The only LPWAN connectivity piloted for Taiwan's largest IoT project: Next generation smart electricity metering with Weightless

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June 2018

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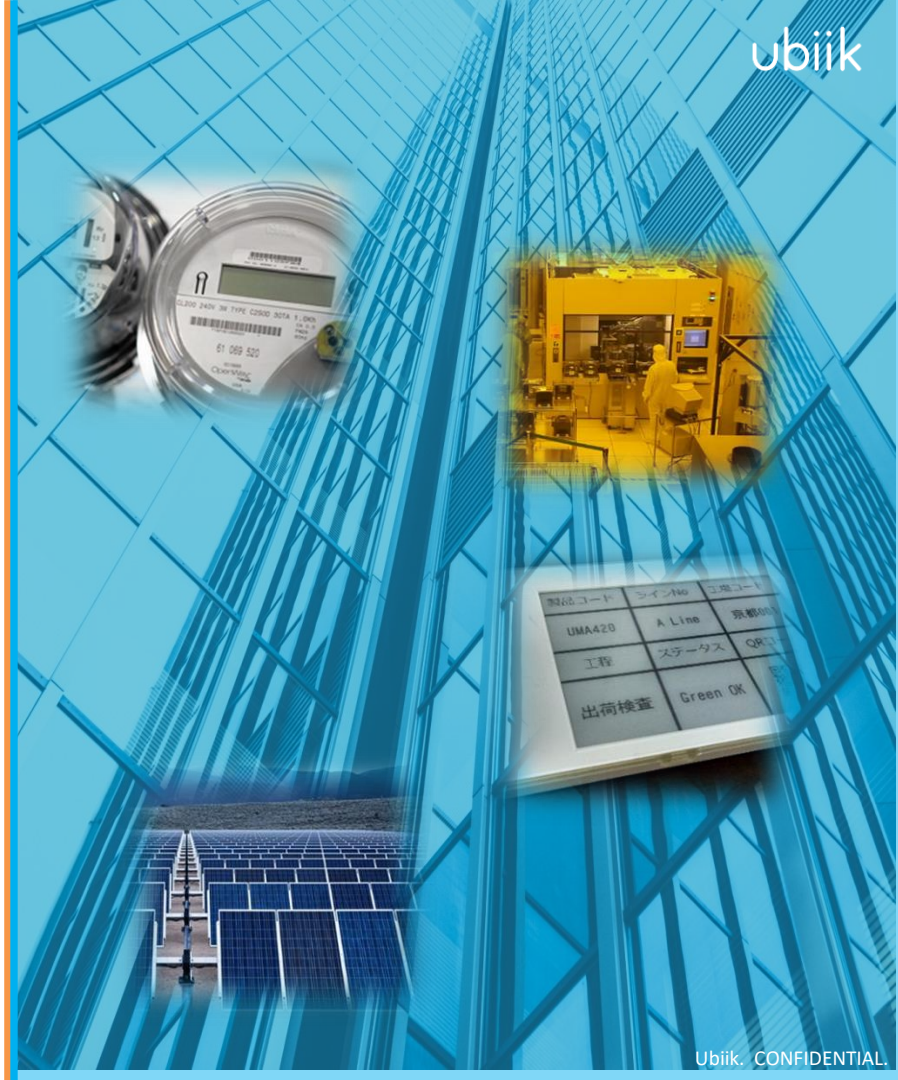
SUMMARY:

Delivering Value in Wireless Industrial IoT

- Ubiik implemented & commercialized **Weightless** which it used to win supplier qualification **at the largest smart metering IoT project of Taiwan in the decade.**
- Ubiik also sells Weightless **equipment to partners** who make their devices, services, or networks
- Most sought-after use cases are **High Data-rate Uplink Driven** and **Downlink Remote Control** projects due to limitations of other LPWAN technologies
- Pilot use cases: **smart electricity meters, precision agriculture, air/gas sensors monitoring, long-range e-paper transportation signage, …**
- **Enthusiastic feedback** from 80 evaluations over 35 countries: **Weightless solves challenges that 1st Gen LPWAN's can't**



Weightless - Real Open Standard: Looking for partners
Healthy Ecosystem, Continuous Innovation, Sustainable Growth

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WEIGHTLESS™

- UK-based non-profit organization promoting LPWAN open standard
- Board composed of Accenture, Ubiik and others
- Currently focusing on promoting Weightless as the next generation LPWAN global standard

ubiik **Leading Weightless Solution Provider**

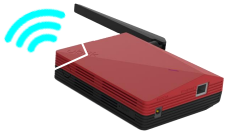
- Taiwan-based Weightless-P technology pioneer since 2016
- Leading vendor for connected e-Paper signage for factory automation, logistics, and IIoT
- Senior team members led the drafting of Weightless-P Standard in 2015
- Shipped more than 75 Weightless Starter Kit to customers worldwide from Aug 2017

Ubiik Weightless Architecture: Simple Infrastructure for IIoT

Backend

Management Server
(cloud / on premise, optional)

Weightless Base Station



Sub-GHz ISM or licensed Frequencies

+2 km - city

+5 km - suburban

Weightless End Device Module

Devices

Weightless: Opens New Markets by Filling Tech Gaps

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High Capacity

- **Narrow-Band Operation (8 channels of 12.5kHz)**
- A single Weightless base station can connect **more end-devices than any other LPWAN technology**
- Scheduled and un-scheduled traffic types (TDMA/FDMA and *slotted* ALOHA)
- Frequency-hopping with channel blacklisting

Kilometer-Long Range

- -130dBm sensitivity at 625bps (10%PER)
- **>2km range in urban environment**

Very Low Power

- **TDMA+FDMA** avoids collisions and retransmissions
- Lean protocol stack minimizing overhead
- **0.625kbps to 100kbps adaptive data rate** for short air time
- **Adaptive power control** to reduce battery drain

Bi-Directional Communication

- **Low latency, bi-directional communication** between the end devices and base station ensures a reliable network
- Standard MCS: GFSK and PSK combined with Convolutional FEC
- **Natively supports Firmware-over-the-air (FOTA) upgrades**

True Security

- Mutual authentication with trusted third-party
- Cipher suite negotiation
- EAP-GPSK authentication scheme as baseline
- Minimum AES-128
- **Multicast for key updates and patches**

OPEN standard

- **The only open standard,** allowing the creation of a future-proof wireless technology and a healthy ecosystem.
- **Royalty-Free Standard**, multiple vendors, and interoperability will harbor continuous innovation and drive down costs

Weightless: Advanced Features Meeting Market Requirements

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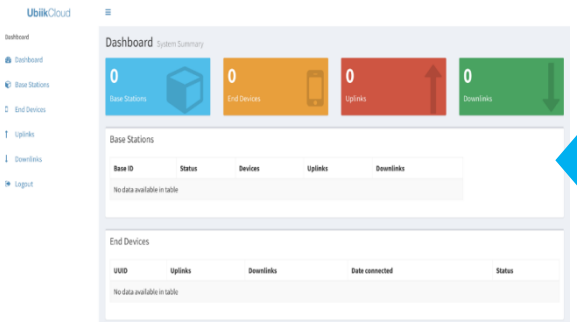
	Symmetric DL/UL	Multicast / Broadcast	Message Ack	Battery operation	Power control	Location services*	Handover support	Firmware upgrade
LoRa	◐	◐	◐	○	●	◐	●	◐
UNB/SigFox	●	●	●	○	○	●	●	●
Weightless-P	○	○	○	○	○	○	○	○
RPMA	○	○	○	○	○	◐	○	○
Telensa UNB	○	○	○	○	○	○	●	○
LTE Cat-1	○	○	○	●	○	○	○	○
LTE Cat-m1	○	○	○	○	○	○	○	○
LTE NB-IoT	○	○	○	○	○	○	◐	○

Legend:
○: Supported | ●: Not supported | ◐: Partial support; optional support | ○: Not required
* Location services include paging capability.

Source: "Mobile Experts: Mobile and Wide-Area IOT: LPWA and LTE connectivity. 2016"

High Level of Anticipation in LPWAN market to try & use Weightless

Ubiik Weightless Product Family:
Total Connectivity Solutions, Technology Blocks, IoT Devices

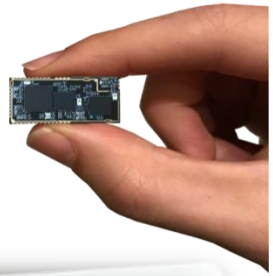


Software Suite

- Cloud Service & Analytics (optional)
- Online / Offline GUI
- Abundant development tools, API's, sample code, …

End Device Module

- Small form factor
- Cortex M3 MCU
- Weightless Protocol



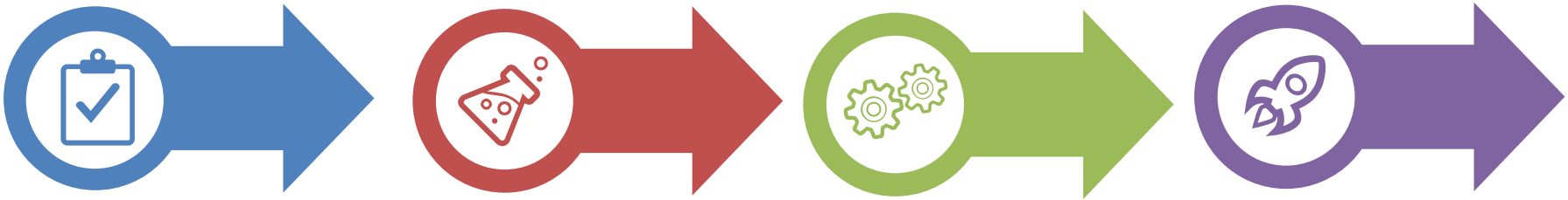
Base Stations

- Weightless Protocol Stack
- SDK version
- Indoor version
- Outdoor version

Turnkey End Devices

- **Weightless e-Paper Signage (world's first)**
- **Weightless GPS Tracker**
- **Metering FAN Module**

Weightless Commercial Status: Actuals and Next Goals



Internal Tests	3rd Party Evaluations	Live Pilot Installations	Deployments
Devices in Taiwan	>50 SDKs Worldwide	> 10 POCs Worldwide	> 3 Large Networks
H1’17, Successful	H2/17, Successful	H1’18, Successful	Q4’ 18 – On Track

High-Value LPWAN Use Cases solved by Weightless

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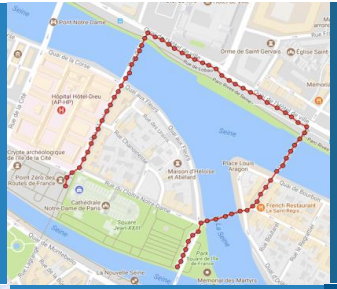
Products Benefit from Ultra-Low Power, Reliable Bi-directional, High-Capacity Long Range Networking

Japan

Industrial Automation:
Weightless Base Stations & Connected e-Paper
Strong Downlink, FOTA

Argentina

Asset Tracking:
Weightless Base Stations & Modules, or GPS Tracker
Capacity, FOTA, Licensed Band



Taiwan

Electricity Metering:
Weightless Base Stations & Modules
FOTA, Capacity, Robust Two-way, Downlink Control, Licensed Band

Taiwan, China

Equipment Monitoring:
Weightless Base Stations & Modules
Frequent High Data Rate Uplinks, Remote Control

Germany

Solar PV Installations Monitoring
Weightless Base Stations & Modules
Frequent High Data Rate Uplinks with ACK

USA

Factory Gas Monitoring:
Weightless Base Stations & Modules
FOTA, Capacity, Robust Two-way System

New Zealand, China

Smart Farming : Location and Sensor network
Weightless Base Stations & Modules
Robust Two-Way, Remote Control

Japan

EV Charging Station Monitoring:
Weightless Base Stations & Modules
Frequent High Data Rate Uplinks, Remote Control

Taiwan

Smart Lighting:
Weightless Base Stations & Modules
Robust Two-way System, Remote Downlink Control

Smart Grid Electricity Metering / Automatic Metering Infrastructure

Ubiik is a qualified vendor to Tai-Power

Taiwan's Largest IoT Project

Ubiik Business Opportunity (Taiwan only):

2018: 250,000 meters

2019-2023: 3 million meters

2023-2028: 9 million meters

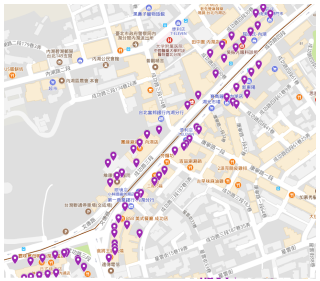
Source: Taipower

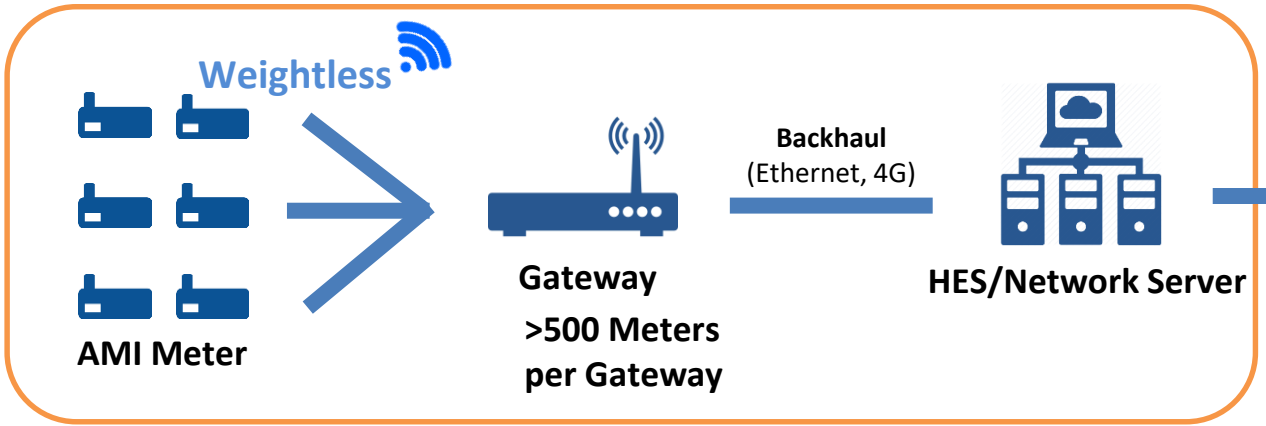
System requirements (Taiwan Smart Meters):

1) Sending data every 15 minutes
2) Remote downlink command
3) On-demand system configuration commands
4) Licensed or unlicensed spectrum
5) FOTA
6) High success rate for data transmission

Build and Operation Business Model :

'Operator' business model - running AMI service for 10 years

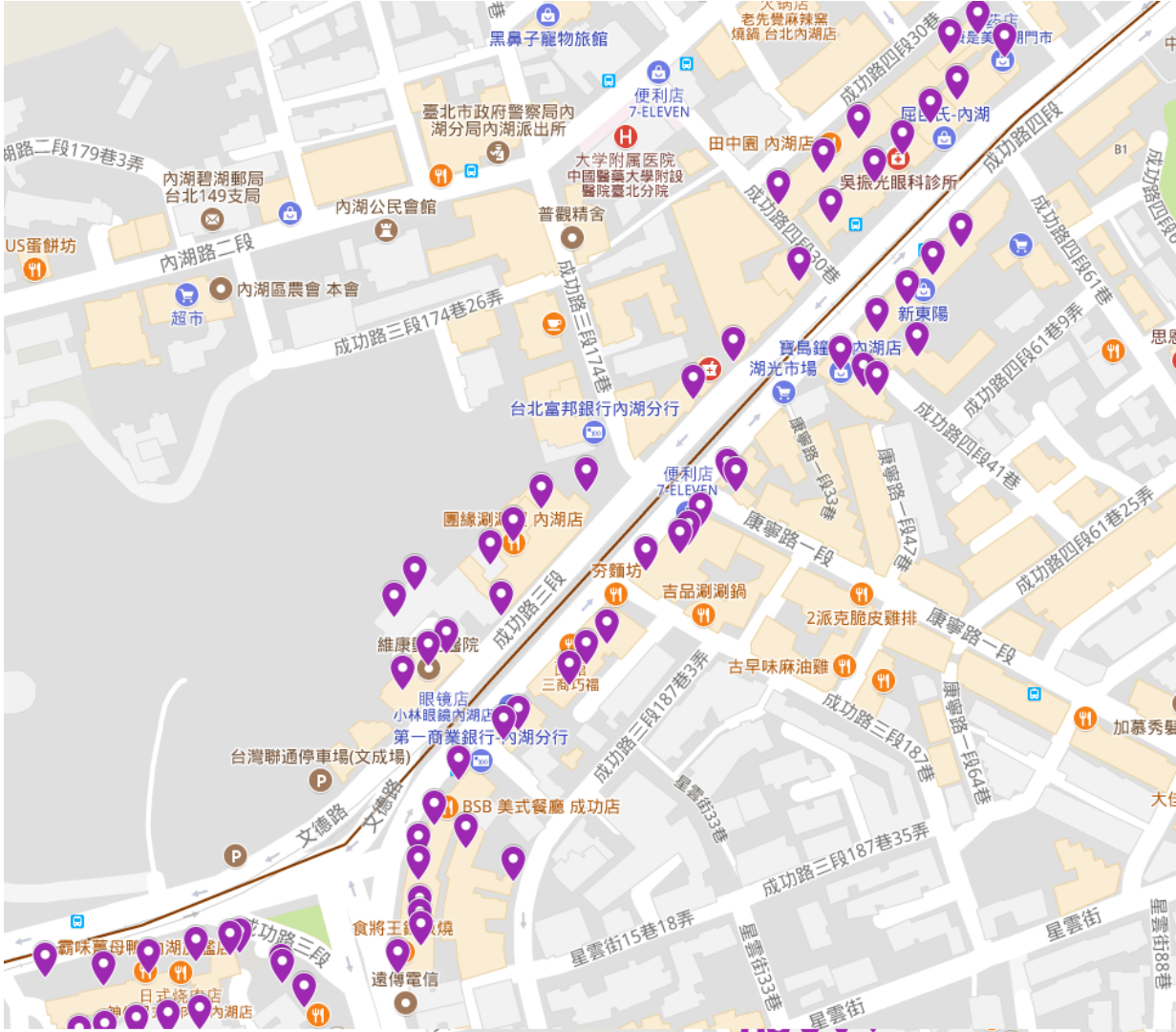




Neihu Field Profile

Meter Installed Apartment Type	Meter Quantity
4F apartment	78
5F apartment	224
7F apartment	105
9F apartment	16
10F apartment	14
11F apartment	25
14F apartment	349
15F apartment	99
TOTAL	910

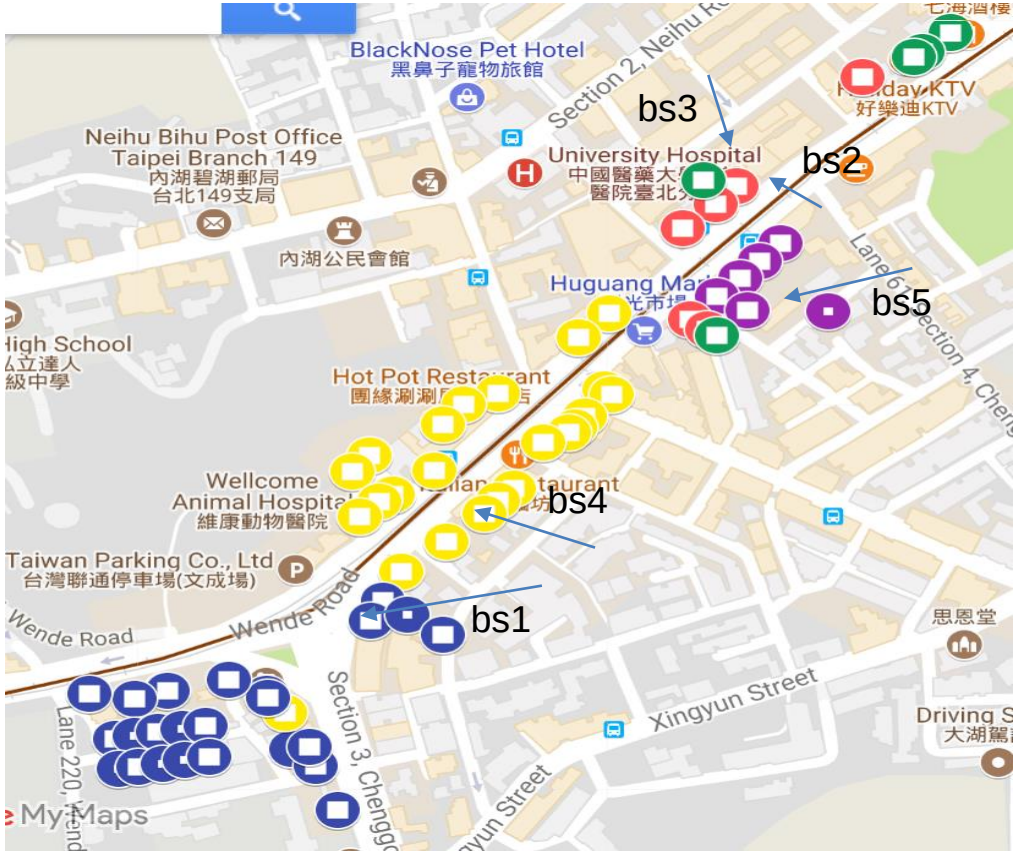
Meter Installed Type	Meter Quantity
Floor 1,2,5,8 stairwell meters	25
Floor 1 stairwell meters	293
Floor 1 stairwell meters with metal enclosure	139
Floor 3,6,9 stairwell meters	14
Floor 5-13 stairwell meters	56
Floor 5-14 stairwell meters	60
Floor 7-15 stairwell meters	53
Basement meters	270
TOTAL	910



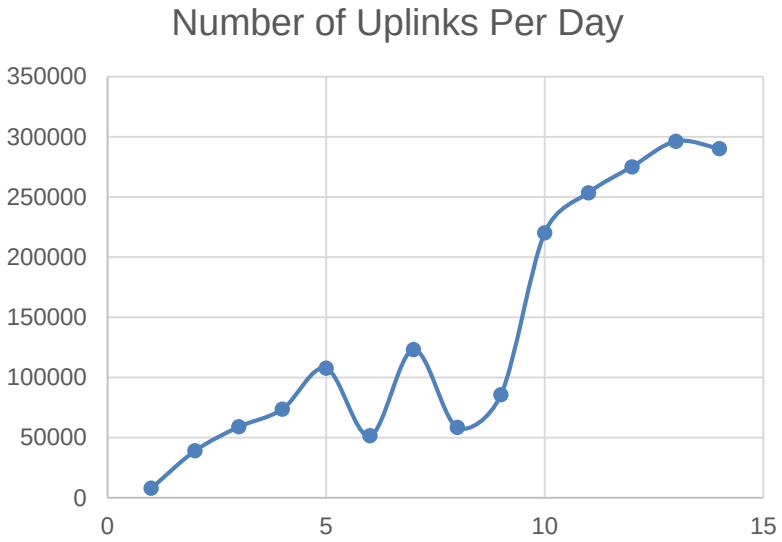
Neihu Coverage Map

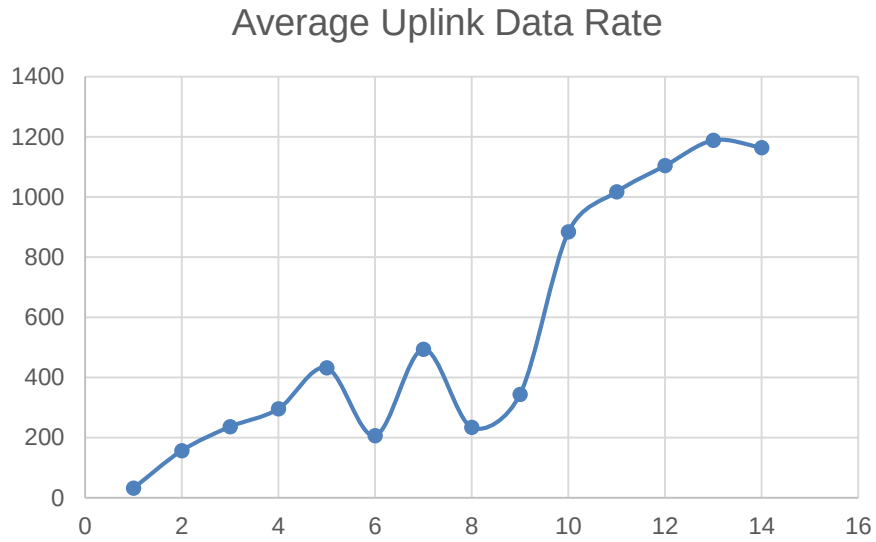
BS1: Blue
BS2: Red
BS3: Green
BS4: Yellow
BS5: Purple

Addresses with complete coverage: large white square.
Addresses with partial coverage: small white square.



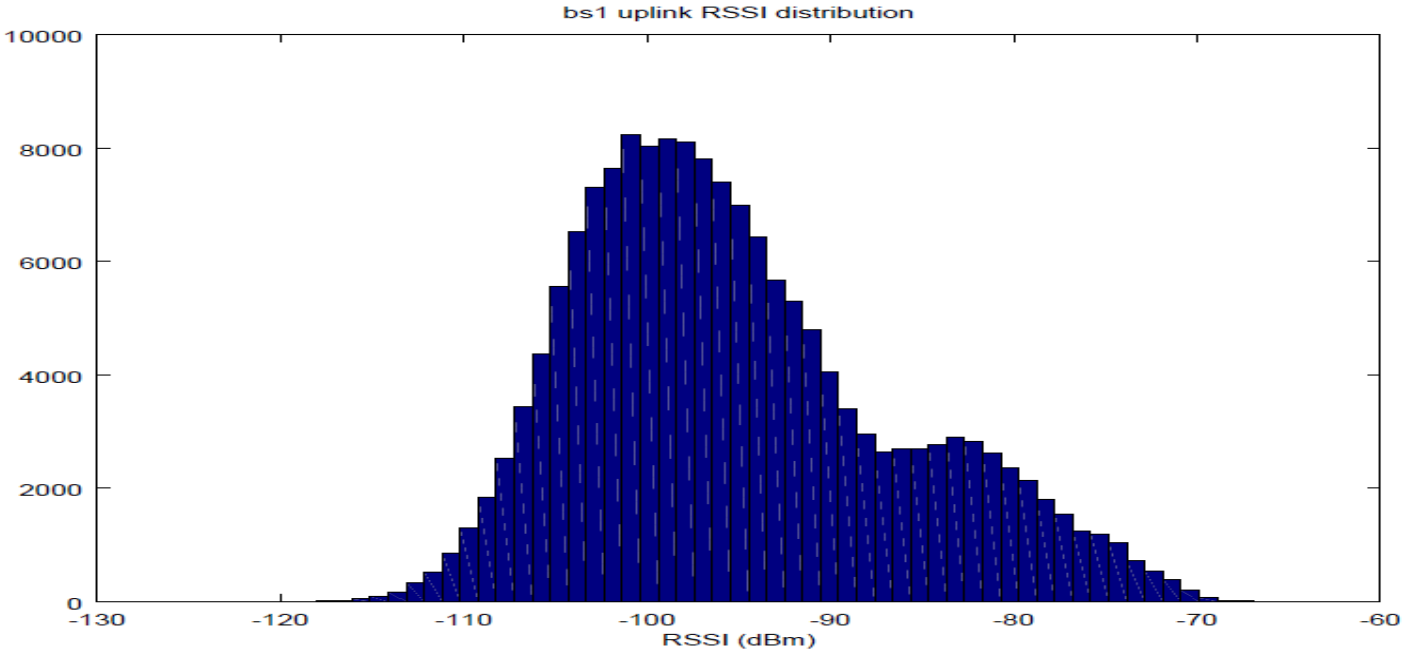
Uplinks per day





Date	12月19日	12月20日	12月21日	12月22日	12月23日	12月24日	12月25日	12月26日	12月27日	12月28日	12月29日	12月30日	12月31日	1月1日
Day	1	2	3	4	5	6	7	8	9	10	11	12	13	14
No of Uplinks	7880	39027	58882	73696	107587	51500	123093	58402	85720	220162	253426	275089	296126	290136
Uplink Average Data Rate	31.61728395	156.58981	236.25494	295.69383	431.67623	206.6358	493.89167	234.32901	343.93827	883.36605	1016.8327	1103.7522	1188.1599	1164.1226

RSSI distribution: Base Station 1

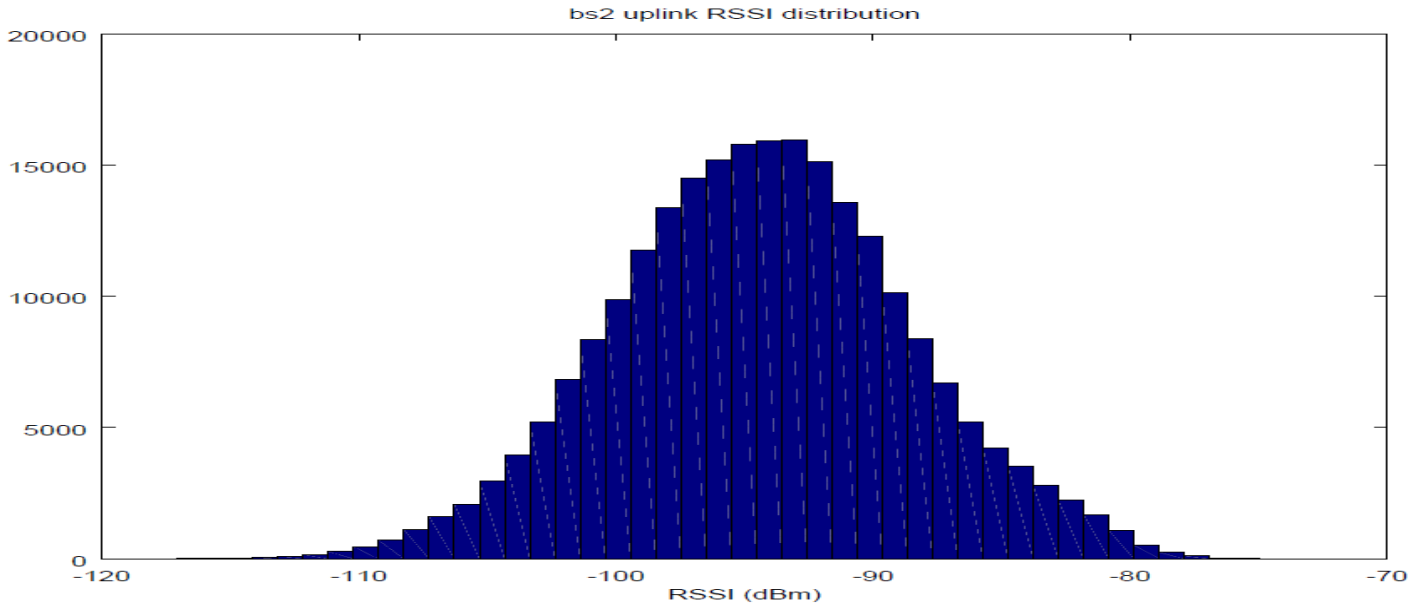


Max RSSI: -64dBm; Min RSSI: -122dBm

Percentage of RSSI <= -110: 2%

Percentage of RSSI <= -115: 0.1%

RSSI distribution: Base Station 2

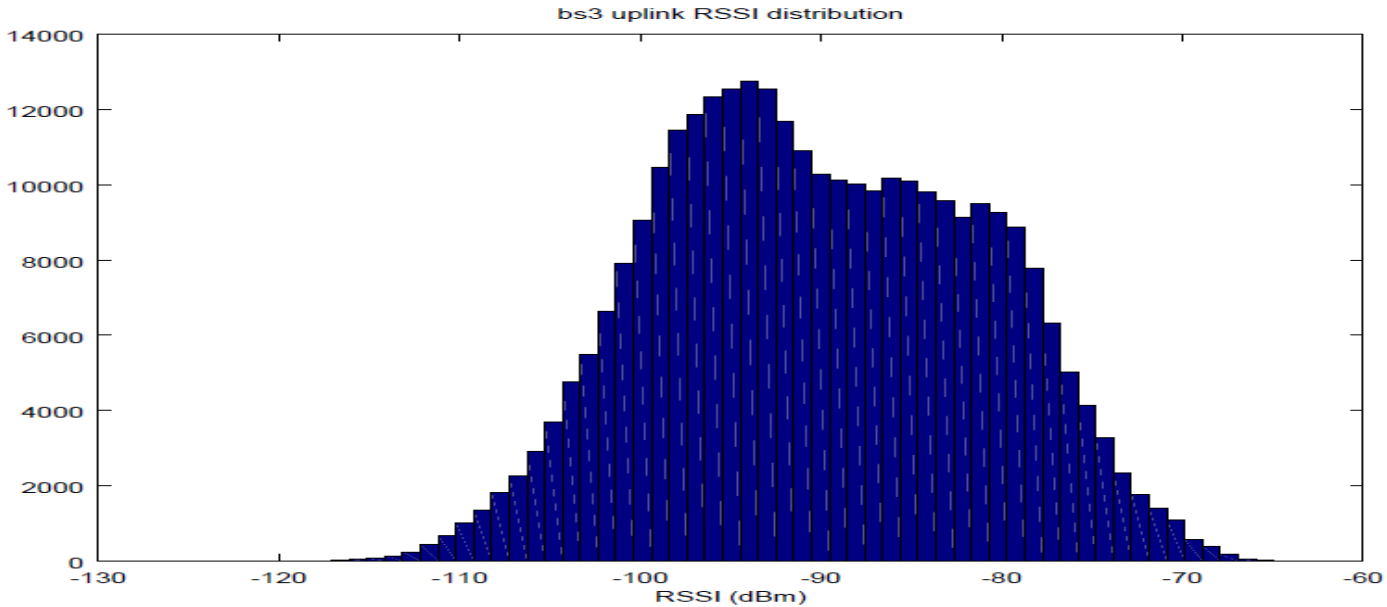


Max RSSI: -73dBm; Min RSSI: -120dBm

Percentage of RSSI <= -110: 0.05%

Percentage of RSSI <= -115: 0.02%

RSSI distribution: Base Station 3

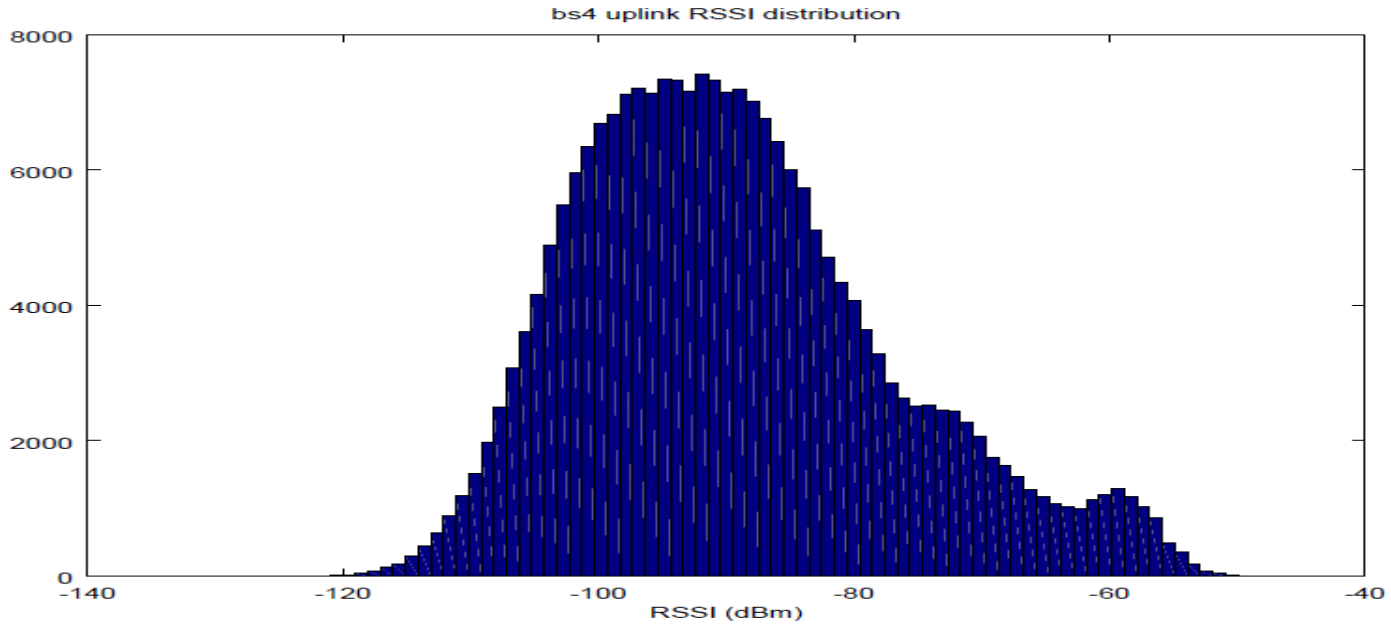


Max RSSI: -62dBm; Min RSSI: -123dBm

Percentage of RSSI <= -110: 0.09%

Percentage of RSSI <= -115: 0.05%

RSSI distribution: Base Station 4

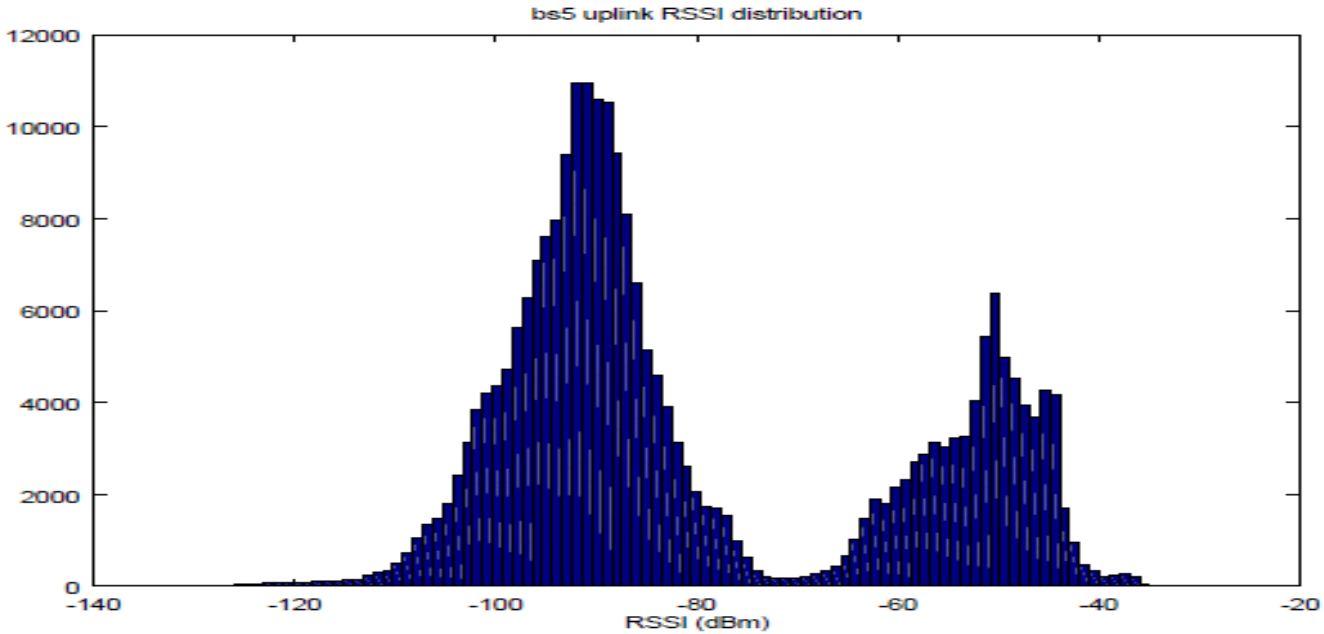


Max RSSI: -46dBm; Min RSSI: -124dBm

Percentage of RSSI <= -110dBm : 2%

Percentage of RSSI <= -115dBm : 0.3%

RSSI distribution: Base Station 5



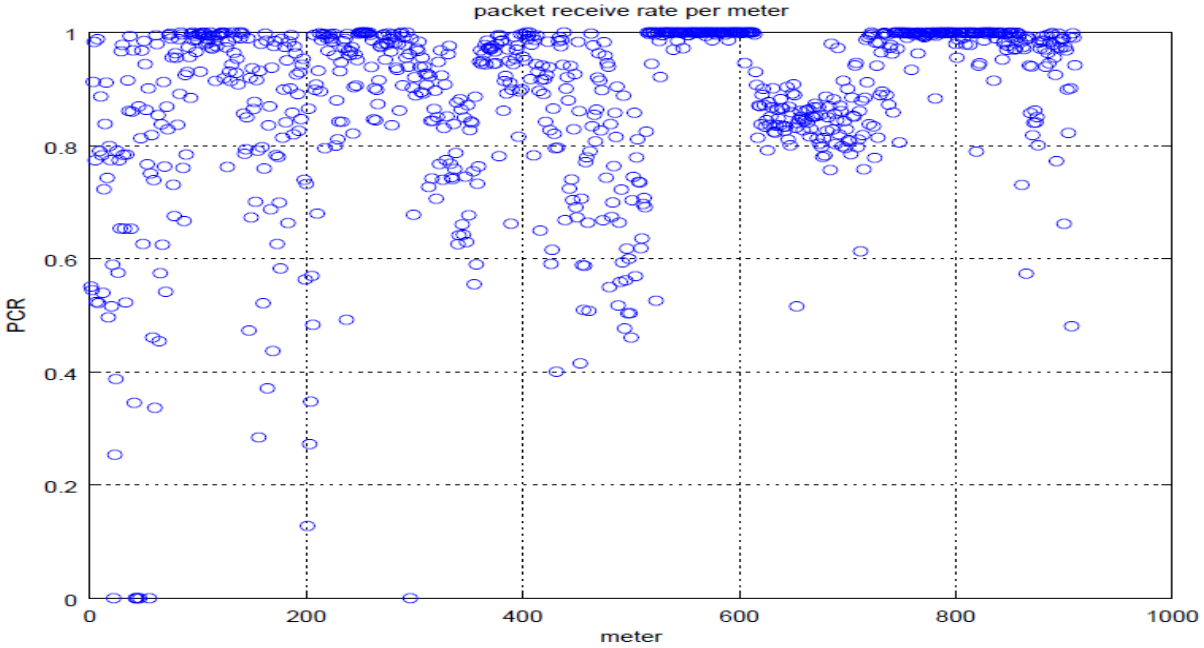
Max RSSI: -34dBm ; Min RSSI -132dBm

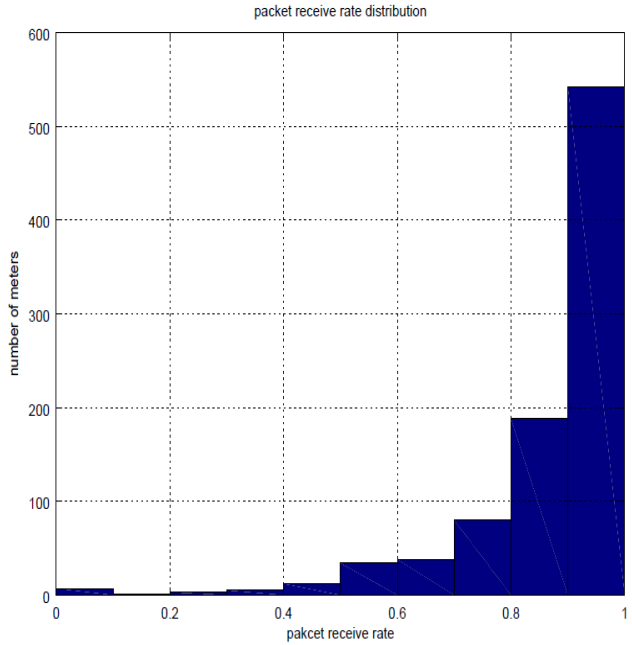
Percentage of RSSI <= -110dBm: 1%

Percentage of RSSI <= -115dBm: 0.4%

Percentage of RSSI <= -125dBm: 0.06%

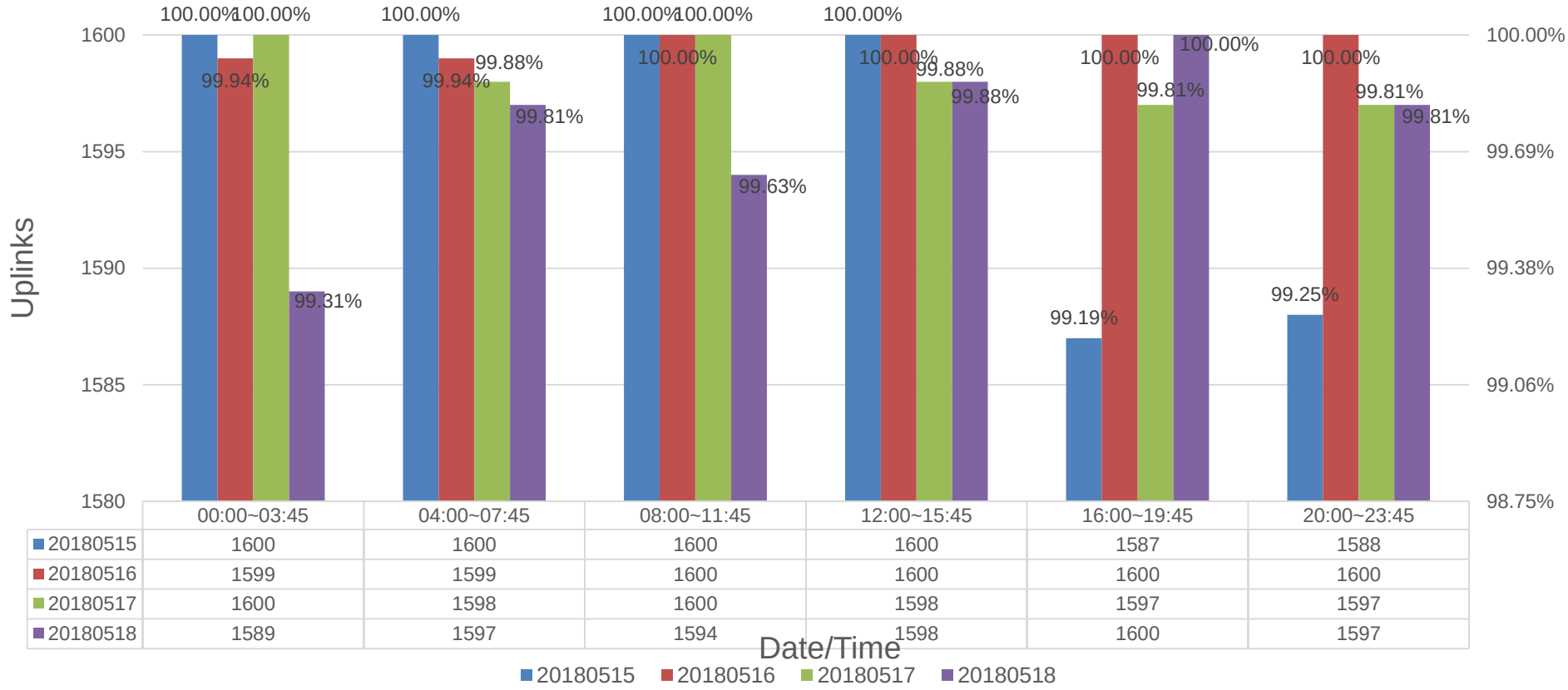
Packet Correct Rate





Packet Correct Rate of 25% for the worst 1%, 42% for the worst 2%, 55% for the worst 5%

Sulin POC Result



ubiik
Ubiik Inc.
優 必 闊 科 技

Weightless Base Station: Subscription-free LPWA Network
Bi-Directional. High-Throughput. High-Capacity. Supports FOTA.

General

- On-board Weightless™ protocol stack
- Ethernet
- Dimensions: 142 x 103 x 44 mm
- Weight: 220g
- Environmentally friendly, RoHS compliant
- FCC, CE compliant
- Supports end-device firmware upgrade (OTA) over-the-air
- Dual core ARM Cortex-A9 @667MHz running Linux

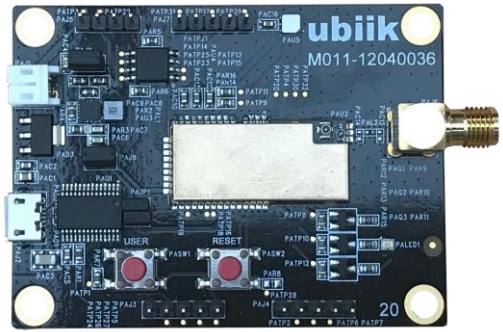
Operational

- Power supply: AC Adaptor
- Temperature range: 0°C to 85°C
- Uplink Data Rate: 100/50/12.5/6.25kbps single channel or 10/5/1.25/0.625kbps with 8 sub-channels
- Downlink Data Rate: 100/50/12.5/6.25kbps
- Memory: 1GB DDR3 SDRAM

RF/Analog Features

- Supports 868 MHz & 915 MHz frequency bands
- Sensitivity: 0.625kbps -128dbm
- Transmit Power: adjustable up to +30 dBm high efficiency PA
- PSK/GMSK modulation

Weightless Sensing Board / Eval Board: Temperature, Humidity, LED



General Features

- On-board Weightless™ protocol stack
- AT command interface over UART
- Form factor: 65 x 55 mm
- Environmentally friendly, RoHS compliant
- FCC, CE compliant
- Device Firmware Upgrade (DFU) over UART
- Device Firmware Upgrade (OTA) over-the-air
- ARM® Cortex®-M3@40MHz running FreeRTOS
- 256kB Flash / 32kB RAM

Operational

- USB port operating voltage: 5V
- Battery port operating voltage: 1.8V to 5.5V (Type. 3V)
- Temperature range: -40°C to +85°C
- Low-power consumption
- Programmable data rate from 625bps to 100kbps with PSK/GMSK modulation
- High-performance low-power ARM® Cortex®-M3 running at 40 MHz

RF/Analog Features

- Low-Power Long Range Transceiver operating in the 868/915/923MHz frequency bands
- High Receiver Sensitivity: -124 dBm @ 6.25 kbps
- Transmit Power: adjustable up to +12 dBm high efficiency PA
- PSK/GMSK modulation

Weightless End Device Module: The Low-Power in LPWAN Multiple TX/RX and Frequencies Available

General Features

- On-board Weightless™ protocol stack
- AT command interface over UART / GPIO
- Compact form factor: 28 x 13mm
- Environmentally friendly, RoHS compliant
- FCC, CE compliant
- Device Firmware Upgrade (DFU) over UART
- Device Firmware Upgrade (OTA) over-the-air
- ARM® Cortex®-M3@40MHz running FreeRTOS
- 256kB Flash / 32kB RAM

Operational

- Single operating voltage: 2.1V to 3.6V (3.3V typical)
- Temperature range: -40°C to +85°C
- Low-power consumption
- Programmable data rate from 625bps to 100kbps with PSK/GMSK modulation
- High-performance low-power ARM® Cortex®-M3 running at 40 MHz

RF/Analog Features

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- High Receiver Sensitivity: -124 dBm @ 6.25 kbps
- Transmit Power: adjustable up to +12 dBm high efficiency PA
- PSK/GMSK modulation
- Over 2 km range in urban environment