October 29, 2025

Spectrum Awards
Ofcom
Riverside House
2a Southwark Bridge Road
London SE1 9HA

Re: Award of 1492-1517 MHz Spectrum for Mobile Services

Dear 1.4 GHz Authorisation Team:

The GPS Innovation Alliance ("GPSIA") submits this letter in response to the proposal by the Office of Communications ("Ofcom") to auction the upper block of the 1492-1517 MHz band (the "Upper 1.4 GHz Band") for mobile use.[1/] This Consultation was recently brought to the attention of GPSIA, and we have endeavored to gather and submit relevant data that has not previously been submitted in the record.

GPSIA observes that Ofcom's objective is to achieve optimal use of the band, including making additional spectrum available for 4G, 5G, and future mobile services, and allocating the spectrum to the most efficient user.[2/] Ofcom's objective also includes "ensuring that appropriate protections are put in place for systems using adjacent frequency bands."[3/] It is in this last connection that GPSIA comments here to bring important information to Ofcom's attention for careful consideration. We respectfully urge Ofcom to take into account extensive technical data from directly relevant studies conducted in the United States that seem to be absent from the record Ofcom has amassed to date. Those studies demonstrate the substantial risks of harmful interference from high-powered terrestrial base station transmitters to receiver devices utilizing adjacent satellite spectrum, including Global Navigation Satellite System ("GNSS") devices that receive signals in the 1525-1559 MHz Mobile Satellite Service ("MSS") downlink band for critical high-precision applications, such as precision agriculture, construction, and automated or assisted guidance of automobiles.

These studies were conducted between 2016 and 2018 in connection with consideration by the U.S. Federal Communications Commission ("FCC") of proposals to repurpose MSS spectrum for terrestrial use[4/] and were the subject of a comprehensive report by the U.S. National

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1/ *See* Ofcom, *Award of 1492-1517 MHz Spectrum for Mobile Services*, Consultation (Feb. 4, 2025) ("Ofcom Consultation").

2/ *See* Ofcom Consultation at 6.

3/ *Id.*

4/ *See LightSquared Technical Working Group Report et al.*, Order and Authorization, 35 FCC Rcd 3772, ¶¶ 9-16 (2020) (describing the terrestrial network Ligado proposed to deploy using its MSS license in conjunction with its ancillary terrestrial component authority).

Telecommunications and Information Administration ("NTIA").[5/] The NTIA Report was largely validated by an independent analysis by a panel of the National Academies of Sciences, Medicine, and Engineering in the U.S.[6/] These results are meaningful to operations proposed for the United Kingdom because GNSS manufacturers operate on a global basis, and products tested in the United States are generally the same as those used in the U.K.

In particular, the studies examined the effect of high-powered terrestrial base station transmissions in close spectral proximity to bands utilized by highly sensitive satellite receivers. The engineering challenges to coexistence in this context are formidable if not prohibitive. GNSS receivers evolved over the past four decades in a spectrum environment that was purposefully kept quiet as a matter of sound international and national spectrum policy, and so were developed to operate below the "noise floor" (the level of radiofrequency noise occurring naturally and apart from manmade sources). While GNSS receivers are typically designed to withstand near-band transmissions hundreds of millions of times stronger than GNSS signals, the terrestrial base station signals contemplated by Ofcom's proposals would be billions of times stronger than the GNSS signals received on Earth, depending on proximity to a base station.

In proposing to establish conditions for the use of the Upper 1.4 GHz band for mobile services, Ofcom considered that the adjacent 1.5 GHz band is currently used for MSS operations (to which Ofcom refers as "Satcom") on maritime vessels, aircraft, and land[7/] and that "[s]ome satellite terminals receiving in this band, specifically those using the Inmarsat network and especially older terminal models, are susceptible to blocking from mobile network transmissions at frequencies below 1518 GHz."[8/] Ofcom has not, however, considered that a variety of applications other than MSS terminals rely on the 1.5 GHz band to operate. In particular, GNSS devices used for high-precision applications rely on both signals in the 1518-1559 MHz MSS bands and GNSS signals in the 1559-1610 MHz RNSS band to derive highly precise locations. For the reasons set forth in this letter, GPSIA respectfully requests that Ofcom reconsider its proposals in light of the potential for harmful interference to high-precision GNSS/MSS receivers.

Ofcom's Proposed Conditions for EIRP Limits in the Upper 1.4 GHz Band Will Impact Vital GNSS-Based Services

As noted above, in proposing conditions for operation in the Upper 1.4 GHz band, Ofcom considered potential blocking interference to MSS terminals. While noting the potential for

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5/ Assessment of Compatibility Between Global Positioning System Receivers and Adjacent Band Base Station and User Equipment Transmitters Technical Memorandum at 9, *attached to*, Letter from Kathy Smith, Chief Counsel, NTIA (filed Dec. 4, 2020) ("NTIA Report").

6/ National Academies of Sciences, Engineering, and Medicine, *Analysis of Potential Interference Issues Related to FCC Order 20-48 (2022)*, at 58 (2022) ("NAS Report"), https://nap.nationalacademies.org/catalog/26611/analysis-of-potential-interference-issues-related-to-fcc-order-20-48.

7/ *See* Ofcom Consultation at 64.

8/ *See id.* While the Ofcom Consultation refers to Inmarsat, the company was acquired by Viasat. Accordingly, GPSIA refers to the entity as Viasat.

interference to those current and legacy terminals, Ofcom nonetheless proposed to adopt EIRP limits of (i) 68 dBm/5 MHz in the 1492-1512 MHz band; and (ii) 58 dBm/5 MHz in the 1512-1517 MHz band,[9/] which are the maximum EIRP limits contained in the 2017 reports supporting CEPT Electronic Communications Committee ("ECC") Decision (17)06 cited by Ofcom[10/] as well as a recent ITU recommendation.[11/] As the data summarized below and in Exhibit 1 show, operations at these power levels will be extremely problematic for many high-precision GNSS/ MSS receivers.

GNSS devices used for high-precision applications rely on both MSS signals in the 1518-1559 MHz band and GNSS signals in the 1559-1610 MHz band to receive augmentation or corrections data services. The data transmitted in the MSS band is used by high-precision receivers using the GNSS band to apply corrections to the GNSS receivers' positioning, navigation, and timing ("PNT") outputs. A GNSS receiver will report its position on the Earth within a margin of error, as anyone who has tried to meet a driver using uncorrected GNSS on their phone can attest. The errors arise from many sources, including: satellite signal delay and bias (the satellite moves slightly during the signal transmission); satellite clock error (the satellite clock is not precisely synchronized); satellite orbit error (the satellite is not physically at the exact reported location in orbit); ionospheric distortion of the signal (and the ionospheric effects are constantly changing); and tropospheric distortion of the signal (the ionosphere and the troposphere need different compensation based on different mathematical models).

Correction service providers, including GPSIA members as well as other international market participants, operate networks of ground stations (referred to as reference stations) which collect real-time data by monitoring GNSS satellites. The MSS-delivered data stream is processed in real time, along with data received from GNSS satellites to correct for sources of error in the GNSS signals, to generate a stream of real-time data which is used by a suitably equipped GNSS receiver to produce a far more accurate PNT output than would be produced by simply processing the GNSS observables from even a high quality GNSS receiver. The resulting centimeter-level of resolution is necessary to support critical commercial applications such as precision agriculture, automated control of construction machines, automated guidance of automobiles, and precise navigation of unmanned aerial vehicles.

9/ *See id.*

10/ Ofcom cites "The Harmonized Use of the Frequency Bands 1427-1452 MHz and 1492-1518 MHz for Mobile/Fixed Communications Networks Supplemental Downlink (MFCN SDL)," approved November 17, 2017, corrected March 2, 2018, CEPT, at 7 ("ECC Decision (17)06"). ECC Decision (17)06 in turn relied on ECC Report 263, "Adjacent Band Compatibility Studies Between IMT Operating in the Frequency Band 1492-1518 MHz and the MSS Operating in the Frequency Band 1518-1525 MHz," approved March 3, 2017, CEPT ("ECC Report 263") and ECC Report 269, "Least Restrictive Technical Conditions for Mobile/Fixed Communications Networks in 1427-1518 MHz," approved November 17, 2017, corrected March 2, 2018, CEPT ("ECC Report 269").

11/ *See* ECC Decision (17)06 (relying on ECC Report 263 at 10 and ECC Report 269 at 10, 15); International Telecommunication Union, Recommendation ITU-R M.2159-0 at 4, 7, 9 (2023), https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2159-0-202312-I!!PDF-E.pdf ("ITU-R Recommendation M.2159").

For historical, legal and contractual reasons, high-precision MSS/GNSS receivers are designed to receive the signals across the entire 1525-1559 MHz MSS band in addition to the 1559-1610 MHz GNSS band. Because of international coordination requirements for use of the MSS band, the frequencies used by MSS operators, including Viasat internationally and Ligado Networks in the U.S., were subject to change if future international coordination agreements required it.[12/] MSS operators also reserved the right to change the frequencies on which they transmitted their satellite services if needed to meet business needs. Because of this, MSS providers required that parties using their MSS services be capable of receiving signals anywhere in the applicable downlink frequency range (from 1525-1559 MHz, depending on the region involved), regardless of the frequencies on which they were transmitting at any point in time.[13/] As a result, manufacturers of high-precision combined MSS/GNSS receivers implemented filtering to address adjacent band signals at the lower end of the MSS band, which has little spectrum separation from high-powered terrestrial base station signals in the Upper 1.4 GHz Band.

The interference test results compiled in the NTIA Report show that a very high percentage of high-precision combined MSS/GNSS receivers would suffer harmful interference from terrestrial transmissions in the Upper 1.4 GHz Band at the power levels proposed by Ofcom, which is unsurprising based on the design characteristics of high-precision combined MSS/GNSS receivers and the close spectral proximity of the band.

The NTIA Report summarized the results of rigorous tests of 84 high-precision receivers in a table which is included in the chart attached as Exhibit 1. The table reports results in terms of the power level at the receiver input, measured in dBm/10 MHz. The receive power was derived from the EIRP at the base station transmitter (measured in dBm/5MHz) by assuming that the receiver is located 100 meters from the transmitter and using the free space path loss model.

12/ *See Flexibility for Delivery of Communications by Mobile Satellite Service Providers in the 2 GHz Band, the L-Band, and the 1.6/2.4 GHz Band*, Notice of Proposed Rulemaking, 16 FCC Rcd 15532, ¶ 13 (2001) (explaining that the administrations governing the L-band satellite operators developed and agreed upon a framework to facilitate annual and dynamic spectrum assignment agreements among the operators, to be revisited annually, and that "unlike most international coordinations that create permanent assignments of specific spectrum, the operators' assignments could change from year to year based on their marketplace needs"); *see also Establishing Rules and Policies for the use of Spectrum for Mobile Satellite Services in the Upper and Lower L-band*, Report and Order, 17 FCC Rcd 2704, ¶¶ 1, 15 (2002) (assigning Motient spectrum in the lower L-band that has been internationally coordinated and stating that the Commission "agree[s] that all satellite licenses are granted subject to the uncertainties of international coordination").

13/ *See, e.g.*, Letter from Catherine Wang, Bingham, Counsel to Deere & Company, to Ms. Marlene H. Dortch, Secretary, FCC, IB Docket No. 11-109 *et al.* (filed Sep. 18, 2014); Letter from Catherine Wang and Tim Bransford, Bingham, Counsel to Deere & Company, to Ms. Marlene H. Dortch, Secretary, FCC, IB Docket No. 11-109 *et al.*, at 2 (filed Oct. 27, 2011) (highlighting that "precision GPS receivers by their nature must be wideband in order to obtain additional navigational data to provide precise measurements, and in addition, augmented receivers are designed to accept signals across the entire L-band in direct response to the requirement of L-Band satellite operators (Inmarsat and LightSquared itself) that earth terminals accommodate the satellite operators' decision to reassign downlink frequencies within the L-Band based on their own business needs").

The receive antenna was modeled as having -3 dBi gain in the direction of the base station and had an additional 3 dB of loss from receiving a linearly polarized signal with a circularly polarized antenna. The compiled test results show that at a transmitter EIRP of 58 dBm, Ofcom's proposed power level in the 1512-1517 MHz band, 72.6% of the tested receivers would experience a 1 dB degradation in C/N_0, 62% would experience a 3 dB degradation, and 60% would suffer a 5 dB degradation. A transmitter EIRP of 68 dBm in the band up to 1512 MHz would cause a 1 dB degradation in C/N_0 in 88.5% of receivers, a 3dB degradation in 69.7%, and a 5 dB degradation in 63.9% of the receivers tested.

These results are highly concerning to GPSIA, and we expect that they would have been concerning to Ofcom if they had been available prior to the initiation of the Ofcom Consultation. As one example of potential impacts, high-precision receivers are extensively used in precision agriculture applications, and thus will inevitably be present in the rural areas that Ofcom has identified as likely to be served using the Upper 1.4 GHz band.[14/] A 1 dB degradation in C/N_0 produces roughly a 25 percent increase in noise due to interference. GPSIA has extensively documented the adverse effects of such a degradation in submissions to the U.S. FCC, and most recently in its submission to the NAS panel, including impacts on continuity of high-precision operations.[15/]

The NTIA Report finds that degradations in C/N_0 – whether 1 dB, 3 dB, or 5 dB – can be correlated with errors in signal acquisition and positional accuracy, which are the critical operating parameters for GNSS-dependent devices.[16/] The NAS Report observed that interference can affect continuity of operations, which can be highly problematic for high-precision devices. The NAS found that "[l]osing signals even for a very short time during a surveying operation … could cause immense operational problems for the user."[17/] Agricultural operations also require continuity in GNSS-supported applications because they guide agriculture machines continuously while they are conducting planting, application of inputs such as water, fertilizer and pesticides, and harvesting. As the recent EU GNSS market report noted, "GNSS delivers huge value to the [agricultural] sector by helping farmers to guide machinery and track their livestock, ensuring farm operations remain as efficient as possible."[18/]

Ofcom's Reliance on Guidance from the CEPT's ECC Should be Revisited

Ofcom bases its proposed base station power limits on ECC Decision (17)06,[19/] which was adopted in 2017. Use of GNSS applications has grown substantially since then, and in any

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14/ Ofcom Consultation at 17, n.14.

15/ Letter from Alex M. Damato, Acting Executive Director, GPS Innovation Alliance., to Dr. Jon Eisenberg, Director, Computer Science and Telecommunications Board, NASEM, National Academies of Sciences, (Feb. 22, 2022).

16/ *See* NTIA Report at iii, 7-10, 32.

17/ NAS Report at 55.

18/ European Union Agency for the Space Programme (EUSPA), *EO and GNSS Market Report* 34 (2024).

19/ *See* Ofcom Consultation at 64; ECC Decision (17)06 at 7.

case were not considered in the decisions and accompanying reports. [20/] As ECC Decision (17) 06 states, the proposed EIRP limits were based on deployment requirements and compatibility studies that were available at that time.[21/] As discussed above, more recent studies evaluating the potential impact of mobile services on MSS services operating in adjacent spectrum are available, and those studies confirm that GNSS devices using MSS augmentation signals, particularly high-precision receivers, operating in close proximity to mobile services are at risk from high-power terrestrial operations in adjacent bands.

It is noteworthy that ITU-R Recommendation M.2159 neither adopted nor endorsed the proposed EIRP limits in ECC Decision (17)06.[22/] This recommendation acknowledges the interference risks to existing mobile earth station ("MES") terminals operating in the MSS band and outlines a series of technical standards as options to manage interference. Annex 4 outlines a series of power flux density limits to be applied where an "administration decides to apply additional regulatory compatibility measures to reduce the risk of interference in specific geographical areas for land MES. This may be local areas or countrywide."[23/] Annex 4 further observes that "[i]n general, land MES are deployed in a ubiquitous manner and operate nationwide. Therefore, IMT operations may not be feasible in the band 1 512-1 518 MHz in such cases."[24/] ITU-R Recommendation M.2159 also contains an important time element – the technical options that it outlines are divided into a Phase 1, with restrictions based on the susceptibility to interference of current MES, and Phase 2, which could be implemented when more interference resistant MES are widely deployed. Annex 10 lists Ofcom's proposed 58 dBm/5 MHz power limit as a Phase 2 option and explicitly notes that this option would be associated with "higher interference." Based on the studies described above, both the proposed 68 dBm/5 MHz power limit in the 1492-1512 MHz band and the 58 dBm/5 MHz in the 1512-1517 MHz band present significant risks of interference to high-precision GNSS/MSS devices. The 68 dBm/5 MHz power limit is particularly problematic. GPSIA notes that other options have been proposed which would mitigate these risks.[25/]

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[20/] While ECC Decision (17)06 was modified in 2018, those modifications were not related to the EIRP limits proposed by Ofcom.

[21/] *See* ECC Decision (17)06 at 7.

[22/] ITU-R Recommendation M.2159 at 3.

[23/] *Id.* at 10.

[24/] *Id*.

[25/] Viasat observes that "the ITU has only just finished its studies regarding continued protection of 1.5 GHz earth station terminals from adjacent band interference[,]" making it "simply infeasible to plan for terminal updates before the ITU has set standards for the operations in the band." Response of Viasat, Inc. to Ofcom Consultation, *Award of 1492-1517 MHz Spectrum for Mobile Services*, at 15 (filed April 25, 2025) ("Viasat Response"). Viasat offers a number of alternatives, including "Option 3" in ITU Recommendation M.2159-0 and adopt "an out-of-band EIRP of -41 dBM/MHz for [International Mobile Telecommunications] base stations," Viasat Response at 15; *see also* ITU-R Recommendation M.2159 at 3 (limiting deployments in the 1.4 GHz band to indoor or small cell deployments and allocating a suitable guard band within the Upper 1.4 GHz band); Viasat Response at 12.

GPSIA encourages Ofcom to take the matters set forth above into consideration in setting conditions for use of the Upper 1.4 GHz Band. The subject of this letter is critical not only to the MSS, but also to GNSS, and the material provided is essential to the development of a complete record for the Ofcom Consultation.

Should you have any questions about the foregoing, please do not hesitate to contact me.

Very truly yours,

/s/ Lisa Dyer
Lisa Dyer
Executive Director
GPS Innovation Alliance

EXHIBIT 1

	Transmit Signal Strength		Path Loss	Received Signal Strength		NTIA Summary Table K1 (pg 365) - HP GPS Rcvr Interference Power Levels						
	1492 -1502 MHz	1518 - 1525 MHz	Distance to Rcvr	1492 -1502 MHz	1518 - 1525 MHz	1525-1535MHz Interferer	Number of Rcvrs			Percentage of Rcvrs		
	Tx Pwr Level	Tx Pwr Level	**0.10 km**	Pwr @ Rcvr Input	Pwr @ Rcvr Input	Pwr Level @ Rcvr Input	Degradation in C/No					
	dBW EIRP	EIRP dBW	FSPL (dB)	dBW EIRP	dBW EIRP	(dBm/10MHz)	1dB	3dB	5dB	1dB	3dB	5dB
	≤ -13	≤ -23	76 dB	≤ -89	≤ -99	≤ -75	1			1.2 %		
	≤ -8	≤ -18	76 dB	≤ -84	≤ -94	≤ -70	3			3.6 %		
	≤ -3	≤ -13	76 dB	≤ -79	≤ -89	≤ -65	8			9.5 %		
	≤ 2	≤ -8	76 dB	≤ -74	≤ -84	≤ -60	12	5	2	14.3 %	10.0 %	4.0 %
	≤ 5	≤ -5	76 dB	≤ -71	≤ -81	≤ -57	16	7	4	18.6 %	14.8 %	8.8 %
	≤ 7	≤ -3	76 dB	≤ -69	≤ -79	≤ -55	18	9	6	21.4 %	18.0 %	12.0 %
	≤ 9	≤ -1	76 dB	≤ -67	≤ -77	≤ -53	21	10	7	25.2 %	19.6 %	14.4 %
	≤ 11	≤ 1	76 dB	≤ -65	≤ -75	≤ -51	24	11	8	29.0 %	21.2 %	16.8 %
	≤ 12	≤ 2	76 dB	≤ -64	≤ -74	≤ -50	26	11	9	30.9 %	22.0 %	18.0 %
	≤ 15	≤ 5	76 dB	≤ -61	≤ -71	≤ -47	28	14	11	33.8 %	28.0 %	22.8 %
	≤ 17	≤ 7	76 dB	≤ -59	≤ -69	≤ -45	30	16	13	35.7 %	32.0 %	26.0 %
	≤ 21	≤ 11	76 dB	≤ -55	≤ -65	≤ -41	39	19	17	45.7 %	37.7 %	33.5 %
	≤ 22	≤ 12	76 dB	≤ -54	≤ -64	≤ -40	43	19	18	51.2 %	38.0 %	36.0 %
	≤ 28	≤ 18	76 dB	≤ -48	≤ -58	≤ -34	50	24	23	59.5 %	48.0 %	46.0 %
	≤ 32	≤ 22	76 dB	≤ -44	≤ -54	≤ -30	56	29	26	66.7 %	58.0 %	52.0 %
	≤ 33	**≤ 23**	76 dB	≤ -43	≤ -53	≤ -29	57	30	27	68.2 %	59.6 %	53.6 %
Ofcom +58dBm @ 1517	≤ 37	**≤ 27**	76 dB	≤ -39	≤ -49	≤ -25	61	31	30	**72.6 %**	62.0 %	60.0 %
	≤ 38	**≤ 28**	76 dB	≤ -38	≤ -48	≤ -24	63	31	30	75.0 %	62.8 %	60.4 %
	≤ 41	≤ 31	76 dB	≤ -35	≤ -45	≤ -21	69	32	31	82.1 %	65.2 %	61.6 %
	≤ 42	≤ 32	76 dB	≤ -34	≤ -44	≤ -20	71	33	31	84.5 %	66.0 %	62.0 %
Ofcom +68dBm @ 1512	≤ 45	**≤ 35**	76 dB	≤ -31	≤ -41	≤ -17	74	35	32	**88.5 %**	69.7 %	63.9 %
	≤ 47	≤ 37	76 dB	≤ -29	≤ -39	≤ -15	73	37	33	86.9 %	74.0 %	66.0 %
	≤ 52	≤ 42	76 dB	≤ -24	≤ -34	≤ -10	81	47	47	96.4 %	94.0 %	94.0 %
	≤ 57	≤ 47	76 dB	≤ -19	≤ -29	≤ -5	81	47	47	96.4 %	94.0 %	94.0 %
	≤ 62	≤ 52	76 dB	≤ -14	≤ -24	≤ 0	82	47	47	97.6 %	94.0 %	94.0 %
	≤ 67	≤ 57	76 dB	≤ -9	≤ -19	≤ 5	84	50	50	100.0 %	100.0 %	100.0 %

Ofcom Proposed BS EIRP level of +58dBm/5MHz @ 1517 MHz => +28dBW EIRP + Receiver Filter Rejection at 1517 ~ 1dB = **+27dBW EIRP**

Ofcom Proposed BS EIRP level of +68dBm/5MHz @ 1512 MHz => +38dBW EIRP - Receiver Filter Rejection at 1512MHz ~ 3dB = **+35dBW EIRP**

Assumes Rcvr Ant Effenciency (dBi to dBm) = Avg GNSS Rcvr +5dBi Ant Gain - 3dB Polarization - 8dB Pattern Loss = -6dB

Columns J through P are pulled directly from the NTIA report for for tolerable LTE signals levels vs impact probbalility of High Precision GNSS receivers.

Column I represents maximum Rcvr input power in dBW EIRP from 1518-1525 MHz. Max Rcvr Pwr (dBw EIRP) = Max Rcvr Power 1525MHz (Column J) + Rcvr Ant Efficiency (6dB) - 30dB (dBm to dBW)

Column H represents maximum Rcvr input power in dBW EIRP from 1492-1502 MHz based on expected receiver filter rejection of 10dB.

Column G is Free Space Path Loss at ~ 1510MHz for given distance of 100m.

Columns C thru F reflect Base Station dBm and EIRP dBW levels at 1492-1502 & 1518-1525 MHz bands respectively that correspond to the values in tolerable Receiver input levels (Column J) at a distance of 100m from the base station.