A

FCC Part 22 Type Acceptance

Performed on the

CDPD Data Module
Model: USWD500
for
U.S. Wireless Data Inc.

FCC ID: N5RUSWD500

Date of Test: July 30, 1998

Report #: J98023667

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The results contained in this report were derived from measurements performed on the identified test samples. Any implied performance of other samples on this report is dependent on the representative of the samples tested.

Table of Contents

1.0 Introduction

1.1 Test Summary

FCC RULE	DESCRIPTION OF TEST	RESULT	PAGE
2.985	RF Power Output	Pass	3
22.913	Effective Radiated Power	Pass	4
2.987	Modulation Requirements	N/A	6
22.915(d)(1)	Audio Filter Characteristics	N/A	7
2.989(c) 22.917(b)(d)	Emission Limitation, Occupied Bandwidth	Pass	9
22.917(e) 22.917(f)	Out of Band Emissions at Antenna Terminals Mobile Emissions In Base Frequency Range	Pass	11
2.993	Field Strength of Spurious Radiation	Pass	13
15.107	Line Conducted Emissions	Pass	Appendix I
2.995(a)	Frequency Stability vs. Temperature	Pass	16
2.995(d)(2)	Frequency Stability vs. Voltage	Pass	17
2.1091, 2.1093	Specific Absorption Rate	Pass	24

Tested By: September 17, 1998

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1.2 Product Description

The U.S. Wireless Data Inc. Model USWD500 is a CDPD data module. It is a network component by which CDPD network subscribers gain access to the CDPD network. Support services provided by the USWD500 include transmission and reception of data across the airlink on full-duplex basis, medium access control to the airlink, mobile data link procedures, subnetwork convergence features, and end-to-end delivery of network level packets that are either based on UDP/IP.

Use of Product	CDPD Data Module
Whether quantity (>1) production is planned	[X] Yes, [ ] No
Cellular Phone standards	[ ] AMPS [ ] NAMPS [X] CDPD [ ] TDMA [ ] CDMA
Type(s) of Emission	30K0F1D
Max. Allowed modulation	10 **kHz**
Max. Allowed deviation	4.8 **kHz**
Range of RF Output	660 **mW**
The dc voltage applied to and current into the several elements of the final RF amplifying device	*Voltage:* 5**V** Current: 0.5**A**
Frequency Range	824.01-848.97 **MHz**
Antenna(e) & Gain	Monopole, 0 **dBi**
Detachable antenna ? External input	[X]Yes[ ] No [ ] Audio [X] Digital Data

1.3 Related Submittal(s) Grants

[X] None

[X] DOC for computer section, a separate DOC is prepared.

2.0 **RF Power Output**, FCC §2.985(a), §22.913

2.1 Test Procedure

The transmitter output was connected to a calibrated coaxial attenuator, the other end of which was connected to a spectrum analyzer. Transmitter output was read off the spectrum analyzer in dBm. The power output at the transmitter antenna port was determined by adding the value of the attenuator to the spectrum analyzer reading.

Tests were performed at three frequencies (low, middle, and high channels) and on all power levels which can be setup on the transmitters.

2.2 Test Equipment

Hewlett Packard HP8566B Spectrum Analyzer, 100 Hz - 22 GHz
Tektronix 2782

2.3 Test Results

Refer to the attached plots:

2.3.a Low Channel
2.3.b Middle Channel
2.3.c High Channel

3.0 **Effective Radiated Power**, FCC § 22.913

The Effective Radiated Power (ERP) of mobile transmitters and auxiliary test transmitters must not exceed 7 Watts.

3.1 Test Procedure

The EUT was positioned on a non-conductive turntable, 0.8m above the ground plane on an open test site.

The radiated emission at the fundamental frequency was measured at 3m distance with a test antenna and spectrum analyzer. During the measurement, the resolution and video bandwidths of the spectrum analyzer were set to 100 kHz. Worst case emission was recorded with the rotation of the turntable and the raising and lowering of the test antenna. The spectrum analyzer reading (R_{EUT}) was recorded.

The ERP was calculated as follows:

$$ERP(dBm) = E(dBuV/m) + 20 \log D - 10 \log 30 - 10 \log G - 90$$

where D = 3m, distance
G = 1.64, gain of half-wave dipole

The test was performed at three frequencies (low, middle, and high channels).

In addition, the Equivalent Isotropic Radiated Power (EIRP) in dBpW was calculated as follows:

$$EIRP_{(dBpW)} = ERP_{(dBm)} + 90 + 10 \log 1.64$$

3.2 Test Equipment

Rhode & Schwartz SMH Signal Generator
Hewlett Packard HP8566B Spectrum Analyzer
Attenuator 20 dB

3.3 Test Results

Passes	Refer to the attached data sheet.

4.0 **Modulation Deviation Limiting**, FCC § 2.987, § 22.915(c)s

4.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through sufficient attenuation so as not to overload the meter or distort the readings. An audio signal generator with a variable attenuator on the output was coupled into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

At three different modulating frequencies, the output level of the audio generator was varied and the FM deviation level was recorded (Table 4.1a).

4.2 Test Equipment

Marconi 2955A Radio Communication Test Set
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

4.3 Test Results

X	Not applicable, the unit has no audio port

5.0 **Audio Filter Characteristics**, FCC § 22.915(d)

For mobile stations, these signals must be attenuated, relative to the level at 1 kHz, as follows:

(i) In the frequency ranges of 3.0 to 5.9 kHz and 6.1 to 15.0 kHz, signals must be attenuated by at least 40 log (f/3) dB, where f is the frequency of the signal in kHz.

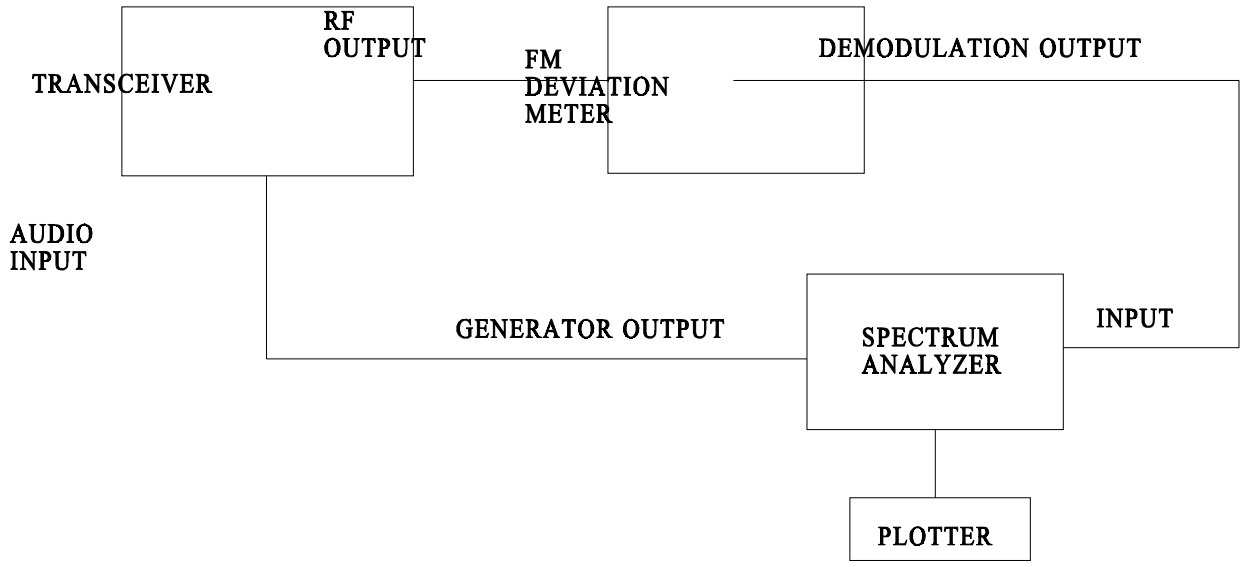
(ii) In the frequency range of 5.9 to 6.1 kHz, signals must be attenuated at least 35 dB.

(iii) In the frequency range above 15 kHz, signals must be attenuated at least 28 dB.

5.1 Test Procedure

The RF output of the transceiver was connected to the input of an FM deviation meter through suffecient attenuation so as not to overload the meter or distort the readings. An audio signal generator with a variable attenuator on the output was coupledl into the external microphone jack of the transceiver, or alternatively, the microphone element was removed and the generator output was connected to the microphone wires by clip leads.

The audio signal at the transceiver audio input was adjusted to obtain 8-9 kHz deviation at the more



sensitive modulation frequency (approximately 2.7 kHz). The audio frequency was varied from 300 Hz to 30 kHz and the deviation was measured while maintaining a constant input level. Using the level measured at 1 kHz as a reference (0 dB), the audio filter response was calculated (See Table 5-1).

The block diagram of the test setup is shown below.

On that block diagram, the HP 3885A spectrum analyzer having the tracing generator, and the Marconi 2955A Radio Communication Test Set having an output of a demodulator, are used. After the calibration was made (the -20 dBm reading of the spectrum analyzer corresponds to the 9 kHz deviation) the spectrum analyzer was set to scan the frequency from 300 Hz to 30 kHz, with the same audio input level as described above, and with compressor OFF and expander OFF.

The audio filter response was plotted directly from the spectrum analyzer

5.2 Test Equipment

Marconi Instruments 2955A Radio Communications Test Set
HP 3588A Spectrum Analyzer
HP 7470A Plotter
Leader LFG-1300S Function Generator
LMV-182 AC Millivoltmeter

5.3 Test Results

X	Not applicable, the unit has no audio port

6.0 **Emission Limitations, Occupied Bandwidth**, FCC § 22.917(b)(d), FCC § 2.989(b)(1)

For F3E/F3D emission mask uses with audio filter, the mean power of emissions must be attenuated below the mean power of the unmodulated carrier wave (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but not more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz, up to the first multiple of the carrier frequency: at least 60 dB or 43 + 10 log P dB, whichever is the lesser attenuation.

For F1D emission mask, the mean power of emissions must be attenuated below the mean power of the unmodualted carrier (P) as follows:

(1) On any frequency removed from the carrier frequency by more than 20 kHz but no more than 45 kHz: at least 26 dB;

(2) On any frequency removed from the carrier frequency by more than 45 kHz but not more than 90 kHz: at least 45 dB;

(2) On any frequency removed from the carrier frequency by more than 90 kHz, up to the first multiple ofthe carrier frequency: at least 60 dB or 43 +10 log P db, whichever is the lesser attenuation.

6.1 Test Procedure

The RF output of the transceiver was connected to the input of the spectrum analyzer through sufficient attenuation.

The spectrum with no modulation was recorded.

The resolution bandwidth of the spectrum analyzer was set at 300 Hz and the spectrum was recorded in the frequency band ±50 kHz and ±150 kHz from the carrier frequency.

6.2 Test Equipment

HP 8566B Spectrum Analyzer
Leader LFG-1300S Function Generator
Leader LMV-182 AC Millivoltmeter
Marconi 2955A Radio Communication Test Set
HP 7470A Plotter

6.3 Test Results

Passes	Refer to the attached plots.

Plot Number	Description
6.3.a	Carrier (No modulation), scan 100 kHz
6.3.b	Wideband emissions (Random Numbers), scan 100 kHz
6.3.c	Wideband emissions (Random Numbers), scan 300 kHz
6.3.d	0,1,0,1, data scan 100 kHz
6.3.e	0,1,0,1, data scan 300 kHz

7.0 **Out of Band Emissions at Antenna Terminals** , FCC § 22.917(e), FCC § 22.917(f)

Out of Band Emissions:

The mean power of emissions must be attenuated below the mean power of the unmodulated carrier (P) on any frequency twice or more than twice the fundamental frequency by at least 43 + 10 log P dB.

Mobile Emissions in Base Frequency Range:

The mean power of any emissions appearing in the base station frequency range from cellular mobile transmitters operated must be attenuated to a level not to exceed -80 dBm at the transmit antenna connector.

7.1 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 30 kHz. The audio modulating signal was adjusted like it is described in Section 6.1 of this report. Sufficient scans were taken to show the outband emissions if any up to 10th harmonic.

7.2 Test Equipment

HP 8566B Spectrum Analyzer
Leader LFG-1300S Function Generator
Leader LMV-182 AC Millivoltmeter

7.3 Test Results

Passes	Refer to the attached plots.

ANTENNA OUTPUT CONDUCTED EMISSIONS SPECTRUM ANALYZER PLOTS	
Plot Number	**Description**
7.3.a - 7.3.d	Low Channel, 1 MHz - 10 GHz
7.3.e - 7.3.h	Middle Channel 1 MHz - 10 GHz
7.3.i - 7.3.l	High Channel, 1 MHz - 10 GHz
7.3.m - 7.3.o	Low, Middle, & High Channels, 869 - 894 MHz

8.0 **Field Strength of Spurious Radiation**, FCC § 2.993, § 22.917(e)

8.1 Test Procedure

The measurement antenna was placed at a distance of 3 meters from the EUT. During the tests, the antenna height and polarization as well as EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

The frequency range up to tenth harmonic of each of the three fundamental frequency (low, middle, and high channels) was investigated.

The spurious emissions attenuation was calculated as the difference between EIRP in dB(pW) at the fundamental frequency (See Section 3) and at the spurious emissions frequency.

8.2 Test Equipment

EMCO 3115 Horn Antenna
HP 8566B Spectrum Analyzer
Tektronix 2782 Spectrum Analyzer
Low Pass Filter
Preamplifier

8.3 Test Results

Refer to the attached data sheets.

Test Result:	Passes

8.4 Test Setup - Harmonic Configuration Radiated Emissions

9.0 **Line Conducted Emissions**, FCC § 15.107

See attached DOC report.

10.0 **Frequency Stability vs Temperature**, FCC § 2.995(a), § 22.355
Frequency Tolerance: ±2.5 ppm

10.1 Test Procedure

The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feedthrough attenuators. The EUT was placed inside the temperature chamber. The DC leads, RF output cable, and external PTT cable exited the chamber through an opening made for that purpose.

After the temperature stabilized for approximately 20 minutes, the external PTT switch was activated, and the frequency output was recorded from the counter.

10.2 Test Equipment

Temperature Chamber, -50C to +100C
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303
Rohde & Schwarz ESVP Test Receiver

10.3 Test Results

Test Result:	Passes

Frequency: 836.010000 MHz Tolerance: ±2091 Hz		
TEMPERATURE, °C	**FREQUENCY (MHz)**	**DIFFERENCE (Hz)**
60	836.009870	-130
50	836.009760	-240
40	836.009720	-280
30	836.00960	-40
20	836.009770	-230
10	836.009490	-510
0	836.009250	-750
-10	836.009270	-730
-20	836.008800	-1200
-30	836.008280	-1720

11.0 **Frequency Stability vs Voltage**, FCC § 2.995(d)(2), § 22.355
Frequency Tolerance: ±2.5 ppm

11.1 Test Procedure

An external variable DC power supply was connected to the battery terminals of the equipment under test. The voltage was set to 115% of the nominal value and was then decreased until the transmitter light no longer illuminates; i.e., the battery end point. The output frequency was recorded for each battery voltage.

11.2 Test Equipment

Hewlett Packard 5383A Frequency Counter
DC Power Supply
Rohde & Schwarz ESVP Test Receiver

11.3 Test Results.

Test Result:	Passes

Frequency: 837.00 MHz (High Channel) **Tolerance: ±2091 Hz**		
D.C VOLTS	**FREQUENCY (MHz)**	**DIFFERENCE (Hz)**
4.25 (85%)	836.009750	-250
5.0 (0%)	836.009760	-240
5.75 (115%)	836.009770	-230

Appendix A - Photographs

See attached.

Appendix B - FCC Label Format

See attached.

Appendix C - Block Diagram

See confidential package.

Appendix D - Circuit Diagram

See confidential package.

Appendix E - Theory of Operation & Tune-Up Procedure

a) DC voltage and current into the final RF amplifier (See Page 3 of the product description)

b) Function of each semiconductor or other outline circuit device (See confidential package).

c) Tune up procedure (See confidential package).

Appendix F - ESN protection guidelines (FCC §22.919)

See attached.

Appendix G - SAR Data

x	Not applicable. Refer to the attached warning label.
	See attached measurement data.
	See attached simulation results.

Appendix H - Users Manual

Attached is a preliminary copy of the Instruction Manual.

This manual will be provided to the end-user with each unit sold/leased in the United States.

Appendix I - DoC Report

See attached.