



Test report No:  
NIE: 64733RRF.003A1

## Partial Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Headphone Emitter Module
(*) Trademark	Jaguar – Land Rover
(*) Model and /or type reference	HEM
Other identification of the product	HW version: C2 SW version: 7.2.1 FCC ID: 2AE5I-HEM IC: 2145A-HEM
(*) Features	Bluetooth
Applicant	Jaguar Land Rover Jaguar Land Rover, Banbury Road, Gaydon, CV35 0RR, UK
Test method requested, standard	USA FCC Part 15.247 (10-1-18 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-18 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 (April 2018). 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: - Transmitter out of band radiated emissions with simultaneous transmissions.
Approved by (name / position & signature)	José Carlos Luque RF Lab. Supervisor

Date of issue	2020-08-06
Report template No	FDT08_22 (*) "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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## General conditions

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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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## Uncertainty

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

## Data provided by the client

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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 HEM is an Original Equipment Telematic Control Unit. Provides in car-connectivity for OEM telematic services.

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.

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

Control Nº	Description	Model	Serial Nº	Date of reception
62417/210	Headphone Emitter Module	HEM	E440000705	2020/05/19

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
62417/104	Harness	--	--	2020/02/18
62417/011	Interface Board	--	--	2019/12/26

Sample S/01 has undergone the following test(s): All Radiated tests indicated in Appendix A.

## Test sample description

Ports.....:	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded	Coupled to patient <sup>(4)</sup>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Supplementary information to the ports.....:						
Rated power supply .....	Voltage and Frequency	Reference poles				
		L1	L2	L3	N	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		X	DC:13.5V			
		<input type="checkbox"/>	DC:			

Rated Power .....	1W		
Clock frequencies.....			
Other parameters .....			
Software version .....	7.2.1		
Hardware version .....	C2		
Dimensions in cm (W x H x D) ....	12.82 x 7.12 x 2.3		
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"/> X Other: Inside the car		
Modules/parts.....	Module/parts of test item	Type	Manufacturer
Accessories (not part of the test item) .....	Description	Type	Manufacturer
	M8 ADC Amplifier	C2	Lear
	Media Converter		
	Pcan CAN-simulator	Pcan	PEAK System
Documents as provided by the applicant .....	Description	File name	Issue date

<sup>(3)</sup> Only for Medical Equipment

## Identification of the client

Lear Corporation Engineering GmbH  
Butzweilerhofallee 2-4. 50829 Cologne - GERMANY

## Testing period and place

<b>Test Location</b>	DEKRA Testing and Certification S.A.U.
<b>Date (start)</b>	2020-06-19
<b>Date (finish)</b>	2020-06-22

## Document history

Report number	Date	Description
64733RRF.003	2020-07-31	First release
64733RRF.003A1	2020-08-06	Second release. A sentence in "Summary" section is added to indicate the full report. This modification test report cancels and replaces the test report 64733RRF.003.

## Environmental conditions

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

<b>Temperature</b>	Min. = 15 °C Max. = 35 °C
<b>Relative humidity</b>	Min. = 20 % Max. = 75 %
<b>Air pressure</b>	Min. = 860 mbar Max. = 1060 mbar

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

<b>Temperature</b>	Min. = 15 °C Max. = 35 °C
<b>Relative humidity</b>	Min. = 20 % Max. = 75 %
<b>Air pressure</b>	Min. = 860 mbar Max. = 1060 mbar

## Remarks and comments

The tests have been performed by the technical personnel: José Gabriel Pendón and Miguel Angel Torres.

Used instrumentation:

<u>Radiated Measurements:</u>	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2. Biconical/Log Antenna ETS LINDGREN 3142E	2020/04	2023/04
3. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2019/10	2021/10
4. DC Power Supply Keysight Technologies U8002A	N.A.	N.A.
5. Digital multimeter FLUKE 175	2019/10	2020/10
6. Broadband Horn antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
7. Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2018/07	2021/07
8. RF pre-amplifier 1-18 GHz Bonn Elektronik BLMA 0118-1M	2020/05	2021/05
9. Low Noise Amplifier G>30dB, 18 - 40 GHz BONN ELEKTRONIK BLMA 1840-1M	2019/02	2021/02
10. Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV40	2019/10	2021/10
11. RF pre-amplifier 10 MHz-6 GHz Bonn Elektronik BLNA 0160-01N	2020/02	2021/02

## 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 15.247, 15.209 / RSS-247, RSS-Gen Emission limitations radiated (Transmitter)	P	(1) (2)
<u>Supplementary information and remarks:</u>		
(1) Only co-location radiated spurious emission test was requested. (2) Report 64733RRF.003 is partial test report of the full report 64733.RRF002.		

## **Appendix A: Test results.**

## INDEX

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## TEST CONDITIONS

### POWER SUPPLY (V):

V nonimal: 13.5 Vdc  
 Type of Power Supply: External DC (Car battery).

### ANTENNA:

Antenna Gain[dBi]				
Freq. [MHz]	Integrated Antenna BT1	Integrated Antenna BT2	Integrated Antenna BT3	Integrated Antenna BT4
2402	1,12	0,65	3,26	1,17
2441	0,75	-0,38	2,38	0,71
2480	-0,38	-1,79	-0,02	0,09

### RADIOS AND CHANNELS TESTED:

Bluetooth EDR model CS3BT4 / FHSS		
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	0	2402

Bluetooth EDR model CS2BT3 / FHSS		
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	39	2441

Bluetooth EDR model CS1BT2 / FHSS		
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	78	2480

Bluetooth EDR model CS0BT1 / FHSS		
Mode:	Basic Rate (GFSK - 1DH5)	
Channel Spacing:	1 MHz	
Frequency Range:	2402 MHz to 2480 MHz	

Transmit Channel:	Channel	Channel Frequency (MHz)
	2	2404

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/modulation 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.

#### **Selected Transmission Mode for each Radio:**

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

\* Bluetooth Basic Rate: Transmitter radiated spurious emissions tests were performed with the four Bluetooth EDR modules (CS3BT4, CS2BT3, CS1BT2 and CS0BT1) of the EUT transmitting in Basic Rate mode because its power is higher than EDR mode.

#### **TESTED SIMULTANEOUS TRANSMISSION MODES:**

\* **Co-Location Bluetooth**, with the EUT configured to simultaneously transmit four signals at maximum output power:

Bluetooth Basic Rate in 1DH5 mode.

#### **RADIATED MEASUREMENTS:**

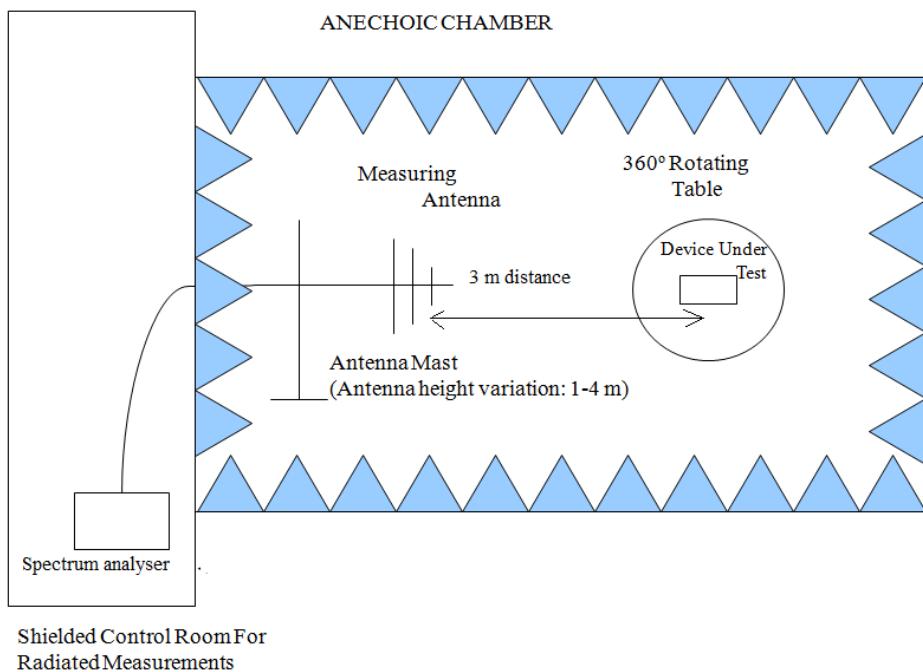
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1m for the frequency range 17 GHz-26 GHz (17 GHz-26 GHz horn antenna).

For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

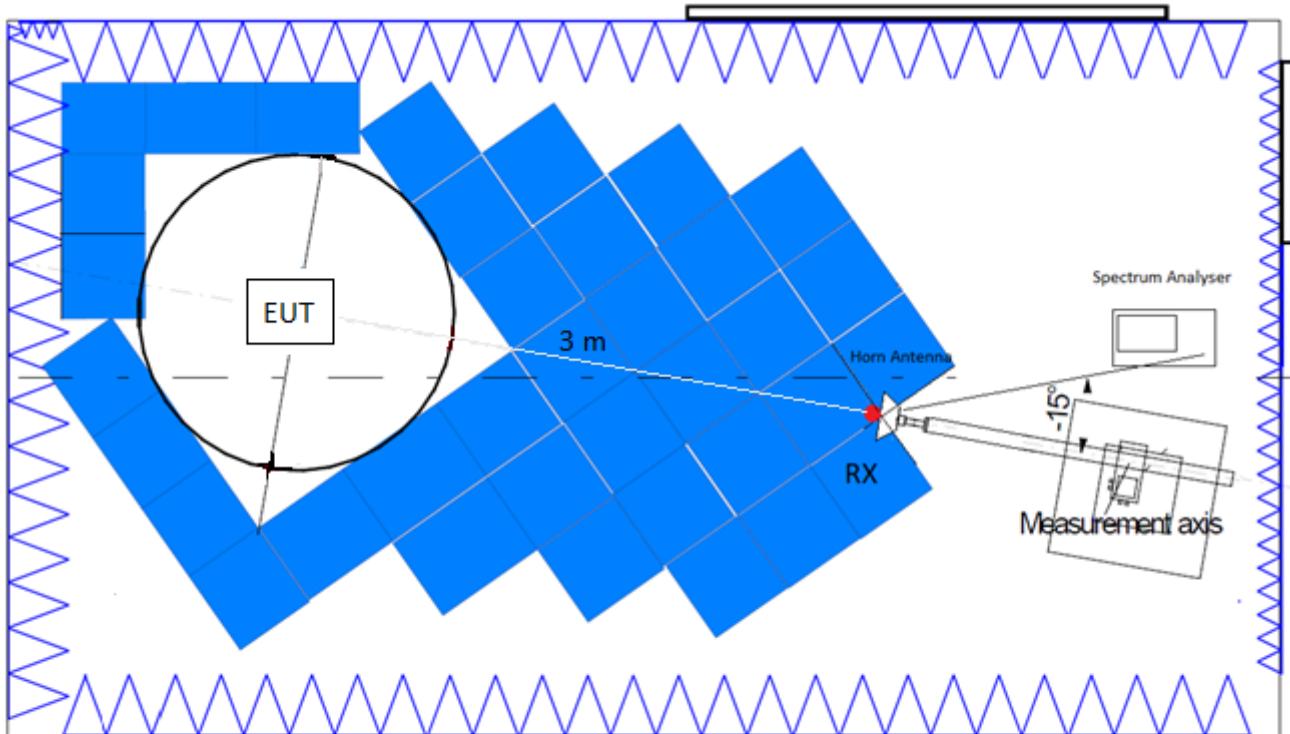
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

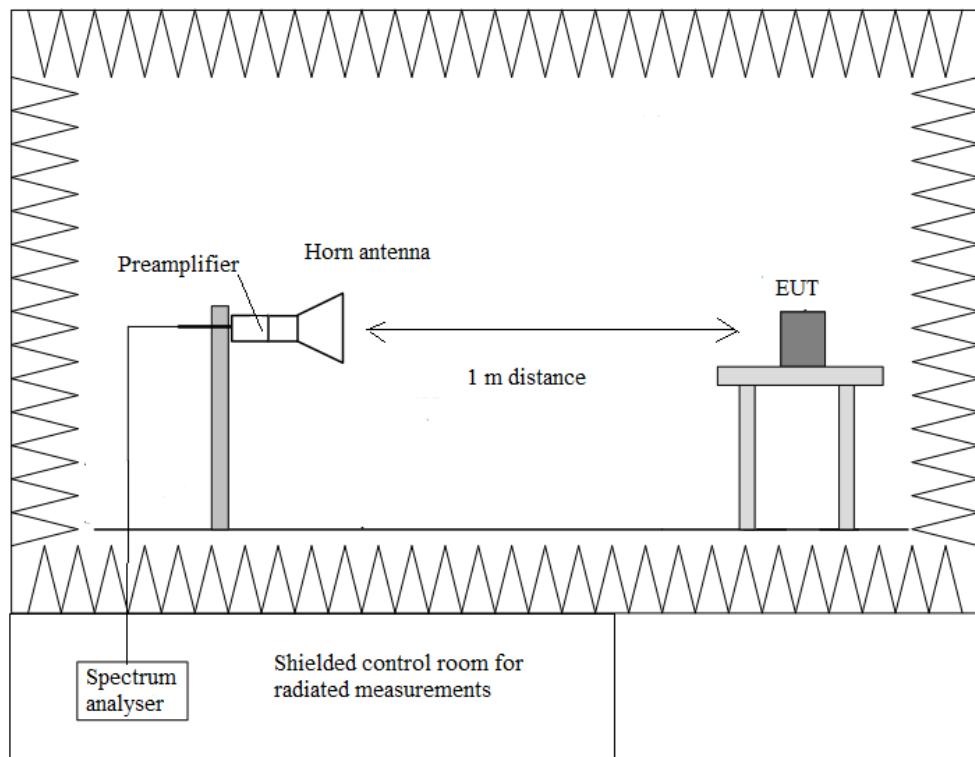
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup from 17 GHz to 26 GHz:



## FCC 15.247 (d) / RSS-247 5.5. Emission limitations radiated (Transmitter)

### SPECIFICATION:

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

Frequency Range (MHz)	Field strength ( $\mu$ V/m)	Field strength (dB $\mu$ 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	-	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
960 - 25000	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 of simultaneous transmission in all relevant tests channels:

- Mode Bluetooth EDR:

Bluetooth EDR module CS3BT4:	Low Channel (2402 MHz). GFSK.
Bluetooth EDR module CS2BT3:	Middle Channel (2441 MHz). GFSK.
Bluetooth EDR module CS1BT2:	High Channel (2480 MHz). GFSK.
Bluetooth EDR module CS0BT1:	Low Channel (2404 MHz). GFSK.

LIMIT: The spurious frequencies were measured at 3 meter. The limit of the test is determined by:

Frequency Range	Detector	Limit at 3m (dB $\mu$ V/m)
30 MHz to 88 MHz	Quasi-PK	40 dB $\mu$ V/m
88 MHz to 216 MHz	Quasi -PK	43.5 dB $\mu$ V/m
216 MHz to 960 MHz	Quasi -PK	46 dB $\mu$ V/m
960 MHz to 1 GHz	Quasi -PK	54 dB $\mu$ V/m
1 to 26 GHz	PK	74 dB $\mu$ V/m(*) (**)
1 to 26 GHz	AVG	54 dB $\mu$ V/m (**)

(\*) Radiated emissions which fall in the non-restricted bands.

(\*\*) Radiated emissions which fall in the restricted bands, as defined in §15.205(a).

### Frequency range 30 MHz - 1 GHz

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

Spurious frequencies detected closest to the limit:

Spurious frequency (MHz)	Emission Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
34.2195	17.37	40	V	Quasi-peak	<± 4.99
223.9515	20.69	46	V	Quasi-peak	<± 4.99
308.002	23.26	46	H	Quasi-peak	<± 4.99
539.9775	23.53	46	V	Quasi-peak	<± 4.99
931.8575	26.42	46	H	Quasi-peak	<± 4.99

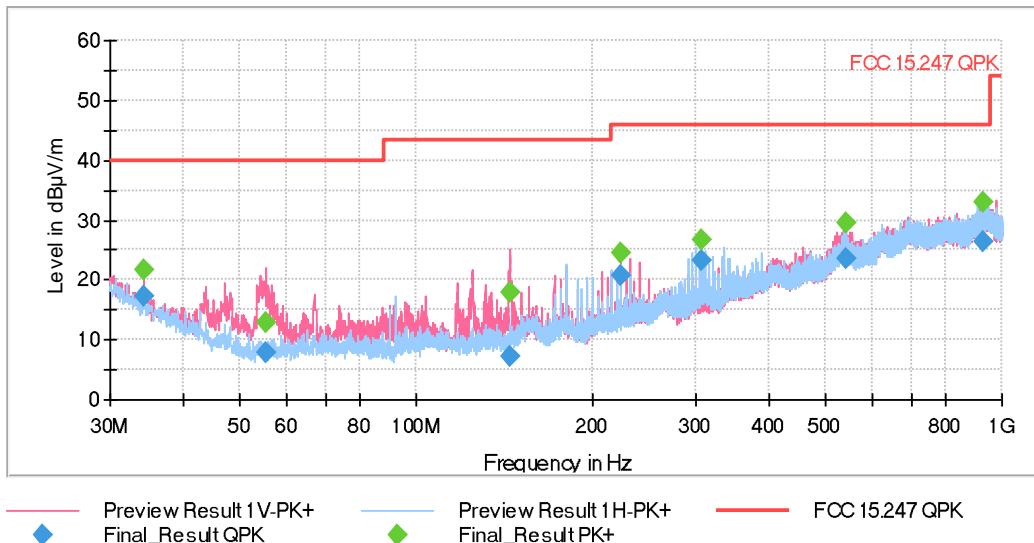
### Frequency range 1 - 26 GHz

Spurious frequencies detected closest to the limit:

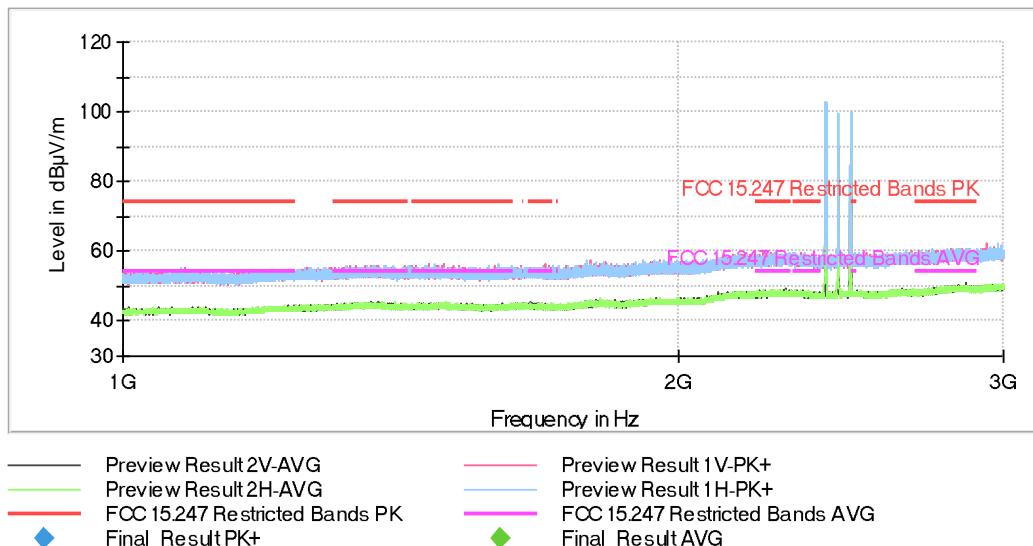
Spurious frequency (GHz)	Emission Level (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.804	53.83	74	V	Peak	<± 4.98
4.882	54.17	74	H	Peak	<± 4.98
	50.31	54		Average	<± 4.98
7.2065	57.31	74	H	Peak	<± 4.98
	50.3	54		Average	<± 4.98
7.3225	53.96	74	H	Peak	<± 4.98
	57.35	74		Peak	<± 4.98
7.439	46.5	54	H	Average	<± 4.98
	58.33	74		Peak	<± 4.98
7.440	53.62	54		Average	<± 4.98

Verdict: PASS

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

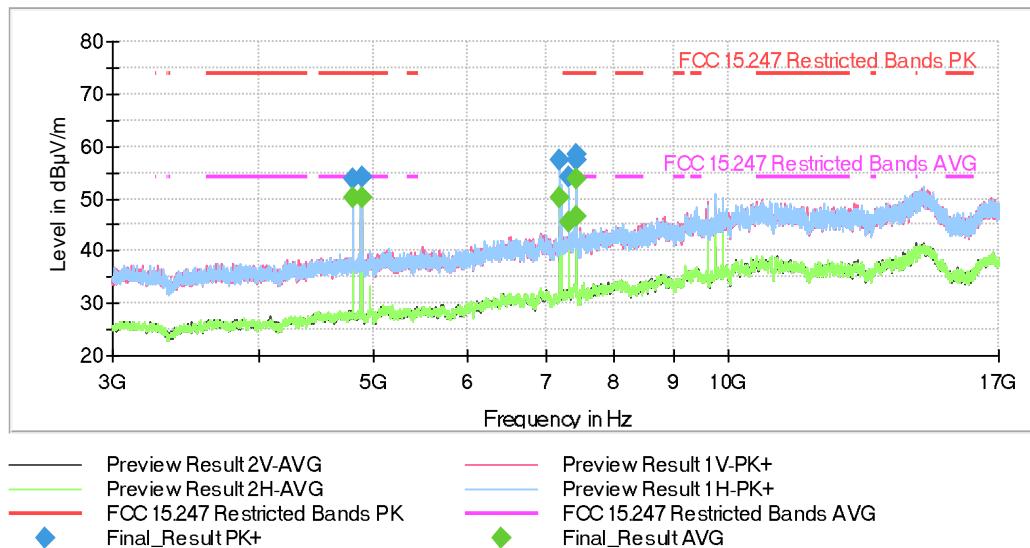


**FREQUENCY RANGE 1 - 3 GHz (worst case):**

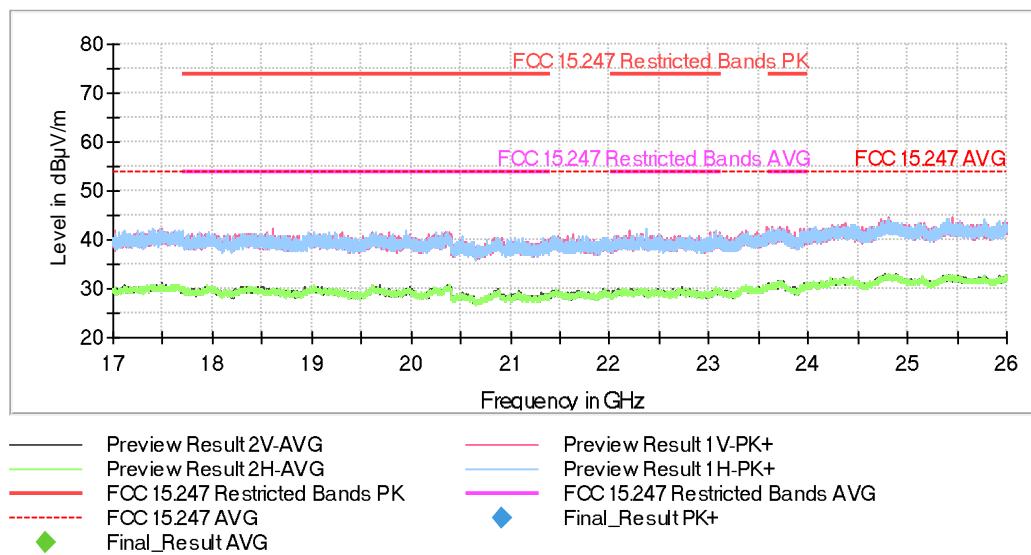


The peaks above the limit are the carrier frequencies of the four Bluetooth EDR modules (CS3BT4, CS2BT3, CS1BT2 and CS0BT1)

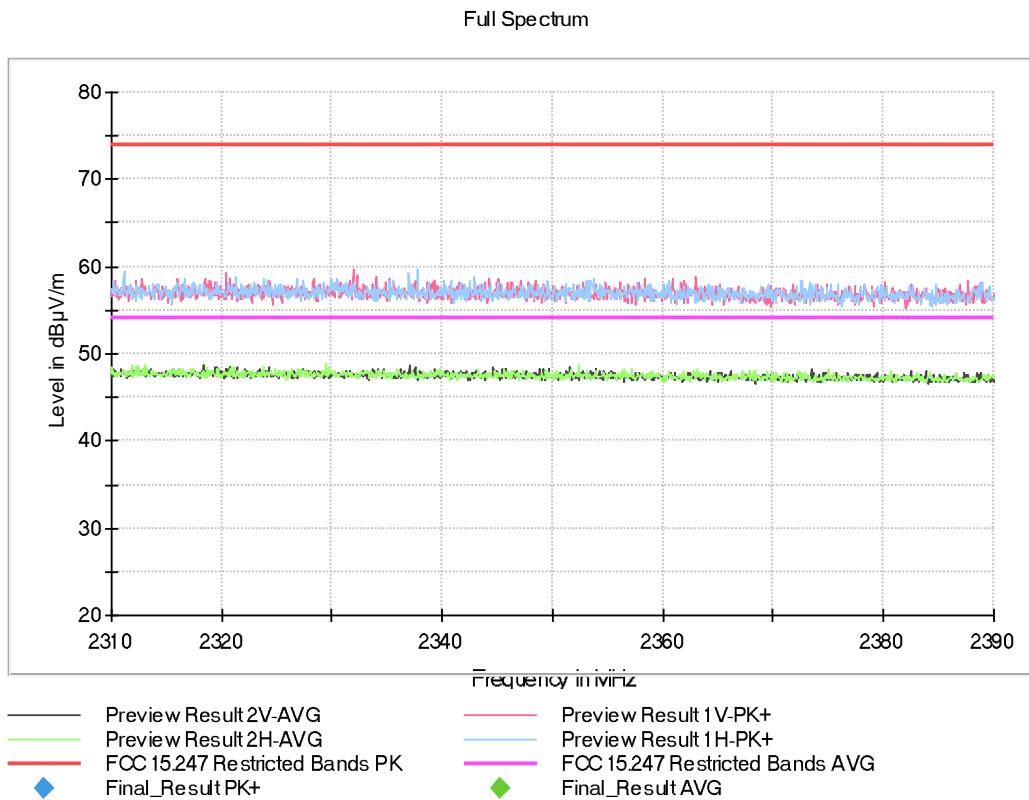
**FREQUENCY RANGE 3 - 17 GHz (worst case):**



**FREQUENCY RANGE 17 - 26 GHz (worst case):**



**FREQUENCY RANGE 2.31-2.39 GHz (worst case):**



**FREQUENCY RANGE 2.4835-2.5 GHz (worst case):**

