

Frequency planning approaches for DRM+ in VHF-Band III

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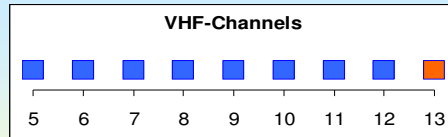


Subjects

- Resources and use of VHF-Band III
- DAB coordination (history)
- Proposal of a channel raster for DRM+
- Suggestion of a migration scenario
- Example of a reception scenario

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Resources and use of VHF-Band III



VHF Band:

- 8 + 1 Channels @ 7 MHz
 - total bandwidth = 56 MHz
 - Channel 13 can not be used everywhere in Europe

- Former use for TV, now DVB-T
- Now, spectrum is shared with DAB.
- New demand by DRM.



Frequency planning approaches for DRM+ in VHF-Band III

Assumption for use of DRM+ in VHF-Band III



The present use of VHF-Band III is indicated with:

- Digital broadcasting (DVB-T, DAB, DAB+) is agreed and coordinated by RRC'06.
- Germany may use tree layers for sound broadcasting (DAB)
 - Nation-wide layer,
 - State-wide layer and a
 - Regional layer.
- Furthermore, it is intended to use four additional DAB layers instead of DVB-T.

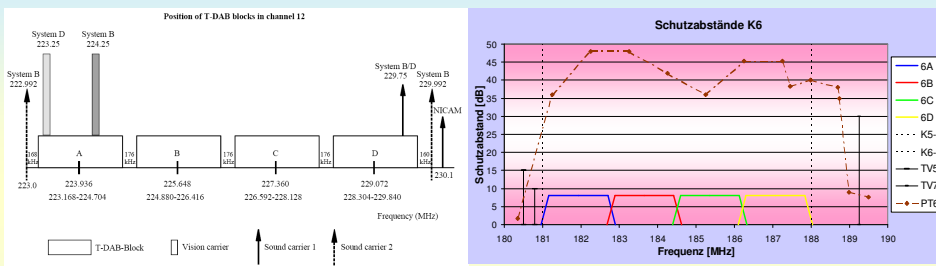
It is assumed that the use of VHF-Band III for DRM+ will be possible without serious problems if:

- the radiated DRM+ signal fulfills the coordinated parameters of DAB and/or DVB-T (i.e. spectrum mask, protection ratio) and
- the total power of a certain number of DRM+ programmes will not exceed the power limit of a coordinated DAB or DVB-T channel.

Subjects

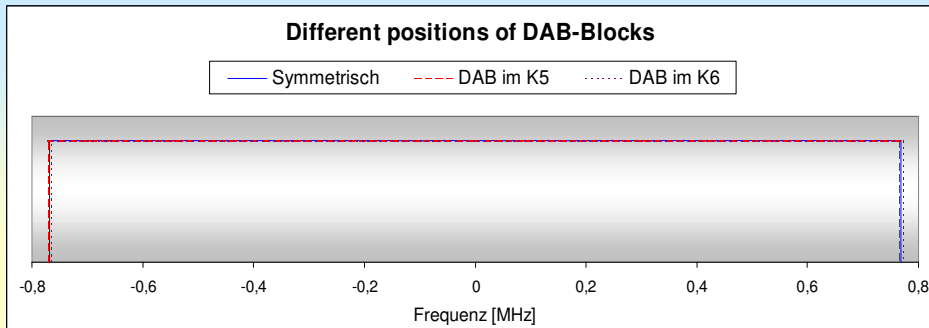
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Key-parameters for DAB coordination in VHF-Band III has been determined in the documents of Wiesbaden '95.



Key-features for DAB coordination:

- 4 DAB blocks are placed within a 7 MHz channel.
- Protection ratios are different depending on the spectral power of the TV signal.
- Protection ratio for sound signals (analog and NICAM) must be taken into account particularly.



Center frequency of DAB-blocks is different in VHF channels (Wiesbaden 95)

- Block distance A-B, B-C, C-D 176 kHz
- Distance between A and channel border 160 kHz (K5, K7, K9, K11, K13)
- Distance between A and channel border 168 kHz (K6, K8, K10, K12)
- Distance between D and channel border 168 kHz (K5, K7, K9, K11, K13)
- Distance between D and channel border 160 kHz (K6, K8, K10, K12)

Subjects

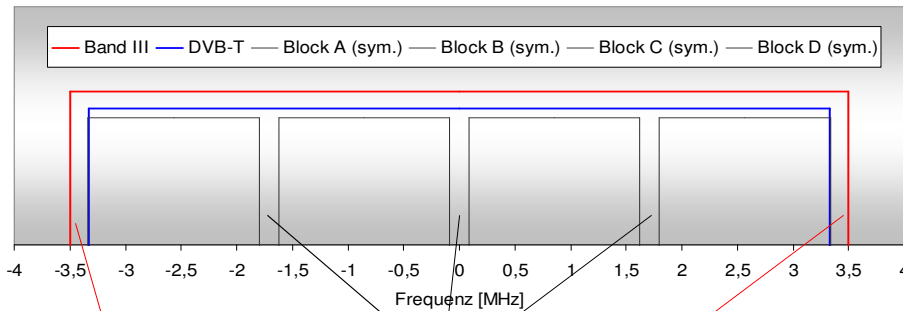
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Assignment opportunities in VHF-Band III



Digitaler Rundfunk im VHF-Bereich



Broadcast channels in Band III

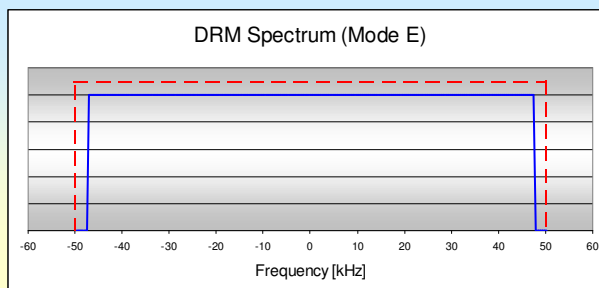
	Bandwidth	Block distance	Distance to channel border
VHF Channel	7 MHz		
DVB-T	6,67 MHz		165 kHz
DAB-Block	1,536 MHz	1,864 MHz	164 kHz (harmonized)

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Spectrum characteristics of DRM+ channels (Mode E)



DRM Spectrum (Mode E)

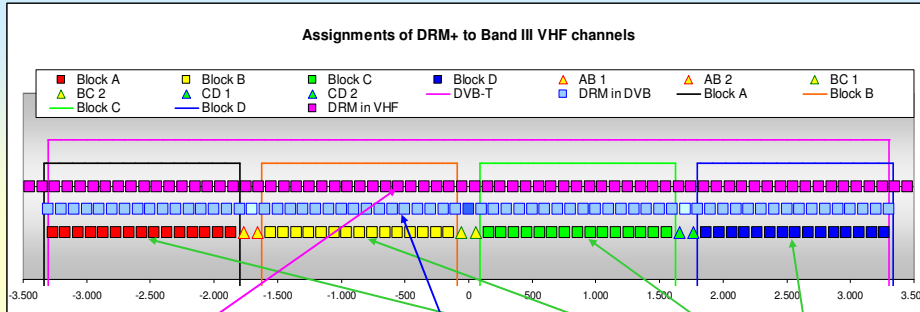


Spectrum characteristics of DRM+ (DRM Mode E)

- Number of active sub-carriers 213
- Sub-carrier distance 444,444 Hz
- Active channel bandwidth 94,667 kHz
- Defined channel bandwidth 100 kHz
- Number of equivalent sub-carriers 225

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Possible assignments of DRM+ channels



With reference to the 7 MHz channel

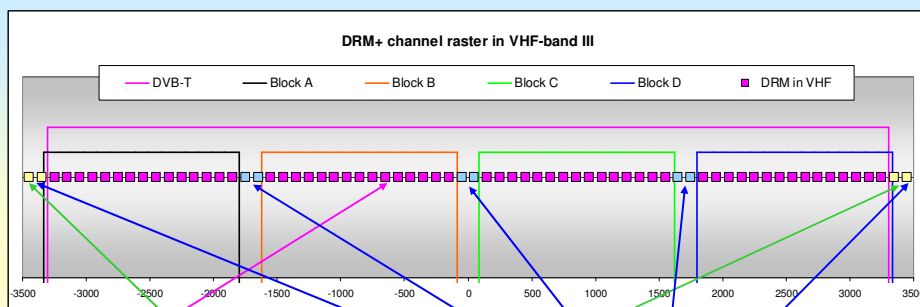
Corresponding to DVB-T

Corresponding to DAB

Such a channel assignment is absolutely impractical !!!

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Suggestion on an uniform DRM+ channel raster in VHF-Band III



DRM within 7 MHz VHF channels (70 channels at all)

Restricted use in case of coordination for DVB-T (66 channels useable)

Restricted use in case of coordination for DAB (60 DRM+ channels total or 15 channels per DAB-block)



Calculation of DRM+ Channel frequency:

$$f_{\text{DRM(III)}} = (K_{\text{DRM(III)}} - 1) * 0,1 + f_{\text{uIII}} + 0,05 \quad [\text{MHz}]$$

with

$f_{\text{DRM(III)}}$ \Rightarrow DRM+ Channel frequency in VHF Band III

$K_{\text{DRM(III)}}$ \Rightarrow Number of the DRM+ Channel ($\in \{1, 2, \dots, 560\}$)

f_{uIII} \Rightarrow Lower bound of VHF Band III ($f_{\text{uIII}} = 174 \text{ [MHz]}$)

DRM+ Channel numbers within the VHF-Band III channels

- K5 \Rightarrow 1 ... 70 K9 \Rightarrow 281 ... 350
- K6 \Rightarrow 71 ... 140 K10 \Rightarrow 351 ... 420
- K7 \Rightarrow 141 ... 210 K11 \Rightarrow 421 ... 490
- K8 \Rightarrow 211 ... 280 K12 \Rightarrow 491 ... 560
- (K13 \Rightarrow 561 ... 630)



Kanal-Nr.	Kanäle in DAB-Blöcken	DRM	DRM im 7MHz-Kanal	Y-Wert	DRM in K5	DRM in K6	DRM in K7	DRM in K8	DRM in K9	DRM in K10	DRM in K11	DRM in K12	DRM in K13
1		-35	-3.497	1	174,05	181,05	188,05	195,05	202,05	209,05	216,05	223,05	230,05
2		-34	-3.397	1	174,15	181,15	188,15	195,15	202,15	209,15	216,15	223,15	230,15
3	1	-33	-3.297	1	174,25	181,25	188,25	195,25	202,25	209,25	216,25	223,25	230,25
4	2	-32	-3.197	1	174,35	181,35	188,35	195,35	202,35	209,35	216,35	223,35	230,35
5	3	-31	-3.097	1	174,45	181,45	188,45	195,45	202,45	209,45	216,45	223,45	230,45
6	4	-30	-2.997	1	174,55	181,55	188,55	195,55	202,55	209,55	216,55	223,55	230,55
7	5	-29	-2.897	1	174,65	181,65	188,65	195,65	202,65	209,65	216,65	223,65	230,65
8	6	-28	-2.797	1	174,75	181,75	188,75	195,75	202,75	209,75	216,75	223,75	230,75
9	7	-27	-2.697	1	174,85	181,85	188,85	195,85	202,85	209,85	216,85	223,85	230,85
10	8	-26	-2.597	1	174,95	181,95	188,95	195,95	202,95	209,95	216,95	223,95	230,95
11	9	-25	-2.497	1	175,05	182,05	189,05	196,05	203,05	210,05	217,05	224,05	231,05
12	10	-24	-2.397	1	175,15	182,15	189,15	196,15	203,15	210,15	217,15	224,15	231,15
13	11	-23	-2.297	1	175,25	182,25	189,25	196,25	203,25	210,25	217,25	224,25	231,25
14	12	-22	-2.197	1	175,35	182,35	189,35	196,35	203,35	210,35	217,35	224,35	231,35
15	13	-21	-2.097	1	175,45	182,45	189,45	196,45	203,45	210,45	217,45	224,45	231,45
16	14	-20	-1.997	1	175,55	182,55	189,55	196,55	203,55	210,55	217,55	224,55	231,55
17	15	-19	-1.897	1	175,65	182,65	189,65	196,65	203,65	210,65	217,65	224,65	231,65
18		-18	-1.797	1	175,75	182,75	189,75	196,75	203,75	210,75	217,75	224,75	231,75
19		-17	-1.697	1	175,85	182,85	189,85	196,85	203,85	210,85	217,85	224,85	231,85
20	1	-16	-1.597	1	175,95	182,95	189,95	196,95	203,95	210,95	217,95	224,95	231,95
21	2	-15	-1.497	1	176,05	183,05	190,05	197,05	204,05	211,05	218,05	225,05	232,05
67	14	31	3.103	1	180,65	187,65	194,65	201,65	208,65	215,65	222,65	229,65	236,65
68	15	32	3.203	1	180,75	187,75	194,75	201,75	208,75	215,75	222,75	229,75	236,75
69		33	3.303	1	180,85	187,85	194,85	201,85	208,85	215,85	222,85	229,85	236,85
70		34	3.403	1	180,95	187,95	194,95	201,95	208,95	215,95	222,95	229,95	236,95



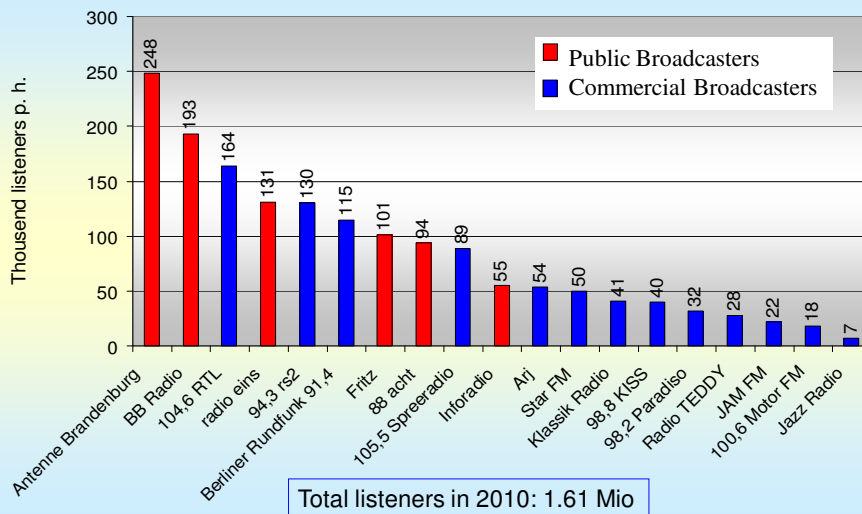
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Suggestion of a migration scenario – FM programmes in Berlin

Broadcast market in Berlin/Brandenburg



Frequency planning approaches for DRM+ in VHF-Band III

Suggestion of a migration scenario – Broadcasters requirements



The market position of broadcasters is different (see previous foil) !

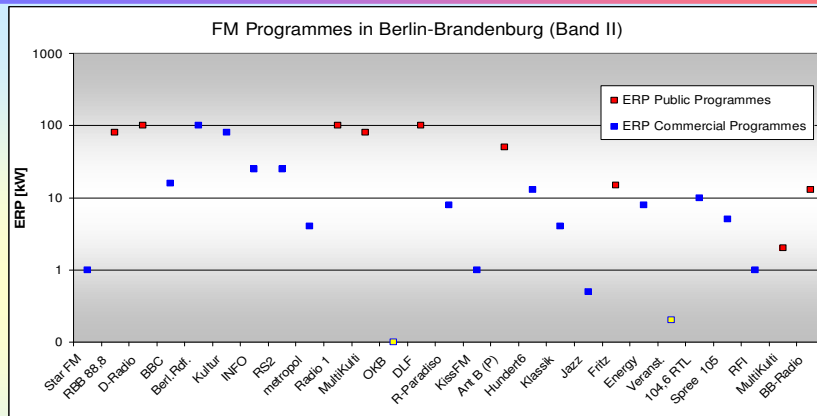
Broadcasters require for migration from analog to digital that:

- the digital transmission of sound and data services must correspond to their business model,
- the coverage has to meet the target area where the potential listeners are situated,
- it should be possible to modify the transmission parameters or network simply if market situation requires,
- every modification must be possible without coordination with other broadcasters,
- transmission cost must be as low as necessary.

Only DRM+ can fulfill these individual requirements !

Frequency planning approaches for DRM+ in VHF-Band III

Suggestion of a migration scenario – Migration potential



- There are 27 FM-Programmes on air in Berlin-Brandenburg
- There are 9 public programmes and 18 commercial programmes on air.
- Two Programmes belong to special local services (OKB, campus radio)

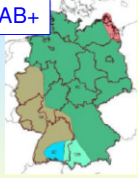
16 programmes could be the potential for DRM+

Frequency planning approaches for DRM+ in VHF-Band III

Suggestion of a migration scenario – common use of DAB/DAB+ and DRM+



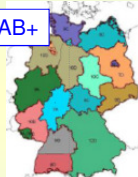
DAB+



Nationwide programmes are transmitted by DAB

- The planning is ongoing.
- Broadcast network operator is selected by BNetzA.
- Potential broadcasters (public and commercial) are identified.
- Service could start in IV/2010

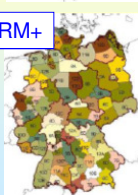
DAB+



Regional programmes are transmitted by DAB

- Several regional networks are on air.
- Public programmes dominate the service.

DRM+

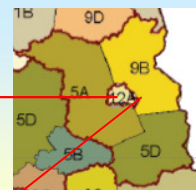
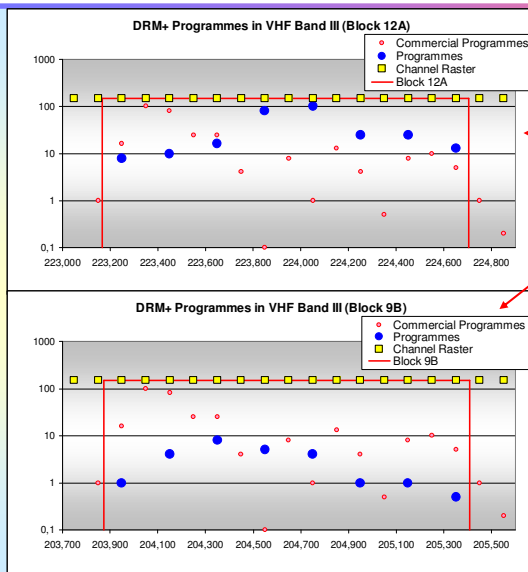


Local programmes could be transmitted by DRM+

- Most of local programmes are offered by commercial broadcasters.
- DRM+ could provide a cost efficient distribution based on the individual requirements of the broadcasters.
- Advance services (i.e. Journaline) can also be provided economically.

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Suggestion of a migration scenario – Migration potential



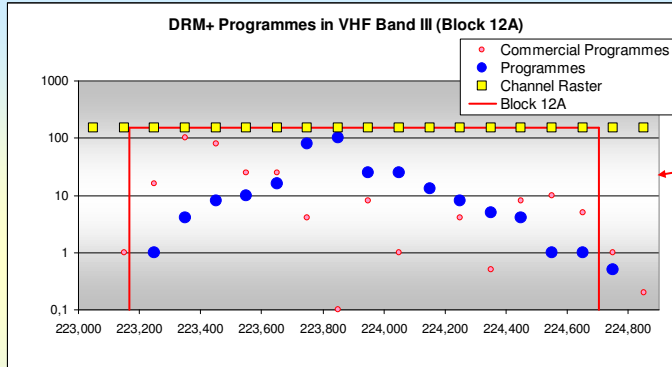
Scenario:

- Two DAB-Blocks are used from the regional layer to assign all 16 programmes.
- Only every third channel is used to avoid interferences.
- Block 9B channels could be "shifted" to TV-Tower Berlin to improve the coverage.

Frequency planning approaches for DRM+ in VHF-Band III



Suggestion of a migration scenario – higher frequency efficiency



It could also be possible that all 16 Programmes placed in only one DAB-Block if:

- the receivers allowed to use every adjacent channel and
- restricted channels can also be used.

(Note: For this it makes sense to sort the programs in order of there radiated power)

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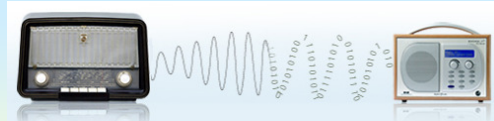


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Example of a reception scenario



From analog to digital !

What will happen if someone will move from analog to digital reception ?

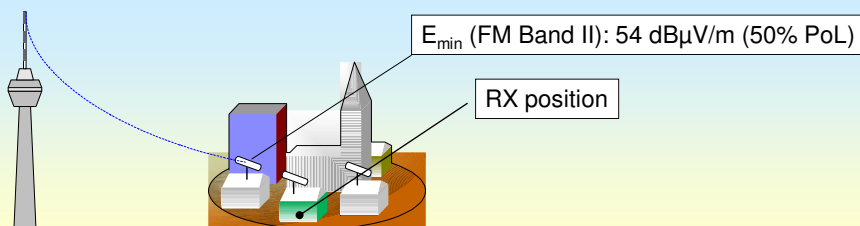
- he will buy a digital receiver,
- he will bring it to his home,
- he will replace the old analog receiver by the digital one,
- he will switch on the device,
- he will start the programme search - and

he is surprised because there is no reception !?

Why ???

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Example of a reception scenario - requirements



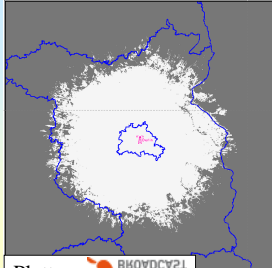
DRM requires indoor reception because:

- Most of FM-receivers are not connected to a roof-top-antenna!
- DRM+ reception must be possible indoors at the ground floor.
- Simple antennas should be use.
- Building penetration loss has to be considered for coverage planning.
- Digital transmission doesn't provide "graceful degradation". Therefore, higher probability of location (PoL) is required.
- A reference receiver has to be defined for coverage planning.

Frequency planning approaches for DRM+ in VHF-Band III

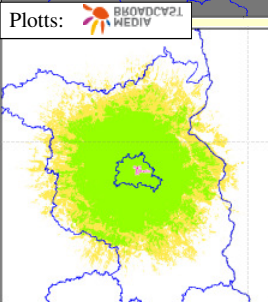


Example of a reception scenario - Coverage comparison



Forecast of FM reception

- Transmitter power 10 kW (ERP, ND)
- Stationary reception at 10 m
- Probability of location: 50 %
- No Service



Forecast of DRM+ reception

- Transmitter power 10 kW (ERP, ND)
- Portable indoor reception at 1.5 m (critical reception)
- Probability of location: 70 %
- Probability of location: 95 %

DRM+ transmission doesn't get more expensive than FM !

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Thank you for your attention !

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