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FEDERAL COMMUNICATIONS COMMISSION
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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

In the Matter of	)	
	)	
Reallocation of the 216-220 MHz,	)	ET Docket 00-221
1390-1395 MHz, 1427-1429 MHz,	)	RM-9267
1429-1432 MHz, 1432-1435 MHz,	)	RM-9692
1670-1675 MHz and 2385-2390 MHz	)	RM-9797
Government Transfer Bands	)	RM-9854

To: The Commission

REPLY COMMENTS OF
ELECTRONIC TRACKING SYSTEMS, L.L.C.

Electronic Tracking Systems, L.L.C. ("ETS"), by its counsel, hereby replies to certain of the opening comments filed in the above-captioned proceeding.

Background

As ETS discussed in its opening Comments, re-allocation of the band 216-220 MHz would destroy its utility for a multitude of highly beneficial low power uses. These include, most notably, the law enforcement tracking systems provided by ETS in numerous cities around the United States -- systems which have made a material contribution to reduced robbery rates and improved public safety. Those uses also include auditory assistance devices which have greatly improved the lives of many disabled citizens, and seismic telemetry equipment used in the search for new domestic oil and gas reserves -- one of the Bush Administration's highest policy priorities.

ETS further demonstrated that the Commission need not auction the 216-217 MHz band; that even if an auction were required, ETS systems operate in that band on two discrete

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frequencies dedicated exclusively for law enforcement purposes; that law enforcement tracking systems in this band should therefore be deemed auction-exempt as a public safety radio service; and, finally, that low power users should be granted primary status without the need for individual licensing (in the case of low power users like law enforcement tracking which are licensed by rule).

Based on the opening comments it is clear that the vast majority of commenters agree that the band should be preserved for low power uses. By contrast, there are only a handful of proposals seeking high power operations. These include, for example, filings by Mobex Communications, Inc. ("Mobex"), which would have the band allocated for base stations with powers as high as 1000 watts or more; and Trimble Navigation Limited ("Trimble") and Pacific Crest Corporation ("Pacific Crest"), which seek to have the band authorized for survey operations using "real-time kinematic" ("RTK") technology.[1] These systems would operate with base station powers up to 35 watts and a range of 30 miles. Pacific Crest at 3, 6-7; *but see* Trimble at 8 (suggesting that RTK power-height could be up to 500 watts ERP at a height of 670 meters (HAAT) for a coverage area with an 80 km radius).

Discussion

As explained in greater detail in the attached Technical Statement from Mr. David Wood, President, ETS, there is no way law enforcement tracking can co-exist with high power operations like these. Claims by Mobex, for example, of an intention to protect incumbent low power users, while perhaps sincere, are without foundation from an engineering standpoint.

[1] Mobex appears to contemplate expansion of automated maritime services, power levels for which are specified at Rule 80.215(h). Mobex's subsidiary, Regionet, had previously proposed paging services for this band. Rule 22.535 prescribes power as high as 1,400 watts for paging.

Indeed, high power proponents themselves appear to recognize the problem by suggesting in the alternative that low power users like law enforcement tracking be relegated to some other band.

Insofar as interference is concerned, Mr. Wood's statement explains in detail the effects that Mobex and/or Trimble equipment would have on law enforcement tracking equipment. That equipment would be de-sensed by high power emissions, particularly given the sensitivity of tracking receivers -142 dbm necessary to achieve practical tracking ranges of one to two miles. Even Mobex/RTK operation on nearby channels would be such as to preclude practical operation for law enforcement tracking. As Mr. Wood observes, the emission mask of an RTK transmitter would need to be 104 db below its 35 watt transmitted power in order to avoid interference even at a one mile range from the RTK transmitter.

The Commission has previously addressed the issue of potential interference to law enforcement tracking. Indeed, the agency determined to dedicate two frequencies exclusively for this purpose in order to minimize "the threat of interference from other low power services." *Report and Order* in WT Docket No. 95-56, 11 FCC Rcd 18517, 18532 (1996). For the same reasons, the Commission restricted maximum transmitter power for all low power users in the 216-217 MHz band to 100 mW ERP. The proposed Mobex/RTK high power operations present a "threat of interference" orders of magnitude greater than that contemplated in the *Report and Order*. Thus, such operations should continue to be precluded in this band.

Nor is relocation for low power incumbents, as some have proposed, a viable option.[2]

First. The high power proponents fail to identify just where the low power community might be relocated to. This is no trivial issue given the increasing difficulty that the Commission

[2] *See* Mobex at 7; *see also* Securicor Wireless Holdings, Inc. at 6.

confronts in identifying spectrum suitable for portable/mobile communications (spectrum below 3 GHz).

Second. Even if the proponents had identified a band, it is questionable whether such a band would offer propagation characteristics suitable for low power users, especially for law enforcement tracking where range is a critical factor.

In the case of such systems, one is dealing with extremely low power devices which emit very weak signals (typically on the order of 1 mw ERP), and must be tracked through urban canyons. Worse, the transmitters are often in the trunk or on the floorboard of a getaway car, reducing the ERP to less than 1 mw. Thus, signal attenuation is of concern under the best of circumstances.

Path losses associated with higher frequencies, such as 400 MHz or above, combined with multipath effects, render it virtually impossible to conduct operations at the distances necessary for reliable tracking, e.g. one mile from a bank robber to a patrol car, five miles from a robber to roof-top receive sites.

At lower frequencies (say below 200 MHz), wavelengths require use of larger antennas on both the transmitting and receiving end, precluding their use in clandestine applications. In addition, at frequencies below 200 MHz man-made noise tends to de-sense the receivers used for tracking and triangulation. As the Commission is aware, the presence of background noise (chiefly from paging operations) in the 72-76 MHz band forced the migration of low power users to 216-220 MHz.

Accordingly, no weight should be accorded arguments that low power users like law enforcement tracking simply can be relocated. *See, e.g., Notice of Proposed Rulemaking* in PR Docket No. 89-599, 4 FCC Rcd 8657, 8660 (1989) (Commission proposes to authorize

emergency locator transmitters at 220-222 MHz due, *inter alia*, to favorable antenna design/propagation characteristics vis-à-vis 72-76 MHz); *Report and Order* in Gen. Docket No. 87-14, 3 FCC Rcd 5287, 5289 (1989) (rejecting allocation for narrowband land mobile services in low band VHF range due to, *inter alia*, antenna length and man-made radio noise problems).

Finally, the contention by Trimble that a "carrier sense" function can be used to avoid occupied channels is unavailing. *Id.* at 6. Coverage of the 35 watt RTK transmitters is far broader (a 30 mile radius according to Pacific Crest) than that of law enforcement tracking systems; the RTK equipment would likely sense the presence of a tracking signal only if the tracking transmitter were within a mile or so of the RTK transmitter site. Tracking operations further removed , i.e. within the remaining 29 mile radius of the RTK coverage area, would go undetected and, consequently, be disrupted.

The other problem with carrier sense is that it makes no allowance for the channel availability required for tracking systems. Tracking transmitters must remain in an "off" state until a crime occurs, at which time the channel must be instantly available. This is another reason the Commission, in its 1996 Report and Order, assigned two channels exclusively for law enforcement tracking. However, the RTK unit might have determined the channel to be available just moments before; the carrier sense function does not account for this.

Conclusion

For the reasons expressed here and in ETS' opening Comments, the 216-220 MHz band should be protected against new, high power entry.

Respectfully submitted,

Electronic Tracking Systems, L.L.C.

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DECLARATION

I, David Wood, hereby declare as follows:

I am President, Electronic Tracking Systems, L.L.C. ("ETS"). I am submitting this Declaration in connection with ETS' Reply Comments being filed in ET Docket No. 00-221. In particular, this Declaration addresses the interference that would be experienced by law enforcement tracking systems ("LETS") if high power uses were allowed in the band 216-217 MHz; and suggestions that low power incumbents like law enforcement tracking should be relocated to other spectrum.

Issue 1 – High Power Transmitters in 216 to 217 MHz

Mobex Communications, Inc. ("Mobex" or "Regionet") is among the commenters seeking high power entry. The services contemplated by Mobex (automated maritime telecommunications or possibly paging) would presumably be at effective radiated power levels of 1,000 or even 1,400 watts. See Rules 22.535, 80.215(h). Other commenters, such as Pacific Crest Corporation, have proposed 35-watt transmitters with a 30 mile range for "real-time kinematic" ("RTK") technology.

At power levels like these, low power radio service users in general, and law enforcement tracking operations in particular, would be terminally affected. High power transmitters emanating on the same channel as tracking operations would completely de-sense ETS receivers. These receivers have a very wide dynamic range (over 100db) so as to pick up a very wide range of low-level signals, and these receivers have a very high sensitivity, -142dbm worst case. This sensitivity is needed to receive and track the very low signal levels emanating from miniature transmitters (1 mw in typical conditions, often less in practice) hidden in stolen cash or goods – signals which are often seeking to radiate from the trunk of an automobile or under a seat.

Even on channels nearby, the high transmitter powers proposed would jeopardize tracking operations. The emission mask of an RTK transmitter would need to be approximately 104db below its 35 watt transmitted power to prevent disruption of law enforcement communications on nearby channels, even at a distance of one mile from the interfering transmitter. The need for this level of emission protection can be illustrated with the following example:

> Assume that a law enforcement emergency occurs at the one mile distance referenced above. If the ETS transmitter is emitting from the floorboard of a getaway vehicle, the transmitted signal might be received as low as –142dbm, the minimum sensitivity of ETS-provided tracking receivers. Over a one mile distance from a 35 watt transmitter, the path loss is approximately 83db, meaning that the power level transmitted on adjacent channels by that radio can be no higher than –59dbm before interference occurs to a law enforcement receiver one mile away (83db path loss added to –142dbm sensitivity). With the 35 watt transmitter power equating to approximately +45dbm, an adjacent channel emission mask rejection of 104db would be required to limit the power in those adjacent channels to –59dbm.

The FCC was aware of this in 1996 when it provided exclusive channels for operations and specified a ceiling of 100 mw maximum transmitted power levels for all low power users including those on nearby channels. Mobex's operations at 500 watts or more, and RTK operations at 35 watts, clearly would disrupt law enforcement tracking.

Issue 2 – Relocation of the Low Power Radio Service and Law Enforcement Tracking to Another Band

Some commenters (e.g. Mobex and Securicor Wireless Holdings, Inc.) have suggested that LPRS be relocated to other spectrum. Based upon more than 20 years experience in providing the FBI and hundreds of local law enforcement agencies with tracking equipment, it is clear that the 216 to 220 MHz band is optimum for LETS service.

Below approximately 200 MHz, radio wavelengths become so long that antennas and other components can no longer be made small enough for clandestine law enforcement use. In LETS, a tracking antenna array of three antennas is mounted on the top of patrol cars and under the belly of police helicopters. A quarter wavelength of continuous ground plane is required around this array, and the three antennas, at 216 MHz, are about one foot apart. At frequencies less than 200 MHz, the required ground plane increases in size such that it is no longer feasible to operate on the limited roof size of vehicles or underbelly of helicopters.

At longer wavelengths, the miniaturized transmitter's antenna also becomes impractically large for the clandestine applications required in law enforcement. If low frequency antennas are compressed into small sizes, their efficiency degrades. This in turn degrades the radiated power below that usable for these law enforcement purposes.

Finally, at frequencies below 200 MHz radio propagation must contend with RF noise generated from a multitude of industrial sources besides licensed radios. This background noise also tends to de-sense receivers used for very low signal level LETS operations.

Problems also exist for LETS systems at frequencies above about 400 MHz. Path losses associated with higher frequencies make attempts to receive very small signals over considerable distances impossible – in the case on LETS, 5 miles from ground to building-top receiver antenna sites, and 1 mile ground to ground (bank robber to tracking police vehicle). In this regard, LETS operations depend on omni-directional antennas, negating the use of directional, high gain antennas that might otherwise be used to offset some path loss. A similar problem that increases with frequency is signal loss due to RF multipath. Triangulation for LETS tracking, by whatever method, becomes much more difficult with increased multipath effects; among other

things, the higher loss of signal strength from environmental effects (buildings, foliage, etc.) significantly decreases usable tracking ranges.

Therefore, to move law enforcement tracking systems from the 216 MHz band -- to some band completely unknown at this point -- with its need for vehicle ground planes, maximized ranges/minimized path loss, low interference levels, etc., could damage the utility of law enforcement tracking as a public safety tool.

The Use of Carrier Sensing to Avoid Interference

Certain of the RTK parties, like Trimble Navigation Limited, contend that "carrier sense" circuitry could identify unoccupied channels before transmitting, thus preventing interference. However, the typical data receiver has only approximately –120dbm sensitivity. By contrast, ETS' signal levels are often well below this, down to –142dbm. In other words, a typical RTK carrier sense circuit might only detect the LETS signal if that signal were within about one mile of the RTK 35 watt transmitter. However, Pacific Crest appears to propose one RTK transmitter to cover a 30 mile radius, an area probably larger than most metropolitan areas and certainly larger than most ETS installations. Most law enforcement tracking operations would go undetected by the carrier sense scheme and would be disrupted by RTK transmissions. Hence, the carrier sense option would prove not useful in protecting LETS and other LPRS users.

Even more sensitive carrier detection would not protect LETS operations. Pacific Crest, in its comments, advises that its transmitters could have a 70 percent duty cycle. Yet ETS systems require that the transmitters remain in a non-emitting state until a crime occurs; at that time, a LETS transmitter must immediately begin operation and the signal be immediately detectable by law enforcement personnel. This was a major reason for the Commission's dedication of two exclusive frequencies for LETS. The RTK carrier sense circuitry, which

previously might have been sensed a LETS channel as being "open" (as indeed it was), and therefore start its high power transmission, would not prevent crippling interference to LETS when the tracking transmitter is triggered.

In any event, even if carrier-sense circuitry were somehow able to protect LETS channels, it would not address the problems referenced earlier from interference on nearby and adjacent channels.

For all these reasons, the Commission should not allow additional high power operations in the 216-220 MHz band.

Executed under penalty of perjury this 6th day of April 2001.

David Wood

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