<b>Elliot</b>	t	EM	C 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:	В
Immunity Spec:		Environment:	N/A

### EMC Test Data

For The

#### Nokia

Model

#### 2.4GHz FHSS Wireless 10/100 w/ AMP

<b>Elliot</b>	t	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:	В	
Immunity Spec:		Environment:	N/A	

#### TEST SUMMARY

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

# Client:NokiaJob Number:J36596Client:NokiaJob Number:J36596Model:2.4GHz FHSS Wireless 10/100 w/ AMPT-Log Number:T38457Contact:Ivar SandersProj Eng:Mark BriggsContact:Ivar SandersClass:BImmunity Spec:Cnotent:N/A

#### 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			

<b>Ellio</b>	tt		EMC Te	st Data						
Client:	Nokia		Job Number:	J36596						
Model:	2.4GHz FHSS Wireless	s 10/100 w/ AMP	T-Log Number:	T38457						
Original	have Constant		Proj Eng:	Mark Briggs						
Contact:	Ivar Sanders		Class	D						
Emissions Spec:	FUU		Environmont:	B N/A						
			Liivii oliinent.	N/A						
	Test Configuration Information (1)									
Manufacturer	Model	Description	Serial Number	FCC ID						
Maxrad	MFB24008	8 dBi Omni Antenna	N/A							
Manufacturer	Re	emote Support Equipm	ent 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 on	ly used to configure the	EUT prior to testing. It was no <b>EUT Interface Ports</b>	ot connected during testin	ng.						
		Description	Cable(s)							
LUI POIT			Shielded of Unshield	Lengtn(m)						
Antenna Output	Amelifier		Shielded	1.3						
EUT was set to transmit o	EUT continously on a single cl	<b>Operation During Emis</b> hannel for radiated emissions	s <b>sions</b> , power and bandwidth te	sts.						

E	Ellio	ott		ЕМС	Test l	Data
Client:	Nokia			Jo	b Number:	J36596
Model:	2.4GHz F	HSS Wireless 10/100 w/ AMP		T-Lo	og Number:	T38457
					Proj Eng:	Mark Briggs
Contact:	Ivar Sand	ers				
Spec:	FCC				Class:	В
		Cond	ducted Emissio	ns		
Test Spe	cifics					
	Objective:	The objective of this test session specification(s) defined above.	n is to perform final qualif	ication testir	ig the EUT i	relative to the
Dat	te of Test:	07/20/2000	Config. Used:	1		
Test	Engineer:	Pamela Galvan	Config Change:	None		
Test	Location:	SVOATS #3	EUT Voltage:	120V/60Hz		
General	Test Cor	nfiguration				
For table located changing	top equipn 80 cm fron 1 the chanr	nent, the EUT was located on a n the EUT. The laptop was loca nels.	wooden table, 40 cm fror ted on the test table durir	n a vertical o ng conducteo	coupling pla d emissions	ne. The LISN was testing to facilitate
Ambient	Conditio	ons: Temperature:	16 °C			
		Rel. Humidity:	75%			
Summar	y of Res	ults				
Rur	า #	Test Performed	Limit	Result	Ма	argin
1 (Low c	hannel)	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 c	hannel)	CE, AC Power 120V/60Hz	FCC 15.207(a)	Pass	-9.3dB @	.848MHz

#### Modifications Made During Testing: None

E	Ellio	ott					EMC Test	Data
Client:	Nokia						Job Number:	J36596
Model:	2.4GHz F	HSS Wire	eless 10/10	0 w/ AMP			T-Log Number:	T38457
							Proj Eng:	Mark Briggs
Contact:	Ivar Sand	ers						
Spec:	FCC						Class:	В
Run #1: A	C Power I	Port Con	ducted Em	issions, 0.4	l5 - 30 MHz	120 V / 60 H	2	
DC power i	njector. L	ow Chani	nel. Transn	nit 75% / Re	ceive 20 %			
Frequency	Level	Power	FCC 15	5.207(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 bro	adband, QP reading cor	rected by -13dB
0.9266	33.9	Line	48.0	-14.1	QP			
0.5081	32.6	Neutral	48.0	-15.4	QP	Signal is broa	adband, QP reading cor	rected by -13dB
0.6714	30.1	Line	48.0	-17.9	QP	Signal is bro	adband, QP reading cor	rected by -13dB
0.6701	28.9	Neutral	48.0	-19.1	QP	Signal is broa	adband, QP reading cor	rected by -13dB

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

DC power li	njector. C	enter Ch	annei. Tran	ISMIT 75% /	Receive 20	%
Frequency	Level	Power	FCC 15	5.207(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 %

	1	3				
Frequency	Level	Power	FCC 15	5.207(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

y Lin	<u>Ju</u>		LIVIC	10311	Dala
Client: Nokia			J	ob Number:	J36596
Model: 2.4GHz F	HSS Wireless 10/100 w/ AMP	T-L	.og Number:	T38457	
			Proj Eng:	Mark Briggs	
Contact: Ivar Sand	ers				
Spec: FCC				Class:	N/A
	Rac	diated Emissior	าร		
est Specifics					
Objective:	The objective of this test sessio specification defined above.	n is to perform final qualif	fication testi	ng the EUT r	relative to the
Date of Test	7/17/2000 & 7/18/00	Config Used	1		
Test Engineer:	Tuan Banh	Config Change:	None		
Test Location:	OATS #2	EUT Voltage:	120V /60H	Z	
General Test Con The EUT and all lo For radiated emiss	nfiguration cal support equipment were loca ions testing the measurement an	ted on the turntable for ra tenna was located 3 met	adiated spur ers from the	rious emissio e EUT.	ons testing.
General Test Con The EUT and all lo For radiated emiss Unless stated othe Ambient Condition	nfiguration cal support equipment were loca ions testing the measurement an rwise the EUT was operating suc ons: Temperature: Rel. Humidity:	ted on the turntable for ra itenna was located 3 met ch that it constantly hoppe 13.9°C 83%	adiated spur ers from the ed on either	ious emissio e EUT. the low, cen	ons testing. hter or high c
General Test Con The EUT and all lo For radiated emiss Unless stated othe Imbient Condition	nfiguration cal support equipment were loca ions testing the measurement an rwise the EUT was operating suc ons: Temperature: Rel. Humidity: ults	ted on the turntable for ra itenna was located 3 met ch that it constantly hoppe 13.9°C 83%	adiated spur ers from the ed on either	ious emissio e EUT. the low, cen	ons testing. hter or high c
The EUT and all lo For radiated emiss Unless stated othe mbient Condition ummary of Res	nfiguration cal support equipment were loca ions testing the measurement an rwise the EUT was operating suc ons: Temperature: Rel. Humidity: ults Test Performed	ted on the turntable for ra itenna was located 3 met ch that it constantly hoppe 13.9°C 83% Limit	adiated spur ers from the ed on either Result	ious emissio EUT. the low, cen	ons testing. hter or high c
eneral Test Con The EUT and all lo For radiated emiss Unless stated othe mbient Condition ummary of Res Run # 1	nfiguration cal support equipment were loca ions testing the measurement an rwise the EUT was operating suc ons: Temperature: Rel. Humidity: ults Test Performed Output Power	ted on the turntable for ra itenna was located 3 met ch that it constantly hoppe 13.9°C 83% Limit FCC Part 15.247	adiated spur ers from the ed on either Result Pass	ious emissio EUT. the low, cen Com Power was	ons testing. hter or high c nment s 29.19dBm
General Test Con The EUT and all lo For radiated emiss Unless stated othe Ambient Condition Summary of Res Run # 1 2,3,4	nfiguration cal support equipment were loca ions testing the measurement an rwise the EUT was operating suc ons: Temperature: Rel. Humidity: ults Test Performed Output Power Spurious Emissions In Restricted Bands - Omni Antenna	ted on the turntable for ra itenna was located 3 met ch that it constantly hoppe 13.9°C 83% Limit FCC Part 15.247 FCC Part 15.209 / 15.247( c)	Adiated spur ers from the ed on either Result Pass Pass	ious emissio EUT. the low, cen Power was -1.8dB @	nment s 29.19dBm 4878MHz
General Test Con The EUT and all lo For radiated emiss Unless stated othe Ambient Condition Summary of Res Run # 1 2,3,4 5	Infiguration   cal support equipment were loca   ions testing the measurement an   rwise the EUT was operating succons:   Temperature:   Rel. Humidity:   ults   Test Performed   Output Power   Spurious Emissions In   Restricted Bands - Omni   Antenna   20dB Bandwidth	ted on the turntable for ra tenna was located 3 met that it constantly hopped 13.9°C 83% Limit FCC Part 15.247 FCC Part 15.209 / 15.247(c) 15.247(a)	Adiated spur ers from the ed on either Pass Pass Pass	ious emissio EUT. the low, cen Power was -1.8dB @ 995	ons testing. hter or high c nment s 29.19dBm 4878MHz 5kHz

## Elliott

#### 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.

Level	Pol	15.209/	/ 15.247	Detector	Azimuth	Height	Comments
dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
52.7	V	54.0	-1.3	Avg	200	1.0	
49.6	V	54.0	-4.4	Avg	320	1.0	
47.8	Н	54.0	-6.2	Avg	330	1.0	
43.9	Н	54.0	-10.1	Avg	90	1.0	
60.4	V	74.0	-13.6	Pk	200	1.0	
59.6	V	74.0	-14.4	Pk	320	1.0	
57.7	Н	74.0	-16.3	Pk	330	1.0	
54.1	Н	74.0	-19.9	Pk	90	1.0	
	Level dBµV/m 52.7 49.6 47.8 43.9 60.4 59.6 57.7 54.1	Level   Pol     dBμV/m   V/H     52.7   V     49.6   V     47.8   H     43.9   H     60.4   V     59.6   V     57.7   H     54.1   H	Level   Pol   15.209 //     dBμV/m   V/H   Limit     52.7   V   54.0     49.6   V   54.0     47.8   H   54.0     43.9   H   54.0     60.4   V   74.0     59.6   V   74.0     57.7   H   74.0     54.1   H   74.0	Level   Pol   15.209/15.247     dBμV/m   V/H   Limit   Margin     52.7   V   54.0   -1.3     49.6   V   54.0   -4.4     47.8   H   54.0   -6.2     43.9   H   54.0   -10.1     60.4   V   74.0   -13.6     59.6   V   74.0   -14.4     57.7   H   74.0   -16.3     54.1   H   74.0   -19.9	Level   Pol   15.209 / 15.247   Detector     dBμV/m   V/H   Limit   Margin   Pk/QP/Avg     52.7   V   54.0   -1.3   Avg     49.6   V   54.0   -4.4   Avg     47.8   H   54.0   -6.2   Avg     43.9   H   54.0   -10.1   Avg     60.4   V   74.0   -13.6   Pk     59.6   V   74.0   -16.3   Pk     57.7   H   74.0   -19.9   Pk	Level   Pol   15.209 / 15.247   Detector   Azimuth     dBμV/m   V/H   Limit   Margin   Pk/QP/Avg   degrees     52.7   V   54.0   -1.3   Avg   200     49.6   V   54.0   -4.4   Avg   320     47.8   H   54.0   -6.2   Avg   330     43.9   H   54.0   -10.1   Avg   90     60.4   V   74.0   -13.6   Pk   200     59.6   V   74.0   -14.4   Pk   320     57.7   H   74.0   -16.3   Pk   330     54.1   H   74.0   -16.3   Pk   90	Level   Pol   15.209/15.247   Detector   Azimuth   Height     dBμV/m   V/H   Limit   Margin   Pk/QP/Avg   degrees   meters     52.7   V   54.0   -1.3   Avg   200   1.0     49.6   V   54.0   -4.4   Avg   320   1.0     47.8   H   54.0   -6.2   Avg   330   1.0     43.9   H   54.0   -10.1   Avg   90   1.0     60.4   V   74.0   -13.6   Pk   200   1.0     59.6   V   74.0   -16.3   Pk   320   1.0     57.7   H   74.0   -16.3   Pk   330   1.0     57.7   H   74.0   -16.3   Pk   330   1.0     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	Н	54.0	-7.3	Avg	120	1.1	
7317.000	44.4	Н	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	Н	74.0	-18.7	Pk	190	1.1	
4878.000	55.2	Н	76.0	-20.8	Pk	120	1.1	

E	Elliott	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	Н	54.0	-12.0	Avg	330	1.0	
4957.940	39.2	Н	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	Н	74.0	-20.0	Pk	330	1.0	
4957.940	50.9	Н	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 hand omissions more than 20dP
Mid	T38457/605-608	All out-of-ballo emissions more than 2000
High	T38457/609-612	below the highest in-band signal level