

SE40 (meeting #75)

Web meeting, 7 – 10 December 2021

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Source: IARU R1

Subject: Amateur vs RNSS WI39

Group membership required to read? (Y/N)

N

Summary:

This document provides an initial analysis of the preliminary studies reported in section 6.1.9 of the draft ECC Report <RNSS_AS>. Reference document SE40(21)035_ANNEX 9_WD_draft ECC report RNSS Amateurs_Final

Proposal:

See the Annex 1 for the proposal. This is submitted for consideration in the draft ECC Report.

Background:

ANNEX 1:

The simulations presented in the working document estimate the “Interfered Area” around a range of amateur transmitters based on the calculations and analysis performed on the basis of the propagation model P.1546. The interfered area depends largely upon the transmitted power and the shape around the amateur transmitter depends on the antenna radiation pattern in the horizontal plane. Of course, the Interfered Area only exists in the presence of emissions from the amateur station.

Interfered Area

The interfered area derived from the output plots from the propagation model simulations and can be evaluated as a percentage of the area around an amateur radio station based on the typical density of active stations observed at the busiest times (See section 2.1.9:-). Only results assuming a clutter height = 0m were considered.

Table 1: Home Station 1

Power (Watts)	Location Probability %	Narrowband Interfered Area km ²	% Area	Wideband Interfered Area km ²	% Area
1	50	42	0.8483	31	0.31
	1	4769	0.94138	42	0.42
100	50	289280	5.786	254	2.54
	1	433438	8.6677	305	3.05
300	50	433	8.6667	433	4.33
	1	740	14.879	466814	4.668.15

Table 2: Satellite uplink

Up tilt Degrees	Location Probability %	Narrowband Interfered Area km ²	% Area ¹	Wideband Interfered Area km ²	% Area
5	50	53	0.0701	29	N/A
	1	56	0.0701	38	N/A
45	50	4344	0.0601	28	N/A
	1	5051	0.0701	38	N/A
90	50	38	0.0501	20	N/A
	1	38	0.0501	28	N/A

Table 3: Earth-Moon-Earth

Uptilt Degrees	Location Probability %	Narrowband Interfered Area km ²	% Area	Wideband Interfered Area km ²	% Area ²
5	50	167	0.2202	126	N/A
	1	173174	0.2302	168	N/A
45	50	153156	0.2002	79	N/A
	1	204204	0.2602	133	N/A
90	50	154	0.2002	95	N/A
	1	201	0.2603	154	N/A

¹ Assuming a similar Earth-Moon-Earth station density.

² Wideband modes are not achievable via Earth-Moon-Earth paths due to the challenging link budget.

Permanent Station

Power (Watts)	Location Probability %	Narrowband Interfered Area km ²	% Area	Wideband Interfered Area km ²	% Area
1	50	60	1.8	60	0.6
	1	136	4.1	76	0.76

From these tables it can be seen that any activity requiring antenna up tilt suggests an interfered area of 0.2603% at most between active stations.

The results for the Home Station 1 show a larger percentage area particularly for the most stringent propagation model settings. However these stations are not continuously transmitting and further account of the actual transmission time should be considered too.

The results for the Permanent Station show an interfered area less than 5% between active stations but in this case the transmissions may be evident for considerably longer and there may be a population of stations active at the same time.

Likelihood of Interference using a Home Station 1 Example:

The data in [section 2.1.7](#) on amateur station usage patterns enables the percentage of time that interference might occur to be estimated over the area estimated by the simulation study.

Taking the example of a Home Station 1 operating with a maximum transmitter power of 100W for narrow-band activity periods and radiosport over a one-year cycle:

Total hours of active operation: 108 hours = 1.23% of time p.a.

Active transmitting time = 0.62% of time p.a.

In this case the simulations estimate that interference exceeding the RNSS receiver protection threshold could be observed over 8.6677% of the area in any territory for just 0.62% of time, given the most stringent protection level (1% location probability) from a single Home Station 1.

Other considerations:

For Home Station 1 applications the amateur radio transmitter is not active for 100% of time and the antenna direction is not fixed. Therefore the following additional considerations will mitigate the potential for interference:

- Transmission time is not continuous. Usually, they will last just a few tens of seconds followed by an equal (but often longer) receiving period.
- The mean power of the most common amateur applications in use for narrow-band activity periods for weak signal operating and radiosport (voice (analogue) SSB) is around 30% of the maximum capability of the equipment.
- The interference area is directional with around a 1 in 5 chance of the maximum range being reached. For 80% of directions away from the amateur station the maximum range will be considerably less.
- Only 7.512% of Home Stations have the capability to transmit at a maximum power of 100 Watts and even fewer have the capability to transmit at a maximum power of 300W.
- [Wideband transmissions at power levels of 100W and 300W would require equipment with extremely high power output capability beyond the reach of amateur radio operators.](#)
- Almost all transmitting activity takes place outside normal business hours.

Commented [BL1]: This error spotted during the meeting.

[Contributors Note: Considerations for the other station types continue to be under development]

