCI multiplexing: UL-SCH and periodic/non-periodic CSI and HARQ-ACK

Features	Description
Sounding RS	Transmission period: periodic/non-periodic
PDCCH	• Formats: DCI Format 0_0/0_1/1_0/1_1 • Search space aggregation levels: 1/2/4/8/16 • CORESET interleaved/non-interleaved • reg-BundleSize: 2/3/6
PDSCH Signal	Maximum modulation level: 256QAM
PDSCH Time Domain Resource Allocation	Mapping type: type A/type B
PDSCH Frequency Domain Resource Allocation	Distributed/Centralized: resourceAllocationType0/Type1
PDSCH DMRS	• type 1/type 2 • DMRS symbol count: single symbol/double symbol/extra symbol
CSI-RS	• Number of antenna ports: 1/2/4/8/12/16/24/32 • Measurement period: periodic/non-periodic • Reporting period: periodic/non-periodic • Measurement codebook: type I-Single Panel/type I-Multi Panel
MAC	• CBRA • HARQ • BSR • Uplink logical channel priority handling • Uplink logical channel multiplexing • Downlink logical channel demultiplexing
RLC	• TM/UM/AM RLC-SAP • TX side segmentation • RX side reassembly • Status report sending/processing • RX side deduplication and discarding duplicates • RX side window overflow discard • AM retransmission
PDCP	• SRB/DRB mapping • Integrity protection/encryption • RLC-AM-SAP successful transmission acknowledgment (ACK_SN) processing • Reordering • Out-of-order delivery for DRB

Features	Description
SDAP	• PDUSessionID and QFI mapping • QFI reflection: reflective • Status report
RRC	• System message processing • Connection control • SRB/DRB establishment • SMC processing • Paging • Provides programmable protocol stack capabilities, allowing editing of RRC layer signaling encoding/decoding formats and signaling flows for systematic base station protocol stack robustness testing and protocol vulnerability discovery. Additionally, the programmable protocol stack can facilitate the development and verification of specific private air interface protocols, as well as cutting-edge verification work for air interface protocols.
NAS	• Registration/deregistration process • PDUSession establishment/release • AKA/SMC • QoS Rules • Provides programmable protocol stack capabilities, allowing editing of UE NAS layer signaling encoding/decoding formats and signaling flows for systematic base station protocol stack robustness testing and protocol vulnerability discovery. Additionally, the programmable protocol stack can facilitate the development and verification of specific private air interface protocols, as well as cutting-edge verification work for air interface protocols.
User Plane Data	• Integrated XPRO Network Simulator: supports 50 types of protocol stacks and real APP traffic playback, supports per-packet delay measurement • Integrated XproIMS: VoNR/ViNR • Integrated XproIMS: new call

Recommended Hardware Server Speficication

Items	Configuration Requirements
CPU	2 * Intel® Xeon® CPU Silver 4214R, 48 threads in total
Memory	At least 8 memory modules with a total memory capacity of no less than 128GB
NIC	2 Ports 10GE NIC
GPU	NVIDIA A10
SDR	Y590Neo

Ordering Information

Licensing	Description
XPRO UESimulator _32	Support 32 UEs
XPRO UESimulator _64	Support 64 UEs
XPRO UESimulator _100	Support 100 UEs
XPRO UESimulator _512	Support 512 UEs
XPRO UESimulator _1000	Support 1000 UEs
XPRO UESimulator _2000	Support 2000 UEs

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