



# SNS COLLEGE OF TECHNOLOGY

(Autonomous Institution)

COIMBATORE-35

DEPARTMENT OF BIOMEDICAL ENGINEERING



## 19BME308 - Medical Radiation Safety

### UNIT I - INTRODUCTION TO RF AND MICROWAVE RADIATION

#### 1.1 Source of Radio Frequency Radiation

##### **Introduction**

RF equipment is now extremely used in applications which would not have been conceived twenty or thirty years ago. Apart from the enormous diversity of equipment available in the established fields of communications, broadcasting, radar, navigation, production processing and medical therapy, there is an increasing use in applications such as anti-theft systems in shops, vehicle location, motorway control, telemetry to operate control systems remotely and many other novel applications. Uses are continually extending, as evidenced by the use of mobile telephones. In the amateur radio field also modern equipments are smaller and more compact, facilitating mobile use in motor vehicles.

##### **Broadcasting:** MF and HF broadcasting

Broadcast transmitters in the MF and HF bands use considerable power, 250 kW to 750 kW being common. MF transmitters are usually used for national broadcasting to give wide coverage whilst HF equipment is used for long distance broadcasting. By their nature and size, high power HF broadcast transmitters provide a good example of equipment which requires quite a lot of survey time because of the need to measure RF and X-ray radiation safety on a number of different frequencies.

Antenna systems used for MF may be wire systems or towers fed directly so that they become the radiators. For HF broadcasting wire curtain arrays, rhombic and other types may be used. These involve a lot of masts and towers to support the arrays and hence a very large amount of land. The feeders are often 300 ohms open wire types or 50/75 ohms coaxial types. Since more than one frequency may be used over a twenty-four-hour period, additional antenna systems are



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required. Unused antenna systems can become 'live' due to parasitic energisation from working antennas.

### **UHF and VHF broadcasting**

Television and VHF radio broadcasting is now taken for granted in most of the world. The number of broadcasting stations has increased considerably over the last thirty years and the need for full coverage with television and VHF radio has resulted in many lower power repeater transmitters being used to bring the services to local communities.

### **Radar systems**

There are many varieties of radar equipment in use around the world. Most involve movement of the antenna system, i.e. rotation or movement in azimuth, movement in elevation, etc. Leaving aside HF radar, radar systems are generally characterized by using microwave beams which are usually relatively narrow in azimuth but the characteristic in the elevation plane depends on the nature and function of the radar.

The applications include:

1. Defense
2. Air traffic control
3. Meteorology and the study of weather changes
4. Mapping the earth
5. Specialized applications ranging from radars for measuring the state of the sea and sea wave motion, to hand held police radar speed meters for checking motor vehicle speeds.



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## Medical therapy equipment

Belief in the beneficial effects of magnetic fields and electrical currents applied to the human body dates back to the late nineteenth century. 'Short wave' (HF) therapy has been used in hospitals and clinics since the early twentieth century. Some of the very early claims were somewhat dubious but serious medical people have devoted their time in trying to explore the benefits and devise effective therapies.

The equipment used was usually 27 MHz equipment since this frequency gives a significant penetration in the human tissues and this is necessary for those therapies which essentially aim to induce heating in joints.

From the point of view of safety surveys for all RF energy based equipments, we are concerned with:

- 1 Exposure of the patient – basically a medical matter
- 2 Exposure of the attending physiotherapist, which is a general health and safety matter
- 3 Any exposure of other people nearby.

Whatever the frequency and the equipment used, the safety measures will include careful control of the patient's exposure to the wanted radiation, and keeping the patient at a reasonable distance from stray radiation from the equipment applicator leads. For the physiotherapist there is a need to minimize exposure since there can sometimes be high field levels near the equipment and its leads.

**Reference:** *Ronald Kitchen - RF and Microwave radiation safety handbook.*