



ISED LISTED
REGISTRATION NUMBER
4621A-4

Test report No:
NIE: 55234RRF.005

Test report

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

Identification of item tested	Electronic Reader Series including all mechanical variants.
Trademark	Modular Wall Reader 2.0
Model and /or type reference	WRM0B (type reference: P0506)
Other identification of the product	HW version: 1.0 SW version: 0152 (Control Firmware) + 0136 (BGM111 Firmware) FCC ID: UKCWRM0B IC: 10088A-WRM0B
Features	Contains 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 (10–1–17 Edition): Operation within the band 13.110 -14.010. USA FCC Part 15.209 (10–1–17 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.
Summary	IN COMPLIANCE
Approved by (name / position & signature)	A. Llamas RF Lab. Manager  Firmado digitalmente por ALEJANDRO LLAMAS RODRIGUEZ Fecha: 2019.03.27 11:01:31 +01'00'
Date of issue	2019-03-27
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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 is a 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 a laboratory with a measurement site in compliance with the requirements of RSS 212, Issue 1 (Provisional) and has been added to the list of filed sites of the Canadian Certification and Engineering Bureau. Reference File Number: ISED 4621A-4.

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.

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General conditions

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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.

Data provided by the client

The sample consists of a Modular Wall Reader 2.0, with Bluetooth Smart (BGM111 module) and ISO14443A & ISO15693 standard based technology - Mifare.

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	Reception
55234C/023	Electronic Reader	WRM0B (type reference: P0506)	--	2018/10/31
55234C/001	AC/DC Adaptor	6A-181WP12	--	2018/01/10
55234C/002	Control Unit	CU42E0	--	2018/01/10

Sample S/01 has undergone the following test(s): All 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⁾	
			☐	☐	☐	
Supplementary information to the ports..... :						
Rated power supply	Voltage and Frequency		Reference poles			
			L1	L2	L3	N
	☒	DC: 12 Vdc from CU42xx.				
Rated Power	1,92 W (max)					
Clock frequencies	27,12 MHz					
Other parameters..... :	RS-485 bus					
Software version	0152 (Control Firmware) + 0136 (BGM111 Firmware)					
Hardware version..... :	1.0					
Dimensions in cm (W x H x D).... :	8,2 x 8,2 x 2 cm					
Mounting position..... :	☒	Wall/Ceiling mounted equipment				
Modules/parts	Module/parts of test item			Type	Manufacturer	
	BGM111			BLE Module	Silicon Labs	

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 document		

⁽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)	2018-10-31
Date (finish)	2018-11-27

Document history

Report number	Date	Description
55234RRF.005	2019-03-27	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 %
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

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
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω
Normal site attenuation (NSA)	< ±4 dB at 10 m distance between item under test and receiver antenna, (30 MHz to 1000 MHz)
Field homogeneity	More than 75% of illuminated surface is between 0 and 6 dB (26 MHz to 1000 MHz).

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
Shielding effectiveness	> 100 dB
Electric insulation	> 10 kΩ
Reference resistance to earth	< 1 Ω

Remarks and comments

The tests have been performed by the technical personnel: Francisco José Alcaide, Jaime Barranquero Gómez, Ignacio Cabra, José Alberto Aranda, Miguel Ángel Torres.

Used instrumentation:

Conducted measurements:

		Last Calibration	Due Calibration
1.	Chamber HERAEUS VMT 04/35	2018/06	2020/06
2.	Signal Analyzer 20 Hz to 8 GHz ROHDE AND SCHWARZ FSQ8	2018/08	2020/08
3.	Spectrum Analyzer PSA 3Hz-26.5 GHz AGILENT TECHNOLOGIES E4440A	2017/10	2019/10
4.	DC Power Supply 40V/40A Rohde & Schwarz NGPE40	2018/02	2021/02

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 7 GHz ROHDE AND SCHWARZ ESR7	2017/08	2019/08
3. Active Loop Antenna HEWLETT PACKARD 11966A	2018/06	2020/06
4. RF Pre-amplifier, 38 dB, 30 MHz-6 GHz BONN ELEKTRONIK BLNA 0360-01N	2018/07	2019/07
5. Biconical/Log Antenna 30 MHz - 6 GHz ETS LINDGREN 3142E	2018/07	2021/07

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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TEST CONDITIONS

POWER SUPPLY (V):

Vn: 12 Vdc (*)
Vmin: 10.2 Vdc
Vmax: 13.8 Vdc

Type of power supply: External power supplied from CU42xx

Type of antenna: Integral, chip

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

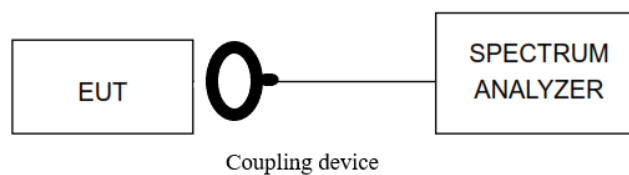
(*): Declared by applicant.

TEST FREQUENCY:

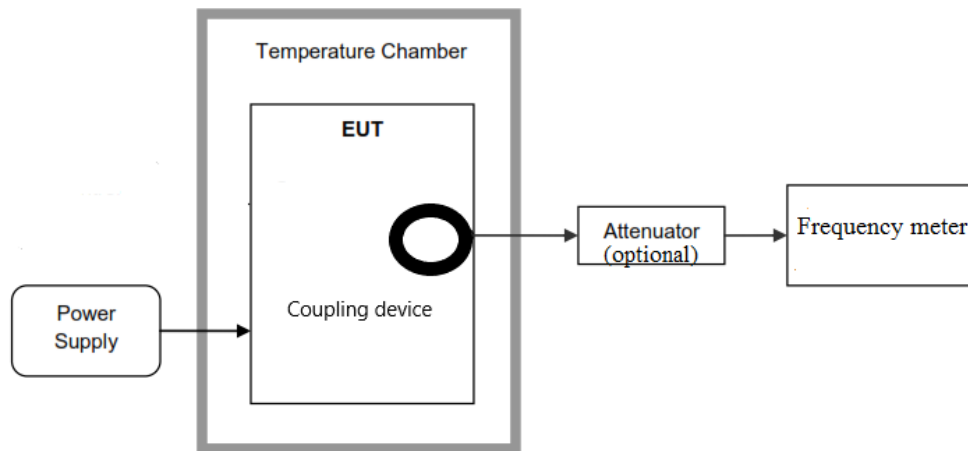
Nominal Operating Frequency: 13.56 MHz

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 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.

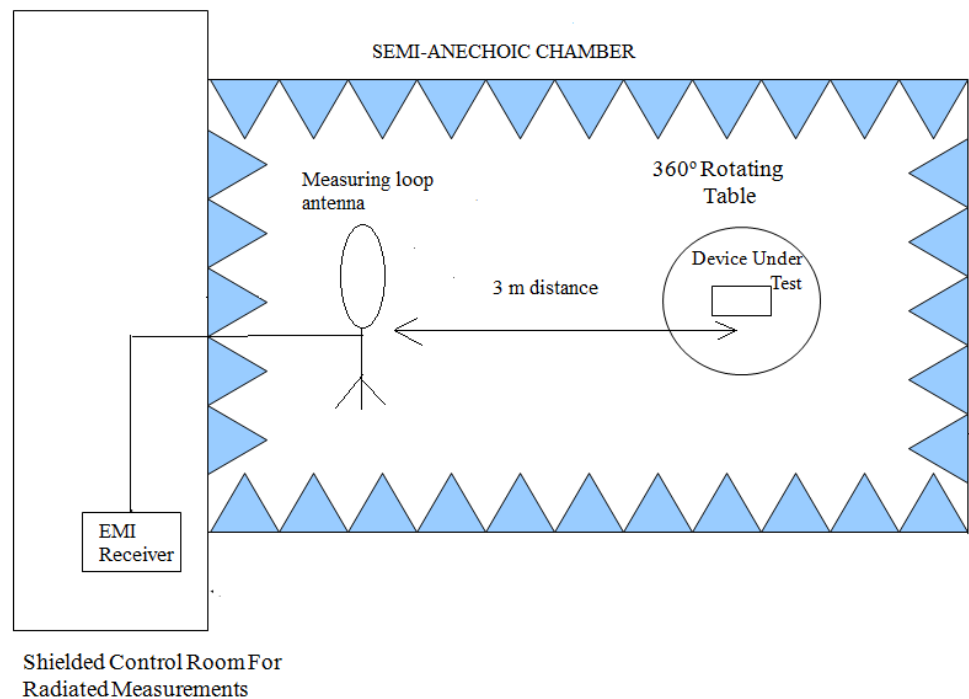
The equipment under test was set up on a non-conductive platform above the ground plane and the situation and orientation was varied to find the maximum radiated emission. It was also rotated 360° and in the range between 30 MHz and 200 MHz the antenna height was varied from 1 to 4 meters to find the 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.

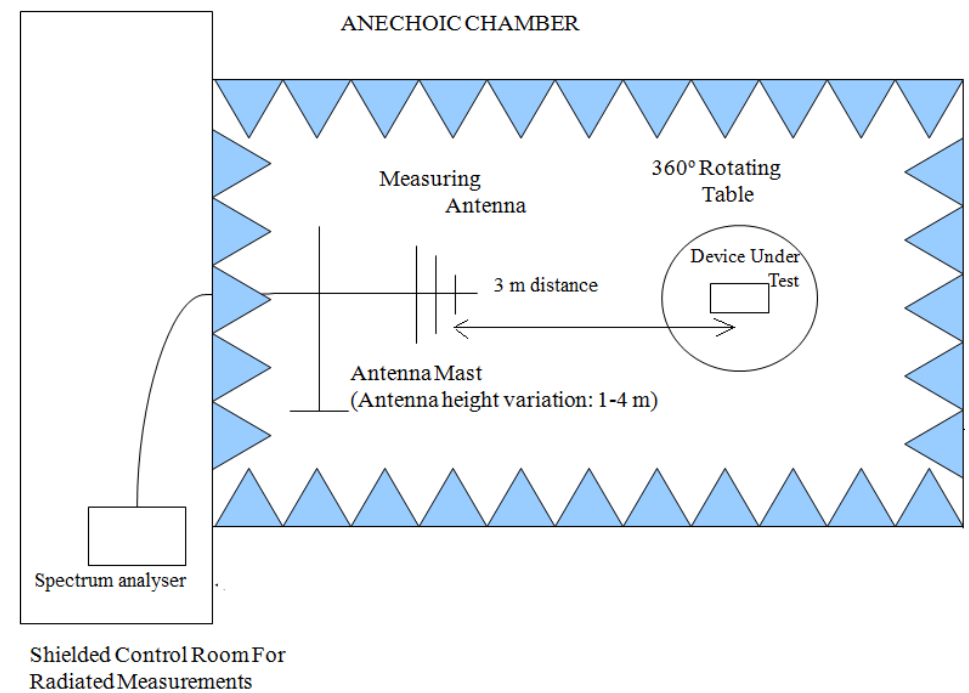
In the range between 30 MHz and 200 MHz the measurements were made in both horizontal and vertical planes of polarization.

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 200 MHz.



Occupied Bandwidth

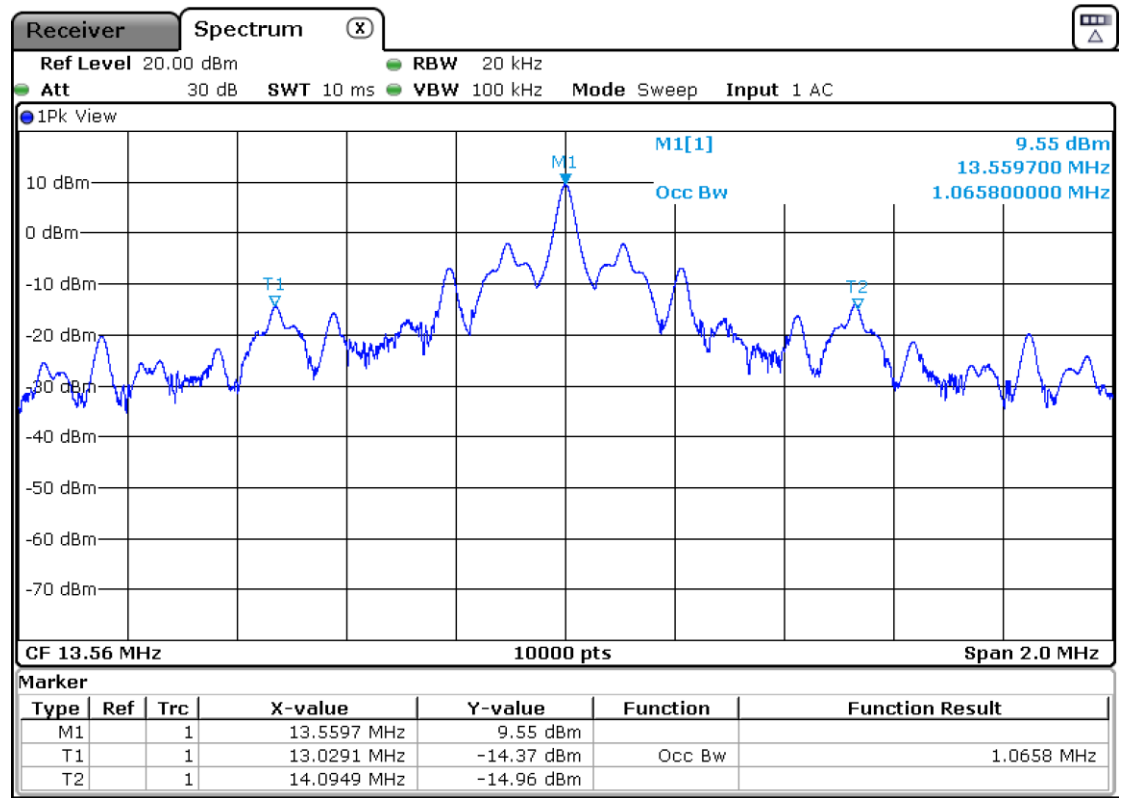
RESULTS:

99 % Occupied Bandwidth and 20 dB Bandwidth.

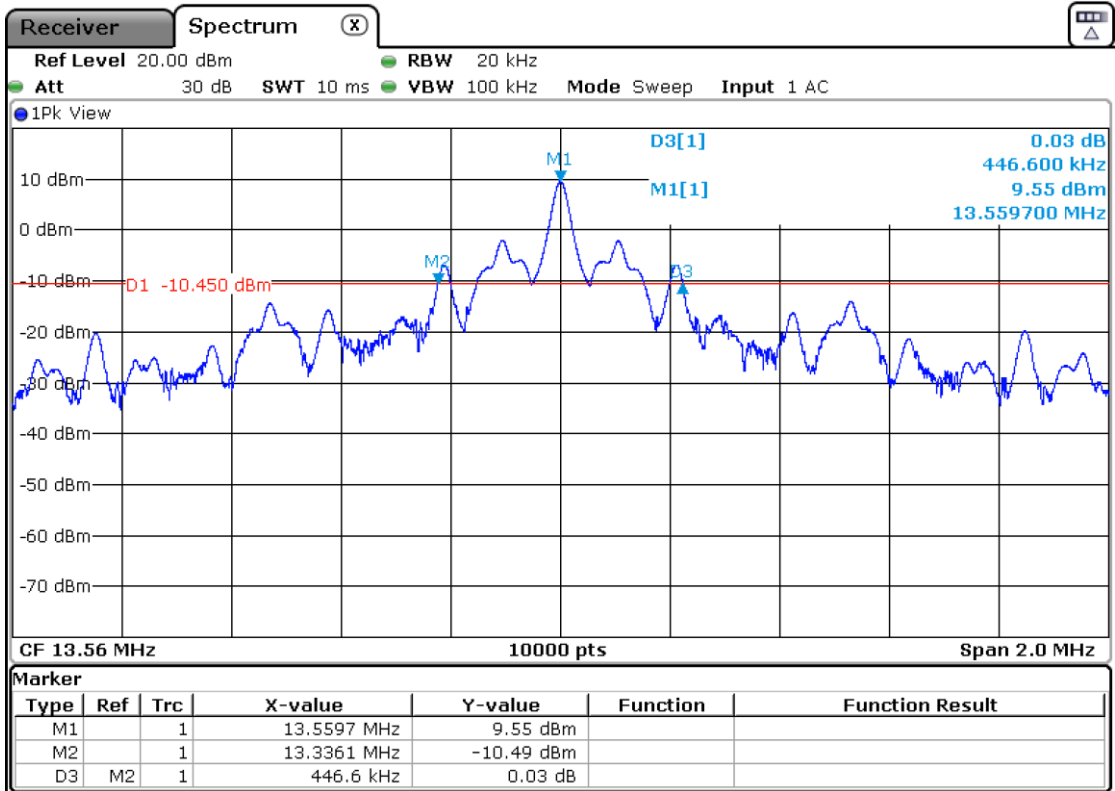
- NFC mode ISO 14443A

Operation Mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC mode ISO 14443A	1065.8	446.6
Measurement uncertainty (kHz)	<±0.40	

- 99% Occupied Bandwidth:



- 20 dB Bandwidth:

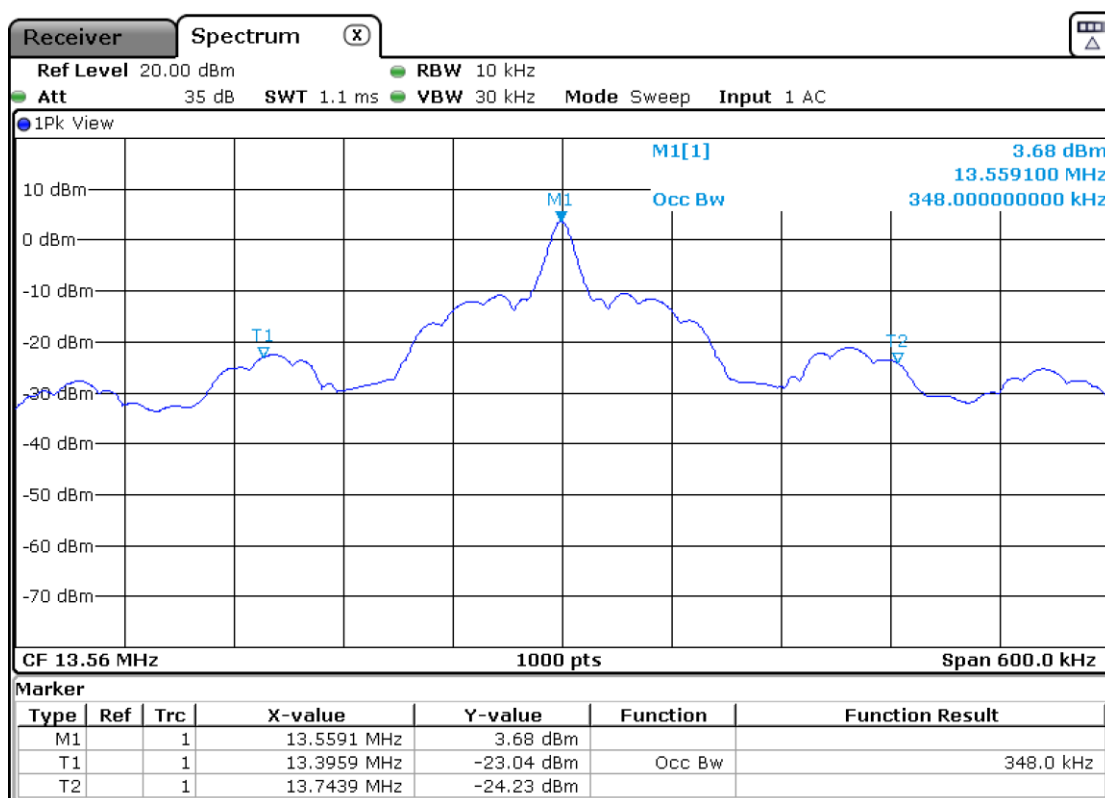


Verdict: PASS

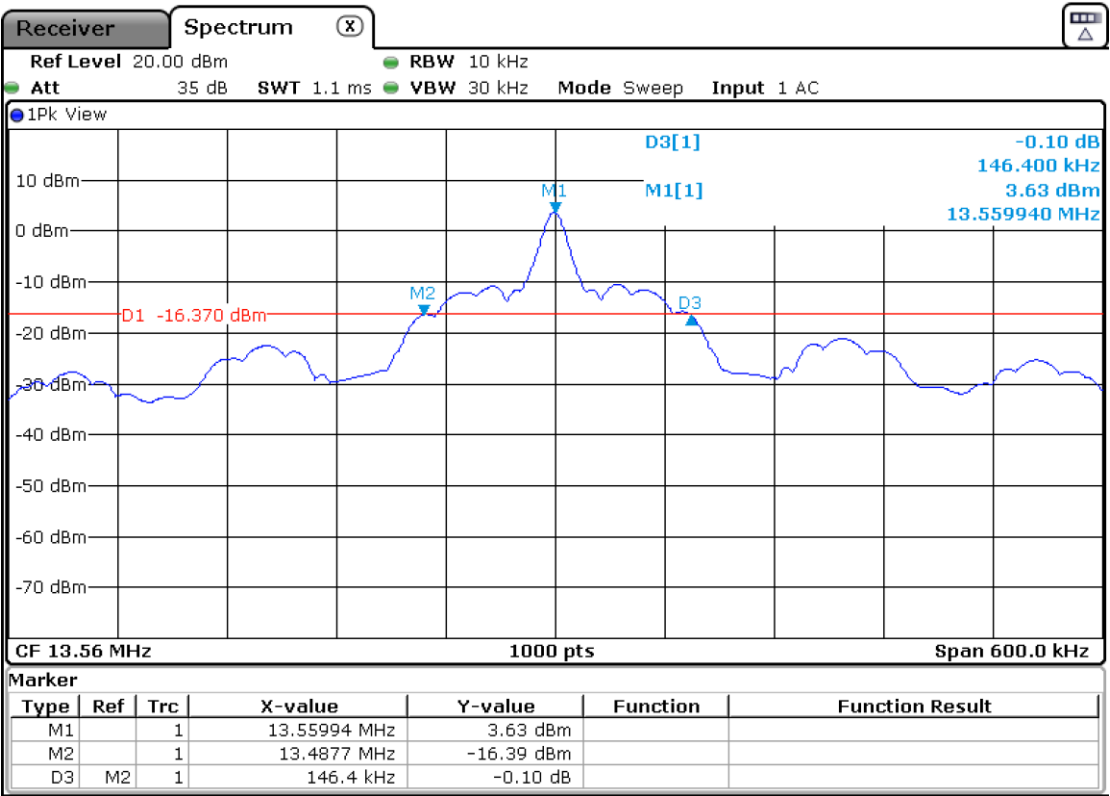
- **NFC mode ISO 15693**

Operation Mode	99% Occupied Bandwidth (kHz)	20 dB Bandwidth (kHz)
NFC mode ISO 15693	348.0	146.4
Measurement uncertainty (kHz)	<±0.4	

- 99% Occupied Bandwidth:



- 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.

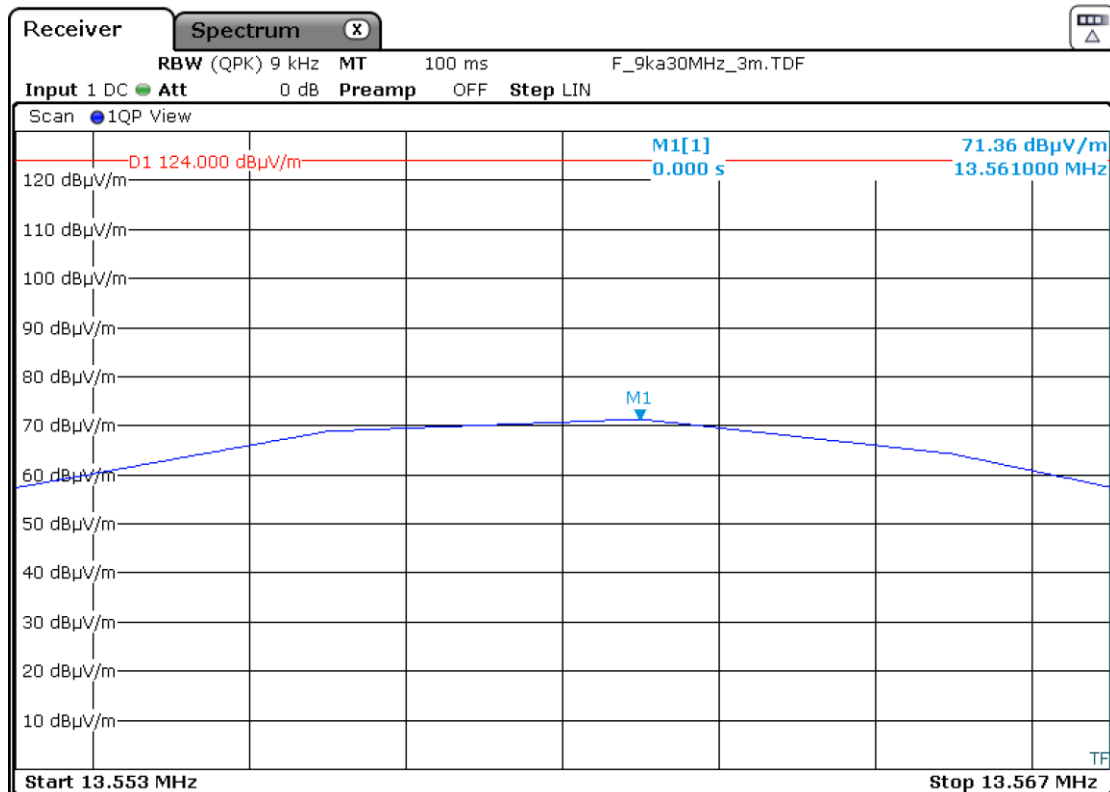
RESULTS:

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	71.36	31.36
Measurement uncertainty (dB)	<±3.44	



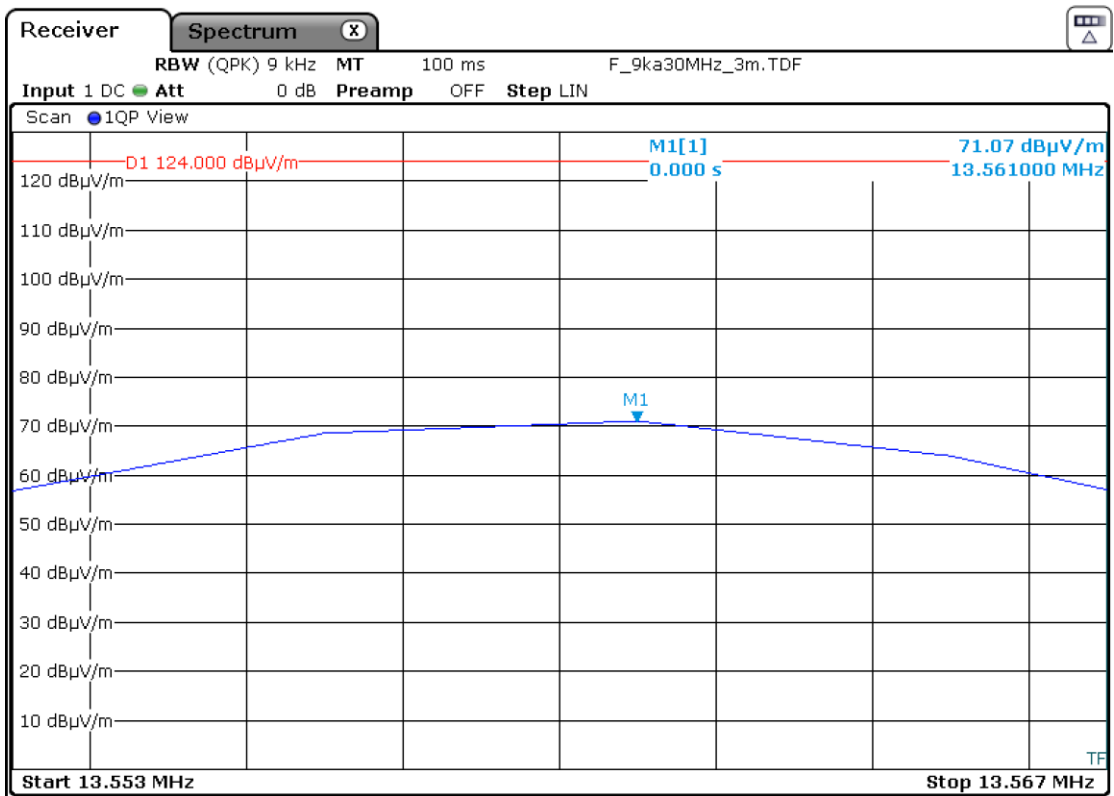
The limit shown in the above plot is extrapolated to 3 meters

Verdict: PASS

• **NFC mode ISO 15693**

The maximum field strength of fundamental emission:

Frequency (MHz)	Maximum field strength (dBµV/m) measured at 3 m (quasi-peak detector)	Maximum field strength (dBµV/m) extrapolated to 30 m (40 dB/decade)
13.561	71.07	31.07
Measurement uncertainty (dB)	<±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.

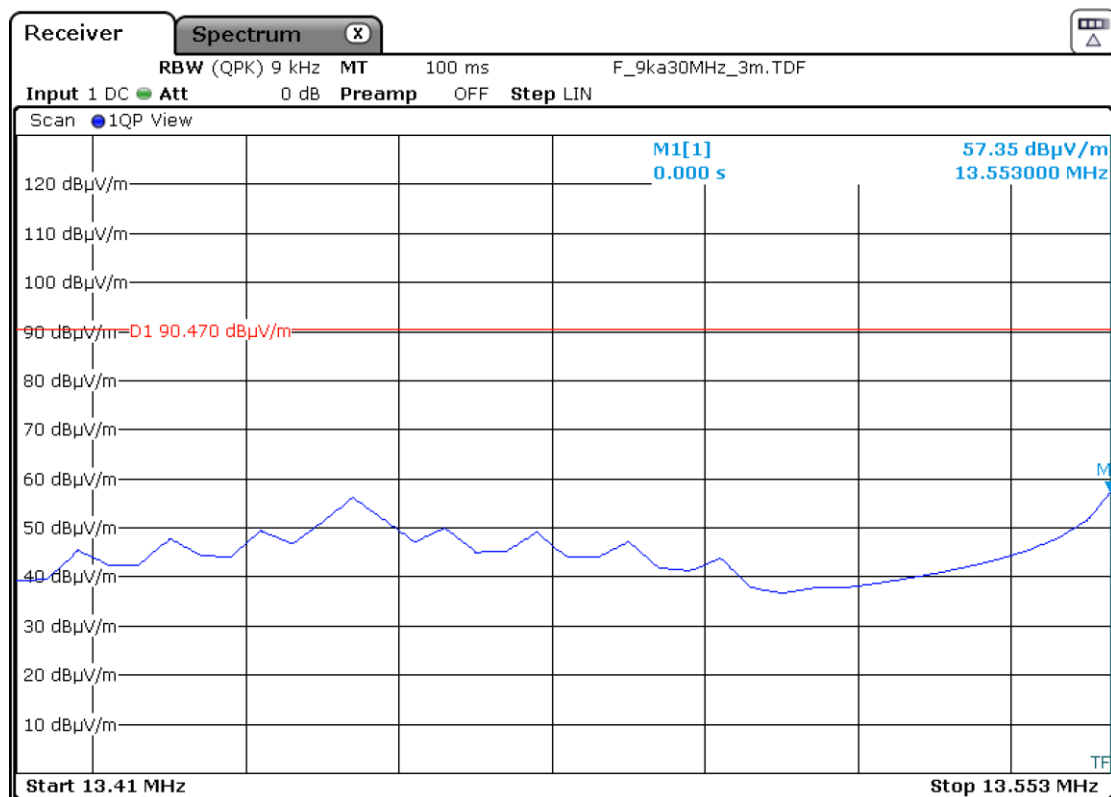
RESULTS:

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	57.35	17.35
Measurement uncertainty (dB)	< $\pm$ 3.44	

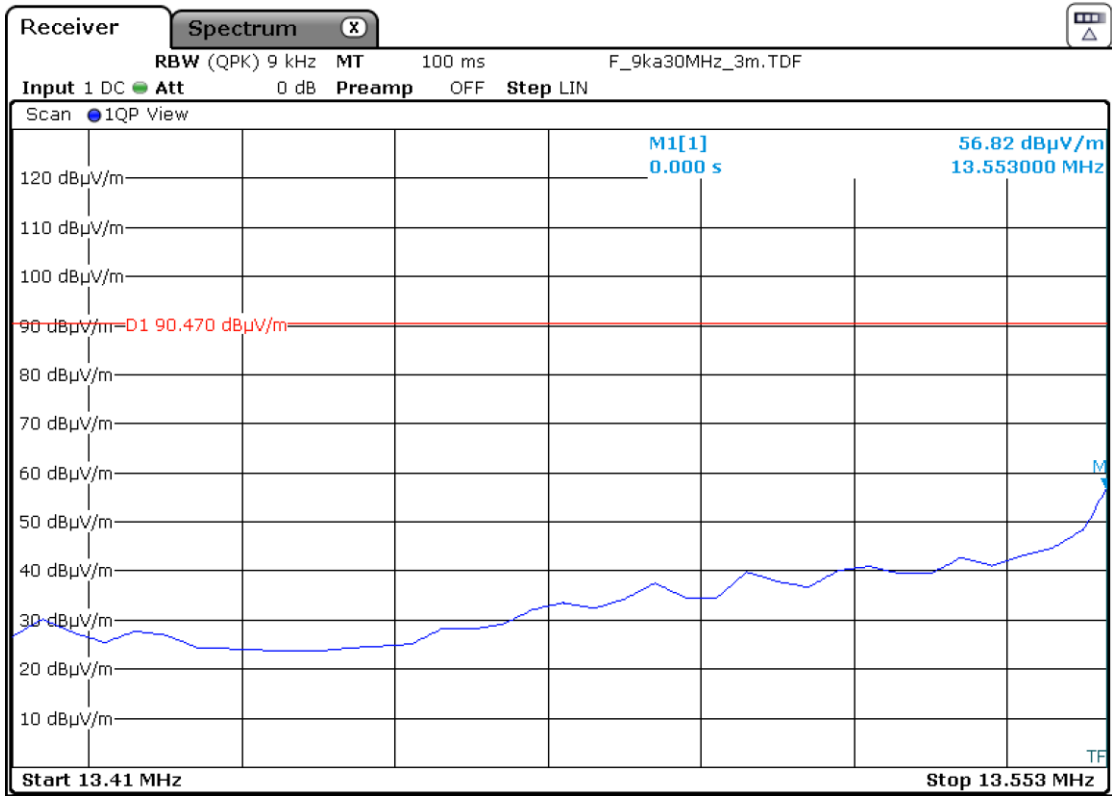


The limit shown in the above plot is extrapolated to 3 meters

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	56.82	16.82
Measurement uncertainty (dB)	<±3.44	



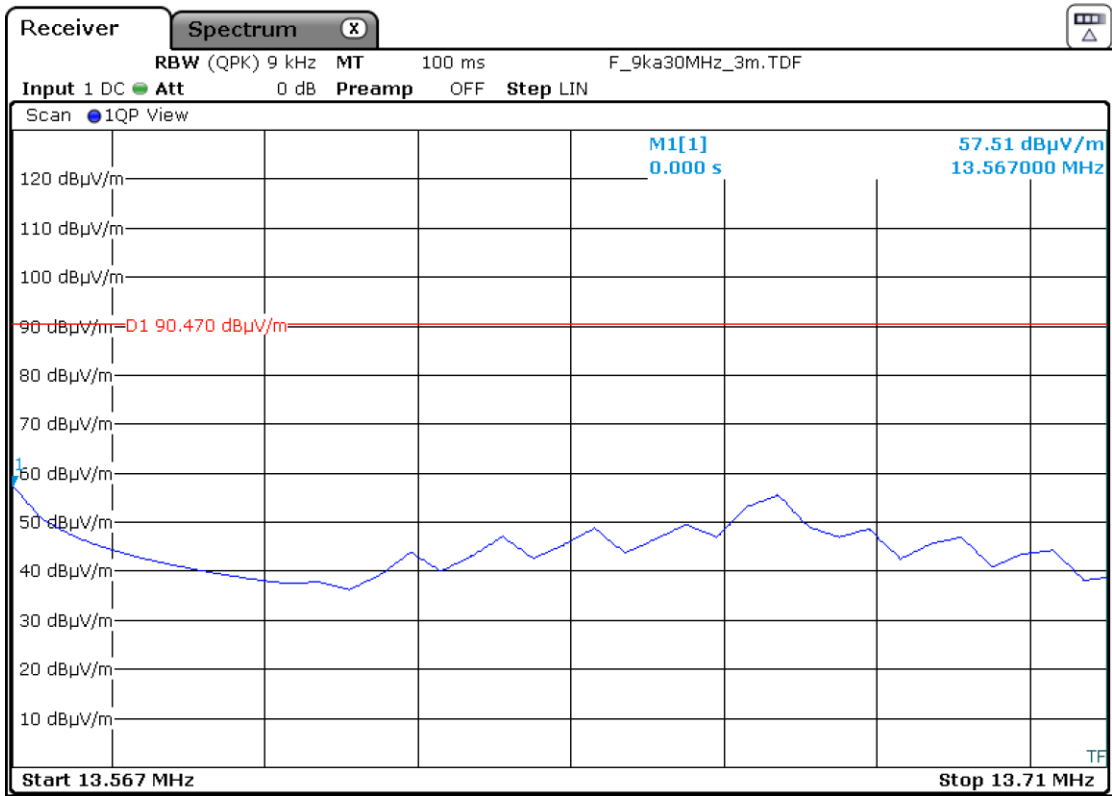
The limit shown in the above plot is extrapolated to 3 meters

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	57.51	17.51
Measurement uncertainty (dB)	<±3.44	

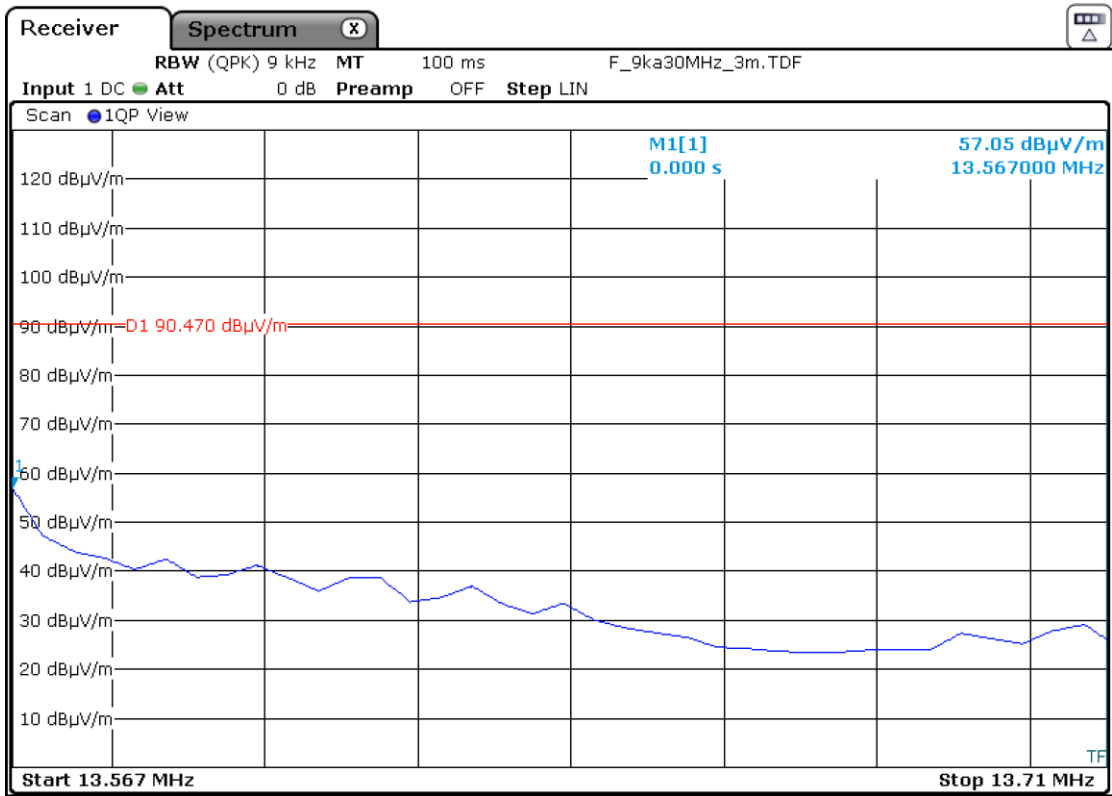


The limit shown in the above plot is extrapolated to 3 meters

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	57.05	17.05
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.

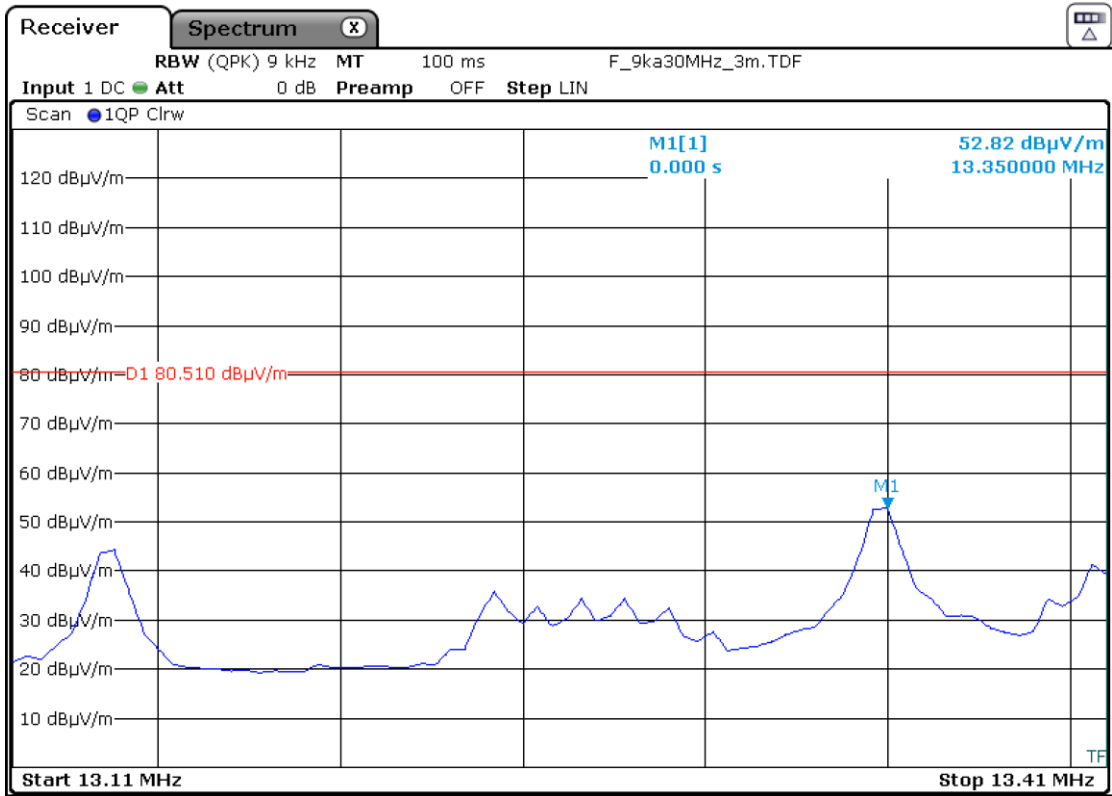
RESULTS:

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	52.82	12.82
Measurement uncertainty (dB)	<±3.44	

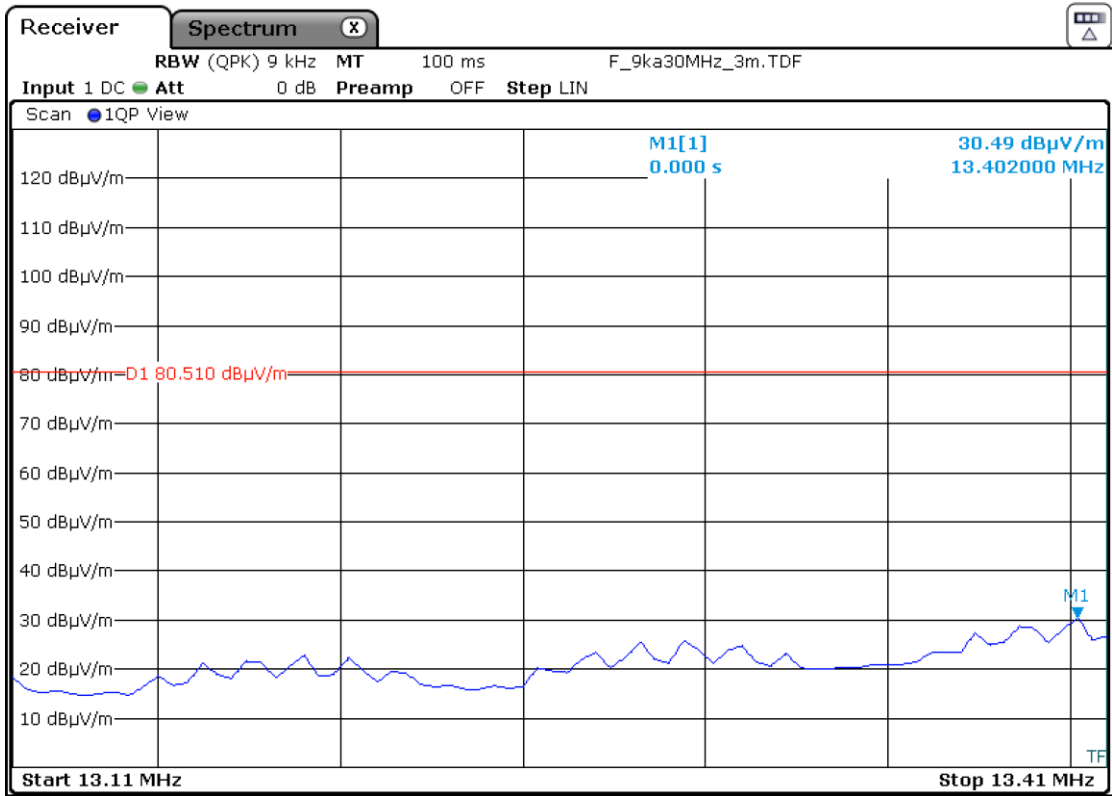


The limit shown in the above plot is extrapolated to 3 meters

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	30.49	-9.51
Measurement uncertainty (dB)	<±3.44	



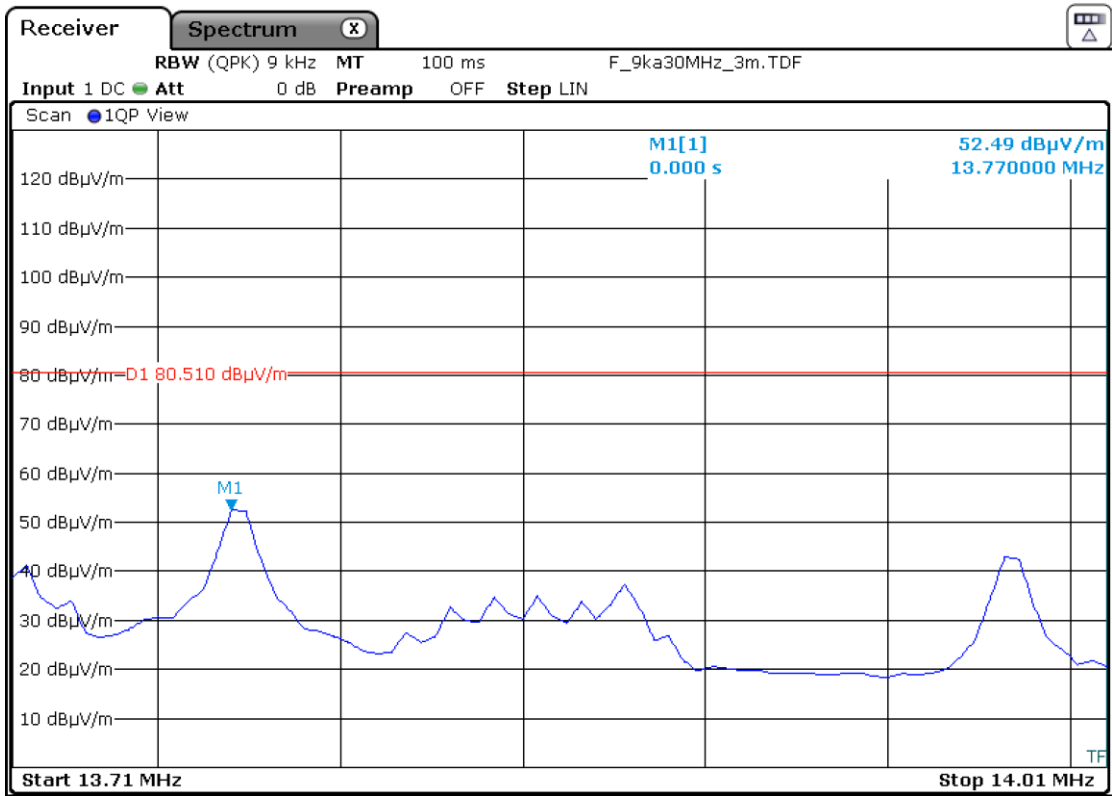
The limit shown in the above plot is extrapolated to 3 meters

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	52.49	12.49
Measurement uncertainty (dB)	<±3.44	

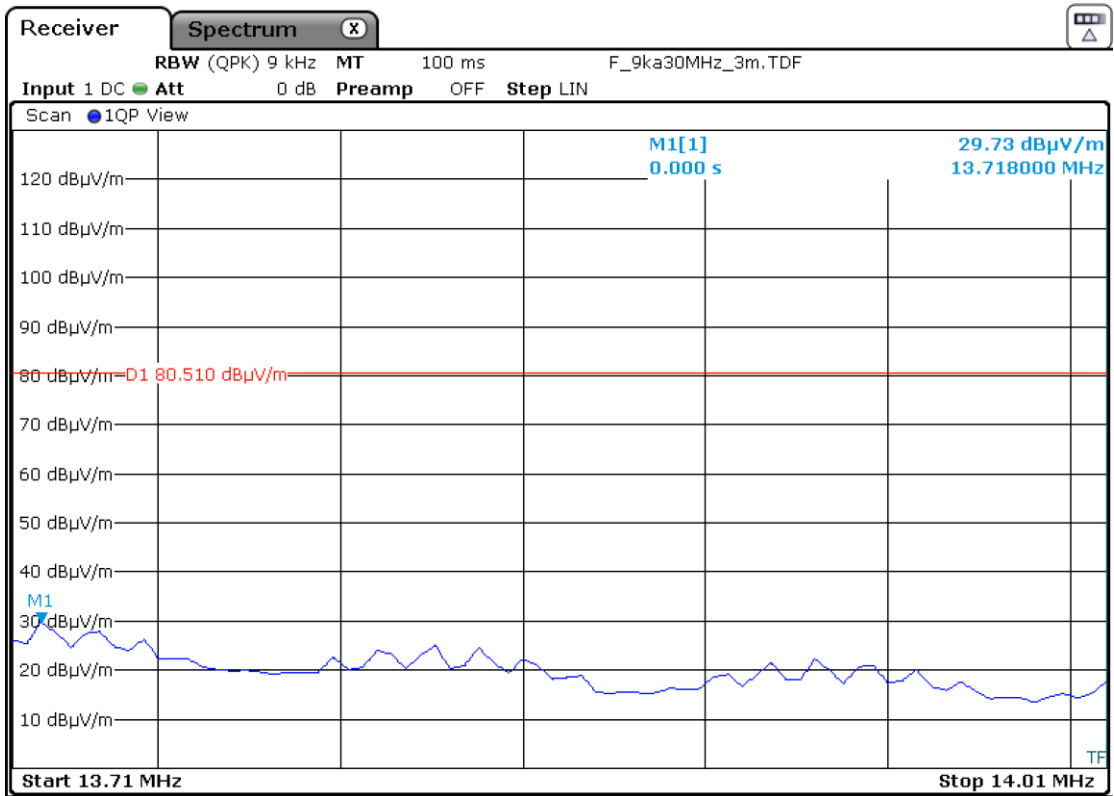


The limit shown in the above plot is extrapolated to 3 meters

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	29.73	-10.27
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.

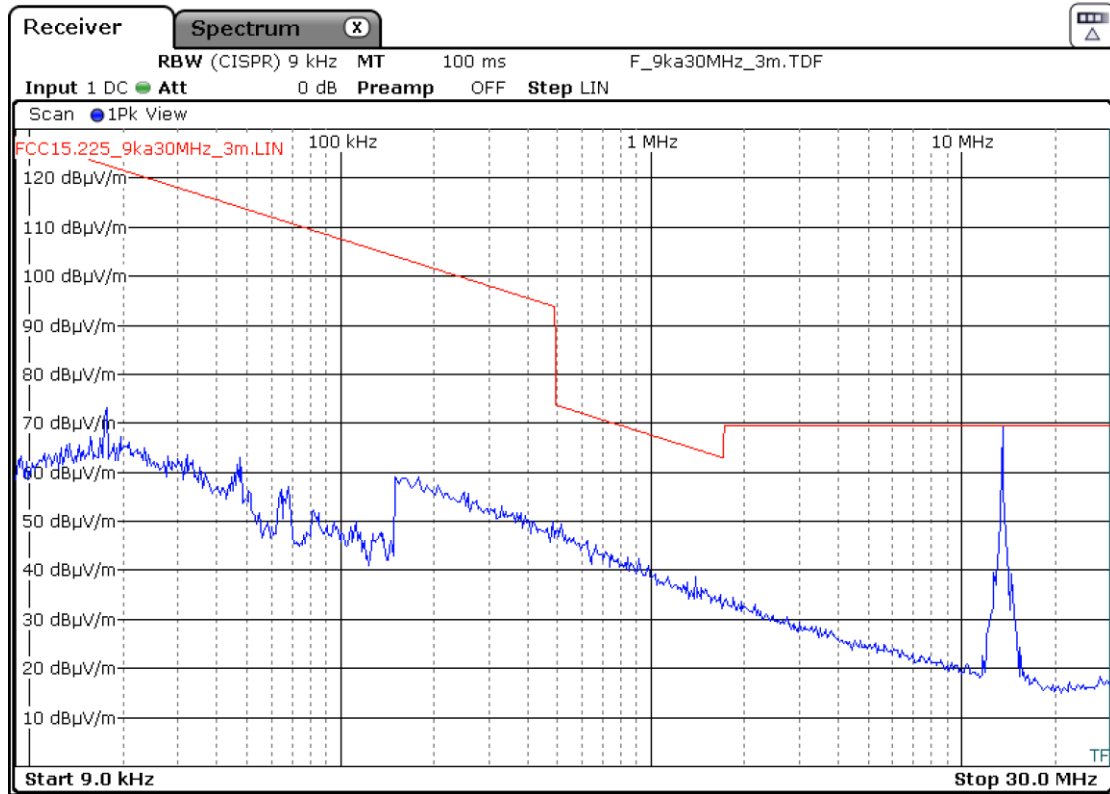
The spectrum was inspected from 9 kHz to 200 MHz searching for spurious signals.

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.

- 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.

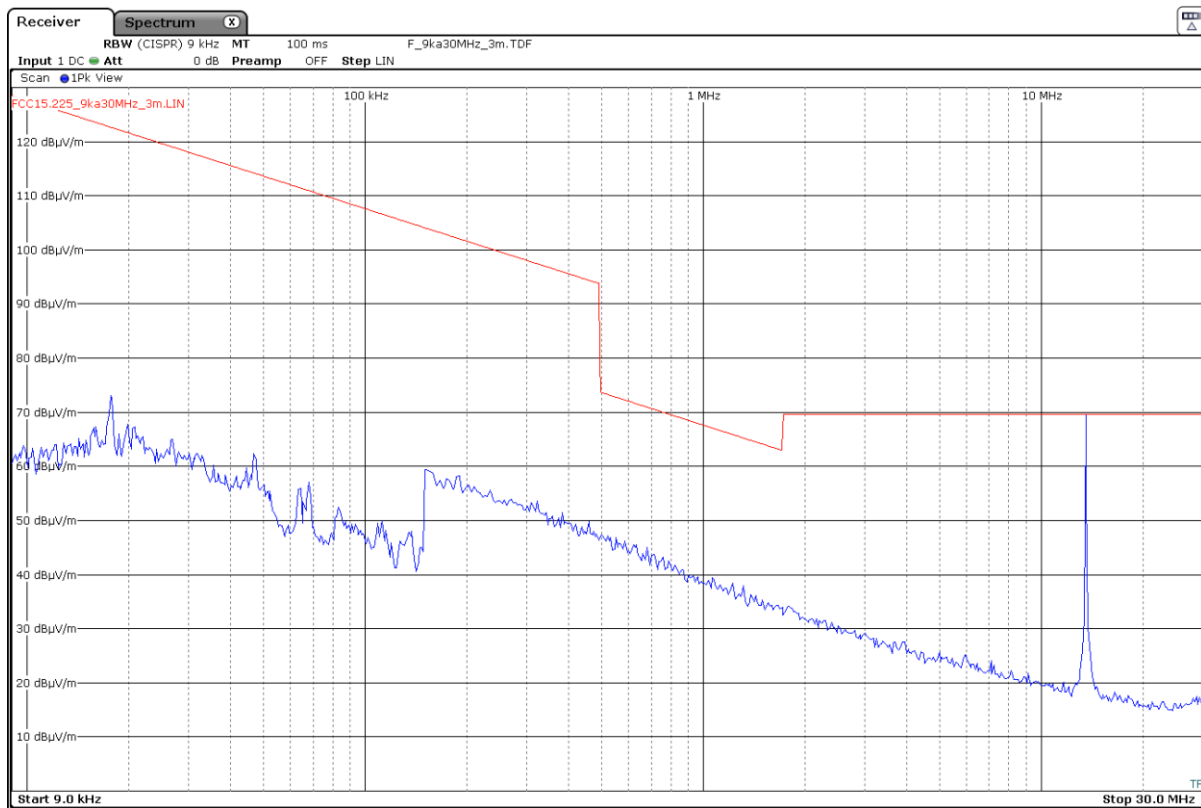
Resolution bandwidth:

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:

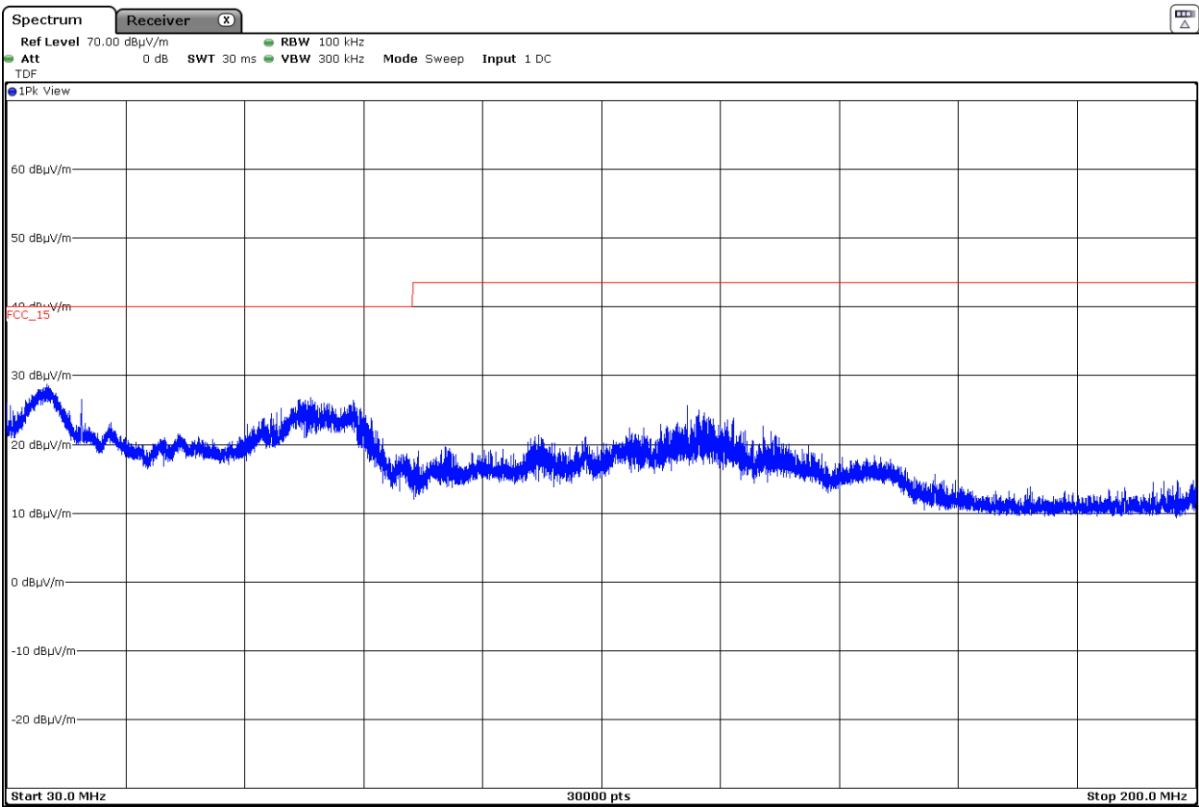
200 Hz for $9 \text{ kHz} \leq f \leq 150 \text{ kHz}$

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

- Frequency range 30 - 200 MHz

- NFC mode ISO 14443A

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
35.6865	Quasi peak	23.2	V	<± 3.88
40.6788	Quasi peak	25.1	V	<± 3.88

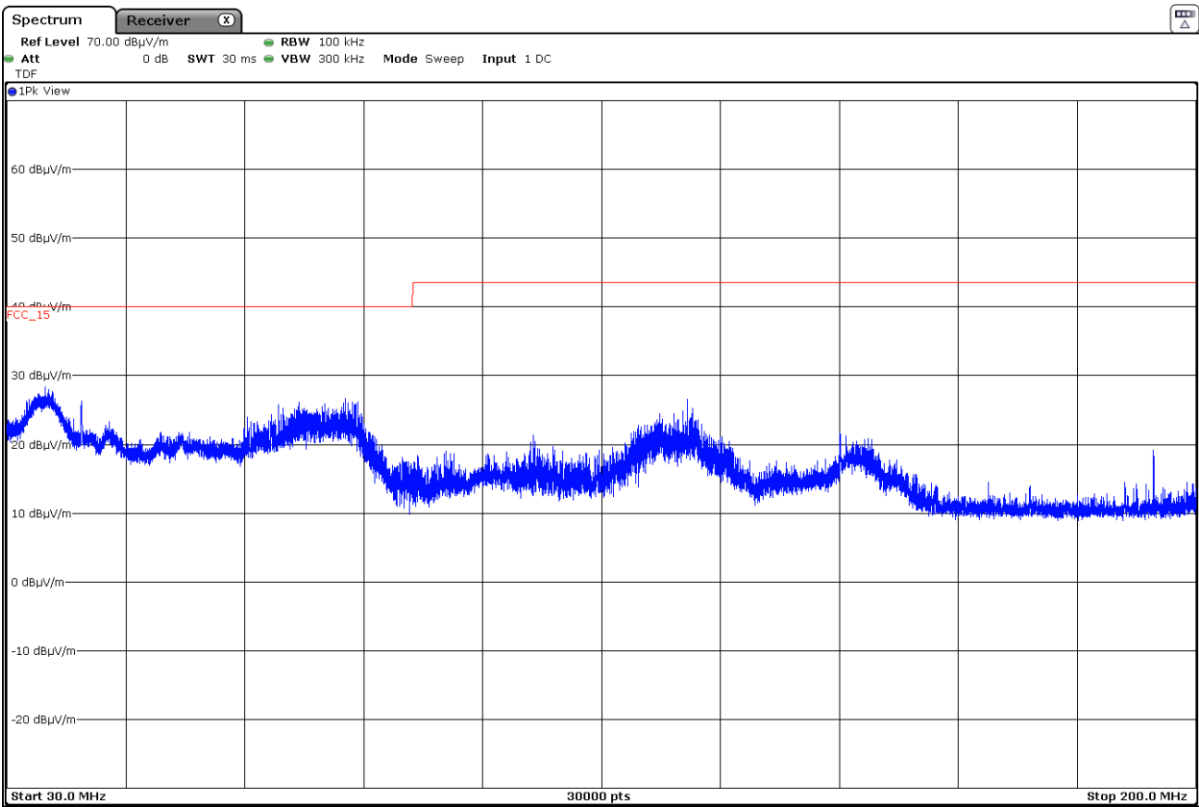


The above plot shows the results of the scan using peak detector.

Verdict: PASS

• **NFC mode ISO 15693**

Spurious frequency (MHz)	Detector	Emission Level (dBµV/m)	Polarization	Measurement Uncertainty (dB)
35.4712	Quasi peak	22.7	V	<± 3.88
40.6902	Quasi peak	25.6	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 (Hz)	Frequency Error (%)
+50	1.310	0.000010
+40	1.794	0.000013
+30	4.165	0.000031
+20	3.521	0.000026
+10	0.735	0.000005
0	0.933	0.000007
-10	1.820	0.000013
-20	1.023	0.000008

- Frequency stability over voltage variations:

DC Supply	Voltage (V)	Frequency Error (Hz)	Frequency Error (%)
Vmax	13.8	6.568	0.000048
Vmin	10.2	5.468	0.000040

Verdict: PASS

- **NFC mode ISO 15693**

- Frequency stability over temperature variations:

Temperature (°C)	Frequency Error (Hz)	Frequency Error (%)
+50	5.132	0.000038
+40	5.132	0.000038
+30	4.370	0.000032
+20	4.370	0.000032
+10	4.370	0.000032
0	4.470	0.000033
-10	8.240	0.000061
-20	5.121	0.000038

- Frequency stability over voltage variations:

DC Supply	Voltage (V)	Frequency Error (Hz)	Frequency Error (%)
Vmax	13.8	4.378	0.000032
Vmin	10.2	4.378	0.000032

Verdict: PASS