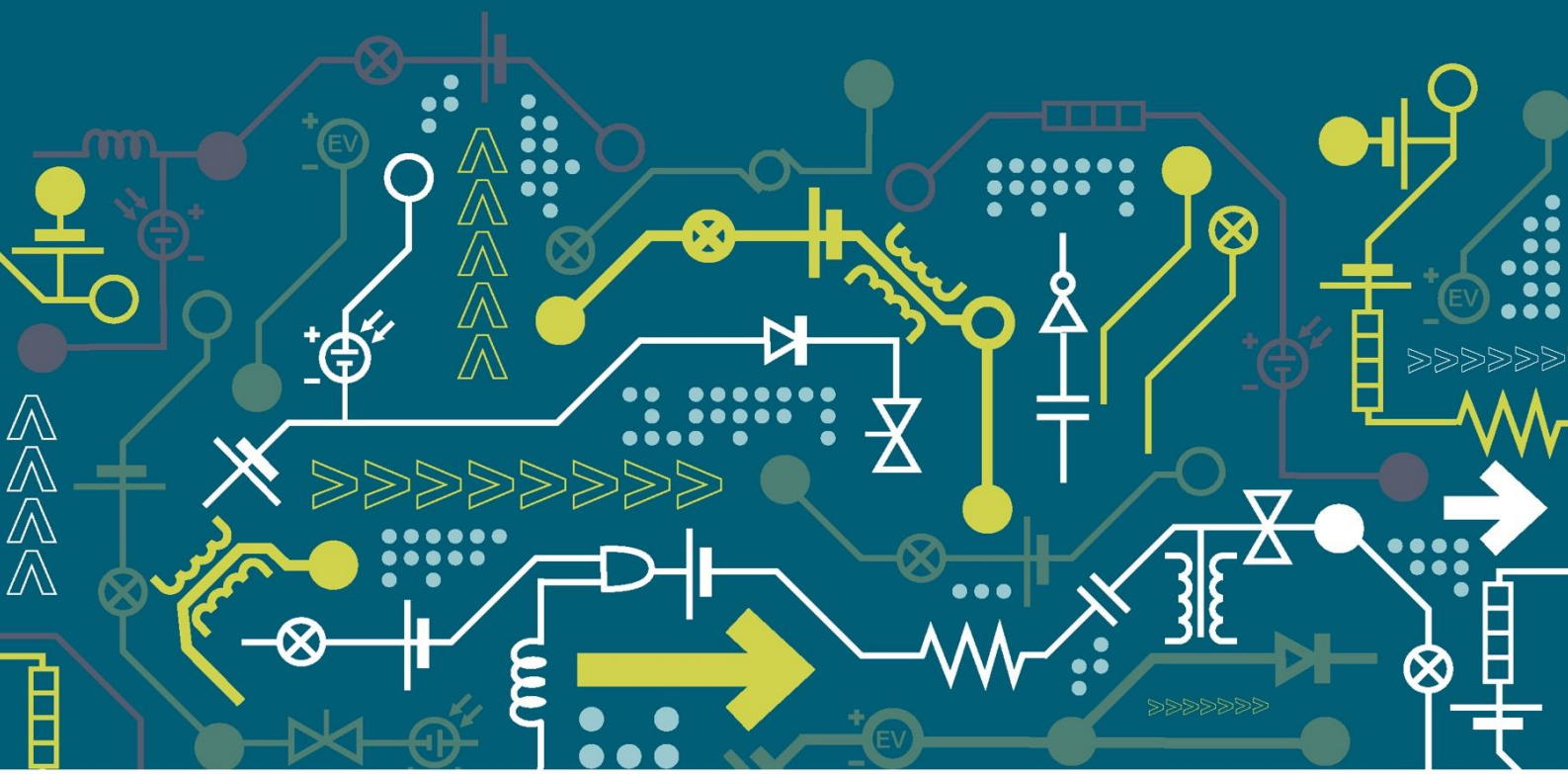
WPD INNOVATION

# LTE Connecting Futures Project

WPD_NIA_050

NIA Major Progress 6 Monthly Report

Reporting Period: January – March 2020



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# Contents

# 1 Executive Summary

The Long Term Evolution (LTE) Connecting Futures Project, funded through Ofgem's Network Innovation Allowance (NIA), started on 2nd Jan 2020 and will be completed by the 31st of December 2020.

A key feature of this project will be to create a multi-base-station, multi-vendor network test-bed to validate assumptions from previous work, trial the operational telecommunications component necessary to monitor and control future critical energy infrastructure and provide practical support to the work of Ofcom and others in investigating the future radio spectrum needs of UK Energy Utilities.

The success criteria include:

- Confirmed propagation predictions and performance in a multi-site environment;
- Confirmed seamless interoperability of multi-vendor Customer Premises Equipment (CPE) and Evolved Packet Core (EPC) equipment;
- Security & authentication successfully tested on LTE ecosystem;
- Testing of mobile and handheld device connectivity including Wireless Fidelity (Wi-Fi);
- Confirmation that LTE will support low-latency applications such as tele-protection;
- Document(s) outlining installation practises, test regimes and training requirements for LTE.

The radio network in this project will operate in the 400MHz Ultra High Frequency (UHF) frequency range, the same band as is used today for Supervisory Control and Data Acquisition (SCADA) telemetry. This spectrum band, commonly termed the 'Sweet-Spot' for critical telecommunications, combines the capability to provide good coverage and capacity with a reasonable data payload and compact antennas. There is however uncertainty in the United Kingdom (UK) regarding the availability of 400MHz spectrum thus the results from this project will be used to support discussions with government and the regulator Ofcom. Given the competing demands for 400MHz, the 700MHz band is a slightly less ideal but viable alternative but the results of this project will be applicable with modification to that band also. In this context the Western Power Distribution (WPD) Wireless Communications Seminar, scheduled for 18th March in Taunton, has been postponed due to Coronavirus Disease 2019 (COVID19). This event will be rescheduled in due course.

The trial is being supported by the Joint Radio Company (JRC) who are providing project management and technical support, and Nokia who are providing LTE systems and engineering, integration and management services using their extensive experience with more than 150 utilities globally.

The project budget is £1,035,614.80 of which £932,053 has come from the Network Innovation Allowance (NIA) funding.

The original project plan comprises of four phases, including laboratory work and field work, split into a number of work packages over a 12 month period. However, as a result of the COVID-19 outbreak, most activity was suspended in the third week of March. It is not clear at the moment when normal service will fully resume. It is now expected that the project and associated expenditure will run into 2021.

This report details progress of the project, focusing on the period, from initial registration at the end of December 2019 to the end of March 2020.

## 1.1 Business Case

In our (Revenue, Incentives, Innovation, Outputs: Electricity Distribution) RIIO: ED1 business plan, we made a commitment to improve visibility of the network. Greater awareness of the characteristics of network flows in local distribution networks and more active management as well as interconnectivity is required as network supply and demand characteristics become more flexible by more dynamically adding and removing power or time shifting energy demand customers. By better understanding the latest developments in LTE data communications systems and the ability to support a greater range of Internet Protocol (IP)-based applications, informed decisions can be made regarding how these will interact with, or replace, legacy communications systems within the UK's power distribution networks.

Electricity distribution methods have changed significantly in the last ten years or so, and the need for fundamental change across electricity systems globally is of paramount importance. As the WPD system evolves, especially with the deployment of Active Network Management (ANM) schemes and the impact of intermittent generation, there will be a need for enhanced real time monitoring and control to facilitate and support real time asset monitoring. The importance of real time monitoring cannot be overestimated.

The benefits include:

- Greater awareness of the characteristics of network flows;
- More active management to reduce instability as renewable energy sources reduce network inertia;
- Enables flexibility services by more dynamically adding and removing power or time shifting energy demand;
- Allows the power flow from distributed generation to be more actively managed resulting in curtailment provisions being minimised to enhance value creation and avoid reinforcement costs and disruption;
- Enhanced switchgear control capability aligned to greater visibility of customers being off supply will facilitate quicker re-energisation of customers avoiding engineer visit delays;
- Disturbance monitoring to highlight any unusual activity or abnormalities on the network to investigate the cause; and
- Faster restoration of supplies after an incident.

This project will therefore look to highlight a range of issues that are likely to impact the scope and scale of the future LTE environment. These will include the following:

- Advances in telecoms software and hardware have made the possibility of a fully intelligent power/energy delivery value chain realisable both operationally and economically.
- Today's power distribution network remote control and management functions are currently broadly limited to the extra high voltage (EHV) and high-voltage (HV) networks. If Smart Grids are to offer maximum environmental and energy efficiencies, communications solutions will need to extend these capabilities throughout the medium voltage (MV) and low voltage (LV) networks, including ultimately providing interactive connectivity with each and every customer. In addition, the smart telecoms solutions must provide maximum operational flexibility to thereby support the longer-term objectives of power distribution systems.
- The LTE networks must support a range of differing applications needs regarding, amongst others, Quality of Service (QoS), latency and redundancy.

## 1.2 Project Progress

This is the first progress report. It covers progress from initial registration at the end of December 2019 to the end of March 2020.

The construction and configuration of the Radio Access Network (RAN), EPC and CPE lab build has been mostly completed. Initial testing of the CPE technical parameters of the Encore CPE's has been completed. The Group Communications server for field mobile voice has been provisionally completed and basic voice and video calls have been successfully carried out in the lab environment.

The Bowdens Hill eNode has been installed and is operational, Priorswood is partly installed and Elworthy Barrows is yet to be started. Both of these sites are impacted by access restrictions and hence their installation has been delayed. The backhaul link between Priorswood and Elworthy Barrows has been partly installed. Priorswood is complete but dependant on completion of works at Elworthy Barrows, which has been delayed due to Covid19.

All existing project documentation is currently being consolidated into both the high level and low level design templates minimise ambiguity and duplication.

## 1.3 Project Delivery Structure

### 1.3.1 Project Review Group

The LTE Connecting Futures Project Review Group is set to meet on a quarterly basis. The role of the Project Review Group is to:

- Ensure the project is aligned with organisational strategy;
- Ensure the project makes good use of assets;
- Assist with resolving strategic level issues and risks;
- Approve or reject changes to the project with a high impact on timelines and budget;
- Assess project progress and report on project to senior management and higher authorities;
- Provide advice and guidance on business issues facing the project;
- Use influence and authority to assist the project in achieving its outcomes;
- Review and approve final project deliverables; and
- Perform reviews at agreed stage boundaries.

### 1.3.2 Project Resource

Table 1: Project resource

| Project Partner | Resource | Detail |
|---|---|---|
| Western Power Distribution | Faithful Chanda | Project Manager, WPD |
| | Steve Pike | WPD Infrastructure Manager |
| Joint Radio Company | Bob Tyler | Project Manager |
| | Andrew Barker | Radio Engineer |
| Nokia | Margarida Garimpo | Project Manager |
| | Neil Goolding, Liana Ault, Gabo Balizs | Nokia Technical Lead Engineers |
| Nokia | Andy Cameron, Dave Sargent, Tatiana Pavlov, Simon Hodgson | Nokia Supporting Team |

## 1.4 Procurement

Table 2: Procurement

| Provider | Services/goods | Area of project applicable to | Anticipated delivery dates |
|---|---|---|---|
| IOActive | Security Assessment | Security Assessment of LTE Network Security | April 2020 (Report) |
| JRC | Project Management & Technical Support | All | Jan 2020 – Dec 2020 |
| Amphenol Procom | eNodeB Sector Antennas | Field installation | March 2020 – April 2020 |
| Powertec South West Ltd | DC Installation for Priorswood eNodeB | Field Installation | Feb 2020 – March 2020 |
| GCA Ltd | eNodeB - Fibre, Power and cabling | Field Installation | March 2020 – April 2020 |
| Beacon Communications | eNodeB & Microwave Installation | Field Installation | March 2020 – April 2020 |
| Applied System Engineering Inc. | SCADA Protocol Simulator Test Sets | Lab Installation and commissioning | Jan 2020 - March 2020 |
| Sematron UK Ltd | RF Test Components | Lab Installation and commissioning | Jan 2020 - March 2020 |
| UK Grid Solutions Ltd | Tele-Protection Relays | Lab Installation and commissioning | April 2020 – July 2020 |
| NEC | Backhaul Infrastructure | Field Installation | March 2020 – April 2020 |
| RS Components Ltd | Cabling, connectors. DC Installation for Priorswood enB | Lab Installation | Jan 2020 – March 2020 |

## 1.5 Project Risks

A proactive role in ensuring effective risk management for LTE Connecting Futures is taken. This ensures that processes have been put in place to review whether risks still exist, whether new risks have arisen, whether the likelihood and impact of risks have changed, reporting of significant changes that will affect risk priorities and deliver assurance of the effectiveness of control.

Contained within Section **Error! Reference source not found.** of this report are the current top risks associated with successfully delivering LTE Connecting Futures as captured in our Risk Register. Section 0 provides an update on the most prominent risks identified at the project bid phase.

## 1.6 Project Learning and Dissemination

Project lessons learned and what worked well are captured throughout the project lifecycle. These are captured through a series of on-going reviews with stakeholders and project team members, and will be shared in lessons learned workshops at the end of the project.

The WPD Wireless Communications Seminar, scheduled for 18th March in Taunton, was postponed due to COVID19.  This event will be rescheduled in due course.

# 2 Project Manager's Report

## 2.1 Project Background

This project will be the UK's first multi-site, multi-vendor LTE trial designed to mimic on a small scale, and develop proposals for, the roll-out of a telecommunications network to support Active Management and later full Smart Grid functionality. This is an important follow up to the a single vendor; single base station LTE evaluation trial at Portishead which provided data on the fundamental design and capabilities of LTE and illustrated how such a communications network might be integrated into WPD infrastructure. This showed that an LTE network is better equipped than a traditional narrow-band SCADA network to deliver the required data throughput in the harsh environment [e.g. electrically noisy sites, Radio Frequency (RF) interference, multipath etc.] to be found in the context of an energy network.

The recent NIA funded 'Next Generation Wireless Telecoms' analysis was carried out jointly with JRC and established a provisional model of the radio network planning methodology and technical infrastructure for an LTE radio network deployment across single or multiple DNO area(s). This project is important as a traditional narrow-band SCADA system will not be able to support the number of connections and services required in future. It is therefore essential to plan to deploy a more advanced technology and this project is an important step in reducing the risks associated with achieving the predicted coverage and throughput in any subsequent full-scale rollout with the required availability and resilience.

This project will utilise an LTE network to provide connectivity to a range of energy network assets. Working with suppliers and project partners, three LTE base stations will be installed in adjacent locations and connected back to a central Evolved Packet Core (EPC). This installation represents the minimal building blocks required to construct a basic LTE network and provides the ability to evaluate the inherent characteristics of LTE.
The trial LTE system will cover a service area of up to 25km radius from the central base station located in Taunton. This service area also includes the other two LTE base stations and represents a typical service area that would be expected of conventional narrow band radio networks. CPEs will be installed at strategic locations within this service area and will be determined by a number of factors; such as radio coverage parameters, the access to those locations and the suitability of the Primary and Distribution substations selected. The trial will evaluate the noise characteristics of the site locations and the impact of Inter and Intra base station interference on the CPEs.

The EPC is central to the operation and maintenance of the LTE network and is constructed from a number of key components, each responsible for a specific core element. All base stations connect to the EPC and this has significant risks to the resilience of the LTE network. Therefore the EPC is distributed around the network to mitigate this risk. The trial will assess various vendor EPC's to establish their resilience capability and their operational scopes.

LTE provides the transport medium for data and voice services such as SCADA, mobile data, mobile voice, fixed voice and Closed Circuit Television (CCTV) etc. This trial will assess the capability of LTE to connect these services to the WPD network and will evaluate the impact on both the LTE network as well as those services being carried.

The proposed project runs for twelve months including laboratory work and field work, split into four phases with each having a number of work packages.

Seven milestones are tabled below:

Table 3: Outline Project Plan

| Key Milestones | Type | Description | Start Date | Completion Date |
|---|---|---|---|---|
| Milestone 1 | Document | Project Approval / Eligibility | Nov 2019 | Dec 2019 |
| Milestone 2 | Document | Project Start | Jan 2020 | December 2020 |
| Milestone 3 | Document (Test Plan – Delivery Acceptance Testing) | Lab Installation and commissioning - Lab procurement, delivery, installation, commissioning of Nokia equipment. | Dec 2019 | Feb 2020 |
| Milestone 4 | Document (Network communications Encryption requirements) | Lab Testing - Testing Nokia Equipment | Jan 2020 | Oct 2020 |
| Milestone 5 | Document (Fixed communications requirements) | Field Installation and commissioning - Field installation, connectivity, testing of SCADA (RTU); voice for mobile and fixed applications; Tele-protection; CCTV. | Mar 2020 | Apr 2020 |
| Milestone 6 | Document (Mobile field force Communications Requirements) | Field Testing - Multi-vendor testing and interoperability, Multi-antenna testing and interoperability. | Mar 2020 | Oct 2020 |
| Milestone 7 | Report | Reporting- Closedown report and dissemination | Nov 2020 | Dec 2020 |

### 2.1.1 Scale of the project

A full scale LTE network consists of many, many base stations and a number of EPCs. A base station consists of a number of sector antennas which cumulatively contributes to a 360 degree service area surrounding the site, typically between three and six sectors per base station. Each sector represents a cell attached to the base station and CPEs will connect to a particular cell on a particular base station, depending on radio characteristics.

The trial will consist of the minimum number of three base stations and sectors (cells) needed to fulfil a basic LTE network which will allow for an evaluation of the system characteristics. Therefore it is intended to install a three sector (cell) base station at Taunton and two single sector (cell) base stations at Elworthy Burrows and Bowdens Hill. The single sector (cell) base stations will face towards the Taunton base station to represent a typical LTE configuration. All three base stations will be connected back to the EPC which will be installed in Taunton.

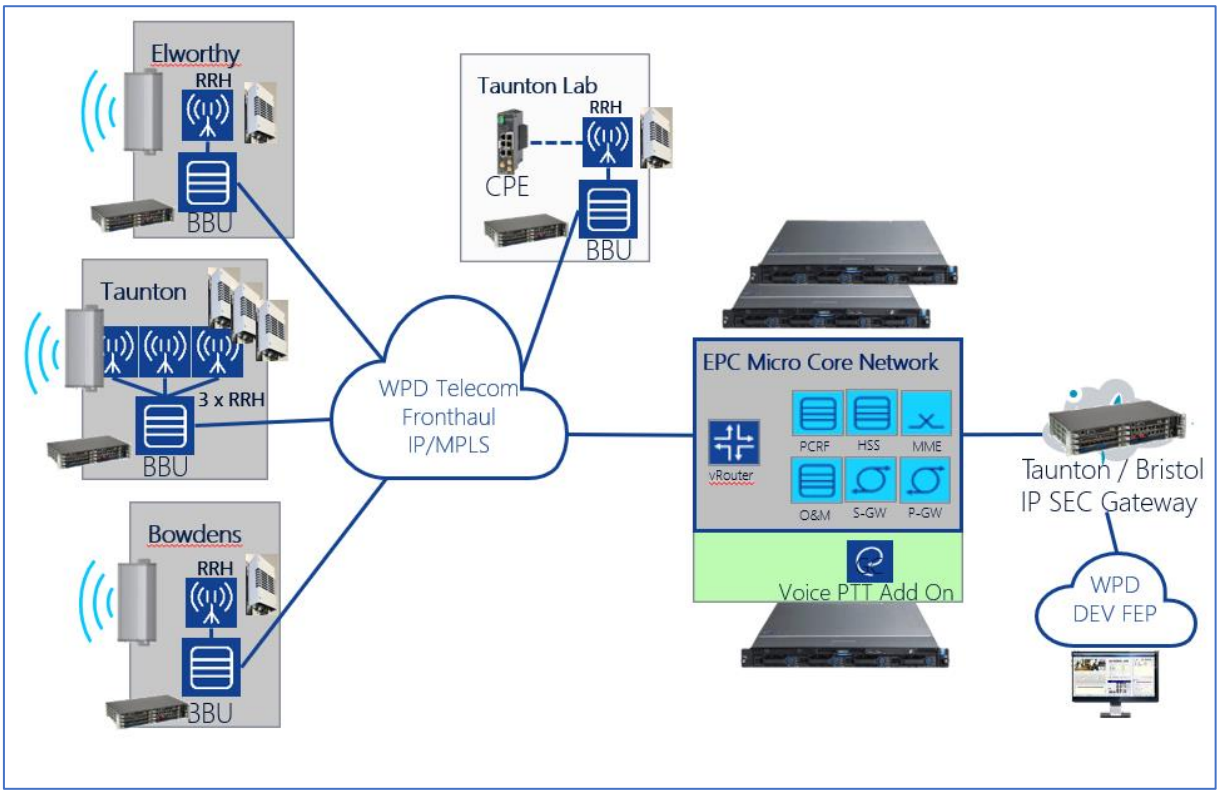



**Figure 1: Taunton LTE Architecture**

## 2.2 Project Progress

### 2.2.1 Work packages

Progress against each of the work packages is discussed below.

#### Work Package 1 - Project Management & Reporting

This work package has been progressing in accordance with the project plans and all relevant documentation updated accordingly. Though the project has been impacted by COVID-19, this has not prevented the project team from attending the project meetings, nor on updating project reports, risk register etc.

#### Work Package 2 - Lab Procurement Delivery & Installation

The test lab has mostly been completed and has successfully hosted the first work package test programme. Access to the lab is now restricted and as such no further testing can progress until restrictions are lifted.

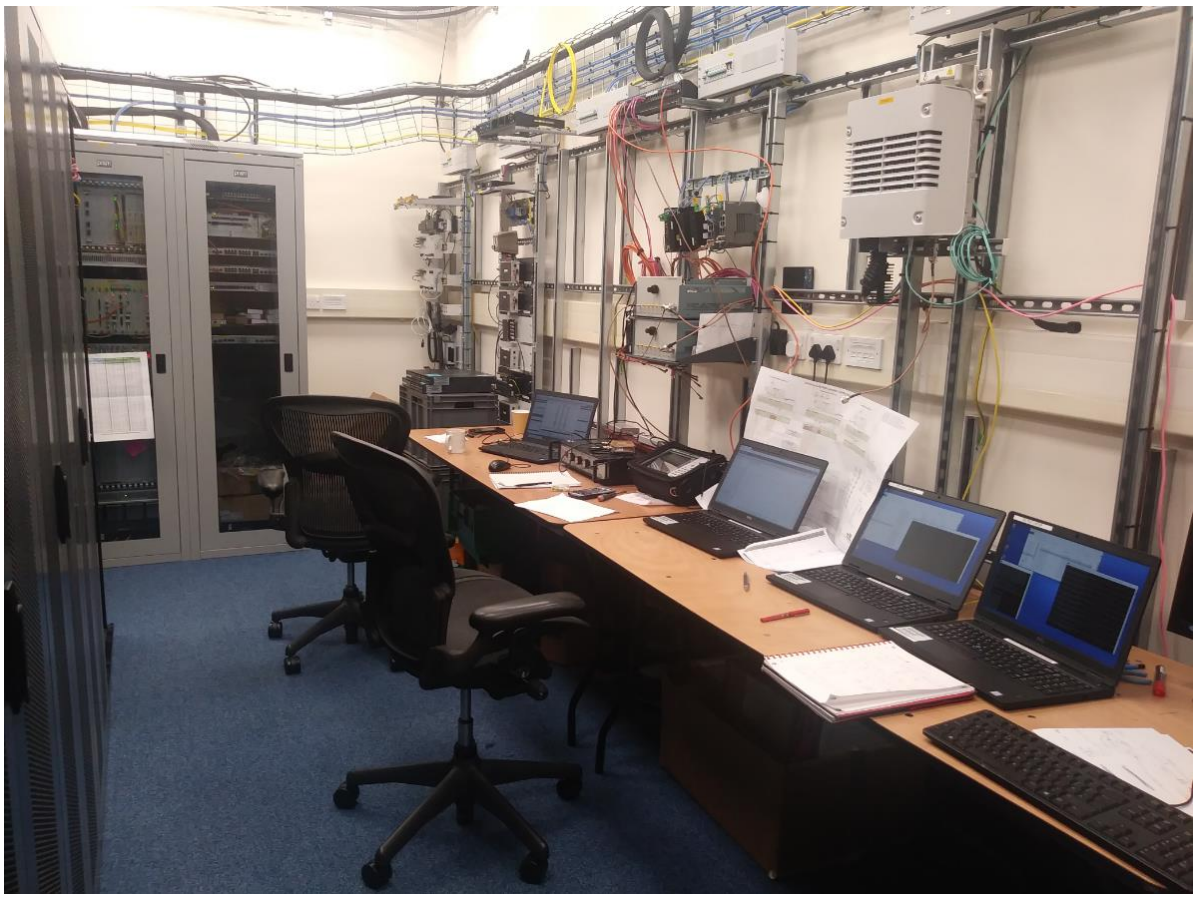


Figure 2: Taunton Lab Setup

## Work Package 3 - Lab Commissioning and Lab Training

Commissioning of the test lab is mostly completed. There are still a number of ‘diagnostic and test tools’ which need to be set-up for future work packages but this has been delayed due to access restrictions brought about by COVID-19.

Figure 3: Radio Unit in the Lab at Taunton

### Work Package 4 - Lab System & Security Testing

The final reports have been received and issued to both Nokia and Encore Networks respectively under strict document control. Both vendors will review the report's findings over the next few weeks and issue action plans accordingly.

### Work Package 5 - Lab Power-On Connectivity

This work package is dependent on successful implementation of the action plans resultant from the previous work package. An interim mitigation plan is to utilise simulator software to replicate the PowerOn Front End Processor (FEP), if possible.

### Work Package 6 - Lab Network Slicing

The EPC has been configured to allow for segregated data traffic however no testing has yet taken place.

### Work Package 7- Lab Procurement and Testing of Third-Party Equipment

Currently two vendor CPE equipment are installed in the test lab environment and a third company has expressed an interest in testing their products. Basic testing has taken place on one product and the second is currently being configured to allow for service access to allow for future tests to be carried out. There is currently no projected date as to when the third vendor equipment would be available.

### Work Package 8 - Field Commissioning and Testing

Bowdens Hill eNodeB has been installed and commissioned back to the EPC in Priorswood. Priorswood has only partly been completed and Elworthy Barrows not started. Both of these sites are impacted by the site and travel restrictions in place due to COVID-19 with no current end date scheduled. The backhaul link between Priorswood and Elworthy Barrows is only partly completed and is currently delayed due to site and travel restrictions in place as a consequence of COVID-19.

### Work Package 9 - Field SCADA RTU Installation and Connectivity

This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 10 - Field SCADA RTU Testing

This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 11- Mobile Voice Installation, Commissioning and Testing

The Group Communications server has been installed and configured in the test lab. Initial tests have been carried out between mobile to mobile and mobile to despatcher over the test lab RAN, via Wi-Fi enabled CPE devices. Successful voice and video calls were established between these devices. Further testing and ultimately field testing is due to be carried out later in the project.

### Work Package 12 - Fixed Voice Installation, Commissioning and Testing

The Group Communications server has been installed and configured in the test lab. There is still a fair amount of work needed to develop Session Initiation Protocol (SIPs) communications over the LTE RAN, including procurement of SIP's enabled devices for the fixed telephony infrastructure.

### Work Package 13 - Tele-Protection Installation, Commissioning and Testing

The tele-protection devices are due to be delivered in late April and further work on the EPC is required to allow for this service to be carried over LTE, including testing.

### Work Package 14 - CCTV Installation, Commissioning and Testing
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 15 - Automation Installation, Commissioning and Testing
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 16 - LV & Innovation Installation, Commissioning and Testing
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 17- Wi-Fi & Mobile Data Installation, Commissioning and Testing
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 18 - Multi-Vendor Testing and Inter-operability
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 19 - Multi-Antenna Testing and Inter-operability
This work package has not yet started and is likely to be delayed due to COVID-19.

### Work Package 20 - Training and Test Equipment
This work package has not yet started and is likely to be delayed due to COVID-19.

## 2.2.2 Other Installations


**Figure 4: Deployment of test CPEs in the lab at Taunton**

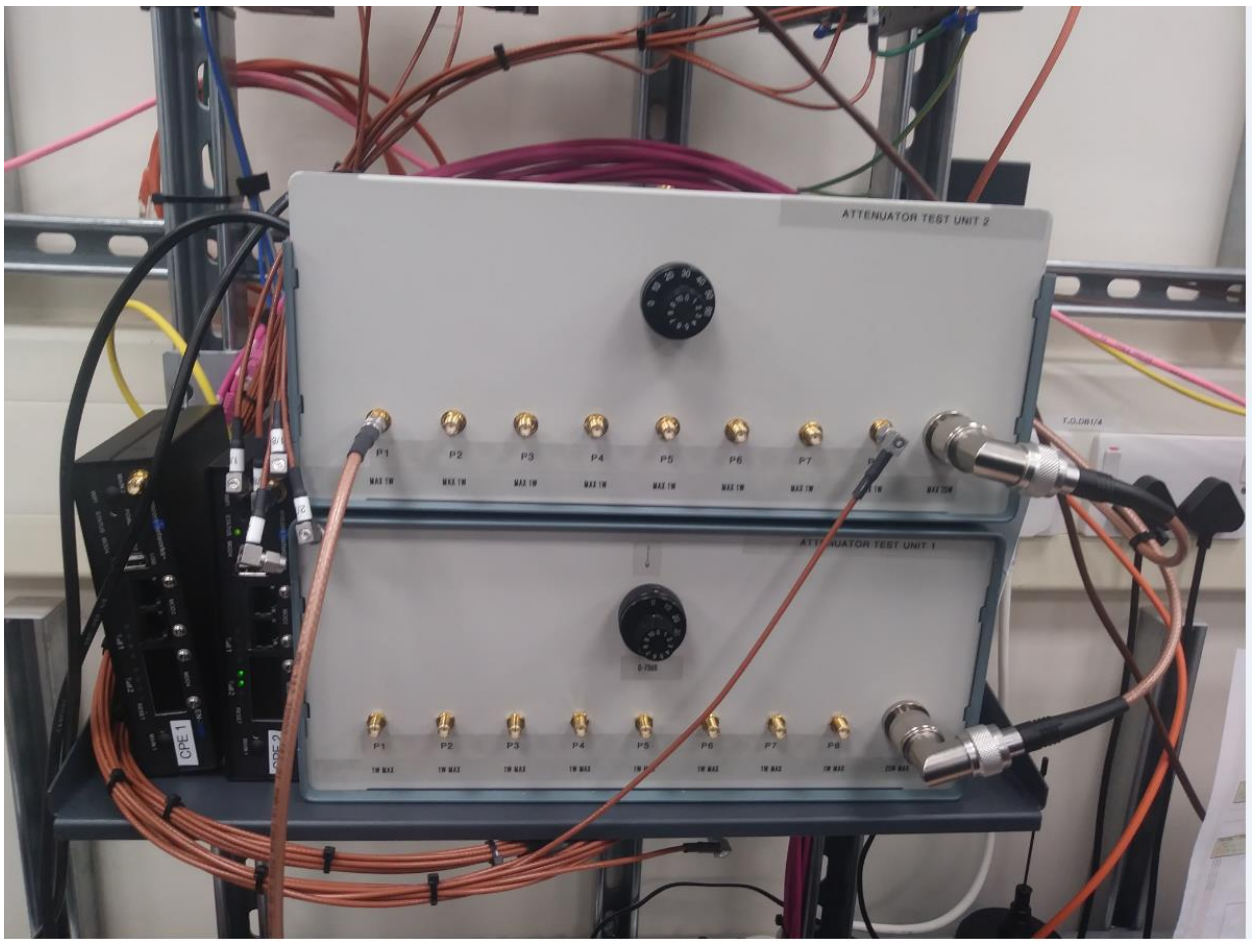



**Figure 5: Deployment of attenuators in the lab at Taunton**

### 2.2.3 Next Steps

**Table 4: Next steps**

| Description | Due Date | Revised Due Date | Progress | Output in KOM Y/N? |
|---|---|---|---|---|
| WP8c – Nokia Field Installation | 28 Mar 2020 | Reschedule to a new date once the situation becomes clear | Suspended following guidelines on entry to WPD depots/sites | No |
| WP7b - Lab Testing – 3rd Party equipment [CPE] | 20 Apr 2020 | Reschedule to a new date once the situation becomes clear | Suspended following guidelines on entry to WPD depots/sites | No |
| WP9a - Field Commissioning (Nokia Equipment) | 12 Apr 2020 | Reschedule to a new date once the situation becomes clear | Suspended following guidelines on entry to WPD depots/sites | No |

# 3 Progress against Budget

**Table 5: Progress against budget**

| Spend Area | Budget (£) | Expected Spend to Date (£) | Actual Spend to Date (£k | Variance to Expected (£) | Variance to expected (%) |
|---|---|---|---|---|---|
| WPD Internal Costs | £111.498 | £39,308 | £57,944 | £18,636 | 47 |
| Contractors | £800,000 | £445,000 | £182,171 | -£262,829 | -59 |
| TOTAL | **£911,498** | **£484,308** | **£240,115** | **-£244,193** | **-50** |

The LTE - Contractors costs included a significant spend allocated to Nokia as the principle vendor for the first half of the project. However one of the key issues in setting up a contract with them was that their procurement rules stipulated that WPD were not allowed to engage directly with them, but through supply partner (Nuvias). The agreement between WPD and Nuvias as advised by Nokia was for a staged payment based on the hardware delivery and separate 'services' payments determined by meeting key delivery of the project. Thus the spend to date has only been for the hardware delivery.

There has also been less than anticipated spend on the test lab work, mainly attributed to the fact that Encore Networks, one of the other vendors, have contributed to the project at no cost to WPD, however it must be noted that this may change and costs could be incurred in the second half. There is also currently no additional vendors involved in the project at this stage, though there have been numerous engagements with suppliers and chipset manufacturers of communications equipment. It is anticipated that at least one vendor will be able to supply equipment towards the project in the next few months. Part of the issue has been the suspension due to COVID-19, of the LTE Seminar where these vendors were due to meet with the project team to demonstrate some of their products.

# 4 Progress towards Success Criteria

**Table 6: Progress towards Success Criteria**

| Expected success | How this is being achieved |
|---|---|
| Confirmed propagation predictions and performance in a multi-site environment | Filed surveys will be carried out on completion of the RAN infrastructure. The data collected will be used to compare with, and 'tweak', the modelling data which was completed during a previous project. |
| Confirmed seamless interoperability of multi-vendor CPE and EPC equipment; | We currently have two vendors CPE equipment undergoing configuration and upgrades. These will be tested for comparison against throughput metrics in differing 'cell' criteria. Additional vendors have been engaged and there are possible additional to the mix at a later date. An alternative EPC vendor has been engaged and it is anticipated that this will also be implemented at a later stage in the project. |
| Security & authentication successfully tested on LTE ecosystem | The firmware and software security testing has been completed and an interim report shared with the main vendors. The final report is due to be released and will be shared with the main vendors in the next week or two. Further software upgrades will be released in response to the report findings. |
| Testing of mobile and handheld device connectivity including Wi-Fi | Group Communications server has been installed in the lab and connectivity achieved for voice and video between two handsets connected via Wi-Fi over the LTE RAN. Further testing will be carried out both in the lab and in the field at a later stage in the project. |
| Confirmation that LTE will support low-latency applications such as tele-protection | The data channels are currently being configured for all the services being carried over LTE, including tele-protection. Protection relay devices are on order and will be connected in the lab environment over one of these channels to establish the LTE capabilities with respect to low latency support. |
| Document(s) outlining installation practises, test regimes and training requirements for LTE | This is an ongoing 'data capture' process between Nokia and WPD. Existing project documentation is currently being consolidated into both High Level Low Level Design portfolios |

# 5 Learning Outcomes

We are still in the early stages of the project and no learning in terms of functionality has been generated so far. However, we are beginning to understand the issues associated with connectivity and the wider LTE market in terms of resourcing materials and devices.
Some of the learning on the project include the following:

- IP High Level Design: Factor in good time ahead of project commencement in order to learn what administrative Virtual Local Area Networks (VLANs) and Operational VLANS will be required as part of a design - Saving time later.
- Secure Subject Matter Expert: Make sure resource is confirmed as remote support is rarely 100% effective should key personnel not engage on site.
- Security Design Ethos: Passwords and Access should be carefully designed to stop misconfiguration or leaking access rights.
- Documentation: Ensure Documentation is well recorded as often as possible as there could be unexpected lapses resulting from work pressures.

# 6 Intellectual Property Rights

None has been developed for the project.

# 7 Risk Management

Our risk management objectives are to:

- Ensure that risk management is clearly and consistently integrated into the project management activities and evidenced through the project documentation;
- Comply with WPDs risk management processes and Ofgem governance requirements;
- Anticipate and respond to changing project requirements.

These objectives will be achieved by:

- ✓ Defining the roles, responsibilities and reporting lines within the Project Delivery Team for risk management;
- ✓ Including risk management issues when writing reports and considering decisions;
- ✓ Maintaining a risk register;
- ✓ Communicating risks and ensuring suitable training and supervision is provided;
- ✓ Preparing mitigation action plans;
- ✓ Preparing contingency action plans; and
- ✓ Monitoring and updating of risks and the risk controls.

## 7.1 Current Risks

The LTE Connecting Futures risk register is a live document and is updated regularly. There are currently 13 live project related risks. Mitigation action plans are identified when raising a risk and the appropriate steps then taken to ensure risks do not become issues wherever possible. In **Error! Reference source not found.Error! Reference source not found.**, we give details of our top five current risks by category. For each of these risks, a mitigation action plan has been identified and the progress of these are tracked and reported.

**Table 7-1: Top five current risks (by rating)**

| Details of the Risk | Previous Risk Rating | Current Risk Rating | Mitigation Action Plan | Progress |
|---|---|---|---|---|
| Field testing disrupted by operations [impact on CPEs at substations - which then require work] | None – this is the first report | Moderate | Move CPE to alternative location (Note - may alter sector coverage and environment). | CPE locations not yet finalised. Operational restrictions in place due to Covid19 |
| Spectrum availability - T&D Licence expires 30/09/20. Project completion may now depend on extension of T&D Licence. | None - this is the first report | Moderate | Liaise with Ofcom / apply for a further T&D Licence / reschedule critical field Wi-Fi testing. | WPD [Phil Rigden / Steve Pike] to liaise with Ofcom |
| Coronavirus - Continued impact on project team and progress given public health recommendations | None - this is the first report | Major | All three parties [WPD / Nokia / WPD] to monitor situation and react accordingly. | Additional Risks added to Registers by all three parties. Able to work from home and able to do most of the activities remotely. |

| | | | | |
|---|---|---|---|---|
| Allocation of resource may be compromised for key resources | None - this is the first report | Moderate | 1) Analyse key roles, develop a back-up plan in case of absence (e.g. substitutability).<br>2) Learning and knowledge sharing with WPD. | Current delays not jeopardising resource allocation. Project Managers are monitoring other projects involving common resource. |
| Field system testing - noise / interference [Electrical or RF] | None - this is the first report | Minor | Impact may be limited by testing being moved or done on a mobile basis | WPD / JRC planning meeting held [March 2020] |

**Error! Reference source not found.** provides a snapshot of the risk register, detailed graphically, to provide an on-going understanding of the projects' risks.

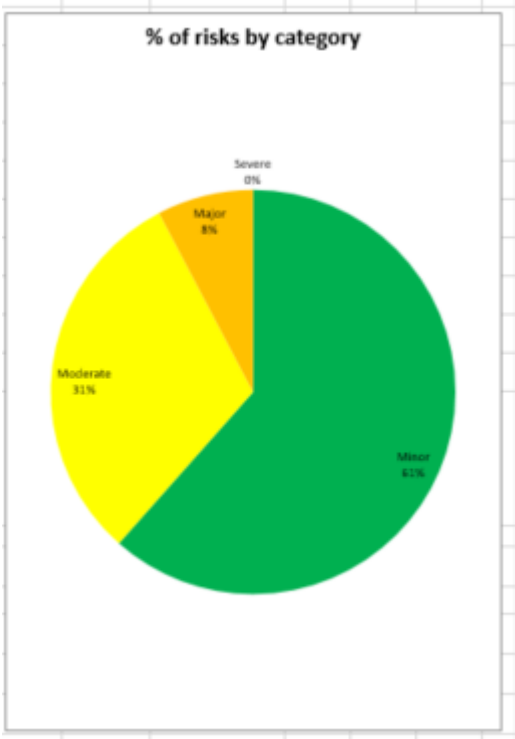
**Table 7-2: Top five current risks (by rating)**

| Likelihood = Probability x Proximity | | | | | | |
|---|---|---|---|---|---|---|
| | Certain/Imminent (21-25) | 0 | 0 | 0 | 0 | 0 |
| | More likely to occur than not/Likely to be near future | 1 | 0 | 0 | 0 | 0 |
| | 50/50 chance of occuring /Md to short term (11-15) | 0 | 0 | 0 | 0 | 0 |
| | Less likely to occur/Md to long term (6-10) | 0 | 0 | 1 | 0 | 1 |
| | Very unlikely to occur/Far in the future (1-5) | 0 | 3 | 5 | 1 | 1 |
| | | 1. Insignificant changes, re-planning may be required | 2. Small Delay, small increased cost but absorbable | 3. Delay, increased cost in excess of tolerance | 4. Substantial Delay, key deliverables not met, significant increase in time/cost | 5. Inability to deliver, business case/objective not viable |
| | | Impact | | | | |

| Legend | Minor | Moderate | Major | Severe | |
|---|---|---|---|---|---|
| | 8 | 4 | 1 | 0 | No of instances |
| Total | 13 | | | | No of live risks |

**Error! Reference source not found.** provides an overview of the risks by category, minor, moderate, major and severe.This information is used to understand the complete risk level of the project.

Table 7-3: Percentage of Risk by category




## 7.2 Update for risks previously identified

This is the first six monthly report and there are no risks to discuss from before.

# 8 Consistency with Project Registration Document

The scale and timeframe of the project has remained consistent with the registration document, a copy of which can be found here:

https://www.westernpower.co.uk/downloads/79219

However, the duration of the project may be extended by to up to three months due to the inability to complete most of the project activities in the light of the corona virus.

# 9 Accuracy Assurance Statement

This report has been prepared by the LTE Connecting Futures Project Manager Faithful Chanda, reviewed and approved by the Innovation Team Manager (Jon Berry).

All efforts have been made to ensure that the information contained within this report is accurate. WPD confirms that this report has been produced, reviewed and approved following our quality assurance process for external documents and reports.

# Glossary

| Abbreviation | Term |
|---|---|
| Base Station | A site equipped with, typically 3, eNodeB sectors & equipment |
| CPE | Customer Premises Equipment |
| DNO | Distribution Network Operator |
| DSO | Distribution System Operator |
| eNodeB | Evolved Node B (Equipment for one base station sector) |
| EPC | Evolved packet Core |
| GHz / MHz / kHz | 1GHz = 1000 MHz; 1MHz = 1000kHz; 1kHz = 1000 cycles per sec |
| LTE | Long Term Evolution, the 4$^{th}$ Generation mobile phone technology (4G) specifically designed to carry data traffic. |
| NIA | Network Innovation Allowance, UK government sponsored scheme to encourage innovation in energy networks and services. |
| Outstation | A network node requiring an LTE data connection with a base station. Mostly substations [Primary or Distribution] in this case. |
| RF | Radio Frequency |
| RTU | Remote Telemetry Unit |
| SCADA | Supervisory Control and Data Acquisition |
| UHF | Ultra-High Frequency, refers to radio frequency range 300-3000 MHz |

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