

LoRaWAN Network Plan & Site Survey

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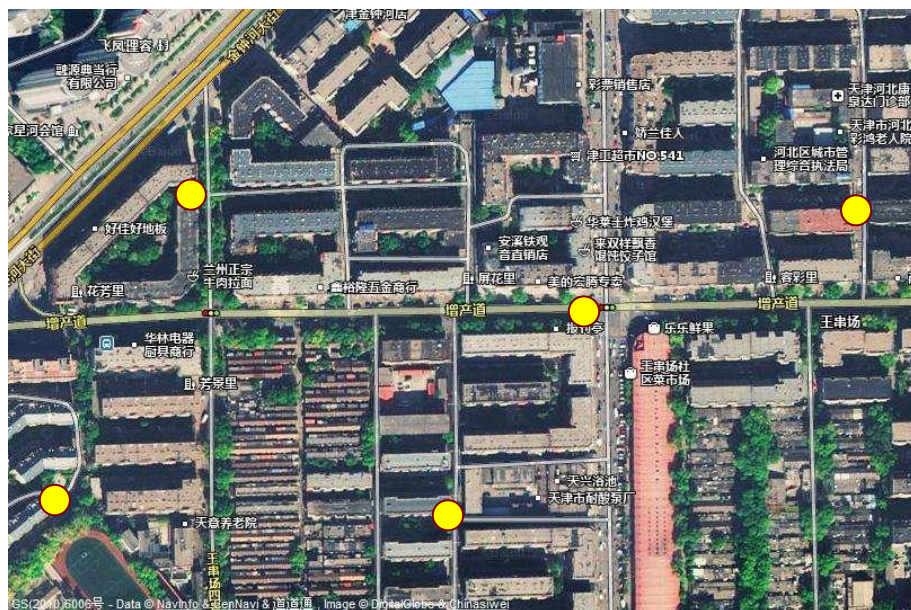
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LoRaWAN Network Plan



Network for Outdoor coverage model

Outdoor:
The device installed above
the ground 1.5m



Installation: Gateway installed above ground 25m-30m

- Network coverage depends on both the LoRaWAN gateway and end devices' TX and RX performance.
- Lansitec badge covers at least 1.5KM, sight distance.
- Lansitec solar Bluetooth gateway covers at least 3KM, sight distance.

LoRaWAN Network Plan



Network for Indoor basic coverage

Indoor:
End devices installed indoor
but close to the window



Installation:
Gateway installed above ground 25m-30m

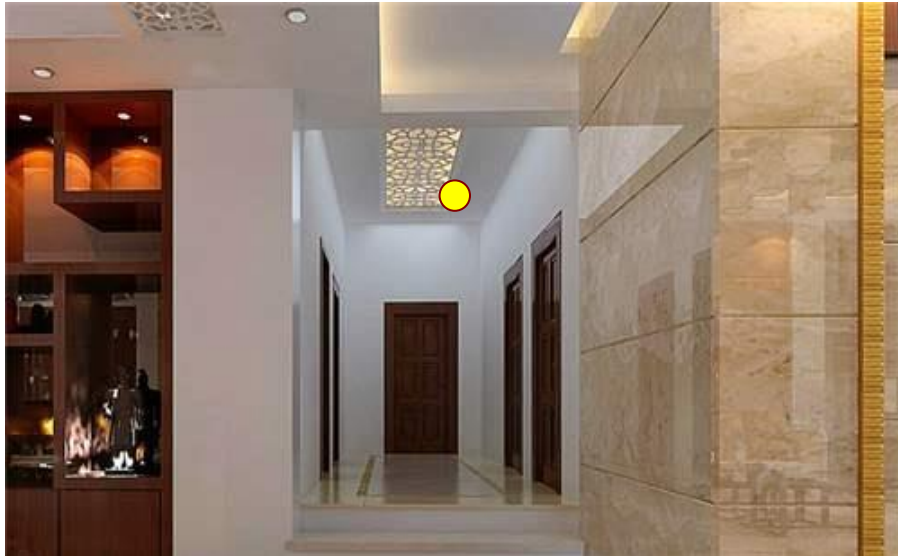
- Indoor basic coverage Radius=1-1.5km

LoRaWAN Network Plan



Network for Indoor deep coverage

Deeply indoor installation:
Install the end device far
away from window and
outdoor



Installation:
Gateway installed above ground 25m-30m

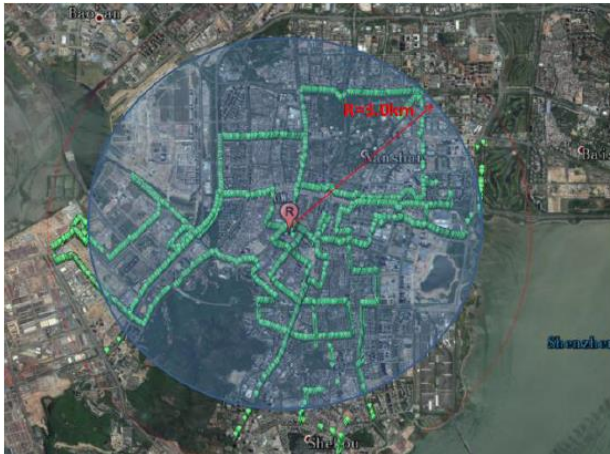
- Indoor deep coverage, Radius=500-700m, even less than 300m in some situation

LoRaWAN Network Plan

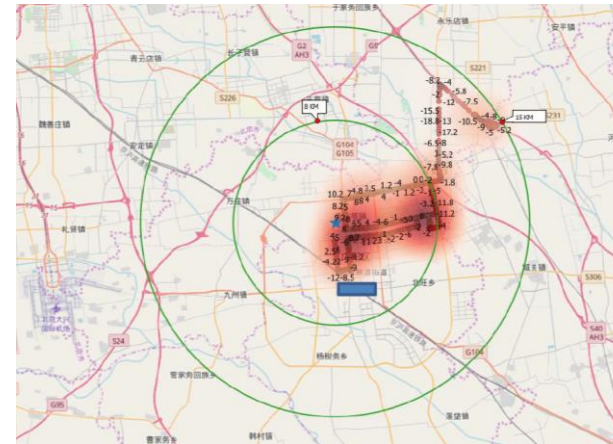


LoRaWAN Coverage Test

Gateway installed on the top of the building, 20m above ground



Gateway installed on the top of the building, 70m above ground



Gateway



Deeply indoor:
500-700m

Basic Indoor:
1-1.5km

Outdoor:
2-3km

LoRaWAN Network Plan



Factors

Application & Model

Outdoor
Indoor basic coverage
Indoor deeply coverage
Others model

Network Capacity

Data transform :
Uplink requirement
Downlink requirement
Gateway model :
Full-duplex
Half-duplex
Network band
Density of nodes

Refer to 8 channel LoRaWAN Network capacity evaluation.xlsx (doc number: 511-00054) to evaluate the network capacity.

LoRaWAN Network Site Survey



Step 1 Environment estimate and Frequency plan select

The network plan is done based on normal noise floor level. It is better to estimate the electromagnetic environment before site survey.
Higher level of interference and noise, more gateways are needed.

Noise floor level required:

RSSI should be less than -105dBm@Operation band

The tests is done on the CN470 band. But the requirement is the same for all others.



	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510
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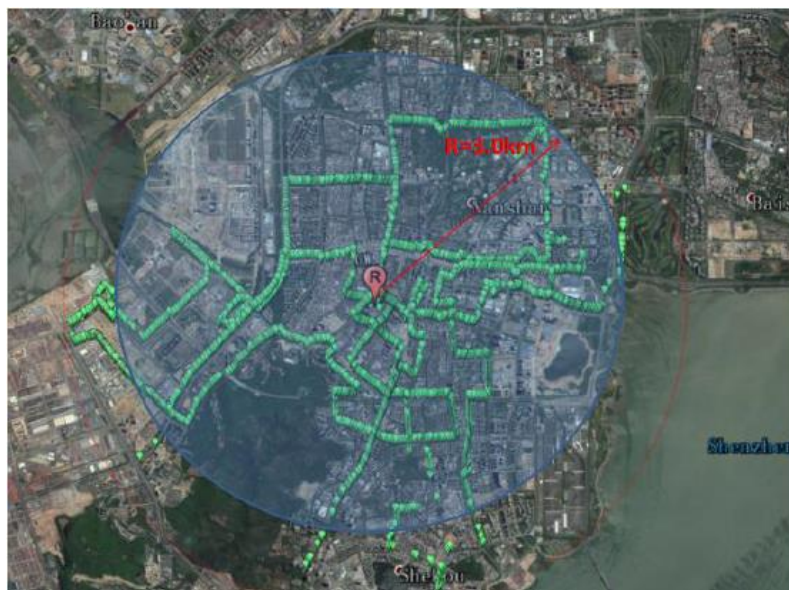
LoRaWAN Network Site Survey



Step 2 Coverage/Range test and gateway installation

LoRaWAN network plan is theoretical. Please do more coverage test before the site survey for each project.

The test can be done with your end devices.



LoRaWAN Network Site Survey



Step 2 Coverage/Range test and gateway installation

Test condition:

- Antenna gain of the gateway: 3dBi
- Operation band: 470~510MHz
- Noise floor level: -105~-110dBm
- Antenna gain of the end device: -2dBi~0dBi
- Efficiency of the antenna: 20%

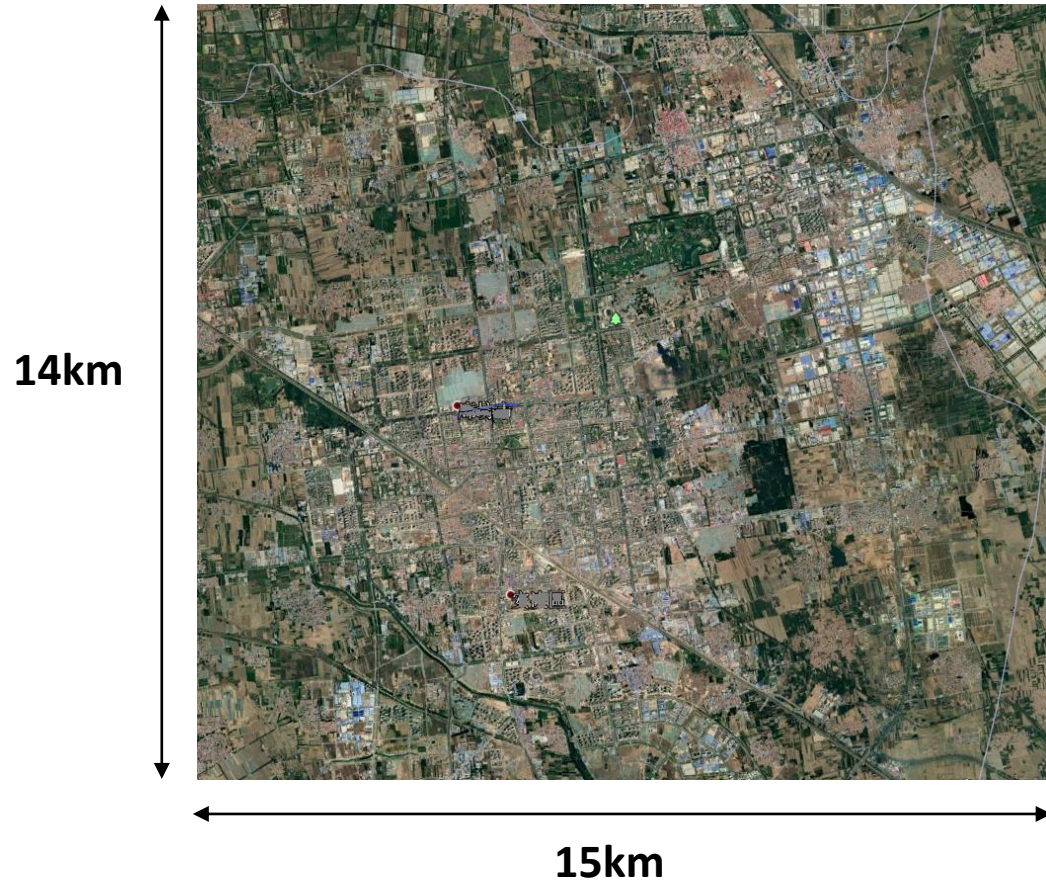
Standard:

- DR0@SF12/125kHz
- SNR threshold should be more than 8~10dB
- PER<5%

LoRaWAN Network Site Survey



Example A LoRaWAN network site survey example in China



Area:
210 square km

=

High density:
97 square km

+

Suburban district:
118 square km

LoRaWAN Network Site Survey



Evaluation

High density district:

- Deep coverage
- Radius=500m=0.5km= $92/(3.14*0.7*0.7) \approx 60$ pcs

Suburban district:

- Basic coverage
- Radius=1000m~1500m=1.0km~1.5km
- @1.0km= $118/(3.14*1.0*1.0) \approx 37$ pcs

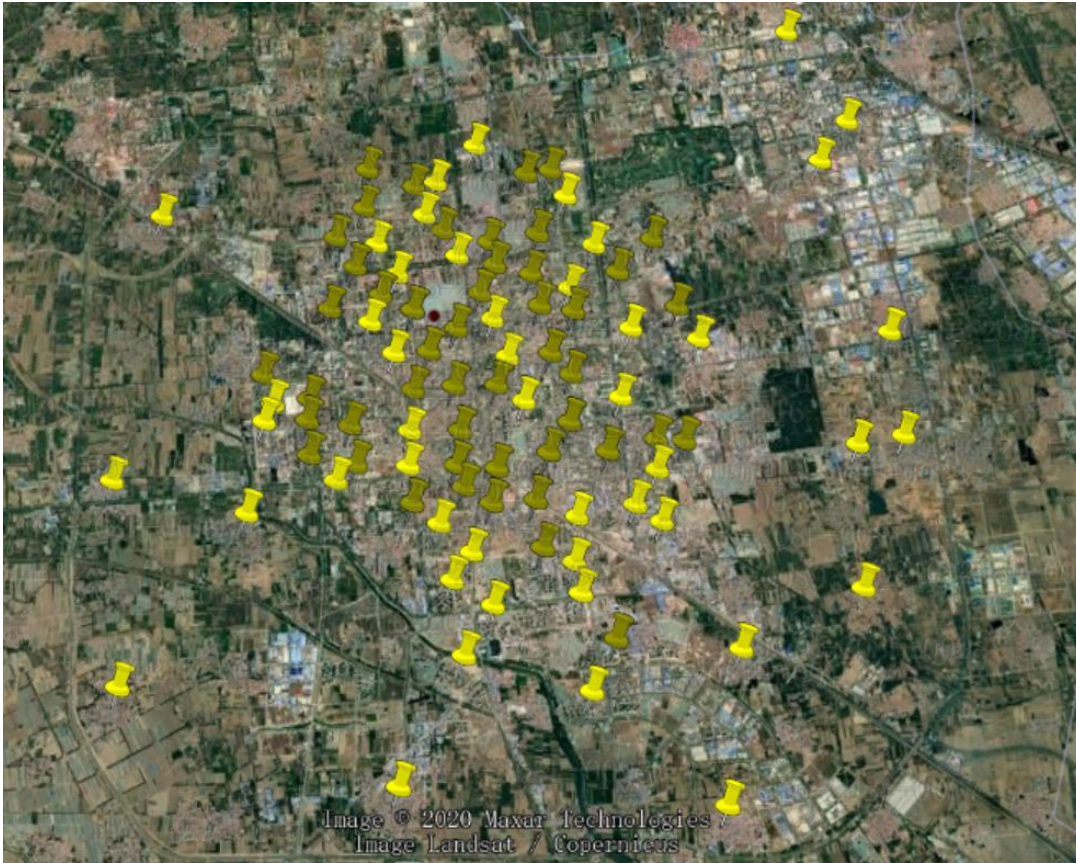
Total:

- Max= $(60+37)*(1+5\%)=102$ pcs

LoRaWAN Network Site Survey

Draft

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Gateway Installation & Diagnosis



Gateway installation guide

How to select the position for installation

Centre



High



Clear



Diffraction



In a campus, install the LoRaWAN gateway on a nearby building to cover each other.

LoRaWAN Network Site Survey



Gateway Installation Highlight

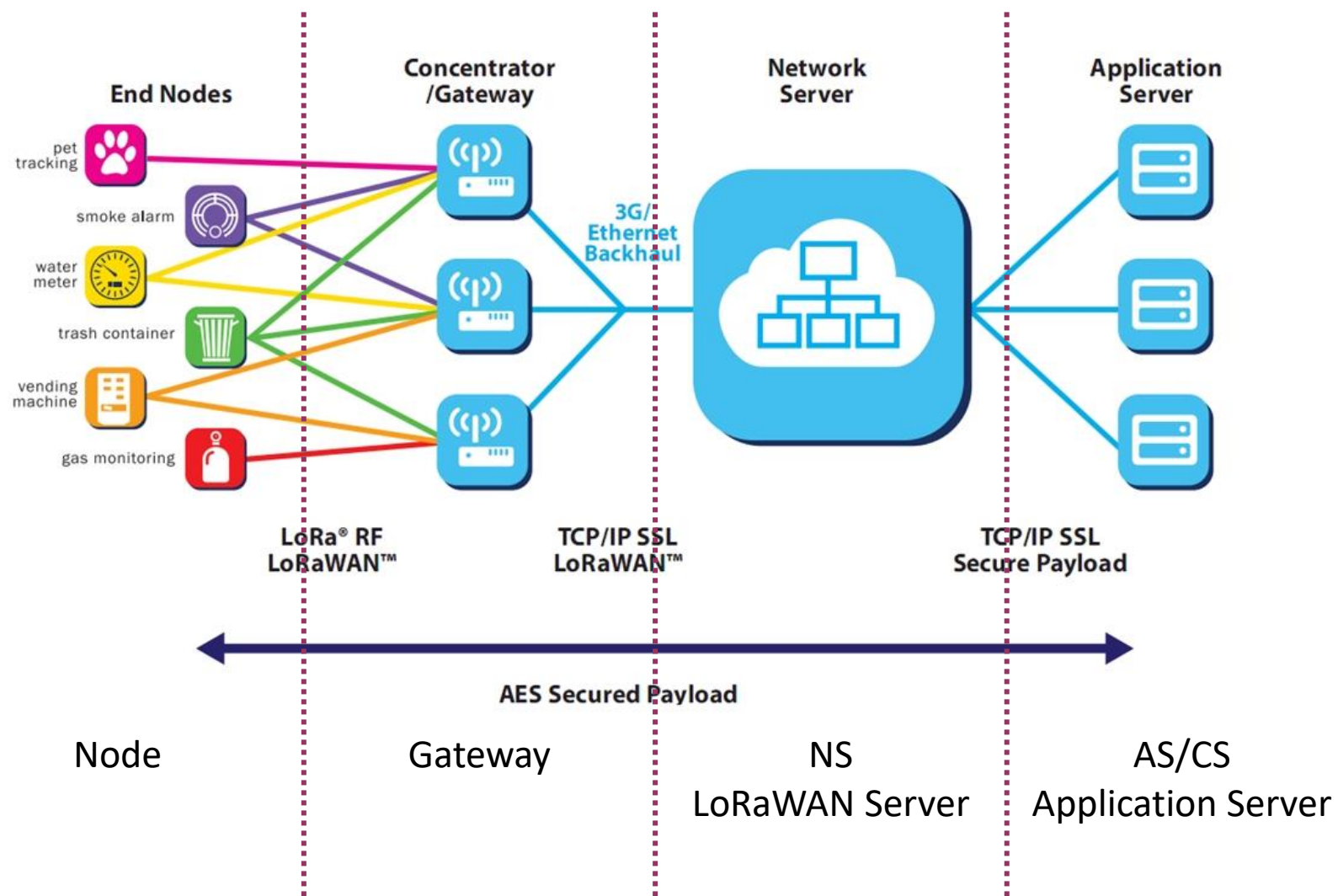
Lightning and surge protection:

Please install gateway in the protection area of the lightning rod

- Gateway antenna below the lighting rod 1.5m !!!
- Ground the lighting and surge protector !!!
- Ground the fixture !!!

Questions & Answer

LoRaWAN Network Topology



Question & Answer



End Device

1. Why range is short/ Coverage is short?

A:

- I. In design or test stage, please check if the antenna of the device matching or not. Please do the range test in the open area without block. It's better to do range test in LOS first. And check noise floor level.
- II. In project implementation stage, please check if the noise floor is higher in the operation band.
- III. If the range is different in different time or in different district. Please check block and Noise floor level.

2. Why PER is high?

A:

- I. Please measure the noise floor level with the gateway or handheld set. The noise level should be below -110dbm usually. High Noise floor level, high PER.
- II. Please evaluate the capacity of the gateway first. To avoid interference between different nodes.
- III. To check the RSSI and SNR level. SNR margin should be more than 10dB than threshold.
- IV. You could measure the PER with the device nearby gateway first. And then put the device in the field.

Question & Answer



End Device

4. Why battery life is short?

A:

- I. Check if the device works normal. Check the uplink period. Check sleep current.
- II. Use a bigger uplink period or decrease transmit times to get a longer battery life.
- III. To check if the device repeat uplink often when signal is weak.
- IV. If the device is in a low temperature environment, battery capacity would decrease.

5. Why the uplink repeat very frequently?

- I. If the device work in CMSG mode with ACK required. If the device couldn't get the ACK from the platform, it will repeat.
- II. To check if the signal is weak.
- III. To check if the Rx window configuration.

6. Device reset, the uplink count will be reset?

Correct.

7. If the device comply with local rule?

In different country, the requirement of wireless is different. Include power, frequency, duty cycle, time on air and so on. Lansitec modules could comply with CE/FCC/SRRC and so on.

Question & Answer



System

1. How to evaluate the capacity of the gateway?

LoRaWAN is a Aloha system. Please try to use RisingHF tool to evaluate the capacity.

Refer to 8 channel LoRaWAN Network capacity evaluation.xlsx (doc number: 511-00054) to evaluate the network capacity.

2. How can I get a bigger capacity of the gateway?

- 1) Use LBT (Listen before talk) and delay transmit with a random slot.

- 2) Decrease the coverage of the gateway and end devices gateway and make the device use high data rate.

3. In OTAA mode, how to avoid or decrease the conflict and compete between different nodes?

- 1) Device powered on in different time.

- 2) Delay the join process with a random slot to avoid all the devices joining at the same time.

4. How to judge the device on-line or off-line?

- 1) The LoRaWAN system is a weak connecting system. It's difficult for NS to confirm if the device is on-line or off-line. For example, for a device work in Class A which just do uplink report, the different uplink period will lead to different result.

- 2) Actually, the on-line or off-line status of the nodes is related to the application. The on-line checking mechanism should be related with Transmit period, packet lost and target application.

Thank You