COMPRION

COMPRION Design Validation

Solution for Visualizing and Analyzing NFC Operating Volumes

Measurement and Analysis of Contactless Interfaces with Design Validation Center

The increasing availability of day-to-day applications that are based on contactless communication technologies like NFC requires the transmitters and receivers to be integrated into vast numbers of devices and objects. However, acceptance of contactless applications stands or falls with availability of robust and reliable connections between the individual components. Consequently, there is a growing demand for suitable development and analysis tools that help to design the required transmission and reception units, like antennas, in such a way that they defy the odds of everyday business.

Target Groups

COMPRION has developed Design Validation Center exactly for this purpose. It targets companies that are in charge of integrating readers or antennas into their products like:

- NFC chip manufacturers
- Smartphone manufacturers
- Manufacturers of household appliances

These companies typically serve among others the mobile payments, public transport, and automotive industries.

Practically every contactless communication in the field suffers from interferences. That's why Design Validation Center offers tools exactly for the purpose of measuring and analyzing these interferences. It offers straightforward visualization that enables the user to derive hints for necessary improvements and integrate them into the product design.

Use Case Design Validation

The magnetic field strength is the decisive physical quantity of contactless communication. Weaknesses of the field in the application's defined reading range can cause unreliable data transmission. Such weaknesses of the NFC field are identified by Design Validation Center. Together with the connected hardware (CL Verify A and CL Quantify, see Info Box) and the Vector Field Probe (3D antenna) the magnetic field strength and the direction of the magnetic field are measured. The measured values are analyzed and visualized in an easily comprehensible way. These field measurement-based capabilities are just one part of the range of analysis options:

- Loaded field measurement
- Vector field measurement
- Field strength response (ISO/IEC 10373-6)
- Reader sensitivity examination
- Reader wakeup examination

The following example of a 3D vector field scan shows the advantages of design validation with COMPRION. This measurement series has the goal of visualizing the distribution of the field strength and its direction in space that informs the developer about the quality and quantity of the reading range (in other words: the operating volume).

CL Verify A & CL Quantify

- NFC field measurement devices
- Trace tools for contactless communication
- Simulation of contactless cards, readers, and tags
- Standards covered: NFC Forum, EMVCo, ISO/IEC 14443
- Integrated oscilloscope

Prepared for NFC Forum, EMVCO, and ISO 10373-6 pre-conformance testing with COMPRION Device Test Center

Setup for the 3D Vector Field Scan

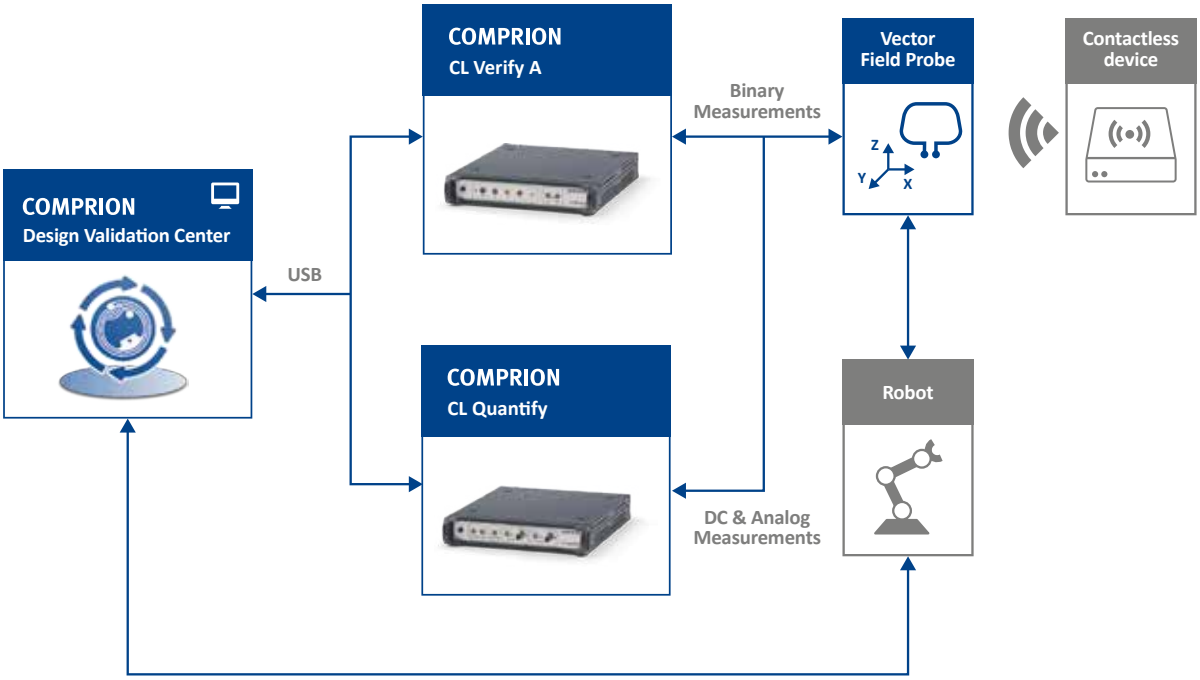


Figure 1: Setup for 3D vector field scan with Design Validation Center installed on host PC, CL Verify A, CL Quantify, and Vector Field Probe

The Vector Field Probe is an antenna designed by COMPRION that detects all three directions in space at right angles. Consequently, one single measurement position is sufficient to determine size and direction of the vector.

The Vector Field Probe is connected to CL Verify A and CL Quantify, two calibrated measurement instruments that actually acquire the measurement values. CL Verify A additionally monitors NFC communication.

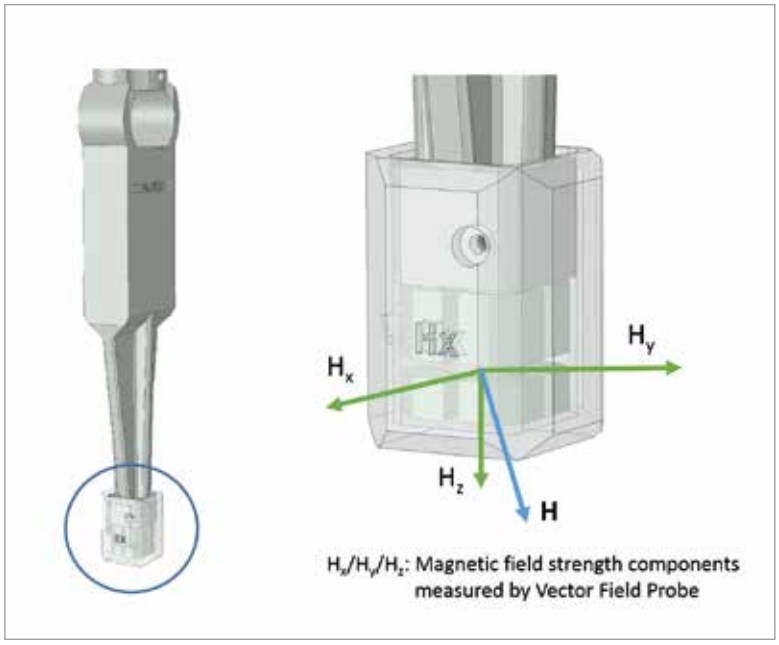


Figure 2: Measurement of magnetic field vector H with Vector Field Probe

Measurement Volume Designer

The space in which the magnetic field is measured is called measurement volume. Design Validation Center provides a Measurement Volume Designer which is dedicated especially for the customized design of a measurement volume. From the individual requirements regarding form and dimensions of a suitable measurement volume plus the desired number of measurement positions, it generates an even distribution of measurement positions within the measurement volume.

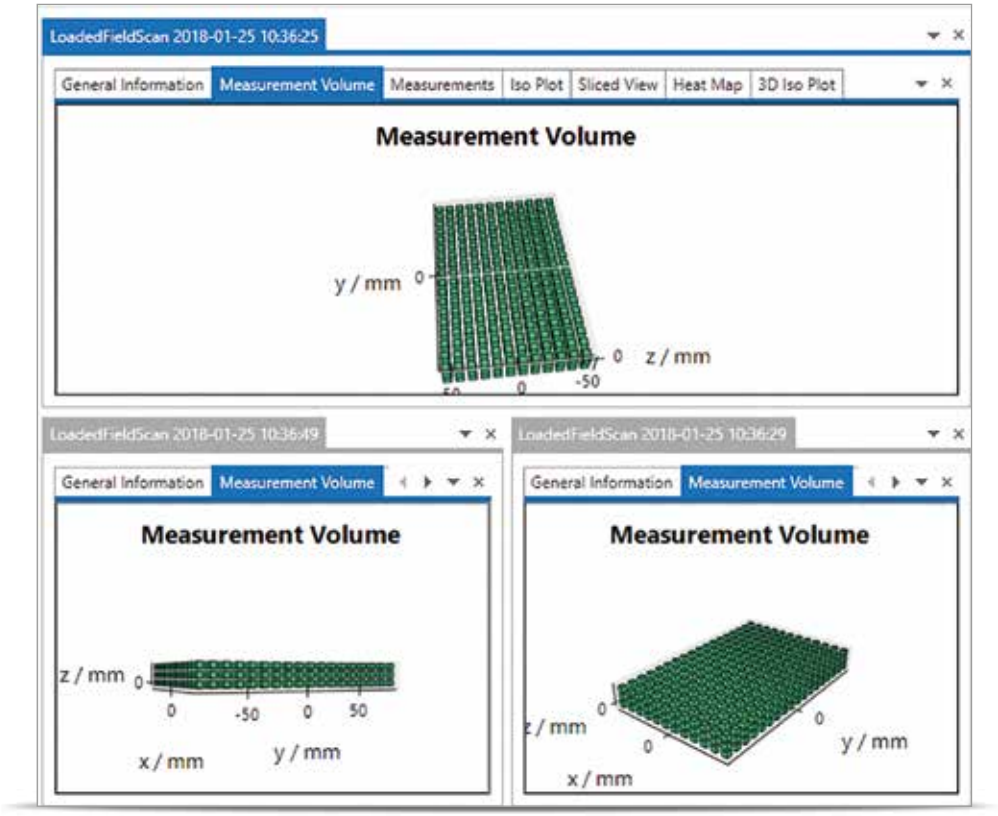


Figure 3: Measurement Volume Designer

We strongly recommend to use an industrial robot arm to ensure the necessary positioning and repetition accuracy. The robot is also controlled by the Design Validation Center software (see Figure 1).

Design Validation Center comes with a sample program for a 4-axes robot, thus facilitating the integration of the robot.

Figure 4: Setup with robot for automated measurements

Visualization of Measurement Results

When all positions of the measurement volume have been approached and measured, Design Validation Center offers various visualizations of the magnetic field.

For example, if you want to optimize the integration of an NFC antenna into a car's door handle, then the absolute values of the magnetic field strength on all measurement levels can be visualized in 2D or 3D to improve the design further (see Figure 5).

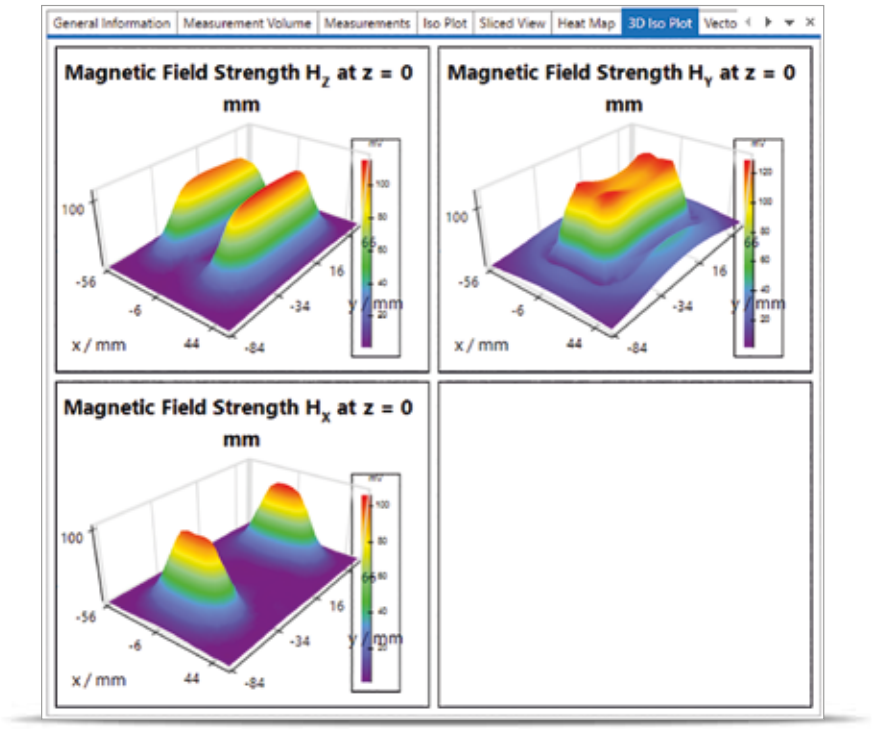
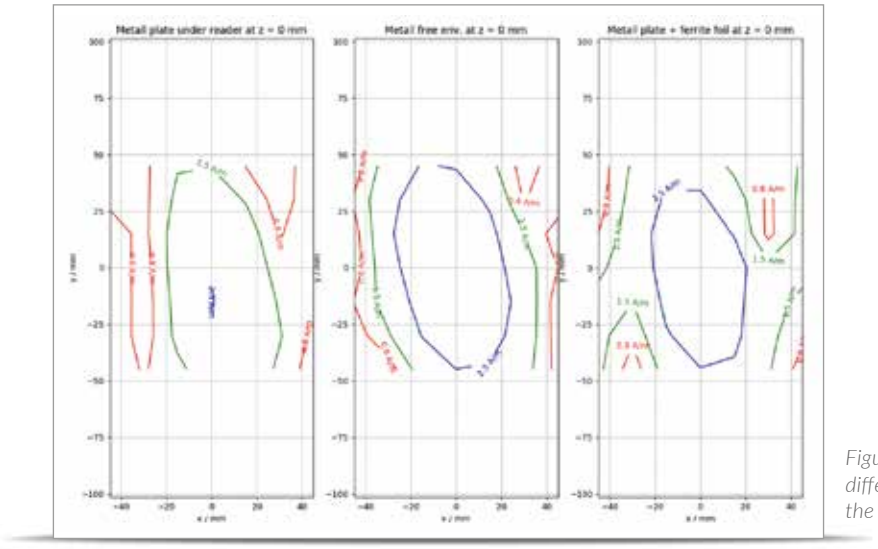


Figure 5: 3D Iso Plot



It is much easier and quicker to identify improvement measures before and after the modification by visual comparison of measurement results than by comparing tables of measurement values (see Figure 6).

Figure 6: Resulting field strength when using different materials in direct neighborhood of the measured object

However, the key feature of measuring with the Vector Field Probe is identifying the direction of the field, not only the value of the magnetic field strength. This makes it possible to visualize the field characteristics in 3D. For example, stray magnetic fields and antenna defects can be identified much quicker).

Quick NFC Signal Analysis with Integrated NFC Oscilloscope

For developing an NFC interface and for troubleshooting, it is equally important to analyze the analog signals as the above-mentioned optimal dimensioning of the magnetic field. The NFC oscilloscope integrated in Design Validation Center combines the features of a digital oscilloscope with that of a measurement instrument designed according to NFC, EMVCo, and ISO standards. This includes comprehensive analysis tools, like for example, envelope calculation, timing, amplitude and frequency analysis.

The necessary parameterization of the recording triggers (see Figure 7) through to the selection of the parameters to be measured requires only a few clicks in the Design Validation Center GUI.

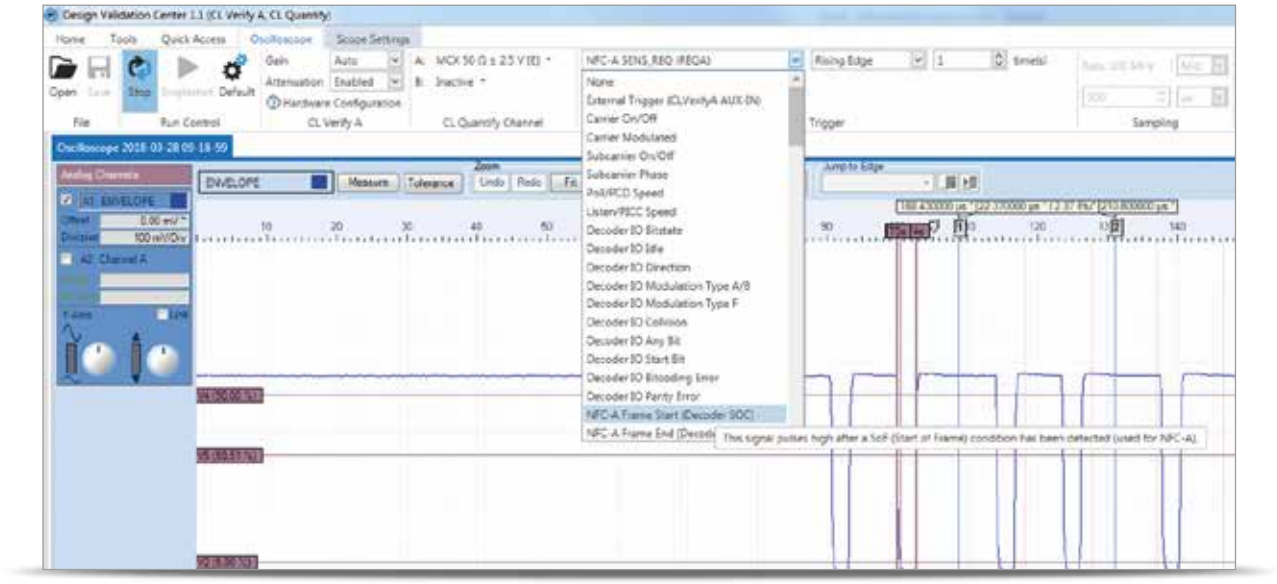


Figure 7: Convenient trigger selection provided by the integrated NFC oscilloscope

Benefits

With Design Validation Center and the measuring instruments CL Verify A und CL Quantify, COMPRION offers a universal and singular measurement solution for analyzing and visualizing NFC fields.
This solution enables fast and timely analyses of antenna geometries and interferences at the installation location, thus allowing for optimization already in the design phase.

Key Features

- Various 2D and 3D visualizations of the magnetic field strength
- Visualization of the direction of the magnetic vector field
- Analysis of contactless reader performance (e.g. sensitivity)

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