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STS 024

Schweizerischer Prüfstellendienst
 Service suisse d'essai
 Swiss testing service



Report:	<i>Electromagnetic compatibility and Radio spectrum Matters</i>		Report no:	17'013
Product name:	<i>Reconvilier HERCULES Golf Master - Caddy</i>		Mandate no:	20119921
Serial no:	AAAA5555	Model number:	1088-E	
Customer:	<i>Trilogis Sarl Epancheurs 34b 2012 Auvernier Switzerland</i>		Date of test:	<i>July 13, 17 and 31, 2012</i>

Standards	Result
47 CFR, Part 15 (Subpart C, Intentional radiator: §§ 15.209/249)	Pass

Test performed by

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Report prepared by

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Report controlled and approved by

Mr C. Perrenoud

Rossens, November 8th, 2012

(Issue Date / Date d'édition / Ausstelldatum)

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The present document results from tests on a specimen and does not prejudice to the conformity of all the manufactured products. - Le présent document résulte d'essais sur un spécimen. Il ne préjuge pas de la conformité de l'ensemble des produits fabriqués à l'objet essayé. - Dieser Bericht beinhaltet die Prüfergebnisse des geprüften Gerätes und macht keine Aussage über die Konformität weiterer gleicher Geräte.

q:\mandats\2011\20119921_trilogis\rap_trilogis_17013_fcc_caddy.doc

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1. Summary of test results

- ✓ Pass
 ✗ Fail
 Ø Not applicable to this product
 — Not tested
 ■ No requirements

§	Test Type	Result
7	Emission	CFR 47 Part 15, Subpart C
-	Conducted emission CFR 47 § 15.207	Ø ¹⁾
7.1 7.2	Radiated emission – EM-field CFR 47 § 15.209	✓
7.3	Radiated emission – Carrier CFR 47 § 15.249	✓
	Emission	CFR 47 Part 2 Sub C
7.4	Designation of emission FCC 47 §2.201 FCC 47 §2.202	82k9F1D / 86k8F1D

1. Powered by internal battery / accumulator

2. Applied standards

47 CFR Part 2	Code of Federal Regulations - Title 47 - Telecommunication, Part 2 – Frequency allocations and radio treaty matters; General rules and regulations
47 CFR Part 15 Subpart C	Code of Federal Regulations - Title 47 - Telecommunication, Part 15, Subpart C: "Intentional Radiators"

3. Abbreviations

AC	Alternating current	d(t)	Relative voltage change characteristic	N	Neutral
AM	Amplitude Modulation	EMC	ElectroMagnetic Compatibility	NNB	Line impedance substitution network
AV	Average	ESD	Electro Static Discharge	MDS	Absorbing measuring clamp
BW	Bandwith	EUT	Equipment under Test	PE	Protective earth
CDN	Coupling Decoupling Network	GTEM	Gigahertz Transverse ElectroMagnetic cell	PK	Peak
CW	Continuous Wave	LISN	Line impedance substitution network	Plt	Long-term flicker indicator
dB	Decibel	L1,L2,L3	Phase	PM	Pulse Modulation
DC	Direct current	GRP	Ground reference plane	Pst	Short-term flicker Indicator
dmax	Maximum relative voltage change			TEM	Transverse ElectroMagnetic cell
AFA	Adaptive Frequency Agility	ICNIRP	International Commission on Non-Ionizing Radiation Protection	RF	Radio Frequency
DAA	Detect And Avoid spectrum access technique	ISM	Industrial Scientific Medical (frequency band)	RFID	Radio Frequency Identification
dBi	gain in decibels relative to an isotropic antenna	ITU-R	International Telecommunications Union, Radio Sector	R&TTE	Radio and Telecommunications Terminal Equipment
DL	Downlink	ITU-T	International Telecommunications Union, Telecommunications Sector	RU	Remote Unit
DSSS	Direct Sequence Spread Spectrum	LBT	Listen Before Talk	SCU	System Control Unit
e.i.r.p.	equivalent isotropically radiated power	MU	Master Unit	SF-CW	Step Frequency Continuous Wave (spread spectrum)
ERC	European Radiocommunication Committee	NISV	National Radio Interfaces	SND/ND	Signal + Noise + Distortion divided by Noise + Distortion
FHSS	Frequency Hopping Spread Spectrum	NRI	National Radio Interfaces	SRD	Short Range Device
GBSAR	Ground Based Synthetic Aperture Radar	ORNI		TETRA	TErrestrial TRunked Radio
				Tx	Transmitter
				UL	Uplink
				UWB	Ultra Wide Band
				VSWR	Voltage Standing Wave Ratio

4. Client

Client name and address	<i>Trilogis Sarl Epancheurs 34b 2012 Auvernier Switzerland</i>
Contact Person	<i>Mr Beljakovic</i>
Telephone	<i>+41 32 730 61 51</i>
Fax	<i>+41 32 730 61 51</i>
E-mail	<i>gilles.beljakovic@trilogis.ch</i>
Mandate no	<i>20119921</i>

5. Equipment under test

5.1 Identification

Manufacturer name and address	<i>Trilogis Sarl Epancheurs 34b 2012 Auvernier Switzerland</i>
Production country	<i>Switzerland</i>
Brand name	<i>Société Horlogère Reconvilier AG</i>
Product name	<i>Reconvilier HERCULES Golf Master - Caddy</i>
Product description	<i>The "Reconvilier HERCULES Golf Master - Caddy" is composed of two devices: the "watch" and the "Caddy". The Caddy has a GPS receiver and calculates the residual distance from the actual position to the next hole and transmits this information to the watch by wireless communication techniques.</i>
Model number	<i>1088-E</i>
Serial no	<i>AAAA5555</i>
Software version (Firmware)	<i>V.9.99</i>
Highest frequency	<i>915 MHz (transmitter frequency)</i>
Supply	<i>Rechargeable accumulator by USB</i>
Dimension	<i>Caddy : 20.3 x 59.1 x 108.8 [mm]</i>
Weigth	<i>Caddy : 100 g</i>
Technical documentation	<i>None. The equipment is completely identified by the above-mentioned information. Trilogis Sarl assures the traceability of the documentation and is responsible for the product identification.</i>

5.2 Pictures of the EUT



5.3 Classification

CFR 47 Part 15 Subpart C	☒ The highest fundamental frequency of the EUT is less than 10 GHz (measurement shall be made up to the tenth harmonic or 40 GHz, whichever is lower). ☐ The highest fundamental frequency of the EUT is between 10 GHz and 30 GHz (measurement shall be made up to the fifth harmonic or 100 GHz, whichever is lower). ☐ The highest fundamental frequency of the EUT is above 30 GHz (measurement shall be made up to the fifth harmonic or 200 GHz, whichever is lower).
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5.4 Ports

Port	Cable			Remark
	Max. length	Type	Screen	
USB	5 m	standard	yes	Only for battery charging of the GPS receiver

6. Test conditions

6.1 Climatic conditions, location and date

Location:	Date:	Temp	Pressure [QFF]:	Rel. humidity:
montena emc sa 1728 Rossens Switzerland	July 13, 2012	22 - 23 °C	1008 - 1013 hPa	45-48 %
	July 17, 2012	22 - 26 °C	1024 - 1028 hPa	38 - 42 %
	July 31, 2012	22 - 26 °C	1015 - 1020hPa	38 - 42 %

6.2 Test facility and methodology / Lieu d'essai et méthodologie / Prüfort und Methodik

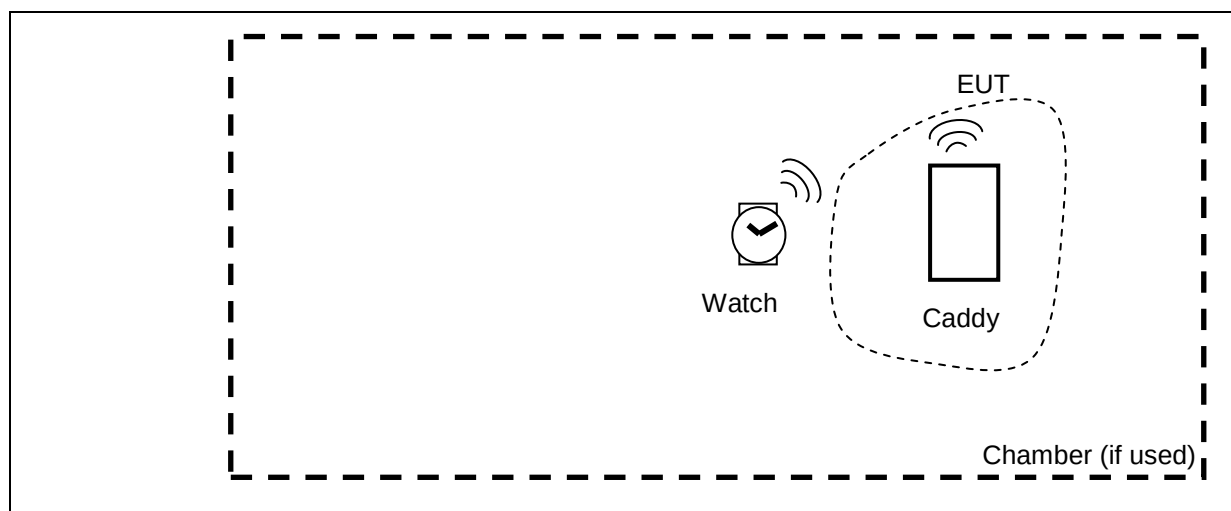
*The alternate test site (ferrite chamber) is accepted by FCC (Reg. No. 90808).
Conducted and radiated measurements are performed according to the ANSI C63.4 (2003) procedure.
The open area test site is accepted by Industry Canada (Site number 3625A-1).*

6.3 Attendant persons**Test Engineer(s):**

M.M. C.A. Baumgartner and E. de Raemy

Other(s):

Name	Company
<i>none</i>	---

6.4 Test configuration**6.5 Operating conditions**

Continuous transmission with max output power and at the frequency of 915 MHz (both, frequency and power output can not be changed by the operator) or in continuous receiver mode.

6.6 Auxiliary equipment

The following pieces of equipment are used for the monitoring of the EUT or are necessary for the EUT but they are not part of the EUT.

Watch

7. Emission tests

7.1 Radiated emission - Electromagnetic field (radiated – 30 MHz to 1 GHz)

Test site: ☒ anechoic chamber (ferrites) ☐ anechoic chamber (foam)
☐ semi-anechoic chamber (hybrid) ☐ open test site

Distance: ☐ 3 m ☒ 10 m ☐ 30m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.6 dB (30 - 300 MHz) / ± 3.7 dB (300 - 1000 MHz)

Measuring method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are remeasured manually using a receiver.

Test set-up:



Remarks: - - -

Test equipment:

Spectrum analyser	☐ 88-14	☐ 02-06	☐ 03-45	☐ 05-39	☐ 07-53	☒ 10-70
Receiver	☐ 94-35	☐ 04-29	☒ 10-70			
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	☐ 05-87
Antenna, (log-per)	☐ 88-20	☐ 90-30	☐ 91-35	☐ 94-64		
Antenna, (bilog)	☒ 94-03	☐ 05-38				
Cables	☐ 06-00A	☐ 06-00B	☐ 06-00C	☒ 06-01A	☒ 06-01B	☒ 06-01C

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement Type : Radiated Field
 Polarisation : Vertical
 Table Angle : 0-360°
 Antenna Height : 1-2-3-4m

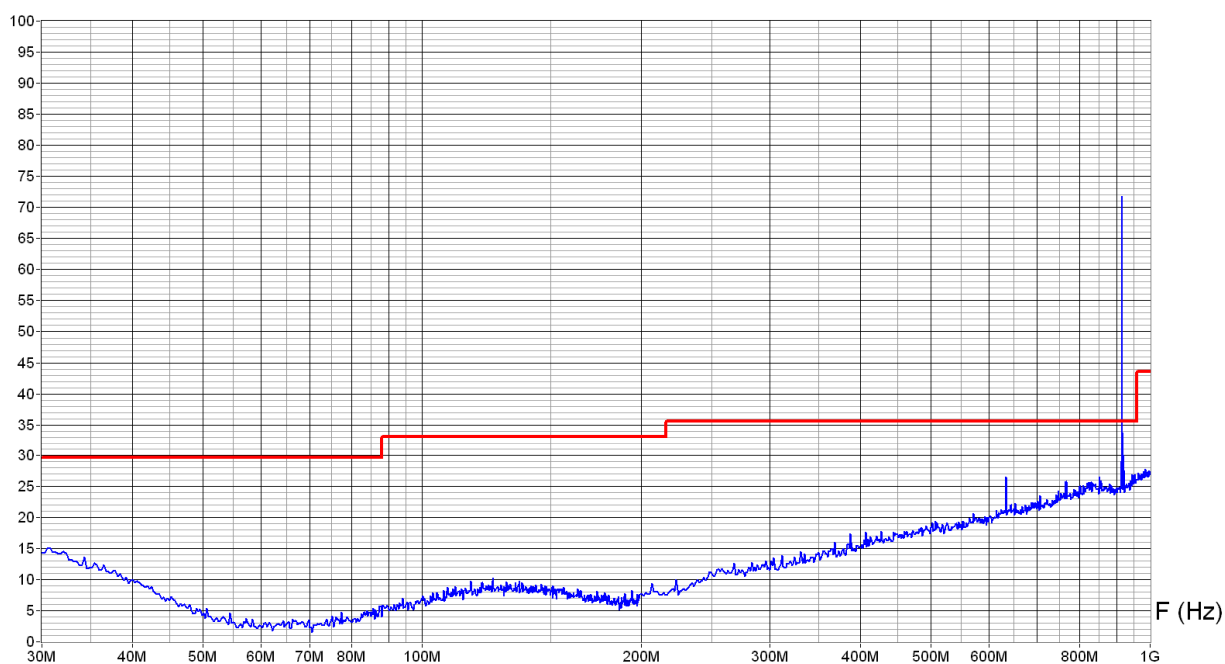


Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
 Set-Up : see picture
 Operating Conditions : Caddy transmitting. Watch listening.
 Remarks : The peak at 915 MHz is due to the internal transmitter.

Level dBuV/m

FCC 15.209

QP Limit



Zone	30 MHz - 199 MHz	199 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	100 KHz	100 KHz

Limit values expressed in dBuV/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
 e.g.: for f = 100 MHz the limit is 150 uV/m at 3 m;

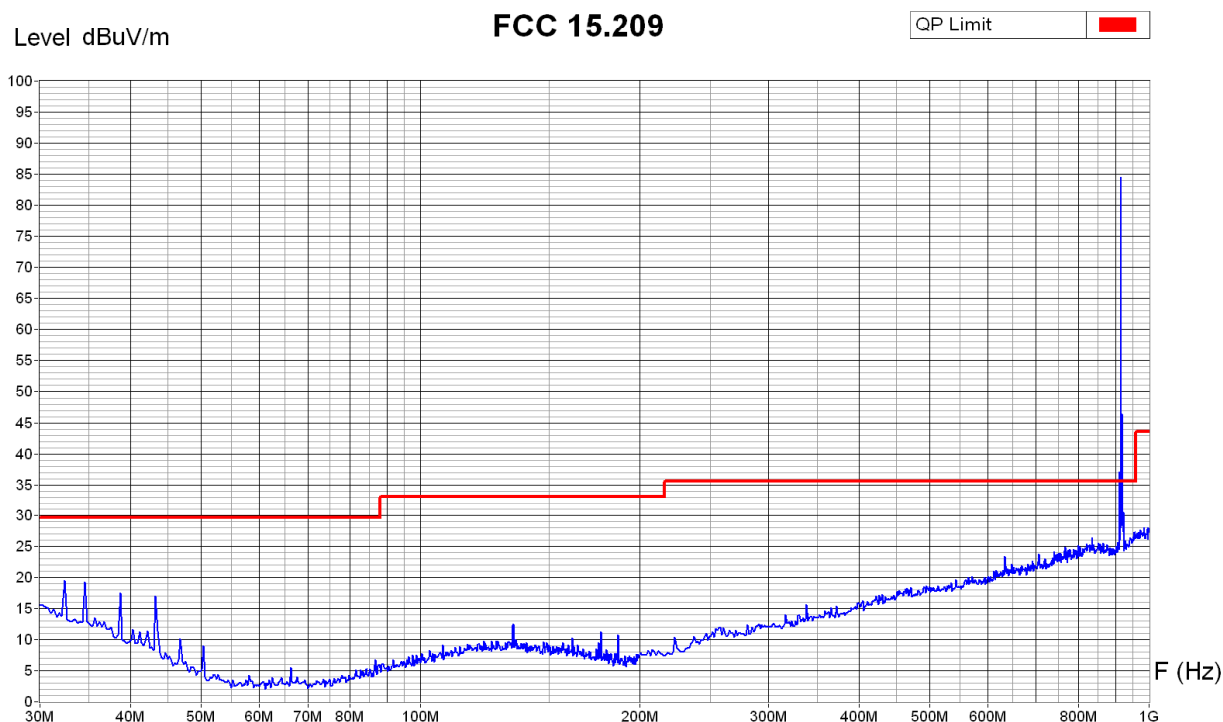
$$20 \log \left(\frac{150 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{10m} \right) = 33.1 \frac{dB\mu V}{m} \text{ at } 10m$$

Operator: Baumgartner
 Date/Time: 13.07.2012 16:29
 Filename:
 RV.png/.txt

Measurement Type : Radiated Field
 Polarisation : Horizontal
 Table Angle : 0-360°
 Antenna Height : 1-2-3-4m



Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
 Set-Up : see picture
 Operating Conditions : Caddy transmitting. Watch listening.
 Remarks : The peak at 915 MHz is due to the internal transmitter.



Zone	30 MHz - 199 MHz	199 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	100 KHz	100 KHz

Limit values expressed in dB μ V/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
 e.g.: for f = 100 MHz the limit is 150 μ V/m at 3 m;

$$20 \log \left(\frac{150 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{10m} \right) = 33.1 \frac{dB\mu V}{m} \text{ at } 10m$$

Operator: Baumgartner
 Date/Time: 13.07.2012 16:12
 Filename:
 RH.png/.txt

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0-360°
Antenna Height : 1-2-3-4m

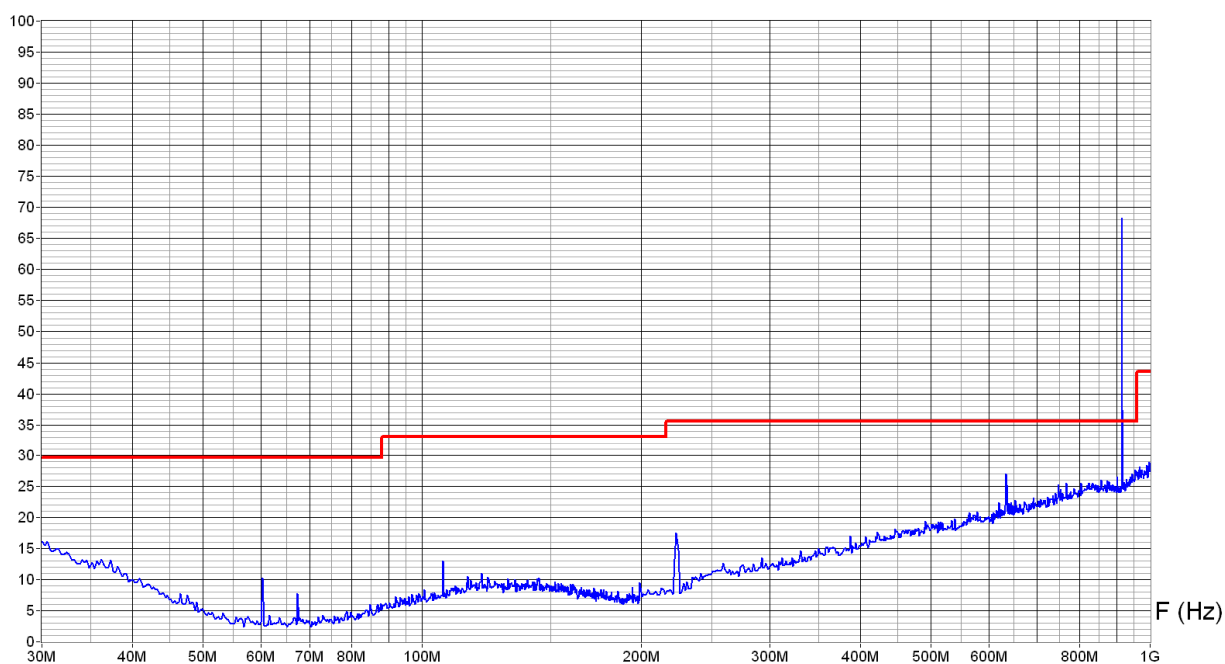


Equipment Under Test : Golf solution (Watch and Caddy)
Set-Up : see picture
Operating Conditions : Watch transmitting. Caddy listening.
Remarks : The peak at 915 MHz is due to the internal transmitter.

Level dBuV/m

FCC 15.209

QP Limit



Zone	30 MHz - 199 MHz	199 MHz - 1 GHz
Video Bandwidth	300 KHz	300 KHz
Resol Bandwidth	100 KHz	100 KHz

Limit values expressed in dBuV/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
e.g.: for f = 100 MHz the limit is 150 μ V/m at 3 m;

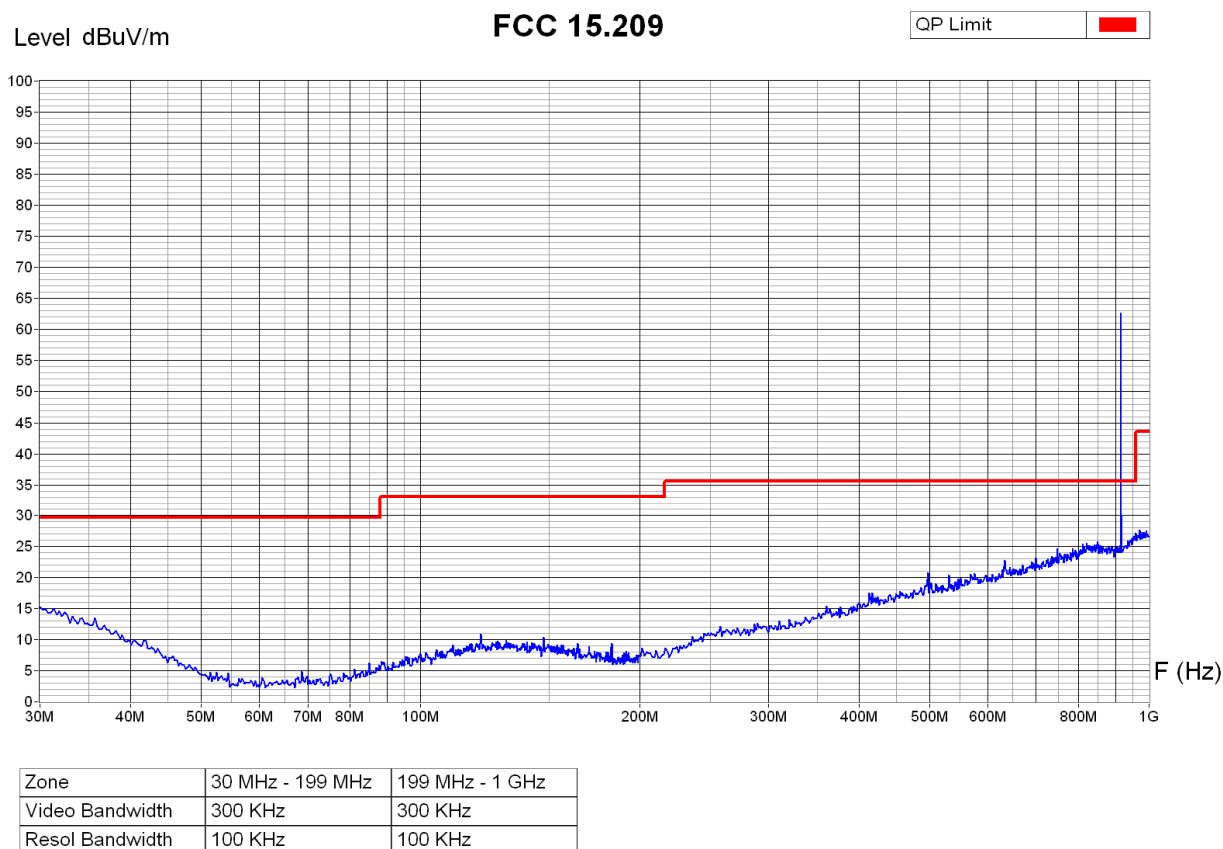
$$20 \log \left(\frac{150 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{10m} \right) = 33.1 \frac{dB\mu V}{m} \text{ at } 10m$$

Operator: Baumgartner
Date/Time: 17.07.2012 09:17
Filename:
RV_Watch.png/.txt

Measurement Type : Radiated Field
 Polarisation : Horizontal
 Table Angle : 0-360°
 Antenna Height : 1-2-3-4m



Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
 Set-Up : see picture
 Operating Conditions : Watch transmitting. Caddy listening.
 Remarks : The peak at 915 MHz is due to the internal transmitter.



Limit values expressed in dBμV/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
 e.g.: for f = 100 MHz the limit is 150 μV/m at 3 m;

$$20 \log \left(\frac{150 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3 m}{10 m} \right) = 33.1 \frac{dB \mu V}{m} \text{ at } 10 m$$

Operator: Baumgartner
 Date/Time: 17.07.2012 09:36
 Filename:
 RH_Watch.png/.txt

7.2 Radiated emission - Electromagnetic field (radiated – 1 GHz to 10 GHz)

Test site: ☐ anechoic chamber (ferrites) ☒ anechoic chamber (foam)
☐ semi-anechoic chamber (hybrid) ☐ open test site

Distance: ☒ 1 m ☐ 3 m ☐ 10 m ☐ 30m

Position of EUT: 0.8 m (height of the equipment under test above floor)

Meas. uncertainty: ± 4.7 dB

Measuring method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are remeasured manually using a receiver.

Test set-up:



Remarks: ---

Test equipment:

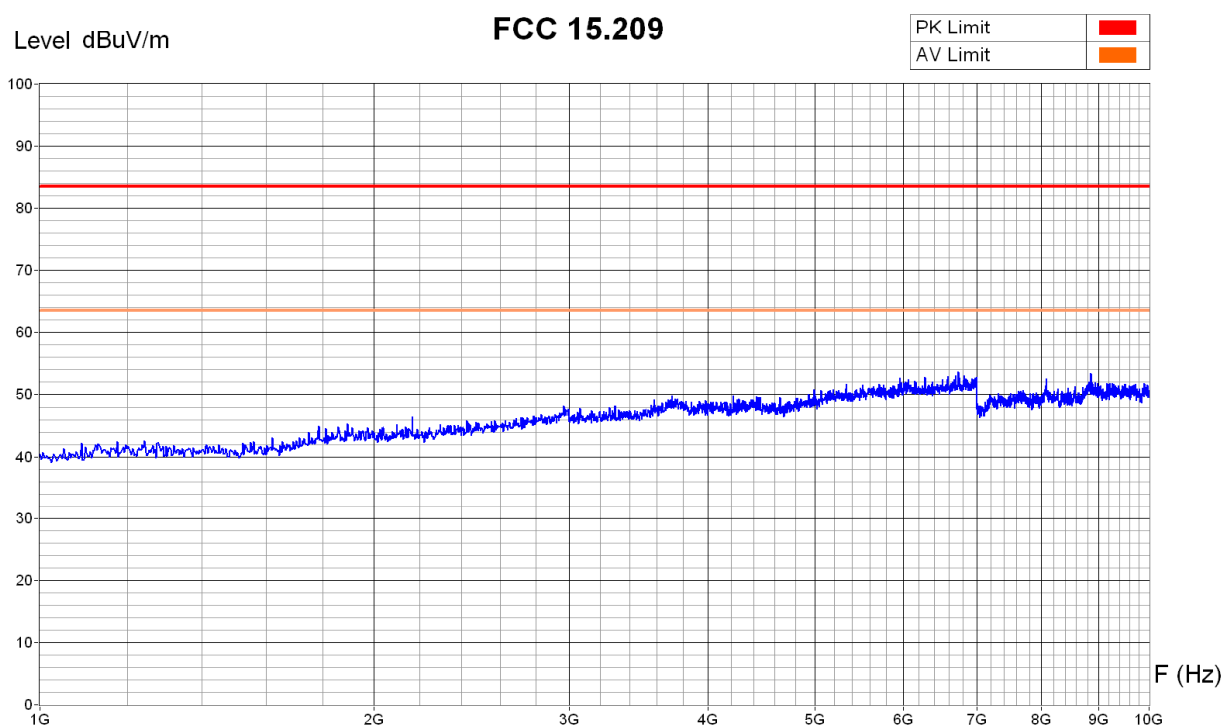
Spectrum analyser	☐ 88-14	☐ 02-06	☐ 03-45	☐ 05-39	☒ 07-53	☐ 10-70
Receiver	☐ 94-35	☐ 04-29	☐ 10-70			
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☐ 05-59	☐ 05-62	☐ 05-87 ☒ 11-29
Antenna, (horn)	☒ 90-24	☐ 98-12	☐ 98-13	☐ 07-31		
Cables	☒ 11-61	☒ 10-75				

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement Type : Radiated Field
 Polarisation : Vertical
 Table Angle : 0-360°
 Antenna Height : 1m



Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
 Set-Up : see picture
 Operating Conditions : Caddy transmitting. Watch listening.
 Remarks : 10dB attenuator.



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	1 MHz	300 KHz
Resol Bandwidth	1 MHz	300 KHz

Limit values expressed in dBuV/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade)
 e.g.: for f = 2 GHz the limit is 500 μV/m at 3 m;

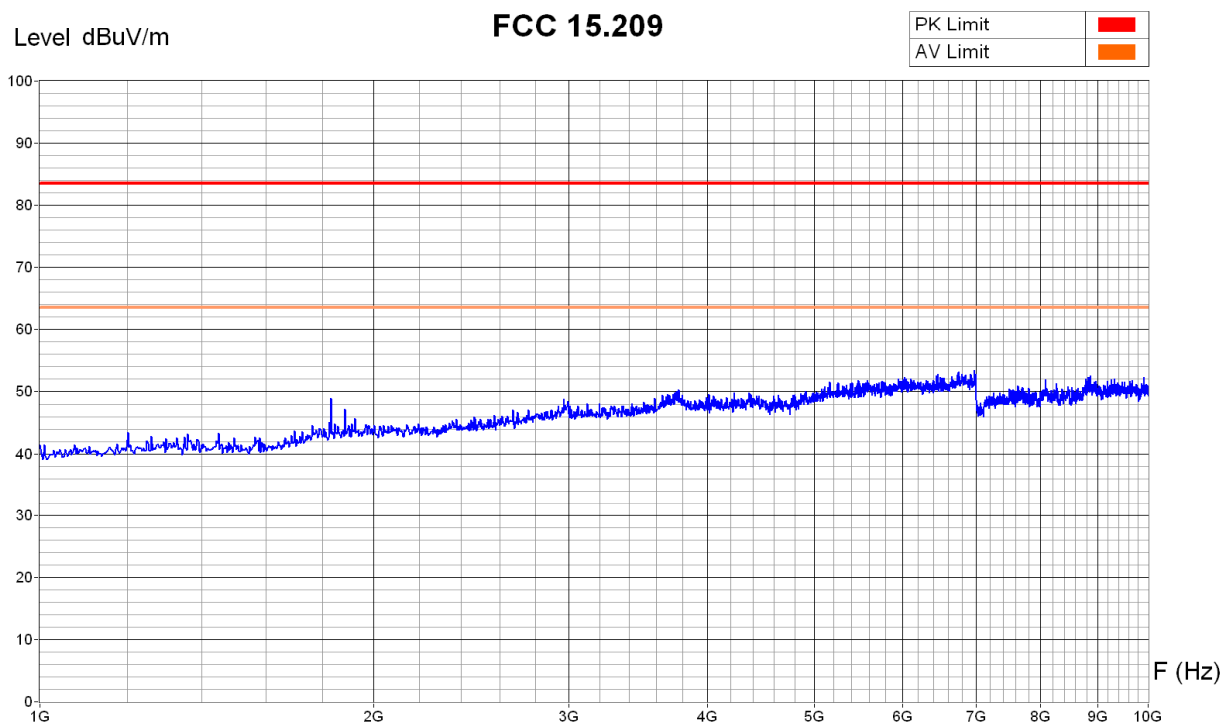
$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Operator: Baumgartner
 Date/Time: 13.07.2012 14:00
 Filename:
 22RV_1-10GHz_10dB_att.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0-360°
Antenna Height : 1m



Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
Set-Up : see picture
Operating Conditions : Caddy transmitting. Watch listening.
Remarks : 10dB attenuator.



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	1 MHz	300 KHz
Resol Bandwidth	1 MHz	300 KHz

Limit values expressed in dB μ V/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade)
e.g.: for f = 2 GHz the limit is 500 μ V/m at 3 m;

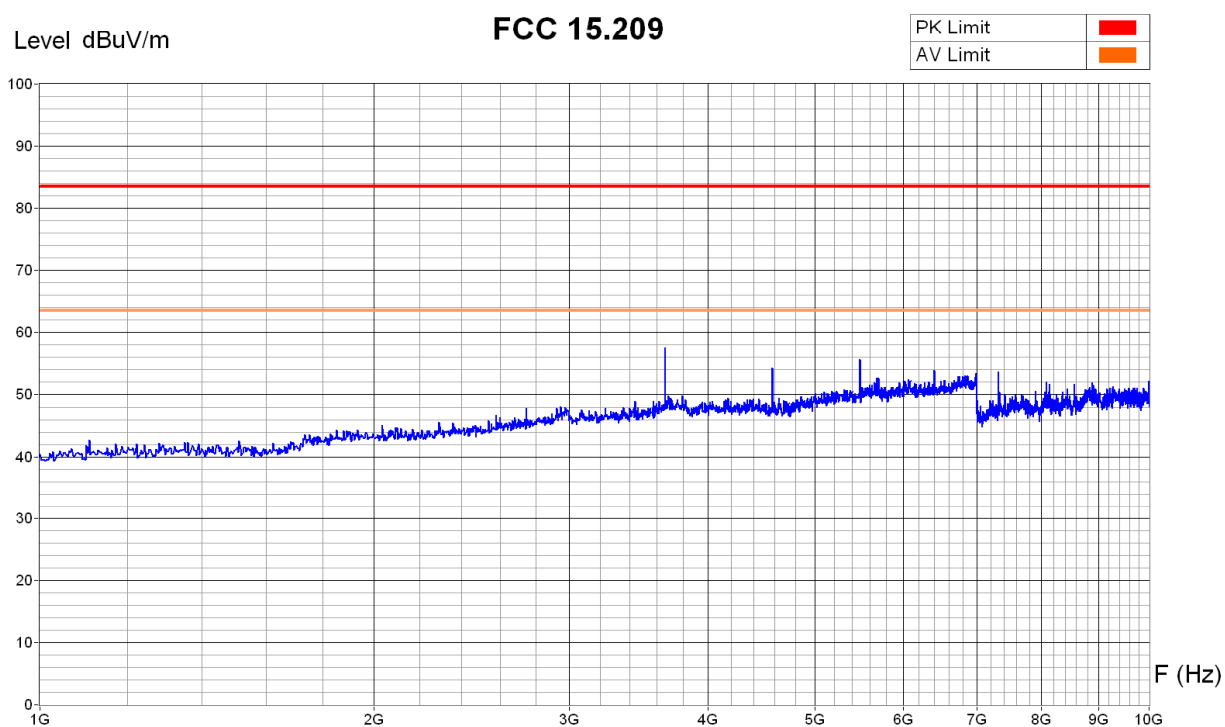
$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Operator: Baumgartner
Date/Time: 13.07.2012 13:47
Filename:
21RH_1-10GHz_10dB_att.png/.txt

Measurement Type : Radiated Field
Polarisation : Vertical
Table Angle : 0-360°
Antenna Height : 1m



Equipment Under Test : Golf solution (Watch and Caddy)
Set-Up : see picture
Operating Conditions : Watch transmitting. Caddy listening.
Remarks : 10dB attenuator.



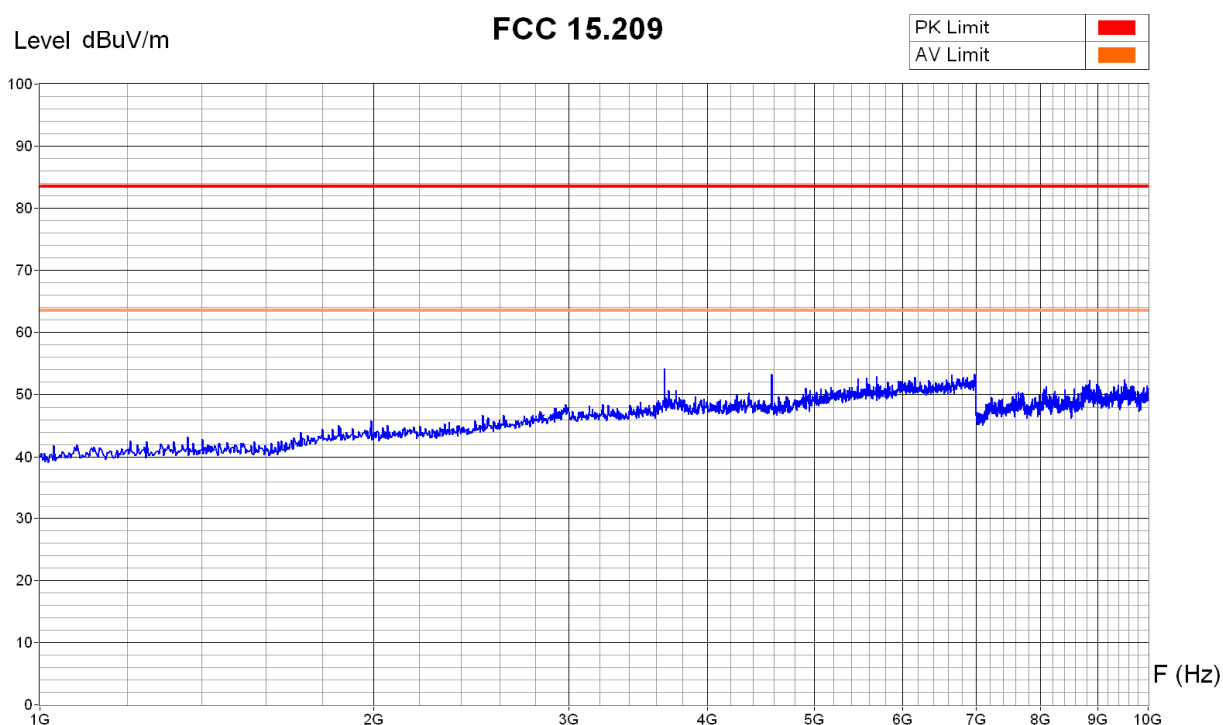
Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	1 MHz	300 KHz
Resol Bandwidth	1 MHz	300 KHz

Operator: Baumgartner
Date/Time: 13.07.2012 14:33
Filename:
32RV_1-
10GHz_10dB_att_watch.png/.txt

Measurement Type : Radiated Field
Polarisation : Horizontal
Table Angle : 0-360°
Antenna Height : 1m



Equipment Under Test : Reconvilier HERCULES Golf Master (Watch and Caddy)
Set-Up : see picture
Operating Conditions : Watch transmitting. Caddy listening.
Remarks : 10dB attenuator.



Zone	1 GHz - 7 GHz	7 GHz - 13 GHz
Video Bandwidth	1 MHz	300 KHz
Resol Bandwidth	1 MHz	300 KHz

Limit values expressed in dBμV/m and transformed to a measuring distance of 1 m (factor used = 20 dB/decade)
e.g.: for f = 2 GHz the limit is 500 μV/m at 3 m;

$$20 \log \left(\frac{500 \frac{\mu V}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{1m} \right) = 63.5 \frac{dB\mu V}{m} \text{ at } 1m$$

Operator: Baumgartner
Date/Time: 13.07.2012 14:28
Filename:
31RH_1-
10GHz_10dB_att_watch.png/.txt

7.3 Carrier - Radiated emission

Test site: ☒ anechoic chamber (ferrites) ☐ open test site
☐ anechoic chamber (foam) ☐
 Meas. distance: ☐ 1 m ☐ 3 m ☒ 10 m ☐ 30 m

Meas. uncertainty: ± 4.7 dB

Position of EUT: 0.8 m (height above floor of equipment under test)

Measuring method: The carrier radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is placed at the same height as the EUT successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit are remeasured manually using a receiver.

Test set-up:



Remarks: ---

Test equipment:

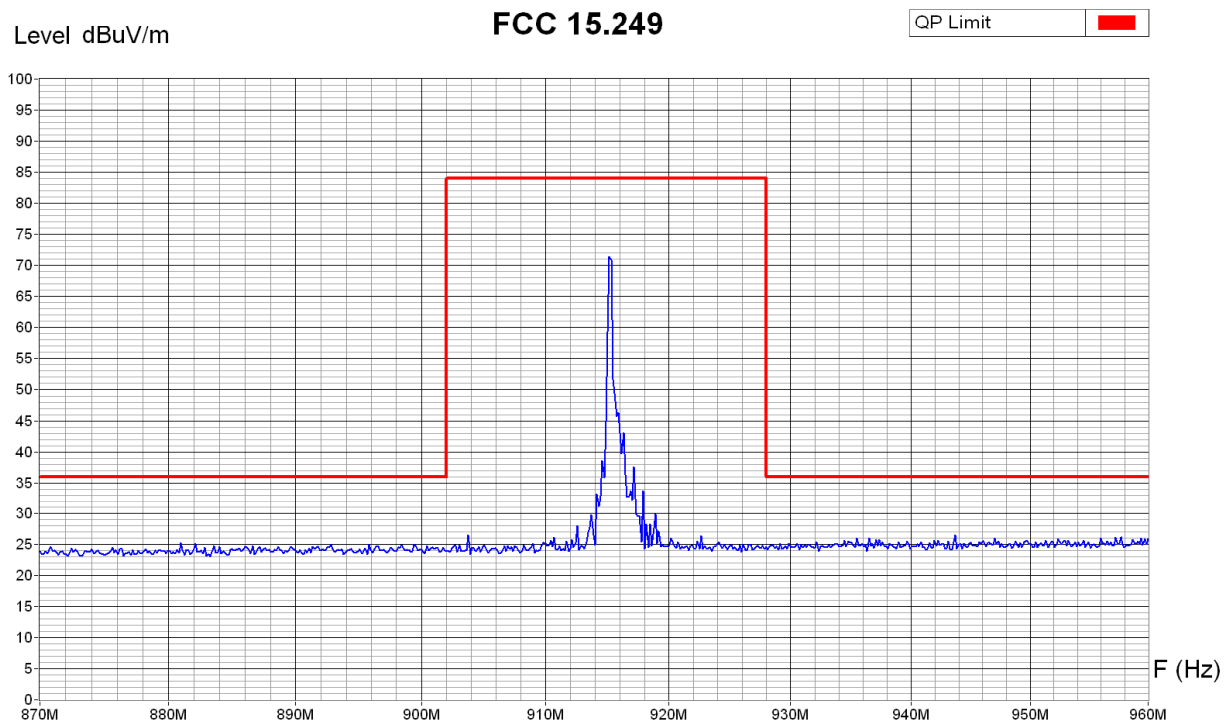
Spectrum analyser	☐ 88-14	☐ 02-06	☐ 03-45	☐ 05-39	☐ 07-53	☒ 10-70
Receiver	☐ 94-35	☐ 04-29	☒ 10-70			
Preamplifier	☐ 90-01	☐ 95-86	☐ 05-56	☒ 05-59	☐ 05-62	☐ 05-87
Antenna, (log-per)	☐ 88-20	☐ 90-30	☐ 91-35	☐ 94-64		
Antenna, (bilog)	☒ 94-03	☐ 05-38				
Cables	☐ 06-00A	☐ 06-00B	☐ 06-00C	☒ 06-01A	☒ 06-01B	☒ 06-01C

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement Type : Radiated Field
 Polarisation : Vertical
 Table Angle : 0-360°
 Antenna Height : 1-2-3-4m



Equipment Under Test : Reconvilier HERCULES Golf Master (Caddy)
 Set-Up : see picture
 Operating Conditions : Caddy transmitting. Watch listening.
 Remarks :



Zone	870 MHz - 960 MHz
Video Bandwidth	500 KHz
Resol Bandwidth	120 KHz

Limit values expressed in dB μ V/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
 e.g.: for f = 915 MHz the limit is 50 mV/m at 3 m;

$$20 \log \left(\frac{50 \frac{mV}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{10m} \right) = 83.5 \frac{dB\mu V}{m} \text{ at } 10m$$

Operator: Baumgartner
 Date/Time: 13.07.2012 15:41
 Filename:
 RV_power.png/.txt

Measurement Type : Radiated Field
 Polarisation : Horizontal
 Table Angle : 0-360°
 Antenna Height : 1-2-3-4m

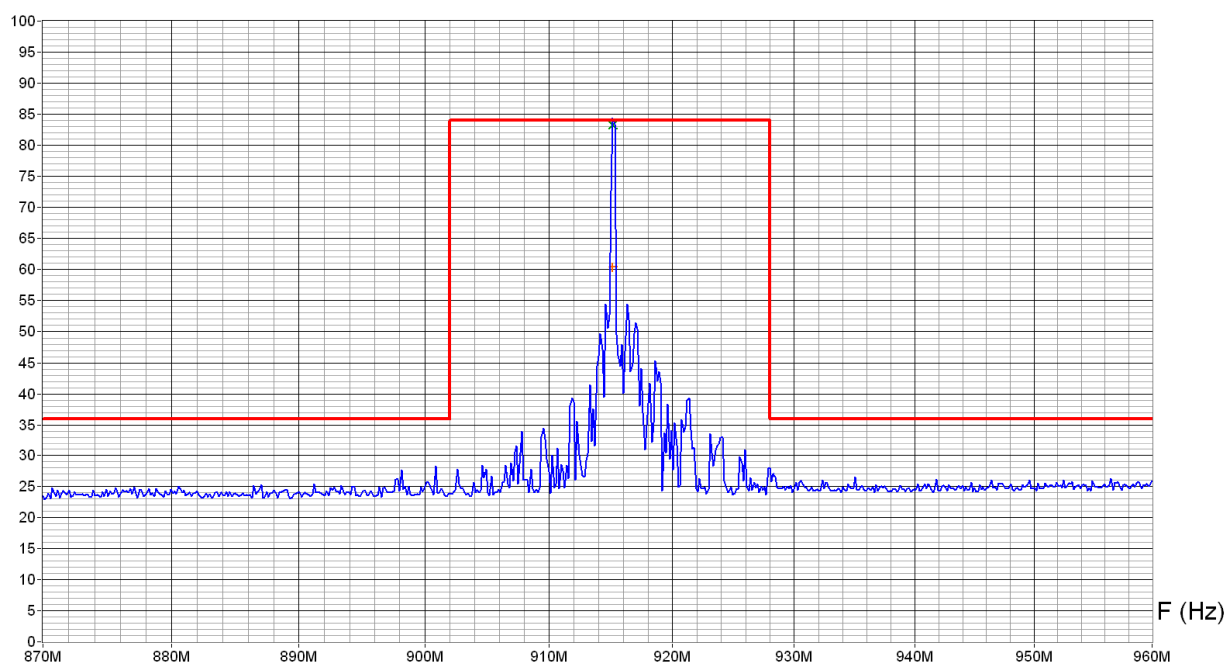


Equipment Under Test : Reconvilier HERCULES Golf Master (Caddy)
 Set-Up : see picture
 Operating Conditions : Caddy transmitting. Watch listening.
 Remarks : EUT - antenna distance = 10m

Level dBuV/m

FCC 15.209

QP Limit



Zone	870 MHz - 960 MHz
Video Bandwidth	500 KHz
Resol Bandwidth	120 KHz

Receiver Measures

Frequency	Peak	QuasiPeak (x)	Average (+)	QP Margin
915.15 MHz	84.2 dBuV/m	83.3 dBuV/m	60.4 dBuV/m	0.7 dB

Limit values expressed in dBuV/m and transformed to a measuring distance of 10 m (factor used = 20 dB/decade)
 e.g.: for f = 915 MHz the limit is 50 mV/m at 3 m;

$$20 \log \left(\frac{50 \frac{mV}{m}}{1 \frac{\mu V}{m}} \right) + 20 \log \left(\frac{3m}{10m} \right) = 83.5 \frac{dB\mu V}{m} \text{ at } 10m$$

Operator: Baumgartner

Date/Time: 17.07.2012 09:47

 Filename:
 RH_power.png/.txt

7.4 Designiation of emission

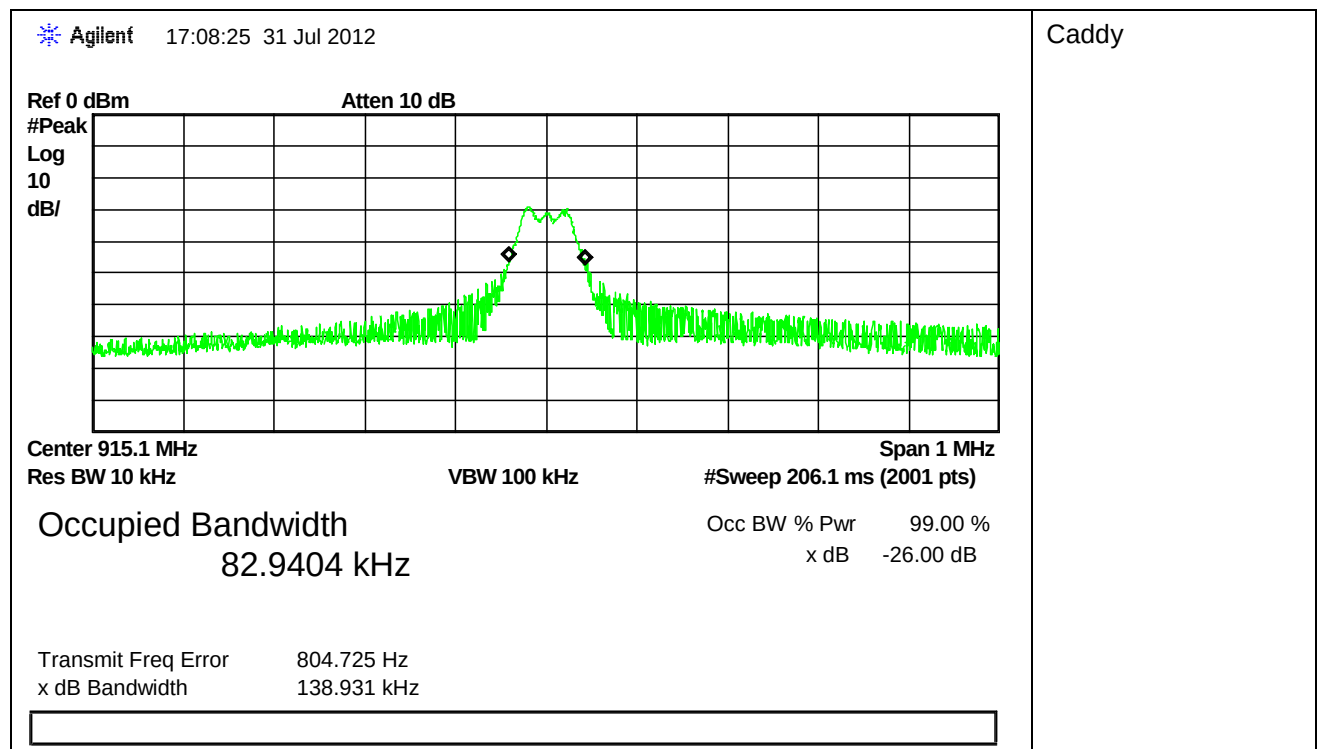
Standard: United States: 47 CFR "Code of Federal Regulations" – Telecommunication
☒ FCC Part 2, Subpart C: Emission: §2.201 and §2.202

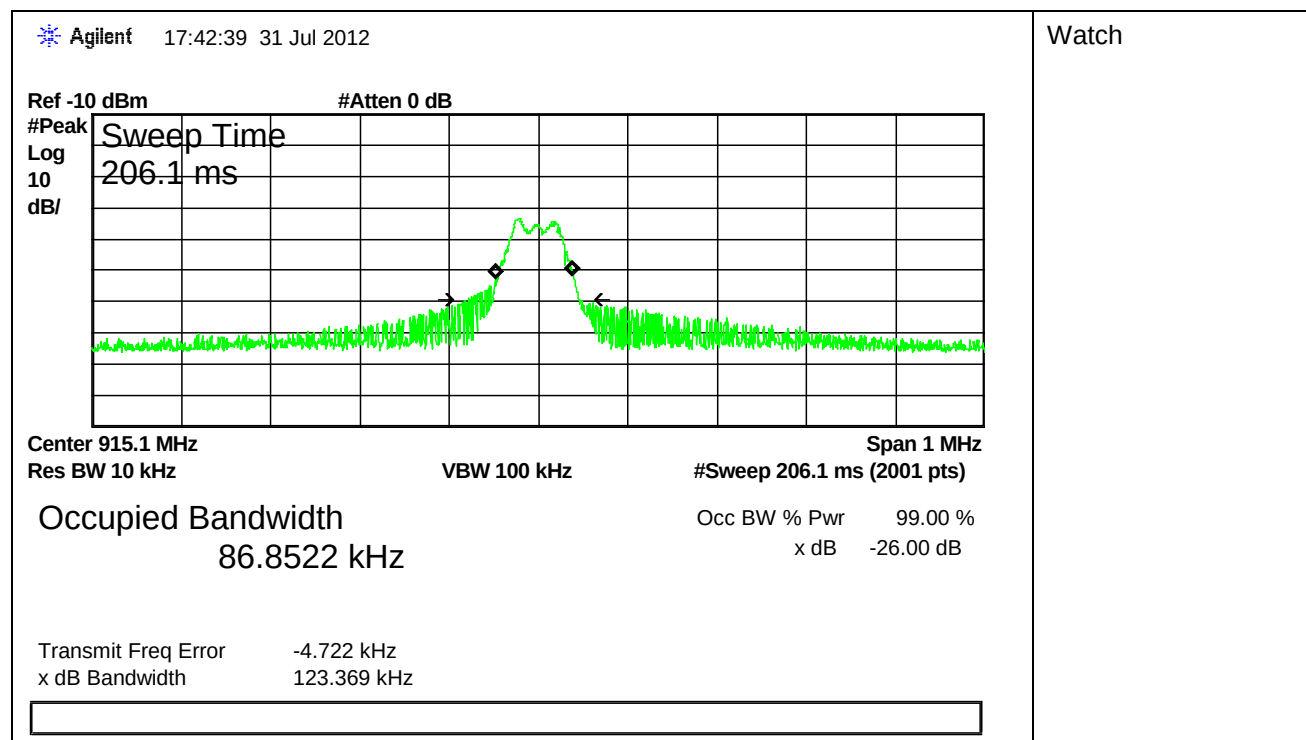
Introduction: A system of designating emission, modulation and transmission characteristics shall be employed.
 (a) Emissions are designated according to their classification and their necessary bandwidth.
 (b) A minimum of three symbols are used to describe the basic characteristics of radio waves.
 (c) Four symbols are used to describe the necessary bandwidth.

Necessary bandwidth: For a given class of emission, the minimum value of the occupied bandwidth sufficient to ensure the transmission of information at the rate and with the quality required for the system employed, under specified conditions.
 $B_n = 82.9 \text{ kHz}$ or 86.8 kHz (occupied bandwidth)

Basic characteristics: F1D F : frequency modulation
 1 : a single channel containing digital information without the use of a modulating sub-carrier
 D : data transmission

Designation: 82k9F1D / 86k8F1D
 of emission





Date of test: July 31, 2012
Operator: E. de Raemy