Workshop on GPS Protection and Receiver Performance

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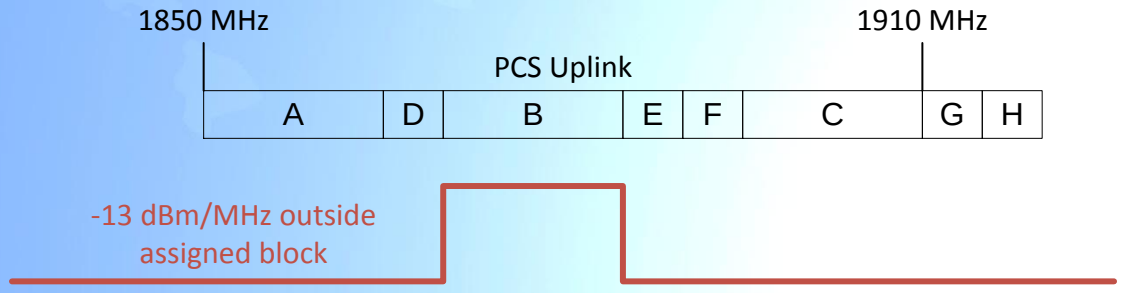
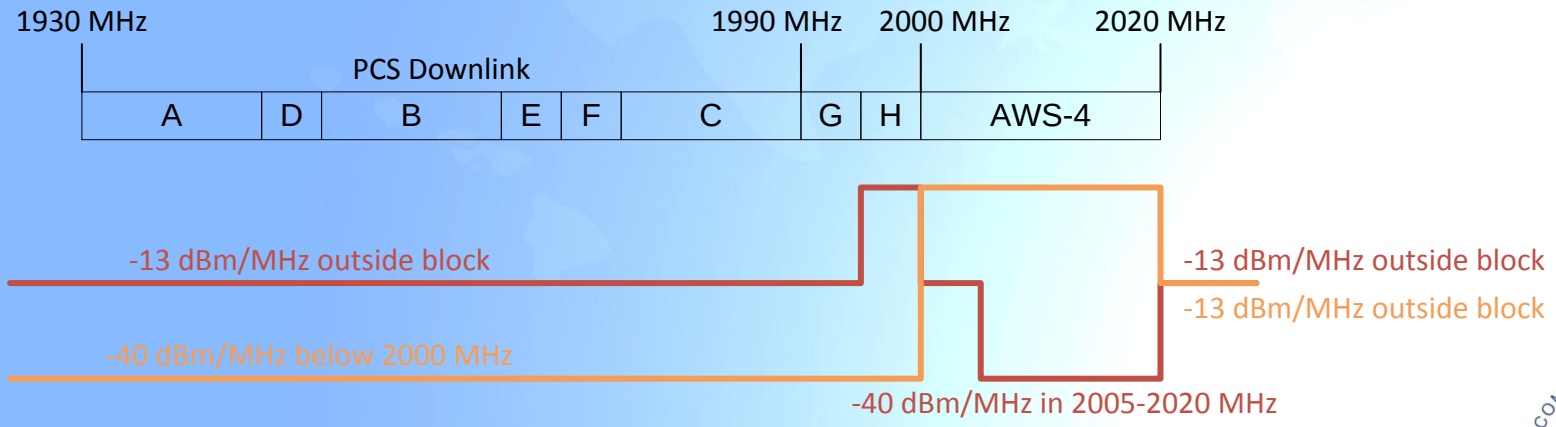
General FCC OOBE Limits

- $43+10\log_{10}(P)$, which means -13 dBm
  - -13 dBm/MHz for bands over 1 GHz
    - For example, PCS, AWS-1 (47 C.F.R. § 24.238, 27.53(h))
  - -13 dBm/100 kHz for bands under 1 GHz
    - For example, Cellular, 700 (47 C.F.R. § 22.91, 27.53(c))
- This requirement is at the edge of the assigned channel or block
  - It is recognized, but not required, that power will continue to fall off farther from the channel edge



Stricter FCC OOBE Limits

- The FCC has occasionally required tighter limits, generally in cases of close proximity of disparate services
- For example, -40 dBm/MHz between AWS-4 uplink and H block downlink
  - 47 CFR § 27.53(h)(2)



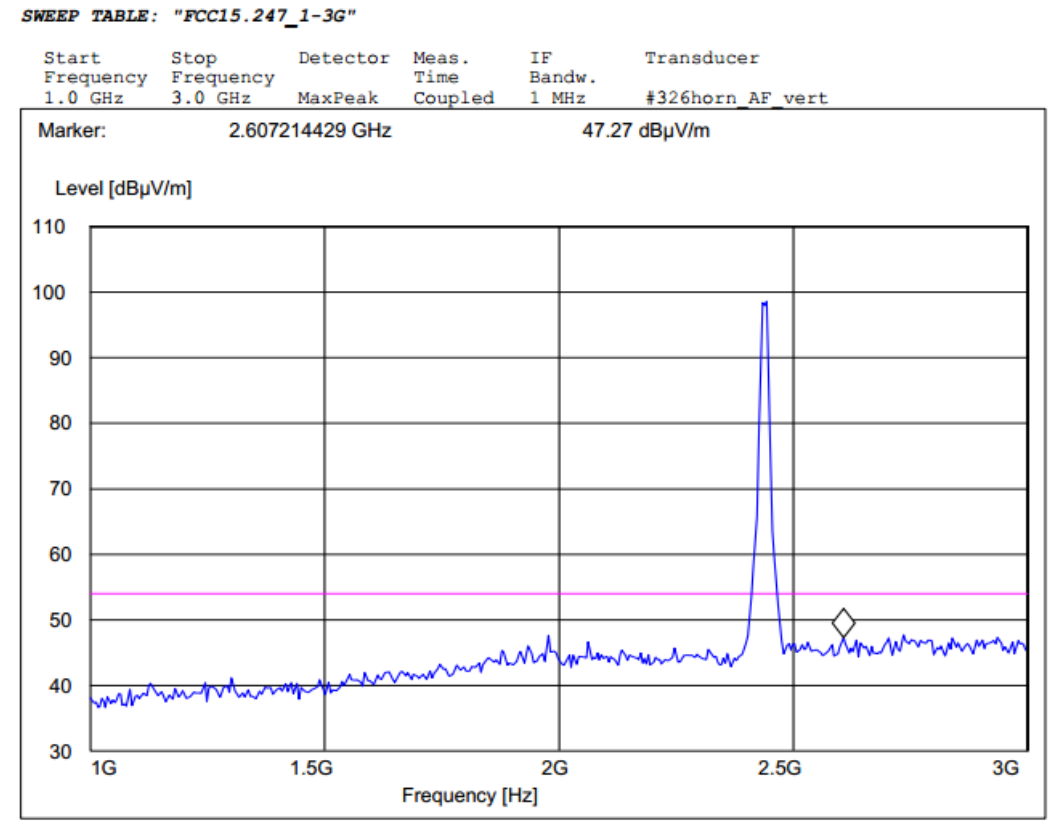
FCC Limits in GPS Band

- Some bands with proximity or possible harmonics have a limit of -40 dBm/MHz in the GPS band, with modification for narrow emissions
- MSS mobile example (proximity):
  - The e.i.r.p. density of emissions from mobile earth stations placed in service after July 21, 2002 with assigned uplink frequencies between 1610 MHz and 1660.5 MHz shall not exceed −70 dBW/MHz, averaged over any 2 millisecond active transmission interval, in the band 1559-1605 MHz. The e.i.r.p. of discrete emissions of less than 700 Hz bandwidth from such stations shall not exceed −80 dBW, averaged over any 2 millisecond active transmission interval, in the 1559-1605 MHz band. (47 C.F.R. § 25.216(c))
- 700 and 800 MHz example (harmonics):
  - For operations in the 746-758 MHz, 775-788 MHz, and 805-806 MHz bands, emissions in the band 1559-1610 MHz shall be limited to −70 dBW/MHz equivalent isotropically radiated power (EIRP) for wideband signals, and −80 dBW EIRP for discrete emissions of less than 700 Hz bandwidth. (47 C.F.R. § 27.53(f))
- Some companies have in some cases entered into voluntary agreements to further limit their emissions in the GPS band

Typical Performance

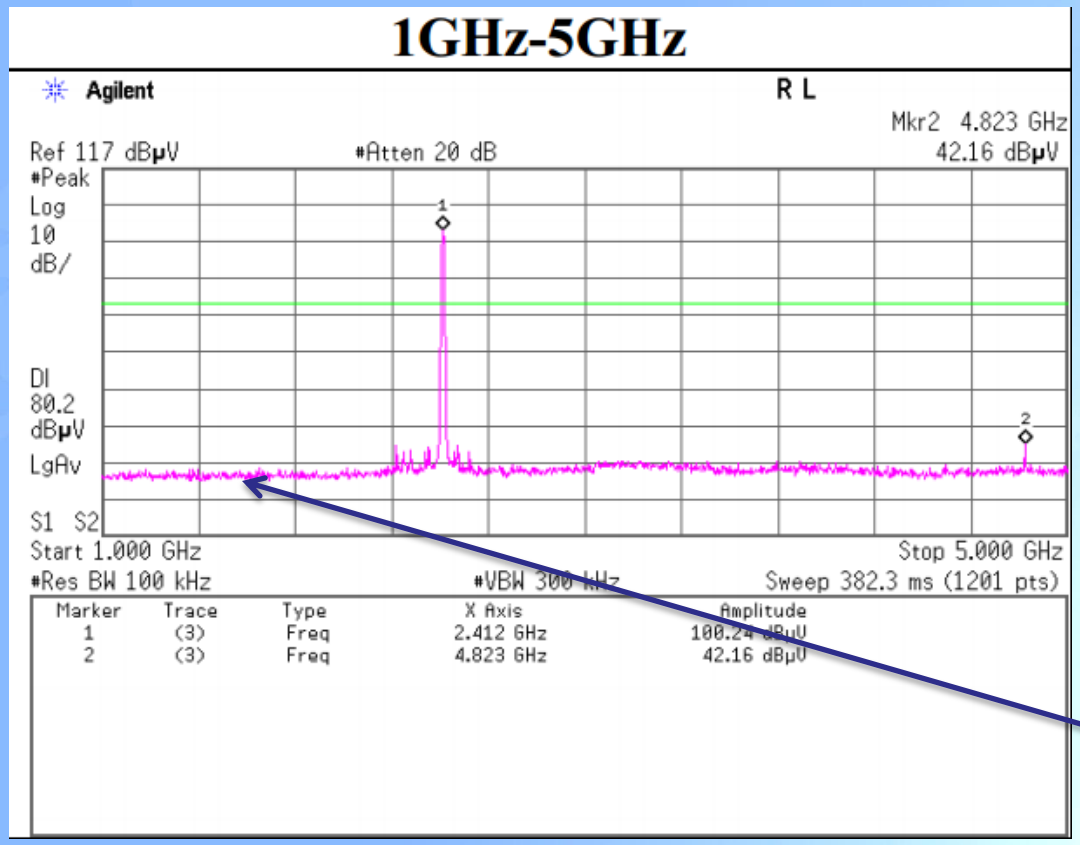
- The FCC has looked at device certification data to see what power levels are being emitted in practice in the GPS band
- Current certifications do not closely examine the GPS band, but it is captured on wide frequency sweeps
- These sweeps include the main transmission, so the analyzer's dynamic range (70 dB) limits the noise floor to around:
  - -40 dBm/100 kHz when testing devices with the main transmission below 1 GHz
  - -40 dBm/MHz when testing devices with the main transmission above 1 GHz
- Examine of device certifications shows that emission in the GPS band are below these noise floors (of course, we cannot determine how far below the noise floor the actual emissions are)

Example phone



- 40dBuV/m @3m in 1MHz RB = -55dBm/MHz EIRP
- Note that 40dBuV/m may be the Analyzer NF

Example phone



- Floor appears to be about 36 dBuV/m
- Equivalent to about -59 dBm/MHz

1.6GHz