Data Rain

Communication Platform

Technology overview and
test results for Special Mission

XXLSEC

April 2020

EXECUTIVE SUMMARY

Latest developments in communication technologies and increased security requirements have transformed the strategic model and front line “tool box” for critical communication. Special Forces (“SOF”) operations highlight the leadership and operating requirements for an advanced communication platform in the most visible fashion. Modern communication technologies with compelling new features are now available to provide a superior command capability and operational advantage.

We have submitted to the Special Forces a proposal for the adoption of a **Data Rain (“DR”) communication platform** as the core technology solution. This unique solution

- meets the strictest requirements for communication security;
- gives complete operational independence;
- secures a comprehensive network coverage for full operating area; and
- is easily available for all ad-hoc deployments.

The DR platform relies on highly sophisticated encryption technology for information security, and all users of the platform benefit directly from simultaneous data feed.

A SOF mission was completed in Helsinki in April 2020 to demonstrate the performance of a DR communication platform. This mission - engaging a full SOF Battalion set-up (Battalion HQ, Company HQ, Platoon leader and two SOF Teams) - included comprehensive and rigorous tests to gain deep command and operational level insights based on live action.

The above mentioned mission and related tests confirmed the compelling strategy, operating and tactical advantages of the proposed DR platform, in particular by

1. **Providing shared situational awareness for all operating entities by the use of a fully secured and encrypted communication, command and control platform under all operational scenarios.**

2. **Securing highly reliable and resilient short to medium range connection and reliable coverage all the way from the SOF Team to the Battalion HQ**

A comprehensive Report has been prepared by XXLSEC OY to describe the DR communication platform in the Special Forces context. The Report includes the above mentioned test results in detail, and gives a practical “hands-on” insight to the benefits of the DR solution.

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1. Introduction

This document describes Data Rain (“DR”) communication platform performance based on an illustrative Special Forces (“SOF”) mission in Helsinki. For completeness, we include long range test results for extra long range scenarios covering ground-to-air and ground-to-sea examples. The described mission takes into consideration the engagement of all the key operating entities of a SOF Battalion - namely the Battalion HQ, Company HQ, Platoon leader (static) and two SOF Teams.

From **operating and tactical perspective** the DR solution gives a superior leadership and command capability – in particular the platform

- meets the strictest of requirements for communication security;
- gives complete independence as it is separate and standalone from any other network (be it a commercial or any other communication network);
- gives a comprehensive MESH network coverage for the full operating area;
- provides ample communication and transmission capacity;
- gives maximum operating flexibility and ease of movement as the network is available for all ad-hoc deployments.

From **technical perspective** the DR platform relies on highly sophisticated encryption technology for information security. All users of the platform benefit directly from simultaneous data feed using sensors in multiple locations.

Training the relevant tactical operators, mission leaders and technical teams is an essential step in the process to build the described superior operational command capability.

2. Special Mission Objectives

The described SOF Special Mission and performed tests demonstrate the platform capability from two important perspectives:

1. **Providing shared situational awareness for all operating entities by the use of a fully secured and encrypted communication, command and control platform under all operational scenarios.**

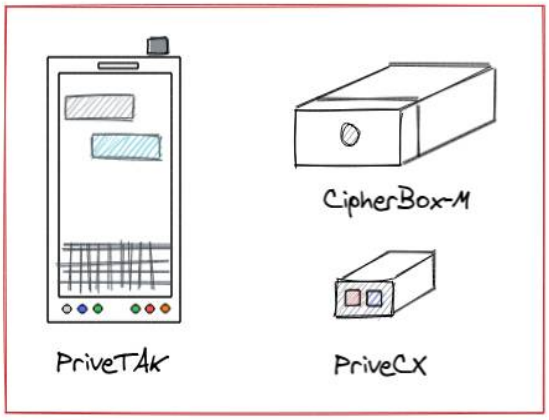
2. **Securing highly reliable and resilient short to medium range connection and reliable coverage all the way from the SOF Team to the Battalion HQ**

3. Data Rain Communication Platform - fully secured and encrypted communication

3.1 Communication security

The DR platform makes a fundamental design and operating **distinction between communication security and communication network**. DR separates all encryption functions to a distinct domain which can be independently verified by the relevant end user. This security domain can then be connected to any available network for transmission purposes. **As a result it is possible to surpass consumer level security and meet the highest possible national security requirements.**

At the implementation level we apply "**clean hardware/clean software methodology, using a range of XXLSEC developed encryption devices** including 'PriveTAK', system line encryption unit 'CipherBox-M' and sensor mounted 'PriveCX' models. These devices form a security perimeter which places the customer in full control of the relevant device internals and any encryption related functions. The devices can then be connected with various networks – be they public, private, tactical and/or satellite networks.



3.2 Reliability 24/7 - including Off-The Grid

The DR platform is truly standalone and usable 24/7 without access to any other networks, third party servers or cloud services. The same applies to 'Off-The-Grid' situations where the relevant user group is disconnected from national infrastructure (electricity, communication networks, satellite navigation) for any reason.

Importantly, the DR network can be equipped with interference avoidance/anti jamming technology features. This gives full protection against any efforts for frequency jamming or other third party interventions in the operational area.

Local networks (Cellular/Tetra) can be connected with the DR network to create interoperability between operations and connectivity between countries if so needed.

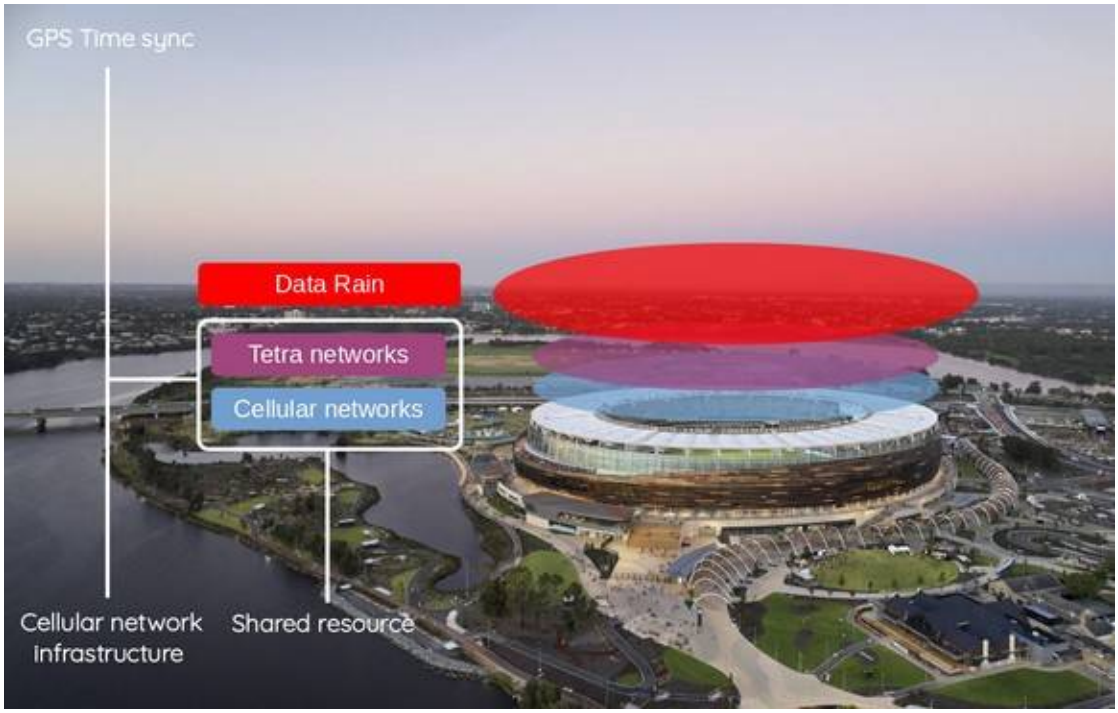


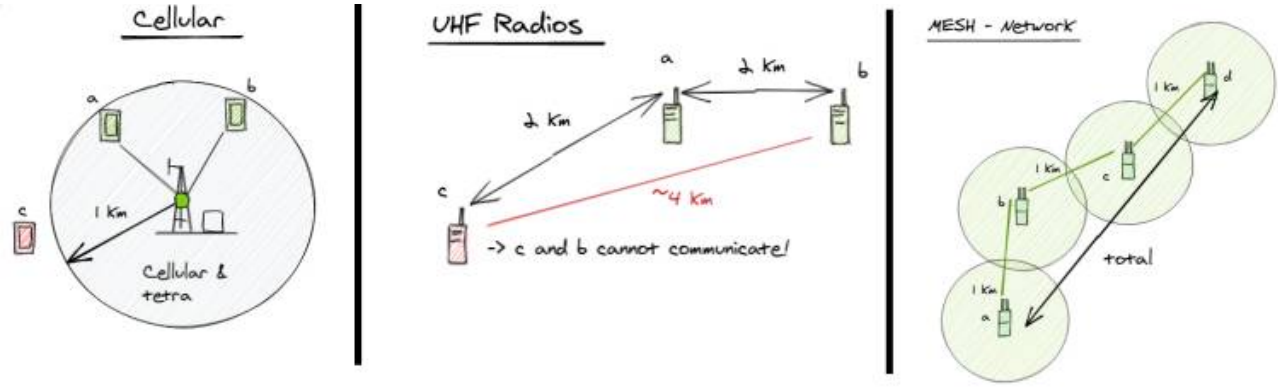
Image: DR platform is fully independent providing 5-100MBit/s throughput and all operation command capabilities - unlike Tetra, PTT UHF and Cellular networks which are centralized networks.

3.3 Resilience

Securing platform resilience is a fundamental consideration for secure communication. Platform resilience together with the secure infrastructure elements (inc. cloud, servers and software) represents a powerful combination with an uncompromising reliability.

3.4 Range vs Coverage

MESH technology changes radio network planning at fundamental level. 'What is the range between the radios? This is the question raised by the radio teams reflecting the traditional operating model where total radio coverage is defined by the range of a single radio in the system. However, the MESH technology is completely different as 'every radio is a base station'. This operating model extends the total coverage dramatically as described below.

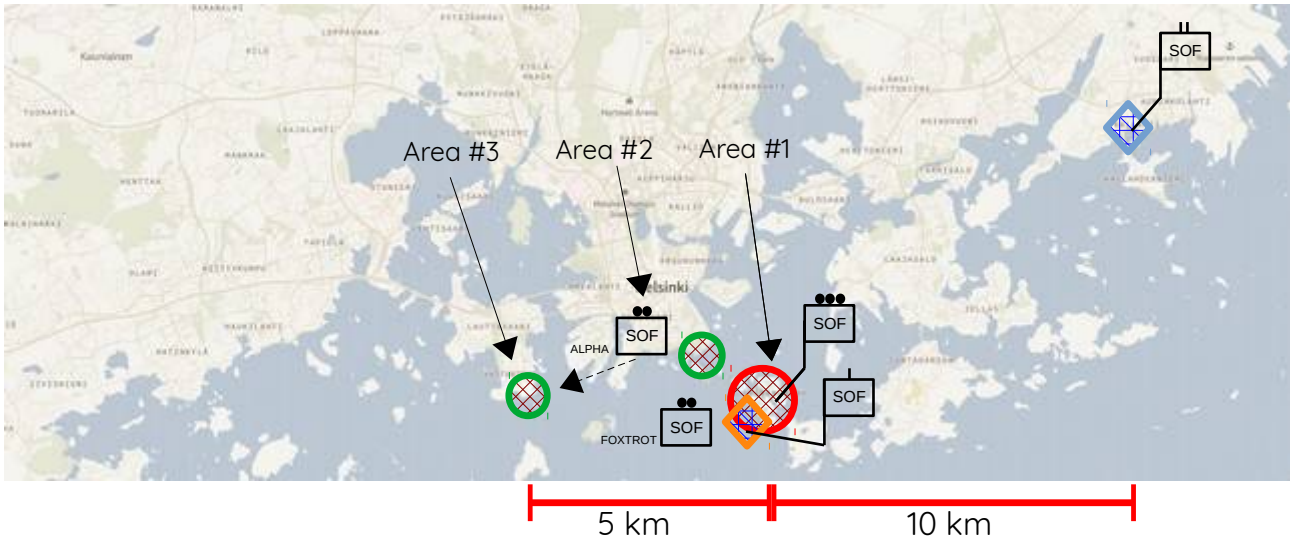


4. SOF Special Mission – Operational Scenario

To demonstrate practical deployment, a Special Mission was conducted using the DR platform. Most notably,

- The operation relied on secure real time communication from the Special Mission areas 1-3 to the Battalion HQ;
- This exercise was conducted without any support from the host country telecommunication networks, and
- The Mission took place “under the radar” from any third party network interception.

As noted in the map below, the Battalion HQ was located in the ‘Cirrus’ building and operational troops included a static Company HQ and a Platoon leader with two separate SOF teams.



SOF TEAM Alpha	• MESH connected PriveTAK communication terminal • Concealed FullHD video camera equipment • Primary 4W node with 3 dBi OMNI antennas
Platoon leader and SOF team Foxtrot	• MESH connected PriveTAK communication terminal • Concealed FullHD video camera equipment • Support 4W node + 3 dBi OMNI vehicle antenna • Data Rain tactical server
Company HQ	• 8W Support Coverage Node with 3.5 dBI OMNI antennas • 4 W Support Coverage MESH node with 3 dBi OMNI antennas
Battalion HQ	• 8 W Support Coverage Node with 3.5 dBI OMNI antennas • HQ site with secure communication, video receiving and recording

4.1 Equipment Deployment

This section covers the equipment deployment in detail for the Mission.

4.1.1 Battalion HQ

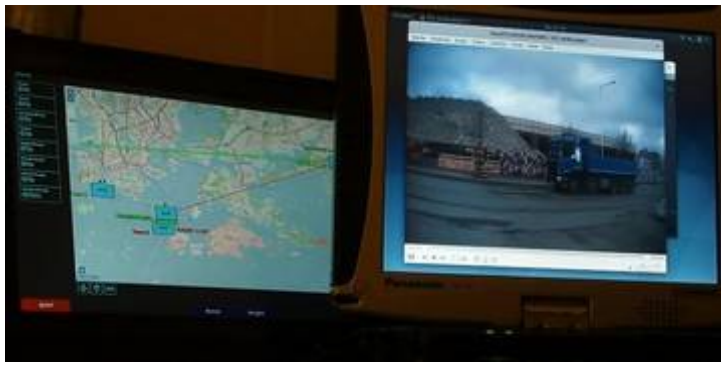
Battalion HQ was located in the Cirrus building, some 11km from Company HQ. One MESH node (8W) was rapid mounted to a helicopter pad (86 m from the sea level) on top of the Cirrus building. This MESH node created **a backbone beam between Battalion HQ and Company HQ**. The radio was faced towards the Company HQ and Special Mission area #1 with an unobstructed line of sight (LOS) condition and a 11 km range. Two 4W MESH nodes were located at Battalion HQ to create low beam coverage to Battalion HQ. Communication devices used in Battalion HQ were 2pcs of PriveBook laptops and Push-To-Talk (PTT) devices which carried encrypted communication and situational awareness services (location sharing, map data, calls, PTT, instant messaging, file transfer and video streams) for mission command and control. Battalion HQ was also equipped with LTE-router and Cipher Box to create encrypted tunnel with XXLSEC Office over public cellular network.

Real time map and location information monitoring at Battalion HQ

MESH node at Cirrus building roof top.

Photo from Battalion HQ roof top. Red circle highlighting the Company HQ location

Used equipments to establish an encrypted tunnel over LTE network from Battalion HQ to XXLSEC office



Real time situational awareness with MIL-STD-2525 icons and video stream received in Battalion HQ from SOF teams.

4.1.2 Company HQ and Platoon leader location

The Company HQ and Platoon leader operated at Special Mission area #1, in the island of Suomenlinna, which is a densely built fortress of stone houses with multiple blind areas with no direct line of sight. This fortress demonstrates very well the possibility of using high frequency devices in a difficult built (urban) environment in no line of sight situations.

The Suomenlinna area were covered by two MESH nodes (8 W and 4 W). This created full coverage to the SOF team Foxtrot operating at Special Mission area #1 and connectivity with the SOF team Alpha. Company HQ was equipped with Privebook laptop and Pust-To-Talk devices for all communications. Platoon leader was equipped with Tactical Server, Pust-To-Talk and 4W MESH node.

8 W MESH node at Company HQ facing towards Battalion HQ.

Platoon leader 4 W MESH node and Tactical Server at Special Mission area #1

4.1.3 SOF team Alpha

A tactical team was equipped with a PriveTAK handheld communication security terminal, body worn HD-video camera and a portable 4Watt MESH node. Team was a mobile unit, operating dismounted and/or with a vehicle as needed.

PriveTAK handheld terminal and 4Watt MESH node

Body worn HD-camera

4.1.4 SOF team Foxtrot

Tactical SOF team Foxtrot was a mobile team equipped with a PriveTAK communication security terminal and a 4 W MESH node. Team Forxtrot was operating in the Special Mission area #1 in the Suomenlinna fortress.

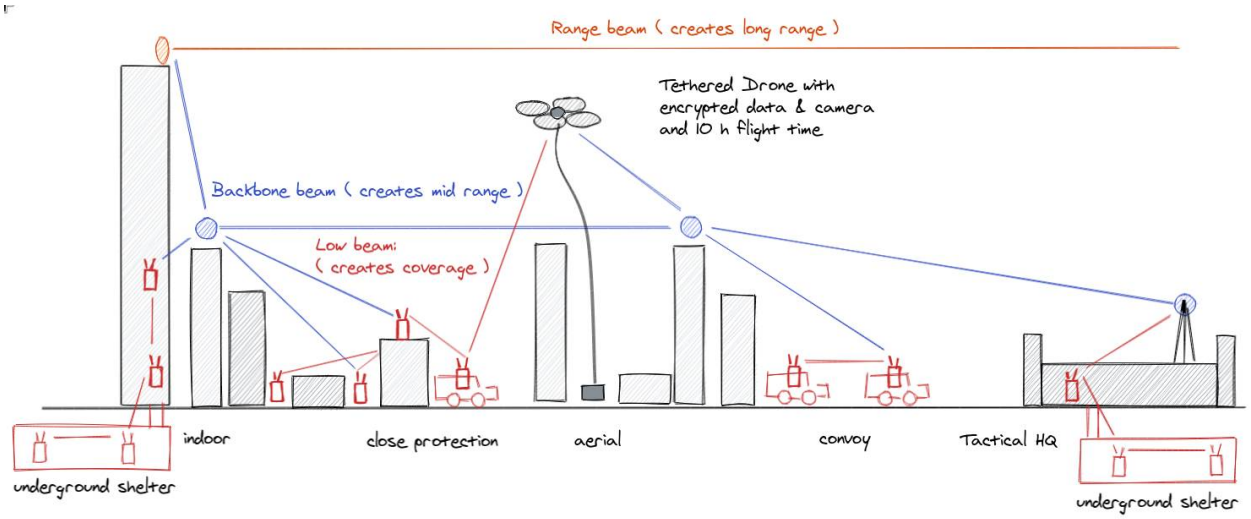
PriveTAK handheld terminal with 4W MESH node

Helmet mounted HD camera

4.2 Operational Coverage

When tactical considerations define operating places, and a secure platform provides the means to communicate – the final remaining thing is to design the appropriate operational coverage.

Planning a radio network "on the fly" is a demanding challenge. However a MESH radio node takes this burden off from an operator. Creating the required tactical presence using the MESH network for the discussed operating scenario is illustrated below.



MESH node technology creates a totally independent and movable network delivering the relevant user payload in full – be it voice, messaging or high definition video streams.

We divide the network coverage into 'beams', which cover the different functions for an operational area as follows:

Range beam	Long range links to jump between geographical areas	20 to 70 km typical
Backbone beam	Extends backbone access to tactical HQ	5 to 15 km typical
Low Beam	Tactical coverage area between user groups, typically urban or in built environments	100m to 2 km typical

NOTE: distances and performance are driven by the used frequency and output power combined with the chosen antenna technology

Attachment 1 introduces the network specifications adapted in the Data Rain communication platform

5. Data Rain Platform Capability - Observations and Test Results

As noted before the purpose of the conducted Special Mission and the tests was to demonstrate superior operation command capabilities and performance of the DR platform against the following two requirements:

1. **Providing shared situational awareness for all operating entities by the use of a fully secured and encrypted communication, command and control platform under all operational scenarios.**

2. **Securing highly reliable and resilient short to medium range connection and reliable coverage all the way from the SOF Team to the Battalion HQ**

The attached results confirm that the stated performance objectives and targets were achieved.

Observations and Considerations

- The tests were completed using 2,4GHz frequency (publicly free to use). With lower frequencies the ranges are naturally higher. However lower frequency may not represent the optimum for data transmission purposes.
- Signal strength affects transmission speed in the MESH network. The required payload transmission speed needs to be adjusted accordingly. In the given example, even 11 km back bone beam (link 1) between two 8 W nodes gave 10Mbit/s throughput, being more than sufficient for the Mission purposes.
- In the test scenario every SOF team operator was able to stream live video, and all SOF team members were able to use encrypted Push-To-Talk and messaging communication with situational awareness and location sharing.

The illustrative SOF mission was conducted on a rainy day, temperature around +3 celcius.

Detailed commentary on the test results for the completed Special Mission is given on the following pages.

5.1 Special Mission 1

“Create superior command and communication capability from areas #1 and #2“

Link	Type	Between	Transmission power (antenna dBi)	Range	Signal strength
Link 1	Medium range “Backbone beam”	Battalion HQ ↔ Company HQ	8 W (3.5 dBi) ↔ 8 W (3.5 dBi)	11 km	9 dB (avg)
Link 2	Short / medium range “Low Beam”	Company HQ ↔ Platoon leader ↔ SOF team Bravo	8 W (3.5 dBi) ↔ 4 W (3 dBi)	2 km	9 – 41 dB

Network node locations and data links created for the Mission 1

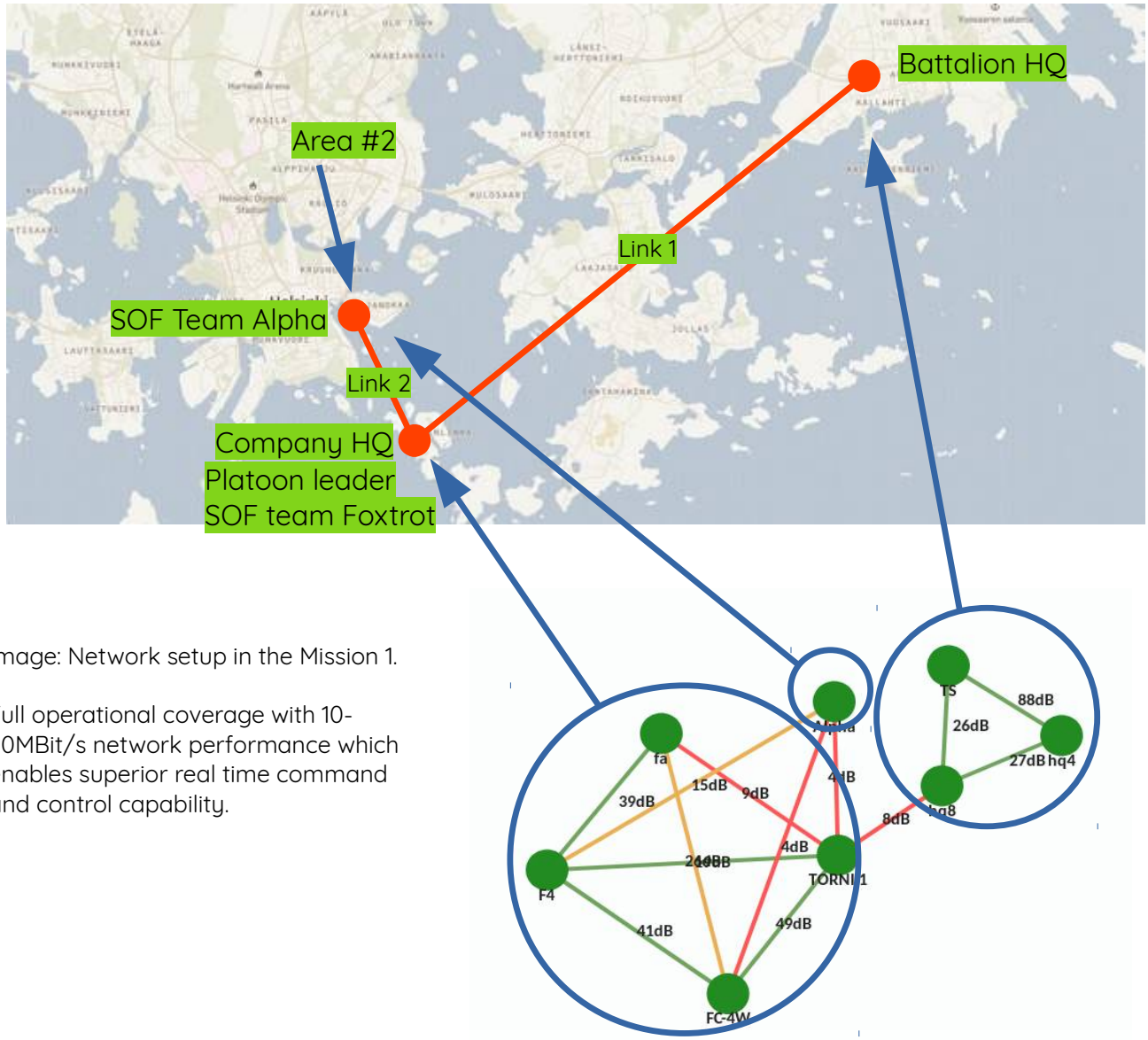


Image: Network setup in the Mission 1.

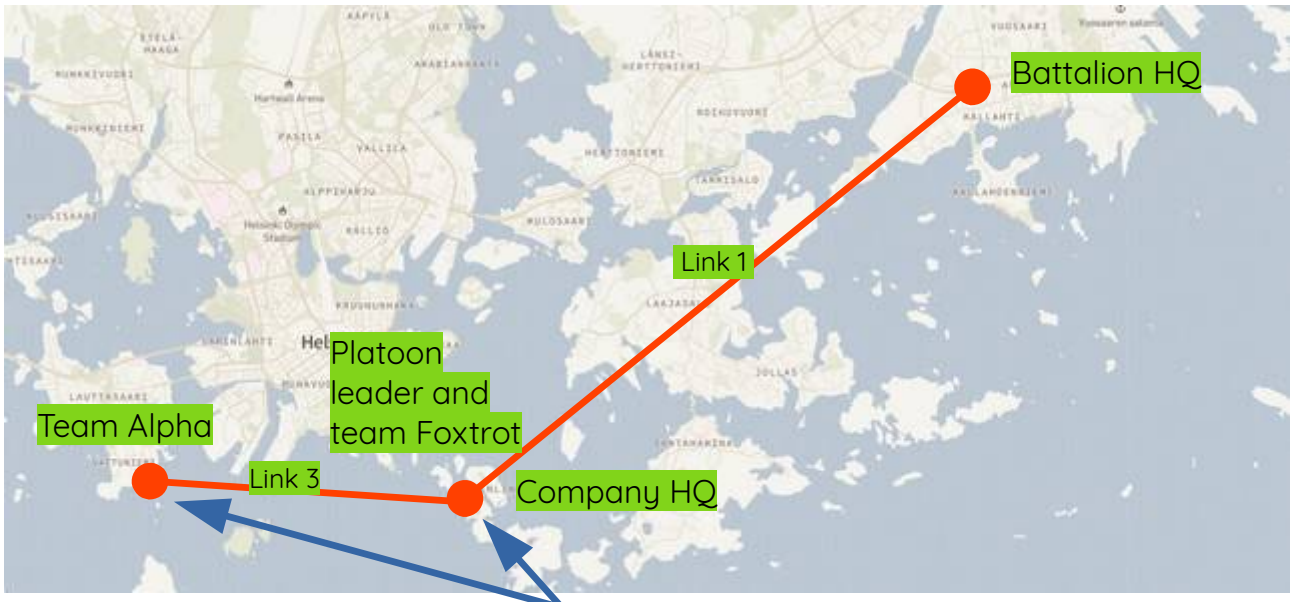
Full operational coverage with 10-50MBit/s network performance which enables superior real time command and control capability.

5.2 Special Mission 2

"Create superior command and communication capability from areas #1 and #3"

Link	Type	Between	Transmission power (antenna dBi)	Range	Signal strength
Link 1	Medium Range "Backbone beam"	HQ ↔ SUPPORT	8 W (3.5 dBi) ↔ 8 W (3.5 dBi)	11 km	9 dB (avg)
Link 3	Medium Range	SUPPORT ↔ TEAM 2	8 W (3.5 dBi) ↔ 4 W (3 dBi)	5 km	11 dB (to 4 W radio) 37 dB (to 8 W radio)

Network node locations and data links created for the Mission 2



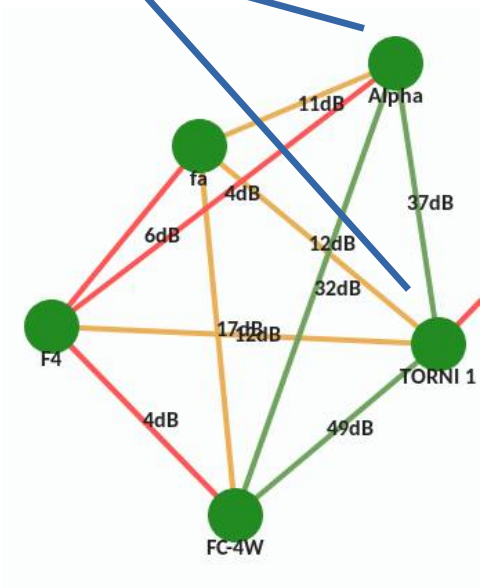


Image: Network setup in the Mission 2.

Result:
Full operational coverage with 10-20MBit/s network performance which enables superior real time command and control capability.
Total operational coverage 16km

6. Conclusions for Special Mission

The DR platform deployment for the Special Mission was highly successful and demonstrated the superior capabilities in action.

More detailed test result are introduced in Attachment 2.

Operational benefits

- **Real time shared situational awareness (location & video) shared over DRS to all operational units.** This superior command capability creates faster and more reliable overall situational understanding to all HQs and command elements than command and control systems where situational awareness is based on information collected only manually at the Battalion HQ. This feature enables the operative organisation be one step ahead against any hostile troops in the battlespace.
- **Fast deployment:** All command elements are ready in 15-30 minutes after arriving to the operation area. Mobile units were in operation in 2-3 minutes – demonstrating the fast the build-up time for the command and control capability.
- **Significant improvement in line-of-sight** (LOS) range compared to cell networks and single antenna radio systems.
- **Superior reliability in non-line-of-sight** (NLOS) environments and multipath-rich locations typical of urban operational areas compared to cell networks.
- **Unique encrypted Push-To-Talk capability** compared to any other cell network or RF network system. This enables truly end-to-end encrypted group voice communication.
- **Higher throughput rates** than in cell networks and single antenna radio networks.
- **Constant network planning and re-organisation** enables all users to monitor and react in advance for possible “network coverage lost” situations.
- **Encrypted command, control and communication applications** and MANET network with **zero meta data and network footprints**. Superior **counter intelligence protection** for all command and control operations. No eavesdropping or denial of service attacks are possible against the DR command and control solution.
- DR creates C4ISR situational awareness and battle management capability with **global coverage, superior resilience and full independency**.
- DR platform enables intelligence information and sensor gathering within the same platfrom. This makes DR flexible and easy to extend with mobile and static info gathering sensors (like signal intelligence, imaging, thermal and environmental sensors). The DR platfrom creates full cyber protection for own

command and control capacity and **enables offensive stealth mode intelligence information gathering**.

End of document

Attachment 1: Data Rain communication platform specifications
Attachment 2: Test results summary

Further test documentation available if requested:

1) RHIB boat range test results

2) Helsinki SOF mission detailed test results

3) Aircraft extra long range test results