

# NFC ANTENNA SELF-CALIBRATION

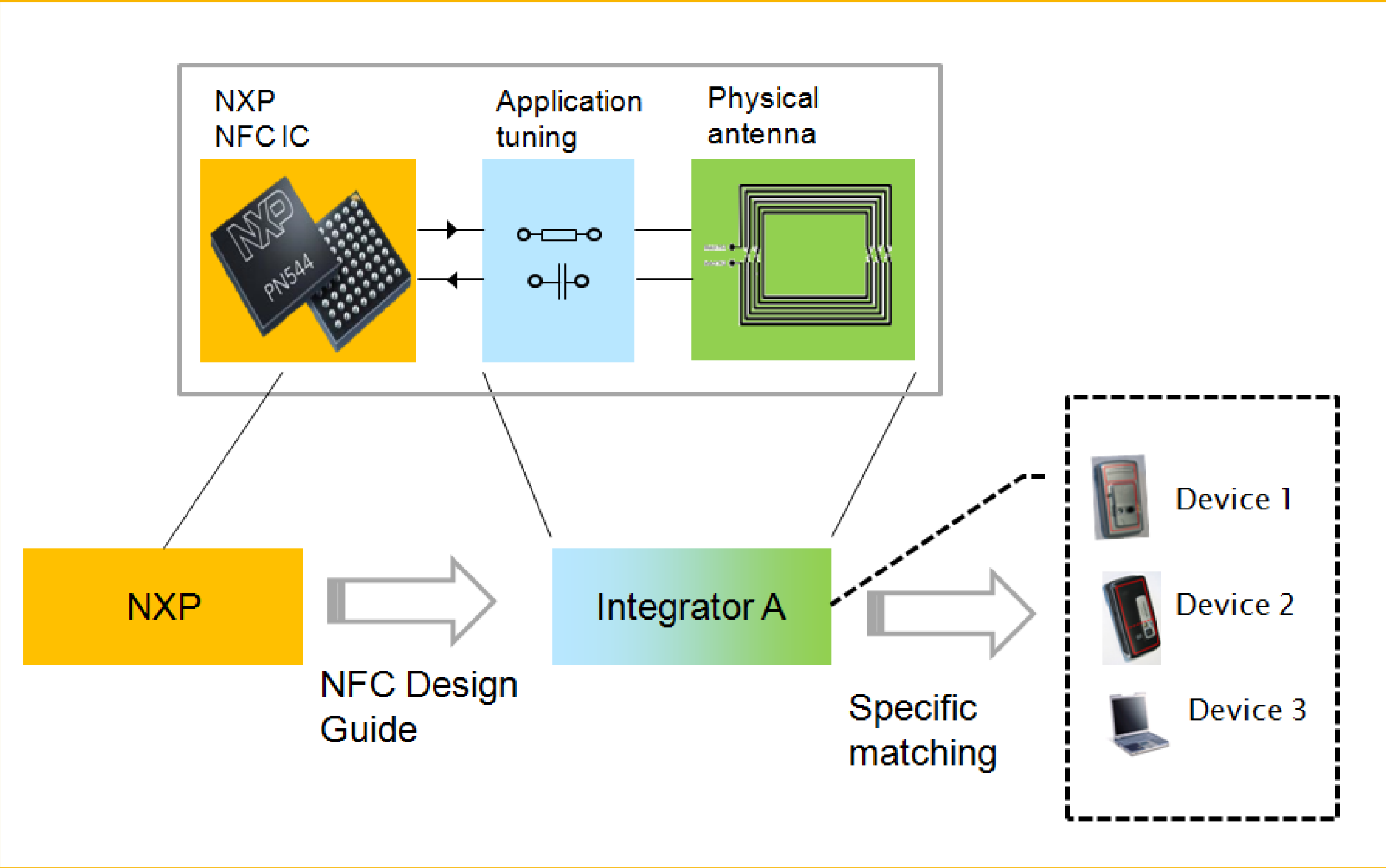
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## NFC Architecture



## Motivations

- ❖ Based on RFID technology @ 13.56MHz
- ❖ Communication by magnetic coupling
- ❖ Operating distance 0 - 4cm
- ❖ Data rate : 106 - 848 kb/s

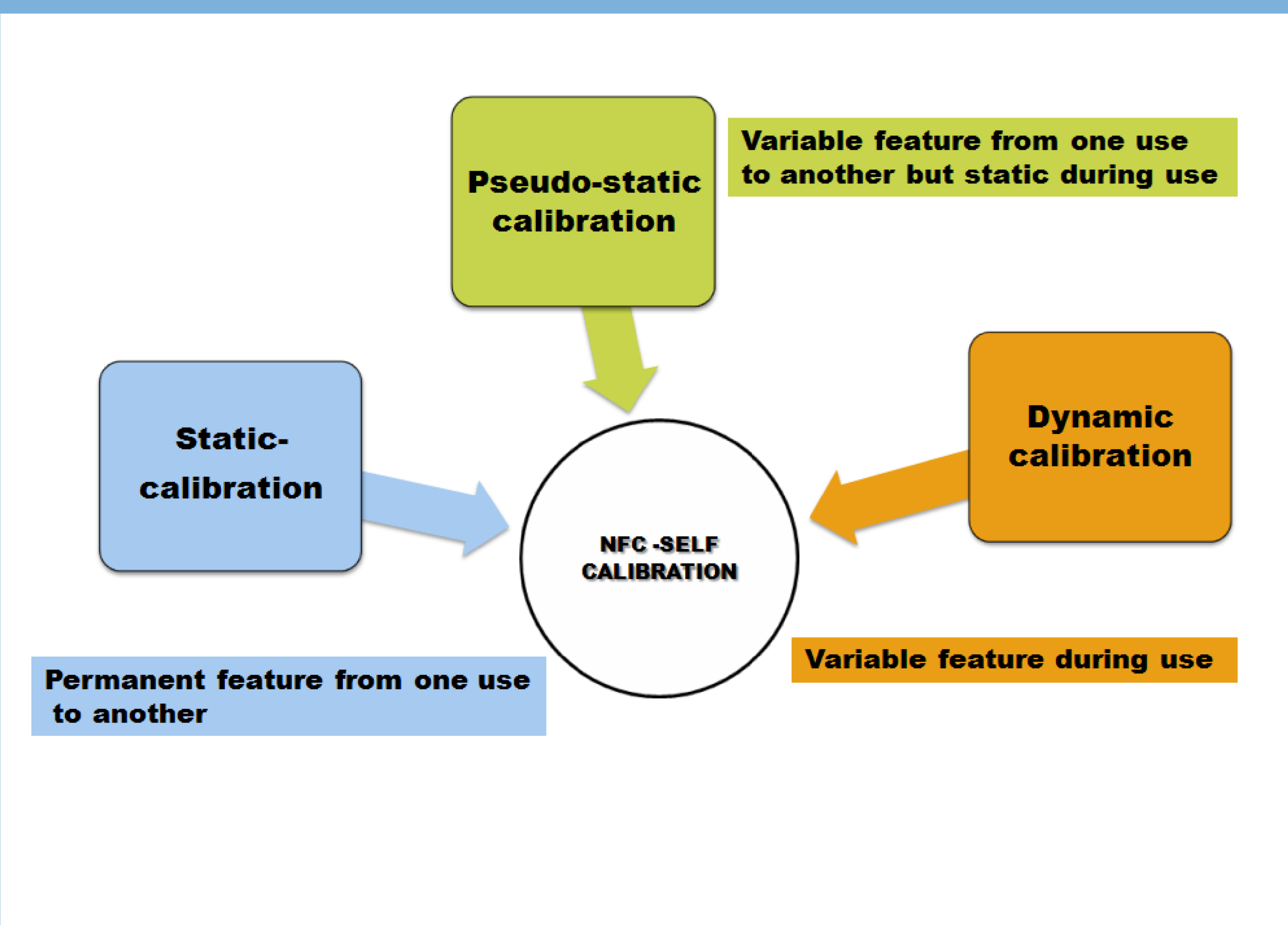
### Current NFC Antenna Tuning

- Time - high expertise - expensive equipment
- Trade off Reader -card - P2P
- Standards compliance

### Antenna Self-Calibration Advantages

- NFC development simplification
- Performance optimization (Reader, Card and P2P)
- Better interoperability (large field compatibility)

## Self-calibration types



## Self-calibration Concept

### NFC Self adaptation system circuitry

The complete automatic tuning setup consists of a detection part, a matching circuit and a controller.

The role of detection part is to be able to detect any change of the antenna impedance in presence of proximity card using only the IC current and voltage

The matching circuitry will be done by varying the capacitance C1 and C2. The best way to do these actions is to use a network of parallel switched capacitors.

The controller permits to analyze the impedance change, calculate the additional impedance and control the capacitance arrays.

## NFC Antenna Modeling

The modeling process involves taking a Physical Antenna and creating an Electrical model (Cs, R(f), La) that accounts for physical phenomena like eddy current (skin effect, proximity effect and ferrite loss).

The process follows these steps:

- Theoretical analysis
- Formula prototype
- Curve fitting
- Final formula

Model validation from 3D Finite Element Simulations (EMpro) involves parameterized simulation with EMPro and a Data base.

## Self-adaptation system

An excel tool was developed in a flexible and easy way to offer availability of the overall understanding of the system behavior and self adaptation

The tool provides detailed analysis including:

- Antenna Matching: Single Element, Zmatch, Cant, EMI Filter, Optimal coupling.
- Antenna Tuning: Smith chart, Available energy (battery Off mode), Expected side band vs Field (mV vs A/m).
- Antenna modeling: Antenna selection, Measured performance.