



**STTP- Sanction Letter**

Ref. No. 34-65/220/RIFD/STTP/Policy-1/2018-19

Date \_\_\_\_\_

To

The Drawing and Disbursing Officer,  
All India Council for Technical Education,  
Nelson Mandela Marg,  
Vasant Kunj, New Delhi – 110070

**Sub:** Release of grant for conduct of Short Term Training Programme (STTP) under AQIS 2018-19 during the financial year 2019-20– reg.

Sir,

This is to convey the sanction of the Council for payment of **Rs. 300000 /- (Rupees Three Lakh Only)** for conduct of Short Term Training Program as per details given below:-

1.	Name and address of the beneficiary University / Institution	VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE , VASANTHA NAGAR KANURU VIJAYAWADA - 7 AP, INDIA KRISHNA-520007 Andhra Pradesh
2.	Permanent ID of Institute	1-10213343
3.	Institute type	Unaided - Private
4.	Name of Coordinator	Dr. JHANSI ARETI
5.	Amount sanctioned	Rs. 300000/-
6.	Amount to be released	Rs.300000/- Full & final payment
7.	Head of account	<b>601.15(a) Gen. Short Term Training Programme (Plan)</b>
8.	The authorized officer in whose favour Cheque/ Demand Draft/ RTGS is to be made	REGISTRAR / DIRECTOR / PRINCIPAL
9.	Title of the programme	Trends and challenges in Design and implementation of Reconfigurable Antennas for increased spectrum access in Cognitive Radio Communication.

1. The amount of the grant shall be drawn by the Drawing and Disbursing Officer, All India Council for Technical Education on the grant-in-aid bill and shall be disbursed to and credited to the Registrar/ Director/Principal of the institute through RTGS.

2. This grant-in-aid is being released in conformity with the terms & conditions as well as norms of the scheme as already communicated, and also being communicated in this letter.
3. The Principal of the Institute and the Coordinator of the Program are requested to verify the correctness of the under-mentioned Bank Account / RTGS Details submitted by them alongwith the proposals, in which the grant is being released:-

Institute PAN No.	Bank Name	Bank Branch Name	Bank Branch Address	Account Holder Name	Account Type	Account Number	IFSC Code
AABTS1271J	SYNDICATE BANK	VRSECKANURU	VIJAYAWADA, ANDHRA PRADESH, PIN:520007	PRINCIPAL V R SIDDHARTHA ENGINEERING COLLEGE	Saving Account	33672200037089	SYNB0003367

### **Instructions/Guidelines to be followed by the University/Institution**

#### **I. Disbursement of funds to University/Institutions**

- a. The full amount of the grant sanctioned is being released as advance to the University/Institute.
- b. The amount spent by the institute on the conduct of STTP shall be adjusted on the basis of utilization certificate and detailed expenditure statement submitted by the University/Institution on the prescribed format along with other mandatory documents viz feedback form, copy of proceedings and completion report etc.
- c. The above said amount of grant shall be refunded back to AICTE if the Letter of Approval (LOA) / Extension of Approval (EOA) is not issued by AICTE to the institute for the academic year 2019-20.

#### **II Maintenance of Accounts**

- a. The Institute shall strictly follow the provisions laid down in the scheme document as available on the portal.
- b. Funds covered by this grant shall be kept separately and would not be mixed up with other funds so as to know the amount of interest accrued on the grant.
- c. The University/College/Institute shall maintain proper accounts of the expenditure out of the grants, which shall be utilized only on approved items of expenditure.
- d. The grant is intended to cover items of expenditure connected with the Short Term Training Programme such as Boarding & Lodging to the participants, TA to outstation participants, Honorarium to Course Coordinator, reading material to participants, Honorarium to resource persons, TA/DA to resource persons including two outstations resource persons & working expenses (reprographic services, postage, transport, daily wages, tea/coffee etc.

#### **III. Conduct of test and issuance of certificate**

A test shall be conducted by Program Evaluation Committee (PEC) at the end of the program and the certificates shall be issued to those participants who have attended the program and have qualified in the test.

#### IV. Submission of Documents by the University/Institutions to AICTE

a. The following mandatory relevant documents are required to be submitted by the University/Institution within one month of the completion of the program:-

- (i) Original Statement of actual expenditure & Utilization Certificate in the prescribed proforma duly signed by the Head of the institution and countersigned by Registrar/Finance Officer/Govt. Auditor. In case of self-financing/private institutions, Statement of actual Expenditure & Utilization Certificate are required to be audited & signed and sealed by a Chartered Accountant endorsing the membership number and complete postal address. Format for the same is available on AICTE web portal.

The University/Institution is not required to submit bills/vouchers/invoices etc for the expenditure incurred out of recurring grants. However, such copies of bills/vouchers/invoices shall be digitized by respective institutions receiving grant and uploaded scanned copies of such bills/vouchers/invoices etc on the portal for availability and view at any point of time.

- (ii) Feedback form in the prescribed proforma.
  - (iii) Copy of the proceedings and completion report.
  - (iv) List of candidates who have successfully completed the program on the basis of the test conducted by Program Evaluation Committee (PEC).
  - (v) Report submitted by Program Evaluation Committee (PEC).
- b. The amount of the grant shall be adjusted on submission of utilization certificate & detailed expenditure statement by University/Institution. On receipt of these documents, the total amount of financial assistance, admissible as per the norms, shall be worked out and grant-in-aid adjusted.


#### V. General instructions

- a. **Preferably 10% of the participants may be industry professionals deputed by industry. Further, not more than 2 participants shall be from the host institution/group of institutions.**
- b. **Money to be reimbursed on the grant (for any reasons to include unspent amount, interest , penalty if imposed) shall be refunded back to AICTE in the form of Demand Draft payable to Member Secretary, AICTE, New Delhi.**
- c. **As AICTE needs adequate time for depositing the Demand Draft in the bank, the same be immediately dispatched to avoid any lapse of the validity period.**
- d. **The STTP is a residential program of a duration of six days with minimum 40 participants.** The approved STTP shall be conducted within three months from the date of release of funds.
- e. **If programme is not conducted in the period of three months of the issuance of this Sanction Order, the released amount, alongwith interest accrued thereon, has to be necessarily returned back to AICTE within a month.**

- f. The expenditure under the Heads '**Honorarium to Course Coordinator**' and '**Honorarium to Resource Persons**' shall not exceed **1% & 20% respectively** of the total sanctioned grant for the Programme. However, overall expenditure shall not exceed the funds sanctioned for the Programme.
- g. Any extra money required to complete the programme must be borne by the institute from their own resources. But the quality of the activities should not be compromised.
- h. Any unavoidable circumstantial change in the program with respect to name of Project Coordinator, Venue and date for organizing STTP would mandatorily require prior approval of the Council. All such requests should be addressed to AICTE, in advance, recording the specific reasons for proposed changes, failing which the offer for the grant already issued would be treated as automatically withdrawn and the financial assistance released in favour of the beneficiary institution shall be refunded immediately to the Council. Kindly mention the File No. 34-65/220/RIFD/STTP/Policy-1/2018-19 in your future correspondence.
- i. **Program Evaluation Committee (PEC)** is required to be constituted at institutional level. The constitution of the PEC shall be as under:
- (i) Principal/Director/Registrar of the institution (Chairperson).
  - (ii) Coordinator of the program (Member Secretary).
  - (iii) Two HoDs and one subject expert (members).
- The members of the said PEC shall not be below the rank of Associate Professor. A test shall be conducted by Program Evaluation Committee (PEC) at the end of the program and the certificates shall be issued to those participants who have attended the program and have qualified in the test. The minutes of the meetings, along with PEC report, are to be submitted to the Council at end of the program along with other mandatory documents.
- j. **GoI GFR rules** (@<https://doe.gov.in/order-circular/general-financial-rules2017-0>) should be followed during utilization of grant.
- k. This Sanction Order may be treated as Offer Letter for all purposes.

**NOTE:- Any deviation from the above will invoke serious action against the Institute.**

Yours sincerely,

  
(Dilcep N Malkhede)  
Advisor-I (RIFD)

Copy forwarded for information and necessary action to: -

12 DEC 2019

1. **Name and Address of the Coordinator**  
Dr. JHANSI ARETI  
VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE  
VASANTHA NAGAR KANURU VIJAYAWADA - 7 AP, INDIA  
VIJAYAWADA 520007 Andhra Pradesh
2. **The Registrar / Director / Principal**  
VELAGAPUDI RAMAKRISHNA SIDDHARTHA ENGINEERING COLLEGE  
VASANTHA NAGAR KANURU VIJAYAWADA - 7 AP, INDIA  
VIJAYAWADA 520007 Andhra Pradesh

## REGISTRATION FORM

One Week National Level Online Short Term Training Program (STTP)

on

“Trends and Challenges in Design and Implementation of Reconfigurable Antennas for Increased Spectrum Access in Cognitive Radio Communication”

STTP-I 20<sup>th</sup> -25<sup>th</sup> July 2020

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Institution/Organization: \_\_\_\_\_

Address: \_\_\_\_\_

Contact Number: \_\_\_\_\_

Email: \_\_\_\_\_

Qualifications: \_\_\_\_\_

Experience in years: \_\_\_\_\_

Teaching: Research: Industry: \_\_\_\_\_

Signature of the Participant      Signature of the Head of the Institution

Last date for Registration: 16<sup>th</sup> July 2020

Address for Communication:

Dr. A. Jhansi Rani

Professor, ECE Dept.

V.R. Siddhartha Engg. College

Kanuru, Vijayawada-520007, AP

Mail id: [aictesttp2020.ece@gmail.com](mailto:aictesttp2020.ece@gmail.com)

Mobile. No: 9949894526 & 9494049281

### Chief Patrons

Sri N. Venkateswarlu, President,  
Siddhartha Academy of General & Technical  
Education (SAGTE), Vijayawada

### Patrons

Sri P. Lakshmana Rao, Secretary, SAGTE  
Sri S. Venkateshwara Rao, Treasurer, SAGTE  
Sri M. Rajayya, Vice-President, SAGTE &  
Convener, VRSEC

### College Advisory Committee

Dr. A. V. Ratna Prasad, Principal  
Dr. N. N. Sastry, Prof. of ECE & Dean R & D  
Dr. B. Panduranga Rao, Prof. of CE & Dean SA

### Convener

Dr. P. V. Subbaiah  
Professor & Head of ECE

### Organizing Advisory Committee

Faculty members of ECE Department

### Registration link:

[https://docs.google.com/forms/d/e/1FAIpQLSdE  
EuuKecuS5MPo7pZ73GMq0YxygwWk860Z4y  
Q1tI9Knbm\\_A/viewform](https://docs.google.com/forms/d/e/1FAIpQLSdE EuuKecuS5MPo7pZ73GMq0YxygwWk860Z4y Q1tI9Knbm_A/viewform)

### Eligibility

The STTP is open to faculty members of AICTE approved Institutions, Research scholars and persons from industry and R&D organizations from all over country.

Registration Fee: \*\*\*NIL\*\*\*

Online meeting link will be provided through  
WhatsApp.

**The number of Participants will be limited to  
150**

**\*Note:** E- Certificates will be provided to those participants who attend all the sessions of the program and also appear for the online test as per the norms of AICTE.

AICTE Sponsored



ONE WEEK NATIONAL LEVEL ONLINE  
SHORT TERM TRAINING PROGRAM

on

“Trends and Challenges in Design and  
Implementation of Reconfigurable  
Antennas for Increased Spectrum  
Access in Cognitive Radio  
Communication”

STTP-I 20<sup>th</sup> -25<sup>th</sup> July 2020

### Coordinators

Dr. A. Jhansi Rani, Prof. of ECE

### Co Coordinators

Dr. M. Padmaja, Prof. of ECE  
Mr. A. Raviraja Asst. Prof. of ECE

Organized by



Department of  
Electronics & Communication Engineering  
Velagapudi Ramakrishna  
Siddhartha Engineering College

(Autonomous)

(Sponsored by Siddhartha Academy of General &  
Technical Education)

Kanuru, Vijayawada-520007  
Andhra Pradesh

[www.vrsiddhartha.ac.in](http://www.vrsiddhartha.ac.in)

☎: 0866-2582333, 2584930



### About the College:

Velagapudi Ramakrishna Siddhartha Engineering College (VRSEC) was established in the year 1977 as the first Self-financing Engineering College in the state of A.P. It is located in a vast expanse of 24.05 acres of land on the outskirts of Vijayawada city at a distance of about 6Kms from the city centre. The college is offering 7 UG (B.Tech) Courses with intake of 1140, 9 PG- M.Tech with 180, MBA with 60 and MCA with 60. The college has been accredited four times by National Board of Accreditation (NBA) of All India Council for Technical Education (AICTE), New Delhi in respect of all Engineering disciplines and also certified for ISO 9001:2008. It is affiliated to Jawaharlal Nehru Technological University, Kakinada, AP. Autonomous status was conferred by UGC in the year 2006 and extended for 10 years upto 2027-28 without visit to the college, first in AP. It is one among the top 16 Engineering Colleges selected with Rs 6 crores funding under World Bank aid for R&D and PG enhancement programme called TEQIP –II (S.C.1.2) by MHRD, Govt. of India. The institute secured AAA ranking and all India 7<sup>th</sup> position for the participation by students and faculty in NPTEL/SWAYM. The College received Platinum Award in years 2017, 2018 & 2019 as a Best Industry Linked Technical Institute by AICTE-CII Survey. It is also recognized as “Scientific & Industrial Research Organization (SIRO)” by DSIR, MST, Govt. of India since August 2017.

### About ECE Department:

Established in the year 1977, the department of ECE offers B.Tech Programme in Electronics & Communication Engineering with an intake of 240 and two M.Tech Programmes in Communication Engineering & Signal Processing and VLSI Design & Embedded Systems with an intake of 18 each. The department has been accredited by NBA of AICTE four times. More than 40% faculties are with Ph.D. qualification. Led by a team of highly qualified experienced faculty with specializations such as RF & Microwave, Antennae, Digital Signal

Processing, Wireless Communications, Digital Image Processing, VLSI and Embedded systems etc, the department provides excellent academic and research environment to the UG, PG and research students. A centre of Excellence (TIFAC CORE- DST) in Telematics was established in the year 2009 with the state of the art facilities. Having successfully completed many research projects funded by UGC, AICTE, NRSC-ISRO DLRL & ANURAG-DRDO etc., it is also recognized by JNTUK as "**Research Center.**" Faculty members extend guidance to research scholars, produce Ph.D.'s and publish their findings in peer reviewed national and international journals and conferences.

### About STTP:

Cognitive radio (CR) is a cutting edge technology for wireless communications that requires the design of novel spectrum sensing schemes with high degree of reliability. These networks can dynamically allocate spectrum to multiple users, thereby easing network congestion. Reconfigurable antennas play important roles in smart and adaptive systems which offer several advantages such as multifunctional capabilities, low front-end processing efforts with no need for a filtering element, good isolation, and sufficient out-of-band rejection. These make them well suited for use in wireless applications such as 4G and 5G mobile terminals.

**Note:** The STTP is planned in three phases. The basic concepts and fundamentals in the first STTP, current technologies and applications in the second STTP and futuristic trends and challenges in the third STTP. However they are independent. The dates for the other two STTPs will be informed later.

### Objectives of STTPs:

The program focuses on Antenna design aspects and simulation for cognitive radio Communication with a synthesis approach and progressively builds up the background through an illustrative design and characterization set of learning activities of some of the basic concepts of spectrum access techniques

### Course Contents:

- Overview of Antennas and its parameters
- Basics of Reconfigurable Antennas for Cognitive Radio Communications
- Fundamental issues regarding dynamic spectrum access
- Increased spectrum access in Cognitive Radio Communication
- Different spectrum sharing models.
- Cellular IoT
- Overview of Basic 5G Standard
- High speed Communications -IC design perspective
- Retro Direct antenna concepts for autonomous cars
- Design of Reconfigurable Patch Antenna using HFSS
- Design and simulation of planer antenna (patch antenna) and non-planer antennas (horn antenna)

### Keynote speaker

**Dr. M. Lakshminarayana**

Scientist-H (Retd.), DLRL/DRDO

Director R&D, Unistring Tech Solutions Pvt. Ltd.

### Resource Persons:

**Dr. G. Rama Murthy**, Prof. of CSE

Mahindra University, Hyderabad

**Dr. Radhakrishna Ganti**, Associate Professor,

Dept. of Electrical Engineering, IIT Madras

**Dr. Abhinav Kumar**, Associate Professor,

Dept. of Electrical Engineering, IIT Hyderabad

**Dr.P. Sri Hari**, Associate Professor of ECE,

NITW, Warangal

**Dr. D. Vakula**, Associate Professor of ECE,

NITW, Warangal

**Er.P.Mahalakshmi**, Sr. Researchist (Radar Optimizations)

Wilma Communications Groups, Asia Division.

**Er. M.Vinoth**, Co-Founder & Head.

Wilma Communications Groups (Asia | US | Europe)

**Er. shashikumar R** Application Engineer

Entuple technologies, Bangalore

**Er. Rajesh kulalar** (Application Engineer)

Jyoti Electronics, Bangalore

Registration ID	Name of the participant	Gender	Email address	Phone	Dept.	Designation	Name of the Institution/ University/Organization	Place of the Institution/ University/ Organization
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**Trends and challenges in Design and Implementation of Reconfigurable Antennas for Increased Spectrum Access in Cognitive Radio Communication Dt: 20<sup>th</sup> -25<sup>th</sup>July 2020**

**STTP-I**

**Online Platform : ZOOM**



<b>Date</b>	<b>Expert Details</b>	<b>Timings</b>	<b>Module Content</b>
<b>Day-1</b> <b>20.07.2020</b>	<b>Dr. M. Lakshminarayana</b> Scientist-H (Retd.), DLRL/DRDO Director R&D, Unistring Tech Solutions Pvt. Ltd.	9.30AM to 11.30AM	Inaugural speech and Keynote address
	<b>Dr. D Vakula</b> , Assoc. Prof., NITW, Warangal	2.30PM to 4.00PM	Antennas and parameters
<b>Day-2</b> <b>21.07.2020</b>	<b>Dr. D Vakula</b> , Assoc. Prof., NITW, Warangal	10.00AM to 11.30AM	Basics of Reconfigurable Antennas
	<b>Dr. Radhakrishna Ganti</b> Associate Professor, IIT Madras	2.30PM to 4.00PM	Overview of Basic 5G Standard
<b>Day-3</b> <b>22.07.2020</b>	<b>Dr. D Vakula</b> , Assoc. Prof., NITW, Warangal	10.00AM to 11.30AM	Reconfigurable Antennas
	<b>Er.P.Mahalakshmi</b> Sr. Researchist (Radar Optimizations) Wilma Communications Groups (WCG) <b>Er. M. Vinoth</b> Co-Founder & Head, WCG (Asia   US   Europe)	2.30PM to 4.00PM	RetroDirect antenna concepts for autonomous cars
<b>Day-4</b> <b>23.07.2020</b>	<b>Dr. G. Rama Murthy</b> , Professor Dept. of CSE, Mahindra University, Hyderabad	10.00AM to 11.30AM	Design and Implementation of Reconfigurable Antennas
		2.30PM to 4.00PM	Increased Spectrum Access and Reconfigurable Antennas:
<b>Day-5</b> <b>24.07.2020</b>	<b>Dr. P. Sri Hari</b> , Assoc. Prof, NITW, Warangal	10.00AM to 11.30AM	High speed Communications -IC design perspective
	<b>Dr. Abhinav Kumar</b> , Associate Professor, Department of Electrical Engg., IIT Hyderabad,	2.30PM to 4.00PM	Control Channel Design for Cellular Internet-of-Things
<b>Day-6</b> <b>25.07.2020</b>	<b>Er. Shashikumar R</b> Application Engineer Entuple Technologies, Bangalore	10.00AM to 11.30AM	Design of Reconfigurable Patch Antenna using HFSS
	<b>Er. Rajesh kulalar</b> (Application Engineer) Jyoti Electronics, Bangalore	2.30PM to 4.00PM	Design and simulation of planer antenna (patch antenna) and non-planer antennas (horn antenna) using CST

# **STTP I- Report on TRENDS AND CHALLENGES IN DESIGN AND IMPLEMENTATION OF RECONFIGURABLE ANTENNAS FOR INCREASED SPECTRUM ACCESS IN COGNITIVE RADIO COMMUNICATION**

This is six day STTP programme organized by ECE department, VRSEC during 20 -25 july 2020.

Cognitive radio (CR) is a cutting edge technology for wireless communications that requires the design of novel spectrum sensing schemes with high degree of reliability. These networks can dynamically allocate spectrum to multiple users, thereby easing network congestion.

Reconfigurable antennas play important roles in smart and adaptive systems which offer several advantages such as multifunctional capabilities, low front-end processing efforts. These make them well suited for use in wireless applications such as 4G and 5G mobile terminals.

**Dr. M. Lakshminarayana**, Scientist-H (Retd.), DLRL/DRDO, Director R&D, Unistring Tech Solutions Pvt. Ltd. is keynote speaker

## **The resource persons are:**

### **Academicians**

1. **Dr. M. Lakshminarayana**, Scientist-H (Retd.), DLRL/DRDO, Director R&D, Unistring Tech Solutions Pvt. Ltd.
2. **Dr. G. Rama Murthy**, Prof. of CSE, Mahindra University, Hyderabad
3. **Dr. Radhakrishna Ganti**, Associate Professor, Dept. of Electrical Engineering, IIT Madras
4. **Dr. Abhinav Kumar**, Associate Professor, Dept. of Electrical Engineering, IIT Hyderabad
5. **Dr. P. Sri Hari**, Associate Professor of ECE, NITW, Warangal
6. **Dr. D. Vakula**, Associate Professor of ECE, NITW, Warangal

### **Industry experts**

7. **Er. M.Vinoth**, Co-Founder & Head. Wilma Communications Groups (Asia | US | Europe)
8. **Er. shashikumar R** Application Engineer Entuple technologies, Bangalore
9. **Er. Rajesh kulalar** (Application Engineer) Jyoti Electronics, Bangalore

**Day 1 (20-07-2020): Session 1**

**Dr. M. Lakshminarayana**, Scientist-H (Retd.), DLRL/DRDO, Director R&D, Unistring Tech Solutions Pvt. Ltd. He delivered expert lecture on **Reconfigurable Antennas for Cognitive Radio**.

10:04 AM 4G 74

Recording

**One Week National Level Short Term Training Program**

**Keynote Lecture on**  
**TRENDS AND CHALLENGES IN THE DESIGN AND IMPLEMENTATION OF RECONFIGURABLE ANTENNAS FOR INCREASED SPECTRUM ACCESS IN COGNITIVE RADIO**

**Presents**  
**RECONFIGURABLE ANTENNAS FOR COGNITIVE RADIO**

**By**  
**Dr. M. LAKSHMINARAYANA**  
Scientist-H (Retd.) DLRL / DRDO & Former Associate Director – DLRL  
Director R&D, Unistring Tech Solutions, Hyderabad  
Adjunct Professor, BIET Hyderabad

**Venue : VRS\_BZA** **Date: 20<sup>th</sup> Jul 2020**

10:16 AM Anvithashwika left Recording

**COGNITIVE RADIO**

- **FCC definition:** "A radio or system that senses its operational electromagnetic environment and can dynamically and autonomously adjust its radio operating parameters to modify system operation, such as maximize throughput, mitigate interference, facilitate interoperability, access secondary markets."
- A cognitive radio can be seen as a software-defined radio that is aware of its environment and that can change its modes of operation (operating frequency, modulation scheme, waveform, transmit power, etc.), both via software and hardware manipulation.
- RF-antenna community views cognitive radio as an upgrade of software-defined radio. The communication community relates cognitive radio to dynamic spectrum allocation and sharing.

Inmerugu's screen

10:51 AM Recording

**RECONFIGURATION BY MECHANICAL MEANS**



Rotation Angle

a) The UWB sensing antenna is fixed; (Freq: 2-10 GHz)  
 b) The transmitting antenna can be reconfigured by rotating the disc.  
 The reconfiguration mechanisms can be modelled by assigning a parameter to the rotation angle.

## Day 1 (20-07-2020): Session 2

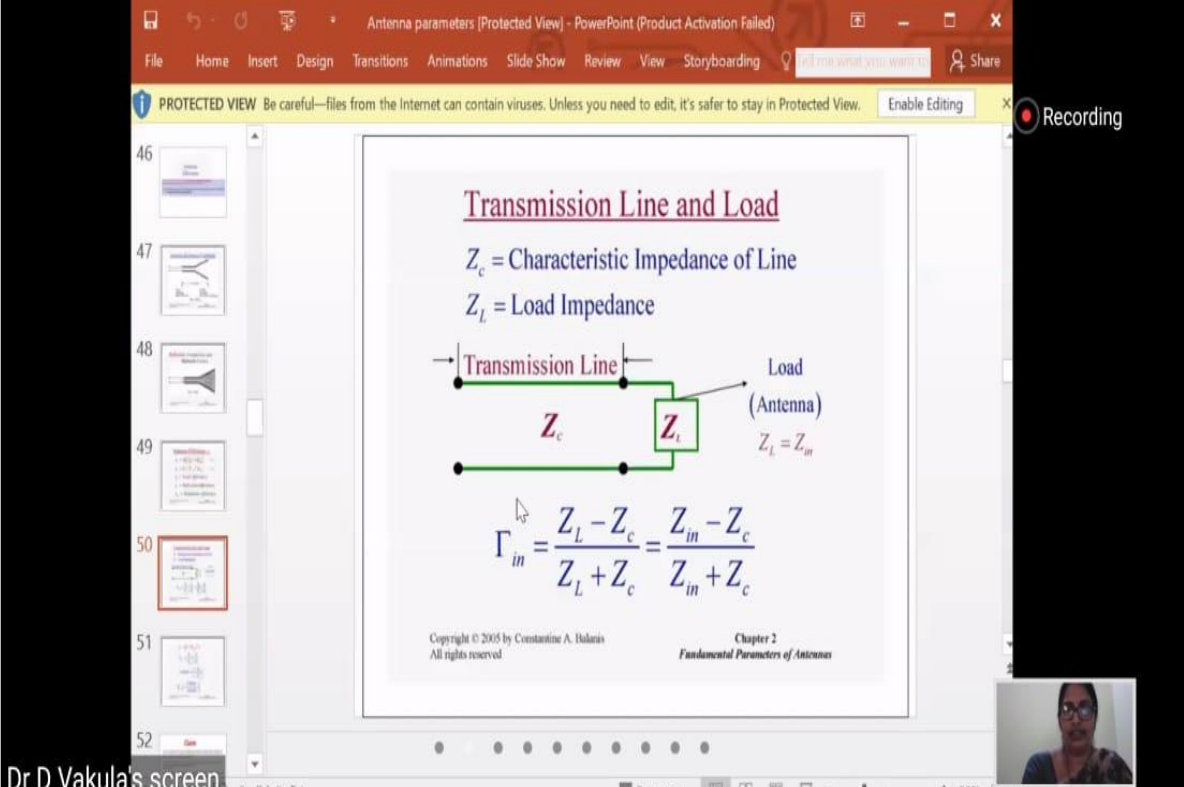
This session was presented by **Dr. Vakula**, Associate Professor of ECE, NITW, Warangal and her talk is on **Overview of Antennas and its parameters**

- Different Antenna Parameters,
- Difference between various apertures,
- How the current distribution can be explained with the transmission line concept?
- Different Horn Antenna Structures,
- Different antennas in real life applications.
- Different types of radiation pattern.
- Radiation power density by using time and spatial variations.
- Antenna efficiency and Gain.

# Antenna Parameters

Dr D Vakula  
Associate Professor  
Dept of Electronics and Communication Engineering  
National Institute of Technology  
Warangal-506004, Telangana  
20/07/2020  
[vakula@nitw.ac.in](mailto:vakula@nitw.ac.in)



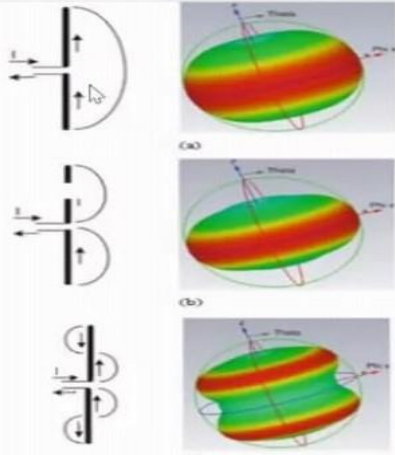


The screenshot shows a PowerPoint slide titled "Transmission Line and Load". The slide content includes:

- Transmission Line and Load**
- $Z_c$  = Characteristic Impedance of Line
- $Z_L$  = Load Impedance
- A circuit diagram showing a transmission line with characteristic impedance  $Z_c$  connected to a load impedance  $Z_L$  (Antenna). The load impedance is also labeled as  $Z_m$ .
- The reflection coefficient formula: 
$$\Gamma_{in} = \frac{Z_L - Z_c}{Z_L + Z_c} = \frac{Z_m - Z_c}{Z_m + Z_c}$$
- Copyright © 2005 by Constantine A. Balanis, All rights reserved.
- Chapter 2: Fundamental Parameters of Antennas

The slide is displayed in a PowerPoint application window titled "Antenna parameters [Protected View] - PowerPoint (Product Activation Failed)". The window shows a "PROTECTED VIEW" warning and a "Recording" indicator on the right. A small video feed of Dr. D. Vakula is visible in the bottom right corner of the screen.





Dipole Antenna  
Current distribution  
and radiation pattern

### Rotation of Wave

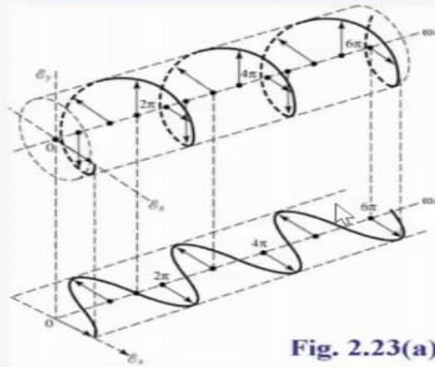


Fig. 2.23(a)

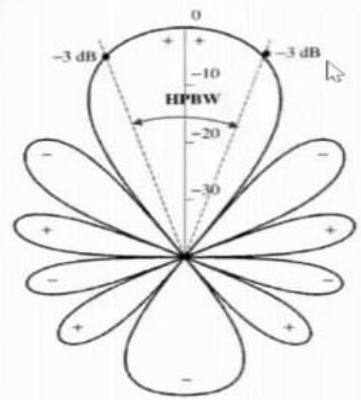
Copyright © 2005 by Constantine A. Balanis  
All rights reserved

Chapter 2  
Fundamental Parameters of Antennas

### 2-D Normalized Power $|E_n|^2$ Pattern of a Linear Array

**dB Scale**  
 $N = 10$  element  
 $d = \lambda/4$  spacing  
 $HPBW = 38.64^\circ$

Fig. 2.2(c)



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Chapter 2  
Fundamental Parameters of Antennas

## Day 2 (21-07-2020) Session 3

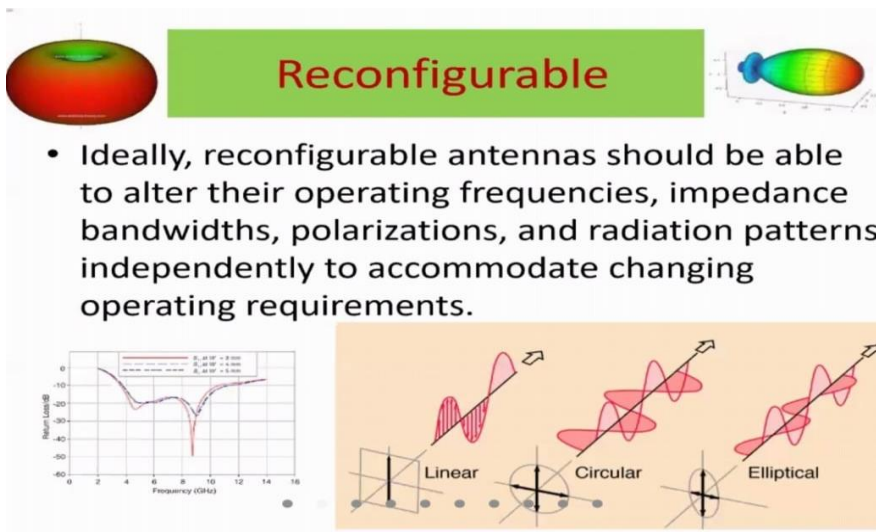
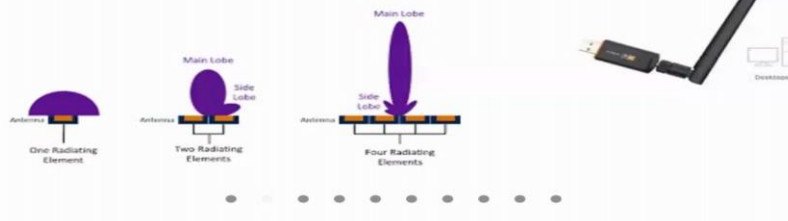
This session was chaired by **Dr .D Vakula**, Associate Professor NITW, and her talk is on “Basics of Reconfigurable Antennas”.

- Overview of reconfigurable Antennas
- Challenges of reconfigurable Antennas
- Necessity of reconfigurable Antennas
- Why reconfigurable is required?
- How to achieve reconfigurability

### Necessity Of Reconfigurability

Let us consider two general application areas

1. Single Element
2. Array



**Reconfigurable Antennas**

- There are several antenna structures that are suitable for implementation of reconfigurable antennas, among them microstrip patch antennas are very attractive structures for various types of reconfigurable antennas
- All such antennas are usually equipped with switches that are controlled by DC bias signals. Upon toggling the switch between on and off states, the antenna can be reconfigured

Forward Biased

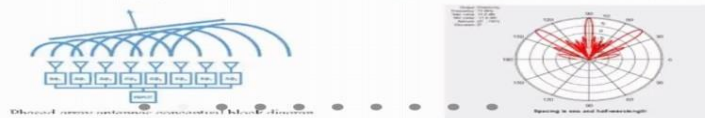
Forward Bias (switch closed)

Reversed Biased

Reverse Bias (switch open)

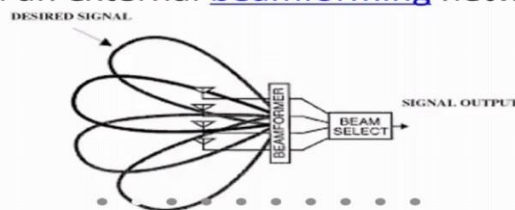
## Arrays

- Limited in both scan angle and frequency bandwidth as a result of the limitations of the individual array elements and the restrictions on antenna element spacing.
- This restriction comes from mutual coupling effect on one hand, appearance on grating lobe on other hand.



## Smart Antenna

- Reconfigurable antennas differ from smart antennas because the reconfiguration mechanism lies inside the antenna, rather than in an external beamforming network.



green

## Day 2 (21-07-2020) Session 4

**Dr .Radhakrishna Ganti** Associate Professor, IIT Madras; delivered lecture on “**Overview of Basic 5G Standard**”.

HE clearly discussed on

- Overview of 5G technology.
- Major goals of 5G test band.
- UG oriented design.
- Massive MIMO.
- 5G ENVISIONED USE CASES: ULTRA CAPACITY/DENSITY/RELIABILITY

A collage of five images showing different laboratory environments. The top row includes a workstation with multiple monitors, a person working at a desk, and a server rack. The bottom row shows a large open-plan lab with many workstations and a specialized testing setup with a large antenna array and a computer monitor. A logo for 'VLSI 2020 BANGALORE' is in the top right corner of the collage.

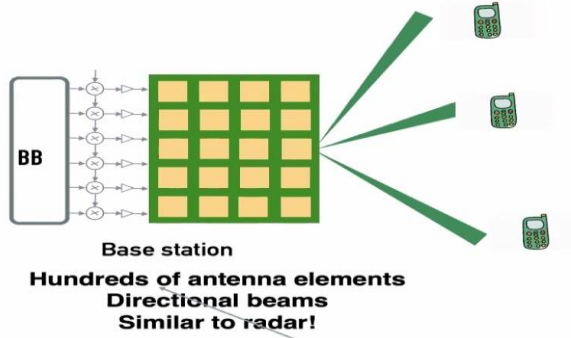
**Labs**

- State of the art 5G Labs have been developed across these institutes
  - 5G test equipment (sub 6 GHz and Mmwave)
  - Requisite Software(s)
  - Protocol testers
- Open to outside companies\*

- Krishna Ganti's screen

# MASSIVE MIMO

5G: Don't transmit where it is not required



4G and below

Transmit all around!

Hopefully UE will receive

5G: Beam to the required users!

$$\text{Capacity} = N W \log(1 + \text{SNR})$$

16

## 5G ENVISIONED USE CASES: ULTRA CAPACITY/DENSE/RELIABILITY

5G	OFDM MIMO	>10 Gbps	USA, EU, Korea, China, Japan	2020	2020?
4G	OFDM MIMO	20-1000 Mbps	USA, EU, Korea, China	2010	2015
3G	CDMA	0.5-20 Mbps	USA	2000	2010
2G	GSM	10Kbps	EU	1991	1995

Santi's screen



## Day-3 (22-07-2020) Session 5

This session was chaired by **Dr .D Vakula, Assoc. Prof.**, NITW, Warangal, presented her talk on “Basics of Reconfigurable Antennas”,  
He deliberated about

- Components required for reconfiguration.
- Types of frequency reconfiguration.
- Reconfigurable UWB antenna.
- Polarization reconfigurable.
- Multi beam and multi polarization.

### Modelling of switch

Recording

- A considerable amount of effort and research has gone into accurately predicting the electrical behaviour of PIN diode switches.
- One of the most compelling reasons for using PIN diode switches in antenna applications are that they have shown to approximate to a very good degree, ideal switches.

Dr D Vakula's screen

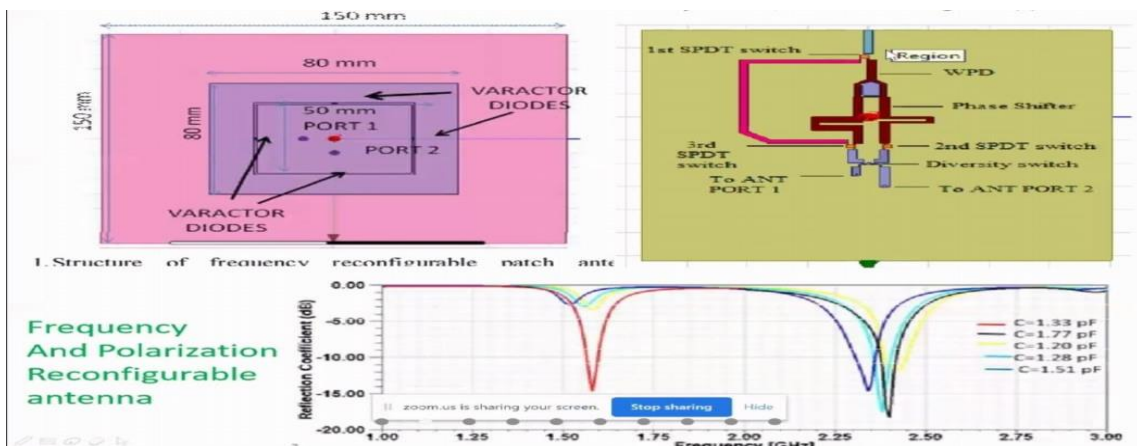
### Frequency And Polarization Reconfigurable antenna

1. Structure of frequency reconfigurable match ante

Reflection Coefficient (dB)

Unmute Start Video Share Participants More





1. Structure of frequency reconfigurable match anti

### Frequency And Polarization Reconfigurable antenna

## Reconfigurability-Techniques

- Antennas based on electronic switching components to redirect their surface currents are called electrically reconfigurable.
- Antennas that rely on photoconductive switching elements are called optically reconfigurable antennas.
- Physically reconfigurable antennas can be achieved by altering the structure of the antenna.
- Finally, reconfigurable antennas can be implemented through the use of smart materials such as ferrites and liquid crystals..

## Performance comparison

Parameter	Mechanical Switch	Solid State Switch
Frequency range	from [DC]	from kHz
Insertion loss	Low	High
Return loss	Good	Good
Isolation	Good	excellent
Switching speed	in ms	in ns
Settling time	< 15 ms	< 1 us
Power handling	High	Low
Operating life	5 million cycles	infinite
ESD immunity	High	Low
Sensitive to	Vibration	RF power overstress

Performance comparison of Mechanical and Solid state switches

## Multi Beam and Multi Polarization

- A four-way power divider made by three Wilkinson power dividers and interconnected with switches (switch A and switch B) is designed to feed-fourrectangular-radiating-patcheantenna.
- By controlling the state of the switches, the antenna characteristics can be changed into two modes.
- When switch A is closed and switch B is open, the four rectangular radiating patches are excited by four sources with equal amplitude and phase. A metamaterial antenna with conical beam and linear polarization is achieved.
- When switch A is open and switch B is closed, four sources with equal amplitude but 90-phase difference for each adjacent output lead to a wideband antenna with broadside beam and circular polarization

### Day-3 (22-07-2020) Session 6

**Er. M.Vinoth** Co-Founder & Head, WCG (Asia | US | Europe) presented about “RetroDirect antenna concepts for autonomous cars”.

He explained about

- Retro directive array.
- Retrace antenna.
- Corner reflector.
- Application of SAs.

The screenshot shows a Zoom meeting interface with a central slide. The slide content is as follows:

**Zoom** (with a dropdown arrow)

**Velagapudi Ramakrishna Siddhartha Engineering College (Autonomous)**  
(Sponsored by Siddhartha Academy of General & Technical Education)  
Kanuru, Vijayawada-520007

Welcomes

**Er. P Mahalakshmi**  
Sr. Researchist Wilma Communications Groups

**Er. M Vinoth**  
Co-Founder & Head Wilma Communications Groups

To  
**AICTE Sponsored**

**ONE WEEK NATIONAL LEVEL ONLINE SHORT TERM TRAINING PROGRAM**  
on  
**“Trends and Challenges in Design and Implementation of Reconfigurable Antennas for Increased Spectrum Access in Cognitive Radio Communication”**  
STTP-I 20<sup>th</sup> -25<sup>th</sup> July 2020

Organized by  
Department of Electronics & Communication Engineering  
Velagapudi Ramakrishna Siddhartha Engineering College (Autonomous)

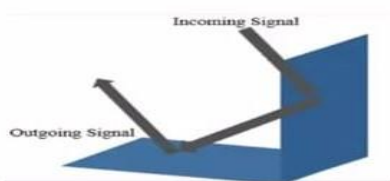
Zoom interface elements: Unmute, Start Video, Share, Participants, More (3), Leave, Recording, and a small video thumbnail of a participant.

# Application of SAs


- Mobile Communications
- Cellular and Wireless networks
- Satellite Communications
- Wireless Sensor Networks (Autonomous Car)
- Military
- Electronic Warfare

WCG Corner Reflector

- It Consist of orthogonal metal sheets , each quadrant provides retro directivity of any angle of incidence in x-y plane.
- By intersecting the two metal sheets to reflect back the incoming waves from all possible angles in three dimension spaces in same direction




The diagram illustrates a two-sided corner reflector. It consists of two perpendicular metal sheets forming a 90-degree corner. An 'Incoming Signal' is shown as a line with an arrow pointing towards the corner. The signal is reflected off the first sheet, then off the second sheet, and finally back out as an 'Outgoing Signal' in the opposite direction of the incoming signal. The entire structure is labeled 'Two sided corner reflector'.



Please move this window away from

## Retro directive Array

- Retro directive systems reacts to an incoming signal from an *unknown direction* by transmitting a response to that same direction.
- The response is performed *without any prior knowledge* of the *location of the source* and completely automatic without *phase shifters or digital circuits*.



Please move this window away from

## Advantage of Smart Antennas

- Reduce the co-channel interference.
- Range Improvement
- Increase in capacity
- Less transmit Power
- Reduce In handoff

www.wilmacomms.com

10

### Day4 (23-07-2020) Session 7

**Dr. G. Rama Murthy**, Professor of CSE, Mahindra University, Hyderabad. presented his talk on “Design and Implementation of Reconfigurable Antennas”,

- Applications of reconfigurable antennas.
- Recent trends of reconfigurable antennas.
- Some examples of reconfigurable antennas.
- Design tradeoffs of reconfigurable antennas.



Shrenik Sarade joined

Zoom

Leave

Recording

## RECONFIGURABLE ANTENNAS: CURRENT & FUTURE WIRELESS COMMUNICATION SYSTEMS

Garimella Rama Murthy, Professor  
Mahindra Ecole Centrale,  
Hyderabad .

Unmute

Start Video

Share

Participants

More 6





## 2. Reconfigurable Antennas : Features

---

- Single or Multiple Reconfiguration Features
  - Number of Reconfigurable Features: dependent on Number of Employed Active Elements and increasing as the number of Switches increases
- 



## 5. Reconfigurable Antennas: Specific Example

---

- Reconfigurable Component: CMOS Digitally Tunable Capacitor (DTC)
- Advantages:
  - High Power Handling,
  - Low power consumption, low supply voltage and good capacitance scale in a compact packaging

### **Day4 (23-07-2020) Session 8**

**Dr. G. Rama Murthy**, Professor Dept. of CSE, Mahindra University, Hyderabad, presented his talk on “Increased Spectrum Access and Reconfigurable Antennas,”

He deeply explained about

- Advantages of reconfigurable antennas.
- Features: Antennas with single and multiple reconfigurable.

# 1. Advantages of Reconfigurable Antennas

- Multi-Band Functioning
- Steerable Radiation Pattern
- Polarization Diversity
- Reduced Size
- Complexity
- Cost of Antenna and improving the total performance of RF system

NAGARAJU P joined

Zoom

Leave

## Design and Implementation of Reconfigurable Antennas for Increased Spectrum Access: Cognitive Radio Communications

Garimella Rama Murthy, Professor  
Mahindra Ecole Centrale,  
Hyderabad .

Unmute Start Video Share Participants More

## Day 5 (24-07-2020) Session 9

Dr.P. Sri Hari, Assoc. Prof, NITW, Warangal, presented his talk on “High speed Communications -IC design perspective”

He explained about

- Effects of non linearity.
- Performance measures.
- Comparison between time domain and frequency domain.



A screenshot of a Zoom meeting window. The main content is a slide titled "Multidisciplinary" with a blue background and a list of topics. The slide content is as follows:

- Micro wave theory
- Signal propagation
- Multiple access
- Wireless standards
- CAD tools
- Random signals
- Commn theory
- TX RX archtrs
- IC design

At the bottom of the slide, it says: SREEHARI RAO PATRI, CHIP DESIGN CENTER, NITW, 7/24/2020, 47. In the top right corner of the Zoom window, there is a "Recording" indicator. At the bottom left, it says "SREEHARI RAO PATRI's screen".



A screenshot of a Zoom meeting window. The main content is a slide titled "summary" with a blue background and a list of topics. The slide content is as follows:

- Modelling signals suitable for high speed transmission → MLHD
- Bottlenecks of RFIC Design
- Characterization of RF IC systems

At the bottom of the slide, it says: SREEHARI RAO PATRI, CHIP DESIGN CENTER, NITW, 7/24/2020. In the top right corner of the Zoom window, there is a "Recording" indicator and a "Leave" button. At the bottom, there is a toolbar with icons for "Unmute", "Start Video", "Share", "Participants" (101), and "More" (3). The name "SREEHARI RAO PATRI" and "CHIP DESIGN CENTER NITW" are also visible in the bottom center.



# EFFECTS OF NON LINEARITY

- Assumptions: sys is ML and TV and

$$y(t) \approx \alpha_1 x(t) + \alpha_2 x^2(t) + \alpha_3 x^3(t).$$

- HARMONICS:

If a sinusoid is applied to NL system, O/p consists of freq comp that are integer multiples of i/p freq.

If  $x(t) = A \cos \omega t$ , then

$$y(t) = \alpha_1 A \cos \omega t + \alpha_2 A^2 \cos^2 \omega t + \alpha_3 A^3 \cos^3 \omega t \quad (2.12)$$

$$= \alpha_1 A \cos \omega t + \frac{\alpha_2 A^2}{2} (1 + \cos 2\omega t) + \frac{\alpha_3 A^3}{4} (3 \cos \omega t + \cos 3\omega t)$$

(2.13)

$$= \frac{\alpha_2 A^2}{2} + \left( \alpha_1 A + \frac{3\alpha_3 A^3}{4} \right) \cos \omega t + \frac{\alpha_2 A^2}{2} \cos 2\omega t + \frac{\alpha_3 A^3}{4} \cos 3\omega t.$$

7/24/2020

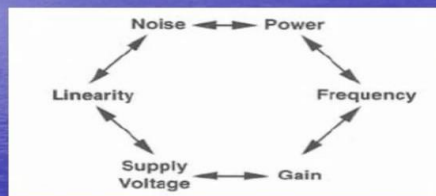
# PERFORMANCE MEASURES

- MAXIMUM distance across which satisfactory reception can be provided
- This is determined by
  - i) Power delivered to antenna
  - II) SENSITIVITY of the receiver
- practical environment makes received signal burried in the adjacent channel/reflections from the surroundings

7/24/2020 PATRI's screen

SREEHARI RAO PATRI  
CHIP DESIGN CENTER NITW

57



→ any 2 of the six parameters trade with each other

7/24/2020

SREEHARI RAO PATRI  
CHIP DESIGN CENTER NITW

49

## Day 5 (24-07-2020) Session 10

Dr. Abhinav Kumar, Associate Professor, Department of Electrical Engg., IIT Hyderabad, presented his talk on “Cellular IoT

- Motivation for machine type communication.
- IOT applications.
- Why cellular IOT.
- eMTC
- NB-IOT
- Open challenges and Future research directions

### LTE- IoT

**eMTC Cat-M1**  
Optimizing for the broadest range of IoT applications with VoLTE & mobility support

**NB-IoT Cat-NB1**  
Providing extreme optimizations for low-throughput, delay-tolerant IoT use cases

**LTE IoT:** complementary narrowband technologies for low-power, wide-area IoT use cases

Abhinav Kumar's screen

### LTE MTC introduces a new Power Save Mode (PSM)

More efficiently turn on/off modem for device-originated or scheduled applications

**Without LTE MTC**  
LTE Advanced with deep sleep

Model power consumption vs Time: Off → Setup registration and connection → M2M Data (Tx/Rx) → Off

Device requires signaling prior to data transmission in order to register with the network.

**With LTE MTC**  
LTE Advanced with Power Save Mode (PSM)

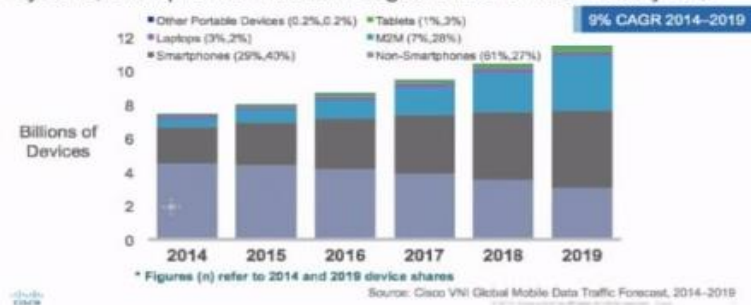
Model power consumption vs Time: PSM → Efficient modem 'wakeup' → M2M Data (Tx/Rx) → PSM

Device remains registered with the network, reducing the signaling required for modem wakeup

Dr. Abhinav Kumar's screen

## Global Mobile Device Growth by Type

By 2019, Smartphones Will Attain Largest Share to Reach Nearly 40%



## Day6 (25-07-2020) Session 11

• **Er. Shashikumar R** Application Engineer Entuple Technologies, Bangalore, presented “Design of Reconfigurable Patch Antenna using HFSS

- Overview of microstrip patch antenna
- Design of Reconfigurable microstrip patch antenna using HFSS

**ANSYS** **Reconfigurable Patch Antenna** **ENTUPLE TECHNOLOGIES**

- **Objective:** Create, simulate & analyze a microstrip patch antenna at 2.4 GHz
- **Problem Statement:** This Patch Antenna must be capable of being reconfigured in terms of its polarization

**Cross View**  
 $\epsilon_r = 4.4$   
 $H = 1.6 \text{ mm}$   
Ground Plane

36 mm  
16.2 mm  
0.7 mm  
1.0 mm  
17.11 mm  
3.059 mm  
42 mm  
CONFIDENTIAL

ANSYS Electronics Desktop (32-bit) - reconfigurable antenna - both diode off - Gain Plot 1 - SOLVE - reconfigurable antenna - both diode off - Gain Plot 1

Driven Solution Setup

General | Options | Advanced | Hybrid | Expression Cache | Derivatives | Defaults

Setup Name: Setup1

Enabled  Solve Ports Only

Adaptive Solutions

Solution Frequency:  Single  Multi-Frequencies  Broadband

Frequency: 2.4 GHz

Maximum Number of Passes: 6

Maximum Delta 5: 0.02

Use Matrix Convergence

Design1 - Modeler

Gain Plot 1

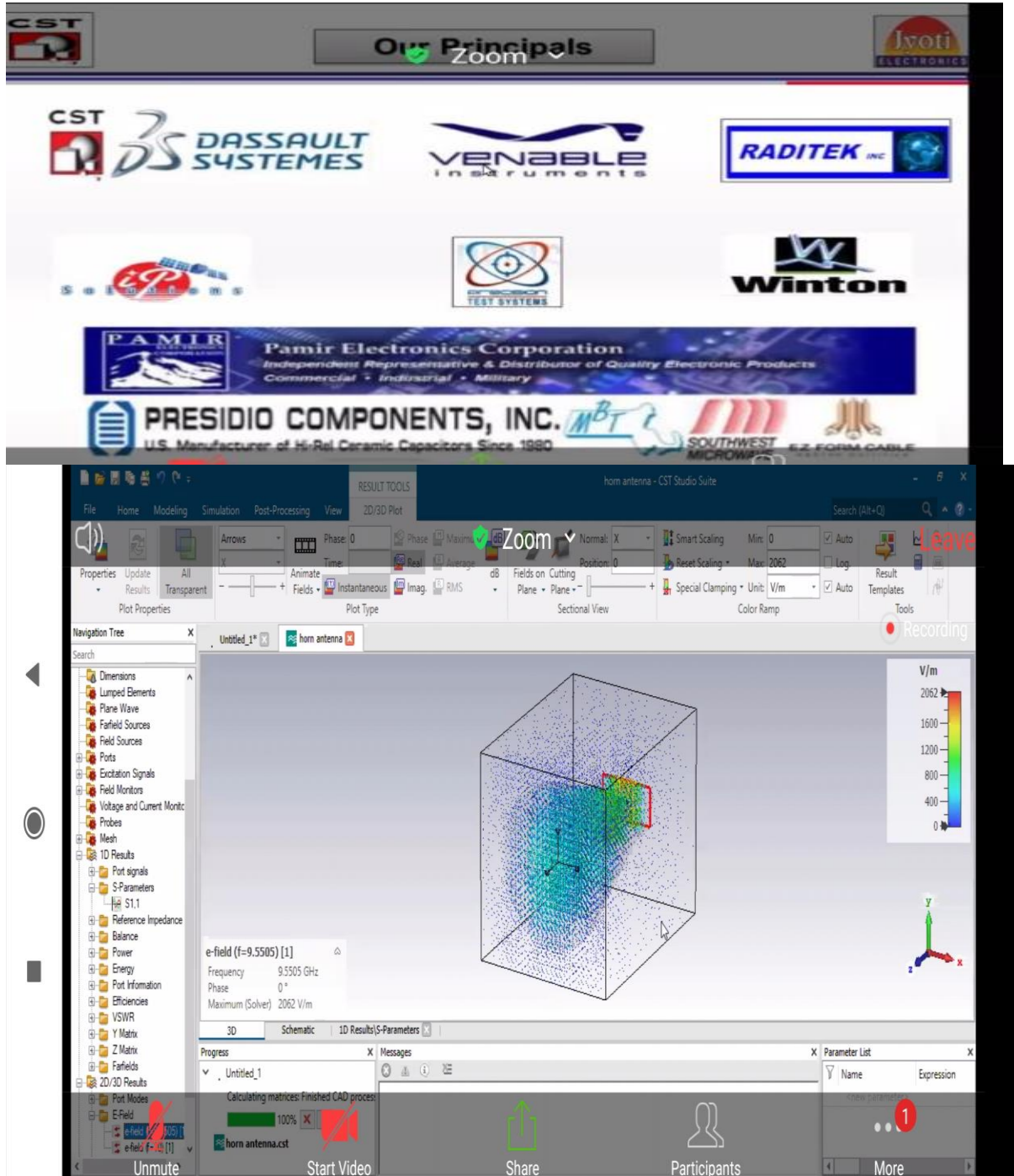
Min: 2.0  
Max: -10.0

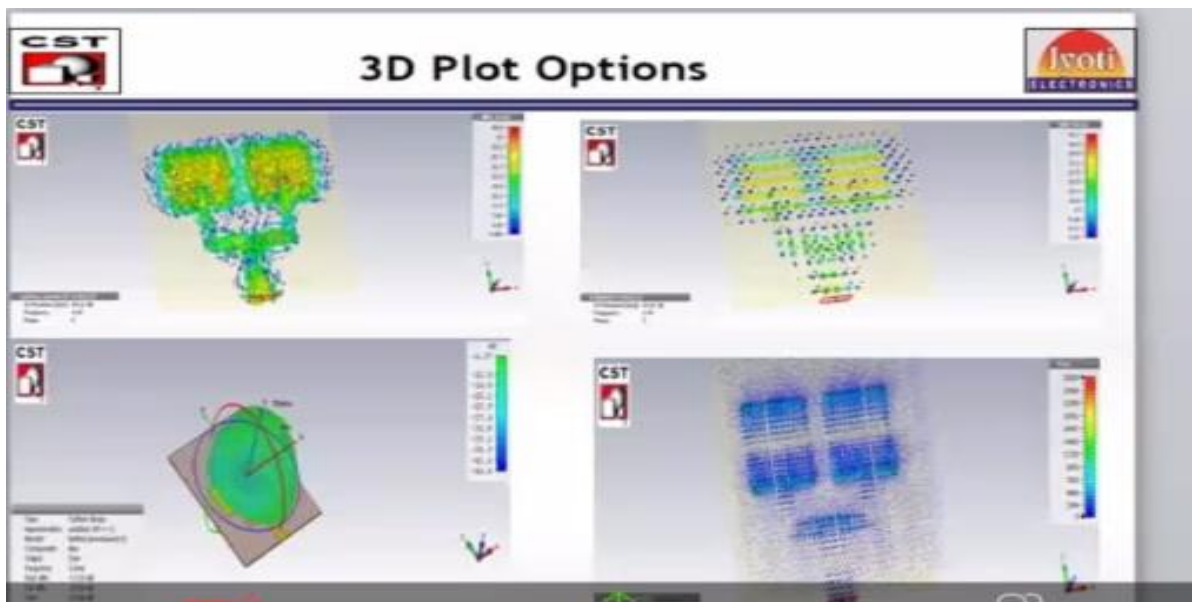


## Day6 (25-07-2020) Session 12

Er. Rajesh kulalar (Application Engineer) Jyoti Electronics, Bangalore, demonstrated “Design and simulation of planer antenna (patch antenna) and non-planner antennas (horn antenna) using CST”

- Basic introduction of CST.
- Features of CST.
- Design and simulation of planer and non planer antennas.
- Result analysis







## CST Simulation Products CST PARTICLE STUDIO

Zoom


CST PARTICLE STUDIO® is a specialist tool for the fast and accurate analysis of charged particle dynamics in 3D electromagnetic fields. It is suitable for tasks ranging from designing of magnetrons and tuning electron tubes to modelling particle sources and accelerator components.



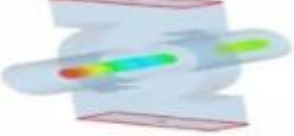
Magnetron




TWT




Electron Gun




Output Cavity (workflow)




SH Magnetron




Multi-Beam Gun



Beam Position Monitor



Coaxial Connector (II)



Pierce Type Gun

At the end **Dr. M.Padmaja**, one of the coordinators of STTP offered a vote of thanks and we conducted the online exam to the participants.