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February 19, 1999

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Ms. Magalie R. Salas
Secretary
Federal Communications Commission
445 Twelfth Street, S.W.
Washington, D.C. 20554

Re: ET Docket No. 97-214

Dear Ms. Salas:

Leo One USA Corporation ("Leo One USA"), by its attorneys, hereby notifies the Commission, pursuant to Section 1.1206 of the Commission's rules, of a meeting held yesterday with representatives of Leo One USA and Orbital Communications Corporation ("Orbcomm") and Tom Derenge, Julius Knapp, Geraldine Matise, Bruno Pattan and Charles Iseman of the Office of Engineering and Technology, Cassandra Thomas and Harry Ng of the International Bureau, and Jay Jackson and Charlene Lagerwerff of the Wireless Bureau. The purpose of the meeting was to discuss the technical issues raised in ET Docket No. 97-214. Enclosed are the presentations Leo One USA and Orbcomm made at this meeting. An original and one copy of this notice are being submitted to the Secretary's Office. Copies of this letter are being provided to the meeting participants as well.

Any questions regarding this matter should be directed to the undersigned.

Respectfully submitted,

Robert A. Mazer
Counsel for Leo One USA Corporation

RAM:dks
Enclosure

cc: Tom Derenge
Julius Knapp
Geraldine Matise
Bruno Pattan
Charles Iseman
Cassandra Thomas
Harry Ng
Jay Jackson
Charlene Lagerwerff

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FCC Meeting, 2/18/99

148-149.9 MHz BAND ALLOCATED TO NVNG MSS BASED ON ABILITY TO SHARE SPECTRUM WITH LAND MOBILE SERVICE

- In 1991 FCC proposes in ET-Docket No. 92-18 to allocate 148-149.9 MHz to NVNG MSS

- In 1993 FCC in ET-Docket No. 92-18 allocates 148-149.9 MHz to NVNG MSS
  - 148-149.9 MHz is shared with Land Mobile Service
  - OET determined that sharing on a statistical basis between NVNG MSS operating using DCAAS and with Land Mobile Services is viable if certain operational constraints are employed

U.S. PROPOSED AND ACHIEVED INTERNATIONAL ALLOCATION OF 455-456 MHz & 459-460 MHz

- Formal proposal for allocation submitted to ITU by U.S.
- Proposal agreed to by CITEL
- U.S. attempted to sell this proposed allocation at numerous bilaterals prior to WRC-95
- U.S. delegation to WRC-95 actively promoted allocation
- U.S. and CITEL countries supported allocation at WRC-95
- U.S. achieved Region 2 allocation at WRC-95

U.S. Again Proposed Worldwide Allocation of 455-456 MHz & 459-460 MHz at WRC-97

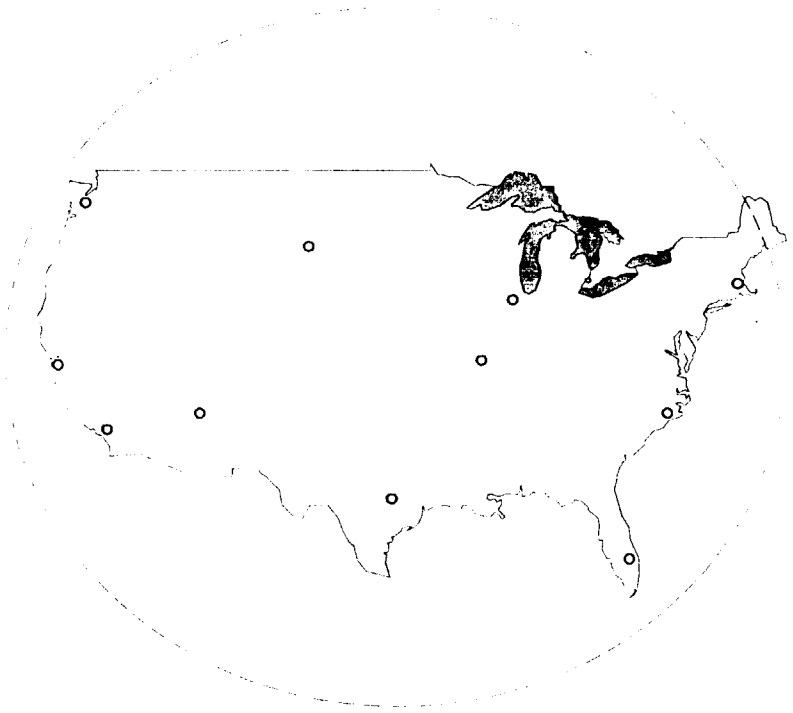
FCC HAS FOUND THAT SHARING IS FEASIBLE

- Report in IC Docket No. 94-31 states

  "We believe that the technical analysis presented by the system proponents corroborate the channel assignment and low power techniques, in conjunction with brief message duration and geographical separator similar to those adopted by the Commission in §2.106, Table of Allocations for other frequency bands can be used to successfully assure that oil spill containment operations are not adversely affected. These techniques will also, we believe, protect broadcast auxiliary uses. We therefore propose to allocate the 455-456 MHz and 459-460 MHz band in the Earth-to-Space direction."

NVNG MSS Co-Frequency Sharing with Terrestrial Services

- Mobile Earth Stations (MESs) use frequencies when terrestrial channels are temporarily not actively used.
- Terrestrial channel activity monitored by band-scanning receiver in MSS satellite.
  - Satellite beam covers area of CONUS. (See figure.)
  - Dynamic Channel Activity Assignment System (DCAAS) determines active channels.



NVNG MSS Co-Frequency Sharing with Terrestrial Services

- Satellite transmits to MESs the available frequencies (Doppler shift taken into account).
- MES transmitters are allowed to transmit only on inactive frequencies as directed by the DCAAS operating autonomously in the satellites.
    - DCAAS is currently in use at 149 MHz and is internationally recognized.
- MES transmits packet (from 30 to 450 ms in length).
- Succeeding transmissions from the same MES are on frequencies available at those times, subject to constraints on frequency use as in existing US 323, at 148-149.9 MHz.
    - Less than 1% of time in any 15 minute period
    - Consecutive transmissions on a single frequency separated by at least 15 seconds

When DCAAS identifies active channels, interference does not occur.

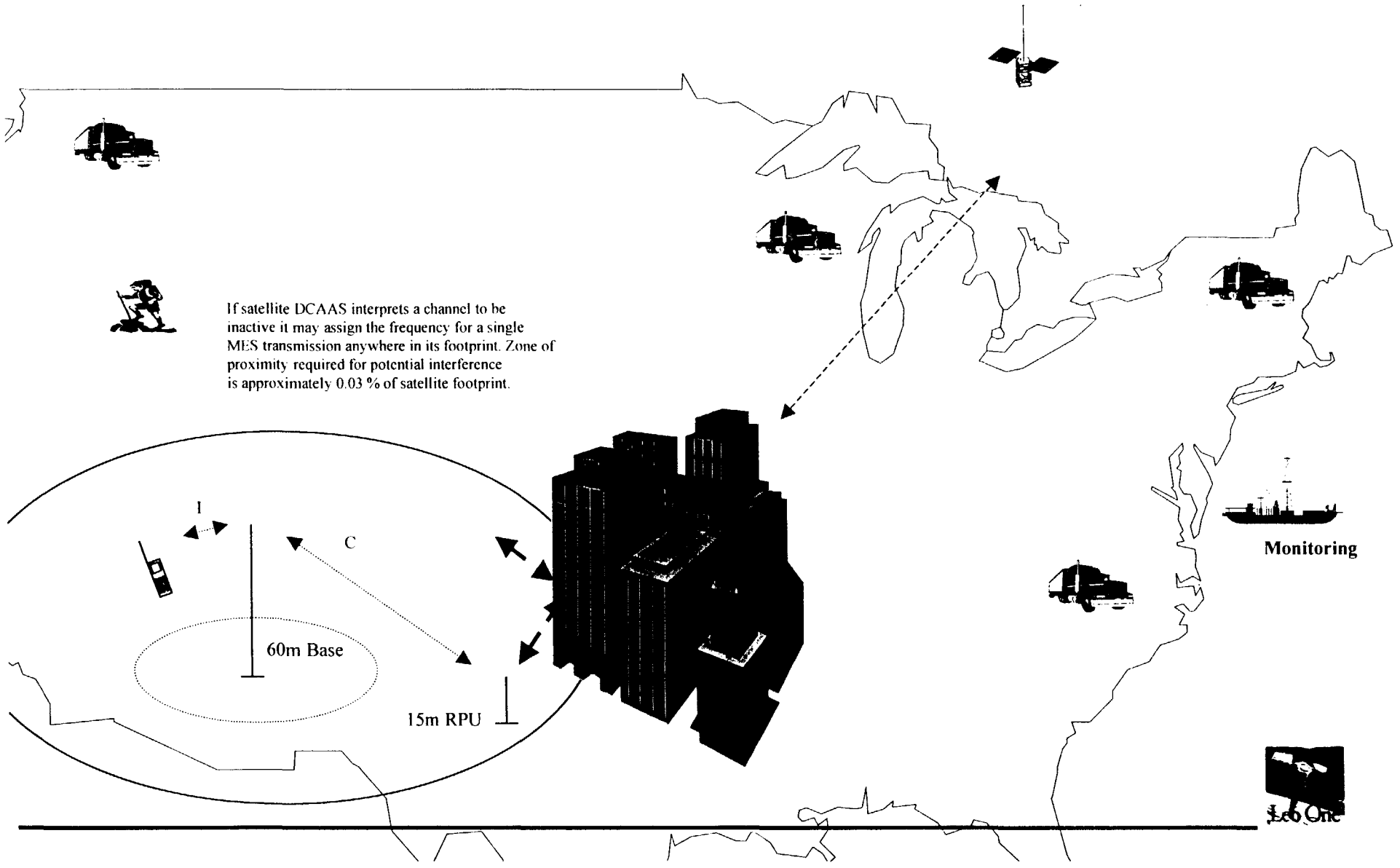
Operational Characteristics Protect Terrestrial Users

- When the DCAAS is not triggered, technical and operational constraints on the MSS network result in low probabilities of interference to active terrestrial channels.
  - Operational constraints – like US 323
  - 450 ms maximum duration
    - Less than 1% of time in any 15 minute period
    - Consecutive transmissions on a single frequency separated by at least 15 seconds
  - Other features
    - Wide geographic distribution of MESs
    - Frequency agility of MESs

- Potential interference from a non-GSO MSS uplink to a terrestrial receiver is a localized event, requiring four conditions to be met.
  - Proximity of MES and terrestrial receiver
  - Terrestrial receiver on same frequency
  - Terrestrial receiver actively listening
  - MES enabled by DCAAS and transmitting

Potential interference can be modeled

A Leo One Satellite Must Assign An Active Channel to a MES in Proximity of the Victim Receiver to Create Interference



Modeling of Potential Interference

- Repeated random trials of MES transmissions and calculation of C/I or C/(I+N) values for the specific random geometries are used to model the probabilities of interference.

- Studies have been done for MSS uplinks sharing with LMS, FS, and BAS.

- Systems modeled include:
  - antenna heights from 3m to 200m
  - analog and digital
  - frequencies of 149 and 460 MHz

- Results have shown low probabilities of interference (specific results provided)

What is acceptable interference - Level, duration, frequency.....

What is the impact of interference?

Summary

- Probability of interference is low and a function of
  - Proximity of MES and terrestrial receiver
  - Terrestrial receiver on same frequency
  - Terrestrial receiver actively listening
  - MES enabled by DCAAS and transmitting
- NVNG MSS proposes further protection via operational constraints
  - 1 % duty cycle during any 15 minute period
  - minimum 15 sec repeat interval on same frequency
  - maximum 450 ms transmission length

Sharing in the 148-149.9 MHz band has been successful on the basis of a low probability of interference and operational constraints.

FCC REVERSAL OF IC DOCKET NO. 94-31 DECISION WOULD HAVE SIGNIFICANT REPERCUSSIONS

- NVNG MSS industry denied opportunity to grow
- Raises questions on NVNG MSS requirements and industry viability
- Puts into question NVNG MSS system's ability to share uplinks with terrestrial services
- Other administrations would seek to overturn WARC-92 allocation of 148-149.9 MHz for NVNG MSS uplinks
  - Many administrations would seek to flip International Footnote 608(c) and make 148-149.9 MHz uplink band secondary
- Change of status in 148-149.9 MHz band could have devastating impact on emerging NVNG MSS industry
  - raises serious questions with investors
  - access to foreign markets would be made more difficult
- U.S. would be denied opportunity to export important new technology and service

U.S. CREDIBILITY AT ITU WOULD BE UNDERMINED

- U.S. should not make allocation proposals to a WRC, obtain allocations at WRC and in subsequent domestic proceeding reverse itself and rule that the technical basis for the allocation is not sufficient
  - undermines future U.S. technical credibility at ITU

- U.S. experienced a similar problem when it changed its WARC-92 satellite PCS proposals at WRC-95

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ORBCOMM Interference Avoidance Techniques

148 - 149.9 Mhz

17 February 1999

Presentation Overview

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- ORBCOMM's 4-level sharing approach
- European evaluation
- DCAAS demonstrations
- ORBCOMM's interference record

Interference Avoidance

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- **ORBCOMM avoids interference from a mobile earth station (MES) to a mobile receiver through a 4-level process**
  1 - DCAAS avoids using active mobile channels
  2 - low probability of mes-mobile proximity
  3 - short duration of MES transmissions minimizes any interference effects
  4 - US rules limit extent of any interference

Level 1 - DCAAS

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- One of the oldest approaches to interference avoidance is "Listen before Transmit"
- The Dynamic Channel Activity Assignment System avoids channels used by terrestrial mobile systems by listening before it permits an ORBCOMM mobile earth station(mes) to transmit

DCAAS Operation

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- **DCAAS receiver on satellites continuously scans the band to identify and use inactive terrestrial channels**
  - Channel occupancy evaluated every 5 seconds
  - ORBCOMM operates using terrestrial guard bands and temporarily inactive channels
  - Protects terrestrial receivers by preventing MES transmissions on active Mobile channels
- **If a Mobile unit starts to transmit on a DCAAS selected channel, the satellite will sense the higher error rate and move ORBCOMM MESs to a different channel in 1 to 2 seconds**

Typical DCAAS Scan

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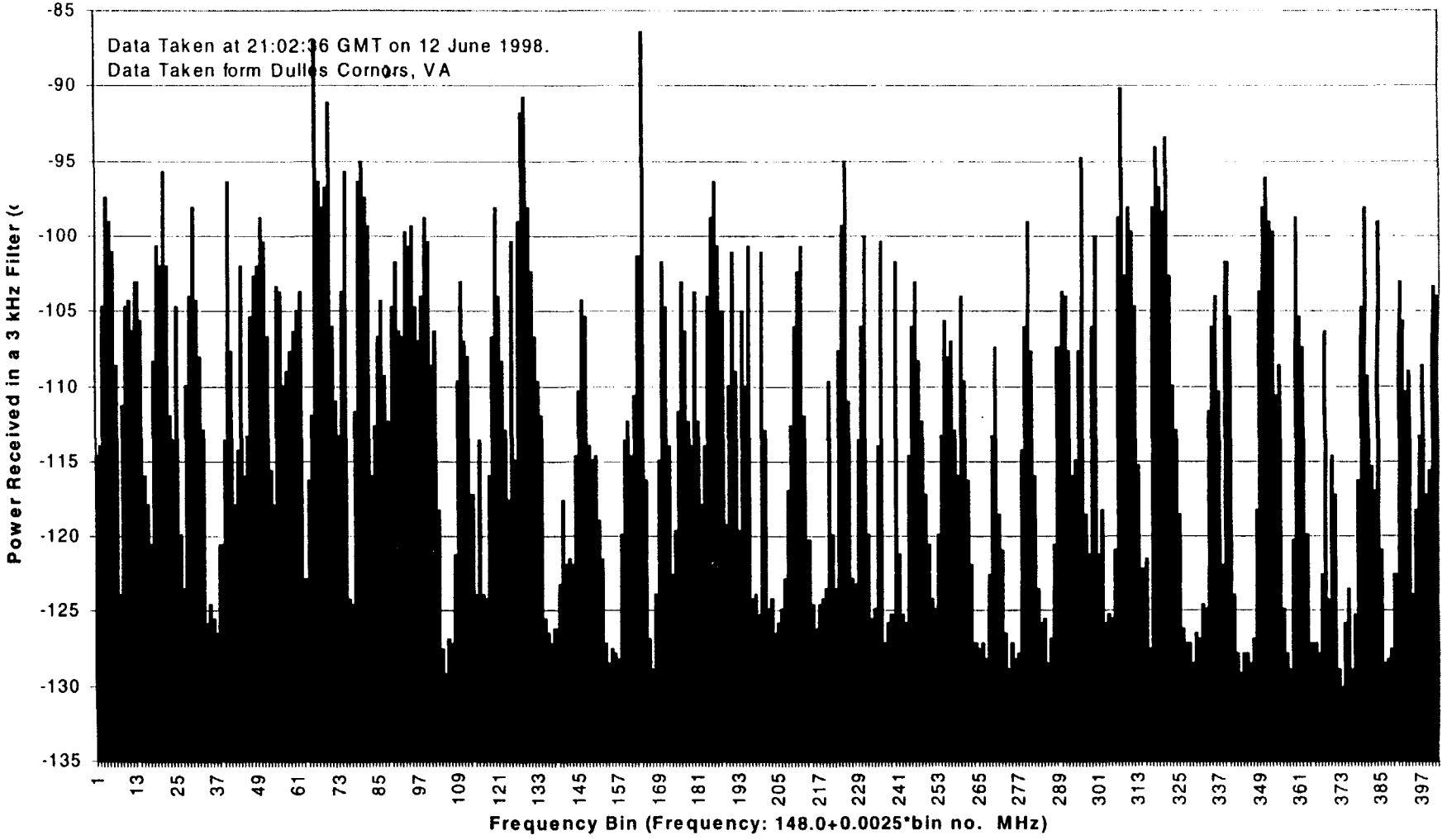

DCAAS Is Essential

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- **Without DCAAS to make channel assignments on clear channels, the satellite receivers would be continually receiving interference**
  - If a 5 W MES tries to transmit on a channel used by a 5W mobile transmitter anywhere in the satellite footprint, the ORBCOMM satellite receiver would receive interference and the ORBCOMM signal would be lost
  - Without DCAAS, only a small percentage of ORBCOMM signals could ever be received
- **If a mobile unit starts to transmit on a DCAAS selected channel, the satellite will sense the higher error rate and move ORBCOMM mess to a different channel in 1 to 2 seconds**

2 - Low Probability of Proximity

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- **If an MES transmits co-channel with a Mobile receiver, the probability of their being close together is very low**
  - Maximum of 6 simultaneous MES transmissions in satellite footprint (5,000 km across)
  - MES must be within a few 10s of km of terrestrial receiver to noticed
  - Ratio of areas $(20/5000)^2$ is on the order of .001%

3 - Short Transmissions

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- **If an MES transmits co-channel with a mobile receiver and is close to the receiver, the interference signal still has little effect due to its short duration**
- **Canadian and german tests indicate little impact**
  - Short burst transmissions (<50 msec) not detected
  - Longer transmissions (up to 500 msec) detectable but have little effect
- **"...The effect on terrestrial mobile users should be imperceptible, in terms of carrier squelch activation or for a call in progress"**
  (document wp8d/160 from canada)

4 - ORBCOMM Signal Restrictions

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- **Footnote US323 limits ORBCOMM user emissions and protects mobile systems**
  - Maximum duty cycle: 1% of 15 minutes
  - Maximum duration: 450 ms
  - Transmissions on the same frequency separated by at least 15 seconds

Uplink Band - Summary

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- **Typical service environment for terrestrial mobile receivers in 148 - 149.9 mhz band is not appreciably changed by ORBCOMM**
- **Interference events will be extremely rare**
  - DCAAS avoids active mobile channels
  - Low probability that a transmitting MES is near a receiving mobile unit
  - Short duration of MES transmissions minimizes any interference effects
  - If interference occurs, it cannot re-occur per US323
- **In Canada, ORBCOMM shares with ambulance dispatch and other safety services**
- **In U.S., ORBCOMM shares with military mobile radios**

European Evaluations

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- **The German administration performed tests of ORBCOMM's DCAAS system**
  - Results verified that ORBCOMM could sense and avoid terrestrial emitters of 100 mw eirp or greater

- **WRC-2000 has an agenda item to consider constraints in the 148 - 149.9 mhz band. The CEPT is developing the following text for WRC-2000**
  - "Existing S-PCS<1ghz systems can operate with the present constraints therefore CEPT does not see a need to review constraints in this frequency band."

DCAAS Demonstration

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- **DCAAS has been demonstrated to officials in the US and numerous foreign countries**
- **"Chase the rabbit test" demonstrates how DCAAS works**
  - A DCAAS test set receives the channel assignments broadcast by the satellite
  - It selects one of the uplink channel assignments and transmits a "mobile" signal on that channel
  - It can be observed that DCAAS changes the channel assignment to avoid that channel
- **ORBCOMM would be happy to demonstrate this to the FCC**

ORBCOMM's Record

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- First ORBCOMM launch - April 1995
- Full constellation and commercial service - September 1998
- Approximately 1.4 million ORBCOMM messages have been sent
- There have been no reports of interference