



"The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities in summary, The faculties (Science stream) of GEMS Arts & Science college have made an excellent attempt to bring about this book *Homo Scientia* covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts. I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts."

Dr. Balagopalan Unni



Gems Arts & Science College (Affiliated to University of Calicut), Ramapuram, Kadungapuram (PO), Malappuram (DT) Pin - 679321

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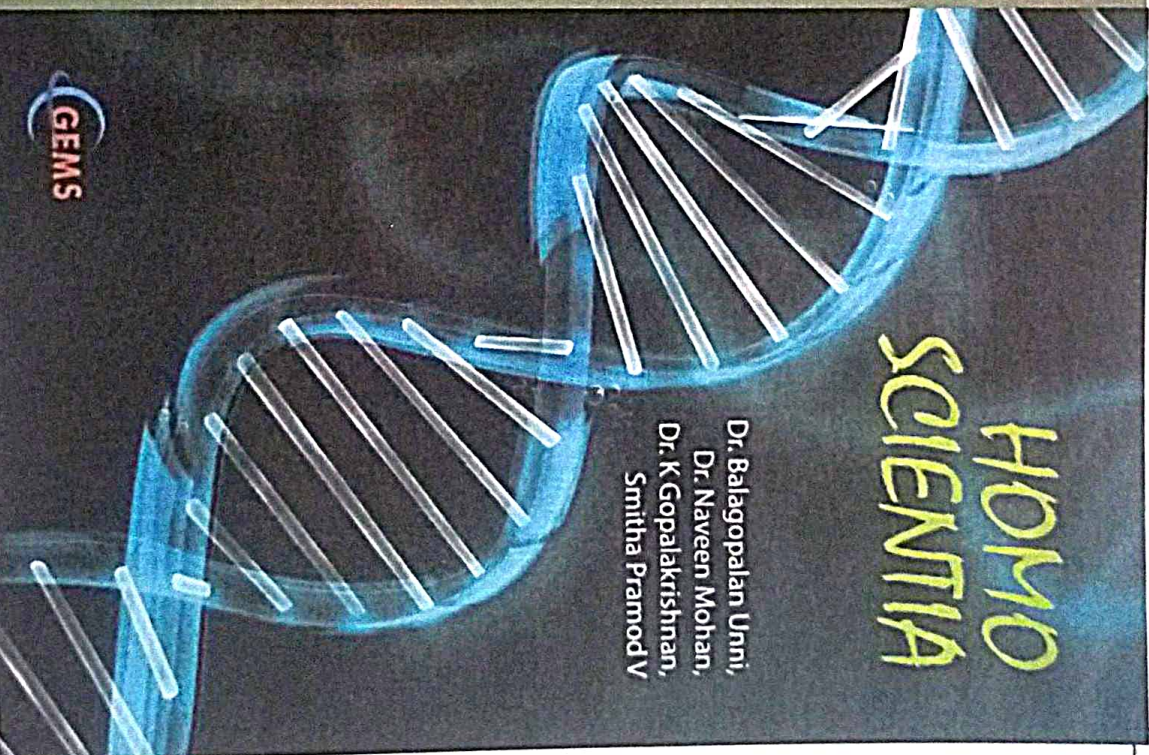


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HOMO SCIENTIA

Dr. Balagopalan Unni,
Dr. Naveen Mohan,
Dr. K Gopalakrishnan,
Smitha Pramod V



DR. NAVEEN MOHAN
PRINCIPAL
GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321



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Dr. NAVEEN MOHAN
PRINCIPAL

GEMS ARTS AND SCIENCE COLLEGE
KADUNGAPURAM (PO), RAMAPURAM
MALAPPURAM DT., KERALA-679 321

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<https://gemsasc.ac.in/>

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PRINCIPAL

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Brief Biography

Dr. B.G.Unni, (Balagopalan Unni) Ph.D
(Allahabad central University)
FRES (London), FIANSc , FISAgBc, FICCE


Former Chief Scientist and Area Coordinator (Biotechnology & Biological Sciences) DADD and Fulbright Fellow retired from CSIR service in 2015 after 38 years of research career at CSIR North East Institute of Science & Technology Jorhat Assam. Appointed at Assam down town University as Director-Research in March 2015 and continued up to June 2019 and then re-designated as Adviser Research in August 2019). Back in Kerala, Dr.Unni is appointed as Director Academic & Research at GEMS College of Arts & Science affiliated to University of Calicut from August 2019. Both the positions are on honorary basis to strengthen the institutions in research areas. He did his BSc Biology (1972-74, Ewing Christian College, Alld University), MSc in Biochemistry(1974-76)(Second Rank) and Ph.D in Biochemistry from Allahabad University(1976-80) and PDF in Molecular Biology from Texas A&M University, USA(1988-91). Dr. Unni is specialized in Biochemistry, Molecular Biology, and Biotechnology and well established in his area of research and completed more than 40 years of research in both basic and applied fields of research. Dr.Unni got more than 130 research papers, 190 abstracts, 35 papers in proceedings, 7 patents, 1 technology. 18 chapters in books, edited 3 books and 29 students



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received PhD degrees under his guidance and supervision. Dr. Unni had completed more than 20 projects sponsored by Commonwealth Science Council, London, Ministry of Non conventional Energy Sources, Department of Non conventional Energy Sources Govt of India, North Eastern Council Govt of India, Department of Science & Technology, Department of Biotechnology, Central Silk Board, GB Pant Institute of Himalayan Environment and Development, CSIR and DRDO, Ministry of Defense, Govt of India during his scientific tenure at CSIR NEIST. Dr Unni received- Fulbright Travel Award/ Fellowship (USA) Dr. B.M. Das Memorial Science award, Hebrew University Award , H.R. Cama Memorial Travel Award, COSTED Travel Award, DAAD- fellowship-Germany, Well Mark International Scholarship (USA) & Technology award in life sciences by CSIR, Govt of India . Best Fulbright Alumni Chapter Leader-South Asia Selected by the United States Education Foundation In India (USIEF), New Delhi .Nominated to represent India at the International Fulbright Scholars meet at Marrakech, Morocco- Nominated by United States Education Foundation In India, New Delhi . Dr. Unni is in the editorial board of more than eight indexed journal in the country .Dr.Unni was nominated to various state and central committees such as High power committee for development of sericulture activities Muga, Eri, Tassar and Mulberry in Assam nominated by Governor of Assam, .Expert in the area of non mulberry sericulture, Ministry of Textiles, Advisory Board, Post graduate Biotechnology programme, Academic Council, Assam Agricultural University, Research Council, Central Silk Board, Ministry of Textiles , DBT's Nominee for Biosafety Committee , Vice President SBC (India) Indian Institute of Science Bangalore, Vice President Indian Academy of Neuro-sciences, Member Fulbright Academy of Science & Technology, USA, Board of studies- Botany Nagaland University and Biotechnology Saugar University Madhya Pradesh., Fellow, Indian Academy of Neurosciences & Indian Society of Agricultural Biochemists, Fellow Royal Entomological Society, London UK and Scientific





Dr. NAVEEN MOHAN
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MALAPPURAM DT., KERALA-679 321

Advisor International Foundation of Science, Sweden, Member, Board of Studies Raiganj University (2017----), Member Research Review committee Tea Board of India (2016-2019), Member Advisory Committee Cancer Research Advisory Board, North East Cancer Hospital & Research Institute (2017--) President, Tea Improvement Consortium, Ltd, Tocklai Assam (2018-2020) .

Dr.Unni visited USA, Germany, Israel, Jordan, France, Morocco ,UK, Thailand ,Jordan, Singapore , China and UAE under various exchange program.





Dr. NAVEEN MOHAN
PRINCIPAL
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Preface

I am very happy to learn that, the GEMS Arts & Science College is bringing out a series of books written by the faculty in this academic year. The college is occupying a very important position among the colleges in Kerala, the same way the college is having unique standing in both academic and research fronts too. This is because of the excellent management, faculties and the best performances of the students.. I have full confident that in the course of time, and with the sincere commitment and dedication of the faculties , students and with management , the college will attain high level perfection and excellence and became a model college in the state of Kerala

This book entitled " Homo Scientia" had comprehensive research topics in various aspects in the topics of cyber security, biotechnology, microbiology and geology. A brief description about the cybersecurity, the protection of computer set up such as hardware, software data from several threats have been described in the chapter. The best practices for deploying and managing IPS network security tools have been explored. The integration of intrusion prevention system (IPS) solutions, adherence to security policies, regular updates, monitoring and the implementation of incident response procedures are considered to be the essential components of a comprehensive network security framework. The risk management in cyber security, various cyber-attack kinds, malware, and some strategies to tackle these attacks are also explained by the authors. A comprehensive overview of the evolution of computer graphics, exploring the advancements in hardware, software, algorithms, and techniques that have propelled the field from its early pixel-based beginnings to the current state of realism etc also described. Optical character recognition has been extensively investigated in the past few years, and has been proven that high recognition rates can be achieved in specific





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application scenarios using some standard and well-studied methods such as neural network, support vector machine (SVM), etc. The possibility of learning an appropriate set of features for designing optical character recognition (OCR) has been investigated

Biotechnology is an interdisciplinary science using modern technologies to construct biological processes in research, agriculture, formulation of pharmaceutical products and other related fields. The better understanding of advances in plant genetic resources, genome modifications, omics technologies to generate new solutions for food security under changing environmental scenarios etc have been discussed in this chapter. The increasing demand for food had a great impact on the agriculture sector to address the various challenges associated with crop productivity. The tremendous advancement in plant research helps in understanding plant biology for sustainable food security, functional ecosystems, crop improvement and human health. One of the sustainable farming techniques is the use of fertilizer at nano level. Nanomaterials that enhance plant nutrition could be considered as an alternative to the conventional chemical fertilizers. one chapter covered the importance of nano fertilizer to enhance metabolic processes in plants and reviewed the concerns in developing nanotechnological methods in the future. Metabolomics has now emerged as a powerful tool for the comprehensive analysis of metabolites within biological systems. One of the chapters provides a review on metabolomics, encompassing its methodologies, applications, potential impact on personalized medicine ,and discusses further the need for advancements in analytical technologies. The antifungal activity of mangroves, particularly Rhizophora species are one of the main sources for fungicidal compounds due to the presence of high concentration of phenols. The antifungal activity of Rhizophora species has been elucidated, and could be further utilized as biocontrol agents for fungal disease in agricultural crops. One of the chapters discussed the species identification and its impact on economical and ecological level in the species like Nutmeg, one of the important medicinal plants that had a greater attention ,however, it was very difficult to differentiate the sexual identity




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in the seedling stages. But the protein content screening among the studied plantlets had differentiated the sexes in the species as explained by the author.

AI (Artificial Intelligence) or machine intelligence enables farmers to enhance the quality and ensure a quick go-to market strategy for crops, and adoption of these algorithms to improve food industries. Artificial intelligence (AI) has also the potential to revolutionize education, from personalized learning to assessment and grading. Additionally, AI-powered tools can provide greater accessibility to students with disabilities, while also enabling more engaging and interactive content. AI continues to develop and become more prevalent in education, towards responsible and equitable implementation. However the negative and positive part of the AI may also be looked into.

The chapters related to microbiological aspects have also been incorporated in this book. Carbapenem-resistant *A. baumannii* (CRAB), bacteria that cause multi-infections in humans and resistant to multiple drugs too. The study attempted to isolate and characterize the bacterial species from the clinical specimens using biochemical techniques. The enzyme, carbapenemase produced by the bacteria was isolated and determined by different assays. Another study identified the antibacterial, antioxidant and anticancer activities of *Ganoderma lucidum* by various chromatographic techniques. Anticancer activity was also assessed on HeLa cell lines using MTT assay and DPPH assay. In one of the chapters, the author discussed L-asparaginase, one of the widely exploited enzymes for the treatment of acute lymphoblastic leukemia (ALL). Also attempted to isolate and characterize the enzyme from soil samples collected from different locations at Kerala. The study indicated that soils can provide a rich source for L-asparaginase which has got ample application in pharmaceutical industries.

The studies on various geological aspects with respect to different geographical areas in Kerala soil has been included in the book. The vertical geochemical variation and elemental mobility of the lateritic terrain in the Makkaraparamba of Malappuram District, Kerala has been very well investigated. Under extremely oxidizing and leaching conditions, laterite



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soil transformed into a variety of rocks and further developed into stable secondary product in the existing humid tropical and subtropical environments. The hydrogeological conditions in Kumbala- Kaliyar river basin, Kasaragod district, Kerala was assessed by means of Vertical Electrical Sounding (VES). The digital spatial data output of the present study would be much helpful for planning and management of surface and sub-surface water resources of Kasaragod River basin in which the Kasaragod township is centrally located

The contributed chapters in the book written by the faculties of science stream in the light of the recent thinking and developments in the field of science and education. Science & Technology is now dominates almost every field of our activities. In summary, The faculties (Science stream) of GEMS Arts & Science college have made a n excellent attempt to bring about this book "Homo Scientia". covering almost all the important areas from biological sciences to artificial intelligence. Every article has its own merits in both academic and research fronts..I record my grateful appreciation and thanks to the contributors of this book for their untiring efforts.

Dr. Balagopalan Unni

Ph.D (Allahabad Central University), FRES (London)
Director Academic & Research
GEMS Arts & Science College, Malappuram Kerala
(Former Chief Scientist, CSIR-DST, Govt of India)
dir.ac.res@gemscollege.in




Dr. NAVEEN MOHAN
PRINCIPAL
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COMPARISON BETWEEN L/C AND L/S BAND ANTENNA

Swathi KG
Assistant Professor
Department of Computer Science

ABSTRACT

A switchable frequency slot ring antenna switching in between L and C bands and L and S band is represented. Here in L and C band there are 4 slot rings are presented in each slot rings there will be 4 switches, by properly turning them ON&OFF we can perform as L and C bands. In the case of L and S band there will be only 4 switches and by properly turning them ON&OFF we can perform as L and S bands. The L and C band antenna will operate at 1.76/5.71 GHz having fractional bandwidth of 8.6%/11.5% respectively. For L and S band antenna will operate at 1.4/2.9 GHz having fractional bandwidth of 3.5%/5.8% respectively. It is simulated in HFSS.

INTRODUCTION

Array of antenna is widely used in communication area such as radar, wireless communication and remote sensing. Now a days multi-functional antennas array have great role in the wireless communication as it have the flexibility of antenna properties such as frequency, bandwidth, radiation pattern and polarization. Multiband antenna array which having same aperture received a attention now multifrequency band antenna radiators can different layers or same layers. Multi frequency band antenna can be classified as two categories. (1) common feed for multiple frequency band and (2) separate feed for multiple frequency band. For common feed for multiple frequency band, the element spacing for higher band is larger than lower band and for lower band the element spacing will



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be maintained at $\lambda_0/2$. If the element spacing of higher band is nearly to $\lambda_0/2$ then the element spacing of lower band much smaller than $\lambda_0/2$, that will result in stronger mutual coupling and larger number of electronics for lower band. For separate feed for multiple frequency band the element spacing for higher band and lower band will maintained at $0.5/0.5\lambda_0$ and it can use folded dipole design for this purpose. Phased array radar sensors have a great role in communication that is in wireless communication that are post disaster management, threat identification and surveillance.

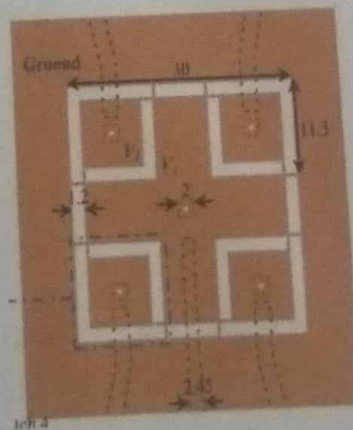
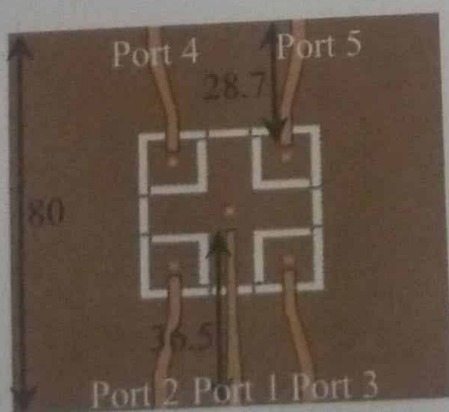
In future multi function sensors can be attractive solutions for ship and reconfigurable multi band antennas. In this paper we are using RF switches to switch these two different bands. For multi band wide angle scanning, a small element periodicity is virtual and it will avoid grating lobes at high frequency, at lower frequency the elements need to placed very densely. as the result, coupling can be increases or decreases the radiation efficiency and gain.

ANTENNA CONFIGURATION AND DESIGN

L/C Band Antenna

Schematic representation of multi frequency band antenna is shown in figure (1). There are 16 pin diodes switches (DSM 8100-000, 0201 package) inside each slot and by turning them properly it can be either 2x2 C-band slot ring antenna or L-band slot ring antenna perform. A C-band slot ring antenna is represented in figure (2) shows the detailed representation of switches also.

Working of LC Band based on switches



When switch 1 and switch 2 are closed and switch 3 and switch 4 are open i.e., state1 the antenna resonates at 1.76GHz that is L-band state and excited by port 1 and by closing switch3 and switch4 and opening switch1 and switch2 i.e., state2 the antenna resonates at 5.71GHz that is C-band and excited by ports 2 or 3 or 4 or 5. This relation is shown in table (1).

Table. 1 Switch states in the L- and C-band operating states.

State	Operation state	Switches 1, 2	Switches 3, 4	V_1	V_2
I	L-band	ON	OFF	0V	2V
II	C-band	OFF	ON	2V	0V

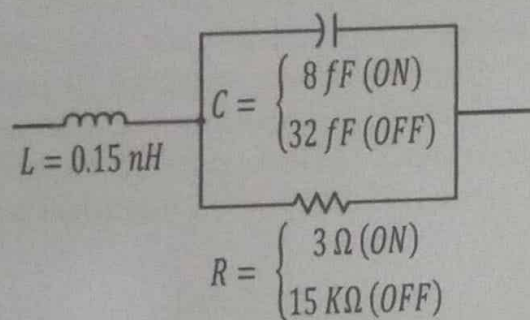


Fig. 2. Circuit model for the PIN diode switch.

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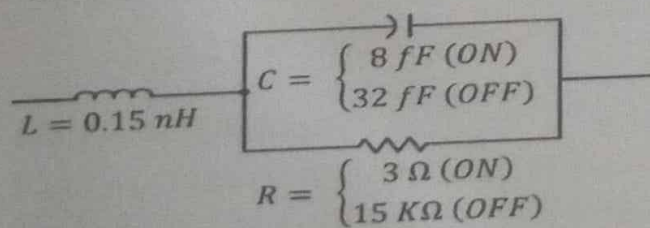


Fig. 2. Circuit model for the PIN diode switch.

The resonant frequency can be calculated by the perimeter of the square slot ring.

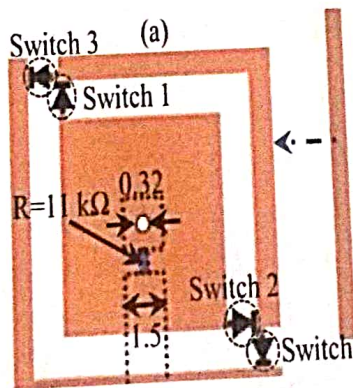


i.e., perimeter $P = \lambda_g = C_0 / (f r \sqrt{\epsilon_{eff}})$

where λ_g is the guided wavelength C_0 is the speed of light f is the resonant frequency ϵ_{eff} is the effective dielectric constant here in this design it is 1.84. As the lateral length of the slot ring is $\lambda_0/4$ which is very smaller than $\lambda_0/4$, so the element spacing is very easy as it is smaller than $\lambda_0/4$ and also it can avoid grating lobes at larger scan angles.

Feed

The main feeds of antenna are microstrip line feeding, coaxial feeding, aperture coupling and proximity coupling. Here in the antenna type microstrip line feeding is used figure (3). The distance between the slot and the microstrip line is optimized, then we can have impedance matching at each of the operating frequency i.e., 1.76 and 5.71 GHz. To achieve 50 Ω characteristic impedance at the end of the antenna the width of the microstrip lines slowly widened. And lumped ports are used. This is simulated in high frequency structure simulator.



L/S Band Antenna

Figure (4) shows the structure of L/S band antenna. Here we are dual patches to switch the both frequency band (L and S band). Here two switches are present.

Working of L/S Band based on switch

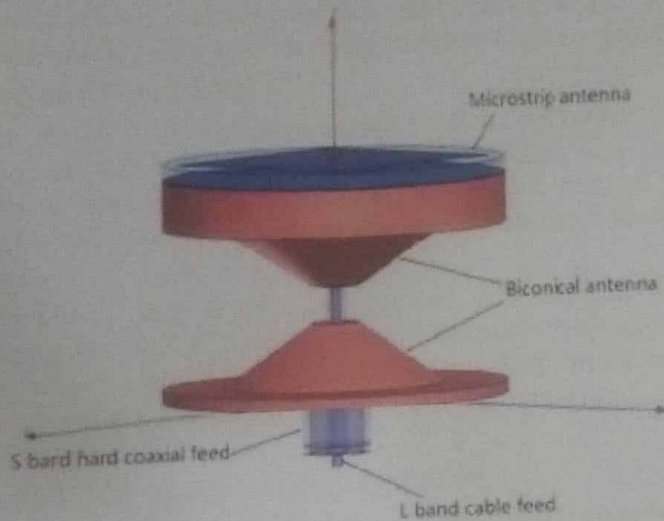
When switches are closed state, the metal ring (outer) will connect to the patch (inner) and the antenna radiates at lower



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frequency band. When switches are open state, the metal ring is detached from the patch and act as parasitic higher frequency band. The antenna is designed in R04003C substrate, the permittivity $\epsilon_r = 3.5$, the thickness is $\lambda_{dh}/6$ where λ_{dh} is the wavelength in the dielectric at the highest frequency. As it is perfect square patch the length of inner patch is 50mm. And the gap in between the inner and outer patch effects performance of the antenna.



Comparison between L/S & L/C Band Antenna

L/C band and L/S band antennas are both types of microwave antennas commonly used in various applications, including satellite communications, radar systems, and wireless networks. Here's a comparison between L/C band and L/S band antennas:

Frequency Range:

L/C Band: The L/C band covers a frequency range of approximately 1 to 8 gigahertz (GHz). The L band occupies the lower portion (1 to 2 GHz), while the C band covers the higher portion (4 to 8 GHz).

L/S Band: The L/S band covers a frequency range of approximately 1 to 4 gigahertz (GHz). The L band occupies the



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lower portion (1 to 2 GHz), while the S band covers the higher portion (2 to 4 GHz).

Applications

L/C Band: L/C band antennas are commonly used in various applications such as satellite communications, weather radar, long-range radio navigation systems, and some terrestrial wireless networks.

L/S Band: L/S band antennas are also used in satellite communications, particularly for low Earth orbit satellite systems, mobile satellite services, and some military applications.

Size and Directivity

L/C Band: L/C band antennas tend to be larger in size compared to L/S band antennas due to the longer wavelengths associated with lower frequencies. They often require larger parabolic reflectors or arrays to achieve the desired directivity and gain.

L/S Band: L/S band antennas are generally smaller in size compared to L/C band antennas because they operate at higher frequencies. The smaller size makes them more suitable for applications where space or weight constraints are a consideration.

Signal Propagation and Penetration

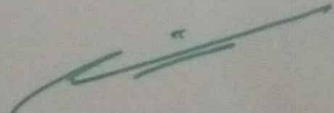
L/C Band: L/C band signals have longer wavelengths, which enables them to propagate over longer distances and penetrate obstacles like vegetation and atmospheric conditions to some extent. They are less affected by rain fade compared to higher frequency bands.

L/S Band: L/S band signals have shorter wavelengths compared to L/C band, which makes them more susceptible to absorption and attenuation by atmospheric conditions and obstacles. They are more prone to rain fade and have reduced penetration capabilities compared to L/C band.

Interference and bandwidth

L/C Band: The wider frequency range of L/C band provides more available bandwidth for various applications. However, due to its popularity and extensive use, the L/C band can be more susceptible to interference from other systems operating




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in the same frequency range.

L/S Band: The narrower frequency range of L/S band limits the available bandwidth but can provide better immunity to interference since it is less crowded compared to the L/C band.

Data Rate and bandwidth

L/C band antennas generally offer higher data rates and wider bandwidth capabilities compared to L/S band antennas. This makes them suitable for applications that require high-speed data transmission and larger bandwidth requirements.

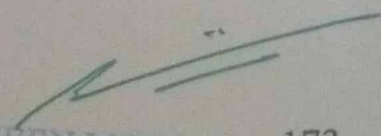
System Cost

L/C band antennas are often more expensive than L/S band antennas due to their broader frequency range and higher performance capabilities. However, the cost can vary depending on specific requirements and the quality of construction.

CONCLUSION

L/C band antennas typically operate at a lower frequency range, have larger sizes, and provide longer propagation distances and better penetration capabilities. L/S band antennas, on the other hand, operate at higher frequencies, have smaller sizes, and offer narrower bandwidth but can be less susceptible to interference. The choice between L/C band and L/S band antennas depends on specific application requirements, available frequency allocations, and environmental conditions. The choice between L/C band and L/S band antennas depends on the specific application requirements, such as frequency range, signal propagation characteristics, data rate needs, and budget constraints. L/C band antennas offer a wider frequency range and higher performance capabilities, while L/S band antennas provide better signal penetration and can be more cost-effective in certain applications.




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