

**DON'T GET
KNOCKED BACK
IN THE FIELD**



QPER-C2X – The HiL Test System for Car-2-Car Communication

- Emulates signal strength
- Models radio channels
- Reproduces drive tests



Test Automation - Less Effort, Better Results

www.qosmotec.com/car2x



GET CAR-2-X COMMUNICATION OUT OF THE TRANSITION ZONE

Speed up C2X communication's transition from research & development to deployment. Replace drive tests by a time and money saving testing process which ensures reproducibility of the received results.

QPER-C2X reproduces traffic scenarios in a test lab and simulates Car-to-Car and Car-to-Infrastructure communication under realistic field conditions. This extends HiL test benches by the control of the air interface.

The channel emulation is not limited to a specific radio technology: No matter whether communication is based on 3G, 4G or ITS-G5 – QPER-C2X implements real-life signal propagation models for each transmission or broadcasting technology on any frequency.

Reduce test periods, cut down costs and gain quality!

CONVINCING IN ACTION



TERMINAL BENCHMARKING AND INTEROPERABILITY TESTING

Compare sender and receiver characteristics, sensitivity and stability of terminals of several manufacturers.
Successfully employed at ETSI plugtests for ITS-G5 radio modules and terminals.



INTEGRATION TESTING – VALIDATION OF ANTENNA SYSTEMS

Test coverage, range and transmission properties of antenna systems as well as vehicle dependent propagation patterns. Find the perfect mounting position for every car model.



FUNCTIONAL TESTING – MESSAGE TRANSMISSION

Check signal transmission between ITS terminals depending on traffic situations. Detect packet errors and delays in the message flow.



LOAD TESTING – CONGESTION CONTROL

Emulate overload situations, for example during road congestions or big events.



IMMUNITY TO NOISE AND INTERFERENCE

Noise and interferences can collapse every communication network. Check how system components cope with noise and interference – from ITS-G5 or other disturbing sources, e.g. WiFi or LTE.



RECONSTRUCTION OF ROAD MEASUREMENTS

Use our software to design extensive traffic situations and simulate them in the lab. This allows for the easy and efficient reproduction of problematic situations. Store the created scenarios in a database and replay them as often as required.



TEST BENCH INTEGRATION

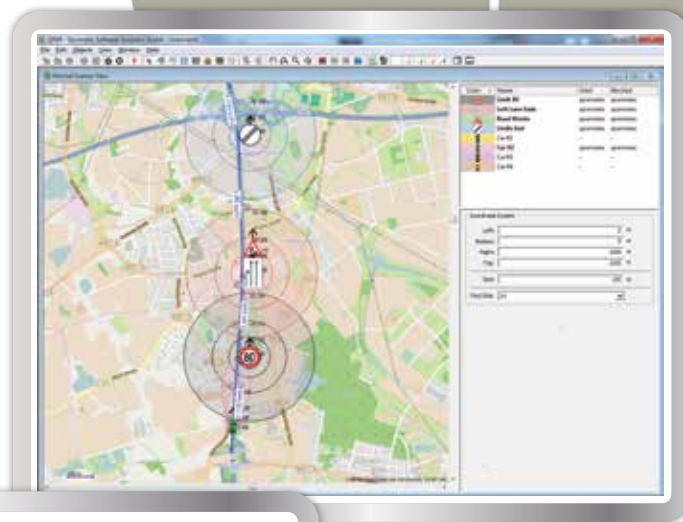
An open system architecture allows the integration of our emulator into other system environments and HiL test benches. It can be adapted to other traffic simulators or combined with drive test solutions.

QPER-C2X – TECHNICAL FEATURES

On a Car-to-X test bench, ITS stations transmit their messages via coaxial cables. Each radio station is kept in its own shielding box to prevent unwanted communication links over the air.

QPER-C2X simulates the air interface conditions between each pair of ITS stations in the test bench. Thus, it provides for propagation conditions on the radio links that are comparable to the channel conditions occurring in the field, caused by the distance between the cars, by their mobility and by signal reflexions in the environment.

Testers, who are working with QPER-C2X, do not need to be radio experts to run a simulation. They simply draw traffic scenarios with vehicles and roadside-infrastructure components. The application computes and emulates the conditions on an attenuator rack.



By varying channel conditions dynamically, testers can assess the value of Car-to-X communication for the driver: They see the direct impact of traffic situations on the radio transmission on the network layer (packet error rates) as well as on the application layer (user data like CAMs or DENMs).



SIGNAL PROPAGATION MODELS ARE BASED ON:

- Standard propagation models (free-space path loss, two-way propagation)
- Antenna gains and shapes
- Multi-antenna systems (MIMO)
- Slow fading models
- Fast fading models (Rayleigh fading, Rice fading)
- Urban, rural and highway V2V propagation models
- Models for urban intersections



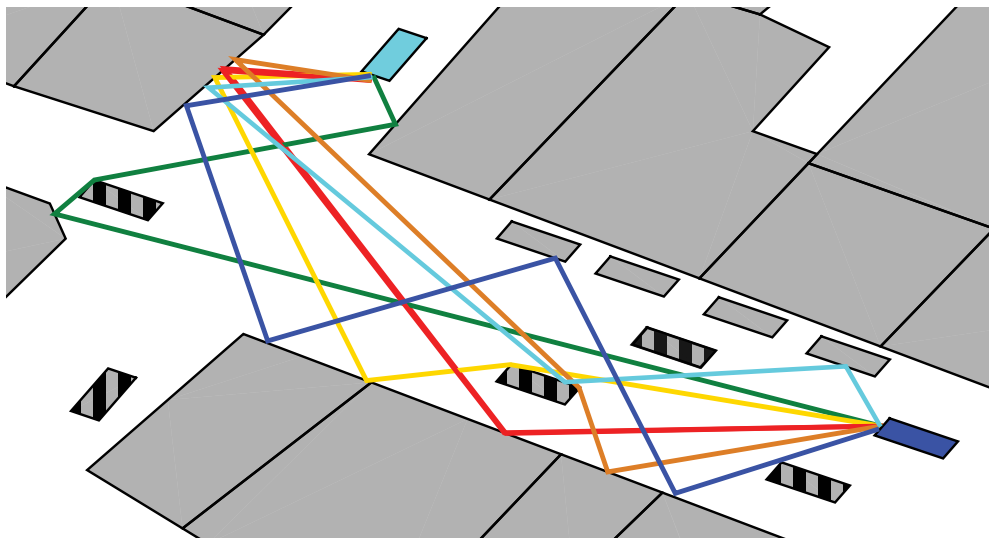
TYPICAL ENVIRONMENTS WITH LINE-OF-SIGHT (LOS) AND NON-LOS CONDITIONS:

- Rural LOS
- Urban Approaching LOS
- Urban Following NLOS
- Urban Crossing NLOS
- Highway LOS
- Highway NLOS



ACCURATE PREDICTION OF SIGNAL PROPAGATION IN REAL URBAN ENVIRONMENTS, CONSIDERING:

- Buildings
- Parking cars
- Road traffic
- Road signs





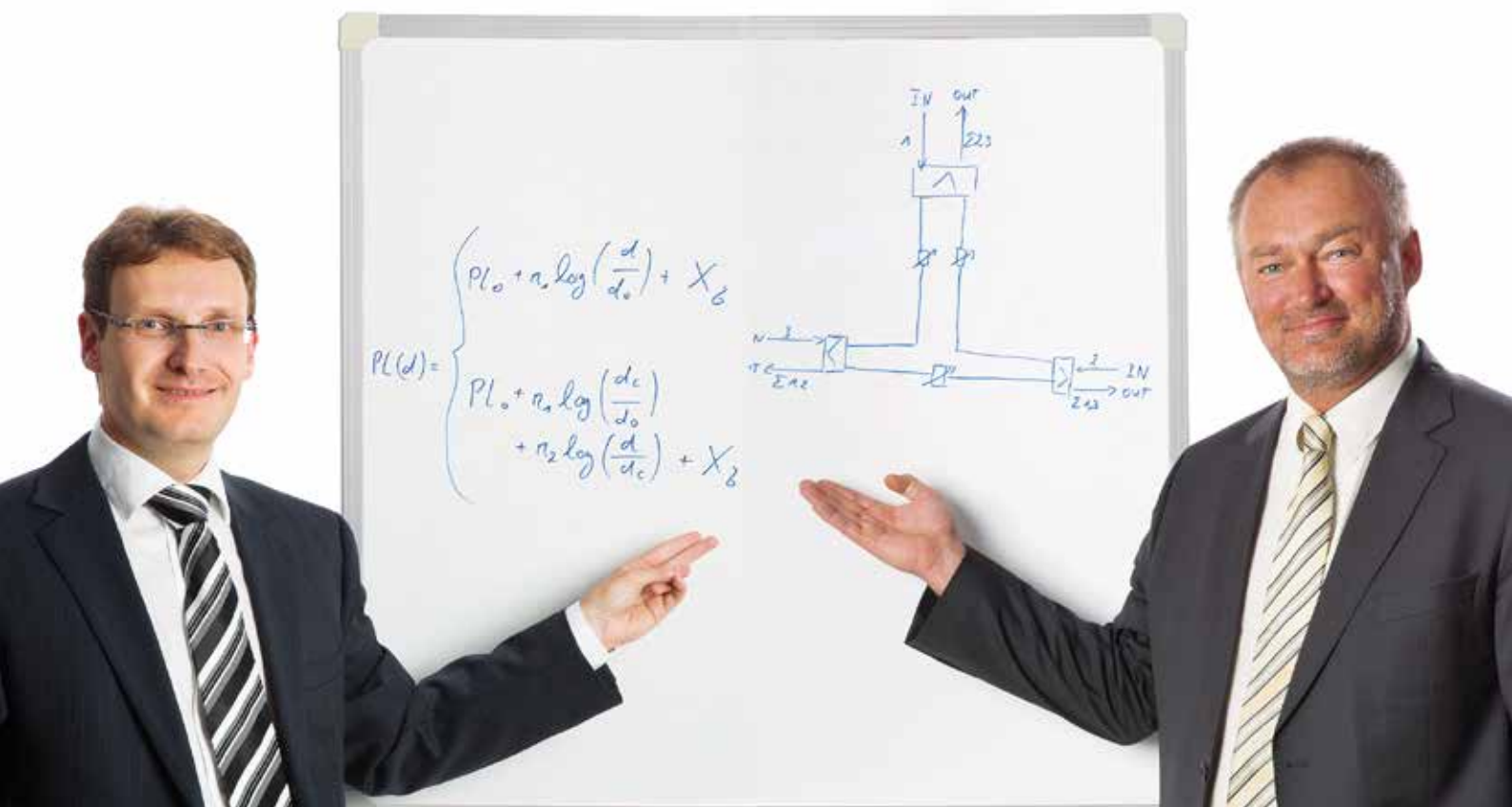
FIND THE RIGHT STRATEGY FOR SUCCESS

No leaflet can provide a comprehensive description of high-technology equipment. That's what we are for! We would be pleased to explain and demonstrate the full functional range of QPER-C2X – how to work with it, and what results can be achieved.

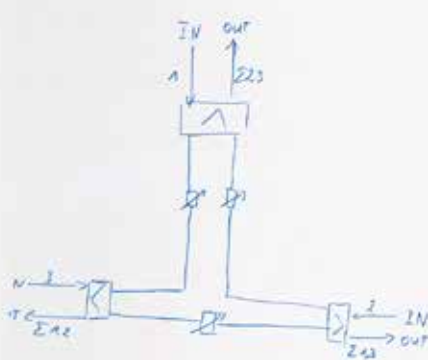
Developing QPER-C2X is an ongoing process. During the course of a few months new features will be added – including enhancements based on customer feedback. All this is discussed best in a personal meeting.

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$$PL(d) = \begin{cases} PL_0 + n_s \log\left(\frac{d}{d_0}\right) + X_G \\ PL_0 + n_s \log\left(\frac{d_c}{d_0}\right) \\ \quad + n_2 \log\left(\frac{d}{d_c}\right) + X_2 \end{cases}$$



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