

FCC PART 22, 24 TYPE APPROVAL EMI MEASUREMENT AND TEST REPORT

For

VeriFone Inc.

3755 Atherton Road
Rocklin, CA 95765

FCC ID: B32OMNI3600D

2003-10-14

This Report Concerns: <input checked="" type="checkbox"/> Original Report	Equipment Type: Wireless Point of Sale Terminal
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Report No.: R0309221	
Test Date: 2003-09-25	
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1 - GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

The *VeriFone Inc.*'s product, model: *OMNI 3600D* or the "EUT" as referred to in this report is a wireless point of sale terminal, which is measured approximately 8.9"L x 3.6"W x 2.8"H. The EUT is a portable device.

** The test data was only good for test sample. It may have deviation for other product samples.*

1.2 Objective

This type approval report is prepared on behalf of *VeriFone Inc.* in accordance with Part 2, Subpart J, Part 15, Subparts A and B, Part 22 Subpart H, and Part 24 Subpart E of the Federal Communication Commissions rules.

It is also prepared in accordance with Part 2, Subpart J, Part 15, Subparts A and B, Part 22 Subpart H and Part 24 Subpart E of the Federal Communication Commissions rules.

The objective of the manufacturer is to demonstrate compliance with FCC rules for output power, modulation characteristic, occupied bandwidth, spurious emission at antenna terminal, field strength of spurious radiation, frequency stability, and conducted and radiated margin.

1.3 Related Submittal(s)/Grant(s)

No Related Submittals

1.4 Test Methodology

All tests and measurements indicated in this document were performed in accordance with the Code of Federal Regulations Title 47 Part 2, Sub-part J as well as the following parts:

Part 15 Subpart B – Unintentional Radiators
Part 22 Subpart H - Public Mobile Services
Part 24 Subpart E - PCS

Applicable Standards: TIA EIA 137-A, TIA EIA 98-C, ANSI 63.4-1992, American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz.

All radiated and conducted emissions measurement was performed at Bay Area Compliance Laboratory, Corp. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

1.5 Test Facility

The Open Area Test site used by BACL Corp. to collect radiated and conducted emission measurement data is located in the back parking lot of the building at 230 Commercial Street, Sunnyvale, California, USA.

Test site at BACL Corp. has been fully described in reports submitted to the Federal Communication Commission (FCC) and Voluntary Control Council for Interference (VCCI). The details of these reports has been found to be in compliance with the requirements of Section 2.948 of the FCC Rules on February 11 and December 10, 1997 and Article 8 of the VCCI regulations on December 25, 1997. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-1992.

The Federal Communications Commission and Voluntary Control Council for Interference has the reports on file and is listed under FCC file 31040/SIT 1300F2 and VCCI Registration No.: C-1298 and R-1234. The test site has been approved by the FCC and VCCI for public use and is listed in the FCC Public Access Link (PAL) database.

Additionally, BACL is a National Institute of Standards and Technology (NIST) accredited laboratory, under the National Voluntary Laboratory Accredited Program (Lab Code 200167-0). The scope of the accreditation covers the FCC Method - 47 CFR Part 15 - Digital Devices, CISPR 22: 1997, Electromagnetic Interference - Limits and Methods of Measurement of Information Technology Equipment test methods.

2 - SYSTEM TEST CONFIGURATION

2.1 Justification

The EUT was configured for testing in a typical fashion (as normally used in a typical application).

The final qualification test was performed with the EUT operating at normal mode.

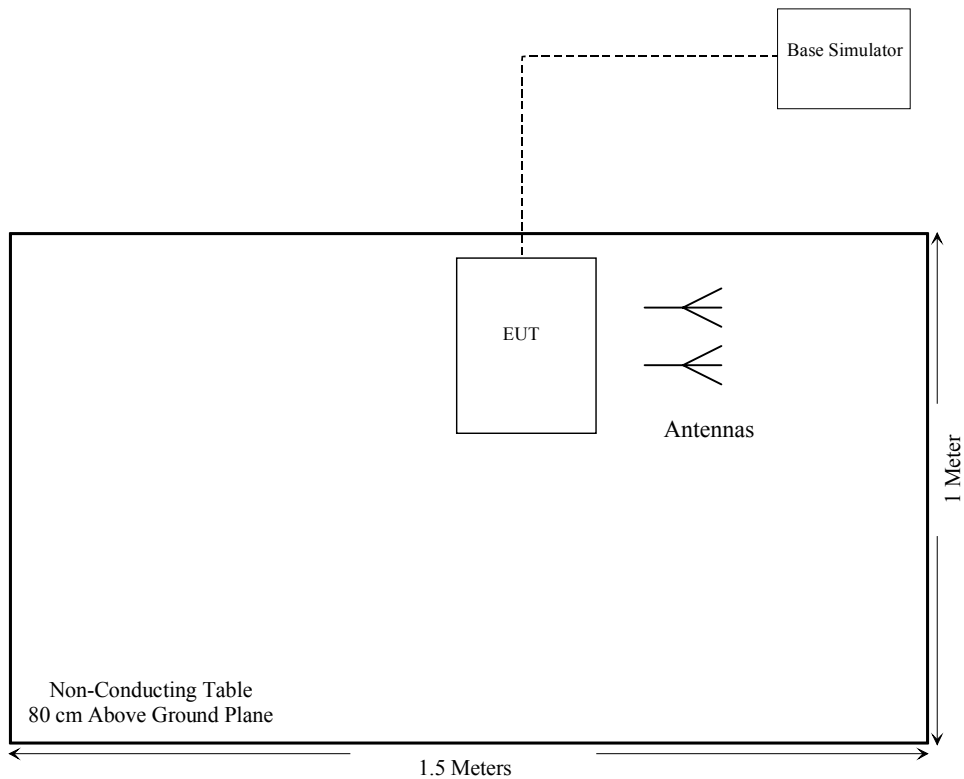
2.2 Block Diagram

Please refer to Exhibit D.

2.3 Equipment Modifications

No modifications were necessary for the EUT to comply with the applicable limits and requirements.

2.4 Test Setup Block Diagram



3 - SUMMARY OF TEST RESULTS

FCC RULE	DESCRIPTION OF TEST	RESULT
§ 2.1046, § 22.913 (a) § 24.232	Conducted Output Power	Compliant
2.1047	Modulation Characteristics	Compliant
§ 2.1049 § 22.917 § 22.905 § 24.238	Out of Band Emission, Occupied Bandwidth	Compliant
§ 22.917 § 24.238	Band Edge	Compliant
§ 2.1051, § 22.917 § 24.238(a)	Spurious emissions at antenna terminals	Compliant
§ 2.1053	Field strength of spurious radiation	Compliant
§ 2.1055 (a) § 2.1055 (d) § 22.355 § 24.235	Frequency stability vs. temperature Frequency stability vs. voltage	Compliant
§ 15.107	AC Line Conducted emission	Compliant
§ 15.109	Radiated Emission Limit (Digital Portion)	Compliant

4 – CONDUCTED OUTPUT POWER

4.1 Applicable Standard

According to FCC §2.1046 and §22.913 (a), the ERP of mobile transmitters and auxiliary test transmitters must not exceed 7 watts.

According to FCC §2.1046 and §24.232 (a), in no case may the peak output power of a base station transmitter exceed 100 watt.

4.2 Test Procedure

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

4.3 Test Equipment

Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01.

Hewlett Packard HP 7470A Plotter, Calibration not required.

A.H. Systems SAS200 Horn Antenna, Calibration Due Date: 2004-05-31

Com-Power AB-100 Dipole Antenna, Calibration Due Date: 2004-09-05

Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

4.4 Test Results

Part 22:

Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit in W
LOW	824.73	23.33	0.215	7
MIDDLE	836.40	23.67	0.233	7
HIGH	848.19	23.33	0.215	7

Part 24:

Channel	Frequency (MHz)	Output Power in dBm	Output Power in W	Limit in W
LOW	1851.25	23.50	0.224	100
MIDDLE	1880.00	23.67	0.233	100
HIGH	1908.75	23.50	0.224	100

5 - RF POWER OUTPUT

5.1 Applicable Standard

According to FCC §2.1046 and §24.232 (1), mobile/portable stations are limited to 2 watts EIRP. According to FCC §22.912(d), the ERP of mobile transmitters must not exceed 7 watts.

5.2 Test Procedure

1. On a test site, the EUT shall be placed at 1.5m height on a turn table, and in the position closest to normal use as declared by the applicant.
2. The test antenna shall be oriented initially for vertical polarization located 3m from EUT to correspond to the frequency of the transmitter.
3. The output of the test antenna shall be connected to the measuring receiver and the quasi-peak detector is used for the measurement.
4. The transmitter shall be switched on, if possible, without modulation and the measuring receiver shall be tuned to the frequency of the transmitter under test.
5. The test antenna shall be raised and lowered through the specified range of height until a maximum signal level is detected by the measuring receiver.
6. The transmitter shall then be rotated through 360° in the horizontal plane, until the maximum signal level is detected by the measuring receiver.
7. The test antenna shall be raised and lowered again through the specified range of height until a maximum signal level is detected by the measuring receiver.
8. The maximum signal level detected by the measuring receiver shall be noted.
9. The transmitter shall be replaced by a horn (substitution antenna).
10. The substitution antenna shall be orientated for vertical polarization and the length of the substitution antenna shall be adjusted to correspond to the frequency of the transmitter.
11. The substitution antenna shall be connected to a calibrated signal generator.
12. In necessary, the input attenuator setting of the measuring receiver shall be adjusted in order to increase the sensitivity of the measuring receiver.
13. The test antenna shall be raised and lowered through the specified range of height to ensure that the maximum signal is received.
14. The input signal to the substitution antenna shall be adjusted to the level that produces a level detected by the measuring receiver, which is equal to the level noted while the transmitter radiated power was measured, corrected for the change of input attenuator setting of the measuring receiver.
15. The input level to the substitution antenna shall be recorded as power level in dBm, corrected for any change of input attenuator setting of the measuring receiver.
16. The measurement shall be repeated with the test antenna and the substitution antenna orientated for horizontal polarization.

17. The measure of the effective radiated power is the large of the two levels recorded, at the input to the substitution antenna, corrected for gain of the substitution antenna if necessary.

5.3 Test Results

For CDMA1900 :

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dbm)	EIRP (dBm)
1851.25	16.7	6.7	0.3	23.1
1880.00	18.4	6.7	0.3	24.8
1908.75	17.3	6.7	0.3	23.7

For CDMA800:

FREQUENCY (MHZ)	SUBSTITUTION READING (dBm)	SUBSTITUTION ANTENNA GAIN	SUBSTITUTION CALBE LOSS (dBm)	ERP (dBm)
824.73	23.5	0.0	0.1	23.4
836.40	23.9	0.0	0.1	23.8
848.19	23.5	0.0	0.1	23.4

Sample calculation:

Absolute level = substitution reading + antenna gain - cable loss

For example:

$$16.7+6.7-0.3=23.1$$

6 - OCCUPIED BANDWIDTH

6.1 Applicable Standard

Requirements: CFR 47, Section 2.1049, Section 22.901, Section 22.917 and Section 24.238.

6.2 Test Procedure

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

The resolution bandwidth of the spectrum analyzer was set at 100 KHz and the 26 dB bandwidth was recorded.

6.3 Test Equipment

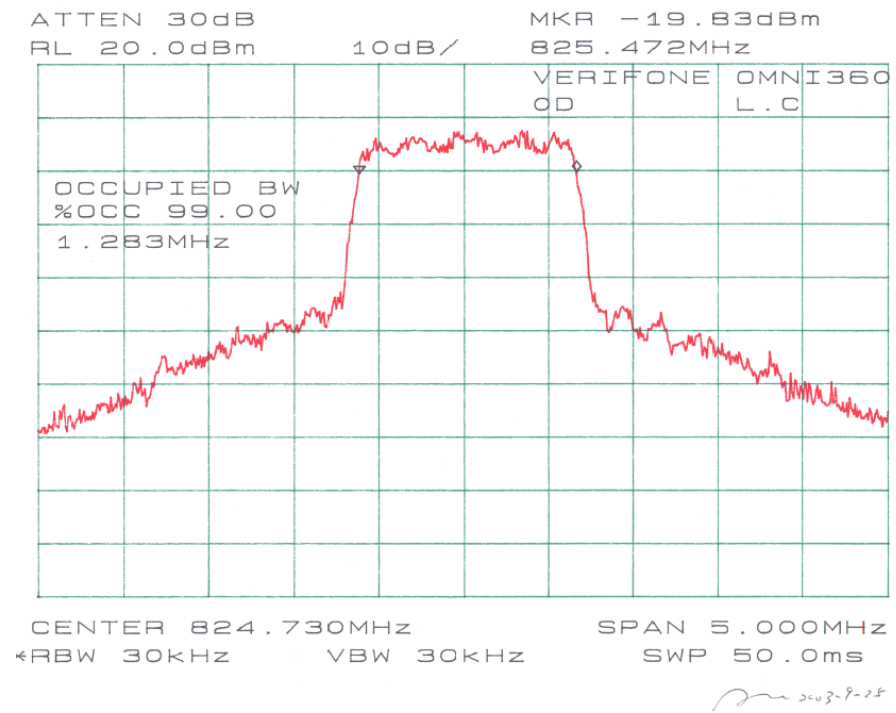
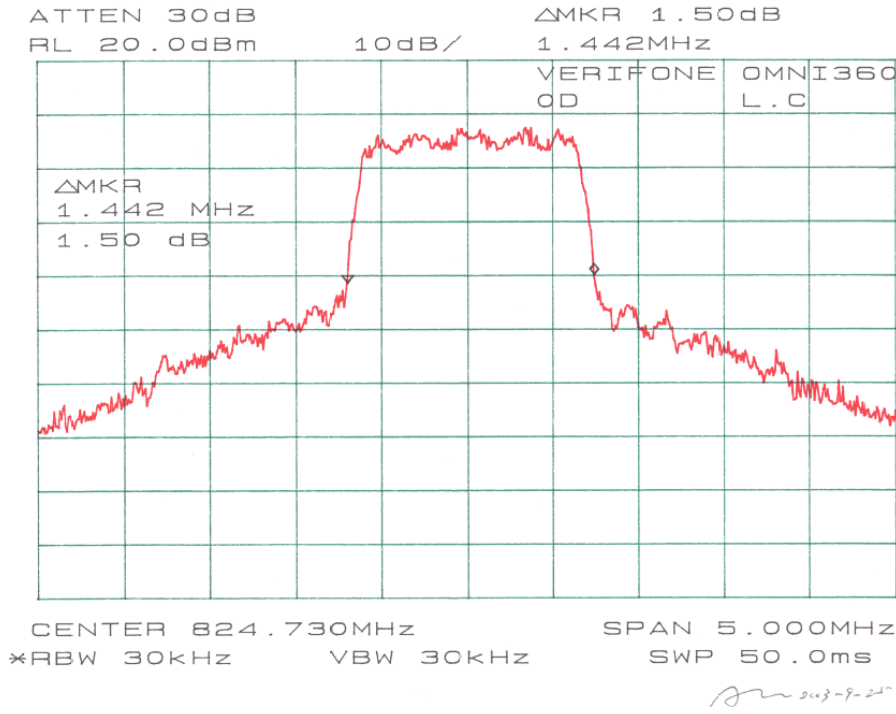
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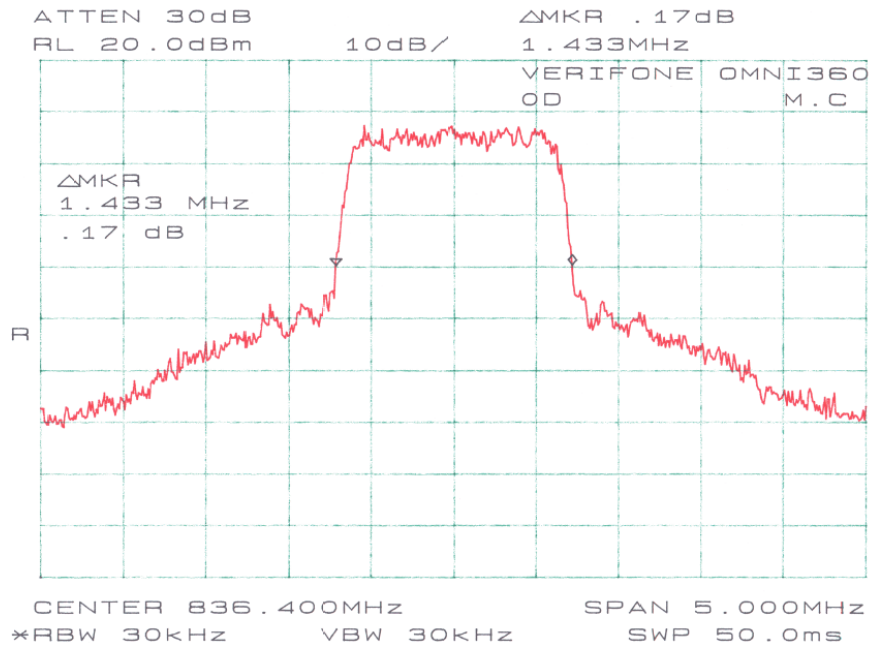
Hewlett Packard HP 7470A Plotter, Calibration not required.

Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

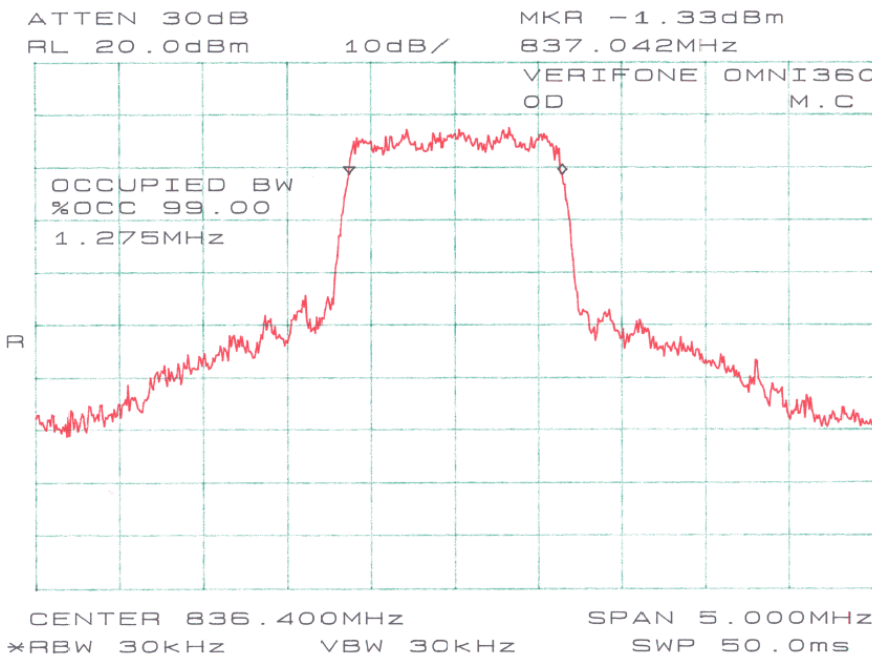
6.4 Test Results

Please refer to the following plots.

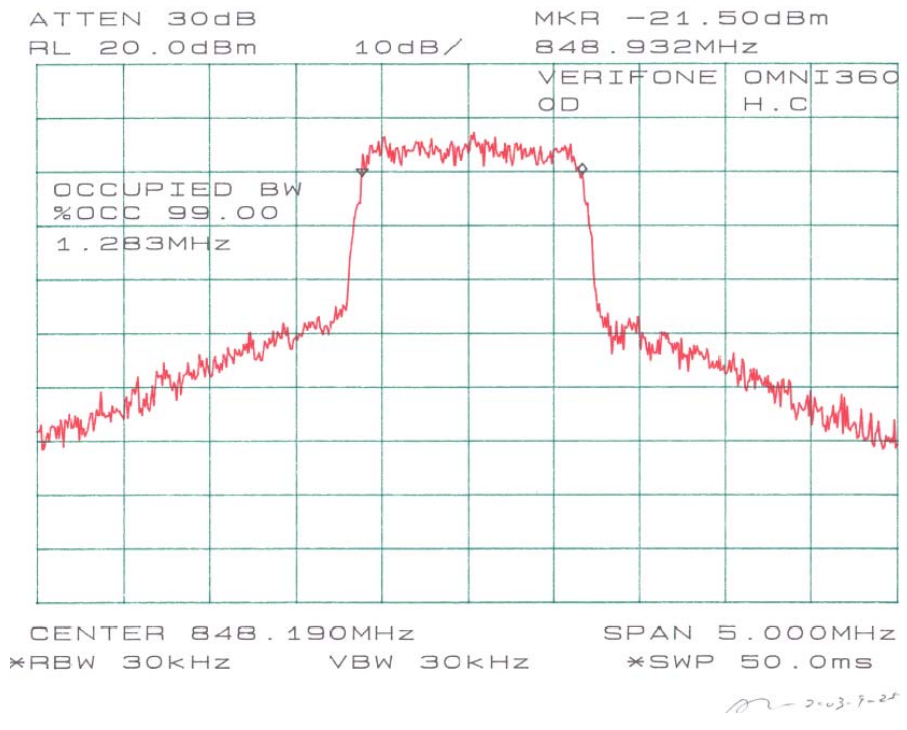
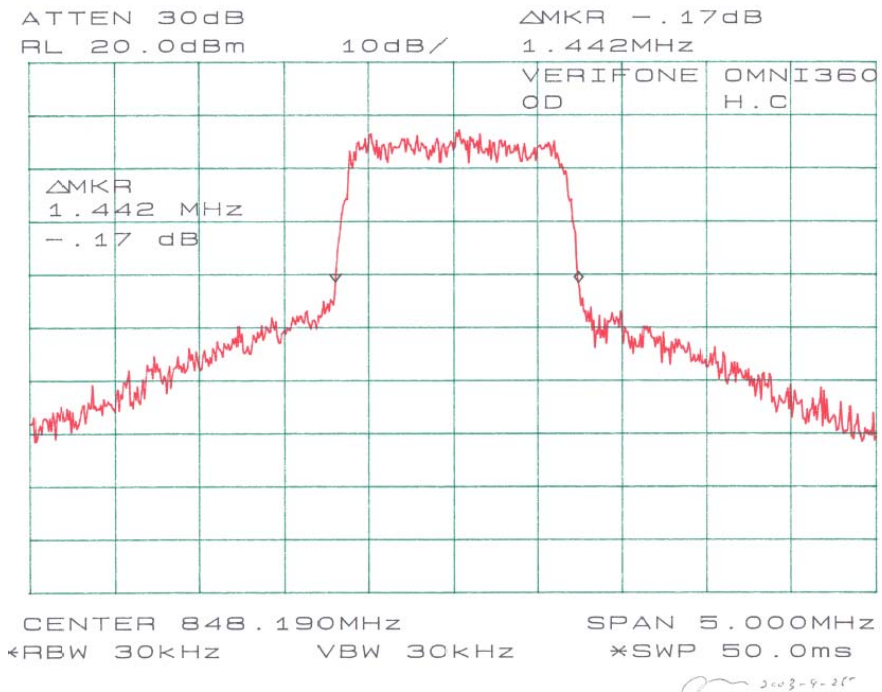


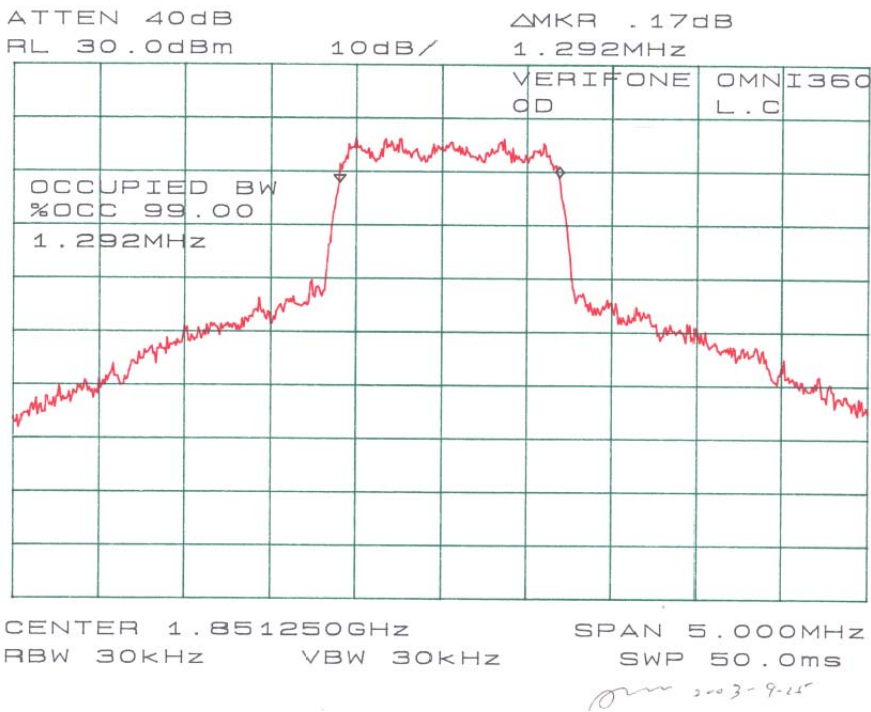
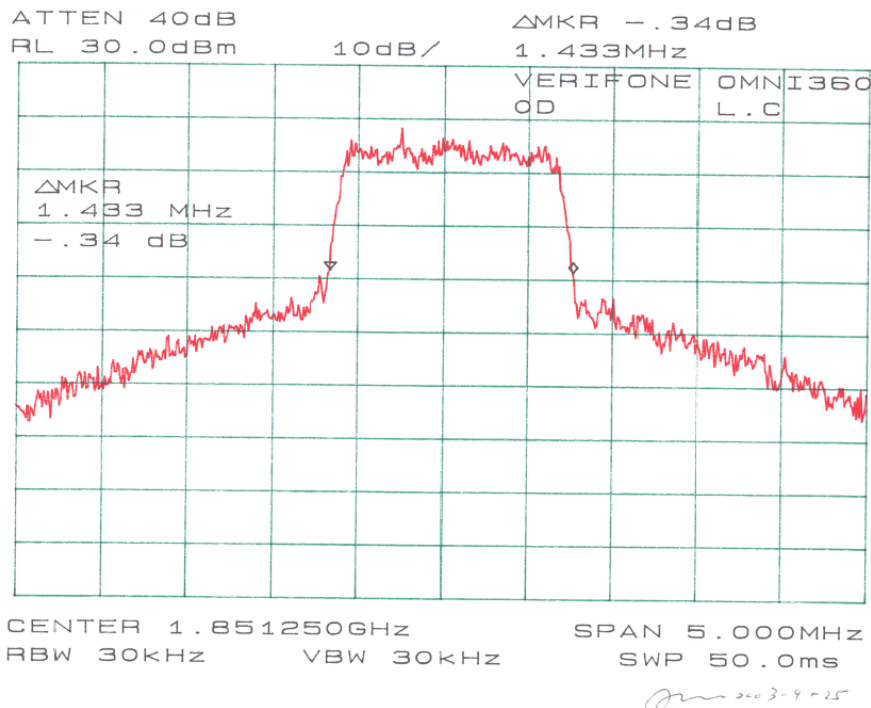


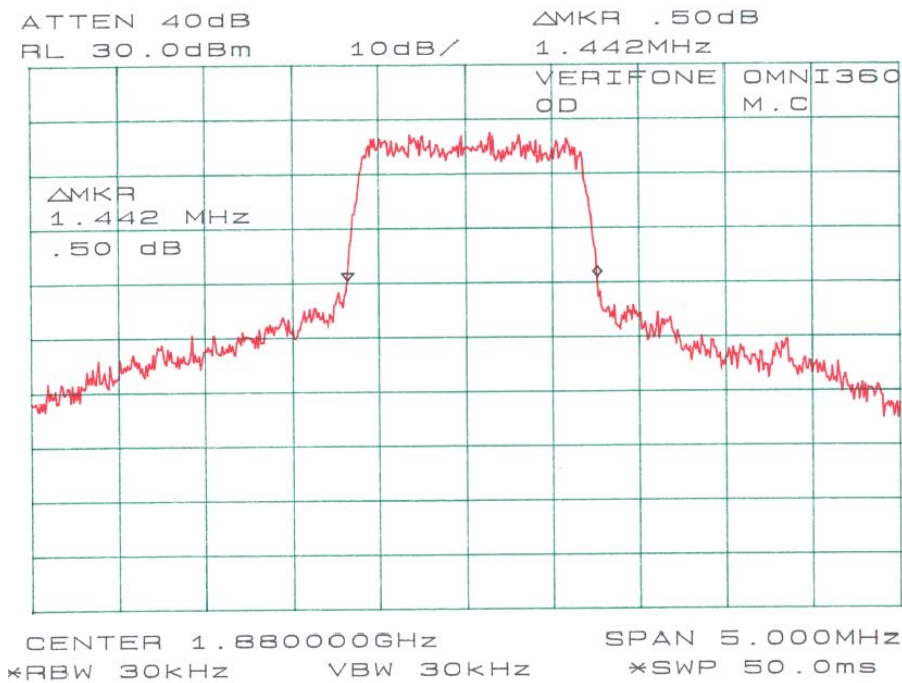
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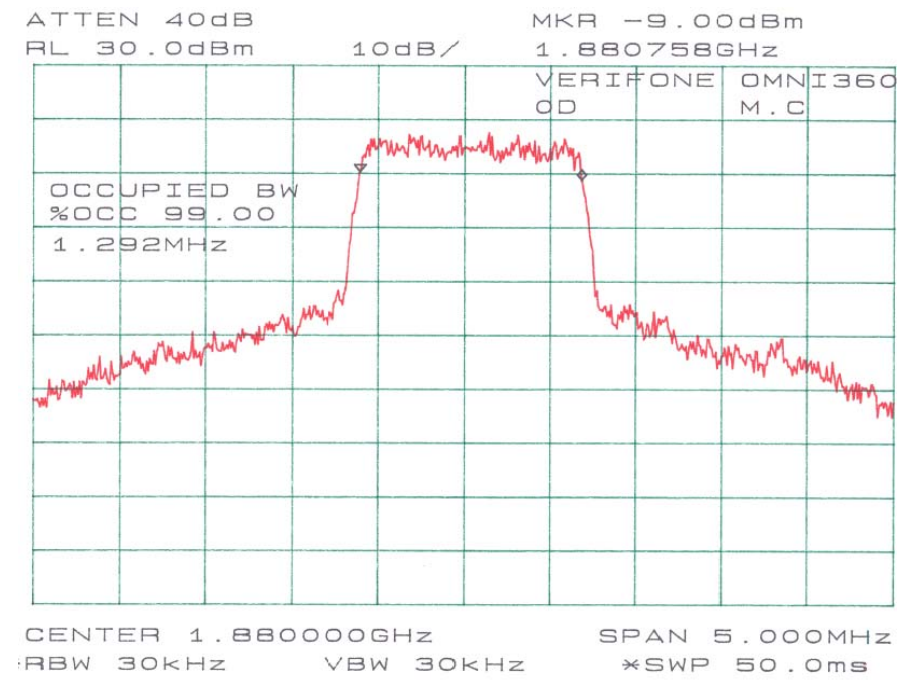
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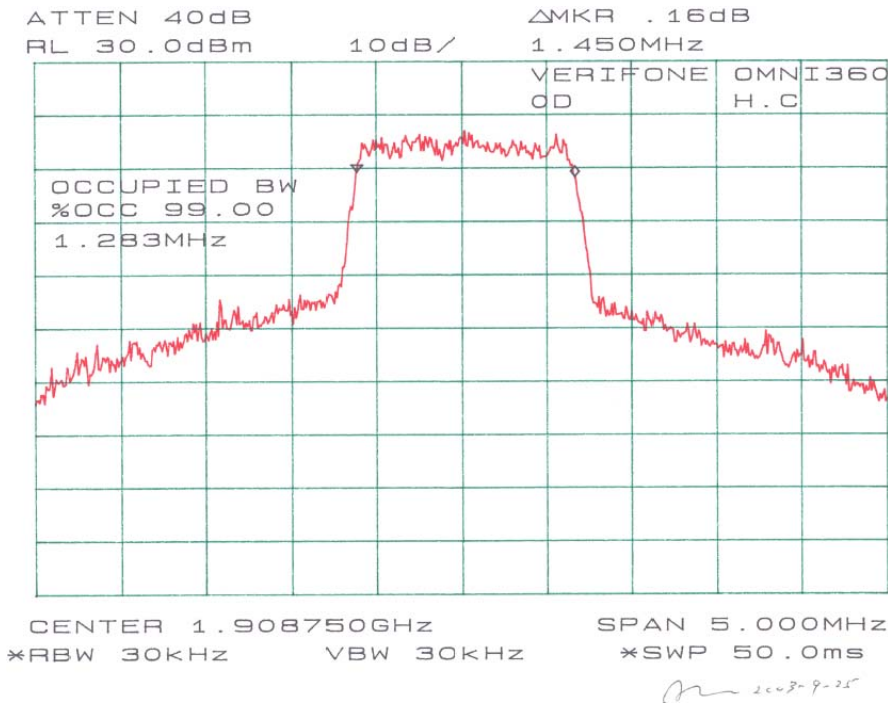
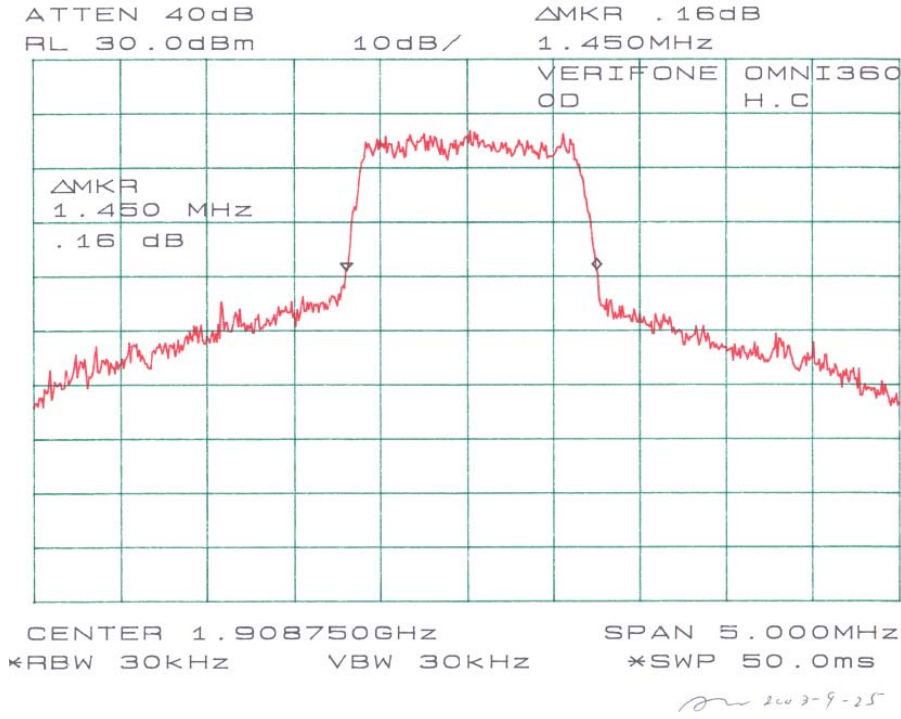




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7 - MODULATION CHARACTERISTIC

7.1 Applicable Standard

Requirement: FCC § 2.1047.

7.2 Test Procedure

CDMA digital mode is used by EUT.

7.3 Test Equipment

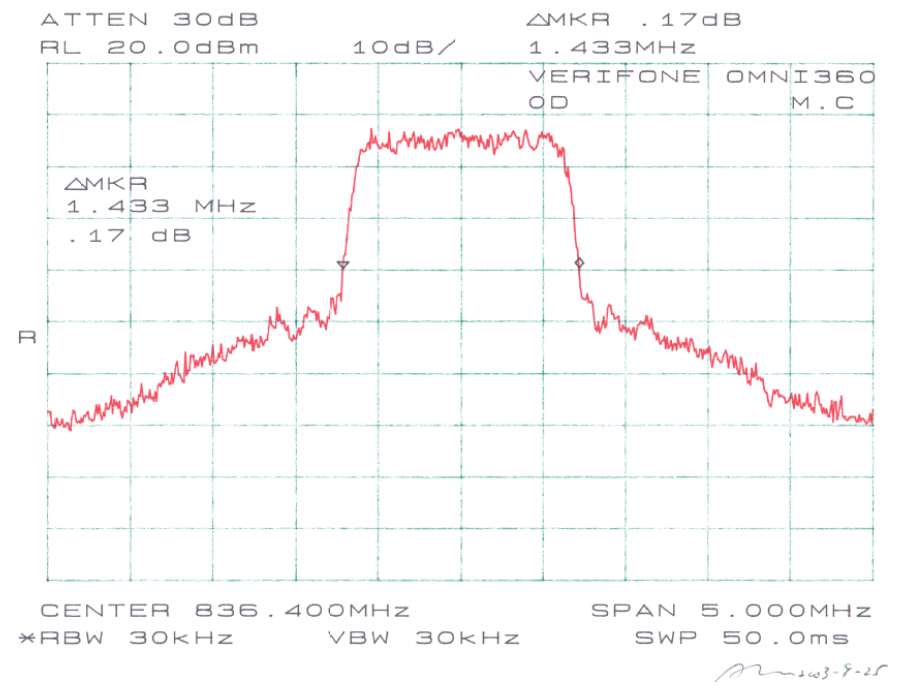
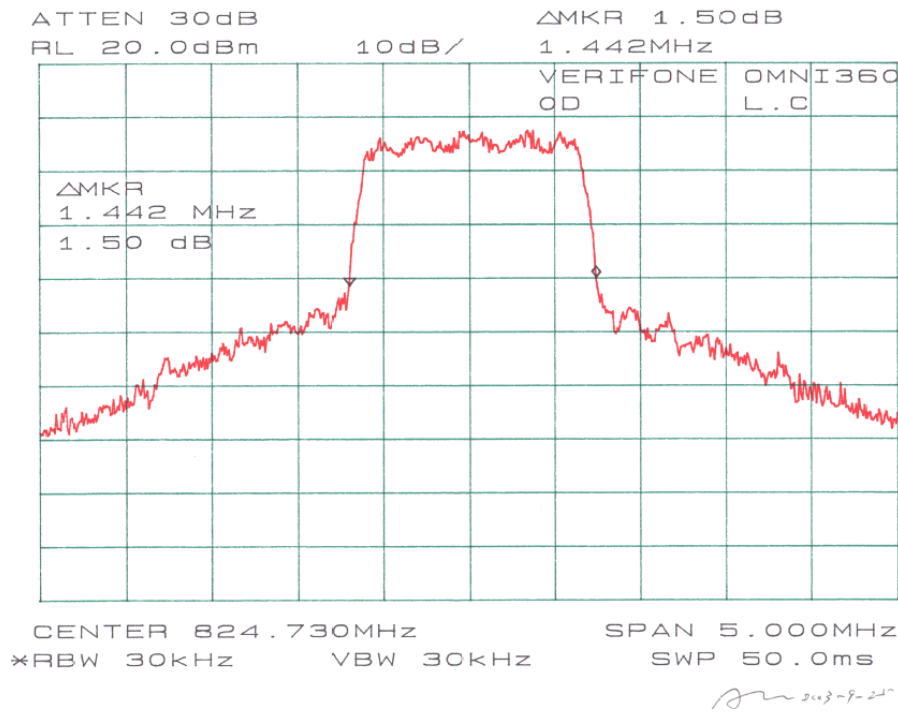
Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01

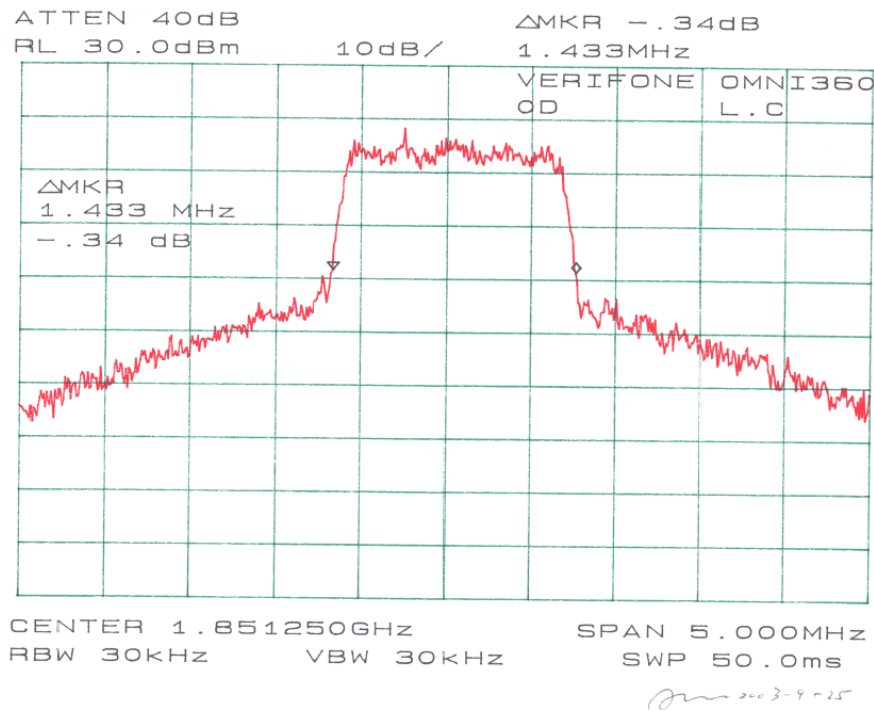
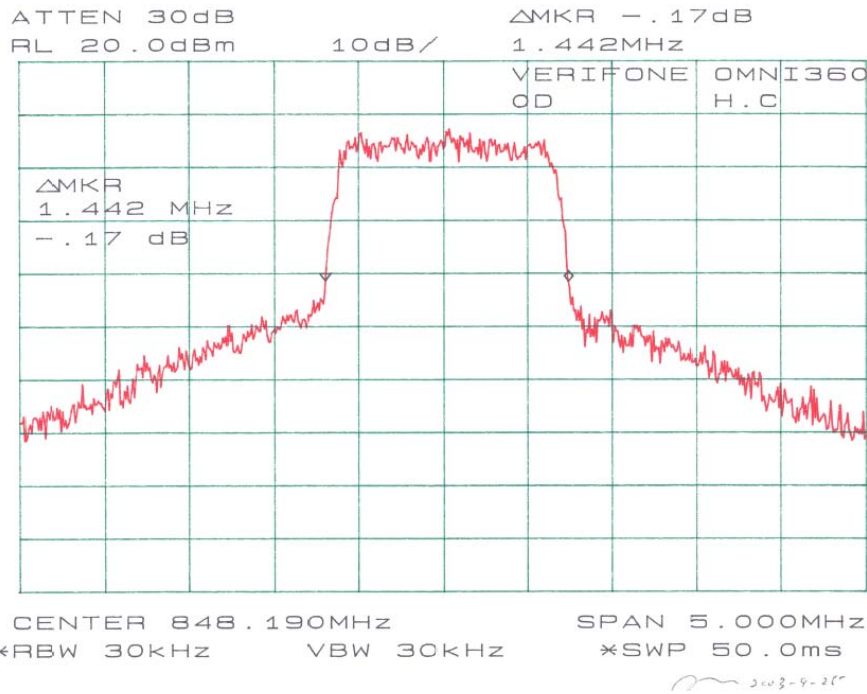
Hewlett Packard HP 7470A Plotter, Calibration not required.

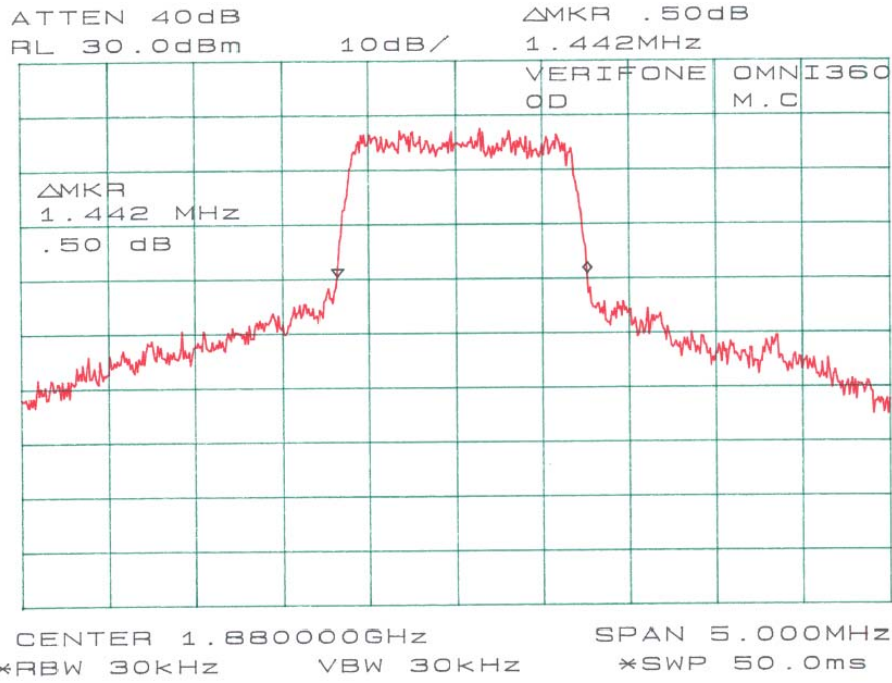
Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

7.4 Test Results

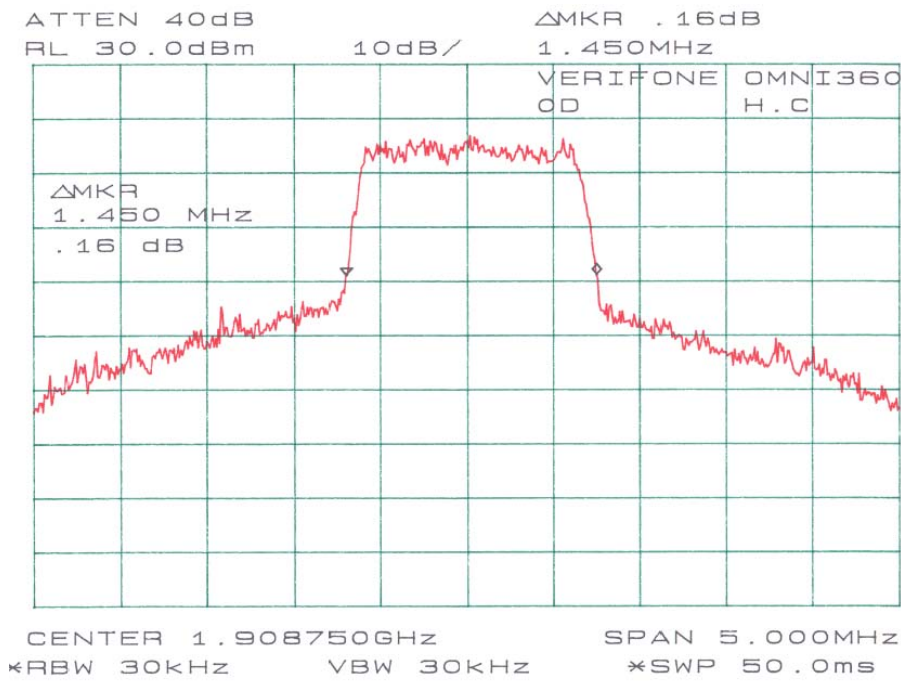
Please refer to the hereinafter plots.







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8 - SPURIOUS EMISSIONS AT ANTENNA TERMINALS

8.1 Applicable Standard

Requirements: CFR 47, § 2.1051.

The spectrum was to be investigated to the tenth harmonics of the highest fundamental frequency as specified in § 2.1057.

8.2 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 100 kHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

8.3 Test Equipment

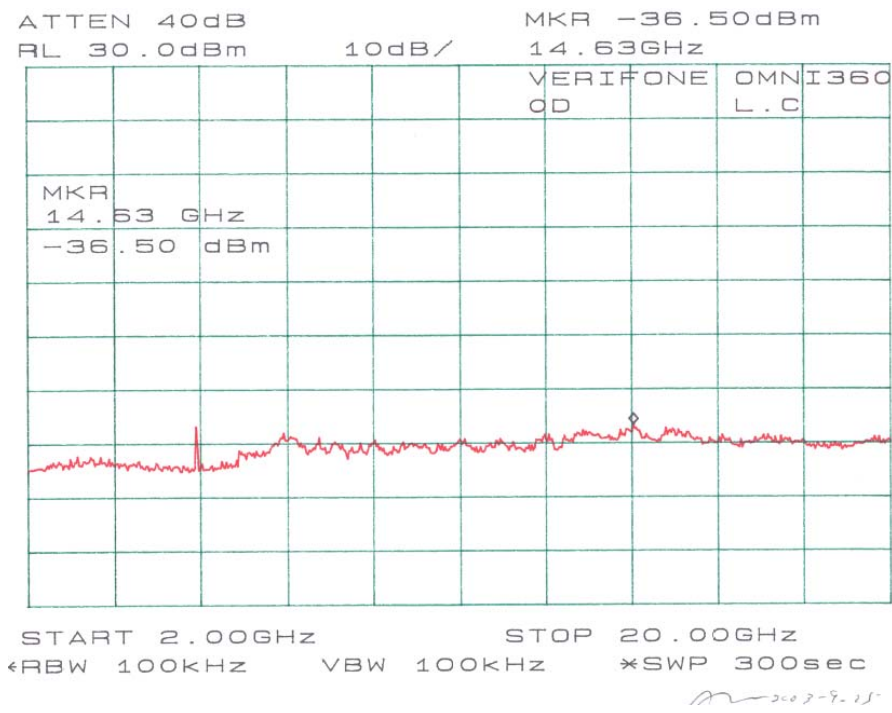
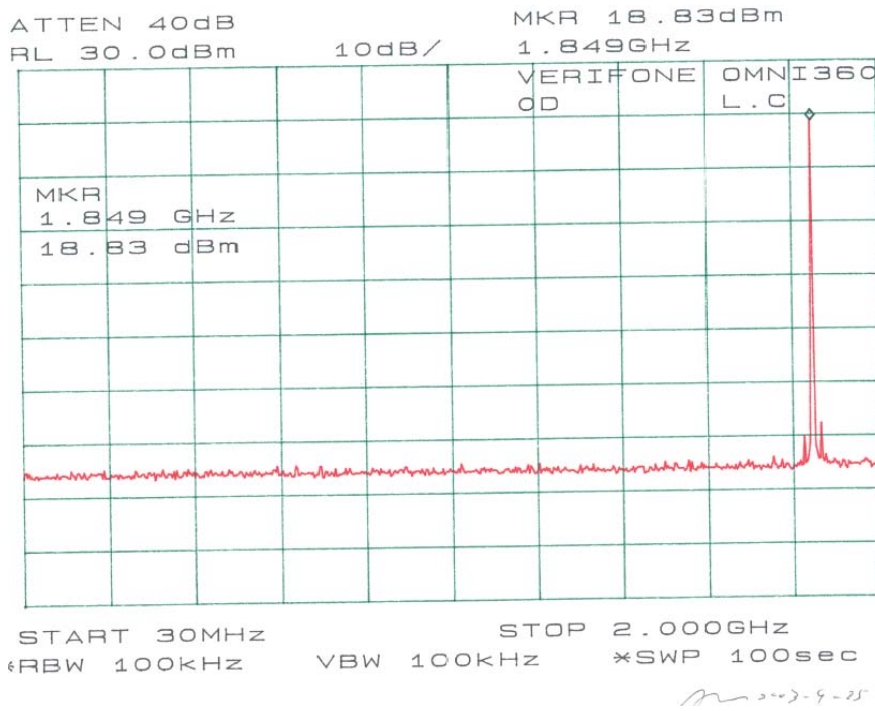
Hewlett Packard HP 8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01

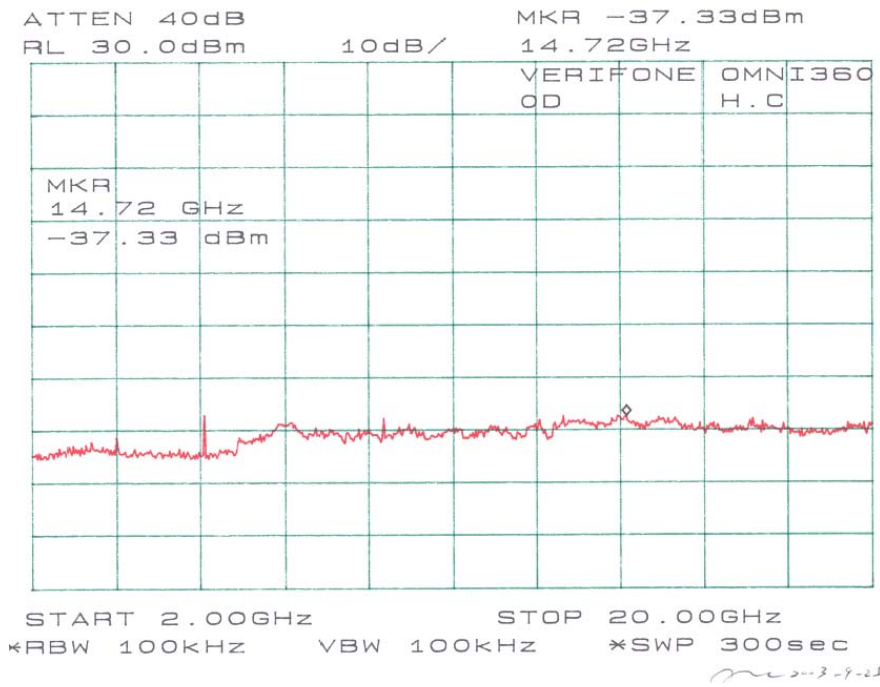
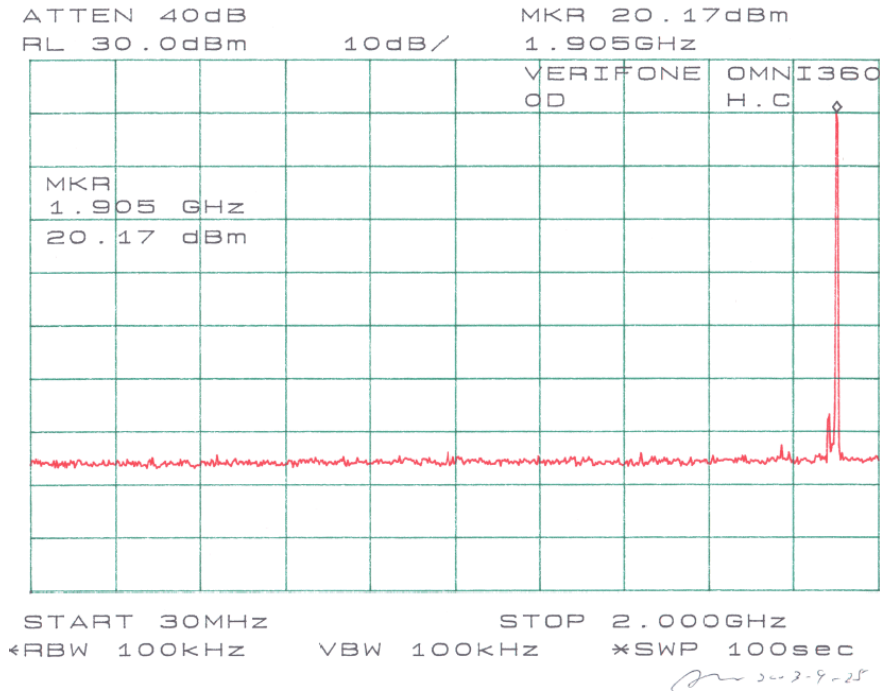
HP 7470A Plotter, Calibration not required.

Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

8.4 Test Results

Please refer to the hereinafter plots.





9 – BAND EDGE

9.1 Applicable Standard

Requirement: § 22.917 & §24.238.

9.2 Test Procedure

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

The center of the spectrum analyzer was set to block edge frequency, RBW set to 30KHz.

9.3 Test Equipment

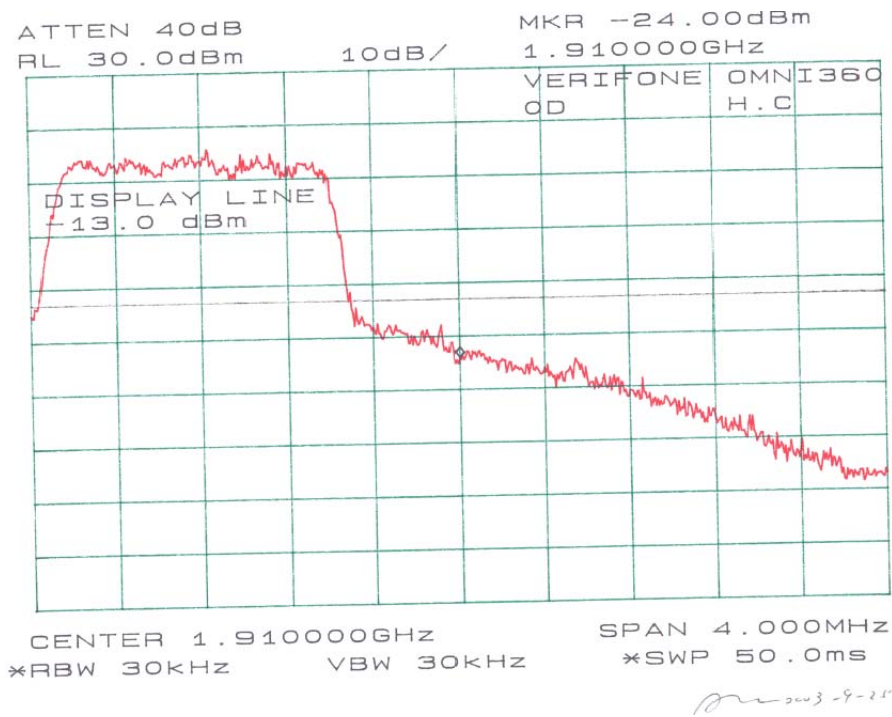
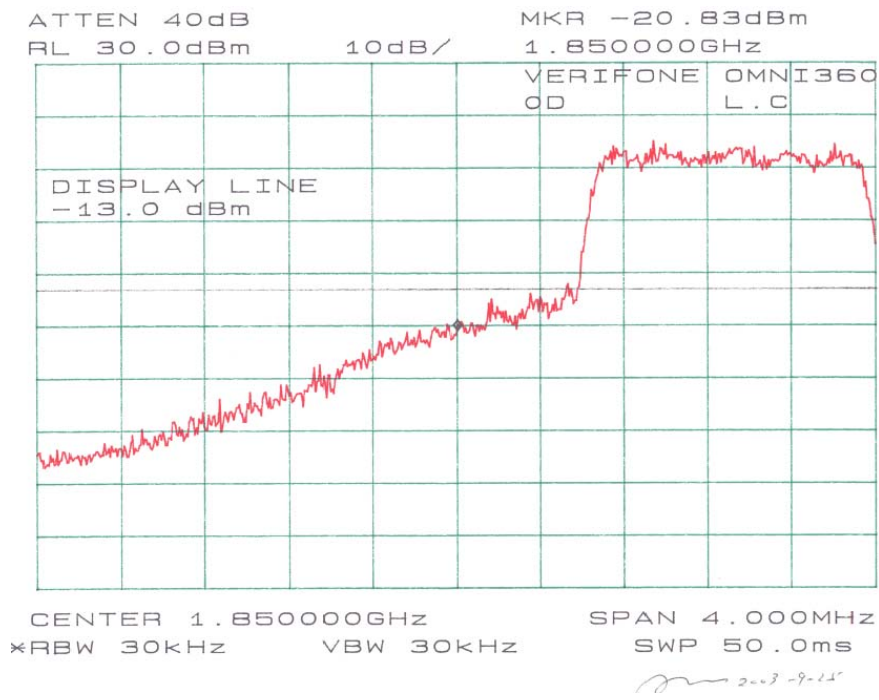
Hewlett Packard HP8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01.

Hewlett Packard HP 7470A Plotter, Calibration not required.

Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

9.4 Test Results

Please refer to the following plots.



10 - FIELD STRENGTH OF SPURIOUS RADIATION

10.1 Applicable Standard

Requirements: CFR 47, § 2.1053.

10.2 Test Procedure

The transmitter was placed on a wooden turntable, and it was transmitting into a non-radiating load which was also placed on the turntable.

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 test was performed by placing the EUT on 3-orthogonal axis.

The frequency range up to tenth harmonic of the fundamental frequency was investigated.

Remove the EUT and replace it with substitution antenna. A signal generator was connected to the substitution antenna by a non-radiating cable. The absolute levels of the spurious emissions were measured by the substitution.

Spurious emissions in dB = $10 \lg(\text{TXpwr in Watts}/0.001)$ – the absolute level

Spurious attenuation limit in dB = $43 + 10 \text{Log}_{10}(\text{power out in Watts})$

10.3 Test Equipment

EMCO Biconical Antennas, Calibration Due Date: 2004-09-11

EMCO Log Periodic Antenna, Calibration Due Date: 2004-08-11

A.H. Systems SAS200 Horn Antenna, Calibration Due Date:2004-05-31

Hewlett Packard HP 8564E Spectrum Analyzer, Calibration Due Date: 2004-08-01

Preamplifiers, Calibration Due Date:2004-03-14

Non-radiating Load

Anritsu MT8802A Base Simulator, Calibration Due Date: 2004-09-10

10.4 Test Result

FCC Part 24: CDMA 1900

Low Frequency: -18.2 dB at 3702.5 MHz
Middle Frequency: -17.4 dB at 3760 MHz
High Frequency: -18.4 dB at 3817.5 MHz

FCC Part 22: CDMA 800

Low Frequency: -26.6 dB at 1649.46 MHz
Middle Frequency: -26.8 dB at 167.8 MHz
High Frequency: -27.0 dB at 1696.38 MHz

10.4.1 Test Data for CDMA1900

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
1851.25	85.2	30	1.5	V	1851.25	16.7	V	6.7	0.3	23.1		
1851.25	79.4	0	1.6	H	1851.25	11.3	H	6.7	0.3	17.7		
3702.50	49.1	160	1.5	V	3702.50	-39.4	V	8.8	0.6	-31.2	-13	-18.2
3702.50	44.6	180	1.5	H	3702.50	-43.3	H	8.8	0.6	-35.1	-13	-22.1
5553.75	43.7	180	1.6	V	5553.75	-45.5	V	9.1	0.8	-37.2	-13	-24.2
5553.75	40.5	270	1.8	H	5553.75	-48.7	H	9.1	0.8	-40.4	-13	-27.4
MIDDLE CHANNEL												
1880.00	86.3	30	1.8	V	1880.00	18.4	V	6.7	0.3	24.8		
1880.00	81.4	120	1.5	H	1880.00	13.7	H	6.7	0.3	20.1		
3760.00	49.7	330	2.0	V	3760.00	-38.6	V	8.8	0.6	-30.4	-13	-17.4
3760.00	45.4	150	2.2	H	3760.00	-43.1	H	8.8	0.6	-34.9	-13	-21.9
5640.00	44.2	300	1.8	V	5640.00	-44.7	V	9.1	0.8	-36.4	-13	-23.4
5640.00	41.1	150	2.2	H	5640.00	-48.2	H	9.1	0.8	-39.9	-13	-26.9
HIGH CHANNEL												
1908.75	85.5	60	1.6	V	1908.75	17.3	V	6.7	0.3	23.7		
1908.75	80.6	90	1.8	H	1908.75	12.9	H	6.7	0.3	19.3		
3817.50	49.1	330	1.8	V	3817.50	-39.6	V	8.8	0.6	-31.4	-13	-18.4
3817.50	44.7	90	1.6	H	3817.50	-43.4	H	8.8	0.6	-35.2	-13	-22.2
5726.25	44.1	100	2.1	V	5726.25	-45.2	V	9.1	0.8	-36.9	-13	-23.9
5726.25	40.8	150	2.1	H	5726.25	-48.6	H	9.1	0.8	-40.3	-13	-27.3

10.4.2 Test Data for CDMA800

EUT					Generator						Standard	
Indicated		Table	Test Antenna		Substitution			Antenna	Cable	Absolute	FCC	FCC
Frequency MHz	Ampl. dBuV/m	Angle Degree	Height Meter	Polar H/V	Frequency MHz	Level dBm	Polar H/V	Gain Corrected	Loss dBm	Level dB	Limit dBm	Margin DBm
Low Channel												
824.73	80.7	180	1.5	V	824.73	22.3	V	0.0	0.1	22.2		
824.73	81.2	300	2.2	H	824.73	23.5	H	0.0	0.1	23.4		
1649.46	45.1	90	1.5	V	1649.46	-46.1	V	6.8	0.3	-39.6	-13	-26.6
1649.46	45.6	120	1.5	H	1649.46	-48.9	H	6.8	0.3	-42.4	-13	-29.4
2474.19	44.1	180	1.6	V	2474.19	-54.5	V	7.5	0.5	-47.5	-13	-34.5
2474.19	43.5	230	1.8	H	2474.19	-57.3	H	7.5	0.5	-50.3	-13	-37.3
MIDDLE CHANNEL												
836.40	81.3	30	1.6	V	836.40	23.2	V	0.0	0.1	23.1		
836.40	81.7	180	1.5	H	836.40	23.9	H	0.0	0.1	23.8		
1672.80	45.5	200	1.7	V	1672.80	-46.3	V	6.8	0.3	-39.8	-13	-26.8
1672.80	45.9	270	2.0	H	1672.80	-49.1	H	6.8	0.3	-42.6	-13	-29.6
2509.20	44.6	0	1.8	V	2509.20	-54.7	V	7.5	0.5	-47.7	-13	-34.7
2509.20	43.9	270	1.5	H	2509.20	-57.9	H	7.5	0.5	-50.9	-13	-37.9
HIGH CHANNEL												
848.19	80.9	90	1.5	V	848.19	22.7	V	0.0	0.1	22.6		
848.19	81.5	110	1.5	H	848.19	23.5	H	0.0	0.1	23.4		
1696.38	45.2	0	2.0	V	1696.38	-46.5	V	6.8	0.3	-40	-13	-27.0
1696.38	45.7	90	1.8	H	1696.38	-49.7	H	6.8	0.3	-43.2	-13	-30.2
2544.57	44.1	0	2.0	V	2544.57	-55.1	V	7.5	0.5	-48.1	-13	-35.1
2544.57	43.6	270	1.5	H	2544.57	-58.2	H	7.5	0.5	-51.2	-13	-38.2

11 - FREQUENCY STABILITY

11.1 Applicable Standard

Requirements: FCC § 2.1055 (a) and § 2.1055 (d).

11.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external DC power supply and the RF output was connected to a frequency counter via feed-through attenuators. The EUT was placed inside the temperature chamber. The DC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the counter.

Frequency Stability vs. Voltage: 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 illuminated; i.e., the battery end point. The output frequency was recorded for each battery voltage.

11.3 Test Equipment

Temperature Chamber -50° to $+100^{\circ}\text{C}$
Hewlett Packard 5383A Frequency Counter
Goldstar DC Power Supply, GR303

11.4 Test Results

Frequency Stability Versus Input Voltage

Reference Frequency: 836.52 MHz, Limit: 2.5ppm			
Environment Temperature (°C)	Power Supplied (Vdc)	Frequency Measure with Time Elapsed	
		MCF (MHz)	PPM Error
60	4	836.5197	-0.36
50	4	836.5197	-0.36
40	4	836.5198	-0.24
30	4	836.520	0.00
20	4	836.520	0.00
10	4	836.520	0.00
0	4	836.5202	0.24
-10	4	836.5202	0.24
-20	4	836.5205	0.60
-30	4	836.5205	0.60

Frequency Stability Versus Input Voltage

Power Supplied (Vdc)	Reference Frequency: 836.600 MHz, Limit: 2.5ppm					
	Frequency Measure with Time Elapsed					
	2 Minutes		5 Minutes		10 Minutes	
	MHz	PPM	MHz	PPM	MHz	PPM
3.6 Vdc	836.52	0	836.52	0	836.5201	0.12

Battery end point: 3.6 Vdc