

**FCC CERTIFICATION INFORMATION**

The P1804-2-24 customer premises transceiver made by TSI is a single integrated unit design using a single antenna for both transmit and receive. The transceiver is designed to interface with cable modems (not supplied by TSI). The transceiver receives RF input from the modem, up converts, amplifies, and transmits the signal to the base station.

The following information is in accordance with FCC Rules, 47CFR Part 2.

**2.1033(c)1**    Applicant:    TranSystem Inc.

**2.1033(c)2**    FCC ID: OUPP1804-2

**2.1033(c)3**    Installation instructions are found in attached document.

**2.1033(c)4**    Emission type is dependent on IF input to EUT. Refer to Table 1 below.

**2.1033(c)5**    Frequency range: 2644-2686 MHz

**2.1033(c)6   Range of Operating Power**

0 - 24 dBm ( dependent on input from indoor cable modem unit)

**2.1033(c)7   Maximum Power Rating**

24.4 dBm

**2.1033(c)8   Applied voltages and currents into the final transistor elements**

Refer to schematics accompanying this application

**2.1033(c)10   Circuit and Functional Block Diagram, Description of Circuitry**

Refer to separate attachment

**2.1033(c)11   FCC ID Label**

Refer to separate attachment

**2.1033(c)12   Product Photographs**

Refer to separate attachment

### 2.1033(c)13 Description of Modulation System

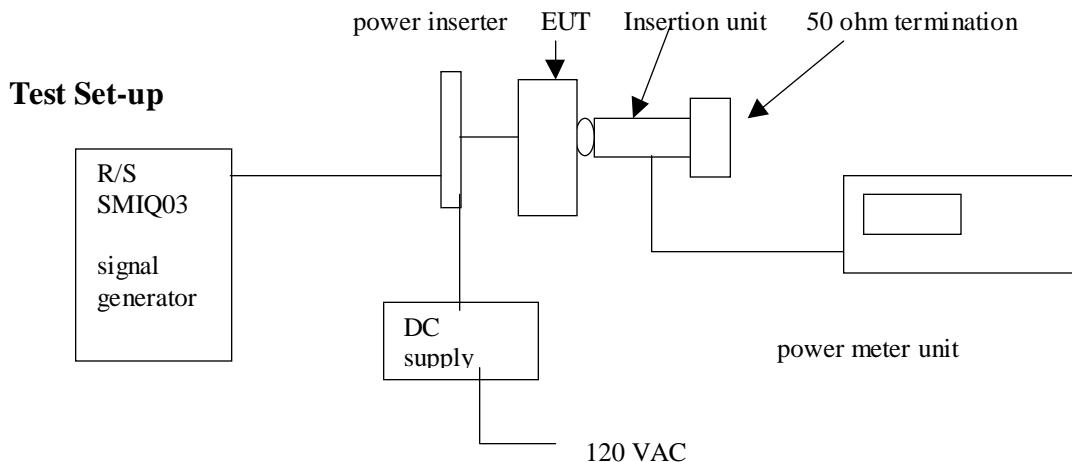
128 - 2560 kbps QPSK and  
160 - 2560 kbps 16QAM

### 2.1033(c)14 Test Data per 2.1046 – 2.1057

#### 2.1055 RF Output Power Measurements

##### Measurement equipment used:

Rohde&Schwarz NRVS Power Meter model DE12101  
Rohde&Schwarz Insertion Unit model DE3366B  
Rohde&Schwarz I/Q signal generator model SMIQ03



NOTE: "Insertion unit" is directional coupler used with power meter to measure forward power.

#### Test Procedures

Signal generator was set to IF frequency for maximum RF output at desired frequency.  
Maximum RF output power was obtained with 128 QPSK modulation

RF output frequency =  $(2621 + \text{IF}) \text{ MHz}$

#### Test Results

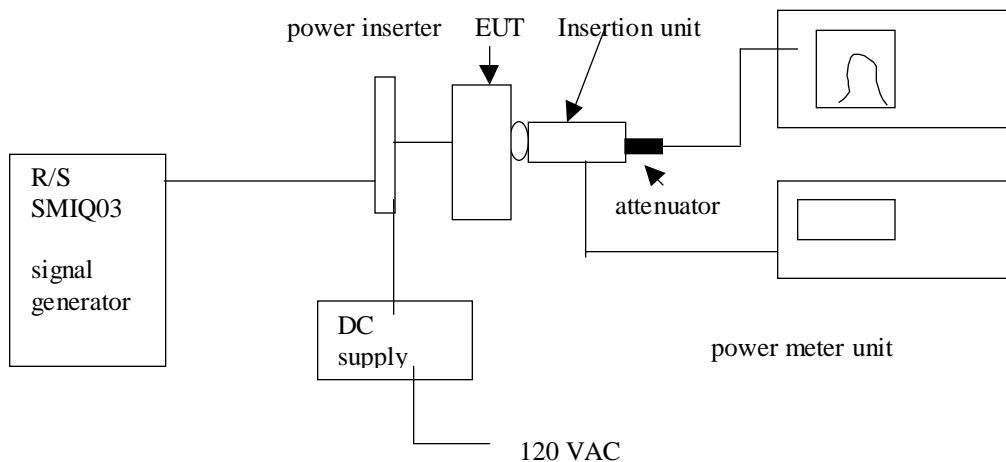
IF Frequency	IF power	RF output	RF output
26 MHz	0.2 dBm	2647 MHz	24.4 dBm
44 MHz	0 dBm	2665 MHz	24.4 dBm
62 MHz	0.9 dBm	2683 MHz	24.4 dBm

## Section 2.1047 Modulation Characteristics

### Measurement Equipment Used:

Rohde&Schwarz NRVS Power Meter model DE12101  
 Rohde&Schwarz Insertion Unit model DE3366B  
 Rohde&Schwarz I/Q signal generator model SMIQ03  
 HP 8593EM spectrum analyzer  
 13dB coaxial attenuation

### Test Set-up:



### Test Procedures:

For the various modulations IF power and frequency were set to produce maximum output power without exceeding the mask limits of 21.908(a).

### Test Results

Refer to QPSK masks and 16QAM plots in separate attachment. Description of plots is found in Table 1 below.

NOTE: Spectrum analyzer REF OFFST was entered incorrectly. The reference level offset should be 13 dB atten + 2.1 cable loss = 15.1 dB. Reference levels are actually 3 dB higher than shown on the plots.

### Limits

Out -of-band emissions limits, digital modulation, section 21.908(a):

At 6MHz channel edge: attenuated -25 dB licensed average 6 MHz channel power  
 From edge to 250 kHz : attenuated along a slope to at least -40 dB  
 Beyond 250 kHz removed: attenuated along a slope to at least -60 dB at 3 MHz removed

Per section 21.908(e):

Attenuation in dB (below "flat top") = A + 10log (RBW1/RBW2)

A = attenuation specified (25, 40, 60 dB)

RBW1 = Resolution bandwidth for flat top measurement (relative)

RBW2 = Resolution bandwidth for spectral point measurement (relative)

**TABLE 1 Modulation, Spectrum Analyzer Plots**

Plot No.	fo, MHz	fo Out, dBm	Modulation	Symbol rate	BW, kHz	Emission Designator
<b>QAM</b>						
34,35	2644.2	24.4	16QAM	160 kbps		200KD7W
36,37	2685.8	24.4	16QAM	160 kbps		200KD7W
38,39	2644.3	24.5	16QAM	320 kbps		400KD7W
40,41	2685.8	24.4	16QAM	320 kbps		400KD7W
42,43	2644.5	24.3	16QAM	640 kbps		800KD7W
44,45	2685.6	23.7	16QAM	640 kbps		800KD7W
46,47	2645.0	23.2	16QAM	1280 kbps		1M60D7W
48,49	2685.1	23.7	16QAM	1280 kbps		1M60D7W
50,51	2645.6	18.4	16QAM	2560 kbps		3M0D7W
52,53	2683.4	21.8	16QAM	2560 kbps		3M0D7W
<b>QPSK</b>						
54,55	2644.2	24.3	QPSK	128 kbps		160KG7W
56,57	2685.9	23.9	QPSK	128 kbps		160KG7W
58,59	2644.2	24.3	QPSK	160 kbps		200KG7W
60,61	2685.9	24.3	QPSK	160 kbps		200KG7W
62,63	2644.3	24.3	QPSK	320 kbps		400KG7W
64,65	2685.8	24.4	QPSK	320 kbps		400KG7W
66,67,68	2644.4	24.5	QPSK	512 kbps		640KG7W
69,70	2685.7	23.8	QPSK	512 kbps		640KG7W
71,72	2644.6	24.5	QPSK	640 kbps		800KG7W
73,74	2685.6	23.3	QPSK	640 kbps		800KG7W
75,76	2644.9	24.6	QPSK	800 kbps		1M00G7W
77,78	2685.4	24.0	QPSK	800 kbps		1M00G7W
79,80,81	2644.9	19.0	QPSK	1280 kbps		1M60G7W
82,83	2685.2	19.0	QPSK	1280 kbps		1M60G7W
84,85	2645.0	19.0	QPSK	1544 kbps		1M93G7W
86,87	2684.8	19.0	QPSK	1544 kbps		1M93G7W
88,89	2645.3	19.0	QPSK	2048 kbps		2M40G7W
90,91	2684.7	18.0	QPSK	2048 kbps		2M40G7W
92,93	2645.6	18.0	QPSK	2560 kbps		3M0G7W
94,95	2684.4	18.0	QPSK	2560 kbps		3M0G7W

**Section 2.1049 Occupied Bandwidth****Measurement Equipment Used:**

Rohde&Schwarz I/Q signal generator model SMIQ03  
HP 8593EM spectrum analyzer  
10dB coaxial attenuator  
3 ft Flexco low loss cable

**Test Procedures**

1. Set RF generator to produce desired modulation
2. Set analyzer RES BW = VID BW = 10 kHz
3. Set display line to -20 dBc, measure bandwidth

**Test Results**

Refer to occupied bandwidth plots in separate attachment. Description of plots is found in Table 2 below.

**TABLE 2 Occupied bandwidth, Spectrum Analyzer Plots**

Modulation	Plot number
128 QPSK	96
160 QPSK	97
320 QPSK	98
512 QPSK	99
640 QPSK	100
800 QPSK	101
1280 QPSK	102
1544 QPSK	103,104
2048 QPSK	105
2560 QPSK	106

**Section 2.1051 Spurious and Harmonic Emissions at Antenna Terminals****Measurement Equipment Used:**

Rohde&Schwarz I/Q signal generator model SMIQ03  
HP 8593EM spectrum analyzer  
10dB coaxial attenuator  
3 ft Flexco low loss cable

**Test Procedures**

Section 21.908(e) requires all emissions removed from the channel edge by more than 3 MHz must be attenuated at least 60 dB below the channel emission flat top.

1. Set modulation to CW (worst case harmonic level production)
2. Set spectrum analyzer to TX output center frequency, RES BW = 100 kHz, VID BW = 100 Hz.
3. Use analyzer PEAK SEARCH to find flat top peak.
4. Set DISPLAY LINE to a level 60 dB below flat top peak
5. Record transmitter output spectrum from 1 MHz to 10<sup>th</sup> harmonic of TX output frequency
6. Plot/photograph spectrum analyzer data

NOTE: Internal analyzer noise floor exceeded -60 dBc level when continuous sweep measurements were attempted to 26.5 GHz. Therefore, additional measurements were performed at each transmitter harmonic frequency, using a frequency span of approximately 50 MHz, and a resolution bandwidth of 10 kHz. The lower span and lower REW BW resulted in noise floor below -60 dBc level.

**Test Results**

Refer to spurious emissions plots in separate attachment. Description of plots is found in Table 3 below.

**TABLE 3 Spurious Output, Spectrum Analyzer Plots**

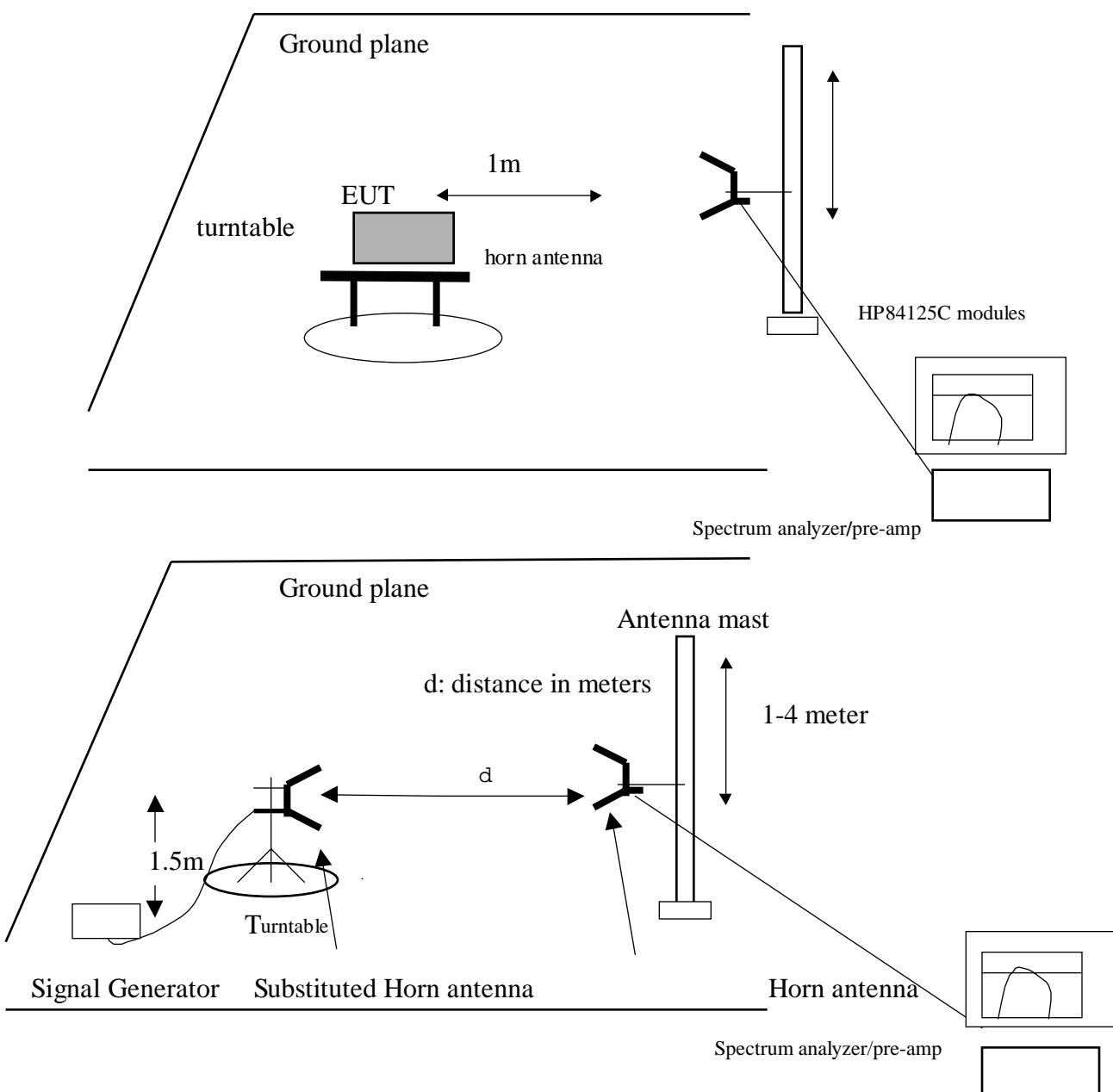
Description of Plot	Plot No.
Spurious output, fo = 2644 MHz Reference	1
Spurious output, fo = 2644 MHz, Harmonics 2-10	2 - 11
Spurious output, fo = 2666 MHz Reference	12
Spurious output, fo = 2666 MHz, Harmonics 2-10	13-22
Spurious output, fo = 2685.83 MHz Reference	23
Spurious output, fo = 2685.83 MHz, Harmonics 2-10	24-33

## Section 2.1053 Field Strength of Spurious and Harmonic Radiation

### Measurement Equipment Used:

HP 8595EM Spectrum Analyzer  
 EMCO 3115 Horn antenna, 1- 18 GHz  
 Antenna Research Associates MWH 1826/B, 18 - 26.5 GHz  
 HP 8449D pre-amplifier

### Test Set-Up



## Minimum Requirement

The magnitude of each spurious and harmonic emission detected as being radiated from the EUT must be at a level more than 60 dB below the emission flat top.

## Test Method

The antenna output port of the EUT was terminated with a 50 ohm load. With the transmitter operating at full power, the EUT was rotated 360° and the search antenna was raised and lowered in both polarities, all in an attempt to maximize the levels of the received emission for each harmonic and spurious emission up to 10 fo.

## Test Results

**Pass.** Refer to separate attachment for data spread sheet. Worst-case margin is -3.25 dB.

## 2.1055 Frequency Stability

### Limit: Frequency v Temperature

-30 to +50C: +/- .001% limit (10 ppm)

### Limit: Frequency v Supply Voltage Variation

85% - 115%: +/- .001% (10 ppm)

The frequency determining circuit for the radio is a TCXO (U31, p8 schematic) :

Manufacturer: Raltron Electronics Corporation

Model Type: RTXT-681

Frequency: 35.593750 MHz

Frequency Stability:  $\pm 2.5$  ppm over temperature range -30C to + 75C

Refer to separate attachment for frequency stability data.