Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Rohde & Schwartz USA, Inc.	)	ET Docket No. 19-88
Request for Waiver of Sections 15.205 and 15.231 of the Commission's Rules	)	

COMMENTS OF THE
NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

The National Academy of Sciences, through its Committee on Radio Frequencies (hereinafter, CORF[1]), hereby submits its comments in response to the Commission's March 28, 2019 Public Notice in the above-captioned docket. In these comments, CORF addresses concerns regarding potential interference to protected radio astronomy observations at 76-81 GHz and recommends waiver conditions designed to mitigate such interference significantly.

I. The Role of Radio Astronomy and Its Unique Vulnerability to Interference.

CORF has a substantial interest in this proceeding, as it represents the interests of scientific users of the radio spectrum, including users of the Radio Astronomy Service (RAS) band. These users perform extremely important, yet vulnerable, research.

As the Commission has also long recognized, radio astronomy is a vitally important tool used by scientists to study our universe. It was through the use of radio astronomy that scientists discovered the first planets outside the solar system, circling a

[1] See the Appendix for the membership of the Committee on Radio Frequencies.

distant pulsar. The Nobel Prize–winning discovery of pulsars by radio astronomers has led to the recognition of a widespread population of rapidly spinning neutron stars with gravitational fields at their surface up to 100 billion times stronger than on Earth's surface. Subsequent radio observations of pulsars have revolutionized understanding of the physics of neutron stars and have resulted in the first experimental evidence for gravitational radiation, which was recognized with the awarding of another Nobel Prize. Radio astronomy has also enabled the discovery of organic matter and prebiotic molecules outside our solar system, leading to new insights into the potential existence of life elsewhere in the Milky Way galaxy. Radio spectroscopy and broadband continuum observations have identified and characterized the birth sites of stars in the Milky Way, the processes by which stars slowly die, and the complex distribution and evolution of galaxies in the universe. The enormous energies contained in the enigmatic quasars and radio galaxies discovered by radio astronomers have led to the recognition that most galaxies, including our own Milky Way, contain supermassive black holes at their centers, a phenomenon that appears to be crucial to the creation and evolution of galaxies. Synchronized observations using widely spaced radio telescopes around the world give extraordinarily high angular resolution, far superior to that which can be obtained using the largest optical telescopes on the ground or in space.

The critical scientific research undertaken by RAS observers, however, cannot be performed without access to interference-free bands. Notably, the emissions that radio astronomers receive are extremely weak—a radio telescope receives less than 1 percent of one-billionth of one-billionth of a watt (10^{-20} W) from a typical cosmic object. Because radio astronomy receivers are designed to pick up such remarkably weak

signals, radio observatories are particularly vulnerable to interference from in-band emissions, spurious and out-of-band emissions from licensed and unlicensed users of neighboring bands, including emissions that produce harmonic signals in the RAS bands, even if those human-made emissions are weak and distant.

II. Radio Astronomy Observation at 70-80 GHz and Protection of the RAS.

The RAS has a primary allocation at 76-81 GHz in the U.S. Table of Allocations. The frequency line at 80.578 GHz is among those of greatest importance to radio astronomy. *See, Handbook on Radio Astronomy* (ITU Radiocommunications Bureau, 2013) at page 37, Table 3.2. Similarly, the 76-81 GHz band is included in one of the bands preferred for continuum observation. *Id.* at page 35, Table 3.1. RAS use of this band is important for observations of complex organic molecules. Currently, U.S.-based RAS facilities with receivers at this frequency band include the Green Bank Observatory in West Virginia and the Kitt Peak Observatory in Arizona.[2] In the longer term, the Next Generation Very Large Array will also be capable of observations in this band.[3]

Rohde & Schwarz seek a waiver to operate their QPS 201 Personal Security Scanner system at power levels that exceed the emission limits set forth in Section 15.231 of the Commission's rules and in a restricted frequency band under Section 15.205 of the Commission's rules. The waiver request contains only a generic and conclusory statement (on page 3) that the need to protect against harmful interference is "fully satisfied by the QPS 201 PSS operations in the 70-80 GHz band because of its

[2] In the near future, the James Clerk Maxwell Telescope (JCMT) on Mauna Kea in Hawaii will be equipped with a receiver that operates in this band.

[3] *See,* http://ngvla.nrao.edu/image/ngvla-main-array. The ngVLA will have 214 antennas, primarily in New Mexico and Texas.

very low power, directed radiation, the propagation characteristics of this band and the exceedingly short transmissions," without providing (at least to the public) any documentation or analysis to support that claim.

In the absence of any available supporting documentation, CORF notes that in footnote 1 of the waiver request, Rohde & Schwartz request that the limit for the QPS 201 PSS "be set at 31,405 μV/m at 3 meters (8 dB higher than the 12,500 μV/m limit of Section 15.231(b))." To achieve ITU-R RA.769 spectral line threshold limits at 70-80 GHz,[4] the device would need to be located at least 70 kilometers from a radio astronomy facility observing in this band, assuming open-air propagation and an average atmospheric attenuation of 0.1 dB/km (appropriate for high, dry sites like Kitt Peak, AZ).[5] However, if the device is utilized indoors, inside a permanent solid building, the additional attenuation from the intervening structures could reduce the required separation distance considerably.

The 76-81 GHz RAS allocation is subject to Footnote US342, which provides that when making assignments to stations in other services at 76-86 GHz, "all practicable steps shall be taken to protect the radio astronomy service from harmful interference." CORF recommends that, in this case, the appropriate practical steps be a restriction on use of the QPS 201 to indoors only, or a separation distance of 70 km around RAS sites

[4] CORF notes that RAS primary allocations at 136-158.5 GHz are also at risk from spurious and unwanted emissions that correspond to the first harmonic of this device (140-160 GHz). Furthermore, as stated in US 246, "[n]o station shall be authorized to transmit" in the frequency range of 148.5-151.5 GHz. Thus, evidence demonstrating the suppression of harmonics should be provided before any waiver is granted.

[5] The proposed increase of 8 dB in the permitted emission limit increases the required separation distance by a multiplicative factor of 2.51 relative to the separation distance required by emission limits in Section 15.231(b), which, with no atmospheric attenuation, results in a separation distance of at least 122 km to achieve the ITU-R RA.769 spectral line threshold limit (-208 dB(W/m^{2}Hz)) for these increased emission limits. Adding atmospheric attenuation of 0.1 dB/km reduces the required separation limit to 70 km.

where observations occur in this band. These restrictions should not impede the intended use or deployment of these devices significantly, but will provide protection for RAS, which has a primary allocation in this band. CORF notes that Canadian authorities have limited use of the QPS 201 to indoors.[6] In a case involving a similar request for waiver of Part 15 rules for a security scanning device operating at 24.25-30 GHz, the Office of Engineering and Technology also required that the device be operated indoors only, as a condition of the waiver.[7]

III. Conclusion

While CORF always supports the sharing of spectrum use where it can be done without harmful interference, the important science performed by radio astronomers cannot be performed without access to interference-free bands. Loss of such access constitutes a loss for the scientific and cultural heritage of all people. Accordingly, CORF recommends that if the QPS 201 waiver request is to be granted, that the grant

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[6] *See,* July 3, 2018 Letter Martin Proulx, Director General, ISED, to Mr. Angelo Pallotta, Rohde & Schwartz Canada, Inc., at Annex, Requirement e.3 ("This device shall be used indoor only").

[7] *See, In the Matter of SafeView, Inc.,* 21 FCC Rcd. 8814 (2006) at paras. 25 and 29. Certain other conditions required therein of SafeView in order to minimize and remedy interference to other users would also be appropriate to provide protection in the present case:

> 5). SafeView shall create and maintain a record of installations of all devices operating under this waiver, including the identity of the customer, type of location (*e.g.*, airport or government building), and street address and/or coordinates. This list shall be made available to the Commission and to NTIA upon request.
> 6). SafeView shall inform purchasers that SafeScout imaging devices may not be resold to third parties for use at another installation in the United States unless appropriate arrangements are made to meet all of the conditions of this waiver.
> 7). This waiver shall apply to the SafeScout imaging device produced by SafeView as described herein and provided no major changes are made to the transmitter circuitry or to the housing and position of the antenna masts that would increase the devices radiated power or bandwidth.

21 FCC Rcd at 8823-24.

In connection with implementing a condition similar to the SafeView condition "6" above, any grant of the Rohde & Schwartz Waiver Request should require that Rohde & Schwartz alert its customers in writing of the requirement to operate the device only indoors.

be subject to conditions discussed herein, including the requirement for indoor use or a 70 kilometer separation distance.

Respectfully submitted,

NATIONAL ACADEMY OF SCIENCES'
COMMITTEE ON RADIO FREQUENCIES

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Appendix

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