

TEST REPORT

Test report no.: 1-7159-23-01-06_TR1-R06



Deutsche
Akkreditierungsstelle
D-PL-12047-01-00

Testing laboratory

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Accredited Testing Laboratory:

The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS)

The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00

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Manufacturer

same as applicant

Test standard/s

FCC - Title 47 CFR Part 15 FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices

RSS - 210 Issue 11 Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item: **RFID Reader**
RFID 1AC FX CWU
RFID 1AC FX WA
Model name: **RFID 1AC MI**
RFID 1AC ST 430
RFID 1AC KF
Frequency: 13.553 MHz – 13.567 MHz
Technology tested: RFID
Antenna: external antenna
Power supply: 5.0 V DC through USB cable
Temperature range: -20°C to +55°C

This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

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1 Table of contents

1	Table of contents.....	2
2	General information.....	3
2.1	Notes and disclaimer	3
2.2	Application details	3
2.3	Test laboratories sub-contracted.....	3
3	Test standard/s	4
4	Reporting statements of conformity – decision rule	5
5	Test environment	6
6	Test item	6
6.1	General description.....	6
6.2	EUT information.....	7
6.3	Additional information	7
7	Description of the test setup.....	8
7.1	Shielded semi anechoic chamber.....	9
7.2	Shielded fully anechoic chamber	11
7.3	AC conducted	12
7.4	Conducted measurements	13
7.5	Frequency error	14
8	Sequence of testing.....	15
8.1	Sequence of testing radiated spurious 9 kHz to 30 MHz	15
8.2	Sequence of testing radiated spurious 30 MHz to 1 GHz.....	16
9	Measurement uncertainty	17
10	Summary of measurement results	18
11	Additional comments	18
12	Measurement results	19
12.1	Occupied bandwidth	19
12.2	Field strength of the fundamental	23
12.3	Field strength of the harmonics and spurious	24
12.4	Conducted limits.....	40
12.5	Frequency error	51
13	Glossary.....	54
14	Document history	55

2 General information

2.1 Notes and disclaimer

The test results of this test report relate exclusively to the test item specified in this test report. cetecom advanced GmbH does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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This test report replaces the test report with the number 1-7159-23-01-06_TR1-R05 and dated 2026-09-11.

2.2 Application details

Date of receipt of order:	2023-11-14
Date of receipt of test item:	2024-05-29
Start of test:*	2024-05-28
End of test:*	2024-05-30
Person(s) present during the test:	-/-

*Date of each measurement, if not shown in the plot, can be requested. Dates are stored in the measurement software.

2.3 Test laboratories sub-contracted

None

3 Test standard/s

Test standard	Date	Description
FCC - Title 47 CFR Part 15		FCC - Title 47 of the Code of Federal Regulations; Chapter I; Part 15 - Radio frequency devices
RSS - 210 Issue 11	25.06.2024	Spectrum Management and Telecommunications Radio Standards Specification - Licence-Exempt Radio Apparatus: Category I Equipment
RSS - Gen Issue 5 incl. Amendment 1 & 2	February 2021	Spectrum Management and Telecommunications Radio Standards Specification - General Requirements for Compliance of Radio Apparatus

Guidance	Version	Description
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ANSI/USEMCSC C63.10 (methods of measurement for unlicensed wireless devices):

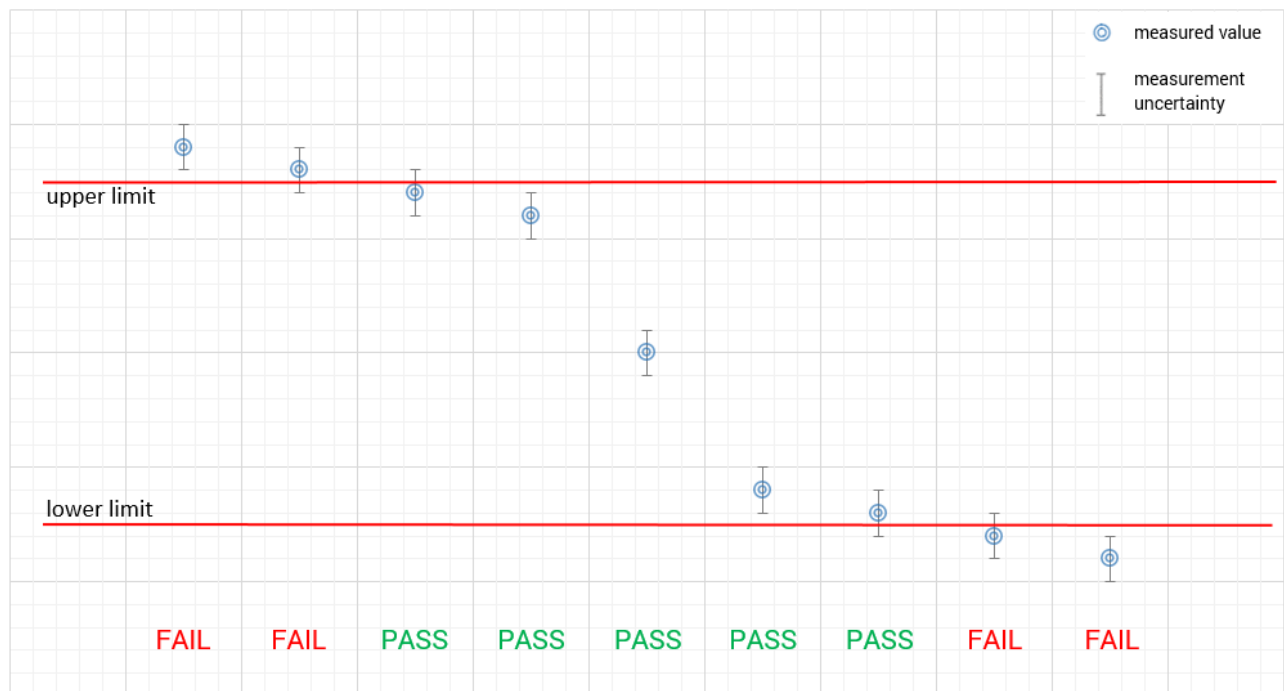
- ANSI C63.10-2020+Cor. 1-2023+C63.10a-2024 + Errata to C63.10a-2024

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.

The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong."

measured value, measurement uncertainty, verdict



5 Test environment

Temperature	:	T_{nom} T_{max} T_{min}	+22 °C during room temperature tests +55 °C during high temperature tests -20 °C during low temperature tests
Relative humidity content	:		55 %
Barometric pressure	:		not relevant for this kind of testing
Power supply	:	V_{nom} V_{max} V_{min}	5.0 V DC through USB cable -/- V -/- V

6 Test item

6.1 General description

Kind of test item	:	RFID Reader
Model name:	:	RFID 1AC FX CWU RFID 1AC FX WA RFID 1AC MI RFID 1AC ST 430 RFID 1AC KF
S/N serial number	:	prototype
Hardware status	:	see EUT info table chapter 6.2
Software status	:	
Firmware status	:	
Frequency band	:	13.553 MHz – 13.567 MHz
Type of radio transmission	:	modulated carrier
Use of frequency spectrum	:	
Type of modulation	:	OOK
Number of channels	:	1
Antenna	:	external antenna
Power supply	:	5.0 V DC through USB cable
Temperature range	:	-20°C to +55°C

6.2 EUT information

Model Name	Type	HW	SW	FCC ID	ISED ID	PMN	HVIN	FVIN
RFID 1AC ST	RFID 1AC ST 430	HW 4.1	SW 6.13	2ADLV60900936	12507A-60900936	RFID 1AC ST	HW 4.1	SW 6.13
RFID 1AC FX	RFID 1AC FX CWU	HW 4.411	SW 7.03	2ADLV1002018	12507A-1002018	RFID 1AC FX CWU	HW 4.411	SW 7.03
RFID 1AC FX	RFID 1AC FX WA	HW 4.412	SW 7.03	2ADLV1002019	12507A-1002019	RFID 1AC FX WA	HW 4.412	SW 7.03
RFID 1AC KF	RFID 1AC KF	HW 4.2	SW 6.13	2ADLV1002023	12507A-1002023	RFID 1AC KF	HW 4.2	SW 6.13
RFID 1AC MI	RFID 1AC MI	HW 4.3.0	SW 6.13	2ADLV1002011	12507A-1002011	RFID 1AC MI	HW 4.3.0	SW 6.13

6.3 Additional information

The content of the following annexes is defined in the QA. It may be that not all of the listed annexes are necessary for this report, thus some values in between may be missing.

Test setup and EUT photos are included in test report:

1-7159-23-01-01_TR1-A101-R01
1-7159-23-01-01_TR1-A102-R01
1-7159-23-01-01_TR1-A104-R01

7 Description of the test setup

Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Weekly chamber inspections and range calibrations are performed. Where possible, RF generating and signaling equipment as well as measuring receivers and analyzers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

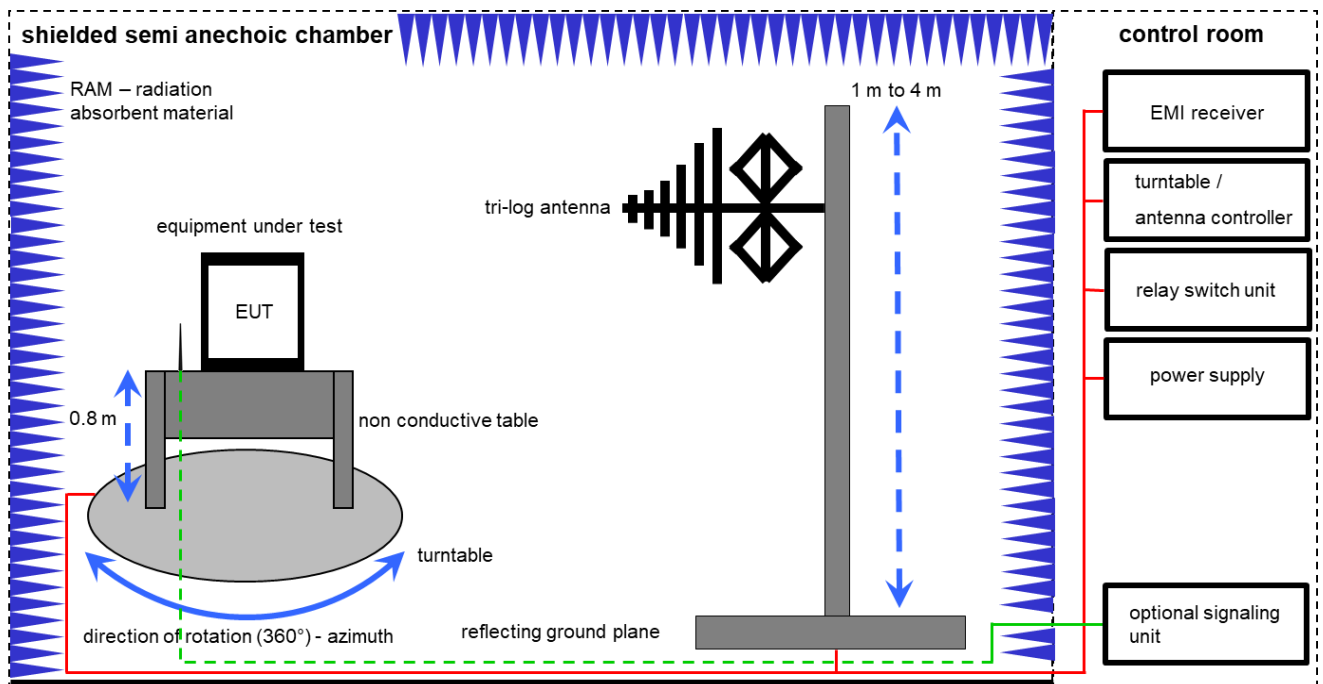
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

Agenda: Kind of Calibration

k	calibration / calibrated	EK	limited calibration
ne	not required (k, ev, izw, zw not required)	zw	cyclical maintenance (external cyclical maintenance)
ev	periodic self verification	izw	internal cyclical maintenance
Ve	long-term stability recognized	g	blocked for accredited testing
vlk!	Attention: extended calibration interval		
NK!	Attention: not calibrated	*)	next calibration ordered / currently in progress

7.1 Shielded semi anechoic chamber

The radiated measurements are performed in vertical and horizontal plane in the frequency range from 30 MHz to 1 GHz in semi-anechoic chambers. The EUT is positioned on a non-conductive support with a height of 0.80 m above a conductive ground plane that covers the whole chamber. The receiving antennas are conform to specifications ANSI C63. These antennas can be moved over the height range between 1.0 m and 4.0 m in order to search for maximum field strength emitted from EUT. The measurement distances between EUT and receiving antennas are indicated in the test setups for the various frequency ranges. For each measurement, the EUT is rotated in all three axes until the maximum field strength is received. The wanted and unwanted emissions are received by spectrum analyzers where the detector modes and resolution bandwidths over various frequency ranges are set according to requirement ANSI C63.



Measurement distance: tri-log antenna 10 meter
EMC32 software version: 10.59.00

$$FS = UR + CL + AF$$

(FS-field strength; UR-voltage at the receiver; CL-loss of the cable; AF-antenna factor)

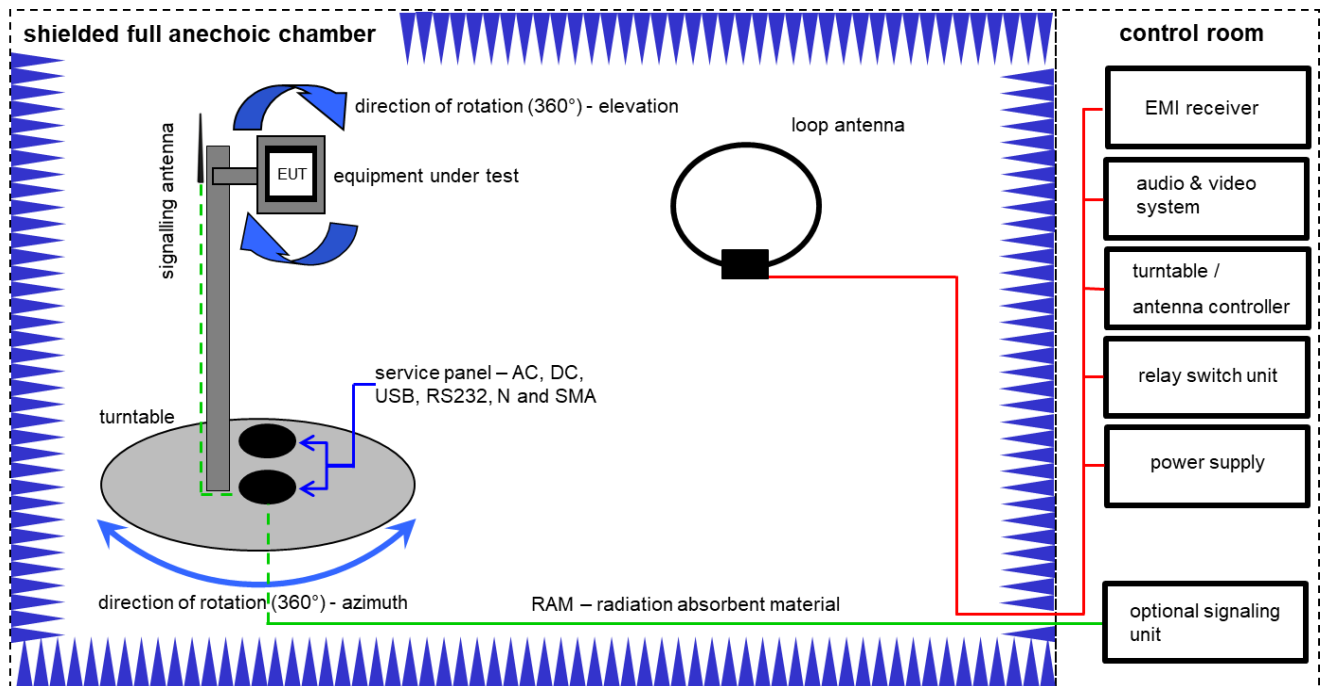
Example calculation:

$$FS [dB\mu V/m] = 12.35 [dB\mu V/m] + 1.90 [dB] + 16.80 [dB/m] = 31.05 [dB\mu V/m] (35.69 \mu V/m)$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Switch-Unit	3488A	HP	2719A14505	300000368	ev	-/-	-/-
2	A	Semi anechoic chamber	3000023	MWB AG	-/-	300000551	ne	-/-	-/-
3	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
4	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
5	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
6	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	295	300003787	vIKI!	23.05.2023	31.05.2025
7	A	Turntable	2089-4.0	EMCO	-/-	300004394	ne	-/-	-/-
8	A	PC	TecLine	F+W	-/-	300004388	ne	-/-	-/-
9	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	06.12.2023	31.12.2024

7.2 Shielded fully anechoic chamber



Measurement distance: loop antenna 3 meter

$$FS = UR + CA + AF$$

(FS-field strength; UR-voltage at the receiver; CA-loss of the signal path; AF-antenna factor)

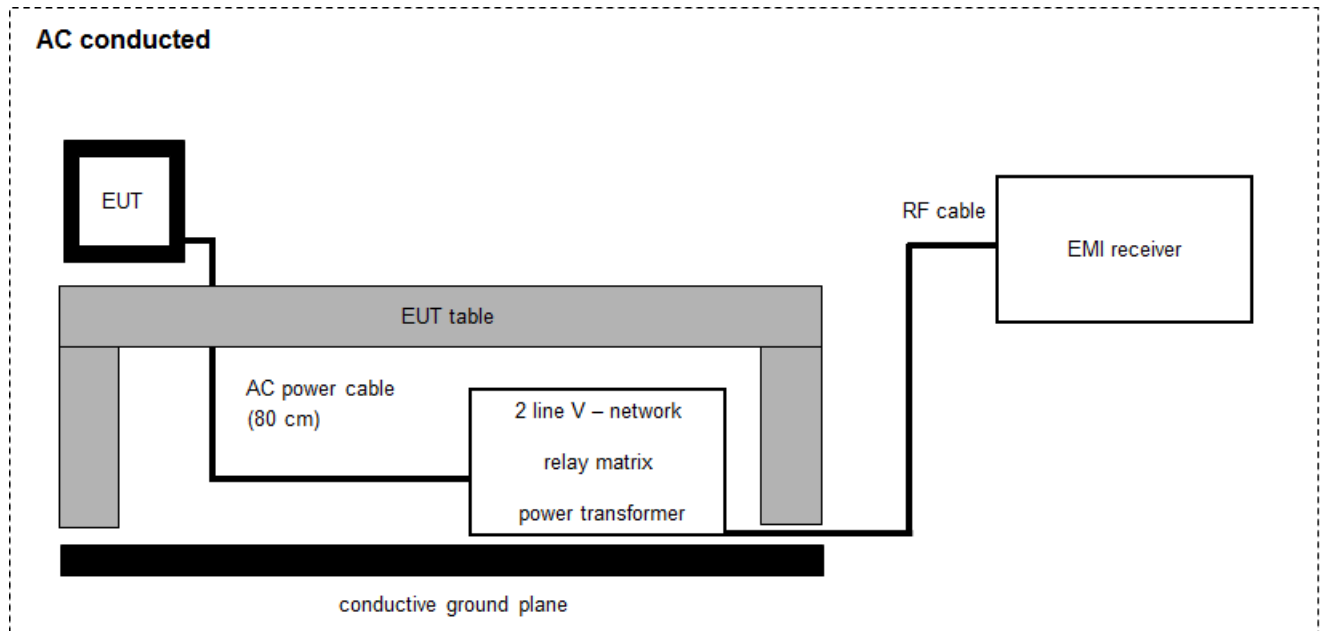
Example calculation:

$$FS \text{ [dB}\mu\text{V/m]} = 40.0 \text{ [dB}\mu\text{V/m]} + (-35.8) \text{ [dB]} + 32.9 \text{ [dB/m]} = 37.1 \text{ [dB}\mu\text{V/m]} (71.61 \mu\text{V/m})$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
2	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	11.12.2023	31.12.2024
3	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vIKI!	02.08.2023	31.08.2025
4	A	NEXIO EMV-Software	BAT EMC V2022.0.22.0	Nexio	-/-	300004682	ne	-/-	-/-

7.3 AC conducted



$$FS = UR + CF + VC$$

(FS-field strength; UR-voltage at the receiver; CR-loss of the cable and filter; VC-correction factor of the ISN)

Example calculation:

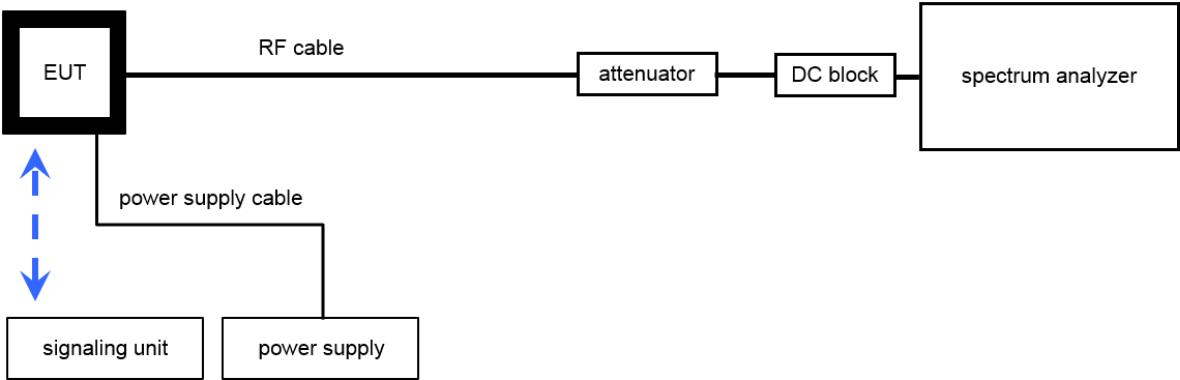
$$FS [dB\mu V/m] = 37.62 [dB\mu V/m] + 9.90 [dB] + 0.23 [dB] = 47.75 [dB\mu V/m] \quad (244.06 \mu V/m)$$

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Two-line V-Network (LISN) 9 kHz to 30 MHz	ESH3-Z5	Rohde & Schwarz	892475/017	300002209	vIKI!	12.12.2023	31.12.2025
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
4	A	PC	TecLine	F+W		300003532	ne	-/-	-/-
5	A	Analyzer-Impedance-System	ALS16/1	Spitzenberger + Spies GmbH & Co. KG	UO2076 07/0 1023	400001751	k	19.10.2023	31.10.2025
6	A	EMI Test Receiver 3.6 GHz	ESR3	Rohde & Schwarz	102981	300006318	k	08.12.2023	31.12.2024

7.4 Conducted measurements

Conducted measurements normal conditions



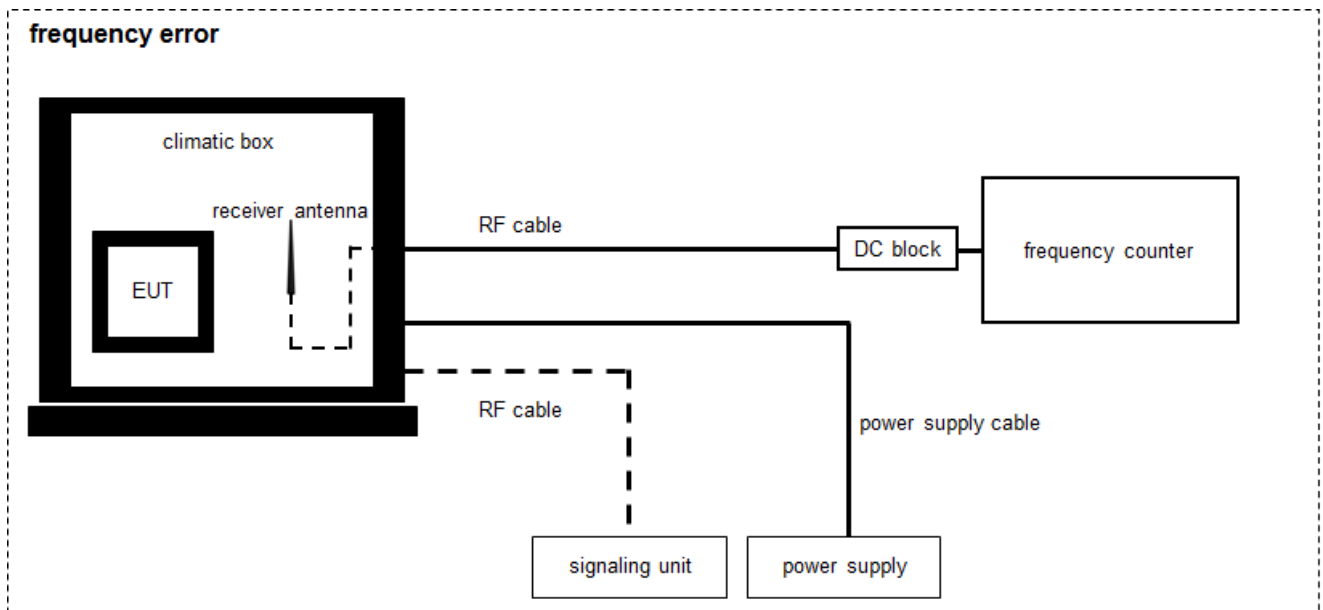
OP = AV + CA
(OP-output power; AV-analyzer value; CA-loss signal path)

Example calculation:
OP [dBm] = 6.0 [dBm] + 11.7 [dB] = 17.7 [dBm] (58.88 mW)

Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Loop Antenna		ZEG TS Steinfurt		400001208	ev	-/-	-/-
2	A	Signal analyzer	FSV30	Rohde&Schwarz	104365	300005923	k	13.12.2023	31.12.2024

7.5 Frequency error



Equipment table:

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	Temperature Test Chamber	VT 4002	Heraeus Voetsch	521/84193	300003889	ev	09.05.2022	31.05.2024
2	A	Loop Antenna		ZEG TS Steinfurt		400001208	ev	-/-	-/-
3	A	Signal analyzer	FSV30	Rohde&Schwarz	104365	300005923	k	13.12.2023	31.12.2024

8 Sequence of testing

8.1 Sequence of testing radiated spurious 9 kHz to 30 MHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, it is placed on a table with 0.8 m height.
- If the EUT is a floor standing device, it is placed directly on the turn table.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement*

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna height is 1 m.
- At each turntable position the analyzer sweeps with positive-peak detector to find the maximum of all emissions.

Final measurement

- Identified emissions during the pre-measurement are maximized by the software by rotating the turntable from 0° to 360°.
- Loop antenna is rotated about its vertical axis for maximum response at each azimuth about the EUT. (For certain applications, the loop antenna plane may also need to be positioned horizontally at the specified distance from the EUT)
- The final measurement is done in the position (turntable and elevation) causing the highest emissions with quasi-peak (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, turntable position, correction factor, margin to the limit and limit will be recorded. A plot with the graph of the premeasurement and the limit is stored.

*)Note: The sequence will be repeated three times with different EUT orientations.

8.2 Sequence of testing radiated spurious 30 MHz to 1 GHz

Setup

- The equipment is set up to simulate normal operation mode as described in the user manual or defined by the manufacturer.
- If the EUT is a tabletop system, a table with 0.8 m height is used, which is placed on the ground plane.
- If the EUT is a floor standing device, it is placed on the ground plane with insulation between both.
- Auxiliary equipment and cables are positioned to simulate normal operation conditions as described in ANSI C 63.4.
- The AC power port of the EUT (if available) is connected to a power outlet below the turntable.
- Measurement distance is 10 m or 3 m (see ANSI C 63.4) – see test details.
- EUT is set into operation.

Premeasurement

- The turntable rotates from 0° to 315° using 45° steps.
- The antenna is polarized vertical and horizontal.
- The antenna height changes from 1 m to 3 m.
- At each turntable position, antenna polarization and height the analyzer sweeps three times in peak to find the maximum of all emissions.

Final measurement

- The final measurement is performed for at least six highest peaks according to the requirements of the ANSI C63.4.
- Based on antenna and turntable positions at which the peak values are measured the software maximize the peaks by changing turntable position $\pm 45^\circ$ and antenna height between 1 and 4 m.
- The final measurement is done with quasi-peak detector (as described in ANSI C 63.4).
- Final levels, frequency, measuring time, bandwidth, antenna height, antenna polarization, turntable angle, correction factor, margin to the limit and limit are recorded. A plot with the graph of the premeasurement with marked maximum final results and the limit is stored.

9 Measurement uncertainty

Measurement uncertainty	
Test case	Uncertainty
Occupied bandwidth	$\pm$ used RBW
Field strength of the fundamental	$\pm$ 3 dB
Field strength of the harmonics and spurious	$\pm$ 3 dB
Receiver spurious emissions and cabinet radiations	$\pm$ 3 dB
Conducted limits	$\pm$ 2.6 dB

10 Summary of measurement results

☒	No deviations from the technical specifications were ascertained
☐	There were deviations from the technical specifications ascertained
☐	This test report is only a partial test report. The content and verdict of the performed test cases are listed below.

TC Identifier	Description	Verdict	Date	Remark
RF-Testing	CFR Part 15 RSS 210 Issue 11 RSS Gen Issue 5	See table!	2026-09-15	-/-

Test specification clause	Test case	Temperature conditions	Power source conditions	C	NC	NA	NP	Remark
RSS Gen Issue 5	Occupied bandwidth	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 10	Field strength of the fundamental	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.209 § 15.225 (b-d) RSS Gen Issue 5	Field strength of the harmonics and spurious	Nominal	Nominal	☒	☐	☐	☐	-/-
§15.107 §15.207	Conducted limits	Nominal	Nominal	☒	☐	☐	☐	-/-
§ 15.225 (a) RSS 210 Issue 10	Frequency tolerance	Normal & extreme conditions	Normal & extreme conditions	☒	☐	☐	☐	-/-

Note:

C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed

11 Additional comments

Reference documents: None

Special test descriptions: None

Configuration descriptions: - all tests have been performed by the use of Aclaris RFID 1AC Tester (see photo annex)
- AC conducted measurement (chapter 12.4) has been performed on a device where the RFID antenna port was terminated with a 51R resistor according KDB 174176

12 Measurement results

12.1 Occupied bandwidth

Measurement:

The emission bandwidth (x dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated x dB below the maximum in-band spectral density of the modulated signal. Measurement performed according to ANSI C63.10, chapter 6.9.3, "Occupied bandwidth—power bandwidth (99%) measurement procedure"

Measurement parameters	
Detector:	Peak
Resolution bandwidth:	1 % – 5 % of the occupied bandwidth
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Analyser function:	99 % power function
Used equipment:	See chapter 7.4A
Measurement uncertainty:	See chapter 9

Limit:

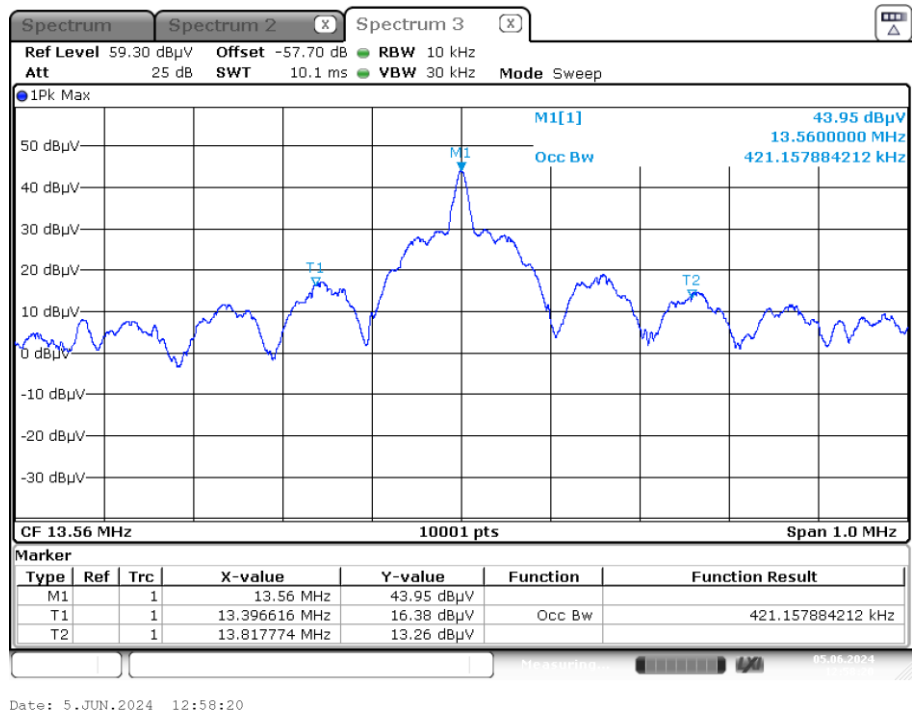
IC
for RSP-100 test report coversheet only

Result:

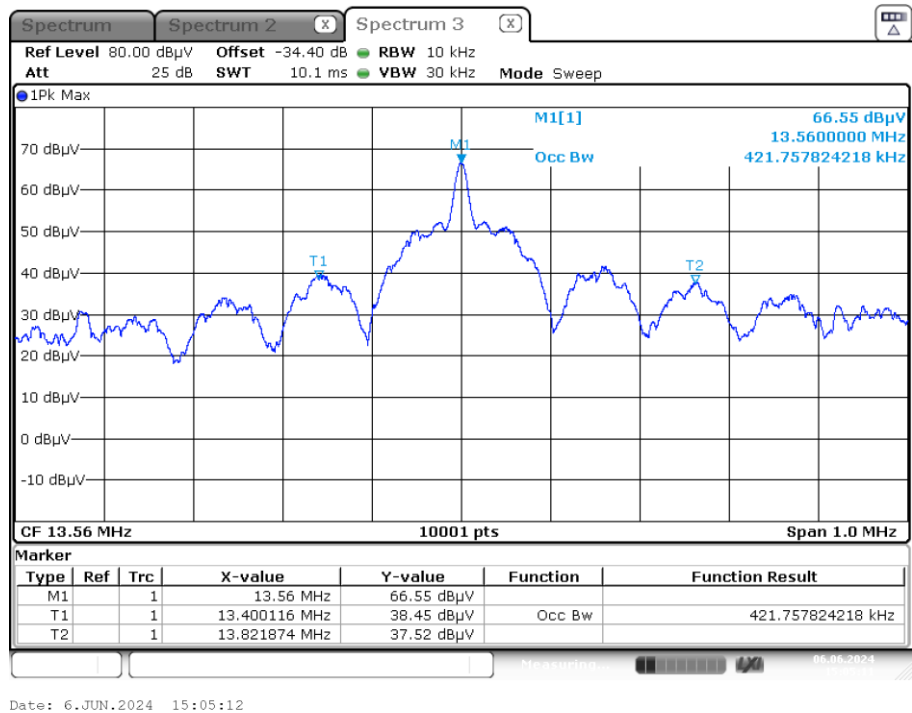
99% emission bandwidth	
RFID 1AC FX CWU	421.15 kHz
RFID 1AC FX WA	421.75 kHz
RFID 1AC MI	407.95 kHz
RFID 1AC ST 430	411.35 kHz
RFID 1AC KF	416.05 kHz

Plot:

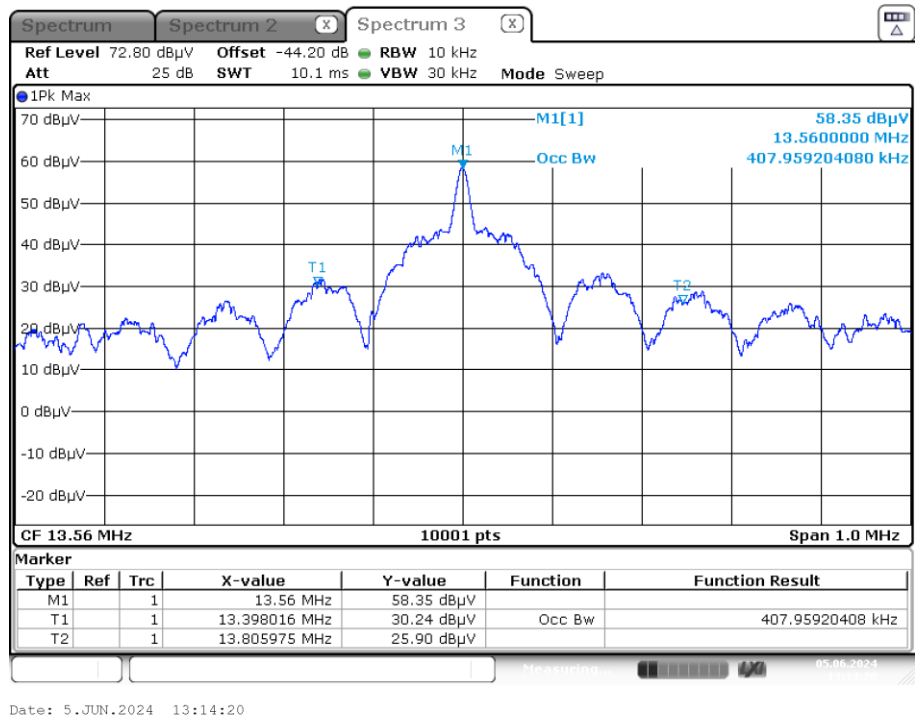
Plot 1: 99 % emission bandwidth RFID 1AC FX CWU



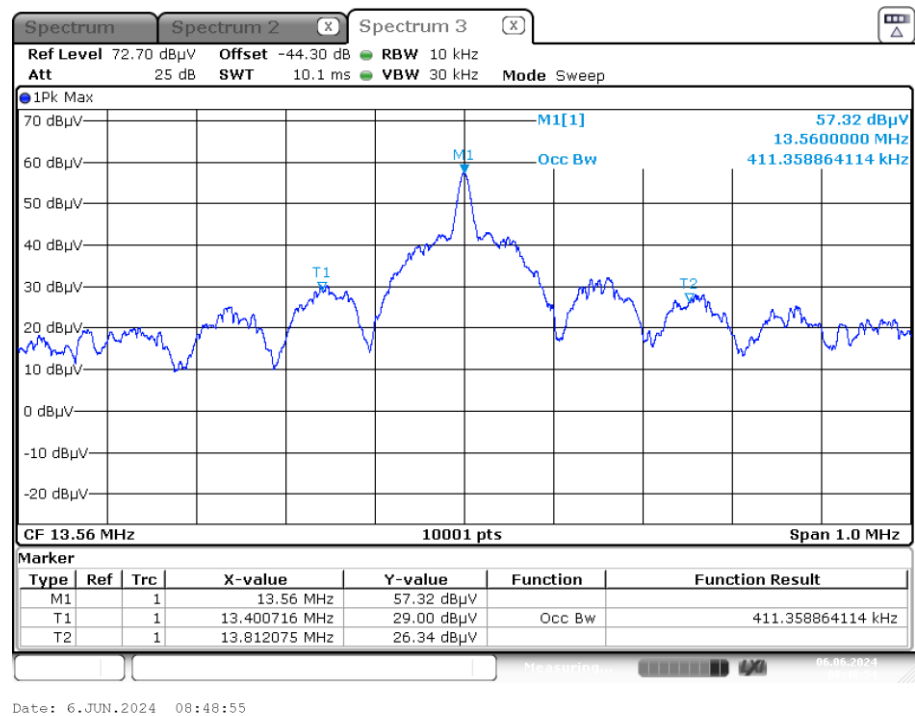
Plot 2: 99 % emission bandwidth RFID 1AC FX WA



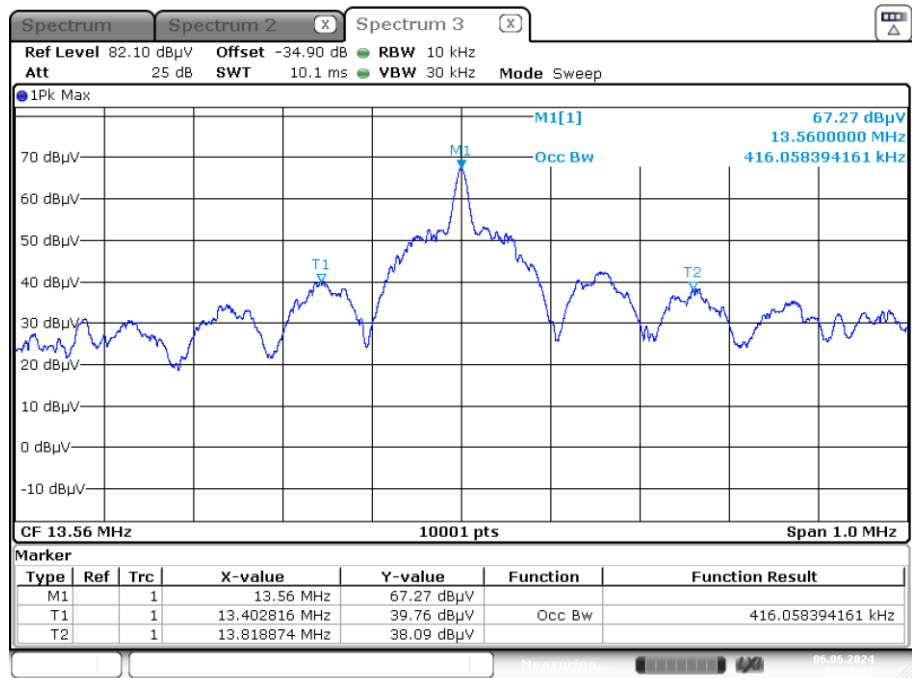
Plot 3: 99 % emission bandwidth RFID 1AC MI



Plot 4: 99 % emission bandwidth RFID 1AC ST 430



Plot 5: 99 % emission bandwidth RFID 1AC KF



Date: 6.JUN.2024 08:56:17

12.2 Field strength of the fundamental

Measurement:

The maximum detected field strength for the carrier signal. Measurement performed according to ANSI C63.10 chapter 6.4

Measurement parameters	
Detector:	Quasi Peak
Resolution bandwidth:	9 kHz
Video bandwidth:	≥ 3x RBW
Trace mode:	Max hold
Used equipment:	See chapter 7.2A
Measurement uncertainty:	See chapter 9

Limit:

FCC & IC		
Frequency / MHz	Field strength / (μV/m)	Measurement distance / m
13.553 to 13.567	15,848 (84 dBμV/m)	30

Recalculation:

According to ANSI C63.10		
Frequency	Formula	Correction value
13.56 MHz	$FS_{\text{limit}} = FS_{\text{max}} - 40 \log \left(\frac{d_{\text{nearfield}}}{d_{\text{measure}}} \right) - 20 \log \left(\frac{d_{\text{limit}}}{d_{\text{nearfield}}} \right)$ FS_{limit} is the calculation of field strength at the limit distance, expressed in dBμV/m FS_{max} is the measured field strength, expressed in dBμV/m $d_{\text{near field}}$ is the $\lambda/2\pi$ distance d_{measure} is the distance of the measurement point from EUT d_{limit} is the reference limit distance	-21.4 dB from 3m to 30m

Result:

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
RFID 1AC FX CWU	65.82 dBμV/m	44.42 dBμV/m
RFID 1AC FX WA	66.28 dBμV/m	44.88 dBμV/m
RFID 1AC MI	58.50 dBμV/m	37.10 dBμV/m
RFID 1AC ST 430	56.51 dBμV/m	35.11 dBμV/m
RFID 1AC KF	66.49 dBμV/m	45.09 dBμV/m

12.3 Field strength of the harmonics and spurious

Measurement:

The maximum detected field strength for the harmonics and spurious. Measurement performed according to ANSI C63.10, chapter 6.4 and 6.5

Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz 150 kHz < F < 30 MHz: 9 kHz 30 MHz < F < 1 GHz: 120 kHz
Video bandwidth:	F < 150 kHz: 1 kHz 150 kHz < F < 30 MHz: 100 kHz 30 MHz < F < 1 GHz: 300 kHz
Trace mode:	Max hold
Used equipment:	See chapter 7.1A & 7.2A & 7.3A
Measurement uncertainty:	See chapter 9

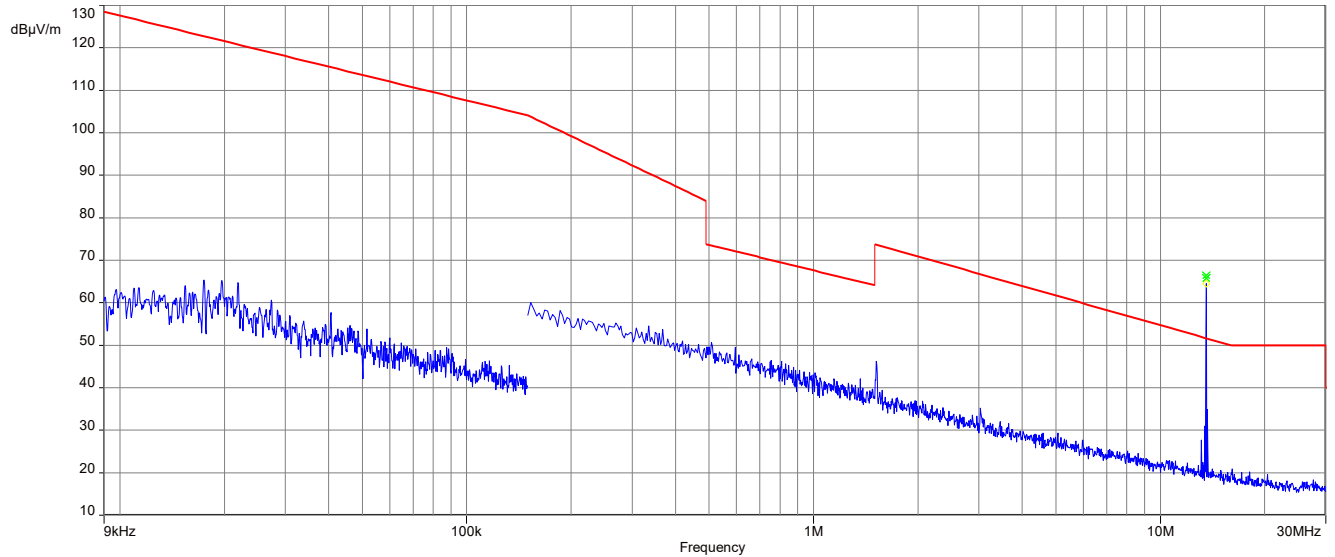
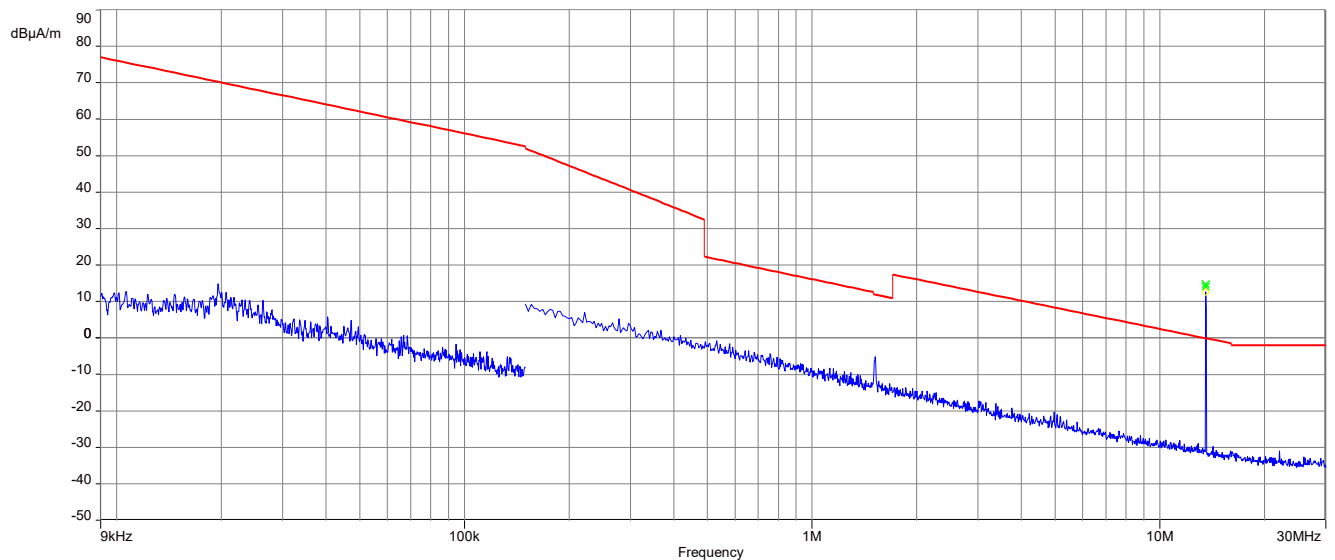
Limit:

FCC		
Frequency (MHz)	Field strength (μV/m)	Measurement distance (m)
0.009 – 0.490	2400/(F/kHz)	300
0.490 – 1.705	24000/(F/kHz)	30
1.705 – 30	30 (29.5 dBμV/m)	30
30 – 88	100 (40 dBμV/m)	3
88 – 216	150 (43.5 dBμV/m)	3
216 – 960	200 (46 dBμV/m)	3

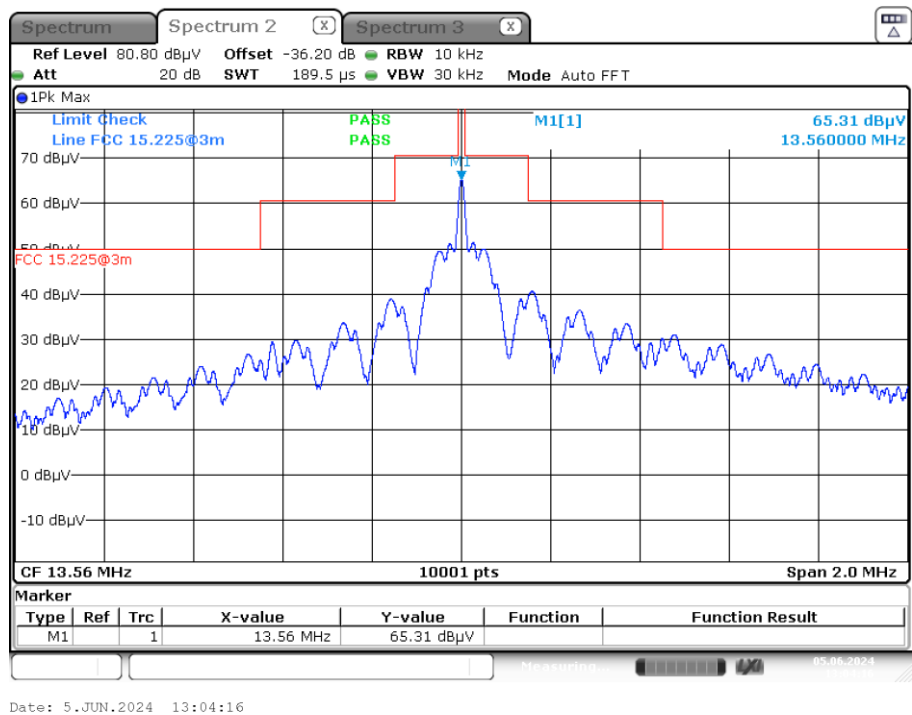
IC		
Frequency (MHz)	Field strength (μA/m)	Measurement distance (m)
0.009 – 0.490	6.37/F (F in kHz)	300
0.490 – 1.705	63.7/F (F in kHz)	30
1.705 – 30	0.08 (-22 dBμA/m)	30

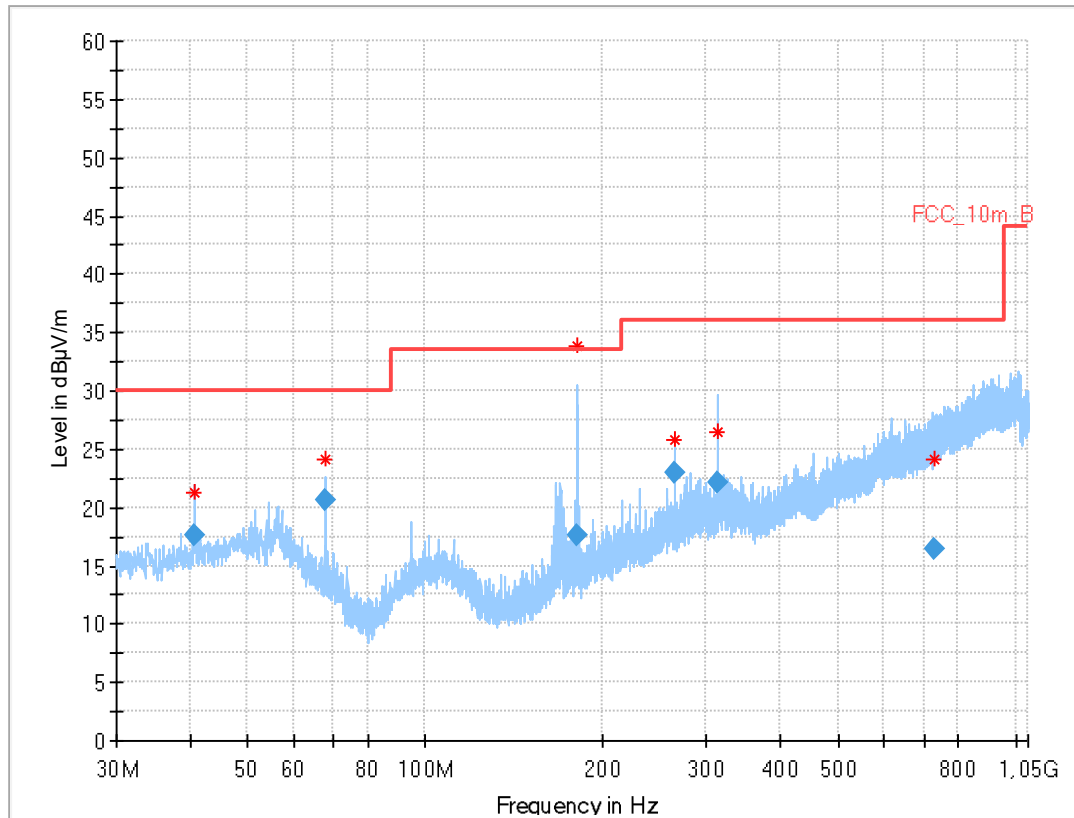
Result:

Detected emissions			
Frequency	Detector	Resolution bandwidth	Detected value (@ 3m)
no peaks detected			

Plots RFID 1AC FX CWU:**Plot 1:** 9 kHz – 30 MHz, magnetic emissions FCC**Plot 2:** 9 kHz – 30 MHz, magnetic emissions IC

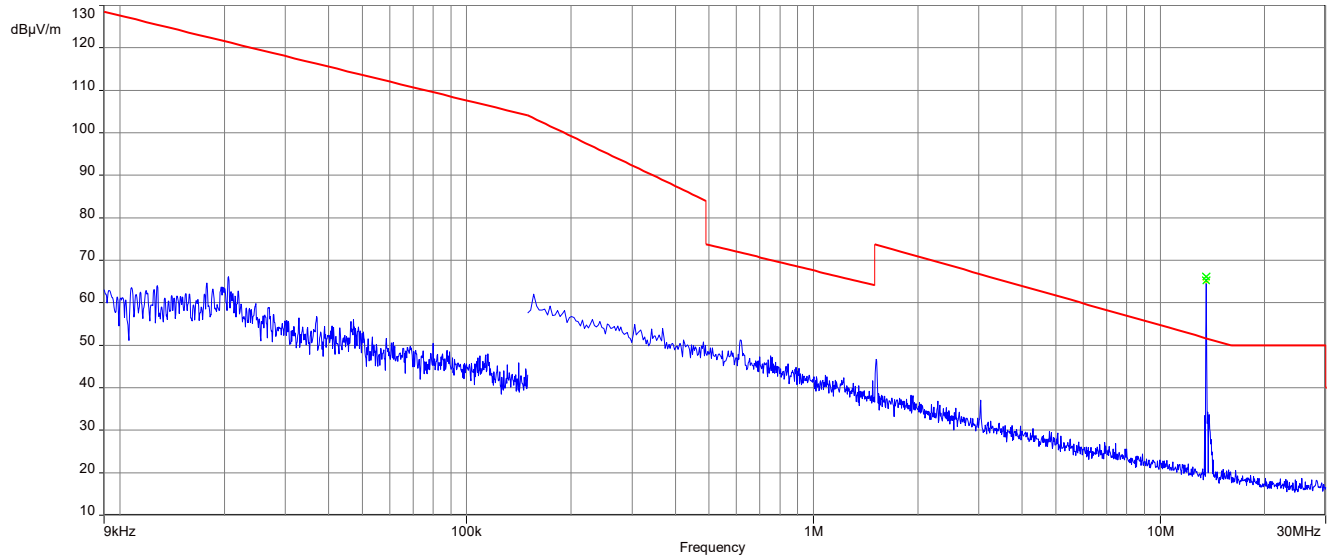
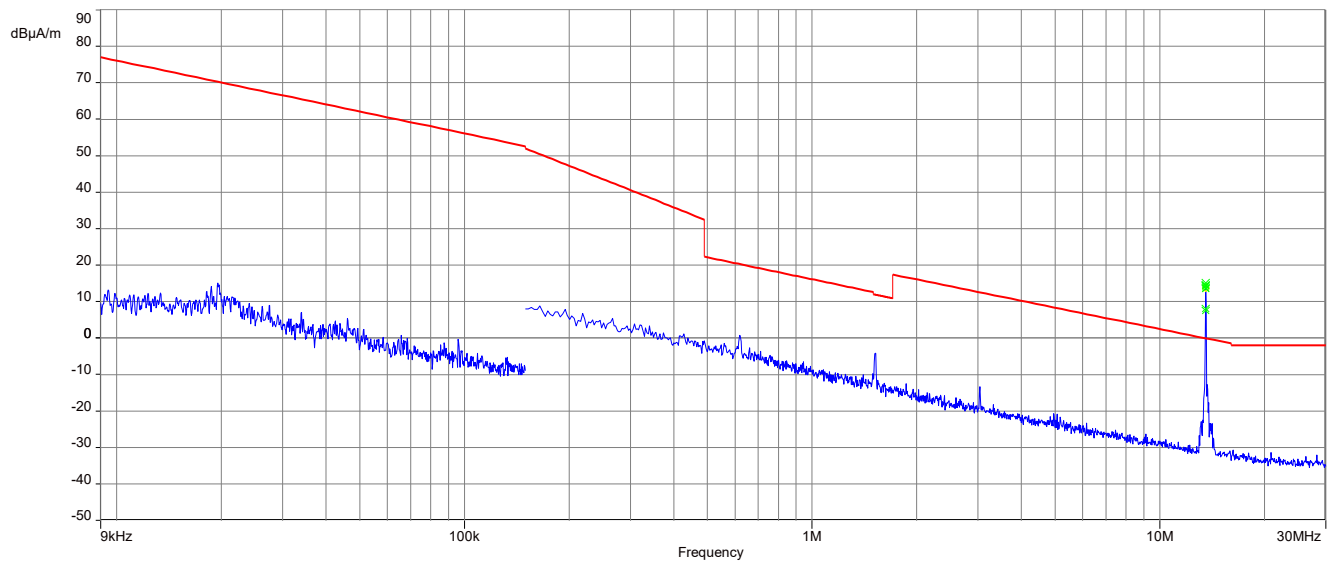
Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



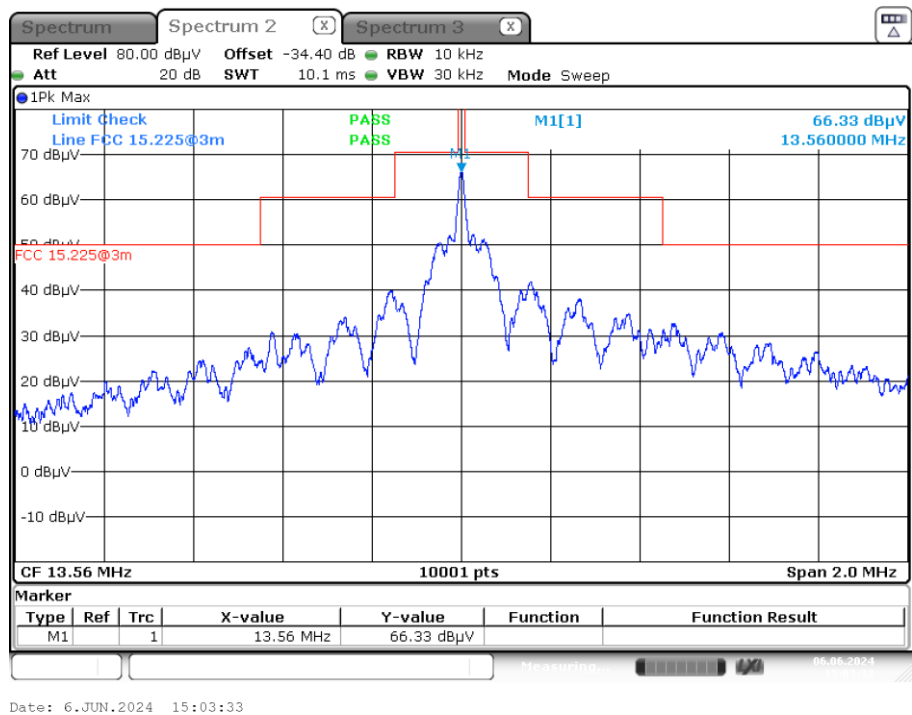
Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation

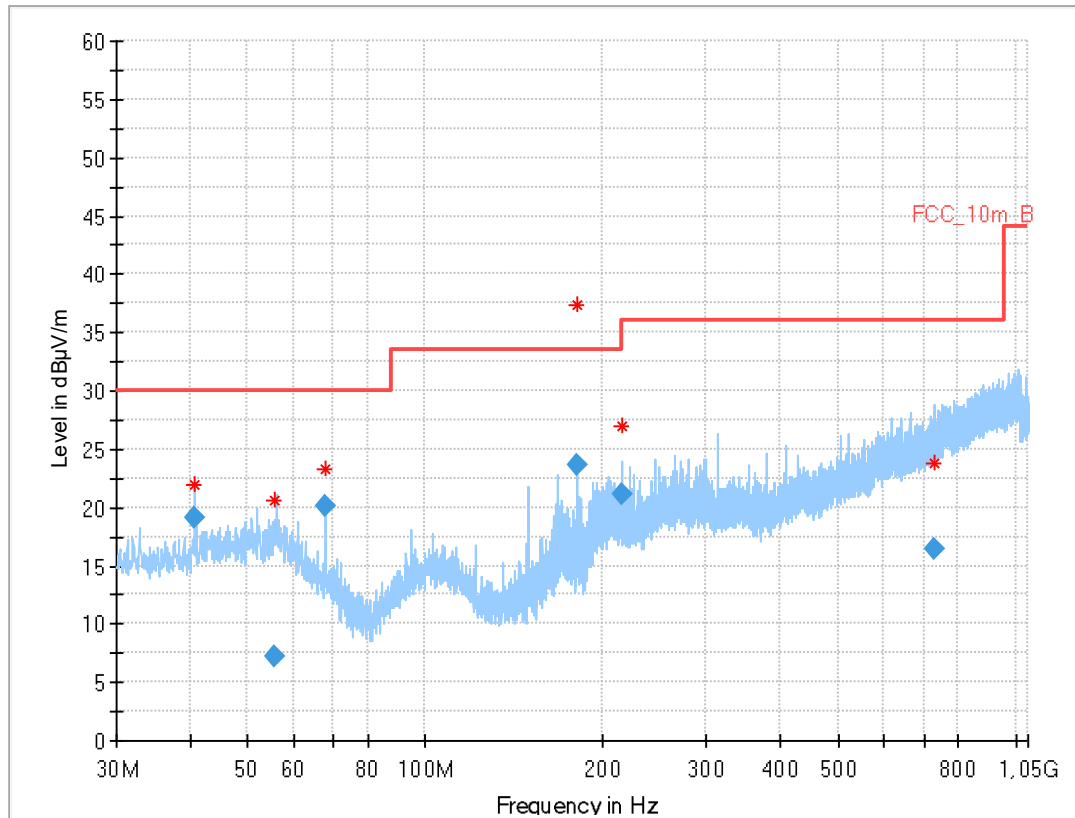
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.688	17.63	30.0	12.4	1000	120.0	103.0	V	216	14
67.789	20.57	30.0	9.4	1000	120.0	265.0	V	0	11
180.698	17.60	33.5	15.9	1000	120.0	242.0	V	92	11
264.009	22.99	36.0	13.0	1000	120.0	200.0	V	-45	14
312.005	22.15	36.0	13.9	1000	120.0	200.0	V	-17	15
726.108	16.36	36.0	19.6	1000	120.0	396.0	V	135	23

Plots RFID 1AC FX WA:**Plot 1:** 9 kHz – 30 MHz, magnetic emissions FCC**Plot 2:** 9 kHz – 30 MHz, magnetic emissions IC

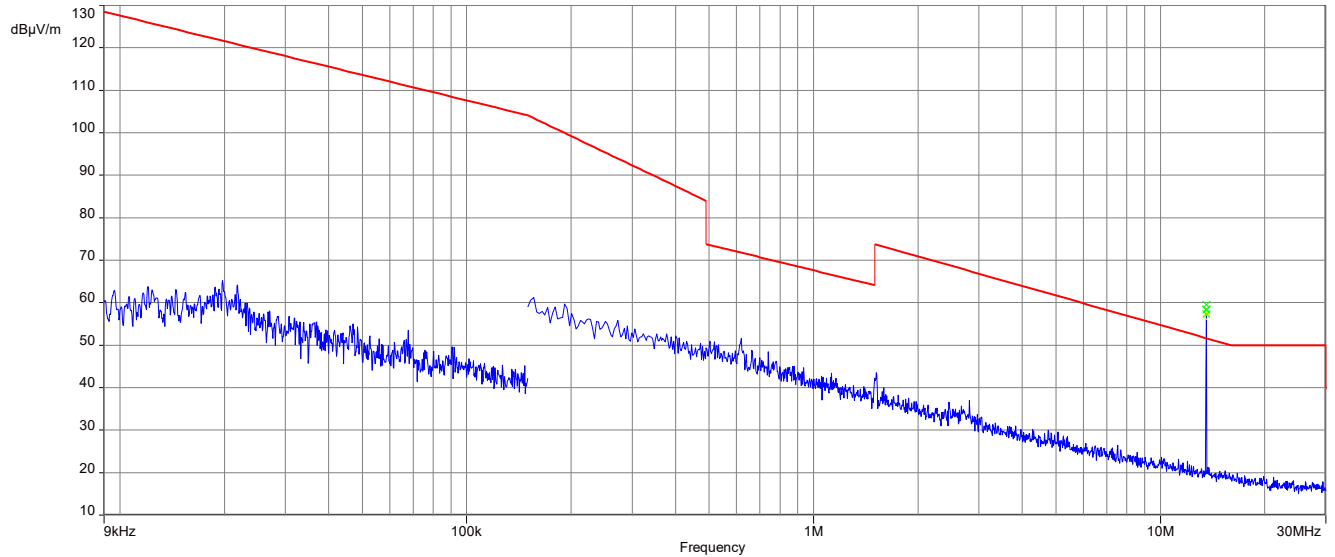
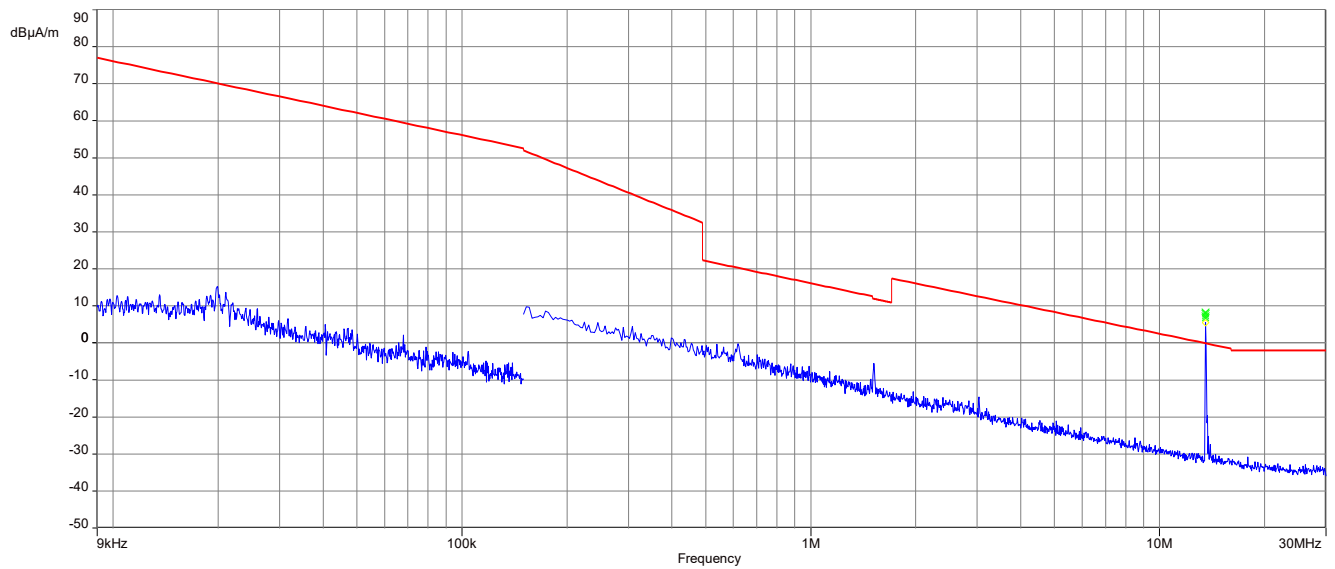
Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



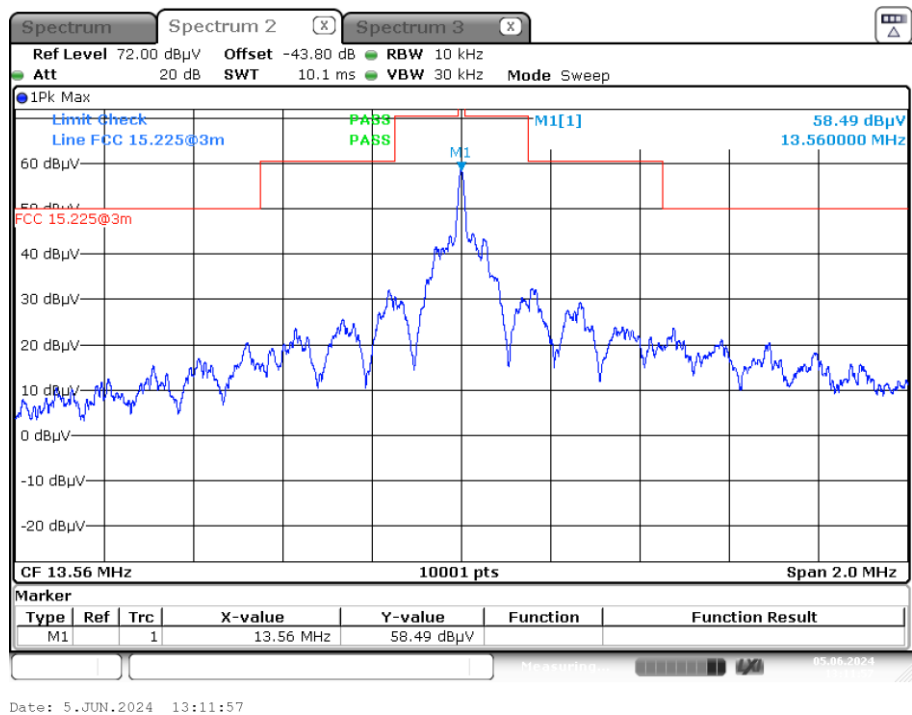
Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation

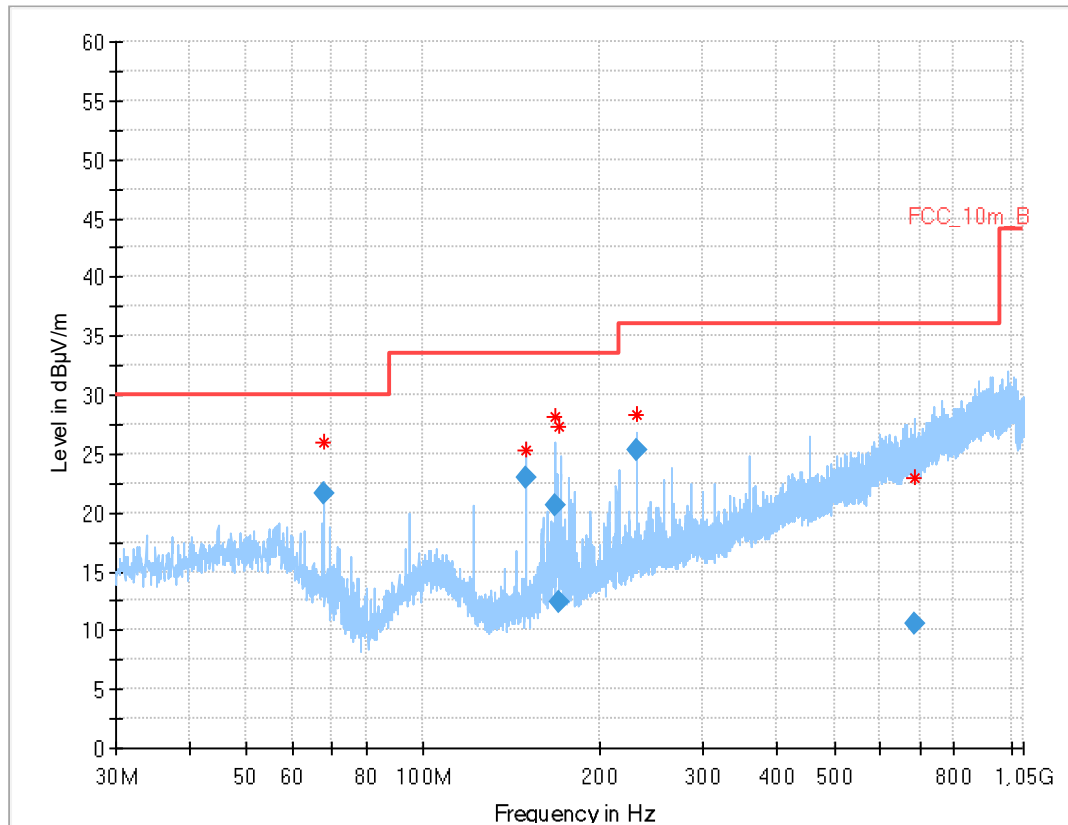
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.662	19.04	30.0	11.0	1000	120.0	103.0	V	201	14
55.372	7.18	30.0	22.8	1000	120.0	212.0	V	45	15
67.800	20.16	30.0	9.8	1000	120.0	350.0	V	86	11
181.410	23.67	33.5	9.8	1000	120.0	121.0	V	94	11
216.011	21.10	36.0	14.9	1000	120.0	200.0	V	54	13
727.516	16.46	36.0	19.5	1000	120.0	273.0	V	90	23

Plots RFID 1AC MI:**Plot 1:** 9 kHz – 30 MHz, magnetic emissions FCC**Plot 2:** 9 kHz – 30 MHz, magnetic emissions IC

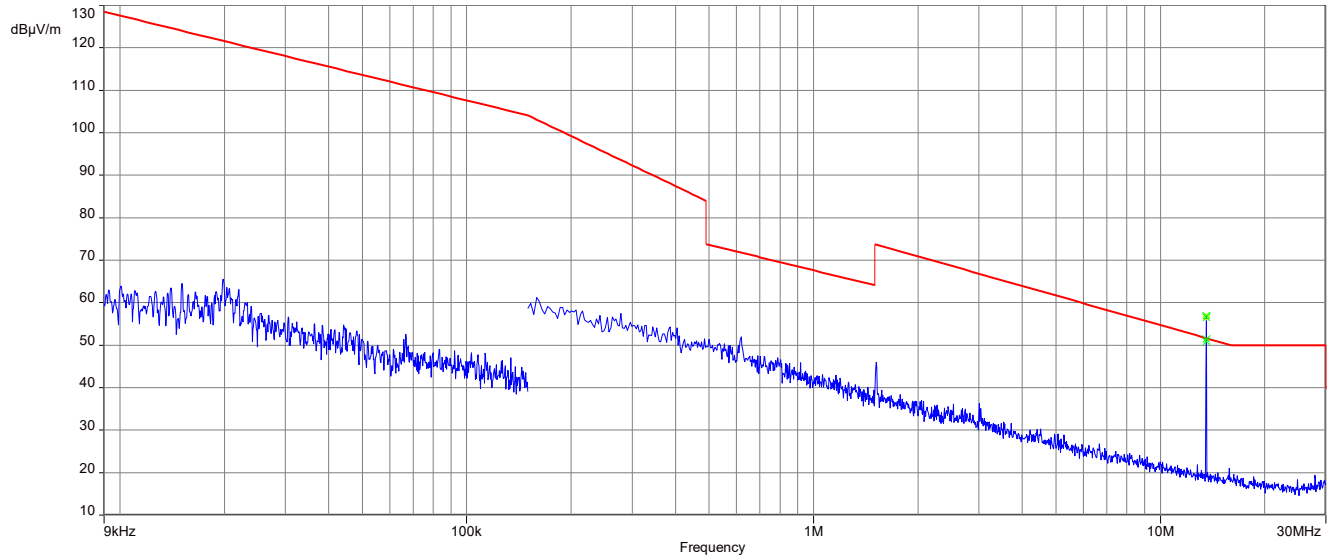
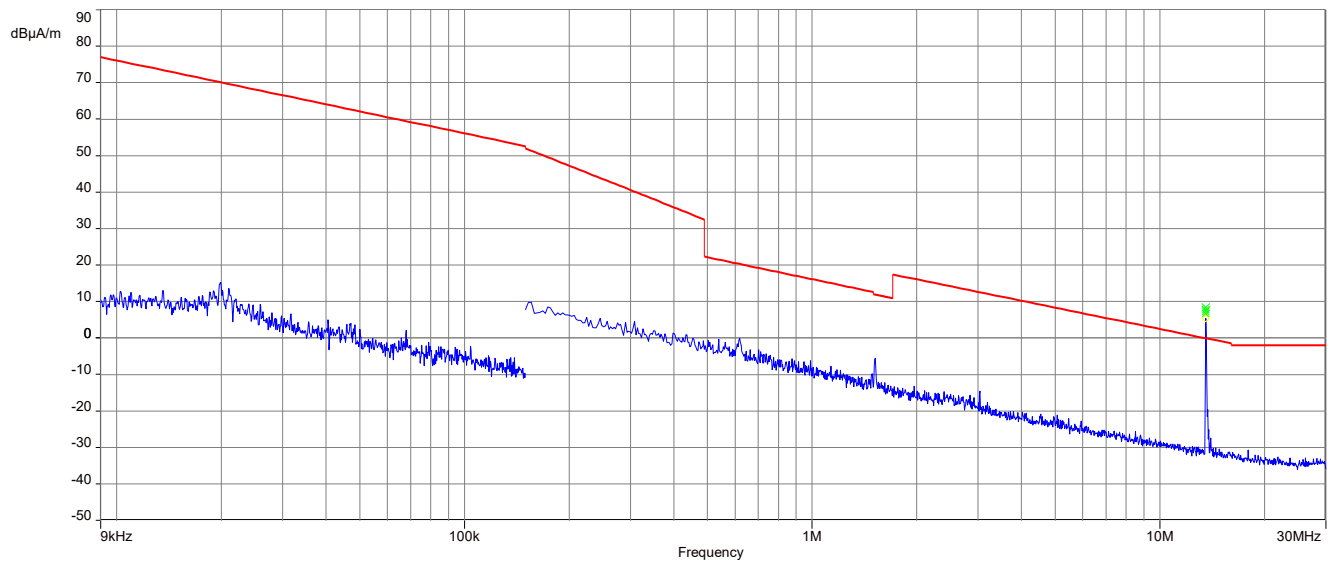
Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



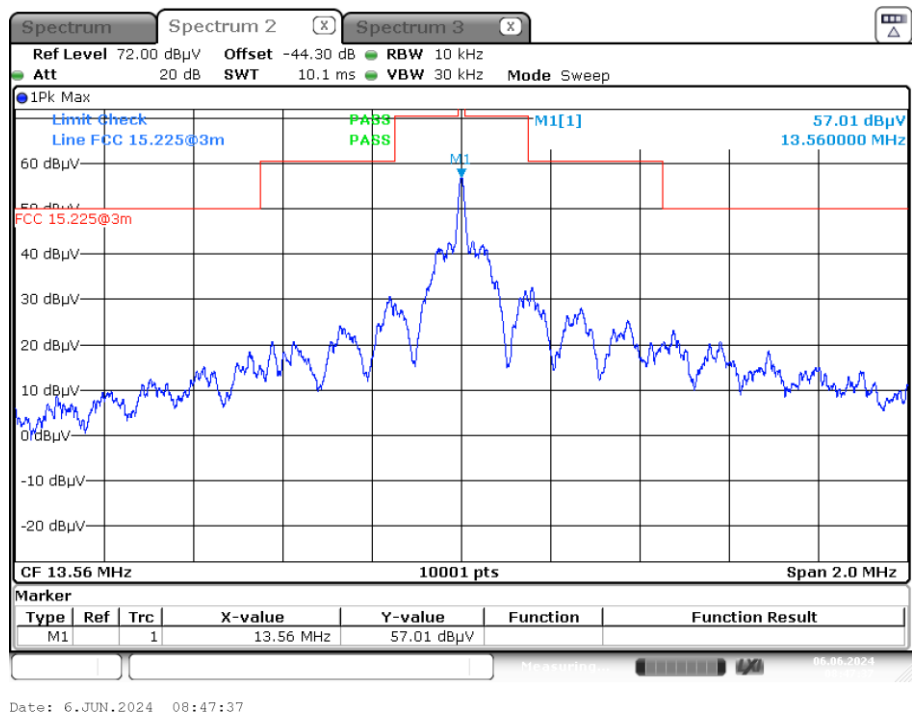
Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation

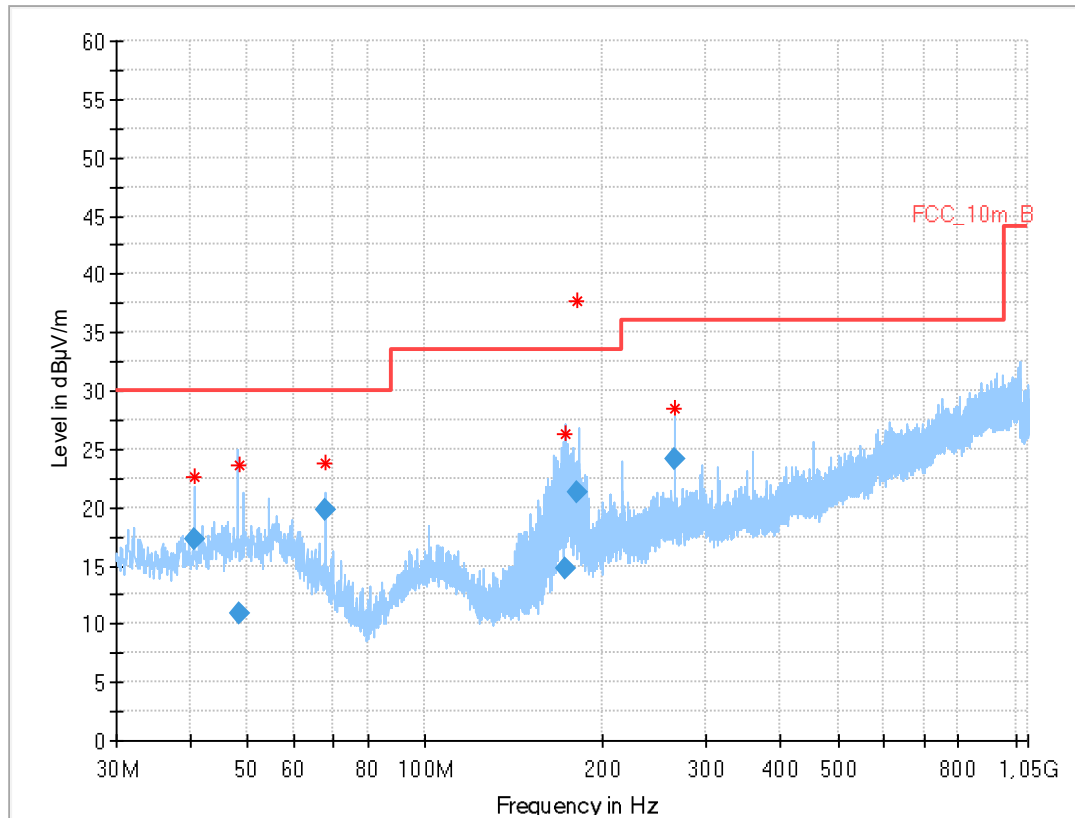
Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
67.805	21.58	30.0	8.4	1000	120.0	400.0	V	-25	11
149.145	23.03	33.5	10.5	1000	120.0	134.0	V	-6	10
168.023	20.69	33.5	12.8	1000	120.0	173.0	V	186	11
170.711	12.43	33.5	21.1	1000	120.0	400.0	V	129	11
230.526	25.26	36.0	10.7	1000	120.0	136.0	V	293	13
686.736	10.56	36.0	25.4	1000	120.0	396.0	V	-45	22

Plots RFID 1AC ST 430:**Plot 1:** 9 kHz – 30 MHz, magnetic emissions FCC**Plot 2:** 9 kHz – 30 MHz, magnetic emissions IC

Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



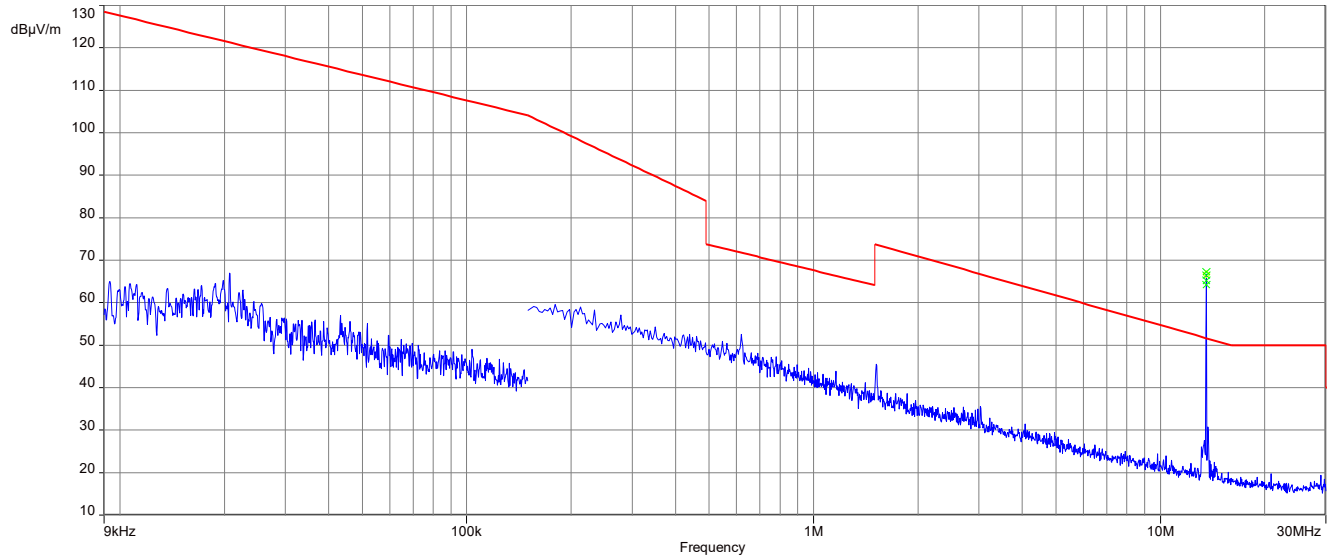
Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation

Final_Result

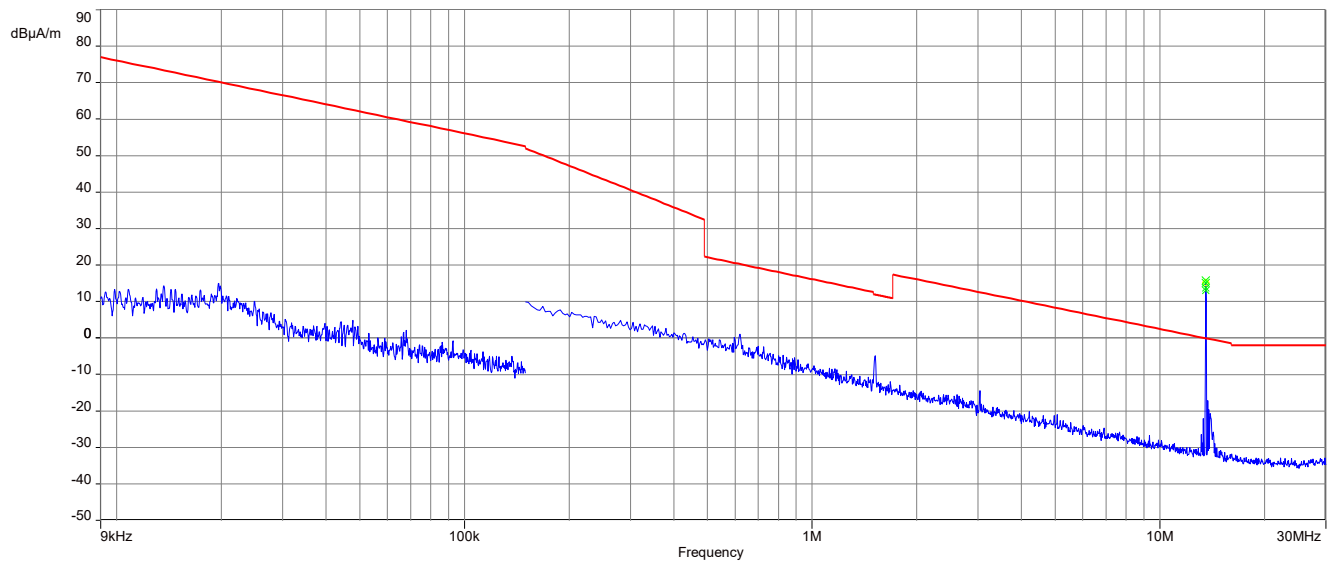
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.684	17.31	30.0	12.7	1000	120.0	116.0	V	90	14
48.407	10.97	30.0	19.0	1000	120.0	200.0	V	0	15
67.808	19.84	30.0	10.2	1000	120.0	307.0	V	-44	11
172.886	14.79	33.5	18.7	1000	120.0	132.0	V	-12	11
181.518	21.27	33.5	12.2	1000	120.0	106.0	V	199	11
264.011	24.08	36.0	11.9	1000	120.0	153.0	V	14	14

Plots RFID 1AC KF:

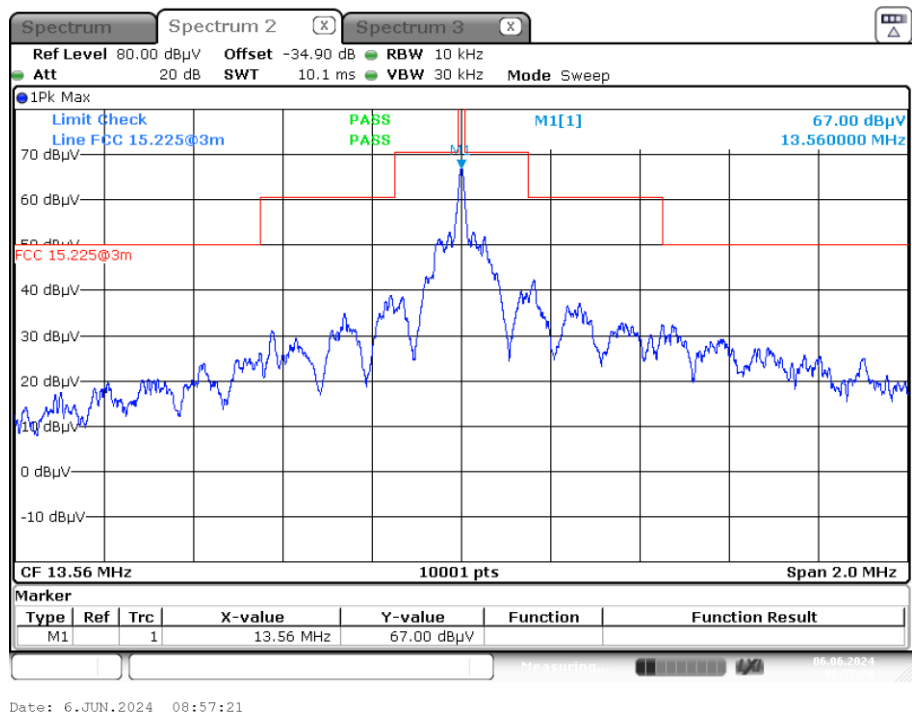
Plot 1: 9 kHz – 30 MHz, magnetic emissions FCC

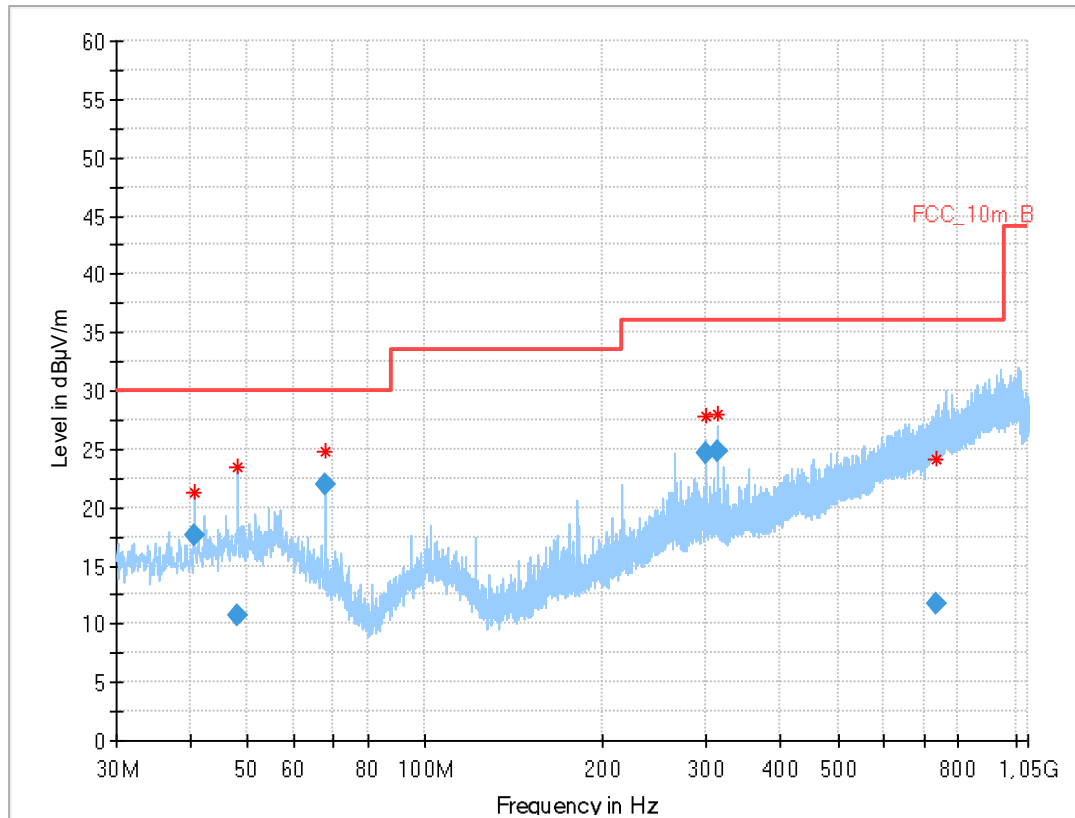


Plot 2: 9 kHz – 30 MHz, magnetic emissions IC



Plot 3: Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



Plot 4: 30 MHz – 1 GHz, vertical and horizontal polarisation

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
40.680	17.52	30.0	12.5	1000	120.0	177.0	V	111	14
48.009	10.81	30.0	19.2	1000	120.0	104.0	V	171	15
67.806	21.91	30.0	8.1	1000	120.0	305.0	V	115	11
298.326	24.65	36.0	11.4	1000	120.0	400.0	H	292	15
311.993	24.87	36.0	11.1	1000	120.0	290.0	V	90	15
733.660	11.68	36.0	24.3	1000	120.0	336.0	V	344	23

12.4 Conducted limits

Measurement:

Measurement of the conducted spurious emissions for an intentional radiator that is designed to be connected to the public utility (AC) power line. Measurement performed according to ANSI C63.10, chapter 6.2

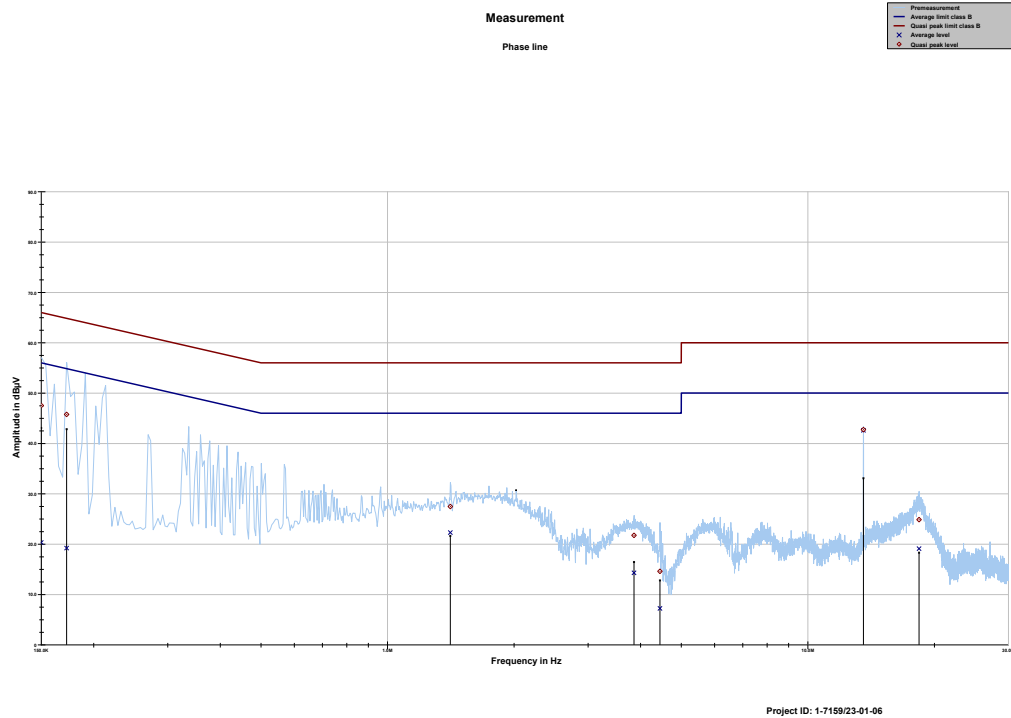
Measurement parameters	
Detector:	Quasi peak / average or peak (worst case – pre-scan)
Resolution bandwidth:	F < 150 kHz: 200 Hz F > 150 kHz: 9 kHz
Video bandwidth:	F < 150 kHz: 1 kHz F > 150 kHz: 100 kHz
Trace mode:	Max hold
Used equipment:	See chapter 7.3A
Measurement uncertainty:	See chapter 9

Limit:

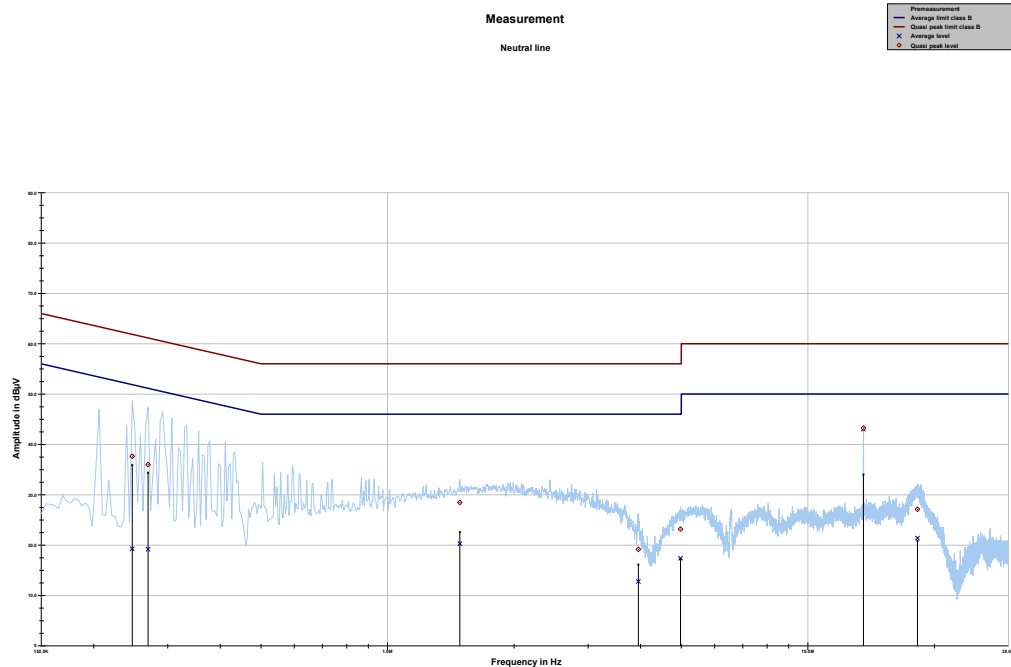
FCC & IC		
Frequency / MHz	Quasi-peak / (dB μ V/m)	Average / (dB μ V/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

Result:

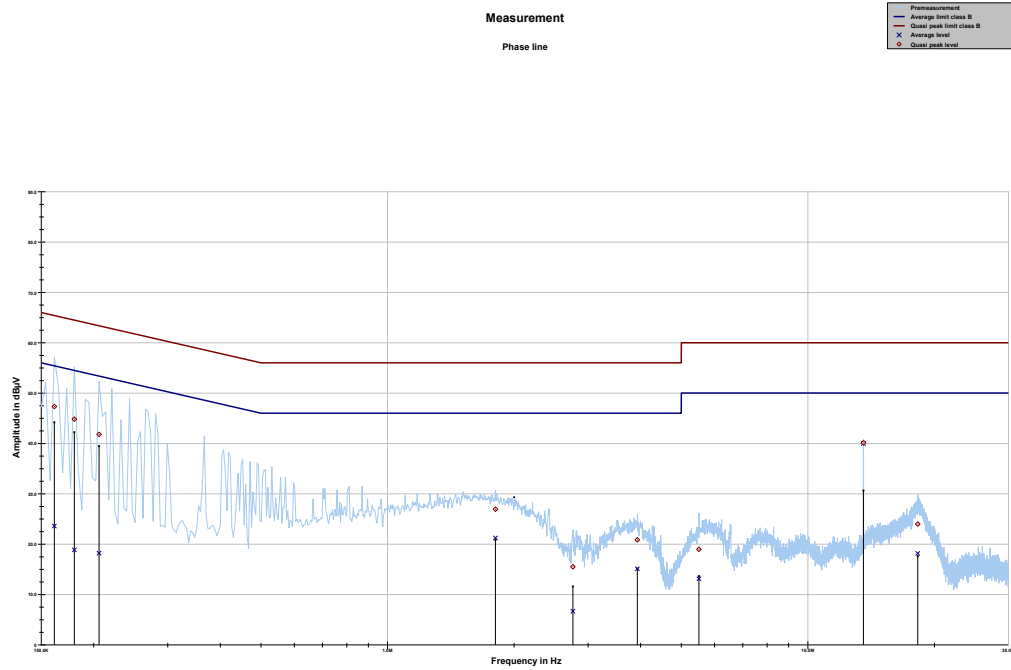
see table below plots

Plots: 1AC FX CWU**Plot 1:** 150 kHz to 30 MHz, phase line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.150000	47.52	18.48	66.000	20.33	35.67	56.000
0.172387	45.75	19.09	64.845	19.21	36.15	55.360
1.411163	27.46	28.54	56.000	22.29	23.71	46.000
3.858862	21.74	34.26	56.000	14.30	31.70	46.000
4.448400	14.60	41.40	56.000	7.23	38.77	46.000
13.560113	42.74	17.26	60.000	42.59	7.41	50.000
18.388350	24.87	35.13	60.000	19.10	30.90	50.000

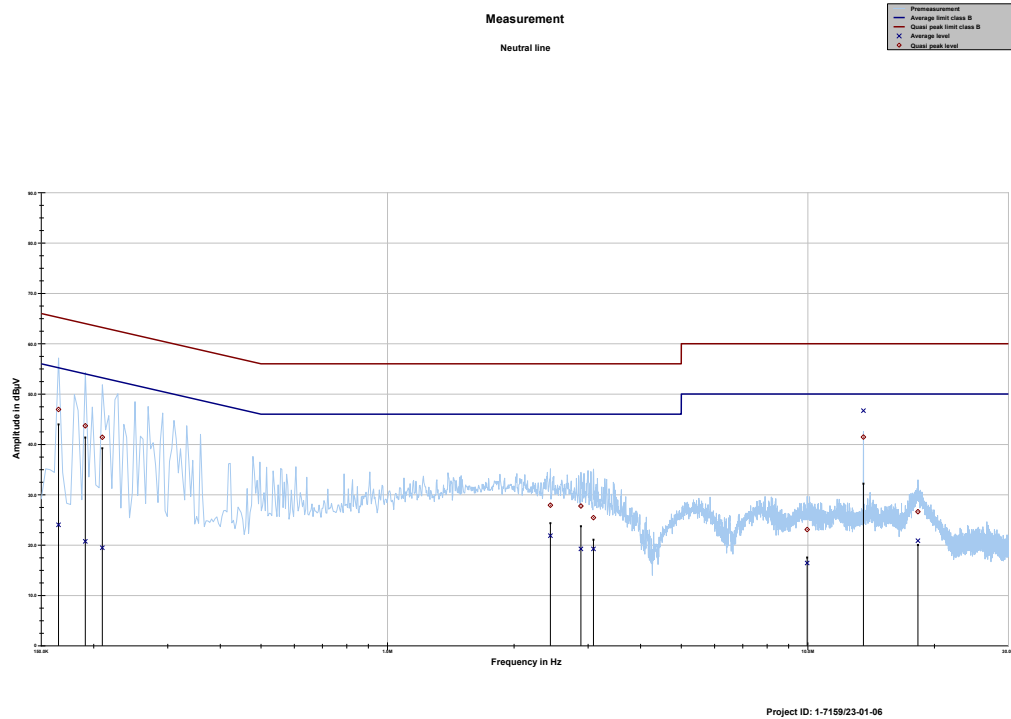
Plot 2: 150 kHz to 30 MHz, neutral line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.247012	37.64	24.22	61.857	19.27	33.96	53.228
0.269400	36.00	25.14	61.136	19.17	33.42	52.589
1.485788	28.48	27.52	56.000	20.29	25.71	46.000
3.952144	19.16	36.84	56.000	12.79	33.21	46.000
4.978237	23.17	32.83	56.000	17.38	28.62	46.000
13.560113	43.24	16.76	60.000	43.03	6.97	50.000
18.231638	27.11	32.89	60.000	21.38	28.62	50.000

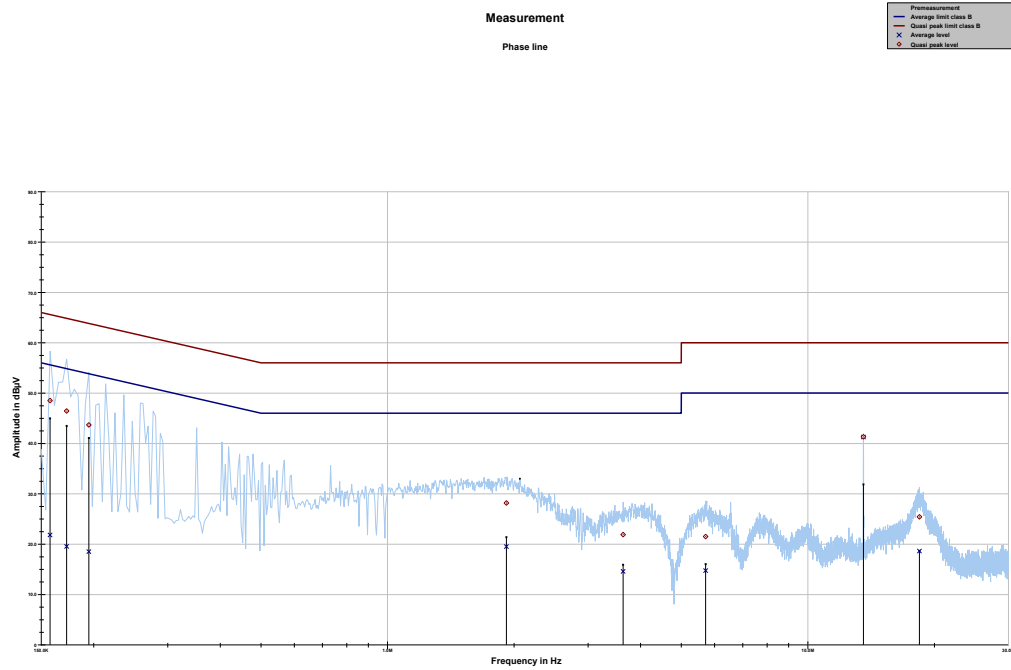
Plots: 1AC FX WA**Plot 1:** 150 kHz to 30 MHz, phase line

Project ID: 1-7159/23-01-06

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBμV	dB	dBμV	dBμV	dB	dBμV
0.161194	47.32	18.08	65.402	23.59	32.09	55.680
0.179850	44.82	19.67	64.493	18.86	36.29	55.147
0.205969	41.79	21.58	63.366	18.20	36.20	54.401
1.806675	26.93	29.07	56.000	21.23	24.77	46.000
2.761875	15.51	40.49	56.000	6.67	39.33	46.000
3.929756	20.86	35.14	56.000	15.09	30.91	46.000
5.508075	18.97	41.03	60.000	13.12	36.88	50.000
13.560113	40.11	19.89	60.000	40.00	10.00	50.000
18.257756	23.97	36.03	60.000	18.15	31.85	50.000

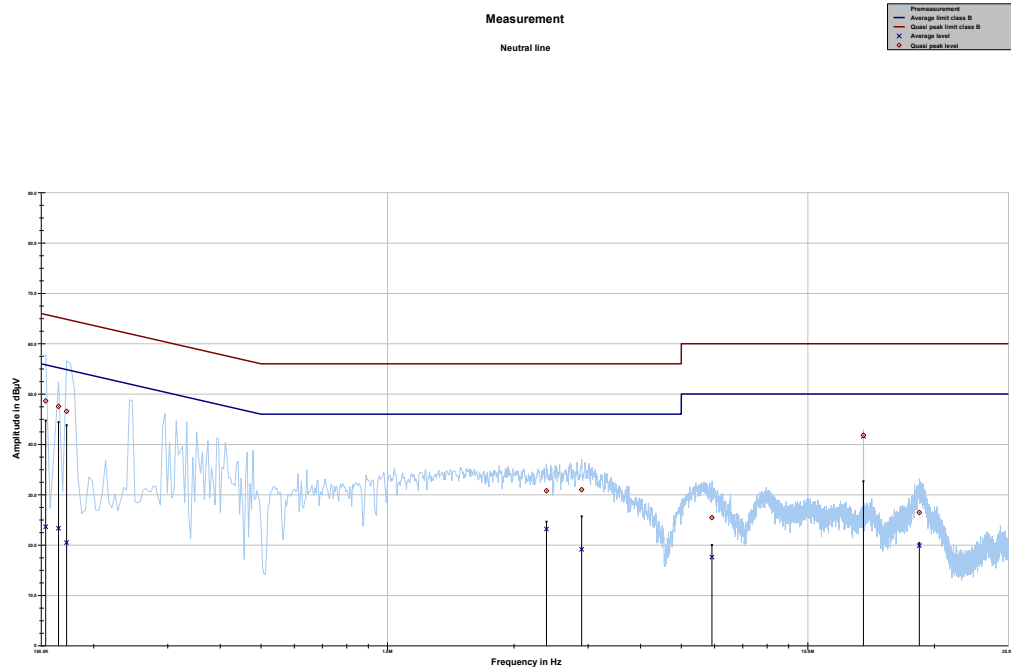
Plot 2: 150 kHz to 30 MHz, neutral line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.164925	46.93	18.28	65.212	24.02	31.55	55.574
0.191044	43.68	20.31	63.991	20.74	34.08	54.827
0.209700	41.42	21.79	63.217	19.46	34.83	54.294
2.440987	27.93	28.07	56.000	21.88	24.12	46.000
2.885006	27.75	28.25	56.000	19.24	26.76	46.000
3.090225	25.46	30.54	56.000	19.24	26.76	46.000
9.963188	23.08	36.92	60.000	16.45	33.55	50.000
13.560113	41.46	18.54	60.000	46.70	3.30	50.000
18.276412	26.63	33.37	60.000	20.86	29.14	50.000

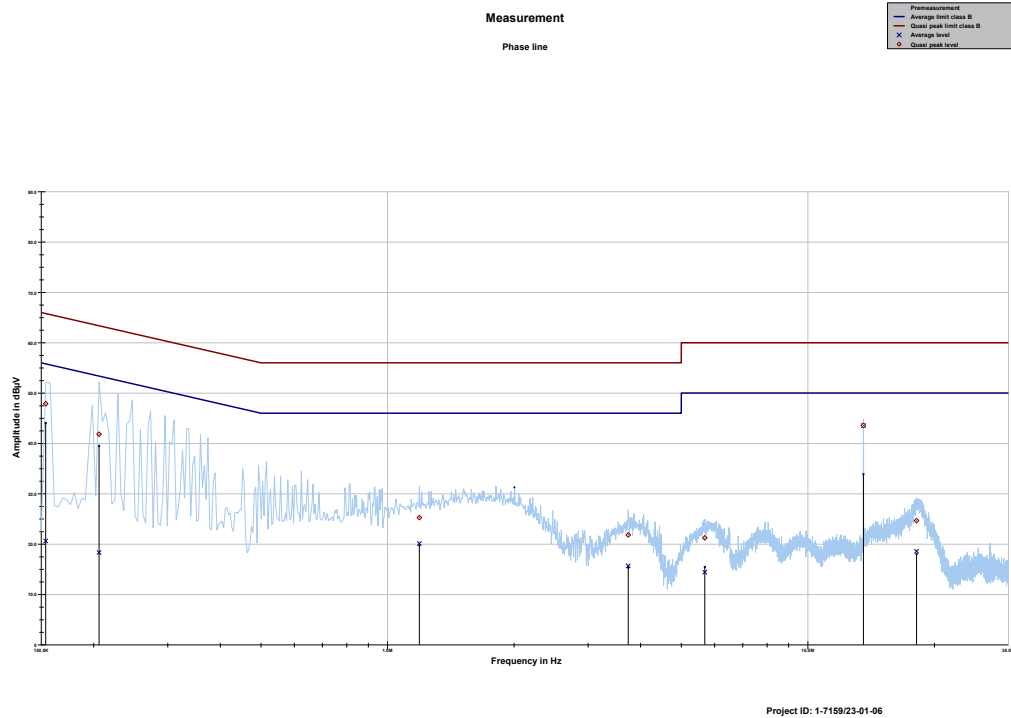
Plots: 1AC MI**Plot 1:** 150 kHz to 30 MHz, phase line

Project ID: 1-7159/23-01-06

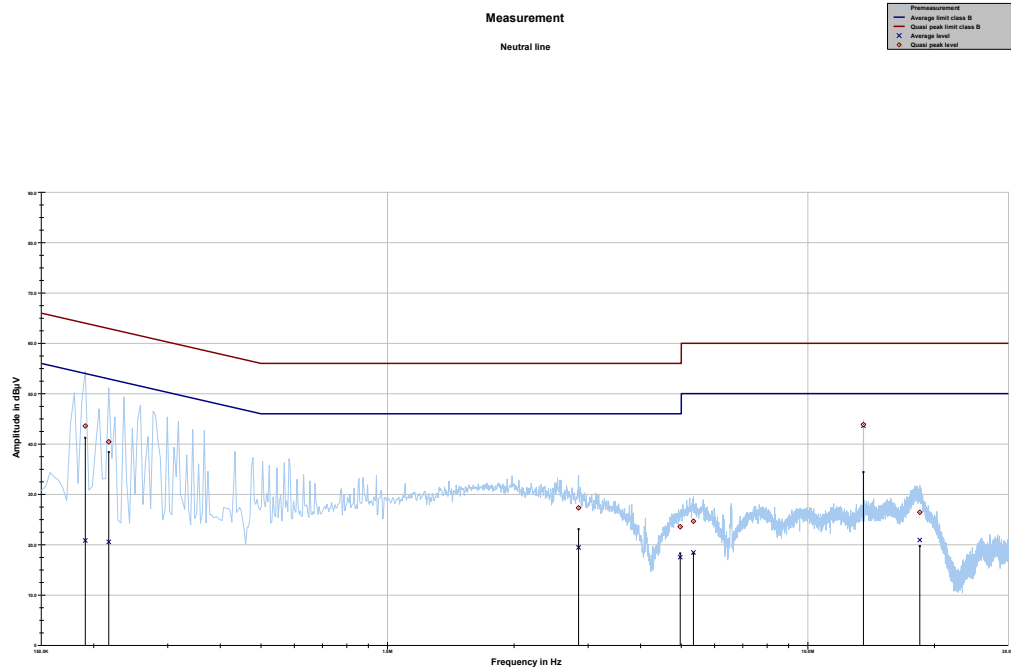
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	48.51	17.08	65.597	21.81	33.97	55.787
0.172387	46.44	18.40	64.845	19.54	35.82	55.360
0.194775	43.68	20.15	63.830	18.50	36.22	54.721
1.918613	28.17	27.83	56.000	19.51	26.49	46.000
3.634987	21.89	34.11	56.000	14.58	31.42	46.000
5.713294	21.49	38.51	60.000	14.74	35.26	50.000
13.560113	41.31	18.69	60.000	41.26	8.74	50.000
18.433125	25.41	34.59	60.000	18.61	31.39	50.000

Plot 2: 150 kHz to 30 MHz, neutral line

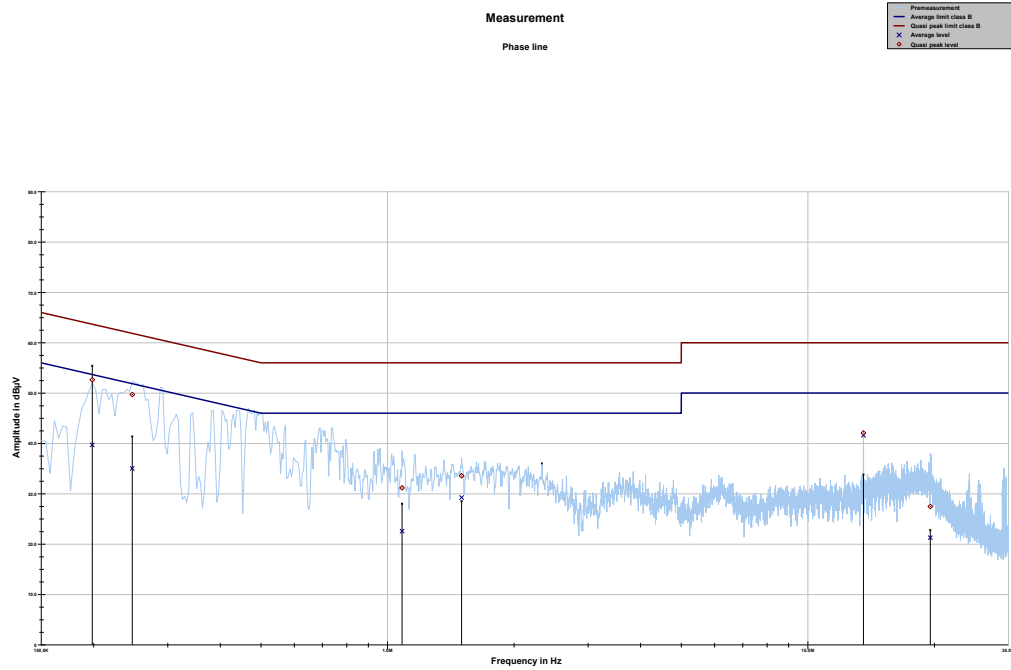
Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBμV	dB	dBμV	dBμV	dB	dBμV
0.153731	48.64	17.15	65.796	23.64	32.26	55.893
0.164925	47.55	17.67	65.212	23.35	32.22	55.574
0.172387	46.56	18.28	64.845	20.50	34.86	55.360
2.388750	30.79	25.21	56.000	23.19	22.81	46.000
2.896200	31.01	24.99	56.000	19.15	26.85	46.000
5.914781	25.45	34.55	60.000	17.61	32.39	50.000
13.560113	41.81	18.19	60.000	41.62	8.38	50.000
18.418200	26.47	33.53	60.000	19.88	30.12	50.000

Plots: 1AC ST**Plot 1:** 150 kHz to 30 MHz, phase line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.153731	47.89	17.91	65.796	20.63	35.26	55.893
0.205969	41.83	21.54	63.366	18.32	36.08	54.401
1.191019	25.27	30.73	56.000	20.14	25.86	46.000
3.739463	21.83	34.17	56.000	15.68	30.32	46.000
5.687175	21.24	38.76	60.000	14.41	35.59	50.000
13.560113	43.57	16.43	60.000	43.54	6.46	50.000
18.138356	24.65	35.35	60.000	18.58	31.42	50.000

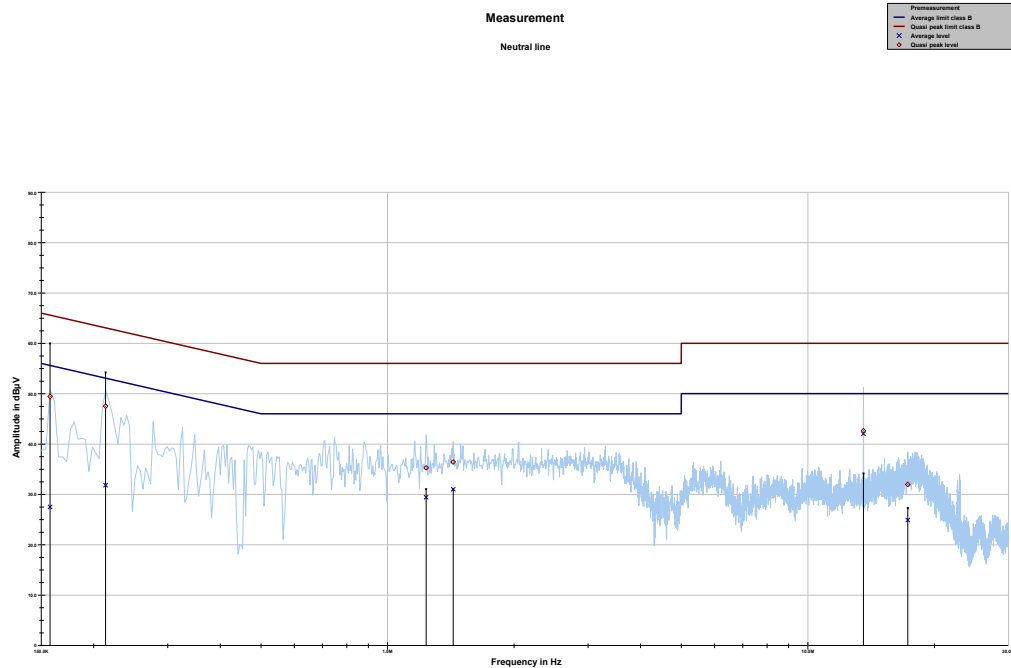
Plot 2: 150 kHz to 30 MHz, neutral line

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.191044	43.58	20.41	63.991	20.83	33.99	54.827
0.217163	40.44	22.48	62.927	20.56	33.52	54.081
2.847694	27.31	28.69	56.000	19.46	26.54	46.000
4.970775	23.56	32.44	56.000	17.54	28.46	46.000
5.343900	24.65	35.35	60.000	18.46	31.54	50.000
13.560113	43.84	16.16	60.000	43.64	6.36	50.000
18.470437	26.43	33.57	60.000	20.92	29.08	50.000

Plots: 1AC KF**Plot 1:** 150 kHz to 30 MHz, phase line

Project ID: 1-7159/23-01-06

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.198506	52.65	11.03	63.673	39.71	14.90	54.614
0.247012	49.70	12.15	61.857	35.04	18.19	53.228
1.082812	31.17	24.83	56.000	22.57	23.43	46.000
1.500712	33.57	22.43	56.000	29.26	16.74	46.000
13.560113	42.07	17.93	60.000	41.60	8.40	50.000
19.563694	27.45	32.55	60.000	21.27	28.73	50.000

Plot 2: 150 kHz to 30 MHz, neutral line

Project ID: 1-7159/23-01-06

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.157463	49.44	16.16	65.597	27.50	28.28	55.787
0.213431	47.52	15.55	63.071	31.82	22.37	54.188
1.235794	35.25	20.75	56.000	29.41	16.59	46.000
1.433550	36.42	19.58	56.000	31.01	14.99	46.000
13.560113	42.62	17.38	60.000	42.03	7.97	50.000
17.295094	31.97	28.03	60.000	24.89	25.11	50.000

12.5 Frequency error

Measurement:

The maximum detected field strength for the spurious. Measurement performed according to ANSI C63.10, chapter 6.8

Measurement parameters	
Detector:	Peak detector
Resolution bandwidth:	10 Hz / 100 Hz
Video bandwidth:	> RBW
Trace mode:	Max hold
Used equipment:	See chapter 7.5B
Measurement uncertainty:	See chapter 9

Limit:

FCC & IC
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. (± 1.356 kHz)
Carrier frequency stability shall be maintained to $\pm 0.01\%$ (± 100 ppm)

- RFID 1AC FX CWU

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error	Conditions	Result
13.560122	9.00	-20 °C & 100% voltage	compliant
13.560165	12.17	-10 °C & 100% voltage	compliant
13.560120	8.85	0 °C & 100% voltage	compliant
13.560112	8.26	+10 °C & 100% voltage	compliant
13.560047	3.47	+30 °C & 100% voltage	compliant
13.560007	0.52	+40 °C & 100% voltage	compliant
13.559965	-2.58	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error	Conditions	Result
13.560012	0.88	+20 °C & 85% voltage	compliant
13.560007	0.52	+20 °C & 100% voltage	compliant
13.560060	4.42	+20 °C & 115% voltage	compliant

- RFID 1AC FX WA

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560085	6.26	-20 °C & 100% voltage	compliant
13.560100	7.37	-10 °C & 100% voltage	compliant
13.560100	7.37	0 °C & 100% voltage	compliant
13.560060	4.42	+10 °C & 100% voltage	compliant
13.559995	0.37	+30 °C & 100% voltage	compliant
13.559953	3.5	+40 °C & 100% voltage	compliant
13.559908	6.81	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.559966	2.52	+20 °C & 85% voltage	compliant
13.559968	2.40	+20 °C & 100% voltage	compliant
13.559990	0.74	+20 °C & 115% voltage	compliant

- RFID 1AC MI

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.559828	12.68	-20 °C & 100% voltage	compliant
13.559878	9.00	-10 °C & 100% voltage	compliant
13.559830	12.54	0 °C & 100% voltage	compliant
13.559808	14.16	+10 °C & 100% voltage	compliant
13.559923	5.68	+30 °C & 100% voltage	compliant
13.559885	8.48	+40 °C & 100% voltage	compliant
13.559843	11.58	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.559698	22.27	+20 °C & 85% voltage	compliant
13.559712	21.24	+20 °C & 100% voltage	compliant
13.559705	21.76	+20 °C & 115% voltage	compliant

- RFID 1AC ST

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560025	1.84	-20 °C & 100% voltage	compliant
13.560005	0.37	-10 °C & 100% voltage	compliant
13.560012	0.88	0 °C & 100% voltage	compliant
13.560005	0.37	+10 °C & 100% voltage	compliant
13.559968	2.36	+30 °C & 100% voltage	compliant
13.559928	5.31	+40 °C & 100% voltage	compliant
13.559893	7.89	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.559955	3.32	+20 °C & 85% voltage	compliant
13.559973	1.99	+20 °C & 100% voltage	compliant
13.559968	2.36	+20 °C & 115% voltage	compliant

- RFID 1AC KF

Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560085	6.27	-20 °C & 100% voltage	compliant
13.560112	8.26	-10 °C & 100% voltage	compliant
13.560085	6.27	0 °C & 100% voltage	compliant
13.560072	5.31	+10 °C & 100% voltage	compliant
13.560015	1.11	+30 °C & 100% voltage	compliant
13.559978	1.62	+40 °C & 100% voltage	compliant
13.559943	4.20	+50 °C & 100% voltage	compliant

Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560016	1.18	+20 °C & 85% voltage	compliant
13.559998	0.15	+20 °C & 100% voltage	compliant
13.560021	1.55	+20 °C & 115% voltage	compliant

13 Glossary

AVG	Average
C	Compliant
C/N₀	Carrier to noise-density ratio, expressed in dB-Hz
CAC	Channel availability check
CW	Clean wave
DC	Duty cycle
DFS	Dynamic frequency selection
DSSS	Dynamic sequence spread spectrum
DUT	Device under test
EN	European Standard
ETSI	European Telecommunications Standards Institute
EMC	Electromagnetic Compatibility
EUT	Equipment under test
FCC	Federal Communications Commission
FCC ID	Company Identifier at FCC
FHSS	Frequency hopping spread spectrum
FVIN	Firmware version identification number
GNSS	Global Navigation Satellite System
GUE	GNSS User Equipment
HMN	Host marketing name
HVIN	Hardware version identification number
HW	Hardware
IC	Industry Canada
Inv. No.	Inventory number
MC	Modulated carrier
NA	Not applicable
NC	Not compliant
NOP	Non occupancy period
NP	Not performed
OBW	Occupied bandwidth
OC	Operating channel
OCW	Operating channel bandwidth
OFDM	Orthogonal frequency division multiplexing
OOB	Out of band
OP	Occupancy period
PER	Packet error rate
PMN	Product marketing name
PP	Positive peak
QP	Quasi peak
RLAN	Radio local area network
S/N or SN	Serial number
SW	Software
UUT	Unit under test
WLAN	Wireless local area network

14 Document history

Version	Applied changes	Date of release
R01	Initial release	2024-09-11
R02	EUT information added (chapter 6.2)	2026-06-10
R03	update chapter 6.3	2026-07-27
R04	Corrected HVIN in chapter 6.2	2026-09-10
R05	Updated HW information in chapter 6.2	2026-09-11
R06	Updated HVIN information in chapter 6.2	2026-09-15

END OF TEST REPORT