

ISED CABid: ES1909

Test report No:
 NIE: 70227RRF.006

Partial Test Report

USA FCC Part 15.31, 15.247, 15.209

CANADA RSS-247, RSS-Gen

(*) Identification of item tested	SALTO Neo Cylinder including all mechanical variants
(*) Trademark	SALTO
(*) Model and /or type reference	N0M / Type reference: G1824
Other identification of the product	HW version: 1.0 SW version: 0195 (Control FW); 0186 (STM32WB55RG FUS FW); 0187 (STM32WB55RG BLE STACK FW); 0148 (Motor FW) FCC ID: UKCN0M IC: 10088A-N0M
(*) Features	Bluetooth Smart (STM32WB55RG radio solution)
Applicant	SALTO SYSTEMS, S.L. Arkotz 9, Polígono Lanbarren 20180, Oiartzun (Gipuzkoa), SPAIN
Test method requested, standard	USA FCC Part 15.31 (10-1-20) Edition : Measurements standards. 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. 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	2022-01-27
Report template No	FDT08_23 (*) "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 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 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.
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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 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 consist of a SALTO Neo Cylinder with Mifare (ISO14443A & ISO15693 standard based) and Bluetooth Smart (STM32WB55RG radio solution) 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
70227B/001	SALTO Neo Cylinder	N0M	--	2021-11-08

Sample S/01 has undergone the test(s): All 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..... :	--					
Rated power supply	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	[]	AC:	[]	[]	[]	[]
	[X]	DC: 6 Vdc (4 x LR1 batteries)				
Rated Power	--					
Clock frequencies..... :	27.12 MHz, 32 MHz, 32.768 KHz					
Other parameters	N/A					
Software version	0195 (Control FW) + 0186 (STM32WB55RG FUS FW) + 0187 (STM32WB55RG BLE FW) + 0148 (Motor FW)					
Hardware version	1.0					
Dimensions in cm (W x H x D)	3.1 x 3.8 x 7.6 cm					
Mounting position	[]	Table top equipment				
	[]	Wall/Ceiling mounted equipment				
	[]	Floor standing equipment				
	[]	Hand-held equipment				
	[X]	Other: Door mounting				
Modules/parts..... :	Module/parts of test item		Type	Manufacturer		
	STM32WB55RG (SoC) + 2450AT18B100 (Antenna)		BLE	ST + JOHANSON		
	--					
Accessories (not part of the test item)	Description		Type	Manufacturer		
	--					
Documents as provided by the applicant..... :	Description		File name	Issue date		
	User manual					
	FW Explanation					
	--					

⁽³⁾ Only for Medical equipments.

Identification of the client

SALTO SYSTEMS, S.L.
Arkotz 9, Polígono Lanbarren
20180, Oiartzun (Gipuzkoa), SPAIN

Testing period and place

Test Location	DEKRA Testing and Certification S.A.U.
Date (start)	2021-11-30
Date (finish)	2021-12-09

Document history

Report number	Date	Description
70227RRF.006	2022-01-27	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: Pablo Redondo, José Gabriel Pendón.

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. Semianechoic Absorber Lined Chamber III FRANKONIA SAC-3	N.A.	N.A.
4. Shielded Room FRANKONIA	N.A.	N.A.
5. HYBRID BILOG ANTENNA 30MHz-6GHz ETS LINDGREN 3142E	2021/09	2024/09
6. HORN ANTENNA 1-18GHz SCHWARZBECK MESS- ELEKTRONIK BBHA 9120 D	2021/07	2024/07
7. PREAMPLIFIER 30dB 500MHz-18GHz SCHWARZBECK BBV 9718 C	2021/06	2022/06
8. EMI Test Receiver 7 GHz ROHDE AND SCHWARZ ESR7	2021/11	2023/11
9. Digital Multimeter, FLUKE 175	2021/11	2022/11
10. Active Loop antenna 9 kHz-30 MHz HEWLETT PACKARD 11966A	2020/07	2022/07
11. Broadband Horn antenna 18 - 40 GHz SCHWARZBECK MESS-ELEKTRONIK BBHA 9170	2020/05	2023/05
12. Pre-amplifier, G>30 dB, 17-40 GHz BONN ELEKTRONIK BLMA 1840-4A	2021/09	2022/09

Testing verdicts

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

Summary

FCC PART 15 PARAGRAPH / RSS-247 / RSS-Gen		
Requirement – Test case	Verdict	Remark
FCC 15.31 (h), 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.

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TEST CONDITIONS

POWER SUPPLY:

Vnominal:	6 Vdc
Type of Power Supply:	DC external power supply.

ANTENNA:

	Type of Antenna	Maximum Declared Antenna Gain
RFID	Integral, PCB	0 dBi
Bluetooth LE	Integral, Chip	+0.5 dBi

RADIOS AND CHANNELS TESTED:

- Co-Location mode NFC, Bluetooth LE: (Worst case)

	RFID	
Mode:	ISO 14443A: ASK 100%, OOK (subcarrier fc/16) & ISO 15693: ASK 10% - 30%, OOK (subcarrier fc/32)	
Channel Spacing:	N/A	
Frequency Range:	13.553 - 13.567 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	1	13.56

	Bluetooth LE	
Mode:	GFSK (1-DH5)	
Channel Spacing:	2 MHz	
Frequency Range:	2400 - 2483.5 MHz	
Transmit Channels	Channel	Channel Frequency (MHz)
	37	2402

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.

Transmission modes selected with each Radio:

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

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

* RFID 13.56 MHz: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in the single channel configuration supported by this radio.

Simultaneous transmission modes selected:

* **Co-Location mode Bluetooth Low Energy, RFID**, with the EUT configured to simultaneously transmit three signals at maximum output power:

Bluetooth Low Energy in 1 Mbps mode / RFID 13.56 MHz ISO 14443A mode.

* **Co-Location mode Bluetooth Low Energy, RFID**, with the EUT configured to simultaneously transmit three signals at maximum output power:

Bluetooth Low Energy in 1 Mbps mode / RFID 13.56 MHz ISO 15693 mode.

RADIATED MEASUREMENTS:

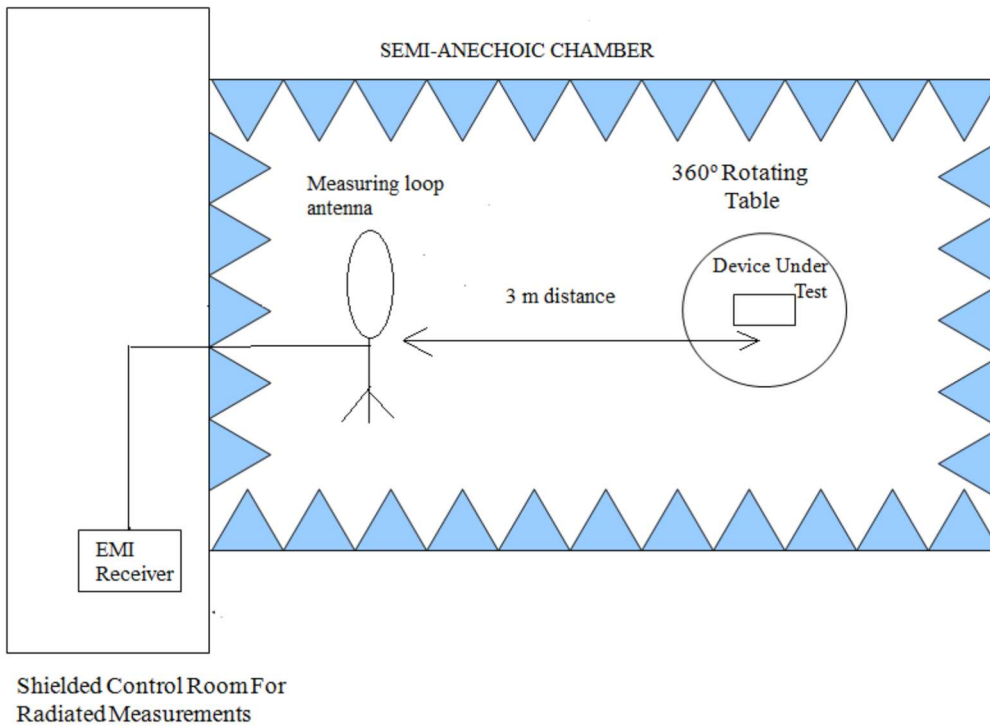
All radiated tests were performed in a semi-anechoic chamber. The measurement antenna is situated at a distance of 3 m (Loop antenna for the range between 9 kHz to 30 MHz, Bilog antenna for 30 MHz to 1000 MHz and Double ridge horn antenna for 1 GHz-17 GHz) and at distance of 1 m for the frequency range 17 GHz-26 GHz (18 GHz-26 GHz horn antenna).

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.

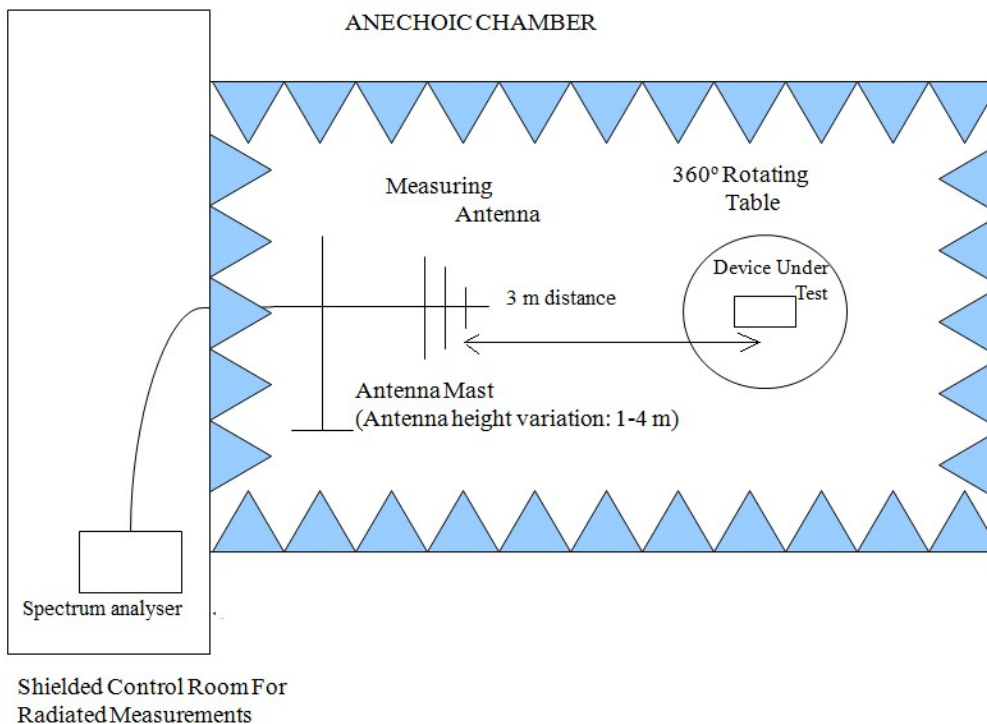
Measurements were made in both horizontal and vertical planes of polarization.

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

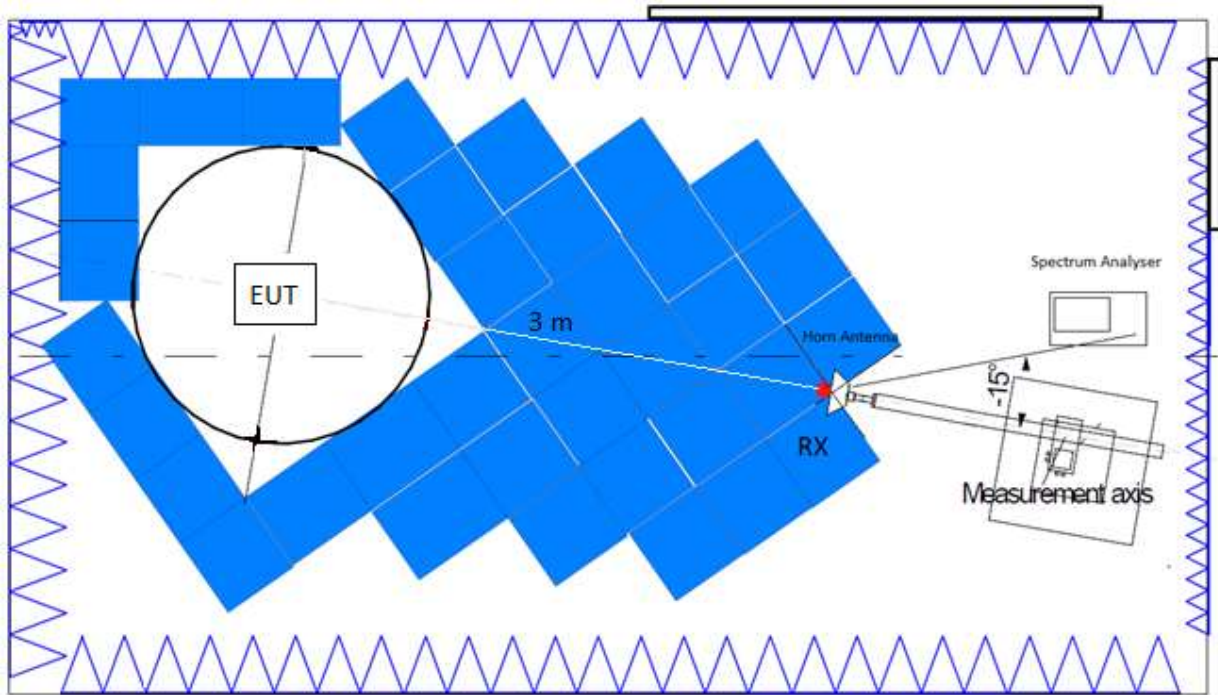
Radiated measurements setup $f < 30$ MHz:



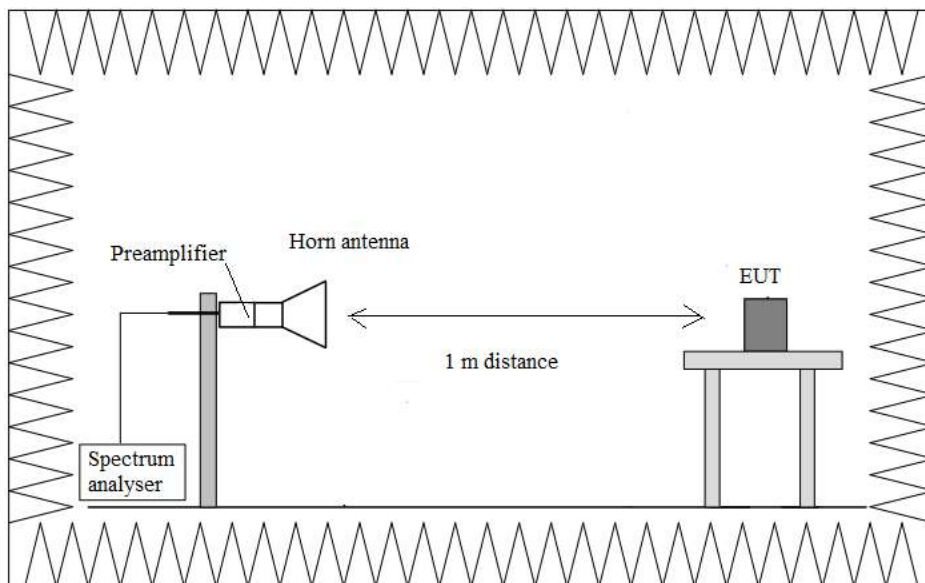
Radiated measurements setup $30 \text{ MHz} < f < 1 \text{ GHz}$:



Radiated measurements setup $f > 1$ GHz up to 17 GHz:



Radiated measurements setup $f > 17$ GHz up to 26 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	29.54	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 9 kHz-1 GHz and at distance of 1m for the frequency range 1 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.

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

- **Colocation Bluetooth Low Energy 1 Mbps, RFID ISO A**

Frequency range 9 kHz - 30 MHz:

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected closest to the limit.

Measurement uncertainty (dB): $\leq \pm 3.04$

Frequency range 30 MHz - 1 GHz:

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected closest to the limit.

Measurement uncertainty (dB): $\leq \pm 5.35$

Frequency range 1 - 26 GHz:

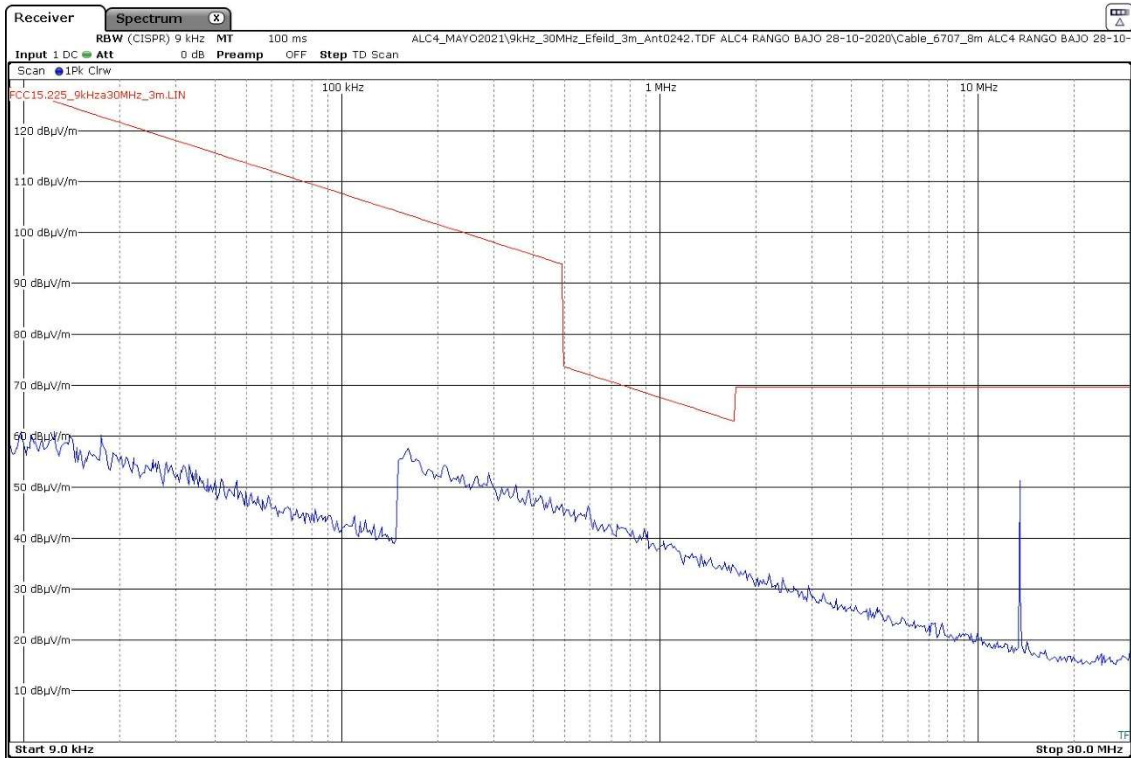
Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
4.8033	47.47	V	Peak
7.2056	49.93	H	Peak
12.0083	58.50	V	Peak
	51.91		Average
16.8153	54.09	V	Peak

Measurement Uncertainty (dB):
 1 GHz to 3 GHz $\leq \pm 4.02$
 3 GHz to 17 GHz $\leq \pm 4.28$
 17 GHz to 26 GHz $\leq \pm 5.51$

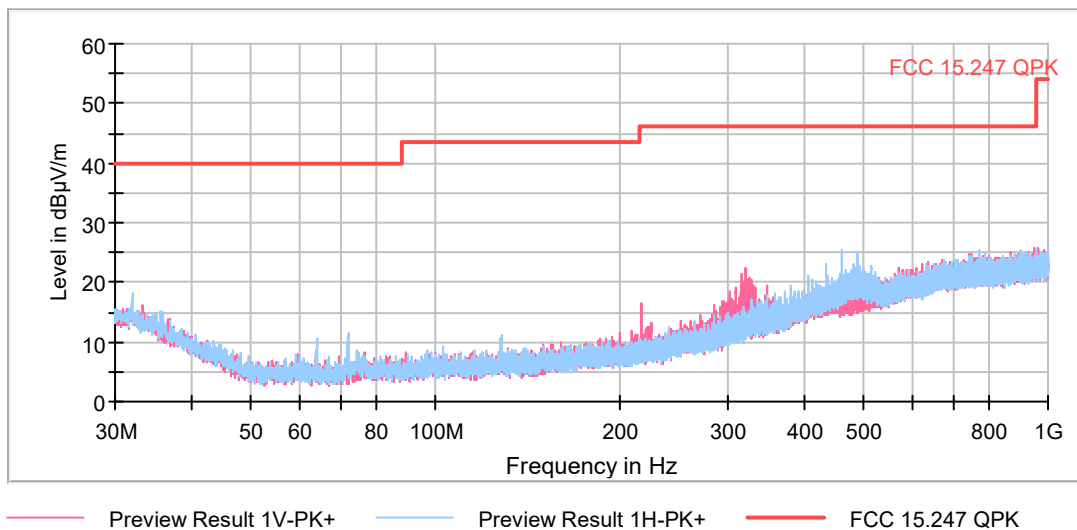
Verdict: PASS

FREQUENCY RANGE 9 kHz - 30 MHz (worst case):

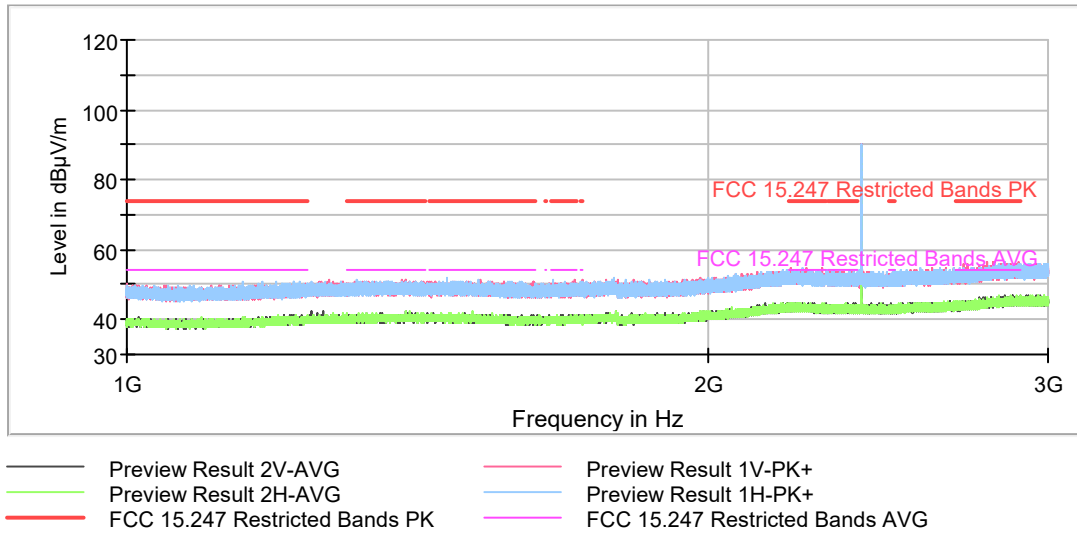


The highest peak is the carrier frequency (RFID 13.56 MHz)

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

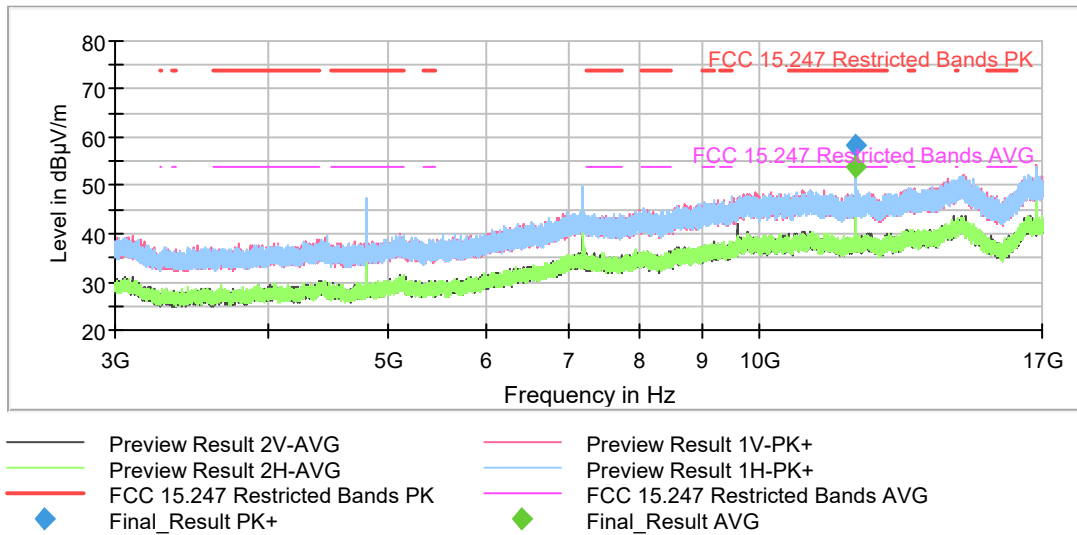


FREQUENCY RANGE 1 - 3 GHz (worst case):

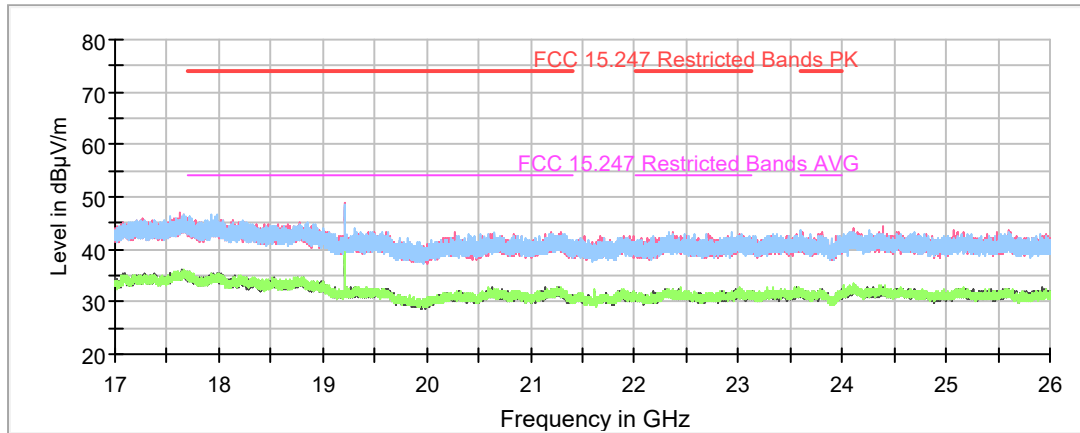


The highest peak is the carrier frequency (Bluetooth LE 2402 MHz)

FREQUENCY RANGE 3 - 17 GHz (worst case)



FREQUENCY RANGE 17 - 26 GHz (worst case):



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

- **Colocation Bluetooth Low Energy 1 Mbps, RFID ISO V**

Frequency range 9 kHz - 30 MHz:

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected closest to the limit.

Measurement uncertainty (dB): $\leq \pm 3.04$

Frequency range 30 MHz - 1 GHz:

The spurious emissions below 1 GHz do not depend on either the operating channel or the modulation mode.

No spurious frequencies detected closest to the limit.

Measurement uncertainty (dB): $\leq \pm 5.35$

Frequency range 1 - 26 GHz:

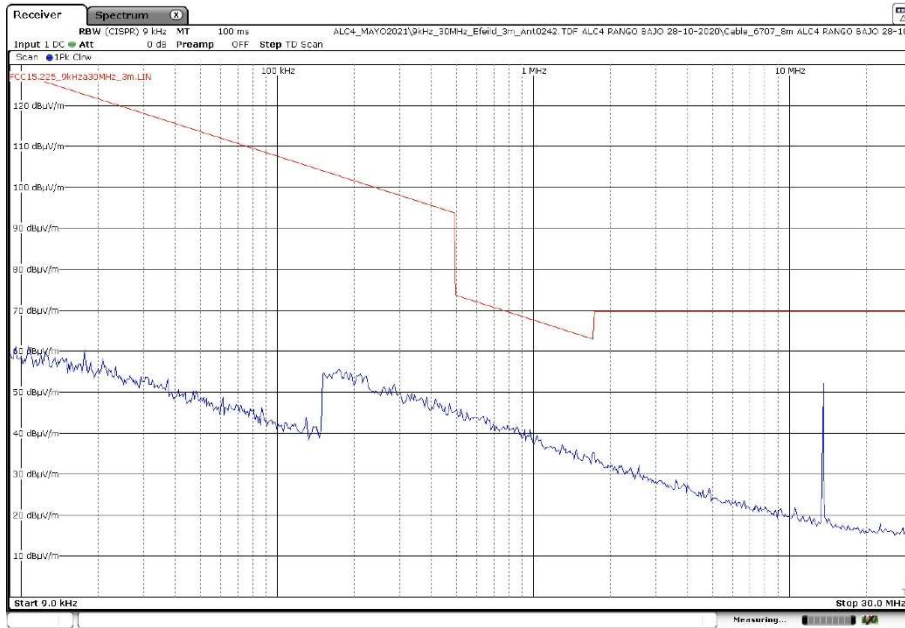
Spurious frequencies detected closest to the limit:

Spurious frequency (GHz)	Emission Level (dB μ V/m)	Polarization	Detector
7.2060	50.15	H	Peak
12.0086	57.42	V	Peak
	50.89		Average
16.8160	54.18	H	Peak

Measurement Uncertainty (dB):
1 GHz to 3 GHz $\leq \pm 4.02$
3 GHz to 17 GHz $\leq \pm 4.28$
17 GHz to 26 GHz $\leq \pm 5.51$

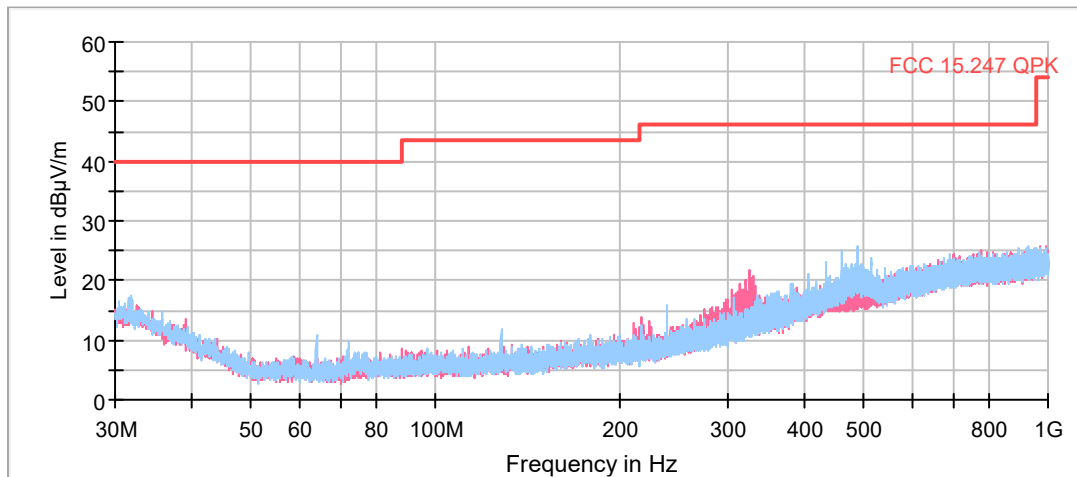
Verdict: PASS

FREQUENCY RANGE 9 kHz - 30 MHz (worst case):



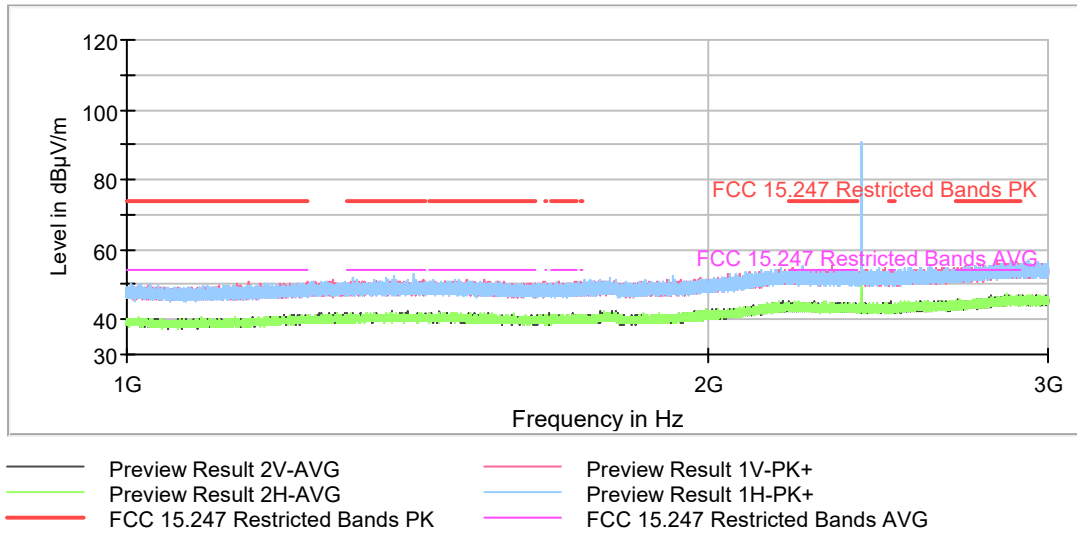
The highest peak is the carrier frequency (RFID 13.56 MHz)

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



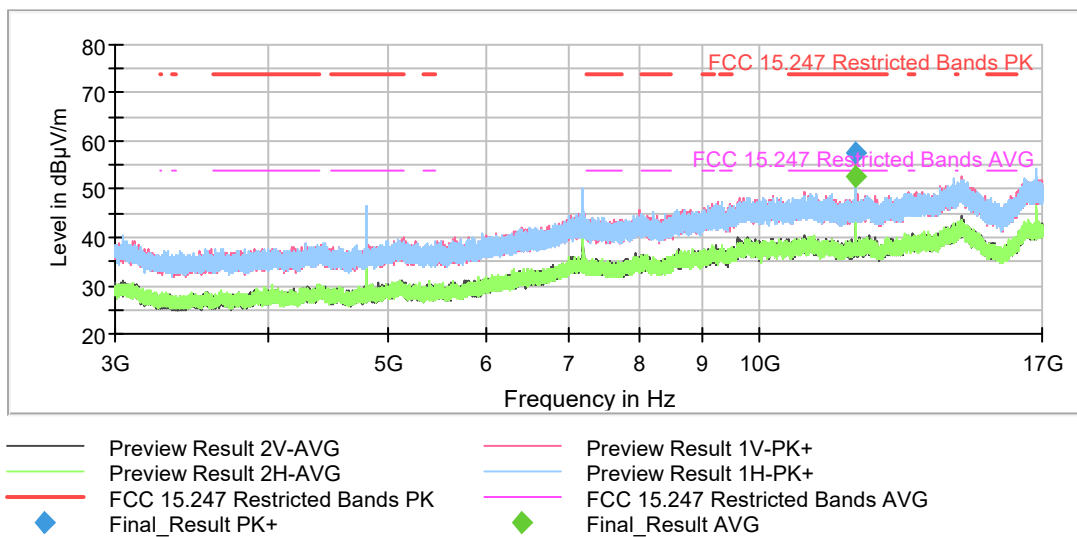
Preview Result 1V-PK+ Preview Result 1H-PK+ FCC 15.247 QPK

FREQUENCY RANGE 1 - 3 GHz (worst case):

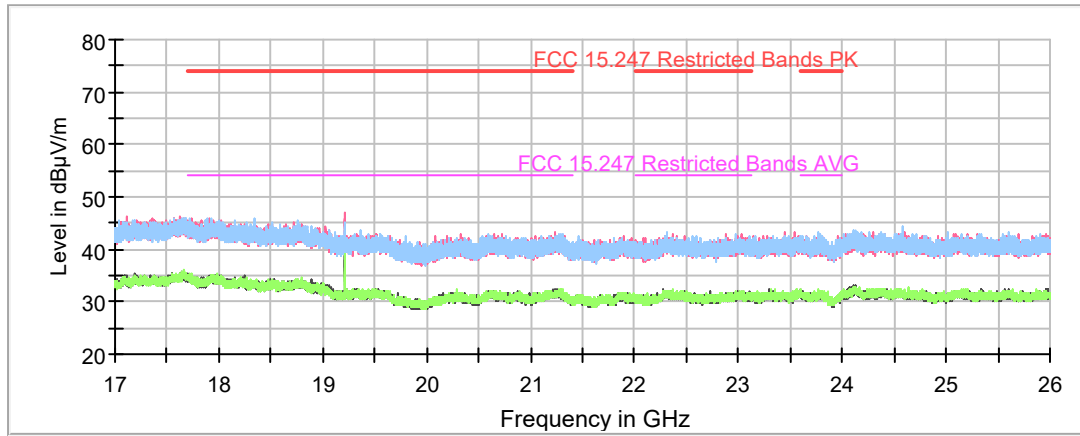


The highest peak is the carrier frequency (Bluetooth LE 2402 MHz)

FREQUENCY RANGE 3 - 17 GHz (worst case)



FREQUENCY RANGE 17 - 26 GHz (worst case):



- Preview Result 2V-AVG
- Preview Result 2H-AVG
- FCC 15.247 Restricted Bands PK
- Preview Result 1V-PK+
- Preview Result 1H-PK+
- FCC 15.247 Restricted Bands AVG