

ISED CABid: ES1909 Lab. Company Number: 4621A Test Report No: 74915RRF.008A1

# **Partial Test Report**USA FCC Part 15.31(h), 15.247, 15.407, 15.209 CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Automotive infotainment System
(*) Trademark	Mercedes-Benz
(*) Model and /or type reference	NTG7Q PREMIUMPLUS
Other identification of the product	FCC ID: T8GNTG7QPREPLU IC: 6434A-NTG7QPREPLU
(*) Features	FM/AM/DAB/DVBT, USB, Bluetooth, WLAN, GNSS. HW version: D15 SW version: E444.201
Applicant	HARMAN BECKER AUTOMOTIVE SYSTEMS GMBH BECKER-GOERING-STR. 16; 76307 KARLSBAD GERMANY
Test method requested, standard	USA FCC Part 15.31(h) (10-1-21 Edition): Measurement standards. USA FCC Part 15.407 (10-1-21) Edition: Unlicensed National Information Infrastructure (U-NII) Devices. General technical requirements.  USA FCC Part 15.247 (10-1-21) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz.  USA FCC Part 15.209 (10-1-21) Edition: Radiated emission limits; general requirements.  CANADA RSS-247 Issue 2 (February 2017).  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
Date of issue	2023-07-17
Report template No.	FDT08_24 (*) "Data provided by the client"

**Report No**: 74915RRF.008A1 2023-07-17



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

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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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## 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  $\leq \pm 5.01$  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  $\leq \pm 4.22$  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  $\leq \pm 4.71$  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  $\leq \pm 4.92$  dB (with factor k = 2).

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## 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 NTG7Q PREMIUMPLUS is an Automotive head unit to be installed in cars with the following features: FM/AM/DAB/DVBT, USB, Bluetooth, WLAN and GNSS.

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.

ld	Control Number	Description	Model	Serial N <sup>o</sup>	Date of Reception	Application
S/01	74915_5.1	Module	NTG7Q PREMIUMPLUS	HBM620P4552004	2023-03-07	Element Under Test
S/01	74915_11.1	Harness			2023-03-07	Element Under Test
S/01	74915_32.1	4 way SMA cable- Fakra connector			2023-03-07	Auxiliary Element

Notes referenced to samples during the project:

Id	Туре
S/01	Radiated tests.

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## Test sample description

Ports:					Ca	ble		
	Port name and description		Specified max length [m]	Attac	ched g test	Shielded		to atient <sup>(3)</sup>
	Car C	Connector A	>3m	[)	(]	[]		[]
	Car C	Connector B	>3m	[>	<b>(</b> ]	[]		[]
		ay Connector PIP / RVC	>3m	[)	<b>(</b> ]	[X]		[]
	USB	Connector	<3m	()	<b>(</b> ]	[X]		[]
	Eth C	connector	1,82 m	[>	<b>(</b> ]	[]		[]
	BT/W	'LAN-Antenna	>3m	[>	<b>(</b> ]	[X]		[]
Supplementary information to the ports:	GNSS Antenna >3m			<u>'</u>		<u> </u>	<u> </u>	
Rated power supply:	Voltage and Frequency		,	Reference poles				
	, ,	go aa		L1	L2	L3	N	PE
	[]	AC:		[]	[]	[]	[]	[]
	[]	AC:		[]	[]	[]	[]	[]
	[X] DC:							
	[ ] DC: 12V car batt		ery /attenua	tor (9,5	-15,5v	normal op	eratio	n)
Rated Power	12V							
Clock frequencies								
Other parameters:								
Software version	E444.201							
Hardware version:	D15							
Dimensions in cm (W x H x D):								
Mounting position:	[ ] Table top equipment							
	[]	Wall/Ceiling mou	ınted equipm	nent				
	[ ] Floor standing equipment							
	[ ] Hand-held equipment							

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	[X]	Other: automotive		
Modules/parts:	Module/parts of test item		Туре	Manufacturer
Accessories (not part of the test	Descri	iption	Туре	Manufacturer
item):	HARM	1ANeco (with Display or headless)	HARMANec o	HARMAN
	Cable	harness	harness	HARMAN
	Displa	у	different suppliers	different versions
	BT/WI	LAN-Antenna	OEM- Antenna	HIRSCHMAN N
Documents as provided by the	Descr	iption	File name	Issue date
applicant	Techn	ical description	Technical Description NTG7_A18 200717 SOP2 AllVariant.p	A18
	Testin	g Guide	NTG7- TestsetupS cript_19120 9 HU+RSU_v 2.0.pdf	v2.0

<sup>(3)</sup> 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)	2023-03-31
Date (finish)	2023-03-31

## **Document history**

Report number	Date	Description
74915RRF.008	2023-05-30	First release.
74915RRF.008A1	2023-07-17	Second release. Modification due to typos. This modification test report cancels and replaces the test report 74915.RRF008

## **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.

Tomporoturo	Min. = 15 °C Max. = 35 °C
Relative humidity	Min. = 20 % Max. = 75 %





## Remarks and comments

The tests have been performed by the technical personnel: Fernando Chito.

#### 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 30 MHz - 6 GHz ETS	2020-04	2023-04
	LINDGREN 3142E		
4.	RF Preamplifier, G>38dB 30MHz-6GHz BONN	2022-06	2023-06
	ELEKTRONIK BLNA 0360-01N		
5.	EMI Test Receiver 7 GHz ROHDE AND	2021-11	2023-11
	SCHWARZ ESR7		
6.	Two-channel power supply, 32V, 10/5A, 188W	N/A	N/A
	ROHDE AND SCHWARZ HMP2020		
7.	Digital Multimeter FLUKE 175	2022-11	2023-11
8.	EMC/RF Testing SW ROHDE AND SCHWARZ	N/A	N/A
	EMC32		

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## **Testing verdicts**

Not applicable:	N/A
Pass:	Р
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)	Р	(1)
Supplementary information and remarks:		
(1) Only Co-Location radiated spurious emission test was requested.		

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# **Appendix A:** Test results

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#### **TEST CONDITIONS**

#### (\*): Declared by the Applicant.

#### POWER SUPPLY (\*):

Vnominal: 13.2 Vdc

Type of Power Supply: External DC (vehicle battery).

#### ANTENNA (\*):

802.11 bgn20 SISO:

Type of Antenna: External.

Maximum Declared Antenna Gain: +2.4 dBi.

802.11 a20 / n2040 / ac2040 / ac80 SISO:

Type of Antenna: External.

Maximum Declared Antenna Gain: 0 dBi.

#### RADIOS AND CHANNELS TESTED:

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

	WLAN 2.4 GHz (IEEE 802.11 b/g/n20) / DTS		
Mode:	802.11 g: 6 Mbps		
Channel Spacing:	20 MHz		
Frequency Range:	2412 MHz to 2462 MHz		
Transmit Channels	Channel Channel Frequency (MHz)		
	Middle: 7 2442		

	WLAN 5 GHz (IEEE 802.11 a	WLAN 5 GHz (IEEE 802.11 a20/n2040/ac204080) / U-NII-1		
Mode:	802.11 ac20: index MSC0.	802.11 ac20: index MSC0.		
Frequency Range:	5725 MHz to 5850 MHz	5725 MHz to 5850 MHz		
Channel Spacing:	20 MHz	20 MHz		
Transmit Channels	Channel	Channel Frequency (MHz)		
	Low: 36 5180			

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	WLAN 5 GHz (IEEE 802.11 a20/n2040/ac204080) / U-NII-3		
Mode:	802.11 n20: index MSC0.		
Frequency Range:	5725 MHz to 5850 MHz		
Channel Spacing:	20 MHz		
Transmit Channels	Channel Channel Frequency (M		
	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:

- \* <u>Bluetooth Basic Rate:</u> Transmitter radiated spurious emissions tests were performed with the EUT transmitting in Basic Rate mode because its power is higher than the other modes.
- \* <u>WLAN 2.4 GHz:</u> Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 g / 6 Mbps mode configuration as this mode was found as the worst-case for spurious emissions than all the other WLAN 2.4 GHz SISO modes.
- \* <u>WLAN 5 GHz band U-NII-1:</u> Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 ac / 20 / MCS0 mode configuration as this mode was found as the worst-case for spurious emissions than all the other WLAN 5 GHz band U-NII-1 SISO modes.
- \* <u>WLAN 5 GHz band U-NII-3:</u> Transmitter radiated spurious emissions tests were performed with the EUT transmitting in 802.11 n / 20 / MCS0 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.

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

- \* Co-location Bluetooth EDR, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-1, with the EUT configured to simultaneously transmit two signals at maximum output power:

  Bluetooth Basic Rate in 1-DH5 mode, WLAN 2.4 GHz in 802.11 g / 6 Mbps, WLAN 5 GHz band U-NII-1 in 802.11 ac / 20 / MCS0.
- \* Co-location Bluetooth EDR, WLAN 2.4 GHz, WLAN 5 GHz band U-NII-3, with the EUT configured to simultaneously transmit two signals at maximum output power:

  Bluetooth Basic Rate in 1-DH5 mode, WLAN 2.4 GHz in 802.11 g / 6 Mbps, WLAN 5 GHz band U-NII-3 in 802.11 n / 20 / MCS0.

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#### **RADIATED MEASUREMENTS:**

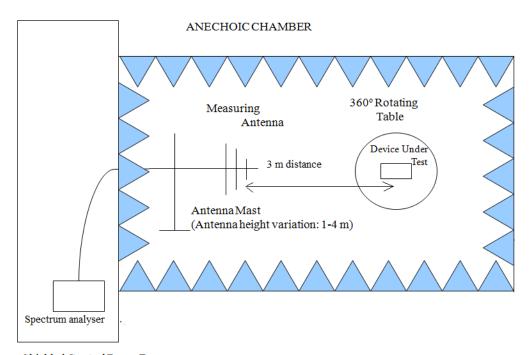
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1 GHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1.5 m for the frequency range 17 GHz-40 GHz (17 GHz-40 GHz horn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

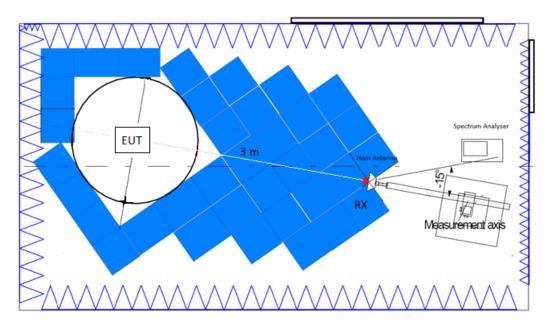
#### Radiated measurements setup from 30 MHz to 1 GHz:



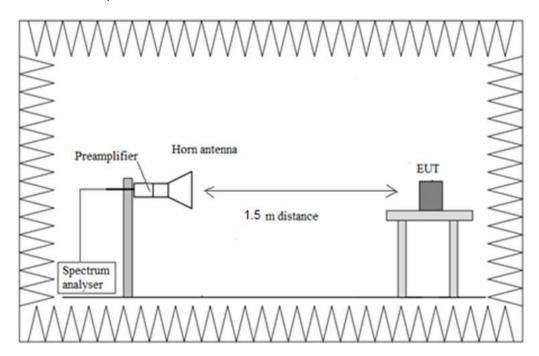
Shielded Control Room For Radiated Measurements



#### Radiated measurements setup from 1 GHz to 17 GHz:



#### Radiated measurements setup f > 17 GHz:



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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.

#### **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-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:

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#### • Co-location mode Bluetooth EDR, WLAN 2.4 GHz, WLAN 5 GHz U-NII-1:

Bluetooth EDR: Low Channel (2402 MHz). Basic Rate. GFSK. WLAN 2.4 GHz 802.11 g: Middle Channel (2442 MHz). BW: 20 MHz. 1 Mbps. WLAN 5 GHz U-NII-1 802.11 ac20: Low Channel (5180 MHz). BW: 20 MHz. MCS0.

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 (**)

<sup>(\*)</sup> Radiated emissions which fall in the non-restricted bands.

#### 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.

#### Frequency range 1 - 40 GHz:

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

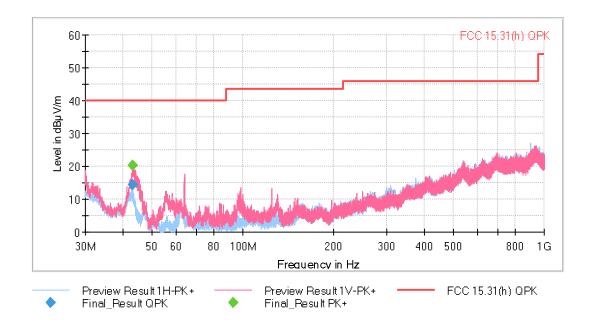
Verdict: PASS

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



Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	0 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	0 dB
17 - 26 GHz	300 kHz	PK+; AVG	1 MHz	1 s	0 dB
26 - 40 GHz	766.667 kHz	PK+ : AVG	1 MHz	1 s	0 dB

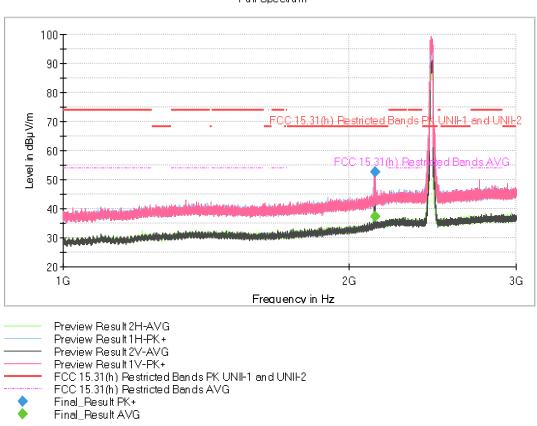
#### FREQUENCY RANGE 30 MHz - 1 GHz:





#### FREQUENCY RANGE 1 - 3 GHz:

#### Full Spectrum

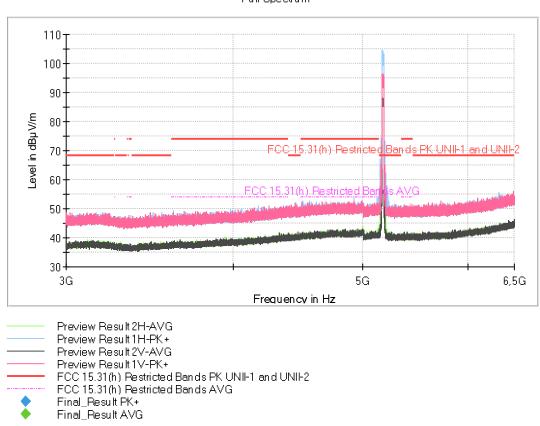


The peak above the limit is the WLAN 2.4 GHz carrier frequency.



#### FREQUENCY RANGE 3 - 6.5 GHz:

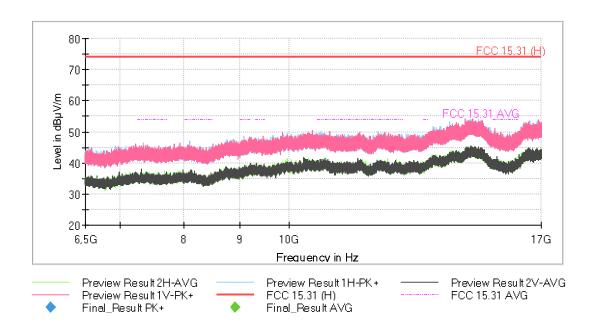




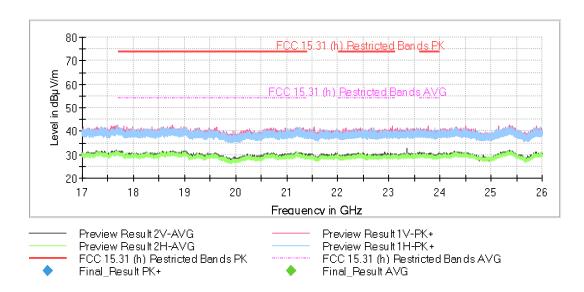
The peak above the highest limit is the WLAN 5 GHz band U-NII-1 carrier frequency.



#### FREQUENCY RANGE 6.5 - 17 GHz:



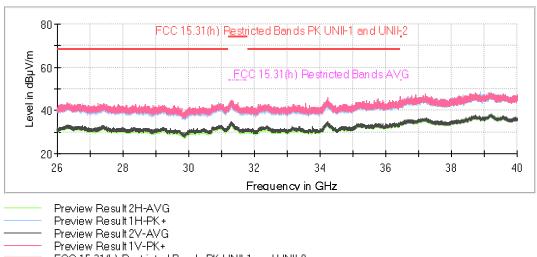
#### FREQUENCY RANGE 17 - 26 GHz:





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#### FREQUENCY RANGE 26 - 40 GHz:



FCC 15.31(h) Pestricted Bands PK UNII-1 and UNII-2 FCC 15.31(h) Pestricted Bands AVG

Final\_Result PK+ Final\_Result AVG C.I.F. A29507456



#### Co-location mode WLAN 2.4 GHz, WLAN 5 GHz U-NII-3:

Bluetooth EDR: Low Channel (2402 MHz). Basic Rate. GFSK. WLAN 2.4 GHz 802.11 g: Middle Channel (2442 MHz). BW: 20 MHz. 1 Mbps. WLAN 5 GHz U-NII-3 802.11 n20: Low Channel (5745 MHz). BW: 20 MHz. MCS0.

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 (**)

<sup>(\*)</sup> Radiated emissions which fall in the non-restricted bands.

#### 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): <± 5.01

#### Frequency range 1 - 40 GHz:

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

Measurement Uncertainty (dB): 1 - 17 GHz <± 4.22

17 - 26.5 GHz <± 4.71

26.5 - 40 GHz <± 4.92

Verdict: PASS

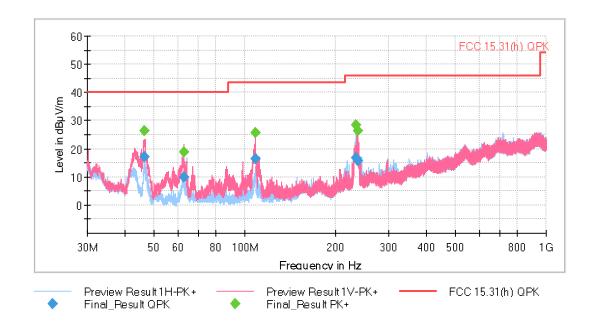
<sup>(\*\*)</sup> Radiated emissions which fall in the restricted bands, as defined in §15.205(a).





Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	0 dB
1 GHz - 6.5 GHz	100 kHz	PK+; AVG	1 MHz	1 s	0 dB
6.5 GHz - 17 GHz	105 kHz	PK+; AVG	1 MHz	1 s	0 dB
17 GHz - 26 GHz	300 kHz	PK+; AVG	1 MHz	1 s	0 dB
26 GHz - 40 GHz	766.667 kHz	PK+; AVG	1 MHz	1 s	0 dB

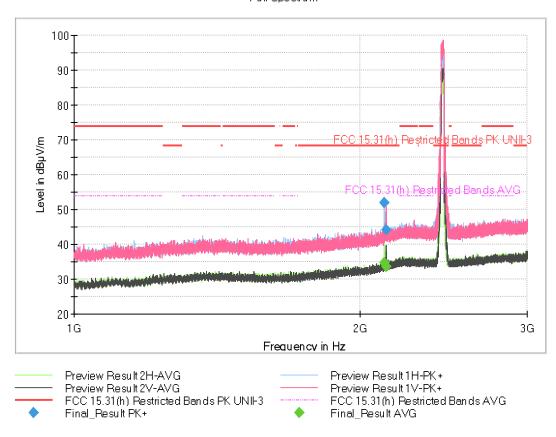
#### FREQUENCY RANGE 30 MHz - 1 GHz:





#### FREQUENCY RANGE 1 - 3 GHz:

Full Spectrum

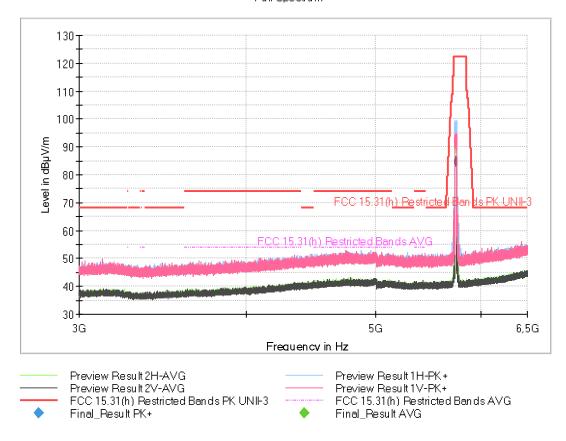


The peak above the limit is the WLAN 2.4 GHz carrier frequency.



#### FREQUENCY RANGE 3 - 6.5 GHz:

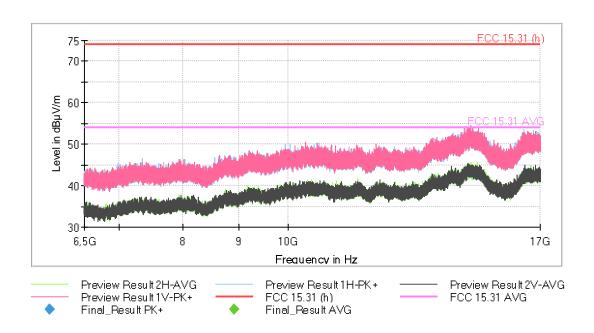
Full Spectrum



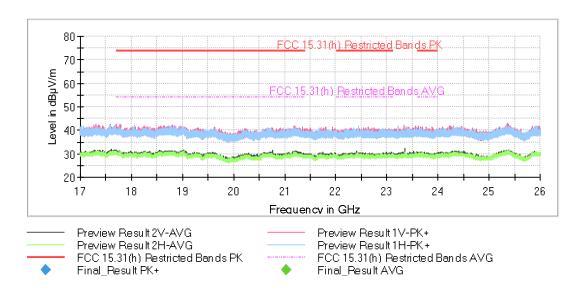
The peak above the highest limit is the WLAN 5 GHz band U-NII-3 carrier frequency.



#### FREQUENCY RANGE 6.5 - 17 GHz:



#### FREQUENCY RANGE 17 - 26 GHz:





2023-07-17

#### FREQUENCY RANGE 26 - 40 GHz:

