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C.I.F. A29507456

ISED CABid: ES1909

Lab. Company Number: 4621A

Test Report No:

72667RRF.003

Partial Test Report

USA FCC Part 15.31, 15.225, 15.247, 15.209
CANADA RSS-210, RSS-247, RSS-Gen

(*) Identification of item tested	SALTO DBolt Touch electronic lock series including all mechanical variants
(*) Trademark	SALTO
(*) Model and /or type reference	DM0M / (Type reference: E2133)
Other identification of the product	FCC ID: UKCDM0M IC: 10088A-DM0M
(*) Features	Features: Bluetooth LE HW version: 1.0 SW version: 0190 (Control FW), 0179 (Motor FW) 0186 (FUS FW), 0187 (BLE FW)
Applicant	SALTO SYSTEMS, S.L. Arkotz 9, Polígono Lanbarren 20180, Oiartzun, Gipuzkoa, SPAIN
Test method requested, standard	USA FCC Part 15.31 (10-1-21 Edition): Measurement standard. USA FCC Part 15.225 (10-1-21 Edition): Operation within the band 13.110 -14.010. 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-210 Issue 10 (December 2019). CANADA RSS-247 Issue 2 (February 2017). CANADA RSS-Gen Issue 5 amendment 2 (February 2021). 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)	José Manuel Gómez Galván EMC Consumer & RF Lab. Manager Firmado digitalmente por 53680346W JOSE MANUEL GOMEZ (C:A29507456)
Date of issue	2023-05-16
Report template No	FDT08_24 (*) "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 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.

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. **IMPORTANT:** No parts of this report may be reproduced or quoted out of context, in any form or by any means, except in full, without the previous written permission of DEKRA Testing and Certification S.A.U.

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.

The total uncertainty of the measurement system for the radiated emissions of the EUT is:

From 9 kHz to 30 MHz:	Measurement uncertainty ≤± 3.04 dB.
From 30 MHz to 1 GHz:	Measurement uncertainty ≤± 5.01 dB.
From 1 to 3 GHz:	Measurement uncertainty ≤± 4.00 dB.
From 3 to 17 GHz:	Measurement uncertainty ≤± 4.22 dB.
From 17 to 26 GHz:	Measurement uncertainty ≤± 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 consists of a SALTO DBolt Touch electronic lock series with RFID Mifare (ISO 14443A & ISO 15693 standard based) and Bluetooth LE 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 undergoing test have been selected by: The client.

Id	Control Number	Description	Model	Serial Nº	Date of Reception	Application
S/01	72667_24.1	SALTO DBolt Touch electronic lock	DM0M	--	2022-09-29	Element Under Test

Notes referenced to samples during the project:

Id	Type
S/01	Sample used for radiated test

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	PE
	[ ]	AC:					
	[X]	DC: 4.5 Vdc (3 x LR6 batteries), 5 Vmax, 3.2/3 Vmin					

Rated Power .....:	--
Clock frequencies.....:	32 MHz, 32.768 kHz, 27.12 MHz
Other parameters .....:	N/A
Software version .....:	0190 (Control FW) + 0179 (Motor FW) + 0186 (FUS FW) + 0187 (BLE FW)
Hardware version .....:	1.0
Dimensions in cm (W x H x D) ....:	Reader: 6.8 x 16 x 4.6 cm; Control: 7.2 x 14.8 x 5.27 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
	SoC + 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
	--		

(3) Only for Medical Equipment

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)	2023-03-07
Date (finish)	2023-03-08

Document history

Report number	Date	Description
72667RRF.003	2023-05-16	First release.

Environmental conditions

In the control chamber, the following limits were not exceeded during the test:

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

In the semianechoic chamber, the following limits were not exceeded during the test.

Temperature	Min. = 15 ºC Max. = 35 ºC
Relative humidity	Min. = 20 % Max. = 75 %

Remarks and comments

The tests have been performed by the technical personnel: Rafael Fernandez.

Used instrumentation:

Control No.	Equipment	Model	Manufacturer	Next Calibration
4825	SEMIANECHOIC ABSORBER LINED CHAMBER	FACT 3 200 STP	ETS LINDGREN	N/A
4826	SHIELDED ROOM	S101	ETS LINDGREN	N/A
0242	ACTIVE LOOP ANTENNA 9 KHZ-30 MHz	11966A	HEWLETT PACKARD	2024-08-18
4578	HYBRID BILOG ANTENNA 30MHz-6GHz	3142E	ETS LINDGREN	2023-04-30
6142	PRE-AMPLIFIER G>38dB 30MHz-6GHz	BLNA 0360-01N	BONN ELEKTRONIK	2023-06-16
4611	HORN ANTENNA 1-18GHz	BBHA 9120 D	SCHWARZBECK MESS-ELEKTRONIK	2026-01-16
5705	PRE-AMPLIFIER G>40dB 1-18 GHz	BLMA 0118-1M	BONN ELEKTRONIK	2023-07-21
4657	HORN ANTENNA 18-40GHz	BBHA 9170	SCHWARZBECK	2023-05-05
8856	PRE-AMPLIFIER G>30dB 17-40GHz	BLMA 1840-4A	BONN ELEKTRONIK	2023-11-02
4716	SIGNAL AND SPECTRUM ANALYZER 2Hz-50GHz	FSW50	ROHDE AND SCHWARZ	2024-08-12
6165	EMI TEST RECEIVER 9kHz-7GHz	ESR7	ROHDE AND SCHWARZ	2023-11-08
4848	SOFTWARE FOR EMC/RF TESTING	EMC32	ROHDE AND SCHWARZ	N/A

Testing verdicts

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

Summary

FCC PART 15 PARAGRAPH / RSS-Gen/ RSS-210/ RSS-247		
Requirement – Test case	**Verdict**	**Remark**
FCC 15.31 (h), FCC 15.209 (a), 15.225 (d), 15.247 (d) / RSS-Gen 8.9, RSS-210 B.6 (a)(iv), RSS-247 5.5: - Emission limitations radiated (Transmitter)	P	(1)
Supplementary information and remarks: (1) Only simultaneous mode radiated spurious emission test was requested.		

Appendix A: Test results.

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TEST CONDITIONS

(*) Declared by the Applicant

POWER SUPPLY (*):

Vnominal: 4.5Vdc

Type of Power Supply: 3 x LR06 batteries

ANTENNA (*):

Type of Antenna for Bluetooth Low Energy: Integral (Chip).

Maximum Declared Antenna Gain for Bluetooth Low Energy: +0.5 dBi

Type of Antenna for RFID 13.56 MHz ISO 15693: Integral (PCB).

Maximum Declared Antenna Gain for RFID 13.56 MHz ISO 15693: N/A

RADIOS AND CHANNELS TESTED:

	Bluetooth Low Energy / DTS	
Mode:	1M (GFSK - 1DH5)	
Channel Spacing:	2 MHz	
Frequency Range:	2402 MHz to 2480 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	37	2402

	RFID 13.56 MHz ISO 15693 / ASK 10% - 30%, OOK (subcarrier fc/32)	
Mode:	Single Channel	
Channel Spacing:	Not Applicable	
Frequency Range:	13.553 - 13.567 MHz	
Transmit Channel:	Channel	Channel Frequency (MHz)
	1	13.56

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 Low Channel (2402 MHz).

* RFID 13.56 MHz ISO 15693: Transmitter radiated spurious emissions tests were performed with the EUT transmitting in the Single Channel configuration supported by this radio.

TESTED SIMULTANEOUS TRANSMISSION MODES:

*** Simultaneous transmission mode Bluetooth, RFID 13.56 MHz ISO 15693**, with the EUT configured to simultaneously transmit two signals at maximum output power:

Bluetooth Low Energy in 1 Mbps in the Low Channel (2402 MHz), RFID 13.56 MHz ISO 15693 Single Channel.

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 1.5 m for the frequency range 17 GHz-26 GHz (17 GHz-40 GHz horn antenna).

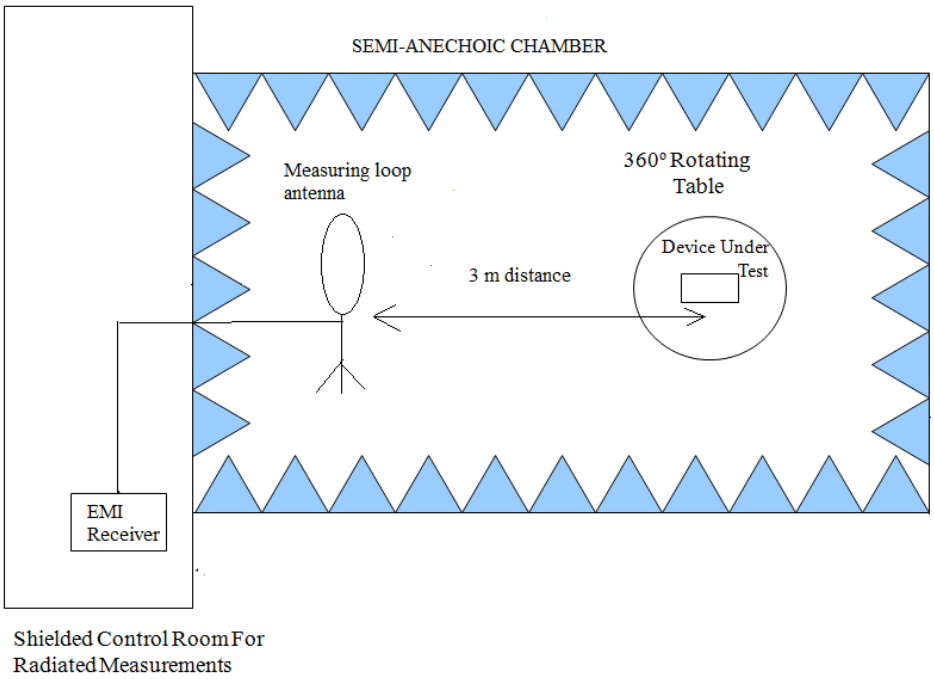
For radiated emissions in the range 17 GHz-26 GHz performed at a distance closer than the distance specified in the standard, an inverse proportionality factor of 20 dB per decade is used to normalize the measured data for determining compliance.

The equipment under test was set up on a non-conductive platform above the ground plane and its situation and orientation were varied to find the maximum radiated emission. It was also rotated 360º and the antenna height was varied from 1 to 4 meters (up to 17 GHz) to find the maximum radiated emission.

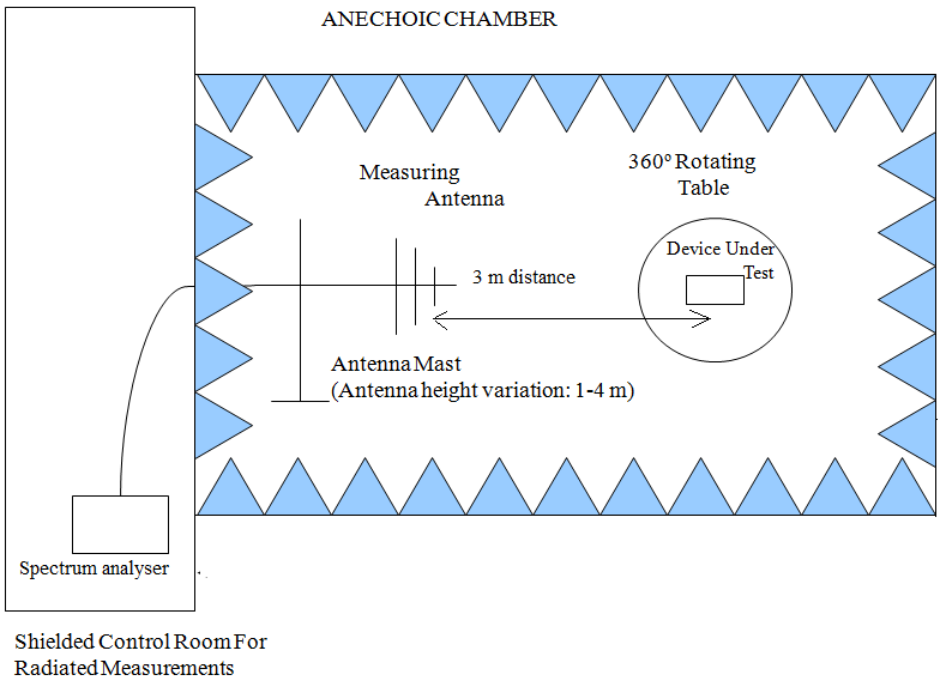
Measurements were made in both horizontal and vertical planes of polarization.

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.

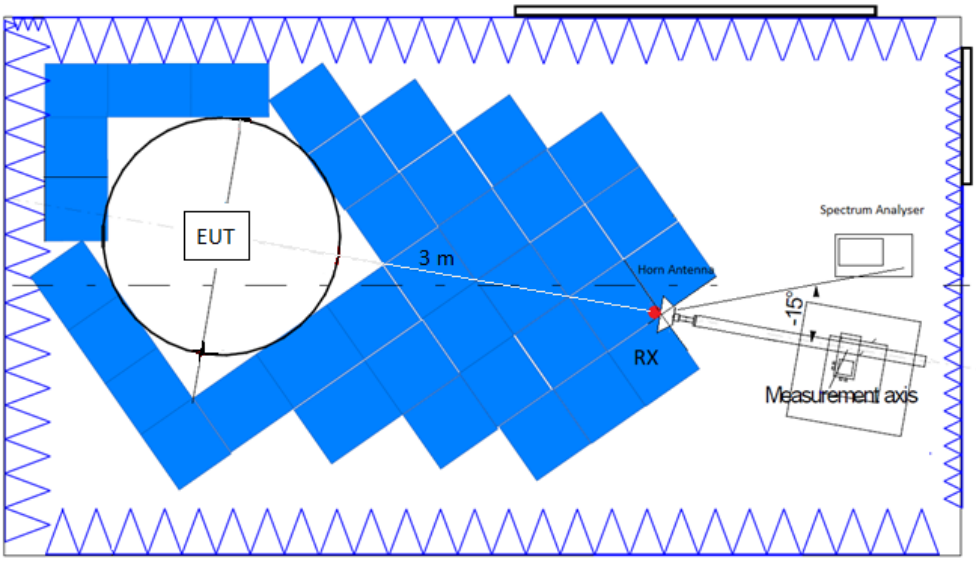
Radiated measurements setup f < 30 MHz:



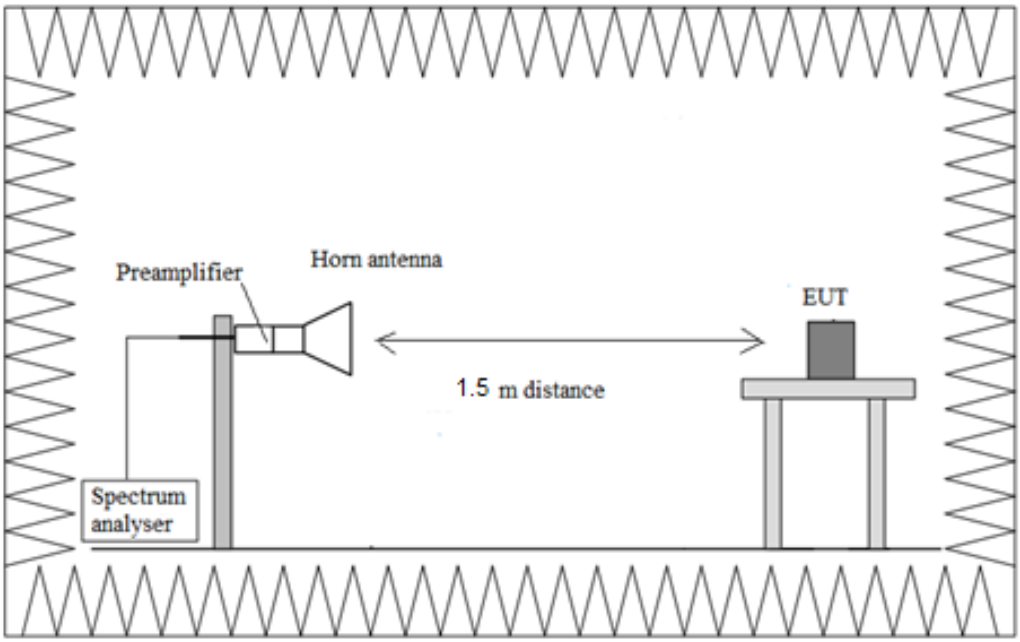
Radiated measurements setup 30 MHz < f < 1 GHz:



Radiated measurements setup f > 1 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 (µV/m)	Field strength (dBµV/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
Above 960	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.

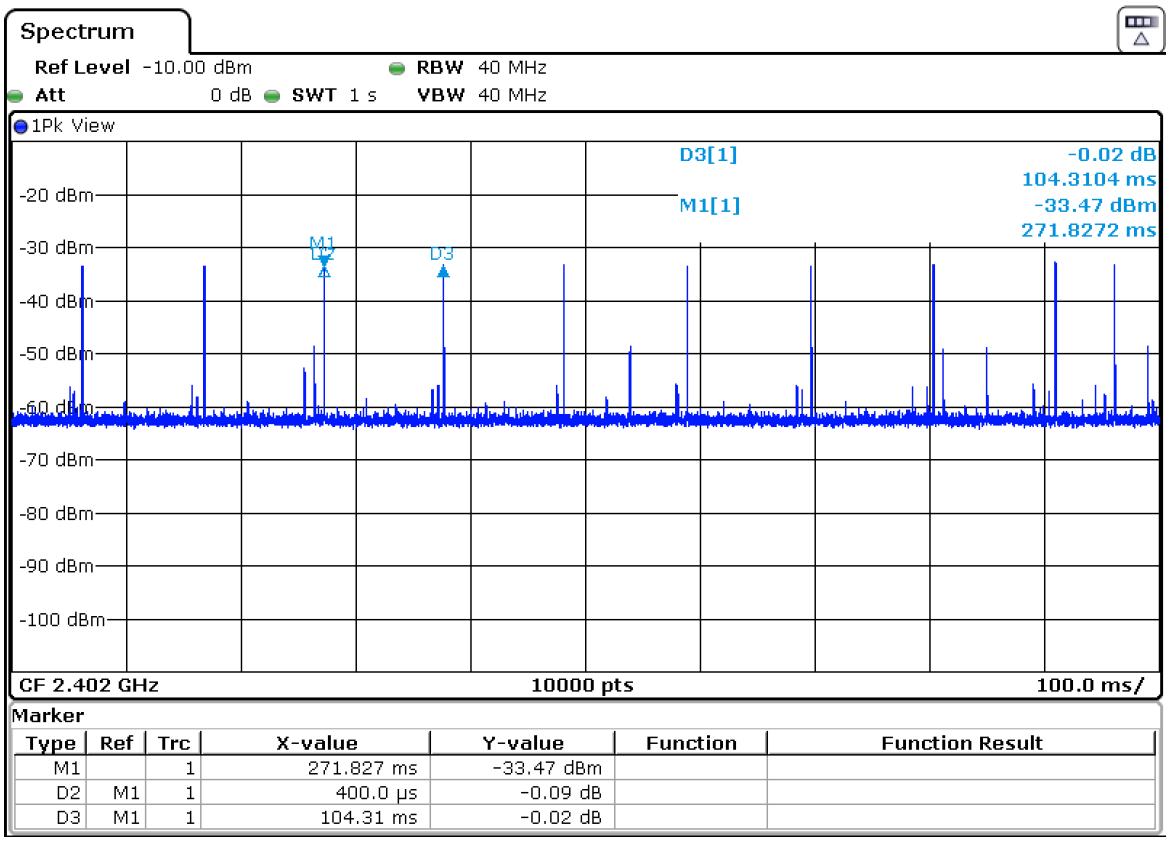
RSS-247. Attenuation below the general field strength limits specified in RSS-Gen is not required.

Results

- **Simultaneous transmission mode Bluetooth Low Energy, RFID 13.56 MHz ISO 15693:**

Bluetooth Low Energy:	Low Channel (2402 MHz)
RFID 13.56 MHz ISO 15693:	Single Channel (13.56 MHz)

Computation of duty-cycle correction factor



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	271.827 ms	-33.47 dBm		
D2	M1	1	400.0 µs	-0.09 dB		
D3	M1	1	104.31 ms	-0.02 dB		

According to ANSI C63.10, paragraph 7.5, we can determinate the Duty Cycle in this way:

Duty cycle correction factor δ = 20 * log (Tx ON (ms) * Number of pulses within 100 ms) / 100 ms

δ = 20 log (400us)/100ms = -47.97 dB.

Frequency range 9 kHz - 30 MHz:

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

Frequency range 30 MHz - 1 GHz

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

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.

According to 558074 D01 15.247 Meas Guidance v05r02:
Several measurement methods are available for making average measurements for radiated and antenna-port conducted spurious emission provided that:

i. The spurios emission fall in restricted band
ii. Emission are temporally related to the fundamental
iii. The maximum duty cycle used in determining the reduction factor is hardwired such that under no condition can it be changed or modified by either the device or end user
iv. documented justification for use of Section 15.35(c) including the measurements used to determine the worst-case duty cycle must be included in the test report, and
v. the duty cycle correction factor is the worst-case operational duty cycle based on the maximum transmission time in any 100 msec period.

If the above criteria are satisfied, one of the following measurement techniques may be used:

Applying a duty cycle correction to the Peak measurement – First, a Peak measurement is made using the Peak detector function of a spectrum analyzer. The spectrum analyzer settings should be such that it meets the requirements of 11.12.2.4 in ANSI C63.10 for making a Peak measurement. Then the operational duty cycle of the EUT may be subtracted from the Peak reading to derive the RMS average value. If the EUT supports more than one operational duty cycle the worst-case value should be used, i.e., the highest operational duty cycle.

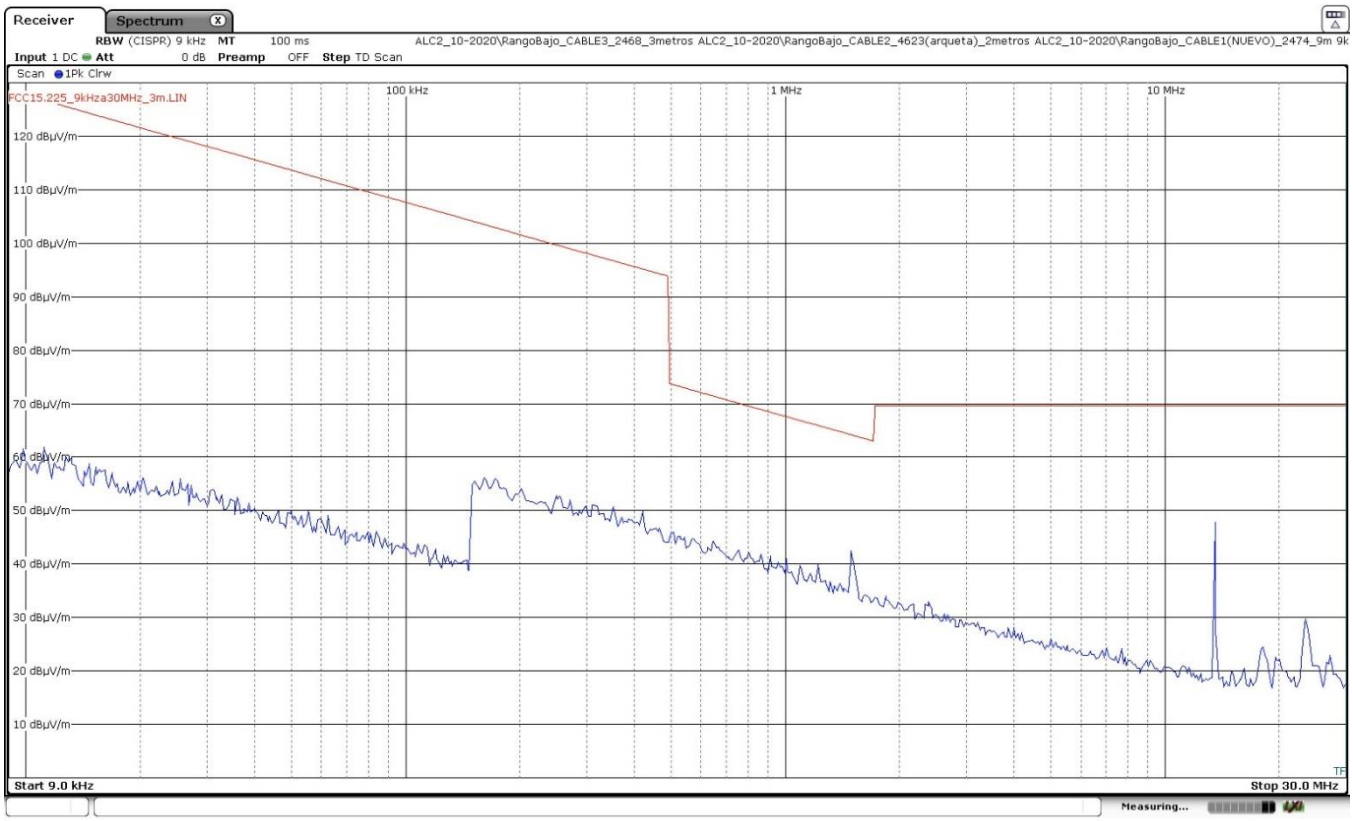
Spurious frequencies detected at less than 20 dB below the limit:

** Duty Cycle correction factor: -47.97 dB*

Freq Rng (GHz)	Unwanted Freq (MHz)	Unwanted Lvl (dBµV/m)	Corrected RMS Unwanted Lvl (dBµV/m)	Pol	Detector
[3, 17]	4804.00	67.94	--	H	PK
		--	19.97		AVG
	7206.00	50.46	--	V	PK
	12008.86	64.65	--	V	PK
		--	17.68		AVG

Verdict: PASS

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

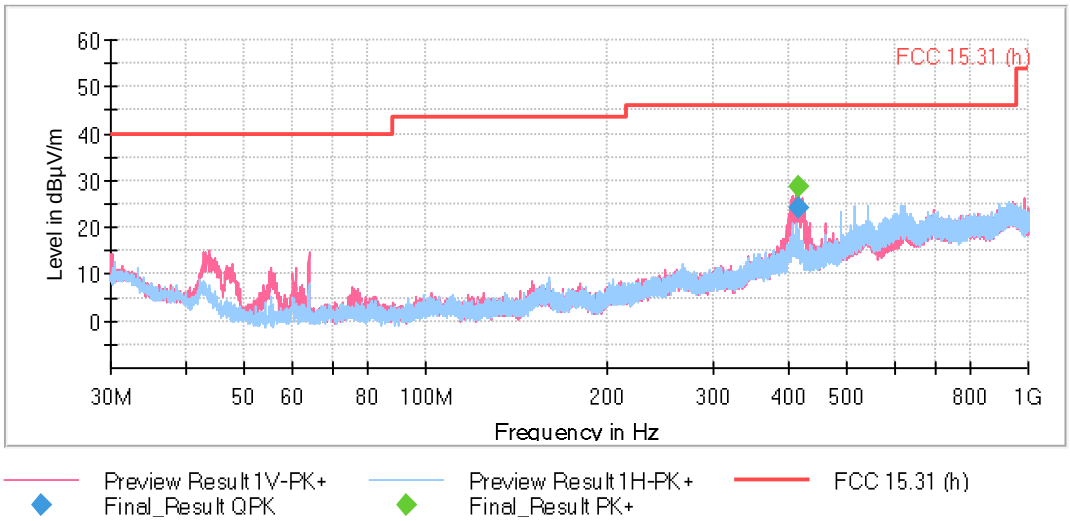


The highest peak is the RFID 13.56 MHz carrier frequency.

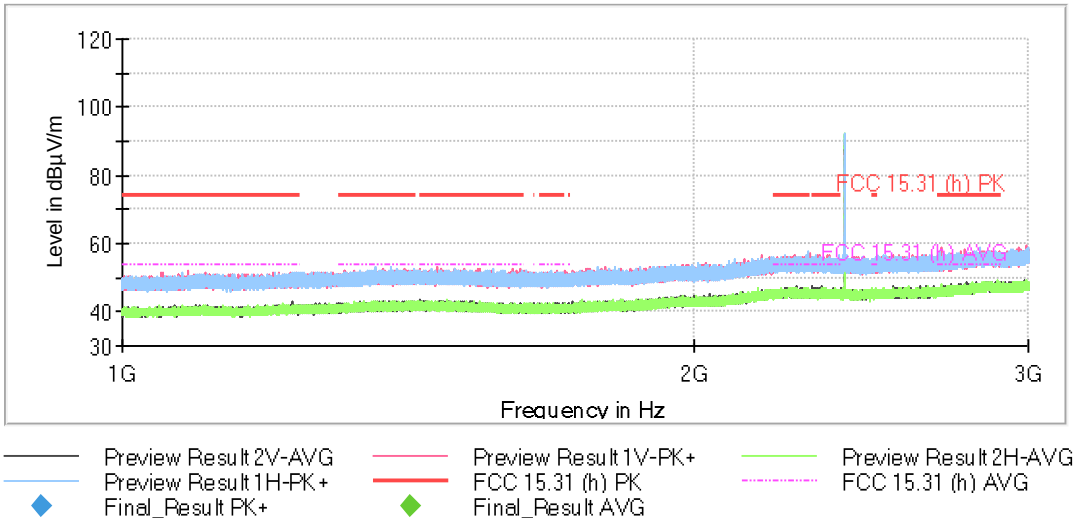
Spectrum Analyzer Parameters:

Subrange	Step Size	Detectors	Bandwidth	Sweep Time	Preamp
Receiver: [ESR 7]					
30 MHz - 1 GHz	30,312 kHz	PK+	100 kHz	1 s	0 dB
Receiver: [FSW 50]					
1 GHz - 3 GHz	30,769 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Receiver: [FSW 50]					
3 GHz - 17 GHz	140 kHz	PK+ ; AVG	1 MHz	1 s	0 dB
Receiver: [FSW 50]					
17 GHz - 26 GHz	300 kHz	PK+ ; AVG	1 MHz	1 s	0 dB

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

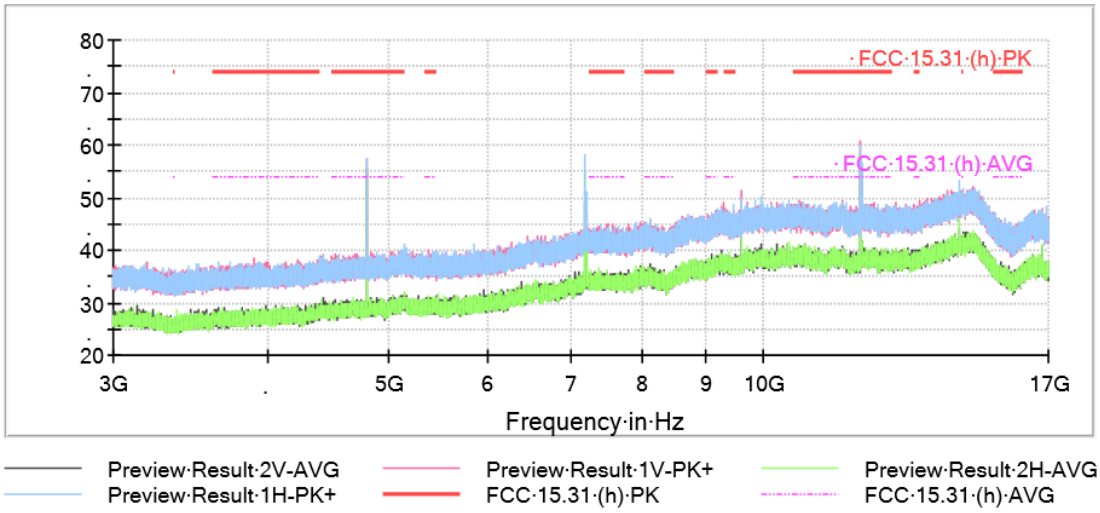
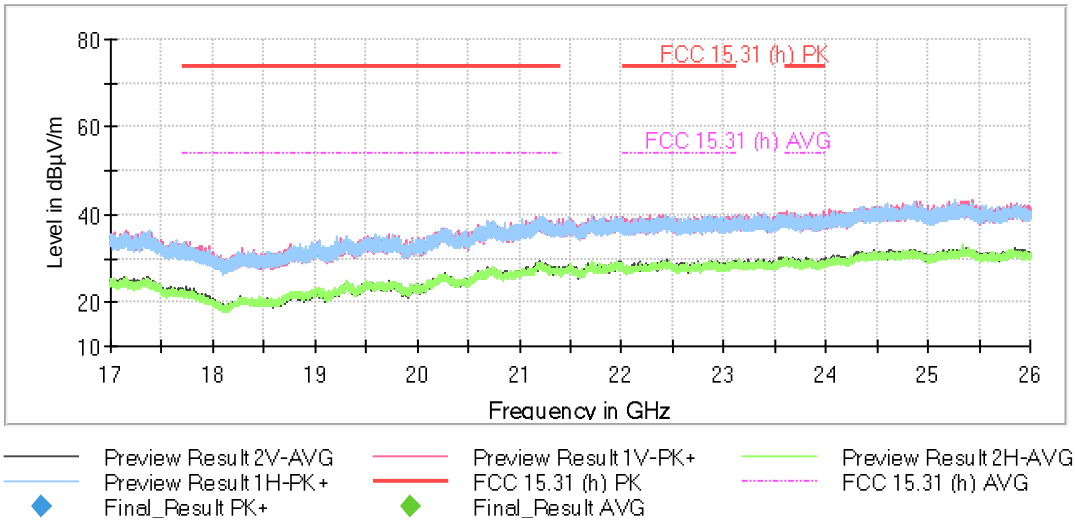


FREQUENCY RANGE 1 - 3 GHz (worst-case):



The peak above the limit is the Bluetooth LE carrier frequency.

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



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