DEKRA Testing and Certification, S.A.U.
Parque Tecnológico de Andalucía
c/ Severo Ochoa nº 2 · 29590 Campanillas · Málaga · España
C.I.F. A29507456

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
79469RRF.003A1

Partial Test Report

USA FCC Part 15.31(h), 15.247, 15.407, 15.209
CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Infotainment Head Unit
(*) Trademark	Marelli
(*) Model and /or type reference	HUAIDP21BY
Other identification of the product	FCC ID: RX2HUAIDP21BY IC: 4983A-HUAIDP21BY
(*) Features	Bluetooth, WLAN a, n, ac: (20/40/80 MHz BW), channel #149 HW version: PRS2.1 SW version: PI26.53
Applicant	Marelli Europe S.p.A. Viale A. Borletti 61/63 – 20011 Corbetta (MI) - ITALY
Test method requested, standard	USA FCC Part 15.31(h) (10-1-23 Edition): Measurement standards. USA FCC Part 15.407 (10-1-23 Edition): Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements. USA FCC Part 15.247 (10-1-23) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-23) Edition: Radiated emission limits; general requirements. CANADA RSS-247 Issue 3 (February 2023). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). 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)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2024-08-09
Report template No.	FDT08_24 (*) "Data provided by the client"

Index

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 is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that covers the performed tests in this report.

DEKRA Testing and Certification is an ISED-recognized accredited testing laboratory, CABid: ES1909, Company Number: 4621A, with the appropriate scope of accreditation that covers the performed tests in this report.

In order to assure the traceability to other national and international laboratories, DEKRA Testing and Certification S.A.U. has a calibration and maintenance program for its measurement equipment.

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.

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.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification S.A.U.
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 radiated emissions of EUT from 30 MHz to 1 GHz is:
Measurement uncertainty ≤ ±5.15 dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 1 GHz to 17 GHz is:
Measurement uncertainty ≤ ±4.28 dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 17 GHz to 26.5 GHz is:
Measurement uncertainty ≤ ±4.89 dB (with factor k = 2).

The total uncertainty of the measurement system for the radiated emissions of EUT from 26.5 GHz to 40 GHz is:
Measurement uncertainty ≤ ±5.02 dB (with factor 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 an Infotainment Head Unit. Infotainment Head Unit, with Bluetooth and Wi-Fi.

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.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	75807_1.1	Infotainment Head Unit	HUAIDP21BY	1ATF3B158F1E	2024-02-05	Element Under Test
S/01	75807_10.1	CONNECTION CABLE	--	--	2024-02-05	Auxiliary Element
S/01	75807_12.1	CONNECTION CABLE	--	--	2024-02-05	Auxiliary Element
S/01	75807_3.1	CAN BOX	--	2026-08	2024-02-05	Auxiliary Element
S/01	75807_5.1	MAIN HARNESS	--	--	2024-02-05	Auxiliary Element
S/01	75807_6.1	CONNECTION CABLE (USB)	--	--	2024-02-05	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Radiated tests.

Test sample description

Ports..... :	Port name and description	Cable			
		Specified max length [m]	Attached during test	Shielded	Coupled to patient(3)
	Main connector (12ways)	>3	[X]	[ ]	[ ]
	MQS connector (8ways)	>3	[X]	[ ]	[ ]
	shielded cables	>3	[X]	[X]	[ ]

	.....	.....	[ ]	[ ]	[ ]

Supplementary information to the ports…… :	.....						
Rated power supply .....:	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	[ ]	AC:	[ ]	[ ]	[ ]	[ ]	[ ]
	[X]	DC: Main and MQS cables: 12 Vdc nominal voltage (9.5 - 16 Vdc)					
	[X]	DC: shielded cables: 12 Vdc nominal voltage (9.5 - 16 Vdc)					
Rated Power .....:	.....						
Clock frequencies.....:	.....						
Other parameters .....:	.....						
Software version .....:	PI26.53						
Hardware version .....:	PRS2.1						
Dimensions in cm (W x H x D) ....:	220 x 160 x 52 mm						
Mounting position .....:	[ ]	Table top equipment					
	[ ]	Wall/Ceiling mounted equipment					
	[ ]	Floor standing equipment					
	[ ]	Hand-held equipment					
	[X]	Other: HUAIDP21BY is installed in vehicle dashboard (automotive environment)					

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

Marelli Europe S.p.A.

Viale A. Borletti 61/63 - 20011 Corbetta (MI) - ITALY

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2024-06-13
Date (finish)	2024-06-14

Document history

Report number	Date	Description
79469RRF.003	2024-07-05	First release.
79469RRF.003A1	2024-08-09	Second release. This test report is modified due to a missing information. This modification test report cancels and replaces the test report 79469RRF.003.

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: Valentín Andarias, Rafael Fernández.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
6143	HYBRID BILOG ANTENNA 30 MHz - 6 GHz	3142E	ETS LINDGREN	2027-01-22

Control No.	Equipment	Model	Manufacturer	Next Calibration
6144	PRE-AMPLIFIER G>40 dB, 10 MHz - 6 GHz	BLNA 0160-01N	BONN ELEKTRONIK	2024-07-25
10418	EMI TEST RECEIVER 1Hz-26.5GHz	ESW26	ROHDE & SCHWARZ	N/A
6791	SEMIANECHOIC ABSORBER LINED CHAMBER IV	FACT 3 200STP	ETS LINDGREN	N/A
6792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
9555	TWO CHANNEL POWER SUPPLY, 32V, 10/5A, 188W	HMP2020	ROHDE AND SCHWARZ	N/A
7760	DIGITAL MULTIMETER	175	FLUKE	2024-11-08
6609	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2025-04-22
6615	TEMPERATURE AND HUMIDITY PROBE	HWg-STE	HW GROUP	2025-04-04
6496	HORN ANTENNA 1-18 GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2026-12-01
4657	HORN ANTENNA 18-40 GHz	BBHA 9170	SCHWARZBECK MESS-ELEKTRONIK	2026-06-12
3783	PRE-AMPLIFIER G>30 dB, 1-18 GHz	BLMA 0118-3A	BONN ELEKTRONIK	2025-02-07
8856	PRE-AMPLIFIER G>30 dB, 17-40 GHz	BLMA 1840-4A	BONN ELEKTRONIK	2025-02-27
10304	EMI TEST RECEIVER 2 Hz-44 GHz	ESW44	ROHDE AND SCHWARZ	2026-02-19
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	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), 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

INDEX

TEST CONDITIONS

(*): Declared by the Applicant.

POWER SUPPLY (*):

Vnominal:	Main and MQS cables: 12 Vdc nominal voltage (9.5 - 16 Vdc) or shielded cables: 12 Vdc nominal voltage (9.5 - 16 Vdc)
Type of Power Supply:	Vehicle battery

ANTENNA (*):

Bluetooth EDR:

Type of Antenna:	Integral (PCB).
Maximum Declared Antenna Gain:	0 dBi.

802.11 a20 / n2040 / ac2040 / ac80 SISO:

Type of Antenna:	PCB integral antenna (printed antenna).
Maximum Declared Antenna Gain:	0 dBi.

RADIOS AND CHANNELS TESTED:

	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)
	High: 39	2480

	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 modulations and channels configured for each technology are the worst-case combinations in terms of spurious emissions, based on preliminary testing.

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 two signals at maximum output power:
Bluetooth Basic Rate in GFSK 1-DH5 mode, WLAN 5 GHz band U-NII-3 in 802.11 a / 20 / 6 Mbps.

RADIATED MEASUREMENTS:

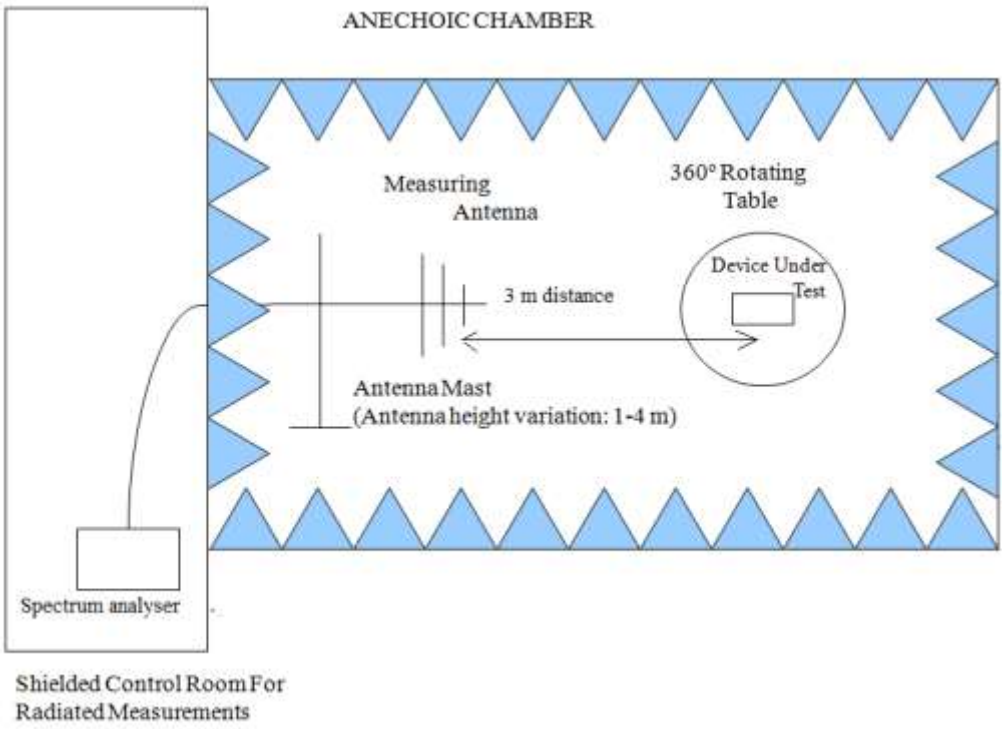
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-40 GHz (17 GHz-40 GHz horn 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.

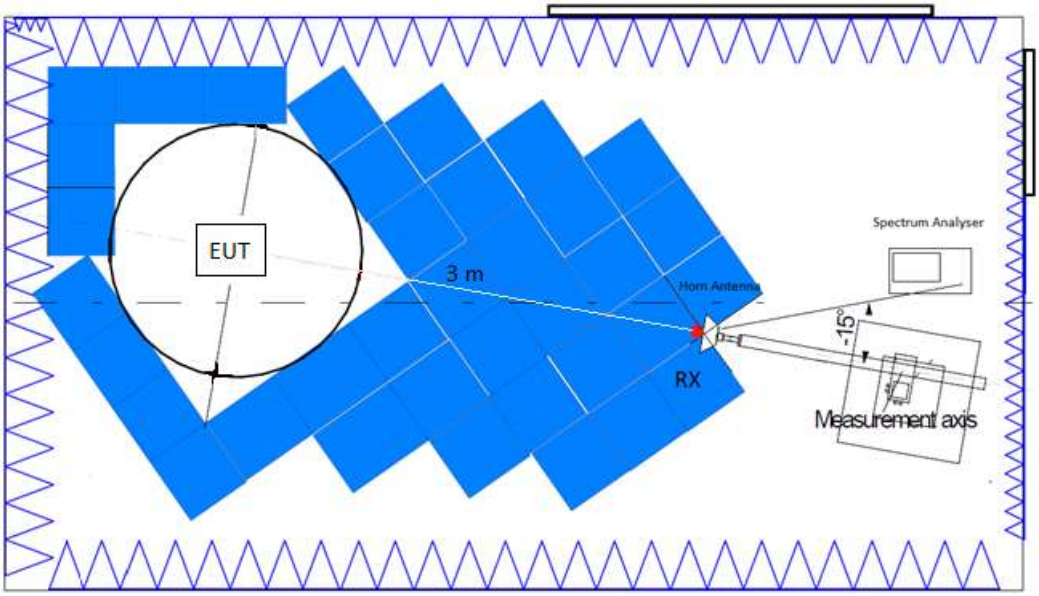
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360º and the antenna height (Bilog antenna and Double ridge horn antenna) was varied from 1 to 4 meters to find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

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

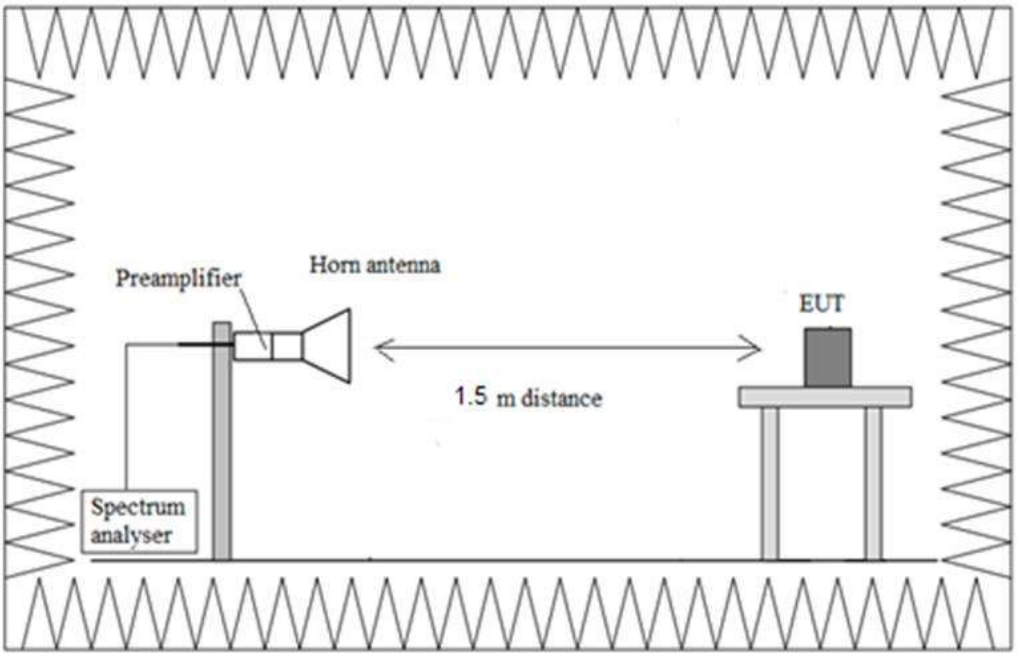
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup f > 17 GHz:



FCC 15.31 (h), 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.

Frequency range tested for Radiated emissions:

Start frequency: no radiofrequency signal generated in the device found below 10th sub-harmonic, no further investigation required.
Stop frequency: it has been performed the radiated spurious emissions until 10th harmonic.

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 1.5 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:**

Bluetooth EDR: High Channel (2480 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.

Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	QuasiPeak (dBµV/m)	Polarization
30.636563	23.33	V
54.250000	20.76	V

Measurement Uncertainty (dB): <± 5.15

Frequency range 1 - 40 GHz:

Spurious frequencies at less than 20 dB below the limit:

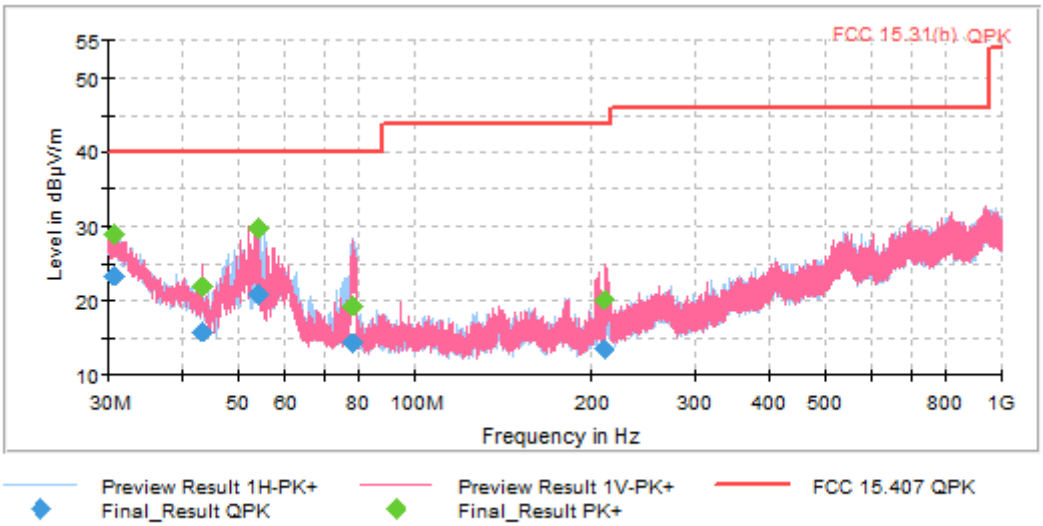
Spurious frequency (MHz)	Level (dBµV/m)	Polarization	Detector
7660.355000	49.77	H	Peak
11490.020000	55.81	V	Peak
	44.85		Average

Measurement Uncertainty (dB): 1 - 17 GHz <± 4.28
17 - 26.5 GHz <± 4.89
26.5 - 40 GHz <± 5.02

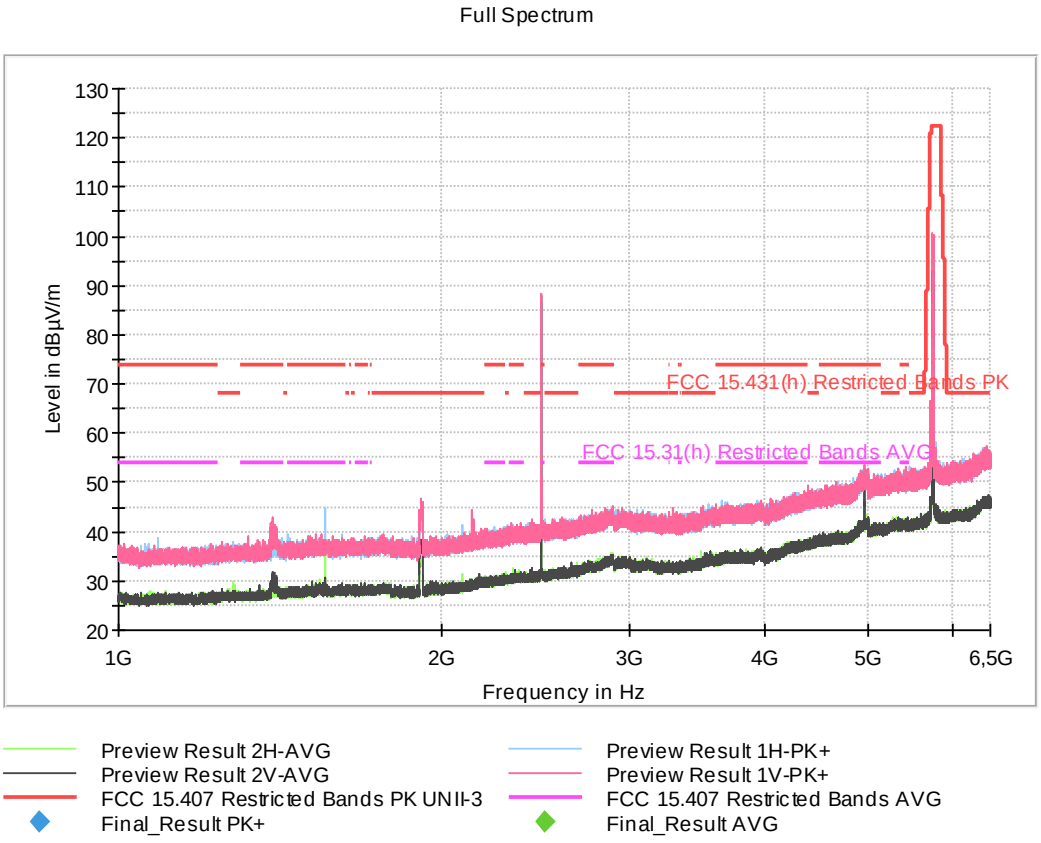
Verdict: PASS

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	30 dB
1 - 6.5 GHz	100 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
6.5 - 17 GHz	105 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
17 - 40 GHz	766.667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

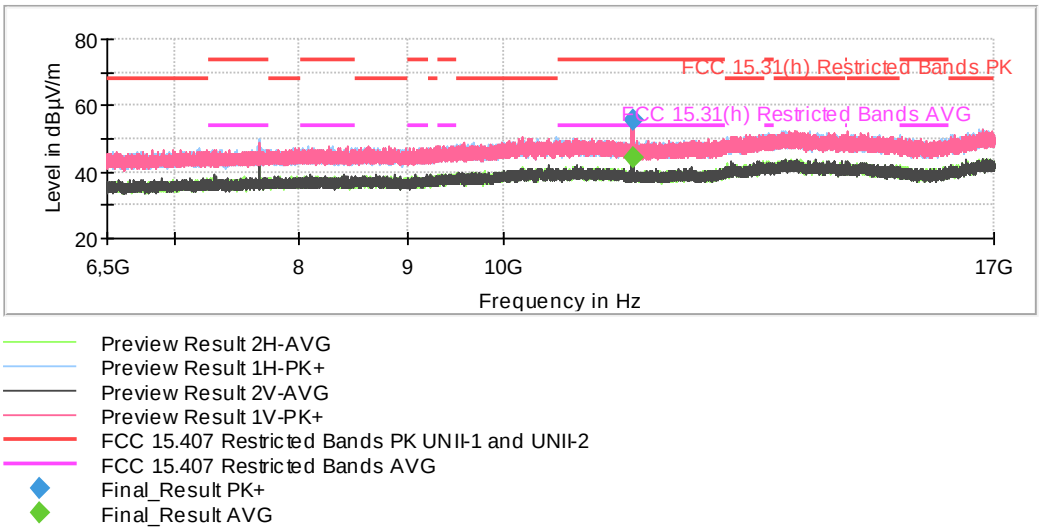
FREQUENCY RANGE 30 MHz - 1 GHz:



FREQUENCY RANGE 1 - 17 GHz:



The peak above the limit on the left is the BT EDR carrier frequency.
The peak above the limit on the right is the WLAN 5 GHz band U-NII-3 carrier frequency.



FREQUENCY RANGE 17 - 40 GHz: