DRD TECHNOLOGY

ANSYS AEDT/HFSS

Multi-antenna problems, Large Problem Spaces, and Co-site Interference

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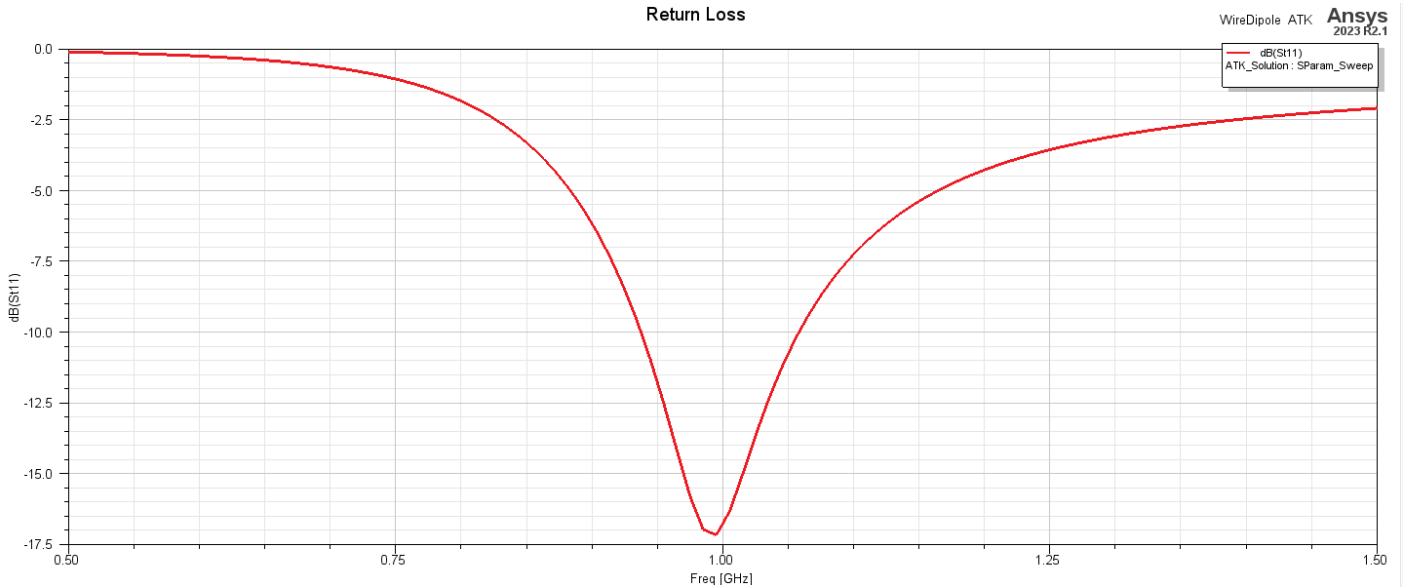
DRD

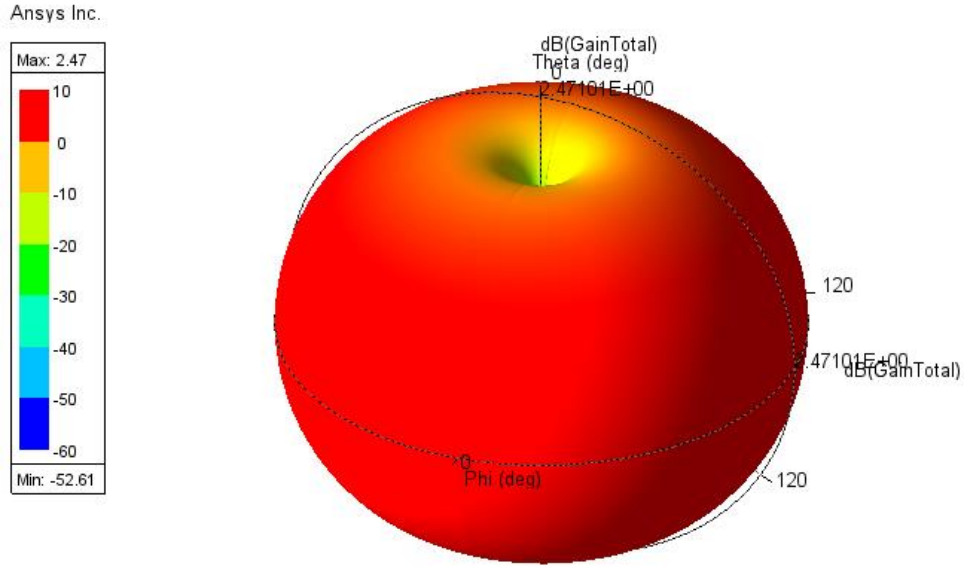
Agenda

- HFSS Simulations with multiple antennae
  - Get from the component library
  - HFSS 3D Components
- The “Hybrid” HFSS Solver for large solution domains
  - FEBI, IE, and SBR+
- Antenna System simulation with EMIT
  - Co-site Interference Problem
- Discussion

Let’s Solve a Problem!

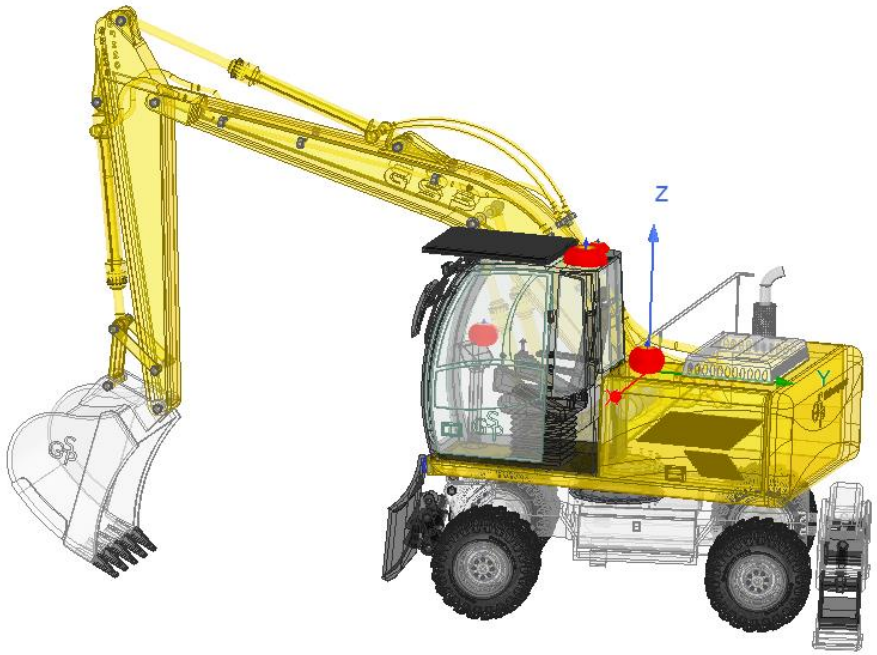
- Interactive demo of AEDT HFSS





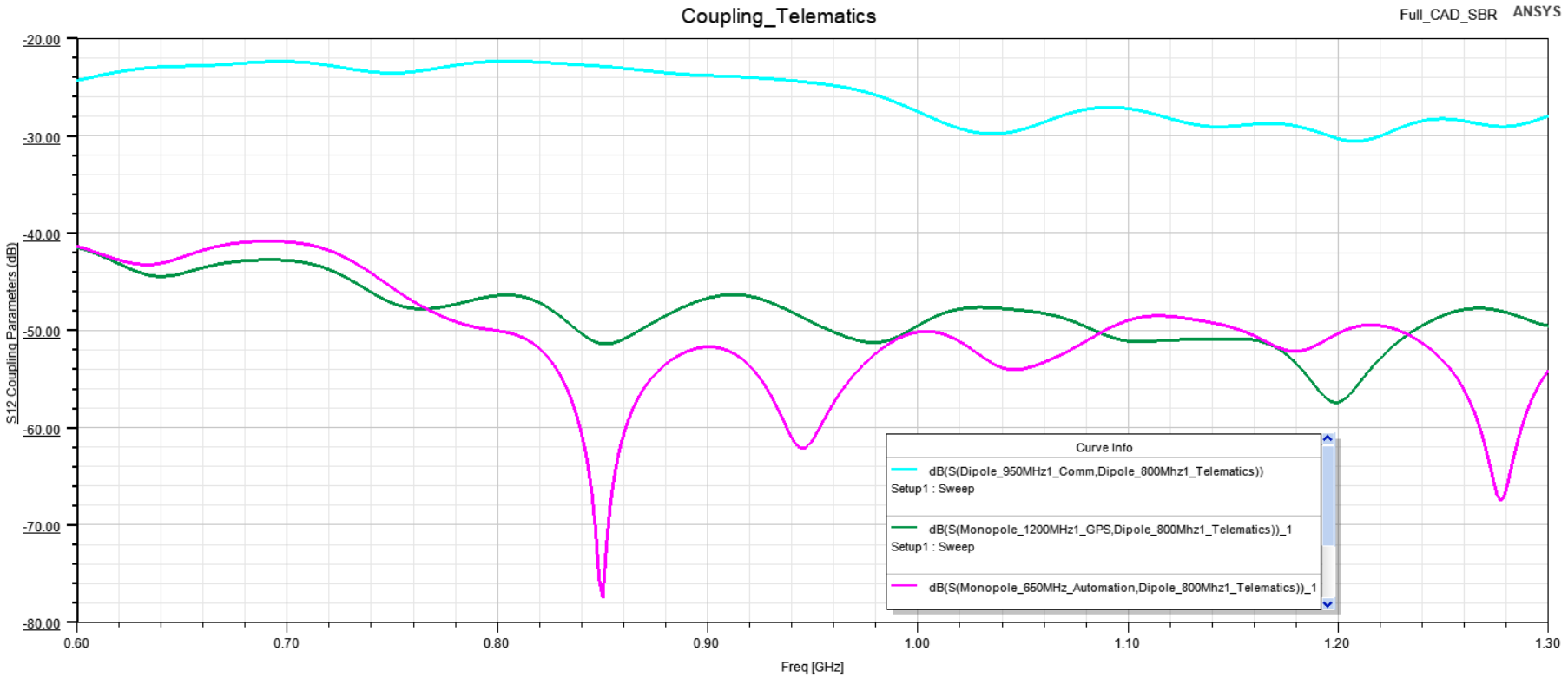
Multi-antenna placement, Real Platform

- Designing Antennas in HFSS SBR+
  - Utilizing the "*Create an Antenna*" feature in HFSS SBR+
    - Telematics Antenna: 800 MHz
    - GPS Antenna: 1200 MHz
    - Communication Antenna: 950 MHz
    - Automation: 650 MHz
- Antenna Placement on Excavator CAD Geometry
- Create Solution Set-up & Defining Frequency Sweep



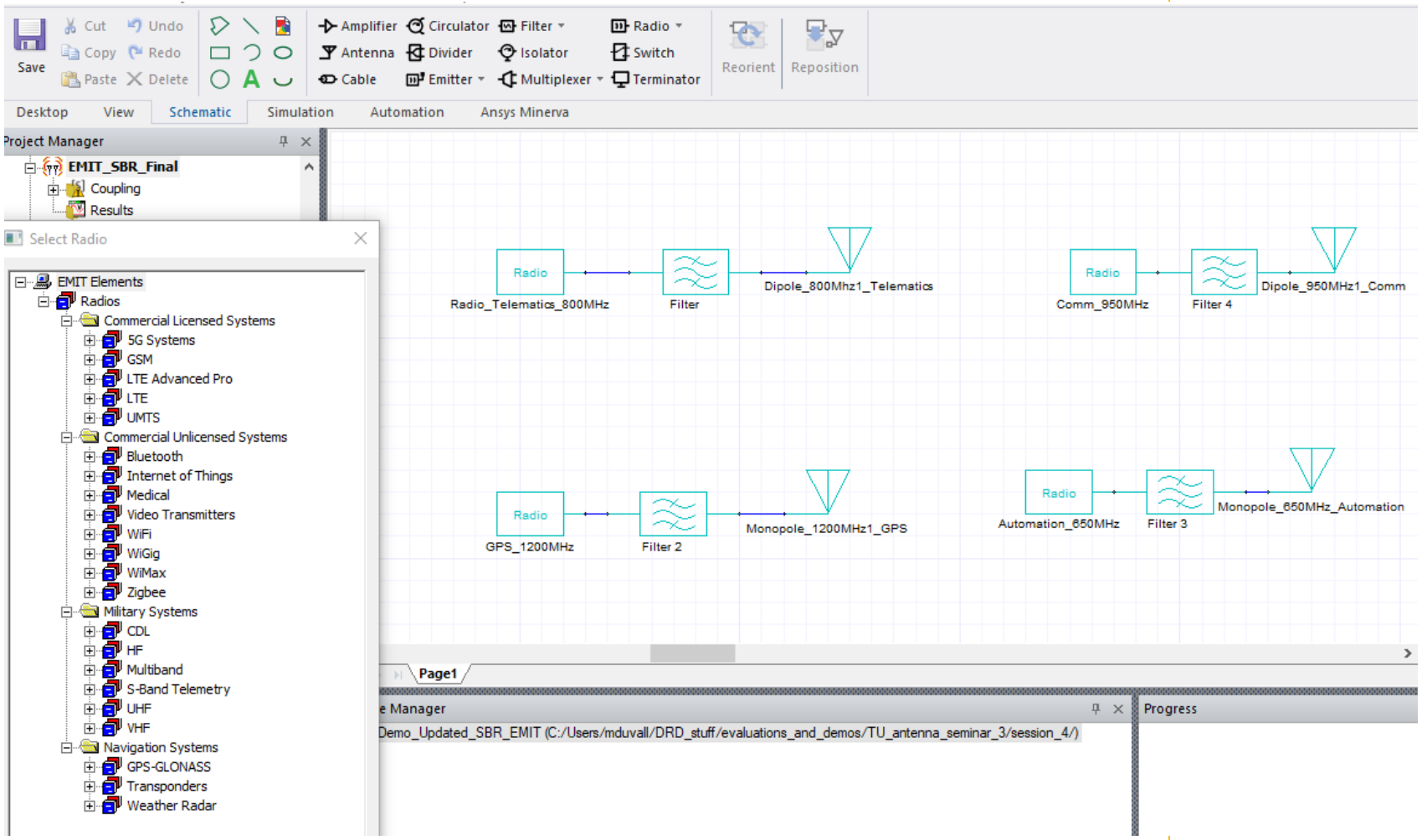
Antenna Coupling Parameters

- Once the design is simulated, the coupling parameters can be seen and analyze the coupling between the antennas



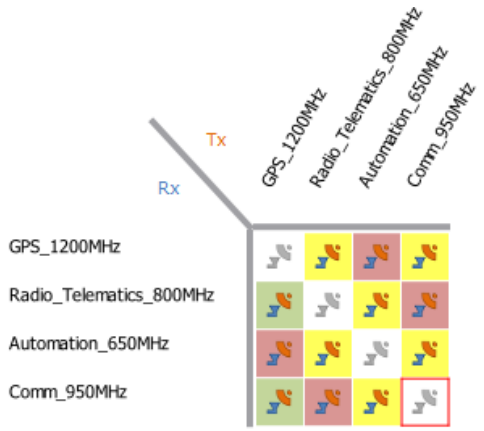
ANSYS EMIT

- Antenna system simulation
  - Engineer radio system behavior and minimize coupling/interference
    - Spurious Emissions…



Co-site Interference Analysis in EMIT

- Link the HFSS design to an EMIT design
- Create Radio for each antenna
  - Defining Frequency Band
    - For Tx & Rx
    - Peak Power
    - Minimum received Signal power
  - Sampling: Frequencies of interest
- Analyzing Electromagnetic Interference (EMI) Margins



FREQUENCY RANGE:
2.0-29.999 MHz

NUMBER OF CHANNELS:
28,000

METHOD OF FREQUENCY CHANGE:
Automatic resonating power amplifier and antenna matching circuits.

POWER SOURCE:
Model A – 115 V, 400 cps, single phase
Model B – 208 V, 400 cps, 3 phase

POWER REQUIREMENTS:
Receive – 190 Watts
Transmit SSB – 850 Watts
Transmit AM – 1100 Watts

FREQUENCY STABILITY:
0.7 parts per million per month

NOMINAL CHANNEL SETTLING TIME:
6 seconds

AMBIENT TEMPERATURE RANGE:
-40°C to +70°C

AMBIENT HUMIDITY RANGE:
Up to 95% relative humidity

ALTITUDE RANGE:
Up to 30,000 feet

TRANSMITTING CHARACTERISTICS

RF POWER OUTPUT:
SSB – 400 Watts PEP
AM – 100 Watts Carrier

RF OUTPUT IMPEDANCE:
52 Ohms

VSWR:
Not to exceed 1.3:1

AUDIO INPUT IMPEDANCE:
100 Ohms unbalanced; 600 Ohms balanced

AUDIO FREQUENCY RESPONSE:
5 dB peak-to-valley ratio from 300-3000 Hz

DISTORTION:
SSB – 3rd order products down at least 30 dB.
AM – less than 20% at 85% modulation

RECEIVING CHARACTERISTICS

SENSITIVITY:
SSB – 1 uV for a 10 dB (S+N)/N ratio
AM – 3 uV modulated 30% at 1 kHz for a 6 dB (S+N)/N ratio

SELECTIVITY:
SSB – 2.85 kHz, 6 dB down; 6.0 kHz, 60 dB down
AM – 5.5 kHz, 6 dB down; 14 kHz, 60 dB down

AGC CHARACTERISTICS:
Maximum variation of audio output is 6 dB for signals from 10-100,000 uV. No overload below 1 V signal input

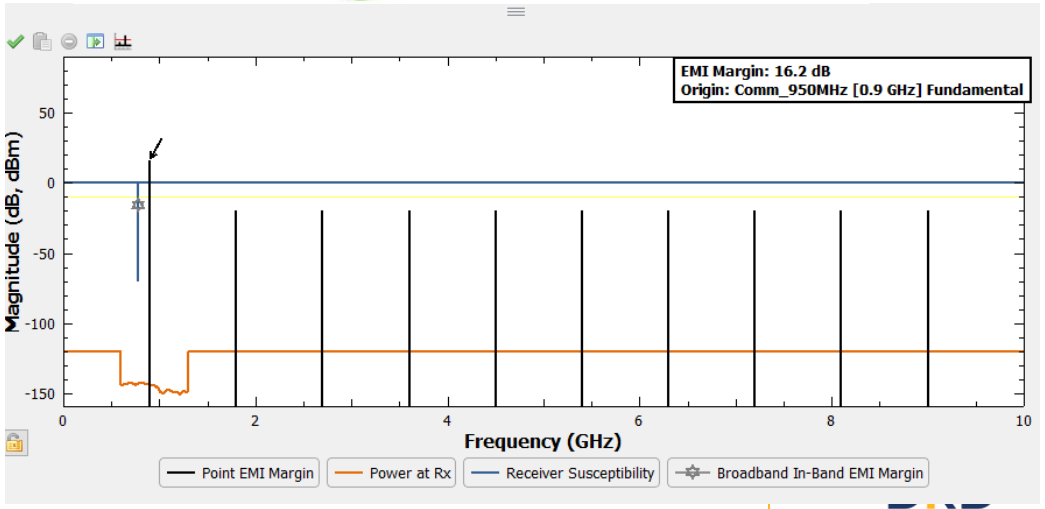
IF REJECTION:
80 dB minimum

AUDIO OUTPUT POWER:
100 mW into a 300 Ohm load

AUDIO DISTORTION:
Less than 10%

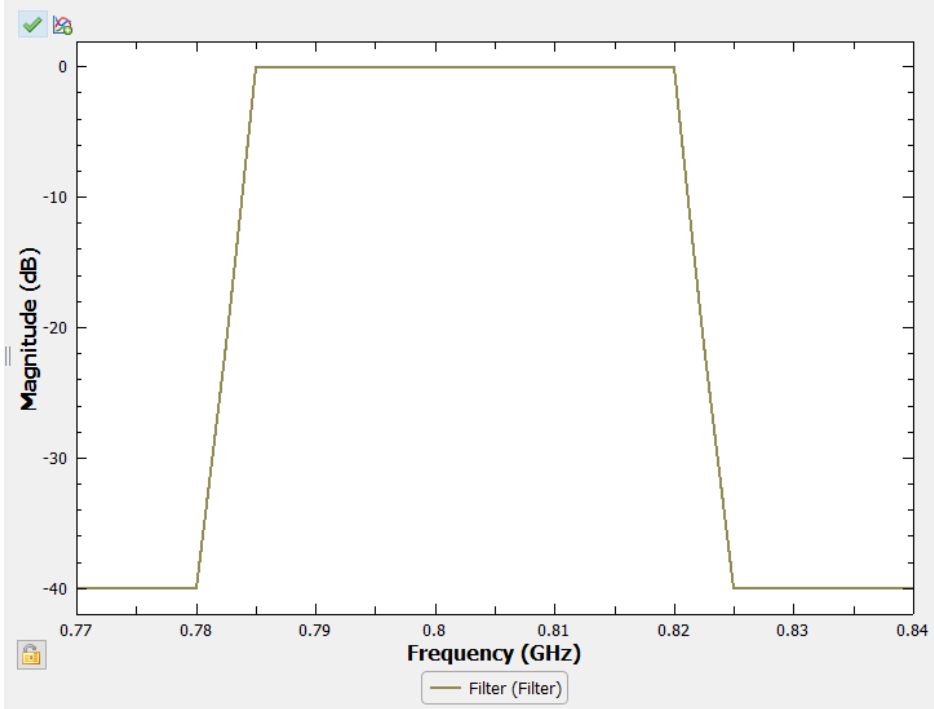
AUDIO FREQUENCY RESPONSE:
5 dB peak-to-valley ratio from 300-3000 Hz

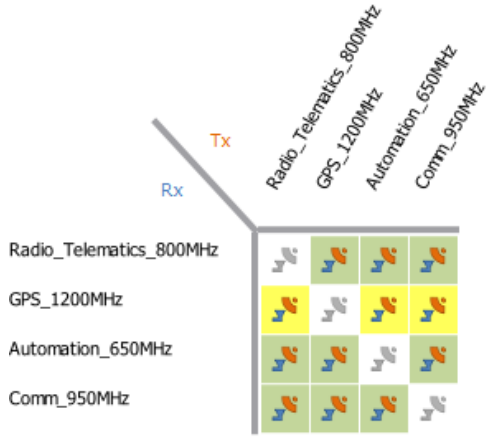
ABC COMMUNICATIONS

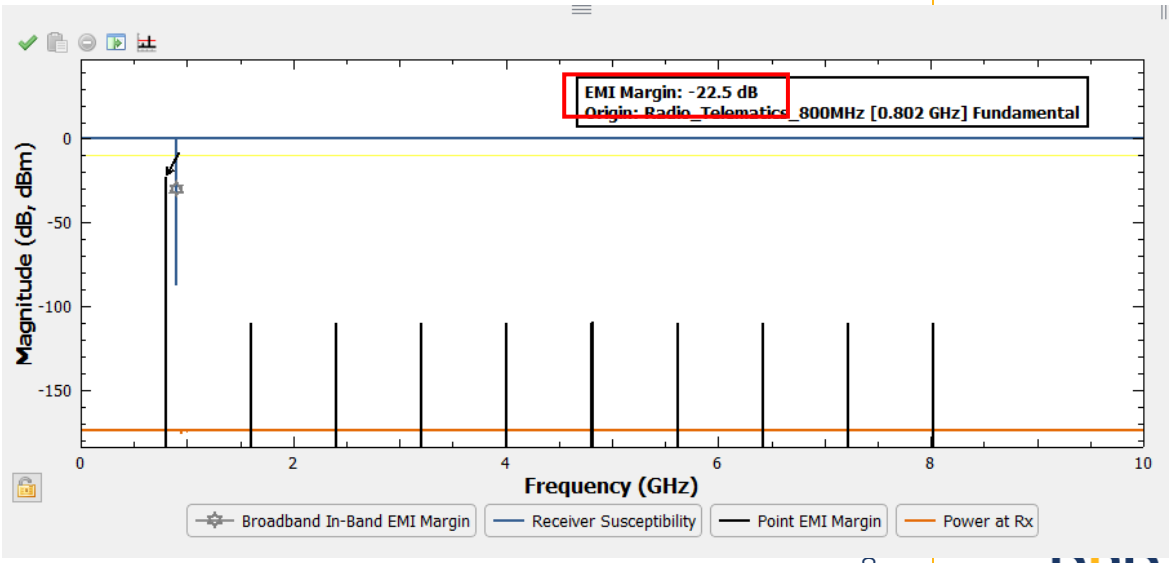


Co-site Interference Mitigation in EMIT

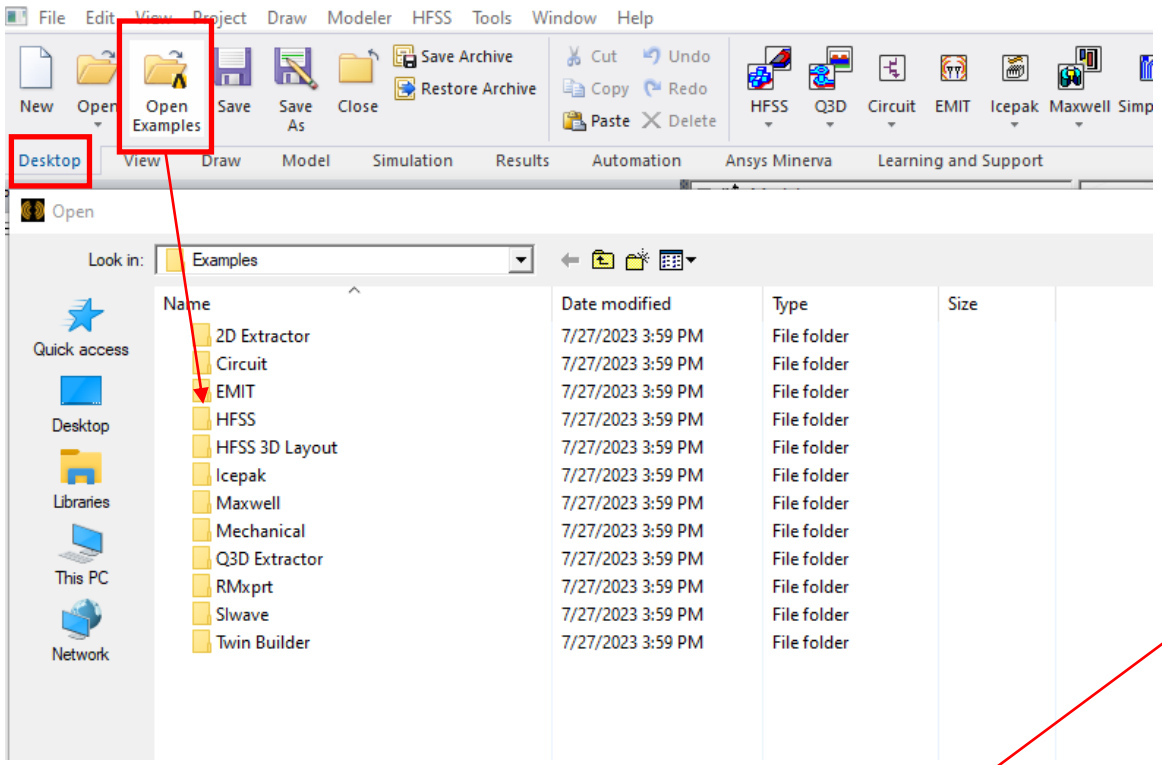
- Mitigating Electromagnetic Interference by implementing Bandpass filters

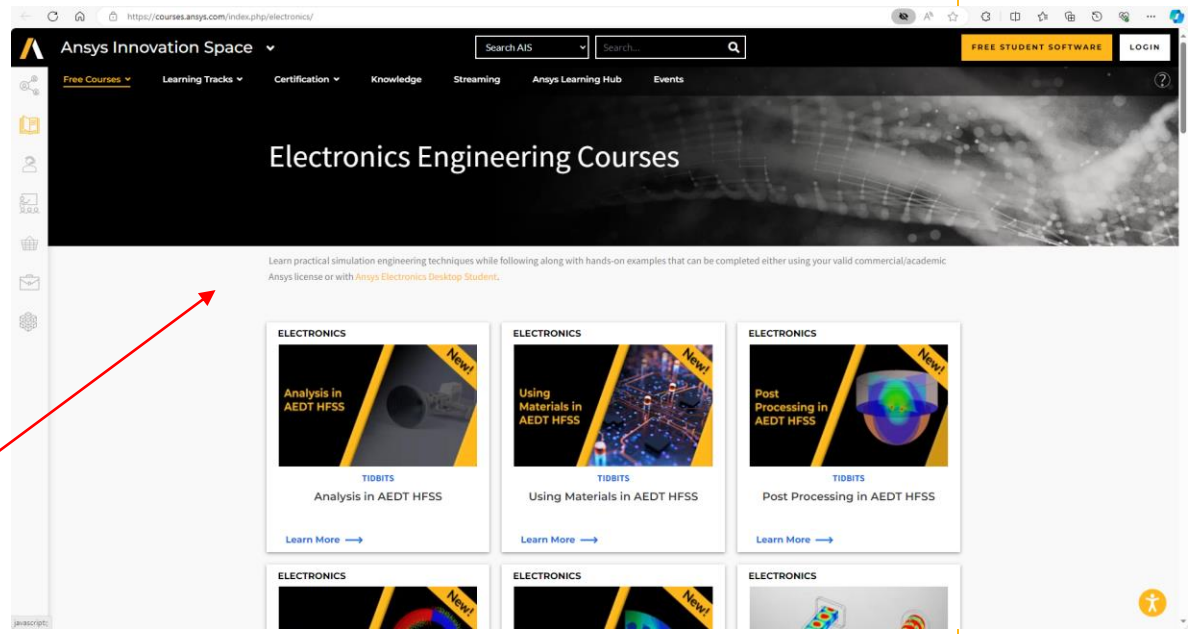


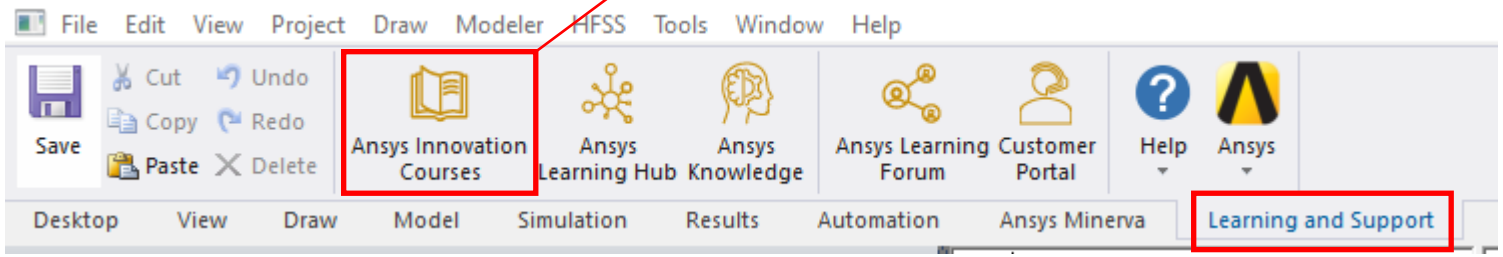




How can you improve your HFSS skills?







Discussion

- Questions?
- Comments?