



# PCTEST Engineering Laboratory, Inc.

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## CERTIFICATE OF COMPLIANCE FCC Part 22 Certification

**NOKIA MOBILE PHONES INC.**  
12278 Scripps Summit Drive  
San Diego, CA 92131  
Attn: Dan Laramie, Senior EMC Engineer

Dates of Tests: November 21-22, 2002  
Test Report S/N: 22.221121631.QMN  
Test Site: PCTEST Lab, Columbia MD

FCC ID

**QMNRH-17**

APPLICANT

**NOKIA MOBILE PHONES INC.**

Classification: Non-Broadcast Transmitter held to ear (TNE)  
FCC Rule Part(s): §22(H), §22.901(d), §2  
EUT Type: Dual-Mode Cellular Phone (AMPS/CDMA)  
Model: 2280  
Tx Frequency Range: 824.04MHz – 848.97MHz (AMPS) / 824.70 – 848.31MHz (CDMA)  
Rx Frequency Range: 869.04MHz – 893.97MHz (AMPS) / 869.70 – 893.31MHz (CDMA)  
Max. RF Output Power: 0.415 W ERP AMPS (26.183 dBm) / 0.425 W ERP CDMA (26.283 dBm)  
Emission Designator(s): 40K0F8W / 40K0F1D (AMPS), 1M25F9W (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.

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. 862.*

Alfred Cirwithian  
Vice President Engineering



|                                      |                                     |                          |                     |              |                                 |
|--------------------------------------|-------------------------------------|--------------------------|---------------------|--------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 | PCTEST Engineering Laboratory, Inc. |                          | FCC CERTIFICATION   | NOKIA        | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17 | Page 1 of 23 |                                 |

## TABLE OF CONTENTS

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|                                     |       |
|-------------------------------------|-------|
| 1.1 SCOPE                           | 3     |
| 2.1 INTRODUCTION                    | 4     |
| 3.1 DESCRIPTION OF TESTS            | 5-7   |
| 4.1 EFFECTIVE RADIATED POWER OUTPUT | 8-9   |
| 5.1 RADIATED MEASUREMENTS           | 10-15 |
| 6.1 FREQUENCY STABILITY             | 16-19 |
| 7.1 PLOTS OF EMISSIONS              | 20    |
| 8.1 LIST OF TEST EQUIPMENT          | 21    |
| 9.1 SAMPLE CALCULATIONS             | 22    |
| 10.1 CONCLUSION                     | 23    |

ATTACHMENT A: TEST PLOTS

ATTACHMENT B: FCC ID LABEL / LOCATION

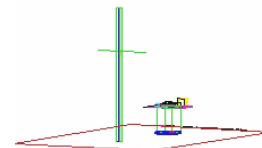
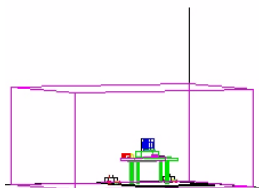
ATTACHMENT C: TEST SETUP PHOTOGRAPHS

ATTACHMENT D: EXTERNAL PHOTOGRAPHS

ATTACHMENT E: INTERNAL PHOTOGRAPHS

|                                      |                                                                                     |                          |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
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# MEASUREMENT REPORT



## 1.1 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.

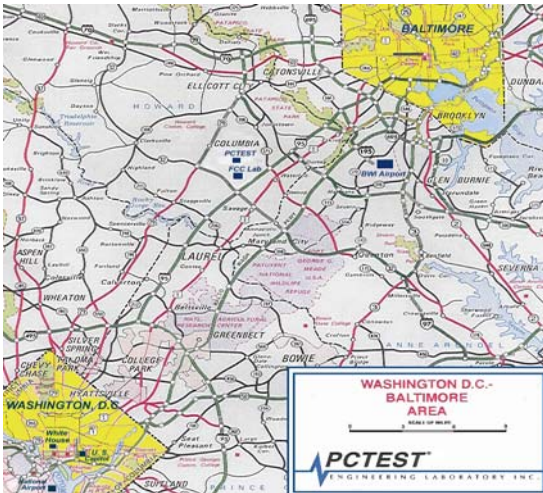
## §2.1033 General Information

|                        |                                                           |
|------------------------|-----------------------------------------------------------|
| <b>Applicant Name:</b> | <b>NOKIA MOBILE PHONES INC.</b>                           |
| <b>Address:</b>        | <b>12278 Scripps Summit Drive<br/>San Diego, CA 92131</b> |
| <b>Attention:</b>      | <b>Dan Laramie, Senior EMC Engineer</b>                   |

- FCC ID: **QMNRH-17**
- Quantity: Quantity production is planned
- Emission Designators: 40K0F8W / 40K0F1D (AMPS), 1M25F9W (CDMA)
- Tx Freq. Range: 824.04 – 848.97 MHz (AMPS)  
824.70 – 848.31 MHz (CDMA)
- Rx Freq. Range: 869.04 – 893.97 MHz (AMPS)  
869.70 – 893.31 MHz (CDMA)
- Max. Power Rating: 0.415 W ERP AMPS (26.183 dBm)  
0.425 W ERP CDMA (26.283 dBm)
- FCC Classification(s): Non-Broadcast Transmitter held to ear (TNE)
- Equipment (EUT) Type: Dual-Mode Cellular Phone (AMPS/CDMA)
- Modulation(s): AMPS / CDMA
- Frequency Tolerance:  $\pm 0.00025\%$  (2.5 ppm)
- FCC Rule Part(s): §22(H), §22.901(d), §2
- Dates of Tests: November 21-22, 2002
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 22.221121631.QMN

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## 2.1 INTRODUCTION



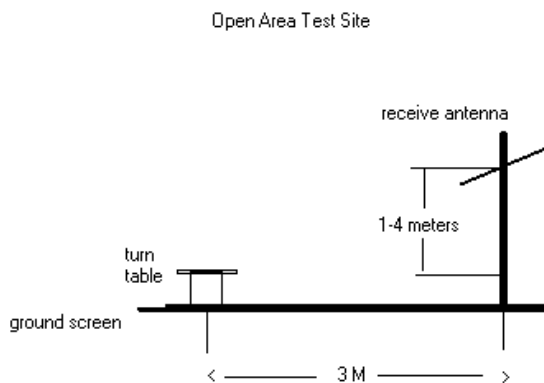
**Figure 1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area.**

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 a 3-meter test range (see Figure2). The equipment under test is placed on a wooden turntable 3-meters from the receive antenna.

The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic antenna are taken into consideration.



**Figure 2. Diagram of 3-meter outdoor test range**

|                                             |                                        |                                 |                                        |
|---------------------------------------------|----------------------------------------|---------------------------------|----------------------------------------|
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| Page 4 of 23                                |                                        |                                 |                                        |

## 3.1 DESCRIPTION OF TESTS

### 3.2 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.

### 3.3 Audio Low Pass Filter Frequency Response

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.

### 3.4 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 3000Hz), 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. Measurements were performed for ST, SAT, and wide-band data modulations. The corresponding results are shown herein.

Note: ST, SAT, & Wide-Band data were internally generated by the EUT.

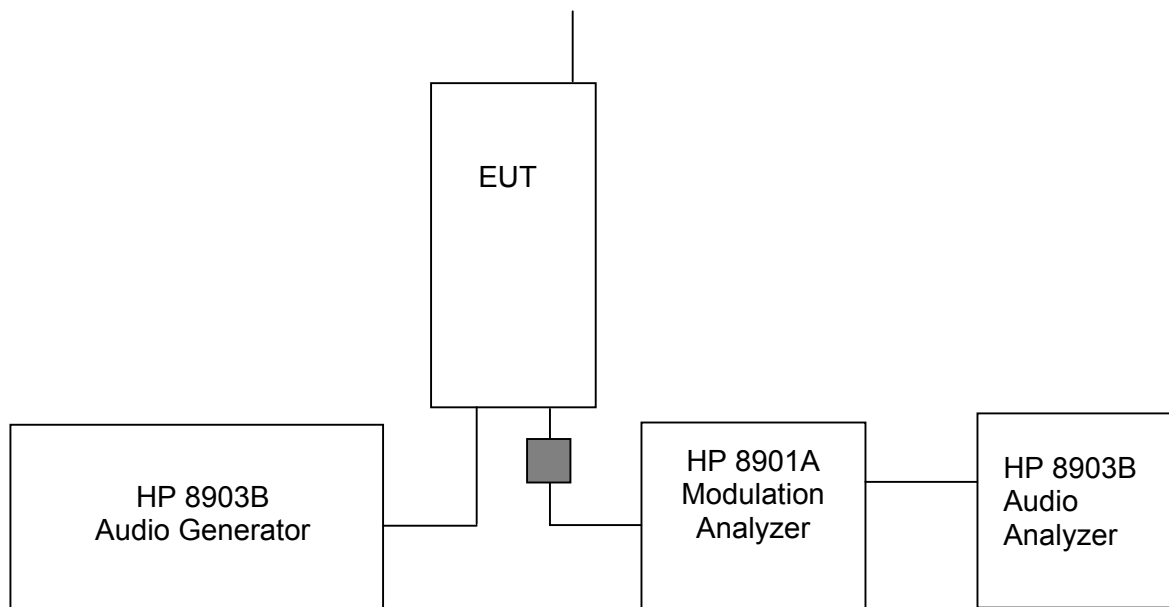


Fig. 3. Transmitter Audio Frequency & Tone Modulation Test Setup.

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

### 3.5 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:

- 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.
- 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.
- 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.

### 3.6 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 provided 50% modulation.

At the input terminals of the spectrum analyzer, an isolator (RF circulator with on 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 bandpass filter insertion loss to be calibrated.

### 3.7 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 1.6 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.

### 3.8 Radiation Spurious and Harmonic Emissions

Radiation and harmonic emissions are measured outdoors at our 3-meter test range. The equipment under test is placed on a wooden turntable 3-meters from the receive antenna. The receive antenna height and turntable rotations were adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator with the level of the signal generator being adjusted to obtain the same receive spectrum analyzer reading. This level is recorded. For readings above 1GHz, the above procedure is repeated using horn antennas and the difference between the gain of the horn and an isotropic or dipole antenna are taken into consideration.

|                                      |                                                                                     |                          |                                                                                       |                                 |
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## 4.0 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  $\pm 0.00025$  ( $\pm 2.5$  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 are 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 re-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.**

|                                             |                                                                                     |                                 |                                                                                       |                                        |
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## 4.1 Test Data

### 4.2 Effective Radiated Power Output

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

| Freq. Tuned<br>(MHz) | REF.<br>LEVEL<br>(dBm) | POL<br>(H/V) | ERP<br>(W) | ERP<br>(dBm) |
|----------------------|------------------------|--------------|------------|--------------|
| 824.04               | -35.700                | V            | 0.004      | 5.573        |
| 836.49               | -35.500                | V            | 0.004      | 5.929        |
| 848.97               | -35.400                | V            | 0.004      | 6.185        |

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

| Freq. Tuned<br>(MHz) | REF.<br>LEVEL<br>(dBm) | POL<br>(H/V) | ERP<br>(W) | ERP<br>(dBm) | BATTERY  |
|----------------------|------------------------|--------------|------------|--------------|----------|
| 824.04               | -15.700                | V            | 0.36085    | 25.573       | Standard |
| 836.49               | -15.500                | V            | 0.39201    | 25.933       | Standard |
| 848.97               | -15.400                | V            | 0.41524    | 26.183       | Standard |

Note: Standard batteries are the only options for this phone

#### **NOTES:**

Effective Radiated Power Output Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

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| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 8 of 23                    |



## 4.1 Test Data (Continued)

### 4.3 Effective Radiated Power Output

#### A. POWER: High (CDMA Mode)

| Freq. Tuned<br>(MHz) | REF.<br>LEVEL<br>(dBm) | POL<br>(H/V) | ERP<br>(W) | ERP<br>(dBm) | BATTERY  |
|----------------------|------------------------|--------------|------------|--------------|----------|
| 824.70               | -15.800                | V            | 0.35260    | 25.473       | Standard |
| 836.49               | -15.500                | V            | 0.39199    | 25.933       | Standard |
| 848.31               | -15.300                | V            | 0.42489    | 26.283       | Standard |

Note: Standard batteries are the only options for this phone

#### NOTES:

Effective Radiated Power Output Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001.

The EUT was placed on a wooden turn table 3-meters from the receive antenna. The receive antenna height and turntable rotation was adjusted for the highest reading on the receive spectrum analyzer. A half-wave dipole was substituted in place of the EUT. This dipole antenna was driven by a signal generator and the level of the signal generator was adjusted to obtain the same receive spectrum analyzer reading. The conducted power at the terminals of the dipole is measured. The ERP is recorded.

|                                      |                                                                                     |                          |                                                                                       |                                 |
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## 5.1 Test Data

### 5.2 A MPS Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 824.04 MHz  
 CHANNEL: 0991 (Low)  
 MEASURED OUTPUT POWER: 26.183 dBm = 0.415 W  
 MODULATION SIGNAL: FM (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.18 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1648.08        | -38.18                                   | 6.10                                   | -32.08                                 | V            | 58.3  |
| 2472.12        | -50.08                                   | 6.70                                   | -43.38                                 | V            | 69.6  |
| 3296.16        | -54.18                                   | 6.80                                   | -47.38                                 | V            | 73.6  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

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## 5.1 Test Data (Continued)

### 5.3 A MPS Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 836.49 MHz  
 CHANNEL: 0383 (Mid)  
 MEASURED OUTPUT POWER: 26.183 dBm = 0.415 W  
 MODULATION SIGNAL: FM (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.18 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1672.98        | -39.88                                   | 6.10                                   | -33.78                                 | V            | 60.0  |
| 2509.47        | -49.08                                   | 6.70                                   | -42.38                                 | V            | 68.6  |
| 3345.96        | -53.98                                   | 6.80                                   | -47.18                                 | V            | 73.4  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

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## 5.1 Test Data (Continued)

### 5.4 A MPS Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 848.97 MHz  
 CHANNEL: 0799 (High)  
 MEASURED OUTPUT POWER: 26.183 dBm = 0.415 W  
 MODULATION SIGNAL: FM (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.18 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1697.94        | -40.08                                   | 6.10                                   | -33.98                                 | V            | 60.2  |
| 2546.91        | -48.88                                   | 6.70                                   | -42.18                                 | V            | 68.4  |
| 3395.88        | -55.78                                   | 6.80                                   | -48.98                                 | V            | 75.2  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

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## 5.1 Test Data (Continued)

### 5.5 CELLULAR CDM A Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 824.70 MHz  
 CHANNEL: 1013 (Low)  
 MEASURED OUTPUT POWER: 26.283 dBm = 0.425 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.28 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1649.40        | -38.48                                   | 6.10                                   | -32.38                                 | V            | 58.7  |
| 2474.10        | -49.78                                   | 6.70                                   | -43.08                                 | V            | 69.4  |
| 3298.80        | -54.48                                   | 6.80                                   | -47.68                                 | V            | 74.0  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

|                                      |                                                                                     |                          |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 13 of 23                   |

## 5.1 Test Data (Continued)

### 5.6 CELLULAR CDM A Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 836.49 MHz  
 CHANNEL: 0363 (Mid)  
 MEASURED OUTPUT POWER: 26.283 dBm = 0.425 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.28 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1672.98        | -39.48                                   | 6.10                                   | -33.38                                 | V            | 59.7  |
| 2509.47        | -49.68                                   | 6.70                                   | -42.98                                 | V            | 69.3  |
| 3345.96        | -54.48                                   | 6.80                                   | -47.68                                 | V            | 74.0  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

|                                      |                                                                                     |                          |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 14 of 23                   |

## 5.1 Test Data (Continued)

### 5.7 CELLULAR CDM A Radiated Measurements

#### Field Strength of SPURIOUS Radiation

OPERATING FREQUENCY: 848.31 MHz  
 CHANNEL: 0777 (High)  
 MEASURED OUTPUT POWER: 26.283 dBm = 0.425 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.28 dBc

| FREQ.<br>(MHz) | LEVEL @<br>ANTENNA<br>TERMINALS<br>(dBm) | SUBSTITUTE<br>ANTENNA<br>GAIN<br>(dBi) | CORRECT<br>GENERATOR<br>LEVEL<br>(dBm) | POL<br>(H/V) | (dBc) |
|----------------|------------------------------------------|----------------------------------------|----------------------------------------|--------------|-------|
| 1696.62        | -39.58                                   | 6.10                                   | -33.48                                 | V            | 59.8  |
| 2544.93        | -48.88                                   | 6.70                                   | -42.18                                 | V            | 68.5  |
| 3393.24        | -55.78                                   | 6.80                                   | -48.98                                 | V            | 75.3  |
|                |                                          |                                        |                                        |              |       |

#### NOTES:

Radiated Spurious Emission Measurements by Substitution Method  
according to ANSI/TIA/EIA-603-A-2001, Aug. 15, 2001:

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

|                                      |                                                                                     |                          |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 15 of 23                   |



## 6.1 Test Data

### 6.2 FREQUENCY STABILITY (AMPS)

OPERATING FREQUENCY: 836,490,004 Hz

CHANNEL: 383

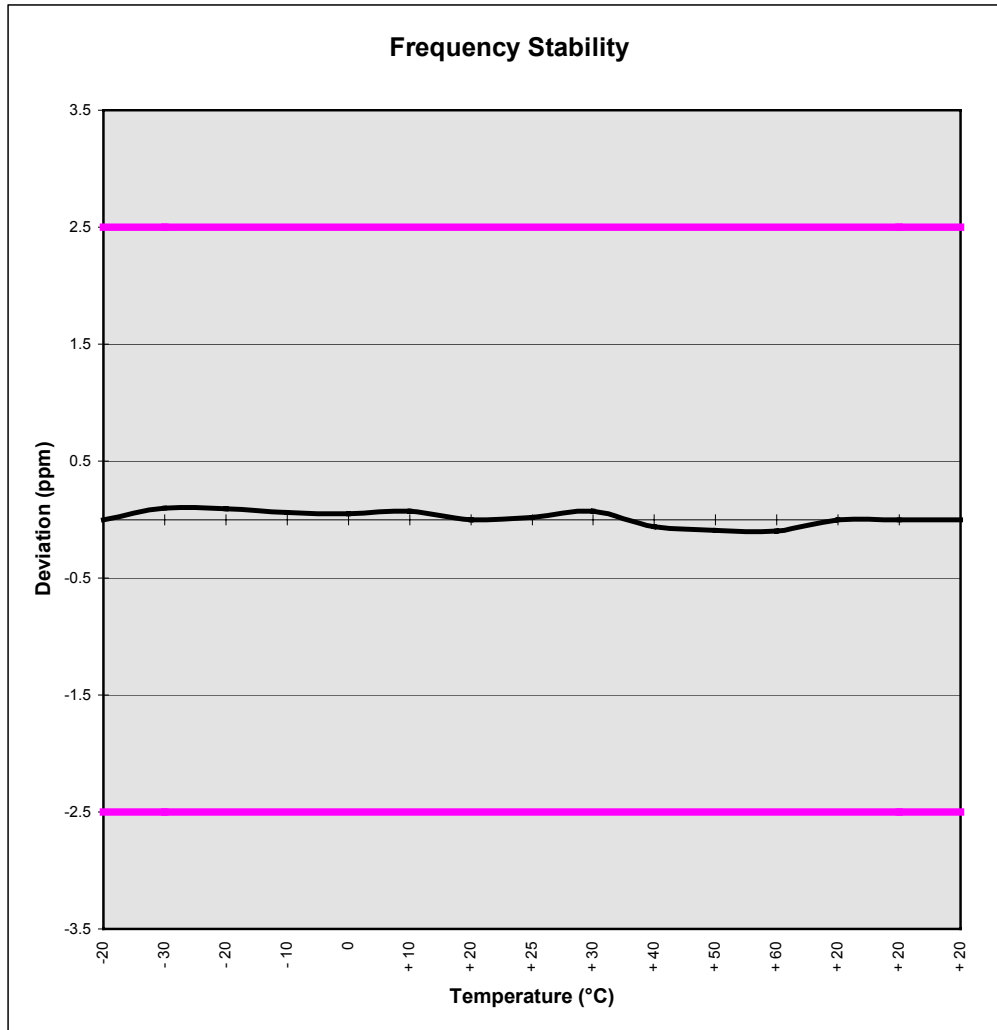
REFERENCE VOLTAGE: 3.7 VDC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE<br>(%) | POWER<br>(VDC) | TEMP<br>(°C) | FREQ.<br>(Hz) | Deviation<br>(%) |
|----------------|----------------|--------------|---------------|------------------|
| 100 %          | 3.70           | + 20 (Ref)   | 836,490,004   | 0.000000         |
| 100 %          |                | - 30         | 836,489,920   | 0.000010         |
| 100 %          |                | - 20         | 836,489,929   | 0.000009         |
| 100 %          |                | - 10         | 836,489,954   | 0.000006         |
| 100 %          |                | 0            | 836,489,962   | 0.000005         |
| 100 %          |                | + 10         | 836,489,945   | 0.000007         |
| 100 %          |                | + 20         | 836,490,004   | 0.000000         |
| 100 %          |                | + 25         | 836,489,987   | 0.000002         |
| 100 %          |                | + 30         | 836,489,945   | 0.000007         |
| 100 %          |                | + 40         | 836,490,054   | -0.000006        |
| 100 %          |                | + 50         | 836,490,079   | -0.000009        |
| 100 %          |                | + 60         | 836,490,088   | -0.000010        |
| 85 %           | 3.17           | + 20         | 836,490,004   | 0.000000         |
| 115 %          | 4.26           | + 20         | 836,490,004   | 0.000000         |
| BATT. ENDPOINT | 2.95           | + 20         | 836,490,004   | 0.000000         |

## 6.1 Test Data (Continued)

### 6.3 FREQUENCY STABILITY (AMPS)



|                                      |                                                                                                              |                          |                                                                                       |                                 |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  <b>FCC CERTIFICATION</b> |                          |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                                              | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 17 of 23                   |

## 6.1 Test Data (Continued)

### 6.4 FREQUENCY STABILITY (CDMA)

OPERATING FREQUENCY: 836,520,000 Hz

CHANNEL: 384

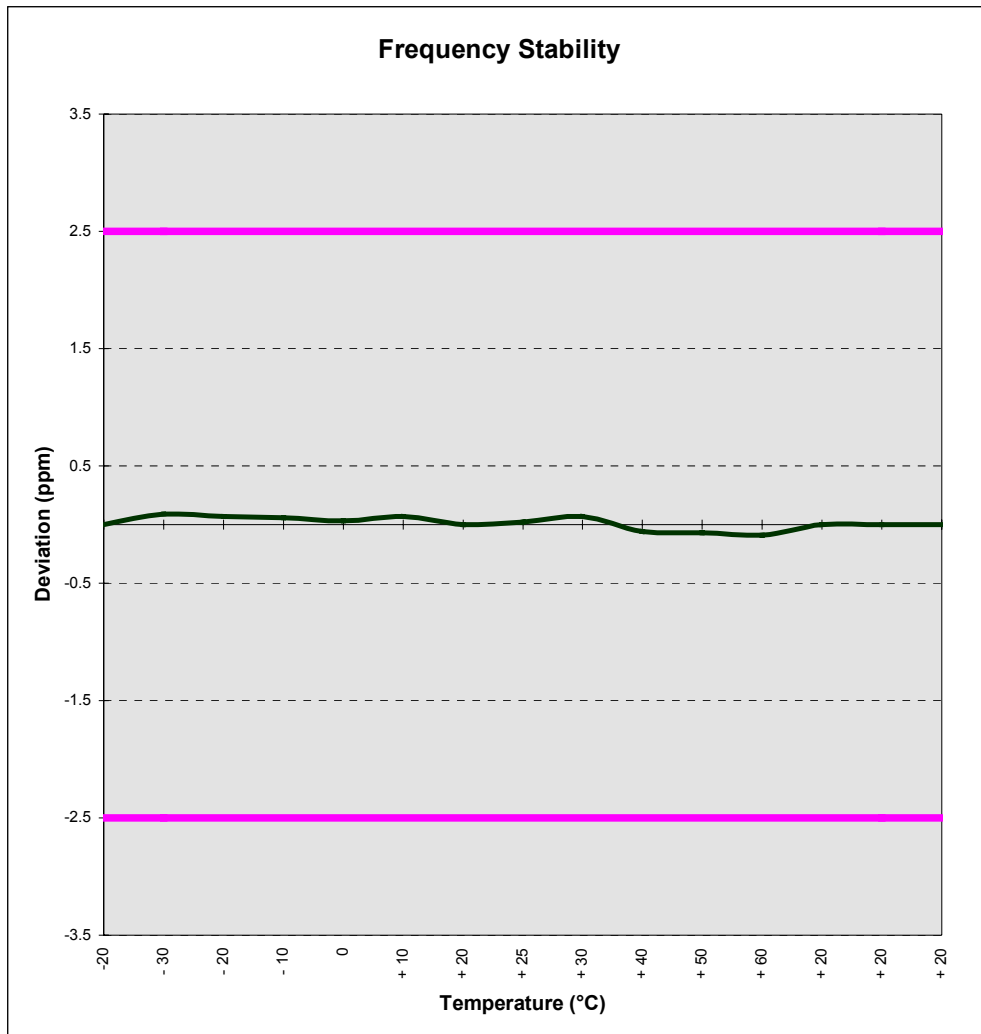
REFERENCE VOLTAGE: 3.7 VDC

DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

| VOLTAGE<br>(%) | POWER<br>(VDC) | TEMP<br>(°C) | FREQ.<br>(Hz) | Deviation<br>(%) |
|----------------|----------------|--------------|---------------|------------------|
| 100 %          | 3.70           | + 20 (Ref)   | 836,520,000   | 0.000000         |
| 100 %          |                | - 30         | 836,519,925   | 0.000009         |
| 100 %          |                | - 20         | 836,519,941   | 0.000007         |
| 100 %          |                | - 10         | 836,519,950   | 0.000006         |
| 100 %          |                | 0            | 836,519,975   | 0.000003         |
| 100 %          |                | + 10         | 836,519,941   | 0.000007         |
| 100 %          |                | + 20         | 836,520,000   | 0.000000         |
| 100 %          |                | + 25         | 836,519,983   | 0.000002         |
| 100 %          |                | + 30         | 836,519,941   | 0.000007         |
| 100 %          |                | + 40         | 836,520,050   | -0.000006        |
| 100 %          |                | + 50         | 836,520,059   | -0.000007        |
| 100 %          |                | + 60         | 836,520,075   | -0.000009        |
| 85 %           | 3.17           | + 20         | 836,520,000   | 0.000000         |
| 115 %          | 4.26           | + 20         | 836,520,000   | 0.000000         |
| BATT. ENDPOINT | 2.95           | + 20         | 836,520,000   | 0.000000         |

## 6.1 Test Data (Continued)

### 6.5 FREQUENCY STABILITY (CDMA)



|                                      |                                                                                                              |                          |                     |                                 |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------|---------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  <b>FCC CERTIFICATION</b> |                          | <b>NOKIA</b>        | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                                              | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17 | Page 19 of 23                   |

## 7.1 PLOT(S) OF EMISSIONS

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(SEE ATTACHMENT A)

|                                      |                                                                                     |                          |                                                                                       |                                 |
|--------------------------------------|-------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 20 of 23                   |

## 8.1 TEST EQUIPMENT

| Type                              | Model                                                                       | Cal. Due Date | S/N                    |
|-----------------------------------|-----------------------------------------------------------------------------|---------------|------------------------|
| Microwave Spectrum Analyzer       | HP 8566B (100Hz-22GHz)                                                      | 08/15/03      | 3638A08713             |
| Microwave Spectrum Analyzer       | HP 8566B (100Hz-22GHz)                                                      | 04/17/03      | 2542A11898             |
| Spectrum Analyzer/Tracking Gen.   | HP 8591A (100Hz-1.8GHz)                                                     | 08/10/03      | 3144A02458             |
| Signal Generator*                 | HP 8640B (500Hz-1GHz)                                                       | 06/03/03      | 2232A19558             |
| Signal Generator*                 | HP 8640B (500Hz-1GHz)                                                       | 06/03/03      | 1851A09816             |
| Signal Generator*                 | Rohde & Schwarz (0.1-1000MHz)                                               | 09/11/03      | 894215/012             |
| Ailtech/Eaton Receiver            | NM 37/57A-SL (30-1000MHz)                                                   | 04/12/03      | 0792-03271             |
| Ailtech/Eaton Receiver            | NM 37/57A (30-1000MHz)                                                      | 03/11/03      | 0805-03334             |
| Ailtech/Eaton Receiver            | NM 17/27A (0.1-32MHz)                                                       | 09/17/03      | 0608-03241             |
| Quasi-Peak Adapter                | HP 85650A                                                                   | 08/15/03      | 2043A00301             |
| Ailtech/Eaton Adapter             | CCA-7 CISPR/ANSI QP Adapter                                                 | 03/11/03      | 0194-04082             |
| Gigatronics Universal Power Meter | 8657A                                                                       |               | 1835256                |
| Gigatronics Power Sensor          | 80701A (0.05-18GHz)                                                         |               | 1833460                |
| Signal Generator                  | HP 8648D (9kHz-4GHz)                                                        |               | 3613A00315             |
| Amplifier Research                | 5S1G4 (5W, 800MHz-4.2GHz)                                                   |               | 22322                  |
| Network Analyzer                  | HP 8753E (30kHz-3GHz)                                                       |               | JP38020182             |
| Audio Analyzer                    | HP 8903B                                                                    |               | 3011A09025             |
| Modulation Analyzer               | HP 8901A                                                                    |               | 2432A03467             |
| Power Meter                       | HP 437B                                                                     |               | 3125U24437             |
| Power Sensor                      | HP 8482H (30μW-3W)                                                          |               | 2237A02084             |
| Harmonic/Flicker Test System      | HP 6841A (IEC 555-2/3)                                                      |               | 3531A00115             |
| Broadband Amplifier (2)           | HP 8447D                                                                    |               | 1145A00470, 1937A03348 |
| Broadband Amplifier               | HP 8447F                                                                    |               | 2443A03784             |
| Horn Antenna                      | EMCO Model 3115 (1-18GHz)                                                   |               | 9704-5182              |
| Horn Antenna                      | EMCO Model 3115 (1-18GHz)                                                   |               | 9205-3874              |
| Horn Antenna                      | EMCO Model 3116 (18-40GHz)                                                  |               | 9203-2178              |
| Biconical Antenna (4)             | Eaton 94455/Eaton 94455-1/Singer 94455-1/Compliance Design 1295, 1332, 0355 |               | 0608, 1103, 1104       |
| Log-Spiral Antenna (3)            | Ailtech/Eaton 93490-1                                                       |               |                        |
| Roberts Dipoles                   | Compliance Design (1 set)                                                   |               |                        |
| Ailtech Dipoles                   | DM-105A (1 set)                                                             |               | 33448-111              |
| EMCO LISN (6)                     | 3816/2                                                                      |               | 1079                   |
| Microwave Preamplifier 40dB Gain  | HP 83017A (0.5-26.5GHz)                                                     |               | 3123A00181             |
| Microwave Cables                  | MicroCoax (1.0-26.5GHz)                                                     |               |                        |
| Ailtech/Eaton Receiver            | NM37/57A-SL                                                                 |               | 0792-03271             |
| Spectrum Analyzer                 | HP 8594A                                                                    |               | 3051A00187             |
| Spectrum Analyzer (2)             | HP 8591A                                                                    |               | 3034A01395, 3108A02053 |
| Microwave Survey Meter            | Holaday Model 1501 (2.450GHz)                                               |               | 80931                  |
| Digital Thermometer               | Extech Instruments 421305                                                   |               | 426966                 |
| Attenuator                        | HP 8495A (0-70dB) DC-4GHz                                                   |               |                        |
| Bi-Directional Coax Coupler       | Narda 3020A (50-1000MHz)                                                    |               |                        |
| Shielded Screen Room              | RF Lindgren Model 26-2/2-0                                                  |               | 6710 (PCT270)          |
| Shielded Semi-Anechoic Chamber    | Ray Proof Model S81                                                         |               | R2437 (PCT278)         |
| Environmental Chamber             | Associated Systems Model 1025 (Temperature/Humidity)                        |               | PCT285                 |

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

|                                      |                                                                                                              |                          |                                                                                       |                                 |
|--------------------------------------|--------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------|---------------------------------|
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| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                                              | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 21 of 23                   |

## 9.1 SAMPLE CALCULATIONS

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### A. Emission Designator

#### **Emission Designator = 1M25F9W**

CDMA BW = 1.25 MHz

F = Frequency Modulation

9 = Composite Digital Info

W = Combination (Audio/Data)

(Measured at the 99.75% power bandwidth)

#### **Emission Designator = 40K0F8W**

Calculation: Voice + SAT

Modulation: Voice is 2.5 kHz and SAT is 6 kHz – Maximum modulation is M = 6 kHz

Deviation: Voice is 12 kHz and SAT is 2 kHz – Maximum deviation is D = 12 + 2 = 14 kHz

Bn = 2xM + 2xDK with K = 1

Bn = 40 kHz

Calculation: Signaling Tone (ST) + SAT

Modulation: ST is 10 kHz and SAT is 6 kHz – Maximum modulation is M = 10 kHz

Deviation: ST is 8 kHz and SAT is 2 kHz – Maximum deviation is D = 8 + 2 = 10 kHz

Bn = 2xM + 2xDK with K = 1

Bn = 40 kHz

#### **Emission Designator = 40K0F1D**

Calculation: Voice + SAT

Modulation: Wideband Data is 10 kHz and SAT is 6 kHz – Maximum modulation is M = 10 kHz

Deviation: Wideband Data is 8 kHz and SAT is 2 kHz – Maximum deviation is D = 8 + 2 = 10 kHz

Bn = 2xM + 2xDK with K = 1

Bn = 40 kHz

|                                      |                                                                                     |                          |                                                                                       |                                 |
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| PCTEST™ PT. 22REPORT                 |  | FCC CERTIFICATION        |  | Reviewed By:<br>Quality Manager |
| Test Report S/N:<br>22.221121631.QMN | Test Dates:<br>Nov. 21-22, 2002                                                     | Phone Type:<br>Dual-Mode | FCC ID:<br>QMNRH-17                                                                   | Page 22 of 23                   |

## 10.1 CONCLUSION

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The data collected shows that the **NOKIA Dual-Mode Cellular Phone (AMPS/CDMA) FCC ID: QMNRH-17** complies with all the requirements of Parts 2 and 22 of the FCC rules.

|                                             |                                                                                     |                                 |                                                                                       |                                        |
|---------------------------------------------|-------------------------------------------------------------------------------------|---------------------------------|---------------------------------------------------------------------------------------|----------------------------------------|
| <b>PCTEST™ PT. 22REPORT</b>                 |  | <b>FCC CERTIFICATION</b>        |  | <b>Reviewed By:</b><br>Quality Manager |
| <b>Test Report S/N:</b><br>22.221121631.QMN | <b>Test Dates:</b><br>Nov. 21-22, 2002                                              | <b>Phone Type:</b><br>Dual-Mode | <b>FCC ID:</b><br>QMNRH-17                                                            | Page 23 of 23                          |