

MagicOffice Repeater

**No More Complaints for
Poor Mobile Signal from
Customers or Employees**

**MagicOffice Repeater
Installation Guide**

Instantly maximize indoor cellular signals and expand coverage

Donor antenna installation is crucial for a mobile repeater solution because donor signal strength and signal quality have significant impact on indoor signal coverage, call quality and data performance.

For the system integrators in IBS field, donor signal measurement and antenna installation are fundamental tasks, however, for IT-based system integrators, the tasks could be complicated like an art, because the tasks typically require a RF specialist to proceed a site survey for deployment.

Thanks for intelligent system design such as auto gain control (AGC), oscillation avoidance, and auto levelling, plus intuitive and clear LED indicators on the MagicOffice Repeater, donor signal measurement and repeater installation now become easy as 1-2-3.

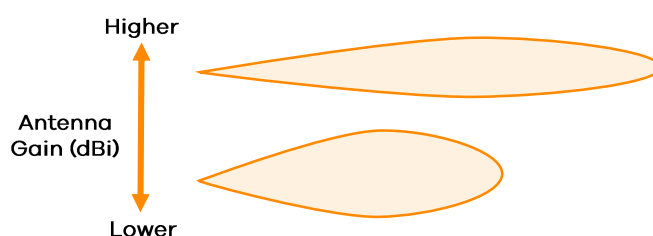
This document provides a step-by-step guideline for the MagicOffice installation, including donor antenna selection, donor signal identification, donor antenna and service antenna installation and LED indicator recognition to get the MagicOffice Repeater online and ready for service instantly.

Choosing a donor antenna

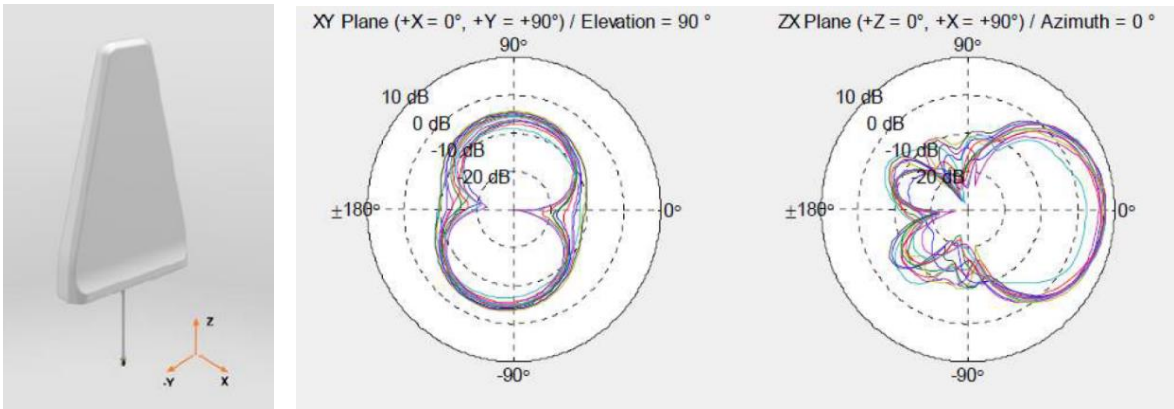
Outdoor directional antenna (Yagi or Log-Periodic antenna)

The directional Yagi antenna transmits or receives signal coming from specific direction. It is ideal as the donor antenna for communicating a base station (BTS) faraway, or perfect for very weak signal coverage area. On the other hand, by its directional nature, the antenna gain is higher, its transmission beam is much narrower and more focus.

Hence, if the installation scenario is in a rural area with very weak signal, e.g. 1 bar signal only, or at a multi-carrier co-location deployment one specific carrier delivering weaker signal compared to other carriers, the directional antenna has advantages in these scenarios by aiming the directional antenna toward the BTS with weaker signal. However, if outdoor donor signal has good signal strength and quality e.g. 3 bar signal, or the signal gap among multiple carries is quite balanced, choosing a directional antenna as the donor antenna would be a downside for the installation, then an outdoor panel antenna would be a better option.



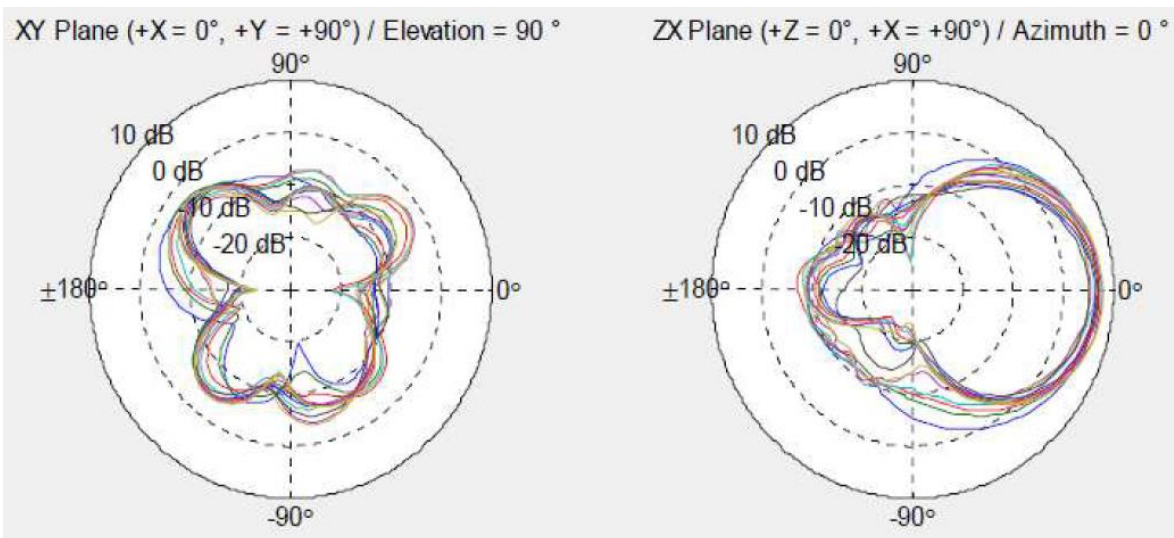
Directional Yagi antenna: gain higher, radiation pattern narrower



Zyxel Outdoor Wideband Directional Antenna
 (7dBi antenna gain, dimension: 20 * 31 cm, part code: IBCACCY-ZZ0103F)

Outdoor panel antenna

An outdoor panel antenna is also a type of directional antenna, but different from a directional Yagi antenna that has focused transmission beam (e.g. ZX plane has narrower horizontal angle and XY plane has less vertical angle for transmitting and receiving signal) and requires carefully pointing the antenna direction for well receiving the BTS signal, the panel antenna has a wider beam for signal transmitting and receiving. When outdoor donor signal has good signal strength or balanced signal gap among multiple carries, choosing an outdoor panel antenna would save the time and effort for pointing antenna direction.

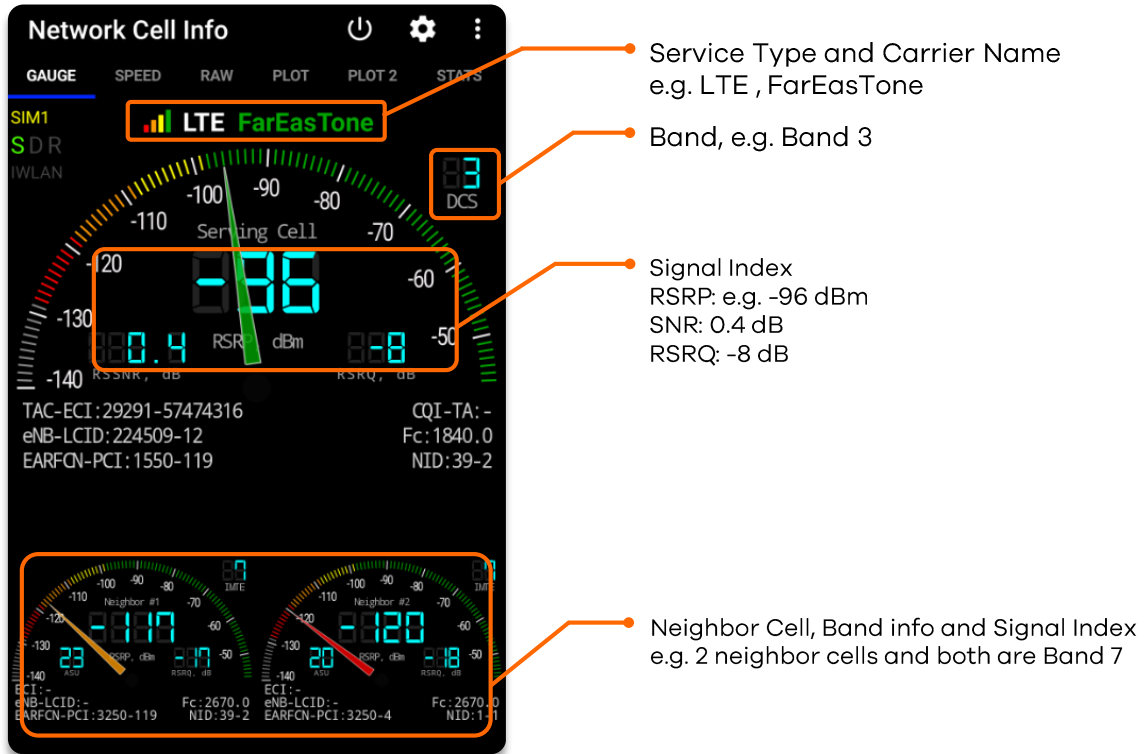


Zyxel Outdoor Wideband Panel Antenna
 (7.5 dBi antenna gain, dimension: 20 * 20 cm, part code: IBCACCY-ZZ0104F)

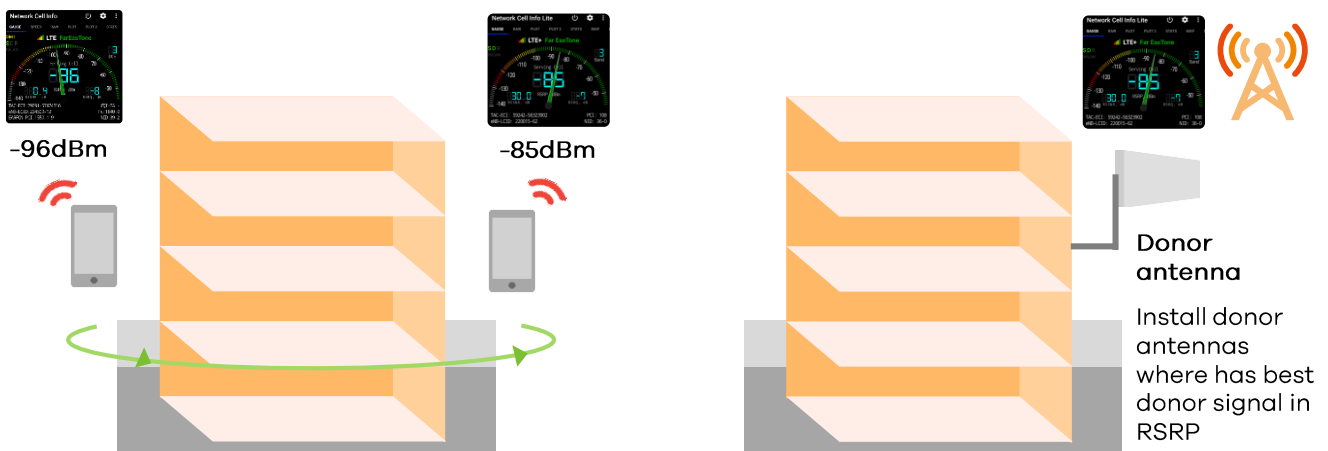
Finding a feasible location for donor antenna installation

Option 1: Android App Network Cell Info

- Prepare 1 or 2 Android phones with dual SIM support and multiple operator's SIM cards for site survey.



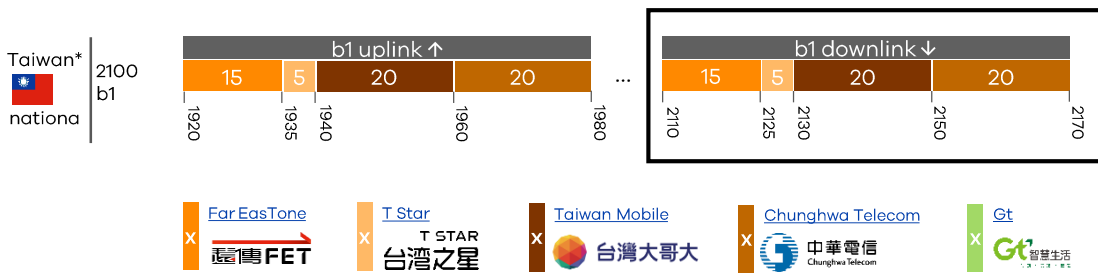
- Walk around the building and find the best donor signal location with Android App Network Cell Info.
- Signal gap among carriers shall be less than 20dB to ensure balanced output power.



Option 2: Spectrum Analyzer (e.g. Seed Studio's RF Explorer) plus the website "Spectrummonitoring.com"

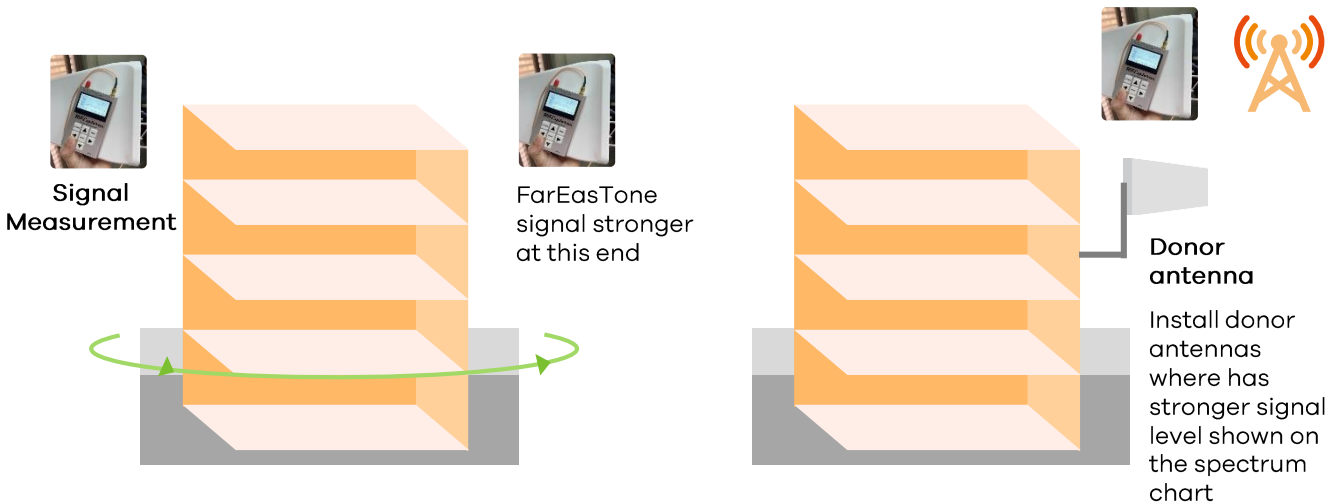
When working on signal measurement, please ensure to use a directional antenna connecting to the spectrum analyzer, and adjust the target frequency range for observing. For repeater installation, simply focus on the "downlink" frequency, there is no need to focus on the "uplink" because the repeater software will automatically handle the uplink frequency.

In the following example, B1 2100MHz is illustrated. FarEasTone signal is at the left-hand side of the frequency range, and on the spectrum chart it shows FarEasTone signal is lower at that position.



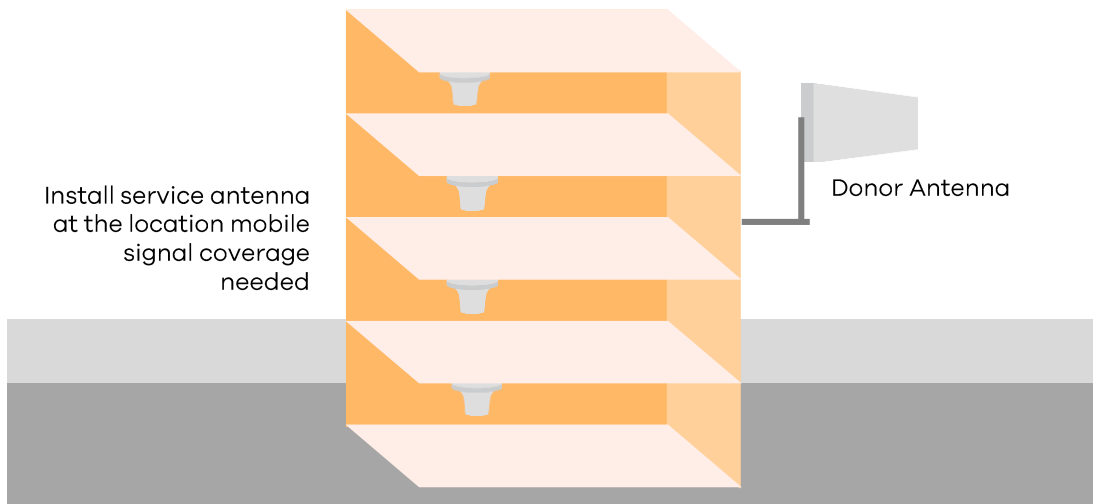
Website: <https://www.spectrummonitoring.com/frequencies.php>

- Walk around the building and find the best donor signal location with the Spectrum Analyzer.
- Signal gap among carriers shall be less than 20dB to ensure balanced output power.



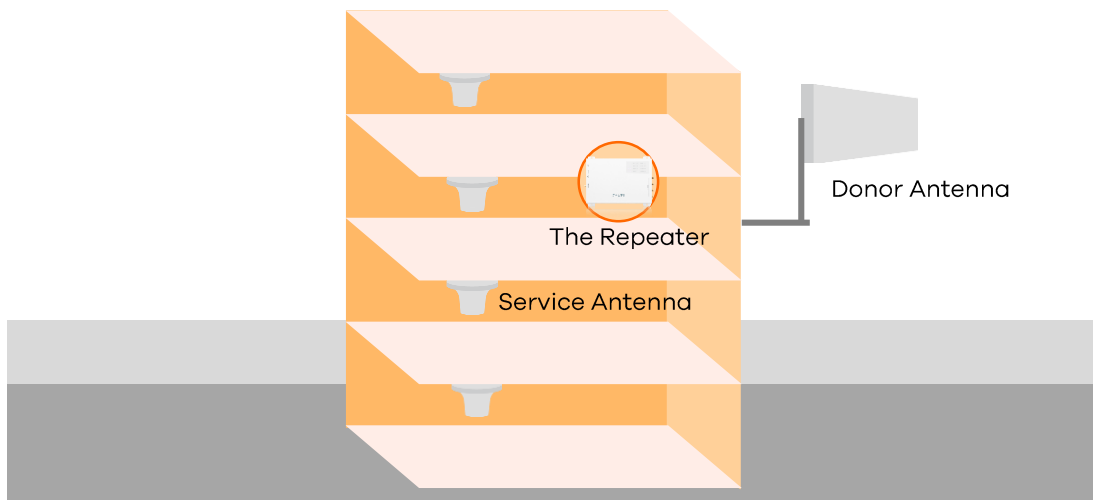
Identify service antenna location

A rule of thumb for service antenna installation is to identify the location where cellular coverage improvement needed, try to maximize the distance as far as possible between the donor and the service antenna, or create more RF isolation between the donor and service antennas, e.g. leverage substantial material between the antennas, or antenna pattern toward opposite direction etc., so that the MagicOffice can maximize its system gain, and mobile users can benefit from larger indoor coverage area from the service antenna.



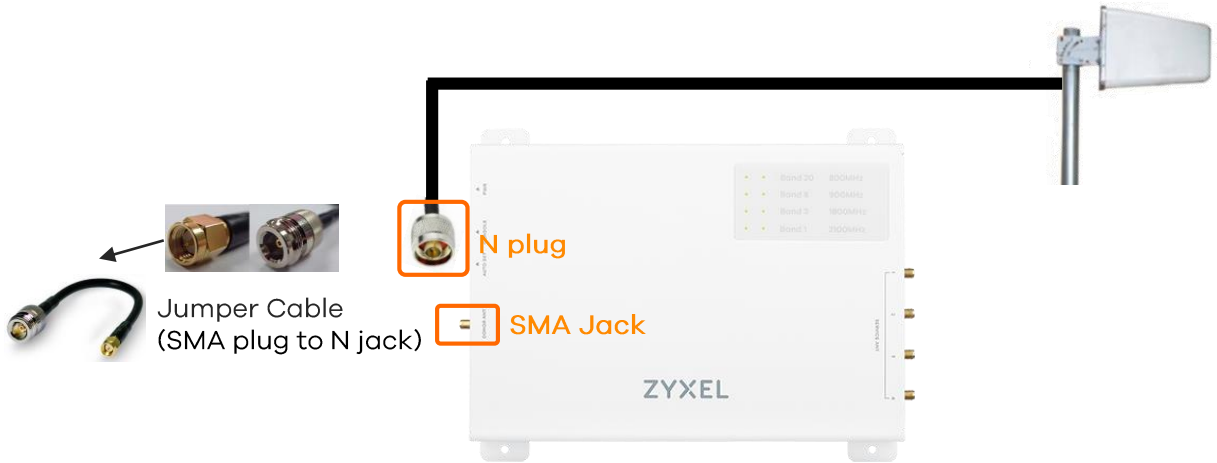
Mount the MagicOffice Repeater

Identify the location where the cable lengths of service antennas are balanced and install the repeater near a power outlet. Do not power on the repeater at this moment.



Wiring the donor antenna

While installing a donor antenna, the right-fit height for donor antenna location is 5th floor height or lower, and shall be free of obstructions if possible. It is because BTS antennas have about 6~8 degree down-tilt angle, and when RF signal propagates and is reflected by buildings, the signal would locate around 1st ~ 4th floor, consequently the best donor antenna height for well receiving donor signal shall not be higher than 5th floor.



Install service antennas

Use coaxial cables with 50Ohm impedance as possible to mitigate cable loss.



IBCACCY-ZZ0101F



SMA plug

Validate MagicOffice LED status and optimize antenna aiming if needed

Power on the repeater, the repeater will automatically relay and boost mobile signal. The MagicOffice system is operating automatically and is detecting BTS signal and system isolation. After the LED turns to Steady Green, the system automatically relays and boosts cellular signal.



| LED Status | LED 1 | LED 2 | Description | Action |
|------------------------|-------|-------|--|--|
| Booting | Flash | Off | Booting time 20 sec | No |
| Normal | On | Off | Operational | No |
| Waiting BTS signal | Off | On | (BTS signal < -85dBm RSSI) → Turn off DL output and standby | No |
| BTS signal too weak | Flash | On | (BTS signal < -65dBm RSSI) → DL output < 10dBm | Fine tune outdoor antenna |
| BTS signal too strong | Off | Flash | (BTS signal > -20dBm RSSI) → Turn off DL input and sleep 60 sec | Fine tune outdoor antenna |
| Oscillation protection | Flash | Flash | Required GAIN > Isolation -20dB → GAIN decreased | Move indoor antenna away outdoor antenna |
| Hardware failure | Off | On | Hardware failure and send back to factory | Call |

Common problems

1. The LED status shows BTS signal too weak or too strong, please fine tune or adjust the Donor Antenna aiming till the LED1 of the Band shows steady Green. For BTS signal too weak, if a directional Yagi antenna is used, please check if the directional antenna can be mounted higher and try to twist the antenna aiming by rotating the donor antenna horizontally, then check if the LED turns to steady Green. For BTS signal too strong, please adjust the antenna direction to the opposite direction to reduce the signal strength or change to use a lower gain omni-antenna as the donor antenna.
2. The LED status shows Oscillation Protection. It represents the Donor Antenna and the Service Antenna are not far enough, there is no enough RF isolation for the MagicOffice system. Possible option is to move the Service Antenna to a location where there are substantial materials e.g. a concrete wall in between the Service and the Donor Antenna, or alternatively to use an indoor panel antenna facing toward opposition direction of the donor antenna.

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NETWORKS

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