Hirschmann Car Communication
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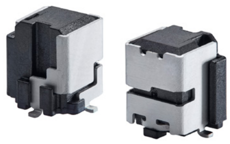
DATASHEET

UWB STANDALONE ANTENNA PART NUMBER 903-003-002



UWB STANDALONE ANTENNA

FEATURES

- UWB (Ultra Wide Band) Antenna
- High Performance
- Omnidirectional Radiation Pattern
- 6.0-8.5 (9.5*) GHz
- Channels: 5, 6, 8, 9, (10*, 12*)
- Application: UWB Ranging, UWB AoA (Angle of Arrival)
- SMT Compatible

* see technical data for details

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TECHNICAL DATA

Dimensions	6.55 x 7.15 x 7.55 mm^3
Pad Configuration	Pad 1 = Feed UWB; Pad 2 = GND; Pad 3 = GND
Material	Brass (metal), LCP (resin)
Temperature Range	-40 to +105 °C
Manufacturing Process	SMT Placeable (Tape & Reel)

ELECTRICAL	CHANNEL 5	CHANNEL 9
Frequency Range	6.24 to 6.74 GHz	7.73 to 8.24 GHz
Return Loss S11	< -7 dB	< -10 dB
Efficiency	> -1.3 dB	> -1.3 dB
Peak Gain	3 dBi	5 dBi
Radiation Properties	Omnidirectional	
Polarization	Linear Vertical	
Impedance	50 Ohm	
Max. Input Power	10 W	

Notes:
1. Performance data on 30x45 mm^2 eval ground plane.
2. Reference plane for measurement is the connector.

Comment to* on title page: The radiation pattern is omnidirectional for the UWB channels 5, 6, 8, and 9. In addition, the impedance bandwidth spans the channels 10 and 12. The antenna is suitable for the channels 10 and 12 with its radiation pattern being more directional.

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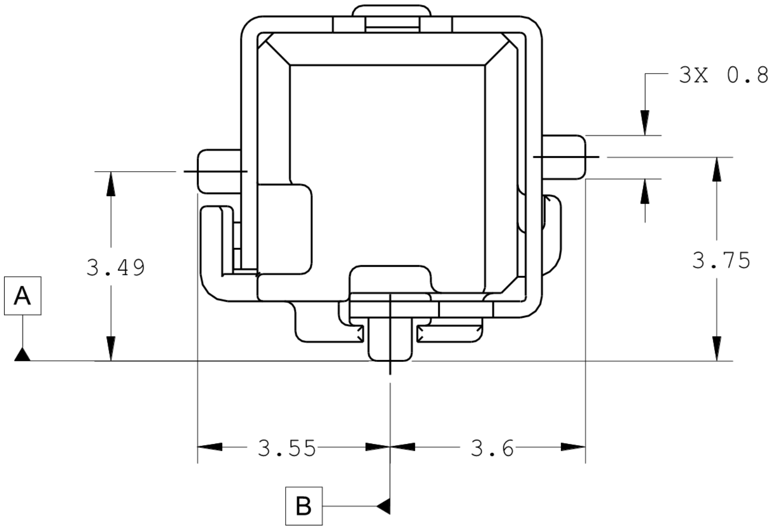
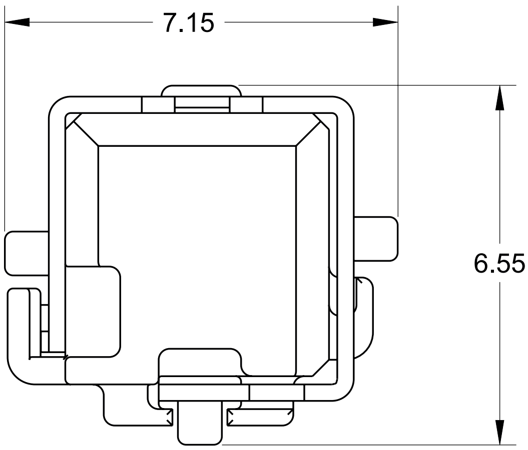
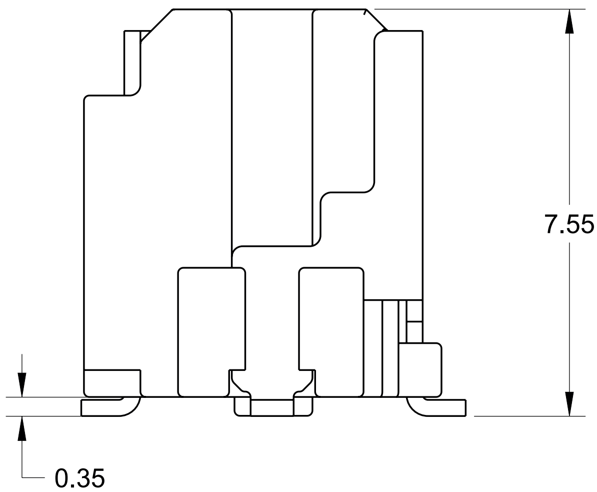
ANTENNA DIMENSIONS

Pad Position



Outline





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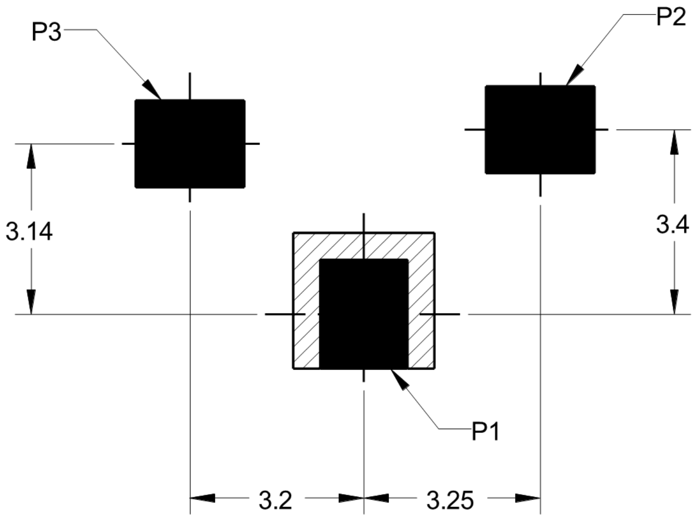
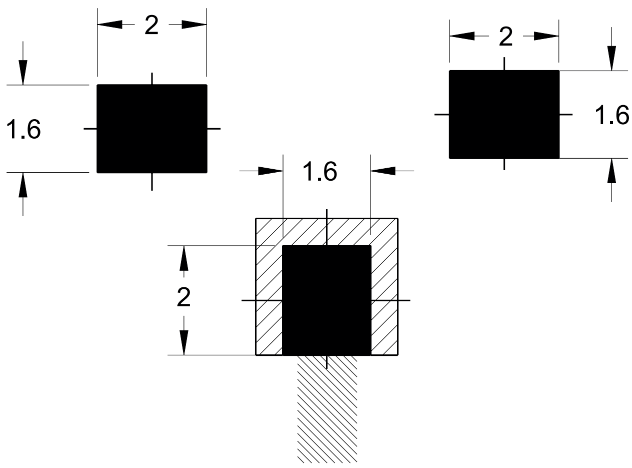
ANTENNA LAND PATTERN

PAD	DESCRIPTION
P1	UWB Feed Pad
P2	Ground Pad
P3	Ground Pad

Copper Keep-out Area
Antenna Copper Area
50 Ohm Transmission Line
All other areas to be GND



Dimensions referenced to P1 center.



Copper keep-out area width around P1 is 0.5mm.

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FEEDING PAD

Excessive capacitive loading of the feeding pad can degrade the achievable matching and impedance bandwidth of the antenna. The pad capacitance is controlled by the pad clearance to the coplanar ground plane on the top layer and the distance to lower ground layer(s).

- The recommended clearance around the pad is 0.5 mm for the recommended pad dimensions of 1.6 x 2.0 mm^2.
- The vertical spacing between pad and continuous ground planes should be ≥ 0.8 mm for optimum performance (≥ 0.6 mm for acceptable matching on sufficient ground plane sizes).

For **two-layer PCBs** of typical thickness (1.0 mm to 1.6 mm) the bottom ground layer can be continuous underneath the antenna pad. In case of thinner PCBs a recessed bottom ground plane can be used (see four-layer PCB).

For **four-layer PCBs** with inner layers closer than 0.6/0.8 mm to the top layer the capacitance can be reduced by opening the inner ground layers underneath the antenna feeding pad. A rectangular recess of 2.8 x 3.2 mm (aligned and centered to the patch) is recommended for all ground layers within 0.8 mm vertical distance to the top layer.

The recommended layout for 4-layer PCBs with a total thickness above 0.8 mm is shown in Fig. 1. The closed bottom ground plane assures backside shielding.

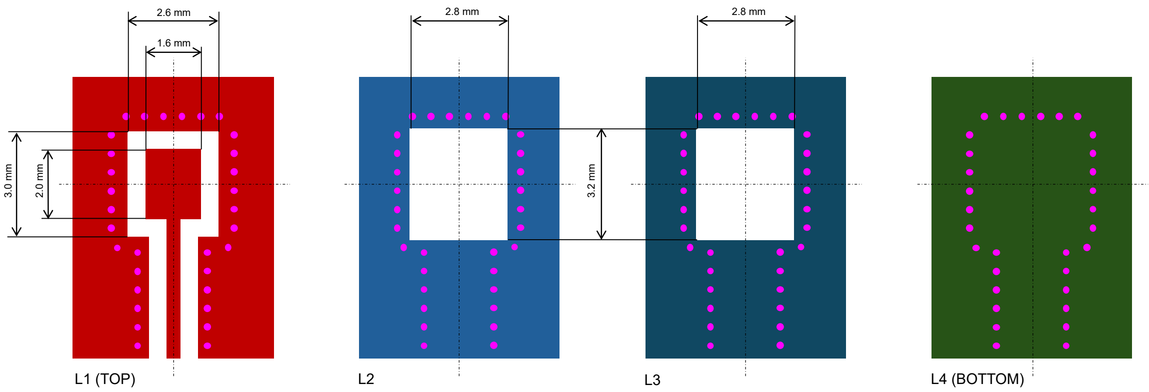

Fig. 1: Layout recommendation for the feeding pad on a 4-layer PCB with a total thickness above 0.8 mm (violet dots = dense via fence along RF feeding line and around antenna feeding pad).

If the spacing between L1 and L3 is ≥ 0.8 mm the ground opening on L3 is optional and can be closed if required.

For thin PCBs with a total thickness below 0.8 mm the bottom ground shall be recessed as well (opening identical to L2 and L3).

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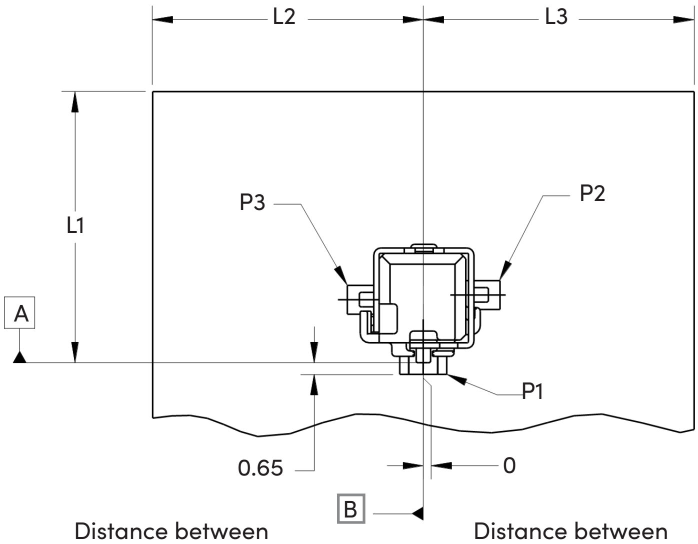
ANTENNA PLACEMENT GUIDELINE

DIMENSION	DISTANCE FROM PCB OUTLINE
A	10 mm min.
B	10 mm min.
C	10 mm min.

Top view



Distance between the center of Pad-1 and Datum-A.

Distance between the center of Pad-1 and Datum-B.

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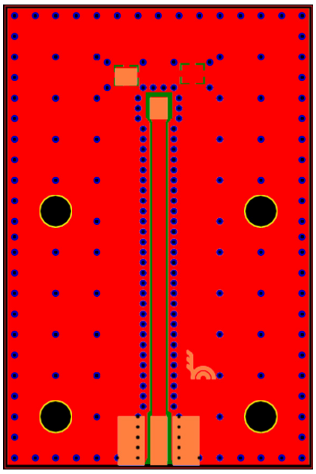
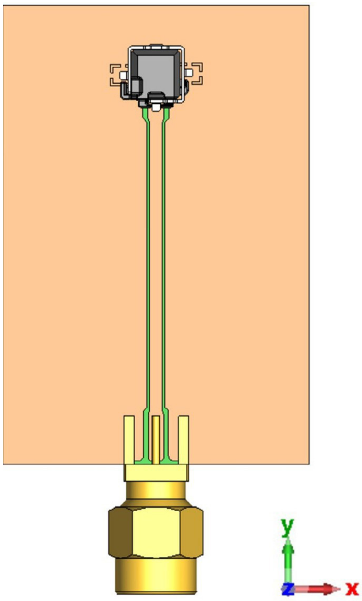
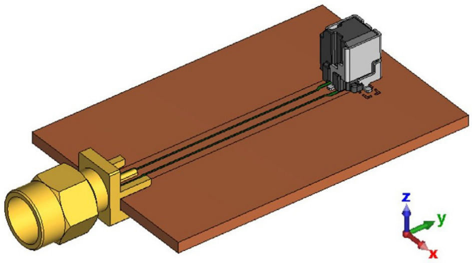
EVAL-BOARD



.dxf files available

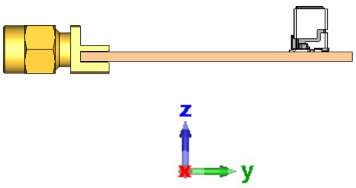


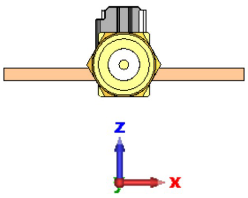
UWB Standalone
Eval-Board
30 x 45 mm²



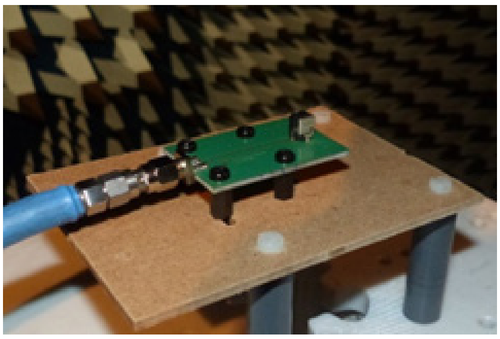
Recommended Connector: Linx CONSMA013.062

Simulation Model





Measurement Setup



Reference plane for simulation and measurement is the connector. Therefore, the insertion loss of the SMA connector and the microstrip line is included in the results (0.9-1.1 dB @ 6000-9500 MHz).

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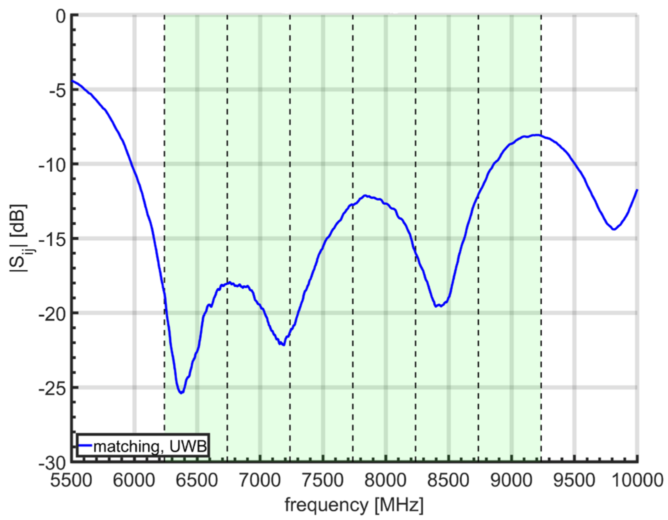
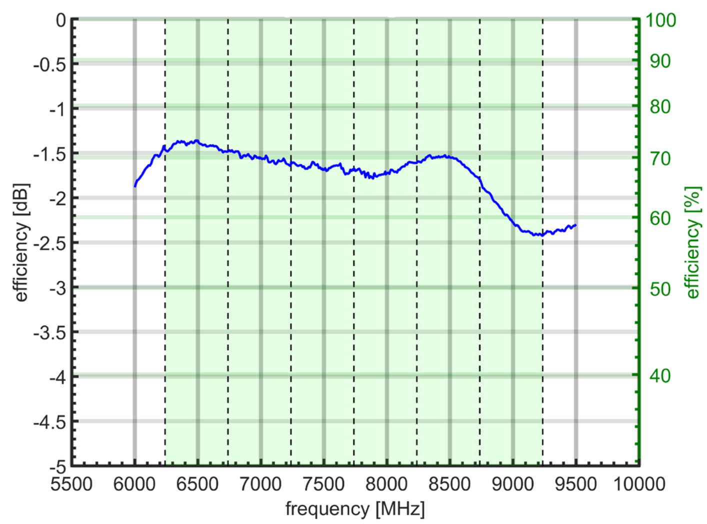
RETURN LOSS S11 (MEASURED)

UWB Standalone Antenna @ Eval-Board



EFFICIENCY (MEASURED)

UWB Standalone Antenna @ Eval-Board



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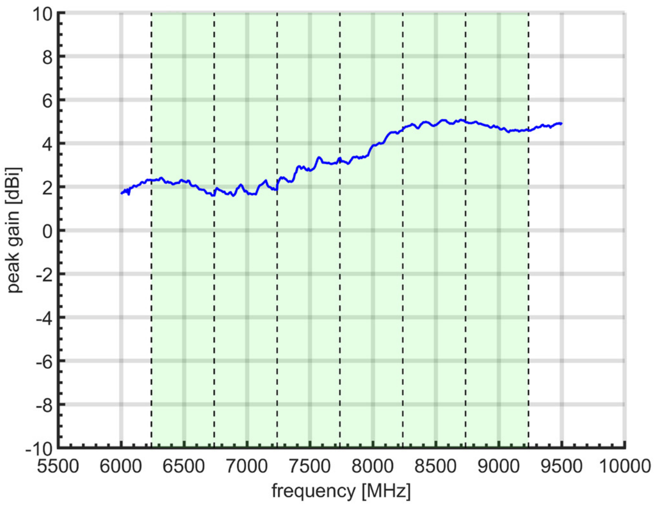
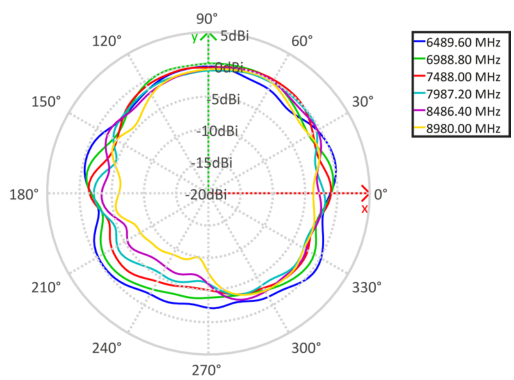
PEAK GAIN (MEASURED)

UWB Standalone Antenna @ Eval-Board
E_Total ; Theta=[0 - 180]° ; Phi= [0 - 360]°

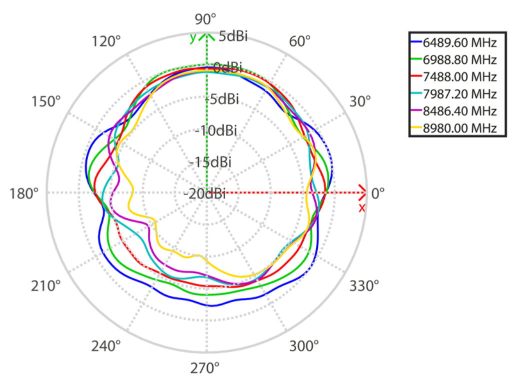


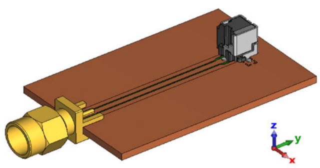
RADIATION PATTERN XY-PLANE - TOTAL & THETA POLARIZATION (MEASURED)

UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Total) @ XY-Plane



UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Theta) @ XY-Plane





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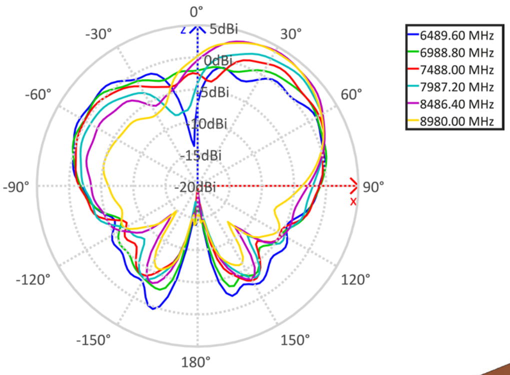
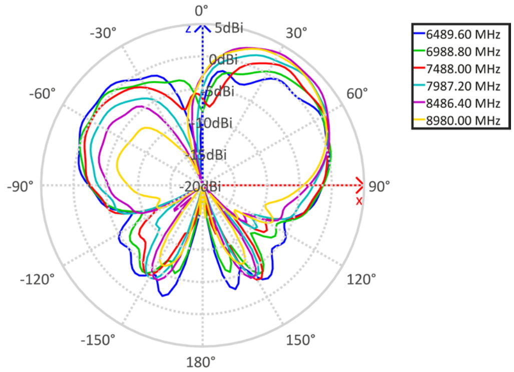
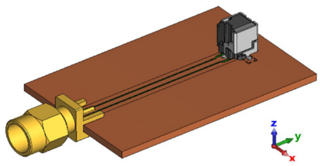
RADIATION PATTERN XZ-PLANE - TOTAL & THETA POLARIZATION (MEASURED)

UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Total) @ XZ-Plane



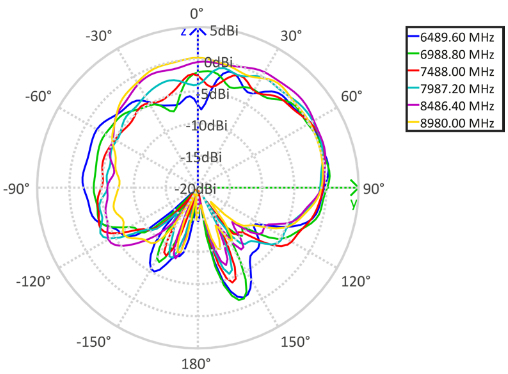
UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Theta) @ XZ-Plane



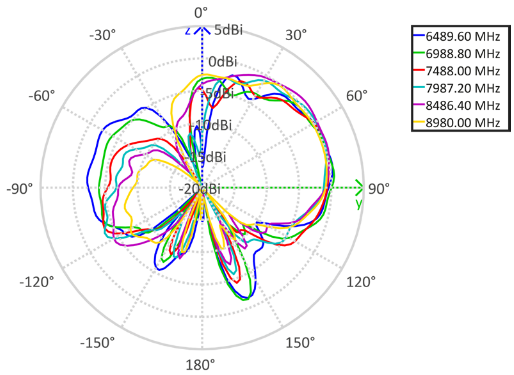


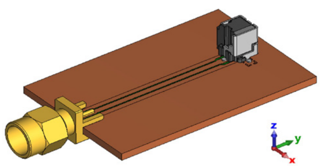
RADIATION PATTERN XY-PLANE - TOTAL & THETA POLARIZATION (MEASURED)

UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Total) @ YZ-Plane



UWB Standalone Antenna @ Eval-Board
Realized Gain (E_Theta) @ YZ-Plane





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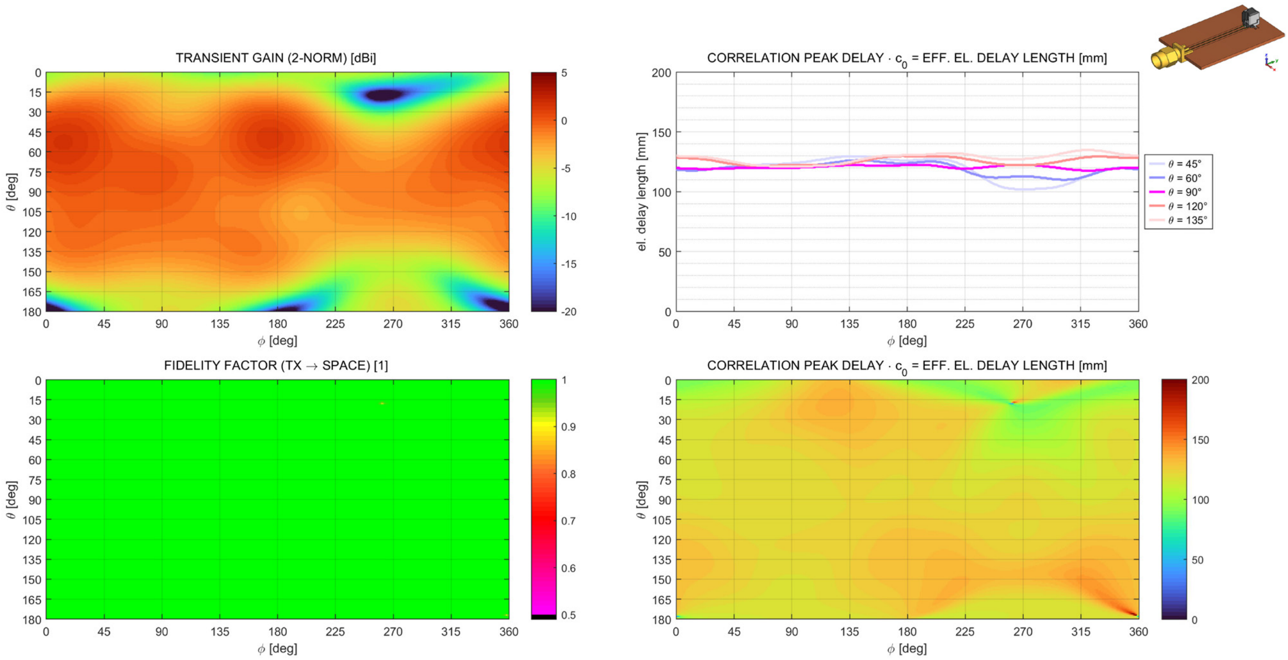
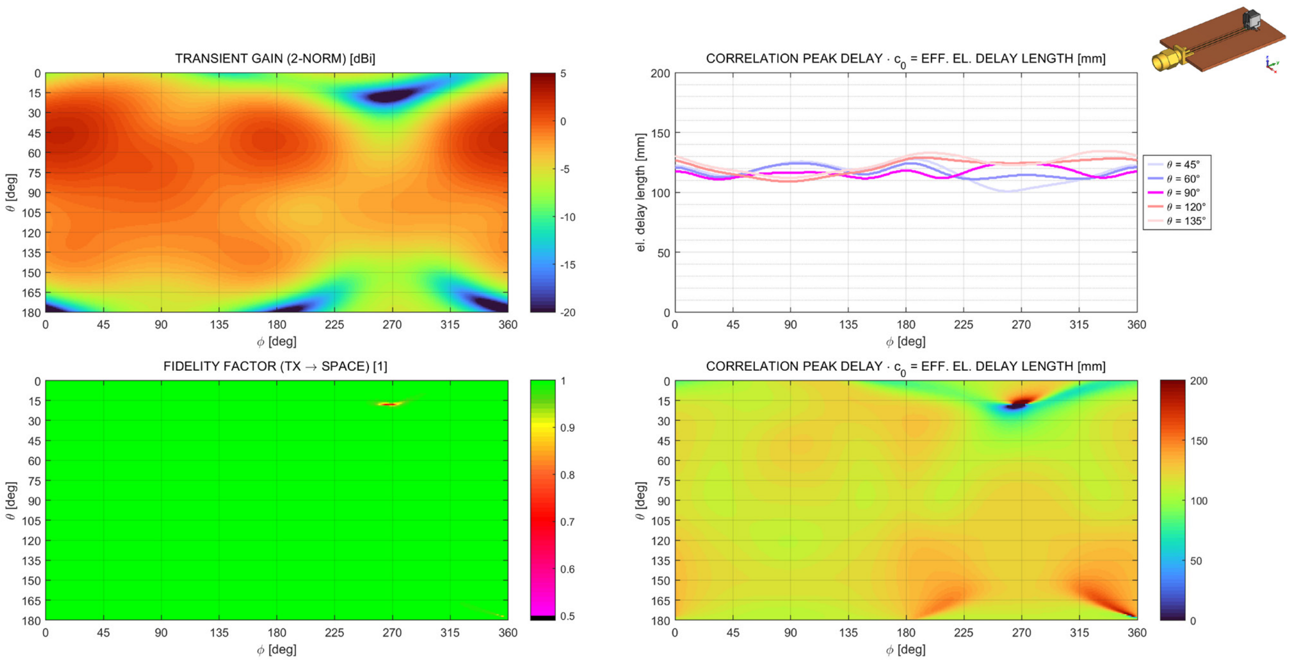
TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY – CHANNEL 5 (SIMULATED)



TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY – CHANNEL 6 (SIMULATED)



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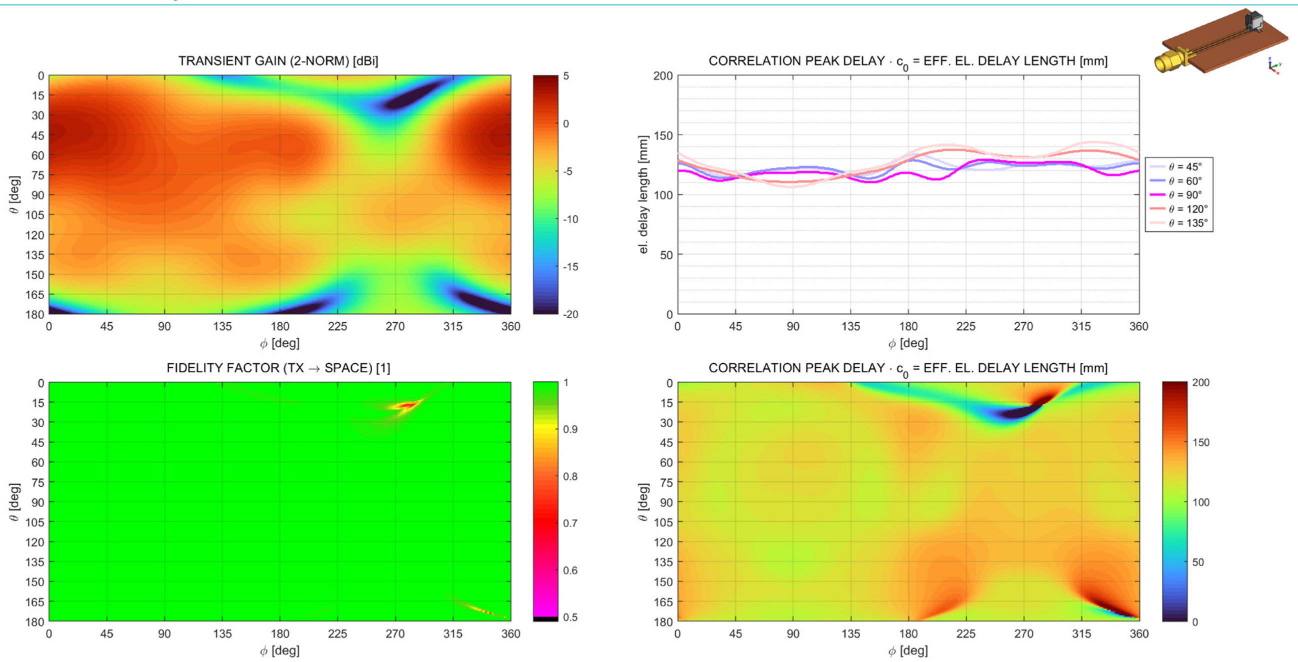
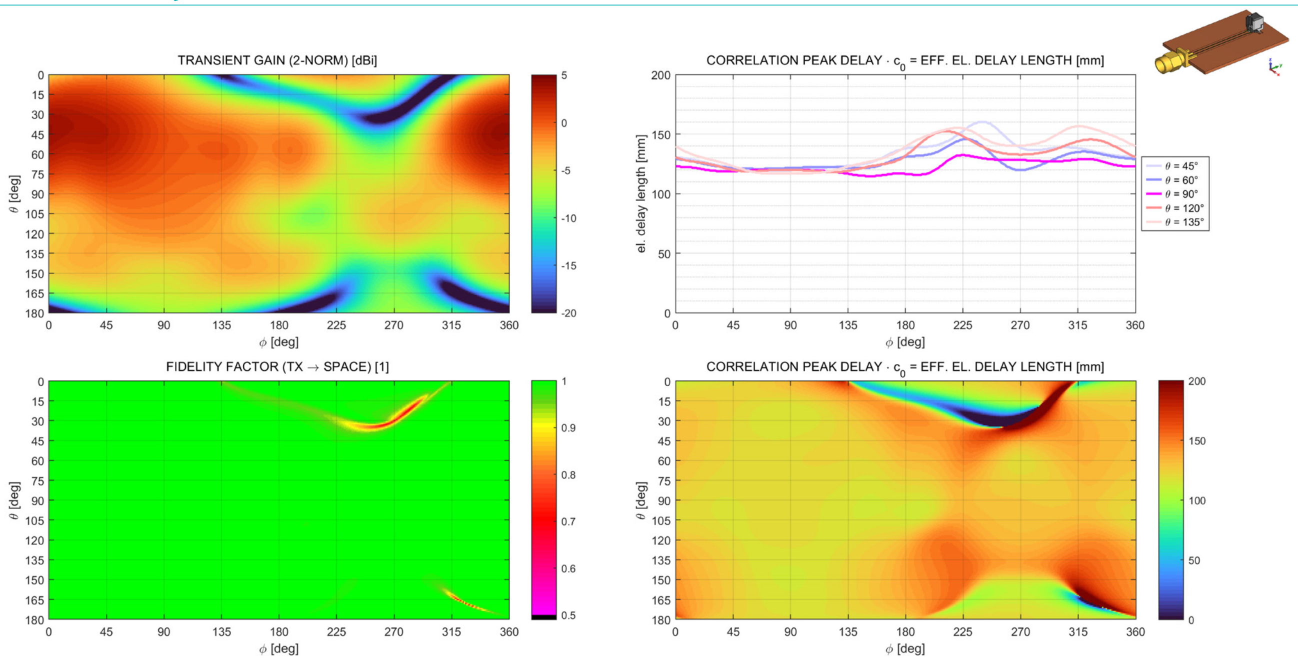
TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY - CHANNEL 8 (SIMULATED)



TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY - CHANNEL 9 (SIMULATED)



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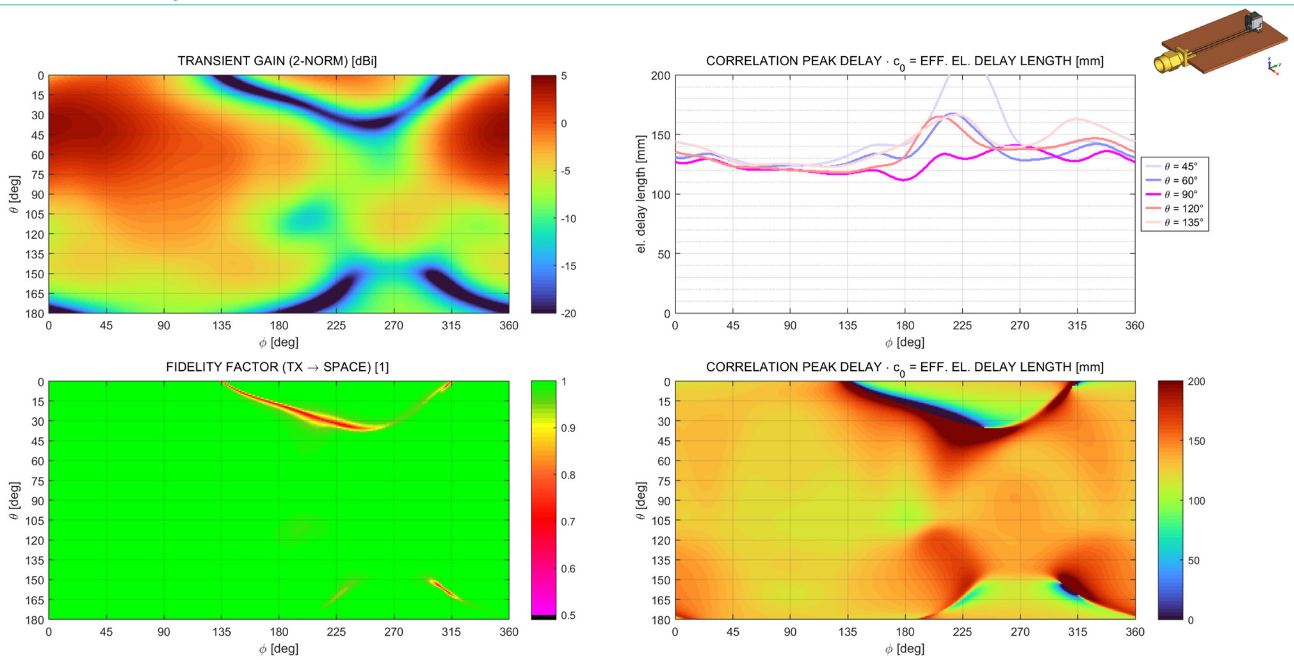
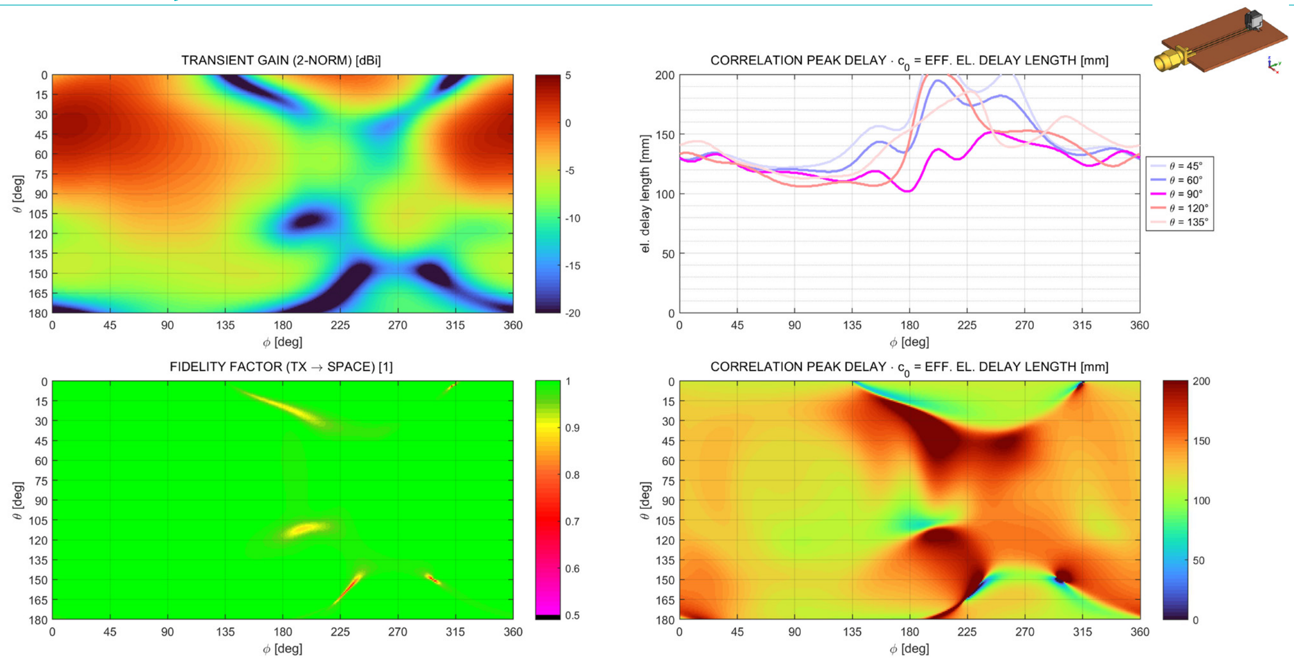
TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY - CHANNEL 10 (SIMULATED)



TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY - CHANNEL 12 (SIMULATED)



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TRANSIENT GAIN

Definition

Broad-band and energy-based pendant to classical power-based antenna gain
→ Mean gain weighted with power spectral density of UWB reference pulse (acc. to IEEE standard 802.4.15).

$$g_\theta(\theta,\phi) = \frac{\int_{-\infty}^{+\infty} G_\theta(\omega,\theta,\phi)\cdot\left|S_{\mathrm{TX}}(\omega)\right|^2\,\mathrm{d}\omega}{\int_{-\infty}^{+\infty}\left|S_{\mathrm{TX}}(\omega)\right|^2\,\mathrm{d}\omega}$$

W. Wiesbeck, et. al.: Basic properties and design principles of UWB antennas. Proc. IEEE, Vol. 97, No. 2, Feb. 2009.

FIDELITY FACTOR

Definition

Normalized cross-correlation of radiated pulse (electr. far-field of antenna) with transmit pulse in TD when antenna is stimulated with a UWB reference pulse (acc. to IEEE standard 802.4.15).

$$F_\theta(\theta,\phi) = \max_\tau\left\{\frac{\left|\int_{-\infty}^{+\infty} e_\theta^{\mathrm{FF}}(t+\tau,\theta,\phi)\cdot s_{\mathrm{TX}}^*(t)\,\mathrm{d}t\right|}{\sqrt{\int_{-\infty}^{+\infty}\left|e_\theta^{\mathrm{FF}}(t,\theta,\phi)\right|^2\mathrm{d}t}\cdot\sqrt{\int_{-\infty}^{+\infty}\left|s_{\mathrm{TX}}(t)\right|^2\mathrm{d}t}}\right\}$$

D.-H. Kwon: Effect of antenna gain and group delay variations on pulse-preserving capabilities of ultrawideband antennas. IEEE Trans. AP, Vol. 54., No. 8, Aug. 2006.

DELAY

Definition

Time-lag τ (available from above fidelity factor calculation) cross-correlation peak between radiated and stimulated pulse in TD. Electrical far-field of antenna can be referenced to any distance from phase-center. The delay is referenced to the antenna phase center (with zero radial distance).

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