Wireless Visualizaiton - Sam Dong

Wireless Insite:

A suite of RF propagation models, providing 3D ray-tracing, fast ray-based methods, and empirical models for the analysis of site-specific radio wave propagation and wireless communication systems. Wireless Insite simulates the wireless signal propagation and documents all the related data, such as complex impulse response, direction of arrival, direction of departure, mean direction of arrival, mean direction of departure, propation paths, and received power, in either p2m or binary files.

Collaboration with NCSA on wireless visualization: https://virdir.ncsa.illinois.edu/dbock/Vis/WiFi/

I examined three indoor 3D models in this project: "Home", "Office Space", and "MMIO Sweep".

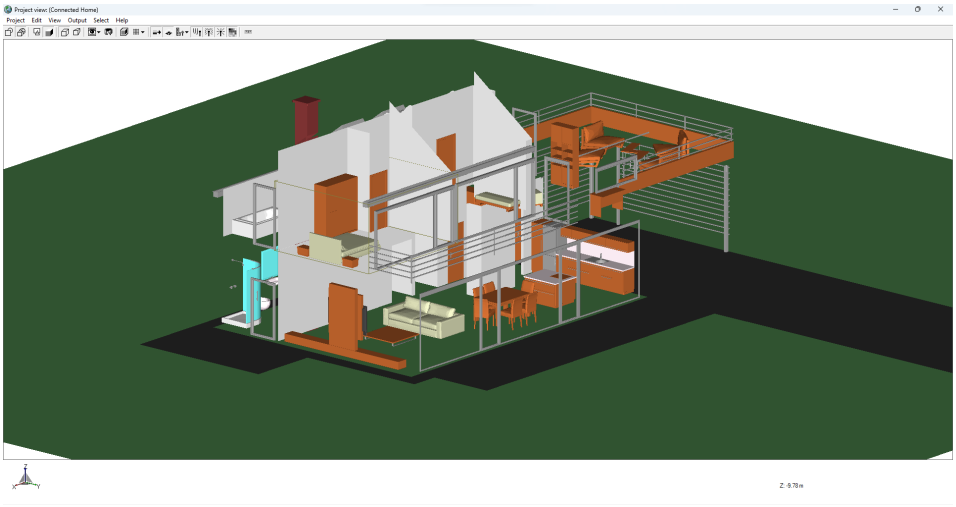


Figure 1: "Indoor Model 1" - "Home"

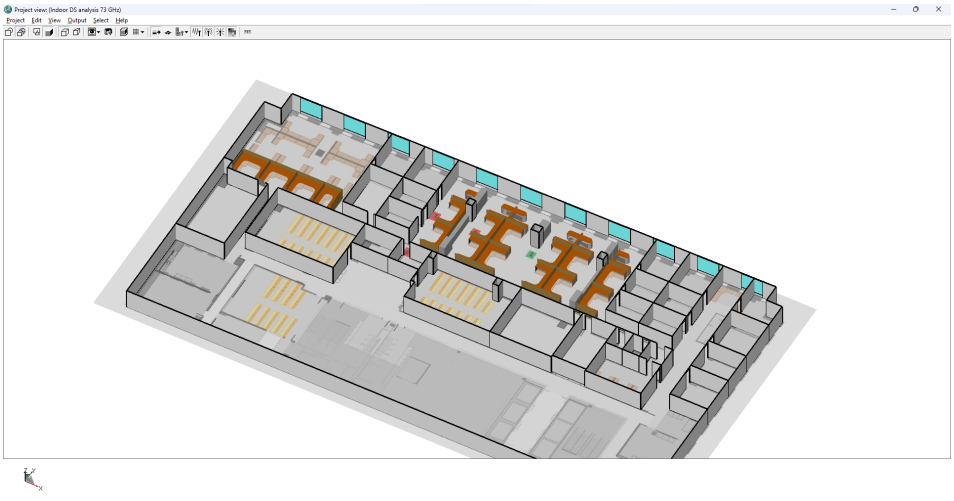


Figure 2: "Indoor Model 2" - "Office Space"

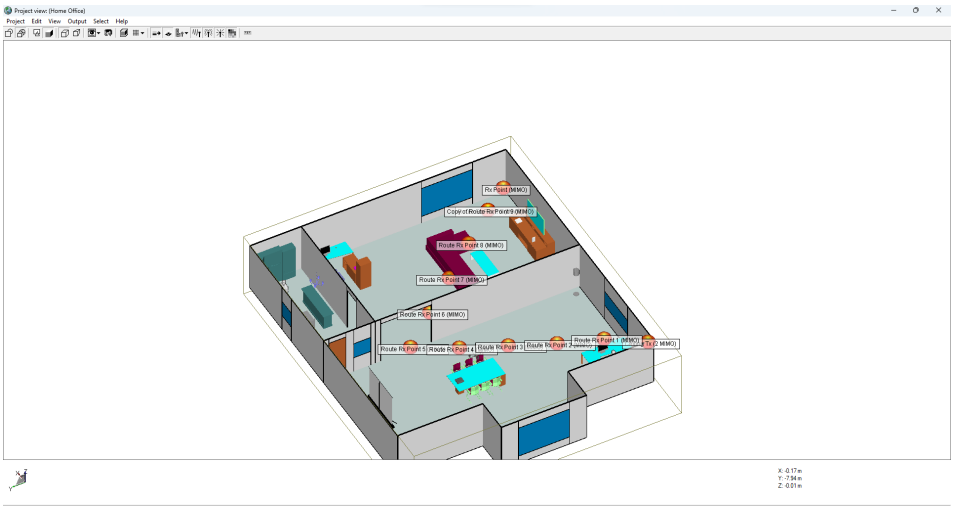


Figure 3: "Indoor Model 3" - "MMIO Sweep"

- **Propagation Path**
  In the simulation, Wireless Insite picks the first 50 propagation paths that have the strongest received power from one transmitter to one receiver and documents all the information about those propagation paths, namely point of departure, point of reflection, and point of arrival, in p2m format. Each study area will populate a folder of p2m files that's named after the name of the study area. Each study area only calculate the propagation paths within its boundary. The propagation paths p2m data is used to train data learning model in Saif Ur Rahman.

  All the compressed data are stored in this google drive. Follow the instruction in the "Data Documentation" folder.
  https://drive.google.com/drive/u/1/folders/11Dedy–oiE9P7VvSMCYLdDdxdjBR_Oki?ths=true

- **Received Power**
  Wireless Insite also enables received power visualization. It can color-code each point receiver based on the strength of power it receives. In this project, I use multiple receiver grids to display the signal strength over the room.

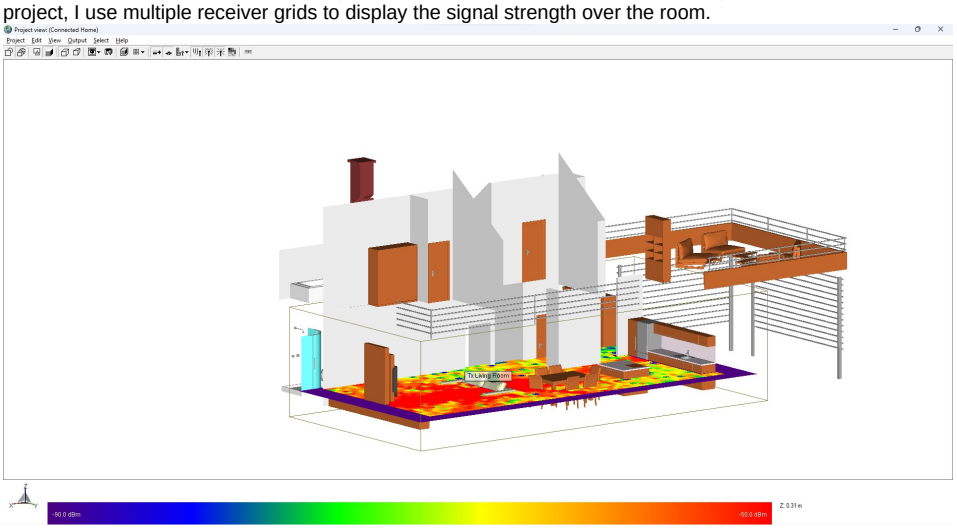


Figure 4: Received Power visualization of Grid 4 with height 0.8m of Living Room Simulation in Indoor Model 1 above the ground (Color spectrum is shown at the bottom)

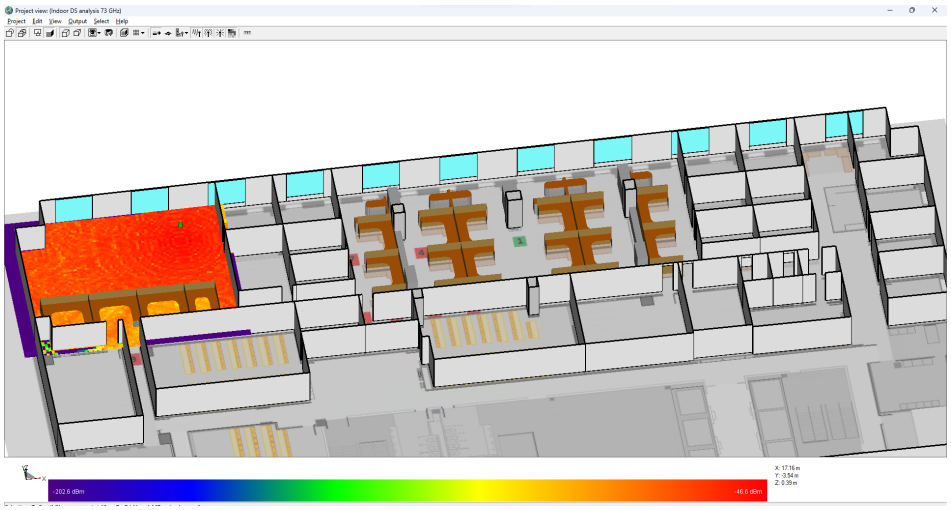


Figure 5: Received Power visualization of Grid 4 with height 0.8m of Classroom 2 in Indoor Model 2 above the ground (Color spectrum is shown at the bottom)

The HeatMap from Brid Eye View screenshots:

https://drive.google.com/file/d/1GGLu-k0_K2ni-37w18hFTUnYqChybd_T/view?usp=drive_link

The HeatMap from Brid Eye View Demo video:

https://drive.google.com/file/d/1GGLu-k0_K2ni-37w18hFTUnYqChybd_T/view?usp=drive_link

- **Post Processing**

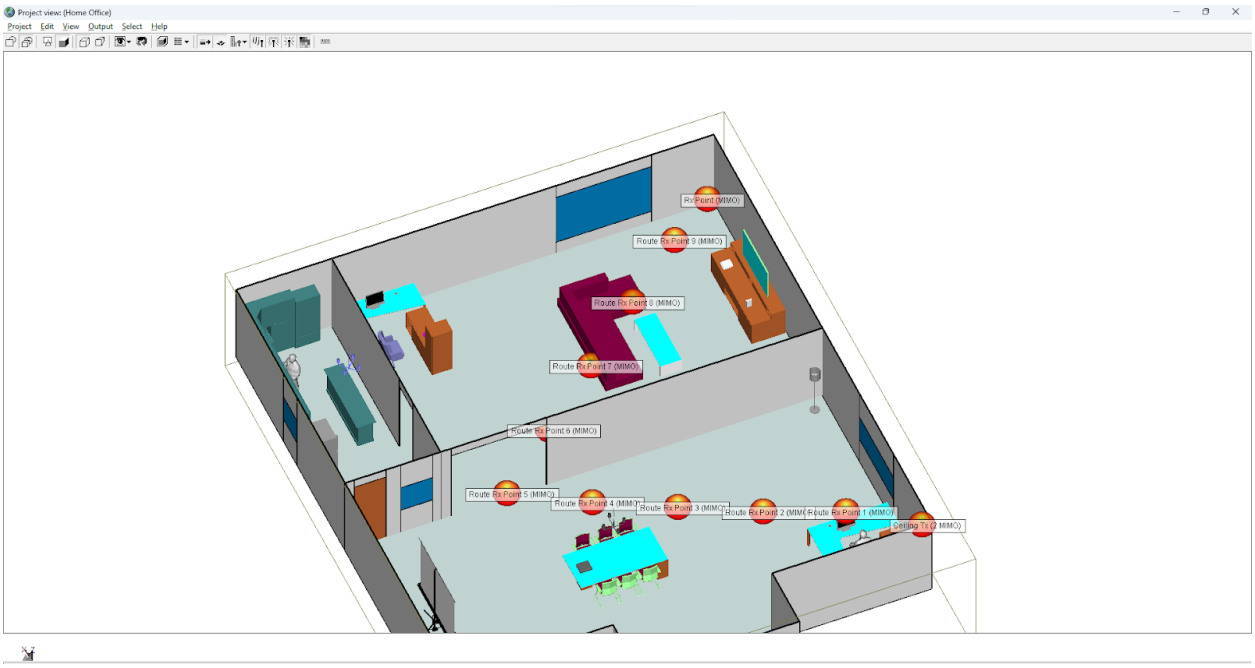
Plotly:
Plotly is a great python library for visualizations. In this project , I made 3D heatmaps visualizations of Wireless Insite simulations. Plotly enables users to change the angle and zoom in / zoom out the 3D heatmap model to get a better viewing position.

Github of Plotly Post-processing: https://github.com/Hongyi-Sam-Dong/Wireless-Visualization/tree/main

Demo of Plotly Heatmap of Bedroom model in Indoor Model 1:
https://drive.google.com/file/d/1oEwXAQV9XebfCHcVdTq1zMlKmyPXzj7v/view?usp=drive_link

WirelessInSite Broadband Analyzer:
The broadband analyzer is a utility that post-processes results from a Wireless InSite simulation file and generates the broadband impulse response and frequency spectrum over a user-specified frequency band.

Line of receivers for analyzer:


Project view: (Home Office)
Project Edit View Output Select Help
Rx Point (MIMO)
Route Rx Point 9 (MIMO)
Route Rx Point 8 (MIMO)
Route Rx Point 7 (MIMO)
Route Rx Point 6 (MIMO)
Route Rx Point 5 (MIMO)
Route Rx Point 4 (MIMO)
Route Rx Point 3 (MIMO)
Route Rx Point 2 (MIMO)
Route Rx Point 1 (MIMO)
Setting Tx (2 MIMO)

Point 1:

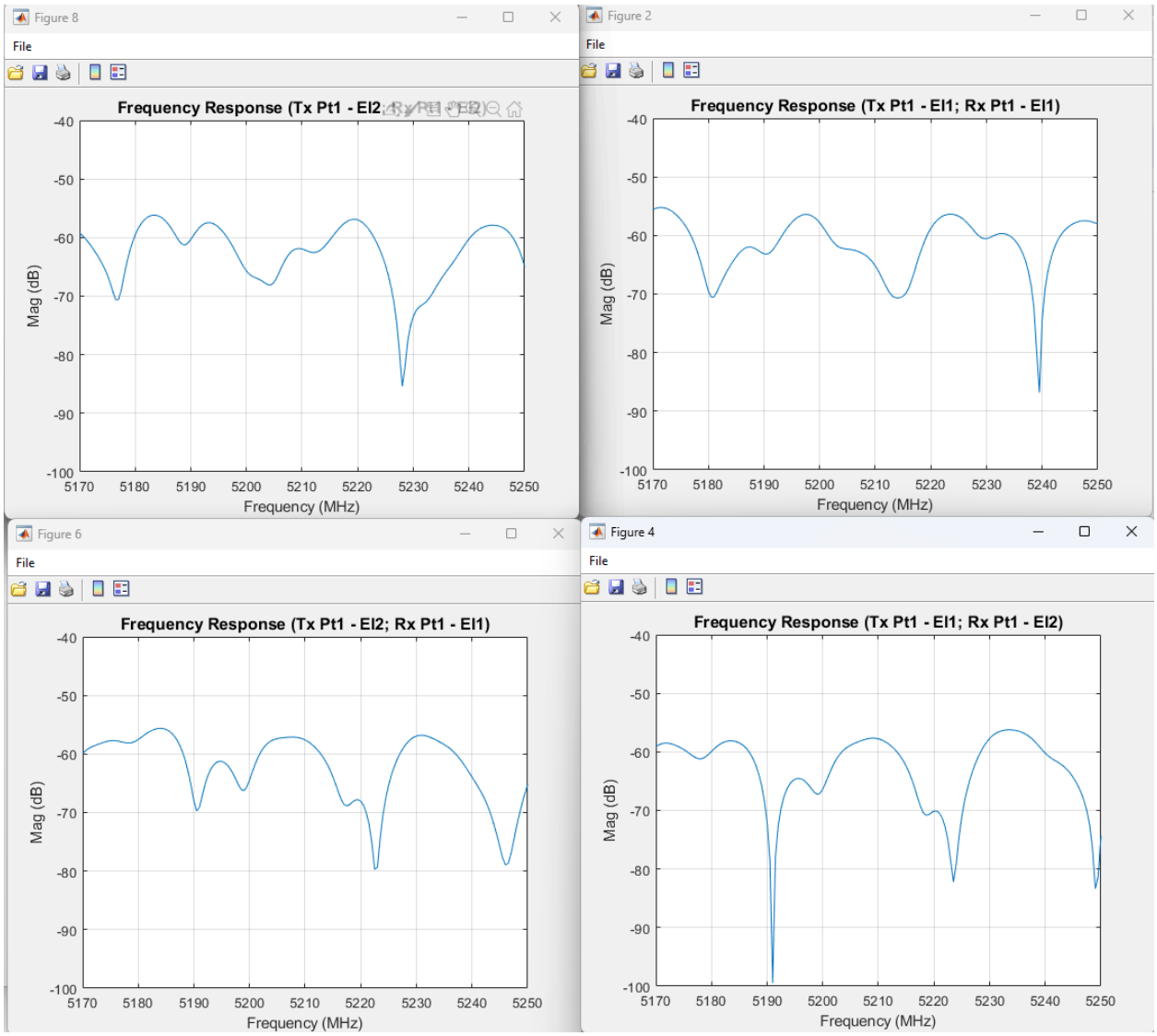


Figure 8
File
Frequency Response (Tx Pt1 - El2; Rx Pt1 - El2)
Mag (dB)
Frequency (MHz)
Figure 2
File
Frequency Response (Tx Pt1 - El1; Rx Pt1 - El1)
Mag (dB)
Frequency (MHz)
Figure 6
File
Frequency Response (Tx Pt1 - El2; Rx Pt1 - El1)
Mag (dB)
Frequency (MHz)
Figure 4
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Frequency Response (Tx Pt1 - El1; Rx Pt1 - El2)
Mag (dB)
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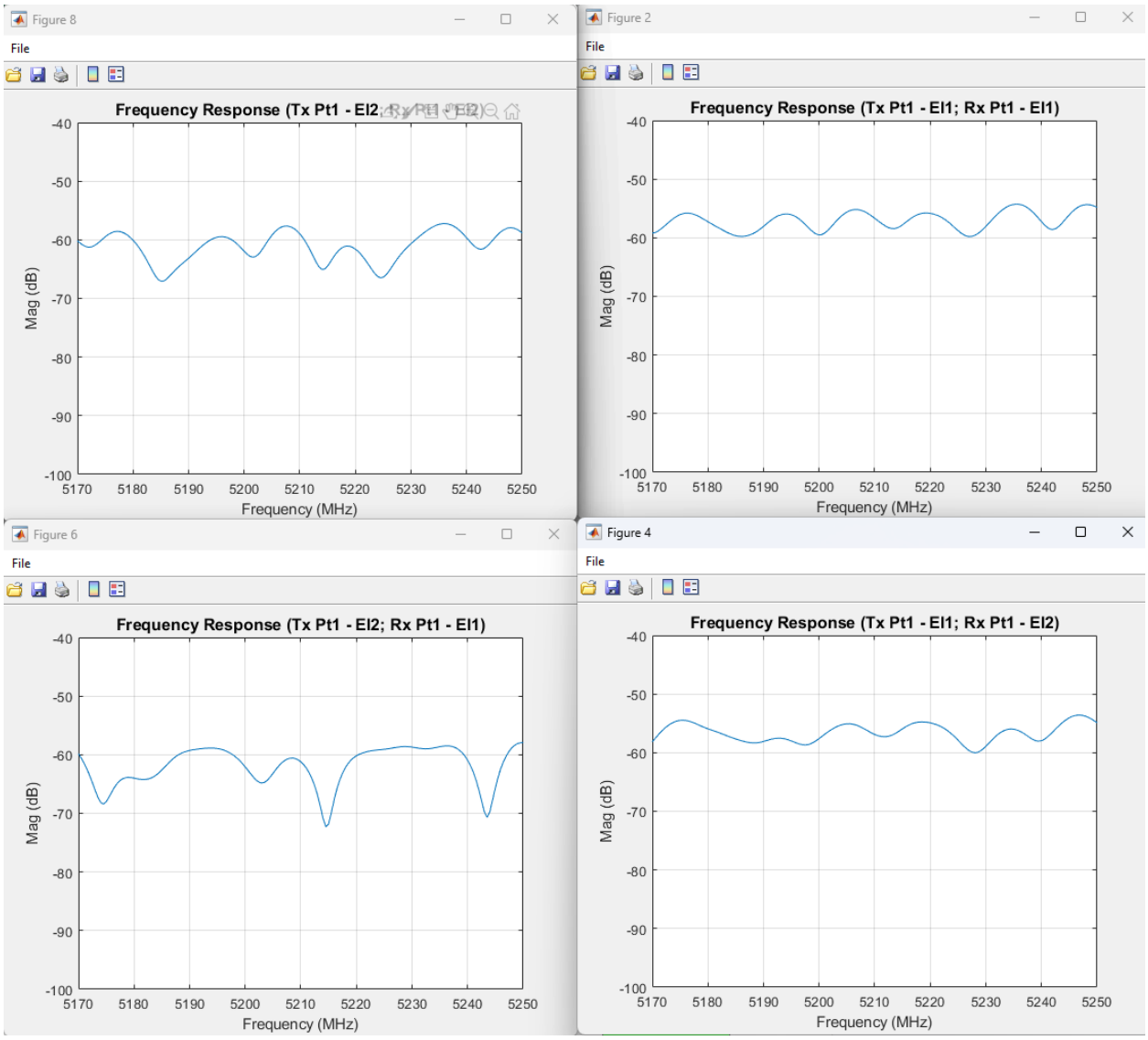
Point 2: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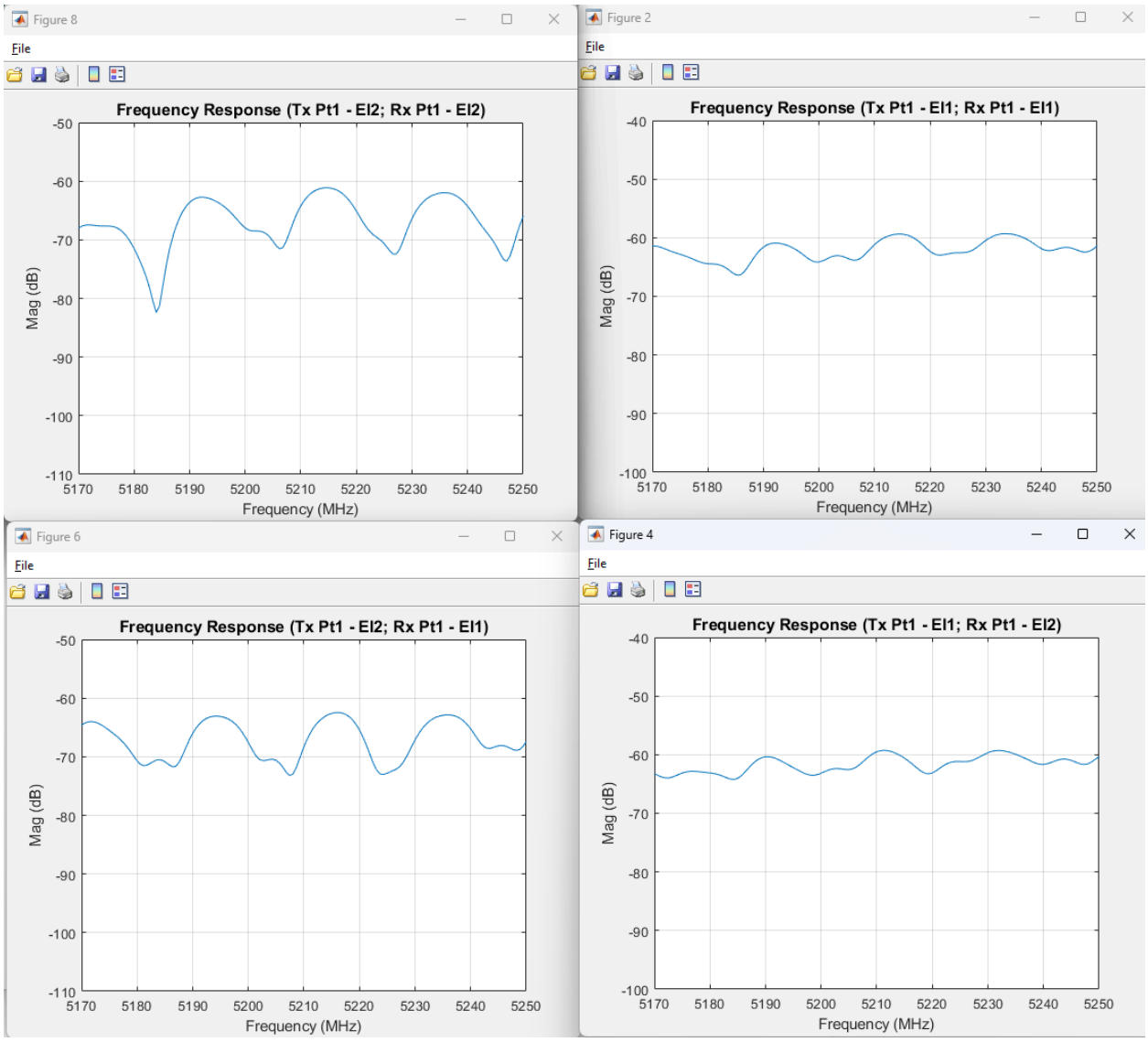
Point 3: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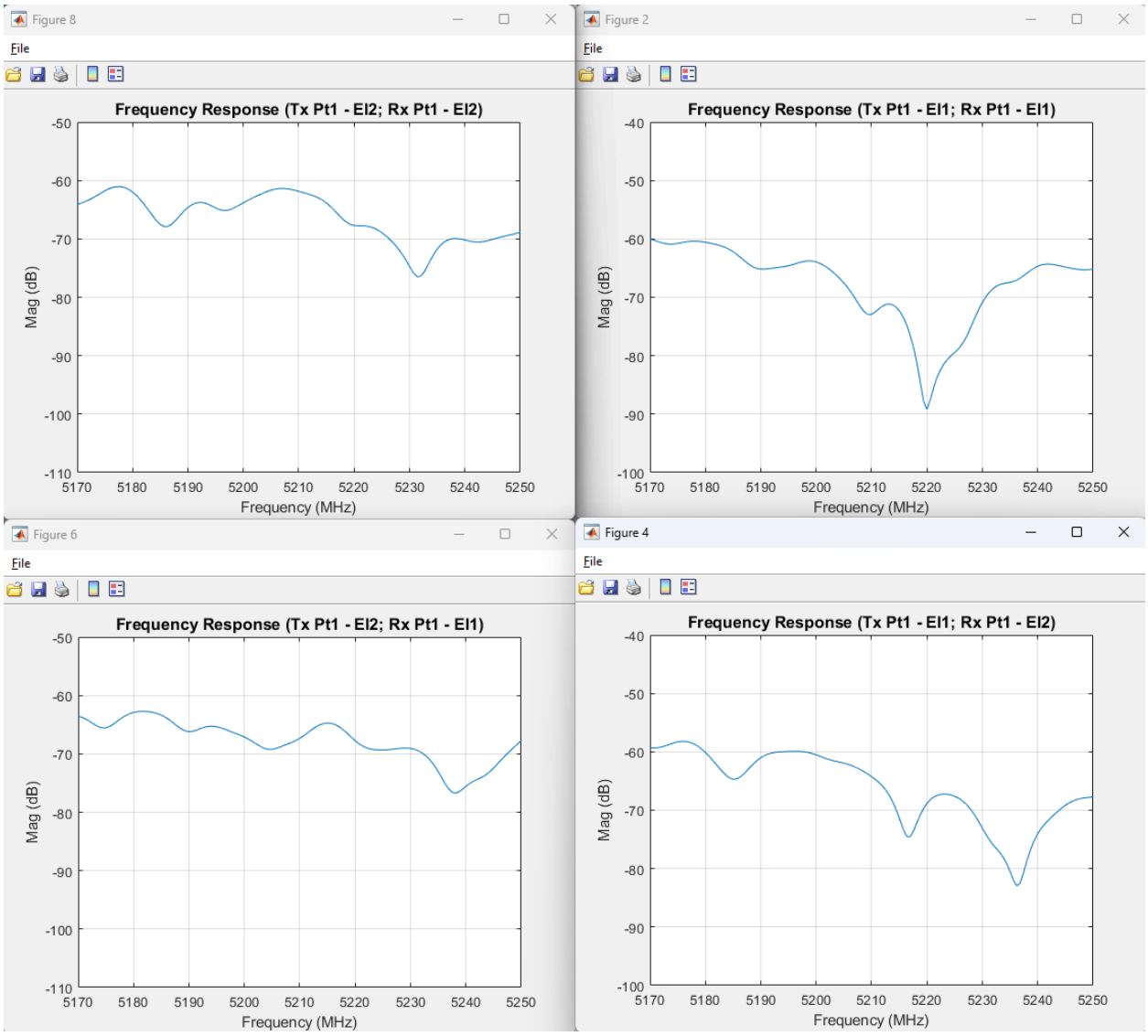
Point 4: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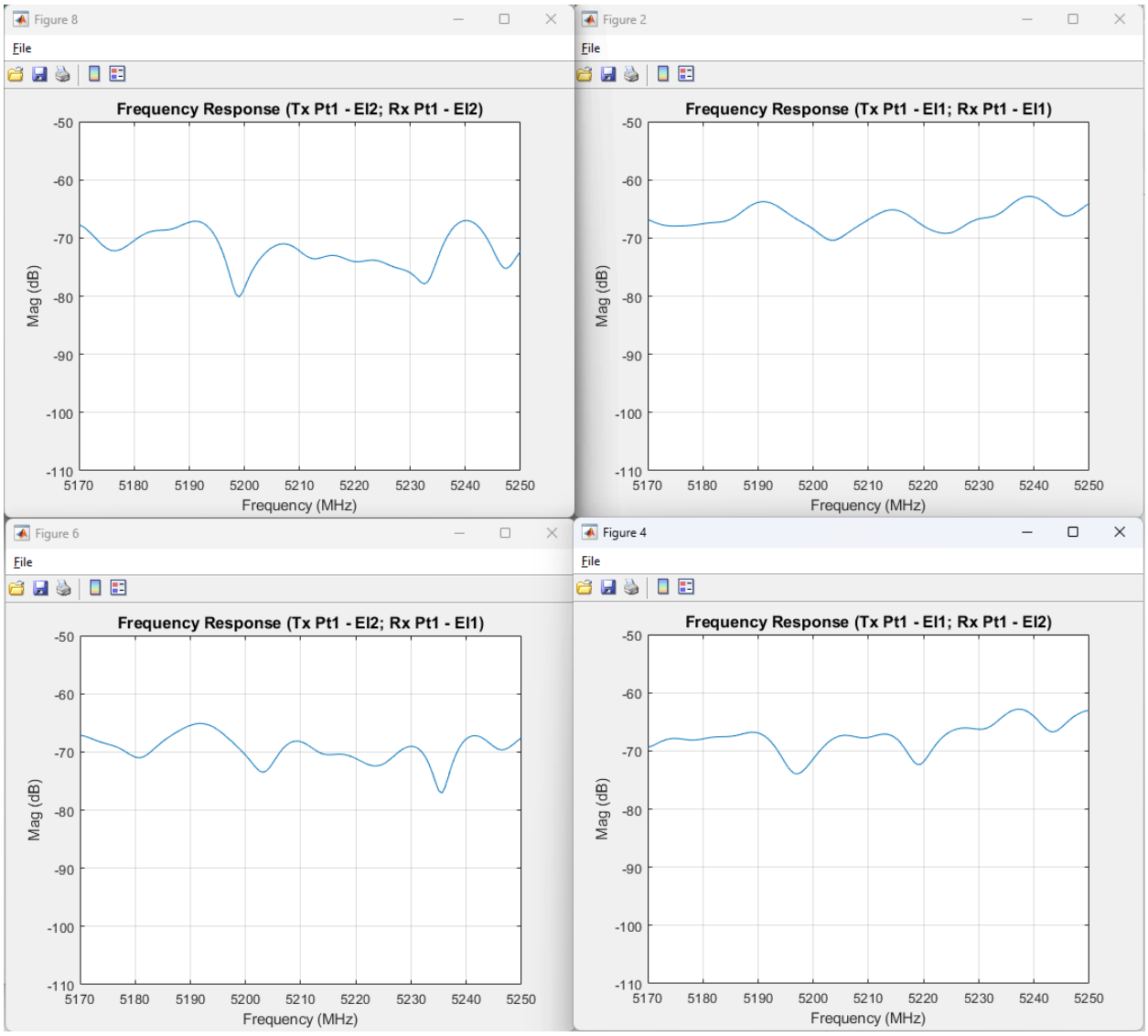
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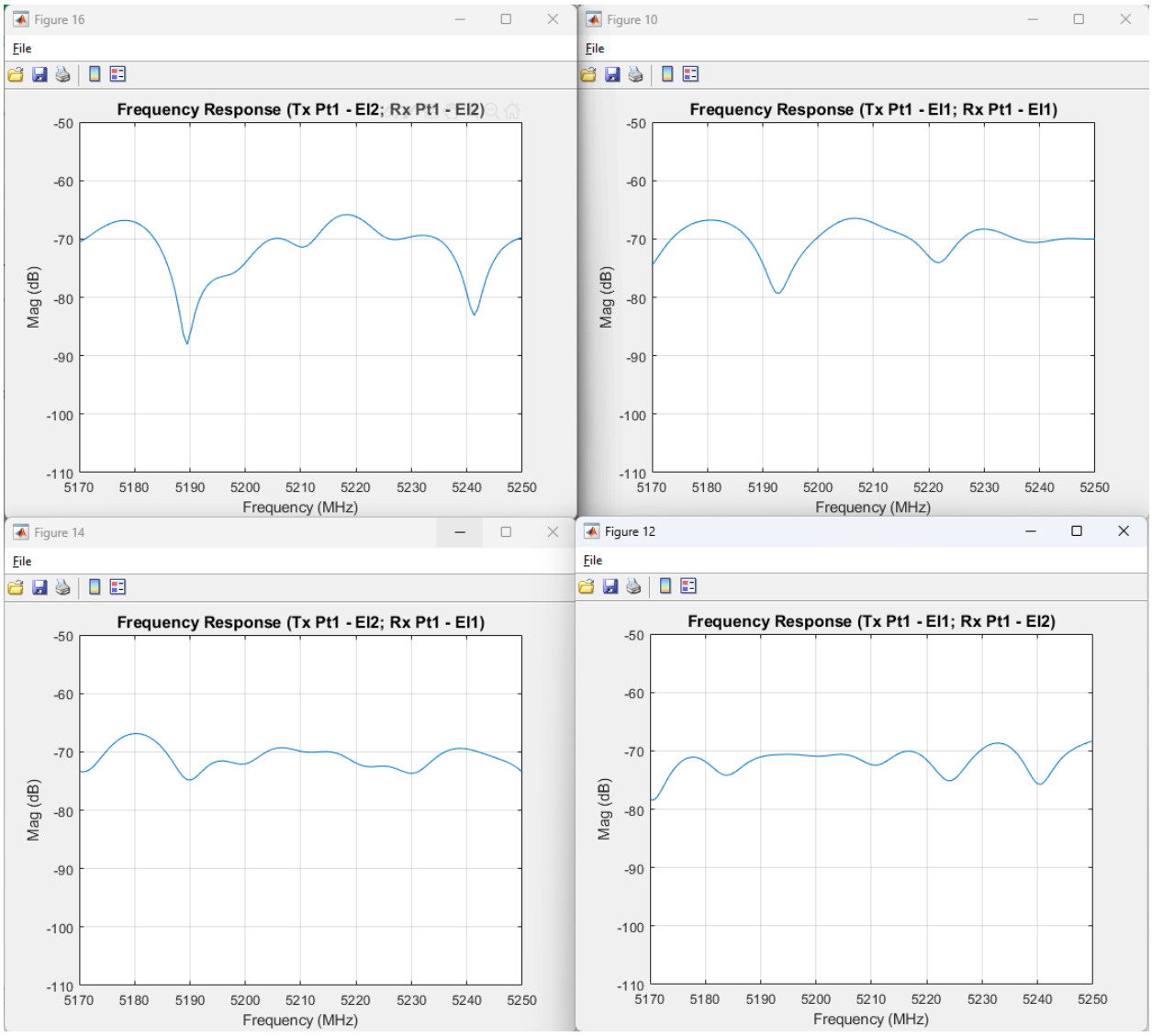
Figure 16
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Frequency (MHz)
Figure 10
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Frequency Response (Tx Pt1 - El1; Rx Pt1 - El1)
Mag (dB)
Frequency (MHz)
Figure 14
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Frequency Response (Tx Pt1 - El2; Rx Pt1 - El1)
Mag (dB)
Frequency (MHz)
Figure 12
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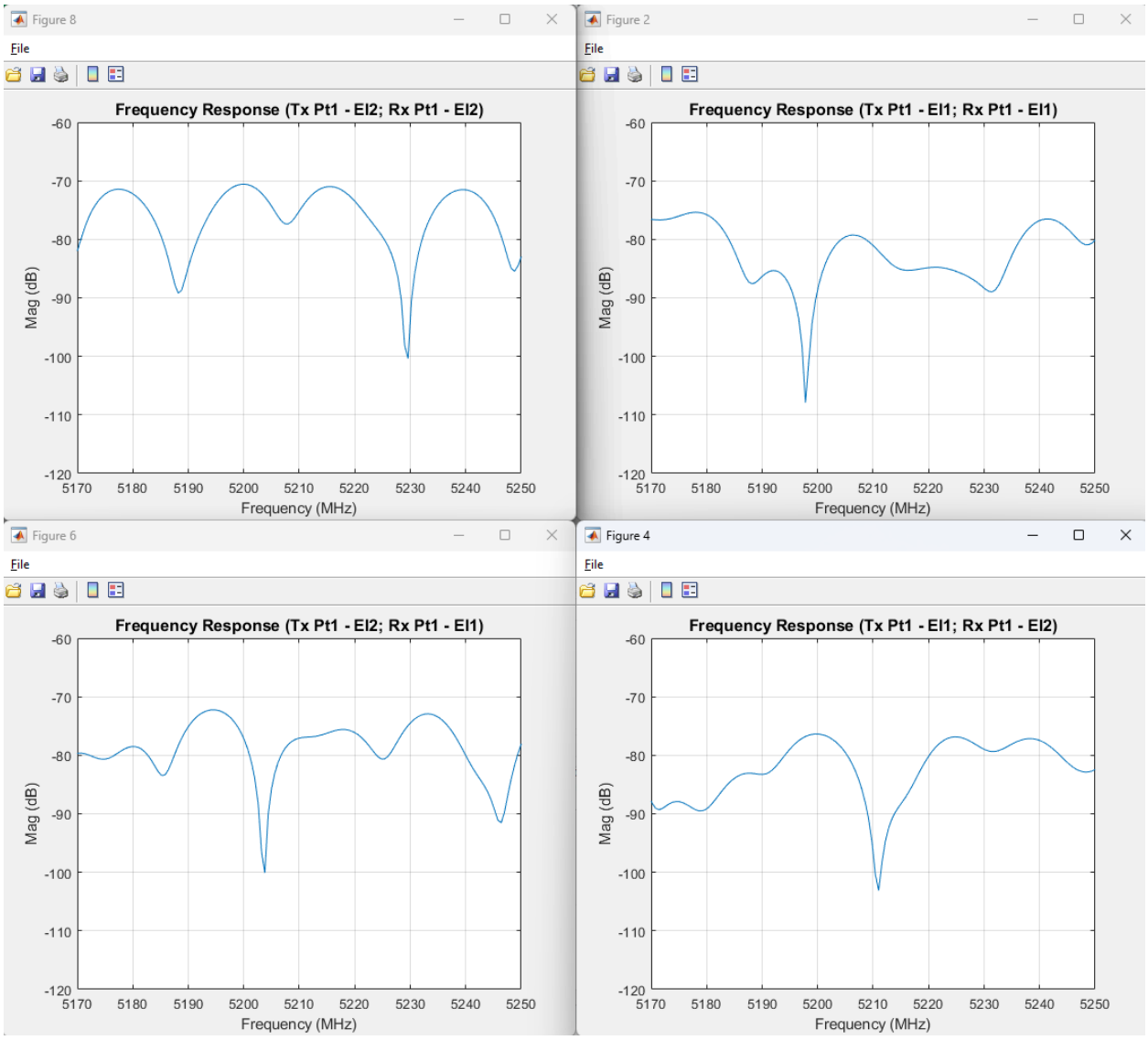
Frequency Response (Tx Pt1 - El1; Rx Pt1 - El2)
Mag (dB)
Frequency (MHz)

Point 7: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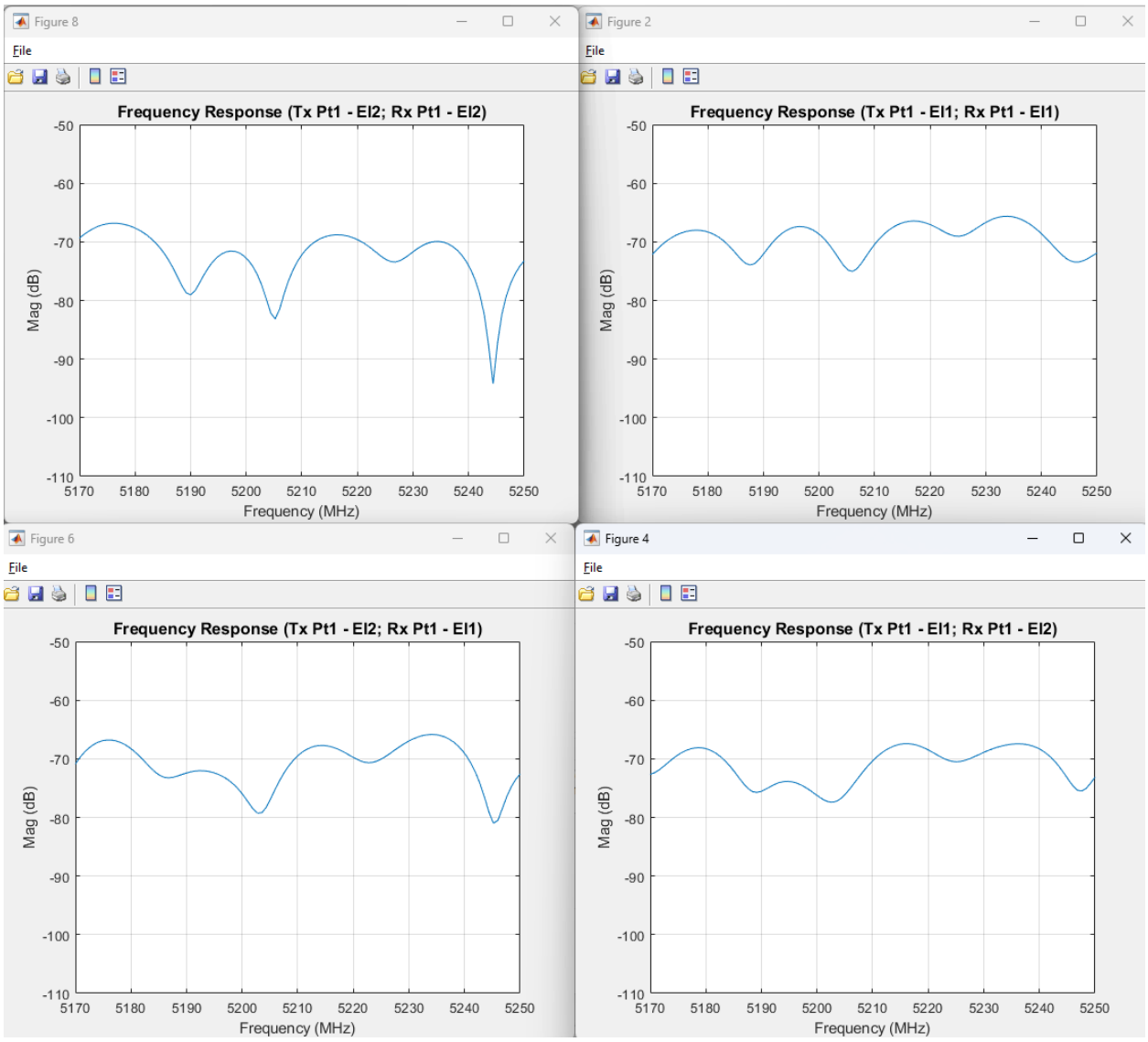
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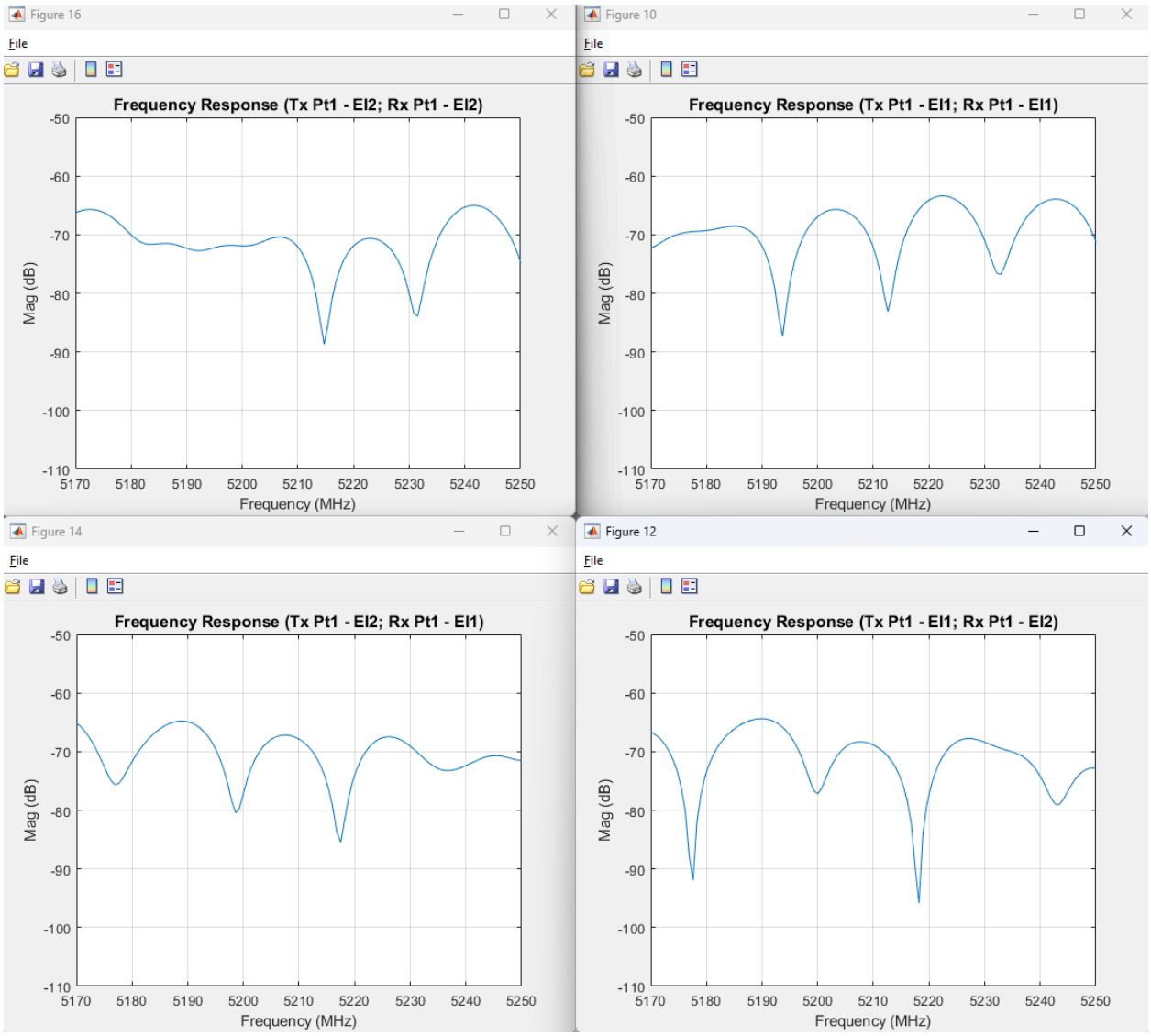
Point 9: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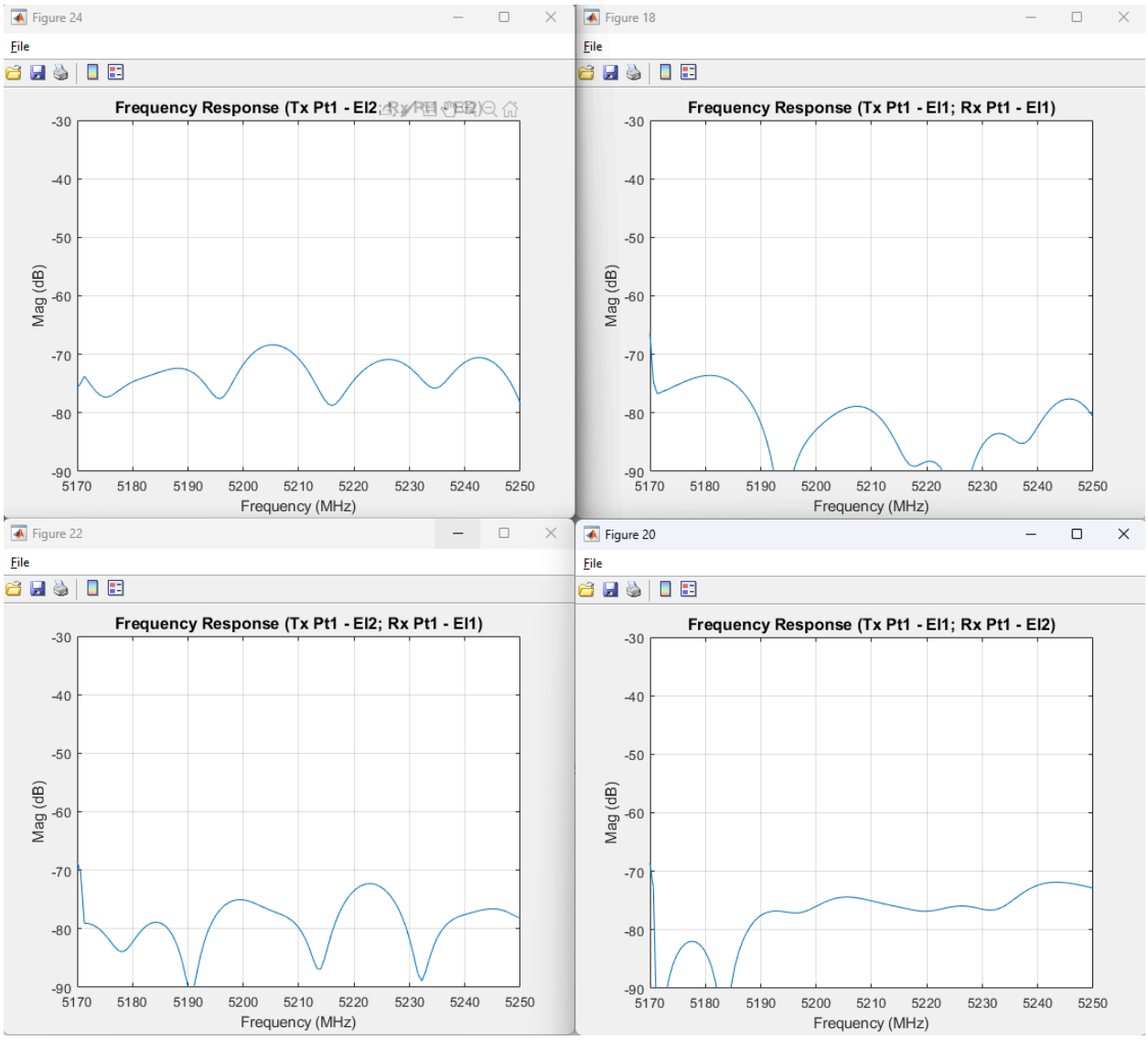

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Citation:

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