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Millimeter Wave communications in frequency bands above 30 GHz are the next frontier of the wireless age. At these frequencies, immense uncompressed data rates are possible (1-10 Gbps). The unprecedented data rates possible at millimeter-wave frequencies are not available in lower frequency bands, which are spectrally crowded due to the rapid expansion of traditional wireless technologies. Several major corporations have already committed resources towards creating products for the unlicensed 60 GHz band, and several short range indoor products are already on the market. Future uses of millimeter wave bands, such as 38 GHz and 60 GHz, include vehicle-to-vehicle or base-station to mobile applications in the sub 1km range.

The physical circuit challenges of operating at these frequencies are important for communication systems, and have been explored extensively for the past decade. However, reliable wireless communication systems must operate in more than a highly controlled laboratory environment. In this context, channel sounding, or channel propagation measurements, are required to provide knowledge that may be used in the proper design of any wireless millimeter wave communication system.

The research group in the University of Texas at Austin possesses one of the few systems in academia capable of performing channel measurements at 38 GHz and 60 GHz for a distance of a few hundred meters. Professor Theodore Rappaport, who served on the FCC technological advisory board for several years, has utilized this system previously both indoors and outdoors (See References 1-3). These preliminary investigations received many citations and are currently of great interest to communication system engineers planning millimeter wave radios.

The proposed 24-month project involves outdoor stationary and mobile measurements around the University of Texas main campus with transmission range not exceeding this area. Various types of measurements will be taken including power delay profile, angle of arrival, foliage, fog attenuation effects, as well as Doppler shift. Such measurements are vital for understanding the link budget, range and proper spatial frequency re-use distances. The frequency bands that will be investigated are 35-41 GHz and 57-63 GHz at a transmission power of +15 dBm nominal and 1W peak power. The transmitted signal is a spread spectrum type with the signal being spread over a bandwidth of 2 GHz. Various directional antennas will be used with gains not exceeding 40 dB. These antennas built by DBS Microwave are listed in the table below with their corresponding boresight gains and beamwidths.

Antenna	**Gain (dBi)**	**3dB Beamwidth (degrees)**
U-band Tx Rectangular Horn (60 GHz)	25	6.25
Q-band Tx Sectorial Horn (38 GHz)	19	7.51
Q-band Rx Conical Horn Reflector (38 GHz)	39	16.91

Once data is collected, it will be processed and integrated into channel models. This information will be published to assist other researchers and designers in developing advanced communication systems.

References

1. Anderson, C.R., Rappaport, T.S., “In-Building Wideband and Partition Loss Measurements at 2.5 and 60 GHz,” *IEEE Transactions on Wireless Communications*, vol. 3, no. 3, pp. 922-928, May 2004.
2. Xu, H., Kukshya, V., Rappaport, T.S., “Spatial and Temporal Characteristics of 60 GHz Indoor Channels,” *IEEE Journal on Selected Areas in Communications*, vol. 20, no. 3, pp. 620-630, Apr. 2002.
3. Xu, H., Rappaport, T.S., Boyle, R.J., Schaffner, J.H., "38-GHz Wide-Band Point-to-Multipoint Measurements Under Different Weather Conditions," *IEEE Communications Letters*, vol.4, no.1, pp.7-8, Jan. 2000.