

Test report No:
 NIE: 70048REM.002

Test report

**FCC Rules and Regulations CFR 47, Part 15, Subpart B
 (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)**

(*) Identification of item tested	e-bike user interface controller
(*) Trademark	Bosch
(*) Model and /or type reference	BRC 3600
Other identification of the product	FCC ID: 2AWRC-BRC3600 IC: 26294-BRC3600 HW version: 5.0.2 – NDK Crystal SW version: brc3600_20201223_emc
(*) Features	Bluetooth Low Energy
Manufacturer	Robert Bosch GmbH – eBike Systems Gerhard-Kindler-Strasse 3 72770 Reutlingen, Germany
Test method requested, standard	FCC Rules and Regulations CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López EMC Consumer & RF Lab. Manager
Date of issue	2021-11-04
Report template No	FDT08_23 (*) "Data provided by the client"

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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.

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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 e-bike user interface controller e-bike user interface controller

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	70048_23.1	e-bike user interface controller	BRC 3600	17517-0003-01-368-00-0000	2021-10-15	Element Under Test
S/01	70048_12.1	RS232 cable	--	--	2021-10-15	Auxiliary Element
S/01	70048_13.1	RS232 to USB adapter (PEAK 1)	--	--	2021-10-15	Auxiliary Element
S/01	70048_14.1	RS232 to USB adapter (PEAK 2)	--	--	2021-10-15	Auxiliary Element
S/01	70048_4.1	Laptop	RTL8821CE	CND0533ZTV	2021-10-15	Auxiliary Element
S/02	70048_20.1	e-bike user interface controller	BRC 3600	17517-0016-01-368-00-0000	2021-10-15	Element Under Test
S/02	70048_12.1	RS232 cable	--	--	2021-10-15	Auxiliary Element
S/02	70048_13.1	RS232 to USB adapter (PEAK 1)	--	--	2021-10-15	Auxiliary Element
S/02	70048_14.1	RS232 to USB adapter (PEAK 2)	--	--	2021-10-15	Auxiliary Element
S/02	70048_4.1	Laptop	RTL8821CE	CND0533ZTV	2021-10-15	Auxiliary Element

Notes referenced to samples during the project.

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⁾		
	<i>USB service port (USB-C interface for service)</i>	[]	[]	[]		
	System cable connector (Supply+CAN FD) connected to ebike	[X]	[]	[]		
	[]	[]	[]		
	[]	[]	[]		
	[]	[]	[]		
	[]	[]	[]		
Supplementary information to the ports..... :						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[]	AC:	[]	[]	[]	[]	[]
	[]	DC: USB port, nom. 5VDC					
[]	DC: System cable, nom. 13,5VDC						
Rated Power	System cable: max. 2,7W (13,5V/0,2A) / USB port: max. 2,5W (5V/0,5A)						
Clock frequencies.....	110MHz, 55MHz, 48MHz, 2MHz, 1.1MHz						
Other parameters						
Software version	brc3600_20201223_emc						
Hardware version	HW 5.0.2 - NDK Crystal						
Dimensions in cm (W x H x D)	72,8 x 53,2 x 34,3 mm						
Mounting position	[]	Table top equipment					

	<input type="checkbox"/>	Wall/Ceiling mounted equipment		
	<input type="checkbox"/>	Floor standing equipment		
	<input type="checkbox"/>	Hand-held equipment		
	<input checked="" type="checkbox"/>	Other: Bicycle handlebar		
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

Bittium Wireless OY
Ritaharjuntie 1, 90590 Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-10-19
Date (finish)	2021-10-22

Document history

Report number	Date	Description
70048REM.001	2021-11-04	First release

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, Humberto Perez Guerrero and Julio Bautista Martin.

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
6815	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2022-02-01
6196	PRE-AMPLIFIER G>55dB 1-18GHz	AMF-7D-01001800-22-10P	NARDA	2022-02-25
6204	THREE-PHASE ARTIFICIAL NETWORK 32A	PMM L3-32	NARDA	2023-09-27
7771	TRANSIENT LIMITER 10DB N CONNECTOR	VTSD 9561-F	SCHWARZBECK	2021-11-24

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	

Supplementary information and remarks:

None

Appendix A: Test results

Appendix A content

DESCRIPTION OF THE OPERATION MODES	14
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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. Communication CAN active. BLE off. Power supply: 12 Vdc.
OM/02	EUT ON. Transferring data through USB Port. Charging mode via USB. BLE off. Power supply: 5Vdc through laptop USB port (115 VAC)
OM/03	EUT ON. Transferring data through USB Port. Charging mode via USB. BLE ON and connected to an ancillary equipment. Power supply: 5Vdc through laptop USB port (115 VAC)

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 (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	RE Radiated emission.
FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 (2014)	CE Continuous conducted emission

Test Cases Details

FCC 47 CFR Part 15B

RE Radiated emission. Electromagnetic field measure

Limits

Limits of interference Class B

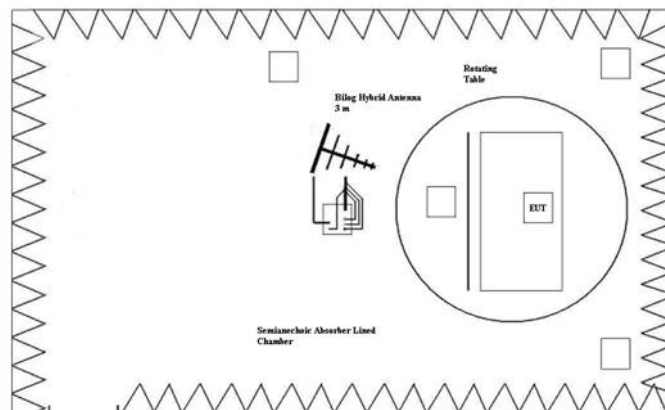
The applied limit for radiated emissions, 3 m distance, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-19 Edition), Secs. 15.109 & ICES-003 Issue 7 (October 2020)

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
	($\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)	($\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)	($\text{dB}\mu\text{V}/\text{m}$)
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

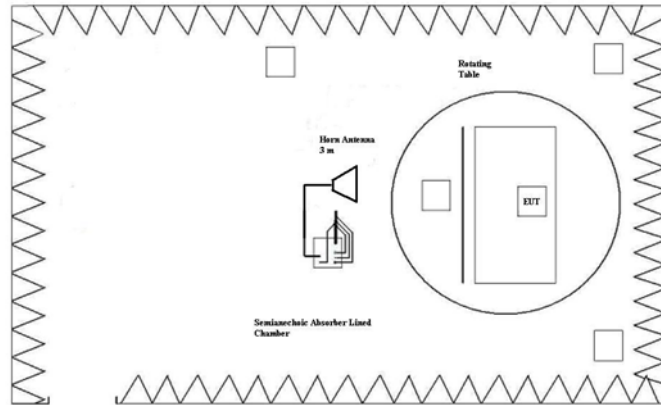
NOTE: FCC QP and AVG limits are in concordance with RSS-Gen Issue 5 (March 2019), Secs. 7.1 and 7.3.

Limits according to FCC Part 15B, equal to 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)	Comments	V
01	OM/01	RE0101LR	[30, 1000]	---	P
01	OM/01	RE0101HR	[1000, 12750]	---	P
01	OM/02	RE0102LR	[30, 1000]	---	P
01	OM/02	RE0101HR	[1000, 12750]	---	P

Verdict

Pass

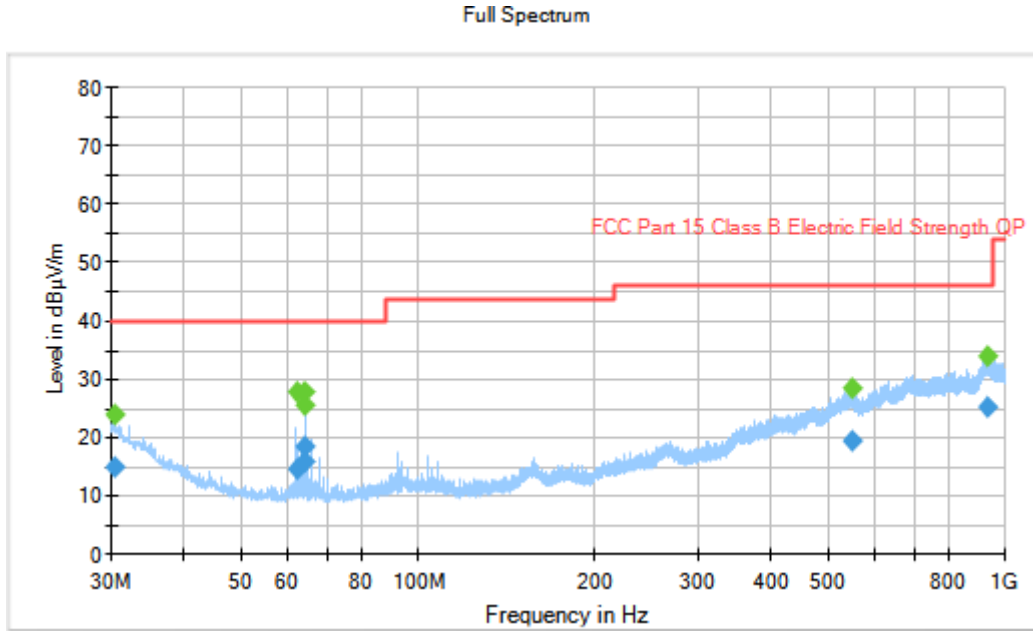
Attachments

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

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Communication CAN active. BLE off. Power supply: 12 Vdc..

Images:



Documents:

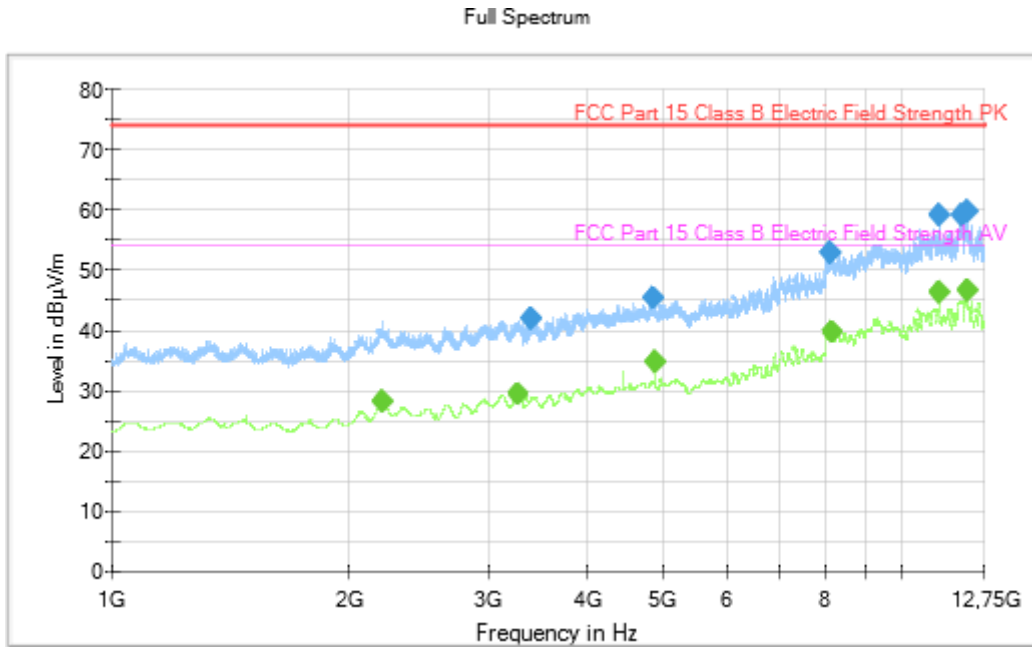
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.437400	---	24.02	---	---	384.0	V	277.0
30.437400	14.90	---	40.00	25.10	384.0	V	277.0
62.083000	14.68	---	40.00	25.32	125.0	V	0.0
62.083000	---	27.84	---	---	125.0	V	0.0
63.965000	18.37	---	40.00	21.63	124.0	V	75.0
63.965000	---	27.68	---	---	124.0	V	75.0
64.029000	---	25.52	---	---	212.0	V	103.0
64.029000	15.88	---	40.00	24.12	212.0	V	103.0
548.155000	19.27	---	46.00	26.73	363.0	V	260.0
548.155000	---	28.47	---	---	363.0	V	260.0
938.146000	25.29	---	46.00	20.71	141.0	V	248.0
938.146000	---	34.00	---	---	141.0	V	248.0

EMC Test Code = RE0101HR, Frequency Range MHz = [1000, 12750]

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Communication CAN active. BLE off. Power supply: 12 Vdc..

Images:



Documents:

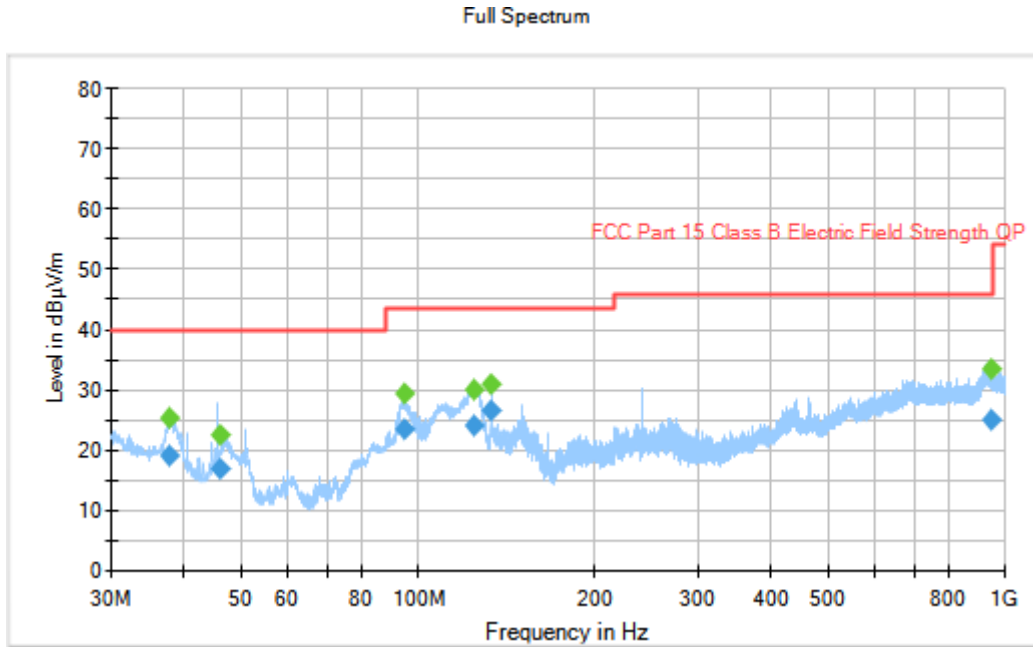
Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2203.200000	---	28.08	53.97	25.89
3268.000000	---	29.27	53.97	24.70
3404.400000	41.99	---	73.97	31.98
4848.000000	45.33	---	73.97	28.65
4882.000000	---	34.81	53.97	19.16
8142.400000	52.86	---	73.97	21.11
8159.200000	---	39.55	53.97	14.42
11170.400000	58.92	---	73.97	15.05
11171.600000	---	46.29	53.97	7.68
11922.400000	59.02	---	73.97	14.95
12110.400000	59.61	---	73.97	14.36
12113.600000	---	46.63	53.97	7.34

EMC Test Code = RE0102LR, Frequency Range MHz = [30, 1000]

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE off. Power supply: 5Vdc through laptop USB port (115 VAC)

Images:



Documents:

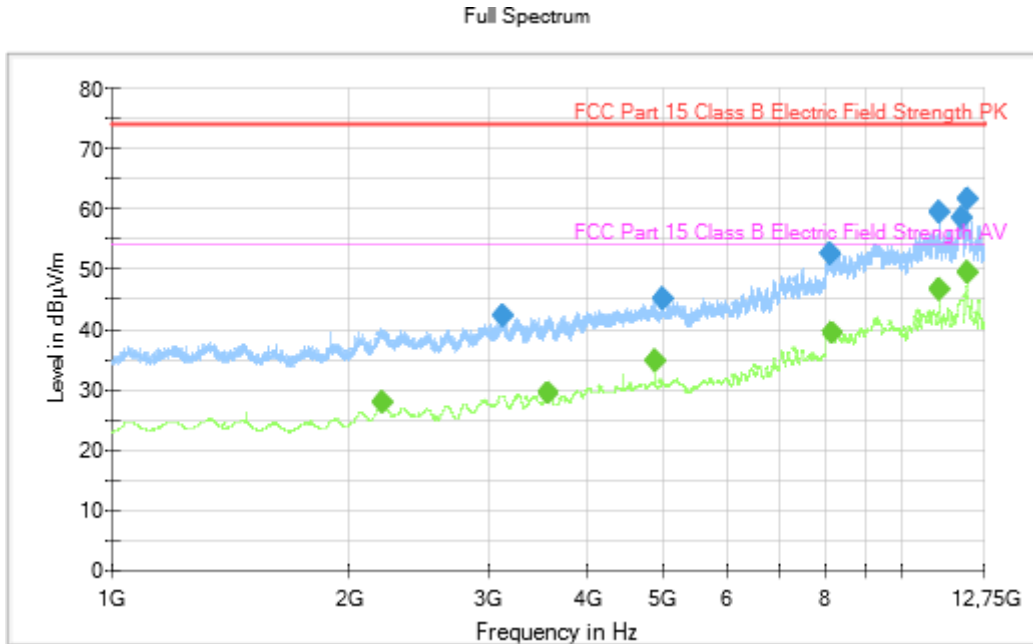
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	PoI	Azimuth (deg)
37.763000	19.11	---	40.00	20.89	120.0	V	94.0
37.763000	---	25.25	---	---	120.0	V	94.0
45.911000	---	22.51	---	---	105.0	V	305.0
45.911000	16.98	---	40.00	23.02	105.0	V	305.0
94.884000	23.47	---	43.52	20.05	153.0	V	276.0
94.884000	---	29.48	---	---	153.0	V	276.0
124.479000	---	29.85	---	---	106.0	V	85.0
124.479000	23.99	---	43.52	19.53	106.0	V	85.0
133.274000	26.58	---	43.52	16.94	237.0	H	194.0
133.274000	---	30.98	---	---	237.0	H	194.0
947.458000	24.94	---	46.00	21.06	100.0	H	258.0
947.458000	---	33.58	---	---	100.0	H	258.0

EMC Test Code = RE0101HR, Frequency Range MHz = [1000, 12750]

Sample ID: S/01

Operation Mode: OM/02. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE off. Power supply: 5Vdc through laptop USB port (115 VAC)

Images:



Documents:

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
2201.200000	---	27.81	53.97	26.16
3123.200000	42.14	---	73.97	31.83
3570.000000	---	29.40	53.97	24.57
4882.000000	---	34.62	53.97	19.35
4989.600000	45.13	---	73.97	28.84
8136.800000	52.45	---	73.97	21.52
8159.600000	---	39.43	53.97	14.54
11172.400000	59.22	---	73.97	14.75
11174.000000	---	46.67	53.97	7.30
11966.000000	58.28	---	73.97	15.69
12117.200000	61.46	---	73.97	12.51
12118.000000	---	49.29	53.97	4.68

CE Continuous conducted emission

Limits

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 (10-1-19 Edition), Secs. 15.107 & ICES-003 Issue 6 (April 2019), in the frequency range 0,15 to 30 MHz, for Class B equipment was:

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

Results

S/	OM	Code	Freq Rng (MHz)	Line	Comments	V
02	OM/02	CE02020N	[0.15, 30]	N	---	P
02	OM/02	CE0202L1	[0.15, 30]	L1	---	P
02	OM/03	CE02030N	[0.15, 30]	N	---	P
02	OM/03	CE0203L1	[0.15, 30]	L1	---	P

Verdict

Pass

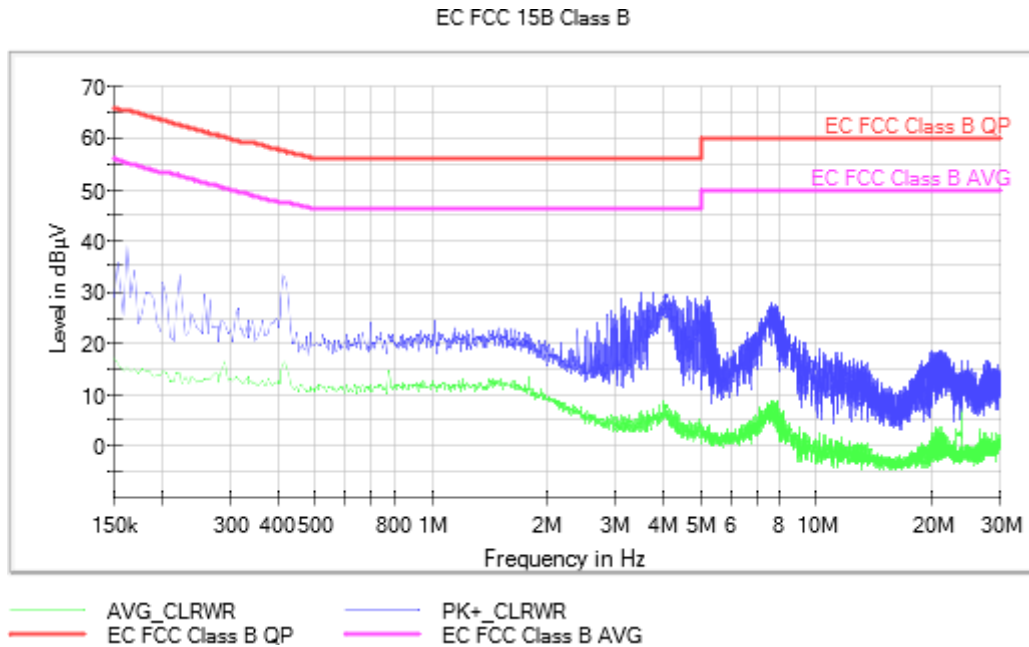
Attachments

EMC Test Code = CE02020N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/02

Operation Mode: OM/02. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE off. Power supply: 5Vdc through laptop USB port (115 VAC).

Images:



Documents:

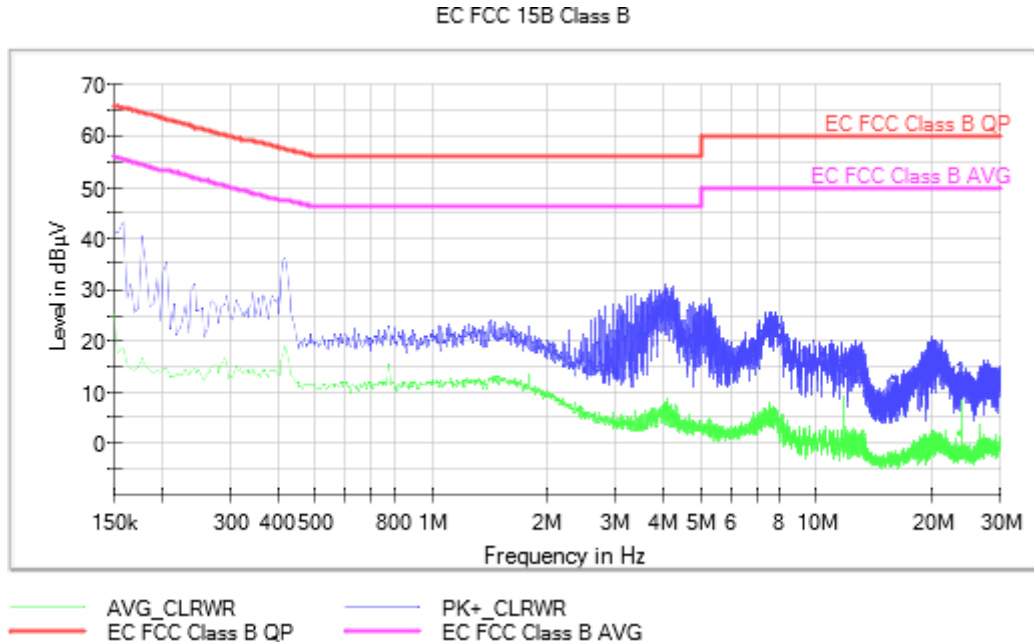
Frequency(MHz)	MaxPeak (dBµV)	Average (dBµV)
0.162000	39.2	15.2
0.414000	33.2	16.1
0.690000	24.2	11.9
1.026000	24.5	11.4
1.498000	23.1	12.0
3.506000	30.1	7.0
3.770000	30.0	7.4
7.702000	28.1	8.9
11.314000	18.4	1.0
19.954000	18.8	2.4

EMC Test Code = CE0202L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/02

Operation Mode: OM/02. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE off. Power supply: 5Vdc through laptop USB port (115 VAC).

Images:



Documents:

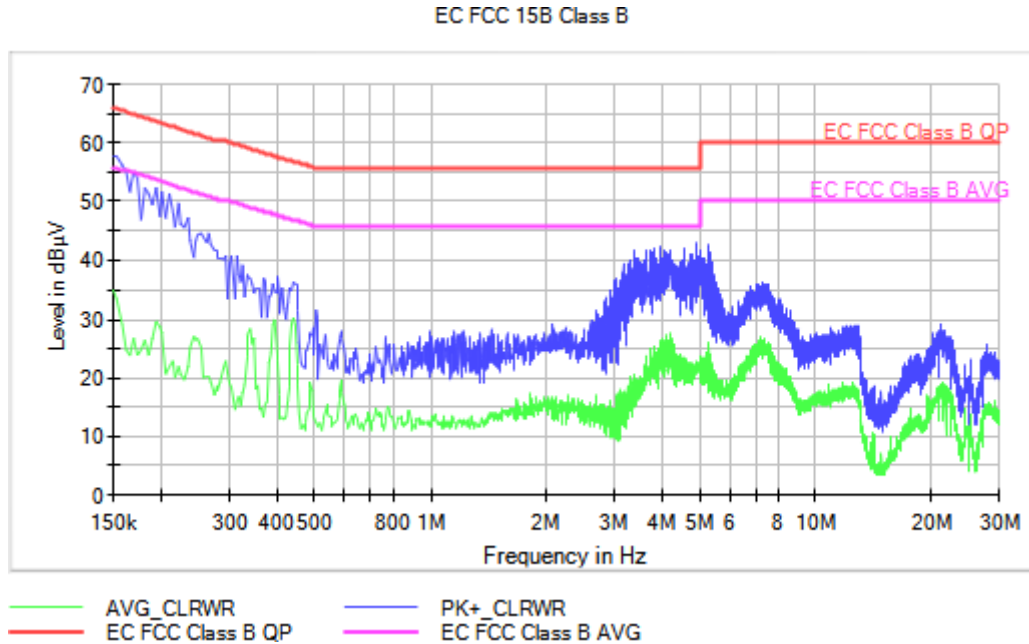
Frequency(MHz)	MaxPeak (dBµV)	Average (dBµV)
0.158000	43.3	18.7
0.418000	36.2	18.9
0.434000	26.0	13.6
1.106000	23.4	11.9
1.418000	24.0	12.7
3.398000	29.2	6.6
4.050000	31.2	7.9
7.890000	26.1	6.8
12.554000	20.1	2.6
19.982000	21.1	2.5

EMC Test Code = CE02030N, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = N

Sample ID: S/02

Operation Mode: OM/03. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE ON and connected to an ancillary equipment. Power supply: 5Vdc through laptop USB port (115 VAC)

Images:



Documents:

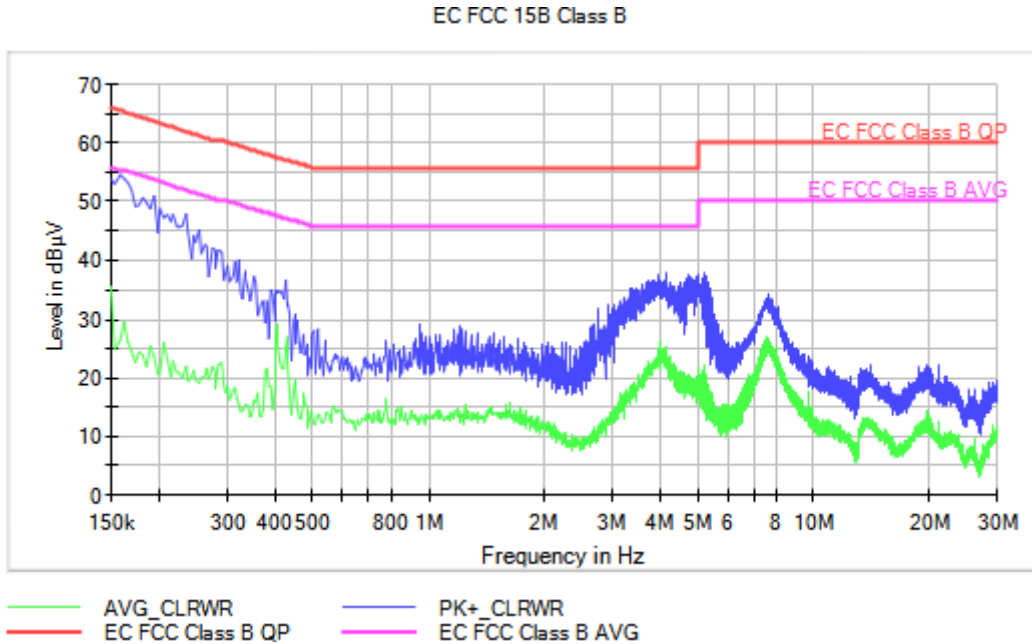
Frequency(MHz)	Maxpeak (dBµV)	Average (dBµV)
0.150000	57.8	34.9
0.266000	44.6	20.3
0.442000	36.2	30.0
1.226000	28.1	12.9
2.074000	29.3	16.6
3.370000	41.6	20.6
4.918000	43.0	22.3
7.266000	36.2	26.2
12.318000	29.0	18.4
21.162000	29.2	18.4

EMC Test Code = CE0203L1, Frequency Range MHz = [0.15, 30], Conducted Emissions - Tested Line = L1

Sample ID: S/02

Operation Mode: OM/03. EUT ON. Transferring data through USB Port. Charging mode via USB. BLE ON and connected to an ancillary equipment. Power supply: 5Vdc through laptop USB port (115 VAC)

Images:



Documents:

Frequency(MHz)	Maxpeak (dBµV)	Average (dBµV)
0.158000	54.5	26.4
0.262000	42.6	20.4
0.434000	32.8	23.0
0.950000	29.2	13.2
1.258000	28.0	14.2
3.594000	35.9	17.9
4.142000	38.0	25.3
7.706000	34.3	25.4
14.118000	22.1	12.0
21.070000	22.3	12.4