



Engineering and Testing for EMC and Safety Compliance

DIRECT SEQUENCE SPREAD SPECTRUM TRANSMITTER

**Nokia wireless Business Communications
P.O. Box 88
Tieteenkatu 1
Tampere, FIN-33721, Finland**

**MODEL: Nokia C110 and C111
FCC ID: ORE-C110-C111**

April 11, 2000

This report concerns (check one): Original Grant: X Class II Change:
Equipment Type: PCMCIA Board
Deferred grant requested per 47 CFR 0.457 (d) (1) (ii)? Yes: No: X If yes, defer until: _____ <i>Date</i>
Company name agrees to notify the Commission by: _____ (date) of the intended date of announcement of the product so that the grant can be issued on that date.
Transition Rules Request per 15.37? Yes: No: X If no, assumed Part 15, subpart B for unintentional radiators - the new 47 CFR [10-1-90 Edition] provision..

REPORT PREPARED BY:

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Rhein Tech Laboratories, Inc.

Work Order Number: 2000156

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1.0 GENERAL INFORMATION

The following Application for RSS210 Canadian Certification for a Direct Sequence Spread Spectrum Transmitter is prepared on behalf of Nokia Wireless Business Communications in accordance with Part 15.247 of the Federal Communications Commissions rules and regulations. The Equipment Under Test (EUT) was the Nokia C110, FCC ID: ORE-C110-C111. The test results reported in this document relate only to the item that was tested.

All measurements contained in this Application were conducted in accordance with ANSI C63.4 Methods of Measurement of Radio Noise Emissions, 1992. The instrumentation utilized for the measurements conforms to the ANSI C63.4 standard for EMI and Field Strength Instrumentation. Some accessories are used to increase sensitivity and prevent overloading of the measuring instrument. These are explained in the appendix of this report. Calibration checks are performed regularly on the instruments, and all accessories including the high pass filter, preamplifier and cables.

All radiated emissions measurement were performed manually at Rhein Tech, Incorporated. The radiated emissions measurements required by the rules were performed on the three meter, open field, test range maintained by Rhein Tech Laboratories, Inc., 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. Complete description and site attenuation measurement data have been placed on file with the Federal Communications Commission. The power line conducted emission measurements were performed in a shielded enclosure also located at the Herndon, Virginia facility. The FCC accepts Rhein Tech Laboratories, Inc. as a facility available to do measurement work for others on a contractual basis.



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1.1 TEST METHODOLOGY

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 1992. Radiated testing was performed at an antenna to EUT distance of 3 meters.

CONDUCTED EMISSIONS MEASUREMENTS

The power line conducted emission measurements were performed in a Series 81 type shielded enclosure manufactured by Rayproof. The EUT was assembled on a wooden table 80 centimeters high. Power was fed to the EUT through a 50 ohm / 50 microhenry Line Impedance Stabilization Network (EUT LISN). The EUT LISN was fed power through an A.C. filter box on the outside of the shielded enclosure. The filter box and EUT LISN housing are bonded to the ground plane of the shielded enclosure. A second LISN, the peripheral LISN, provides isolation for the EUT test peripherals. This peripheral LISN was also fed A.C. power. A metal power outlet box, which is bonded to the ground plane and electrically connected to the peripheral LISN, powers the EUT host peripherals.

The spectrum analyzer was connected to the A.C. line through an isolation transformer. The 50-ohm output of the EUT LISN was connected to the spectrum analyzer input through a Solar 400 kHz high-pass filter. The filter is used to prevent overload of the spectrum analyzer from noise below 400 kHz. Conducted emission levels were measured on each current-carrying line with the spectrum analyzer operating in the CISPR quasi-peak mode (or peak mode if applicable). The analyzer's 6 dB bandwidth was set to 9 kHz. No video filter less than 10 times the resolution bandwidth was used. Average measurements are performed in linear mode using a 10 kHz resolution bandwidth, a 1 Hz video bandwidth, and by increasing the sweep time in order to obtain a calibrated measurement. The emission spectrum was scanned from (150/450) kHz to 30 MHz. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in this report.

RADIATED EMISSIONS MEASUREMENTS

Before final measurements of radiated emissions were made on the open-field three/ten meter range; the EUT was scanned indoors at one and three meter distances. This was done in order to determine its emissions spectrum signature. The physical arrangement of the test system and associated cabling was varied in order to determine the effect on the EUT's emissions in amplitude, direction and frequency. This process was repeated during final radiated emissions measurements on the open-field range, at each frequency, in order to insure that maximum emission amplitudes were attained.

Final radiated emissions measurements were made on the three-meter, open-field test site. The EUT was placed on a nonconductive turntable 0.8 meters above the ground plane. The spectrum was examined from 30 MHz to 1000 MHz.

At each frequency, the EUT was rotated 360 degrees, and the antenna was raised and lowered from one to four meters in order to determine the maximum emission levels. Measurements were taken using both horizontal and vertical antenna polarizations. The spectrum analyzer's 6 dB bandwidth was set to 120 kHz, and the analyzer was operated in the CISPR quasi-peak detection mode. No video filter less than 10 times the resolution bandwidth was used. When any clock exceeds 108 MHz, the EUT was tested between 1 to 2 Gigahertz in peak mode with the resolution bandwidth set at 1 MHz as stated in ANSI C63.4. The highest emission amplitudes relative to the appropriate limit were measured and recorded in this report.

Note: Rhein Tech Laboratories, Inc. has implemented procedures to minimize errors that occur from test instruments, calibration, procedures, and test setups. Test instrument and calibration errors are documented from the manufacturer or calibration lab. Other errors have been defined and calculated within the Rhein Tech quality manual, section 6.1. Rhein Tech implements the following procedures to minimize errors that may occur: yearly as well as daily calibration methods, technician training, and emphasis to employees on avoiding error.



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1.2 TEST FACILITY

The open area test site and conducted measurement facility used to collect the radiated data is located on the parking lot of Rhein Tech Laboratories, Inc. 360 Herndon Parkway, Suite 1400, Herndon, Virginia 20170. This site has been fully described in a report dated June 24, 1996, submitted to and approved by the Federal Communication Commission to perform AC line conducted and radiated emissions testing (ANSI C63.4 1992).

1.3 RELATED SUBMITTAL(S)/GRANT(S)

N/A. This is an original submission for Certification. Rhein Tech Laboratories, Inc. has the Declaration of Conformity Report on the digital portion of the device on file.



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1.4 EMISSIONS TEST EQUIPMENT

DESCRIPTION	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. LAB
AMPLIFIER	HEWLETT PACKARD	11975A	2304A00348	TEST EQUITY
AMPLIFIER (S/A 1)	RHEIN TECH	PR-1040	00001	RTL
AMPLIFIER (S/A 2)	RHEIN TECH	RTL2	900723	RTL
AMPLIFIER (S/A 3)	RHEIN TECH	8447F	2944A03783	RTL
AMPLIFIER (S/A 4)	RHEIN TECH	8447D	2727A05397	RTL
BICONICAL/LOG ANTENNA 1	ANTENNA RESEARCH	LPB-2520	1037	LIBERTY LABS
BICONICAL/LOG ANTENNA 2	ANTENNA RESEARCH	LPB-2520	1036	LIBERTY LABS
FIELD SITE SOURCE	EMCO	4610	9604-1313	RTL
FILTER (ROOM 1)	SOLAR	8130	947305	RTL
FILTER (ROOM 2)	SOLAR	8130	947306	RTL
HARMONIC MIXER 1	HEWLETT PACKARD	11970K	2332A00563	TELOGY
HARMONIC MIXER 2	HEWLETT PACKARD	11970A	2332A01199	TELOGY
HORN ANTENNA 1	EMCO	3160-10	9606-1033	EMCO
HORN ANTENNA 2	EMCO	3160-9	9605-1051	EMCO
HORN ANTENNA 3	EMCO	3160-7	9605-1054	EMCO
HORN ANTENNA 4	EMCO	3160-8	9605-1044	EMCO
HORN ANTENNA 5	EMCO	3160-03	9508-1024	EMCO
LISN (ROOM 1/L1)	SOLAR	7225-1	900727	ACUCAL
LISN (ROOM 1/L2)	SOLAR	7225-1	900726	ACUCAL
LISN (ROOM 2/L1)	SOLAR	7225-1	900078	ACUCAL
LISN (ROOM 2/L2)	SOLAR	7225-1	900077	ACUCAL
PRE-AMPLIFIER	HEWLETT PACKARD	8449B OPT	3008A00505	TELOGY
QUASI-PEAK ADAPTER (S/A 1)	HEWLETT PACKARD	85650A	3145A01599	ACUCAL
QUASI-PEAK ADAPTER (S/A 2)	HEWLETT PACKARD	85650A	2811A01276	ACUCAL
QUASI-PEAK ADAPTER (S/A 3)	HEWLETT PACKARD	85650A	2521A00473	ACUCAL
QUASI-PEAK ADAPTER (S/A 4)	HEWLETT PACKARD	85650A	2521A01032	ACUCAL
RF PRESELECTION (S/A 1)	HEWLETT PACKARD	85685A	3146A01309	ACUCAL
SIGNAL GENERATOR (HP)	HEWLETT PACKARD	8660C	1947A02956	ACUCAL
SIGNAL GENERATOR (WAVETEK)	WAVETEK	3510B	4952044	ACUCAL
SPECTRUM ANALYZER 1	HEWLETT PACKARD	8566B	3138A07771	ACUCAL
SPECTRUM ANALYZER 2	HEWLETT PACKARD	8567A	2841A00614	ACUCAL
SPECTRUM ANALYZER 4	HEWLETT PACKARD	8567A	2727A00535	ACUCAL
TUNABLE DIPOLE	EMCO	3121	274	LIBERTY LABS
ANTENNA	ATM	WR08	08443-6	ATM
MIXER	OLESON	M08HW	F80814-1	OLESON
MIXER	OLESON	M05HW	G80814-1	OLESON
DIPLEXER	OLESON	M05HW	G80814-1	OLESON
MIXER	HEWLETT PACKARD	11970U	2332A01110	ACUCAL
MIXER	HEWLETT PACKARD	11970V	2521A00512	TELOGY
MIXER	HEWLETT PACKARD	11970W	2521A00710	TELOGY
ANTENNA	ATM	WR15	15-443-6	ATM
ANTENNA	ATM	WR10	10-443-6	ATM
ANTENNA	ATM	WR05	05-443-6	ATM
SWEEP GENERATOR	HEWLETT PACKARD	83752A	3610A00866	HEWLETT PACKARD



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2.0 SYSTEM TEST CONFIGURATION

The EUT was configured in a laptop computer typical of its use. Two external antennas namely an Omni, and a Dipole antenna, including an internal Omni antenna on the EUT were used during testing.

2.1 RATIONALE

The Nokia device is configured as a PCMCIA device with an internal antenna C110 as well as with an RF antenna connector for external antennas C111. During testing the C110 and C111 were investigated and tested. Both devices are electrically and functionally the same except the internal antenna and the external antenna connector. The C111 with the external connector represented the worst case configuration.

The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance.

2.2 JUSTIFICATION

The EUT was tested in all three orthogonal planes in order to determine worst case emission. Channel 1 at 2.412GHz, Channel 6 at 2.437GHz and Channel 11 at 2.461GHz were tested and investigated from 9kHz to 24GHz. All three channels were found to exhibit the same signature. Data was presented for Channel 1, 6, and 11 used for final testing during antenna conducted spurious emissions measurement, radiated spurious noise measurement, and conducted emissions measurement.

To complete the configuration required by the FCC, the transmitter was tested in a lap top computer with the patch antenna connected to the antenna port similar to its intended use.

The transmitter antenna connector is a unique customized connector manufactured for Nokia and is non-interchangeable.

Since the EUT is a digital interface device a DOC label is affix to the EUT as well as on page 9 of the users manual. A DOC report has been generated for the client.

2.3 EXERCISING THE EUT

The EUT was enabled to continuously transmit by selecting the highest data rate, which was verified by a receiving unit during testing. The carrier was also checked to verify that the information was being transmitted.

2.4 MODIFICATIONS

No modifications were made to the EUT.

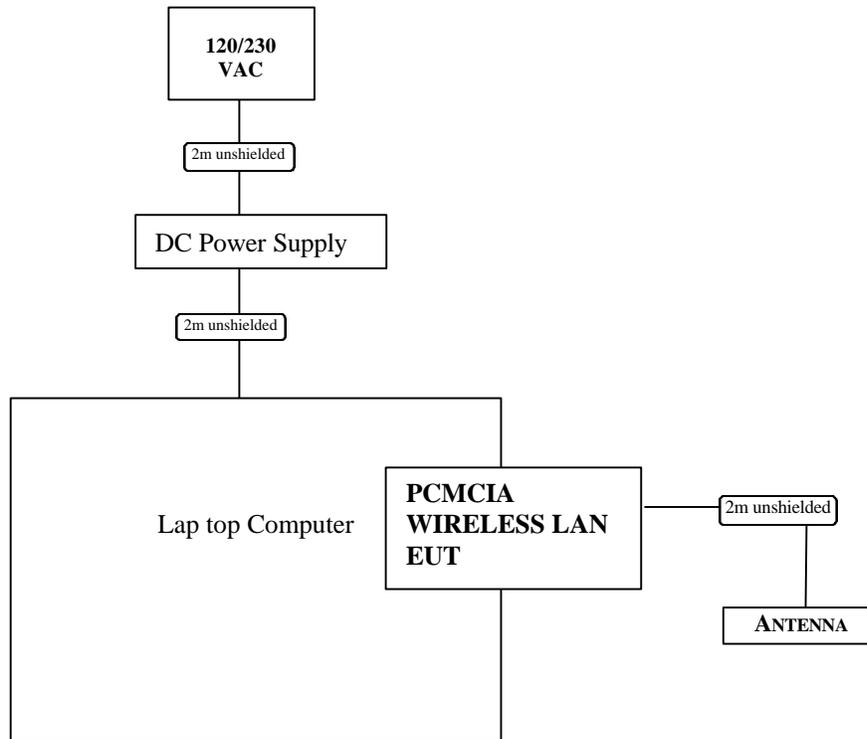


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2.5 TEST SYSTEM DETAILS

PART	MANUFACTURER	MODEL	SERIAL NUMBER	FCC ID	CABLE DESCRIPTION	RTL BAR CODE
LAP TOP- THINK PAD	IBM	2645-UA0	5509CYZ	DOC		011483
ANTENNA	NOKIA	OMNI DIRECTIONAL	N/A	PROTO	UNSHIELDED I/O	N/A
ANTENNA	NOKIA	DIPOLE	BI-D	PROTO	UNSHIELDED I/O	N/A
PCMCIA LAN CARD	NOKIA	C111/VER:P 2.0A	1022/0900/047825	PROTO	UNSHIELDED I/O	N/A
PCMCIA LAN CARD	NOKIA	C110/VER P 2.10	10121100047954	PROTO	UNSHIELDED I/O	N/A
PCMCIA LAN CARD	NOKIA	C110/VER P 2.10	10121100047965	PROTO	UNSHIELDED I/O	N/A
PCMCIA LAN CARD	NOKIA	C110/VER P 2.10	1012110004791A	PROTO	UNSHIELDED I/O	N/A
LAP TOP- THINK PAD	IBM	2645-450	55263PZ	DOC		011486

2.6 CONFIGURATION OF TESTED SYSTEM





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3.0 CONFORMANCE STATEMENT

I, the undersigned, hereby declare that the equipment tested and referenced in this report conforms to the identified standard(s) as described in this attached test record. No modifications were made during testing to the equipment in order to achieve compliance with these standards.

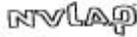
Furthermore, there was no deviation from, additions to or exclusions from the ANSI C63.4 test methodology.

Signature: 

Date: April 11, 2000

Typed/Printed Name: Desmond A. Fraser

Position: President
(NVLAP Signatory)

 Accredited by the National Voluntary Accreditation Program for the specific scope of accreditation under Lab Code 20061-0.

Note: This report may not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government.



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4.0 TEST RESULTS

4.1 MODULATED BANDWIDTH

The minimum 6dB bandwidth per FCC 15.247(a)(2) was measured using a 50 ohm spectrum analyzer with the resolutions bandwidth set at 100 kHz, the video bandwidth set at 100 kHz, and the SPAN>>RBW. The minimum 6 dB-modulation bandwidth is in the following Table. See 6dB bandwidth plots.

TABLE 1: MODULATED BANDWIDTH

CHANNEL	Bandwidth (MHz)	Limit (kHz)
1	10.4	>500
6	9.84	>500
11	8.58	>500

4.2 POWER OUTPUT

The power output per FCC 15.247(b) was measured on the EUT using a peak power meter 50 ohm. The Peak power measured for modulated output power is in the following table:

TABLE 2: PEAK OUTPUT POWER

CHANNEL (MHz)	Power Meter (dBm) HP 437B/HP 8482H
1 2412	12.28
6 2437	12.56
11 2461	11.89

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



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4.3 ANTENNA CONDUCTED SPURIOUS EMISSIONS

Antenna spurious emission per FCC 15.247 (c) was measured from the EUT antenna port using a 50 ohm spectrum analyzer with the resolution bandwidth set at 100 kHz, and the video bandwidth set at 300 kHz.

Harmonics and spurious noise must be at least 20dB down from the highest emission level within the authorized band as measured with a 100 kHz RBW. The table below is the results from the highest emission for each channel within the authorized band. This table was used to determine the spurious limits for each channel.

TABLE 3: ANTENNA CONDUCTED SPURIOUS

CHANNEL (MHz)	Highest emission level (dBm) Corrected (CL=pad)
1 2412	3.6 dBm
6 2437	3.5 dBm
11 2461	4.3 dBm

The data taken for conducted spurious represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance.

4.4 RADIATED SPURIOUS EMISSIONS

Radiated Spurious emissions apply to harmonics and spurious emissions that fall in the restricted bands. The restricted bands are listed in Section 15.205. the maximum permitted average field strength for the restricted band is listed in Section 15.209.

Above 1 GHz and within the bands 9-90kHz and 110-490kHz, set RBW = 1MHz, VBW = 10 Hz (average detector). Below 1 GHz, except as specified above, QP detector with a 120kHz RBW, Spectrum Analyzer 1MHz/1MHz if pulsed operation, apply the peak average correction factor per 15.35(b).

TABLE 4: RADIATED SPURIOUS EMISSIONS

Frequency (MHz)	E (uV/m)	Distance
0.009-0.490	2400/F (kHz)	300
0.490-1.705	24000/F (kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



4.5 POWER SPECTRAL DENSITY

The power spectral density per FCC 15.247(d) was measured from the antenna port of the EUT using a 50ohm spectrum analyzer with the resolution bandwidth set at 3kHz, the video bandwidth set at 30kHz, a span of 1.5 MHz, and the sweep time set at 500 seconds.

TABLE 5: POWER SPECTRAL DENSITY

Carrier Frequency (MHz)	Amplitude (dBm)
Channel 1	-8.67 dBm
Channel 6	-9.00 dBm
Channel 11	-9.17 dBm

These levels are well below the +8 dBm limit. Please refer to the power spectral density plots section of this report.

4.6 COMPLIANCE WITH THE RESTRICTED BAND EDGE

Compliance with the band edges was performed using the FCC's "Radiated Measurement at a Band Edge" guidance document. The final data derived below were from radiated measurements only. The data taken in this report represents the worst case at 11 MBPS. Data rates of 5.5MBPS, 2 MBPS and 1 MBPS were investigated and found to be in compliance. The worst case antennas with the highest gain were used namely, internal omni and external dipole.

Bandedge Measurement

Frequency	Radiated Level dBμV	Site Correction Factor	Corrected Level	Delta Value dBμV	Bandedge Emissions Level	FCC Limit
Omni Internal Antenna Channel 1						
2413.40	76.7	-1	75.7	42.7	33.0	54
Omni Internal Antenna Channel 11						
2463.07	72.6	1.6	74.2	43.2	31.0	54
Dipole Antenna Channel 1						
2471.50	77.53	-1	76.5	48.7	27.8	54
Dipole Internal Antenna Channel 11						
2462.77	74.74	1.6	76.3	45.3	31.0	54

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



4.7 CONDUCTED EMISSION DATA

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. If the conducted emissions exceed the average limit with the instrument set to the quasi-peak mode, then measurements are made in the average mode.

The conducted test was performed with the EUT exercise program loaded, and the emissions were scanned between 450 kHz to 30 MHz on the NEUTRAL SIDE and HOT SIDE, herein referred to as L1 and L2, respectively.

TABLE 6: CONDUCTED EMISSIONS (OMNI ANTENNA)

Neutral Side (L1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.489	Pk	45.5	0.3	45.8	48.0	-2.2
0.596	Pk	45.6	0.3	45.9	48.0	-2.1
0.704	Pk	45.1	0.4	45.5	48.0	-2.5
0.813	Pk	44.8	0.4	45.2	48.0	-2.8
0.920	Pk	45.1	0.5	45.6	48.0	-2.4
2.670	Pk	44.2	1.1	45.3	48.0	-2.7
15.280	Pk	35.7	2.6	38.3	48.0	-9.7

Hot Side (L2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.483	Qp	45.6	0.3	45.9	48.0	-2.1
0.487	Qp	45.0	0.3	45.3	48.0	-2.7
0.591	Qp	45.4	0.4	45.8	48.0	-2.2
0.596	Qp	45.1	0.4	45.5	48.0	-2.5
0.702	Pk	44.8	0.4	45.2	48.0	-2.8
0.809	Pk	45.6	0.4	46.0	48.0	-2.0
0.918	Pk	44.8	0.4	45.2	48.0	-2.8
1.160	Pk	44.9	0.6	45.5	48.0	-2.5
14.840	Pk	34.6	2.4	37.0	48.0	-11.0

⁽¹⁾Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Signature: 

Date: April 7, 2000

Typed/Printed Name: Daniel Baltzell



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TABLE 7: CONDUCTED EMISSIONS (OMNI INTERNAL ANTENNA)

Neutral Side (L1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.482	Qp	45.6	0.3	45.9	48.0	-2.1
0.484	Qp	45.6	0.3	45.9	48.0	-2.1
0.595	Pk	45.4	0.3	45.7	48.0	-2.3
0.701	Pk	45.1	0.4	45.5	48.0	-2.5
0.808	Pk	45.1	0.4	45.5	48.0	-2.5
1.132	Pk	45.0	0.6	45.6	48.0	-2.4
2.640	Pk	43.8	1.1	44.9	48.0	-3.1
15.900	Pk	34.4	2.8	37.2	48.0	-10.8

Hot Side (L2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.482	Qp	45.8	0.3	45.1	48.0	-2.9
0.484	Qp	46.6	0.3	45.9	48.0	-2.1
0.595	Pk	46.5	0.4	45.9	48.0	-2.1
0.700	Pk	45.0	0.4	45.4	48.0	-2.6
0.810	Pk	45.2	0.4	45.6	48.0	-2.4
0.916	Pk	45.0	0.4	45.4	48.0	-2.6
1.780	Pk	44.2	0.8	45.0	48.0	-3.0
16.470	Pk	30.5	2.8	33.3	48.0	-14.7

⁽¹⁾Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Signature: 

Date: April 7, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 8: CONDUCTED EMISSIONS (DIPOLE ANTENNA)

Neutral Side (L1)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.483	Qp	45.6	0.3	45.9	48.0	-2.1
0.487	Qp	45.3	0.3	45.6	48.0	-2.4
0.591	Pk	45.4	0.3	45.7	48.0	-2.3
0.703	Pk	45.5	0.4	45.9	48.0	-2.1
0.720	Pk	44.5	0.5	45.0	48.0	-3.0
0.809	Pk	44.9	0.4	45.3	48.0	-2.7
0.917	Pk	45.2	0.5	45.7	48.0	-2.3
15.230	Pk	34.1	2.6	36.7	48.0	-11.3

Hot Side (L2)

Emission Frequency (MHz)	Test Detector	Analyzer Reading (dBuV)	Site Correction Factor (dB)	Emission Level (dBuV)	FCC B QP Limit (dBuV)	FCC B QP Margin (dBuV)
0.483	QP	44.8	0.3	45.1	48.0	-2.9
0.486	Qp	45.6	0.3	45.9	48.0	-2.1
0.591	Pk	45.6	0.4	46.0	48.0	-2.0
0.697	Pk	45.0	0.4	45.4	48.0	-2.6
0.720	Pk	44.0	0.5	44.5	48.0	-3.5
0.803	Pk	44.9	0.4	45.3	48.0	-2.7
0.909	Pk	44.9	0.4	45.3	48.0	-2.7
14.490	Pk	32.1	2.3	34.4	48.0	-13.6

⁽¹⁾Pk = Peak; QP = Quasi-Peak; Av = Average

TEST PERSONNEL:

Signature: 

Date: April 7, 2000

Typed/Printed Name: Daniel Baltzell



4.8 RADIATED EMISSION DATA

The table below is used to calculate the de facto +36dBm EIRP limit per FCC 15.247 (b) (3) from the antenna gain and the conducted power meter measurement, as well the 20dB limit for non restricted band radiated spurious noise per FCC 15.257 (c) derived from the radiated emissions of each channel using the various antennas.

Omni Antenna

Radiated measurement								+36 dBm EIRP limit
Omni	Freq.	Meas. dBm	SCF	Corr Level	-20dB Limit	Ant. Gain (dBi)	Power	Power + Gain dBm
Ch 1	2410.02	-21.67	-0.83	84.50	64.50	2.15	12.28	14.43
Ch 6	2437.80	-22.5	-0.36	84.14	64.14	2.15	12.56	14.71
Ch 11	2460.99	-23.83	0.04	83.21	63.21	2.15	11.89	14.05

Omni Internal Antenna

Radiated measurement								+36 dBm EIRP limit
Omni Int.	Freq.	Meas. dBm	SCF	Corr Level	-20 dB Limit	Ant. Gain (dBi)	Power	Power + Gain dBm
Ch 1	2413.40	-29.5	-0.77	76.73	56.73	1	12.28	13.28
Ch 6	2437.47	-32.5	-0.36	74.14	54.14	1	12.56	13.56
Ch 11	2463.07	-34.5	0.07	72.57	52.57	1	11.89	12.89

Dipole Antenna

Radiated measurement								+36 dBm EIRP limit
Dipole	Freq.	Meas. dBm	SCF	Corr level	-20 dB limit	Ant. Gain (dBi)	Power	Power + Gain dBm
Ch 1	2411.50	-28.67	-0.80	77.53	57.53	4	12.28	16.28
Ch 6	2436.47	-32.17	-0.38	74.45	54.45	4	12.56	16.56
Ch 11	2462.77	-32.33	0.07	74.74	54.74	4	11.89	15.89



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 9: RADIATED EMISSIONS {OMNI ANTENNA: CHANNEL 1 (2412 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2389.795	Av	V	180	1.0	42.67	-1.17	41.50	54.0	-12.5
2378.730	Av	V	180	1.0	39.67	-1.36	38.31	54.0	-15.7
2367.875	Av	V	180	1.0	38.17	-1.55	36.62	54.0	-17.4
2356.580	Av	V	180	1.0	38.17	-1.74	36.43	54.0	-17.6
2345.637	Av	V	180	1.0	39.00	-1.90	37.10	54.0	-16.9
2367.548	Av	V	180	1.0	38.00	-1.55	36.45	54.0	-17.6
2378.798	Av	V	180	1.0	39.50	-1.36	38.14	54.0	-15.9
2384.690	Av	V	180	1.0	52.67	-1.26	51.41	54.0	-2.6
2425.610	Av	V	180	1.0	53.67	-0.56	53.11	64.5	-11.4
2433.867	Av	V	180	1.0	44.50	-0.42	44.08	64.5	-20.4
2444.717	Av	V	180	1.0	40.17	-0.24	39.93	64.5	-24.6
2466.625	Av	V	180	1.0	37.50	0.13	37.63	64.5	-26.9
2477.670	Av	V	180	1.0	36.67	0.32	36.99	64.5	-27.5
2521.738	Av	V	180	1.0	40.83	1.07	41.90	64.5	-22.6
4823.929	Av	V	180	1.0	34.83	-3.50	31.33	54.0	-22.7
7236.000	Av	V	180	1.0	34.00	-0.60	33.40	64.5	-31.1
9648.000	Av	V	180	1.0	33.83	3.90	37.73	64.5	-26.8
12060.000	Av	V	180	1.0	33.67	4.90	38.57	54.0	-15.4
14472.000	Av	V	180	1.0	35.50	11.30	46.80	54.0	-7.2
16884.000	Av	V	180	1.0	34.14	10.80	44.94	64.5	-19.6
19296.000	Av	V	180	1.0	32.50	15.70	48.20	54.0	-5.8

***All readings are quasi-peak, unless stated otherwise.**

Calculation Information:

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 10: RADIATED EMISSIONS {OMNI ANTENNA: CHANNEL 6 (2437 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2359.732	Av	V	70	1.1	38.83	-1.70	37.13	54.00	-16.9
2370.745	Av	V	65	1.1	43.00	-1.50	41.50	54.00	-12.5
2381.639	Av	V	70	1.1	39.50	-1.30	38.20	54.00	-15.8
2312.701	Av	V	70	1.1	39.00	-2.48	36.52	54.00	-17.5
2392.581	Av	V	70	1.1	39.17	-1.13	38.04	64.14	-26.1
2403.810	Av	V	70	1.1	40.33	-0.94	39.39	64.14	-24.8
2414.676	Av	V	70	1.1	42.00	-0.75	41.25	64.14	-22.9
2458.806	Av	V	70	1.1	42.50	0.00	42.50	64.14	-21.6
2469.731	Av	V	70	1.1	37.83	0.20	38.03	64.14	-26.1
2491.850	Av	V	70	1.1	37.33	0.56	37.89	54.00	-16.1
2502.780	Av	V	70	1.1	36.50	0.75	37.25	64.14	-26.9
2513.845	Av	V	70	1.1	36.50	0.94	37.44	64.14	-26.7
2524.426	Av	V	70	1.1	35.50	1.12	36.62	64.14	-27.5
2547.743	Av	V	70	1.1	36.83	1.50	38.33	64.14	-25.8
4873.853	Av	V	20	1.3	34.67	-3.50	31.17	54.00	-22.8
7311.000	Av	V	70	1.1	34.00	-0.70	33.30	54.00	-20.7
9748.000	Av	V	70	1.1	34.50	3.90	38.40	64.14	-25.7
12185.000	Av	V	70	1.1	32.83	4.80	37.63	54.00	-16.4
14622.000	Av	V	70	1.1	34.67	11.50	46.17	64.14	-18.0
17059.000	Av	V	70	1.1	34.00	11.20	45.20	64.14	-18.9
19496.000	Av	V	70	1.1	33.33	15.20	48.53	54.00	-5.5

****All readings are quasi-peak, unless stated otherwise.***

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 11: RADIATED EMISSIONS {OMNI ANTENNA: CHANNEL 11 (2462 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2384.770	Av	V	70	1.2	39.50	-1.30	38.20	54.00	-15.8
2395.900	Av	V	70	1.2	44.00	-1.07	42.93	63.21	-20.3
2407.040	Av	V	70	1.2	40.00	-0.88	39.12	63.21	-24.1
2417.950	Av	V	70	1.2	38.00	-0.70	37.31	63.21	-25.9
2429.310	Av	V	70	1.2	38.50	-0.50	38.00	63.21	-25.2
2440.260	Av	V	70	1.2	42.17	-0.32	41.85	63.21	-21.4
2483.728	Av	V	70	1.2	44.13	0.42	44.55	54.00	-9.5
2494.870	Av	V	70	1.2	38.00	0.61	38.61	54.00	-15.4
2505.800	Av	V	70	1.2	36.50	0.80	37.30	54.00	-16.7
2516.830	Av	V	70	1.2	38.00	0.99	38.99	54.00	-15.0
2527.730	Av	V	70	1.2	35.67	1.17	36.84	54.00	-17.2
2539.300	Av	V	70	1.2	35.50	1.40	36.90	54.00	-17.1
4923.928	Av	V	40	1.2	36.00	-3.50	32.50	54.00	-21.5
7386.000	Av	V	70	1.2	34.83	-1.10	33.73	54.00	-20.3
9848.000	Av	V	70	1.2	35.00	3.70	38.70	63.21	-24.5
12310.000	Av	V	70	1.2	34.33	4.50	38.83	54.00	-15.2
14772.000	Av	V	70	1.2	35.50	11.30	46.80	63.21	-16.4
17234.000	Av	V	70	1.2	34.67	11.10	45.77	63.21	-17.4
19696.000	Av	V	70	1.2	34.67	15.10	49.77	54.00	-4.2

**All readings are quasi-peak, unless stated otherwise.*

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 12: RADIATED EMISSIONS {OMNI INTEGRAL ANTENNA: CHANNEL 1 (2412 MHZ)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2345.727	Av	V	260	1.2	35.67	-1.9	33.77	54.00	-20.2
2356.723	Av	V	70	1.6	35.50	-1.74	33.76	54.00	-20.2
2378.737	Av	V	70	1.6	35.67	-1.36	34.31	54.00	-19.7
2389.750	Av	V	70	1.6	39.17	-1.17	38.00	54.00	-16.0
2400.728	Av	V	70	1.6	43.33	-0.99	42.34	56.73	-14.4
2433.728	Av	V	70	1.6	35.83	-0.43	35.40	56.73	-21.3
2447.27	Av	V	70	1.6	34.83	-0.2	34.63	56.73	-22.1
2467.900	Av	V	70	1.6	34.33	0.2	34.53	56.73	-22.2
4823.951	Av	V	70	1.6	31.83	-3.5	28.33	54.00	-25.7
7236.000	Av	V	70	1.6	34.67	-0.6	34.07	56.73	-22.7
9648.000	Av	V	70	1.6	34.67	3.9	38.57	56.73	-18.2
12060.000	Av	V	70	1.6	34.00	4.9	38.90	54.00	-15.1
14472.000	Av	V	70	1.6	36.00	11.3	47.30	54.00	-6.7
16884.000	Av	V	70	1.6	36.00	10.8	46.80	56.73	-9.9
19296.000	Av	V	70	1.6	34.67	15.7	50.37	54.00	-3.6

****All readings are quasi-peak, unless stated otherwise.***

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 13: RADIATED EMISSIONS {OMNI INTEGRAL ANTENNA: CHANNEL 6 (2437 MHZ)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2359.732	Av	V	70	2.0	35.33	-1.69	33.64	54.00	-20.4
2370.728	Av	V	70	2.0	36.17	-1.498	34.67	54.00	-19.3
2381.730	Av	V	70	2.0	35.67	-1.31	34.36	54.00	-19.6
2392.720	Av	V	70	2.0	35.17	-1.1	34.07	54.14	-20.1
2403.724	Av	V	70	2.0	35.33	-0.94	34.39	54.14	-19.8
2414.727	Av	V	70	2.0	36.33	-0.75	35.58	54.14	-18.6
2451.700	Av	V	70	2.0	47.50	-0.1	47.40	54.14	-6.7
2459.700	Av	V	70	2.0	36.17	0	36.17	54.14	-18.0
2489.747	Av	V	70	2.0	34.33	0.5	34.83	54.14	-19.3
2491.743	Av	V	70	2.0	34.00	0.56	34.56	54.14	-19.6
4874.000	Av	V	70	2.0	33.00	-3.5	29.50	54.00	-24.5
7311.000	Av	V	70	2.0	34.67	-0.7	33.97	54.00	-20.0
9748.000	Av	V	70	2.0	35.00	3.9	38.90	54.14	-15.2
12185.000	Av	V	70	2.0	33.50	4.8	38.30	54.00	-15.7
14622.000	Av	V	70	2.0	35.83	11.5	47.33	54.14	-6.8
17059.000	Av	V	70	2.0	35.00	11.2	46.20	54.14	-7.9
19496.000	Av	V	70	2.0	35.00	15.2	50.20	54.00	-3.8

**All readings are quasi-peak, unless stated otherwise.*

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 14: RADIATED EMISSIONS {OMNI INTEGRAL ANTENNA: CHANNEL 11 (2462 MHZ)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2417.900	Av	V	70	1.2	34.50	-0.7	33.80	52.57	-18.8
2428.900	Av	V	70	1.2	34.33	-0.5	33.83	52.57	-18.7
2483.722	Av	V	70	1.2	34.00	0.4	34.40	54.00	-19.6
2494.727	Av	V	70	1.2	33.33	0.6	33.93	54.00	-20.1
4924.000	Av	V	70	1.2	33.00	-3.5	29.50	54.00	-24.5
7386.000	Av	V	70	1.2	33.33	-1.1	32.23	54.00	-21.8
9848.000	Av	V	220	1.3	33.67	3.7	37.37	52.57	-15.2
12310.000	Av	V	70	1.2	36.67	4.5	41.17	54.00	-12.8
14772.000	Av	V	70	1.2	34.83	11.3	46.13	52.57	-6.4
17234.000	Av	V	70	1.2	34.33	11.1	45.43	52.57	-7.1
19696.000	Av	V	70	1.2	34.50	15.1	49.60	54.00	-4.4

****All readings are quasi-peak, unless stated otherwise.***

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 15: RADIATED EMISSIONS {DIPOLE ANTENNA: CHANNEL 1 (2412 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2345.715	Av	V	260	1.2	36.17	-1.9	34.27	54	-19.73
2356.723	Av	V	70	1.6	36	-1.7	34.3	54	-19.7
2378.722	Av	V	70	1.6	36.17	-1.4	34.77	54	-19.23
2389.722	Av	V	70	1.6	37.33	-1.2	36.13	54	-17.87
2400.737	Av	V	70	1.6	44.17	-0.99	43.18	57.53	-14.35
2433.723	Av	V	70	1.6	36.33	-0.4	35.93	57.53	-21.6
2444.710	Av	V	70	1.6	35.33	-0.2	35.13	57.53	-22.4
2466.742	Av	V	70	1.6	34.83	0.14	34.97	57.53	-22.56
2521.700	Av	V	70	1.6	34.33	1.1	35.43	57.53	-22.1
4823.930	Av	V	70	1.6	33.67	-3.5	30.17	54	-23.83
7236.000	Av	V	70	1.6	34.67	-0.6	34.07	57.53	-23.46
9648.000	Av	V	70	1.6	34.67	3.9	38.57	57.53	-18.96
12060.000	Av	V	70	1.6	34	4.9	38.9	54	-15.1
14472.000	Av	V	70	1.6	36	11.3	47.3	54	-6.7
16884.000	Av	V	70	1.6	36	10.8	46.8	57.53	-10.73
19296.000	Av	V	70	1.6	34.67	15.7	50.37	54	-3.63

**All readings are quasi-peak, unless stated otherwise.*

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 16: RADIATED EMISSIONS {DIPOLE ANTENNA: CHANNEL 6 (2437 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2359.033	Av	V	70	2.0	35.17	-1.7	33.47	54.00	-20.5
2370.713	Av	V	70	2.0	36.00	-1.5	34.50	54.00	-19.5
2381.163	Av	V	70	2.0	35.17	-1.3	33.87	54.00	-20.1
2392.717	Av	V	70	2.0	35.17	-1.1	34.07	54.45	-20.4
2403.720	Av	V	70	2.0	35.50	-0.9	34.60	54.45	-19.9
2414.707	Av	V	70	2.0	36.50	0.8	37.30	54.45	-17.2
2458.717	Av	V	70	2.0	35.00	0	35.00	54.45	-19.5
2469.683	Av	V	70	2.0	34.00	0.2	34.20	54.45	-20.3
2491.742	Av	V	70	2.0	33.83	0.6	34.39	54.00	-19.6
2502.692	Av	V	70	2.0	33.67	0.8	34.42	54.00	-19.6
4873.633	Av	V	70	2.0	33.17	-3.5	29.67	54.00	-24.3
7311.000	Av	V	70	2.0	34.67	-0.7	33.97	54.00	-20.0
9748.000	Av	V	70	2.0	35.00	3.9	38.90	54.45	-15.6
12185.000	Av	V	70	2.0	33.50	4.8	38.30	54.00	-15.7
14622.000	Av	V	70	2.0	35.83	11.5	47.33	54.45	-7.1
17059.000	Av	V	70	2.0	35.00	11.2	46.20	54.45	-8.3
19496.000	Av	V	70	2.0	35.00	15.2	50.20	54.00	-3.8

****All readings are quasi-peak, unless stated otherwise.***

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell



COMPANY NAME: NOKIA WIRELESS BUSINESS COMMUNICATIONS
EUT: NOKIA C110 AND C111
CLIENT REFERENCE NUMBER: QUOTE NUMBER
WORK ORDER NUMBER: 2000156
FCC ID: ORE-C110-C111

TABLE 17: RADIATED EMISSIONS {DIPOLE ANTENNA: CHANNEL 11 (2462 MHz)}

(Temperature: 70° F Degree, Humidity: 60%)

Emission Frequency (MHz)	Test Detector	Antenna Polarity (H/V)	Turntable Azimuth (deg)	Antenna Height (m)	Analyzer Reading (dBuV/m)	Site Correction Factor (dB/m)	Emission Level (dBuV/m)	FCC Limit (dBuV/m)	FCC Margin (dB)
2384.780	Av	V	70	1.2	35.17	-1.3	33.87	54.00	-20.1
2395.767	Av	V	70	1.2	35.50	-1.1	34.40	54.74	-20.3
2406.720	Av	V	70	1.2	35.17	-0.9	34.27	54.74	-20.5
2417.710	Av	V	70	1.2	35.00	-0.7	34.30	54.74	-20.4
2428.672	Av	V	70	1.2	34.83	-0.5	34.33	54.74	-20.4
2439.733	Av	V	70	1.2	35.00	-0.3	34.70	54.74	-20.0
2483.682	Av	V	220	1.3	36.33	0.4	36.75	54.00	-17.3
4923.940	Av	V	70	1.2	33.33	-3.5	29.83	54.00	-24.2
7386.000	Av	V	70	1.2	33.33	-1.1	32.23	54.00	-21.8
9848.000	Av	V	70	1.2	33.67	3.7	37.37	54.74	-17.4
12310.000	Av	V	70	1.2	36.67	4.5	41.17	54.00	-12.8
14772.000	Av	V	70	1.2	34.83	11.3	46.13	54.74	-8.6
17234.000	Av	V	70	1.2	34.33	11.1	45.43	54.74	-9.3
19696.000	Av	V	70	1.2	34.50	15.1	49.60	54.00	-4.4

**All readings are quasi-peak, unless stated otherwise.*

TEST PERSONNEL:

Signature: 

Date: April 11, 2000

Typed/Printed Name: Daniel Baltzell