C-Band Interference Management

7 November 2019

verizon

MBX measurements at FSS earth stations

CBA threshold -128 dBm/MHz at LNA input.

Isotropic equivalent is -125 dBW/m²/MHz.

- Much of the country will not see on-horizon gains greater than this for any satellite position
- FSS antenna elevation~20°

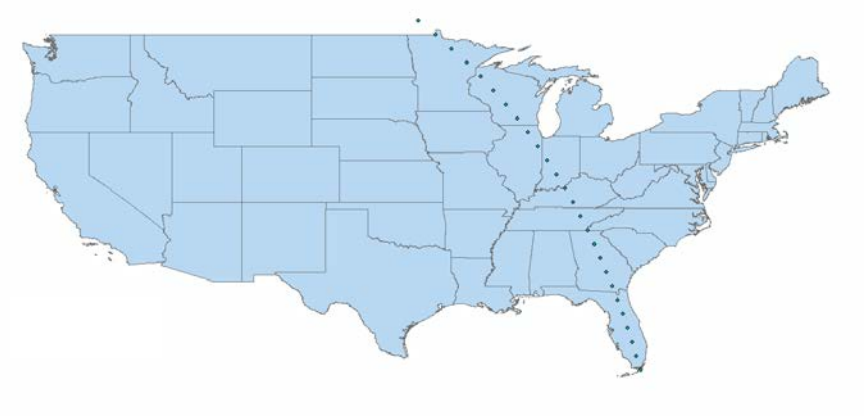
20 dBi standard gain horn Ae=-13.2dB-m

Prx=-125+30-13.2=-108.2 dBm/MHz

For 10 dB measurement S/N

No=-118.2 dBm/MHz

Te<20.4 dB-K or NFsys=1.4 dB



The western 2/3 of the US will always have FSS elevation angles greater than 20° (equivalent to an FSS on-horizon antenna gain of 0 dBi or less).

Example Equipment

20 dBi WR229 horn
12”x8”x24” long, 5 lbs.

WR229 LNA
60 dB gain
16.5 dB-K

5G NR OTA signal analyzer/
Spectrum analyzer
14 dB NF

Example Procedure.

MBX in-band signals from base stations can be identified by the Signal Analyzer, associated with a specific licensee via PLMN ID, and their strength recorded.

Sum MBX in-band signal powers and compare to the -59 dBm (plus filter rejection) blocking threshold to determine if an FSS de-sense condition exists.

- Resolution would depend on the distribution of signal strengths among licensees.

The contribution of each MBX base station's OOBE can be inferred from additional measurements near those base stations, once identified.

Licensee A's strongest base station is measured at -50 dBm/MHz.

An additional measurement near that base station shows that that base station OOBE is 40 dB/MHz lower.

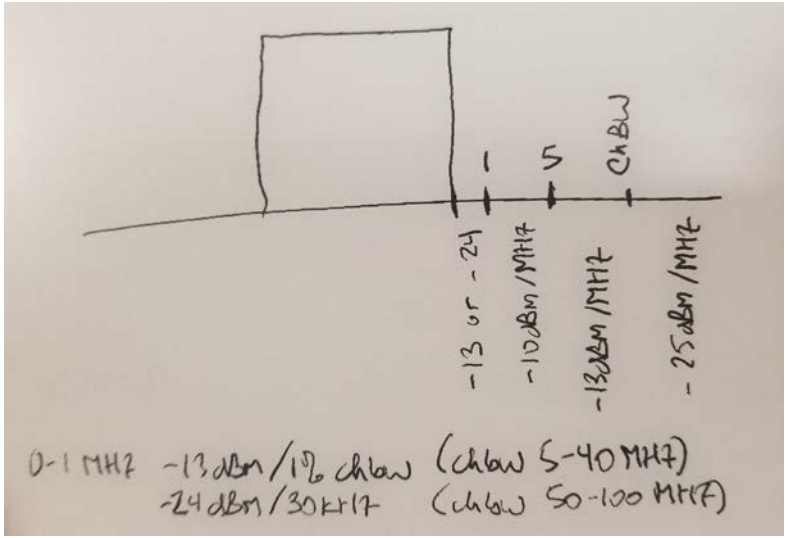
- Therefore Licensee A's base station OOBE is -90 dBm/MHz at the FSS receiver.

Review of 3GPP SEM

Given a 20 MHz guard band,

20 MHz channels always meet -25 dBm/MHz (FSS in-band).

As long as the upper edge of a channel of width W is W MHz away from the MBX-FSS edge, the 3GPP spec calls for -25 dBm/MHz OOBE.



Extracted from 3GPP 38.521-1, section 6.5.2.

Example Procedure.

MBX out-of-band signals will present themselves as a composite power at the Spectrum Analyzer input.

Scan the test antenna (e.g., 20 dBi horn) in azimuth and find the peak directional response.

In that direction, determine the FSS antenna gain and convert to a threshold .

- For example, if FSS gain were 0 dBi the threshold would be -108.2 dBm
- If the threshold is exceeded, the most likely candidates would be
  - Wideband transmissions closer than W from the band edge.
  - End-User devices served by the licensee with the weakest base station signal (determined from previous step), as those end-user devices would be transmitting at relatively higher power.

Potential Improvements.

FSS elevation angles below 20° require greater sensitivity near the main beam

The narrow width of the main beam helps provide a narrow geographic filter to locate potential offenders.

Additional test sensitivity is possible, but becomes mechanically more difficult.

- +5 dB would require either a 2’ reflector or a 25 dBi standard gain horn (~6’ long).
- An H-plane sectoral horn oriented for horizontal polarization could be another alternative.

Industry Experience

The wireless industry has extensive experience collectively dealing with interference cases of all kinds:

Among licensees

- Near-far scenarios
- Neutral-Host DAS systems
- Intermodulation and MPE at collocated transmitter sites

Among services

- Adjacent services (public safety, air-to-ground, BAS)
- Transitional services (TV relocations, BRS, DoD)

Ad-hoc

- Unintentional radiators (industrial lighting, LED billboards)
- Defective consumer devices (baby monitors, wireless mics, mast-mount UHF TV preamplifiers, wireless boosters)