

_Spectral aggregation InfiLINK Evolution / InfiMAN Evolution

Spectral aggregation

It is recommended to place base station sectors above the subscriber terminals as high as possible to provide proper antenna tilt in vertical direction and to minimize self-interference. The optimal antenna tilt is defined by the vertical beam width of the sectoral antenna and by the required sector coverage. It must cover all the area, where you plan to deploy the subscriber terminals.

Spectral aggregation should be taken into account when planning composite backhauling links, when installing devices in close proximity to each other on the same pole or in order to implement redundancy and link aggregation. For more information, proceed with the "[Link aggregation, balancing and redundancy](#)" article. The devices located close to each other can cause mutual interference. Do not ignore the spectral aggregation rules, otherwise it can lead to a degradation of the wireless links.

The document will provide recommendations on distance and frequency separation for scenarios with and without an external synchronization hub. An external clock source allows you to synchronize the time (the beginning of each second) on multiple devices, up to 7 devices, with an accuracy of less than a microsecond so that all connected devices can turn on the transmitters at the same time. This completely eliminates the mutual influence of neighboring sectors, when one transmitting device with its powerful signal prevents the neighboring device from receiving weak signals from its terminals. Wireless devices synchronization using AUX-ODU-SYNC makes it possible to reuse the frequency within the same base station, that is, different sectors of the same base station can operate on the same frequency channels. When using synchronization, a four-sector base station can operate on only two frequency channels, significantly increasing the real spectral efficiency of the system.

Mutual interference occurs not only between sectors and subscriber terminals of one multi-sector base station, but also between different base stations when they are densely located in a limited frequency range. Synchronization of base stations prevents mutual interference of such base stations and subscriber terminals that working with them.

Recommendations for distance and frequency separation for a four-sector ABAB base station are given below.

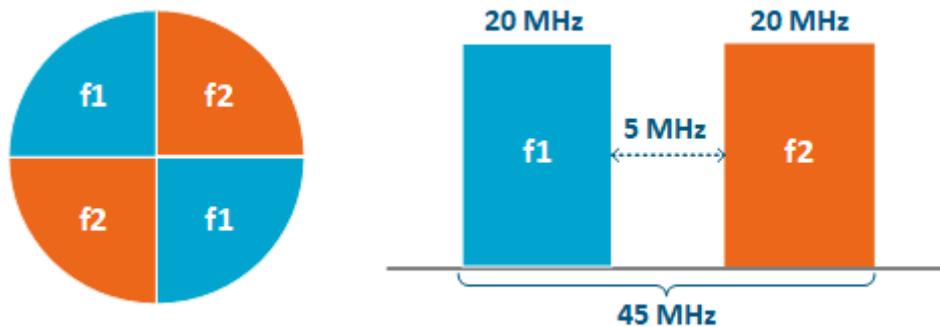
Without synchronization

- Distance separation (vertical or horizontal) must be at least two meters between the edges of the antennas.
- Reduce the transmission power.

With synchronization

4 collocated base stations mounted back-to-back.

- The recommended guard interval between the end/boundary frequencies of the occupied bands of the neighboring sectors 5 MHz.



Synchronization settings

To perform synchronization using an external hub, each base station sector must be connected to an AUX-ODU-SYNC.

The following conditions should be met:

- Frame size and DL/UL ratio should be equal on all sync-end units.
- The automatic downlink ratio selection is not allowed.

**NOTE**

The AUX-ODU-SYNC antenna is not included in the standard packing list. For more information about this antenna, proceed to the [AUX-ODU-SYNC](#) article.

Configuration via web interface

To enable synchronization via web interface:

- Go to the section "Basic Sttings" → "Link Settings" → "rf6.0".
- Check the box "Use AUX-ODU-SYNC" and click "Apply". Synchronization status and the number of visible satellites is displayed in the "Device Status" -> "Link Statistics" section.

Title

General Settings

Enable Link:

Type:

Mode:

R5000 Compatibility mode:

Max Links:

Use AUX-ODU-SYNC: Sync Hold Time:

Frame Size (ms): Auto: Turbo:

DL/UL ratio (%): Max Range (Km):

STA RSSI (dBm):

Tx Power (dBm): Auto:

Node Name:

Scrambling:

Trap gateway:

Switch Border:

Network Entry SNR (dB): High Low

Network Entry EVM (-dB): High Low

RX Attenuation (dB):

Multicast Mode:

Authentication Mode:

ODR:

OTA:

Log Level:

Fixed Cost:

Extra Cost:

Join Cost:

MINT Failover: MAC:

Current Settings

Channel Width (MHz):

Frequency (MHz):

Tx Bitrate (Kbps): Auto:

Channel Type:

Network SID:

Node ID:

Security Key:

Additionally in order to determine the device coordinates GNSS position can be enabled.

- Go to the section "Basic Settings" -> "System Settings".
- Check the box "Enable GNSS Receiver" and click "Apply" button.

▼ System Settings

| | | | | | | | |
|-------------------------------|--------------------------------------|---|---|--------------------------|----------------------|--------------------------|----------------------------------|
| Device Name: | <input type="text" value="E5-BSE"/> | Start SNTP: | <input type="checkbox"/> Use GNSS time: | <input type="checkbox"/> | SNTP Server: | <input type="checkbox"/> | |
| User Name: | <input type="text" value="admin"/> | SNTP IP Address: | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="button" value="X"/> |
| Password: | <input type="text"/> | Time Zone: | <input type="text"/> | | | | |
| Confirm Password: | <input type="text"/> | Latitude: | <input type="text"/> | | | | |
| Keep current system password: | <input checked="" type="checkbox"/> | Longitude: | <input type="text"/> | | | | |
| WEB Interface language: | <input type="text" value="English"/> | Enable GNSS Receiver: | <input checked="" type="checkbox"/> | | | | |
| HTTPS only: | <input type="checkbox"/> | <input type="button" value="Open Map"/> | | | | | |

Click "Open map" to view the device location. The map is updated in real time that allows to monitor the movement of the device mounted on the mobile object.

Configuration via CLI

Enable synchronization:

```
Enable synchronization
tsync enable
```

The synchronization mode information:

```
Synchronization info
tsync
```

The following parameters will be displayed:

| Parameter | Description |
|---------------|---|
| Status | Current device status |
| Total enabled | Total time during which the synchronizaion unit was enabled |
| Total valid | Total time during which the timing accuracy was better than 10 microseconds |
| Valid time | Time during which the timing accuracy was better than 10 microseconds |
| Last message | Last message from synchronization software |

Additionally in order to determine the device coordinates GNSS position can be enable:

```
Receiving navigation information mode
gps start
```

Detailed GNSS statistic can be obtained:

| |
|-----------------------|
| GNSS statistic |
| gps stat |

GNSS statistics parameters:

| Parameter | Description |
|---|---|
| Total GPS time | Total time of GPS operation |
| Total nonvalid time | Total time during which the information about coordinates was unavailable |
| Number of losses | Quantity of cases when the information about coordinates had become unavailable |
| Now coordinates are valid last ... | Time of GPS operation since last coordinates discovering |
| Sattelites histogram | Histogram of visible satellites quantity |
| SATmin | Minimum of visible satellites (since the last time you cleared the statistic) |
| SATmax | Maximum of visible satellites (since the last time you cleared the statistic) |