

Test report No:
 NIE: 60287RRF.001A1

Test report

**FCC Rules and Regulations CFR 47, Part 15, Subpart B
 (10-1-20 Edition) & ICES-003 Issue 7 (October 2020)**

(*) Identification of item tested	Bluetooth Low Energy Cryptocurrency Hardware Wallet
(*) Trademark	Ledger
(*) Model and /or type reference	NanoX
Other identification of the product	FCC ID: 2ASAL1407 IC: 24697-1407 HW version: 2.0.1 SW version: 2.0.0
(*) Features	Bluetooth LE
Manufacturer	Ledger SAS 1 rue du Mail 75002 Paris, France
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-20 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-01-18
Report template No	FDT08_23 (*) "Data provided by the client"

Index

ACRONYMS	3
COMPETENCES AND GUARANTEES	3
GENERAL CONDITIONS	4
UNCERTAINTY	4
DATA PROVIDED BY THE CLIENT	4
USAGE OF SAMPLES	5
TEST SAMPLE DESCRIPTION	6
IDENTIFICATION OF THE CLIENT	8
TESTING PERIOD AND PLACE	8
DOCUMENT HISTORY	8
ENVIRONMENTAL CONDITIONS	9
REMARKS AND COMMENTS	10
TESTING VERDICTS	10
LIST OF EQUIPMENT USED DURING THE TEST	10
SUMMARY	11
APPENDIX A: TEST RESULTS	12

Acronyms

Acronym ID	Acronym Description
Code	EMC Test Code
Freq Rng	Frequency Range
Line	Conducted Emissions - Tested Line
OM	Operation Mode
S/	Sample
V	Verdict

Competences and guarantees

DEKRA Testing and Certification S.A.U. is a testing laboratory accredited by the National Accreditation Body (ENAC -Entidad Nacional de Acreditación), to perform the tests indicated in the Certificate No. 51/LE 147.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification S.A.U. guarantees the reliability of the data presented in this report, which is the result of the measurements and the tests performed to the item under test on the date and under the conditions stated on the report and, it is based on the knowledge and technical facilities available at DEKRA Testing and Certification S.A.U. at the time of performance of the test.

DEKRA Testing and Certification S.A.U. is liable to the client for the maintenance of the confidentiality of all information related to the item under test and the results of the test.

The results presented in this Test Report apply only to the particular item under test established in this document.

IMPORTANT: No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

General conditions

1. This report is only referred to the item that has undergone the test.
2. This report does not constitute or imply on its own an approval of the product by the Certification Bodies or competent Authorities.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
4. This test report cannot be used partially or in full for publicity and/or promotional purposes without previous written permission of DEKRA Testing and Certification S.A.U. and the Accreditation Bodies.

Uncertainty

Uncertainty (factor $k=2$) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the measured conducted disturbance characteristics of EUT from 150 kHz to 30 MHz is $I = \pm 3,9$ dB for quasi-peak measurements, $I = \pm 3,2$ dB for peak measurements ($k = 2$).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1000 MHz is $I = \pm 4,9$ dB for quasi-peak measurements, $I = \pm 4,6$ dB for peak measurements ($k = 2$).

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 1000 MHz to 12.75 GHz is $I = \pm 2,6$ dB for peaks and average measurements ($k = 2$).

Data provided by the client

The following data has been provided by the client:

1. Information relating to the description of the sample ("Identification of the item tested", "Trademark", "Model and/or type reference tested")
2. The sample consists of a Cryptocurrency Hardware Wallet with BLE connectivity and USB communication, with embedded LiPo Battery.

DEKRA Testing and Certification S.A.U. declines any responsibility with respect to the information provided by the client and that may affect the validity of results.

Usage of samples

Samples undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial N°	Date of Reception	Application
S/01	60287_2.1	Nano X device	NanoX	--	2021-07-27	Element Under Test

Notes referenced to samples during the project.

EUT is connected to a Laptop and this is used as an auxiliary element.

Test sample description

Test Sample description (compulsory information for EMC and RF testing services)

Ports..... :	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	USB Type C (5Vdc)	2	[X]	[]	[]		
	[]	[]	[]		
	[]	[]	[]		
Supplementary information to the ports..... :						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: USB Type C (5Vdc)					
[X]	DC: Lithium-Ion Polymer Battery 3.7V (Included in product packaging)						
Rated Power	350 mW with USB Power supply, 111mW with battery only						
Clock frequencies.....	32MHz and 32.768kHz clocks						
Other parameters						
Software version	2.0.0						
Hardware version	2.0.1						
Dimensions in cm (W x H x D)	18.5x71.95x11.55mm						
Mounting position	[]	Table top equipment					
	[]	Wall/Ceiling mounted equipment					
	[]	Floor standing equipment					
	[X]	Hand-held equipment					
	[]	Other:					

Modules/parts.....:	Module/parts of test item	Type	Manufacturer

Accessories (not part of the test item)	Description	Type	Manufacturer

Documents as provided by the applicant	Description	File name	Issue date

⁽³⁾ Only for Medical Equipment

Identification of the client

Ledger SAS
1 rue du Mail. 75002,
Paris, France.

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-09-20
Date (finish)	2021-10-06

Document history

Report number	Date	Description
60287REM.001	2021-11-22	First release
60287RRF.001A1	2022-01-18	Second release. First modification due to typos. This modification test report cancels and replaces the test report 60287REM.001

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 75 %
Air pressure	Min. = 860mbar Max. = 1060mbar

In the chamber for conducted measurements, the following limits were not exceeded during the test:

Temperature	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 30 % Max. = 60 %
Air pressure	Min. = 860mbar Max. = 1060mbar

Remarks and comments

The tests have been performed by the technical personnel: Beatriz Cabello De Alba Bujalance and José Antonio Santiago Galván.

Testing verdicts

Fail	F
Inconclusive	I
Not applicable	N/A
Not measured	N/M
Pass	P

List of equipment used during the test

Control No.	Equipment	Model	Manufacturer	Next Calibration
6666	EMI TEST RECEIVER 2Hz-44GHz	ESW44	ROHDE AND SCHWARZ	2022-02-05
7743	HORN ANTENNA 0,75-18GHz	3115	ETS LINDGREN	2023-08-24
7746	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-07-23
4659	PRE-AMPLIFIER G>28dB 1-18GHz	BBV 9718	SCHWARZBECK	2022-07-09
6204	THREE-PHASE ARTIFICIAL NETWORK 32A	PMM L3-32	NARDA	2023-09-27
6165	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2022-10-13

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC 47 CFR Part 15B	RE Radiated emission. Electromagnetic field measure	Pass	--
FCC 47 CFR Part 15B	CE Continuous conducted emission	Pass	--
<u>Supplementary information and remarks:</u> None			

Appendix A: Test results

Appendix A content

DESCRIPTION OF THE OPERATION MODES	14
TEST STANDARDS VERSION APPLIED	15
TEST CASES DETAILS	16
RE RADIATED EMISSION. ELECTROMAGNETIC FIELD MEASURE	16
CE CONTINUOUS CONDUCTED EMISSION	20

Description of the operation modes

The operation modes described in this paragraph constitute a functionality of the sample under test for itself. Every operation mode takes a failure criteria for the immunity test that they were applying to it and a monitoring to guarantee performance of the same ones.

The operation modes used by the samples to which the present report refers, are shown in the following table:

Id	Description
OM/01	EUT ON. Bluetooth Low Energy without transmission. Power supply: 5 Vdc via USB Port Laptop (115Vac).
OM/02	EUT ON. Bluetooth Low Energy in communication, transferring data through USB Port. Power supply: 5 Vdc via USB Port Laptop (115Vac).

Test standards version applied

The product standards and test standards applied for each test cases are shown in the following table:

Product Test Standard	Test standard	Requirement – Test case
FCC CFR 47, Part 15, Subpart B (10-1-20 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.
FCC CFR 47, Part 15, Subpart B (10-1-20 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	CE Continuous conducted emission

Test Cases Details

RE Radiated emission. Electromagnetic field measure

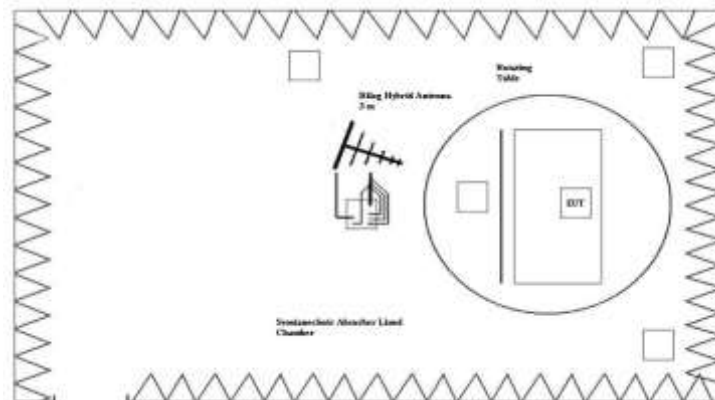
Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-01-20 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

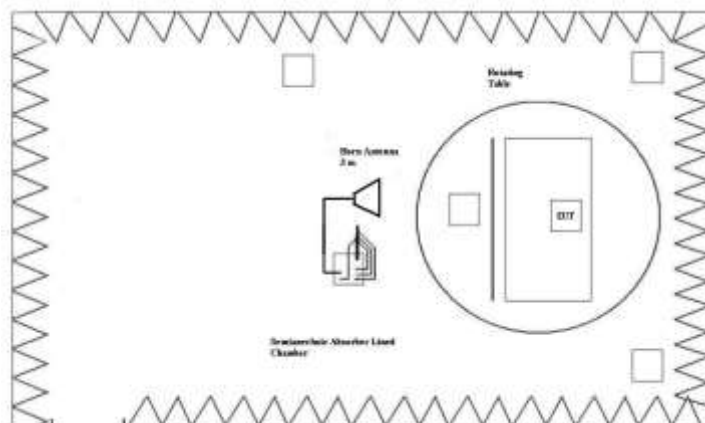
Frequency range (MHz)	FCC Part 15B		ICES-003 Issue 7		FCC Part 15B & ICES-003 Issue 7	
	QP Limit for 3 m		QP Limit for 3 m		PK Limit for 3 m	AVG Limit for 3 m
	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)	($\text{dB}\mu\text{V/m}$)
30 to 88	100	40	100	40	---	---
88 to 216	150	43.5	150	43.5	---	---
216 to 230	200	46	200	46	---	---
230 to 960	200	46	224	47	---	---
960 to 1000	500	54	500	54	---	---
Above 1000	---	---	---	---	74	54

NOTE: FCC QP and AVG limits are in concordance with RSS-Gen Issue 5 (March 2019), Secs. 7.1 and 7.3. Limits according to FCC Part 15B, equal to or more stringent than those of ICES-003 Issue 7.

Setup for measurements



Setup for measurements < 1GHz.



Setup for measurements > 1GHz.

Results

S/	OM	Code	Freq Rng (MHz)	V
01	OM/01	RE0101LR	[30, 1000]	P
01	OM/01	RE0101HR	[1000, 17000]	P

Verdict

Pass

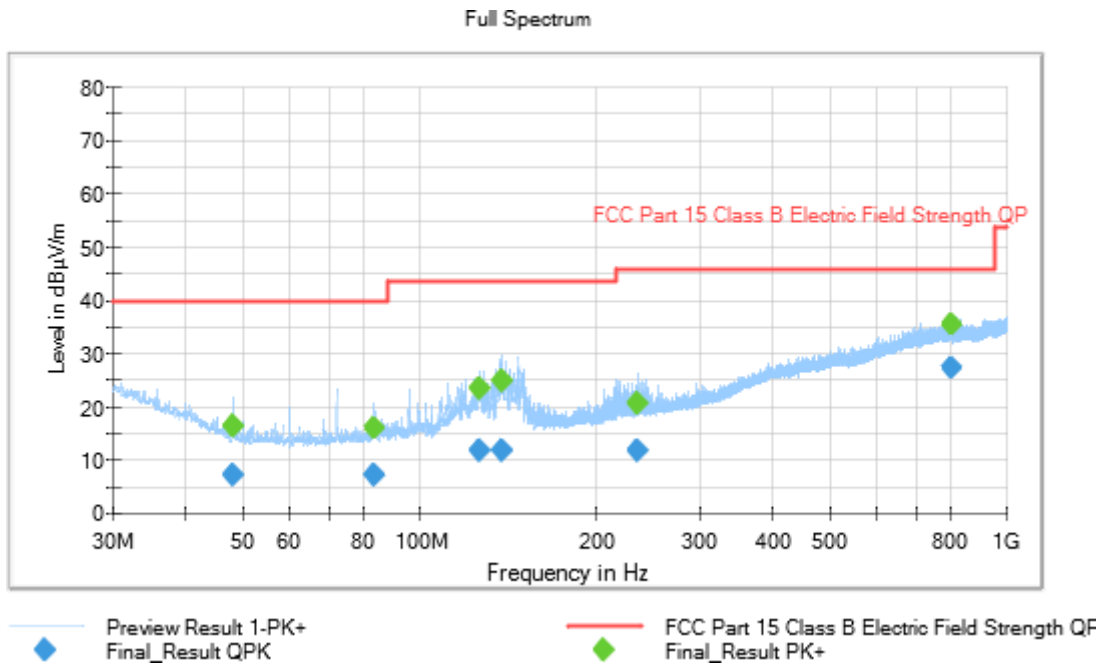
Attachments

EMC Test Code = RE0101LR, Frequency Range MHz = [30, 1000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth Low Energy without transmission. Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

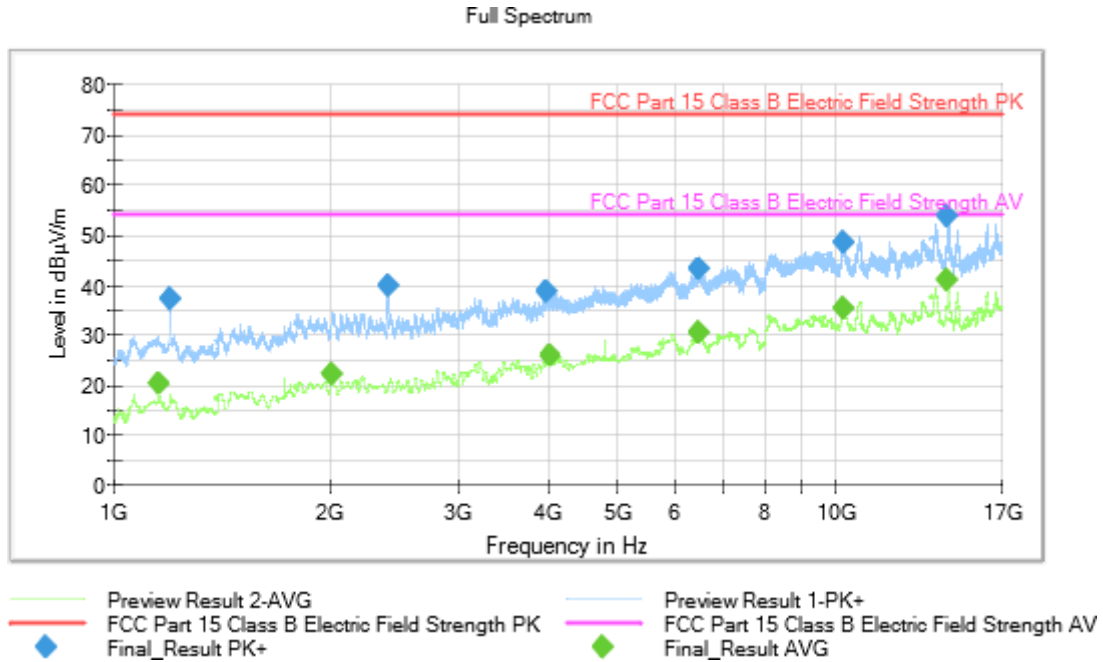
Frequency(MHz)	QuasiPeak(dBµV/m)	MaxPeak(dBµV/m)	Limit(dBµV/m)	Margin(dB)	Height(cm)	Pol	Azimuth(deg)
47.959000	---	16.41	---	---	184.0	V	246.0
47.959000	6.94	---	40.00	33.06	184.0	V	246.0
83.852000	---	15.88	---	---	233.0	H	16.0
83.852000	7.06	---	40.00	32.94	233.0	H	16.0
126.397000	---	23.51	---	---	171.0	H	210.0
126.397000	11.71	---	43.52	31.81	171.0	H	210.0
138.688000	11.60	---	43.52	31.92	166.0	H	47.0
138.688000	---	24.83	---	---	166.0	H	47.0
235.949000	---	20.59	---	---	172.0	H	355.0
235.949000	11.82	---	46.00	34.18	172.0	H	355.0
808.263000	27.29	---	46.00	18.71	337.0	V	193.0
808.263000	---	35.45	---	---	337.0	V	193.0

EMC Test Code = RE0101HR, Frequency Range MHz = [1000, 17000]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth Low Energy without transmission. Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

Frequency(MHz)	MaxPeak(dBµV/m)	Average(dBµV/m)	Limit(dBµV/m)	Margin(dB)
1154.800000	---	20.34	53.97	33.63
1197.200000	37.02	---	73.97	36.95
2010.000000	---	22.07	53.97	31.90
2399.600000	39.89	---	73.97	34.08
3986.400000	38.82	---	73.97	35.15
4032.800000	---	25.95	53.97	28.02
6468.400000	43.22	---	73.97	30.75
6478.400000	---	30.52	53.97	23.45
10268.000000	48.48	---	73.97	25.49
10270.800000	---	35.33	53.97	18.64
14325.600000	53.78	---	73.97	20.19
14326.800000	---	41.00	53.97	12.97

CE Continuous conducted emission

Limits of interference Class B

The applied limit for continuous conducted emissions in power leads, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B, Secs. 15.107 & ICES-003 Issue 7, in the frequency range 0,15 to 30 MHz, for Class B equipment was:

Frequency range (MHz)	Limit (dB μ V)	
	Quasi-Peak	Average
0,15 to 0,5	66 - 56	56 - 46
0,5 to 5	56	46
5 to 30	60	50

Results

SI	OM	Code	Freq Rng (MHz)	Line	V
01	OM/01	CE01010N	[0.15, 30]	N	P
01	OM/01	CE0101L1	[0.15, 30]	L1	P
01	OM/02	CE01020N	[0.15, 30]	N	P
01	OM/02	CE0102L1	[0.15, 30]	L1	P

Verdict

Pass

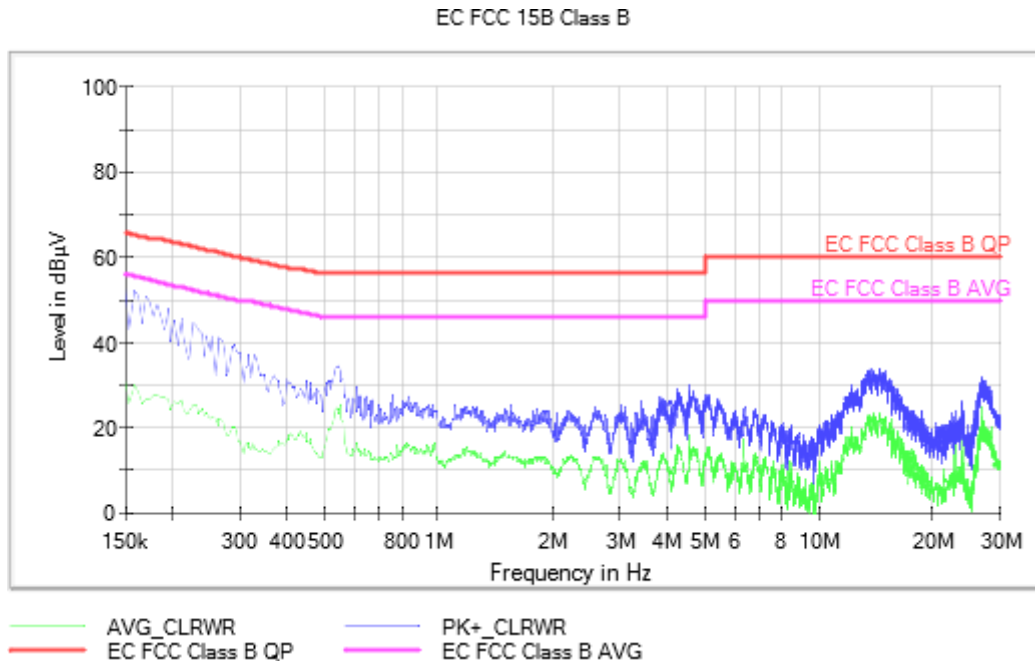
Attachments

EMC Test Code = CE01010N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth Low Energy without transmission. Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

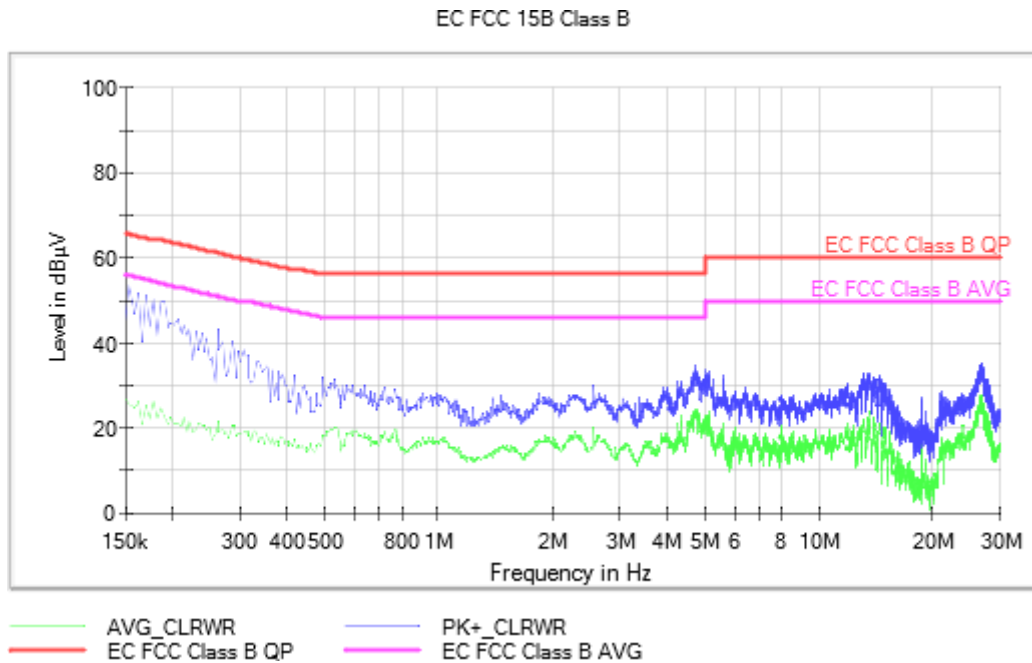
Frequency(MHz)	PK+_CLRWR(dBµV)	AVG_CLRWR(dBµV)	Line
0.150000	52.6	31.2	N
0.266000	41.0	22.1	N
0.546000	34.6	24.3	N
0.754000	28.0	13.5	N
1.542000	25.0	12.8	N
3.418000	26.4	11.4	N
4.590000	30.0	18.5	N
6.398000	24.9	16.9	N
14.406000	34.1	22.0	N
26.666000	32.4	25.1	N

EMC Test Code = CE0101L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth Low Energy without transmission. Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

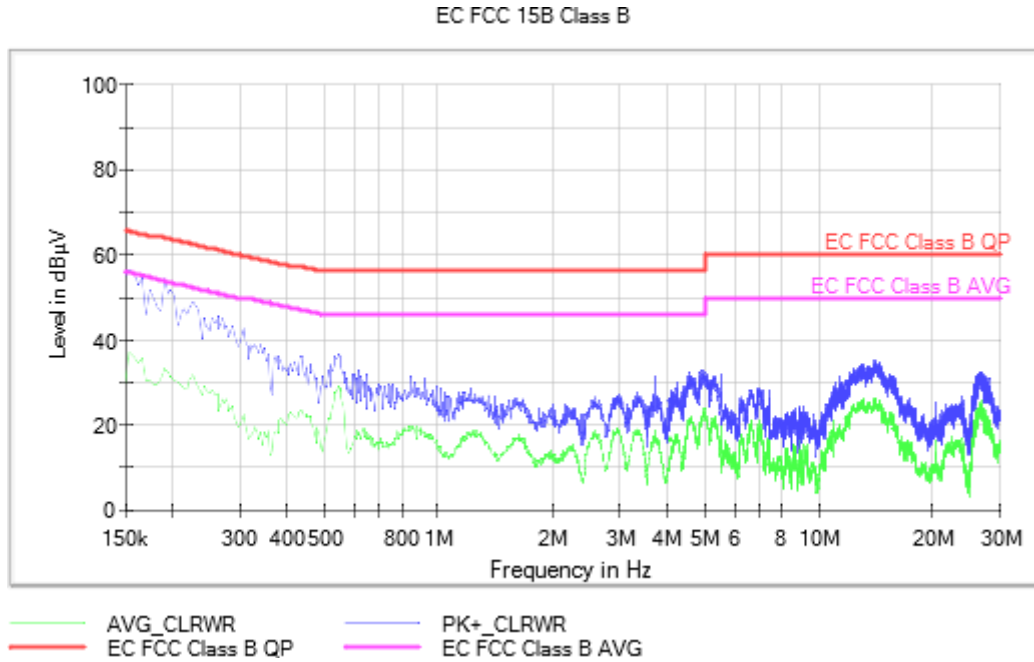
Frequency(MHz)	PK+_CLRWR(dBµV)	AVG_CLRWR(dBµV)	Line
0.154000	53.6	25.8	L1
0.262000	43.3	21.5	L1
0.498000	31.9	18.0	L1
0.762000	29.4	19.5	L1
1.830000	28.1	16.5	L1
2.574000	30.2	19.8	L1
4.730000	34.8	24.5	L1
6.446000	29.7	17.3	L1
13.574000	33.4	22.0	L1
26.750000	35.6	25.4	L1

EMC Test Code = CE01020N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Bluetooth Low Energy in communication, transferring data through USB Port.
 Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

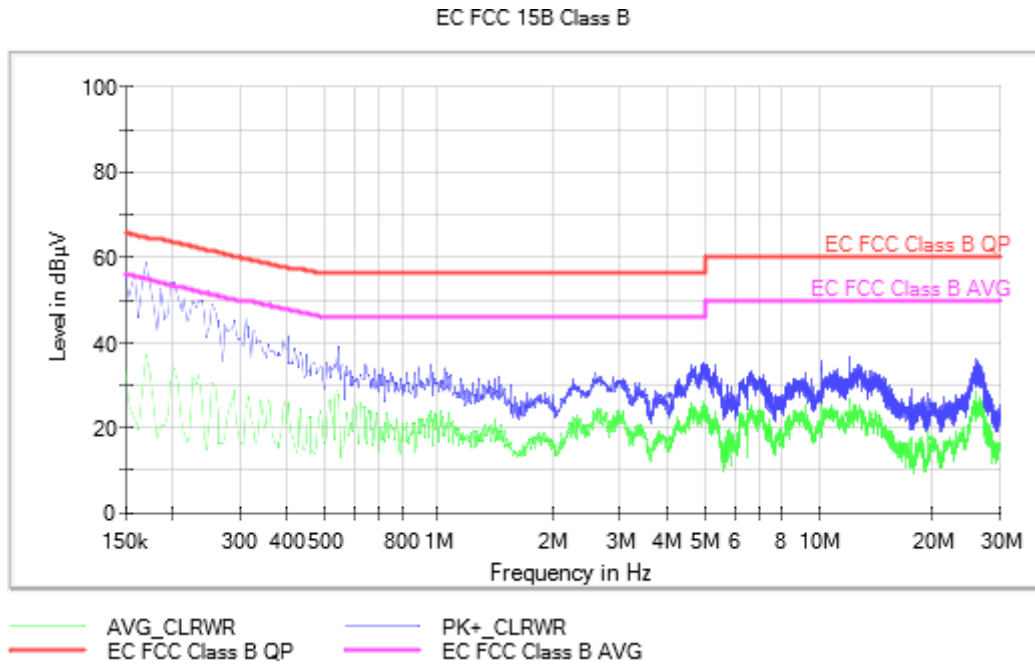
Frequency(MHz)	PK+_CLRWR(dBµV)	AVG_CLRWR(dBµV)	Line
0.154000	56.7	37.4	N
0.262000	45.7	27.2	N
0.546000	36.8	28.7	N
0.850000	31.6	19.7	N
1.254000	27.2	18.4	N
3.330000	27.8	18.3	N
4.946000	33.4	22.1	N
6.930000	28.6	19.4	N
13.954000	35.2	24.7	N
26.898000	32.9	24.8	N

EMC Test Code = CE0102L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Bluetooth Low Energy in communication, transferring data through USB Port.
 Power supply: 5 Vdc via USB Port Laptop (115Vac).

Images:



Documents:

Frequency(MHz)	PK+_CLRWR(dBµV)	AVG_CLRWR(dBµV)	Line
0.170000	58.8	37.3	L1
0.258000	47.3	29.6	L1
0.542000	38.9	27.6	L1
0.946000	34.8	21.6	L1
1.442000	31.8	18.5	L1
2.602000	32.9	23.1	L1
4.982000	35.6	26.2	L1
10.174000	35.9	26.3	L1
12.038000	36.6	27.0	L1
25.862000	36.2	28.6	L1