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DESIGN OF A BOW-TIE AND MEANDER LINES BASED TRIPLE BAND ANTENNA

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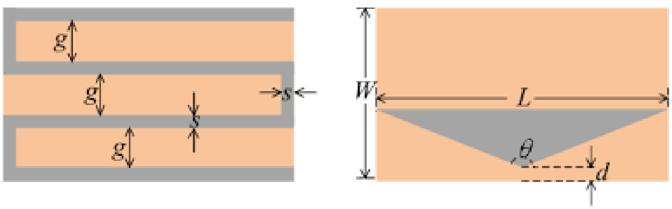
ABSTRACT
Designing of antennas face many challenges like expanding bandwidth and multimode operation. Multiband antennas offer potential solutions to solve the challenges. In this project, we propose a triple-band antenna by combining meander-line structure. Multi-band antennas play a vital role in modern communication techniques. Introduction of slots in the original antenna structure is implemented in this study. Bow-tie monopole radiator is inserted in obtuse angle (140^0) to the meander-lines.

Keywords: multimode operation, multi-band antenna, meander-line structure, bow-tie slot antenna, monopole radiator.

I. INTRODUCTION
A bow-tie antenna is also known as Biconical antenna or Butterfly antenna. Biconical antenna is an omnidirectional wide-band antenna. According to the size of this antenna, it has low- frequency response, and acts as a high-pass filter. As the frequency goes to higher limits, away from the design frequency, the radiation pattern of the antenna gets distorted and spreads. Most of the bow-tie antennas are derivatives of biconical antennas. The discone is as a type of half-biconical antenna. The bow-tie antenna is planar, and therefore, directional antenna.



(a) Meander-line structure (b) Bowtie monopole

Previous multi-band antenna
A method of using patch antennas to generate millimeter-wave at E-band. A notched band is formed using four inset-fed microstrip patch elements arranged with a microstrip corporate feeding network. The designed antennas are fabricated on a high performance FR4 circuit board with relative permittivity of 3.75 and loss tangent of 0.018. The overall size of the antenna is 8 x 8 x 0.125 mm3. A full-wave electromagnetic simulator, CST, is used to design the notched band antennas. Radiation pattern measurements were taken on a NSI 700S-360 spherical near-field system at 73 GHz together with an Agilent vector network analyzer. The simulations and measurements are in good agreement.

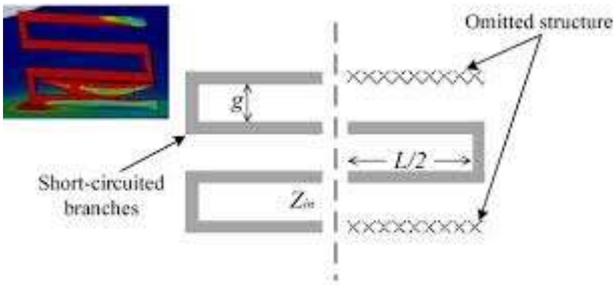
II. ANTENNA CONFIGURATION AND OPERATING PRINCIPLES

A. Antenna structure
Double-slot and slot-ring antennas on a quartz and silicon dielectric lenses have been extensively used for planar millimetre wave and terahertz applications, with applications in radio astronomy, communication systems, and low-power radars. They offer symmetrical patterns into the dielectric lens, which transfers to a high Gaussian-beam coupling efficiency in a quasi-optical system. Also, they do not support substrate modes and have a low cross-polarization level (< −20 dB) and their geometry allows for a dual-polarization design. The effect of the

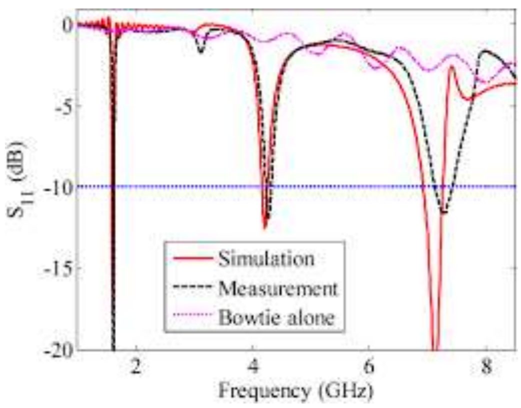
dielectric lens-to-air interface was also extensively studied versus the extension length. Also, the reflections inside the lens on the far-field patterns and antenna impedance can now be accurately simulated using CST and are now taken into account in the design procedure of high-performance receivers.

B. Principle of operation

In meander linebased bow-tie slot antenna there are three essential design criteria, which are required for multiband operation and these are: wideband impedance at the detector ports; a low-pass filter capable of operating at millimetre wave frequencies and presenting a low impedance to the slot-antenna feed point over a 3:1 frequency range; and wideband and symmetrical patterns with low cross-polarization levels and capable of a high polarization and coupling efficiency. The wideband low-pass filter rejects any RF power leaking out of the bow-tie slot antenna and increases the antenna efficiency.



III. MEASURED RESULTS



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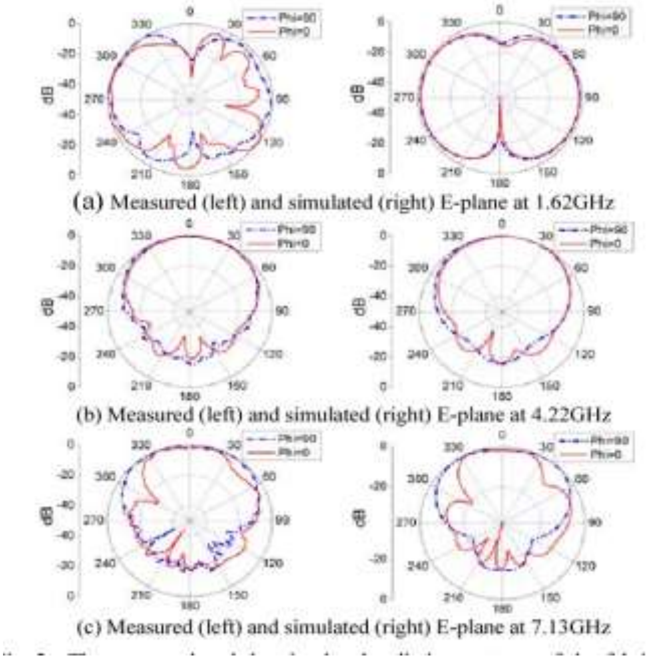
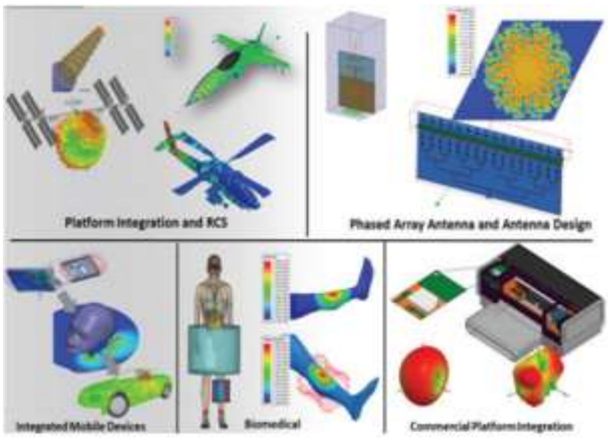

(a) Measured (left) and simulated (right) E-plane at 1.62GHz
(b) Measured (left) and simulated (right) E-plane at 4.22GHz
(c) Measured (left) and simulated (right) E-plane at 7.13GHz

Simulation procedure to design an antenna
STEP 1: Open the CST software.
STEP 2: Click on new project and select insert determine units. The left hand side present icon on the window are 3-deimentional. The icons which are present on the right hand side corner are 2-dimentional representation.
STEP 3: Start the designing procedure.
STEP 4: Now choose the shape which is needed for the design. The design of the antenna must be started with substrate. The substrate represents the base of the antenna.
STEP 5: Now draw the substrate and right click on it and select the properties.
STEP 6: In properties we can change the name of the shape and the length, position, and material of the antenna.
STEP 7: Likewise draw the patch and feed and do the same procedure as it is done for substrate.
STEP 8: Then interconnect all the substrate, patch and feed.
STEP 9: This interconnection helps the current to flow all over the design.
STEP 10: Now apply electric field to the antenna.
STEP 11: After finishing all the process, run the design
STEP 12: Then choose the parameter and view the output

IV. IMPLANTED ANTENNA DESIGN



Automatic Adaptive Meshing a key feature of CST is automatic adaptive mesh refinement which generates an accurate solution based on the physics or electromagnetics of the design. This automated meshing technique leaves the focus on the antenna design rather than spending time determining and creating the best mesh. This automation and guaranteed accuracy differentiates CST from all other electromagnetic simulators, which typically require manual user controls to ensure that the generated mesh is suitable and accurate for simulation.

Without the correct mesh, the results from such simulators can be erroneous. But with automatic adaptive meshing, CST lets the physics define the mesh and not the other way around and guarantees accurate results. The meshing algorithm adaptively refines the mesh throughout the geometry; it iteratively adds mesh elements in areas where a fine mesh is needed due to the localized electromagnetic field behavior. Figure 8 illustrates the adaptive meshing process for a patch antenna operating at 11. 5 GHz using the finite element method (FEM) in CST.

V. CONCLUSION

The meander line based slot antennas are shown to cover a range frequency range of 100–350 ,100–400 and 100-700 ghz for millimeter-wave and terahertz applications. the use of a bow-tie slot significantly INCREASES the impedance bandwidth, and a new design for the meander lines ensures a wideband short over a 3:1 frequency range. This antenna should find applications in radio-astronomical systems or terahertz imaging systems required a 3:1 frequency range.

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