Case Study

Indoor and Outdoor Spectrum Co-existence
Real world operational experience

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1.0 Abbreviations

The following abbreviations are used within this documentation:

AP	Access Point
CPE	Customer Premises Equipment
GHz	Gigahertz
MHz	Megahertz
P2P	Point to Point
P2MP	Point to Multi-Point
RF	Radio Frequency
TXOP	Transmit opportunity

2.0 Introduction

Ofcom is inviting responses to the consultation document 'Hybrid sharing: Enabling both licensed mobile and Wi-Fi users to access the upper 6 GHz band', where Ofcom are exploring options that would enable both licensed mobile and Wi-Fi users to access the upper 6 GHz band (6425-7125 MHz).

With this background, the presented case study serves to illustrate real word scenario where indoor and outdoor competing systems operating within the same band, co-exist and the impact on streaming video delivery.

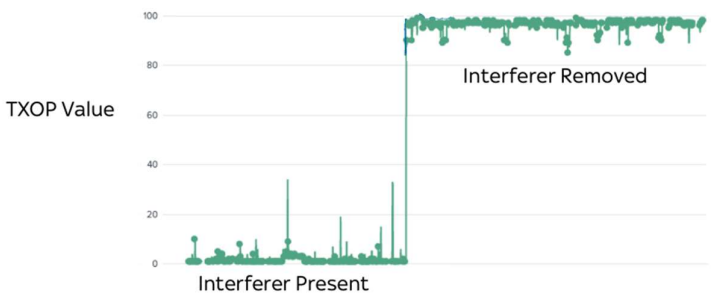
3.0 Background

Sky field engineers were tasked with investigating Sky viewing disruption on the Sky Q product platform, this was instigated due to a number customer complaints in a certain geographical area.

These investigations resulted in the identification of the cause of the service disruption as interference generated by point-to-point outdoor radio links operating in breach of UK regulatory requirements, utilising frequencies only permitted for indoor use (IR2030/8/1a).

Engineering laboratory testing was initiated to validate field engineering's findings and to determine telemetry markers generated by the customer equipment that could be used to proactively identify interferers.

It was determined that prolonged low TXOP value on the CPE 5GHz radio interface was indicative of such interference.

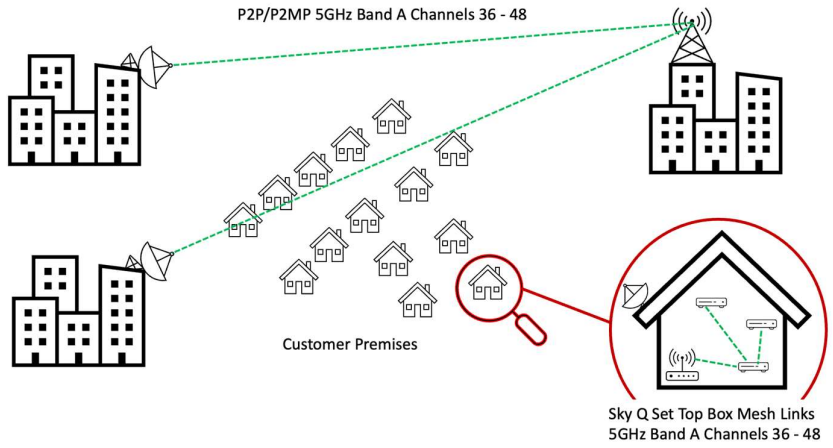


Telemetry Data Visualisation

Daily reporting was generated based on CPE 5GHz radio interface presenting a TXOP value below threshold for a period of time, enabling field engineering to target problem geographic locations. This programme of works has to date, resulted in the issuing of over 150 compliance cases with Ofcom's Spectrum Management Investigation Team.

4.0 Operational Environment

The diagram below represents the typical operational environment encountered.
P2P or P2MP fixed links operating outside regulatory requirements, operating as a fixed outdoor installation in the frequency band 5150- 5250 MHz in breach of IR2030/8/1a.



5.0 Menstrie Sky Q Service Disruption

5.1 Background

Menstrie is a small village near Sterling in Scotland with a population of circa 3,000.

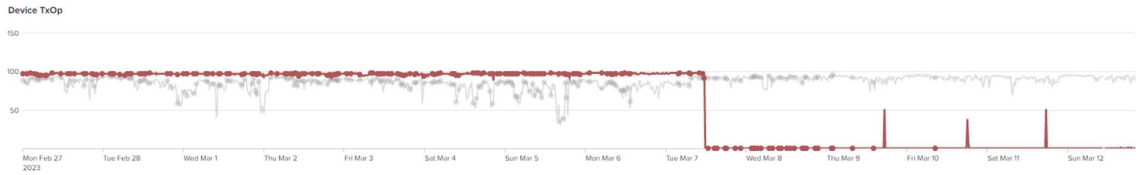
In March 2023 a high number of Sky customer in a single postcode contacted customer services reporting loss of streaming video services on Sky Q product set top boxes.

Customer loss of service was occurring on more than 10 FK11 postcode areas.

5.2 Investigation

Telemetry data was gathered that indicated that there was indeed a service issue in the area, where CPE 5GHz radio interfaces had continuous near zero TXOP values.

The graph below is taken from the actual incident and shows loss of TXOP on 7th March 2023.

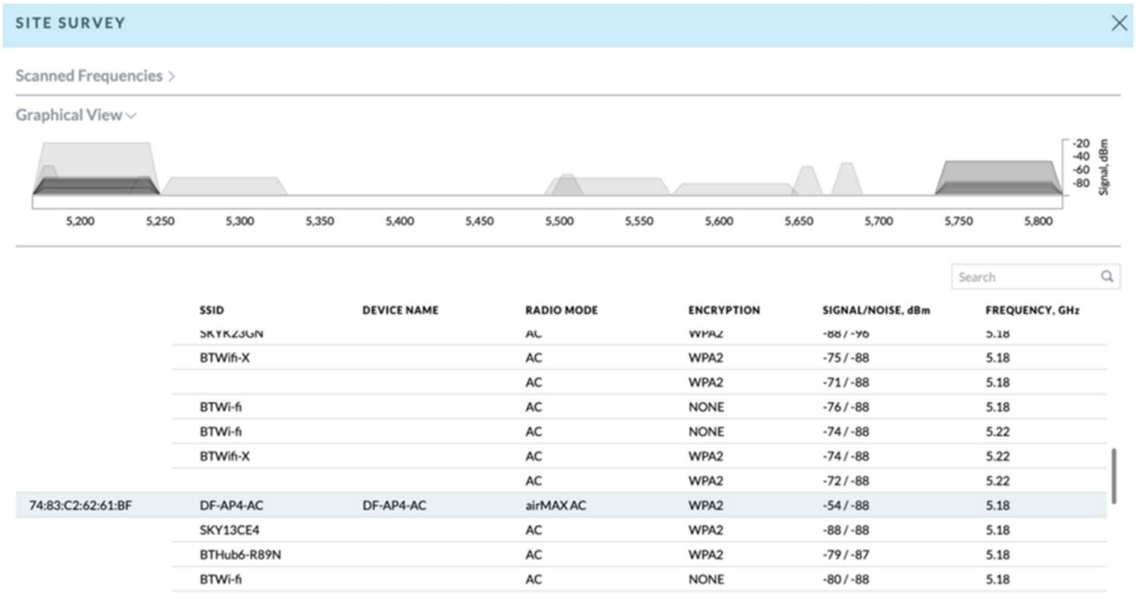


TXOP Values

Based on this indicative information, Sky engineers were dispatched to the location with the necessary tool to determine the RF environment, potential interferers and means to locate any source.

The Sky Q platforms mesh connectivity on the 5GHz radio interface operating on channel 36-48 was impacted, focusing the primary investigation on devices operating on the same channel space.

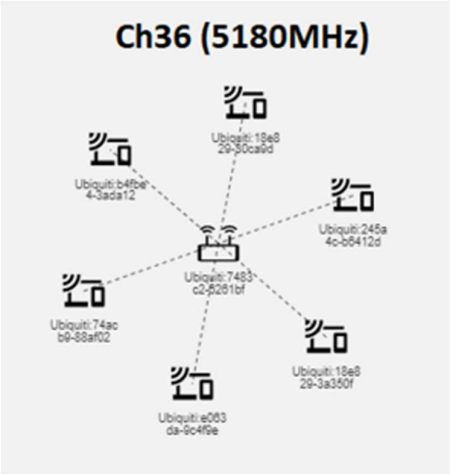
A scan of the 5GHz band surfaced a suspect AP operating on channel 36, where the device type was known to be associated with an outdoor specific product.



Local Scan

In order to validate the field engineer's suspicions, the device MAC was investigated and found to indeed belong to an RF outdoor product, Ubiquiti RP-5AC-Gen2

Additionally, it appeared to be part of a larger P2MP deployment:



Although the potential site of the node appeared to make itself obvious, triangulation with a directional antenna and signal strength analysis were employed to locate the site.

Data gathered by the field engineering team was collated and submitted to Ofcom's Spectrum Investigation Team and a formal case opened on 14th March for a breach of IR2030 by operating a fixed outdoor service within the 5150- 5250 MHz frequency band.
A request was made to Ofcom to expedite the investigation due to the number of customers affected. This was noted.

5.3 Service Restoration

Ofcom's Spectrum Investigation Officers attended site on 16th March.
They were able to identify the source of the interference and contacted the service operator and they able to get the issues addressed immediately.

The telemetry data below gives a visualisation of the removal of the interferer where the 5GHz data TXOP value returns to the pre-7th March operating values.