

Test report No:
NIE: 69207RRF.003

Test Report

USA FCC Part 15.247, 15.209

Radio Frequency Devices. Operation within the bands 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz.

Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices.

General Requirements and Information for the Certification of Radio Apparatus.

(*) Identification of item tested	Left soccer shin guard
(*) Trademark	Humanox Soccer
(*) Model and /or type reference	HUOX 50 Soccer shin guard (Left)
Other identification of the product	HW version: 2.0 SW version: 29 FCC ID: 2A292-HUX5L25
(*) Features	Bluetooth LE
Applicant	Humanox Soccer, S.A. Lugar de la Oropéndola, Calle "D", 1, - C.P. 11500 – El Puerto de Santa María (Cádiz), Spain.
Test method requested, standard	USA FCC Part 15.247 (10-1-20) Edition: Operation within the bands 902 - 928 MHz, 2400 -2483.5 MHz, and 5725 - 5850 MHz. USA FCC Part 15.209 (10-1-20) Edition: Radiated emission limits; general requirements. 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.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Consumer EMC & RF Lab. Manager
Date of issue	2021-11-30
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 is a FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test 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.
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.

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 HUOX 50 Soccer shin guard (Left) is a Soccer shin guard with IoT technology

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 under test have been selected by: The client.

- Sample S/01 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
69207B/007	Soccer shin guard	HUOX 50 Soccer shin guard (Left)	---	2021/10/13

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

- Sample S/02 is composed of the following elements:

Control N°	Description	Model	Serial N°	Date of reception
69207B/016	Soccer shin guard	HUOX 50 Soccer shin guard (Left)	---	2021/11/26

Sample S/02 has undergone the following test(s): Conducted 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⁾		
			☐	☐	☐		
Supplementary information to the ports..... :	N/A						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐		☐	☐	☐	☐	☐
	☐	DC: 3.8 V					
Rated Power	Not provided data						
Clock frequencies..... :	Not provided data						
Other parameters	Not provided data						
Software version	v28						
Hardware version	v2.0						
Dimensions in cm (W x H x D)	8 x 17 x0.8						
Mounting position	☒	Other: Shinbone of the football player					
Modules/parts..... :	Module/parts of test item		Type		Manufacturer		
	Right soccer shin guard				Humanox Soccer		
Accessories (not part of the test item)	Description		Type		Manufacturer		
	N/A						
Documents as provided by the applicant	Description		File name		Issue date		
	N/A						

⁽³⁾ Only for Medical Equipment

Identification of the client

Humanox Soccer, S.A.

Lugar de la Oropéndola, Calle "D", 1, - C.P. 11500 –
El Puerto de Santa María (Cádiz), Spain.

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-10-13
Date (finish)	2021-11-26

Document history

Report number	Date	Description
69207RRF.003	2021-11-30	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 %

In the chamber for conducted measurements, 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: Jaime Barranquero and Victoria Olmedo.

Used instrumentation:

Radiated Measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ALBATROSS P29419	N.A.	N.A.
2.	Shielded Room ALBATROSS 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.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019/11	2022/11
6.	HORN ANTENNA 18-40GHz SCHWARZBECK BBHA 9170	2021/03	2024/03
7.	PRE-AMPLIFIER 30dB 500MHz-18GHz, SCHWARZBECK BBV 9718 C	2021/02	2022/02
8.	PRE-AMPLIFIER G>30dB 18-40GHz BONN ELEKTRONIK BLMA 1840-3G	2019/11	2021/11

Conducted Measurements

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N/A	N/A
2.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2021/02	2023/02
3.	Open Switch Unit up to 7.5GHz ROHDE AND SCHWARZ OSP-B157W8 PLUS	2021/08	2023/08
4.	Open Switch Unit up to 40 GHz ROHDE AND SCHWARZ OSP-B157Wx	N.A.	N.A.

Testing verdicts

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

Summary

Bluetooth Low Energy (5.0)

FCC PART 15 PARAGRAPH			
Requirement – Test case		Verdict	Remark
FCC 15.247 (a)(2)	6 dB Bandwidth	P	
FCC 15.247 (b)	Maximum output power and antenna gain	P	
FCC 15.247 (d)	Band-edge emissions compliance (Transmitter)	P	
FCC 15.247 (e)	Power spectral density	P	
FCC 15.247 (d)	Emission limitations radiated (Transmitter)	P	
<u>Supplementary information and remarks:</u>			
(1) The equipment only supports BLE5.0 at 2Mbps.			

Appendix A: Test results. Bluetooth Low Energy

TEST CONDITIONS.....	11
Occupied Bandwidth.....	14
FCC 47 CFR Part 15.247 (a) (2) 6 dB Bandwidth	16
FCC 15.247 (b) Maximum output power and antenna gain	18
FCC 15.247 (d) Band-edge emissions compliance (Transmitter).....	21
FCC 15.247 (e) Power spectral density	23
FCC Section 15.247 (d). Emission limitations radiated (Transmitter).....	25

TEST CONDITIONS

POWER SUPPLY (V):

V nominal:	3.8 Vdc.
Type of Power Supply:	Internal battery.

ANTENNA:

Type of Antenna:	Internal (PCB).
Maximum Declared Antenna Gain:	+3.3 dBi

TEST FREQUENCIES:

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

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is connected to the TS8997 using a low loss RF cable. The reading of the spectrum analyser is corrected taking into account the cable loss.



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 (17 GHz-40 GHz horn antenna).

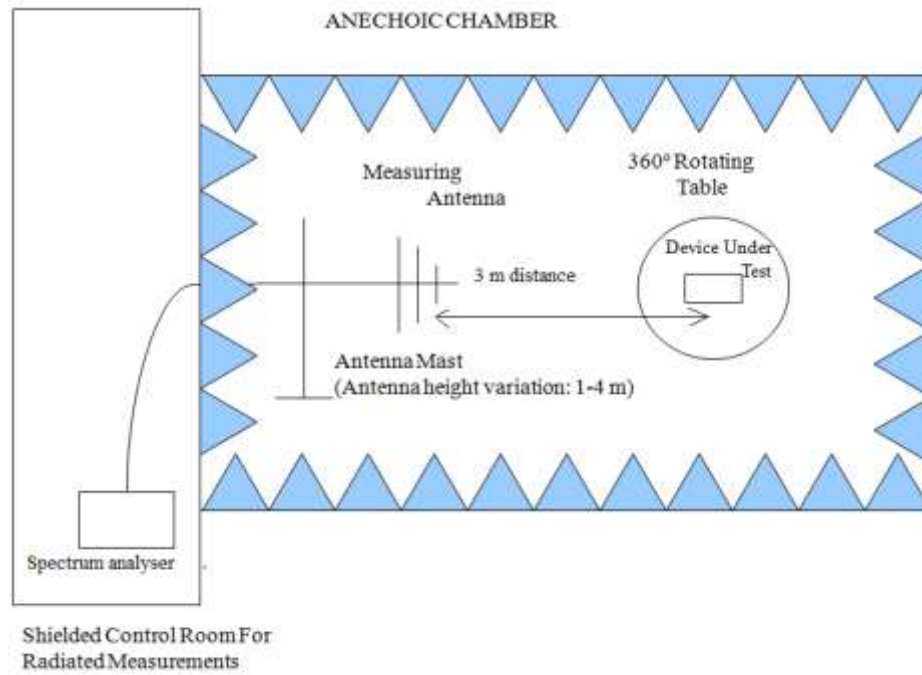
For radiated emissions in the range 17 GHz-26 GHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

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.

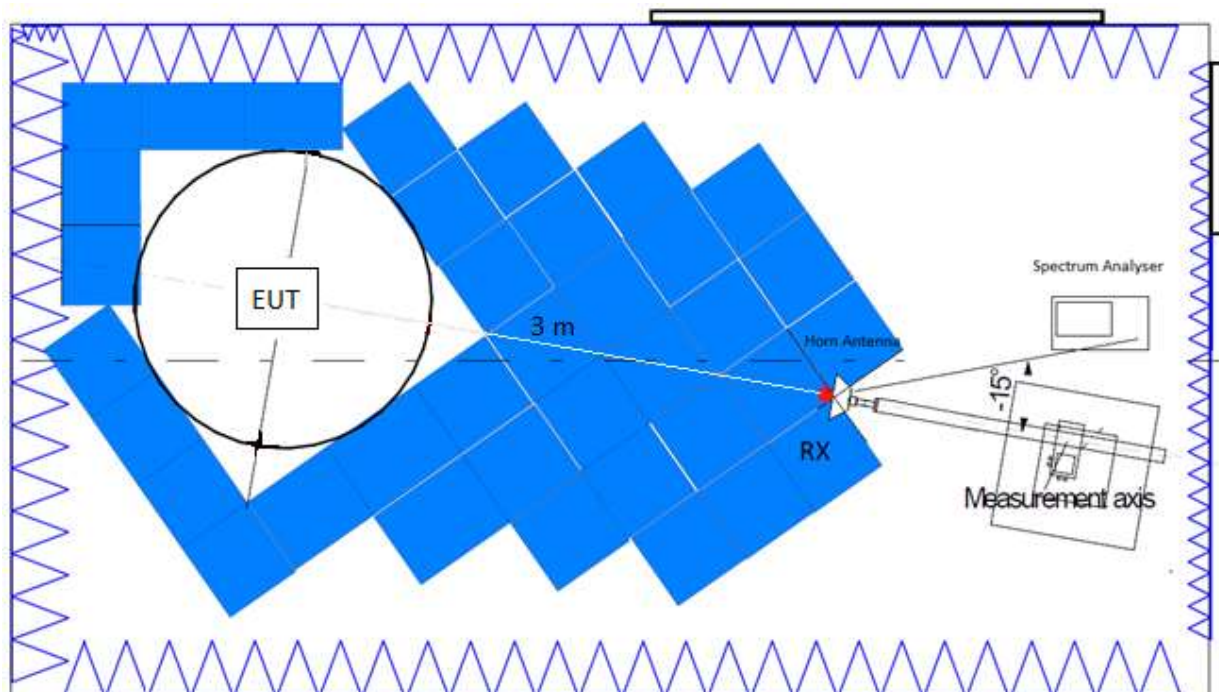
Measurements were made in both horizontal and vertical planes of polarization.

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.

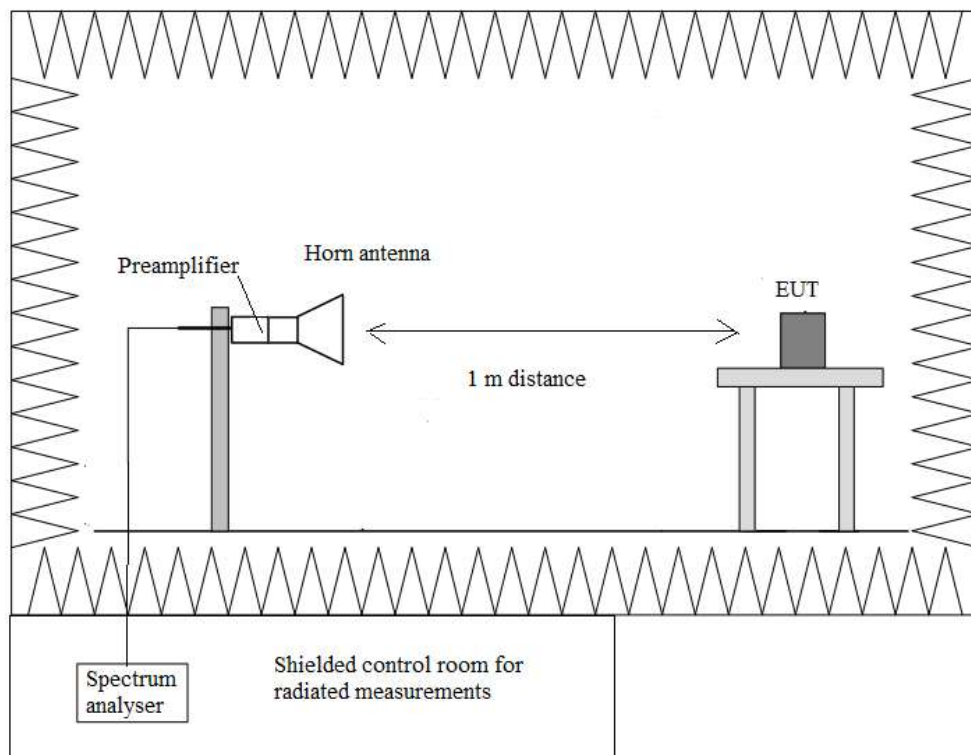
Radiated measurements setup from 30 MHz to 1 GHz:



Radiated measurements setup from 1GHz to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



Occupied Bandwidth

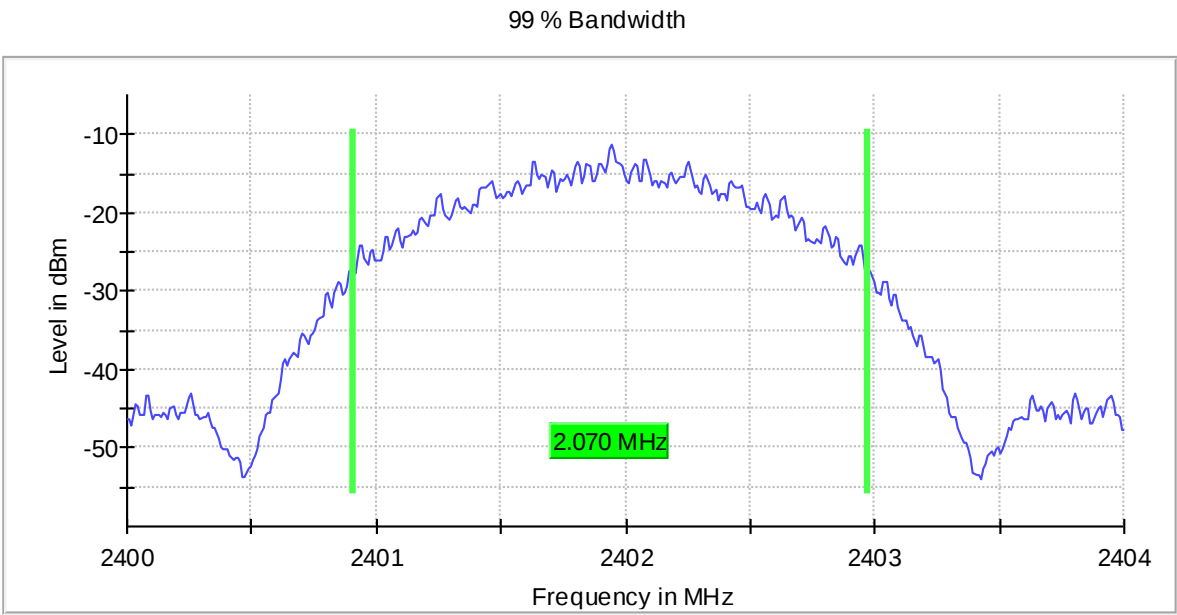
RESULTS:

- 2M modulation

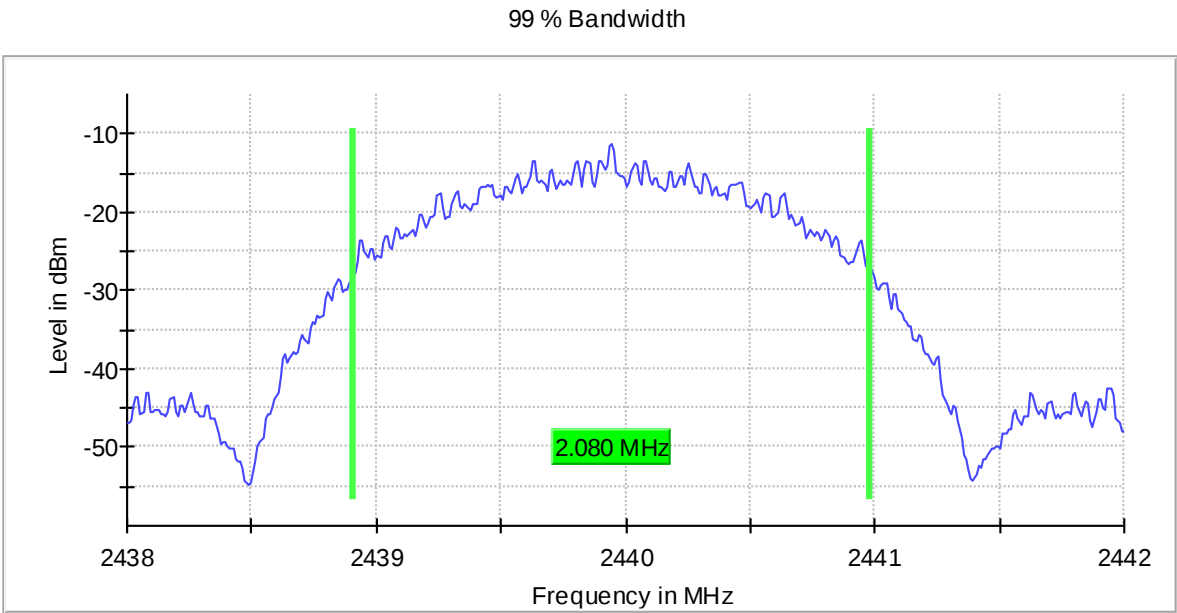
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
99% bandwidth (MHz)	2070	2080	2090
Measurement uncertainty (%)	<± 2.08		

Verdict: PASS

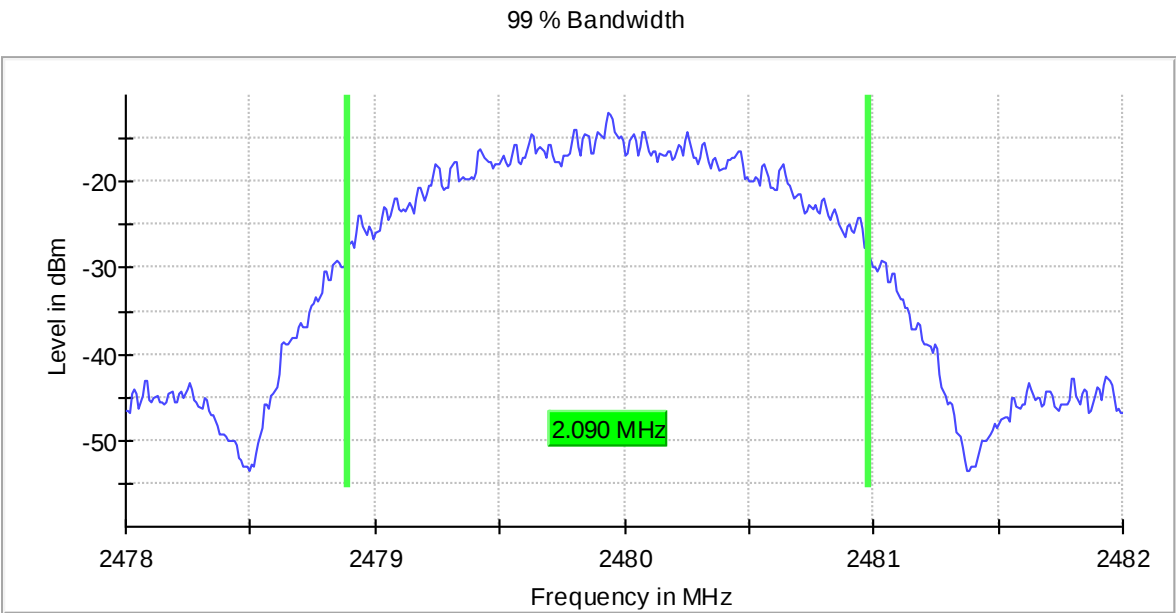
- Low Channel:



- Middle Channel:



- High Channel:



FCC 47 CFR Part 15.247 (a) (2) 6 dB Bandwidth

Limits

The minimum 6 dB bandwidth shall be at least 500 kHz.

Results

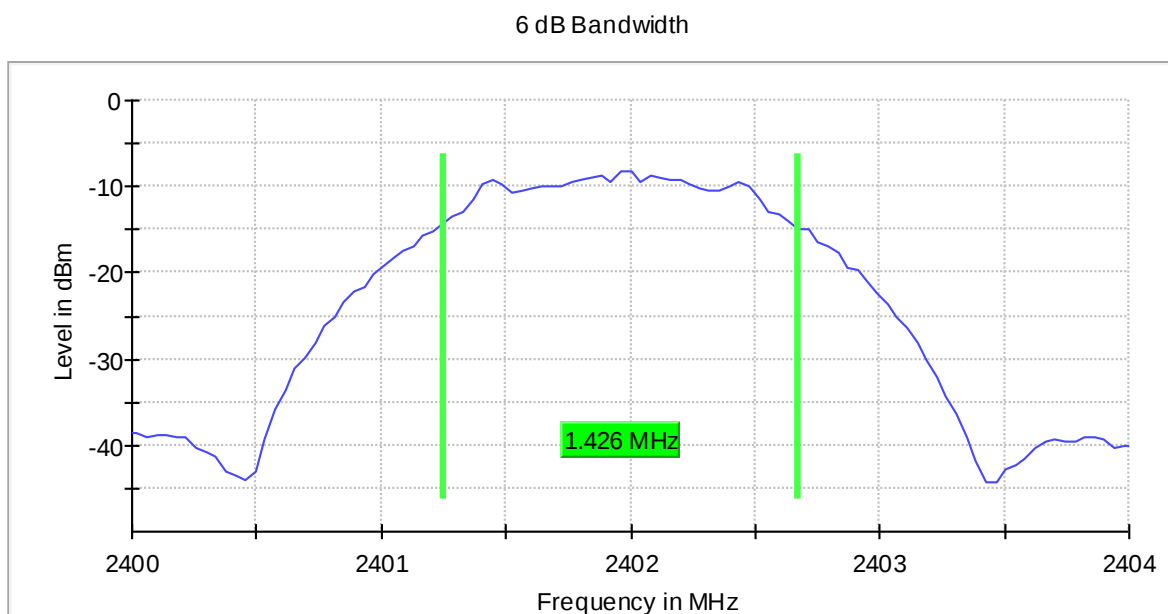
Modulation: BTLE 5.0 (GFSK 2 Mbit/s)

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
6 dB Spectrum bandwidth (kHz)	1426	1505	1465
Measurement uncertainty (%)	<±2.08		

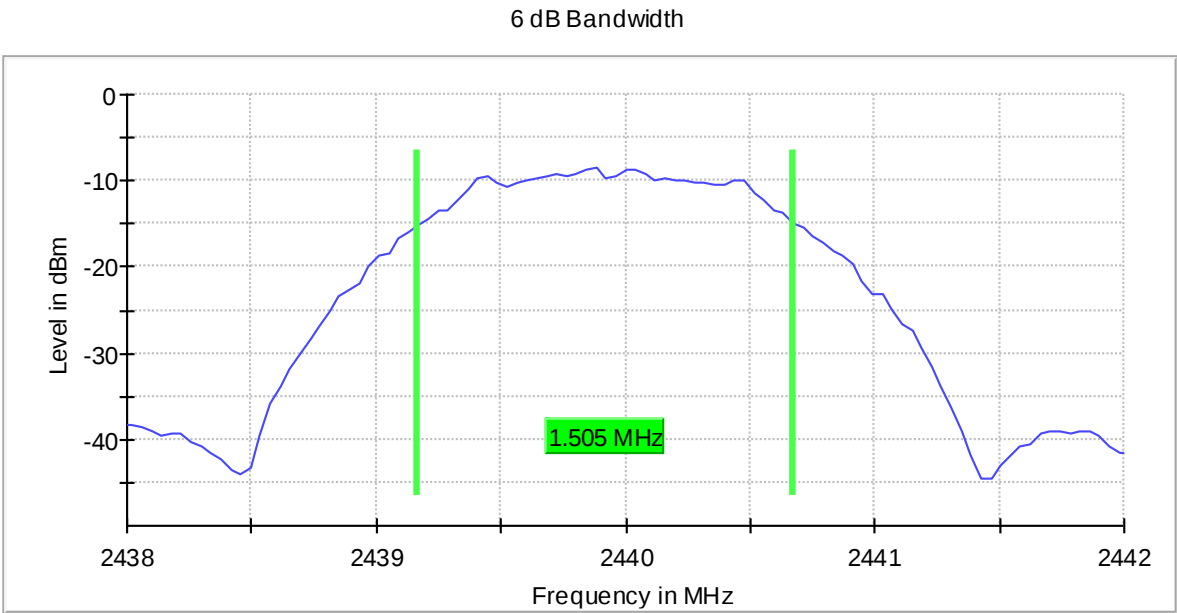
Measurement Uncertainty (dB): < ± 4.94

Verdict: PASS

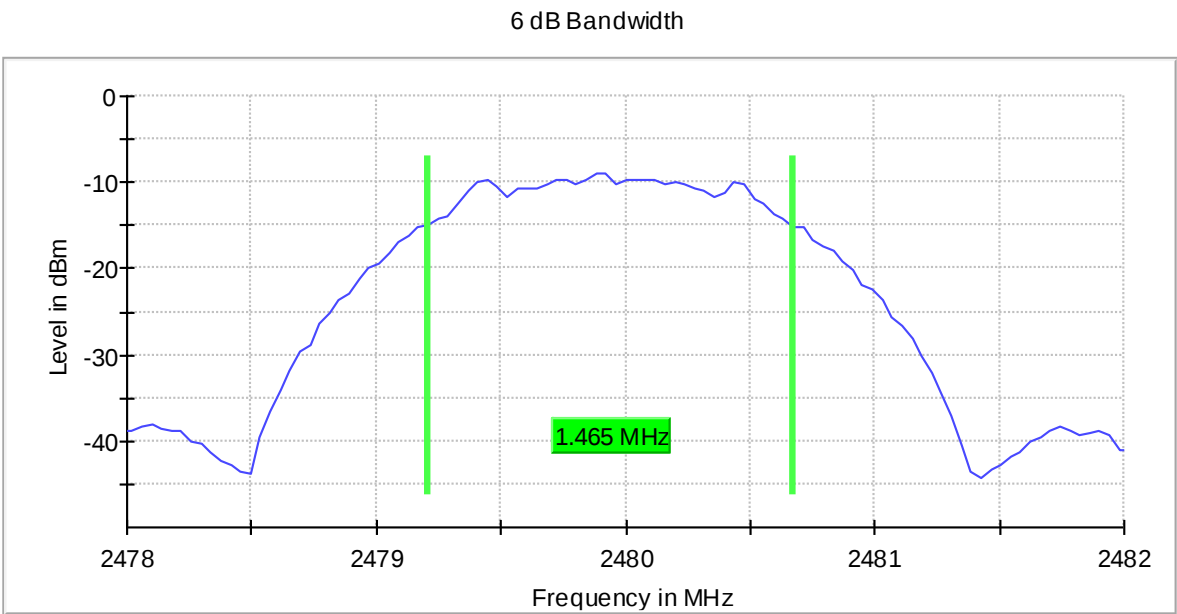
- Low Channel:



- Middle Channel:



- High Channel:



FCC 15.247 (b) Maximum output power and antenna gain

SPECIFICATION:

For systems using digital modulation in the 2400-2483.5 MHz band: 1 watt (30 dBm).

RESULTS:

The maximum peak conducted output power level in the fundamental emission was measured using the method according to point 11.9.1.1 "RBW $\geq$ DTS bandwidth" of ANSI C.63.10-2013.

The EIRP power (dBm) is calculated by adding the declared maximum antenna gain to the measured conducted power.

Maximum Declared Antenna Gain: 3.3 dBi

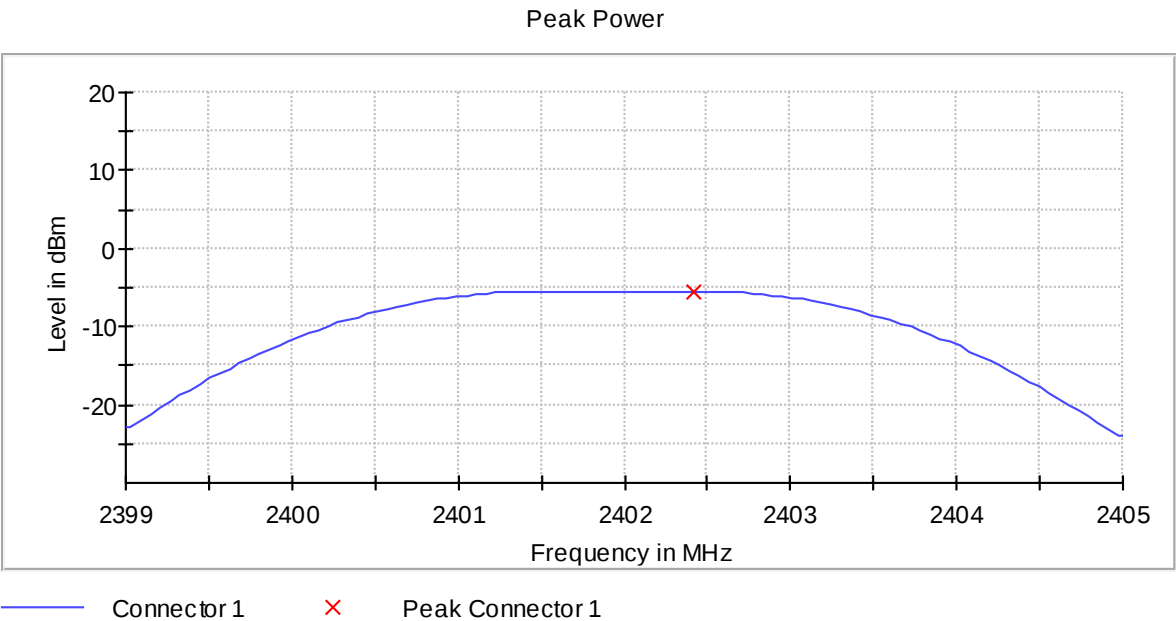
- **2M modulation**

	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Maximum Conducted Power (dBm)			
Maximum EIRP Power (dBm)			
Measurement uncertainty (dB)	< $\pm$ 0.99		

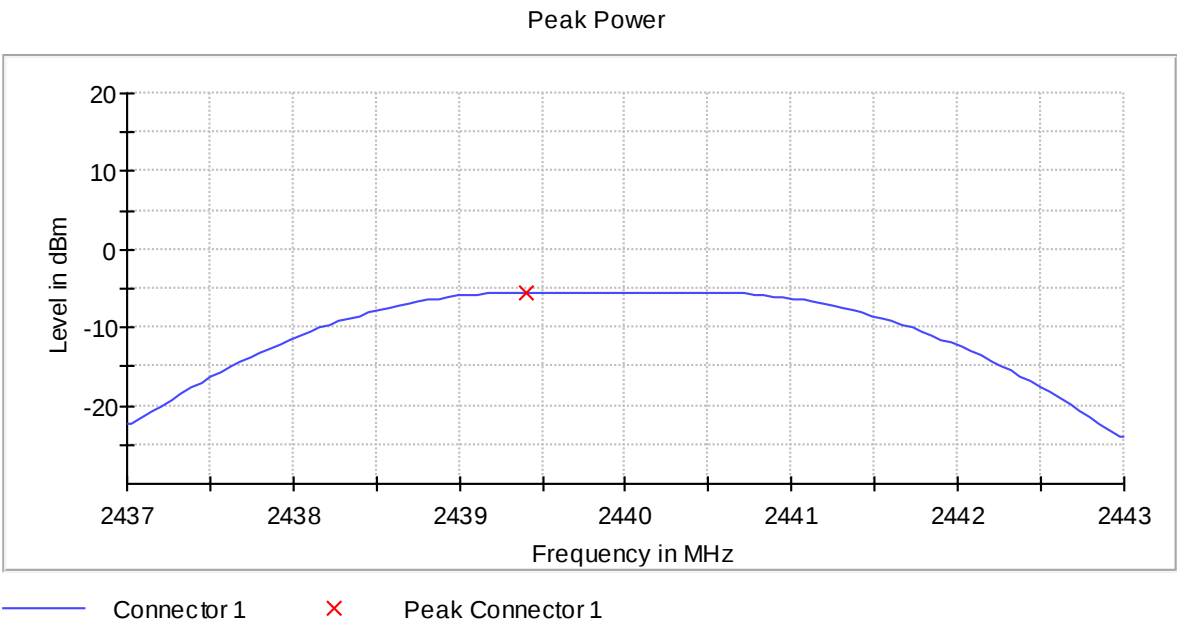
The maximum directional gain of the antenna is less than 6 dBi and therefore the maximum output power is not required to be reduced from the stated values.

Verdict: PASS

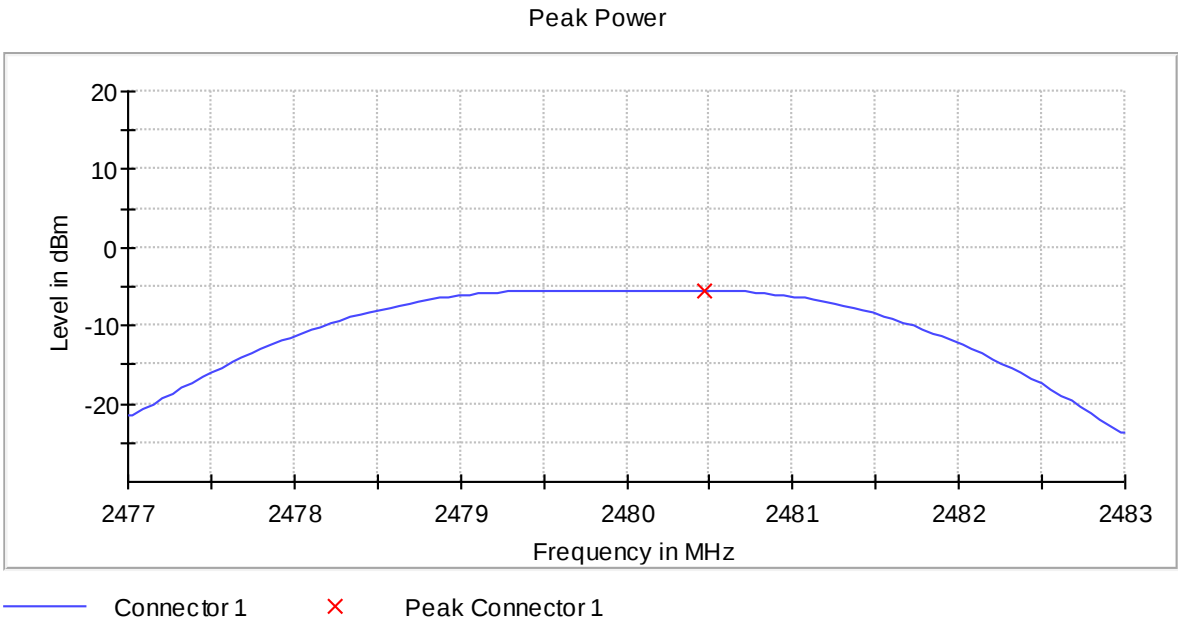
- Low Channel:



- Middle Channel:



- High Channel:



FCC 15.247 (d) Band-edge emissions compliance (Transmitter)

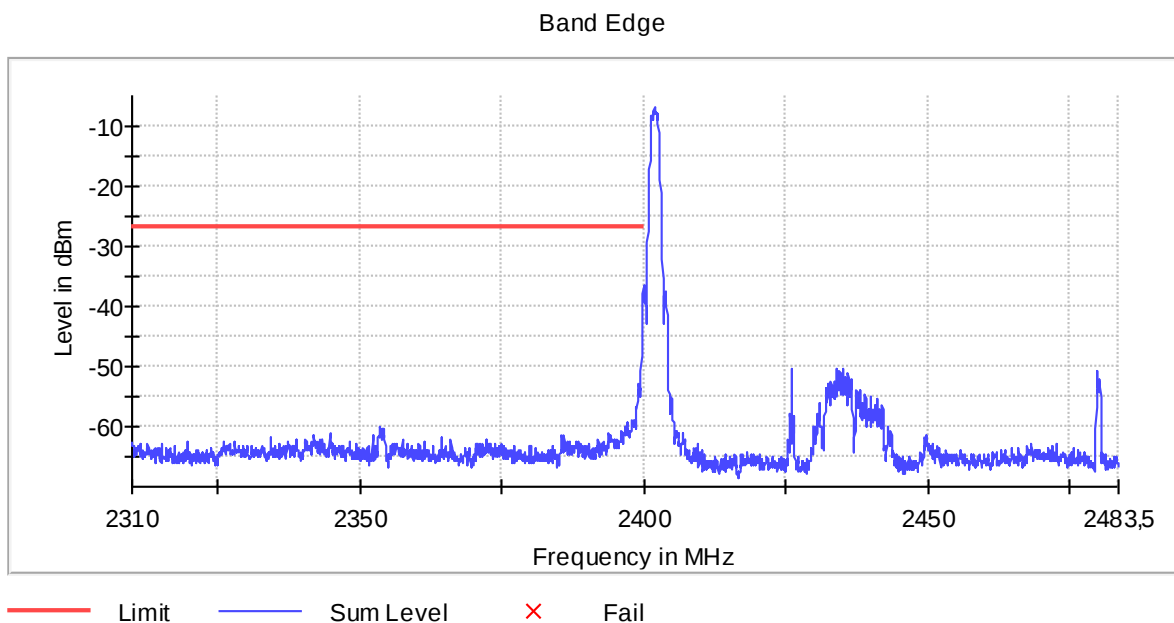
SPECIFICATION:

In any 100 kHz bandwidths outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

RESULTS:

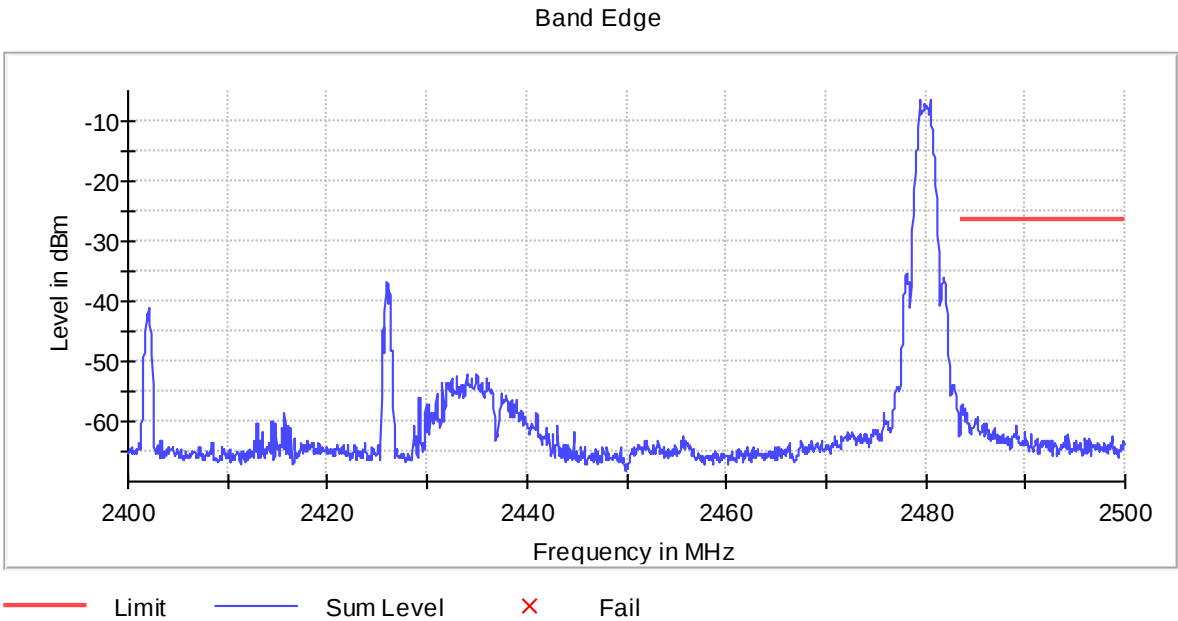
- **2M modulation**

- Low Channel:



Verdict: PASS

- High Channel:



Verdict: PASS

Measurement uncertainty (dB)	<±0.89
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FCC 15.247 (e) Power spectral density

SPECIFICATION:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

RESULTS:

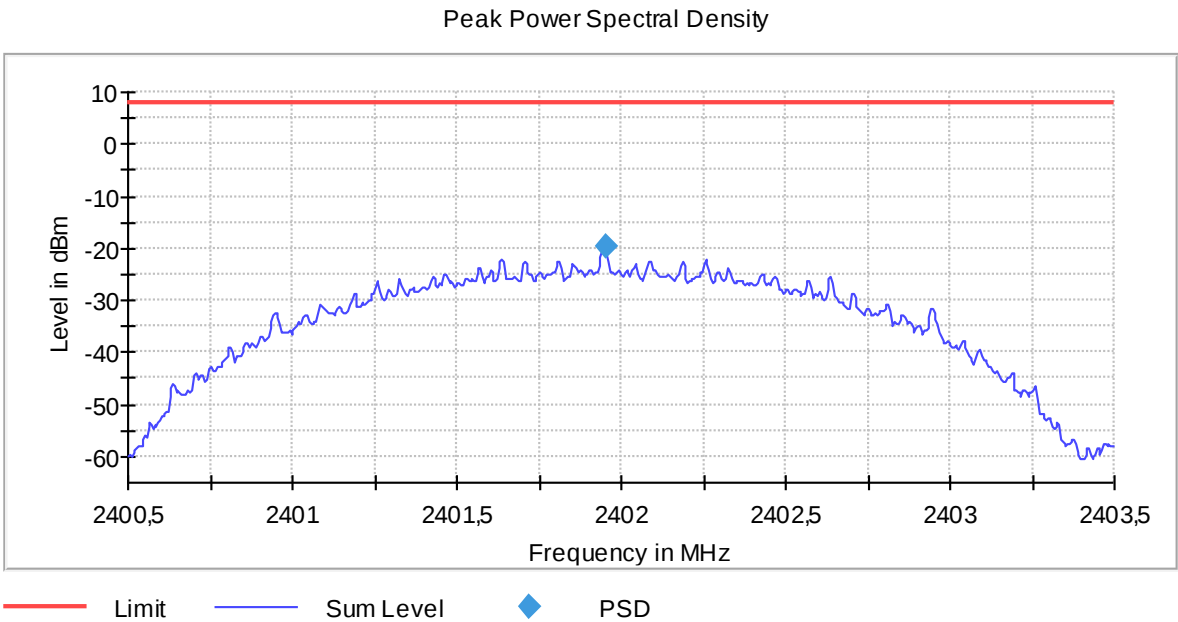
The maximum power spectral density level in the fundamental emission was measured using the method according to point 11.10.2.” Method PKPSD (peak PSD)” of ANSI C.63.10-2013.

- 2M modulation

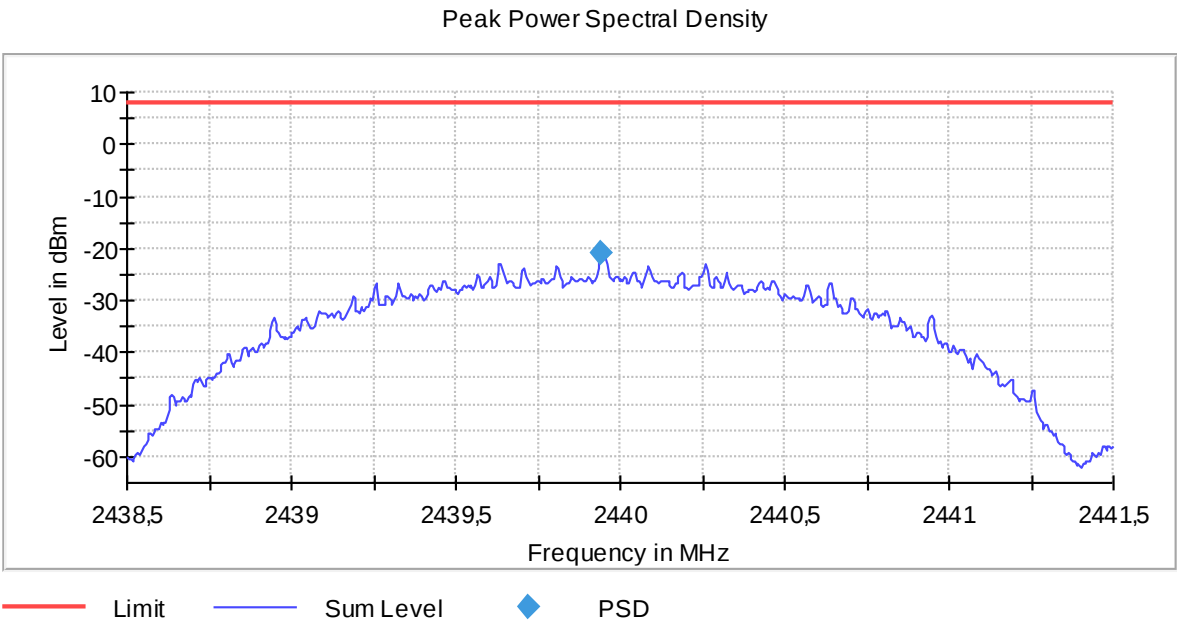
	Low Channel 2402 MHz	Middle Channel 2440 MHz	High Channel 2480 MHz
Power Spectral Density (dBm)	-19.718	-20.958	-21.243
Measurement uncertainty (dB)	<±0.99		

Verdict: PASS

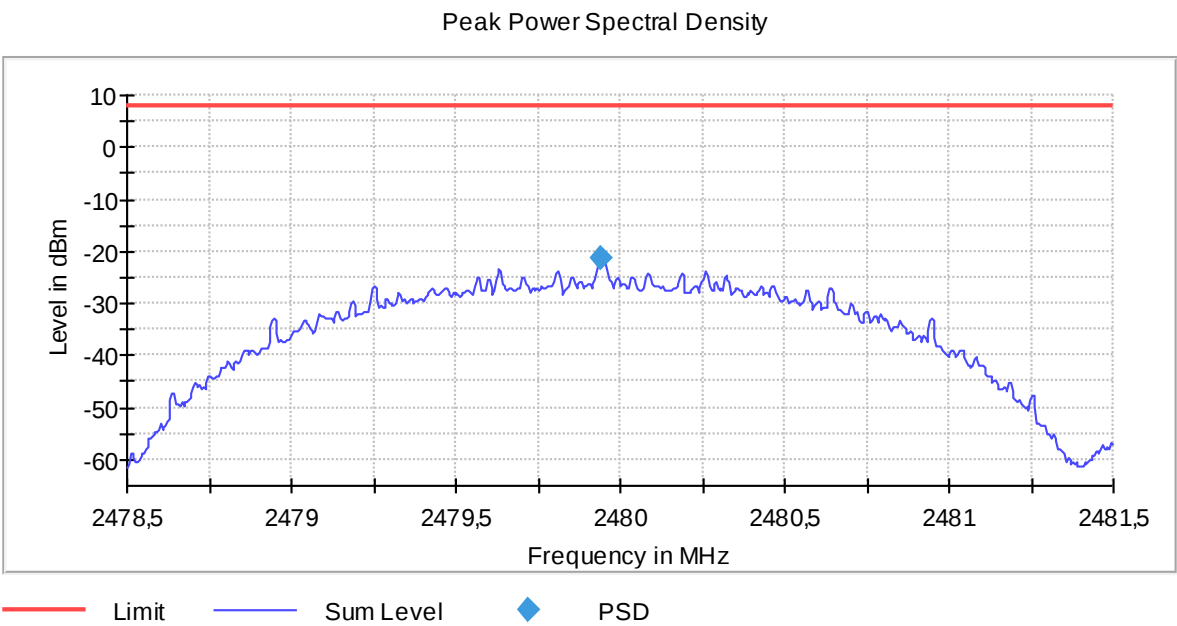
- Low Channel:



- Middle Channel:



- High Channel:



FCC Section 15.247 (d). 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 ($\mu\text{V/m}$)	Field strength ($\text{dB}\mu\text{V/m}$)	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 - 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.

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 1m 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 signals detected do not depend on the operating channel.

No spurious emissions at less than 20 dB from the limit:

Measurement Uncertainty (dB): $< \pm 4.94$

Verdict: PASS

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 dB μ V/m at 3 m) are measured with average detector for checking compliance with the average limit.

- LOW CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.8045	57.37	H	Peak	$< \pm 4.60$
	51.69		Average	$< \pm 4.60$
7.2040	67.16	H	Peak	$< \pm 4.60$

- MIDDLE CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.8785	46.38	H	Peak	$< \pm 4.60$
7.3215	60.39	H	Peak	$< \pm 4.60$
	51.58		Average	$< \pm 4.60$

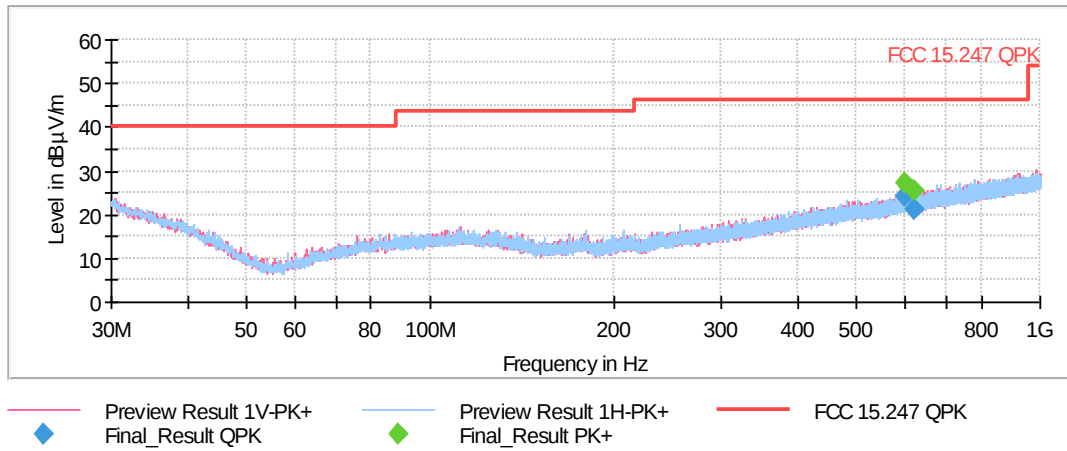
- HIGH CHANNEL. Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector	Measurement Uncertainty (dB)
4.9610	50.66	H	Peak	$< \pm 4.60$
7.4380	56.35	H	Peak	$< \pm 4.60$
	46.03		Average	$< \pm 4.60$

Measurement Uncertainty (dB): 1-3 GHz $< \pm 3.98$
3-17 GHz $< \pm 4.60$
17-26 GHz $< \pm 4.89$

Verdict: PASS

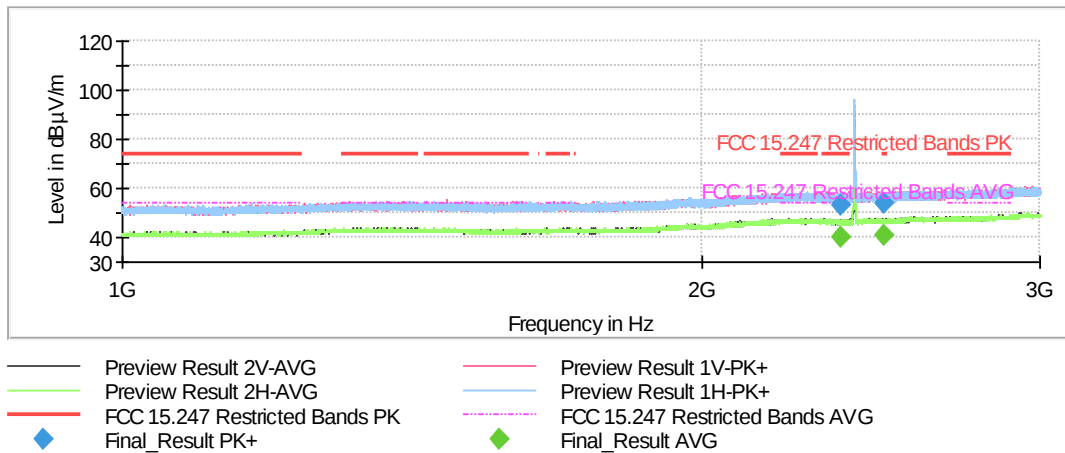
FREQUENCY RANGE 30 MHz - 1 GHz:



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

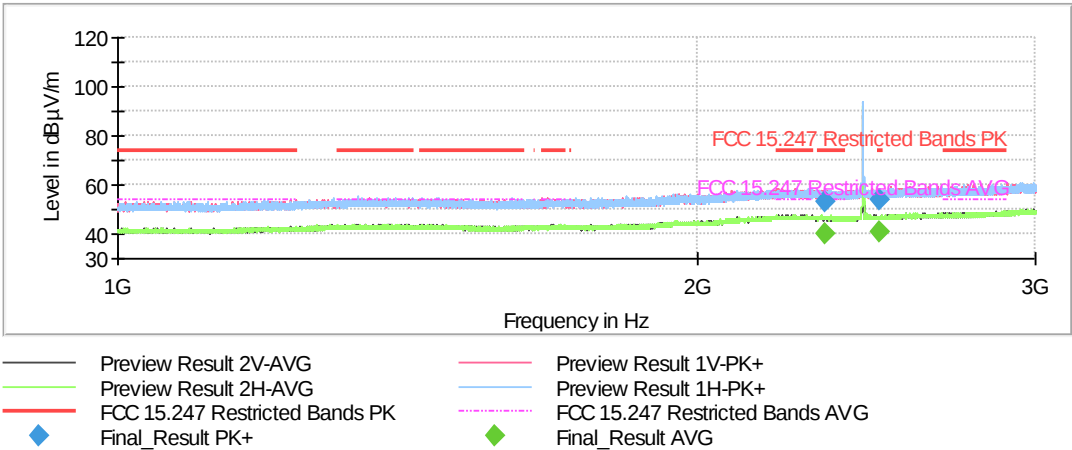
FREQUENCY RANGE 1 - 3 GHz:

- Low Channel:



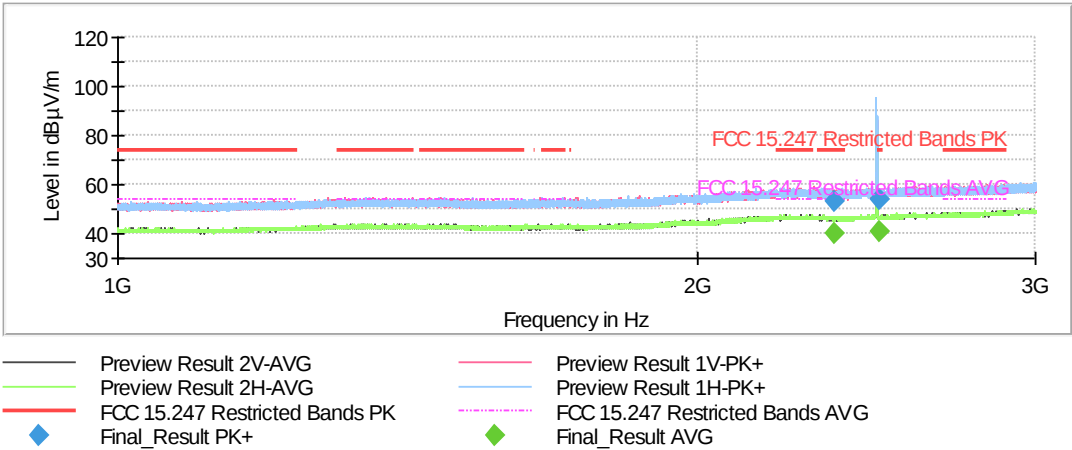
The peak above the limit is the carrier frequency.

- Middle Channel:



The peak above the limit is the carrier frequency.

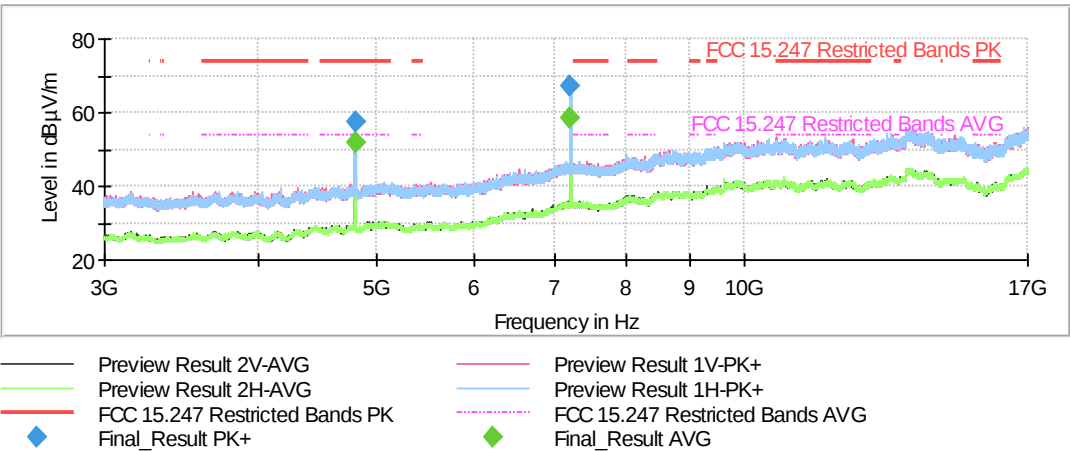
- High Channel:



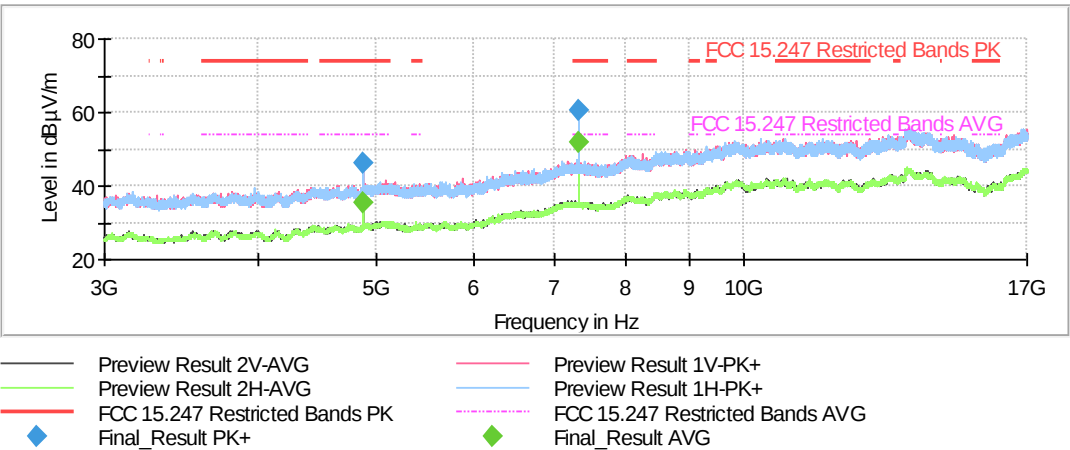
The peak above the limit is the carrier frequency.

FREQUENCY RANGE 3 - 17 GHz:

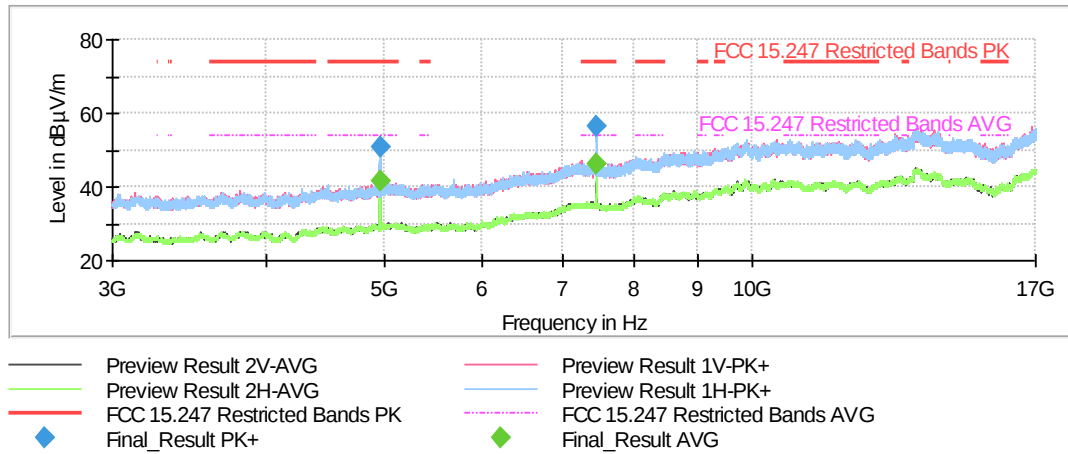
- Low Channel:



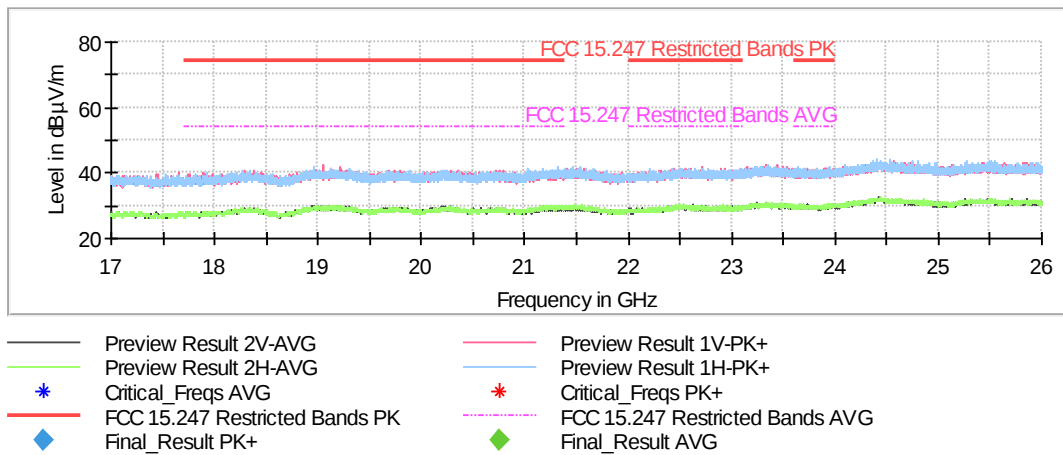
- Middle Channel:



- High Channel:



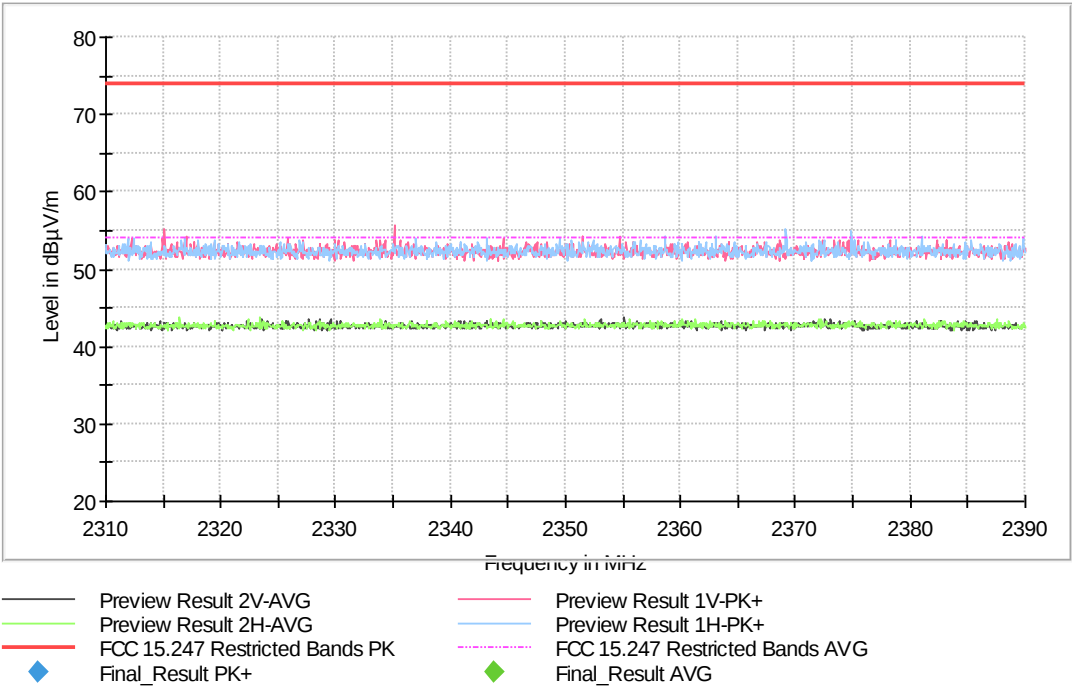
FREQUENCY RANGE 17 - 26 GHz:



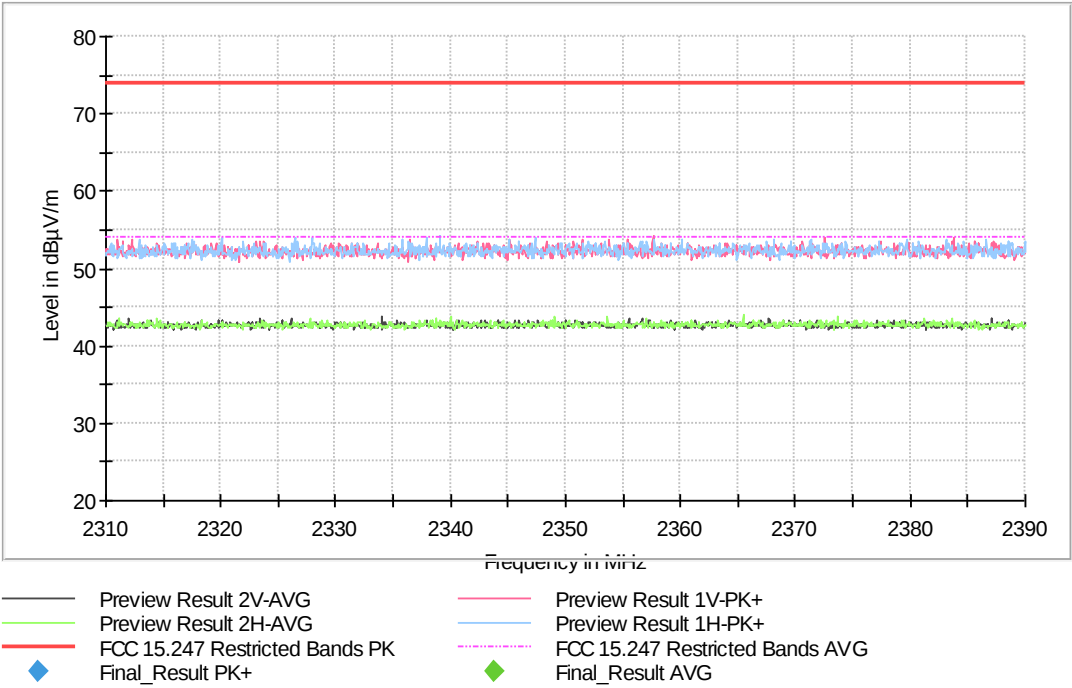
This plot is valid for the Low, Middle and High Channels.

FREQUENCY RANGE 2.31-2.39 GHz:

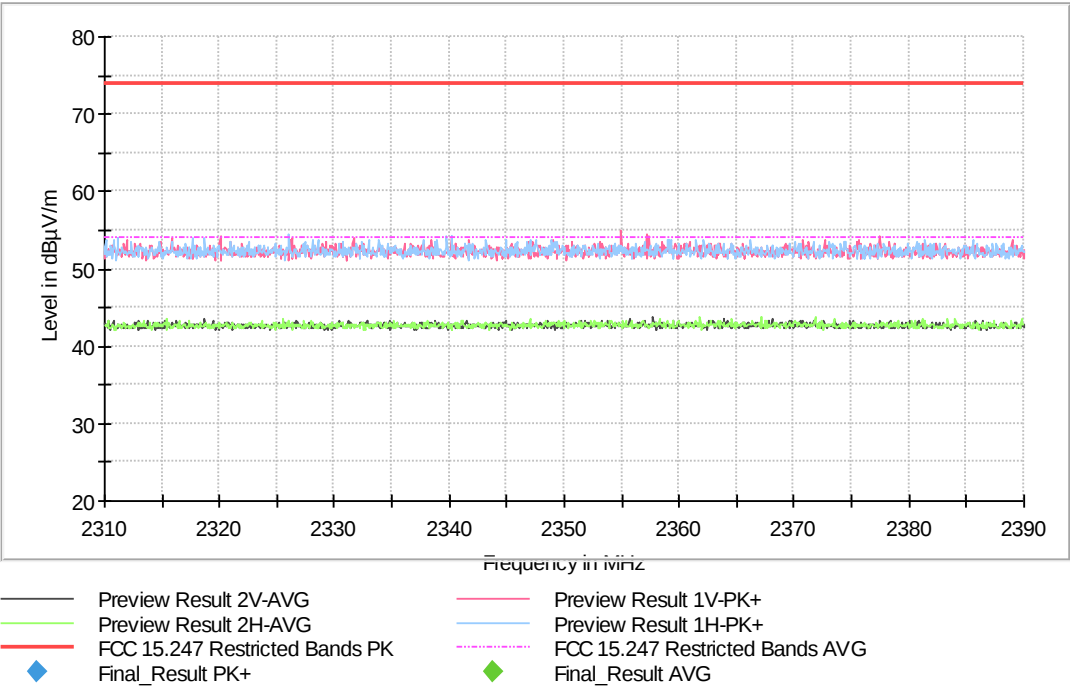
- Low Channel:



- Middle Channel:

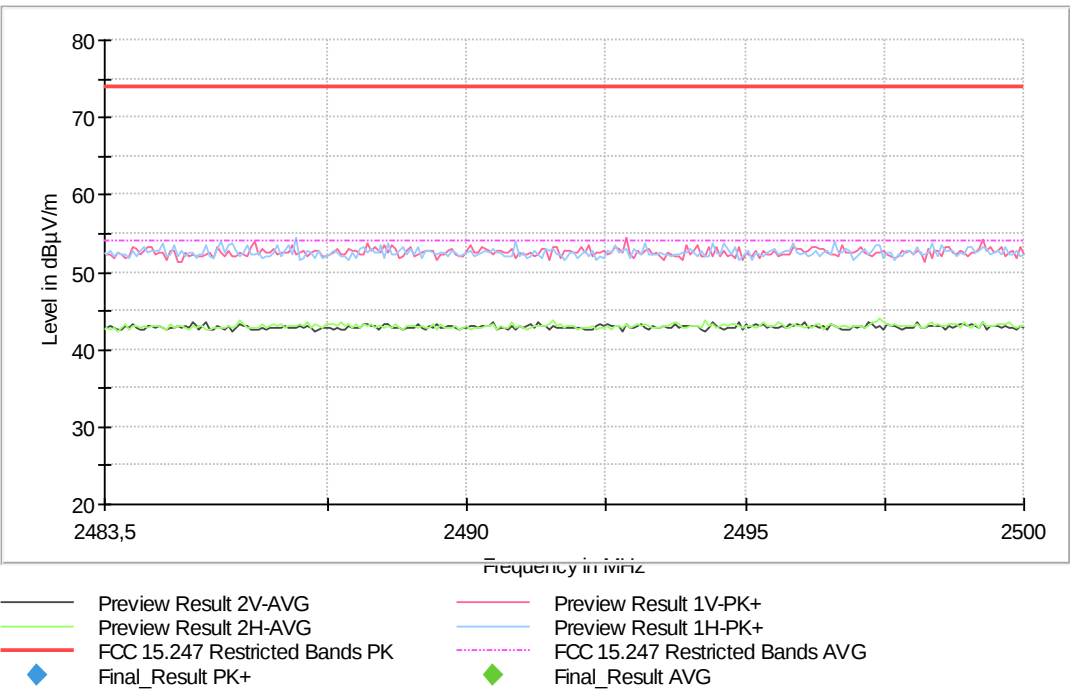


- High Channel:

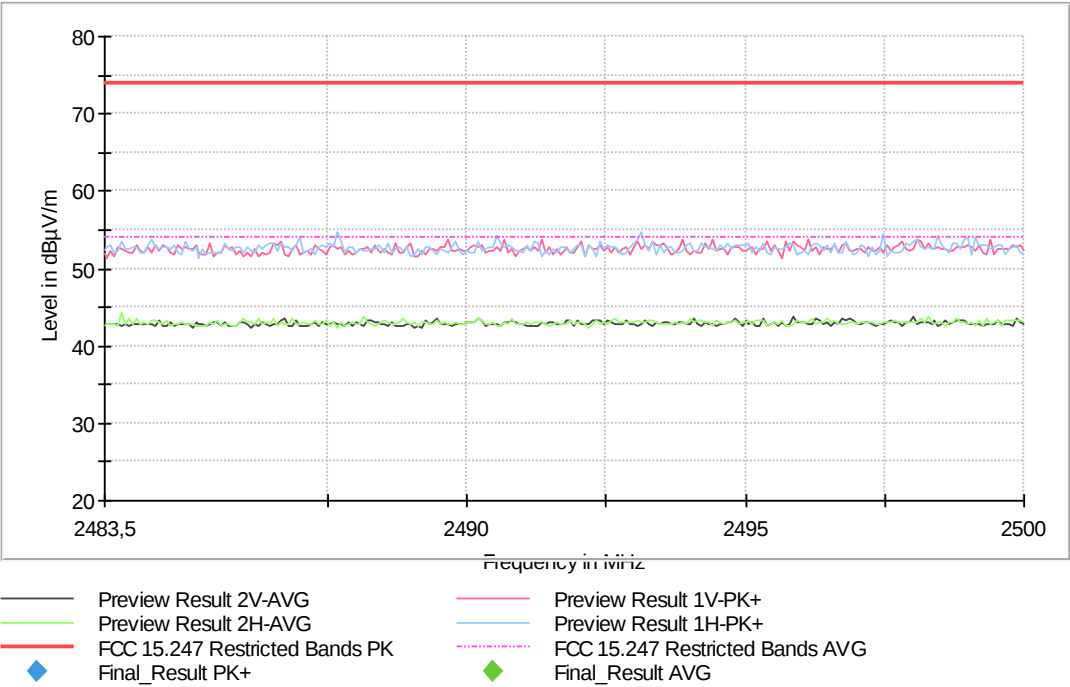


FREQUENCY RANGE 2.4835-2.5 GHz:

- Low Channel:



- Middle Channel:



- High Channel:

