

# How Will Digital FM Transform FM Radio Broadcasting: Suggested Way Forward

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## abstract

This paper addresses the introduction of digital radio in the FM band, without disturbing the on-going analogue FM radio services. It discusses the watershed transformation that will take place in FM radio broadcasting business and industry with the introduction of digital FM in a country.

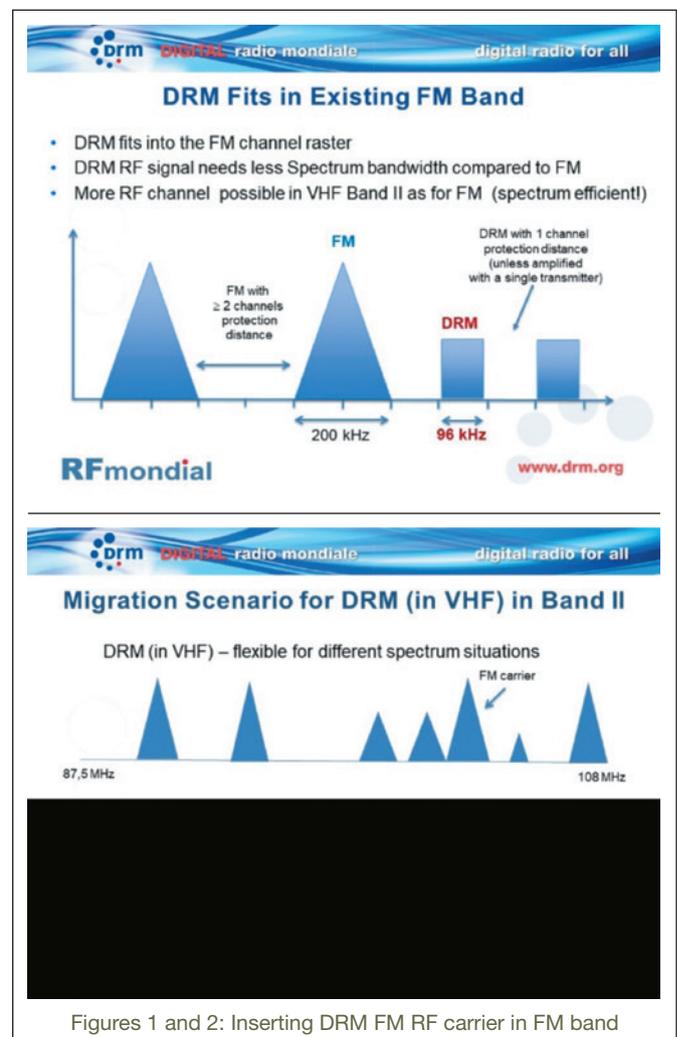
Technology developments in digital radio now enable seamless introduction of digital radio in the FM band without disturbing the on-going analogue FM radio services. With the introduction of digital FM radio, a watershed transformation will take place in the FM radio broadcasting business and industry. This paper considers many of these aspects and offers several suggestions as a possible approach to set up DRM digital FM radio broadcasting in the FM band where there are on-going analogue FM radio transmissions.

## DRM FM Considerations by Regulators and FM Radio Broadcasters

In many places such as in capital cities and other large cities, existing frequency spectrum in the FM band is highly congested. It has been clearly established that even in these situations, DRM FM digital radio services based on the open ITU endorsed Digital Radio Mondiale technology<sup>1</sup> can be operated without impacting the ongoing analogue FM services, as shown through field trials in Batam in Indonesia, Johannesburg in South Africa, Edinburgh in the UK, et al<sup>2</sup>.

It has been positively demonstrated that the DRM digital FM transmissions can be inserted in the guard-bands between two analogue FM radio carriers without disturbing (or impacting in any way) operation of the ongoing analogue FM radio services. It can be emphasised that in any proper introduction of DRM FM in analogue FM spectrum (say in big cities), there will be no adverse impact on the ongoing services in that band.

It has also been established that each of the 96 kHz wide DRM FM transmissions can provide up to three high-quality stereo radio services plus text and multimedia components



<sup>1</sup> For more information see the DRM Consortium's web site: [www.drm.org](http://www.drm.org)

<sup>2</sup> Please see the Annex at the end of this document.

among other advantages, three radio services provided by DRM digital FM can be employed to reduce the prevailing congestion in the FM band existing in major cities and to allow broadcasters to diversify their target audience.

in other countries.)<sup>3</sup> Existing FM radio stations with FM transmitters of recent vintage can in many cases be used for DRM FM digital radio with only minor modifications. This leads to the conclusion that virtually all those FM transmitter sites can accommodate the DRM digital FM signals with very limited or even no additional transmitter infrastructure investment for adding DRM digital FM services at those locations. In other places, maintaining the analogue FM transmitters un-touched while adding a small-power DRM digital FM exciter (providing the same or larger coverage) with antenna combining will be the most economical way to upgrade to DRM FM digital radio.

It may also be pertinent to use low-power DRM FM digital radio to replace those analogue FM radio stations operating at the top edge of the FM band to effectively avoid interfering in sensitive services, such as near airports.

## Suggestions for Implementation by Regulators and FM Radio Broadcasters

Keeping the developments stated above in mind, it may be a good time to set up one or more pilot DRM FM digital radio broadcasting services in countries wanting to test or adopt this technology.

The following steps are suggested for consideration:

1. The National Regulator may initiate a study to verify the efficiency and effectiveness of DRM FM digital radio broadcasting in major towns, also to determine how DRM FM digital radio can reduce congestion and interference in the currently existing FM analogue transmissions.
2. The Regulator may consider setting up an 'All Stakeholders Group' to verify the advantages provided by DRM digital FM broadcasting in the currently obtained FM band, with the participation of all existing FM broadcast stakeholders. The objective would be to supervise the setting up of one or two DRM FM radio pilot broadcasting stations in large cities.
3. The Regulator may consider assigning frequency slots (100 kHz wide DRM slots in the FM band) for these two DRM digital FM pilot transmissions according to the published ITU planning parameters<sup>4</sup> for DRM digital FM radio broadcasts. There would be no need to make any changes to the existing FM analogue frequency channels.
4. As DRM FM radio broadcasting according to the ITU planning parameters requires substantially less EIRP for the same coverage (compared to analogue FM) and does not contribute to any additional interference, accommodation of DRM digital FM frequency slots will not pose any problems.
5. The Regulator may also consider identifying other operating parameters for these two DRM digital FM pilot broadcasting stations.

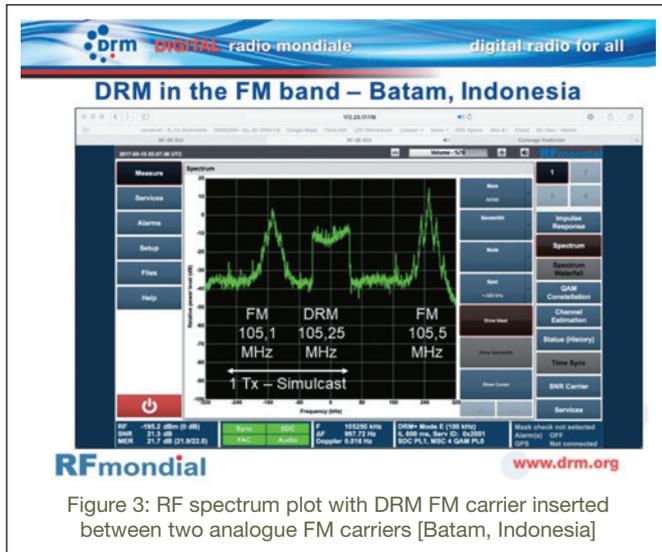


Figure 3: RF spectrum plot with DRM FM carrier inserted between two analogue FM carriers [Batam, Indonesia]



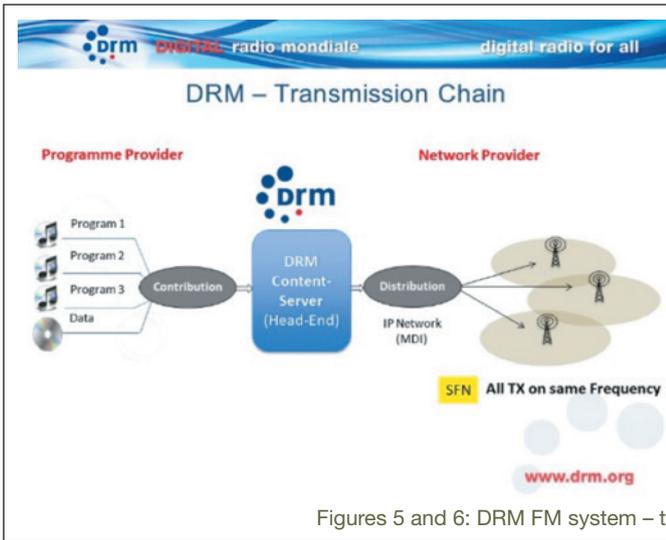
Figure 4: RF spectrum plot of DRM FM carrier [Johannesburg]

In fact, the additional channels offered by DRM FM digital radio can be utilised to meet growing channel requirements of the existing FM operators. Many of the national spectrum regulators are considering the possibility of further reducing the congestion in the FM band in major cities and towns. As such, these additional channels can be used to reduce pressure of FM analogue services on the FM spectrum, reduce or eliminate interference and at the same time provide good audio quality programmes.

It has been conclusively demonstrated that in many cases the current FM radio operators may be able to use their ongoing analogue FM service transmitting equipment for the newly added DRM digital FM service, including sharing site, combiner and antenna infrastructure, and in some cases even upgrading analogue FM exciters to simulcast operation. (This was very well demonstrated in the Batam DRM FM experiment in 2017 as well as in many similar field trials

<sup>3</sup> Please see the Annex at the end of this document.

<sup>4</sup> Document ITU-R BS.1660: <https://www.itu.int/rec/R-REC-BS.1660-7-201510-I/en>



### DRM in FM Band: Transmission System

Most important DRM signal parameters

| General Parameters     |                                                |
|------------------------|------------------------------------------------|
| Frequency Range        | 47 MHz to 254 MHz                              |
| RF Channel Bandwidth   | 96 kHz, conform to FM raster (100kHz nominal)  |
| Audio Coding           | MPEG xHE-AAC, MPEG4 HE-AAC (5.1 surround)      |
| Data Rate              | 37 kbit/s to 186 kbit/s (scalable)             |
| Modulation             | COFDM, 216 carrier                             |
| Sub-Carrier Modulation | 4 QAM / 16 QAM                                 |
| Transmission Power     | -8 dB to -20 dB to coordinated FM Power        |
| Services               | Up to 3 services plus Multimedia (Audio, Data) |

www.drm.org

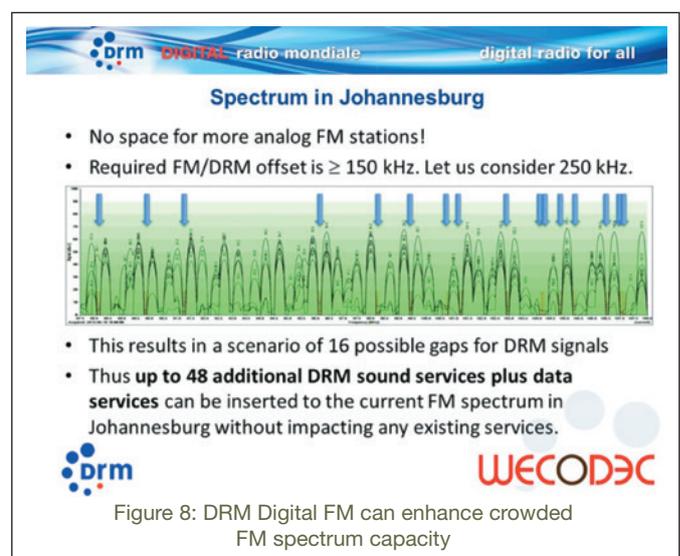
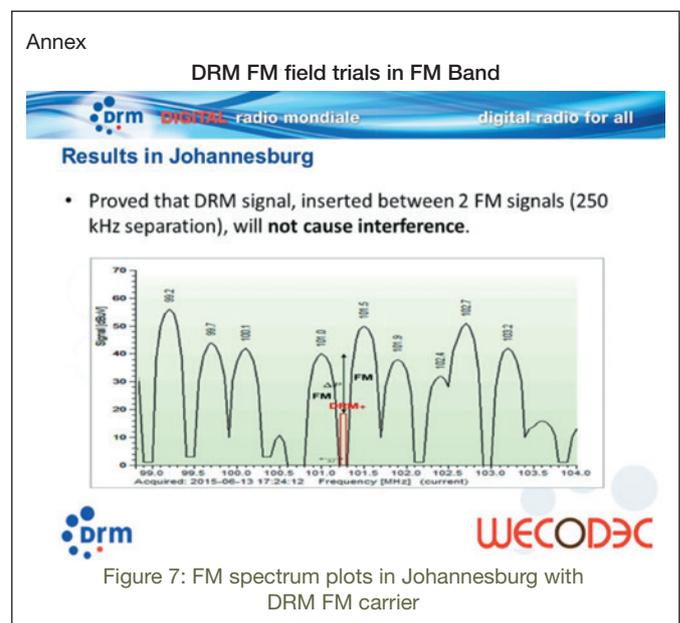
Figures 5 and 6: DRM FM system – transmission chain and signal parameters

6. As explained, the proposed DRM FM digital radio pilot broadcasting stations can make often use of the existing sites, transmission equipment and antennas. In this case, only two additional pieces of equipment are required for each DRM FM transmission station. These are:

1. DRM ContentServer (studio equipment to encode the digital DRM signal content)
2. Low-power DRM-ready Exciter with DRM Modulator

In fact, the DRM Modulator will often be a built-in part of the DRM Exciter already. This way we can insert the ready-made output signal of the DRM Exciter into the FM combiner, without the need to modify an existing analogue FM transmitter.

7. Procurement of the DRM ContentServers and DRM-ready Exciter will be required before the two DRM FM pilot services can be started.
8. With all the steps (1 to 7) in place, it is possible to start the two DRM digital FM radio pilot broadcasting services. (The regulator might require some assistance and guidance in setting up the pilot transmitting stations. It is possible to arrange this assistance in this regard e.g. with the DRM Consortium.)
9. As a next step, sufficient field measurements are required to assess the DRM FM radio transmissions. Also to verify absence of any interference in the ongoing analogue FM radio services. For this step a professional monitoring receiver with full support for DRM digital FM and analogue FM signals is to be procured.
10. DRM digital FM roll-out: For the following mass-market roll-out of DRM digital FM services, affordable digital consumer radio receivers are an important component. Various manufacturers have developed consumer receivers for DRM digital FM and are ready for mass-scale production; these include software based and tablet based digital radio receiver solutions. Several countries have already announced that the DRM digital FM standard will be used for digitising radio services in the FM band<sup>5</sup>. This movement is expected to grow.



<sup>5</sup> Russian Republic: <https://ria.ru/amp/society/20180911/1528303185.html>; South Africa Policy RfC: <https://www.doc.gov.za/newsroom/media-releases/communications-invites-comments-digital-sound-broadcasting-policy-directive>

<sup>6</sup> Source: DRM Handbook (Version 3): [http://www.drm.org/DRM\\_Handbook\\_2018.pdf](http://www.drm.org/DRM_Handbook_2018.pdf)

# authors

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Since 2000, Dipl.-Ing. Alexander Zink, MBA, has worked at the Fraunhofer Institute for Integrated Circuits (Erlangen, Germany) as Senior Business Development Manager Digital Radio and Streaming Applications.

Initially he developed the mobile and location-based information system UMIS (Universal Mobile Information System). From 2001 on he focused on the professional broadcast systems "Fraunhofer DRM, DAB ContentServer". Since 2002 he is project director for Journaline, an interactive text based information system for digital radio.

In addition he works in the fields of AudioServers, software defined radio, transmission protocols, technology development and standardization, and IP management and licensing.

For Digital Radio Mondiale (DRM) he acts as Vice-Chairman of the DRM Consortium and Vice-Chairman Technical Committee. In addition, he is an active member of the WorldDAB Technical Committee and various DAB and DRM work groups.

## Sharad Sadhu Media Specialist



Sharad's career in the media industry spans more than 50 years. He was the Director Technology of the Asia-Pacific Broadcasting Union till 2013. Sharad has previously worked as Director Engineering in Doordarshan-India, General Manager in TCIL and as Professor in the Film and TV Institute of India. Currently he is a Technical Consultant helping out in projects on digital TV and radio broadcasting, OTT and radio streaming, and on VoLTE in mobile phone industry.

He has received extensive exposure internationally in broadcasting technologies and spectrum regulation. He also served the ITU's WRC conferences in several capacities since 1988 and has contributed as a senior expert in many ITU projects, including for the ITU Akademie.

Sharad has authored a large number of papers on topics of current interest and has made presentations at eminent conferences in four continents.

His profile is available at: <http://sharad-sadhu-profile.weebly.com>

## ABU TECHNOLOGY CALENDAR OF EVENTS

### 2019

|                        |                                                                              |              |
|------------------------|------------------------------------------------------------------------------|--------------|
| June                   | Workshop on Satellite Technologies for Broadcasters                          | TBC          |
| 18-20 June             | BroadcastAsia2019                                                            | Singapore    |
| 8-12 July              | ABU-ASBU-AIBD WorldDAB Digital Radio Workshop                                | Kuala Lumpur |
| July                   | Regional Workshop on Radio Studio Automation                                 | TBC          |
| 15 August-13 September | ABU Technology Webinar Series                                                | Online       |
| 13-17 September        | International Broadcasting Convention 2019                                   | Amsterdam    |
| September              | Regional Workshop on OTT and IBB Technologies & Services                     | Kuala Lumpur |
| October                | ABU-AIBD-DRM Regional Workshop on Digital Radio 2019                         | Kuala Lumpur |
| 17 November            | ABU Technical Bureau Annual Meeting                                          | Tokyo        |
| 18-19 November         | ABU Technical Committee Meeting                                              | Tokyo        |
| 21-22 November         | ABU General Assembly                                                         | Tokyo        |
| 13-15 November         | Inter BEE 2019                                                               | Japan        |
| November               | 16th Iran Media Technology Conference                                        | Tehran       |
| December               | Training Course on Engineering Fundamentals for Broadcasters 2019 (ABU-AIBD) | Kuala Lumpur |