




Test Report

Product	RFID Card Reader		
Name and address of the applicant	Ascom Sweden AB Grimbodalen 2, Goteborg, SE-40276, Sweden		
Name and address of the manufacturer	Ascom Sweden AB Grimbodalen 2, Goteborg, SE-40276, Sweden		
Model	NUCR-HU		
Rating	5.5Vdc		
Trademark	Ascom		
Serial number	See page 3		
Additional information	RFID Card Reader operates in 13.56MHz		
Tested according to	FCC Part 15.225 Low Power Transmitter 13.110 - 14.010 MHz Band Industry Canada RSS-210, Issue 10 Low Power Licence-Exempt Radiocommunications Devices		
Order number	407218		
Tested in period	2020-10-21 – 2020-10.23		
Issue date	2021-01-06		
Name and address of the testing laboratory	 Instituttveien 6 Kjeller, Norway www.nemko.com	CAB Number: FCC: NO0001 ISED: NO0470 TEL: +47 22 96 03 30 FAX: +47 22 96 05 50	  NORWEGIAN ACCREDITATION TEST 033
An accredited technical test executed under the Norwegian accreditation scheme			
 Prepared by [G.Suhanthakumar]		 Approved by [Frode Sveinsen]	
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1 INFORMATION

1.1 Test Item

Name :	Ascom
FCC ID :	BXZNUCR
Industry Canada ID :	3724B-NUCR
Model/version :	NUCR-HU
Serial number :	M0083539
Hardware identity and/or version:	Revision B
Software identity and/or version :	1.02
Operating frequency:	13.56MHz
Assigned Frequency Band :	13.110-14.010 MHz
Tunable Bands :	None
Number of Channels :	1
Operating Modes :	TX/RX
Type of Modulation :	ASK
Data rate:	106 kbit/s
User Frequency Adjustment :	None
Type of Power Supply :	5Vdc
Antenna Connector :	Integral loop antenna
Antenna Diversity Supported :	None
Desktop Charger :	None

Description of Test Item

RFID card readers enable the logging, storage and retrieval of staff movement into and out of individual locations, such as resident rooms.

1.2 Normal test condition

Temperature:	20 - 24 °C
Relative humidity:	20 - 50 %
Normal test voltage:	5.5Vdc

The values are the limit registered during the test period.

1.3 Test Engineer(s)

G. Suhanthakumar

1.4 Test Equipment

See list of test equipment in clause 5.

2 TEST REPORT SUMMARY

2.1 General

All measurements are traceable to national standards.

The tests were conducted for the purpose of demonstrating compliance with FCC CFR 47 Part 15, paragraph 15.225, RSS-GEN Issue 5 and Industry Canada RSS-210 Issue 10.

Tests were performed in accordance with ANSI C63.4-2014 and ANSI C63.10-2013.

Radiated tests were made in a semi-anechoic chamber at measuring distances of 3m and 10m.

A description of the test facility is on file with FCC and ISED.

New Submission

Production Unit

Class II Permissive Change

Pre-production Unit

DXX Equipment Code

Family Listing



THIS TEST REPORT APPLIES ONLY TO THE ITEM(S) AND CONFIGURATIONS TESTED.

Deviations from, additions to, or exclusions from the test specifications are described in "Summary of Test Data".

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2.2 Test Summary

Name of test	FCC Part 15 reference	RSS-210 Issue 10 & RSS-GEN Issue 5	Result
Supply Voltage Variations	15.31(e)	N/A	Complies ¹
Antenna Requirement	15.203	6.8 (RSS-Gen)	NA ²
Power-Line Conducted Emission	15.207(a)(c)	7.2/.8.8 (RSS-Gen)	Complies ¹
99% Occupied Bandwidth	N/A	6.7 (RSS-GEN)	-
Fundamental Field strength	15.225(a)	B.6(a) (RSS-210)	Complies
Band Emissions	15.225(b)(c)	B.6(b)(c) (RSS-210)	Complies
Spurious Emissions (Radiated)	15.225 (d) 15.209	B.6(d) (RSS-210) 7.3/8.9/8.10 (RSS-GEN)	Complies
Frequency stability	15.225(e)	B.6 (RSS-210) B.6.11 (a) (RSS-Gen)	Complies

¹ EUT is operated by DC power. (via Auxiliary device)

² Integral loop antenna.

RSS Gen issue 5 covers section 6,7 and 8

RSS 210 issue 9 covers section B.6

Revision history

Revision #	Date	Order #	Comment	Sign
00	2020-10-30	407218	First version	GNS
01	2021-01-06	407218	RSS-210 Version is corrected.	gns

2.3 Description of modification for Modification Filing

Not applicable.

2.4 Antenna Requirement

Is the antenna detachable?

Yes No

If detachable, is the antenna connector non-standard?

Yes No

Type of antenna connector: N/A

Ref. FCC §15.203

2.5 Worst-Case Configuration and Mode

Radiated Emissions were performed with the EUT set to transmit at the channel with the highest output power as worst-case scenario.

2.6 Comments

And the output level is set to maximum in the software.

The radiated measurements are tested on three axis.

All measurements were done with the EUT powered with 5.5VDC voltage. The DC voltage is delivered from an auxiliary device NICRA 4, which can be powered by either AC/DC adapter or PoE.

Following ports were populated during spurious emission measurements:

- DC

2.7 Family List Rational

Not Applicable.

3 TEST RESULTS

3.1 Power Line Conducted Emissions

FCC Part 15.207 (a)(c)

ISED Canada RSS-GEN Issue 5, Clause 7.2/8.8

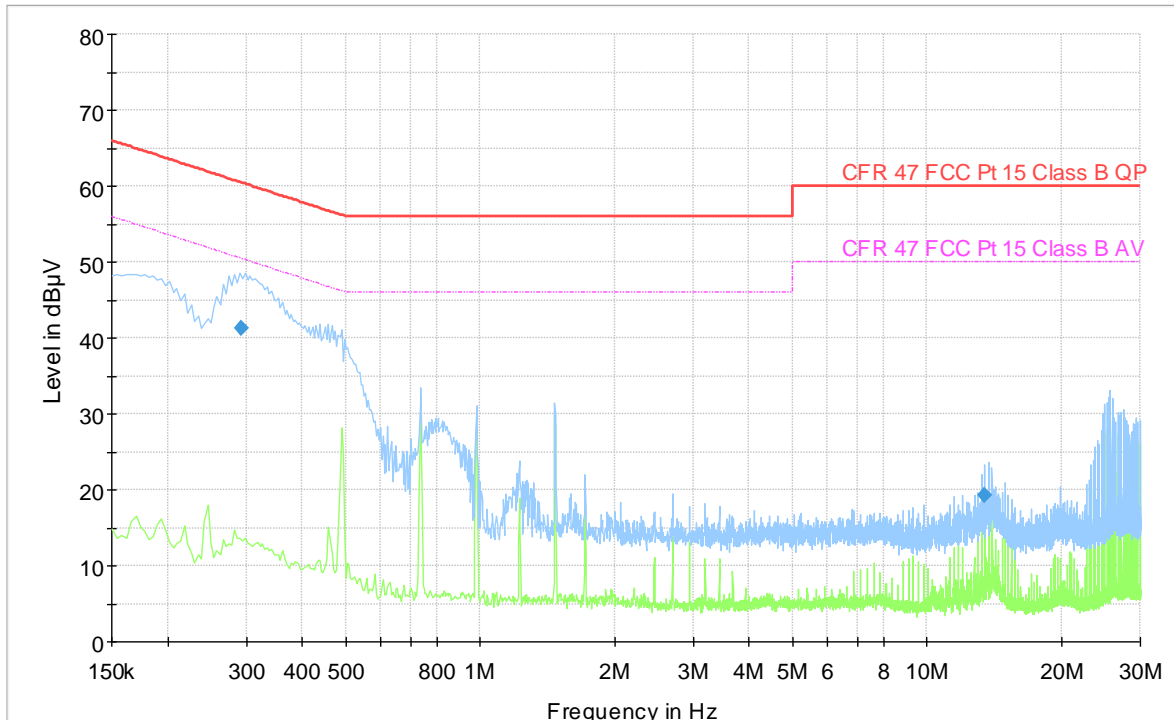
Measurement procedure: ANSI C63.4-2014 using 50 μ H/50 ohms LISN.

Test Results: Complies

Measurement Data: See attached plots.

Highest measured value (L1 and N): All spurious emissions are well below the PK

Full Spectrum



Frequency (MHz)	QuasiPeak (dB μ V)	Average (dB μ V)	Limit (dB μ V)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	Filter
0.292	41.21	---	60.47	19.25	1000	9	N	OFF
13.488	19.19	---	60.00	40.81	1000	9	L1	OFF

Measured with AC/DC adapter 120Vac/60Hz, Model: CMP S008ACM00120

3.2 99% Occupied Bandwidth

ISED Canada RSS-GEN Issue 5, Clause 6.7

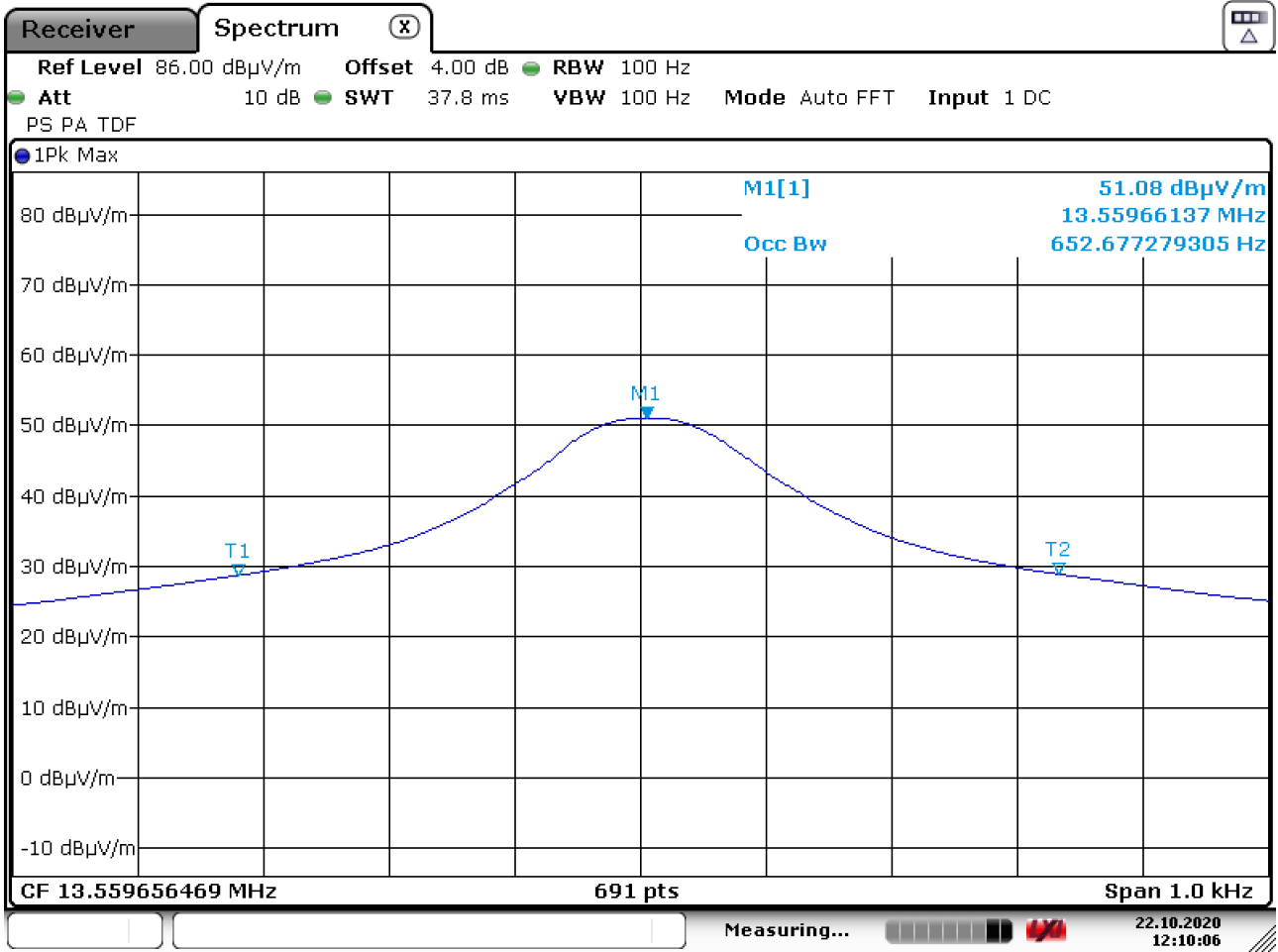
Test Results: Complies

Measurement Data:

99% BW (kHz)
13.56MHz
0.657

Requirements:

For information only



Date: 22.OCT.2020 12:10:06

13.56MHz – 99% BW

3.3 Fundamental Field Strength

FCC 15.225 (a) / B.6 (a)

ISED Canada RSS-210 Issue 10, B.6(a)

Test Results: Complies

Measurement data:

Maximum field strength

RF channel	Measured PK value (dB μ V/m) @ 10m	Distance Correction factor for Limit dB	Converted Limit @10m (dB μ V/m)
13.56MHz	53.93	9.5	93.5

The limit line given in the graph is corrected to 10m distance.

Pulse train period during reading card reading mode (duty cycle: 7.8%)

Radiated measurements are performed at 10 m distance.

Detachable antenna?

Yes

No

If detachable, is the antenna connector non-standard?

Yes

No

Integral loop antenna

Requirements:

The maximum field strength within band 13.553 – 13.567MHz at 30 meters shall be \leq 84.0 dB μ V/m (at 10 meters \leq 93.5 dB μ V/m)

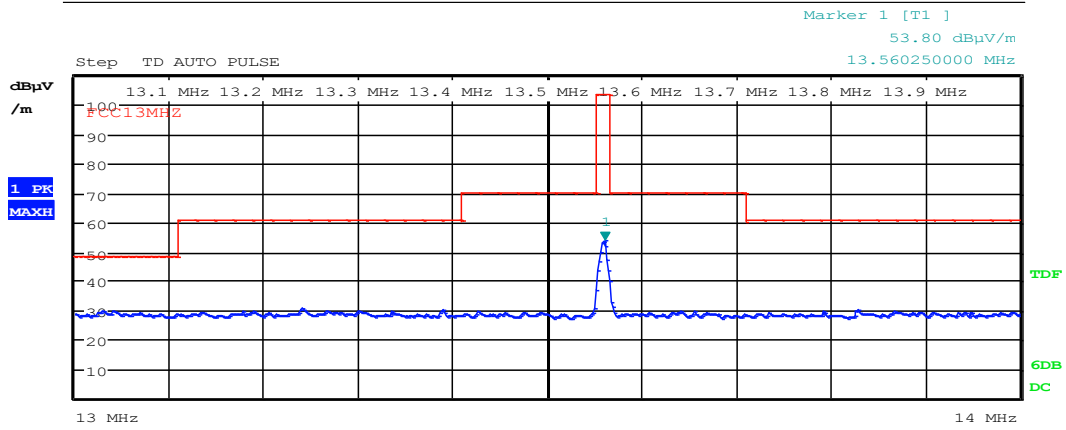
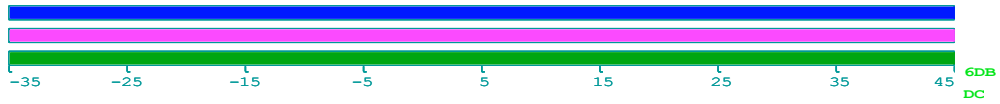
(b) 334 microvolts/m (50.5 dB μ V/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz. (at 10 meters \leq 89.5 dB μ V/m)

(c) 106 microvolts/m (40.5 dB μ V/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz. (at 10 meters \leq 50 dB μ V/m)



Att 0 dB AUTO
 RBW 9 kHz
 MT 1 s
 PREAMP ON

FREQUENCY	13.5602500 MHz		
LEVEL PK+	53.93	dB μ V/m	
QPK	53.48	dB μ V/m	
AV	53.48	dB μ V/m	



Date: 22.OCT.2020 07:47:59

Field strength – 13.56MHz

3.4 Spurious emissions (radiated)

FCC 15.209 / 15.225 (b,c,d)

ISED Canad RSS-210 Issue 10, B.6(d) and RSS-Gen 7.3/8.9/8.10

Test Results: Complies

Measurement Data:

Radiated Emissions with loop antenna, 9kHz – 30MHz

measured at a distance of 10m.

Measured with Peak Detector:

Frequency	Dist. corr. factor	Measured Field strength, Peak @ 10m	Duty cycle corr. factor	Calculated Field strength, Average @ 30m	Limit @ 300m	Margin
kHz	dB	dB μ V/m	dB	dB μ V/m	dB μ V/m	dB
/	/	/	/	/	/	> 30

The limit line given in the graph is corrected to 10m distance.

The maximum is observed in longitudinal polarization

Antenna factor, amplifier gain and cable loss are included in spectrum analyzer "Transducer factor".

Duty Cycle Correction Factor Calculation:

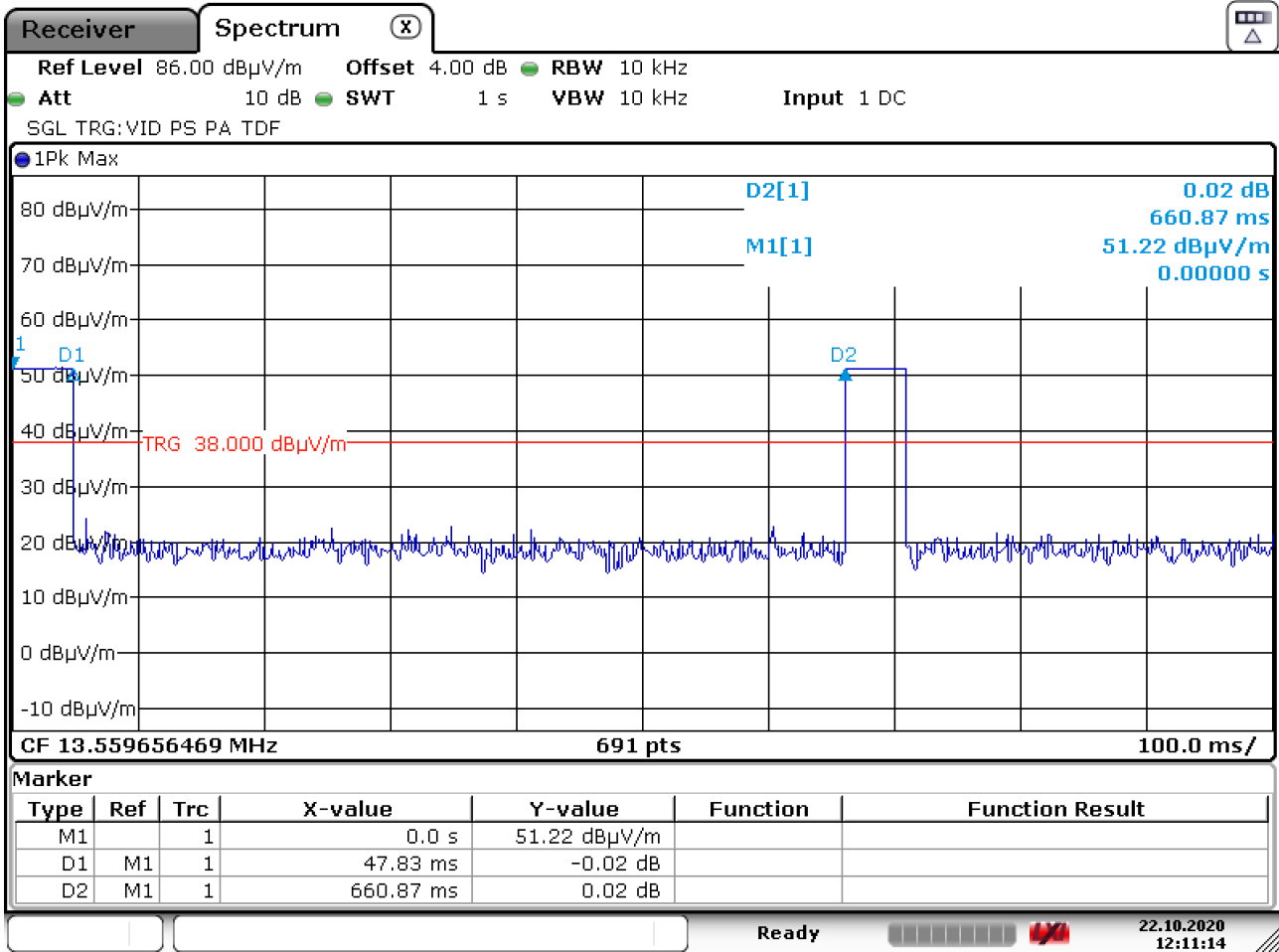
RF duty cycle: Calculation according to RF burst Para 15.35 (c)

minimum DC Correction factor = $-20 \times \log(0.0078) = -42$ dB

Maximum Duty Cycle Correction Factor according to Para 15.35 (b): 20 dB

Requirement:

(d) 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.



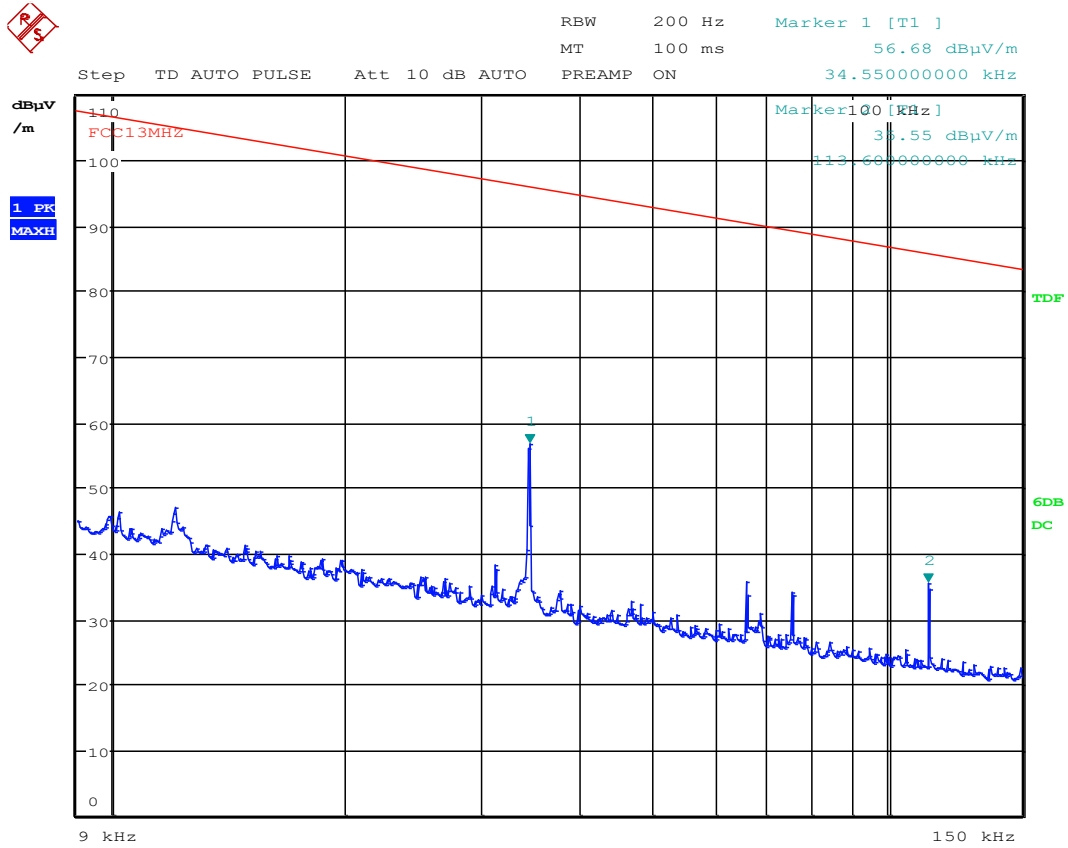
Date: 22.OCT.2020 12:11:14

Duty cycle during card reading

Radiated emissions 9kHz – 30 MHz.

Detector: Peak

Measuring distance 10 m. The limit is corrected to 10m distance.



Date: 22.OCT.2020 07:41:08

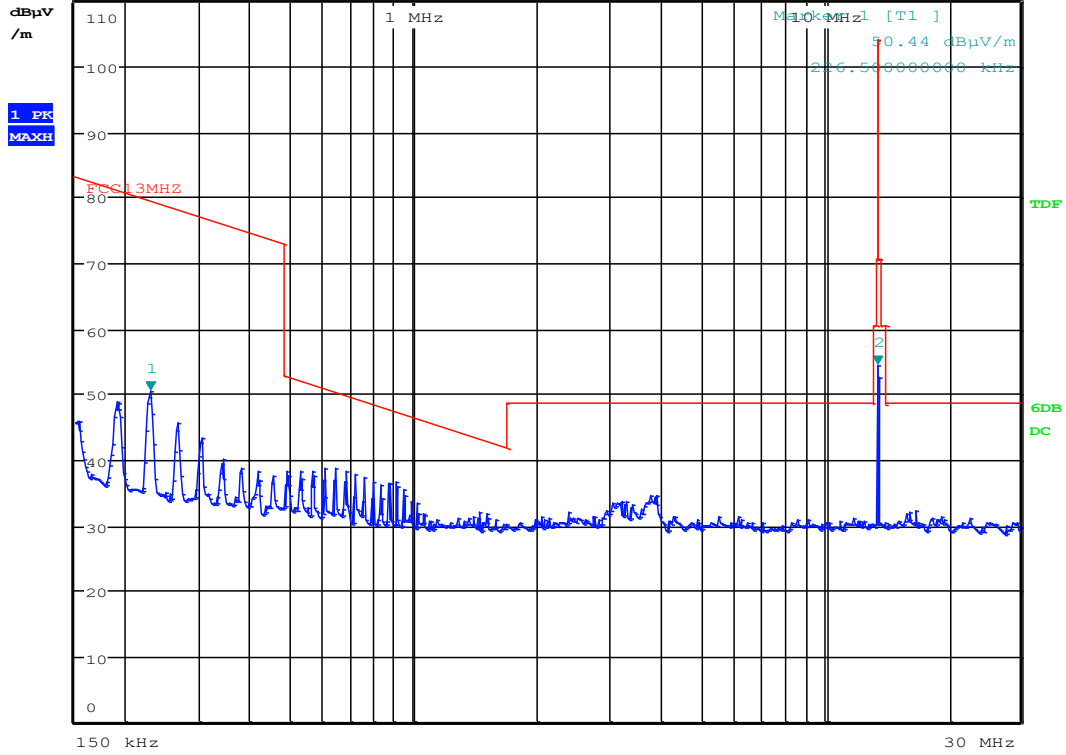
Radiated spurious emissions, 9kHz – 150kHz, PK scan (The emission at 34.55kHz is not from the EUT, it is a part of the test setup)



MARKER 2
 13.56 MHz

RBW 9 kHz Marker 2 [T1]
 MT 50 ms 54.49 dBµV/m
 13.560000000 MHz

Step TD AUTO PULSE Att 10 dB AUTO PREAMP ON



Date: 22.OCT.2020 07:43:58

Radiated spurious emissions, 150kHz - 30MHz, PK scan

Radiated emissions 30 – 1000 MHz.

Detector: QP

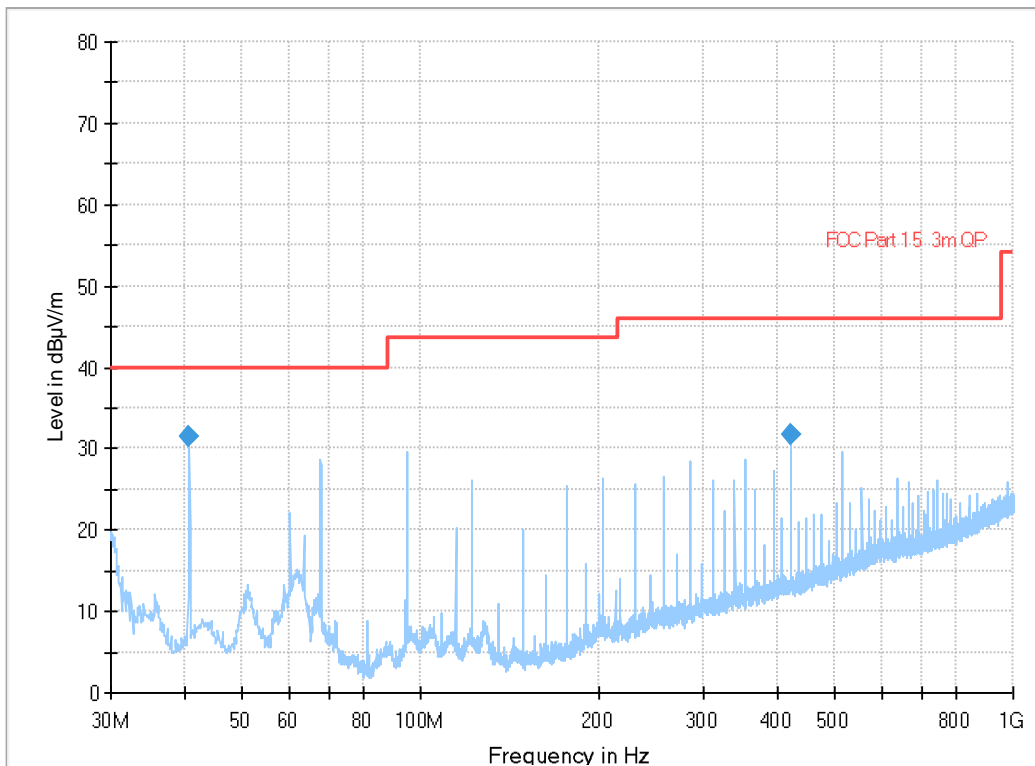
Measuring distance 3 m.

The graph shows peak scan and highest values.

Frequency (MHz)	QuasiPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40.678700	31.56	40.00	8.44	1000.0	120.000	103.0	V	3.0
420.346400	31.75	46.00	14.25	1000.0	120.000	102.0	V	155.0

30 - 100MHz (PK scan)

Full Spectrum



3.5 Transmitter Frequency Stability

FCC 15.225(e)

ISED Canada RSS-210 Issue 10, B.6 and RSS-Gen B.6.11 (a)

Test Results: Complies

Measurement Data:

Temperature	Given Frequency (MHz)	Measured value (MHz)	Deviation (%)
+50 ° C	13.56	13.56013945	0.00029
+20 ° C	13.56	13.56017945	Reference
-20 ° C	13.56	13.56024245	0.00178

Supply voltage:5.5Vdc

Requirement:

(e) The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ ($\pm 100\%$) of the operating frequency over a temperature variation of -20 degrees to +50 degrees C at normal supply voltage.

4 Measurement Uncertainty

Measurement Uncertainty Values		
Test Item		Uncertainty
Output Power		±0.5 dB
Power Spectral Density		±0.5 dB
Out of Band Emissions, Conducted	< 3.6 GHz	±0.6 dB
	> 3.6 GHz	±0.9 dB
Spurious Emissions, Radiated	< 1 GHz	±2.5 dB
	> 1 GHz	±2.2 dB
Emission Bandwidth		±4 %
Power Line Conducted Emissions		+2.9 / -4.1 dB
Spectrum Mask Measurements	Frequency	±5 %
	Amplitude	±1.0 dB
Frequency Error		±0.6 ppm
Temperature Uncertainty		±1 °C

All uncertainty values are expanded standard uncertainty to give a confidence level of 95%, based on coverage factor k=2

5 LIST OF TEST EQUIPMENT

To facilitate inclusion on each page of the test equipment used for related tests, each item of test equipment and ancillaries are identified (numbered) by the Test Laboratory.

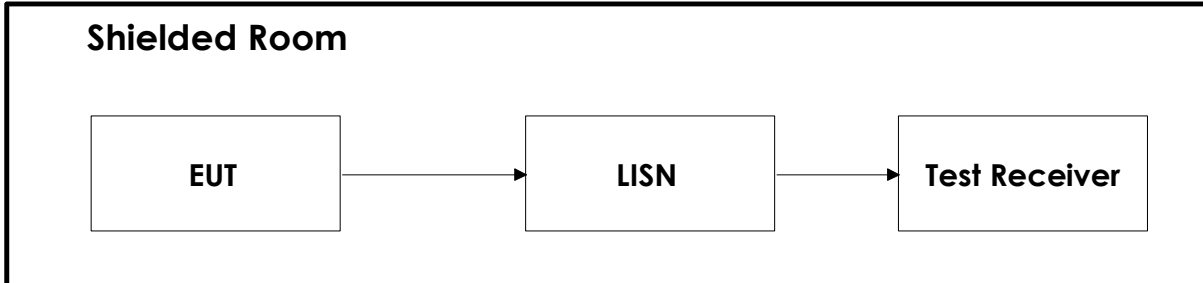
No.	Instrument/ ancillary	Type of instrument/ ancillary	Manufacturer	Ref. no.	Cal. Date	Cal. Due
1.	ESU40	EMI Receiver	Rohde & Schwarz	LR1639	2020.01	2021.01
2.	ESR	Spectrum analyser	Rohde & Schwarz	LR1675	2019.01	2021.01
3.	HFH2-Z2	Active Loop antenna	Rohde & Schwarz	LR1660	2019.06	2021.06
4.	3115	Antenna horn	EMCO	LR 1330	2016.10	2020.10
5.	3117-PA	Horn antenna with PreA	EMCO	LR 1717	2017.12	2020.12
6.	PM 320K	Antenna Horn	Sivers	LR 1717	N/A	
7.	DBF-520-20	Antenna Horn	Systron-Donner corp	LR 102	N/A	
8.	638	Antenna Horn	NARDA	LR 1480	N/A	
9.	637	Antenna Horn	NARDA	LR 099	N/A	
10	VULB9163	Bi-log Hybrid Antenna	Schwarzbeck	LR 1616	2020.01	2022.01
11	4768-10	Attenuator	Narda	LR 1670	Cal b4 use	
12	6HC1500/18000	Highpass Filter	Trilithic	LR 1612	Cal b4 use	
13	8449B	Pre-amplifier	Hewlett Packard	LR 1322	2020.08	2021.08
14	310N	Pre-amplifier	Sonoma	LR 1686	2020.08	2021.08
15	Model 87	Multimeter	Fluke	N4672	2018.11	2020.11
16	CPX400D	Power supply	TTi	LR 1744	Cal b4 use	
17	6812B	AC Power source	Agilent	LR 1515	2019.03	2021.03
18	TY 80	Climatic chamber	ACS	LR 1083	2020.03	2021.03

The software listed below has been used for one or more tests.

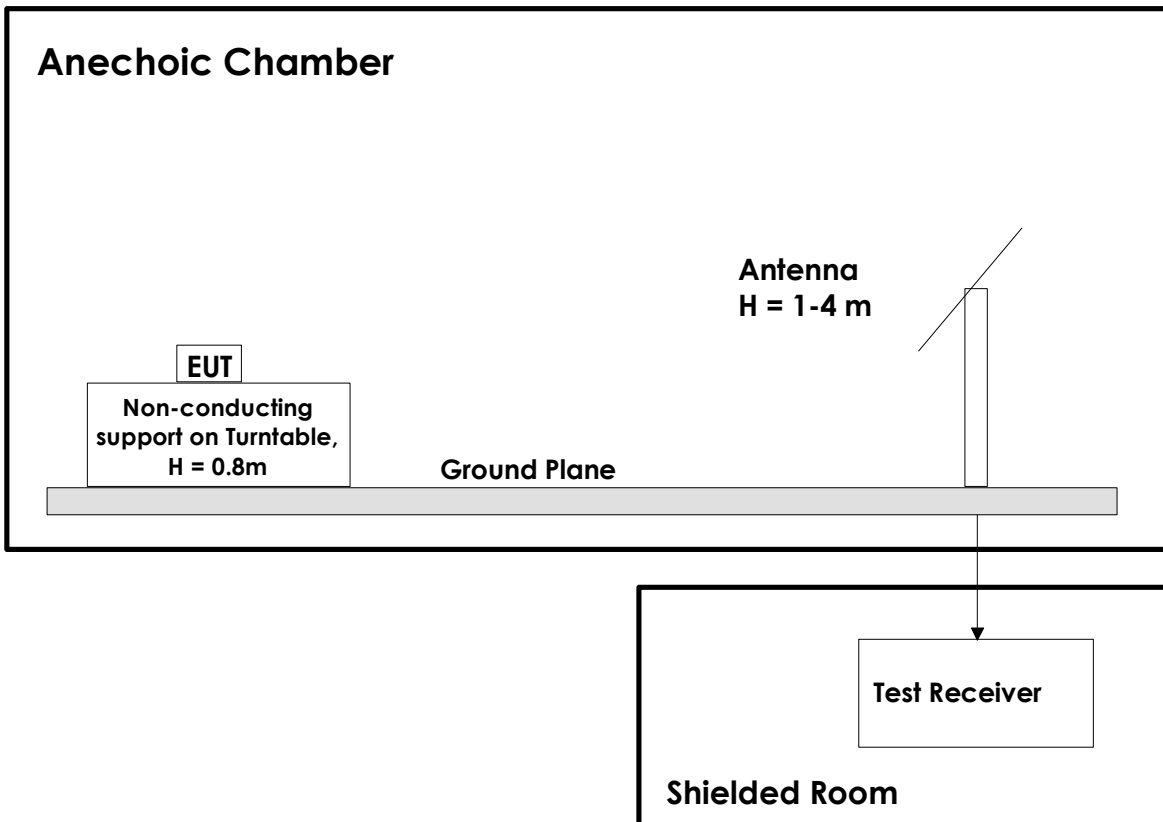
No.	Manufacturer	Name	Version	Comment
1	Rohde & Schwarz	GPiBSHOT	2.7	Screenshots from R&S Spectrum Analyzers
2	Rohde & Schwarz	RSCommander	1.9.2	Software Tool for R&S Instruments
3	Rohde & Schwarz	EMC 32	10.40.10	Radiated Emission test software

7 BLOCK DIAGRAM

7.1 Power Line Conducted Emission



7.2 Test Site Radiated Emission



This test setup is used for all radiated emissions tests. For frequencies below 30 MHz the measuring distance is 10m, for all other frequencies it is 3m or 1m. Emissions above 1 GHz are measured with a Spectrum Analyzer and Horn Antenna. For measurements above 18 GHz the test receiver is moved inside the anechoic chamber and located next to the antenna to minimize the cable loss. All measurements at 1GHz and above were performed with turntable height 1.5m and with the ground plane covered by absorbers. A pre-amplifier is used for all measurements above 30 MHz, and High-Pass or Band-Pass filter is used for all harmonics