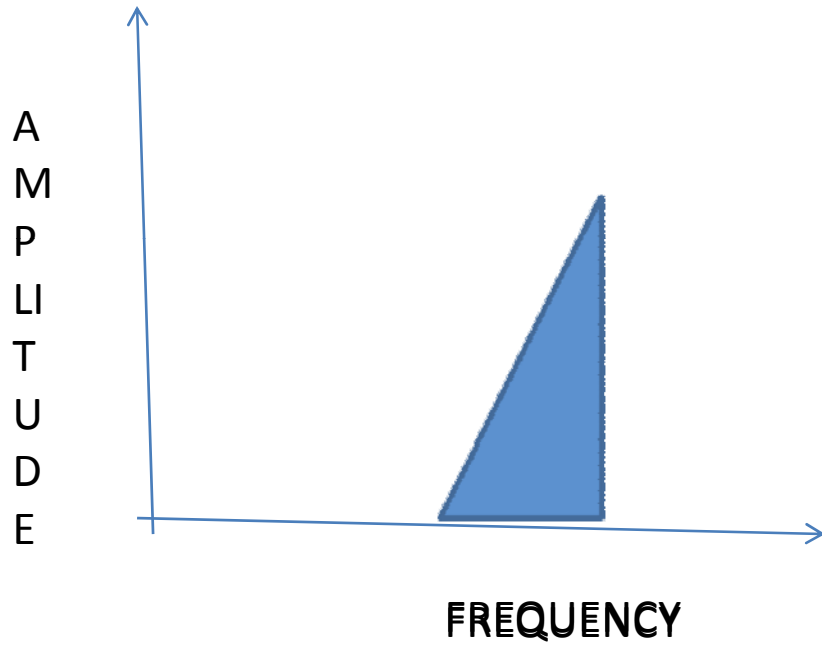
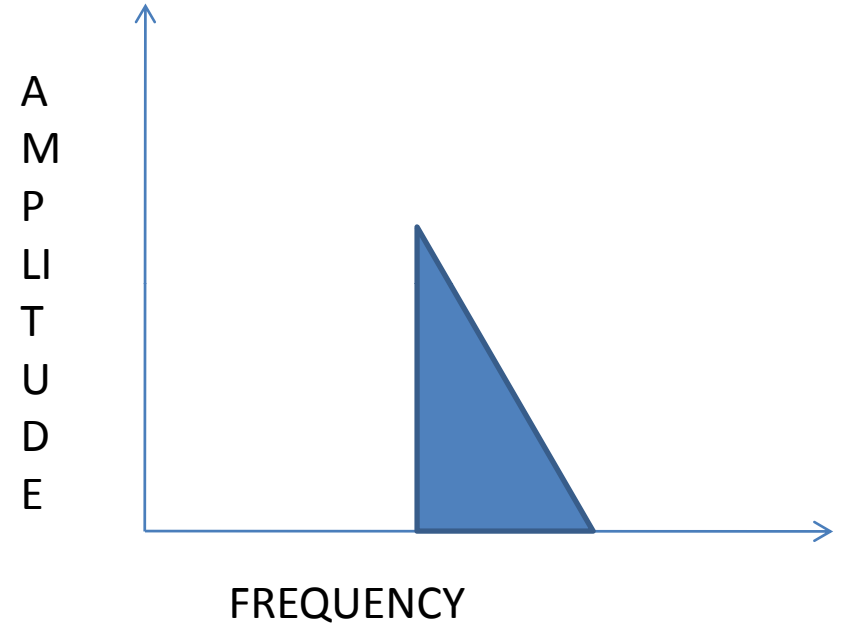


# BASE BAND ANALOG (VOICE )SIGNAL

- ANALOG DIGITAL
- FLAT SPECTRUM 300-3100 Hz
- CCITT 3000-3400 Hz
- SPECTRUM OF BASE BAND SIGNAL IS REPRESENTED BY A TRIANGLE



NORMAL SPECTRUM



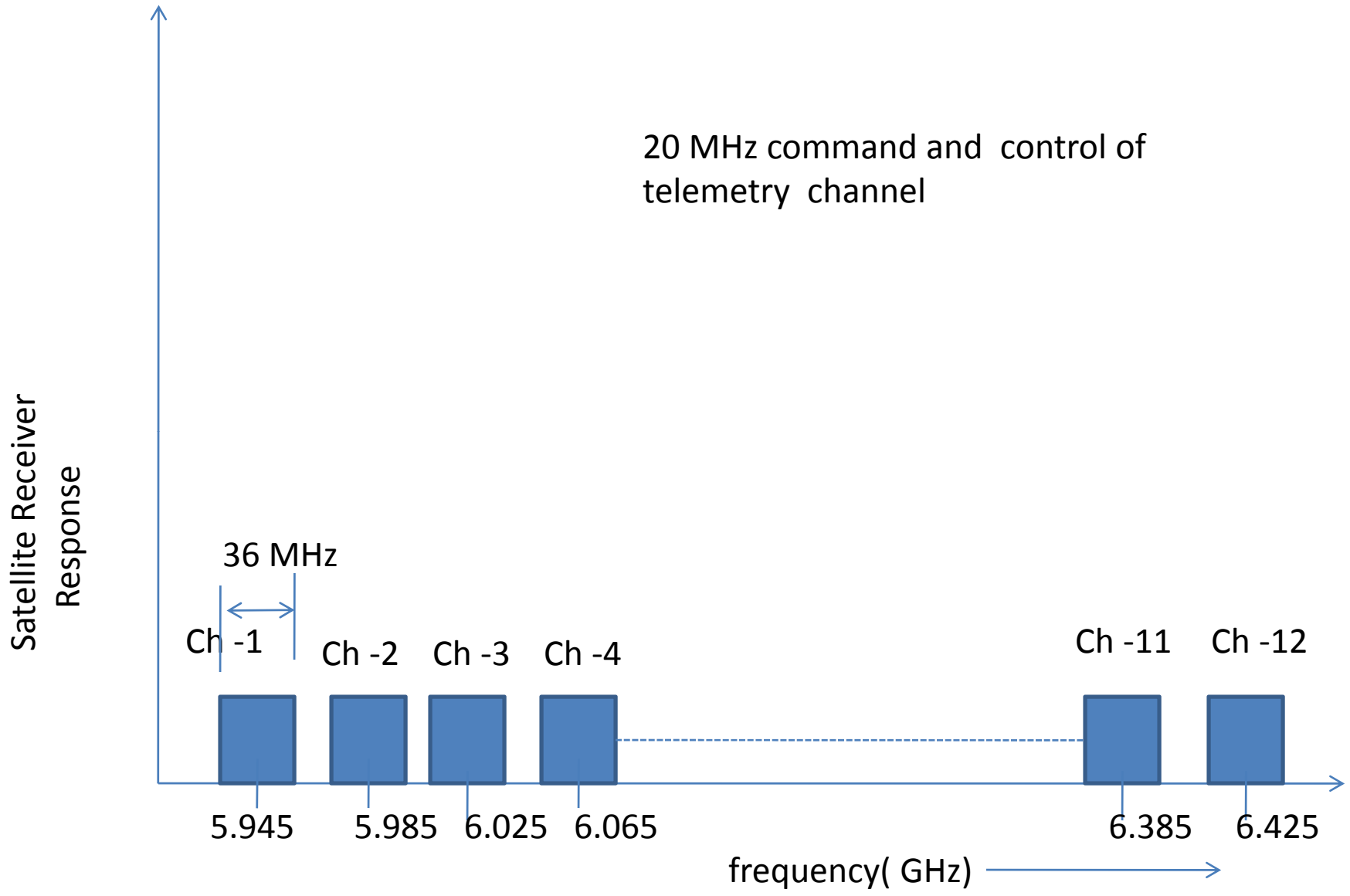
INVERTED SPECTRUM

# Continued

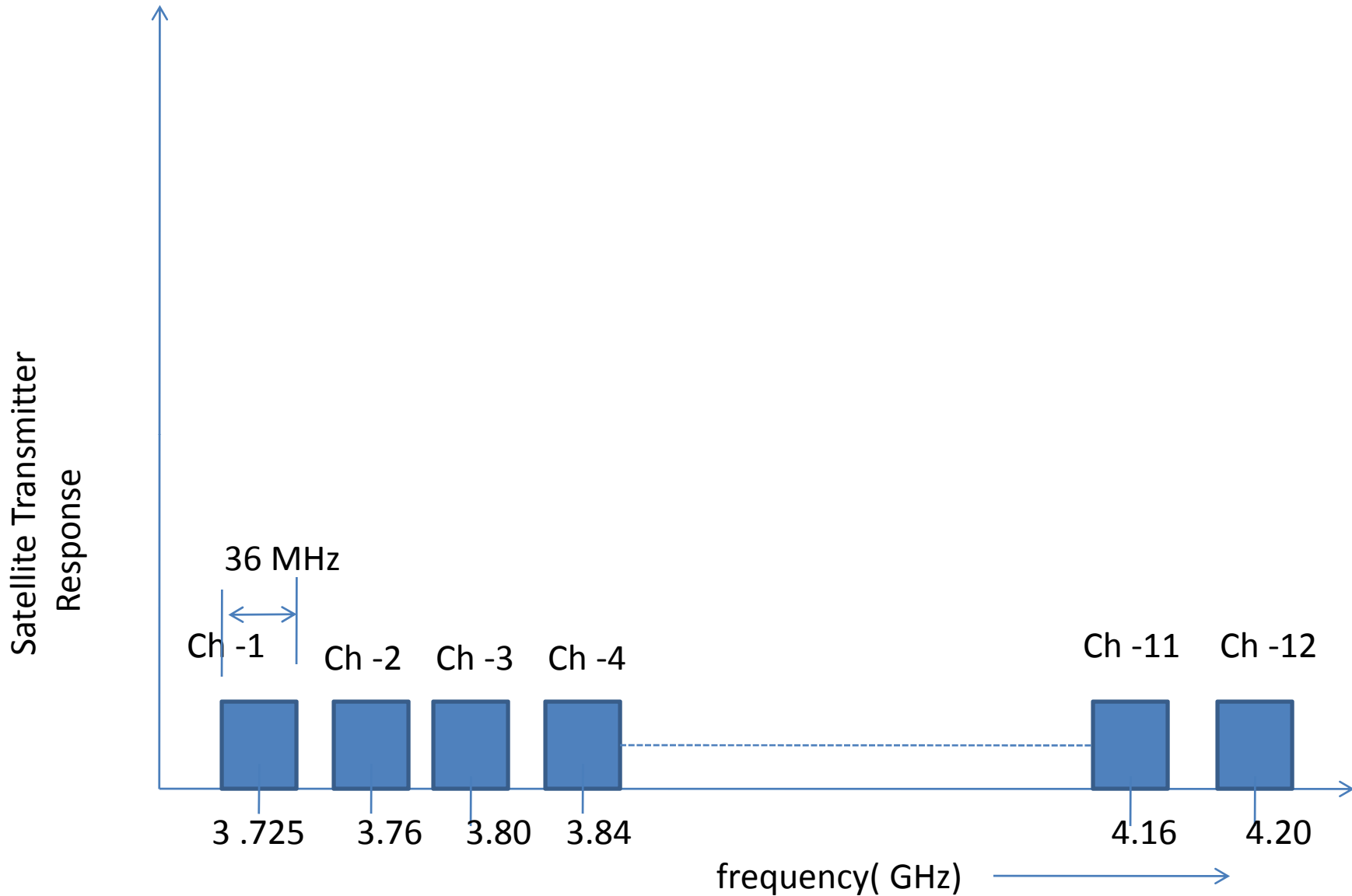
- TRANSMISSION LEVEL with reference dBmo
- 0 – zero transmission level point
- -2dbmo – 2dBm at reference
- Test tone – 1 kHz tone at 0dB to simulate peak power on one channel
- -19.8 dBmo for terrestrial FDM/FM
- -22dBmo for satellite links

# Frequency Division Multiplexing Technique

- Analog communication is carried out with FM.
- Satellite link relays many signals from single earth station.
- Each satellite has certain no. of transponders as receiver transmitter pair
- Uplink frequency range is 5.925 to 6.425 GHz



# SATELLITE RECEIVER CHANNEL



# SATELLITE TRANSMITTER CHANNEL

# S/N RATIO AND C/N RATIO IN FM IN SATELLITE LINK

- FM has poor spectral efficiency but wider bandwidth and considerable S/N ratio improvement
- FM signal

$$E(t) = A \cos(\omega_c t + m \sin \omega_m t)$$

$\omega_c$  = carrier frequency

$\omega_m$  = modulating signal

$m$  = modulation index

$m = \Delta\omega / \omega_m$

$\Delta\omega$  is frequency deviation

$\Delta f = k A_m$  ( instantaneous modulating signal amplitude)

## Contt---

- Frequency spectrum FM modulated signal –infinite series of discrete components

$$E(t) = A\{j_0(m)\cos\omega_c t + \sum_{n=1} j_n(m)[\cos(\omega_c + n\omega_m)t + [(-1)^n \cos(\omega_c - n\omega_m)t]\}$$

- Infinite side bands and so infinite bandwidth
- Only a finite BW is needed and thus some of side bands are filtered out by band limiting filter.
- Finite band width is represented by Carson's rule
- $B=2f_{max} (m+1)$   
   $= 2(\Delta f+f_m)$   
 $\Delta f$  is peak deviation



## Contt---

- Real modulating signal contains multiple sinusoids and fm is replaced by maximum modulating frequency  $f_{max}$ .
- $B=2(\Delta f+f_{max})$
- Energy associated with the side bands outside the bandwidth  $B$  is very small
- Filter with band width  $B$ .
- Little distortion in FM signal
- So BW  $B$  of detected signal is smaller than input signal
- Thus Band width compression by FM detector
- Improvement in S/N ratio with band width compression