

Test Report No.8212306905 Rev1.

For Alvarion (formerly Breezecom & Floware) Ltd.

Equipment Under Test: One Box 2.4 GHz Radio (BreezeNet)

Model: AP-10, AP-10D; SA-10, SA-10D; WB-10, WB-10D; SA-40, SA-40D

From The Standards Institution Of Israel Industry Division Telematics Laboratory EMC Section





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Order placed by:	Alvarion (formerly Breezecom & Floware) Ltd.
Address:	P.O. Box 13139 Tel Aviv 61131 Israel
Sample for test selected by:	The orderer
The date of test:	09/04/2002.
The date of test:	09/04/2002.

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Description of Equipment

Under Test (EUT):	One Box 2.4 GHz Radio (BreezeNet)
Model:	AP-10, AP-10D; SA-10, SA-10D; WB-10, WB-10D; SA-40, SA-40D
Manufactured by:	Alvarion (formerly Breezecom & Floware) Ltd.

Reference Documents:

✤ CFR 47 FCC:	"Rules and Regulations";
	Part 15. "Radio frequency devices";
	Subpart C: "Intentional radiators"

Test Results: The EUT was found to be in compliance with the requirements of: FCC Rules Part 15 Subpart C Sec.15.205, 15.207,15.209, 15.247 (c).

This Test Report contains 34 pages	This Test Report applies only to the specimen tested and may not
and may be used only in full.	be applied to other specimens of the same product.



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1 General

1.1 EUT general description:

Description of EquipmentOne Box 2.4 GHz Radio (BreezeNet)Under Test (EUT):Model:AP-10, AP-10D; SA-10, SA-10D; WB-10, WB-10D; SA-40, SA-40DManufactured by:Alvarion (formerly Breezecom & Floware) Ltd.

The EUT is a spread spectrum transmitter operating within the frequency band 2400 – 2483 MHz. The EUT comes in 8 software versions.

The EUT brief specification:

RF power 22 dBm Antenna used 2400 – 2700 MHz TYP 11 dBi mfr Smartant <u>service@smartant.com</u> S/N 2B100012 P/N ALA-05001

The EUT internal view is shown in Figure 1.

1.2 Scope:

This test report contains results of the tests, performed on One Box 2.4 GHz Radio (BreezeNet) according to the following requirements of CFR 47 FCC Part 15 Subpart C:

- 1. Conducted emission measurements per Sec. 15.207;
- 2. Spurious emission measurements up to 10th harmonic for low, middle and high channels per C Sec.15.209;
- 3. Radiated emission measurements in restricted bands 2310-2390 MHz and 2483.5-2500 MHz, per Sec.15.205, 15.35.
- 4. Spurious Emission, Antenna conducted per Sec.15.247 (c).
- 5. RF power measurements per Sec.15.247 (c).



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Figure 1 EUT internal view (component side & printed side)



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2Test specification, Methods and Procedures

Test Specification:

 CFR 47 FCC: "Rules and Regulations"; Part 15. "Radio frequency devices"; Subpart C: "Intentional radiators".

Methods and Procedures:

 ANSI C63/4/1992: "American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9 kHz to 40 GHz".

3 Measurements, examinations and derived results

3.1 Location of the Test Site:

EMC laboratory of the Standards Institution of Israel in Tel-Aviv.

3.2 Test condition:

Temperature:22 °CHumidity:60 %



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3.3 Conducted emission test:

3.3.1 <u>Requirements:</u>

EUTs conducted emission within the band 450 kHz to 30 MHz shall not exceed value required in section 15.207.

3.3.2 <u>Test configuration:</u>

The measurements were performed on the mains input of the EUT power adapter. The EUT was placed on a non-metallic table in a shielded chamber at a height of 80 cm from the floor of the shielded chamber and 40 cm from the wall of the shielded chamber.

3.3.3 <u>Test procedure:</u>

The EUT was operated to transmitting through the customer software. First, initial scans were performed. Final measurements were performed at the frequencies where emission exceeded the tolerance limit.

Test equipment (EMI receiver) setup was as follow:

Initial scan:

Detector type	Peak
Mode	Max hold
Bandwidth	9 kHz
Step size	Continuous sweep
Sweep time	>100 msec
<u>Measurements</u>	
Detector type	Quasi-peak, Avg (CISPR)
Bandwidth	9 kHz
Measurement time	200 seconds/MHz
Observation	>15 seconds

3.3.4 <u>Test results:</u>

The conducted emissions from the EUT were found below specified limit. Test results are shown in Table 1 and Plots #1 - #4.



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Frequency (MHz)	Tested line	Detector type	Emissions (dBµV)	Limit (dBµV)	Margin (dB)	Results
		Peak	38.54	-		
0.59	Phase	QP	37.04	48	11.0	Complies
		AVG	36.16	-		
		Peak	34.0	-		
0.691	Phase	QP	32.36	48	15.6	Complies
		AVG	31.23	-		
		Peak	40.1	-		
2.164	Phase	QP	38.87	48	9.1	Complies
		AVG	38.2	-		
		Peak	40.86	-		
2.262	Phase	QP	39.99	48	8.0	Complies
		AVG	38.63	-		
		Peak	40.56	-		
2.364	Phase	QP	39.54	48	8.5	Complies
		AVG	38.19	-		
	Phase	Peak	38.68	-		
2.462		QP	37.67	48	10.3	Complies
		AVG	36.35	-		
		Peak	27.7	-		
0.994	Neutral	QP	23.17	48	24.8	Complies
		AVG	20.2	-		
		Peak	38.01	-		
1.88	Neutral	QP	35.85	48	12.2	Complies
		AVG	31.45	-		
		Peak	41.51	-		
2.175	Neutral	QP	39.32	48	8.7	Complies
		AVG	36.2	-		
		Peak	41.09	-		
2.269	Neutral	QP	40.21	48	7.8	Complies
		AVG	39.14	-		
		Peak	41.1			
2.369	Neutral	QP	40.01	48	8.0	Complies
		AVG	39.15			
		Peak	39.64	-		
2.468	Neutral	QP	37.5	48	10.5	Complies
		AVG	31.72	-		

Table 1. Conducted emission test resultsEUT: One Box 2.4 GHz Radio



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Plot 1. Conducted emissions measurement result Reference standard: FCC Part 15 Subpart C sec.15.207 Frequency range: 450 kHz-5 MHz line: phase



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(bp)	11:46:47	7 Apr 9,	2002							
BREEZE	ENET 22d	Bm							Mkr1 12	2.25 MHz
Ref 58	dB µ V		Ĥ	tten 5 dB	3 Ext PG	-10 dB			23.3	35 dB µ V_
Peak										
Log										
10										
dB/			1							
		<u>ь н</u>	.							
	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	ym HVI	YWWWWWW	MANA	month	turn	mon	MMm	moment	Mm
				•	* ·		• •			
V1 S2										
Start 5	5 MHz								Stop	30 MHz
#Res B	W 9 kHz				VBW 30 kl	Hz			Sweep	671 ms

Plot 2. Conducted emissions measurement result Reference standard: FCC Part 15 Subpart C sec.15.207 Frequency range: 5-30 MHz line: phase



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**Plot 3.** Conducted emissions measurement result Reference standard: FCC Part 15 Subpart C sec.15.207 Frequency range: 450 kHz-5 MHz line: neutral

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(bp)	11:57:2	3 Apr 9,	2002							
BREEZE	ENET 22d	IBm NEUTI	RAL						Mkr1 11	.69 MHz
Ref 58	dB <b>µ</b> V		A	ltten 5 df	B Ext PG	–10 dB			22.6	62 dB <b>µ</b> V
Peak										
Log										
10										
dB/			1							
			nd. 81.	L.						
	white	www.thu	<del>∿₩₩~v₩</del>	mong	monor	Am	Month	mont	mon	www.hw
										· ¥
	Mark	er								
	11 0									
	11.0	130006	) MITZ							
	- 22.	62 dB	⊔₩							
V1 S2										
Start 5	5 MHz								Stop	) 30 MHz
#Res B	W 9 kHz				VBW 30 k	Hz			Sweep	671 ms
		Dia	+ 1 C	anductod	omission		romont r	acult		
		<u>F10</u>	<u>R</u>	forence	standard	· FCC Da	ort 15 Sub	<u>bouit</u> Coart Coa	ac 15 207	,
V1 S2 Start 5 #Res B	Mark 11.8 22.	er 90000 62 dB <u>Plo</u>	) MHz ⊭V	onducted	VBW 30 k emission standard	Hz s measu : FCC Pa	rement re	esult ppart C se	Stop Sweep ec.15.207	) 30 MHz 671 ms

Frequency range: 5-30 MHz

line: neutral



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#### 3.4 Radiated emission test:

#### 3.4.1 <u>Requirements:</u>

EUTs radiated emission shall not exceed value required in sections 15.209.

#### 3.4.2 <u>Test procedure:</u>

The measurements were performed in the anechoic Chamber. The EUT was arranged on a non-metallic table 0.8 m placed on the turntable. Measuring antenna used: Double Ridge, height 1 m. Measurement distance – 1m

Measuring detector function and bandwidths:

Detector type	Peak
Resolution bandwidth	1MHz
Video bandwidth	1 MHz
Detector type	Average
Resolution bandwidth	1MHz
Video bandwidth	3 kHz*

The frequency range was investigated up to 24820 MHz. Results above 18GHz are not calibrated. No harmonics above 18GHz were detected.

#### 3.4.3 Radiated emission test results:

The test results of spurious emissions are shown in table #1 to #3. The test results of emissions in restricted bands are shown in Plots #5 to #8.

Note : The measurements in were performed at 1 m distance instead of 3 m, thus the restricted bands specified limit line of 54 dB $\mu$ V/m (for Average detector) and 74 dB $\mu$ V/m (for Peak detector) were raised to 10 dB.



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#### Table 1. Spurious emissions test results

Tested unit:	
Frequency:	

One Box 2.4 GHz Radio Low operating frequency 2402 MHz

Frequency (MHz)	Emission Level (dBμV/m)		Limit @ 3m (dBµV/m)		Mar (d	Results	
	Average	Peak	Average	Peak	Average	Peak	
4804	44.6	45.6			9.4	28.4	Complies
7206	50.9	54.3			3.1	19.7	Complies
9608	37.2	49.5			16.8	24.5	Complies
12010	42.3	50.8			11.7	23.2	Complies
14412	48.5	55	54	74	5.5	19	Complies
16814	48.8	55.5			5.2	18.5	Complies
19216	46.7	52.3			7.3	21.7	Informative
21618	48.4	55.4			5.6	18.6	Informative
24020	50.2	55.7			3.8	18.3	Informative

Note : Emission level = E Reading  $(dB\mu V)$  + measuring cable loss (dB) + measuring antenna factor (dB/m) + Distance correction factor For measuring cable loss and measuring antenna factor refer to Appendix 2. Distance correction factor = -9.5 dB (correction to extrapolation reading from 1 m to 3m specified distance)



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#### Table 2. Spurious emissions test results

Tested unit:	
Frequency:	

One Box 2.4 GHz Radio Middle operating frequency 2441 MHz

Frequency (MHz)	Emission Level (dBμV/m)		Limit @ 3m (dBµV/m)		Mar (d	rgin B)	Results
	Average	Peak	Average	Peak	Average	Peak	
4882	49.8	50.9			4.2	23.1	Complies
7323	54	56.9			0	17.1	Complies
9764	47.1	50.7			6.9	23.3	Complies
12205	42	52.8			12	21.2	Complies
14646	48.6	55.4	54	74	5.4	18.6	Complies
17087	49.5	57.5			4.5	16.5	Complies
19528	47.3	55.1			6.7	18.9	Informative
21969	49.7	56			4.3	18	Informative
24410	51	58.7			3	15.3	Informative

Note : Emission level = E Reading  $(dB\mu V)$  + measuring cable loss (dB) + measuring antenna factor (dB/m) + Distance correction factor For measuring cable loss and measuring antenna factor refer to Appendix 2. Distance correction factor = -9.5 dB (correction to extrapolation reading from 1 m to 3m specified distance)



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#### Table 3. Spurious emissions test results

Tested unit:	
Frequency:	

One Box 2.4 GHz Radio High operating frequency 2482 MHz

Frequency (MHz)	Emission Level (dBμV/m)		Lir @ (dBµ	nit 3m V/m)	Mar (d	·gin B)	Results
	Average	Peak	Average	Peak	Average	Peak	
4964	52.8	54			1.2	20	Complies
7446	51.9	53.8			2.1	20.2	Complies
9928	42.1	49.2			11.9	24.8	Complies
12410	42	52.8			12	21.2	Complies
14892	48.6	55.4	54	74	5.4	18.6	Complies
17374	49.5	57.5			4.5	16.5	Complies
19856	47.3	55.1			6.7	18.9	Informative
22338	49.7	56			4.3	18	Informative
24820	51	58.7			3	15.3	Informative

Note : Emission level = E Reading  $(dB\mu V)$  + measuring cable loss (dB) + measuring antenna factor (dB/m) + Distance correction factor For measuring cable loss and measuring antenna factor refer to Appendix 2. Distance correction factor = -9.5 dB (correction to extrapolation reading from 1 m to 3m specified distance)



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#### Plot # 5 Radiated emissions measured in restricted band 2483.5 –2500 MHz at High operating frequency 2482 MHz

Detector used:

Average

(bp)	15:40:9	52 Apr	9,200	2				
BREEZI Ref_97	ENET 2 .99 dB	2dBm 8 <b>µ</b> V∕m	Atten	15 dB		Mkr1 58	2.483 3.48 dE	00 GHz 3 <b>µ</b> V/m
Peak Ing								
10 dB/								
DI 🕹				~~~~~~	 			
dB <b>µ</b> V∕	n							
V1 S2 S3 FC								
A AA								
Start 2.483 GHz Stop 2.5 GHz					5 GHz			
Kes DM	Kes BW I MHZ #VBW 3 KHZ Sweep 17.67			67 ms				



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#### Plot # 6 Radiated emissions measured in restricted band 2483.5–2500 MHz at High operating frequency 2482 MHz

Detector used:

Peak





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#### Plot #7 Radiated emissions measured in restricted band 2310 –2390 MHz at Low operating frequency 2402 MHz

Detector used:

Average





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#### Plot #8 Radiated emissions measured in restricted band 2310 –2390 MHz at Low operating frequency 2402 MHz

Detector used:

Peak





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#### 3.5 Spurious Emission, Antenna conducted:

#### 3.5.1 <u>Requirements:</u>

The EUTs spurious emissions antenna conducted shall not exceed value required in sections 15.247 (c).

#### 3.5.2 <u>Test procedure:</u>

The EUTs antenna connector was connected directly to the spectrum analyzer input The measurements were performed from 1 to 26 GHz for low, middle and high channels were the unit is set to packetized transmission. In addition output power measurements were performed with Power Meter.

#### 3.5.3 <u>Test results:</u>

Test results are shown in Plots #9 to #14. Output power measured with power meter: Low channel: 21.4 dBm Mid channel: 21.7 dBm High channel: 21.3 dBm



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Plot # 9 Antenna conducted output power, Low operating frequency







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Plot #11
Antenna conducted output power, High operating frequency





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Plot # 12 Spurious Emission, Antenna conducted, Low operating frequency





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#### Plot # 13 Spurious Emission, Antenna conducted, Middle operating frequency





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Plot # 14		
Spurious Emission, Antenna conducted, High operating	freq	uency





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# 4 Compliance with specification

Test	FCC Part 15 Subpart C Sec #	Test result
Conducted emission	Sec.15.207	Complies
Spurious radiated emission	Sec.15.209	Complies
Radiated emissions in restricted bands	Sec.15.205	Complies
Spurious emissions antenna conducted	Sec.15.247 (c )	Complies

Name: Eng. Yuri Rozenberg Position: Head of EMC Branch Telematics Laboratory 8 May, 2002

Name Maxim Reizin Position: Testing Technician



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# 5 Appendix 1: Test equipment used

All measurements equipment is on SII calibration schedule with a recalibration interval not exceeding once a year.

Instrument	Manufac- turer	Model	Serial No.	Last calibration date	Next calibration date
Spectrum analyzer 10 KHz-26.5 GHz	HP	E7405a	SII 4944	04/02	04/03
Antenna Double Ridge 1-18 GHz	EMCO	3115	SII4873	03/02	03/03
LISN 9 kHz – 30 MHz	FCC	LISN- 50/250-32-4- 16	SII 5023	05/01	05/02
Power Meter	HP	HP 437B	3125U08091	07/01	07/02
Power Sensor		HP 8481A			
Transient limiter 0.009-200 MHz	HP	11947A	31074A3105	05/01	05/02



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# 6 Appendix 2: Antenna Factor and Cable Loss

Cable Loss Type: Sucoflex 104PE; Ser.No.21324/4PE; 4 m length					
Point	Frequency (GHz)	Cable Loss (dB)			
0	0.0-1.8	1.67			
1	1.8 – 3.6	2.39			
2	3.6 - 5.4	3.04			
3	5.4-7.2	3.58			
4	7.2-9.0	4.06			
5	9.0-10.8	4.49			
6	10.8-12.6	4.91			
7	12.6-14.4	5.31			
8	14.4-16.2	5.66			
9	16.2-18.00	6.01			

Antenna Factor Double Ridged Guide Antenna mfr EMCO model 3115

Point	Frequency (MHz)	Antenna Factor (dB/m)
1	2000	27.4
2	2500	28.9
3	3000	31.0
4	4000	33.1
5	4500	32.5
6	5000	32.4
7	6000	53.7
8	6500	35.6
9	7000	36.4
10	7500	36.9
11	8000	37.0
12	8500	38.0
13	9000	38.6
14	9500	38.4
15	10000	38.4
16	10500	38.4
17	11000	38.9
18	11500	39.6
19	12000	39.4
20	12500	39.2
21	13000	40.3
22	13500	41.0
23	14000	41.2
24	14500	41.3
25	15000	40.0
26	15500	38.0
27	16000	38.1
28	16500	40.3
29	17000	42.2
30	17500	44.6
31	18000	46.2



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# 7 Appendix 3: Test configuration illustration



Photo #1. One Box 2.4 GHz Radio

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Photo #2. One Box 2.4 GHz Radio

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Photo #3 One Box 2.4 GHz Radio test setup



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Photo #4 One Box 2.4 GHz Radio test setup



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Photo #5 Antenna 2400-2700 MHz/TYP 11dBi