

Test report No:
 NIE: 66837REM.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	Nokia Industrial MulteFire Router 700H
(*) Trademark	Nokia
(*) Model and /or type reference	HWNDUSEB1006
Other identification of the product	HW version: A101 SW version: 20210121_01_UESW_MF_DEV_00540_12b1d3b_3f985 03 FCC ID: 2AVO2MFRTR700H1 IC: 661AF-MFRTR700H1
(*) Features	MulteFire 1.0
Manufacturer	Nokia Innovations US LLC 600-700 Mountain Ave Murray Hill, NJ, 07974 USA
Test method requested, standard	FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020) & ANSI C63.4-2014
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2021-07-28
Report template No	FDT08_23 (*) "Data provided by the client"

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Acronyms

Acronym ID	Acronym Description
Avg	Radiated Average Level
Avg	Conducted Average Level
Az	Azimuth
CPL	Zones / Coupling Cables
Code	EMC Test Code
EUT	Equipment Under Test
Freq	Frequency
Freq Rng	Frequency Range
H	Height
HR	High Range
Line	Conducted Emissions - Tested Line
LR	Low Range
MP	Measurement Point
Max	Conducted Maximum Level
MaxPeak	Radiated Maximum Peak Level
OM	Operation Mode
Pol	Polarization
QuasiPeak	Conducted Quasi Peak Level
QuasiPeak	Radiated Quasi Peak Level
S/	Sample
V	Verdict
Volt Immunity Lvl	Voltage Immunity Severity Level
Volt Immunity Type	Voltage Immunity Type

Competences and guarantees

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DEKRA Testing and Certification S.A.U. is a FCC recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report, FCC designation number ES0004.

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

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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.
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Uncertainty

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

The total uncertainty of the measurement system for the measured radio disturbance characteristics of EUT from 30 MHz to 1000 MHz is $l = \pm 4,9$ dB for quasi-peak measurements, $l = \pm 4,6$ 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 26 GHz is $l = \pm 2,6$ 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 Nokia Industrial MulteFire Router 700H acts as a client device. When connected to an Access Point, it provides wireless data service.

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	66837_01	Nokia Industrial MulteFire Router 700H	HWNDUSEB1006	03#	2020-12-01	Element under test
S/01	66837_02	Antenna	---	---	2020-12-01	Element under test
S/01	66837_03	Antenna	---	---	2020-12-01	Element under test
S/01	66837_04	AC/DC adapter	G0957B-120-200	---	2020-12-01	Auxiliary element

Notes referenced to samples during the project.

Id	Note
S/01	N/A

Test sample description

Ports..... :	Port name and description		Cable				
			Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	RJ45	100	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
	USB 2.0	4	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports..... :	N/A						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	<input type="checkbox"/>	AC:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	<input checked="" type="checkbox"/>	DC: 10 – 30 V					
Rated Power	12W max						
Clock frequencies.....	XO 12MHz/25MHz/125MHz, SoC 1000MHz/750MHz, DDR 800MHz						
Other parameters	N/A						
Software version	20210121_01_UESW_MF_DEV_00540_12b1d3b_3f98503						
Hardware version	A101						
Dimensions in cm (W x H x D) :	10.5 x 16.2 x 2.5						
Mounting position	<input checked="" type="checkbox"/>	Table top equipment					
	<input checked="" type="checkbox"/>	Wall/Ceiling mounted equipment					
	<input checked="" type="checkbox"/>	Floor standing equipment					
	<input type="checkbox"/>	Hand-held equipment					
	<input checked="" type="checkbox"/>	Other: Industrial machine mounted equipment. Pole.					
Modules/parts..... :	Module/parts of test item		Type	Manufacturer			
	Nokia Industrial MulteFire Router 700H		---	Nokia			
	5150-5925MHz 3dBi Antenna x 2		Antenna	Shenzhen DongLi			
	Description		Type	Manufacturer			

Accessories (not part of the test item)..... :	N/A		
Documents as provided by the applicant..... :	Description	File version	Issue date
	TestMac User Guide for Regulatory Certification	N/A	Nov 20, 2020

⁽³⁾ Only for Medical Equipment

Identification of the client

NOKIA INNOVATIONS US LLC
 600-700 Mountain Ave
 Murray Hill, NJ, 07974 USA

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-02-09
Date (finish)	2021-06-11

Document history

Report number	Date	Description
66837REM.002	2021-07-28	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. = 20 % 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. = 20 % 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. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Antonio Ruiz.

Testing verdicts

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

List of equipment used during the test

Nº de Control / Control Number	Descripción / Description	Modelo / Model	Fabricante / Manufacturer	Próxima Calibración / Next Calibration
2942	EMI TEST RECEIVER 20Hz-40GHz	ESU40	ROHDE AND SCHWARZ	2021-09-17
4523	EMI TEST RECEIVER 20Hz-26.5GHz	ESU26	ROHDE AND SCHWARZ	2023-03-15
4573	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2022-04-06
4612	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2021-06-14
4656	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2021-07-19
5641	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2021-07-31
6064	SEMIANECHOIC ABSORBER LINED CHAMBER III	SAC-3	Frankonia	---
6126	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2022-04-05
6132	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2022-04-05
6193	PRE-AMPLIFIER G>48dB 18-40GHz	JS44-18004000-33-8P	NARDA	2022-03-24
6195	PRE-AMPLIFIER G>55dB 1-18GHz	AMF-7D-01001800-22-10P	NARDA	2021-05-19
6205	THREE-PHASE ARTIFICIAL NETWORK 32A	PMM L3-32	NARDA	2021-12-11
6329	SHIELDED ROOM	---	FRANKONIA	---

Summary

Test Specification.	Requirement – Test case	Verdict	Remark
FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020) & ANSI C63.4-2014	Radiated emission (30MHz-1GHz)	Pass	---
FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020) & ANSI C63.4-2014	Radiated emission (1GHz-26GHz)	Pass	---
FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020) & ANSI C63.4-2014	Conducted emission.	Pass	---

Supplementary information and remarks:

N/A

Appendix A: Test results

Appendix A Content

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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. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).
OM#02	EUT ON. MulteFire 5GHz ON in communication. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).

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	Radiated emission
FCC CFR 47, Part 15, Subpart B (10-1-19 Edition) & ICES-003 Issue 7 (October 2020)	ANSI C63.4 – 2014	Conducted emission. AC input power supply port.

Test Cases Details

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

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), Sec. 15.109 & ICES-003 Issue 7 (October 2020) Sec 3.2.2:

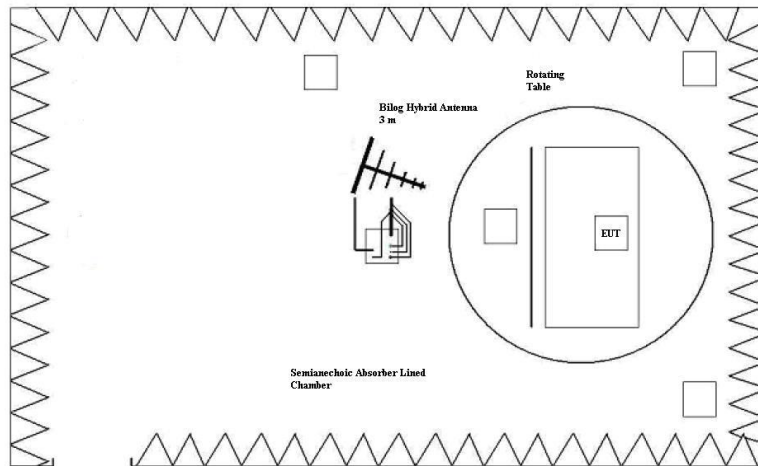
Table 2: Radiated emission limits

Frequency range (MHz)	FCC Part 15B Class B (3 m) Quasi-Peak (dBµV/m)	ICES-003 Issue 7 Limit for 3 m Quasi-Peak (dBµV/m)	FCC Part 15B & ICES-003 Issue 7	
			PK Limit for 3m (dBµV/m)	AVG Limit for 3m (dBµV/m)
30-88	40.0	40.0	---	---
88-216	43.5	43.5	---	---
216-230	46.0	46.0	---	---
230-960	46.0	47.0	---	---
960-1000	54.0	54.0	---	---
1 GHz – F _M	---	---	74	54

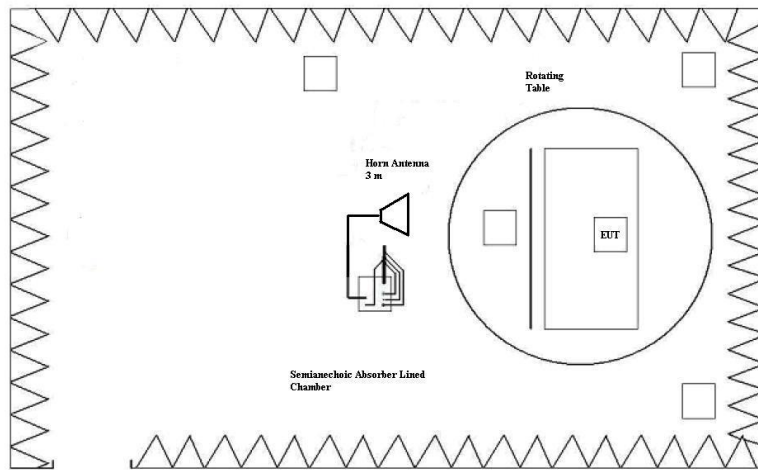
Above 1 GHz, except for outdoor units of home satellite receiving systems, the ITE or digital apparatus shall comply with the limits specified in table 2 up to the frequency F_M, which shall be determined as per table 3.

Table 3: Required highest measurement frequency for radiated emission

Highest internal Frequency (F _x)	Highest measurement Frequency (F _M)
F _x ≤ 108 MHz	1 GHz
108 MHz < F _x ≤ 500 MHz	2 GHz
500 MHz < F _x ≤ 1 GHz	5 GHz
F _x > 1 GHz	5 x F _x up to a maximum of 40 GHz
*F _x is the highest fundamental frequency generated and/or used in the ITE or digital apparatus under test.	



Setup for measurements < 1GHz.



Setup for measurements > 1GHz.

RESULTS

REmmnnRR	Description	Result
RE0101LR	Range: 30 MHz - 1000 MHz.	P
RE0101HR1	Range: 1 GHz – 17 GHz.	P
RE0101HR2	Range: 17 GHz – 26 GHz	P

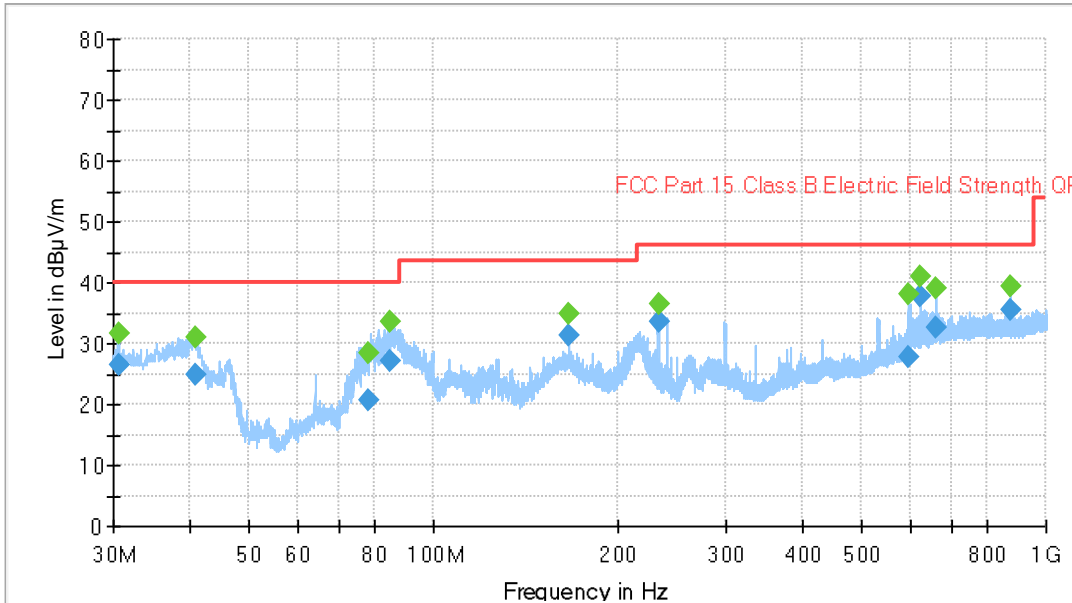
REmmnnRR: RE: Radiated Emission; mm: Sample number; nn: Operation mode; RR: Measurement range.

VERDICT

Pass

Project: 66837REM.002
 Company: NOKIA INC.
 Sample: S/01
 Operation mode: 01
 Graphical code: RE0101LR
 Description: EUT ON. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).
 Verdict: Passed

Full Spectrum



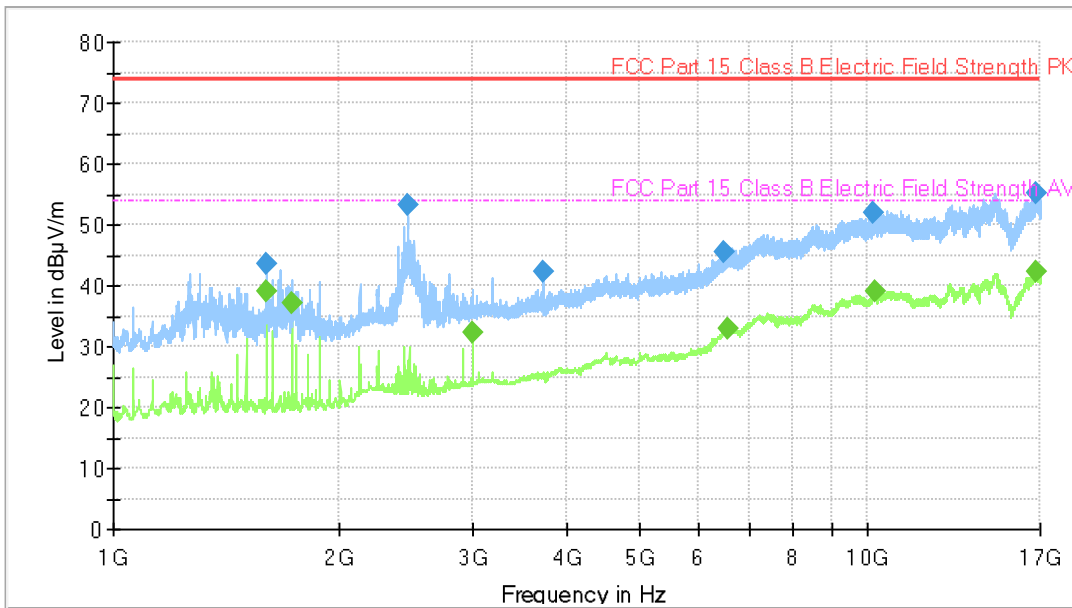
Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
30.571000	26.56	---	40.00	13.44	130.0	V	-54.0
30.571000	---	31.57	---	---	130.0	V	-54.0
40.862000	24.85	---	40.00	15.15	151.0	V	90.0
40.862000	---	31.10	---	---	151.0	V	90.0
78.537000	20.78	---	40.00	19.22	275.0	V	27.0
78.537000	---	28.32	---	---	275.0	V	27.0
84.690000	---	33.64	---	---	140.0	V	-92.0
84.690000	27.12	---	40.00	12.88	140.0	V	-92.0
165.980000	31.44	---	43.52	12.08	191.0	H	158.0
165.980000	---	34.82	---	---	191.0	H	158.0
232.800000	---	36.61	---	---	145.0	H	48.0
232.800000	33.62	---	46.00	12.38	145.0	H	48.0
596.176000	---	38.10	---	---	161.0	H	-159.0
596.176000	27.64	---	46.00	18.36	161.0	H	-159.0
624.998000	---	41.04	---	---	162.0	H	25.0
624.998000	37.63	---	46.00	8.37	162.0	H	25.0
662.438000	---	38.96	---	---	140.0	H	-180.0
662.438000	32.43	---	46.00	13.57	140.0	H	-180.0
874.962000	35.46	---	46.00	10.54	141.0	V	93.0
874.962000	---	39.46	---	---	141.0	V	93.0

Project: 66837REM.002
 Company: NOKIA INC.
 Sample: S/01
 Operation mode: 01
 Graphical code: RE0101HR1
 Description: EUT ON. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).

Verdict: Passed

Full Spectrum



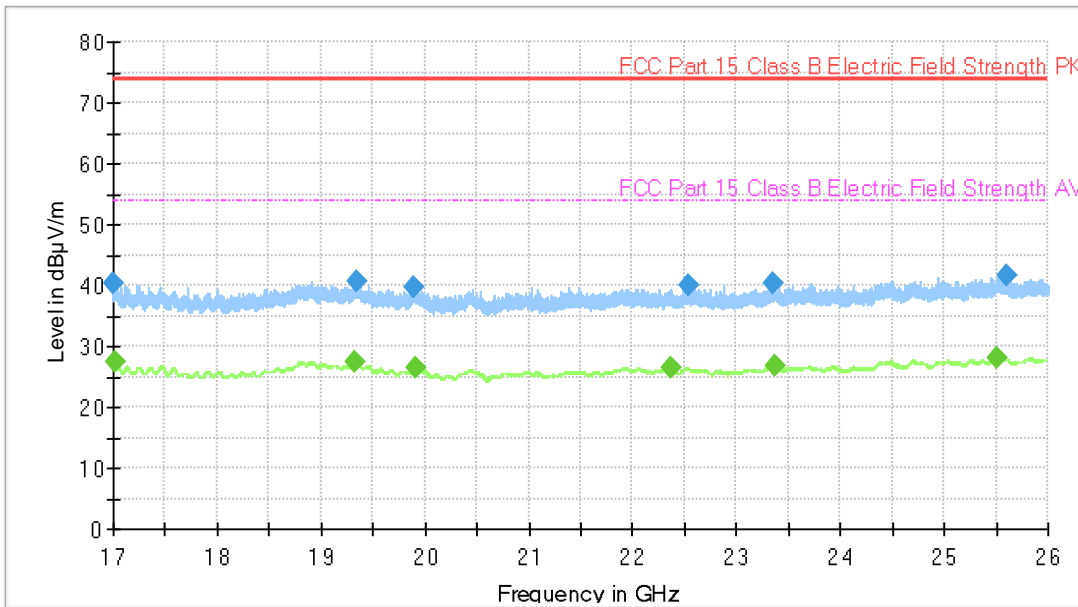
Final_Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1600.000000	---	38.98	53.97	14.99
1600.000000	43.48	---	73.97	30.49
1722.400000	---	37.22	53.97	16.75
2459.600000	53.12	---	73.97	20.85
3000.000000	---	32.21	53.97	21.76
3722.800000	42.21	---	73.97	31.76
6471.200000	45.63	---	73.97	28.34
6526.400000	---	33.00	53.97	20.97
10214.800000	52.08	---	73.97	21.89
10257.200000	---	38.95	53.97	15.02
16825.600000	55.23	---	73.97	18.74
16830.800000	---	42.37	53.97	11.60

Project: 66837REM.002
 Company: NOKIA INC.
 Sample: S/01
 Operation mode: 01
 Graphical code: RE0101HR2
 Description: EUT ON. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).

Verdict: Passed

Full Spectrum



Final Result

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)
17005.200000	40.43	---	73.97	33.54
17024.400000	---	27.41	53.97	26.56
19334.400000	---	27.53	53.97	26.44
19338.400000	40.73	---	73.97	33.24
19902.000000	39.80	---	73.97	34.17
19903.200000	---	26.56	53.97	27.41
22376.400000	---	26.44	53.97	27.53
22536.800000	40.05	---	73.97	33.92
23356.000000	40.26	---	73.97	33.71
23371.600000	---	26.85	53.97	27.12
25514.000000	---	28.14	53.97	25.83
25596.800000	41.59	---	73.97	32.38

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

Conducted emission on power leads: Limits of interference Class B

The applied limit for continuous conducted emissions in power leads, according to the requirements of FCC Rules and Regulations 47 CFR Part 15, Subpart B (10-1-19 Edition), Secs. 15.107 & ICES-003 Issue 7 (October 2020), 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 ⁽¹⁾	56 – 46 ⁽¹⁾
0,5 to 5	56	46
5 to 30	60	50

(1) The limit level in dBµV decreases linearly with the logarithm of frequency

RESULTS

CCmmnnhh	Description	Result
CE0101N	Range: 150kHz – 30MHz.AC input power supply port.Neutral wire noise.	P
CE0101L1	Range: 150kHz – 30MHz.AC input power supply port. Phase wire noise.	P
CE0102N	Range: 150kHz – 30MHz. AC input power supply port.Neutral wire noise.	P
CE0102L1	Range: 150kHz – 30MHz. AC input power supply port.Phase wire noise.	P

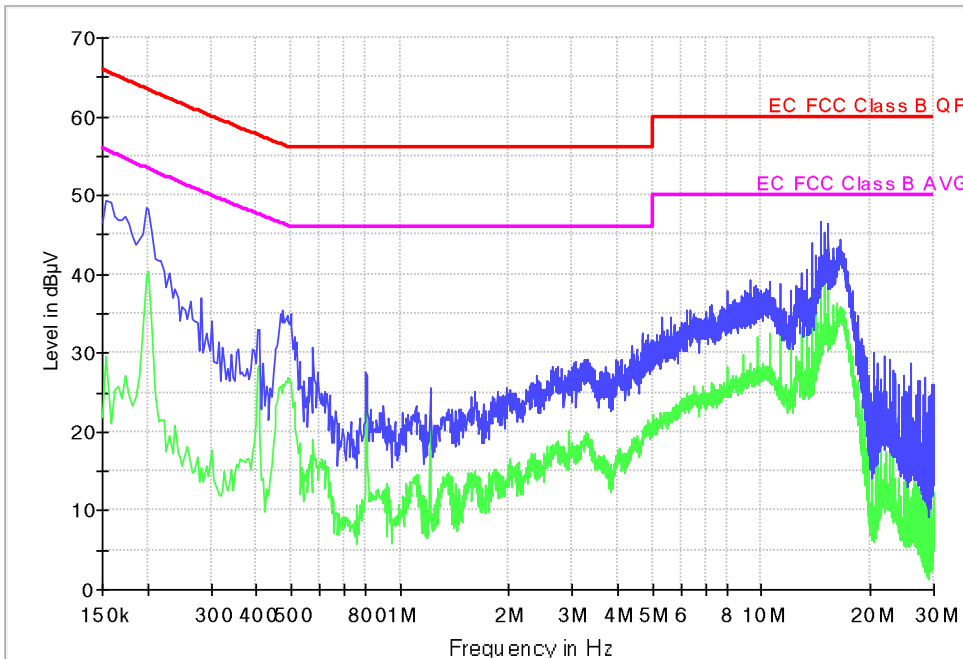
CEmmnnhh: CE: Conducted Emission; mm: Sample number; nn: Operation mode; hh: Wire

VERDICT

Pass

Project: 66837REM.002
Company: NOKIA INC.
Sample: S/01
Operation mode: 01
Graphical code: CE0101N
Description: EUT ON. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).. Neutral wire noise.
Verdict: Passed

FCC Part 15 Class B

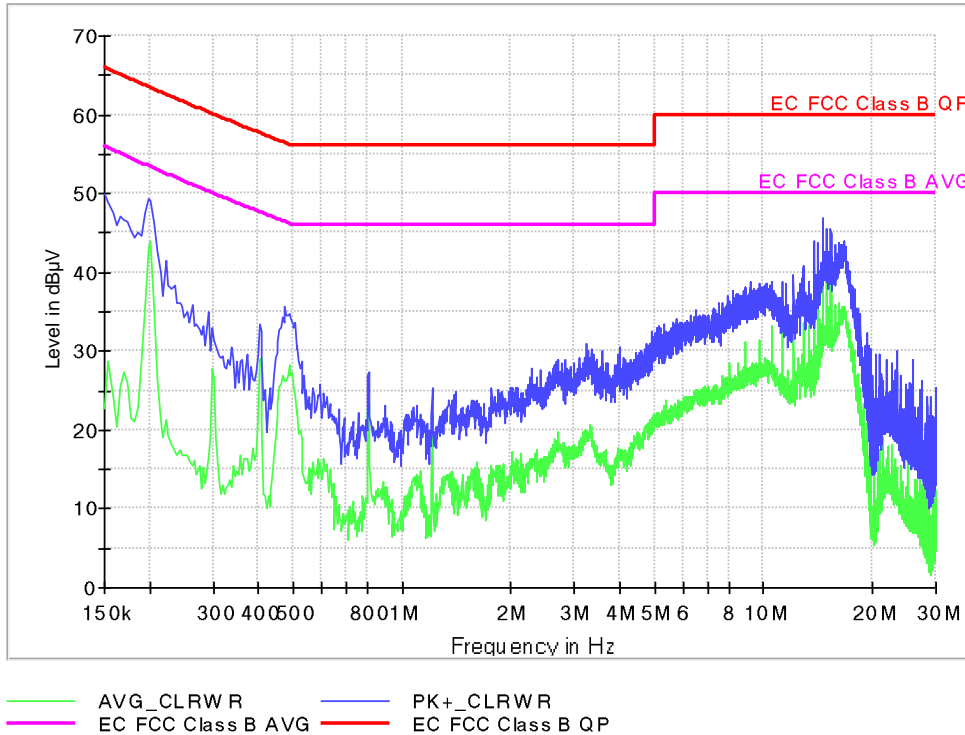


— AVG_CLRWR — PK+_CLRWR
— EC FCC Class B AVG — EC FCC Class B QP

Project: 66837REM.002
Company: NOKIA INC.
Sample: S/01
Operation mode: 01
Graphical code: CE0101L1
Description: EUT ON. MulteFire 5GHz OFF. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).. Phase wire noise.

Verdict: Passed

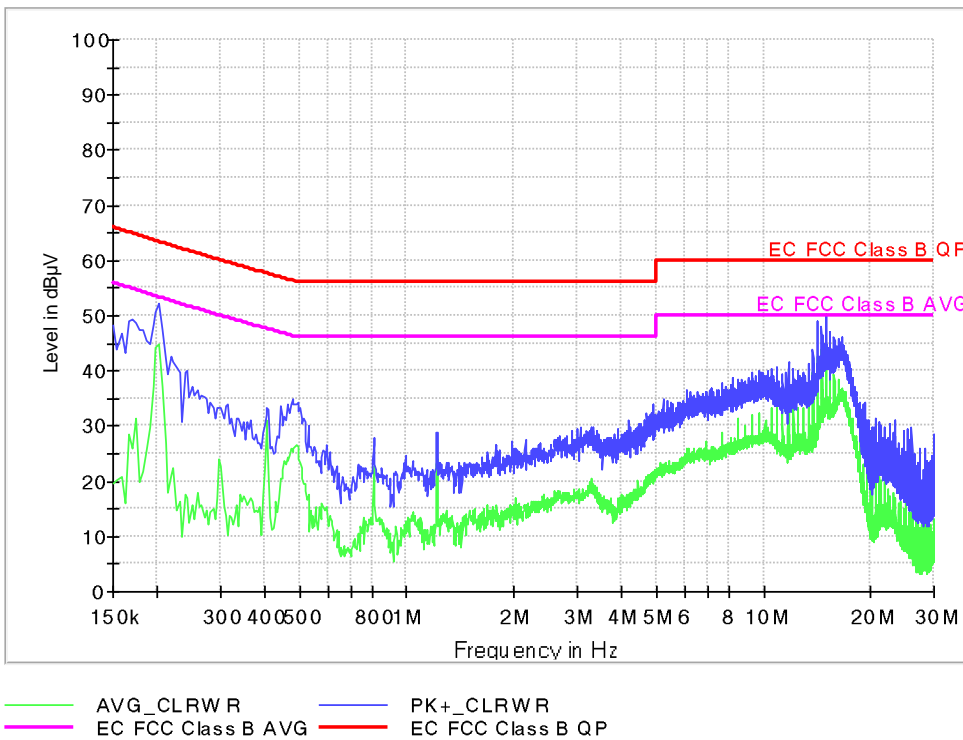
FCC Part 15 Class B



Project: 66837REM.002
 Company: NOKIA INC.
 Sample: S/01
 Operation mode: 02
 Graphical code: CE0102N
 Description: EUT ON. MulteFire 5GHz ON in communication. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).. Neutral wire noise.

Verdict: Passed

FCC Part 15 Class B



Project: 66837REM.002
Company: NOKIA INC.
Sample: S/01
Operation mode: 02
Graphical code: CE0102L1
Description: EUT ON. MulteFire 5GHz ON in communication. Ethernet port in transmission with central unit. Power supply: 12 Vdc (through an auxiliary AC/DC adaptor supplied at 110Vac).. Phase wire noise.

Verdict: Passed

FCC Part 15 Class B

