DRM Digital Radio Standard is Ready for Local Services

Successful demonstration and trial of DRM in the FM-band in India

DRM in the FM band is ready for India's mass market. The Indian car industry has rolled-out DRM enabled radio sets in the millions and proven during the trial that, after a simple firmware upgrade, those receiver models will support DRM in the FM band with the full feature set. Stakeholders are eagerly waiting for the Indian Government to urgently announce a much-awaited policy, recommending the adoption of DRM in the FM band for public service and private broadcasters in India.

DIGITAL RADIO BROADCASTING IN INDIA

AIR has already adopted and rolled-out nation-wide the DRM digital radio standard for its large-area services in the MF and HF bands. Today, India has successfully established the largest digital radio network in the world; it possesses a fleet of over 3 million cars with line-fit DRM reception capability and is host to the world-leading chipset industry for DRM reception.

Telecom Regulatory Authority of India (TRAI), the regulator for broadcasting, has recommended to the Ministry of Information and Broadcasting Government of India that digital broadcasting in the FM band should also be allowed in the unused white spaces, without disturbing the existing analogue transmissions. The Regulator has not specified the digital standard to be used.

TRIAL OF DRM DIGITAL RADIO BROADCASTING IN THE FM BAND IN INDIA

Considering the TRAI recommendations, the Ministry asked Prasar Bharati/AIR to test the various digital standards approved by ITU and recommend the one best suited for digitising the FM band after taking into consideration the existing state of FM broadcasting and the infrastructure in the country.

To address the task Prasar Bharati constituted a special Committee. After carrying out the trial of HD Radio, the Committee asked the DRM Consortium to demonstrate all the features of DRM in the FM band from a standalone broadcast antenna in Delhi and then in Jaipur, in the 600 kHz whitespace between the two analogue FM stations.

TEST PLAN AND DURATION

The first phase of the DRM trial was in Delhi, from 24th Feb to 18th Mar 2021. Its aim was to demonstrate and test the key features of DRM, its coverage efficiency potential and flexible on-air signal configurations.

The second phase from 22nd to 24th Mar 2021 was in Jaipur. It was designed to prove the compatibility of DRM with the FM band "channelisation" in India, where DRM fills the otherwise unusable gaps between existing analogue FM services, as well as its compliance with the existing CTI (shared FM transmitter infrastructure) sites.

The DRM standard in the FM band (VHF band-II) occupies a fixed amount of spectrum: 96 kHz of bandwidth per 'block' (i.e., DRM transmission signal).

Site	Delhi	Jaipur
Location	Akashwani Bhawan, Parliament Street, New Delhi (77° 12' 39" E, 28° 37' 20" N)	Common Transmission Infrastructure (CTI), All India Radio, Transmitter Campus, Vaishali Nagar, Jaipur (26°54'38.80"N, 75°44'58.55"E)
Antenna Height above ground level	80 meters	77 meters
Transmitting Frequency	100.7 MHz	93.9 MHz
Transmitter Total Output Power (TOP)	100 W	
Transmitting Aerial	4-bay, circular polarization	
Space between existing CTI antenna and DRM showcase antenna	-	13 meters below the CTI antenna
ContentServer	RFmondial DRM ContentServer R7 Professional, based on Fraunhofer DRM ContentServer technology	
Modulator	RFmondial DRM Modulator	
Transmitter	Nautel 2.5 kW VS series	

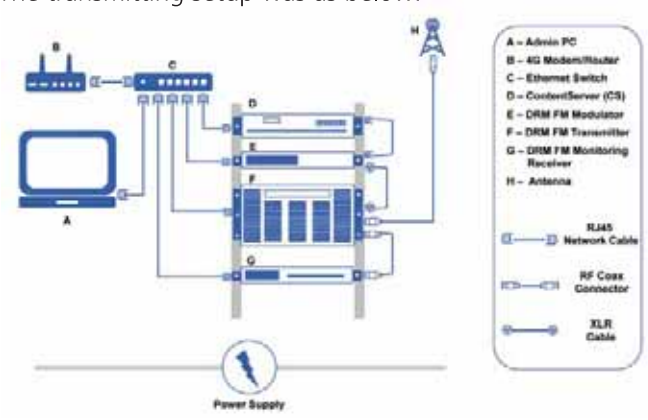
Every DRM signal can carry up to four services; typically, up to three DRM Audio Services including PAD (programme associated data) and one DRM Data Service (such as Journaline).

The following features were introduced to the committee and then demonstrated during the trial. On-the-road measurements were also carried out in every case:

i. Pure Digital operation for
   - Single DRM signal
   - Multi-DRM configuration
ii. Simulcast (DRM and analogue FM) operation
iii. Multi-DRM in FM white spaces

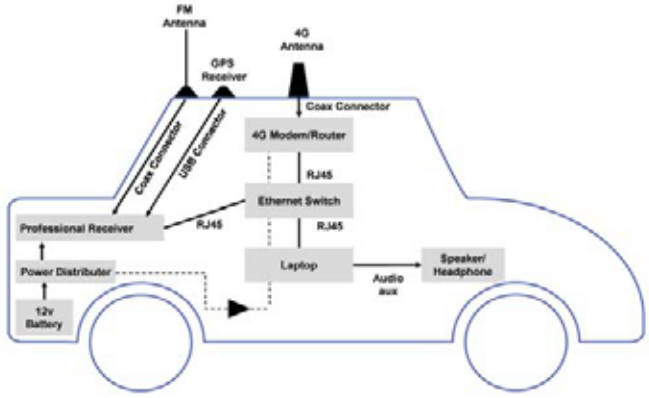
TRANSMITTING SETUP

The transmitting setup was as below:



RECEIVING/TEST SETUP

A measurement vehicle, arranged and equipped by the DRM Consortium, was fitted with the receiving set up as shown in the graphic, with a professional DRM monitoring receiver by RFmondial (RF-SE) plus the Fraunhofer DRM MultimediaPlayer Radio App at its core. This setup recorded the transmission parameters and reception signal quality.



DEMONSTRATIONS CARRIED OUT DURING THE TEST PERIOD

1. DRM Features

The following features of DRM were demonstrated:

a. Basic Features

i. Transmission of **up to 3 audio services and 1 multimedia service**
ii. **Service Labels** (Unicode) including Hindi and other official Indian scripts
iii. **Service description** indicating audio programme type, language and country of origin
iv. **Graphical Station Logo** for every audio and data service
v. **DRM text messages**, which can accompany every audio service
vi. **Journaline**, the advanced text application of DRM digital radio services, fully based on Unicode, and which provides hierarchically structured information, to access information on-demand without the need for internet or mobile networks
vii. **DRM Online hybrid and interactivity functionality** through Journaline

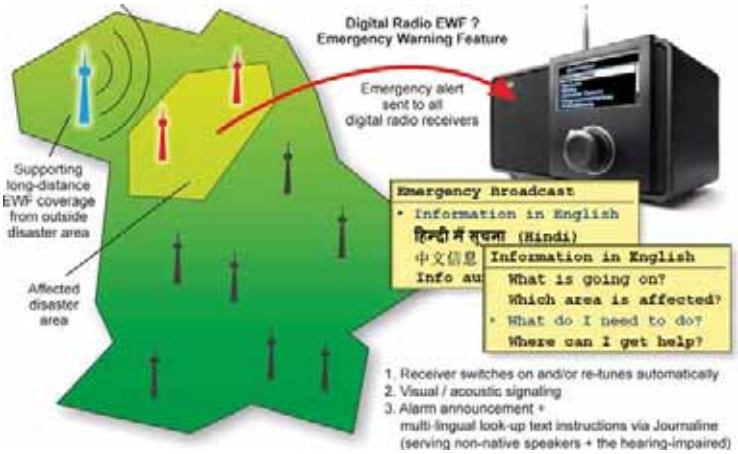
b. Transmission of live content

Possibility to transmit AIR News Channel and Mann ki Baat programme, originated from online services, was demonstrated, in audio and Journaline text.

c. Emergency Warning Functionality (EWF)

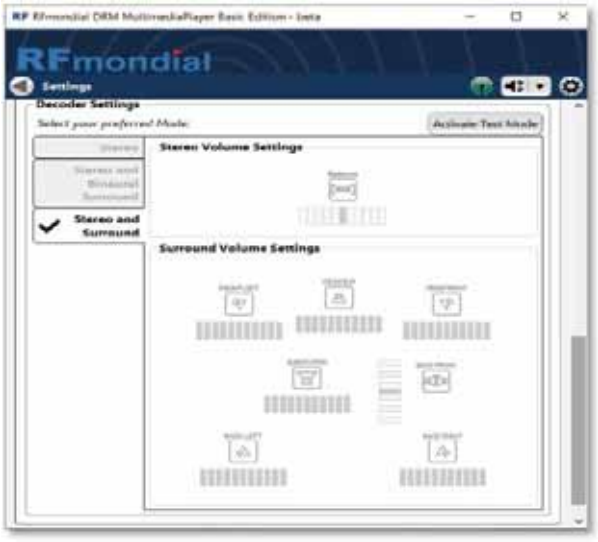
DRM's fully integrated disaster and early warning service, the aim of which is to inform the general public (and relevant authorities) about impending disasters, with maximum speed and reach.

It was shown that, on triggering the alarm signal, all running DRM receivers picked up the alarm signal from the currently tuned DRM service, switching to the emergency broadcast. All DRM receivers presented the audio content of the emergency broadcast, text headlines (DRM text messages) plus detailed multilingual information, based on Journaline, to serve hearing impaired users. It was also demonstrated that receivers, which were turned off during the EWF test, were switched on automatically to access the emergency messages.



d. 5.1 Surround Sound Capability

DRM's capability to transmit 5.1 surround sound services with full backward compatibility to mono/stereo-only commercial receivers was demonstrated.



e. Advanced Applications

- **Radio Schooling/Distance Learning**
  Radio Schooling or Distance Learning, another DRM application that uses Journaline as a core element, was demonstrated. It was shown that educational content can be broadcast to pupils and students, without the need for an internet connection. Besides spoken

lessons as an audio service, classes with enriched Journaline texts, quizzes and solution pages were also demonstrated.

These screenshots of the "DRM MultimediaPlayer Radio App" show an example for a radio schooling service.

- **Traffic and Travel Information and Programme Schedules (EPG information)**
  The possibility of transmitting Traffic/Travel Information and Programme Schedules (EPG information) was demonstrated.

- **Public Signage**
  This use-case was demonstrated, enabled by DRM based on regular Journaline content plus the DRM-EWF feature.

- **Slide Show**
  Slide Show, the transmission of sequence of images, which a multimedia enabled DRM receiver displays in response to a trigger set by the broadcaster, was demonstrated by transmitting logos of Prasar Bharati, AIR and DRM; and a picture of Akashwani Bhawan Delhi.

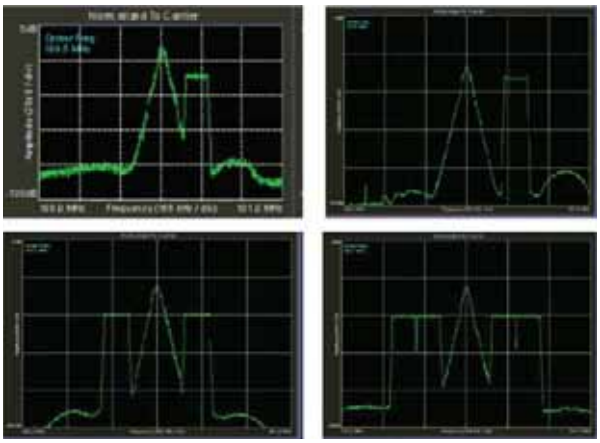
The screenshot of the "DRM Multimedia Player Radio App" shows an example for a SlideShow service component.

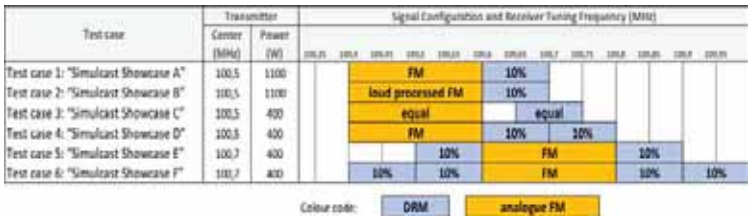
2. Simulcast (FM and DRM) operation

DRM supports transmission of analogue FM services along with digital DRM signals (blocks) from the same FM transmitter. The number of DRM blocks depends upon the bandwidth of the transmitter.

The RFmondial DRM modulator was used to prepare combined DRM/FM signals in various configurations for this demo. The VS series Nautel transmitter amplified this combined signal up to its maximum bandwidth of 600 kHz.

Six different simulcast configurations were demonstrated in Delhi from the single transmitter:





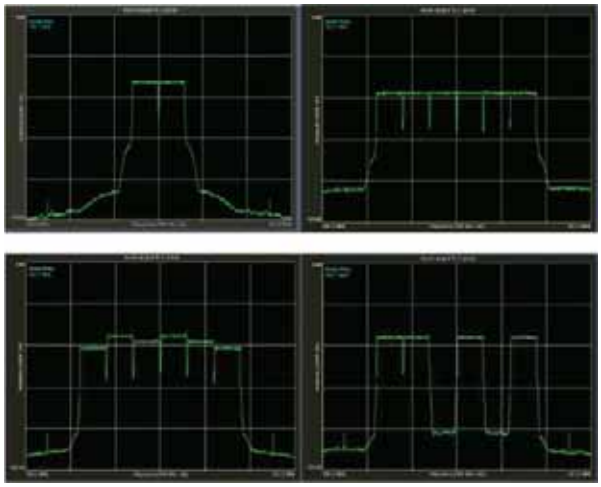
3. Multi-DRM operation

Multiple DRM signals (blocks) can be transmitted from a single FM transmitter. Every DRM signal can have its individual power level and even gaps in the spectrum are feasible. Individual SFN networks per DRM signal are also possible.

Every DRM signal can originate from an individual broadcaster, who remains in full control over both content and the on-air configuration (e.g. DRM modulation parameters and content elements).

Transmission of up to 6 DRM digital blocks (18 Audio + 6 Multimedia Journaline services) was demonstrated from the VS series Nautel transmitter, which has 600 kHz bandwidth, enabled by the RFmondial DRM modulator.

Following 4 configurations of multi-DRM were showcased:



Test case	Transmitter		Signal Configuration and Receiver Tuning Frequency (MHz)					
	Exciter (MHz)	Power (W)						
Test case 1: "Multi-DRM Showcase A"	100.65	200			100%	100%		
Test case 2: "Multi-DRM Showcase B"	100.65	600	100%	100%	100%	100%	100%	100%
Test case 3: "Multi-DRM Showcase C"	100.65	100	75%	100%	50%	100%	50%	75%
Test case 4: "Multi-DRM Showcase D"	100.65	100	100%	100%		100%		100%

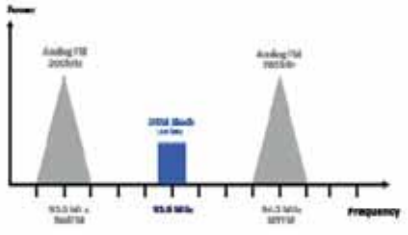
Colour code: DRM | analogue FM

4. DRM in analogue-FM white spaces

Six private FM stations operate from the CTI tower at Jaipur at frequencies of 91.1, 93.5, 94.3, 95.0, 98.3 and 104.0 MHz. These transmit from a single antenna with the help of an FM combiner. Each analogue FM signal occupies a bandwidth of 200 kHz, with a transmitter power of 10 kW.

There is unused white space of 600 kHz between the stations operating at 93.5 and 94.3 MHz and DRM digital transmission was carried out in this white space. The following 5 cases were demonstrated:

Single-block DRM transmission @ 100 W
DRM Configuration: 3 audio services + 1 multimedia service
Gap to each existing analogue FM signal: 250 kHz
DRM tuning frequency: 93.9 MHz



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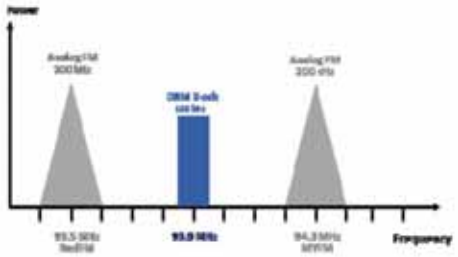
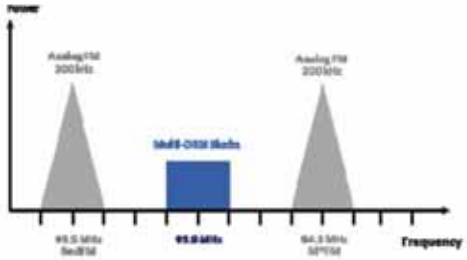
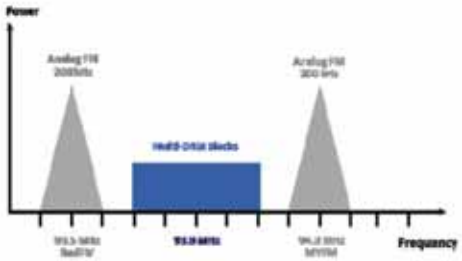


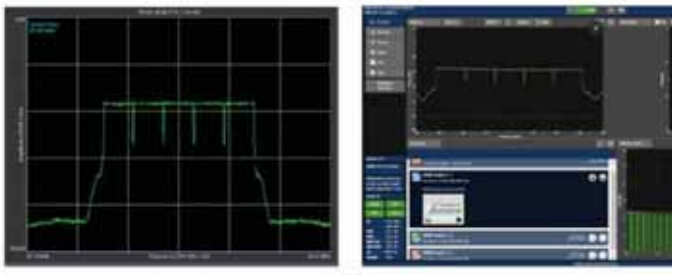
Dual-block Multi-DRM transmission @ 200 W total
DRM Configuration: 6 audio services + 2 multimedia service
Gap to each existing analogue FM signal: 200 kHz
DRM tuning frequencies: 93.85, 93.95 MHz



4-block Multi-DRM transmission @ 400 W total
DRM Configuration: 12 audio services + 4 multimedia service
Gap to each existing analogue FM signal: 100 kHz
DRM tuning frequencies: 93.75, 93.85, 93.95, 94.05 MHz



5-block Multi-DRM transmission @ 500 W total
DRM Configuration: 15 audio services + 5 multimedia service
Gap to each existing analogue FM signal: 50 kHz
DRM tuning frequencies: 93.7, 93.8, 93.9, 94.0, 94.1 MHz



DRM DIGITAL RECEIVERS USED FOR THE DEMOS

A number of receiver brands made their DRM receiver solutions available for this trial. Receiver models included desktop and portable radio sets, automotive line-fit head-units, automotive after-market models and upgrade kits, Android-based mobile phones and Windows based tablets, laptops and desktop computers.

Professional Monitoring Receivers

RFmondial

Standalone/Desktop Receivers from Gospell and Starwaves

Gospell

Starwaves

In-Car Receivers
Line-fit Dashboard Receivers

Mobis (Hyundai)

Harman (Maruti-Suzuki)

Car Box Radio

Starwaves

The receivers, which were being used for the regular DRM services on-air throughout India, were upgraded to receive DRM services in the FM band.

Mobile Phones (Android), Window Tablets, Laptops and Desktops as Radio Receivers, with USB Dongles

Samsung Galaxy M51 with Fraunhofer DRM MultimediaPlayer RadioApp (analogue) FM USB-dongles

MEASUREMENTS

Field measurements were carried out in 8 directions in Delhi and 2 directions in Jaipur. Recording of the reception parameters was carried out by the DRM Consortium using the RFmondial professional receiver RF-SE 12 with the mobile setup described above. It was observed that the coverage of 100W DRM signals was better than that of 1 kW analogue FM signals.

Coverage of DRM as plotted for in south-east direction in Delhi is as below:

In the coverage measurement shown, the 100 W low-power DRM signal provided perfect DRM coverage for at least 25 km.

It was also observed that the reception of DRM signals is excellent on mobile phones. Reception on standalone/desktop receivers varied from model to model. Excellent uninterrupted reception was observed on the Mobis car receiver fitted in a Hyundai Verna car which was driven around Delhi.

DEMONSTRATION WAS ORGANISED BY DRM CONSORTIUM WITH INDUSTRY-WIDE SUPPORT

The trial and demos of the DRM digital radio standard were successfully completed by the DRM Consortium with the joint collaborative effort and support of Technomedia, BECIL, Fraunhofer IIS, Nautel, NXP, RFmondial, the DRM Indian Platform, the DRM Automotive India Workgroup, Gospell and Starwaves receiver manufacturers and automotive Tier-1 companies Mobis (Hyundai) and Harman (Maruti-Suzuki).

DRM IN FM BAND IS BEST SUITED FOR THE INDIAN ENVIRONMENT

The Committee constituted by the Prasar Bharati has allegedly already submitted its own test report, but this has, so far, not been made public. The demonstration of DRM services in the FM band is a 'feast of firsts' for digital radio services and features in India, including the multi-DRM transmissions on a single transmitter and distance learning enabled by the non-proprietary, open-to-all, DRM radio standard. After successful international trials we are confident that the DRM standard is best suited for the Indian environment also in the FM band for local and regional services:

i. **Ease in implementation** – DRM is a truly flexible standard. It can be implemented very easily and can be deployed as an individual signal, multi-DRM shared transmitter setup, simulcast with analogue FM services and/or efficient utilisation of FM band white-spaces.

ii. **Digitalisation without disturbing existing analogue FM services** – Digitalisation in the FM band using DRM can be introduced without disturbing existing analogue FM services.

iii. **Backward compatibility** – DRM works in all broadcast bands. It is one single standard for all radio broadcast bands.

iv. **Existing DRM receivers can be easily firmware upgraded** – Existing standalone as well as car DRM radios could be easily firmware upgraded without any changes in the hardware.

v. **DRM on existing Android phones** – It was demonstrated that all the Android phones could receive DRM in the FM band using off-the-shelf dongles and the Fraunhofer DRM MultimediaPlayer Radio App.

   A consumer version of this app can now be downloaded from the Google Play Store and the Amazon Appstore under the brand name "STARWAVES DRM SoftRadio". The App can also be installed on Windows, Linux, MacOS and Android based tablets, laptops as well as desktop computers.

vi. **No additional royalties** – DRM in the FM band, being the same digital radio standard already used in MW & SW bands today in India, no additional IP royalties are required to be paid.

vii. **Make in India** – DRM in FM band fulfils the 'Make in India' mission of the Hon. Prime Minister.

viii. **Unmatched spectrum efficiency** – maximising the number of digital audio services in the given spectrum.

ix. **DRM Tuning frequency is within the allocated frequency band** – DRM tuning frequency for each DRM signal (block) falls within the allocated frequency band in all cases, even in the multi-DRM case.

x. **Additional Journaline service in multiple Indian languages** – DRM is ideal to provide EWF and online teaching capabilities, without the need for Internet and is free-to-air for everybody.

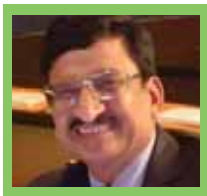
xi. **Fully compliant with regulator's (TRAI) recommendations & existing analogue FM spectrum licensing** – Private Broadcasters would be able to broadcast up to 2 DRM digital blocks (i.e. up to 8 services) in digital in the already allocated bandwidth of 200 kHz.

xii. **Commercial Potential** – DRM in FM band provides additional revenue streams for the broadcasters through Journaline interactive and sponsored content, more audio programmes/ content for additional audience groups, option for pop-up stations.

TO SUM UP

DRM in the FM band is ready for India's mass market, being based on the vast in-country know-how, accumulated over many years; especially in chipset design and production. Adopting DRM in the FM-band, thanks to its flexibility, backward compatibility and to the fact that it is evidently part of a single standard for one nation, will only fast track the digitisation process and will be embraced by the industry and broadcasters alike.

The Indian car industry has rolled-out DRM enabled radio sets in the millions and proved during the trial that, after a simple firmware upgrade, those receiver models will support DRM in the FM band with the full feature set. We are eagerly awaiting the official announcement of DRM for FM in India. ■



Yogendra Pal, Hon Chairman, India Chapter of DRM Consortium

Yogendra Pal is the Honorary Chairman of the India Chapter of DRM Consortium, the international not-for-profit organisation which has been created for the development and implementation of the DRM standard for the digitisation of the terrestrial radio transmissions. He is also the honorary member of Board of DRM Consortium.

He was Advisor with the Ministry of Information & Broadcasting, for the implementation of Digitisation Addressable System (DAS) in the Cable TV network in the country and was closely associated with the strengthening of the Community Radio network in the country. He superannuated from All India Radio & Doordarshan as Additional Director General after over 36 years of glorious service and was associated with implementation of state-of-the-art fully digital studio setup (New Broadcasting House) in Delhi; News-on-Phone, Internet and AIRNET services and networking of AIR stations.

He is the life fellow of Broadcast Engineering Society (India) and Institution of Electronics & Telecommunication Engineers.