



Test report No:
NIE: 59220RRF.001

Test report

USA FCC Part 15.225, 15.209
CANADA RSS-210, RSS-Gen

(*) Identification of item tested	USB/Ethernet RFID encoder
(*) Trademark	SALTO NCoder
(*) Model and /or type reference	EC0B (type reference: A1928)
Other identification of the product	Hardware version: 1.0 Software version: 0164 (Control Firmware) + 0172 (Reader Firmware) + 0136 (BGM111 Firmware) FCC ID: UKCEC0B IC: 10088A-EC0B
(*) Features	USB, Ethernet and a certified Bluetooth module (BGM111)
Applicant	SALTO Systems, S.L. Arkotz 9, Polígono Lanbarren 20180, Oiartzun, Gipuzkoa, SPAIN
Test method requested, standard	USA FCC Part 15.225 (10–1–18 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10–1–18 Edition): Radiated emission limits, general requirements. CANADA RSS-210 Issue 9 (August 2016). CANADA RSS-Gen Issue 5 (April 2018). ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices.
Approved by (name / position & signature)	Jose Carlos Luque RF Lab. Supervisor 74841983Y JOSE CARLOS LUQUE (C:A29507456) Firmado digitalmente por 74841983Y JOSE CARLOS LUQUE (C:A29507456) Fecha: 2019.11.21 14:26:28 +01'00'
Summary	IN COMPLIANCE
Date of issue	2019-11-21
Report template No	FDT08_22 (*) "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.

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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.

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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 consists of a SALTO NCoder with USB/Ethernet RFID Mifare (ISO14443A & ISO15693 standard based) and Bluetooth Smart (BGM111 module) 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 Nº	Description	Model	Serial Nº	Date of reception
59220B/004	USB/Ethernet RFID encoder	EC0B	---	2019-04-19

Auxiliary elements used with sample S/01:

Control Nº	Description	Model	Serial Nº	Date of reception
59220B/005	AC/DC adapter	6A-054WP05B	---	2019-04-17
59220B/006	USB cable	---	---	2019-04-17

Sample S/01 has undergone the following test(s): All RADIATED tests indicated in Appendix A.

- Sample S/02 is composed of the following elements:

Control Nº	Description	Model	Serial Nº	Date of reception
59220B/004	USB/Ethernet RFID encoder	EC0B	---	2019-04-19

Auxiliary elements used with sample S/02:

Control Nº	Description	Model	Serial Nº	Date of reception
59220B/006	USB cable	---	---	2019-04-17

Sample S/02 has undergone the following test(s): All CONDUCTED tests indicated in Appendix A.

Test sample description

Ports..... :	Port name and description	Cable				
		Specified max length [m]	Attached during test	Shielded	Coupled to patient ⁽³⁾	
	Ethernet	100m	☐	☐	☐	
	USB		☒	☐	☐	
Supplementary information to the ports..... :	-					
Rated power supply	Voltage and Frequency	Reference poles				
		L1	L2	L3	N	PE

	☒	DC: 5 Vdc	
Rated Power	2.5 W (max)		
Clock frequencies	25 MHz, 27.12 MHz		
Other parameters	--		
Software version	0164 (Control Firmware) + 0172 (Reader Firmware) + 0136 (BGM111 Firmware)		
Hardware version	1.0		
Dimensions in cm (W x H x D)	9.55 x 3.05 x 14.1		
Mounting position	☒	Table top equipment	
Modules/parts	Module/parts of test item		Type
	BGM111		BLE Module
Accessories (not part of the test item)	Description		Type
	-		
Documents as provided by the applicant	Description		File name
	User manual		
	FW explanation document		

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)	2019-04-17
Date (finish)	2019-04-25

Document history

Report number	Date	Description
59220RRF.001	2019-11-21	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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

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. = 35 %
Air pressure	Min. = 860 mbar Max. = 1060 mbar

Remarks and comments

The tests have been performed by the technical personnel: Verónica García, Jose Gabriel Pendón, Juan Carlos Fuentes, Jose Alberto Aranda, Jose Manuel Jimenez.

Used instrumentation:

Conducted measurements:

		Last Calibration	Due Calibration
1.	Chamber HERAEUS VMT 04/35	2018/06	2020/06
2.	Signal and Spectrum analyser 10Hz – 40GHz RODHE AND SCHWARZ FSV40	2017/07	2019/07
3.	DC Power Supply 40V/40A GW INSTEK GPS-3030D	N/A	N/A
4.	Digital multimeter FLUKE 179	2019/04	2020/04

Radiated measurements:

		Last Calibration	Due Calibration
1.	Semianechoic Absorber Lined Chamber ETS LINDGREN FACT 3 200 STP	N.A.	N.A.
2.	EMI Test Receiver 9kHz – 7GHz ROHDE AND SCHWARZ ESR7	2018/10	2020/10
3.	Active Loop Antenna SCHWARZBECK FMZB 1519B	2018/01	2021/01
4.	RF Pre-amplifier, 40 dB, 10 MHz-6 GHz BONN ELEKTRONIK BLNA 0160-01N	2019/02	2020/02
5.	Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2017/09	2020/09
6.	Active Loop Antenna SCHWARZBECK FMZB 1519B	2018/01	2021/01

Testing verdicts

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

Summary

FCC Part 15.225, 15.209 CANADA RSS-210, RSS-Gen		
Requirement – Test case	Verdict	Remark
15.225 Subclause (a) / RSS-210 Clause B.6 (a). Field strength of emissions within the band 13.553 - 13.567 MHz	P	
15.225 Subclause (b) / RSS-210 Clause B.6 (b). Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 – 13.710 MHz	P	
15.225 Subclause (c) / RSS-210 Clause B.6 (c). Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 – 14.010 MHz	P	
15.225 Subclause (d) / RSS-210 Clause B.6 (d). Field strength of emissions outside of the band 13.110 MHz -14.010 MHz	P	
15.225 Subclause (e) / RSS-210 Clause B.6. Frequency tolerance of the carrier signal	P	
<u>Supplementary information and remarks:</u>		
None		

Appendix A: Test results.

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band 13.110 - 14.010 MHz.....26

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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 5 Vdc (*)
Vmin: 4.4 Vdc (*)
Vmax: 5.5 Vdc (*)

Type of Power Supply: External power supply.

The subscripts 'n', 'min' and 'max' mean nominal, minimum and maximum respectively.

(*): Declared by applicant.

ANTENNA:

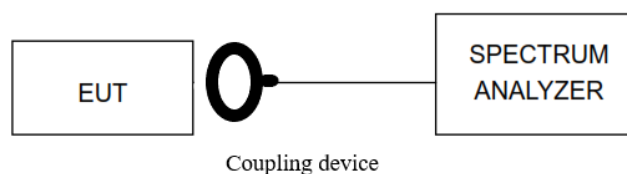
Type of Antenna: Integral (PCB).

TEST FREQUENCY:

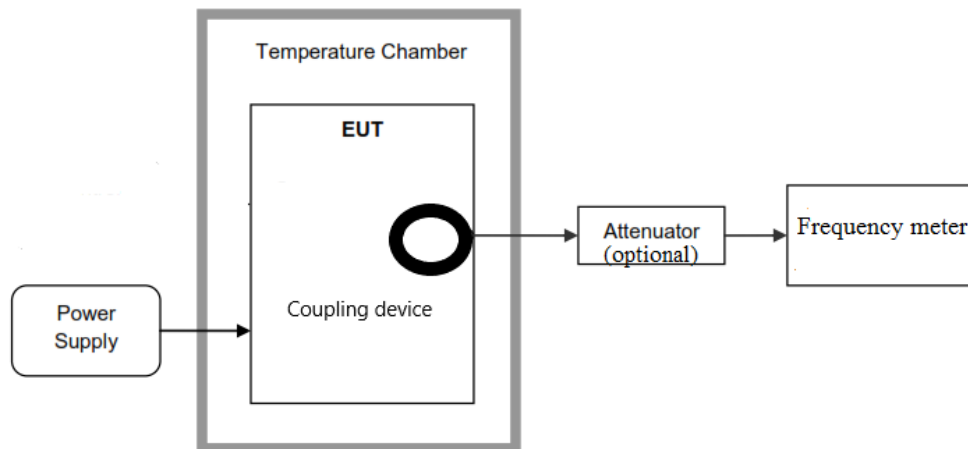
Nominal Operating Frequency: 13.56 MHz

CONDUCTED MEASUREMENTS

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



For frequency stability test the EUT was placed inside a climatic chamber and connected to a frequency meter using a low loss cable and a coupling device. 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 140 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.

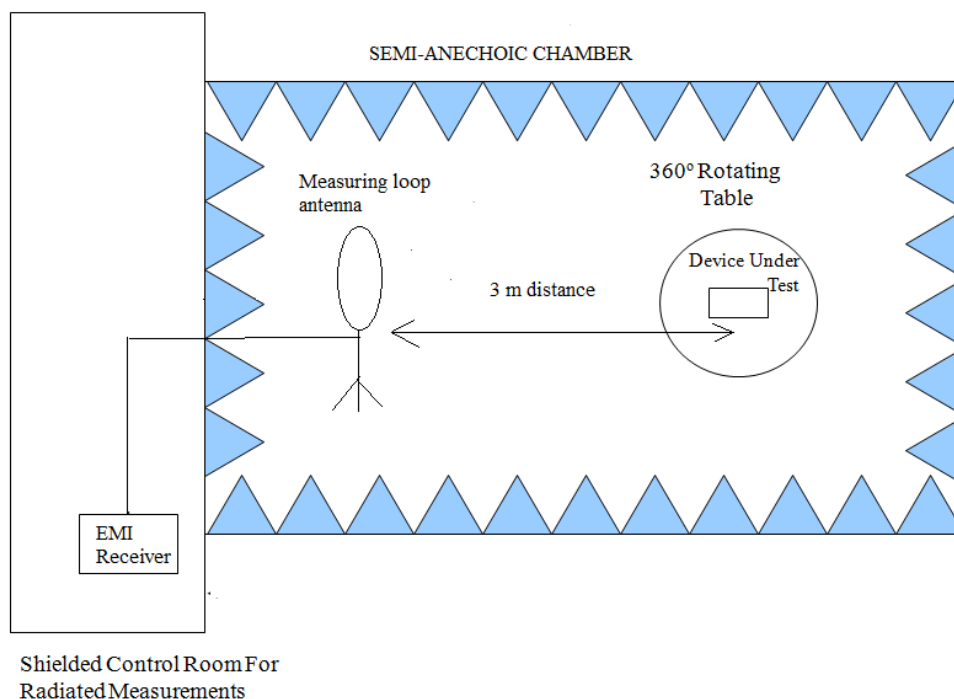
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and in the range between 30 MHz and 140 MHz the antenna height was varied from 1 to 4 meters to find the 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.

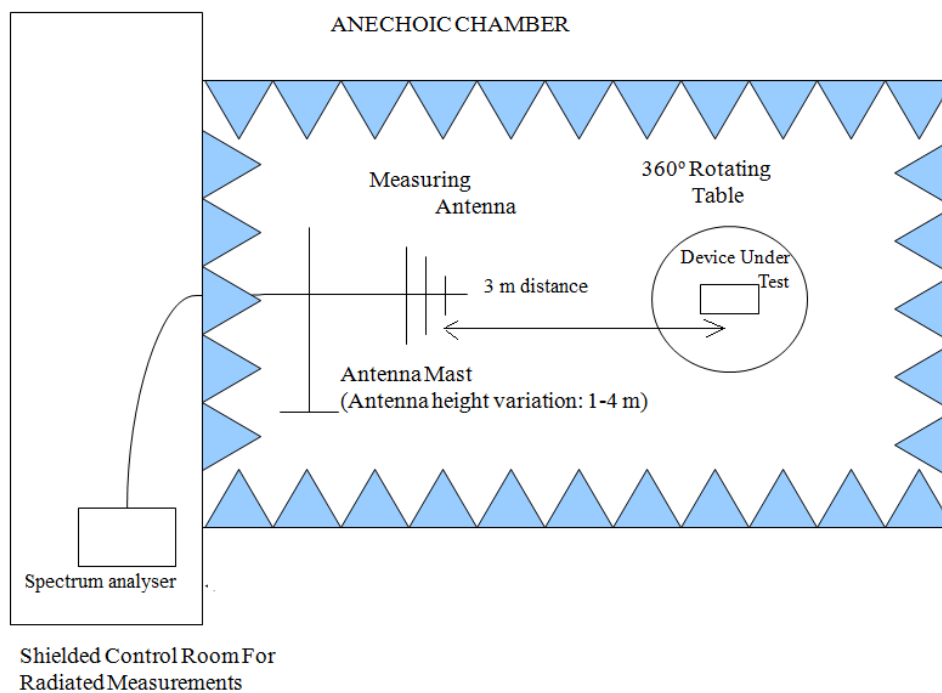
In the range between 30 MHz and 140 MHz the measurements were made in both horizontal and vertical planes of polarization.

The test was performed with the equipment transmitting first with only the 13.56 MHz radio and repeated with Bluetooth Low Energy 2.4 GHz radio transmitting simultaneously to check the impact of the co-location of the other radio interfaces. The results and plots below show the worst results obtained.

Radiated measurements setup 9 kHz to 30 MHz:



Radiated measurements setup 30 MHz to 140 MHz:



Occupied Bandwidth

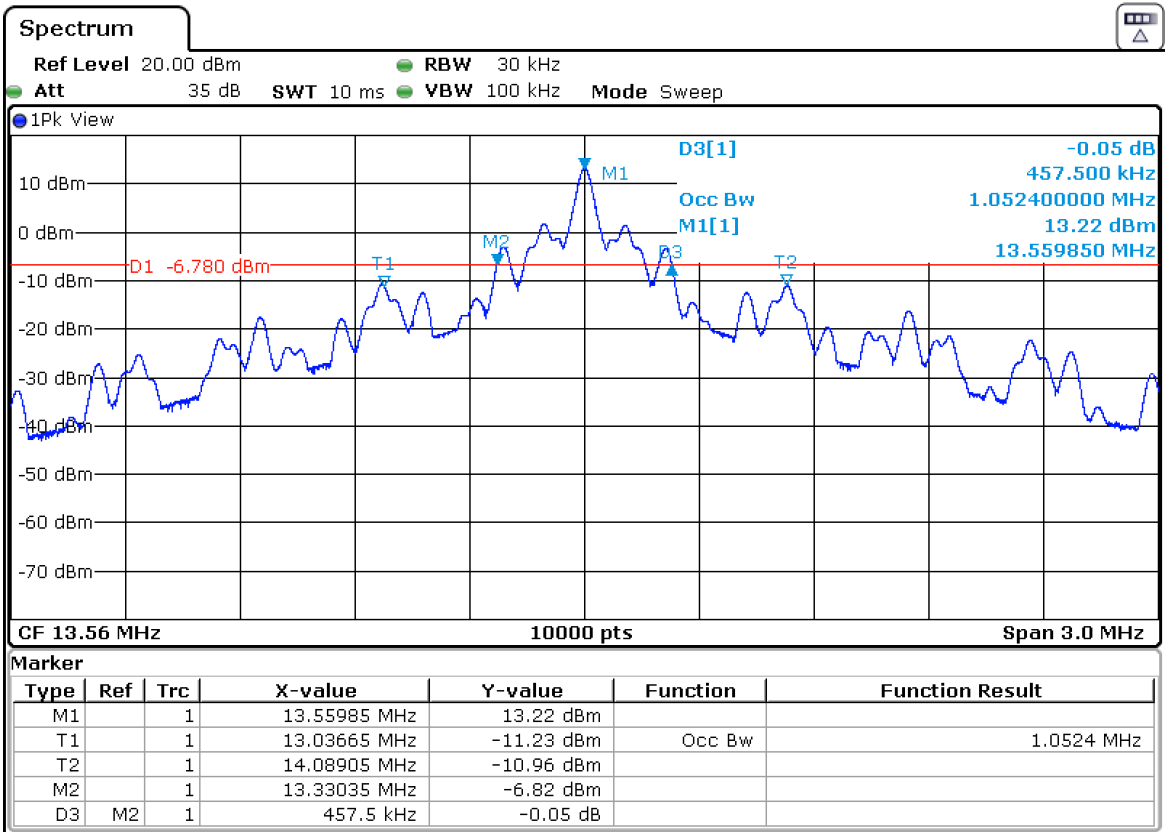
RESULTS:

99 % Occupied Bandwidth and 20 dB Bandwidth.

- NFC mode ISO 14443A

Operation Mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC mode ISO 14443A	1052.4	457.5
Measurement uncertainty (kHz)	<±0.40	

- 99% Occupied Bandwidth and 20 dB Bandwidth:

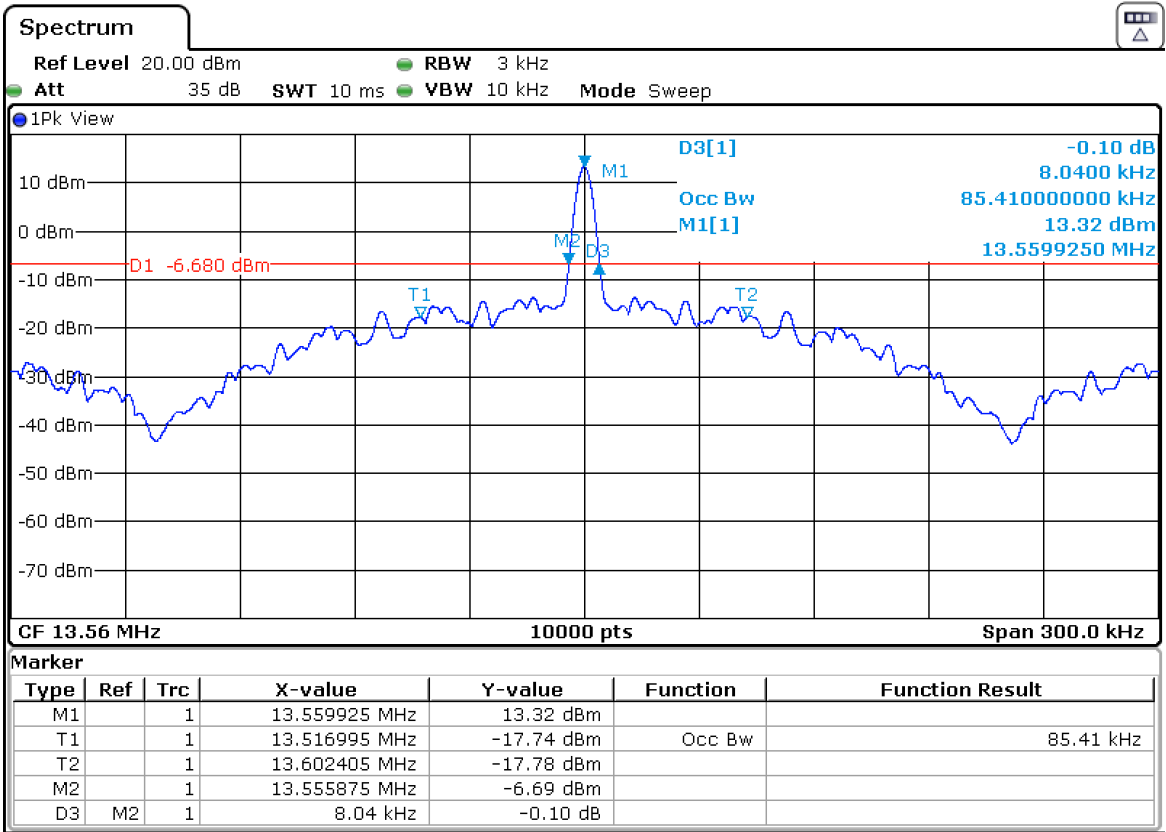


Verdict: PASS

• NFC mode ISO 15693

Operation Mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC mode ISO 15693	85.41	8.04
Measurement uncertainty (kHz)	<±0.4	

- 99% Occupied Bandwidth and 20 dB Bandwidth:



Verdict: PASS

Section 15.225 Subclause (a) / RSS-210 Clause B.6 (a). Field strength of emissions within the band 13.553 - 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.

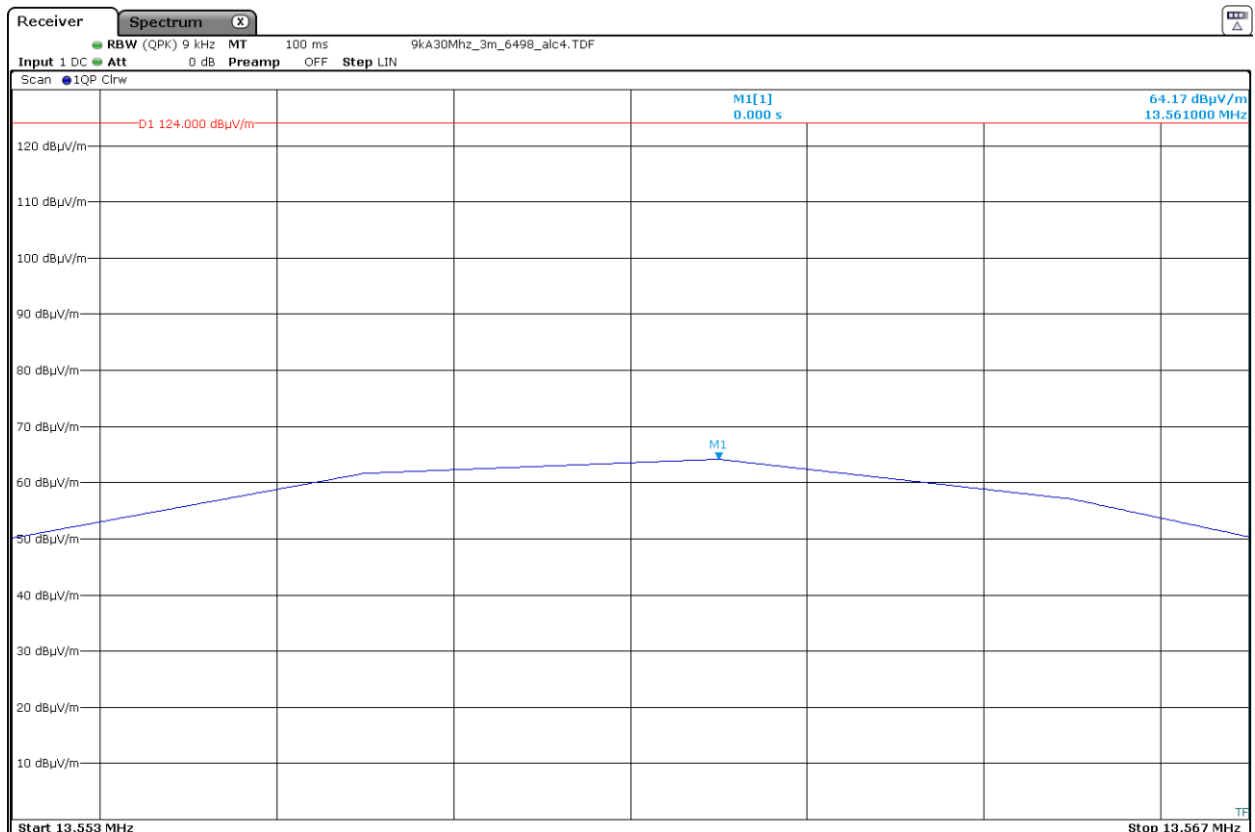
RESULTS:

Measurement distance: 3 meters.

- NFC mode ISO 14443A**

The maximum field strength of fundamental emission:

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)
13.561	64.17	24.17
Measurement uncertainty (dB)	<±3.44	



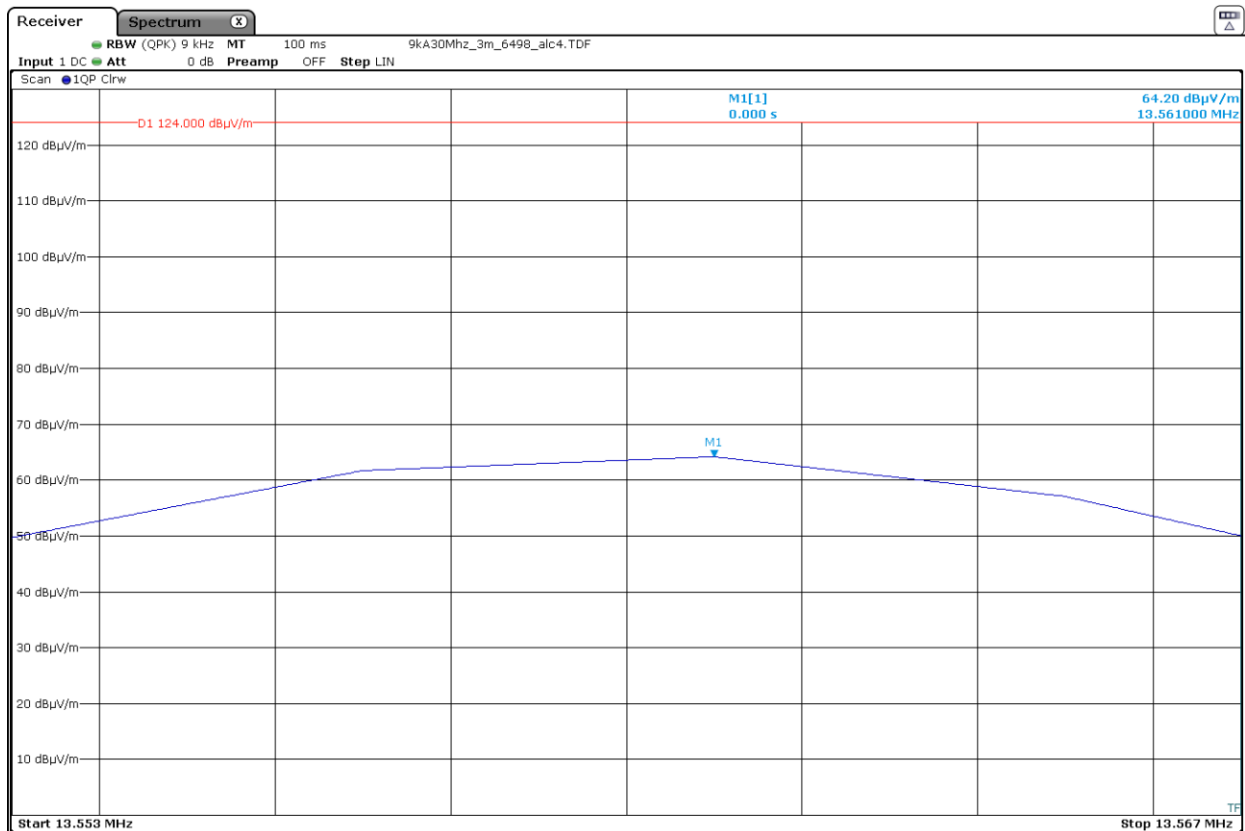
The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

- NFC mode ISO 15693**

The maximum field strength of fundamental emission:

Frequency (MHz)	Maximum field strength (dB μ V/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dB μ V/m) extrapolated to 30 m (40 dB/decade)
13.561	64.20	24.20
Measurement uncertainty (dB)	< $\pm$ 3.44	



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

Verdict: PASS

Section 15.225 Subclause (b) / RSS-210 Clause B.6 (b). Field strength of emissions within the band 13.410 - 13.553 MHz and 13.567 - 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 dB μ V/m) at 30 meters.

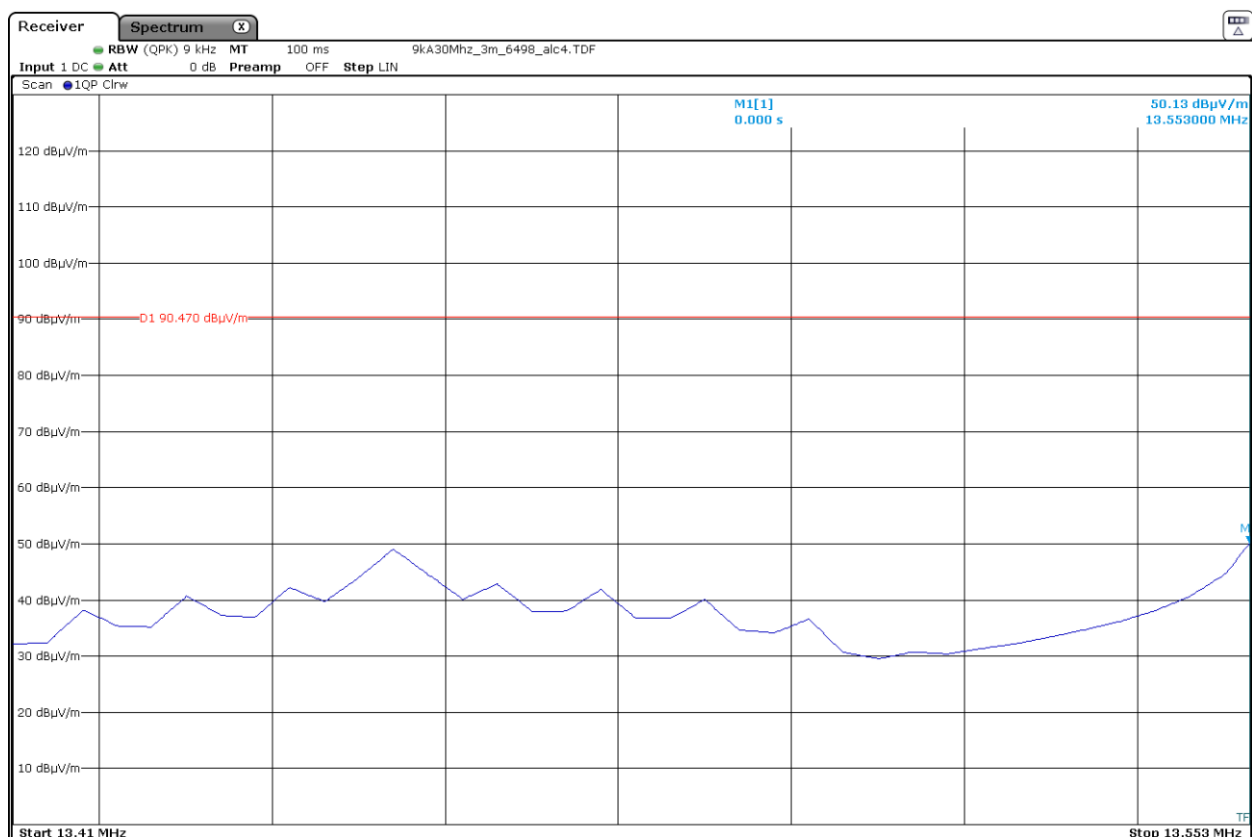
RESULTS:

Measurement distance: 3 meters.

- Band 13.410 - 13.553 MHz

- **NFC mode ISO 14443A**

Frequency (MHz)	Maximum field strength (dB μ V/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dB μ V/m) extrapolated to 30 m (40 dB/decade)
13.553	50.13	10.13
Measurement uncertainty (dB)	< $\pm$ 3.44	

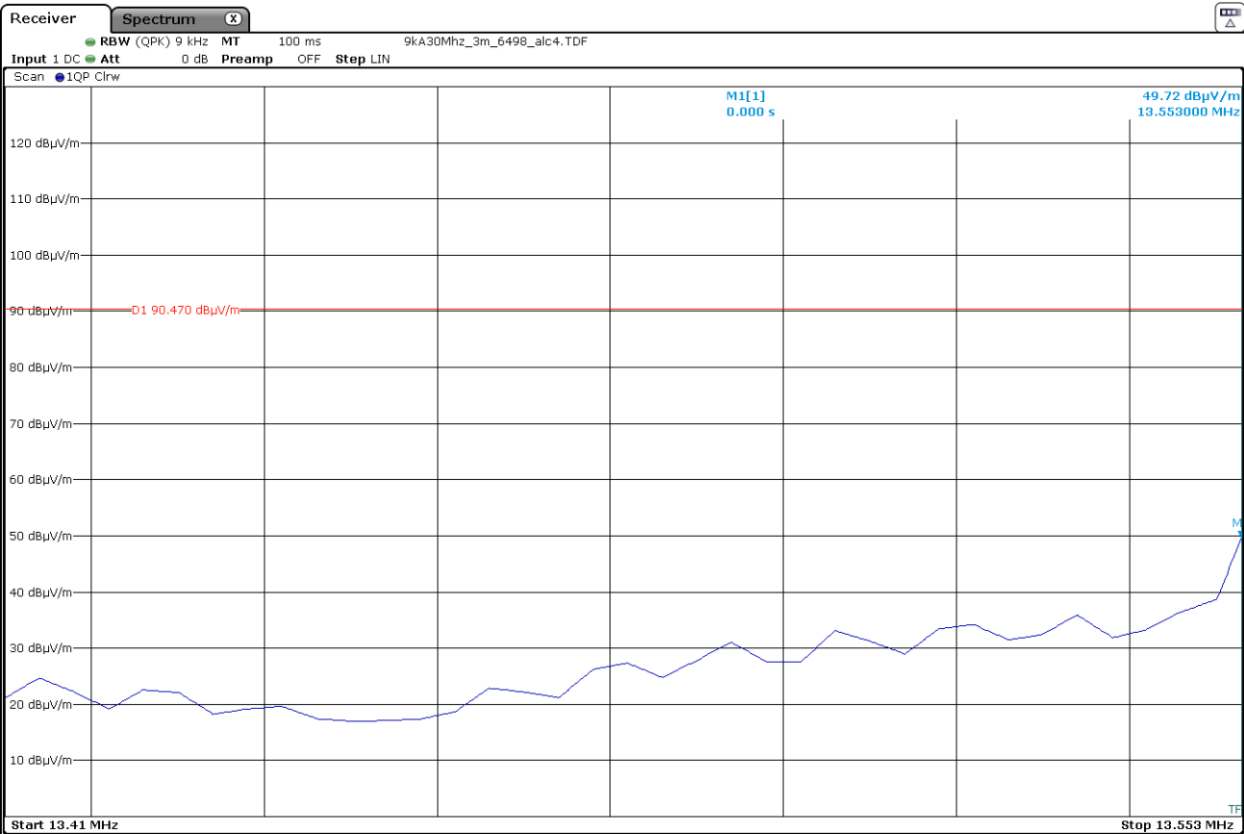


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

NFC mode ISO 15693

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	49.72	9.72
Measurement uncertainty (dB)	<±3.44	



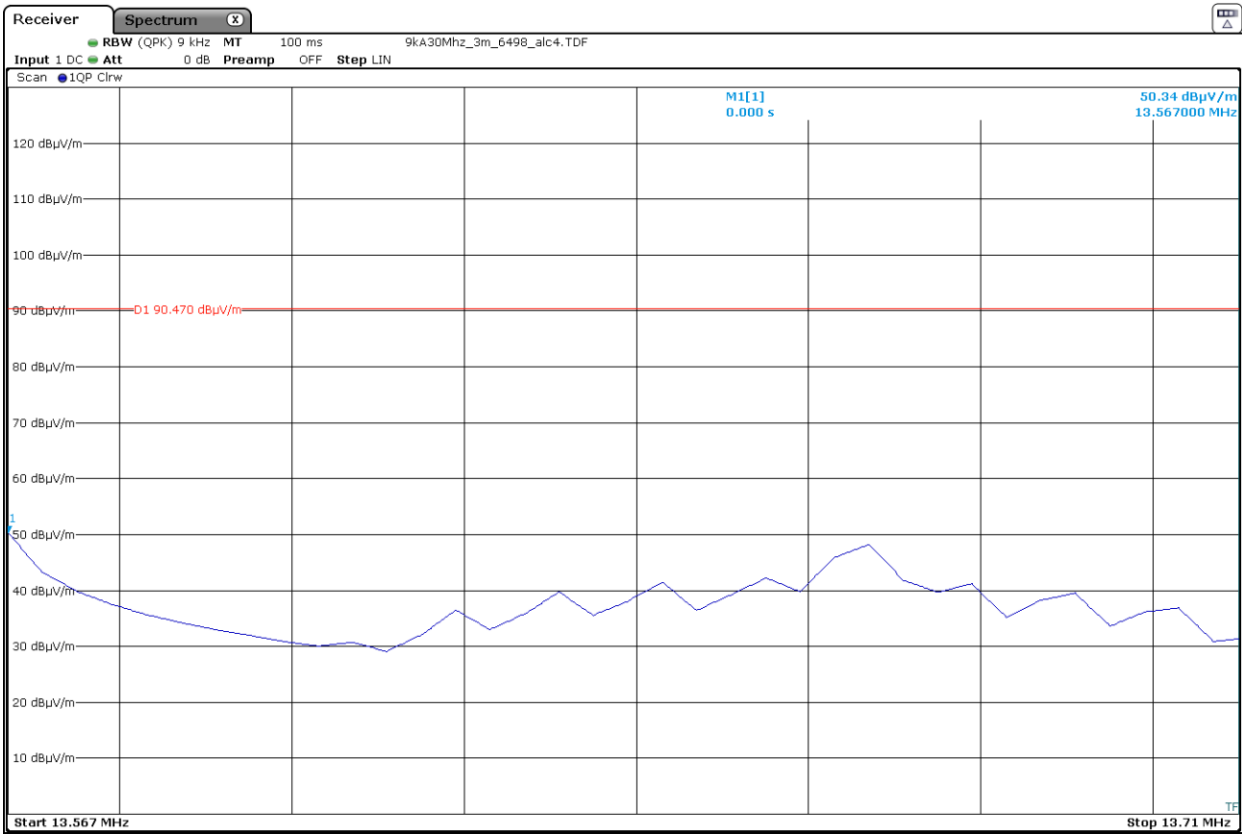
The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

- Band 13.567-13.710 MHz

- NFC mode ISO 14443A

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	50.34	10.34
Measurement uncertainty (dB)	<±3.44	

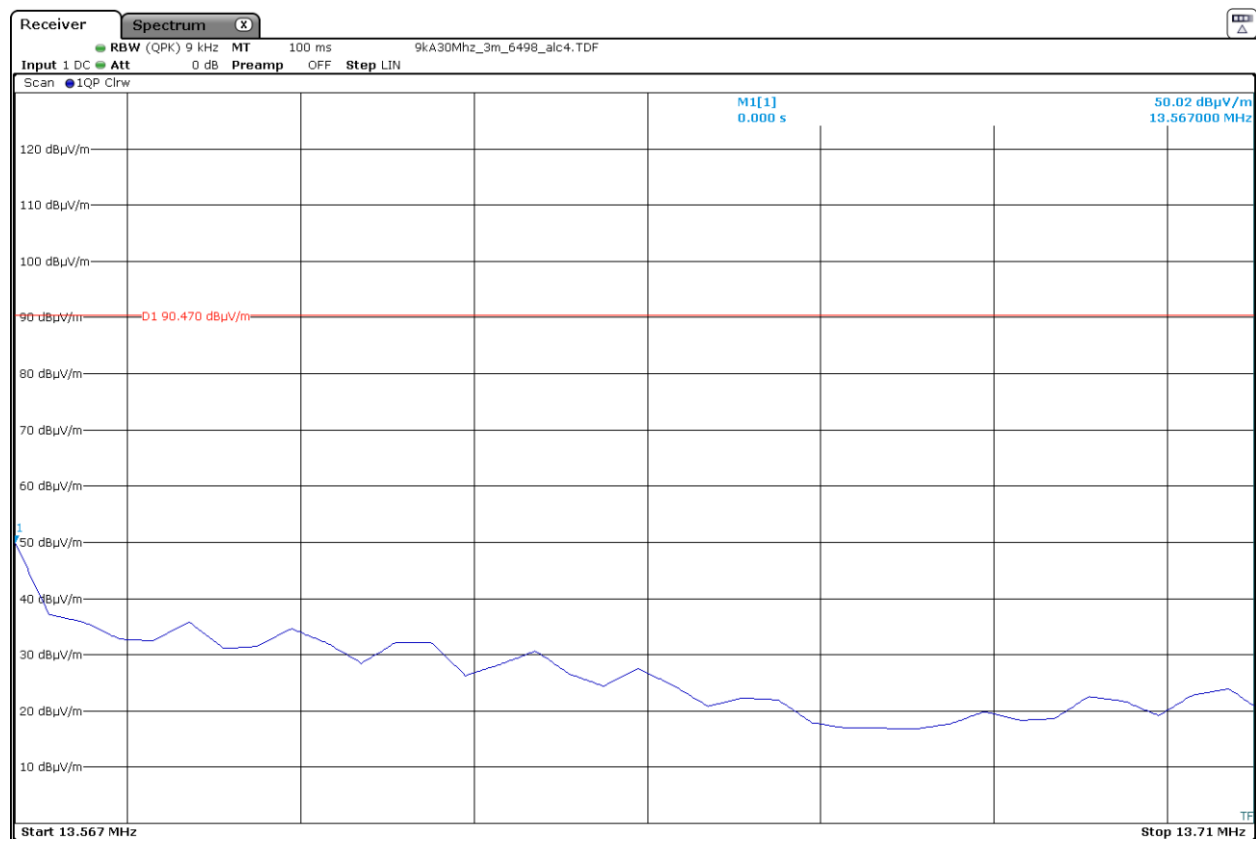


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

NFC mode ISO 15693

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	50.02	10.02
Measurement uncertainty (dB)	<±3.44	



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

Verdict: PASS

Section 15.225 Subclause (c) / RSS-210 Clause B.6 (c). Field strength of emissions within the band 13.110 - 13.410 MHz and 13.710 - 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.

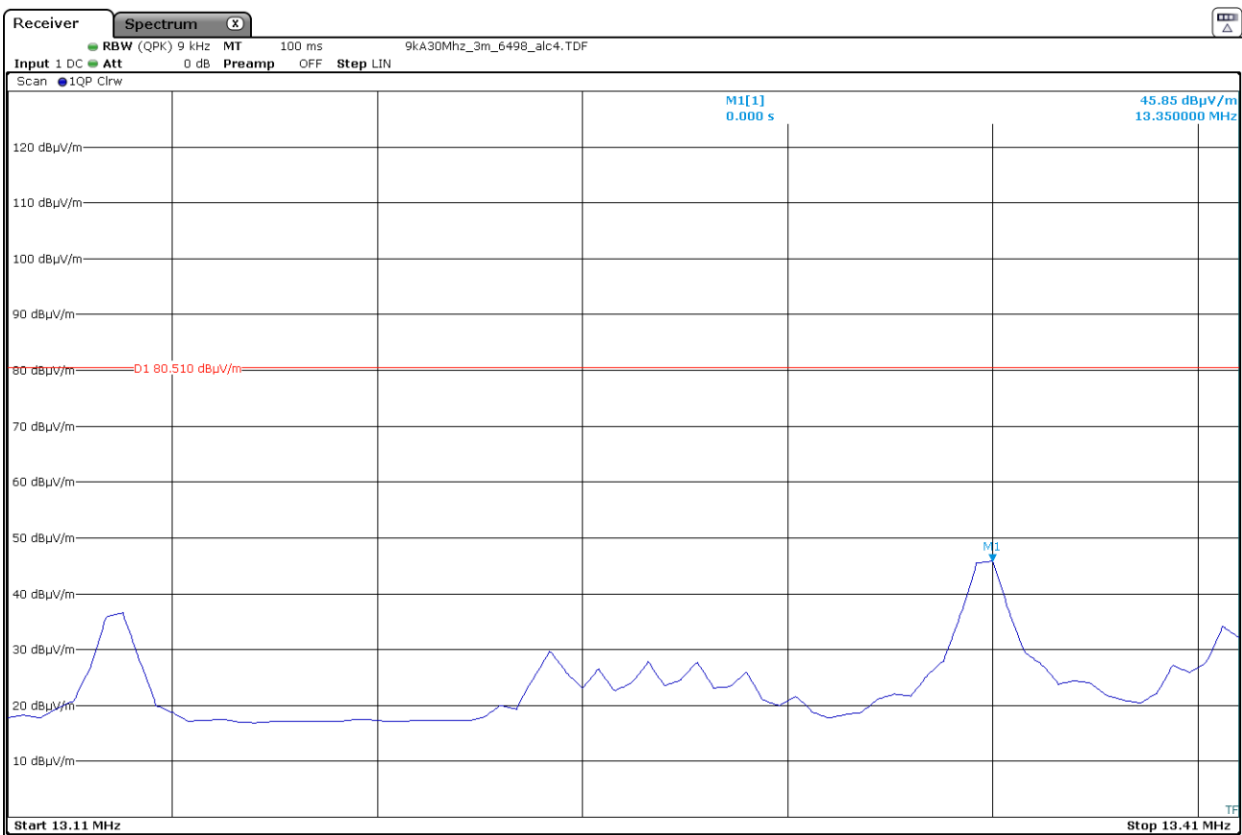
RESULTS:

Measurement distance: 3 meters.

- Band 13.110-13.410 MHz

- NFC mode ISO 14443A

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)
13.350	45.85	5.85
Measurement uncertainty (dB)	<±3.44	

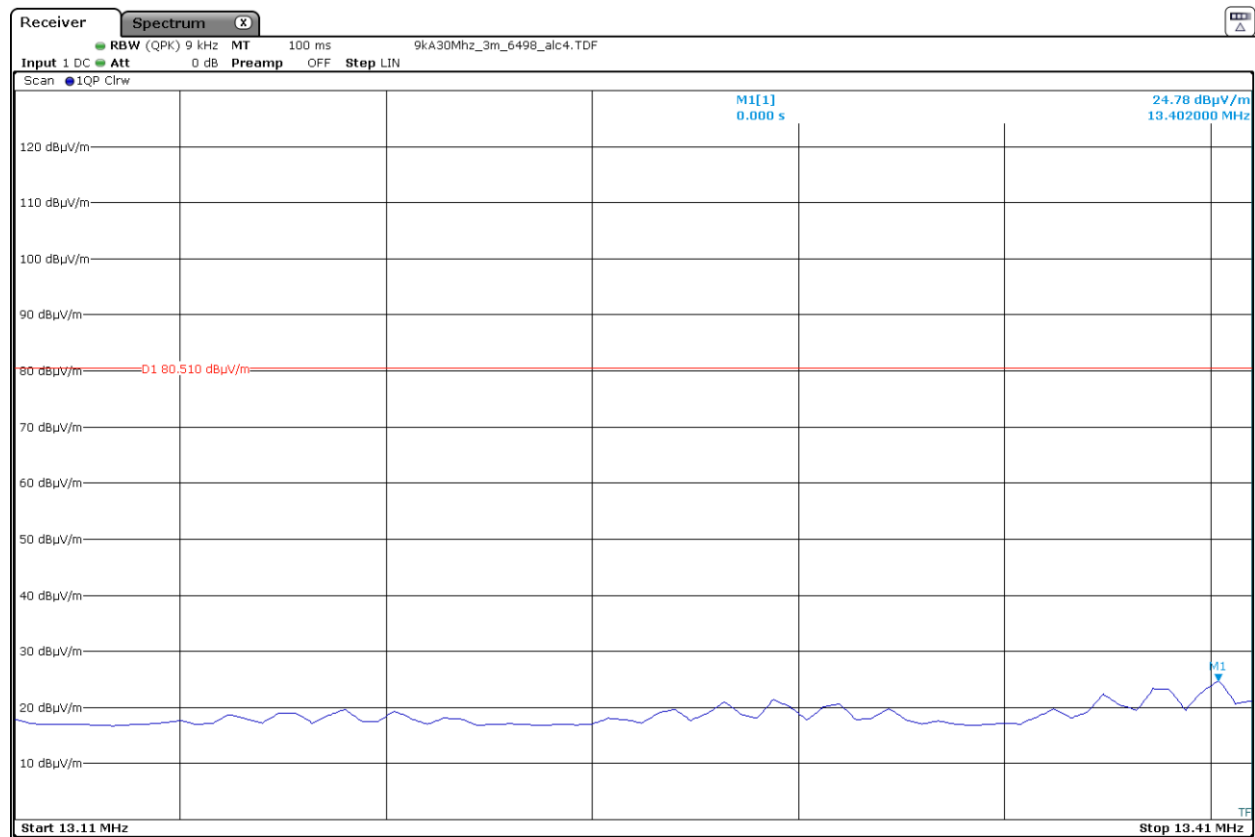


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

• NFC mode ISO 15693

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)
13.402	24.78	-15.22
Measurement uncertainty (dB)	<±3.44	



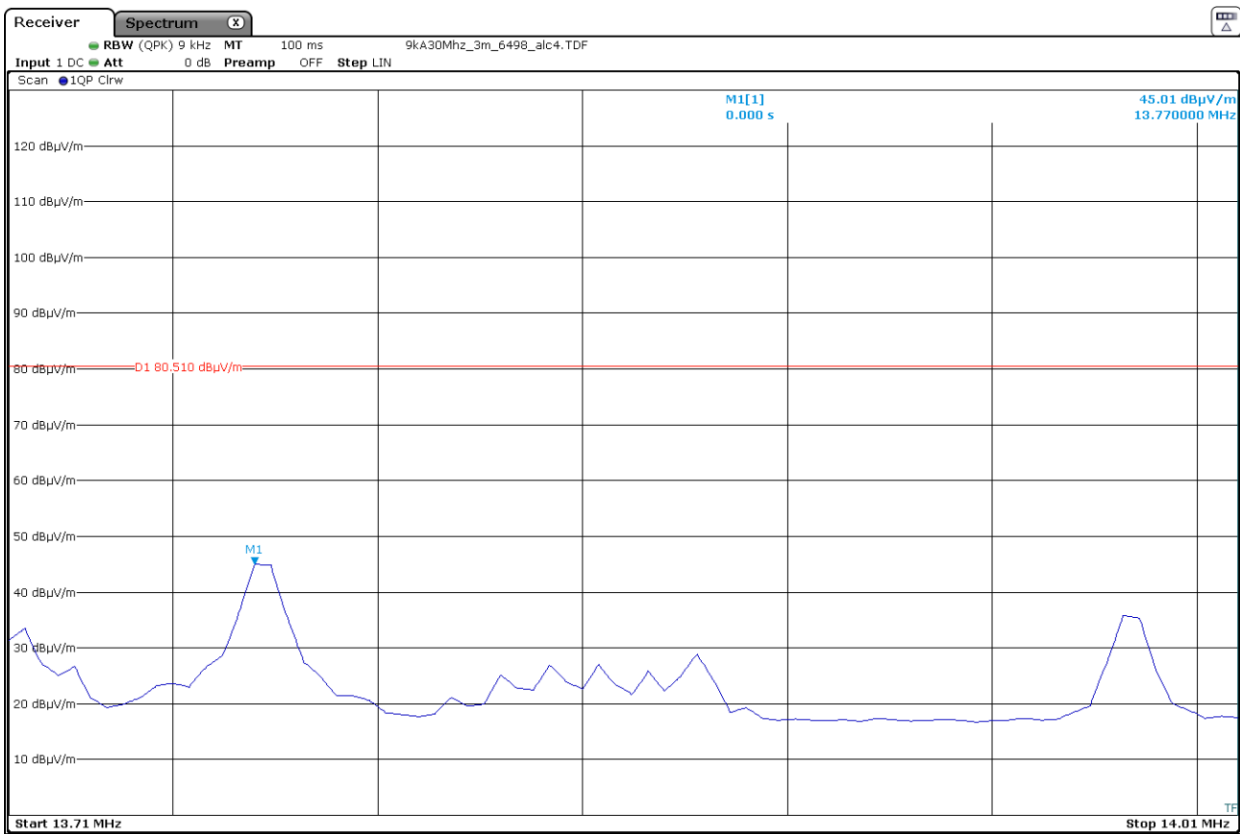
The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

- Band 13.710-14.010 MHz

- NFC mode ISO 14443A

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)
13.770	45.01	5.01
Measurement uncertainty (dB)	±3.44	

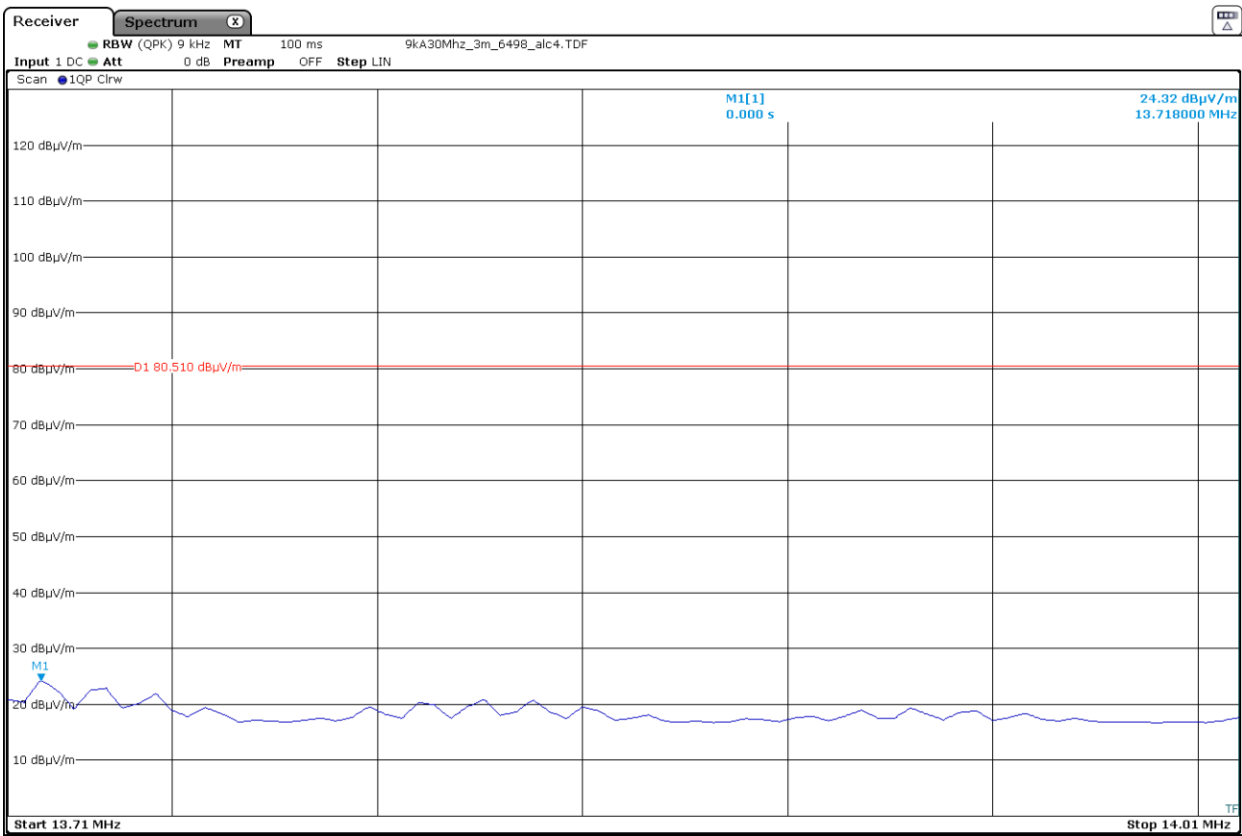


The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

• NFC mode ISO 15693

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)
13.718	24.32	-15.68
Measurement uncertainty (dB)	±3.44	



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

Verdict: PASS

Section 15.225 Subclause (d) / RSS-210 Clause B.6 (d). Field strength of emissions outside of the band 13.110 - 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.

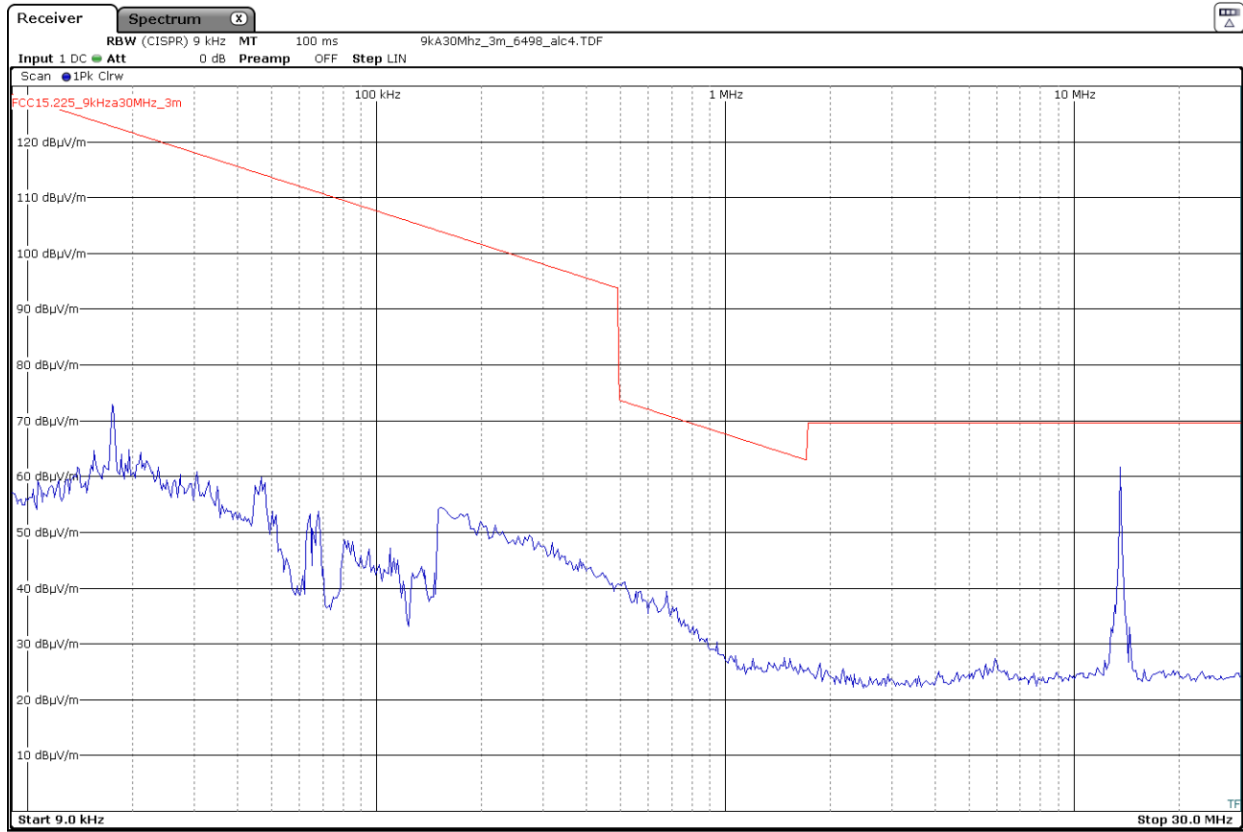
The spectrum was inspected from 9 kHz to 140 MHz searching for spurious signals.

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.

- Frequency range 9 kHz - 30 MHz:

- NFC mode ISO 14443A

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



The limits shown in the above plot are extrapolated to 3 meters. The highest peak corresponds to the carrier level.

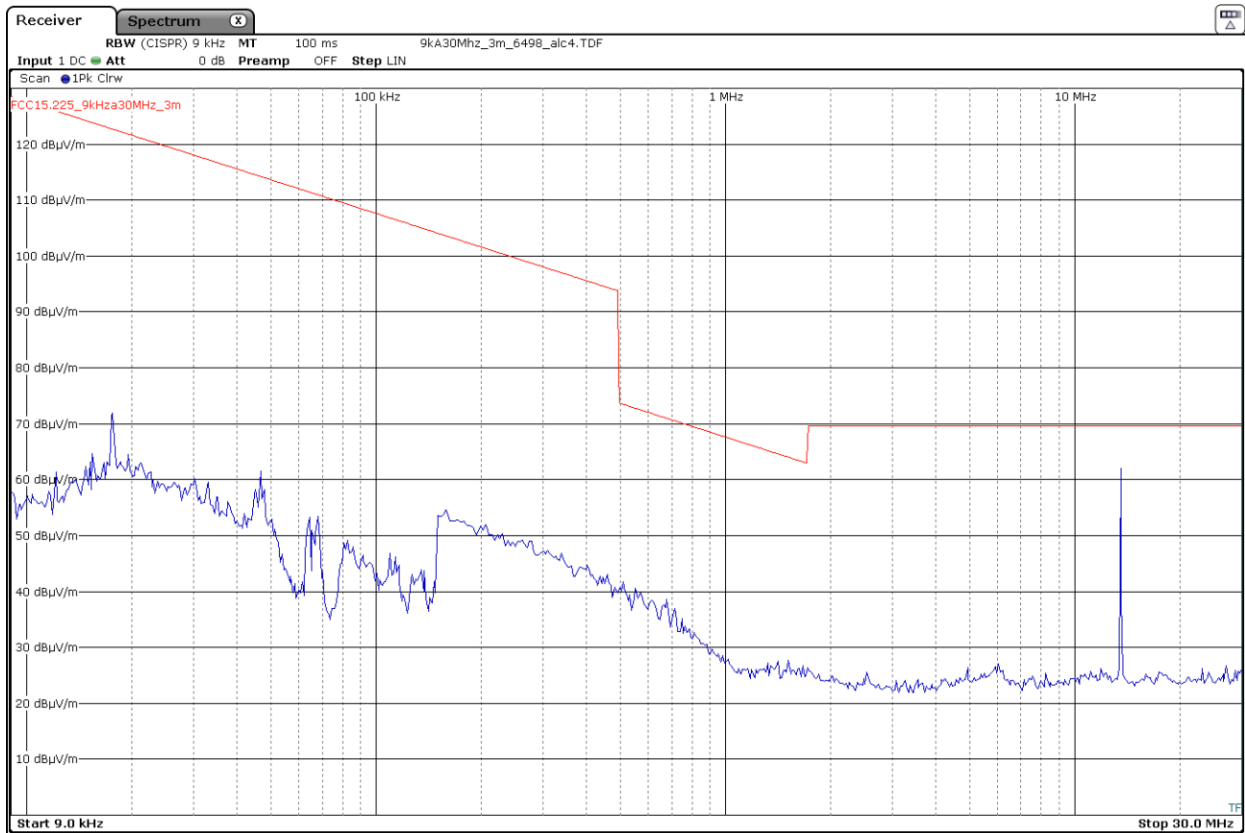
Resolution bandwidth:

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

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

- **NFC mode ISO 15693**

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



The limits shown in the above plot are extrapolated to 3 meters. The highest peak corresponds to the carrier level.

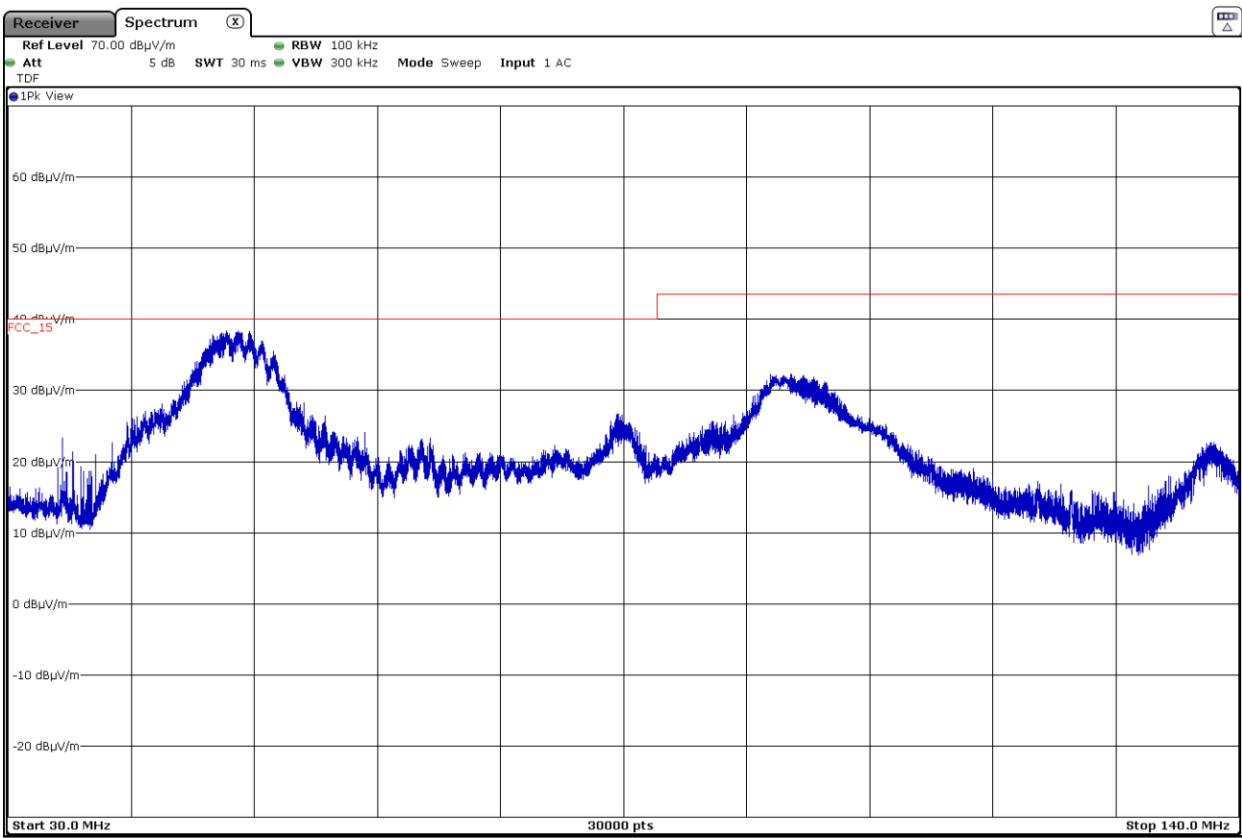
Resolution bandwidth:
 200 Hz for $9 \text{ kHz} \leq f \leq 150 \text{ kHz}$
 9 kHz for $150 \text{ kHz} \leq f \leq 30 \text{ MHz}$

- Frequency range 30 - 140 MHz

- NFC mode ISO 14443A

Spurious emissions at less than 20 dB from the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
51.5912	Quasi peak	33.3	V	<± 3.88
100.0425	Quasi peak	24.8	V	<± 3.88



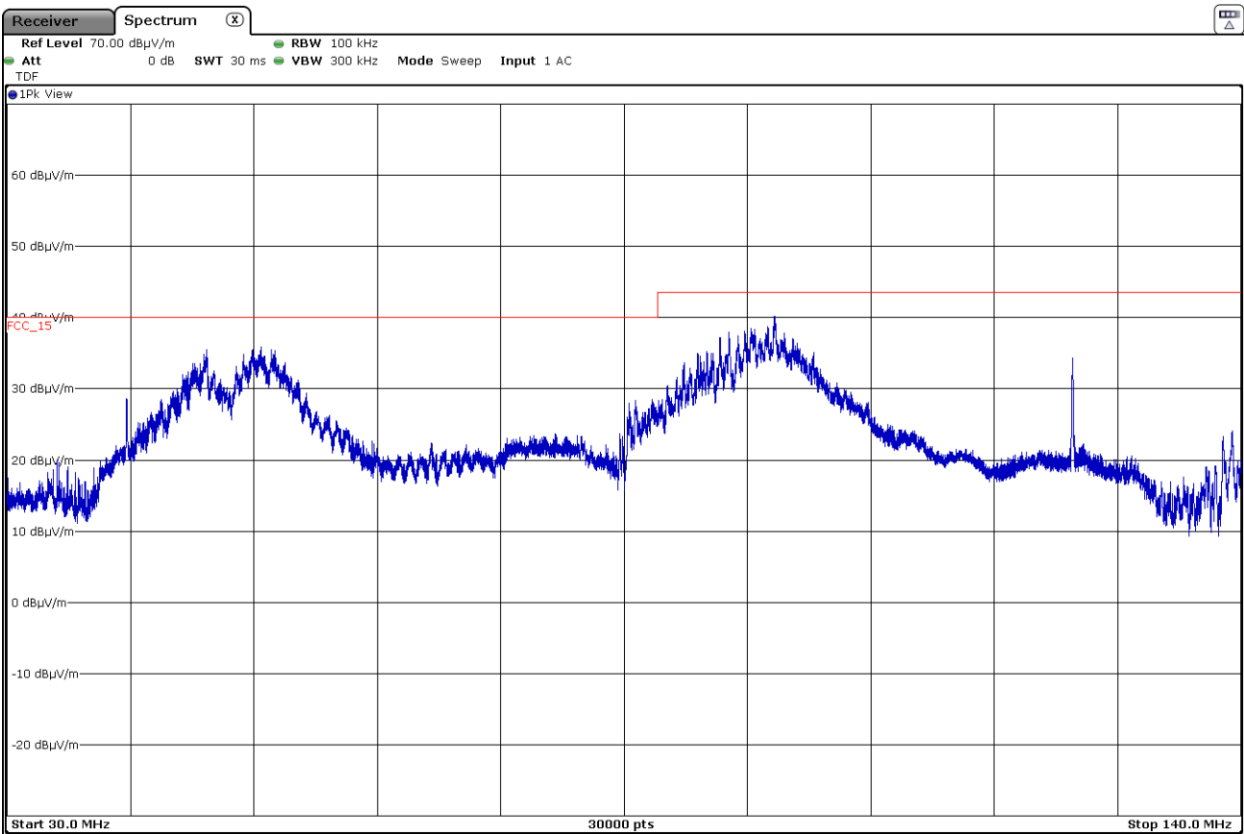
The above plot shows the results of the scan using peak detector.

Verdict: PASS

- NFC mode ISO 15693

Spurious emissions at less than 20 dB from the limit:

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
40.6682	Quasi peak	30.8	V	<± 3.88
41.5445	Quasi peak	20.0	H	<± 3.88
47.7925	Quasi peak	36.5	V	<± 3.88
52.6288	Quasi peak	36.1	V	<± 3.88
98.4292	Quasi peak	40.5	V	<± 3.88
124.9868	Quasi peak	37.3	V	<± 3.88



The above plot shows the results of the scan using peak detector.

Verdict: PASS

Section 15.225 Subclause (e) / RSS-210 Clause B.6. 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.

- **NFC mode ISO 14443A**

- Frequency stability over temperature variations:

Temperature (°C)	Frequency Error (KHz)	Frequency Error (%)
+50	0.0275	0.000203
+40	0.0375	0.000277
+30	0.0400	0.000295
+20	0.0425	0.000313
+10	0.0250	0.000184
0	0.0175	0.000129
-10	-0.0175	-0.000129
-20	-0.0375	-0.000277

- Frequency stability over voltage variations:

DC Supply	Voltage (V)	Frequency Error (KHz)	Frequency Error (%)
Vmax	5.5	0.0075	0.000055
Vmin	4.4	-0.0050	-0.000037

Verdict: PASS

- **NFC mode ISO 15693**

- Frequency stability over temperature variations:

Temperature (°C)	Frequency Error (KHz)	Frequency Error (%)
+50	0.032500	0.000002
+40	0.057500	0.000004
+30	0.057500	0.000004
+20	0.052500	0.000004
+10	0.047500	0.000004
0	0.027500	0.000002
-10	0.005000	0.000000
-20	-0.035000	-0.000003

- Frequency stability over voltage variations:

DC Supply	Voltage (V)	Frequency Error (KHz)	Frequency Error (%)
Vmax	5.5	0.022500	0.000002
Vmin	4.4	0.022500	0.000002

Verdict: PASS