



OFCOM CONSULTATION RESPONSE

STRENGTHENING THE UK'S RADIO SPECTRUM REGULATORY FRAMEWORK FOR INNOVATION

UAV-BORNE MULTI-BAND SYNTHETIC APERTURE RADAR, LOW-POWER COEXISTENCE LICENSING AND UK SPACE-INSTRUMENT COLLABORATION

Executive summary

This response is based on practical experience operating a specialist UAV-borne P-, L- and C-band Synthetic Aperture Radar (SAR) system in the UK. The present licensing process can require a new Demonstration and Trial authorisation for individual deployments even where the same instrument, emissions and operating procedures are being repeated.

The organisation invites Ofcom to consider a longer-term route for repeat commercial use of low-power specialist active-sensing equipment. A possible model would authorise a defined instrument and operating envelope, with non-interference/no-protection conditions, power and altitude limits, geographic coordination controls and a simplified notification process for individual deployments.

The Radaz Explorer RD350 provides a useful case study. The manufacturer's technical description identifies maximum operating ranges of 400-450 MHz (P-band), 1225-1375 MHz (L-band) and 5250-5650 MHz (C-band), with a maximum transmitting power of 100 mW (20 dBm) in each band. The equipment is configurable to accommodate telecommunications-authority restrictions.

A further use case is the potential contribution of characterised UAV-borne L-band SAR measurements to UK calibration and validation activity for spaceborne radar missions. NASA's NISAR mission operates an L-band SAR centred at 1260 MHz, within the RD350's stated L-band tuning range, and NISAR calibration and validation activities make use of ground targets and airborne L-band SAR measurements. This creates a credible basis for exploring UK-based cross-calibration, validation and science collaboration, subject to instrument characterisation and agreement with the relevant mission teams.

A robust and sustainable UK licensing framework would also strengthen the exportability of UK-developed remote-sensing services and workflows. In EU and wider international markets, specialist airborne radar equipment and its associated operational processes may be less familiar, and regulatory arrangements may be less mature or less consistent. The ability to demonstrate that the equipment and workflow have been assessed and operated in the UK under a clear Ofcom coexistence framework would provide useful regulatory credibility and assurance. It would help UK operators show overseas regulators, partners and clients that the approach is technically controlled, proportionate to interference risk and sensitive to the circumstances of each application.

POTENTIAL LICENSING MODEL FOR OFCOM CONSIDERATION

Element	Possible approach	Purpose
Authorisation basis	Approved instrument or equipment type plus operating envelope	Avoid repeating the full technical assessment for unchanged equipment
Licence duration	3-5 years, with periodic confirmation of unchanged technical parameters	Provide operational certainty while retaining regulatory oversight
Deployment process	Electronic notification or simplified site check for operations within the approved envelope	Reduce administrative delay for repeat surveys
Coexistence conditions	Non-interference/no-protection, defined EIRP, bandwidth, altitude, duty cycle and exclusion zones	Protect incumbents proportionately to actual risk
Escalation	Full bespoke review where a mission falls outside the pre-assessed envelope	Retain detailed scrutiny for higher-risk or unusual operations

QUESTION 1: DO YOU THINK WE SHOULD PERMIT MORE COMMERCIAL TRIAL ACTIVITY UNDER THE DEMONSTRATION AND TRIAL LICENCE, INCLUDING WITH PAYING CUSTOMERS, AND WHETHER WE SHOULD IMPOSE ANY LIMITATIONS ON THIS?

Confidential? No

Yes. Where the technical activity is unchanged, the presence of a paying customer does not itself increase radio-frequency interference risk.

Commercial trial activity could therefore be permitted where the operation remains inside the technical limits Ofcom has assessed. Conditions could include defined maximum power and EIRP, authorised frequency ranges and bandwidths, antenna and unwanted-emission limits, altitude restrictions where relevant, geographic coordination or exclusion zones, non-interference/no-protection status, a requirement to cease transmission if harmful interference is identified, and retention of basic operating records.

The central principle is that limitations should relate to spectrum risk and coexistence rather than the commercial status of the activity.

QUESTION 2: DO YOU HAVE ANY OTHER SUGGESTIONS FOR HOW THE TRANSITION FROM TRIAL TO COMMERCIAL DEPLOYMENT COULD BE IMPROVED?

Confidential? No

The organisation would welcome an explicit progression from successful Innovation and Trial licensing into longer-term operational authorisation for repeat specialist users.

A possible mechanism would be an instrument-based low-power operational licence. Once the operator has demonstrated a defined instrument and supplied an acceptable baseline coexistence assessment, Ofcom could approve an operating envelope covering the equipment identity, maximum power/EIRP, frequency ranges, bandwidths, emission characteristics, antenna characteristics, maximum altitude, permitted classes of location and any required exclusion or coordination zones.

Subsequent commercial deployments within that envelope could then use a short electronic notification or automated location check. Operations outside the approved envelope would remain subject to bespoke assessment.

This would establish a clearer progression from research, to demonstration, to commercial trial, to routine authorised use.

QUESTION 3: DO YOU THINK IT WOULD BE BENEFICIAL TO ENABLE SOME LONGER-TERM LICENSING OPTIONS FOR INNOVATION AND TRIAL LICENCES?

Confidential? No

Yes. Longer-term authorisation would be particularly useful for universities, research organisations and specialist commercial operators using low-volume scientific instrumentation repeatedly but intermittently.

A three-to-five-year period is a practical model for consideration. An annual declaration could confirm that the equipment and core technical parameters remain unchanged, with full reassessment triggered only by material changes to frequencies, power, emissions, equipment configuration or the agreed coexistence envelope.

Longer tenure would improve the ability to plan customer frameworks, research programmes, staff capability and capital investment while preserving Ofcom's ability to intervene where spectrum conditions change.

QUESTION 4: DO YOU THINK IT WOULD BE BENEFICIAL TO ENABLE FASTER PROCESSING OF LOW POWER INNOVATION AND TRIAL LICENCE APPLICATIONS, BASED ON LIGHTER-TOUCH ASSESSMENT? ARE THERE ANY PARTICULAR FREQUENCY BANDS OR LOCATIONS OFCOM SHOULD LOOK TO PRIORITISE?

Confidential? No

Yes. A risk-based approach would be useful for low-power specialist sensing systems, provided that airborne operation is assessed using more than conducted transmitter power alone.

For example, the RD350 manufacturer states a maximum transmitter power of 100 mW (20 dBm) in each of its P-, L- and C-band channels. Its technical operating ranges are 400-450 MHz, 1225-1375 MHz and 5250-5650 MHz respectively.

For airborne sensing, the assessment should also consider EIRP, antenna pattern, operating altitude, bandwidth, duty cycle, propagation and the characteristics of incumbent receivers.

An initial lighter-touch regime could prioritise rural and sparsely populated sites, agricultural and forestry locations, remote infrastructure sites, established research areas and other locations where coexistence analysis demonstrates a low probability of interaction with incumbent systems.

QUESTION 5: DO YOU HAVE ANY OTHER SUGGESTIONS FOR IMPROVING OFCOM'S CURRENT APPROACH TO INNOVATION AND TRIAL LICENSING?

Confidential? No

A reusable technical profile for approved equipment could reduce duplicated work for both Ofcom and the operator.

The profile could contain transmitter specifications, antenna patterns, bandwidths, emissions, operating altitude and other information required for coexistence assessment. For each deployment, the operator would submit only the location, date or window, altitude and required frequencies.

Where the proposed operation remains inside the approved technical and geographic envelope, authorisation could be automatic or notification-based. A digital record would also provide Ofcom with an auditable history of operations and a mechanism for introducing new restrictions if spectrum use changes.

QUESTION 6: ARE THERE NEW APPROACHES TO MANAGING COEXISTENCE FOR BESPOKE SPECTRUM LICENSING REQUESTS THAT WE SHOULD IMPLEMENT TO SPEED UP THE PROCESS?

Confidential? No

A tiered risk model could be considered.

- Green category: the equipment and operation remain within pre-defined low-risk limits, allowing automated or notification-only approval.
- Amber category: the equipment is already characterised, but the location or operating circumstances require additional coordination and a simplified assessment.
- Red category: the proposal materially departs from the pre-assessed parameters or is close to a particularly sensitive incumbent system, so a full bespoke review continues to apply.

This could be supplemented by geographic exclusion zones, time-based sharing, frequency agility, altitude limits, power/EIRP limits, duty-cycle controls and non-interference/no-protection conditions.

QUESTION 7: DO YOU THINK THAT THERE SHOULD BE A GREATER EXPECTATION FOR APPLICANTS TO PROVIDE THE COEXISTENCE ANALYSIS TO SUPPORT THEIR BESPOKE SPECTRUM REQUESTS?

Confidential? No

Yes, where the requirement is proportionate and applicants have access to enough information to undertake a meaningful analysis.

For repeat specialist equipment, the operator could provide a reusable baseline assessment covering conducted power, EIRP, antenna pattern, centre frequency, occupied bandwidth, unwanted and out-of-band emissions, altitude, duty cycle, propagation assumptions and credible worst-case interference scenarios.

Ofcom would still need to make the final comparison against protected or sensitive incumbents where receiver locations or protection criteria are not publicly available.

A standard Ofcom coexistence-analysis template would make this process more consistent and accessible.

QUESTION 8: WHAT DO YOU THINK IS THE MINIMUM SECURITY OF TENURE NEEDED TO SUPPORT INNOVATIVE USES?

Confidential? No

For the operating model described in this response, three years would provide useful minimum certainty, with five years offering greater support for commercial and research planning.

Any longer-term licence could retain an immediate power for Ofcom to require cessation or modification in the event of demonstrated harmful interference, alongside a reasonable notice mechanism for wider changes in spectrum policy or incumbent use.

QUESTION 9: SHOULD WE CONSIDER EXTENDING THE LOCAL ACCESS LICENSING REGIME TO OTHER BANDS AND TECHNOLOGIES?

Confidential? No

The principle of geographically and temporally constrained access could be useful for specialist active-sensing technologies where coexistence can be demonstrated.

A comparable mechanism for low-power radar and scientific instrumentation could allow local or temporary access without implying unrestricted national availability. Technical, geographic and temporal conditions could be applied as required.

Over time, automated coordination could support increasingly dynamic access where sufficient incumbent data and protection criteria are available.

QUESTION 10: WHAT DO YOU THINK SHOULD BE OFCOM'S FOCUS IN UPDATING HOW WE LICENCE SPECTRUM TO SUPPORT WIRELESS INNOVATION? DO YOU HAVE ANY OTHER COMMENTS OR VIEWS ON THE ISSUES DISCUSSED?

Confidential? No

The organisation's experience suggests value in licensing approaches that respond to the actual interference risk and repeatability of an operation, rather than requiring a substantially new process solely because an activity has moved from trial to routine commercial use.

One option for consideration is a low-power shared-spectrum operational licence, or equivalent bespoke framework, following successful Innovation and Trial operation. It could apply to an approved instrument, permit routine commercial use within a defined envelope, operate on non-interference/no-protection terms where appropriate, use geographic and temporal controls, require electronic notification where necessary, and remain valid for a multi-year period.

There is also a wider UK industrial and export benefit in establishing a common, robust and sustainable domestic approach. A well-defined Ofcom framework would give UK companies a credible regulatory reference point when taking specialist sensing services into EU and international markets, particularly where local regulators or customers have limited familiarity with the sensor technology and end-to-end workflow, or where coordination processes are less developed. UK authorisation would not replace compliance with the rules of the host country, but it would provide evidence that the

equipment and operating methodology have been subject to a mature coexistence assessment and that controls for power, location, altitude, frequency and application setting are embedded within the workflow. That assurance could reduce perceived regulatory and technical risk for overseas clients and partners, strengthen the credibility of UK suppliers, and help convert domestic innovation into exportable services and international collaboration.

Spaceborne and airborne SAR collaboration is an example of the type of activity that could benefit. The RD350's stated L-band operating range of 1225-1375 MHz encompasses NISAR's 1260 MHz L-band centre frequency. NISAR is in its science-operations phase and its calibration/validation framework uses ground targets such as trihedral corner reflectors and airborne L-band SAR resources.

A UK field capability could therefore explore coincident NISAR and UAV measurements using accurately surveyed reflectors, GNSS control, ground observations and repeat UAV acquisitions. The aim would be to provide high-resolution airborne reference data for cross-calibration, geolocation assessment, radiometric comparison and validation of derived products, subject to suitable characterisation of the UAV radar and agreement with the mission teams.

Time-critical satellite underflights are a particularly useful example of why a standing, carefully constrained authorisation can be operationally preferable to mission-by-mission licensing. Satellite acquisition times are fixed, while UAV operations remain dependent on aviation constraints, weather and site access.

QUESTION 11: ARE THERE ANY OTHER SIGNIFICANT NON-SPECTRUM BARRIERS TO INNOVATION FOR WIRELESS SERVICES THAT YOU ENCOUNTER?

Confidential? No

For airborne remote sensing, spectrum licensing sits alongside aviation requirements, land access, equipment compliance, weather and site-specific operational controls.

The cumulative lead time can make coordinated scientific observations difficult, particularly where an airborne acquisition needs to coincide with a satellite overpass or another external event.

Closer coordination between spectrum regulation, the UK space sector and organisations involved in advanced UAV operations could make it easier to establish predictable UK calibration and validation environments for active sensors while maintaining the required protections.

Appendix A - Technical basis and collaboration opportunity

A1. RD350 TECHNICAL CHARACTERISTICS RELEVANT TO LICENSING

Parameter	Manufacturer-stated characteristic
System type	Drone-borne multi-band interferometric Synthetic Aperture Radar
P-band operating range	400-450 MHz, maximum 50 MHz bandwidth
L-band operating range	1225-1375 MHz, maximum 150 MHz bandwidth; full HH/HV/VH/VV polarimetry
C-band operating range	5250-5650 MHz, maximum 400 MHz bandwidth
Maximum transmitter power	100 mW (20 dBm) in each band
Navigation	Integrated IMU and dual-frequency GNSS
Research access	Radar and navigation raw data available to the user
Configurable operation	Operating mode may be modified to meet telecommunications-authority restrictions

A2. NISAR RELEVANCE

NASA's NISAR mission uses L-band and S-band SAR. The NISAR Science Users' Handbook identifies the L-band radar centre frequency as 1260 MHz, which falls within the RD350 manufacturer's stated 1225-1375 MHz L-band operating range.

NASA describes NISAR calibration and validation as including comparison with known ground targets, including trihedral corner reflectors, and the use of contemporary remotely sensed measurements. NASA also identifies airborne UAVSAR L-band data as a resource for NISAR calibration and validation.

This frequency overlap alone does not make the UAV system a calibrated reference instrument. A credible collaboration would require radiometric and geometric characterisation, traceable ground control, suitable calibration targets, coordinated acquisitions and agreement with the relevant NISAR science or calibration teams.

A3. POSSIBLE UK DEMONSTRATION

1. Establish or use a suitable UK test site with accurately surveyed trihedral corner reflectors.
2. Characterise the UAV radar radiometrically and geometrically, including antenna pattern and stable operating parameters.
3. Plan UAV acquisitions to coincide with selected NISAR passes and suitable NISAR L-band observation modes.
4. Collect GNSS-controlled ground measurements and, where relevant, vegetation, soil-moisture or deformation observations.
5. Compare radar response, geolocation, polarimetric behaviour and derived products between the UAV, ground targets and NISAR data.
6. Use the exercise as a practical Ofcom coexistence case study for a repeat low-power airborne active-sensing authorisation.

References

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