

ISED CABid: ES1909

Test Report No:
NIE: 70227RRF.005

Test Report

USA FCC Part 15.225, 15.209

CANADA RSS-210, 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 15.225 (10–1–20 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10–1–20 Edition): Radiated emission limits, general requirements. CANADA RSS-210 Issue 10 (December 2019). CANADA RSS-Gen Issue 5 (March 2019). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	Rafael López Martín EMC Consumer & RF Lab. Manager  2022.02.01 18:16:19 +01'00'
Date of issue	2022-01-27
Report template No	FDT08_23 (*) "Data provided by the client"

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Competences and guarantees

DEKRA Testing and Certification 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.

DEKRA Testing and Certification 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.
3. This document is only valid if complete; no partial reproduction can be made without previous written permission of DEKRA Testing and Certification.
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 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 results.

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°	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	PE						
	[]	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 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)	2021-12-04
Date (finish)	2021-12-21

Document history

Report number	Date	Description
70227RRF.005	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 %

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: Javier Miguel Nadales.

Used instrumentation:

Conducted measurements:

		Last Calibration	Due Calibration
1.	Shielded Room ETS LINDGREN S101	N/A	N/A
2.	Signal and Spectrum Analyzer ROHDE AND SCHWARZ FSV 40	2021/10	2023/10
3.	Climatic chamber BINDER MK 56	2021/03	2022/03
4.	DC Power Supply 30V/5A Keysight Technologies U8002A	N/A	N/A
5.	Digital Multimeter FLUKE 175	2021/07	2022/07

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.	Active Loop antenna 9 kHz-30 MHz HEWLETT PACKARD 11966A	2020/07	2022/07
4.	EMI Test Receiver 9kHz-7GHz ROHDE AND SCHWARZ ESR7	2021/11	2023/11
5.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2020/10	2023/10
6.	RF Pre-amplifier, G>40 dB, 10MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2021/03	2022/03

Testing verdicts

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

Summary

ISO A, ISO V

FCC PART 15 PARAGRAPH / RSS-247		
Requirement – Test case	Verdict	Remark
FCC 15.225 (a) / RSS-210 B.6 (a)(i) Field strength of emissions within the band 13.553 MHz -13.567 MHz	P	
FCC 15.225 (b) / RSS-210 B.6 (a)(ii) Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 – 13.710 MHz	P	
FCC 15.225 (c) / RSS-210 B.6 (a)(iii) Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 – 14.010 MHz	P	
FCC 15.225 (d) / RSS-210 B.6 (a)(iv) Field strength of emissions outside of the band 13.110 MHz -14.010 MHz	P	
FCC 15.225 (e) / RSS-210 B.6 (b) Frequency tolerance of the carrier signal	P	
<u>Supplementary information and remarks:</u>		
None.		

Appendix A: Test results

TEST CONDITIONS	11
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TEST CONDITIONS

POWER SUPPLY:

Vn: 6 Vdc (*)
Vmin: 5.1 Vdc (*)
Vmax: 6 Vdc (*)

Type of Power Supply: External DC power supply.

The subscripts 'n', 'min' and 'max' mean nominal, minimum and maximum respectively.
(*): Declared by applicant.

ANTENNA:

Type of Antenna: Integral, PCB
Maximum Declared Antenna Gain: 0 dBi

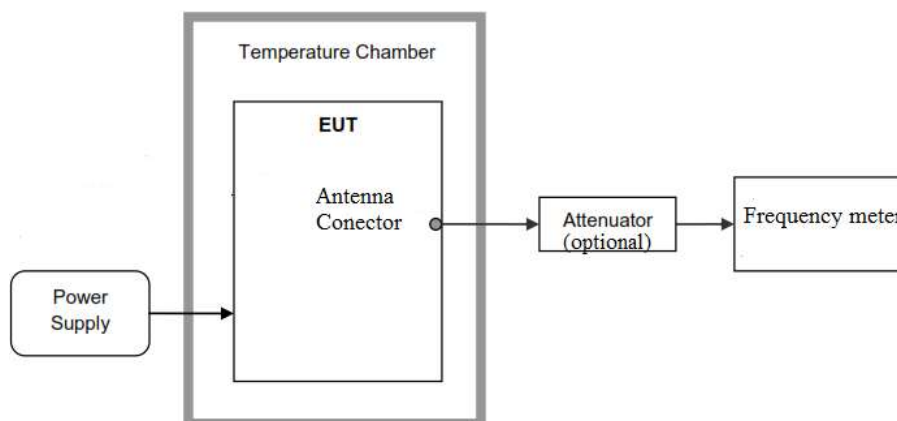
TEST FREQUENCIES:

Nominal Operating Frequency: 13.56 MHz

CONDUCTED MEASUREMENTS:

The equipment under test was set up in a shielded room and it is directly connected to the spectrum analyzer.

For frequency stability test the EUT was placed inside a climatic chamber and connected to a frequency meter using a low loss cable. An external DC power supply was connected to the EUT for voltage variation test.



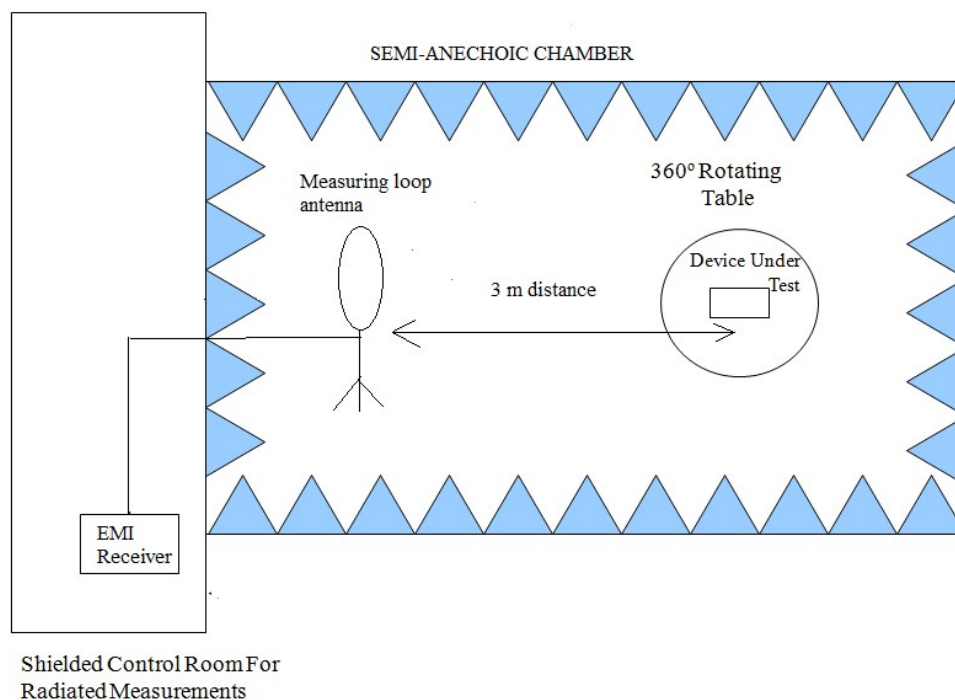
RADIATED MEASUREMENTS:

All radiated tests were performed in a semi-anechoic chamber. The measurement antenna (Loop antenna for the range between 9 kHz to 30 MHz and Bilog antenna for the range between 30 MHz to 200 MHz) is situated at a distance of 3 m.

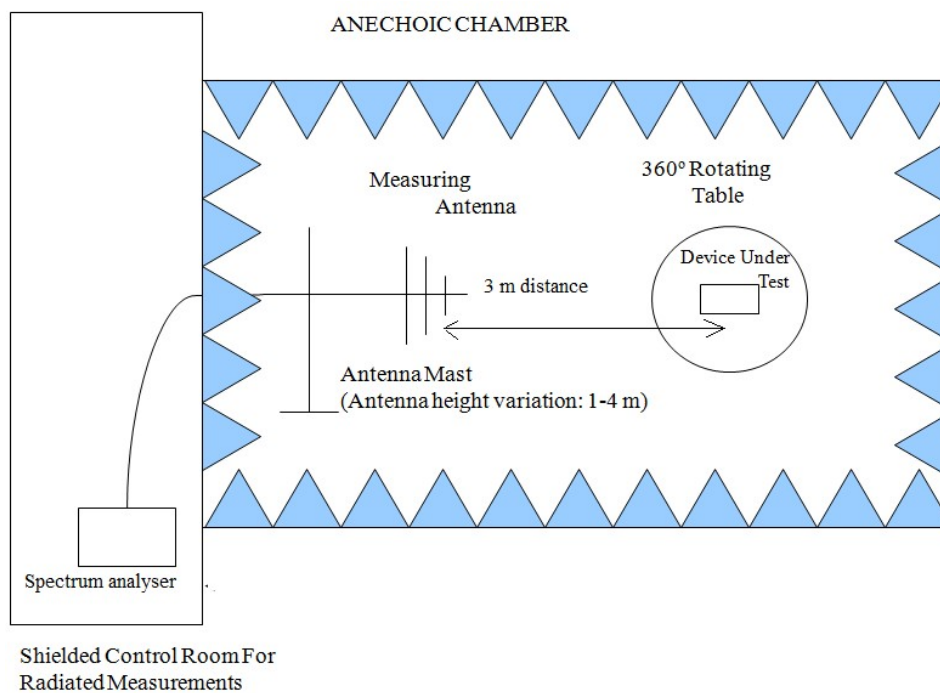
For radiated emissions in the range 9 kHz to 30 MHz that is performed at a distance closer than the specified distance, an inverse proportionality factor of 40 dB per decade is used to normalize the measured data for determining compliance.

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 in the range between 30 MHz and 200 MHz the antenna height was varied from 1 to 4 meters to find the maximum radiated emission. In the range between 9 kHz and 30 MHz the measurements were made in the three different orientation planes of the loop antenna to determine the maximum received field. In the range between 30 MHz and 200 MHz the measurements were made in both horizontal and vertical planes of polarization.

Radiated measurements setup 9 kHz to 30 MHz:



Radiated measurements setup 30 MHz to 200 MHz:



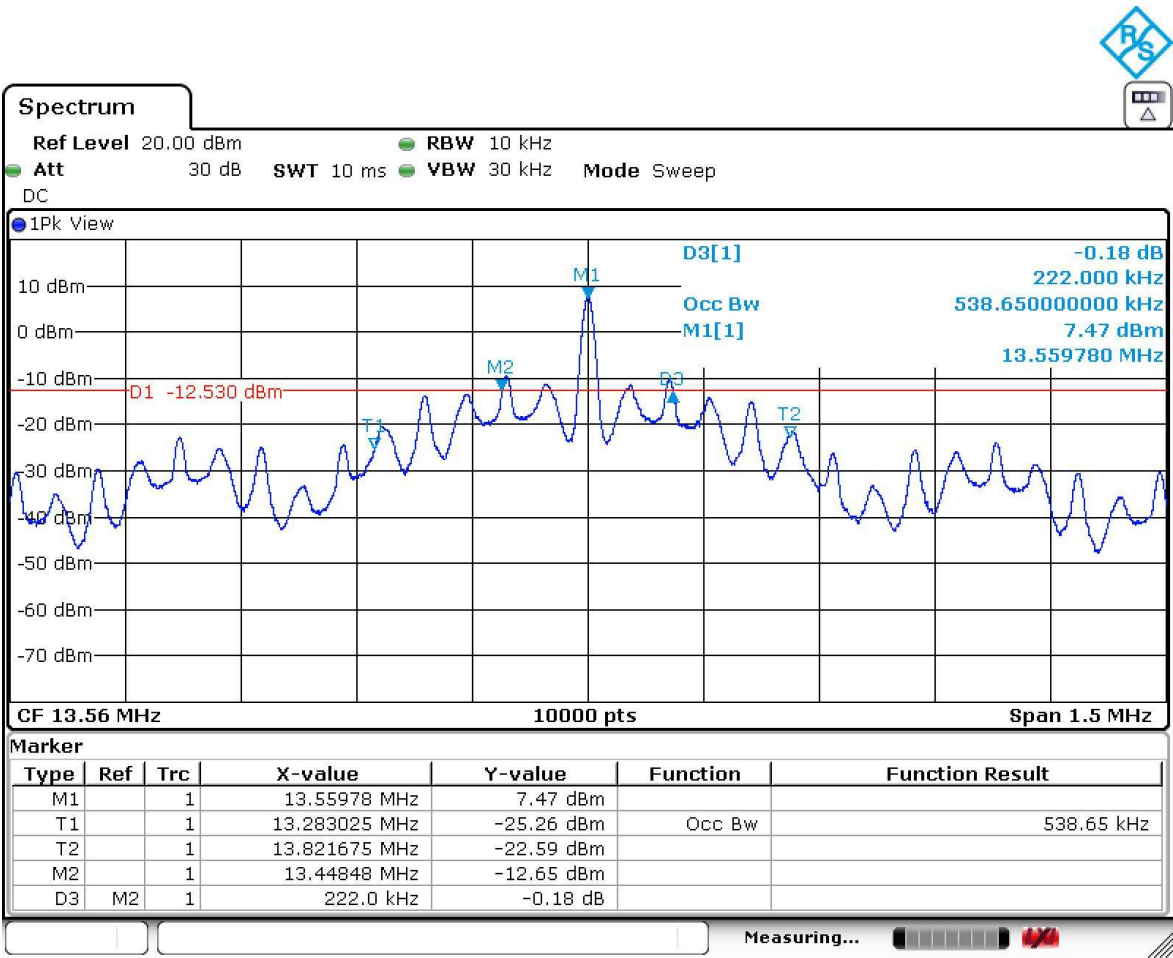
Occupied Bandwidth

RESULTS:

99 % Occupied Bandwidth and 20 dB Bandwidth.

- Modulation type 14443A (ISO A):

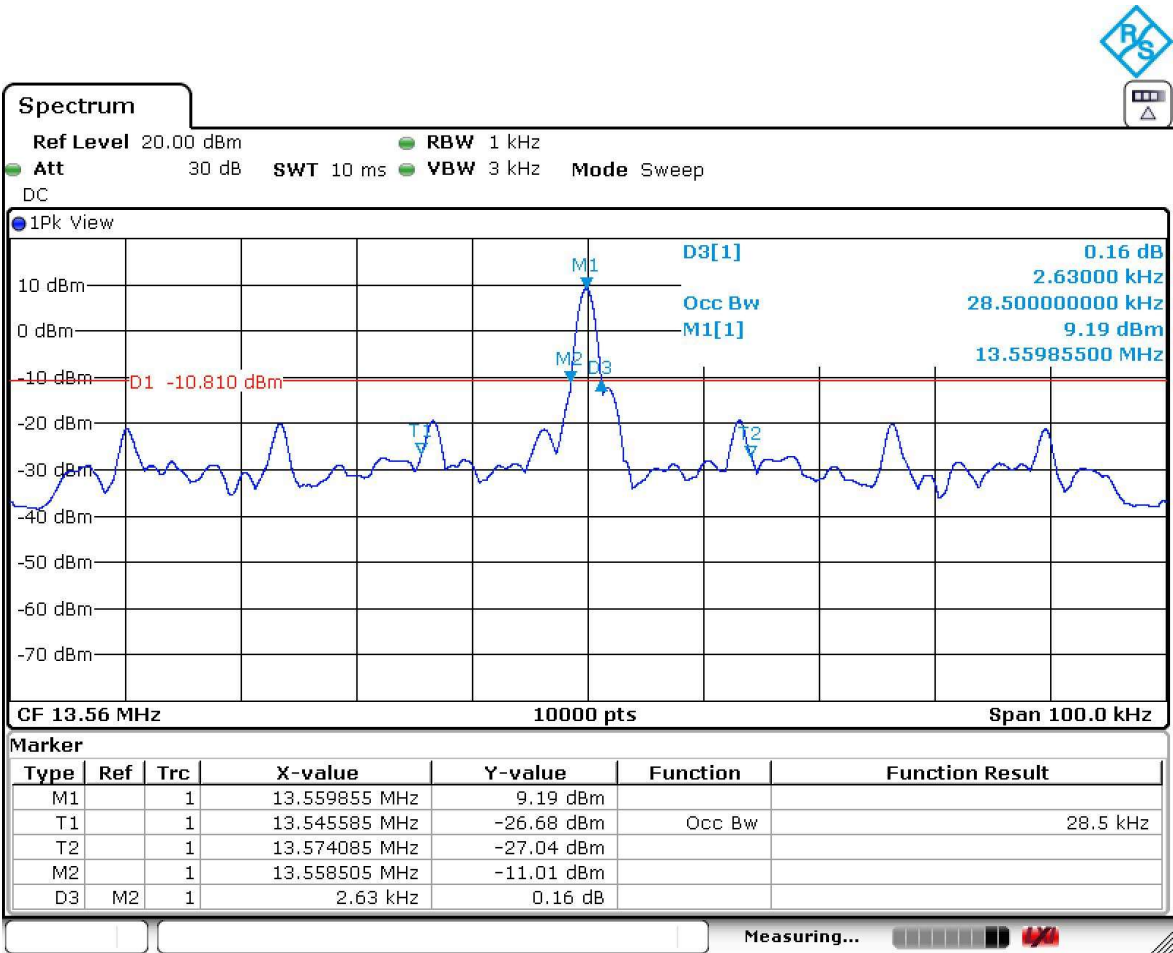
Operation mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC	538.65	222.00
Measurement uncertainty (kHz)	<±3.70	



Verdict: PASS

Modulation type 15693 (ISO V):

Operation mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC	28.50	2.63
Measurement uncertainty (kHz)	<±0.61	



Verdict: PASS

15.225 (a) / RSS-210 B.6 (a)(i) Field Strength of Emissions
within the band 13.553 MHz - 13.567 MHz

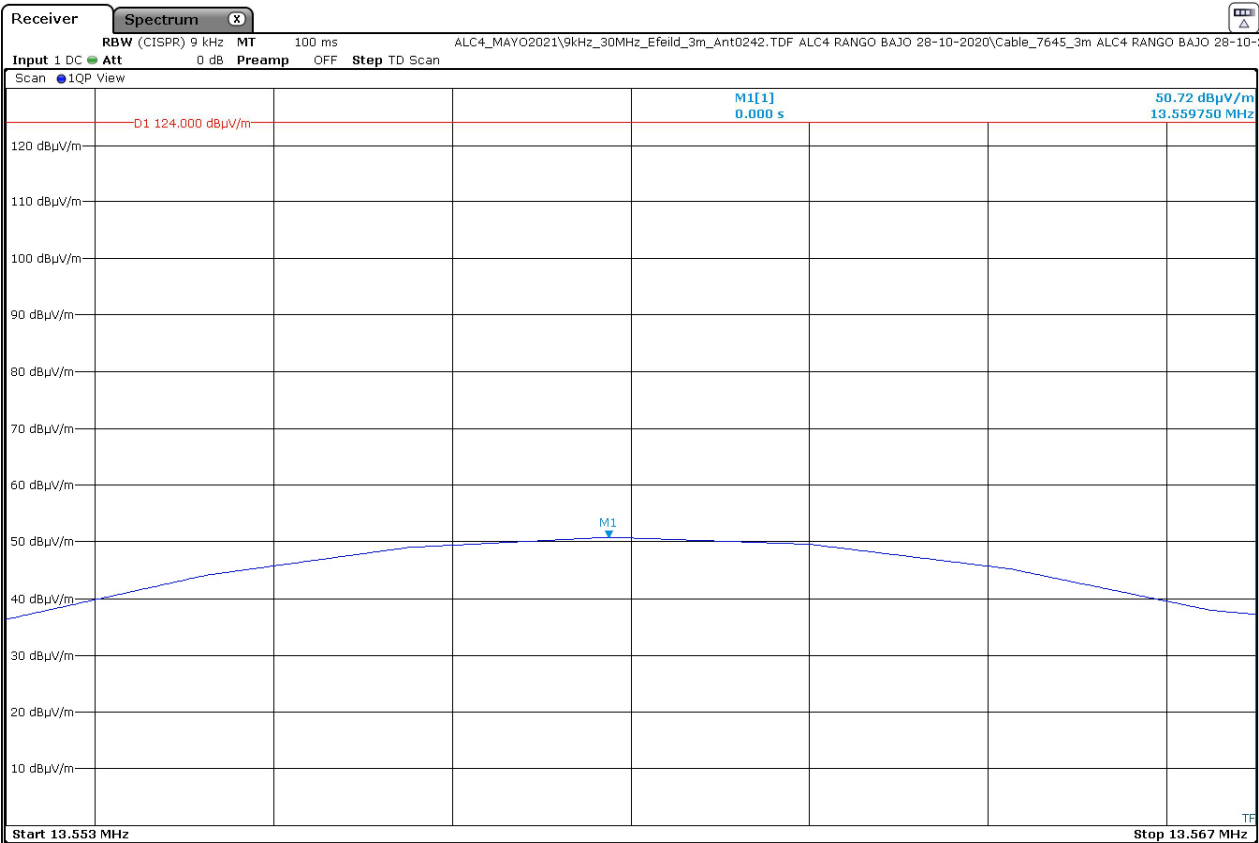
SPECIFICATION:

The field strength of any emissions within the band 13.553 – 13.567 MHz shall not exceed 15,848 microvolts/meter (84 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

- Modulation type 14443A (ISO A):

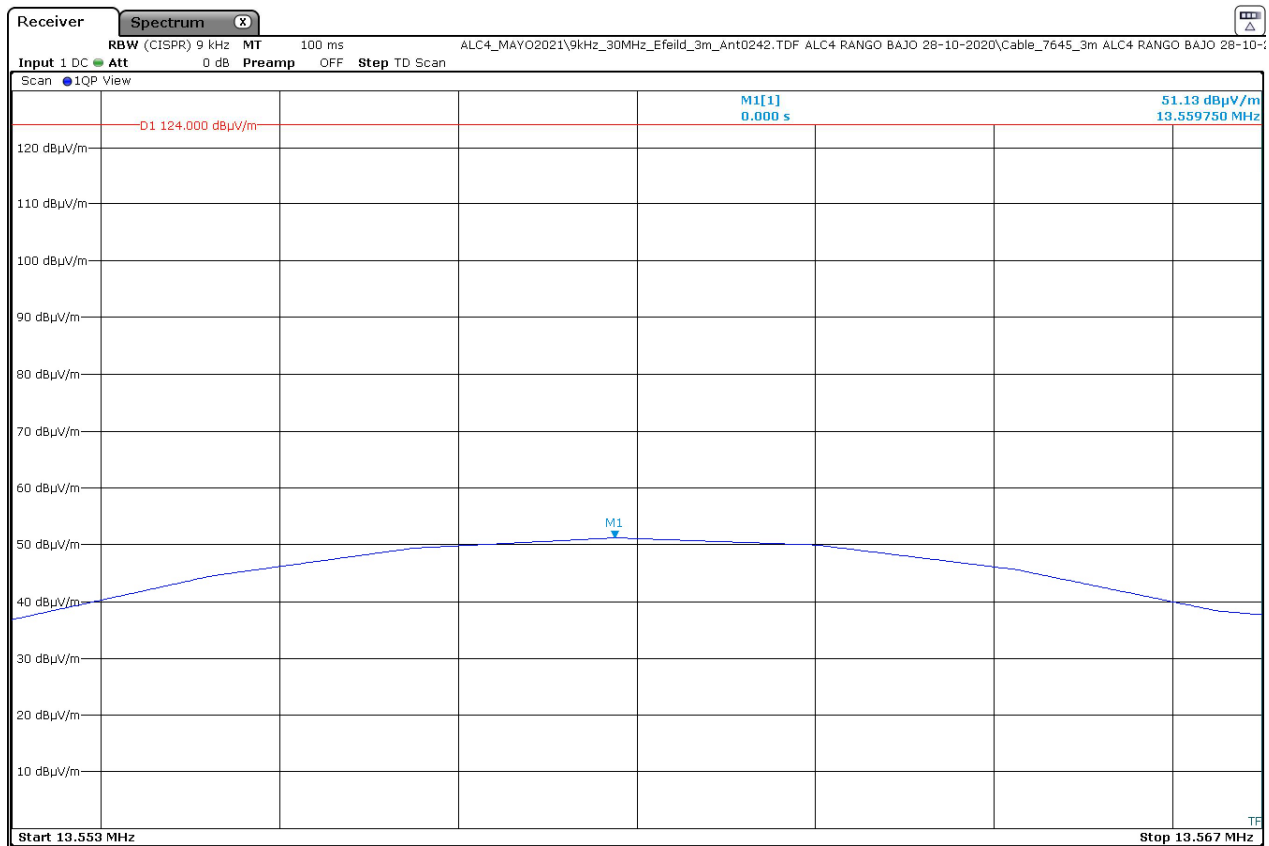


The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.560	50.72	10.72
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

Modulation type 15693 (ISO V):



The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.560	51.13	11.13
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

15.225 (b) / RSS-210 B.6 (a)(ii) Field Strength of Emissions within
the band 13.410 MHz -13.553 MHz and 13.567 MHz -13.710 MHz

SPECIFICATION:

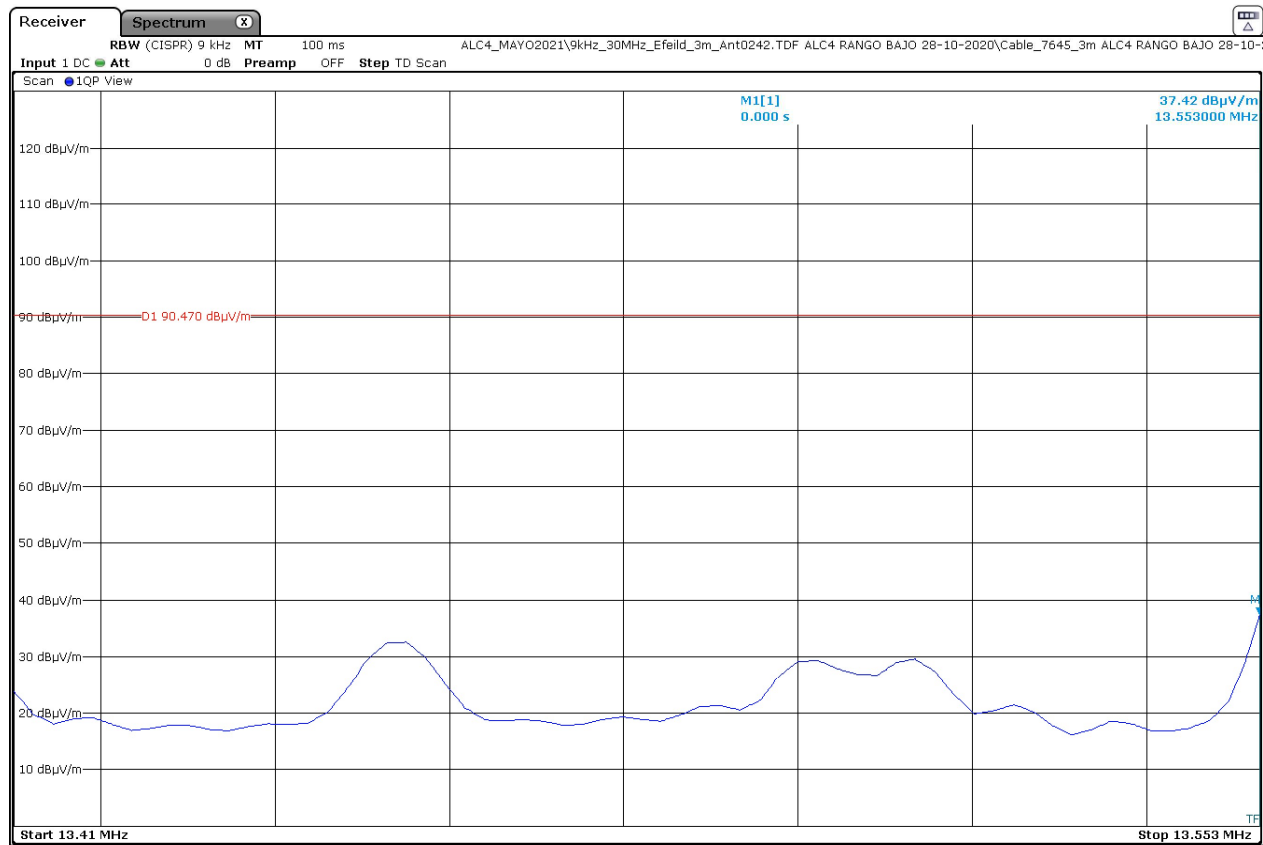
Within the bands 13.410-13.553 MHz and 13.567-13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter (50.47 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

- Modulation type 14443A (ISO A):

Band 13.410 - 13.553 MHz:

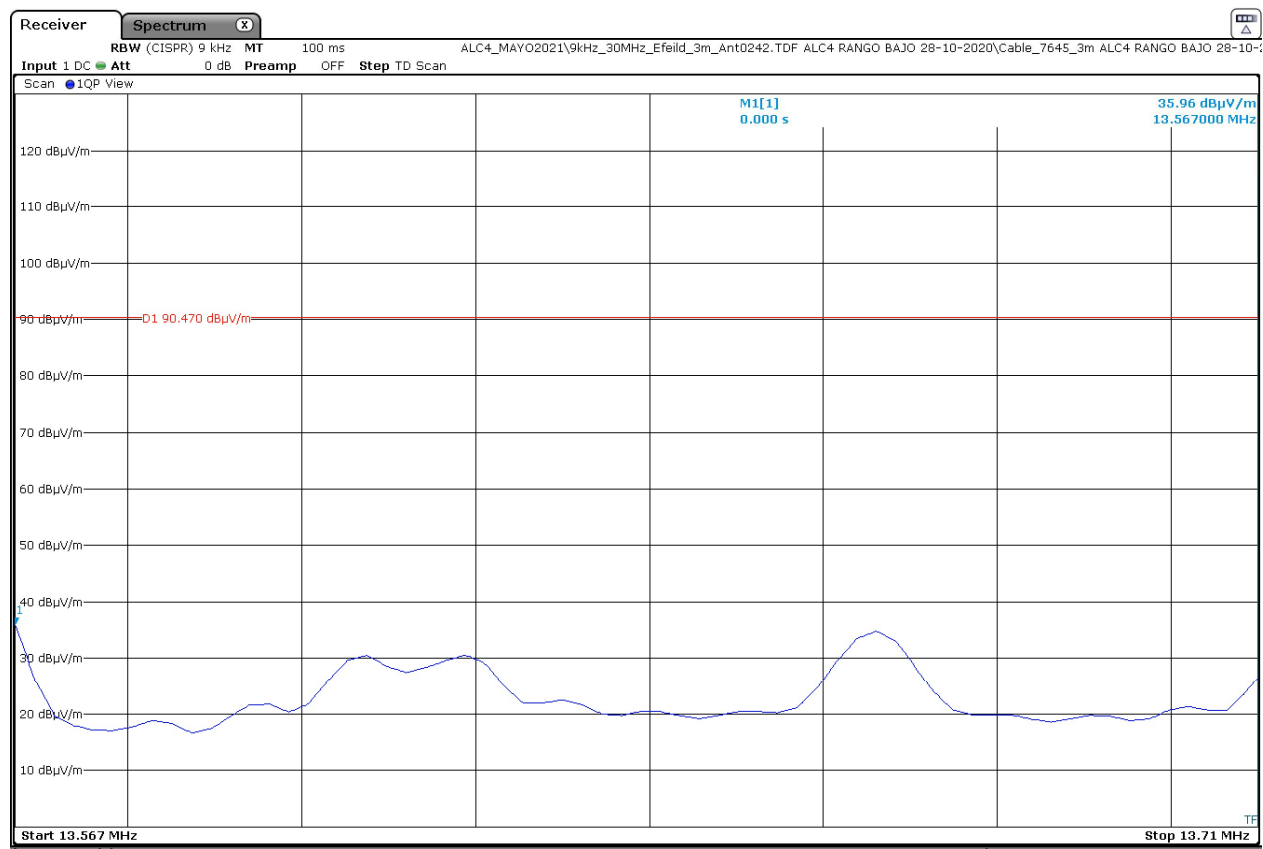


The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.553	37.42	-2.58
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

Band 13.567 - 13.710 MHz:



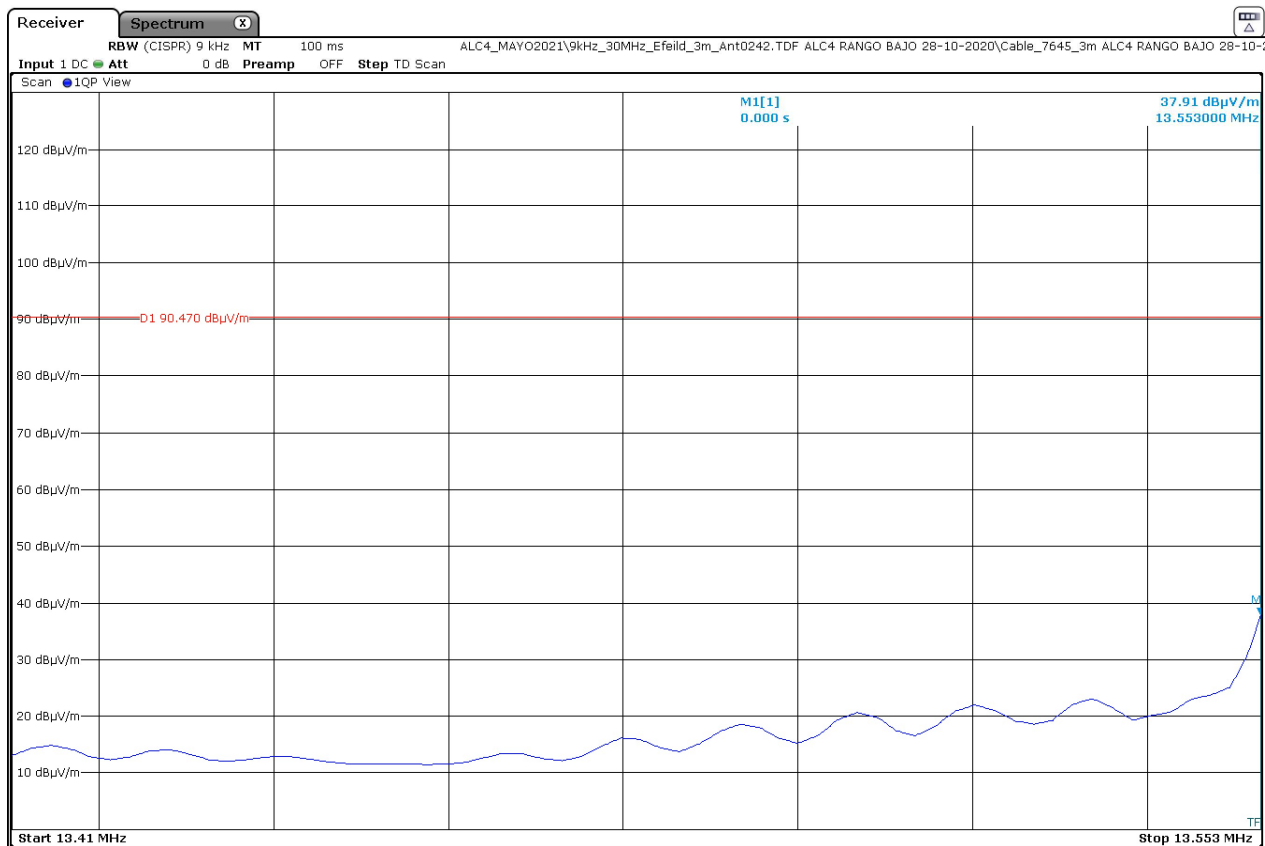
The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.567	35.96	-4.04
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

• Modulation type 15693 (ISO V):

Band 13.410 - 13.553 MHz:

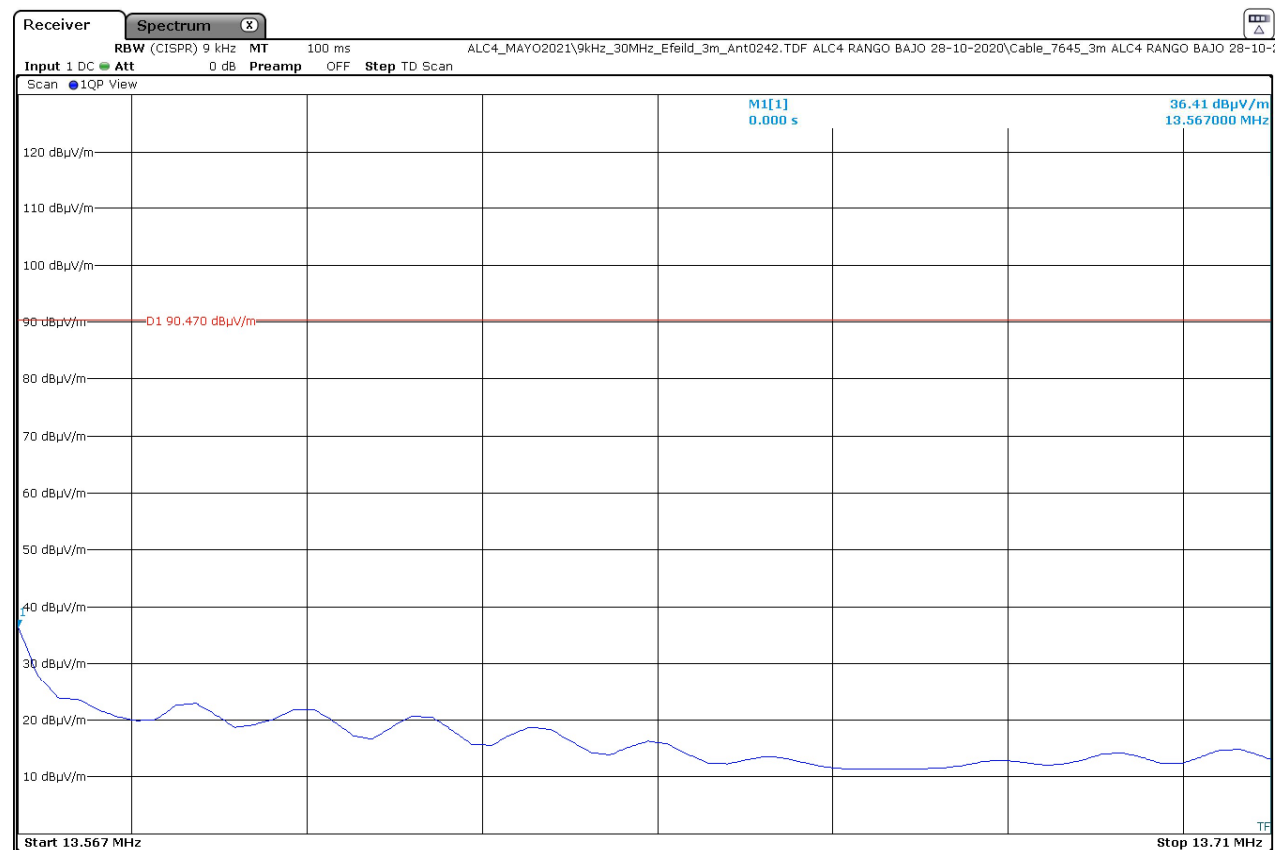


The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.553	37.91	-2.09
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

Band 13.567 - 13.710 MHz:



The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.567	36.41	-3.59
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

15.225 (c) / RSS-210 B.6 (a)(iii) Field Strength of Emissions within
the band 13.110 MHz -13.410 MHz and 13.710 MHz - 14.010 MHz

SPECIFICATION:

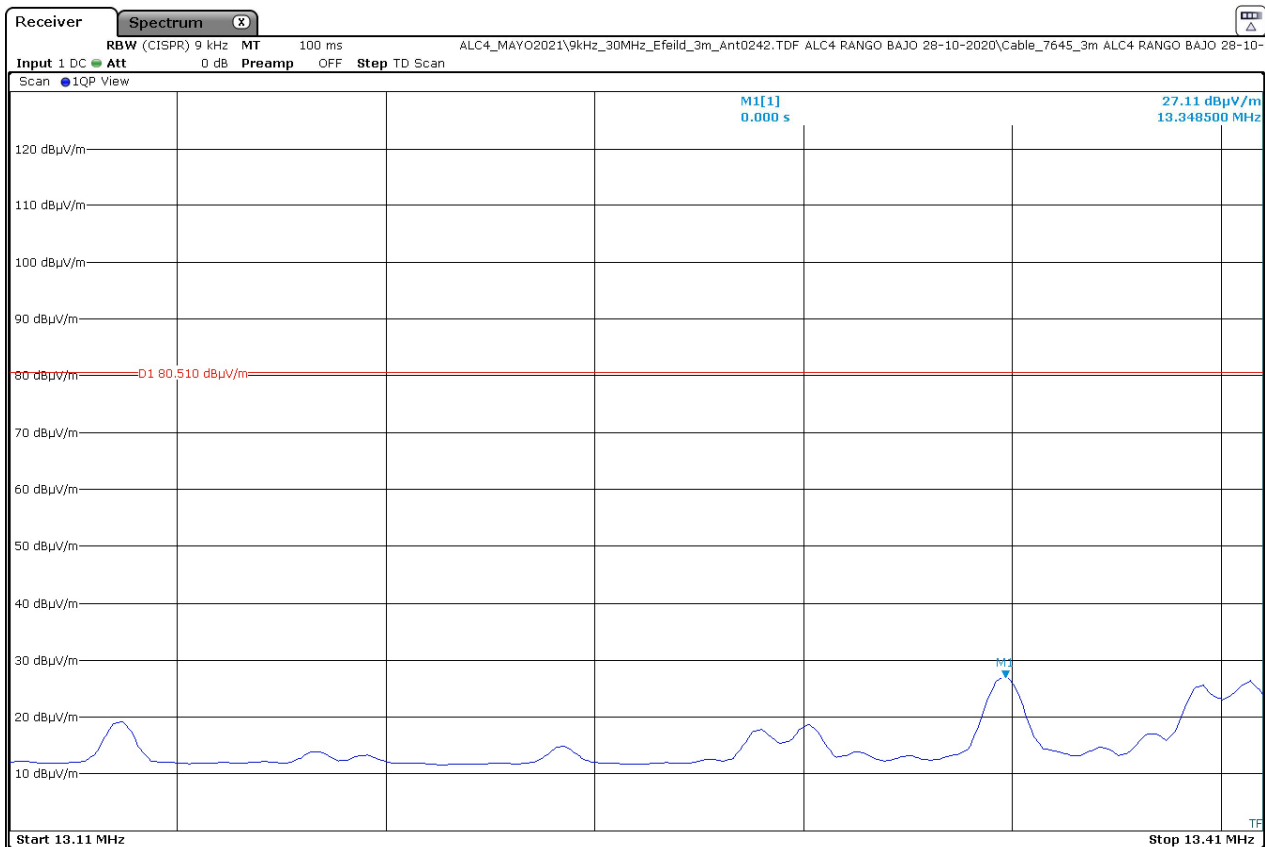
Within the bands 13.110-13.410 MHz and 13.710-14.010 MHz, the field strength of any emissions shall not exceed 106 microvolts/meter (40.51 dBµV/m) at 30 meters.

RESULTS:

Measurement distance: 3 meters.

- Modulation type 14443A (ISO A):

Band 13.110 - 13.410 MHz:

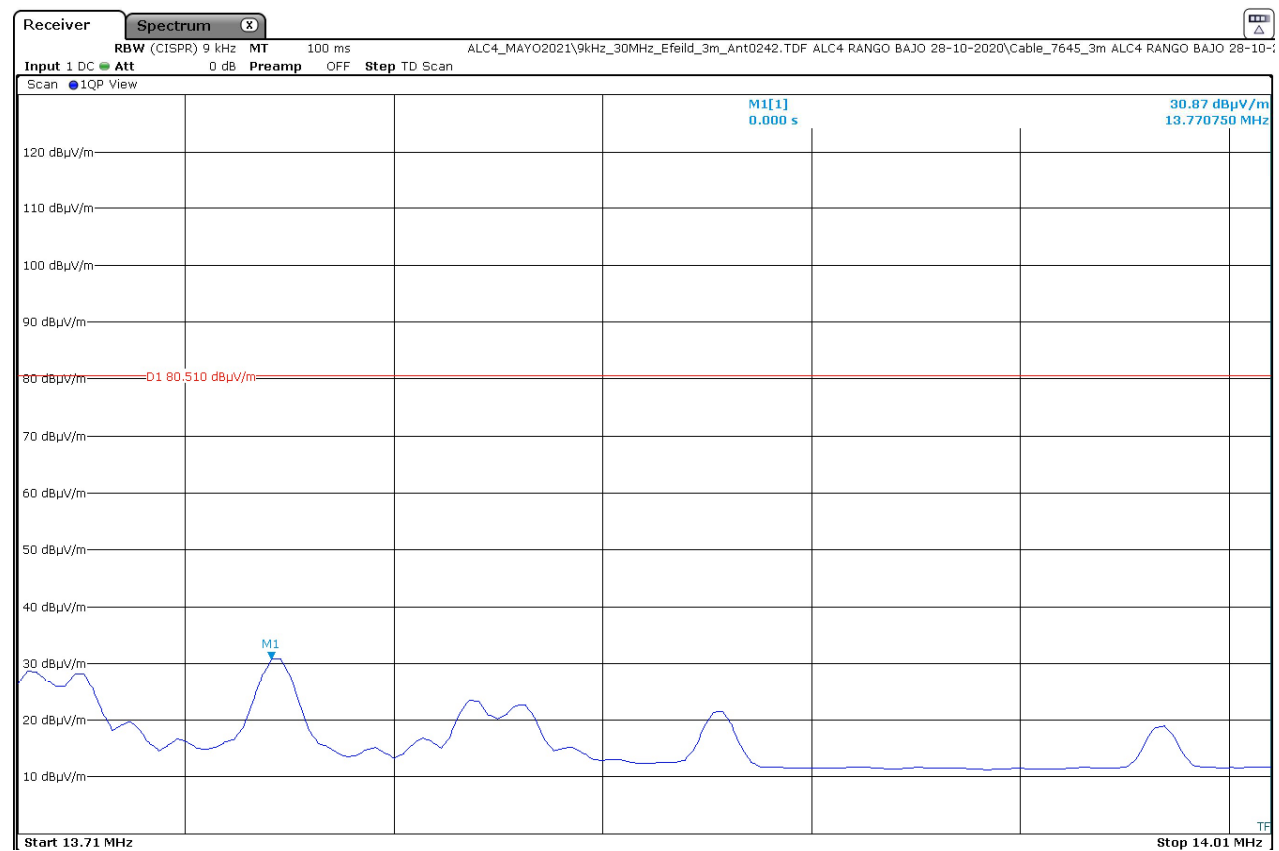


The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.349	27.11	-12.89
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

Band 13.710 - 14.010 MHz:



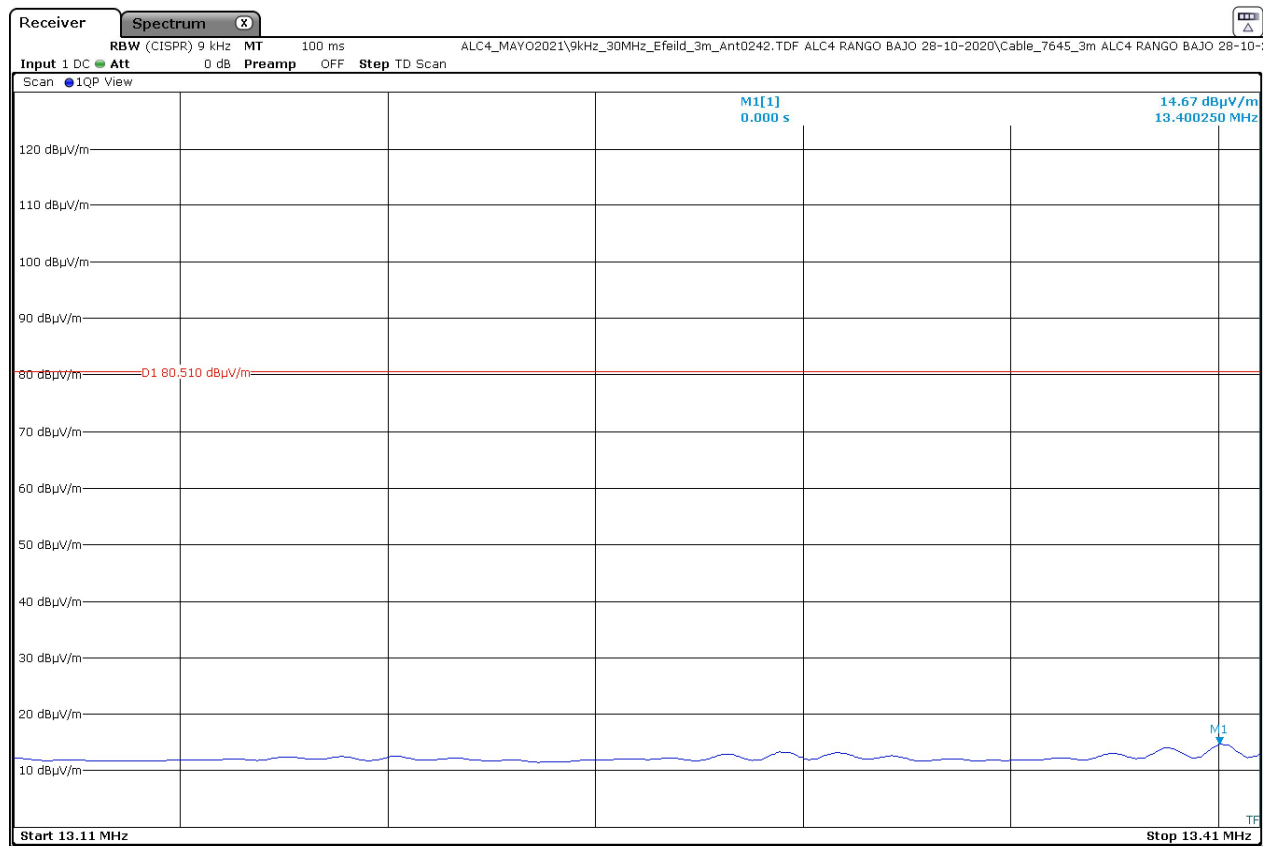
The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.771	30.87	-9.13
Measurement uncertainty (dB)	±3.04	

Verdict: PASS

- Modulation type 15693 (ISO V):

Band 13.110 - 13.410 MHz:

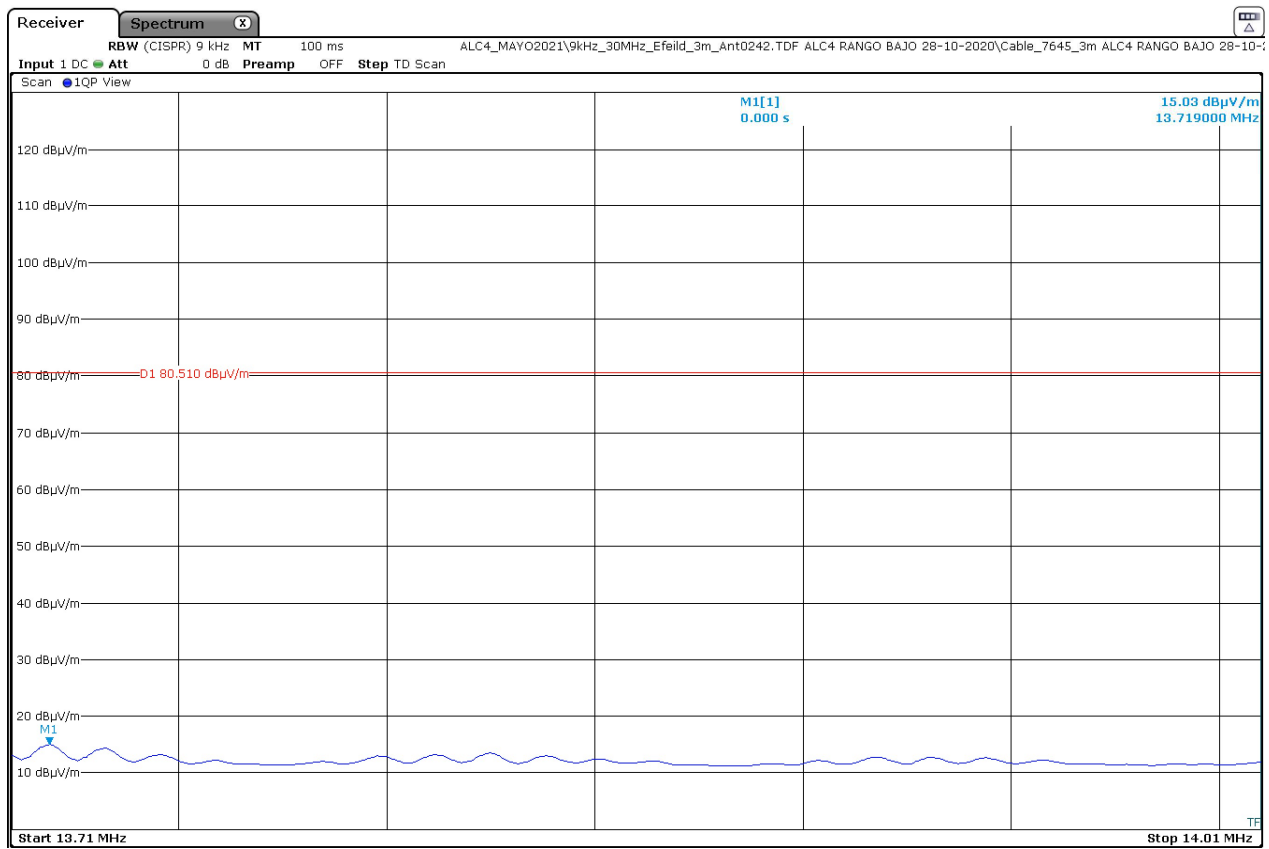


The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.400	14.67	-25.33
Measurement uncertainty (dB)	<±3.04	

Verdict: PASS

Band 13.710 - 14.010 MHz:



The limit shown in the above plot is extrapolated to 3 meters.

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.719	15.03	-24.97
Measurement uncertainty (dB)	±3.04	

Verdict: PASS

15.225 (d) / RSS-210 B.6 (a)(iv) Field Strength of Emissions outside of the band 13.110 MHz - 14.010 MHz

SPECIFICATION:

Field strength of any emissions appearing outside of the band 13.110 MHz - 14.010 MHz band shall not exceed the general radiated emission limits in 15.209/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	29.54	30
30 - 88	100	40	3
88 - 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

RESULTS:

All tests were performed in a semi-anechoic chamber at a distance of 3 m.

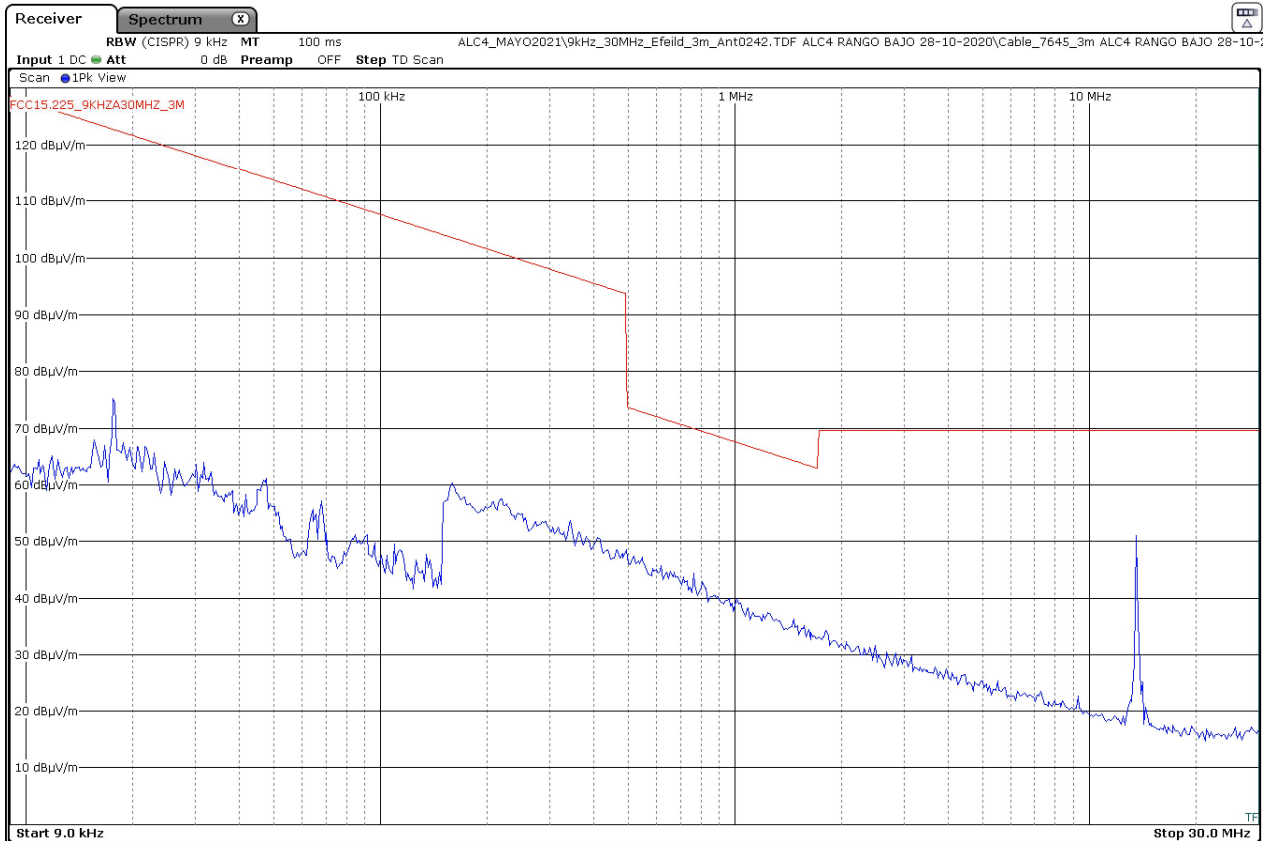
The spectrum was inspected from 9 kHz to 200 MHz searching for spurious signals.

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-amplifier gain.

- **Modulation type 14443A (ISO A):**

Frequency range 9 kHz - 30 MHz:

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



The limits shown in this plot are extrapolated to 3 m. The highest peak is the carrier frequency.

Resolution bandwidth:

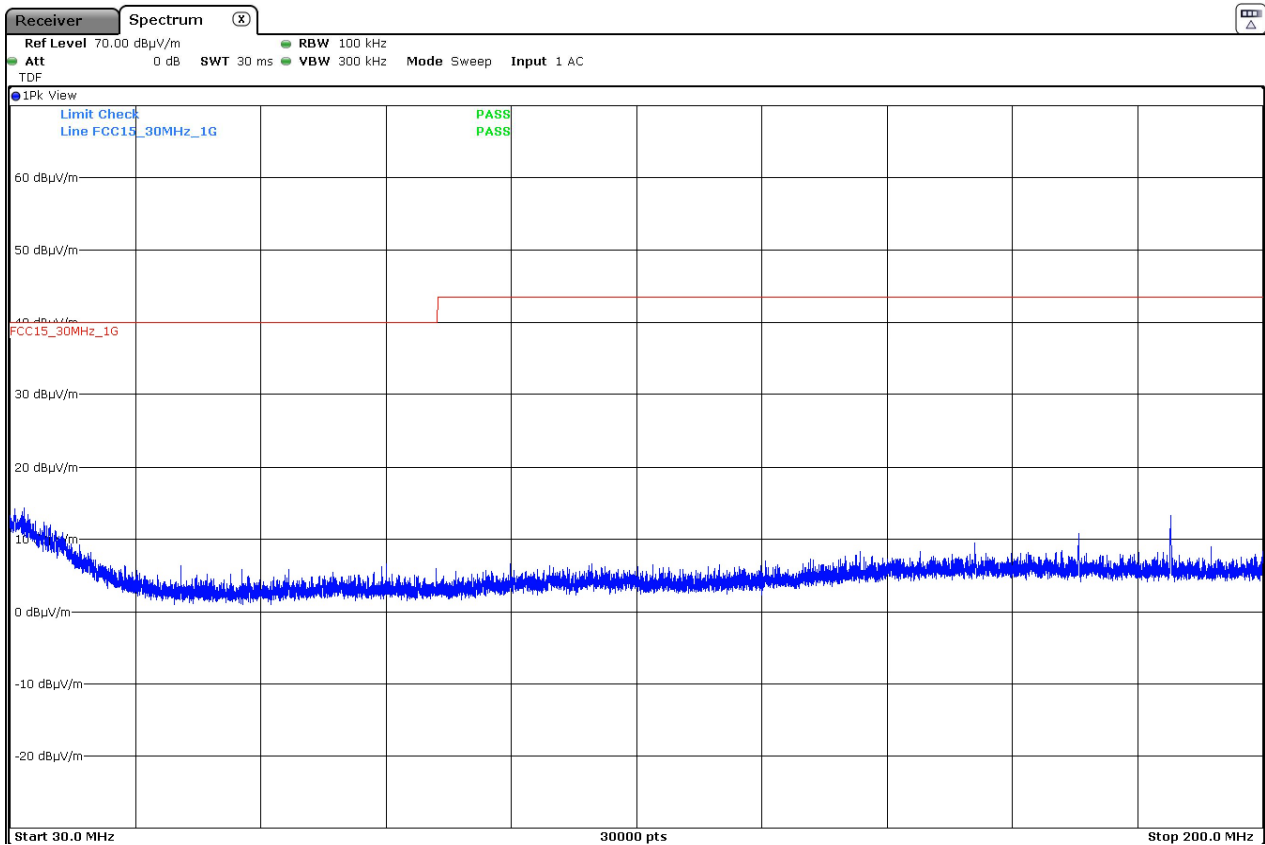
200 Hz for 9 kHz ≤ f ≤ 150 kHz

9 kHz for 150 kHz ≤ f ≤ 30 MHz

Measurement Uncertainty (dB) <± 3.04

Frequency range 30 - 200 MHz:

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



This plot shows the results of the scan using peak detector.

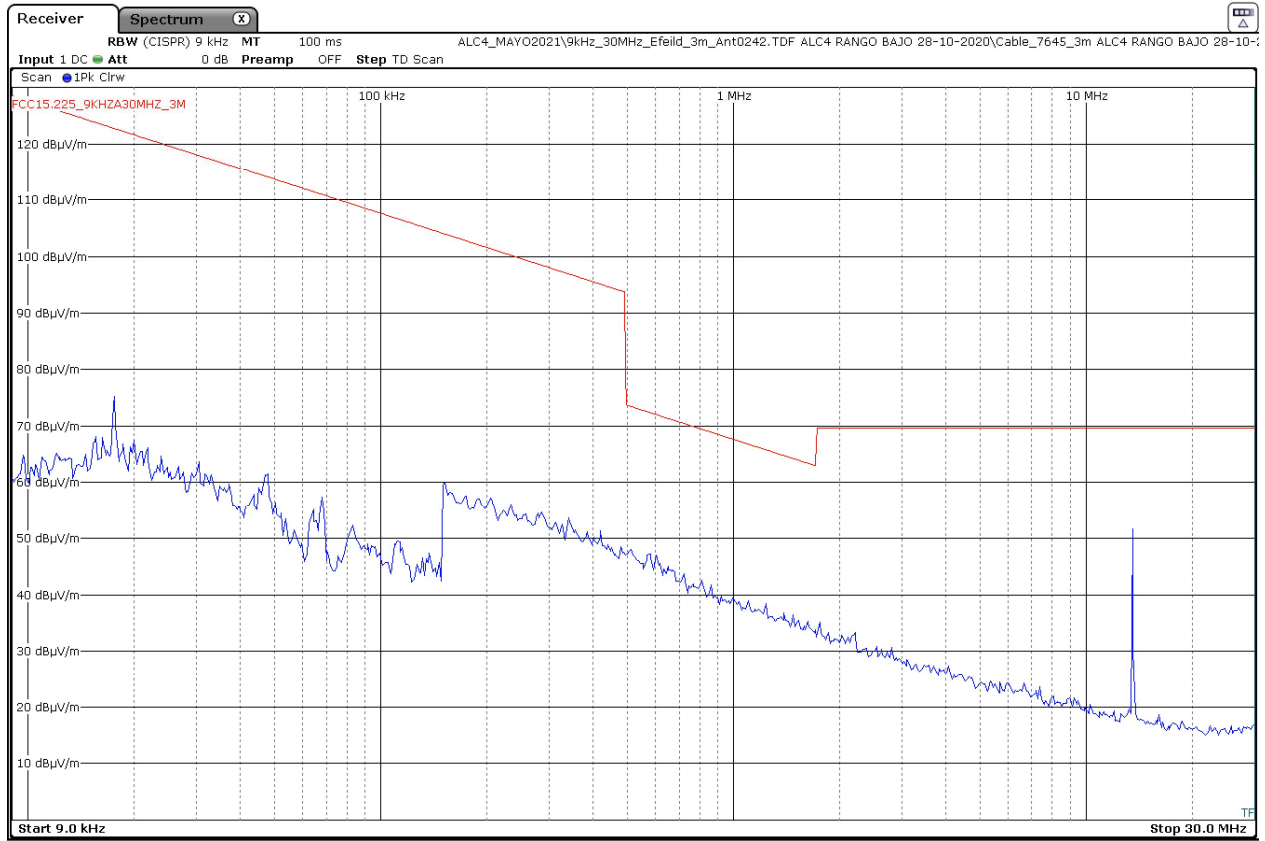
Measurement Uncertainty (dB) <± 5.03

Verdict: PASS

- **Modulation type 15693 (ISO V):**

Frequency range 9 kHz - 30 MHz:

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



The limits shown in this plot are extrapolated to 3 m. The highest peak is the carrier frequency.

Resolution bandwidth:

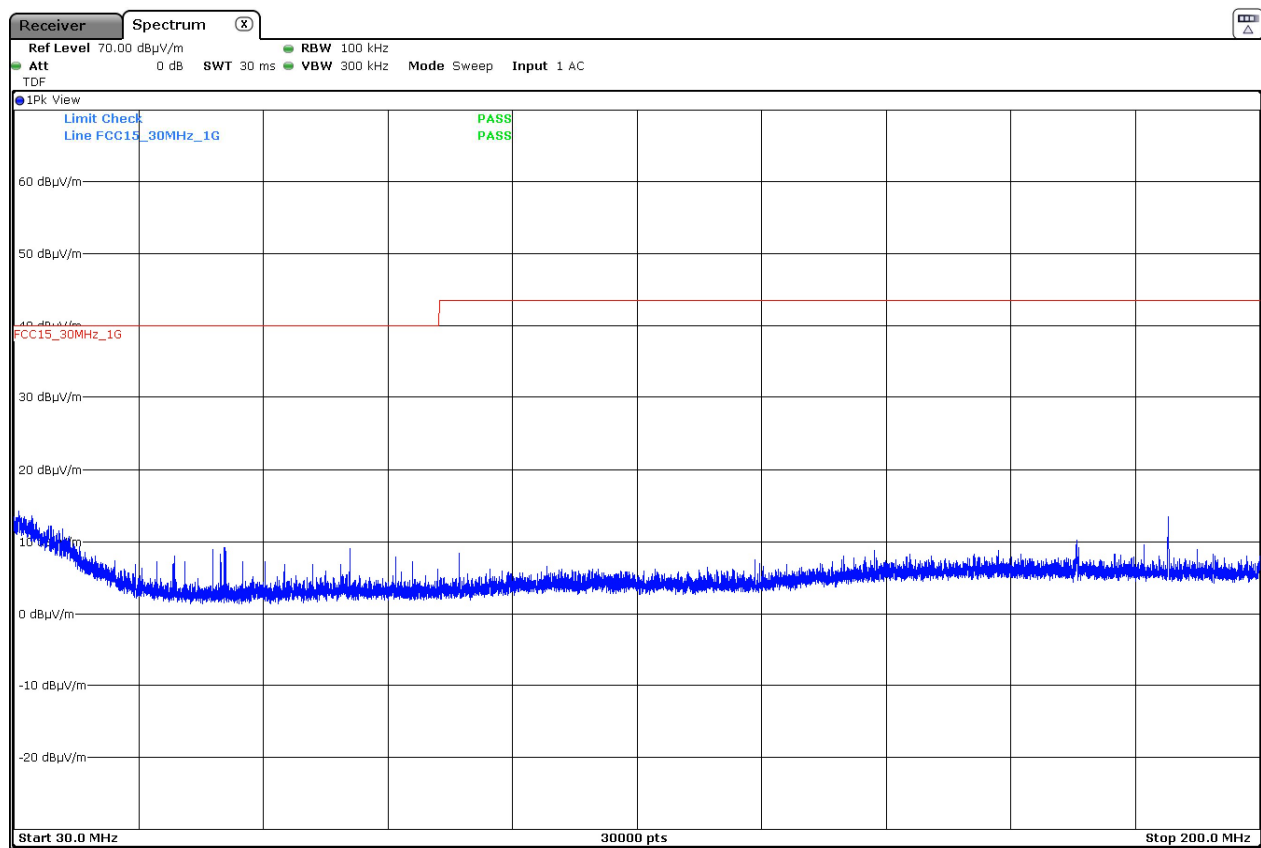
200 Hz for $9 \text{ kHz} \leq f \leq 150 \text{ kHz}$

9 kHz for $150 \text{ kHz} \leq f \leq 30 \text{ MHz}$

Measurement Uncertainty (dB) $< \pm 3.04$

Frequency range 30 - 200 MHz:

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



This plot shows the results of the scan using peak detector.

Measurement Uncertainty (dB) <± 5.03

Verdict: PASS

15.225 (e) / RSS-210 B.6 (b) Frequency Tolerance of the Carrier Signal

SPECIFICATION:

The frequency tolerance of the carrier signal shall be maintained within +/- 0.01% of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage, and for a variation in the primary supply voltage from 85% to 115% of the rated supply voltage at a temperature of 20 degrees C. For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

RESULTS:

Nominal Operating Frequency: 13.56 MHz.

- **Modulation type 14443A (ISO A):**

- **Frequency Stability over Temperature Variations:**

Temperature (°C)	Frequency Error (kHz)	Frequency Error (%)
+50	0.154500	0.001139
+40	0.121500	0.000896
+30	0.115500	0.000852
+20	0.115500	0.000852
+10	0.052500	0.000387
0	0.060000	0.000442
-10	0.046500	0.000343
-20	0.046500	0.000343

- **Frequency Stability over Voltage Variations:**

DC Voltage	Voltage (V)	Temperature (°C)	Frequency Error (kHz)	Frequency Error (%)
Vmax	6.0	+20	0.112500	0.000830
Vmin	5.1	+20	0.103500	0.000763

Verdict: PASS

- **Modulation type 15693 (ISO V):**

- **Frequency Stability over Temperature Variations:**

Temperature (°C)	Frequency Error (kHz)	Frequency Error (%)
+50	0.150000	0.001106
+40	0.141000	0.001040
+30	0.139500	0.001029
+20	0.087000	0.000642
+10	0.048000	0.000354
0	0.043500	0.000321
-10	0.048000	0.000354
-20	0.049500	0.000365

- **Frequency Stability over Voltage Variations:**

DC Voltage	Voltage (V)	Temperature (°C)	Frequency Error (kHz)	Frequency Error (%)
Vmax	6.0	+20	0.079500	0.000586
Vmin	5.1	+20	0.093000	0.000686

Verdict: PASS