

## **Exhibit B:**

**L5X-PMP-04-000**

### **Types of Emission**

#### **Section 2.1033**

**(C) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:**

##### **(4) Types of Emission**

Intentional Radiator employing QPSK, 16-QAM or 64-QAM digital modulation.

## **Exhibit K:**

**L5X-PMP-04-000**

### **Spurious Emission**

Refer to Section 6.1.3.2 Radiated 15.209(a)/101.111 of Exhibit R (Independent Laboratory Test Results) for detailed information on radiated emissions.

## **Exhibit L:**

**L5X-PMP-04-000**

### **Measured Spurious Field Strength**

Refer to Section 6.1.3.2 Radiated 15.209(a)/101.111 of Exhibit R (Independent Laboratory Test Results) for detailed information on radiated emissions.

**Exhibit C:**

**L5X-PMP-04-000**

**Frequency Range of Operation: IF and RF**

This Exhibit provides a response to Section 2.1033 (c) (5).

**Radio Frequency (RF) Bands Supported:**

\*38,600.00 to 40,000.00 MHz

**Intermediate Frequencies (IF):**

|              |                          |
|--------------|--------------------------|
| Transmit IF: | *490 MHz ( $\pm$ 25 MHz) |
| Receive IF:  | *205 MHz ( $\pm$ 25 MHz) |

\*These frequencies are adjustable in 100 KHz increments.

## Exhibit D:

### L5X-PMP-04-000

#### Operational Power Levels and Control Methods

This Exhibit provides a response to Section 2.1033 (c) (6).

Range of operating power values or specific operating power levels and description of any means provided for variation of operating power.

| Frequency            | Output Power Range |
|----------------------|--------------------|
| 38,600 to 40,000 MHz | * -20 to +20.0 dBm |

\*Output levels are based on measurements taken at the antenna flange and are maintained by automatic power control.

REMOTE TUNE-UP: Transmit Levels from the Remote ODU are controlled by the Sector. The Sector employs Automatic Power Control (APC) circuitry that allows minimum transmit power to be used at any given time for the selected service quality (BER). The Sector dynamically adjusts the Remote's transmit power output to compensate for changes in environmental conditions.

**Exhibit E:**  
**L5X-PMP-04-000**

**Maximum Operational Power Levels per FCC Rules**

This Exhibit provides a response to Section 2.1033 (c) (7), based on the transmitter power limitations of Section 101.113.

The transmit power level limitation at 38.600 GHz to 40.000 GHz is +55 dBW

Each Remote antenna in the 38 GHz Frequency Band has a gain of 40.1 dBi as specified by the vendor. This gain applies to the upper end of the band.

The power amplifiers in the 38 GHz band RF Unit have a P1dB of +25 dBm at the antenna interface. With no backoff the maximum EIRP of this system will be  $(40.1 + 25)$  or 65.1 dBm. In practice, this equipment will operate with a backoff of 7.0 dB that will provide a peak EIRP of 58.1 dBm.

The antennas are discussed in more detail in Exhibit N.

The above calculations indicate that the equipment will not exceed the maximum EIRP limitation of +55 dBW at any time during operation.

File 6/15

## **Exhibit F:**

### **L5X-PMP-04-000**

#### **DC Voltages and Current Requirements of PA**

This Exhibit provides a response to Section 2.1033 (c) (8).

**The DC voltages applied to and DC currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.**

Final frequency up-conversion and amplification takes place in the Outdoor Unit (ODU). The ODU has the following voltages and currents supplied:

|               |             |
|---------------|-------------|
| Input Voltage | +44 VDC     |
| Current       | 625 mA, max |

## Exhibit G:

L5X-PMP-04-000

### Power Level Setting Alignment

This Exhibit provides a response to Section 2.1033 (c) (9).

**Tune-up procedure over the power range, or at specific operating power levels.**

REMOTE TUNE-UP: Transmit Levels from the Remote ODU are controlled by the Sector. The Sector employs Automatic Power Control (APC) circuitry that allows minimum transmit power to be used at any given time for the selected service quality (BER). The Sector dynamically adjusts the Remote's transmit power output to compensate for changes in environmental conditions.

Alignment

**Exhibit H:**

**L5X-PMP-04-000**

**Measured RF Output Power**

**This Exhibit provides a response to Section 2.1046 (a), based on the transmitter power limitations of Section 101.113.**

**Transmitter Power Limitations:**

| <u>Frequency</u>         | <u>Max Allowable EIRP</u> |
|--------------------------|---------------------------|
| 38.600 GHz to 40.000 GHz | +55 dBW                   |

Each Remote antenna in the 38 GHz Frequency Band has a gain of 40.1 dBi as specified by the vendor. This gain applies to the upper end of the band.

The power amplifiers in the 38 GHz band RF Unit have a P1dB of +25 dBm at the antenna interface. With no backoff the maximum EIRP of this system will be  $(40.1 + 25)$  or 65.1 dBm. In practice, this equipment will operate with a backoff of 7.0 dB that will provide a peak EIRP of 58.1 dBm.

The antennas are discussed in more detail in Exhibit N.

The above calculations indicate that the equipment will not exceed the maximum EIRP limitation of +55 dBW at any time during operation.

## Exhibit I:

L5X-PMP-04-000

### Modulation Characteristics

This Exhibit provides a response to Section 2.1047 (d), based on the requirements specified in Section 101.141.

Refer to Table 1 FDMA Modem and compare columns under the headings ATM Cell Rate Mbits/s and DSB BW (MHz).

Table 1 FDMA Modem

| Modulation Type | Number of T1/E1's | ATM Cell Rate (Mbits/s) | symbol rate (Msym/s) | DSB BW (MHz) | Channel spacing (MHz) | Demod Supported (Hub or Remote) |
|-----------------|-------------------|-------------------------|----------------------|--------------|-----------------------|---------------------------------|
| 64-QAM          | 2/1               | 3.7                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| 64-QAM          | 4/3               | 7.2                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 64-QAM          | 8/6               | 14.4                    | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 64-QAM          | 12/9              | 21.7                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 64-QAM          | 16/13             | 30.9                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 64-QAM          | 22**/17**         | 40.0                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| 16-QAM          | 1/1               | 2.4                     | 0.664902             | 0.745        | 1.0                   | Hub only                        |
| 16-QAM          | 2/2               | 4.8                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 16-QAM          | 5/4               | 9.6                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 16-QAM          | 8/6               | 14.5                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 16-QAM          | 11/8              | 20.6                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 16-QAM          | 14/11             | 26.7                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| QPSK            | N/A               | 1.2                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| QPSK            | 1/1               | 2.4                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| QPSK            | 2/2               | 4.8                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| QPSK            | 4/3               | 7.2                     | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| QPSK            | 5/4               | 10.3                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| QPSK            | 7/5               | 13.3                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |

\*\* These rates are not supported with the present clear channel FDMA Cell Engine design

## Exhibit J:

### L5X-PMP-04-000

#### Occupied Bandwidth

This Exhibit provides a response to Section 2.1049, based on the requirements specified in Section 101.109.

#### Frequency Band

38.600 GHz to 40.000 GHz

#### Maximum Authorized Bandwidth

50 MHz

Refer to Table 1 FDMA Modem. In the column under the heading DSB BW (MHz) occupied Bandwidths are listed and referenced to each Modulation Type and selected Bit Rate.

Table 1 FDMA Modem

| Modulation Type | Number of T1/E1's | ATM Cell Rate (Mbits/s) | symbol rate (Msym/s) | DSB BW (MHz) | Channel spacing (MHz) | Demod Supported (Hub or Remote) |
|-----------------|-------------------|-------------------------|----------------------|--------------|-----------------------|---------------------------------|
| 64-QAM          | 2/1               | 3.7                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| 64-QAM          | 4/3               | 7.2                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 64-QAM          | 8/6               | 14.4                    | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 64-QAM          | 12/9              | 21.7                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 64-QAM          | 16/13             | 30.9                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 64-QAM          | 22**/17**         | 40.0                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| 16-QAM          | 1/1               | 2.4                     | 0.664902             | 0.745        | 1.0                   | Hub only                        |
| 16-QAM          | 2/2               | 4.8                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 16-QAM          | 5/4               | 9.6                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 16-QAM          | 8/6               | 14.5                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 16-QAM          | 11/8              | 20.6                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 16-QAM          | 14/11             | 26.7                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| QPSK            | N/A               | 1.2                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| QPSK            | 1/1               | 2.4                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| QPSK            | 2/2               | 4.8                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| QPSK            | 4/3               | 7.2                     | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| QPSK            | 5/4               | 10.3                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| QPSK            | 7/5               | 13.3                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |

\*\* These rates are not supported with the present clear channel FDMA Cell Engine design

## Exhibit M:

L5X-PMP-04-000

### Measured Frequency Stability

This Exhibit provides a response to Section 2.1055, based on the requirements specified in Section 101.107.

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 degrees to +50 degrees centigrade...

#### P-COM Test Results for Remote Terminal Outdoor Unit Frequency Stability

**Purpose:** long-term frequency stability of the Remote ODU is compliant to product specifications at room and elevated temperatures. This test is conducted at RF.

**Pass Criteria:** Based on measurements every 15 minutes over a 45 minute period, the frequency deviation shall be within  $\pm 1$  ppm.

Test Environment: **P-COM Engineering Laboratory.**

Equipment: **One Sector Terminal, Frequency Counter (HP 53152A), Environmental Chamber.**

#### Remote Terminal Outdoor Unit Tests Results

Test Frequency: 39.2950 GHz

| Test Time* | Temperature | Measured Frequency |
|------------|-------------|--------------------|
| 0 min.     | 25°C        | 39.2950316         |
| 15 min.    |             | 39.2950316         |
| 30 min.    |             | 39.2950316         |
| 45 min.    |             | 39.2950316         |
| 0 min.     | -40°C       | 39.2950316         |
| 15 min.    |             | 39.2950316         |
| 30 min.    |             | 39.2950316         |
| 45 min.    |             | 39.2950316         |
| 0 min.     | 60°C        | 39.2950316         |
| 15 min.    |             | 39.2950316         |
| 30 min.    |             | 39.2950316         |
| 45 min.    |             | 39.2950316         |

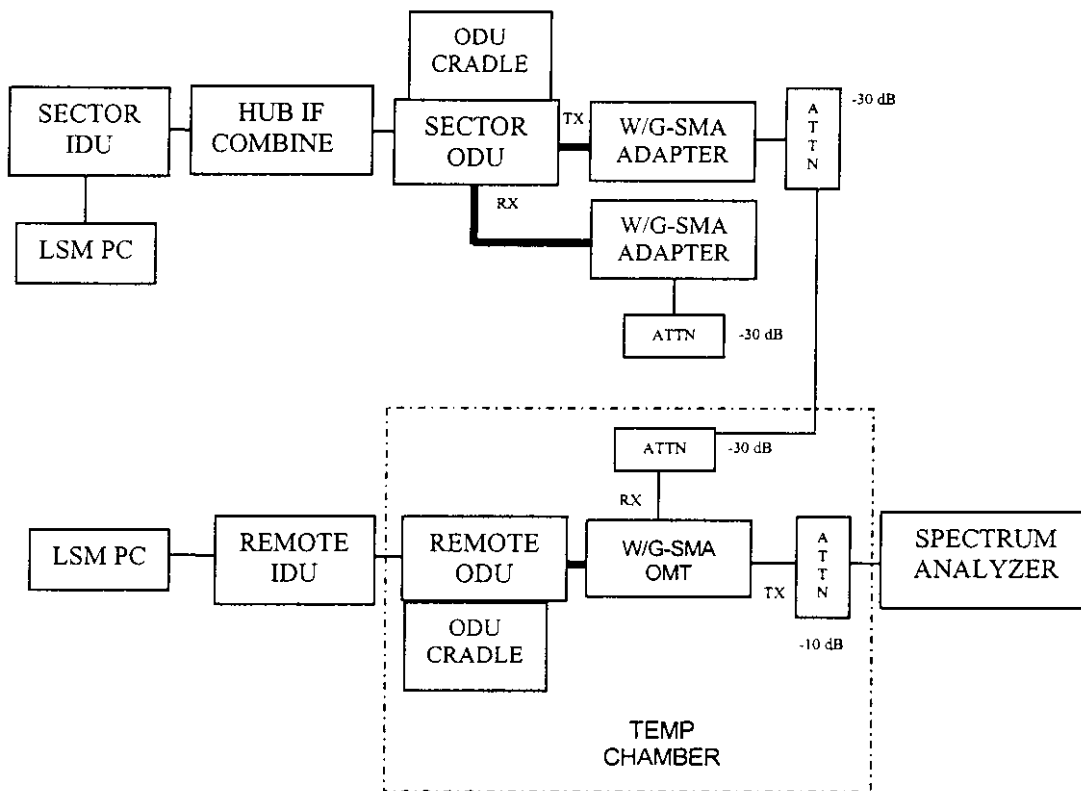
\*After initial 20 minutes soak.

- ❑ Measured frequency deviation from Test Freq. at +0°C: 31.6 KHz
- ❑ Measured frequency deviation from Test Freq. at +25°C: 31.6 KHz
- ❑ Measured frequency deviation from Test Freq. at +45°C: 31.6 KHz
- ❑ Measured frequency drift across full temperature range: 0.0 KHz

Comments: \_\_\_\_\_

### Test Setup Diagram

#### Frequency Stability– Remote Terminal Outdoor Unit



## Frequency Stability - Remote Terminal Indoor Unit

**Purpose:** Verify long-term frequency stability of the Remote Terminal reference oscillator is compliant to product specifications at room and elevated temperatures. This test is conducted at RF.

**Pass Criteria:** Based on measurements every 15 minutes over a 45 minute period, the frequency deviation of the reference 10 MHz oscillator shall be within  $\pm 1$  ppm.

**Test Environment:** P-COM Engineering Laboratory.

**Equipment:** One Sector Terminal, Spectrum Analyzer (HP 8564E), Environmental Chamber.

Test Frequency: 39.465 GHz

### Remote Terminal Indoor Unit Tests Results

| Test Time* | Temperature | Measured Frequency |
|------------|-------------|--------------------|
| 0 min.     | +25°C       | 39.4649767         |
| 15 min.    |             | 39.4649769         |
| 30 min.    |             | 39.4649767         |
| 45 min.    |             | 39.4649765         |
| 0 min.     | 0°C         | 39.4649763         |
| 15 min.    |             | 39.4649759         |
| 30 min.    |             | 39.4649758         |
| 45 min.    |             | 39.4649758         |
| 0 min.     | +45°C       | 39.4649765         |
| 15 min.    |             | 39.4649765         |
| 30 min.    |             | 39.4649766         |
| 45 min.    |             | 39.4649766         |

\*After initial 20 minutes soak.

- ❑ Measured frequency deviation from Test Freq. at 0°C: 23.5 KHz
- ❑ Measured frequency deviation from Test Freq. at +25°C: 24.2 KHz
- ❑ Measured frequency deviation from Test Freq. at +45°C: 23.5 KHz
- ❑ Measured frequency drift across full temperature range: 1.10 KHz

Comments:

All the frequency stability results are dependant upon the temperature stability of the system's 10.0 MHz reference oscillator that is located within the HUB Combiner. The HUB Combiner is considered part of the Sector Indoor Unit Equipment. The reference of

the Remote Terminal is then phase locked to the reference oscillator within the Sector Indoor Unit. The following is a table of data that describes typical measured results for this Reference Oscillator's stability and the resulting transmit frequency. A column is provided that indicates the specified temperature range.

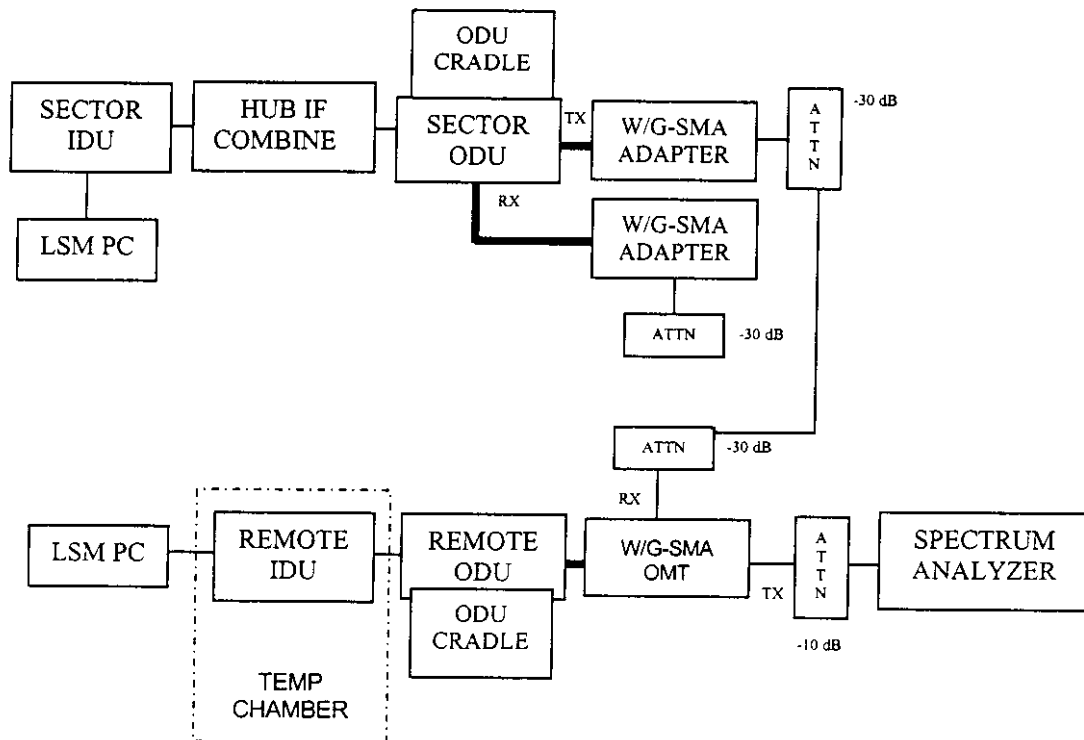
Desired Transmit RF Frequency: 39.465000 GHz

| <u>Temp (C)</u> | <u>Freq. Offset (ppm)</u> | <u>Resultant TX Freq. (GHz)</u> |
|-----------------|---------------------------|---------------------------------|
| * -40           | -0.52                     | 39.4649795                      |
| * -30           | -0.03                     | 39.4649988                      |
| * -15           | -0.40                     | 39.4649842                      |
| * -5            | -0.15                     | 39.4649941                      |
| 25              | 0.00                      | 39.4650000                      |
| * 50            | 0.19                      | 39.4650075                      |

\* These temperatures do not fall within P-COM's advertised Equipment Specifications and are listed for FCC purposes only.

## Test Setup Diagram

### Frequency Stability- Remote Terminal



## **Exhibit N**

### **L5X-PMP-04-000**

#### **Antenna Characteristics**

The information on antenna characteristics provided in this exhibit includes responses to Sections 101.115 & 101.117 of the FCC Rules and Regulations.

The Point to Multipoint remote terminal uses a standard one foot parabolic reflector that has the following specifications:

##### **38 GHz Band Antenna:**

|                 |                                                    |
|-----------------|----------------------------------------------------|
| Diameter        | 1 foot                                             |
| Band            | 38,600 to 40,000 Mhz                               |
| Gain            | 39.8 dBi, min over band<br>40.1 dBi, max over band |
| Beamwidth, 3 dB | 1.6 degrees                                        |
| Sidelobe        | Per FCC Category A                                 |
| Manufacturer    | Endgate Corporation                                |
| Model Number    | FF-38-13-HPA                                       |

Linear Polarization is used for transmission and reception.

**Exhibit O:**

**L5X-PMP-04-000**

**Modulation System Description**

**This Exhibit provides a response to Section 2.1033 (c) (13).**

**For equipment employing digital modulation techniques, a detailed description of the modulation system to be used, including the response characteristics (frequency, phase and amplitude) of any filters provided, and a description of the modulating wavetrain, shall be submitted for the maximum rated conditions under which the equipment will be operated.**

The P-Com Point-to-Multipoint product utilizes digital modulation. There are three selectable types of modulation implemented; Quadrature Phase Shift Keying (QPSK), 16-Ary Quadrature Amplitude Modulation (16-QAM) and 64-Ary Quadrature Amplitude Modulation (64-QAM). All three of these modulation types are spectral shaped.

The filters implementing the spectral shaping is a linear phase square-root Nyquist baseband filter with a 12 % excess bandwidth. A X/six X filter is also implemented to provide for baseband DAC distortion compensation. The various combinations of symbol rates and modulation types are listed In the table below:

## List of Data Rates for the PTM product Line

Table 1 FDMA

| Modulation Type | Number of T1/E1's | ATM Cell Rate (Mbits/s) | symbol rate (Msym/s) | DSB BW (MHz) | Channel spacing (MHz) | Demod Supported (Hub or Remote) |
|-----------------|-------------------|-------------------------|----------------------|--------------|-----------------------|---------------------------------|
| 64-QAM          | 2/1               | 3.7                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| 64-QAM          | 4/3               | 7.2                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 64-QAM          | 8/6               | 14.4                    | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 64-QAM          | 12/9              | 21.7                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 64-QAM          | 16/13             | 30.9                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 64-QAM          | 22**/17**         | 40.0                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| 16-QAM          | 1/1               | 2.4                     | 0.664902             | 0.745        | 1.0                   | Both Sector and Remote          |
| 16-QAM          | 2/2               | 4.8                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| 16-QAM          | 5/4               | 9.6                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| 16-QAM          | 8/6               | 14.5                    | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| 16-QAM          | 11/8              | 20.6                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| 16-QAM          | 14/11             | 26.7                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |
| QPSK            | N/A               | 1.2                     | 0.664902             | 0.745        | 1.0                   | Sector only                     |
| QPSK            | 1/1               | 2.4                     | 1.316528             | 1.475        | 2.0                   | Both Sector and Remote          |
| QPSK            | 2/2               | 4.8                     | 2.619781             | 2.934        | 4.0                   | Both Sector and Remote          |
| QPSK            | 4/3               | 7.2                     | 3.949127             | 4.423        | 5.6                   | Both Sector and Remote          |
| QPSK            | 5/4               | 10.3                    | 5.625000             | 6.300        | 8.0                   | Both Sector and Remote          |
| QPSK            | 7/5               | 13.3                    | 7.265625             | 8.138        | 10.0                  | Remote only                     |

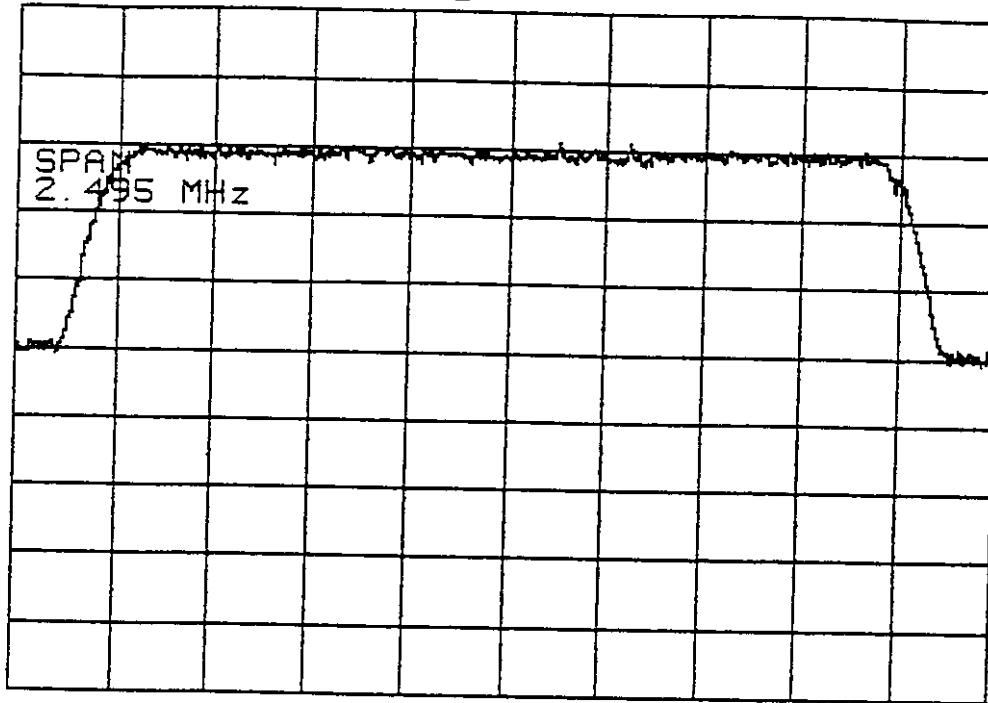
\*\* These rates are not supported with the present clear channel FDMA Cell Engine design.

The digital modulation modem is implemented in two application-specific-integrated-circuits (ASICs). There is an Intermediate Frequency (IF) interface going into the demodulator and an IF interface coming out the modulator ASIC. Thus the ASIC implementation prevents a baseband modulating wavetrain from being measured and provided in this report. Shown below are measured spectrum plots with the user input rate kept constant at 2XT1 rate.

\*ATTEN 20dB

RL -30.0dBm

10dB/



CENTER 24.255000GHz

RBW 30kHz

VBW 300Hz

SPAN 2.495MHz

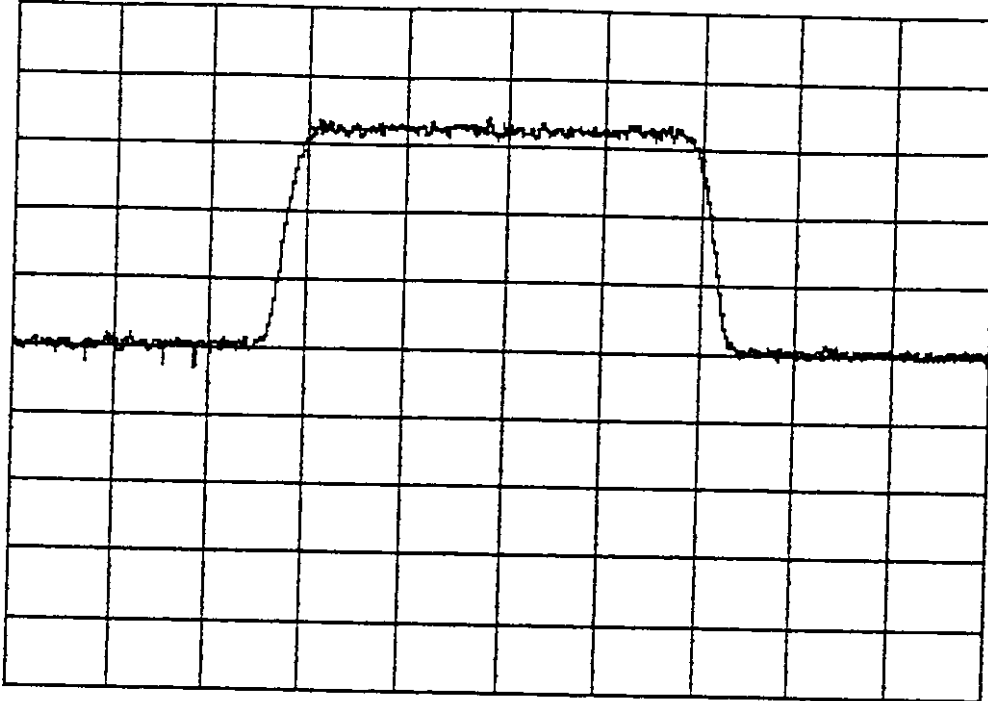
SWP 700ms

QPSK 2XT1

\*ATTEN 20dB

RL -30.0dBm

10dB/



CENTER 24.255000GHz

SPAN 2.495MHz

RBW 30kHz

VBW 300Hz

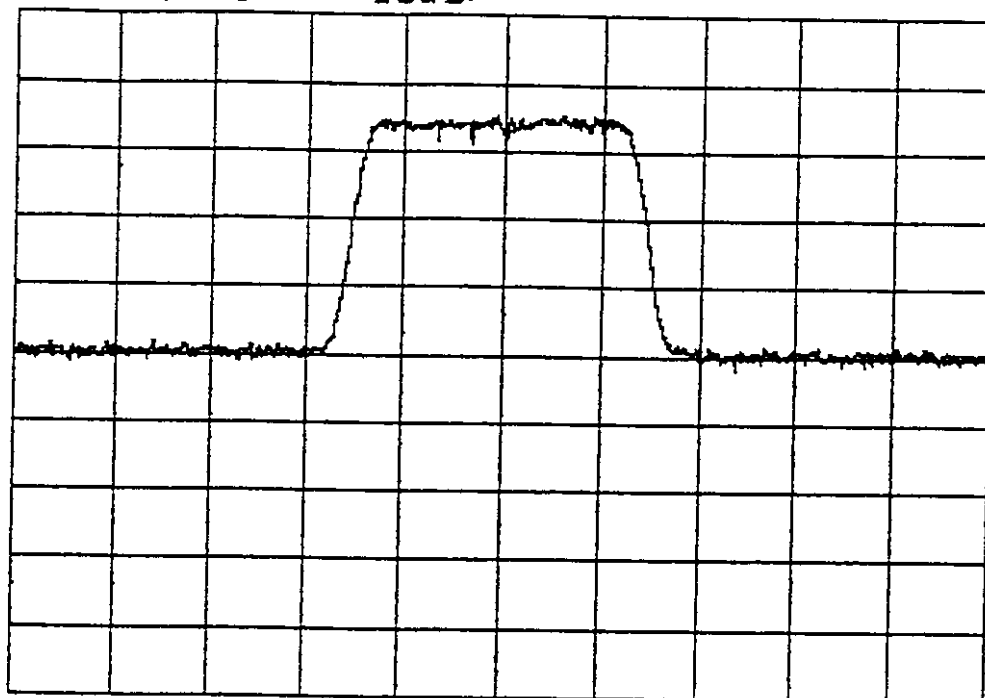
SWP 700ms

16 QAm 2xT1

\*ATTEN 20dB

RL -30.0dBm

10dB/



CENTER 24.255000GHz

SPAN 2.495MHz

RBW 30kHz

VBW 300Hz

SWP 700ms

64 QAM 2xTs