

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
77842RRF.004A2

Partial Test Report

USA FCC 15.31(h), 15.209, 15.247, 15.519, 15.521,
22, 24, 27

CANADA RSS-132, RSS-133, RSS-199, RSS-220,
RSS-247, RSS-Gen

(*) Identification of item tested	Telematic Control Unit with GNSS, Wi-Fi, UWB, BT classic, BLE, 4G LTE CAT 4
(*) Trademark	IDNEO
(*) Model and /or type reference	EBOX
Other identification of the product	FCC ID: 2BGE31EBOX0524 IC: 32504-1EBOX0624
(*) Features	GNSS, Wi-Fi, UWB, BT classic, BLE, 4G LTE CAT 4 HW version: 419100346 SW version: 414100493
Applicant	IDNEO TECHNOLOGIES, S.A.U. Carrer Rec de Dalt, 3 08100 Mollet del Vallès, Barcelona, Spain
Test method requested, standard	USA FCC Part 15.31(h) (10-1-23 Edition): Measurement standard. USA FCC Part 15.209 (10-1-23 Edition): Radiated emission limits; general 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 15.519 (10-1-23 Edition): Technical requirements for hand held UWB systems. USA FCC Part 15.521 (10-1-23 Edition): Technical requirements applicable to all UWB devices. USA FCC Part 22 (10-1-23 Edition): Public Mobile Services. USA FCC Part 24 (10-1-23 Edition): Personal Communications Services. USA FCC Part 27 (10-1-23 Edition): Miscellaneous Wireless Communications Services. CANADA RSS-132 Issue 4, Jan. 2023. CANADA RSS-133 Issue 6, amendment 1, Jan. 2018. CANADA RSS-199 Issue 4, Jul. 2023. CANADA RSS-220 Issue 1, amendment 1 (July 2018). CANADA RSS-247 Issue 3, Aug. 2023. CANADA RSS-Gen Issue 5, amendment 2, Feb. 2021.

	<p>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.</p> <p>Measurement Guidance for Certification of Licensed Digital Transmitters. 971168 D01 Power Meas License Digital Systems v03r01 dated April 9, 2018.</p> <p>ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.</p> <p>ANSI C63.26-2015 IEEE/ANSI Standard for Testing of Transmitters Used in Licensed Radio Services.</p>
Approved by (name / position & signature)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager .
Date of issue	2025-03-04
Report template No.	FDT08_25 (*) "Data provided by the client"

Index

Competences and guarantees	4
General conditions	4
Uncertainty	4
Data provided by the client	5
Usage of samples	5
Test sample description	6
Identification of the client	6
Testing period and place	7
Document history	7
Environmental conditions	7
Remarks and comments	8
Testing verdicts	9
Summary	9
Appendix A: Test results	10

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 has a calibration and maintenance program for its measurement equipment.

DEKRA Testing and Certification 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 at the time of performance of the test.

DEKRA Testing and Certification 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.

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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 the EUT from 30 MHz to 1 GHz is:
Measurement uncertainty $\leq \pm 5.03$ dB (with factor $k=2$).

The total uncertainty of the measurement system for the radiated emissions of the EUT from 1 to 17 GHz is:
Measurement uncertainty $\leq \pm 4.32$ dB (with factor $k=2$).

The total uncertainty of the measurement system for the radiated emissions of the EUT from 17 to 26.5 GHz is:
Measurement uncertainty $\leq \pm 4.58$ dB (with factor $k=2$).

The total uncertainty of the measurement system for the radiated emissions of the EUT from 26.5 to 40 GHz is:
Measurement uncertainty $\leq \pm 4.75$ 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 model EBOX is a Telematic Control Unit with GNSS, Wifi, UWB, BT classic, BLE, 4G LTE CAT 4.

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. The laboratory is not responsible for such information and it is not covered by accreditation.

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	77842_7.1	Telematic Control Unit	EBOX	202403T 00202	2024-03-21	Element Under Test
S/01	77842_13.1	Harness	-	-	2024-03-21	Auxiliary Element

Notes referenced to samples during the project:

Id	Type
S/01	Samples used for radiated tests

Test sample description

Ports.....:	Port name and description	Cable																																
		Specified length [m]	Attached during test	Shielded																														
	MAIN CONNECTOR	1m	[X]																															
Supplementary information to the ports.....:	Wiring Harness shipped by customer																																	
Rated power supply	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2">Voltage and Frequency</th><th colspan="5">Reference poles</th></tr> <tr> <th>L1</th><th>L2</th><th>L3</th><th>N</th><th>PE</th><th></th><th></th></tr> </thead> <tbody> <tr> <td>[]</td><td>AC:</td><td>[]</td><td>[]</td><td>[]</td><td>[]</td><td>[]</td></tr> <tr> <td>[X]</td><td>DC: 12.8V</td><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table>						Voltage and Frequency		Reference poles					L1	L2	L3	N	PE			[]	AC:	[]	[]	[]	[]	[]	[X]	DC: 12.8V					
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L1	L2	L3	N	PE																														
[]	AC:	[]	[]	[]	[]	[]																												
[X]	DC: 12.8V																																	
Rated Power	1.92W																																	
Clock frequencies.....:	(32,7KHz, 16MHz, 16.66MHz, 25MHz and 55,2MHz)																																	
Other parameters	-																																	
Software version	414100493																																	
Hardware version	419100346																																	
Dimensions in cm (W x H x D):	70 (W) x 105 (L) x 26-32.9 (H) mm																																	
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: In specific plastic bracket inside the vehicle (screwed)																																	
Modules/parts.....:		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Module/parts of test item</th> <th>Type</th> <th>Manufacturer</th> </tr> </thead> <tbody> <tr> <td>AG35 EU /AG35 NAM</td><td>Modem</td><td>Quectel</td></tr> <tr> <td>AF20-Q4B</td><td>Wifi/BT</td><td>Quectel</td></tr> <tr> <td>ANNA-B112</td><td>BLE</td><td>UBLOX</td></tr> <tr> <td>NCJ29D5DHN/00201Y</td><td>UWB</td><td>NXP</td></tr> </tbody> </table>					Module/parts of test item	Type	Manufacturer	AG35 EU /AG35 NAM	Modem	Quectel	AF20-Q4B	Wifi/BT	Quectel	ANNA-B112	BLE	UBLOX	NCJ29D5DHN/00201Y	UWB	NXP													
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Identification of the client

IDNEO TECHNOLOGIES, S.A.U.
Carrer Rec de Dalt, 3,
08100 Mollet del Vallès, Barcelona (SPAIN)

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2024-06-10
Date (finish)	2024-07-18

Document history

Report number	Date	Description
77842RRF.004	2024-09-13	First release.
77842RRF.004A1	2025-02-05	Second release. Updated information. This modification test report cancels and replaces the test report 77842RRF.004s.
77842RRF.004A2	2025-03-04	Third release. Updated information. This modification test report cancels and replaces the test report 77842RRF.004A1s.

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 semi-anechoic 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: Álvaro Gutiérrez and Pablo Redondo.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
06791	SEMIANECHOIC ABSORBER LINED CHAMBER	FACT 3 200 STP	ETS LINDGREN	N/A
06792	SHIELDED ROOM	S101	ETS LINDGREN	N/A
06609	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-22
06615	ETHERNET TEMPERATURE AND HUMIDITY LOGGER	HWg-STE	HW GROUP	2025-04-04
06143	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2027-01-22
06496	HORN ANTENNA 1-18 GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2026-12-01
04657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2026-06-12
06144	PRE-AMPLIFIER G>40dB 10MHz-6GHz	BLNA 0160-01N	BONN ELEKTRONIK	2024-07-25
03783	PRE-AMPLIFIER G>30dB 1GHz-18GHz	BLMA 0118-3A	BONN ELEKTRONIK	2025-03-15
08856	PRE-AMPLIFIER G>30dB 18-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2025-02-27
07817	EMI TEST RECEIVER 2 Hz-44 GHz	ESW44	ROHDE AND SCHWARZ	2026-07-01
09555	TWO CHANNEL POWER SUPPLY, 32V, 10/5A, 188W	HMP2020	ROHDE AND SCHWARZ	N/A
07760	DIGITAL MULTIMETER	FLUKE	175	2024-11-08
04848	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 15, 22, 24, 27 / CANADA RSS-132, RSS-133, RSS-199, RSS-220, RSS-247, RSS-Gen PARAGRAPH			
Requirement – Test case	Verdict	Remark	
FCC 15.31 (h), 15.209 (a), 15.247 (d), 15.519 (c),(d), 15.521 (c), 22.917 (a), 24.238 (a), 27.53 (m) (4) / RSS-132 5.5, RSS-133 6.5, RSS-199 5.6, RSS-220 5.3.1. (c),(d),(e), Annex 4. (m), RSS-247 5.5, RSS- Gen 8.9	Emission limitations radiated (Transmitter)	P	(1)
<u>Supplementary information and remarks:</u>			
(1) Only simultaneous transmission radiated spurious emission test was requested.			

Appendix A: Test results

INDEX

TEST CONDITIONS	12
FCC 15.31 (h), 15.209 (a), 15.247 (d), 15.519 (c),(d), 15.521 (c), 22.917 (a), 24.238 (a), 27.53 (m) (4) / RSS-132 5.5, RSS-133 6.5, RSS-199 5.6, RSS-220 5.3.1 (c),(d),(e), Annex 4. (m), RSS-247 5.5, RSS- Gen 8.9 Emission limitations radiated (Transmitter)	14

TEST CONDITIONS

(*): Data provided by the Applicant.

POWER SUPPLY (*):

Vnominal: 12.8 Vdc.

Type of Power Supply: External DC.

ANTENNA (*):

Technologies	Antenna Gain	Type of Antenna
Bluetooth Low Energy	0.5 dBi	Internal
WLAN 2.4 GHz	+3.0 dBi	Internal
2G 850	+1.2 dBi	Internal
WLAN 5 GHz	+ 4.5 dBi	Internal
2G 1900	+1.9 dBi	Internal
LTE Band 7	+3.0 dBi	Internal
UWB	+5.8 dBi	Internal

RADIOS AND CHANNELS TESTED (worst cases):

Frequency range	Technologies	Modulations	Worst case
f < 1 GHz	2G 850	GPRS, EDGE	Low Channel 128 (824.2 MHz) GPRS
1 GHz < f < 2 GHz	2G 1900	GPRS, EDGE	High Channel 810 (1909.8 MHz) GPRS
f > 2 GHz	LTE Band 7	QPSK, 16QAM	High Channel 21350 (2560 MHz), QPSK
	Bluetooth LE (ANNA)	GFSK	Low Channel (2402 MHz), GFSK
	WLAN 2.4 GHz	802.11 bgn20	Middle Channel (2442 MHz), 802.11 b
f > 5 GHz	UWB	BPSK and/or BPM	Channel 9 (7987.2 MHz)

The test set-up was made according to the general provisions of FCC 558074 D01 15.247 Meas Guidance v05r02 dated April 2, 2019.

The EUT was tested in the following operating mode during the transmitter tests:

For cellular technologies, the EUT was controlled by a communication tester to transmit at maximum power on the test channels and modes as required.

TEST FREQUENCIES FOR SIMULTANEOUS TRANSMISSION MODE RADIATED TESTS:

The EUT was configured to simultaneously transmit the following signals at maximum output power:

- **Operation Mode 1:**

Simultaneous transmission mode 2G 850, Bluetooth Low Energy, WLAN 2.4 GHz, UWB:

2G 850:	Low Channel (824.2 MHz). GPRS.
Bluetooth Low Energy:	Low Channel (2402 MHz). GFSK. (1M).
WLAN 2.4 GHz:	Middle Channel (2442 MHz). 802.11 b. BW: 20 MHz.
UWB:	Channel 9 (7987.2 MHz). BW: 20 MHz.

- **Operation Mode 2:**

Simultaneous transmission mode 2G 1900, Bluetooth Low Energy, WLAN 2.4 GHz, UWB:

2G 1900:	High Channel (1909.8 MHz). GPRS.
Bluetooth Low Energy:	Low Channel (2402 MHz). GFSK. (1M).
WLAN 2.4 GHz:	Middle Channel (2442 MHz). 802.11 b. BW: 20 MHz.
UWB:	Channel 9 (7987.2 MHz). BW: 20 MHz.

- **Operation Mode 3:**

Simultaneous transmission mode LTE Band 7, Bluetooth Low Energy, WLAN 2.4 GHz, UWB:

LTE Band 7:	High Channel (2560 MHz). QPSK. BW 20 MHz. RB Size: 1. RB Offset: 0.
Bluetooth Low Energy:	Low Channel (2402 MHz). GFSK. (1M).
WLAN 2.4 GHz:	Middle Channel (2442 MHz). 802.11 b. BW: 20 MHz.
UWB:	Channel 9 (7987.2 MHz). BW: 20 MHz.

- **Operation Mode 4:**

Simultaneous transmission mode Bluetooth Low Energy, WLAN 2.4 GHz, UWB:

Bluetooth Low Energy:	Low Channel (2402 MHz). GFSK. (1M).
WLAN 2.4 GHz:	Middle Channel (2442 MHz). 802.11 b. BW: 20 MHz.
UWB:	Channel 9 (7987.2 MHz). BW: 20 MHz.

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

FCC 15.31 (h), 15.209 (a), 15.247 (d), 15.519 (c),(d), 15.521 (c), 22.917 (a), 24.238 (a),
27.53 (m) (4) / RSS-132 5.5, RSS-133 6.5, RSS-199 5.6, RSS-220 5.3.1 (c),(d),(e),
Annex 4. (m), RSS-247 5.5, RSS-Gen 8.9 Emission limitations radiated (Transmitter)

Limits:

Bluetooth Low Energy, WLAN 2.4 GHz:

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 (μ V/m)	Field strength ($\text{dB}\mu$ 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 specified when measuring with peak detector function corresponding to 20 dB above the indicated values in the table above.

For transmitters operating in the 5.725-5.85 GHz band: All emissions shall be limited to a level of -27 dBm/MHz (68.23 dB μ V/m at 3 m distance) at 75 MHz or more above or below the band edge increasing linearly to 10 dBm/MHz at 25 MHz above or below the band edge, and from 25 MHz above or below the band edge increasing linearly to a level of 15.6 dBm/MHz at 5 MHz above or below the band edge, and from 5 MHz above or below the band edge increasing linearly to a level of 27 dBm/MHz at the band edge.

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

2G 850. FCC §2.1053 & §22.917 (a) / RSS-132 5.5:

FCC §22.917 (a):

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-132 5.5:

Equipment shall meet the unwanted emission limits specified below:

i. In the first 1.0 MHz band immediately outside and adjacent to each of the sub-bands specified in Section 5.1, the power of emissions per any 1% of the occupied bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts).

ii. After the first 1.0 MHz immediately outside and adjacent to each of the sub-bands, the power of emissions in any 100 kHz bandwidth shall be attenuated (in dB) below the transmitter output power P (dBW) by at least $43 + 10 \log_{10} p$ (watts). If the measurement is performed using 1% of the occupied bandwidth, power integration over 100 kHz is required.

p is the output power specified in watts.

Measurement Limit:

According to the specification the power of emissions shall be attenuated below the transmitter power (P) by a factor of at least $43 + 10 \log (P)$ dB. P in Watts.

At P_o transmitting power the specified minimum attenuation becomes $43+10\log (P_o)$ and the level in dBm relative P_o becomes:

$$P_o (\text{dBm}) - [43 + 10 \log (P_o \text{ in mWatts})] - 30 = -13 \text{ dBm}$$

2G 1900. FCC §2.1053 & §24.238 (a) / RSS-133 6.5:

FCC §24.238 (a):

(a) Out of band emissions. The power of any emission outside of the authorized operating frequency ranges must be attenuated below the transmitting power (P) by a factor of at least $43 + 10 \log(P)$ dB.

RSS-133 5.6:

5.6. Unwanted emission limits

Unwanted emissions shall be measured in terms of average values while the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, specified in table 3, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 MHz bands immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth (OBW). Beyond these 1 MHz bands, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth may be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% of the OBW, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in the table 3.

Table 3: Unwanted emission limits for all equipment

Offset frequency from the edge of the frequency block group (MHz)	Unwanted emission limit
≤ 1	-13 dBm/(1% of OBW)
> 1	-13 dBm/MHz

LTE 7. FCC §2.1053 & §27.53 (m) (4) / RSS-199 5.6:

FCC §27.53 (m) (4):

(4) For mobile digital stations, the attenuation factor shall be not less than $40 + 10 \log (P)$ dB on all frequencies between the channel edge and 5 megahertz from the channel edge, $43 + 10 \log (P)$ dB on all frequencies between 5 megahertz and X megahertz from the channel edge, and $55 + 10 \log (P)$ dB on all frequencies more than X megahertz from the channel edge, where X is the greater of 6 megahertz or the actual emission bandwidth as defined in paragraph (m)(6) of this section. In addition, the attenuation factor shall not be less than $43 + 10 \log (P)$ dB on all frequencies between 2490.5 MHz and 2496 MHz and $55 + 10 \log (P)$ dB at or below 2490.5 MHz. Mobile Satellite Service licensees operating on frequencies below 2495 MHz may also submit a documented interference complaint against BRS licensees operating on channel BRS Channel 1 on the same terms and conditions as adjacent channel BRS or EBS licensees.

RSS-199 5.6:

Unwanted emissions shall be measured in terms of average values when the transmitter is operating at the manufacturer's rated power and modulated as specified in RSS-Gen.

Equipment shall meet the unwanted emission limits, specified below, outside each frequency block group. For each channel bandwidth supported by the equipment under test, the unwanted emissions shall be measured and reported for two channel frequencies: one located as close as possible to the low end and one located as close as possible to the high end of the equipment's operating frequency range.

For the unwanted emission limits, in the 1 MHz band immediately outside and adjacent to the frequency block group, the power shall be measured with a resolution bandwidth of at least 1% of the occupied bandwidth for fixed stations, base stations, and fixed subscriber equipment, and 2% for subscriber equipment other than fixed subscriber equipment. Beyond this 1 MHz band, a resolution bandwidth of 1 MHz shall be used. A narrower resolution bandwidth can be used, provided that the measured power is integrated over the full required measurement bandwidth of 1 MHz, or 1% or 2% of the occupied bandwidth, as applicable.

For all equipment, the TRP or total conducted power (sum of conducted power across all antenna connectors), where applicable, of the unwanted emissions outside the frequency block or frequency block group shall not exceed the limits shown in the tables below.

Table 4: Unwanted emission limits for fixed station, base station and fixed subscriber equipment

Offset frequency from the edge of the frequency block group (MHz)	Unwanted emission limit
≤ 1	-13 dBm/(1% of OBW)
> 1	-13 dBm/MHz

*OB is the occupied bandwidth

UWB. FCC §15.519 (c),(d), §15.521 (c), §15.247 (d) / RSS-220 5.3.1. (c),(d),(e), Annex 4. (m)

FCC §15.519 (c): The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in § 15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency Range (MHz)	EIRP (dBm)
960-1610	-75.3
1610-1990	-63.3
1990-3100	-61.3
3100-10600	-41.3
Above 10600	-61.3

FCC §15.519 (d): In addition to the radiated emission limits specified in the table above, UWB transmitters shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency Range (MHz)	EIRP (dBm)
1164-1240	-85.3
1559-1610	-85.3

FCC §15.521 (c): Emissions from digital circuitry used to enable the operation of the UWB transmitter shall comply with the limits in §15.209, rather than the limits specified above for EIRP, provided it can be clearly demonstrated that those emissions from the UWB device are due solely to emissions from digital circuitry contained within the transmitter and that the emissions are not intended to be radiated from the transmitter's antenna.

RSS-220 5.3.1. (c): Radiated emissions at or below 960 MHz from a device shall not exceed the limits. Measurements of radiated emissions at and below 960 MHz are to be made using a CISPR quasi-peak detector. CISPR measurement bandwidth specifications are to be used.

Frequency Range (MHz)	Field strength (μ V/m)	Measurement distance (m)	E.i.r.p (dBmW)
0.009-0.490	2400/F(kHz)	300	10 log (17.28 / F ²) (F in KHz)
0.490-1.705	24000/F(kHz)	30	10 log (17.28 / F ²) (F in KHz)
1.705 - 30.0	30	30	-45.7
30 - 88	100	3	-55.2
88 - 216	150	3	-51.7
216 - 960	200	3	-49.2

Note: The emission limits for the bands 9-90 kHz and 110-490 kHz are based on measurements employing an average emissions detector.

RSS-220 5.3.1. (d): Radiated emissions above 960 MHz from a device shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz.

Frequency Range (MHz)	EIRP (dBm) in a RBW of 1 MHz
960-1610	-75.3
1610-4750	-70.0
4750-10600	-41.3
Above 10600	-61.3

RSS-220 5.3.1. (e): In addition to the radiated emission limits specified in the table above, radiated emissions shall not exceed the following average limits when measured using a resolution bandwidth greater than or equal to 1 kHz. The measurements shall demonstrate compliance with the stated limits at whatever resolution bandwidth is used.

Frequency Range (MHz)	EIRP (dBm)
1164-1240	-85.3
1559-1610	-85.3

RSS-220 Annex 4. (m): Emissions from digital circuitry (used only to enable the operation of the UWB transmitter and that does not control additional functions or capabilities) shall comply with the average and peak power limits applicable to the UWB transmitter. If it can be clearly demonstrated that an emission from a UWB transmitter is due solely to emissions from digital circuitry contained within the transmitter, and that the emission is not intended to be radiated from the transmitter's antenna, the limits for emissions from digital circuitry prescribed in RSS-Gen apply to that emission rather than the UWB limits.

Method:

The measurement was performed with the EUT inside a semi-anechoic chamber.

The spectrum was scanned from 30 MHz to at least the 10th harmonic of the highest frequency of the co-located radios up to 40 GHz.

The EUT was placed on a non-conductive stand at a 3-meter distance from the measuring antenna for measurements up to 17 GHz and at 1.5-meter distance for measurements above 17 GHz.

Detected emissions were maximized at each frequency by rotating the EUT and adjusting the measuring antenna height and polarization. The maximum meter reading was recorded. Measurements were made in both horizontal and vertical planes of polarization.

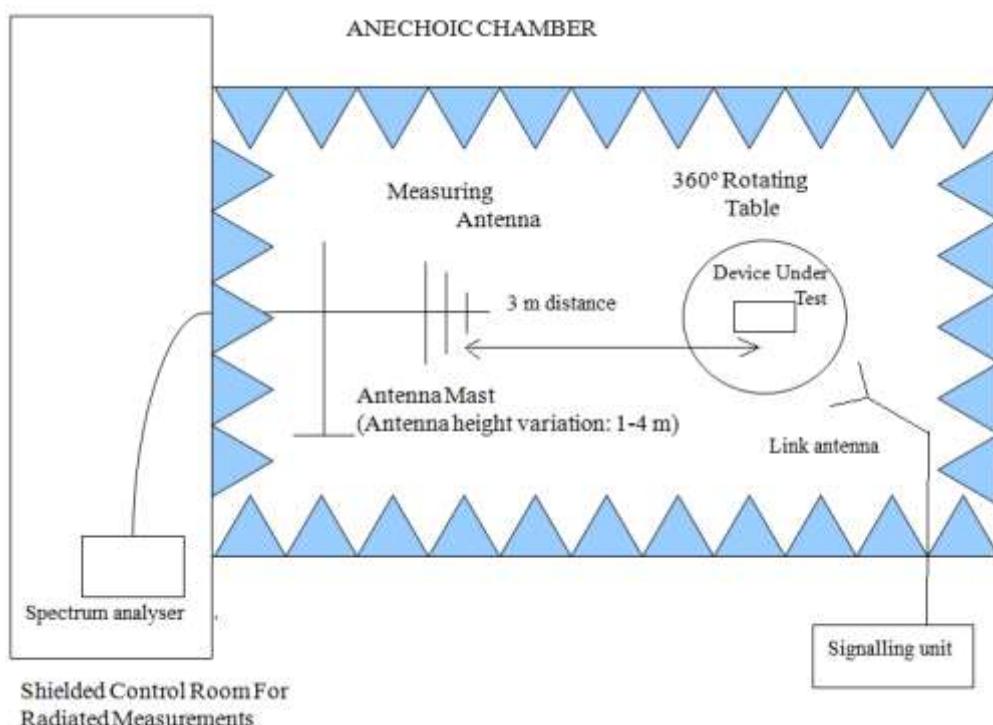
The field strength is calculated by adding correction factor to the measured level from the spectrum analyzer. This correction factor includes antenna factor, cable loss and pre-amplifiers gain.

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

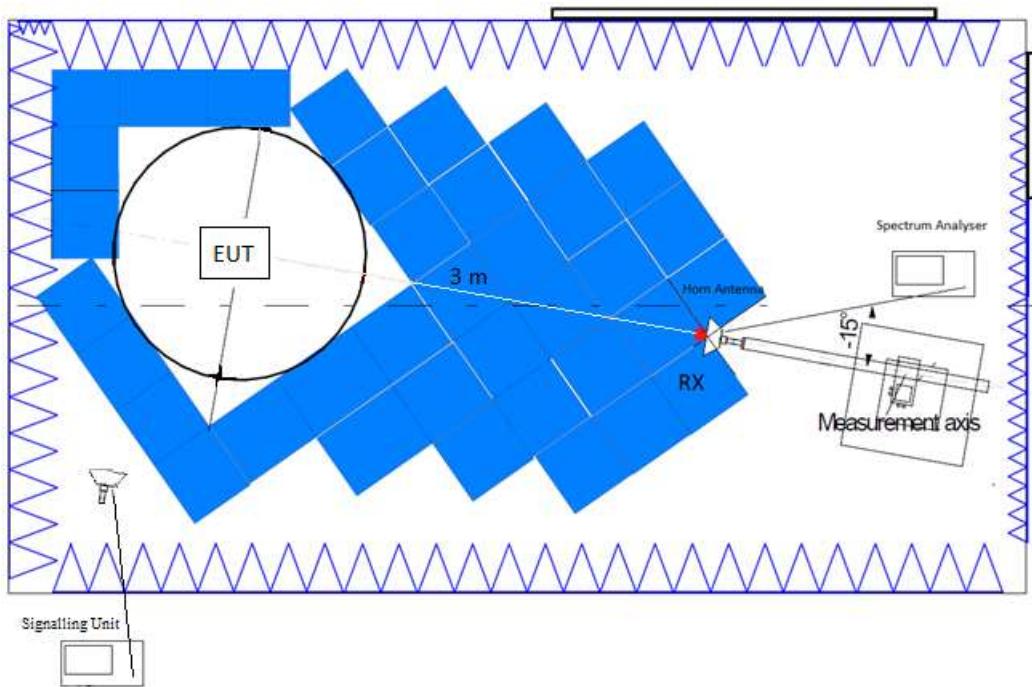
These measurements have been performed in order to check the impact of the Co-Location of all radio interfaces (that can transmit simultaneously).

Test setup:

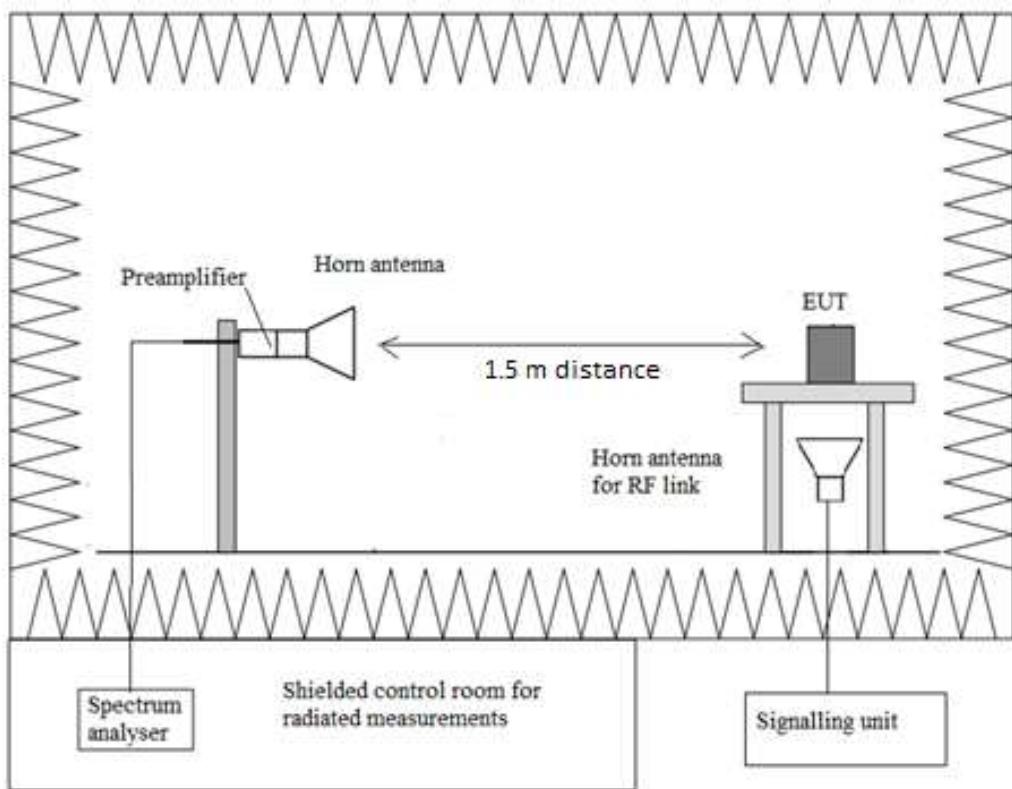
Radiated measurements below 1 GHz.



Radiated measurements between 1 GHz and 17 GHz.



Radiated measurements above 17 GHz.



Results:

- **Operation Mode 1**

Frequency range 30 MHz - 1 GHz

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

Frequency range 1 - 40 GHz

Spurious frequencies at less than 20 dB below the limit:

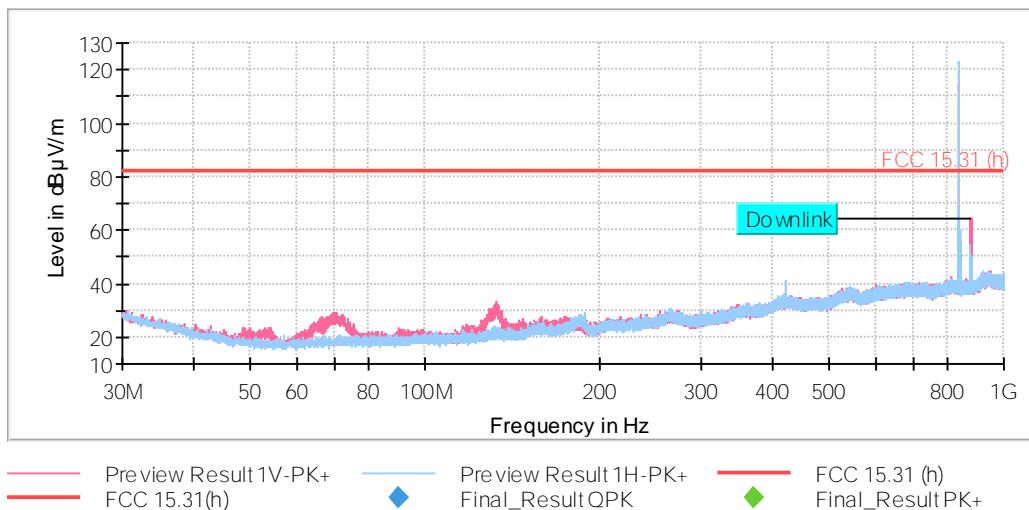
Spurious frequency (MHz)	E (dB μ V/m)	Polarization	Detector
2481.784615	68.78	H	Peak

Verdict

Pass

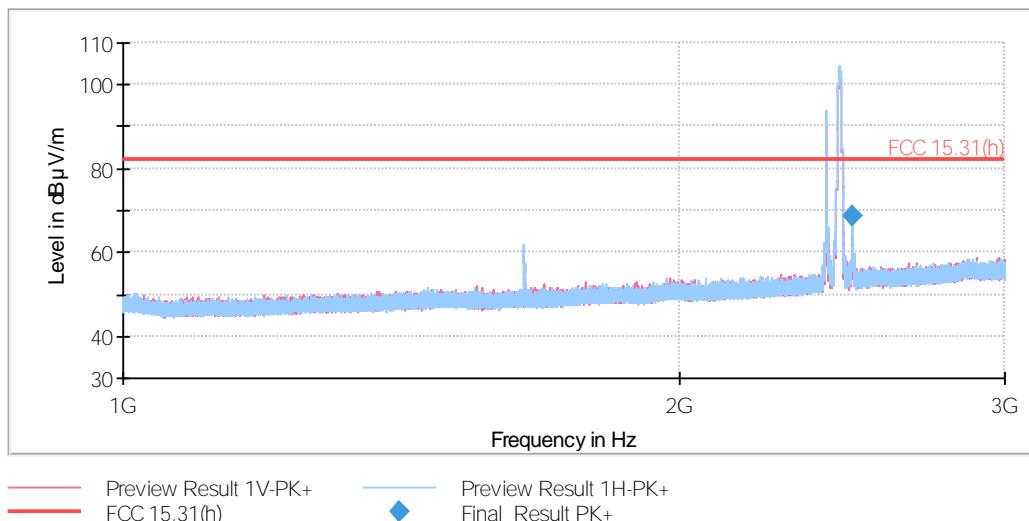
Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	0 dB
1 GHz - 3 GHz	30.769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
26 GHz - 40 GHz	766.667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz



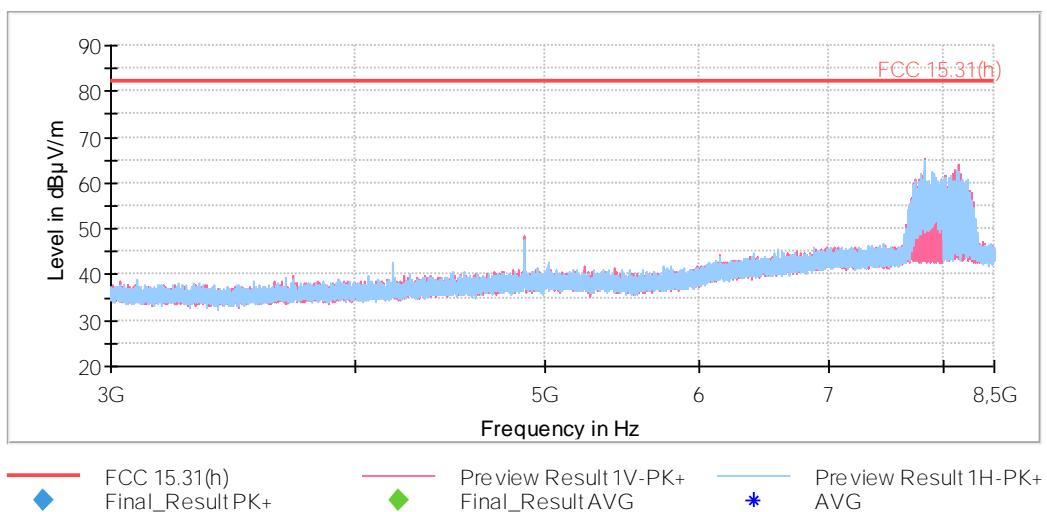
The peak above the limit is the 2G 850 carrier frequency (824.2 MHz).

FREQUENCY RANGE 1 - 8.5 GHz



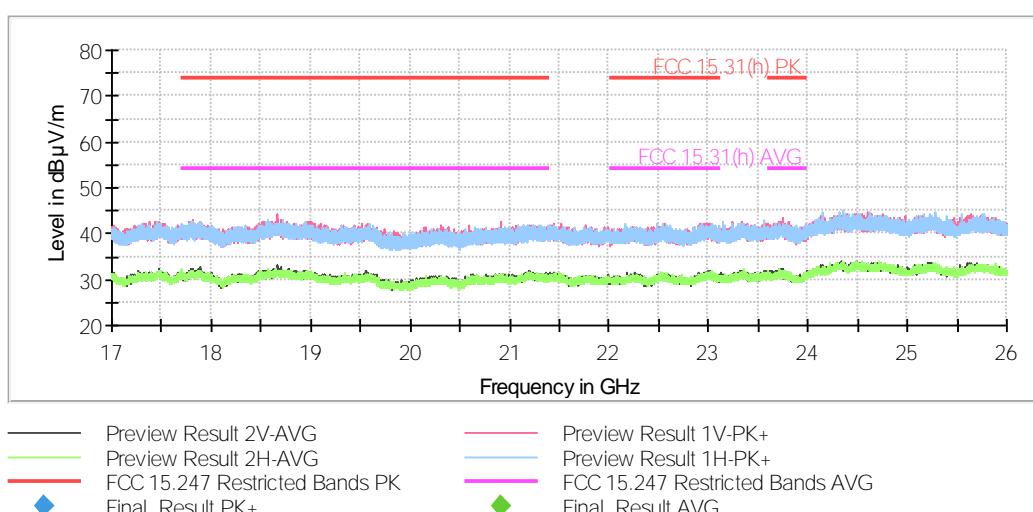
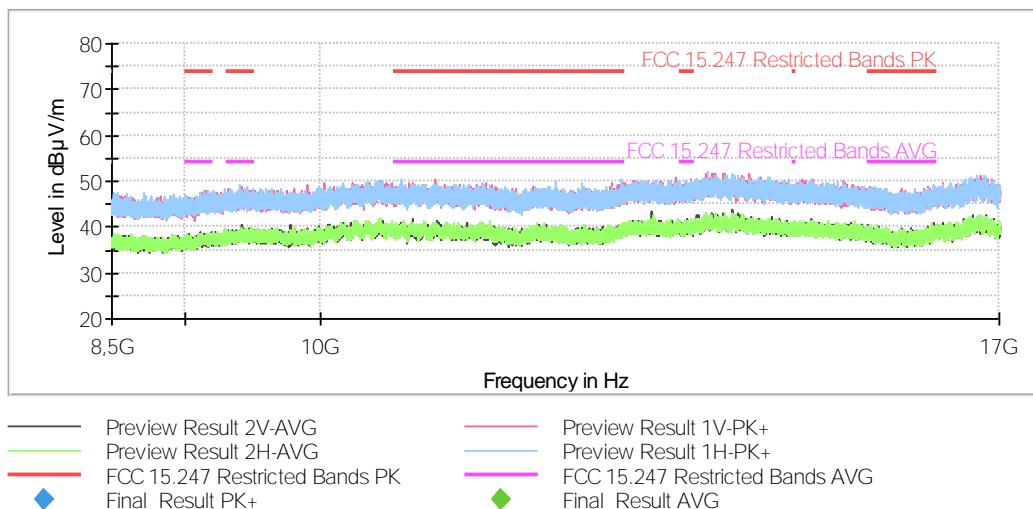
The peak above the limit on the left is the BLE (1M) carrier frequency (2402 MHz).

The peak above the limit on the right is the WLAN 2.4 GHz carrier frequency (2442 MHz).



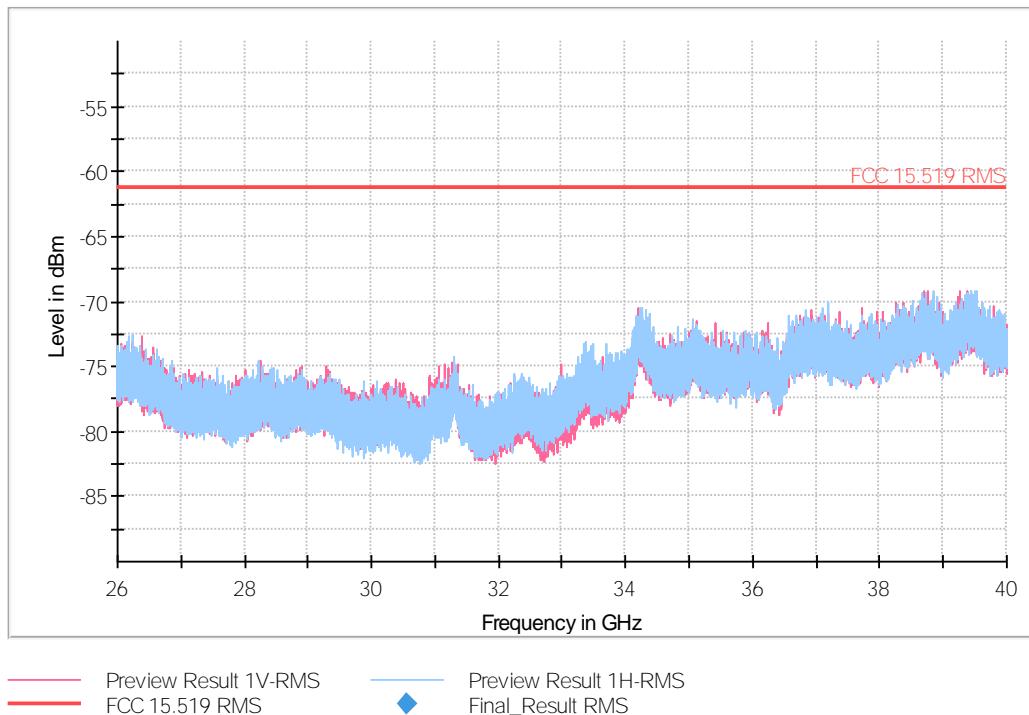
The highest peak on the right is the UWB carrier frequency (7987.2 MHz).

FREQUENCY RANGE 8.5 - 26 GHz



FREQUENCY RANGE 26 - 40 GHz

Full Spectrum



- **Operation Mode 2**

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 40 GHz:

Spurious frequencies at less than 20 dB below the limit:

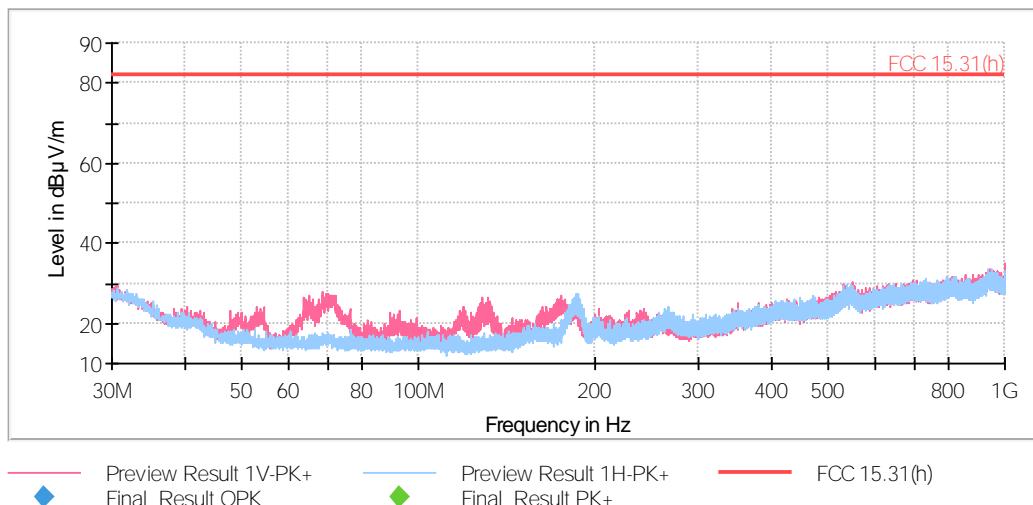
Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
2481.753846	67.57	H	Peak

Verdict

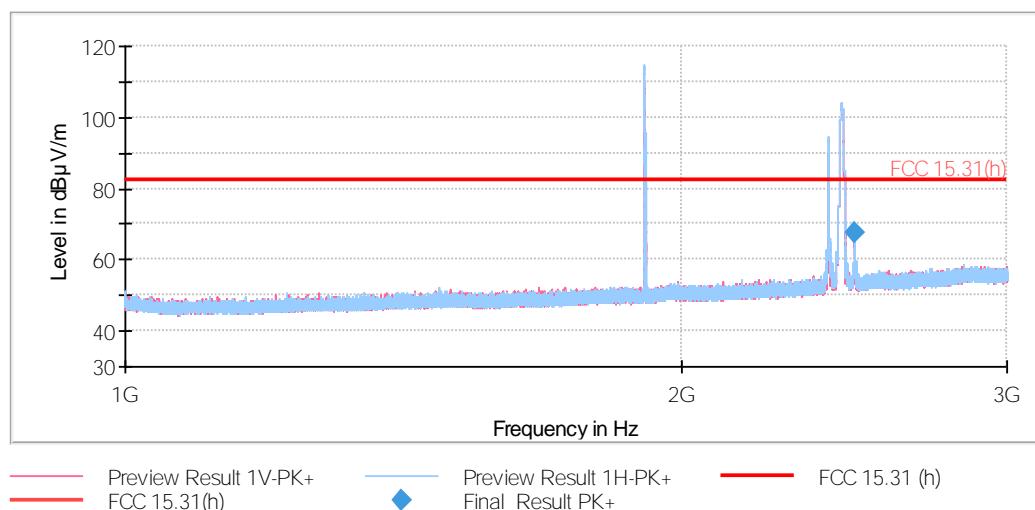
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	0 dB
1 GHz - 3 GHz	30.769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 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

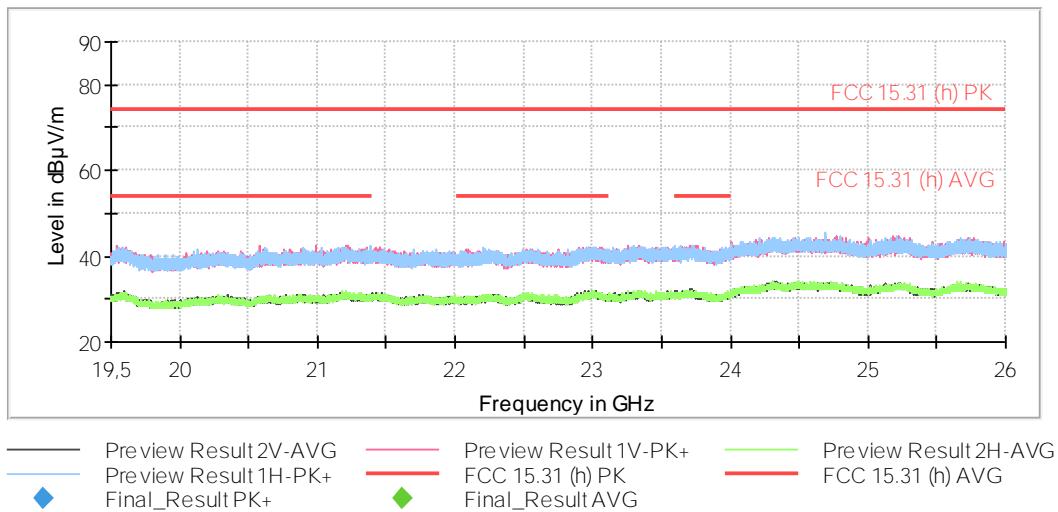
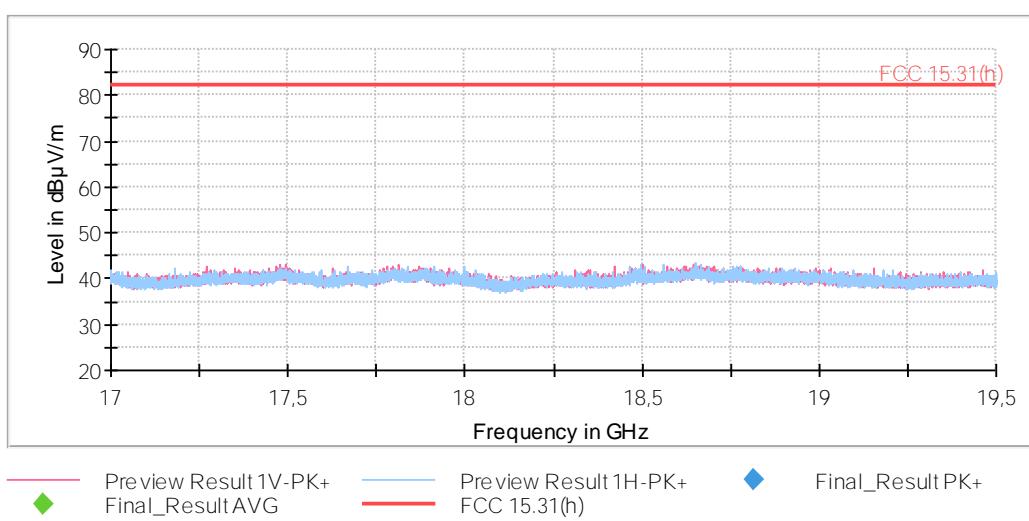
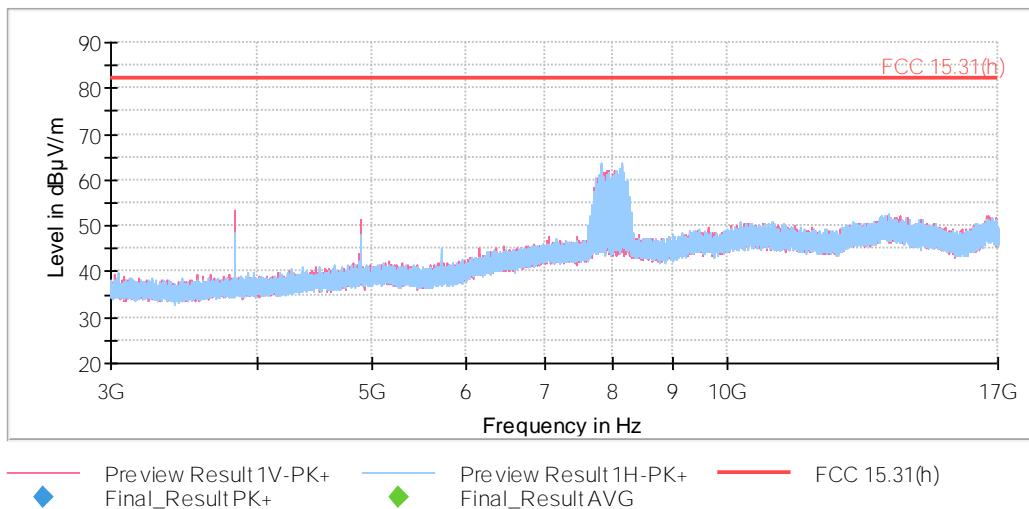


FREQUENCY RANGE 1 - 26 GHz

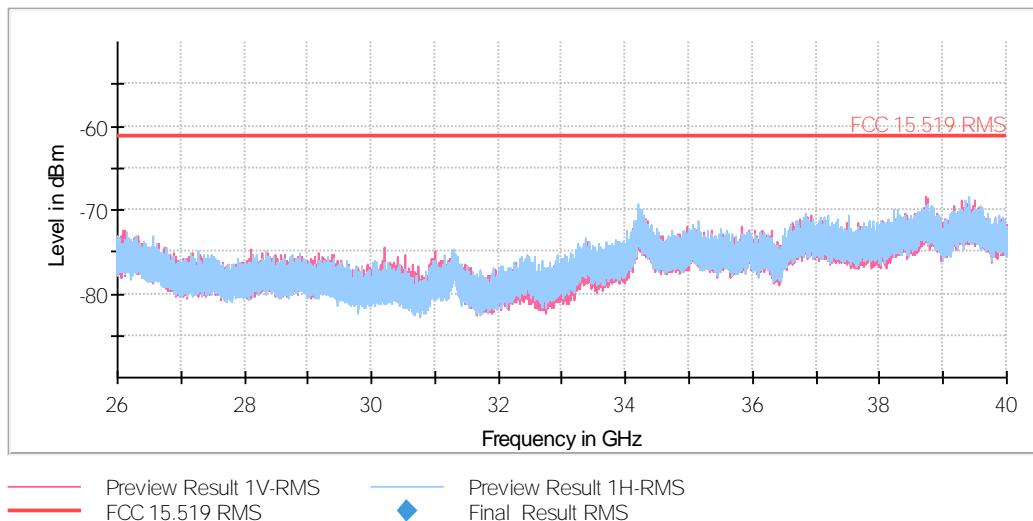


The peak above the limit on the left is the 2G 1900 carrier frequency (1909.8 MHz).

The peaks above the limit on the right are the BLE (1M) carrier frequency (2402 MHz) and the WLAN 2.4 GHz carrier frequency (2442 MHz), respectively.



FREQUENCY RANGE 26 - 40 GHz



- **Operation Mode 3**

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 40 GHz:

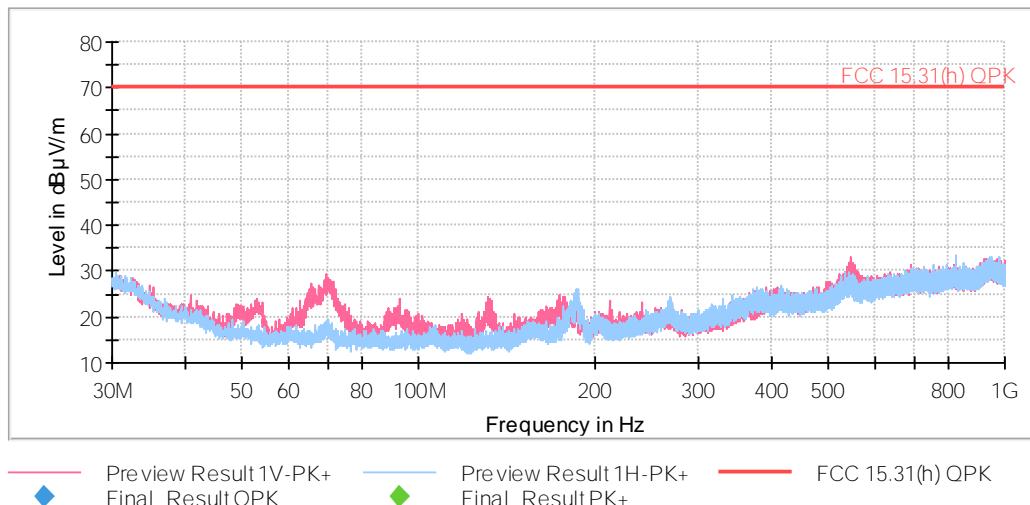
No spurious frequencies detected at less than 20 dB below the limit.

Verdict

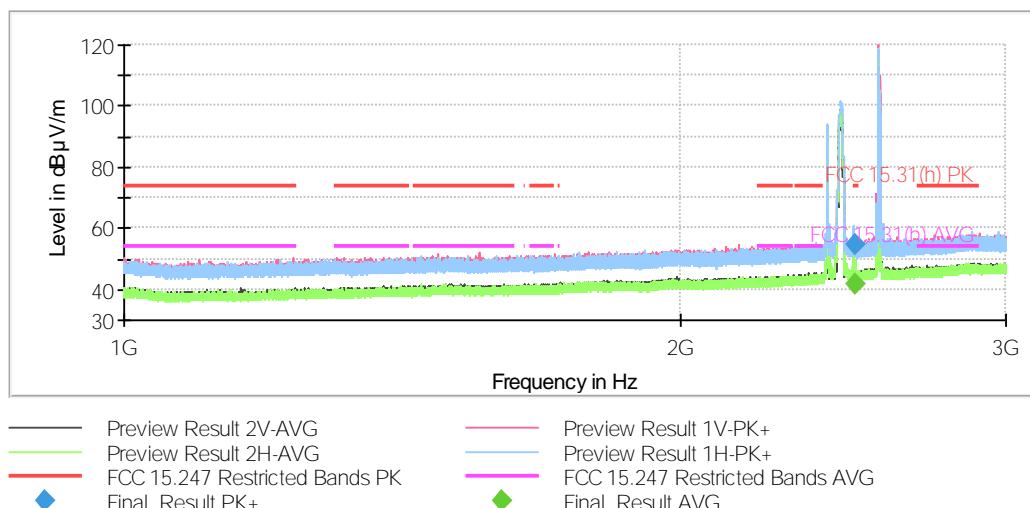
Pass

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
30 MHz - 1 GHz	30.312 kHz	PK+	100 kHz	1 s	0 dB
1 GHz - 3 GHz	30.769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	30 dB
17 GHz - 40 GHz	766.667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

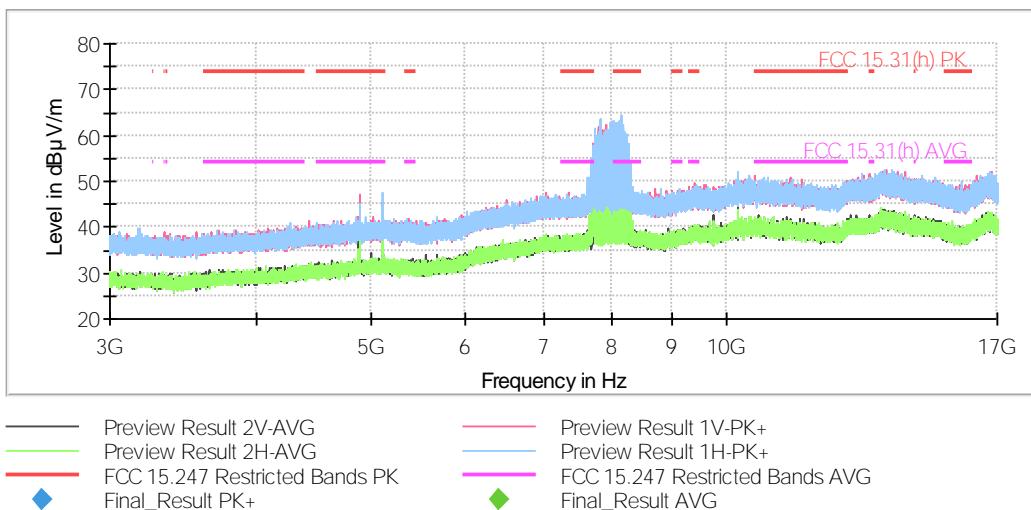


FREQUENCY RANGE 1 - 26 GHz

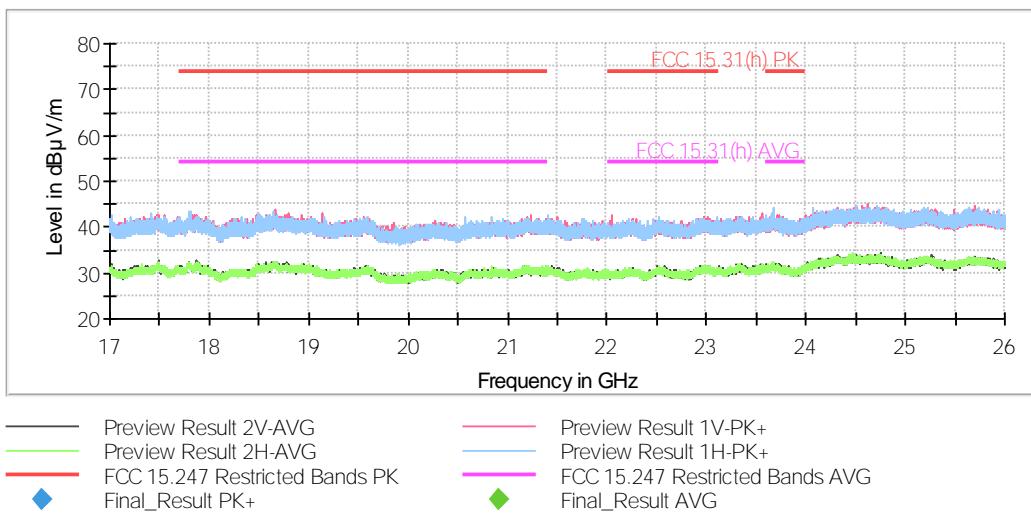


The peaks above the limit on the left are the BLE (1M) carrier frequency (2402 MHz) and the WLAN 2.4 GHz carrier frequency (2442 MHz), respectively.

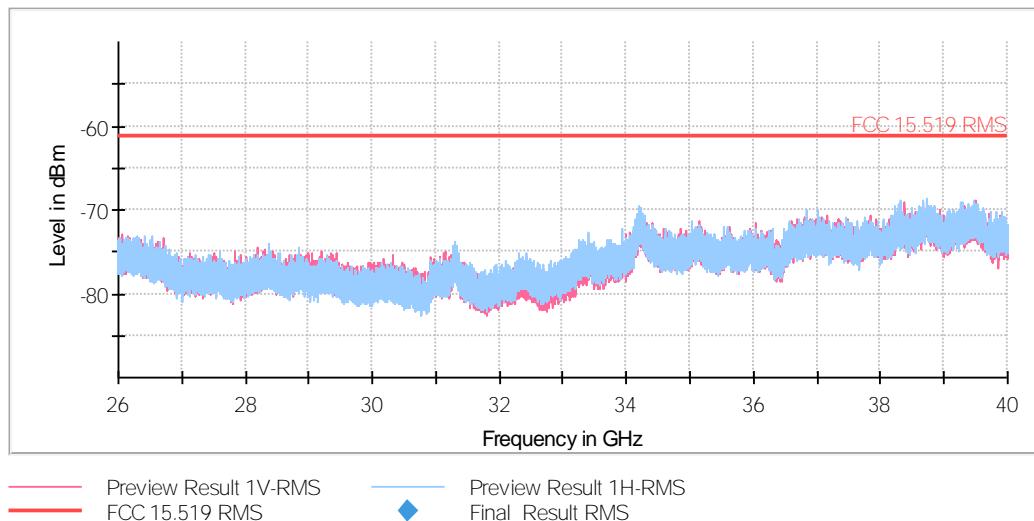
The peak above the limit on the right is the LTE Band 7 carrier frequency (2560 MHz).



The peak above the limit is the UWB carrier frequency (7987.2 MHz).



FREQUENCY RANGE 26 - 40 GHz



- **Operation Mode 4**

Frequency range 30 MHz - 1 GHz:

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

Frequency range 1 - 40 GHz:

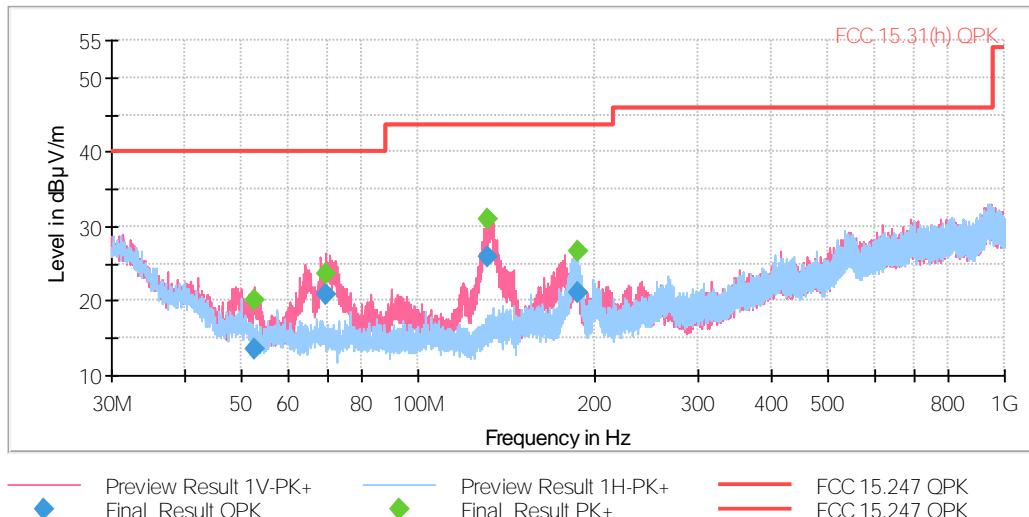
Spurious frequencies at less than 20 dB below the limit:

Spurious frequency (MHz)	E.I.R.P (dBm)	Polarization	Detector
2485.507692	60.30	H	Peak
	51.48		Average
4883.980000	49.03	H	Peak

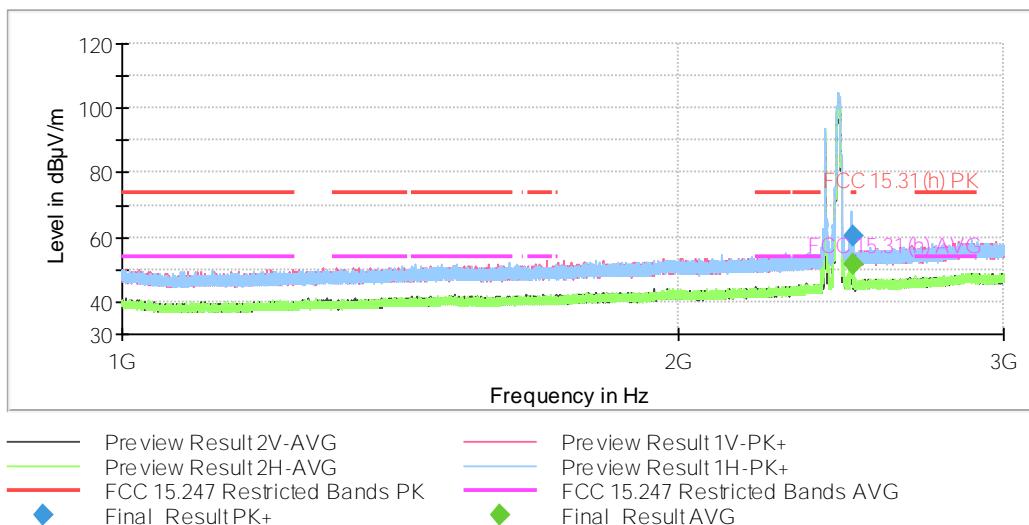
Verdict: PASS

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	30.769 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 - 40 GHz	766.667 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

FREQUENCY RANGE 30 MHz - 1 GHz:

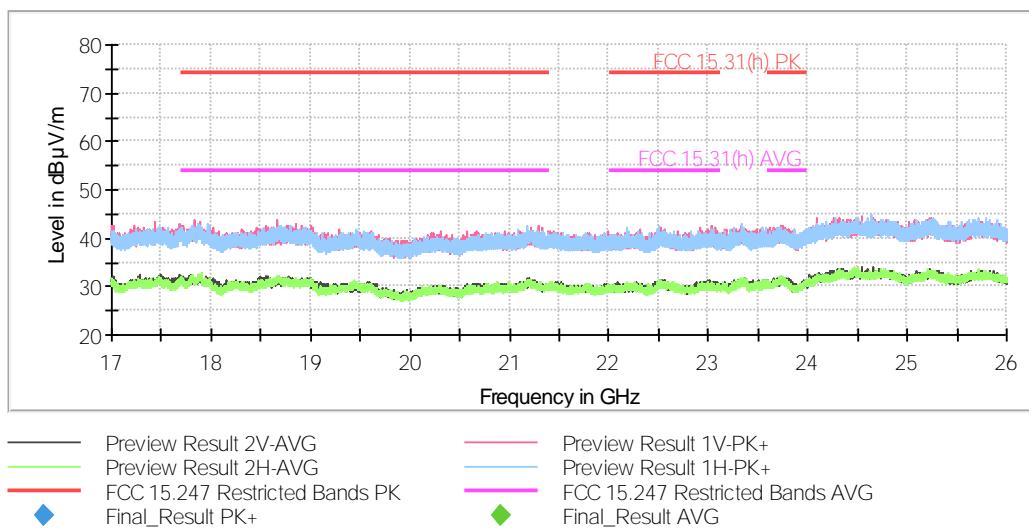
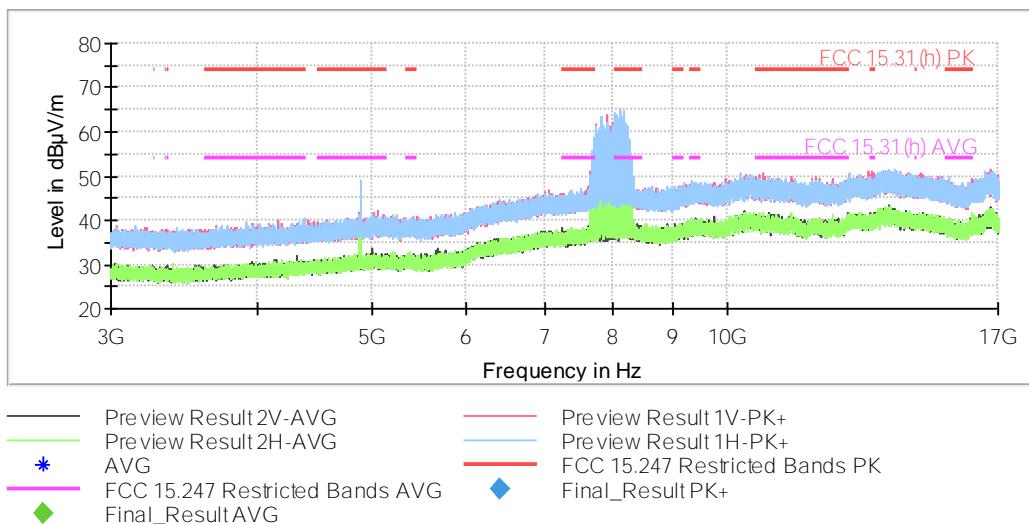


FREQUENCY RANGE 1 - 26 GHz:



The peak above the limit on the left is the BLE (1M) carrier frequency (2402 MHz).

The peak above the limit on the right is the WLAN 2.4 GHz carrier Frequency (2442 MHz).



FREQUENCY RANGE 26 - 40 GHz:

