
3rd ITU Regional
Frequency Coordination
Meeting for Central
America and
the Caribbean Region
Digital Radio
Mondiale
Drives Forward

DRM –
The Complete Digital Radio Solution

Mike…

Titus SDR – DRM Consortium Member

Why DRM?

- **Universal and free access** to information, education & entertainment
- Reaching **all citizens of Indonesia**,
  whether in big cities, in villages, on islands, abroad, or at sea
- Using a **single technical standard** / solution
  for local, regional, national and international radio servies
- Using spectrum more **efficiently** at much **reduced cost**
- Making radio the **digital media hub** for modern listeners,
  with multi-lingual and on-demand information
- Enabling a **smooth transition from analogue to digital radio**,
  taking listeners along, and using existing infrastructure
- Great opportunity for **local manufacturing and know-how**

Selection of Consortium Members

Pakistan Broad. Corp

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

The DRM Standard -

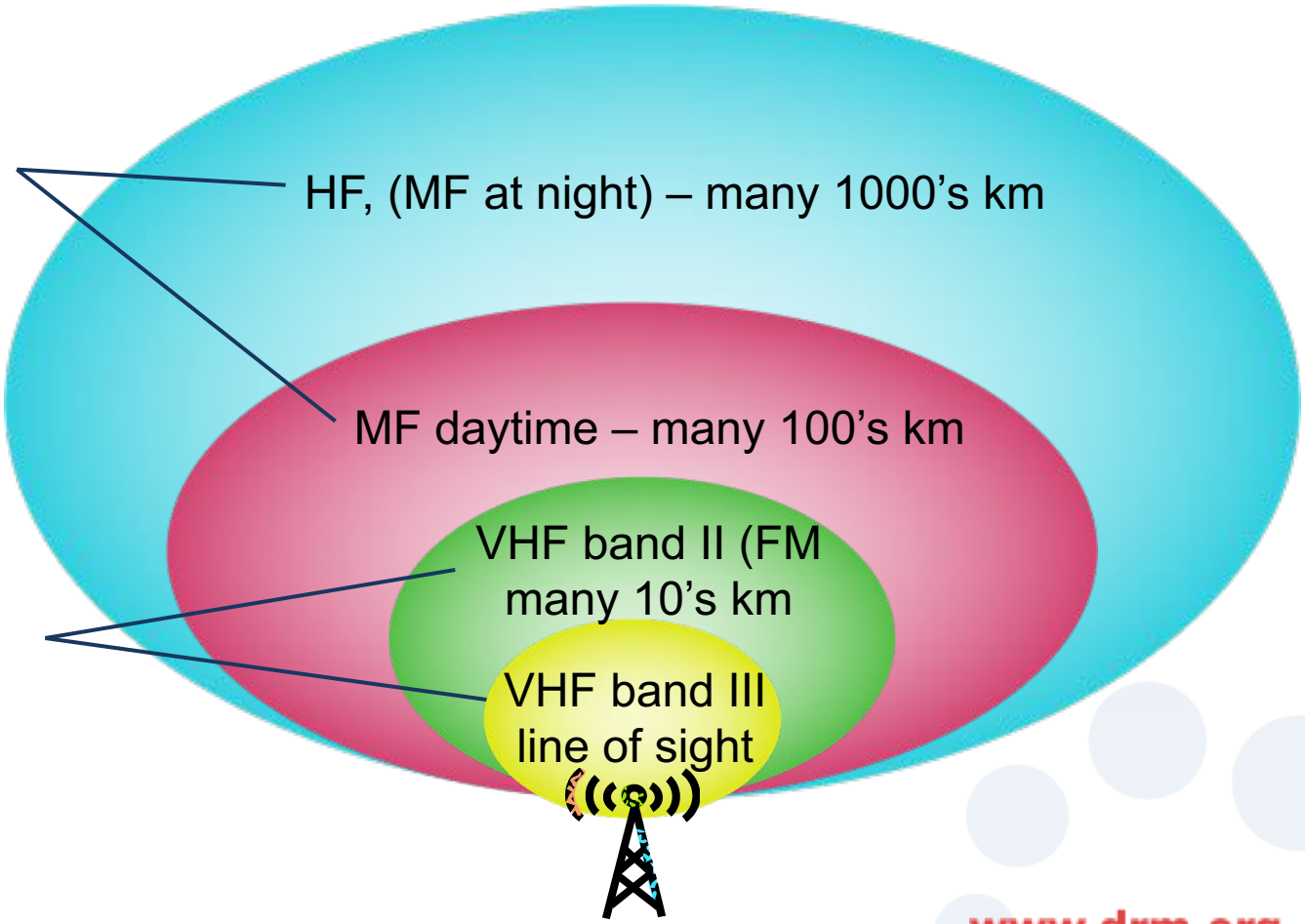
DRM – Key Facts

- Global **standard for terrestrial Digital Radio**
- **Enables all coverages:** local, regional, national, international (in broadcast bands AM & FM/VHF)
- Digital-only or **simulcast** operation (with AM or FM analogue signal)
- Transmission equipment and multi-standard receiver chips / car model **readily available**, with **upgrade path for existing AM/FM transmitters**!
- **ITU endorsed** for worldwide operation
- All details **openly standardized** (ETSI) and published, Not controlled by a single company/organisation – No licenses required
- Not a multiplex solution – Each **broadcaster in full control** of their transmission and content

Where DRM fits – Serves all coverage needs

AM bands
Large-area coverage

VHF (FM) bands
Local coverage



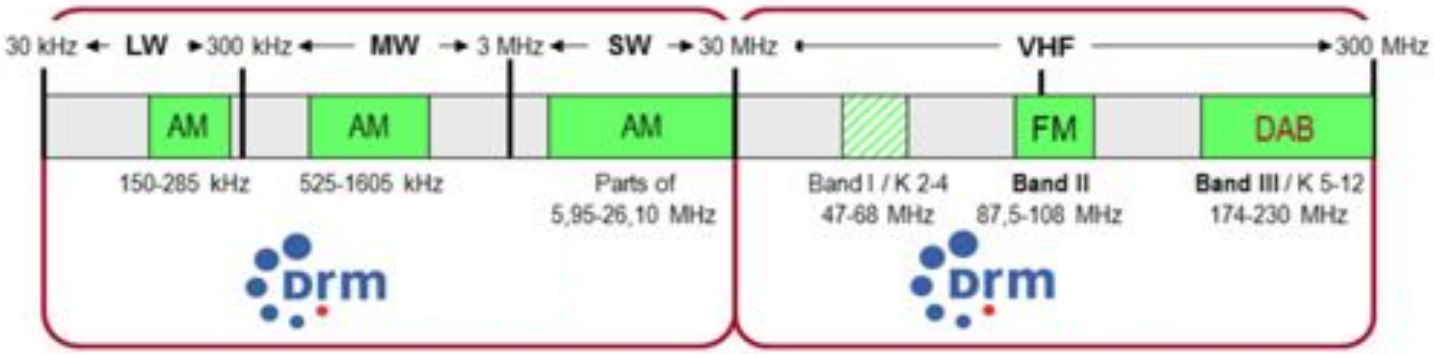
DRM in All Bands

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

30 MHz

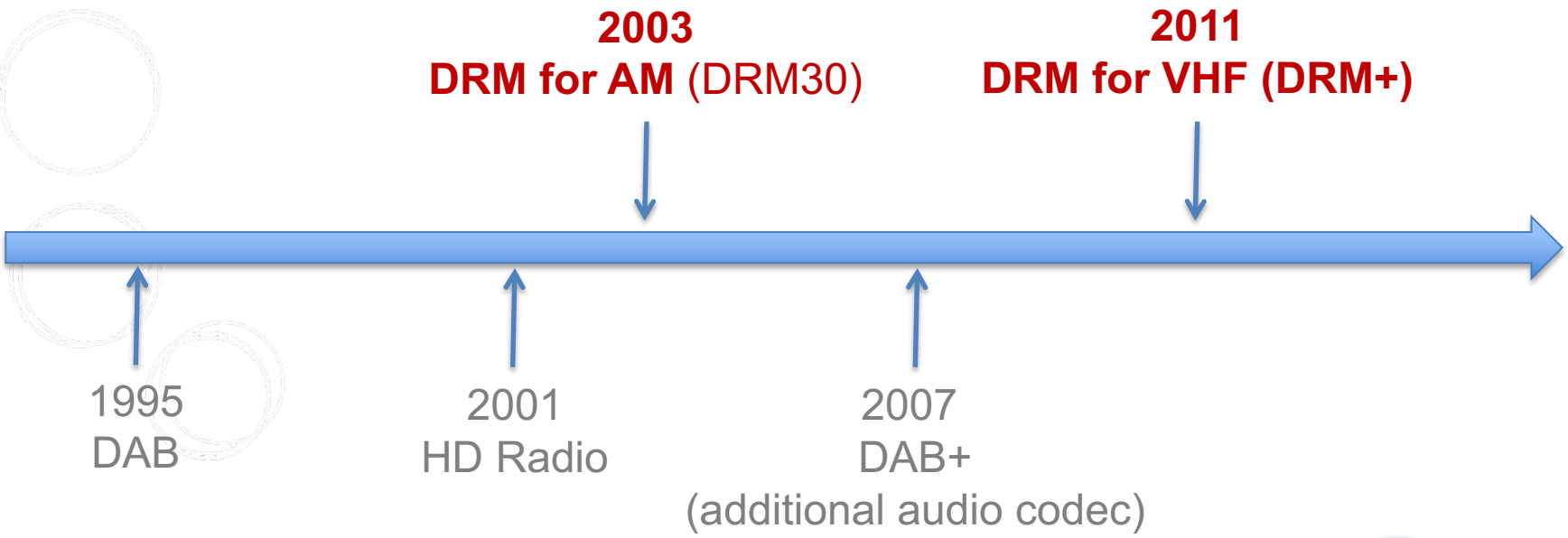
DRM for medium/large area coverage (AM bands)
(or LW, MW, SW) – the AM bands

DRM



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

DRM is the most recent ITU confirmed Digital Radio Standard



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** in 2003
  - **Endorsed by the ITU** in 2002
- **Worldwide spectrum compatibility:** 9/10, 18/20 kHz bandwidth
- **Flexible configuration**: robustness ←→ coverage ←→ transmission power
- **Useful content bit rate:** up to 72 kbps
- **Covers large areas using a single frequency:** good for rural coverage and on the move
- **Significant Cost Savings:** Green and energy efficient

DRM for Regional, Local Coverage (VHF Bands)

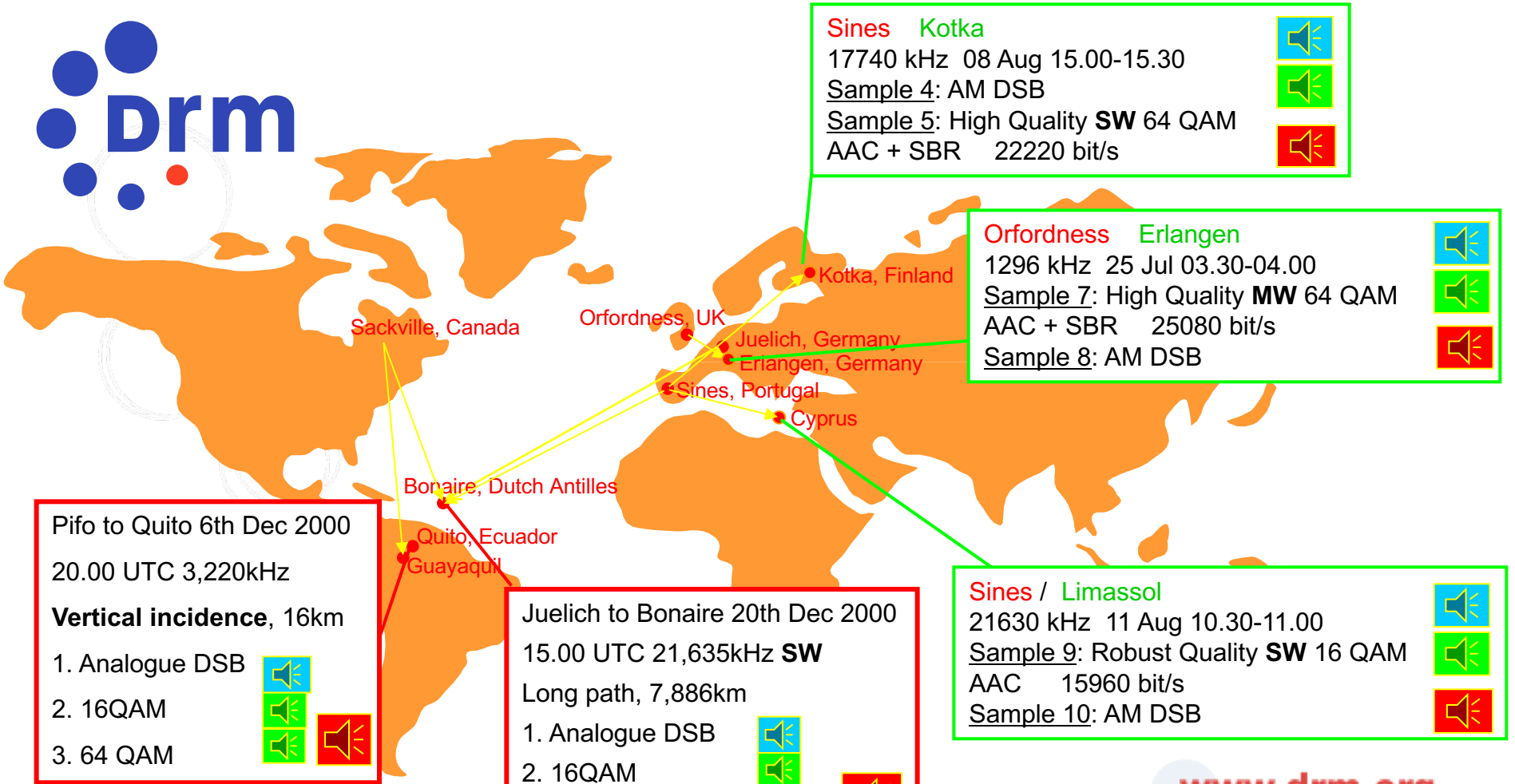
- **Most recent** global digital radio standard in **all the VHF bands: Band I, Band II** (FM-Band)**, Band III**

- **Endorsed by the ITU** in 2011
  ITU-R Rec. BS.1114 (system),
  ITU-R Rec. BS.1660 (planning parameters)
- **ETSI standard ratified** in 2011
- **Worldwide spectrum compatibility:** 100 kHz bandwidth (half of FM)
- **Useful content bit rate:** 37—186 kbps
- **Flexible configuration**: robustness ←→ coverage ←→ transmission power
- **Significant Cost Savings:** Green and energy efficient
- Transition path for **established FM networks**

DRM Key Features

- **More choice** for listeners
  - Up to 3 programmes + multimedia on 1 frequency
  - Simulcast analog / 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

Why Digital Radio Mondiale?
Audio Quality Demonstration (AM)



Sines Kotka
17740 kHz 08 Aug 15.00-15.30
Sample 4: AM DSB
Sample 5: High Quality **SW** 64 QAM
AAC + SBR 22220 bit/s

Orfordness Erlangen
1296 kHz 25 Jul 03.30-04.00
Sample 7: High Quality **MW** 64 QAM
AAC + SBR 25080 bit/s
Sample 8: AM DSB

Pifo to Quito 6th Dec 2000
20.00 UTC 3,220kHz
Vertical incidence, 16km
1. Analogue DSB
2. 16QAM
3. 64 QAM

Juelich to Bonaire 20th Dec 2000
15.00 UTC 21,635kHz **SW**
Long path, 7,886km
1. Analogue DSB
2. 16QAM
3. 64QAM

Sines / Limassol
21630 kHz 11 Aug 10.30-11.00
Sample 9: Robust Quality **SW** 16 QAM
AAC 15960 bit/s
Sample 10: AM DSB

www.drm.org

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DRM Key Features

- **More choice** for listeners
  - Up to 4 programmes on 1 frequency
  - Simulcast analog / digital
- **Excellent audio** quality
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Analogue vs. Digital Sound

Recently two recordings have been made of the same BBC news programme broadcast simultaneously to two countries far apart:

a. One transmission was in **analogue AM (SW)** to Nairobi
b. One transmission in **DRM digital AM (SW)** to Austria (Vienna)

Here are the examples of the received sound quality in each of these two countries:

a. Analogue AM

a. DRM digital

DRM on AIR

Content example from
AIR Bengaluru:

Live Monitoring Access
to DRM Broadcast Content
on MW over the Internet!

→ **xHE-AAC** audio
with web streaming
→ **Journaline**
→ Text Messages
→ Dynamic Reconfigurations

Experience yourself on
www.airbengaluru.com

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

MOT Slideshow
programme accompanying images + animation

EPG – Electronic Program Guide
What's up now & next;
Search for programs and schedule recording

TPEG / TMC Traffic Information

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

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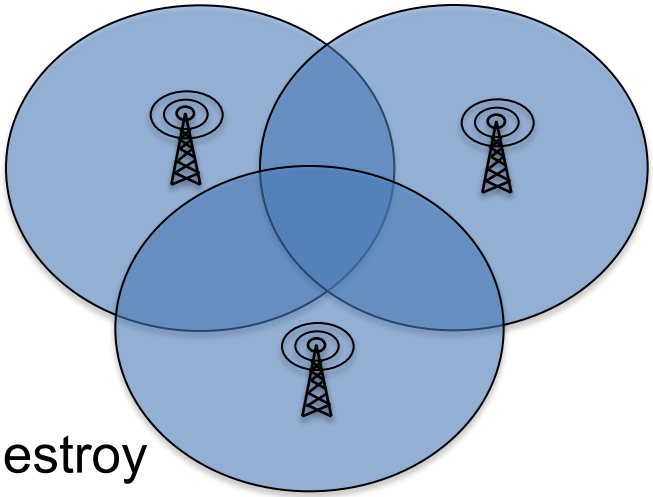
Single Frequency Networks (SFN) with DRM

- Two or more transmitter transmitting:
  1. The same content (same bit)
  2. At the same time
  3. On same frequency



Advantage for **Listener**:

- Signals from multiple transmitters no longer destroy signal (analog FM!), but rather improve reception
  → SFN Gain
- No distortions from reflections and multi-path anymore (guard interval)

Advantages for **Broadcasters**:

- Simple installation of gap-fillers
- Option to migrate from high-power single-tx to lower-power distributed coverage

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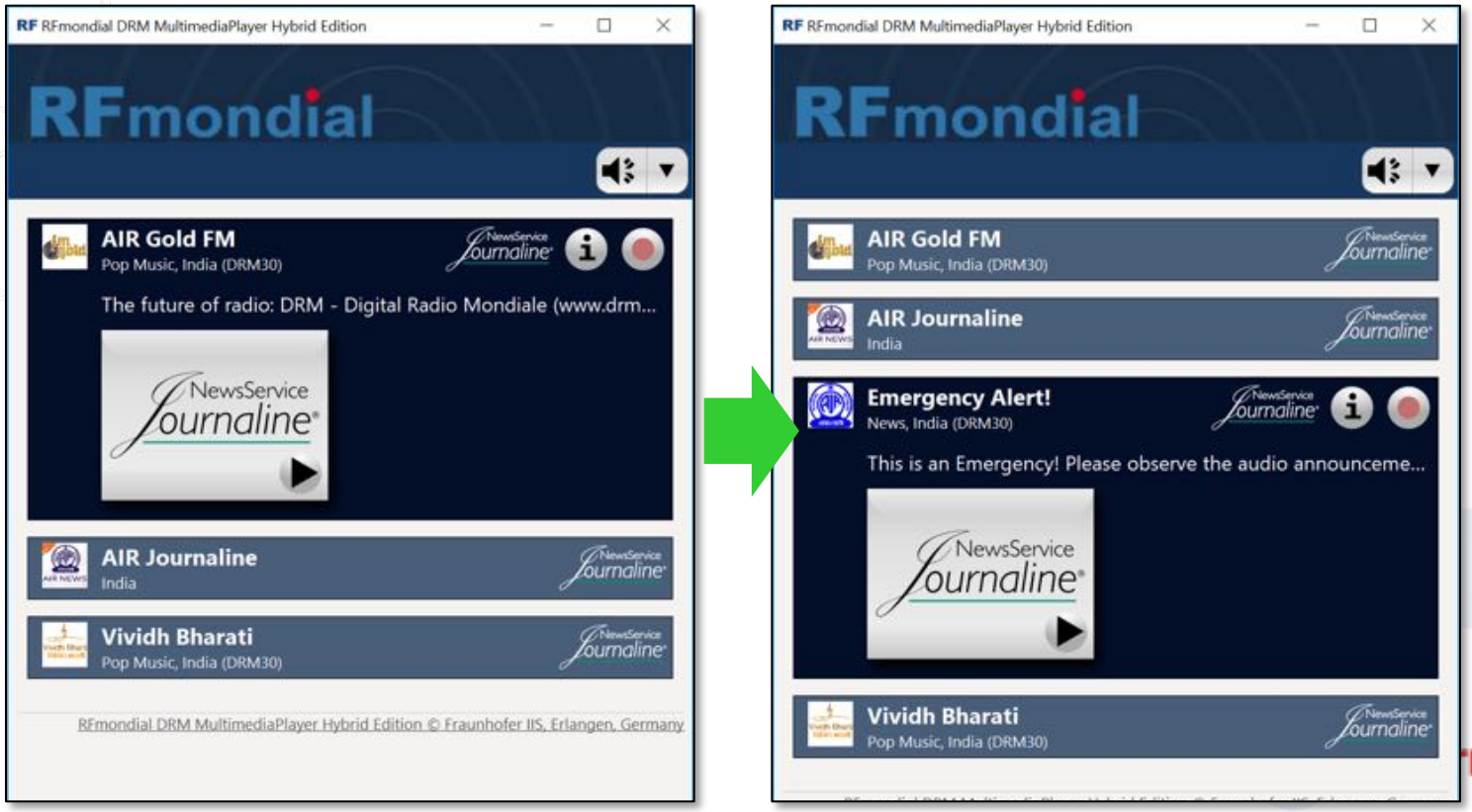
DRM EWF - Technology

- The **DRM Emergency Warning Feature (EWF)** is **mandatory** (see DRM Receiver profiles)
- **All components are part of DRM standard**
  No special chipset or 'extra' adaption is needed, but feature must be enabled in receivers!
- DRM should be the major building block of a **national emergency warning policy**
- DRM provides **full and continuous services** even from **remote transmitter sites**

DRM EWF Implementation

AIR has organized **DRM EWF Workshop** including NDMA/C-DOT, to launch integration of DRM network into national CAP based emergency alerting infrastructure



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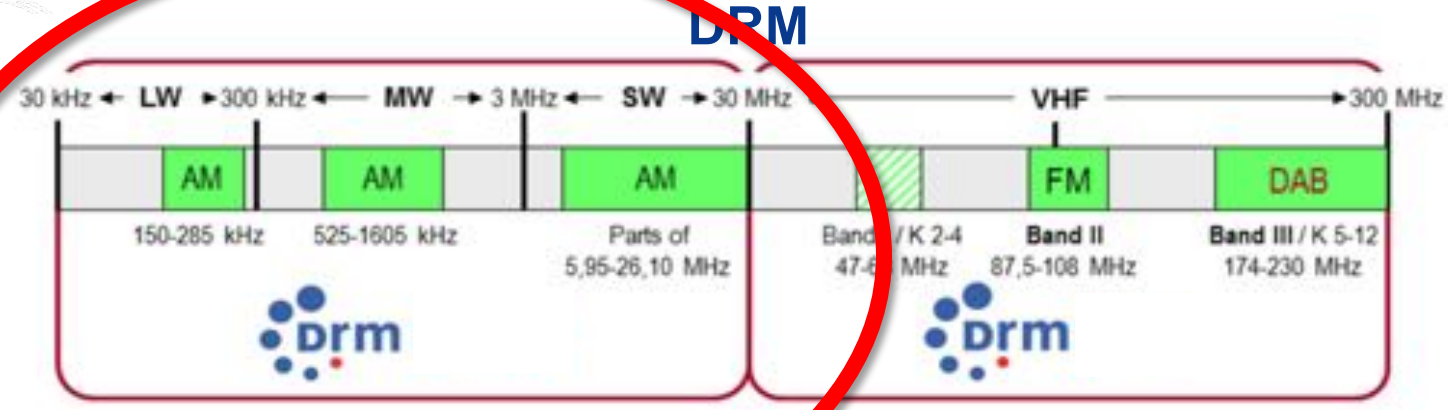


DRM Digital Radio standard – One single standard:
Same key features throughout

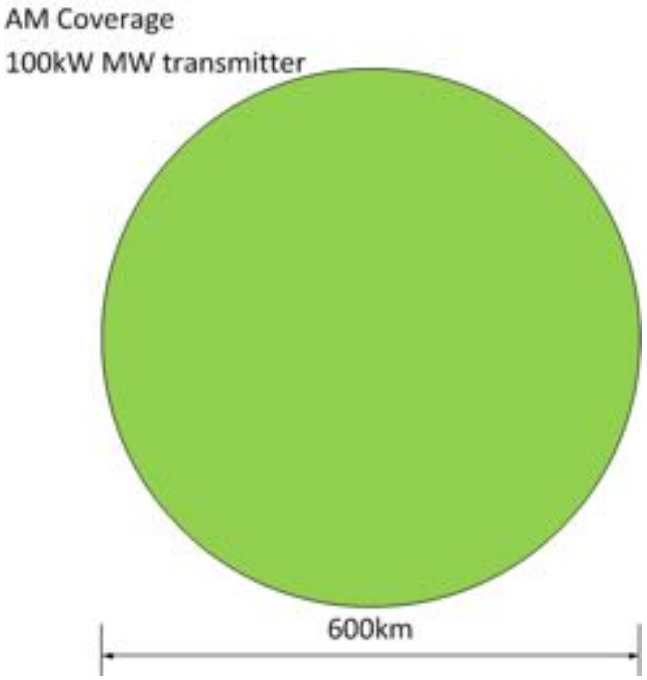
DRM for Large Area Coverage (AM Bands)

- 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
- **Flexible configuration**:
  robustness ←→ coverage ←→ transmission power
- **Covers large areas using a single frequency (SFN):**
  full-country coverage

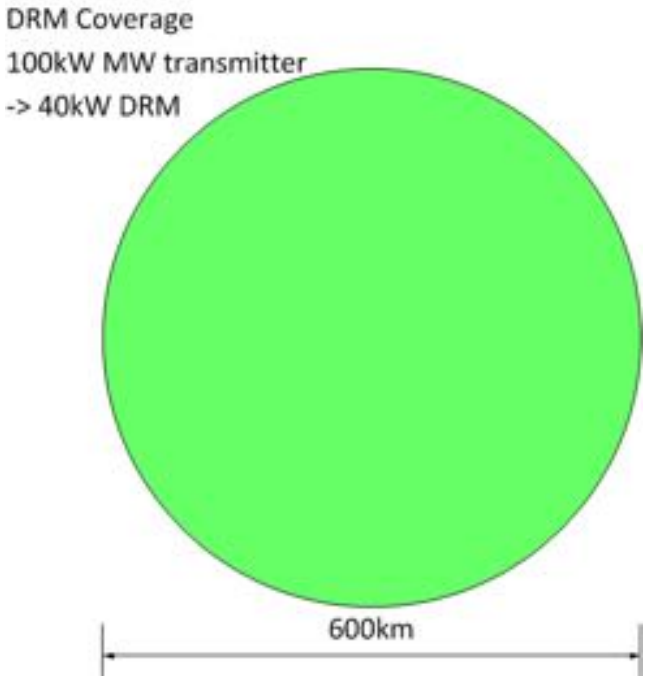
Coverage - AM analogue versus DRM

1 Analogue transmitter =
1 programme



235 000 km^2

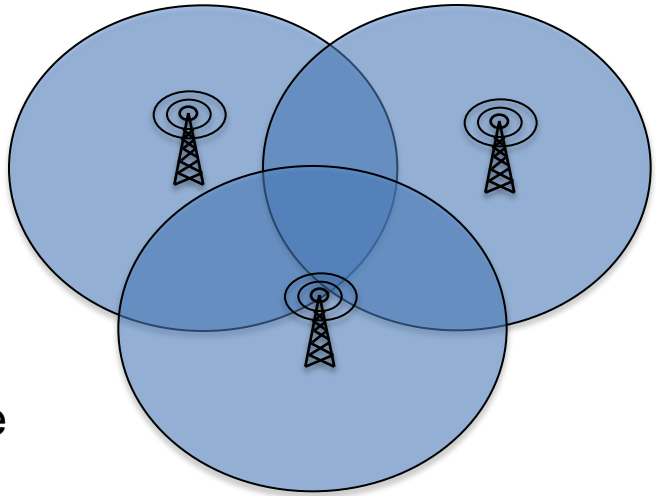
1 DRM transmitter =
Up to 3 audio programmes + multiple data components



235 000 km^2

Note: Conservative calculation! ITU suggests **20 kW DRM** for same coverage.

SFN – Single Frequency Networks with DRM



- Two or more transmitter transmitting:
  1. The same content (same bit)
  2. At the same time
  3. On same frequency

- Time synchronisation by GPS/GLONASS 1pps pulse
  Frequency synchronization by 10MHz reference from GPS/ GLONASS or other external source

Advantage for Receiver:

- Better reception even if no direct line of sight to transmitter, because RF signal from different direction (transmitter) available -> SFN Gain (!)
- No distortions from reflections and multi-path anymore (guard interval)

DRM for Large Area Coverage (AM Bands) – Conclusions

- DRM standard applied in the AM bands optimised system for **wide area coverage**
- **Simple AM to DRM upgrade path** (if equipment not too old):
  → no need for complete new infrastructure
  → secures long-term investment & existing transmitters
- Transmission **energy saving** (MW and SW example)
  more than **50%** compared to analogue AM
  (enabling **1–3 programmes** and **extra benefits**)
- **Lower cost** for maintenance and spare inventory

→ all new AM transmitters today are
analogue & DRM broadcast ready

DRM in VHF Bands

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(Band I, II – FM band, III)

30 MHz

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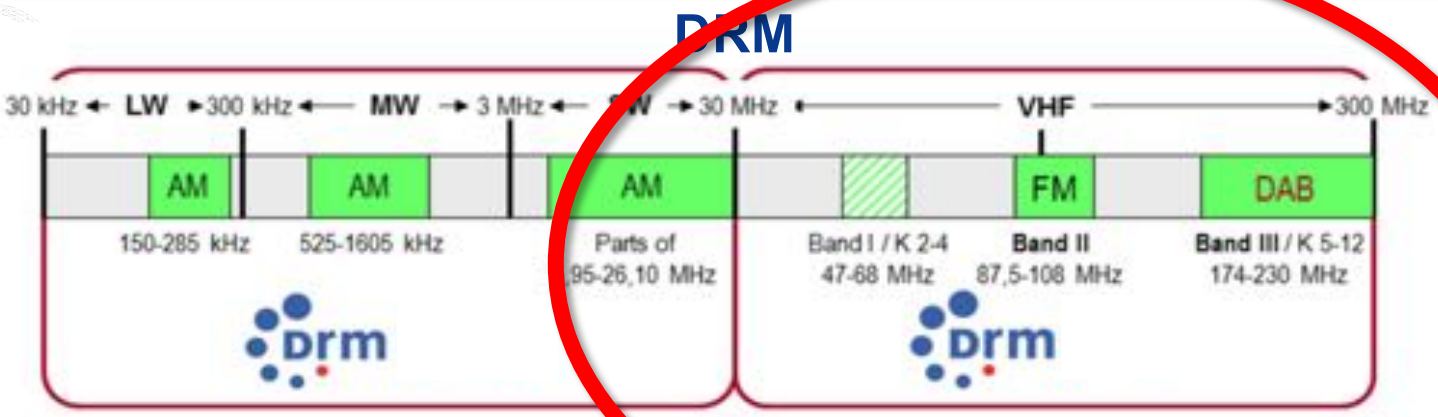
(or LW, MW, SW) – the AM bands



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

DRM for Regional Local Coverage (VHF Bands)

- **Most recent** global digital radio standard in **all the VHF bands: Band I, Band II** (FM-Band)**, Band III**

- **Endorsed by the ITU** in 2011
- **ETSI standard ratified** in 2011
- **Worldwide spectrum compatibility:**
  96 kHz bandwidth (half of FM) – for up to 3 programmes!
- **In VHF band-III** (1.5 MHz spectrum)**:**
  Up to 15 DRM transmissions → up to 45 programmes!
- **Flexible configuration**:
  robustness ←→ coverage ←→ transmission power
- Transition path for **established FM networks**

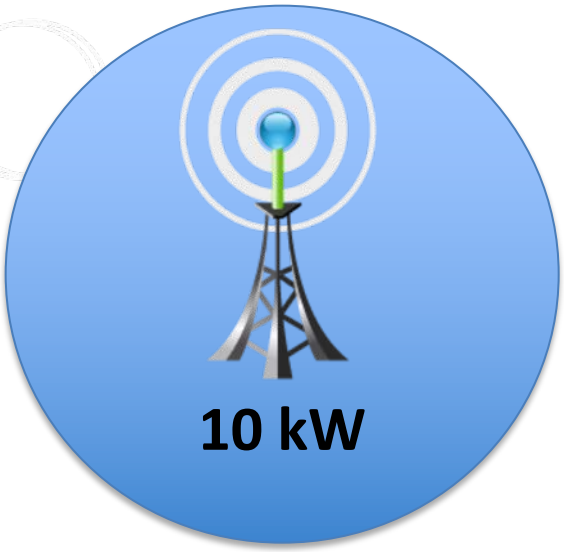
Coverage of DRM in VHF Band / FM

Assumption:

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

FM 1x

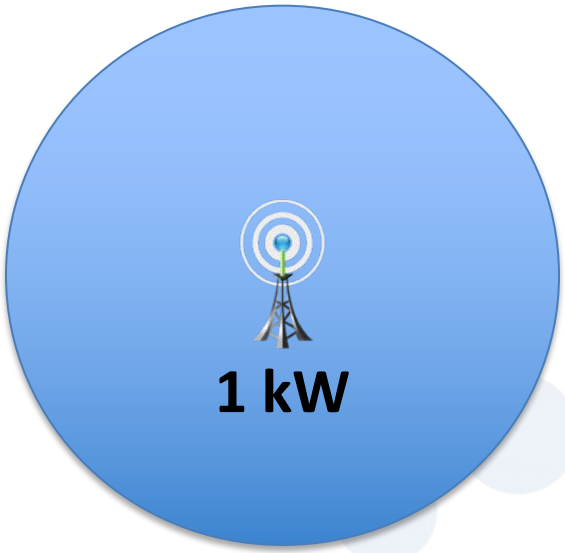
at 200 kHz bandwidth



10 : 1 power

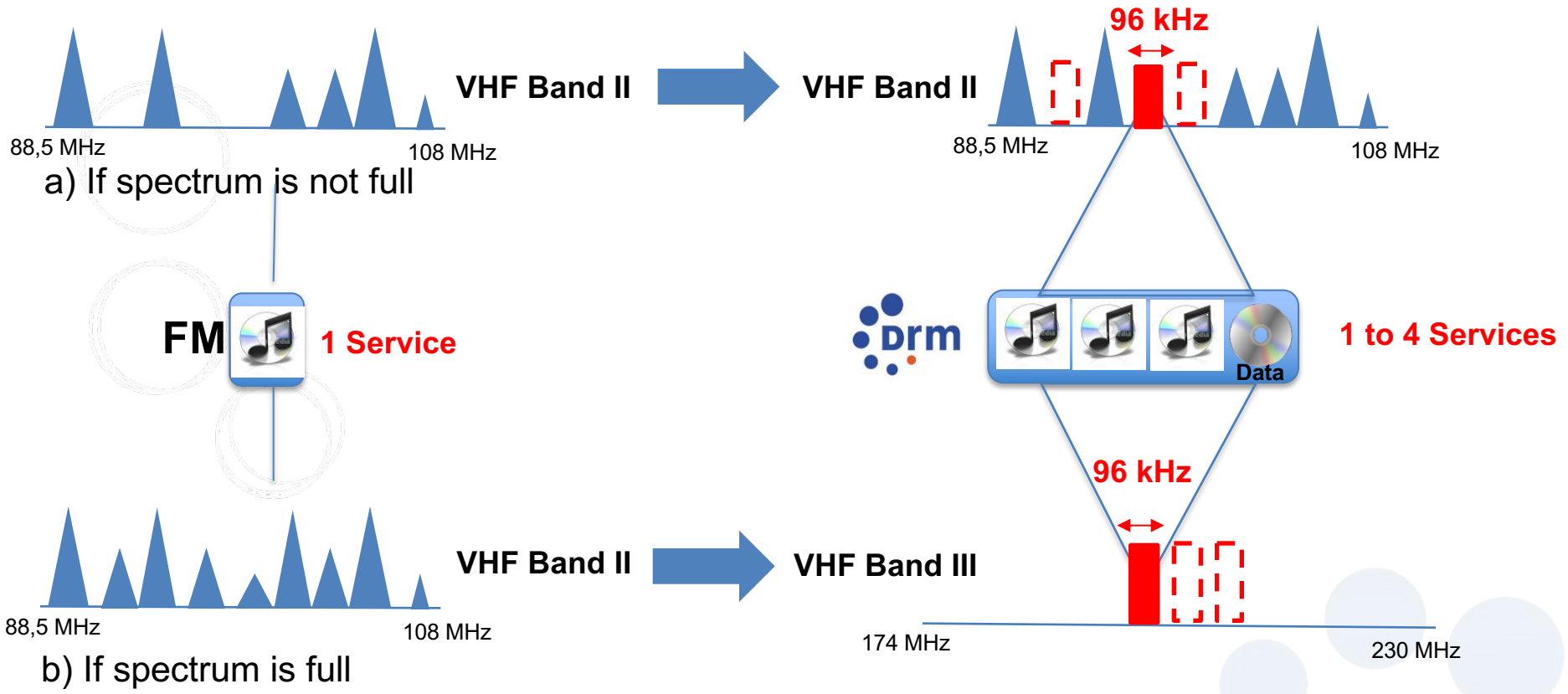
DRM 3x

at 96 kHz bandwidth



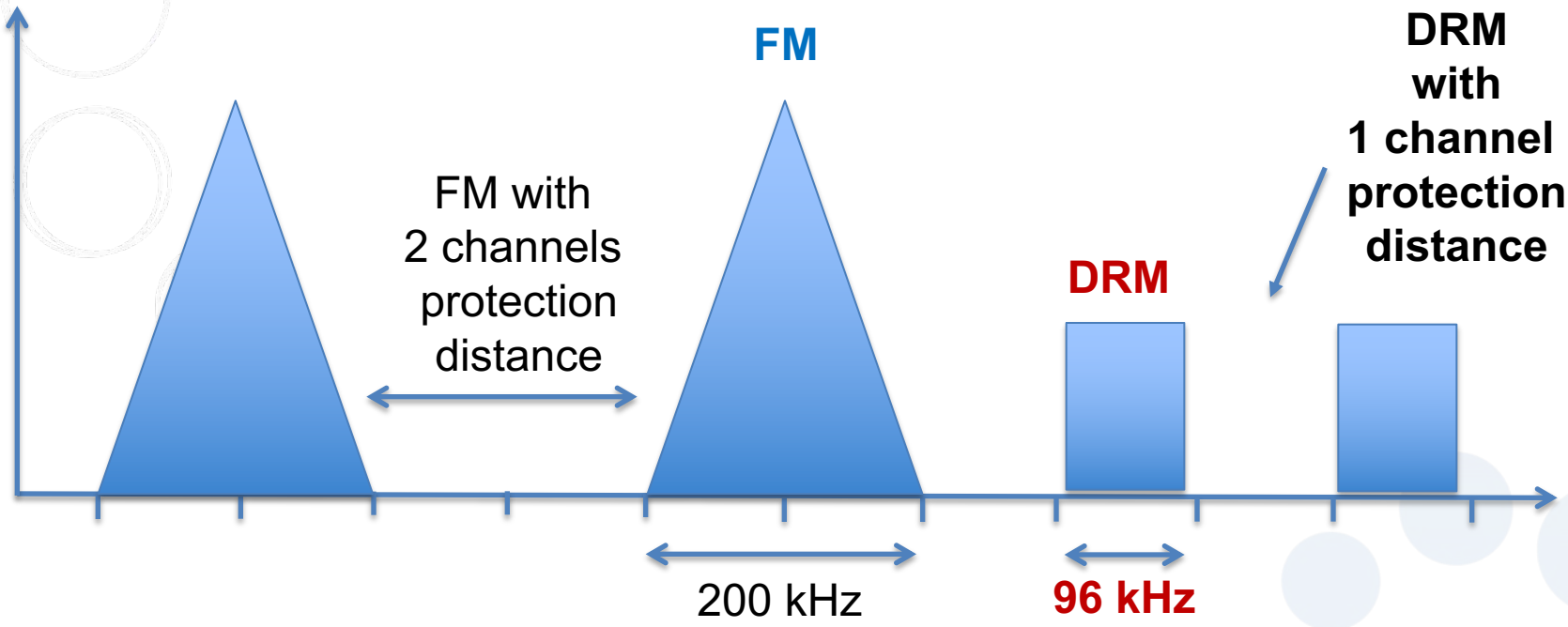
Migration Scenario for DRM (VHF Band)

DRM in VHF is flexible for different spectrum situations using VHF Band I, II and III



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!)



Typical Generic Cost Scenario – High Power

Scenario: network with 10 tx sites	FM replacement	DRM on existing FM site	DRM upgrade
Power level (TX)	**10 kW**	**1 kW**	
Transmitter	$ 40.000	$ 20.000	$ 10.000
Mask Filter	$0	$ 1.000	$ 1.000
Cooling System	$ 5.000	$ 2.000	$ 0
Antenna & RF Line, Installation	Exists	Exists	Exists
TX Installation	$ 5.000	$ 2.000	$ 2.000
Total site cost (per site)	**$ 50.000**	**$ 25.000**	**$ 13.000**
Head-End (1x for network)	$ 0	($ 20.000)	($ 20.000)
No. of programs	1	3	3
Cost per programme & site	**$ 50.000**	**$ 8.300**	**$ 4.300**

GATESAIR

Energy Costs – High Power

- Energy is stated as largest position of Operational Costs for Broadcaster
- **DRM with significant energy costs savings !**

Transmitter	FM	DRM
Power	10 kW	1 kW
Efficiency	72 %	50 %
Energy consumption per Transmitter	13.9 kW	2 kW
Annual Energy Bill per Transmitter	18 250 USD	2 640 USD
Programmes per Transmitter	1	3
Annual Energy Bill per Programme	**18 250 USD**	**880 USD**

Assumes 0.15 USD per kWh

GATESAIR

Reduced Service & Operational Costs with DRM in FM band

9 x FM Transmitter @ high power

3 x DRM Transmitter @ low power

→ **Significant savings in Service & Operation with DRM compared to FM !**

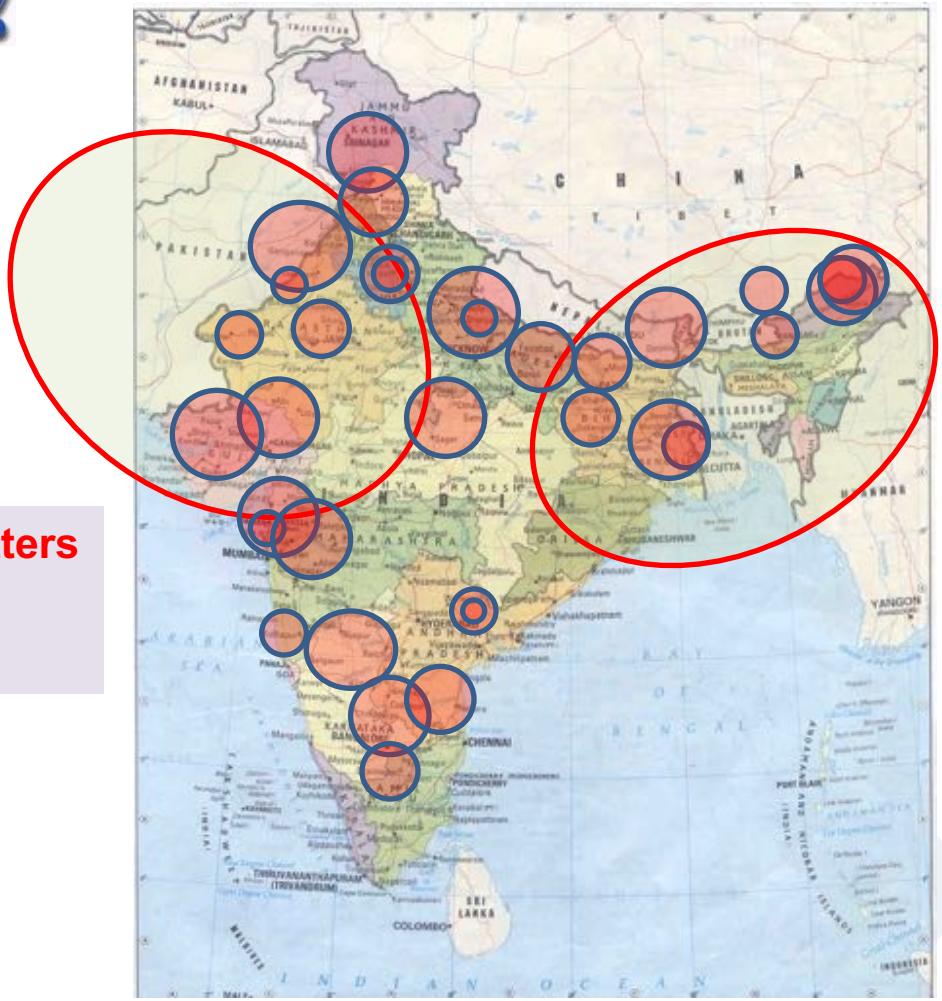
GATESAIR

DRM in the World
Some Key Countries

- India
- Indonesia
- Bangladesh
- Pakistan
- Southern Africa
- Brazil
- Russia

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 – 4 transmitters
500 kW - 1
250 kW - 1
100 kW - 2

Transmitters	**39**
Investment	**Over 3 Billion INR**
Power	**8,000 kW**
Coverage	**0.6 Billion people**

India DRM Roll-Out Progress over past year!

- **Latest DRM ContentServers** installed by AIR for MW (5 in metros)
- **Improved DRM audio quality** (xHE-AAC, studio-side encoding)
- Full set of **DRM data features on MW** (Journaline, logos)
- National Register for **DRM service ID** established
- Kick-off for **DRM-EWF integration** in national CAP alarm system
- Lots of **new car models with DRM reception** as line-fit feature
- TRAI has released recommendation for **digital radio services in FM band**

drm DIGITAL radio mondiale

India DRM Implementation

Phase 1: Completed – transmitters on the air
(600 million people covered)

Phase 2: Now started:
- full service specification
- audio quality & extra features (Journaline, logos)
- communication, marketing, links to the industry

Phase 3: Full digital services on all transmitters
→ analogue switch-off, receivers widely available,
DRM also for the FM Band established

TRAI Recommendation on Digital Radio Broadcasting in FM Band

Biggest advantage of digital: **More choice and spectrum savings**

TRAI

- **NO affect to analogue FM** services
- Auctioning of **free spectrum gaps** in VHF-II band for providing digital radio broadcasting services
- **Financial incentives** for receiver manufacturers

DRM in AM Trial in South Africa (Radio Pulpit)

South African Executive Summary

(ITU submitted Sep 2017)

Radio Pulpit initiated a DRM in AM trial broadcast with support from Broadcom International, BBC and Sentech Ltd. The DRM test transmission was conducted in Pretoria, South Africa during the period September 2014 up to October 2015.

DRM Measurements were conducted successfully on 1440 kHz using a 10 kW DRM30 transmitter.
Two low profile antennas were used in the trial and both were capable to provide good signal coverage.

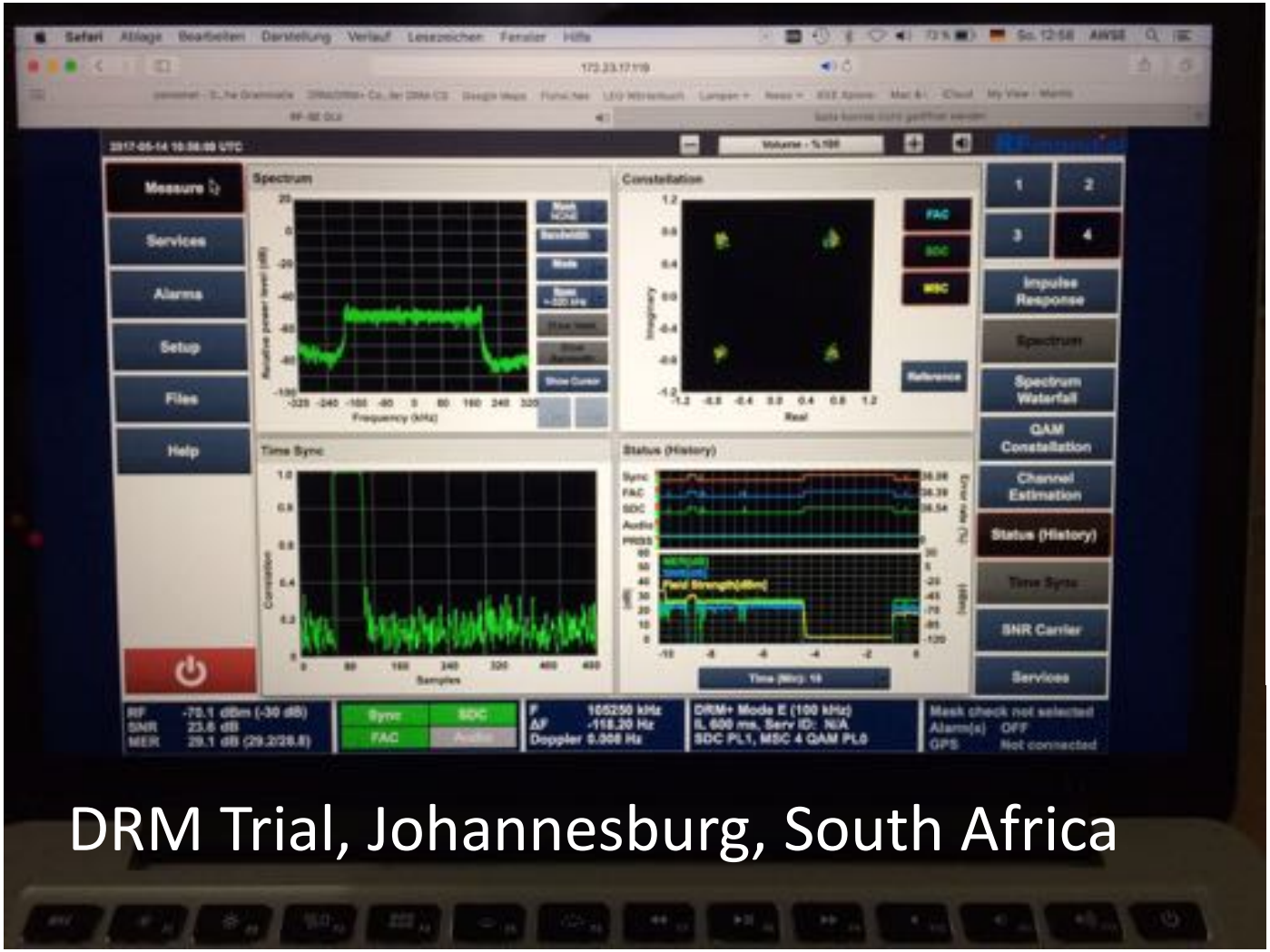
The DRM30 signal performed better than the analogue AM signal with regard to coverage area for the same transmitter power.

- **Full results out in February 2017**:

http://www.drmsa.org/images/pdfs/SEN_RFN_REP_MEASM_DRM30_RADIO_PULPIT_FINAL_REPORT_V1_04.pdf

DRM for Local Coverage Project (FM) – First Time Tested in Africa

- Kofifi/Wecodec in Johannesburg – “community station”
- DRM trial started in **March 2017** while SA deciding on standard and giving the lead to SADC and Africa
- Interim report available – to be finalised
- National policy in preparation
- ICASA consultation paper out **April 2018**



DRM Trial, Johannesburg, South Africa

WECODEC
the westbury community development centre
IT 4455/00

drm

Interim Report of a DRM Mode E Trial in South Africa

V1.4

Release Date: 08 July 2017

Project Partners:

Kofifi Media Group, Roodepoort, South Africa

BluLemon, Edenvale, South Africa

CR Electronics, Springs, South Africa

Genssoft Technologies, Midrand, South Africa

BBC World Service, London, UK

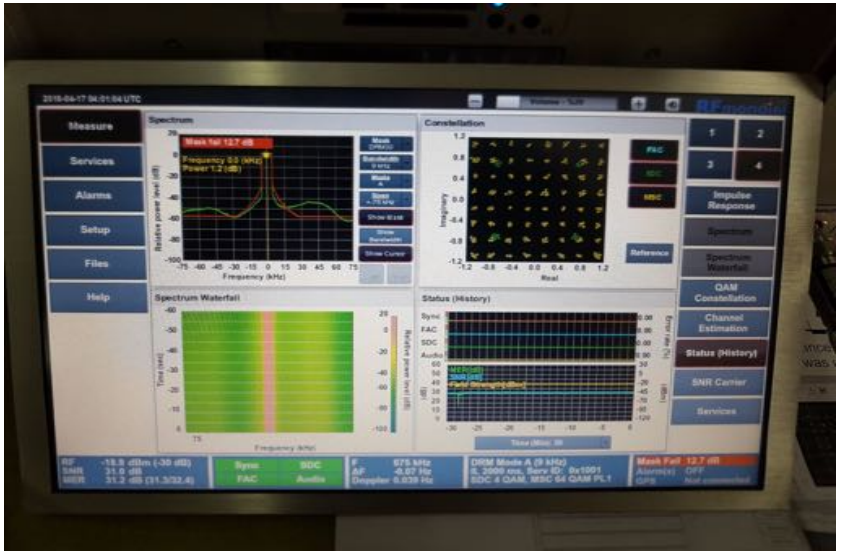
Fraunhofer IIS, Erlangen, Germany

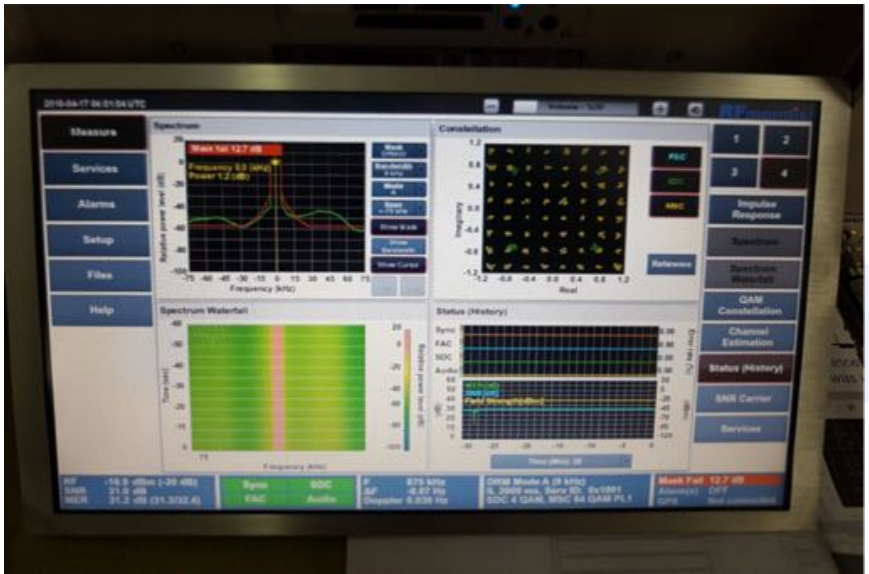
Interim Report

www.drm.org

Other Countries – Vietnam

Voice of Vietnam, tested DRM on medium wave on April 16th and 17th on MW 675 kHZ from transmitter 30 kilometres outside Hanoi. On one single (analogue) frequency three audio channels were broadcast (VOV1, VOV2 and VOV3), as well as some data.





Indonesia

April 2015 – RRI trial and workshop at **Bogor/ DRM in mediumwave**

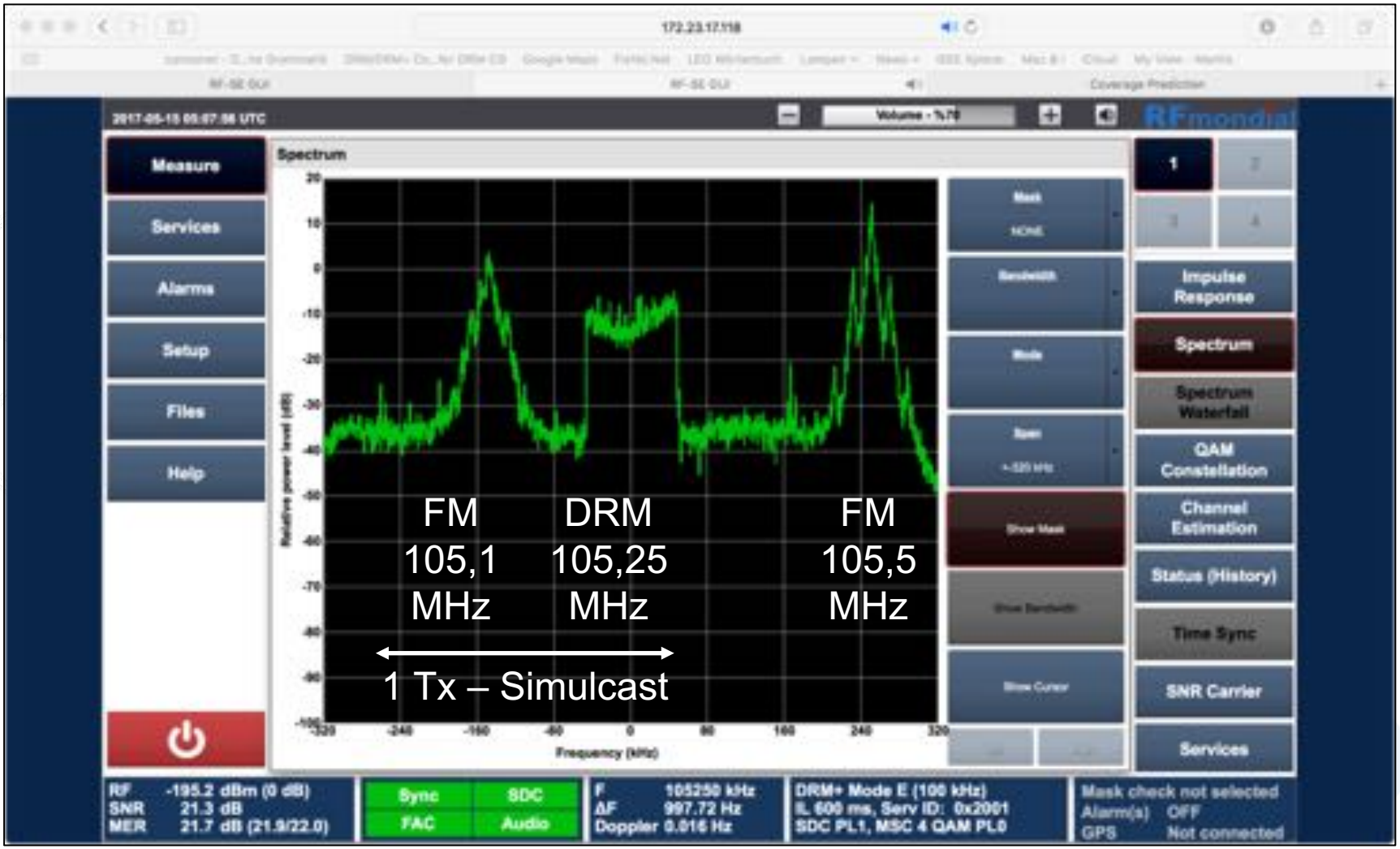
Oct 2015 **RRI signs a cooperation agreement** with the DRM Consortium to promote the technology

Oct 2015 **RRI becomes a DRM Consortium member**

Oct 2016 RRI **DRM for AM trial in Bali**

May 2017 RRI **DRM for FM trial in Batam – report submitted to ITU – out in 2018**

DRM for VHF in Batam 2017



DRM for VHF in Batam RRI Project – Measurement Field Trip Conclusion

- Simulcast analogue FM and DRM transmission 
- No disturbance to neighbouring FM stations 
- Good mobile and indoor reception 
- Large coverage area in DRM mode 

Other Countries

Major recent developments in:

- China (international & national services)
- Russia (local coverage; SW tests)
- Kuwait (full DRM setup)
- Saudi Arabia (full DRM setup)
- USA (Coast Guard)
- Germany (Navy)
- New Zealand (Pacific Islands services)
- Romania (worldwide services)
- United Kingdom (intl. services)
- African Countries
  (Nigeria, Algeria, Morocco…)
- …

DRM Receivers in Cars

"The work and tests which have been carried out highlight that DRM in India is a reality and that the **auto industry is at the forefront of the Indian digital radio**"

Bob Paul Raj, Hyundai Mobis

Hyundai – cars fitted with DRM radio

Elantra
July 2016

Tucson
Nov 2016

Grand i10
Jan 2017

Xcent
April 2017

Verna
Aug 2017

Elite i20
Launched in Feb 2018

Maruti IGNIS *Has line-fit DRM Receiver*

Maruti

Ignis - The top variant Maruti Ignis Alpha has on board DRM receiver

S-Cross - 3 variants has on board DRM receiver

Maruti S-Cross Alpha
Maruti S-Cross Zeta
Maruti S-Cross Delta

Mahindra TUV 300 *Has line-fit DRM Receiver*

Mahindra

TUV300 – DRM

Exclusive feature in the TUV300. The TUV300 is equipped with the latest digital Radio which is DRM (Digital Radio Mondiale) compliant .

Receivers – Cars

Gospell from China have developed a cost-effective after-market car device with the complete DRM standard as well as DAB+, analogue AM and FM

It has been showcased at the recent BES Expo and Conference in Delhi

DRM Stand-Alone Receivers & Solutions

Avion AV DR1401

Full DRM feature set

Titus II

GOSPELL® GR-216 Radio Receiver

New generation of low cost DRM high quality and performance receiver

- DRM for AM & FM bands
- AM, FM analogue
- xHE-AAC Stereo
- Journaline advanced text
- EWF – Emergency Warning
- USB record and play back
- High quality full range speaker
- Large LCD display

DRM Receivers – desktops

Titus II –
SDR receiver by Titus SDR

- MultimediaPlayer Radio App on Android tablet
- Support for DRM (AM and VHF), DAB(+), FM (with RDS), AM (with AMSS)
- Full DRM feature set: Journaline, EWF, Slideshow, EPG/SPI, …

- Fine tuning being done → **Manufacturer ready for local partnerships**

DRM Receiver Chipsets – Enabling Local Receiver Designs

New Generation of Chipset and SDR Solutions Brings Radio on all Frequencies to Cars and Devices

Fraunhofer IIS

NXP

ANALOG DEVICES

Parrot

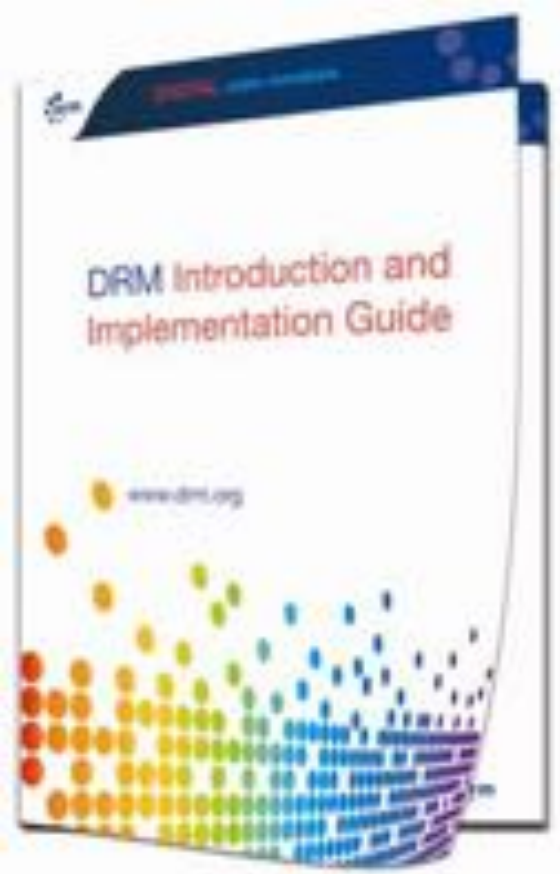
PnpNetwork Technologies Inc

All you need to know about DRM Digital Radio

DRM Handbook

New Version 3!

Free download from: www.drm.org



DRM e-Book – 2018 now available

https://nbmedia.wufoo.com/forms/z1n9yz730

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projectoffice@drm.org

… and now let's address your case and questions