
# PCTEST Engineering Laboratory, Inc.

*6660-B Dobbin Road • Columbia, MD 21045 • U.S.A.*
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## CERTIFICATE OF COMPLIANCE
## FCC Part 22 Certification

**AXESSTEL, Inc.**
**6480 Weathers Place**
**Suite 300**
**San Diego, CA 92121**
**Attn: Mr. David S. Kim**
**Product Manager**

**Dates of Tests: March 29, 2001**
**Test Report S/N: 22.210321181.PH7**
**Test Site: PCTEST Lab, Columbia MD U.S.A.**

| | |
|---|---|
| **FCC ID** | **PH7ACWP800** |
| **APPLICANT** | **AXESSTEL, Inc.** |

| | |
|---|---|
| **FCC Classification:** | **Non-Broadcast Station Transmitter (TNB)** |
| **FCC Rule Part(s):** | **§22(E), §2** |
| **EUT Type:** | **CDMA WLL Phone** |
| **Trade Name/Model(s):** | ***AXESSTEL ACW-P800*** |
| **Tx Frequency Range:** | **824.70 ~ 848.31 MHz** |
| **Rx Frequency Range:** | **869.64 ~ 893.37 MHz** |
| **Max. RF Output Power:** | **0.345 W EIRP (25.373 dBm)** |
| **Frequency Tolerance:** | **0.00025% (2.5 ppm)** |
| **Emission Designator:** | **1M25F9W** |

**This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in §2.947):**

**I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.**

*PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 853(a).*

Randy Ortanez
President & Chief Engineer

**2 1 0 3 2 1 1 8 1 . P H 7**



NVLAP® LAB CODE 100431-0

# TABLE OF CONTENTS


ATTACHMENT A: COVER LETTER(S)

ATTACHMENT B: ATTESTATION STATEMENT(S)

ATTACHMENT C: TEST REPORT

| | |
|---|---|
| 1.1 SCOPE | 1 |
| 2.1 INTRODUCTION (SITE DESCRIPTION) | 2 |
| 3.1 INSERTS | 3 |
| 4.1 DESCRIPTION OF TESTS | 4-5 |
| 5.1 TEST DATA (Equivalent Radiated Power) | 6 |
| 6.1 TEST DATA (RADIATED) | 7-9 |
| 7.1 TEST DATA (FREQUENCY STABILITY) | 10-11 |
| 8.1 PLOTS OF EMISSIONS | 12 |
| 9.1 LIST OF TEST EQUIPMENT | 13 |
| 10.1 SAMPLE CALCULATIONS | 14 |
| 11.1 CONCLUSION | 15 |

ATTACHMENT D: TEST PLOTS

ATTACHMENT E: FCC ID LABEL & LOCATION

ATTACHMENT F: TEST SETUP PHOTOGRAPHS

ATTACHMENT G: EXTERNAL PHOTOGRAPHS

ATTACHMENT H: INTERNAL PHOTOGRAPHS

ATTACHMENT I: BLOCK DIAGRAM(S)

ATTACHMENT J: CIRCUIT DIAGRAMS & DESCRIPTION

ATTACHMENT K: PARTS LIST/TUNE UP PROCEDURE

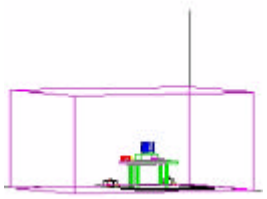
ATTACHMENT L: OPERATIONAL DESCRIPTION

ATTACHMENT M: USER'S MANUAL

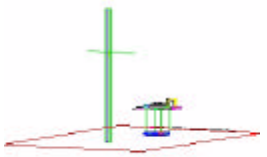
ATTACHMENT N: SAR MEASUREMENT REPORT

ATTACHMENT O: SAR TEST DATA

ATTACHMENT P: SAR TEST SETUP PHOTOGRAPHS



# MEASUREMENT REPORT



## 1.1 Scope

*Product Evaluation and determination of electromagnetic emissions (EME) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.*

## General Information

| | |
|---|---|
| **Applicant Name:** | **AXESSTEL, Inc.** |
| **Address:** | **6480 Weathers Place, Suite 300** |
| | **San Diego, CA 92121** |
| **Attention:** | **David S. Kim, Product Manager** |

- FCC ID: **PH7ACWP800**
- Trade Name: ***AXESSTEL***
- Model(s): ***ACW-P800***
- Quantity: Quantity production is planned
- Emission Designator: 1M25F9W
- Tx Freq. Range: 824.70 – 848.31 MHz
  Rx Freq. Range: 869.64 – 893.37 MHz
- Equipment Class: Non-Broadcast Station Transmitter (TNB)
- Equipment Type: CDMA WLL Phone
- Modulation: CDMA
- Frequency Tolerance: ± 0.00025% (2.5 ppm)
- Max. RF Output Power: 0.345 W EIRP (25.373 dBm)
- FCC Rule Part(s): §22(E), §2
- Dates of Tests: March 29, 2001
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 22.210321181.PH7

## 2.1 INTRODUCTION

These measurement tests were conducted at ***PCTEST Engineering Laboratory, Inc.*** facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 1992.

PCTEST Lab is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. The Scope of PCTEST Accreditation are for Electromagnetic Compatibility and Telecommunications and FCC.

## 2.2 PCTEST Location

The map at right shows the location of the PCTEST Lab, its proximity to the FCC Lab, the Columbia vicinity area, the Baltimore-Washington International (BWI) airport, and the city of Baltimore, and the Washington, D.C. area. (see Figure1).

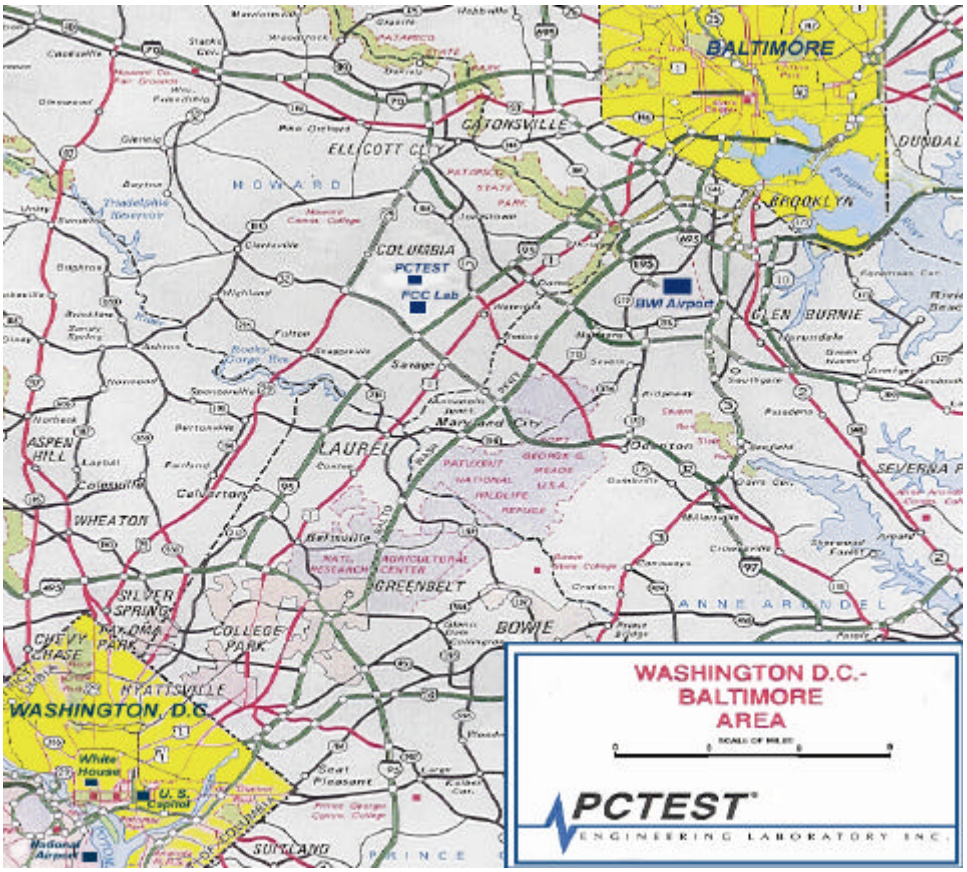



**Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.**

## 3.1 INSERTS

### Function of Active Devices (Confidential)

The Function of active devices are shown in Attachment L.

### Circuit Diagrams & Description (Confidential)

The circuit diagrams and description are shown in Attachment J.

### Block Diagrams (Confidential)

The block diagrams are shown in Attachment I.

### Operating Instructions

The instruction manual is shown in Attachment M.

### Tune-Up Procedure (Confidential)

The tune-up procedure is shown in Attachment K.

### Parts List (Confidential)

The parts list is shown in Attachment K.

### Description of Freq. Stabilization Circuit (Confidential)

The description of frequency stabilization circuit is shown in Attachment J.

### Description for Suppression of Spurious Radiation, for Limiting Modulation, and Harmonic Suppresion Circuits (Confidential)

The description of suppression stabilization circuits is shown in Attachment J.

# 4.1 DESCRIPTION OF TESTS

## 4.2 Occupied Bandwidth Emission Limits

(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block, a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

## 4.3 Spurious and Harmonic Emissions at Antenna Terminal

The level of the carrier and the various conducted spurious and harmonic frequencies are measured by means of a calibrated spectrum analyzer and microwave pre-amplifier. The spectrum is scanned from 10 MHz or the lowest frequency generated in the equipment up to 20 GHz. The transmitter is set to its maximum rated output power and modulated according to the manufacturer's supplied modulation characteristics.

| BLOCK | Freq. Range (MHz) Transmitter (Tx) | Freq. Range (MHz) Receiver (Rx) |
|---|---|---|
| A | 1850 - 1865 | 1930 - 1945 |
| B | 1870 - 1885 | 1950 - 1965 |
| C | 1895 - 1910 | 1975 - 1990 |
| D | 1865 - 1870 | 1945 - 1950 |
| E | 1885 - 1890 | 1965 - 1970 |
| F | 1890 - 1895 | 1970 - 1975 |

Table 1. Broadband PCS Service Frequency Blocks.

# 4.1 DESCRIPTION OF TESTS (CONTINUED)

## 4.4 Frequencies

At the input terminals of the spectrum analyzer, an isolator (RF pad), and a high-pass filter are connected between the test transceiver (for conducted tests) or the receive antenna (for radiated tests), and the analyzer. The high-pass filter (signals below 2 GHz) is to limit the fundamental frequency from interfering with the measurement of low level spurious and harmonic emissions and to ensure that the preamplifier is not saturated.

## 4.5 Radiation Spurious and Harmonic Emissions

Radiation and harmonic emissions above 1 GHz is measured at out 3-meter indoor site. The EUT is placed on the turntable connected to a dummy load in normal operation using the intended power source. A receiving antenna located 3 meters from the turntable receives any signal radiated from the transmitter and its operating accessories. The antenna is varied from 1 to 4 meters and the polarization is varied (horizontal and vertical) to determine the worst-case emission level. To obtain actual radiated signal strength, a signal generator is adjusted in output until a reading identical to that obtained with the actual transmitter is obtained at the receiver. Signal strength is read directly from the generator and recorded on the attached table.

## 4.6 Frequency Stability/Temperature Variation

The frequency stability of the transmitter is measured by:

a.) **Temperature:** The temperature is varied from -30°C to +50°C using an environmental chamber.

b.) **Primary Supply Voltage:** The primary supply voltage is varied from 85% to 115% of the voltage normally at the input to the device or at the power supply terminals if cables are not normally supplied.

*Specification – The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block. The frequency stability of the transmitter shall be maintained within ±0.0001 (±1 ppm) of the center frequency*.

**NOTE: The EUT is tested down to the battery endpoint.**

# 5.1 Test Data (Continued)

## 5.2 Effective Radiated Power Output

B. POWER: **High (CDMA Mode)**

| Freq. Tuned (MHz) | LEVEL (dBm) | POL (H/V) | ERP (W) | ERP (dBm) | BATTERY |
|---|---|---|---|---|---|
| 824.70 | -16.300 | H | 0.31489 | 24.982 | Extended |
| 835.89 | -16.600 | H | 0.30421 | 24.821 | Extended |
| 848.31 | -16.200 | H | 0.34488 | 25.377 | Extended |

**NOTES:**

ERP Measurements by Substitution Method:
The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This ERP level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.

# 6.1 Test Data

## 6.2 Radiated Measurements

Field Strength of SPURIOUS Radiation (CDMA)

| | | | |
|---|---|---|---|
| OPERATING FREQUENCY: | 824.64 MHz | | |
| CHANNEL: | 1011 (Low) | | |
| MEASURED OUTPUT POWER: | 25.373 dBm = | 0.345 | W |
| MODULATION SIGNAL: | CDMA (Internal) | | |
| DISTANCE: | 3 meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.37 | dBc |

| FREQ. (MHz) | LEVEL (dBm) | AFCL (dB) | POL (H/V) | F/S ($\mu$V/m) | ERP (dBm) | (dBc) |
|---|---|---|---|---|---|---|
| 1649.28 | -89.00 | 34.6 | H | 426.6 | -44.78 | 70.15 |
| 2473.92 | -99.00 | 38.8 | H | 218.8 | -50.58 | 75.95 |
| 3298.56 | -102.50 | 42.6 | H | 226.5 | -50.28 | 75.65 |
| 4123.20 | -116.80 | 46.2 | H | 66.1 | -60.98 | 86.35 |
| 4947.84 | < -130 | 48.0 | H | | | |
| | | | | | | |

**NOTES:**

1. The bandwidth is set per §22.917 (RBW = 1MHz, VBW = 1MHz).
2. The spectrum was checked from 25 MHz up to the 10th harmonic.
3. All emissions not listed were found to be more than 20dB below the limit.
4. < -130dBm is below the floor of the spectrum analyzer.
5. The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
6. The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

ERP (dBm) = 10 $\text{Log}_{10}$ (((r(mV/m)/1 x $10^6$)$^2$ / 49.2/1 x $10^{-3}$)

ERP (dBm) = 10 $\text{Log}_{10}$ [ (3 x FS/1 x $10^6$)$^2$ / (49.2) x 1000]

ERP (Watts) = {(3 x FS)/1 x $10^6$}$^2$ / 49.2

# 6.1 Test Data (Continued)

## 6.3 Radiated Measurements

Field Strength of SPURIOUS Radiation (CDMA)

| | | | |
|---|---|---|---|
| OPERATING FREQUENCY: | 835.89 MHz | | |
| CHANNEL: | 363 (Middle) | | |
| MEASURED OUTPUT POWER: | 25.373 dBm = | 0.345 | W |
| MODULATION SIGNAL: | CDMA (Internal) | | |
| DISTANCE: | 3 meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.37 | dBc |

| FREQ. (MHz) | LEVEL (dBm) | AFCL (dB) | POL (H/V) | F/S ($\mu$V/m) | ERP (dBm) | (dBc) |
|---|---|---|---|---|---|---|
| 1671.78 | -89.60 | 34.7 | H | 402.7 | -45.28 | 70.65 |
| 2507.67 | -99.33 | 39.0 | H | 215.5 | -50.71 | 76.08 |
| 3343.56 | -100.90 | 42.7 | H | 275.4 | -48.58 | 73.95 |
| 4179.45 | -117.00 | 46.1 | H | 63.8 | -61.28 | 86.65 |
| 5015.34 | < -130 | 48.0 | H | | | |
| | | | | | | |

**NOTES:**

1. The bandwidth is set per §22.917 (RBW = 1MHz, VBW = 1MHz).
2. The spectrum was checked from 25 MHz up to the 10th harmonic.
3. All emissions not listed were found to be more than 20dB below the limit.
4. < -130dBm is below the floor of the spectrum analyzer.
5. The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
6. The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

ERP (dBm) = 10 Log $_{10}$ (((r(mV/m)/1 x $10^6$)$^2$ / 49.2/1 x $10^{-3}$)

ERP (dBm) = 10 Log $_{10}$ [ (3 x FS/1 x $10^6$)$^2$ / (49.2) x 1000]

ERP (Watts) = {(3 x FS)/1 x $10^6$}$^2$ / 49.2

# 6.1 Test Data (Continued)

## 6.4 Radiated Measurements

Field Strength of SPURIOUS Radiation (CDMA)

| | | | |
|---|---|---|---|
| OPERATING FREQUENCY: | 848.31 MHz | | |
| CHANNEL: | 779 (High) | | |
| MEASURED OUTPUT POWER: | 25.373 dBm = | 0.345 | W |
| MODULATION SIGNAL: | CDMA (Internal) | | |
| DISTANCE: | 3 meters | | |
| LIMIT: | 43 + 10 $\log_{10}$ (W) = | 38.37 | dBc |

| FREQ. (MHz) | LEVEL (dBm) | AFCL (dB) | POL (H/V) | F/S ($\mu$V/m) | ERP (dBm) | (dBc) |
|---|---|---|---|---|---|---|
| 1696.62 | -88.50 | 34.8 | H | 462.4 | -44.08 | 69.45 |
| 2544.93 | -98.50 | 39.3 | H | 245.5 | -49.58 | 74.95 |
| 3393.24 | -100.30 | 43.1 | H | 309.0 | -47.58 | 72.95 |
| 4241.55 | -115.00 | 46.2 | H | 81.3 | -59.18 | 84.55 |
| 5089.86 | < -130 | 48.0 | H | | | |
| | | | | | | |

**NOTES:**

1. The bandwidth is set per §22.917 (RBW = 1MHz, VBW = 1MHz).
2. The spectrum was checked from 25 MHz up to the 10th harmonic.
3. All emissions not listed were found to be more than 20dB below the limit.
4. < -130dBm is below the floor of the spectrum analyzer.
5. The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
6. The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

ERP (dBm) = 10 $\text{Log}_{10}$ (((r(mV/m)/1 x $10^6$)$^2$ / 49.2/1 x $10^{-3}$)

ERP (dBm) = 10 $\text{Log}_{10}$ [ (3 x FS/1 x $10^6$)$^2$ / (49.2) x 1000]

ERP (Watts) = {(3 x FS)/1 x $10^6$}$^2$ / 49.2

# 7.1 Test Data

## 7.2 FREQUENCY STABILITY

OPERATING FREQUENCY: 835,890,004 Hz

CHANNEL: 363

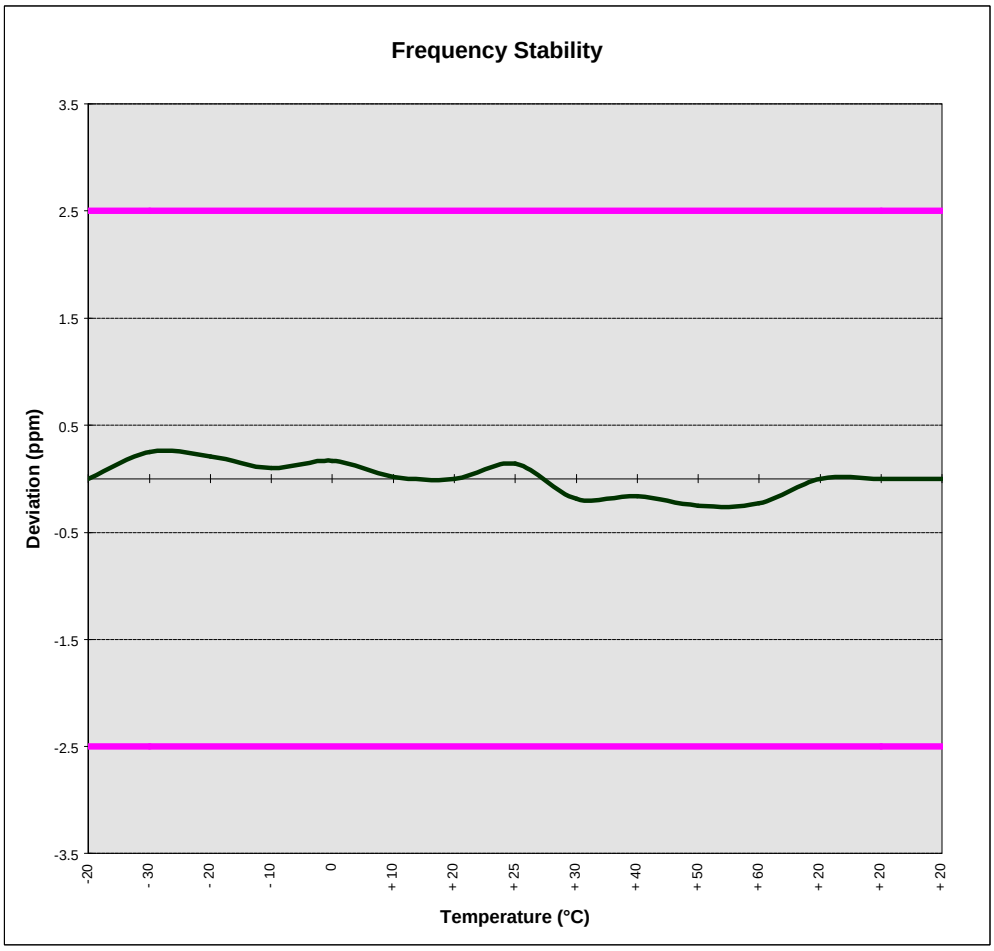
REFERENCE VOLTAGE: 4.8 VDC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE (%) | POWER (VDC) | TEMP (ºC) | FREQ. (Hz) | Deviation (%) |
|---|---|---|---|---|
| 100 % | 4.80 | + 20 (Ref) | 835,890,004 | 0.000000 |
| 100 % | | - 30 | 835,889,795 | 0.000025 |
| 100 % | | - 20 | 835,889,828 | 0.000021 |
| 100 % | | - 10 | 835,889,920 | 0.000010 |
| 100 % | | 0 | 835,889,862 | 0.000017 |
| 100 % | | + 10 | 835,889,987 | 0.000002 |
| 100 % | | + 20 | 835,890,004 | 0.000000 |
| 100 % | | + 25 | 835,889,887 | 0.000014 |
| 100 % | | + 30 | 835,890,163 | -0.000019 |
| 100 % | | + 40 | 835,890,138 | -0.000016 |
| 100 % | | + 50 | 835,890,213 | -0.000025 |
| 100 % | | + 60 | 835,890,196 | -0.000023 |
| 85 % | 4.08 | + 20 | 835,890,004 | 0.000000 |
| 115 % | 5.52 | + 20 | 835,890,004 | 0.000000 |
| BATT. ENDPOINT | 2.95 | + 20 | 835,890,004 | 0.000000 |

# 7.1 Test Data (Continued)

## 7.3 FREQUENCY STABILITY



## 8.1 PLOT(S) OF EMISSIONS

(SEE ATTACHMENT D)

## 9.1 TEST EQUIPMENT

| 9.2 Type | Model | Cal. Due Date | S/N |
|---|---|---|---|
| Microwave Spectrum Analyzer | HP 8566B (100Hz-22GHz) | 08/15/02 | 3638A08713 |
| Microwave Spectrum Analyzer | HP 8566B (100Hz-22GHz) | 04/17/02 | 2542A11898 |
| Spectrum Analyzer/Tracking Gen. | HP 8591A (100Hz-1.8GHz) | 08/10/02 | 3144A02458 |
| Signal Generator* | HP 8640B (500Hz-1GHz) | 06/03/02 | 2232A19558 |
| Signal Generator* | HP 8640B (500Hz-1GHz) | 06/03/02 | 1851A09816 |
| Signal Generator* | Rohde & Schwarz (0.1-1000MHz) | 09/11/02 | 894215/012 |
| Ailtech/Eaton Receiver | NM 37/57A-SL (30-1000MHz) | 04/12/02 | 0792-03271 |
| Ailtech/Eaton Receiver | NM 37/57A (30-1000MHz) | 03/11/02 | 0805-03334 |
| Ailtech/Eaton Receiver | NM 17/27A (0.1-32MHz) | 09/17/02 | 0608-03241 |
| Quasi-Peak Adapter | HP 85650A | 08/15/02 | 2043A00301 |
| Ailtech/Eaton Adapter | CCA-7 CISPR/ANSI QP Adapter | 03/11/02 | 194-04082 |
| Gigatronics Universal Power Meter | 8657A | | 1835256 |
| Gigatronics Power Sensor | 80701A (0.05-18GHz) | | 1833460 |
| Signal Generator | HP 8648D (9kHz-4GHz) | | 3613A00315 |
| Amplifier Research | 5S1G4 (5W, 800MHz-4.2GHz) | | 22322 |
| Network Analyzer | HP 8753E (30kHz-3GHz) | | JP38020182 |
| Audio Analyzer | HP 8903B | | 3011A09025 |
| Modulation Analyzer | HP 8901A | | 2432A03467 |
| Power Meter | HP 437B | | 3125U24437 |
| Power Sensor | HP 8482H (30µW-3W) | | 2237A02084 |
| Harmonic/Flicker Test System | HP 6841A (IEC 555-2/3) | | 3531A00115 |
| Broadband Amplifier (2) | HP 8447D | | 1145A00470, 1937A03348 |
| Broadband Amplifier | HP 8447F | | 2443A03784 |
| Horn Antenna | EMCO Model 3115 (1-18GHz) | | 9704-5182 |
| Horn Antenna | EMCO Model 3115 (1-18GHz) | | 9205-3874 |
| Horn Antenna | EMCO Model 3116 (18-40GHz) | | 9203-2178 |
| Biconical Antenna (4) | Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design 1295, 1332, 0355 | | |
| Log-Spiral Antenna (3) | Ailtech/Eaton 93490-1 | | 0608, 1103, 1104 |
| Roberts Dipoles | Compliance Design (1 set) | | |
| Ailtech Dipoles | DM-105A (1 set) | | 33448-111 |
| EMCO LISN (6) | 3816/2 | | 1079 |
| Microwave Preamplifier 40dB Gain | HP 83017A (0.5-26.5GHz) | | 3123A00181 |
| Microwave Cables | MicroCoax (1.0-26.5GHz) | | |
| Ailtech/Eaton Receiver | NM37/57A-SL | | 0792-03271 |
| Spectrum Analyzer | HP 8594A | | 3051A00187 |
| Spectrum Analyzer (2) | HP 8591A | | 3034A01395, 3108A02053 |
| Microwave Survey Meter | Holaday Model 1501 (2.450GHz) | | 80931 |
| Digital Thermometer | Extech Instruments 421305 | | 426966 |
| Attenuator | HP 8495A (0-70dB) DC-4GHz | | |
| Bi-Directional Coax Coupler | Narda 3020A (50-1000MHz) | | |
| Shielded Screen Room | RF Lindgren Model 26-2/2-0 | | 6710 (PCT270) |
| Shielded Semi-Anechoic Chamber | Ray Proof Model S81 | | R2437 (PCT278) |
| Enviromental Chamber | Associated Systems Model 1025 (Temperature/Humidity) | | PCT285 |

* Calibration traceable to the National Institute of Standards and Technology (NIST).

# 10.1 SAMPLE CALCULATIONS

## A. EIRP Calculation

$$\text{Level } \mu\text{/Vm @ 3 meters} = \text{Log}_{10}^{-1}\left(\frac{\text{dBm} + 107 + \text{AFCL}}{20}\right)$$

$$\text{Log}_{10}^{-1}\left(\frac{-14 + 107 + 31.7}{20}\right)$$

1717908.4 µ/Vm @ 3 meters

Sample Calculation (relative to a dipole)

EIRP (dBm) = $10\ \text{Log}_{10}(((r(\mu V/m)1x10^{6})^{2}/30.0/1x10^{-3})$

EIRP (dBm) = $10\ \text{Log}_{10}(((3(1717908.4)1x10^{6})^{2}/30.0/1x10^{-3})$

EIRP (dBm) = 29.46

## B. Emission Designator

**CDMA Sample**

2M + 2DK

CDMA BW = 1.25 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

Emission Designator = 1M25F9W

## 11.1 CONCLUSION

The data collected shows that the **AXESSTEL, Inc., CDMA WLL Phone FCC ID: PH7ACWP800** complies with all the requirements of Parts 2 and 22 of the FCC rules.