

FCC SPECTRUM DEVELOPMENTS

June 2021 – May 2022

CORF Meeting
May 2022

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I. High Altitude Platforms 71-76/81-86/92-95 GHz

HAP station = transmitter located at an altitude of 20 to 50 km and at a specified, fixed point relative to the Earth. (FCC)

May 2020 – FCC Notice of Proposed Rulemaking:

Propose new technical rules to enhance commercial use of the 71-76 GHz, 81-86 GHz, and 92-94/94.1-95 GHz bands (“70/80/90 GHz Bands”). Most notably, the FCC proposes to allow transmissions at 71-76 and 81-86 GHz (“70/80 GHz Bands”) to moving ships, airplanes, drones and aerostats.

October 2021: FCC seeks additional comments re use of 70/80/90 GHz Bands for HAPS

I. HAPS at 70/80/90 GHz

Current U.S. Allocations:

<u>Band</u>	<u>Allocations</u>	<u>Use/Footnotes</u>
<i>71–74 GHz</i>	Fixed, Fixed Satellite, Mobile, and Mobile Satellite	Primarily terr. Fixed Satellite: s-E downlinks
<i>74–76 GHz</i>	Fixed, Fixed Satellite, Mobile, Broadcasting, and Broadcasting Satellite	Primarily terr. Fixed Satellite: s-E downlinks
<i>76–81 GHz</i>	RAS , Radio Location	Footnote US342
<i>81–84 GHz</i>	Fixed, Fixed Satellite, Mobile, Mobile Satellite, and Radio Astronomy	Primarily terr. Fixed Satellite: E-s uplinks US161 US342
<i>84–86 GHz</i>	Fixed, Fixed Satellite, Mobile, and Radio Astronomy	Primarily terr. Fixed Satellite: E-s uplinks US161 US342
<i>86–92 GHz</i>	EESS and RAS	US246

I. HAPS at 70/80/90 GHz

CORF re-filed earlier 70/80/90 GHz Comments in HAPS proceeding

CORF 70/80/90 GHZ Comments:

- Oppose new proposed terrestrial to air/ship links in these bands

- If links to be authorized, then protect RAS:

- >uplinks at 81-86 GHz only
- >downlinks and aircraft-to-aircraft limited to 71-76 GHz
- >coordination with protected RAS per RA.769, noting line of sight issues
- >oppose increases in max. EIRP or transmit power

- If links to be authorized, then protect EESS:

- >minimum 500 MHz guard band
- >OOBE limits per Res. 750
- >facilities targeting aircraft should protect EESS in real time by nulling or cessation of transmissions

II. Proposed New Rules for 57-64 GHz Radars

July 2021 – FCC proposes new rules for radars at 57-64 GHz

Background:

- > Section 15.255 of FCC rules sets parameters for unlicensed device operation in 57-71 GHz band: indoor/outdoor communication devices such as WiGig wireless local area networking (WLAN) devices and outdoor fixed point-to-point communication links, as well as *field disturbance sensors* (FDS) used in *mobile devices* currently restricted to short-range interactive motion sensors (SRIMS)
- > EESS allocations at 57-59.3 GHz – key data for weather
- > After initial victory by CORF, in Nov. 2017 FCC reverses and authorizes use of unlicensed 57-71 GHz devices on *aircraft*. This “opened the door.”
- > Dec. 2018 grant of *waiver to Google for Soli* touchless hand gesture tech at 57-71 GHz to operate at *higher power levels than under rule*.

II. Proposed New Rules for 57-64 GHz

2019 Leica requests waiver for UAV transmission at 60-64 GHz, with conditions negotiated with CORF to protect passive services.

July 2020 : FCC Grants Leica Waiver Request:

- 1) device to operate in the 60-64 GHz band at a *maximum +19 dBm peak EIRP*.
- 2) installed to *transmit on a horizontal plane* with respect to the UA on which it is mounted to limit emissions above the horizon. UA operation shall be limited to line-of-sight only.
- 3) *Out-of-band emissions shall not exceed -51.3 dBm EIRP/MHz; transmit duty cycle shall not exceed 50% over any 40 milliseconds interval; and transmission shall occur only* when the device is in motion.
- 4) Devices must operate below a *maximum altitude of 400 feet above ground level*, unless UA: (1) is flown within a 400-foot radius of a structure; and (2) *does not fly higher than 400 feet above the structure's immediate uppermost limit*.
- 5) *U.S. sales shall not exceed 400 devices in the first year and up to 800 per year for subsequent years.* Device shall not be marketed for retail consumer markets.

II. Proposed New Rules for 57-64 GHz

April 2021: FCC granted *waivers* to a number of companies to operate radars in the 57-64 or 60-64 GHz frequency band in *passenger motor vehicles* to perform *detection of children* inadvertently left in hot weather and other related passenger safety functions, at *higher power levels than specified* in the applicable FCC rule.

-Waivers contain specific conditions negotiated with NTIA on behalf of federal agencies, presumably to provide some protection to EESS observations at 57-59.3 GHz:

- > Device to operate at a maximum *+13 dBm EIRP*, *+10 dBm* transmitter conducted output power, and *+13 dBm/MHz* power spectral density.
- > Each individual radar device shall not exceed a *maximum transmit duty cycle* of 10% in any 33 milliseconds interval.
- > Restricted to *factory installation* in the *interior* cabin of *new* passenger motor vehicles and shall not be marketed in after-market add-on products.
- > Operations under this waiver may not be used to *transmit data*.

II. Proposed New Rules for 57-64 GHz

Now, FCC seeks comments on a *general rule for FDS devices*, rather than continuing to operate on a waiver order by waiver order basis:

all FDS devices that limit their operating frequencies to the 57-64 GHz portion of the band would be *permitted to transmit* at:

- a *maximum* of 20 dBm average EIRP
- 13 dBm/MHz *average* EIRP power spectral density
- 10 dBm transmitter *conducted output power*
- *maximum 10% duty cycle* restriction within any 33 ms interval

Based on ETSI Standard EN 305 550

FCC also seeks comments on *loosening current limits on airborne use* of 57 GHz FDS – Only used in aircraft with a *high RF attenuation body* (e.g. commercial airliners), and cannot be used in *wireless avionics intra-communication* applications where external structural sensors or external cameras are mounted on the outside of the aircraft structure.

II. Proposed New Rules for 57-64 GHz

CORF Comments:

-FCC *should not expand airborne use* of 57-59 GHz

>Amount of *current use is unclear*, so unreasonable to expand without data

>Danger of *low level* insidious interference

-FCC proposing to *abandon architecture* that was basis for prior airborne use:

Access point stations affixed to the *interior ceiling* in commercial passenger aircraft to deliver internet/entertainment products wirelessly to travelers' laptops/tablets, or to in-seat display monitors

Replacing with personal device approach based on flawed Google study. Actual testing required.

-FCC *should not increase allowed power* – Increased risk to EESS. ETSI is tech standard, not regulation, and does not address airborne use.

II. Proposed New Rules for 57-64 GHz

CORF Comments:

-UAVs/Wireless Avionics:

-*Leica Waiver* for UAVs was for limited use, with protections for EESS
This should not be expanded.

-Continue prohibition on use of band for wireless avionics.

III. LEO/NGSO Satellite Order - Boeing

2020: FCC Orders authorizing or modifying Low Earth Orbit satellite constellations for Kuiper, One Web and Space X

November 2021: Boeing authorized to construct and operate a non-geostationary orbit (NGSO) fixed-satellite service (FSS) system using frequencies in portions of the *V-band*, and to operate inter-satellite links (ISLs) using frequencies in portions of the V-band and the *Ka-band*.

>V-band constellation will consist of 132 low Earth orbit (LEO) satellites in a circular orbit at an altitude of 1056 kilometers and 15 highly inclined NGSO satellites at an altitude between approximately 27,355 and 44,221 km.

>Initially provide broadband Internet and communications services to users in the U.S., Puerto Rico and USVI. Once full deployment of the 147-satellite system is complete, the V-band Constellation would provide high speed data access to consumers on a global basis.

III. LEO/NGSO Satellite Order - Boeing

Uplinks:

47.2-50.2 GHz, subject to the conditions that

-per footnote US342, Boeing takes “*all practicable steps to protect* radio astronomy observations from harmful interference from its operations in the 48.94-49.04 GHz band” and

-any future grant of *earth station* licenses for the V-band system will be subject to the following condition: in the 48.94-49.04 GHz band, operations must be *coordinated* with radio astronomy stations operating on a co-primary basis in this band.

50.4-51.4 GHz

To address *unwanted emissions into EESS observations at 50.2-50.4 GHz*: Boeing must comply with limits set forth in WRC-19 *Resolution 750*, but subject to any future FCC actions regarding whether or not to adopt such limits into its rules.

III. LEO/NGSO Satellite Order - Boeing

Downlinks:

37.5-40.0 GHz, subject to the condition that

-operations at 37.5-38.0 and 40.0-40.5 must coordination with Federal Space Research Service facilities per Rec. ITU-R SA.1396.

40.0-42 GHz, subject to the condition that

-per footnote US211, Boeing takes “all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference from its operations in the 40.5-42 GHz band....”

Inter-Satellite Links

65-71 GHz

IV. 24 GHz OOBE – UMFUS

April 2021 – FCC Public Notice seeking comments on implementing out-of-band-emission (“OOBE”) limits from active services at 24.25/24.45 and 24.75/25.25 GHz into the passive band at 23.6-24.0 GHz.

2017 – FCC enacted service rules for *fixed and mobile* operation in the 24.25-24.45 GHz and 24.75-25.25 GHz bands under the Upper Microwave Flexible Use Service (UMFUS).

UMFUS rules: emissions outside of a licensee’s assigned frequency block must be limited to -13 dBm/MHz , but FCC previously noted that ongoing international action at WRC-19 regarding International Mobile Telecommunications (IMT) OOBE limits necessary to protect passive sensors onboard weather satellites would be implemented here in the U.S.

WRC-19 modified a footnote to the International Table of Allocations to specify that *Resolution 750* applies to the 24.25-27.5 GHz band.

IV. 24 GHz OOB – UMFUS

Resolution 750 specifies unwanted emission limits in terms of *Total Radiated Power (TRP)* that *currently* apply to IMT stations, and stricter emission limits that are effective for IMT stations brought into use *after September 1, 2027*:

Table 1: WRC-19 Resolution 750 Unwanted emissions permitted within any 200 megahertz in the 23.6-24 GHz passive band		
Type of Station	Current TRP Limits	TRP Limits After Sept. 1, 2027
IMT Base Stations	–33 dBW	–39 dBW
IMT Mobile Stations	–29 dBW	–35 dBW

IV. 24 GHz OOBE – UMFUS

FCC 2021 PN:

-How to implement the new Res. 750 limits in the FCC's rules?

Unwanted emission limits in Resolution 750 and the current OOBE limits in the UMFUS rules are *specified differently*.

-Legal/Policy questions:

>Should revised limits be in the *UMFUS rules*, or in footnotes to *Table of Allocations*?

>Should unwanted emission limits of Resolution 750 apply only to “*IMT* base stations and mobile stations” or to *all* UMFUS operations?

IV. 24 GHz OOBE – UMFUS

CORF Comments:

- Importance of passive science at 23.6-24.0 GHz, and specific satellites and RAS facilities.
- WRC-19 *should have adopted* proposals of European Commission (-42 dBW in 200 MHz) or WMO (-55 dBW in 200 MHz) for Res. 750, as more in line with the degree of OOBE attenuation required to meet the ITU-R Recommendation RS.2017 interference thresholds.
- Revised OOBE standards for UMFUS should be in the *UMFUS rules themselves*.
- Revised OOBE standard should apply to *all UMFUS equipment operating at 24 GHz*: mobile and base stations (regardless of whether they meet the definition of IMT), as well as UMFUS fixed point-to-point and point-to-multipoint equipment.
 - > At very least, however, going forward the OOBE standard for fixed UMFUS operations should be no less stringent than that established in Res. 750 for IMT base stations.

IV. 24 GHz OOBE – UMFUS

August 2021:

House Committee on Science, Space and Technology sends letter to FCC Chair urging protection of EESS at 24 GHz.

Cites to CORF comments, among others, and endorses specific CORF advocacy points.

Impact of CORF

FCC proceeding still pending

V. 4.9 GHz Proposed Rules

October 2021: the FCC released another NPRM seeking comments on new rules for use of spectrum at 4940-4990 MHz (“4.9 GHz”).

- Band *currently* authorized for *public safety – terrestrial fixed/mobile*; some waivers granted for *aeronautical* use.

- RAS has *primary allocation* at 4990-5000 MHz.

- At 4940-4990 the ATA, Arecibo, NRAO, VLBA, and OVRO have protection under FN US385: “*Every practicable effort* will be made to avoid the assignment of frequencies to stations in the *fixed and mobile services* that could interfere with radio astronomy observations within the geographic areas given above. In addition, every practicable effort will be made to avoid assignment of frequencies in these bands to stations in the *aeronautical* mobile service which operate *outside* of those geographic areas, but which may cause harmful interference to the listed observatories. Should such assignments result in harmful interference to these observatories, the situation will be *remedied to the extent practicable*.” (Similar protection under US342)

V. 4.9 GHz Proposed Rules

Band *historically underused* by public safety entities (per FCC).

2020 - FCC enacted rules allowing states to *lease the spectrum to commercial users*. Those rules were controversial, and strongly opposed by public safety entities.

2021 - FCC *deleted the rules from 2020*, and offered yet another proposal. Key elements of the proposal from CORF's perspective are:

- allowing manned *aeronautical* use

- allowing *unlicensed* use

V. 4.9 GHz Proposed Rules

CORF Comments:

-*Oppose* proposal to revise Commission's rules to allow aeronautical use of the 4.9 GHz band.

-If FCC authorizes aeronautical use, then new rules should include provisions to *protect RAS observations at 4950-4990 MHz* from interference.

>Support prior FCC proposal for *maximum operational altitude of 1,500 feet* above ground level, and operation is *prohibited within 100 kilometers* of an observatory listed in footnotes US385 or US161.

>Procedures for notification when and if *additional RAS observatories* commence observing at this frequency band.

V. 4.9 GHz Proposed Rules

CORF Comments:

- Support FCC prior proposal to *limit aeronautical use of this band to 4940-4945 MHz*, thus creating a “*guard band*” of separation from the RAS allocation at 4950-4990 MHz.
- Support stringent OOB mask.
- Prohibit use by UAVs
- Terrestrial* use of 4.9 GHz: exclusion zones or prior coordination.
- Unlicensed use: exclusion zones and limit use to 4940-4945 MHz.

VI. NAS Views on Agenda Items for WRC-23

November 2021 – House Science Committee sent letter to U.S. Office of Science and Technology Policy (Science Advisor to the President) requesting Report supporting passive science in WRC-23 Agenda, *citing the NAS Views* document.

Impact of CORF

March 2022: *NAS Views on Agenda Items for WRC-23*, filed at FCC.

VII. FCC Inquiry on Receiver Standards

Traditional approach to interference prevention in FCC regulation: focus on transmitters - transmitted radiated power (watts, dBW or dBm) and on emission mask (out-of-band emission limits).

Is the “victim” receiver always faultless? (Ligado/GPS)

FCC goes through *cycles of exploring tighter receiver technical standards* in order to shoehorn potentially interfering services closer together, in the name of “spectrum efficiency.”

VII. FCC Inquiry on Receiver Standards

April 2022: New FCC Inquiry on receiver standards:

“Improved Receiver Interference Immunity Performance”

Voluntary industry standards?

FCC policy guidance?

FCC rules?

Heavy reliance on prior FCC *Technological Advisory Council* (TAC) White Papers, including proposal for “*Harm Claim Thresholds*” -- interference limits that must be exceeded before a user of the victim receiver can claim harmful interference.

Also influential: Reports from the *Silicon Flatirons Center* at the University of Colorado

VII. FCC Inquiry on Receiver Standards

CORF Comments:

- Passive services consider exceptionally small signal levels, demanding receivers with *unparalleled sensitivity*.
- Passive services *already take extensive steps to shield* receivers from interference.
- For EESS and RAS, Harm Claim Thresholds are a well-established principle, documented in ITU recommendations, and this approach should continue.
- Framework for an FCC Policy Statement* - Comments on the “nine basic principles” set forth in the FCC TAC White Paper on *Basic Principles for Assessing Compatibility of New Spectrum Allocations*

VII. FCC Inquiry on Receiver Standards

-Passive services are a source of *technical innovation*.

Conclusion:

“While adoption of spectral selectivity standards for receivers has the potential to enable more efficient spectrum usage in regions where multiple active services are allocated, this approach cannot be expected on its own to enable more intensive use of the spectrum in regions adjacent to bands allocated to the passive services. In such cases, protection will continue to be dependent on adequate restrictions on out of band and spurious emissions (especially harmonics) framed in a manner that appropriately anticipates aggregate effects from large numbers of transmitters, along with other protections such as geographical shielding for RAS. These protections should continue to be based on the internationally agreed thresholds for harmful interference codified in ITU-R RS.2017 and ITU-R RA.769.”

QUESTIONS?

THANKS!

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