

ANDREW

Exhibit 1, response to Section 4(a)

4(a) The link will be operated over the range of 27.5-28.35 GHz. The frequency of operation will be variable over the band limits of 27.5 GHz to 28.35 GHz. All RF power will be confined to this band, regardless of the particular center frequency of operation. The data rate will be varied, dependent on the modulation type, which will keep RF energy around a given center frequency inside a bandwidth of ~67.5 MHz. In addition, the center frequency will be varied to keep all emissions inside the larger band limits. See description of complex emissions below. This testing will characterize all components of the LMDS terminal over the entire band.

Exhibit 2, response to Section 4(c, e-g)

4(c) Power Calculation

The PA Power (maximum) output will be 0.5 watt, (-3 dBw). The test antenna (maximum) gain brings the maximum ERP to $(-3 \text{ dBw}) + (25.4 \text{ dB}) = +22.4 \text{ dBw}$. All testing will be indoors with an antenna height of 10 ft.

4(e) Emission Type

See Exhibit 1, frequency of operation is variable over stated band. Also see below, modulation types are 8PSK, QPSK, and 16QAM over entire band. See emission designator descriptions below.

<i>Modulation Type</i>	<i>Emission Designator</i>	<i>Data Rate</i>	<i>Bandwidth</i>
QPSK	67M50G1W	90.71 Mbps	67.5 MHz
8PSK	67M50G1W	129.60 Mbps	67.5 MHz
16QAM	67M50D1W	155.52 Mbps	67.5 MHz

4(f-g) Descriptions of complex emissions and bandwidth calculation.

(1) Emission Designator, 16QAM:

(per Part 2.201)

Bandwidth Calculations:

Maximum Raw Data Rate = 155.52 Mbps

Coded Data Rate, 204/188 RS plus Rate 3/4 Convolutional coding =

$155.52 \times (204/188) \times 4/3 = 225.0077 \text{ Mbps}$

Symbol Rate (16 QAM; 4 bits/symbol) = $225.0077/4 = 56.25 \text{ M Symbols/sec}$

Two Sided Nyquist BW = 56.25 MHz

Filter Characteristic:

Square Root Cosine Roll-Off

Factor = .20

99% Power Bandwidth = $56.25 \times 1.20 = 67.50 \text{ MHz}$

For 16 QAM modulation

For Bandwidth = 67.50 MHz, symbol= 67M50

Emission in which the main carrier is amplitude and angle-modulated either simultaneously or in a pre-established sequence

First symbol="D"

Single carrier, quantized/digital information; 2nd symbol = "1"

Information Type, combination of types, 3rd Symbol="W"

(16QAM) - Emission Designator = 67M50D1W

(2) Emission Designator, 8PSK:

(per Part 2.201)

Bandwidth Calculations:

Maximum Raw Data Rate = 129.595 Mbps

Coded Data Rate, 204/188 RS plus Rate 5/6 Convolutional coding =

$129.595 \times (204/188) \times 6/5 = 168.75$ Mbps

Symbol Rate (8PSK; 3 bits/symbol) = $168.75/3 = 56.25$ M Symbols/sec

Two Sided Nyquist BW = 56.25 MHz

Filter Characteristic:

Square Root Cosine Roll-Off

Factor = .20

99% Power Bandwidth = $56.25 \times 1.20 = 67.50$ MHz

For 8PSK modulation

For Bandwidth = 67.50 MHz, symbol= 67M50

Emission in which the main carrier is angle (phase) modulated,

first symbol="G"

Single carrier, quantized/digital information; 2nd symbol = "1"

Information Type, combination of types, 3rd Symbol="W"

(8PSK) - Emission Designator = 67M50G1W

(3) Emission Designator, QPSK:

(per Part 2.201)

Bandwidth Calculations:

Maximum Raw Data Rate = 90.71 Mbps

Coded Data Rate, 204/188 RS plus Rate 7/8 Convolutional coding =

$90.71 \times (204/188) \times 8/7 = 112.5$ Mbps

Symbol Rate (QPSK; 2 bits/symbol) = $112.5/2 = 56.25$ M Symbols/sec

Two Sided Nyquist BW = 56.25 MHz

Filter Characteristic:

Square Root Cosine Roll-Off

Factor = .20

99% Power Bandwidth = $56.25 \times 1.20 = 67.50$ MHz

For OPSK modulation

For Bandwidth = 67.50 MHz, symbol= 67M50

Emission in which the main carrier is angle (phase) modulated,
first symbol="G"

Single carrier, quantized/digital information; 2nd symbol = "1"

Information Type, combination of types, 3rd Symbol="W"

(OPSK) - Emission Designator = 67M50G1W

Exhibit 3, response to Section 6(a-c)

6(a) Several different Antennas will be tested, with horizontal beamwidth and gain as stated.

Andrew 28 GHz, similar to #BCAH030-285-H, 30 degree, 25.4 dBi Gain

Andrew 28 GHz, similar to #BCAH045-285-H, 45 degree, 23.8 dBi Gain

Andrew 28 GHz, similar to #BCAH060-285-H, 60 degree, 22.6 dBi Gain

Andrew 28 GHz, similar to #BCAH090-285-H, 90 degree, 21.0 dBi Gain

Andrew 28 GHz, similar to #BCAH0120-285-H, 120 degree, 19.8 dBi Gain

Andrew 28 GHz, similar to #BCAH0180-285-H, 180 degree, 18.0 dBi Gain

Andrew 28 GHz, similar to #BCAH0360-285-H, 360 degree, 15.0 dBi Gain

All antennas are horizontally polarized. All testing will be indoors with an antenna height of 10 ft.

6(b) The horizontal orientation will be variable, depending on the test.

6(c) The vertical orientation will be 0 degrees.

Exhibit 4, response to Section 10(a-c)

10(a) The purpose of this program is to develop and test RF transmitter and receiver equipment, including antennas, which will be used in Local Multipoint Distribution Service (LMDS), and which will operate in the 27.5 to 28.35 GHz frequency band. The initial testing will begin with a one-way (downlink) configuration, and be conducted indoors. The antennas will be selected from the series of antennas stated in Exhibit 3. Three digital modulation types will be used, (see Exhibit 2). These modulation types will operate over the entire band.

Time and Date of Proposed Operation

Andrew would like to commence testing on March 2, 1998, at the Garland, Texas location. The time of operation will be for short periods, (less than 15 minutes) during the hours of 8 AM - 9PM , 6 days per week, for the duration of the license.

10(b) The transmitter electronic equipment will consist of an antenna-mounted up-converter unit which will accept IF signals limited to the frequency band of from 2000 MHz to 2850 MHz and will translate these signals to the frequency band from 27.50 GHz to 28.35 GHz.

The RF output amplifier will have a saturated output power of not more than one watt. The operating output power will be backed off to no more than one-half watt (typically +24 dBm or less). The frequency accuracy of this translation process will be assured by the provision of a suitably accurate reference frequency to the up-converter unit, along with the IF signals.

The type of modulation of the transmitted signal will be QPSK, 8PSK, or 16 QAM, (see Exhibit 2). The modulation will be performed by various units as they become available. The primary unit will be the Sicom SM1-960-000B543V which can be configured to select any of these types of modulation at symbol rates from 5 to 56 mega-symbols per second (Mbaud). This unit performs data randomization, Reed-Solomon 204/188 (RS 204/188) Forward Error Correction plus Convolutional encoding at various rates of from $\frac{1}{2}$ to $\frac{7}{8}$. The modulation may be performed for various data rates corresponding to the selected output symbol rate and the selected type of modulation and rate of convolutional encoding. The output signal of the Sicom modulator is at a center frequency of 140 MHz.

The 140 MHz modulated signal from the Sicom modulator, or other experimental modulators, will be translated to the frequency band from 2000 to 2850 MHz by various up-converter units being developed. The IF output signal from these up-converter units will be applied to the antenna-mounted RF up-converter unit previously described.

10(c) The Andrew LMDS terminal in it's final configuration will meet all the needs of the LMDS service. It will contribute a sophisticated and economical terminal to the market. This terminal will be capable of two way, high speed optimized data transmission. It will carry computer data, video, and telephony signals.

Exhibit 5, response to Section 13

(13) PA Amplifier, Wavecom Experimental, $P_{\text{sat}}=1.0$ watt, backed off to 0.5 watt output Modulator, Sicom #SM1-960A-0008543V
Converter, Filters, Receiver, by Wavecom, experimental
Antennas, various 28 GHz, as listed in Exhibit 3.