EXPERIMENT AE2: DESIGN AND SIMULATION OF A MICROSTRIP PATCH ANTENNA (MPA)

STUDENT NAME : _____
MATRIC NO. : _____
GROUP : _____
DATE : _____

A. Equipment and System Verification Checklist

Item	Verification Requirement	✓
CST Software	CST opens correctly and the required antenna design environment is available.	☐
Model Units	Frequency, dimensions and material units are checked before modelling.	☐
Antenna Parameters	Patch dimensions, substrate parameters and feedline dimensions are calculated before modelling.	☐
Materials Assignment	Patch and ground are assigned Copper (Annealed) and substrate is assigned FR4 (lossy).	☐
Feeding Structure	Feedline and excitation port are configured correctly.	☐
Field Monitors	E-field and Farfield/RCS monitors are configured at the intended operating frequency.	☐
Simulation Setup	Frequency range and solver settings are verified before simulation.	☐
File Management	Project is saved using an identifiable filename and folder structure.	☐

B. HIRARC Checklist (OSH-Based Risk Assessment)

Hazard / Unsafe Condition	Potential Consequence	Control Measure	✓
Incorrect patch dimensions or calculation errors	Resonant frequency deviates from design target	Verify all design calculations before modelling.	☐
Incorrect substrate material properties	Incorrect antenna performance prediction	Confirm dielectric constant and substrate thickness before simulation.	☐
Wrong feedline width or feed configuration	Impedance mismatch and poor return loss	Verify feedline dimensions and feeding technique before simulation.	☐
Incorrect port assignment	Invalid excitation and unreliable S11 results	Verify port location, orientation and excitation settings.	☐
Wrong monitor frequency or output selection	Missing or inaccurate E-field/Farfield results	Check monitor type and operating frequency before simulation.	☐
Unverified solver settings	Simulation failure or inaccurate results	Review frequency range, mesh settings and solver configuration.	☐
Unsaved or overwritten project files	Loss of design and simulation work	Save work periodically using systematic file naming.	☐
Extended computer use / poor workstation setup	Physical discomfort and reduced concentration	Maintain proper posture and organise the workstation during simulation.	☐

C. Engineering Practice Verification

Requirement	✓
Patch dimensions are calculated using the assigned group frequency and recorded.	☐
Resonant frequency and minimum S11 value are identified from simulation.	☐
Gain and directivity results are recorded and analysed.	☐
Radiation patterns are generated and interpreted correctly.	☐
Surface current distribution is generated and critical current regions are identified.	☐
Conformal and planar antenna performances are compared and discussed.	☐

D. Student Declaration

I confirm that:

☐ The assigned operating frequency was determined correctly from the laboratory group number.

☐ The substrate dielectric constant, substrate height, copper thickness, patch shape, and feeding technique were recorded before calculation.

☐ The patch width, patch length, effective dielectric constant, fringing-length extension, and feedline dimensions were calculated before modelling.

☐ The CST model units, frequency range, material properties, antenna dimensions, and boundary conditions were verified.

☐ The patch and ground plane were assigned copper, and the substrate was assigned the specified dielectric material.

☐ The feeding structure and excitation port were positioned and configured correctly.

☐ The required field and far-field monitors were configured at the intended operating frequency.

☐ The planar and conformal antenna simulations were completed using verified solver settings.

☐ The S11, gain, directivity, radiation-pattern, and surface-current results were obtained from actual CST simulations.

☐ All calculations, simulation results, screenshots, and observations were recorded accurately.

☐ The CST project files were saved and backed up using identifiable filenames.

☐ Engineering ethics and academic integrity were maintained throughout the experiment.

Student Signature : _____

Date : _____

E. Experimental Results Record

Task 1: Microstrip Patch Antenna Design

Parameter	Observed Value / Observation
Operating Frequency	_____ GHz
Patch Width (W)	_____ mm
Patch Length (L)	_____ mm
Feedline Width (Wf)	_____ mm
Dielectric Constant (εr)	_____
Substrate Height (h)	_____ mm
Conformal Angle (θ)	_____ °

Task 2: Antenna Performance Analysis

Parameter	Observed Value / Observation
S-Parameters (S11)	Lowest point: _____ dB at _____ GHz
Gain	_____ dBi
Directivity	_____ dBi
Radiation Pattern	Description: _____
Surface Current Distribution	Maximum current location: _____

Task 3: Conformal vs Planar Antenna Comparison

Parameter	Planar Antenna	Conformal Antenna
Resonant Frequency (GHz)		
Return Loss, S11 (dB)		
Gain (dBi)		
Directivity (dBi)		
Radiation Pattern		
Surface Current Distribution		

Comparison Notes
How do S11, gain, directivity, radiation pattern and surface current distribution change when the antenna is transformed from planar to conformal geometry?

DISCUSSION:

CONCLUSION:

LAB LECTURER

SIGNATURE : _____

DATE : _____

INSTRUCTOR

SIGNATURE : _____

DATE : _____