



National Radio Astronomy Observatory

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Written Ex Parte Communication

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: Use of Spectrum Bands Above 24 GHz for Mobile Radio Services, GN Docket No. 14-177; IB Docket Nos. 15-256, 97-95; WT Docket No. 10-112

Dear Ms. Dortch:

The National Radio Astronomy Observatory (NRAO), along with its sister observatories the Green Bank Observatory (GBO, <http://greenbankobservatory.org/>) and the Long Baseline Observatory (LBO, <https://public.lbo.us/>), all operated by Associated Universities, Inc (AUI, <http://www.aui.edu/>) under contract with the National Science Foundation, operates most of the US radio telescopes that stand to be affected by use of spectrum bands above 24 GHz for 5G mobile service as discussed in the above-mentioned dockets.

NRAO, on behalf of itself, the GBO and the LBO, has the following comment on the ex-parte written contribution from T-Mobile dated October 2, 2017, the “Coexistence Study” that is found at <https://ecfsapi.fcc.gov/file/10022172210545/TMobile%205G%20Coexistence%20Study%2010.2.2017.pdf>. The comment is in regard to two points: I) The need for consistency in defining the coordination zones that will be used to achieve compatibility between operations of 5G (aka IMT-2020) and radio astronomy, and II) the relevant level of unwanted emissions of IMT-2020 equipment, which is in fact the FCC’s own unwanted emissions mask.

I. A consistent derivation of the size of coordination zones is needed to protect radio astronomy in the 31.3 – 31.8 GHz band

T-Mobile discusses the coordination radii that will ensure compatibility between 5G and radio astronomy operations in spectrum bands on either side of 31.8 GHz, on the basis of unwanted emissions masks for 5G base stations (BS) and user equipment (UE). Real-world masks describing the unwanted emissions from future 5G systems are necessarily uncertain in the absence of operating 5G systems, so T-Mobile derives plausible masks for 5G operations based on existing equipment. As noted by T-Mobile, these masks are more restrictive, emitting at lower levels, than the existing FCC mask that is used to gauge compliance with FCC regulations and is shown in Figure 7 of T-Mobile’s contribution. On this account, the T-Mobile masks allow smaller coordination zones than if the FCC emissions mask had been used.

This creates a regulatory inconsistency with possible harmful consequences for radio astronomy operations. The issue is that unwanted emissions from T-Mobile’s hoped-for operations in the 31.8 – 33.4 GHz band fall most heavily into the immediately adjacent passive band at 31.3 – 31.8 GHz, which is subject to US 246 and US 74. US 246 prohibits stations from transmitting in the band while US 74 limits the protection afforded to

radio astronomy to offending stations that operate in violation of the technical standards or criteria applicable to the service in which they operate. It is US 74 that governs the level of interference that radio astronomy must accept in the band at 31.3 – 31.8 GHz, and it relies on the FCC emissions mask.

In this way, 5G equipment legitimately operating in accord with the FCC emissions mask, and lying outside a coordination zone defined by T-Mobile’s more restrictive mask, could also legitimately interfere with radio astronomy operations in the 31.3 – 31.8 GHz band.

T-Mobile has no means of enforcing compliance with the unwanted emissions mask used in its coordination studies, nor does it propose any means of doing so, for instance a change to the FCC’s own mask. But when coordination radii are determined using the T-Mobile mask, for equipment that is only held to meet a more permissive FCC mask, the way is created to generate interference about which radio astronomy would have no right to complain to the FCC. Coordination zones should be defined using the technical standards and criteria that the FCC uses to decide compliance with its rules, ie, the FCC’s unwanted emissions mask.

II. The FCC mask should be used in compatibility studies of unwanted emissions levels from 5G aka IMT-2020 (in ITU-R terminology) equipment.

The T-Mobile mask for emissions into the 31.3-31.8 GHz band is inconsistent with the US position regarding unwanted emissions to be used in compatibility studies at the ITU-R for WRC-19 Agenda Item 1.13, that is, the work of ITU-R Working Party 5D and ITU-R Task Force TG 5/1 regarding IMT-2020, aka 5G.

The US contributed to the definition of IMT-2020 characteristics during the work of WP 5D, and Tables 1 and 2 here give the levels of unwanted emissions that are relevant to the 31.3 – 31.8 GHz band, as excerpted from Attachment 2 to the defining document https://www.itu.int/dms_ties/itu-r/md/15/tg5.1/c/R15-TG5.1-C-0036!!MSV-E.docx. The term “Spurious domain limits” in Tables 1 and 2 corresponds to -13 dBm/MHz in the 32 GHz studies contributed by the US to TG 5/1, coincident with the FCC mask. ***The FCC mask used in ITU-R studies internationally should also be used in compatibility studies within the US.***

TABLE 1

BS spectrum mask for Outdoor scenarios and $P_{Tx} \geq 34.5$ dBm in the frequency range 24.25-33.4 GHz

Frequency offset from “edge of transmission” Δf	Emission limit	Measurement bandwidth
$0 \leq \Delta f < 20$ MHz	-5 dBm	1 MHz
$20 \text{ MHz} \leq \Delta f < 400$ MHz	-13 dBm	1 MHz
$\Delta f > 400$ MHz	Spurious domain limits	1 MHz

TABLE 2

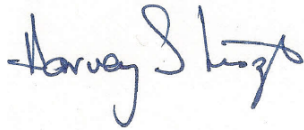
UE spectrum mask

Frequency offset from “edge of transmission” Δf	Emission limit	Measurement bandwidth
$0 \leq \Delta f < 20$ MHz	-5 dBm	1 MHz
$20 \text{ MHz} \leq \Delta f < 400$ MHz	-13 dBm	1 MHz
$\Delta f > 400$ MHz	Spurious domain limits	1 MHz

III. Some general considerations

As T-Mobile noted there are many factors that go into achieving compatibility, and some specific ITU-R studies presently underway at TG 5/1 find only modestly larger coordination radii even when the FCC mask is used, depending on particular circumstances such as the amount of clutter loss. Separation distances could also be smaller if stricter mandatory unwanted emissions limits were enacted. There are relatively few US radio astronomy stations and protecting their use of the spectrum is a matter of paying attention to detail in the context of mutual cooperation between the radio astronomy and 5G operators, under the watchful eye of the FCC.

Respectfully submitted,

A handwritten signature in blue ink that reads "Harvey S. Liszt". The signature is written in a cursive style with a large initial 'H' and 'L'.

Harvey S. Liszt

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Astronomer and Spectrum Manager

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