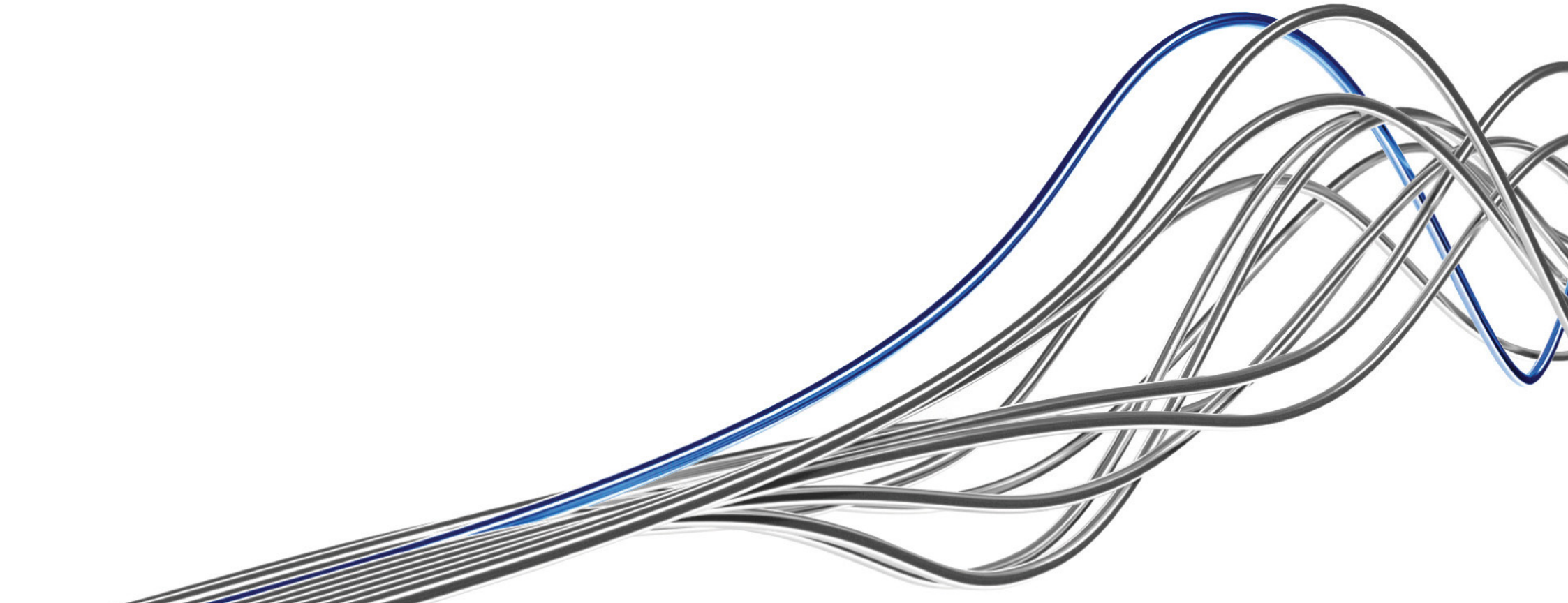
OptaSense®
a QinetiQ company

Pipeline Security and Monitoring



Reducing the cost of ownership

OptaSense is designed to detect, classify and locate events along pipelines and surrounding assets with sufficient accuracy and early warning to enable corrective action to be put in place *to prevent damage and cost occuring.*

Security: *Preventing pipeline damage*

OptaSense provides unprecedented levels of around the clock *situational awareness* of the pipeline and surrounding assets you wish to protect in order to prevent damage from Third Party Interference, whether intentional or accidental.

Condition monitoring: *Cost saving information*

A number of features have been built into OptaSense to extract value from real time *operational data* to further protect the integrity of your entire pipeline. OptaSense is being used in a number of locations to detect leaks, track pigs, monitor the condition of equipment at block valve stations and even monitor the movements of security patrols.

Unique features

- ***Retro fit to to your environment***
  - Uses existing fibre optic cable and requires no modifications
  - Low infield power consumption
  - No new infield equipment locations required
- ***Smart zones & custom user interface***
  - OptaSense can be tailored to your pipelines exact needs
- ***Classification engine***
  - Intelligent software effectively minimises nuisance alarms
- ***Cues other security platforms***
  - Integrate with other platforms such as CCTV & UAVs (OPC, Pelco and others supported)
- ***Management reporting & forensic analysis***
  - Instantly review historical data of activity around your pipeline

A proven system

OptaSense is a proven method for detecting any activity in the vicinity of a pipeline over long distances. OptaSense converts your existing fibre optic communications cables into an array of virtual microphones with no infield equipment. An operator is able to detect, classify and locate any threatening events near to your pipeline in real time.

System components

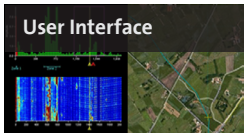
Interrogator Unit

The OptaSense Interrogator Unit sends a conditioned pulse of light into the fibre to create virtual microphones. By varying the size of the pulse the virtual microphone can be spaced between 5 and 15m along the length of the fibre.

Processing Unit

The acoustic data is received by the Processing Unit which monitors each microphone channel in real time for the presence of specific acoustic events. The classification engine then passes the event data onto the User Interface. The Interrogator/Processing Unit combination is typically installed in block valve stations every 100km.

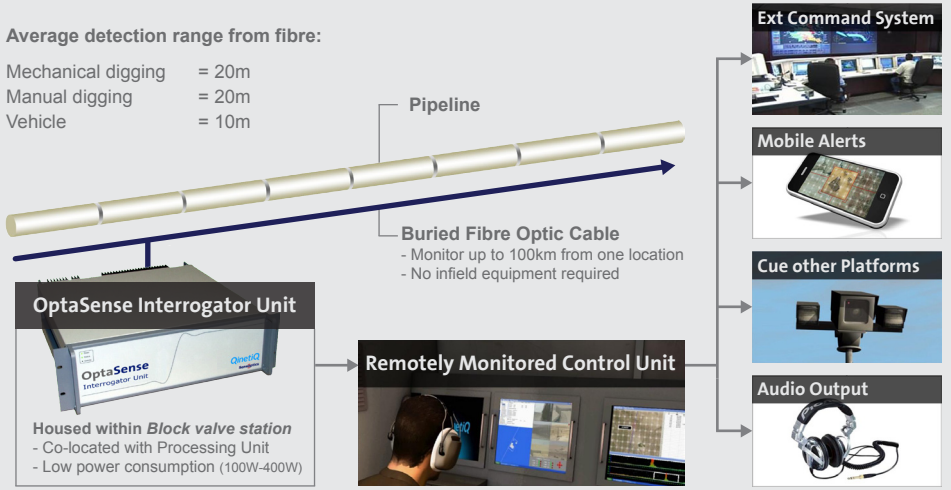
User Interface



The User Interface presents the real time event data to the operator in a clear and intuitive manner where classified alerts are shown on a map display with location coordinates. By networking Interrogator Units together the system has the capability to allow an operator to monitor over 5,000km from one location and can easily be integrated with existing control systems (e.g. via OPC, Pelco etc).

Operations globally

Typical system deployment



Security

Preventing Third Party Interference (TPI)

Third Party Interference, whether intentional or accidental, is the most common cause of serious pipeline failure and the consequences can be catastrophic. OptaSense has been deployed on numerous pipelines around the world to prevent damage from Third Party Interference by providing around the clock monitoring for threatening activity within the vicinity of a pipeline and surrounding assets.

On installations to date, the OptaSense system has used a single optical fibre from existing fibre optic cable that has been buried next to the pipeline during construction for telecommunication or SCADA purposes.

Automated processing and alerting can be confirmed by the operator who can listen into any specific 10m section along the entire pipeline. Detection ranges from the pipeline itself depend on ground type and fibre quality but average detection ranges on deployments to date have been; mechanical digging 20m, manual digging 20m and vehicles 10m.

OptaSense allows its operators to take appropriate action in order to prevent threatening events from causing an unwanted incident. This unique capability has significant financial benefits, saving millions of dollars in the cumulative cost of downtime, loss of product, physical repair and environmental damage. OptaSense can be a vital tool to assure the supply of energy to those the pipeline serves.

Classification engine: *Alarms tailored to your requirements*

Pipeline Detectors

- Manual digging
- Mechanical digging
- Activity
- Vehicle
- Personnel
- Stealth

A key feature of the OptaSense system is to provide alerts for real threats only. Built upon decades of military sonar processing expertise, OptaSense not only picks out the acoustic fingerprint of an event, but it monitors its activity over a short period of time to build up an exact picture of what the event is. In this way nuisance alarms are effectively minimised.

OptaSense also offer a service to create bespoke alerts for customers to suit your unique requirements.

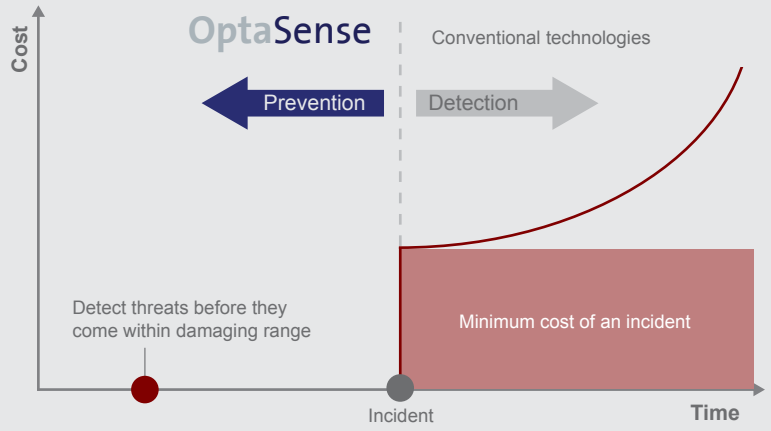
Smart zones: *Enabling real world implementation*

OptaSense is easy to tailor to your pipelines specific needs. Smart zones allow you to have different alert settings protecting different regions. Each zone is completely flexible, allowing you to choose which type of activity the system should alert to for a given zone.

OptaSense understands that your pipeline crosses many different terrains such as roads and rivers over its length. That's why we give you the option of setting up zones to suit your particular pipeline. This includes the ability to add zones around your valuable facilities to provide perimeter intrusion detection.

OptaSense knows that the time of day matters. Traffic on a road during the day may be no issue, but a vehicle arriving late at night, stopping, and unloading several people is quite different. Time settings on different zones minimise nuisance alarms and give you the sensitivity you need, when you need it.

Incident prevention: *A unique OptaSense capability*

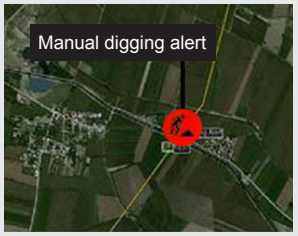


Case study: Eastern Europe

OptaSense monitors over 700km of Oil pipeline in Eastern Europe. Initially installed in early 2009 OptaSense has successfully prevented multiple illegal hot tap events.

By preventing hot tap events from occurring, OptaSense has saved the customer a significant amount of money due to the cost of repair, product loss and downtime that each incident incurs.

Payback of the OptaSense system has been seen within the first few months of operation.



21:30 Digging alert
Activity detected, classified and located

21:31 Police notified
A patrol is dispatched to investige

23:14 Thieves flee
Hot tap equipment left behind

23:15 Police arrive
Incident Prevented, pipeline undamaged

Condition monitoring

OptaSense offers more than just threat detection. A host of built in features are available to extract value from real time operational data to further protect the integrity of your entire pipeline. OptaSense is being used in a number of locations to detect leaks, track pigs, monitor the condition of equipment at block valve stations and even monitor the movements of security patrols.

Leak detection

With OptaSense it is possible to monitor differences in ambient temperature at a specific location on the fibre over time. Where leaks cause a change in the temperature around the fibre OptaSense can provide early warning and avoid dangerous and costly delays in detection. The possibility of combining this capability with the detection of leaks that cause an acoustic impact around the fibre compliments its security function.

Pig tracking / profiling

Pigs, used for inline inspection and cleaning are an integral part of the pipeline integrity management plan. OptaSense monitors the speed of pigs and locates them to within 10m, in real time. It can also use a pig as a tool for providing acoustic analysis of the pipes condition. Data of pigging runs is stored for future analysis as well as being displayed in real time on the OptaSense user interface.

When a pig passes through a girth weld inline, the pressure pulses created propogate through the pipe which OptaSense can pick up tens of kilometes away. This allows the use of cleaning pigs to gain valuable pipeline data that can be used to construct a picture of the pipeline's condition over time. This capability is currently being developed and initial tests confirm the potential for a comprehensive condition monitoring solution for pipelines and the ground in which it's deployed.

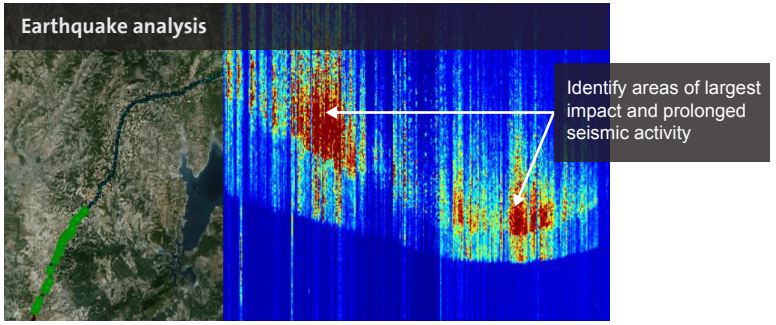
Equipment monitoring

OptaSense can detect changes in the underlying acoustic signature of equipment and machinery. It can therefore be used to monitor previously unmonitored equipment at remote locations such as block valve stations.

Lots of equipment (especially those with rotating parts such as pumps, valves, air conditioning units or generators) produce strong acoustic fingerprints. OptaSense detects these fingerprints and can be configured to produce an alert when equipment fails or operates out of specification. This monitoring application is implemented in software with no additional hardware required at the remote locations thereby making a practical and cost effective solution to gather vital operational data.

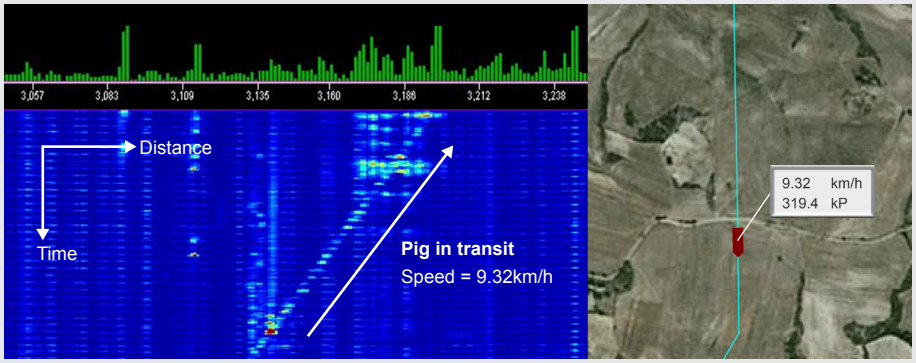
Reporting & forensic analysis

As standard, OptaSense records all the activity in the vicinity of your pipeline and associated assets for one month. Before and after analysis of particular activities and events such as earthquakes can be undertaken to make sure the integrity of your pipeline has not been compromised. This data also allows OptaSense engineers to provide further in-depth analysis of activity if required.

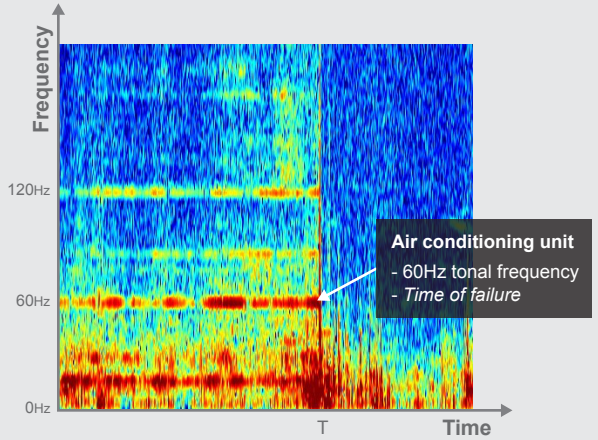


Real time pig tracking capability

The image below shows how a pigging run is tracked in real time and displayed on a pipeline map. A profile of the pig run is recorded for comparative analysis with previous data.



Case study: Remote equipment monitoring



Failure of the air conditioning unit in a telecoms room at a remote block valve station had led to the shut down of critical electronic equipment due to over heating, resulting in pipeline shut down.

As the diagram shows, the main acoustic fingerprint that the air conditioning unit produces is around 60Hz.

At time T the air conditioning unit fails. OptaSense can no longer detect the fingerprint and is configured to produce an alert.

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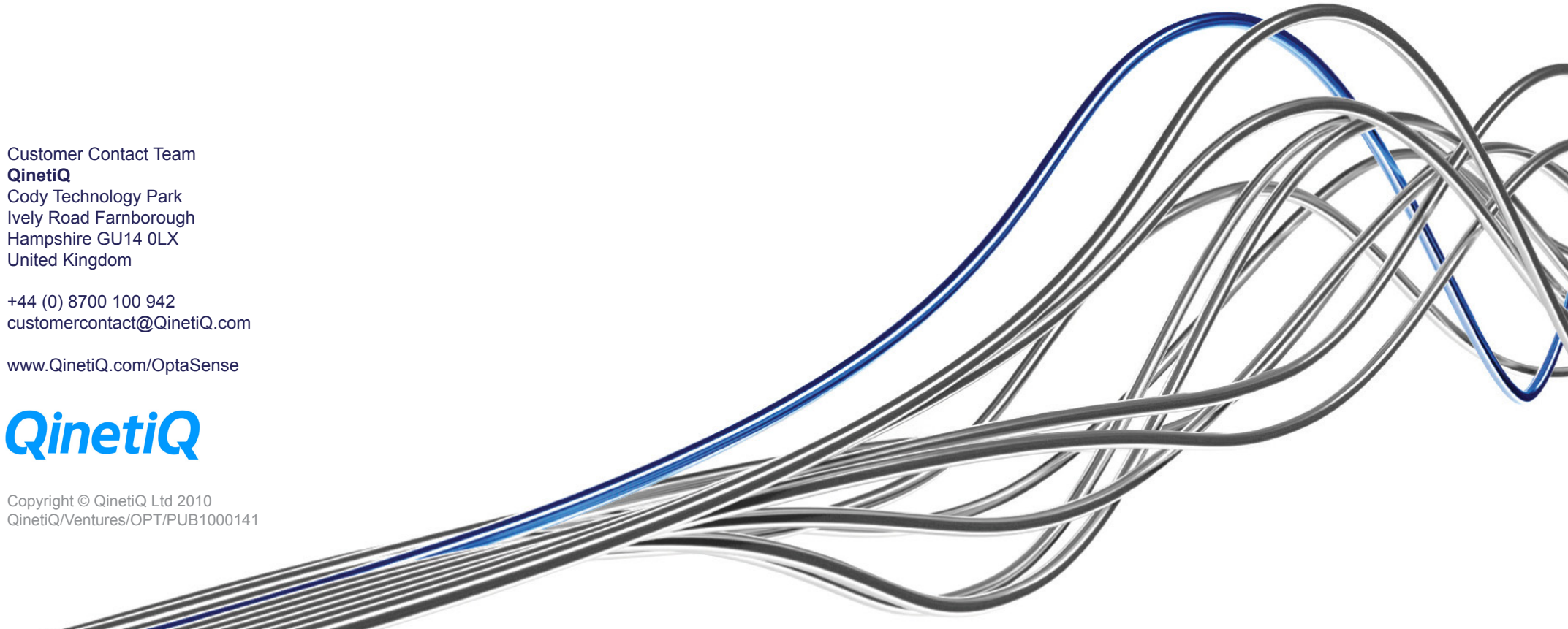

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