**STUDENT LAB SAFETY, HIRARC, DATASHEET VERIFICATION CHECKLIST, AND BRIEF REPORT SUBMISSION**

## EXPERIMENT AE1: DESIGN & SIMULATION OF DIPOLE ANTENNA USING CST

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

### A. Equipment and System Verification Checklist

| Item | Verification Requirement | ✓ |
|---|---|---|
| CST Software | CST opens correctly and the required project/modeling environment is available. | ☐ |
| Model Units | Units used for antenna dimensions and frequency are checked before modeling. | ☐ |
| Dipole Geometry | Length, radius and central gap are calculated from the assigned group frequency before entry. | ☐ |
| Material | Dipole conductor is assigned as copper (annealed) as specified in the experiment. | ☐ |
| Port | Discrete port is positioned across the dipole gap and impedance is set to 50 ohm. | ☐ |
| Field Monitors | Required field/surface-current monitors are configured at the intended frequency. | ☐ |
| Simulation Setup | Frequency and model parameters are checked before starting the simulation. | ☐ |
| File Management | Project is saved using an identifiable filename/location before substantial simulation work. | ☐ |

### B. HIRARC Checklist (OSH-Based Risk Assessment)

| Hazard / Unsafe Condition | Potential Consequence | Control Measure | ✓ |
|---|---|---|---|
| Incorrect antenna dimensions or units | Invalid geometry and misleading simulation results | Verify wavelength, length, radius, gap and units before modeling. | ☐ |
| Incorrect material assignment | Simulation does not represent the intended conductor | Confirm copper (annealed) is assigned to the dipole model. | ☐ |
| Incorrect or missing dipole gap | Port placement/model behaviour becomes invalid | Check the central gap against the calculated design before port creation. | ☐ |
| Incorrect discrete-port location or impedance | Invalid excitation and unreliable S11/results | Verify the selected central points and 50-ohm port setting before simulation. | ☐ |
| Wrong monitor frequency / output selection | Required E-field, surface-current or far-field results are unavailable or incorrect | Check monitor type and frequency before starting simulation. | ☐ |
| Unverified simulation parameters | Wasted computation and unreliable output | Review geometry, excitation and monitors before Start Simulation. | ☐ |
| Unsaved or overwritten CST project | Loss of modelling/simulation work | Save the project systematically and use an identifiable file name. | ☐ |
| Extended computer use / poor workstation setup | Physical discomfort and reduced concentration | Maintain appropriate seated posture and organise the workstation during the session. | ☐ |

### C. Engineering Practice Verification

| Requirement | ✓ |
|---|---|
| Antenna dimensions are derived from the assigned group frequency and calculations are recorded. | ☐ |
| S11 minimum value and corresponding frequency are recorded from the simulation. | ☐ |
| IEEE gain result and associated frequency are recorded. | ☐ |
| E-field radiation pattern at 0° and H-field pattern at 90° are generated and described. | ☐ |
| Surface-current distribution is generated and its maximum-current region is identified. | ☐ |
| Task 1 and assigned-frequency Task 2 results are compared consistently. | ☐ |

## D. Student Declaration

**I confirm that:**

☐ The assigned operating frequency and corresponding antenna dimensions were calculated before modelling.

☐ The CST model units, dipole dimensions, conductor material, and central gap were verified.

☐ Copper (annealed) was assigned as the dipole conductor material.

☐ The discrete port was positioned across the dipole gap and set to 50 Ω.

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

☐ The antenna geometry, excitation, frequency range, and simulation settings were checked before running the simulation.

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

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

☐ The CST project file was saved and backed up.

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

## E. Experimental Results Record

### Task 1: Analysis of Antenna Parameters

| Parameter | Observed Value / Observation |
|---|---|
| S-Parameters (S11) | Lowest point: _____ dB at _____ GHz |
| Gain (IEEE) | Gain value: _____ dBi at _____ GHz |
| E-Field Radiation Pattern | Cut angle: 0°. Shape/direction: _____ |
| H-Field Radiation Pattern | Cut angle: 90°. Shape/direction: _____ |
| Surface Current Distribution | Location of maximum current: _____ |

### Task 2: Antenna Design Based on Group Frequency

**Group Number: _____ Assigned Frequency: _____ GHz**

| Parameter | Calculated Value (mm) |
|---|---|
| Wavelength (λ) | |
| Length (L) | |
| Radius | |
| Gap | |

### Antenna Performance Comparison

| Parameter | Frequency 1 GHz (Task 1) | Frequency ____ GHz (Task 2) |
|---|---|---|
| Return Loss (S11) (dB) | | |
| Gain (dBi) | | |
| Radiation Pattern (describe) | | |
| Surface Current (describe) | | |

**Comparison notes: How do S11, gain, radiation pattern and surface-current distribution change with frequency?**

_____

_____

_____

_____

**DISCUSSION:**

**CONCLUSION:**

**LAB LECTURER**

**SIGNATURE : _____**

**DATE : _____**

**INSTRUCTOR**

**SIGNATURE : _____**

**DATE : _____**