

Radio test report

20103327300

based on:

- FCC part 15; subpart C; section 15.247 (ed. 10-1-09);
FCC part 15, subpart B, section 15.109 (ed. 10-1-09);
IC RSS 210, Annex 8 (issue 7)

Motor unit for solar/battery powered blinds
VELUX
863820

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This report comprises of three modules. The total number of pages is: 19

Main module

1 Introduction

This report contains the result of tests performed by:

Telefication B.V.
Edisonstraat 12a
6902 PK Zevenaar
The Netherlands

Telefication complies with the accreditation criteria for test laboratories as laid down in ISO/IEC 17025:2005. The accreditation covers the quality system of the laboratory as well as the specific activities as described in the authorized annex bearing the accreditation number L021 and is granted on 30 November 1990 by the Dutch Council For Accreditation (RvA: Raad voor Accreditatie). The contents of this test report, if reproduced, shall be copied in full, unless special consent in writing for reproduction in part is granted by Telefication. Copyright of this test report is reserved to Telefication.

Ordering party:

Company name : VELUX A/S
Address : Baekgaardsvej 40
Zipcode : 6900
City/town : Skjern
Country : Denmark
Date of order : 20 April 2010

2 Product

A sample of the following product was submitted for testing:

Product description	: Motor unit for solar/battery powered blinds
Manufacturer	: Gaasdal Bygningsindustri A/S
Trade mark	: VELUX
Type designation	: 863820
FCC ID	: XSG863820
IC ID	: 8642A-863820
Hardware version	: --
Serial number	: --
Firmware release	: --

3 Test schedule

Tests are carried out in accordance with the specification detailed in chapter 7 “Summary” of this report.

Tests are carried out at the following location:

- Telefication, Zevenaar

The sample of the product is received on:

- 19 April 2010

Tests are carried out between:

- 26 April 2010 and 29 April 2010

4 Product documentation

For production of this report the following product documentation has been used:

Description:	Date:	Identification:
RF test modes, version 3.1	09-02-2010	VELUX
Manufacturer declarations for RF approval of DSL, version 1.0	19-04-2010	VELUX

The above-mentioned documentation will be filed at Telefication for a period of 10 years following the issue of this test report.

5 Observations and comments

The EUT was able to transmit or receive continuously on three channels.

Furthermore the EUT was able to operate in normal (intermittent) mode.

6 Modifications to the sample

No modifications are made to the sample.

7 Summary

The product is intended for use in the following application area(s):

INTENTIONAL RADIATOR OPERATING IN THE FREQUENCY BAND 2400 - 2483.5 MHz

The sample is tested according to the following specification(s):

FCC part 15; subpart C; section 15.247 (ed. 10-1-09);

FCC part 15, subpart B, section 15.109 (ed. 10-1-09);

IC RSS 210, Annex 8 (issue 7)

8 Conclusions

The samples of the product showed **NO NON-COMPLIANCES** to the specification stated in chapter 7 of this report:

The results of the tests as stated in this report, are exclusively applicable to the product item as identified in this report. Telefication accepts no responsibility for any stated properties of product items in this test report, which are not supported by the tests as specified in section 7 "Summary".

All tests are performed by:

name : ing. P.A. Suringa

function : Senior Engineer Radio/EMC

signature : 

Review of test report by:

name : G.J. Gort

function : Senior Test Engineer

signature : 

The above conclusions have been verified by the following signatory:

Date : 11 May 2010

name : ing. P.A.J.M. Robben

function : Manager Laboratory

signature : 

Test results module

1 General information

1.1 Equipment information

Type of equipment	Motor unit for solar/battery powered blinds using IEEE 802.15.4 (Zigbee)	
Modulation	O-QPSK	
Spreading type	DSSS	
Bit rate	250 kb/s	
Operating frequencies (channel set)	Channel	Freq (GHz)
	1	2.425
	2	2.450
	3	2.475
Rated RF antenna power density	1.0 mW/MHz	
Type of antenna	$\frac{1}{2} \lambda$ wire	
Antenna gain	3.3 dBi (max.)	

1.2 Tested channels

Operating frequencies as stated in 1.1 (equipment information).

2 Emission tests

2.1 Maximum conducted output power

Compliance standard : FCC part 15, subpart C, section 15.247 (b) (3)
Method of test : FCC KDB publication No. 558074
Ambient temperature : 23 °C
Relative humidity : 23 %

Test results :

Mode	Level (dBm)		
	CH 1	CH 2	CH 3
Continuously transmitting	1.55	1.44	1.32

Measurement uncertainty: + 1.6 /- 1.9 dB

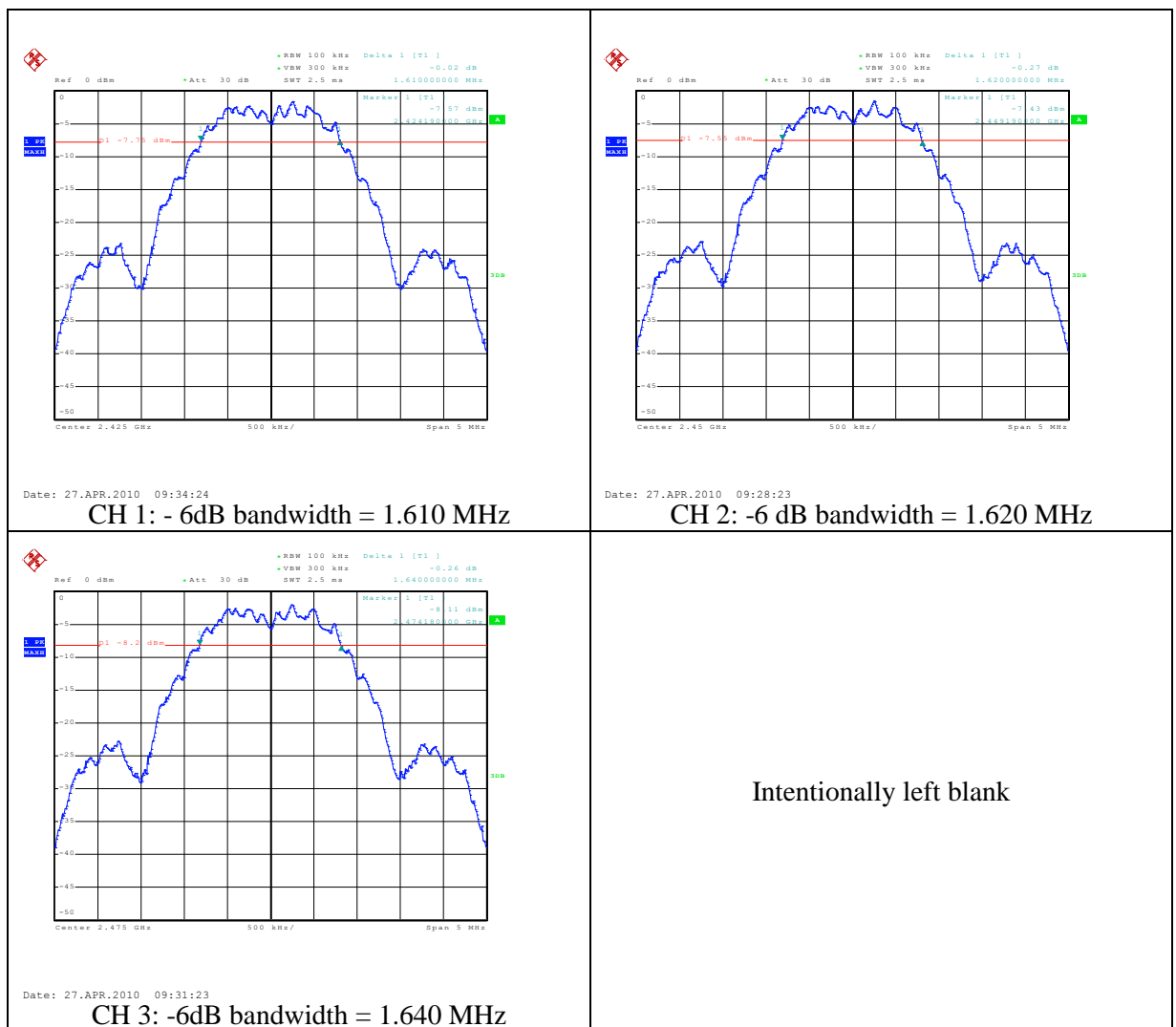
Limit:

Maximum conducted output power	≤ 30 dBm (antenna gain < 6 dBi)
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2.2 Minimum 6 dB bandwidth

Compliance standard : FCC part 15, subpart C, section 15.247 (a) (2)
 Method of test : FCC KDB publication No. 558074
 Ambient temperature : 23 °C
 Relative humidity : 23 %

Test results :



Measurement uncertainty: +/- 2 kHz

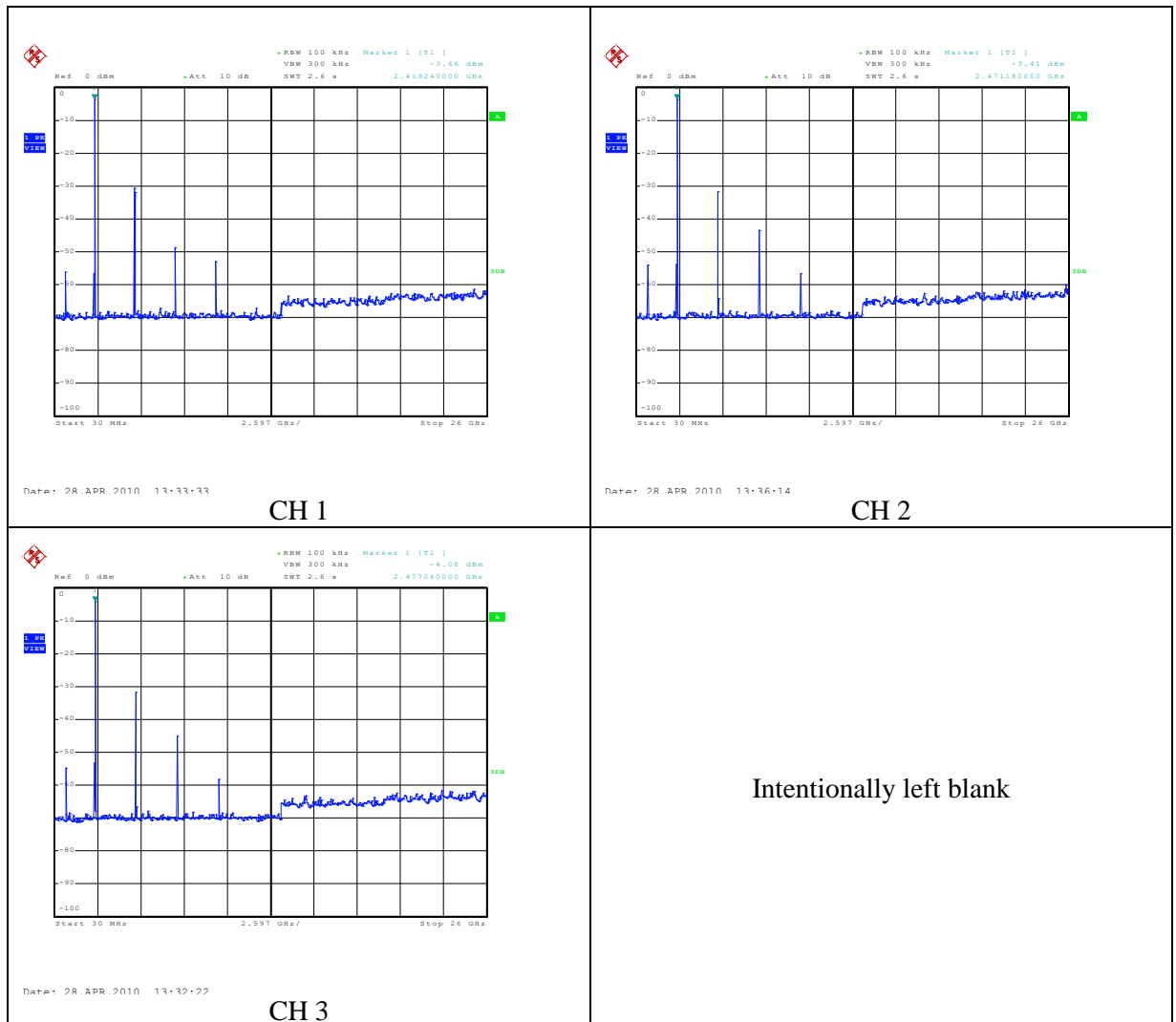
Limit:

Minimum 6 dB bandwidth	at least 500 kHz
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2.3 Tx unwanted emissions attenuation (conducted, 0.030 – 26 GHz)

Compliance standard : FCC part 15, subpart C, section 15.247(d)
 Method of test : FCC KDB publication No. 558074
 Ambient temperature : 23 °C
 Relative humidity : 23 %

Test results :



Measurement uncertainty: < 2 GHz: + 1.7/- 1.9 dB;
 ≥ 2 GHz: +2.4/-2.7 dB

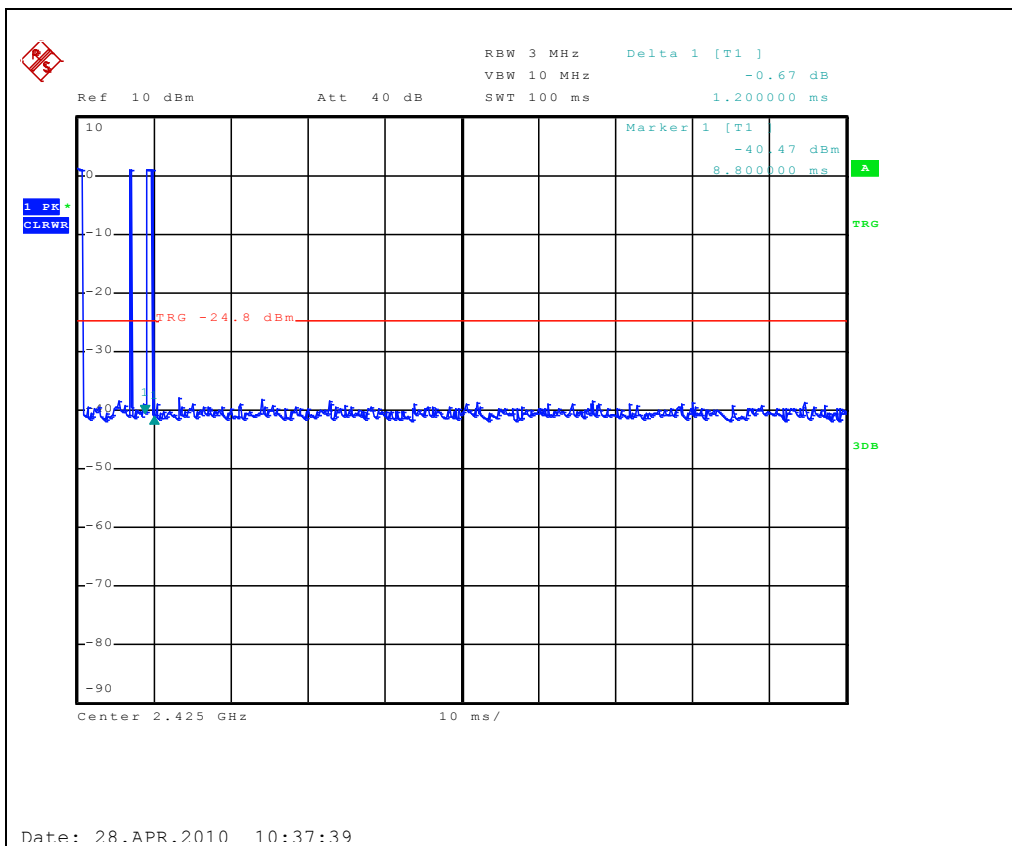
Limit:

In any 100 kHz bandwidth	at least 20 dB down from the highest emission level within the authorized band as measured with a 100 kHz bandwidth.
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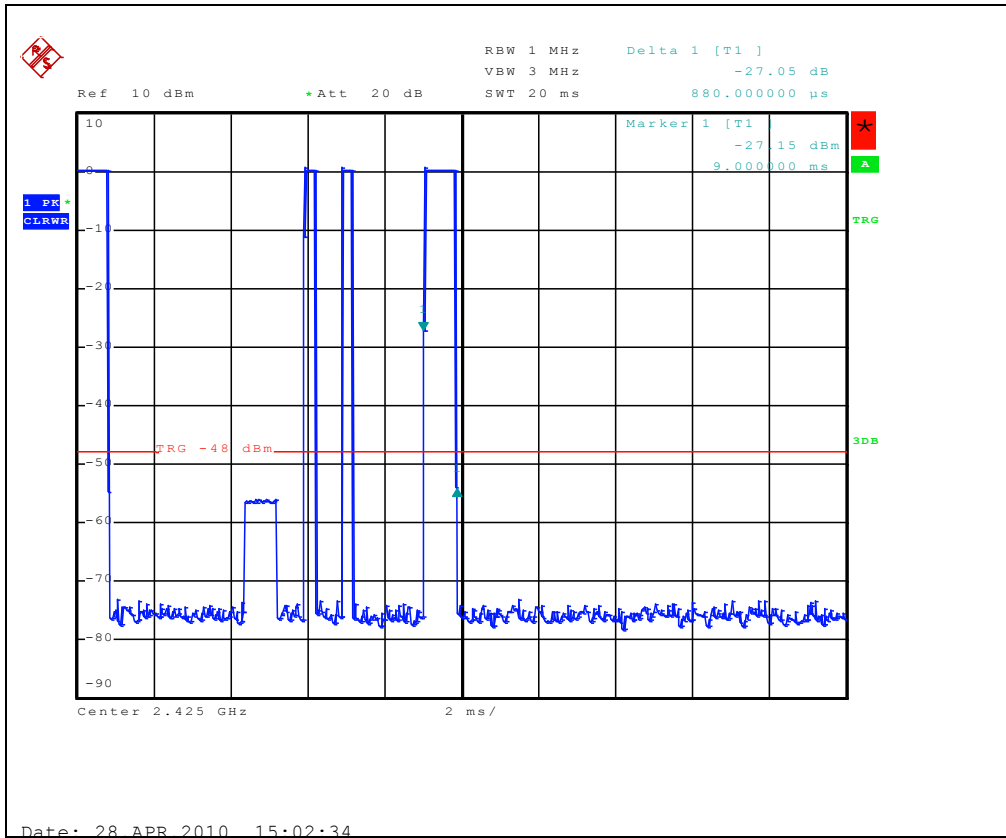
2.4 Average factor

Compliance standard : --
 Method of test : FCC part 15, subpart C, section 15.35 (b) and (c)
 Ambient temperature : 23 °C
 Relative humidity : 23 %
 Test results :

Plot 1: transmissions in 100 msec interval (10 msec/div)



Plot 2: transmissions in 20msec interval (2 msec/div)



Calculation

Total transmission “on” time from plot 2: 2.3 msec.

Average factor: $20 * \log (2.3/100) = -32.8 \text{ dB}$

Measurement uncertainty: $+0.2/-0.2 \text{ μsec.}$

2.5 Tx unwanted emissions in the restricted bands

Compliance standard : FCC part 15, subpart C, section 15.247(d)
 Method of test : FCC KDB publication No. 558074
 Ambient temperature : 23 °C
 Relative humidity : 23 %

Test results :

Frequency (MHz)	Test results peak (dBm eirp)		Average factor (dB)	Test results average (dBm eirp)		Resolution bandwidth (kHz)	Average Limit (dBm eirp)*)	Peak limit (dBm eirp)
	V	H		V	H			
4850	-28.5	-35.0	-32.8	-61.3	-67.8	1000	-41.2	-21.2
4900	-30.5	-32.0	-32.8	-63.3	-64.8	1000	-41.2	-21.2
4950	-30.3	-35.3	-32.8	-63.1	-68.1	1000	-41.2	-21.2
7275	-39.3	-39.0	-32.8	-72.1	-71.8	1000	-41.2	-21.2
7350	-37.2	-39.0	-32.8	-70.0	-71.8	1000	-41.2	-21.2
7425	-36.7	-36.2	-32.8	-69.5	-69.0	1000	-41.2	-21.2
12125	≤ -40	≤ -40	-32.8	≤ -72.8	≤ -72.8	1000	-41.2	-21.2
12250	≤ -40	≤ -40	-32.8	≤ -72.8	≤ -72.8	1000	-41.2	-21.2
12375	≤ -40	≤ -40	-32.8	≤ -72.8	≤ -72.8	1000	-41.2	-21.2
19400	≤ -46	≤ -46	-32.8	≤ -78.8	≤ -78.8	1000	-41.2	-21.2
19600	≤ -46	≤ -46	-32.8	≤ -78.8	≤ -78.8	1000	-41.2	-21.2
19800	≤ -46	≤ -46	-32.8	≤ -78.8	≤ -78.8	1000	-41.2	-21.2

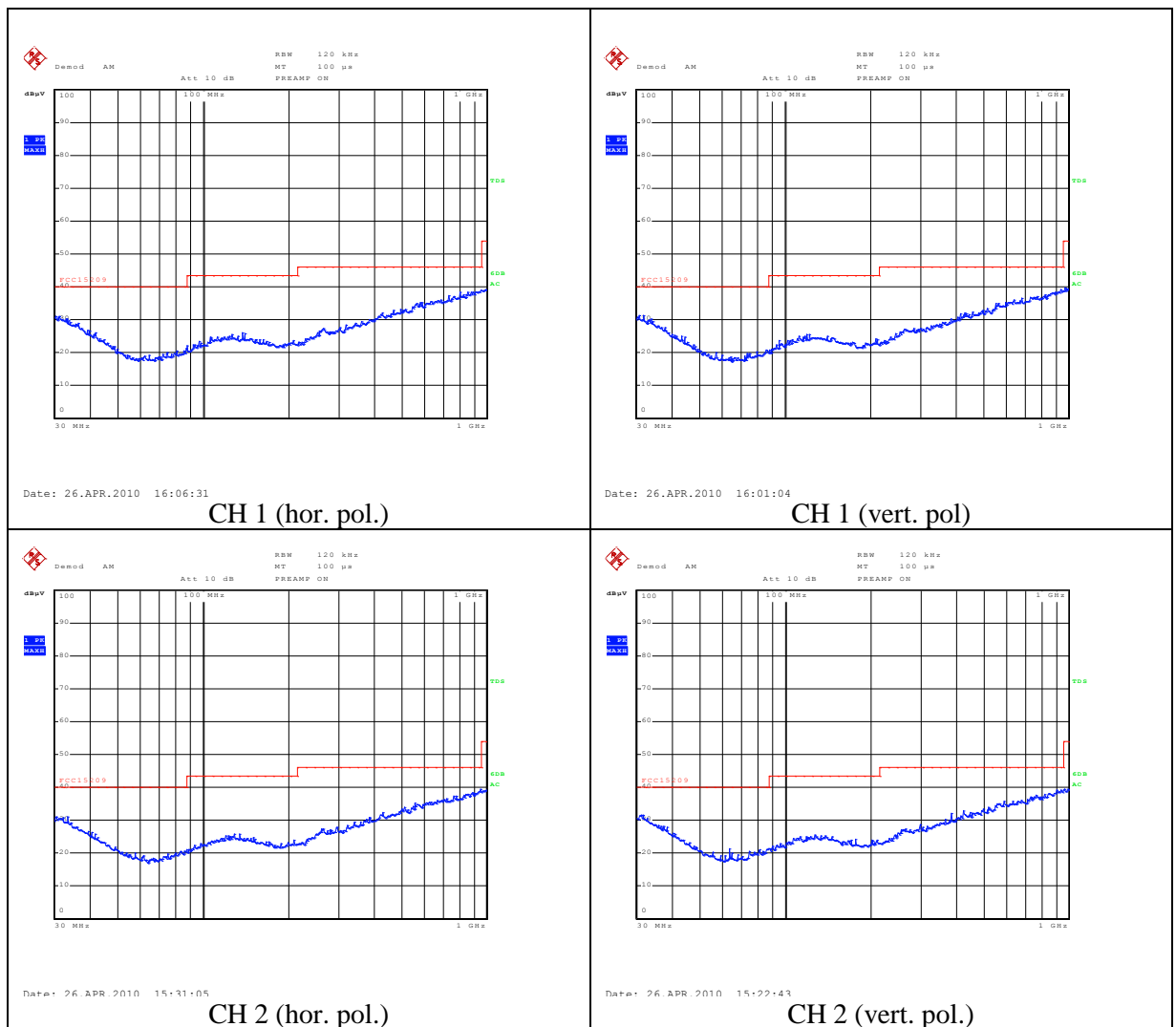
*¹) derived from the expression $EIRP_{dBm} = E_{dB\mu V/m} - 95.2_{dB}$
 (Max. field strength at band edge: 500 $\mu V/m$ @ 3 m distance (equivalent to 54 $dB\mu V/m$))

Measurement uncertainty: +4.5 / -6.1 dB

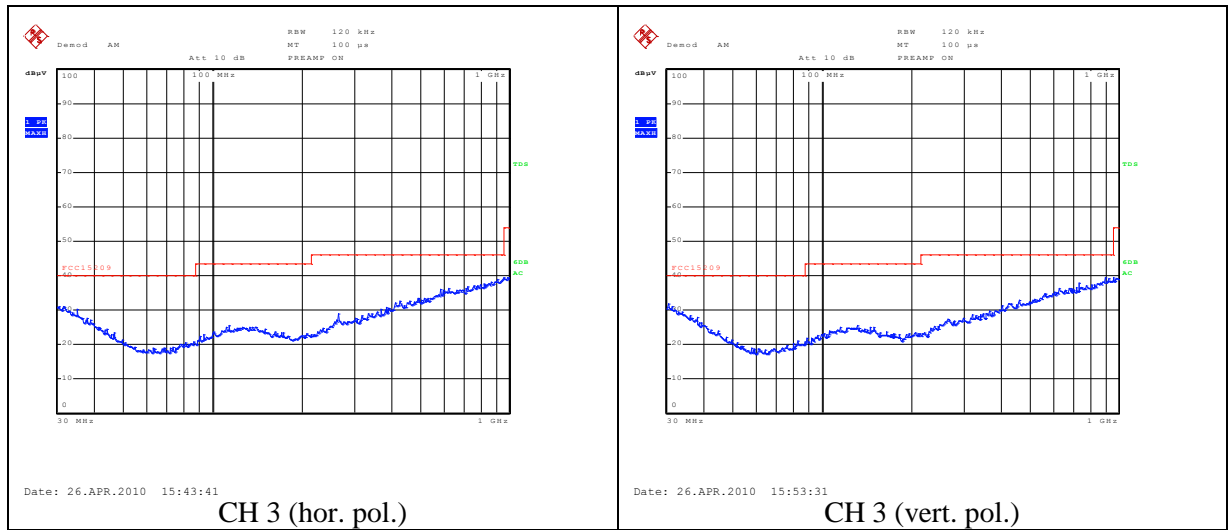
2.6 Rx unwanted emissions (radiated, 0.03 – 1 GHz)

Compliance standard : FCC part 15, subpart B, section 15.109
 Method of test : ANSI C63.10-2009, section 6.5.4.2
 Ambient temperature : 23 °C
 Relative humidity : 23 %

Test results :



Test results module



Measurement uncertainty:

Horizontal polarization	
30 – 200 MHz	4.5 dB
200 – 1000 MHz	3.6 dB
Vertical polarization	
30 – 200 MHz	5.4 dB
200 – 1000 MHz	4.6 dB

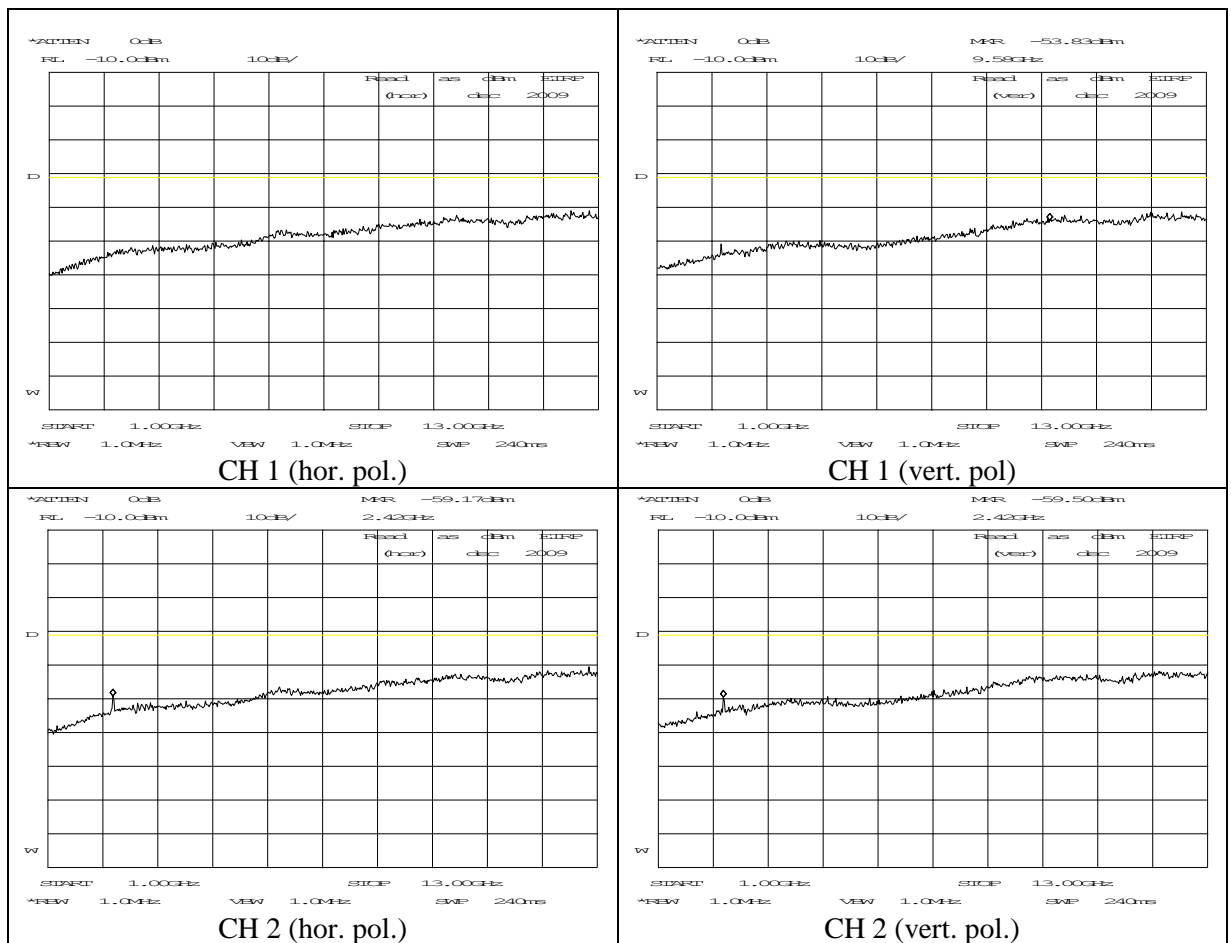
Limit:

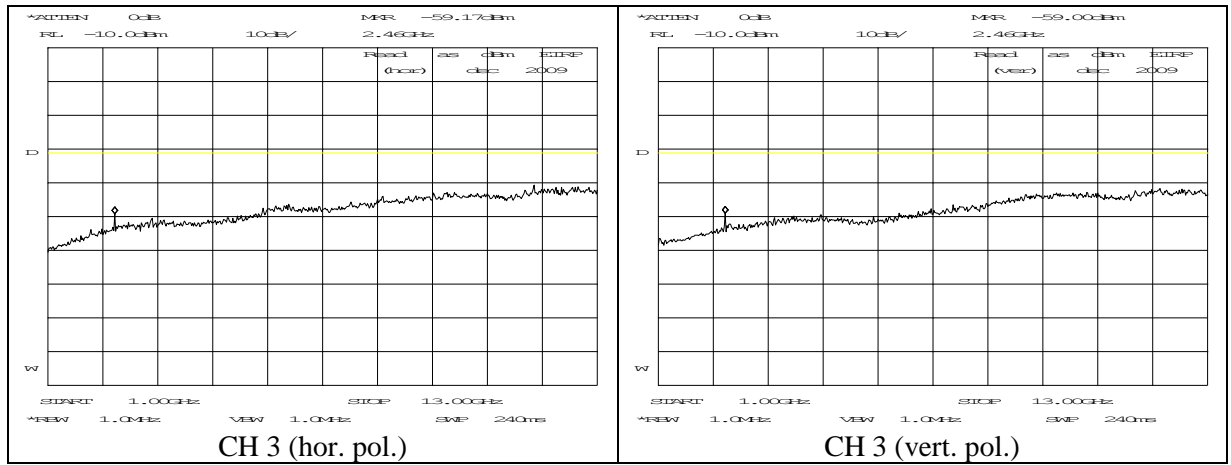
Field strength at 3 meter distance	30 – 88 MHz: $\leq 40 \text{ dB}\mu\text{V/m}$; 88 – 216 MHz: $\leq 43.5 \text{ dB}\mu\text{V/m}$; 216 – 960 MHz: $\leq 46 \text{ dB}\mu\text{V/m}$; Above 960 MHz: $\leq 54 \text{ dB}\mu\text{V/m}$
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2.7 Rx unwanted emissions (radiated, > 1GHz)

Compliance standard : FCC part 15, subpart B, section 15.109
 Method of test : ANSI C63.10-2009: section 6.6
 Ambient temperature : 23 °C
 Relative humidity : 23 %

Test results :





Measurement uncertainty: +4.5 / -6.1 dB

Limit:

Radiated power	Above 1 GHz: ≤ -41.2 dBm eirp ^{*)}
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^{*)} derived from the expression $EIRP_{dBm} = E_{dB\mu V/m} - 95.2_{dB}$
(Max. field strength at band edge: 500 $\mu V/m$ @ 3 m distance (equivalent to 54 dB $\mu V/m$))

Used test equipment module

Description	Telef. ID	Manufacturer	Model	Used at par.
Spectrum Analyzer	TE 11125	Rohde & Schwarz	FSP 40	2.2, 2.3, 2.4
Power meter	TE 00354	Hewlett Packard	437B	2.1
Power sensor	TE 00355	Hewlett Packard	8481A	2.1
Spectrum analyzer	TE 00359	Hewlett Packard	8563E	2.5, 2.7
Pre amplifier	TE 00092	Hewlett Packard	8449B	2.5, 2.7
Horn antenna	TE 00531	EMCO	3115	2.5, 2.7
Anechoic chamber	TE 01064	Euroshield	RFD-F-100	2.5, 2.7
Semi anechoic chamber	TE 00861	Comtest	--	2.6
EMI test receiver	TE 00481	Rohde & Schwarz	ESCI	2.6
Biconilog	TE 00967	Chase	CBL6112A	2.6

Cross reference table

Transmitter	
IC RSS-210 Issue 7, Annex 8	FCC 47 CFR Ch. 1 part 15, subpart C (10-1-09 Edition)
A8.2 (a)	§ 15.247 (a) (2)
A8.4 (4)	§ 15.247 (b) (3)
A8.2 (b)	§ 15.247 (e)
A8.5	§ 15.247 (d)
Receiver	
IC RSS-Gen Issue 2	FCC 47 CFR Ch. 1 part 15, subpart B (10-1-09 Edition)
§ 7.2.3	§ 15.109