DEKRA Testing and Certification, S.A.U.
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C.I.F. A29507456

ISED CABid: ES1909

Test Report No:
NIE: 69536RRF.011A1

Partial Test Report
USA FCC Part 15.247, 15.407, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Automotive infotainment System
(*) Trademark	BMW
(*) Model and /or type reference	MGU FQ
Other identification of the product	HW: 3.2 SW: K18_21w43.1-1 FCC ID: T8GMGUFQ IC: 6434A-MGUFQ
(*) Features	USB 2.0 (including support for Apple Devices), Bluetooth, WLAN Modul 2.4 / 5 GHz, GNSS, AR-CAM input, Video-out APIX3, CAN, 100Base-T1 and 1000Base-T1
Applicant	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16, 76307 KARLSBAD, GERMANY
Test method requested, standard	USA FCC Part 15.407 (10-1-20) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. 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. Guidance for Compliance Testing of Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017. 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)	Rafael López EMC/RF Lab. Manager  2022.01.26 08:50:17 +01'00'
Date of issue	2022-01-25
Report template No	FDT08_23 (*) "Data provided by the client"

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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. 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 consists of a MGU Head-Unit. The main functionalities are: Navigation, USB, voice recognition and several interfaces to the vehicle and Bluetooth / WLAN. The Head-unit provides different interfaces like: Video-out APIX2 (for the connection of an external Display), 3 USB interfaces (including support for Apple devices), CAN and 100Base-T1.

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
69536B/036	Automotive infotainment System	MGU FQ	B49299M278000021	2021/11/11

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
69536B/026	OABR Converter Board	--	--	2021/11/11
69536B/027	OABR Converter Cable	--	--	2021/11/11
69536B/028	Power Cable DC	--	--	2021/11/11
69536B/029	Ethernet Cable	--	--	2021/11/11
69536B/030	Ethernet to USB Adapter	EU-4306	--	2021/11/11
69536B/031	Power Harness	--	--	2021/11/11

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

Test sample description

Ports……:	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	2xFakra		☒	☒	☐
	USB1 connector – CONM-SM 4POL ROS D4S20Y-40MA5-B		☐	☒	☐
	USB2 connector – CONM-SM 4POL ROS D4S20Y-40MA5-C		☐	☒	☐
	USB3 connector – CONM-SM 4POL ROS D4S20Y-40MA5-E		☐	☒	☐
	APIX2 connector – CONM-SM 4+2POL ROS 99S22A-40MA5-D		☒	☐	☐
	Car Main-connector – CONM 16POL TYC 2300483-s		☒	☐	☐
	Ethernet BroadR-Reach, 100 BASE-T1		☒	☐	☐
	GNSS connector		☒	☒	☐

Supplementary information to the ports……:	-						
Rated power supply ..... :	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: 10.8 to 15.6					
	☐	DC:					
Rated Power..... :	-						
Clock frequencies..... :	-						
Other parameters ..... :	-						
Software version..... :	K18_21w43.1-1						
Hardware version ..... :	3.2						
Dimensions in cm (W x H x D) ... :	-						
Mounting position ..... :	☐	Table top equipment					
	☐	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☒	Other: Automotive dashboard					

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

HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH

BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-12-14
Date (finish)	2021-12-20

Document history

Report number	Date	Description
69536RRF.011	2022-01-12	First release
69536RRF.011A1	2022-01-25	First modification due to typos. This modification test report cancels and replaces the test report 69536RRF.011

Environmental conditions

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

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

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Nicolás Salguero and Miguel Manuel López.

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.	Biconical/Log Antenna ETS LINDGREN 3142E	2020/04	2023/04
4.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
5.	Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
6.	RF pre-amplifier 10 MHz-6 GHz Bonn Elektronik BLNA 0160-01N	2021/03	2022/03
7.	RF Preamplifier, 40 dB ,1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2021/06	2022/06
8.	Pre-Amplifier G>30dB 17-40GHz BONN ELEKTRONIK BLMA 1840-4A	2021/09	2022/09
9.	EMI Test Receiver ROHDE AND SCHWARZ ESR7	2021/11	2023/11
10.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2020/07	2022/07
11.	DC Power Supply, 30V/5A KEYSIGHT TECHNOLOGIES U8002A	N/A	N/A
12.	Digital Multimeter FLUKE 179	2021/06	2022/06

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 15.209 (a), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2, 6.2.4.2: - Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks: (1) Only Co-Location radiated spurious emission test was requested.		

Appendix A: Test results

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TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnominal: 12 Vdc

Type of Power Supply: DC External (Car Battery).

ANTENNA (*):

Bluetooth EDR:

Type of Antenna: External antenna.

Maximum Declared Antenna Gain: -2.5 dBi (Antenna gain plus antenna cable loss).

802.11 a20 / n2040 / ac2040 / ac80 SISO:

Type of Antenna: External antenna.

Maximum Declared Antenna Gain: -2.8 dBi (Antenna gain plus antenna cable loss).

RADIOS AND CHANNELS TESTED (*):

* Co-location Bluetooth EDR, WLAN 5 GHz band U-NII-3:

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

	WLAN 5 GHz (IEEE 802.11 a20/n2040/ac204080) / U-NII-3	
Mode:	802.11 a20: 6 Mbps	
Frequency Range:	5725 MHz to 5850 MHz	
Channel Spacing:	20 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	Low: 149	5745

The test set-up was made in accordance to the general provisions of FCC DTS Measurement 558074 D01 DTS Meas Guidance v05r2 dated April 2, 2019 and FCC Unlicensed National Information Infrastructure (U-NII) Devices 789033 D02 General U-NII Test Procedures New Rules v02r01 dated Dec 14, 2017.

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.

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 EUT transmitting in Basic Rate mode because its power is higher than the other modes.

* WLAN 5 GHz band U-NII-3: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 a / 20 / 6 Mbps mode configuration as this mode was found as the worst-case for spurious emissions than all the other WLAN 5 GHz band U-NII-3 SISO modes.

TESTED SIMULTANEOUS TRANSMISSION MODES:

*** Co-location Bluetooth EDR, WLAN 5 GHz band U-NII-3**, with the EUT configured to simultaneously transmit three signals at maximum output power:
Bluetooth Basic Rate in 1-DH5 mode, WLAN 5 GHz band U-NII-3 in 802.11 a / 20 / 6 Mbps.

RADIATED MEASUREMENTS:

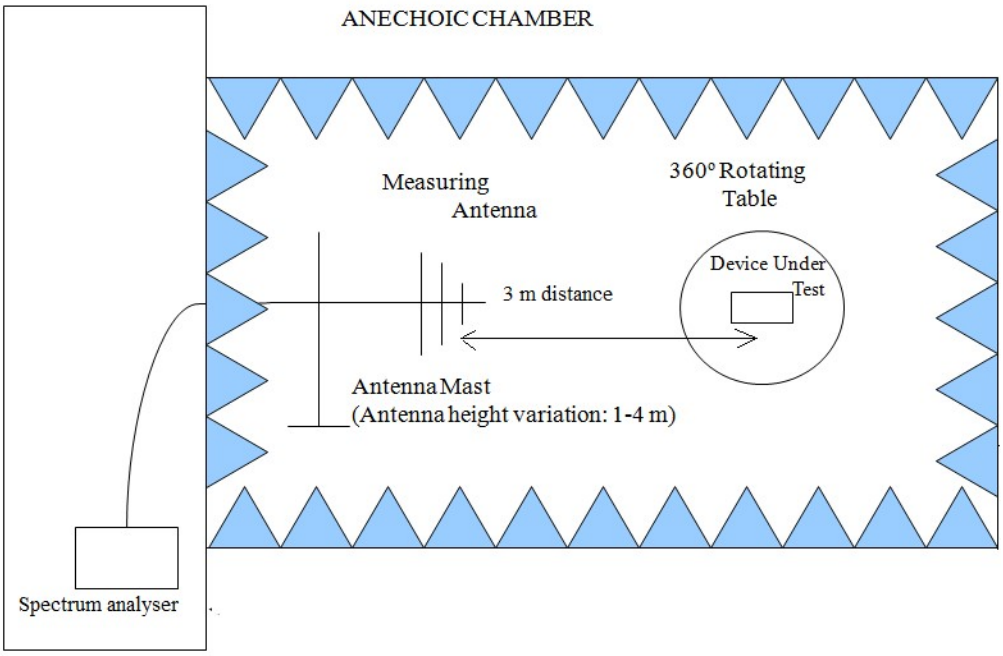
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1m for the frequency range 17 GHz-40 GHz (17 GHz-40 GHz horn antenna).

For radiated emissions in the range 17 GHz-40 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.

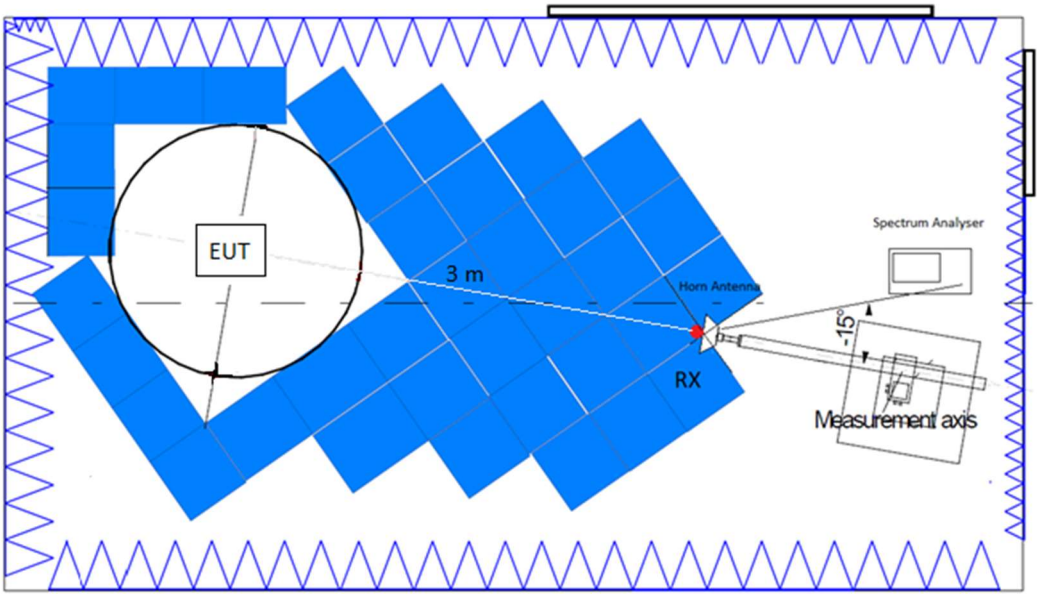
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

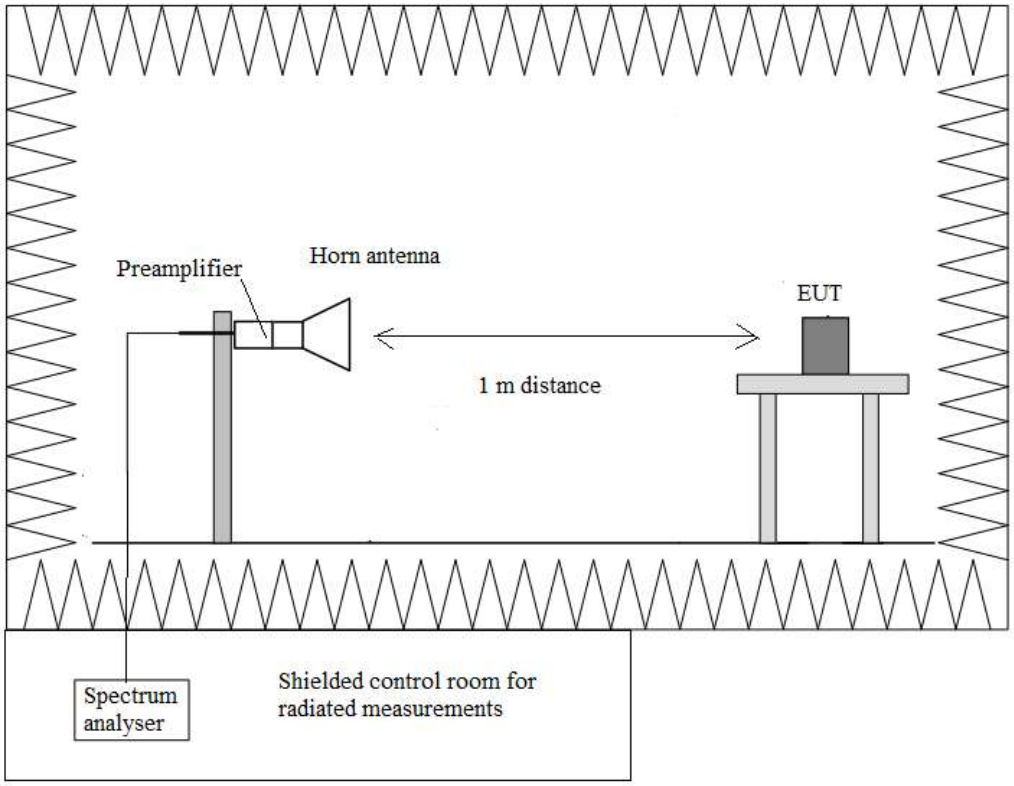
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



FCC 15.209 (a), 15.247 (d), 15.407 (b) / RSS-Gen 8.9, RSS-247 5.5, 6.2.1.2 & 6.2.4.2 Emission limitations radiated (Transmitter)

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 (µV/m)	Field strength (dBµV/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 360º 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-17 GHz and at distance of 1 m for the frequency range 17 GHz-40GHz.

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:

- **Co-location mode Bluetooth EDR, WLAN 5 GHz band U-NII-3 802.11 a20:**

Bluetooth EDR:	Low Channel (2402 MHz). Basic Rate. GFSK.
WLAN 5 GHz U-NII-3 802.11 a20:	Low Channel (5745 MHz). BW: 20 MHz. 6 Mbps.

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

Frequency Range	Detector	Limit at 3m (dBµV/m)
30 MHz to 88 MHz	Quasi-peak	40 dBµV/m
88 MHz to 216 MHz	Quasi-peak	43.5 dBµV/m
216 MHz to 960 MHz	Quasi-peak	46 dBµV/m
960 MHz to 1 GHz	Quasi-peak	54 dBµV/m
1 GHz to 26 GHz	Peak	74 dBµV/m
26 to 40 GHz	Peak	68.23 dBµV/m (*) OR 74 dBµV/m (**)
1 to 40 GHz	Average	54 dBµV/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.

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

Measurement Uncertainty (dB): <± 4.99

Frequency range 1 - 40 GHz:

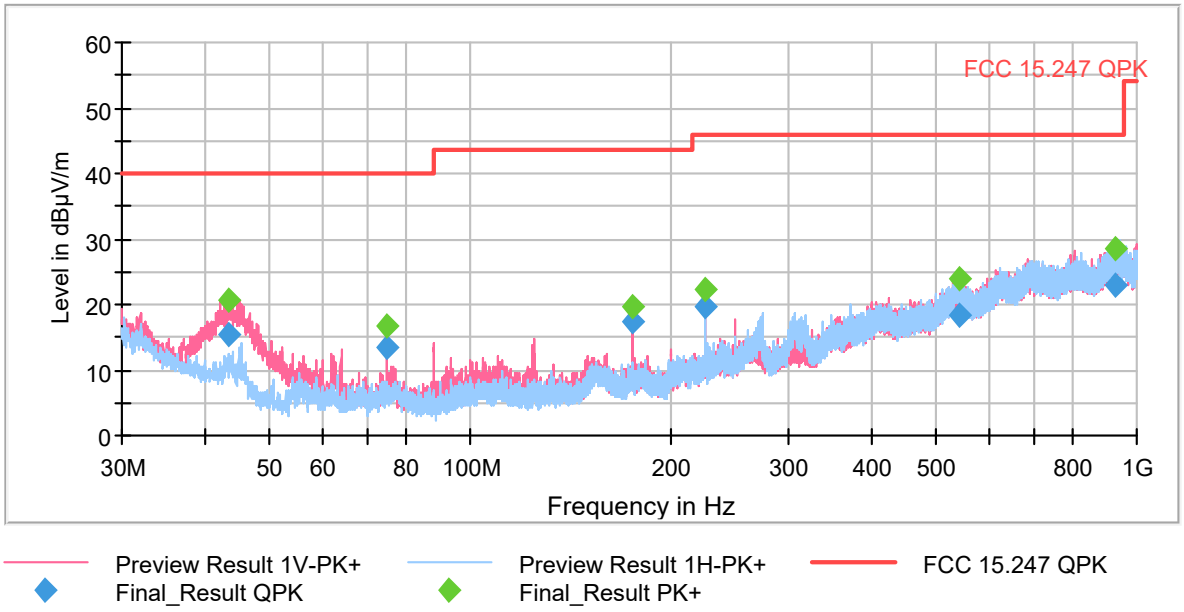
Spurious frequencies closest to the limit:

Spurious frequency (MHz)	Emission Level (dBµV/m)	Polarization	Detector
4981.2	52.56	H	Peak

Measurement Uncertainty (dB): 1 GHz – 17 GHz <± 4.98
17 GHz – 26.5 GHz <± 5.08
26.5 GHz – 40 GHz <± 5.33

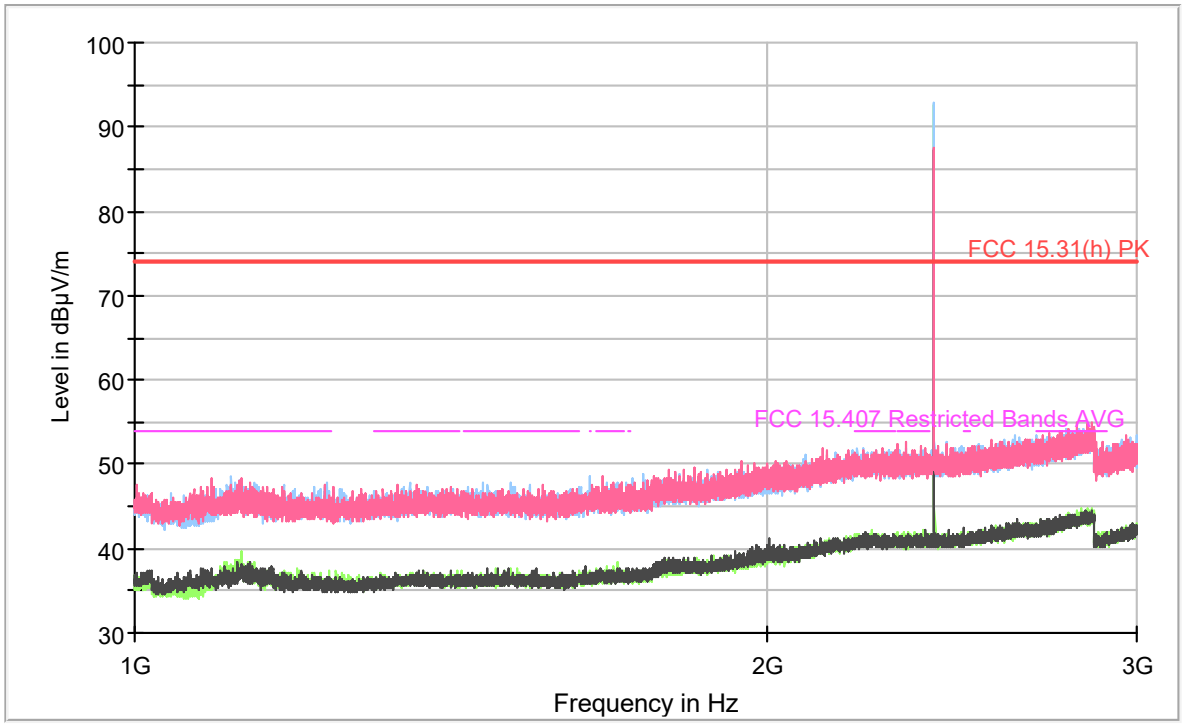
Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:



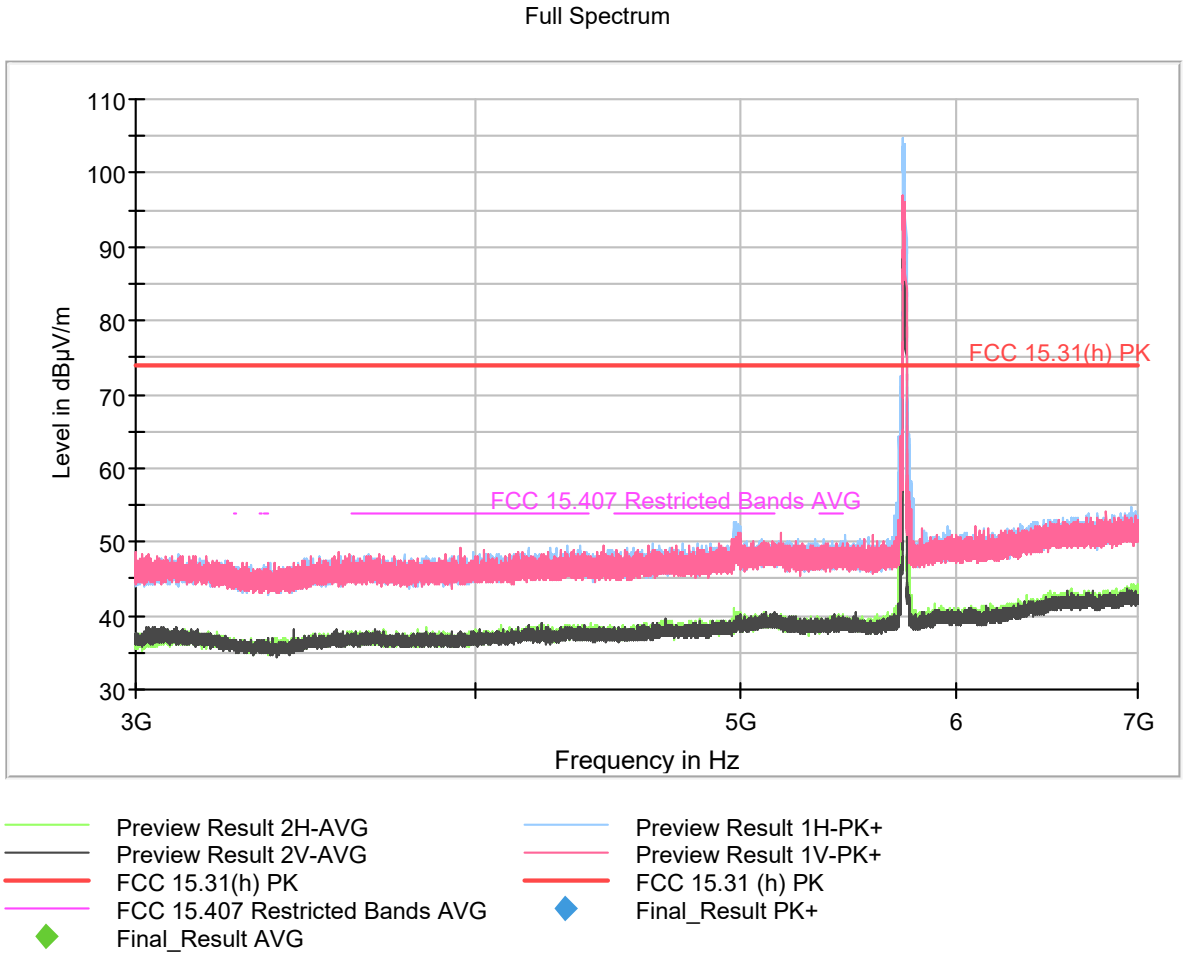
FREQUENCY RANGE 1 - 3 GHz:

Full Spectrum



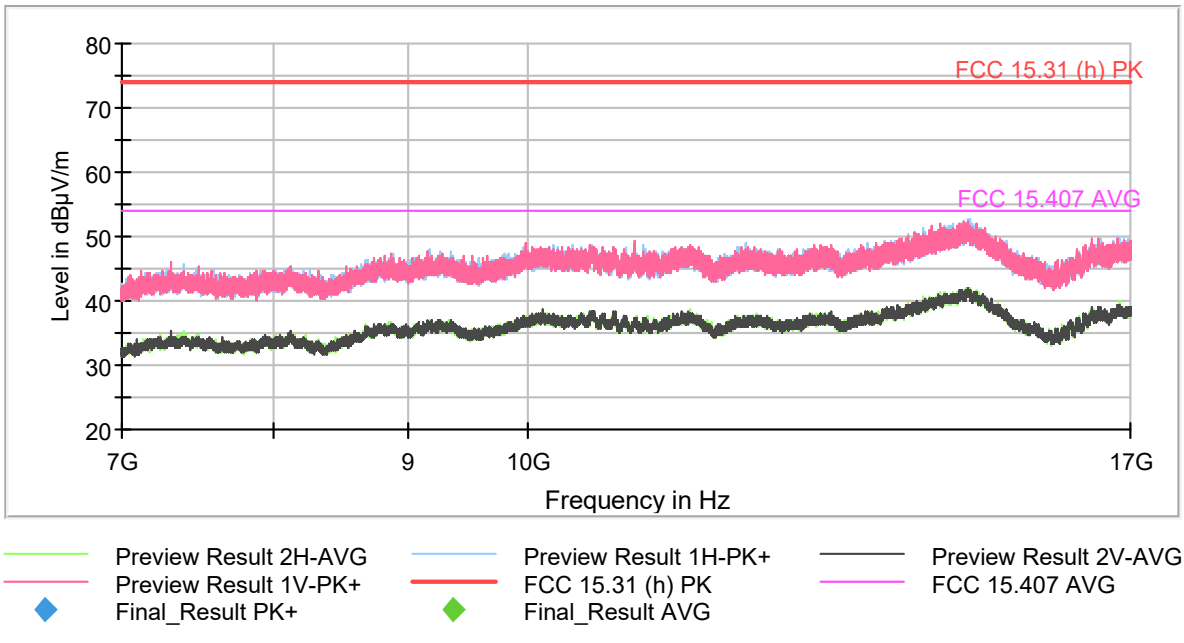
The peak above the highest limit is the Bluetooth EDR carrier frequency.

FREQUENCY RANGE 3 - 7 GHz:

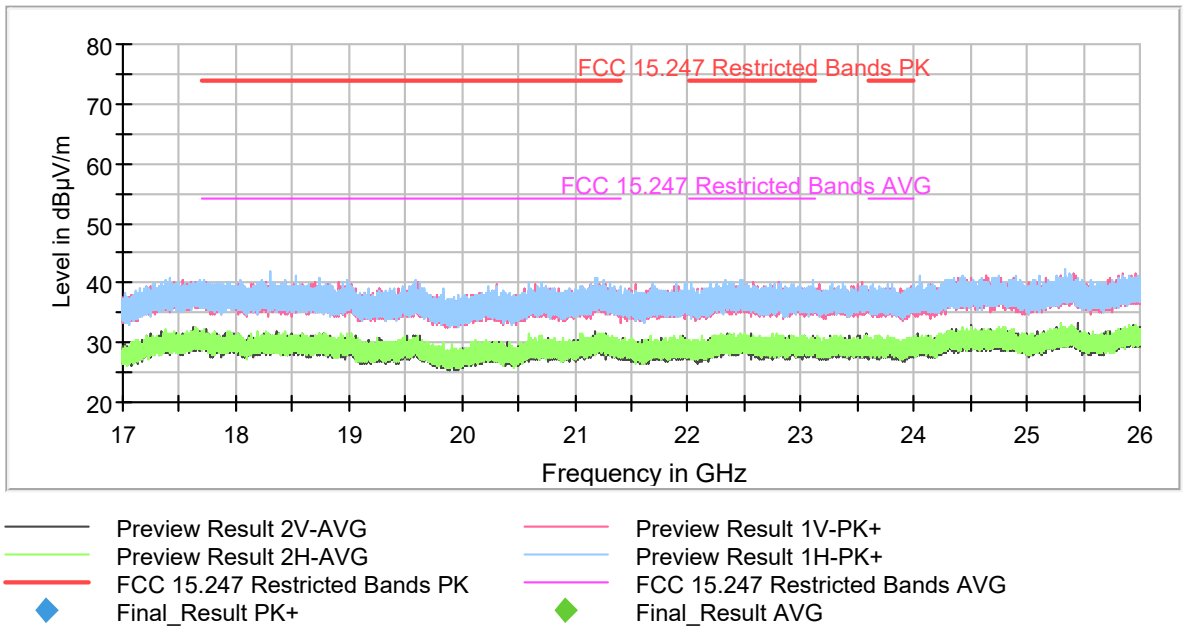


The peak above the highest limit is the WLAN 5 GHz band U-NII-3 carrier frequency.

FREQUENCY RANGE 7 - 17 GHz:

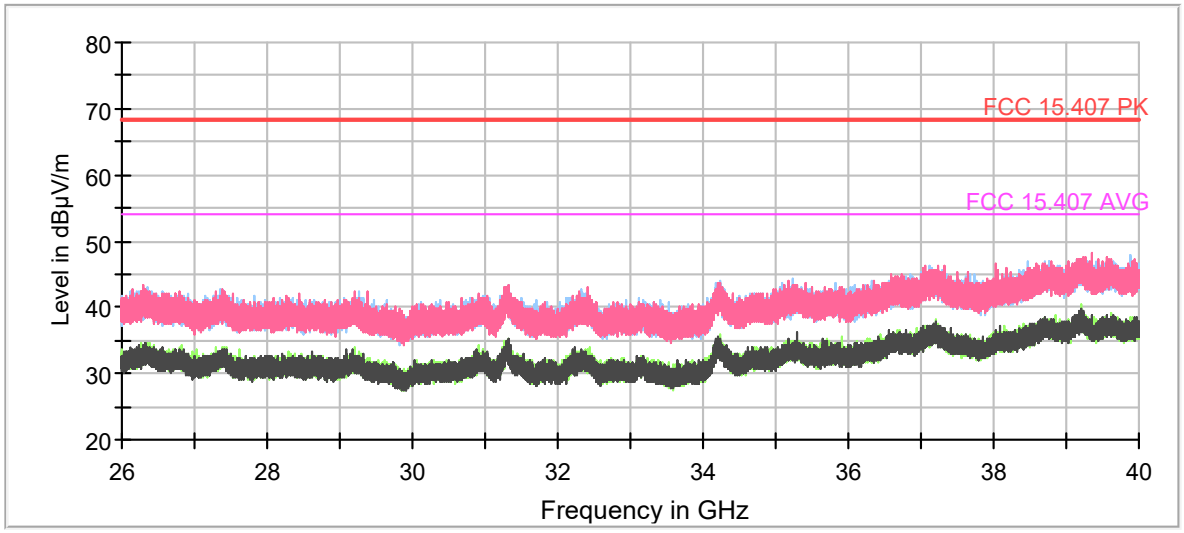


FREQUENCY RANGE 17 - 26 GHz:



Preview Result 2V-AVG
Preview Result 2H-AVG
FCC 15.247 Restricted Bands PK
Final_Result PK+
Preview Result 1V-PK+
Preview Result 1H-PK+
FCC 15.247 Restricted Bands AVG
Final_Result AVG

FREQUENCY RANGE 26 - 40 GHz:



Preview Result 2H-AVG
Preview Result 1V-PK+
Final_Result PK+
Preview Result 1H-PK+
FCC 15.407 PK
Final_Result AVG
Preview Result 2V-AVG
FCC 15.407 AVG