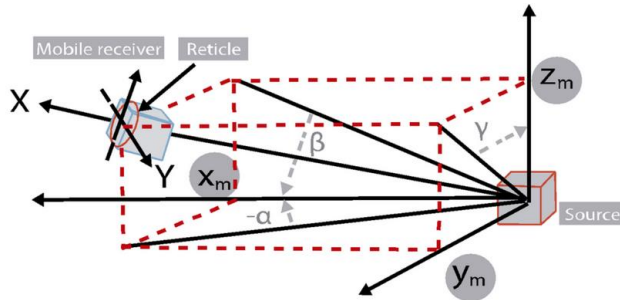


Evolution of motion tracking with 3D coils sensors



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Booth 13



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Het ontwerpen van
innovatieve elektronica

Woensdag 20 maart 2024
1931 Congressentrum 's-Hertogenbosch

Introduction



- Specialized component distributor serving machine- & equipment manufacturers

Power - EMC - Energy - Housing - Connectivity - Auto-ID - Thermal management - LED



- Specialized distributor in EMC shielding and T&M equipment

Conductive compounds – EMC components – Shielding materials – Thermal interfacing – EMC chambers – T&M equipment



Introduction



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Introduction



- Design & production of specialized magnetics

Mobility Access & Security Systems
E-Mobility Power Magnetics
Advanced Passive Components

- HQ Spain, > 1300 employees, founded in 1962

Production: Morocco, China, Vietnam
R&D: Spain, France, China, Vietnam, Korea, India
Sales: Spain, USA, Germany, France, China, Vietnam, Korea, India

- ISO9001 / ISO14001 / IATF1694

- > 70 patents



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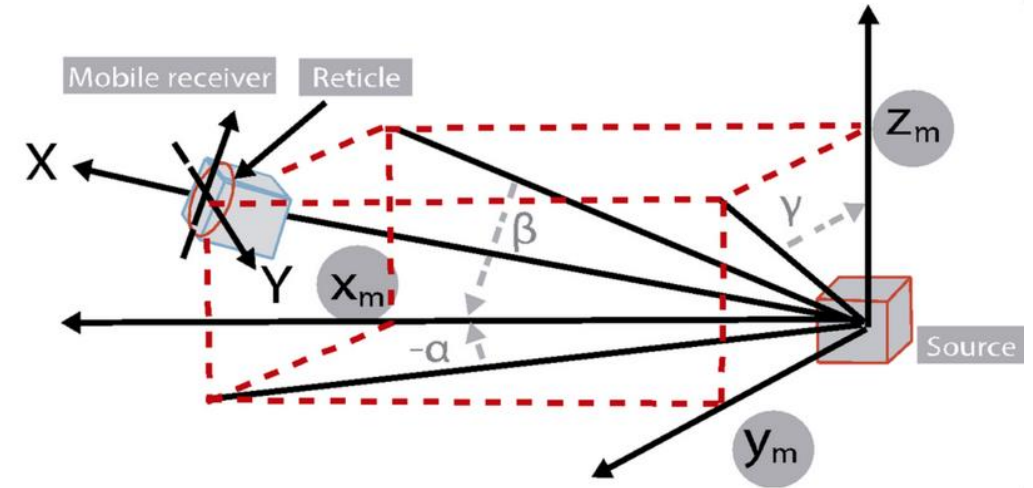
Content Evolution of motion tracking with 3D coils sensors

- Tracking Systems
- Emitter Coils
- Sensor Coils
- EM Tracking System
- Q&A



Tracking Systems

Tracking or motion tracking can be defined as the process aiming to capture, follow and get information about an object's orientation and position, to be transferred to an application for further processing



Classified as 3DoF or 6DoF according degree of freedom:

- **3DoF:** Rotational tracking (Roll, Pitch, Yaw)
- **6DoF:** Rotational and position tracking (Roll, Pitch, Yaw, x, y, z)



Tracking Systems Degrees of Freedom

3DoF



6DoF



Example of 3DoF:

Headsets that follow movement of the head in immersive VR applications

Example of 6DoF:

Handhelds and videogame controls in immersive VR applications



Tracking Systems

Tracking system technologies:

- Optical
- Mechanical
- Electromagnetic
- Inertial



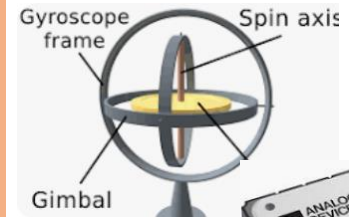
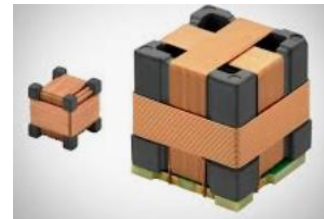
Applications:

- Gaming
- Education
- Industry (training)
- Medical (diagnosis and surgery)

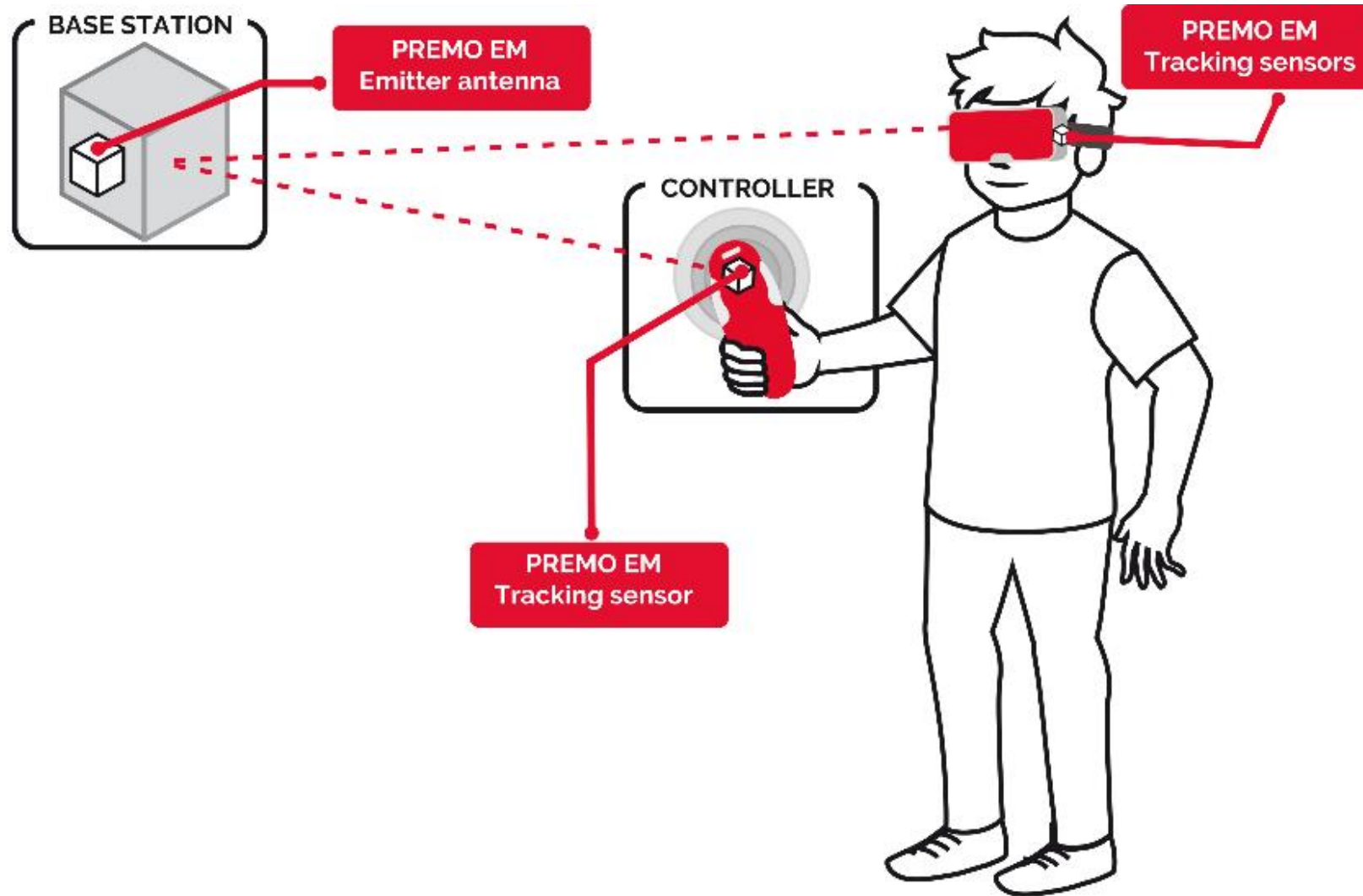


Tracking Systems Comparing Tracking Technology

	Avantages	Disadvantages
Optical	<ul style="list-style-type: none"> • Precision < 1mm • Wireless 	<ul style="list-style-type: none"> • Position only • Line of Sight needed (Occlusions) • Post-processing latency
Electromagnetic	<ul style="list-style-type: none"> • Portable • Wireless • Reduced latency (real-time) • Flexible sensor arrangement 	<ul style="list-style-type: none"> • Limited range • No reference position • Magnetic disturbances
Mechanical	<ul style="list-style-type: none"> • Portable • Wireless • Robust 	<ul style="list-style-type: none"> • Restrictive movement • No reference position • Relative orientation only
Inertial	<ul style="list-style-type: none"> • Accelerations • Precision < a degree • Portable • Wireless • Fast calibration 	<ul style="list-style-type: none"> • No reference position • Post-processing latency • Drift (accumulative error) • Noise • Magnetic disturbances



Tracking Systems Premo Electromagnetic



Tracking Systems What is a 3D-Coil?

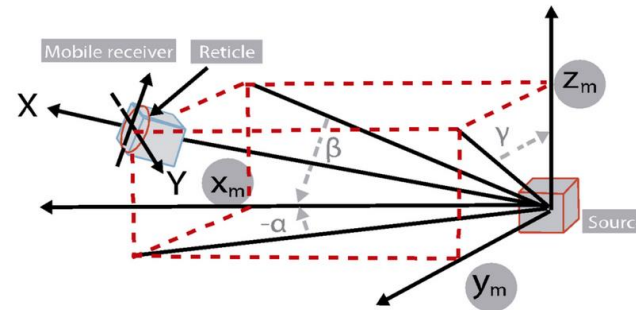


Sensor Coils How it works

Sensor coils in EM motion tracking are 3D coils (three orthogonal coils), over same ferromagnetic core



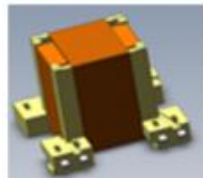
3DCC08



Core SMT High Precision base



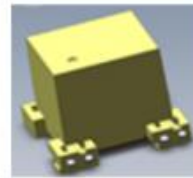
X winding Pitch Sensor Coil



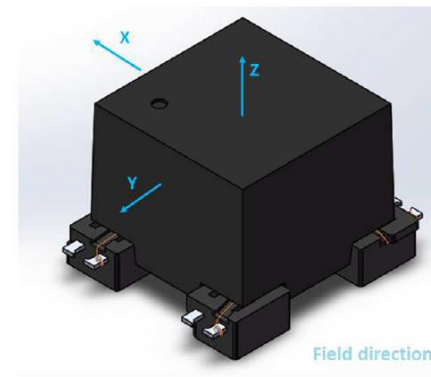
Y Winding Yaw Sensor Coil



Z Winding Roll Sensor Coil



SMT Receiver 3DCoilCube



Mobile receiver (sensor coil)
Orthogonal coordination system



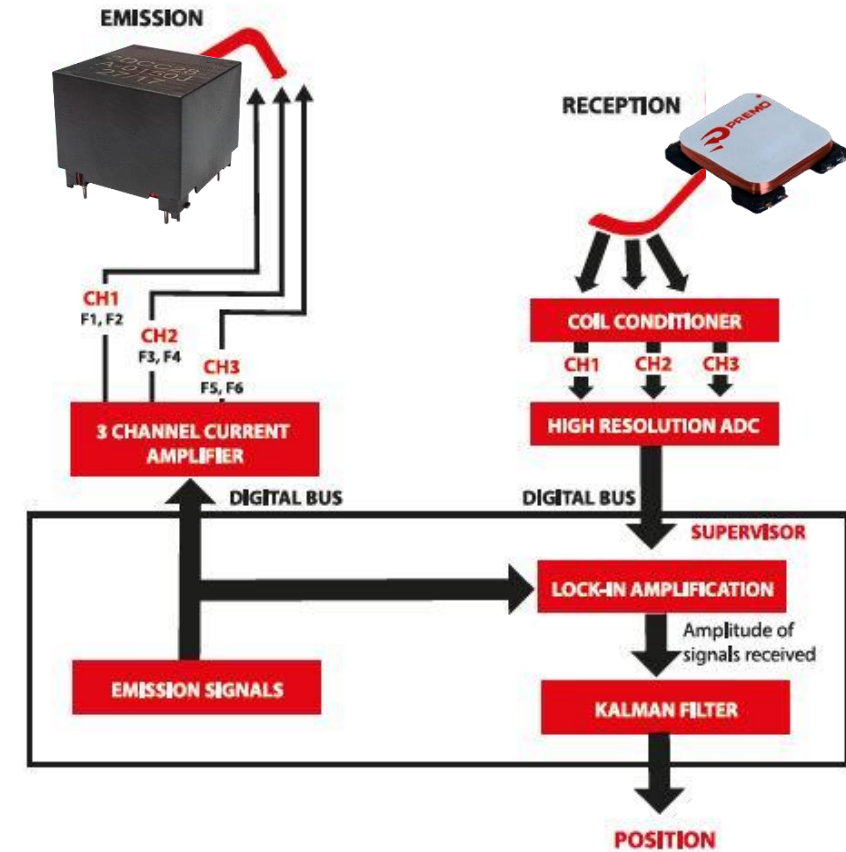
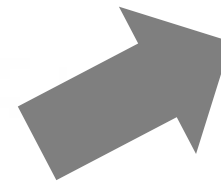
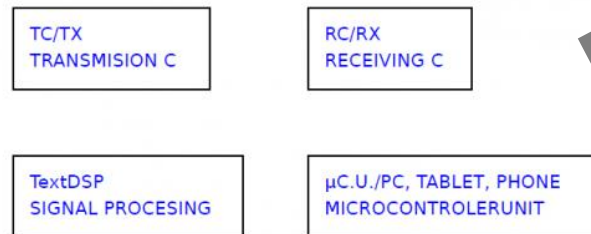
Manufacturing process to create three orthogonal coils

Tracking Systems

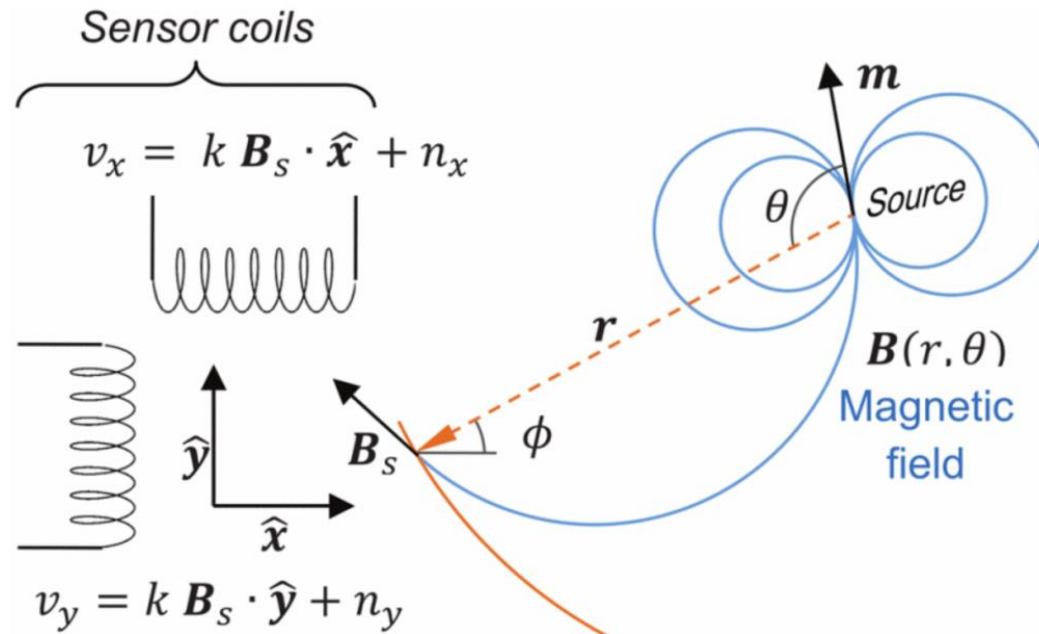
Modules of tracking systems

EM tracking systems, functional modules:

- Tx Circuit
- Rx Circuit
- DSP (Digital Signal Processing)
- MCU (Micro-Controller Unit) based on PC or Smart Device



Tracking Systems How it works?



(Third axis (Z) of 3D coil sensor not shown)

Faraday's law:

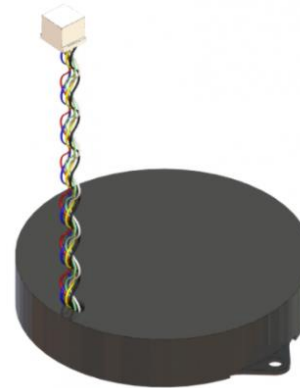
When the receiver sensor moves inside an alternating AC magnetic field (B), a voltage proportional to the vector of cross product of the cross section winding area and the intensity of the magnetic field, is induced in every winding and generates N times the total voltage across the coils (N = number of turns of the winding)



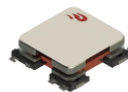
Tracking Systems Comparing Tracking Technology

Technology	Cost	Latency	Precision	Range	LoS (Line of sight)
3Dcoilcube (EM)	++	++	+++	++	+++
Inertial Measurement Units (IMU)		-		+	+
Visual / Optical	-		+	+	--

- Emitter coils



- Sensor coils



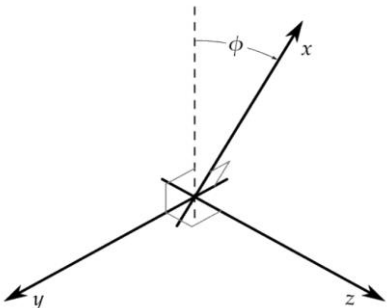
Emitter Coils Geometry parameters

Geometry and isotropy:

- For this model, the magnetic center of the 3D emitter coil should be a single point. If three orthogonal coils/dipoles have different magnetic centers, an error is introduced that should be balanced by computing



- Orthogonality is mandatory because all non-orthogonality of the 3D emitter coil also introduce error that reduces accuracy in positioning



According to emitter power this non-orthogonality can create errors up to 10 mm and 0.5° at 1 meter. Orthogonality should be guaranteed even in larger antennas



Sensor Coils

Low Profile Sensor Coils

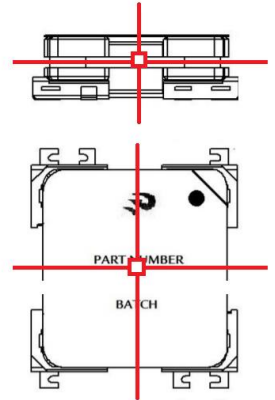
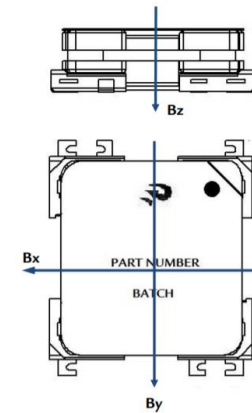
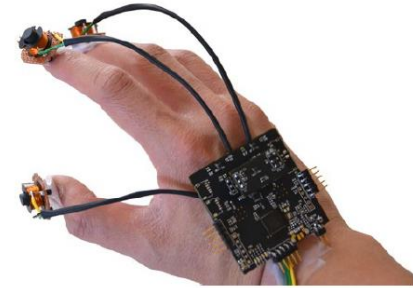
3D coil “Low profile” advantages:

- **Small Size:** allows reduction of size up to 6mm
- **Low profile:** for integration in mobile devices like handheld and smart devices



- **Isotropy:** inductance of Z axis is increased to balance similar sensitivity in three axis, common magnetic and geometric center (< 1mm)

- **Compact size:** three axis components integrated in one, saving space and costs
- **SMT contacts:** available for standard P&P automatic lines
- **Mass production fully automatic:** available for high quantities

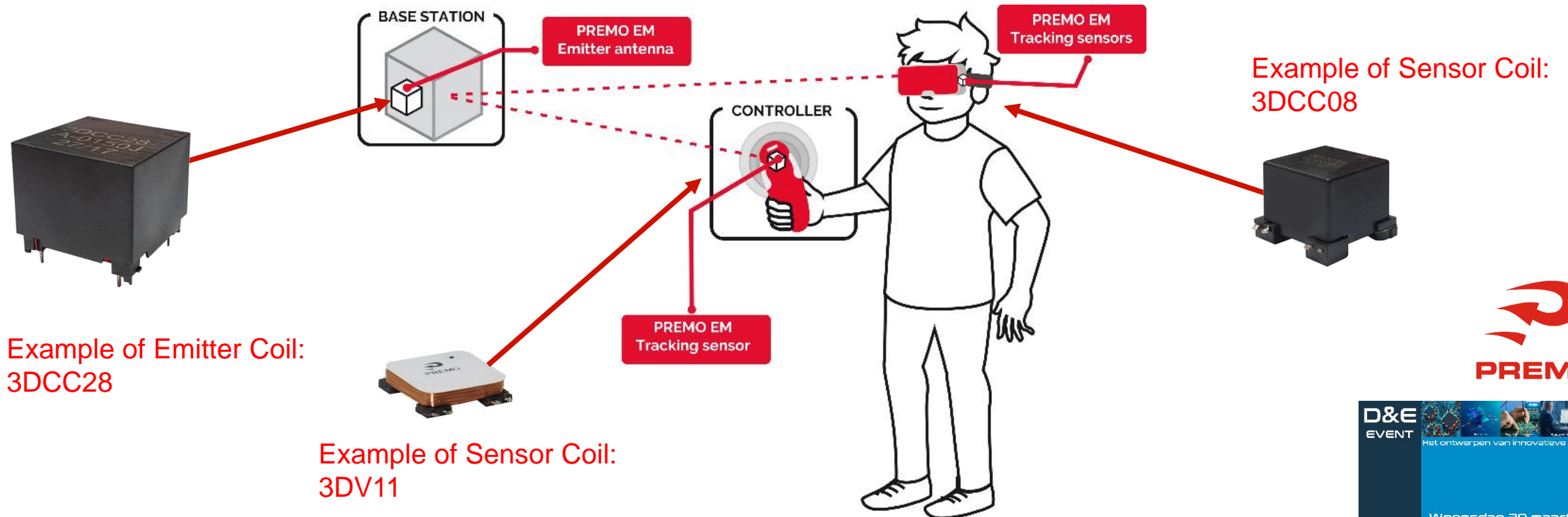


Example:
3DV11-A-S0600J



EM Tracking Systems Example of a complete system

EM Tracking Systems consists of Emitter and Sensor coils:
all 3D coils to allow 6DoF motion tracking



EM Tracking Systems Example of a complete system

AMFITRACK Gen3

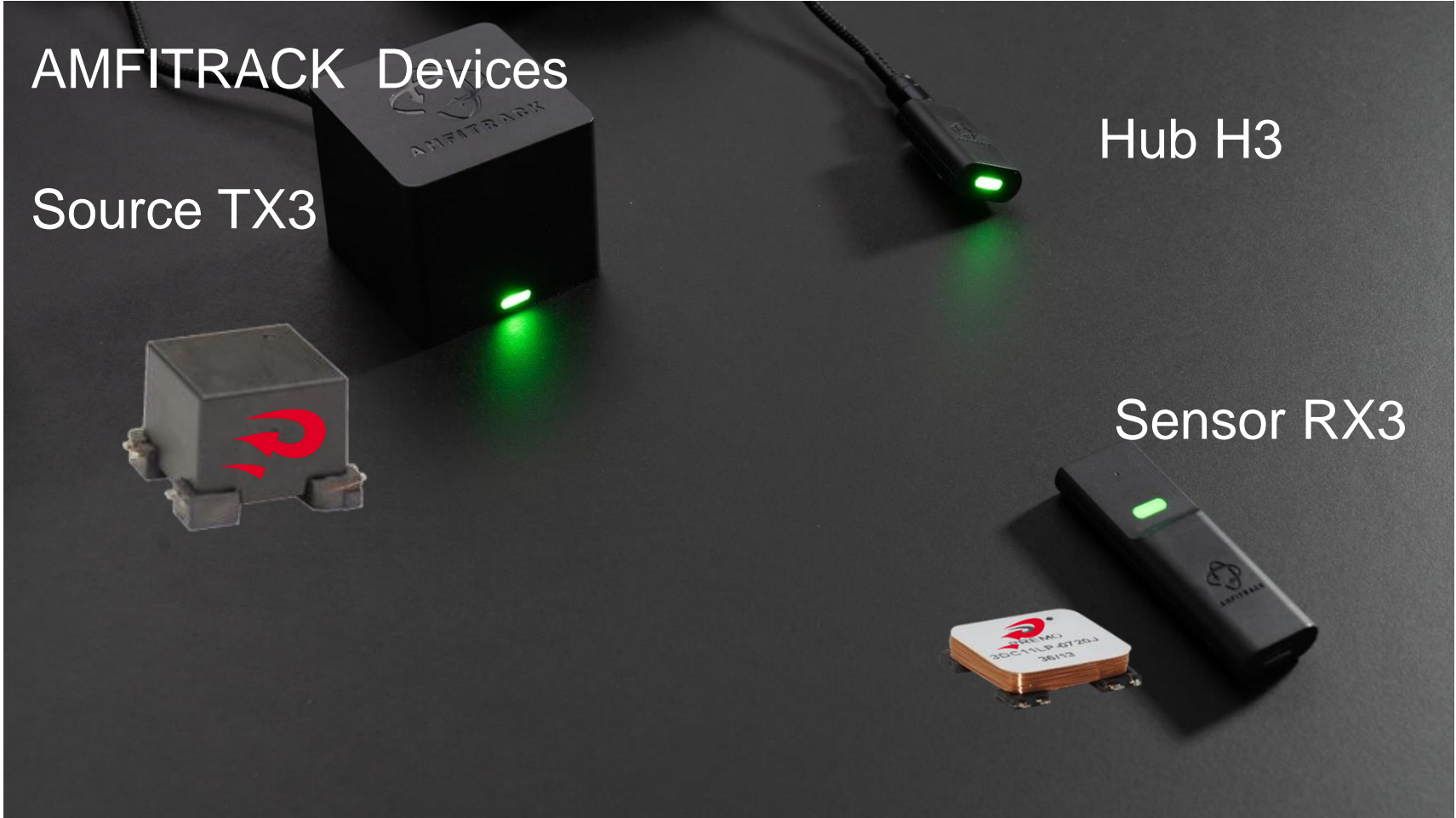


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EM Tracking Systems Example of a complete system



EM Tracking Systems **Example of a complete system**

AMFITRACK Development kit:
boost your innovations!



- 1 pc Gen3 Source Type TX3-28
- 3 pc Gen3 Sensor Type RX3
- 1 pc Gen3 RF-USB Hub Type H3
- 1 pc 5V power supply
- 2 pcs USB-C cables
- 1 pc Dev Kit transportation and storage box
- AMFITRACK™ Windows Viewer application and SDK



QUESTION?



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MOBILITY ACCESS & SECURITY SYSTEMS

- Electronic Modules (HF & UWB solutions)
- Custom Antennas (LF Antennas)
- Keyless Entry System
- TPMS
- NFC
- Custom Coils

Emitter Antennas



3D Coils



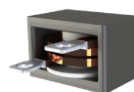
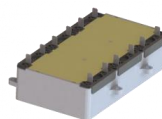
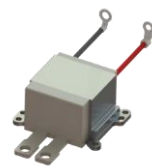
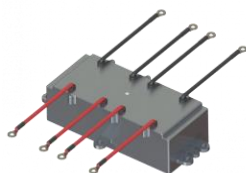
Door Handle Modules



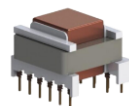
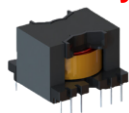
E-MOBILITY POWER MAGNETICS

- Custom Integrated Magnetics
- Custom Power Magnetics
- On-Board Chargers
- DC-DC Converters
- Battery Management Systems
- Inverter
- Thermal System

Power Transformers & Chokes



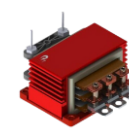
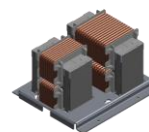
Auxiliary Transformers



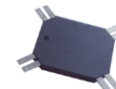
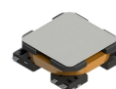
ADVANCED PASSIVE COMPONENTS

- Off-Board Chargers
- Solar Power Inverters
- Medical
- Data & Communications
- Industrial
- Access
- Medical
- RFID

Power Components



RFID Components



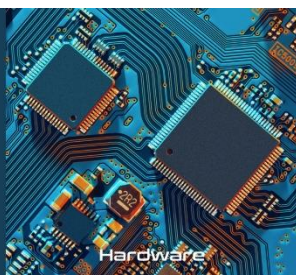
VR/AR Components



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Hardware



Software



Test & Measurement



Engineering



Research & Development

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