Hirschmann Car Communication
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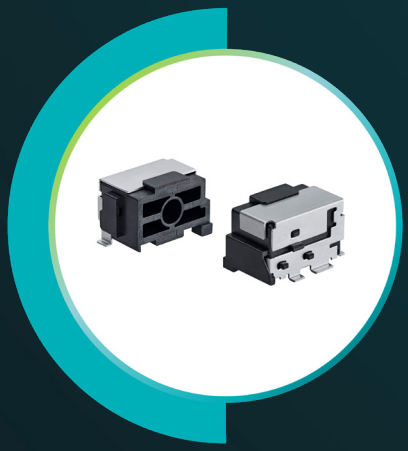


DATASHEET

UWB/BLE COMBO ANTENNA PART NUMBER 2389101-1

UWB/BLE COMBO ANTENNA

FEATURES

- UWB (Ultra Wide Band) Antenna
- BLE (Bluetooth Low Energy) Antenna
- Omnidirectional Radiation Pattern
- UWB: 6.0–8.5 GHz (Channels 5,6,8,9)
- Channels: 5, 6, 8, 9
- BLE: 2.4–2.5 GHz
- Application: UWB Ranging, UWB Angle of Arrival, BLE
- SMT Compatible

UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

TECHNICAL DATA

Dimensions	9.35 x 16.10 x 10.00 mm^3
Pad Configuration	Pad 1 = Feed UWB; Pad 2 = Feed BLE; Pad 3 / 4 = GND
Material	Brass (metal), LCP (resin)
Temperature range	-40 to + 105 °C
Manufacturing Process	SMT Placeable (Tape & Reel)

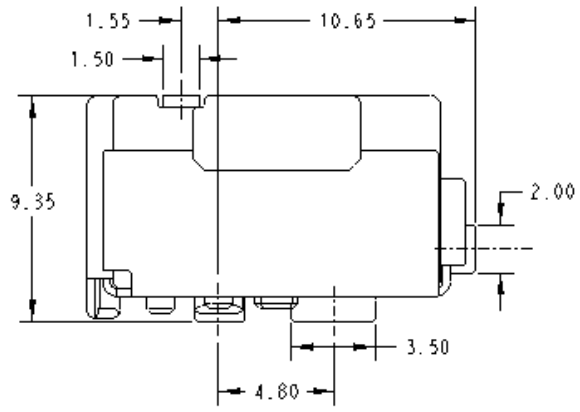
ELECTRICAL	BLE	CHANNEL 5	CHANNEL 9
Frequency range	2.40 to 2.50 GHz	6.24 to 6.74 GHz	7.73 to 8.24 GHz
Return Loss S11	< -7 dB	< -10 dB	< -10 dB
Efficiency	> -2.5 dB	> -2.0 dB	> -2.0 dB
Peak Gain	2 dBi	5 dBi	5.5 dBi
Radiation Properties	Omnidirectional		
Polarization	Linear Vertical		
Impedance	50 Ohm		
Max. Input Power	10 W		

Notes:
1. Performance data on 60x85 mm^2 eval ground plane.
2. Reference plane for measurement is the connector.

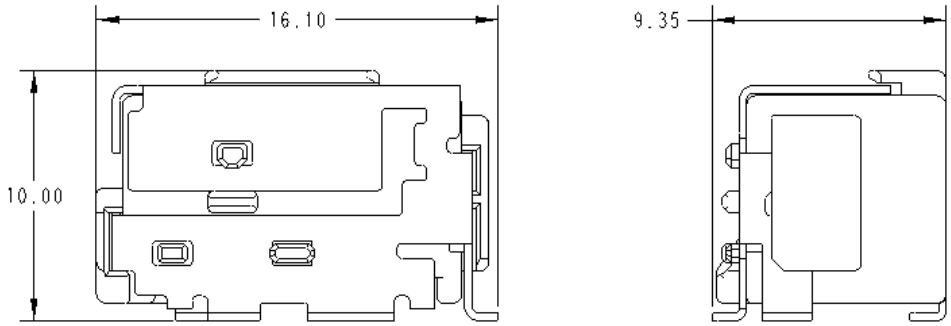
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

ANTENNA DIMENSIONS

Pad Position



Outline

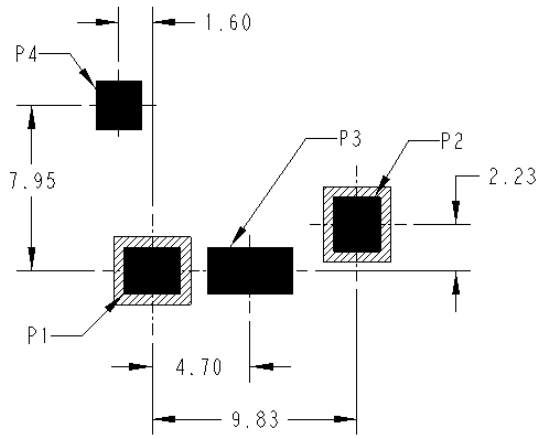


UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

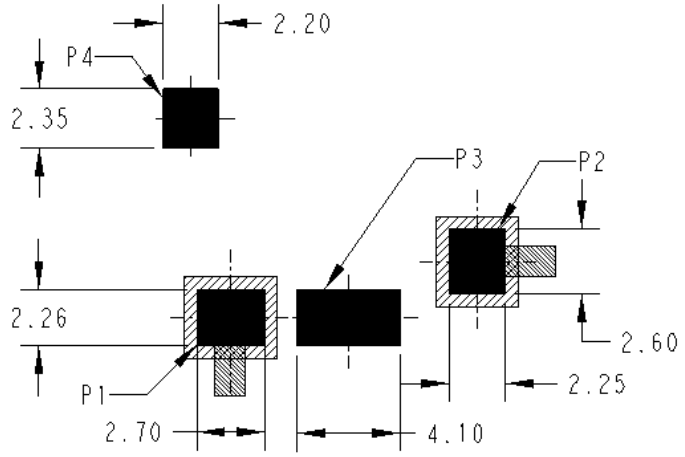
ANTENNA LAND PATTERN

PAD	DESCRIPTION
P1	UWB Feed Pad
P2	BLE Feed Pad
P3	Ground Pad
P4	Ground Pad

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



Dimensions referenced to P1 center.

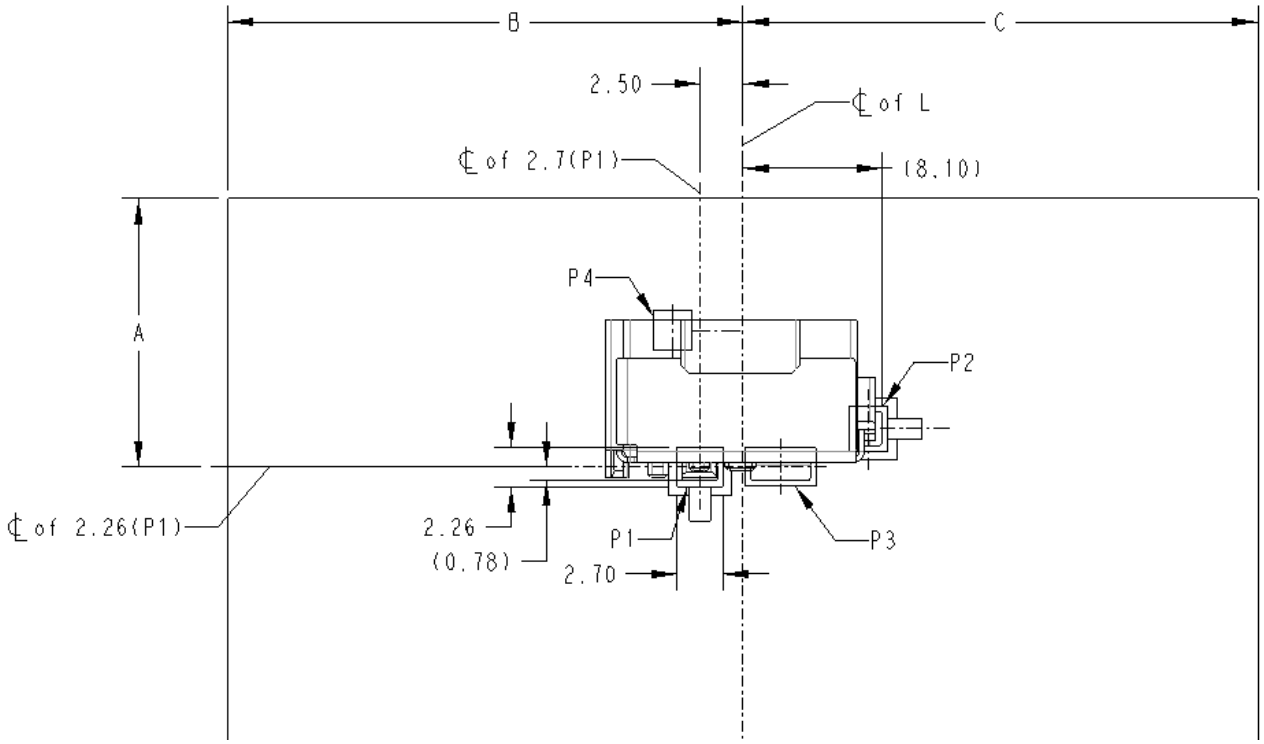


Copper keep-out area width around P1 and P2 is 0.5mm.

UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

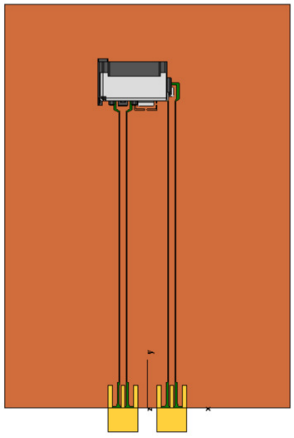
ANTENNA LAND PATTERN

LOCATION	DIMENSION FROM PCB OUTLINE [MM]
A	16 mm min.
B	16 mm min.
C	21 mm min.



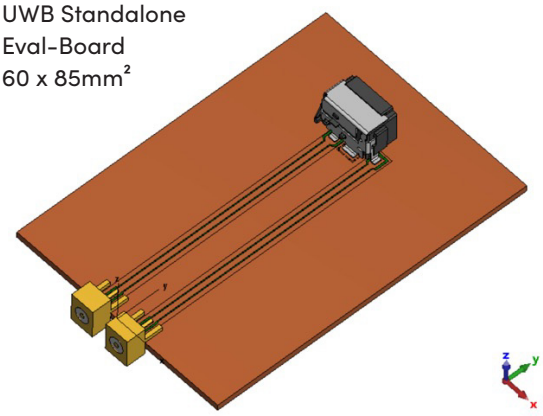
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

EVAL-BOARD



.dxf files available

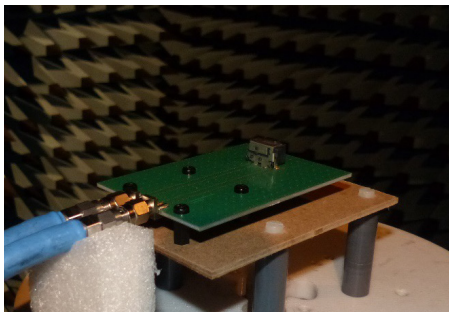
UWB Standalone
Eval-Board
60 x 85mm²



Recommended Connector: Linx CONSMA013.062

Simulation Model

Measurement Setup

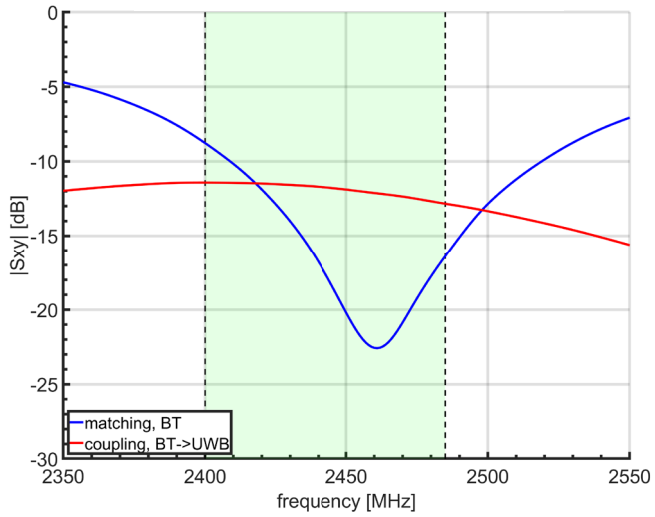


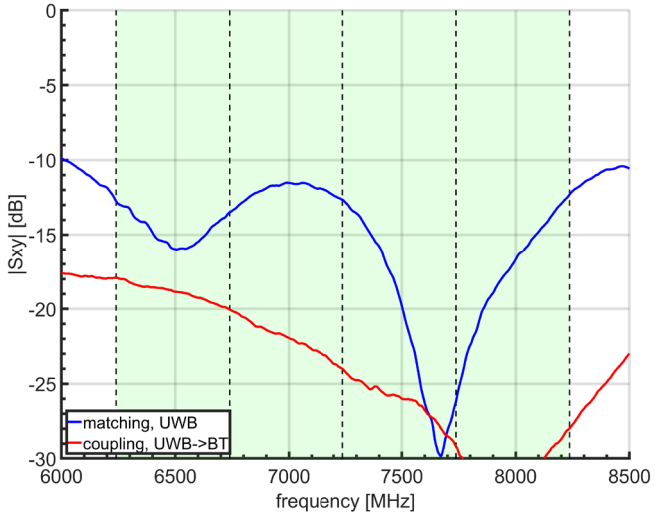
Reference Plane for Simulation and Measurement is the Connector.

UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

RETURN LOSS S11 AND COUPLING S21 (MEASURED)

UWB/BLE Combo Antenna @ Eval-Board

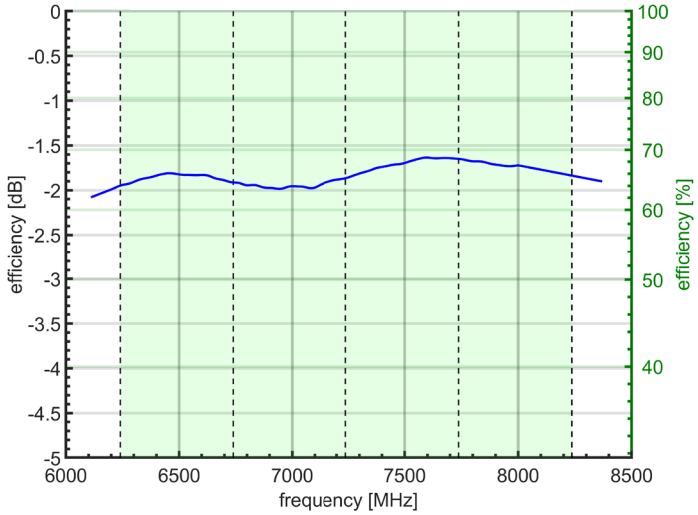


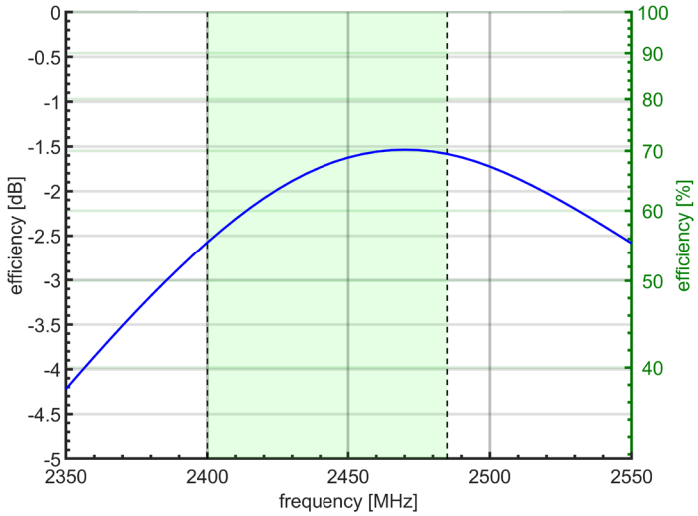


UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

EFFICIENCY (MEASURED)

UWB/BLE Combo Antenna @ Eval-Board

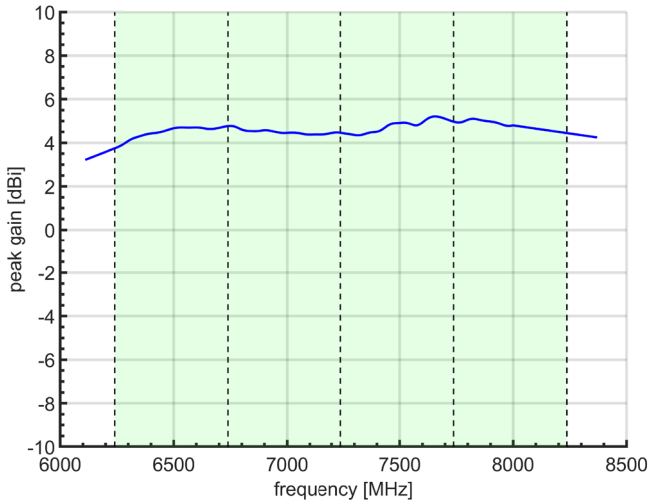


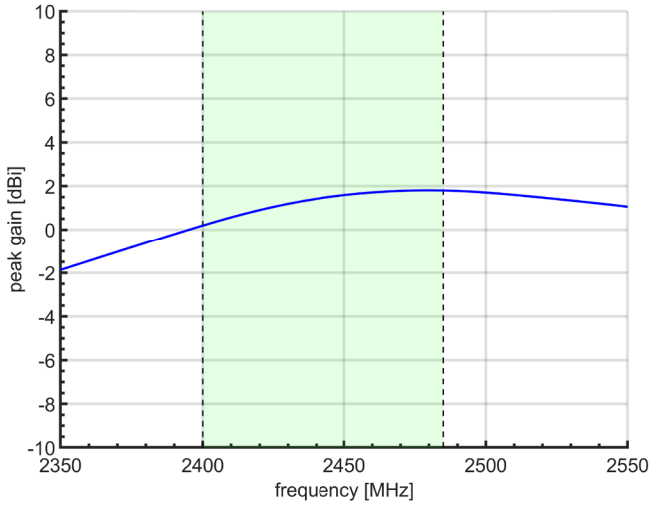


UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

PEAK GAIN (MEASURED)

UWB/BLE Combo Antenna @ Eval-Board

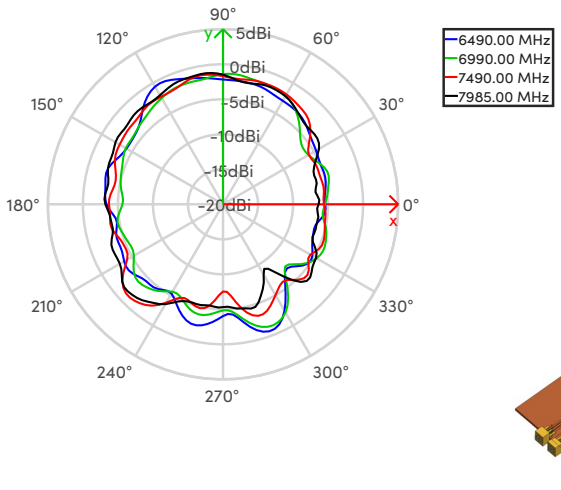




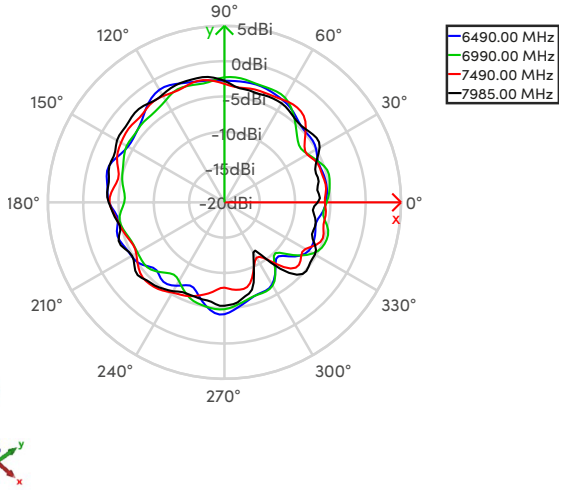
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

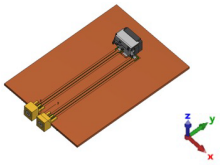
RADIATION PATTERN XY-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ XY-Plane



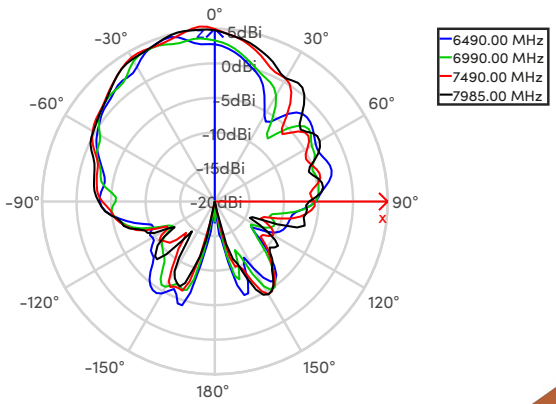
UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ XY-Plane



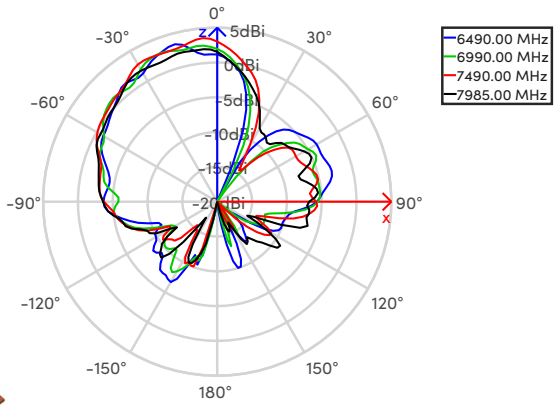


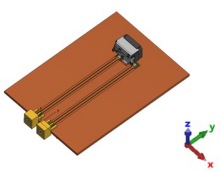
RADIATION PATTERN XZ-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ XZ-Plane



UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ XZ-Plane

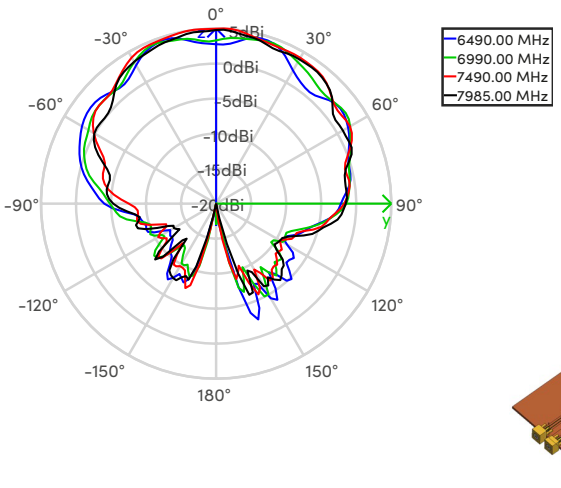




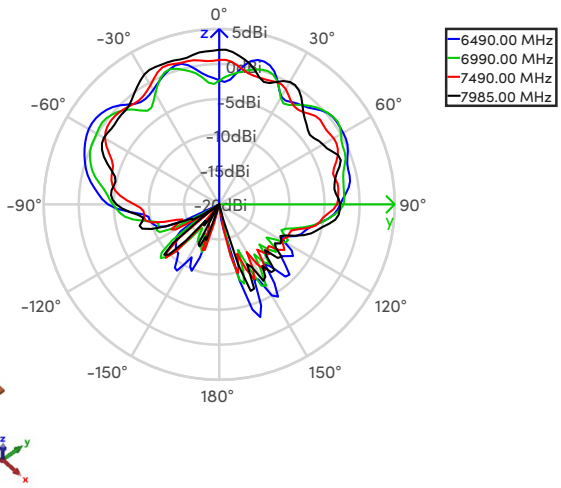
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

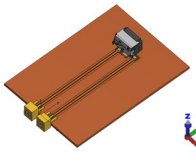
RADIATION PATTERN YZ-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ YZ-Plane



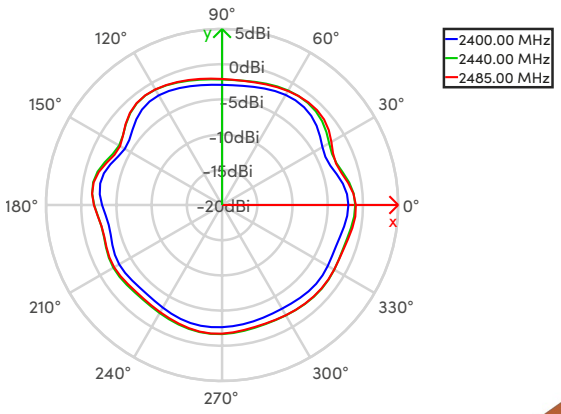
UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ YZ-Plane



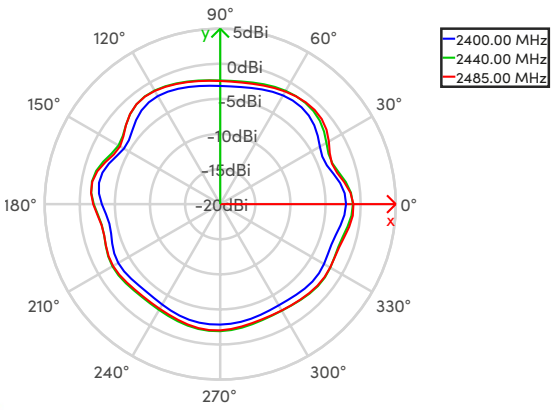


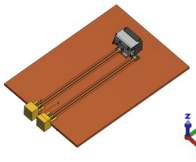
RADIATION PATTERN XY-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ XY-Plane



UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ XY-Plane

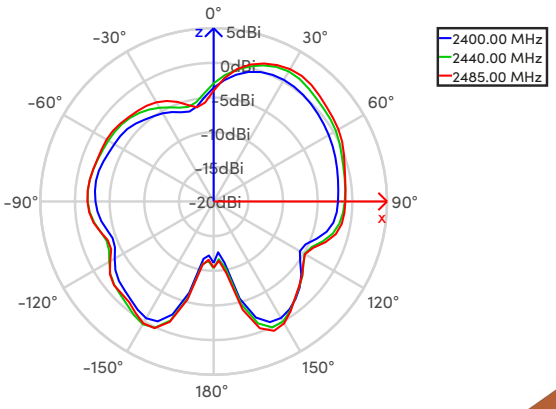




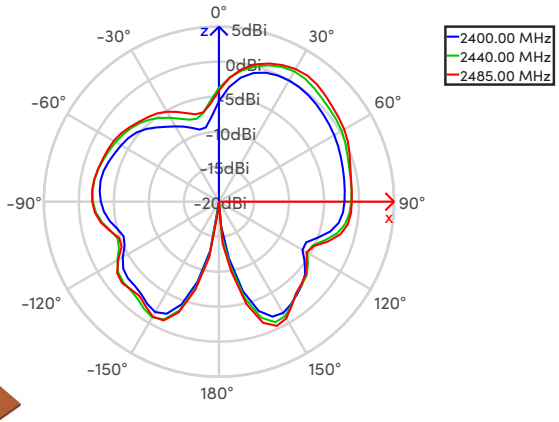
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

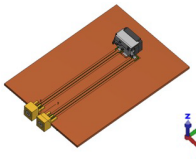
RADIATION PATTERN XZ-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ XZ-Plane



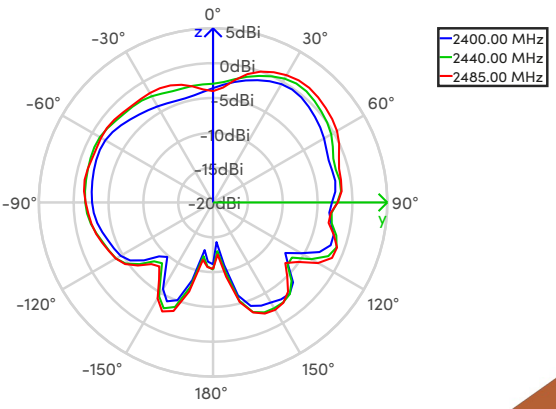
UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ XZ-Plane



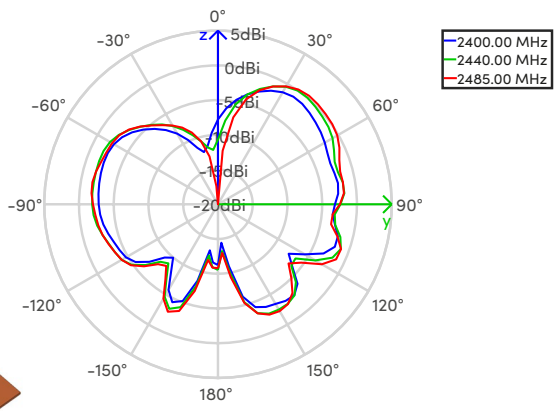


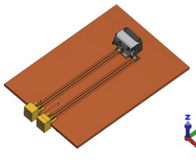
RADIATION PATTERN YZ-PLANE - TOTAL & THETA POLARISATION (SIMULATED)

UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Total) @ YZ-Plane



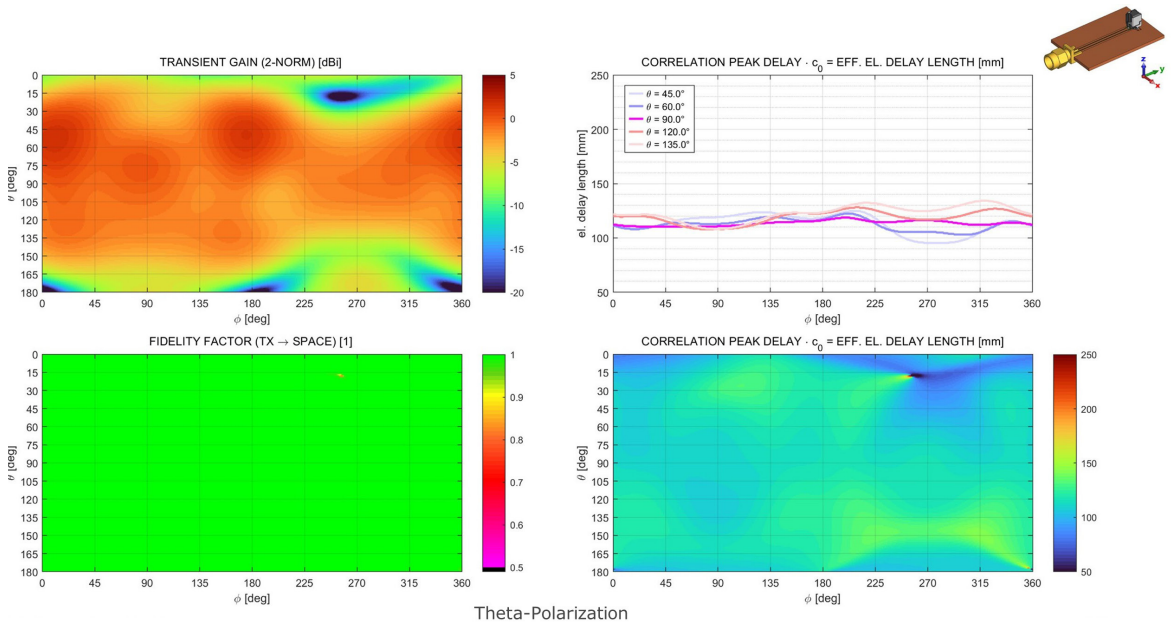
UWB/BLE Combo Antenna @ Eval-Board
Realized Gain (E_Theta) @ YZ-Plane





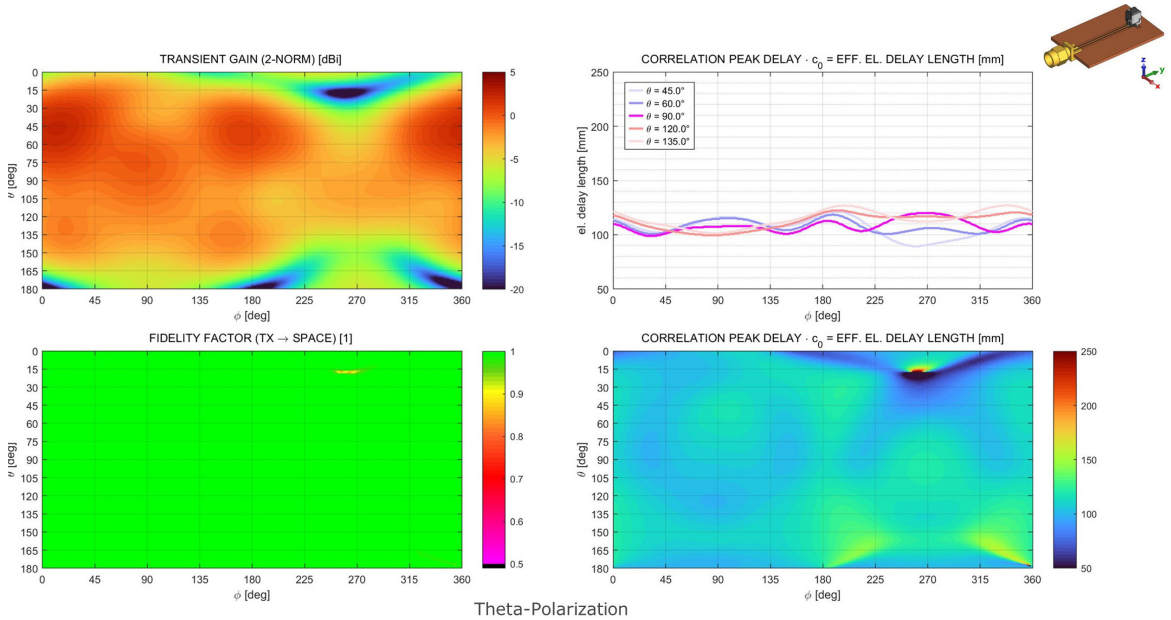
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

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



Theta-Polarization

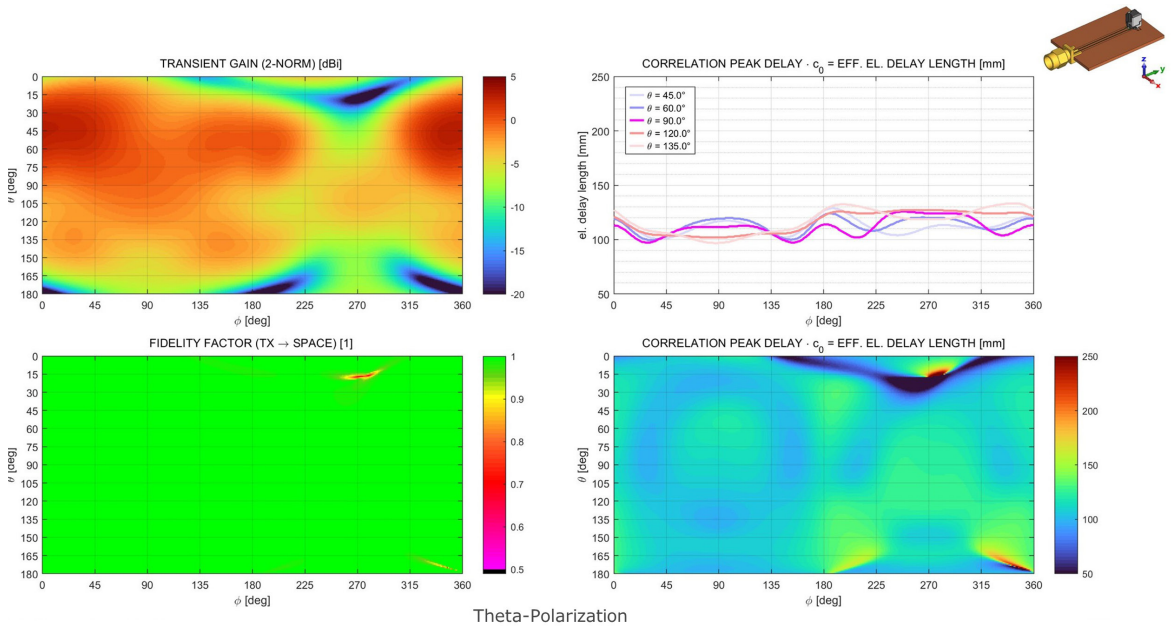
TRANSIENT GAIN, FIDELITY FACTOR AND CORRELATION PEAK DELAY - CHANNEL 6 (SIMULATED)



Theta-Polarization

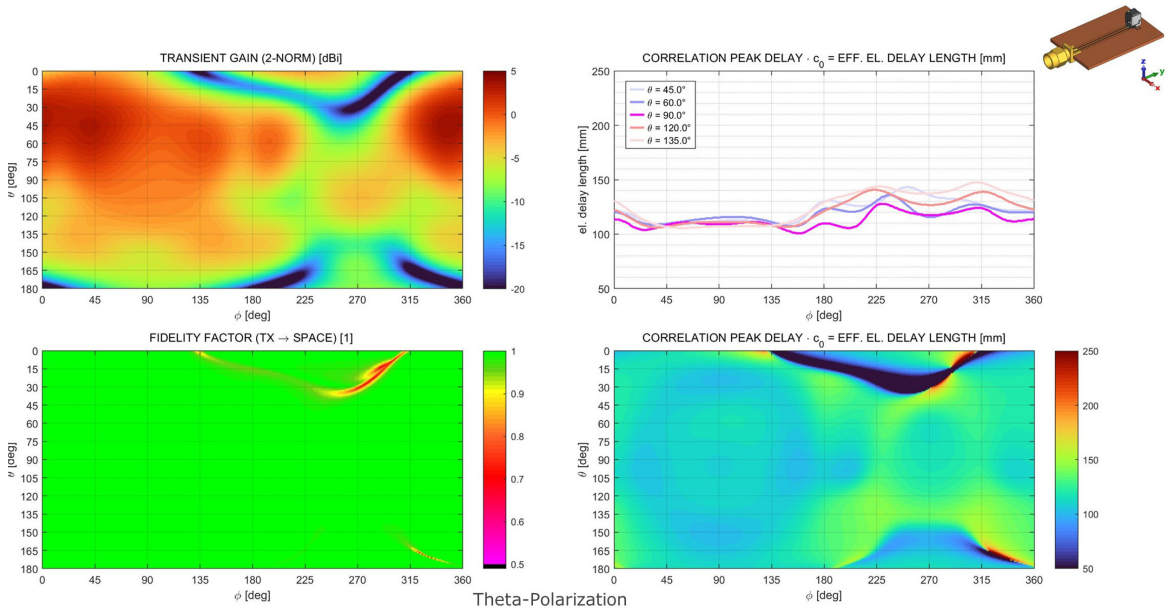
UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

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



Theta-Polarization

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



Theta-Polarization

UWB/BLE COMBO ANTENNA | PART NUMBER 2389101-1

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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