BEFORE THE FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, DC

In the matter of	)	
Replacement of Part 90	)	
by Part 88 to Revise the	)	PR Docket 92-235
Land Mobile Radio Services	)	
and Modify the Policies	)	
Governing Them	)	

REPLY COMMENTS
OF
CYCOMM CORPORATION

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SUMMARY

Cycomm supports the Commission's efforts to bring very narrow band communications into the private land mobile marketplace. Several different very narrow band technologies have been type accepted for use in the 220 MHz band and can be applied without much difficulty or delay to provide significant additional communications capacity in the Private Radio Services. Additional very narrow band technologies are also being developed, and these will also provide growth capability and options.

Cycomm believes that delays in the adoption of new technology will place the US mobile radio industry in an even more disadvantageous position in the global economy. The basic technologies associated with a 12.5 kHz bandwidth have been fully exploited by other countries that have used this bandwidth for the past 20 years. However, the basic technologies associated with a 5 kHz bandwidth have not yet been internationally adopted and the US has an opportunity to recapture a significant share of the international market if it proceeds quickly to implemenation of very narrow band technologies.

The comments that decry the expense of wholesale replacement of radio systems must be viewed in context. Existing radio equipment is changed out as it becomes unserviceable or

uneconomic to retain, generally on a 7-10 year cycle. It is somewhat less for mobiles and portables, somewhat more for base stations and repeaters. Therefore, it is the difference in expense related to early replacement of the original system, rather than the cost of an entire new system with added features, that should be allocated to the adoption of a new technology.

1. BACKGROUND

Cycomm Corporation is a leading manufacturer of communications privacy and security products and is also the North American manufacturer's representative for Securicor PMR Systems, Ltd. and Linear Modulation Technology, Ltd., both of Midsomer Norton, England. Cycomm participates actively in the deliberations and work of Project 25[1] and of TIA's technical standards committees.[2] Additionally, Cycomm provided comments in response to the Commission's Notice of Proposed Rule Making for Comments in the instant proceeding[3] and its preceding Notice of Inquiry.[4]

2. DOCKET 92-235 IS REVOLUTIONARY

The principal effect of this docket is to change forever the technologically restricted nature of the Private Land Mobile Radio Services. The Commission proposes to rechannel the 72-76 and 150-174 MHz bands from 20 and 30 kHz respectively to 5 kHz, and to rechannel the 450-470 and 470-512 MHz bands from 25 kHz to 6.25 kHz. The Commision also proposes to permit exclusivity in the lower frequency bands, to constrain field strengths such that with exclusivity the frequency can be reassigned on a 50 mile grid. It also

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[1]Project 25 is a joint effort of the Association of Public Safety Communications Officers, Inc. (APCO), the National Association of State Telecommunications Directors, Inc. (NASTD) and some agencies of the Federal Government.
[2]TIA is an acronym for Telecommunications Industry Association, Inc.
[3]Notice of Proposed Rule Making (FCC 92-469), PR Docket 92-235, 57 FR 54034 (November 16, 1992)
[4]Notice of Inquiry, PR Docket 91-170, 6 FCC Rcd 4125 (1991)

proposes to reduce the variations of user categories to three, and to stage the transition in a timely fashion that would still allow existing users a period of time to amortize their radio system investment. This would require, and more importantly, would also enable, new users to immediately adopt new narrower bandwidth technologies

B. THE MANUFACTURERS ARE NOT UNANIMOUS

As previously noted, Cycomm is a member of TIA's Private Land Mobile and Personal Radio Section as well as other Sections and technical standards committees within the organization. Cycomm authored parts of the original draft documents that were later submitted as TIA's Comments. However, Cycomm, among others, dissented from the documents submitted as the TIA position.

Cycomm did this not to frustrate the TIA position, but because Cycomm believes that the position taken by TIA is not technologically correct and, further, is not an even-handed analysis of the available technologies and their long term potential to permit technological growth. Perhaps more significant, however, is the inference that TIA's submittal represents a consensus of its members, with a further inference that its position is impartial, technically correct and the best technical advice the US land mobile manufacturers can offer.

Cycomm has also been involved in the preparation of the TIA Reply Comments in this proceeding. At this writing, it appears that the same issues remain unresolved and a consensus has not been achieved.

4. CYCOMM SUPPORTS THE COMMISSION'S GOALS

We recognize the concerns expressed in the comments are valid to those who expressed them, and we also expressed our own concerns in our Comments. However, the Notice of Proposed Rule Making in Docket 92-235 aims at a higher goal -- that of the common good. We believe the Commission's overall approach to resolution of the long term demand for more communications capacity, usually expressed as a demand for more spectrum, is on target. Our reply to the commenters can be summarized as "let's do more".

5. THE COMMISSION'S PROPOSED APPROACH IS LARGELY CORRECT

The Commission should stay on its course to vastly improve the communications opportunities for private radio users and should expedite the transition to improved spectrum use consistent with established Federal regulations and policies such as tax laws. Delay in the implementation of efficient use in the construction and operation of private land mobile radio systems is not in the public interest. Such a delay disenfranchises both those existing users who would benefit from a reduction in the interference received from co-channel users and those future users who would be able to satisfy their private communications needs in a timely and cost effective manner. The lost opportunity costs far

outweigh any differential in early receiver and transmitter replacement costs.

6. VERY NARROW BAND TECHNOLOGIES ARE AVAILABLE TODAY

Several very narrow band technologies and narrow band equivalent technologies are being produced commercially or are available to be produced commercially within the next two years. These technologies give at least a two fold improvement over technologies being offered for 12.5 kHz channeling. One of these technologies, linear modulation, is among those here today. Three significantly different technologies, two linear and one FM, have been type accepted for application in the 220 MHz band, indicating that it is possible to manufacture different radio equipment offering a

Mobile Services for the next 30 years should be determined by business considerations of today. As has been demonstrated by the 220 MHz proceeding, a rule making to implement very narrow band technology is self-fulfilling.

If the Commission were to choose 5 kHz bandwidth and set a requirement for release of licenses in the new channelization when at least two manufacturer's products had been type accepted, we think the release of the licenses for the new channelization might occur virtually simultaneously with the release of the Report and Order in this docket.

7. THE COMMISSION NEEDS TO PROVIDE ACCESS TO NEW TECHNOLOGY THROUGH THE PRIVATE RADIO SERVICES

Those who ask to continue today's technology for the next 20 years must surely not understand that this rule making will determine whether the Private Land Mobile Radio Services will have the capacity to survive the challenges by the other new wireless technologies (PCN, PCS, radio PDA, CDPD). The technology available to private radio users must keep pace and be commensurate with the wireless technology available to the general public, or else the private radio services, except for life or business critical functions where absolute control is favored over modern solution, will be replaced by the more nearly universal public service offerings.

For example, compare the time cycle for introduction of new, advanced private radio handhelds with the time cycle for new, advanced cellular portables. Only in the frequency bands where cellular-like service is possible can one find highly advanced portable radios with the 6-18 month technology introduction time cycles approximating cellular radio. Note that virtually all the private cellular-like service providers are transitioning to high customer base technologies, increasing frequency reuse, applying very narrow band-equivalent modulation technology and networking the stations to provide equivalent or better coverage.

8. THE PRIVATE LAND MOBILE RADIO INDUSTRY NEEDS TO REFOCUS ON SIGNIFICANT OPPORTUNITIES FOR ACCOMMODATION OF MORE USERS RATHER THAN ON MAINTAINING STATUS QUO

Several of the commenters wanted no significant changes to the current rule base, or requested a 10-20 year delay in the implementation of plans to improve the communications capacity of the current spectrum. Such a delay would be self-defeating. The pace of technology is such that many wireless services that ought to be offered to private radio service licensees will be denied because not enough communications capacity is available within the present rules.

Such a denial is unnecessary because the technology is available to increase 5:1 the number of primary channels and to get an additional 2:1 improvement over that which comes from use of the tertiary offset with distance scheme currently employed in most of the 150 MHz service allotments, or an overall 10:1 growth when needed. Immediate benefits accrue to all users, existing and new, from the reduction in congestion and the increased communications capacity that will permit entities to adopt new communications services.

9. LINEAR MODULATION TECHNOLOGY IS AVAILABLE TODAY TO VASTLY IMPROVE THE LEVEL OF SERVICE WITHIN THE CURRENTLY ALLOCATED SPECTRUM, FOR BOTH ANALOG AND DIGITAL APPLICATIONS

Some commenters remarked that very narrow band linear modulation technology has not yet been tested in dense urban markets and one should wait until the 220 MHz band has been sufficiently built out and loaded before such technologies are inflicted on the mass of users in the 150 MHz band.[5] Contrary to what those commenters argue, the measurement standards, metrics, are clearly defined in the international

[5]*See* Comments of the Telecommunications Industry Association, pages 10-12

standard MPT 1376, and the procedures to test radios against the metrics are straightforward.[6]

Other commenters suggested that multi-[redacted]

narrow band technologies. Because the principal goal of the instant proceeding is to cause a dramatic increase in communications capacity to occur within the existing spectrum, the Commission should move aggressively toward the adoption of 5 kHz linear modulation technology.

11. A BANDWIDTH CHOICE OF 12.5 KHZ IS AN ECONOMIC AND TECHNOLOGICAL ALBATROSS

A transition to 12.5 kHz channel bandwidth, regardless of technology, may be a more detrimental decision than the continuation of 25 kHz. It will not result in significant improvement in the accommodation of users and will certainly not be able to accommodate exclusive use in the frequency bands of interest. All three bands below 470 MHz are heavily used in frequency offset configurations. Additionally, the 72-76 MHz band is currently channeled for 20 kHz channels, making it difficult to easily adopt a phased migration plan. Ericsson-General Electric (E-GE) detailed the net gain in the 150 MHz and 450 MHz band public safety channels in a presentation to the TIA TR-8.15 Committee on Common Air Interface Committee on May 1, 1993. E-GE concluded there would be no gain in the number of 150 MHz channels by channeling at 15 kHz to accommodate 12.5 kHz bandwidth and only 76 additional channels could be gained from the 450 MHz band. However, a count of the 450 MHz channels identified in Section 90.555 of the Commissions

Rules, 47 CFR §90.555, revealed there are 633 primary channels and in 47 CFR §90.267 there are 616 offset channels. In all the services, the communications capacity to be gained from a 12.5 kHz primary channel plan is largely illusory.

A. THE HALF LIFE OF THE 12.5 kHz TECHNOLOGIES HAS BEEN EXCEEDED

This bandwidth has been extensively used in Europe and elsewhere for the past 20 years. Several European initiatives would move away from 12.5 FDMA to much more bandwidth efficient technologies. The 12.5 kHz modulation technologies do not yield the high communications capacity and flexibility of very narrow band technologies. Also, as pointed out above, there is little if any additional real communications capacity to be gained from a plan to use 12.5 kHz bandwidth, because those services already using the frequency offsets will have to be accommodated in some fashion.

B. VERY NARROW BAND TECHNOLOGIES HAVE WORLD MARKET POTENTIAL

The US has experienced some difficulty in international and domestic negotiations for additional land mobile spectrum in part because the US has not pursued options in common use in the rest of the world to meet the demand. Typical US urban application specific parameters such as antenna height and radiated power exceed those of European systems by an order of magnitude. Nor do equipment specific parameters closely

match the European requirements. However, Europe and the rest of the world are only now beginning to set standards for, and implement, very narrow band technology. By taking the lead in setting out the base requirements, the US will gain stature and US manufacturers have an opportunity to take their technology to the world market. The 12.5 kHz technologies do not provide this market opportunity.

12. THE 450 MHZ BAND SHOULD BE CHANNELED AT 5 KHZ

There is no need to set different bandwidths for the different frequency bands.[9] Linear modulation technology is frequency independent. Frequency modulation's inherent advantages disappear when the allowable bandwidth is collapsed, and virtually all 6.25 kHz technologies offer some form of linear modulation, with an occupied bandwidth of at least 5 kHz. However, the same operational functions are also available in 5 kHz bandwidth. Therefore, there is no technological justification for setting the channel bandwidth for the 450-470 MHz and 470-512 MHz bands at 6.25 kHz when an additional 25% gain in the number of assignable channels can be achieved at no additional cost to the user. The field operational performance of linear modulation radios ranges from equivalent to significantly superior to that of today's 25 kHz FM radios. For any 5 kHz linear

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[9] *ibid.*

modulation technology, the occupied bandwidth is 4 kHz, leaving 1 kHz for frequency drift. This translates to a frequency tolerance at 150 MHz of 0.0003%. At 450 MHz, the required frequency tolerance is 0.0001%. Both of these tolerances are easily achieved by today's radio equipment. The tolerance of 0.0003% is comparable to that accepted by industry for 450 MHz operation some 25 years ago. The tolerance of 0.0001% is comparable to that selected for 800 MHz operation more than 20 years ago.

13. SUBMITTED COST DATA MAY BE MISLEADING

Several commenters submitted cost data associated with changeout of systems to narrow band technology. We have reviewed these comments and have found the commenters did not separate the costs associated with replacement due to "normal wear and tear" from the costs due to early replacement as a result of changed FCC requirements.

Only those portions of the equipment costs associated with early replacement can be properly identified as FCC bandwidth changeout costs. A gradual phase in of the new operation can be achieved, no matter what channel bandwidth is eventually adopted and at a very low marginal cost, because modern day radios typically incorporate microprocessors to perform various operational functions. Very narrow band radios, due to their linear transmitters

and extensive use of microprocessors in tuning, modulation, filtering and control, can be designed to be backward compatible to 25 kHz operation at an extremely low cost. For normal replacement, only the marginal costs associated with dual mode/new technology can be properly identified as FCC bandwidth changeout costs. Therefore, all cost data submitted is suspect.

When assigning costs due to a reduction of field strength associated with the FCC's proposed reductions in effective radiated power and antenna height, separate technology and cost analyses are required to evaluate the effect on service area, co-channel interference and adjacent channel interference. Only then can one correctly analyze the cost/benefit ratio of adopting new technology.

For these reasons, the submitted cost analyses are invalid.

14. THE WORLD COMMUNICATIONS NETWORK IS RAPIDLY CHANGING TO DIGITAL OPERATION

Virtually every communications service in the world has been affected by the development of new technologies that employ digital transmission and digital techniques to accomplish what was performed previously through analog circuits. The integration of multiple new digital technologies make it possible to provide seamless roaming, not just nationwide,

but continent wide, for dispatch services as well as for public mobile services and wireless networks. Only If communications capacity is available can these modern business tools will be able to be incorporated into the private radio users menu of choices.

Many utilities are installing fiber optic cable combined with the overhead static ground wire or buried in the utility right of way as a replacement for their various radio and microwave fixed communications networks. By and large, these fiber optic systems replicate digital services available from communications common carriers and satellite service providers. These fiber networks are digital and can be easily tied into a digital radio network. Therefore, one can logically expect to encounter increasing requirements for digital operation, and linear modulation accommodates efficient, rapid digital communications at significantly higher data rates than are possible in 12.5 kHz constant envelope (FM) systems.

An additional benefit of linear modulation is its ability to

Therefore, the Commission's most desirable path of action is to move expeditiously and directly to a 5 kHz channel plan for all private radio frequency bands and services, with the accommodation of wider bandwidths on a secondary basis, under specific terms and conditions.

15. THE MIGRATION PATH TO LINEAR MODULATION IS EASY TO ACHIEVE

A basic requirement of APCO Project 25 is backward compatibility. Additionally, several commenters expressed concern that any technology eventually adopted should be required to be backward compatible to permit operation on 25 (or 30) kHz channels, so users can extract the full economic life from their existing radio systems. Due to the inherent nature of radios that are software controlled and filtered, and the characteristics of linear final amplifiers, linear modulation radios are capable of backward compatibility with a large variety of modulation schemes and bandwidths. We view this concern as being relevant to existing proprietary control and modulation systems, but unimportant to conventional analog systems because there will not be any proprietary issues to resolve, and compatibility will therefore be easy to achieve.

16. LINEAR MODULATION TECHNOLOGY WILL CAUSE LESS INTERFERENCE

Linear modulation technologies, unlike the FM or constant envelope technologies, have an average transmitted power significantly lower than the peak power. Therefore, as linear modulation technologies are adopted, ambient RF noise on congested sites such as Mt. Wilson or the World Trade Center will be lowered by the simple fact that the transmitters at those sites and ones nearby will migrate to systems that have lower average powers for the same peak power. This reduction in site noise also reduces intermodulation, adjacent channel interference, and for the same transmitter spacing, co-channel interference.

TIA, among others, is concerned that the adoption of very narrow band technologies might create a major problem in that the increased number of possible frequencies to be considered in intermodulation analysis would be larger than could be analyzed by present methods.[10]

If current methods of analysis cannot cope with the large numbers of frequencies in use within interference range of the proposed site, the Commission will have largely achieved its goal. The Commission will have significantly increased

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[10] *See* Comments of the Telecommunications Industry Association, pages 12-14

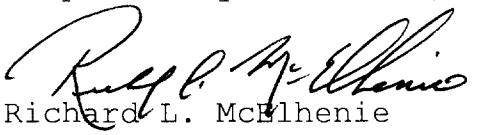
access to communications opportunities for much larger numbers of users, manufacturers will have taken advantage of the greatly increased market opportunities, and radio users will have found the price, quality and availability of private radio communications to be advantageous. This is the classic, but rare, "Win, Win, Win"!

18. CONCLUSIONS

Very narrow band technologies currently being considered offer definite spectrum assignment advantages over any 12.5 kHz FDMA technology, when comparing like service offerings. The difference can be as much as a 9:1 advantage per 25 kHz FM channel for narrow band technology, dependent on the individual technology. For example, linear modulation radios that meet the international standard MPT 1376 can provide this spectrum savings.

Many analogies can be drawn between the Commission's Spectrum Refarming docket and the long standing Federal Government program to encourage suppliers and buyers to adopt fuel efficiency. Would that the results of this docket be so successful.

Respectfully Submitted,



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