

# PCTEST Engineering Laboratory, Inc.

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## CERTIFICATE OF COMPLIANCE (Parts 24/22 Certification)

DENSO INTERNATIONAL AMERICA, INC.  
5770 Armada Drive  
Carlsbad, CA 92008-4608  
Attention: Steve Burrington, Test & Verification Group

Dates of Tests: March 08-12, 1999  
Test Report S/N: 24/22.990308149.LXC  
Test Site: PCTEST Lab, Columbia MD

FCC ID

**LXC-E120**

APPLICANT

**DENSO INTERNATIONAL AMERICA, INC.**

|                     |                                                               |
|---------------------|---------------------------------------------------------------|
| Classification:     | Licensed Portable Transmitter Held to Ear (PCE)               |
| FCC Rule Part(s):   | §§§§24(E), 22(H), 2.983, 2.987                                |
| EUT Type:           | Dual-Band Analog/PCS Phone (AMPS/CDMA)                        |
| Trade Name:         | DENSO                                                         |
| Model:              | E120                                                          |
| Tx Frequency Range: | 1851.25MHz – 1908.75MHz (CDMA) / 824.04MHz – 848.97MHz (AMPS) |
| Rx Frequency Range: | 1931.25MHz – 1988.75MHz (CDMA) / 869.04MHz – 893.97MHz (AMPS) |
| Max Output Power:   | 0.6 W ERP (AMPS) / 0.6 W EIRP (CDMA)                          |

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 with the following remarks (Note Codes):

*\*(BC) The output power is continuously variable from the value listed in this entry to 5%-10% of the value listed.*

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 Orlanez  
President & Chief Engineer



**NVLAP**<sup>®</sup>  
LAB CODE 100431-0

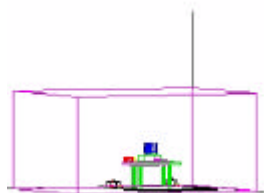
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## TABLE OF CONTENTS

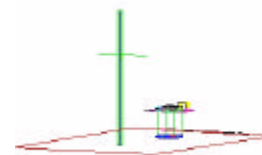
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|               |                                         |       |
|---------------|-----------------------------------------|-------|
| ATTACHMENT A: | COVER LETTER(S)                         |       |
| ATTACHMENT B: | ATTESTATION STATEMENT(S)                |       |
| ATTACHMENT C: | TEST REPORT                             |       |
|               | SCOPE                                   | 1     |
|               | INTRODUCTION                            | 2     |
|               | DESCRIPTION OF TESTS                    | 3-7   |
|               | EFFECTIVE RADIATED POWER OUTPUT         | 8     |
|               | EQUIVALENT ISOTROPICALLY RADIATED POWER | 9     |
|               | RADIATED MEASUREMENTS                   | 10-15 |
|               | FREQUENCY STABILITY                     | 16-19 |
|               | PLOTS OF EMISSIONS                      | 20    |
|               | LIST OF TEST EQUIPMENT                  | 21    |
|               | SAMPLE CALCULATIONS                     | 22    |
|               | RECOMMENDATION / CONCLUSION             | 23    |
| 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: | SCHEMATIC DIAGRAM(S)                    |       |
| ATTACHMENT K: | OPERATIONAL DESCRIPTION                 |       |
| ATTACHMENT L: | PARTS LIST/TUNE UP PROCEDURE            |       |
| ATTACHMENT M: | USER'S MANUAL                           |       |
| ATTACHMENT N: | SAR MEASUREMENT REPORT                  |       |
| ATTACHMENT O: | SAR TEST DATA                           |       |
| ATTACHMENT P: | SAR TEST SETUP PHOTOGRAPHS              |       |

# MEASUREMENT REPORT



*Scope - Measurement 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.*



## §2983(a) General Information

|                        |                                                        |
|------------------------|--------------------------------------------------------|
| <b>Applicant Name:</b> | <b>DENSO INTERNATIONAL AMERICA, INC.</b>               |
| <b>Address:</b>        | <b>5770 Armada Drive<br/>Carlsbad, CA 92008-4608</b>   |
| <b>Attention:</b>      | <b>Steve Burrington, Test &amp; Verification Group</b> |

- §2983(b) FCC ID: **LXC-E120**
- §2983(c) Quantity: Quantity production is planned
- §2.983(d) Emission Designator: 1M25F9W, 40K0F8W, 40K0F1D
- §2.983(d) Tx Freq. Range: 1851.25 – 1908.75 MHz (CDMA)  
824.04 – 848.97 MHz (AMPS)
- §2.983(d) Rx Freq. Range: 1931.25 – 1988.75 MHz (CDMA)  
869.04 – 893.97 MHz (AMPS)
- §2.983(d) Max Power Rating: 0.6 W EIRP (CDMA) / 0.6 W ERP (AMPS)
- Battery Pack: 3.6 VDC Li-Ion Battery Pack
- AC Desktop Charger: Denso Model: DTC-100
- FCC Classification(s): Licensed Portable Tx Held to Ear (PCE)
- Equipment (EUT) Type: Dual Band Analog/PCS Phone (AMPS/CDMA)
- Frequency Tolerance:  $\pm 0.00025\%$  (2.5 ppm)
- FCC Rule Part(s): §§§§ 24(E), 22(H), 2.983, 2.987
- Dates of Tests: March 08-12, 1999
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 24/22.990308149.LXC



## 1.1 INTRODUCTION

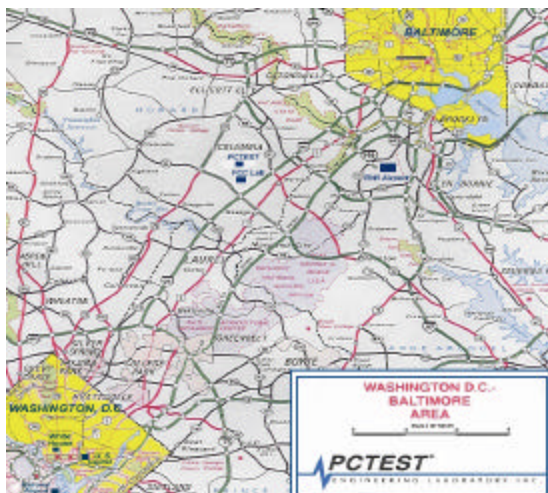
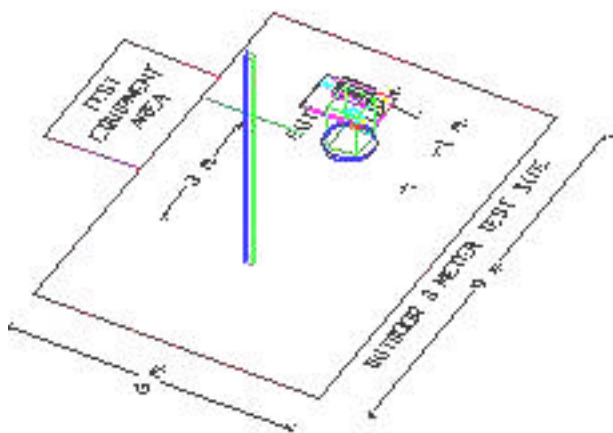


Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.

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.

### Measurement Procedure

The radiated and spurious measurements were made outdoors at 3-meter test range (see Figure2). The equipment under test is placed on the turntable connected to a RF wattmeter and a dummy RF load, and then its power is adjusted to its rated output. A receiving antenna located 2 meters from the turntable picks up any signal radiated from the transmitter. The turntable containing the system was rotated; the receiving antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. The testing procedure is repeated for both horizontal and vertical polarization of the receiving antenna. The actual radiated signal strength is obtained by substitution method with a signal generator with a calibrated output. The signal generator is adjusted in output until its reading is identical to that obtained when the receiving antenna is connected to the receiver. Signal strength is then read directly from the signal generator.



## **2.1 INSERTS PER §2.983(d)**

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### **§2.983(d) Function of Active Devices (Confidential)**

The Function of active devices are shown in Attachment L.

### **§2.983(d) Circuit Diagrams & Description (Confidential)**

The circuit diagrams & description are shown in Attachment J and the Block Diagram(s) are shown in Attachment I.

### **§2.983(d) Operating Instructions**

The instruction manual is shown in Attachment M.

### **§2.983(d) Tune-Up Procedure (Confidential)**

The tune-up procedure is shown in Attachment L.

### **§2.983(d) Description of Freq. Stabilization Circuit (Confidential)**

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

### **§2.983(d) Description for Suppression of Spurious Radiation, for Limiting Modulation, and Harmonic Suppression Circuits (Confidential)**

The description of suppression stabilization circuits are shown in Attachment L.

## 3.1 DESCRIPTION OF TESTS

### **3.2 §2.987(a) Transmitter Audio Frequency Response**

The frequency response of the audio modulating circuit over the frequency range 100 – 5000 Hz is measured. The audio signal generator is connected to the audio input circuit/microphone of the EUT. The audio signal input is adjusted to obtain 50% modulation at 1kHz and this point is taken as the 0dB reference.

With the input held constant and below the limit at all frequencies, the audio signal generator is varied from 100 to 50 kHz. The response in dB relative to 1kHz is measured using the HP8901 a Modulation Analyzer. For the frequency response of the audio low-pass filter, the audio input is connected at the input to the modulation limiter and the modulated stage. The audio output is connected at the output of the modulated stage. The corresponding plots are shown herein

### **3.3 §2.987(b) Modulation Limiting.**

The audio signal generator is connected to the audio input circuit/microphone of the EUT. The modulation response is measured for each of the three modulating frequencies (300Hz, 1000 Hz, and 2990Hz), and the input voltage is varied from 30% modulation ( $\pm 3.6$ kHz deviation) to at least 20dB higher than the saturation point. Measurements of modulation and the plots are attached herein.

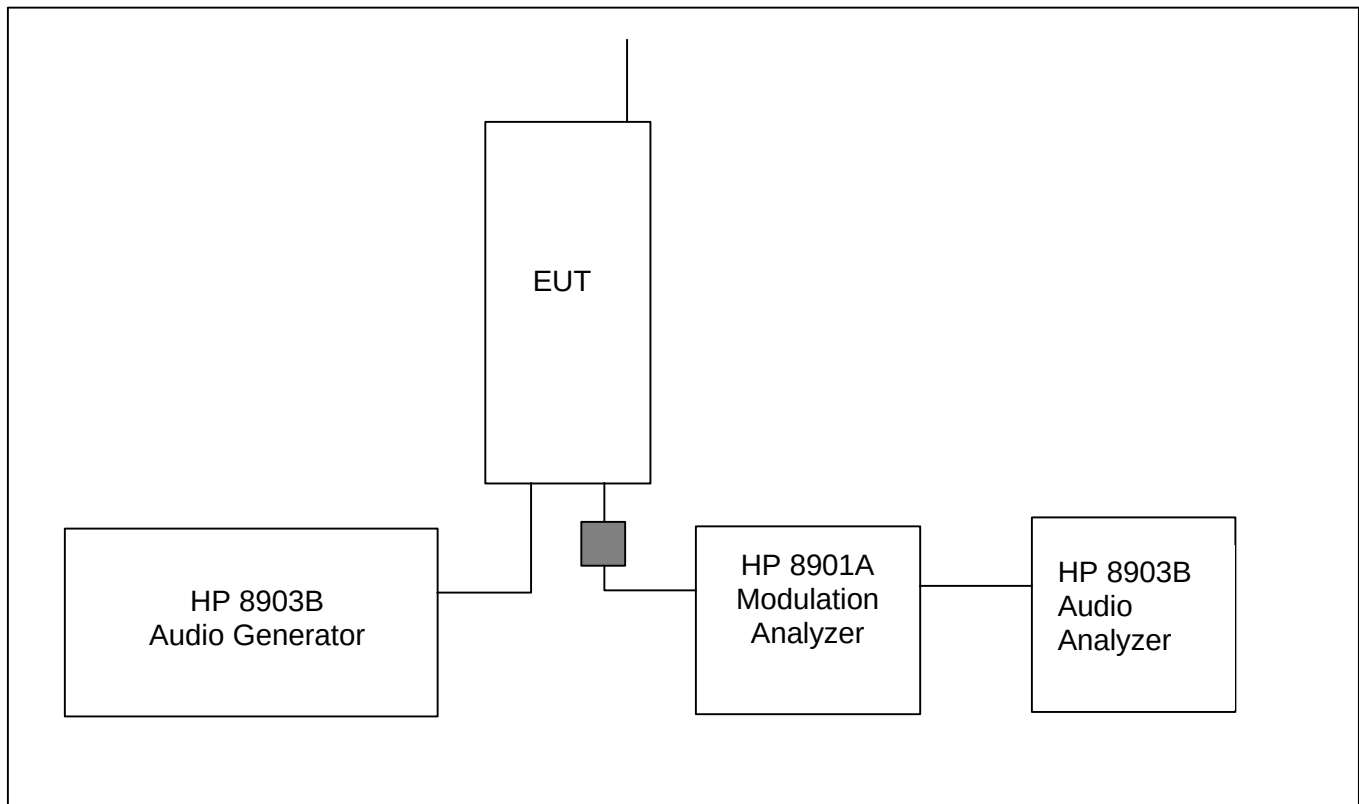


Fig. 3. Transmitter Audio Freq. Test Setup

### 3.1 DESCRIPTION OF TESTS (CONTINUED)

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#### **3.4 §24.238 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 emission 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.

| BLOCK | Freq. Range (MHz)<br>Transmitter (Tx) | Freq. Range (MHz)<br>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.

### **3.1 DESCRIPTION OF TESTS (CONTINUED)**

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#### **3.4 §2.989(c)(1) Occupied Bandwidth**

The audio signal generator is adjusted to 1kHz. The output level is set to  $\pm 6$ kHz deviation. With the level constant, the frequency is set to 2500Hz. Then the audio signal level is increased by 16dB. The occupied bandwidth data is obtained for the SAT (Supervisory Audio Tone), ST (Signaling Tone), WBD (Wideband data), and DTMF (Dual Tone Multi Frequencies). The results are shown on the attached graphs.

Specified Limits:

- a. On any frequency removed from the assigned carrier frequency by more than 20 kHz, up to and including 45kHz, the sideband is at least 26dB below the carrier.
- b. On any frequency removed from the assigned carrier frequency by more than 45 kHz, up to and including 90kHz, the sideband is at least 45dB below the carrier.
- c. On any frequency removed from the assigned carrier frequency by more than 90 kHz, up to the first multiple of the carrier frequency, the sideband is at least 60dB below the carrier or  $40 + \log_{10}$  (mean power output in Watts) dB, whichever is the smaller attenuation.

#### **3.5 §2.991 Spurious and Harmonic Emissions at Antenna Terminal**

The level of the carrier and the various conducted spurious and harmonic frequencies is measured by means of a calibrated spectrum analyzer. The spectrum is scanned from the lowest frequency generated in the equipment up to 10 GHz. The transmitter is modulated with a 2500Hz tone at a level of 16dB greater than that required to provide 50% modulation.

At the input terminals of the spectrum analyzer, an isolator (RF circulator with one port terminated with 50 ohms) and an 870 MHz to 890 MHz bandpass filter is connected between the test transceiver (for conducted tests) or the receive antenna (for radiated tests) and the analyzer. The rejection of the bandpass filter to signals in the 825 – 845 MHz range is adequate to limit the transmit energy from the test transceiver which appears to a level which will allow the analyzer to measure signals less than  $-90$ dBm. Calibration of the test receiver is performed in the 870 – 890 MHz range to insure accuracy to allow variation in the passband filter insertion loss to be calibrated.

#### **3.6 §24.229 Frequencies**

At the input terminals of the spectrum analyzer, an isolator (RF pad) and an 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.

### **3.7 §2.993 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.3.8 §24.135 Frequency Stability/Temperature Variation

The frequency stability of the transmitter is measured by:

- a.) **Temperature:** The temperature is varied from -30°C to +60°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  $\pm 0.0001$  ( $\pm 1$  ppm) of the center frequency.*

#### **Time Period and Procedure:**

1. The carrier frequency of the transmitter and the individual oscillators is measured at room temperature (25°C to 27°C to provide a reference).
2. The equipment is subjected to an overnight “soak” at -30°C without any power applied.
3. After the overnight “soak” at 30°C (usually 14-16 hours), the equipment is turned on in a “standby” condition for one minute before applying power to the transmitter. Measurement of the carrier frequency of the transmitter and the individual oscillators is made within a three minute interval after applying power to the transmitter.
4. Frequency measurements is made at 10°C interval up to room temperature. At least a period of one and one half hour is provided to allow stabilization of the equipment at each temperature level.
5. Again the transmitter carrier frequency and the individual oscillators is measured at room temperature to begin measurement of the upper temperature levels.
6. Frequency were made at 10 intervals starting at 30°C up to +50°C allowing at least two hours at each temperature for stabilization. In all measurements the frequency is measured within three minutes after applying power to the transmitter.
7. The artificial load is mounted external to the temperature chamber.

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

## Test Data

### § 22.913 Effective Radiated Power Output

A. POWER: **Low (Analog Mode)**

| Freq.<br>Tuned<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F / S<br>( $\mu$ V/m) | ERP<br>(W) | ERP<br>(dBm) |
|-------------------------|----------------|--------------|--------------|-----------------------|------------|--------------|
| 824.04                  | -34.00         | 31.65        | V            | 170815                | 0.00535    | 7.27         |
| 836.49                  | -34.50         | 31.81        | V            | 164175                | 0.00494    | 6.93         |
| 848.97                  | -33.80         | 31.96        | V            | 181178                | 0.00602    | 7.78         |

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

| Freq.<br>Tuned<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F / S<br>( $\mu$ V/m) | ERP<br>(W) | ERP<br>(dBm) |
|-------------------------|----------------|--------------|--------------|-----------------------|------------|--------------|
| 824.04                  | -14.00         | 31.65        | V            | 1708146               | 0.53500    | 27.27        |
| 836.49                  | -14.50         | 31.81        | V            | 1641747               | 0.49422    | 26.93        |
| 848.97                  | -13.80         | 31.96        | V            | 1811783               | 0.60000    | 27.77        |

#### NOTES:

The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

$$\text{ERP (dBm)} = 10 \log_{10} \left( \left( (r(\text{mV/m})/1 \times 10^6)^2 / 49.2/1 \times 10^{-3} \right) \right)$$

$$\text{ERP (dBm)} = 10 \log_{10} \left[ (3 \times \text{FS}/1 \times 10^6)^2 / (49.2) \times 1000 \right]$$

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

## Test Data

### § 24.232(b) Equivalent Isotropically Radiated Power (E.I.R.P.)

The RF output power is measured via HP436A Power Meter Sensor.

Supply Voltage: 3.6 VDC

Modulation: CDMA

| FREQ.<br>(MHz) | Level<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | Height<br>(m) | Azimuth<br>(° angle) | F/S<br>(μV/m) | Margin<br>(dBm) | EIRP<br>(W) |
|----------------|----------------|--------------|--------------|---------------|----------------------|---------------|-----------------|-------------|
| 1851.25        | - 19.3         | 35.31        | V/H          | 1.2           | 60                   | 1414165       | 27.78           | 0.60000     |
| 1880.00        | - 19.6         | 35.48        | V/H          | 1.2           | 60                   | 1393157       | 27.65           | 0.58226     |
| 1908.75        | - 20.9         | 35.65        | V/H          | 1.2           | 60                   | 1106624       | 25.65           | 0.43200     |

**Mobile / portable stations are limited to 2 watts e.i.r.p. peak power and the equipment must employ means to limit the power to the minimum necessary for successful communications**

The EUT is placed 3m. away from the receiving antenna and the EIRP is calculated using the formula:

$$\text{EIRP (dBm)} = 10 \text{ Log } 10 \left( \left( \frac{r(\text{mV/m})}{1 \times 10^6} \right)^2 / 30.0 / 1 \times 10^{-3} \right)$$

$$\text{EIRP (dBm)} = 10 \text{ Log } 10 \left[ \left( 3 \times \text{FS} / 1 \times 10^6 \right)^2 / (30.0) \times 1000 \right]$$

$$\text{EIRP (dBm)} = \{ (3 \times \text{FS}) / 1 \times 10^6 \}^2 / 30.0$$

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (CDMA)

OPERATING FREQUENCY: 1851.25 MHz  
 CHANNEL: 025 (Low)  
 MEASURED OUTPUT POWER: 27.78 dBm = 0.60 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  40.79 dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 3702.50        | -80.5          | 44.4         | V            | 3507.5              | -24.33       | 52.1  |
| 5553.75        | -116.5         | 49.7         | V            | 102.3               | -55.03       | 82.8  |
| 7405.00        | -128.0         | 53.7         | V            | 43.2                | -62.53       | 90.3  |
| 9256.25        | < -130         |              |              |                     |              |       |
| 11107.50       | < -130         |              |              |                     |              |       |
|                |                |              |              |                     |              |       |

#### NOTES:

- The bandwidth is set per §24.238 (RBW = 1MHz, VBW = 1MHz).
- The spectrum was checked from 25 MHz up to the 10th harmonic.
- All emissions not listed were found to be more than 20dB below the limit.
- < -130dBm is below the floor of the spectrum analyzer.
- The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
- The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:  

$$\text{ERP (dBm)} = 10 \log_{10} (((r(\text{mV/m})/1 \times 10^6)^2 / 30.0) / 1 \times 10^{-3})$$

$$\text{ERP (dBm)} = 10 \log_{10} [ (3 \times \text{FS} / 1 \times 10^6)^2 / (30.0) \times 1000 ]$$

$$\text{ERP (Watts)} = \{ (3 \times \text{FS}) / 1 \times 10^6 \}^2 / 30.0$$

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (CDMA)

OPERATING FREQUENCY: 1880.00 MHz  
 CHANNEL: 600 (Middle)  
 MEASURED OUTPUT POWER: 27.78 dBm = 0.60 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) = 40.79$  dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 3760.00        | -80.7          | 44.7         | V            | 3548.1              | -24.23       | 52.0  |
| 5640.00        | -117.0         | 49.9         | V            | 98.9                | -55.33       | 83.1  |
| 7520.00        | -128.0         | 54.0         | V            | 44.7                | -62.23       | 90.0  |
| 9400.00        | < -130         |              |              |                     |              |       |
| 11280.00       | < -130         |              |              |                     |              |       |
|                |                |              |              |                     |              |       |

#### NOTES:

- The bandwidth is set per §24.238 (RBW = 1MHz, VBW = 1MHz).
- The spectrum was checked from 25 MHz up to the 10th harmonic.
- All emissions not listed were found to be more than 20dB below the limit.
- < -130dBm is below the floor of the spectrum analyzer.
- The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
- The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

$$\text{ERP (dBm)} = 10 \log_{10} \left( \left( \frac{r(\text{mV/m})}{1 \times 10^6} \right)^2 / 30.0 / 1 \times 10^{-3} \right)$$

$$\text{ERP (dBm)} = 10 \log_{10} \left[ \left( 3 \times \text{FS} / 1 \times 10^6 \right)^2 / (30.0) \times 1000 \right]$$

$$\text{ERP (Watts)} = \left\{ \left( 3 \times \text{FS} \right) / 1 \times 10^6 \right\}^2 / 30.0$$

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (CDMA)

OPERATING FREQUENCY: 1908.75 MHz  
 CHANNEL: 1175 (High)  
 MEASURED OUTPUT POWER: 27.78 dBm = 0.60 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) = 40.79$  dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 3817.50        | -81.7          | 45.0         | V            | 3273.4              | -24.93       | 52.7  |
| 5726.25        | -117.0         | 50.1         | V            | 101.2               | -55.13       | 82.9  |
| 7635.00        | -128.0         | 54.2         | V            | 45.7                | -62.03       | 89.8  |
| 9543.75        | < -130         |              |              |                     |              |       |
| 11452.50       | < -130         |              |              |                     |              |       |
|                |                |              |              |                     |              |       |

#### NOTES:

- The bandwidth is set per §24.238 (RBW = 1MHz, VBW = 1MHz).
- The spectrum was checked from 25 MHz up to the 10th harmonic.
- All emissions not listed were found to be more than 20dB below the limit.
- < -130dBm is below the floor of the spectrum analyzer.
- The EUT is manipulated through 3 orthogonal axis and the worst-case are reported.
- The EUT is placed 3m. away from the receiving antenna and the ERP is calculated using the formula:

$$\text{ERP (dBm)} = 10 \log_{10} (((r(\text{mV/m})/1 \times 106)^2 / 30.0/1 \times 10^{-3})$$

$$\text{ERP (dBm)} = 10 \log_{10} [(3 \times \text{FS}/1 \times 106)^2 / (30.0) \times 1000]$$

$$\text{ERP (Watts)} = \{(3 \times \text{FS})/1 \times 106\}^2 / 30.0$$

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (Analog)

OPERATING FREQUENCY: 824.04 MHz  
 CHANNEL: 991 (Low)  
 MEASURED OUTPUT POWER: 27.80 dBm = 0.60 W  
 MODULATION SIGNAL: ST (Signalling Tone)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  40.81 dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 1648.08        | -75.2          | 34.5         | V            | 2065.4              | -31.08       | 58.9  |
| 2472.12        | -79.5          | 38.8         | V            | 2065.4              | -31.08       | 58.9  |
| 3296.16        | -90.0          | 42.5         | V            | 944.1               | -37.88       | 65.7  |
| 4120.20        | -95.0          | 46.1         | V            | 803.5               | -39.28       | 67.1  |
| 4944.24        | -97.0          | 48.0         | V            | 794.3               | -39.38       | 67.2  |
| 5768.28        | -106.0         | 50.1         | V            | 358.9               | -46.28       | 74.1  |

#### NOTES:

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

$$\text{ERP (dBm)} = 10 \log_{10} \left( \left( (r(\text{mV/m})/1 \times 10^6)^2 / 49.2/1 \times 10^{-3} \right) \right)$$

$$\text{ERP (dBm)} = 10 \log_{10} \left[ (3 \times \text{FS}/1 \times 10^6)^2 / (49.2) \times 1000 \right]$$

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

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (Analog)

OPERATING FREQUENCY: 836.49 MHz  
 CHANNEL: 383 (Middle)  
 MEASURED OUTPUT POWER: 27.80 dBm = 0.60 W  
 MODULATION SIGNAL: ST (Signalling Tone)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  40.81 dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 1672.98        | -75.8          | 34.7         | V            | 1972.4              | -31.48       | 59.3  |
| 2509.47        | -80.1          | 39.0         | V            | 1972.4              | -31.48       | 59.3  |
| 3345.96        | -89.5          | 42.7         | V            | 1023.3              | -37.18       | 65.0  |
| 4182.45        | -97.0          | 46.1         | V            | 638.3               | -41.28       | 69.1  |
| 5018.94        | -100.0         | 48.2         | V            | 575.4               | -42.18       | 70.0  |
| 5855.43        | -106.0         | 50.3         | V            | 367.3               | -46.08       | 73.9  |

#### NOTES:

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

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

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

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

## Test Data

### Radiated Measurements

#### § 2.993 Field Strength of SPURIOUS Radiation (Analog)

OPERATING FREQUENCY: 848.97 MHz  
 CHANNEL: 799 (High)  
 MEASURED OUTPUT POWER: 27.80 dBm = 0.60 W  
 MODULATION SIGNAL: ST (Signalling Tone)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  40.81 dBc

| FREQ.<br>(MHz) | LEVEL<br>(dBm) | AFCL<br>(dB) | POL<br>(H/V) | F/S<br>( $\mu$ V/m) | ERP<br>(dBm) | (dBc) |
|----------------|----------------|--------------|--------------|---------------------|--------------|-------|
| 1697.94        | -73.5          | 34.8         | V            | 2600.2              | -29.08       | 56.9  |
| 2546.91        | -80.4          | 39.2         | V            | 1949.8              | -31.58       | 59.4  |
| 3395.88        | -90.0          | 42.9         | V            | 988.6               | -37.48       | 65.3  |
| 4244.85        | -100.0         | 46.1         | V            | 451.9               | -44.28       | 72.1  |
| 5093.82        | -105.2         | 48.6         | V            | 331.1               | -46.98       | 74.8  |
| 5942.79        |                | 50.5         | V            |                     |              |       |

#### 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:

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

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

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

## Test Data

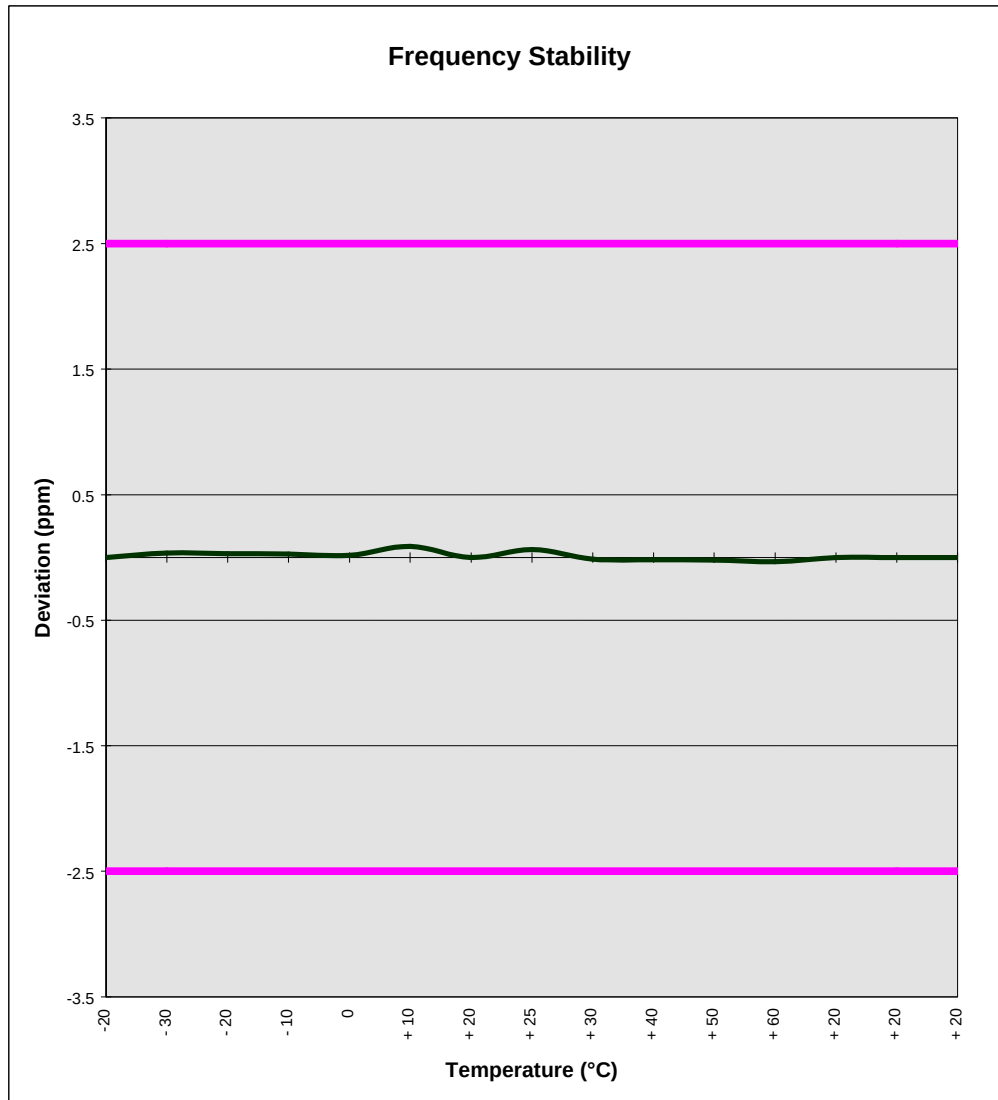
### § 24.135 FREQUENCY STABILITY (CDMA)

OPERATING FREQUENCY: 1,880,000,010 Hz  
 CHANNEL: 600  
 REFERENCE VOLTAGE: 3.6 VDC  
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE<br>(%) | POWER<br>(VDC) | TEMP<br>(°C) | FREQ.<br>(Hz) | Deviation<br>(%) |
|----------------|----------------|--------------|---------------|------------------|
| 100 %          | 3.60           | + 20 (Ref)   | 1,880,000,010 | 0.000000         |
| 100 %          |                | - 30         | 1,879,999,945 | 0.000003         |
| 100 %          |                | - 20         | 1,879,999,954 | 0.000003         |
| 100 %          |                | - 10         | 1,879,999,961 | 0.000003         |
| 100 %          |                | 0            | 1,879,999,980 | 0.000002         |
| 100 %          |                | + 10         | 1,879,999,848 | 0.000009         |
| 100 %          |                | + 20         | 1,880,000,010 | 0.000000         |
| 100 %          |                | + 25         | 1,879,999,893 | 0.000006         |
| 100 %          |                | + 30         | 1,880,000,038 | -0.000002        |
| 100 %          |                | + 40         | 1,880,000,045 | -0.000002        |
| 100 %          |                | + 50         | 1,880,000,051 | -0.000002        |
| 100 %          |                | + 60         | 1,880,000,074 | -0.000003        |
| 85 %           | 3.06           | + 20         | 1,880,000,010 | 0.000000         |
| 115 %          | 4.14           | + 20         | 1,880,000,010 | 0.000000         |
| BATT. ENDPOINT | 2.50           | + 20         | 1,880,000,010 | 0.000000         |

## Test Data

### § 24.135 FREQUENCY STABILITY (CDMA)



## Test Data

### § 2.995 FREQUENCY STABILITY (AMPS)

OPERATING FREQUENCY: 836,490,100 Hz

CHANNEL: 383

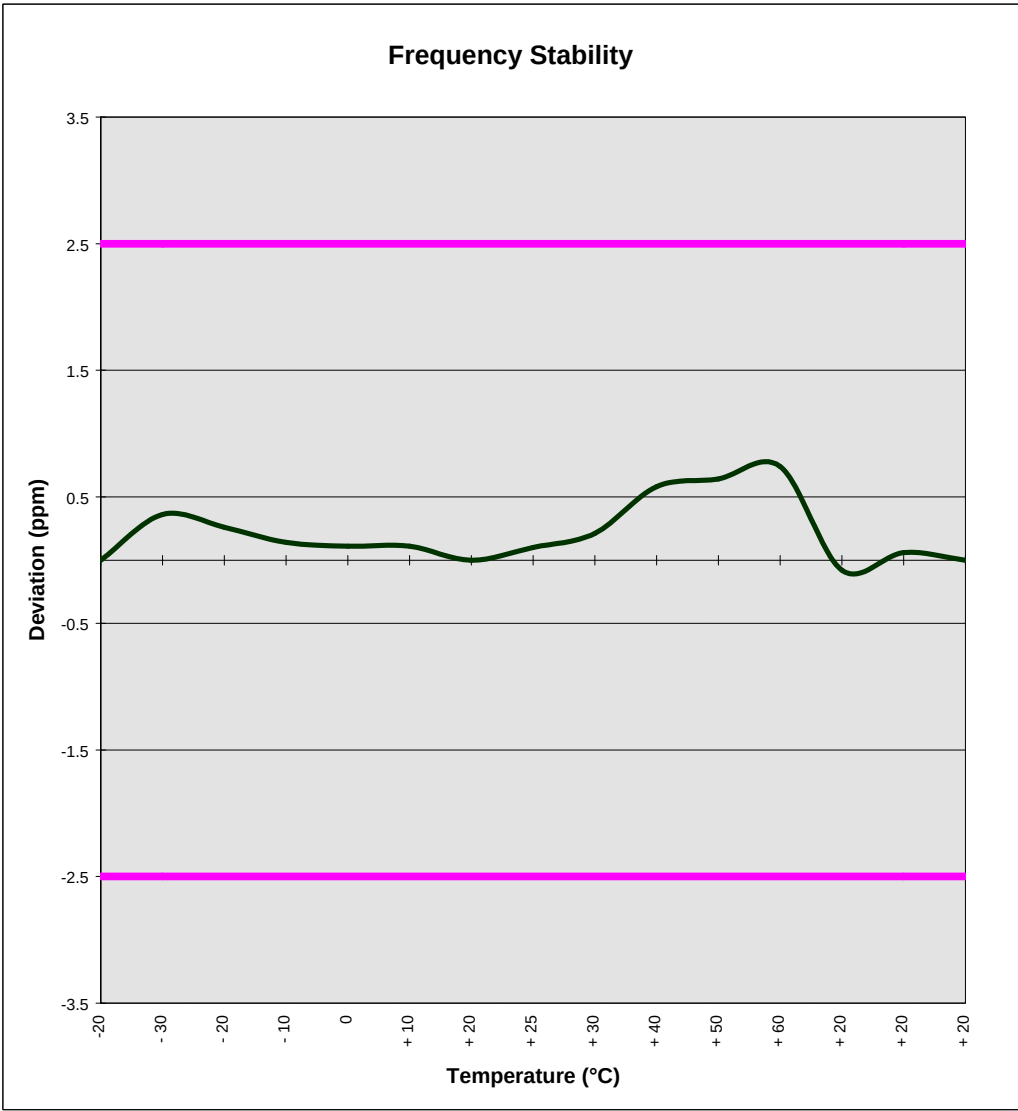
REFERENCE VOLTAGE: 3.6 VDC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE<br>(%) | POWER<br>(VDC) | TEMP<br>(°C) | FREQ.<br>(Hz) | Deviation<br>(%) |
|----------------|----------------|--------------|---------------|------------------|
| 100 %          | 3.60           | + 20 (Ref)   | 836,490,100   | 0.000000         |
| 100 %          |                | - 30         | 836,489,799   | 0.000036         |
| 100 %          |                | - 20         | 836,489,883   | 0.000026         |
| 100 %          |                | - 10         | 836,489,983   | 0.000014         |
| 100 %          |                | 0            | 836,490,008   | 0.000011         |
| 100 %          |                | + 10         | 836,490,008   | 0.000011         |
| 100 %          |                | + 20         | 836,490,100   | 0.000000         |
| 100 %          |                | + 25         | 836,490,016   | 0.000010         |
| 100 %          |                | + 30         | 836,489,924   | 0.000021         |
| 100 %          |                | + 40         | 836,489,615   | 0.000058         |
| 100 %          |                | + 50         | 836,489,565   | 0.000064         |
| 100 %          |                | + 60         | 836,489,481   | 0.000074         |
| 85 %           | 3.06           | + 20         | 836,490,167   | -0.000008        |
| 115 %          | 4.14           | + 20         | 836,490,050   | 0.000006         |
| BATT. ENDPOINT | 2.50           | + 20         | 836,490,100   | 0.000000         |

# Test Data

## § 2.995 FREQUENCY STABILITY (AMPS)



## **5.1 PLOT(S) OF EMISSIONS**

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(SEE ATTACHMENT D)

## 6.1 TEST EQUIPMENT

| 6.2 Type                         | Model                                                                       | Cal. Due Date | S/N                    |
|----------------------------------|-----------------------------------------------------------------------------|---------------|------------------------|
| Microwave Spectrum Analyzer      | HP 8566B (100Hz-22GHz)                                                      | 08/15/99      | 3638A08713             |
| Microwave Spectrum Analyzer      | HP 8566B (100Hz-22GHz)                                                      | 04/17/99      | 2542A11898             |
| Spectrum Analyzer/Tracking Gen.  | HP 8591A (100Hz-1.8GHz)                                                     | 08/10/99      | 3144A02458             |
| Signal Generator*                | HP 8640B (500Hz-1GHz)                                                       | 08/09/99      | 2232A19558             |
| Signal Generator*                | HP 8640B (500Hz-1GHz)                                                       | 08/09/99      | 1851A09816             |
| Signal Generator*                | Rohde & Schwarz (0.1-1000MHz)                                               | 09/11/99      | 894215/012             |
| Ailtech/Eaton Receiver           | NM 37/57A-SL (30-1000MHz)                                                   | 04/12/99      | 0792-03271             |
| Ailtech/Eaton Receiver           | NM 37/57A (30-1000MHz)                                                      | 03/11/00      | 0805-03334             |
| Ailtech/Eaton Receiver           | NM 17/27A (0.1-32MHz)                                                       | 09/17/99      | 0608-03241             |
| Quasi-Peak Adapter               | HP 85650A                                                                   | 08/15/99      | 2043A00301             |
| Ailtech/Eaton Adapter            | CCA-7 CISPR/ANSI QP Adapter                                                 | 03/11/00      | 0194-04082             |
| RG58 Coax Test Cable             | No. 167                                                                     |               | n/a                    |
| Harmonic/Flicker Test System     | HP 6841A (IEC 555-2/3)                                                      |               | 3531A00115             |
| Broadband Amplifier (2)          | HP 8447D                                                                    |               | 1145A00470, 1937A03348 |
| Broadband Amplifier              | HP 8447F                                                                    |               | 2443A03784             |
| Transient Limiter                | HP 11947A (9kHz-200MHz)                                                     |               | 2820A00300             |
| 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                        | 3816/2                                                                      |               | 1079                   |
| EMCO LISN                        | 3816/2                                                                      |               | 1077                   |
| EMCO LISN                        | 3725/2                                                                      |               | 2009                   |
| 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 |
| Modulation Analyzer              | HP 8901A                                                                    |               | 2432A03467             |
| NTSC Pattern Generator           | Leader 408                                                                  |               | 0377433                |
| Noise Figure Meter               | HP 8970B                                                                    |               | 3106A02189             |
| Noise Figure Meter               | Ailtech 7510                                                                |               | TE31700                |
| Noise Generator                  | Ailtech 7010                                                                |               | 1473                   |
| 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)         |
| Environmental Chamber            | Associated Systems Model 1025 (Temperature/Humidity)                        |               | PCT285                 |

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

## 7.1 SAMPLE CALCULATIONS

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

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

$$1717908.4 \mu\text{V/m @ 3 meters}$$

Sample Calculation (relative to a dipole)

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

$$\text{ERP (dBm)} = 10 \text{ Log}_{10} (((3(1717908.4)1 \times 10^6)^2 / 49.2 / 1 \times 10^{-3})$$

$$\text{ERP (dBm)} = 27.32$$

## 8.1 RECOMMENDATION/CONCLUSION

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The data collected shows that the **DENSO Dual Band Analog/PCS (AMPS/CDMA) Phone FCC ID: LXC-E120** complies with all the requirements of Parts 2, 22, and 24 of the FCC rules.