

ISED CABid: ES1909

Test Report No:
 NIE: 66479RRF.004

Partial Test Report

USA FCC Part 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	Radio mesh device
(*) Trademark	KONE
(*) Model and /or type reference	Pulse (KM51671506G02)
Other identification of the product	HW version: Rev.C SW version: 5.0.0.46 FCC ID: 2ALQBPULSE IC: 4228A-PULSE Powered by USB cable Kone Reference Number: 51786350D18
(*) Features	Wirepas radio, USB and RS485 serial connections
Applicant	KONE CORPORATION Keilasatama 3, 02150 Espoo, Finland
Test method requested, standard	USA FCC Part 15.247 (10-1-19 Edition): Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-19 Edition): Radiated emission limits; general requirements. CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 1 (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. ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor
Date of issue	2021-07-02
Report template No	FDT08_23 (*) "Data provided by the client"

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

DEKRA Testing and Certification S.A.U. is an ISED-recognized accredited testing laboratory, CABid: ES1909, 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.

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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.
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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.

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 Pulse (KM51671506G02) is a radio mesh device for Elevator use.

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
66479C/021	Radio mesh device	Pulse (KM51671506G02)	17	2021/03/17

Auxiliary elements used with the Sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
66479C/023	RS-485 Cable	KONE MESH NODE	--	2021/03/17
CTC-2527-K	Laptop	Dell Latitude 7290	FWKWQQ2	---

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⁾
	USB cable type: 4x0.5mm ² , Shielded, 0.5m (KM51753663V000)	< 3 m	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	-		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Supplementary information to the ports..... :	-				
Rated power supply	Voltage and Frequency				
	<input checked="" type="checkbox"/> DC: USB 5 V				
Rated Power	250mW				
Clock frequencies..... :	32,678 kHz, 32 MHz				
Other parameters	-				
Software version	5.0.0.46				
Hardware version	Rev. C				
Dimensions in cm (W x H x D)	90 mm x 90 mm x 43 mm				
Mounting position	<input type="checkbox"/>	Table top equipment			
	<input checked="" type="checkbox"/>	Wall/Ceiling mounted equipment			
	<input type="checkbox"/>	Floor standing equipment			
	<input type="checkbox"/>	Hand-held equipment			
	<input type="checkbox"/>	Other:			
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
	Schematics	51671507D 02	
	Layout	51671507D 03	
	Part list / Bom	51671507D 01	
	Production files (Gerber)	51671508D 01	

Identification of the client

Bittium Oy
 Ritaharjuntie 1, 90590, Oulu, Finland

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-04-06
Date (finish)	2021-04-07

Document history

Report number	Date	Description
66479RRF.004	2021-07-02	First release.

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.

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: Antonio Manuel Sánchez, Jaime Barranquero and Daniel Mejías.

Used instrumentation:

Radiated Measurements:

	Last Calibration	Due Calibration
1. Semianechoic Absorber Lined Chamber VI ALBATROSS P29419	2020/01	2023/01
2. Shielded room ALBATROSS PROJECTS GMBH P29419	N.A.	N.A.
3. Ultralog Antenna 30MHz-6GHz, ROHDE AND SCHWARZ HL562E_UPG	2019/10	2022/10
4. EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2019/10	2021/10
5. DC Power Supply 30V/5A KEYSIGHT TECHNOLOGIES, U8002A	N.A.	N.A.
6. Digital Multimeter FLUKE 175	2019/11	2020/11
7. Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
8. Preamplifier 30 dB 500MHz-18GHz, SCHWARZBECK BBV 9718 C	2021/02	2022/02
9. DC Power Supply 30V/3A 90W, GW INSTEK GPS-3030D	N.A.	N.A.

Testing verdicts

Not applicable:	N/A
Pass:	P
Fail:	F
Not measured:	N/M

Summary

Bluetooth Low Energy 5.0 (2M, 1M).

FCC PART 15 PARAGRAPH / RSS-247			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(2) / RSS-247 5.2. (a)	6 dB Bandwidth	N/M	(1)
FCC 15.247 (b) / RSS-247 5.4. (d)	Maximum output power and antenna gain	N/M	(1)
FCC 15.247 (d) / RSS-247 5.5.	Band-edge emissions compliance (Transmitter)	N/M	(1)
FCC 15.247 (e) / RSS-247 5.2. (b)	Power spectral density	N/M	(1)
FCC 15.247 (d) / RSS-247 5.5.	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1) Test not requested by the client.			

Appendix A: Test results. Bluetooth Low Energy 5.0 (2M, 1M) (Wirepas)

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TEST CONDITIONS

POWER SUPPLY (*):

Vnominal:	5 Vdc
Type of Power Supply:	External, USB cable

(*) Declared by the Applicant

ANTENNA (*):

Type of Antenna:	Integral.
Maximum Declared Antenna Gain:	+3 dBi

(*) Declared by the Applicant

TEST FREQUENCIES:

Low Channel:	2402 MHz
Middle Channel:	2440 MHz
High Channel:	2480 MHz

RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Bilog antenna for the range between 30 MHz to 1000 MHz and 1 GHz-17 GHz Double ridge horn antenna) is situated at a distance of 3 m and at a distance of 1 m for the frequency range 17 GHz-26 GHz (antenna and 18 GHz-40 GHz horn antenna).

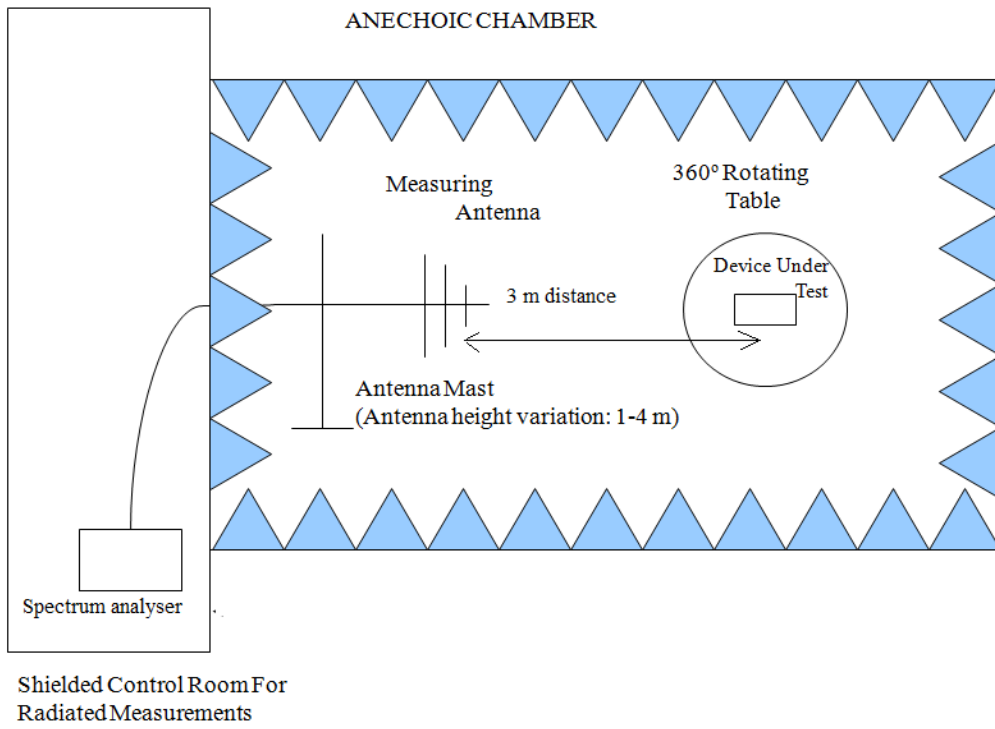
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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

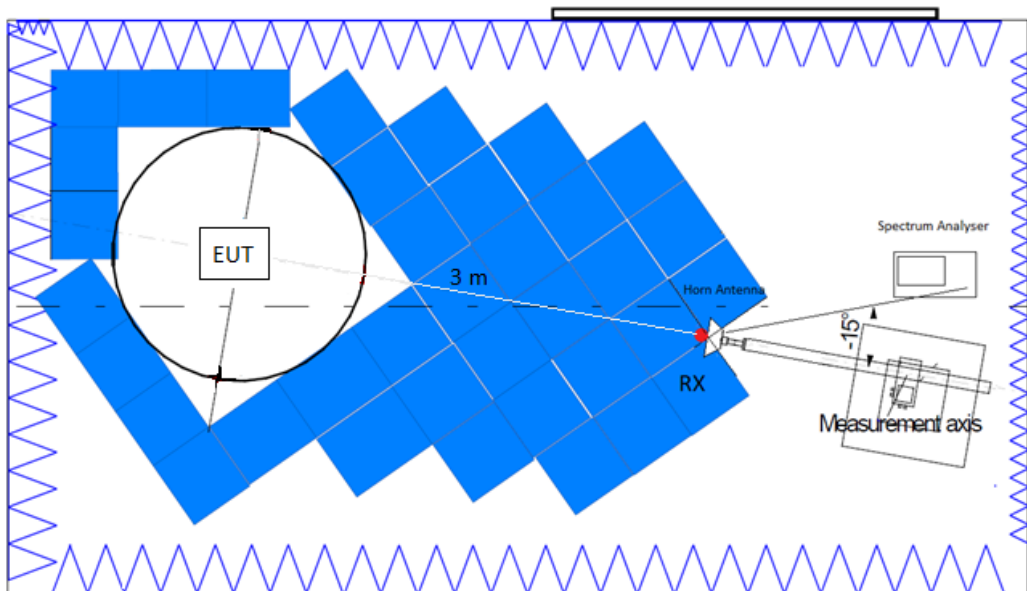
Measurements were made in both horizontal and vertical planes of polarization.

A resolution bandwidth/video bandwidth of 100 kHz / 300 kHz was used for frequencies below 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

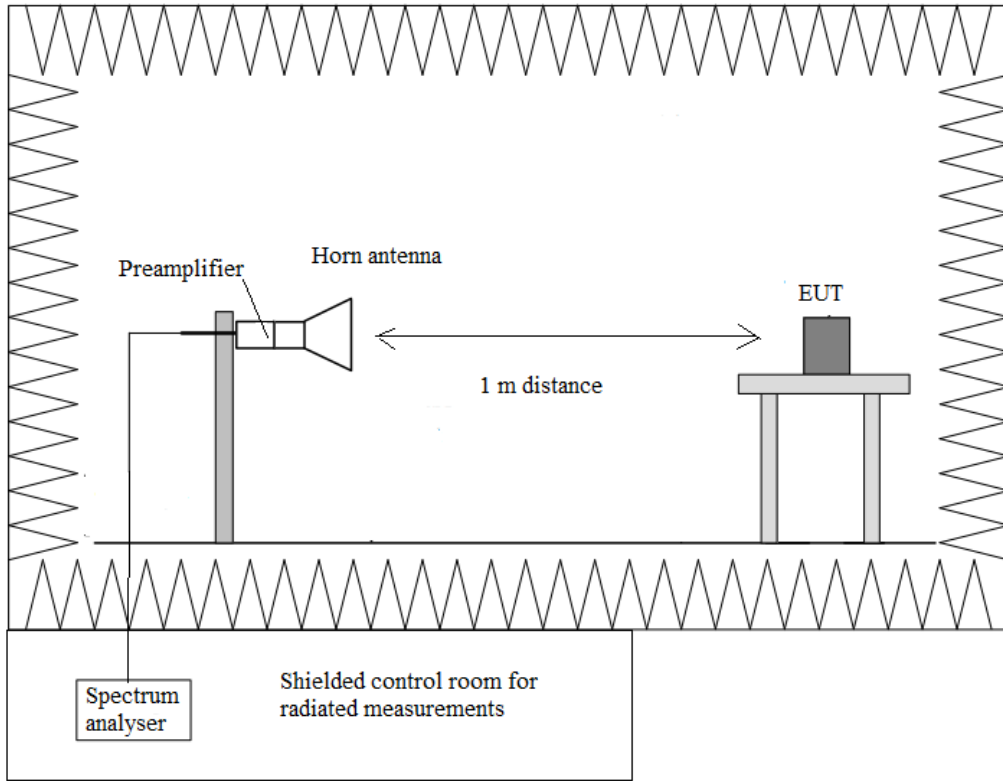
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1 GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



FCC 15.247 (d) / RSS-247 5.5. Emission Limitations Radiated (Transmitter)

SPECIFICATION:

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

Frequency Range (MHz)	Field strength ($\mu\text{V}/\text{m}$)	Field strength ($\text{dB}\mu\text{V}/\text{m}$)	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 - 10000	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-26 GHz.

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

Frequency range 30 MHz - 1 GHz:

The spurious frequencies detected do not depend neither on the operating channel nor the modulation mode.

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

Measurement Uncertainty (dB) $<\pm 5.1$

Frequency range 1 - 26 GHz:

The results in the next tables show the maximum measured levels in the 1-26 GHz range including the restricted bands 2.31-2.39 GHz and 2.4835-2.5 GHz.

Spurious frequencies with peak levels above the average limit (54 dBµV/m at 3 m) are measured with average detector for checking compliance with the average limit.

- **2M modulation:**

- LOW CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.3584	54.58	-	54.58	V	Peak	<± 4.6
	41.24	4.82	46.06		Average	<± 4.6
2.492	54.64	-	54.64	V	Peak	<± 4.6
	41.43	4.82	46.25		Average	<± 4.6
4.8035	43.02	-	39.42	V	Peak	<± 4.6
7.2045	52.59	-	52.59	V	Peak	<± 4.6

- MIDDLE CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.3786	54.54	-	54.54	V	Peak	<± 4.6
	41.19	4.82	46.01		Average	<± 4.6
2.487066667	54.57	-	54.57	V	Peak	<± 4.6
	41.38	4.82	46.2		Average	<± 4.6
4.8805	40.32	-	40.32	V	Peak	<± 4.6
7.321	51.21	-	51.21	V	Peak	<± 4.6

- HIGH CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.370866667	54.22	-	54.22	V	Peak	<± 4.6
	41.20	4.82	46.02		Average	<± 4.6
2.485	57.23	-	57.23	V	Peak	<± 4.6
	42.09	4.82	46.91		Average	<± 4.6
4.960	39.30	-	39.30	V	Peak	<± 4.6
7.4385	52.25	-	52.25	V	Peak	<± 4.6

Measurement Uncertainty (dB): <± 4.6 for 1 < f <= 17 GHz
 <± 4.89 for 17 < f <= 26 GHz

Verdict: PASS

- **1M modulation:**

- LOW CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.338266667	54.12	-	54.12	V	Peak	<± 4.6
	41.16	4.82	45.98		Average	<± 4.6
2.484266667	54.65	-	54.65	V	Peak	<± 4.6
	41.34	4.82	46.16		Average	<± 4.6
4.8035	43.08	-	43.08	V	Peak	<± 4.6
7.2065	52.90	-	52.90	V	Peak	<± 4.6

- MIDDLE CHANNEL. Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.375733333	54.46	-	54.46	V	Peak	<± 4.6
	41.37	4.82	46.19		Average	<± 4.6
2,485	54.31	-	54.31	H	Peak	<± 4.6
	41.35	4.82	46.17		Average	<± 4.6
4.880	41.78	-	41.78	V	Peak	<± 4.6
7.3195	52.06	-	52.06	V	Peak	<± 4.6

- HIGH CHANNEL. Spurious frequencies detected closest to the limit:

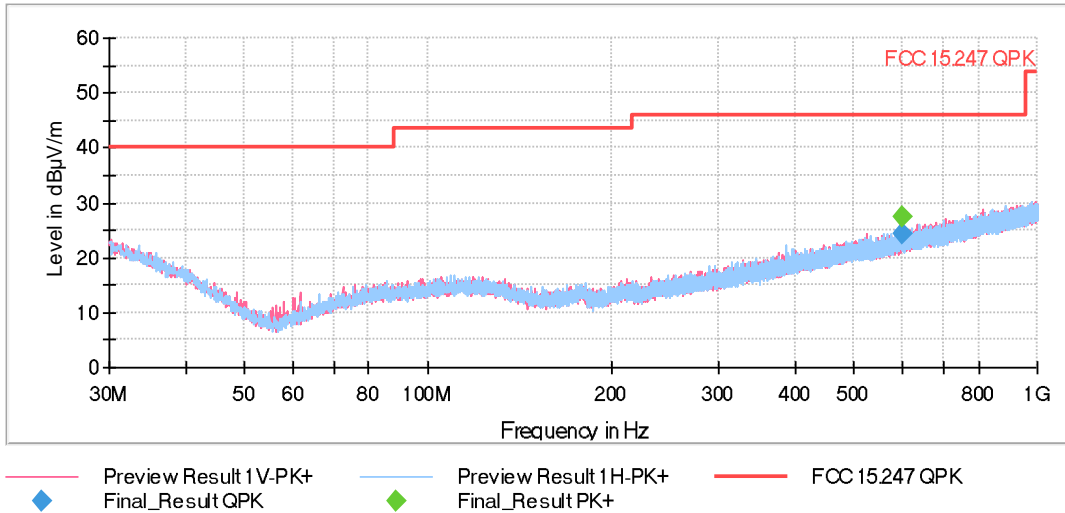
Spurious frequency (GHz)	Emission Level (dBµV/m)	Duty cycle Correction (dB)	Corrected Emission Level (dBµV/m)	Polarization	Detector	Measurement Uncertainty (dB)
2.349733333	54.31	-	54.31	H	Peak	<± 4.6
	41.22	4.82	46.04		Average	<± 4.6
2.492066667	54.58	-	54.58	V	Peak	<± 4.6
	41.50	4.82	46.32		Average	<± 4.6
4.960	42.59	-	42.59	V	Peak	<± 4.6
7.440	52.02	-	52.02	V	Peak	<± 4.6

Measurement Uncertainty (dB): <± 4.6 for $1 < f \leq 17$ GHz
 <± 4.89 for $17 < f \leq 26$ GHz

Verdict: PASS

FREQUENCY RANGE 30 MHz - 1 GHz:

The spurious frequencies detected do not depend neither on the operating channel nor the modulation mode.

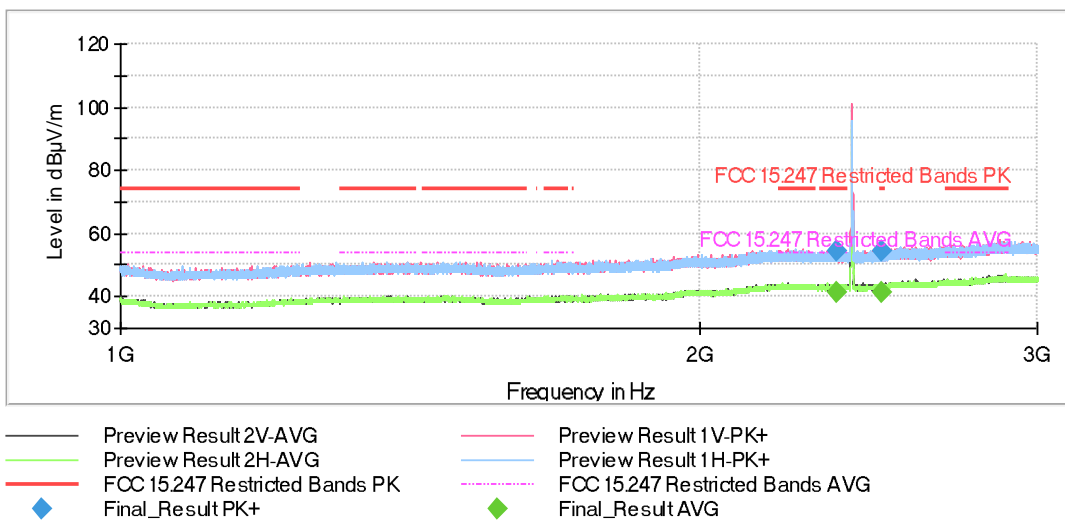


This plot is valid for the Low, Middle and High Channels.

- **2M modulation:**

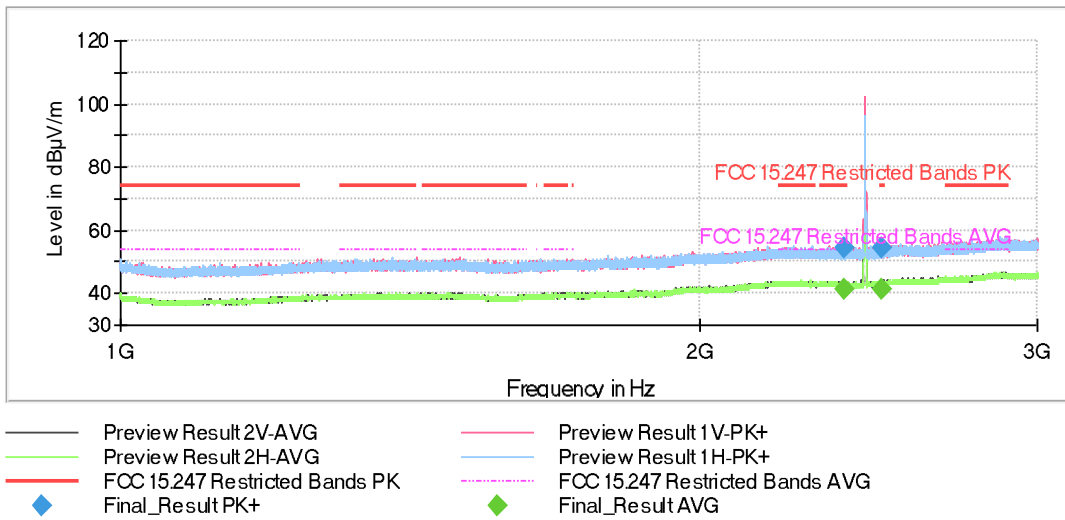
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



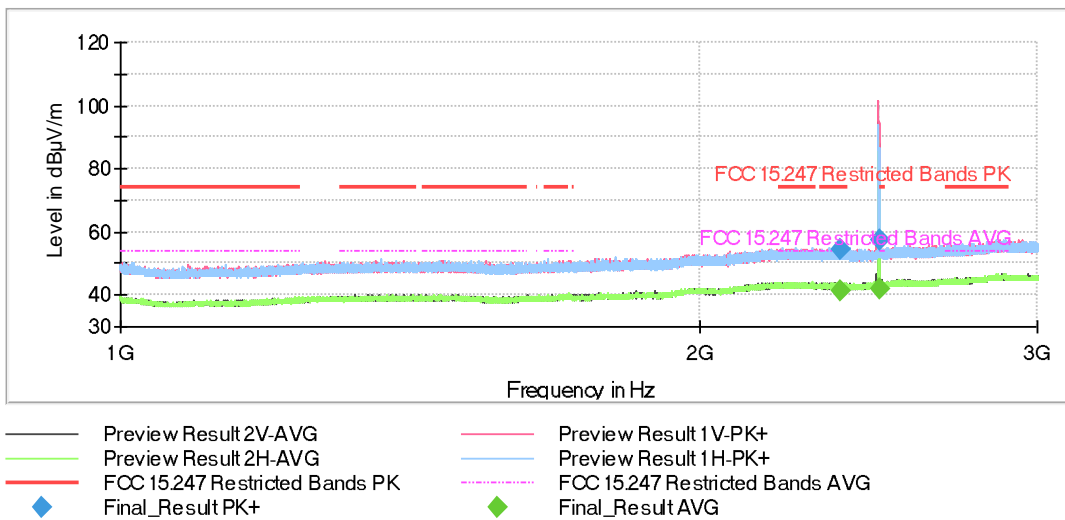
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

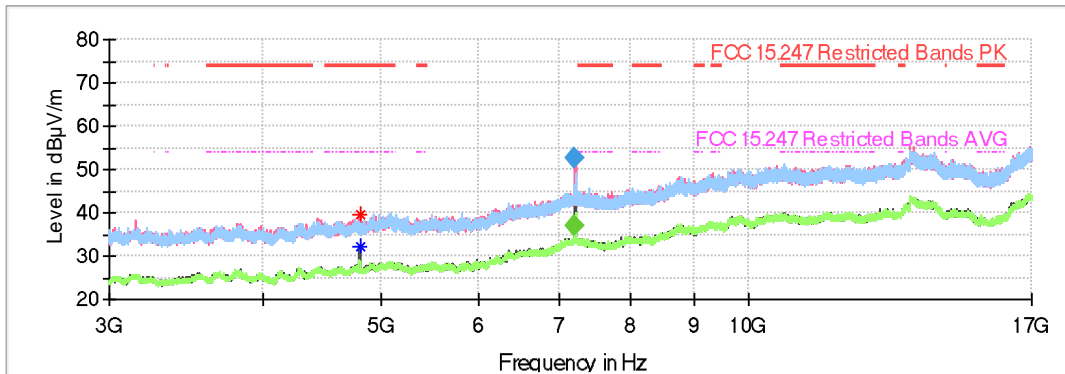
- High Channel:



The peak above the limit is the carrier frequency.

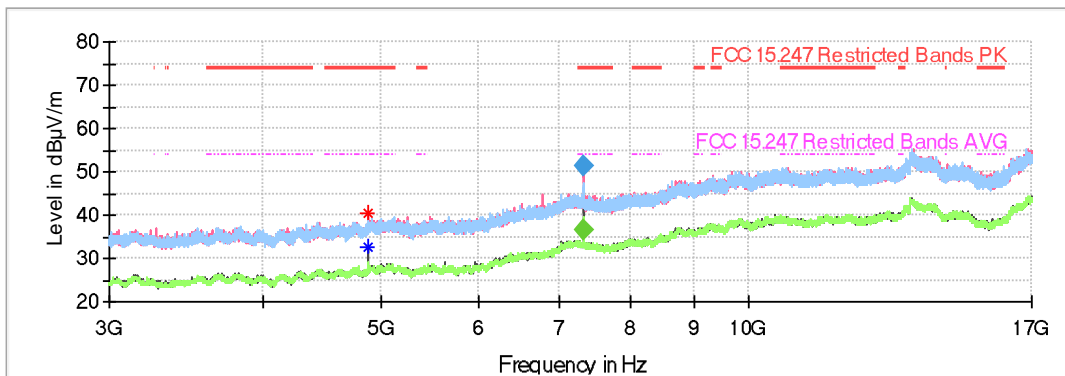
FREQUENCY RANGE 3 - 17 GHz:

- Low Channel:



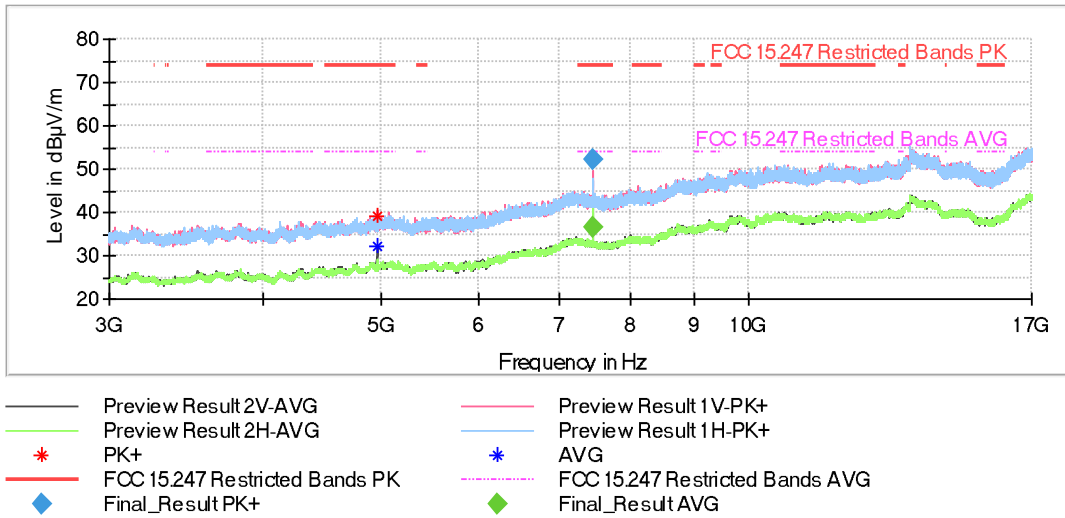
- | | | | |
|---|--------------------------------|---|---------------------------------|
| — | Preview Result 2V-AVG | — | Preview Result 1V-PK+ |
| — | Preview Result 2H-AVG | — | Preview Result 1H-PK+ |
| * | PK+ | * | AVG |
| — | FCC 15.247 Restricted Bands PK | — | FCC 15.247 Restricted Bands AVG |
| ◆ | Final_Result PK+ | ◆ | Final_Result AVG |

- Middle Channel:



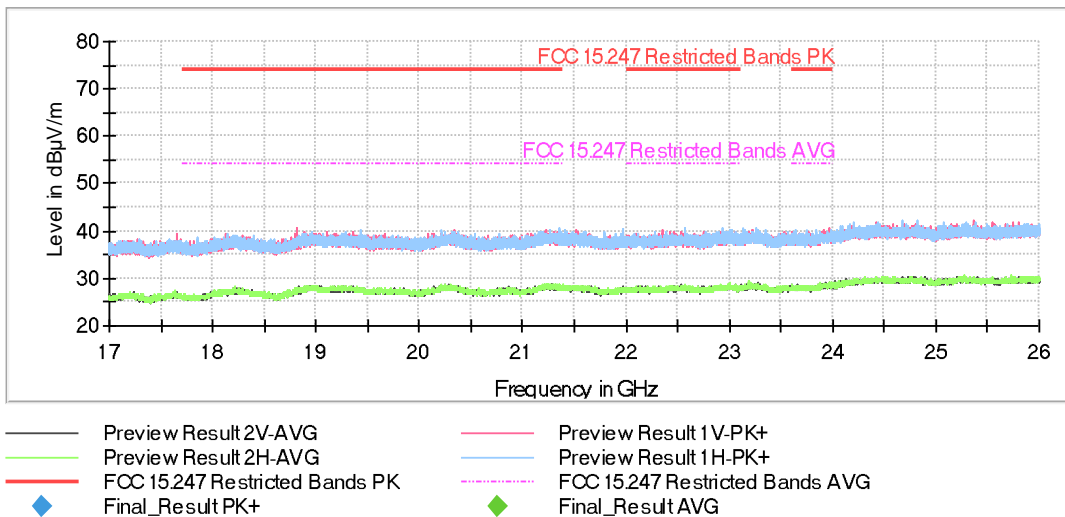
- | | | | |
|---|--------------------------------|---|---------------------------------|
| — | Preview Result 2V-AVG | — | Preview Result 1V-PK+ |
| — | Preview Result 2H-AVG | — | Preview Result 1H-PK+ |
| * | PK+ | * | AVG |
| — | FCC 15.247 Restricted Bands PK | — | FCC 15.247 Restricted Bands AVG |
| ◆ | Final_Result PK+ | ◆ | Final_Result AVG |

- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

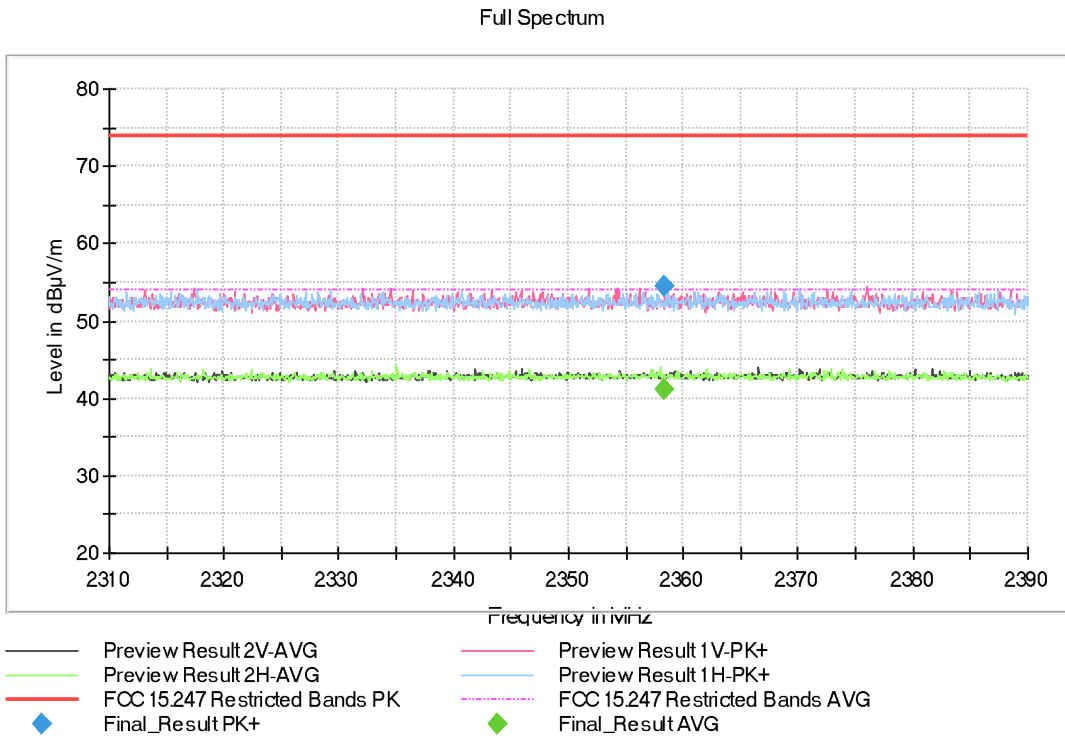
The spurious frequencies detected do not depend on the operating channel.



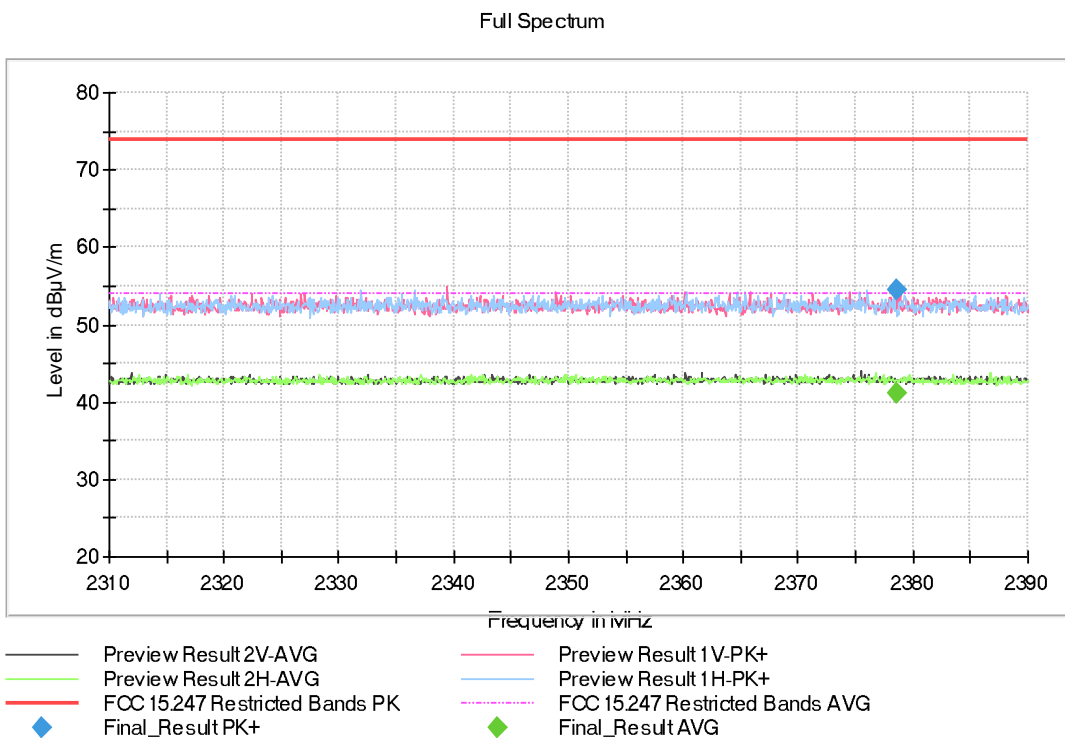
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz:

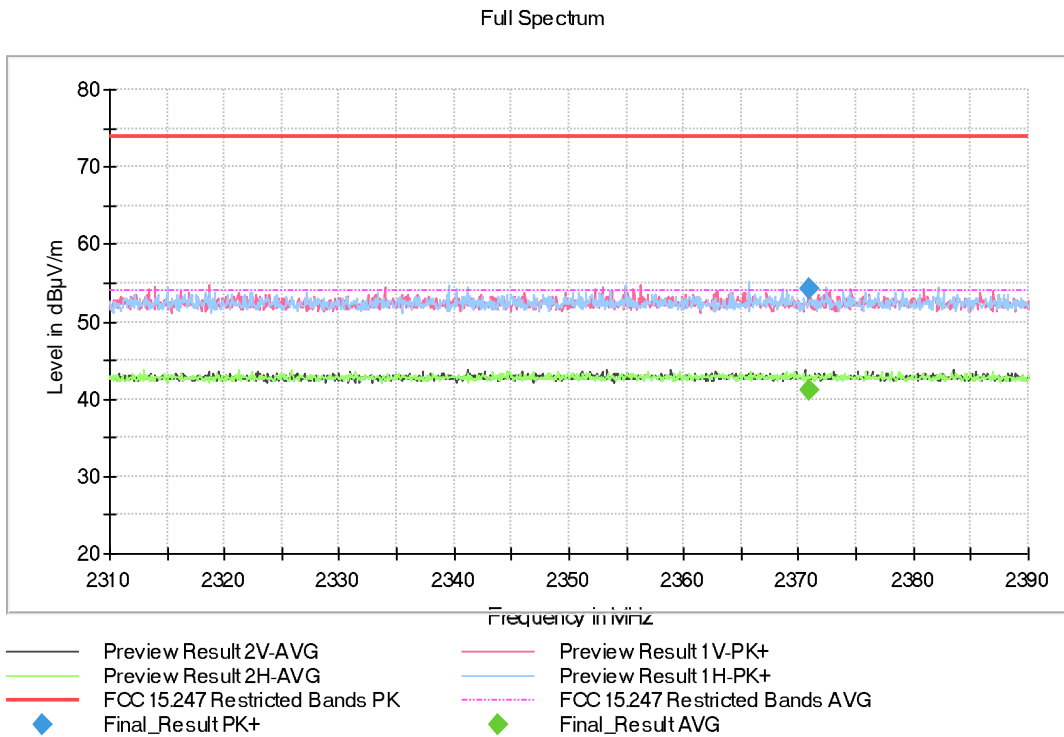
- Low Channel:



- Middle Channel:

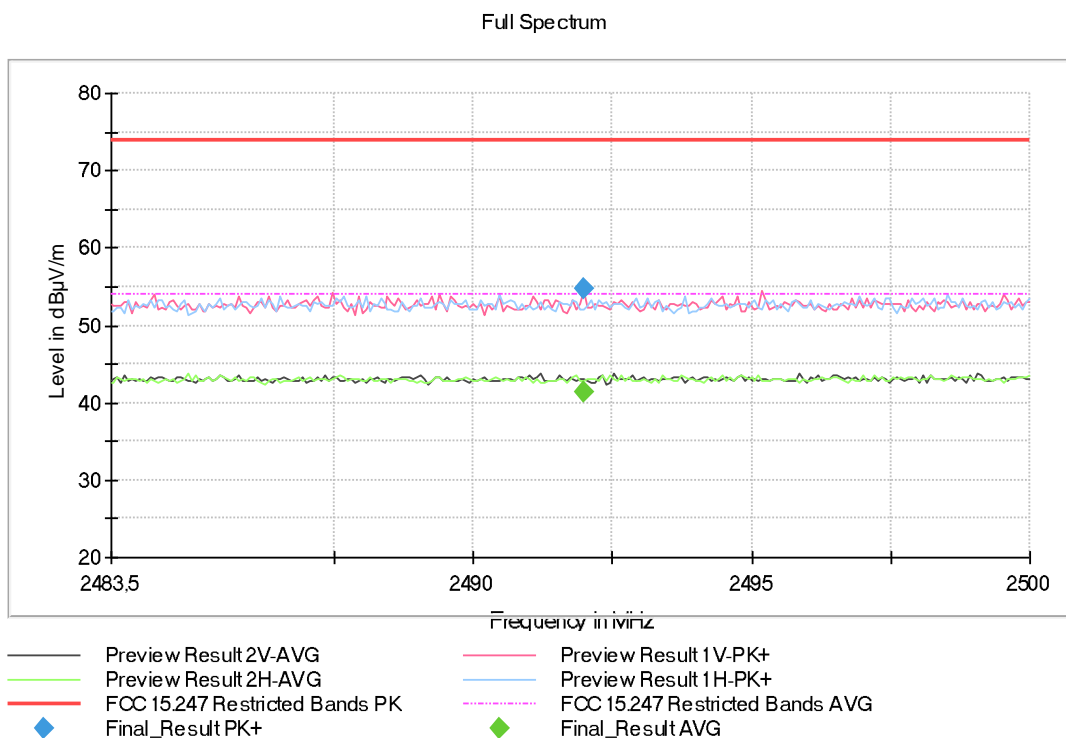


- High Channel:

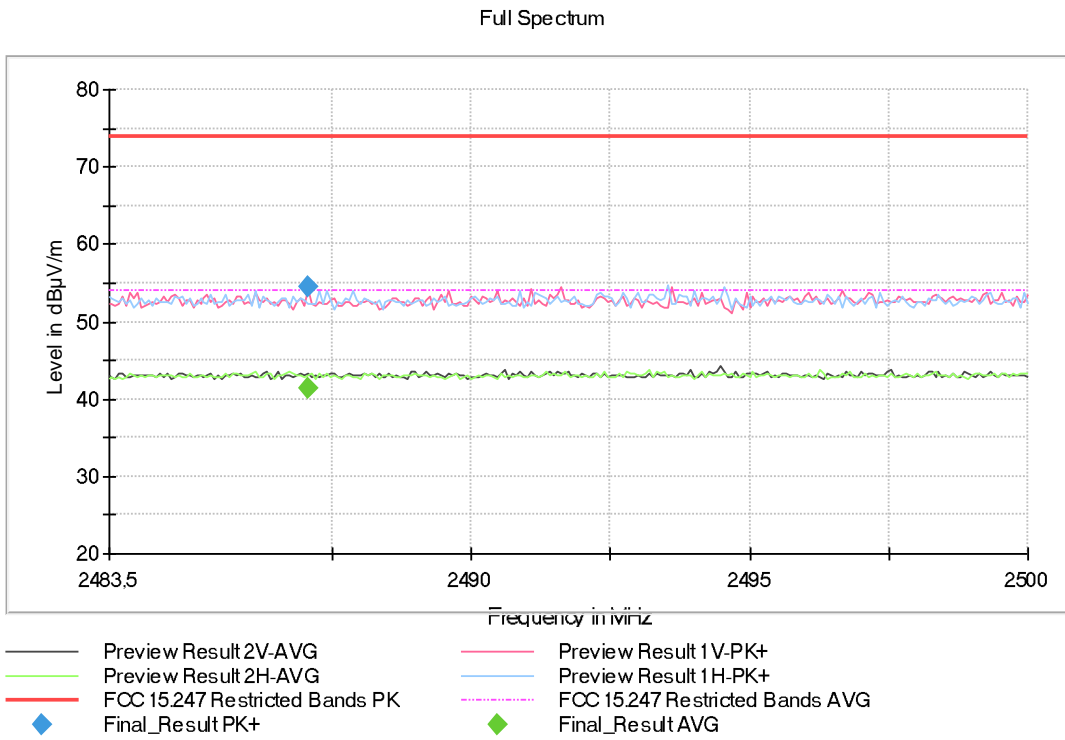


FREQUENCY RANGE 2.4835-2.5 GHz:

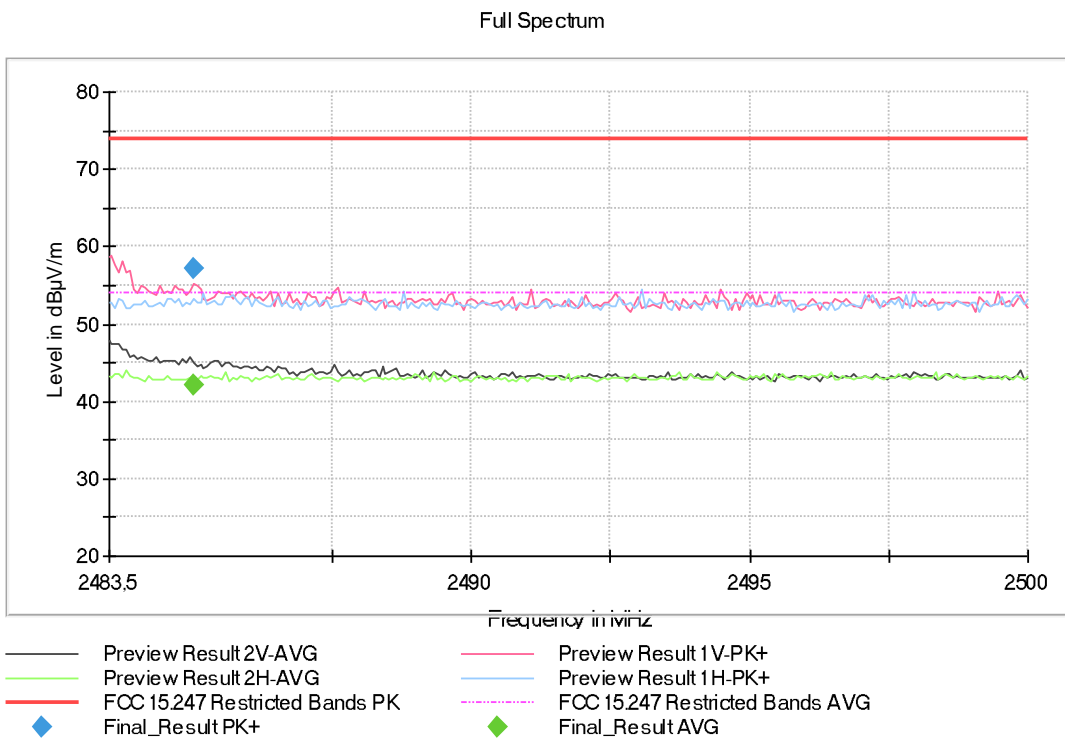
- Low Channel:



- Middle Channel:



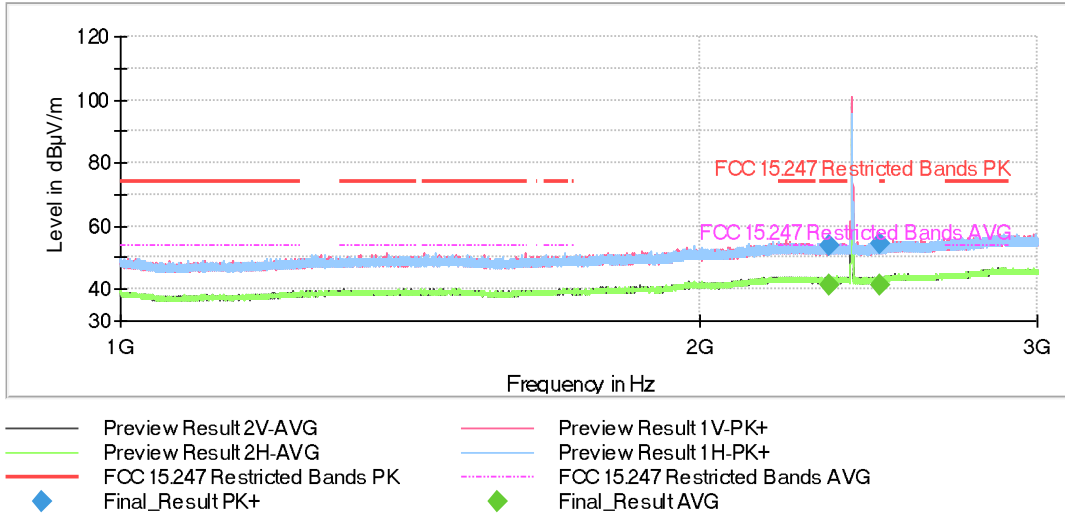
- High Channel:



• **1M modulation:**

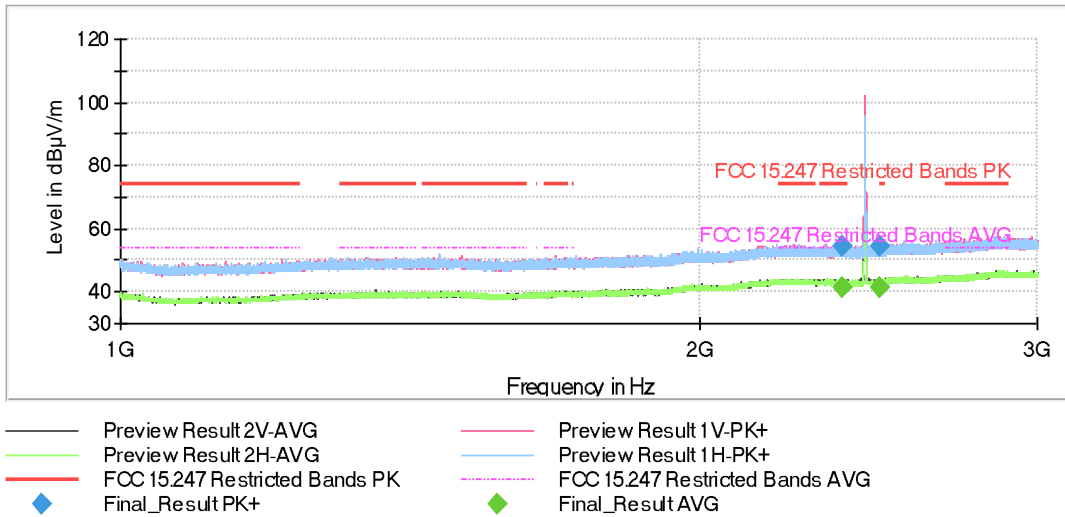
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



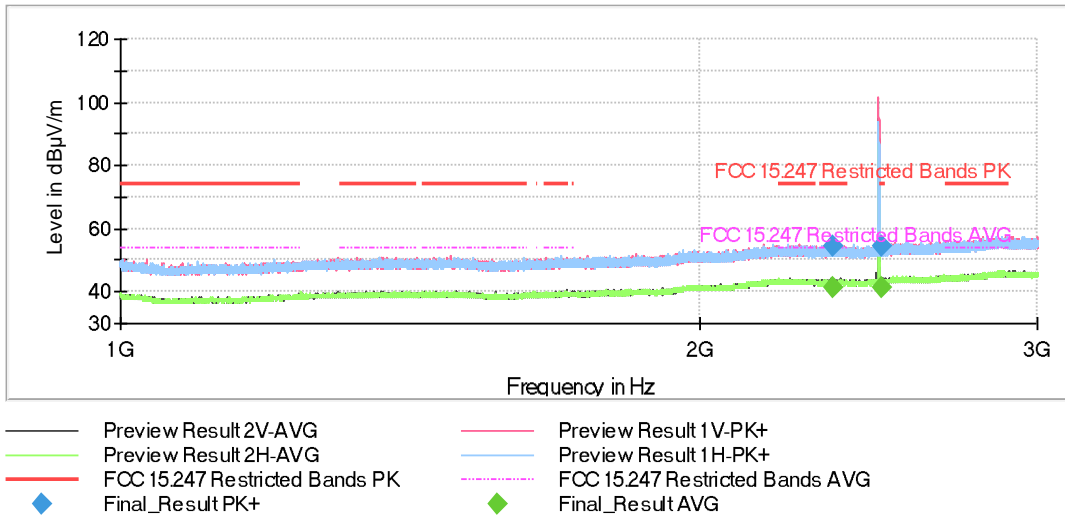
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

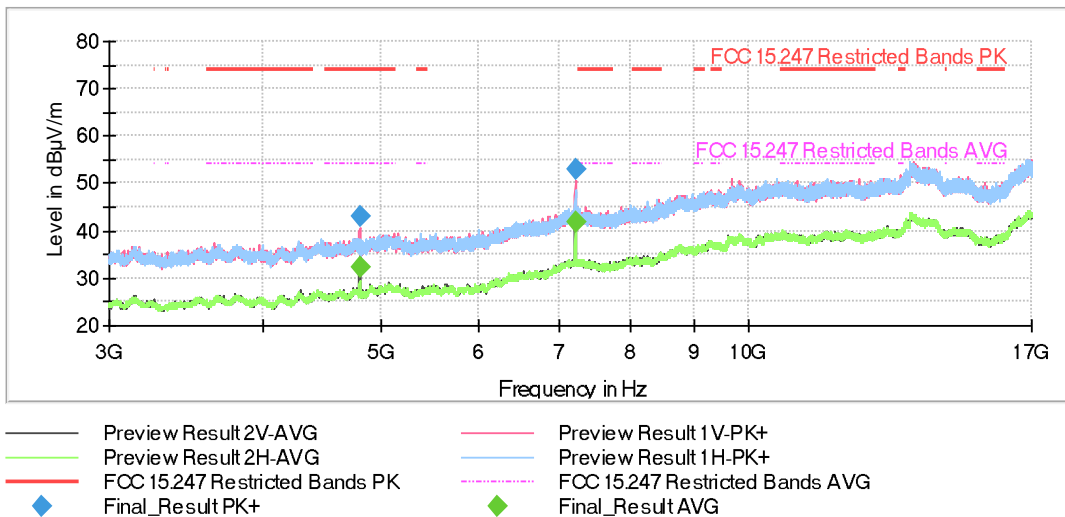
- High Channel:



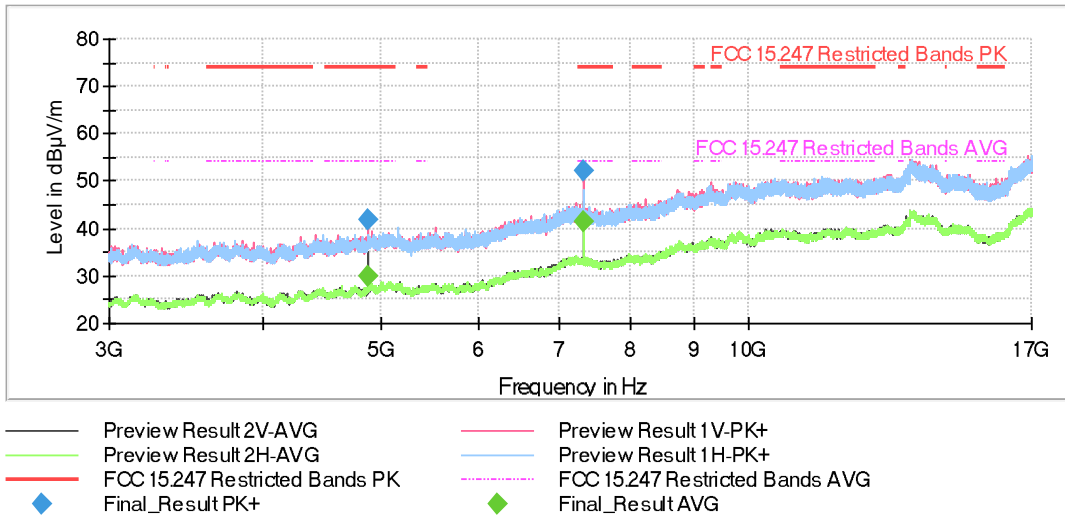
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

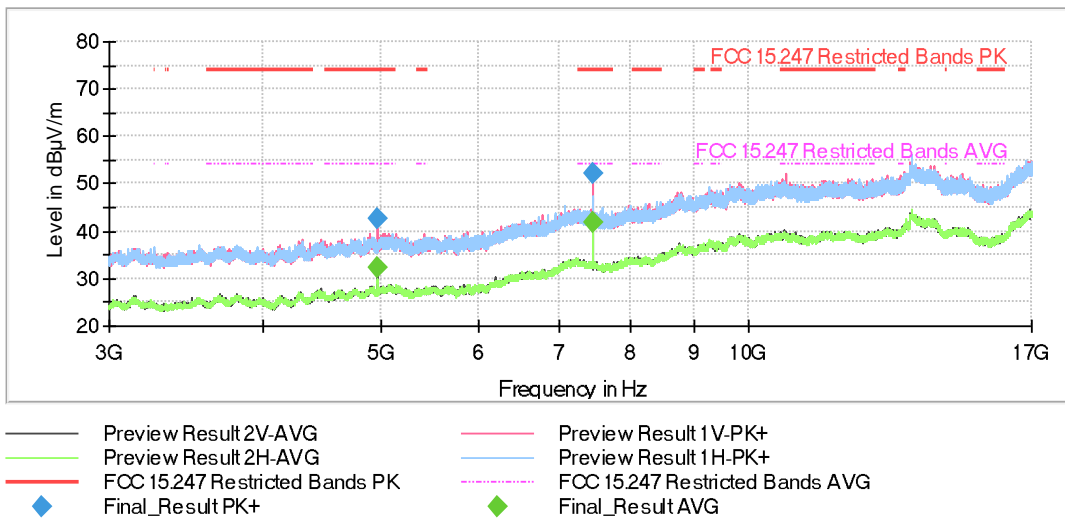
- Low Channel:



- Middle Channel:

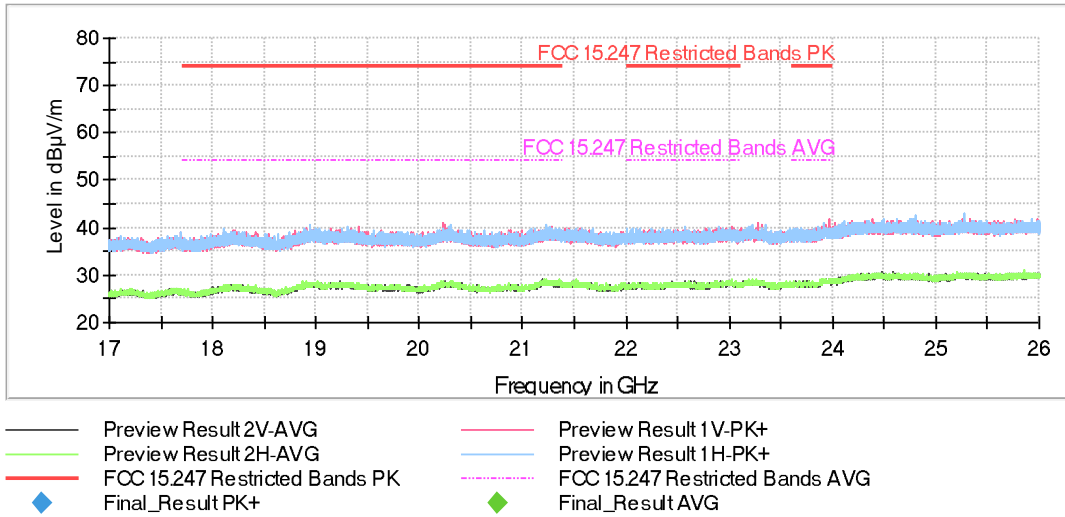


- High Channel:



FREQUENCY RANGE 17 - 26 GHz:

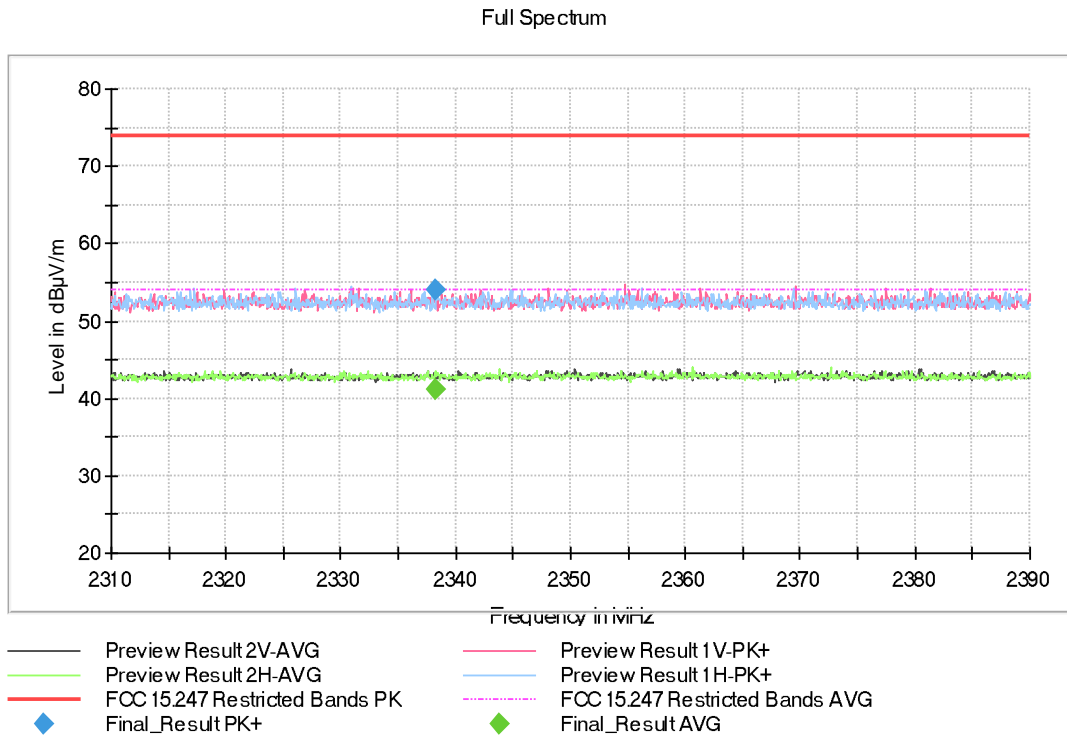
The spurious frequencies detected do not depend on the operating channel.



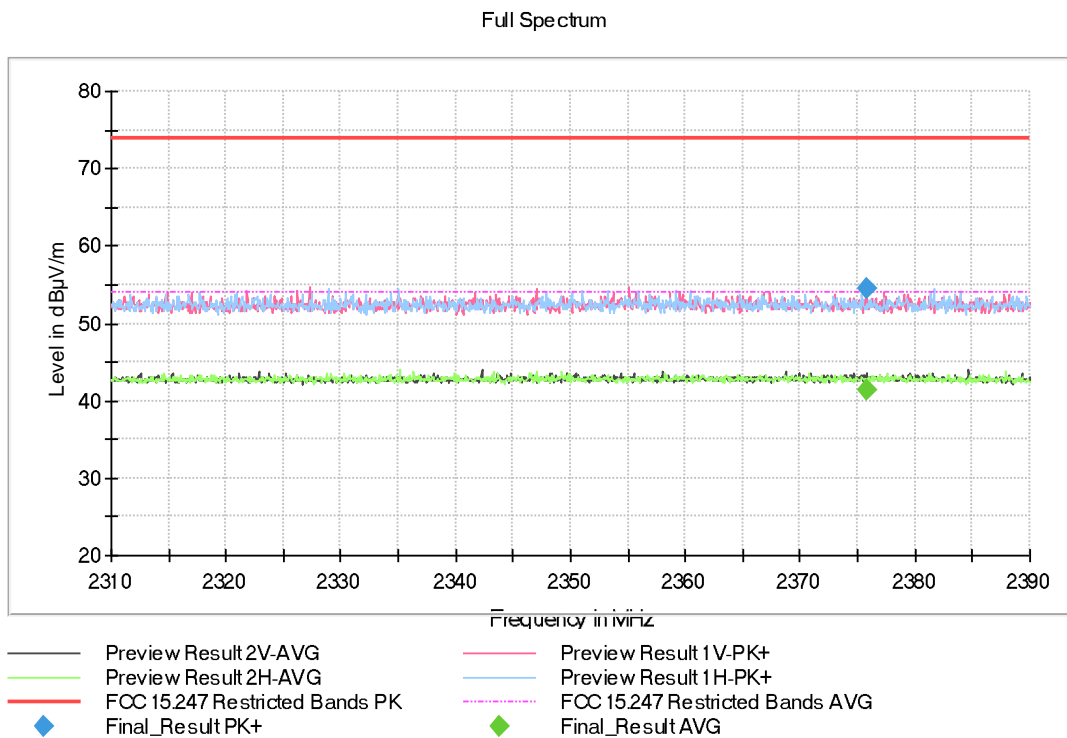
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz:

- Low Channel:

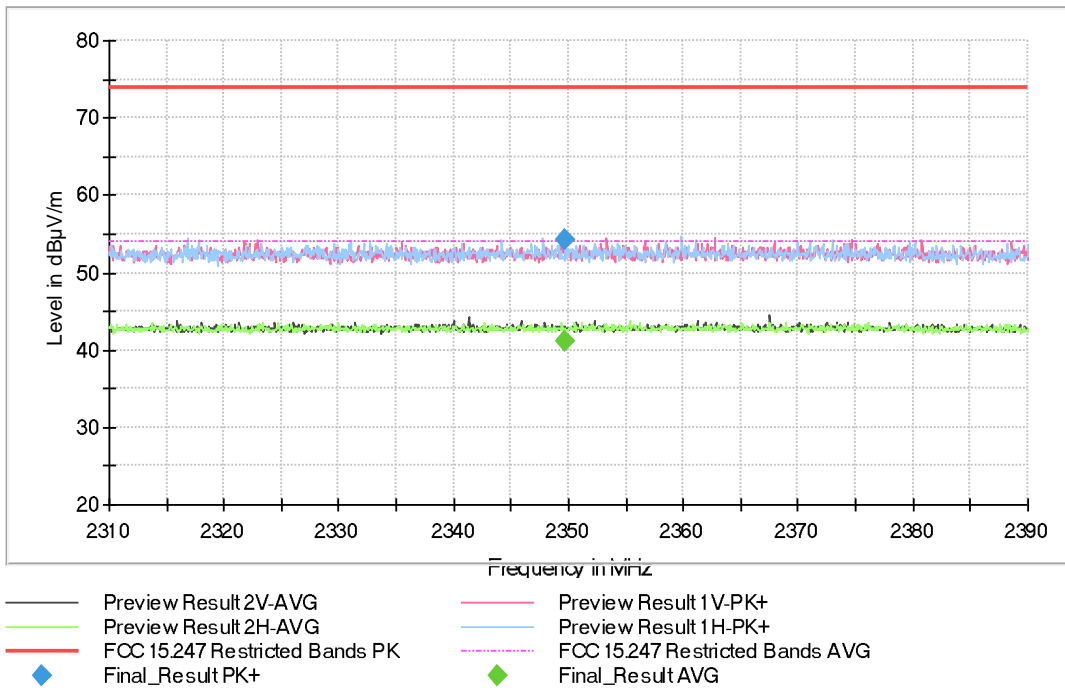


- Middle Channel:



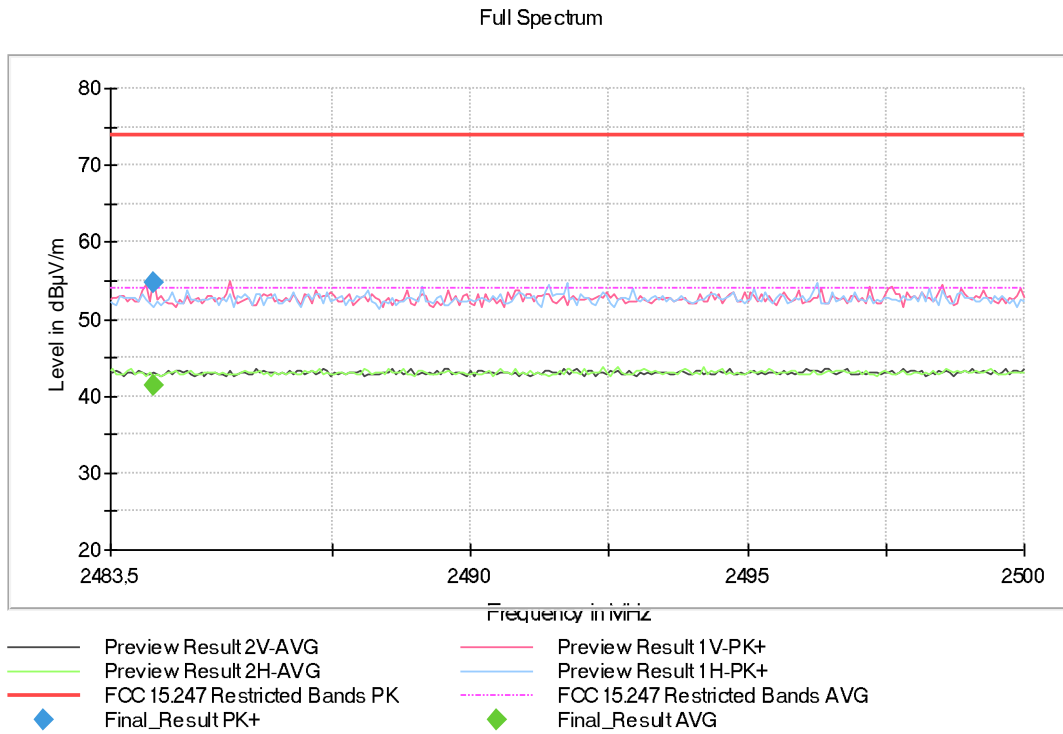
- High Channel:

Full Spectrum

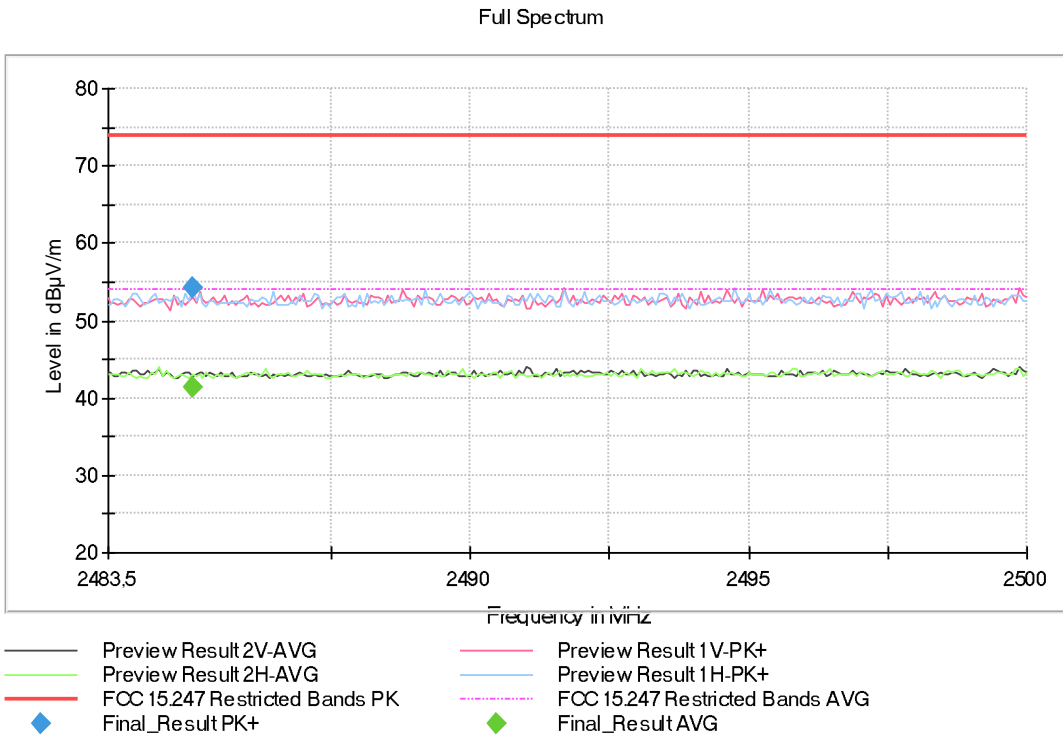


FREQUENCY RANGE 2.4835-2.5 GHz:

- Low Channel:



- Middle Channel:



- High Channel:

Full Spectrum

