EDGES MEMO #053

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To: EDGES Group
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Subject: Path loss needed to meet ITU RA769-1

The International Telecommunications Union (ITU) recommendation for Radio Astronomy (RA769-1) gives the levels which active services and unintentional radiators should meet in order to avoid interference with passive users in the radio astronomy bands. In the 25-327 MHz range the limits of receiver spectral flux are:

| Freq (MHz) | dBW/m$^2$/Hz |
|---|---|
| 25 | -249 |
| 73 | -258 |
| 151 | -259 |
| 327 | -258 |

The FCC and the WARC (internationally) set limits on the emissions from transmitters and unintentional radiators, like laptops etc. For unintentional radiators the limits are given by "Part 15" which are

| Freq (MHz) | Microvolts/m at 3 m |
|---|---|
| 30-88 | 100 |
| 88-216 | 150 |
| 216-960 | 200 |

The limits on transmitters are more complicated and for our purpose we assume that the transmitter meets part 15 and out of band emissions are 70 dB below the carrier. Given the RA769-1 levels, along with the part 15 and -70 dBc specifications I have computed the path loss between the device or transmitter and the radio astronomy antenna needed to meet RA769-1 and have plotted the results in Figure 1. I have also plotted the path loss for the line of sight (LOS) to an aircraft, LOS to a low Earth orbit satellite as well as the path loss for meteor and lunar scatter. Meteor scatter is always present for distances up to about 2000 km and the region or mutual linear visibility is much larger.

Comments on Figure 1.

1] Meteor scatter

Using the data from "Meteor burst communications" by Schilling I approximated the path loss by 195 dB at 65 MHz with an increase of 30 dB per decade of frequency. Meteor scatter can only be completely avoided by being more than 2000 km away from strong

transmitters. To some extent interference excision can be performed by using the signal levels in the FM bands as a “proxy” for the RFI. It is noted, however, that the - 70 dBc out of band specification is sufficient to avoid RFI in the radio astronomy bands

2] Moon reflections

The path loss from a moon reflection is insufficiently large to avoid signals larger than the RA769-1 levels from kilowatt class transmitters. Consequently any broadband radars in the 30-300 MHz range need to avoid the Radio Astronomy bands.

General comments on emission sources

Out of band emissions for low Earth orbit satellites should not be a problem if the satellites meet part 15. On the other hand part 15 levels from a laptop in an aircraft several hundred km away could exceed RA769-1 in the radio astronomy bands. Even low power broadband radars could be a serious problem, due to meteor scatter unless they are restricted more than 2000 km from a radio quite zone.

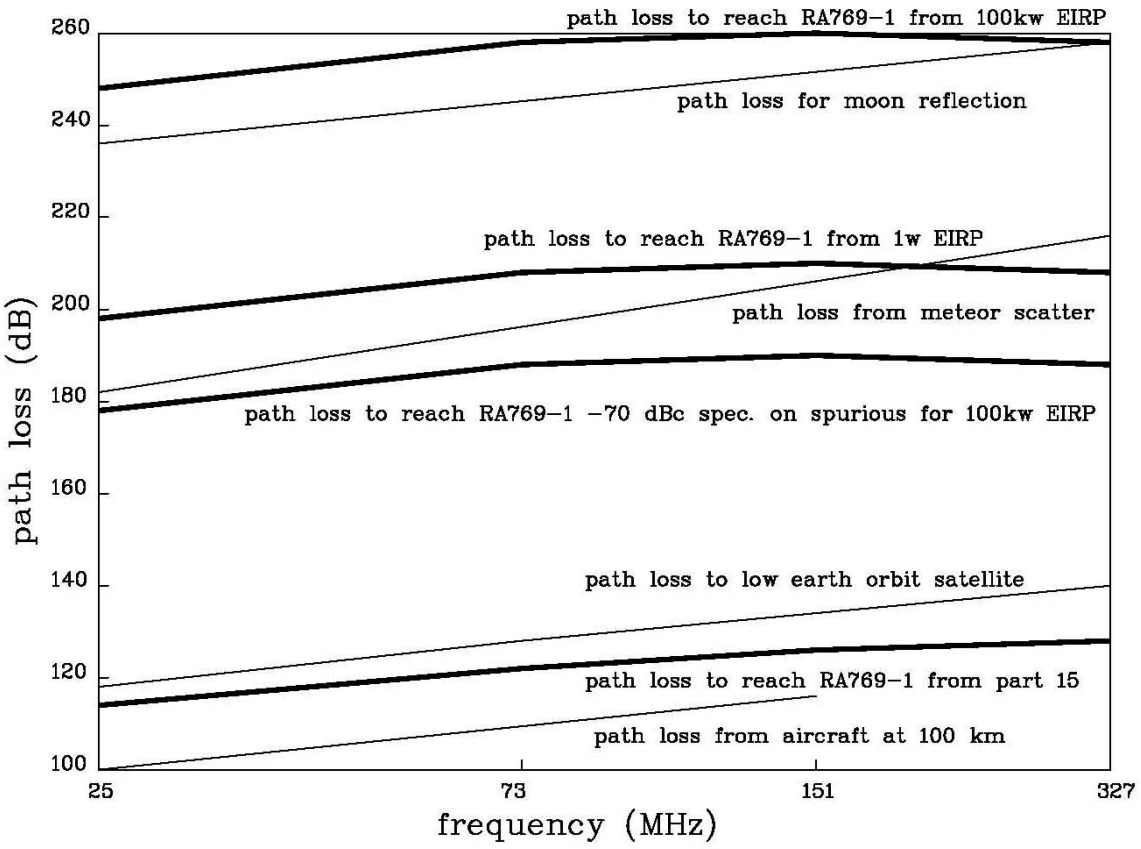


Figure 1. Path loss to meet RA769-1 assuming 100 kHz bandwidth for transmitters.