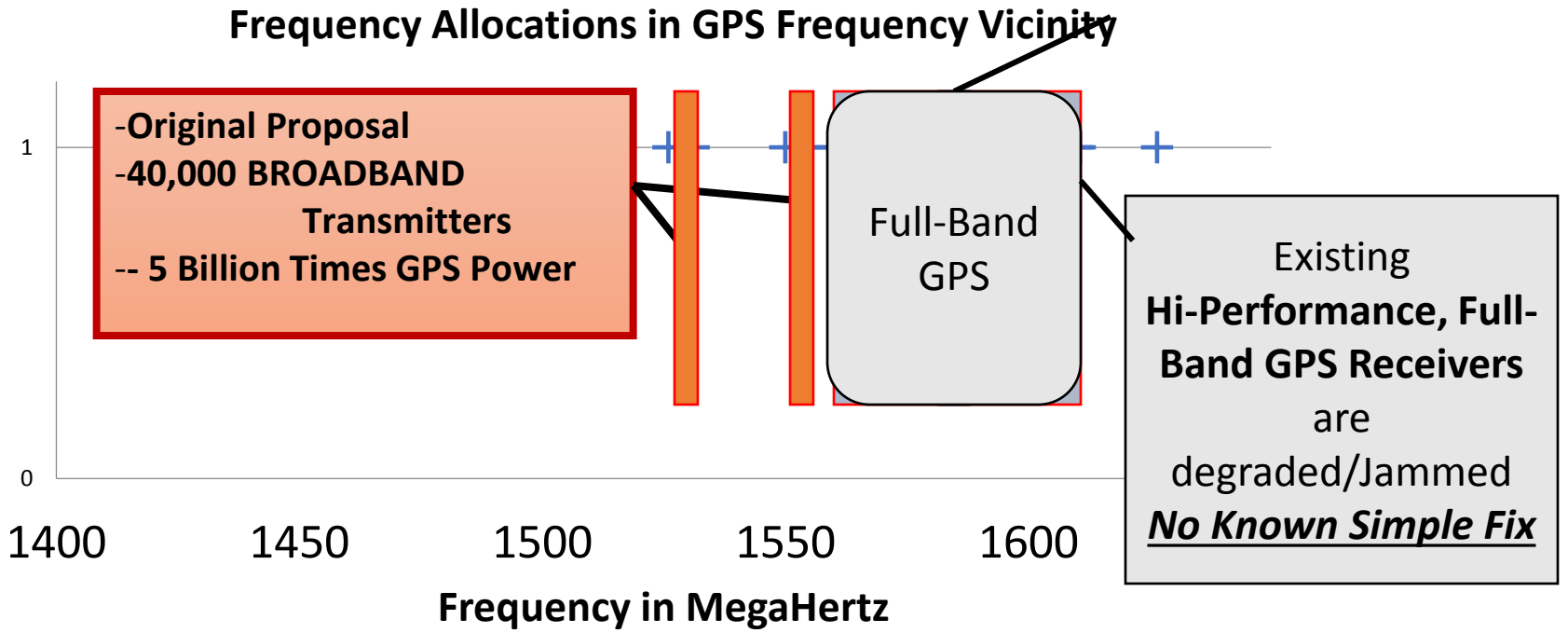
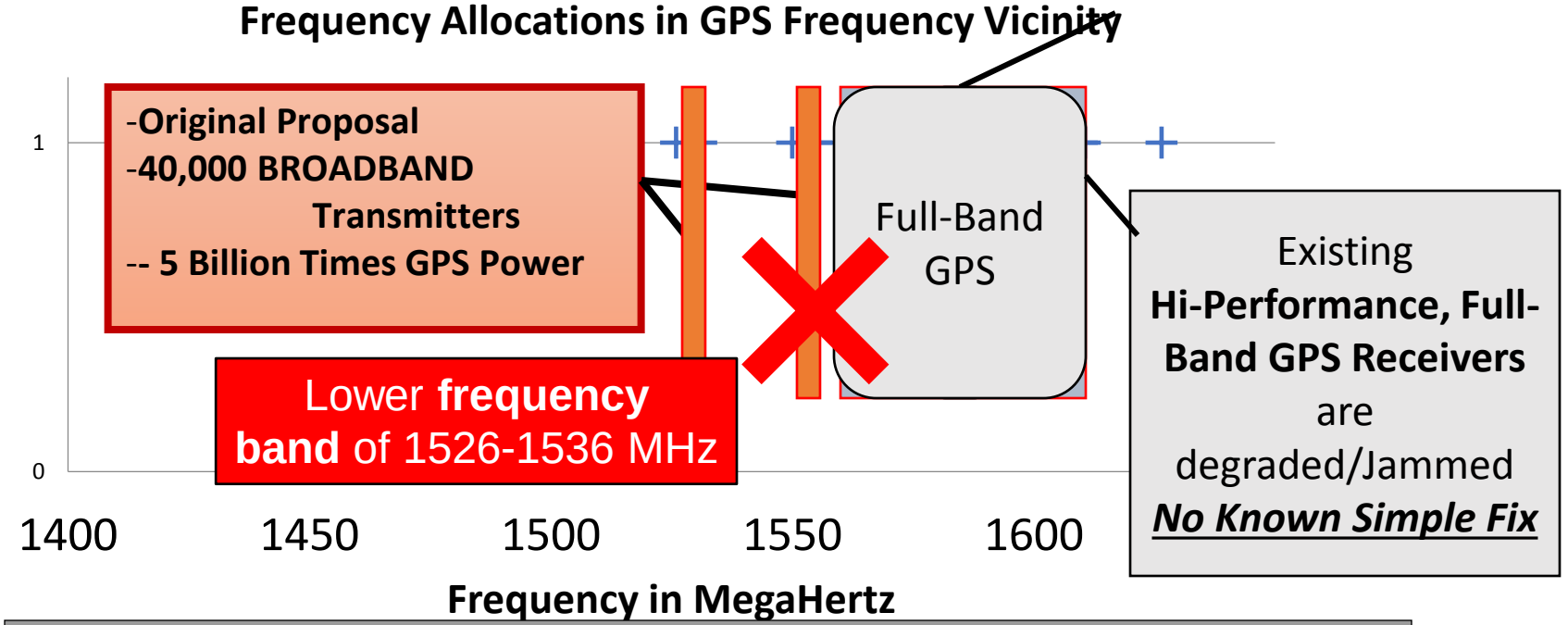
Frequency Allocations

Existential Threat to GPS – FCC Re-allocation of Nearby Band to Higher Power



Existential Threat to GPS – FCC Re-allocation of

New? Proposal

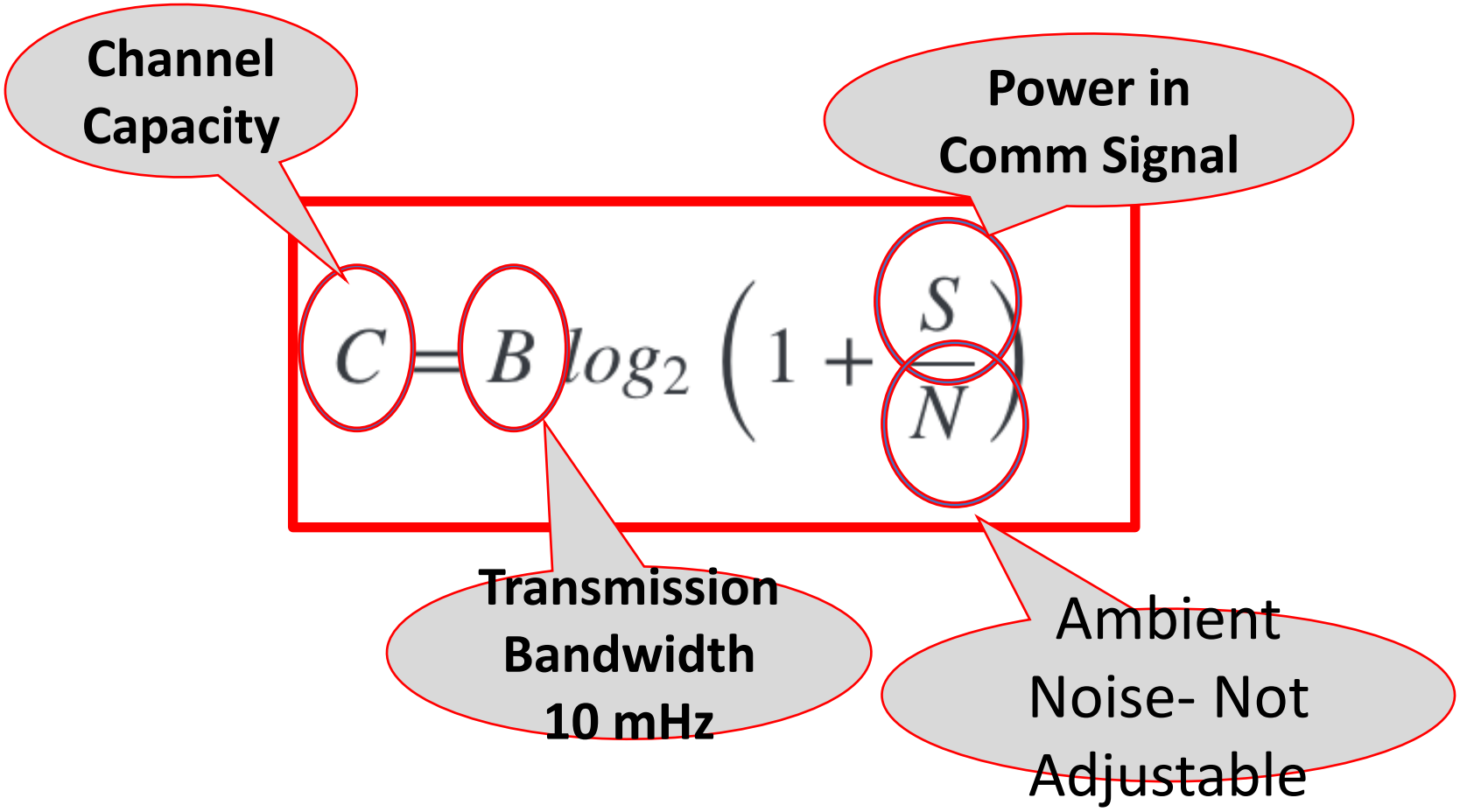


Problems:

Proximity (geographic and RF spectrum)

and ***Power***

The Fundamental Problem: The Shannon Limit



PNTAB view: *Minimum Criteria* for Testing/Evaluation of Interference Potential of High Power terrestrial transmitters in repurposed radio bands

1. **Accept and strictly apply the 1 dB degradation Interference Protection Criterion** (IPC) for **worst case conditions**. *(This is the accepted, world-wide standard for PNT and many other radio-communication applications)*
2. Verify interference for **all classes of GPS receivers is less than criteria, especially precision** *(Real Time Kinematic - requires both user and reference station to be interference-free)* **and timing receivers** *(economically these two classes are the highest payoff applications – many $B/year)*
3. Test and **verify interference for receivers** in **all operating modes** is less than criteria, particularly **acquisition** and **reacquisition** of GNSS signals under difficult conditions (see attachment of representative interference cases)
4. **Focus analysis on worst cases**: use ***maximum*** **authorized transmitted interference** powers and ***smallest-attenuation*** **propagation models** (antennas and space losses) that do not underrepresent the maximum power of the interfering signal (including multiple transmitters).
5. Ensure **interference to emerging Global Navigation Satellite System (GNSS) signals** *(particularly wider bandwidth GPS L1C – Galileo, GLONASS)*, is less than criteria
6. All **testing must include GNSS expertise** and be **open to public comment** and scrutiny.

Correction: The recent testing by proposer does not meet *any* of the six universal Criteria

PNTAB view: *Minimum Criteria* for Testing/Evaluation of Interference Potential of High Power terrestrial transmitters in repurposed radio bands

1. **Accept an[d] strictly apply the 1 dB degradation Interference Pr[o]tection Criterion** (…PC) for **w…** …accepted, wor[l]d-wide standard *for PNT an[d] many other …)* — **Not Met**
2. Verify inter… …eria, **especially [p]recision** (…*Time K…* …*uires b…th user and refe[r]ence station to be interferen[c]e-free)* **ar[d]** … *…y these two clas[s]es are the highest payo[f]f applications – many $B/year)* — **Not Met**
3. Test and ver… …less than criteria, par[ti]cularly **ac…** …NSS signals under difficult con[d]itions (see att… …ference cases) — **Not Met**
4. **Focus analys…** …**ed interference** [p]owers a… …**gation model** (antennas and space los[s]es) that … …aximum power of the interfering si… — **Not Met**
5. Ensure **interf[e]rence to en…** …**lite Syste[m] (GNSS) signals** *(parti[cu]larly wider b… …1C … …SS)*, is less than criteria — **Not Met**
6. All **testing m[u]st include G…** … **…blic com[m]ent** and scrutiny. — **Not Met**

2011 ***Tested*** and **2016** proposed Base Stations – no significant changes to configuration that has ***now failed USG tests twice***

Parameter	2011 LSQ Proposal	2011 NPEF Test**	2016 Proposal	Observations
Transmit Power (EIRP)	42 dBW	32 dBW**	32 dBW*	NPEF/2016* Identical
Frequency Range	1526-1536 and 1545-1555 MHz	1526-1536 MHz**	1526-1536 MHz	NPEF/2016 Identical
Emissions into RNSS Band (1559-1610 MHz)	- 100 dBW/MHz	- 100 dBW/MHz	- 100 dBW/MHz	NPEF/2016 Identical
Emissions into MSS Band (1541-1559 MHz)	No commitment	- 81 to - 135 dBW/MHz (Measured values)	- 85 dBW/MHz (Commitment)	New proposal significantly worse across MSS band compared to NPEF test measurements

* Ligado studies submitted by FAA to RTCA on October 20, 2016. No consensus in RTCA and FAA has not agreed. Nominal eirp per tower could be as low as 10-13

** Revised proposal by LSQ in 2011.

Correction to Public Statements: The "New Proposal" Does *not differ* from the one that failed NPEF Testing, except the interference emissions are *Worse*

Proposer Claim: We have agreement from all principal GPS manufacturers

- Four major companies specifically ***did not support*** changing the International 1 dB interference criterion
- Manufacturers ***do not represent*** the diverse and multifaceted GPS user community
  - Aviation
  - Survey and Farmers
  - Applications of RTK

Current Proposers still have not acknowledged or agreed to protect existing and future high precision GNSS users

GNSS Precision Survey in construction of High-Rise Buildings

UAVs – Delivery and Reconnaissance

Flying Car/Robotic Taxi

Precision control of Construction Vehicles