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EMC Test Data

Client:	Nokia	Job Number:	J36596
Model:	2.4GHz FHSS Wireless 10/100 w/ AMP	T-Log Number:	T38457
		Proj Eng:	Mark Briggs
Contact:	Ivar Sanders		
Emissions Spec:	FCC	Class:	B
Immunity Spec:		Environment:	N/A

EMC Test Data

For The

Nokia

Model

2.4GHz FHSS Wireless 10/100 w/ AMP

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Immunity Spec:		Environment:	N/A

TEST SUMMARY

Date	Test Performed	Level	Results	Margin
07/20/2000	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-8.7dB @ .8996MHz
07/20/2000	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-9.7dB @ .8314MHz
07/20/2000	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-9.3dB @ .848MHz
7/17/2000 & 7/18/00	Output Power	FCC Part 15.247	Pass	Power was 29.19dBm
7/17/2000 & 7/18/00	Spurious Emissions In Restricted Bands - Omni	FCC Part 15.209 /	Pass	-1.8dB @ 4878MHz
7/17/2000 & 7/18/00	20dB Bandwidth	15.247(a)	Pass	995kHz
7/17/2000 & 7/18/00	Out-Of Band Antenna Spurious	15.247(a)	Pass	All out-of-band emissions more than

Abbreviations Used: RE - Radiated Emissions, CE- Conducted Emissions, RI - Radiated Immunity, CI - Conducted Immunity, ESD - Electrostatic Discharge, EFT - Electrical Fast Transients, VDI - Voltage Dips and Interrupts

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EUT INFORMATION

General Description

The EUT is a 2.4 – 2.4835 GHz frequency-hopping spread spectrum (FHSS) transceiver that is designed for point-to-multipoint and point-to-point operation. Normally, the EUT would be placed on a table top during operation. The EUT was, therefore, placed in this position during testing to simulate the end user environment.

Equipment Under Test

Manufacturer	Model	Description	Serial Number	FCC ID
Nokia	R242	Module	PCB #79295d	
Nokia	LA-302C-500-1C	Radio card	UG34H3	
Nokia		Power Supply	00000047FH2410594X	
Nokia	to be provided	Pre-Amp		

Other EUT Details

EUT Enclosure

It measures approximately 13.7 cm wide by 11.4 cm deep by 3.4 cm high. It is primarily constructed of plastic with an internal conductive coating. The amplifier and dc injector are mounted in die-cast metal boxes.

Modification History

Mod. #	Test	Date	Modificaiton
1			
2			
3			

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Immunity Spec:		Environment:	N/A

Test Configuration Information (1)

Local Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
Maxrad	MFB24008	8 dBi Omni Antenna	N/A	

Note: Antennas used for radiated spurious emissions tests.

Remote Support Equipment

Manufacturer	Model	Description	Serial Number	FCC ID
IBM		Laptop	78-LZ070	
IBM		AC Adapter	J15JR533PB4	
Young	2441-E1	DC injector and 2.4GHz amplifier		

Note: The laptop was only used to configure the EUT prior to testing. It was not connected during testing.

EUT Interface Ports

		Cable(s)		
EUT Port	Connected To	Description	Shielded or Unshielded	Length(m)
Antenna Output	Antenna	Coax (Andrew)	Shielded	1.5
Antenna Output	Amplifier	Coax (Andrew)	Shielded	1.8

EUT Operation During Emissions

EUT was set to transmit continously on a single channel for radiated emissions, power and bandwidth tests.

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Spec:	FCC	Class:	B

Conducted Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification(s) defined above.

Date of Test: 07/20/2000
Test Engineer: Pamela Galvan
Test Location: SVOATS #3

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table, 40 cm from a vertical coupling plane. The LISN was located 80 cm from the EUT. The laptop was located on the test table during conducted emissions testing to facilitate changing the channels.

Ambient Conditions:

Temperature: 16 °C
Rel. Humidity: 75%

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1 (Low channel)	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-8.7dB @ .8996MHz
2 (center channel)	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-9.7dB @ .8314MHz
3 (high channel)	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-9.3dB @ .848MHz

Modifications Made During Testing: None

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EMC Test Data

Client:	Nokia	Job Number:	J36596
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		Proj Eng:	Mark Briggs
Contact:	Ivar Sanders		
Spec:	FCC	Class:	B

Run #1: AC Power Port Conducted Emissions, 0.45 - 30 MHz 120 V / 60 Hz

DC power injector. Low Channel. Transmit 75% / Receive 20 %

Frequency	Level	Power	FCC 15.207(a)		Detector	Comments
MHz	dBµV	Lead	Limit	Margin	QP/Ave	
0.8996	39.4	Neutral	48.0	-8.6	QP	
0.5219	35.7	Line	48.0	-12.3	QP	Signal is broadband, QP reading corrected by -13dB
0.9266	33.9	Line	48.0	-14.1	QP	
0.5081	32.6	Neutral	48.0	-15.4	QP	Signal is broadband, QP reading corrected by -13dB
0.6714	30.1	Line	48.0	-17.9	QP	Signal is broadband, QP reading corrected by -13dB
0.6701	28.9	Neutral	48.0	-19.1	QP	Signal is broadband, QP reading corrected by -13dB

Run #2: AC Power Port Conducted Emissions, 0.45 - 30 MHz 120 V / 60 Hz

DC power injector. Center Channel. Transmit 75% / Receive 20 %

Frequency	Level	Power	FCC 15.207(a)		Detector	Comments
MHz	dBµV	Lead	Limit	Margin	QP/Ave	
0.8314	38.4	Line	48.0	-9.6	QP	
0.8322	38.3	Neutral	48.0	-9.7	QP	
0.4742	35.1	Line	48.0	-12.9	QP	Signal is broadband, QP reading corrected by -13dB
0.6564	29.1	Line	48.0	-18.9	QP	Signal is broadband, QP reading corrected by -13dB
0.4767	28.7	Neutral	48.0	-19.3	QP	Signal is broadband, QP reading corrected by -13dB
0.6583	28.7	Neutral	48.0	-19.3	QP	Signal is broadband, QP reading corrected by -13dB

Run #3: AC Power Port Conducted Emissions, 0.45 - 30 MHz 120 V / 60 Hz

DC power injector. High Channel. Transmit 75% / Receive 20 %

Frequency	Level	Power	FCC 15.207(a)		Detector	Comments
MHz	dBµV	Lead	Limit	Margin	QP/Ave	
0.8480	38.8	Neutral	48.0	-9.2	QP	
0.8480	37.4	Line	48.0	-10.6	QP	
0.4836	35.6	Line	48.0	-12.4	QP	Signal is broadband, QP reading corrected by -13dB
0.4836	30.4	Neutral	48.0	-17.6	QP	Signal is broadband, QP reading corrected by -13dB
0.6589	28.9	Neutral	48.0	-19.1	QP	Signal is broadband, QP reading corrected by -13dB
0.6565	28.6	Line	48.0	-19.4	QP	Signal is broadband, QP reading corrected by -13dB

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EMC Test Data

Client:	Nokia	Job Number:	J36596
Model:	2.4GHz FHSS Wireless 10/100 w/ AMP	T-Log Number:	T38457
		Proj Eng:	Mark Briggs
Contact:	Ivar Sanders		
Spec:	FCC	Class:	N/A

Radiated Emissions

Test Specifics

Objective: The objective of this test session is to perform final qualification testing the EUT relative to the specification defined above.

Date of Test: 7/17/2000 & 7/18/00
Test Engineer: Tuan Banh
Test Location: OATS #2

Config. Used: 1
Config Change: None
EUT Voltage: 120V /60Hz

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 13.9°C
Rel. Humidity: 83%

Summary of Results

Run #	Test Performed	Limit	Result	Comment
1	Output Power	FCC Part 15.247	Pass	Power was 29.19dBm
2,3,4	Spurious Emissions In Restricted Bands - Omni Antenna	FCC Part 15.209 / 15.247(c)	Pass	-1.8dB @ 4878MHz
5	20dB Bandwidth	15.247(a)	Pass	995kHz
6	Out-Of Band Antenna Spurious	15.247(a)	Pass	All out-of-band emissions more than 20dB below fundamental signal level.

Modifications Made During Testing: None

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EMC Test Data

Client:	Nokia	Job Number:	J36596
Model:	2.4GHz FHSS Wireless 10/100 w/ AMP	T-Log Number:	T38457
		Proj Eng:	Mark Briggs
Contact:	Ivar Sanders		
Spec:	FCC	Class:	N/A

Run #1: Output Power

Channel	Frequency (MHz)	Res BW	Output Power	Graph reference #
Low	2.401	3MHz	29.19dBm	T38457/101
Mid	2.439	3MHz	28.65dBm	T38457/102
High	2.4789	3MHz	28.16dBm	T38457/103

Run #2: Radiated Spurious Emissions, 2400-24000 MHz. Low Channel @ 2401 MHz

Config: EUT is now tested with Amplifier and is running Slow frame in the software.

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
4802.000	52.7	V	54.0	-1.3	Avg	200	1.0	
7202.910	49.6	V	54.0	-4.4	Avg	320	1.0	
7202.910	47.8	H	54.0	-6.2	Avg	330	1.0	
4802.000	43.9	H	54.0	-10.1	Avg	90	1.0	
4802.000	60.4	V	74.0	-13.6	Pk	200	1.0	
7202.910	59.6	V	74.0	-14.4	Pk	320	1.0	
7202.910	57.7	H	74.0	-16.3	Pk	330	1.0	
4802.000	54.1	H	74.0	-19.9	Pk	90	1.0	

Run #3: Radiated Spurious Emissions, 2400-24000 MHz. Center Channel @ 2439 MHz

Config: EUT is now tested with Amplifier and is running Slow frame in the software.

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4878.000	52.2	V	54.0	-1.8	Avg	90	1.0	
7317.000	50.8	V	54.0	-3.2	Avg	180	1.0	
4878.000	46.7	H	54.0	-7.3	Avg	120	1.1	
7317.000	44.4	H	54.0	-9.6	Avg	190	1.0	
7317.000	61.2	V	74.0	-12.8	Pk	180	1.0	
4878.000	60.0	V	74.0	-14.0	Pk	90	1.0	
7317.000	55.3	H	74.0	-18.7	Pk	190	1.1	
4878.000	55.2	H	76.0	-20.8	Pk	120	1.1	

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EMC Test Data

Client:	Nokia	Job Number:	J36596
Model:	2.4GHz FHSS Wireless 10/100 w/ AMP	T-Log Number:	T38457
		Proj Eng:	Mark Briggs
Contact:	Ivar Sanders		
Spec:	FCC	Class:	N/A

Run #4: Radiated Spurious Emissions, 2400-24000 MHz. High Channel @ 2479 MHz

Config: EUT is now tested with Amplifier and is running Slow frame in the software.

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4957.940	44.5	V	54.0	-9.5	Avg	270	1.0	
7436.910	43.4	V	54.0	-10.6	Avg	300	1.0	
7436.910	42.0	H	54.0	-12.0	Avg	330	1.0	
4957.940	39.2	H	54.0	-14.8	Avg	200	1.5	
7436.910	56.2	V	74.0	-17.8	Pk	300	1.0	
4957.940	55.3	V	74.0	-18.7	Pk	270	1.0	
7436.910	54.0	H	74.0	-20.0	Pk	330	1.0	
4957.940	50.9	H	75.0	-24.1	Pk	200	1.0	

Run #5: Signal Bandwidth

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Signal Bandwidth	Graph reference #
Low	2.401	30kHz	995kHz	T38457/501
Mid	2.439	30kHz	990kHz	T38457/502
High	2.4789	30kHz	955kHz	T38457/503

Run #6: Antenna Conducted Spurious Emissions

Channel	Graph reference #s	Comments
Low	T38457/601-604	All out-of-band emissions more than 20dB below the highest in-band signal level
Mid	T38457/605-608	
High	T38457/609-612	