

**RF-EXPOSURE ASSESSMENT REPORT**

**FCC 47 CFR Part 2.1091  
Industry Canada RSS-102**

**RF-Exposure evaluation of mobile equipment**

**Report Reference No.** ..... : G0M-1201-1705-TFC091M-V03

**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** ..... : Leica Geosystems AG

**Address** ..... : Heinrich Wild Strasse 1  
9435 Heerbrugg  
SWITZERLAND



**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	VIPER Radio Modul 300m	
Model No.	785828	
Hardware version	v2	
Firmware / Software version	U	
	FCC-ID: RFD-CT300	IC: 3177A-CT300

**Test result** ..... : **Passed**

<b>Possible test case verdicts:</b>	
- not applicable to test object .....	N/A
- test object does meet the requirement.....	P (Pass)
- test object does not meet the requirement.....	F (Fail)
<b>Testing:</b>	
Date of receipt of test item .....	2012-03-19
Date (s) of assessment .....	2012-10-19
Compiled by .....	Christian Weber
Assessed by (+ signature) .....	Christian Weber
(Testing Manager)	
Approved by (+ signature) .....	Jens Zimmermann
(Test Lab Manager)	
Date of issue .....	2012-10-19
Total number of pages .....	12
<b>General remarks:</b>	
<p><b>The test results presented in this report relate only to the object tested.</b></p> <p><b>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.</b></p>	
<p>This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.</p>	
<b>Additional comments:</b>	

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## 1 Equipment (Test item) Description

<b>Description</b>	VIPER Radio Modul 300m
<b>Model</b>	785828
<b>Serial number</b>	None
<b>Hardware version</b>	v2
<b>Software / Firmware version</b>	U
<b>FCC-ID</b>	RFD-CT300
<b>IC</b>	3177A-CT300
<b>Equipment type</b>	Radio module

## 1.1 Reference Documents

Document type	Document No.	Issued by	Date
FCC 15.247 Test Report	G0M-1201-1705-TFC247W-V03	Eurofins Product Service GmbH	2012-10-19

**1.2 Radiation Sources**

Mode #	Description	
ZIGBEE	Frequency range [MHz]	2405 – 2475
	Channels	15
	Transmission modes	DSSS
	Modulations	O-QPSK
	Maximum radiated power [dBm]	14.21
	Maximum transmission duty cycle [%]	100
	Antenna 1 gain [dBi]	3.0
	Antenna 1 diameter [cm]	~1

## 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	
<b>Remarks:</b>			

### 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	$3.54 \cdot f^{0.5}$	$0.0094 \cdot f^{0.5}$	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 <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	$1.585 \cdot f^{0.5}$	$0.0042 \cdot f^{0.5}$	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 100 MHz; 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				
$\lambda[m] = \frac{c \left[ \frac{m}{s} \right]}{f[Hz]} ; R_{FF}[m] \geq \frac{2 \cdot D[m]^2}{\lambda[m]}$ $S[mW/cm^2] = \frac{P_{E.I.R.P.}[mW]}{4\pi R[cm]^2} ; R[cm] = \sqrt{\frac{P_{E.I.R.P.}[mW]}{4\pi S[mW/cm^2]}}$ $P_R[mW] = P_C[mW] \cdot G ; P_R[dBm] = P_C[dBm] + G[dBi]$ $DCC [dB] = 10 \cdot \text{Log}_{10} \left( \frac{DC[\%]}{100} \right)$				
Assessment procedure				
<p>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.</p>				

<b>Assessment results – ZIGBEE</b>		
Transmission mode		
Operating mode frequency range [MHz]	2405 – 2475	
Assessment frequency (f) [MHz]	2440	
Transmission duty cycle (DC) [%]	100	
Peak conducted power (P <sub>C</sub> ) [dBm]	11.21	
Peak radiated power (P <sub>R</sub> ) [dBm e.i.r.p.]	14.21	
Peak Antenna gain (G) [dBi]	3.00	
Maximum Antenna Diameter D [cm]	1.0	
Antenna far-field distance		
Transmission frequency wavelength (λ)	0.123 m	12.30 cm
Antenna far-field distance (R <sub>FF</sub> )	0.002 m	0.16 cm
Power evaluation		
Peak conducted power (P <sub>C</sub> )	13.21 mW	11.21 dBm
Peak Antenna Gain (G)	2.00	3.00 dBi
Calculated peak radiated power (P <sub>R-Calc</sub> )	26.36 mW	14.21 dBm
Measured peak radiated power (P <sub>R</sub> )	26.36 mW	14.21 dBm
Source average Power		
Maximum transmission duty cycle (DC)	100.0 %	
Duty cycle correction (DCC)	1.00	0.00 dB
Measured peak radiated power (P <sub>R</sub> )	26.36 mW	14.21 dBm
Averaged peak radiated power (P <sub>RAVG</sub> )	26.36 mW	14.21 dBm
Power density		
Compliance power density limit	1.000 mW/cm <sup>2</sup>	10.00 W/m <sup>2</sup>
Power density @ Antenna far-field distance	79.285 mW/cm <sup>2</sup>	792.854 W/m <sup>2</sup>
Power density @ 20cm	0.005 mW/cm <sup>2</sup>	0.052 W/m <sup>2</sup>
Distance for compliance power density	0.014 m	1.45 cm
Verdict		
<b>The power density of the EUT at 20cm is below the FCC/IC MPE limit!</b>		
Comments:		

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## Version History

Version	Issue Date	Remarks	Revised by
01	2012-09-25	Initial Release	
02	2012-10-04	Replaced document: G0M-1201-1705-TFC091M-V01 Replaced by: G0M-1201-1705-TFC091M-V02  Reason: <ul style="list-style-type: none"><li>• Page 1 &amp; 4: Software version changed</li><li>• Page 5: References corrected</li></ul>	C. Weber
03	2012-10-19	Replaced document: G0M-1201-1705-TFC091M-V02 Replaced by: G0M-1201-1705-TFC091M-V03  Reason: <ul style="list-style-type: none"><li>• Page 5: References updated</li><li>• Page 6: Maximum radiated power corrected</li></ul>	C. Weber