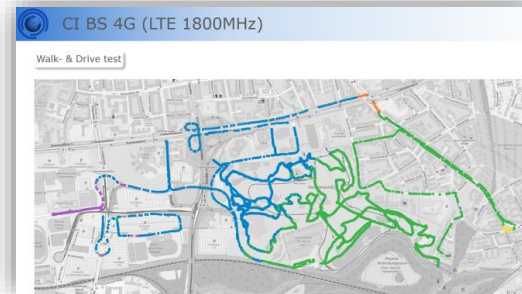
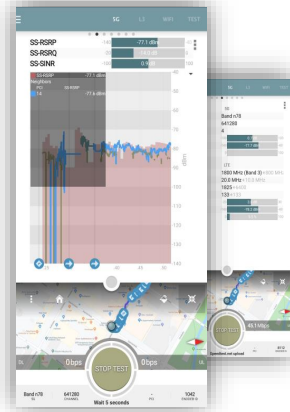




Airscout Mobility

Wireless Network Performance Testing



Agenda

1. Overview
2. Applications
3. Product Features
4. Competitive Information



Who is Tempo Communications?

Tools for Tower Technicians

Fiber Test



FSP200– Optical Fusion Splicer



OPM/SLS– Optical power meters and light sources



RF Safety Monitors



WaveControl – Person RF Safety Monitor

Spectrum Analyzers/ Signal Generators



Aircout RF – 0 – 50 GHz Compact, Rugged Spectrum Analyzers

PIM Test/Mitigation



PIM Site Assessment – Use Imagery and AI to assess PIM problems



PIM Shield - PIM Mitigation Material

"Serving technicians for over 25 years"

1. Overview

What is Airscout Mobility?

Test Wireless Performance across indoor and outdoor wireless networks

- 5G, LTE, UMTS, GSM, WiFi, Bluetooth, TETRA, P25 and also 3G technologies
- For in-building, outdoor stadium and outdoor drive test applications
- Uses an app on your phone to test your network exactly as your customers see it
- Full and customizable reporting
- The ONLY solution in the industry that:
 - Offers cloud-based licensing to maximize cost and flexibility
 - Full remote control and customizable tests to reduce time of test at the local site



In-Building



Stadium/ oDAS



Outdoor Drive Test

AirScout Mobility Tests

- Idle and active testing using manual or scripted mode for
 - voice call
 - voice quality
 - FTP and HTTP data transfers
 - iPerf
 - HTML browsing
 - YouTube video streaming testing
 - Facebook testing
 - SMS testing
 - ping testing.
- Support for POLQA voice quality testing real-time MOST calculation (optional).
- System lock, band lock, LTE cell lock, and carrier lock (UMTS) (device-dependent feature).
- **Built-in script editor in AirScout Mobility tools and in Cloud enables the creation and editing of manual and scripted tests (automatic synchronization).**



AirScout Mobility: Apps and Technologies

Feature: Tests	AirScout Mobility
Voice Call (MOC)	X
Voice Call (MTC)	X
VoLTE	X
VoWiFi	X
MOS (POLQA)	X
FTP (UL/DL)	X
SMS	X
HTTP Browser and File UI/DL	X
PING	X
YouTube	X
Facebook	X
iPerf TCP/UPD (UL/DL)	X
Manual Script Testng	X
Automatic Script Testing	X
Wi-Fi	X
Ookla Speedtest.net UI/DL/Ping	X
Traceroute test	X

Feature: Technologies	AirScout Mobility
GSM	X
UMTS	X
EVDO	X
LTE (TDD/FDD)	X
Wi-Fi	X
Bluetooth	X
5G	X

Feature: Forcing	AirScout Mobility
Technology	X
Band	X
Channel	X
Cell	X

Feature: Cloud Integration	AirScout Mobility
Cloud by default	X
License Management	X
Device Remote Control	X
Device Remote Monitoring	X
Script Handling	X
Measurement Control	X
Measurement File Management	X
Device Configuration	X
Cell File Management	X
Indoor Map management	X
Scanner Configuration	X
File Export Configuration	X

AirScout Mobility Feature Set

Feature: Map Support	AirScout Mobility
Indoor Map	X
iBwave Support	X
Multiple Outdoor Map Providers	X
Route planning	X

Feature: Supported Measurement file format	AirScout Mobility
AirScout Mobility	X
Qualcomm	X
ZK-SAM	X
Nemo	X
PCAP	X
GNS	X
Wi-Fi & Bluetooth survey CSV	X
CSV	X
Google Earth KLM	X
ESRI Shape	X

Feature: User Interface	AirScout Mobility
Real-time display of RF Parameters	X
L3 Signaling with decode	X
Customizable UI	X
Test Status Display	X
*Limited set of RF parameters available	

Feature: License Model	AirScout Mobility
Buy to Own (Permanent)	X
Day Pass	X
Month Pass	X

Feature: Phone Rooting	AirScout Mobility
Standard Android Root (Free of Charge)	X
No Rooting Required	

Feature: Remote Control	AirScout Mobility
Measurement Control	X
Script Management	X
Device Monitoring	X

Feature: Chipset Support	AirScout Mobility
Qualcomm	X
HiSilicon	X
Samsung	In Implementation
Other Chipset	On Demand

2. Applications

Applications: Basic Functions

Step 1: Set test configuration (preset or custom), and upload site map from Google maps or floor plan.



Step 2: Perform walkthrough



Step 3: View reports and make adjustments to address problem areas.



Applications: Multiple Technologies



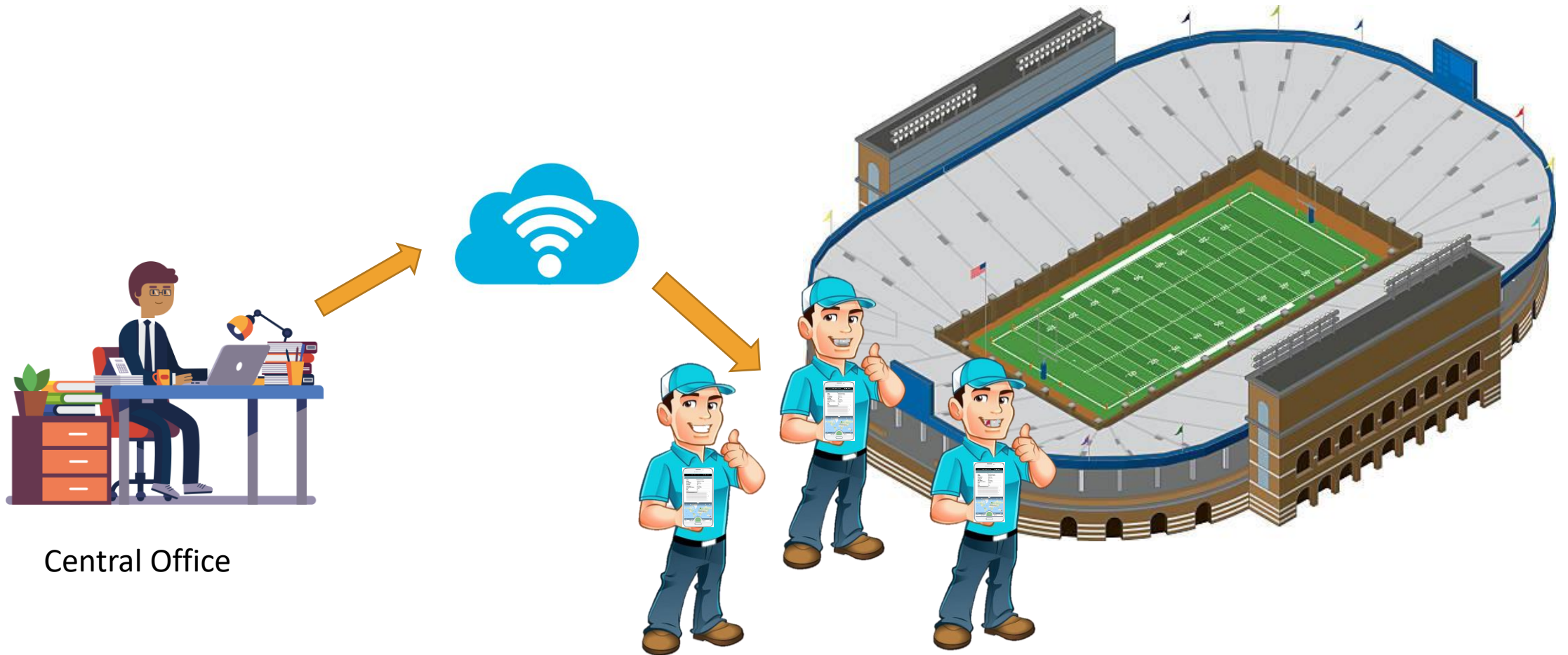
Applications: Multiple Technologies

Example configuration 4G/5G

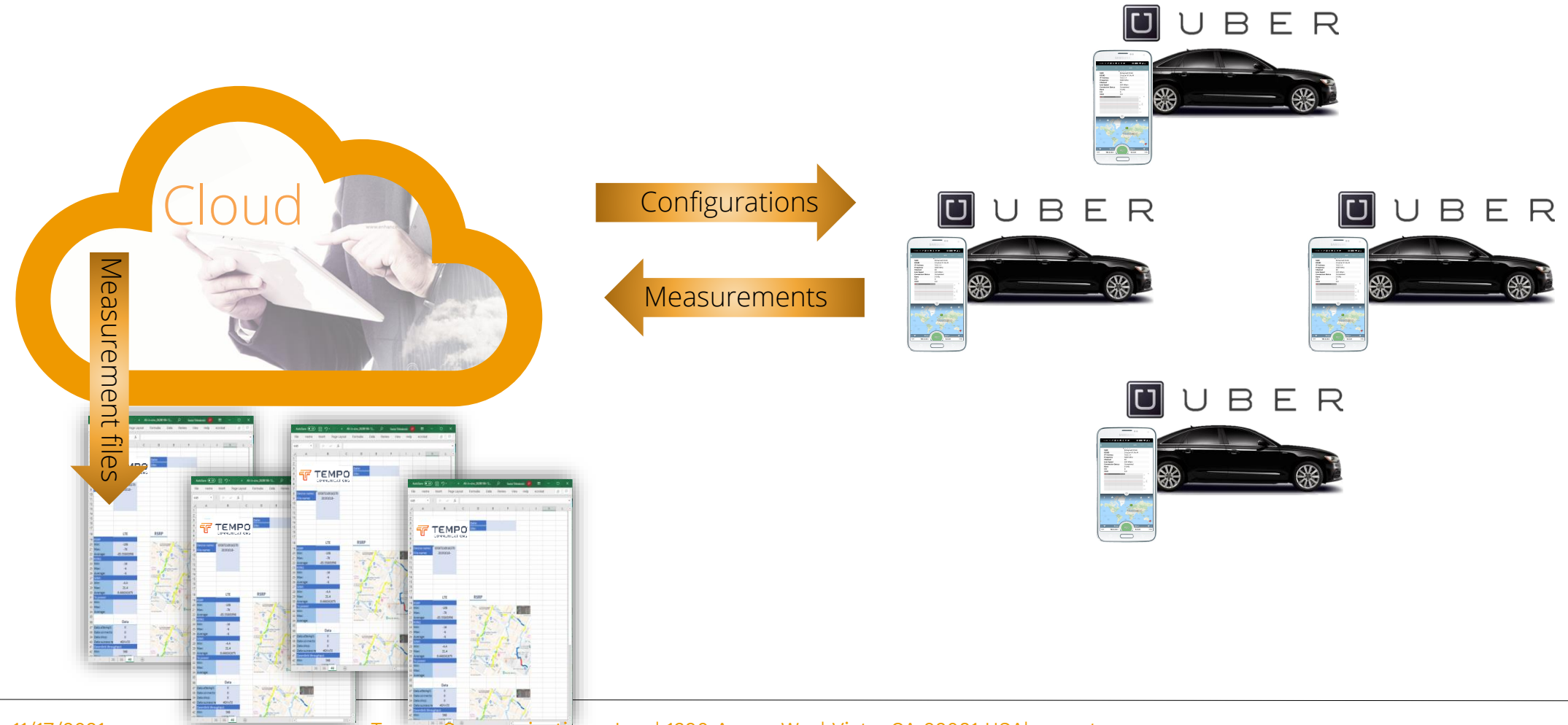
- Phones: 3 x OnePlus 6T, 3 x OnePlus 7 5G
- 3 x power bank 20000mAh
(2 phones per power bank)
- Scanner: 2 hot changeable batteries
(operation time 2 x 4h)
- Dimensions: 48 x 35 cm
- Tablet: Samsung Android
- Operation time > 8h
- Weight:
 - 3,7 kg (6 phones, 3 power banks)
 - 5,6 kg (6 phones, 3 power banks, 1 scanner)
- Maximum number of technologies: 20



Applications: Remote Control Feature



Use cases: autonomous probes, mobile and/or stationary



Variety of Customer Use Cases

- Network optimization
- Indoor/Outdoor testing
- Benchmarking with Master PC and benchmarking of operators
- QoE test for regulators
- Statistical benchmarking with multiple (>100) devices
- Fleet control of multiple (>100) devices
- Fixed probes
- Automated Reports
- Nonstop monitoring



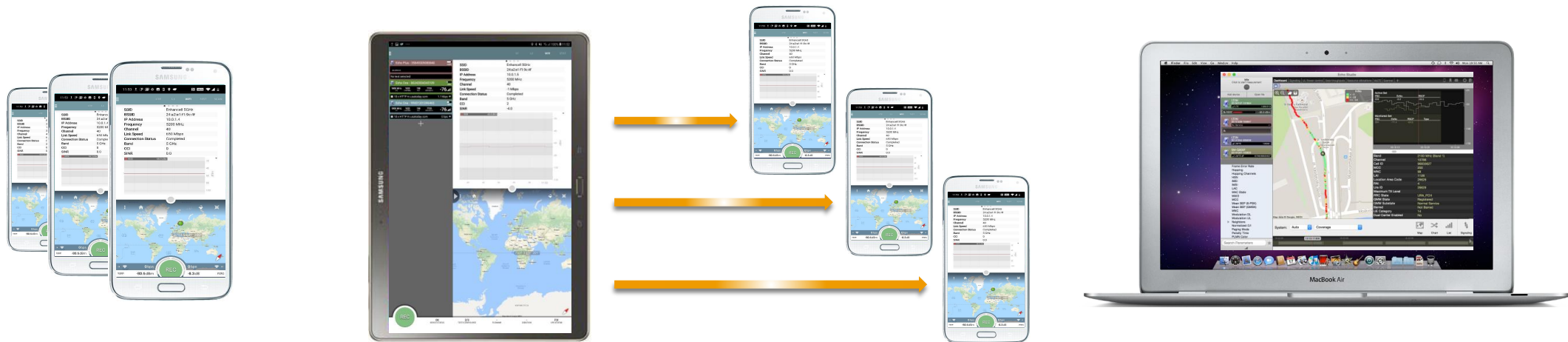
3. Product Features

AirScout Mobility product line

AirScout Mobility

AirScout Mobility Plus

AirScout Mobility Studio



Standalone / autonomous

Tablet controlled walk / drive test
and benchmarking

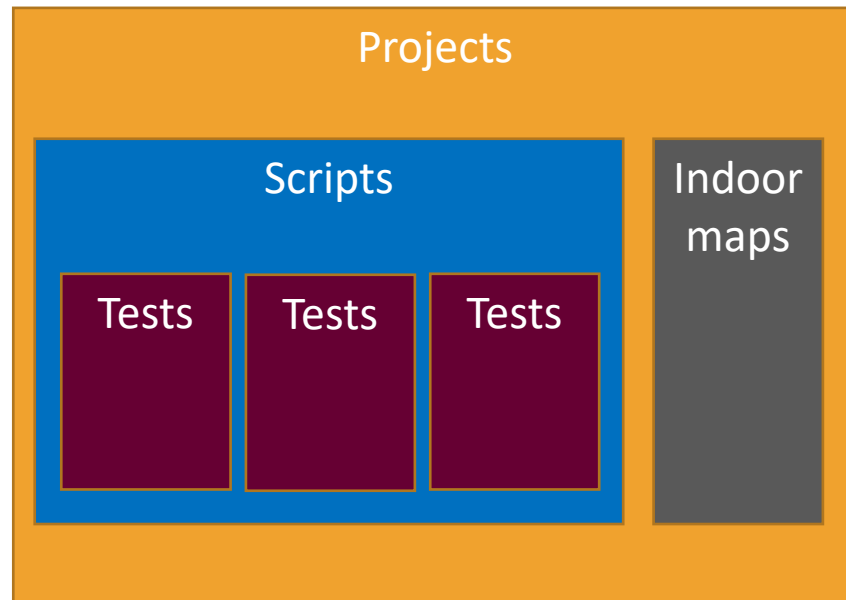
Control and reporting

AirScout Mobility Tests

- Idle and active testing using manual or scripted mode for
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- **Built-in script editor in AirScout Mobility tools and in Cloud enables the creation and editing of manual and scripted tests (automatic synchronization).**



Cloud Project Construction

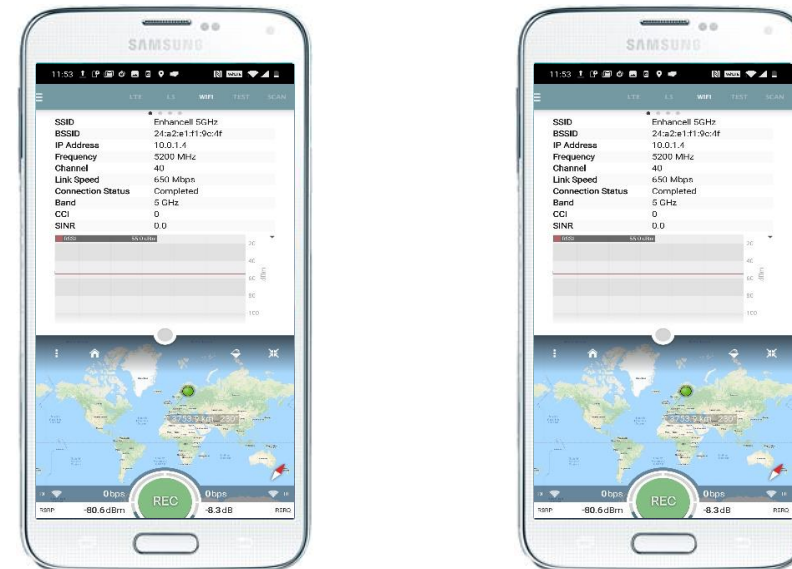


AirScout Mobility One and AirScout Mobility Lite

AirScout Mobility One and Lite are extremely versatile hand-held cellular protocol measurement tools.

- AirScout Mobility One and Lite can operate on several commercial Android and Harmony OS handsets*.
- AirScout Mobility One and Lite allow the user to perform the most thorough hand-held measurements in the industry.

AirScout Mobility



*Capabilities vary between phone models. Please contact Tempo Communications sales for more information.

AirScout Mobility Plus

Simultaneous Performance of Multiple Technologies and Full Remote Control Testing

- AirScout Mobility Plus introduces new methods of enabling users conducting surveys and optimizing equipment. It enables the user to control several different AirScout Mobility devices simultaneously in real time.
- Only one set of measurement configurations is needed which adds to the efficiency of performing measurements.
- AirScout Mobility Plus includes features such as
 - Remote Start and Logging
 - Location Ping
 - Cloud-based logging
 - Transferable Licensing.



AirScout Mobility Cloud

- File handling
- License management
- Device management
- Remote device configuration
- Remote device control
- Built-in file export and converter
- Free 1 GB Cloud included in the AirScout Mobility tools
- Larger configurations with monthly rate
- Cloud hosting service by default
- Customer cloud service optional

AirScout Mobility Cloud (from AWS) with an option for client Private Cloud



Note: AirScout Mobility Cloud has 3 options (at differing costs & based on client requirements).

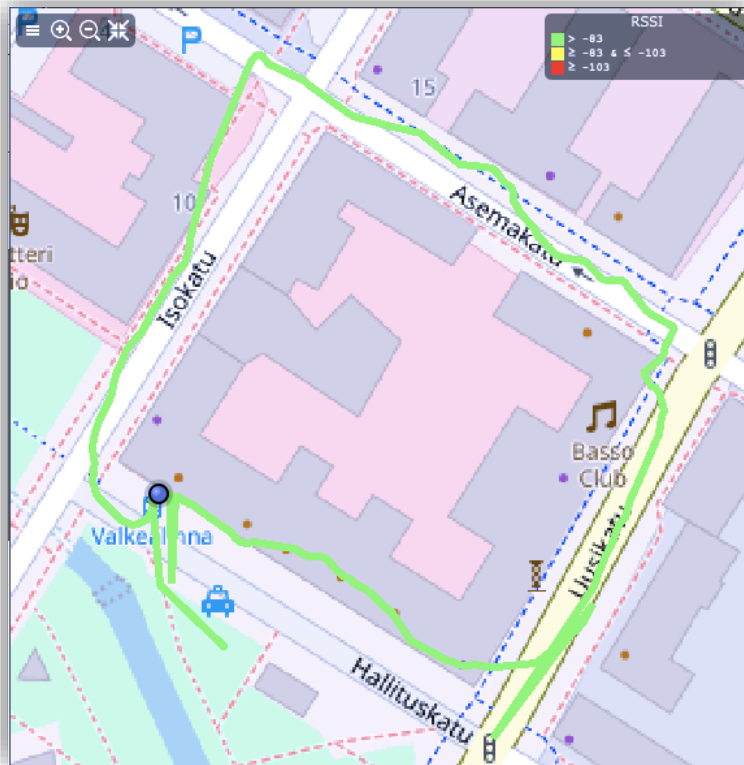
Cloud option	Description
Tempo Communications Cloud	AWS-based cloud solution
Dedicated Cloud	AWS-based cloud solution in a dedicated region
Private Cloud	Customer-specific HW and SW in customer's premises and network

AirScout Mobility Studio: Reporting

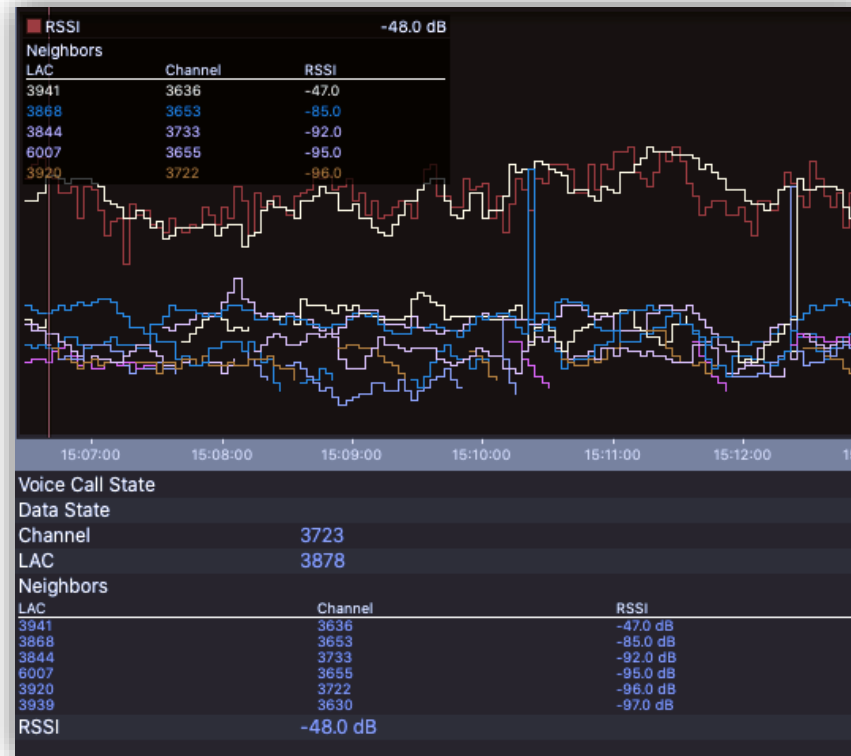
- **Visualization of Test Results:** AirScout Mobility Studio is a measurement and analysis tools which offers quick and easy way to produce reports and visualizations of the measurement test results.
- **Instantaneous Reports from Multiple Devices:** Synchronization to Cloud enables instantaneous report production of measurements performed remotely with other AirScout Mobility devices.
- **Remote Control:** AirScout Mobility devices can also be remotely controlled with Studio.



Reporting Examples: TETRA



Map Coverage



Spectrum View

Handovers		
Completes	0/0	0%
Location updates		
Accepts	0/0	0%
Calls		
Connects	3/3	100%
Disconnects	2/3	66%
SMS		
Attempts	0/0	0%
Delivered	0/0	0%
Data		

Parameter Text Report

Reporting Examples: Multiple Technology

Technologie	Pegel		Datenrateb	
	AVG Signalstärke [dBm]	AVG Signalqualität [dB]	AVG Download [Mbit/s]	AVG Upload [Mbit/s]
UMTS	-90,07	-9,84	9,61	2,20
LTE 800	-110,50	-1,25	7,88	3,70
LTE 1800	-109,51	9,57	33,44	2,40
LTE 2600	-126,00	-2,00	-	-



Technologie	AVG Ping [ms]					
	104.160.64.64	104.160.74.77	130.211.14.80	130.211.44.186	216.198.34.1	Speedtest.net
UMTS	116,00	196,00	39,00	39,00	167,00	149,00
LTE 800	108,00	138,00	85,00	67,00	147,00	47,00
LTE 1800	140,00	119,00	57,40	64,30	150,00	25,80
LTE 2600	-	-	-	-	-	-

Reporting Examples: In-Building



4. What's Unique about Airscout Mobility?

Competitive Information

Value Proposition	Tempo Communications Solution	Other Tool Vendors
Floating, transferable license	✓ (Fully transferrable)	✗ (Locked to the device)
One price for any chipset support	✓ (One price and same license for any chipset)	✗ (Separate license costs for each chipset)
Local device cost	✓ (Local market price)	✗ (Company list price)
Support for any firmware version	✓	✗ (Specific firmware/model)
Flexible license terms (rental monthly/daily or perpetual)	✓	✗ (Purchase only)
Compatible post processing results	✓	✗ (Limited compatibility)
Device only upgrade cost	✓ (Only phone, no license cost)	✗ (Phone with license)
Immediate On-demand license availability	✓	✗ (Lead time for order and delivery)

Unparalleled flexibility on license

AirScout Mobility offers “cloud-based” licensing, giving the user unparalleled flexibility:

- **Fully Functional License:** All technology functions are included by default.
- **Floating License:** The transfer is standard from handset to handset.
- **Flexible term:** Purchase licenses by the year, month, week, or day. Perpetual licenses also available.
- **Real-time monitoring:** Monitor license usage in real time, saving more money by scheduling your projects accordingly.
- **Technology-independent licensing:** The same license can be used for any technology you are measuring.
- **On-demand licensing:** Authorize any device instantaneously



Value Proposition (continued)

Automation

- Fully autonomous drive test and benchmarking with hundreds of devices or more.
- Off-the-shelf phones from local stores are adequate.
 - **AirScout Mobility** : a rooted Android phone (QC or HiSilicon chipset) with full L3 parameters.
- Automatic log file upload to Cloud (via Wi-Fi or Mobile data).

Remote Testing Management

- Administer entire projects, drive routes and walk tests from the convenience of the office.

Remote control

- Schedule tests and measurements remotely with scripts.
- Remote measurement Start and Stop.

Storage

- Reliable and trusted landing platform for easy storage, post-processing and analysis.
- Customized report generation (within seconds) after upload.
- Scalable storage system – AWS or own in-house storage.

Airscout Mobility Summary

Test Wireless Performance across indoor and outdoor wireless networks

- 5G, LTE, UMTS, GSM, WiFi, Bluetooth, TETRA, P25 and also 3G technologies
- For in-building, outdoor stadium and outdoor drive test applications
- Uses an app on your phone to test your network exactly as your customers see it
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- The ONLY solution in the industry that:
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In-Building



Stadium/ oDAS

Outdoor Drive Test



Questions?



Contact:

sales@tempocommunications.com

Thank you!

Universal licenses (chipset support)

Tempo Communications officially supports Qualcomm and HiSilicon (Huawei) chipsets with one universal license.

Feel free to choose your test device from more than 150 commercial phones.

All supported chipsets are covered by one universal license that can be allocated to any commercial phone daily; make Drive tests with a Sony phone today and a Huawei phone tomorrow at no additional cost!

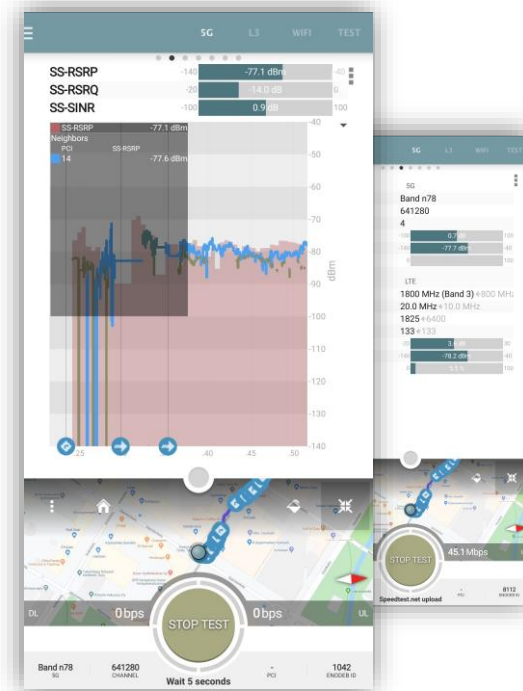


5G Support

In addition to 4G and other established technologies, AirScout Mobility product line supports 5G measurement* and introduces various new features making your AirScout Mobility product more powerful than ever.

- 4G licenses are upgradable to a 5G license making it convenient and cost-effective for existing customers.
- New customers can enjoy the 5G license benefits regardless of the devices and post-processing tools they use.

*AirScout Mobility Lite does not support 5G measurement for Android 10.



5G-SA/NSA Solution & Supported functions

- Support of available commercial terminals.
- Full support of Qualcomm/HiSilicon traces.
- Other chipsets to follow.
- Supported functions depending on phone functions.
- QC NSA support from Q4/2019.
- First commercial SA phones expected in the 2nd half of 2020.
- Upgrade path for existing customers (5G upgrade).
- No phone charges, only license cost.
- No SW charge for new functions/features within one technology.



Qualcomm Snapdragon 865 support

AirScout Mobility 3.0 versions officially support Snapdragon 865 chipset-based phones.

AirScout Mobility tools have been verified to work with OnePlus 8 and OnePlus 8 Pro, which expands the selection of AirScout Mobility supported commercial phones even further.

In addition to latest Qualcomm X55 modem features, OnePlus 8 models support also various new bands for 5G.

More phones to be supported as soon as they enter the market



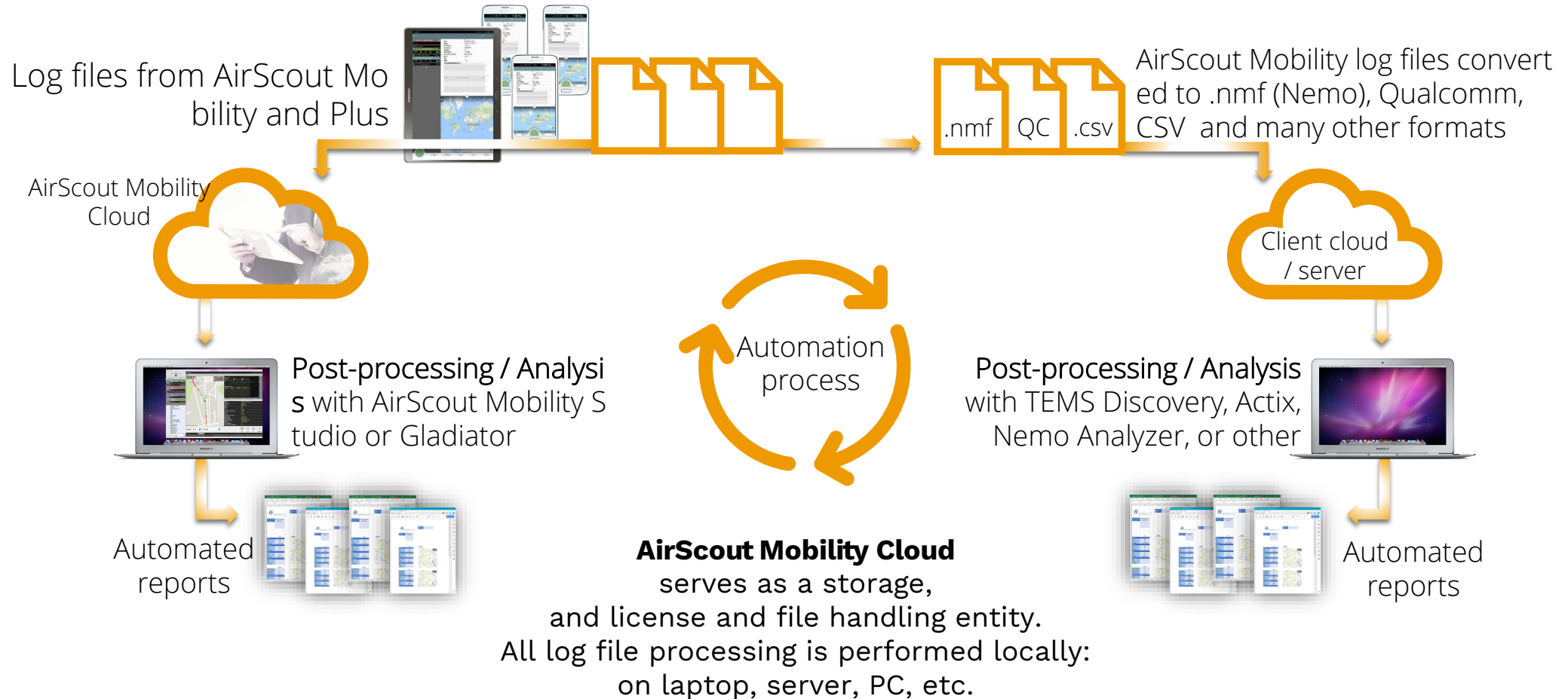
HiSilicon (Huawei) based phone support

Tempo Communications officially supports HiSilicon chipset-based phones.

Take advantage of Huawei's leading position on the 5G phones.



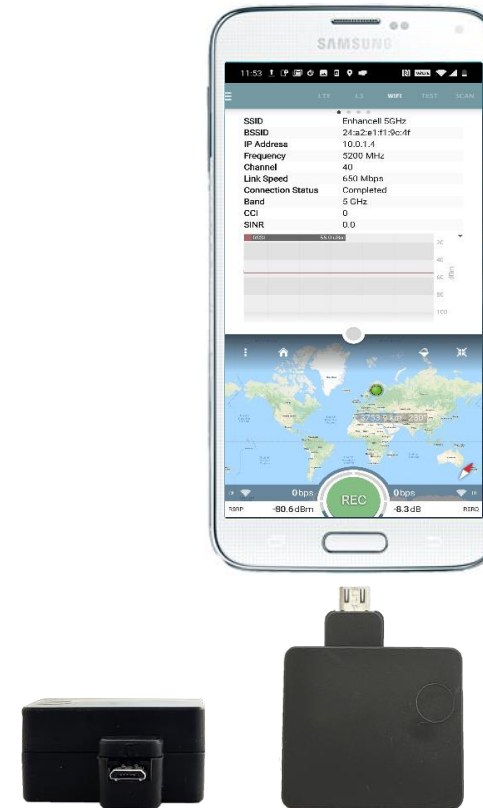
AirScout Mobility log file flow



AirScout Mobility connect for AirScout Mobility

Game changer:

- Plug it in to a 100% commercial phone and it will enable AirScout Mobility One in the phone.
- No root or special firmware required anymore.
- Patented in Europe and the US.

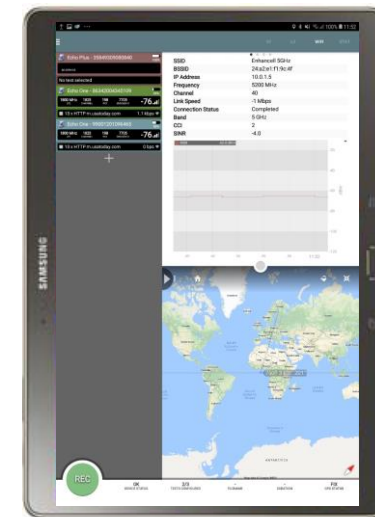


AirScout Mobility Plus TETRA measurement option

TETRA measurement option allows connection of Airbus/EADS commercial TETRA terminal to AirScout Mobility Plus via USB UTG cable.

Measured parameters:

- System, MNC, MCC
- Serving channel, LAC and RSSI
- Neighbor channels, LAC and RSSI
- Call statistics



AirScout Mobility Plus TETRA measurement option

- Detailed serving system information.
- Coverage measurements of serving and neighbor base stations.
- Call generation and statistics.
- Fully user-configurable displays for showing real time measurements.
- All parameters can be displayed with graphical or textual display.



Total Cost of Ownership (TCO)

	Conventional Cellular Test solutions	Tempo Communications Cellular Test solutions
Device	<ul style="list-style-type: none"> • Phone HW (SW embedded limited units) • Lesser no. of HW units/licenses (due to device costs) • Longer delivery process • New LTE = New Test Device • Lost, stolen or broken devices need to be fully replaced 	<ul style="list-style-type: none"> • Software (commercial off-the-shelf, locally sourced) • More licenses/probes due to SW equating to mass deployment • Almost immediate delivery • No SW upgrade, only device upgrade (locally sourced) • Replaced immediately – floating licenses
ROM	<ul style="list-style-type: none"> • Customized ROMs involve costs (e.g. client branding for specific device – typically costs \$10k and up to 4 weeks to deliver) • Devices with specific ROM for testing 	<ul style="list-style-type: none"> • No additional costs or delays • No specific ROM but actual customer device ROM
License	<ul style="list-style-type: none"> • Fixed Licensing • Additional costs for optional items e.g. VoLTE, CA, etc. • Not transferable (if transferable, may incur costs) • QC & Samsung supported with separate licenses (2 different costs due to differ chipsets). 	<ul style="list-style-type: none"> • Flexible licensing • One-time cost • Transferable at no costs • QC and Samsung support with same license (licenses are not chipset dependent)
Server	<ul style="list-style-type: none"> • HW costs and SW maintenance costs • Office storage space/staff • Backoffice/Logistics 	<ul style="list-style-type: none"> • AWS Cloud services (1Gb free with additional on subscription) • Option to integrate with client cloud (if any, integration costs apply) • Various Cloud options – AirScout Mobility, Dedicated or Private
R/MP*	<ul style="list-style-type: none"> • *Resource/Manpower: High 	<ul style="list-style-type: none"> • *Resource/Manpower: Low

Operational Savings

	Operational Savings
Resources	Less engineers required in the field as all control & administration takes place in Cloud (at the office). Engineers can focus on troubleshooting at the office without spending time in the field configuring handsets etc.
Drive Testers	Unexperienced drivers are suitable too, keeping the costs lower. Uber, Gojek, Grab, Ola, Loca & other e-hailing drivers can be employed to increase the amount of data collected. Company staff can also be employed as drive testers
Static Testing	Devices can be kept in strategic locations such as airports, public transport, MRTs, taxis, cafes, offices, MNO service centers. All tests and scripts can be sent, and devices remotely controlled via Cloud - no need for human interaction.
Timeline	Increased no. of licenses allows quicker timeline to complete benchmarking or test activities. More cities can be covered with higher no. of licenses due to low per license price. Less DT teams are required due to the higher no. of licenses allowing more tests / operators benchmark. Increase in license utilization 100% (no need logistic/Transportation cost or time.
Customer Profiling	Easily done without interrupting the user. All tests and scripts can be sent via Cloud - no need for human interaction.
Post- Processing	No additional investments for post-processing solutions are required since AirScout Mobility solutions are compatible with all 3 rd party post-processing & analysis tools.

AirScout Mobility Cloud

AirScout Mobility Cloud is a perfect companion to your AirScout Mobility network measurement tools. You can take full advantage of your AirScout Mobility fleet with AirScout Mobility Cloud.

AirScout Mobility Cloud not only gives your AirScout Mobility fleet a fully automated data storage for all the drive test file but also a way to control and configure your fleet remotely.

License management tool in AirScout Mobility Cloud makes your asset management a breeze. With total control on your purchased licenses you can

- easily transfer licenses to new phones
- pull licenses from phones you no longer use.
- 1 GB free
- Annual plans up to 1 TB

