

Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF SECRETARY

In the Matter of )  
)  
Replacement of Part 90 by )  
Part 88 to Revise the Private )  
Land Mobile Radio Services )  
and Modify the Policies )  
Governing Them )

PR Docket 92-235

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**SUPPLEMENT TO COMMENTS**

Linear Modulation Technology Limited ("LMT"), by its counsel, hereby supplements the Comments filed previously in the above-captioned proceeding by its affiliate, Securicor PMR Systems Ltd. This Supplement will address the ex parte submission in this proceeding dated November 16, 1994 of the Association of Public-Safety Communications Officers-International, Inc. ("APCO").<sup>1</sup>

By its submission, APCO has listed seven reasons underlying its stated opposition to 5 kHz channel spacing. This material is new to the record in this proceeding, and was submitted on an ex parte basis. LMT, accordingly, wishes to respond to each criticism of 5 kHz technology to correct any misimpressions concerning the capabilities of that technology that may have been created by the APCO submission. As discussed herein, APCO's criticisms of 5 kHz channel spacing appear based largely upon the assumption of the use of FM technology, and thus

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<sup>1</sup>The APCO submission presents material new to this proceeding. LMT, accordingly, requests leave to submit this Supplement to Comments and requests that this Supplement be accepted in the record in this proceeding.

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ignores capabilities of the Linear Modulation, or "LM," technology that has been developed by LMT. LMT thus does not believe that APCO's assumption reflects the current state-of-the-art of available 5 kHz technology, nor that APCO's criticisms of 5 kHz technology are otherwise sound.

LMT, indeed, has developed the LM 5 kHz private mobile radio system that was described by Peter Hilton, Managing Director of LMT, during the FCC's May 6, 1993 roundtable discussion in this proceeding. See Letter of Richard Shibben, Chief, Land Mobile and Microwave Division, Private Radio Bureau (May 18, 1993) (Appendix A to these Comments). The LM system, which was type-accepted by the FCC in March 1994, uses the very latest digital processing and linear radio techniques to give superior voice quality together with, currently, 14.4 kb/s high speed data in a 5 kHz channel. The LM system meets the MPT 1376 U.K. specification for 5 kHz channelization.

With the view that multiple sources of supply will ensure the robustness of the 220 MHz equipment market and will maximize product diversity and availability, LMT has embarked upon a program to ensure the licensing, manufacturing and distribution of LM technology in the 220 MHz band in the U.S. LMT itself manufactures and distributes 220 MHz LM equipment in the U.S., and has also licensed E.F.Johnson Co. for these purposes. LMT, in addition, is currently in discussions with other potential suppliers of 220 MHz LM products in the U.S. LMT has committed a significant amount of resources to ensuring the

successful introduction of LM systems in the U.S.

1. FIELD TESTING OF 5 KHZ EQUIPMENT

APCO's first criticism of 5 kHz channel spacing is that it is "[b]ased on equipment which has not been fully field tested and proven as capable of performing the necessary function." This comment, in LMT's view, ignores the considerable efforts and expenditures of many parties, including LMT, in developing 5 kHz technology, and in bringing that technology to market, efforts that, among other things, have formed the basis for the allocation of the 220 MHz band in the U.S. and the adoption of the MPT 1376 standard in the U.K.

In its decision allocating the 220-222 MHz band for use by the Private Land Mobile Radio Services, the FCC made clear its intent that the band provide a "home" for the development of narrowband technologies to their fullest capabilities and serve as a test bed for the possible deployment of those technologies in other bands. See Amendment of Part 90 of the Commission's Rules to Provide for the Use of the 220-222 MHz Band by the Private Land Mobile Radio Services, 6 FCC Rcd. 2356, 2358 (1991), recon., 7 FCC Rcd. 4484 (1992). The FCC's award of licenses in the 220 MHz band by lottery thereafter was the subject of protracted litigation, which delayed the rollout of 5 kHz technologies. The FCC has now established a construction deadline of April 4, 1995 for the 220 MHz local licensees. See Implementation of Sections 3(n) and 332 of the Communications Act (Third Report and Order), FCC 94-212 (September 23, 1994), recon.

pending.

Despite the delays in implementation of the 220 MHz service, Securicor PMR, SEA Inc., E.F. Johnson, II Morrow and Uniden have all received type acceptance for 220 MHz 5 kHz equipment. Much testing and experimental operation of these 5 kHz products, of course, preceded the FCC's grant of type acceptance.

In addition, LMT has been an active proponent of the development of emerging spectrally-efficient very narrowband land mobile technologies and a frequent participant in matters before the Radiocommunications Agency ("RA") of the U.K.'s Department of Trade and Industry looking toward the establishment of standards and rules to govern the migration of U.K. PMR systems from their existing 12.5 kHz channelization to VNBR 5 kHz channelization. These proceedings have culminated in the adoption by the RA of the MPT 1376 5 kHz standard that was reported by Securicor PMR to the FCC in this proceeding in its Supplemental Comments of September 8, 1993.

To the best of LMT's knowledge, approximately three hundred 220 MHz systems have been constructed and are operational or will soon be operational; substantially more of these systems will be constructed and operational by the April 4 deadline.<sup>2</sup>

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<sup>2</sup>SunCom Mobile & Data, Inc. ("SunCom") has requested that the FCC reconsider its denial in the Third Report and Order of extended implementation authority to consolidate and construct a wide-area 220 MHz system. LMT will be submitting Comments to the FCC on SunCom's Petition For Reconsideration by the January 20 deadline supporting the grant of a further extension of the April 4 construction deadline for those 220 MHz licensees that can

The installation and operation of these 220 MHz systems will provide over the next six to twelve months far more information and, indeed, operating experience than can be obtained from any level of testing.

Accordingly, LMT urges both the FCC and APCO to recognize the substantial efforts and expenditures that have resulted in much progress to date in the implementation of 5 kHz technologies in the U.S. LMT, indeed, has demonstrated the capabilities of its LM systems (including its high speed data performance) to many prospective users, including APCO-25, and restates here its commitment to working with all prospective users of LM technology. LMT further notes that, in fact, 5 kHz LM equipment is in operation today. Given these considerations and the lengthy time scales for refarming of the PLMS bands below 512 MHz under consideration in this proceeding, APCO's expressed concern over the lack of field testing of 5 kHz technology is inapposite to the resolution of the issues in this proceeding.

## 2. 5 kHz System Performance

APCO's second stated criticism of 5 kHz technology is that as channel widths are reduced, system performance suffers, signal to noise ratio suffers and throughput is reduced. LMT has demonstrated in this proceeding and generally to the land mobile community, however, that use of LM technology does not in fact require the acceptance of worse system performance with a

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demonstrate good faith efforts toward construction of their systems.

reduction in bandwidth from that currently authorized in the PLMS bands using FM equipment.

To this end, APCO's criticisms regarding reduced system performance resulting from the reduction in bandwidth assume that FM equipment is employed in the 5 kHz channel. This assumption thus fails to consider the capabilities of LM equipment, which do not follow the principles of FM. LM's performance in terms of voice quality in fact is demonstrably comparable to 25 kHz FM voice and considerably superior to that proposed for 12.5 kHz APCO-25 equipment. LM signal-to-noise ratios are comparable to the best FM receivers. As noted above, LM data speed of 14.4 kb/s is well in excess of any existing FM system and is superior to the proposed APCO-25 standard of 9.6 kb/s.

### 3. Encryption over 5 kHz Channels

APCO suggests further that 5 kHz equipment does not appear to be readily adaptable to encryption technology. LM equipment, however, operates independently from the choice of modulation (e.g., analog voice, QAM, modulated data, etc.) and therefore can readily accommodate encrypted voice with less distortion than that which will be obtained under APCO-25's standard due to LM's superior bit error rate performance. In LMT's view, land mobile users will continue to demand voice quality that is at least comparable to that now available. LM technology thus provides the real advantage of clear analog voice transmissions, with the option, when necessary, of digital encrypted voice.

#### 4. System coverage

APCO further states that field tests of 5 kHz systems indicate that system range will be reduced and that additional repeaters may therefore be necessary to cover the same service area. APCO has not, however, provided detail on, or the results of, these field tests.

Assuming identical effective radiated power, LM equipment in fact will provide superior system coverage over either existing FM or digital APCO-25 12.5 kHz technology. LM has a softer degradation at the range edge than these technologies making analog voice more comprehensible in range-limited systems. LMT is confident that the system performance of the 220 MHz LM systems now under implementation will demonstrate this conclusively.

#### 5. Interoperability

LMT is confident that compatibility between 5 kHz LM equipment and other technologies can and will be achieved if the PLMS markets ultimately demand interoperability.

#### 6. Intermodulation

APCO questions the potential for increase in intermodulation problems due to the implementation of 5 kHz technology. This issue is, however, not exclusive to 5 kHz technology. Indeed, as is reflected on the Intermodulation Products chart attached to the APCO ex parte submission, any problems from increased intermodulation will also exist with the deployment of any technology more spectrally-efficient than that

serving the existing channelization of the PLMS bands. LMT believes that the answer to any increase in intermodulation resulting from the implementation of narrowband channelization is sound system engineering. For example, proper site selection and combining techniques (such as the use of high power linear amplifiers and band pass filters as is common in the U.K.) will minimize intermodulation effects. Moreover, given the lower average power level required by LM equipment to attain the same range, the intermodulation effects resulting from the use of 5 kHz channel spacings are further minimized through lower site noise and overall RF pollution. The sole way to eliminate increased intermodulation simply is to retain the existing channelization of the PLMS bands which, of course, would defeat the purpose of this proceeding.

#### 7. Ancillary devices

APCO, finally, expresses a concern over the limitations of equipment ancillary to radio transmitters and receivers, such as antenna duplexing schemes. Beyond its speculation that there "is a finite limit" to these devices, APCO has provided no detail whatsoever establishing that these devices can not and will not accommodate 5 kHz channel spacings, nor has it provided any reason to differentiate between the capabilities of these ancillary devices to operate with 5 kHz technology as opposed to 6.25 kHz or 12.5 kHz technology.

LMT is confident that any equipment or devices necessary to enable the operation of 5 kHz technology to capture

usable channels exist today. LMT believes that this is evident from the on-going deployment of 5 kHz technology in the 220 MHz band. LMT further believes that with operational experience, the equipment manufacturers will develop an enhanced and improved array of ancillary equipment and associated devices. LMT to date has expended significant research and development efforts to diversify LM product offerings and will continue to respond in kind to market demand, no doubt as will other vendors of 5 kHz equipment.

For these reasons and those articulated earlier in this proceeding by Securicor PMR, LMT believes that this refarming initiative offers the Commission the unique opportunity to provide its PLMS licensees with improved system performance, increased equipment options and service offerings and increased channel capacity. For its part, LMT stands ready to demonstrate the capabilities of 5 kHz LM equipment and is confident that the on-going deployment of 5 kHz systems in the 220 MHz band will answer fully and finally any concerns, such as those expressed by APCO, regarding the capabilities of 5 kHz equipment.

**Respectfully submitted,  
LINEAR MODULATION TECHNOLOGY LTD.**

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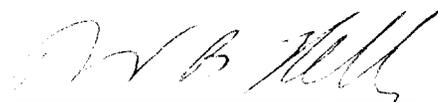
January 18, 1995

CERTIFICATE OF SERVICE

I, Robert B. Kelly, hereby certify that a copy of the foregoing Supplement to Comment was mailed, first class, U.S. mail, this 18th day of January, 1995, to the following parties:

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