

Test Report

Radio Frequency Devices – Intentional Radiators

Test Report – No.: 2225368KAU-002

Date of issue: 2016-02-18

Type/ Model: GAT Lock 6010 F

Description: Battery-Operated MIFARE® Locker Lock

Serialnumber: 1548000468

Manufacturer: GANTNER Electronic GmbH

Applicant: GANTNER Electronic GmbH

Address (Applicant): Montafonerstr. 8
6780 Schruns
Österreich

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

Test methods according to ANSI C63.10-2009 / RSS-GEN

Test Laboratory:

Intertek Deutschland GmbH, Innovapark 20, 87600 Kaufbeuren

Compiled by: R. Dressler
Technical Manager EMC/ Radio

Approved by: U. Gronert
Senior Project Engineer



This test report consists of 27 pages. All measurement results exclusively refer to the equipment, which was tested. Reproduction of this report except in its entirety is not permitted without written approval of Intertek Deutschland GmbH.

Revision History

Edition	Date	Description
1	2016-02-18	First release

Details about Accreditation/ Acceptance

EMC/ Radio National



The Intertek Deutschland EMC- Lab is accredited of the Deutsche Akkreditierungsstelle GmbH (DAkkS)

Registration Number: **D-PL-12085-01-01**

International



The Intertek Deutschland EMC- Lab is accepted of the Worldwide System for Conformity Testing and Certification of Electrotechnical Equipment and Components (IECEE)

CB Test Laboratory: **TL118**



The Intertek Deutschland EMC- Lab is listed at the Federal Communications Commission (FCC)

Registration Number: **498399**



The Intertek Deutschland EMC- Lab is listed at Industry Canada

No. **8882A-1** (OATS) and **8882A-2** (3 m alternative test site)

Automotive



The Intertek Deutschland EMC- Lab is recognized technical Service of the Kraftfahrt-Bundesamt (KBA)

Registration Number: **KBA-P 00046**

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1 Equipment under test (EUT)

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

Type/ Model: GAT Lock 6010 F

Description: Battery-Operated MIFARE® Locker Lock

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:

Temperature range (usage): ☐ 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 +60°C

Transmitter stand by mode supported: ☒ Yes ☐ No

1.2 FCC ID and IC ID

The EUT is certified (is requested to be certified) with the FCC ID: NC4-GEA1160002A
The EUT is certified (is requested to be certified) with the IC ID: 11873A-1160002A

1.3 Additional hardware information about the EUT

No additional hardware information are available.

1.4 Additional software information about the EUT

During the tests the EUT supported the following software:

No additional software information are available.

1.5 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.

No peripheral equipment needed for the tests,

1.6 Test signals

The test signals are described in the test sections.

1.7 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 15.225 / RSS-210

Test methods in:

ANSI C63.10-2009: American National Standard for Testing Unlicensed Wireless Devices
RSS-GEN

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 #
ANECHOIC CHAMBER 1	Semi-anechoic 3m	8882A-2

2.4 Test set-up

See photos in 2225368KAU-002_Appendix_Photos

2.5 Test conditions

If not additionally specified, the tests were performed under the following environmental conditions:

Parameter	Normal	Extreme
Supplying voltage, V	6	5.1
Air temperature, °C	22.7	-30 to +60

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	NA		Class A / B
Radiated test below 30 MHz	Pass	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 -20dB Bandwidth	Pass	8	
Field strength 13.110 MHz – 14.010 MHz (Emission Mask)	Pass	4	
99% Occupied Bandwidth	Pass	9	
Power Spectral Density < 40 GHz	NA		
Power Spectral Density > 40 GHz	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:	2016-02-08	Test location:	Anechoic chamber 1
EUT Serial:	EUT continuous field: 1548000468 EUT pulsed field and standby: 1548000849	Ambient temp.	22.6°C
Tested by:	Uwe Gronert	Relative humidity	27%
Test result:	Pass	Margin:	>40 dB

4.1 Requirement

Reference: FCC §15.225 (a) – (c) and IC RSS-210, Issue 8, section A2.6

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 a 1 kHz for the band 13.553 to 13.567 MHz and to 10 kHz outside this band. The video bandwidth shall be at least three times greater than the resolution bandwidth.

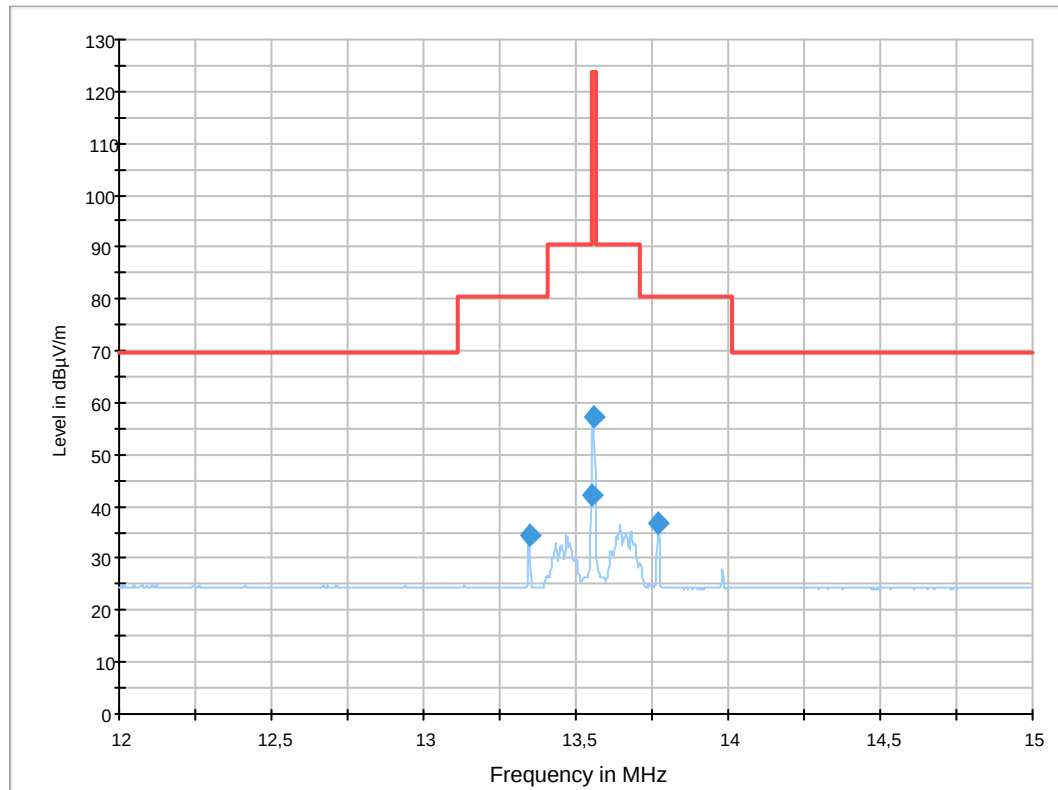
The test was carried out automatically by the test receiver.

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

Operating Conditions: Normal operation pulsed field

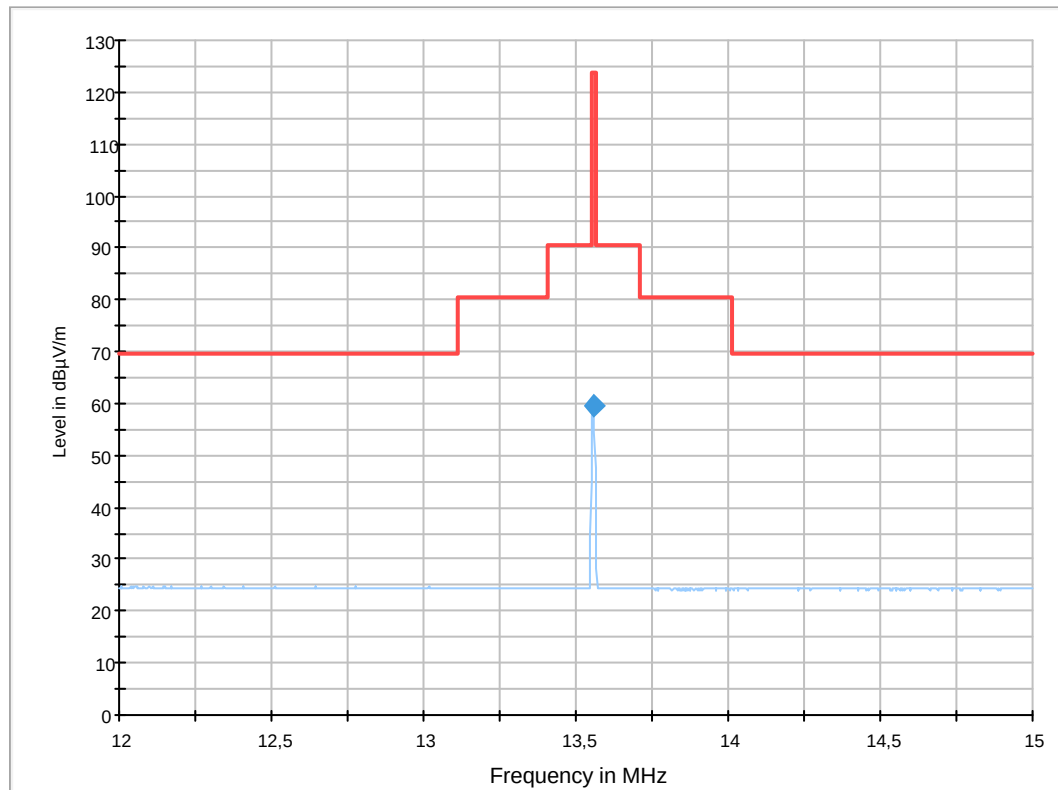


Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBμV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV/m)	Comment
13.346250	34.4	H	0.0	20.4	46.1	80.5	
13.551000	42.1	H	0.0	20.5	48.4	90.5	
13.557750	57.2	H	0.0	20.5	66.8	124.0	PK: 59.4 dBμV/m AV: 43.4 dBμV/m
13.769250	36.7	H	0.0	20.5	43.8	80.5	

Operating Conditions:

Test mode continuous field



Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
13.557750	59.8	H	0.0	20.5	64.2	124.0	

Correction factor [dB(m)] = antenna factor [dB(S/m)] + 51,5 dB(1/S) + cable loss [dB]
Example: 20.5 dB(m) = -31.9 dB(S/m) + 51,5 dB(1/S) + 0,9 dB

Measured level [dBµV/m] = Analyser reading [dBµV] + Correction factor [dB(m)]
Example: 59.8 dBµV/m = 39.3 dBµV + 20.5 dB(m)

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	2016-07
Loop antenna, 9 kHz- 30 MHz	Rohde & Schwarz	HFH2-Z2	PM KF 1401	2017-09

5 Radiated test below 30 MHz

Date of test:	2016-02-08	Test location:	Anechoic chamber 1
EUT Serial:	EUT continuous field: 1548000468 EUT pulsed field and standby: 1548000849	Ambient temp.	22.6°C
Tested by:	Uwe Gronert	Relative humidity	27%
Test result:	Pass	Margin:	>40 dB

5.1 Requirement

Reference: FCC §15.225 (d)/ §15.209 and IC RSS-210, Issue 8, section A2.6

Methods of measurement: ANSI C63.10, Clause 6.4 and RSS-Gen 6.13 / 8.9

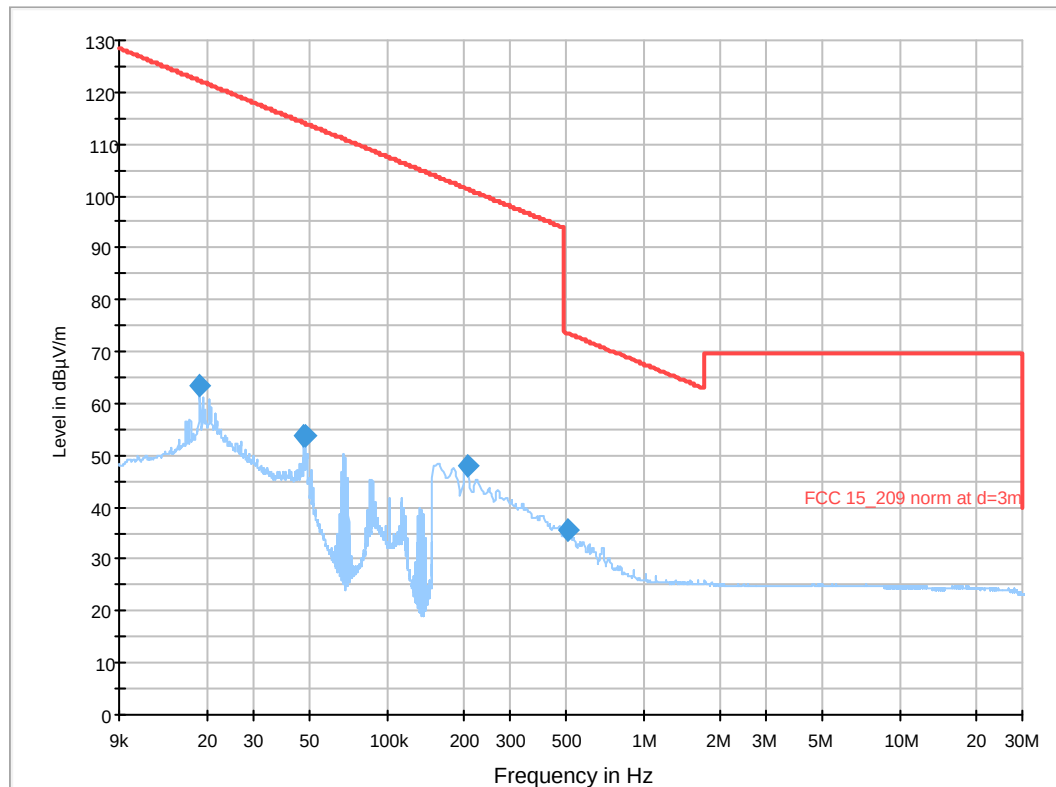
The limits below 30 MHz are given for different measurement distances. The limits below 30 MHz are converted to 3 m by using the extrapolation factor 40 dB/decade (according to §15.31)

Frequency (MHz)	Field strength (μV/m)	Field strength (dBμV/m)	Measurement distance (m)
0.009 - 0.490	2400/F(kHz)	$67.6 - 20 \cdot \log(F(\text{kHz}))$	300
0.490 - 1.705	24000/F(kHz)	$87.6 - 20 \cdot \log(F(\text{kHz}))$	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 data

Overview sweeps performed with peak detectors

Operating Conditions: Normal operation standby

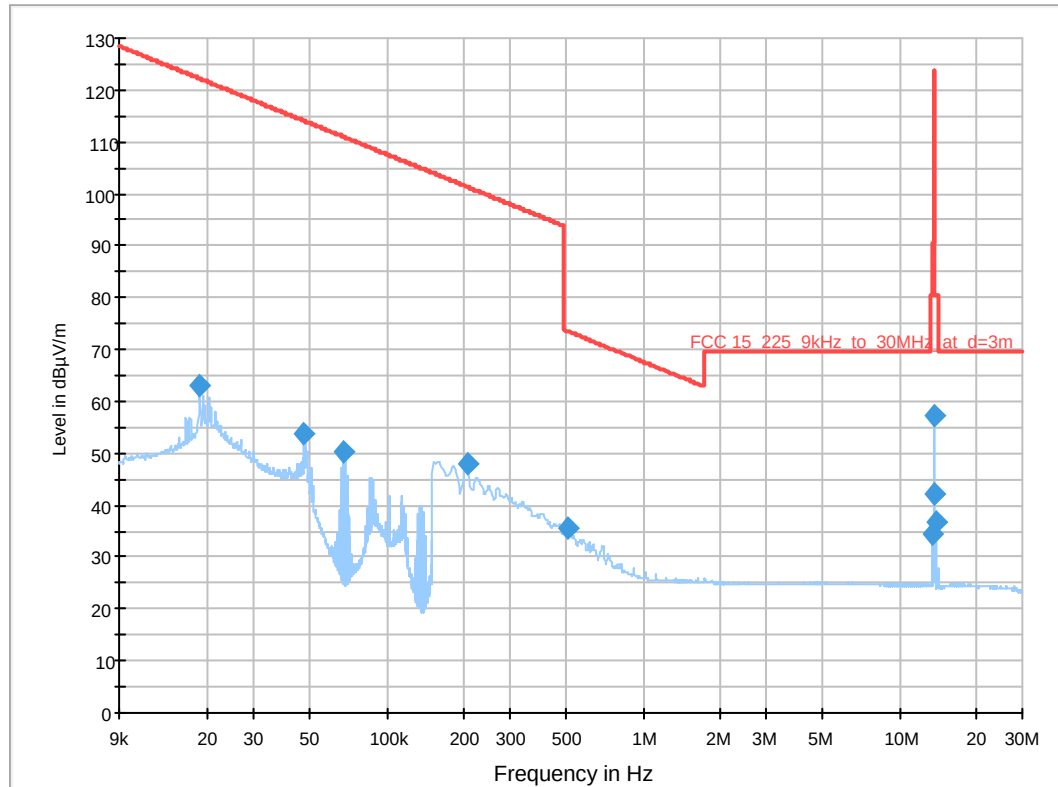


Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBμV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBμV/m)	Comment
0.018500	63.3	H	315.0	21.4	58.9	122.2	
0.047400	53.7	H	225.0	20.5	60.4	114.1	
0.048200	53.6	H	0.0	20.5	60.3	113.9	
0.204000	47.9	H	0.0	20.3	53.5	101.4	
0.510000	35.5	H	0.0	20.4	37.9	73.5	

Operating Conditions:

Normal operation pulsed field

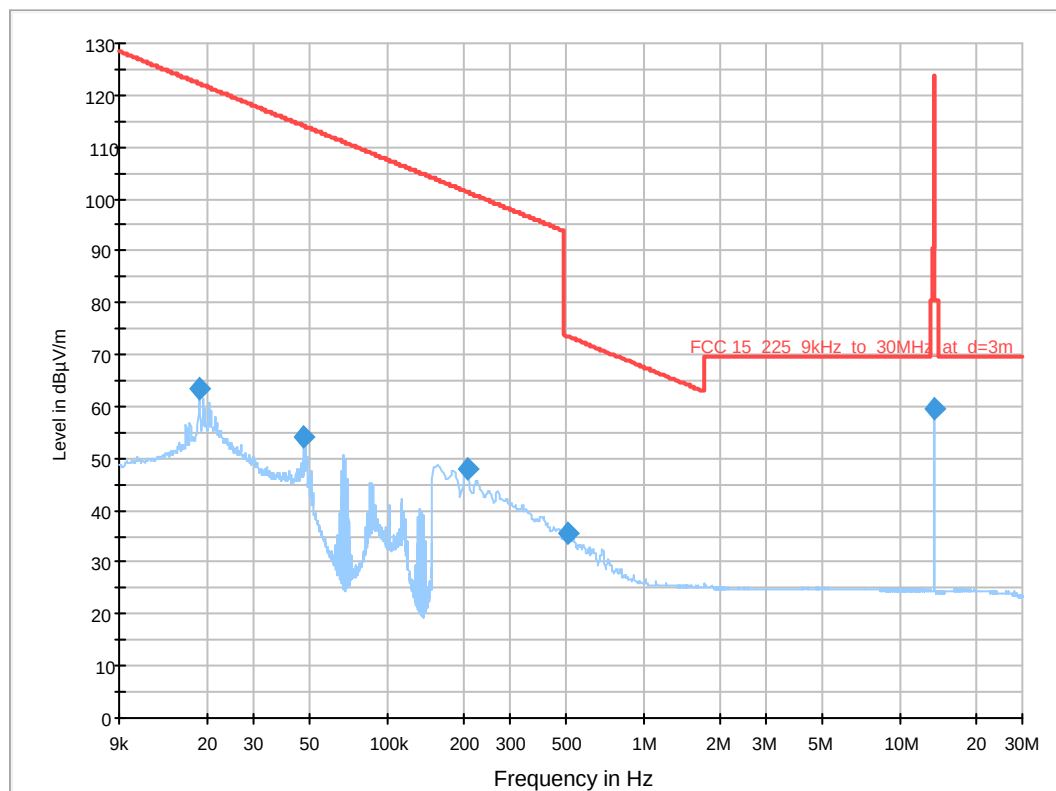


Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
0.018450	63.0	H	135.0	21.4	59.3	122.3	
0.047450	53.9	H	270.0	20.5	60.2	114.1	
0.067000	50.4	H	180.0	20.4	60.7	111.1	
0.204000	47.8	H	135.0	20.3	53.6	101.4	
0.510000	35.5	H	0.0	20.4	37.9	73.5	
13.346250	34.4	H	0.0	20.4	46.1	80.5	
13.551000	42.1	H	0.0	20.5	48.4	90.5	
13.557750	57.2	H	0.0	20.5	66.8	124.0	PK: 59.4 dBµV/m AV: 43.4 dBµV/m
13.769250	36.7	H	0.0	20.5	43.8	80.5	

Operating Conditions:

Test mode continuous TX



Final Result 1

Frequency (MHz)	QuasiPeak-ClearWrite (dBµV/m)	Polarization	Azimuth (deg)	Corr. (dB)	Margin - QPK (dB)	Limit - QPK (dBµV/m)	Comment
0.018450	63.6	H	270.0	21.4	58.7	122.3	
0.047450	54.2	H	135.0	20.5	59.9	114.1	
0.204000	48.0	H	180.0	20.3	53.4	101.4	
0.510000	35.6	H	90.0	20.4	37.8	73.5	
13.557750	59.8	H	0.0	20.5	64.2	124.0	

Correction factor [dB(m)] = antenna factor [dB(S/m)] + 51,5 dB(1/S) + cable loss [dB]

Example: 20.5 dB(m) = -31.9 dB(S/m) + 51,5 dB(1/S) + 0,9 dB

Measured level [dBµV/m] = Analyser reading [dBµV] + Correction factor [dB(m)]

Example: 59.8 dBµV/m = 39.3 dBµV + 20.5 dB(m)

5.3 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	2016-07
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

Date of test:	2016-02-05	Test location:	Anechoic chamber 1
EUT Serial:	1548000849	Ambient temp.	22.5°C
Tested by:	Uwe Gronert	Relative humidity	28%
Test result:	Pass	Margin:	5.8

6.1 Requirement

Reference: FCC §15.225 (d)/ §15.209 and IC RSS-210, Issue 8, section A2.6
 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

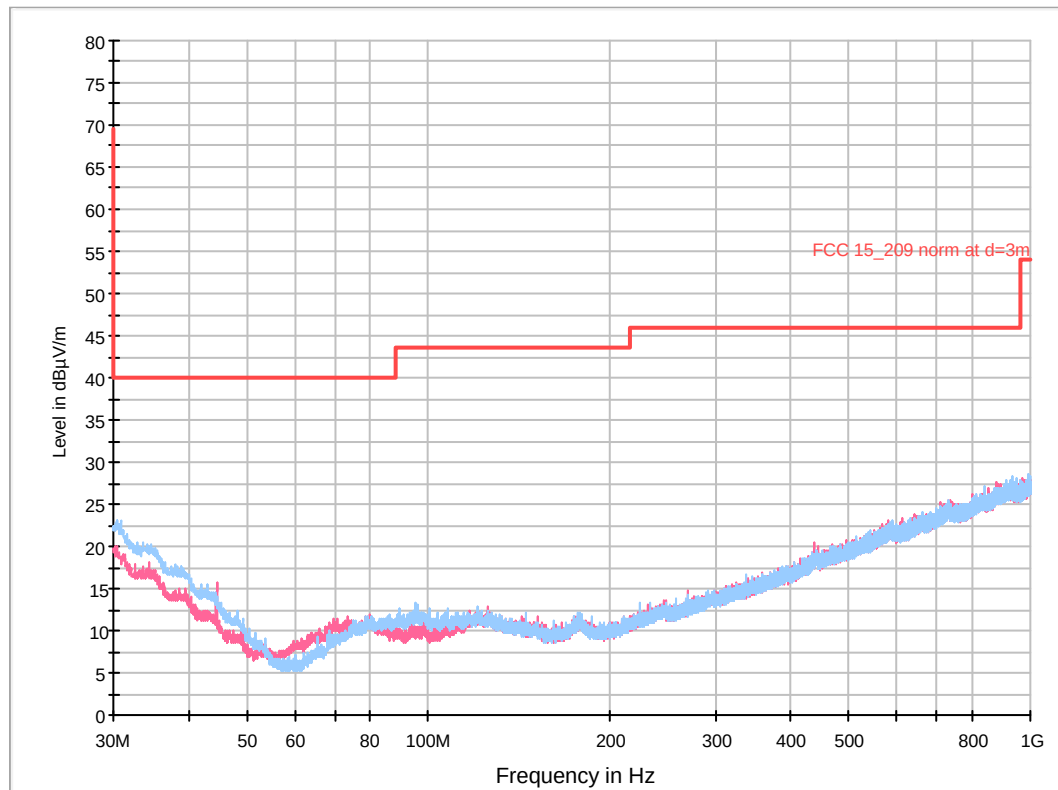
6.2 Test setup details

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).

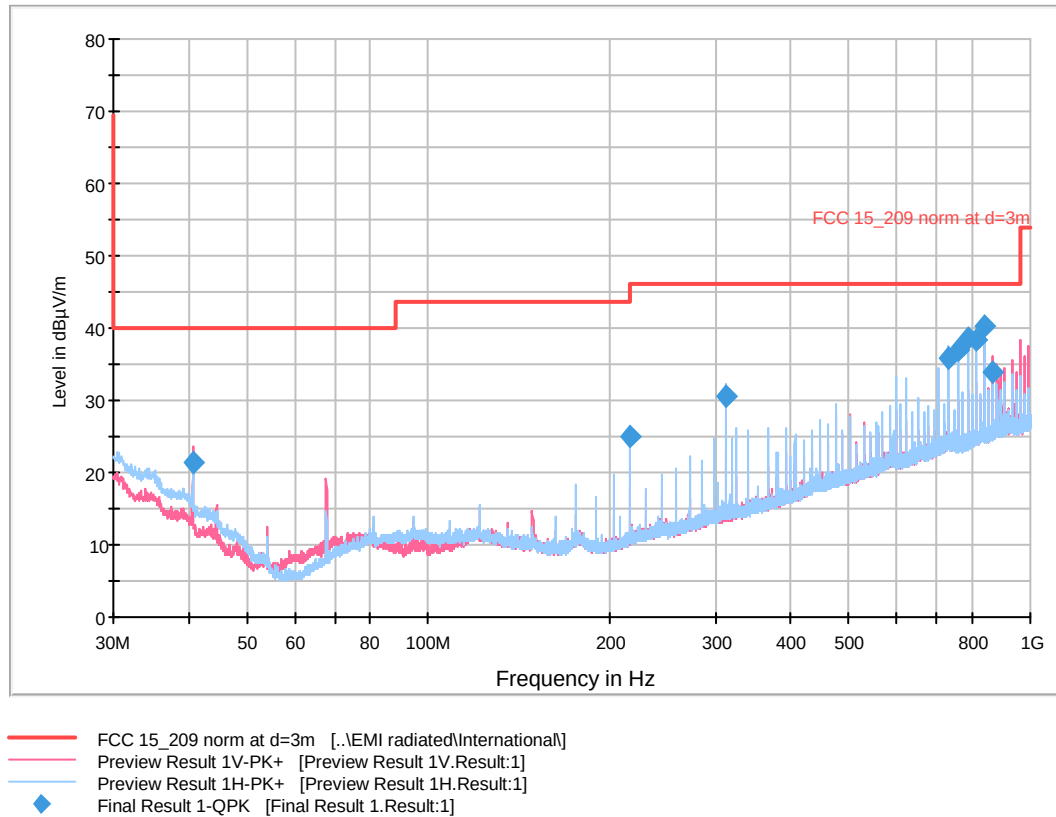
6.3 Test data

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

Stand-by mode:



Normal operation, pulsed field:



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)
40.650000	21.3	1000.0	120.000	100.0	V	275.0	12.5	18.7	40.0
216.930000	24.9	1000.0	120.000	116.0	H	187.0	9.8	21.1	46.0
311.850000	30.6	1000.0	120.000	100.1	H	13.0	13.3	15.5	46.0
732.150000	35.9	1000.0	120.000	116.0	H	107.0	22.0	10.2	46.0
759.270000	36.8	1000.0	120.000	100.1	H	89.0	22.3	9.2	46.0
786.390000	38.7	1000.0	120.000	115.0	H	95.0	22.6	7.3	46.0
813.480000	38.4	1000.0	120.000	100.1	H	261.0	23.3	7.6	46.0
840.600000	40.2	1000.0	120.000	100.1	H	79.0	23.5	5.8	46.0
867.720000	34.0	1000.0	120.000	131.0	V	303.0	23.7	12.0	46.0

Correction factor [dB(m)] = antenna factor [dB(1/m)] + cable loss [dB]
Example: 23.5 dB(m) = 20 dB(1/m) + 3.5 dB

Measured level [dBμV/m] = Analyser reading [dBμV] + Correction factor [dB(m)]
Example: 40.2 dBμV/m = 16.7 dBμV + 23.5 dB(m)

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	2016-07
Antenna, 30-3000 MHz	Rohde & Schwarz	HL 562	PM KF 1123	2018-02

7 Frequency stability measurements

Date of test:	2016-02-12	Test location:	EMC Lab
EUT Serial:	1548000468	Ambient temp.	22.7 °C
Tested by:	R. Dressler	Relative humidity	20.5 %
Test result:	pass		

7.1 Requirement

Reference: FCC §15.225 (e) and IC RSS-210, Issue 8, section A2.6/ RSS-Gen Issue 3, section 4.7
Methods of measurement: ANSI C63.10, Clause 6.5

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:	-30°C to +60°C (at normal supply voltage)
Voltage range:	85% of the battery voltage (at a temperature of +20°C)

7.2 Test data

Test Conditions		Frequency	
Temperature °C	Voltage DC	Carrier MHz	Error kHz
60	Normal supply voltage = 6 V	13.558043	0.0
50		13.558043	0.0
40		13.558043	0.0
30		13.558043	0.0
20		13.558043	0.0
10		13.558043	0.0
0		13.558043	0.0
-10		13.558043	0.0
-20		13.558043	0.0
-30		13.558043	0.0
+20°C	85% of lower rated supply voltage = 5.1 V	13.558043	0.0

At a temperature of 60°C the carrier level was reduced for 0.12 dB and at a temperature of -30°C the carrier level was increased for 1.5 dB. No frequency changes occurred over the complete temperature range.

No frequency, nor level changes occurred through the voltage reduction (85%) down to 5.1 V DC.

7.3 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Signal Analyzer, 10 Hz-40 GHz	Rohde & Schwarz	FSV40	PM KF 2783	2016-10
Near field probe set, 901-6 cm Loop probe	EMCO	7405	PM KF 0139	-/-
Temperature chamber	Heraeus-Vötsch	HT4010	PM KF 1402	2016-02-19

8 Occupied -20dB Bandwidth

Date of test:	2016-03-17	Test location:	Radio area in KF
EUT Serial:	1548000849	Ambient temp.	20.5 °C
Tested by:	R. Dressler	Relative humidity	20 %
Test result:	Pass		

8.1 Requirement

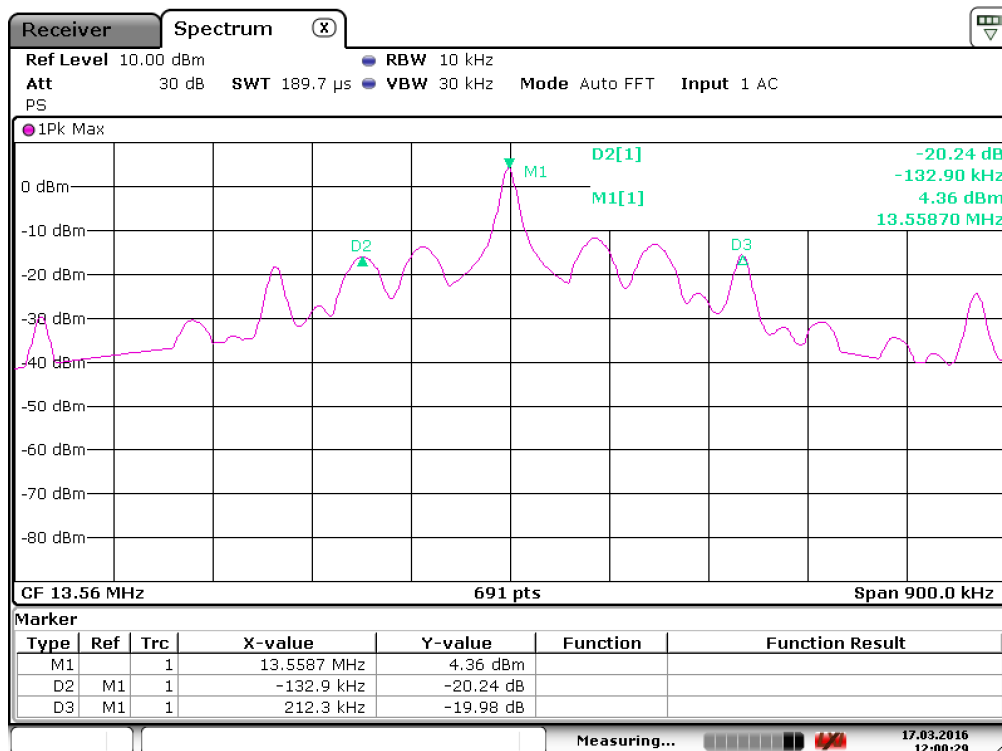
Reference, 20dB bandwidth: Section 15.215 (c) and ANSI C63.10, Section 6.9

Intentional radiators operating under the additional provisions to the general emission limits, as contained in Sections 15.217 to 15.255 and in Subpart E of part 15, must be designed to ensure that the 20dB bandwidth of the emission is contained within the frequency band designated in the rule.

Frequency Band: $F_{MIN} = 13.110 \text{ MHz}$
 $F_{MAX} = 14.010 \text{ MHz}$

	-20 dB Frequency measured	Lower & upper band edge	Result
	MHz	MHz	
F_{LO}	13.4258	13.11	Pass ($F_{LO} > F_{MIN}$)
F_{HI}	13.7710	14.01	Pass ($F_{HI} < F_{MAX}$)

8.2 Test data



Date: 17.MAR.2016 12:00:29

8.3 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2016-07
Near field probe set, 901-6 cm Loop probe	EMCO	7405	PM KF 0139	-/-

9 99% Occupied Bandwidth

Date of test:	2016-03-17	Test location:	Radio area in KF
EUT Serial:	1548000849	Ambient temp.	20.5 °C
Tested by:	R. Dressler	Relative humidity	20 %
Test result:	Pass		

9.1 Requirement

Reference, 99% occupied bandwidth: RSS-Gen, Issue 4, 6.6

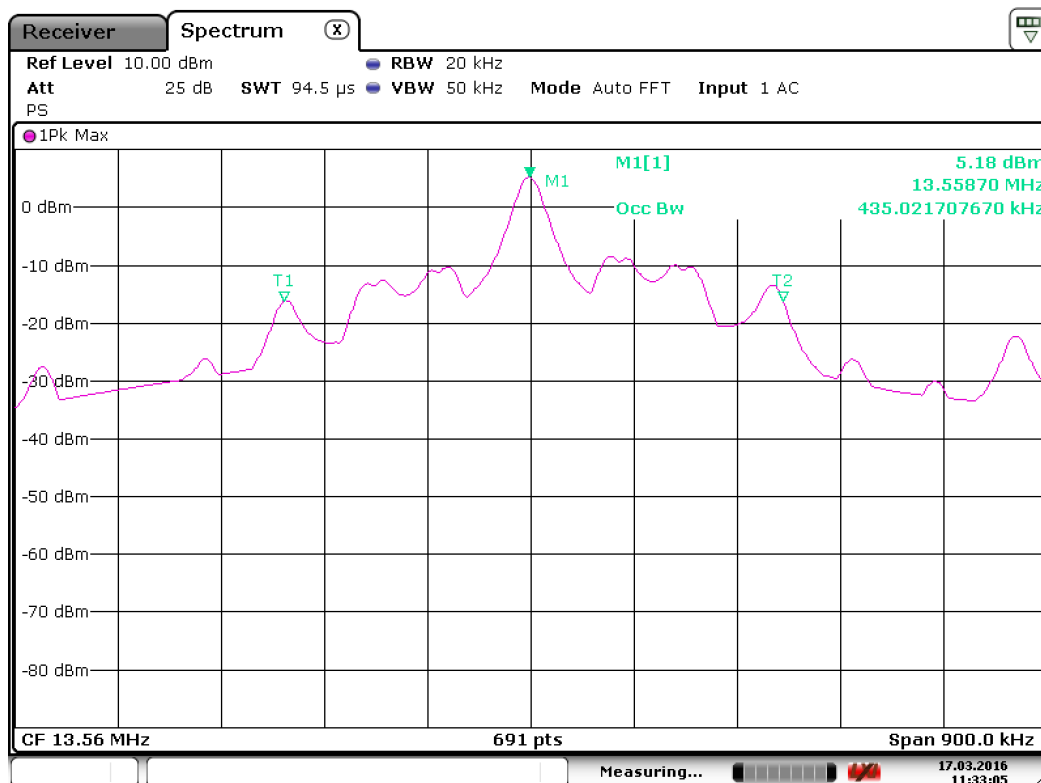
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3x RBW.

9.2 Test procedure

After the basic settings, the test was performed utilizing the automated 99% bandwidth function of the spectrum analyzer.

9.3 Test data



Date: 17.MAR.2016 11:33:06

Test result: The occupied bandwidth is 435.0217 kHz.

9.4 Test equipment

Equipment type	Manufacturer	Model	Inv. No.	Cal. due date
Receiver, 10 Hz- 7 GHz	Rohde & Schwarz	ESR 7	PM KF 2441	2016-07
Near field probe set, 901-6 cm Loop probe	EMCO	7405	PM KF 0139	-/-

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