



## TEST REPORT

Test report no.: 1-4929\_22-01-06-A

BNetzA-CAB-02/21-102

### Testing laboratory

**CTC advanced GmbH**

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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 starting with the registration number: D-PL-12076-01.

### Applicant

**ifm electronic gmbh**

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### Manufacturer

**ifm electronic gmbh**

Friedrichsstraße 1  
45128 Essen / GERMANY

### 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 10      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 read/write head with CAN interface  
**Model name:**                DTC124  
**FCC ID:**                        UN6-DTCHFGB  
**ISED certification number:** 6799A-DTCHFGB  
**Frequency:**                 13.56 MHz  
**Technology tested:**         RFID  
**Antenna:**                      Integrated antenna  
**Power supply:**                24 V DC  
**Temperature range:**         -20°C to +60°C

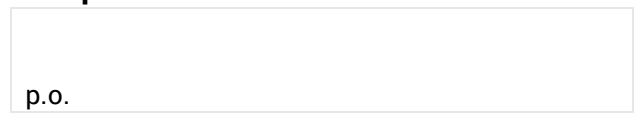
This test report is electronically signed and valid without handwritten signature. For verification of the electronic signatures, the public keys can be requested at the testing laboratory.

### Test report authorized:



Christoph Schneider  
Lab Manager  
Radio Communications

### Test performed:



Hans-Joachim Wolsdorfer  
Lab Manager  
Radio Communications

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

**This test report replaces the test report with the number 1-4929\_22-01-06 and dated 2022-12-05.**

### 2.2 Application details

Date of receipt of order:	2022-08-10
Date of receipt of test item:	2022-08-19
Start of test:*	2022-08-23
End of test:*	2022-11-21
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, references and accreditations

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 10	December 2019	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
ANSI C63.4-2014	-/-	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10-2013	-/-	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

Accreditation	Description	
D-PL-12076-01-04	Telecommunication and EMC Canada <a href="https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf">https://www.dakks.de/as/ast/d/D-PL-12076-01-04e.pdf</a>	 
D-PL-12076-01-05	Telecommunication FCC requirements <a href="https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf">https://www.dakks.de/as/ast/d/D-PL-12076-01-05e.pdf</a>	 

ISED Testing Laboratory Recognized Listing Number: DE0001  
FCC designation number: DE0002

#### 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 +60 °C -20 °C
Relative humidity content	:		55 %
Barometric pressure	:		1021 hpa
Power supply	:	$V_{nom}$ $V_{max}$ $V_{min}$	24.0 V DC by external power supply 27.6 V DC 20.4 V DC

## 6 Test item

### 6.1 General description

Kind of test item	:	RFID read/write head with CAN interface	
Model name	:	DTC124	
HMN	:	-/-	
PMN	:	DTC124	
HVIN	:	DTC124	
FVIN	:	-/-	
S/N serial number	:	-/-	
Hardware status	:	AA	
Software status	:	1.10	
Firmware status	:	-/-	
Frequency band	:	13.56 MHz	
Type of radio transmission	:	Modulated carrier	
Use of frequency spectrum	:		
Type of modulation	:	ASK	
Number of channels	:	1	
Antenna	:	Integrated antenna	
Power supply	:	24 V DC by external power supply	
Temperature range	:	-20°C to +60°C	

### 6.2 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:

- 1-4929\_22-01-01\_AnnexA
- 1-4929\_22-01-01\_AnnexB
- 1-4929\_22-01-01\_AnnexF

## 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).

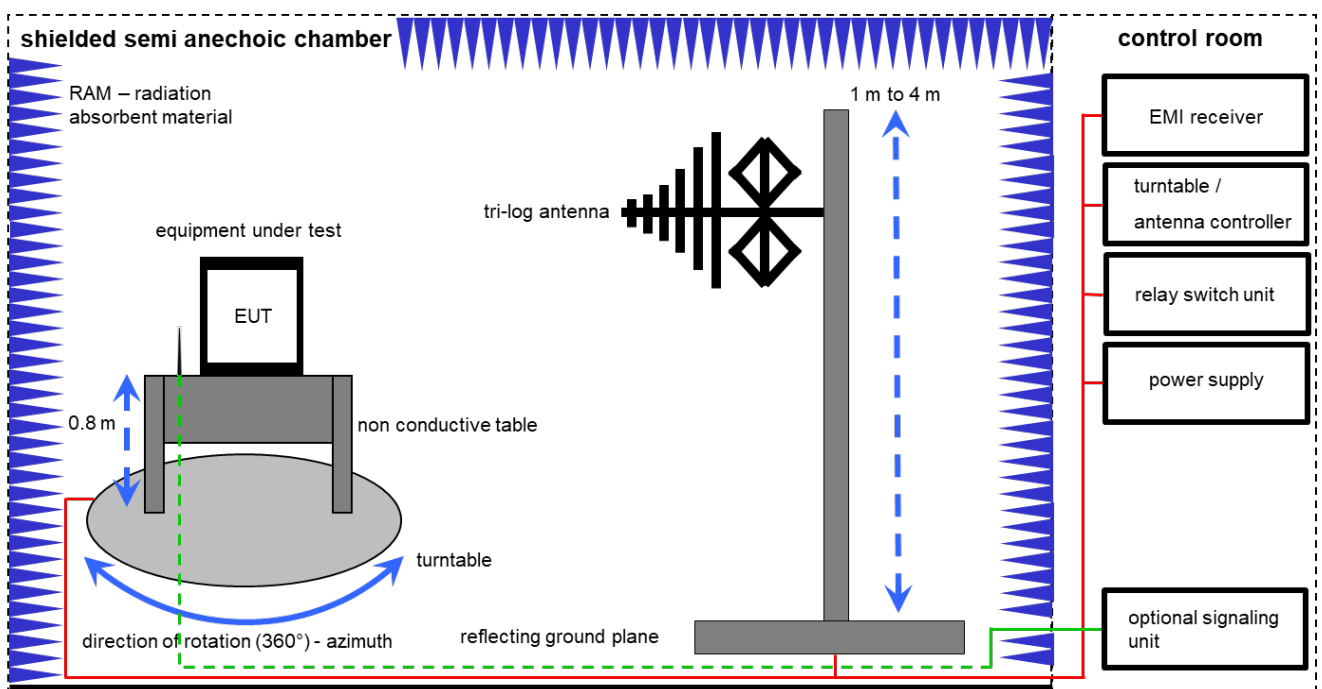
Each block diagram listed can contain several test setup configurations. All devices belonging to a test setup are identified with the same letter syntax. For example: Column Setup and all devices with an A.

### **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:

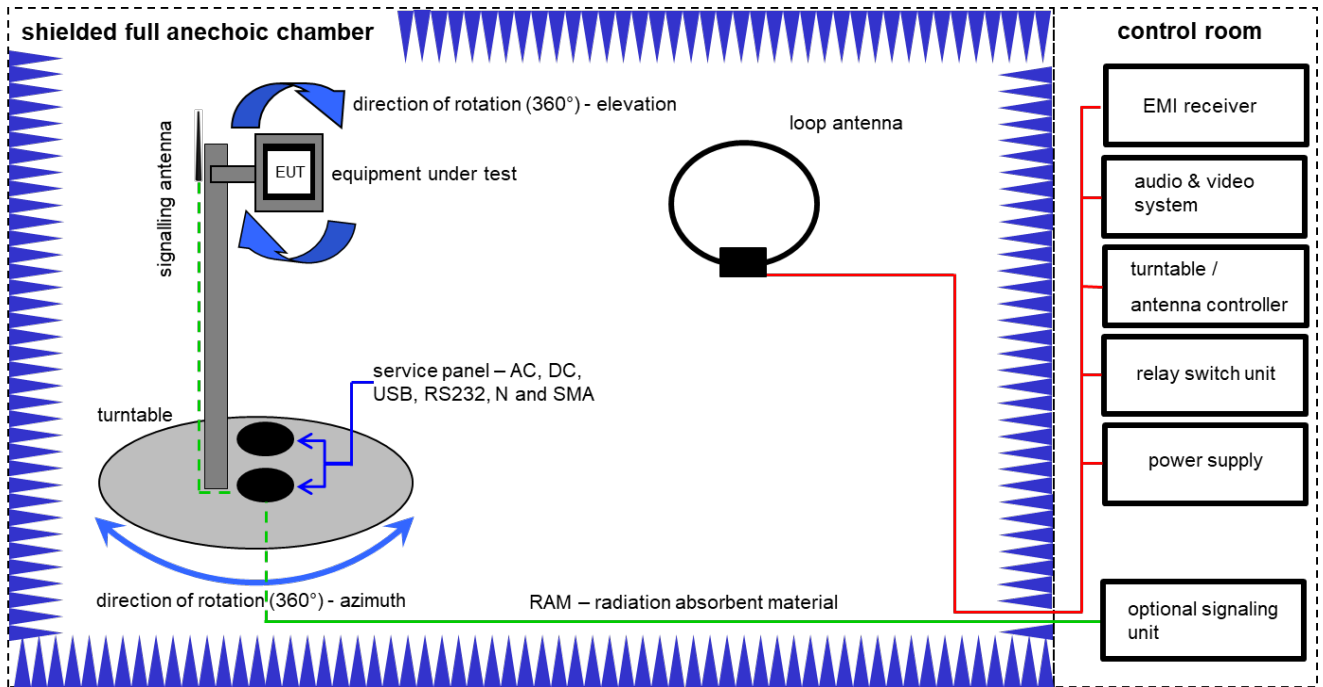
$$FS \text{ [dB}\mu\text{V/m]} = 12.35 \text{ [dB}\mu\text{V/m]} + 1.90 \text{ [dB]} + 16.80 \text{ [dB/m]} = 31.05 \text{ [dB}\mu\text{V/m]} \text{ (35.69 } \mu\text{V/m)}$$



**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	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2920A04466	300000580	ne	-/-	-/-
3	A	Semi anechoic chamber	3000023	MWB AG		300000551	ne	-/-	-/-
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vKI!	29.12.2021	31.12.2023
5	A	Antenna Tower	Model 2175	ETS-Lindgren	64762	300003745	izw	-/-	-/-
6	A	Positioning Controller	Model 2090	ETS-Lindgren	64672	300003746	izw	-/-	-/-
7	A	Turntable Interface-Box	Model 105637	ETS-Lindgren	44583	300003747	izw	-/-	-/-
8	A	TRILOG Broadband Test-Antenna 30 MHz - 3 GHz	VULB9163	Schwarzbeck Mess - Elektronik	318	300003696	vKI!	30.09.2021	29.09.2023
9	A	Turntable	2089-4.0	EMCO		300004394	ne	-/-	-/-
10	A	PC	TecLine	F+W		300004388	ne	-/-	-/-
11	A	EMI Test Receiver	ESR3	Rohde & Schwarz	102587	300005771	k	20.05.2022	19.05.2023

## 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)

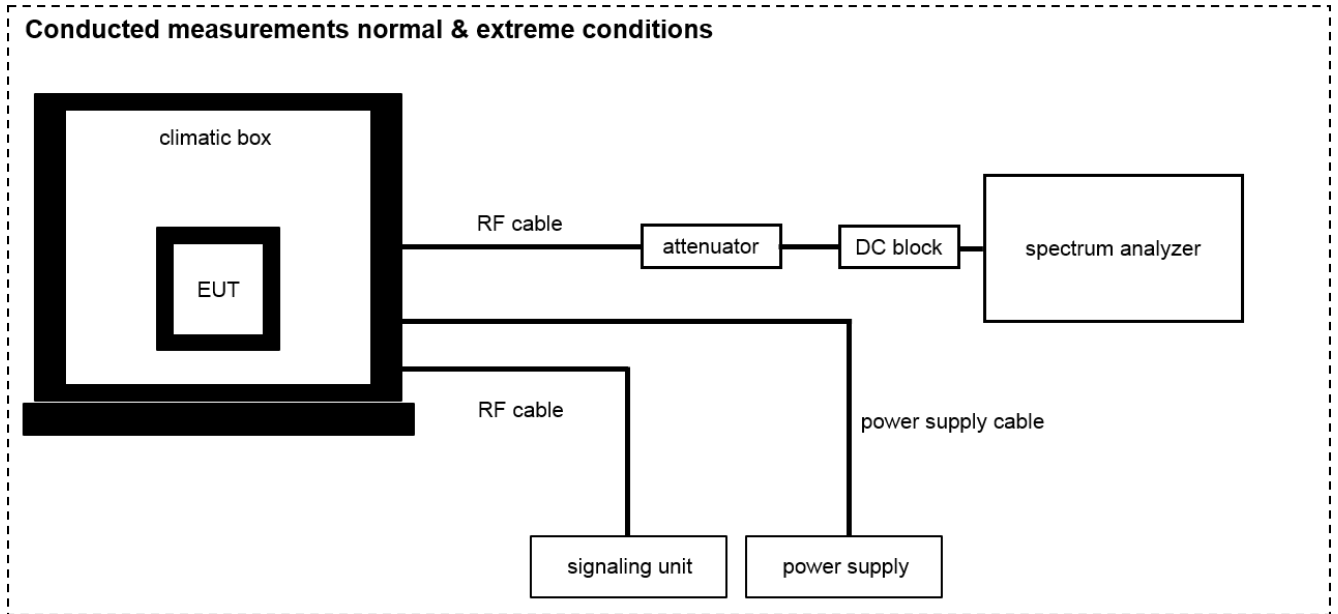
Example calculation:

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

**Equipment table:**

No.	Setup	Equipment	Type	Manufacturer	Serial No.	INV. No.	Kind of Calibration	Last Calibration	Next Calibration
1	A	DC power supply, 60Vdc, 50A, 1200 W	6032A	HP	2818A03450	300001040	vKI!	09.12.2020	08.12.2023
2	A	Active Loop Antenna 9 kHz to 30 MHz	6502	EMCO	2210	300001015	vKI!	01.07.2021	31.07.2023
3	A	Anechoic chamber	FAC 3/5m	MWB / TDK	87400/02	300000996	ev	-/-	-/-
4	A	Switch / Control Unit	3488A	HP	*	300000199	ne	-/-	-/-
5	A	EMI Test Receiver 20Hz- 26,5GHz	ESU26	R&S	100037	300003555	k	09.12.2021	31.12.2022
6	A	4U RF Switch Platform	L4491A	Agilent Technologies	MY50000037	300004509	ne	-/-	-/-
7	A	NEXIO EMV-Software	BAT EMC V3.21.0.32	EMCO		300004682	ne	-/-	-/-
8	A	Open Switch and Control Unit and Power Sensors	OSP120 incl. B157	Rohde & Schwarz	101274, 100877	300004825	vKI!	16.12.2020	15.12.2022
9	A	PC	ExOne	F+W		300004703	ne	-/-	-/-

### 7.3 Conducted measurements normal and extreme conditions



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

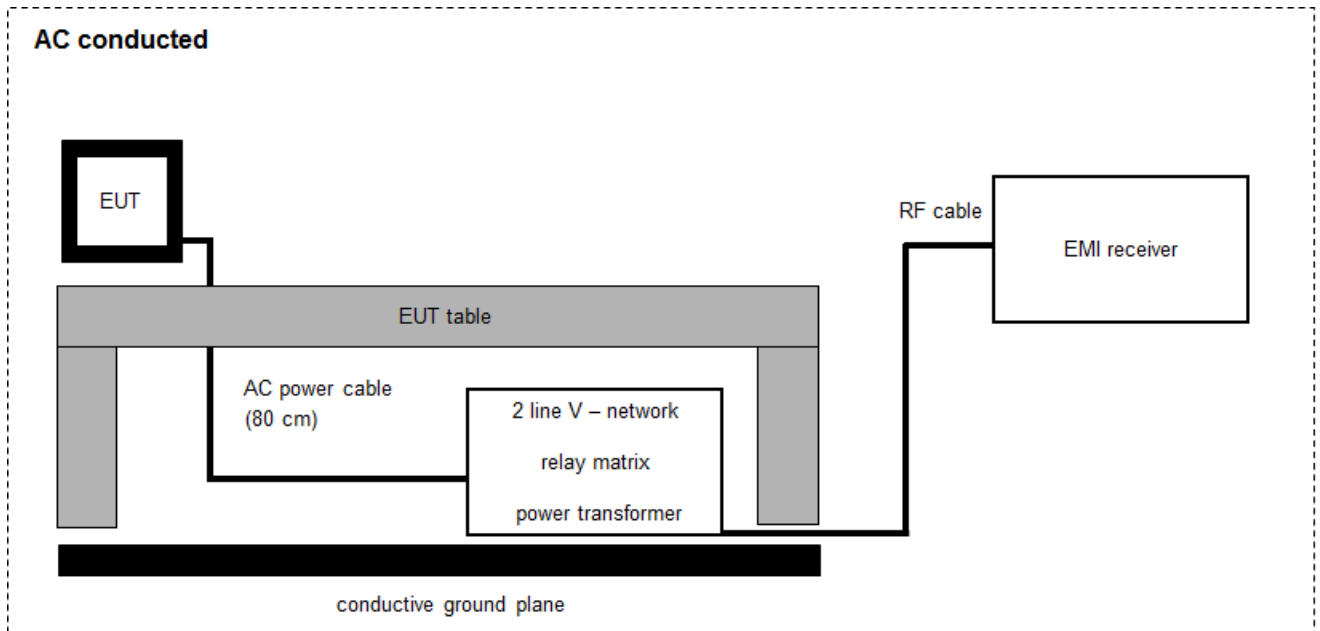
Example calculation:

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,B	Loop Antenna		ZEG TS Steinfurt		400001208	ev	-/-	-/-
2	B	Temperature Test Chamber	VT 4011	Voetsch Industrietechnik	585662306000 10	300005363	ev	09.05.2022	31.05.2024
3	A,B	Signal analyzer	FSV30	Rohde&Schwarz	104365	300005923	k	14.12.2021	31.12.2022
4	A,B	Power Supply	HMP2020	Rohde & Schwarz	102219	300006192	k	08.04.2021	07.04.2023

## 7.4 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:

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

**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	vKI!	14.12.2021	31.12.2023
2	A	RF-Filter-section	85420E	HP	3427A00162	300002214	NK!	-/-	-/-
3	A	EMI Test Receiver	ESCI 3	R&S	100083	300003312	g	-/-	-/-
4	A	Analyzer-Reference-System (Harmonics and Flicker)	ARS 16/1	SPS	A3509 07/0 0205	300003314	vKI!	29.12.2021	31.12.2023
5	A	Hochpass 150 kHz	EZ-25	R&S	100010	300003798	ev	-/-	-/-
6	A	PC	TecLine	F+W		300003532	ne	-/-	-/-

## 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**

<b>Measurement uncertainty</b>	
<b>Test case</b>	<b>Uncertainty</b>
Occupied bandwidth	± used RBW
Field strength of the fundamental	± 3 dB
Field strength of the harmonics and spurious	± 3 dB
Receiver spurious emissions and cabinet radiations	± 3 dB
Conducted limits	± 2.6 dB

## 10 Summary of measurement results

<input checked="" type="checkbox"/>	No deviations from the technical specifications were ascertained
<input type="checkbox"/>	There were deviations from the technical specifications ascertained
<input type="checkbox"/>	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 10 RSS Gen Issue 5	See table!	2022-12-12	-/-

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

**Note:**

C	Compliant
NC	Not compliant
NA	Not applicable
NP	Not performed

## 11 Additional comments

Reference documents: ctcadvanced test report 1-2799\_21-01-03

Special test descriptions: None

Configuration descriptions: None



## 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 7.3A
Measurement uncertainty:	See chapter 8

**Limit:**

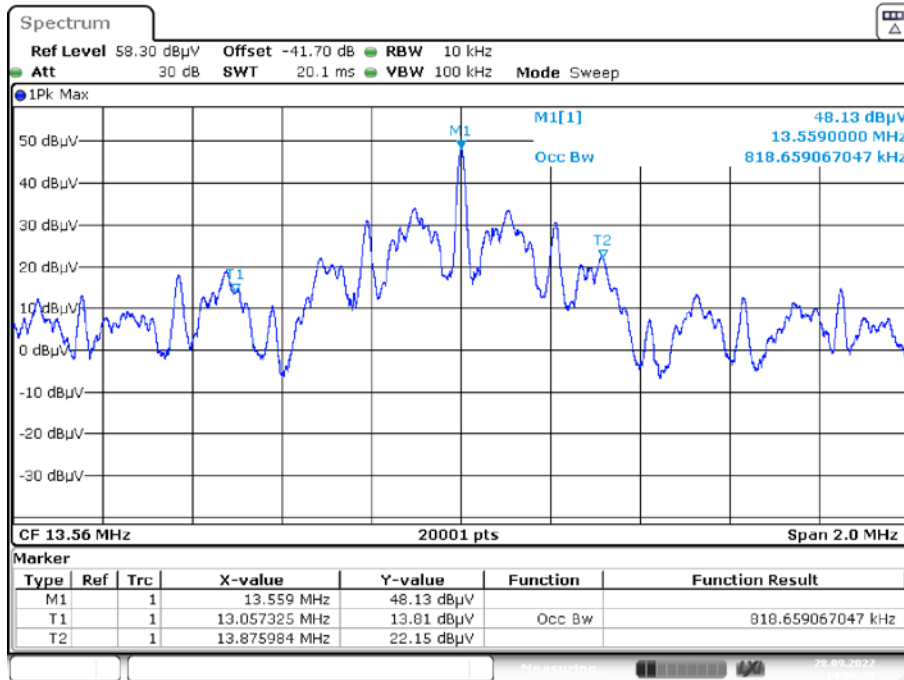
IC
for RSP-100 test report coversheet only

**Result:**

99% emission bandwidth
818.65 kHz

**Plot:**

**Plot 1: 99 % emission bandwidth**



Date: 28.SEP.2022 14:00:38

## 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:	average
Resolution bandwidth:	120 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	$FS_{\text{limit}} = FS_{\text{max}} - 40 \log\left(\frac{d_{\text{nearfield}}}{d_{\text{measure}}}\right) - 20 \log\left(\frac{d_{\text{limit}}}{d_{\text{nearfield}}}\right)$ <p> <math>FS_{\text{limit}}</math> is the calculation of field strength at the limit distance, expressed in dBµV/m  <math>FS_{\text{max}}</math> is the measured field strength, expressed in dBµV/m  <math>d_{\text{near field}}</math> is the <math>\lambda/2\pi</math> distance  <math>d_{\text{measure}}</math> is the distance of the measurement point from EUT  <math>d_{\text{limit}}</math> is the reference limit distance                 </p>	-21.4 dB from 3 m to 30 m

### Result:

Field strength of the fundamental		
Frequency	13.56 MHz	
Distance	@ 3 m	@ 30 m
Measured / calculated value	48.27 dBµV/m	26.87 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
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

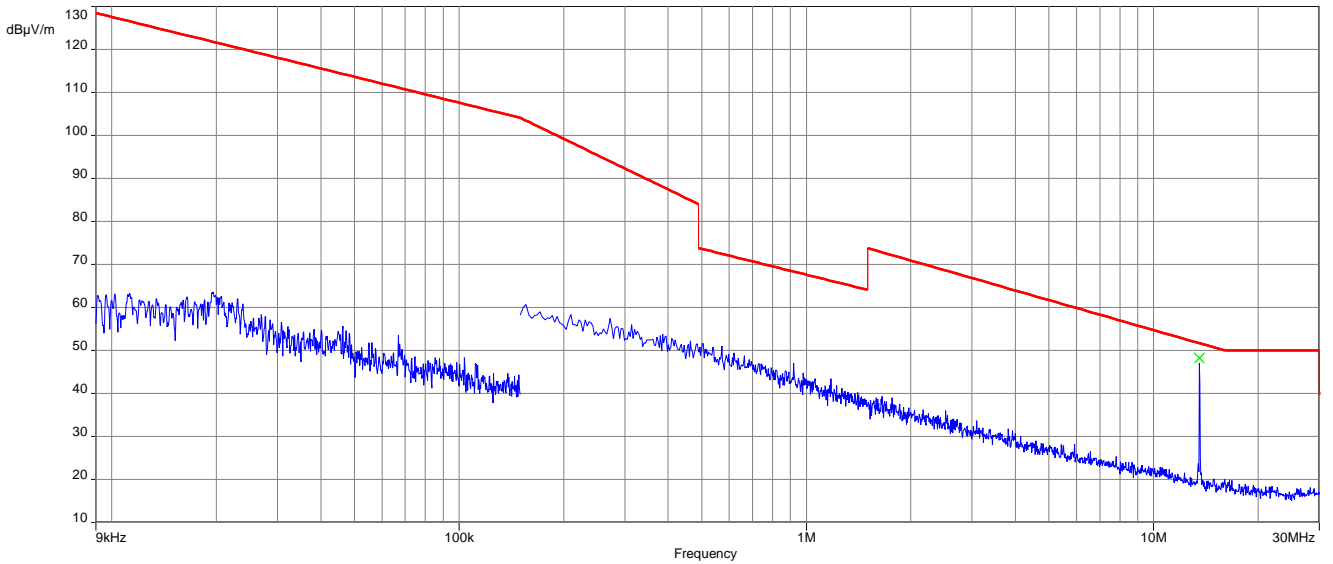
**Note:** For a reduced measurement distance, please take a look at the limit line and the ANSI C63.10-2013 sub clause 6.4 radiated emissions from unlicensed wireless devices below 30 MHz.

**Result:**

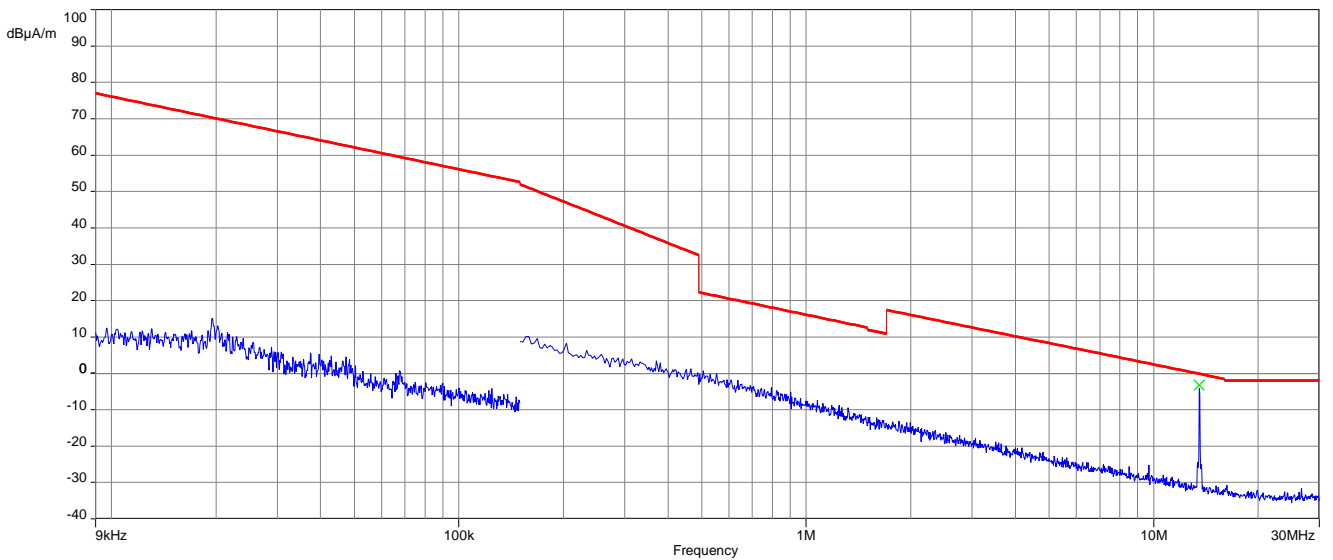
Detected emissions			
Frequency	Detector	Resolution bandwidth	Detected value (@ 3m)
no peaks detected			

**Plots:**

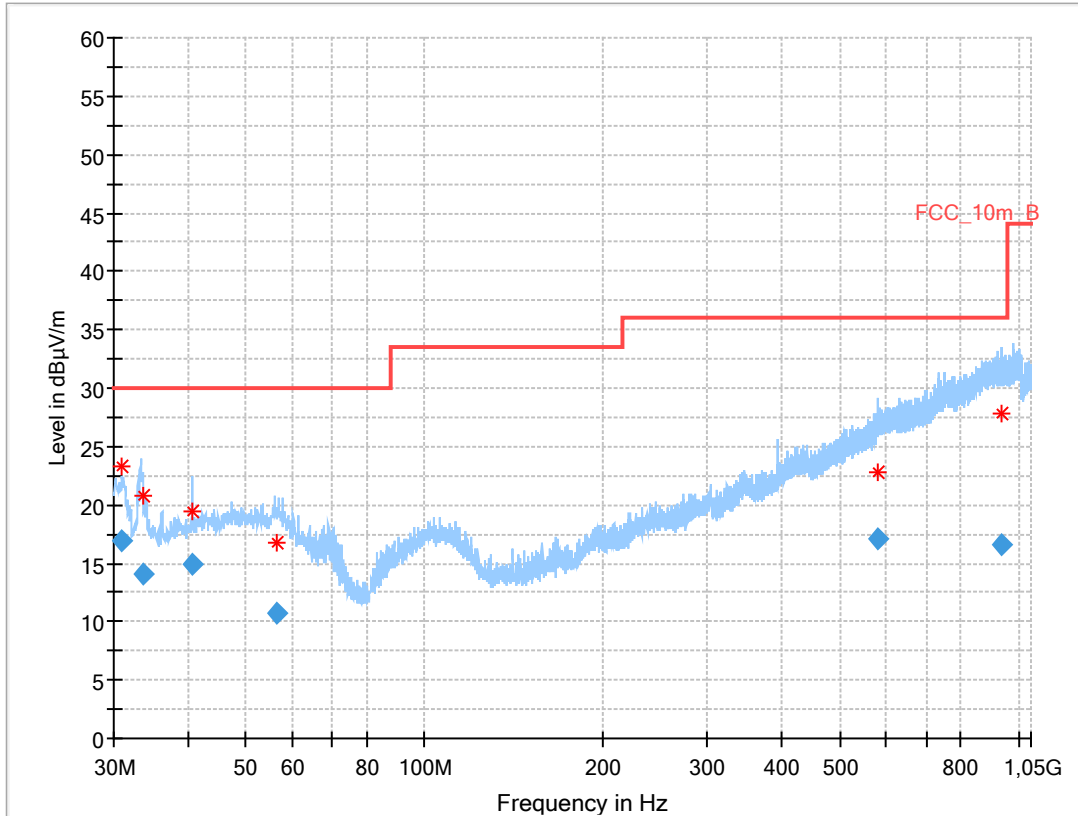
**Plot 1: 9 kHz – 30 MHz, magnetic emissions FCC**



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



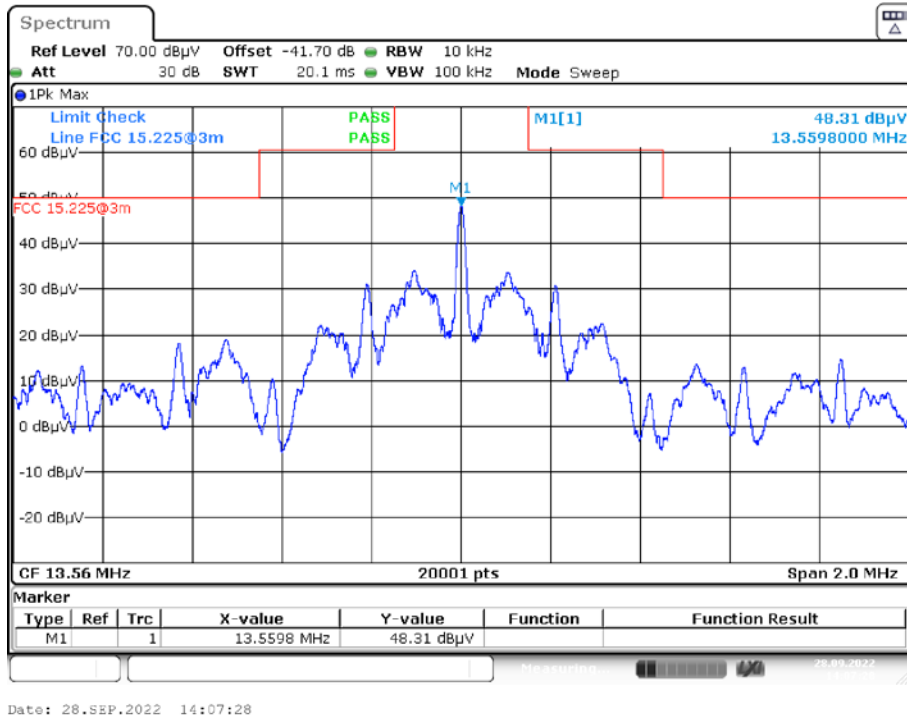
**Plot 3:** 30 MHz – 1 GHz, vertical and horizontal polarisation



### 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)
30.994	16.94	30.0	13.1	1000	120.0	385.0	V	186	13
33.754	14.15	30.0	15.9	1000	120.0	103.0	V	135	13
40.670	14.87	30.0	15.1	1000	120.0	194.0	V	85	14
56.406	10.77	30.0	19.2	1000	120.0	100.0	V	275	16
578.984	17.09	36.0	18.9	1000	120.0	146.0	V	270	21
938.072	16.51	36.0	19.5	1000	120.0	400.0	V	270	26

**Plot 4:** Spectrum mask (the limits are recalculated according to the ANSI C63.10-2013 sub clause 6.4)



## 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 / (dBµV/m)	Average / (dBµV/m)
0.15 – 0.5	66 to 56*	56 to 46*
0.5 – 5	56	46
5 – 30.0	60	50

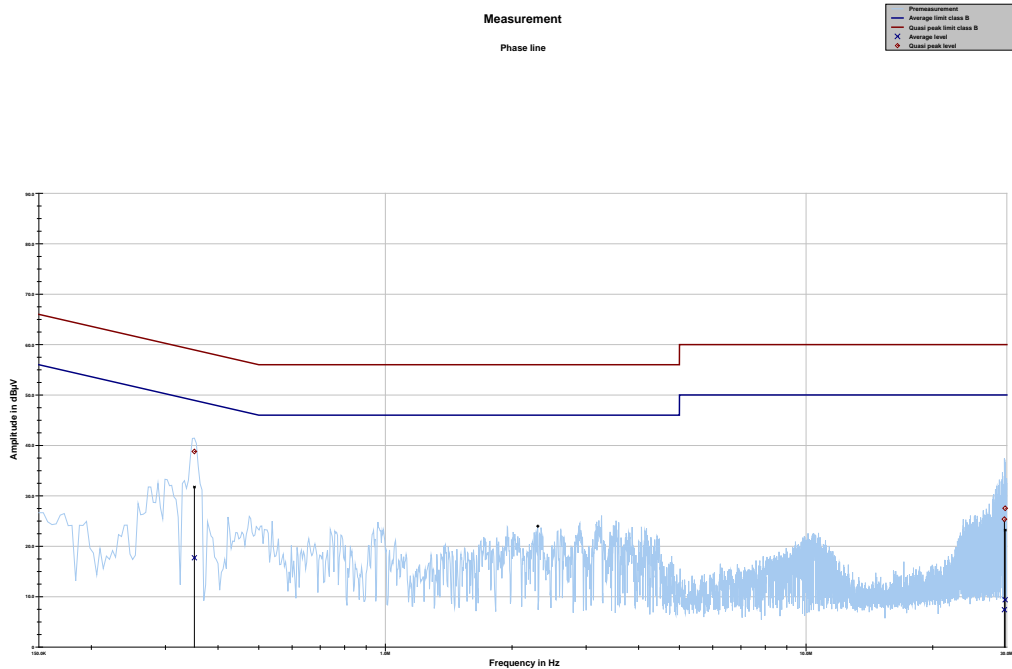
### Result:

see table below plots



**Plots:**

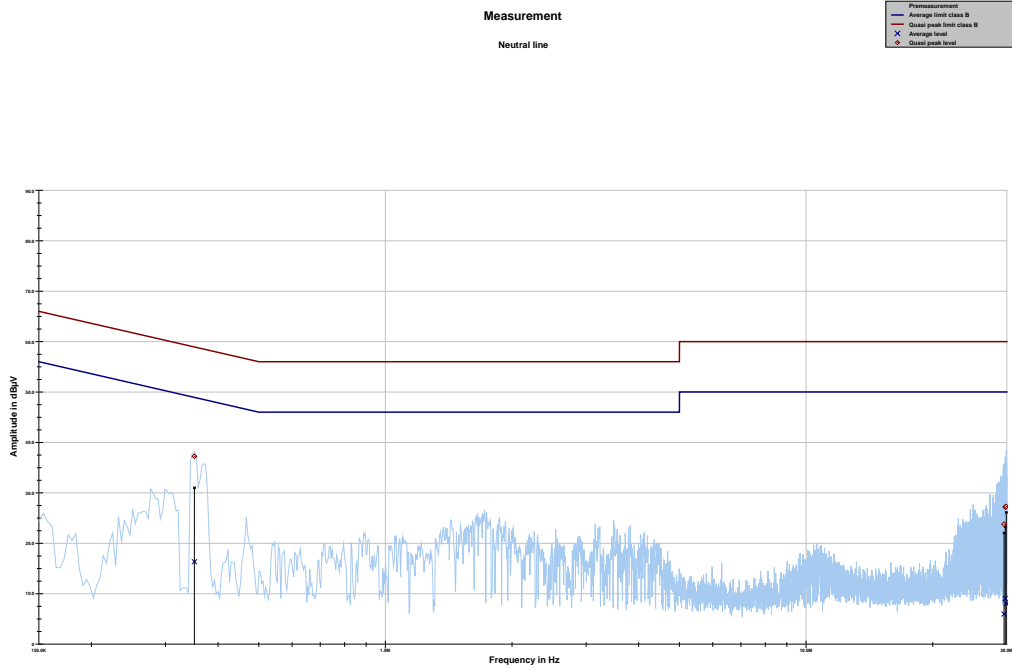
**Plot 1:** 150 kHz to 30 MHz, phase line



Project ID: 1-4829/22-1-8

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.351488	38.81	20.12	58.927	17.71	32.53	50.243
29.615681	25.37	34.63	60.000	7.41	42.59	50.000
29.738813	27.54	32.46	60.000	9.39	40.61	50.000

**Plot 2:** 150 kHz to 30 MHz, neutral line



Project ID: 1-4829/22-1-8

Frequency	Quasi peak level	Margin quasi peak	Limit QP	Average level	Margin Average	Limit AV
MHz	dBµV	dB	dBµV	dBµV	dB	dBµV
0.351488	37.24	21.69	58.927	16.33	33.92	50.243
29.548519	23.76	36.24	60.000	5.98	44.02	50.000
29.742544	27.18	32.82	60.000	9.06	40.94	50.000
29.914181	27.28	32.72	60.000	8.04	41.96	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 7.3B
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. ( $\pm 1.356$ kHz)
Carrier frequency stability shall be maintained to $\pm 0.01\%$ ( $\pm 100$ ppm)

### Result: Temperature variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560272	20.06	-20 °C & 100% voltage	compliant
13.560307	22.64	-10 °C & 100% voltage	compliant
13.560302	22.27	0 °C & 100% voltage	compliant
13.560277	20.43	+10 °C & 100% voltage	compliant
13.560235	17.33	+20 °C & 100% voltage	compliant
13.560197	14.53	+30 °C & 100% voltage	compliant
13.560132	9.73	+40 °C & 100% voltage	compliant
13.560072	5.31	+50 °C & 100% voltage	compliant

### Result: Voltage variation

Frequency tolerance			
Measured frequency	Frequency error (ppm)	Conditions	Result
13.560234	17.26	+20 °C & 85% voltage	compliant
13.560235	17.33	+20 °C & 100% voltage	compliant
13.560235	17.33	+20 °C & 115% voltage	compliant

## 13 Observations

No observations except those reported with the single test cases have been made.

## 14 Glossary

<b>EUT</b>	Equipment under test
<b>DUT</b>	Device under test
<b>UUT</b>	Unit under test
<b>GUE</b>	GNSS User Equipment
<b>ETSI</b>	European Telecommunications Standards Institute
<b>EN</b>	European Standard
<b>FCC</b>	Federal Communications Commission
<b>FCC ID</b>	Company Identifier at FCC
<b>IC</b>	Industry Canada
<b>PMN</b>	Product marketing name
<b>HMN</b>	Host marketing name
<b>HVIN</b>	Hardware version identification number
<b>FVIN</b>	Firmware version identification number
<b>EMC</b>	Electromagnetic Compatibility
<b>HW</b>	Hardware
<b>SW</b>	Software
<b>Inv. No.</b>	Inventory number
<b>S/N or SN</b>	Serial number
<b>C</b>	Compliant
<b>NC</b>	Not compliant
<b>NA</b>	Not applicable
<b>NP</b>	Not performed
<b>PP</b>	Positive peak
<b>QP</b>	Quasi peak
<b>AVG</b>	Average
<b>OC</b>	Operating channel
<b>OCW</b>	Operating channel bandwidth
<b>OBW</b>	Occupied bandwidth
<b>OOB</b>	Out of band
<b>DFS</b>	Dynamic frequency selection
<b>CAC</b>	Channel availability check
<b>OP</b>	Occupancy period
<b>NOP</b>	Non occupancy period
<b>DC</b>	Duty cycle
<b>PER</b>	Packet error rate
<b>CW</b>	Clean wave
<b>MC</b>	Modulated carrier
<b>WLAN</b>	Wireless local area network
<b>RLAN</b>	Radio local area network
<b>DSSS</b>	Dynamic sequence spread spectrum
<b>OFDM</b>	Orthogonal frequency division multiplexing
<b>FHSS</b>	Frequency hopping spread spectrum
<b>GNSS</b>	Global Navigation Satellite System
<b>C/N<sub>0</sub></b>	Carrier to noise-density ratio, expressed in dB-Hz

## 15 Document history

Version	Applied changes	Date of release
-/-	Initial release	2022-12-05
A	FCC ID changed	2022-12-12

## 16 Accreditation Certificate – D-PL-12076-01-04

first page	last page
 <p>The first page of the accreditation certificate includes the DAKKS logo, the name 'Deutsche Akkreditierungsstelle GmbH', and the accreditation details for CTC advanced GmbH. It states that the laboratory is competent under the terms of DIN EN ISO/IEC 17025:2018 for Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards. The registration number is D-PL-12076-01-04. The certificate was issued in Frankfurt am Main on 09.06.2020 by order of Dipl.-Ing. (FH) Ralf Egner, Head of Division.</p>	 <p>The last page of the accreditation certificate contains contact information for Deutsche Akkreditierungsstelle GmbH in Berlin, Frankfurt am Main, and Braunschweig. It also includes a disclaimer regarding the publication of extracts and the scope of accreditation, and provides information on how to retrieve the up-to-date state of membership from various websites (EA, ILAC, IAF).</p>

**Note: The current certificate annex is published on the websites (link see below).**

<https://www.dakks.de/files/data/as/pdf/D-PL-12076-01-04e.pdf>

or

[https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-04\\_Canada\\_TCEMC.pdf](https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-04_Canada_TCEMC.pdf)

17 Accreditation Certificate – D-PL-12076-01-05

first page	last page			
 <p>Deutsche Akkreditierungsstelle GmbH</p> <p>Entrusted according to Section 8 subsection 1 AkkStelleG in connection with Section 1 subsection 1 AkkStelleGBV Signatory to the Multilateral Agreements of EA, ILAC and IAF for Mutual Recognition</p> <p><b>Accreditation</b> </p> <p>The Deutsche Akkreditierungsstelle GmbH attests that the testing laboratory <b>CTC advanced GmbH</b> Untertürkheimer Straße 6-10, 66117 Saarbrücken is competent under the terms of DIN EN ISO/IEC 17025:2018 to carry out tests in the following fields: <b>Telecommunication (FCC Requirements)</b></p> <p>The accreditation certificate shall only apply in connection with the notice of accreditation of 09.06.2020 with the accreditation number D-PL-12076-01. It comprises the cover sheet, the reverse side of the cover sheet and the following annex with a total of 05 pages.</p> <p>Registration number of the certificate: <b>D-PL-12076-01-05</b></p> <p>Frankfurt am Main, 09.06.2020  by order of Dipl.-Ing. (FH) Ralf Egner Head of Division</p> <p><small>The certificate together with its annex reflects the status at the time of the date of issue. The current status of the scope of accreditation can be found in the database of accredited bodies of Deutsche Akkreditierungsstelle GmbH. <a href="https://www.dakks.de/en/content/accredited-bodies-dakks">https://www.dakks.de/en/content/accredited-bodies-dakks</a> 30x44mm 000001</small></p>	<p>Deutsche Akkreditierungsstelle GmbH</p> <table border="0"> <tr> <td>Office Berlin Spittelmarkt 10 10117 Berlin</td> <td>Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main</td> <td>Office Braunschweig Bundesallee 100 38116 Braunschweig</td> </tr> </table> <p>The publication of extracts of the accreditation certificate is subject to the prior written approval by Deutsche Akkreditierungsstelle GmbH (DAkKS). Exempted is the unchanged form of separate disseminations of the cover sheet by the conformity assessment body mentioned overleaf.</p> <p>No impression shall be made that the accreditation also extends to fields beyond the scope of accreditation attested by DAkKS.</p> <p>The accreditation was granted pursuant to the Act on the Accreditation Body (AkkStelleG) of 31 July 2009 (Federal Law Gazette I p. 2625) and the Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products (Official Journal of the European Union L 218 of 9 July 2008, p. 30). DAkKS is a signatory to the Multilateral Agreements for Mutual Recognition of the European co-operation for Accreditation (EA), International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC). The signatories to these agreements recognise each other's accreditations.</p> <p>The up-to-date state of membership can be retrieved from the following websites: EA: <a href="http://www.european-accreditation.org">www.european-accreditation.org</a> ILAC: <a href="http://www.ilac.org">www.ilac.org</a> IAF: <a href="http://www.iaf.eu">www.iaf.eu</a></p>	Office Berlin Spittelmarkt 10 10117 Berlin	Office Frankfurt am Main Europa-Allee 52 60327 Frankfurt am Main	Office Braunschweig Bundesallee 100 38116 Braunschweig
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[https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05\\_TCB\\_USA.pdf](https://ctcadvanced.com/app/uploads/2020/06/D-PL-12076-01-05_TCB_USA.pdf)

##### END OF TEST REPORT #####