

_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.

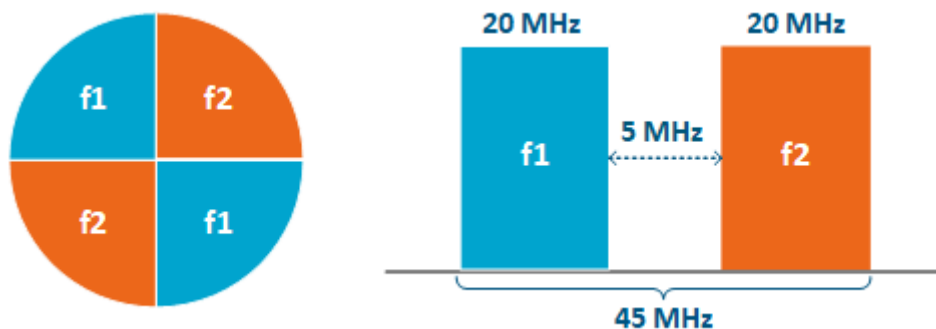
Without synchronization

- 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:

Master

Mode:

Fixed

R5000 Compatibility mode:

On

Max Links:

Use AUX-ODU-SYNC: ☒

Sync Hold Time:

0

Frame Size (ms):

5

Auto: ☒

Turbo: ☒

DL/UL ratio (%):

Max Range (Km):

70

STA RSSI (dBm):

-40

Tx Power (dBm):

12

Auto: ☒

-

0

+

Node Name:

E5-BSE

Scrambling: ☐

Trap gateway: ☐

Switch Border: ☐

Network Entry SNR (dB):

High

4

Low

0

Network Entry EVM (-dB):

High

8

Low

0

RX Attenuation (dB):

Multicast Mode:

Unicast 3

Authentication Mode:

public

ODR:

Disabled

OTA:

Passive

Log Level:

normal

Fixed Cost:

Extra Cost:

Join Cost:

MINT Failover: ☐

MAC:

Add Profile

Current Settings

Channel Width (MHz):

40

Frequency (MHz):

5860

Tx Bitrate (Kbps):

Max

Auto: ☒

-

0

+

Channel Type:

Dual

Network SID:

10101010

Node ID:

37425

Security Key:

456123

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:	E5-BSE	Start SNTP:	☐ Use GNSS time: ☐ SNTP Server: ☐
User Name:	admin	SNTP IP Address:	. . . X
Password:		Time Zone:	
Confirm Password:		Latitude:	
Keep current system password:	☒	Longitude:	
WEB Interface language:	English ▼	Enable GNSS Receiver:	☒
HTTPS only:	☐	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)