Spirent **Automotive C1**

Layer 2-7 System for Deterministic Testing of Automotive Ethernet Applications

Solution Overview

Test Automotive InCar or Car2X devices and systems with a solution that reproduces a realistic and deterministic environment accelerating product development and improving quality. Spirent's C1 minimizes your risk with its highly accurate emulated traffic and measurements so networks and individual network elements can be quickly validated.

The C1 lowers the barrier to entry and enables companies of all sizes to test smarter and optimize their test investment by leveraging the industry-leading test capabilities Spirent offers.

The Spirent Automotive C1 supports the Spirent TestCenter™, CyberFlood™ and TTworkbench™ Software Test Suites. Whether you are an InCar network engineer, product researcher/developer, or systems engineer — Spirent will empower you to better manage your solutions and deliver on the promise of next-generation Automotive services.

The Spirent Automotive C1 offers the power of Spirent's award-winning Layer 2–7 router, switch, application and security test solutions in a portable form factor.

With support for line-rate 10/100 BroadR-Reach® (100BASE-T1), 1000BASE-T1, 10/100/1000BASE-T, and 100M/1/2.5/5/10G (NBASE-T) Ethernet test ports, the C1 offers the power of a professional test tool for deterministic testing of Automotive Ethernet products and solutions.

A complete Layer 2 to Layer 7 test tool is now available to replace open source utilities and ad-hoc testing methods. Test smarter by moving up to Spirent C1.

Features & Benefits

- Native BroadR-Reach PHY eliminates latency measurement inaccuracies and provides true interoperability testing
- Transceiver based PHY options provide flexibility: 100BASE-T1, 1000BASE-T1, 10/100/1000BASE-T and 100M/1/2.5/5/10G (NBASE-T)
- Hardware-based timestamp measurements for highly accurate latency measurements
- Best-in-industry for measuring ultra-low sub-microsecond latencies with 10ns precision and 2.5ns resolution (10ns resolution for native copper interfaces)
- Wizard-driven RFC benchmark suites for push-button, repeatable tests
- Realistic stateful protocol emulation to exercise protocol state machines
- Small footprint appliance and quiet operation for benchtop or desktop operation

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Testing the In-Car Network

Solutions for Automotive Ethernet

- Protocol conformance and functional testing
- Interoperability testing
- Device/network security and robustness
- Pre-defined, automated test suites (such as IEEE1588v2 or TSN/AVB)
- Performance/stress testing
- Real-life network traffic emulation

Testing BroadR-Reach (Ethernet/IP Performance Testing)

- Throughput, Delay, Jitter, Packet-Loss, Packet Out of Order
- Switch Benchmarking (RFC 2544 & RFC2889)
- Quality of Service (Diffserv & IEEE 802.1Q)
- Timing and Synchronization (IEEE 1588v2 & 802.1AS)
- Full TSN (Time Sensitive Network) test support
- Application Playback (Unicast & Multicast)

What to test

Automotive Ethernet-BroadR-Reach®

Test interoperability, functionality, & performance.

Simplify compliance with network protocols.

Realism

- Realistic Layer 2–3 traffic to test Quality of Service (QoS) mechanisms
- Realistic Layer 4–7 user and endpoint emulation to test applications and application infrastructure—industry's most comprehensive TSN standard and protocol emulation support
- Security and vulnerability testing: Emulate attacks & malware, fuzzing

Productivity

- Intelligent Results™ allow users to quickly confirm positive results and identify problematic areas
- Real-time traffic and protocol controls enable the tester to validate and troubleshoot problems by altering the test configuration while the test is running
- Real-time results views allow the user to see how the network responds to changes in specific test conditions without having to stop the test and save the results
- Built-in wizards and automated test scenarios reduce test setup and execution times

Applications

The C1 is an ideal fit for Automotive OEMs, suppliers, component manufacturers and service providers performing:

- R&D testing involving technology feasibility studies and performance modeling
- Device and protocol functional testing
- Conformance and certification testing
- Device, sub-system, or services performance characterization and availability
- Security and vulnerability testing: Emulate attacks & malware, fuzzing

Technical Specifications	
Spirent C1 Appliance	
Chassis (with four ports)	• Four ports of 10/100 BroadR-Reach, 10/100/1000BASE-T, 1G SFP or 100M/1/2.5/5/10GBASE-T interfaces • 2U (3.5 inches) height x 13 inches wide x 10 inches deep • 100-240 V AC input, 300 W max • Supports Spirent TestCenter and TTworkbench
Interface media support (based on configuration)	• **10/100 BroadR-Reach:** 2 x 2-wire DE9M connectors (2 ports per connector) • 10/100/1000BASE-T (RJ-45) • 10/100/1000BASE-T, 100BASE-T1, 1000BASE-T1 or Fiber (SFP) Transceivers • 100M/1/2.5/5/10GBASE-T (NBASE-T)
Traffic encapsulations	• **Layer 2:** 802.3, Ethernet II, 802.1Q, 802.1ad, 802.1ah • **Layer 3 and 4:** IPv4, IPv6, UDP, TCP • Custom PDU builder
Timing	Internal Tx clock: Stratum-3 rated oscillator is the default time source. Transmit line clock is at the precise nominal Ethernet rate +/- < 1 PPM on initial shipment. Accurate to +/- 4.6 PPM over 15 years of operation.
User reservations	Per port
Layer 2/3 Generator and Analyzer	
Frame transmit modes	• Port based (rate per port) • Stream based (rate per tream) • Burst • Timed • Manual Rate Scheduling (supported by kits with NIC-65)
Min/max frame size (w/CRC)	60 to 10,240
Min/max Tx rates	1 packet per 3.43 seconds to 101% of line rate
Real-time Tx stream adjustments	Change rate and frame length settings without stopping the generator or analyzer for truly interactive, cause and effect analysis
Advance per-stream statistics available in real-time	Over 35 measurements tracked in real-time for each received stream including: • Real-time loss and advanced sequencing • Out of sequence • **Latency**: Avg, min, max and short-term avg; first/last frame arrival timestamp • **Latency modes**: LILO (forwarding delay per RFC 4689), LIFO (store and forward devices per RFC 1242) and FIFO (bit forwarding devices per RFC 1242) • **Data integrity**: IP checksum, TCP/UDP checksum, frame CRC, embedded CRC and PRBS bit errors
Packet capture	• 4 MB (first 128 bytes of each frame via CPU RAM) • Stateful capture/replay for extended protocol support
Reporting	• Integrated test Results Reporter (TM) • Full raw test results in CSV and customizable report generation in PDF and HTML
Automotive C1 advanced software kit	• IGMPv1/v2/v3 and MLDv1/ v2 protocol emulation • IEEE 1588v2 protocol emulation • IEEE 802.1x protocol emulation • Spirent dynamic protocol generator • RFC 2544 network device benchmarking suite and wizard • RFC 2889 switching benchmarking suite and wizard • HTTP, SIP, and FTP emulation

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About Spirent Communications

Spirent Communications (LSE: SPT) is a global leader with deep expertise and decades of experience in testing, assurance, analytics and security, serving developers, service providers, and enterprise networks.

We help bring clarity to increasingly complex technological and business challenges.

Spirent's customers have made a promise to their customers to deliver superior performance. Spirent assures that those promises are fulfilled.

For more information, visit: www.spirent.com

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Layer 2/3 Generator and Analyzer	
TSN/AVB software kits	• Full TSN/AVB emulation of multiple talker or listeners on each port • Mixed TSN/AVB and non-TSN/AVB traffic generation capability on each port • Full set of standards supported: – IEEE 802.1BA – IEEE 802.1AS (-Rev) – IEEE 802.1Qat – IEEE 802.1Qav – IEEE 1722 – IEEE 1733 – IEEE 802.1Qci – IEEE 802.1Qbv – IEEE 802.1CB – IEEE 802.3br – IEEE 802.1Qbu

Ordering Information	
Part Number	**Product Description**
AUTO-C1-KIT-01	AUTOMOTIVE C1 KIT 4-PORT 1G COPPER (10/100/1000BASE-T / RJ-45) & L2-3 SW
AUTO-C1-KIT-02	AUTOMOTIVE C1 KIT 4-PORT 10/100M BROADR-REACH & L2-3 SW
AUTO-C1-KIT-03	AUTOMOTIVE C1 KIT 4-PORT 1G (SFP) & L2-3 SW
AUTO-C1-KIT-04	AUTOMOTIVE C1 KIT 4-PORT 100M/1/2.5/5/10GBASE (NBASE-T / RJ-45) & L2-3 SW
Base SW included with every HW Kit	
BPK-1001A	PACKET GENERATOR AND ANALYZER BASE PACKAGE A
Accessories	**Product Description**
AUTO-ACC-0012	COPPER SFP TRANSCEIVER 100BASE-T1
AUTO-ACC-0013	COPPER SFP TRANSCEIVER 1000BASE-T1