

Gantner Electronic GmbH

TEST REPORT

SCOPE OF WORK

RADIO TESTING – AUTOMAT FOR THE RETURN OF WRISTBANDS: GRT7.2300

REPORT NUMBER

2251229KAU-002

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TYPE: GRT7.2300
DESCRIPTION: Automat for the return of Wristbands
SERIAL NO: 2328010016
PMN: GRT7.2300
HVIN: GRT7.2300
FVIN: 3.7.0

All measurement results refer to the equipment which was tested

MANUFACTURER: Gantner Electronic GmbH
CUSTOMER NAME: Gantner Electronic GmbH
ADDRESS (CUSTOMER): Bundesstr. 12
AT-6714 Nüziders
AUSTRIA

REPORT NO: 2251229KAU-002

TEST RESULT: The equipment complies to 47 CFR Part 15, Subpart C, Intentional radiators, section 15.225 / RSS-210, Issue 11 and RSS-GEN, Issue 5 (Referring to the operating modes specified in this report).

TEST LABORATORY: Intertek Deutschland GmbH
Innovapark 20, 87600
Kaufbeuren
Germany



FCC DESIGNATION NUMBER: DE0014

FCC TEST FIRM REGISTRATION NUMBER: 359260

ISED CAB IDENTIFIER: DE0014
ISED #: 24854

TEST ENGINEER: R. Abdelli
Project Engineer

REVIEWER: R. Dressler
Technical Manager EMC/ Radio



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SECTION 2

MEASUREMENT AND TEST SPECIFICATION

47 CFR Part 15, Subpart C, Intentional radiators, section 15.207 and section 15.225 /
RSS-210, Issue 11 and RSS-GEN, Issue 5

Test methods in:

ANSI C63.10-2013: American National Standard for Testing Unlicensed Wireless Devices

No additions, deviations or exclusions have been made from standards and accreditation.

The test results detailed in this report apply only to the GRT7.2300 with the test setup described. Any modification such as a change, addition to or inclusion of another device into this product will require an additional evaluation.

The support equipment listed as part of the emission tests is required to properly exercise and test the device under test.

SECTION 3

GENERAL INFORMATION

Possible test case verdicts:

Test case does not apply to the test object: N/A (Not Applicable)

Test object does meet the requirement: P (Pass)

Test object does not meet the requirements: F (Fail)

Samples arrived: 2024-03-18

Testing: 2024-04-03, 2024-04-18, 2024-04-19,
2024-04-22, 2024-04-23, 2024-04-25,
2024-04-26 and 2025-01-09

Decimal separator: ☒ Point ☐ Comma

Environmental conditions during testing: Temperature: 15 °C - 35 °C

Humidity: 20 % - 60 %

Atmospheric pressure: 900 mbar - 1000 mbar

If explicitly required by a basic standard the measured climatic conditions are documented in the corresponding test section.

SECTION 4

SUMMARY OF TESTING

4.1 General annotation and Co-location

The tests were performed in the order of the right column in the “Test Results – Overview” table.

The GRT7.2300 includes a RFID module on 13.56 MHz that is tested in this test report.
Above this it includes a Bluetooth module, that is already certified (see 6.5 of this test report).
A spot-check was performed at this Bluetooth module mounted inside the device under test.
According to the customer both transmitters are never active at the same time, therefore the co-location requirements are fulfilled.

4.2 Measurement uncertainty

For each test method an uncertainty evaluation was carried out. The results of the evaluation can be found in the annex of this test report.

4.3 Identical type

The following variant models were not tested as part of this evaluation and are not eligible for certification, but have been identified by the manufacturer as being electrically identical models, depopulated models, or with reasonable similarity to the model(s) tested.
Intertek does not make any claims of compliance for samples or variants which were not tested.

GRT7.2300 EE
GRT7.2310

The differences are according to the manufacturer/customer:

The three device types GRT7.2300, GRT7.2300 EE and GRT7.2310 are completely identical in electronic terms. They consist of identical circuit boards and are also identical in function.
The only difference lies in the mounting of the devices:

GRT7.2300	GRT7.2300 EE	GRT7.2310
Slim metal frame	No mounting frame	Wide metal frame

4.4 Document History

REVISION	DATE	REPORT	CHANGES	AUTHOR
Initial release	2025-02-11	2251229KAU-002	Initial issue	RAB

SECTION 5

TEST RESULTS – OVERVIEW

EMISSION	REQUESTED	VERDICT	DATE	NO
Field strength (13.110 MHz – 14.010 MHz)	see 7.1	P	2024-04-03	1
Radiated emissions (< 30 MHz), FCC	see 7.2	P	2024-04-03	2
Radiated emissions (< 30 MHz), ISSED	see 7.3	P	2025-01-09	8
Radiated emissions (30 MHz – 200 MHz)	see 7.4	P	2024-04-03	3
Frequency Stability Test (Temperature variation)	see 7.5	P	2024-04-19 2024-04-22 2024-04-23	5
Frequency Stability Test (Voltage Variation)	see 7.5	P	2024-04-18	4
Occupied bandwidth test	see 7.6	P	2024-04-26	7
Conducted Emissions (0.15 MHz - 30 MHz)	see 7.7	P	2024-04-25	6

SECTION 6

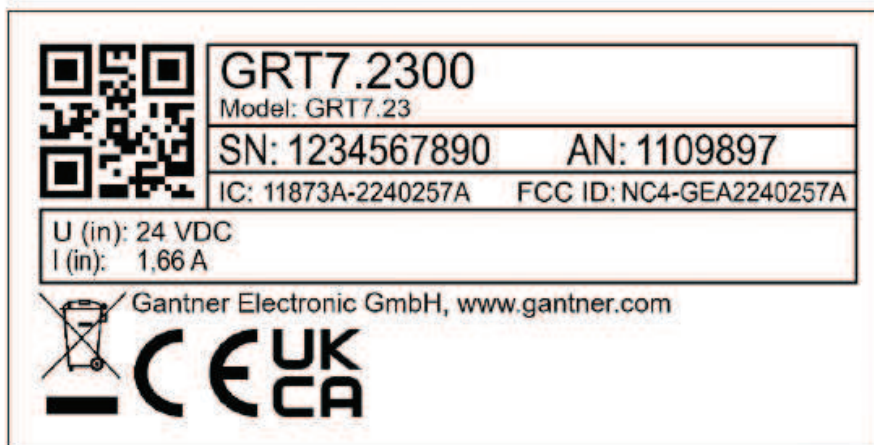
INFORMATION ABOUT THE EUT

6.1 Description of the EUT

☒ table-top EUT		☐ floor-standing EUT	
Dimensions:	Height:	Width:	Length:
	26.6 cm	18 cm	13 cm
Software version:	Special Firmware for testing		
Description: The GRT7.2300 is a vending machine for the return of RFID data carriers of the wristband type.			
Transmitter frequency range: 13.56 MHz			
Frequency agile or hopping:	☐ Yes	☒ No	
Antenna:	☒ Internal antenna	☐ External antenna	
Antenna connector:	☒ None, internal antenna	☐ Yes, type	
Type of used TAG:	Mifare		
Temperature range (specified by the manufacturer):	☐ Category I (General): -20°C to +55°C		
	☐ Category II (Portable equipment): -10°C to +55°C		
	☐ Category III (For normal indoor use): +5°C to +35°C		
	☒ Other: 0°C to +40°C		
Power rating:	100 -240 VAC, 50/60 Hz 1A		

6.1.1 Photo of the device and the rating plate

Sample of the rating plate:



6.2 Power interface

MODE	VOLTAGE (V)	FREQUENCY (Hz)	COMMENT
1	120 V	60 Hz	-

Power sources/associated test equipment

DEVICE	MANUFACTURER	TYPE	SN	ASSET NO.
Power supply	Spitzenberger + Spies	PAS 5000	A5215 01/0 1113	PM KF 2555

6.3 Configuration mode

MODE	DESCRIPTION
1	The DUT was connected to the power supply

6.4 Operation mode

MODE	DESCRIPTION
1	the RFID module was activated via the touchscreen while BLE (Bluetooth Low Energy) was inactive.
2	the tag was attached to the RFID module with adhesive tape so that the RFID module could be read permanently. BLE (Bluetooth Low Energy) was inactive.

6.5 Major subassemblies or internal peripherals

DEVICE	MANUFACTURER	TYPE	SN	FCC ID / IC ID
Bluetooth LE wireless radio module	Rayson Technology Co.	QS9322	None	FCC ID: QWO-QS9322PLCS IC: 4460A-QS9322PLCS

6.6 Peripheral devices used for testing.

N/A

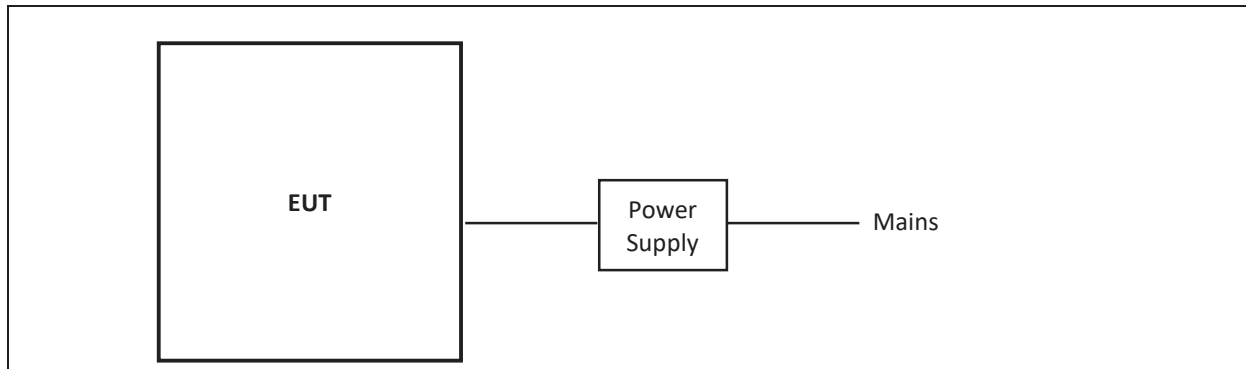
6.7 Supply and interconnecting cables used for testing.

LINE	LENGTH (cm)	SHIELDING
AC cable (Power supply)	188	N
DC cable (Power supply)	37	N

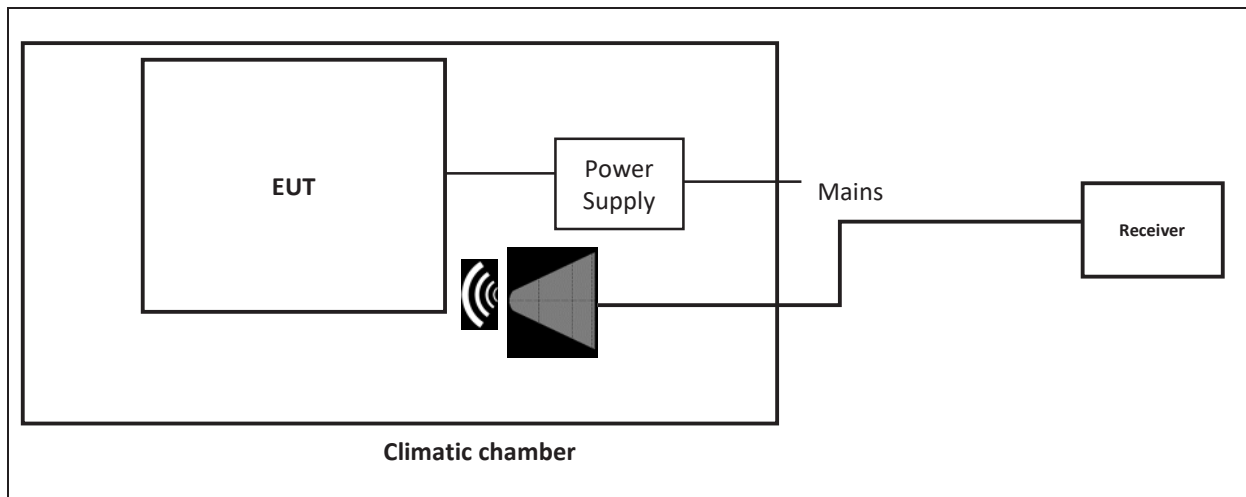
6.8 Clock frequencies of the EUT

SOURCE	FREQUENCY
RFID	13.56 MHz
μC	3 Crystals: 25 MHz, 24 MHz, 32.768 kHz
CoProcessor	32 kHz
BLE	2.4 GHz range

6.9 Block diagram of the test setup



6.10 Block diagram at the frequency stability test (voltage variation)



SECTION 7

CONFORMANCE REQUIREMENTS

7.1 Field strength 13.110 MHz – 14.010 MHz (Emission Mask)

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (a) – (c) RSS-210, Issue 11, section B6		P
Methods of measurement according to:	ANSI C63.10, section 6.3, 6.4 RSS-Gen 6.13, 8.9		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1	
Test requirements	Frequency range	13.110 MHz – 14.010 MHz	
	Measurement time	1 s	
	Antenna height	1 m	

Limits

The limits below 30 MHz are given for different measurement distances. The measurement results below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31). The field strength limits remain the same when the measurement is done at a distance of 3 m, but the extrapolation factor is already included in the correction factor of the software.

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
13.110 - 13.410	106	40.5	30
13.410 - 13.553	334	50.5	30
13.553 - 13.567	15848	84.0	30
13.567 - 13.710	334	50.5	30
13.710 - 14.010	106	40.5	30

Test setup details

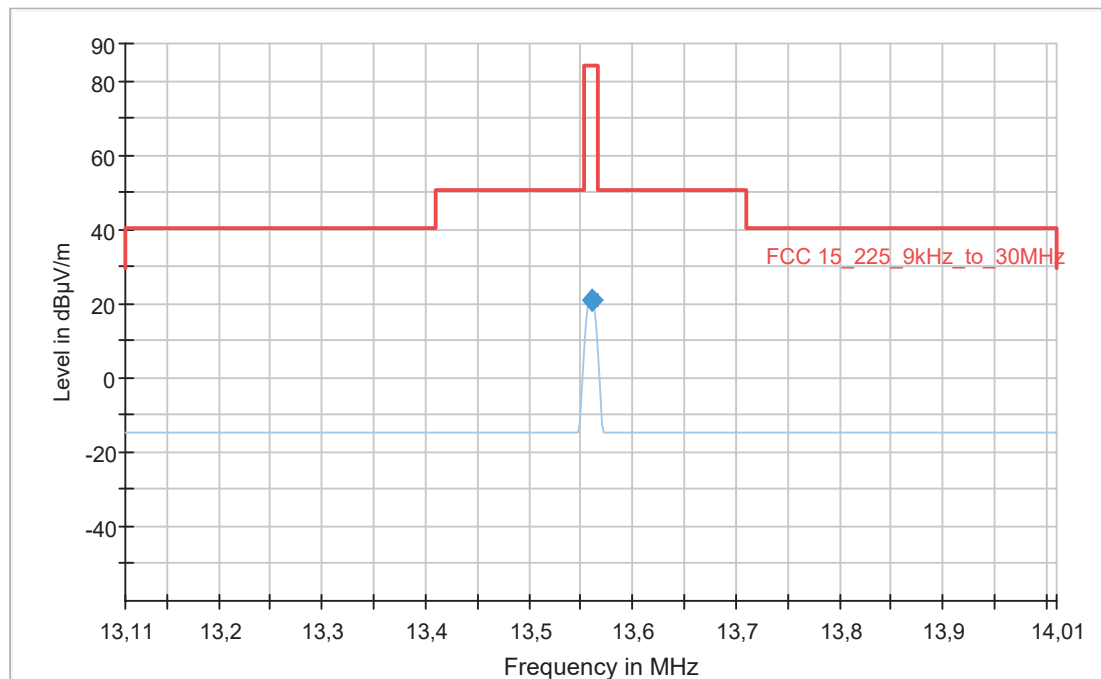
Compliance with the spectrum mask is tested using a spectrum analyzer with resolution bandwidth set to 10 kHz or 9 kHz CISPR. The video bandwidth shall be at least three times greater than the resolution bandwidth. The test was carried out automatically by the test receiver. The EUT is a table-top EUT and was standing on a table made of Styrodur with a Rohacell plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height). The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber	Siepel	REF W460SLB	-	PM KF 1150-01	2022-12 (3 years)
Turntable	Inn-Co	-	-	PM KF 2949-04	-
Controller	Inn-Co	CO 3000	4970815	PM KF 2949	-
Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESR7	101757	PM KF 3371	2023-05 (1 year)
Loop Antenna 9 kHz – 30 MHz	Rohde & Schwarz	HFH2-Z2	881 058/48	PM KF 1401	2023-09 (2 years)
Test software	Rohde & Schwarz	EMC 32 V10.50.40	-	PM KF 2983	-

Measurement results – Field strength 13.110 MHz – 14.010 MHz (Emission Mask):

EUT: GRT7.2300
Test Verdict: Passed
Test Description: 15.225
Operating Conditions: Operation mode 1 of section 6.4 of this test report
Operator Name: RAB
Project Number: 51229
Date: 2024.04.03



— Preview Result 1-QPK [Preview Result 1.Result:1]
* Critical_Freqs AVG [Critical_Freqs.Result:5]
* Critical_Freqs QPK [Critical_Freqs.Result:4]
— FCC 15_225_9kHz_to_30MHz [.\zF radiated\FCC Part 15C]
◆ Final_Result QPK [Final_Result.Result:4]
◆ Final_Result AVG [Final_Result.Result:5]

Final_Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)
0.021550	-28.48	---	40.94	69.41	1000.0	0.200	V	176.0
0.043400	-33.89	---	34.86	68.75	1000.0	0.200	V	176.0
0.339000	-35.71	---	17.00	52.71	1000.0	9.000	V	176.0
13.560000	21.18	---	84.00	62.82	1000.0	9.000	V	176.0

Frequency (MHz)	Corr. (dB/m)	Comment
0.021550	-60	-
0.043400	-60	-
0.339000	-61	-
13.560000	-22	-

EMI Auto Test Template: xF-RE-R17-AN23

Hardware Setup: xF-RE-R17-AN23
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: -80 dBμV/m - 50 dBμV/m

Preview Measurements:

Antenna height: 0 - 1000 cm , Step Size = 0 cm , Positioning Speed = 1
Polarization: H + V
Turntable position: 0 - 352 deg , Step Size = 22 deg , Positioning Speed = 8
Scan Test Template: xF-RE-R17-AN23_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESR 7]					
9 kHz - 150 kHz	50 Hz	QPK	200 Hz	1 s	0 dB
150 kHz - 30 MHz	2,25 kHz	QPK	9 kHz	1 s	0 dB

Anechoic chamber

Test procedure

The test site is an anechoic chamber suitable for radiated emission measurements in the frequency range of 9 kHz – 30 MHz¹⁾. It includes automatic turntable of radius 2 m. It enables manual and fully automatic measurements.

To find the highest level of radiation

- the height of the antenna is 1m with antenna in horizontal and vertical polarization.
- the turntable is rotated in range from 0° to 360°.

The system was configured for testing in a typical worst-case fashion (as a customer may use it). All interface cables were moved to determine the position which resulted in the highest emission levels.

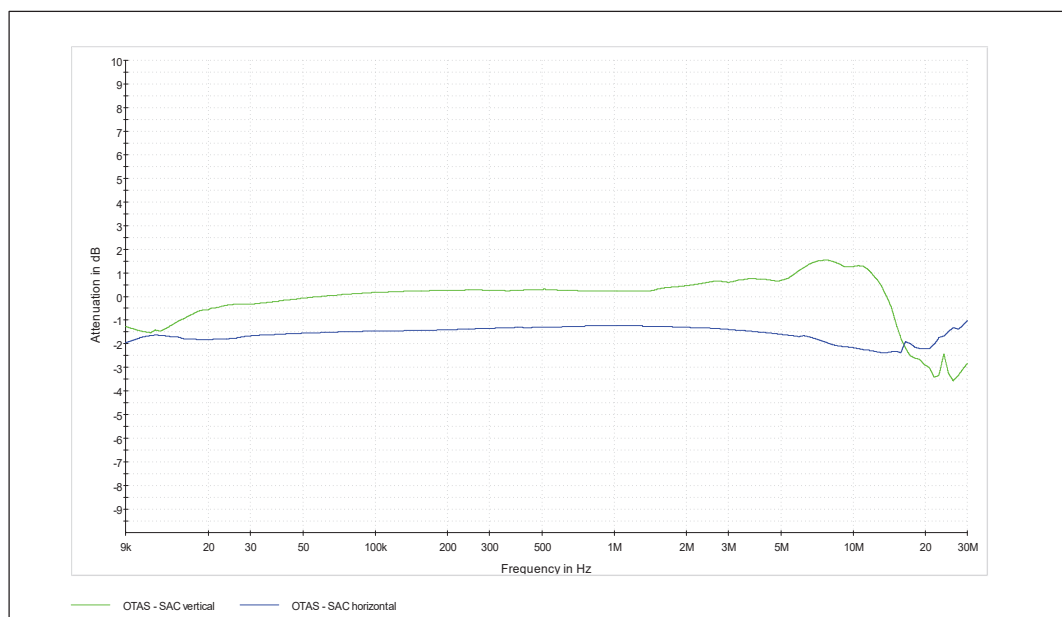
Correction factors

The field strength is calculated by adding the antenna factor and cable attenuation. The calculations are performed automatically by the measurement software EMC 32. As example consider the following input values and result:

FREQUENCY (MHZ)	RECEIVER READING U (dBμV)	ANTENNA FACTOR AF (dB/m)	CABLE ATTENUATION A (dB)	CORRECTION ANTENNA + CABLE (dB)	RADIATED FIELD STRENGTH E (dBμV/m)
30.0	20	20.6	0.8	21.4	41.4

$$E = U + AF + A$$

- 1) Comparison field attenuation: free field (OTAS) to anechoic chamber (SAC):



7.2 Radiated emissions < 30 MHz, FCC

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (d), §15.209		P
Methods of measurement according to:	ANSI C63.10, section 6.3, 6.4		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1	
Test requirements	Frequency range	9 kHz - 30 MHz	
	Antenna height	1 m	

Limits

The limits below 30 MHz are given for different measurement distances. The measurement values below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31). The field strength limits remain the same when the measurement is done at a distance of 3 m, but the extrapolation factor is already included in the correction factor of the software.

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	67.6 - 20 · log(F(kHz))	300
0.490 - 1.705	24000/F(kHz)	87.6 - 20 · log(F(kHz))	30
1.705 - 13.110	30	29.5	30
14.010 - 30.000	30	29.5	30
Additionally, the level of any unwanted emissions shall not exceed the level of the fundamental emission.			

Test setup details

The EUT is a table-top EUT and was standing on a table made of Styrodur with a Rohacell plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height).

The test was carried out automatically by the test receiver.

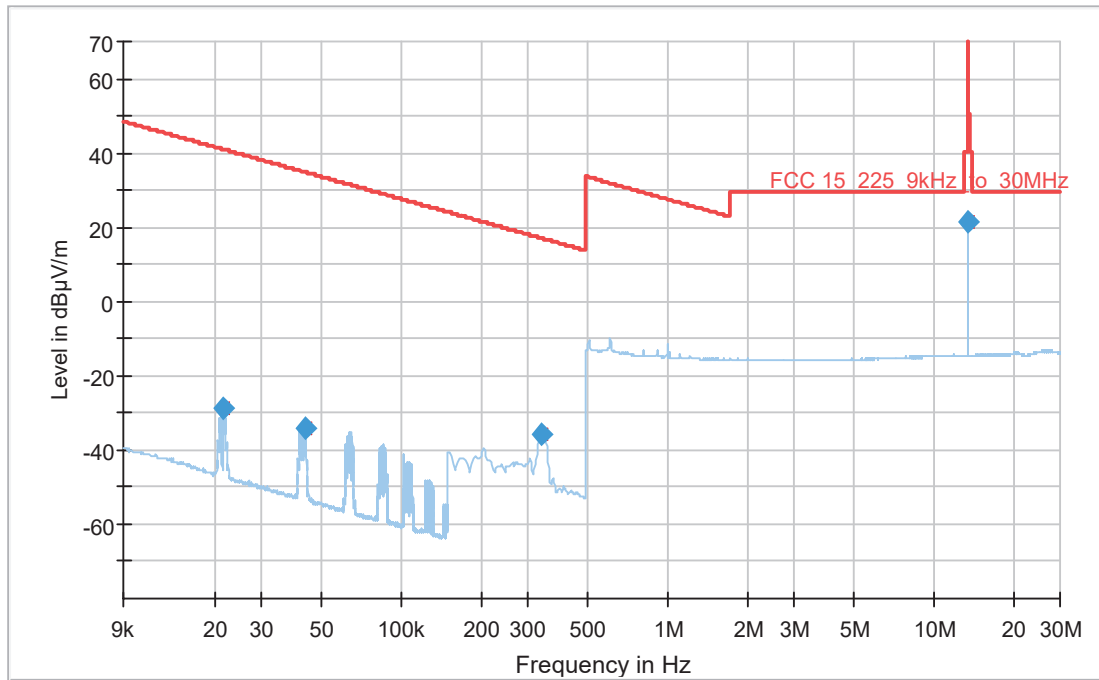
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber	Siepel	REF W460SLB	-	PM KF 1150-01	2022-12 (3 years)
Turntable	Inn-Co	-	-	PM KF 2949-04	-
Controller	Inn-Co	CO 3000	4970815	PM KF 2949	-
Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESR7	101757	PM KF 3371	2023-05 (1 year)
Loop Antenna 9 kHz - 30 MHz	Rohde & Schwarz	HFH2-Z2	881 058/48	PM KF 1401	2023-09 (2 years)
Test software	Rohde & Schwarz	EMC 32 V10.50.40	-	PM KF 2983	-

Measurement results – Radiated emissions < 30 MHz:

EUT: GRT7.2300
Test Verdict: Passed
Test Description: 15.225 / 15.209
Operating Conditions: Operation mode 1 of section 6.4 of this test report
Operator Name: RAB
Project Number: 51229
Date: 2024.04.03



Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Average (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)
0.021550	-28.48	---	40.94	69.41	1000.0	0.200	V	176.0
0.043400	-33.89	---	34.86	68.75	1000.0	0.200	V	176.0
0.339000	-35.71	---	17.00	52.71	1000.0	9.000	V	176.0
13.560000	21.18	---	84.00	62.82	1000.0	9.000	V	176.0

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Corr. (dB/m)
0.021550	-60
0.043400	-60
0.339000	-61
13.560000	-22

EMI Auto Test Template: xF-RE-R17-AN23

Hardware Setup: xF-RE-R17-AN23
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: -80 dBμV/m - 50 dBμV/m

Preview Measurements:
Antenna height: 0 - 1000 cm , Step Size = 0 cm , Positioning Speed = 1
Polarization: H + V
Turntable position: 0 - 352 deg , Step Size = 22 deg , Positioning Speed = 8
Scan Test Template: xF-RE-R17-AN23_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamplifier
Receiver: [ESR 7]					
9 kHz - 150 kHz	50 Hz	QPK	200 Hz	1 s	0 dB
150 kHz - 30 MHz	2,25 kHz	QPK	9 kHz	1 s	0 dB

7.3 Radiated emissions < 30 MHz, ISED

NORMATIVE REFERENCES			RESULT
Limits according to:	RSS-Gen 8.9		P
Methods of measurement according to:	RSS-Gen 6.5, 6.13, 8.9		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1	
Test requirements	Frequency range	9 kHz - 30 MHz	
	Antenna height	1 m	

Limits

The limits below 30 MHz are given for different measurement distances. The measurement values below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade. The magnetic field strength limits remain the same when the measurement is done at a distance of 3 m, but the extrapolation factor is already included in the correction factor of the software.

Frequency (MHz)	Magnetic field strength (H-field) (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 - 30.000	0.08	30
Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.		

Test setup details

The test was carried out automatically by the test receiver.

The EUT is a table-top EUT and was standing on a table made of Styrodur with a Rohacell plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height).

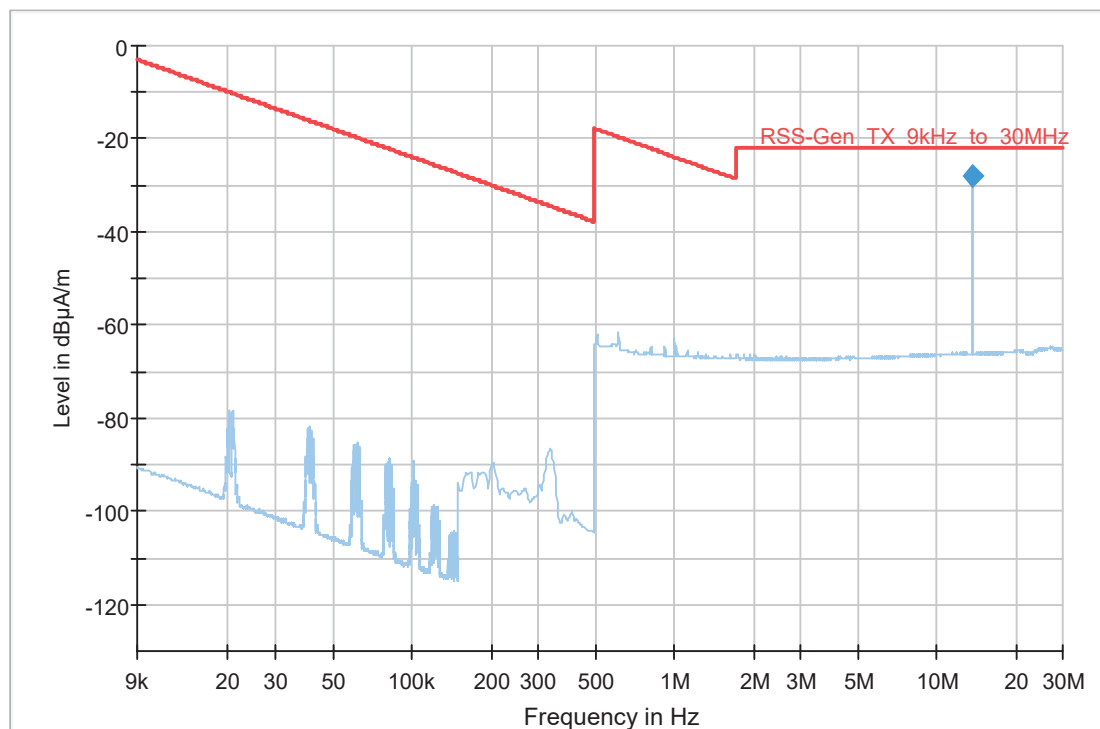
The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber	Siepel	REF W460SLB	-	PM KF 1150-01	2022-12 (3 years)
Turntable	Inn-Co	-	-	PM KF 2949-04	-
Controller	Inn-Co	CO 3000	4970815	PM KF 2949	-
Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESR7	101757	PM KF 3371	2024-05 (1 year)
Loop Antenna 9 kHz – 30 MHz	Rohde & Schwarz	HFH2-Z2	881 058/48	PM KF 1401	2023-09 (2 years)
Test software	Rohde & Schwarz	EMC 32 V10.50.40	-	PM KF 2983	-

Measurement results – Radiated emissions < 30 MHz:

EUT: GRT7.2300
Test Verdict: Passed
Test Description: RSS 210 / RSS Gen
Operating Conditions: Operation mode 1 of section 6.4 of this test report
Operator Name: UGR
Project Number: 51229
Date: 09.01.2025



— Preview Result 1-QPK [Preview Result 1.Result:1]
— RSS-Gen_TX_9kHz_to_30MHz [..\zF radiated\RSS-Gen\]
◆ Final_Result QPK [Final_Result.Result:4]
◆ Final_Result AVG [Final_Result.Result:5]

Final_Result

Frequency (MHz)	QuasiPeak (dBμA/m)	Average (dBμA/m)	Limit (dBμA/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Pol	Azimuth (deg)
13.560000	-27.89	---	-21.94	5.95	1000.0	9.000	H	176.0

(continuation of the "Final_Result" table from column 14 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
13.560000	-71	Peak detector: -27,59 dBμA/m

EMI Auto Test Template: xF-RE-R17-AN24

Hardware Setup: xF-RE-R17-AN24
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: -130 dBμA/m - 0 dBμA/m

Preview Measurements:
Antenna height: 0 - 1000 cm , Step Size = 0 cm , Positioning Speed = 1
Polarization: H + V
Turntable position: 0 - 352 deg , Step Size = 22 deg , Positioning Speed = 8
Scan Test Template: xF-RE-R17-AN24_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESR 7]					
9 kHz - 150 kHz	50 Hz	QPK	200 Hz	1 s	0 dB
150 kHz - 30 MHz	2,25 kHz	QPK	9 kHz	1 s	0 dB

Anechoic chamber

Test procedure

The test site is an anechoic chamber suitable for radiated emission measurements in the frequency range of 9 kHz – 30 MHz.¹⁾ It includes automatic turntable of radius 2 m. It enables manual and fully automatic measurements.

To find the highest level of radiation

- the height of the antenna is 1m with antenna in horizontal and vertical polarization.
- the turntable is rotated in range from 0° to 360°.

The system was configured for testing in a typical worst-case fashion (as a customer may use it). All interface cables were moved to determine the position which resulted in the highest emission levels.

Correction factors

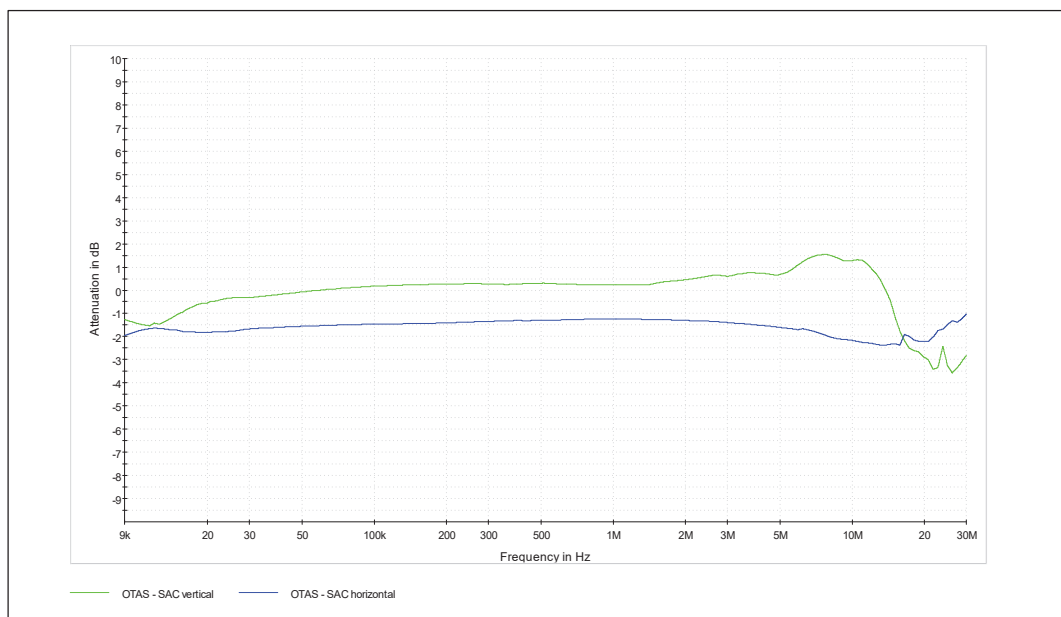
The field strength is calculated by adding the antenna factor and cable attenuation. The calculations are performed automatically by the measurement software EMC 32.

As example consider the following input values and result:

FREQUENCY (MHZ)	RECEIVER READING U (dBμV)	ANTENNA FACTOR AF (dB/m)	CABLE ATTENUATION A (dB)	CORRECTION ANTENNA + CABLE (dB)	RADIATED FIELD STRENGTH E (dBμV/m)
30.0	20	20.6	0.8	21.4	41.4

$$E = U + AF + A$$

- 1) Comparison field attenuation: free field (OTAS) to anechoic chamber (SAC):



7.4 Radiated emissions 30 MHz to 200 MHz

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (d), §15.209 RSS-210, Issue 11, section B6		P
Methods of measurement according to:	ANSI C63.10, section 6.3, 6.5 RSS-Gen 6.13, 8.9		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1	
Test requirements	Frequency range	30 MHz – 200 MHz	

Limits

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 – 960	200	46.0	3
Above 960	500	54.0	3

Test setup details.

The EUT is a tabletop EUT and was standing on a table made of Styrodur with a Rohacell plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height).

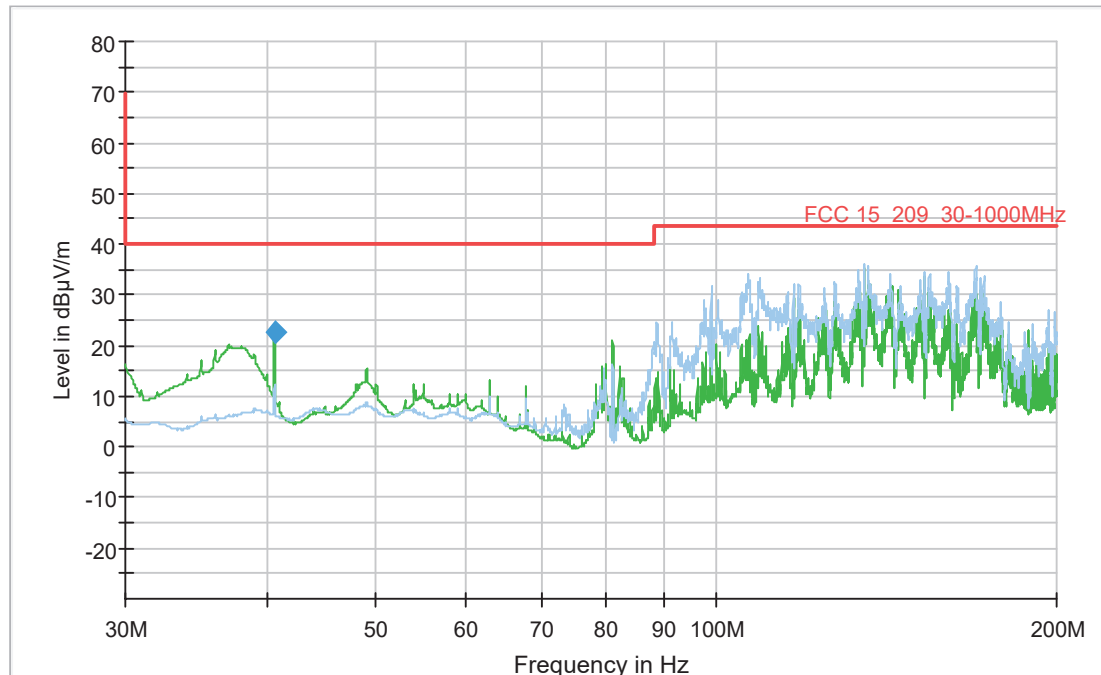
Overview sweeps performed with peak detectors and final measurement with quasi-peak detectors. The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector.

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber (30 – 1000 MHz)	Siepel	REF W460SLB	-	PM KF 1150-01	2022-12 (3 years)
Turntable	Inn-Co	-	-	PM KF 2949-04	-
Tower	Inn-Co	MA4484-XPET	-	PM KF 2949-03	-
Controller	Inn-Co	CO 3000	4970815	PM KF 2949	-
Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESW 44	103218	PM KF 4019	2024-04 (1 year)
Trilog broadband antenna	Schwarzbeck	VULB 9163	9163-974	PM KF 3196	2023-02 (2 years)
Test software	Rohde & Schwarz	EMC 32 V10.50.40	-	PM KF 2983-2	-

Measurement results – Radiated emissions 30 MHz to 200 MHz:

EUT: GRT7.2300
Test Verdict: Passed
Test Description: Radiated Emission FCC Part 15 C
Operating Conditions: Operation mode 1 of section 6.4 of this test report
Operator Name: RAB
Project Number: 51229
Date: 2024.04.03



— Preview Result 1V-QPK [Preview Result 1V.Result:2]
— Preview Result 1H-QPK [Preview Result 1H.Result:2]
— FCC 15_209_30-1000MHz [..\EMI radiated\FCC Part 15C]
* Critical_Freqs QPK [Critical_Freqs.Result:4]
◆ Final_Result QPK [Final_Result.Result:4]
× QuasiPeak-QPK (Single) [Result Table_Single.Result:2]

Final_Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40.680000	22.60	40.00	17.40	1000.0	120.000	100.0	V	88.0

(continuation of the "Final_Result" table from column 15 ...)

Frequency (MHz)	Corr. (dB/m)	Comment
40.680000	13	2.60 dBμV/m @ 30 m

Comment

No further transmitter unwanted emissions than the 40.68 MHz were detectable.

The field strength value at 3 m is 22.60 dBμV/m. This corresponds to 2.60 dBμV/m at 30 m (- 20 dB). Thus the requirement of RSS-GEN (8.9) "the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission" is fulfilled, because the transmitter's fundamental emission is 21.18 dBμV/m at 30m.

EMI Auto Test Template: FCC-RE-R18-AN34_QP

Hardware Setup: EN-RE-R18-AN34
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 30 MHz - 1 GHz
Graphics Level Range: 0 dB μ V/m - 80 dB μ V/m

Preview Measurements:
Antenna height: 100 - 355 cm, Step Size = 85 cm, Positioning Speed = 8
Polarization: H + V
Turntable position: 0 - 352 deg, Step Size = 22 deg, Positioning Speed = 8
Graphics Display: Show separate traces for horizontal and vertical polarization
Scan Test Template: EN-RE-R18-AN34_PRE_QP

Subrange	Step Size	Detectors	IF BW	Meas. Time	Prea
Receiver: [ESW 44]					
30 MHz - 1 GHz	30 kHz	QPK	120 kHz	1 s	20 dB
1 GHz - 3 GHz	250 kHz	QPK	1 MHz	1 s	20 dB

Frequency Zoom:
Zoom Scan Template: EN-RE-R18-AN34_ZOOM_QP

Adjustment:
Antenna height: Range = 300 cm, Measuring Speed = 1
Turntable position: Range = 360 deg, Measuring Speed = 2
Template for Single Meas.: EN-RE-R18-AN34_ADJ_QP

Final Measurements:
Template for Single Meas.: EN-RE-R18-AN34_FIN_15s

Subrange	Step Size	Detectors	IF BW	Meas. Time	Prea
Receiver: [ESW 44]					
30 MHz - 200 MHz	40 kHz	QPK	120 kHz	1 s	20 dB
200 MHz - 1 GHz	40 kHz	QPK	120 kHz	1 s	20 dB
1 GHz - 3 GHz	40 kHz	QPK	1 MHz	1 s	20 dB

Anechoic chamber

Test procedure.

The test site is an anechoic chamber suitable for radiated emission measurements in the frequency range of 30 MHz – 18 GHz (40 GHz). It includes automatic antenna mast of height 4 m and turntable of radius 2 m. It enables both manual and fully automatic measurements. To find the highest level of radiation

- the height of the antenna is scanned in range 1m to 4 m with antenna in horizontal and vertical polarization.
- the turntable is rotated in range from 0° to 360°.

The system was configured for testing in a typical worst-case fashion (as a customer may use it). All interface cables were moved to determine the position which resulted in the highest emission levels.

Correction factors

The field strength is calculated by adding the antenna factor and cable attenuation. The calculations are performed automatically by the measurement software EMC 32. As example consider the following input values and result:

FREQUENCY (MHZ)	RECEIVER READING U (dBμV)	ANTENNA FACTOR AF (dB/m)	CABLE ATTENUATION A (dB)	CORRECTION ANTENNA + CABLE (dB)	RADIATED FIELD STRENGTH E (dBμV/m)
30.0	20	20.6	0.8	21.4	41.4

$$E = U + AF + A$$

7.5 Frequency stability measurement

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (e) RSS-210, Issue 11, section B6 RSS-Gen Issue 5, section 6.11		P
Methods of measurement according to:	ANSI C63.10, section 9.14 ANSI C63.10, section 6.8.1		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1	

Limits

Limit:	The frequency tolerance of the carrier signal shall be maintained within $\pm 0.01\%$ (± 100 ppm) of the carrier frequency under nominal conditions.
Temperature range:	-20°C to +50°C
Voltage:	100 V to 240 V

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Temperature chamber	Heraeus-Vötsch	HT4010	45021	PM KF 1402	2024-03 (1 year)
Spectrum analyser	Rohde & Schwarz	FSV40	837356/012	PM KF 2783	2023-08 (1 year)
Loop antenna	Rohde & Schwarz	HZ-10	100055	PM KF 0965	2024-03 (1 year)

The locks are specified by the manufacturer for a temperature range of 0°C to 40°C.

Due to the required temperature range according to the standards of -20°C to +50°C the temperature variation was applied between -20°C to +50°C to cover the complete range.

Measurement results – Frequency stability measurement:

Temperature °C	Carrier 13.560 MHz	Limit: frequency tolerance $\pm 0.01\%$ (± 100 ppm) equates to ± 1.356 kHz	
		Frequency deviation	
		kHz	%
-20	13.56017370 MHz	0	0.00128
-10	13.56012300 MHz	0	0.00091
0	13.56010850 MHz	0	0.0008
+10	13.56006510MHz	0	0.00048
+20	13.56017370 MHz	Reference value	
+30	13.55996380 MHz	- 0.2	-0.00027
+40	13.55993490 MHz	- 0.2	-0.00048
+50	13.55988420 MHz	-0,2	-0.00085

Comment

After the frequency stability test the the carrier frequency at +20°C was identical as at the beginning of the test.

Through the voltage variation from 100 V-120V to 240 V (at +20°C) the frequency remained on 13.5605 MHz.

7.6 Occupied bandwidth

NORMATIVE REFERENCES			RESULT
Limits according to:	RSS-Gen, Issue 5, 6.7		P
Methods of measurement according to:	RSS-Gen, Issue 5, 6.7		
Equipment mode	Power interface	1	
	EUT configuration mode	1	
	Operation mode	1 and 2	

Test equipment

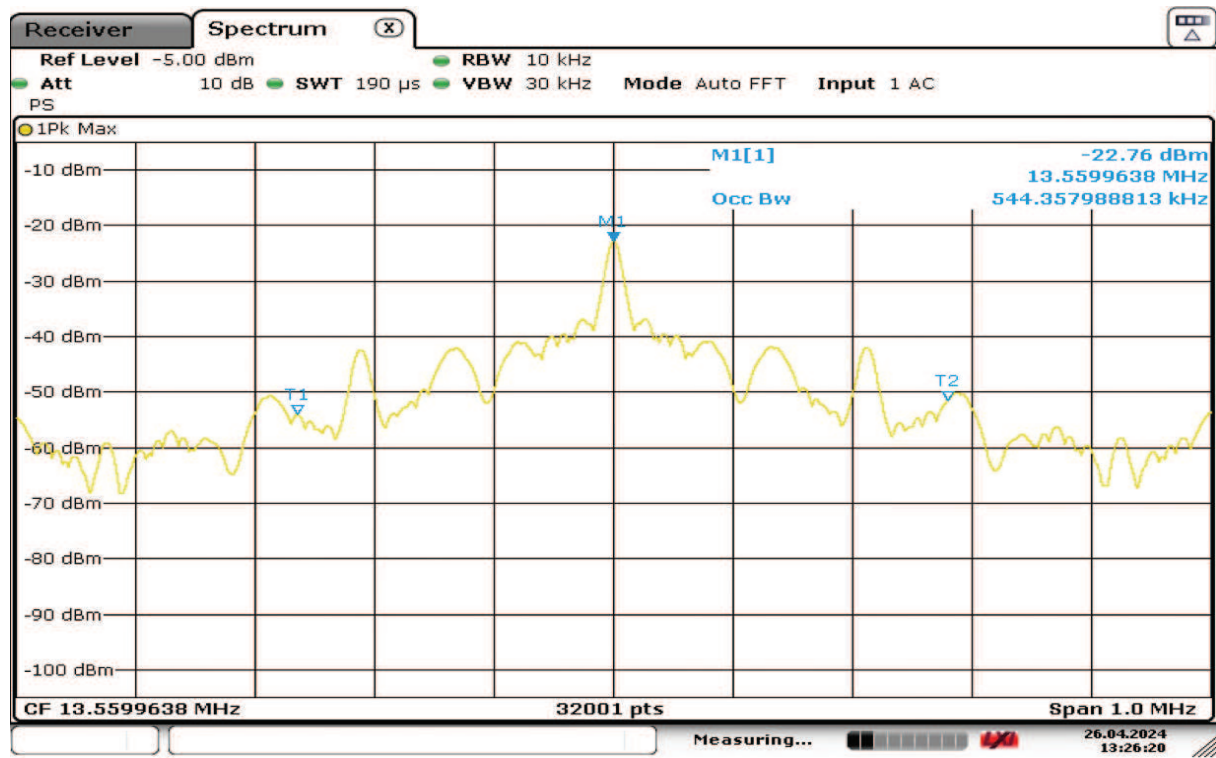
DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Spectrum analyser	Rohde & Schwarz	FSV40	837356/012	PM KF 2783	2023-08 (1 year)
Loop antenna	Rohde & Schwarz	HZ-10	100055	PM KF 0965	2024-03 (1 year)

Comment

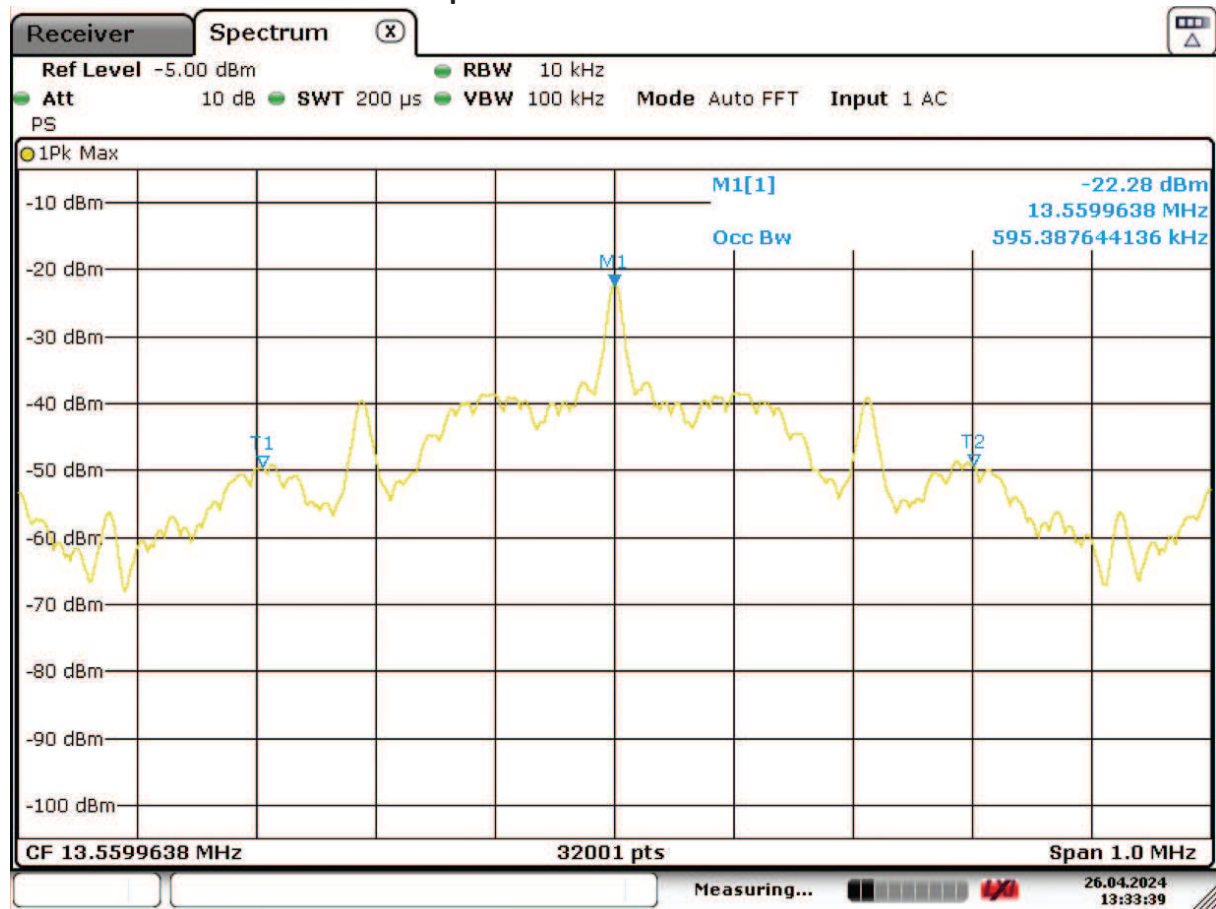
The 99% occupied bandwidth is 544 kHz without TAG (RFID card).

The 99% occupied bandwidth is 595 kHz with TAG (RFID card).

Measurement results – 99% occupied bandwidth – without TAG:



Measurement results – 99% occupied bandwidth – with TAG:



7.7 Conducted emissions.

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.107 ICES-003, table 1		p
Methods of measurement according to:	ANSI C63.4		
Equipment mode	Supply voltage / frequency	1	
	EUT configuration	1	
	Operating mode	1	
Test requirements	Frequency range	150 kHz - 30 MHz	

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Shielded cabin	ETS LINDGREN	RFSD 100	3598	PM KF 2955-2	-
Pulse Limiter 10 dB 9 kHz - 200 MHz	Schwarzbeck	VTSD 9561-F N	9561-F N00327	PM KF 3117	2024-01 (1 year)
10 dB Attenuator	Mini-Circuits	BW-N10W5+	-	PM KF 3053	2023-08 (1 year)
EMI Test Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESR7	101757	PM KF 3371	2023-05 (1 year)
V-Artificial mains- network, 2 Line	Rohde & Schwarz	ESH3-Z5	863367/018	PM KF 0142	2023-08 (2 years)
Test software	Rohde & Schwarz	EMC 32 V.8.54	-	PM KF 2983	-

Comment

In the conducted emission diagrams, the N and L line are merged.

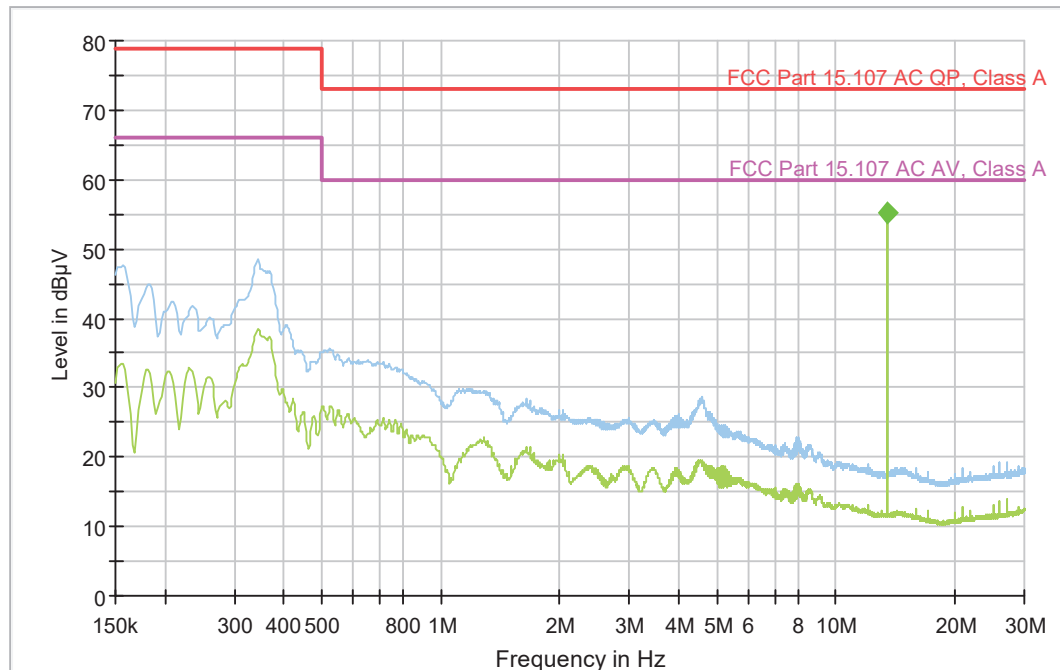
According to KDB 174176 D01 the conducted emission tests were done in two modes:

1. within the transmitter's fundamental emission band with a dummy load in lieu of the antenna and 2. outside the transmitter's fundamental emission band.

Measurement results – Conducted emissions:

EUT: GRT7.2300
Project No.: 51229
Test description: Conducted Emissions
Test standard: FCC §15.107
Tested port: Mains
Test verdict: Passed
Operating conditions: Continuous normal operation, 120 V, 60 Hz
Operator name: RAB
Date of testing: 2024.04.25

EN-CE-R32-LN01



Final Result 2

Frequency (MHz)	CAverage-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
13.560000	55.2	GND	N	20.7	4.8	60.0	

EMI Auto Test Template: EN-CE-R32-LN01

Hardware Setup: EN-CE-R32-LN01
Measurement Type: 2 Line LISN
Frequency Range: 150 kHz - 30 MHz
Graphics Level Range: 0 dBμV - 80 dBμV

Preview Measurements:
Scan Test Template: EN-CE-R32-LN01_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Prea
9 kHz - 150 kHz	50 Hz	QPK; CAV	200 Hz	1 s	20 dB
150 kHz - 30 MHz	2.25 kHz	QPK; CAV	9 kHz	1 s	0 dB

Receiver: [ESR 7]

Data Reduction:
Limit Line #1: FCC Part 15.107 AC QP, Class A
Limit Line #2: FCC Part 15.107 AC AV, Class A
Peak Search: 6 dB , Maximum Results: 10
Subrange Maxima: 10 Subranges , Maxima per Subrange: 1
Acceptance Offset: -10 dB
Maximum Number of Results: 20
After Data Reduction: Interactive data reduction

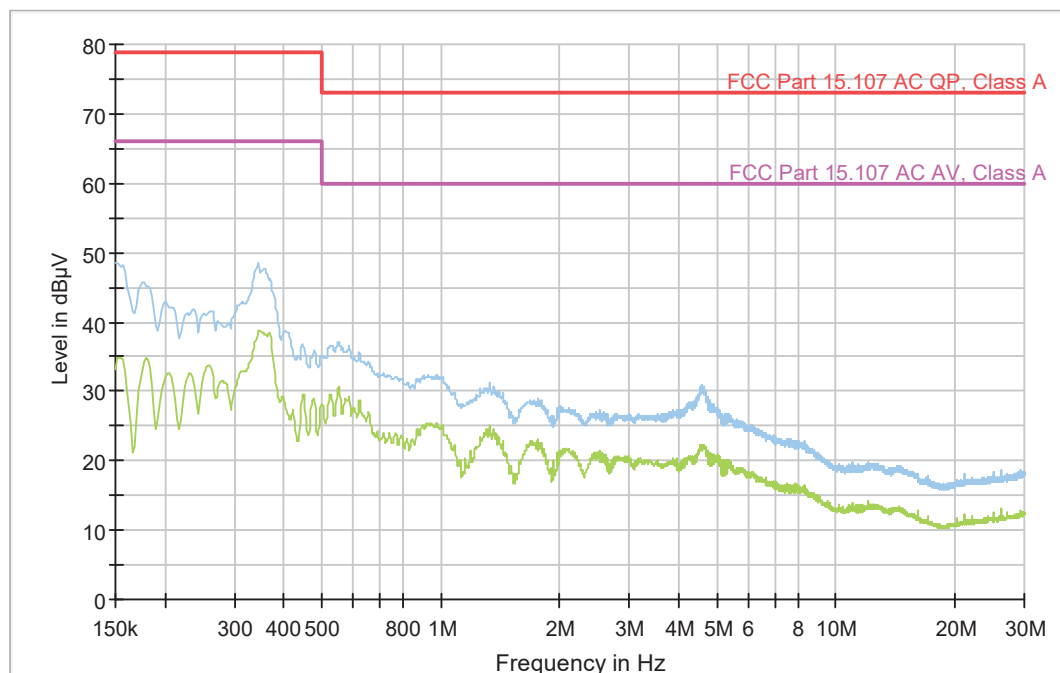
Report Settings:
Report Template: Standard Report_EMC KF_Conducted Emission

Intertek Test Report

Common Information

EUT:	GRT7.2300
Project No.:	51229
Test description:	Conducted Emissions
Test standard:	FCC §15.107
Tested port:	Mains
Test verdict:	Passed
Operating conditions:	120 V, 60 Hz with dummy load
Operator name:	RAB
Date of testing:	2024.04.25

EN-CE-R32-LN01



EMI Auto Test Template: EN-CE-R32-LN01

Hardware Setup: EN-CE-R32-LN01
Measurement Type: 2 Line LISN
Frequency Range: 150 kHz - 30 MHz
Graphics Level Range: 0 dB μ V - 80 dB μ V

Preview Measurements:
Scan Test Template: EN-CE-R32-LN01_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
9 kHz - 150 kHz	50 Hz	QPK; CAV	200 Hz	1 s	20 dB
150 kHz - 30 MHz	2.25 kHz	QPK; CAV	9 kHz	1 s	0 dB

Receiver: [ESR 7]

Data Reduction:
Limit Line #1: FCC Part 15.107 AC QP, Class A
Limit Line #2: FCC Part 15.107 AC AV, Class A
Peak Search: 6 dB , Maximum Results: 10
Subrange Maxima: 10 Subranges , Maxima per Subrange: 1
Acceptance Offset: -10 dB
Maximum Number of Results: 20
After Data Reduction: Interactive data reduction

Report Settings:
Report Template: Standard Report_EMC KF_Conducted Emission

SECTION 8

Product labelling

FCC, Part 15 C, Certification

Information to the user:

For a **Class A** digital device or peripheral, the instructions furnished the user shall include the following or similar statement, **placed in a prominent location in the text of the manual:**

NOTE: This equipment has been tested and found to comply with the limits for a class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of these equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

For a **Class B** digital device or peripheral, the instructions furnished the user shall include the following or similar statement, **placed in a prominent location in the text of the manual:**

NOTE: This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected
- Consult the dealer or an experienced radio/ TV technician for help

Systems incorporating several digital devices:

For systems incorporating several digital devices, the statement mentioned above needs to be contained only in the instruction manual for the main control unit.

Manual is provided in a form other than paper:

In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

Label on the device:

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

(Where a device is constructed in two or more sections connected by wires and marketed together, the statement of this section is required to be affixed only on the main control unit.)

Small devices:

When the device is so small or for such use that it is not practicable to place the statement specified under paragraph "Label on the device" of this section on it, the information required by this paragraph shall be placed in a prominent location in the instruction manual or pamphlet supplied to the user or, alternatively, shall be placed on the container in which the device is marketed.

SECTION 9

ANNEX

9.1 Measurement uncertainty evaluation

Measurement uncertainty for radiated magnetic field, 9 kHz – 30 MHz	± 3.9 dB
Measurement uncertainty for radiated emission, 30 MHz - 1000 MHz	
Uncertainty for the frequency range 30 to 300 MHz using a biconical or a combination antenna at 3 m	± 4.9 dB
Uncertainty for the frequency range 300 to 1000 MHz using a logperiodic or a combination antenna at 3 m	± 4.7 dB
Measurement uncertainty for conducted disturbances at the antenna port on radio equipment	
Frequency range 9 kHz - 1 GHz	± 1.9 dB
Frequency range 1 GHz - 18 GHz	± 3.0 dB
Frequency range 18 GHz -26,5 GHz	± 3.6 dB
Measurement uncertainty for Frequency error	± 1 x 10 ⁻⁸
Measurement uncertainty for Output power (Conducted), 9 kHz - 18 GHz	± 1.0 dB
Measurement uncertainty for RF Power density	
Frequency range 9 kHz - 1 GHz	± 1.9 dB
Frequency range 1 GHz - 18 GHz	± 3.0 dB
Frequency range 18 GHz -26,5 GHz	± 3.6 dB
Measurement uncertainty for humidity	± 4 %
Measurement uncertainty for temperature	± 0.5 °C
Measurement uncertainty for voltage	
DC	± 0.1 %
AC up to 10 kHz	± 1.8 %
Measurement uncertainty for time	± 0.058 %
Measurement uncertainty for conducted emissions, LISN, 150 kHz -30 MHz	± 2.3 dB
Measurement uncertainty for OBW	± 4.3 %
601 points resolution (Spectrum analyzer)	± 0.83 %
30000 points resolution (Spectrum analyzer)	± 0.016 %

End of test report