INTERNSHIP REPORT

PRASAR BHARATI

[BROADCASTING CORPORATION OF INDIA]

ALL INDIA RADIO - BENGALURU

NAME	**LIKITH S**
USN_NO	**1BM16EC052**
COLLEGE	**BMS COLLEGE OF ENGINEERING**
BRANCH	**ELECTRONICS AND COMMUNICATION ENGINEERING**
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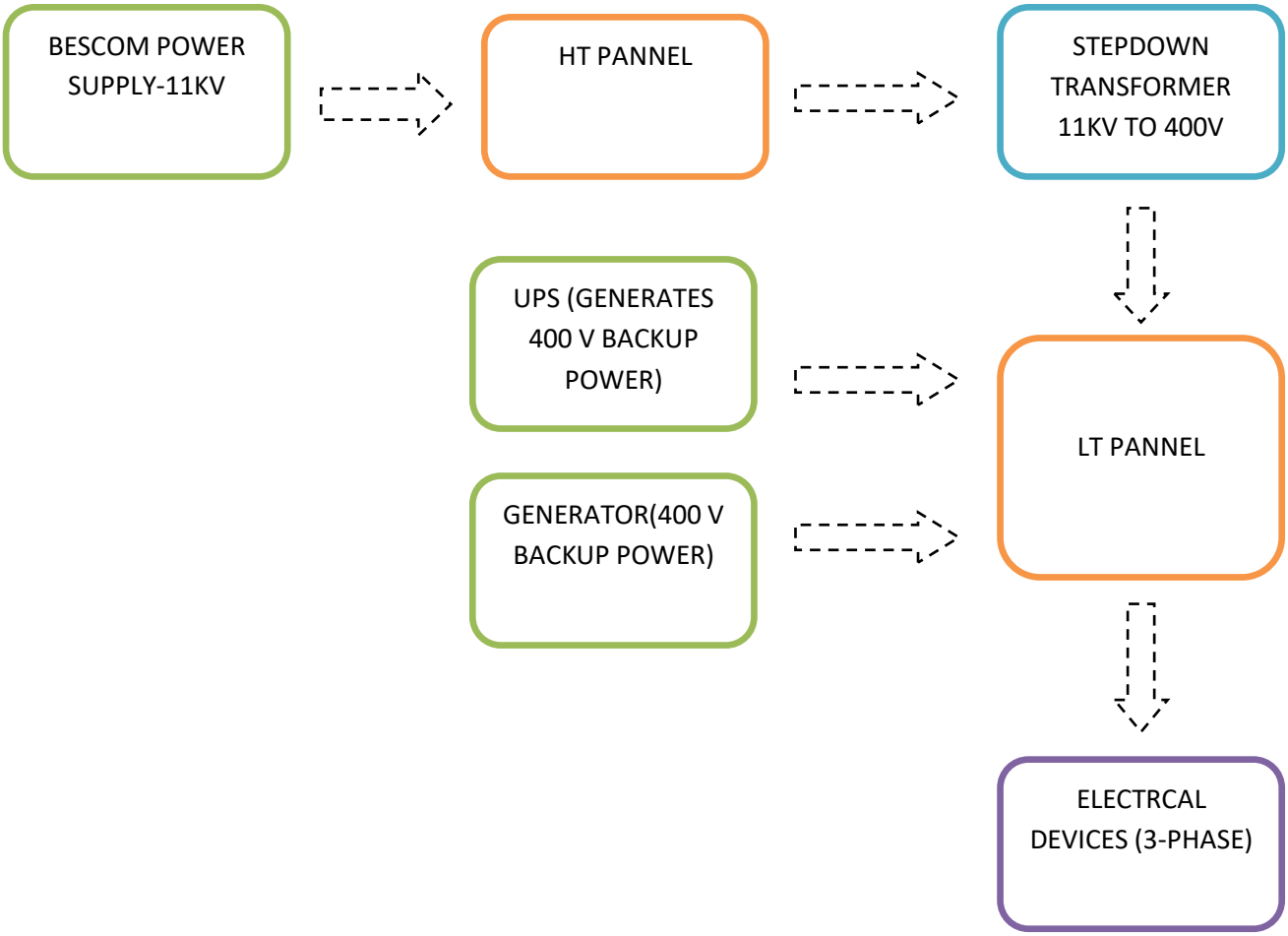
Introduction

In recent times, the habit of radio listening has grown-up leaps and bounds, unraveled the Radio Programme Listenership (RPL) surveys. Radio listeners were more than 95 percent across the socio-economic and demographic classes of the society. The increased number of FM channels has enhanced the number of radio listeners in urban area. The audience are almost five per cent more in urban than rural area. The primary channel of AIR Bengaluru is predominantly listened in rural areas while the *Vividh Bharati* and Rainbow are the urban favourites. Assured daily reach of FM Rainbow was almost 45 per cent. It was the No.1 radio channel in Bengaluru. with amazing reach. The daily reach of the channel was more than 50 per cent in any socio-economic class of audience and it is almost uniform, testify the effective media planning of AIR Bengaluru. Significantly, the listeners for the classical music channel, *Amruthavarshini*, a channel of high class were chiefly from the higher socio-economic classes of the society, whereas the audience for Primary and *Vividh Bharati* channels were mostly from the middle and lower orders of socio-economic classes.

With the changing mass communication scenario, Audience Research has occupied the centre stage. World over, almost all the big media organizations have been doing in-house audience research in one form or the other. Without 'Market Research' (in marketing) no media organization can afford to put their precious resource at stake without knowing the potential audience (consumers) and market for their media content. Besides, they are also subscribing to syndicated research done by the various media and market research organizations. The secret behind the success of private TV and Radio channels lies in their capability to feel the pulse of audience through continuous audience research and to design and modify the programme content including presentation accordingly. All India Radio has been a pioneer in this field. Presently, it has a network of 38 Audience Research Units across the country which started with a humble beginning in 1946 as 'Listeners' Research Wing'.

Power distribution at AIR-BENGALURU



- The power from electricity distributor BESCOM (around 11kV) is given to the HT panel. HT panel –It stands for High Tension panel and is mainly used to handle and stabilize power transmitted in high tension cables. The basic design of a HT panel comprises of circuit breakers or switch fuse which protects the equipment from sudden voltage fluctuations. They are generally outdoor substations.

- The output of HT panel is given to the step-down transformer ,which brings down 11kV power down to 400V , in order to run the 3-phase electrical components .
- However the output of 400v cannot be given directly to the components , so we require a LT panel to handle this 400V power.
- LT panel - LT Panel is an electrical distribution board that receives power from generator or transformer and distributes the same to various electronic devices and distribution boards. Such panels are used in industries both for internal and external use and, therefore, they are quite rugged to withstand different climatic conditions.

- The power from stepdown transformer is not the only source of power at AIR , a backup diesel generator is used to provide power when there is a BESCOM power cutoff , however there is time lapse/delay between the disruption of main power and generation of backup power by the generator . In order to have continuous uninterrupted power supply , an UPS has been installed as a backup power source till the generator turns on .

- The stabilized output of the LT panel (400 V)is used to run various 3-phase electrical components .

Station profile

- Amruthavarshini FM -100.1 MHz ; 3kW FM transmitter
- Vividh Bharati FM -102.9 MHz ; 10kW FM Transmitter
- Rainbow FM- 101.3 MHz ; 10kW FM Transmitter
- Primary Channel AM - 612KHz ; 200kW AM Transmitter
- Raagam 24X7 DTH
- DTH - Direct-to-Home (DTH) satellite television is becoming a buzzword in the satellite broadcast industry due to the fact that DTH offers immense opportunities to both broadcasters and viewers. Thanks to the rapid development of digital technology, DTH broadcast operators worldwide have been able to introduce a large number of new interactive applications in the television market besides a large number of entertainment programmes over a single delivery platform. In addition, since digital technology permits a highly efficient exploitation of the frequency spectrum, the number of TV channels that can be broadcast using digital technology is significantly higher than with analogue technology. The increased number of television channels allows the operator to satisfy the demand of a number of niche markets with dedicated transmissions.
  Transmission in Ku band is most appropriate and widely used for the purpose. As mentioned above, all the encoded transmission signals are digital – thus providing higher resolution picture quality and better audio than traditional analog signals. All the advantages of the digital transmission, as applicable to the terrestrial transmission are relevant in the satellite transmission also.

  AIR KANNADA – Uplink – 6337 Mhz, Downlink – 4112.000 MHz

  FM RAINBOW – Uplink – 6336.6 Mhz, Downlink – 4111.600 MHz.

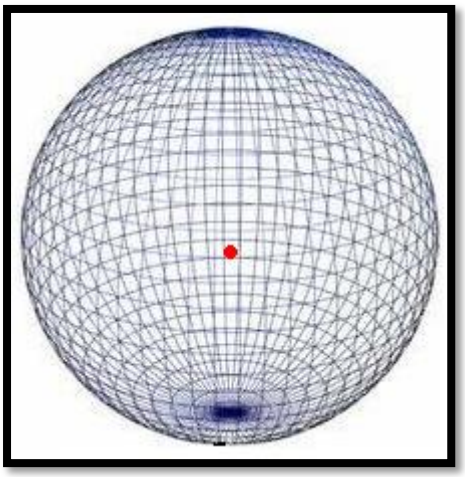
  RAAGAM – Uplink – 6339 Mhz, Downlink- 4114 Mhz.

FM Transmission - Line of sight propagation

At AIR Bengaluru , FM channels include Amruthavarshini FM(100.1 MHz) , Vividh Bharati FM(102.9 MHz) ,Rainbow FM(101.3 MHz).

Frequency modulation (FM) is a technique used to encode data on an alternating digital or analog signal. The method includes varying the frequency of the carrier wave on which useful information is imposed or impressed upon. The signal on which data is imposed is known as the carrier signal and the resulting signal with variable frequency is called a frequency modulated signal.

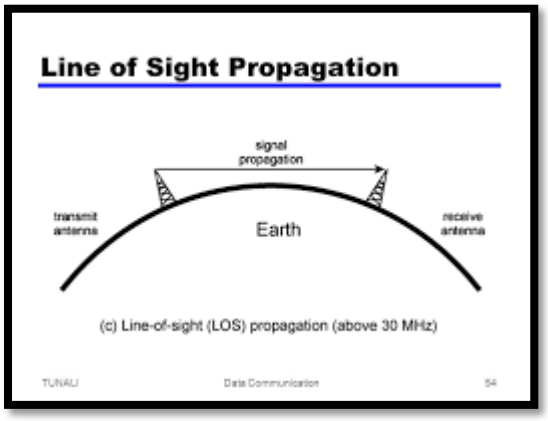
A FM transmitter involves a tower of height 100 meters with 3 Bay and 6 bay antenna of size (ƛ/4) fixed at the top of the tower . The antennas that are used are isotropic antennas, An isotropic antenna is a theoretical antenna that radiates equally in all directions - horizontally and vertically with the same intensity. The antenna has a gain of 1 dB in the spherical space all around it and has an efficiency of 100%. The concept of an isotropic antenna is often used as a reference antenna for the antenna gain. Many antennas specify gain in dBi (decibels over isotropic), which is the power transmitted by an antenna in specific direction, divided by the power transmitted by an isotropic antenna emitting the same total power.



3-D Antenna Pattern of an Isotropic Antenna

FM transmission follows Line of sight communication(LoS) , **Line-of-sight propagation** is a characteristic of electromagnetic radiation or acoustic wave propagation which means waves travel in a direct path from the source to the receiver. Electromagnetic transmission includes light emissions traveling in a straight line. The rays or waves may be diffracted, refracted, reflected, or absorbed

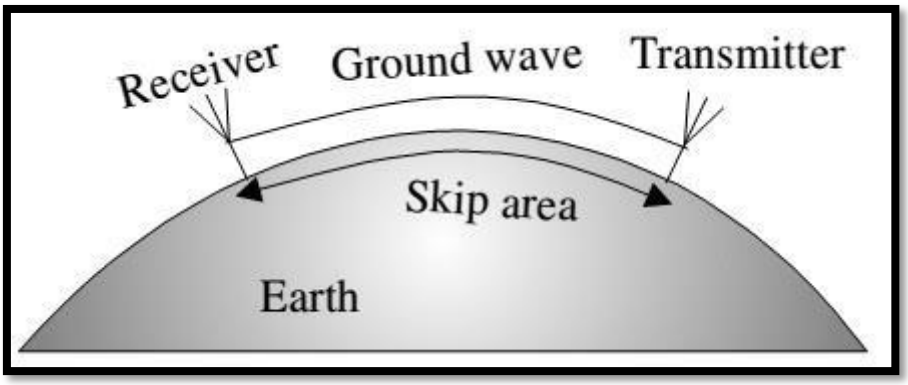
by the atmosphere and obstructions with material and generally cannot travel over the horizon or behind obstacles.
Analysis of line of site is particularly important for planning wireless network deployment. A clear line of site between two antennas is ideal for the best reception. However, a radio signal can permeate and bend or bounce around some obstruction, unlike line of sight for an eye. LOS is often categorized with separate abbreviations for the different levels of obstruction. A fully open path is the situation abbreviated as *LOS*. A near line of site with partial obstructions is abbreviated as *nLOS* and a completely blocked non-line of sight as *NLOS*.



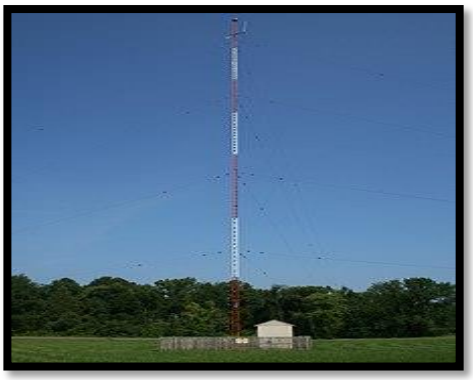
However , the region of coverage or the maximum distance upto which FM signals can be transmitted depends on height of the tower and power of the transmission tower.

AM transmission – Medium Wave propagation

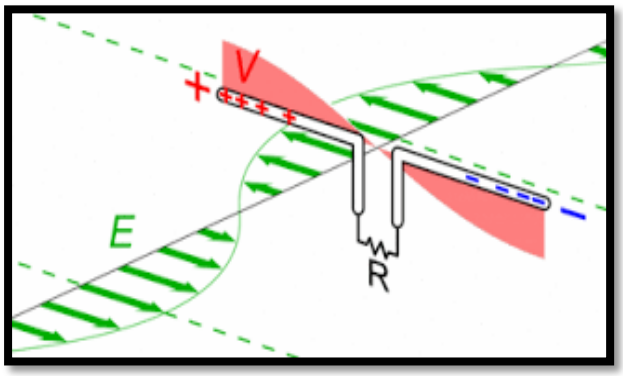
Medium wave propagation is usually used for long distance communication and in AIR Primary channel (612 kHz) implements medium wave propagation. Wavelengths in this band are long enough that radio waves are not blocked by buildings and hills and can propagate beyond the horizon following the curvature of the Earth; this is called the groundwave. Practical groundwave reception typically extends to 200–300 miles, with greater distances over terrain with higher ground conductivity, and greatest distances over salt water. Most broadcast stations use groundwave to cover their listening area. The ground wave propagation is also very dependent upon the nature of the ground over which the signal travels. Ground conductivity, terrain roughness and the dielectric constant all affect the signal attenuation. In addition to this the ground penetration varies, becoming greater at lower frequencies, and this means that it is not just the surface conductivity that is of interest. However there is a higher probability of distorted signal being received due to interference by mountains and undesirable landscapes . The noise factor is predominantly high.

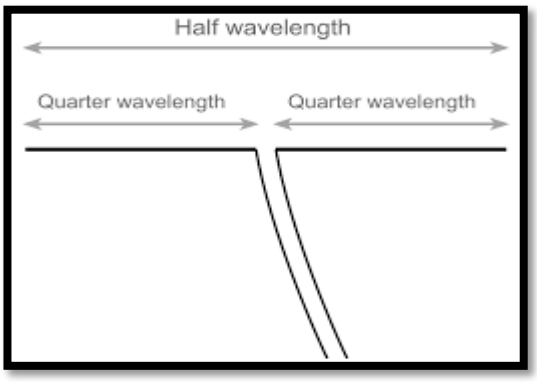


Medium wave transmission involves a high power transmitter (200kW) located in a buffer zone and contains a high tower/mast wherein the entire mast radiates signal in all directions. For broadcasting, mast radiators are the most common type of antenna used, consisting of a steel lattice guyed mast in which the mast structure itself is used as the antenna. Usually mast antennas are series-excited (base driven); the feedline is attached to the mast at the base. The base of the antenna is at high electrical potential and must be supported on a ceramic insulator to isolate it from the ground. Shunt-excited masts, in which the base of the mast is at a node of the standing wave at ground potential and so does not need to be insulated from the ground, have fallen into disuse, except in cases of exceptionally high power, where series excitation might be impractical. If grounded masts or towers are required, cage or long-wire aerials are used. Another possibility consists of feeding the mast or the tower by cables running from the tuning unit to the guys or crossbars at a certain height.



In very rare cases dipole antennas on the transmitter are used for medium wave transmission.A dipole antenna is a straight electrical conductor measuring 1/2 wavelength from end to end and connected at the center to a radio-frequency (RF) feed line. This antenna, also called a *doublet*, is one of the simplest types of antenna, and constitutes the main RF radiating and receiving element in various sophisticated types of antennas. The dipole is inherently a balanced antenna, because it is bilaterally symmetrical.





AM transmission - Short wave propagation

Radio waves in the shortwave band can be reflected or refracted from a layer of electrically charged atoms in the atmosphere called the ionosphere. Therefore, short waves directed at an angle into the sky can be reflected back to Earth at great distances, beyond the horizon. This is called skywave propagation. Thus shortwave radio can be used for very long distance communication, in contrast to radio waves of higher frequency which travel in straight lines (line-of-sight propagation) and are limited by the visual horizon, about 64 km (40 miles). Shortwave radio is used for broadcasting of voice and music to shortwave listeners over very large areas; sometimes entire continents or beyond. It is also used for military over-the-horizon radar, diplomatic communication, and two-way international communication by amateur radio enthusiasts for hobby, educational and emergency purposes, as well as for long distance aviation and marine communications.

A typical phenomenon of shortwave propagation is the occurrence of a skip zone where reception fails. With a fixed working frequency, large changes in ionospheric conditions may create skip zones at night.As a result of the multi-layer structure of the ionosphere, propagation often simultaneously occurs on different paths, scattered by the E or F region and with different numbers of hops, a phenomenon that may be disturbed for certain techniques. Particularly for lower frequencies of the shortwave band, absorption of radio frequency energy in the lowest ionospheric layer, the D layer, may impose a serious limit. This is due to collisions of electrons with neutral molecules, absorbing some of a radio frequency's energy and converting it to heat. Predictions of skywave propagation depend on:

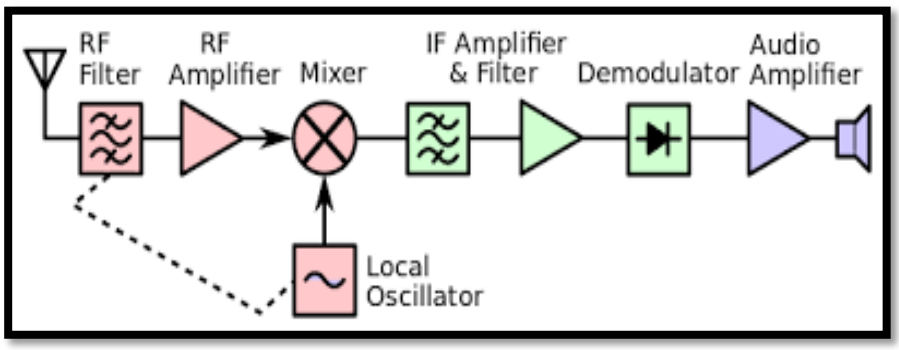
- The distance from the transmitter to the target receiver.
- Time of day. During the day, frequencies higher than approximately 12 MHz can travel longer distances than lower ones. At night, this property is reversed.
- With lower frequencies the dependence on the time of the day is mainly due to the lowest ionospheric layer, the D Layer, forming only during the day when photons from the sun break up atoms into ions and free electrons.
- Season. During the winter months of the Northern or Southern hemispheres, the AM/MW broadcast band tends to be more favourable because of longer hours of darkness.
- Solar flares produce a large increase in D region ionization so high, sometimes for periods of several minutes, all skywave propagation is nonexistent.

Captive Earth Station

CES/Captive Earth Station is mainly used for uplink/downlink of information to/from the satellites respectively.

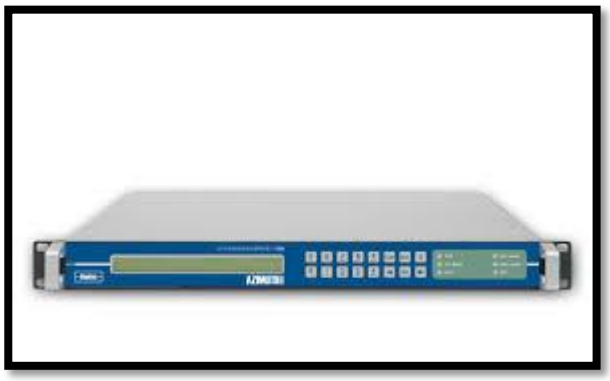
- The CES design at AIR involves the uplink of Rainbow FM,DTH Kannada and Raagam 24X7 to the satellites through a C-band antenna.
- Rainbow FM, message signal is given as input to the 3 way analog switch along with CES comp output, the output of the 3-way switch is given to an audio processor.
- Two o/p lines of audio processor are taken out and given ANALOG SONIFEX DA and ATIDIGITAL DA which then are cross connected to encoder .

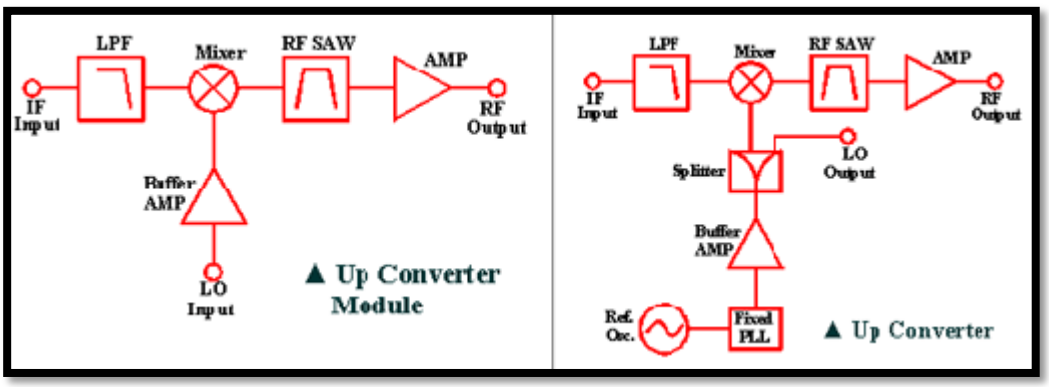
- However , this cross-connection is done for backup purpose in situations of failure of the working line. The frequency of the message signal at this stage in KHz and in order to uplink to a satellite we require the frequency to be in several GHz.
- In order to achieve this the corresponding MPEG data is given to a superheterodyne receiver. A superheterodyne receiver is a type of radio receiver that uses frequency mixing to convert a received signal to a fixed intermediate frequency (IF) which can be more conveniently processed than the original carrier frequency. The intermediate frequency generated is about 70.6 MHz and the entire circuit is broadly called a modem.



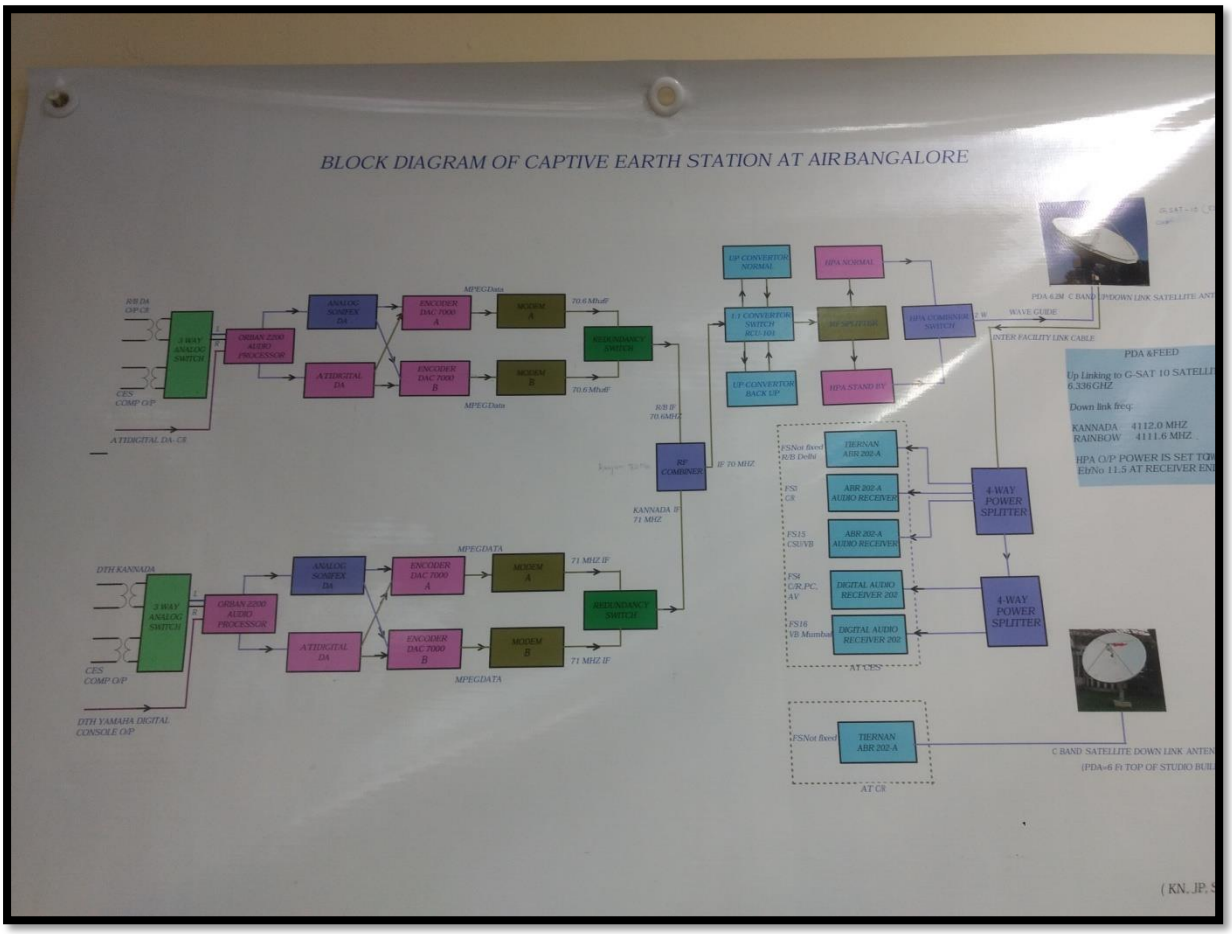
- Both the main and backup lines are combined at the redundancy switch and then given to a RF combiner which thereby combines similar intermediate frequency message signals of DTH Kannada and Raagam 24X7. It is called a R/F combiner as it combines Intermediate frequency signals in Radio frequency range.

- The output of RF combiner is given to a 1:1 converter switch which is used to switch lines with the main UP converter and a backup UP converter . The UP converter is used to convert the frequency range of the signal from MHz to GHz range so that it is suitable for uplink to a G-SAT 10 satellite.





- This output is then given to a High Power Amplifier through a RF splitter and then given to a C-band antenna for uplink. At AIR the uplink frequency is 6 GHz and downlink frequency is 4 GHz.



CES BLOCK DIAGRAM

DIGITALIZATION IN RADIO TRANSMISSION

- With the advent of Digital Radio Transmission in Short-Wave band significant improvement in the reception and coverage of AIR programmes is expected. People can listen to near FM quality programmes of above services by tuning the respective frequencies on DRM Radio receivers only.

- Digital Radio Mondiale(DRM) is a digital transmission system recommended by the International Telecommunication Union (ITU) that offers not only audio broadcasting in near-FM quality, but also different types of multimedia data services. The system can be applied to all AM broadcast bands below 30 MHz (LW, MW and SW) and it is understood as a one-to-many delivery system. DRM is intended to substitute the current analogue AM transmission systems.

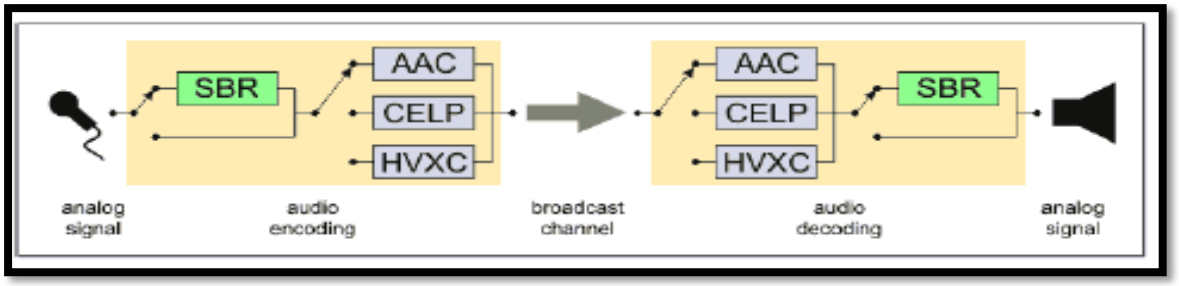
- While it is true that AM (Amplitude Modulation) allows simple receivers and has an average of 2.2 billion receivers worldwide, its poor audio quality (due to a small bandwidth), its out-dated receiver handling (no station label, no automatic frequency switching) and its high power consumption for transmission are just some of the important points to take into account. FM (Frequency Modulation) has a good audio quality compared to AM, but a far smaller coverage area.

OVERVIEW OF THE DRM SYSTEM

- For the broadcast signal, the DRM system uses a high number of QAM modulated carriers spread over a regular AM (SW, MW, LW) spectrum channel. On the transmitter side (to generate the signal in the air), the DRM transmission block diagram consists roughly of the stages explained below. First of all, on the source encoder and data pre-coder, the signal is adapted to an appropriate digital format. This source data stream is then combined in the multiplexer with descriptive information about the RF-signal, the transported data and services and additional functions. The multiplex can support up to four audio/data streams.

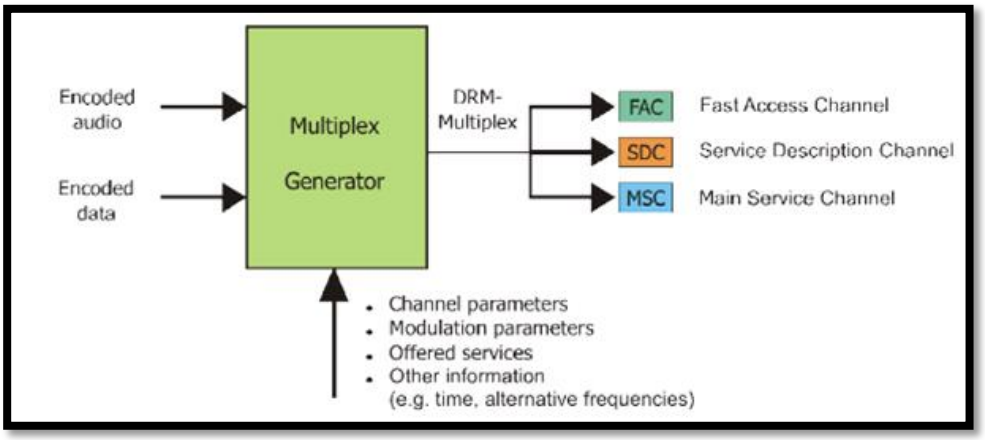
- The next step is the channel encoding, which adds redundant information in order to permit the receiver to reconstruct a distorted signal and defines the mapping of the digital encoded information (the DRM multiplex which is e.g. provided by the DRM ContentServer) onto QAM cells. After that, a set of QAM symbols is interleaved, so that adjacent QAM cells are spread, before the transmission, across the carriers and re-ordered again in the receiver in order to avoid possible long blocks of lost data. Thus, the robustness of the bit stream to channel errors is highly improved.Then, in the OFDM cell mapper, the different types of QAM cells are collected and placed on the time/frequency grid. OFDM symbols are separated by guard intervals between

every symbol. And finally, the modulator converts the digital representation of the OFDM signal into the analogue base band signal.



COMPONENTS OF A DRM-MULTIPLEXER

- The DRM-Multiplex Generator produces the three different components of the DRM-Multiplex:
    - the Main Service Channel (MSC),
    - the Fast Access Channel (FAC)
    - Service Description Channel (SDC).



Main service channel

- The MSC contains the data for the services (audio and multimedia applications).
- the MSC contains between one and four streams (see picture above). Each stream is divided into logical frames of 400 ms length each. Audio streams comprise compressed audio and optionally they can carry text messages.

Data streams, and only they, may be composed of up to four data "sub streams" (if the data stream is configured for DRM packet mode). A sub stream carries packets for one service.

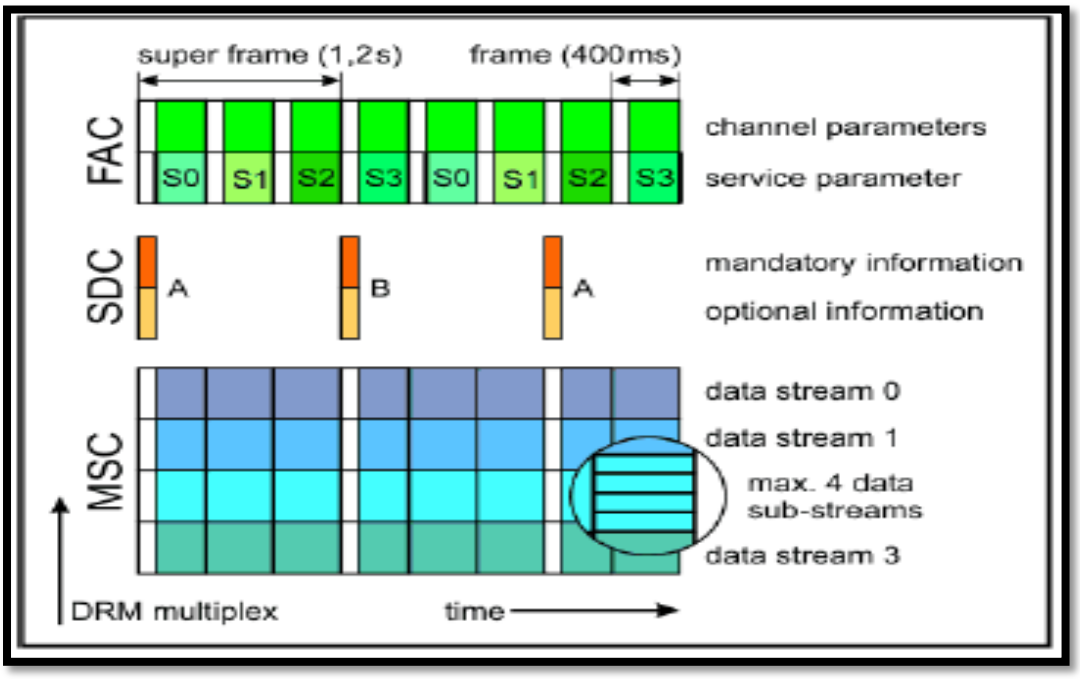
- A data service comprises one data stream or one data sub stream. The logical frames from all the streams are mapped together to form multiplex frames of 400 ms duration which are passed to the channel coder.

Fast access channel

- Each transmission frame contains an FAC block. Each FAC block contains parameters that describe the DRM channel (the on-air signal) and parameters to describe one service. When more than one service is carried in the multiplex, a number of FAC blocks are required to describe all the services.

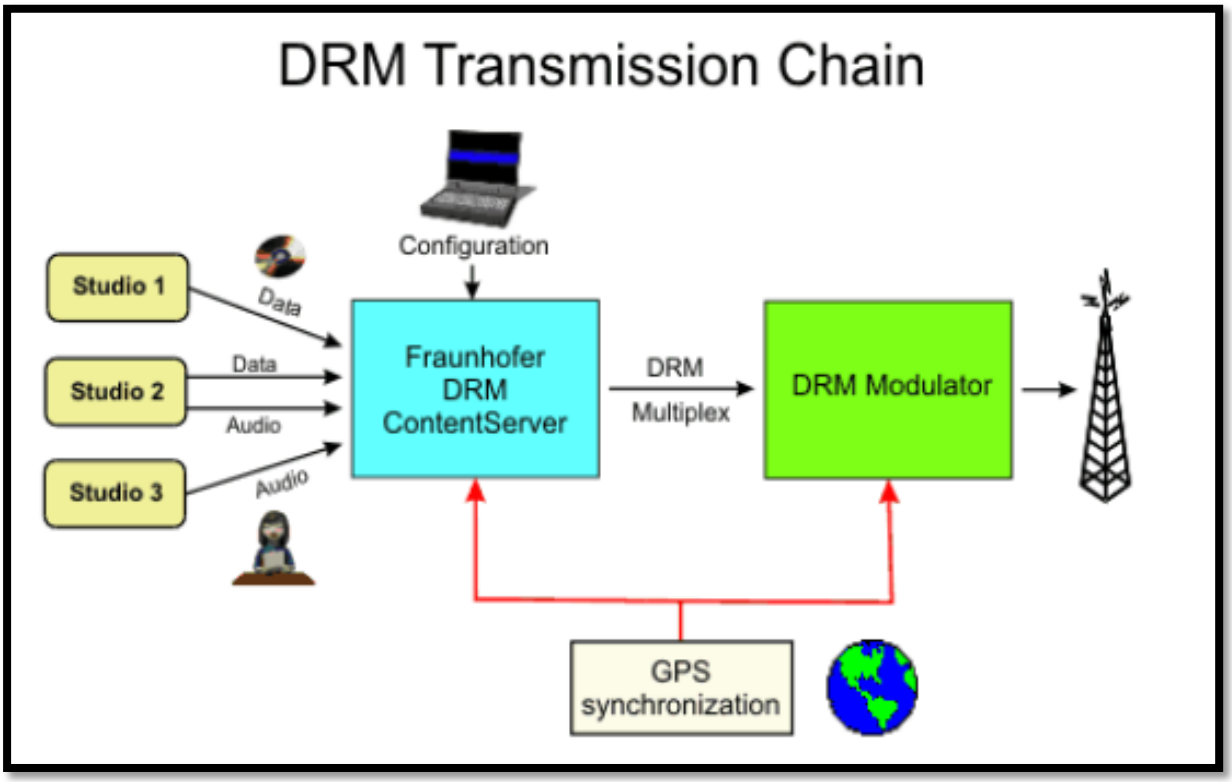
Service description channel

- The SDC information is not sent within every DRM frame (400 ms) but only once per DRM transmission super frame (1.2 sec).
- An SDC block is the SDC data contained in one transmission super frame. The SDC is treated as a single data channel. The total amount of data may require more than a single SDC block to send.
- Therefore it may take several seconds until the receiver has got all the information required to playback and decode the DRM multiplex.
- Currently 13 types of SDC blocks (SDC Entities) are defined, each representing a certain kind of information.



DRM Content Server Transmission Chain

- Various sources of data and audio can be fed into the Content Server, which will import, check, convert and manage this data according to the current Content Provider and Service Component setup.
- The output of the DRM Content Server - a digital DRM Multiplex which is fully compliant to the DRM standard, containing FAC, SDC and MSC streams plus additional information - is transported to one ore more DRM Modulators, which prepare the analog signal to be broadcast via an attached transmitter.
- The DRM Content Server supports a virtually unlimited number of DRM Modulators to be fed with the identical DRM Multiplex including time stamp information. Therefore it is the ideal central data source for SFN setups (Single Frequency Networks), where each modulator/transmitter sends the identical signal at the same time from different places into the same target area. To be optionally able to keep the DRM Content Server located distantly from each modulator/transmitter, the DRM Content Server as well as each modulator is synchronized via the worldwide available GPS (Global Positioning System) timing information.



Advantages of DRM Transmission

- Interference free reception on short, medium and long wave.
- High audio quality ('full' audio frequency spectrum; comparable to FM quality).
- Automatic frequency switching & simple user interface.
- One receiver for worldwide operation.
- DRM reduces the number of bits which is currently at 128 bits to 8 bits.
- DRM at the receiver end,results in increase in accountability.
- Large coverage areas.
- Inexpensive receivers available in the near future.
- Support of ground wave, sky wave and NVIS (Near Vertical Incidence Skywave).
- Bandwidth support for 4.5, 5, 9, 10, 18 and 20 kHz transmission channels.
- Support for single frequency networks.
- Up to four programmes/services on one frequency.
- Consumed transmission power only 1/4 of analog AM.

CONCLUSION

In this sector of training I studied about the overall procedure and objective of the broadcasting process in elaborate form. All India Radio had provided us all the equipments and apparatus for understanding each and every section up to its depth. I visited various sections like server and networking room, lines room, control room, captive earth station etc. After studying these sections I get understood their execution and importance for the transmission and reception of the data at All India radio.

The training started was with the server and networking room where I visited and studied about the overall networking procedure and the interconnection between the servers to access the private data as well as public data. The data like news, audio songs etc are available to every server at any instance in any section. Every server is independent to fetch and add the data to them. The servers are connected to each other via bus topology and Ring topology. The next section was Lines room including all the lines containing data decoding and arriving at same room and can be accessed. This data can be further forwarded to the other studios and control room with help of Encoder. In the Captive Earth Station I learnt about the reception and transmission of data in the form of signals. Satellite communication is general and very important in today's life. Today's human growth and development in the communication field is only because of the satellite communication. However, digitalization is achieved through the use of DRM transmitter and as a result aiding the quality of signal transmitted.

The entire internship was a wonderful experience and a very good opportunity to learn about the new/advanced technologies used in real time systems.

Thank you