

Gantner electronic GmbH

TEST REPORT

SCOPE OF WORK

RADIO TESTING – GL7P.1500

REPORT NUMBER

2236334KAU-021

ISSUE DATE

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PAGES

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DOCUMENT CONTROL NUMBER

R_FCC 15-225_18-01 (25-January-2018)

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TYPE: GL7p.1500
DESCRIPTION: RFID locker lock.
SERIAL NO: **1923020152**

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: 2236334KAU-021

TEST RESULT: The equipment complies to 47 CFR Part 15, Subpart C, Intentional radiators, section 15.225 / RSS-210, Issue 10 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

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Project Engineer

TEST ENGINEER: U. Gronert
Senior Project Engineer

REVIEWER: R. Dressler
Technical Manager EMC/ Radio



Details about Accreditations/Acceptances

EMC / Radio National

	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
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International

	The Intertek Deutschland EMC-Lab is accepted to participate in the IECEE (IEC Conformity assessment for Electrotechnical Equipment and Components) CB-Scheme CB Test Laboratory: TL118
	The Intertek Deutschland EMC-Lab is listed at the Federal Communications Commission (FCC) Designation Number: DE0014 Test Firm Registration Number: 359260
	The <i>Bundesnetzagentur</i> recognizes Intertek Deutschland GmbH as Conformity Assessment Body in the sector electromagnetic compatibility (EMC).
	The Intertek Deutschland EMC-Lab is accredited for Innovation, Science and Economic Development Canada (ISED) ISED CAB IDENTIFIER: DE0014 ISED #: 24854

Automotive

 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
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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 10 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 GL7p.1500 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: 2019-07-08

Testing: 2019-07-22 to 2019-08-03

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.

Test sites:

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

SECTION 4

SUMMARY OF TESTING

4.1 General annotation

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

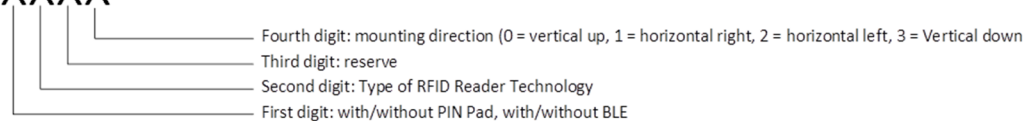
At least at one emission test the margin to the limit is less than 3 dB. A minimum margin of 3 - 6 dB is recommended for a serial production.

4.2 Identical types

The manufacturer/customer declared the following type identical to the tested type:

Name Declaration: GL7p.xxxx #####		
GL7	Gantner Lock Generation 7	
p.	PIN Lock	
1 Digit	0-9	0 = Without PIN Pad, 1 = with PIN Pad, 2 = Without PIN Pad + Network, 3 = With PIN Pad + Network
2 Digit	0-9	0 = No RFID reader, 3 = Legic advant reader, 5 = Mifare/ISO15693 reader
3 Digit	0-9	0 = RFID User Interface enable, 1 = RFID User Interface disabled
4 Digit	0-9	Mounting direction, 0 = vertical up, 1 = horizontal right, 2 = horizontal left, 3 = Vertical down
#####	empty or 0-9 & A-Z	Additional optical description (Colour, Custom-Naming, ...)

GL7p.XXXX



4.3 Measurement uncertainty

For each test method, an uncertainty evaluation was carried out. The results of the evaluation can be provided upon request from Intertek Deutschland GmbH.

4.4 Document History

REVISION	DATE	REPORT	CHANGES	AUTHOR
Initial release	2020-08-03	2236334KAU-021	Initial issue	MBE

SECTION 5

TEST RESULTS – OVERVIEW

EMISSION	REQUESTED	VERDICT	DATE	NO
Field strength (13.110 MHz – 14.010 MHz)	see 7.1	P	2019-08-03	4
Radiated emissions (< 30 MHz)	see 7.2	P	2019-08-03	5
Radiated emissions (30 MHz - 1 GHz)	see 7.3	P	2019-07-22	1
Frequency Stability Test	see 7.4	P	2019-08-02	3
Occupied bandwidth test	see 7.5	P	2019-08-02	2

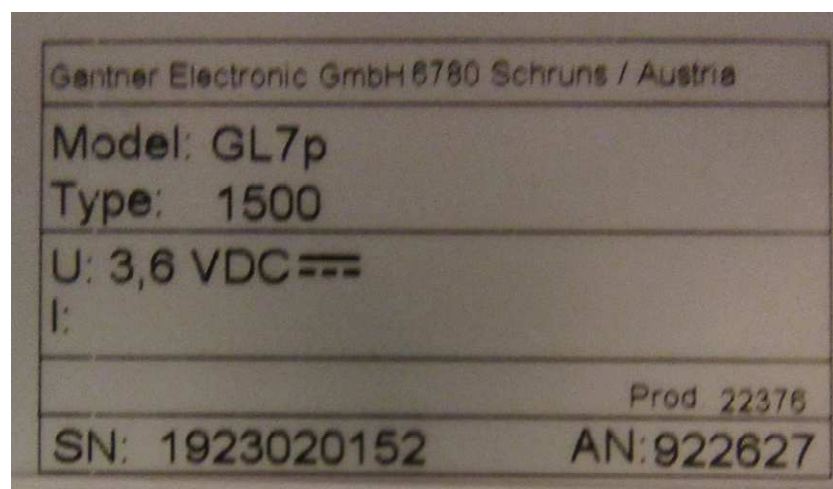
SECTION 6

INFORMATION ABOUT THE EUT

6.1 Description of the EUT

☒ table-top EUT		☐ floor-standing EUT	
Dimensions:	Height:	Width:	Length:
	8.5 cm	3.8 cm	14 cm
Description: The GL7p.1500 is a battery-powered, electronic RFID (Radio Frequency Identification) locker lock that is available with and without PIN-code keypad. The operation is carried out using RFID (NFC) data carriers and/or PIN code.			
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:	Amplitude modulation		
Type of used TAG:	Mifare chipcard		
Temperature range:	☒ Customers specification of EUT: 0°C to +60°C		
Power rating:	3.6 V		
Transmitter stand by mode supported:	☐ Yes	☒ No	

6.1.1 Photo of the rating plate



6.2 Power interface

MODE	VOLTAGE (V)	FREQUENCY (Hz)	COMMENT
1	3.6	DC	Lithium battery
2	3.6	DC	DC power supply

Power sources/associated test equipment

DEVICE	MANUFACTURER	TYPE	SN	ASSET NO.
DC power supply	SIBO Electronics	6721	600104011706710016	PM KF 2938

6.3 Supply and interconnecting cables used for testing

LINE	DESCRIPTION
USB cable	The USB-cable was only used for USB service port (not used in normal operation).
DC-cable	The DC-cable was used for the DC power supply.

6.4 Configuration mode

MODE	DESCRIPTION
1	EUT was placed on the table without connected cable.
2	EUT was placed in the climatic chamber and was connected to DC power supply.

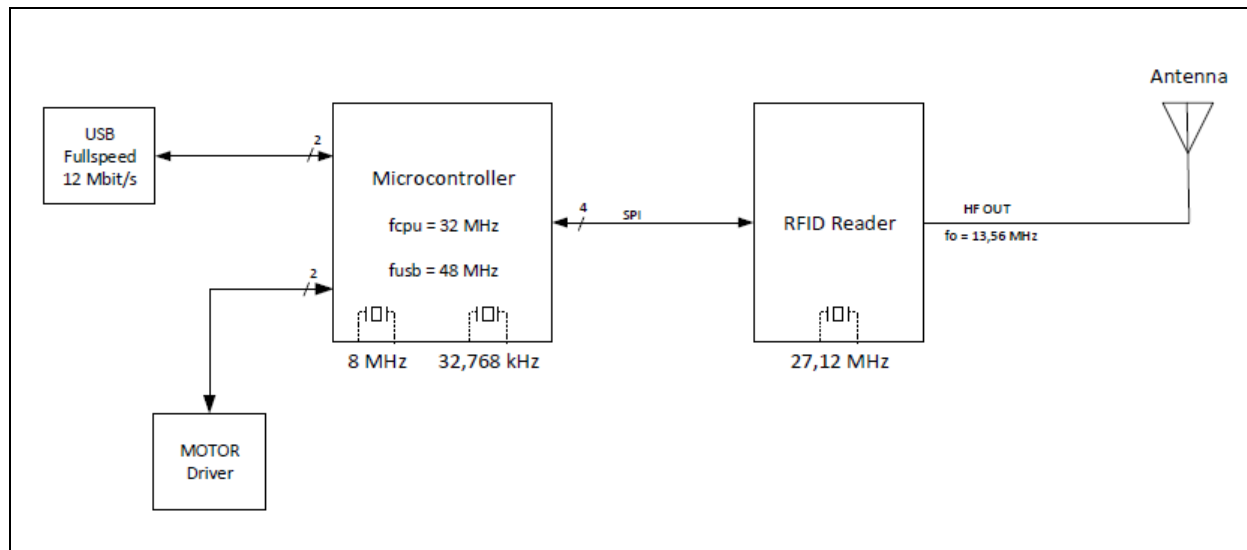
6.5 Operation mode

MODE	DESCRIPTION
1	Transmission mode: The transmit interval was 100 ms for RFID. The RFID-tag was placed in front of the push button.

6.6 Clock frequencies of the EUT

SOURCE	FREQUENCY ()
Microcontroller	f_{cpu} : 32 MHz, f_{usb} : 48 MHz, 2 Crystals: 8 MHz, 32.786 kHz.
RFID reader	SPI @ 2 MHz

6.7 Block diagram of the EUT



SECTION 7

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 10, section B4		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 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

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).

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	2016-12 (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	ESR7	101757	PM KF 3371	2019-04 (1 year)
Loop antenna 9 kHz- 30 MHz	Rohde & Schwarz	HFH2-Z2	881058/48	PM KF 1401	2018-09 (1 years)
Test software	Rohde & Schwarz	EMC 32 V.10.40.10	-	PM KF 2983-2	-

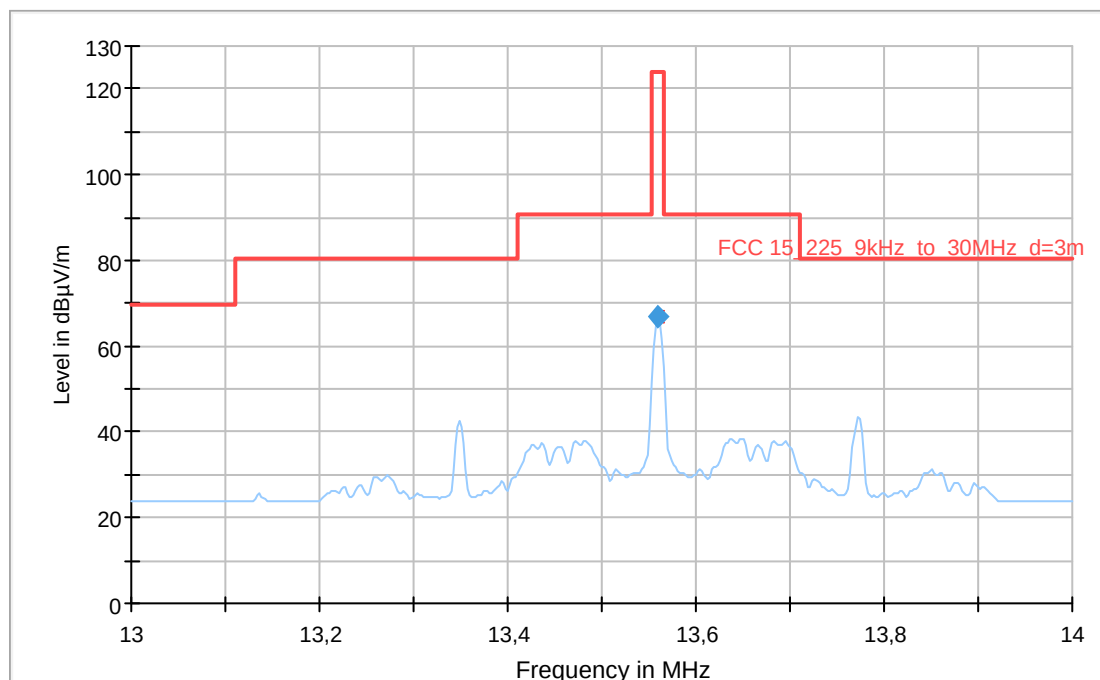
Measurement results – Field strength 13.110 MHz – 14.010 MHz (Emission Mask):

Radiated Emissions Test Report

Common Information

EUT: GL7p.1500
Test Verdict: Pass
Test Description: H Field, FCC Part 15 Subpart C
Operating Conditions: Pulse transmission with interval of 100 ms (RFID on with tag)

Operator Name: MBE, UGR
Project Number: 36334
Date: 03.08.2019



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_d=3m [.\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)
13.560000	66.78	---	124.00	57.22	---	---	H	176.0

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

Frequency (MHz)	Corr. (dB/m)	Comment
13.560000	20	12:19:42 - 03.08.2019

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

Hardware Setup: EN-RE-R12-AN23
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: 0 dBμV/m - 130 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: EN-RE-R12-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 MHz. 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

$$E = U + AF + A$$

7.2 Radiated emissions < 30 MHz

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (d), §15.209 RSS-210, Issue 10, section B4		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	9 kHz - 30 MHz	
	Antenna height	1 m	

Limits

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.			

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).

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.

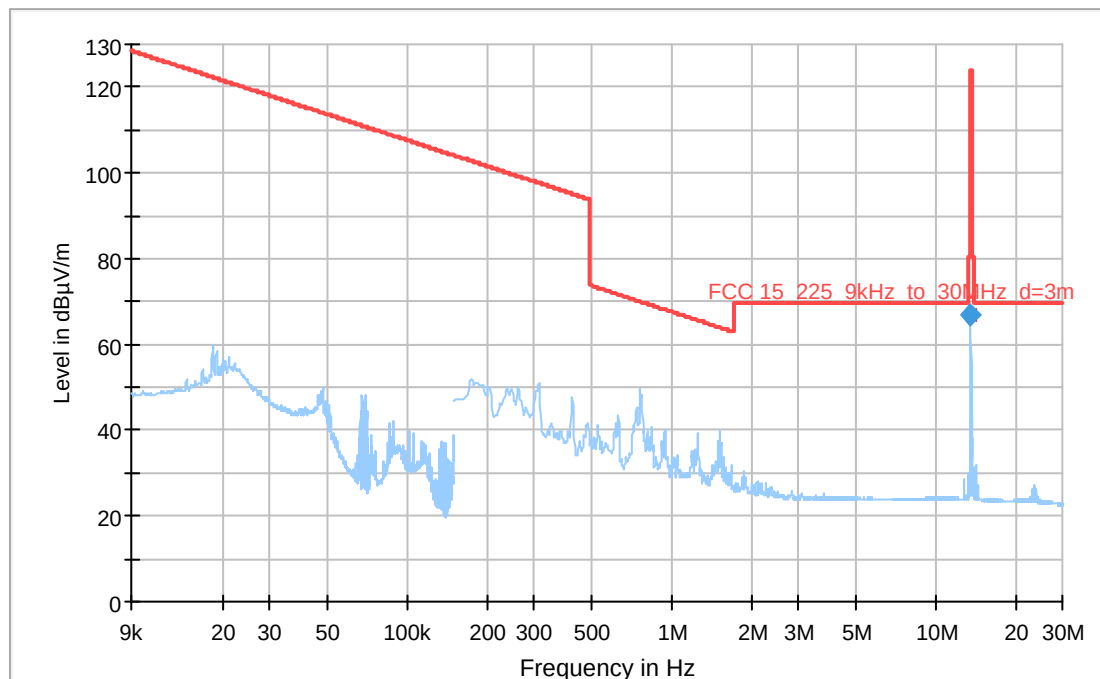
Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber	Siepel	REF W460SLB	-	PM KF 1150-01	2016-12 (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	ESR7	101757	PM KF 3371	2019-04 (1 year)
Loop antenna 9 kHz- 30 MHz	Rohde & Schwarz	HFH2-Z2	881058/48	PM KF 1401	2018-09 (1 years)
Test software	Rohde & Schwarz	EMC 32 V.10.40.10	-	PM KF 2983-2	-

Measurement results – Radiated emissions < 30 MHz:

Common Information

EUT:	GL7p.1500
Test Verdict:	Pass
Test Description:	Radiated Emissions, 9kHz-30 MHz, FCC Part 15 Subpart C
Operating Conditions:	Pulse transmission with interval of 100 ms (RFID on with tag)
Operator Name:	MBE, UGR
Project Number:	36334
Date:	03.08.2019
Comment:	



— 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_d=3m [.\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)
13.560000	66.78	---	124.00	57.22	---	---	H	176.0

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

Frequency (MHz)	Corr. (dB/m)	Comment
13.560000	20	12:19:42 - 03.08.2019

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

Hardware Setup: EN-RE-R12-AN23
Measurement Type: Open-Area-Test-Site (SAC/FAR)
Frequency Range: 9 kHz - 30 MHz
Graphics Level Range: 0 dBμV/m - 130 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: EN-RE-R12-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 MHz. 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

$$E = U + AF + A$$

7.3 Radiated emissions 30 MHz to 1 GHz

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (d), §15.209 RSS-210, Issue 10, section B4		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 - 1 GHz	

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 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).

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

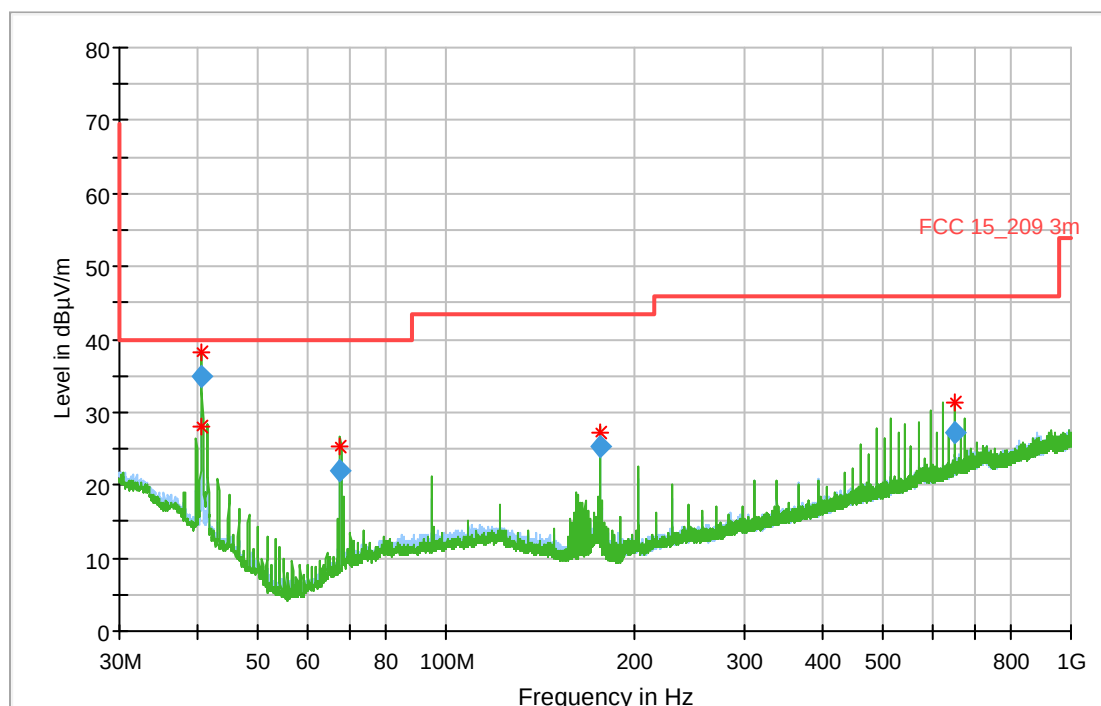
DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Semi-Anechoic chamber	Siepel	REF W460SLB	-	PM KF 1150-01	2016-12 (3 years)
Turntable	Inn-Co	-	-	PM KF 2949-04	-
Tower	Inn-Co	MA4484-XPET	-	PM KF 2949-03	-
Controller	Inn-Co	CO 3000	4970815	PM KF 2949	-
Receiver 9 kHz - 7 GHz	Rohde & Schwarz	ESR7	101757	PM KF 3371	2019-04 (1 year)
Antenna 30 MHz - 3GHz	Rohde & Schwarz	HL 562	100354	PM KF 1123	2018-03 (2 years)
Test software	Rohde & Schwarz	EMC 32 V.10.40.10	-	PM KF 2983-2	-

Measurement results – Radiated emissions 30 MHz to 1 GHz:

Radiated Emissions Test Report

Common Information

EUT:	GL7p.1500
Test Verdict:	Pass
Test Description:	Radiated spurious > 30 MHz
Operating Conditions:	Pulse transmission with an interval of 100ms (RFID with tag)
Operator Name:	MBE
Project Number:	36334
Date:	22.07.2019
Comment:	



Preview Result 1H-PK+ [Preview Result 1H.Result:2]
 Preview Result 1V-PK+ [Preview Result 1V.Result:2]
 * Critical_Freqs PK+ [Critical_Freqs.Result:4]
 FCC 15_209 3m [.\EMI radiated\FCC Part 15C]
 ♦ Final_Result QPK [Final_Result.Result:4]

Final Result

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)
40.680000	35.00	40.00	5.00	1000.0	120.000	100.0	V	246.0
67.800000	21.93	40.00	18.07	1000.0	120.000	145.0	V	71.0
176.280000	25.27	43.52	18.25	1000.0	120.000	100.0	V	63.0
650.910000	27.19	46.02	18.83	1000.0	120.000	105.0	V	11.0

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

Frequency (MHz)	Corr. (dB/m)	Comment
40.680000	14	17:00:46 - 22.07.2019
67.800000	8	16:56:22 - 22.07.2019
176.280000	11	16:57:51 - 22.07.2019
650.910000	20	16:55:00 - 22.07.2019

EMI Auto Test Template: FCC-RE-R17-AN08

Hardware Setup: EN-RE-R12-AN08
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-R12-AN08_PRE

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESR 7]					
30 MHz - 1 GHz	30 kHz	PK+	120 kHz	0,15 s	20 dB
1 GHz - 3 GHz	250 kHz	PK+	1 MHz	0,1 s	20 dB

Frequency Zoom:
Zoom Scan Template: EN-RE-R12-AN08_ZOOM

Adjustment:
Antenna height: Range = 90 cm , Measuring Speed = 3
Turntable position: Range = 30 deg , Measuring Speed = 3
Template for Single Meas.: EN-RE-R12-AN08_MAX

Final Measurements:
Template for Single Meas.: EN-RE-R12-AN08_FIN

Subrange	Step Size	Detectors	IF BW	Meas. Time	Preamp
Receiver: [ESR 7]					
30 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

$$E = U + AF + A$$

7.4 Frequency stability measurement

NORMATIVE REFERENCES			RESULT
Limits according to:	FCC §15.225 (e) RSS-210, Issue 10, section B4 RSS-Gen Issue 5, section 6.11		P
Methods of measurement according to:	ANSI C63.10, section 9.14		
Equipment mode	Power interface	1	
	EUT configuration mode	2	
	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 degree to + 60 degree
Voltage range:	0.85 x 3.6 V and 1.15*3.6 V

Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Temperature Chamber	HT4010	Heraeus-Vötsch	45021	PM KF 1402	
Receiver 10 Hz - 40 GHz	Rohde & Schwarz	FSV40	101400	PM KF 2783	2019-09 (1 year)
Loop antenna	Rohde & Schwarz	HZ-10	100055	PM KF 0965	2017-04 (3 year)

Measurement results – Frequency stability measurement:

Temperature °C	Carrier at 20°C MHz	Upper limit:	13.561923 MHz
		Lower limit:	13.559211 MHz
		Measured frequency under temperature influence:	
+60	13.5603545		13.56035
+50			13.56034
+40			13.56037
+30			13.56039
+20			13.56035
+10			13.56041
0			13.56044
-10			13.56044
-20			13.56044

Comment

The frequency stability under temperature influence remains in the tolerance of $\pm 0.01\%$ (± 100 ppm).

The DC voltage variation from 3 V to 4.14 V had no influence on the frequency and the level of the carrier.

7.5 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	2	
	Operation mode	1	

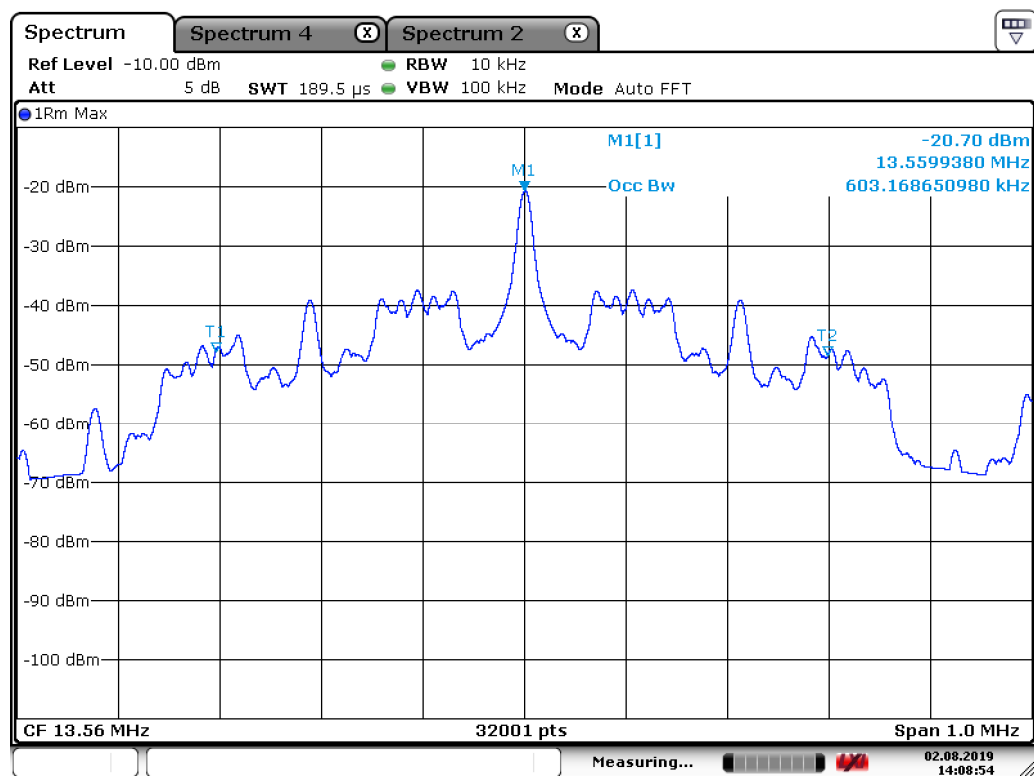
Test equipment

DESCRIPTION	MANUFACTURER	TYPE	SN	ASSET NO.	CALIBRATION
Temperature Chamber	HT4010	Heraeus-Vötsch	45021	PM KF 1402	
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Comment

The 99% occupied bandwidth is 603.169 kHz.

Measurement results – 99% occupied bandwidth:



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7.6 Measurement uncertainty evaluation

Measurement uncertainty for radiated magnetic field, 9 kHz – 30 MHz	± 3.2 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 radiated emission 1 to 26 GHz	
Uncertainty for the frequency range 1 to 18 GHz	± 6.1 dB
Uncertainty for the frequency range 18 to 26,5 GHz	± 6.5 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