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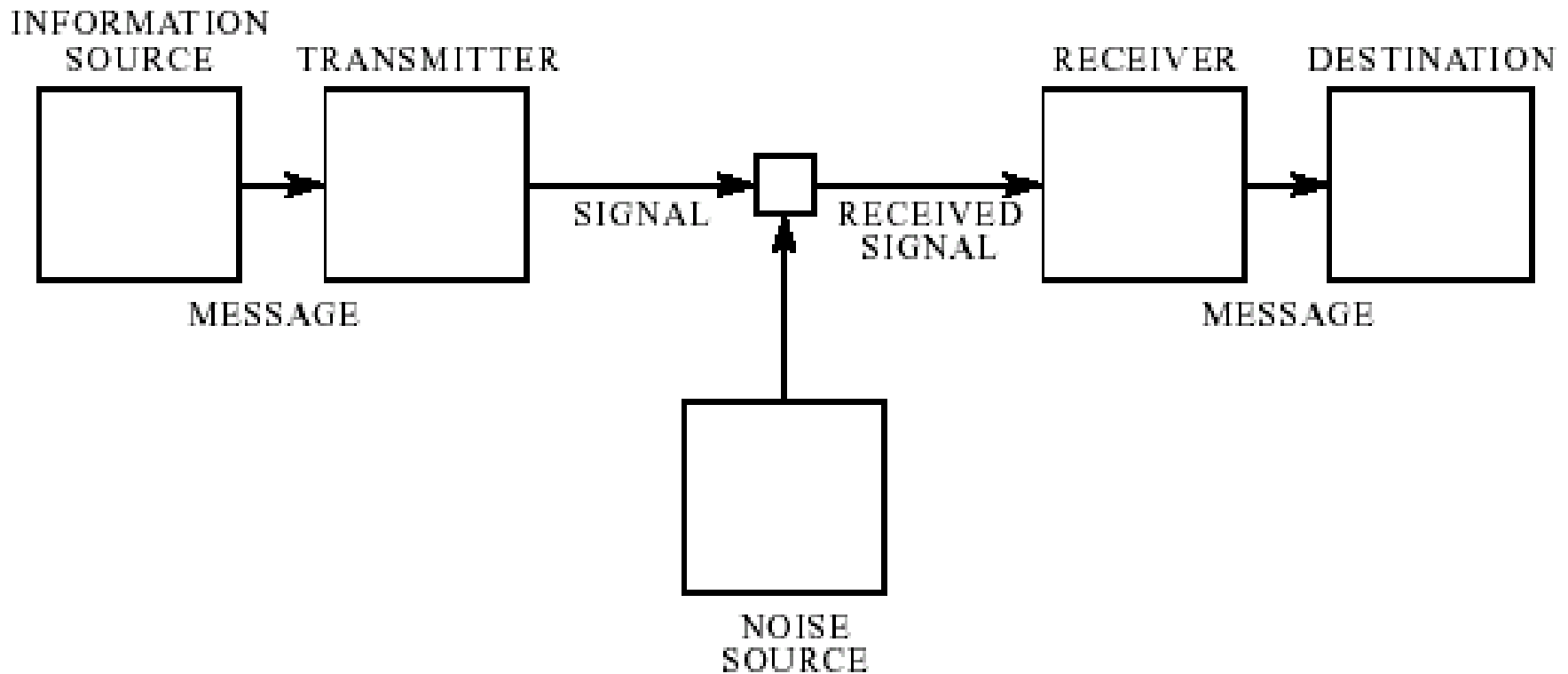
RF Engineering Transmitters Receivers

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Schematic diagram of a general communication; Shannon & Weaver (1949)





Receiver Noise



available noise power = kTB

where k is Boltzmann's constant and B

is the bandwidth. $k = 1.38 \times 10^{-23} \text{ J K}^{-1}$

A useful figure to remember is that at 290K the available noise power density is -174dBm/Hz



Receiver Sensitivity, M.1767



$$P_r (\text{dBm}) = -114 + F + I/N + 10 \log B_v + P_o$$

F : noise figure of the base station or mobile station receivers (dB)

I/N : criterion of interference to receiver system noise ratio (dB)

B_v : equivalent noise bandwidth of the receiver (MHz)

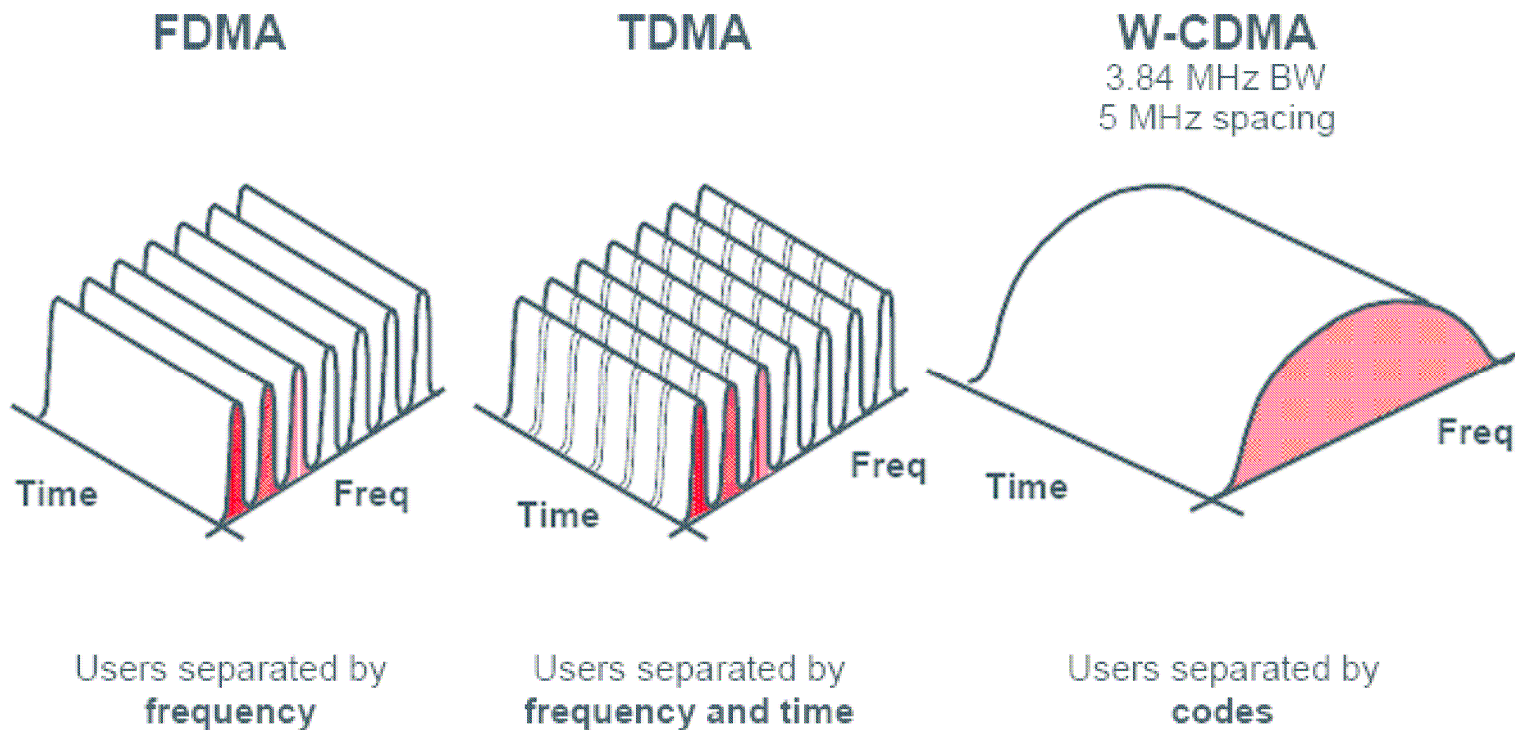
P_o : noise increase due to man-made noise and other interference (dB);

Relationship between field strength, E , power, P_r , in frees

$$P_r = \frac{E^2 G \lambda^2}{Z_0 4\pi} = \frac{E^2 G c^2}{480\pi^2 f^2}$$



Code Division Multiple Access

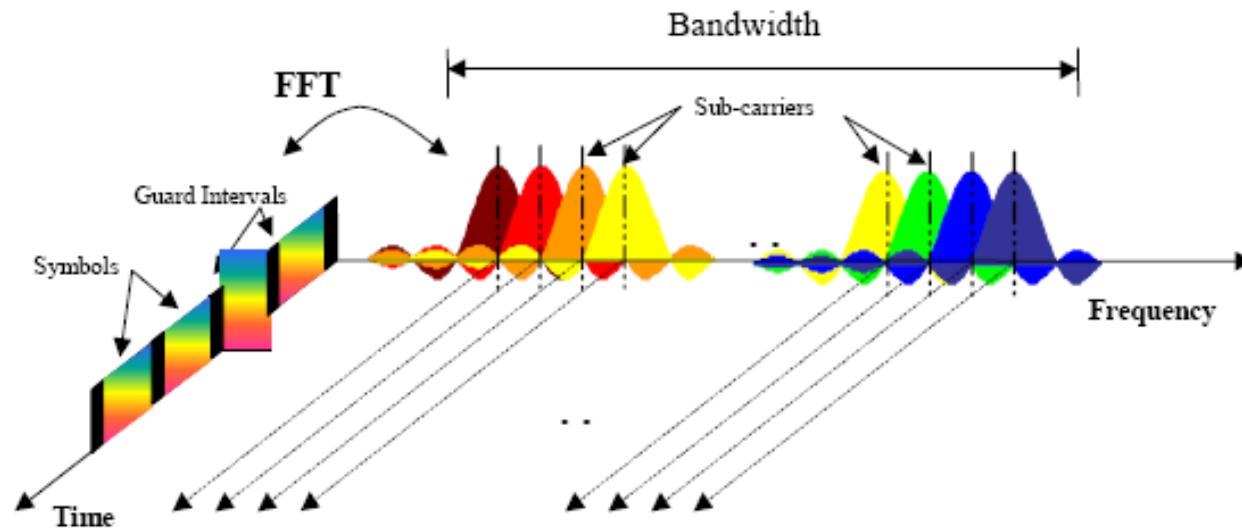




OFDM / OFDMA, RS Seminar



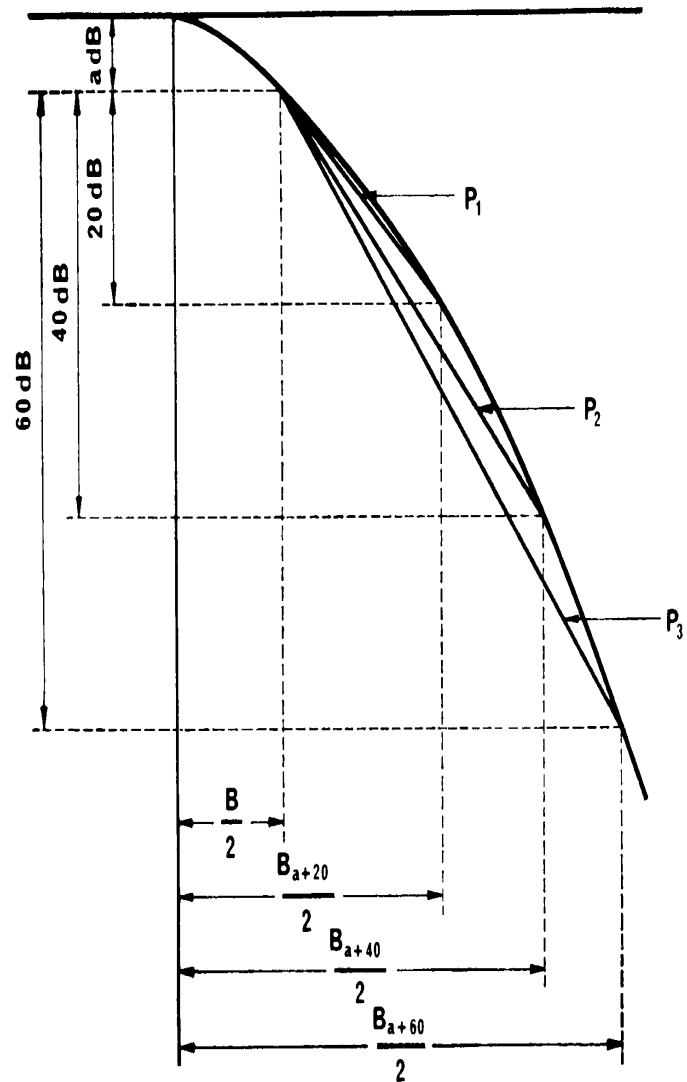
OFDM / OFDMA



- ❖ Each sub-carrier (frequency channel) carries a separate low-rate stream of data
- ❖ Frequencies are chosen so that the modulated data streams are orthogonal to each other
- ❖ Each sub-carrier is independently modulated
- ❖ A guard time is added to each symbol (cyclic prefix)
- ❖ Symbol duration is relatively long compared to channel delay spread -> less intersymbol interference



Single Signal Selectivity Rec SM 332-4



Dr. Haim Mazar (Madjar) mazar@ties.itu.int , mazarh@moc.gov.il Wireless Telecomms Seminar, Nepal Kathmandu 24-28 Nov. 08

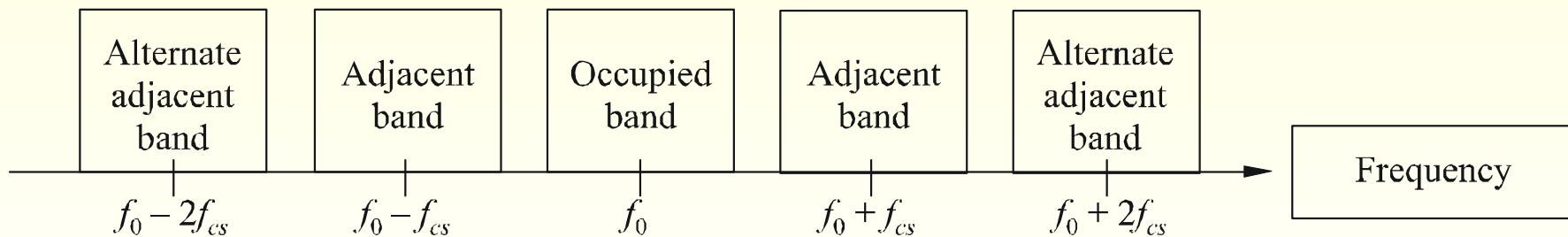


Unwanted Masks, Rec SM 1541



FIGURE 3

Power measurement bands

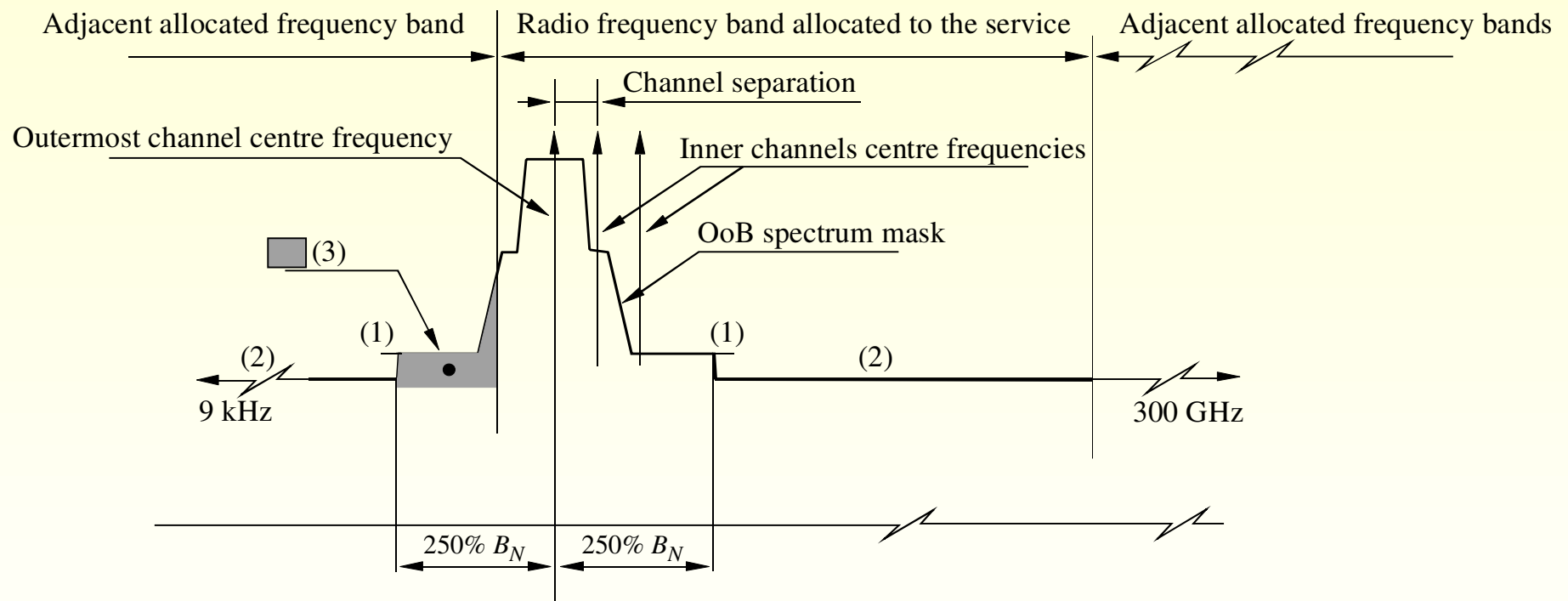


f_{cs} : spacing between assigned frequencies

1541-03



Unwanted Emissions, Rec SM 1540



- (1) Actual OoB mask for the system under consideration
- (2) Spurious limit defined by RR Appendix 3 or Recommendation ITU-R SM.329
- (3) Unwanted emissions in the OoB domain falling in the adjacent allocated frequency band

1540-01



Categories of *spurious emissions* limits



Category A	The attenuation values used to calculate maximum permitted spurious domain emission power levels. RR Appendix 3 is derived from Category A limits.
Category B	Limits are defined and adopted in Europe (all Europe not only EU) and used by some other countries.
Category C	Limits are defined and adopted in the US and Canada and used by some other countries.
Category D	Limits are defined and adopted in Japan and used by some other countries.

Spurious Emissions Rec ITU-R SM 329



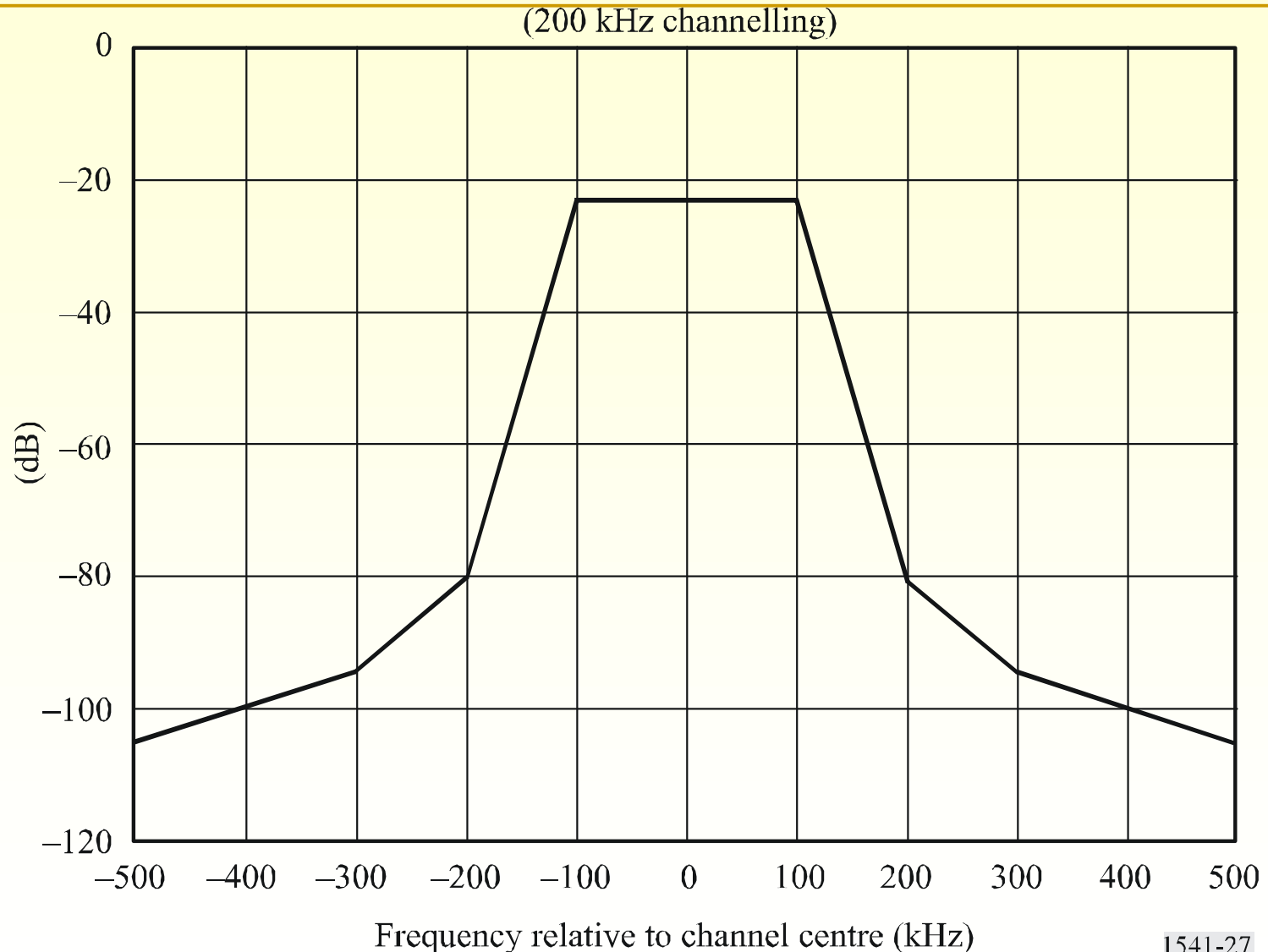
Comparative *spurious emissions* values (dBm)



Type of equipment	Category A: All Countries	Category B: Europe	Category C: USA, Canada	Category D: Japan
Portable, 465 MHz, 1 W, 12.5 kHz channels	-13	-36	-20	-30
Fixed Service, 325 MHz, 10 W	-13	-50	-13	-20
HF Broadcasting, 100 kW	17	17	0	17
FM Broadcast, 100 MHz, 10 kW	0	-15	-10	0



Spectrum Limit VHF FM sound, Rec 1541

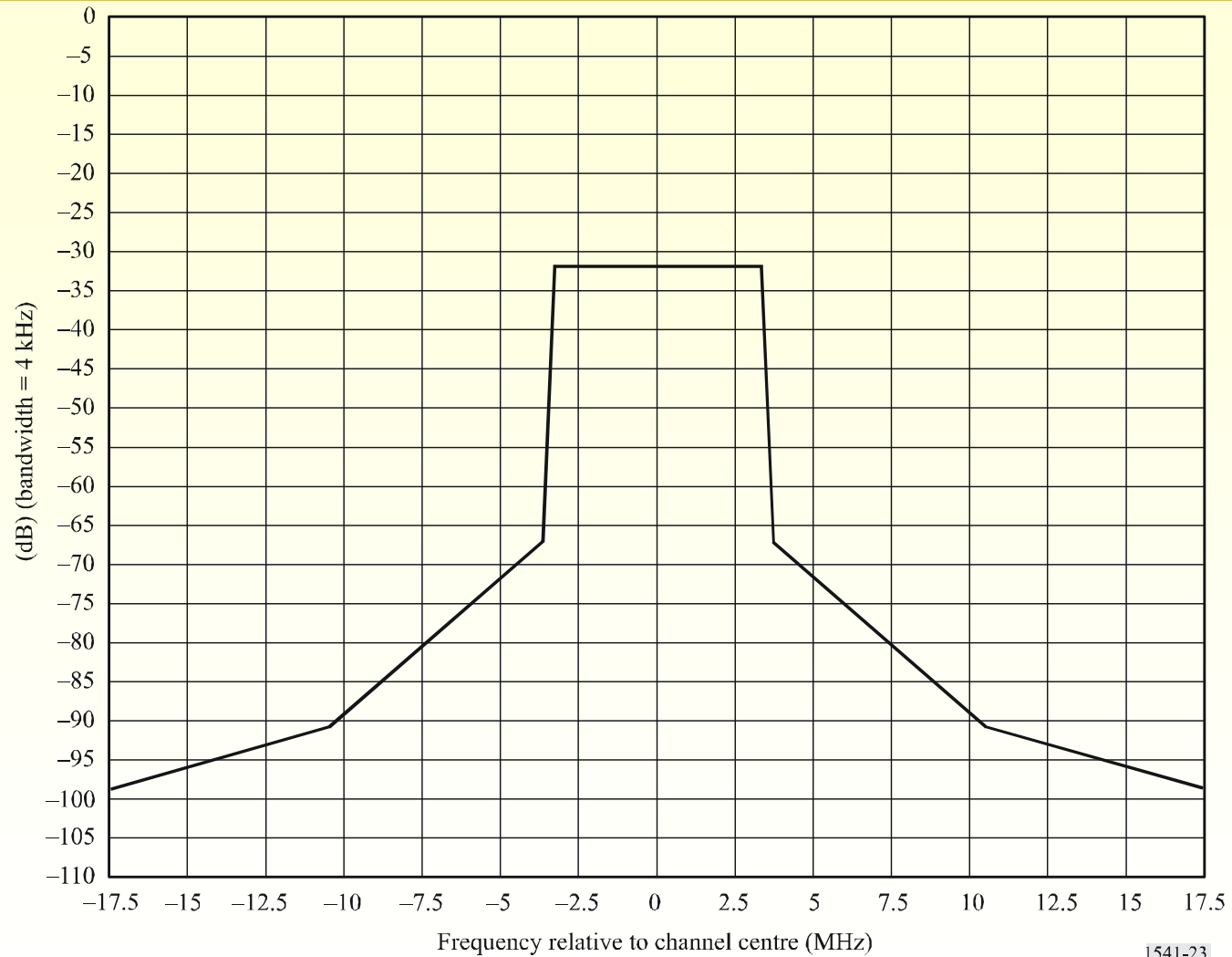


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1541-27
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Spectrum for 7 MHz DVB-T, Rec SM. 1541





CDMA IS95 1,932.55 MHz Ch. Spacing 1.25 MHz

