

Test report No:
NIE: 66479REM.026

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	Radio mesh device
(*) Trademark	KONE
(*) Model and /or type reference	Pulse (KM51671506G02)
Other identification of the product	Powered by USB Cable Kone Reference Number: 51786350D16 FCC ID: 2ALQBPULSE IC: 4228A-PULSE HW version: Rev.C SW version: 5.0.0.46
(*) Features	Wirepas radio, USB and RS485 serial connections
Manufacturer	KONE CORPORATION Keilasatama 3 02150 ESPOO, Finland
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)	José Manuel Gómez Industrial & Automotive EMC Lab. Manager
Date of issue	2021-07-01
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.

DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with the appropriate scope of accreditation that covers the performed test in this report.

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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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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.
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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 Radio mesh device

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 Reception	of Application
S/01	66479C_21.1	KONE MESH NODE	Pulse (KM51671506G02)	17	2021-03-17	Element Under Test
S/02	66479C_18.1	KONE MESH NODE	Pulse (KM51671506G02)	1	2021-03-17	Element Under Test
S/02	66479C_28.1	KONE MESH NODE	Pulse (KM51671506G03)	6	2021-03-17	Auxiliary Element
S/02	N/A	AC/DC	A1400	---	N/A	Auxiliary Element
S/02	66479C_38.1	Laptop	U748	DSAK011995	2021-03-17	Auxiliary Element
S/02	66479C_39.1	AC/DC	--	--	2021-03-17	Auxiliary Element
S/02	66479C_40.1	AC mains cord	--	--	2021-03-17	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⁾	
	USB cable type: 4x0.5mm ² , Shielded, 0.5m (KM51753663V000)		< 3 m	[X]	[X]	[]	
				[]	[]	[]	
				[]	[]	[]	
				[]	[]	[]	
				[]	[]	[]	
				[]	[]	[]	
Supplementary information to the ports..... :							
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[]	AC:	[]	[]	[]	[]	[]
	[]	AC:	[]	[]	[]	[]	[]
	[X]	DC: USB 5 V					
[]	DC:						
Rated Power	250mW						
Clock frequencies.....	32,678 kHz, 32 MHz						
Other parameters							
Software version	5.0.0.46						
Hardware version	Rev. C						
Dimensions in cm (W x H x D)	90mm x 90 mm x 43 mm						
Mounting position	[]	Table top equipment					
	[X]	Wall/Ceiling mounted equipment					

	[]	Floor standing equipment		
	[]	Hand-held equipment		
	[]	Other:		
Modules/parts.....:	Module/parts of test item		Type	Manufacturer
				
				
				
				
Accessories (not part of the test item)	Description		Type	Manufacturer
	KONE MESH NODE		Pulse (KM516715 06G01)	Bittium
	Laptop		U748	Fujitsu
	AC/DC		A1400	Apple
				
				
				
Documents as provided by the applicant	Description		File name	Issue date
	Schematics		51671507D 02	
	Layout		51671507D 03	
	Part list / Bom		51671507D 01	
	Production files (Gerber)		51671508D 01	

⁽³⁾ Only for Medical Equipment

Identification of the client

Bittium Oy
Ritaharjuntie 1
90590 Oulu,
Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-04-16
Date (finish)	2021-04-21

Document history

Report number	Date	Description
66479REM.026	2021-07-01	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 %

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 %

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 %

Remarks and comments

The tests have been performed by the technical personnel: Alejandro Marin Chorro and Víctor Manuel Tamayo Olea.

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
7816	EMI TEST RECEIVER 1Hz-26.5GHz	ESW26	ROHDE AND SCHWARZ	2021-09-05
7746	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2022-07-11
7743	HORN ANTENNA	3115	ETS LINDGREN	2023-08-24
6196	PRE-AMPLIFIER G>55dB 1-18GHz	AMF-7D-01001800-22-10P	NARDA	2022-02-25
1935	EMI Test Receiver	ESPI3	ROHDE AND SCHWARZ	2022-02-05
5151	Transient Limiter	VTSD 9561-F	SCHWARZBECK	2021-10-02
6204	THREE-PHASE ARTIFICIAL NETWORK 32A	PMM L3-32	NARDA	2021-07-29

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC 47 CFR Part 15B	CE Continuous conducted emission	Pass	
FCC 47 CFR Part 15B	RE Radiated emission. Electromagnetic field measure	Pass	

Supplementary information and remarks:

None

Appendix A: Test results

Appendix A context

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RE Radiated emission. Electromagnetic field measure18

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 (Wirepas) RX mode and Test mode ON. Power supply: 5Vdc through USB.
OM/02	EUT ON. Test mode ON and Bluetooth (Wirepas) not connected. Power supply: 115 Vac through AC/DC Adapter
OM/03	EUT ON. Test mode ON and Bluetooth (Wirepas) connected. Power supply: 115 Vac through AC/DC Adapter

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 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

SI	OM	Code	Freq Rng (MHz)	Line	Comments	V
02	OM/02	CE0202N	[0.15, 30]	N	---	P
02	OM/02	CE0202L	[0.15, 30]	L1	---	P
02	OM/03	CE0203N	[0.15, 30]	N	---	P
02	OM/03	CE0203L	[0.15, 30]	L1	---	P

Verdict

Pass

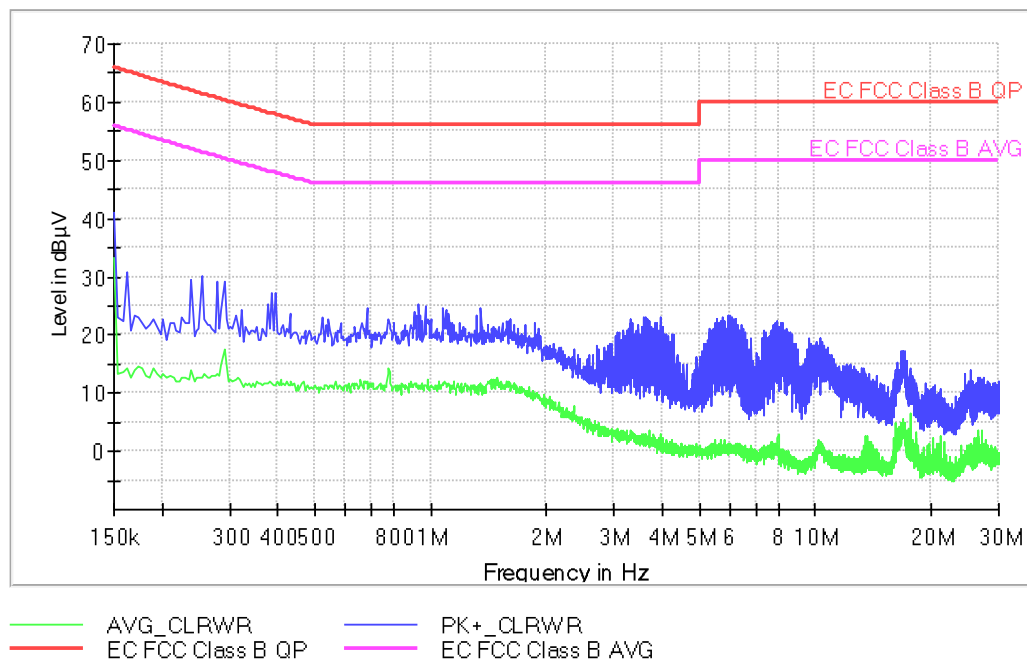
Attachments

EMC Test Code = CE0202N, Frequency Range MHz = [0.15, 30]

Sample ID: S/02

Operation Mode: OM/02. EUT ON. Bluetooth (Wirepas) RX mode and Test mode ON. Power supply: 115 Vac through AC/DC Adapter

Images:



Documents:

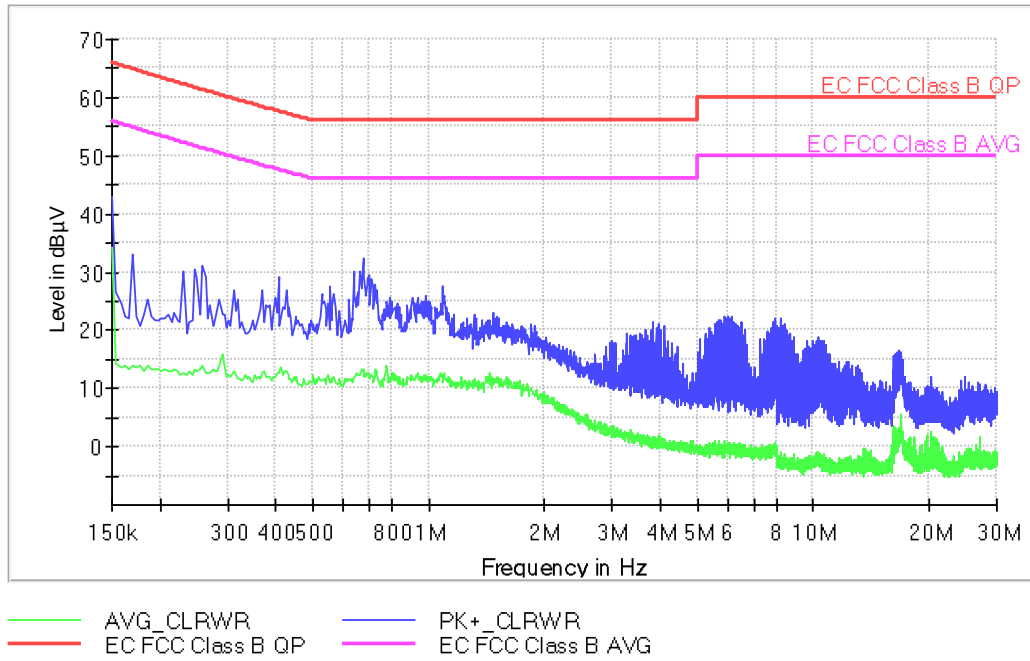
Frequency(MHz)	Peak (dBµV)	Average (dBµV)	Line
0.150000	41.1	33.3	N
0.290000	29.3	17.4	N
0.682000	24.5	11.9	N
0.930000	25.2	11.4	N
1.350000	24.7	10.5	N
3.574000	22.9	3.0	N
5.942000	23.2	1.1	N
6.146000	22.8	0.6	N
10.542000	18.3	0.1	N
25.274000	13.9	1.5	N

EMC Test Code = CE0202L, Frequency Range MHz = [0.15, 30]

Sample ID: S/02

Operation Mode: OM/02. EUT ON. Bluetooth (Wirepas) RX mode and Test mode ON. Power supply: 115 Vac through AC/DC Adapter

Images:



Documents:

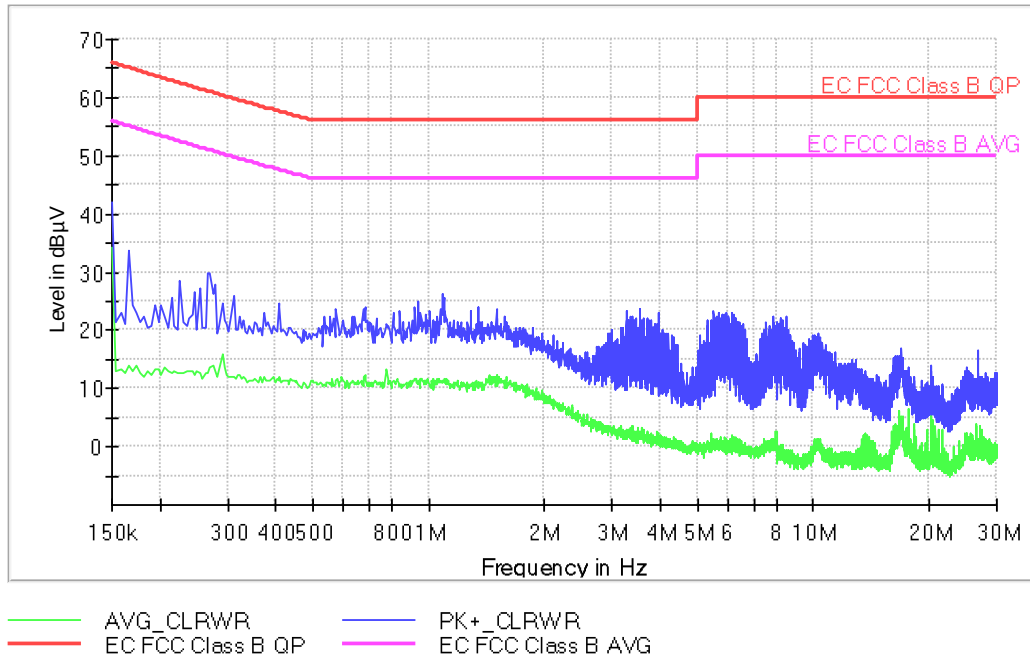
Frequency(MHz)	Peak (dBµV)	Average (dBµV)	Line
0.150000	42.8	33.9	L
0.261000	30.3	14.6	L
0.665000	31.5	13.0	L
1.092000	26.5	11.8	L
1.510000	22.2	11.3	L
3.536000	19.0	1.6	L
5.987000	23.5	0.1	L
6.152000	21.4	0.0	L
10.630000	17.9	-2.3	L
20.478000	11.8	1.5	L

EMC Test Code = CE0203N, Frequency Range MHz = [0.15, 30]

Sample ID: S/02

Operation Mode: OM/03. EUT ON. Test mode ON and Bluetooth (Wirepas) connected. Power supply: 115 Vac through AC/DC Adapter

Images:



Documents:

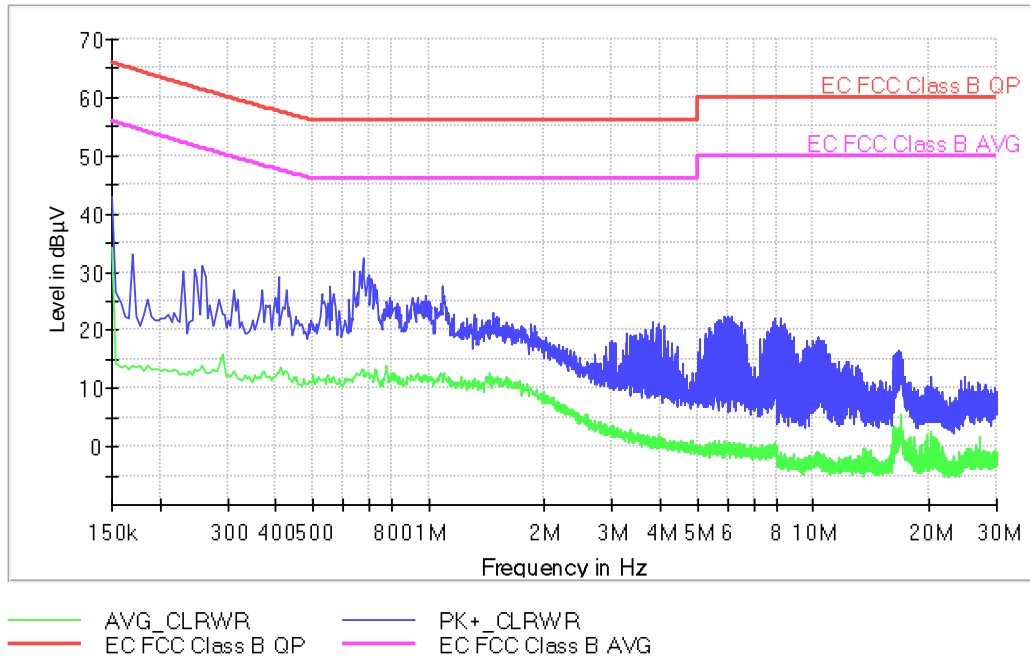
Frequency(MHz)	Peak (dBµV)	Average (dBµV)	Line
0.150000	42.3	34.4	N
0.266000	29.9	12.6	N
0.682000	23.9	12.4	N
1.086000	26.4	11.5	N
1.346000	24.0	10.2	N
3.542000	23.7	2.4	N
5.518000	23.2	0.8	N
6.134000	23.0	1.9	N
10.414000	18.2	-0.1	N
26.818000	16.6	0.8	N

EMC Test Code = CE0203L, Frequency Range MHz = [0.15, 30]

Sample ID: S/02

Operation Mode: OM/03. EUT ON. Test mode ON and Bluetooth (Wirepas) connected. Power supply: 115 Vac through AC/DC Adapter

Images:



Documents:

Frequency(MHz)	Peak (dBµV)	Average (dBµV)	Line
0.150000	43.0	34.4	L
0.258000	31.3	13.9	L
0.674000	32.4	13.4	L
1.086000	27.5	12.3	L
1.470000	23.2	10.7	L
3.526000	19.5	1.5	L
5.998000	22.4	0.3	L
6.142000	22.3	-0.2	L
10.570000	18.2	-2.0	L
20.318000	12.0	1.2	L

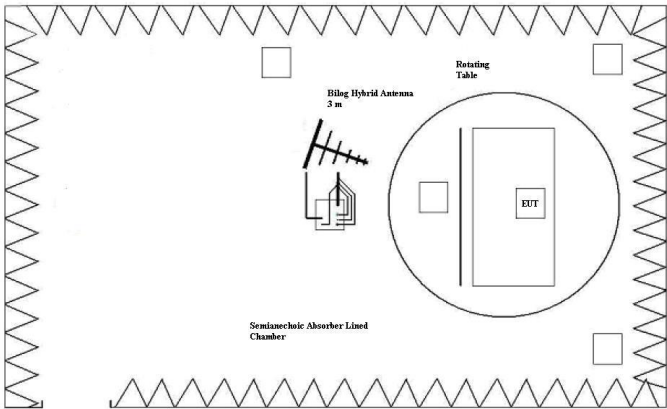
RE Radiated emission. Electromagnetic field measure

Limits

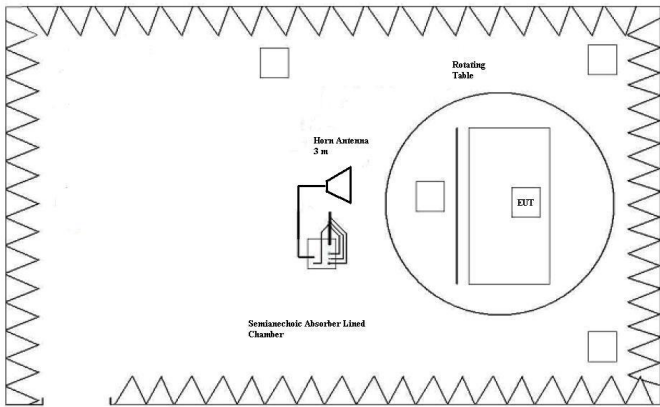
Limits of interference Class B

The applied limit for radiated emissions, 3 m distance, according with the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-19 Edition), Secs. 15.109 & ICES-003 Issue 6 (Updated 04-2019)

Frequency of emission (MHz)	Field strength (microvolt/meter)
30-88	100
88-216	150
21-960	200
Above 960	500
*Above 1GHz, the limit is defined for an AVG detector.	



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

Verdict

Pass

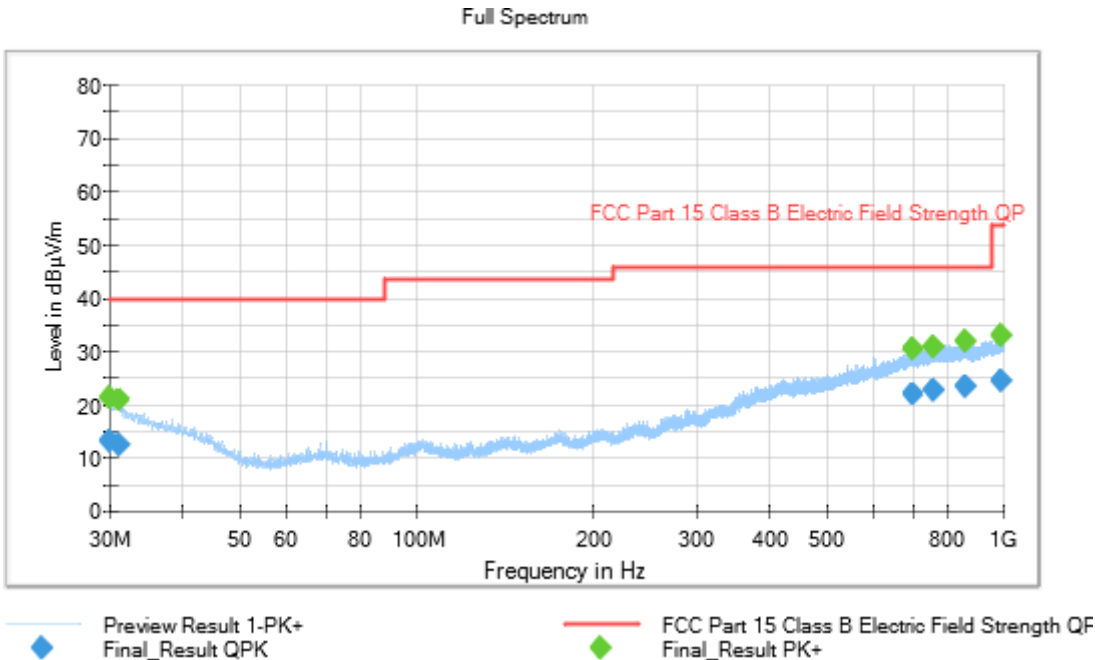
Attachments

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

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth (Wirepas) RX mode. Power supply: 5Vdc through USB.

Images:



Documents:

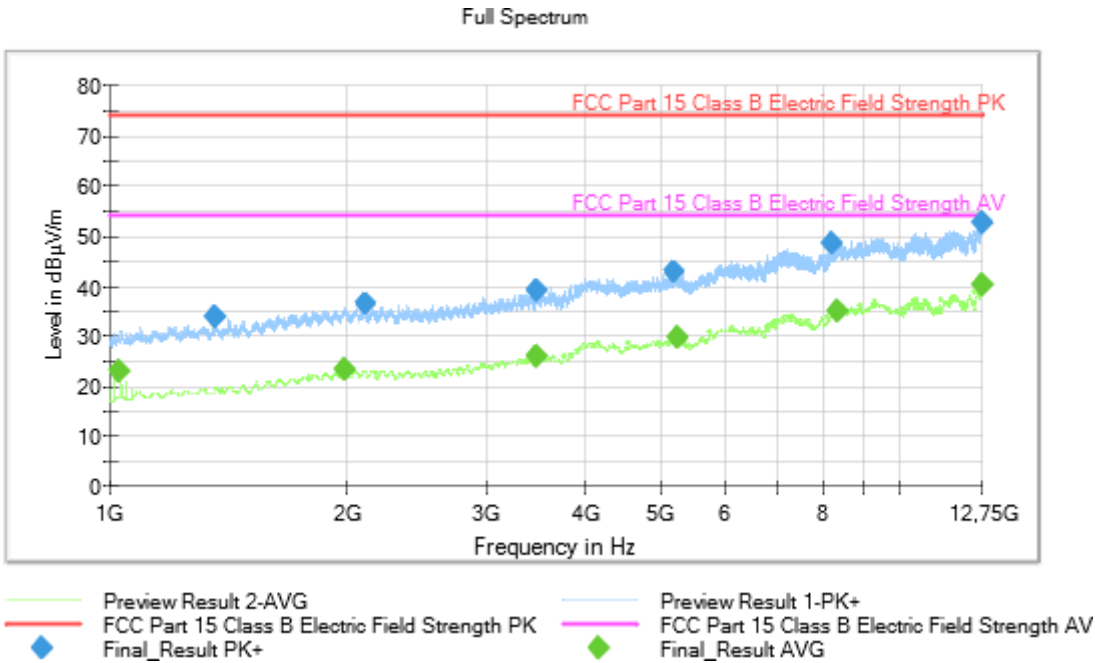
Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.016500	---	21.29	---	---	211.0	H	356.0
30.016500	13.16	---	40.00	26.84	211.0	H	356.0
31.058000	12.55	---	40.00	27.45	400.0	H	91.0
31.058000	---	20.85	---	---	400.0	H	91.0
699.508000	---	30.52	---	---	183.0	H	111.0
699.508000	22.09	---	46.00	23.91	183.0	H	111.0
758.806000	---	30.97	---	---	184.0	V	63.0
758.806000	22.56	---	46.00	23.44	184.0	V	63.0
860.314000	23.29	---	46.00	22.71	336.0	V	65.0
860.314000	---	32.03	---	---	336.0	V	65.0
990.983000	---	32.76	---	---	400.0	V	257.0
990.983000	24.29	---	53.97	29.68	400.0	V	257.0

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

Sample ID: S/01

Operation Mode: OM/01. EUT ON. Bluetooth (Wirepas) RX mode. Power supply: 5Vdc through USB.

Images:



Documents:

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1030.000000	---	22.83	53.97	31.14
1356.800000	33.66	---	73.97	40.31
1990.400000	---	23.23	53.97	30.74
2104.000000	36.53	---	73.97	37.44
3472.800000	39.05	---	73.97	34.92
3481.200000	---	25.94	53.97	28.03
5175.200000	42.64	---	73.97	31.33
5230.400000	---	29.81	53.97	24.16
8225.200000	48.37	---	73.97	25.60
8338.000000	---	34.84	53.97	19.13
12743.600000	52.77	---	73.97	21.20
12749.200000	---	40.26	53.97	13.71