

Test report

Number T251-0043/23

Project file: C20230005

Date: 2023-04-18

Pages: 35

Product: Contactless reader

Type reference: CLRD730

Ratings: 5 Vdc; 450 mA
Protection class: III

Trademark: /

Applicant: ČETRТА POT, d.o.o., Kranj
Planina 3, SI-4000 Kranj, Slovenia

Manufacturer: ČETRТА POT, d.o.o., Kranj
Planina 3, SI-4000 Kranj, Slovenia

Place of manufacture: ČETRТА POT, d.o.o., Kranj
Planina 3, SI-4000 Kranj, Slovenia

Summary of testing

Testing method: 47 CFR Part 15.225 in conjunction with ANSI C63.10:2013

Testing location: SIQ Ljubljana
Mašera-Spasičeva ulica 10, SI-1000 Ljubljana, Slovenia

Remarks: Date of receipt of test items: 2022-12-12
Number of items tested: 1
Date of performance of tests: 2023-01-09 – 2023-02-17
The test results presented in this report relate only to the items tested.
The test items were tested in the condition as received.
The product complies with the requirements of the testing methods.

Tested by: Luka Cvajnar

Approved by: Marjan Mak



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1 GENERAL

History sheet			
Date	Report No.	Change	Revision
2023-04-18	T251-0043/23	Initial Test Report issued.	--

Environmental conditions:

Ambient temperature: 15°C to 35°C

Relative humidity: 30% to 60%

Atmospheric pressure: 860 mbar to 1060 mbar

1.1 Equipment under test

Contactless card reader

Type: CLRD730

FCC ID: 2ADMJCLRD730

Equipment Description

Software version :	05.02.00
Firmware version :	01.00.00
Hardware version:	1.1
SIQ tested number :	S202300809
Serial number :	0025..44
One/two/three phase EUT:	USB powered
Floor standing / table-top equipment or a combination:	Table top
Operating frequency:	13.56 MHz
Built in RFID module	
Manufacturer:	Četrta pot
Antenna type:	PCB type, 63 mm x 63 mm
Modulation type:	100% ASK modified Muller encoding
Number of channels:	2

Highest Internal Frequency (Fx)

Frequency (MHz)	Description
13.56 MHz	RFID module
27.12 MHz	Microcontroller clock

Copy of marking plates (examples):

The artwork below may be only a draft. The use of certification marks on a product must be authorized by the respective NCBS that own these marks.





1.1.1 General product information

Contactless reader CLRD730 is intended to send and receive data according to the ISO 14443A and ISO 14443B protocol. Data transfer from reader to/from contactless cards operates at frequency 13.56 MHz.

At the other side the reader communicates with a host computer via serial USB interface. There is also a mode button available on the side of the devices housing.

Contactless reader CLRD730 is intended for development use and supports large set of commands. Users can also write user specific application for their required needs.

Other possibilities for development purposes are via additional interfaces: I2C Master, I2C Slave and SWD serial interface. I2C Master Interface is available via external connector. SWD interface and additional I2C Slave port are available direct from Peridot 3.1 printed board (Headers). Some other signals are also available direct from Peridot 3.1 printed board: IRQ, AUX, SEL.

CLRD730's main functions are:

- Sending and receiving data to/from contactless cards according ISO 14443A and ISO 14443B protocol.
- Supporting MIFARE contactless memory cards (from Mifare Standard to Mifare DESFire EV3).
- ISO16593 / ISO18000-3 mode 1.
- Contactless card reading distance up to 75 mm.
- ISO/IEC 18000-3-M1&M3 with data rates up to 212kb/s (ICODE, NTAG5).
- ISO/IEC 18000-3-M1&M3 with data rates up to 212kb/s (ICODE, NTAG5).
- ISO 7816 contactless wrapped support to allow mobile interaction (MIFARE2GO).
- The data exchange from Reader to the host PC over USB 2.0 port, or from development board via I2C and SWD interface.

1.2 Antenna requirements (§15.203)

Requirement

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Conclusion:

PASS; EUT has internal PCB antenna.

2 LIMITS

2.1 Subpart C: Intentional Radiators

2.1.1 Section 15.207, Conducted emission limits:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	66 – 56*	56 – 46*
0.5 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 μ V within the frequency band 535-1705 kHz, as measured using a 50 μ H/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

2.1.2 Section 15.209, Radiated emission limits:

Limits:

Frequency Range (MHz)	Limits (dB μ V/m)		Test distance (m)
	VERTICAL	HORIZONTAL	
0,009 to 0,490	$20 \cdot \log(2400/F(\text{kHz}))$	$20 \cdot \log(2400/F(\text{kHz}))$	300
0,490 to 1,705	$20 \cdot \log(24000/F(\text{kHz}))$	$20 \cdot \log(24000/F(\text{kHz}))$	30
1,705 to 30,0	30	30	30
30 to 88	40**	40**	3
88 to 216	43.5**	43.5**	3
216 to 960	46**	46**	3
Above 960	54	54	3

** Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

Additional provisions to the general radiated emission limitations – Section 15.215: In no case shall the level of the unwanted emissions from an intentional radiator operating under these additional provisions exceed the field strength of the fundamental emission as per clause 15.209.

Intentional radiators operating under the alternative provisions to the general emission limits must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

3 ALL TEST EQUIPMENT AND THEIR DESCRIPTION

3.1 General information

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESR 7	111549	2022-01	2023-07	18 months	
Rohde-Schwarz, RFI receiver	ESW 8	100958	2022-05	2023-11	18 months	
Rohde-Schwarz, RFI receiver	ESU26	100428	2022-01	2023-07	18 months	X
Rohde & Schwarz, Artificial main network	ESH2-Z5	106899	2021-08	2024-08	36 months	
Rohde & Schwarz, Artificial main network	ENV216	109818	2021-08	2024-08	36 months	X
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	NPS001	2022-04	2025-04	36 months	
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	NPS002	2022-04	2025-04	36 months	X
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	102508	2020-08	2023-08	36 months	X
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	100842	2020-09	2023-09	36 months	X
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	102494	2020-07	2023-07	36 months	
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100843)	100843	2020-07	2023-07	36 months	
Maturo, Turn table (2 m diameter)	TT 2.0 SI	/	N/A	N/A	N/A	X
Maturo, Bore-sight antenna mast	BAM-4.0-P	/	N/A	N/A	N/A	X
Maturo, Multi-channel positioning equipment	Maturo NCD	/	N/A	N/A	N/A	X
Schwarzbeck, Biconical antenna	VHBB9124 (SN 9124-317)	105112	2021-04	2024-04	36 months	/
Schwarzbeck, Loop Antenna	FMZB 1519 B	109081	2022-10	2024-04	18 months	X
Kambič, Temperature chamber	I-190 CK	107298	N/A	N/A	/	X

3.2 Other instrument information and auxiliary equipment

Description	Model No.	Bandwidth	Detector functions	Antenna factors	Cable loss	Range
Rohde-Schwarz, AMN	ENV216	/	/	/	/	9 kHz – 30 MHz
Rohde & Schwarz, Artificial main network	ESH 2-Z5	/	/	/	/	9 kHz – 30 MHz
Rohde-Schwarz, RFI receiver	ESU8	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 8 GHz
Rohde-Schwarz, RFI receiver	ESU26	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	20 Hz – 26.5 GHz
Hewlett Packard, RF Spectrum Analyzer	8593E	200Hz, 9kHz, 120kHz, 1MHz	Peak, Q-peak, Average	/	/	9 kHz – 26.5 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100843)	/	/	See section 3.2.2	/	30 MHz – 6 GHz
Schwarzbeck, Biconical antenna	VHBB9124 (SN 9124-317)	/	/	See section 3.2.2	/	30 MHz – 300 MHz
Schwarzbeck, Loop Antenna	FMZB 1519 B	/	/	See section 3.2.2	/	9 kHz – 30 MHz

3.2.1 Antenna factors

3.2.2.2 Antenna FMZB 1519 B

Frequency (MHz)	Antenna factor (dB)
0,009	-30,60
0,010	-30,80
0,020	-31,80
0,030	-32,00
0,040	-32,10
0,050	-32,20
0,060	-32,20
0,070	-32,20
0,080	-32,20
0,090	-32,30
0,100	-32,30
0,150	-32,30
0,200	-32,40
0,300	-32,40
0,400	-32,40
0,500	-32,40
0,600	-32,40
0,700	-32,50
0,800	-32,50
0,900	-32,50
1,000	-32,50
2,000	-32,50
3,000	-32,50
4,000	-32,50
5,000	-32,50
6,000	-32,50
7,000	-32,50
8,000	-32,50
9,000	-32,50
10,000	-32,50
11,000	-32,50
12,000	-32,50
13,000	-32,50
14,000	-32,40
15,000	-32,40
16,000	-32,40
17,000	-32,40
18,000	-32,30
19,000	-32,30
20,000	-32,20
21,000	-32,10
22,000	-32,10
23,000	-32,00
24,000	-31,90
25,000	-31,80
26,000	-31,70
27,000	-31,60
28,000	-31,50
29,000	-31,40
30,000	-31,30

3.2.2.3 Antenna HL562E

Frequency (MHz)	Antenna factor HL562E (SN 100842)	Antenna factor HL562E (SN 100843)
30	18.12	18.17
32	17.08	17.07
34	16.01	16
36	14.91	14.94
38	13.76	13.75
40	12.64	12.61
42	11.43	11.4
44	10.17	10.15
46	8.86	8.81
48	7.42	7.44
50	6.01	5.96
52	4.59	4.56
54	3.38	3.37
56	2.84	2.85
58	3.06	3.14
60	3.78	3.76
62	4.44	4.4
64	5.36	5.32
66	6.19	6.18
68	6.96	6.92
70	7.56	7.52
72	8.04	8.01
74	8.38	8.35
76	8.67	8.64
78	8.88	8.85
80	9.04	9.03
82	9.14	9.09
84	9.2	9.14
86	9.22	9.16
88	9.22	9.17
90	9.21	9.17
92	9.22	9.15
94	9.22	9.16
96	9.21	9.16
98	9.22	9.17
100	9.33	9.05
105	9.38	9.39
110	9.67	9.74
115	9.55	10.33
120	10.51	9.88
125	10.15	9.87
130	9.23	9.13
135	8.79	8.71
140	8.4	8.4
145	7.93	7.82
150	7.74	7.75
155	7.68	7.76
160	7.86	7.78
165	8.47	8.33
170	9.83	9.66
175	10.29	10.3
180	7.86	7.93
185	7.19	7.27
190	7.54	7.21

195	7.32	7.2
200	7.56	7.49
205	7.56	7.68
210	7.71	7.95
215	8.68	8.29
220	8.43	8.49
225	8.51	8.62
230	8.85	8.82
235	9.1	9.05
240	9.31	9.29
245	9.33	9.33
250	9.5	9.45
255	9.71	9.64
260	9.86	9.81
265	9.95	9.9
270	10	10.02
275	10.15	10.15
280	10.37	10.36
285	10.58	10.61
290	10.76	10.8
295	10.84	10.9
300	10.83	11.12
305	11.38	11.37
310	11.36	11.32
315	11.53	11.48
320	11.7	11.67
325	11.84	11.81
330	11.98	11.94
335	12.32	12.13
340	12.19	12.22
345	12.29	12.35
350	12.43	12.47
355	12.59	12.61
360	12.72	12.73
365	12.83	12.81
370	12.99	12.99
375	13.08	13.1
380	13.12	13.11
385	13.21	13.2
390	13.38	13.33
395	13.54	13.5
400	13.65	13.63
405	13.74	13.73
410	13.84	13.83
415	14.14	13.96
420	14.1	14
425	14.13	14.08
430	14.24	14.2
435	14.4	14.4
440	14.55	14.49
445	14.7	14.65
450	14.82	14.79
455	14.89	14.91
460	14.9	15.09
465	15.16	15.19
470	15.24	15.22
475	15.31	15.25
480	15.38	15.32
485	15.48	15.43

490	15.58	15.52
495	15.66	15.6
500	15.72	15.7
505	15.74	15.75
510	15.83	15.82
515	16.05	15.92
520	15.95	15.93
525	15.97	15.97
530	16.05	16.01
535	16.09	16.07
540	16.16	16.15
545	16.21	16.21
550	16.29	16.3
555	16.38	16.41
560	16.51	16.53
565	16.67	16.68
570	16.78	16.85
575	16.87	17.02
580	17.03	17.11
585	17.06	17.08
590	17.1	17.09
595	17.15	17.13
600	17.22	17.18
605	17.28	17.25
610	17.35	17.33
615	17.42	17.37
620	17.41	17.42
625	17.48	17.48
630	17.56	17.55
635	17.67	17.65
640	17.8	17.79
645	17.94	17.95
650	18.08	18.13
655	18.16	18.12
660	18.18	18.03
665	18.12	17.99
670	18.13	18.01
675	18.19	18.09
680	18.26	18.24
685	18.42	18.41
690	18.56	18.56
695	18.62	18.61
700	18.67	18.67
705	18.7	18.74
710	18.74	18.79
715	18.81	18.86
720	18.89	18.95
725	19.09	19.09
730	19.22	19.26
735	19.17	19.23
740	19.19	19.14
745	19.14	19.1
750	19.13	19.09
755	19.17	19.1
760	19.19	19.15
765	19.24	19.21
770	19.34	19.29
775	19.37	19.36
780	19.36	19.36

785	19.43	19.41
790	19.51	19.48
795	19.59	19.56
800	19.7	19.66
805	19.83	19.79
810	19.98	19.95
815	20.07	20.04
820	20.1	19.96
825	20.11	19.92
830	20.09	19.94
835	20.09	19.96
840	20.14	20.05
845	20.19	20.11
850	20.27	20.2
855	20.36	20.29
860	20.42	20.37
865	20.46	20.44
870	20.5	20.51
875	20.52	20.55
880	20.59	20.61
885	20.7	20.69
890	20.82	20.77
895	20.89	20.83
900	20.88	20.92
905	20.83	21.08
910	20.93	21.21
915	21.19	21.17
920	21.22	21.1
925	21.09	21.03
930	20.98	21
935	20.95	21
940	20.96	21.01
945	21	21.04
950	21.05	21.06
955	21.09	21.07
960	21.15	21.13
965	21.23	21.2
970	21.27	21.26
975	21.31	21.3
980	21.36	21.37
985	21.43	21.44
990	21.52	21.53
995	21.63	21.64
1000	21.73	21.73

4 TEST SUMMARY

STANDARDS (details on first page)	Tested		Sample	
	yes	no	pass	not pass
ANSI C63.10-2013; 47 CFR Part 15.225, Subpart C	☒	☐	☒	☐

Test	47 CFR Part 15 section	Section within the report	Conclusion
Restricted bands of operation	15.205	6.1	PASS
Conducted emission	15.207	6.2	PASS
Radiated emission	15.209	6.3	PASS
Bandwidth of the emission	15.215	6.4	PASS
Spectrum mask	15.225	6.5	PASS
Frequency tolerance of the carrier signal	15.225	6.6	PASS

4.1 Operating voltages/frequencies used for testing

Section	Test	Operating conditions
6.1	Restricted bands of operation	5 Vdc
6.2	Conducted emission	120 V, 60 Hz
6.3	Radiated emission	5 Vdc
6.4	Bandwidth of the emission	5 Vdc
6.5	Spectrum mask	5 Vdc
6.6	Frequency tolerance of the carrier signal	5 Vdc

5 CONVERSION FACTORS AND ALL OTHER FORMULAS

Unit	Conversion unit	Formula of conversion
dB μ V	dB μ V/m	dB μ V/m = dB μ V + AF
μ V/m	dB μ V/m	dB μ V/m = 20log(X(μ V/m)/1 μ V)

Test distance stated in standard	Test distance of measurement	Conversion factor
3 m	3 m	/
10 m	3 m	20dB/decade (over 30 MHz)
		40dB/decade (under 30 MHz)

6 EMISSION TESTS

6.1 Restricted bands of operation (§15.205 of FCC 47 CFR 15)

6.1.1 Requirement

Except as shown in paragraph (d) of §15.205 only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090-0.110	16.42-16.423	399.9-410	4.5-5.15
¹ 0.495-0.505	16.69475-16.69525	608-614	5.35-5.46
2.1735-2.1905	16.80425-16.80475	960-1240	7.25-7.75
4.125-4.128	25.5-25.67	1300-1427	8.025-8.5
4.17725-4.17775	37.5-38.25	1435-1626.5	9.0-9.2
4.20725-4.20775	73-74.6	1645.5-1646.5	9.3-9.5
6.215-6.218	74.8-75.2	1660-1710	10.6-12.7
6.26775-6.26825	108-121.94	1718.8-1722.2	13.25-13.4
6.31175-6.31225	123-138	2200-2300	14.47-14.5
8.291-8.294	149.9-150.05	2310-2390	15.35-16.2
8.362-8.366	156.52475-156.52525	2483.5-2500	17.7-21.4
8.37625-8.38675	156.7-156.9	2690-2900	22.01-23.12
8.41425-8.41475	162.0125-167.17	3260-3267	23.6-24.0
12.29-12.293	167.72-173.2	3332-3339	31.2-31.8
12.51975-12.52025	240-285	3345.8-3358	36.43-36.5
12.57675-12.57725	322-335.4	3600-4400	(²)
13.36-13.41			

¹Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz.

²Above 38.6

6.1.2 Test results

See Radiated emission results under 6.3 Radiated emission and 6.5 Spectrum mask.

6.2 Conducted emission measurement (§15.207 of FCC 47 CFR 15)

6.2.1 Requirement

Frequency Range (MHz)	Limits (dBµV)	
	Quasi-peak	Average
0.15 to 0.5	66 – 56*	56 – 46*
0.5 to 5.0	56	46
5.0 to 30.0	60	50

* Decreases with the logarithm of the frequency.

The shown limits in table shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

- For carrier current systems containing their fundamental emission within the frequency band 535-1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.
- For all other carrier current systems: 1000 µV within the frequency band 535-1705 kHz, as measured using a 50 µH/50 ohms LISN.
- Carrier current systems operating below 30 MHz are also subject to the radiated emission limits as appropriate.

6.2.2 Test procedure

- As per clause 6.2 from ANSI C63.10-2013.
- The EUT is placed on a non-conductive 0.8 meters high table, 0.4 meters from the vertical conducting wall of the shielded room with EUT being connected to the power mains through a line impedance stabilization network (LISN). LISN provide 50 Ohm / 50 µH + 5 Ohm of coupling impedance for the measuring instrument.
- Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition.
- AC power lines of EUT are checked for maximum conducted interference.
- The frequency range from 150 kHz to 30 MHz is searched using PEAK, QUASI-PEAK and AVERAGE function of the receiver to determine compliance with Section 15.207 limits outside the transmitter's fundamental emission band. Bandwidth is set to 9 kHz.
- Measurement repeated with a dummy load in lieu of the antenna to determine compliance with Section 15.207 limits within the transmitter's fundamental emission band.



6.2.3 Test results

EUT Information

EUT:

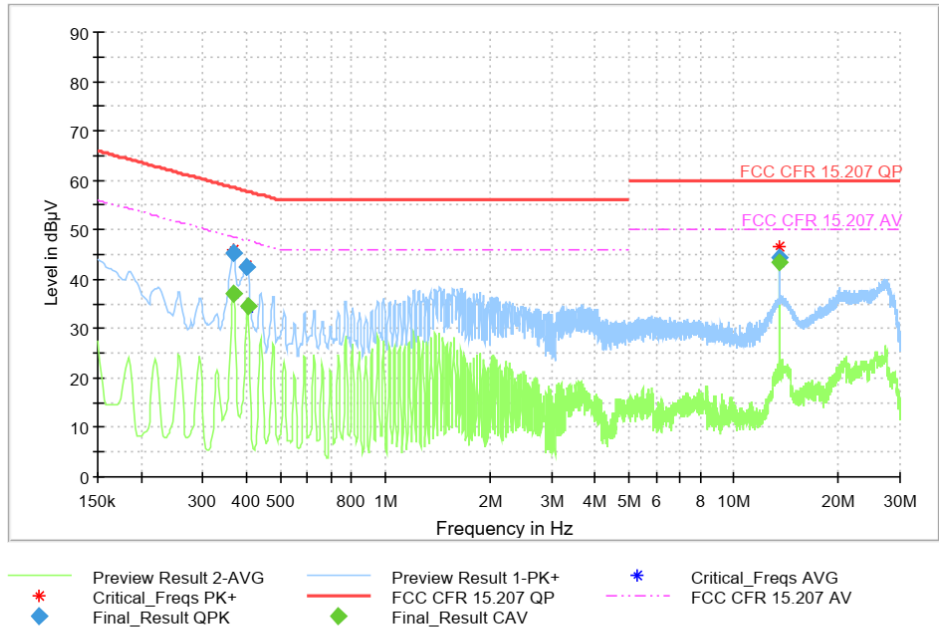
Operating mode:

Line:

Contactless card reader CLRD730

Uin: 120 V / 60 Hz; Waiting for card

L + N



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
13.560000	---	43.53	50.00	6.47	1000.0	9.000	L1	ON	9.8
0.366000	---	37.02	48.59	11.57	1000.0	9.000	L1	ON	9.6
0.368250	45.33	---	58.54	13.21	1000.0	9.000	L1	ON	9.6
0.404250	---	34.52	47.77	13.24	1000.0	9.000	L1	ON	9.6
0.402000	42.34	---	57.81	15.47	1000.0	9.000	L1	ON	9.6
13.560000	44.26	---	60.00	15.74	1000.0	9.000	L1	ON	9.8

EUT Information

EUT:

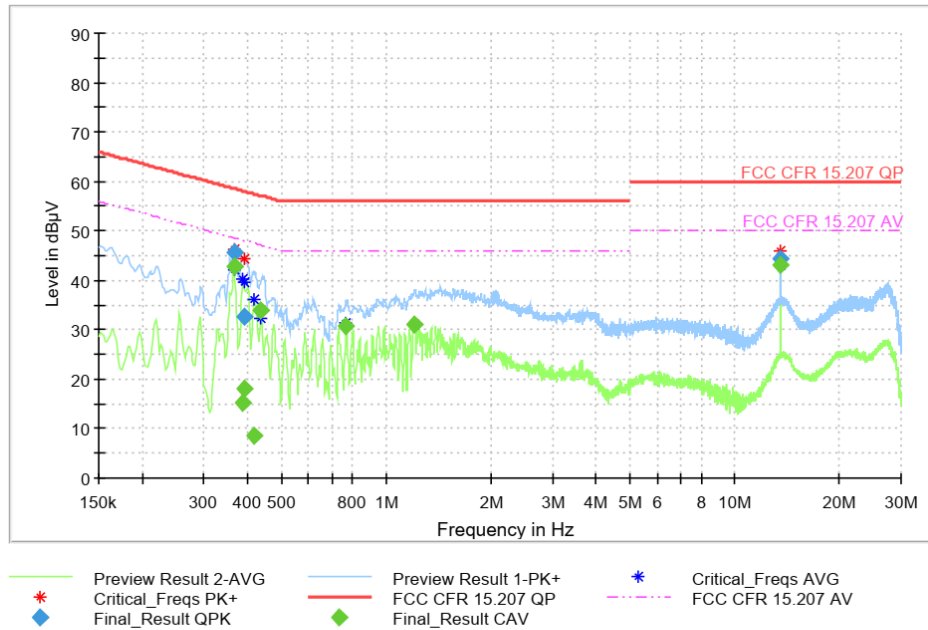
Contactless card reader CLRD730

Operating mode:

Uin: 120 V / 60 Hz; Reading card

Line:

L + N



Final Result

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter	Corr. (dB)
0.366000	---	42.83	48.59	5.76	1000.0	9.000	N	ON	9.6
13.560000	---	43.23	50.00	6.77	1000.0	9.000	L1	ON	9.8
0.368250	45.52	---	58.54	13.02	1000.0	9.000	N	ON	9.6
0.438000	---	33.96	47.10	13.14	1000.0	9.000	N	ON	9.6
1.205250	---	31.08	46.00	14.92	1000.0	9.000	N	ON	9.6
0.766500	---	30.89	46.00	15.11	1000.0	9.000	N	ON	9.6
13.560000	44.39	---	60.00	15.61	1000.0	9.000	L1	ON	9.8
0.390750	32.61	---	58.05	25.44	1000.0	9.000	L1	ON	9.6
0.390750	---	18.12	48.05	29.93	1000.0	9.000	L1	ON	9.6
0.388500	---	15.35	48.10	32.74	1000.0	9.000	L1	ON	9.6
0.420000	---	8.67	47.45	38.78	1000.0	9.000	L1	ON	9.6

6.3 Radiated emission measurement (§15.209 of FCC 47 CFR 15)

6.3.1 Requirement

Frequency Range (MHz)	Limits (dBμV/m)	Test distance (m)
0.009 to 0.490	$20 \cdot \log(2400/F(\text{kHz}))$	300
0.490 to 1.705	$20 \cdot \log(24000/F(\text{kHz}))$	30
1.705 to 30.0	30	30
30 to 88	40**	3
88 to 216	43.5**	3
216 to 960	46**	3
Above 960	54	3

** Except as provided in paragraph below, fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz.

Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications

6.3.2 Test procedure

Measurements from 9 kHz to 30 MHz

1. As per clause 6.4 from ANSI C63.10-2013
2. Radiated emission in the frequency range 9 kHz to 30 MHz are measured Active loop Antenna.
3. First preliminary measurements were performed in Semi-anechoic chamber at a distance of 3 m using active loop antenna.
4. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table and antenna was rotated 360 degrees to determine the position of the highest radiation.
5. Final measurements were done at a distance of 10 m at Open Area Test Site due to low emissions measured during preliminary measurements acc. to the clauses from Part 15, Sections 15.31(d) and 15.31(f)(2). Test results were extrapolated by using the square of an inverse linear distance extrapolation factor (40 dB/decade).

Measurements from 30 MHz to 1 GHz

6. As per clause 6.5 from ANSI C63.10-2013
7. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
8. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
9. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
10. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
11. The test-receiver system was set to PEAK and QUAS-PEAK Detect Function and Specified Bandwidth with Maximum Hold Mode.
12. The highest points would be re-tested one by one using the quasi-peak method.

Measurements from 1 GHz to 18 GHz

13. As per clause 6.6 from ANSI C63.10-2013
14. The EUT was placed on the top of a rotating table 1.5 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
15. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
16. The antenna is a horn antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
17. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.
18. The test-receiver system was set to AVERAGE Detect Function and Specified Bandwidth with Maximum Hold Mode.
19. The highest points would be re-tested one by one using the AVERAGE detector.

6.3.3 Test results

Device passed the requirements stated in 47 CFR Part 15, Subpart C, Section 15.209

Preliminary measurements at 3 m:

EUT Information

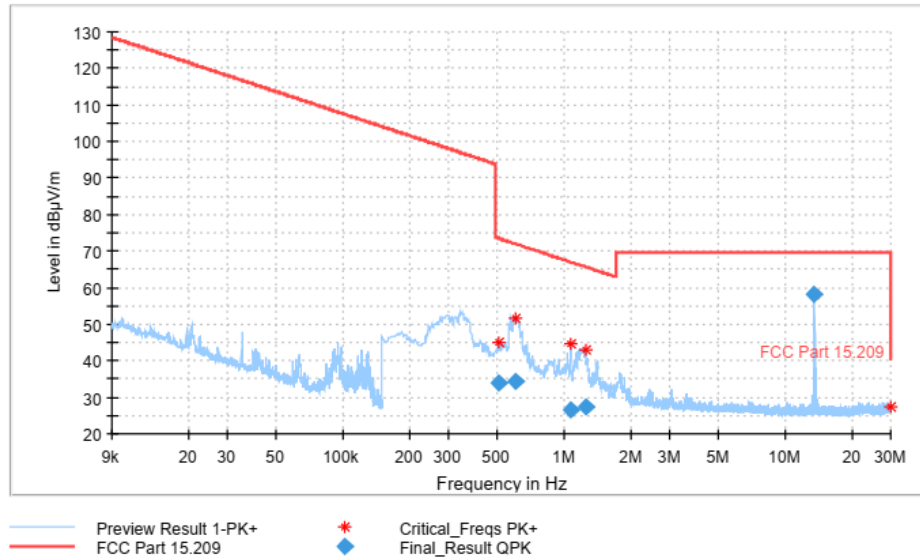
EUT:

Operating mode

Contactless card reader CLRD730

Waiting for EV1 card

Full Spectrum



Final Result

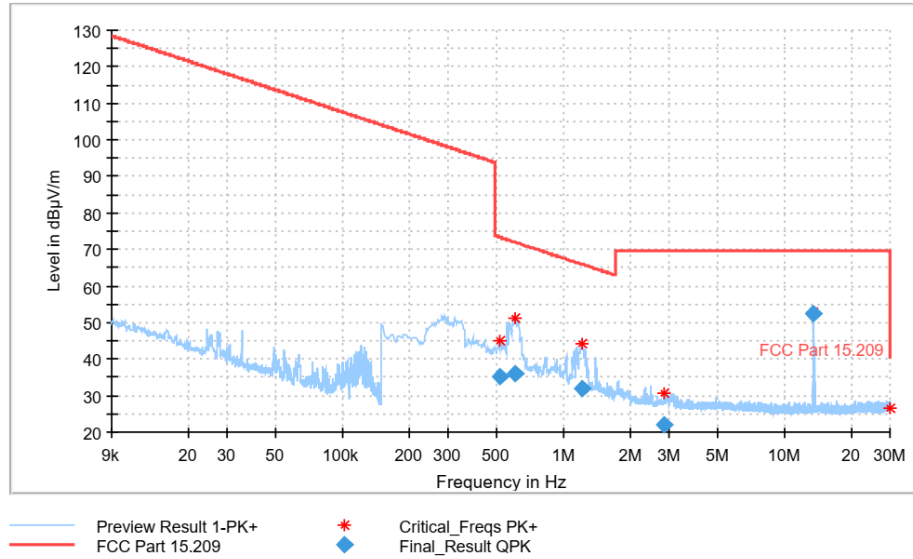
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth (deg)	Corr. (dB/m)
13.560000	58.01	69.50	11.49	H	0.0	19.3
0.604500	34.55	71.98	37.43	H	2.0	19.1
1.243500	27.44	65.73	38.29	H	0.0	19.1
0.507750	33.84	73.49	39.65	H	2.0	19.1
1.068000	26.65	67.05	40.40	H	0.0	19.1

EUT Information

EUT:
Operating mode

Contactless card reader CLRD730
Reading EV1 card

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Azimuth h (deg)	Corr. (dB/m)
13.560000	52.58	69.50	16.92	H	358.0	19.3
1.216500	32.01	65.92	33.91	H	0.0	19.1
0.600000	35.95	72.05	36.10	H	0.0	19.1
0.519000	35.28	73.30	38.02	H	0.0	19.1
2.863500	22.00	69.50	47.50	H	0.0	19.1

Final measurement at 10 m on OATS

Results with measuring distance of 10 m				
Mode	Frequency (MHz)	Measured value (dBμV/m)	Limit (dBμV/m)	Margin (dB)
Waiting for card	13.56	50.18	103	52.82
Reading card	13.56	45.99	103	57.59

Calculated value from 10 m to 30 m						
Mode	Frequency (MHz)	Measured value at 10 m (dBμV/m)	Correction factor from 10 m to 30 m (dB)	Calculated value at 30 m (dBμV/m)	Limit at 30 m (dBμV/m)	Margin (dB)
Waiting for card	13.56	50.18	19	31.18	84.00	52.82
Reading card	13.56	45.99	19	26.99	84.00	57.01

NOTE: Antenna factor and cable loss are included in measurement correction.

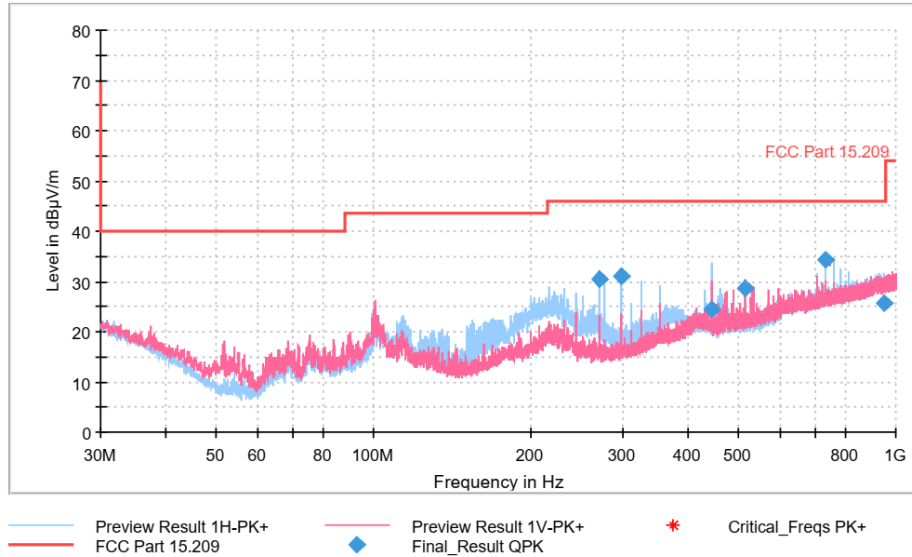
Final measurements from 30 MHz to 1 GHz

EUT Information

EUT:
Operating mode

Contactless card reader CLRD730
Waiting for EV1 card

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	DET 2 (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
732.270000	34.18	---	46.00	11.82	115.0	H	253.0
298.320000	31.01	---	46.00	14.99	100.0	H	82.0
271.200000	30.39	---	46.00	15.61	100.0	H	82.0
515.280000	28.66	---	46.00	17.34	100.0	V	0.0
949.200000	25.59	---	46.00	20.41	150.0	H	40.0
444.000000	24.42	---	46.00	21.58	102.0	H	0.0

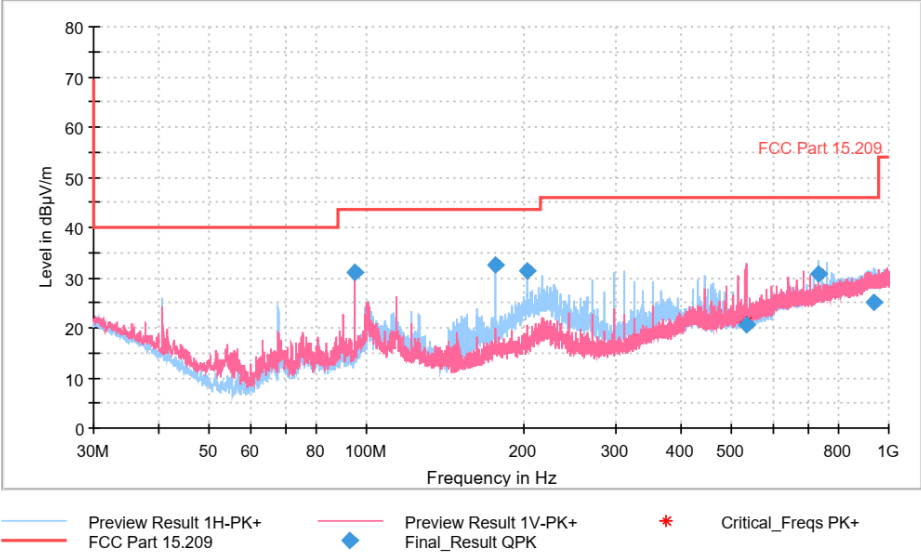


EUT Information

EUT:
Operating mode

Contactless card reader CLRD730
Reading EV1 card

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	DET 2 (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
176.280000	32.48	---	43.50	11.02	150.0	H	245.0
203.400000	31.31	---	43.50	12.19	134.0	H	109.0
94.920000	31.15	---	43.50	12.35	102.0	V	165.0
732.240000	30.76	---	46.00	15.24	121.0	H	201.0
934.290000	25.09	---	46.00	20.91	150.0	H	109.0
533.100000	20.52	---	46.00	25.48	102.0	V	35.0

6.4 Bandwidth of the emission (§15.215 of FCC 47 CFR 15)

6.4.1 Requirements

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §15.217 through 15.257 and in subpart E of FCC Part 15, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

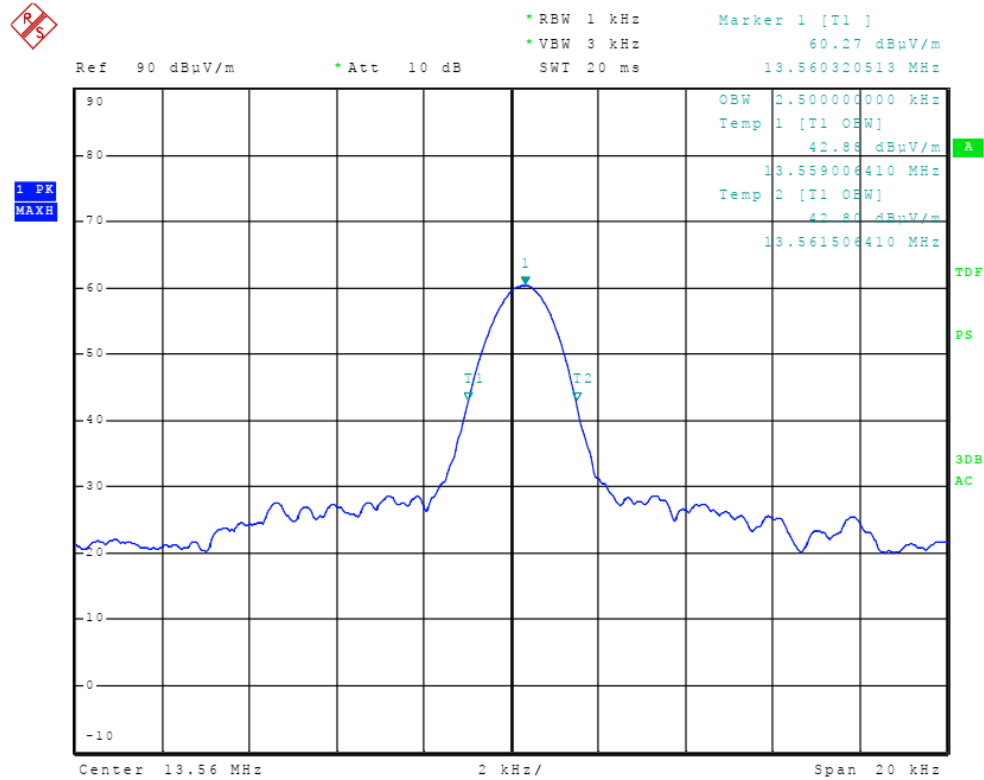
6.4.2 Test procedure

1. As per Clause 6.9.2 from ANSI C63.10-2013
2. The EUT is placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table is rotated 360 degrees to determine the position of the highest radiation.
3. The EUT is set 3 m away from the interference-receiving antenna.
4. Resolution bandwidth is set to a value greater than 5% of the allowed bandwidth.

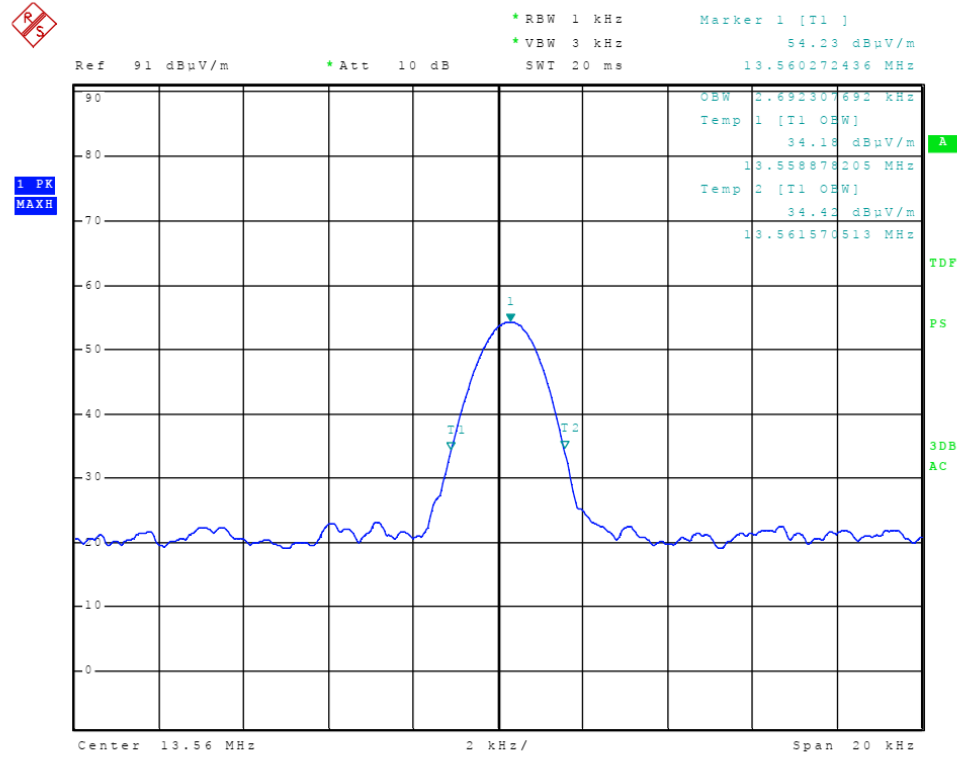
6.4.3 Test results

Device passed the requirements stated in 47 CFR Part 15, Subpart C, Section 15.215

Meas Type	OCCUPIED BANDWIDTH
Equipment under Test	Contactless card reader CLRD730
OP Condition	Waiting on EV1 Card
Test Spec	
Antenna: 0 deg, Sample: 0deg	



Meas Type OCCUPIED BANDWIDTH
Equipment under Test Contactless card reader CLRD730
OP Condition READING EV1 CARD
Test Spec
 Antenn: 0 deg, Sample: 0 deg



Frequency (MHz)	Permitted frequency band (MHz)	20 dB bandwidth (kHz)	PASS/FAIL
13.56	13.110 – 14.010	2.69	PASS

6.5 Spectrum mask (§15.225 (a)-(d) of FCC 47 CFR 15)

6.5.1 Requirements

The field strength of any emissions within the band 13.553-13.567 MHz shall not exceed 15,848 microvolts/meter at 30 meters. 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 at 30 meters. 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 at 30 meters. The field strength of any emissions appearing outside of the 13.110-14.010 MHz band shall not exceed the general radiated emission limits in §15.209.

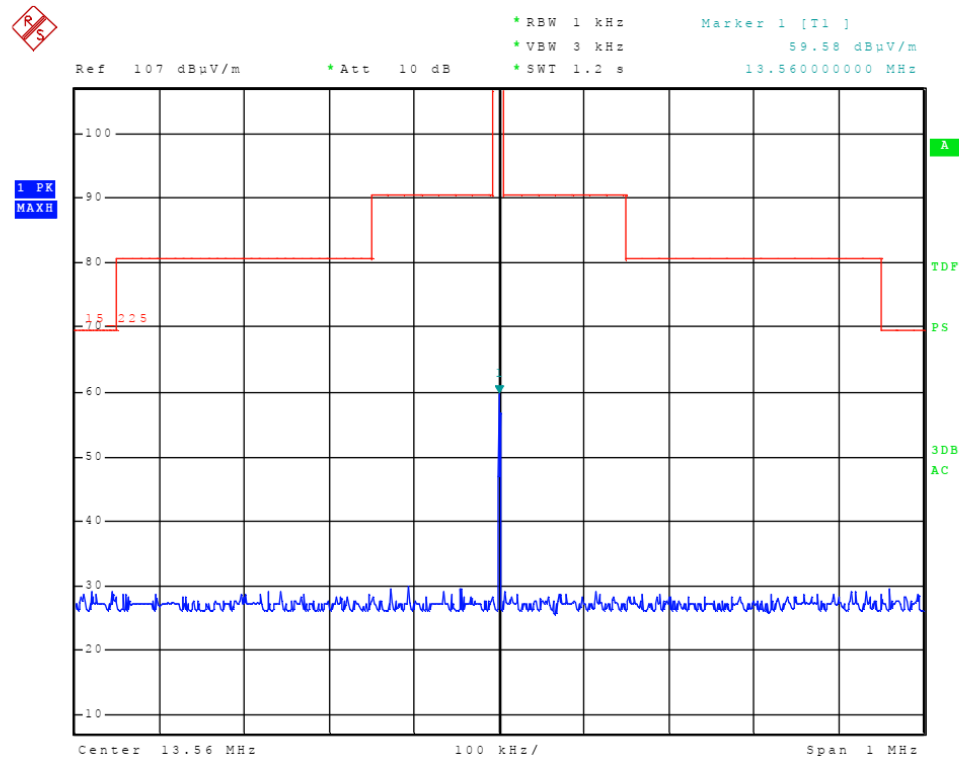
6.5.2 Test procedure

1. As per clause 6.4 from ANSI C63.10-2013
2. The EUT was placed on the top of a rotating table 0.8 meters above the ground in an Anechoic Chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
3. The EUT was set 3 m away from the interference-receiving antenna.
4. Frequencies with maximum emission were retested on OATS.
5. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the turn table was turned from 0 degrees to 360 degrees to find the maximum reading.

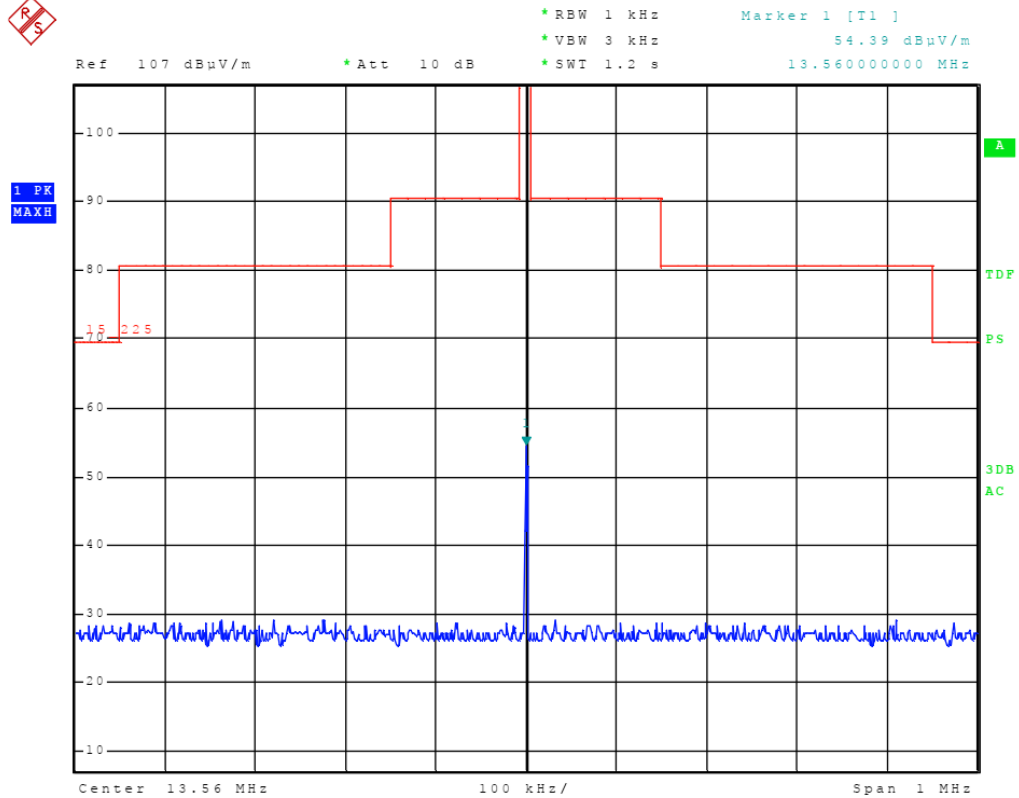
6.5.3 Test results

Device passed the requirements stated in 47 CFR Part 15, Subpart C, Section 15.225

Meas Type SPECTRUM MASK
Equipment under Test Contactless card reader CLRD730
OP Condition WAITING FOR A CARD
Test Spec
Antenn: 0 deg, Sample: 0 deg



Meas Type SPECTRUM MASK
Equipment under Test Contactless card reader CLRD730
OP Condition READING EV1 CARD
Test Spec
 Antenn: 0 deg, Sample: 0 deg



6.6 Frequency tolerance of the carrier signal (§15.225 (e)) of FCC 47 CFR 15)

6.6.1 Requirement

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 battery operated equipment, the equipment tests shall be performed using a new battery.

6.6.2 Test procedure

1. As per clause 6.8 from ANSI C63.10-2013.
2. The frequency tolerance of the carrier signal is measured over a temperature variation of -20 °C to +50 °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 °C.
3. If the EUT provides an antenna connector the spectrum analyzer is connected to this port. In cases where the EUT does not provide an antenna connector a test fixture is used.
4. The peak detector of the spectrum analyzer is selected and the resolution bandwidth as well as the video bandwidth is set to values appropriate to the shape of the spectrum of the EUT.
5. While maintaining a constant temperature inside the environmental chamber, turn the EUT ON and record the operating frequency at startup, and at 2 minutes, 5 minutes, and 10 minutes after the EUT is energized.

6.6.3 Test results

Device passed the requirements stated in of FCC 47 CFR 15, Subpart C, Section 15.225

FREQUENCY STABILITY						
Temperature	Supply voltage (V)	Minutes after switch on	Measured Frequency (MHz)	Allowed tolerance (kHz)	Measured tolerance	RESULT
50	5.0	0	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	2	13.560269200	Fref±1.356 kHz	-0.013	PASS
	5.0	5	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	10	13.560282200	Fref±1.356 kHz	0.000	PASS
40	5.0	0	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	2	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	5	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	10	13.560273500	Fref±1.356 kHz	-0.009	PASS
30	5.0	0	13.560282200	Fref±1.356 kHz	0.000	PASS
	5.0	2	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	5	13.560273500	Fref±1.356 kHz	-0.009	PASS
	5.0	10	13.560273500	Fref±1.356 kHz	-0.009	PASS
20	5.75	0	13.560299600	Fref±1.356 kHz	0.017	PASS
	5.75	2	13.560282200	Fref±1.356 kHz	0.000	PASS
	5.75	5	13.560282200	Fref±1.356 kHz	0.000	PASS
	5.75	10	13.560277900	Fref±1.356 kHz	-0.004	PASS
20	5.0	0	13.560299600	Fref±1.356 kHz	0.017	PASS
	5.0	2	13.560286500	Fref±1.356 kHz	0.004	PASS
	5.0	5	13.560282200	Fref±1.356 kHz	0.000	PASS
	5.0	10	13.560282200	Fref	0.000	PASS
20	4.25	0	13.560295200	Fref±1.356 kHz	0.013	PASS
	4.25	2	13.560286500	Fref±1.356 kHz	0.004	PASS
	4.25	5	13.560286500	Fref±1.356 kHz	0.004	PASS
	4.25	10	13.560286500	Fref±1.356 kHz	0.004	PASS
10	5.0	0	13.560338600	Fref±1.356 kHz	0.056	PASS
	5.0	2	13.560325600	Fref±1.356 kHz	0.043	PASS
	5.0	5	13.560321300	Fref±1.356 kHz	0.039	PASS
	5.0	10	13.560321300	Fref±1.356 kHz	0.039	PASS
0	5.0	0	13.560343000	Fref±1.356 kHz	0.061	PASS
	5.0	2	13.560334300	Fref±1.356 kHz	0.052	PASS
	5.0	5	13.560334300	Fref±1.356 kHz	0.052	PASS
	5.0	10	13.560334300	Fref±1.356 kHz	0.052	PASS
-10	5.0	0	13.560338600	Fref±1.356 kHz	0.056	PASS
	5.0	2	13.560343000	Fref±1.356 kHz	0.061	PASS
	5.0	5	13.560343000	Fref±1.356 kHz	0.061	PASS
	5.0	10	13.560343000	Fref±1.356 kHz	0.061	PASS
-20	5.0	0	13.560325600	Fref±1.356 kHz	0.043	PASS
	5.0	2	13.560338600	Fref±1.356 kHz	0.056	PASS
	5.0	5	13.560228600	Fref±1.356 kHz	-0.054	PASS
	5.0	10	13.560334300	Fref±1.356 kHz	0.052	PASS

Note: Nominal- > At the beginning of each test sequence the battery was fully charged.