Digital Radio Mondiale

HFCC B21
Shortwave Coordination Meeting

1st September 2021

Ruxandra Obreja

Chair DRM Consortium

The DRM Consortium – a Reminder

- **Not-for-profit organisation**
- **Around 100 international members**
  Broadcasters, manufacturers, network operators,
  regulators, research institutes, etc…
- **Experts and technologists**
  Ready to give expert and objective advice on the technology
- **Open to all**
  Companies, organisations, associations and individuals can join at any time
- **Platforms** in Germany, India, Brazil, Russia
  and experts' groups in Pakistan, Indonesia
  → **And now the relaunch of the South Africa DRM Group**

For joining the DRM Consortium, write to: **projectoffice@drm.org**

Selection of Consortium Members

The **not-for-profit** DRM Consortium
supports and promotes the DRM Standard and its take-up globally

The DRM Standard – The User's Experience Video

The DRM Standard – A Reminder

Radu Obreja

Marketing Director, DRM Consortium

DRM System – Key Facts

- Global **ITU standard for terrestrial Digital Radio**

  → **enables all coverage scenarios** (in broadcast bands AM & FM/VHF)
  local, regional, national, international

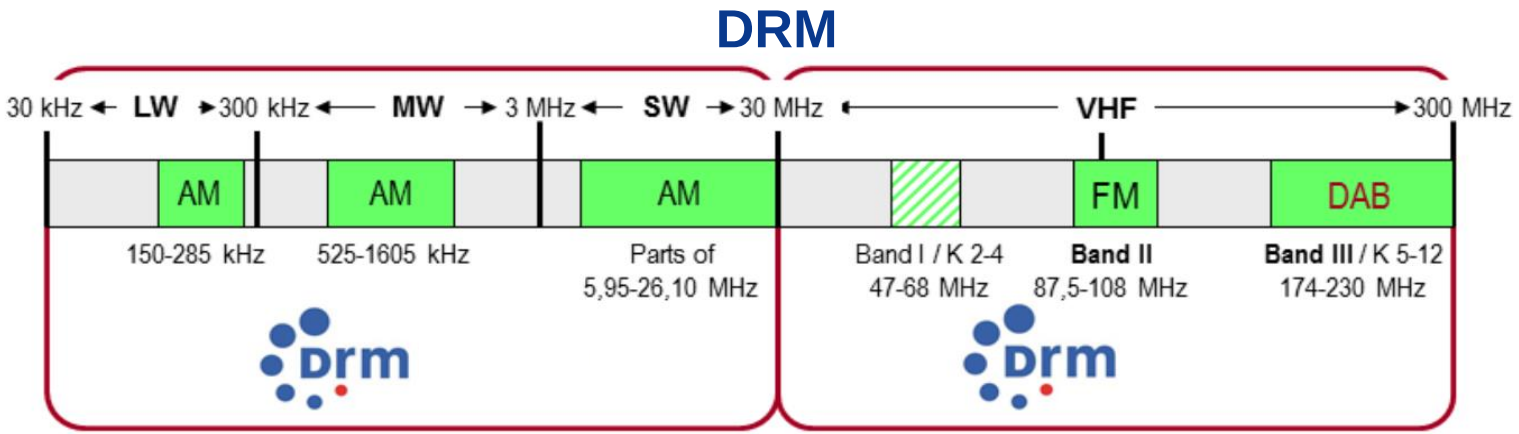
- On a single AM/FM frequency, **up to 3 audio services + multimedia**
- Digital-only or **simulcast** operation (with AM or FM analogue signal)
- **DRM upgrades possible for existing AM/FM infrastructure**
- All technical details are **openly standardized** (ETSI) and published, DRM is **not controlled** by a single company/organization
- **No licenses** required
- Not a multiplex solution – **Each broadcaster in full control** of their transmission and content

DRM Works In All Frequency Bands

DRM for local / regional coverage (VHF bands)
(Band I, II – FM band, III)

30 MHz

DRM for medium/large area coverage (AM bands)
(or LW, MW, SW) – the AM bands

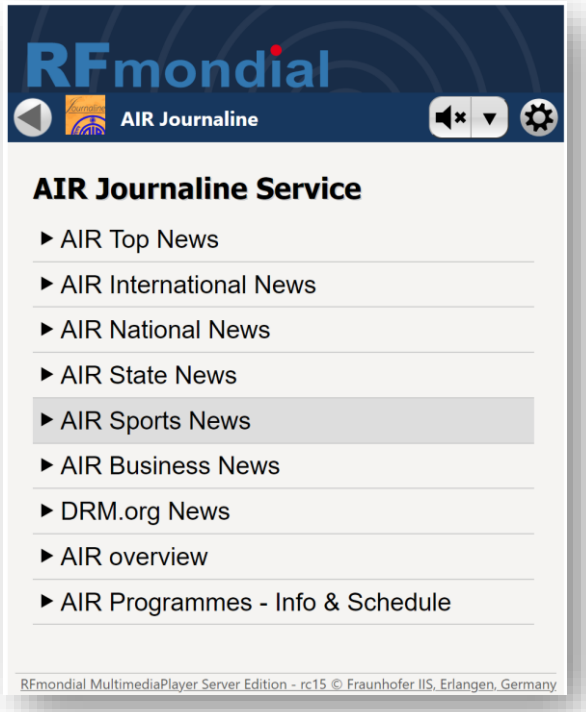


DRM Digital Radio standard – One single standard:
Same key features throughout

DRM Key Features

- **More choice for listeners**
  - Up to 3 programmes + multimedia on 1 frequency
  - Simulcast analogue / digital
- **Excellent audio quality**
  - No distortion
  - Stereo and 5.1 surround sound
- **Multimedia Applications**
  - Great listener benefits
  - Extra revenue opportunities for broadcasters
- **Good coverage area and robust signal**
  - Supporting SFN (Single Frequency Networks)
  - Green and energy efficient
- **Automatic tuning**
  - by station name, no longer by frequency
  - re-tunes when leaving coverage area
- **Emergency warning & alert**
  - All stations switch, present audio and text information

Multimedia Applications



DRM TextMessages
programme accompanying labels (Unicode), max. 128 characters, max. every 20 sec.

Journaline
text based information service (Unicode), supporting all classes of receivers, triggers interactivity and geo-awareness

Slideshow
programme accompanying images + animation

EPG/SPI – Service Programme Information
Station logos; What's up now & next; Search for programs and schedule recording

TPEG / TMC Traffic Information

→ **Great listener benefits & revenue source!**

DRM in the AM bands

Simon Keens

Sales and Business Development Manager
Ampegon

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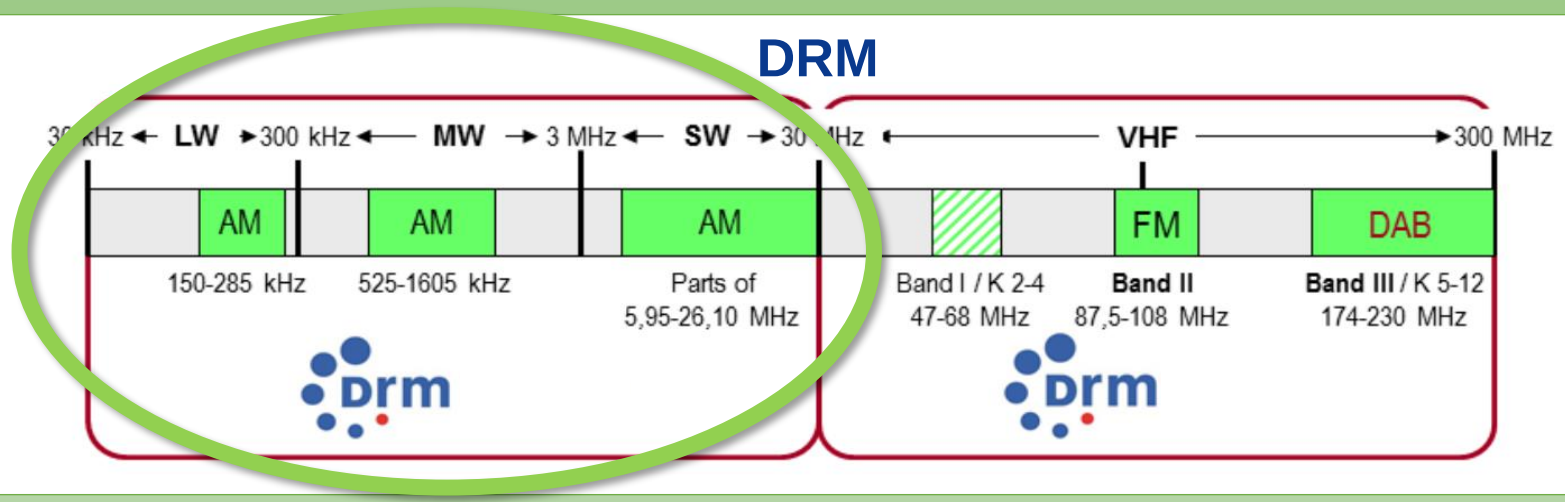


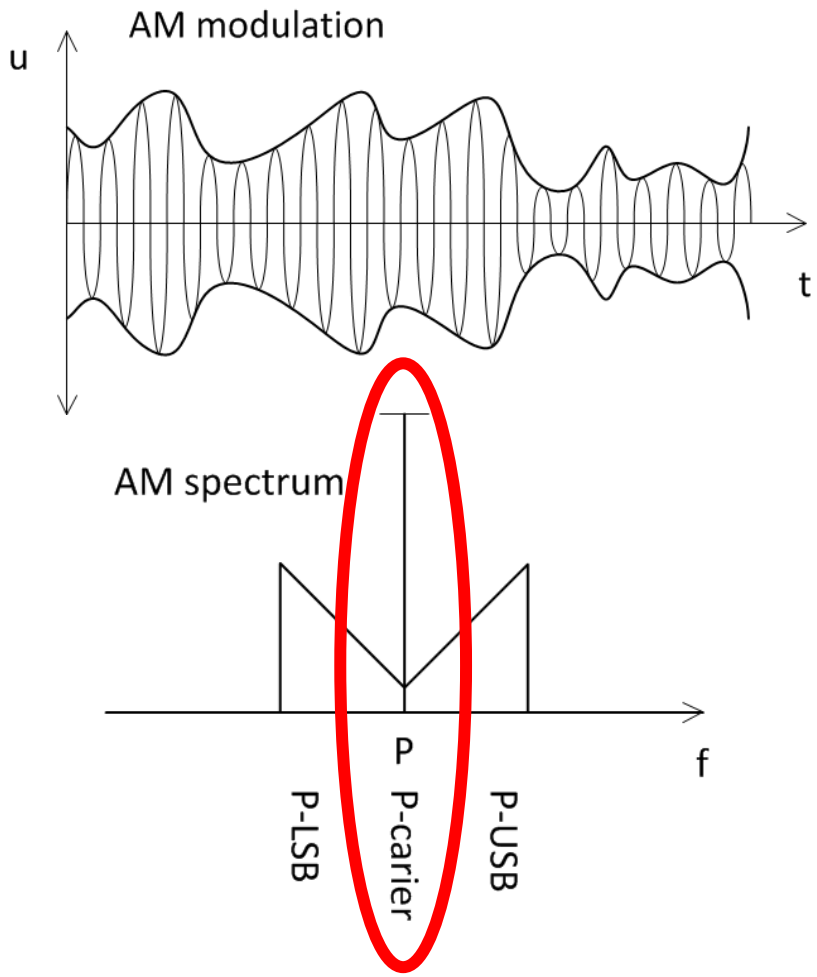
DRM Digital Radio standard – One single standard:
Same key features throughout

DRM for Large Area Coverage (AM Bands)

- Offering **FM like sound quality** with large-area coverage
  (no more fading, crackling, distortions)

- The only standard for all the AM bands:
  - **ETSI standard ratified**
  - **Endorsed by the ITU** (full planning parameters available)
- **Worldwide spectrum compatibility:**
  9/10, 18/20 kHz bandwidth
- **Useful content bit rate:** up to 72 kbps
- **Flexible configuration**:
  robustness ←→ coverage ←→ transmission power
- **Covers large areas using a single frequency (SFN):**
  full-country coverage

AM Energy Consumption



- **AM Carrier > 66% of energy (no content)**
- **P-USB and P-LSB <33% energy (content)**
- **AM reception level > 47dBµV**

Coverage – AM (MW) analogue vs. DRM MW

AM analogue vs. DRM – Same coverage, 1 single tx

AM Coverage
100kW MW transmitter

AM analogue **MW**:
142 kW,
1 service

600km

100 kW ERP @ **72% efficiency**
→ **142 kW power consumption**

same coverage!

DRM Coverage
100kW MW transmitter
-> 40kW DRM

DRM on **MW**:
50 kW,
1–3 services
(plus multimedia)

600km

40 kW ERP @ **80% efficiency**
→ **50kW power consumption**

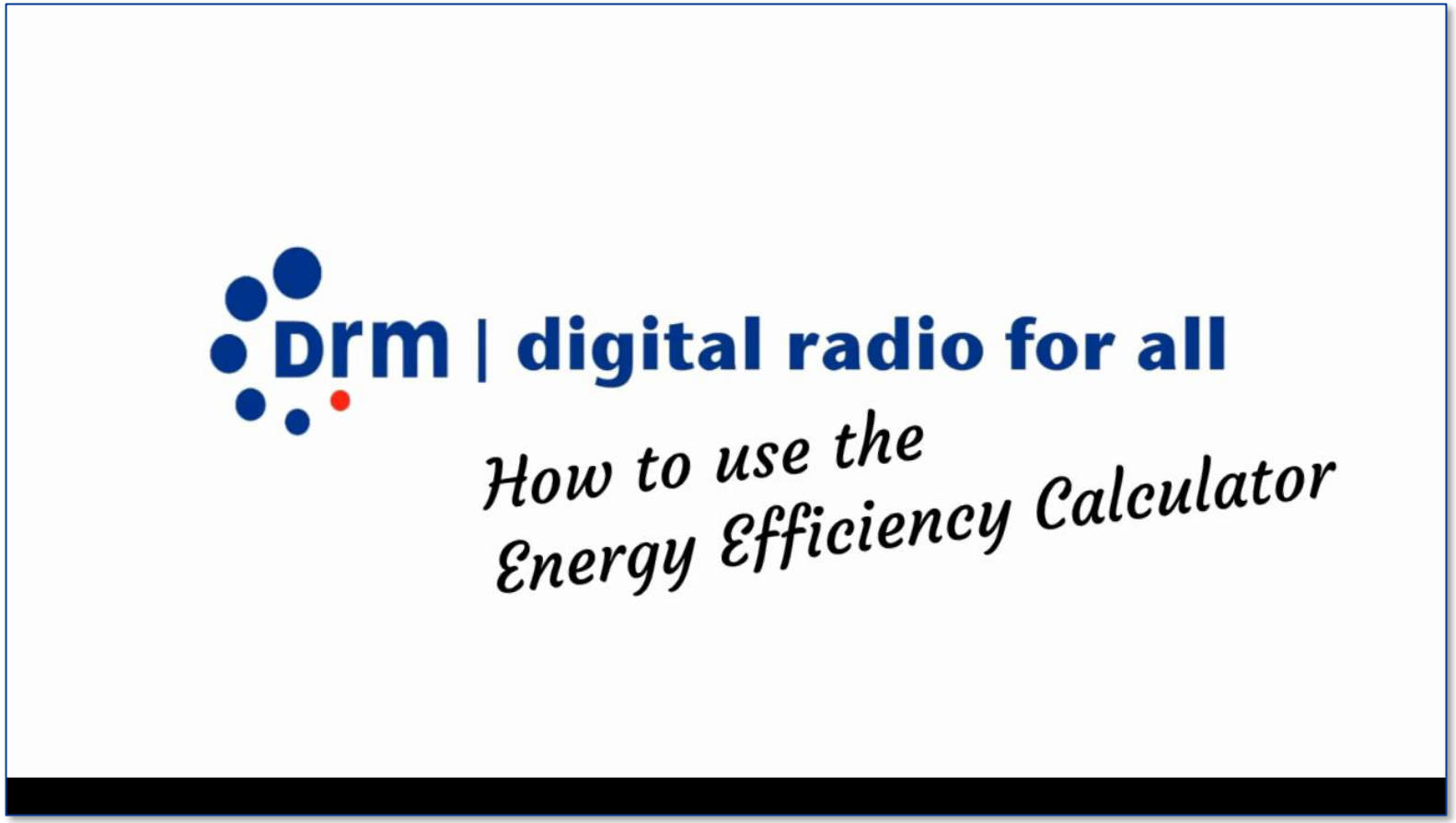
DRM Transmission Schedules

Click on chart to search for DRM broadcasts

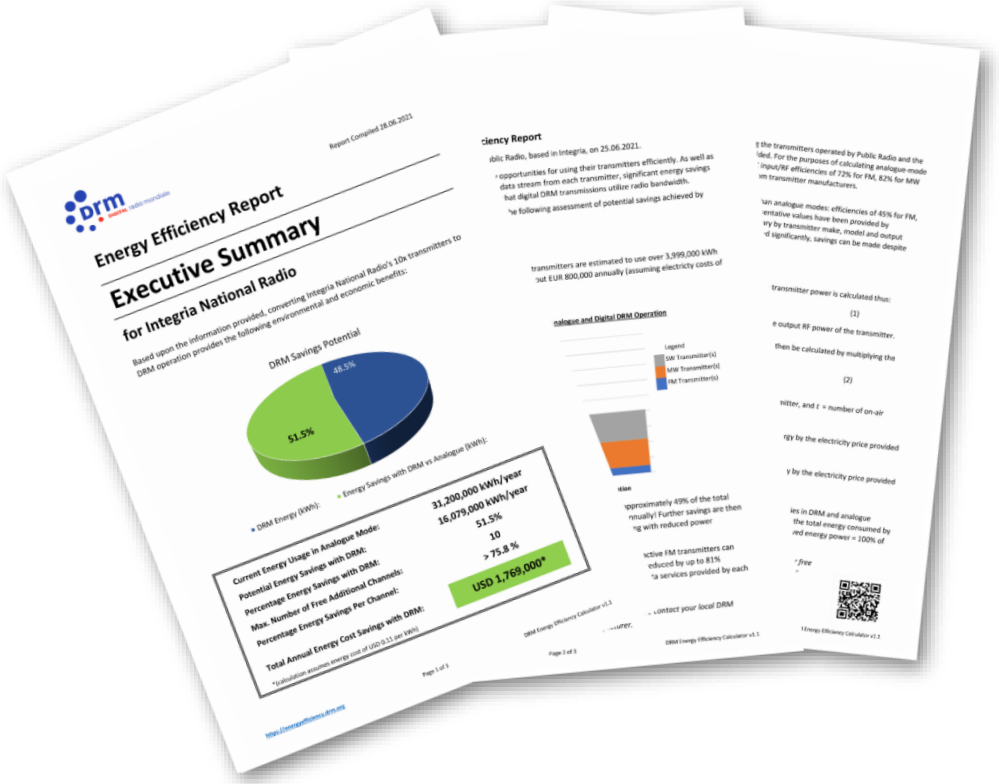
Additional DRM Services

The DRM Standard – The Energy Efficiency Calculator Video

The **DRM Energy Efficiency Calculator** is the DRM Consortium's user-friendly tool that allows to calculate how much energy can be saved by switching transmitters from analogue to digital DRM operation



DRM Additional Services – Energy Efficiency Calculator: Ready for Use



Website:
energyefficiency.drm.org

If you are interested, e-mail us:
energyefficiency@drm.org

DRM in the FM BAND – A FUTURE-PROOF SOLUTION

Alexander Zink

Vice-Chair DRM Consortium;
Senior BDM, Fraunhofer IIS

DRM Works In All Frequency Bands

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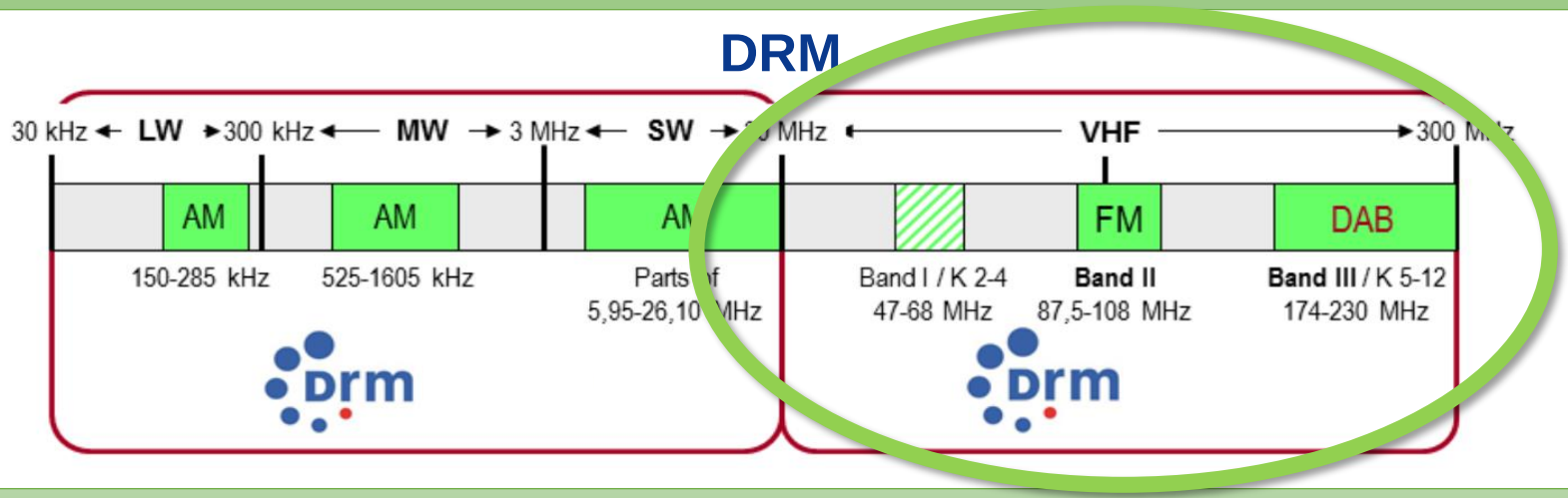


DRM Digital Radio standard – One single standard:
Same key features throughout

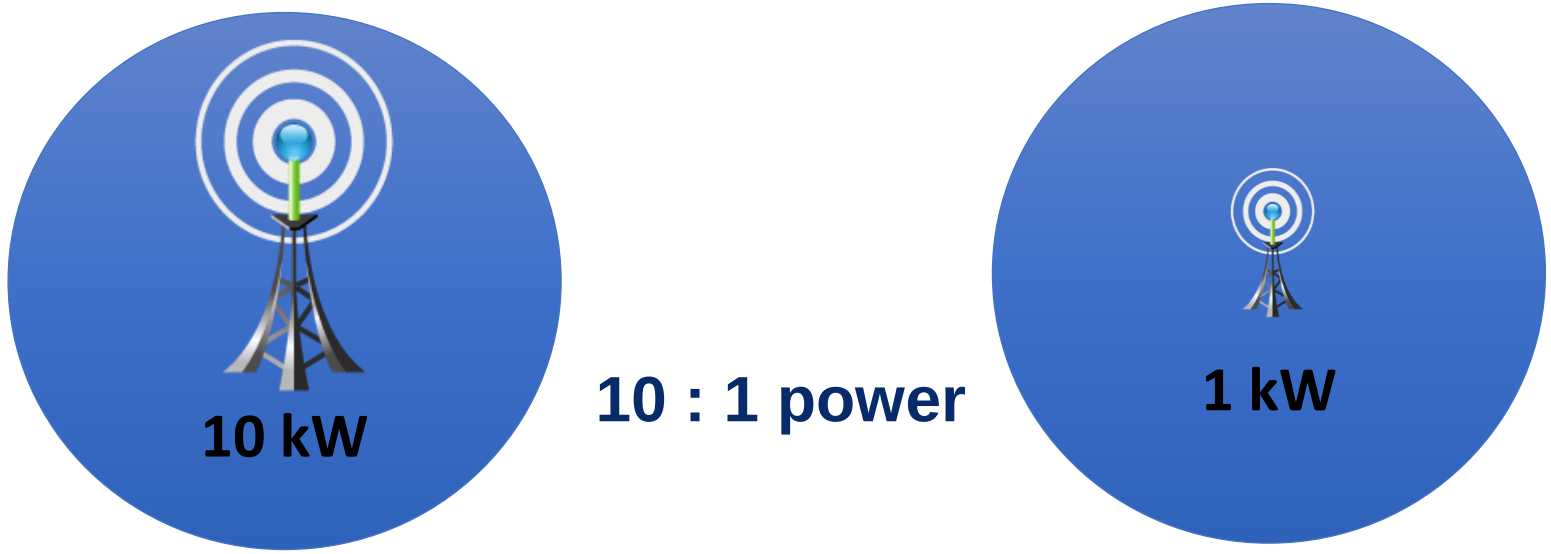
DRM in FM Band – Given Coverage Scenario

Assumption:

- Same coverage in FM and DRM
- **Stationary** reception profile in acc. to ITU-R
- Same Antenna Gain

FM 1x
at 200 kHz bandwidth

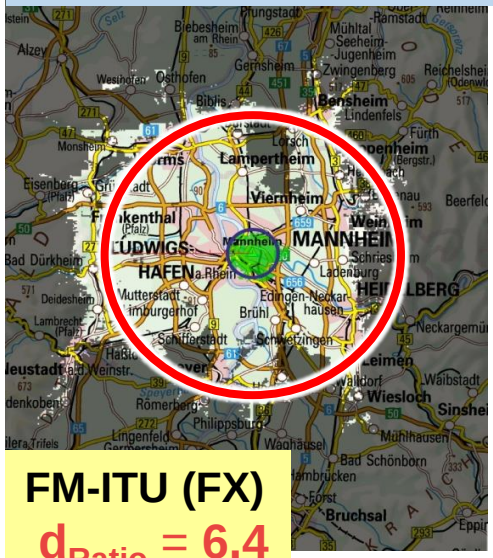
DRM 3x
at 96 kHz bandwidth



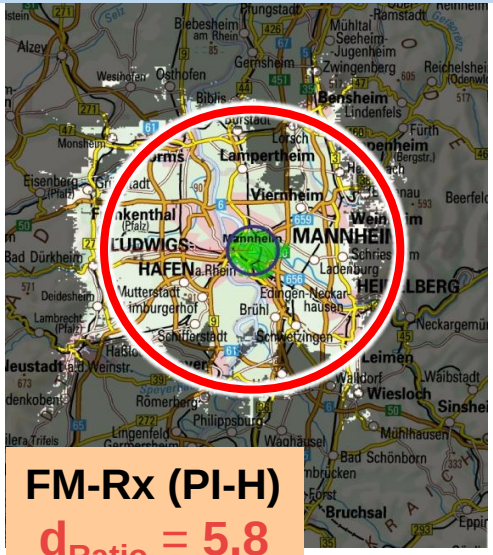
DRM in FM Band – Given Tx Power Scenario

Study on the Comparison of the Coverage and Transmitting Power between FM and DRM in VHF Band II

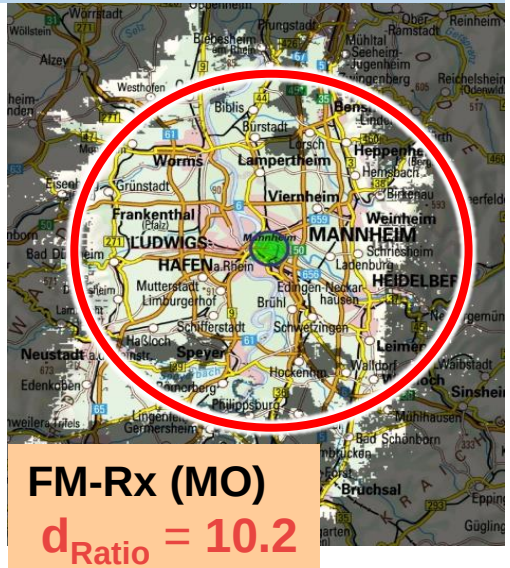
Coverage of Tx Mannheim, Germany, on 93.2 MHz
with equal transmitting power of **1 kW e.r.p. for DRM and FM**



FM-ITU (FX)
d_{Ratio} = 6.4



FM-Rx (PI-H)
d_{Ratio} = 5.8

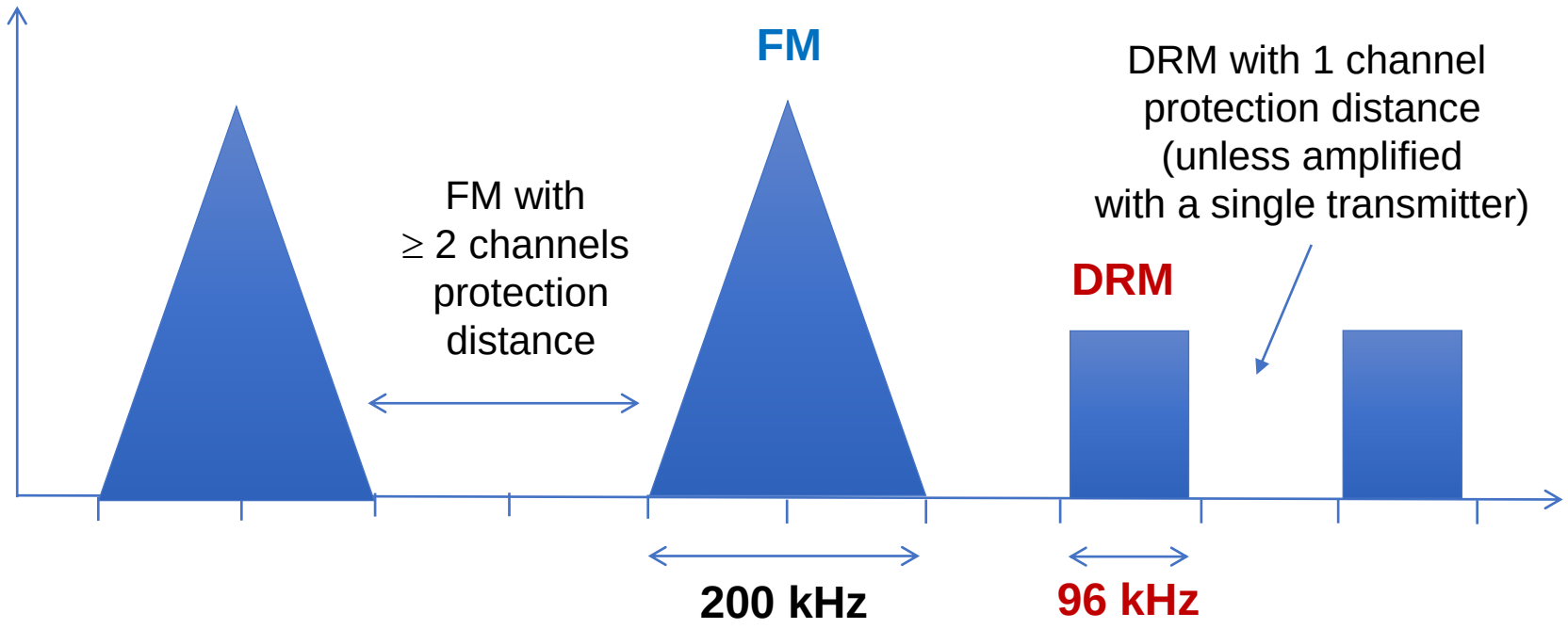


FM-Rx (MO)
d_{Ratio} = 10.2

Green: analogue FM coverage
Red/white: DRM coverage
→ Red circles represent white coverage area for easier comparison
Ratio of the coverage within the circles: $\mathbf{d_{Ratio}} = d_{DRM+}$ *(in red)* / d_{FM} *(in blue)*

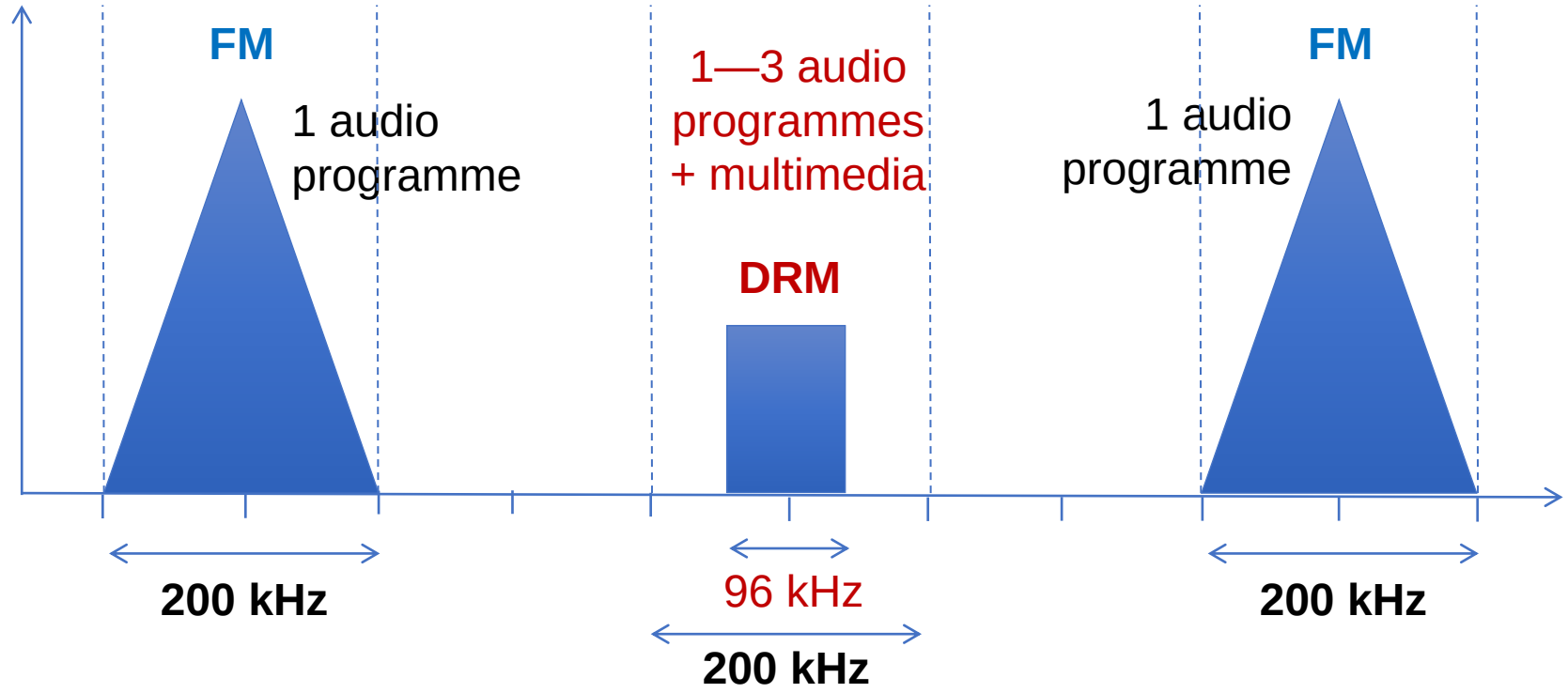
a) DRM Fits in Existing FM Band

- DRM fits into the FM channel raster
- DRM RF signal needs less Spectrum bandwidth compared to FM
- More RF channel possible in VHF Band II as for FM (spectrum efficient!)



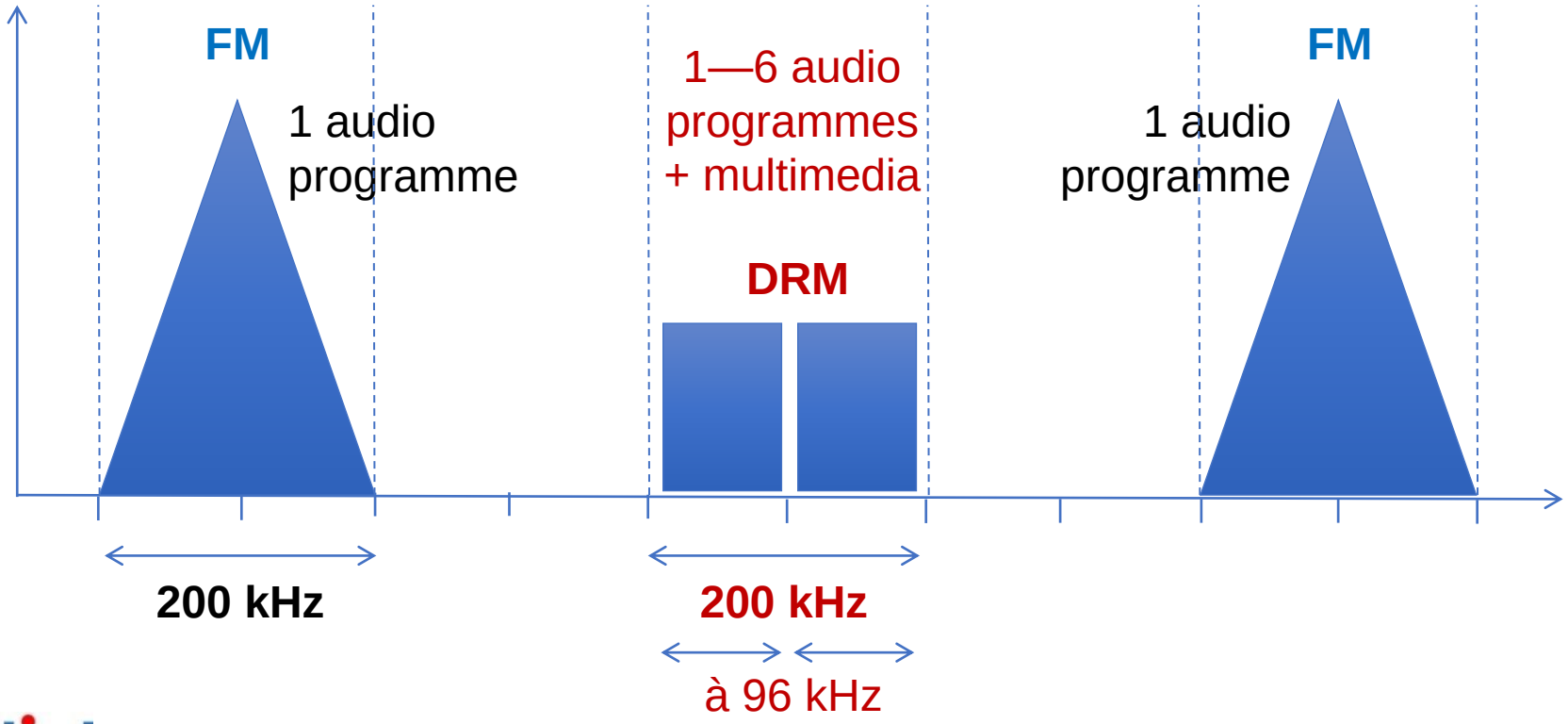
DRM fits in Existing FM Plan

- Existing FM services 700 or 800 kHz apart
- One license allotments (of **200 kHz**) in-between existing FM stations
- **No interference** with existing FM stations!



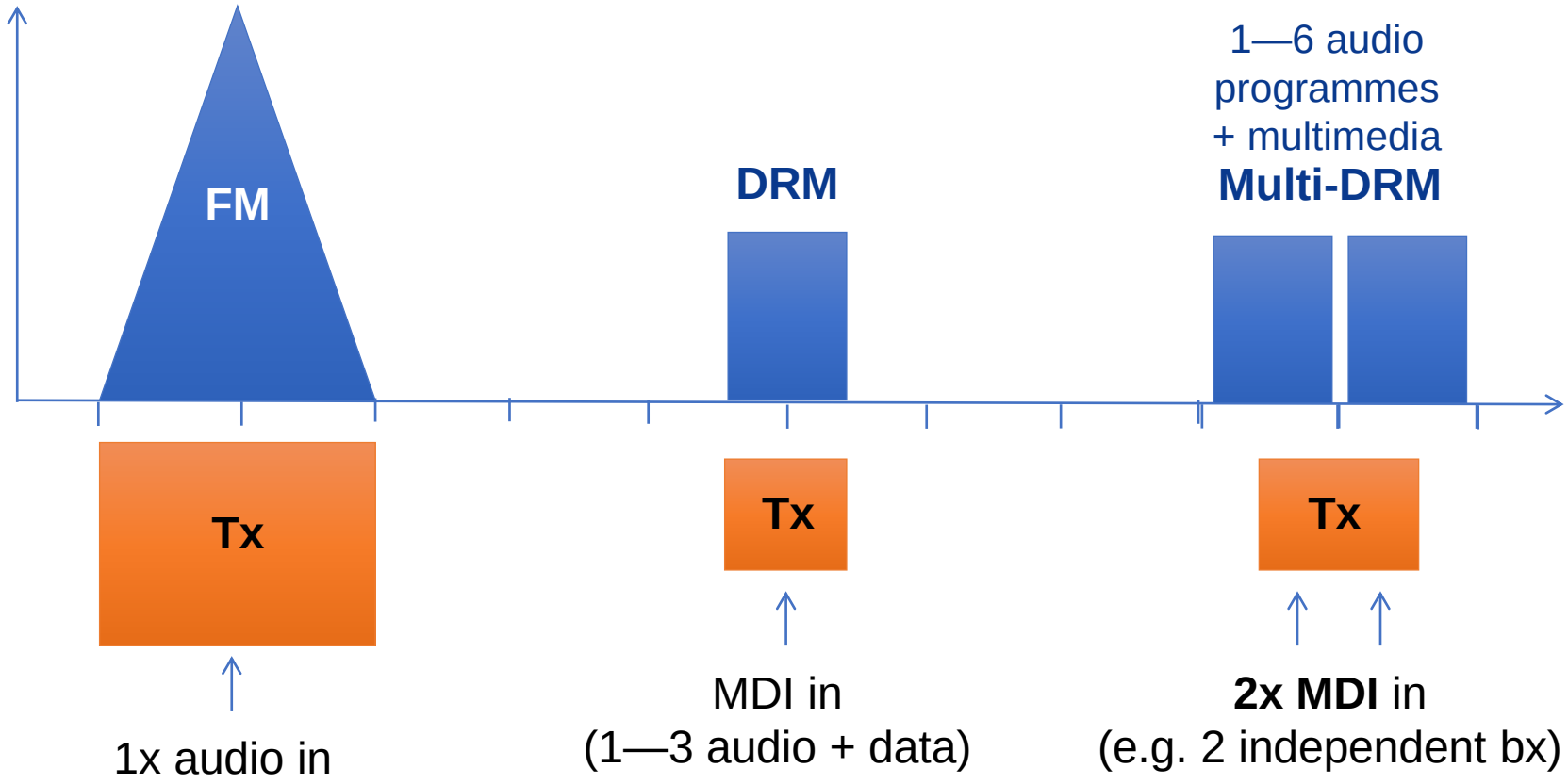
DRM fits in Existing FM Plan

- **Up to 2 DRM blocks** per license allotment
  → Space for up to 6 audio programmes + multimedia
  → 2 DRM blocks (MDI) from **single or different broadcasters**

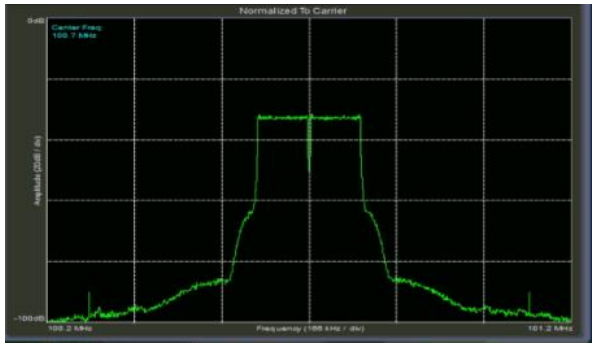
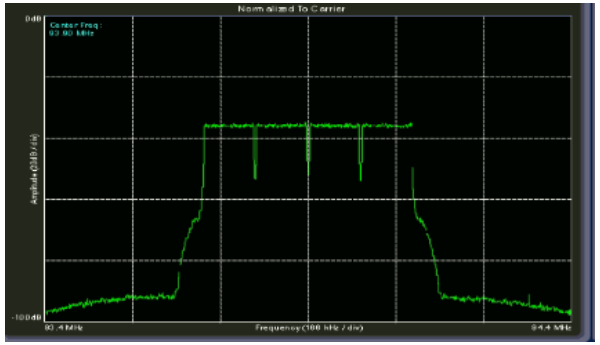
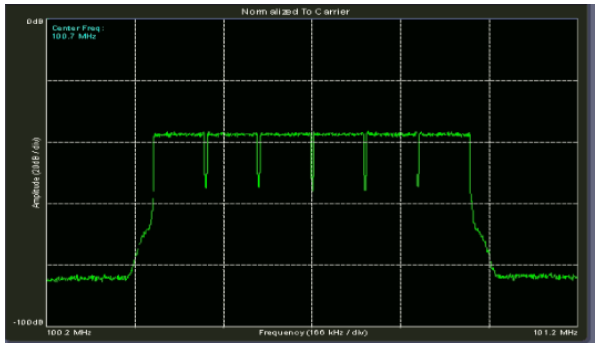
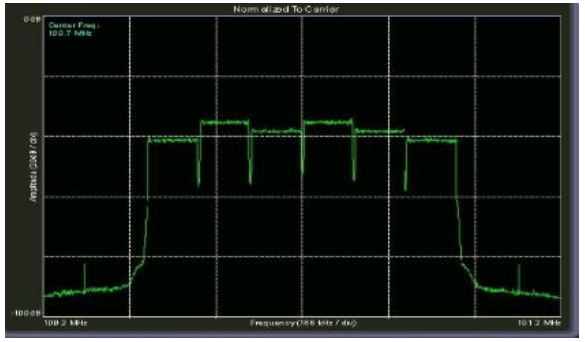


DRM in the FM Band – Infrastructure Efficiency

- FM analogue: each programme requires an individual transmitter
- DRM: **shared transmitter** for all side-by-side DRM blocks
  (per DRM block: one MDI signal from studio over IP network)



Pure Digital – Multi-DRM Configuration

Test case	Transmitter		Signal Configuration and Receiver Tuning Frequency (MHz)												
	Center (MHz)	Power (W)	100,35	100,4	100,45	100,5	100,55	100,6	100,65	100,7	100,75	100,8	100,85	100,9	100,95
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		25%		100%		50%		100%		50%		25%	
Test case 4: “Multi-DRM Showcase D”	100,65	100		100%		100%				100%				100%	

Colour code: DRM analogue FM

Up to 6 DRM signals (18 Audio + 6 Multimedia Journaline services) side-by-side from the same transmitter

India Case Study

Recent DRM FM-band Trial in India

Yogendra Pal

DRM Country Representative
Honorary Chair,
DRM India Chapter

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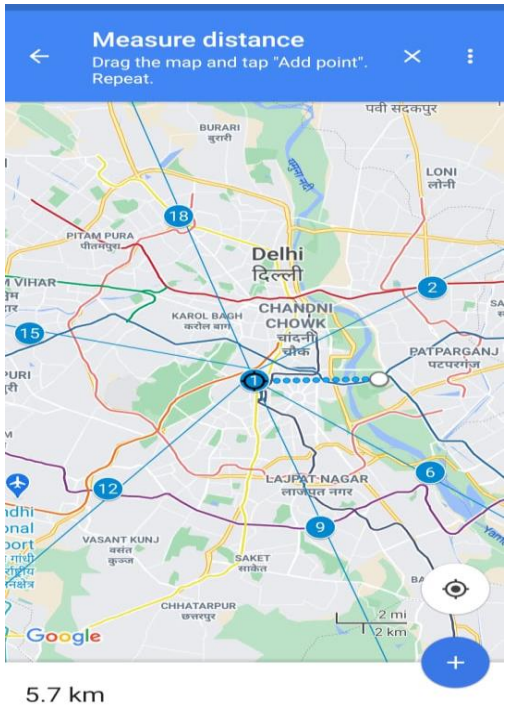
Phones: +91 98115 72044; +91 79826 85313
Twitter: @YogendraPal9

DRM FM band demos in India – Feb & Mar 2021

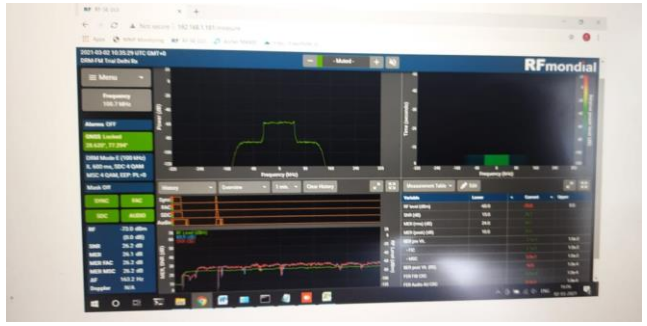
- ✓ 2-day workshop + On-the-road measurements
- ✓ Pure Digital & Feature-Demo
  - Single DRM signal
  - Multi-DRM configuration
- ✓ Simulcast (FM and DRM) operation
- ✓ Multi-DRM in FM white spaces

Delhi

Jaipur

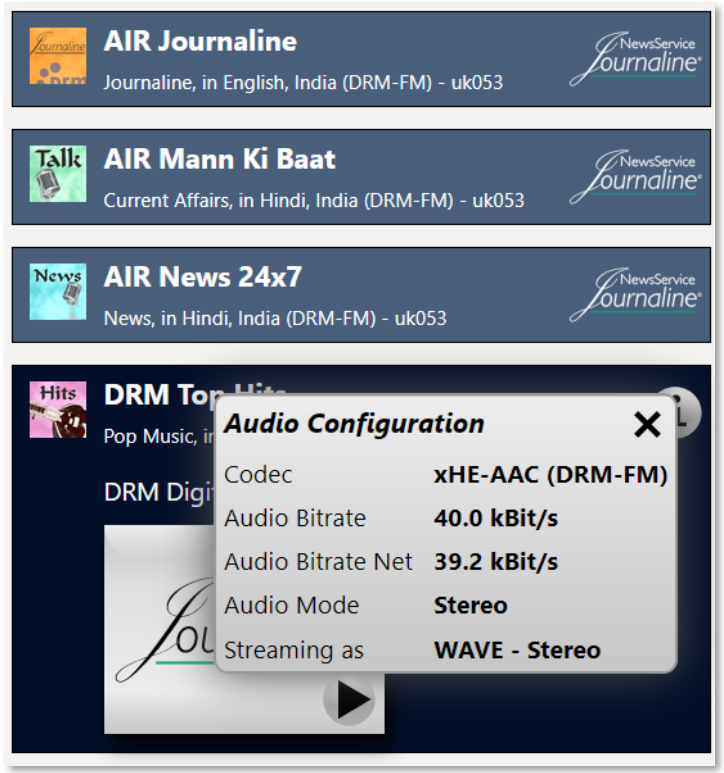


5.7 km



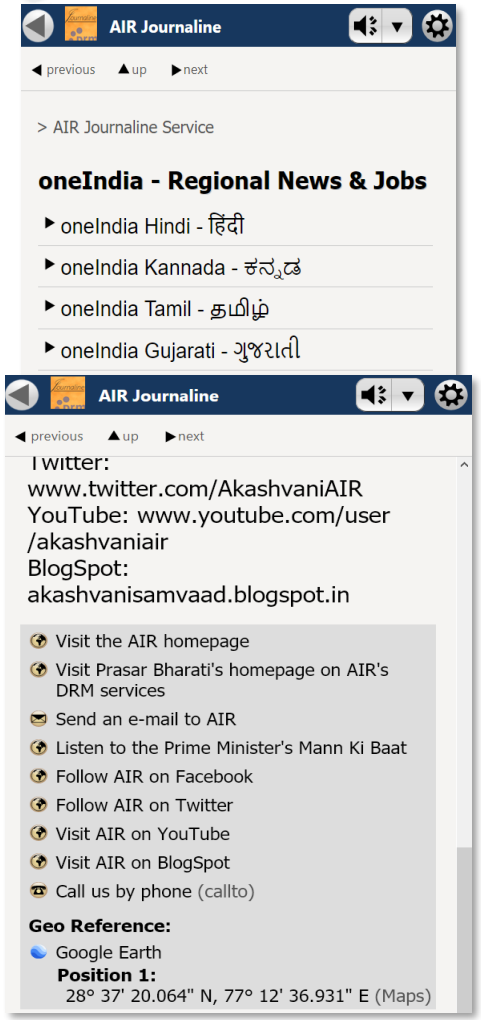
DRM signal – Basic Features

- ✓ Up to 4 services (3 Audio + 1 Multimedia Journaline services) in a bandwidth of 96 kHz
- ✓ High Quality Stereo Sound



- ✓ Service Labels
- ✓ Service Description
- ✓ Station Logos
- ✓ Text messages
- ✓ Unicode support
- ✓ Journaline - interactive text service
- ✓ Online hybrid functionality

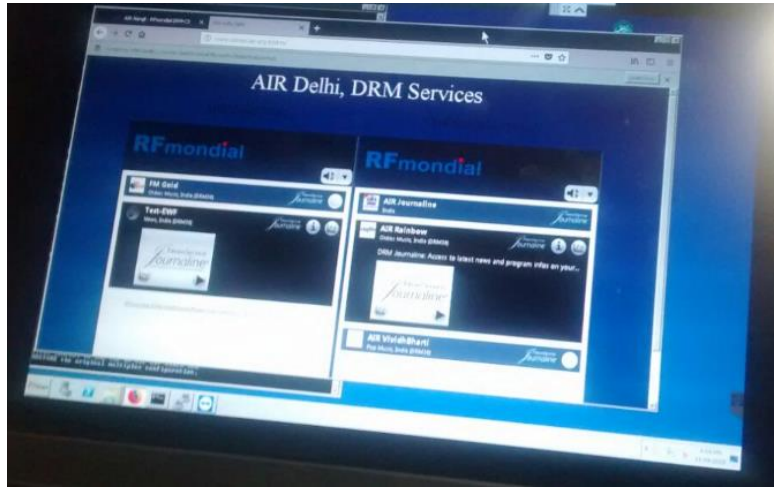
NewsService Journaline®

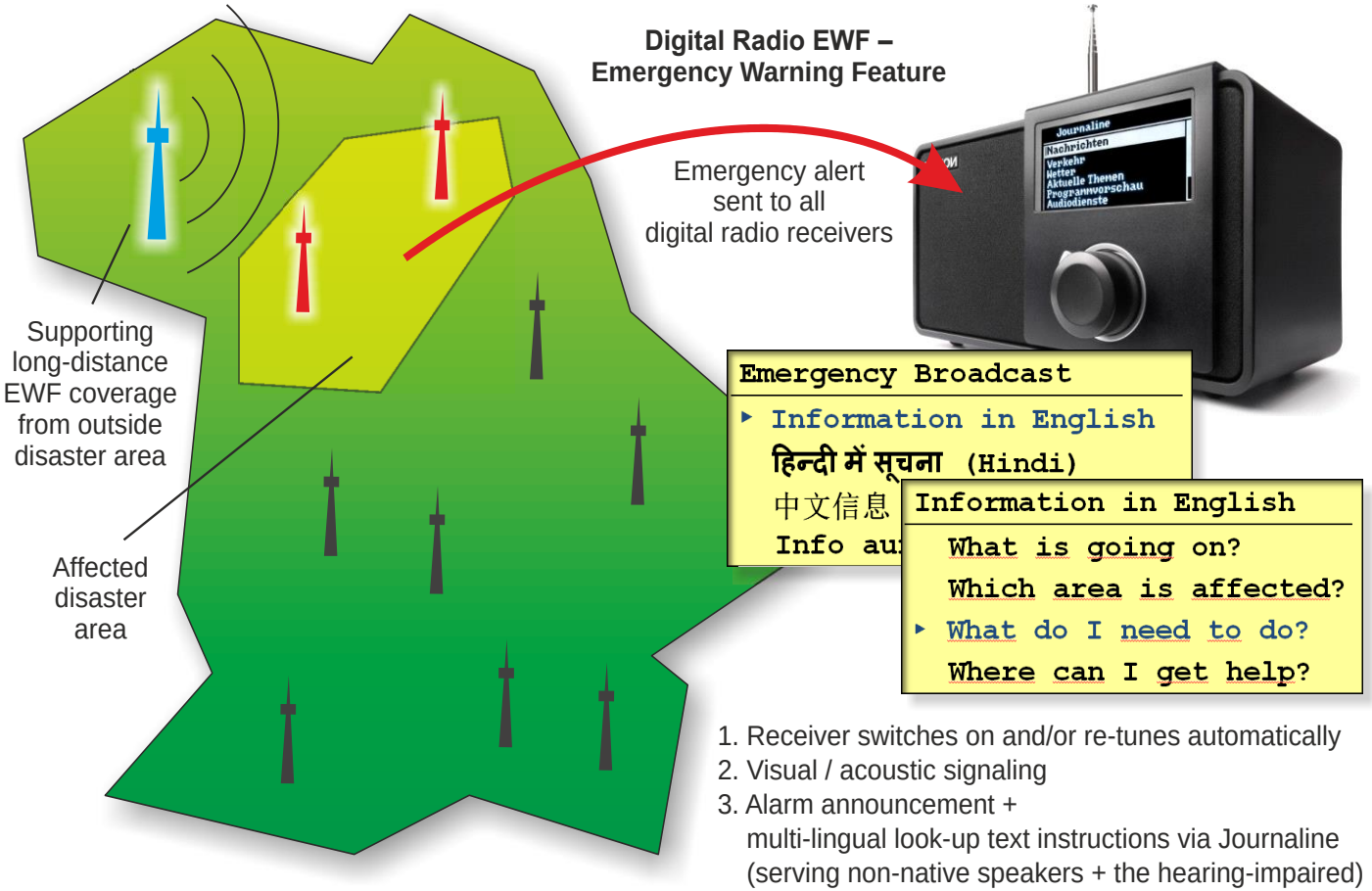


DRM signal – Other Features

Emergency Warning Functionality (EWF)

AIR had carried out test of EWF,
in association with National Disaster Management Authority (NDMA),
on DRM MW transmitters in Delhi

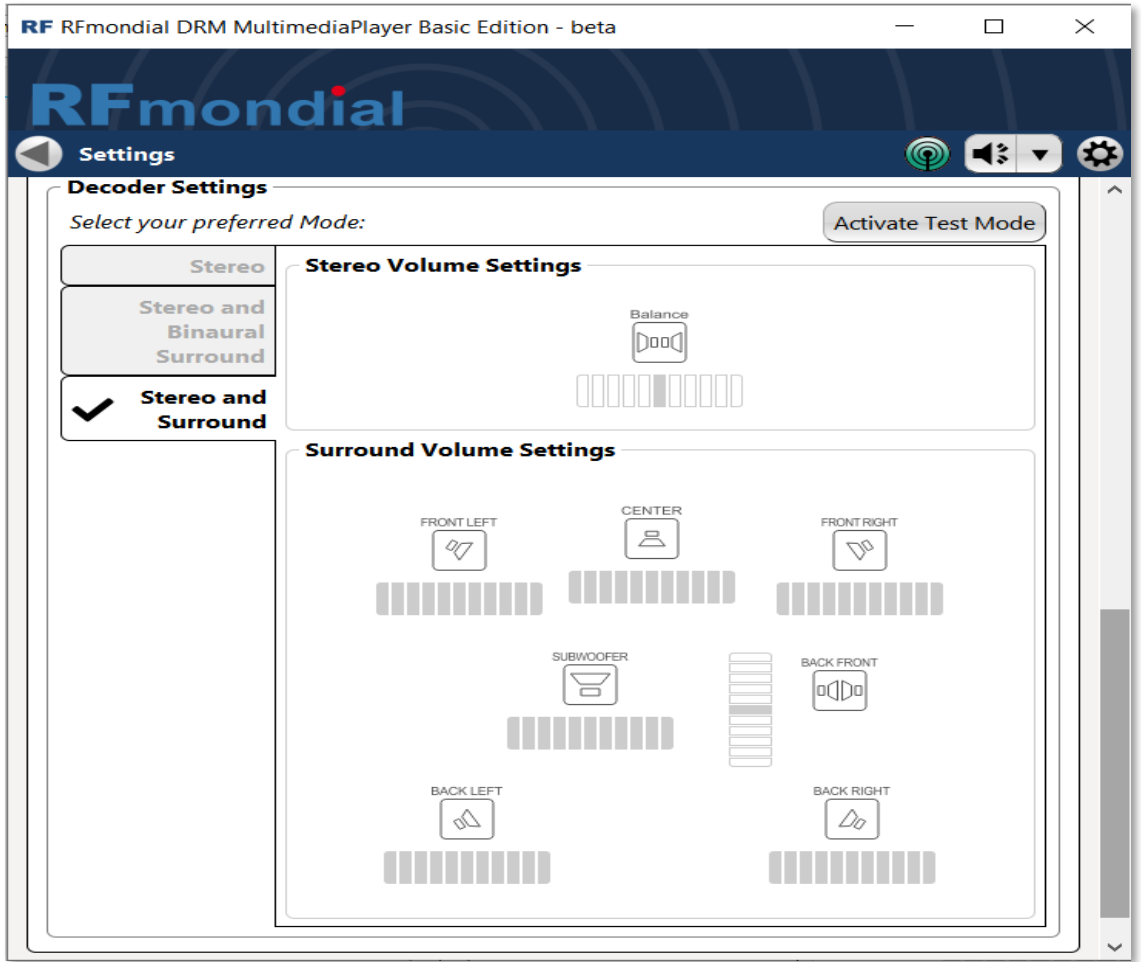




1. Receiver switches on and/or re-tunes automatically
2. Visual / acoustic signaling
3. Alarm announcement +
   multi-lingual look-up text instructions via Journaline
   (serving non-native speakers + the hearing-impaired)

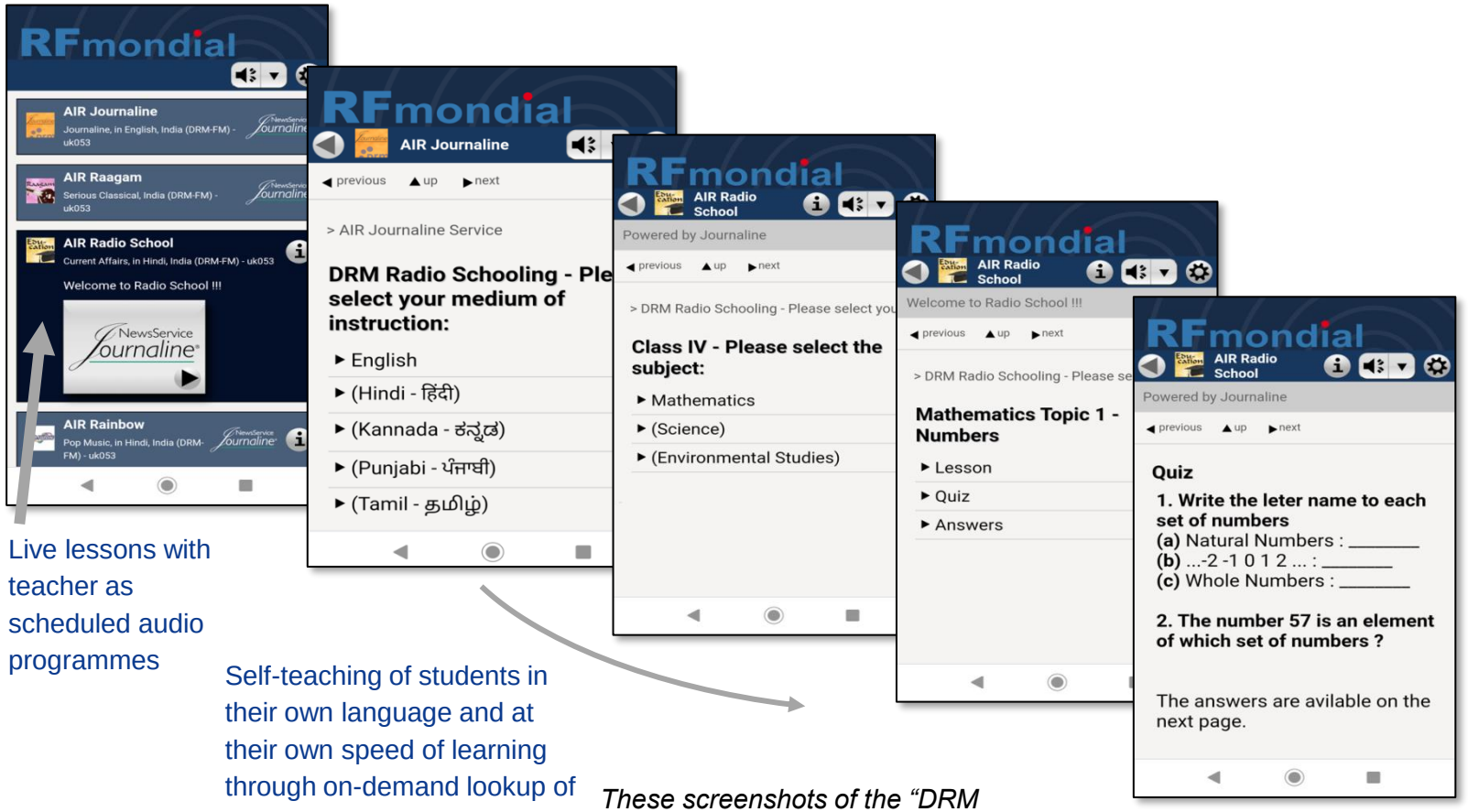
DRM signal – Other Features

5.1 Surround Sound capability



DRM signal – Advanced Applications

Radio Schooling / Distance Learning



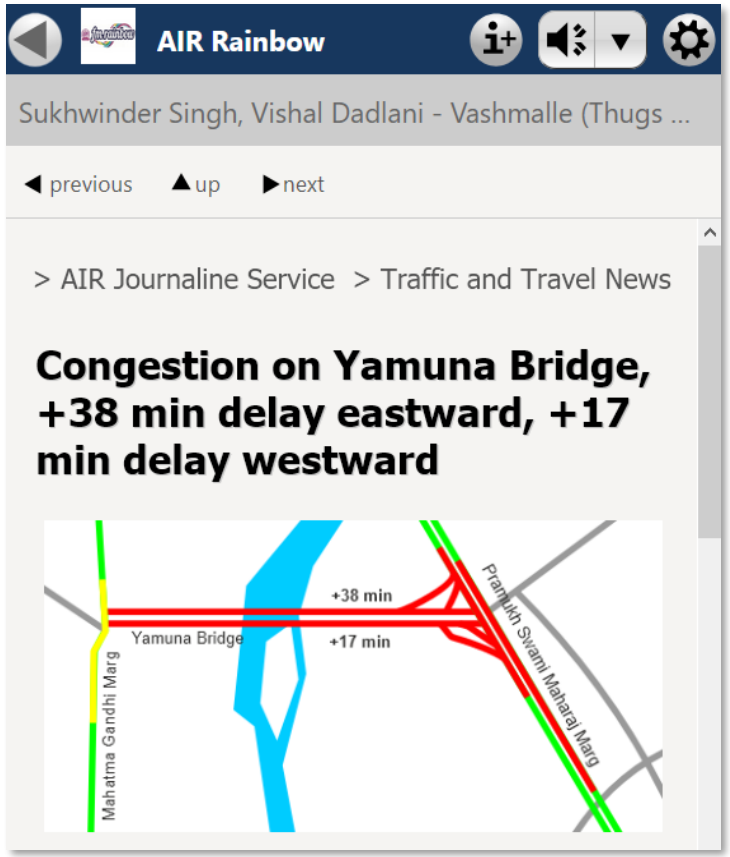
Live lessons with teacher as scheduled audio programmes

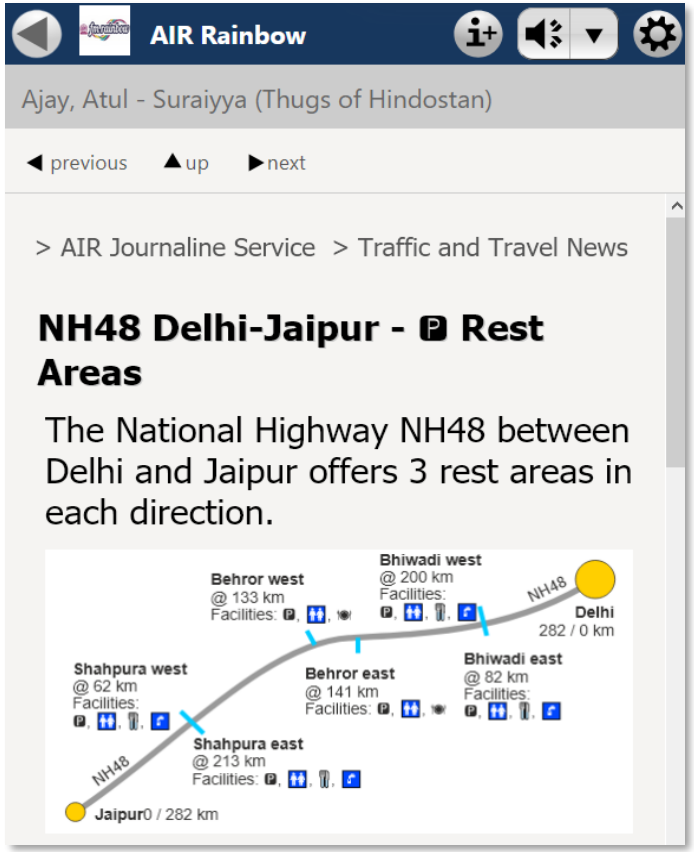
Self-teaching of students in their own language and at their own speed of learning through on-demand lookup of lessons

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

DRM signal – Advanced Applications

Traffic and Travel Information





DRM signal – Advanced Applications

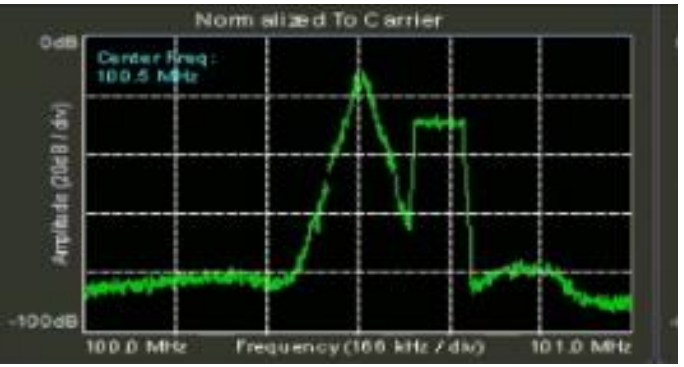
Public Signage Service

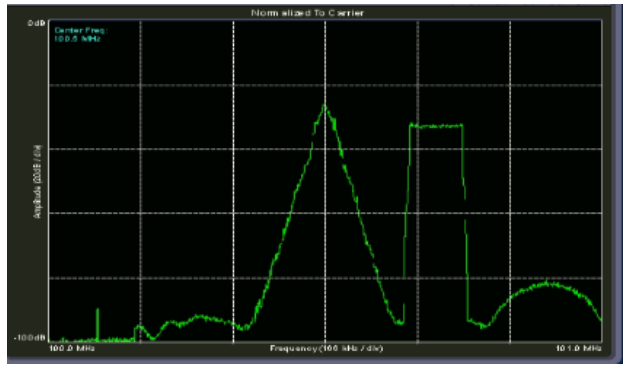
- Based on **Journaline** feature
- Enhances Journaline text content with **layout style indicators** (design+graphics)
- Can **reference article images/photos**
- Supports **file download** (e.g. over night): article images, CSS styles, background graphics
- Supports **EWF**: activates audio, cycles through EWF information

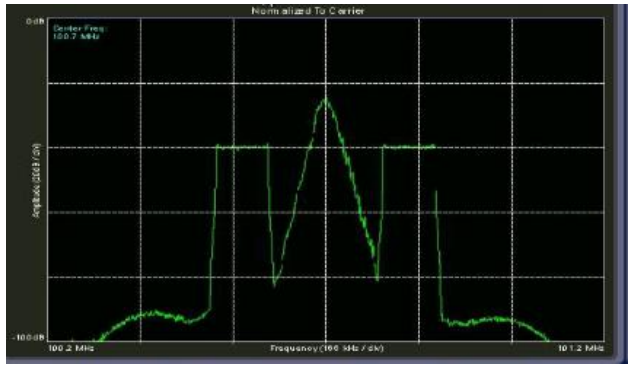
DRM Transmission Delhi – Coverage

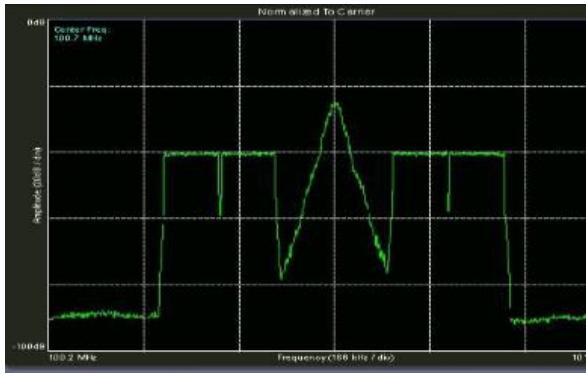
100 W DRM power (ERP) – Measurement was stopped after 24.72 km due to sporadic receiver dropouts

Simulcast DRM operation







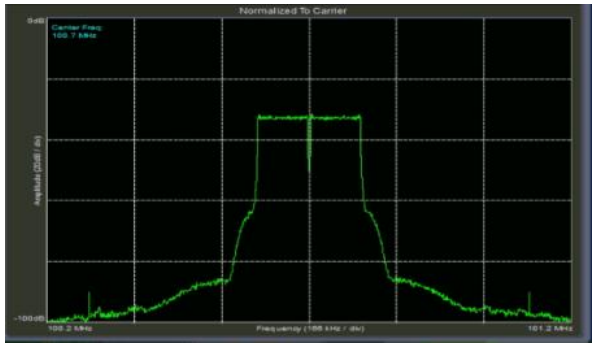
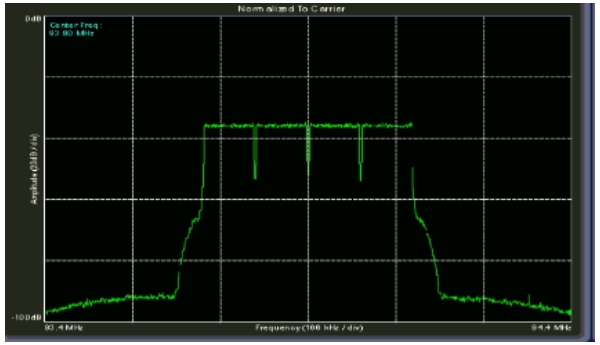
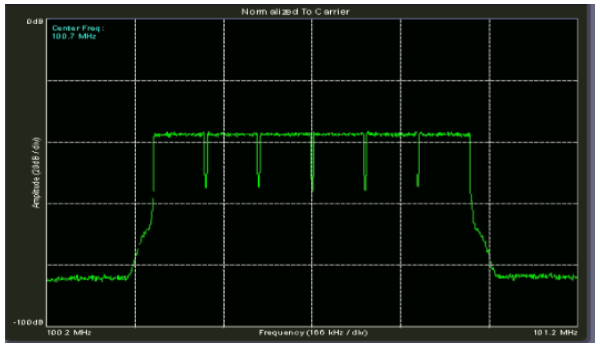
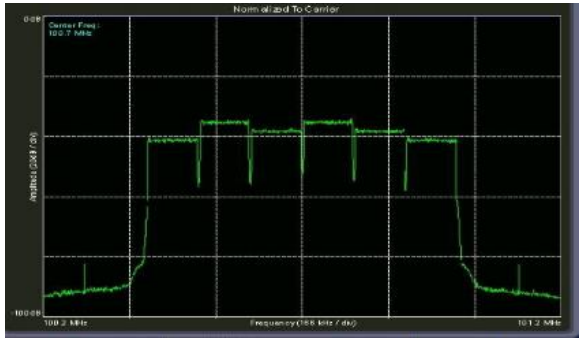


Test case	Transmitter		Signal Configuration and Receiver Tuning Frequency (MHz)
	Center (MHz)	Power (W)	100,35 | 100,4 | 100,45 | 100,5 | 100,55 | 100,6 | 100,65 | 100,7 | 100,75 | 100,8 | 100,85 | 100,9 | 100,95
Test case 1: “Simulcast Showcase A”	100,5	1100	FM | 10%
Test case 2: “Simulcast Showcase B”	100,5	1100	loud processed FM | 10%
Test case 3: “Simulcast Showcase C”	100,5	400	equal | equal
Test case 4: “Simulcast Showcase D”	100,5	400	FM | 10% | 10%
Test case 5: “Simulcast Showcase E”	100,7	400	10% | FM | 10%
Test case 6: “Simulcast Showcase F”	100,7	400	10% | 10% | FM | 10% | 10%

Colour code: DRM analogue FM

Both analogue FM service and up to 4 DRM signals (12 Audio + 4 Multimedia Journaline services) from the same transmitter

Pure Digital – Multi-DRM configuration

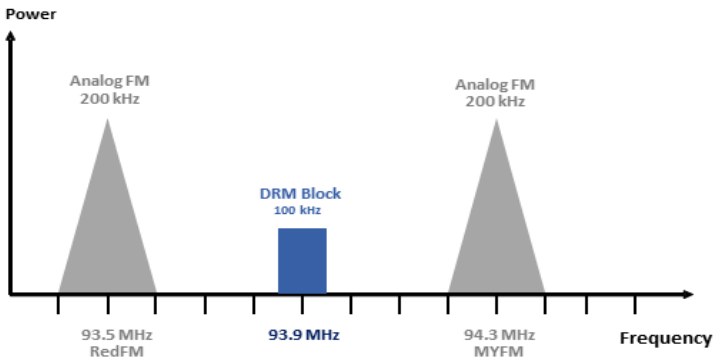





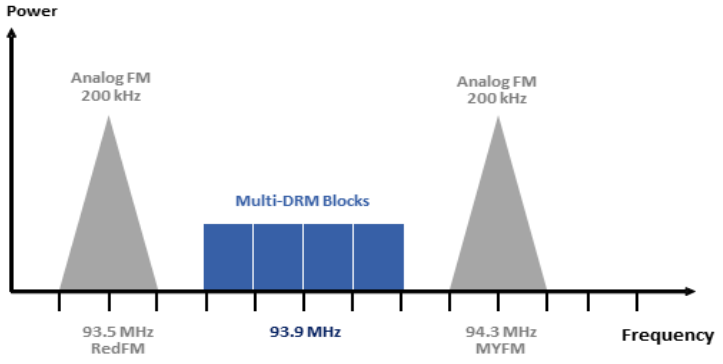
Test case	Transmitter		Signal Configuration and Receiver Tuning Frequency (MHz)												
	Center (MHz)	Power (W)	100,35	100,4	100,45	100,5	100,55	100,6	100,65	100,7	100,75	100,8	100,85	100,9	100,95
Test case 1: “Multi-DRM Showcase A”	100,65	200						100%		100%					
Test case 2: “Multi-DRM Showcase B”	100,65	600		100%		100%		100%		100%		100%		100%	
Test case 3: “Multi-DRM Showcase C”	100,65	100		25%		100%		50%		100%		50%		25%	
Test case 4: “Multi-DRM Showcase D”	100,65	100		100%		100%				100%				100%	

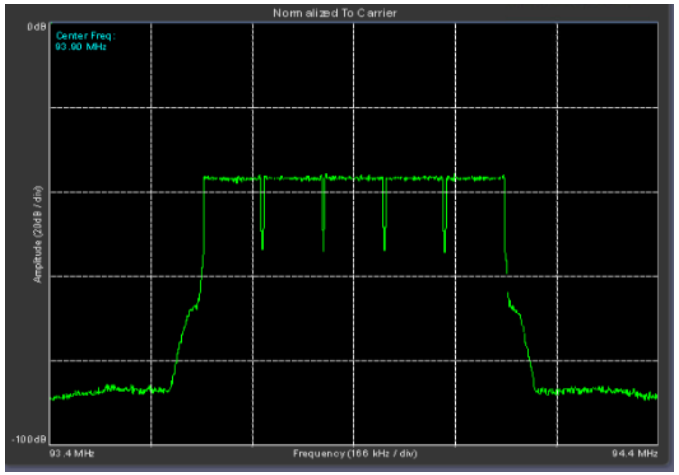
Colour code: DRM analogue FM

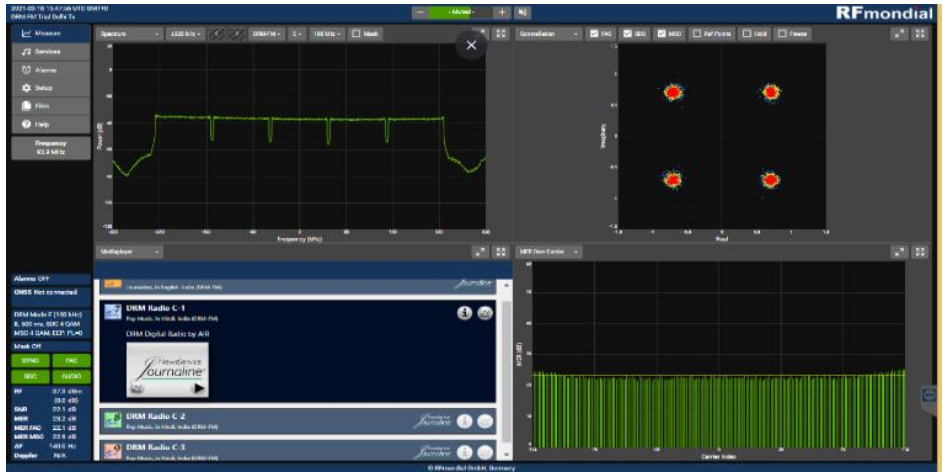
Up to 6 DRM signals (18 Audio + 6 Multimedia Journaline services) side-by-side from the same transmitter

DRM in analogue-FM white spaces









Up to 5 DRM signals (15 Audio + 5 Multimedia Journaline services), from a single transmitter, in the white space of 600 kHz in-between the 2 existing analogue FM services (10 kW each)

DRM Digital Receivers used for demos

Professional Monitoring Receivers

RFmondial

RF-SE19

RF-SE12

Stand-alone/ Desktop Receivers

Gospell

GR-216

GR-224BP

GR-226BP

GR-228BP

Starwaves

W293

DRM Digital Receivers used for demos

DRM in-Car Receivers

DRM Line-fit dashboard Radios

Mobis (Hyundai)

Harman (Maruti-Suzuki)

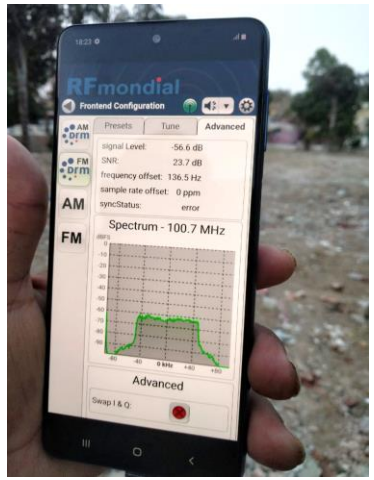
DRM After-market Car Receiver

Starwaves Car Box Radio

DRM Digital Receivers used for demos

DRM Mobile Phone Radio Receiver

DRM MultimediaPlayer Radio App by Fraunhofer



FM-USB-Dongles

India

Overview of Radio in India Today

Population – 1.3 Billion

Public Service Broadcaster - All India Radio

- **Transmitters** – 678
  - MW – 135, SW - 48 & FM - 495
- **Domestic Coverage** (by population)
  - MW – 98.4% FM – 52%
    MW and FM – 99.2%
- **External Services** – 72 Hrs/day in 27 Languages (15 Foreign & 12 Indian)

Private FM Broadcasters – 330 Stations

- **Coverage** – About 40%
- **Expansion Planned** – 839 Stations

Community Radio Stations - 200

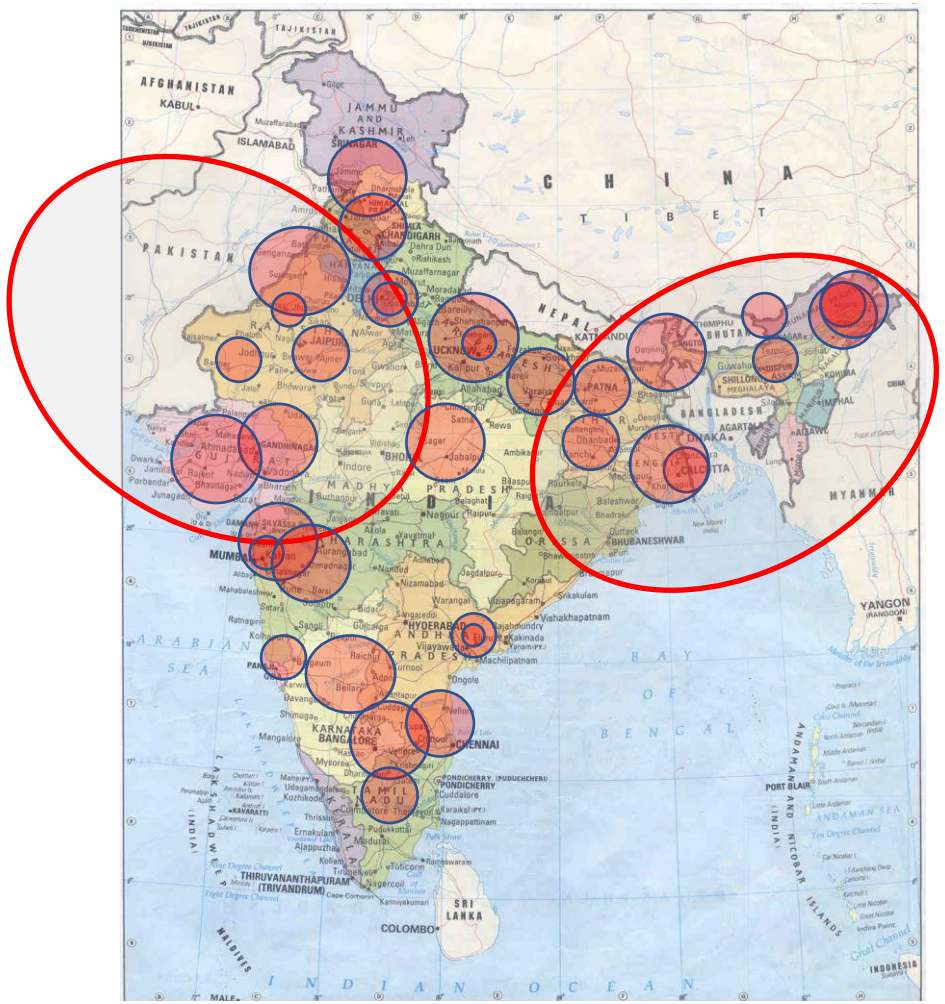
India

"One of the world's largest digital radio deployments"

MW – 35 transmitters
1000 kW - 2
300 kW - 6
200 kW - 10
100 kW - 11
20 kW – 6

SW – 3 transmitters
500 kW - 1
100 kW - 2

Transmitters **38**
Power **8,000 kW** (analogue equivalent)
Coverage > **0.9 Billion people**
(with the operation of all these transmitters in pure DRM)



DRM MW Transmitters – Mode of operation

- 5 transmitters, incl. in all 4 metro cities,
  are now carrying pure DRM transmissions – round the clock (except 3 – 5 pm)
  - Mumbai – 100 kW
  - Kolkata – 100 kW
  - Delhi – 20 kW
  - Chennai – 20 kW
  - Rajkot - 1000 kW
- Remaining 30 transmitters are working in simulcast mode - with 1 hour in pure DRM
- Refer Prasar Bharati official website for details
- No retuning of receivers from simulcast to pure DRM & vice-versa operation
- 24-hour News Channel, Entertainment channel and Journaline services from these transmitters
- 6 more high-power MW Transmitters are likely to start operation in DRM soon

DRM in Cars

More than **3 million cars** with DRM receivers on the road in India

Other Key DRM Countries

- Indonesia
- Pakistan
- Southern Africa
- China
- Russia
- Brazil

Ruxandra Obreja

DRM Chairman

Countries rolling out DRM or trialling and planning to launch

- **India**
  – **DRM (AM)** the largest digital radio roll-out in the world currently over 900 million people covered
  – **DRM for FM trial** – finished as of March 22nd, 2021

- **China** – **DRM shortwave for domestic coverage** – full country coverage (with 7 SW transmitters)

- **Russia** (**DRM endorsed for AM and FM**). Successful demos in VHF band II in St. Petersburg (still on air since 2019) and in AM in Siberia.

- **Brazil** (successful tests in both AM and VHF), SW Transmitter for Amazonia installed near Brasilia – **DRM SW transmissions** to north and south until MARCH 2021

- **Indonesia** (successful trials in both AM as well as VHF, planning roll-out). 5 FM transmitters installed and EWF successfully demonstrated. Plans for DRM AM in 2021

- **Pakistan – Planning DRM in all bands in 2021**. 3-stage plan with cost allocation. On Oct 5th, 2020 PBC installed signboard of future 10kW (DRM) transmitter.

- **Malaysia – interested in DRM having found DAB+ not useful at this stage**

Countries rolling out DRM or trialling and planning to launch

- **In Africa Nigeria, Algeria, Botswana, Zambia, Mozambique, Morocco – planning or broadcasting**
- **South Africa – adopted DRM and DAB+ = DSB (DRM demonstrated in AM (MW)** – in 2014/2015 **DRM tested in FM** – spectrum and energy savings, non-interference to analogue services, extra features
- **SADC (www.sadc.int) 16 countries in Southern Africa) also recommending DRM+ DAB+**
- **Romania -** worldwide DRM SW service, currently received in India and Brazil)
- **United Kingdom -** intl. services, BBC World Service to Europe and India
- **Germany** (tested extensively in all bands and used by German Navy)
- **Hungary –** a. 2 megawatts MW transmitter installed in *Antenna Hungaria*
- **USA** (Used by Coast Guard)
- **Asia: Vietnam, Malaysia, Thailand, Bangladesh, New Zealand** – interest – test or roll
- **Middle East - ADOPTED** Kuwait broadcasting in DRM, Saudi Arabia, Oman

Learn more about DRM field trials all over the world:

https://www.drm.org/what-is-drm-digital-radio/drm-field-trials/

PLANNING TRANSMITTER AM DRM LPP RRI

LOCATION TRANSMITTER FM DRM LPP RRI

Indonesia

Asia's first DRM FM regular transmissions 2020

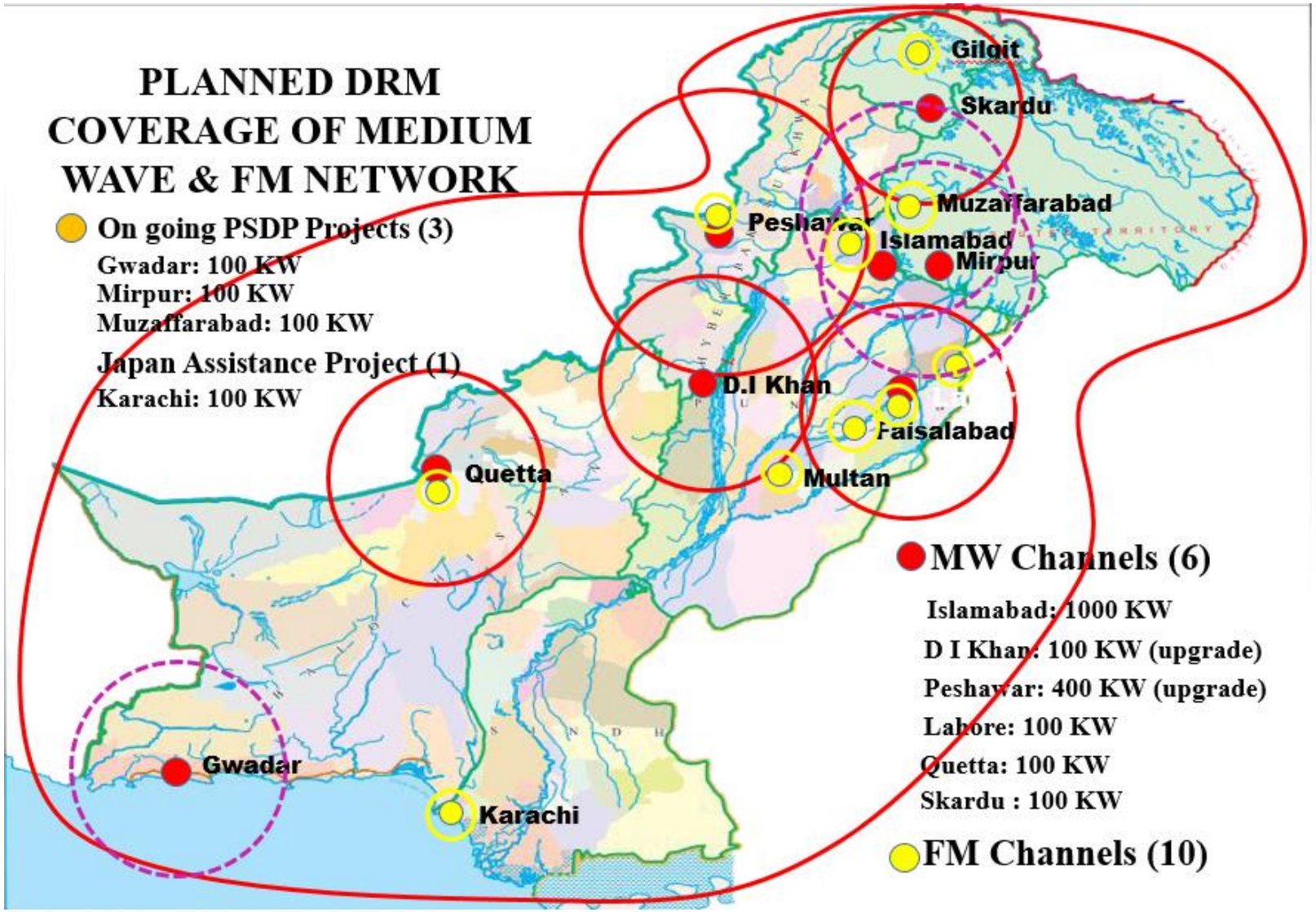
DRM FM Transmitters: 1. Labuan Pantai, Banten Regency, Jawa Timur
2. Pelabuhan Ratu, Sukabumi Province, Jawa Timur
3. Cilacap, Jawa Tengah
4. Labuan Bajo, NTT, East Indonesia
5. Painan, West Sumatra, Indonesia

Services: DRM FM – 2 audio services (PRO 1, 3), Journaline News Service, EWF
FM analogue simulcast – one audio service

RADIO PAKISTAN

DIGITAL RADIO MIGRATION PROJECT

RADIO PAKISTAN



DRM in South Africa

The first African country with a coherent policy – DSB

- **DRM demonstrated in AM (MW) –** with the support of Radio Pulpit, Broadcom, Sentech in 2014/2015

  http://s836646369.websitehome.co.uk/public_html/R15-WP6A-C-0299!P1!PDF-E.pdf

- **DRM tested in FM –** with the support of Wecodec / Radio Kofifi, Thembeka & Associates, JvW, Sentech and other Consortium members and associates.

  Excellent results– spectrum and energy savings, non-interference to analogue services, extra features

  https://www.drm.org/wp-content/uploads/2019/08/Final-Report-for-DRM-Mode-E-Trial-in-South-Africa 2.6i.pdf

Policy Recommendation for Using DRM

Communications Minister:
Stella Ndabeni-Abrahams

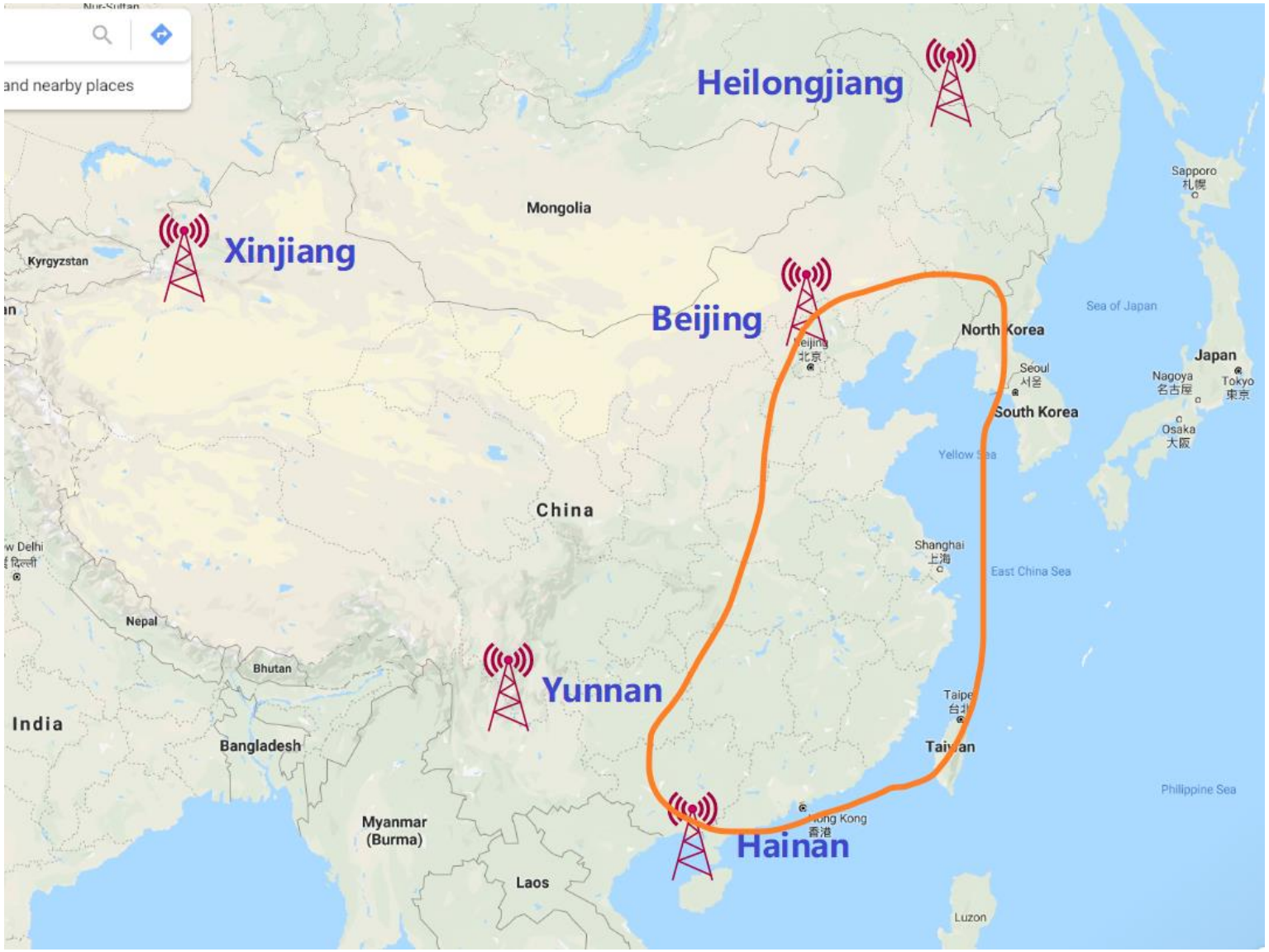
- The Department of Telecommunications and Digital Technologies in South Africa has published in July 2020 a document outlining its policy on digital migration in the country.
- This paves the way for the migration to digital radio broadcasting which includes also the use of DRM digital radio technology.
- **South Africa becomes the first country** to recommend both the all bands DRM standard as well as DAB and therefore the availability of multi-standard chipset could be the catalyst in accelerating the adoption of digital radio broadcasting

China

CNR

- Since 2016, China restarted DRM shortwave (SW) digital broadcasting.
- Administrative Bureau of Radio Stations (ABRS, NRTA), Academy of Broadcasting Science (ABS, NRTA), Communication University of China (CUC) in charge of this work.
- At present**, 7 SW transmitters (each 30 kW) distributed in 5 stations throughout the country- upgraded and rebuilt.**
- **These experimental broadcasts - 79.19 hours a day, cover most areas of North China, East China, South China and Southwest China.**
- DRM is currently being adopted as the Chinese national standard for digital HF broadcasting.

China

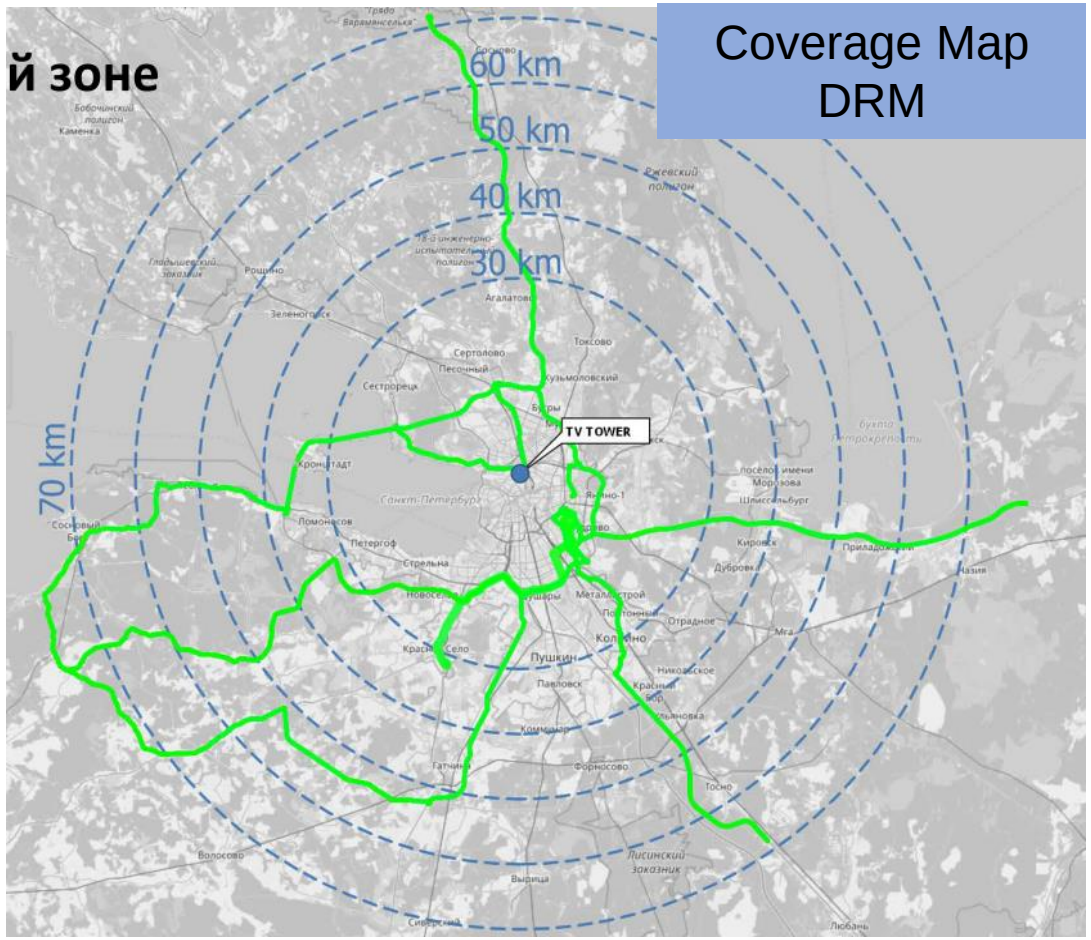

Heilongjiang
Xinjiang
Beijing
Yunnan
Hainan
Mongolia
Kyrgyzstan
China
North Korea
South Korea
Japan
Sea of Japan
Yellow Sea
East China Sea
Philippine Sea
Nepal
Bhutan
India
Bangladesh
Myanmar (Burma)
Laos
Taiwan
Luzon
Sapporo
Seoul
Nagoya
Tokyo
Osaka
Shanghai

DRM-AM in Russia

- Some demo transsmissions in the Eastern part of Russia with DRM-AM (SW)
- Ongoing projects to cover the Eastern part of Russia with DRM-AM (SW, MW)
- DRM receivers are available from the Russian distributors

DRM-FM Russia

- DRM-FM Simulcast Trial in St.-Petersburg, Russia.
- 3kW FM and 0.4-0.8kW DRM Power
- >1800 km for the test drives
- >30 hours of recorded RSCI Data only in Nov. and Dec. 2020
- DRM coverage > 80km



Brazil

- Brazil has been interested and has been testing DRM for more than 10yrs
- EBC/public broadcaster issued a tender for SW, MW and FM in DRM transmitters in 2020. Please see this link:

  https://www.ebc.com.br/acesso-a-informacao/licitacoes

- In parallel DRM SW transmitter (near Brasilia) ready to go on air for Amazonian coverage. Locally manufactured DRM SW transmitter used.
- EBC put Amazon National Radio already on the air from the capital Brasilia in DRM for AM June 2015 and then 2020

Rodeator Park near Brasilia

Brazil's DRM Next Steps

- National production of MF, HF and VHF DRM transmitters
- EBC to install 2x 100 kW HF transmitters for national coverage
- Importation of DRM receivers
- Raise awareness about DRM among commercial broadcasters

➔ **Brazil is ready for fully embracing and rolling out DRM**

The **not-for-profit** DRM Consortium
supports and promotes the DRM Standard and its take-up globally

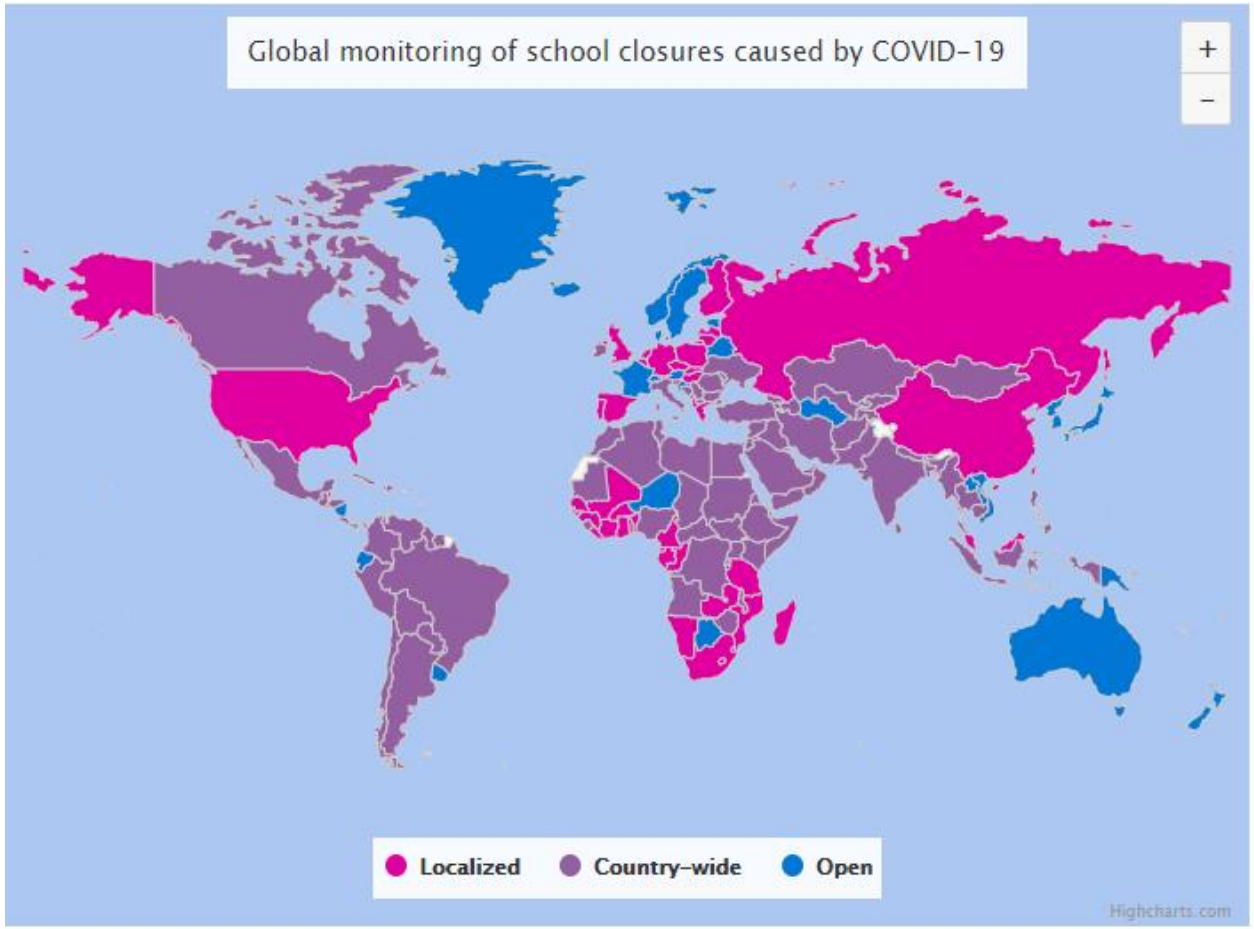
Distance Learning

Alexander Zink

Vice-Chair DRM Consortium;
Senior BDM, Fraunhofer IIS

Distance Learning
Using the DRM Digital Radio Standard

- Education disruption due to COVID-19
- School closures in 105 Countries affecting 1 billion students
- Technology divide and poor infrastructure – lack of internet, poor/no mobile coverage
- **Solution: DRM for schools and general education**



Source: UNESCO Institute for Statistics data

Why Use DRM Digital Radio for Education?

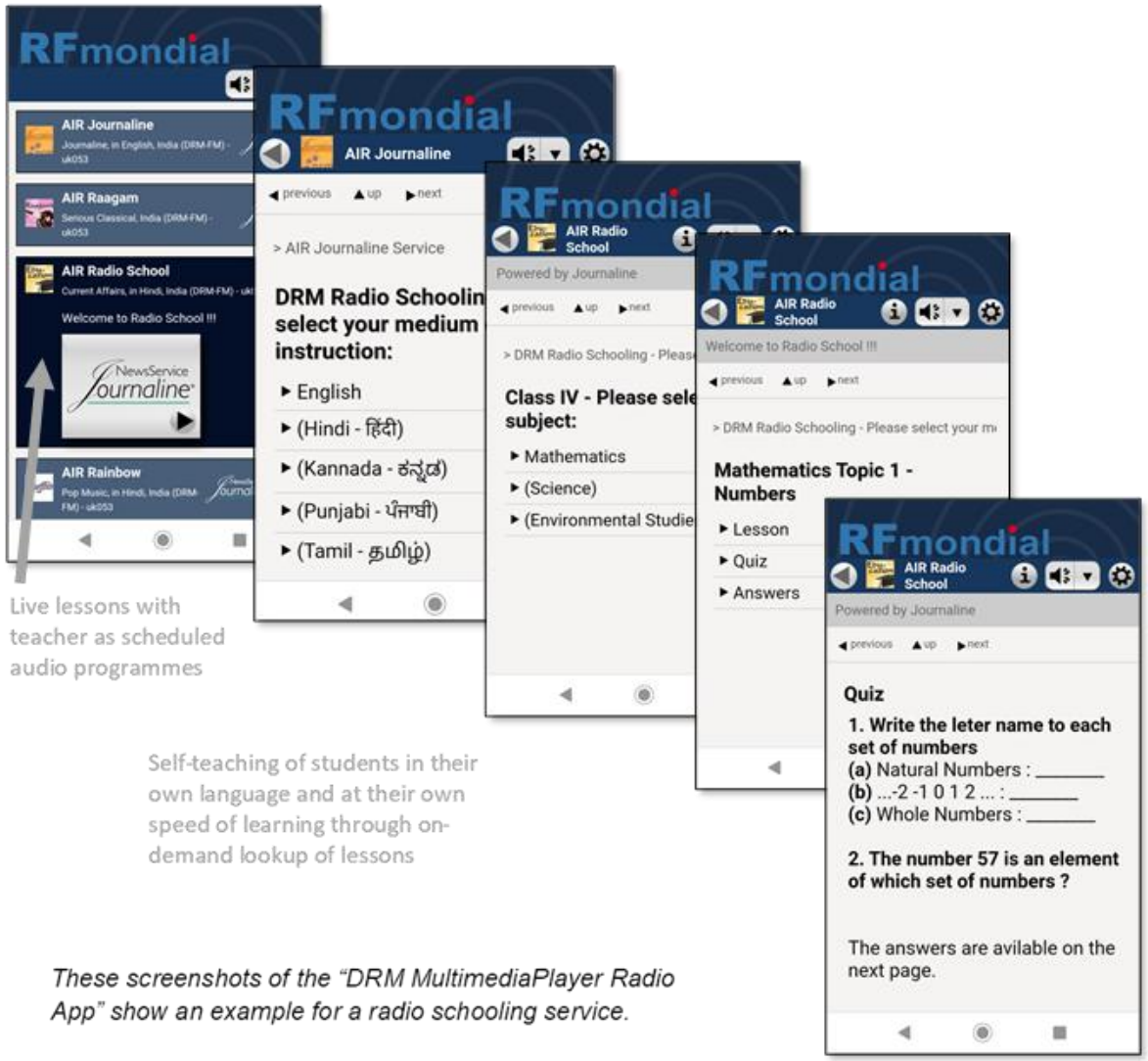
- **Access** to information, education, entertainment and EWF
- Offers **more than audio**. Its **data transmission** possibilities gives it a new dimension
- It can offer **relevant information** to people wherever they are
- It offers information free-to-air to everybody, **without the need for Internet**
- DRM receivers can **cache information** for convenient access at any time (e.g. schooling documents collected over night)
- DRM radio is the **real integrator and universal provider** of education, information and Emergency Warning alerts (EWF)

DRM Distance Learning

- **Purpose**:
  - Self- and class-based learning option via radio
  - During pandemics and reaching remote areas
  - Pure radio broadcast – no Internet required

- **How it works**:
  - Lessons and textbook-content via **Journaline**
    → Always available on-demand, even for self-study
  - At specific times, accompanied by **live teacher** (audio service)
    → Referencing the current Journaline textbook location
  - Options for student **interactivity**: Journaline quiz, Q&A re-broadcast, etc.

DRM Digital Radio for Education



Live lessons with teacher as scheduled audio programmes

Self-teaching of students in their own language and at their own speed of learning through on-demand lookup of lessons

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

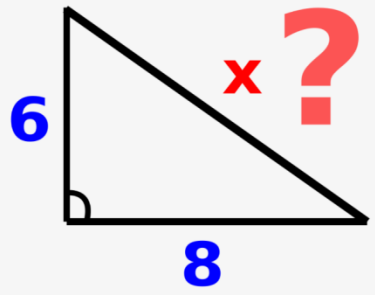
DRM Digital Radio for Education

NewsService Journaline®

Education ➜ … ➜ Class VI ➜ Mathematics

Homework – Today's Math Challenge for You:

Given the following **triangle** with the **legs** length **a = 6** and **b = 8**, what is the value of the **hypotenuse x**?



Edu-cation DRM Distance Learning

drm

NewsService Journaline®

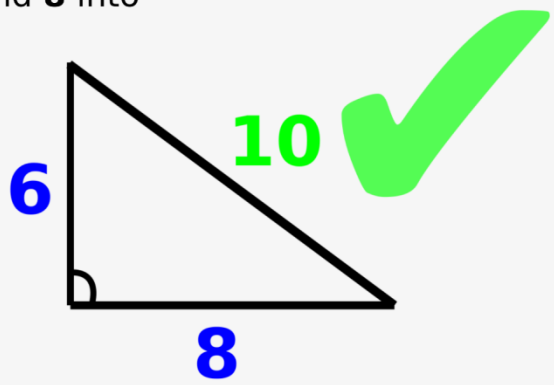
Education ➜ … ➜ Class VI ➜ Mathematics

Answer:

If we pass the values **6** and **8** into the formula we get:
$6^2 + 8^2 = x^2$

Which is the same as:
$100 = x^2$

Therefore we can write:
$x = \sqrt{(100)}$
$x = 10$



So the answer is, that the **hypotenuse** has a length of **10**.

Edu-cation DRM Distance Learning

drm

DRM Receivers: Reality, Successes & Going Forward

Radu Obreja
Marketing Director, DRM Consortium

Over 3 Million Cars On The Roads In India

Smart Radio for All

The Car Industry Rolls Out DRM in India

- **More than 3 million cars with line-fit DRM in India**
- Chipsets exist to support all standards
- Car manufacturers **not charging extra** from consumers for DRM receivers
- **More International car brands adding DRM in their cars**

TOYOTA

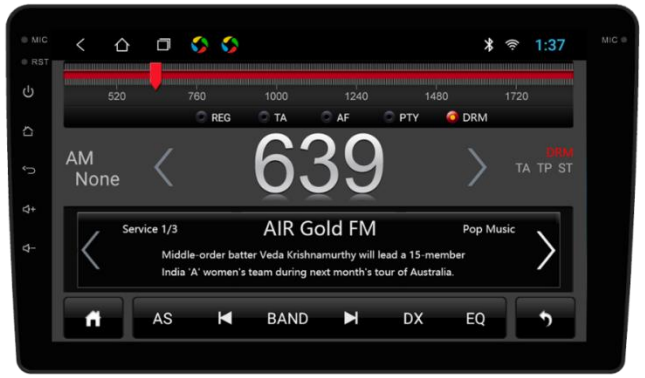
HYUNDAI

MARUTI SUZUKI

Mercedes-Benz

MG

Mahindra



GR-501BCW for after-market

GR-502BCW for OEMs

GOSPELL®
Technology Serves People

DRM Car Stereo – After Market, as well as for OEMs

- Double DIN in-dash car stereo
- 2GB RAM + 32GB ROM
- Quad core
- DRM designed for AM band, ready for FM band
- Journaline® support
- DRM Slideshow support
- AM/FM radio
- Bluetooth music / Handsfree calling / Wi-Fi
- Navigation / backup camera
- USB/SD player
- Internal 4x25w amplifier

GR-500 is a tuner module with DRM radio receiving function, for car multimedia systems in OEM and after market devices

STARWAVES

CarBox / “Tuktuk” Radio

- Ready to use existing car radio & antenna
- DRM in the AM, SW and FM Band
- Also plays analogue AM, FM and SW
- High quality automotive tuner
- Journaline
- Emergency Warning Functionality
- It also works as a standalone version with integrated audio and amplifier available
- Frequency and station name can be scrolled on the LED display
- It comes with IR remote control

We made it ready for the market!

Standalone
DRM only or DRM Multi-standard receivers

Desktop and Portable DRM Receivers

Manufacturers in **China, Germany, India, South Korea, UK** are planning and already producing portable receivers.

GOSPELL®
Technology Serves People

GR-224BP

GR-226BP

GR-228BP

GR-216

Portable DRM/AM/FM Radio

- Portable DRM radio operates on AC or battery
- DRM designed for AM band, ready for FM band
- AM/FM radio
- xHE-AAC audio
- Journaline® support
- Bluetooth stream music and handsfree calling
- USB/SD music player
- DRM scrolling text
- DRM emergency warning reception
- FM RDS
- 60 presets

Antriksh DIGITAL

Gospell Distributor in India

drm | xHE-AAC crystal clear | emergency warning | RDS RADIO DATA SYSTEM | USB | Bluetooth | 60 station presets | built-in battery

NewsService Journaline®

www.drm.org

Future Portable Receivers

GOSPELL® Technology Serves People

GR-220P Pocket DRM/AM/FM Radio

- Full band DRM (MW/SW VHF-II) and AM/FM stereo reception
- DRM xHE-AAC audio decoding
- DRM Journaline and scrolling text message
- DRM Emergency Warning Functionality
- DRM alternative frequency switching
- DRM expert mode for reception status inspection
- FM RDS station name display
- 60 station memory presets
- 1kHz step tuning allows fast and precise station reception
- Station auto seeking and store
- Rechargeable battery
- Automatic time set
- Operates on internal battery or AC adapter

Customer testing expected within next two months

Expected launch in 4th quarter 2021

STARWAVES

Radio Music Player W293-BT

STARWAVES

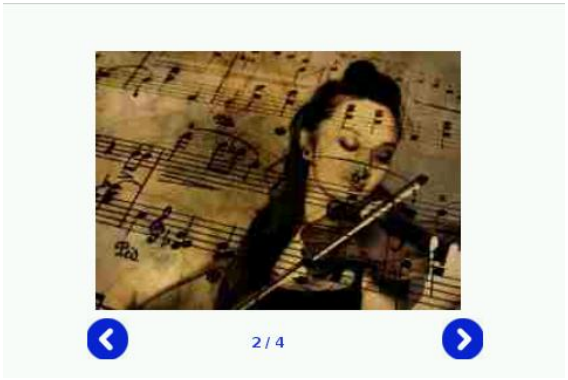
DRM Software Radio App

- Listen to DRM live broadcasts on your Android phone or tablet simply by connecting an external RF dongle to the USB port of your device
- Works with various SDR RF dongles out of the box, including AirSpy HF+, SDRplay, MSi. SDR Panadapter; and supports RTL-SDR through a third-party driver (experimental); requires a device with USB host capability
- Supports DRM digital radio services both in the AM and FM/VHF bands (depending on RF dongle capabilities)
- Supports all standard compliant DRM audio codecs, including xHE-AAC
- Browse through Journaline text content with latest news, sports and weather updates, programme background information and schedules, distance learning / RadioSchooling or travel information
- Supports EWF within DRM transmission

DRM Reference Radio Receiver Design for Consumer Market

inntot

- Supports DRM-AM DRM-FM
- Journaline, Slideshow, SPI
- AM, FM Reception
- MP3 Playback
- Telescopic and Internal AM Antenna
- External antenna support
- 3.5 inch TFT Color display - 320x240 Pixels



Inntot Technologies
info@inntot.com
http://www.Inntot.com

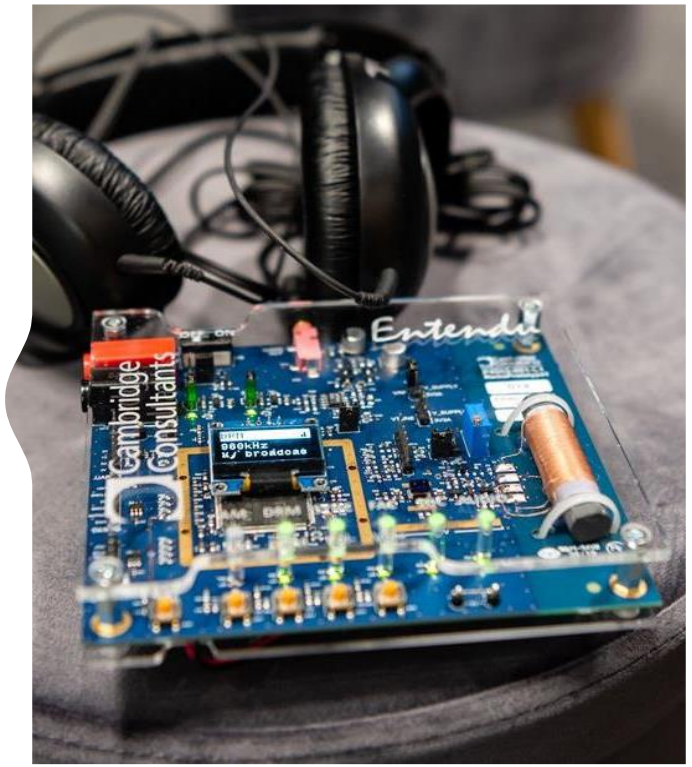
The UK based company is working on a Prototype for an affordable DRM Receiver Solution (~ $20 BOM)

TO BE UNVEILED AT IBC 2021

CML Microsystems Plc
Cambridge Consultants

CML / Cambridge Consultants module aims to open up the low-cost end of the DRM market

- Designed for small portable receivers
  - Minimal display, with the option of no display at all
  - Text-to-speech option indicating station, band,… replaces display
  - Audio-only output in its basic form (no data, slide show etc.)
  - Low module cost - target US$10.00 in large volume
- Fully tested module for easy build into radio designs, well within capability of manufacturers in any country
  - Sold through network of distributors as well as direct
- Low power, designed to run from
  - small low-cost primary cells (typically AA size)
  - rechargeable with solar charging
  - even hand-cranked!
- Targeted primarily at India & Pakistan, Asia, Africa, South America
  - But anywhere where a service exists or is planned



Cambridge Consultants' 2020
Proof-of-Concept / Demonstrator

RF2DIGITAL
㈜알에프투디지털

- South Korean Company
- Developed Software Defined Radio (SDR)
- Works in all broadcast bands – SW, MW and FM
- RF2Digital has produced a Demo Board with a touchable 7- inch display

RF2DIGITAL
㈜알에프투디지털

- Locates in S. Korea, http://www.rf2digital.com/
- The World's First and the Best Pure Automotive SDR solution for all Digital Radio Standards
- Product Name: α-Infuser™

α-Infuser ™

- All Existing and Future Digital Radio Standards
  - ✓Full **DRM**, DAB Family, CDR, ISDB-Tsb, HDRadio
- All Digital Tuner Support
- Various Processor Type Support
- All Automotive Platform Support
- Flexible Interface Method
- Automotive Quality Assured

Updated DRM receiver leaflet

drm DIGITAL radio mondiale

digital radio for all

DRM Receivers

An update

Additional information available also on the
DRM website: www.drm.org – Products page

As of March 2021

DRM Receivers for Cars

The automobile receiver industry in India is already on board and has invested millions of dollars in the development of DRM digital radio capable receivers. The roll-out of DRM equipped cars is growing quickly by the month reaching over **2.5 million by now** (Jan 2021)

Car manufacturers which have so far incorporated DRM digital receivers in their models in India are Hyundai, Maruti-Suzuki, Mahindra, GM Motors and lately Toyota. Many more international car brands are planning or are in the process to fit DRM digital receivers in their vehicles. OEMs use chips from various manufacturers, such as NXP, Silabs and others.

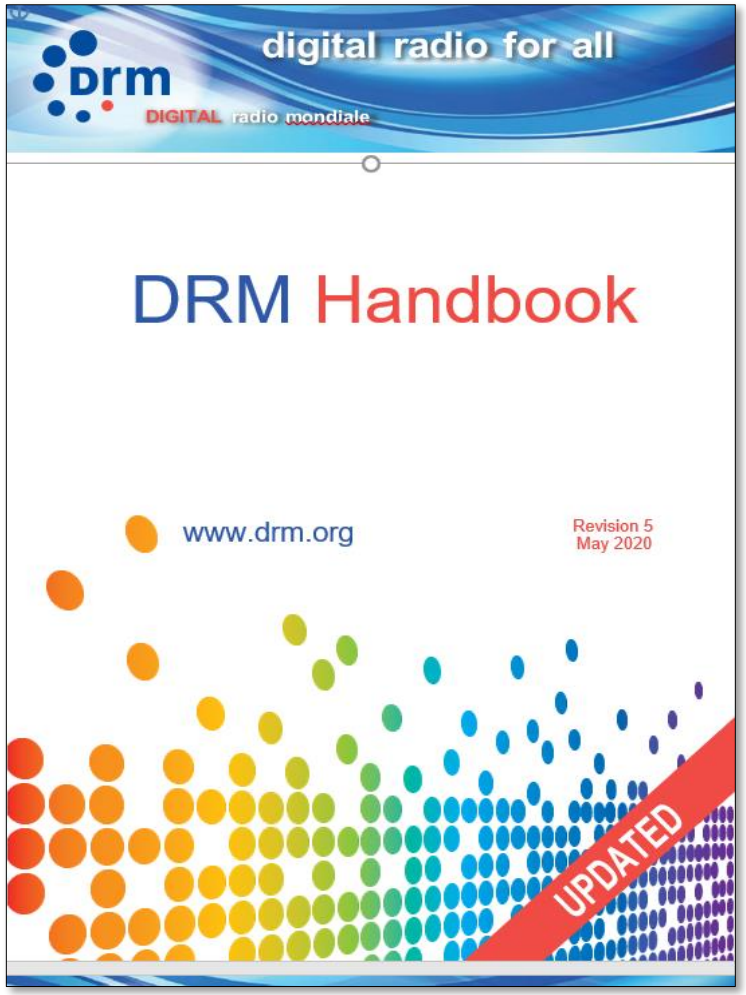
All you need to know about DRM Digital Radio

DRM Handbook

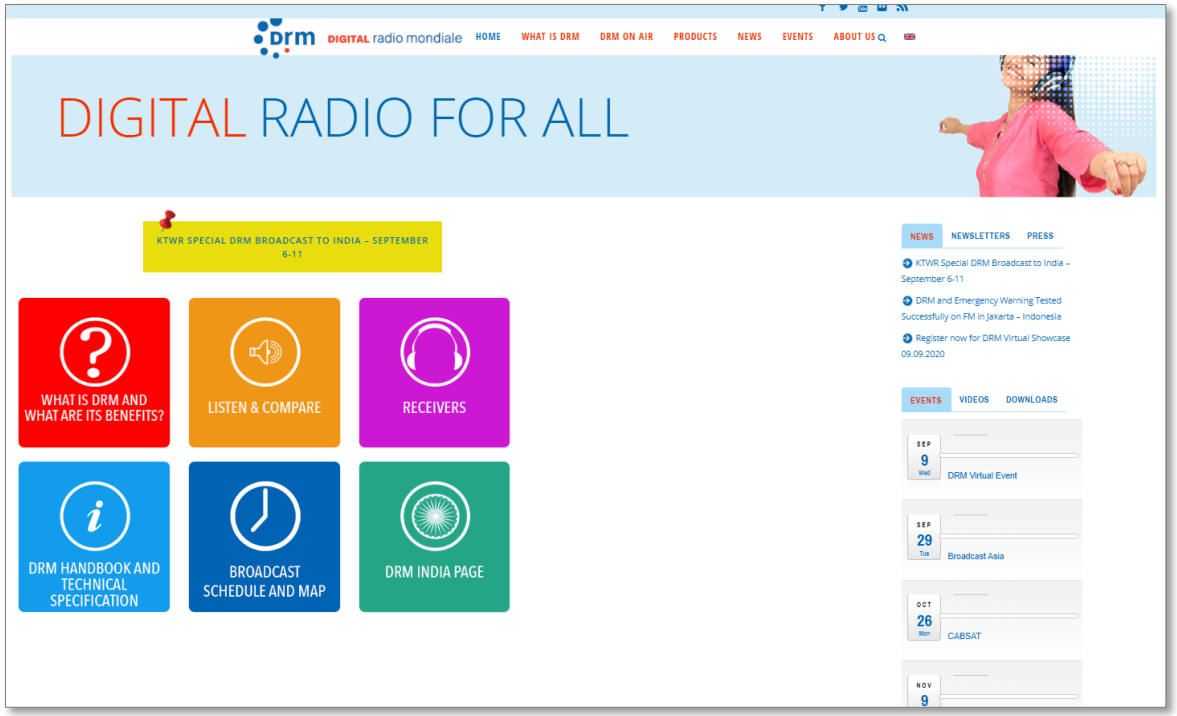
Version 5

Free download from:

handbook.drm.org



Connect with Us



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Thank You!