Mounting spectrum sensing VESNAs in London

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IJS

Introduction

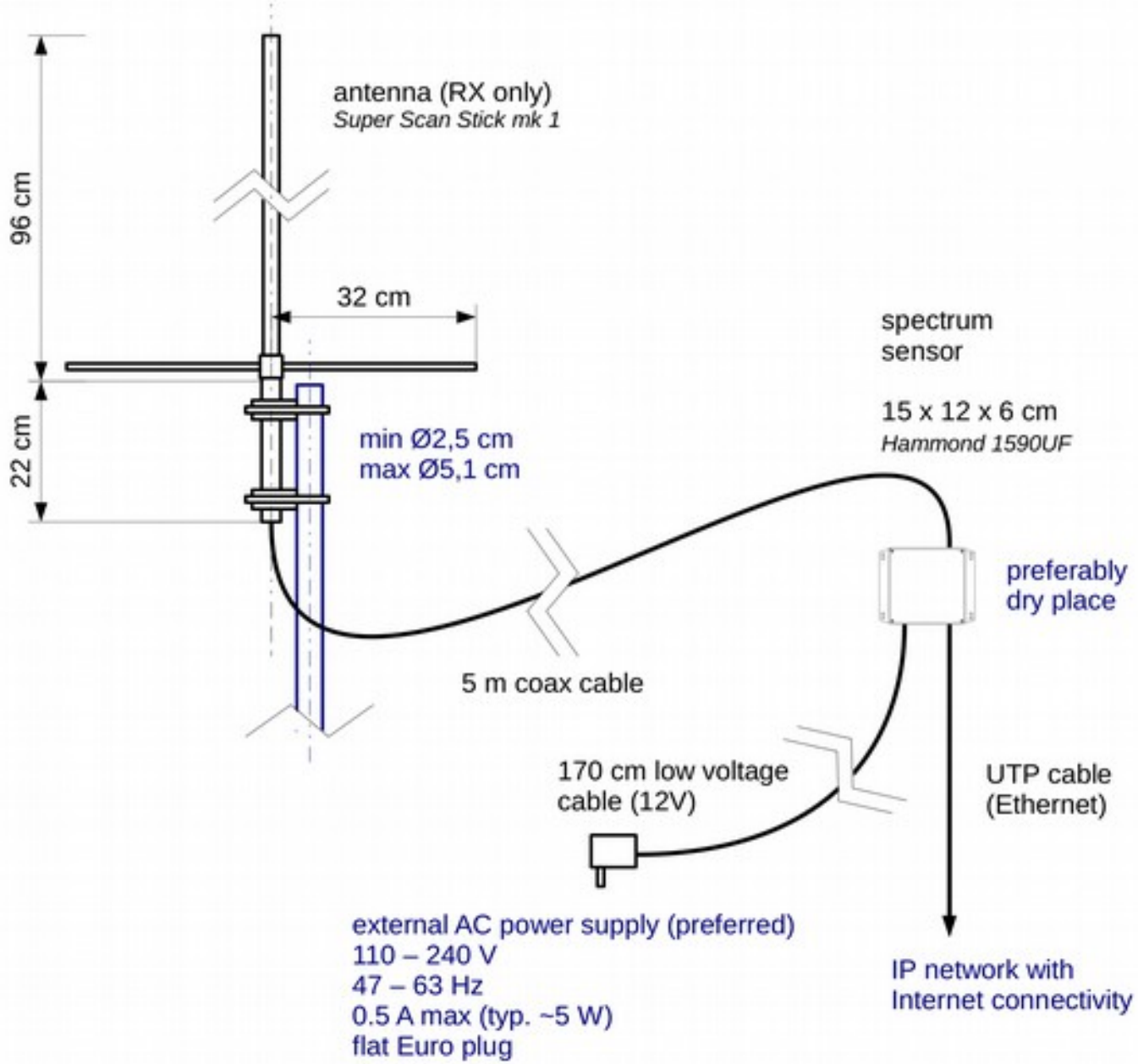
- In January I visited **dr. Oliver Holland** of Centre for Telecommunications Research, King's College London.
  - Installed and tested **2 SNE-ESHTER spectrum sensors** at two locations in London.
  - Attempted some experiments with **Carlson Rural Connect** WRAN devices.
- This was part of involvement of the CREW project in the **Ofcom TVWS pilot**.
  - previously IT Portugal (CREW OC2 partner) also did some DVB-T signal measurements.

About King's College London

- One of the top 25 universities in the world (Times Higher Education 2008)
- Fourth oldest in England
- 19,700 students from more than 150 countries
- 5,400 employees
- In the top group of UK universities for research earnings overall annual income of approximately £450 million.

About the sensors

Setup


antenna (RX only)
Super Scan Stick mk 1
96 cm
32 cm
22 cm
min Ø2,5 cm
max Ø5,1 cm
spectrum
sensor
15 x 12 x 6 cm
Hammond 1590UF
preferably
dry place
5 m coax cable
170 cm low voltage
cable (12V)
UTP cable
(Ethernet)
external AC power supply (preferred)
110 – 240 V
47 – 63 Hz
0.5 A max (typ. ~5 W)
flat Euro plug
IP network with
Internet connectivity

Hardware

VESNA spectrum sensor
CONTACT
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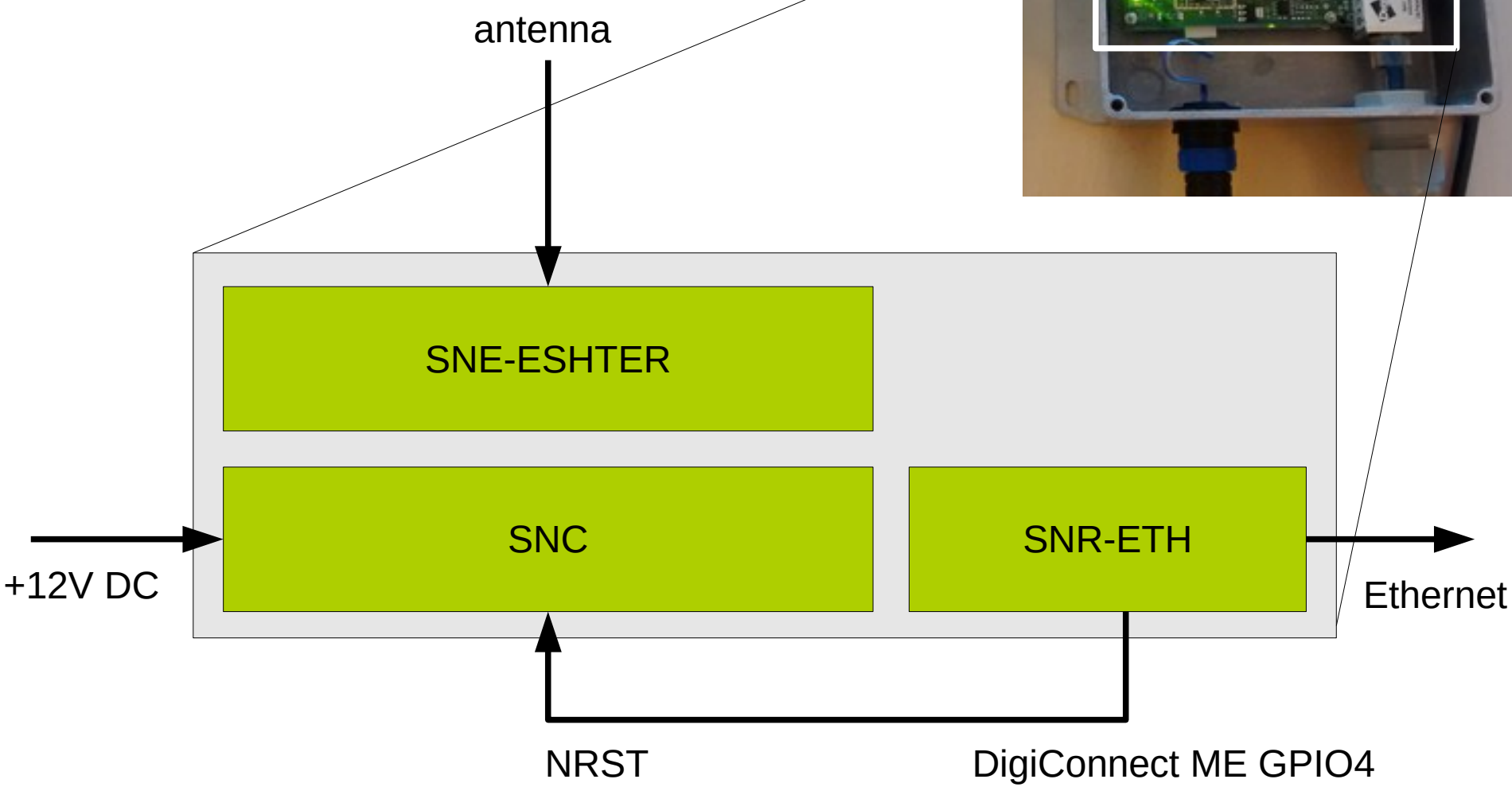
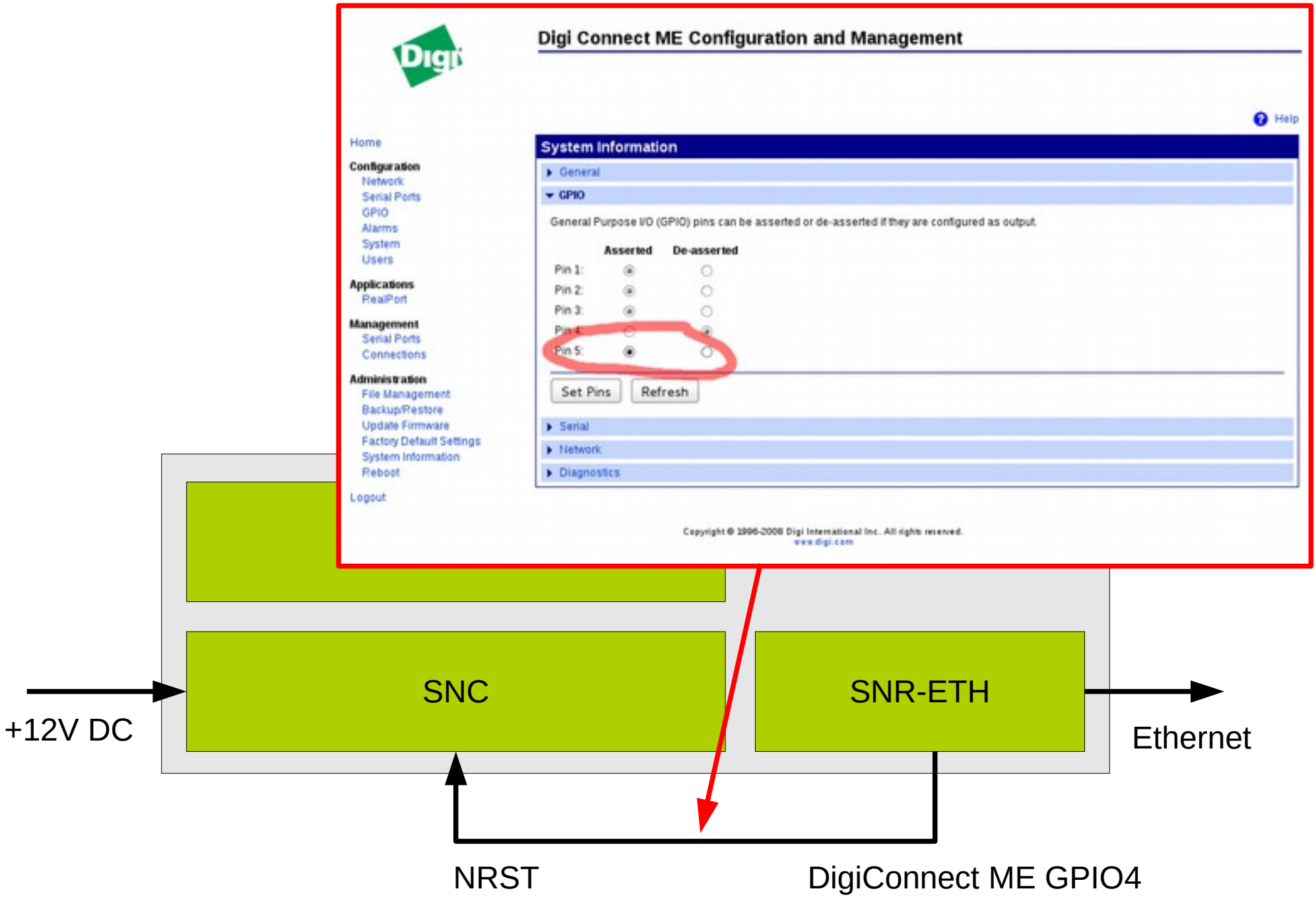
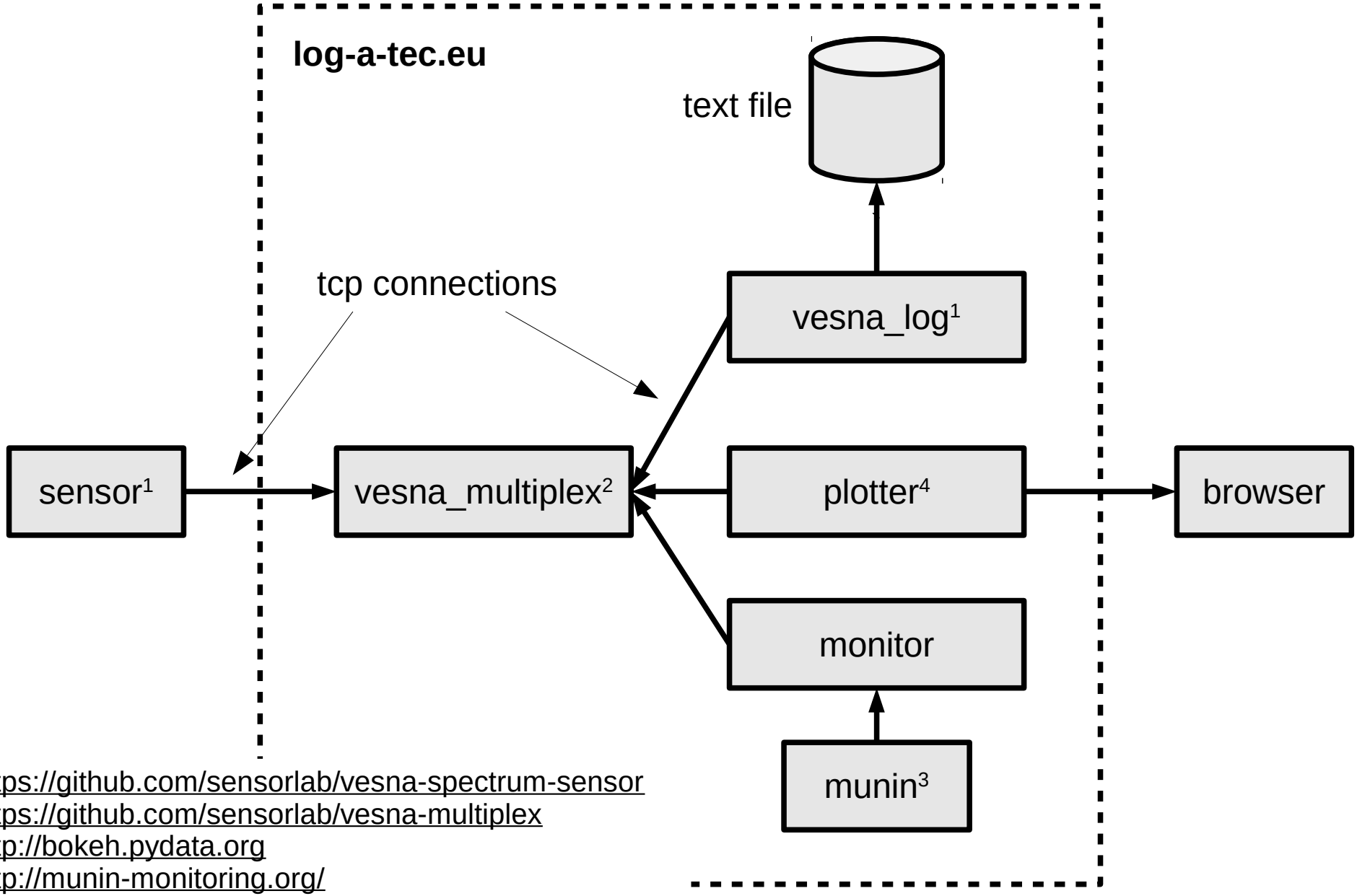
telephone: +386 1 477 3699
IJS
Department of
Communication
Systems
CREW

Hardware


antenna
SNE-ESHTER
SNC
SNR-ETH
+12V DC
Ethernet
NRST
DigiConnect ME GPIO4


Digi Connect ME Configuration and Management
Help
Home
Configuration
Network
Serial Ports
GPIO
Alarms
System
Users
Applications
RealPort
Management
Serial Ports
Connections
Administration
File Management
Backup/Restore
Update Firmware
Factory Default Settings
System Information
Reboot
Logout
System Information
General
GPIO
General Purpose I/O (GPIO) pins can be asserted or de-asserted if they are configured as output.
Asserted
De-asserted
Pin 1:
Pin 2:
Pin 3:
Pin 4:
Pin 5:
Set Pins
Refresh
Serial
Network
Diagnostics
Copyright © 1996-2008 Digi International Inc. All rights reserved.
www.digi.com
SNC
SNR-ETH
+12V DC
Ethernet
NRST
DigiConnect ME GPIO4

Infrastructure



[1] https://github.com/sensorlab/vesna-spectrum-sensor
[2] https://github.com/sensorlab/vesna-multiplex
[3] http://bokeh.pydata.org
[4] http://munin-monitoring.org/

Currently collected data

f_c = 470 ... 790 MHz (in 1 MHz steps)
f_{sample} = 2 MHz
BW = 1 MHz

N = 25000 samples

cca. 300 ms per 1 MHz step
(tuning + sampling + covariance calculation + sending data over Internet)

25 elements of the sample covariance matrix

frequency channel
(f_c = 40 MHz + n * 1 kHz)

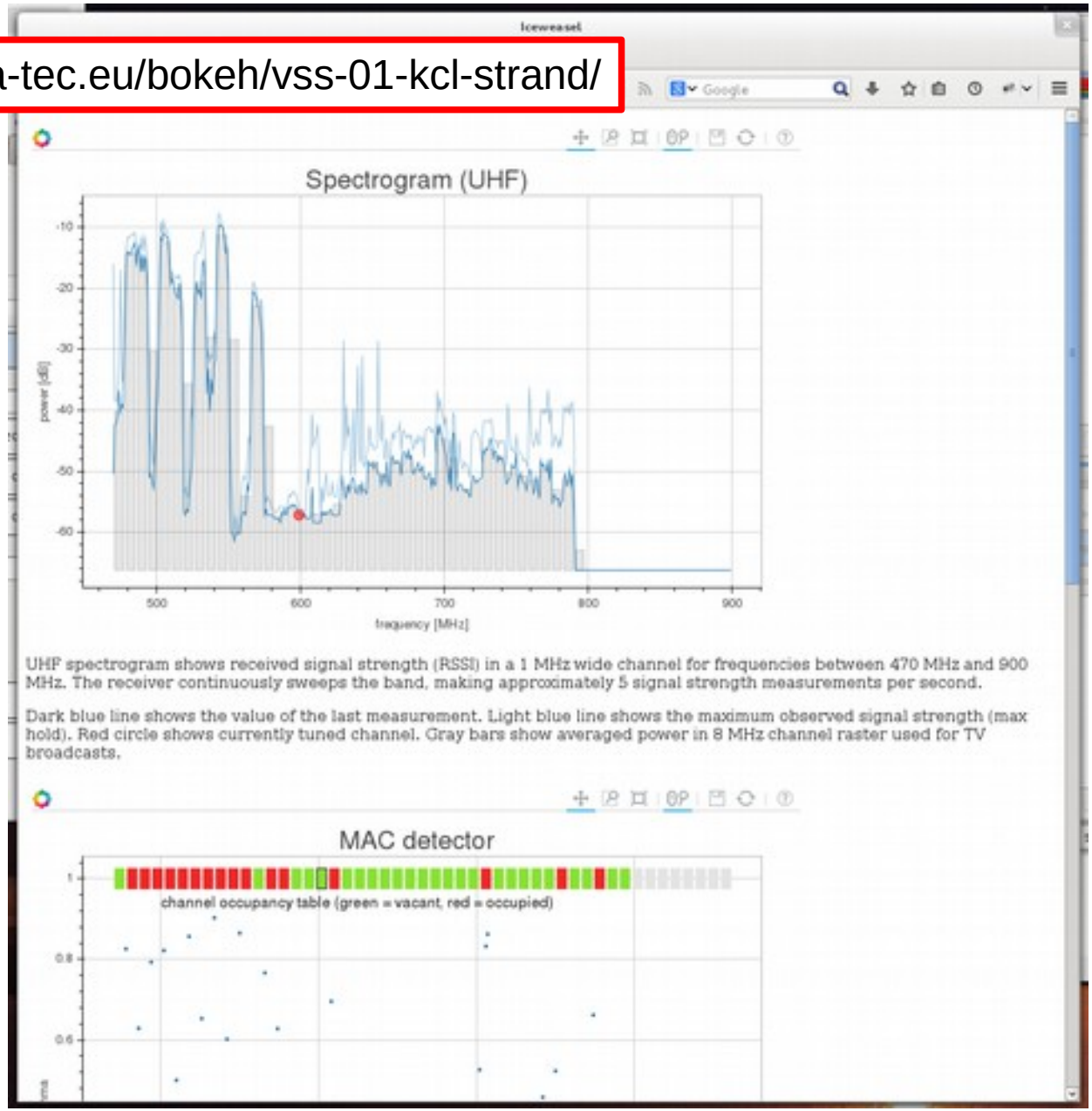
sensor timestamp

server timestamp

TS 1421943705.955069 0.001000 CH 550000 DS 102.0 -12.0 -18.0 -10.0 0.0 -5.0 ... 0.0 DE

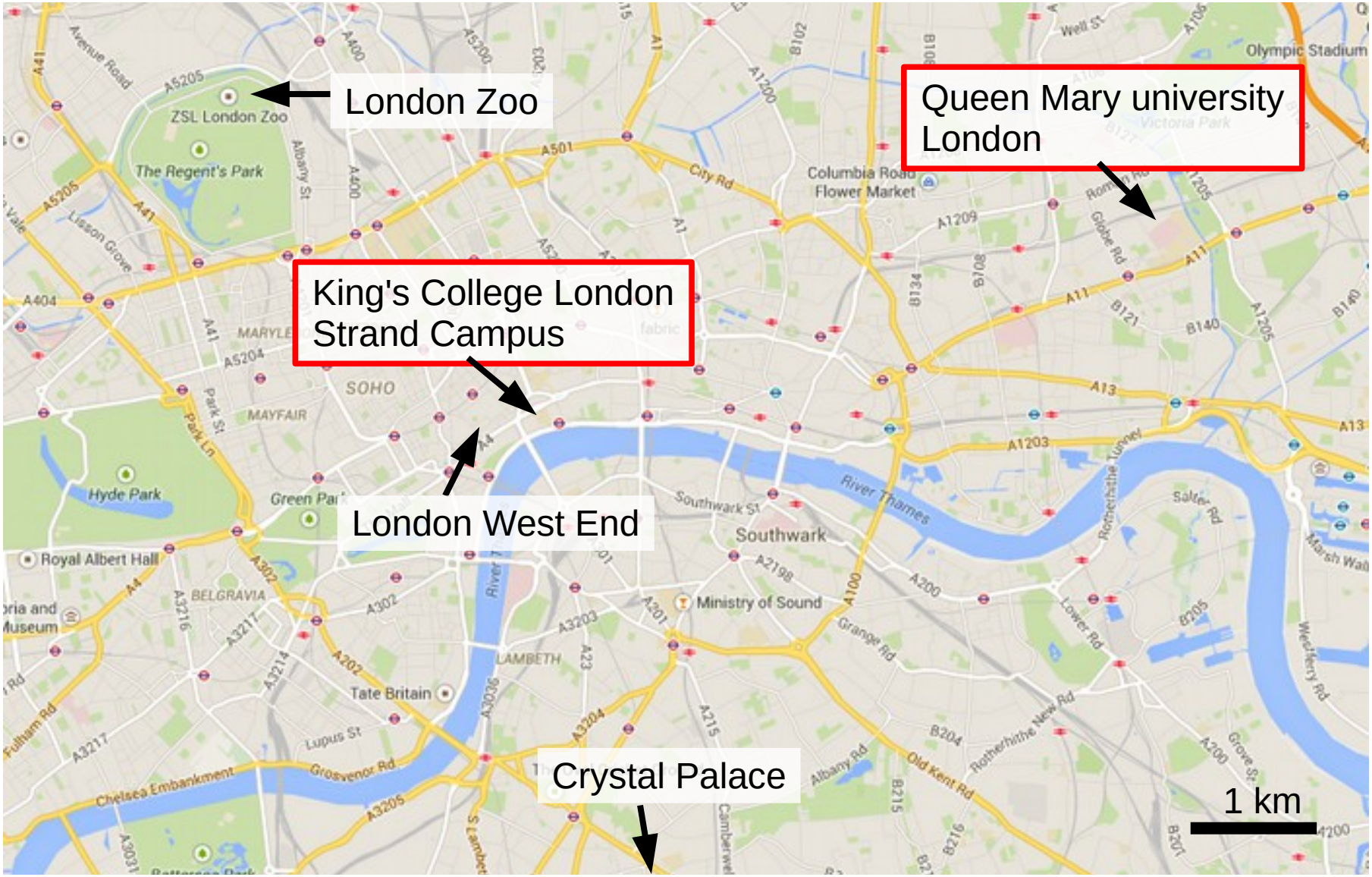
Live web demo

http://log-a-tec.eu/bokeh/vss-01-kcl-strand/



Installation

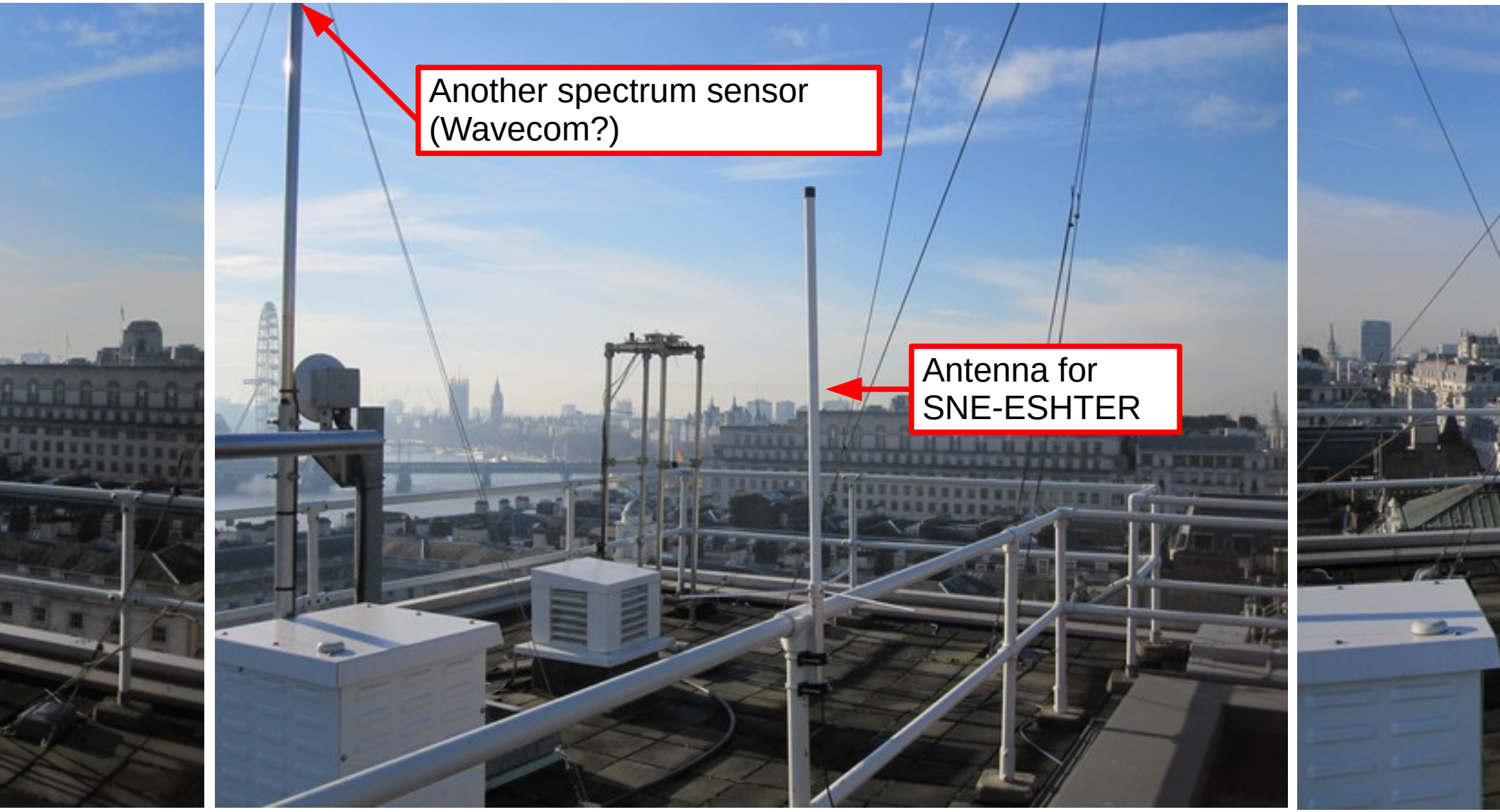
Location


London Zoo
Queen Mary university London
King's College London Strand Campus
London West End
Crystal Palace
1 km
ZSL London Zoo
The Regent's Park
Olympic Stadium
Columbia Road Flower Market
SOHO
MAYFAIR
Hyde Park
Green Park
Royal Albert Hall
BELGRAVIA
LAMBETH
Tate Britain
Southwark
Ministry of Sound
River Thames

Sensor at KCL

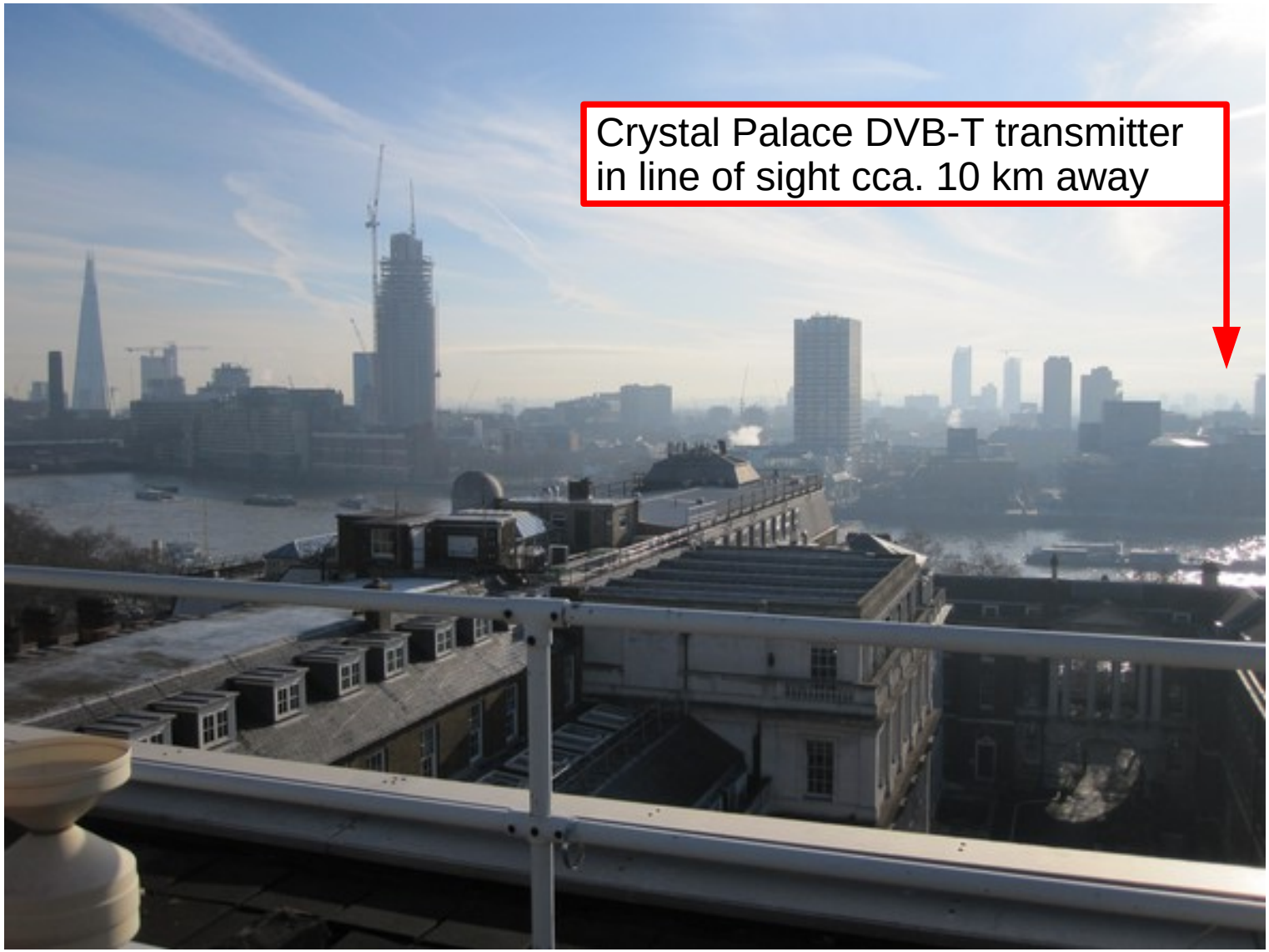
Sensor at KCL

Sensor at KCL



Sensor at KCL

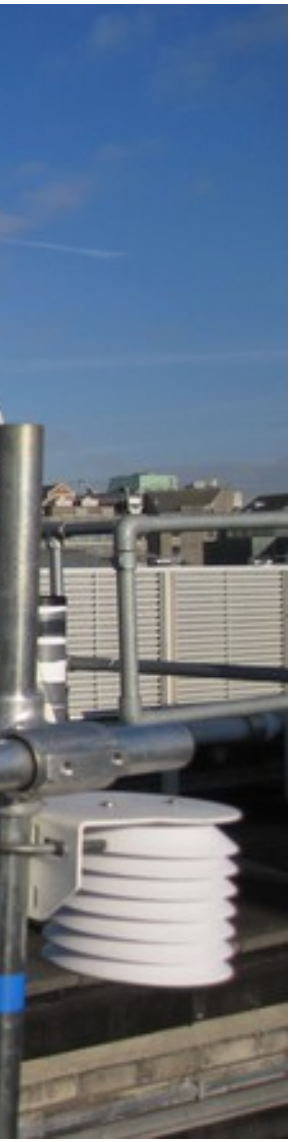
Sensor at KCL



Sensor at KCL

Sensor at KCL

Sensor at KCL

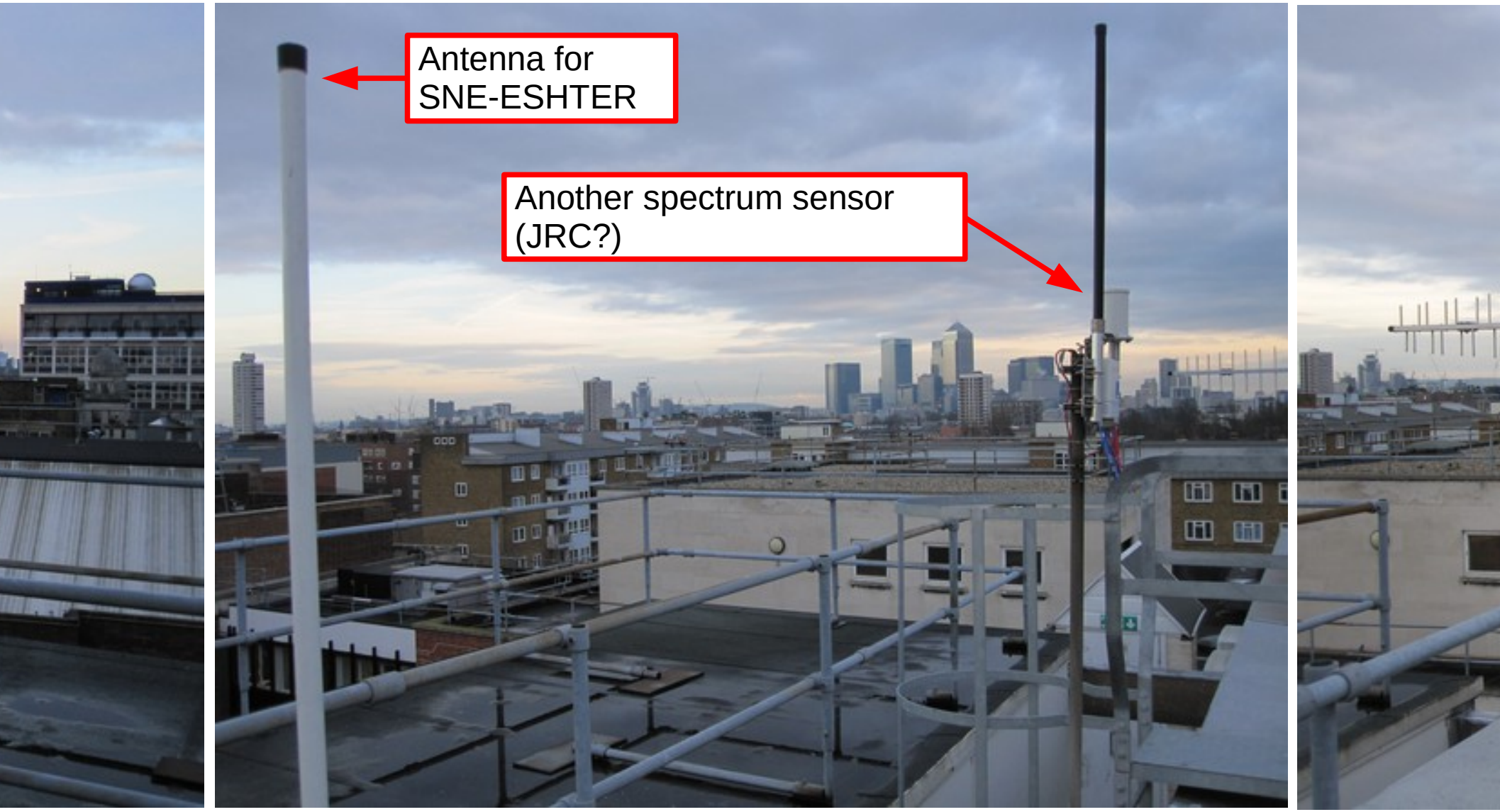


Sensor at KCL

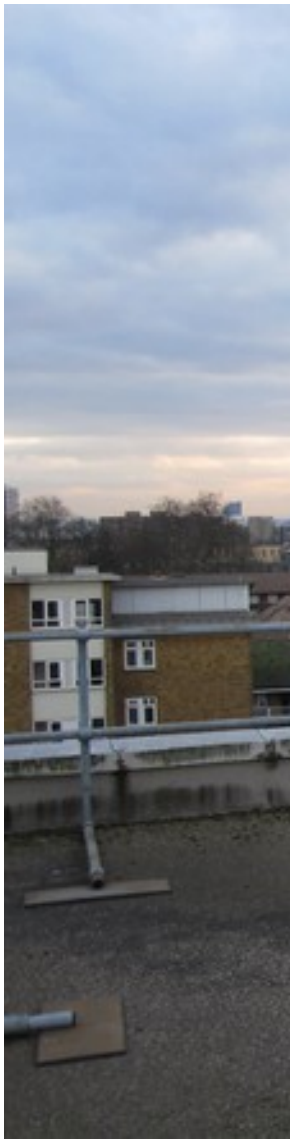
Sensor at QMUL

Sensor at QMUL

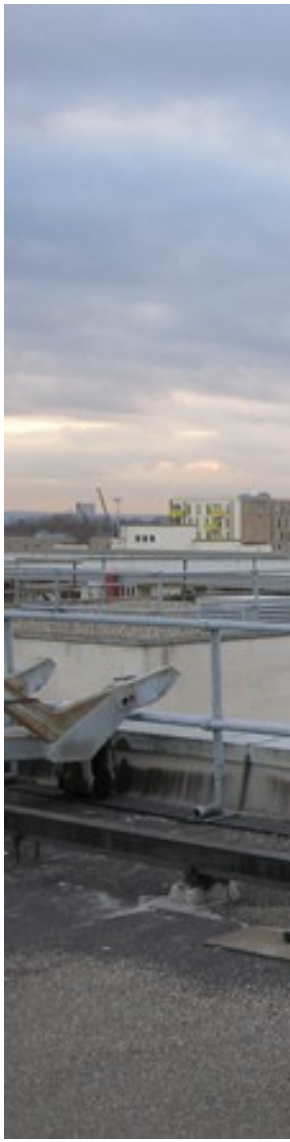
Sensor at QMUL



Sensor at QMUL

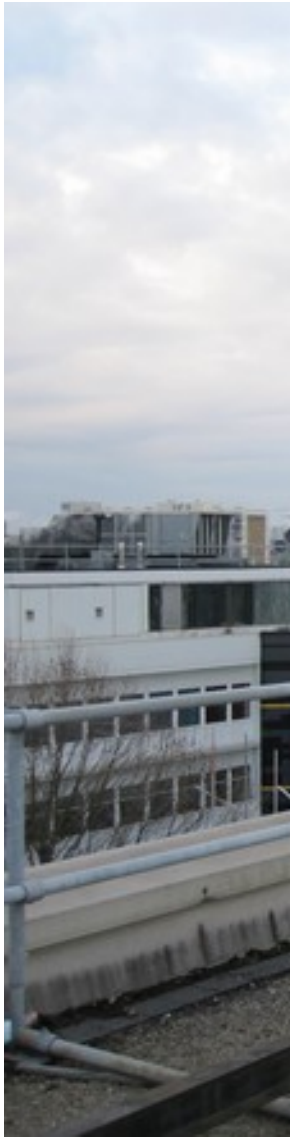


Sensor at QMUL



Sensor at QMUL

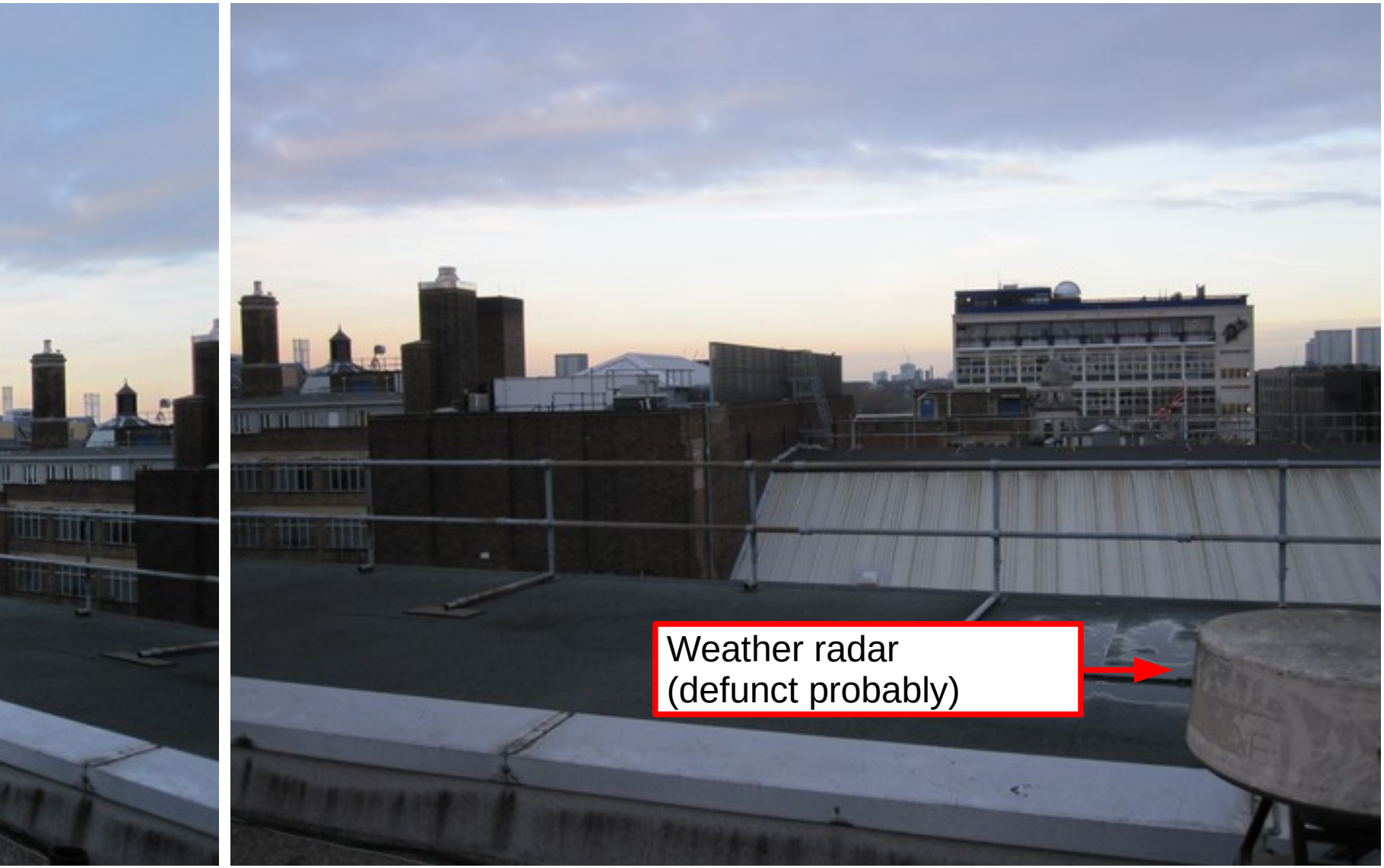
Sensor at QMUL



Sensor at QMUL

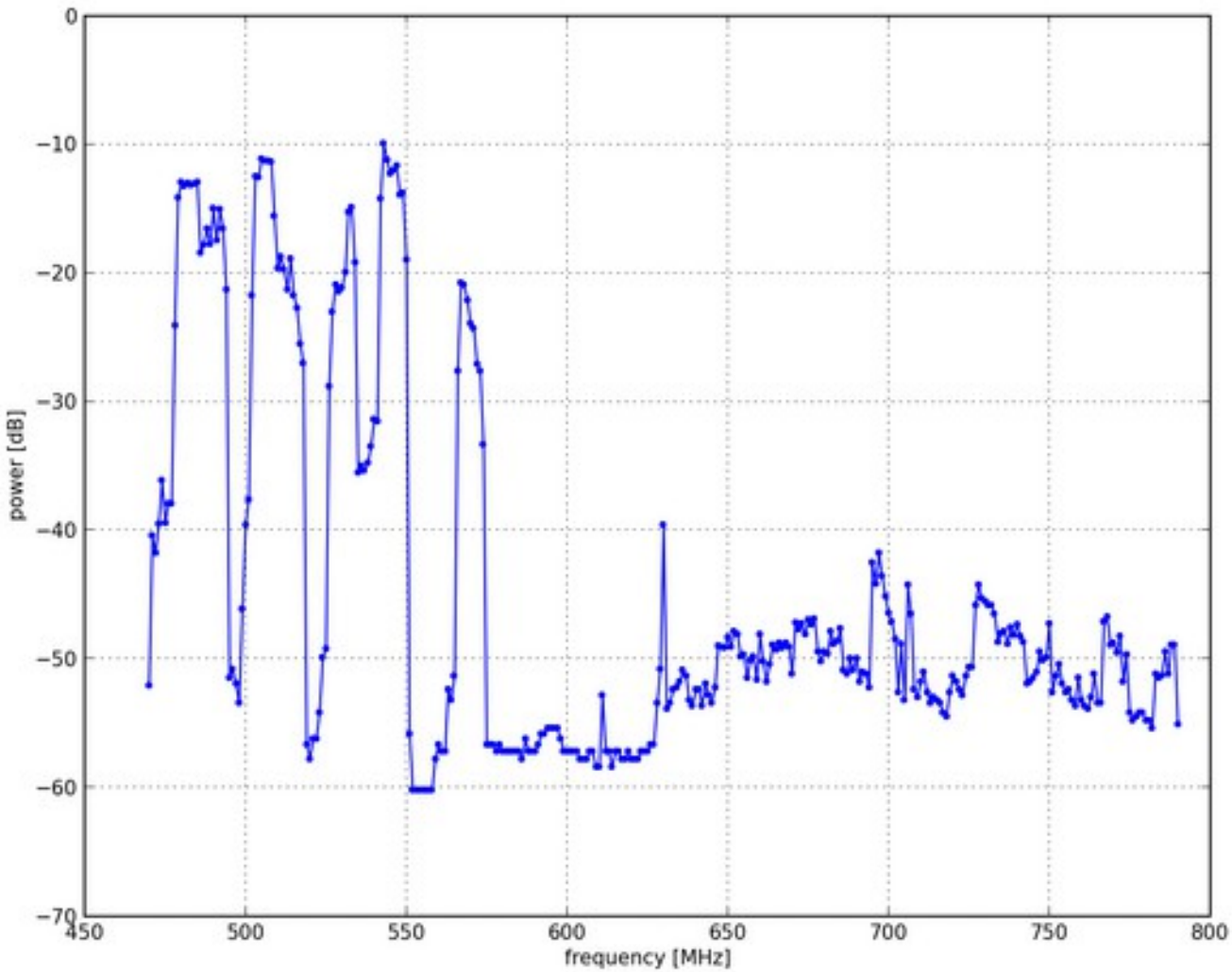
Sensor at QMUL

Sensor at QMUL

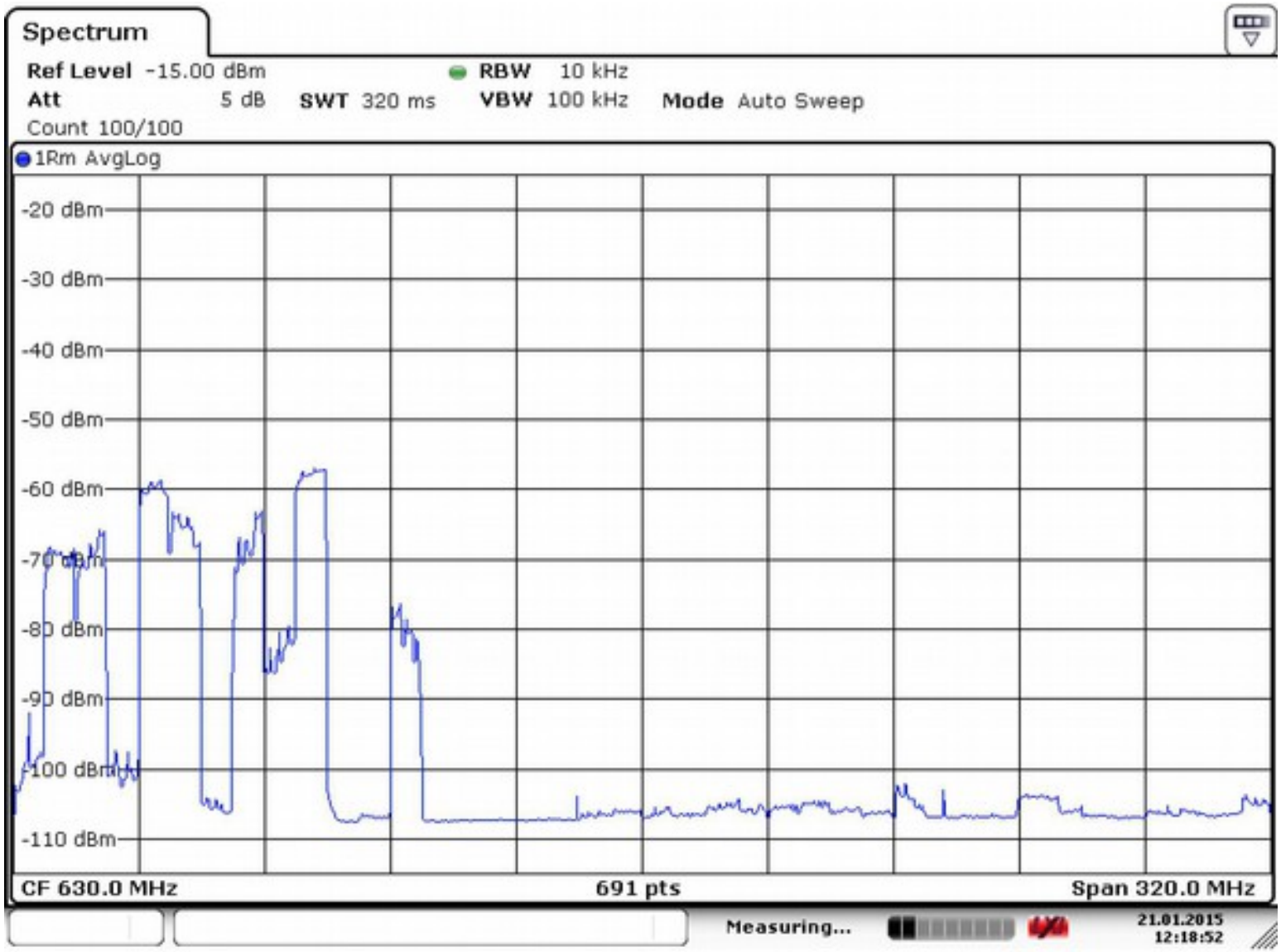


First results

KCL, first measurement

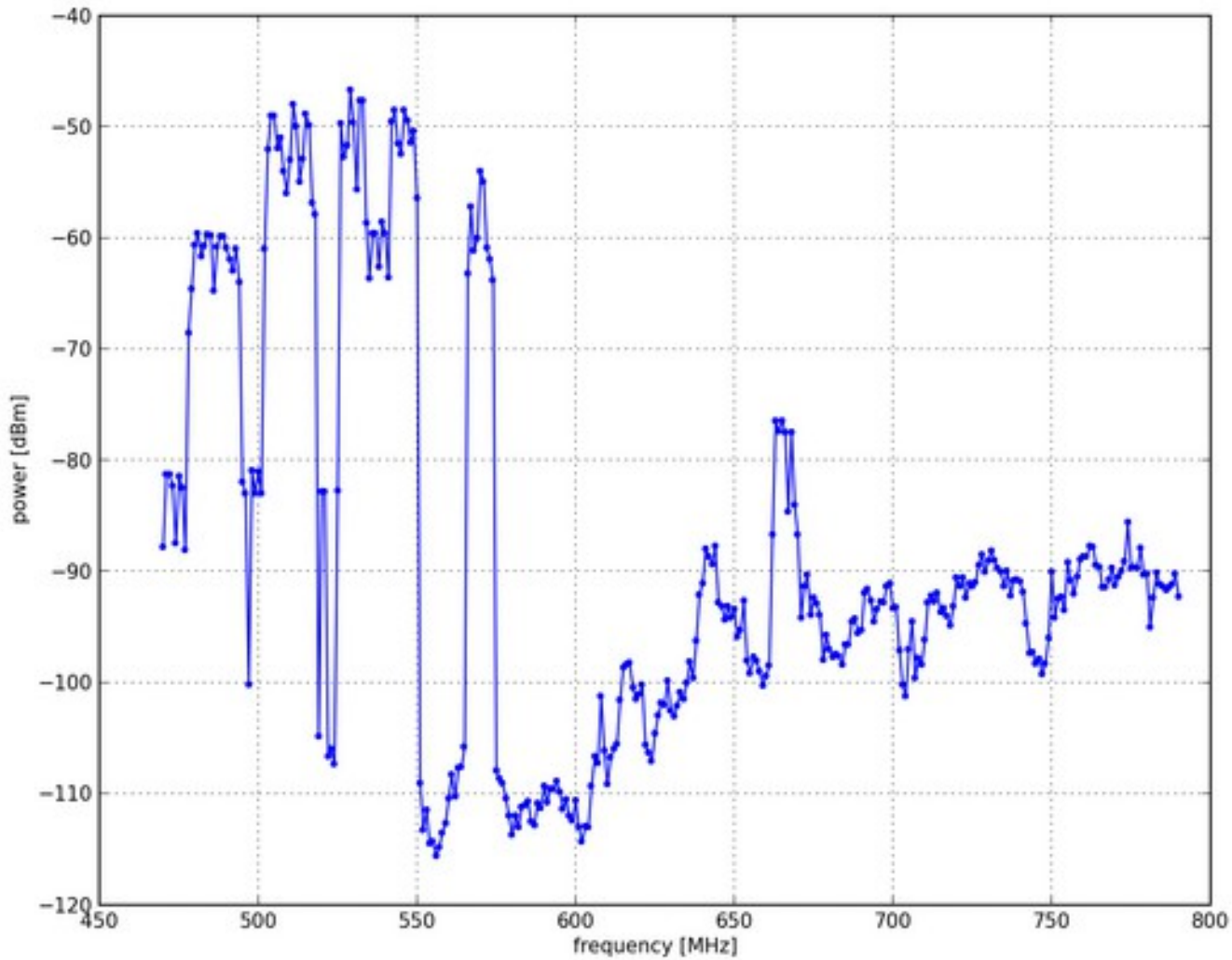


KCL, comparing with R&S FSV

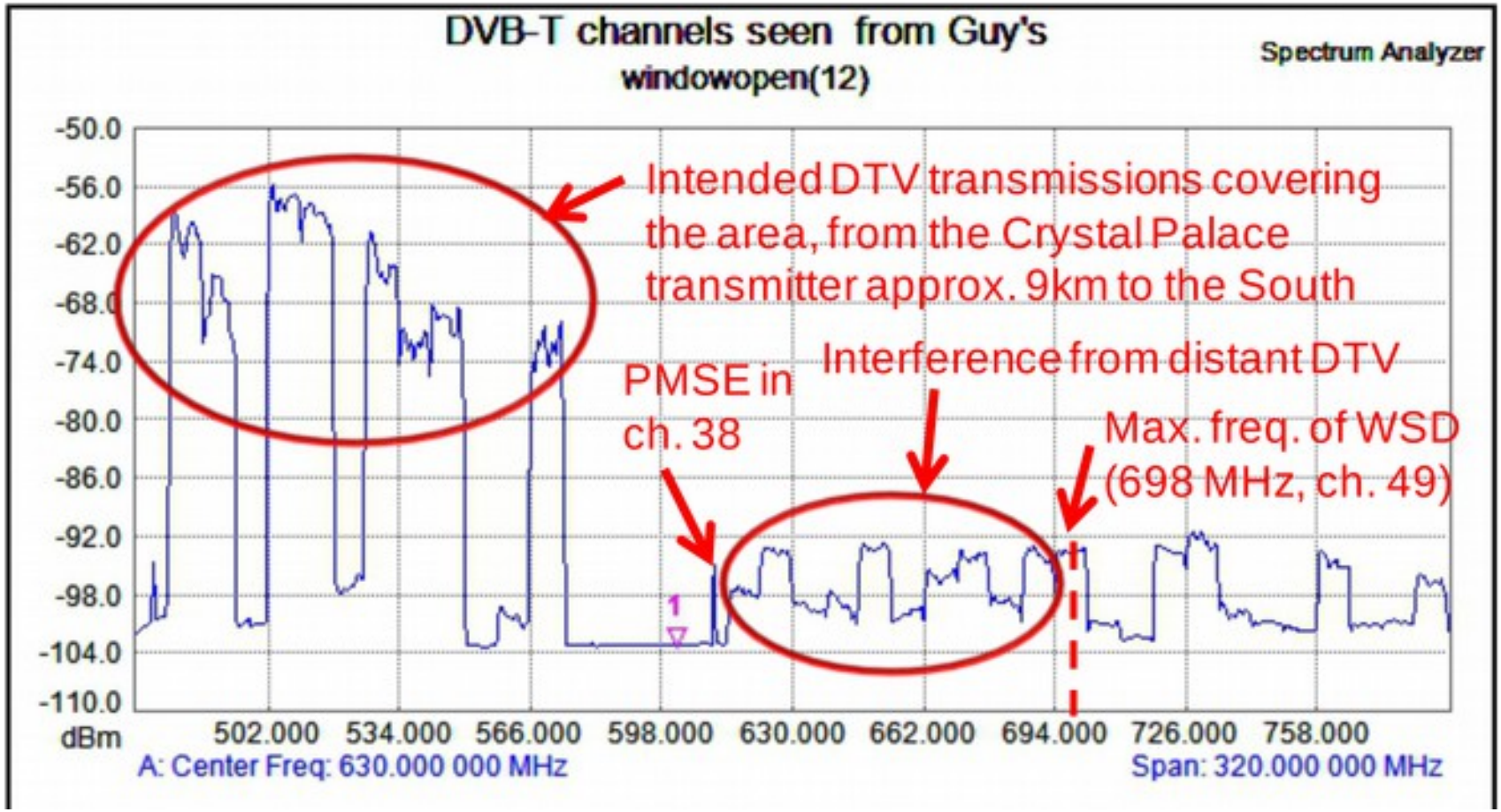


Date: 21.JAN.2015 12:18:52

QMUL, first measurement



Compare with…

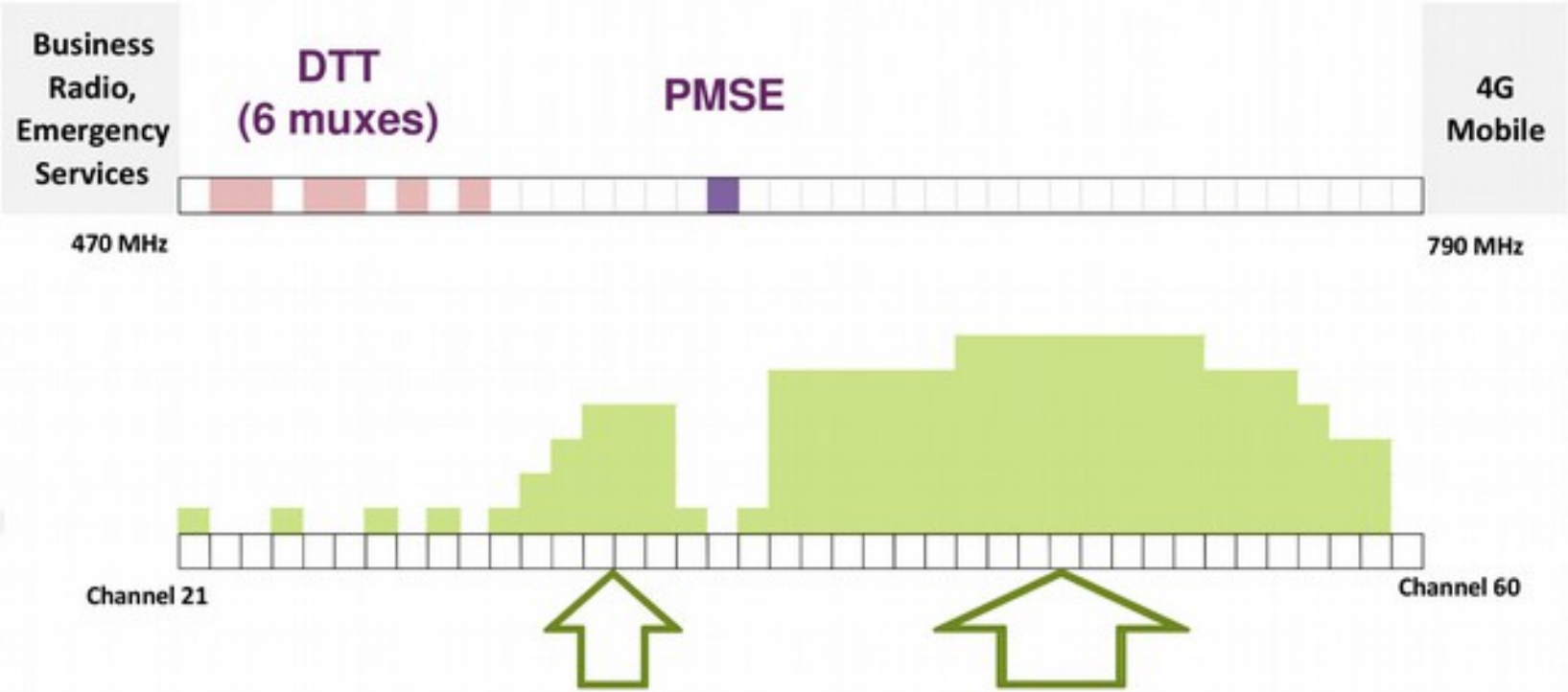


NOTE: Different location (King's College London Guys Campus hospital tower), antenna and equipment.

From: "Some Initial Results and Observations from a Series of Trials within the Ofcom TV White Spaces Pilot"

The TV White Spaces opportunity

What does the TV band occupancy look like at a random location in the UK?



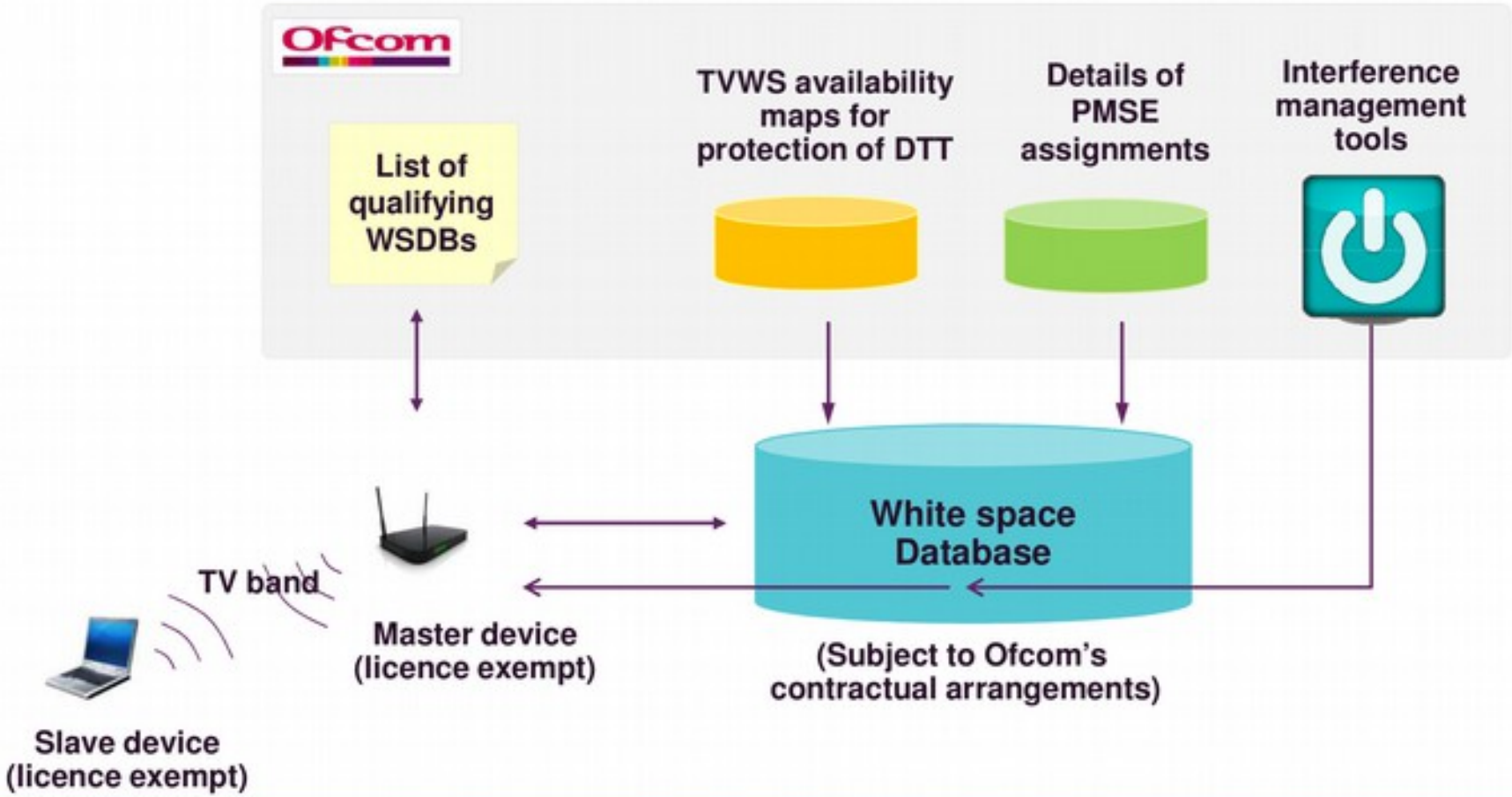
Several channels available at EIRP levels that are usable and do not cause interference to DTT

Tests with Carlson devices

Overview

- Tried to establish an IP link over TVWS using Carlson Rural Connect devices.
  - Base station on the roof of the KCL Strand Campus.
  - CPE on floor lower.
- Run some tests on the link
- ~~See if the link can be detected with the VESNA spectrum sensor on the roof~~
  - wasn't done because of lack of time.

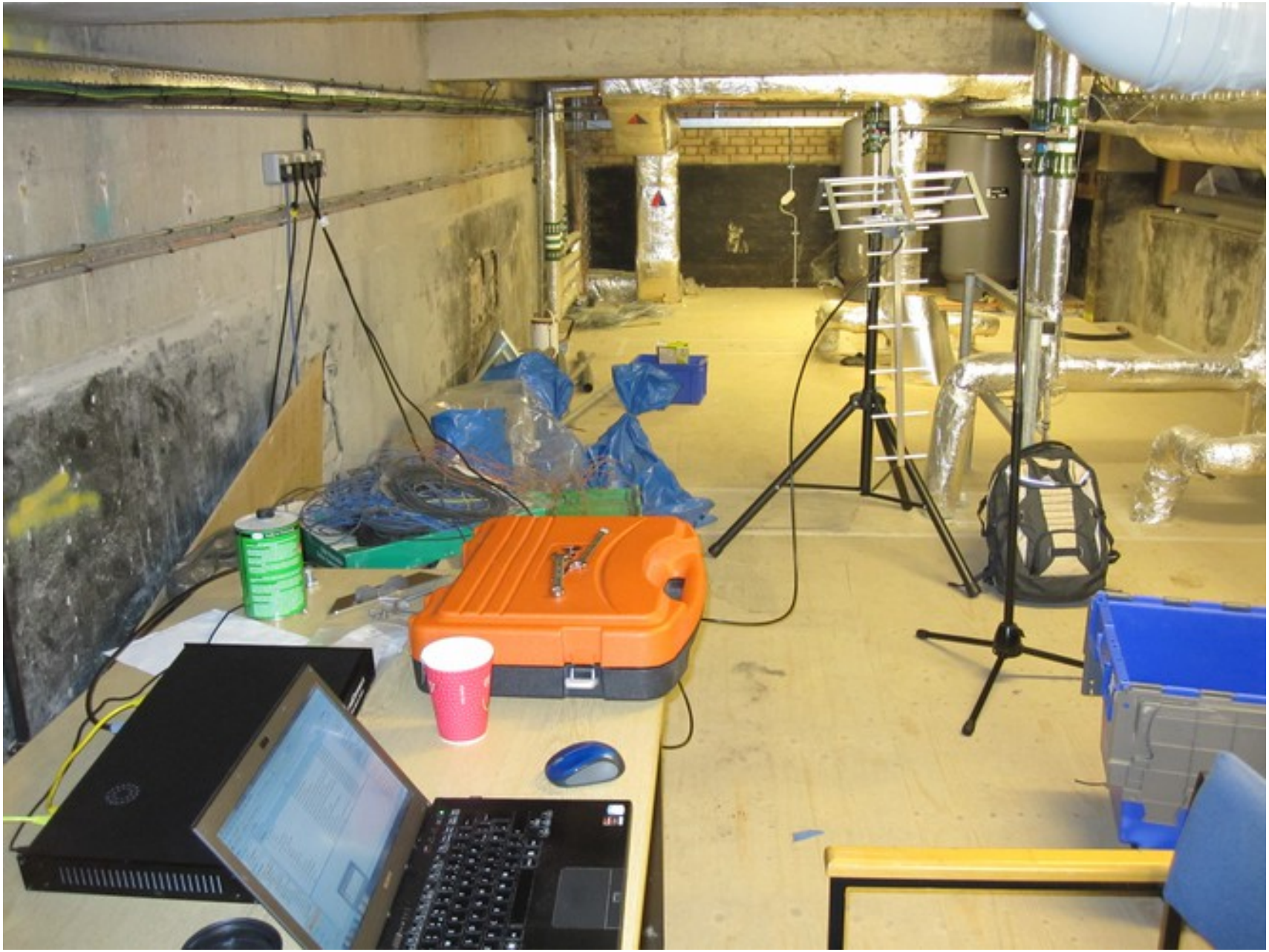
Framework for access to TVWS in the UK



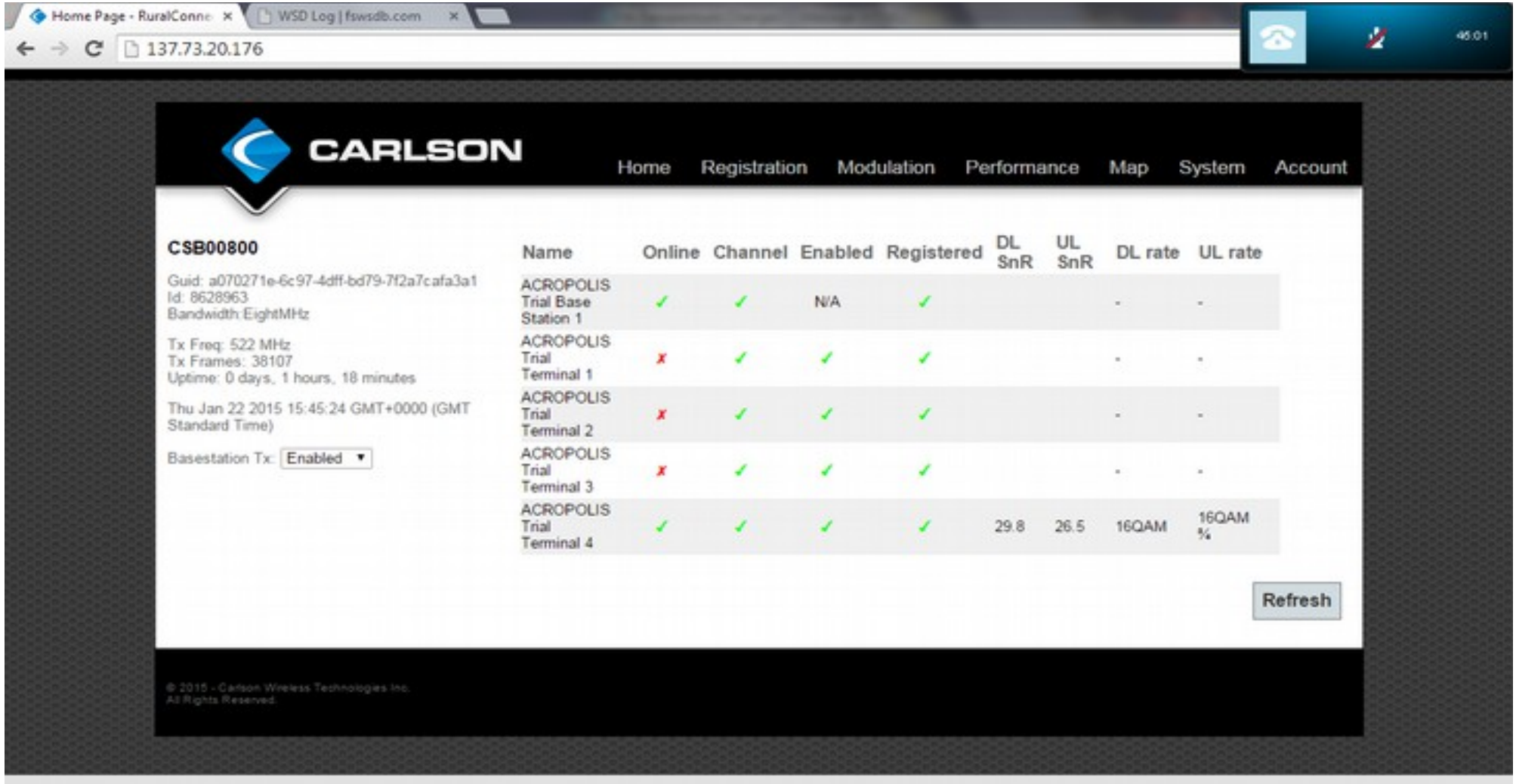
Carlson Wireless Ruralconnect

- http://www.carlsonwireless.com/ruralconnect
- Built for US market, but adapted to operate under Ofcom/ETSI rules in terms of database (and database of databases) communication, channelization, etc. Variable powers and frequency range currently not adapted
- Our trial will use at least 2 base stations and 5 terminals (perhaps different sets at different times)
- Deployment scenarios include the public protection and disaster relief cases
- Also broadband provisioning cases, and to test longer-distance point-to-point links

Base station

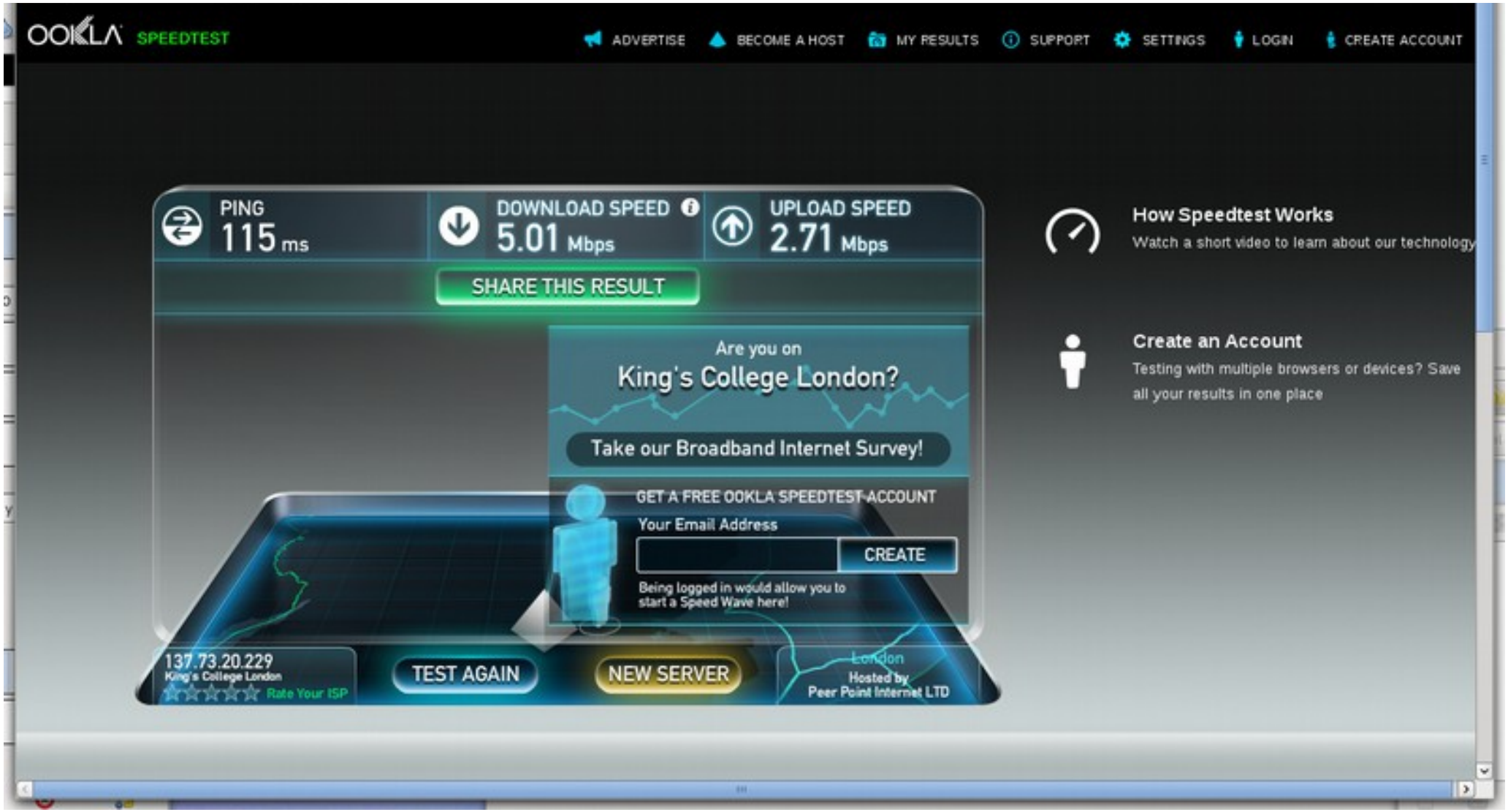


Base station



CPE

iperf doesn't work over TVWS...



Conclusions...

- Deployed SNE-ESHTER sensors work...
  - low noise floor compared to R&S FSV,
  - ~2 weeks of data already collected from sensor at KCL
- but...
  - Sensor at QMUL still hasn't called home (will hopefully get network access in March)
  - Sensor at KCL already required a hard reset after log-a-tec.eu server rebooted (not sure why)
- Apparently there are still problems with TVWS geolocation databases.

Questions?

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