Spectrum Management Update
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Spring 2022 DCS/TWG & STIWG
May 10-12, 2022
Agenda

• DCS Uplink Interference in 402 MHz
  • 401-403 MHz Frequency Usage and Regulations
  • Interference from Canadian Satellite Uplink – Current Status
  • Central & South American Sources
  • Regulatory Considerations

• L-band: Ligado and AWS-3 Update
• Interference and Detection
Frequency Usage in the DCS Uplink Band

DCS Uplink Spectrum: 401.7 – 402.4 MHz, including the International Band

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<th>Rest of World – International Use</th>
<th>NTIA Federal Use</th>
<th>FCC Non-federal Use</th>
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<td>METEOROLOGICAL AIDS</td>
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US frequency usage modified by footnote: Limits non-Federal use to transmitters to GOES, a US federal space station

US384 In the band 401-403 MHz, the non-Federal Earth exploration-satellite (Earth-to-space) and meteorological-satellite (Earth-to-space) services are limited to earth stations transmitting to Federal space stations.
Usage Outside the United States and Possessions

• The other countries in the Americas do not have a limiting footnote in their rules, therefore, there is nothing to prohibit use of 401-403 MHz for uplink transmissions to satellites (Space Operations)

• With the growth of small satellites, this could become a very popular uplink frequency to command the satellites

• If those satellite uplinks point in the direction of a GOES satellite, their signals will be seen by GOES-DCS, and transpond into the L-band downlink spectrum of DCS. Strong signals would interfere with the assigned DCP uplinks in a given channel or channels.
GHGSat – Canadian Greenhouse Gas Satellites

• After some investigation, it was determined that one of the signals that could interfere with the DCS uplink, had the characteristics of an Earth station tracking an orbiting satellite.
  • GHGSat’s first three satellite vehicles were being commanded in this spectrum by several Earth stations, that a few times a day would point in the direction of a GOES satellite, creating detectable interference.

• GHGSat had plans to move their uplink frequency to a different band starting with their third operational satellite. This leaves their developmental satellite and two operational satellites that were launched previously to still use the 402 MHz uplink
Cooperative Testing

• With assistance from ECCC / Meteorological Service of Canada, NOAA entered into discussions with GHGSat to search for some potential solution to the interference from the D-1, C-1 and C-2 satellites
  • GHGSat proposed a cooperative test where their uplinks would switch to the opposite circular polarization from that used by GOES, hopefully attenuating the GHGSat uplink by a significant result.
  • Such a cooperative test was conducted earlier this month.
  • GHGSat uplink, once switched from right-hand to left-hand circular polarization only yielded a signal reduction of about 3 to 4 decibels – which is much less of a change than was expected.
  • It is unlikely that modifying the GHGSat uplink antenna by changing the polarization will be of much help in resolving this problem.
GHGSat

• Flying GHGSat Satellites with 402 MHz uplinks
  • GHGSat-D “Claire” launched 22 June 2016
  • GHGSat-C1 “Iris” launched 2 September 2020
  • GHGSat-C2 “Hugo” launched 24 January 2021

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• Next 3 GHGSats C-3 “Luca”, C-4 “Penny”, C-5 “Diako” moved to a new uplink band. No more transmissions to these satellites at 402 MHz
  • Summer 2022 launch planned on SpaceX
• Company plans a full constellation of 10 satellite by end of 2023
Other Interference Sources at 401-402 MHz

• Only a few of the most prominent signals were noted during the data gathering phase where the GHGSat uplink signals was identified.
  • Other signals noted were in either South or Central America
  • Identifying the source of those signals will be much more complex than that of the GHGSat uplink.

• We were unable to see all sources at any time that DCS may have been experiencing radio frequency interference, and the interference environment changes over time – what one might see today could differ from what was detected one or two years ago.

• With the rapid growth of small satellites in countries that may not have controlled or launched satellites before, the potential for other satellite uplinks in 401-402 MHz in the Americas always exists.
From DCS Uplink to DCS Downlink

Discussions related to the L-band signals into a DRGS or into a Federal Data Acquisition (Ground) Station
1679.7 – 1680.4 MHz DCPR Downlink

• As I think most of you know, the satellite subsystem that receives and relays the original DCP telemetry is a simple transpond.
  • In other words, it is a straight mathematical relationship that determines where an uplink channel appears in the downlink
• Interference on the uplink certainly can appear in the downlink – and a strong enough signal can cause a failure to intercept the desired downlink signal
• Additionally, strong terrestrial signals can cause interference in the ground station receiver, whether they are terrestrial broadband wireless signals in a band just sold for auction, or a wireless signal like that requested by Ligado, where they desire some allocation, that overlaps some of the DCS downlink spectrum
These 3 blocks constitute 75% of the spectrum needed for the original proposed service by Ligado. Notice the downlink from base station to user equipment is operating at reduced power 10W.
Current Status

• For the “other 30 MHz”, not near DCS
  • FCC approved that use two years ago, and Ligado is suggesting that it may begin some operations in 1526-1536 MHz on or after Sept in some areas
  • A Congressionally-mandated study was undertaken by the National Academies of Science on GPS impacts. Do not believe it has published it’s results yet
  • Several Federal agencies and the Federal regulator petitioned the FCC to review that order and stay the use. FCC has taken no action on those requests.

• For 1675-1680 MHz
  • FCC has taken no action to date and there is no indication of when they may do so.
Dish Network to use 1695-1710 MHz licenses

• We have not seen any activity in the 1695-1710 MHz band above GOES, from the AWS-3 auction that was concluded in 2015
  • That seems about to change
  • Dish Network is working on rollout 5G service and has a June 14, 2022 regulatory buildout milestone to meet.
  • Dish intends to rollout in 25 major markets and 100 smaller cities before the June deadline.
    • They must cover 20% of US Population by June 2022 and expand to 70% by June 2023
    • Details: https://www.fiercewireless.com/5g/dish-marks-5g-progress-plans-launch-5g-25-major-markets-june#~:text=Dish%20promises%205G%20launch%20in%2025%20major%20markets%20before%20June%20deadline,-By%20Bevin%20Fletcher&text=Dish%20Wireless%20is%20gearing%20up,of%20its%20June%20buildout%20deadline.
Summary

Questions?