

ISED CABid: ES1909
Lab. Company Number: 4621A

Test Report No:
NIE: 73220RRF.006

Partial Test Report

USA FCC Part 15.31, 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	SALTO KS IQ 2.0
(*) Trademark	SALTO
(*) Model and /or type reference	IQ223 (type reference: IQ2.0)
Other identification of the product	FCC ID: Contains FCC ID: QOQ-BGM220S2 IC: Contains IC: 5123A-BGM220S2
(*) Features	Ethernet/PoE, ZigBee, Bluetooth LE and cellular technology HW version: 2.0 SW version: CCCPROD (Control FW) + 0091 (RF2 Module FW)
Applicant	SALTO SYSTEMS, S.L. Arkotz 9, Polígono Lanbarren 20180, Oiartzun (Guipúzcoa), Spain
Test method requested, standard	USA FCC Part 15.31 (10-1-21 Edition): Measurement standard. 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 (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)	Rafael López Martín EMC Consumer & RF Lab. Manager  2023.01.12 18:08:48 +01'00'
Date of issue	2023-01-12
Report template No	FDT08_24 (*) "Data provided by the client"

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Competences and guarantees

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DEKRA Testing and Certification S.A.U. is an FCC-recognized accredited testing laboratory with appropriate scope of accreditation that include testing performed in this test report.

DEKRA Testing and Certification S.A.U. 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.

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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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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 is:

From 30 MHz to 1 GHz:	Measurement uncertainty $\leq \pm 5.01$ dB.
From 1 to 17 GHz:	Measurement uncertainty $\leq \pm 4.32$ dB.
From 17 to 26 GHz:	Measurement uncertainty $\leq \pm 4.71$ dB.

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 IQ223 (type reference: IQ2.0) is a SALTO KS IQ2.0 communication hub with Ethernet/PoE and cellular technology to connect the wireless locks to the SALTO KS cloud and IEEE 802.15.4 and Bluetooth LE technology to communicate with the access points.

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 N°	Description	Model	Serial N°	Reception
73220C/015	SALTO KS IQ 2.0	IQ223 (type reference: IQ2.0)	-	22-11-2022

Auxiliary elements used with the Sample S/01:

Control N°	Description	Model	Serial N°	Reception
54625D/011	POE Injector	-	-	17-10-2017
54625D/038	Ethernet Cable	-	-	20-12-2017

Sample S/01 has undergone the 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⁾		
	Ethernet	100	☐	☐	☐		
Supplementary information to the ports.....:	-						
Rated power supply	Voltage and Frequency		Reference poles				
			L1	L2	L3	N	PE
	☐	AC:	☐	☐	☐	☐	☐
	☐	AC:	☐	☐	☐	☐	☐
	☒	DC: PoE: IEEE 802.3af (802.3at Type 1)					
☐	DC:						
Rated Power.....:	9.6 W (power supply) and 15.4 W (max. PoE)						
Clock frequencies.....:	32.768 KHz, 12 MHz, 25 MHz and 32 MHz						
Other parameters	-						
Software version.....:	CCCPROD (Control FW) + 0091 (RF2 Module FW)						
Hardware version	2.0						
Dimensions in cm (W x H x D) ...:	14.6 x 14.6 x 3 cm						
Mounting position	☐	Table top equipment					
	☒	Wall/Ceiling mounted equipment					
	☐	Floor standing equipment					
	☐	Hand-held equipment					
	☐	Other:					
Modules/parts.....:	Module/parts of test item		Type	Manufacturer			
	Bluetooth LE certified module		BLE	Silicon Labs			
	IEEE 802.15.4		IEEE 802.15.4	Texas Instruments			
Accessories (not part of the test item)	Description		Type	Manufacturer			
	-		-	-			

Documents as provided by the applicant..... :	Description	File name	Issue date
	Firmware explanation document	-	-
	User manual	-	-

⁽³⁾ Only for Medical Equipment

Identification of the client

SALTO SYSTEMS, S.L.
Arkotz 9, Polígono Lanbarren, 20180, Oiartzun, Guipúzcoa, Spain

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2022-12-14
Date (finish)	2022-12-15

Document history

Report number	Date	Description
73220RRF.006	2023-01-12	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: Francisco Javier Fernández, Miguel Manuel López.

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 LINDGREN 3142E	2020-10	2023-10
4.	RF Preamplifier, G>38dB 30MHz-6GHz BONN ELEKTRONIK BLNA 0360-01N	2022-06	2023-06
5.	EMI Test Receiver 2Hz-44GHz, ROHDE AND SCHWARZ ESW44	2021-12	2023-12
6.	Digital Multimeter, FLUKE 175	2022-11	2023-11
7.	Horn Antenna 1-18 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9120 D	2019-11	2022-11
8.	Horn Antenna 18-40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020-05	2023-05
9.	RF Preamplifier, 40 dB, 1-18 GHz BONN ELEKTRONIK BLMA 0118-1M	2022-07	2023-07
10.	Pre-Amplifier G>30dB 17-40GHz BONN ELEKTRONIK BLMA 1840-4A	2022-11	2023-11
11.	Spectrum Analyzer ROHDE AND SCHWARZ FSW50	2022-08	2024-08
12.	Signal and Spectrum Analyzer 10 Hz - 40 GHz ROHDE AND SCHWARZ FSV40	2021-10	2023-10
13.	EMC/RF Testing SW ROHDE AND SCHWARZ EMC32	N/A	N/A

Testing verdicts

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

Summary

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	Verdict	Remark
FCC 15.31 (h), FCC 15.209 (a), 15.247 (d) / RSS-Gen 8.9, RSS-247 5.5: - Emission limitations radiated (Transmitter)	P	(1)
<u>Supplementary information and remarks:</u> (1) Only co-location radiated spurious emission test was requested.		

Appendix A: Test results. FCC 15.31, 15.247, 15.209 / RSS-247, RSS-Gen

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TEST CONDITIONS

(*) Declared by the Applicant

POWER SUPPLY (*):

Vnominal: IEEE 802.3af (802.3at Type 1)
Type of Power Supply: DC (POE)

ANTENNA (*):

Type of Antenna for Bluetooth Low Energy: Integral (chip).
Maximum Declared Antenna Gain for Bluetooth Low Energy: +2.3 dBi

Type of Antenna for IEEE 802.15.4: Integral (Chip).
Maximum Declared Antenna Gain for IEEE 802.15.4: +0.5 dBi

RADIOS AND CHANNELS TESTED:

	Bluetooth Low Energy / DTS	
Mode:	1M (GFSK - 1DH5)	
Channel Spacing:	2 MHz	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	Middle: 17	2440

	IEEE 802.15.4 / O-QPSK, DSSS	
Mode:	Single Channel	
Channel Spacing:	5 MHz	
Frequency Range:	2400 MHz to 2483.5 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	High: 39	2480

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 Modes for each Radio:

The following configurations were selected based on preliminary testing that identified those corresponding to the worst-cases:

* Bluetooth Low Energy: Transmitter radiated spurious emissions tests were performed with the EUT transmitting 1 Mbps in the Middle Channel (2440 MHz).

* IEEE 802.15.4: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in the High Channel (2480 MHz) configuration supported by this radio.

TESTED SIMULTANEOUS TRANSMISSION MODES:

* **Simultaneous transmission mode Bluetooth, IEEE 802.15.4**, with the EUT configured to simultaneously transmit two signals at maximum output power:

Bluetooth Low Energy in the Middle Channel (2440 MHz), IEEE 802.15.4 High Channel (2480 MHz).

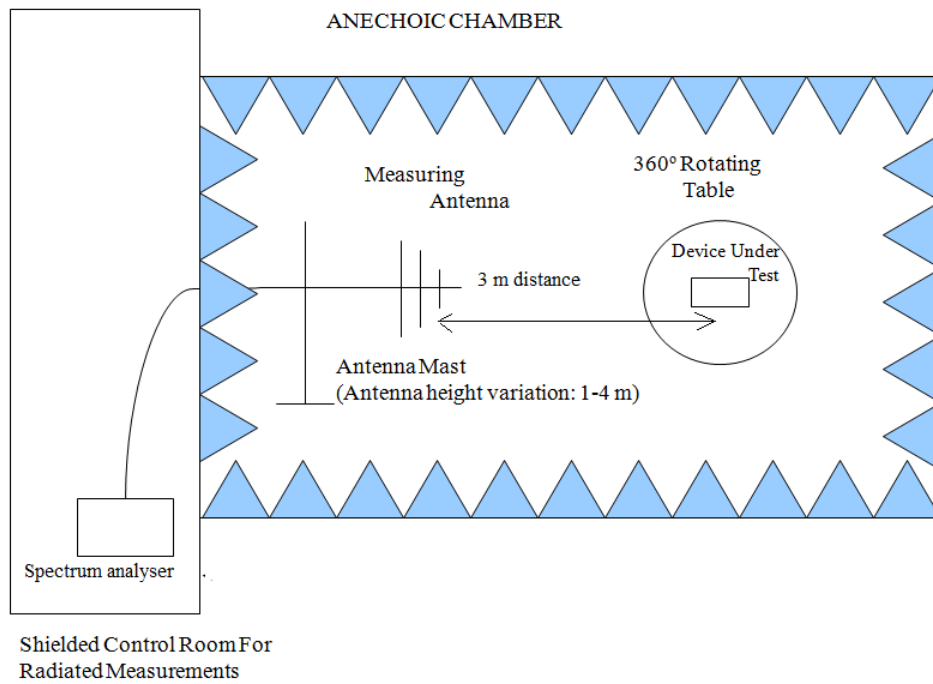
RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m (Bilog antenna for 30 MHz to 1000 MHz, Double ridge horn antenna 1 GHz-17 GHz and horn antenna 17 GHz-26 GHz), at distance of 1.5 m for the frequency range 17 GHz-26 GHz.

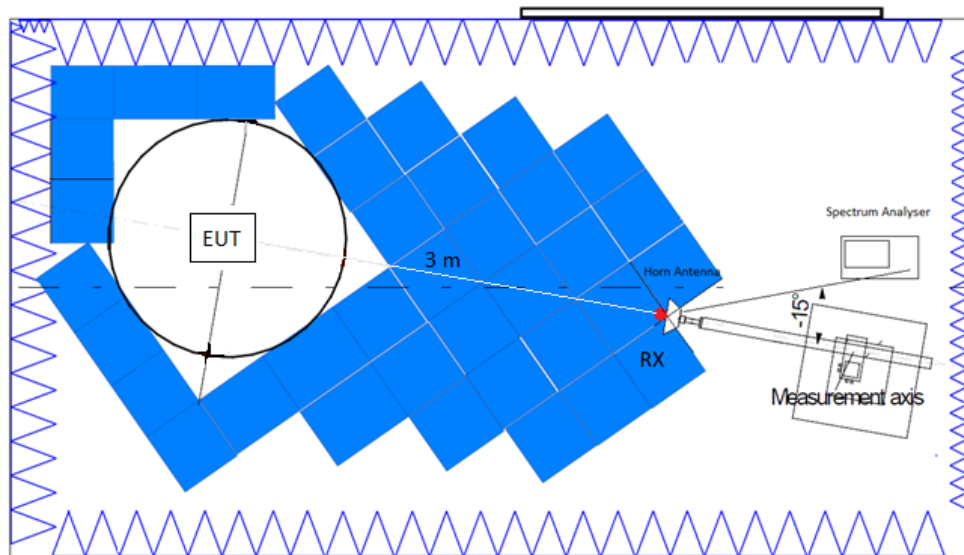
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

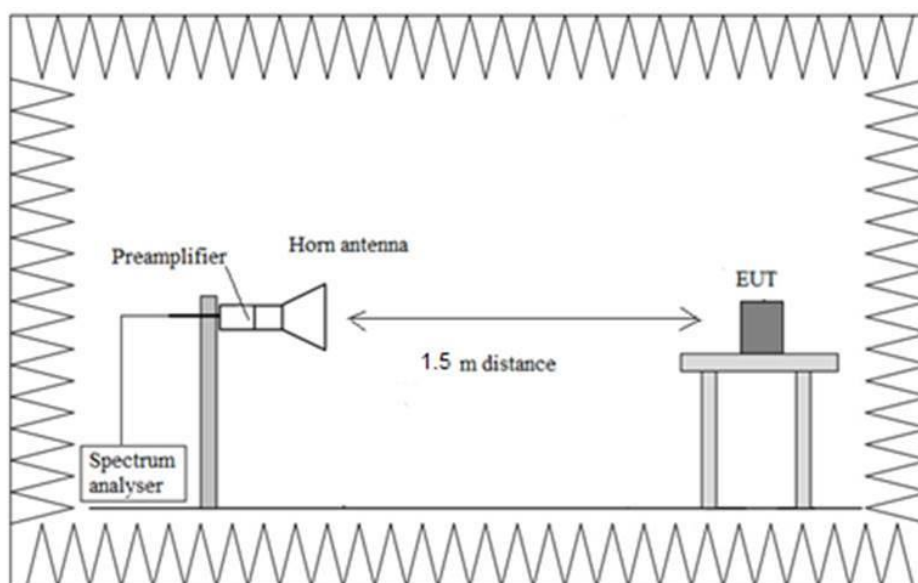
Radiated measurements setup $30 \text{ MHz} < f < 1 \text{ GHz}$:



Radiated measurements setup $f > 1 \text{ GHz}$ up to 17 GHz:



Radiated measurements setup $f > 17$ GHz:



Radiated emissions

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 ($\mu\text{V/m}$)	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 - 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 1.5 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.

A resolution bandwidth / video bandwidth of 100 kHz / 300 kHz was used for frequencies between 30 MHz up to 1 GHz and 1 MHz / 3 MHz for frequencies above 1 GHz.

Test performed on the following worst-cases in all relevant tests channels.

- **Co-Location mode Bluetooth Low Energy, IEEE 802.15.4:**

Bluetooth Low Energy: Middle Channel (2440 MHz)
IEEE 802.15.4: High Channel (2480 MHz)

Frequency range 30 MHz - 1 GHz

Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
39.639375	22.96	V	Quasi-Peak
54.401563	32.38	V	Quasi-Peak
74.256250	35.97	V	Quasi-Peak
350.009063	29.83	H	Quasi-Peak
450.010000	36.58	V	Quasi-Peak

Frequency range 1 - 26 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.

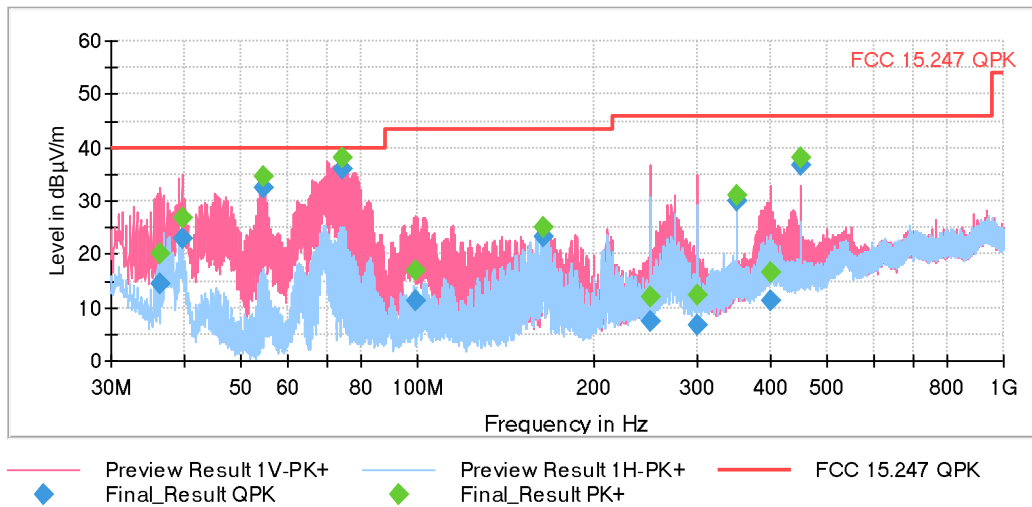
Spurious frequencies detected at less than 20 dB below the limit:

Spurious Frequency (MHz)	Emission Level (dBμV/m)	Polarization	Detector
2484.000000	61.98	V	Peak
	53.57		Average
7319.560000	57.80	V	Peak
	52.81		Average
12201.080000	60.15	H	Peak
	53.79		Average

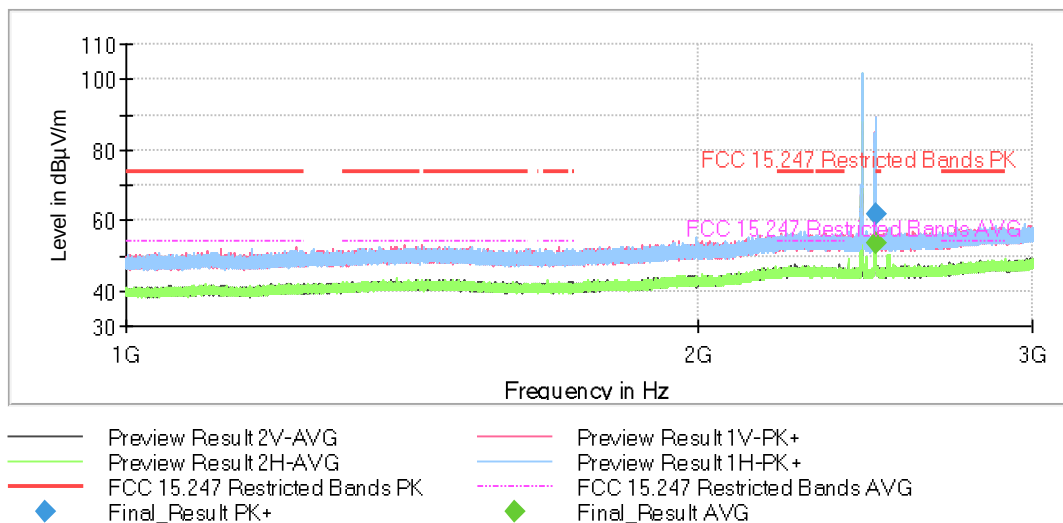
Verdict: PASS

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

FREQUENCY RANGE 30 MHz - 1 GHz (worst-case):

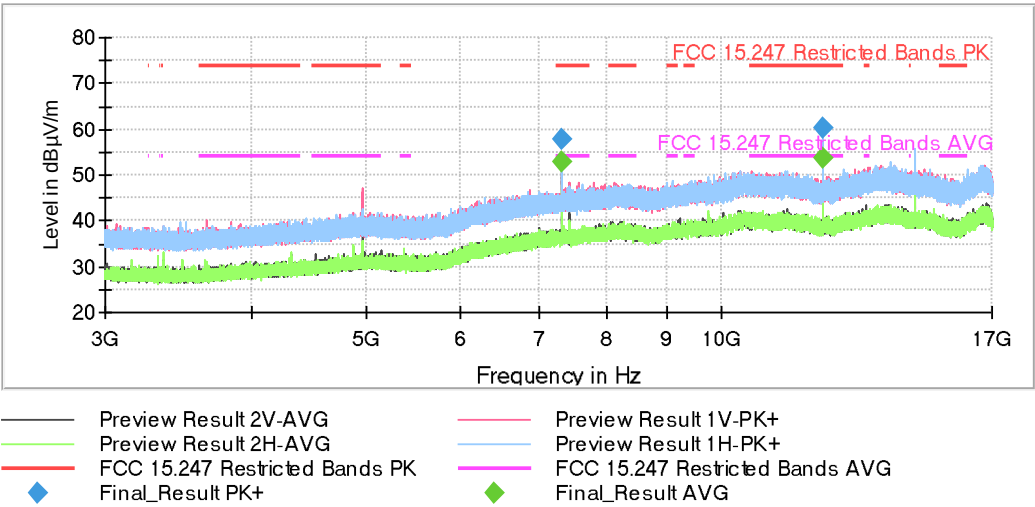


FREQUENCY RANGE 1 - 3 GHz (worst-case):



The peak above the limit on the left is the Bluetooth LE carrier frequency.
The peak above the limit on the right is the IEEE 802.15.4 carrier frequency.

FREQUENCY RANGE 3 - 17 GHz (worst-case):



FREQUENCY RANGE 17 - 26 GHz (worst-case):

