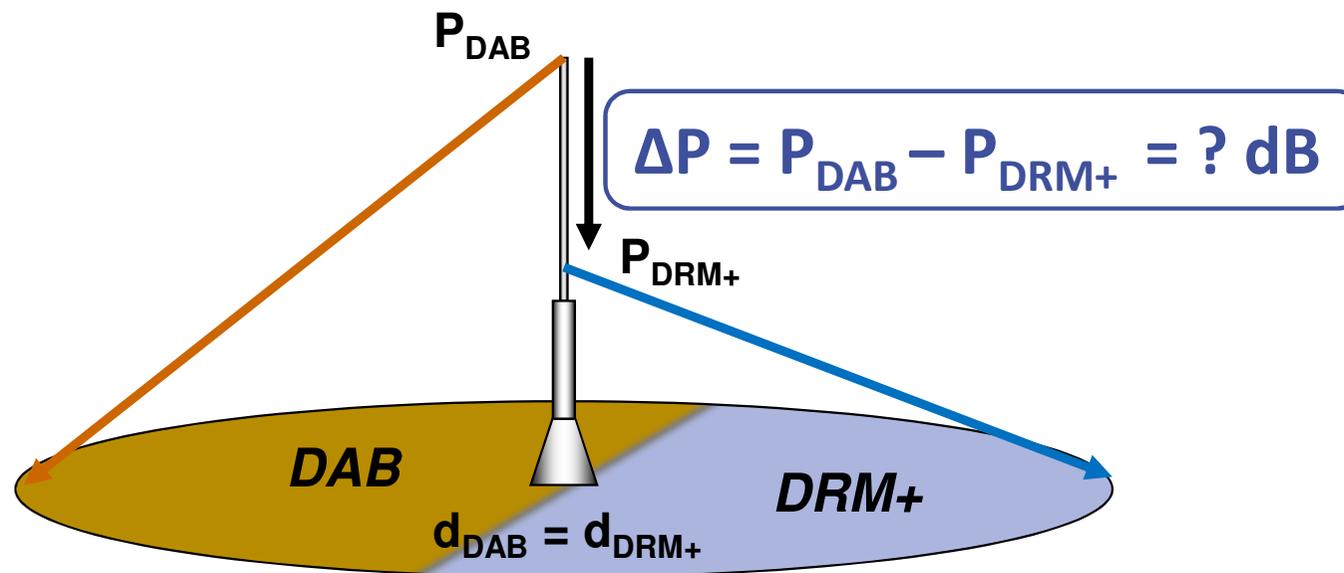


Study on the Comparison of the Transmitting Power between DRM+ and DAB/DAB+ in VHF Band III to Cover the same Service Area

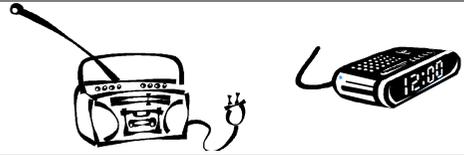


► *Motivation and Objective of the Study*

DAB/DAB+ and DRM+ can both be used in VHF band III

To show the benefit of DRM+ compared to DAB/DAB+ to cover the same service area the **difference of the transmitting power** for equal DAB/DAB+ and DRM+ coverage was calculated.

Basis of the study are **5 portable/mobile reception modes** described in **ITU-R BS.1660-6** for DRM+:

reception modes	<ul style="list-style-type: none">portable indoor – PIportable handheld indoor - PI-H	
	<ul style="list-style-type: none">portable outdoor – POportable handheld outdoor - PO-H	
	<ul style="list-style-type: none">mobile - MO	

► *Basic Documents*

DRM+ (4-QAM with R=1/3 and 16-QAM with R=1/2):

- **ITU-R BS.1660-6:** “Technical basis for planning of terrestrial digital sound broadcasting in the VHF band” → **C/N values**

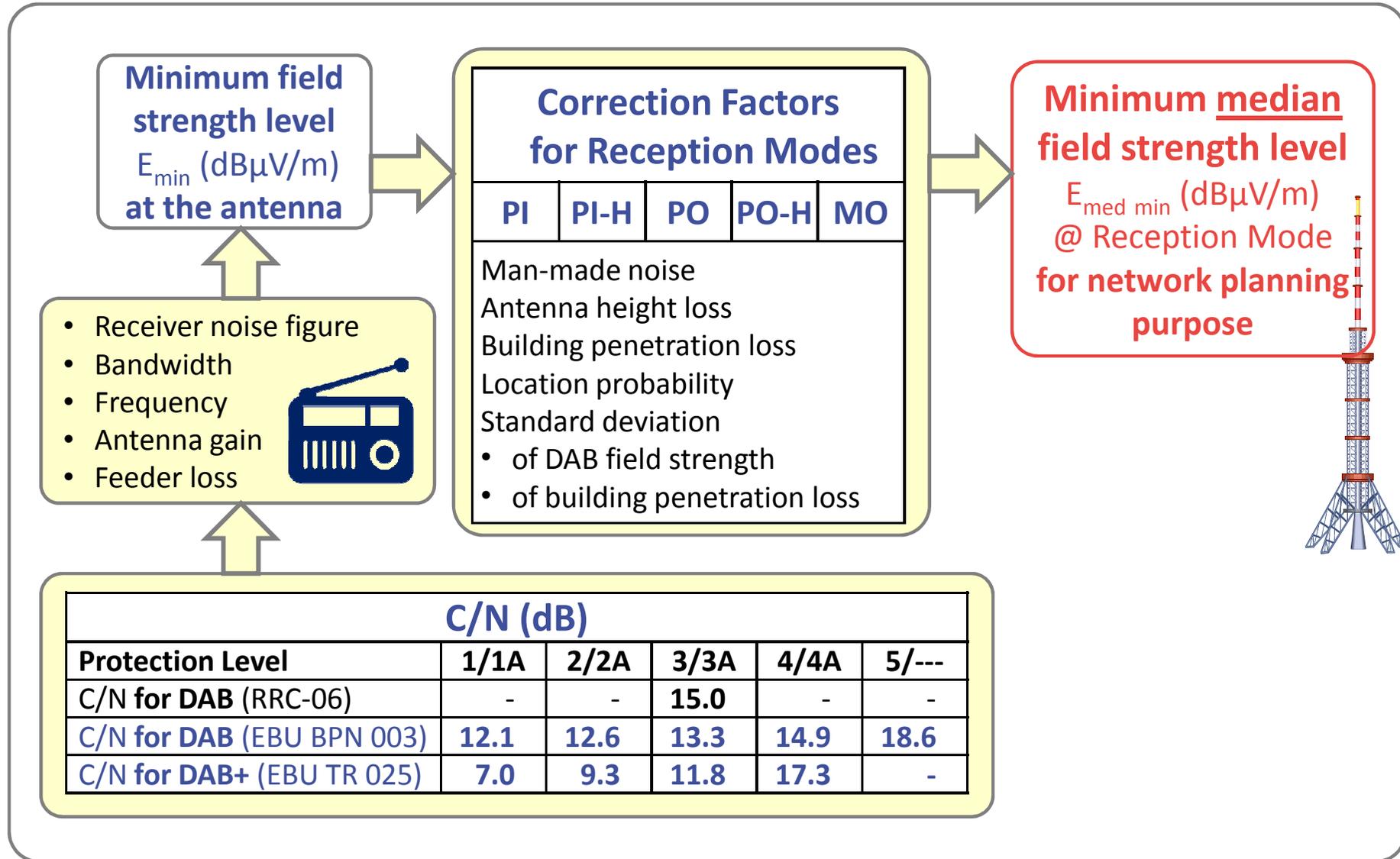
DAB with MPEG 1 layer II audio:

- **ETSI EN 300 401:** "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers"
- **EBU Report BPN 003:** „Technical Basis for T-DAB Services Network Planning and Compatibility with Existing Broadcast Services” (Oct. 2013) → **C/N values**

DAB+ with MPEG 4 AAC audio:

- **ETSI TS 102 563:** “Digital Audio Broadcasting (DAB);Transport of Advanced Audio Coding (AAC) audio”
- **EBU Report TR 025:** “Frequency and Network Planning Parameters related to DAB+ Version” (Dec. 2012) → **C/N values**

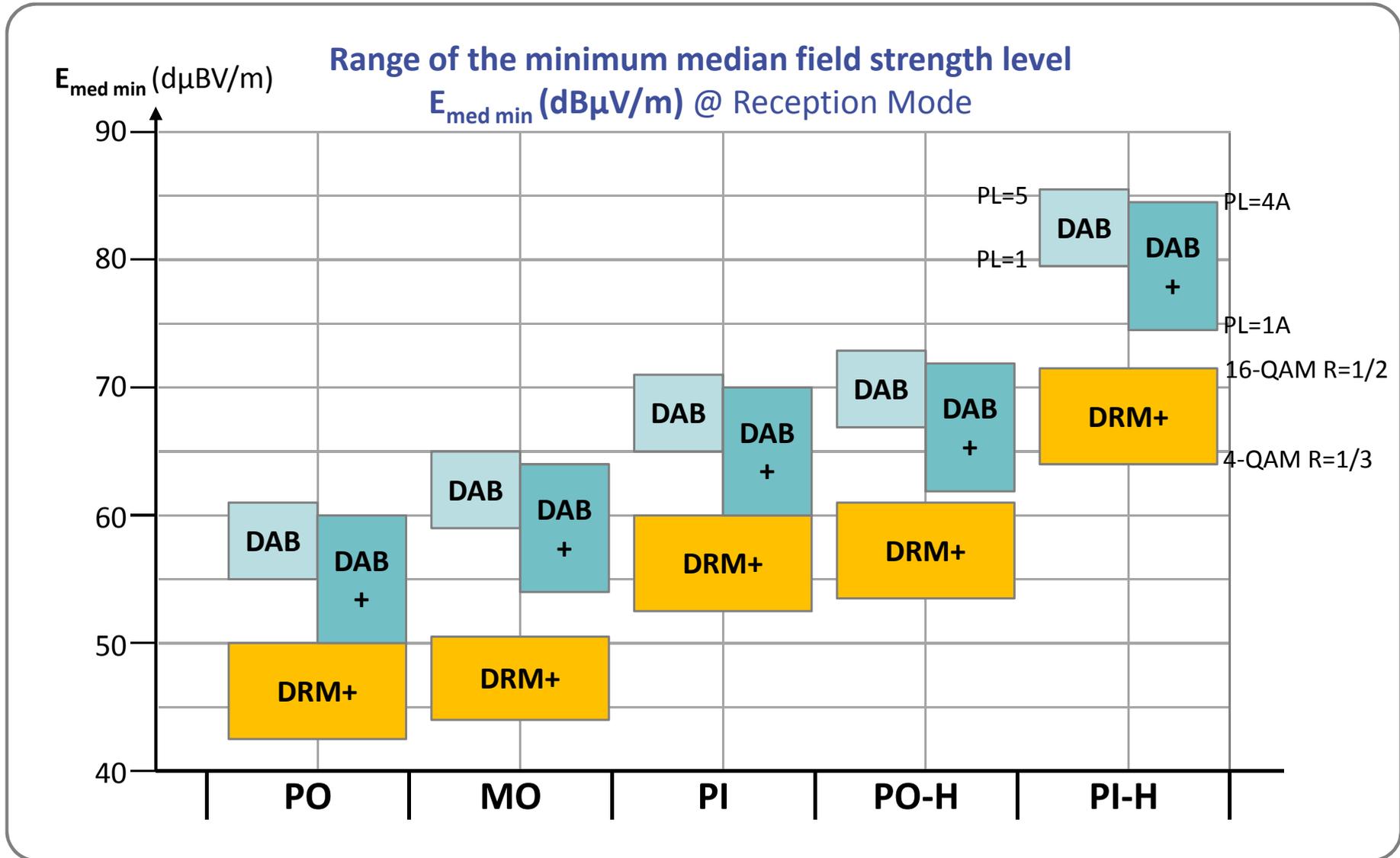
► Calculation of the Field Strength Levels of DAB/DAB+



► *Minimum Median Field Strength Levels*

		Minimum median field strength level $E_{med\ min}$ (dB μ V/m) @ Reception Mode				
System	Mode	PI	PI-H	PO	PO-H	MO
DAB	PL=1	65.2	79.4	54.9	69.1	59.1
	PL=2	65.7	79.9	55.4	69.6	59.6
	PL=3	66.4	80.6	56.1	70.3	60.3
	PL=4	68.0	82.2	57.7	71.9	61.9
	PL=5	71.7	85.9	61.4	75.6	65.6
DAB+	PL=1A	60.1	74.3	49.8	64.0	54.0
	PL=2A	62.4	76.6	52.1	66.3	56.3
	PL=3A	64.9	79.1	54.6	68.8	58.8
	PL=4A	70.4	84.6	60.1	74.3	64.3
DRM+	16-QAM	60.6	72.0	50.5	61.4	51.4
	4-QAM	52.5	63.9	42.4	53.3	44.1

► *Minimum Median Field Strength Levels*



► *Comparison of Field Strength Levels (DRM+_{16QAM} - DRM+_{4QAM})*

		Minimum median field strength level $E_{med\ min}$ (dB μ V/m) @ Reception Mode				
System	Mode	PI	PI-H	PO	PO-H	MO
DRM+	16-QAM	60.6	72.0	50.5	61.4	51.4
	4-QAM	52.5	63.9	42.4	53.3	44.1
		Difference of the minimum median field strength level $\Delta E_{med\ min} = E_{med\ DRM+ 16-QAM} - E_{med\ min\ DRM+ 4-QAM}$ (dB)				
$\Delta E_{med\ min}$		8.1	8.1	8.1	8.1	7.3

Medium value of the difference of the minimum median field strength level between DRM+ 16-QAM and DRM+ 4-QAM

$$\Delta E_{med\ (DRM+ 16-QAM - DRM+ 4-QAM)} = 8\ dB$$

► *Comparison of Field Strength Levels (DAB+ - DRM+_{4QAM})*

		Minimum median field strength level $E_{med\ min}$ (dB μ V/m) @ Reception Mode				
System	Mode	PI	PI-H	PO	PO-H	MO
DAB+	PL=1A	60.1	74.3	49.8	64.0	54.0
	PL=2A	62.4	76.6	52.1	66.3	56.3
	PL=3A	64.9	79.1	54.6	68.8	58.8
DRM+	4-QAM	52.5	63.9	42.4	53.3	44.1
		Difference of the minimum median field strength level $\Delta E_{med\ min} = E_{med\ DAB+} - E_{med\ min\ DRM+ 4-QAM}$ (dB)				
ΔE_{med}	PL=1A	7.6	10.4	7.4	10.7	9.9
	PL=2A	9.9	12.7	9.7	13.0	12.2
	PL=3A	12.4	15.2	12.2	15.5	14.7

Medium value of the difference of the minimum median field strength level between DAB+ and DRM+ 4-QAM

$$\Delta E_{med} (DAB+ - DRM+ 4-QAM) = 12\ dB$$

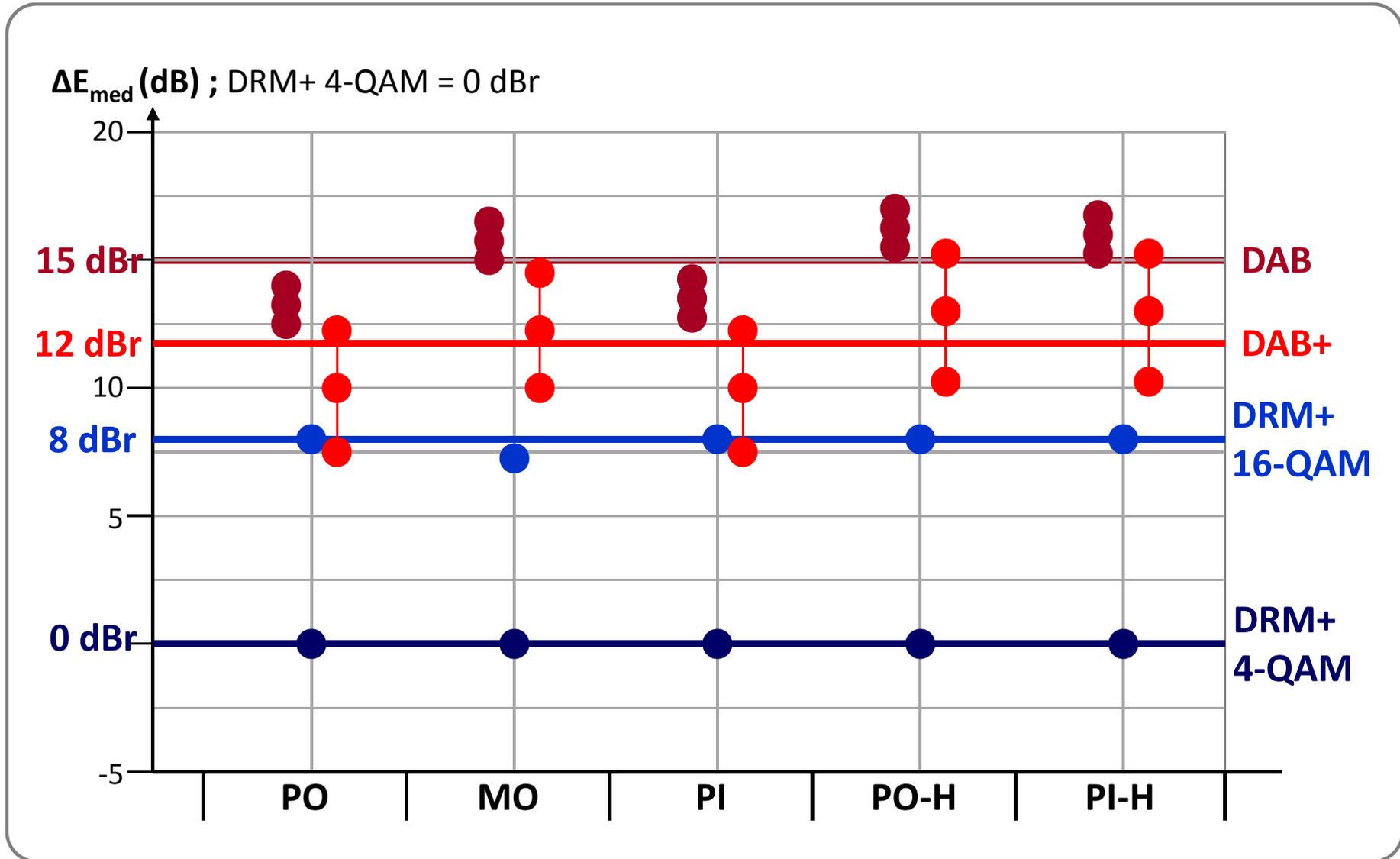
► *Comparison of Field Strength Levels (DAB - DRM+_{4QAM})*

		Minimum median field strength level $E_{med\ min}$ (dB μ V/m) @ Reception Mode				
System	Mode	PI	PI-H	PO	PO-H	MO
DAB	PL=1	65.2	79.4	54.9	69.1	59.1
	PL=2	65.7	79.9	55.4	69.6	59.6
	PL=3	66.4	80.6	56.1	70.3	60.3
DRM+	4-QAM	52.5	63.9	42.4	53.3	44.1
		Difference of the minimum median field strength level $\Delta E_{med\ min} = E_{med\ DAB} - E_{med\ min\ DRM+ 4-QAM}$ (dB)				
ΔE_{med}	PL=1	12.7	15.5	12.5	15.8	15.0
	PL=2	13.2	16.0	13.0	16.3	15.5
	PL=3	13.9	16.7	13.7	17.0	16.2

Medium value of the difference of the minimum median field strength level between DAB and DRM+ 4-QAM

$$\Delta E_{med} (DAB - DRM+ 4-QAM) = 15\text{ dB}$$

► Median Field Strength Levels (relating to DRM+_{4QAM}) in Chart



► *Summarised Results*

The results of the difference of the transmitting power between DRM+ and DAB/DAB+ in VHF band III to cover the same service area are:

- In any case **DRM+ needs less transmitting power than DAB/DAB+.**
- Comparing **DRM+ (4-QAM) with DAB+** the difference has a medium value of **12 dB** ($P_{DAB+} - P_{DRM+ 4QAM}$)
- Comparing **DRM+ (4-QAM) with DAB** the difference has a medium value **15 dB** ($P_{DAB} - P_{DRM+ 4QAM}$)
- Using **DRM+ (16-QAM) instead of DRM+ (4-QAM)** the difference of the transmitting power to DAB/DAB+ is in medium **8 dB lower**
 $P_{DAB+} - P_{DRM+ 16QAM} = 4 \text{ dB} \mid P_{DAB} - P_{DRM+ 16QAM} = 7 \text{ dB}$

Thank you for your kind attention!

Joachim Lehnert
Chairman of the German DRM Platform

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