

Test report

Number T251-0401/23 A1

Project file: C20230947

Date: 2023-09-13

Pages: 54

Product: Contactless reader

Type reference: CLRD730

Ratings: 5 Vdc; 450 mA
Protection class: |||

Trademark: /

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

Manufacturer: Četrta pot, d.o.o., Kranj
Planina 3, SI-4000 Kranj, Slovenia

Place of manufacture: Četrta pot, d.o.o., Kranj
Planina 3, SI-4000 Kranj, Slovenia

Summary of testing

Testing method: 47 CFR Part 15, Subpart B (Clause 15.107 and 15.109) in conjunction with
ANSI C63.4:2014
ICES-003, Issue 7 in conjunction with ANSI C63.4:2014

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: 2022-12-19
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
2023-05-09	T251-0401/23	Initial Test Report issued.	--
2023-09-13	T251-0401/23 A1	This test report substitutes previously issued test report T251-0401/23, dated 2023-05-09, due to amendment of the test report. Removed pictures of the test setup.	1.0

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 reader

Type: **CLRD730**

FCC ID: **2ADMJCLRD730**

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.

1.1.1 General product information

Input/Output Ports

Port No.	Name	Type*	Cable Length / m	Cable Shielded
0	Enclosure	N/E	/	/
1	USB-C 1	I/O	/	Yes
2	USB-C 2	I/O	/	/
3	I2C	I/O	/	/
*Note: AC = AC mains power port DC = DC network power port / input d.c. power port I/O = Signal/control port WNP = wired network port GND = grounding N/E = Non-Electrical				

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 (F_x)

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.



Pictures of EUT





1.2 ANSI C63.4 Subpart selection

Subpart B: Unintentional Radiators

Subpart C: Intentional Radiators

1.3 Class statement requirements

- The Class A statement cautions that operation of the device in a residential area is likely to cause harmful interference.
- The Class B statement offers several suggestions for minimizing interference to radio or TV receivers, including reorienting the receiving antenna and moving the Class B device farther away from the receiver.

1.4 Occupied bandwidth measurement

Fundamental frequency	Minimum resolution bandwidth
9 kHz to 30 MHz	1 kHz
30 to 1000 MHz	10 kHz
1000 MHz to 40 GHz	100 kHz

1.5 Quasi-peak detector

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	Full range (wideband)
10 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz

1.6 Peak, rms, and average detectors

Frequency range	Bandwidth (-6dB)
10 Hz to 20 kHz	10, 100, 1000 Hz
10 kHz to 150 kHz	1 and 10 kHz
150 kHz to 30 MHz	1 and 10 kHz
30 MHz to 1 GHz	10 and 100 kHz
1 GHz to 40 GHz	0.1, 1.0 and 10 MHz

2 LIMITS FOR ALL SUBPARTS

2.1 Subpart B: Unintentional Radiators

2.1.1 Conducted emission limits (according to CFR 47 15.107):

CLASS B 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.

CLASS A limits:

Frequency Range (MHz)	Limits (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	79	66
0.5 to 30.0	73	60

2.1.2 Radiated emission limits (according to CFR 47 15.107):

CLASS B limits:

Frequency Range (MHz)	Limits (dB μ V/m)	
	Test distance 3 m	
30 to 88	40	Quasi Peak
88 to 216	43.5	
216 to 960	46	
960 to 1000	54	
above 1000	54	Average
above 1000	74	Peak

CLASS A limits:

Frequency Range (MHz)	Limits (dB μ V/m)	
	Test distance 10 m	
30 to 88	39	Quasi Peak
88 to 216	43.5	
216 to 960	46.4	
960 to 1000	49.5	
above 1000	49.5	Average
above 1000	69.5	Peak

2.2 Subpart C: Intentional Radiators

2.2.1 Conducted emission limits:

CLASS B limits:

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.

2.2.2 Radiated emission limits:

CLASS B limits:

Frequency Range (MHz)	Limits (dBµV/m)		Test distance (m)
0.009 to 0.490	$20 \cdot \log(2400/F(\text{kHz}))$	Quasi Peak	300
0.490 to 1.705	$20 \cdot \log(24000/F(\text{kHz}))$	Quasi Peak	30
1.705 to 30.0	29.5	Quasi Peak	30
30 to 88	40**	Quasi Peak	3
88 to 216	43.5**	Quasi Peak	3
216 to 960	46**	Quasi Peak	3
960 to 1000	54	Quasi Peak	3
above 1000	54	Average	3
above 1000	74	Peak	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.

NOTE: For special limits refer to standard

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, EMI receiver	ESW	109875	2022-05	2023-11	18 months	/
Rohde-Schwarz, RFI receiver	ESU8	105187	2022-11	2024-05	18 months	/
Rohde-Schwarz, RFI receiver	ESU26	106897	2022-01	2023-07	18 months	X
Rohde & Schwarz, Artificial main network	ESH2-Z5	106899	2021-08	2023-02	18 months	/
Rohde & Schwarz, Artificial main network	ENV216	106765	2022-06	2025-06	36 months	/
Rohde & Schwarz, Artificial main network	ENV216	109818	2021-08	2024-08	36 months	/
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	NPS001	2022-04	2025-04	36 months	/
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 109843)	109063	2020-09	2023-09	36 months	/
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	109064	2020-08	2023-08	36 months	/
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	NPS002	2022-04	2025-04	36 months	X
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 100842)	109056	2020-07	2023-07	36 months	X
Rohde & Schwarz, Horn Antenna	HF907 (SN 102508)	109057	2020-08	2023-08	36 months	X
Horn Antenna, EMCO	3116	/	2020-09	2023-09	36 months	X
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
Spectrum Analyzer, Rohde&Schwarz	FSV 40	/	2022-11	2024-05	18 months	/
PMI Low noise amplifier	PEC-42-1G40G	/	2022-04	2023-10	18 months	/

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, EMI receiver	ESW	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
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	/	/	/	/	30 MHz – 18 GHz
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 109843)	/	/	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
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	/	/	/	/	30 MHz – 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 102508)	/	/	See section 3.2.2	/	0.8 GHz – 18 GHz
Horn Antenna, EMCO	3116	/	/	See section 3.2.2	/	18 GHz – 40 GHz

3.2.1 Cable loss and attenuation of radiated emission

3.2.1.1 Conducted emission cable (SIQ-K115)

Frequency (9kHz-30MHz)	Cable length (meters)	Loss (dB)
0.009000	4	0.0
0.010000	4	0.0
0.020000	4	0.0
0.030000	4	0.0
0.040000	4	0.0
0.050000	4	0.0
0.060000	4	0.0
0.070000	4	0.0
0.080000	4	0.0
0.090000	4	0.0
0.100000	4	0.0
0.200000	4	0.1
0.300000	4	0.0
0.400000	4	0.0
0.500000	4	0.0
0.600000	4	0.0
0.700000	4	0.0
0.800000	4	0.0
0.900000	4	0.0
1.000000	4	0.0
2.000000	4	0.1
3.000000	4	0.1
4.000000	4	0.1
5.000000	4	0.1
6.000000	4	0.1
7.000000	4	0.2
8.000000	4	0.2
9.000000	4	0.2
10.000000	4	0.2
20.000000	4	0.3
30.000000	4	0.3

3.2.1.2 Radiated emission attenuation

SAC1		SAC2	
Frequency (30 MHz – 6 GHz)	Attenuation (dB)	Frequency (30 MHz – 6 GHz)	Attenuation (dB)
30.00	0.40	30.00	0.41
35.00	0.43	35.00	0.44
40.00	0.46	40.00	0.47
45.00	0.49	45.00	0.50
50.00	0.52	50.00	0.53
55.00	0.55	55.00	0.55
60.00	0.57	60.00	0.58
65.00	0.59	65.00	0.60
70.00	0.62	70.00	0.63
75.00	0.64	75.00	0.65
80.00	0.66	80.00	0.67
85.00	0.68	85.00	0.70
90.00	0.71	90.00	0.72
95.00	0.73	95.00	0.73
100.00	0.75	100.00	0.76
125.00	0.84	125.00	0.85
150.00	0.93	150.00	0.94
175.00	1.00	175.00	1.01
200.00	1.07	200.00	1.09
225.00	1.14	225.00	1.18
250.00	1.20	250.00	1.23
275.00	1.27	275.00	1.31
300.00	1.33	300.00	1.38
325.00	1.37	325.00	1.48
350.00	1.43	350.00	1.51
375.00	1.49	375.00	1.58
400.00	1.54	400.00	1.62
425.00	1.59	425.00	1.69
450.00	1.65	450.00	1.74
475.00	1.68	475.00	1.82
500.00	1.72	500.00	1.85
525.00	1.79	525.00	1.93
550.00	1.85	550.00	1.98
575.00	1.85	575.00	2.03
600.00	1.95	600.00	2.05
625.00	1.97	625.00	2.16
650.00	2.00	650.00	2.15
675.00	2.05	675.00	2.33
700.00	2.10	700.00	2.25
725.00	2.13	725.00	2.30
750.00	2.19	750.00	2.34
775.00	2.21	775.00	2.44
800.00	2.27	800.00	2.50
825.00	2.31	825.00	2.56
850.00	2.34	850.00	2.55
875.00	2.36	875.00	2.56
900.00	2.41	900.00	2.63
925.00	2.43	925.00	2.70
950.00	2.54	950.00	2.76
975.00	2.52	975.00	2.78
1000.00	2.55	1000.00	2.84
1050.00	2.59	1050.00	2.87
1100.00	2.69	1100.00	2.96
1150.00	2.74	1150.00	3.14
1200.00	2.84	1200.00	3.08
1250.00	2.88	1250.00	3.16
1300.00	2.98	1300.00	3.33

1350.00	3.11	1350.00	3.38
1400.00	3.12	1400.00	3.33
1450.00	3.20	1450.00	3.56
1500.00	3.25	1500.00	3.57
1600.00	3.39	1600.00	3.71
1650.00	3.42	1650.00	3.70
1700.00	3.60	1700.00	3.78
1750.00	3.53	1750.00	3.81
1800.00	3.59	1800.00	3.93
1850.00	3.66	1850.00	4.07
1900.00	3.67	1900.00	4.00
1950.00	3.72	1950.00	4.18
2000.00	3.77	2000.00	4.08
2050.00	3.91	2050.00	4.16
2100.00	3.87	2100.00	4.26
2150.00	3.89	2150.00	4.27
2200.00	3.99	2200.00	4.31
2250.00	3.99	2250.00	4.39
2300.00	4.02	2300.00	4.49
2350.00	4.10	2350.00	4.55
2400.00	4.20	2400.00	4.57
2450.00	4.40	2450.00	4.62
2500.00	4.20	2500.00	4.74
2550.00	4.24	2550.00	4.72
2600.00	4.30	2600.00	4.84
2650.00	4.37	2650.00	4.77
2700.00	4.40	2700.00	4.81
2750.00	4.47	2750.00	4.90
2800.00	4.50	2800.00	5.00
2850.00	4.52	2850.00	4.98
2900.00	4.59	2900.00	5.06
2950.00	4.77	2950.00	5.07
3000.00	4.65	3000.00	5.15
3050.00	4.72	3050.00	5.23
3100.00	4.78	3100.00	5.34
3150.00	4.80	3150.00	5.25
3200.00	4.83	3200.00	5.33
3250.00	4.91	3250.00	5.38
3300.00	4.98	3300.00	5.48
3350.00	4.87	3350.00	5.48
3400.00	4.98	3400.00	5.52
3450.00	5.01	3450.00	5.76
3500.00	5.14	3500.00	5.55
3550.00	5.18	3550.00	5.60
3600.00	5.15	3600.00	5.64
3650.00	5.20	3650.00	5.78
3700.00	5.29	3700.00	5.74
3750.00	5.40	3750.00	5.86
3800.00	5.33	3800.00	5.82
3850.00	5.32	3850.00	5.88
3900.00	5.37	3900.00	5.89
3950.00	5.41	3950.00	5.95
4000.00	5.65	4000.00	6.02
4050.00	5.84	4050.00	6.07
4100.00	5.69	4100.00	6.01
4150.00	5.65	4150.00	6.10
4200.00	5.71	4200.00	6.17
4250.00	5.65	4250.00	6.19
4300.00	5.75	4300.00	6.27
4350.00	5.59	4350.00	6.32
4400.00	5.96	4400.00	6.41
4450.00	5.81	4450.00	6.53

4500.00	6.02	4500.00	6.51
4550.00	5.93	4550.00	6.46
4600.00	5.90	4600.00	6.61
4650.00	6.03	4650.00	6.82
4700.00	5.96	4700.00	6.60
4750.00	6.47	4750.00	6.63
4800.00	6.07	4800.00	6.78
4850.00	6.36	4850.00	6.69
4900.00	6.05	4900.00	6.77
4950.00	6.81	4950.00	6.95
5000.00	6.25	5000.00	6.96
5050.00	6.41	5050.00	6.88
5100.00	6.67	5100.00	6.92
5150.00	6.65	5150.00	6.99
5200.00	6.31	5200.00	6.98
5250.00	7.40	5250.00	7.05
5300.00	6.48	5300.00	7.26
5350.00	6.68	5350.00	7.22
5400.00	7.07	5400.00	7.44
5450.00	6.86	5450.00	7.19
5500.00	6.65	5500.00	7.29
5550.00	6.71	5550.00	7.32
5600.00	6.72	5600.00	7.48
5650.00	6.69	5650.00	7.37
5700.00	6.87	5700.00	7.43
5750.00	6.89	5750.00	7.35
5800.00	6.92	5800.00	7.52
5850.00	6.90	5850.00	7.48
5900.00	6.89	5900.00	7.53
5950.00	6.95	5950.00	7.58
6000.00	7.00	6000.00	7.69

Frequency (1 GHz – 40 GHz)	Attenuation (dB)
1006.35	0.8
1056.67	0.8
1109.50	0.8
1164.98	0.8
1223.23	0.9
1284.39	0.9
1348.61	0.9
1416.04	0.9
1486.84	1.0
1561.18	1.0
1639.24	1.0
1721.21	1.0
1807.27	1.1
1897.63	1.1
1992.51	1.1
2092.14	1.2
2196.74	1.2
2306.58	1.2
2421.91	1.3
2543.01	1.3
2670.16	1.3
2803.66	1.4
2943.85	1.4
3091.04	1.4
3245.59	1.5
3407.87	1.5
3578.26	1.5
3757.18	1.6
3945.04	1.6
4142.29	1.7
4349.40	1.7
4566.87	1.8
4795.22	1.8
5034.98	1.9
5286.73	1.9
5551.06	2.0
5828.62	2.0
6120.05	2.1
6426.05	2.1
6747.35	2.2
7084.72	2.4
7438.96	2.4
7810.90	2.5
8201.45	2.5
8611.52	2.6
9042.10	2.7
9494.20	2.8
9968.91	2.8
10467.36	2.9
10990.73	3.1
11540.26	3.1
12117.28	3.2
12723.14	3.3
13359.30	3.4
14027.26	3.6
14728.63	3.8
15465.06	3.9
16238.31	3.9
17050.23	4.1
17902.74	4.2

18797.87	5.0
19737.77	4.8
20724.66	4.7
21760.89	4.8
22848.93	4.9
23991.38	5.3
25190.95	5.4
26450.49	5.8
27773.02	5.9
29161.67	6.5
30619.76	6.2
32150.74	6.6
33758.28	8.5
35446.19	7.3
37218.50	8.5
39079.43	7.5
40000.00	8.1

3.2.2 Antenna factors

3.2.2.1 Antenna HL562E

Frequency (MHz)	Antenna factor HL562E (SN 100843)	Antenna factor HL562E (SN 100842)
30.00	18.86	18.95
31.00	18.27	18.43
32.00	17.68	17.88
33.00	17.11	17.33
34.00	16.57	16.79
35.00	16.00	16.23
36.00	15.41	15.67
37.00	14.84	15.10
38.00	14.25	14.53
39.00	13.65	13.94
40.00	13.04	13.34
41.00	12.40	12.72
42.00	11.77	12.07
43.00	11.09	11.42
44.00	10.41	10.72
45.00	9.71	10.02
46.00	9.00	9.30
47.00	8.28	8.58
48.00	7.57	7.84
49.00	6.87	7.13
50.00	6.22	6.44
51.00	5.60	5.81
52.00	5.07	5.26
53.00	4.64	4.83
54.00	4.35	4.54
55.00	4.19	4.41
56.00	4.17	4.45
57.00	4.30	4.59
58.00	4.54	4.79
59.00	4.84	5.07
60.00	5.17	5.38
61.00	5.50	5.66
62.00	5.79	5.88
63.00	6.06	6.15
64.00	6.33	6.53
65.00	6.59	6.89
66.00	6.85	7.18
67.00	7.09	7.41
68.00	7.32	7.63
69.00	7.55	7.82
70.00	7.75	7.99
71.00	7.93	8.15
72.00	8.10	8.27
73.00	8.24	8.37
74.00	8.38	8.48
75.00	8.51	8.63
76.00	8.62	8.78
77.00	8.74	8.90
78.00	8.85	9.00
79.00	8.96	9.09
80.00	9.05	9.18
81.00	9.14	9.24
82.00	9.21	9.29
83.00	9.27	9.36
84.00	9.33	9.41
85.00	9.39	9.46

86.00	9.43	9.51
87.00	9.48	9.57
88.00	9.49	9.60
89.00	9.52	9.63
90.00	9.54	9.68
91.00	9.57	9.73
92.00	9.60	9.77
93.00	9.63	9.82
94.00	9.66	9.87
95.00	9.70	9.92
96.00	9.74	9.97
97.00	9.79	10.03
98.00	9.85	10.10
99.00	9.92	10.18
100.00	9.99	10.25
101.00	10.05	10.33
102.00	10.16	10.42
103.00	10.23	10.50
104.00	10.32	10.58
105.00	10.40	10.65
106.00	10.48	10.73
107.00	10.53	10.79
108.00	10.55	10.84
109.00	10.55	10.87
110.00	10.54	10.89
111.00	10.53	10.91
112.00	10.54	10.93
113.00	10.54	10.94
114.00	10.53	10.93
115.00	10.52	10.90
116.00	10.49	10.87
117.00	10.48	10.84
118.00	10.44	10.78
119.00	10.38	10.72
120.00	10.32	10.63
121.00	10.26	10.52
122.00	10.21	10.41
123.00	10.16	10.30
124.00	10.02	10.26
125.00	10.06	10.21
126.00	10.01	10.10
127.00	9.93	9.98
128.00	9.71	9.86
129.00	9.74	9.89
130.00	9.70	9.87
131.00	9.61	9.78
132.00	9.52	9.68
133.00	9.44	9.58
134.00	9.35	9.47
135.00	9.25	9.36
136.00	9.16	9.26
137.00	9.07	9.16
138.00	8.97	9.05
139.00	8.88	8.95
140.00	8.79	8.85
141.00	8.70	8.74
142.00	8.60	8.65
143.00	8.51	8.55
144.00	8.42	8.46
145.00	8.34	8.38
146.00	8.26	8.31
147.00	8.18	8.23
148.00	8.11	8.17

149.00	8.04	8.11
150.00	7.97	8.06
151.00	7.92	8.02
152.00	7.88	8.00
153.00	7.84	7.97
154.00	7.82	7.98
155.00	7.83	8.03
156.00	7.87	8.07
157.00	7.88	8.05
158.00	7.89	8.05
159.00	7.88	8.06
160.00	7.87	8.08
161.00	7.88	8.12
162.00	7.89	8.14
163.00	7.91	8.17
164.00	7.94	8.19
165.00	7.98	8.22
166.00	8.03	8.24
167.00	8.09	8.24
168.00	8.14	8.37
169.00	8.21	8.46
170.00	8.31	8.54
171.00	8.39	8.64
172.00	8.48	8.71
173.00	8.59	8.81
174.00	8.76	8.92
175.00	8.95	9.06
176.00	9.17	9.23
177.00	9.37	9.42
178.00	9.42	9.50
179.00	9.24	9.39
180.00	8.88	9.09
181.00	8.48	8.70
182.00	8.16	8.37
183.00	7.94	8.14
184.00	7.82	8.01
185.00	7.74	7.93
186.00	7.70	7.89
187.00	7.69	7.89
188.00	7.69	7.91
189.00	7.72	7.97
190.00	7.78	8.05
191.00	7.81	8.01
192.00	7.78	7.97
193.00	7.77	7.97
194.00	7.80	8.01
195.00	7.85	8.07
196.00	7.91	8.14
197.00	7.98	8.21
198.00	8.05	8.26
199.00	8.14	8.25
200.00	8.22	8.49
202.00	8.41	8.65
204.00	8.56	8.77
206.00	8.68	8.88
208.00	8.79	8.98
210.00	8.85	9.06
212.00	8.84	9.02
214.00	8.80	8.96
216.00	8.67	8.83
218.00	8.40	8.56
220.00	8.28	8.41
222.00	8.43	8.55

224.00	8.69	8.79
226.00	8.91	9.04
228.00	9.09	9.21
230.00	9.25	9.36
232.00	9.39	9.48
234.00	9.52	9.60
236.00	9.68	9.71
238.00	9.76	9.82
240.00	9.83	9.91
242.00	9.83	9.93
244.00	9.83	9.94
246.00	9.86	9.97
248.00	9.91	10.01
250.00	10.00	10.03
252.00	10.04	10.16
254.00	10.13	10.25
256.00	10.22	10.34
258.00	10.31	10.42
260.00	10.39	10.51
262.00	10.48	10.60
264.00	10.50	10.61
266.00	10.54	10.63
268.00	10.61	10.70
270.00	10.67	10.77
272.00	10.73	10.82
274.00	10.79	10.89
276.00	10.85	10.95
278.00	10.92	11.02
280.00	11.00	11.07
282.00	11.08	11.16
284.00	11.14	11.23
286.00	11.20	11.28
288.00	11.26	11.33
290.00	11.30	11.37
292.00	11.37	11.40
294.00	11.43	11.44
296.00	11.46	11.49
298.00	11.52	11.54
300.00	11.64	11.65
302.00	11.77	11.82
304.00	11.81	11.91
306.00	11.83	11.93
308.00	11.87	11.95
310.00	11.91	11.99
312.00	11.97	12.03
314.00	12.02	12.12
316.00	12.09	12.20
318.00	12.16	12.26
320.00	12.21	12.33
322.00	12.27	12.39
324.00	12.34	12.46
326.00	12.38	12.49
328.00	12.39	12.48
330.00	12.41	12.49
332.00	12.46	12.57
334.00	12.54	12.67
336.00	12.58	12.65
338.00	12.66	12.69
340.00	12.72	12.78
342.00	12.76	12.82
344.00	12.81	12.87
346.00	12.87	12.93
348.00	12.93	12.99

350.00	13.01	13.05
352.00	13.09	13.13
354.00	13.17	13.20
356.00	13.23	13.27
358.00	13.28	13.34
360.00	13.32	13.38
362.00	13.38	13.41
364.00	13.44	13.44
366.00	13.49	13.49
368.00	13.55	13.55
370.00	13.63	13.64
372.00	13.73	13.75
374.00	13.78	13.80
376.00	13.82	13.83
378.00	13.85	13.87
380.00	13.89	13.90
382.00	13.93	13.95
384.00	14.00	14.02
386.00	14.06	14.09
388.00	14.13	14.14
390.00	14.22	14.17
392.00	14.23	14.27
394.00	14.29	14.33
396.00	14.35	14.40
398.00	14.41	14.47
400.00	14.45	14.50
402.00	14.50	14.51
404.00	14.54	14.51
406.00	14.57	14.52
408.00	14.62	14.56
410.00	14.68	14.63
412.00	14.73	14.74
414.00	14.79	14.86
416.00	14.84	14.94
418.00	14.86	14.98
420.00	14.88	14.99
422.00	14.89	15.01
424.00	14.93	15.04
426.00	14.97	15.07
428.00	15.01	15.11
430.00	15.06	15.16
432.00	15.11	15.20
434.00	15.16	15.26
436.00	15.21	15.28
438.00	15.26	15.36
440.00	15.31	15.40
442.00	15.36	15.45
444.00	15.41	15.49
446.00	15.47	15.54
448.00	15.54	15.60
450.00	15.57	15.66
452.00	15.62	15.70
454.00	15.66	15.73
456.00	15.72	15.78
458.00	15.79	15.84
460.00	15.89	15.95
462.00	15.99	16.10
464.00	16.08	16.19
466.00	16.12	16.20
468.00	16.15	16.21
470.00	16.16	16.22
472.00	16.16	16.22
474.00	16.17	16.23

476.00	16.19	16.25
478.00	16.22	16.28
480.00	16.27	16.31
482.00	16.31	16.36
484.00	16.37	16.41
486.00	16.45	16.48
488.00	16.50	16.59
490.00	16.55	16.63
492.00	16.60	16.68
494.00	16.63	16.72
496.00	16.64	16.75
498.00	16.65	16.78
500.00	16.66	16.77
502.00	16.67	16.77
504.00	16.66	16.77
506.00	16.65	16.75
508.00	16.65	16.73
510.00	16.66	16.73
512.00	16.69	16.78
514.00	16.75	16.88
516.00	16.84	16.96
518.00	16.89	17.00
520.00	16.91	16.99
522.00	16.92	16.97
524.00	16.92	16.95
526.00	16.93	16.95
528.00	16.94	16.97
530.00	16.95	16.99
532.00	16.97	17.00
534.00	16.98	17.01
536.00	17.00	17.02
538.00	17.01	17.04
540.00	17.04	17.06
542.00	17.06	17.09
544.00	17.10	17.11
546.00	17.14	17.18
548.00	17.17	17.21
550.00	17.20	17.25
552.00	17.25	17.29
554.00	17.30	17.34
556.00	17.33	17.39
558.00	17.36	17.44
560.00	17.39	17.47
562.00	17.42	17.51
564.00	17.45	17.52
566.00	17.47	17.54
568.00	17.51	17.57
570.00	17.57	17.63
572.00	17.64	17.69
574.00	17.75	17.79
576.00	17.86	17.90
578.00	17.96	17.99
580.00	18.02	18.04
582.00	18.04	18.07
584.00	18.04	18.08
586.00	18.04	18.08
588.00	18.04	18.09
590.00	18.04	18.09
592.00	18.06	18.10
594.00	18.07	18.10
596.00	18.08	18.11
598.00	18.10	18.13
600.00	18.13	18.15

602.00	18.17	18.18
604.00	18.20	18.20
606.00	18.23	18.22
608.00	18.26	18.24
610.00	18.28	18.24
612.00	18.31	18.25
614.00	18.33	18.27
616.00	18.35	18.34
618.00	18.36	18.35
620.00	18.37	18.36
622.00	18.38	18.37
624.00	18.39	18.37
626.00	18.40	18.37
628.00	18.40	18.37
630.00	18.41	18.37
632.00	18.43	18.39
634.00	18.43	18.42
636.00	18.45	18.45
638.00	18.48	18.47
640.00	18.52	18.51
642.00	18.57	18.57
644.00	18.65	18.66
646.00	18.73	18.79
648.00	18.79	18.93
650.00	18.86	19.08
652.00	18.91	19.17
654.00	18.96	19.22
656.00	18.98	19.19
658.00	18.99	19.17
660.00	18.99	19.13
662.00	18.99	19.10
664.00	18.98	19.09
666.00	18.98	19.08
668.00	18.99	19.08
670.00	19.01	19.09
672.00	19.00	19.10
674.00	19.00	19.11
676.00	18.99	19.13
678.00	19.00	19.14
680.00	19.02	19.16
682.00	19.04	19.19
684.00	19.07	19.21
686.00	19.09	19.24
688.00	19.10	19.26
690.00	19.12	19.28
692.00	19.14	19.30
694.00	19.15	19.34
696.00	19.18	19.38
698.00	19.20	19.42
700.00	19.22	19.44
702.00	19.25	19.44
704.00	19.28	19.44
706.00	19.30	19.44
708.00	19.35	19.45
710.00	19.40	19.46
712.00	19.46	19.48
714.00	19.51	19.49
716.00	19.55	19.51
718.00	19.59	19.56
720.00	19.63	19.61
722.00	19.70	19.68
724.00	19.78	19.76
726.00	19.86	19.84

728.00	19.94	19.93
730.00	20.02	20.04
732.00	20.06	20.12
734.00	20.08	20.16
736.00	20.07	20.15
738.00	20.04	20.09
740.00	20.01	20.05
742.00	19.99	19.99
744.00	19.98	19.97
746.00	19.97	19.94
748.00	19.95	19.94
750.00	19.94	19.93
752.00	19.93	19.92
754.00	19.93	19.93
756.00	19.95	19.94
758.00	19.95	19.96
760.00	19.98	19.97
762.00	20.00	19.98
764.00	20.02	19.99
766.00	20.04	20.01
768.00	20.09	20.02
770.00	20.13	20.04
772.00	20.18	20.06
774.00	20.22	20.10
776.00	20.22	20.17
778.00	20.24	20.20
780.00	20.25	20.22
782.00	20.27	20.24
784.00	20.27	20.24
786.00	20.28	20.24
788.00	20.28	20.23
790.00	20.30	20.24
792.00	20.31	20.25
794.00	20.32	20.25
796.00	20.32	20.26
798.00	20.35	20.29
800.00	20.39	20.32
802.00	20.43	20.39
804.00	20.48	20.45
806.00	20.52	20.56
808.00	20.57	20.65
810.00	20.66	20.77
812.00	20.74	20.87
814.00	20.80	20.94
816.00	20.83	20.95
818.00	20.84	20.96
820.00	20.85	20.93
822.00	20.84	20.90
824.00	20.81	20.89
826.00	20.82	20.86
828.00	20.81	20.86
830.00	20.81	20.87
832.00	20.82	20.86
834.00	20.84	20.86
836.00	20.85	20.86
838.00	20.86	20.87
840.00	20.86	20.88
842.00	20.85	20.88
844.00	20.85	20.90
846.00	20.84	20.91
848.00	20.86	20.93
850.00	20.89	20.93
852.00	20.91	20.94

854.00	20.94	20.95
856.00	20.96	20.96
858.00	20.98	20.98
860.00	21.01	20.99
862.00	21.04	21.02
864.00	21.08	21.05
866.00	21.12	21.09
868.00	21.14	21.12
870.00	21.14	21.14
872.00	21.16	21.19
874.00	21.19	21.23
876.00	21.23	21.28
878.00	21.25	21.31
880.00	21.29	21.34
882.00	21.33	21.36
884.00	21.37	21.38
886.00	21.40	21.41
888.00	21.45	21.43
890.00	21.49	21.44
892.00	21.51	21.45
894.00	21.55	21.46
896.00	21.58	21.46
898.00	21.61	21.48
900.00	21.65	21.51
902.00	21.70	21.55
904.00	21.76	21.61
906.00	21.83	21.70
908.00	21.90	21.78
910.00	21.95	21.87
912.00	21.98	21.92
914.00	21.98	21.94
916.00	21.97	21.93
918.00	21.96	21.90
920.00	21.94	21.88
922.00	21.92	21.84
924.00	21.88	21.80
926.00	21.85	21.79
928.00	21.82	21.77
930.00	21.81	21.77
932.00	21.80	21.78
934.00	21.79	21.77
936.00	21.79	21.75
938.00	21.78	21.74
940.00	21.80	21.73
942.00	21.80	21.74
944.00	21.82	21.75
946.00	21.84	21.75
948.00	21.86	21.76
950.00	21.88	21.77
952.00	21.91	21.78
954.00	21.93	21.80
956.00	21.96	21.80
958.00	22.00	21.81
960.00	22.03	21.81
962.00	22.07	21.81
964.00	22.12	21.83
966.00	22.15	21.86
968.00	22.16	21.95
970.00	22.16	22.00
972.00	22.18	22.01
974.00	22.20	22.01
976.00	22.23	22.02
978.00	22.26	22.03

980.00	22.29	22.04
982.00	22.32	22.07
984.00	22.35	22.09
986.00	22.39	22.13
988.00	22.42	22.15
990.00	22.43	22.20
992.00	22.42	22.27
994.00	22.44	22.36
996.00	22.46	22.42
998.00	22.48	22.47
1000.00	22.52	22.54

3.2.2.2 Antenna HF907

Frequency (GHz)	Antenna factor HF907 (SN 102494)	Antenna factor HF907 (SN 102508)
1.00	24.3	24.26
1.01	24.4	24.28
1.02	24.4	24.30
1.03	24.4	24.31
1.04	24.4	24.33
1.05	24.4	24.34
1.06	24.4	24.33
1.07	24.4	24.34
1.08	24.4	24.35
1.09	24.4	24.36
1.10	24.4	24.35
1.11	24.4	24.37
1.12	24.4	24.39
1.13	24.4	24.39
1.14	24.4	24.39
1.15	24.4	24.38
1.16	24.4	24.38
1.17	24.3	24.35
1.18	24.3	24.33
1.19	24.3	24.33
1.20	24.3	24.30
1.21	24.2	24.29
1.22	24.2	24.29
1.23	24.2	24.29
1.24	24.3	24.32
1.25	24.3	24.35
1.26	24.4	24.40
1.27	24.5	24.48
1.28	24.5	24.53
1.29	24.6	24.60
1.30	24.7	24.68
1.31	24.8	24.73
1.32	24.8	24.78
1.33	24.9	24.84
1.34	24.9	24.87
1.35	24.9	24.88
1.36	24.9	24.90
1.37	24.9	24.92
1.38	24.9	24.93
1.39	24.9	24.94
1.40	25.0	24.96
1.41	25.0	25.01
1.42	25.1	25.06
1.43	25.1	25.12
1.44	25.2	25.21
1.45	25.3	25.32
1.46	25.4	25.44
1.47	25.5	25.55
1.48	25.6	25.65
1.49	25.7	25.76
1.50	25.8	25.85
1.51	25.9	25.93
1.52	26.0	25.99
1.53	26.1	26.06
1.54	26.1	26.11
1.55	26.2	26.14
1.56	26.3	26.16
1.57	26.3	26.20

1.58	26.4	26.23
1.59	26.4	26.24
1.60	26.4	26.25
1.61	26.4	26.27
1.62	26.4	26.28
1.63	26.4	26.29
1.64	26.4	26.29
1.65	26.4	26.32
1.66	26.4	26.36
1.67	26.4	26.38
1.68	26.4	26.41
1.69	26.4	26.45
1.70	26.4	26.49
1.71	26.5	26.52
1.72	26.5	26.53
1.73	26.5	26.59
1.74	26.5	26.63
1.75	26.6	26.66
1.76	26.6	26.73
1.77	26.6	26.79
1.78	26.7	26.87
1.79	26.7	26.94
1.80	26.8	26.99
1.81	26.8	27.07
1.82	26.9	27.12
1.83	26.9	27.15
1.84	27.0	27.18
1.85	27.0	27.19
1.86	27.1	27.22
1.87	27.1	27.23
1.88	27.2	27.24
1.89	27.2	27.30
1.90	27.3	27.35
1.91	27.4	27.42
1.92	27.5	27.50
1.93	27.6	27.60
1.94	27.7	27.74
1.95	27.9	27.85
1.96	28.0	27.97
1.97	28.1	28.09
1.98	28.2	28.21
1.99	28.3	28.30
2.00	28.4	28.36
2.01	28.5	28.42
2.02	28.5	28.48
2.03	28.5	28.50
2.04	28.5	28.48
2.05	28.5	28.48
2.06	28.5	28.48
2.07	28.4	28.41
2.08	28.4	28.37
2.09	28.3	28.32
2.10	28.3	28.26
2.11	28.2	28.19
2.12	28.1	28.13
2.13	28.1	28.08
2.14	28.1	28.06
2.15	28.0	28.03
2.16	28.0	28.03
2.17	28.0	28.06
2.18	28.1	28.08
2.19	28.1	28.11
2.20	28.1	28.14

2.21	28.2	28.18
2.22	28.2	28.22
2.23	28.2	28.24
2.24	28.2	28.25
2.25	28.3	28.27
2.26	28.3	28.28
2.27	28.3	28.28
2.28	28.3	28.28
2.29	28.3	28.30
2.30	28.3	28.31
2.31	28.3	28.32
2.32	28.3	28.35
2.33	28.3	28.39
2.34	28.3	28.41
2.35	28.4	28.45
2.36	28.4	28.48
2.37	28.4	28.51
2.38	28.5	28.55
2.39	28.5	28.58
2.40	28.5	28.63
2.41	28.6	28.68
2.42	28.6	28.73
2.43	28.7	28.80
2.44	28.8	28.87
2.45	28.8	28.94
2.46	28.9	29.02
2.47	29.0	29.10
2.48	29.1	29.16
2.49	29.1	29.21
2.50	29.2	29.25
2.51	29.2	29.30
2.52	29.2	29.31
2.53	29.3	29.33
2.54	29.3	29.35
2.55	29.3	29.38
2.56	29.4	29.41
2.57	29.4	29.44
2.58	29.4	29.48
2.59	29.5	29.54
2.60	29.5	29.60
2.61	29.6	29.65
2.62	29.6	29.70
2.63	29.7	29.76
2.64	29.7	29.79
2.65	29.8	29.81
2.66	29.8	29.83
2.67	29.8	29.83
2.68	29.8	29.81
2.69	29.8	29.78
2.70	29.7	29.74
2.71	29.7	29.69
2.72	29.6	29.63
2.73	29.6	29.57
2.74	29.5	29.53
2.75	29.5	29.48
2.76	29.4	29.44
2.77	29.4	29.42
2.78	29.4	29.40
2.79	29.4	29.40
2.80	29.4	29.42
2.81	29.4	29.44
2.82	29.5	29.48
2.83	29.5	29.52

2.84	29.6	29.57
2.85	29.6	29.61
2.86	29.6	29.65
2.87	29.7	29.71
2.88	29.7	29.75
2.89	29.8	29.78
2.90	29.8	29.82
2.91	29.8	29.87
2.92	29.9	29.92
2.93	29.9	29.97
2.94	30.0	30.03
2.95	30.1	30.11
2.96	30.2	30.20
2.97	30.2	30.28
2.98	30.3	30.36
2.99	30.4	30.48
3.00	30.5	30.60
3.05	31.0	31.13
3.10	31.5	31.58
3.15	31.7	31.70
3.20	31.7	31.71
3.25	31.7	31.69
3.30	31.7	31.68
3.35	31.8	31.74
3.40	31.7	31.74
3.45	31.8	31.81
3.50	31.9	31.91
3.55	31.9	31.95
3.60	32.0	32.06
3.65	32.2	32.30
3.70	32.4	32.51
3.75	32.5	32.60
3.80	32.8	32.79
3.85	33.0	33.02
3.90	32.9	32.90
3.95	32.8	32.72
4.00	32.9	32.82
4.05	33.1	33.00
4.10	33.1	33.08
4.15	33.2	33.15
4.20	33.5	33.48
4.25	33.8	33.80
4.30	33.9	33.97
4.35	33.8	33.91
4.40	33.7	33.76
4.45	33.7	33.70
4.50	33.6	33.57
4.55	33.4	33.40
4.60	33.4	33.29
4.65	33.5	33.37
4.70	33.7	33.57
4.75	33.8	33.71
4.80	34.0	33.87
4.85	34.1	34.07
4.90	34.3	34.27
4.95	34.4	34.33
5.00	34.3	34.25
5.05	34.1	34.11
5.10	34.0	33.99
5.15	33.9	33.90
5.20	33.9	33.82
5.25	33.9	33.83
5.30	34.0	33.91



5.35	34.2	34.07
5.40	34.3	34.22
5.45	34.4	34.33
5.50	34.4	34.41
5.55	34.4	34.40
5.60	34.3	34.31
5.65	34.2	34.21
5.70	34.1	34.11
5.75	34.1	34.03
5.80	34.1	34.06
5.85	34.3	34.18
5.90	34.4	34.34
5.95	34.5	34.45
6.00	34.6	34.55
6.05	34.8	34.69
6.10	34.8	34.76
6.15	34.8	34.75
6.20	34.7	34.69
6.25	34.7	34.64
6.30	34.7	34.66
6.35	34.8	34.73
6.40	34.8	34.78
6.45	34.9	34.87
6.50	35.1	35.02
6.55	35.2	35.16
6.60	35.3	35.24
6.65	35.3	35.20
6.70	35.2	35.15
6.75	35.3	35.15
6.80	35.3	35.18
6.85	35.2	35.17
6.90	35.2	35.17
6.95	35.4	35.32
7.00	35.6	35.50
7.05	35.6	35.60
7.10	35.7	35.64
7.15	35.7	35.68
7.20	35.8	35.73
7.25	35.7	35.65
7.30	35.6	35.55
7.35	35.6	35.52
7.40	35.7	35.60
7.45	35.8	35.71
7.50	35.9	35.81
7.55	36.0	35.94
7.60	36.2	36.14
7.65	36.3	36.29
7.70	36.3	36.31
7.75	36.2	36.26
7.80	36.2	36.24
7.85	36.2	36.24
7.90	36.2	36.19
7.95	36.1	36.16
8.00	36.2	36.20
8.05	36.3	36.31
8.10	36.4	36.42
8.15	36.4	36.50
8.20	36.5	36.59
8.25	36.5	36.64
8.30	36.5	36.62
8.35	36.5	36.62
8.40	36.5	36.58
8.45	36.4	36.54

8.50	36.4	36.53
8.55	36.5	36.55
8.60	36.6	36.65
8.65	36.7	36.72
8.70	36.7	36.80
8.75	36.8	36.90
8.80	36.9	37.00
8.85	36.9	37.03
8.90	36.9	36.96
8.95	36.8	36.92
9.00	36.8	36.88
9.05	36.8	36.84
9.10	36.7	36.81
9.15	36.8	36.82
9.20	36.9	36.90
9.25	37.0	36.99
9.30	37.0	37.07
9.35	37.1	37.11
9.40	37.1	37.14
9.45	37.2	37.18
9.50	37.1	37.14
9.55	37.0	37.06
9.60	37.0	37.00
9.65	37.0	37.00
9.70	37.0	37.02
9.75	37.0	37.05
9.80	37.0	37.06
9.85	37.1	37.13
9.90	37.2	37.20
9.95	37.2	37.23
10.00	37.2	37.20
10.05	37.2	37.19
10.10	37.2	37.18
10.15	37.2	37.16
10.20	37.1	37.12
10.25	37.1	37.09
10.30	37.1	37.10
10.35	37.2	37.16
10.40	37.2	37.18
10.45	37.2	37.18
10.50	37.2	37.20
10.55	37.2	37.22
10.60	37.2	37.21
10.65	37.2	37.18
10.70	37.1	37.15
10.75	37.1	37.15
10.80	37.2	37.16
10.85	37.2	37.19
10.90	37.2	37.24
10.95	37.3	37.28
11.00	37.3	37.34
11.05	37.3	37.36
11.10	37.3	37.35
11.15	37.3	37.34
11.20	37.3	37.34
11.25	37.3	37.31
11.30	37.2	37.33
11.35	37.2	37.31
11.40	37.3	37.33
11.45	37.3	37.38
11.50	37.4	37.45
11.55	37.4	37.48
11.60	37.4	37.50

11.65	37.4	37.52
11.70	37.4	37.52
11.75	37.4	37.51
11.80	37.4	37.48
11.85	37.4	37.47
11.90	37.4	37.50
11.95	37.4	37.54
12.00	37.5	37.57
12.05	37.5	37.59
12.10	37.5	37.64
12.15	37.6	37.69
12.20	37.6	37.72
12.25	37.6	37.69
12.30	37.6	37.67
12.35	37.6	37.67
12.40	37.6	37.69
12.45	37.6	37.70
12.50	37.7	37.72
12.55	37.7	37.76
12.60	37.8	37.79
12.65	37.8	37.86
12.70	37.9	37.92
12.75	37.9	37.92
12.80	37.9	37.95
12.85	38.0	37.99
12.90	38.0	38.04
12.95	38.1	38.05
13.00	38.1	38.09
13.05	38.2	38.16
13.10	38.3	38.23
13.15	38.3	38.29
13.20	38.5	38.39
13.25	38.5	38.48
13.30	38.6	38.54
13.35	38.6	38.60
13.40	38.7	38.66
13.45	38.8	38.72
13.50	38.8	38.78
13.55	38.9	38.85
13.60	39.0	38.92
13.65	39.1	39.02
13.70	39.2	39.13
13.75	39.4	39.27
13.80	39.5	39.37
13.85	39.6	39.48
13.90	39.7	39.61
13.95	39.8	39.73
14.00	39.9	39.82
14.05	39.9	39.85
14.10	40.0	39.92
14.15	40.0	40.00
14.20	40.1	40.10
14.25	40.2	40.18
14.30	40.3	40.26
14.35	40.3	40.38
14.40	40.4	40.51
14.45	40.5	40.62
14.50	40.5	40.70
14.55	40.6	40.77
14.60	40.6	40.82
14.65	40.7	40.89
14.70	40.7	40.93
14.75	40.7	40.94

14.80	40.7	40.91
14.85	40.7	40.96
14.90	40.8	40.97
14.95	40.7	40.97
15.00	40.8	40.97
15.05	40.8	40.98
15.10	40.8	41.00
15.15	40.9	41.08
15.20	40.9	41.11
15.25	40.9	41.13
15.30	40.9	41.16
15.35	40.9	41.18
15.40	40.9	41.19
15.45	40.9	41.18
15.50	40.9	41.16
15.55	40.9	41.15
15.60	40.8	41.14
15.65	40.9	41.14
15.70	40.9	41.14
15.75	40.9	41.16
15.80	40.9	41.18
15.85	41.0	41.21
15.90	41.1	41.26
15.95	41.1	41.29
16.00	41.1	41.31
16.05	41.2	41.33
16.10	41.2	41.37
16.15	41.2	41.40
16.20	41.2	41.43
16.25	41.3	41.46
16.30	41.3	41.48
16.35	41.4	41.52
16.40	41.5	41.58
16.45	41.5	41.64
16.50	41.6	41.70
16.55	41.7	41.77
16.60	41.8	41.86
16.65	41.9	41.92
16.70	42.0	42.03
16.75	42.1	42.15
16.80	42.2	42.26
16.85	42.3	42.33
16.90	42.4	42.45
16.95	42.5	42.55
17.00	42.5	42.63
17.05	42.5	42.74
17.10	42.5	42.81
17.15	42.6	42.89
17.20	42.6	42.96
17.25	42.7	43.04
17.30	42.8	43.13
17.35	42.8	43.18
17.40	42.9	43.27
17.45	43.0	43.35
17.50	43.1	43.43
17.55	43.1	43.49
17.60	43.2	43.57
17.65	43.3	43.66
17.70	43.3	43.72
17.75	43.4	43.80
17.80	43.5	43.88
17.85	43.5	43.96
17.90	43.7	44.06



17.95	43.8	44.14
18.00	43.9	44.26

3.2.2.3 Horn Antenna EMCO 3116

Frequency (GHz)	Antenna factor EMCO 3116
18.000	44.86
18.100	44.88
18.200	44.94
18.300	44.97
18.400	44.95
18.500	44.86
18.600	44.90
18.700	45.04
18.800	45.11
18.900	45.20
19.000	45.23
19.100	45.24
19.200	45.07
19.300	45.01
19.400	45.02
19.500	45.07
19.600	44.96
19.700	44.94
19.800	45.00
19.900	44.83
20.000	44.72
20.100	44.70
20.200	44.68
20.300	44.53
20.400	44.44
20.500	44.48
20.600	44.54
20.700	44.37
20.800	44.25
20.900	44.36
21.000	44.42
21.100	44.35
21.200	44.38
21.300	44.34
21.400	44.30
21.500	44.20
21.600	44.22
21.700	44.25
21.800	44.31
21.900	44.31
22.000	44.44
22.100	44.67
22.200	44.68
22.300	44.68
22.400	44.87
22.500	44.79
22.600	44.68
22.700	44.84
22.800	44.91
22.900	44.84
23.000	44.95
23.100	44.97
23.200	45.14
23.300	45.20
23.400	45.35
23.500	45.45
23.600	45.55
23.700	45.70

23.800	45.75
23.900	45.77
24.000	45.83
24.100	45.85
24.200	45.73
24.300	45.92
24.400	45.83
24.500	45.81
24.600	45.98
24.700	46.12
24.800	46.23
24.900	46.34
25.000	46.36
25.100	46.43
25.200	46.53
25.300	46.49
25.400	46.33
25.500	46.40
25.600	46.34
25.700	46.12
25.800	46.27
25.900	46.19
26.000	46.16
26.100	46.33
26.200	46.32
26.300	46.55
26.400	46.70
26.500	46.68
26.600	46.76
26.700	46.70
26.800	46.57
26.900	46.74
27.000	46.56
27.100	46.40
27.200	46.60
27.300	46.61
27.400	46.69
27.500	46.71
27.600	46.82
27.700	46.84
27.800	46.85
27.900	47.02
28.000	47.07
28.100	47.02
28.200	46.99
28.300	47.02
28.400	47.06
28.500	46.94
28.600	46.88
28.700	47.06
28.800	47.00
28.900	46.96
29.000	47.03
29.100	46.94
29.200	46.95
29.300	46.86
29.400	46.90
29.500	47.05
29.600	46.90
29.700	46.80
29.800	46.95
29.900	46.79
30.000	46.78

30.100	46.76
30.200	46.78
30.300	46.76
30.400	46.80
30.500	46.90
30.600	46.99
30.700	46.97
30.800	46.99
30.900	47.06
31.000	47.18
31.100	47.26
31.200	47.28
31.300	47.32
31.400	47.35
31.500	47.47
31.600	47.54
31.700	47.64
31.800	47.69
31.900	47.74
32.000	47.93
32.100	48.23
32.200	48.17
32.300	48.32
32.400	48.51
32.500	48.50
32.600	48.56
32.700	48.80
32.800	48.90
32.900	49.28
33.000	49.46
33.100	49.76
33.200	49.83
33.300	50.07
33.400	50.49
33.500	50.68
33.600	50.81
33.700	50.89
33.800	51.11
33.900	51.15
34.000	51.22
34.100	51.46
34.200	51.56
34.300	51.79
34.400	51.81
34.500	51.93
34.600	52.17
34.700	52.19
34.800	52.45
34.900	52.66
35.000	52.59
35.100	52.55
35.200	52.41
35.300	52.30
35.400	52.27
35.500	52.05
35.600	52.00
35.700	51.94
35.800	51.94
35.900	51.68
36.000	51.64
36.100	51.51
36.200	51.28
36.300	51.18

36.400	51.29
36.500	51.19
36.600	51.05
36.700	50.78
36.800	50.80
36.900	50.68
37.000	50.57
37.100	50.65
37.200	50.76
37.300	50.73
37.400	50.86
37.500	50.98
37.600	51.16
37.700	51.29
37.800	51.57
37.900	51.58
38.000	51.98
38.100	52.34
38.200	52.34
38.300	52.66
38.400	52.86
38.500	52.96
38.600	53.24
38.700	53.66
38.800	53.81
38.900	53.92
39.000	54.09
39.100	54.02
39.200	53.93
39.300	53.75
39.400	53.75
39.500	53.62
39.600	53.36
39.700	53.54
39.800	53.28
39.900	53.27
40.000	53.34

4 CONVERSION FACTORS AND ALL OTHER FORMULAS

Unit	Conversion unit	Formula of conversion
$\text{dB}\mu\text{V}$	$\text{dB}\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m} = \text{dB}\mu\text{V} + \text{AF}$
$\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m}$	$\text{dB}\mu\text{V}/\text{m} = 20\log(X(\mu\text{V}/\text{m})/1\mu\text{V})$

	Test distance stated in standard	Test distance of measurement	Conversion factor
Class B	3 m	3 m	/
Class A	10 m	3 m	20dB/decade

5 GENERAL AND SPECIAL CONDITIONS DESCRIPTION

5.1 General condition description

Interconnect and power cabling (or wiring)

5.1.1 Test arrangement for conducted emissions

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.

EUT connected to one LISN. Unused LISN measuring port connectors shall be terminated in 50 Ω . LISN can be placed on top of, or immediately beneath, reference ground-plane.

All other equipment powered from additional LISN(s).

Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

LISN at least 80 cm from nearest part of EUT chassis.

Cables of hand-operated devices, such as keyboards, mice, etc.. shall be placed as for normal use.

Non-EUT components of EUT system being tested.

Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

Rear of tabletop shall be 40 cm removed from a vertical conducting plane that is bonded to the ground-plane.

5.1.2 Test arrangement for conducted emissions- floor-standing equipment

Excess I/O cables shall be bundled in the center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling shall not exceed 40 cm in length.

Excess power cords shall be bundled in the center or shortened to appropriate length.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. If bundling is not possible, the cable shall be arranged in serpentine fashion.

EUT and all cables shall be insulated, if required, from the ground-plane by up to 12 mm of insulating material.

EUT connected to one LISN. LISN can be placed on top of, or immediately beneath, the ground-plane.

All other equipment powered from a second LISN or additional LISN(s).

Multiple outlet strip can be used for multiple power cords of non-EUT equipment.

5.1.3 Test arrangement for radiated emissions tabletop equipment

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance. The total length shall not exceed 1 m.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground-plane.

Cables of hand-operated devices, such as keyboards, mice, etc.. shall be placed as for normal use.

Non-EUT components of EUT system being tested.

Rear of EUT, including peripherals, shall all be aligned and flush with rear of tabletop.

No vertical conducting plane used.

Power cords drape to the floor and are routed over to receptacle.

5.1.4 Test arrangement for radiated emissions floor-standing equipment

Excess I/O cables shall be bundled in center. If bundling is not possible, the cables shall be arranged in serpentine fashion. Bundling not to exceed 40 cm in length.

Excess power cords shall be bundled in the center or shortened to appropriate length.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. If bundling is not possible, the cable shall be arranged in a serpentine fashion.

EUT and all cables shall be insulated, if required, from the ground-plane by up to 12 mm of insulating material.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground plane.

Overhead cable trays and suspended ceilings

5.1.5 Test arrangement for floor-standing equipment

Only one vertical riser may be used where typical of system under test.

Excess power cord shall be bundled in the center or shortened to appropriate length.

EUT and cables shall be insulated from ground-plane by up to 12 mm. Where the manual has specified or there exists a code of practice for installation of the EUT, the test arrangement shall allow the use of this practice for the tests.

Power cords being measured connected to one LISN. All other system power cords powered through other LISN(s). A multiple receptacle strip may be used for other power cords.

For *conducted* tests, the LISNs may be placed on top of or immediately beneath and bonded directly to the ground-plane. For *radiated* tests, the LISN(s), if used, should be installed under, with the receptacle flush with the ground-plane.

5.1.6 Placement and manipulation of interconnect cabling (or wiring) of tabletop equipment

LISN(s) may have to be positioned to the side of the table to meet the criterion that the LISN receptacle shall be 80 cm away from the EUT. LISN(s) may be above ground-plane only for conducted emission measurements.

Accessories, such as ac power adapter, if typically table-mounted, shall occupy peripheral positions as is applicable.

Accessories, which are typically floor-mounted, shall occupy a floor position directly below the portion of the EUT to which they are typically connected.

Table length may be extended beyond 1.5 m with peripherals aligned with the back edge. The table depth may be extended beyond 1 m. The 40 cm distance to the vertical conducting plane shall be maintained for conducted emission testing.

Placement of wall-mounted equipment

5.1.7 Test configuration/arrangement for combination floor-standing and tabletop equipment

Interconnecting cables that hang closer than 40 cm to the ground-plane shall be folded back and forth in the center, forming a bundle 30 to 40 cm long.

I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using the correct terminating impedance.

If LISNs are kept in the test setup for radiated emissions, it is preferred that they be installed under the ground-plane with the receptacle flush with the ground-plane.

Cables of hand-operated devices, such as keyboards, mice, etc.. have to be placed as for normal use.

Non-EUT components of EUT system being tested.

I/O cable to floor-standing unit drapes to the ground-plane and shortened or excess bundled. Cables not reaching the metal ground-plane are draped to the height of the connector or 40 cm, whichever is lower.

Power cords and signal cables shall drape to the floor. No extension cords shall be used to the power receptacles.

The floor-standing unit can be placed under the table if its height permits.

5.2 Special condition description

If for some reason the above measurement conditions can't be met, the description below should be used as an appropriate measurement condition and placement.

(Description is written additionally as the measurements differ – all is within test procedure)

6 TEST SUMMARY

STANDARDS (details on first page)	Tested		Sample	
	yes	no	pass	not pass
47 CFR Part 15. Subpart B (Clause 15.107 and 15.109) in conjunction with ANSI C63.4:2014	☒	☐	☒	☐
ICES-003, Issue 7 in conjunction with ANSI C63.4:2014	☒	☐	☒	☐

Test	Section within the report	Class	Conclusion
Conducted emission measurement (unintentional radiator)	7.1	B	PASS
Radiated emission measurement (unintentional radiator)	7.2	B	PASS

6.1 Operating voltages/frequencies used for testing

Section	Test	Operating conditions
7.1	Conducted emission measurement (unintentional radiator)	120 V, 60 Hz
7.2	Radiated emission measurement (unintentional radiator)	5 Vdc

7 EMISSION TESTS

7.1 Conducted emission measurement (unintentional radiator)

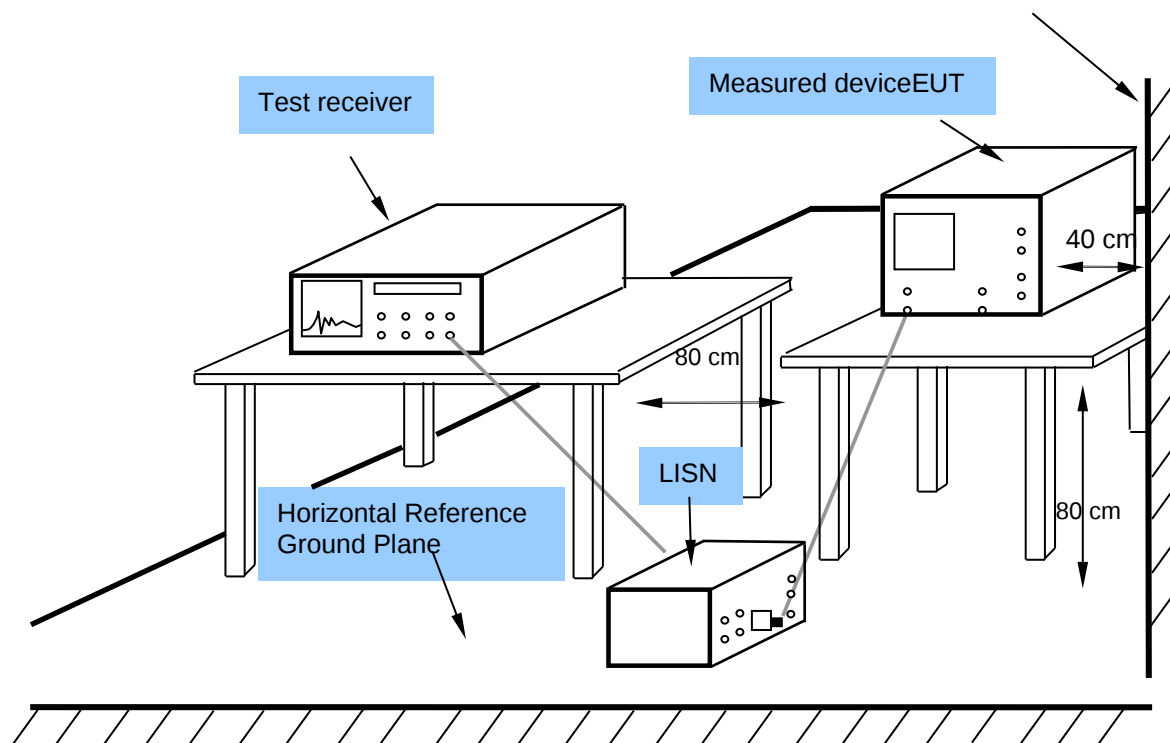
7.1.1 Test instruments

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, RFI receiver	ESU8	105187	2022-06	2024-05	18 months	X
Rohde-Schwarz, RFI receiver	ESU26	106897	2022-01	2023-07	18 months	/
Rohde & Schwarz, Artificial main network	ESH2-Z5	106899	2021-08	2023-02	18 months	/
Rohde & Schwarz, Artificial main network	ENV216	106765	2022-06	2025-06	36 months	/
Rohde & Schwarz, Artificial main network	ENV216	109818	2021-08	2023-02	18 months	X

7.1.2 Test procedure

- 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 μ H + 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. Bandwidth is set to 9 kHz.
- If applicable functions are changed (data transfer speed, clock speed....) it should be noted in the test report.

7.1.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

7.1.4 Test result

EUT Information

EUT:

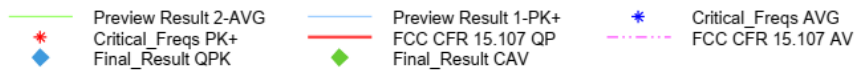
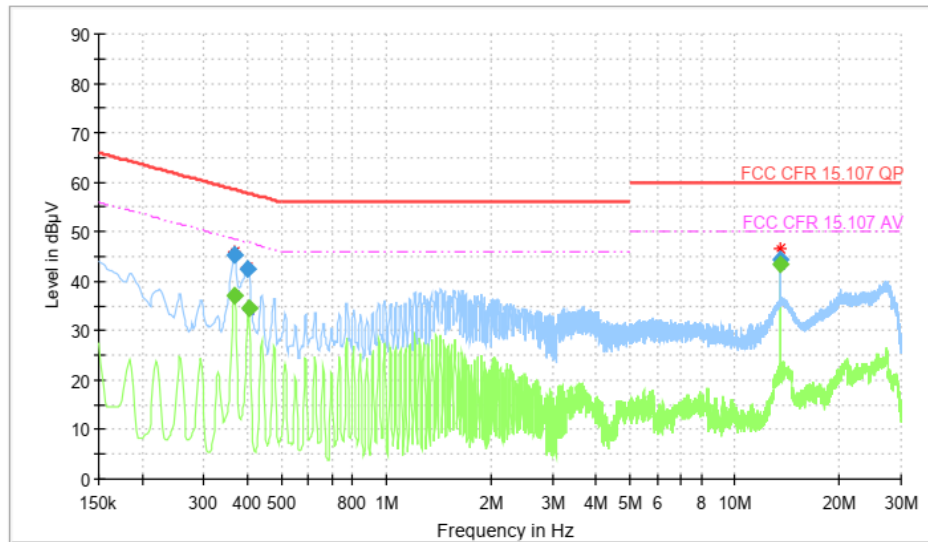
Contactless card reader CLRD730

Operating mode:

Uin: 120 V / 60 Hz; Waiting for 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)
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:

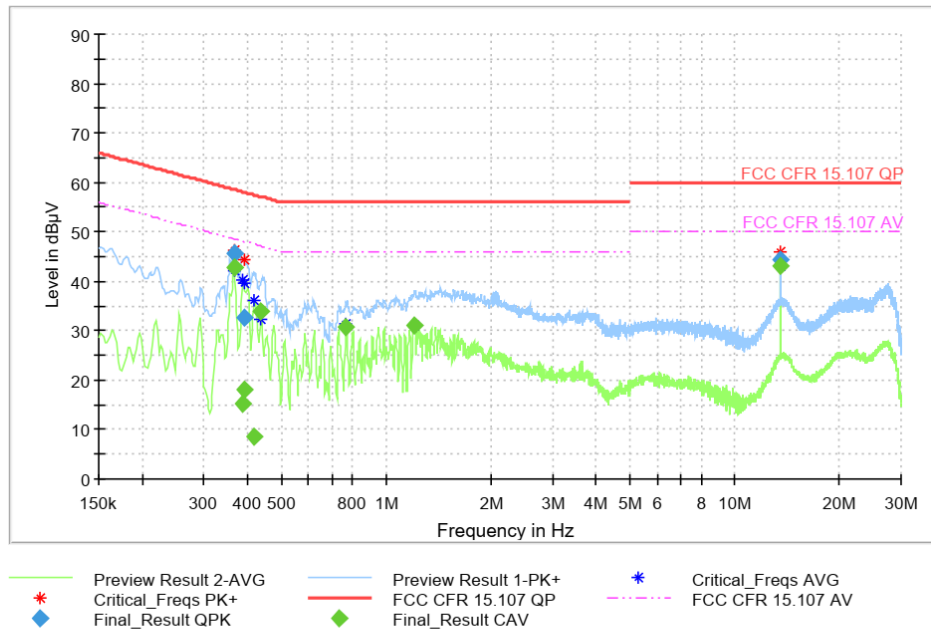
Contactless card reader CLRD730

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

7.2 Radiated emission measurement (unintentional radiator)

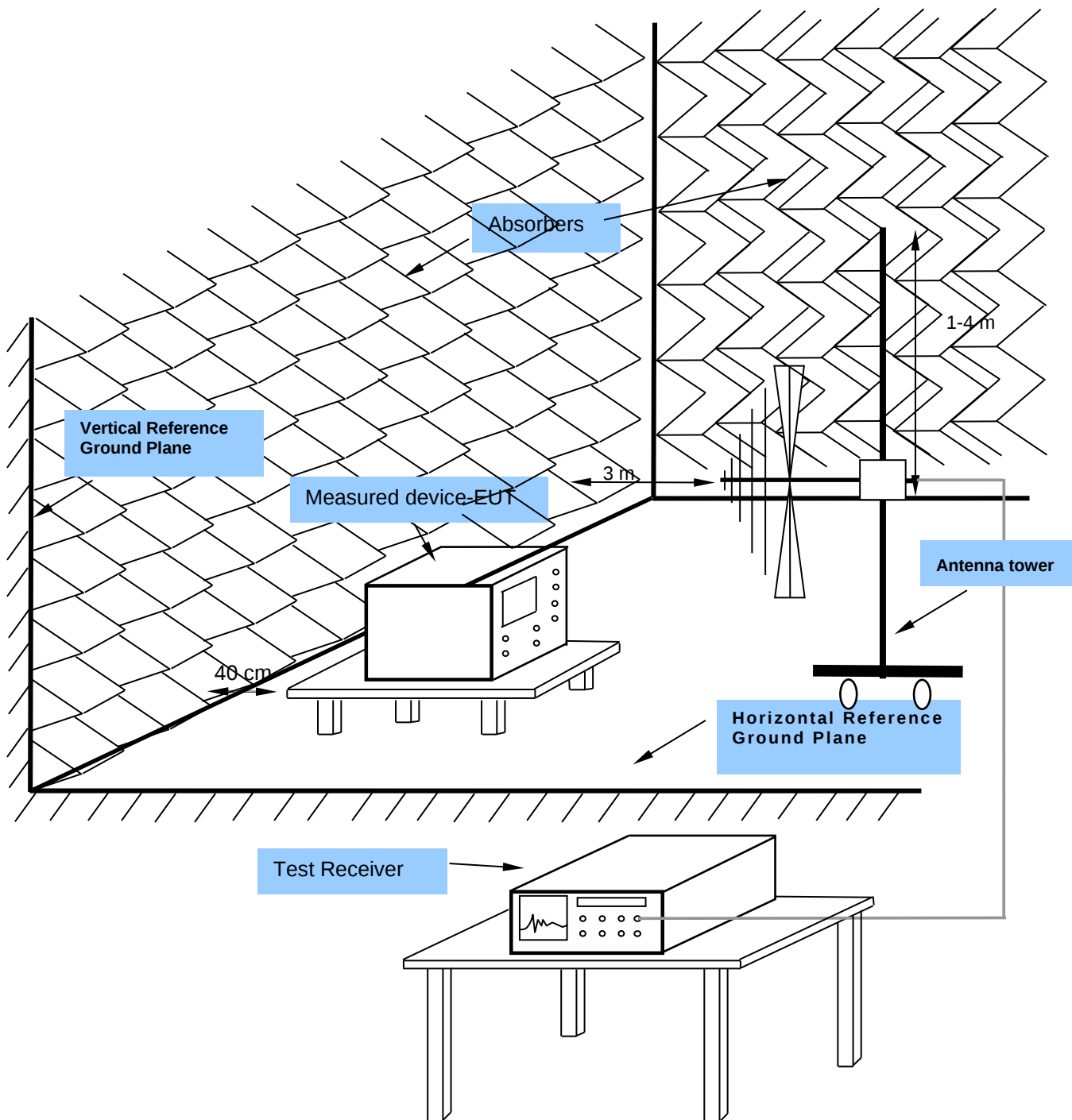
7.2.1 Test instruments

Description	Model No.	SIQ No.	Last calibration	Calibrated until	Calibration period	Used
Rohde-Schwarz, EMI receiver	ESR7	111549	2022-01	2023-07	18 months	/
Rohde-Schwarz, RFI receiver	ESU8	105187	2022-11	2024-05	18 months	/
Rohde-Schwarz, RFI receiver	ESU26	106897	2022-01	2023-07	18 months	X
Comtest Engineering, Semi Anechoic Chamber SAC 1	SAC 3m	NPS001	2022-04	2025-04	36 months	/
Rohde & Schwarz, Ultra Broadband Antenna	HL562E (SN 109843)	109063	2020-07	2023-07	36 months	/
Rohde & Schwarz, Horn Antenna	HF907 (SN 102494)	109064	2020-08	2023-08	36 months	/
Comtest Engineering, Semi Anechoic Chamber SAC 2	SAC 3m	NPS002	2022-04	2025-04	36 months	X
Rohde & Schwarz, Horn Antenna	HL562E (SN 100842)	109056	2020-07	2023-07	36 months	X
Rohde & Schwarz, Ultra Broadband Antenna	HF907 (SN 102508)	109057	2020-08	2023-08	36 months	X
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
Horn Antenna, EMCO	3116	/	2020-09	2023-09	36 months	/
Spectrum Analyzer, Rohde&Schwarz	FSV 40	/	2022-11	2024-05	18 months	/
PMI Low noise amplifier	PEC-42-1G40G	/	2022-04	2023-10	24 months	/

7.2.2 Test procedure

1. 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.
2. The EUT was set 3 m away from the interference-receiving antenna, which was mounted on the top of variable-height antenna tower.
3. 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.
4. 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.
5. The test-receiver system was set to PEAK and QUASI-PEAK Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. The highest points would be re-tested one by one using the quasi-peak method.

7.2.3 Test setup



For the actual test configuration, please refer to the related item – Photographs of the Test Configuration.

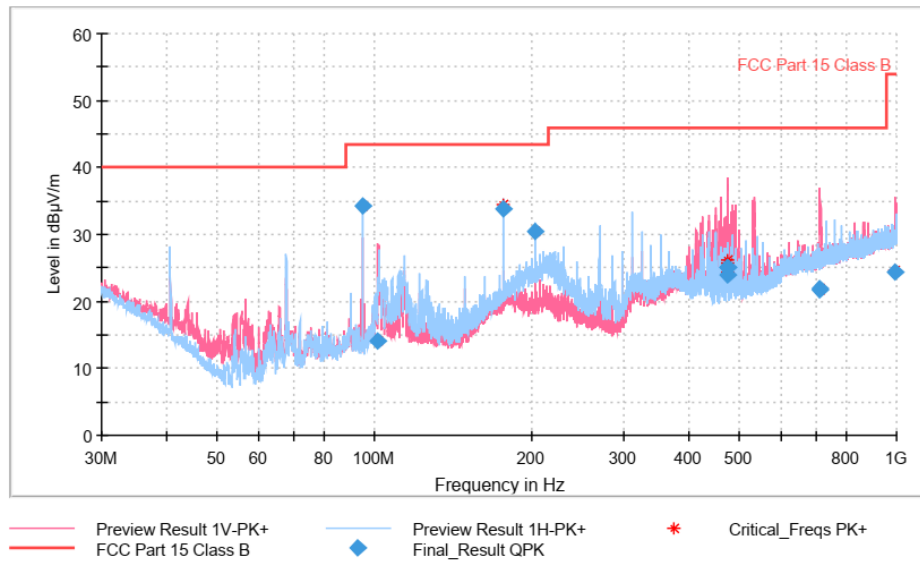
7.2.4 Test result

EUT Information

EUT:
Operating mode

CLRD730 contactless reader, S/N: 0024..25
Reading EV1 card

Full Spectrum



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)
94.920000	34.22	43.50	9.28	184.0	H	105.0
176.280000	33.88	43.50	9.62	129.0	H	52.0
203.400000	30.34	43.50	13.16	132.0	H	52.0
473.970000	25.01	46.00	20.99	103.0	V	358.0
474.150000	24.99	46.00	21.01	104.0	V	52.0
473.790000	23.89	46.00	22.11	105.0	V	52.0
714.090000	21.90	46.00	24.10	100.0	V	0.0
714.660000	21.71	46.00	24.29	100.0	V	0.0
101.700000	14.17	43.50	29.33	100.0	V	211.0
995.460000	24.43	54.00	29.57	104.0	V	0.0

Note: Device complies also with ICES-003 limits as per 3.2.2. table 2.