

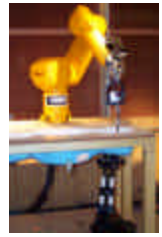


# PCTEST Engineering Laboratory, Inc.

6660-B Dobbin Road · Columbia, MD 21045 · U.S.A.

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<http://www.pctestlab.com>



## CERTIFICATE OF COMPLIANCE FCC Part 22 Certification

**NOKIA MOBILE PHONES INC.**  
12278 Scripps Summit Drive  
San Diego, CA 92131  
Attn: Mary Washington, Senior Product  
Certification Engineer

Dates of Tests: July 15-18, 2003  
Test Report S/N: 22.230715334-R1.QMN  
Test Site: PCTEST Lab, Columbia MD

FCC ID

**QMNRH-48**

APPLICANT

**NOKIA MOBILE PHONES INC.**

Classification:	Licensed Non-Broadcast Transmitter Held to Ear (TNE)
FCC Rule Part(s):	§22.901(d); §2
EUT Type:	Single-Mode CDMA Phone
Model:	3105
Tx Frequency Range:	824.70 – 848.31MHz (CDMA)
Rx Frequency Range:	869.70 – 893.31MHz (CDMA)
Max. RF Output Power:	0.399W ERP CDMA (26.013 dBm)
Emission Designator(s):	1M25F9W (CDMA)
Test Device Serial No.:	Identical Prototype [S/N: 072/02005710]

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



**2 3 0 7 1 5 3 3 4 - R 1 . Q M N**

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ATTACHMENT A: TEST PLOTS

ATTACHMENT B: FCC ID LABEL / LOCATION

ATTACHMENT C: TEST SETUP PHOTOGRAPHS

ATTACHMENT D: EXTERNAL PHOTOGRAPHS

ATTACHMENT E: INTERNAL PHOTOGRAPHS

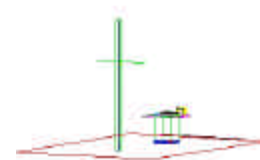
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# MEASUREMENT REPORT



## 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

**Applicant Name:** NOKIA MOBILE PHONES INC.  
**Address:** 12278 Scripps Summit Drive  
San Diego, CA 92131  
**Attention:** Mary Washington,  
Senior Product Certification Engineer

- FCC ID: QMNRH-48
- Quantity: Quantity production is planned
- Emission Designators: 1M25F9W (CDMA)
- Tx Freq. Range: 824.70 – 848.31MHz (CDMA)
- Rx Freq. Range: 869.70 – 893.31MHz (CDMA)
- Max. Power Rating: 0.399W ERP CDMA (26.013 dBm)
- FCC Classification(s): Licensed Non-Broadcast Transmitter Held to Ear (TNE)
- Equipment (EUT) Type: Single-Mode CDMA Phone
- Modulation(s): CDMA
- Frequency Tolerance:  $\pm 0.00025\%$  (2.5 ppm)
- FCC Rule Part(s): § 22.901(d)
- Dates of Tests: July 15-18, 2003
- Place of Tests: PCTEST Lab, Columbia, MD U.S.A.
- Test Report S/N: 22/24.230715334-R1.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.

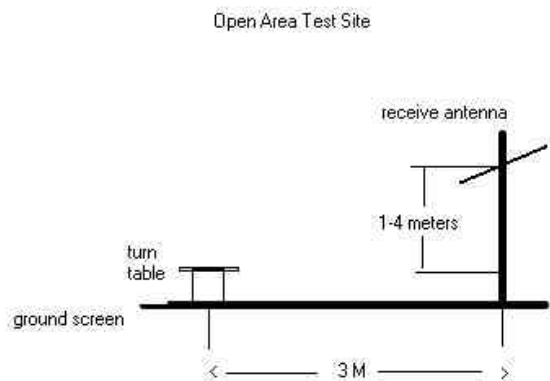




Figure 2. Diagram of 3-meter outdoor test range

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## 3.1 DESCRIPTION OF TESTS

### 3.2 Occupied Bandwidth Emission Limits

- (a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log(P)$  dB.
- (b) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.
- (c) The measurement of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

### 3.3 Occupied Bandwidth

The 99% power bandwidth was measured with a calibrated spectrum analyzer.

### 3.4 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.



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

### 3.5 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.

### 3.6 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 measurements are 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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## 5.1 Test Data

### 5.3 Effective Radiated Power Output

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



Freq. Tuned (MHz)	REF. LEVEL (dBm)	POL (H/V)	ERP (W)	ERP (dBm)	BATTERY
824.70	-17.250	V	0.25251	24.023	Standard
835.89	-15.420	V	0.39928	26.013	Standard
848.31	-16.680	V	0.30923	24.903	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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## 7.1 Test Data

### 7.2 CELLULAR CDMA Radiated Measurements

#### Field Strength of SPURIOUS Radiation



OPERATING FREQUENCY: 824.70 MHz  
 CHANNEL: 1013 (Low)  
 MEASURED OUTPUT POWER: 26.013 dBm = 0.399 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.01 dBc

FREQ. (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBd)	CORRECT GENERATOR LEVEL (dBm)	POL (H/V)	(dBc)
1649.40	-64.68	6.10	-58.58	V	84.6
2474.10	-62.78	6.70	-56.08	V	82.1
3298.80	-61.98	6.80	-55.18	V	81.2
4123.50	-63.28	6.50	-56.78	V	82.8

#### 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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## 7.1 Test Data (Continued)

### 7.3 CELLULAR CDMA Radiated Measurements

#### Field Strength of SPURIOUS Radiation



OPERATING FREQUENCY: 836.52 MHz  
 CHANNEL: 384  
 MEASURED OUTPUT POWER: 26.013 dBm = 0.399 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.01 dBc

FREQ. (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBd)	CORRECT GENERATOR LEVEL (dBm)	POL (H/V)	(dBc)
1673.04	-63.48	6.10	-57.38	V	83.4
2509.56	-61.48	6.70	-54.78	V	80.8
3346.08	-61.98	6.80	-55.18	V	81.2
4182.60	-61.28	6.50	-54.78	V	80.8

#### 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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## 7.1 Test Data (Continued)

### 7.4 CELLULAR CDMA Radiated Measurements

#### Field Strength of SPURIOUS Radiation



OPERATING FREQUENCY: 848.31 MHz  
 CHANNEL: 0777 (High)  
 MEASURED OUTPUT POWER: 26.013 dBm = 0.399 W  
 MODULATION SIGNAL: CDMA (Internal)  
 DISTANCE: 3 meters  
 LIMIT:  $43 + 10 \log_{10} (W) =$  39.01 dBc

FREQ. (MHz)	LEVEL @ ANTENNA TERMINALS (dBm)	SUBSTITUTE ANTENNA GAIN (dBd)	CORRECT GENERATOR LEVEL (dBm)	POL (H/V)	(dBc)
1696.62	-64.38	6.10	-58.28	V	84.3
2544.93	-62.58	6.70	-55.88	V	81.9
3393.24	-63.98	6.80	-57.18	V	83.2
4241.55	-62.08	6.50	-55.58	V	81.6

#### 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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## 8.1 Test Data

### 8.2 FREQUENCY STABILITY (CDMA 800)

OPERATING FREQUENCY: 836,520,005 Hz

CHANNEL: 384

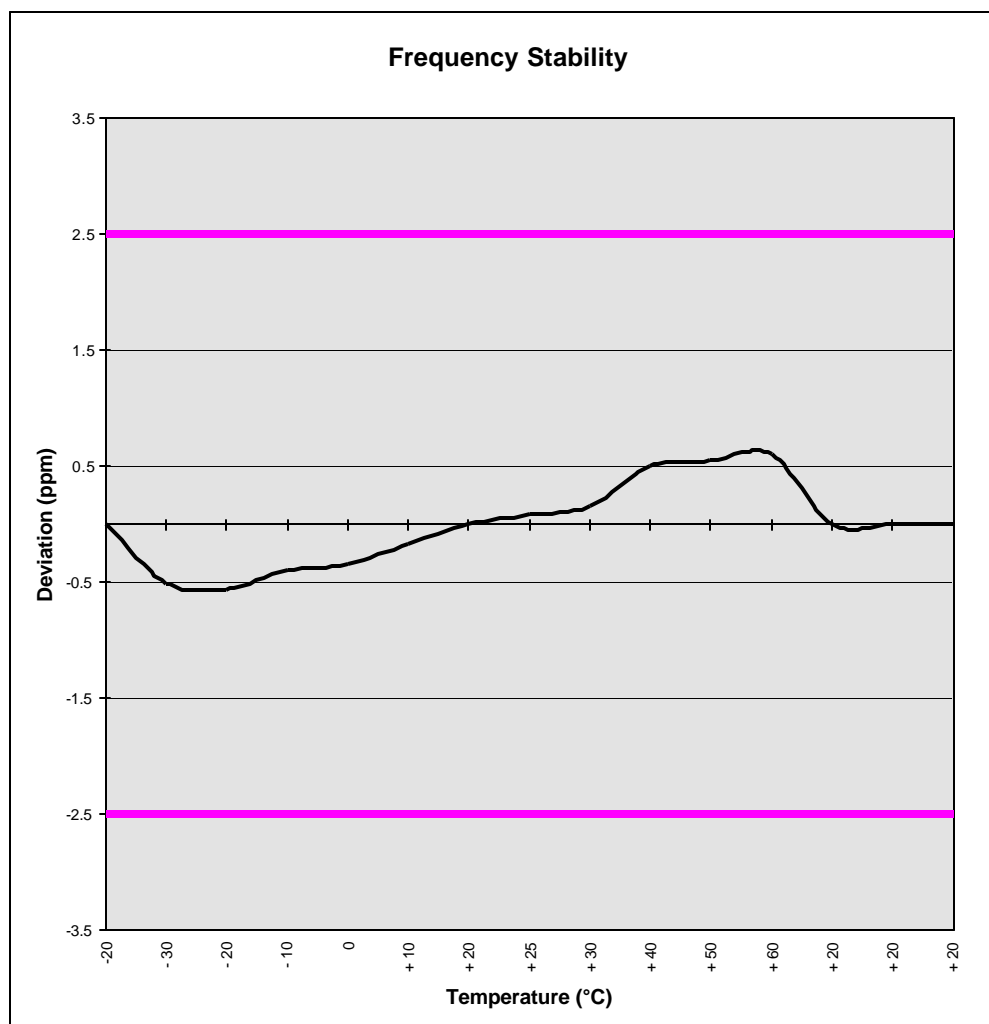
REFERENCE VOLTAGE: 3.7 VDC



DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQ. (Hz)	Deviation (%)
100 %	3.70	+ 20 (Ref)	836,520,005	0.000000
100 %		- 30	836,520,432	-0.000051
100 %		- 20	836,520,473	-0.000056
100 %		- 10	836,520,340	-0.000040
100 %		0	836,520,298	-0.000035
100 %		+ 10	836,520,147	-0.000017
100 %		+ 20	836,520,005	0.000000
100 %		+ 25	836,519,938	0.000008
100 %		+ 30	836,519,880	0.000015
100 %		+ 40	836,519,587	0.000050
100 %		+ 50	836,519,545	0.000055
100 %		+ 60	836,519,503	0.000060
85 %	3.15	+ 20	836,520,005	0.000000
115 %	4.26	+ 20	836,520,005	0.000000
BATT. ENDPOINT	3.02	+ 20	836,520,005	0.000000

## 8.1 Test Data (Continued)

### 8.3 FREQUENCY STABILITY (CDMA 800 MHz)





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## 7.1 PLOT(S) OF EMISSIONS

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(SEE ATTACHMENT A)

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## 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)	04/17/04	2542A11898
Spectrum Analyzer/Tracking Gen.	HP 8591A (100Hz-1.8GHz)	08/10/03	3144A02458
Signal Generator	HP 8640B (500Hz-1GHz)	06/03/04	2232A19558
Signal Generator	HP 8640B (500Hz-1GHz)	06/03/04	1851A09816
Signal Generator	Rohde & Schwarz (0.1-1000MHz)	09/11/03	894215/012
Alitech/Eaton Receiver	NM 37/57A-SL (30-1000MHz)	04/12/04	0792-03271
Alitech/Eaton Receiver	NM 37/57A (30-1000MHz)	03/11/04	0805-03334
Alitech/Eaton Receiver	NM17/27A (0.1-32MHz)	09/17/03	0608-03241
Quasi-Peak Adapter	HP 85650A	08/15/03	2043A00301
Alitech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/04	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	5SIG4 (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	
Log-Spiral Antenna (3)	Alitech/Eaton 93490-1	0608, 1103, 1104	
Roberts Dipoles	Compliance Design (1 set)		
Alitech 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)		
Alitech/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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## 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)

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## 10.1 CONCLUSION

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The data collected shows that the **NOKIA Single-Mode CDMA Phone FCC ID: QMNRH-48** complies with all the requirements of Part 22 of the FCC rules.

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