Interference in Satellite

- Interference is mainly concern on:
  - Interference Type
  - Sources of Interference
  - Causes of Interference

Interference

- **Interference Type:**
  - Digital
  - Spike
  - Cross Polarization
  - TDMA
  - FM TV
  - Intermodulation
  - Unknown

Interference in Satellite

- **Source of Interference:**
  - Neighboring Customer
  - Adjacent Satellite
  - Self-Customer
  - Opposite Polarization
  - Others

- External Factors: 40.22%
- Internal Factors: 59.78%

Interference

- **Cause of Interference:**
  - Human Error: 29.89%
  - Equipment Error: 21.74%
  - Adjacent Satellite: 16.85%
  - Customer Cooperation: 8.15%
  - Others: 23.37%

- Internal Factors: 59.78%
Types of Interference

- FM
- Cross Polarization
- Digital
- CW
- Intermodulation
- Raised Noise Floor
- TV/FM
- TDMA
- Spikes & Unknown

FM Interference

III Source:
- Terrestrial FM Radio Broadcast
- Introduced at the IF level of the Earth Station

IV Cause:
- Poor Connection between BB and RF equipment, so FM broadcast is induced into the system and eventually transmitted to the satellite.
- Poor quality accessory between BB and RF
- Poor grounding system

V Prevention:
- Select accessories with standard specifications
- Good Earth Station installation
- Good grounding system
- Coordinate with PCNS to perform UAT and interference checking when a new station is installed
Cross Polarization Interference

**Source:**
- If XPD level of an uplink antenna is less than 30 dB, antenna will transmit both vertical and horizontal polarizations
- Therefore, cross pole will occur at the other satellite or transponder with opposite pole and will interfere the existing carrier

**Cause:**
- Poor antenna pointing
- Poor cross pole isolation
- Sudden change in the antenna pointing due to mistake or storm
- Carrier uplink without performing proper UAT with PCNS

**Prevention:**
- Do not uplink the carrier without performing UAT with PCNS
- Do not uplink un-modulated carrier for UAT before PCNS’s directions
- Perform Regular Preventive maintenance

Digital & CW Interference

**Source:**
- Earth Station Equipment

**Cause:**
- Transmission of wrong carrier frequency by the user
- Unauthorized access
- Uplink CW for UAT before calling PCNS
- Equipment malfunction

**Prevention:**
- Verify U/L frequency before transponder access
- Do not uplink un-modulated carrier (CW) before PCNS directions
- Perform UAT
- Request PCNS if customer wants to uplink a new carrier for special purpose at some vacant slot
- Perform Preventive Maintenance periodically
Intermodulation Interference

Description:
- If more than one carrier are transmitted by a single HPA, mixing or Intermodulation (IM) processes take place
- This results in Intermodulation products which are displaced from the carriers at multiples of the difference frequencies
- The power level of the Intermodulation products are dependent on the relative power level of the carrier and the linearity of TWTA or SSPA

Intermodulation Interference

Description:
- The frequencies of the Intermodulation products are:
  - \(2f_1-f_2\) \(f_1\): frequency of carrier #1
  - \(2f_2-f_1\) \(f_2\): frequency of carrier #2
- It can occur at both E/S and Satellite

Intermodulation Interference

Cause:
- UL power level of each carrier is set so high that the Intermodulation occurs
- UL power level is increased without considering the possibility of intermodulation
- Increasing the U/L power without informing PCNS

Intermodulation Interference

How does it affects
- It reduces the E/N0 of your carrier using at the same frequency
- May raise the Noise Floor of some slots
- Existing uplink power at E/S would be used more than normal
- Therefore, you have to replace new RFT to get more power when you would want to put new carriers into it

Intermodulation Interference

Prevention:
- Verify the link budget of the station transmitting more than one carrier before transponder access
- Aggregate input back-off for HPA or RFT at E/S must be defined and informed to uplinker
- Do not increase U/L power without informing PCNS
- Do not operate with overused power

Raised Noise Floor

Source:
- Earth Station Equipment
Raised Noise Floor

**Cause:**
- E/S equipment configuration was not set up properly
- The gain of U/L equipment such as U/C or HPA was not set suitably
- The U/L power is too high

**Prevention:**
- Use good E/S setup
- Set suitable gain of E/S equipment
- Do not increase the U/L power without informing PCNS
- Verify uplink noise level at the output of HPA before transponder access

Spike and Unknown

**Description:**
- Unpredictable Frequency, Bandwidth, Time
- Some of them may occur at out of assigned transponder

**Cause:**
- Most of them are caused by the U/L equipment error (both base band and RF equipment)
- It does not affect all carriers transmitted by itself

**Investigation:**
- Only RF equipment such as U/C, HPA, Transceiver needs turning off
- Turning of Base band equipment such as Modem, Exciter, Modulator cannot prove the source of interference

**Prevention:**
- Perform Preventive Maintenance periodically
- Operate all U/L equipment under suitable conditions as directed by operational manual of the equipment
- Find out root cause if it disappeared with unknown reason or equipment reset in order to perform prevention
Sources of Interference

- Co-Channel Interference
- TWTA Intermodulation
- Adjacent Satellite Interference (ASI)
- Adjacent Transponder Interference (Multipath)
- Satellite:
  - Co-Channel Interference
  - TWTA Intermodulation
  - Adjacent Satellite Interference
  - Adjacent Transponder Interference - "Multipath"
- Path Losses:
  - Up link thermal Noise
  - Down link thermal Noise
- Earth Station:
  - HPA Intermodulation
- Outside:
  - Sun Interference
  - Terrestrial Interference
Questions?