

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 |
| 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.

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General conditions

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Uncertainty

Uncertainty (factor k=2) was calculated according to the DEKRA Testing and Certification S.A.U. internal document PODT000.

The total uncertainty of the measurement system for the radiated emissions of 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 Nº | Description | Model | Serial Nº | 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 Nº | Description | Model | Serial Nº | 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 | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | |
| Supplementary information to the ports.....: | - | | | | | |
| Rated power supply | Voltage and Frequency | | Reference poles | | | |
| | <input type="checkbox"/> | AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input type="checkbox"/> | AC: | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| | <input checked="" type="checkbox"/> | DC: PoE: IEEE 802.3af (802.3at Type 1) | | | | |
| | <input type="checkbox"/> | 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 | <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 | | |
| | 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 |
| | Middle: 17 |
| | Channel Frequency (MHz) |
| | 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 |
| | High: 39 |
| | Channel Frequency (MHz) |
| | 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).

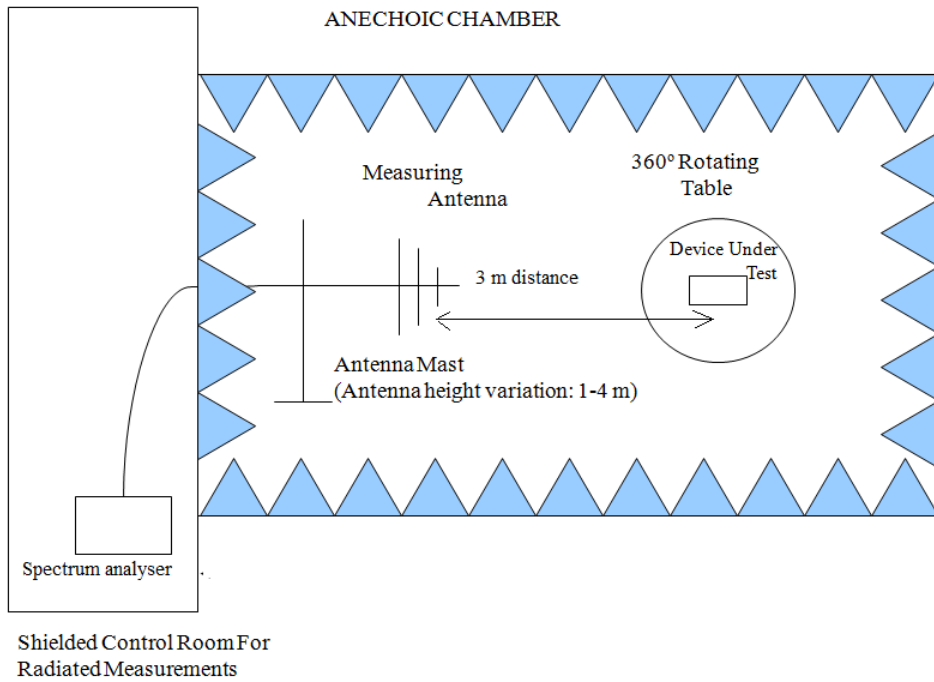
RADIATED MEASUREMENTS:

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.

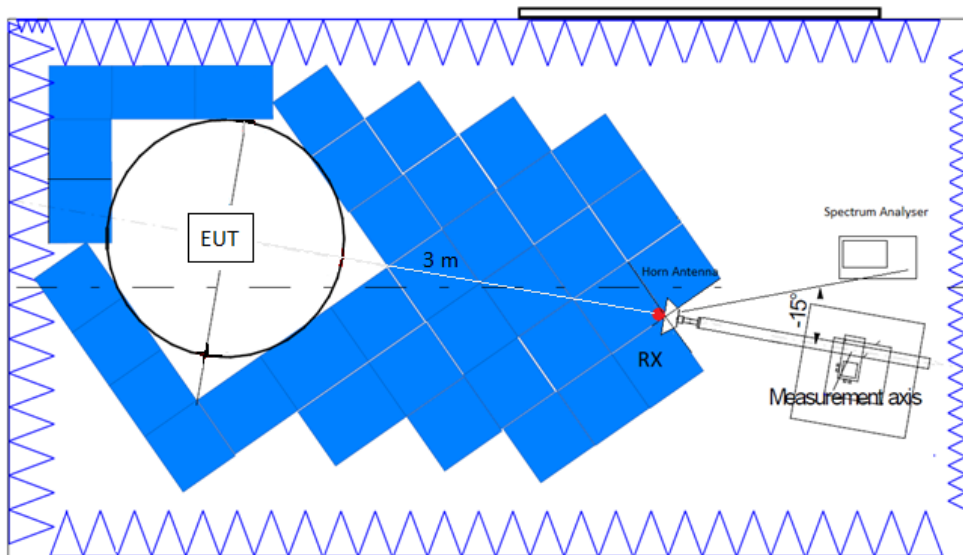
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and the antenna height was varied from 1 to 4 meters to find the maximum radiated emission.

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

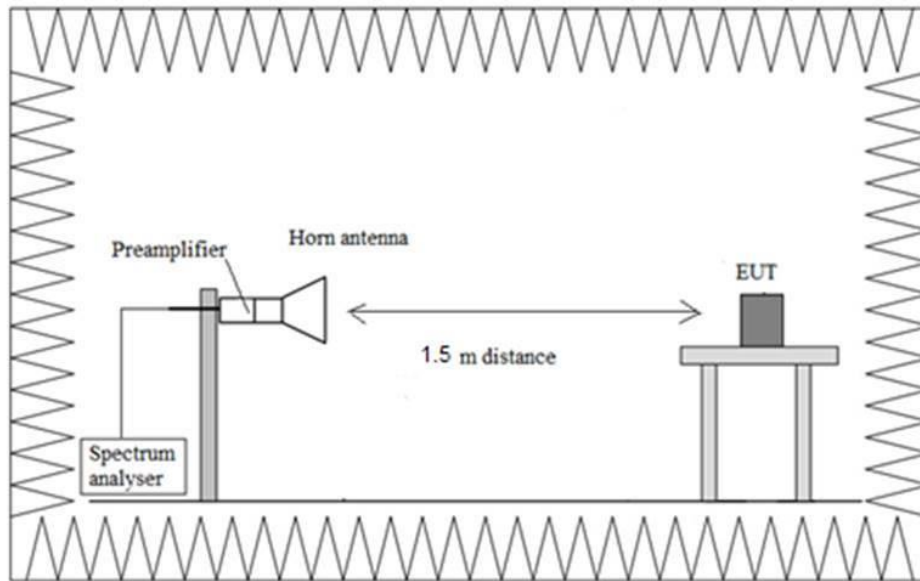
Radiated measurements setup $30 \text{ MHz} < f < 1 \text{ GHz}$:



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

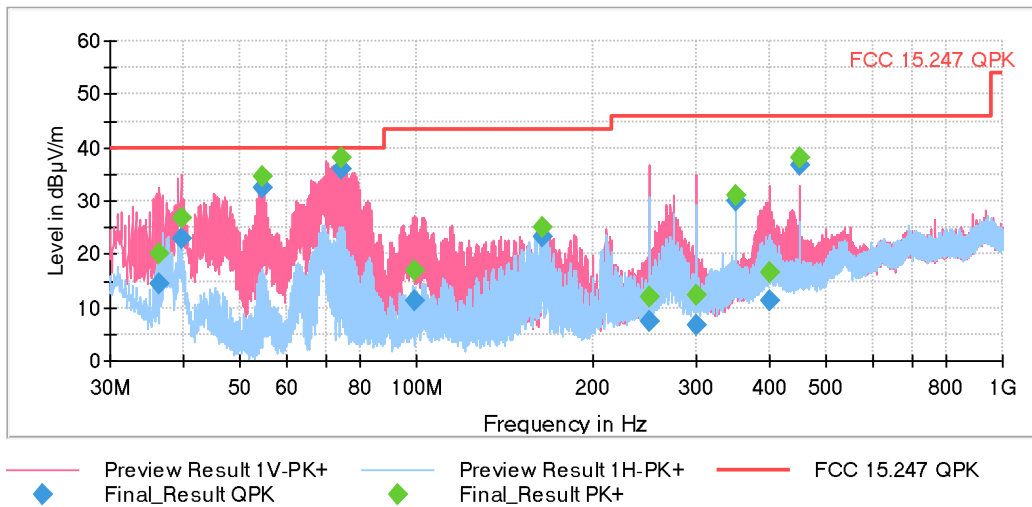
Spurious frequencies detected at less than 20 dB below the limit:

| 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 |

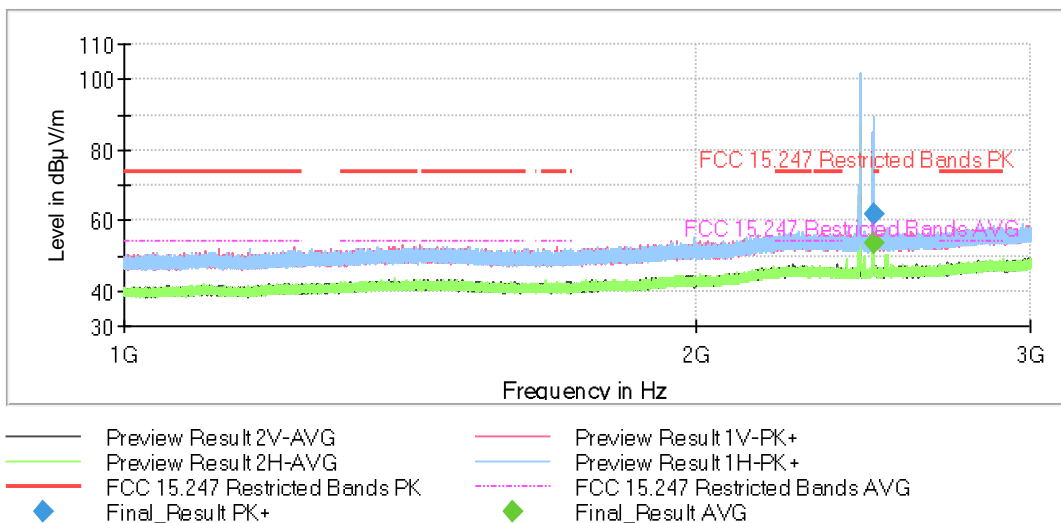
Verdict: PASS

| 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):

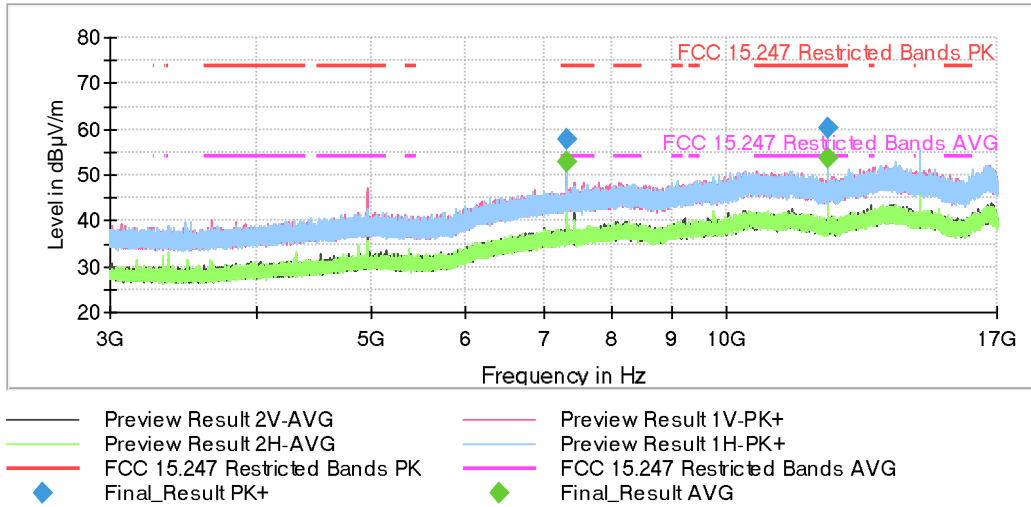


FREQUENCY RANGE 1 - 3 GHz (worst-case):



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):

