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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. ..... :	G0M-1109-1405 – C-4
Testing Laboratory ..... :	Eurofins Product Service GmbH
Address ..... :	Storkower Str. 38c 15526 Reichenwalde Germany
Accreditation ..... :	FCC Filed Test Laboratory, Reg.-No.: 96970 A2LA Accredited Testing Laboratory, Certificate No.: 1983.01 ACCREDITED TESTING CERT# 1983.01
Applicant's name ..... :	Panasonic Electronic Devices Europe GmbH
Address ..... :	Zeppelinstr. 28 21337 Lueneburg Germany
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 Sensor Networks, Meter Reading, home automation
Model No.	ENW59625xxxF
Hardware version	05
Firmware / Software version	01
	FCC-ID: T7V-2580 IC: 216Q-2580
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	:	20.09.2011
Date (s) of assessment	:	12.12.2011
Compiled by	:	Christian Weber
Assessed by (+ signature)	:	Christian Weber
Approved by (+ signature)	:	Jens Zimmermann
Date of issue	:	12.12.2011
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.

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Additional comments:

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1 Equipment (Test item) Description:

Description	Wireless Sensor Networks, Meter Reading, home automation
Model	ENW59625xxxF
Serial number	MAC001C2C1B254CB520
Hardware version	05
Software / Firmware version	01
FCC-ID	T7V-2580
IC	216Q-2580
Equipment type	Radio module

1.1 Reference Documents

Document type	Document No.	Issued by	Date
FCC 15.247 Radio Report	G0M-1109-1405-P-15	Eurofins Product Service GmbH	08.12.2011

1.2 Radiation Sources

Mode #	Description	
902MHz	Frequency range [MHz]	902.4 -927.6
	Channels	64
	Transmission modes	FHSS
	Modulations	FSK
	Maximum radiated power [dBm]	17.90
	Maximum transmission duty cycle [%]	49
	Antenna 1 gain [dBi]	2.0
	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 2.52	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)*	6
1.34 - 30	842/f	2.19/f	(180/f^2)*	6
30 - 300	27.5	0.073	0.2	6
300 - 1500	N/A	N/A	f/1500	6
1500 - 100000	N/A	N/A	1.0	6
* = 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 – Frequency hopping in the 902-928MHz band		
Transmission mode		
Operating mode frequency range [MHz]	902 – 928	
Assessment frequency (f) [MHz]	902.4	
Transmission duty cycle (DC) [%]	49	
Peak conducted power (P_C) [dBm]	17.70	
Peak radiated power (P_R) [dBm e.i.r.p.]	17.90	
Peak Antenna gain (G) [dBi]	2.00	
Maximum Antenna Diameter D [cm]	20.0	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.332m	33.24cm
Antenna far-field distance (R_{FF})	0.241m	24.06cm
Power evaluation		
Peak conducted power (P_C)	58.88mW	17.70dBm
Peak Antenna Gain (G)	1.58	2.00dBi
Calculated peak radiated power ($P_{R\text{-}Calc}$)	93.33mW	19.70dBm
Measured peak radiated power (P_R)	61.66mW	17.90dBm
Source average Power		
Maximum transmission duty cycle (DC)	49.0%	
Duty cycle correction (DCC)	0.49	-3.10dB
Measured peak radiated power (P_R)	61.66mW	17.90dBm
Averaged peak radiated power (P_{RAVG})	30.21mW	14.80dBm
Power density		
Compliance power density limit	0.602mW/cm^2	6.02W/m^2
Power density @ Antenna far-field distance	0.004mW/cm^2	0.042W/m^2
Power density @ 20cm	0.006mW/cm^2	0.060W/m^2
Distance for compliance power density	0.020m	2.00cm
Verdict		
The power density of the EUT at 20cm is below the FCC/IC MPE limit!		
Comments:		