**Before the**

**FEDERAL COMMUNICATIONS COMMISSION**
**Washington, DC. 20554**

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| **In the Matter of** | ) | |
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| **FCC Localism Task Force** | ) | **RM-10803** |
| **- Public Comment** | ) | |
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**To: The Commission**

**ADDITIONAL COMMENTS of Nickolaus E. Leggett**
**N3NL Amateur Radio Operator**

The following is an additional set of comments from Nickolaus E. Leggett, an amateur radio operator (Extra Class licensee – call sign N3NL), inventor (U.S. Patents # 3,280,929 and 3,280,930 and one electronics invention patent application pending), and a certified electronics technician. I also have a Master of Arts degree in Political Science from the Johns Hopkins University (May 1970).

I am one of the original petitioners for Low Power FM (LPFM) broadcasting in RM-9208 (July 1997).

These comments discuss the option of millimeter wave broadcasting as a potential method to increase local access to broadcasting.

**Conflicting Uses of the Broadcast Bands**

Local access to the currently allocated broadcast bands is restricted because there are established broadcasters that occupy many of available channels either directly or through numerous translators. These broadcasters value these channels highly and strive vigorously to keep them.

The work with low power FM (LPFM) and more recently low power AM (LPAM) broadcasting has demonstrated that there are some channels available in the conventional broadcast bands that can be used for local and neighborhood broadcasting. LPFM and LPAM are very important options that should be examined in detail by the Task Force.

However, even with a vigorous set of LPFM and LPAM broadcasters, many communities and neighborhoods will not have any available channels for their own broadcasting. This situation will especially be true in many urban neighborhoods that would have benefited from their own broadcasting station.

**Millimeter Wave Broadcasting Options**

In these comments, I address the option of millimeter wave broadcasting by local communities and neighborhoods.

The broadcasting world has historically been dominated by a situation of spectrum scarcity with only a few potential users having access to a broadcast channel or channels. This situation created a complex legal and regulatory environment for broadcasting activity.

The ongoing development of millimeter wave radio technology promises to reduce and perhaps even eliminate radio spectrum shortages. Millimeter waves are in the frequency range of 30 GHz to 300 GHz. It is also known as the Extremely High Frequency (EHF) band (Reference 1).

The millimeter wave band has a huge capacity because it is so much larger than the lower frequency bands that are used by conventional radio services. This provides the opportunity for a large number of users to access broadcasting.

Another interesting facet of the millimeter waves is that there is significant atmospheric absorption of the signals. This is a major problem for many potential users, but it is actually useful for neighborhood broadcasting. This absorption would prevent a neighborhood broadcaster operating in Reston, Virginia from interfering with a nearby neighborhood broadcaster in another town. Each broadcaster would be limited to a naturally enforced coverage area.

**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. The transmission rate of this protocol would depend on the bandwidth of the transmitted signal and the rotation rate of the antenna.

**Impacts on Other Millimeter Wave Users**

Other users of the millimeter waves are starting to appear. These users are subject to new regulations established by the Commission. The FCC's regulation of these frequencies is based on registration of specific millimeter wave paths:

"Today's action outlines a flexible and innovative regulatory framework for these bands. Because of the "pencil-beam" characteristics of the signals transmitted in the 71-76 GHz, 81-86 GHz and 92-95 GHz bands, systems can be engineered to operate in close proximity to one another without causing interference. In light of this, the FCC has adopted an inventive, non-exclusive licensing approach for these bands. Traditional frequency coordination between users will not be required. Instead, each path will be registered in a database, and entitled to interference protection based on the date of registration." (Reference 2)

The rotating beam used for millimeter wave broadcasting could interfere with existing paths. Regulatory provision will need to be made for millimeter wave broadcasting systems. Perhaps specific fairly small millimeter wave frequency bands will need to be set aside for omni directional radio broadcasting purposes. In assigning

such bands, it should be remembered that the range of each broadcasting transmitter will be significantly constrained by atmospheric absorption of the signal.

**Millimeter Wave Technology**

Millimeter wave radio technology is emerging now. However, it is not the convenient, mature, and off-the-shelf technology used in standard broadcasting.

As a result of this, any millimeter wave broadcasting is going to be an experimental activity for some time. However, it is an appealing technical frontier involving new frequencies and digital technology.

University engineering departments would be interested in developing this type of technology and demonstrating it on their campuses. Amateur radio operators would be interested in devoting their own technical skills to this new technology. Inventors would like to work with this technology and develop new inventions in this technical area. Start-up companies would like to move into this action area.

**Requested Action from the Localism Task Force**

What is needed is Commission leadership to establish regulations that would encourage individuals and organizations to experiment with millimeter wave broadcasting. The Localism Task Force should examine this option and recommend that the Commission develop specific rules to encourage experimentation and development of millimeter wave broadcasting technologies and protocols.

The new rules should encourage vigorous experimentation as well as allowing experimental set-ups to provide actual broadcasting service to neighborhoods and college campuses.

**Respectfully submitted,**

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**Reference 1:** a concise orientation to the millimeter waves is available in the following two columns in QST magazine (The American Radio Relay League, Inc. Newington, CT.) –
Tom Williams (WA1MBA), **Microwavelengths**, QST, July 2003, pp. 79 – 80
Tom Williams, **Microwavelengths**, QST, September 2003, pp. 88 – 89

**Reference 2:** FCC News Release, October 16, 2003, WT Docket No. 02-146