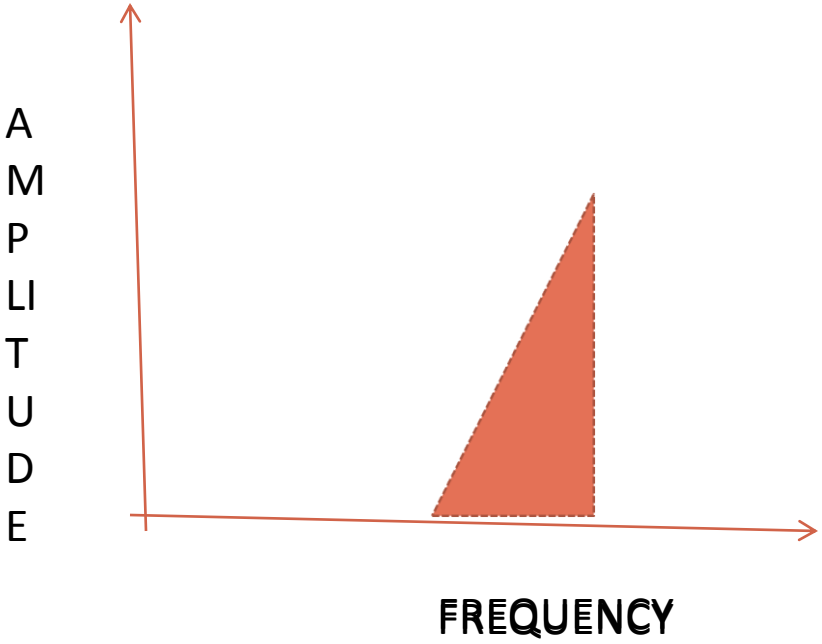
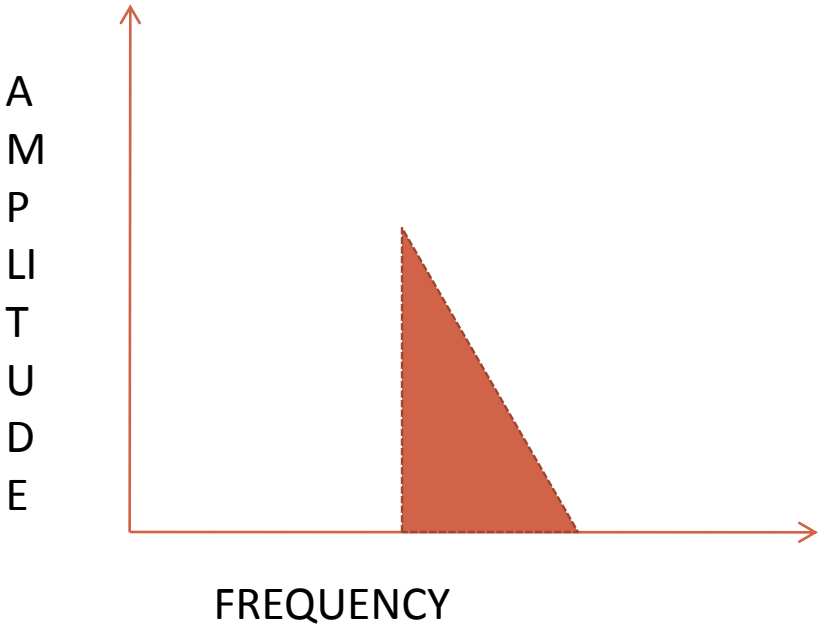
Lecture 7

PRINCIPLES OF SATELLITE COMMUNICATION



NORMAL SPECTRUM



INVERTED SPECTRUM

BASE BAND ANALOG (VOICE)SIGNAL

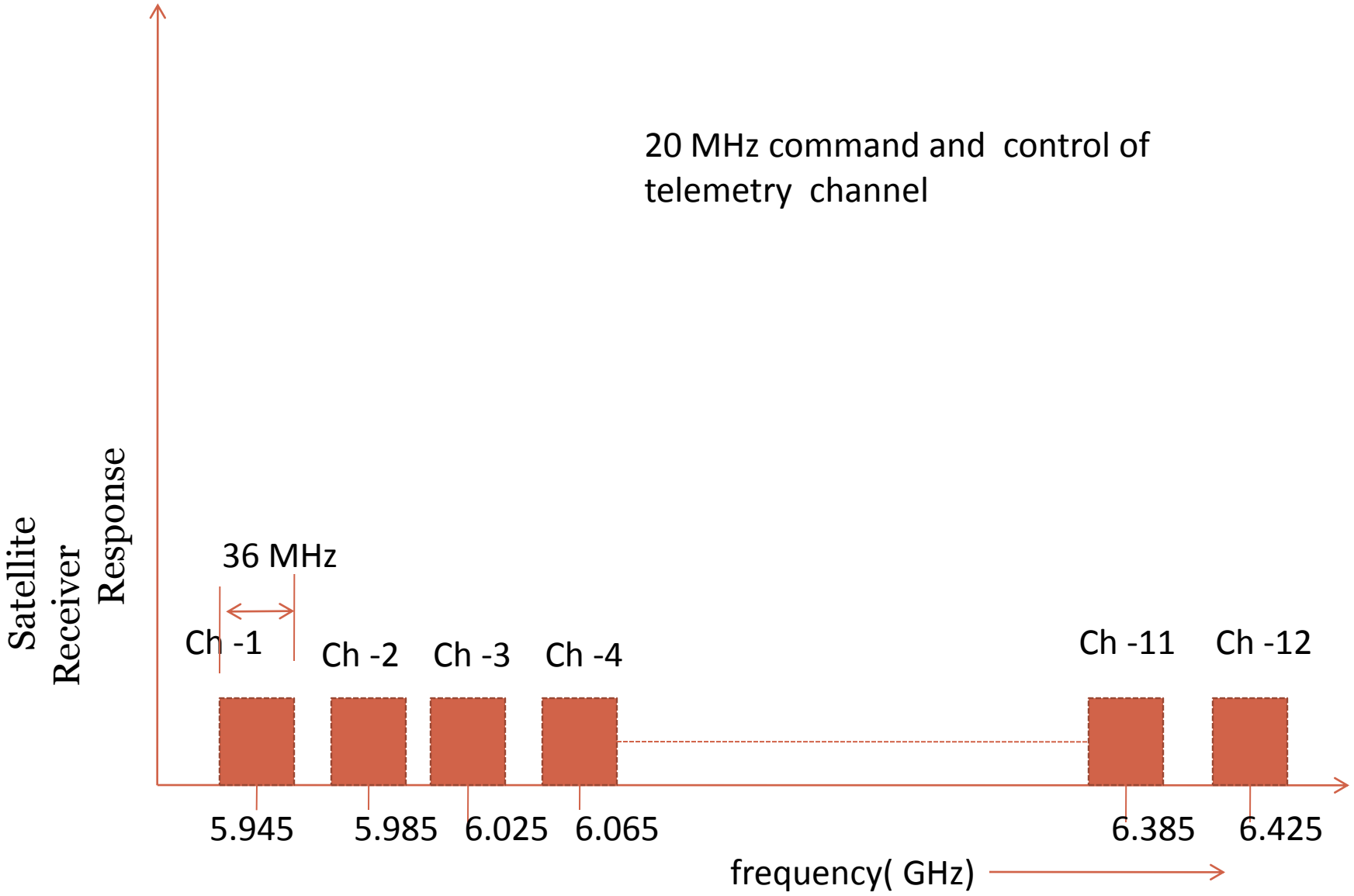
- ANALOG DIGITAL
- FLAT SPECTRUM 300-3100 Hz
- CCITT 3000-3400 Hz
- SPECTRUM OF BASE BAND SIGNAL IS REPRESENTED BY A TRIANGLE

Continued

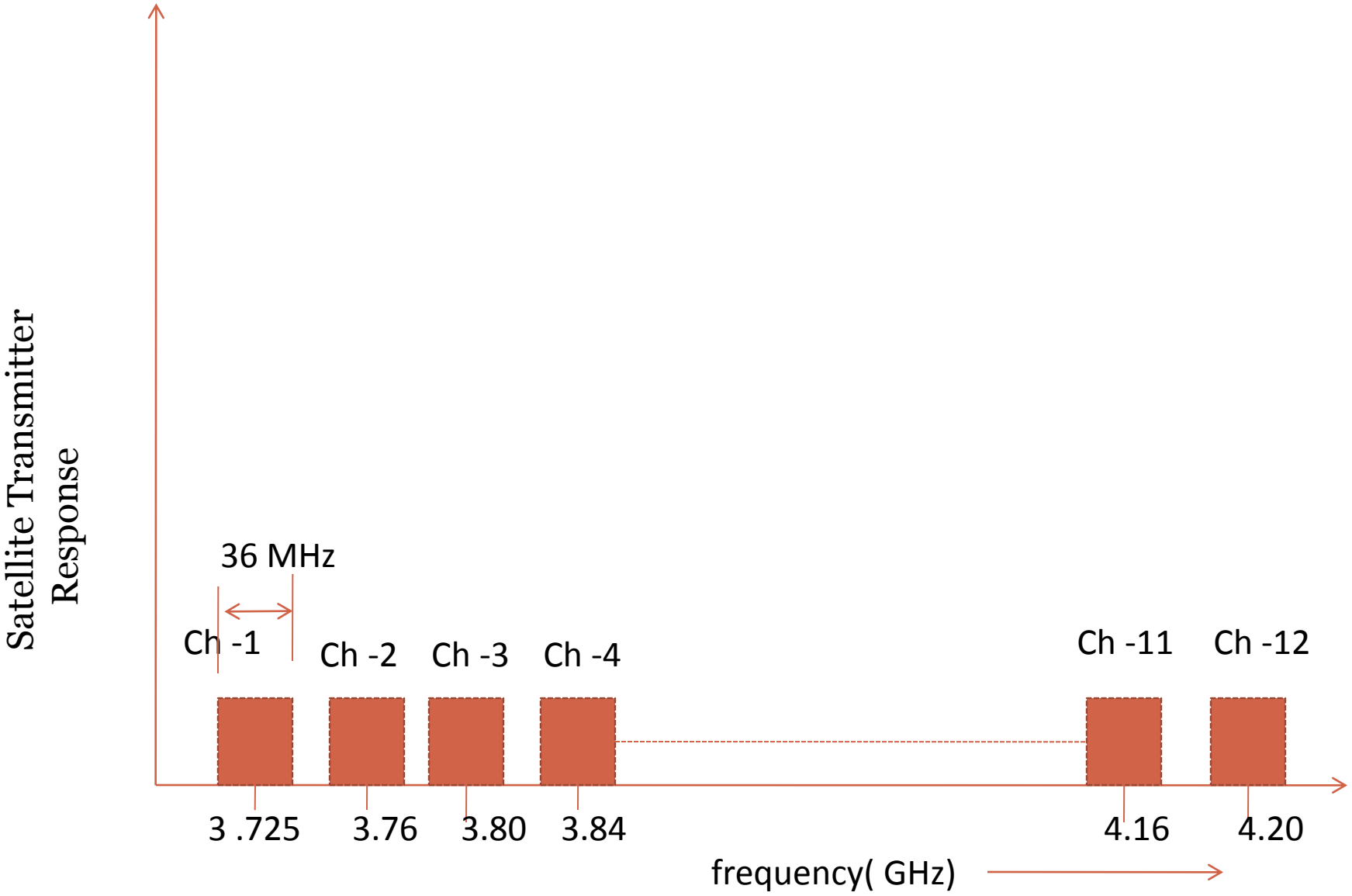
- TRANSMISSION LEVEL with reference dBmo
- O – zero transmission level point
- -2dbmo – 2dBm at reference
- Test tone – 1 kHz tone at 0dB to simulate peak power on one channel
- -19.8 dBmo for terrestrial FDM/FM
- -22dBmo for satellite links

Frequency Division Multiplexing Technique

- Analog communication is carried out with FM.
- Satelite 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 SATELLITLE LINK

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

$$E(t) = A\cos(w_c t + m\sin w_m t)$$

ωc =carrier frequency
ωm = modulating signal
m= modulation index
m=Δω/ωm
Δω is frequency deviation
Δf=k Am (instantaneous modulating signal amplitude)

Contt---

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

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

- 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=2fmax (m+1)
  = 2(Δf+fm)

Δf is peak deviation

Contt---

- Real modulating signal contains multiple sinusoids and fm is replaced by maximum modulating frequency fmax.
- $B=2(\Delta f+fmax)$
- 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