

**TEST REPORT CONCERNING THE COMPLIANCE OF  
A WAVERIDER HF TRANSMITTER,  
BRAND DATAWELL,  
MODEL WAVERIDER HF TRANSMITTER HXV AND  
WAVERIDER HF TRANSMITTER HVA  
WITH THE STANDARDS  
EN 300 390-1 V1.2.1 (2000-09) AND  
EN 300 390-2 V1.1.1 (2000-09)**

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R&TTE, LVD, EMC Notified Body : 1856

**TÜV Rheinland Nederland B.V.**  
**P.O. Box 15**  
**9350 AA Leek (NL)**  
**Eiberkamp 10**  
**9351 VT Leek (NL)**

Telephone: +31 594 505005  
Telefax: +31 594 504804

Internet: [www.tuv.com/nl](http://www.tuv.com/nl)  
E-mail: [info@nl.tuv.com](mailto:info@nl.tuv.com)

### Description of test item

Test item : Waverider HF transmitter  
Manufacturer : Datawell BV  
Brand mark : Datawell  
Model : Waverider HF transmitter HXV  
Waverider HF transmitter HVA  
Serial number(s) : --

### Applicant information

Applicant's representative : Mr. J.J. de Vries  
Company : Datawell BV  
Address : Zomerluststraat 4  
City : 2012 LM Haarlem  
Country : The Netherlands  
Telephone number : +31 32 531 4159  
Telefax number : +31 23 531 1986  
e-mail : info@datawell.nl  
Internet : <http://www.datawell.nl/>

### Test(s) performed

Location : Leek  
Test(s) started : September 17, 2013  
Test(s) completed : September 18, 2013  
Purpose of test(s) : Compliance with standard  
Test specification(s) : EN 300 390-1 V1.2.1  
EN 300 390-2 V1.1.1

Project leader : O. H. Hoekstra

Test engineer(s) : O. H. Hoekstra



Report written by : O. H. Hoekstra

Report approved by : M.C. Edwards van Muyen



Report date : September 26, 2013

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## 1 General

### 1.1 Applied standards

The Waverider HF transmitter, brand Datawell, model Waverider, transmits on a frequency between 25 MHz and 45 MHz and has been tested in conformity with the EN Requirements Table of the standard:

ETSI EN 300 390-2 V1.1.1 (2000-09);

“Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment intended for the transmission of data (and/or speech) and using an integral antenna;

Part 2: Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.”

Test methods are in accordance with:

ETSI EN 300 390-1 V1.2.1 (2003-09);

“Electromagnetic compatibility and Radio spectrum Matters (ERM); Land Mobile Service; Radio equipment intended for the transmission of data (and/or speech) and using an integral antenna;

Part 1: Technical characteristics and methods of measurement.”

### 1.2 Remarks

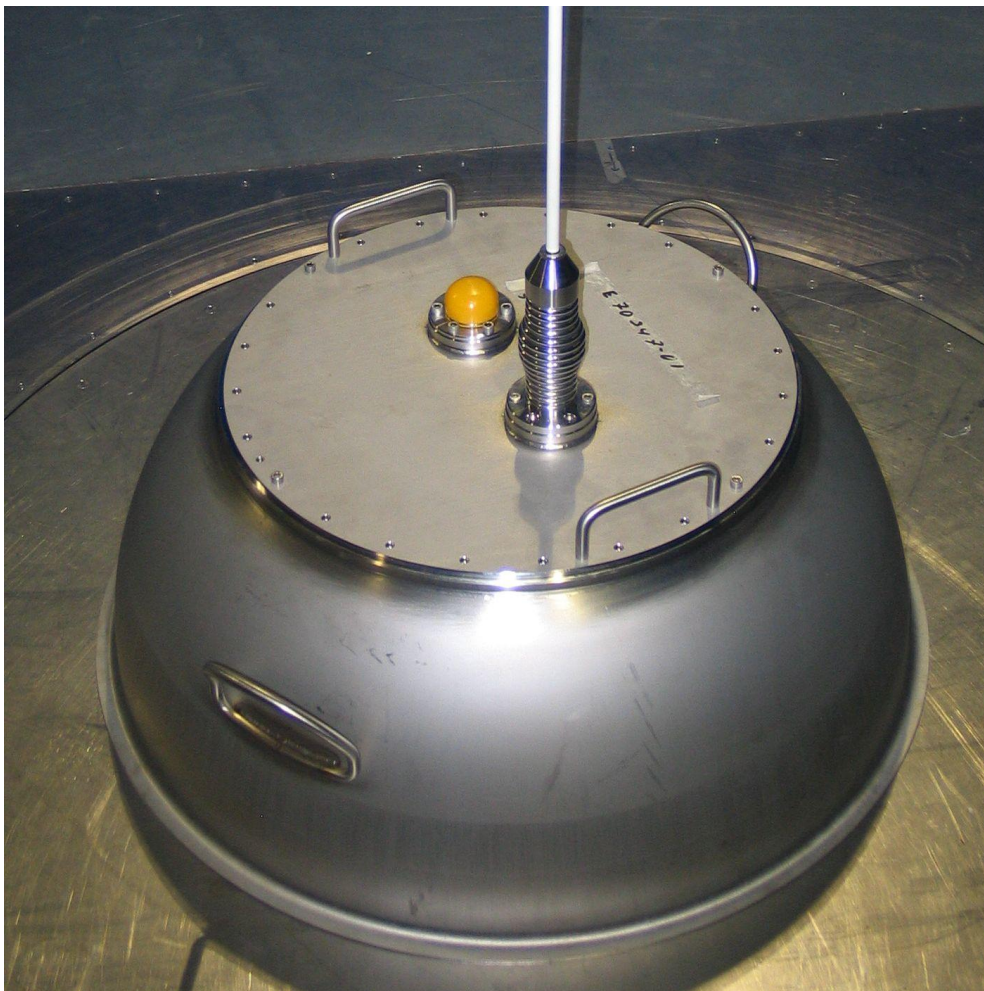
The Waverider HF transmitter, brand Datawell, model Waverider, will be referred to as EUT for the purpose of this test report.

For the test methods, according to the EN 300 390-1 V1.2.1 document, the uncertainty figures have been calculated according to the methods described in the ETR 100-028-1 and ETR 100-028-2.

The expansion factor used is 1,96 (which provides a confidence level of 95% (Gaussian)).

## 2 Description of test configuration

Test item	:	Waverider HF transmitter
Manufacturer	:	Datawell BV
Brand mark	:	Datawell
Model	:	Waverider HF transmitter HXV Waverider HF transmitter HVA
Voltage input rating	:	12.0 – 30.0 VDC (battery powered)
Current input rating	:	-
Antenna	:	Fixed whip antenna
Remarks	:	A GPS module is also included in the test sample.



Buoy with Waverider HF transmitter and GPS module

### 3 Test conditions

The tests have been carried out under the following standard- and extreme test conditions.

#### 3.1 Normal test conditions

Temperature (†) : +15 °C to +35 °C  
Relative humidity (†) : 20 % to 75 %  
Air pressure : 1015 hPa  
Supply voltage : 24.0 VDC (internal batteries)

(†) When it was impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests is stated separately.

#### 3.2 Extreme test conditions

Temperature : -10 °C to +60 °C  
Supply voltage : +12.0 VDC (min) to +30.0 VDC (max)

## 4 Essential radio test suites (overview).

An overview of radio test suites, as laid out in EN 300 390-2 V1.1.1 (2000-09), and a summary of test results is given below.

### 4.1 Transmitter test suites and overview of results.

Essential radio test suite	Applicable	Report clause	Compliance results
4.2.1 Frequency error	Yes	5.1.1	Pass
4.2.2 Effective radiated power	Yes	5.1.2	Pass
4.2.3 Adjacent channel power	Yes	5.1.3	Pass
4.2.4 Radiated spurious emissions	Yes	5.1.4	Pass
4.2.5 Transmitter attack time	No	5.1.5	Not Applicable
4.2.6 Transmitter release time	No	5.1.6	Not Applicable
4.2.7 Transient frequency behavior of the transmitter	No	5.1.7	Not Applicable

### 4.2 Receiver test suites and overview of results.

Essential radio test suite	Applicable	Report clause	Compliance results
4.2.8 Receiver sensitivity	No	-	Not Applicable
4.2.9 Co-channel rejection	No	-	Not Applicable
4.2.10 Adjacent channel selectivity	No	-	Not Applicable
4.2.11 Spurious response rejection	No	-	Not Applicable
4.2.12 Intermodulation response rejection	No	-	Not Applicable
4.2.13 Blocking or desensitization	No	-	Not Applicable
4.2.14 Receiver spurious radiations	No	-	Not Applicable

## 5 Test results.

### 5.1 Transmitter parameters.

#### 5.1.1 Transmitter frequency error.

Ambient temperature : 21 °C      Relative humidity: 50 %  
Transmitter : Operating / ~~Standby~~

Test conditions		Measured frequency (kHz)		
		25.50 MHz version	35.25 MHz version	45.00 MHz version
$T_{nom} +21\text{ °C}$	$V_{nom} +24.0\text{ VDC}$	25499.945	35249.970	44999.960
$T_{min} 0\text{ °C}$	$V_{min} +12.0\text{ VDC}$	25499.990	35249.990	44999.850
	$V_{max} +30.0\text{ VDC}$	25499.990	35249.990	44999.850
$T_{min} -10\text{ °C}$	$V_{min} +12.0\text{ VDC}$	25500.060	35250.010	44999.610
	$V_{max} +30.0\text{ VDC}$	25500.060	35250.010	44999.610
$T_{max} +30\text{ °C}$	$V_{min} +12.0\text{ VDC}$	25499.870	35249.850	44999.860
	$V_{max} +30.0\text{ VDC}$	25499.870	35249.850	44999.860
$T_{max} +60\text{ °C}$	$V_{min} +12.0\text{ VDC}$	25499.880	35249.820	44999.790
	$V_{max} +30.0\text{ VDC}$	25499.880	35249.820	44999.790
Measured frequency (lowest)		25499.870	35249.820	44999.610
Measured frequency (highest)		25500.060	35250.010	44999.960
Maximum frequency error (kHz)		-0.130	-0.180	-0.390
Measurement uncertainty		Better than 2e-7		



#### 5.1.1.1 Limits.

Channel separation (kHz)	Frequency error limit (kHz)				
	< 47 MHz	47 to 137 MHz	>137 to 300 MHz	>300 to 500 MHz	>500 to 1 000 MHz
20 and 25	+/-0.60	+/-1.35	+/-2.00	+/-2.00	+/-2.50
12.5	<b>+/-0.60 (applicable)</b>	+/-1.00	+/-1.50	+/-1.50	No value specified
NOTE: For handportable stations having integral power supplies, the figures given in the table only apply to the limited temperature range 0°C to +30°C. However for the full extreme temperature conditions (clause 6.4.1) exceeding the limited temperature range above, the following frequency error limits apply: ±2.50 kHz between 300 MHz and 500 MHz; ±3.00 kHz between 500 MHz and 1 000 MHz.					

#### 5.1.1.1 Test equipment used (for reference see test equipment listing)

12553	12640	99045	99318			
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### 5.1.2 Effective radiated power.

Ambient temperature: +21 °C Relative humidity: 50 %

Transmitter : operating/~~standby~~  
modulated/~~unmodulated~~

Rated maximum power level declared by manufacturer: 100 mW (= 20.0 dBm)

Measured rated maximum power:	Transmitter power (dB relative to rated maximum power)
25.50 MHz: 18.0 dBm	20.0 – 18.0 = -2.0 dB
25.25 MHz: 19.7 dBm	20.0 – 19.7 = -0.3 dB
45.00 MHz: 18.4 dBm	20.0 – 18.4 = -1.6 dB
Measurement uncertainty	6.0 dB

Rated average power level declared by manufacturer: 100 mW (= 20.0 dBm)

Measured rated average power:	Transmitter power (dB relative to rated average power)
25.50 MHz: 17.4 dBm	20.0 – 17.4 = -2.6 dB
25.25 MHz: 19.0 dBm	20.0 – 19.0 = -1.0 dB
45.00 MHz: 17.9 dBm	20.0 – 17.9 = -2.1 dB
Measurement uncertainty	6.0 dB

Rated output power level (average), declared by manufacturer:  100 mW		Transmitter power (dB relative to rated maximum power)		
		25.50 MHz	35.25 MHz	45.00 MHz
T <sub>nom</sub> = +21 °C	V <sub>nom</sub> = +24.0 VDC	0 (reference)	0 (reference)	0 (reference)
T <sub>min</sub> = -10 °C	V <sub>min</sub> = +12.0 VDC	-0.4	-0.4	-1.3
T <sub>min</sub> = -10 °C	V <sub>max</sub> = +30.0 VDC	-0.4	-0.4	-1.3
T <sub>max</sub> = +60 °C	V <sub>min</sub> = +12.0 VDC	-0.1	-0.2	-0.3
T <sub>nom</sub> = +60 °C	V <sub>max</sub> = +30.0 VDC	-0.1	-0.2	-0.3
Maximum deviation from output power (dB)		-0.4	-0.4	-1.3
Measurement uncertainty		-0.3 dB / +0.3 dB		

#### 5.1.2.1 Limits.

The maximum effective radiated power under normal test conditions shall be within  $d_f$  from the rated maximum effective radiated power. The average effective radiated power under normal test conditions shall be within  $d_f$  from the rated average effective radiated power.

$d_f^2 = 3.98 + 1,41 = +6.25$  dB and  $-6.25$  dB ( $d_m = 6.0$  dB is 3.98 in linear terms, 1.5 dB is 1.41 in linear terms )

The variation of power due to the change of temperature and voltage for the measurements under extreme test conditions shall not exceed +2 dB or -3 dB (the measurements shall be performed using the test fixture). Furthermore the maximum effective radiated power shall not exceed the maximum value allowed by the administrations.

#### 5.1.2.2 Test equipment used (for reference see test equipment listing).

15667	99847	99877				
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### 5.1.3 Adjacent channel power.

Ambient temperature: +21 °C                      Relative humidity: 50 %

Transmitter :            operating/~~standby~~  
                                 modulated/~~unmodulated~~

Note:

Measured under normal conditions only, as the frequency error has been measured under extreme conditions.

#### 5.1.3.1 10 kHz channel separation

Transmit frequency	Measurement displacement	Adjacent channel power (dBc)	
		2 FSK mode	4 FSK mode
25.50 MHz	-5.75 kHz	-69.0	-70.7
	+5.75 kHz	-71.6	-71.6
35.25 MHz	-5.75 kHz	-74.6	-72.5
	+5.75 kHz	-76.7	-74.2
45.00 MHz	-5.75 kHz	-71.8	-73.8
	+5.75 kHz	-71.6	-75.8
Measurement uncertainty		-2.58 dB / +2.31 dB	

#### 5.1.3.2 12.5 kHz channel separation

Transmit frequency	Measurement displacement	Adjacent channel power (dBc)	
		2 FSK mode	4 FSK mode
25.50 MHz	-8.25 kHz	-72.5	-70.4
	+8.25 kHz	-74.1	-72.8
35.25 MHz	-8.25 kHz	-77.3	-74.3
	+8.25 kHz	-79.6	-76.3
45.00 MHz	-8.25 kHz	-74.0	-75.5
	+8.25 kHz	-76.0	-77.9
Measurement uncertainty		-2.58 dB / +2.31 dB	

### 5.1.3.3 20 kHz channel separation

Transmit frequency	Measurement displacement	Adjacent channel power (dBc)	
		2 FSK mode	4 FSK mode
25.50 MHz	-13 kHz	-76.8	-74.9
	+13 kHz	-79.3	-76.6
35.25 MHz	-13 kHz	-79.2	-75.1
	+13 kHz	-83.3	-77.8
45.00 MHz	-13 kHz	-76.9	-77.2
	+13 kHz	-79.9	-80.3
Measurement uncertainty		-2.58 dB / +2.31 dB	

### 5.1.3.4 25 kHz channel separation

Transmit frequency	Measurement displacement	Adjacent channel power (dBc)	
		2 FSK mode	4 FSK mode
25.50 MHz	-17 kHz	-79.1	-75.7
	+17 kHz	-80.8	-77.0
35.25 MHz	-17 kHz	-81.7	-73.3
	+17 kHz	-83.4	-78.1
45.00 MHz	-17 kHz	-79.1	-78.0
	+17 kHz	-79.7	-80.7
Measurement uncertainty		-2.58 dB / +2.31 dB	

### 5.1.3.5 Limits.

	Channel separation 12.5 kHz
Normal test condition	60.0 dBc
Extreme test conditions	55.0 dBc (not applicable)

### 5.1.3.6 Test equipment used (for reference see test equipment listing).

12553

#### 5.1.4 Transmitter spurious emissions radiated.

Ambient temperature: +21 °C Relative humidity: 50 %

Transmitter : Operating/~~standby~~  
Modulated with 2-FSK/~~unmodulated~~

##### 5.1.4.1 25.5 MHz version

Spurious emissions level (dBm)		
Frequency (MHz)	Bandwidth** (kHz)	Level (dBm)
51.0	100	-73.1
76.5	100	-77.3
76.5 – 4000	100	< -67.0
Measurement uncertainty	-2.4 dB / +1.6 dB	

\*\* Bandwidth = the measuring receiver bandwidth

##### 5.1.4.2 35.25 MHz version

Spurious emissions level (dBm)		
Frequency (MHz)	Bandwidth** (kHz)	Level (dBm)
70.5	100	-77.6
105.7	100	-74.9
141.0	100	-86.3
141.0 – 4000	100	< -67.0
Measurement uncertainty	-2.4 dB / +1.6 dB	

\*\* Bandwidth = the measuring receiver bandwidth

#### 5.1.4.3 45.00 MHz version

Spurious emissions level (dBm)		
Frequency (MHz)	Bandwidth** (kHz)	Level (dBm)
90.0	100	-54.8
90.0 – 4000	100	< -67.0
Measurement uncertainty	-2.4 dB / +1.6 dB	

\*\* Bandwidth = the measuring receiver bandwidth

#### 5.1.4.1 DWR-G4, 35.25 MHz version

Spurious emissions level (dBm)		
Frequency (MHz)	Bandwidth** (kHz)	Level (dBm)
70.5	100	-54.2
70.5 – 4000	100	< -67.0
Measurement uncertainty	-2.4 dB / +1.6 dB	

\*\* Bandwidth = the measuring receiver bandwidth

#### 5.1.4.2 DWR-G unit, 35.25 MHz version

Spurious emissions level (dBm)		
Frequency (MHz)	Bandwidth** (kHz)	Level (dBm)
37.5	100	-62.4
50.1	100	-66.1
81.5	100	-63.9
81.5 – 4000	100	< -67.0
Measurement uncertainty	-2.4 dB / +1.6 dB	

\*\* Bandwidth = the measuring receiver bandwidth

#### 5.1.4.3 Limits.

	TX operating	TX standby
30 MHz – 1 GHz	0.25 $\mu$ W (-36 dBm)	2.0 nW (-57 dBm)
1 – 4 GHz	1.00 $\mu$ W (-30 dBm)	20 nW (-47 dBm)

#### 5.1.4.4 Test equipment used (for reference see test equipment listing).

15667	99847	99877				
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#### **5.1.5 Transmitter attack time.**

Not applicable, the transmitter cannot switch on and off, it operates continuously.

#### **5.1.6 Transmitter release time.**

Not applicable, the transmitter cannot switch on and off, it operates continuously.

#### **5.1.7 Transient frequency behavior of the transmitter.**

Not applicable, the transmitter cannot switch on and off, it operates continuously.

### **5.2 Receiver parameters.**

Not applicable, the EUT is a transmitter.

## 6 Conclusion

The Waverider HF transmitter, brand Datawell, model Waverider HF transmitter HXV and Waverider HF transmitter HVA, complies with the requirements of the standard ETSI EN 300 390-2 V1.1.1 (2000-09) in the configuration and operation mode(s) as stated in this test report

## 7 Additional information supplementary to the test report

Photographs of the equipment, see document 13070808.p01.

## 8 Test equipment and ancillaries used for tests

To simplify the identification on each page of the test equipment used, on each page of the test report, each item of test equipment and ancillaries such as cables are identified (numbered) by the Test Laboratory, below.

Inventory number	Description	Brand	Model
12484	Guidehorn	EMCO	3115
12533	Signalgenerator	Marconi	2032
12553	Communication Analyzer	R&S	CMTA 84
12605	Calibrated dipole 28MHz-1GHz	Emco	3121c
12640	Temperature chamber	Heraeus	VEM03/500
13664	Spectrum analyzer	HP	HP8593E
14340	Biconilog antenna	Emco	3143
15453	Magnetic loop antenna	Chase	HLA6120
15667	Measuring receiver	R&S	ESCS 30
99045	DC Power Supply 3A/30V	Delta	E030/3
99077	Regulating trafo	RFT	LTS006
99318	Digital multi meter	HP	34401A
99538	Spectrum analyzer	Rohde & Schwarz	FSP40
99606	Bandfilter / preamplifier system	EMCS	RFS06S
99733	Spectrum analyzer	Rohde & Schwarz	FSV30
99846	Full Anechoic room	Siepel	HERA 3F
99847	Semi Anechoic room	Siepel	HERMES 3
99877	Biconilog antenna	Tesec	CBL6111D