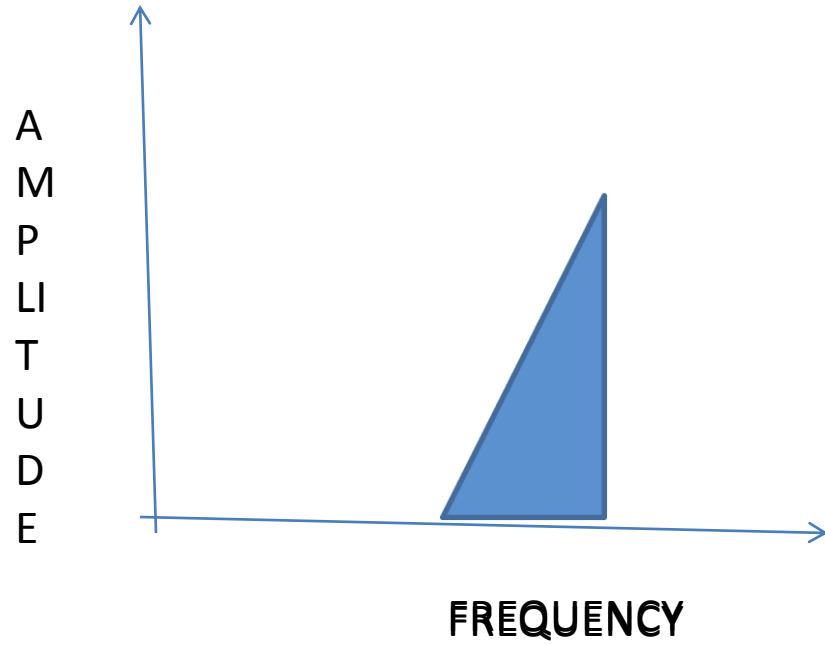
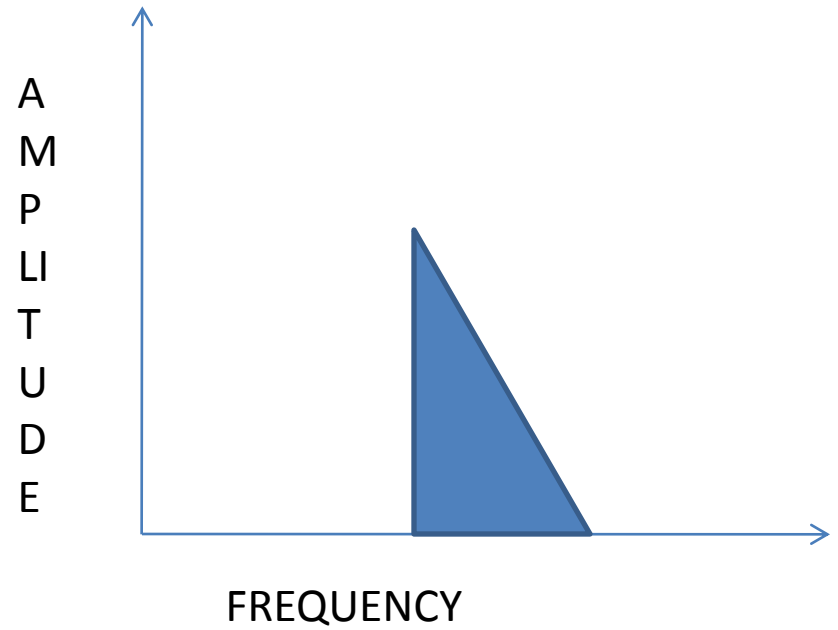


BASE BAND ANALOG (VOICE)SIGNAL

- 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

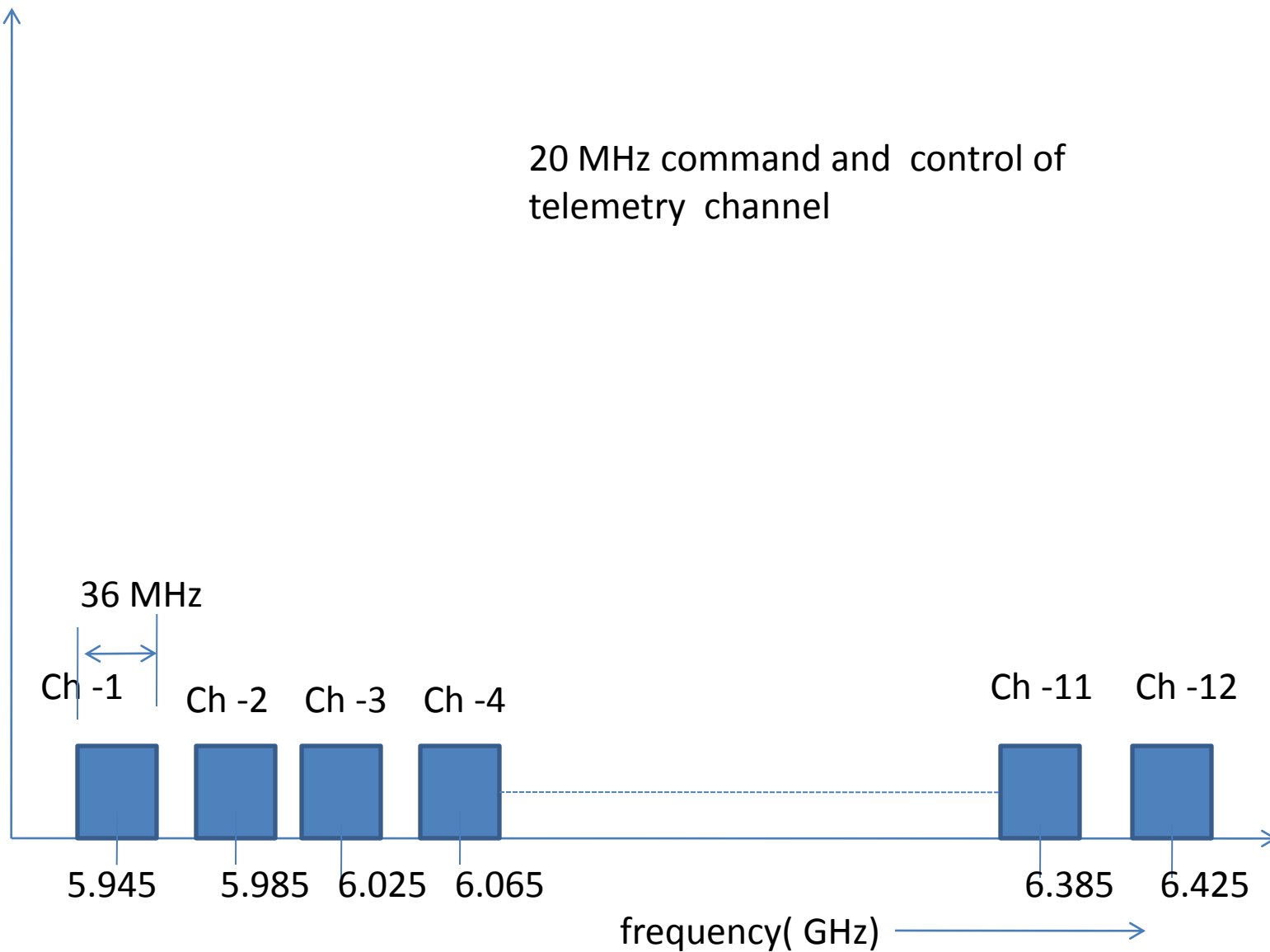
- TRANSMISSION LEVEL with reference dBmo
- 0 – zero transmission level point
- -2dbmo – 2dBm at reference
- Test tone – 1 kHz tone at 0dB to simulate peak power on one channel
- -19.8 dBmo for terrestrial FDM/FM
- -22dBmo for satellite links

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

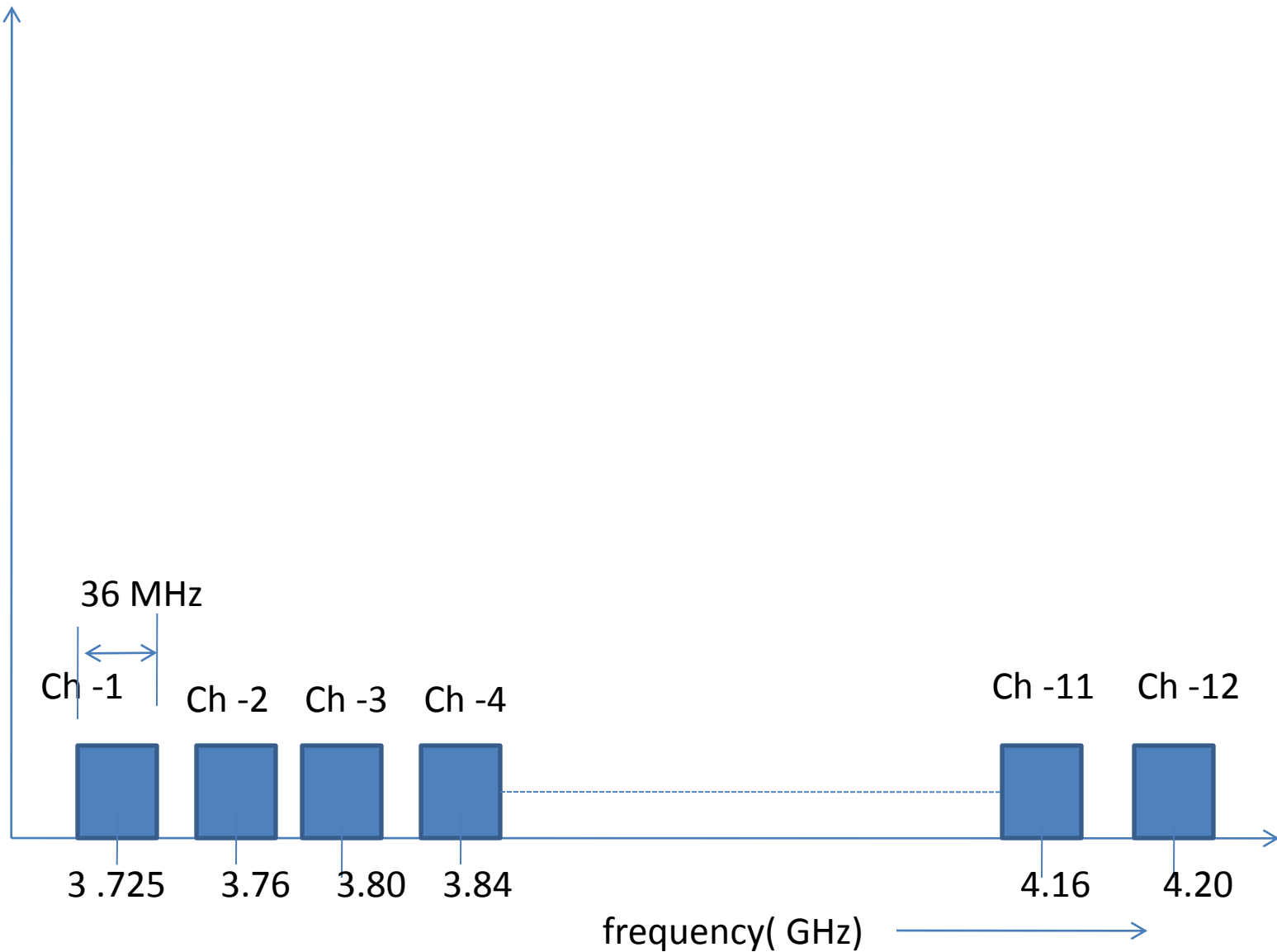
Satellite Receiver
Response

20 MHz command and control of
telemetry channel



SATELLITE RECEIVER CHANNEL

Satellite Transmitter
Response



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

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

ω_c = carrier frequency

ω_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
- $B=2f_{max}(m+1)$
 $= 2(\Delta f+f_m)$
 Δf 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