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June 29, 1994

Modification Request
Experimental Radio License
KI2XAG
(Call Sign)
1820-EX-R-92
(File Number)
Effective June 11, 1993
Expires January 1, 1995

BNR Inc. Exhibit Number 1

- (3) This is a request for Modification of the Experimental Radio License issued to BNR Inc. the Research and Development Affiliate of Northern Telecom Inc. for joint BNR/NT Authorization under Section 5.202 (i) of the Regulations for: Development of radio technique, equipment, operational data or engineering data related to an existing or proposed radio service; Section 5.202 (d) of the Regulations for: Technical demonstrations of equipment or techniques; 5.202 (f) of the Regulations for Demonstrations of equipment to prospective purchasers for proposed stations in existing services by persons engaged in the business of selling radio equipment.

Modification of the existing Experimental Radio License Authority is requested for BNR and Northern Telecom to develop, test and demonstrate radio systems for licensed broadband PCS providers. Modification is requested to increase the base station power to 3 watts ERP for testing the Omnipoint system, 50 watts ERP for testing Licensed PCS systems using Cell Plus antennas, and 1000 watts ERP for testing Licensed PCS systems using the NT SAM (high gain, directional antenna, from the currently authorized 1 watt ERP. The base station transmitter output power will not exceed 100 watts, as provided in the new FCC Opinion and Order for PCS.

The additional power, for the base station transmissions, up to 1000 watts ERP requested in the License Modification is only for the frequency bands 1930-1990 MHz, which will be used for the Base Station to Mobile communication link. Further, authority to test with base station power, up to 1000 watts ERP on the 1930-1990 MHz bands is only requested for the Richardson, Texas location. No increase in power is requested for Mountain View, CA., or Research Triangle Park N. C. locations. License Modification is also requested to increase the power for Mobile/portable transmissions from one watt ERP to two watts ERP, and only for the 1850MHz -1910 MHz bands. Further, authority to test mobile/portable units up to two watts ERP on the 1850-1910 MHz bands is only requested for the Richardson, Texas location. No increase in power is requested for Mountain View,



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the approval of this request, then NT/BNR requests that only the License Modification for 50 watts be approved at this time.

No additional power authority is being requested for the test programs at Mountain View California, and Research Triangle Park, North Carolina. Current ongoing test programs authorized by license at Richardson, Texas, Mountain View California, and Research Triangle Park, North Carolina will continue to be vital for development of a wide range of new radio equipment for Licensed and Unlicensed systems.

Please call me at (202) 508-3605 in the event that you have any questions concerning this application. Should you desire to reach me by FAX, the number is (202) 508-3612.

Cashiers' Check number 693463, drawn on Texins Credit Union, Richardson, Texas, in the amount of \$35.00, together with a original of this application has been mailed to The Federal Communication Commission, P.O. Box 358130, Pittsburgh, PA. 15251

Very truly yours,

A handwritten signature in cursive script that reads 'Raymond L. Strassburger'.

Raymond L. Strassburger
Director Government Relations, Telecommunications Policy

Attached: BNR, Inc. License Modification Request on FCC Form 442, with five Exhibits

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CA., or Research Triangle Park N. C. locations. All modifications to the Experimental Radio License conform to the technical standards in FCC's Opinion and Order, Docket 90-314, Released June 13, 1994.

Northern Telecom, one of the largest communication equipment manufacturers in the world, requests this modification to allow testing of PCS-1900 Personal Communications Systems. The proposed expanded testing will be conducted in the Northern Telecom/BNR buildings in Richardson Texas with addresses of 2100, 2150, 2201, and 2221 Lakeside Blvd., all in Richardson Texas.

The external antennas for the expanded test program will be located at the 2150 Lakeside Blvd. building, which is 520 feet from the 2201 Lakeside Blvd. buildings in Richardson, Texas.

(4a) Frequency

The Following is for PCS-1900 System Testing
Estimated between envelope points 23 dB below carrier level

4(A) Frequency in MHz	4(B) Max. R.F. power @ term. in watts	4(C) Max. power from antenna	4(D)	4(E) Emission type	4(F) mod. Signal	4(G) necessary bandwidth in kHz
1850-1910	2.0 w	2.0 watts EIRP	Peak	QFW	(4) .577ms, 217 Hz	300
1930-1990	20 watts	1000watts ERP	Peak	XFW	(1) 271 KB	300

The Following is for CDMA System Testing
Estimated based on Spreading Code

4(A) Frequency in MHz	4(B) Max. R.F. power @ term. in watts	4(C) Max. power from antenna	4(D)	4(E) Emission type	4(F) mod. Signal	4(G) necessary bandwidth in kHz
1850-1910	2.0 watts	2.0 watts EIRP	Peak	XXX	TBD	1250 or 2500 kHz
1930-1990	20 watts	1000 watts ERP	Peak	XXX	TBD	1250 or 2500 kHz

- The initial test program for outdoor transmissions anticipate using up to eight (8) channels, 200 kHz wide, for the PCS-1900 system.

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- BNR/NT will use 80 MHz separation between the uplink and downlink in all testing programs.
- The test will initially use Northern Telecom TRX1900 radio units that have a maximum RF output at the transmitter terminal of 20 watts (+43 dBm).
- The maximum ERP at the antenna will be at or below 1000 watts (+60 dBm) peak power.
- The maximum EIRP at the mobile/handset will be at or below 2 watts (+33 dBm) peak power.

4(G) Operation will be conducted on specific channels whose spectral characteristics are defined by standards of the GSM-based PCS-1900 or CDMA technology employed.

In the case of the GSM-based PCS-1900 system, channel spacing of 200 kHz. will be employed in conformance with evolving PCS-1900 standards.

In the case of a CDMA-based system, channel width is not yet defined and will probably be 1.25 MHz. or 2.5 MHz.

Regardless of channel width and spacing, the specific channels selected for use will be selected within the above-defined frequency bands. The specific channels employed for the experimental operation will be selected to avoid interference to or from existing authorized microwave users in the area, and future Licensed PCS Operators. BNR/NT will be coordinate with existing microwave operators, future licensed PCS providers, and future other experimental permittees and licensees.

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BNR Inc. Exhibit Number 2

10. (a)

The proposed experimental operation is a necessary part of BNR/NT's comprehensive program for development of a complete family of network equipment for use by system operators under the standards and rules to be ultimately established at the conclusion of the Commission's PCS proceedings.

The applicant proposes to establish test sites for comparative investigation, demonstration, and refinement of the characteristics and performance of equipment implementing the various air interfaces and network architecture now under consideration for PCS service. These tests will include GSM-derived PCS-1900, OmniPoint, CDMA and other technologies.

In these tests, a complete operational PCS system will be established initially using GSM-derived PCS-1900 technology. This system will include a Northern Telecom MSC (Mobile Switching Center), BSC(s) (Base Station Controller(s)), and BTS(s) (Base Transceiver Stations(s)) with Northern Telecom TRX-1900 radio units, CellPlus antennas, and in the future, NT Smart Antennas. Northern Telecom PCS-1900 handsets will be employed during initial tests, with handsets from other vendors to be included in the tests when available.

Future tests will also be conducted using a system of similar functionality based on an implementation of CDMA technology.

10. (b)

Through these tests, Northern seeks to satisfy a number of objectives:

- 1) To establish relevant performance and design criteria for PCS systems utilizing the various technologies, including identifying and quantifying important variables such as: propagation losses associated with outdoor propagation, building and vehicle penetration; interference effects in a real-life environment; and the like;
- 2) To validate and optimize RF and network-related performance of system hardware, including radio, transmission, switching, and inter-system networking elements of the PCS systems, as a necessary part of hardware and software development;
- 3) To evaluate and validate performance of various handsets and subscriber equipment in a real-world environment;

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4) To provide live demonstrations of PCS technologies to prospective operators, appropriate representatives of regulatory agencies, and others, to provide a forum for collecting user observations and developing a body of information to be used in further defining operator and user expectations for performance and features.

10. (c)

The proposed program of experimentation is a necessary part of development and validation of the PCS systems which Northern Telecom intends to manufacture for use by a wide range of PCS operators. The program will facilitate this development and will therefore directly contribute to the social and economic benefits that have already been identified in the PCS proceedings as deriving from the provision of PCS service to the public.

The Experimental Radio License Modification request proposes to increase the Effective Radiated Power (ERP) of the base station antenna from one watt ERP to 1000 watts ERP for future testing of the NT Smart Antenna. We recognize that the requested power exceeds the power currently envisioned for many commercial PCS base stations in urban locations, but the requested power will permit testing for systems where the 1000 watts will be needed by operators to serve less dense portions of their service areas. Further, Northern will limit the transmitter output power of the base station to 100 watts. The 100 watt transmitter output power limitation was adopted by the Commission in its Opinion and Order, Released June 13, 1994, to promote the use of high gain directional antennas. The Modification Request is needed to test NT's Smart Antenna, which is a high gain directional antenna that the Commission seeks to promote in the new rules for PCS.

Northern Telecom has developed the Smart Antenna, a unique application of antenna technology which could substantially reduce the costs of providing PCS service in areas where the density of users is low. The Smart Antenna uses adaptive phased array technology originally developed for military applications to add several decibels of additional gain to the radio link. This gain produces benefits in both the directions from Base Station to Subscriber, and from Subscriber to Base Station. It also provides additional benefits in discriminating against interference at the Base Station, even in environments where additional gain is not required. The ERP of a PCS base station with the Smart Antenna will not exceed +60 dbm, 1000 watts.

The application of the Smart Antenna has significant implications for reducing the cost of providing PCS service in two ways.

First, it will allow coverage of large rural and suburban areas with a smaller number of base stations than otherwise required using conventional antennas. This carries the promise of reducing capital requirements and expanding the areas for which PCS coverage is economically feasible in the near term. This issue is critical to public acceptance of PCS, since the existing competing cellular systems are already much farther along the path of development to ubiquitous coverage of the bulk of the United States.

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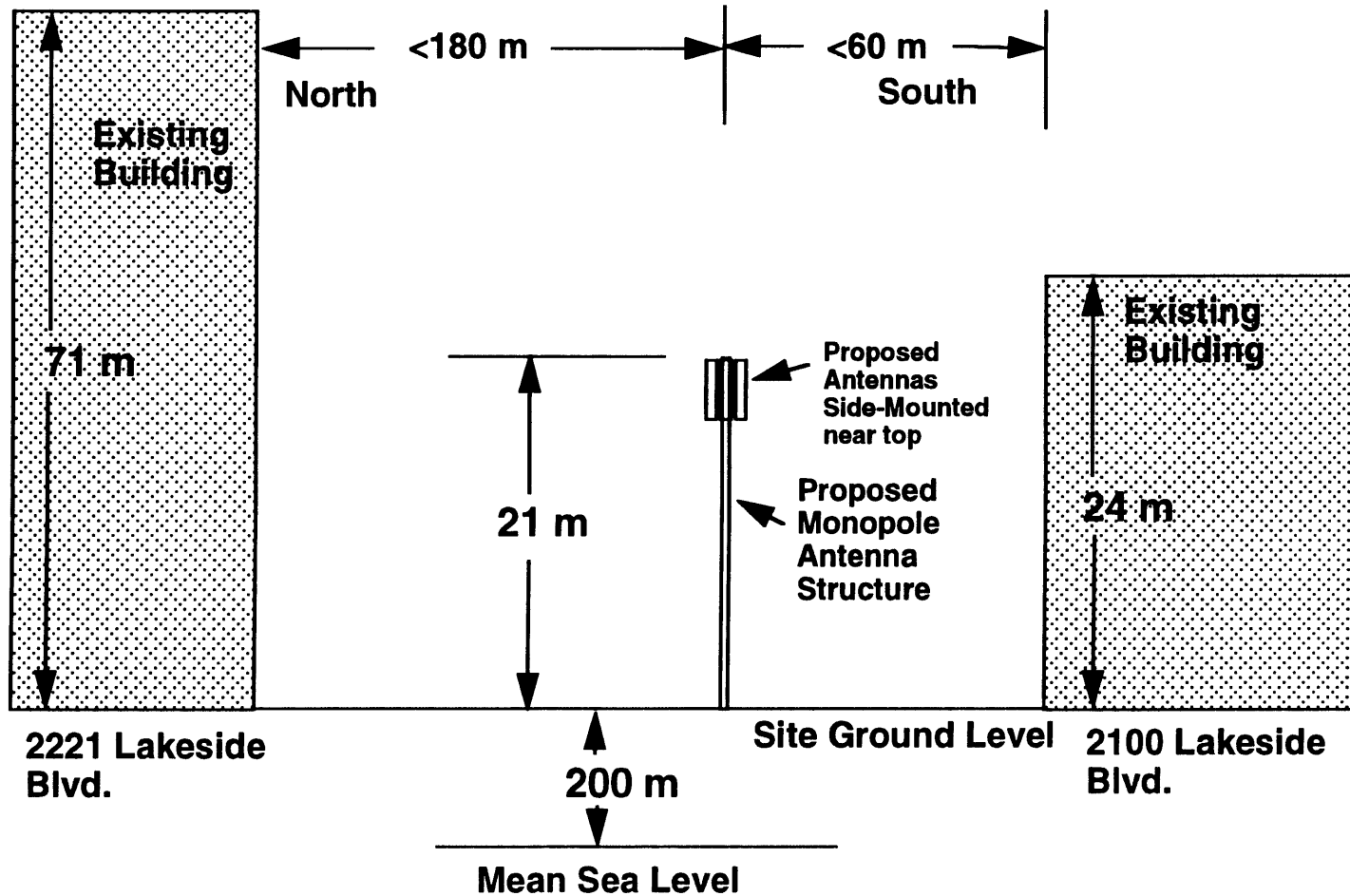
Second, the Smart Antenna enhances the ability of the PCS base station to discriminate against co-channel and adjacent channel interference. This factor improves the carrier-to-interference ratio and holds promise of allowing more dense frequency reuse, thereby increasing the capacity and quality of PCS systems in urban areas.

Northern Telecom recognizes and accepts the requirement to coordinate its experimental operation with existing microwave users, as well as with all PCS operators who may be subsequently authorized for operation in the area, to avoid interference. Northern Telecom will comply with this requirement during all of its experimental operations under the requested license, both using conventional antennas and using the Smart Antenna. Northern's analysis and coordination activities will include appropriate consideration both of its base station and of the mobile or portable subscriber equipment used in the experimental operations.

BNR Inc. EXHIBIT 3 Antenna Vertical Profile Sketch

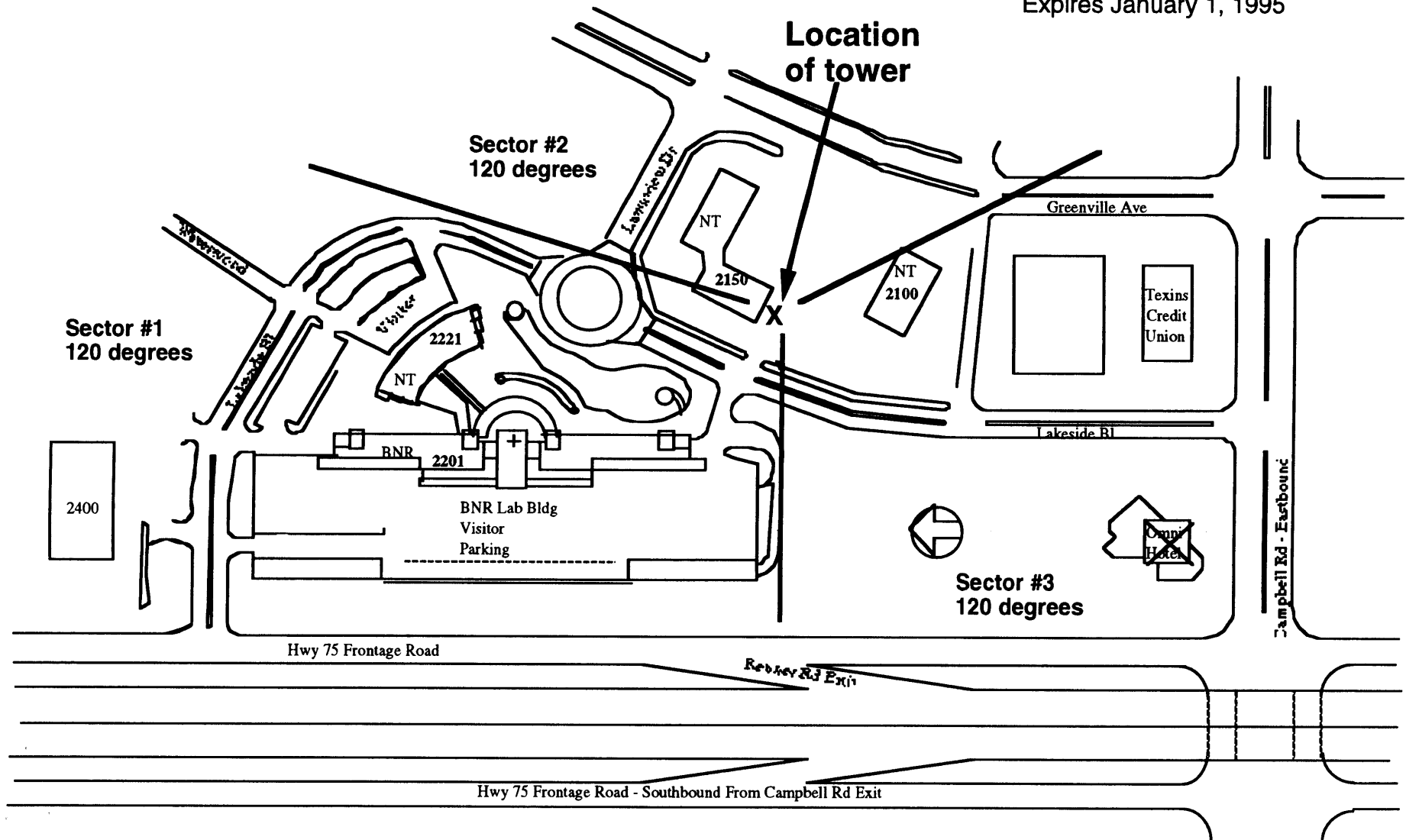
Showing locations of taller nearby existing buildings which shield proposed structure from aircraft

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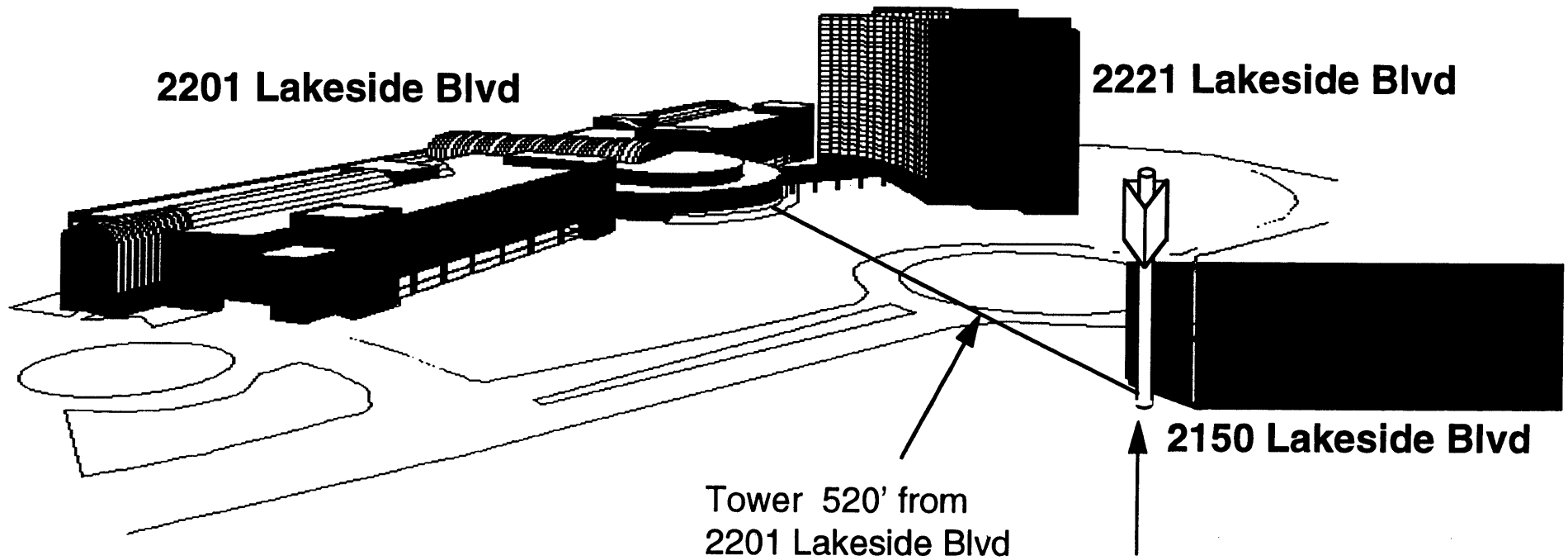
BNR Exhibit 4 Northern Telecom Facility (Richardson, TX)

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BNR Exhibit 5 Tower Location

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Tower height 60'
Antennas mounted at top, then
lightning rods

Total height 68' AGL
(Ground level 656' ASL)

Height above building is 36'

Tower 14' from end of
building (2150 Lakeside
Blvd)

Tower location:
32N-58'-42" - 96W-42'-42"