MICROWAVE SOLUTIONS FOR THE DIGITAL AGE™

May 2, 2003

Secretary
Federal Communications Commission
Washington, DC 20554

Re: ET Docket No. 95-18, Mobile Satellite Service

Gentlemen,

On April 29, 2003, Dr. John B. Payne, president of Nucomm, Inc. met with the following FCC staff members: Gary Thayer, Tom mooring, Alan Scrime, Jamison Prine, Tom Derenge, Geraldine Matise, Ira Keltz and Don Campbell.

Dr. Payne made a slide presentation about the 2GHz BAS re-channelization as proposed in ET Docket No. 95-18. A copy of that presentation is attached. The presentation covered the following points:

- **History of Nucomm**
- **Nucomm 2GHz ENG Products**
- **Installed Base of 2 GHz Analog Radios**
- **Comments on proposed frequency plans**
- **Review of SBE proposed frequency plan**
- **Required Modification of Nucomm Analog Equipment**
- **Required Modification of Nucomm Digital Equipment**
- **Support Level for Discontinued Nucomm Radios**
- **2GHz BAS Relocation Questions**
- **Suggested Change-Over Plan**
- **Overview of Today's 2 GHz BAS Digital Equipment State-of-the Art**

Sincerely,

Dr. john B. Payne

President, Nucomm, Inc

2 GHz BAS Re-channelization Discussions

Reference ET Docket No. 95-18

Mobile Satellite Service

FCC Washington

April 29, 2003

Dr. John B. Payne,
President Nucomm, Inc.

Items to be Discussed

- History of Nucomm
- Nucomm 2GHz ENG Products
- Installed Base of 2 GHz Analog Radios
- Comments on proposed frequency plans
- Review of SBE proposed frequency plan
- Required Modification of Nucomm Analog Equipment
- Required Modification of Nucomm Digital Equipment
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- 2GHz BAS Relocation Questions
- Suggested Change-Over Plan
- Overview of Today's 2 GHz BAS Digital Equipment State-of-the Art

History of Nucomm, Inc

- Founded in 1990
- A privately held company
- Started by purchasing the defunct assets of NURAD, Inc
- Nucomm Develops, Manufactures and Sells Microwave analog and digital products primarily to the Broadcast industry both in the US and Internationally
- Products: microwave ENG/OB, Portable/Airborne and STL from 1 to 15.4 GHz
- Some Nucomm firsts:
  Multi-Band portable microwave transmitter/receiver radio-Tri-band - 1990
  Used surface mount techniques to reduce size, cost and power consumption 1990
  Integrated test pattern generator with field programmable ID (switchable to VI)
  Field programmable audio sub-carriers - 1991
  First digital microwave system for broadcast application in US (USSB) - 1995
  Conducted the first digital ENG tests in NY with WNYW - 1997.
- Estimated that Nucomm represents about 15% of the installed base of equipment

Nucomm
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Nucomm 2GHz ENG Products

Current Digital/Analog 2GHz ENG/Portable Products:

- Transmitters (Heterodyne): MMPT6, Newscaster VT1, TP3D, PT3D, PT5D & PT6
- COFDM/MPEG2 Digital modulators and demodulators
- Receivers: Newscaster CR, RX3D, RX5D and RX6

Current Analog 2GHz ENG/Portable Products:

- Transmitters (Remodulating): MMPT3, TP3A, PT3, PT5A and MPT2
- Receivers: RX3 and RX5A
  These products offered in single & multi-band versions.
  Transmitters at various power levels

Obsolete Analog Products:

- CR3 Central Receiver (Discontinued 3 years ago)
- Nucomm does not support any product of NURAD

Installed Analog Radios:

- Nucomm has installed in excess of 2,000 analog 2GHz radios in the US.
- Undetermined number of 2 GHz radios manufactured by NURAD

Installed Base of 2 GHz Analog Radios

- Total number of installed 2 GHz analog radios requiring re-tuning is unknown; estimated in excess of 12,000 units.
- Present manufactures of 2 GHz digital & analog radios:
  Nucomm, Inc
  MRC (Microwave Radio Corporation)
  BMS (Broadcast microwave Services)
  GMS
  Southern California Microwave
  Hitachi
- Many manufactures now out of this business
  (Probably would not support these radios)
  Harris Ferinon
  Nurad
  Ikegami

Comments on proposed frequency plans

- Two step frequency plan is not realistic. It will require a huge and disruptive effort by both the 2GHz BAS users and the radio manufactures.
- It makes more sense to go directly to a final frequency plan.
- To make the transition easier, the frequency plan should have the resultant **center frequencies in multiples of 250kHz.**
- Plan 1 would require replacing synthesizers having center frequencies with multiples of 125kHz.
- Plan 2 would use existing synthesizers.
- A frequency plan requiring 125kHz multiples would require synthesizer to be changed. This would represent a major cost factor.
- The frequency plan proposed by SBE makes the most sense.
- The following discussions will be based upon the SBE frequency plan.

Review of SBE proposed frequency plan

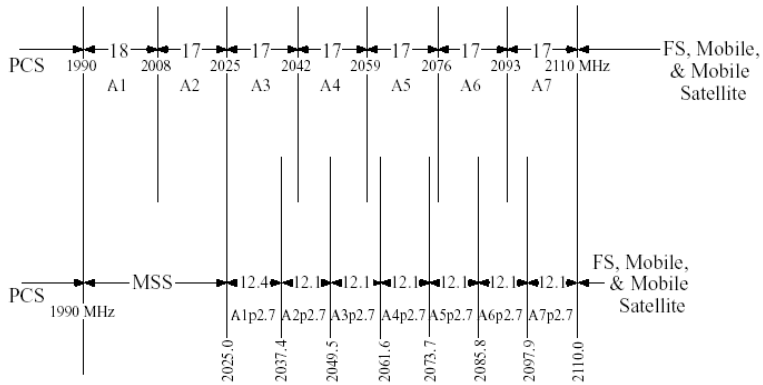
Summary of SBE plan

- 7 channels
- Each channel 12 MHz wide
- 0.5MHz channels on each end for Data Return Link.
- All center frequencies and offsets would be multiples of 250kHz.
- Offset frequencies would be +/ 3.0 MHz.
- Allows reuse of existing synthesizers.

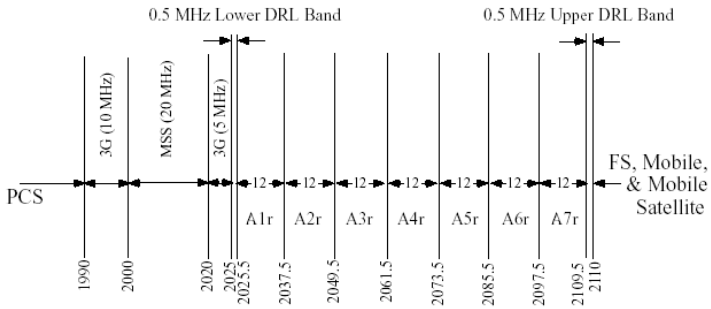
		SBE Proposed Frequency Plan					
	Lower RDL Band Edge	Lower Band Edge	Lower OFFSET	Band Center	Upper OFFSET	Upper Band Edge	Upper RDL Band Edge
Ch. 1	2025	2025.5	2028.5	2031.5	2034.5	2037.5	
Ch. 2		2037.5	2040.5	2043.5	2046.5	2049.5	
Ch. 3		2049.5	2052.5	2055.5	2058.5	2061.5	
Ch. 4		2061.5	2064.5	2067.5	2070.5	2073.5	
Ch. 5		2073.5	2076.5	2079.5	2082.5	2085.5	
Ch. 6		2085.5	2088.5	2091.5	2094.5	2097.5	
Ch. 7		2097.5	2100.5	2103.5	2106.5	2109.5	2110

ET Docket 95-18 Second Report & Order

Existing v. Phase Two 2 GHz BAS Band Plan (Indefinite Adoption Date) and Possible New Band Plan



Original Phase Two Band Plan (7-Channel Option)



Possible New Band Plan

DRL = Data Return Link

All frequencies and bandwidths are in MHz.

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Society of Broadcast Engineers, Inc.
Indianapolis, Indiana

Required Modification to Nucomm Analog Equipment

Analog Transmitters (Portable & ENG):

- Use existing synthesizers
- Replace new channel plan EPROM (switch can be added to changes between plans)
- Adjust or turn off audio sub-carrier frequencies and levels. Most 2GHz systems use 4.83MHz and 6.2MHz sub-carriers as the second sub-carrier. The 4.83MHz sub-carrier would not have to change. The 6.2MHz sub-carrier would have to move to 5.5MHz.
  (all Nucomm sub-carriers are field changeable)
- Adjust transmitters video and audio deviation

Analog Receivers (Portable and Central Receivers):

- Replace new channel plan EPROM (switch can be added to changes between plans)
- Adjust or remove audio sub-carrier frequencies and levels. Most 2GHz systems use 4.83MHz and 6.6MHz sub-carriers. The 6.2MHz sub-carrier would have to move to 5.5MHz
  (all Nucomm sub-carriers are field changeable)
- Adjust receivers video and audio output levels
- Replace IF band-pass-filters (factory replacement and alignment)
- Central Receive antenna channel filters would have to be changed. They are typically located on tall towers.

Required Modification to Nucomm Digital/Analog Equipment

Digital/Analog Transmitters (Portable & ENG):

- Program transmitters to new frequency plan.
  (all transmitters are field re-programmable to new channel plans.)
- Front panel presets allow for multiple RF frequency plans.
- In the Digital mode, no change required of video level or audio channels as video and audio are imbedded.
- In the Analog mode, the audio sub-carrier frequencies must be changed. They are field programmable through the front panel LCD display. Most analog ENG system use 4.83MHz as the first and 6.2MHz as the second sub-carrier. The 4.83MHz sub-carrier would not have to change. The 6.2MHz sub-carrier would have to move to 5.5MHz.
- In the Analog mode, the video and audio deviations must be reduced. They are manually adjusted. Recommend factory adjusted.

Required Modification to Nucomm Digital Equipment

Digital Receivers (Portable and Central Receivers):

- Replace or Download new channel plans into EPROMS for Central Receivers CR6. (switch can be added to changes between plans)
- The frequency plan for Portable Digital receivers are field programmable. Replace IF band-pass-filters as required (factory replacement and alignment). Most Digital Central and Portable Receivers have a switchable 10 MHz filter.
- In the Digital mode, no change required of video level or audio channels as video and audio are imbedded.
- In the Analog mode, the audio sub-carrier frequencies must be changed. They are field programmable by dip switches. Most analog ENG system use 4.83MHz as the first sub-carrier and 6.2MHz as the second sub-carrier. The 4.83MHz sub-carrier would not have to change. The 6.2MHz sub-carrier would have to move to 5.5MHz.
- In the Analog mode, the video and audio output levels must be increased to take account of the transmitters reduced deviation. Recommend factory adjusted.
- Central Receive antenna channel filters and LNA's would have to be changed. They are typically located on tall towers.
- Modify remote control systems

Support Level for Discontinued Radios

- All Nucomm radios, including discontinued radios, can be supported as outlined in previous slides. These synthesizers have step sizes of 250kHz.

Re-Tuning Nucomm Radio's

- A radio returned for re-tuning will be fully tested and performance verified for proper operation. This process will result in additional lead time for completing the repairs, especially the older radios.
- Because of the magnitude of retuning existing radios, Nucomm would have to set up a special operation to handle change over during the transition period.
- Many factors would effect the total time required to retune existing radios: Estimate 1 to 2 years depending on customer scheduling, Nucomm manpower availability and the availability or replacement of obsolete parts.

2GHz BAS Relocation Questions

- What is the new frequency plan?
- What standards do the modified radios have to meet?
- Who will set these standards?
- How will other manufactures handle change over?
- What is the time frame for making the changes?
- What is the change over plan?
- What stations or regions get priorities over others?

- Nucomm recommends that SMPTE or SBE establish a standards committee to address many of these questions.
- Committee members should include users, equipment manufactures and FCC

Suggested Change-Over Plan

- Changing the frequency plan of the transmitters and receivers is only half of the problem. The other half of the problem, and the more time consuming part, is resetting the sub-carrier frequencies, audio and video deviations and IF filters. These adjustments and changes should be done at the factory.

- One possible way to make the change over easier would be:

1 - During the "transition period", modify the radios with the new sub-carrier and deviation settings along with a "frequency plan switch" on the synthesizer that would switch between the current and the new frequency plan.

2 - As the modified radios come on line, operate all radios on the **current frequency plan** during the "transition period" but with the reduced deviation, new sub-carriers frequencies and new IF filters. On a given date the new frequency plans could be activated by the "frequency plan switch". All adjustments would have been made.

Suggested Change-Over Plan (Continued)

3 - During the "transition period", their would be a mix of radios with different deviation settings but with the current frequency plan. Systems are still operable with these mixed deviation and sub-carrier settings. The biggest difference is deviation between transmitters and receivers of about 25% (4 to 3 MHz deviation). This difference can be made up to some degree by temporarily increasing the video and audio input levels to the transmitters and increases in these levels at the studio.

4 - In most cases the 4.83MHz sub-carrier is common to all operations.

5 - If there is good coordination between station and manufactures, no one station would operate with the deviation difference for more than a month or so.

6 - Central Receivers typically have a minimum of two switchable IF filters, a narrow and a wide typically 10 and 17MHz. These would provide good operation until new filters are installed.

7 - By keeping the present frequency plan during the "transition period", nearby DMA's and itinerate operators can still co-exist.

8 - On a given date, all system would change to the new frequency plan by simply activating the switch on the synthesizer.

Overview of Today's 2 GHz BAS Digital Equipment State-of-the Art

- Switchable between Analog and Digital Modulation
- Programmable RF and sub-carrier frequency plans
- Multiple Presets select digital/analog, frequency band/channel, etc
- Digital Modulation is COFDM with integrated MPEG2 encoder
- Digital - 8MHz Bandwidth
- Future equipment switchable between 6, 7 and 8 MHz bandwidth
- Digital systems output 3 to 6 dB lower power for same system gain as analog systems. Lower power output but also lower receiver threshold
- COFDM operates good in multi-path environment. Analog very poor.
- Other digital modulations that fit in 12MHz bandwidths that are good for line-of-sight but not as good with multi-path as COFDM include:
  - QAM, VSB (typically 6 MHz bandwidth)
  - Digital FSK through Analog Radio with bandwidths less than 12 MHz