**FCC ID: M78-C12A**

Prepared for:

**SIEMENS BUSINESS COMMUNICATIONS SYSTEMS, INC.**
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Austin, Texas 78728-3811

By:

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Submitted to:

**Federal Communications Commission**
**Equipment Authorization Division,**
**Applications Processing Branch**
7435 Oakland Mills Road
Columbia, Maryland 21048

August 1998

# FCC Type Acceptance Test Report for an Intentional Radiator

**SIEMENS BUSINESS COMMUNICATION SYSTEMS INC.**
**C12**
**1.9 GHz PCS-1900 Mobile Phone**
**(Transmitter Portion)**

# Table of Contents

# Certificate of Compliance

| | |
|---|---|
| Applicant: | Siemens Business Communications Systems Inc.. |
| Applicant's Address: | 2205 Grand Avenue Parkway<br>Austin, Texas 78728 |
| Model: | C12 1.9 GHz PCS-1900 Mobile Phone |
| Serial Number: | RF Sample #2 |
| Project Number: | 98-495 |
| Test Dates: | June 10 through August 3, 1988 |

I, Jeffrey A. Lenk, for Professional Testing (EMI), Inc., being familiar with the FCC rules and test procedures have reviewed the test setup, measurement data and this report. I believe them to be true and accurate. The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone** was tested and found to be in compliance with FCC Parts 15 and 24 for Intentional Radiators.

_____

Jeffrey A. Lenk
President

## 1.0 Equipment Under Test (EUT) Description

The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** was tested under AC and battery power. The C12 operating under ac power was determined to be "worst case"; therefore, only data taken for ac powered operation is included within this report.

The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** is designed for use in personal or commercial environments. This device is intended for operation under the Broadband PCS requirements of Part 24 (Subpart E). Specific test requirements include the following:

| | |
|---|---|
| 47 CFR 2.995(a) & 47 CFR 24.235 | Frequency Stability vs. Temperature |
| 47 CFR 2.995(d) (1) & 47 CFR 24.235 | Frequency Stability vs. AC Wall Power |
| 47 CFR 2.995(d) (2) & 47 CFR 24.235 | Frequency Stability vs. Battery Power |
| 47 CFR 2.1093 | Specific Absorption Rate (SAR) |
| 47 CFR 24.232 | Effective Radiated Power (ERP) |
| 47 CFR 2.989 | Occupied Bandwidth |
| 47 CFR 24.238 | Out of Band Emissions - Conducted |
| 47 CFR 24.238 | Out of Band Emissions - Radiated |
| 47 CFR 22.919 | Electronic Serial Number (ESN) * |

* Included for informational purposes

Testing of this device was limited to Part 24 related GSM compliance only. The **C12** does not possess the capability to operate using standard analog cellular service. The primary impact of this requirement is in the area of radiated emissions.

**The system tested consisted of the following components:**

| **Manufacturer & Model** | **Serial #** | **FCC ID #** | **Description** |
|---|---|---|---|
| Siemens Business Communications Systems Inc., C12 | RF Sample #2 | M78-C12A | C12 1.9 GHz PCS-1900 Mobile Phone |
| Siemens Business Communications Systems Inc., C12 | RF Sample #3 | M78-C12A | C12 1.9 GHz PCS-1900 Mobile Phone |
| Siemens Business Communications Systems Inc., FW7221<br>P/N AX1000TCHG | N/A | N/A | AC to DC Power Adapter |

**System Peripherals**:

| Manufacturer & Model | Serial # | FCC ID # | Description |
|---|---|---|---|
| Siemens Business Communications Systems,<br>P/N AX1200HNDS | N/A | N/A | Vehicle Adapter Cable |
| Siemens Business Communications Systems,<br>Model TBD | 12 | N/A | C12 RF Port Adapter |

The equipment within this report was tested to verify its compliance with FCC Rule Parts 2, 15 and 24, for Intentional Radiators. A separate verification report pursuant to Part 15, Subpart B has been prepared for the **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone** as a Digital Device. Based on Part 15.101, testing and generation of a report for the receiver portion of the C12 is not required, though the unit is subject to the provisions of Part 15.5.

## 2.0 Frequency Stability

## 2.1 Frequency Stability versus Temperature

Measurements were made on the **C12** to verify compliance with the frequency stability requirements of §2.995(a). Under this specification, the EUT is tested to verify satisfactory frequency stability versus changes in the ambient temperature.

### 2.1.1 Test Procedure

The tests were performed in a temperature and humidity test chamber. A Hewlett Packard 8922M GSM Test Set (with PCS adapter) was used to simulate a GSM cell site and to monitor the transmit frequency of the EUT. The HP 8922M was set to display the frequency variation from the nominal value for the channel under test. This test was performed at a channel setting of 512 (center frequency = 1850.20 MHz), which is near the center of the PCS GSM band. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

The temperature for the EUT was varied from -30 $^{o}$C to +60 $^{o}$C at 10 $^{o}$C intervals. Increasing the operational test temperature range was done to accomidate Industry Canada test requirements. The EUT was allowed to soak at each temperature a minimum of 45 minutes prior to taking the frequency reading. The maximum frequency error was recorded at each data point.

### 2.1.2 Test Criteria

When combined, Sections 2.995 (a), and 24.235 indicate that the output spectrum of the transmitter shall remain within the appropriate channel band with ambient temperature for the EUT ranging from -30 $^{o}$C to +50 $^{o}$C. Based on general channel width requirements, the frequency error for this test should not exceed 9.5 kHz.

### 2.1.3 Test Results

The **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** meets the frequency stability requirements for frequency stability versus temperature variation based on the criteria listed above. Data for this test is located in Appendix A of this report.

## 2.2 Frequency Stability versus AC Wall Power

Measurements were made on the **C12** to verify compliance with the frequency stability requirements of §2.995(d)(1). Under this specification, the EUT is tested to verify satisfactory frequency stability versus changes in the amplitude of the primary power for operation from the AC mains.

### 2.2.1 Test Procedure

The tests were performed in a laboratory environment. A Hewlett Packard 8922M GSM Test Set (with PCS adapter) was used to simulate a GSM cell site and to monitor the transmit frequency of the EUT. The HP 8922M was set to display the frequency variation from the nominal value for the channel under test. This test was performed at a channel setting of 512 (center frequency = 1850.20 MHz), which is near the center of the PCS GSM band. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

Power to the input terminals of the AC to DC power adapter was varied from 102 to 138VAC at a nomial frequency of 60 Hz. The nomial AC mains power for this system is 120 VAC which is listed on the label for the AC to DC converter. The maximum frequency error was recorded at 5 volt intervals as the input voltage was varied from 100 to 140 VAC. The response of the EUT was monitored as the line voltage was changed.

### 2.2.2 Test Criteria

When combined, Sections 2.995 (d)(1), 22.355 and 22.917 indicate that the output frequency of the transmitter shall remain within the appropriate channel band with AC mains power being from 85% to 115% of the nominal value. Based on the analog channel width requirements, the frequency error for this test should not exceed 4 kHz.

### 2.2.3 Test Results

The **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** meets the frequency stability requirements for frequency stability versus AC mains input variation based on the criteria listed above. Data for this test is located in Appendix A of this report.

## 2.3 Frequency Stability versus AC Wall Power

Measurements were made on the **C12** to verify compliance with the frequency stability requirements of §2.995(d)(2). Under this specification, the EUT is tested to verify satisfactory frequency stability versus changes in the amplitude of the battery power for the EUT.

### 2.3.1 Test Procedure

The tests were performed in a laboratory environment. A Hewlett Packard 8922M GSM Test Set (with PCS adapter) was used to simulate a GSM cell site and to monitor the transmit frequency of the EUT. The HP 8922M was set to display the frequency variation from the nominal value for the channel under test. This test was performed at a channel setting of 512 (center frequency = 1850.20 MHz), which is near the center of the PCS GSM band. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

The battery for the EUT was removed and a variable level DC supply was attached to the battery terminals. The DC power level was varied from 4.0 to 2.2 VDC. The maximum frequency error was recorded at 0.4 volt intervals over this range.

### 2.3.2 Test Criteria

When combined, Sections 2.995 (d)(1), 22.355 and 22.917 indicate that the output frequency of the transmitter shall remain within the appropriate channel band with the battery power ranging from the nominal battery operating voltage to the battery operating end point. Based on the analog channel width requirements, the frequency error for this test should not exceed 9.5 kHz.

### 2.3.3 Test Results

The **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** meets the frequency stability requirements for frequency stability versus battery input voltage variation based on the criteria listed above. Data for this test is located in Appendix A of this report.

## 3.0 Specific Absorption Rate Evaluation

An evaluation was performed to determine the near field emission profile of the **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** with respect to the Specific Absorption Rate (SAR) requirements of 47 CFR 2.1093.

## 3.1 Test Procedure

The tests were performed by the Lucent Technologies Holmdel New Jersey facility. The test methods and test configurations are contained in a separate report generated by Lucent Technologies.

## 3.2 Test Criteria

Based on the absorption criteria described in 47 CFR 2.1093, the near field absorption **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** must not exceed 4.0 watts/kilogram.

## 3.3 Test Results

Data for this test is contained in a separate SAR report. **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12)** met the §2.1093 near field absorption requirements requirements

## 4.0 Effective Radiated Power (ERP) Measurements

Measurements were made on **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12)** to verify compliance with the maximum effective radiated power (ERP) requirements of §24.232.

## 4.1 Test Procedure

All measurements were performed in a semi-anechoic chamber. Use of this environment for radiated emission testing is allowed for FCC compliance testing under Part 2.993 as long as the test environment is adequately documented. The EUT was placed on a turntable 1meter above the ground plane. The EUT location inside the chamber was no closer than 2 meters from any wall or absorber material. For radiated emission measurements, the measurement antenna was placed 1 meter from the EUT at the same height as the EUT. During ERP testing, the height of the antenna and the azimuth of the EUT relative to the measurement antenna was varied to maximize the measured signal level.

Prior to formal ERP testing, preliminary testing was performed to determine variation of the outpower of the device versus GSM channel. This involved connecting the EUT directly to the GSM test set and verifying that the output level of the signal transmitted by the **C12** varied based on the signal level received from the cell site. Successful performance of this test is used to verify compliance with the requirement that the EUT only put out the minimum power necessary for reliable communications required by Part 24.232(e).

A Hewlett Packard 8922M GSM Test Set (with PCS adapter) was used to simulate a GSM cell site and to monitor the transmit frequency of the EUT. The HP 8922M was set to display the frequency variation from the nominal value for the channel under test. This test was performed at a channel setting of 512 (center frequency = 1850.20 MHz), which is near the center of the PCS GSM band. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

## 4.2 Test Criteria

Section 24.232(e) requires that mobile/portable devices only output the power necessary for reliable communications. This indicates that the output power of the device should be automatically adjustable by the EUT based on relative base station power.

Section 24.232(e) also requires that the effective radiated power of mobile and portable transmitters be no greater than 2 watts. ERP testing was performed by measuring the maximum electric field from the EUT for the C12 and translating this level to ERP using the following formula:

$$\mathbf{ERP = (E*r)/(30)^{1/2}}$$

Where:

**E = Electric Field in v/m**

**r = distance from the measurement antenna to the EUT in meters**

This formula was obtained from the Industy Canada document, 'Guidelines for Measurement of Radio Frequency Fields at Frequencies from 10 kHz to 300 GHz, Document Reference NIR-E, dated January 1994'.

## 4.3 Test Results

Measurements were performed utilizing a spectrum analyzer IF/video bandwidth of 3 kHz/10 kHz. The frequency span was set for 3 MHz and was centered on the peak of the output signal. Once the signal was centered on the analyzer, the resolution and video bandwidths were expanded to verify that all power radiated by the unit was acquired for the power measurement. The maximum resolution/video bandwidth setting was 3 MHz/3 MHz.

Data for ERP testing is located in Appendix B of this report. **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12)** met the §24.232 ERP and automatically adjustable power requirements.

# 5.0 Occupied Bandwidth Measurements

Measurements were made on **Siemens Business Communications Systems Inc., C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** to determine the occupied bandwidth in accordance with Part 2.989.

## 5.1 Test Procedure

All measurements were performed in an controlled laboratory environment. The occupied bandiwdth of the C12 was measured using a Hewlett Packard 8922M GSM Test Set and a Hewlett Packard 8566 Spectrum Analyzer. A splitter/combiner was used to connect the RF ports of the EUT, GSM test set and the spectrum analyzer together.

Occupied bandwidth was plotted for channels 512 ,661 and 810. Based on section 24.238, the resolution and video bandwidths were set to 30 kHz. The occupied bandwidth was measured based on the emission width 26 dB below the peak emission level. The marker width for this measurement is shown on each plot.

## 5.2 Test Criteria

Section 2.989 requires that the occupied bandwidth for Type Accepted units be measured and reported as part of the device filing.

## 5.3 Test Results

Measurements were performed utilizing a spectrum analyzer IF/video bandwidth of 30 kHz/100 kHz. The frequency span was set for 500 kHz and was centered on the peak of the output signal. The occupied bandwidth was performed at Channel Settings of 512, 661 and 810 (Center Frequencies = 1850.0, 1880.0 and 1909.5 GHz).

Data for occupied bandwidth testing is located in Appendix C of this report. **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** has a worst case occupied bandwidth of 340.5 kHz based on the 26 dBc criteria.

# 6.0 Out of Band Emissions - Conducted

Conducted emissions measurements were made to determine out of band radiated noise produced by the **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** transmitter. All measurements were performed in a controlled laboratory environment.

## 6.1 Test Procedure

The EUT was tested in a controlled laboratory environment. Measurement of the conducted antenna emissions from the **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** where performed by injecting a base station signal from a GSM test set into the EUT through the tap port of a directional coupler. Measurement of the emissions from the C12 were made by a spectrum analyzer attached to the output port of the directional coupler. The EUT was connected to the input port of the coupler, with the tap oriented to tap -20 dB referenced to the input port. This method provided minimal path loss of signals from the EUT to the analyzer by placing these two components in the through path of the coupler. The loss versus the test set is not critical as long as the power level generated by the EUT is constant. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

All recorded data was taken using a peak detector. Bandwidths used for these measurements were based on the requirements of Part 24.238(b). The final measurements provided were determined by using the following formula:

**Corrected Level = Recorded Level + Cable Loss + Coupler Loss**

## 6.2 Test Criteria

Based on the out of band emission criteria of §24.238(a), transmitter related emissions for the **C12** shall be reduced by the following amount with respect to the level of the fundimental:

**43 + 10 log(P) dB**

where P is the peak power of the unmodulated carrier in watts.

The peak conducted power was measured at the beginning of this procedure. The maximum output power for the EUT was 26.5 dBm at Channel setting 661. This indicates that maximum transmit power of the **C12** is:

**+26.5 dBm = 0.446 watts**

Based on this test, out of band emissions for the C12 shall be reduced by the following amount with respect to the level of the fundimental:

**43 + 10 log(0.446) dB**

**= 39.5 dB below the fundimental**

## 6.3 Test Results

The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone C12 )** operates over the frequency range 1854.5 to 1909.5 MHz. Testing was performed with the EUT set ot Channel 512 (Transmit Frequency = 1880.2 MHz). A cursory check of Channels 661 and 810 was made to determine the peak conducted power at these settings and to verify that the emission profile for these channels was similar to that of Channel 810.

Conducted emission data sheets are contained in Appendix D of this report. The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** met the §24.238 conducted emission requirements.

## 7.0 Out of Band Emissions - Radiated

Radiated emissions measurements were made to determine out of band radiated noise produced by the **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** transmitter. All measurements were performed in the semi-anechoic chamber described in Section 4.1.

## 7.1 Test Procedure

The EUT was placed on a non-conductive turntable 1 meter above the ground plane. A measurement antenna was positioned at a distance of 1 meter as measured from the closest point of the EUT. The **Siemens Business Communications Systems, Inc. Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** was rotated 360° in the azimuth plane with the antenna parallel to the EUT.

A Hewlett Packard 8924 GSM Test Set was used to simulate a GSM cell site using a small antenna placed near the test site to allow a wireless link to the EUT. The test set was also used to monitor the power level & spectrum of the EUT during the test. The output of the EUT was placed in a constant transmit mode at the maximum output level for the **C12**. The EUT was placed in a loopback mode which resulted in the EUT transmitting a pseudo-random audio signal. This signal maximized the spectral density of the transmit signal.

A Hewlett Packard Spectrum Analyzer utilizing peak detection was used during the determination of worst-case orientation. All recorded data was taken using a peak detector. Bandwidths used for these

measurements were based on the requirements of Part 24.238(b). The final measurements provided were determined by using the following formula:

**Corrected Level = Recorded Level - Pre-Amp Gain + Antenna Factor + Cable Loss**

## 7.2 Test Criteria

Based on the out of band emission criteria of §24.238(a), transmitter related emissions for the **C12** shall be reduced by the following amount with respect to the level of the fundimental:

**43 + 10 log(P) dB**

where P is the peak power of the unmodulated carrier in watts.

From the conducted power measurements described in Section 6.0, the output power for the EUT can be calculated. This test indicated that maximum transmit power of the **C12** is:

**+26.5 dBm = 0.446 watts**

Based on this test, out of band emissions for the C12 shall be reduced by the following amount with respect to the level of the fundimental:

**43 + 10 log(0.446) dB**

**= 39.5 dB below the fundimental**

## 7.3 Test Results

The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** operates over the frequency range 1854.5 to 1909.5 MHz. Testing was performed on the a channel just above the maximum operating rangefor this device (Channel 810, which has a center frequency of 1909.5 GHz) since this mode should produce the highest range of harmonics for this device.

Radiated emission data sheets are contained in Appendix E of this report. The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** met the §24.238 radiated emission requirements.

## 8.0 Electronic Serial Number Assignment

While ESN evaluation is not required for Part 24 compliance, testing of the **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** to verify that this equipment does possess an ESN which meets industry standard ESN software and hardware requirements. The technical requirements of FCC Part 22.919 were used as a basis for this evaluation.

A conducted signal evaluation were made to determine if the **C12** transmitter possessed an Electronic Serial Number (ESN) which was compliant with the J-STD-007 GSM protocol and §22.919 criteria.

## 8.1 Test Procedure

The tests were performed in an controlled laboratory environment. A Hewlett Packard 8922M GSM Test Set was used to simulate a GSM cell site and to monitor the transmit frequency of the EUT. The HP 8922M was set to display the frequency variation from the nominal value for the channel under test. This test was performed at a channel setting of 512.

The HP 8922M Test Set was preset to only recognize signals which comply with the J-STD-007 GSM criteria. This system has a 'recognition mode', which polls a mobile unit & reads its serial number if it meets the J-STD-007 criteria.

## 8.2 Test Criteria

Based on the ESN requirements of §22.919, the mobile transmitter shall meet the following criteria:

(a) Each unit shall have a unique 32 bit electronic serial number

(b) The ESN component must ber permanently attached to a main circuit board component and cannot be altered, through either software or hardware means.

(c) The ESN must utilize one or more of the following encryption means:

- Multiplication or Division by a Polynomial

- Cyclic Coding

- Spreading of the ESN bits ofver non-sequential memory locations

The J-STD-007 GSM protocol contains specific details regarding the structure of the ESN which is compliant with the guidelines for §22.919. Basically, if a valid ESN is returned from the **C12** using J-STD-007 GSM protocol following interrogation by the test set and the ESN circuitry is hardwired into the unit, the **C12** will meet the requirements of §22.919.

## 8.3 Test Results

Since the ESN is not channel dependent, two **Siemens Business Communications Systems, Inc. C12 1.9 GHz PCS-1900 Mobile Phone s** were interrogated at channel setting 512. These interrogation returned the following valid J-STD-007 GSM protocol based ESNs:

| EUT Designation | Manufacturer Provided ESN | Test Result ESN |
|---|---|---|
| RF Sample #2 | 001010000000001 | 001010000000001 |
| RF Sample #3 | 001010000000001 | 001010000000001 |

The two test articles were programmed with the same ESN for prototype evaluation only. Full production units will possess different ESNs for each item. The ESNs will be hard coded in the device to prevent change or modification of the ESN once the unit has been manufactured.

The **Siemens Business Communications Systems Inc.,C12 1.9 GHz PCS-1900 Mobile Phone (C12 )** met the §22.919 ESN requirements. Data from this test is located in Appendix F.

## 9.0 Form 731 Information

The following information is provided for inclusion in the FCC Form 731 for the **Siemens Business Communications Systems, Inc. C12 Wireless Local LoopModem.**

## 9.1 Emission Designator

*Bandwidth:*

The **C12** utilizes a signalling rate of 270.8333 kb/s. This rate is processed into an J-STD-007 compliant signal with a resulting bandwidth of 320 kHz. This bandwidth is a requirement of the J-STD-007 specification.

*Emission Designator::*

The RF output signals of the **C12** are complaint with the GSM protocol requirements of J-STD-007. This output signal for this protocol is a frequency modulated signal containing voice, data and signaling information in a channel hopping mode. The emission for the C12 can contain voice or non-voice data and will include signaling and traffic control information. This results in the emission designator being derived from the following components:

| Symbol Position | Parameter | Description | Resulting Symbol |
|---|---|---|---|
| 1 | Type of Modulation | Phase | G |
| 2 | Nature of Symbol(s) Modulating the Carrier | Case not covered by standard criteria | X |
| 3 | Type of Information Being Transmitted | Voice & Digital Data (Combination) | W |

This analysis results in an overall emission designator of GXW320K.

## 9.2 Output Power

The rated output power of the **C12** is 300 milliwatts. This is based on manufacturers data and test data for the ERP testing. In the conducted power test, the maximum power output for the three tested channels were withing a normal deviation of 100 milliwatts. The highest peak conducted power between the 3 measured channels was 0.446 watts. The highest peak EIRP was 0.446 watts.

## 9.3 Frequency Band of Operation

The **C12** is rated to be used through most of the authorized 1900 MHz GSM band for mobile units. Production level units are firmware restricted to operate from Channel 512 to 810. The prototype units tested under this effort were enabled to transmit over the entire 1900 MHz PCS band in order to provide worst case emission data at the band edges. Based on the production unit channel range, the transmit frequency range of the **C12** is rated from 1850 to 1910 MHz.

## 9.4 Frequency Stability

Baed on the test data contained in this report, the **C12** is significant more stable than the 0.0005% criteria used as a reference in these tests. The data indicates that the stability of the device is better than 2.5 ppm. For this reason, a stability rating of < 2.5 ppm is requested.

## 10.0 List of Test Equipment

A list of the test equipment utilized to perform the conducted and radiated emission measurements is given below. The date of calibration is given for each.

| **Device** | **Description** | **Date Last Calibrated** | **Calibration Due** |
|---|---|---|---|
| HP 8566B | Spectrum Analyzer | 09/22/97 | 09/22/98 |
| HP 85650A | Quasi Peak Adapter | 02/10/97 | 02/10/98 |
| MITEQ AFS4-00101800-40-10P-N | Preamplifier | 10/23/97 | 10/23/98 |
| Narda 3293-1 | Directional Coupler | 04/1/98 | 04/1/99 |
| EMCO 3115 | Double Ridged Horn Antenna | 05/22/98 | 05/22/99 |
| HP 8922M | GSM Test Set | 09/26/96 | 09/26/98 |
| HP 83220E | PCS Interface | 10/29/97 | 10/29/99 |
| HP34401 | Digital Multimeter | 03/24/98 | 03/24/98 |
| NJE SVC 60-14 | Adjustable DC Power Supply | Not Required | Not Required |
| Powerstat 3PN136B | Variable Transformer | Not Required | Not Required |
| Thermotron SM-32 | Environmental Chamber | 11/19/97 | 11/19/98 |

# Appendix A Frequency Stability Test Data

## Frequency Stability Versus Temperature Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: June 10, 1998

| Temperature (Degrees C) | Frequency Deviation (Hz) | Deviation vs Limit (Hz) |
|---|---|---|
| 60 | -76.20 | -9423.80 |
| 50 | -73.00 | -9427.00 |
| 40 | -69.20 | -9430.80 |
| 30 | -80.70 | -9419.30 |
| 20 | -76.00 | -9424.00 |
| 10 | -79.00 | -9421.00 |
| 0 | -83.20 | -9416.80 |
| -10 | -168.00 | -9332.00 |
| -20 | -80.00 | -9420.00 |
| -30 | Ceased Operation | Ceased Operation |

COMMENT #1: Reference Limit = 9.5 kHz

COMMENT #2: 45 minute soak at each temperature

**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk

## Frequency Stability Versus AC Power Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: August 3, 1998

| AC Line Voltage (V) | Frequency Deviation (Hz) | Deviation vs Limit (Hz) |
|---|---|---|
| 100 | 23.40 | -9476.60 |
| 105 | 22.30 | -9477.70 |
| 110 | 14.10 | -9485.90 |
| 115 | 14.20 | -9485.80 |
| 120 | 12.50 | -9487.50 |
| 125 | 17.00 | -9483.00 |
| 130 | 18.60 | -9481.40 |
| 135 | 25.80 | -9474.20 |
| 140 | 19.50 | -9480.50 |

COMMENT #1: Reference Limit = 9.5 kHz

COMMENT #2: Nominal Line Voltage = 120 VAC at 60 Hz

**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk

## Frequency Stability Versus DC Power Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: June 10, 1998

| DC Supply Setting (V) | Frequency Deviation (Hz) | Deviation vs Limit (Hz) |
|---|---|---|
| 4.0 | -24.00 | -9476.00 |
| 3.6 | 26.00 | -9474.00 |
| 3.2 | -17.00 | -9483.00 |
| 2.8 | Ceased Operation | Ceased Operation |

COMMENT #1: Reference Limit = 9.5 kHz

COMMENT #2:

**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk

# Appendix B Effective Radiated Power (ERP) Test Data

## Effective Radiated Power Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 21, 1998

| Channel | Freq. (MHz) | Recorded Level (dBuV) | Antenna Factor (dB/m) | Cable Loss (dB) | Corrected Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 512 | 1850.00 | 100.50 | 25.00 | 1.40 | 126.90 | 140.70 | -13.80 |
| 661 | 1879.50 | 100.70 | 25.00 | 1.40 | 127.10 | 140.70 | -13.60 |
| 810 | 1909.50 | 98.80 | 25.00 | 1.40 | 125.20 | 140.70 | -15.50 |

COMMENT #1: Limit = 2 watts. At a test distance of 1 meter, an EIRP of 2 watts can be converted to field strength as:

$E = (EIRP * (30)^{1/2})/r$ for r = 1 meter and EIRP = 2 watts, this becomes:

$= 2 * (30)^{1/2}) = 10.95$ v/m = 140.7 dBuV/m

COMMENT #2: All measurements made at an antenna height of 1 meter. Worst case emission direction for all measurements was 180 degrees.

COMMENT #3: Highest EIRP = 127.1 dbuV/m Based on the formula above, the equivalent EIRP for this level is 0.413 Watts.

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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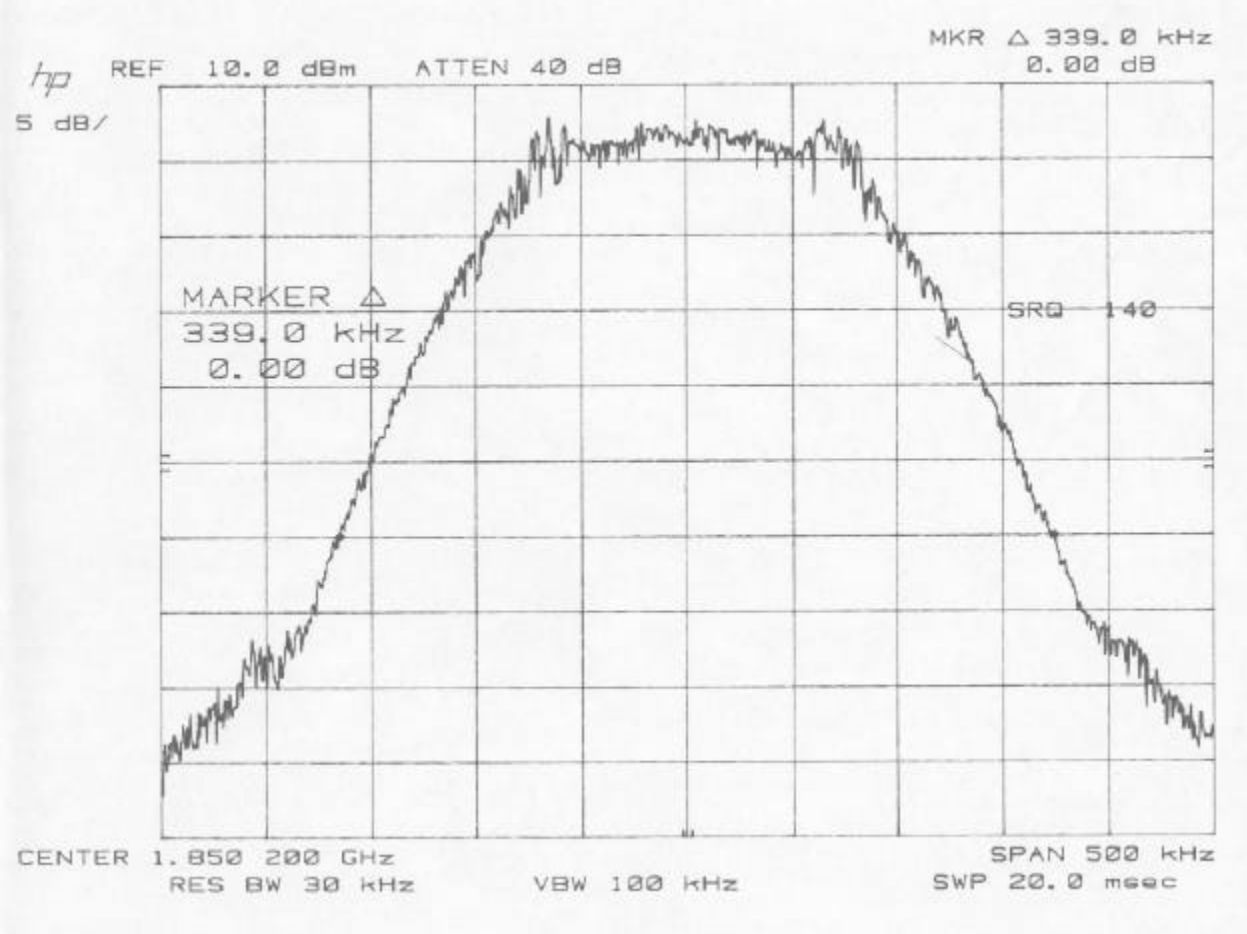
# Appendix C Occupied Bandwidth Test Data

## Occupied Bandwidth Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 15, 1998




COMMENT #1: Channel = 512 (1850.20 MHz)

COMMENT #2: 26 dB Bandiwdth = 339 kHz

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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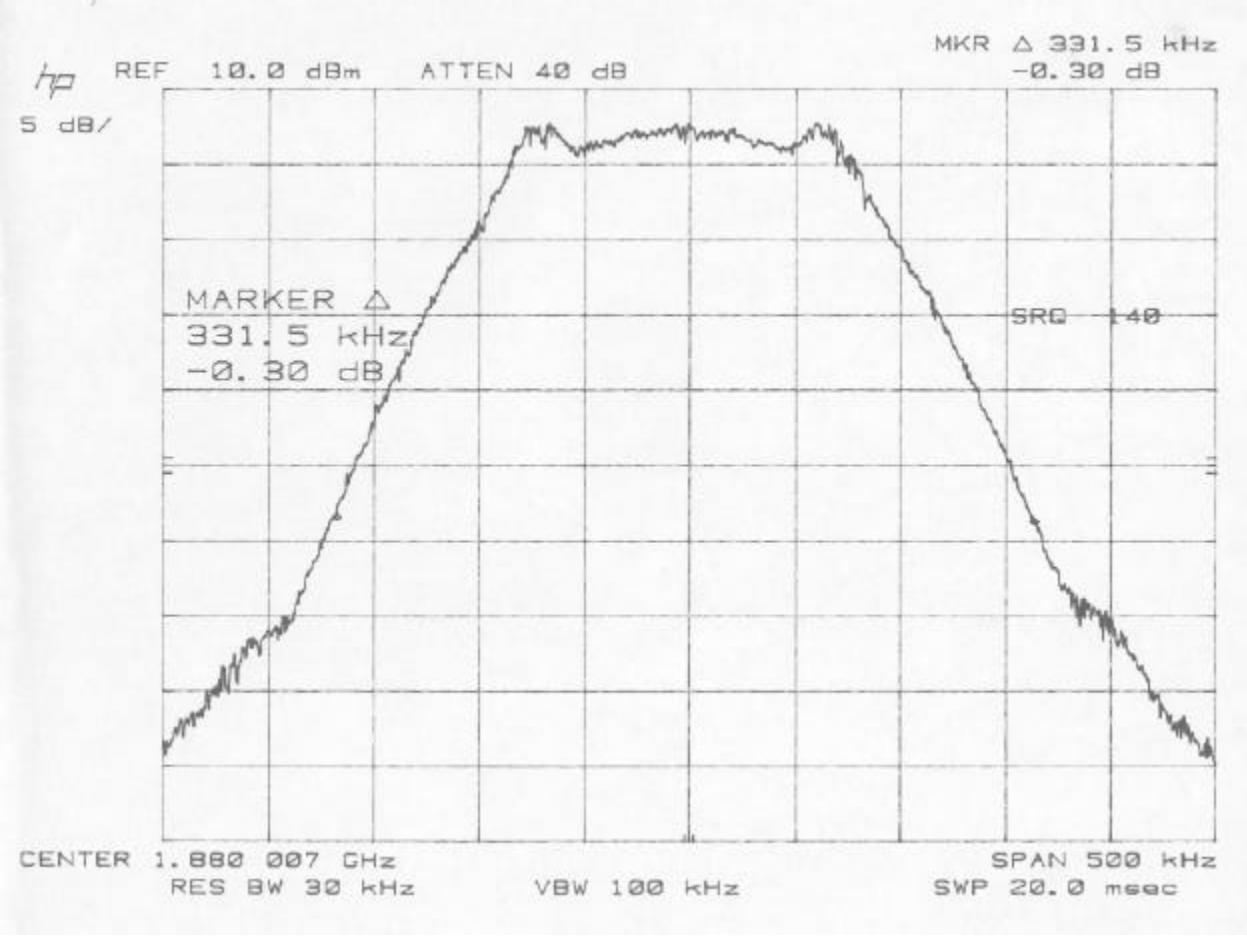
## Occupied Bandwidth Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 15, 1998




COMMENT #1: Channel = 661 (1880.0 MHz)

COMMENT #2: 26 dB Bandiwdth = 331.5 kHz

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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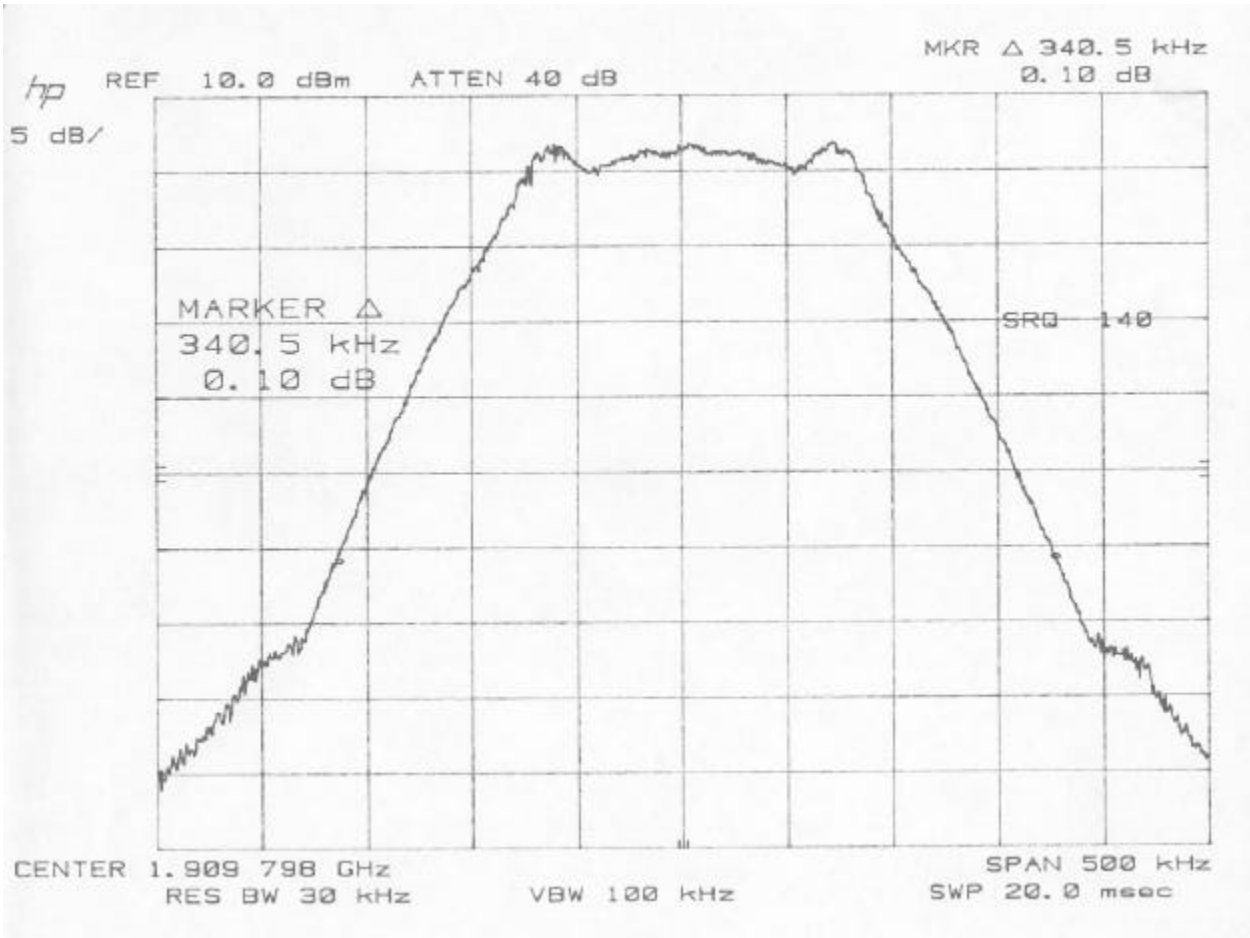
## Occupied Bandwidth Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 15, 1998




COMMENT #1: Channel = 810 (1909.798 MHz)

COMMENT #2: 26 dB Bandiwdth = 340.5 kHz

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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# Appendix D

# Out 0f Band Emissions Conducted Test Data

## Out of Band Emission - Conducted Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 20, 1998

| Freq. (MHz) | Recorded Level (dBm) | Cable Loss (dB) | Coupler Factor (dB) | Corrected Level (dBm) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|
| 1850.0 | 24.5 | 1.2 | 0.2 | 25.9 | Ref | Ref |
| 3700.0 | -62.7 | 1.5 | 0.4 | -60.8 | -13.6 | -47.2 |
| 5550.0 | -70.2 | 2.7 | 0.5 | -67.0 | -13.6 | -53.4 |
| 7400.0 | -61.2 | 4.2 | 0.6 | -56.5 | -13.6 | -42.9 |
| 925.0 | -73.5 | 3.8 | 0.7 | -69.0 | -13.6 | -55.4 |
| 11100.0 | -80.5 | 3.7 | 1.5 | -75.3 | -13.6 | -61.7 |
| 12950.0 | -75.6 | 4.7 | 2.7 | -68.2 | -13.6 | -54.6 |
| 14800.0 | -74.9 | 5.4 | 1.2 | -68.3 | -13.6 | -54.7 |
| 16650.0 | -75.1 | 5.8 | 1.5 | -67.8 | -13.6 | -54.2 |
| 18500.0 | -78.1 | 13.2 | 1.5 | -63.4 | -13.6 | -49.8 |

COMMENT #1: Channel Setting = 512

COMMENT #2: Peak intended conducted emission level for Channels 661 and 810:

| | |
|---|---|
| Channel 661 | 26.3 dBm |
| Channel 1909 | 25.5 dBm |

COMMENT #3: All readings above the fundimental are DSN.

**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk

# Appendix E

# Out 0f Band Emissions Radiated Test Data

## Out of Band Emission - Radiated Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 21, 1998 POLARIZATION: Vertical

| Freq. (MHz) | EUT Direction (Deg) | Recorded Level (dBuV) | Cable Loss (dB) | Antenna Factor (dBuV/m) | Corrected Level (dBuV/m) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1909.5 | 350.0 | 98.8 | 1.5 | 25.9 | 126.2 | Ref | Ref |
| 3818.9 | 350.0 | 37.1 | 1.5 | 32.1 | 70.7 | 86.7 | -16.0 |
| 5728.4 | 350.0 | 38.2 | 1.5 | 34.8 | 74.5 | 86.7 | -12.2 |
| 7637.9 | 350.0 | 23.7 | 1.5 | 36.8 | 62.0 | 86.7 | -24.7 |
| 9547.3 | 350.0 | 22.6 | 1.5 | 38.1 | 62.2 | 86.7 | -24.5 |
| 11456.8 | 350.0 | 23.4 | 1.5 | 39.7 | 64.6 | 86.7 | -22.1 |
| 13366.3 | 350.0 | 25.5 | 1.7 | 40.4 | 67.6 | 86.7 | -19.2 |
| 15275.7 | 350.0 | 27.3 | 2.0 | 41.5 | 70.8 | 86.7 | -15.9 |
| 17185.2 | 350.0 | 28.2 | 1.7 | 42.8 | 72.7 | 86.7 | -14.0 |
| 19094.7 | 350.0 | 32.9 | 1.7 | 48.2 | 82.8 | 86.7 | -3.9 |

COMMENT #1: Channel Setting = 810 (Transmit Frequency = 1909.5 MHz)

COMMENT #2: Measurement antenna height = 1 meter for all measurements. This height was found to be worst cases for all spurious emissions (parallel to case of EUT).

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration. All readings aboe the second harmonic are DSN.

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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## Out of Band Emission - Radiated Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 21, 1998 POLARIZATION: Vertical

| Freq. (MHz) | EUT Direction (Deg) | Recorded Level (dBuV) | Cable Loss (dB) | Antenna Factor (dBuV/m) | Corrected Level (dBuV/m) | Limit (dBm) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 1909.5 | 350.0 | 91.7 | 1.5 | 25.9 | 119.1 | Ref | Ref |
| 3818.9 | 350.0 | 39.7 | 1.5 | 32.1 | 73.3 | 86.7 | -13.4 |
| 5728.4 | 350.0 | 38.2 | 1.5 | 34.8 | 74.5 | 86.7 | -12.2 |
| 7637.9 | 350.0 | 44.5 | 1.5 | 36.8 | 82.8 | 86.7 | -3.9 |
| 9547.3 | 350.0 | 23.5 | 1.5 | 38.1 | 63.1 | 86.7 | -23.6 |
| 11456.8 | 350.0 | 22.6 | 1.5 | 39.7 | 63.8 | 86.7 | -22.9 |
| 13366.3 | 350.0 | 26.4 | 1.7 | 40.4 | 68.5 | 86.7 | -18.3 |
| 15275.7 | 350.0 | 28.5 | 2.0 | 41.5 | 72.0 | 86.7 | -14.7 |
| 17185.2 | 350.0 | 34.9 | 1.7 | 42.8 | 79.4 | 86.7 | -7.3 |
| 19094.7 | 350.0 | 32.9 | 1.7 | 48.2 | 82.8 | 86.7 | -3.9 |

COMMENT #1: Channel Setting = 810 (Transmit Frequency = 1909.5 MHz)

COMMENT #2: Measurement antenna height = 1 meter for all measurements. This height was found to be worst cases for all spurious emissions (parallel to case of EUT).

COMMENT #3: Worst case emissions were for EUT antenna in vertical position. Data is presented for this configuration. All readings aboe the second harmonic are DSN.

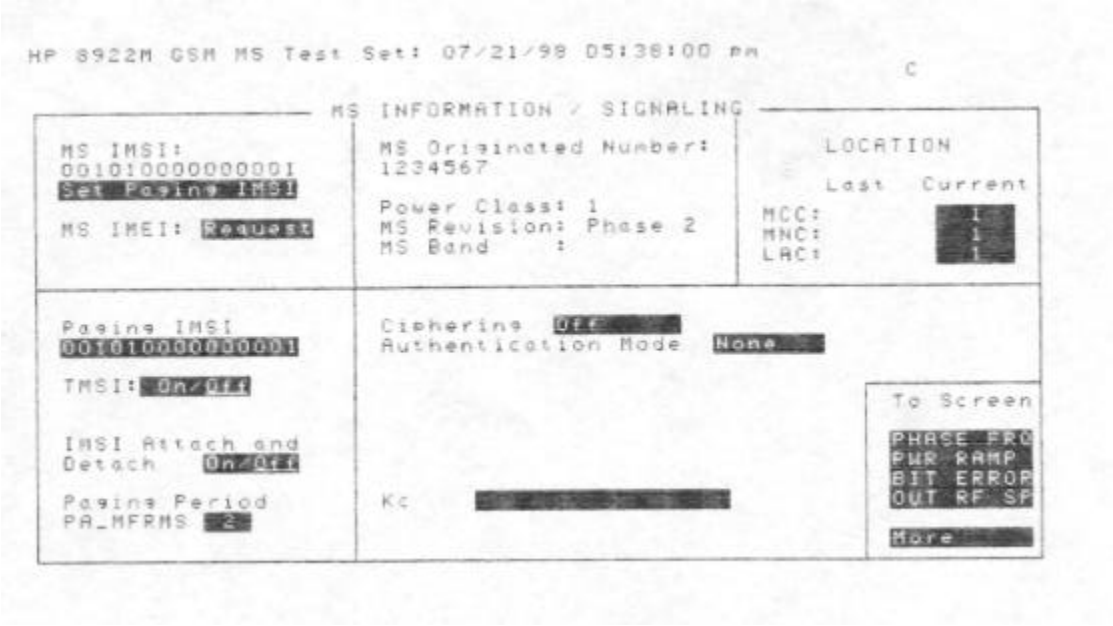
**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk

# Appendix F Electronic Serial Number (ESN) Recognition Test Data

## Electronic Serial Number (ESN) Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 21, 1998




COMMENT #1: Channel Setting = 512

COMMENT #2:

**TEST ENGINEER**:_____ **APPROVED BY**: _____
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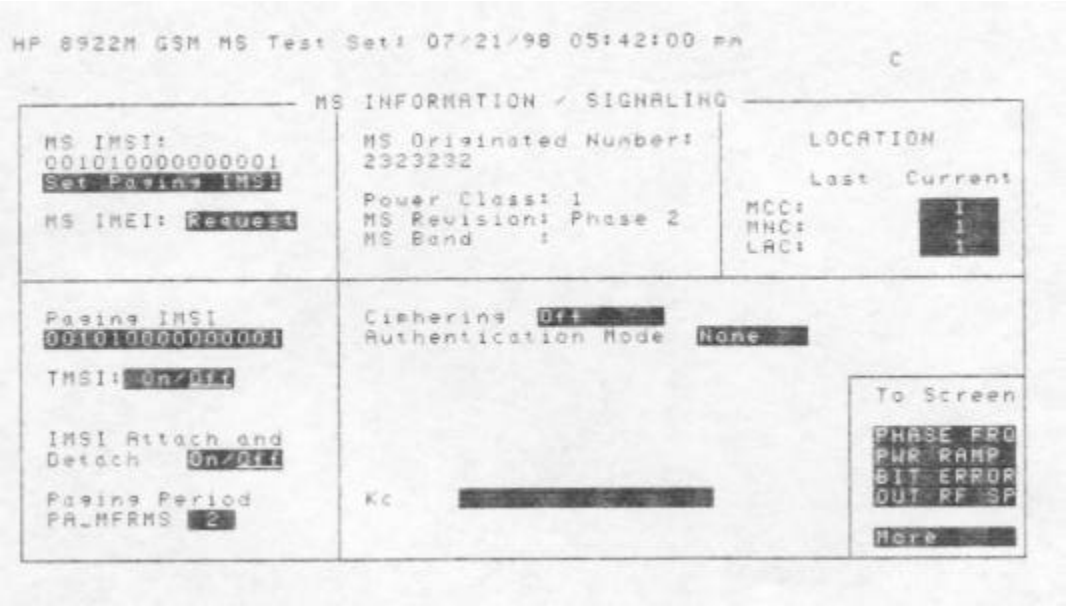
## Electronic Serial Number (ESN) Data Sheet

**Siemens Business Communications Systems Inc.**
**C12 1.9 GHz PCS-1900 Mobile Phone**

SERIAL #: RF SAMPLE #2 PROJECT #: 98-495
DATE: July 21, 1998




COMMENT #1: Channel Setting = 512

COMMENT #2:

**TEST ENGINEER**:_____ **APPROVED BY**: _____
John O'Brien Jeffery Lenk