# EMPIRE XPU Tutorial

#### LTCC Transition



#### **Overview: Topics**



- Template Wizard
- Simulation
- Insert SMD Resistor
- Parameter Sweep
- Via Fence







#### Step 1: Stripline in Dupont 951

Project Wizard

- Start Empire XPU
- Select Templates → Transmission...
   → Strip Line → Impedance
- Keep Substrate Material 7.8 Dupont-951
- Set "Substrate Height" to 400 um <
- Uncheck "Sweep Parameter: Width"
- Click OK
- Select "File -> Save As"
- Select folder and enter name, e.g. Trans.emx

#### Comments:

Using the template "Strip line ... "

- Automatic generation of Dielectric, port and mesh
- QTEM port at start, absorbing port at end
- 50 Ohm line, designed by formula

New Project Open Project	Examples Templates Tuto	nais	
Transmission Lines & Wave Guides     Microstrip Line     Strip Line     Strip Line	Template: Impedance	Parameter	
		Substrate Material	7.80 Dupont-951
		2 Substrate Height	400 💌 µm
Coplanar Waveguide     Coaxial Waveguide			
Rectangular Waveguide     Plate Plane Wave	PIE	Characteristic Impedance	e 50 ▼ Ω
<ul> <li>Coupled Transmission Lines</li> <li>SMD Chip Components</li> </ul>		Options	
► RLC		✓ Calculate Width From	n Impedance Formula
<ul> <li>Filters</li> </ul>		✓ Insert Near Field Re	cording
Thermal     Environments	General	Sweep Parameter: \	Vidth
	Drawing Unit: 1	μm ×	
	Background Materian OI		
	Stop Frequency: 20	GHz 👻	
	Target Frequency: 10	GHz 👻	
	Dielectrics: lossless		
	Conductors: lossless		

#### **Step 2: Structure Check**



- Check the model
- Increase transparency
   of groups
- Optionally recolor groups
- Open groups to verify heights and properties







#### **Step 3: Stripline Simulation**

Click "Start Simulation" 
 S → "OK"

Log Tab: Compilation progress

Plot Tab: Energy vs. Timesteps

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		(amplig (12%)) 15000 (12%) Trau / 6.0.1 (340) (12%)	Char Log		Timesteps	



# Step 4: 2D Postprocessing Results



- Switch to "2D Results" tab. Plot Type: Scattering Parameters
- Click General: Add Result. Change Plot Type to: Voltage (Time Domain)
- Click Toggle View Mode.
- Click Tile Sub Windows





#### **Step 5: Near Field**



- Switch to "3D Results" tab, Click "Iso z View"
- Open Field Monitors Switch On FIELDMON 1
- Turn off visibility of Top\_Ground and Substrate groups



Hint: Move field monitor planes to adjust the field display planes (double click on plane height to adjust the height)



#### **Step 6: Insert SMD Resistor**

- Go back to "3D Design" Tab Iso Z View, Switch off Field Monitor
- Open group Substrate, turn on group
- Double click "Height", set 0...1200, confirm "Assign new height ..."
- Click "Add Group" 🖬, enter Resistor
- Set height 1200...1210
- Click "Create Library Object"
- Tab: "SMD" → Click "SMD Resistor"
- Left click at Point: x=3000, y=1500
- Click "Edit Settings"
- Set size SMD0201, Press Ok (2x)
- Click "Add Group", enter "gnd-via"
- Hide group: Resistor, zoom in
- Click "Create Cylinder",
- Click at Point : x=3250, y=1500
- Press Tab and define:
  - height z: 800 ... 1200
  - radius r=80







#### **Step 7: Boolean History**



For the next steps we need E	Boolean History to define a	a parametric hole	Setup	General	View
<ul> <li>Go to "Editor Op</li> <li>Switch to "Prefer</li> <li>Check box "Keep</li> <li>OK</li> </ul>	tions" ences" tab o Boolean History"		Groups Ibstrate ielectric) onductor onductor) ort onductor)	Editor Options Adjust editor settings, like: - Background colors - Cursor appearance - Layout and Import/Export scale - Object attributes - Snap and Object selection	factors
Editor Options					
2D Design 2D Design Advanced 3D Misc Start in 2D Design ✓ Create Backup Files ✓ Display Hints in Sidebar Last Recently Used Files 5 ▼ Icon Size default ▼	Design 3D Design Advanced Import Bon ean Operations ✓ Keep Boolean History ✓ Simplify Polys Engine for Boolean Operations auto	Export Export Advanced	Components Conversion	n Design Dimensioning	Preferences



#### **Step 7: Hole creation**



- Hide group "Substrate"
- Switch on group "Top\_Ground"
- Right click on group name, select "Set Active"
- Open group, double click "Height", set 800...810, confirm Yes
- Click "Create Cylinder", 🗊
- Click Point : x=2750, y=1500, r=150
- Set height to dw= -10, OK
- Click the plane
- Click the cylinder
- In Boolean Menu click
- Select Subtract (first-rest)





#### **Step 8: Parametric Hole**







## Step 9: Adjust Model, Via Hole

- Create group "sig-via", set height 400...1200
- Show groups: Conductor & sig-via
- "Create Cylinder" 🛐
- Click Point: x=2750, y=1500, r=80, long click for group height, OK
- Unhide all groups O II + S Groups
- Open Group Ports, open Sources, Click GANLIB 1 (Stripline), Click "Delete"



#### EMPIRE XPU

## **Step 10: Simulation Setup**

- Open "Simulation Setup" 🕼 , select "EM Setup" Tab
- Set "Stop Frequency" = 10GHz
- Select "Boundary" Tab
- "Boundary Conditions" ymin=Electric, ymax=Electric
- "Boundary Distance"  $\rightarrow$  Set zmax = 500, OK
- Click "Start Simulation" 🚳 , OK, wait for finish
- Select "2D Results" Tab, Select Plot Type Scattering Parameters, Impedance





#### **Step 11: Diameter Variation**

S11

- Select "Simulation" Tab
- Click "Parameter Sweep Setup"
- Click "Create Parameter Sweep"
- Click "Start", confirm
- Wait for Sweep to finish
- Select "2D Results" Tab
- Plot Type: S-Parameters
- Select all Curves right click Show all



20 dB Matching up to 7.8 GHz with dia=500



#### **Step 12: Via Fence**



- Select "3D Design" tab
- Create group "fence", height <u>0..</u>.800
- Click "Create Library Object" Image Stress
- Tab : "Layout" → "Viafence"
- Click at x=0, y=500, (z=810)
- Click at x=4000, y=500
- Long click to finish and use group height
- Click "Edit Settings"
- Set: D1=160, D2=160, dist=450, 2x OK
- Right click on group "fence", "Select group objects"
- Click "Copy & Mirror "
- Enter Start X=0, Y=1500 Stop X=10, Y=1500, OK
- Click "Simulation Setup"  $\blacksquare \rightarrow$  Boundary Tab
- Change "Boundary Conditions": ymin = ymax = Absorbing Sheet, OK
- Click " Start Simulation", OK



#### **Step 13: Animation**



- "3D Results" Tab, Switch on Field Monitor, Right click Edit, Use Optimization = Off, OK
- Switch off groups Substrate, Top\_ground
- Monitor Planes xz=1500, xy=280

