STANDARD DTMB-A AND THE UNFOLD OF THE TDT IN CUBA

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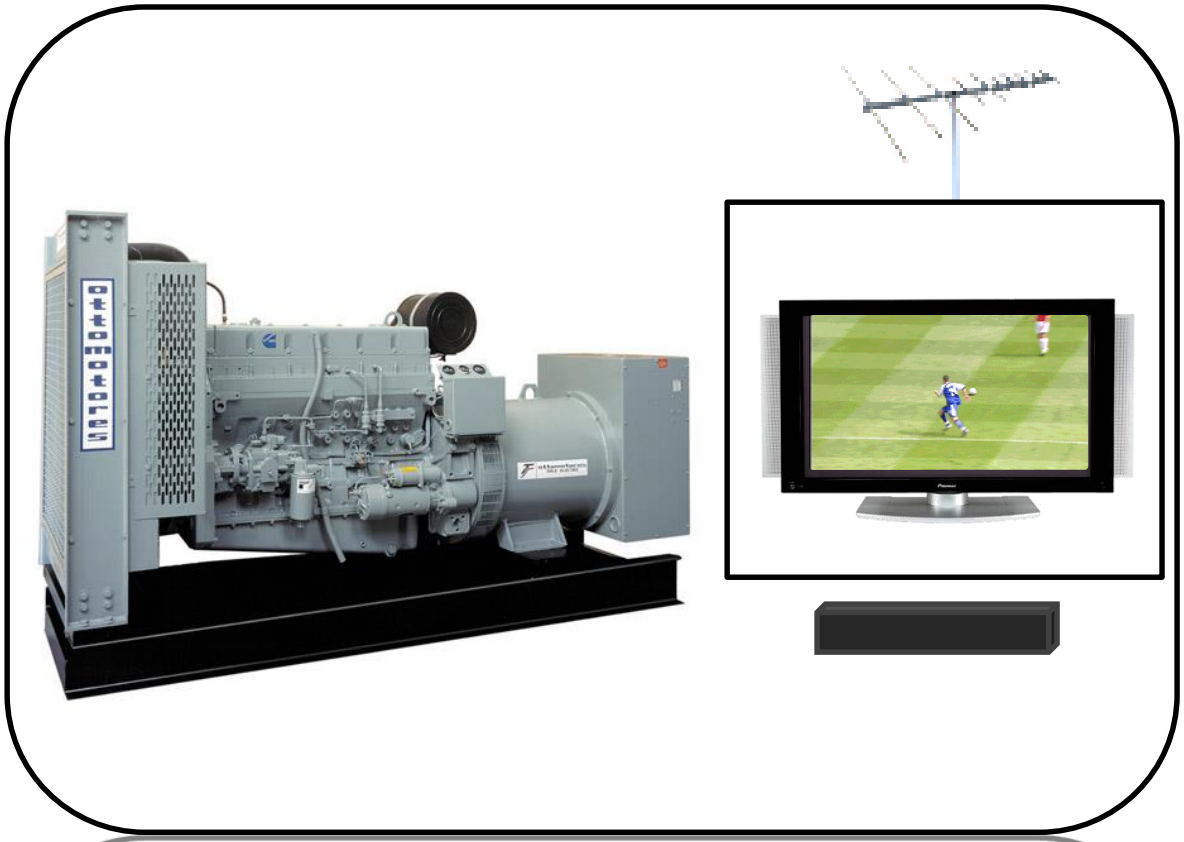
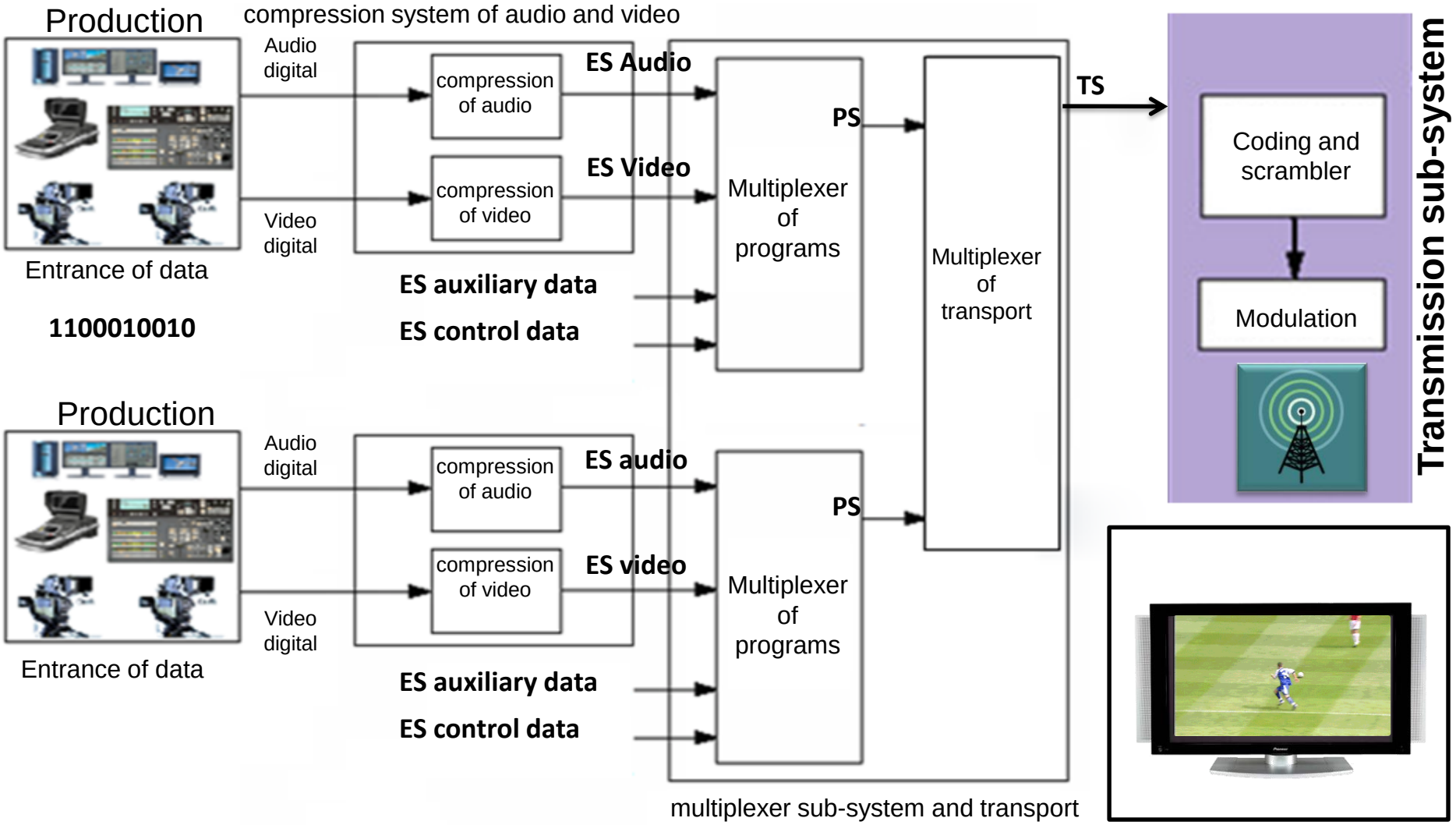
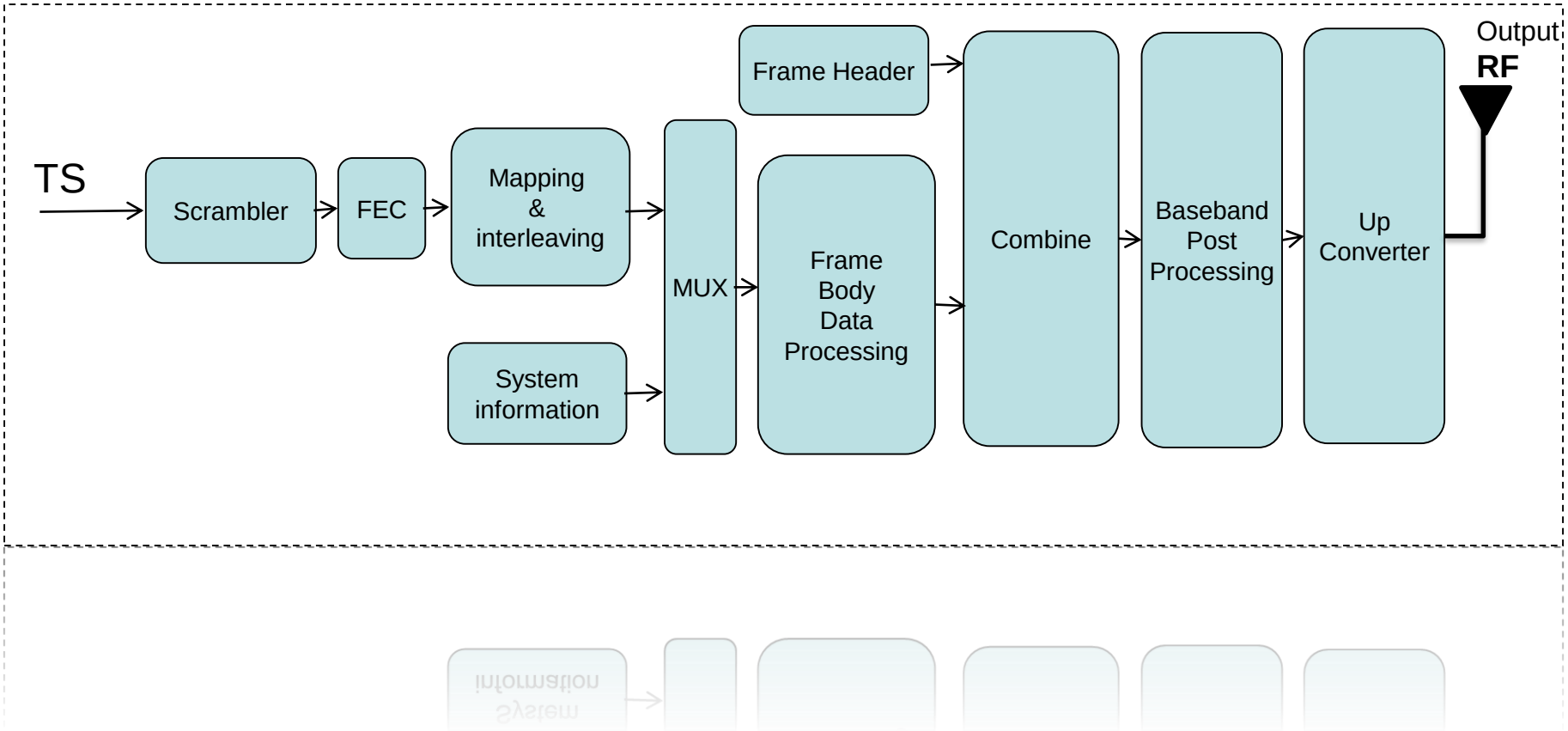
Introduction



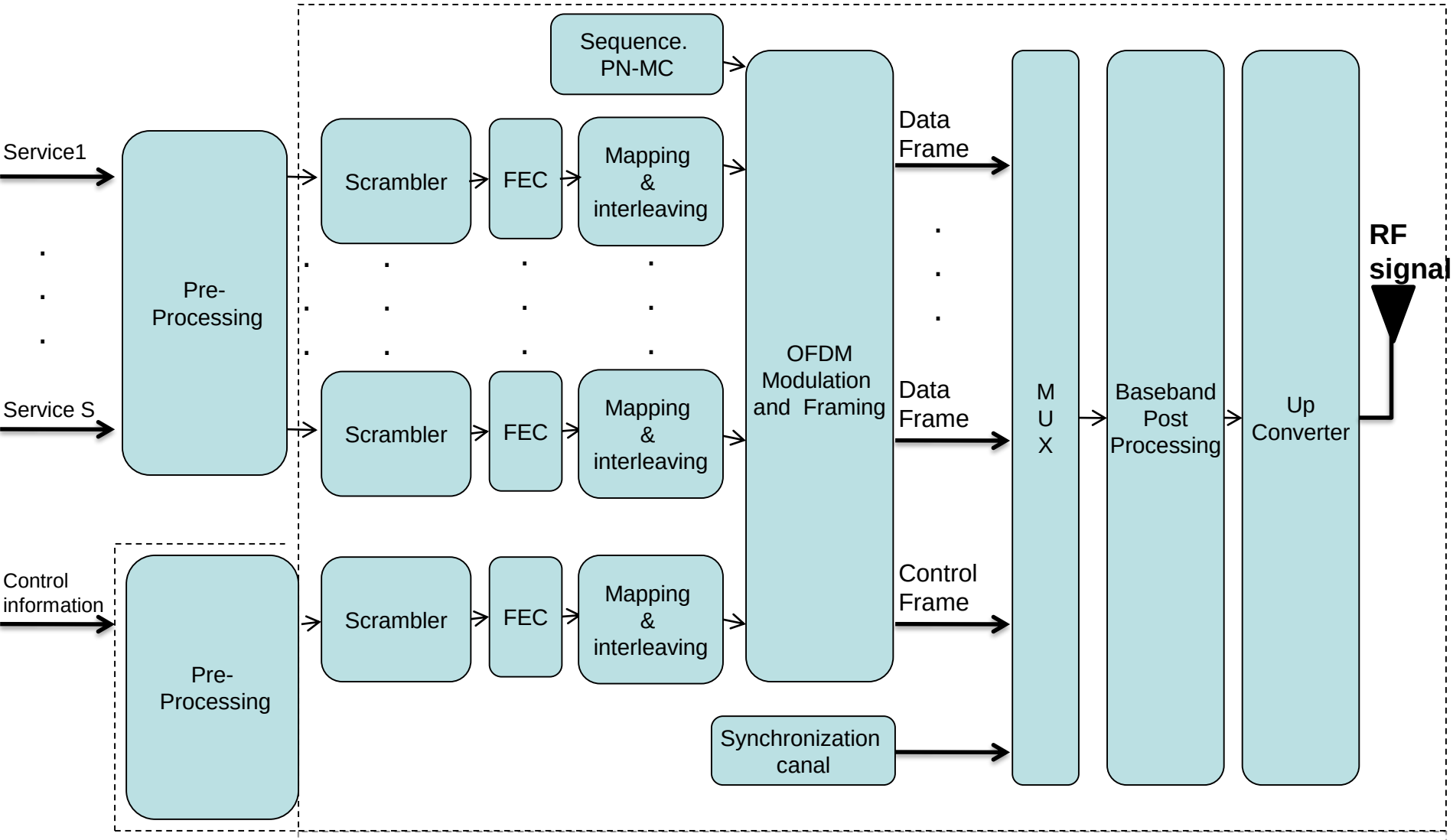
It structures of a system of TDT



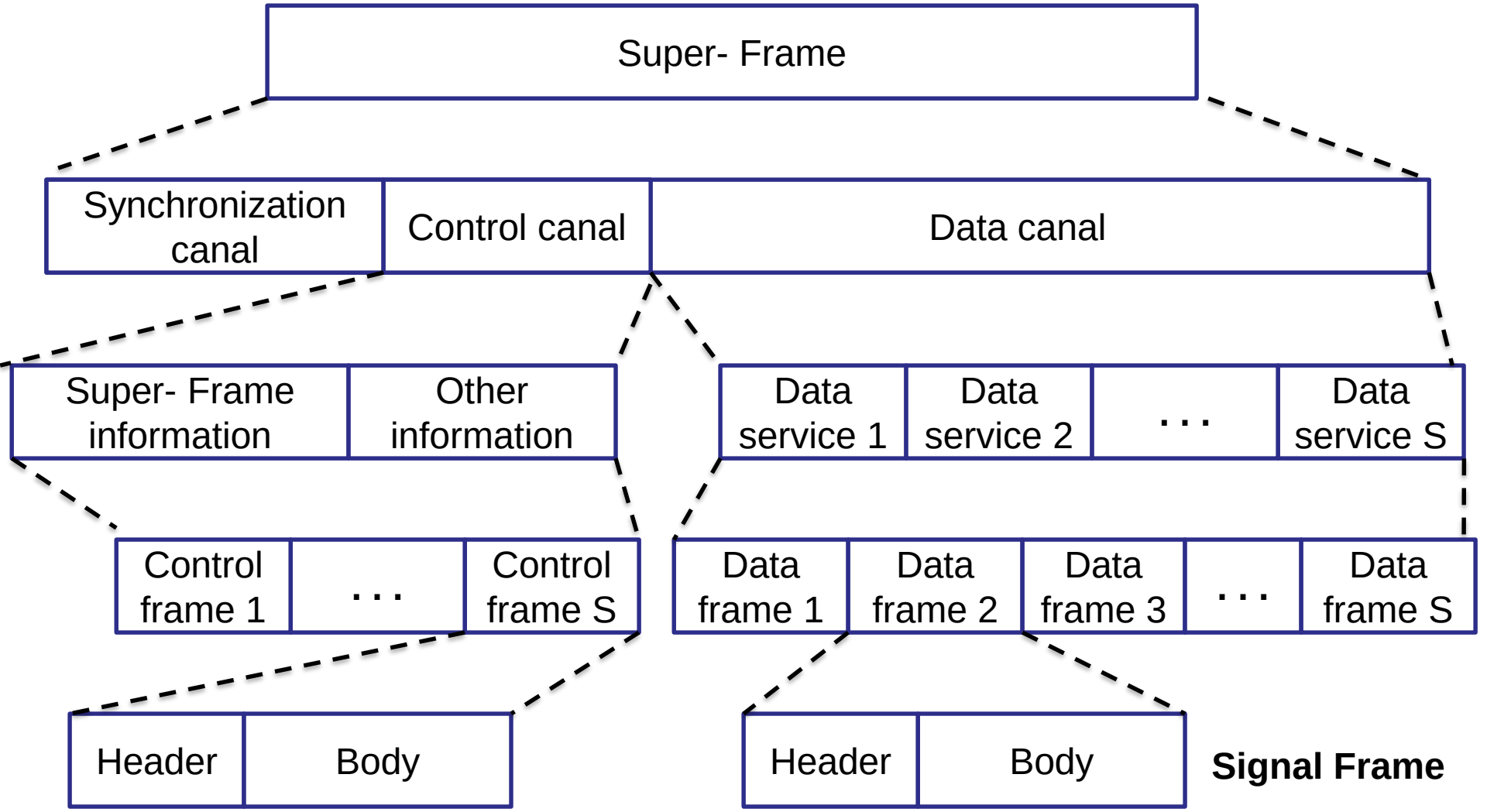
It structures in blocks of the transmission sub-system DTMB



It structures in blocks of the transmission sub-system DTMB-A



It structures of the Frame in DTMB-A



DTMB vs DTMB-A. Shannon

System	DTMB	DTMB-A
Inner FEC	LDPC: Code Length **7488** bits code rate 2/5, 3/5 y 4/5 (0.4, 0.6, 0.8)	LDPC: Code Length **61440** o **15360** bits code rate 1/2, 2/3 and 5/6
Modulation	TDS OFDM: Schemes QPSK, 4 QAM-NR, 4 QAM, 16 QAM, 32 QAM, **64 QAM**	TDS OFDM: Schemes QPSK, 16 APSK, 64 APSK, **256 APSK**

Chain rule of mutual information

For a complex-valued channel, the channel input and output are usually complex-valued signals. Traditionally, the input signal X is decomposed into its real and imaginary parts

$$X = X_I + jX_Q,$$

likewise

$$Y = Y_I + jY_Q,$$

Thereafter, the mutual information between X and Y could be decomposed as

$$I(X;Y) = I(X_I;Y_I) + I(X_Q;Y_Q|X_I,Y_I) + I(X_I;Y_Q|Y_I) + I(X_Q;Y_I|X_I) \qquad (1)$$

Based on the chain rule of mutual information. Such decomposition (1) can be simplified as:

$$I(X;Y) = I(X_I;Y_I) + I(X_Q;Y_Q) \qquad (2)$$

When the following two conditions are satisfied.
1) X_I and X_Q are independent of each other, and
2) The distortions introduced by the channel affect the real and imaginary parts independently.

Polar decomposition of mutual information

Consider a channel with complex-valued input X and output Y , which could be expressed in a polar-coordinate system that

$$X = X_{||} \cdot \exp(jX_{\angle}), \quad X_{||} \in [0, +\infty), X_{\angle} \in [-\pi, \pi), \tag{3}$$

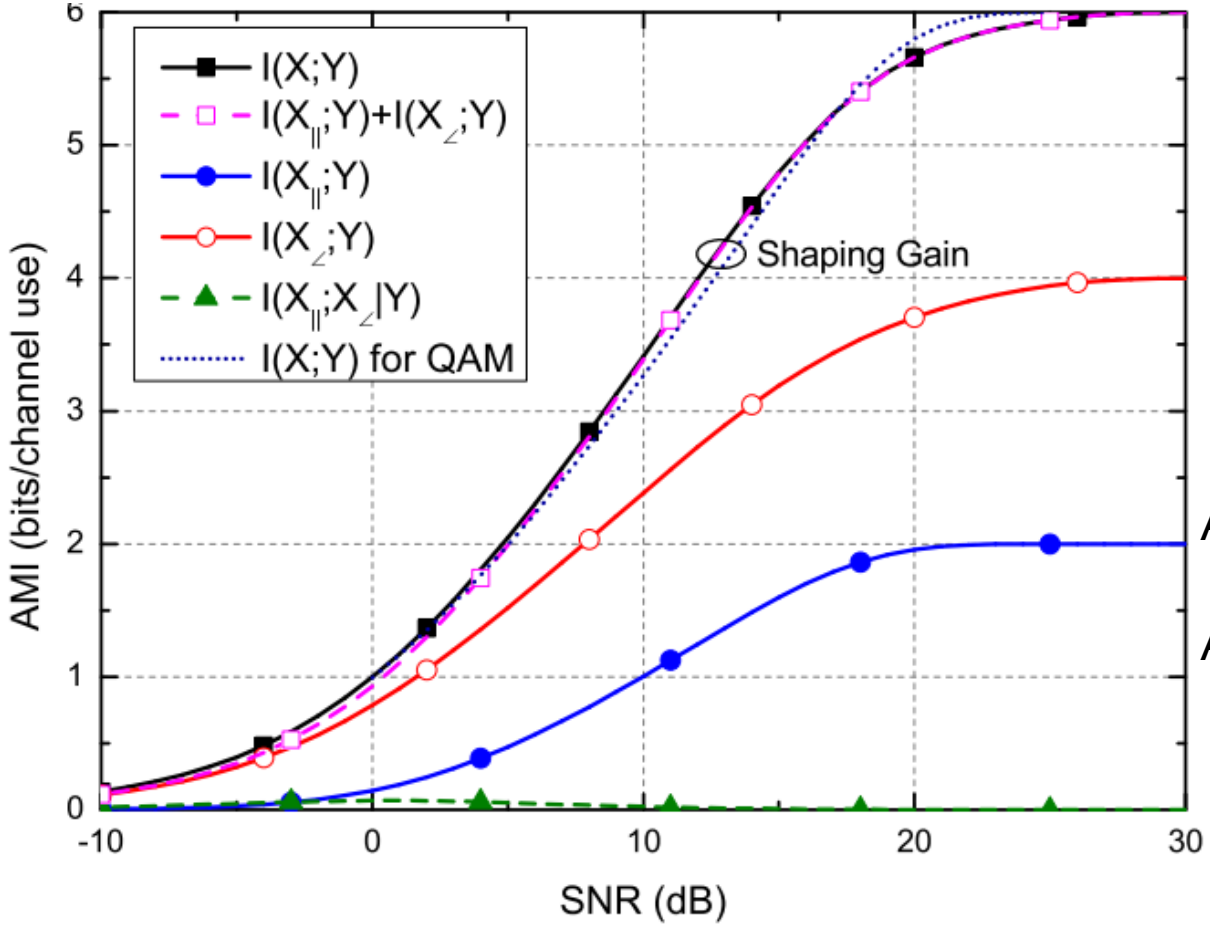
and

$$Y = Y_{||} \cdot \exp(jY_{\angle}), \quad Y_{||} \in [0, +\infty), Y_{\angle} \in [-\pi, \pi), \tag{4}$$

where $X_{||}$ and $Y_{||}$ denote the amplitudes of the X and Y , respectively, and $X_{\angle}$ and $Y_{\angle}$ denote their corresponding phases. Based on the chain rule of mutual information. it is obtained finally:

$$I(X;Y) = \underbrace{I(X_{||};Y)}_{\text{Amplitude term}} + \underbrace{I(X_{\angle};Y)}_{\text{Phase term}} + \underbrace{I(X_{||};X_{\angle}|Y)}_{\text{Cross term}} \tag{5}$$

Polar decomposed terms of mutual information



Amplitude term: I(X||; Y)

Phase term: I (X∠; Y)

Cross term: I (X||; X∠|Y)

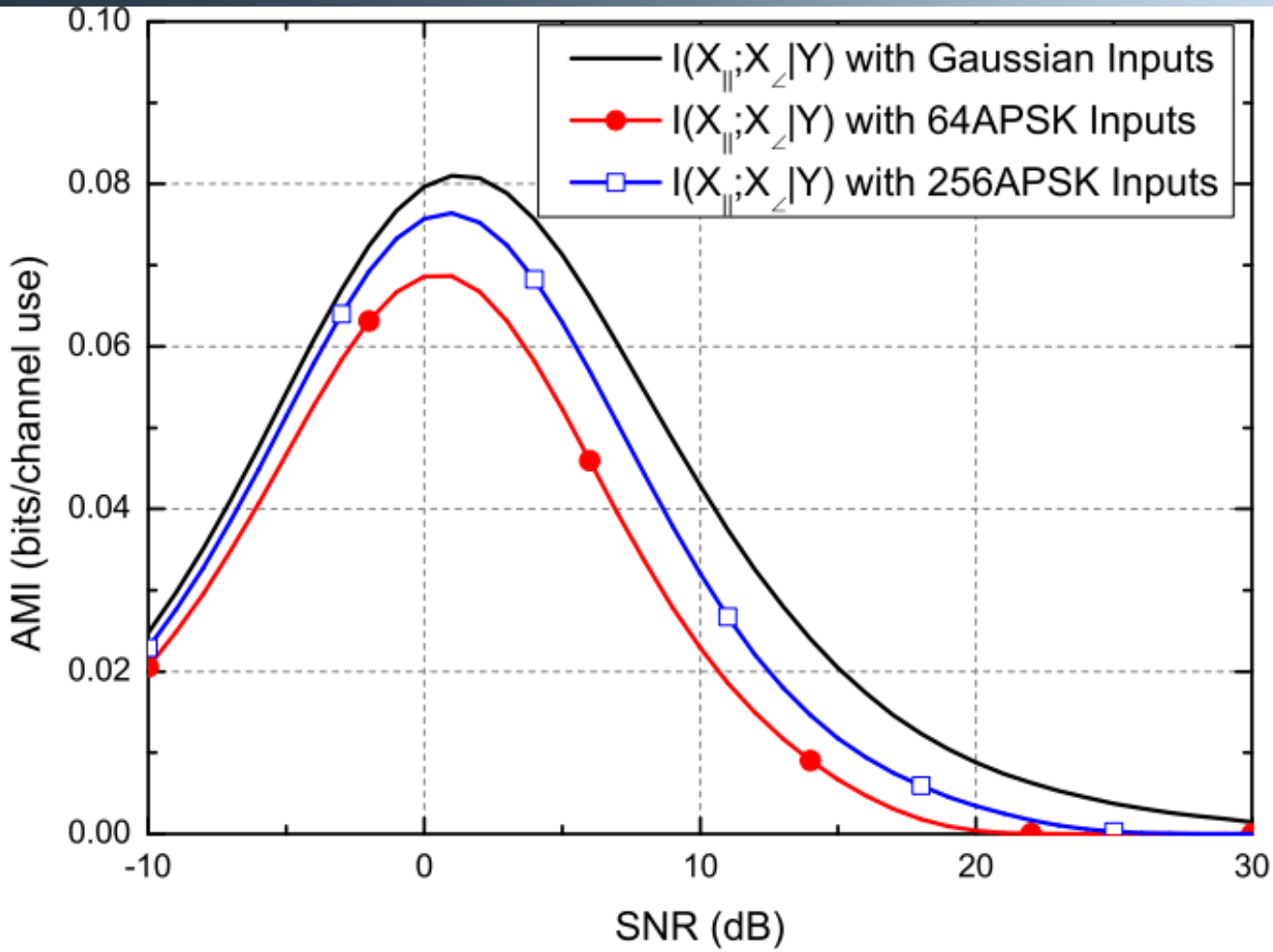
AMI for 64 QAM: I(X;Y)

AMI for 64 APSK: I(X||;Y)+I(X ;Y)

AMI Gaussian inputs: I(X;Y)

Polar decomposed terms of mutual information as a function of SNR for AWGN channels with 64APSK inputs, the AMI associated with 64QAM inputs is also depicted for reference to illustrate the shaping gain obtained by product-APSK.

The cross term of decompositions



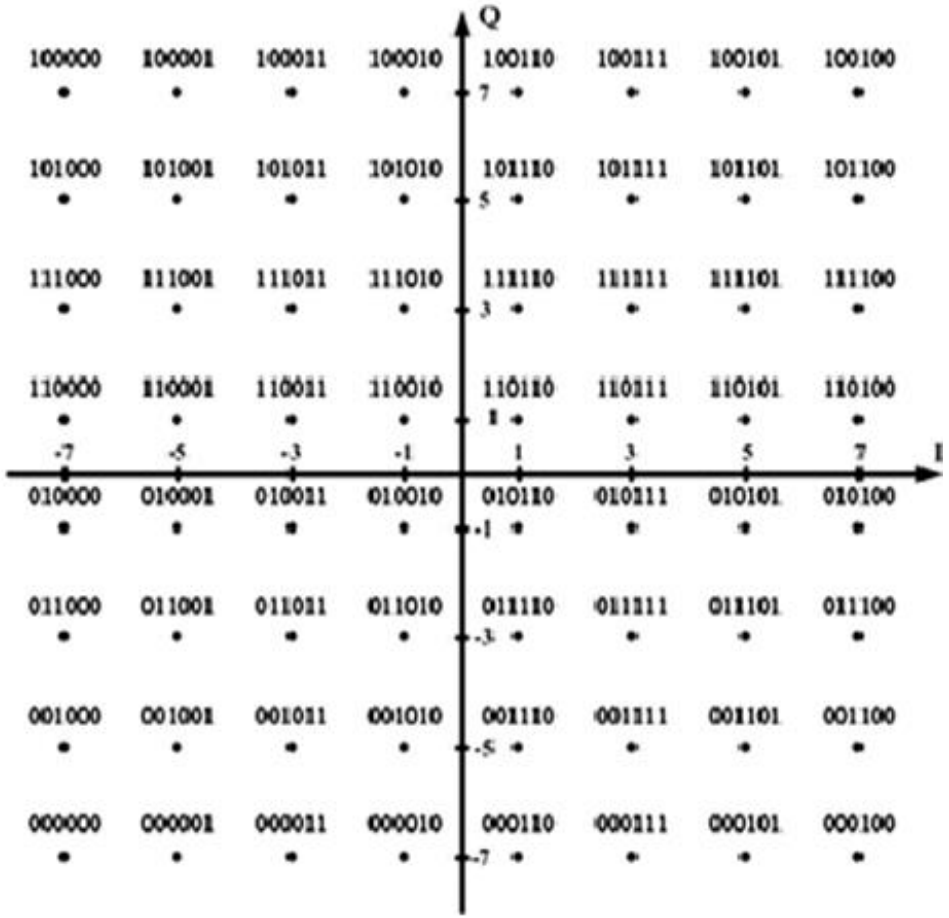
Cross term: I (X||; X∠|Y)

The cross term of decompositions as a function of SNR for AWGN channels with Gaussian inputs, also the 64-APSK and 256-APSK inputs

Modulation schemes

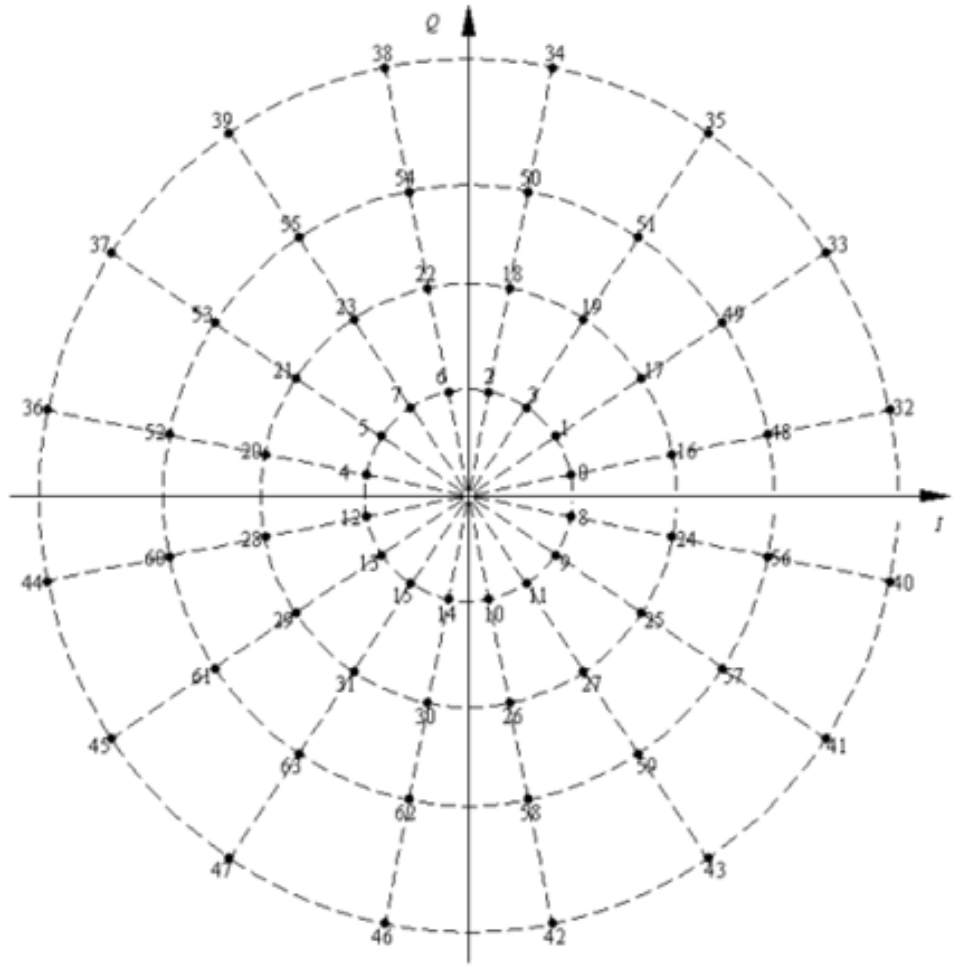
DTMB

64 QAM



DTMB-A

64 APSK



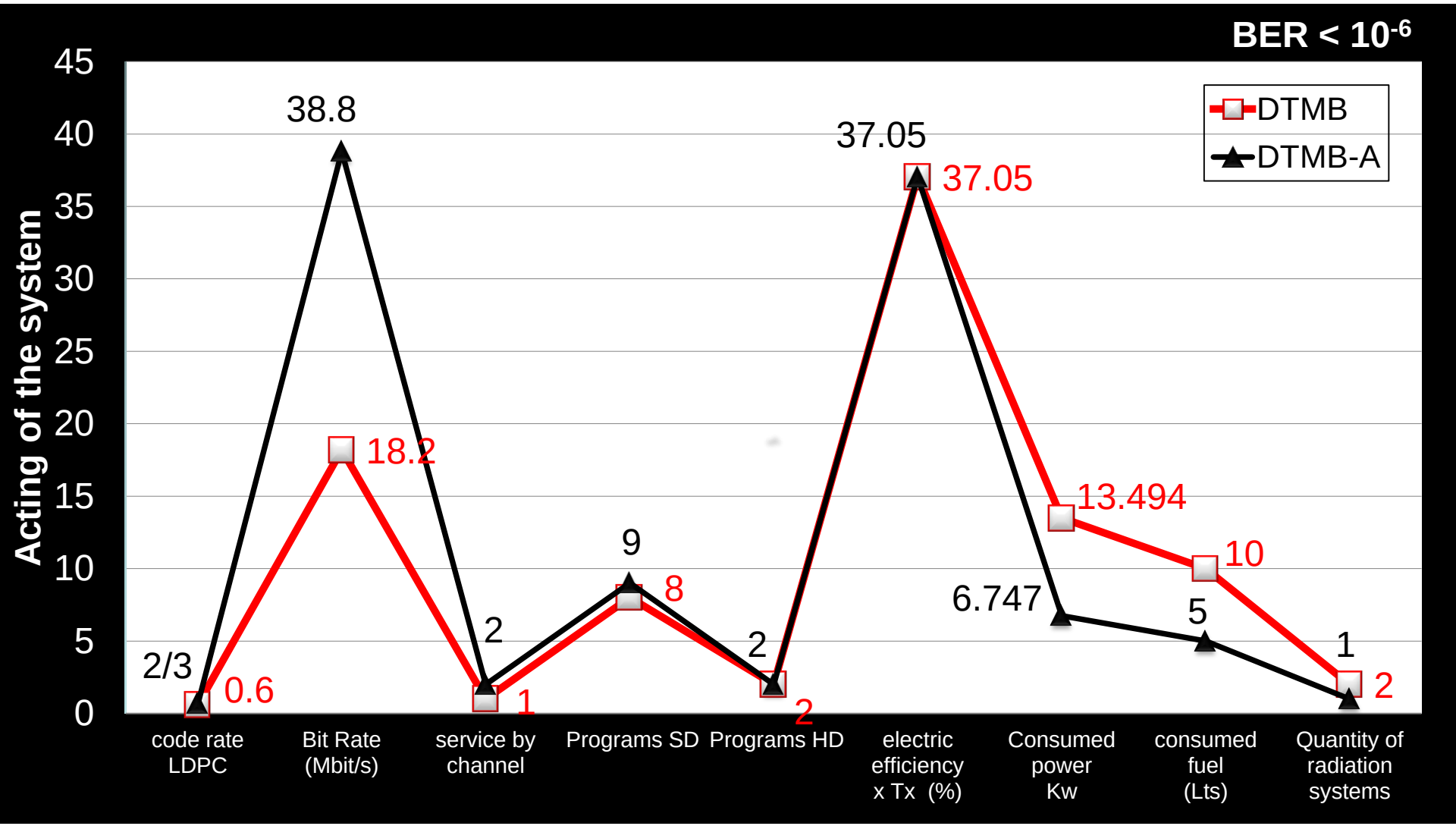
DTMB vs DTMB-A

System	DTMB	DTMB-A
Guard interval	**1/9** (420/3780), **1/6** (595/3780), **1/4** (945/3780)	**1/128** (256/32768), **1/64** (512/32768), **1/32** [(256/8192) y (1024/32768]), **1/16** [(256/4096) y (512/8192)], **1/8** [(512/4096) y (1024/8192)], **1/4** (1024/4096)
IFFT	**4k** (C=3780), Única portadora (C=1)	**4k**(C=4096), **8k**(C=8192), **32k**(C=32768)
Diversity of transmission	------	SISO, MISO (Modified technique of Alamouti) (Improves covering in SFN)

Transport stream

System payload data rate (Mbps)			
DTMB		**DTMB-A**	
Minimum	Maxim	Minimum	Maxim
3,610	32,468	5,000	**49,310**

DTMB vs DTMB-A



Efficiency, consumption and space.

Conclusions

Conclusiones

When studying the evolution of the Chinese standard, the obsolescence was evidenced that DTMB already represents.

Conclusiones

When studying the technical improvements that it incorporates DTMB-A, it was demonstrated that the structure of its supertrama allows to offer the services simultaneously in HDTV and SDTV and the design of the constellations APSK allows to process more information obtaining better acting in the receiver, what increases the use of the electromagnetic spectrum.

Conclusiones

When comparing the acting among DTMB and DTMB-A, it was evidenced that the improvements that it presents DTMB-A by virtue of increasing the use of the electromagnetic spectrum, they influence in improvements as for the energy payees' consumption and use of the space in tower.

Conclusiones

When demonstrating that it is possible to offer with DTMB-A the services HDTV and SDTV for oneself channel of RF was observed that it is possible to obtain a better convergence of these services of TDT with the analogical transmissions of TV.

Recommendations

Alternatives to improve covering in mountainous reliefs

1. To carry out field tests in those that gets ready to the entrance of the sub-system of transmission of several bit rate different but with the same information.

THANK YOU

END

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