

FCC and IC Test Report for Part 15C § 15.209(a),
15.205(a), 15.207(a) and
RSS-Gen (Clauses 8.8, 8.9, 8.10)
Simultaneous transmissions

Product name : IQ2.0
Applicant : SALTO Systems, S.L.
FCC ID : UKCIQ2
ISED ID : 10088A-IQ2

Test report No. : 170600688 08 Ver 2.00

Laboratory information

Accreditation

Telefication is designated by the FCC as an Accredited Test Firm for compliance testing of equipment subject to Certification under Parts 15 & 18. The Designation number is: NL0001.

The Industry Canada registration number for the 3 meter test chamber of Telefication is: 4173A-1.

Documentation

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).

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Testing Location

Test Site	Telefication BV
Test Site location	Edisonstraat 12a 6902 PK Zevenaar The Netherlands Tel. +31889983600 Fax. +31316583189
Test Site FCC	NL0001

Revision History

Version	Date	Remarks	By
v0.50	17-01-2018	First draft	PS
v1.00	06-03-2018	Initial release	PS
v2.00	22-03-2018	Updated clause 1.4 with output power, type of modulation and emission designator. Updated clause 1.6 with variant information. Changed KDB Publication No. 558074 D01DTS Meas. Guidance V0305 to v04	PS

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Summary of Test results

FCC	IC	Description	Section in report	Verdict
15.209 (a)	RSS Gen §8.9	Radiated Spurious emissions	3.1	Pass
15.205 (a)	RSS Gen §8.10	Spurious emissions in the restricted bands	3.1	Pass
15.207 (a)	RSS-Gen §8.8	Conducted spurious on AC mains	3.2, 3.3	Pass

1 General Description

1.1 Applicant

Client name:	Salto systems, S.L.
Address	C/Arkotz 9 Pol. Lanbarren, Oiartzun
Zip code:	20180
Telephone:	+34 943344550
Contact name:	j.imedio@saltosystems.com
E-mail:	Mr. Juan Imedio

1.2 Manufacturer

Manufacturer name:	Salto systems, S.L.
Address:	C/Arkotz 9 Pol. Lanbarren, Oiartzun
Zip code:	20180
Contact name::	j.imedio@saltosystems.com
E-mail:	Mr. Juan Imedio

1.3 Tested Equipment Under Test (EUT)

Product name:	IQ2.0
Brand name:	SALTO
Product type:	Data transmission equipment operating in the 2.4 GHz band
FCC ID:	UKCIQ2
ISED ID	10088A-IQ2
Model(s):	IQ222, IQ223, IQ224
Software version:	--
Hardware version:	--
Date of receipt	07-08-2017
Tests started:	15-08-2017
Testing ended:	06-03-2018

1.4 Product specifications of Equipment under test

Frequency range (MHz)	ZigBee: 2405 – 2480; WiFi: 2412 – 2462 BLE: 2402 – 2480
Maximum output power to antenna (dBm)	ZigBee: +5; WiFi : +19 BLE: +8
Antenna type	ZigBee: chip; WiFi: chip BLE: chip
Antenna gain (dBi)	ZigBee: 0.5; WiFi:0.5; BLE: 1.0
Type of modulation	ZigBee: O-QPSK, DSSS WiFi: acc. to 802.11 b/g/n BLE: GFSK, FHSS
Emission designator	Zigbee: G1D BLE: F1D

1.5 Modification of the Equipment Under Test (EUT)

PoE version only

To minimise radiated emissions in the VHF band two capacitors (2x 4.7 nF) were added:
One between pins 3 and 7 of the PoE module, type Ag9905M, and the other between pins 3 and 5 of the same module.

1.6 Observations and remarks

The sample features a ZigBee (IEEE 802.15.4) embedded radio and two radio modules (WiFi and Bluetooth BLE). The product comes in three variants depending on the type of power supply:

IQ222: BLE + IEEE802.15.4 + Wifi (no PoE)

IQ223: BLE + IEEE802.15.4 (PoE)

IQ224: BLE + IEEE802.15.4 (no PoE)

1.7 Environmental conditions

Test date	15-08-2017	12-1-2018
Ambient temperature	26 °C	18.2°C
Humidity	52 % RH	41.8 %

1.8 Measurement Standards

- FCC KDB Publication No. 558074 D01DTS Meas. Guidance V04
- ANSI C63.10:2013

1.9 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- FCC Part 15 Subpart C §'s 15.205(a),15.209(a), §15.207(a)
- RSS-Gen Issue 4 (Clauses 8.8, 8.9, 8.10)

1.10 Conclusions

The sample of the product showed NO NON-COMPLIANCES to the specifications stated in paragraph 1.9 of this report.

The results of the test as stated in this report, are exclusively applicable to the product items as identified in this report. Telefication accepts no responsibility for any properties of product items in this test report, which are not supported by the tests as specified in paragraph 1.9 "*Applicable standards*".

All tests are performed by:

Name : ing. P.A. Suringa

Review of test methods and report by:

Name : ing R. van Barneveld

The above conclusions have been verified by the following signatory:

Date : 22-03-2018

Name : ing. K.A. Roes

Function : Coordinator Radio Laboratory

Signature :



2 Test configuration of the Equipment Under Test

2.1 Test mode

The applicant provided test mode firmware for the EUT, in which it was possible to configure the EUT into different test channels.

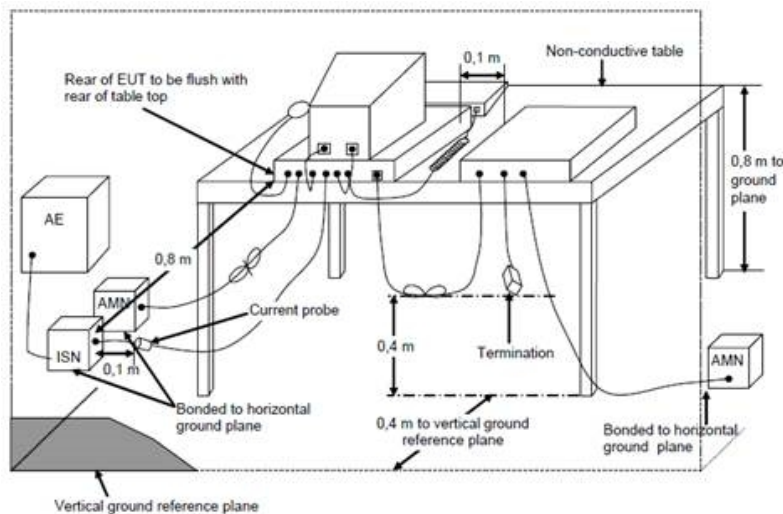
2.2 Tested channels and Data rates

For the purpose of simultaneous transmissions test mode, the following combination of channels and technologies have been selected.

Tx state	BLE channel #	Frequency MHz	IEEE 802.15.4 channel #	Frequency MHz	WiFi channel #	Frequency MHz
Low	4	2412	12	2410	1	2412
Middle	15	2436	17	2435	6	2437
High	28	2462	22	2460	11	2462

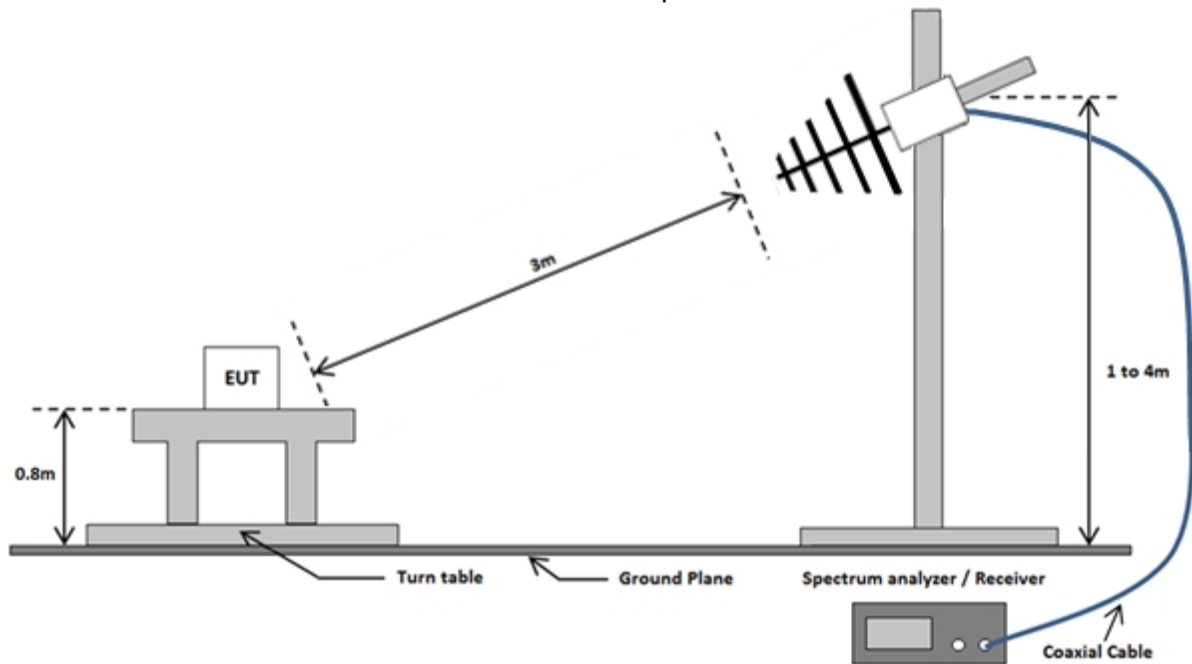
2.3 Conducted Test setup

Emissions test at AC mains

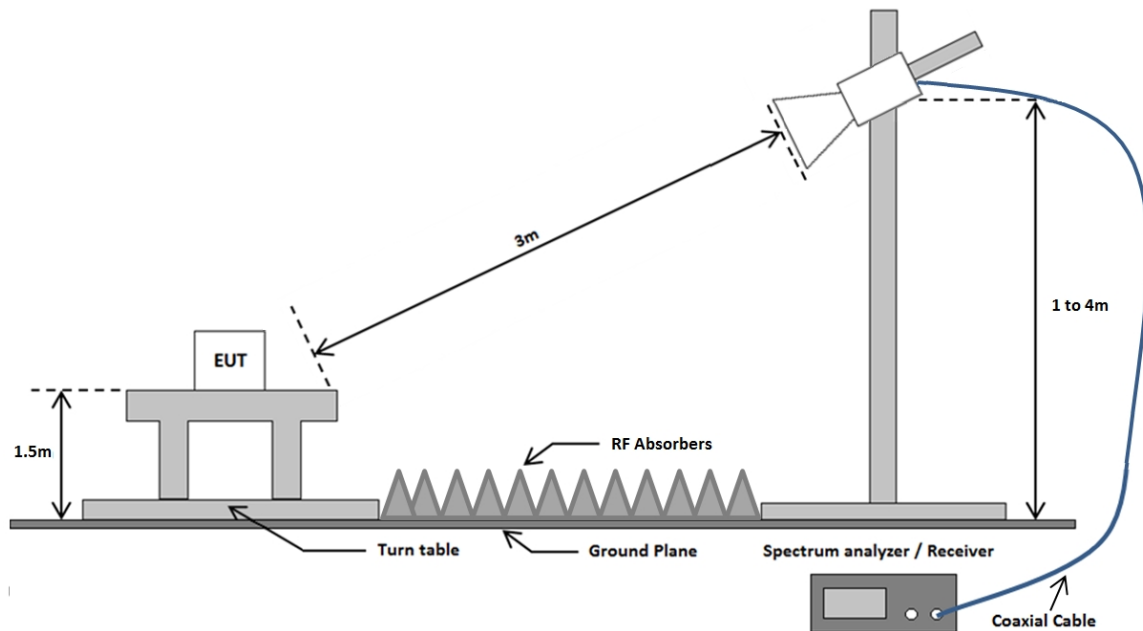


2.4 Radiated Test setup

Radiated emissions test setup 30 MHz - 1 GHz



Radiated emissions test setup above 1 GHz



2.5 Equipment used in the test configuration

Description	Manufacturer	Model	ID	Used at Par.
Spectrum Analyzer	Rohde & Schwarz	FSV40	TE01269	3.1 (18 -26 GHz only)
Spectrum Analyzer	Rohde & Schwarz	FSP40	TE11125	3.1
Spectrum Analyzer	Rohde & Schwarz	ESCI	TE11128	3.1, 3.2
EMI receiver	Rohde & Schwarz	ESR7	TE01220	3.3
Biconilog Antenna	Chase	CBL6112A	TE00967	3.1
Horn Antenna	EMCO The Electro – Mechanics Co	3115	TE00531	3.1
Semi Anechoic Chamber	Comtest Engineering BV	-	TE00861	3.1
Measurement software	Dare	Radimation	2016.2.8	3.1, 3.2, 3.3
Artificial Mains Network (AMN)	Rohde & Schwarz	ESH3-Z5	TE00208	3.2, 3.3
Pulse limiter	Rohde & Schwarz	ESH3-Z2	TE00756	3.2, 3.3
High pass filter	Wainwright instruments	WHK10-2520-3000- 18000-40EF	TE11146	3.1

3 Test results

3.1 Radiated spurious emissions measurement (incl. restricted band spurious emissions)

3.1.1 Limits

The emissions from an intentional radiator shall not exceed the field strength limits specified in the following table.

Frequency (MHz)	Field strength ($\mu\text{V/m}$)	Measurement distance(m)
0.009 – 0.490	2400/F(kHz)	300
0.490 – 1.705	24000/F(kHz)	30
1.705 - 30	30	30
30 -88	100	3
88 - 216	150	3
216-960	200	3
Above 960	500	3

3.1.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.1.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.1.4 Test procedure

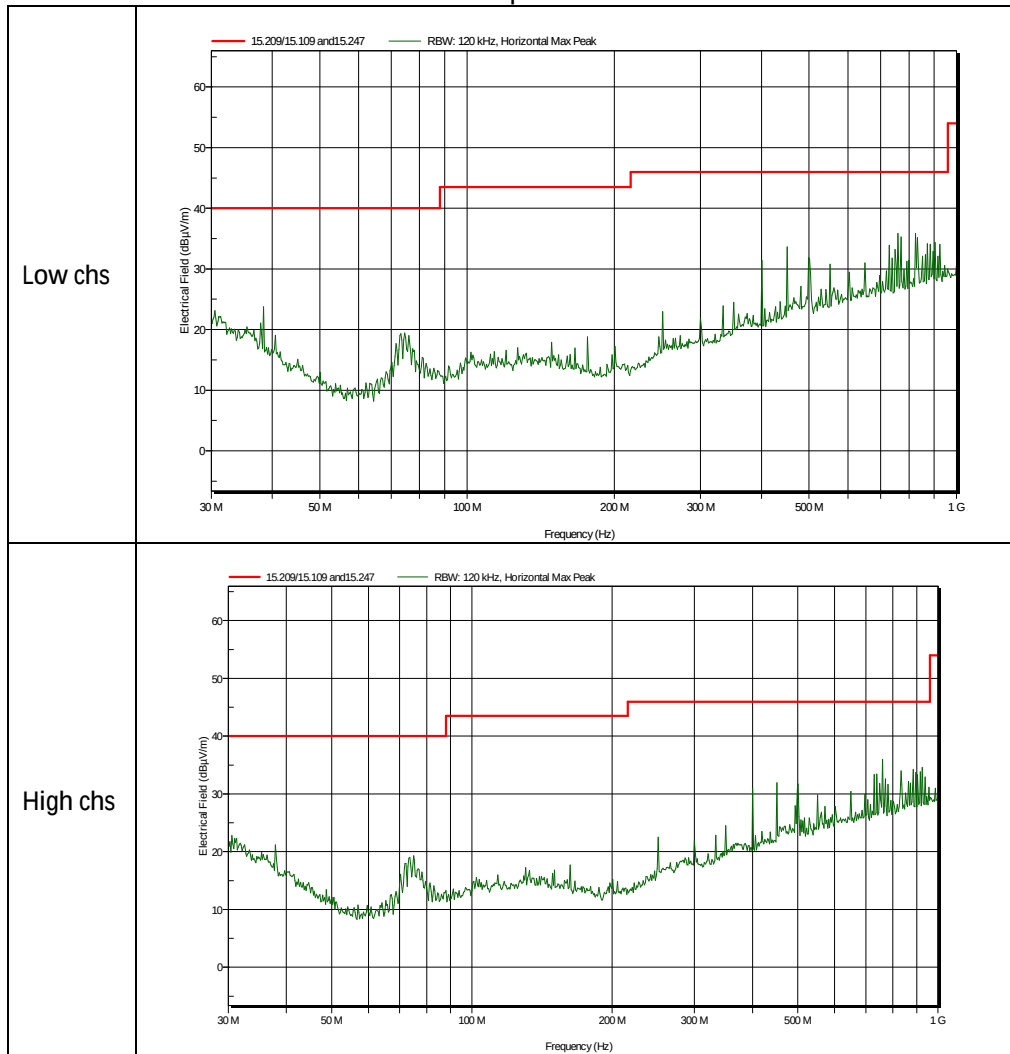
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Other details are according to KDB Publication 558074 V04, sections 11.3 and 12.1.

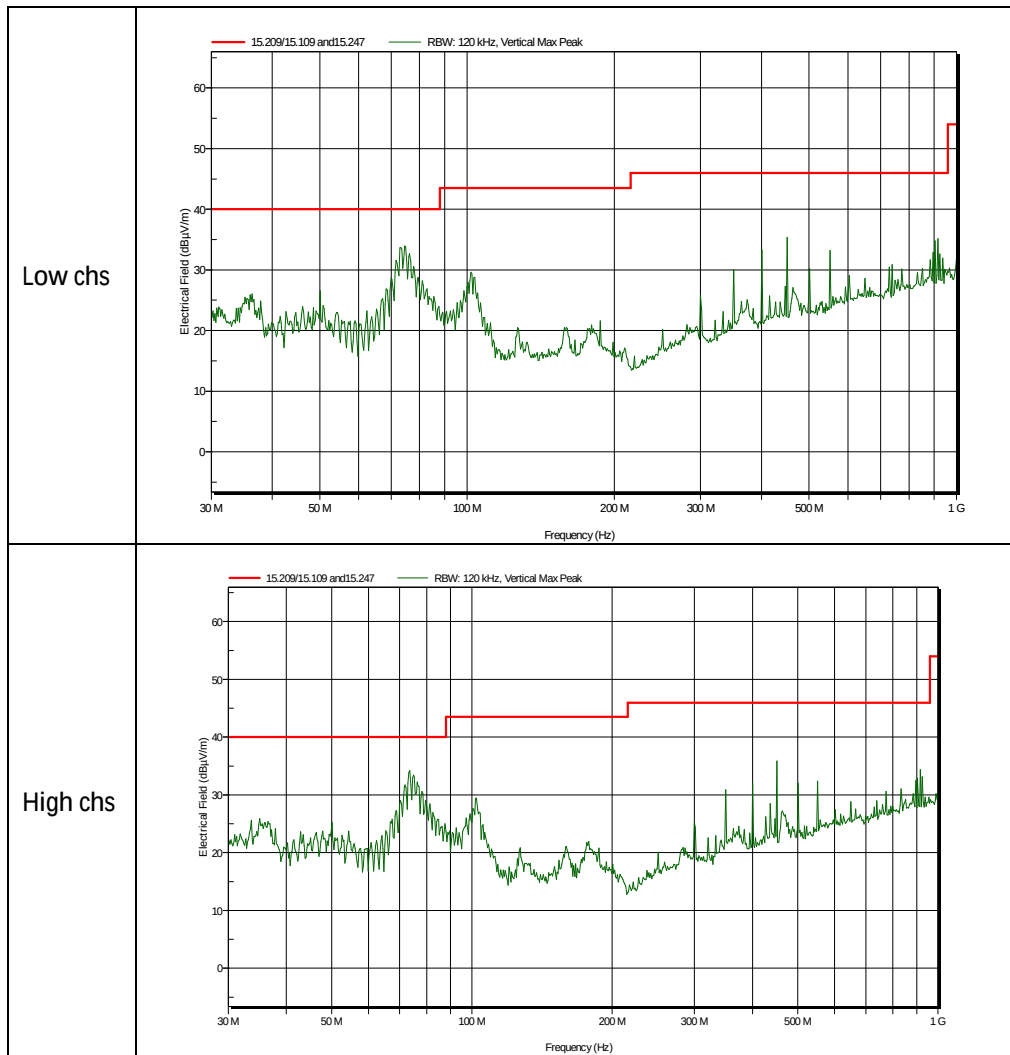
3.1.5 Plots of the Radiated Spurious Emissions Measurement

30 – 1000 MHz

Horizontal polarization

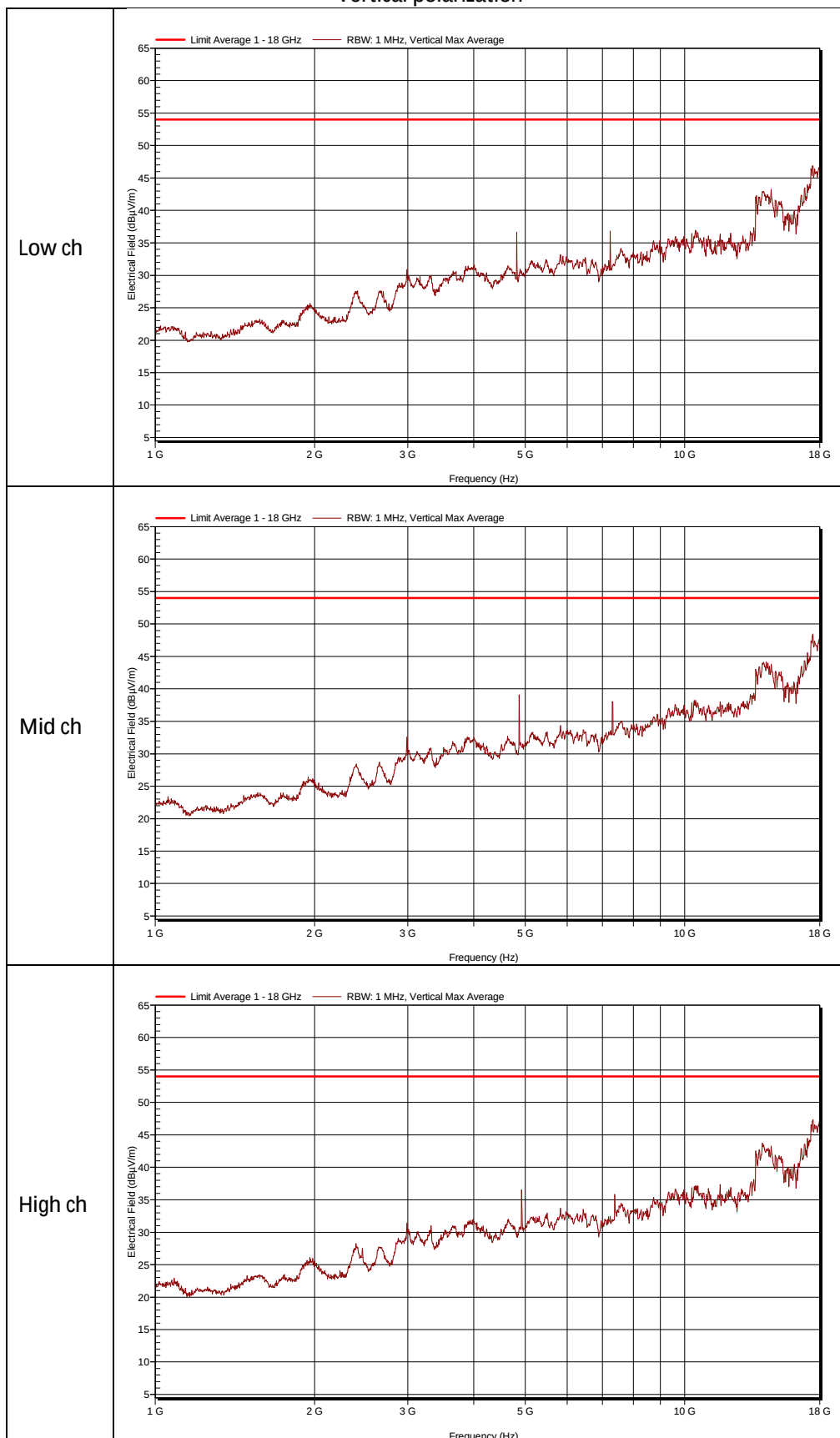


Vertical polarization

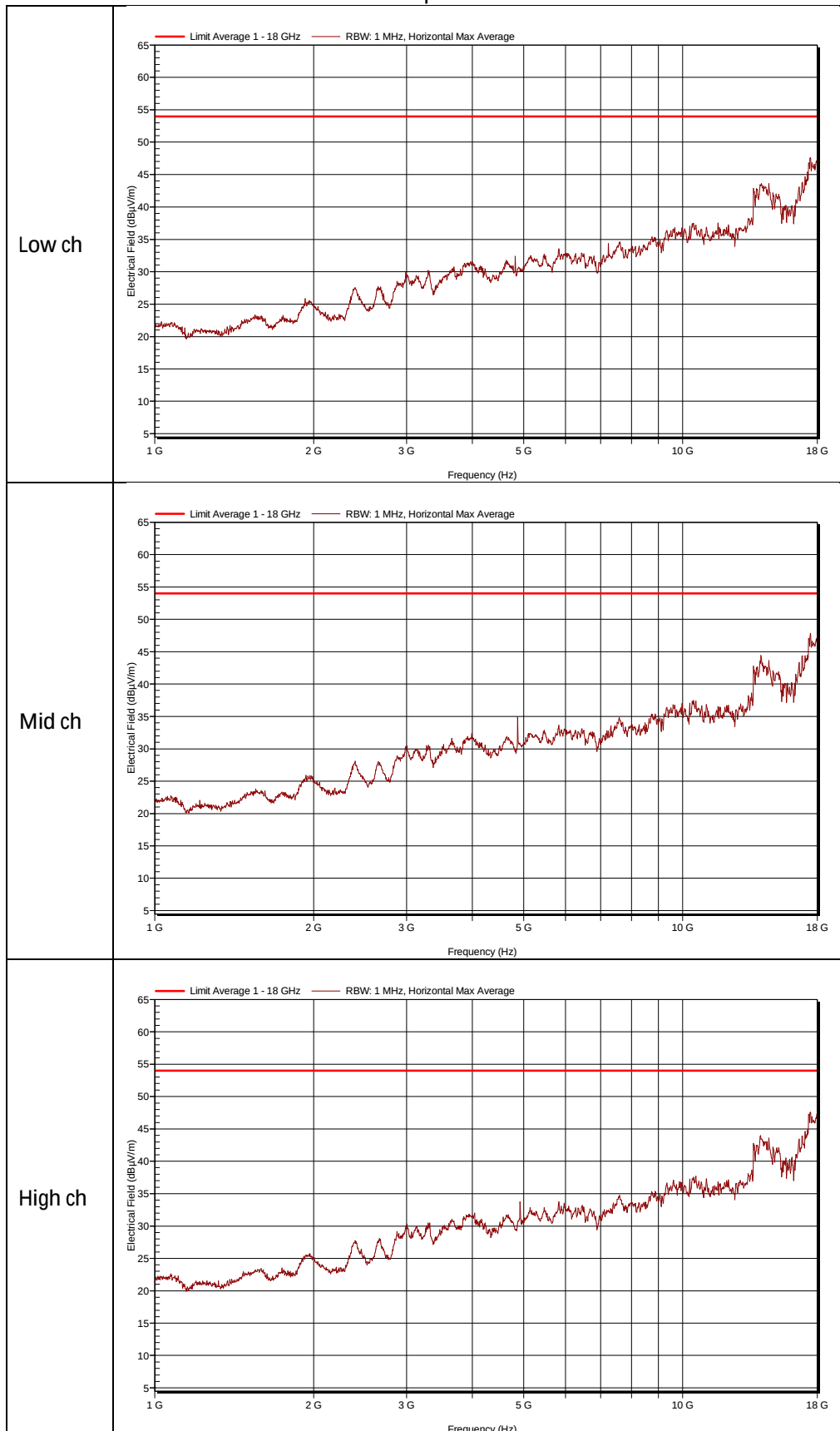


1 – 18 GHz

Vertical polarization

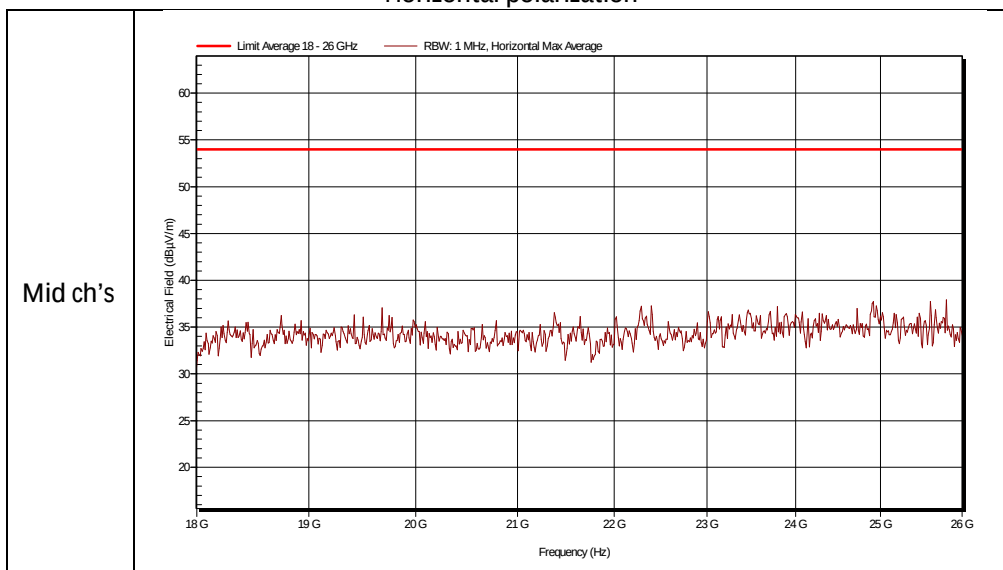


Horizontal polarization

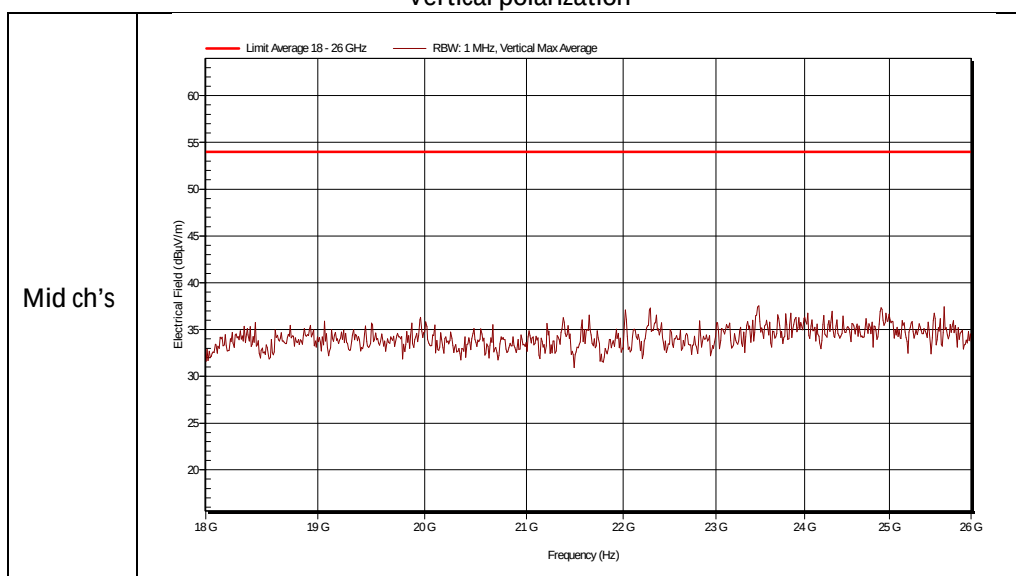


18 GHz to 26 GHz

Horizontal polarization



Vertical polarization



Note: the measurement above is performed on middle channels only.

3.1.6 Measurement Uncertainty

Measurement uncertainty radiated emissions below 1 GHz

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

Measurement uncertainty radiated emissions above 1 GHz

1000- 18000 MHz	5.7 dB
18000- 26000 MHz	3.9 dB

3.2 AC mains conducted spurious measurement

3.2.1 Limit

According to 15.207 (a)

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

3.2.2 Measurement instruments

The measurement instruments are listed in chapter 2.5 of this report.

3.2.3 Test setup

The test setup is as shown in chapter 2.4 of this report.

3.2.4 Test procedure

According to ANSI C63.10: 2013, section 6.2.

The sample is power supplied by the PoE (power over Ethernet) injector.

The test is performed on the AC terminals of the PoE injector, while a ping test is running on the Ethernet connection.

3.2.5 Test results and plots of the AC mains conducted spurious measurement

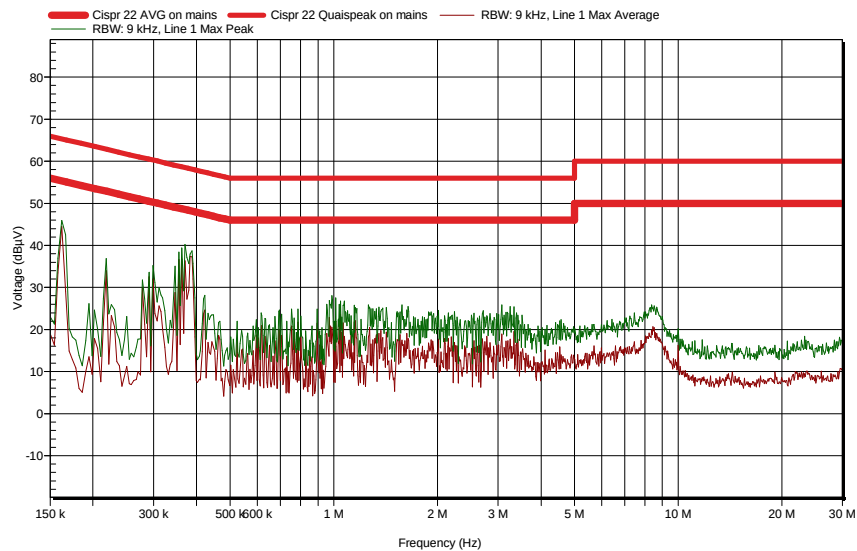
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3.2.6 Measurement uncertainty

+/- 3.6 dB.

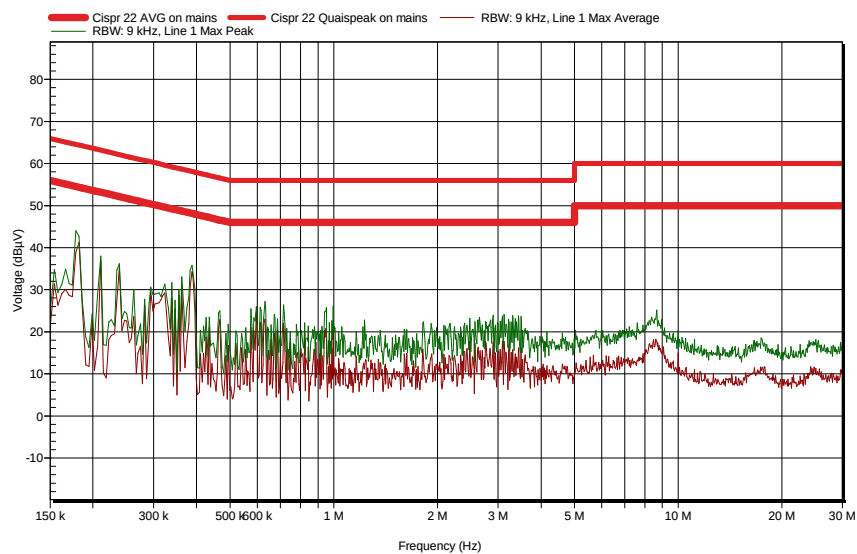
3.2.7 Plots of the AC conducted spurious measurement (AC/DC adaptor)

Phase



Note: peak value is already below the Quasi peak limit so no quasi peak measurement was performed

Neutral



Note: peak value is already below the Quasi peak limit so no quasi peak measurement was performed

3.3 Plots of the AC conducted spurious measurement (PoE adaptor)

3.3.1 Limit

According to 15.207 (a)

An intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table.

Frequency of emission (MHz)	Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*Decreases with the logarithm of the frequency.

3.3.2 Measurement instruments

The measurement instruments are listed in chapter 2.3 of this report.

3.3.3 Test setup

The test setup is as shown in chapter 2.2 of this report.

3.3.4 Test procedure

According to ANSI C63.10: 2013, section 6.2.

The sample is power supplied by the PoE (power over Ethernet) injector.

The test is performed on the AC terminals of the PoE injector, while a ping test is running on the Ethernet connection.

3.3.5 Test results and plots of the AC mains conducted emissions measurement

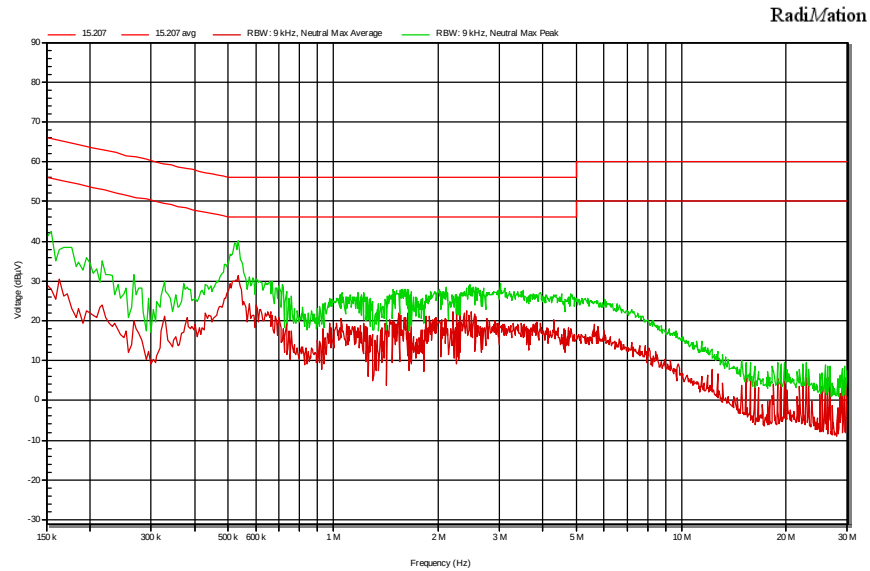
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3.3.6 Measurement uncertainty

+/- 3.6 dB

3.3.7 Plots of the AC mains conducted emissions measurement

Phase 110 Vac 60 Hz



Neutral 110 Vac 60 Hz

