

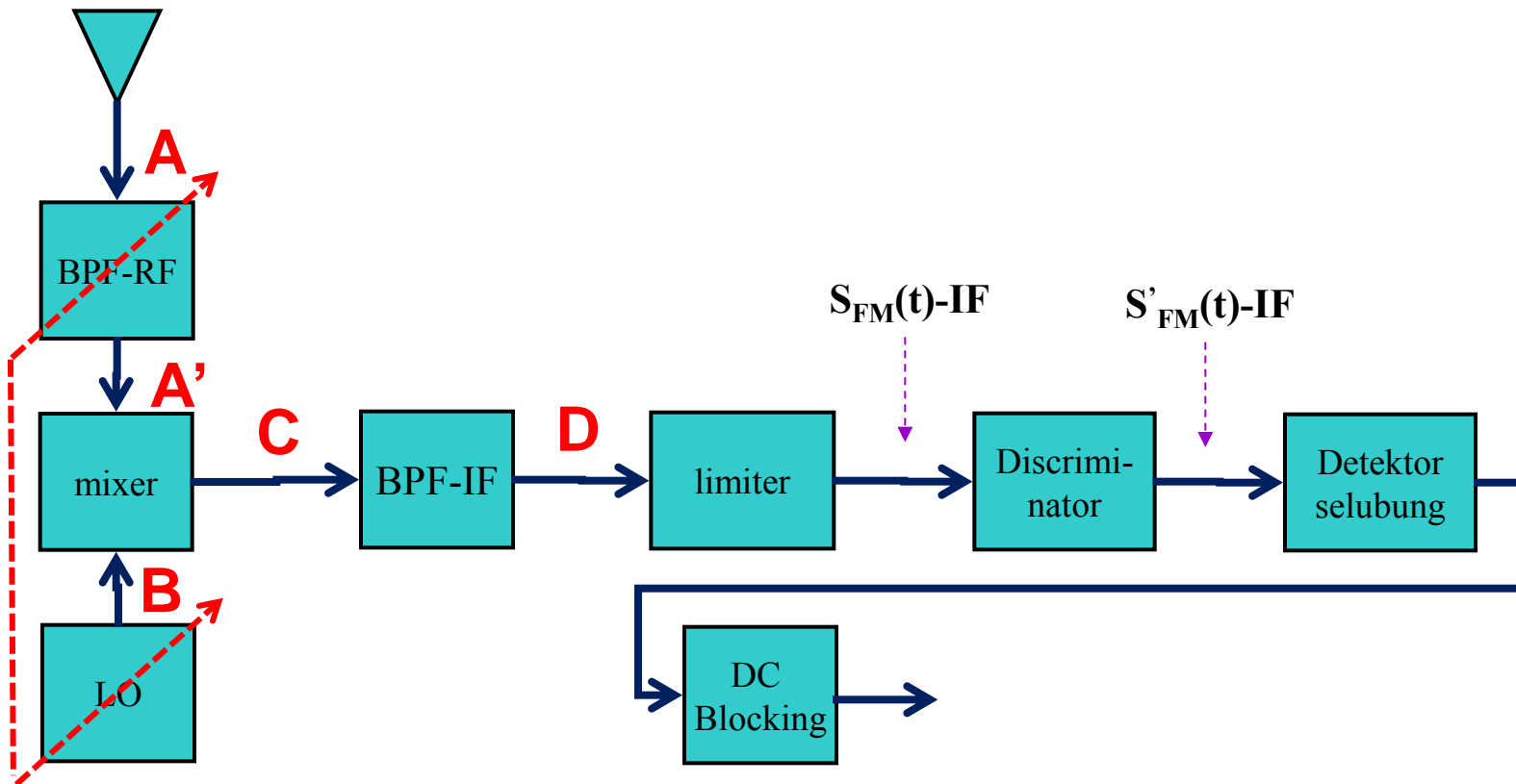
SISTEM KOMUNIKASI

RECEIVER FM & AGC:

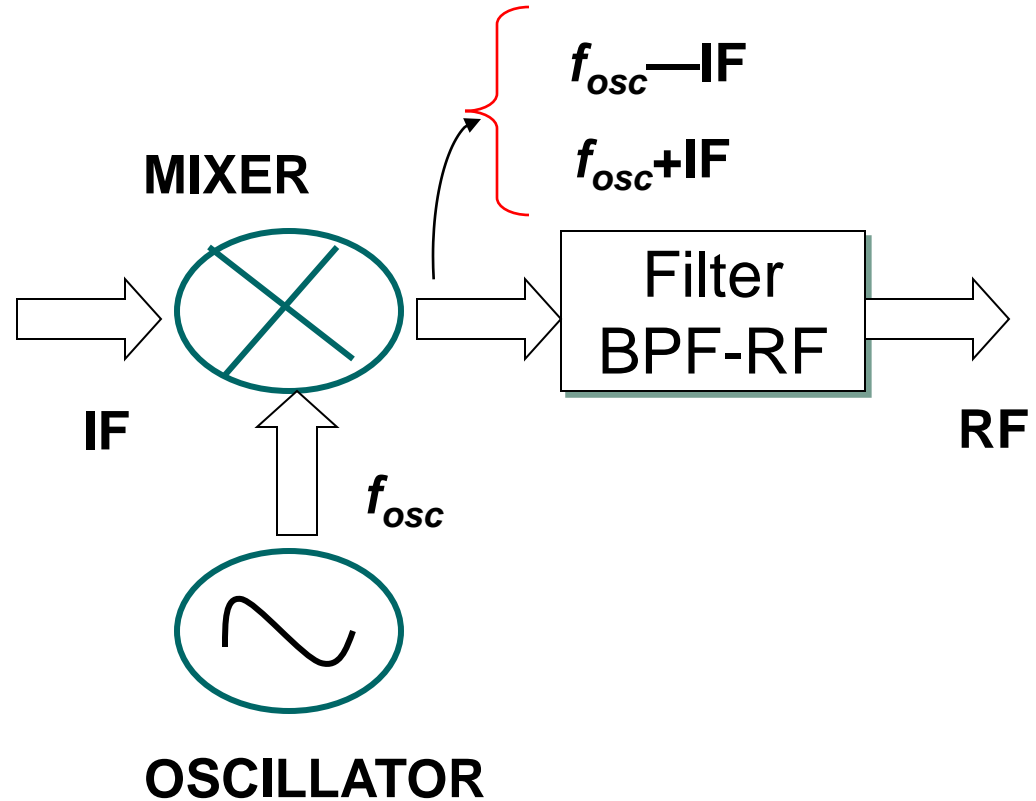
*Superheterodyne, Demodulator FM,
FM Stereo, AGC*

FM receiver

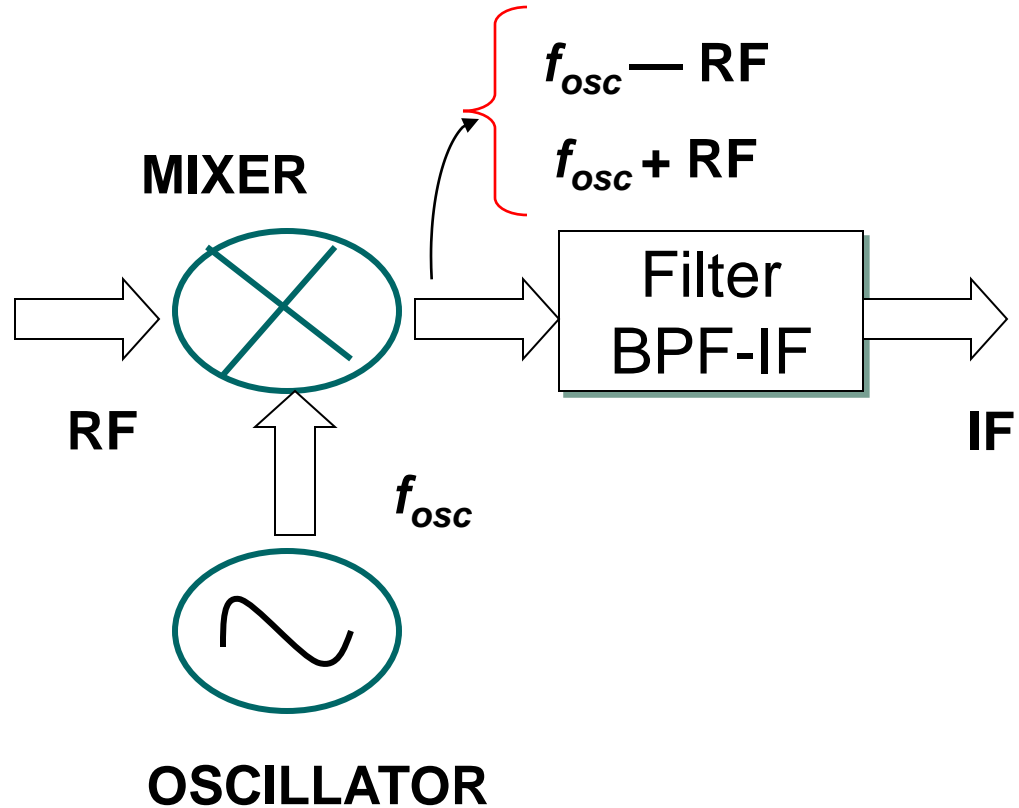
- FM receiver is similar to the superheterodyning (down converting) layout:



Up Converter (di Pemancar)

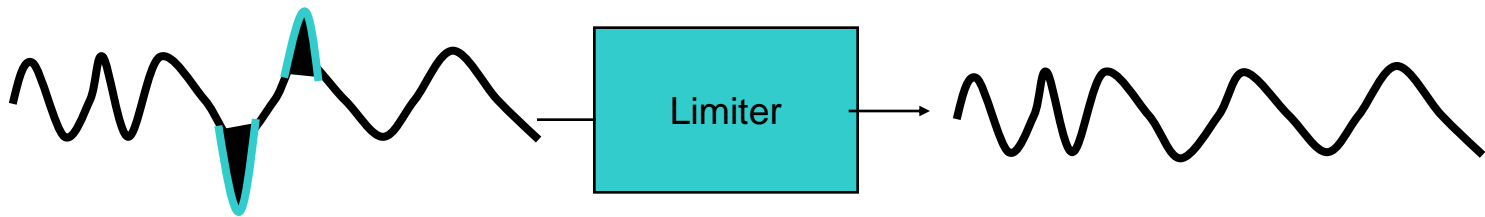


Down Converter (di Penerima)



Limiter

- A limiter is a circuit whose output is constant for all input amplitudes above a threshold
- Limiter's function in an FM receiver is to remove unwanted amplitude variations of the FM signal



Demodulasi Sinyal FM

Dengan menggunakan diskriminator/differensiator

- Pada sinyal FM, informasi terkandung pada frekuensi sinyal FM

$$S_{FM}(t) = A_c \cos \left[2\pi f_{IF} t + 2\pi k_f \int_0^t m(t) dt \right]$$

- Jika dilakukan diferensiasi terhadap $S_{FM}(t)$ (\Rightarrow keluaran discriminator) didapat :

$$S'_{FM}(t) = A_c \left[2\pi f_{IF} + 2\pi k_f m(t) \right] \sin \left(2\pi f_{IF} t + 2\pi k_f \int_{-\infty}^t m(t) dt \right)$$

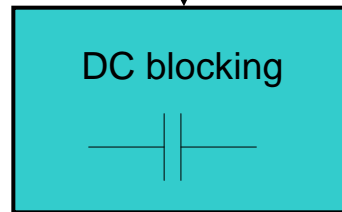
Informasi terkandung pada bagian **selubung** dari $S'_{FM}(t)$

Demodulasi Sinyal FM

- Keluaran detektor selubung (masukan DC blocking):

$$S(t) = A_c [2\pi f_c + 2\pi k_f m(t)]$$

selubung dari $S'_{FM}(t)$



- Keluaran DC blocking:

$$\hat{m}(t) = A_c 2\pi k_f m(t) = C.m(t)$$

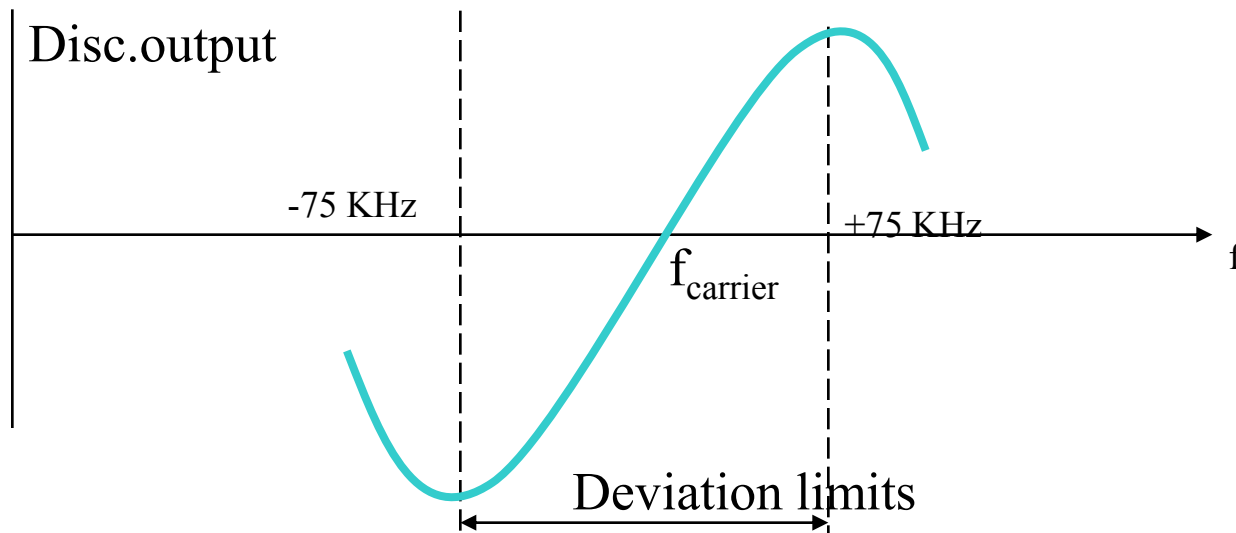
Discriminator

- The heart of FM is this relationship

$$f_i(t) = f_c + k_f m(t)$$

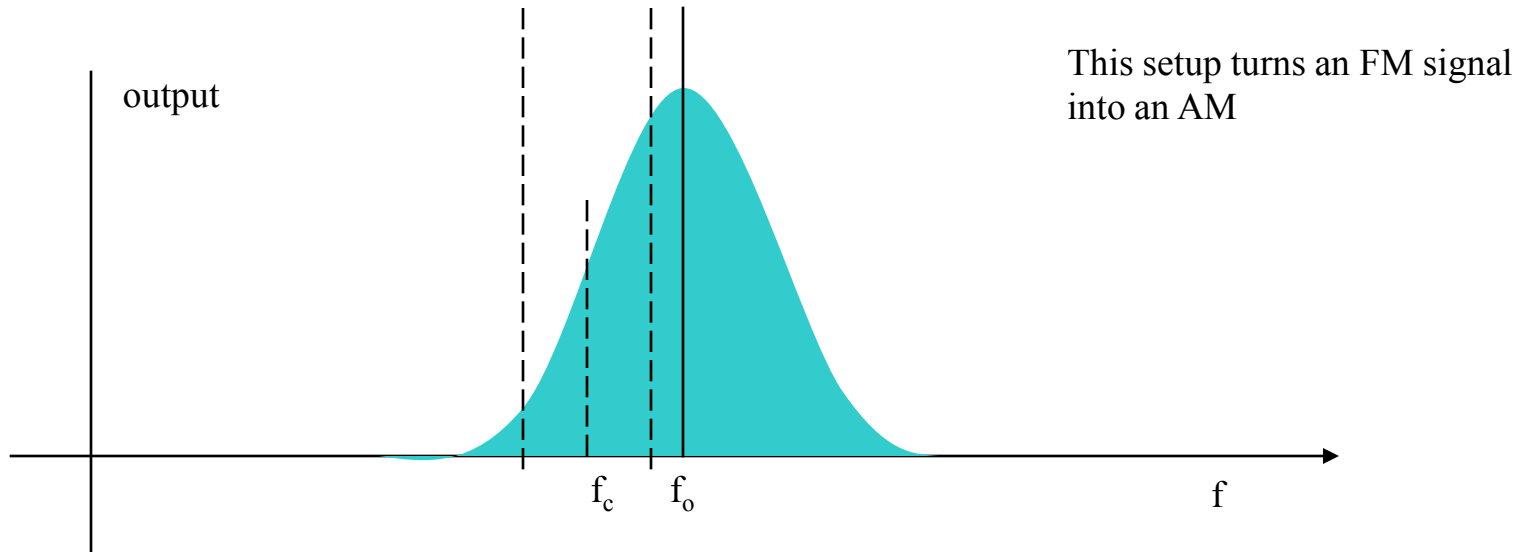
- What we need is a device that linearly follows inst. frequency

f_{carrier} is at the IF frequency
Of 10.7 MHz

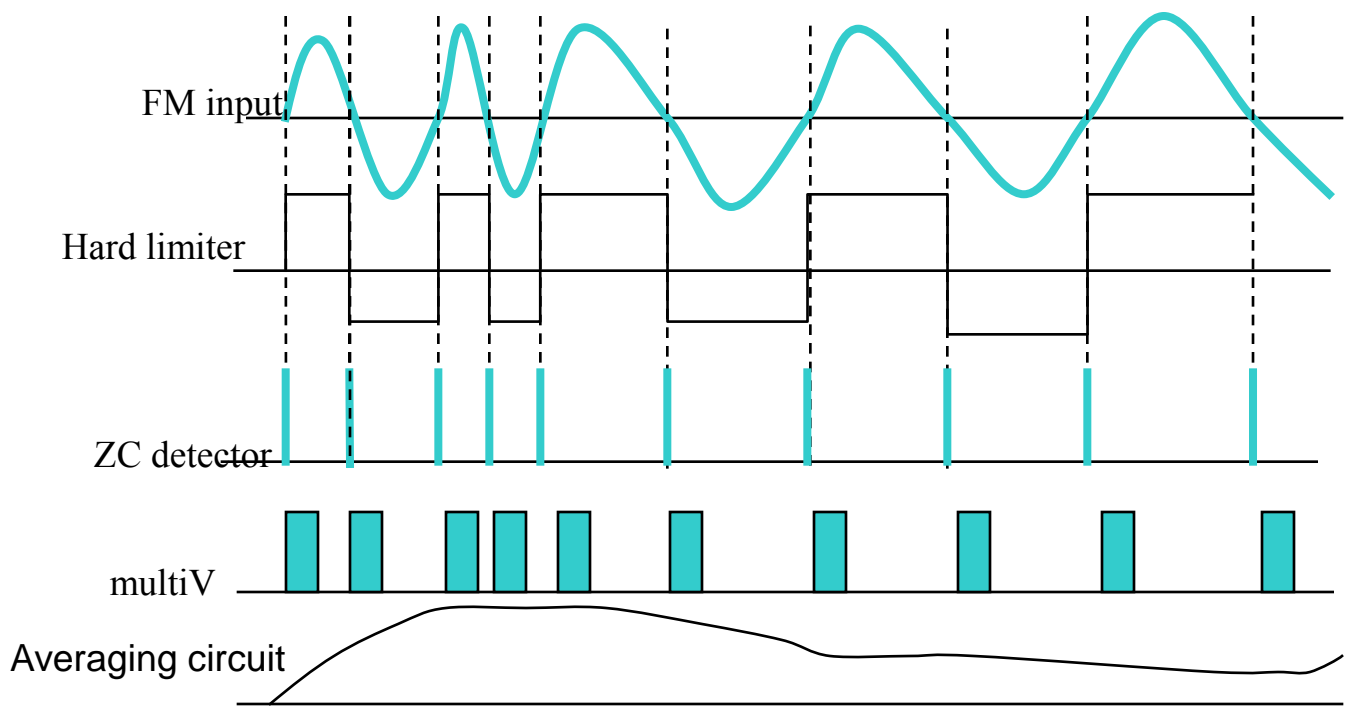
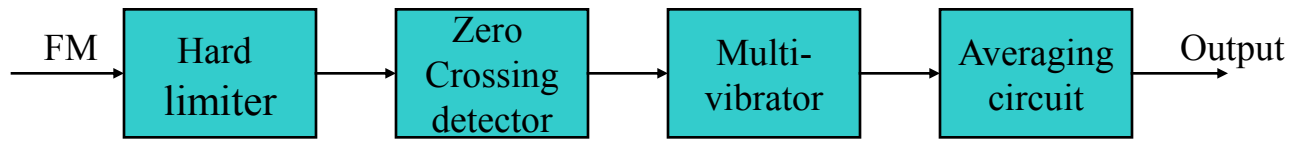


Examples of discriminators

- Slope detector - simple LC tank circuit operated at its most linear response curve



Zero crossing detector



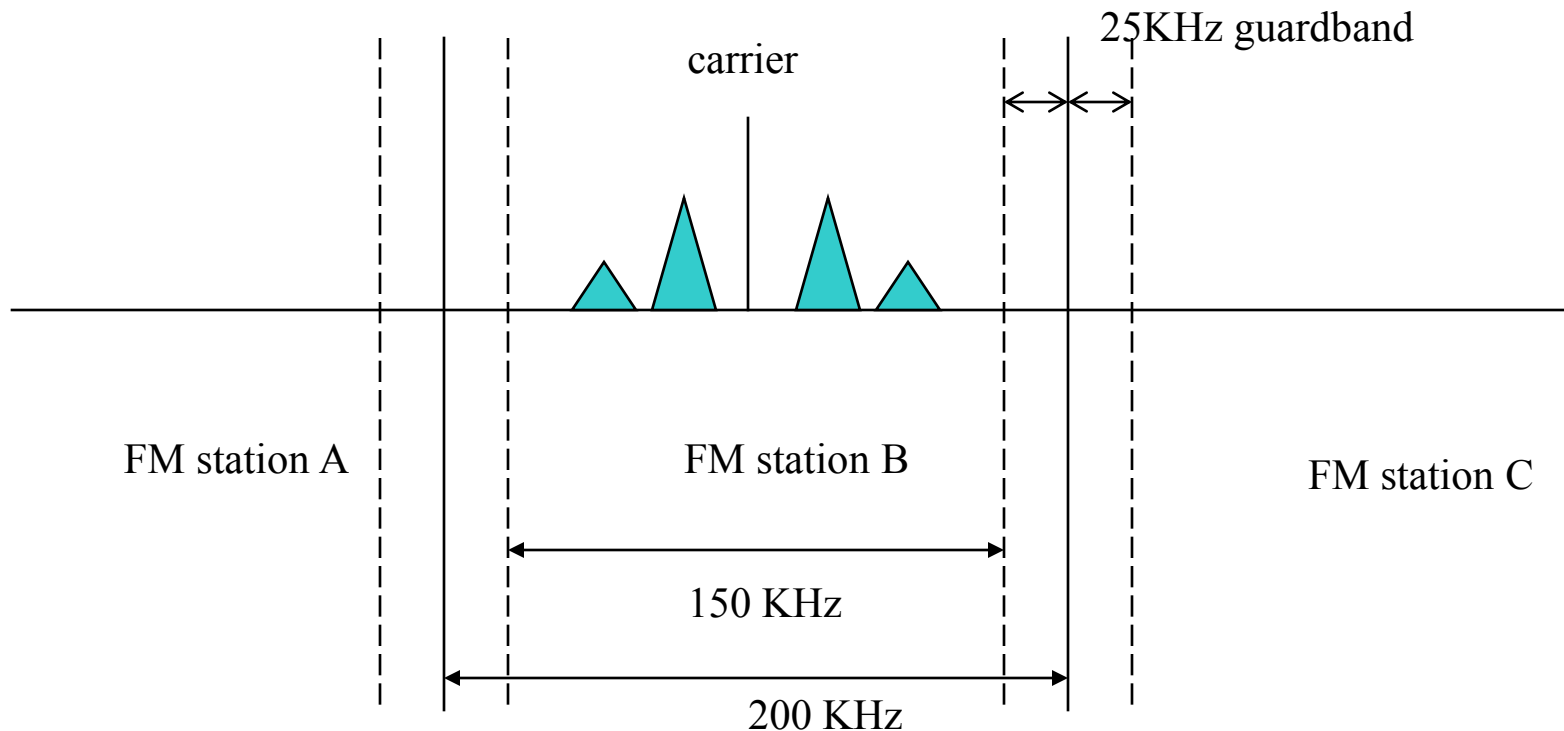
more frequent
ZC's means
higher inst freq
in turn means
Larger message
amplitudes

Commercial FM

- Commercial FM broadcasting uses the following parameters
 - Baseband: 15KHz = $W = f_m$
 - Deviation ratio: 5 (index modulasi)
 - Peak freq. Deviation = 75KHz
 - ➔ $B_{FM} = 2(\beta + 1)W = 2 \times 6 \times 15 = 180\text{KHz}$
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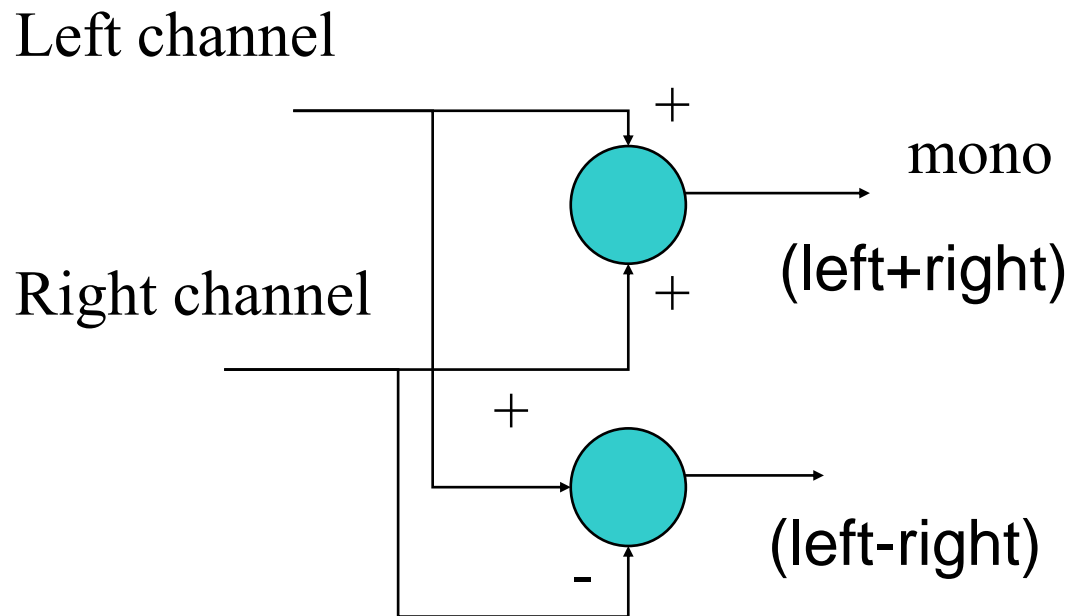
Commercial FM spectrum

- The FM landscape looks like this



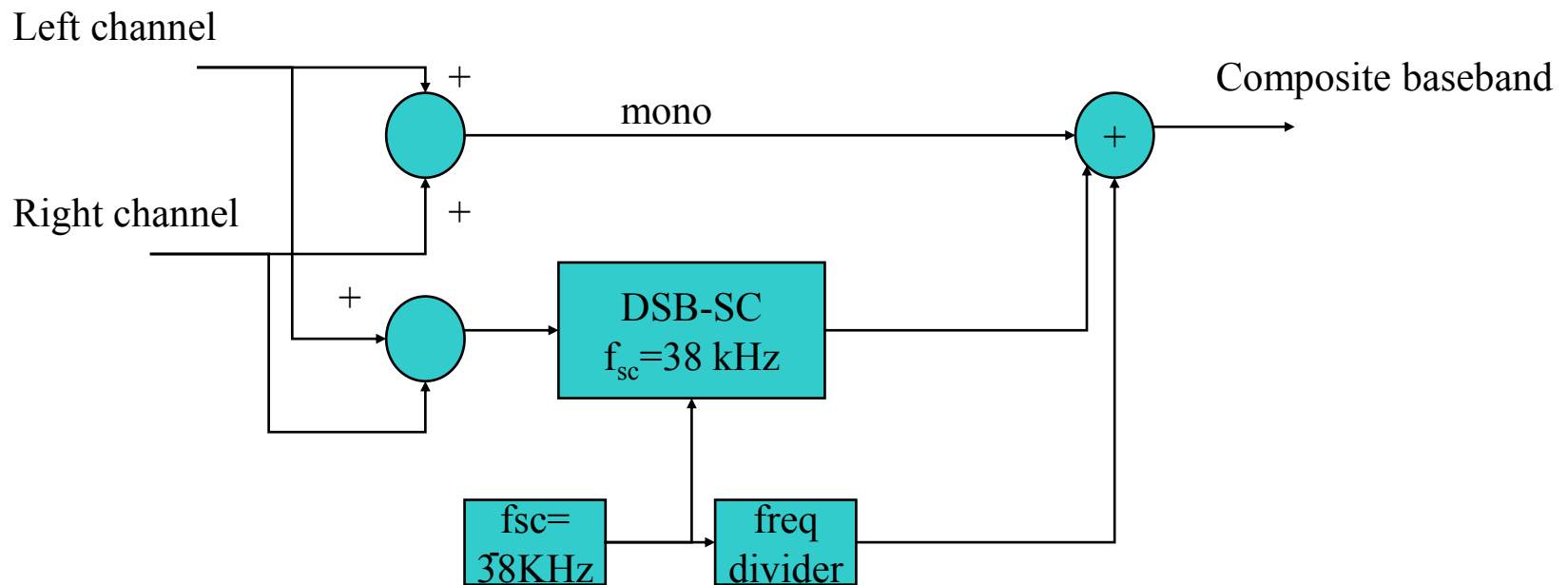
FM stereo:multiplexing

- First, two channels are created; (left+right) and (left-right)
- Left+right is useable by monaural receivers



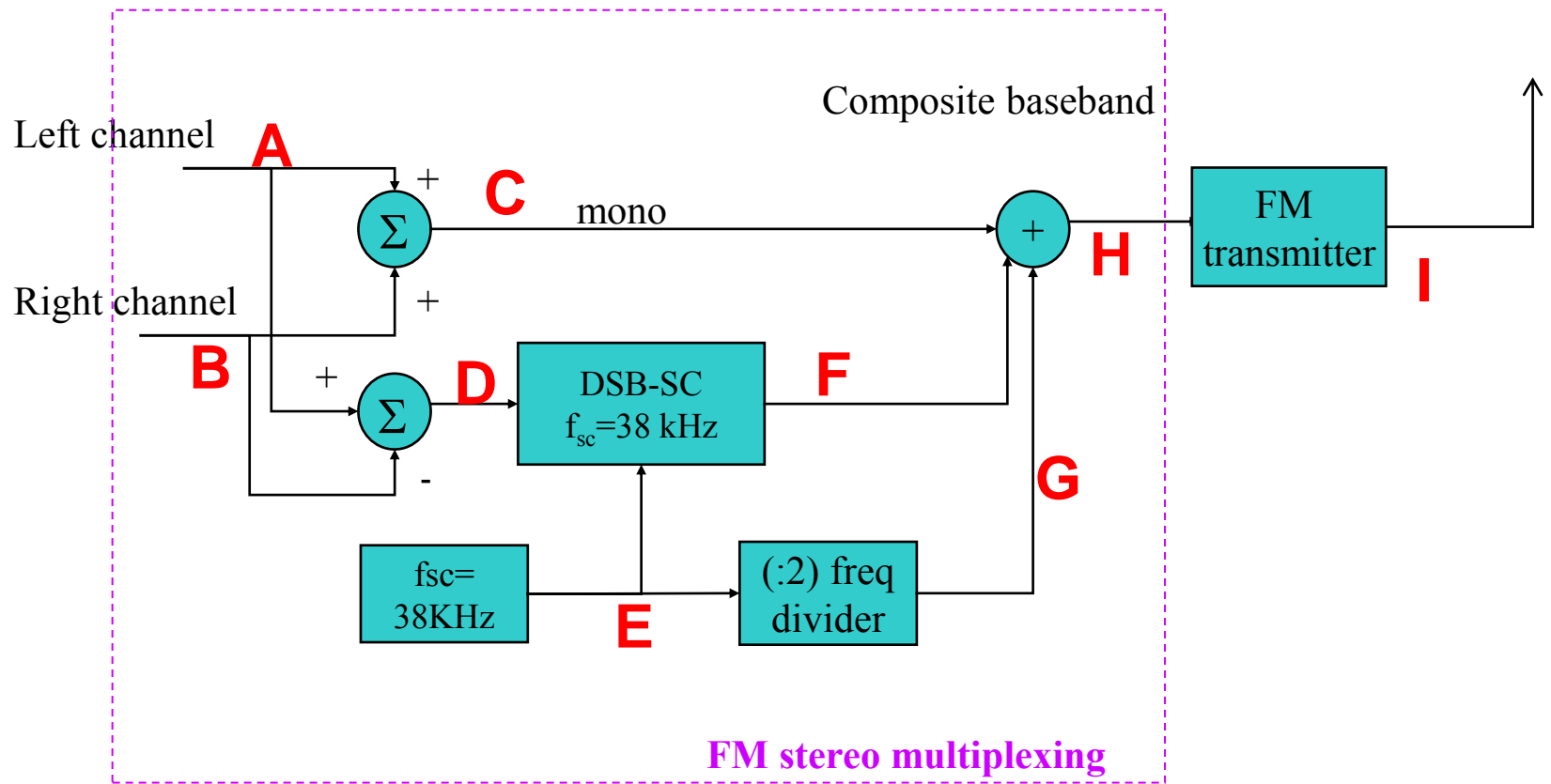
Subcarrier modulation

- The mono signal is left alone but the difference channel is amplitude modulated with a 38 KHz carrier



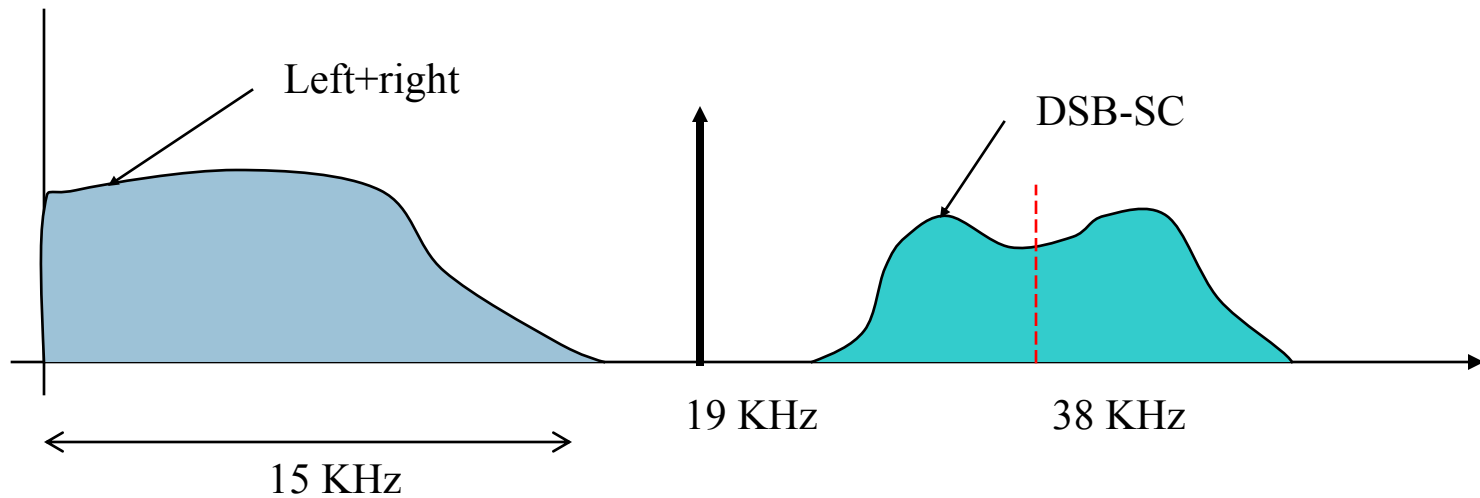
Stereo signal

- Composite baseband signal is then frequency modulated



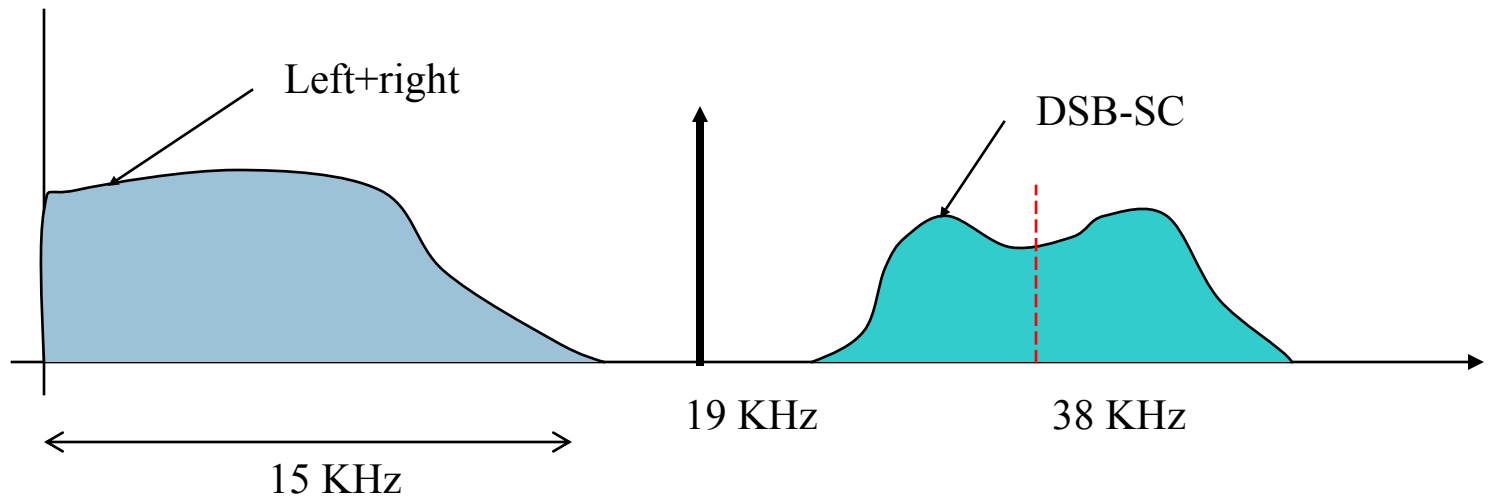
Stereo spectrum

- Baseband spectrum holds all the information. It consists of composite baseband, pilot tone and DSB-SC spectrum

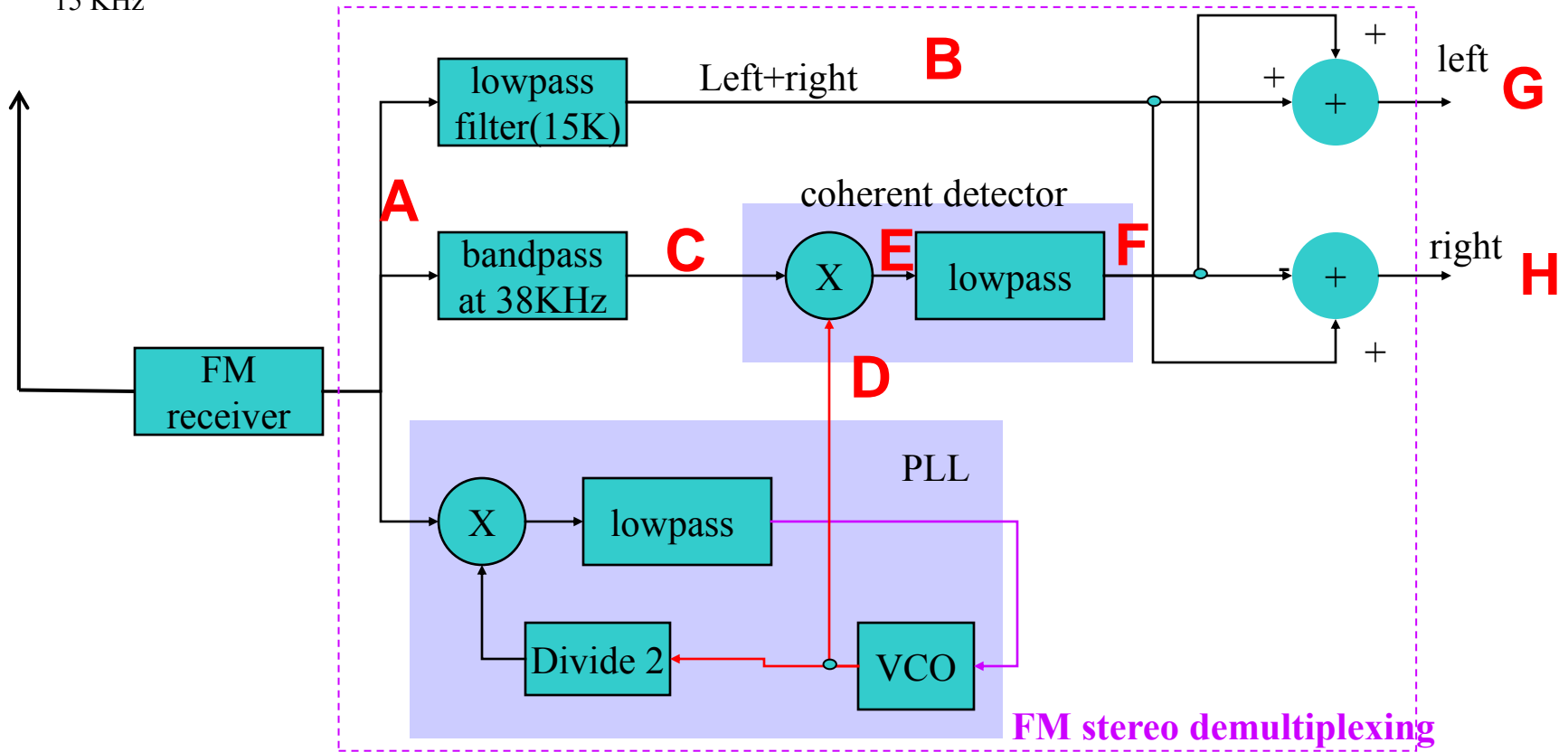
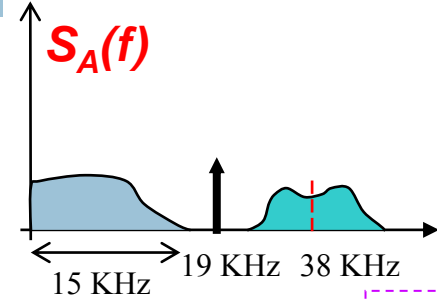


Stereo receiver

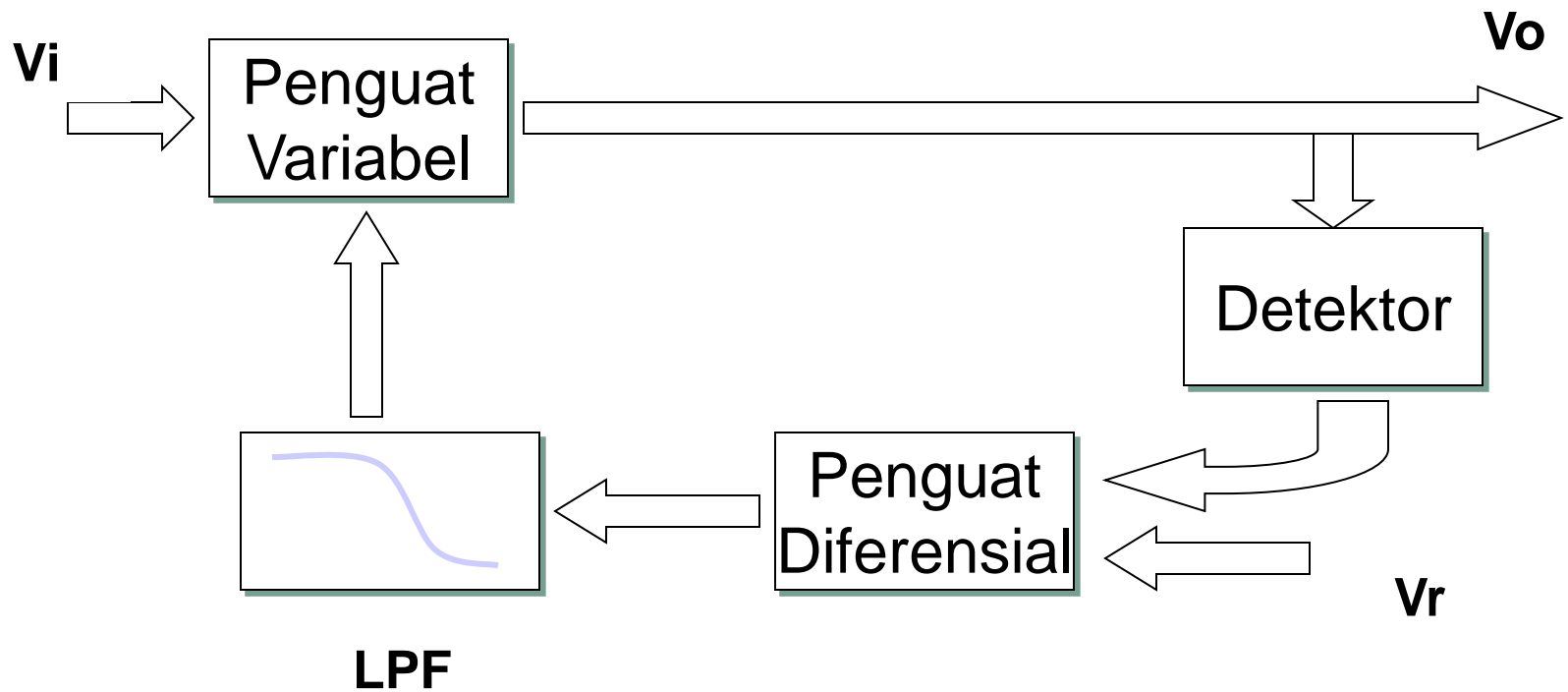
- First, FM is stripped, i.e. demodulated
- Second, composite baseband is lowpass filtered to recover the left+right and in parallel amplitude demodulated to recover the left-right signal



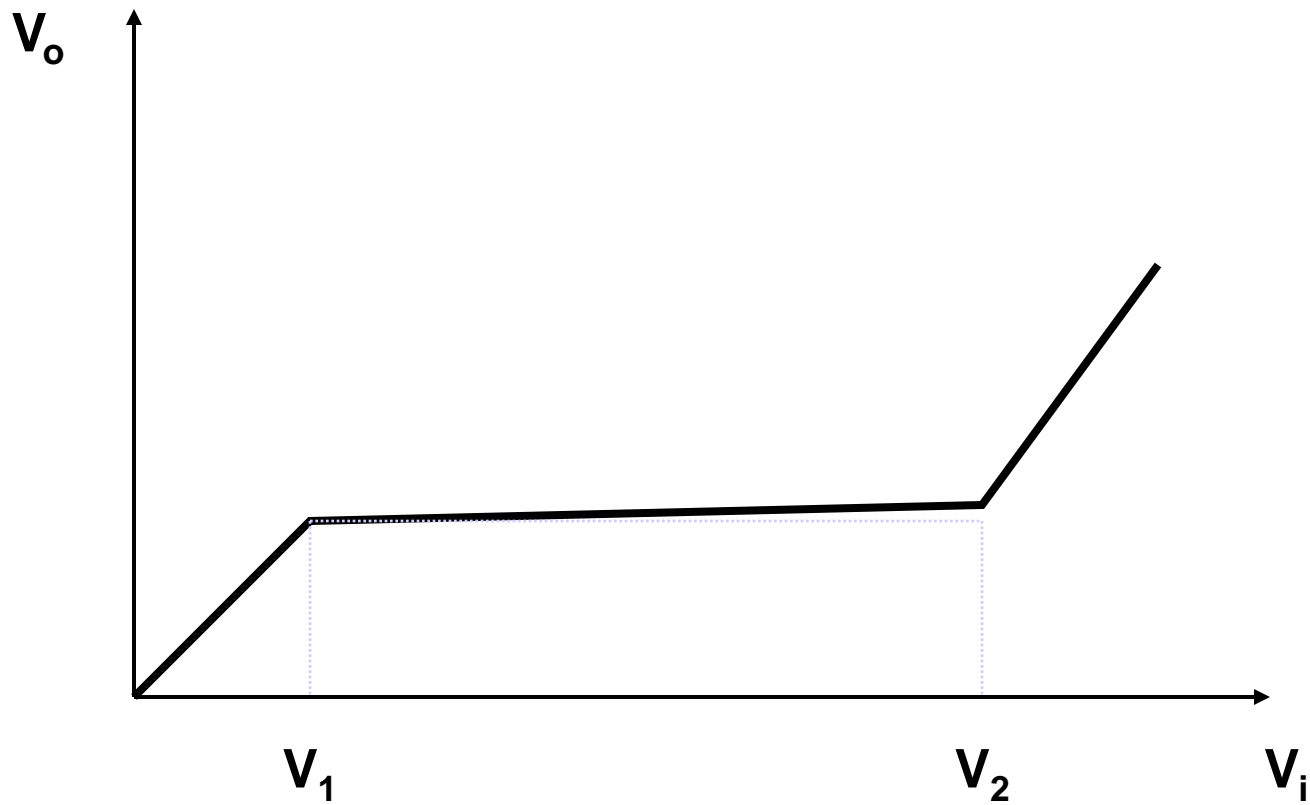
Stereo receiver diagram

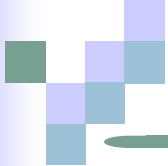


AGC (Automatic Gain Control)



AGC (Automatic Gain Control)



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- MATERI UTS: MODUL 1 – 6
 - SIFAT UJIAN : TUTUP BUKU
 - LAMA UJIAN : \pm 2 JAM (4 SOAL)
 - TIPE SOAL : ESSAY
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