Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of	)	
	)	
Creation of a Low Power Radio Service	)	MM Docket No. 99-25
	)	
	)	

To the Commission:

Comments from Nickolaus E. Leggett

I am one of the original petitioners for the establishment of the Low Power FM (LPFM) radio broadcasting service (RM-9208 July 7, 1997 subsequently included in MM Docket 99-25). I am also a certified electronics technician (ISCET and NARTE) and an Extra Class amateur radio operator (call sign N3NL). I hold an FCC General Radiotelephone Operator License with a Ship Radar Endorsement. I am an inventor holding three U.S. Patents. My latest patent is a wireless bus for digital devices and computers (U.S. Patent # 6,771,935). I have a Master of Arts degree in Political Science from the Johns Hopkins University. I am also one of the petitioners in the recent docket to establish a low power radio service on the AM broadcast band (RM-11287).

Shortage of Radio Broadcasting Frequencies

My comments here are addressed at correcting the statement in this NPRM that there is a shortage of radio frequencies for broadcasting. This statement was once absolutely true. However, advances in the state of the

art of radio technology have made this concept of a shortage obsolete.

As radio technology has developed, it has opened up more and more of the higher frequencies in the electromagnetic spectrum for practical communications uses. As you go higher in frequency, there is more and more spectrum space available. Think of the spectrum as an inverted pyramid with the low frequencies at the pointed "bottom" of the pyramid and the millimeter, sub-millimeter waves, and higher frequencies are the broad "top" of the pyramid. There is not much space for communications in the low frequency ranges, while there is a lot of room at the highest frequencies.

For example, if you establish a neighborhood broadcasting service at the vicinity of 60 GHz you can accommodate a large number of broadcasting stations in a single community. If each station has a 100 kHz channel for audio broadcasting and you allocate 1000 such channels for each community, the resulting frequency range of 60 GHz to 60.1 GHz would accommodate your robust set of 1000 local broadcasters in a single community. Here you have a delightfully large set of local broadcasters and yet you have hardly made a dent on the millimeter wave spectrum of 30 GHz to 300 GHz. In addition, you have even more frequencies about 300 GHz which you can use for the same purpose. Even infrared and light waves could be used for this type of broadcasting.

Does this sound like a shortage? It is only because our current broadcasting allocations are near to the crowded bottom of the inverted

pyramid that we tend to think of shortages. The 1000 community channels would not fit in the entire high frequency (HF) frequency range (2 MHz to 30 MHz), while they fit easily in the millimeter wave part of the spectrum. So if we keep moving upward in frequency, we can accommodate every local group and individual who wants their own broadcast station.

Aspects of Broadcasting on the Millimeter Waves

Broadcasting on the millimeter waves is a different experience than broadcasting on the AM or FM bands. Millimeter wave transmitters currently in use tend to be low power fed to very high gain antennas. This is not a natural match to the omni directional transmissions used by broadcasters. In previous Commission dockets (Media Ownership [Docket No. 06-121] and Localism [Docket No. 04-233]), I have proposed a light-house protocol that would overcome this situation. I am including these previous comments by reference and in an attached summary appendix (Appendix A).

Millimeter wave transmissions are very much a line-of-sight process like light wave transmission. Leaves of trees can absorb the signals. As a result, outdoor receiving antennas above the roof line would be desirable for this radio service. This could conflict with the widespread prohibitions of external antennas by homeowner associations and condominiums. Any docket on millimeter wave broadcasting would have to address these private regulations and their negative impact on this new broadcasting opportunity.

A frequency range in the vicinity of 60 GHz is very desirable because

the atmosphere strongly absorbs these transmitted signals. This will limit each broadcaster to a single neighborhood or modest sized community. The same channels can then be reused in a near by community with no problem of interference. This absorption of the signals is strong enough that you could have several reuses of the 1000-channel set within a single metropolitan area such as the New York City area. Here at last you have a neighborhood broadcasting system that can be used in dense urban areas. This is a contrast to the existing low power FM (LPFM) broadcasting service that has been limited to largely rural areas by spectrum crowding concerns.

The State of the Art in Millimeter Wave Transmission

Current electronics technology includes equipment for transmission in the millimeter wave portion of the radio spectrum. FCC allocations and regulations are established for operations in this spectrum, and yet there is a lot of available room for innovations such as local radio broadcasting. Amateur radio operators have conducted two-way communications in this spectrum with transmissions up to frequencies over 400 GHz. There is an existing technology that can be adapted for neighborhood radio broadcasting that is available for the many urban areas where accommodating standard LPFM is difficult

Requested Actions

Expanded protections for LPFM operation are highly desirable as a method for achieving localism in American radio broadcasting. This should

be accompanied by serious consideration of millimeter wave broadcasting through either a Notice of Inquiry (NOI) or a Notice of Proposed Rulemaking (NPRM). We need to formally address the use of the plentiful frequencies in the upper parts of the radio spectrum. This is necessary so that urban communities that don't have access to LPFM will be able to establish their own radio broadcasting stations for use in community development.

Respectfully submitted,

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Appendix A – Using the Lighthouse Protocol for Local Broadcasting on the Millimeter Waves

Physical Aspects of Millimeter Wave Broadcasting

A millimeter wave installation is typically engaged in point-to-point communication using a narrow beam formed by very high gain antennas. This communication is often referred to as "pencil beam" communication.

Clearly, a fixed pencil beam is the opposite of the broad coverage desired for broadcasting service.

However, a pencil beam can be converted into an omni-directional broadcasting system by using a rotating beam. The high-gain transmitting antenna is mounted so that it can be continuously rotated in a similar manner to a plan position indicator (PPI) radar antenna. The transmitting millimeter wave beam would "paint" the surrounding geographic area like an electronic lighthouse.

Lighthouse Protocol for Broadcasting

The neighborhood broadcasting station would transmit packets of digital program material to the broadcast receivers. Each receiver would store the packets and play the program material to the listener.

The station would use a protocol where the same set of packets would be repeated for each beam width around the points of the compass. For example, if the transmitter has a 10-degree beam width, it would transmit 36 repetitions of the packet set. Each repetition would be at a different compass direction to cover a full 360 degrees.

The radio receivers would put the packets together and play them out to the listeners. This would result in the program material being delayed somewhat from real time, but this would not be a major problem for most

neighborhood broadcasting applications.