Test Report
Radio Frequency Devices – Intentional Radiators

Test Report – No.:	**2227071KAU-002**
Date of issue:	**2016-11-15**
Type:	GAT Vending 6100 BA
Description of the EUT:	RFID Reader
Serialnumber:	----
Manufacturer and Applicant:	GANTNER Electronic GmbH
Address:	Montafonerstr. 8 6780 Schruns Austria

Summary:

Referring to the emission limits and the operating mode during the tests specified in this report the equipment complies with the requirements according to
47 CFR Part 15, Subpart C, Intentional radiators, section 15.225 / RSS-210, Issue 9 and RSS-GEN, Issue 4

Test methods according to ANSI C63.10-2013

Test Laboratory:

Intertek Deutschland GmbH, Innovapark 20, 87600 Kaufbeuren

Compiled by:	U. Gronert Senior Project Engineer
Approved by:	R. Dressler Technical Manager EMC/ Radio

Revision History

Edition	Date	Description
1	2016-11-15	First release

Details about Accreditation/ Acceptance

EMC/ Radio National

DAkkS Deutsche Akkreditierungsstelle D-PL-12085-01-01	The Intertek Deutschland EMC-Lab is accredited by the Deutsche Akkreditierungsstelle GmbH (DAkkS) Registration Number (EMC general): **D-PL-12085-01-01** Registration Number (EMC Med): **D-PL-12085-01-03**

International

IECEE CB SCHEME	The Intertek Deutschland EMC-Lab is accepted by the Worldwide System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE) CB Test Laboratory: **TL118**
FCC Federal Communications Commission	The Intertek Deutschland EMC-Lab is accredited at the Federal Communications Commission (FCC) Designation Number: **DE0014** Test Firm Registration Number: **359260**
Bundesnetzagentur BNetzA-CAB-16/21-10	The *Bundesnetzagentur* recognizes Intertek Deutschland GmbH as Conformity Assessment Body in the sector electromagnetic compatibility (EMC).
Industrie Canada Industry Canada Canada	The Intertek Deutschland EMC-Lab is listed at Industry Canada No.**8882A-1** (OATS) and **8882A-2** (3 m alternative test site)

Automotive

KBA Anerkennungsstelle Anerkannt unter KBA-P 00046-03	The Intertek Deutschland EMC-Lab is recognized as technical service of the Kraftfahrt-Bundesamt (KBA) Registration Number: **KBA-P 00046-03**

Table of Contents

1 Equipment under test (EUT)

1.1 Description of the EUT

The GAT Vending 6100 BA is a read terminal that provides a cashless payment solution for vending machines. System users are identified by the GAT Vending 6100 BA via contactless RFID (Radio Frequency Identification) credentials.

For the test, the test sample was installed in an enclosure together with a power supply unit and an evaluation board.

1.2 Identification of the EUT according to the manufacturer/client declaration

Type/ Model:	GAT Vending 6100 BA	
Description of the EUT:	RFID Reader	
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 modulation:	Transponder: ASK	
Temperature range:	☐ Category I (General): -20°C to +55°C ☐ Category II (Portable equipment): -10°C to +55°C ☐ Category III (Equipment for normal indoor use): +5°C to +35°C ☒ Other: 0°C to +50°C	
Power rating:	20 – 40 V_{DC}, 24 V_{DC} nominal	
Transmitter stand by mode supported:	☒ Yes	☐ No

1.3 Additional hardware information about the EUT

The EUT consists of the following units:

See 2.4

1.4 Peripheral equipment

Peripheral equipment is defined as equipment needed for correct operation of the EUT during the tests, but not included as a part of the testing and evaluation of the EUT.

See 2.4

1.5 Test signals

The radiated emission tests of the GAT Vending 6100 BA were done with modulation and with tag.

1.6 Modification during the tests

No modifications have been made during the tests.

2 Test specifications

2.1 Standards

47 CFR Part 15, Subpart C, Intentional radiators, section 15.207 and section 15.225 /
RSS-210, Issue 9 and RSS-GEN, Issue 4

Test methods in:

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

2.2 Additions, deviations and exclusions from standards and accreditation

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

2.3 Test site

Measurements were performed at:

Intertek Deutschland GmbH, Innovapark 20, 87600 Kaufbeuren

Test sites:

Measurement Chamber	Type of chamber	IC Site filing #
OATS	10m	8882A-1
ANECHOIC CHAMBER 1	Semi-anechoic 3m	8882A-2

2.4 Test set-up

This is the principle block diagram.
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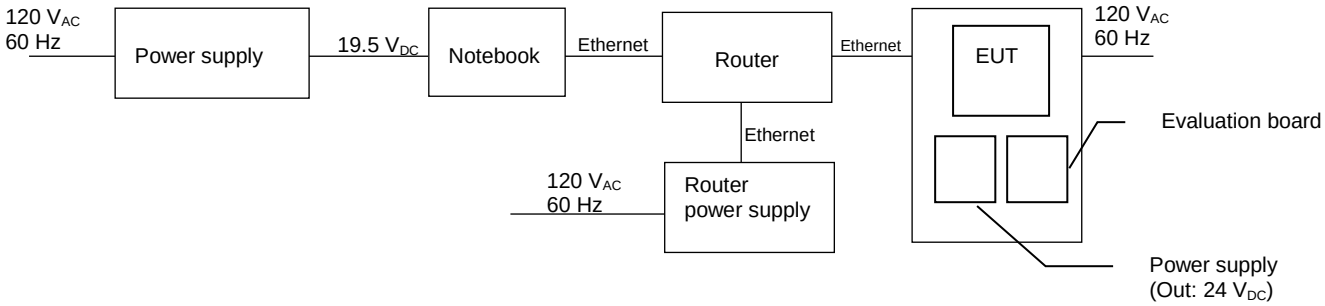


Power supply (notebook):	PPP009C, HP Part No: 677774-002, S/N: WCNXB0BGC9DEG9
Notebook:	HP ProBook 640 G1, S/N: 5CG5401TQH
Power supply (router):	Netgear, AD6610, S/N: *2F01067C0088A*
Router:	Netgear, WNDR3400, S/N: 332-10116-01
Power supply EUT:	3A-403DA24
Evaluation board EUT:	GAT-EvaL Micro7 1.0 +

2.5 Test conditions

The radiated emission tests of the GAT Vending 6100 BA were done with modulation.
If not additionally specified, the tests were performed under the following environmental conditions:

Parameter	Normal
Supplying voltage DC	20 – 40 V_{DC} (nominal 24 V)

3 Test summary

The results in this report apply only to the tested sample:

Test	Result	Section in report	Note
Standard test methods			
AC power-line conducted tests	Pass	9	
Radiated test below 30 MHz	Pass	4, 5	
Radiated emissions measurements from 30 to 1000 MHz	Pass	6	
Determination of radiated and antenna conducted emissions above 1 GHz	NA		
Frequency Stability Test	Pass	7	
Occupied bandwidth test	Pass	8	
Output Power average symbol envelope power	NA		
Power Spectral Density < 40 GHz	NA		
Power Spectral Density > 40 GHz	NA		
In-situ measurements	NA		
Polar plot, main lobe and variation on radiated emissions test	NA		
Device-specific tests			
Measurement of cable locating equipment	NA		
Determining of cordless telephone handset security code	NA		
Determination of total input power	NA		
Procedure determining compliance for periodic operation [15.231, 15.240(b)]	NA		
Determining the average value of pulsed emissions per 15.35(c)	NA		
Comparison of limits per 15.231(b)(3)	NA		
Procedure to determine compliance of frequency pairing for 47 CFR 15.233(b)(2)	NA		
Determination of frequency hopping compliance per 47 CFR 15.247	NA		
Determination of digital modulation compliance per 47 CFR 15.247	NA		
Determination of peak conducted output unlicensed wireless device power [15.247(b), 15.255]	NA		
Determination of maximum conducted output power (15.247, 15-E)	NA		
Determination of MIMO compliance (2nd edition)	NA		
Determination of Smart antenna compliance (2nd edition)	NA		
Determination of antenna gains, including those emitting in multiple directions (15.247)	NA		
Determination of compliance with RF exposure limits	NA		
Millimeter wave test procedures for systems operating at 54GHz and greater	NA		
Determination of EIRP (15-F)	NA		
Determination Transmitter Etiquette FCC Part 15.255	NA		
Determination of Dynamic Frequency Selection (DFS) including Channel Move Time and In Service Monitoring	NA		
Determination of channel availability	NA		
Determination of Dynamic Frequency Selection including Channel Move Time	NA		
Determination of transmitter power control (TPC) (15-E)	NA		
Peak excursion measurement for UNII devices	NA		
Determination of UWB bandwidth	NA		
Determination of the center frequency, *f*C, and highest radiated emissions, *f*M (15-F)	NA		

NT = Not Tested, by request of the Client
NA = Not Applicable

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

Date of test:	2016-10-27	Test location:	Anechoic chamber 1
EUT Serial:	1517000763	Ambient temp.	23.1 °C
Tested by:	UGR	Relative humidity	37 %
Test result:	Pass	Margin:	> 40 dB

4.1 Requirement

Reference: FCC §15.225 (a) – (c) and IC RSS-210, Issue 9, section B4
Methods of measurement: ANSI C63.10, Clause 6.4 and RSS-Gen 6.13 / 8.9
The limits below 30 MHz are given for different measurement distances. The limits below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31).

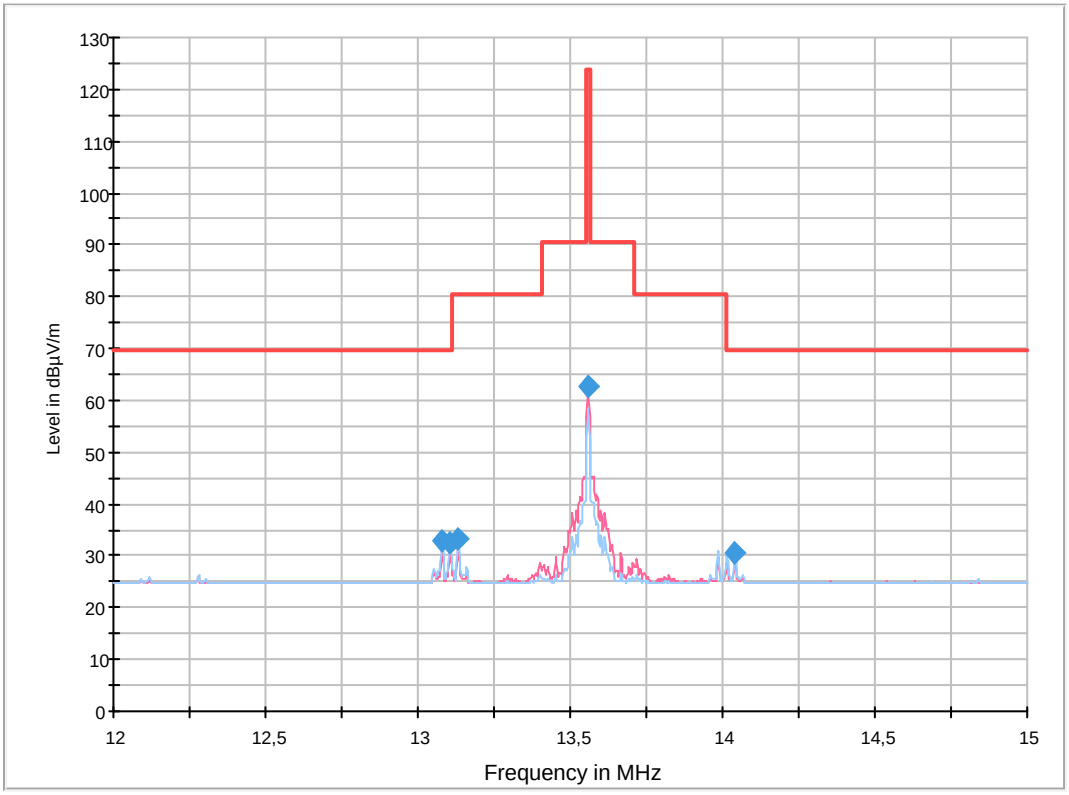
Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)	Field strength (dBµV/m)	Measurement distance (m)
13.110 - 13.410	106	40.5	30	80.5	3
13.410 - 13.553	334	50.5	30	90.5	3
13.553 - 13.567	15848	84.0	30	124.0	3
13.567 - 13.710	334	50.5	30	90.5	3
13.710 - 14.010	106	40.5	30	80.5	3

4.2 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 Pertinax plate on top and the dimensions 1.6 m x 1.0 m x 0.8 m (Length x Width x Height).

4.3 Test data

Overview sweeps performed with peak detectors



Frequency MHz	Disturbance Level dBµV/m	RBW kHz	Detector	Limit dBµV/m	Margin dB
13.56	62.8	9 (CISPR)	Quasi Peak	124	61.2
13.56	64.5	9 (CISPR)	Peak	124	59.5

4.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2017-08
Loop antenna, 9 kHz-30 MHz	Rohde & Schwarz	HFH2-Z2	PM KF 1401	2017-09

5 Radiated test below 30 MHz

Date of test:	2016-10-27	Test location:	Anechoic chamber 1
EUT Serial:	1517000763	Ambient temp.	23.1 °C
Tested by:	UGR	Relative humidity	37 %
Test result:	Pass	Margin:	>30 dB

5.1 Requirement

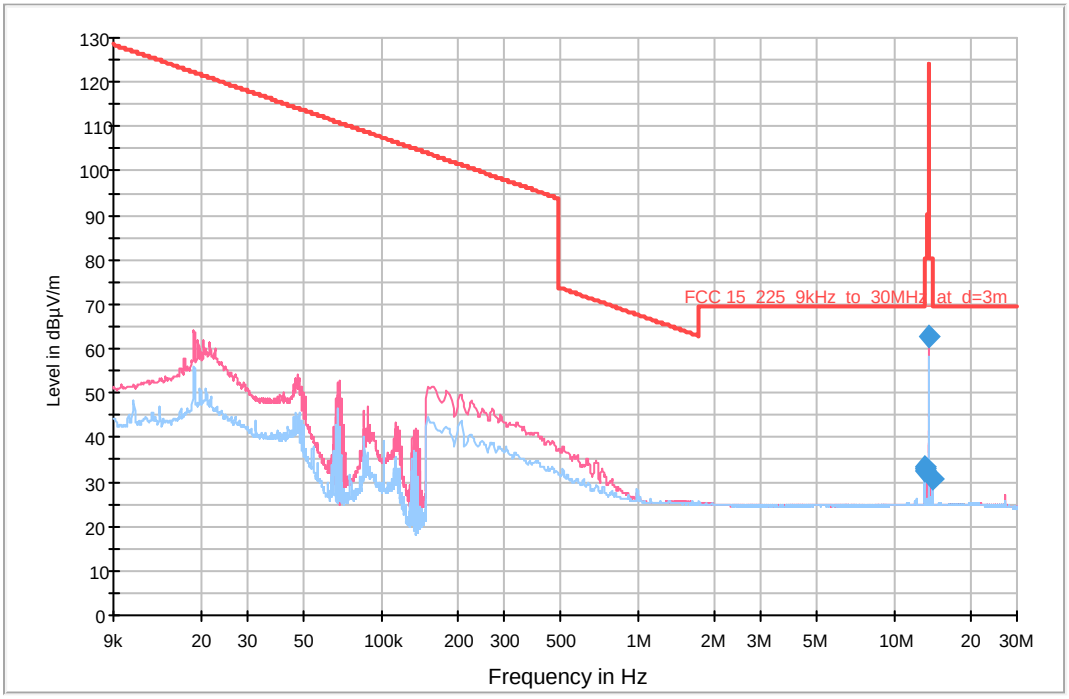
Reference: FCC §15.225 (d)/ §15.209 and IC RSS-210, Issue 9, section B4
Methods of measurement: ANSI C63.10, Clause 6.4 and RSS-Gen 6.13 / 8.9
The limits below 30 MHz are given for different measurement distances. The limits below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31)

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.			

5.2 Test setup details

see 4.2

5.3 Test data



FCC 15_225_9kHz_to_30MHz_at_d=3m [..\EMI radiated\International\]
Preview Result 1V-QPK [Preview Result 1V.Result:1]
Preview Result 1H-QPK [Preview Result 1H.Result:1]
Final Result 1-QPK [Final Result 1.Result:1]

Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)	Comment
13.078500	33.0	H	352.0	20.7	36.5	69.5	
13.105500	32.7	H	352.0	20.7	36.8	69.5	
13.132500	33.4	H	0.0	20.7	47.1	80.5	
13.560000	62.8	V	88.0	20.7	61.2	124.0	PK: 64,5 dBµV/m
14.041500	30.6	H	0.0	20.7	38.9	69.5	

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2017-08
Loop antenna, 9 kHz-30 MHz	Rohde & Schwarz	HFH2-Z2	PM KF 1401	2017-09

6 Radiated emissions measurements from 30 MHz to 1000 MHz

2015-08-11	2016-10-27	Test location:	Anechoic chamber 1
EUT Serial:	151700076325	Ambient temp.	23.1 °C
Tested by:	UGR	Relative humidity	37 %
Test result:	Pass	Margin:	2.5 dB

6.1 Requirement

Reference: FCC §15.225 (d)/ §15.209 and IC RSS-210, Issue 9, section B4
Methods of measurement: ANSI C63.10, Clause 6.5 and RSS-Gen 6.13 / 8.9

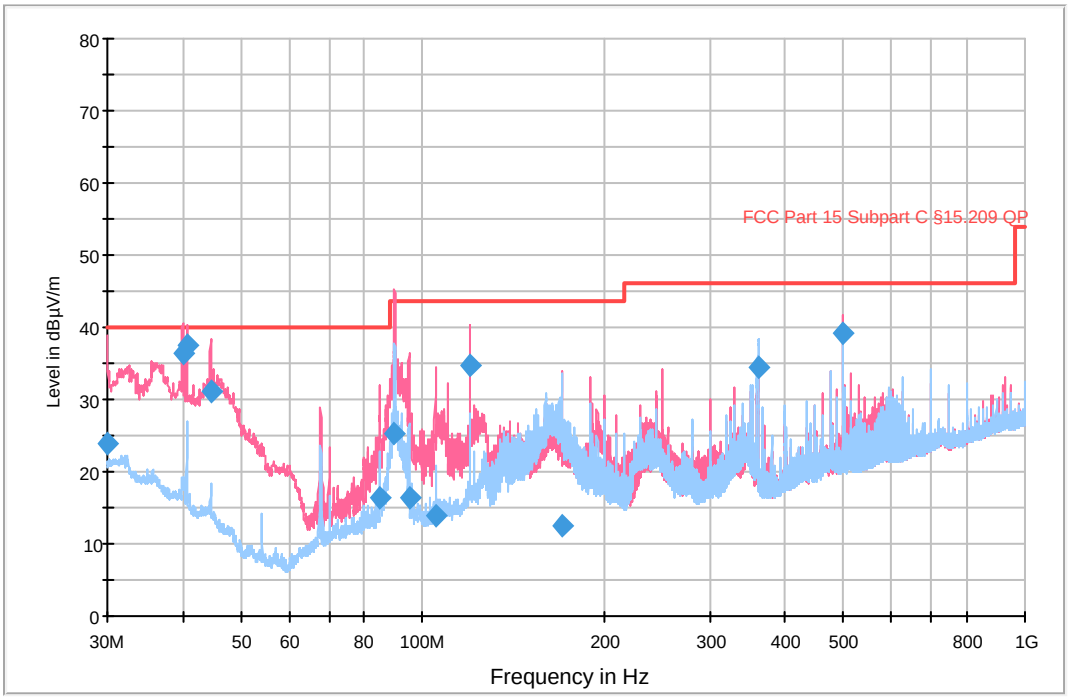
Frequency (MHz)	Field strength (µV/m)	Field strength (dBµV/m)	Measurement distance (m)
30 – 88	100	40.0	3
88 – 216	150	43.5	3
216 – 960	200	46.0	3
Above 960	500	54.0	3

6.2 Test setup details

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

6.3 Test data

Overview sweeps performed with peak detectors and final measurement with quasi-peak detectors.



FCC Part 15 Subpart C §15.209 QP [..\EMI radiated\International\]
Preview Result 1V-PK+ [Preview Result 1V.Result:1]
Preview Result 1H-PK+ [Preview Result 1H.Result:1]
Final Result 1-QPK [Final Result 1.Result:1]

Final Result 1

Frequency (MHz)	QuasiPeak (dBµV/m)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Polarization	Azimuth (deg)	Corr. (dB)	Margin (dB)	Limit (dBµV/m)
30.000000	24.0	1000.0	120.000	124.0	V	179.0	20.3	16.0	40.0
40.020000	36.3	1000.0	120.000	100.0	V	55.0	15.3	3.7	40.0
40.680000	37.5	1000.0	120.000	100.0	V	297.0	14.9	2.5	40.0
44.550000	31.1	1000.0	120.000	100.0	V	344.0	12.5	8.9	40.0
84.990000	16.3	1000.0	120.000	100.0	V	20.0	11.9	23.7	40.0
90.000000	25.4	1000.0	120.000	99.9	V	1.0	12.0	18.1	43.5
95.010000	16.4	1000.0	120.000	100.0	V	300.0	12.3	27.1	43.5
105.000000	14.0	1000.0	120.000	100.0	V	319.0	12.6	29.5	43.5
120.000000	34.7	1000.0	120.000	100.0	V	182.0	13.6	8.8	43.5
170.010000	12.5	1000.0	120.000	100.1	V	64.0	11.9	31.0	43.5
359.970000	34.6	1000.0	120.000	100.3	H	86.0	15.3	11.4	46.0
500.010000	39.1	1000.0	120.000	112.0	V	86.0	18.4	6.9	46.0

6.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Measurement software	Rohde & Schwarz	EMC 32	--	--
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2017-08
Antenna, 30-3000 MHz	Rohde & Schwarz	HL 562	PM KF 1123	2018-02

7 Frequency stability measurements

Date of test:	2016-10-26	Test location:	Test place 4
EUT Serial:	1517000763	Ambient temp.	23.2 °C
Tested by:	UGR	Relative humidity	42 %
Test result:	Pass		

7.1 Requirement

Reference: FCC §15.225 (e) and IC RSS-210, Issue 9, section B4 / RSS-Gen Issue 4, section 6.11
Methods of measurement: ANSI C63.10, Clause 9.14

Limit:	The frequency tolerance of the carrier signal shall be maintained within ± 0.01 % (±100 ppm) of the carrier frequency under nominal conditions.
Temperature range:	-20°C to +50°C (at normal supply voltage)
Voltage range:	20 to 40 VDC

7.2 Test data

Temperature °C	Carrier MHz	DC voltage 24 V_{AC}	
		Frequency deviation	
		Hz	%
-20	13.560030	30	0.0002
-10	13.560046	46	0.0003
0	13.560041	40	0.0003
10	13.560020	20	0.0001
20	13.559978	-22	-0.0002
30	13.559971	-29	-0.0002
40	13.559955	-45	-0.0003
50	13.559954	-46	-0.0003

At a temperature of 50°C the carrier level was reduced for 0.5 dB (minimum value).
At -20°C the carrier level was increased for 0.7 dB (maximum value).
The DC voltage variation from 20 to 40 V_{DC} had no influence on the frequency and the level of the carrier.

7.3 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Spectrum analyser, 10Hz- 40 GHz	Rohde & Schwarz	FSV 40	PM KF 2783	2017-09
Magnetic Field Pickup Coil	Rohde & Schwarz	HZ10	PM KF 0965	2019-09-
Temperature chamber	Heraeus-Vötsch	HT4010	PM KF 1402	2017-02

8 Occupied Bandwidth

Date of test:	2016-11-07	Test location:	Test place 4
EUT Serial:	1517000763	Ambient temp.	23.8 °C
Tested by:	UGR	Relative humidity	26 %
Test result:	Pass		

8.1 Requirement

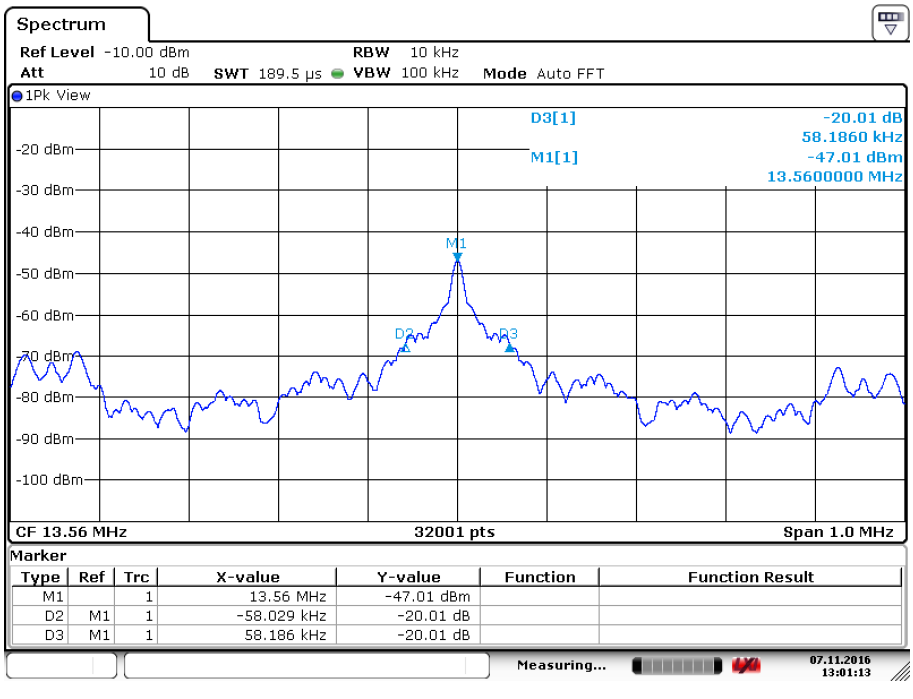
Reference: RSS-Gen, Issue 4, 6.6

8.2 Test setup details

The test setup was identical to the test setup at the radiated tests below 30 MHz.

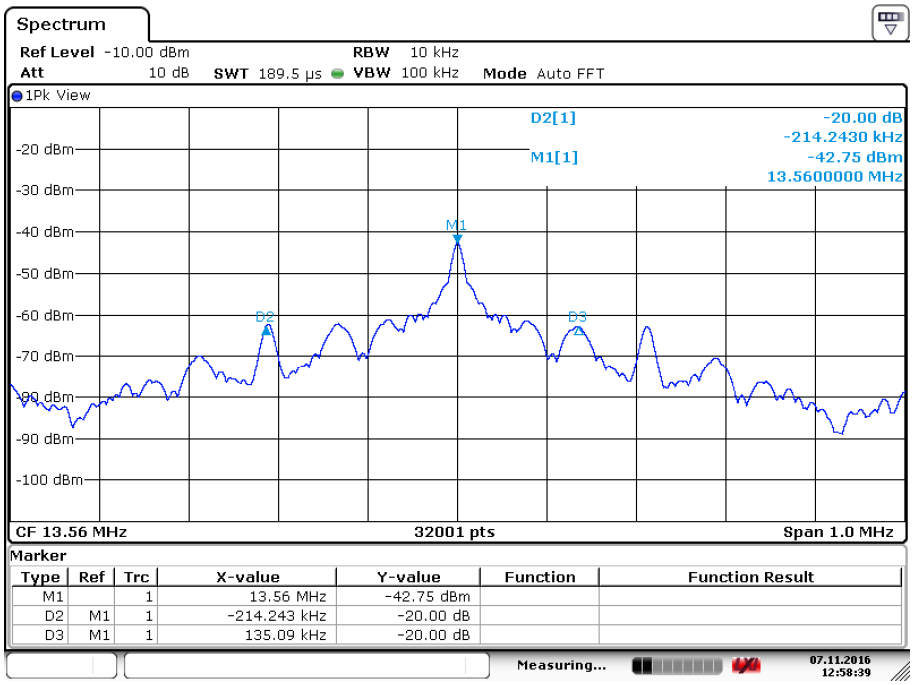
8.3 Test data

Occupied bandwidth (20 dB) with TAG



Date: 7.NOV.2016 13:01:13

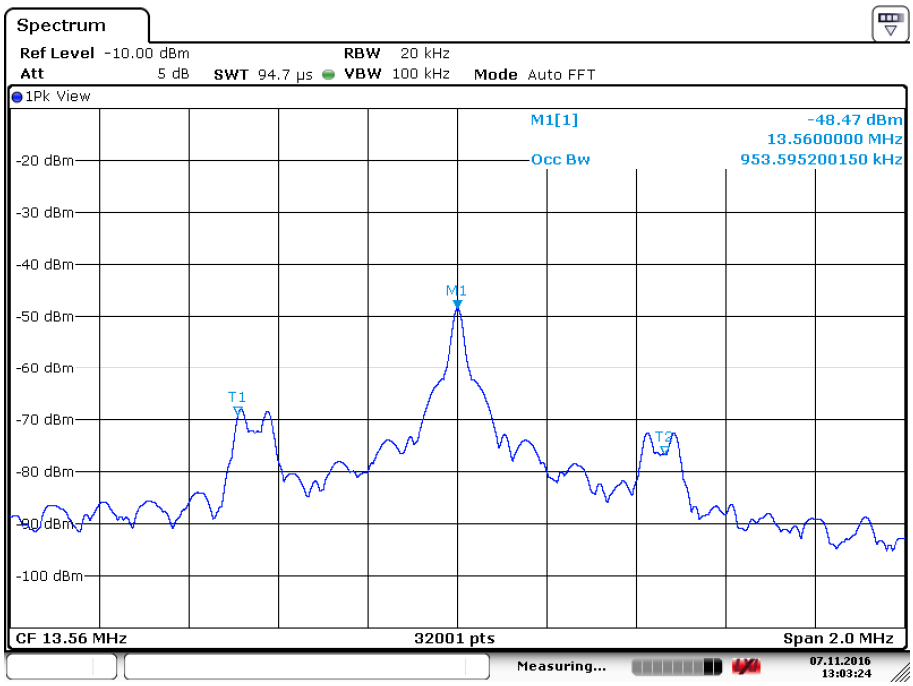
Occupied bandwidth (20 dB) without TAG



Date: 7.NOV.2016 12:58:38

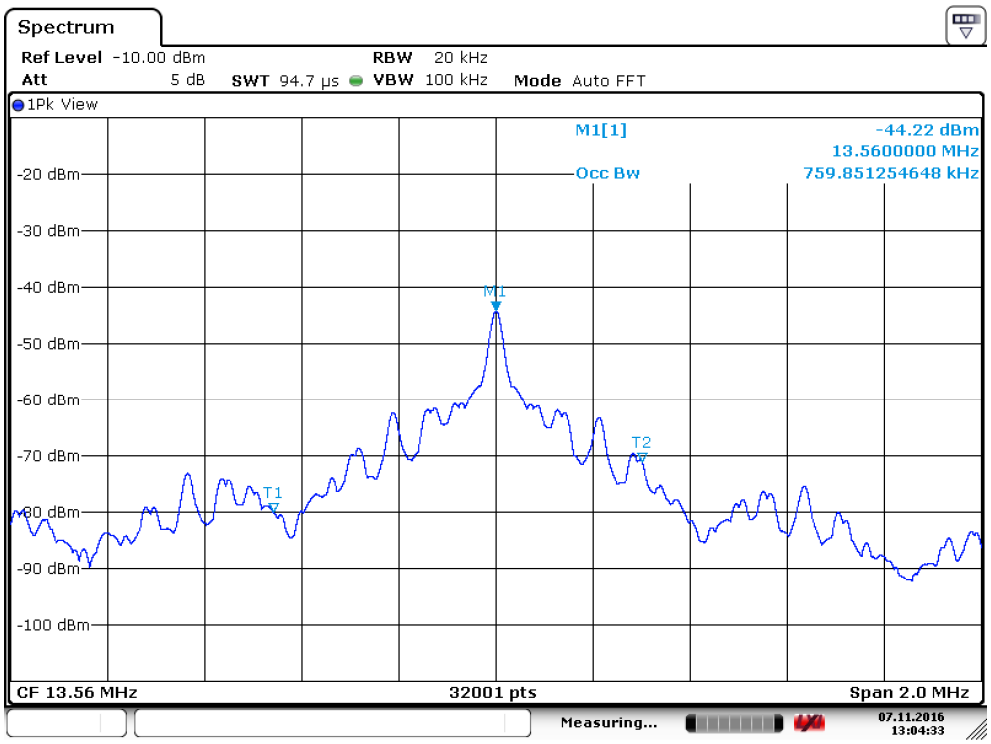
Test result: The maximum occupied bandwidth is 349 kHz (without TAG)

Occupied bandwidth (99%) with TAG



Date: 7.NOV.2016 13:03:24

Occupied bandwidth (99%) without TAG



Date: 7.NOV.2016 13:04:34

Test result: The maximum occupied bandwidth is 953 kHz (with TAG)

8.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Spectrum analyzer, 10 Hz- 40 GHz	Rohde & Schwarz	FSV 40	PM KF 2783	2017-09
Magnetic Field Pickup Coil	Rohde & Schwarz	HZ10	PM KF 0965	2019-09

9 Conducted emission 150 kHz - 30 MHz

Normative references

Limits according to:	**FCC §15.207**
Methods of measurement according to:	**ANSI C63.10, Clause 6.2**

Test requirement

Frequency range	150kHz - 30 MHz

Place of measurement

☒ Shielded cabin Siemens Matsushita CER Nr. C62128-A501-A945-1-0006
☐ Horizontal, vertical plane of reference

Test Procedure

The test was carried out automatically by the test receiver.
The EUT is a table-top EUT and was standing on a wooden table with the dimensions 1,5 m x 1,0 m x 0,8 m (Length x Width x Height).

Test result:

Test requirements ☒ **passed** ☐ **passed with modification** ☐ **not passed**

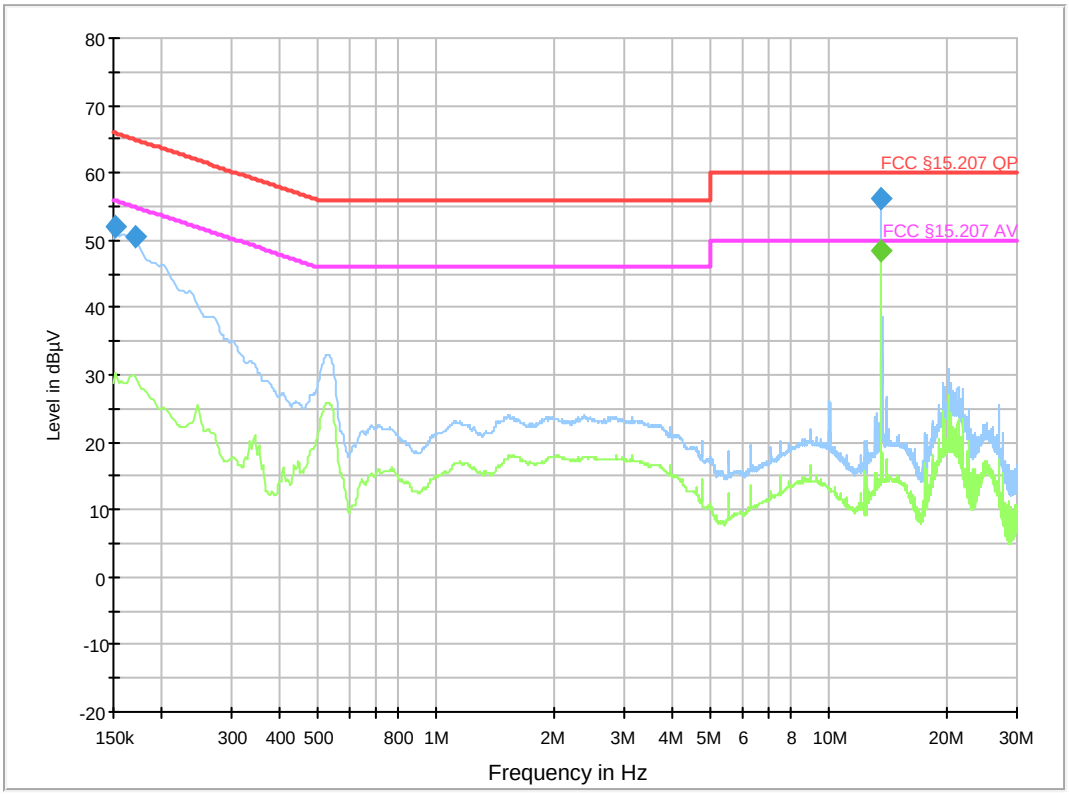
Comment
The conducted emissions between 150 kHz and 30 MHz are below the limits.
These data represent worst case emissions.

Measurement results - Conducted emission:

Intertek Emission Report

Common Information

Test Description:	Conducted Emission
Tested Device	Gantner GAT Vending 6100
Test Standard:	FCC part 15.225 / FCC part 15.207
Operating Conditions:	normal operation (TAG reading)
Operator Name:	UGR
Comments:	
Project Number:	27071
Test Date:	2016-10-28



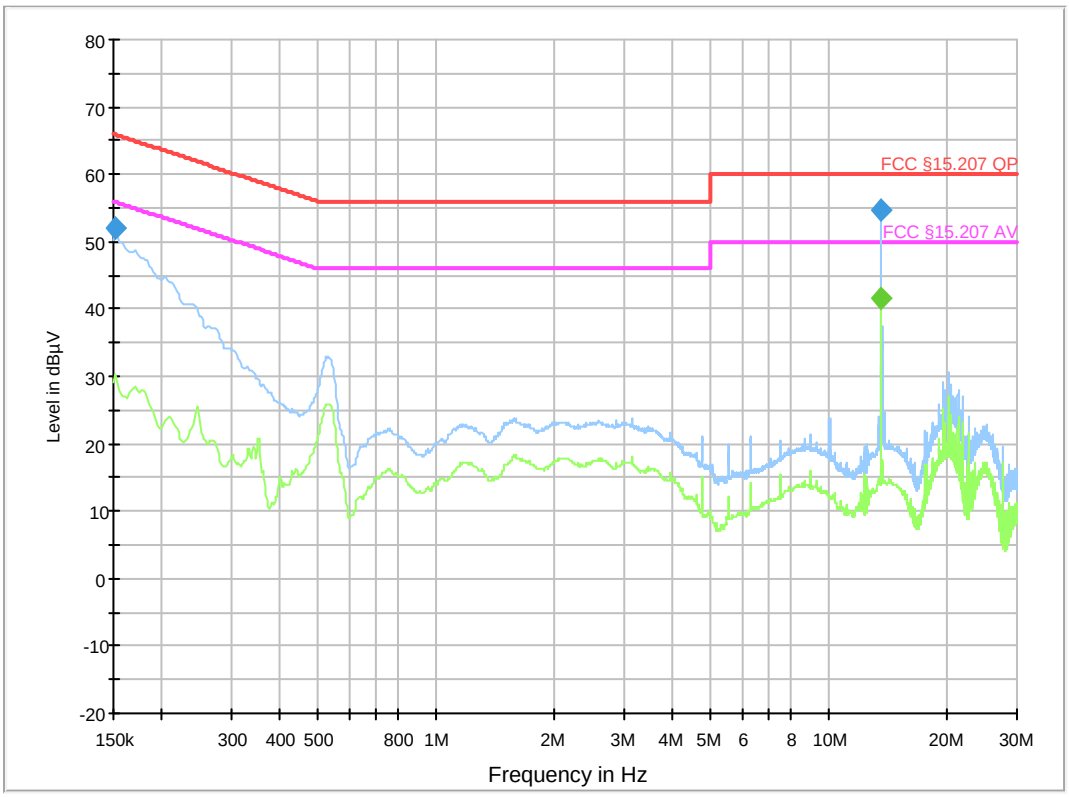
Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152250	52.0	GN	L1	0.2	13.8	65.9	
0.170250	50.4	GN	N	0.2	14.5	64.9	
13.560000	56.3	GN	N	1.0	3.7	60.0	

Intertek Emission Report

Common Information

Test Description:	Conducted Emission
Tested Device	Gantner GAT Vending 6100
Test Standard:	FCC part 15.225 / FCC part 15.207
Operating Conditions:	normal operation (without TAG)
Operator Name:	UGR
Comments:	
Project Number:	27071
Test Date:	2016-10-28



Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV)	PE	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)	Comment
0.152250	51.9	GN	N	0.2	14.0	65.9	
13.560000	54.7	GN	L1	1.0	5.3	60.0	

9.1 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2017-08
LISN	Rohde & Schwarz	ESH3-Z5	PM KF 0142	2017-10

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