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RF-EXPOSURE ASSESSMENT REPORT

FCC 47 CFR Part 2.1091
Industry Canada RSS-102

RF-Exposure evaluation of mobile equipment

Report Reference No. ..... :	G0M21011-3871-C-1
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	 A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 FCC Filed Test Laboratory, Reg.-No.: 96970 IC OATS Filing assigned code: 3470A
Applicant's name ..... :	Connect One Ltd.
Address ..... :	20 Atir Yeda Street 44643 Kfar Saba Israel
Test specification:	
Standard..... :	47 CFR 1.1310 / 47 CFR 2.1091 / 47 CFR 2.1093 OET Bulletin 65:1997 RSS-102, Issue 4:2010 Safety Code 6:2009
Equipment under test (EUT):	
Product description	Wireless 802.11b/g module
Model No.	iW-SM2144N2BIO
Hardware version	CO2144-D
Firmware / Software version	ID807b16
	FCC-ID: XM5-SM2144N2 IC: 8516A-SM2144N2
Test result	**Passed**

Possible test case verdicts:		
- not applicable to test object ..... :	N/A	
- test object does meet the requirement ..... :	P (Pass)	
- test object does not meet the requirement ..... :	F (Fail)	
Testing:		
Date of receipt of test item ..... :	16.11.2010	
Date (s) of assessment ..... :	2012-03-01	
Compiled by ..... :	Christian Weber	
Assessed by (+ signature) ..... : (Testing Manager)	Christian Weber	C. Weber .....
Approved by (+ signature) ..... : (Test Lab Manager)	Jens Zimmermann	.....
Date of issue ..... :	2012-03-01	
Total number of pages ..... :	11	

General remarks:

The test results presented in this report relate only to the object tested.

The results contained in this report reflect the results for this particular model and serial number. It is the responsibility of the manufacturer to ensure that all production models meet the intent of the requirements detailed within this report.

This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.

Additional comments:

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1 Equipment (Test item) Description

Description	Wireless 802.11b/g module
Model	iW-SM2144N2BIO
Serial number	14036DCA
Hardware version	CO2144-D
Software / Firmware version	ID807b16
FCC-ID	XM5-SM2144N2
IC	8516A-SM2144N2
Equipment type	Radio module

1.1 Reference Documents

Document type	Document No.	Issued by	Date
FCC 15.247 Radio Report	G0M21011-3871-P-15	Eurofins Product Service GmbH	03.11.2011

1.2 Radiation Sources

Mode #	Description	
WLAN 802.11b	Frequency range [MHz]	2412 – 2462
	Channels	11
	Transmission modes	CCK, DSSS
	Modulations	BPSK, QPSK
	Maximum radiated power [dBm]	15.00 (1Mbps)
	Maximum transmission duty cycle [%]	100%
	Antenna 1 gain [dBi]	2.68
	Antenna 1 diameter [cm]	~10
WLAN 802.11g	Frequency range [MHz]	2412 – 2462
	Channels	11
	Transmission modes	OFDM
	Modulations	BPSK, QPSK
	Maximum radiated power [dBm]	11.90 (6Mbps)
	Maximum transmission duty cycle [%]	100%
	Antenna 1 gain [dBi]	2.68
	Antenna 1 diameter [cm]	~10

2 Result Summary

FCC 47 CFR Part 2.1091, IC RSS-102			
Product Specific Standard Section	**Requirement**	**Result**	**Remarks**
47 CFR 2.1091	Maximum permissible exposure @ 20cm below limit	PASS	
RSS-102 2.5.2	Maximum permissible exposure @ 20cm below limit	PASS	
Remarks:			

3 RF-Exposure Classifications

Device Types	
Fixed	A fixed device is defined as a device physically secured at one fixed location and cannot be easily re-located.
Mobile	A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. (47 CFR 2.1091)
Portable	A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. (47 CFR 2.1093)

Exposure Categories	
Occupational / Controlled	Limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
General population / uncontrolled	Exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

4 Assessment

4.1 MPE Assessment – 47 CFR 2.1091 / RSS-102

MPE Assessment acc. to 47 CFR 2.1091 / IC RSS-102				Verdict: PASS
Assessment according to reference	Reference Method			
	FCC OET Bulletin 65 / RSS-102 & Safety Code 6			
Device type	mobile			
Exposure category	General public			
IC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m^2]	Averaging time [min]
0.003 – 1.0	600	4.9	N/A	6
1 – 10	600/f	4.9/f	N/A	6
10 – 30	60	4.9/f	N/A	6
30 – 300	60	0.163	10.0*	6
300 – 1500	$3.54 \cdot f^{0.5}$	$0.0094 \cdot f^{0.5}$	f/30	6
1500 - 15000	137	0.364	50	6
15000 - 150000	137	0.364	50	$616000/f^{0.5}$
150000 - 300000	$0.354 \cdot f^{0.5}$	$9.4 \cdot 10^{-4} \cdot f^{0.5}$	$3.33 \cdot 10^{-4} \cdot f$	$616000/f^{0.5}$
IC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m^2]	Averaging time [min]
0.003 – 1.0	280	2.19	N/A	6
1 – 10	280/f	2.19/f	N/A	6
10 – 30	28	2.19/f	N/A	6
30 – 300	28	0.073	2.0*	6
300 – 1500	$1.585 \cdot f^{0.5}$	$0.0042 \cdot f^{0.5}$	f/150	6
1500 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	$616000/f^{0.5}$
150000 - 300000	$0.158 \cdot f^{0.5}$	$4.21 \cdot 10^{-4} \cdot f^{0.5}$	$6.67 \cdot 10^{-5} \cdot f$	$616000/f^{0.5}$
* = Power density is applicable at frequencies greater than 100MHz; f in MHz				

FCC Limits – Occupational / Controlled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [mW/cm^2]	Averaging time [min]
0.3 – 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f^2)*	6
30 - 300	61.4	0.163	1.0	6
300 - 1500	N/A	N/A	f/300	6
1500 - 100000	N/A	N/A	5.0	6
FCC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [mW/cm^2]	Averaging time [min]
0.3 – 1.34	614	1.63	(100)*	30
1.34 - 30	842/f	2.19/f	(180/f^2)*	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	N/A	N/A	f/1500	30
1500 - 100000	N/A	N/A	1.0	30
* = Plane wave equivalent power density; f in MHz				

Assessment Relations

$$\lambda[m] = \frac{c\left[\frac{m}{s}\right]}{f[Hz]} \; ; \; R_{FF}[m] \geq \frac{2 \cdot D[m]^2}{\lambda[m]}$$

$$S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2} \; ; \; R[cm] = \sqrt{\frac{P_{E.I.R.P.}[mW]}{4\pi S[mW/cm^2]}}$$

$$P_R[mW] = P_C[mW] \cdot G \; ; \; P_R[dBm] = P_C[dBm] + G[dBi]$$

$$DCC\ [dB] = 10 \cdot Log_{10}\left(\frac{DC[\%]}{100}\right)$$

Assessment procedure

For each radio and frequency band the worst case transmission mode with the highest peak conducted or radiated power is evaluated at the frequency that results in the most restrictive rf-exposure limit. From the peak power values, antenna gains and duty cycles taken from the reference documents, the source average radiated power values are calculated. From the average radiated power the power densities at antenna far-field distance, at 20cm separation distance from the radiation source is calculated. Compliance with the RF-Exposure limit is determined at 20cm separation distance.

Assessment results – Digital transmission system in the 2400-2483.5MHz band		
Transmission mode		
Operating mode frequency range [MHz]	2412 – 2462	
Assessment frequency (f) [MHz]	2412	
Transmission duty cycle (DC) [%]	100	
Peak conducted power (P_C) [dBm]	15.00	
Peak radiated power (P_R) [dBm e.i.r.p.]	17.68	
Peak Antenna gain (G) [dBi]	2.68	
Maximum Antenna Diameter D [cm]	10.0	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.124m	12.44cm
Antenna far-field distance (R_{FF})	0.161m	16.08cm
Power evaluation		
Peak conducted power (P_C)	31.62mW	15.00dBm
Peak Antenna Gain (G)	1.85	2.68dBi
Calculated peak radiated power ($P_{R\text{-}Calc}$)	58.61mW	17.68dBm
Measured peak radiated power (P_R)	58.61mW	17.68dBm
Source average Power		
Maximum transmission duty cycle (DC)	100.0%	
Duty cycle correction (DCC)	1.00	0.00dB
Measured peak radiated power (P_R)	58.61mW	17.68dBm
Averaged peak radiated power (P_{RAVG})	58.61mW	17.68dBm
Power density		
Compliance power density limit	1.000mW/cm^2	10.00W/m^2
Power density @ Antenna far-field distance	0.018mW/cm^2	0.180W/m^2
Power density @ 20cm	0.012mW/cm^2	0.117W/m^2
Distance for compliance power density	0.022m	2.16cm
Verdict		
The power density of the EUT at 20cm is below the FCC/IC MPE limit!		
Comments: The 1Mbps 802.11b transmission mode has been selected for evaluation because this mode has the highest output power		