SA8700A V2X Full Layer Test Solution

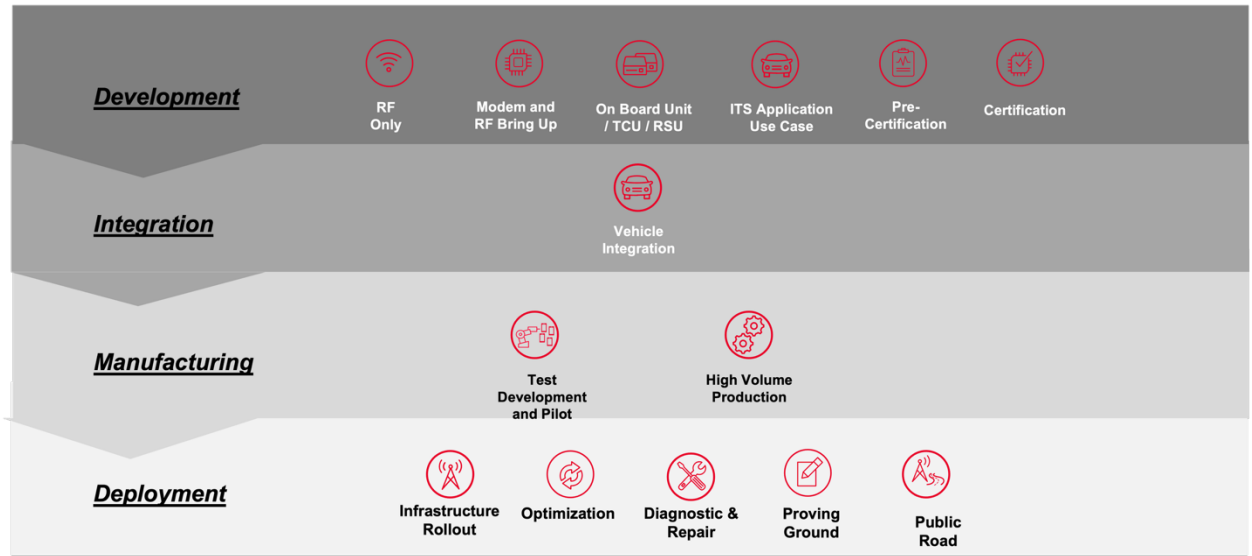
Utilize a Comprehensive Approach to V2X Testing

Introduction

This document provides instructions for configuring Keysight's V2X Full Layer Test Solution. The solution spans V2X Software-in-the-Loop (SiL), Hardware-in-the-Loop (HiL), and Field testing.

- V2X SiL testing, powered by the Keysight Autonomous Drive Emulation (ADE) platform and WaveBee ITS application tools, accelerates application development and scenario validation in a virtual environment, with test assets seamlessly reused in HiL.
- V2X HiL testing, validating real V2X hardware devices (DUTs) in a controlled lab environment, ensuring accurate performance before field deployment. Keysight UXM 5G supports RF, protocol conformance, and application-layer testing exclusively for C-V2X and NR-V2X, while WaveBee Hive complements this by enabling application-layer testing for both DSRC and C-V2X.
- WaveBee V2X Field Tools enable on-road validation through mobile monitoring, route planning, and interoperability checks—completing an end-to-end pipeline from simulation to deployment.

These testing solutions support the entire V2X lifecycle, including Development, Integration, Manufacturing, and Deployment. Each phase is enabled by the appropriate test solution (SiL, HiL, or Field) and leverages reusable software assets to ensure continuity and efficiency.



KEYSIGHT

C-V2X Test Solution Based on UXM

Keysight C-V2X test solution, powered by UXM 5G, delivers a fully integrated approach across all layers. This comprehensive platform combines C-V2X X-Apps software test applications, the ADAS testing platform Autonomous Drive Emulation (ADE), MXG X-Series signal sources with Global Navigation Satellite Systems (GNSS) Signal Studio, regional Intelligent Transportation System (ITS) stacks, and advanced application-layer testing capabilities. Together, these components create a unified environment for complete V2X validation.

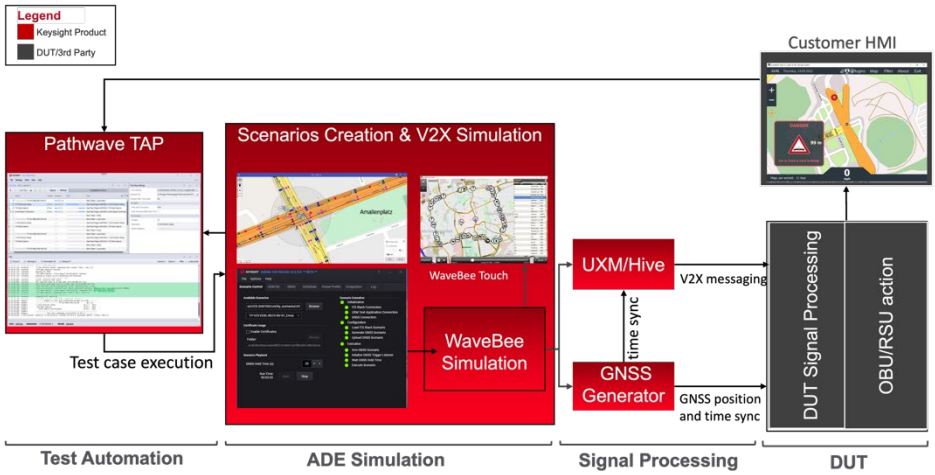
Key Capabilities

By combining PHY, protocol, and application testing on a single platform, Keysight delivers unmatched flexibility and scalability for automotive customers.

- Physical layer: C-V2X PC5, NR V2X Rel-16, also supports LTE, 5G NR, 5G NTN, (e)RedCap, NB-IoT, NB-NTN, eCall, NG-eCall based on different UXM platforms.
- Protocol layer: 3GPP, OmniAir, and China-specific conformance testing
- Application-layer: congestion testing, Day-1 use cases, 3rd party solution integration, and complex scenario testing through the ITS stack.

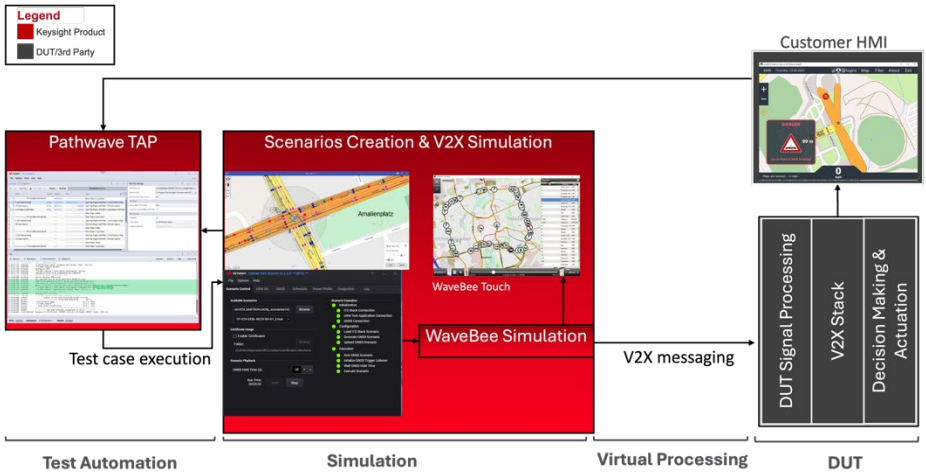
V2X ITS Application - HiL Test on WaveBee Hive

For customers focused solely on application-layer V2X testing across DSRC and C-V2X technologies, Keysight provides a scalable HiL solution using WaveBee Hive systems. This configuration is complemented by a GNSS signal generator, the ADE platform for ADAS testing and third-party integration, TAP test automation, and the WaveBee software suite, which includes WaveBee Touch for monitoring, WaveBee Creator for scenario creation, and ITS communication stacks aligned with regional standards such as ETSI, SAE, and C-SAE.



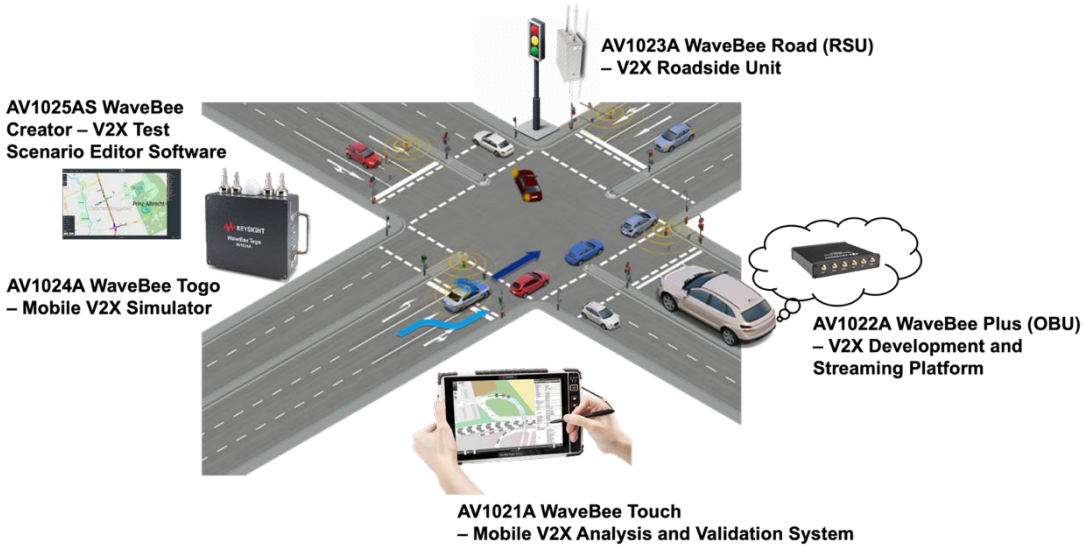
V2X ITS Application - SiL Testing

Software-in-the-Loop (SiL) testing enables early-stage validation of V2X software in a fully virtualized environment, removing the need for physical hardware prototypes. The Keysight V2X SiL solution is built on the ADE platform, WaveBee software tools, and TAP test automation.



V2X WaveBee Field Testing Tools

Keysight's WaveBee field testing suite provides a complete solution for V2X validation in real-world environments. It includes WaveBee Road (RSU) for roadside infrastructure testing, WaveBee Plus (OBU) for in-vehicle development and streaming, WaveBee Touch for mobile V2X analysis and validation, WaveBee Togo for V2X simulation, and WaveBee Creator for scenario editing. Together, these tools enable flexible, interoperable, and standards-compliant testing of V2X applications, ensuring reliable performance across diverse traffic and communication scenarios.



Keysight V2X Full Test Solution Value

Keysight offers a flexible V2X testing platform covering Software-in-the-Loop (SiL), Hardware-in-the-Loop (HiL), and Field testing, across PHY, protocol, and application layers. Customers can choose an all-in-one UXM system or a separate system to fit their needs. Shared software capabilities and reusable ITS application software across SiL and HiL reduce cost and accelerate development, enabling seamless transition from lab to real-world validation

Step-by-Step to Configure your V2X Testing Solutions

1. Select the SA8700A (Except for the V2X Field Test Solution)
2. Select a V2X testing case
3. Select the hardware platform if needed
4. Select the software platform and software options based on specific applications

V2X SiL Test Configuration (Software-Only)

Model#	Description	Notes
Software Platform		
AD1050B	ADE Basic Bench Software License	Mandatory
AV2001B	V2X SiL Software Installation Platform	Mandatory
Software - ITS Applications		
AV3001EUA	WaveBee V2X Stack Simulation License ETSI V2X standard - 10 instances	Mandatory (choose at least one)
AV3001CNA	WaveBee V2X Stack Simulation License C-SAE V2X standard - 10 instances	
AV3001USA	WaveBee V2X Stack Simulation License SAE V2X standard - 10 instances	
AV3002EUA	WaveBee V2X Stack Simulation License ETSI V2X standard - 50 instances	
AV3002CNA	WaveBee V2X Stack Simulation License C-SAE V2X standard - 50 instances	
AV3002USA	WaveBee V2X Stack Simulation License SAE V2X standard - 50 instances	
AV3004EUA	WaveBee Touch Software License ETSI V2X standard	Mandatory (choose at least one)
AV3004CNA	WaveBee Touch Software License C-SAE V2X standard	
AV3004USA	WaveBee Touch Software License SAE V2X standard	
AV3003EUA	WaveBee Creator Software License ETSI V2X standard	Optional [1] (choose at least one)
AV3003CNA	WaveBee Creator Software License C-SAE V2X standard	
AV3003USA	WaveBee Creator Software License SAE V2X standard	
AV3005EUA	V2X Day 1 Use Cases ETSI V2X standard for WaveBee Creator	Optional (choose at least one)
AV3005CNA	V2X Day 1 Use Cases C-SAE V2X standard for WaveBee Creator	
AV3005USA	V2X Day 1 Use Cases SAE V2X standard for WaveBee Creator	
AD1058B	Traffic Scenario & Vehicle Dynamics Simulation Integration Software	Optional [2] (mandatory if no WB Creator is chosen)
KS8400B	PathWave Test Automation (TAP)	Optional [3]- highly recommend

1. WaveBee Creator is optional if the customer uses their own scenario simulator. In this case, AD1058B is required to provide plug-ins for third-party simulators.
2. AD1058B supports IPG Carmaker, AVSimulation SCANeR, Siemens Simcenter Prescan, dSPACE Aurelion, VTD, and Alternative 3D modeling software. For additional systems, please contact your local BD for custom plug-in development.
3. For the TAP license, it is highly recommended. It enables test automation, defines the testing flow, and executes tests in the required sequence.

C-V2X UXM Physical Layer RF Test Configurations

Model#	Description	Notes
Hardware		
E7515B	UXM 5G wireless test platform (R81/SA1/SB1/PA1/PB1/PC1/PD1/506/AC3)	Mandatory
N5172B	EXG X-Series RF vector signal generator (503/656/660, optional-009/403, N7609EMBC)	Mandatory as a GNSS generator (choose one)
N5182B	MXG X-Series RF vector signal generator (503/656/660, optional-009/1EQ/403/UNX, N7609EMBC)	
Software Platform		
AD1050B	ADE Basic Bench Software License	Mandatory
AV2003B	HiL UXM Software Installation Platform	Mandatory
N7609EMBC	GNSS SignalStudio	Mandatory for N5182B
C8700200A	UXM test application framework	Mandatory
C8732114A	C-V2X Rel14 - PC5 signaling	Mandatory
Software for C-V2X PC5 PHY Test		
C87320R1A	C-V2X UL RF measurement	Mandatory
C87320R2A	C-V2X waveform generation	Mandatory
Software for NR-V2X Rel 16 PHY Test		
C873V116A	NR V2X Rel 16 – NR PC5 Signaling	Mandatory
C873V0R1A	NR V2X UL RF Measurements (required for RF measurements)	Mandatory
Software for LTE PHY Test [1]		
C8730115A	LTE Rel 15 – core signaling	Optional
C87300R1A	LTE UL RF measurement	Optional
C87300R2A	LTE waveform generation	Optional
Software for 5G NR Rel 15 PHY Test [1]		
C8735115A	5G NR Rel 15 - core signaling	Optional
C8735315A	5G NR Rel 15 - supplementary SA signaling	Optional
C87350R1A	5G NR UL RF measurements	Optional
C87300P1A	5G NR waveform generation	Optional
Software for 5G NR Rel 16 PHY Test [1]		
C8735116A	5G NR Rel 16 – NSA Core Signaling	Optional
C8735416A	5G NR Rel 16 – SA Core Signaling	Optional
C873N016A	Rel 16 ASN.1	Optional
Software for 5G NR Rel 17 PHY Test [1]		
C8735117A	5G NR Rel 17 – Core Signaling	Optional
Software for 5G NR Rel 18 PHY Test [1]		
C8735118A	5G NR Rel 18 – Core Signaling	Optional

1. For LTE and 5G NR PHY Testing, the items above are only for reference; please contact the NES product management team for the latest final configuration and updates.

C-V2X UXM Protocol Conformance Test

Model#	Description	Notes
Hardware		
E7515B	UXM 5G wireless test platform (R81/SA1/SB1/PA1/PB1/PC1/PD1/506/AC3)	Mandatory
N5172B	EXG X-Series RF vector signal generator (503/656/660, optional-009/403, N7609EMBC)	Mandatory as a GNSS generator (choose one)
N5182B	MXG X-Series RF vector signal generator (503/656/660, optional-009/1EQ/403/UNX, N7609EMBC)	
Software for CN Protocol Conformance Test		
CA8737A	Protocol Conformance Test Suite for China C-V2X - CN	Mandatory
KS8400A	PathWave Test Automation (TAP)	Mandatory
C8700200A	UXM test application framework	Mandatory
C8732114A	C-V2X Rel14 - PC5 signaling	Mandatory
AV3001CNA	WaveBee V2X Stack Simulation License C-SAE V2X standard - 10 instances	Mandatory
Software for OmniAir Protocol conformance test US		
CA8722A	OmniAir C-V2X Protocol Test Cases - US	Mandatory
KS8400B	PathWave Test Automation (TAP)	Mandatory
C8700200A	UXM test application framework	Mandatory
C8732114A	C-V2X Rel14 - PC5 signaling	Mandatory
AV3001USA	WaveBee V2X Stack Simulation License SAE V2X standard - 10 instances	Mandatory
Software for OmniAir RF Radio Conformance test US		
C8702000A	UXM 5G Automation Toolset Application	Mandatory
C870220BA	RFA C-V2X T-0B: RF Transmitter and Receiver Tests for OmniAir	Mandatory
C87320R1A	C-V2X UL RF measurement	Mandatory
C8700200A	UXM test application framework	Mandatory
C8732114A	C-V2X Rel14 - PC5 signaling	Mandatory
AV3001USA	WaveBee V2X Stack Simulation License SAE V2X standard - 10 instances	Mandatory
Software for C-V2X 3GPP PHY conformance testing		
S8705A [1]	Cellular radio conformance testing	Contact NES team
S8704A [1]	Protocol conformance testing	Contact NES team

1. For the 3GPP PHY conformance testing, please contact the NES product management team for the latest configuration and updates.

V2X HiL Test Configuration

Model#	Description	Notes
Hardware		
E7515B	UXM 5G wireless test platform (R81/SA1/SB1/PA1/PB1/PC1/PD1/506/AC3)	Mandatory (choose one based on the request)
AV1000A[5]	WaveBee Hive – V2X HiL Test System	
AV1001A[5]	WaveBee Hive Extended – V2X HiL Test System	
N5172B	EXG X-Series RF vector signal generator (503/656/660, optional-009/403, N7609EMBC)	Mandatory (choose one, GSG7 has region limits, please confirm with AES before booking)
N5182B	MXG X-Series RF vector signal generator (503/656/660, optional-009/1EQ/403/UNX, N7609EMBC)	
C8808B	GSG-7 Advanced GNSS Simulator (001/C8808GP1A/C8808002A/C8808000A)	
Software platform		
AD1050B	ADE Basic Bench Software License	Mandatory
AV2002B	V2X HiL WaveBee Hive Software Platform	Mandatory if choose AV1000A or AV1001A
AV2003B	V2X HiL UXM Software Installation Platform	Mandatory if choose UXM
C8700200A	UXM test application framework	
C8732114A	C-V2X Rel14 - PC5 signaling	
Software – ITS Applications		
AV3001EUA	WaveBee V2X Stack Simulation License ETSI V2X standard - 10 instances	Mandatory (choose at least one)
AV3001CNA	WaveBee V2X Stack Simulation License C-SAE V2X standard - 10 instances	
AV3001USA	WaveBee V2X Stack Simulation License SAE V2X standard - 10 instances	
AV3002EUA	WaveBee V2X Stack Simulation License ETSI V2X standard - 50 instances	
AV3002CNA	WaveBee V2X Stack Simulation License C-SAE V2X standard - 50 instances	
AV3002USA	WaveBee V2X Stack Simulation License SAE V2X standard - 50 instances	
AV3004EUA	WaveBee Touch Software License ETSI V2X standard	Mandatory (choose at least one)
AV3004CNA	WaveBee Touch Software License C-SAE V2X standard	
AV3004USA	WaveBee Touch Software License SAE V2X standard	
AV3003EUA	WaveBee Creator Software License ETSI V2X standard	Optional [1] (choose at least one)
AV3003CNA	WaveBee Creator Software License C-SAE V2X standard	

AV3003USA	WaveBee Creator Software License SAE V2X standard	
AV3005EUA	V2X Day 1 Use Cases ETSI V2X standard for WaveBee Creator	Optional (choose at least one)
AV3005CNA	V2X Day 1 Use Cases C-SAE V2X standard for WaveBee Creator	
AV3005USA	V2X Day 1 Use Cases SAE V2X standard for WaveBee Creator	
AD1058B	Traffic Scenario & Vehicle Dynamics Simulation Integration Software	Optional [2]
AD1079B	Hardware-in-the-Loop HiL System Integration Software	Optional [3]
KS8400B	PathWave Test Automation (TAP)	Highly recommend for UXM

1. WaveBee Creator is optional if the customer uses their own scenario simulator. In this case, AD1058B is required to provide plug-ins for third-party scenario simulators.
2. AD1058B is required for integration with third-party Traffic Scenario and Vehicle Dynamics Simulation Software. Currently supported platforms include: IPG Carmaker, AVSimulation SCANeR, Siemens Simcenter Prescan, dSPACE Aurelion, VTD, and Alternative 3D modeling software.
3. AD1079B is required to provide integration plug-ins for real-time Hardware-in-the-Loop (HiL) systems. Supported platforms include: Vector CANOE HiL, dSpace HiL, NI Veristand HiL, IPG XPack4 HiL, CarSim HiL, and Alternative HiL system integration.
4. For additional third-party system integration requirements, please contact your local Business Development representative for a custom solution.
5. AV1000A supports 10 V2X instances in hardware, AV1001A can max support 50 V2X instances in hardware; currently, both of them only support GSG7/8 as the GNSS generators. If requesting other systems, please contact the local BD for confirmation

V2X Field Test Systems Configurations

Model#	Description	Notes
WaveBee Touch A version		
AV1021A*	WaveBee Touch - Mobile V2X Analysis and Validation System	Mandatory hardware
AV2001CNA	WaveBee Touch CN (C-SAE)	Mandatory (at least choose one)
AV2001EUA	WaveBee Touch EU (ETSI)	
AV2001USA	WaveBee Touch US (SAE)	
WaveBee Touch B version (not ready for SHP)		
AV1021B*	WaveBee Touch B - Mobile V2X Analysis and Validation System	Mandatory hardware
AV2031CNA	WaveBee Touch B version CN (C-SAE)	Mandatory (at least choose one)
AV2031EUA	WaveBee Touch B Version EU (ETSI)	
AV2031USA	WaveBee Touch B Version US (SAE)	
WaveBee Togo A Version		
AV1024A*	WaveBee Togo - Mobile V2X Simulator	Mandatory hardware
AV2004CNA	WaveBee Togo Configuration CN (C-SAE)	Mandatory (at least choose one)
AV2004EUA	WaveBee Togo Configuration EU (ETSI)	
AV2004USA	WaveBee Togo Configuration US (SAE)	
WaveBee Togo B Version		
AV1024B*	WaveBee Togo B - Mobile V2X Simulator	Mandatory hardware

AV2029CNA	WaveBee Togo B Version Configuration CN (C-SAE)	Mandatory (at least choose one)
AV2029EUA	WaveBee Togo B Version Configuration EU (ETSI)	
AV2029USA	WaveBee Togo B Version Configuration US (SAE)	
WaveBee Creator Standalone Software		
AV1025AS	WaveBee Creator Software - V2X Test Scenario Editor	Mandatory software
AV3003EUA	WaveBee Creator Software License ETSI V2X standard	Mandatory (at least choose one)
AV3003CNA	WaveBee Creator Software License C-SAE V2X standard	
AV3003USA	WaveBee Creator Software License SAE V2X standard	
WaveBee Plus		
AV1022A	WaveBee Plus - V2X Development and Streaming Platform	Mandatory hardware
AV2002CNA	WaveBee Plus Configuration CN (C-SAE)	Mandatory (at least choose one)
AV2002EUA	WaveBee Plus Configuration EU (ETSI)	
AV2002USA	WaveBee Plus Configuration US (SAE)	
WaveBee Road		
AV1023A	WaveBee Road - V2X Roadside Unit	Mandatory hardware
AV2003CNA	WaveBee Road Configuration CN (C-SAE)	Mandatory (at least choose one)
AV2003EUA	WaveBee Road Configuration EU (ETSI)	
AV2003USA	WaveBee Road Configuration US (SAE)	

* AV1021A and AV1024A can only be shipped to the EU, UK, AUS/NZL, US, and Canada. All other countries, please choose AV1021B and AV1024B.

SDV-V2X Customized [1] Solution Configuration

Model#	Description	Notes
Custom Hardware		
AV1599A	Software-Defined-Vehicles Custom Hardware Solution	Optional and set up sub-items per request
Custom Software		
AV1598xxx	Software-Defined-Vehicles Custom Hardware Solution	Optional and set up sub-items per request
Custom Service		
AV1597A	Custom Service for Customized Solutions	Optional and set up sub-items per request
Custom Support		
AV1596A	Custom Support for Customized Solutions	Optional and set up sub-items per request

1. For customized items, please reach out to the AES Solution Center for a quotation.

Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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