

## **Radio test report**

### **20134636300 rev 1.0**

based on:

FCC part 15C, sections 15.207 and 15.247  
(ed. 10-1-12);

FCC part 15B, sections 15.107 and 15.109  
(ed. 10-1-12);

IC RSS 210, Annex 8 (issue 8); IC RSS-Gen  
(issue 3)

interface equipment using IEEE 802-15-4 (Zigbee)

Salto

Clay-IQ

## Contents

<b>MAIN MODULE.....</b>	<b>3</b>
1.....INTRODUCTION .....	3
2.....PRODUCT .....	4
3.....TEST SCHEDULE .....	4
4.....PRODUCT DOCUMENTATION.....	5
5.....OBSERVATIONS AND COMMENTS .....	5
6.....MODIFICATIONS TO THE SAMPLE.....	5
7.....SUMMARY.....	5
8.....CONCLUSIONS .....	6
<b>TEST RESULTS MODULE.....</b>	<b>7</b>
1.....GENERAL INFORMATION .....	7
1.1 Equipment information .....	7
1.2 Tested channels.....	7
2.....SUMMARY OF TESTS.....	7
3.....EMISSION TESTS .....	8
3.1 Maximum conducted output power.....	8
3.2 Minimum 6 dB bandwidth .....	9
3.3 99% emission bandwidth .....	10
3.4 Tx unwanted emissions attenuation (conducted, 0.030 – 26 GHz) .....	11
3.5 Tx unwanted emissions in the restricted bands .....	12
3.6 Rx unwanted emissions (radiated, 0.03 – 1 GHz), exploratory.....	14
3.7 Rx unwanted emissions (radiated > 1GHz), exploratory .....	15
3.8 Rx unwanted emissions (radiated > 1GHz), final .....	16
3.9 Conducted emissions into the AC mains.....	17
<b>USED TEST EQUIPMENT MODULE.....</b>	<b>19</b>
<b>CROSS REFERENCE TABLE.....</b>	<b>20</b>
<b>REVISION HISTORY .....</b>	<b>21</b>



## 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).*

*Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Registration Number is: 282250.*

*The Industry Canada number for the Open Area Test Site of Telefication is: 4173A-1.*

*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 : SALTO Systems S.L.  
Address : C/Arkotz 9 Pol. Lanbarren  
Zipcode : 20180  
City/town : Oiartzun (Gipuzkoa)  
Country : Spain  
Date of order : 12 November 2013



## 2 Product

A sample of the following product was submitted for testing:

Product description	: interface equipment using IEEE 802-15-4 (Zigbee)
Manufacturer	: SALTO Systems S.L.
Trade mark	: Salto
Type designation	: Clay-IQ
FCC ID	: UKCCLAYIQ
IC ID	: 10088A-CLAYIQ
Hardware version	: --
Serial number	: --
Firmware release	: --
Variant model	: Clay-REPEATER

## 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:

- 14 November 2013

Tests are carried out between:

- 14 November and 3 December 2013



## 4 Product documentation

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

Description:	Date:	Identification:
Technical file Clay IQ-Repeater V 1.3	12/11/2013	

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

GSM module measurements are not included in the tests.

The variant model Clay-REPEATER differs from the Clay-IQ model in the sense that the GSM module has not been installed.

The devices are intended to be installed as wall-mounted or on a table. It appeared that in the test set up the highest emissions were obtained in the wall mount position. Therefore results of radiated emission tests with the device in this position are laid down in this report.

The device submitted for testing was equipped with built-in test modes.

## 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 15C, sections 15.207 and 15.247 (ed. 10-1-12);  
FCC part 15B, sections 15.107 and 15.109 (ed. 10-1-12);  
IC RSS 210, Annex 8 (issue 8); IC RSS-Gen (issue 3)



## 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 :

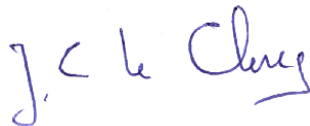


Review of test report by:

name : ing. J.C. le Clercq

function : Test Engineer

signature :



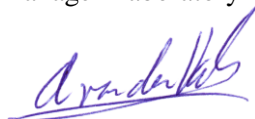
The above conclusions have been verified by the following signatory:

Date : 2 January 2014

name : ing. A. van der Valk

function : Manager Laboratory

signature :



## Test results module

### 1 General information

#### 1.1 Equipment information

Type of equipment	Interface equipment between the two different networks IEEE 802.15.4 (Zigbee) and GPRS
Modulation	O-QPSK
Spreading type	DSSS
Bit rate	250 kb/s
Operating frequencies	$F_c = 2405 + 5(k-11)$ MHz, for $k = 11, 12, \dots, 26$ where $k$ is the channel number
Rated conducted RF power	5 dBm
Type of antenna	PIFA
Antenna gain	3.3 dBi
Duty cycle	100 % (during testing)

#### 1.2 Tested channels

Channel	Freq (GHz)
11	2.405
19	2.445
26	2.480

### 2 Summary of tests

FCC section	Description	Verdict
§ 15.247 (a) (2)	Minimum 6 dB bandwidth	Pass
§ 15.247 (b) (3)	Maximum conducted output power	Pass
§ 15.247 (e)	Power spectral density, conducted	Pass <sup>*)</sup>
§ 15.247 (d)	At least 20 dBc attenuation of RF power in any 100 kHz bandwidth	Pass
§ 15.205	Spurious emissions in restricted bands	Pass
§ 15.109	Field strength of radiated emissions	Pass
§ 15.107	AC mains conducted emissions of unintentional radiators	Pass
§ 15.207	AC mains conducted emissions of intentional radiators	Pass

<sup>\*)</sup> This test has not been performed since maximum output power is much less than 8 dBm. Therefore this test shall be deemed to meet the requirement.

### 3 Emission tests

#### 3.1 Maximum conducted output power

Compliance standard : FCC part 15, subpart C, section 15.247 (b) (3)  
Method of test : FCC KDB publication No. 558074 V03, section 9.1.3  
Ambient temperature : 23 °C  
Relative humidity : 23 %

Test results :

*Modulation* : *on*

Mode	Level (dBm)		
	CH 11	CH 19	CH 26
Continuously transmitting	2.74	2.58	2.50

Measurement uncertainty: + 1.6 /- 1.9 dB

**Limit:**

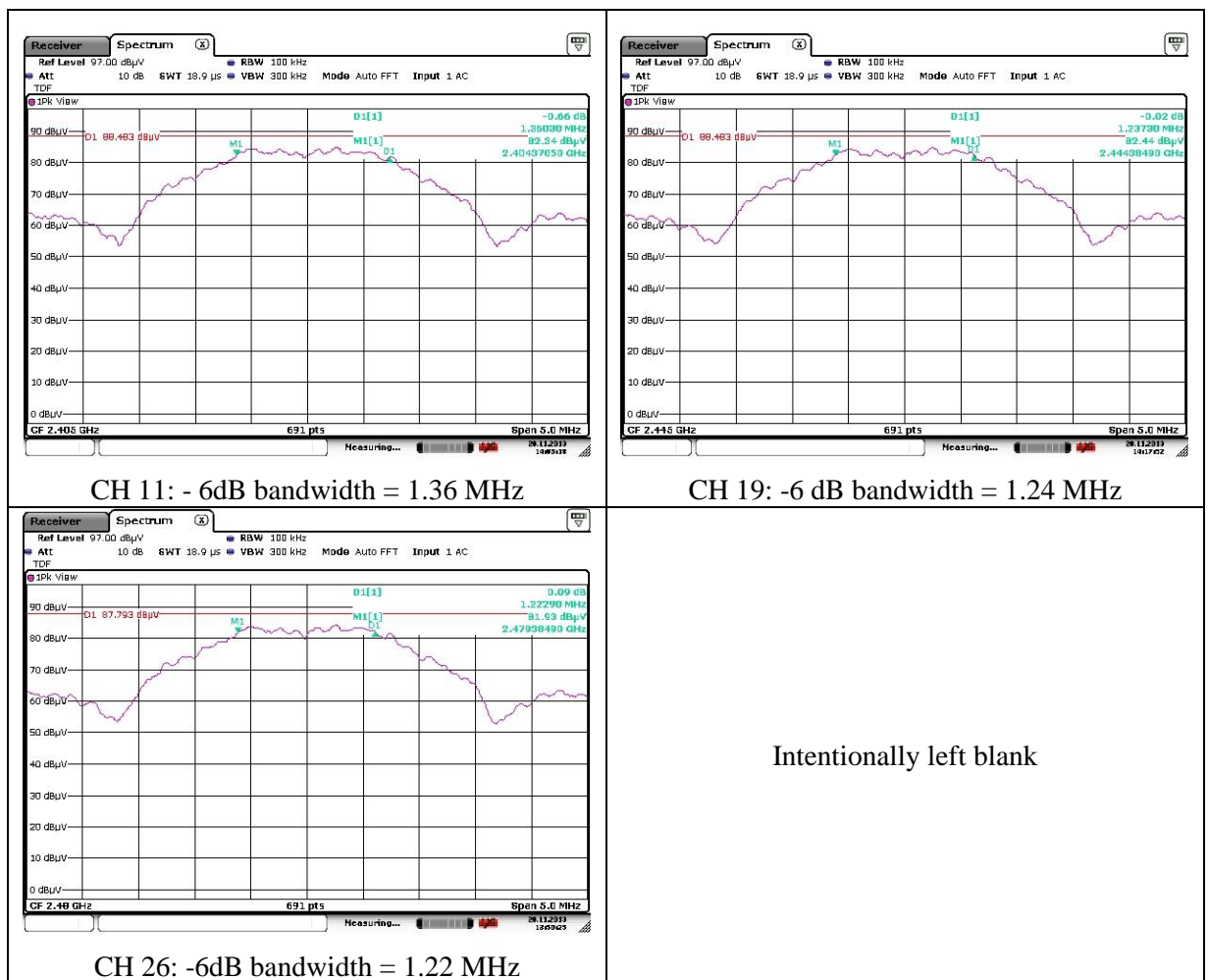
Maximum conducted output power	$\leq 30$ dBm (antenna gain < 6 dBi)
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### 3.2 Minimum 6 dB bandwidth

Compliance standard : FCC part 15, subpart C, section 15.247 (a) (2)  
 Method of test : FCC KDB publication No. 558074 V03, section 8.1  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %

Test results :



Measurement uncertainty: +/- 2 kHz

**Limit:**

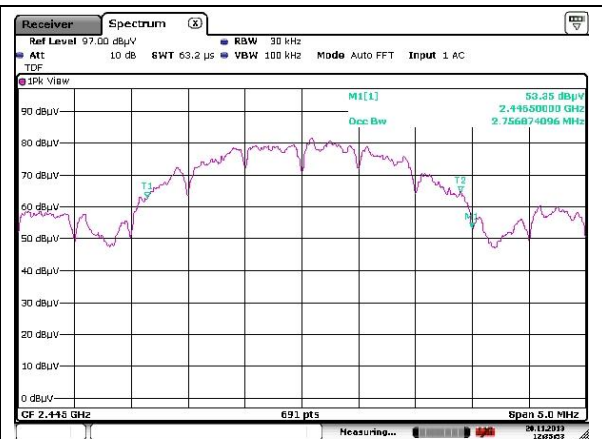
Minimum 6 dB bandwidth	at least 500 kHz
------------------------	------------------

### 3.3 99% emission bandwidth

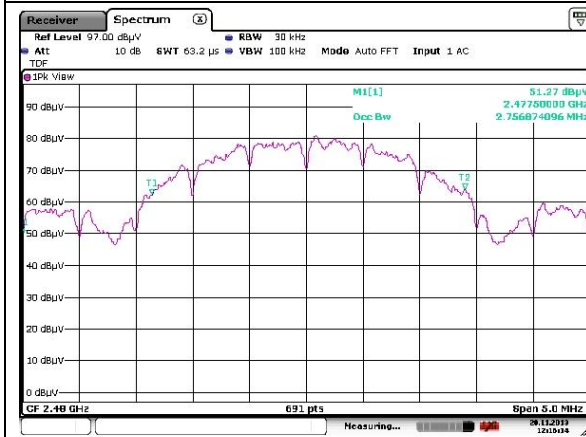
Compliance standard : IC RSS-Gen, section 4.6.1  
 Method of test : IC RSS-Gen, section 4.6.1  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %



Ch 11: 99% emission bandwidth: 2.76 MHz



Ch 19: 99% emission bandwidth: 2.76 MHz



Ch 26: 99% emission bandwidth: 2.76 MHz

Intentionally left blank

Measurement uncertainty: +/- 2 kHz

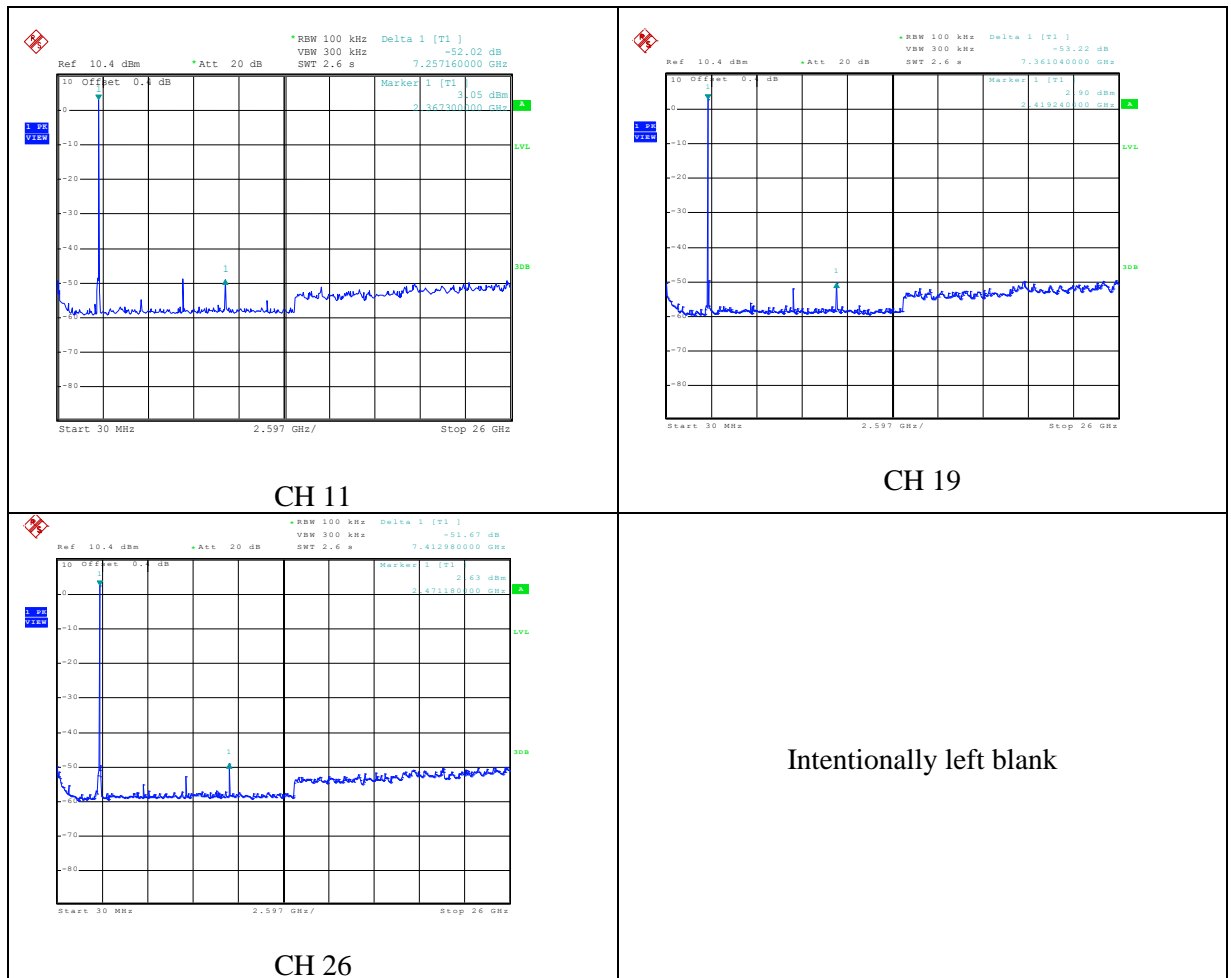
**Limit:**

99% emission bandwidth	Not applicable
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### 3.4 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 V03, section 11.1  
 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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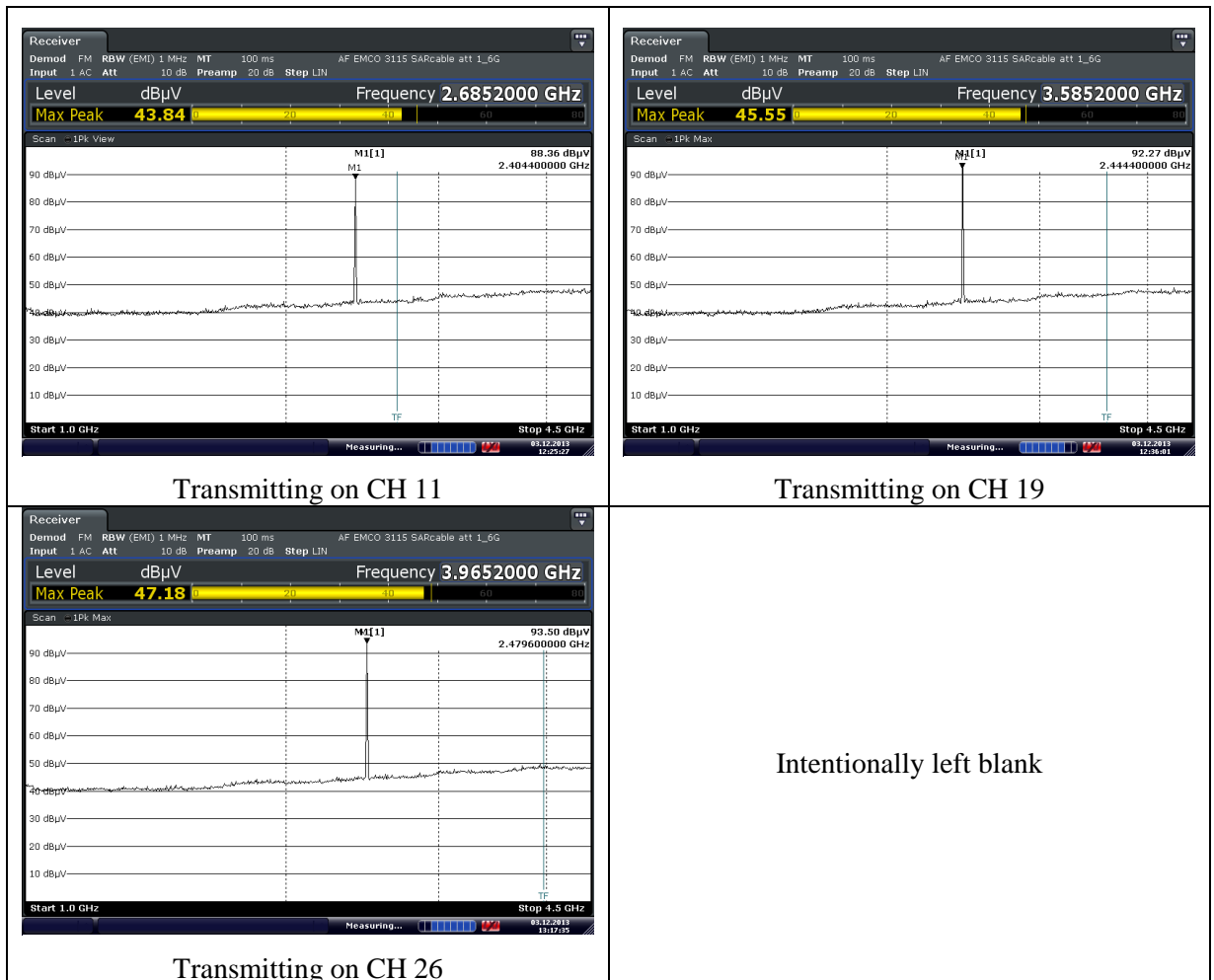
### 3.5 Tx unwanted emissions in the restricted bands

Compliance standard : FCC part 15, subpart C, section 15.247(d)  
 Method of test : FCC KDB publication No. 558074 V03, section 12.1  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %  
 EUT position : wall mount

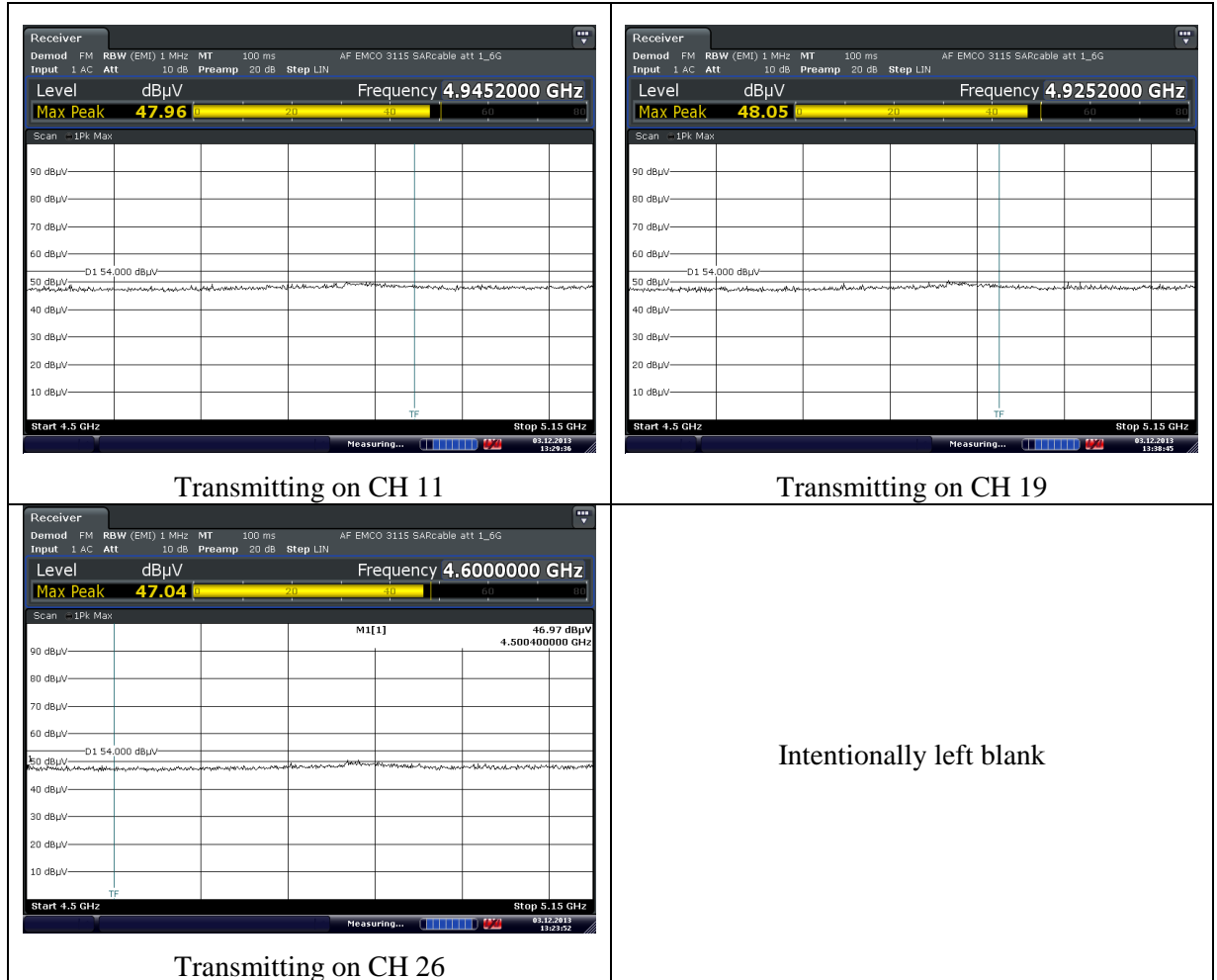
Test results :

*Polarization* : *Horizontal (highest of the two orthogonal polarizations)*

*Restricted bands 1 – 4.5 GHz*



*Restricted band 4.5 – 5.15 GHz*



Frequency (MHz)	Test results peak (dBm eirp)		Average factor (dB)	Resolution bandwidth (kHz)	Average Limit (dBm eirp)*)	Peak limit (dBm eirp)
	V	H				
4810	≤ -53	≤ -53	N/A	1000	-41.2	-21.2
4890	≤ -53	≤ -53	N/A	1000	-41.2	-21.2
4960	≤ -53	≤ -53	N/A	1000	-41.2	-21.2
7335	≤ -53	≤ -53	N/A	100	-41.2	-21.2
7440	≤ -53	≤ -53	N/A	100	-41.2	-21.2
12025	≤ -48	≤ -48	N/A	100	-41.2	-21.2
12225	≤ -48	≤ -48	N/A	100	-41.2	-21.2
12400	≤ -48	≤ -48	N/A	100	-41.2	-21.2
19240	≤ -51	≤ -51	N/A	100	-41.2	-21.2
19560	≤ -51	≤ -51	N/A	100	-41.2	-21.2
19840	≤ -51	≤ -51	N/A	100	-41.2	-21.2
22320	≤ -47	≤ -47	N/A	100	-41.2	-21.2

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

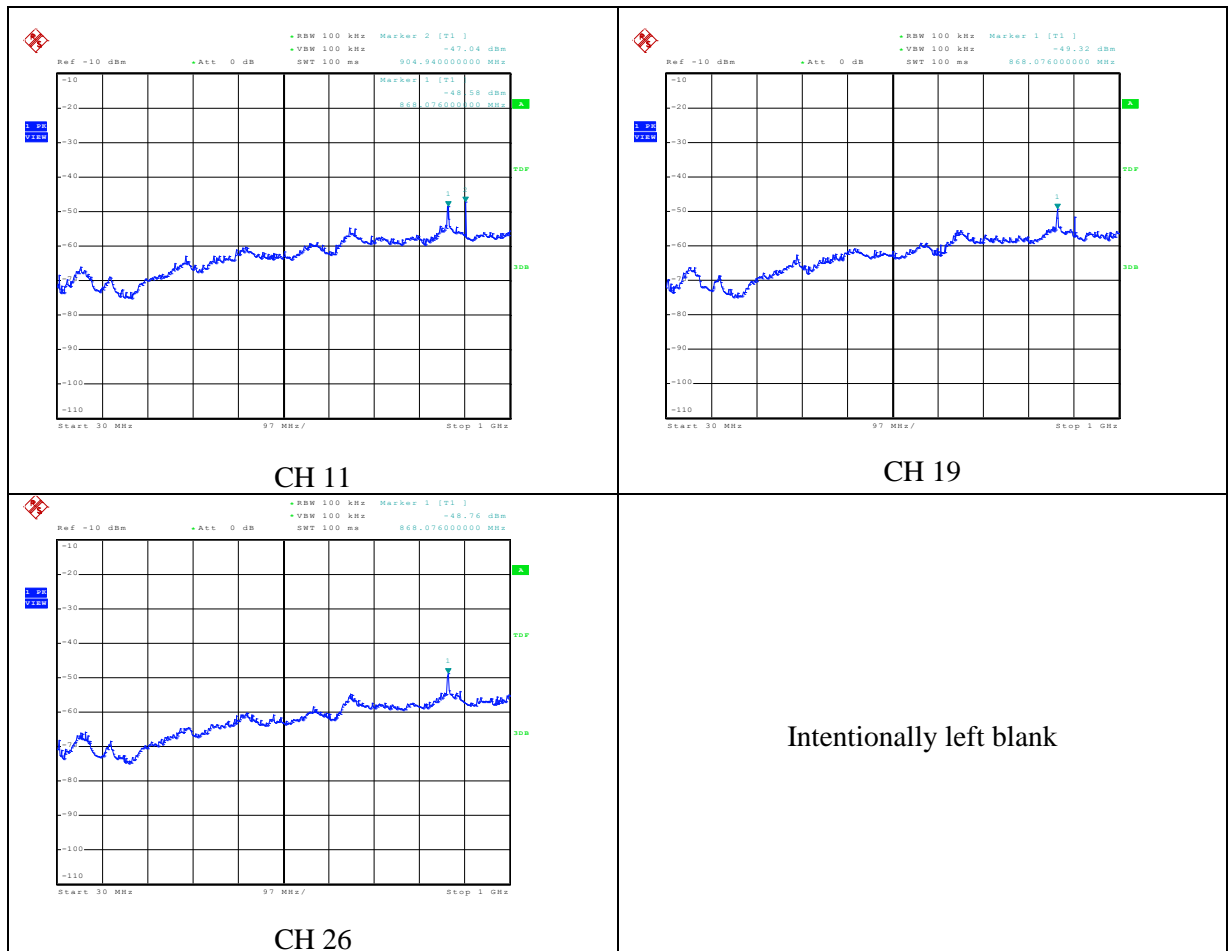
Measurement uncertainty: +4.5 / -6.1 dB

### 3.6 Rx unwanted emissions (radiated, 0.03 – 1 GHz), exploratory

Compliance standard : FCC part 15, subpart B, section 15.109  
 Method of test : ANSI C63.10-2013, section 6.5.3  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %

Test results :

*Polarization* : *Vertical (highest of the two orthogonal polarizations)*



*Remark: emission peaks at 868.076 and 904.94 MHz are ambient signals and therefore not subject to the requirement.*

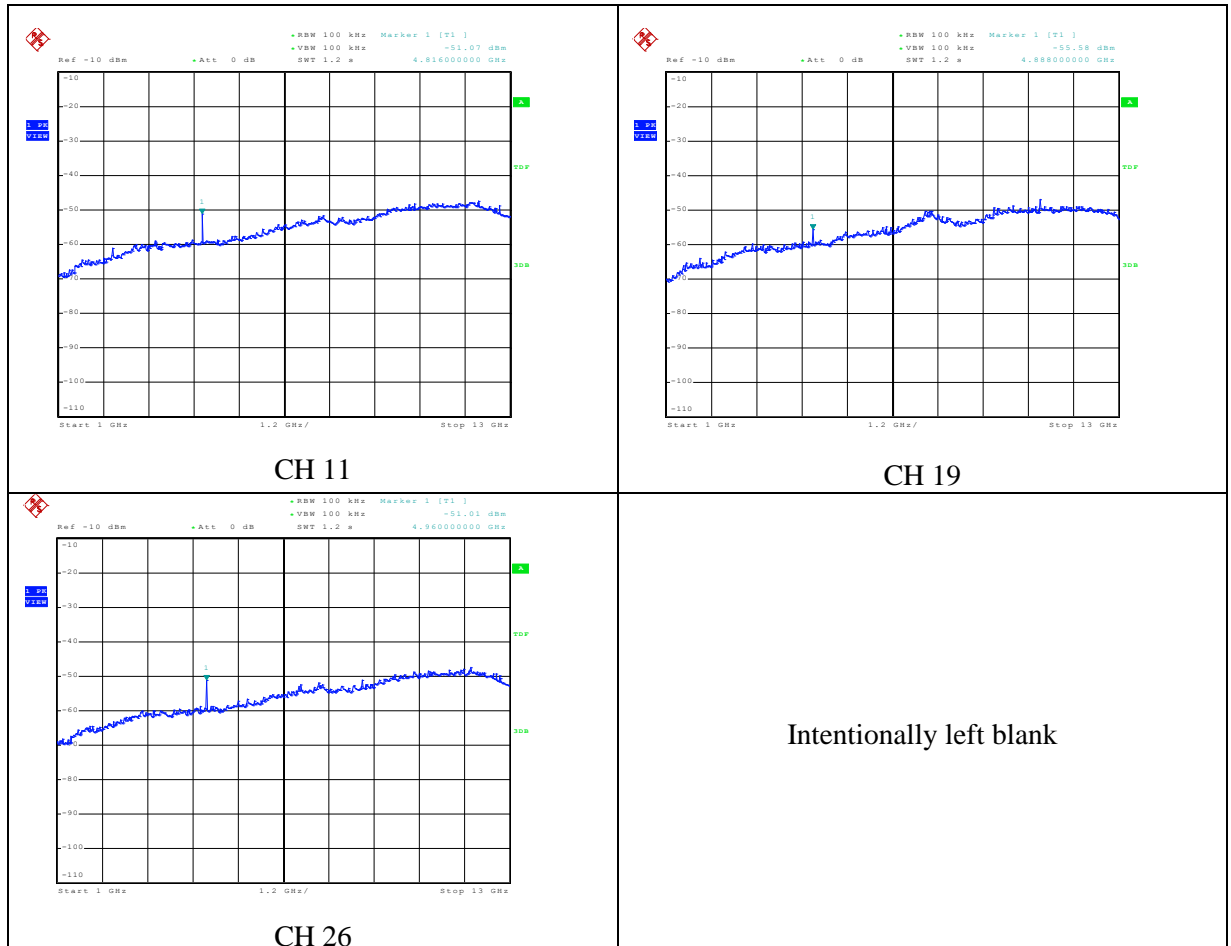
*No other emissions above measurement system noise floor have been detected, so no final measurements were needed.*

### 3.7 Rx unwanted emissions (radiated > 1GHz), exploratory

Compliance standard : FCC part 15, subpart B, section 15.109  
 Method of test : ANSI C63.10-2009: section 6.6.4.2  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %  
 EUT position : wall mount

Test results :

*Polarization* : *Vertical (highest of the two orthogonal polarizations)*



Measurement uncertainty: +4.5 / -6.1 dB

**Limit:**

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

### 3.8 Rx unwanted emissions (radiated > 1GHz), final

Compliance standard	:	FCC part 15, subpart B, section 15.109
Method of test	:	ANSI C63.10-2009: section 6.6.4.2
Ambient temperature	:	23 °C
Relative humidity	:	23 %
EUT position	:	wall mount

The emission peaks at 4816, 4888 and 4960 MHz found during the exploratory measurements with a RBW of 100 kHz are under the measurement system noise floor (50 dB $\mu$ V/m) when measured with the required RBW of 1MHz.

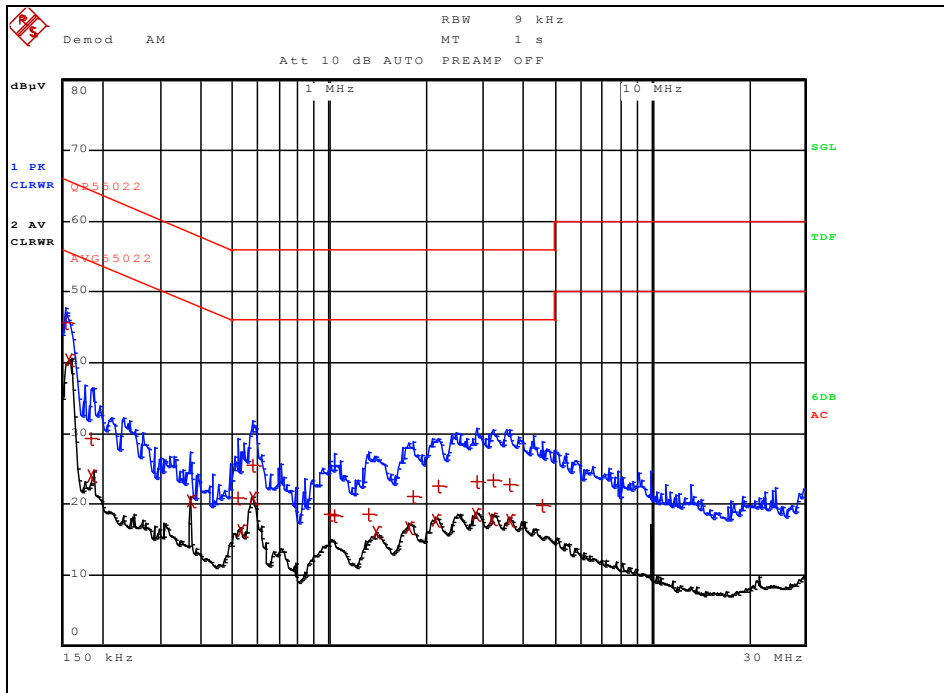


### 3.9 Conducted emissions into the AC mains

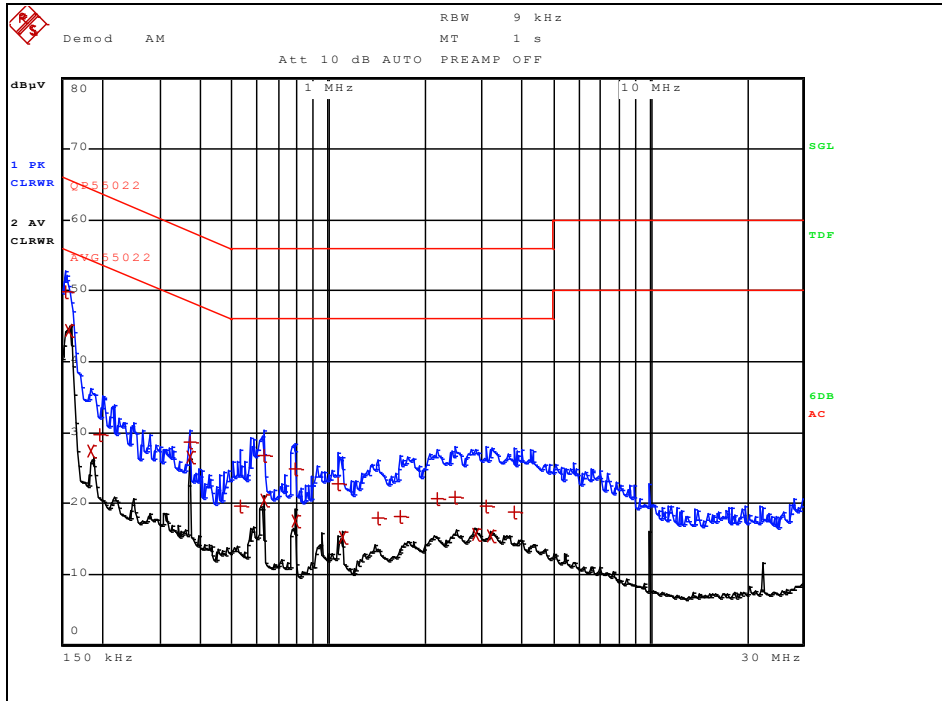
Compliance standard : FCC part 15, subparts B/C, sections 15.107/15.207  
 Method of test : ANSI C63.10: 2009, section 6.2  
 Ambient temperature : 23 °C  
 Relative humidity : 23 %  
 Supply voltage : 110 V (mains side of AC/DC adapter)

Test results : plots

#### AC phase



*AC neutral*



Measurement uncertainty : +/- 3.6 dB.

## Used test equipment module

Description	Telef. ID	Manufacturer	Model	Used at par.
Spectrum Analyzer	TE 11125	Rohde & Schwarz	FSP 40	3.4, 3.6, 3.7
Power meter	TE 00354	Hewlett Packard	437B	3.1
Power sensor	TE 00355	Hewlett Packard	8481A	3.1
Pre amplifier	TE 00092	Hewlett Packard	8449B	3.5, 3.7
Pre amplifier	TE 00098	Rohde & Schwarz	ESV-Z3	3.6
Horn antenna	TE 00531	EMCO	3115	3.5, 3.7, 3.8
Horn antenna	TE 00818	Flann	20240-25	3.5
Anechoic chamber	TE 01064	Euroshield	RFD-F-100	3.6, 3.7
Semi anechoic chamber	TE 00861	Comtest	--	3.5, 3.8
EMI test receiver	TE 01220	Rohde & Schwarz	ESR7	3.2, 3.3, 3.5, 3.8
Biconilog	TE 00967	Chase	CBL6112A	3.6
EMI test receiver	TE 11128	Rohde & Schwarz	ESCI	3.9
Artificial Mains Network	TE 00208	Rohde & Schwarz	ESH3-Z5	3.9

## Cross reference table

<b>Transmitter</b>	
<b>IC RSS-210 Issue 8, Annex 8</b>	<b>FCC 47 CFR Ch. 1 part 15, subpart C (10-1-12 Edition)</b>
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)
<b>IC RSS-Gen Issue 3</b>	<b>FCC 47 CFR Ch. 1 part 15, subpart C (10-1-12 Edition)</b>
§ 4.6.1	--
§ 7.2.4	§ 15.207
<b>Receiver</b>	
<b>IC RSS-Gen Issue 3</b>	<b>FCC 47 CFR Ch. 1 part 15, subpart B (10-1-12 Edition)</b>
§ 7.2.3	§ 15.109
§ 7.2.4	§ 15.107

## Revision history

REVISION	DATE	REMARKS	REVISED BY
1.0	31-12-2013	-Trademark "Clay" changed into "Salto" - FCC and IC ID's mentioned at variant model removed; these ID's are related to the GSM module, which is not covered by this report.	P.A. Suringa