

## RF-EXPOSURE ASSESSMENT REPORT

FCC 47 CFR Part 2.1091  
Industry Canada RSS-102

RF-Exposure evaluation of mobile equipment

**Report Reference No.** ..... : G0M-1111-1529-TFC091M-V01

**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** ..... : TomTom International BV

**Address** ..... : Rembrandtplein 35  
1017 CT Amsterdam  
The Netherlands

### 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	Telematic Device with GPRS/BT/GPS	
Model No.	LINK 5	
Hardware version	TomTom drs1_2a_pcb 37/2011	
Firmware / Software version	10.02.855	
	FCC-ID: SALLINK500	IC: N/A

**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 .....: 2011-11-14

Date (s) of assessment .....: 2012-03-05

Compiled by .....: Christian Weber

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(Test Lab Manager)

*T. Jahn*

Date of issue .....: 2012-03-05

Total number of pages .....: 14

**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

<b>Description</b>	Telematic Device with GPRS/BT/GPS
<b>Model</b>	LINK 5
<b>Serial number</b>	None
<b>Hardware version</b>	TomTom drs1_2a_pcb 37/2011
<b>Software / Firmware version</b>	10.02.855
<b>FCC-ID</b>	SALLINK500
<b>IC</b>	N/A
<b>Equipment type</b>	End product

## 1.1 Reference Documents

Document type	Document No.	Issued by	Date
FCC 22H/24E Test Report	G0M-1111-1529-TFC224M-V01	Eurofins Product Service GmbH	2012-01-23
FCC 15.247 Test Report	G0M-1111-1529-TFC247B-V01	Eurofins Product Service GmbH	2012-01-24

## 1.2 Radiation Sources

Mode #	Description	
GSM850	Frequency range [MHz]	824.2 MHz - 848.8 MHz
	Channels	124
	Transmission modes	Circuit Switched
	Modulations	GMSK
	Maximum radiated power [dBm e.i.r.p.]	34.46 + 2.15 = 36.61
	Maximum transmission duty cycle [%]	12.5 (Single Slot)
	Antenna gain [dBi]	2.2 (external antenna) -1.3 (internal antenna)
	Antenna diameter [cm]	10 (external antenna) 4 (internal antenna)
GPRS850	Frequency range [MHz]	824.2 MHz - 848.8 MHz
	Channels	124
	Transmission modes	Packet Switched
	Modulations	GMSK
	Maximum radiated power [dBm e.i.r.p.]	34.46 + 2.15 = 36.61
	Maximum transmission duty cycle [%]	25 (Multislot Class 10)
	Antenna gain [dBi]	2.2 (external antenna) -1.3 (internal antenna)
	Antenna diameter [cm]	10 (external antenna) 4 (internal antenna)
GSM1900	Frequency range [MHz]	1850.2 MHz - 1909.8 MHz
	Channels	299
	Transmission modes	Circuit Switched
	Modulations	GMSK
	Maximum radiated power [dBm e.i.r.p.]	32.69
	Maximum transmission duty cycle [%]	12.5 (Single Slot)
	Antenna gain [dBi]	2.2 (external antenna) -1.5 (internal antenna)
	Antenna diameter [cm]	10 (external antenna) 4 (internal antenna)

GPRS1900	Frequency range [MHz]	1850.2 MHz - 1909.8 MHz
	Channels	299
	Transmission modes	Packet Switched
	Modulations	GMSK
	Maximum radiated power [dBm e.i.r.p.]	32.69
	Maximum transmission duty cycle [%]	25 (Multislot Class 10)
	Antenna gain [dBi]	2.2 (external antenna) -1.5 (internal antenna)
	Antenna diameter [cm]	10 (external antenna) 4 (internal antenna)
Bluetooth	Frequency range [MHz]	2402 MHz - 2480 MHz
	Channels	79
	Transmission modes	BASIC, EDR
	Modulations	GFSK, PI/4-DQPSK, 8DPSK
	Maximum radiated power [dBm e.i.r.p.]	3.5
	Maximum transmission duty cycle [%]	47
	Antenna gain [dBi]	0
	Antenna diameter [cm]	0.6

## 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	N/A	
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 <sup>2</sup> ]	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·f <sup>0.5</sup>	0.0094·f <sup>0.5</sup>	f/30	6
1500 - 15000	137	0.364	50	6
15000 - 150000	137	0.364	50	616000/f <sup>0.5</sup>
150000 - 300000	0.354·f <sup>0.5</sup>	9.4·10 <sup>-4</sup> ·f <sup>0.5</sup>	3.33·10 <sup>-4</sup> ·f	616000/f <sup>0.5</sup>
IC Limits – General Population / Uncontrolled Exposure				
Frequency range [MHz]	Electric field strength [V/M]	Magnetic field strength [A/M]	Power density [W/m <sup>2</sup> ]	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·f <sup>0.5</sup>	0.0042·f <sup>0.5</sup>	f/150	6
1500 - 15000	61.4	0.163	10	6
15000 - 150000	61.4	0.163	10	616000/f <sup>0.5</sup>
150000 - 300000	0.158·f <sup>0.5</sup>	4.21·10 <sup>-4</sup> ·f <sup>0.5</sup>	6.67·10 <sup>-5</sup> ·f	616000/f <sup>0.5</sup>
* = 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 <sup>2</sup> ]	Averaging time [min]
0.3 – 3.0	614	1.63	(100)*	6
3.0 - 30	1842/f	4.89/f	(900/f <sup>2</sup> )*	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 <sup>2</sup> ]	Averaging time [min]
0.3 – 1.34	614	1.63	(100)*	30
1.34 - 30	842/f	2.19/f	(180/f <sup>2</sup> )*	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				
<p>For each radio and frequency band the worst case standalone 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 and at 20cm separation distance from the radiation source is calculated. Compliance with the RF-Exposure limit is determined at 20cm separation distance.</p>				

Assessment results – GSM/GPRS 850		
Transmission mode		
Operating mode frequency range [MHz]	824.2 - 848.8	
Assessment frequency (f) [MHz]	824.2	
Transmission duty cycle (DC) [%]	25	
Peak conducted power (P <sub>C</sub> ) [dBm]	34.41	
Peak radiated power (P <sub>R</sub> ) [dBm e.i.r.p.]	36.61	
Peak Antenna gain (G) [dBi]	2.20	
Maximum Antenna Diameter D [cm]	10.0	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.364m	36.40cm
Antenna far-field distance (R <sub>FF</sub> )	0.055m	5.49cm
Power evaluation		
Peak conducted power (P <sub>C</sub> )	2760.58mW	34.41dBm
Peak Antenna Gain (G)	1.66	2.20dBi
Calculated peak radiated power (P <sub>R-Calc</sub> )	4581.42mW	36.61dBm
Measured peak radiated power (P <sub>R</sub> )	4581.42mW	36.61dBm
Source average Power		
Maximum transmission duty cycle (DC)	25.0%	
Duty cycle correction (DCC)	0.25	-6.02dB
Measured peak radiated power (P <sub>R</sub> )	4581.42mW	36.61dBm
Averaged peak radiated power (P <sub>RAVG</sub> )	1145.35mW	30.59dBm
Power density		
Compliance power density limit	0.549mW/cm <sup>2</sup>	5.49W/m <sup>2</sup>
Power density @ Antenna far-field distance	3.019mW/cm <sup>2</sup>	30.189W/m <sup>2</sup>
Power density @ 20cm	0.228mW/cm <sup>2</sup>	2.279W/m <sup>2</sup>
Distance for compliance power density	0.129m	12.88cm
Verdict		
The power density of the EUT at 20cm is below the FCC/IC MPE limit!		
Comments: GPRS850 mode at highest transmission frequency and maximum transmission duty cycle		

Assessment results – GSM/GPRS 1900		
Transmission mode		
Operating mode frequency range [MHz]	1850.2 - 1909.8	
Assessment frequency (f) [MHz]	1909.8	
Transmission duty cycle (DC) [%]	25	
Peak conducted power (P <sub>C</sub> ) [dBm]	30.49	
Peak radiated power (P <sub>R</sub> ) [dBm e.i.r.p.]	32.69	
Peak Antenna gain (G) [dBi]	2.20	
Maximum Antenna Diameter D [cm]	10.0	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.157m	15.71cm
Antenna far-field distance (R <sub>FF</sub> )	0.127m	12.73cm
Power evaluation		
Peak conducted power (P <sub>C</sub> )	1119.44mW	30.49dBm
Peak Antenna Gain (G)	1.66	2.20dBi
Calculated peak radiated power (P <sub>R-Calcd</sub> )	1857.80mW	32.69dBm
Measured peak radiated power (P <sub>R</sub> )	1857.80mW	32.69dBm
Source average Power		
Maximum transmission duty cycle (DC)	25.0%	
Duty cycle correction (DCC)	0.25	-6.02dB
Measured peak radiated power (P <sub>R</sub> )	1857.80mW	32.69dBm
Averaged peak radiated power (P <sub>RAVG</sub> )	464.45mW	26.67dBm
Power density		
Compliance power density limit	1.000mW/cm <sup>2</sup>	10.00W/m <sup>2</sup>
Power density @ Antenna far-field distance	0.228mW/cm <sup>2</sup>	2.280W/m <sup>2</sup>
Power density @ 20cm	0.092mW/cm <sup>2</sup>	0.924W/m <sup>2</sup>
Distance for compliance power density	0.061m	6.08cm
Verdict		
The power density of the EUT at 20cm is below the FCC/IC MPE limit!		
Comments: GPRS1900 mode at highest transmission frequency and maximum transmission duty cycle		

Assessment results – Bluetooth		
Transmission mode		
Operating mode frequency range [MHz]	2402 - 2480	
Assessment frequency (f) [MHz]	2441	
Transmission duty cycle (DC) [%]	47	
Peak conducted power (P <sub>C</sub> ) [dBm]	3.5	
Peak radiated power (P <sub>R</sub> ) [dBm e.i.r.p.]	3.5	
Peak Antenna gain (G) [dBi]	0	
Maximum Antenna Diameter D [cm]	0.6	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.123m	12.29cm
Antenna far-field distance (R <sub>FF</sub> )	0.001m	0.06cm
Power evaluation		
Peak conducted power (P <sub>C</sub> )	2.24mW	3.50dBm
Peak Antenna Gain (G)	1.00	0.00dBi
Calculated peak radiated power (P <sub>R-Calc</sub> )	2.24mW	3.50dBm
Measured peak radiated power (P <sub>R</sub> )	2.24mW	3.50dBm
Source average Power		
Maximum transmission duty cycle (DC)	47.0%	
Duty cycle correction (DCC)	0.47	-3.28dB
Measured peak radiated power (P <sub>R</sub> )	2.24mW	3.50dBm
Averaged peak radiated power (P <sub>RAVG</sub> )	1.05mW	0.22dBm
Power density		
Compliance power density limit	1.000mW/cm <sup>2</sup>	10.00W/m <sup>2</sup>
Power density @ Antenna far-field distance	24.397mW/cm <sup>2</sup>	243.966W/m <sup>2</sup>
Power density @ 20cm	0.000mW/cm <sup>2</sup>	0.002W/m <sup>2</sup>
Distance for compliance power density	0.003m	0.29cm
Verdict		
The power density of the EUT at 20cm is below the FCC/IC MPE limit!		
Comments: Bluetooth EDR mode with highest output power at center frequency has been selected		