

Test Report No:
NIE: 70542RRF.012A1

Partial Test Report

USA FCC Part 15.31, 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Wireless hearing instrument
(*) Trademark	ReSound, Beltone, Interton, GN Hearing
(*) Model and /or type reference	CAIR1L
Other identification of the product	HW version: see sample list SW version: see sample list FCC ID: X26CAIR1L IC: 6941C-CAIR1L
(*) Features	Audio amplification, proprietary 2.4 GHz wireless functionality(Proximity), Bluetooth 5.0, 10.667 MHz wireless magnetic induction functionality and WPT at 135.59 kHz
Applicant	GN HEARING A/S Lautrupbjerg 7, 2750 Ballerup, Denmark
Test method requested, standard	USA FCC Part 15.247 (10-1-20) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (March 2019). Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid Systems Devices Operating Under Section 15.247 of the FCC Rules. 558074 D01 Meas Guidance v05r02 dated April 2, 2019. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager
Date of issue	2022-06-20
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

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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 internal document PODT000.

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 of the model CAIR1L is a Wireless hearing aid.
3. Testing performed with the information provided in 0437220[B]_RADIO_TEST_PLAN_CAIR1L document.

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 result.

Usage of samples

Samples undergoing test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
70542C/213	Wireless hearing instrument	CAIR1L	3112280144	2022/03/02

Sample S/01 has undergone the test(s): The Radiated tests indicated in Appendixes A, B.

Id	Type
S/01	Radiated HW: PCBA,CAM.CUST,L,MFI,V1.B,C6 SW: Dooku2 v.9.58.1

Test sample description

Ports.....:	Port name and description	Cable					
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾		
	-		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
Supplementary information to the ports.....:	-						
Rated power supply	Voltage and Frequency		Reference poles				
	<input type="checkbox"/> AC:		<input type="checkbox"/> L1	<input type="checkbox"/> L2	<input type="checkbox"/> L3	<input type="checkbox"/> N	<input type="checkbox"/> PE
	<input checked="" type="checkbox"/> DC: Internal rechargeable battery						
Rated Power.....:	3.8 V						
Clock frequencies.....:	2.48 GHz, 10.667 MHz and 135.59 kHz						
Other parameters	-						
Software version.....:	Dooku2 v.9.58.1						
Hardware version	PCBA,CAM.CUST,L,MFI,V1.B,C6						
Dimensions in cm (W x H x D) ...:	-						
Mounting position	<input type="checkbox"/> 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: Placed in the ear						
Modules/parts.....:	Module/parts of test item		Type	Manufacturer			
	-		-	-			
Accessories (not part of the test item)	Description		Type	Manufacturer			
	Computer		Certified according to IEC 60950-1, IEC 62368-1 or equivalent standard	-			
Documents as provided by the applicant.....:	Description		File name	Issue date			
	-		-	-			

⁽³⁾ Only for Medical Equipment

Identification of the client

GN HEARING A/S

Lautrupbjerg 7, 2750 Ballerup, Denmark

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-03-16
Date (finish)	2022-03-31

Document history

Report number	Date	Description
70542RRF.012	2022-06-17	First release.
70542RRF.012A1	2022-06-20	First modification. Typo correction on sample HW and SW. This report cancels and replaces test report 70542RRF.012.

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 %

Remarks and comments

The tests have been performed by the technical personnel: Alfonso Gutiérrez and José Manuel Jiménez.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N/A	N/A
2.	Shielded Room ETS LINDGREN S101	N/A	N/A
3.	Active Loop Antenna HEWLETT PACKARD 11966A	2020/07	2022/07
4.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2020/12	2022/12
5.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/10	2023/10
6.	RF Preamplifier 40 dB, 10 MHz - 6 GHz BONN ELEKTRONIK BLNA 0160-01N	2022/03	2023/03
7.	EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2021/11	2023/11
8.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
9.	Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
10.	RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
11.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
12.	Digital Multimeter FLUKE 175	2021/11	2022/11
13.	Software WMS 32 ROHDE & SCHWARZ	N/A	N/A

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	Verdict	Remark
FCC 15.31 (h), FCC 15.209 (a), 15.247 (d) / RSS-Gen 8.9, RSS-247 5.5: - Emission limitations radiated (Transmitter)	P	(1)
<u>Supplementary information and remarks:</u> (1) Only co-location radiated spurious emission test was requested.		

Appendix A: Test results.

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TEST CONDITIONS

POWER SUPPLY (V):

Vnominal: 3.8 Vdc
Type of Power Supply: Battery.

ANTENNA:

Type of Antenna: Integral.
Maximum Declared Antenna Gain for Bluetooth LE: -9.18 dBi
Maximum Declared Antenna Gain for Proprietary protocol 2.4 GHz: -9.18 dBi
Maximum Declared Antenna Gain for Inductive coil: Not Applicable

RADIOS AND CHANNELS TESTED:

	Bluetooth Low Energy 5.0 (2M, 1M) / DTS	
Mode:	1M (GFSK - 1DH5)	
Channel Spacing:	2 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	39	2480

	Proprietary protocol 2.4 GHz / DTS	
Mode:	2 Mbps	
Channel Spacing:	2 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	17	2440

	SRD 10.667 MHz / D-BPSK	
Mode:	Single Channel	
Channel Spacing:	Not Applicable	
Frequency Range:	5 – 30 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	1	10.667

The EUT was tested in the following operating mode:

- Continuous transmission with a modulated carrier at maximum power in all required channels selecting the supported data rates/modulations types.

During transmitter test the EUT was being controlled by the SW tool to operate in a continuous transmit mode on the test channel as required and in each of the different modulation modes.

Transmission modes selected with each Radio:

The following configurations were selected based on preliminary testing that identified those corresponding to the worst cases:

* Bluetooth Low Energy 5.0: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 2 Mbps.

* Proprietary protocol 2.4 GHz: Transmitter radiated spurious emissions tests were performed with the EUT transmitting with a bit rate of 2 Mbps.

* SRD 10.667 MHz: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in the single channel configuration supported by this radio.

Simultaneous transmission modes selected:

* Co-location Bluetooth, SRD 10.667 MHz, with the EUT configured to simultaneously transmit two signals at maximum output power: Bluetooth Low Energy in 2Mbps mode, SRD 10.667 MHz.

* Co-location Proprietary protocol 2.4 GHz, SRD 10.667 MHz, with the EUT configured to simultaneously transmit two signals at maximum output power: Proprietary protocol 2.4 GHz in 2 Mbps mode, SRD 10.667 MHz.

RADIATED MEASUREMENTS

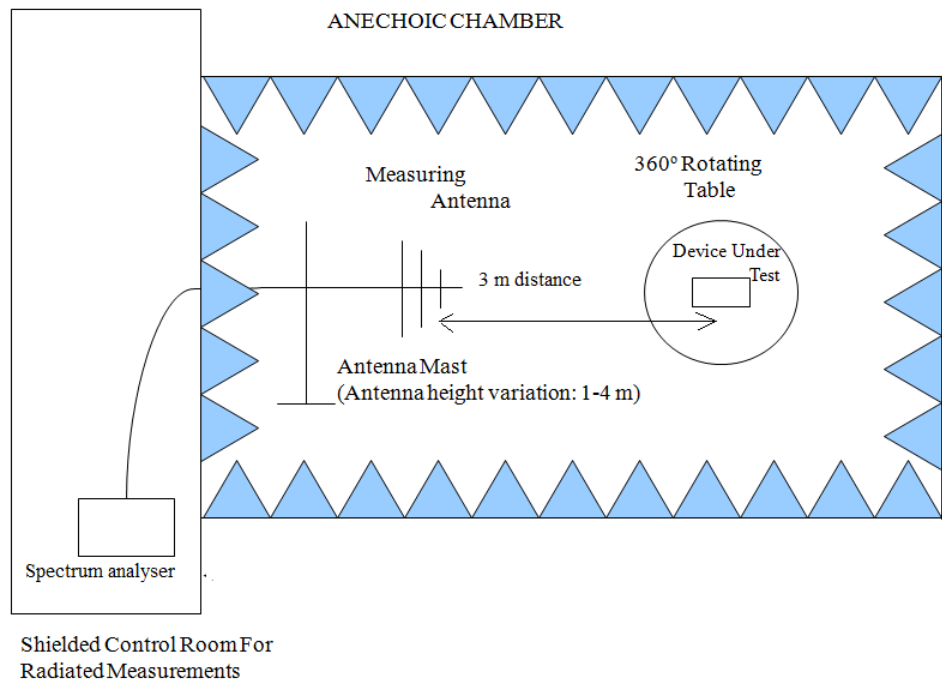
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m (Loop antenna for the range between 9 kHz to 30 MHz and Bilog antenna for 30 MHz to 1000 MHz) and at distance of 1 m for the frequency range 1 GHz-26 GHz (1 GHz-18 GHz Double ridge horn antenna and 18 GHz-26 GHz horn antenna).

The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

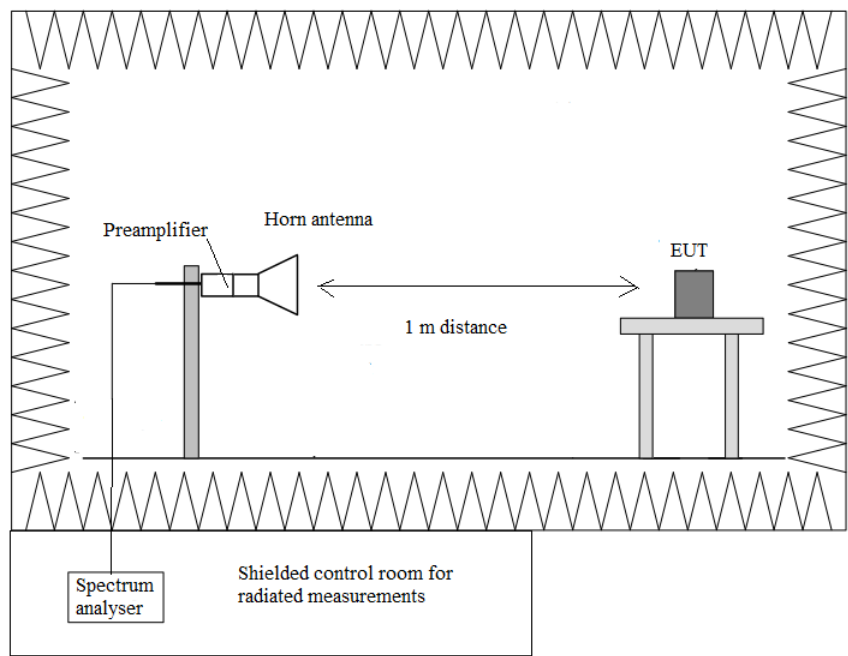
A resolution bandwidth/video bandwidth of 100 kHz/300 kHz was used for frequencies below 1 GHz and 1MHz/3MHz for frequencies above 1 GHz.

Measurements were made in both horizontal and vertical planes of polarization.

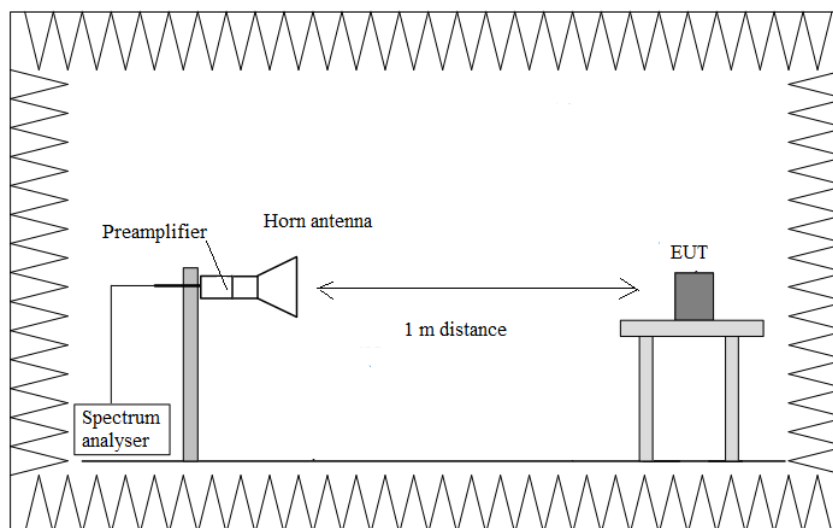
Radiated measurements setup 30 MHz < f < 1 GHz:



Radiated measurements setup f > 1 GHz up to 17 GHz:



Radiated measurements setup $f > 17$ GHz up to 40 GHz:



Radiated emission

SPECIFICATION:

Radiated emissions which fall in the restricted bands, as defined in §15.205(a), appearing outside of the band 13.110 MHz - 14.010 MHz band must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c) / RSS-Gen):

Frequency Range (MHz)	Field strength ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	Measurement distance (m)
0.009-0.490	2400/F(kHz)	-	300
0.490-1.705	24000/F(kHz)	-	30
1.705 - 30.0	30	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 40000	500	54	3

The emission limits shown in the above table are based on measurements employing 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.

For average radiated emission measurements above 1000 MHz, there is also a limit corresponding to 20 dB above the indicated values in the table is specified when measuring with peak detector function.

RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

RESULTS:

The situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

Measurements were made in both horizontal and vertical planes of polarization.

All tests were performed in a semi-anechoic chamber at a distance of 3 m for the frequency range 30 MHz-1000 MHz and at distance of 1m for the frequency range 1 GHz-26 GHz.

The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

Test performed on the following worst cases in all relevant tests channels.

- **Simultaneous transmission Bluetooth Low Energy 2 Mbps, SRD 10.667 MHz**

Frequency range 9 kHz - 30 MHz

The spurious emissions do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement uncertainty (dB): $< \pm 2.99$

Frequency range 30 MHz - 1 GHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement uncertainty (dB): $< \pm 5.08$

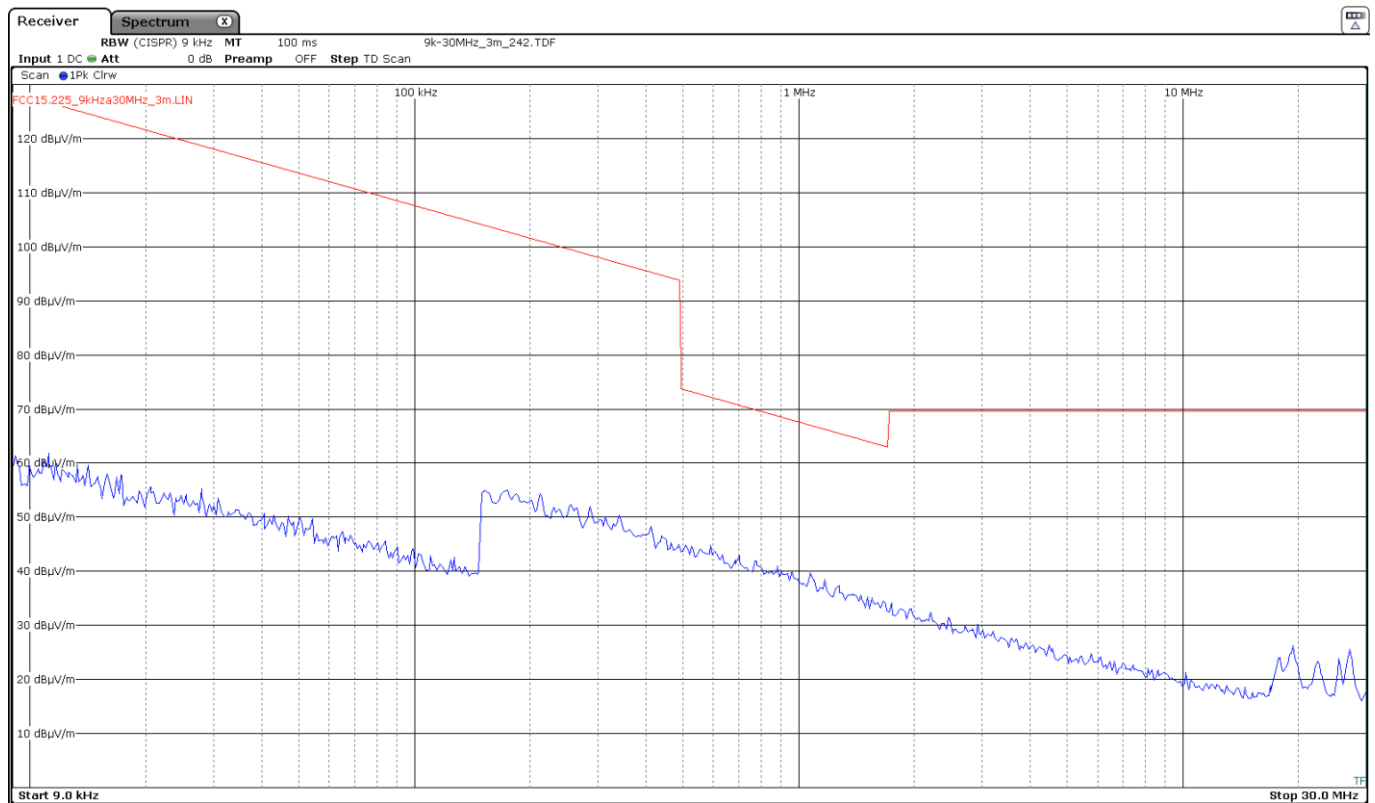
Frequency range 1 - 26 GHz

Spurious frequencies detected closest to the limit:

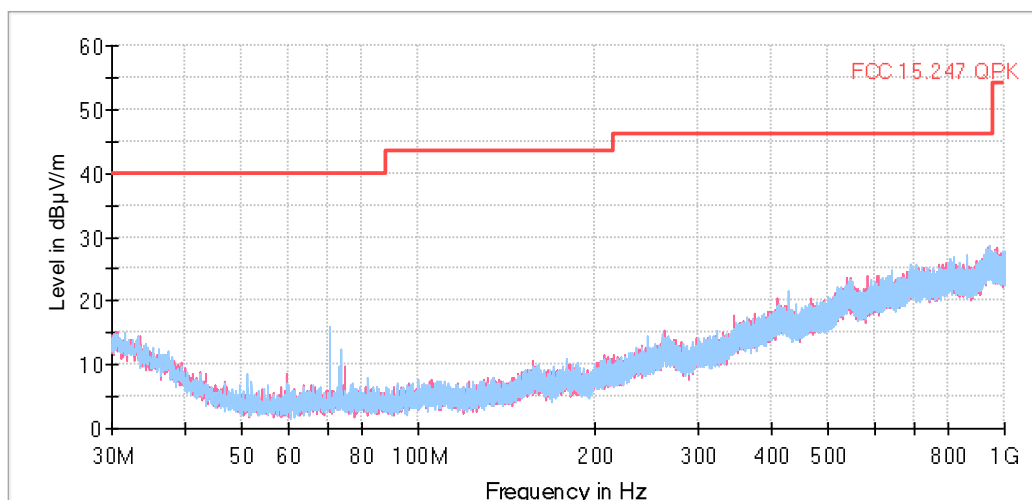
Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.87908	51.86	V	Peak

Verdict: PASS

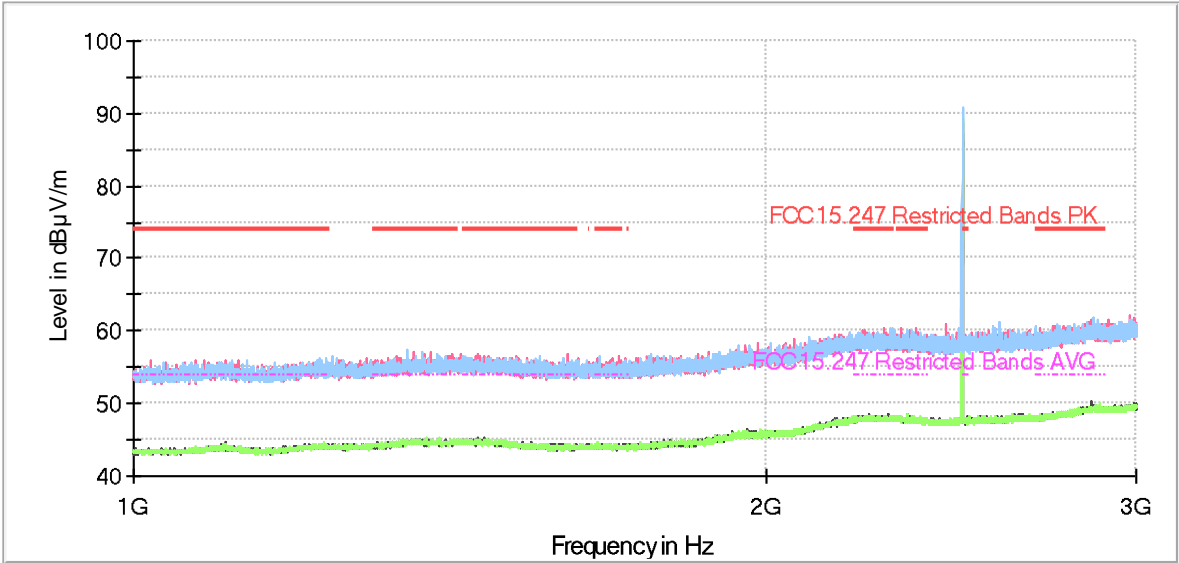
FREQUENCY RANGE 9 kHz - 30 MHz (worst case):



FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

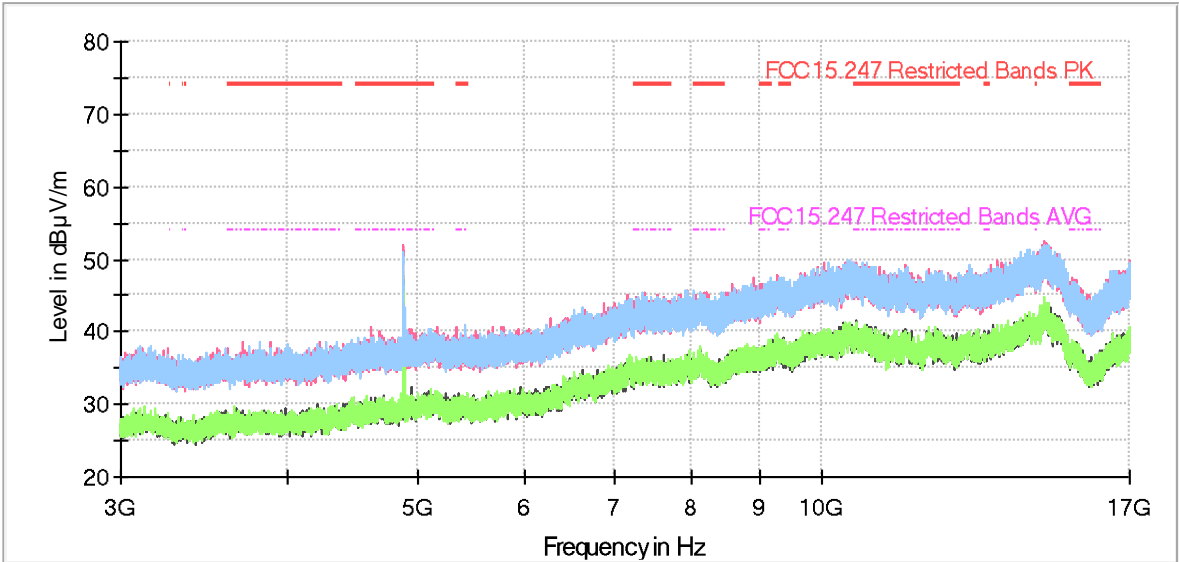


FREQUENCY RANGE 1 – 3 GHz (worst case):

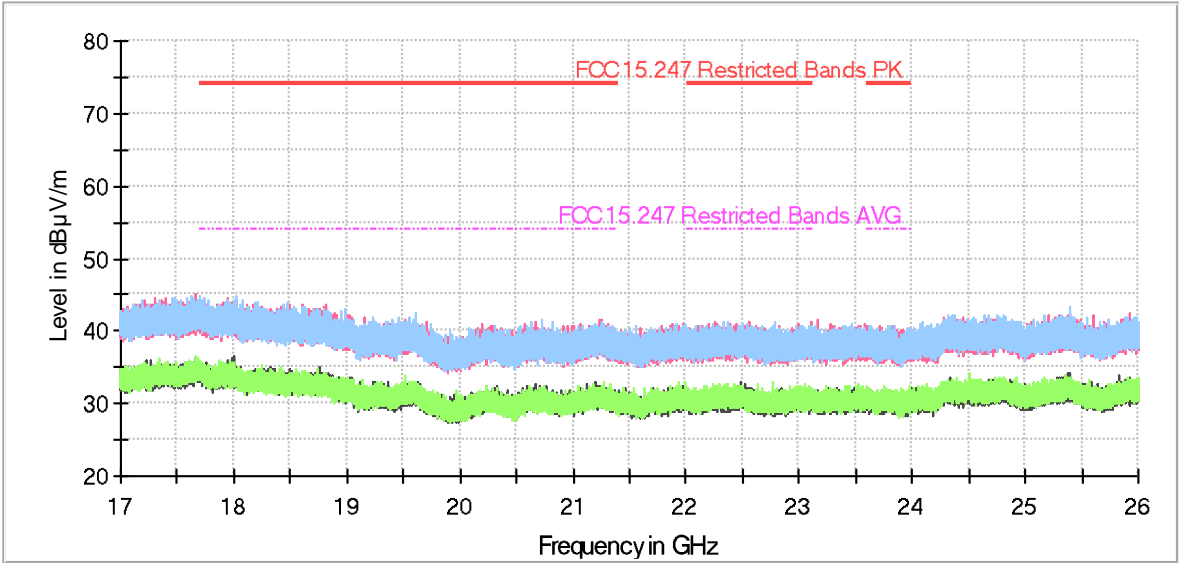


The peak above the highest limit is the Bluetooth LE carrier frequency.

FREQUENCY RANGE 3 – 17 GHz (worst case):



FREQUENCY RANGE 17 – 26 GHz (worst case):



- **Simultaneous transmission Proprietary protocol 2.4 GHz, SRD 10.667 MHz**

Frequency range 9 kHz - 30 MHz

The spurious emissions do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement uncertainty (dB): $< \pm 2.99$

Frequency range 30 MHz - 1 GHz

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected at less than 20 dB below the limit.

Measurement uncertainty (dB): $< \pm 5.08$

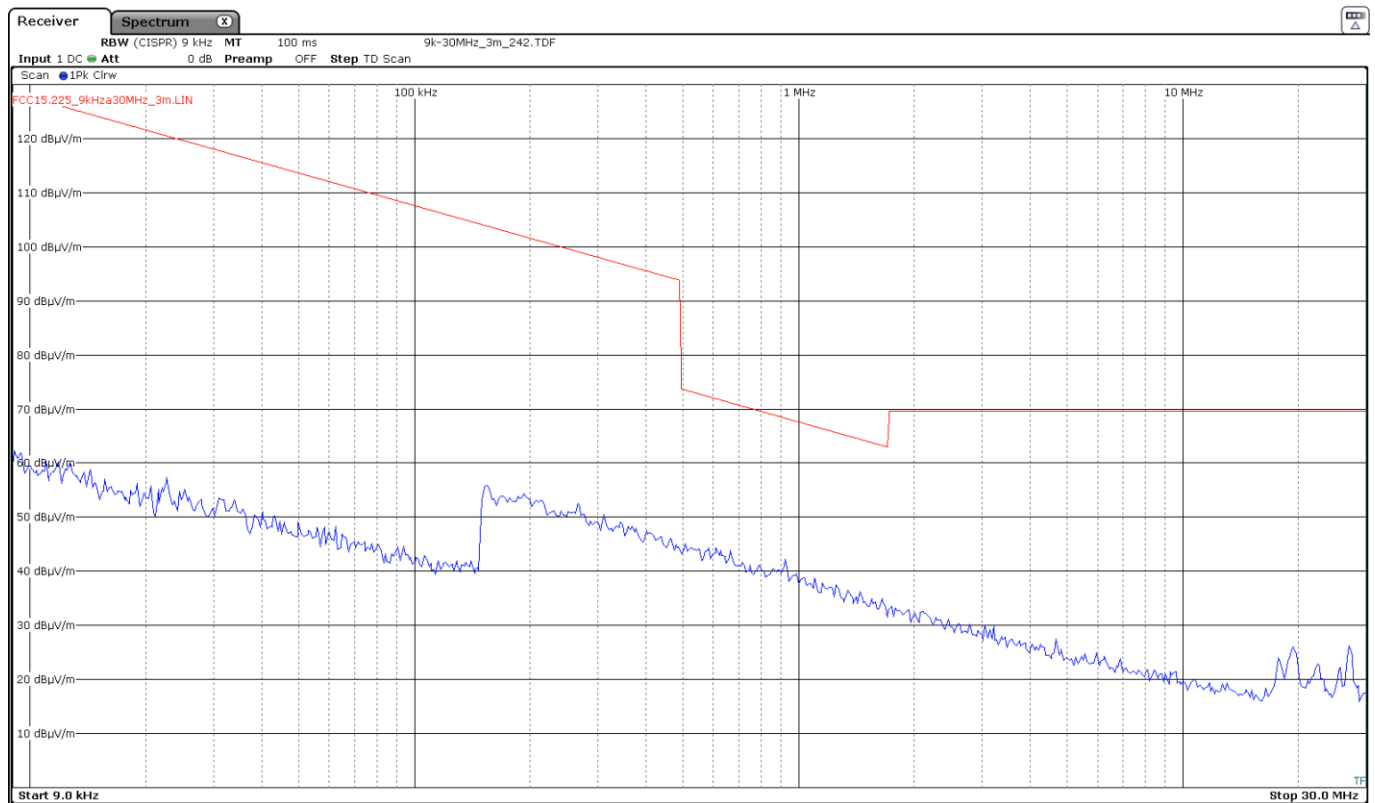
Frequency range 1 - 26 GHz

Spurious frequencies detected closest to the limit:

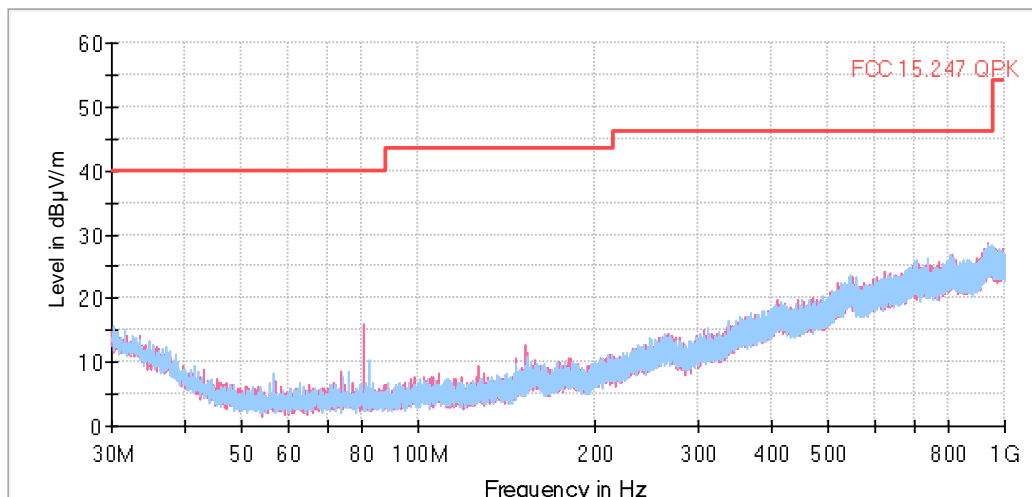
Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.96042	47.44	H	Peak

Verdict: PASS

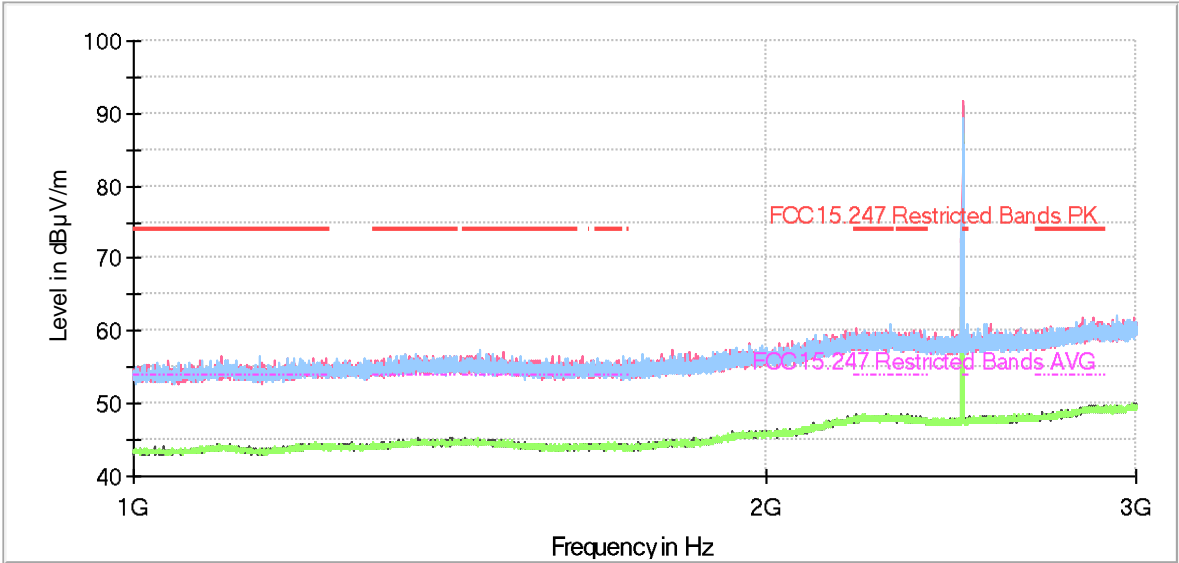
FREQUENCY RANGE 9 kHz - 30 MHz (worst case):



FREQUENCY RANGE 30 MHz - 1 GHz (worst case):

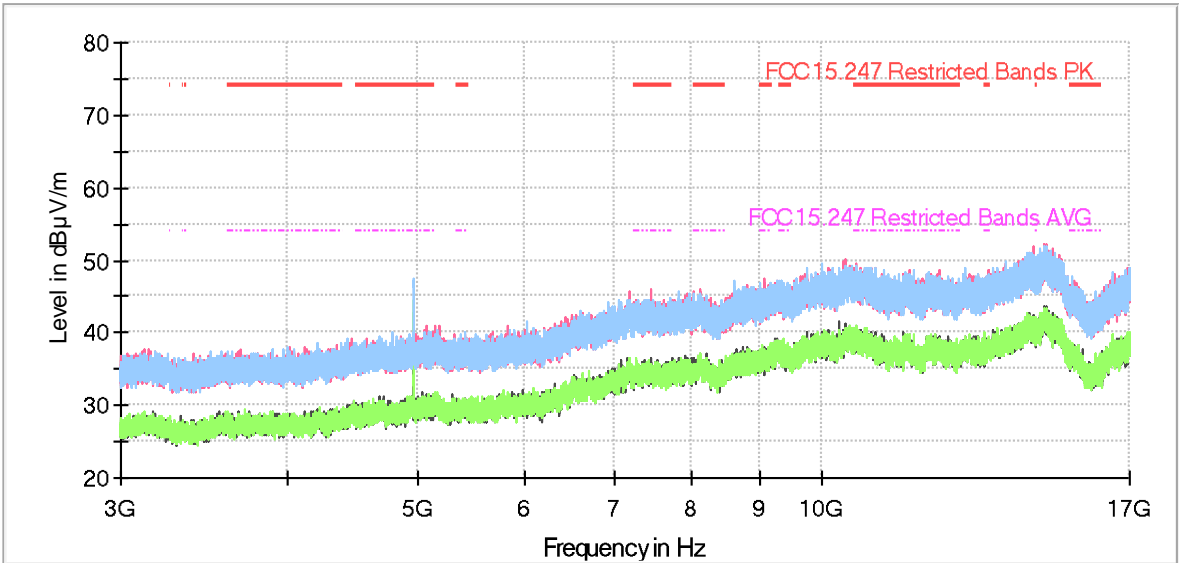


FREQUENCY RANGE 1 – 3 GHz (worst case):



The peak above the highest limit is the Proprietary protocol 2.4 GHz carrier frequency.

FREQUENCY RANGE 3 – 17 GHz (worst case):



FREQUENCY RANGE 17 – 26 GHz (worst case):

