Sub-Test Report* acc. to FCC Title 47 CFR Part 15 relating to FEIG ELECTRONIC GmbH ID ISC.LRU3000-FCC ID ISC.LRU3500-FCC

Title 47 – Telecommunication
Part 15 - Radio Frequency Devices
Subpart C – Intentional Radiators
Measurement Procedure:
ANSI C63.4-2014
ANSI C63.10-2013

ilac-MRA

DAkkS Deutsche Akkreditierungsstelle D-PL-12053-01-00

*** The EUT has not been tested according to all relevant parts of the test specification. This report does not allow a conclusion about the conformity of the EUT.**

MANUFACTURER	
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RELEVANT STANDARD	
Title	**47 - Telecommunication**
Part	**15 - Radio Frequency Devices**
Subpart	**Subpart C – Intentional Radiators - Section 15.247**
Measurement procedure	**ANSI C63.4-2014 & ANSI C63.10-2013**

EQUIPMENT UNDER TEST (EUT)	
Equipment category	FHSS Tranceiver
Trade name	ID ISC.LRU3000 ID ISC.LRU3500
Type designation	ID ISC.LRU3000-FCC ID ISC.LRU3500-FCC
Serial no.	6710013 (ID ANT.U290/290-FCC) 6762129 (ID ANT.U580/290-FCC)
Variants	ID ANT.U290/290-FCC ID ANT.U580/290-FCC

1. Test result summary

Clause	Requirements headline	Test result		
8.1	Antenna requirement	**Pass**	~~Fail~~	~~N.t.~~*
8.2	Conducted limits	~~Pass~~	~~Fail~~	**N.t.**[5]
8.3	Restricted bands of operation	**Pass**	~~Fail~~	~~N.t.~~*
8.4	Radiated emission limits, general requirements	**Pass**	~~Fail~~	~~N.t.~~*
8.5	Bandwidth	~~Pass~~	~~Fail~~	**N.t.**[5]
8.6	Peak output power	**Pass**	~~Fail~~	~~N.t.~~*
8.7	Out of band emissions	**Pass**	~~Fail~~	~~N.t.~~*
8.8	Power spectral density	~~Pass~~	~~Fail~~	**N.t.**[3]

* Not tested

The equipment passed all the conducted tests	**Yes**	~~No~~

Signature	Digital unterschrieben von Ralf Trepper DN: cn=Ralf Trepper, o=TÜV NORD Hochfrequenztechnik GmbH & Co. KG, ou=Labor, email=rtrepper@tuev-nord.de, c=DE Datum: 2019.10.18 17:43:31 +02'00'	Digital unterschrieben von Abdelouahid Ftouhi DN: cn=Abdelouahid Ftouhi, o=TUEV NORD Hochfrequenztechnik, ou, email=aftouhi@tuev-nord.de, c=DE Datum: 2019.10.21 09:16:13 +02'00'
Name	**Mr. Ralf Trepper**	**Mr. Abdelouahid Ftouhi**
Date of issue	**2019-10-14**	**2019-10-14**

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2. Introduction

This test report **is not an expert opinion** and consists of:

- Test result summary
- List of contents
- Introduction and further information
- Performance assessment
- Detailed test information

All pages have been numbered consecutively and bear the TÜV NORD Hochfrequenztechnik GmbH & Co. KG logo, the test report number, the date, the test specification in its current version as well as the type designation of the EUT. The total numbers of pages in this report is **42**.

The tests were carried out in a representative assembly and in accordance with the test methods and/or requirements stated in:

FCC Title 47 CFR Part 15 Subpart C Section 15.247, ANSI C63.4-2014 & ANSI C63.10-2013

The sample of the product was received on:

- 2019-07-30

The tests were carried out in the following period of time:

- 2019-09-03 - 2019-09-09

3. Testing laboratory

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FCC Registration Number: 763407

Accredited by:
DAkkS Deutsche Akkreditierungsstelle GmbH
DAkkS accreditation number: D-PL-12053-01-00

4. Applicant

Company name	: FEIG ELECTRONIC GmbH
Address	: Lange Str. 4 35781 Weilburg
Country	: Germany
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Email	: reinhard.monno@feig.de
Date of order	: 2019-07-16
References	: Mr. Reinhard Monno

5. Product

Sample of the following apparatus was submitted for testing:

Manufacturer	: FEIG ELECTRONIC GmbH
Trademark	: ID ISC.LRU3000 ID ISC.LRU3500
Type designation	: **ID ISC.LRU3000-FCC** **ID ISC.LRU3500-FCC**
Serial number	: 6710013 (ID ANT.U290/290-FCC) // 6762129 (ID ANT.U580/290-FCC)
Hardware version	: ID ISC.LRU3000 / ID ISC.LRU3500
Variant	: Antenna ID ANT.U290/290-FCC & ID ANT.U580/290-FCC
Software release	: ---
Type of equipment	: FHSS Transceiver
Power used	: 24 V DC
Frequency used	: 915 MHz
ITU emission class	: ---
FCC ID	: PJMLRU3000

For issuing this report the following product documentation was used:

Title	Description	Version
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For issuing this report the following product documentation was used:

Description	Date	Identifications
External photographs of the **E**quipment **U**nder **T**est (EUT)	2019-10-04	Annex no. 1
Internal photographs of the **E**quipment **U**nder **T**est (EUT)	2019-10-04	Annex no. 2
Channel occupancy / bandwidth	---	Annex no. 3
Label sample	---	Annex no. 4
Functional description / User Manual	---	Annex no. 5
Test setup photos	2019-10-04	Annex no. 6
Block diagram	---	Annex no. 7
Operational description	---	Annex no. 8
Schematics	---	Annex no. 9
Parts list	---	Annex no. 10
RF exposure	---	Annex no. 11

6. Conclusions, observations and comments

The test report will be filed at TÜV NORD Hochfrequenztechnik GmbH & Co. KG for a period of 10 years following the issue of this report. It may only be reproduced or published in full. Reproduction or publication of extracts from the report requires the prior written approval of TÜV NORD Hochfrequenztechnik GmbH & Co. KG.

The results of the tests as stated in this report are exclusively applicable to the EUT as identified in this report.
TÜV NORD Hochfrequenztechnik GmbH & Co. KG cannot be held liable for properties of the EUT that have not been observed during these tests.

TÜV NORD Hochfrequenztechnik GmbH & Co. KG assumes the sample to comply with the requirements of FCC Title 47 CFR Part 15 for the respective test sector, if the test results turn out positive.

Comments: ---

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7. Operational description

7.1 EUT details

The EUT ID ISC.LRU3500-FCC is a RFID reader working with two different antennas ID ANT.U290/290-FCC and ID ANT.U580/290-FCC.

7.2 EUT configuration

Once the RFID reader LRU3000/3500 is power supplied by 24 V DC, it starts automatically with frequency hopping in the FCC band with 1W at the antenna connector.

7.3 EUT measurement description

Radiated measurements

The EUT was tested in a typical fashion. During preliminary emission tests the EUT was operated in the continuous measuring mode for worst case emission mode investigation. Therefore, the final qualification testing was completed with the EUT operated in continuous measuring mode. All tests were performed with the EUT's typical voltage: 24 V DC.

In order to establish the maximum radiation, firstly, there have been viewed all orthogonal adjustments of the test samples, secondly the test ample have been rotated at all adjustments around the own axis between 0° and 360°, and thirdly, the antenna polarization between horizontal and vertical had been varied.

Radiated measurement above 1 GHz is made by placing loose-laid RF absorber material on the ground plane as mentioned in ANSI C63.4-2014.

Additionally, radiated emission measurements above 1 GHz are made using calibrated linearly polarized antennas as specified in ANSI C63.4-2014, which may have a smaller beamwidth (main lobe) than do the antennas used for frequencies below 1 GHz. The measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal.

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8.1 Antenna requirement

8.1.1 Regulation

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

8.1.2 Result

Antenna Type	Antenna description	Frequency	Gain	Number of Antennas
Single patch antenna	**ANT.U290/290**	**902 MHz 915 MHz 928 MHz**	**6.4 dBi 6.3 dBi 6.6 dBi**	**1**
Double patch antenna	**ANT.U580/290**	**902 MHz 915 MHz 928 MHz**	**9.4 dBi 9.5 dBi 9.2 dBi**	**1**

The equipment passed the conducted tests	**Yes**	~~No~~	~~N.t.~~*

Test setup photos / test results are attached	~~Yes~~	**No**	Page no.:

8.2 Conducted limits

8.2.1 Regulation

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Conducted Limits		
Frequency of Emission	**Quasi-Peak (QP)**	**Average (AV)**
MHz	**dBµV**	**dBµV**
0.15 - 0.5	66 to 56*	56 to 46*
0.5 - 5	56	46
5 -30	60	50
*Decreases with the logarithm of the frequency		

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz. In lieu thereof, these carrier current systems shall be subject to the following standards:

1) For carrier current system containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535–1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in §15.205, §15.209, §15.221, §15.223, or §15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

8.2.2 Test procedures

The EUT and the additional equipment (if required) are connected to the main power through a line impedance stabilization network (LISN). The LISN must be appropriate to ANSI C63.4-2014 Section 7.
Additional equipment must also be connected to a second LISN with the same specifications described in the above section (if required).

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8.2.3 Result

Conducted emissions - Tested with external AC power supply								
Tested Line	**Frequency**	**Bandwidth**	**QP Value**	**QP Limit**	**Margin**	**AV Value**	**AV Limit**	**Margin**
L1 / N	**MHz**	**kHz**	**dBµV**	**dBµV**	**dB**	**dBµV**	**dBµV**	**dB**
		9						
		9						
		9						
		9						
		9						
Measurement uncertainty < ± 2 dB								

Conducted emissions - Tested with a Laptop only								
Tested Line	**Frequency**	**Bandwidth**	**QP Value**	**QP Limit**	**Margin**	**AV Value**	**AV Limit**	**Margin**
L1 / N	**MHz**	**kHz**	**dBµV**	**dBµV**	**dB**	**dBµV**	**dBµV**	**dB**
		9						
		9						
		9						
		9						
		9						
Measurement uncertainty < ± 2 dB								

Test Cables used	
Test equipment used	

The equipment passed the conducted tests	~~Yes~~	~~No~~	**N.t.**[5]

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

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8.3 Restricted bands of operation

8.3.1 Regulation

(a) Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

Restricted bands of operation			
Frequency Band MHz	**Frequency Band MHz**	**Frequency Band MHz**	**Frequency Band GHz**
0.090-0.110	**16.42-16.423**	**399.9-410**	**4.5-5.15**
[1]0.495-0.505	**16.69475-16.69525**	**608-614**	**5.35-5.46**
2.1735-2.1905	**16.80425-16.80475**	**960-1240**	**7.25-7.75**
4.125-4.128	**25.5-25.67**	**1300-1427**	**8.025-8.5**
4.17725-4.17775	**37.5-38.25**	**1435-1626.5**	**9.0-9.2**
4.20725-4.20775	**73-74.6**	**1645.5-1646.5**	**9.3-9.5**
6.215-6.218	**74.8-75.2**	**1660-1710**	**10.6-12.7**
6.26775-6.26825	**108-121.94**	**1718.8-1722.2**	**13.25-13.4**
6.31175-6.31225	**123-138**	**2200-2300**	**14.47-14.5**
8.291-8.294	**149.9-150.05**	**2310-2390**	**15.35-16.2**
8.362-8.366	**156.52475-156.52525**	**2483.5-2500**	**17.7-21.4**
8.37625-8.38675	**156.7-156.9**	**2690-2900**	**22.01-23.12**
8.41425-8.41475	**162.0125-167.17**	**3260-3267**	**23.6-24.0**
12.29-12.293	**167.72-173.2**	**3332-3339**	**31.2-31.8**
12.51975-12.52025	**240-285**	**3345.8-3358**	**36.43-36.5**
12.57675-12.57725	**322-335.4**	**3600-4400**	**([2])**
13.36-13.41	**---**	**---**	**---**
[1] Until February 1, 1999, this restricted band shall be 0.490-0.510 MHz. [2] Above 38.6			

(b) Except as provided in paragraphs (d) and (e) of this section, the field strength of emissions appearing within these frequency bands shall not exceed the limits shown in §15.209. At frequencies equal to or less than 1000 MHz, compliance with the limits in §15.209 shall be demonstrated using measurement instrumentation employing a CISPR quasi-peak detector. Above 1000 MHz, compliance with the emission limits in §15.209 shall be demonstrated based on the average value of the measured emissions. The provisions in §15.35 apply to these measurements.

(c) Except as provided in paragraphs (d) and (e) of this section, regardless of the field strength limits specified elsewhere in this subpart, the provisions of this section apply to emissions from any intentional radiator.

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(d) The following devices are exempt from the requirements of this section:

(1) Swept frequency field disturbance sensors operating between 1.705 and 37 MHz provided their emissions only sweep through the bands listed in paragraph (a) of this section, the sweep is never stopped with the fundamental emission within the bands listed in paragraph (a) of this section, and the fundamental emission is outside of the bands listed in paragraph (a) of this section more than 99% of the time the device is actively transmitting, without compensation for duty cycle.

(2) Transmitters used to detect buried electronic markers at 101.4 kHz which are employed by telephone companies.

(3) Cable locating equipment operated pursuant to §15.213.

(4) Any equipment operated under the provisions of §15.253, 15.255, and 15.256 in the frequency band 75-85 GHz, or §15.257 of this part.

(5) Biomedical telemetry devices operating under the provisions of §15.242 of this part are not subject to the restricted band 608-614 MHz but are subject to compliance within the other restricted bands.

(6) Transmitters operating under the provisions of subparts D or F of this part.

(7) Devices operated pursuant to §15.225 are exempt from complying with this section for the 13.36-13.41 MHz band only.

(8) Devices operated in the 24.075-24.175 GHz band under §15.245 are exempt from complying with the requirements of this section for the 48.15-48.35 GHz and 72.225-72.525 GHz bands only, and shall not exceed the limits specified in §15.245(b).

(9) Devices operated in the 24.0-24.25 GHz band under §15.249 are exempt from complying with the requirements of this section for the 48.0-48.5 GHz and 72.0-72.75 GHz bands only, and shall not exceed the limits specified in §15.249(a).

(10) White space devices operating under subpart H of this part are exempt from complying with the requirements of this section for the 608-614 MHz band.

(e) Harmonic emissions appearing in the restricted bands above 17.7 GHz from field disturbance sensors operating under the provisions of §15.245 shall not exceed the limits specified in §15.245(b).

8.3.2 Result

Test Cables used	K60, K101, K176, K119
Test equipment used	68, 166a, 345, 406, 445a, 452, 502, 660

The equipment passed the conducted tests	**Yes****	~~No~~	~~N.t.~~*

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

****All emissions fall under the restricted bands of operations are included in clause 8.4 and are maked blue.**

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8.4 Radiated emission limits, general requirements

8.4.1 Regulation

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Intentional radiator- radiated emission limits		
Frequency	**Field Strength**	**Measurement distance**
MHz	**µV/m**	**m**
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100**	3
88-216	150**	3
216-960	200**	3
above 960	500	3
Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permItted under other sections of this part, e.g., §§15.231 and 15.241.		

(b) In the emission table above, the tighter limit applies at the band edges.

(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.

(d) 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.

(e) The provisions in §§15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

(f) In accordance with §15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in §15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in §15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in §15.109 that are applicable to the incorporated digital device.

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(g) Perimeter protection systems may operate in the 54-72 MHz and 76-88 MHz bands under the provisions of this section. The use of such perimeter protection systems is limited to industrial, business and commercial applications.

8.4.2 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360° to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2014 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions from 9kHz - 1 GHz & 1 GHz - 40 GHz are covered in Clause 8 of ANSI C63.4-2014. The ANSI C63.4-2014 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Sub clause 8.3.2 of ANSI C63.4-2014 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2014, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTs, measuring system sensitivity, etc.

ANSI C63.4-2014 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

Radiated emissions test characteristics	
Test distance	3 m*
Test instrumentation resolution bandwidth	9 kHz (Below 30 MHz)
	120 kHz (30 MHz - 1,000 MHz)
	1 MHz (Above 1000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/horizontal

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* According to Section 15.31 (f) (1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. Measurements shall not be performed at a distance greater than 30 meters unless it can be further demonstrated that measurements at a distance of 30 meters or less are impractical. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

8.4.3 Calculation of the field strength

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : Antenna factor + cable loss

For example:
The receiver reading is 32.7 dBµV. The antenna factor for the measured frequency is +2.5 dB (1/m) and the cable factor for the measured frequency is 0.71 dB, giving a field strength of 35.91dBµV/m.
The 35.91 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

Level in µV/m = Common Antilogarithm (35.91/20) = 62.44

For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f) (1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear distance for field strength measurements).

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8.4.4 Result

Transmitter spurious radiation below 30 MHz (Section 15.205, 15.209)												
f	**Detct**	**BW**	**Rx Level**	**MD**	**CF**	**DEF**	**LC**	**Limit**	**Margin**	**EP**	**Antenna**	
											Pol	**H**
MHz	**Type**	**kHz**	**dBµV**	**m**	**dB**	**dB**	**dBµV/m**	**dBµV/m**	**dB**	**°**	**H/V**	**m**
	QP	120	**	3			**					
	QP	120	**	3			**					
	QP	120	**	3			**					
	QP	120	**	3			**					
	QP	120	**	3			**					
Measurement uncertainty: ± 4 dB												
****No emissions detected**												

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height

Remark: *[1] Noise level of the measuring instrument ≤ 4.0 dBµV@10m distance (0.009 MHz –30 MHz)
Remark: *[2] Peak Limit according to Section 15.35 (b). Unless otherwise specified, e.g., see §§15.250, 15.252, 15.253(d), 15.255, 15.256, and 15.509 through 15.519 of this part, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

EUT: ID ISC.LRU3000-FCC ID ISC.LRU3500-FCC **FCC ID: PJMLRU3000** **FCC Title 47 CFR Part 15** **Date of issue: 2019-10-14**

Radiated emissons for RFID reader ID ISC.LRU3000/3500 with the antenna variant ID ANT.U290/290:

Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 902 MHz													
f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Antenna	
												Pol	H
MHz	Type	kHz	dBµV	m	dB	dB	dB	dBµV/m	dBµV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2708.25	**RMS**	**100**	**40.4**	**3**	**9.6**	**0**	**0**	**50.0**	**54.0**	**4.0**	**230**	**V**	**1.1**
3611.00	**RMS**	**100**	**40.1**	**3**	**11.8**	**0**	**0**	**48.3**	**54.0**	**5.7**	**18**	**V**	**1.17**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4
Measurement uncertainty: ± 4 dB													

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *6 for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

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Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 915 MHz

f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Antenna Pol	Antenna H
MHz	Type	kHz	dBµV	m	dB	dB	dB	dBµV/m	dBµV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2745.75	**RMS**	**100**	**39.7**	**3**	**9.5**	**0**	**0**	**49.2**	**54.0**	**4.8**	**230**	**V**	**1.1**
3661.00	**RMS**	**100**	**35.9**	**3**	**13.3**	**0**	**0**	**49.2**	**54.0**	**4.8**	**18**	**V**	**1.17**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4

Measurement uncertainty: ± 4 dB

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *6 for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

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Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 928 MHz													
f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Antenna	
												Pol	H
MHz	Type	kHz	dBµV	m	dB	dB	dB	dBµV/m	dBµV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2781.75	**RMS**	**100**	**38.0**	**3**	**9.7**	**0**	**0**	**47.7**	**54.0**	**6.3**	**230**	**V**	**1.1**
3709.00	**RMS**	**100**	**34.2**	**3**	**14.1**	**0**	**0**	**48.3**	**54.0**	**5.7**	**175**	**H**	**1.75**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4
Measurement uncertainty: ± 4 dB													

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

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Radiated emissons for RFID reader ID ISC.LRU3000/3500 with the antenna variant ID ANT.U580/290:

Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 902 MHz

f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Antenna Pol	Antenna H
MHz	Type	kHz	dBµV	m	dB	dB	dB	dBµV/m	dBµV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2708.25	**RMS**	**100**	**43.0**	**3**	**9.6**	**0**	**0**	**52.6**	**54.0**	**1.4**	**5**	**V**	**1.25**
3611.00	**RMS**	**100**	**38.0**	**3**	**11.8**	**0**	**0**	**49.8**	**54.0**	**4.2**	**230**	**V**	**1.60**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4

Measurement uncertainty: ± 4 dB

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
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Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 915 MHz												Antenna	
f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Pol	H
MHz	Type	kHz	dBμV	m	dB	dB	dB	dBμV/m	dBμV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2745.75	**RMS**	**100**	**42.4**	**3**	**9.5**	**0**	**0**	**51.9**	**54.0**	**2.1**	**5**	**V**	**1.25**
3661.00	**RMS**	**100**	**35.1**	**3**	**13.3**	**0**	**0**	**48.4**	**54.0**	**5.6**	**195**	**H**	**1.45**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4
Measurement uncertainty: ± 4 dB													

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ 3.5dBμV @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ 4.5dBμV @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ 10dBμV @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ 14dBμV @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *6 for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

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Transmitter spurious radiation above 30 MHz (Section 15.205, 15.209) – Frequency 928 MHz

f	Detct	BW	Rx Level	MD	CF	DEF	AVC	LC	Limit	Margin	EP	Antenna Pol	Antenna H
MHz	Type	kHz	dBµV	m	dB	dB	dB	dBµV/m	dBµV/m	dB	°	H / V	m
30.00	PK	100	≤ 3.5**	3	-2.6*5	0	0	**0.9**	40.0	**39.1**	0-360	H / V	1-4
88.00	PK	100	≤ 3.5**	3	-10.8*5	0	0	**-7.3**	40.0	**47.3**	0-360	H / V	1-4
196.920	**QP**	**100**	**33.6**	**3**	**-10.8**	**0**	**0**	**22.8**	**40.0**	**17.2**	**135**	**V**	**1.35**
199.780	**QP**	**100**	**30.0**	**3**	**-10.8**	**0**	**0**	**19.2**	**40.0**	**20.8**	**195**	**V**	**1.13**
216.00	PK	100	≤ 3.5**	3	-10.3*5	0	0	**-6.8**	43.5	**50.3**	0-360	H / V	1-4
264.130	**QP**	**100**	**38.3**	**3**	**-8.1**	**0**	**0**	**30.2**	**43.5**	**13.3**	**312**	**V**	**2.69**
327.740	**QP**	**100**	**29.1**	**3**	**-6.6**	**0**	**0**	**23.3**	**43.5**	**20.2**	**245**	**H**	**1.87**
395.800	**QP**	**100**	**14.8**	**3**	**-5.8**	**0**	**0**	**9.0**	**43.5**	**34.5**	**0**	**V**	**2.89**
960.00	PK	100	≤ 3.5**	3	8.50*5	0	0	**12.0**	43.5	**31.5**	0-360	H / V	1-4
1700.00	PK	100	≤ 4.5**	3	3.80*6	0	0	**8.3**	54.0	**45.7**	0-360	H / V	1-4
1805.50	PK	100	≤ 10**	3	9.5*6	0	0	**19.5**	54.0	**34.5**	0-360	H / V	1-4
2250.00	PK	100	≤ 10**	3	8.00*6	0	0	**18.0**	54.0	**36.0**	0-360	H / V	1-4
2781.75	**RMS**	**100**	**42.5**	**3**	**9.7**	**0**	**0**	**52.2**	**54.0**	**1.8**	**5**	**V**	**1.25**
3709.00	**RMS**	**100**	**34.0**	**3**	**14.0**	**0**	**0**	**48.0**	**54.0**	**6.0**	**195**	**H**	**1.45**
4000.00	PK	100	≤ 10**	3	8.40*6	0	0	**18.4**	54.0	**35.6**	0-360	H / V	1-4
5000.00	PK	100	≤ 10**	3	9.10*6	0	0	**19.4**	54.0	**34.6**	0-360	H / V	1-4
7500.00	PK	100	≤ 14**	3	12.9*6	0	0	**26.9**	54.0	**27.1**	0-360	H / V	1-4
8300.00	PK	100	≤ 14**	3	14.8*6	0	0	**28.8**	54.0	**25.2**	0-360	H / V	1-4

Measurement uncertainty: ± 4 dB

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ 3.5dBµV @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ 4.5dBµV @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ 10dBµV @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ 14dBµV @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *6 for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz

Test Cables used	K60, K101, K176, K119
Test equipment used	23, 68, 166a, 345, 406, 445a, 452, 502, 660

The equipment passed the conducted tests	**Yes**	~~No~~	~~N.t.~~*

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

8.5 Bandwidth

8.5.1 Regulation

Section 15.247 (a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

(i) For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.

(ii) Frequency hopping systems operating in the 5725-5850 MHz band shall use at least 75 hopping frequencies. The maximum 20 dB bandwidth of the hopping channel is 1 MHz. The average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 30 second period.

(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

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8.5.2 Result

Operating Frequency	Minimum Measured 6 dB Bandwidth
MHz	kHz

Operating Frequency	Maximum Measured 20 dB Bandwidth
MHz	kHz

Test Cables used	
Test equipment used	

The equipment passed the conducted tests	~~Yes~~	~~No~~	**N.t.**[5]

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

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8.6 Peak output power

8.6.1 Regulation

Section 15.247 (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

(2) For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.

(3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the *maximum conducted output power* is the highest total transmit power occurring in any mode.

(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(c) Operation with directional antenna gains greater than 6 dBi.

(1) Fixed point-to-point operation:

(i) Systems operating in the 2400-2483.5 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

(ii) Systems operating in the 5725-5850 MHz band that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted output power.

(iii) Fixed, point-to-point operation, as used in paragraphs (c)(1)(i) and (c)(1)(ii) of this section, excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located intentional radiators transmitting the same information. The operator of the spread spectrum or digitally modulated intentional radiator or, if the equipment is professionally installed, the installer is responsible for ensuring that the system is used exclusively for fixed, point-to-point operations. The instruction manual furnished with the intentional radiator shall contain language in the installation instructions informing the operator and the installer of this responsibility.

(2) In addition to the provisions in paragraphs (b)(1), (b)(3), (b)(4) and (c)(1)(i) of this section, transmitters operating in the 2400-2483.5 MHz band that emit multiple directional beams, simultaneously or sequentially, for

the purpose of directing signals to individual receivers or to groups of receivers provided the emissions comply with the following:

(i) Different information must be transmitted to each receiver.

(ii) If the transmitter employs an antenna system that emits multiple directional beams but does not do emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device, *i.e.*, the sum of the power supplied to all antennas, antenna elements, staves, etc. and summed across all carriers or frequency channels, shall not exceed the limit specified in paragraph (b)(1) or (b)(3) of this section, as applicable. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dB that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(A) The directional gain shall be calculated as the sum of 10 log (number of array elements or staves) plus the directional gain of the element or stave having the highest gain.

(B) A lower value for the directional gain than that calculated in paragraph (c)(2)(ii)(A) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beamforming.

(iii) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channels, the power supplied to each emission beam is subject to the power limit specified in paragraph (c)(2)(ii) of this section. If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in paragraph (c)(2)(ii) of this section. In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in paragraph (c)(2)(ii) of this section by more than 8 dB.

(iv) Transmitters that emit a single directional beam shall operate under the provisions of paragraph (c)(1) of this section.

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8.6.2 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360° to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2014 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions from 9kHz - 1 GHz & 1 GHz - 40 GHz are covered in Clause 8 of ANSI C63.4-2014. The ANSI C63.4-2014 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Sub clause 8.3.2 of ANSI C63.4-2014 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2014, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTs, measuring system sensitivity, etc.

ANSI C63.4-2014 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

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Radiated emissions test characteristics	
Test distance	10m, 3 m*
Test instrumentation resolution bandwidth	9 kHz (Below 30 MHz)
	120 kHz (30 MHz - 1000 MHz)
	1 MHz (Above 1000 MHz)
Receive antenna scan height	1 m (Below 30 MHz)
	1 m - 4 m (30 MHz - 15000 MHz)
	1 m – 2.5 m (18000 MHz - 40000 MHz)
	1 m (Above 40000 MHz)
Receive antenna polarization	0° or 90° (Below 30 MHz)
	vertical/horizontal (Above 30 MHz)

*According to Section 15.31 (f) (1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).

8.6.3 Calculation of the peak power (radiated)

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-Amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : field attenuation + cable loss

For example:
The receiver reading is +1.0 dBm. The field attenuation for the measured frequency is +19.5 dB and the cable factor for the measured frequency is 2.1 dB, giving a power of +22.6 dBm.
The +22.6dBm value can be mathematically converted to its corresponding level in W.

+22.6 dBm = 0.182 W = 182 mW

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8.6.4 Result

Peak output power at antenna port with original connecting cable (Section 15.247)								
f	**Detct**	**BW**	**Rx Level**	**CF**	**Cable loss**	**LC**	**Limit**	**Margin**
MHz	**Type**	**kHz**	**dBm**	**dB**	**dB**	**dBm**	**dBm**	**dB**
902.750	PK	100	**8.3**	20.0	**1.9**	**26.4**	30.0	**3.6**
915.250	PK	100	**8.1**	20.0	**1.9**	**26.2**	30.0	**3.8**
927.250	PK	100	**7.8**	20.0	**1.9**	**25.9**	30.0	**4.1**
Measurement uncertainty: ± 3 dB								
f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | CF : Correction factor | LC : Level corrected								

Max. radiated peak output power e.i.r.p. Calculated (Section 15.247)						
Antenna Type	**f**	**Rx Level**	**Antenna gain**	**e.i.r.p. LC**	**e.i.r.p. Limit**	**Margin**
External	**(MHz)**	**dBm**	**dBi**	**dBm**	**dBm**	**dB**
Single patch antenna	**902.750**	**26.4**	**6.4**	**32.8**	36*	**3.2**
	915.250	**26.2**	**6.3**	**32.5**	36*	**3.5**
	927.250	**25.9**	**6.6**	**32.5**	36*	**3.5**
Double patch antenna	**902.750**	**26.4**	**9.4**	**35.8**	36*	**0.2**
	915.250	**26.2**	**9.5**	**35.7**	36*	**0.3**
	927.250	**25.9**	**9.2**	**35.1**	36*	**0.9**
Measurement uncertainty: ± 0.5 dB						
f: Frequency | Rx Level : Receiver | e.i.r.p. LC : Corrected e.i.r.p Level |*e.i.r.p. Limit = 30 dBm + 6 dBi (antenna gain) = 4 Watt						
Max. Peak output power (radiated) = Noted receiver level + Antenna gain - Coax cable attenuation (min. = 0.6 dB)						

Test Cables used	K175
Test equipment used	226, 313, 504, 505, 502

The equipment passed the conducted tests	**Yes**	~~No~~	~~N.t.~~*

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

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8.7 Out of band emission

8.7.1 Regulation

Section 15.247 (d) In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

8.7.2 Calculation of the "Out of band emissions"

The field strength is calculated by the following calculation:

Corrected Level = Receiver Level + Correction Factor (without the use of a pre-amplifier)

Corrected Level = Receiver Level + Correction Factor – Pre-Amplifier (with the use of a pre-amplifier)

Receiver Level : Receiver reading without correction factors
Correction Factor : field attenuation + cable loss

For example:
The receiver reading in a 100 kHz bandwidth is -45.0 dBm. The field attenuation for the measured frequency is +10.5 dB and the cable factor for the measured frequency is 1.5 dB, giving a power of -33.0 dBm.
The measured peak power in a 100 kHz bandwidth is +3.6dBm. Therefore the Attenuation can be calculated as follows:

Attenuation = measured peak power – out of band emission receiver reading = +3.6 dBm – (-33.0 dBm) =36.6 dB

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8.7.3 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360° to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2014 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions from 9kHz - 1 GHz & 1 GHz - 40 GHz are covered in Clause 8 of ANSI C63.4-2014. The ANSI C63.4-2014 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Sub clause 8.3.2 of ANSI C63.4-2014 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2014, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTs, measuring system sensitivity, etc.

ANSI C63.4-2014 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

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8.7.4 Result

Out of band Spurious Emissions - Conducted (Transmitter) (Section 15.247) frequency, 902.750 MHz							
f	**Detct**	**BW**	**Rx Level**	**CF**	**LC**	**Limit**	**Margin**
MHz	**Type**	**kHz**	**dBm**	**dB**	**dBm**	**dBm**	**dB**
902.750	PK	100	**8.3**	**= Analyzer offset**	**26.4**	30.0	**3.6**
	PK	100	**	**= Analyzer offset + transducer factors**	**≤ -30.8**	6.4	**37.2**
	PK	100	**			6.4	
	PK	100	**			6.4	
Out of band Spurious Emissions - Conducted (Transmitter) (Section 15.247) frequency, 902.750 MHz							
f	**Detct**	**BW**	**Rx Level**	**CF**	**LC**	**Limit**	**Margin**
MHz	**Type**	**kHz**	**dBm**	**dB**	**dBm**	**dBm**	**dB**
915.250	PK	100	**8.1**	**= Analyzer offset**	**26.2**	30.0	**3.8**
	PK	100	**	**= Analyzer offset + transducer factors**	**≤ -30.8**	6.2	**37.0**
	PK	100	**			6.2	
	PK	100	**			6.2	
Out of band Spurious Emissions - Conducted (Transmitter) (Section 15.247) frequency, 902.750 MHz							
f	**Detct**	**BW**	**Rx Level**	**CF**	**LC**	**Limit**	**Margin**
MHz	**Type**	**kHz**	**dBm**	**dB**	**dBm**	**dBm**	**dB**
927.250	PK	100	**7.8**	**= Analyzer offset**	**25.9**	30.0	**4.1**
	PK	100	**	**= Analyzer offset + transducer factors**	**≤ -30.8**	5.9	**36.7**
	PK	100	**			5.9	
	PK	100	**			5.9	
Measurement uncertainty: ± 3 dB							
**** All emissions lower than the noise level of the measuring equipment! The worst case noise level is lower than -30.8 dBm**							
f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | CF : Correction factor | LC : Level corrected							

Test Cables used	K175
Test equipment used	502, 504, 505

The equipment passed the conducted tests	**Yes**	~~No~~	~~N.t.~~*

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

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8.8 Power spectral density

8.8.1 Regulation

Section 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

8.8.2 Test procedure

The EUT and this peripheral (when additional equipment exists) are placed on a turn table which is 0.8 m above the ground. The turn table would be allowed to rotate 360° to determine the position of the maximum emission level. The test distance between the EUT and the receiving antenna are 3m. To find the maximum emission, the polarization of the receiving antenna is changed in horizontal and vertical polarization; the position of the EUT was changed in different orthogonal determinations.

ANSI C63.4-2014 Section 8 “Radiated Emissions Testing”

Measurement procedures for electric field radiated emissions from 9kHz - 1 GHz & 1 GHz - 40 GHz are covered in Clause 8 of ANSI C63.4-2014. The ANSI C63.4-2014 measurement procedure consists of both an exploratory test and a final measurement. The exploratory test is critical to determine the frequency of all significant emissions. For each mode of operation required to be tested, the frequency spectrum is monitored. Variations in antenna height, antenna orientation, antenna polarization, EUT azimuth, and cable or wire placement is explored to produce the emission that has the highest amplitude relative to the limit.

The final measurements are made based on the findings in the exploratory testing. When making exploratory and final measurements it is necessary to maximize the measured radiated emission. Sub clause 8.3.2 of ANSI C63.4-2014 states that the measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” We consider the “cone of radiation” to be the 3 dB beam width of the measurement antenna.

While the “bore-sighting” technique is not explicitly mentioned in ANSI C63.4-2014, it is a useful technique for measurements using a directional antenna, such as a double-ridged waveguide antenna. Several precautions must be observed, including: knowledge of the beam width of the antenna and the resulting illumination area relative to the size of the EUT, estimation for source of the emission and general location within larger EUTs, measuring system sensitivity, etc.

ANSI C63.4-2014 requires that the measurement antenna is kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. That means that if the directional radiation pattern of the EUT results in a maximum emission at an upwards angle from the EUT, when a directional antenna is used to make the measurement it will be necessary for it to be pointed towards the source of the emission within the EUT. This can be done by either pointing the antenna at an angle towards the source of the emission, or by rotating the EUT, in both height and polarization, to maximize the measured emission. The emission must be kept within the illumination area of the 3 dB beamwidth of the antenna so that the maximum emission from the EUT is measured.

8.8.3 Result

Power spectral density (section 15.247)												
f	Detct	BW	Rx Level	MD	CF	AVC*7	LC	Peak Limit	Margin	EP	Antenna Pol	Antenna H
MHz	Type	kHz	dBm	m	dB	dB	dBm	dBm	dB	°	H / V	m
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
	PK	100		3		0					H / V	1-4
Measurement uncertainty: ± 4 dB												

f: Frequency | Detct : Detector type | BW: Bandwidth | Rx Level : Receiver level | MD: Measurement distance | CF : Correction factor | DEF :Distance extrapolation factor | AVC : Averaging Correction factor | LC : Level corrected | EP: EUT Position | Pol:Antenna polarization | H: Antenna height |

Remark: *1 noise floor noise level of the measuring instrument ≤ -103 dBm @ 3m distance (30 – 1,000 MHz)
Remark: *2 noise floor noise level of the measuring instrument ≤ -102.5 dBm @ 3m distance (1,000 – 2,000 MHz)
Remark: *3 noise floor noise level of the measuring instrument ≤ -97 dBm @ 3m distance (2,000 – 5,500 MHz)
Remark: *4 noise floor noise level of the measuring instrument ≤ -93 dBm @ 3m distance (5,500 – 14,500 MHz)
Remark: *5 noise floor noise level of the measuring instrument ≤ -90 dBm @ 3m distance (14,500 – 25,500 MHz)
Remark: *6 for using a pre-amplifier in the range between 100 kHz and 1,000 MHz
Remark: *7 for using a pre-amplifier in the range between 1.0 GHz and 18.0 GHz
Remark: *7 for using a pre-amplifier in the range between 18.0 GHz and 30 GHz
Remark: *9 for periodic operated transmitter

Test Cables used	
Test equipment used	

The equipment passed the conducted tests	~~Yes~~	~~No~~	**N.t.**[3]

Test setup photos / test results are attached	~~Yes~~	**No**	Annex no.:

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9. Additional information to the test report

Remarks	Description
N.t.[1]	Not tested, because the antenna is part of the PCB
N.t.[2]	Not tested, because the EUT is directly battery powered
N.t.[3]	Not tested, because not applicable to the EUT
N.t.[4]	Not tested, because not ordered
N.t.[5]	Not tested, because only permissive change 2

10. List of test equipment

Test equipment / Specifications	Manufacturer / Model Type	Internal Equipment No.	Calibration/ Validation Validity
Low Noise Signal Generator	Marconi 2042	6	05/21
EMI-Test Receiver	Schwarzbeck FMLK1518	22a	11/20
Field strength measurement Additional 0.09-30MHz	FMZB 1516	23	09/22
10 V Durchgangskopf	R&S URY-Z2	34a	02/22
RF Current Probe 9 kHz – 30 MHz	Rohde & Schwarz ESH2-Z1	42	06/21
VHF- Current Probe 9 kHz – 600 MHz	Rohde & Schwarz ESV-Z1	43	06/21
Passive Test Probe - 9 kHz – 30 MHz	TÜV NORD - VDE 0876	45	05/21
EFT / Burst – Generator - Up to 125 kHz | 5 kV	Schlöder GmbH - SFT 1400	46a	05/20
Coaxial Fixed Attenuator DC – 1 GHz	Texscan HFP50/10	60	07/20
Bandpass Filter 41 0 MHz – 41 MHz	Schomandl BN 86871	66	11/21
Bandpass Filter 174 0 MHz –174 MHz	Schomandl BN 86873	67	11/21
8 Wire Impedance Stabilisation Network 150 kHz – 30 MHz	Schwarzbeck CAT5 8158	71a	09/19
Artificial Mains Network 1 9 – 150 kHz / 150 kHz – 30 MHz	RFT NNB 11	72	09/19
Power Sensor 10 MHz – 18 GHz	Rohde & Schwarz NRV-Z2	76a	02/20
VHF-Half - Wave Tuned Dipole Antenna 30 –300 MHz	Schwarzbeck VHA 9103	80	04/20
Temperature Chamber – -60 °C – +70.0 °C	Brabender - TTE 32/40H	87	05/20
T-Section - 50 Ω	R&S BN 42441/50	93	08/21
Temperature cabinet	Heraeus Vötsch – VMT 04-35	102a	---
Open Area Test Site - 9 kHz – 1.0 GHz	TÜV NORD	103	10/19
Open Area Test Site - Substitution	TÜV NORD	104	06/20
ESD Simulator - Air: 0.2 – 16.5 kV | Contact: 0.2 – 9.0 kV	Schlöder GmbH - SESD 200	112a	01/20
Open Area Test Site - 1 – 6 GHz | CISPR 16	TÜV NORD	122	06/20
Microwave Frequency Counter	Hewlett-Packard - 5351A	130	11/21
Signal generator - 0.1 – 1000 MHz	Rohde & Schwarz - SMG	136	05/22
RF Current Injection Clamp 0.15 – 1000 MHz	Lüthi GmbH EM 101	156	10/19
Absorbing Clamp MDS 30MHz – 1GHz	Lüthi GmbH - MDS-21	160	10/19
Volt & RF Power Meter	Rohde & Schwarz - URV35	161	05/22
Insertion Unit	Rohde & Schwarz - URV5-Z4	162	05/22
Coaxial RF Termination - 0 – 1000 MHz	Telewave Inc. - TWL 35	164	11/21
Coaxial RF Termination - 0 – 1000 MHz	Telewave Inc. - TWL 60	165	11/21
Double Ridged Broadband Horn Antenna 2 – 18 GHz	Schwarzbeck - BBHA 9120-C	169	09/19
Spectrum Analyser - 9 kHz – 18 GHz	Rohde & Schwarz - FSL 18	171a	07/20
Fixed Attenuator - DC – 1.5GHz | 50Ω N |6 dB | 100 W	Bird - Mod/ 8343-060	177	02/20
Rotary Step Attenuator DC – 2 GHz	Texscan - TA – 50	184	03/20
Signal generator 10 kHz – 2.4 GHz	Marconi 2024	213	05/21
Miteq Amplifier - 26.5 – 40 GHz	Miteq	223a	03/20
RF Power Sensor 10 MHz – 20 GHz	Marconi - 6920	228	09/19
Radio communication Service Monitor 0.4 – 1000 MHz	Rohde & Schwarz - CMS 54	229	06/20
Voltage Interruption Simulator	Schlöder GmbH - VIS 1700	241a	03/21
Power Sensor - 40 GHz	Marconi - 6914	258	08/21
Coupling Decoupling Network 0.1 MHz – 230 MHz	MEB - KEN-M 2 /M 3	264	09/19
Volt & RF Power Meter	Rohde & Schwarz - URV35	271	09/19
Impulse limiter 10 dB	ESH3 Z2	272	05/22
Low Pass Filter DC – 520 MHz	Mini-Circuits - SLP550	273	05/21
Low Pass Filter DC – 520 MHz	Mini-Circuits - SLP550	274	05/21
Fixed Attenuator - DC – 18 GHz | 30 dB	MTS	275	11/20

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Test equipment Specifications	Manufacturer / Model Type	Internal Equipment No.	Calibration/ Validation Validity
Fixed Attenuator - DC – 18 GHz | 30 dB	MTS	276	03/20
Double Ridged Broadband Horn Antenna 0.5 – 5.5 GHz	Schwarzbeck - BBHA 9120 A	284	03/20
Power Sensor 10MHz – 26.5GHz	Marconi - 6913	286	09/19
Passive Probe - 9 kHz – 30 MHz | 2.5 kΩ	RFT-TK 121	302	06/20
Broadband Voltage, Level and Power Meter - 9 kHz – 3 GHz	Rohde & Schwarz - URY	307	05/22
Termination resistor 50 Ω	Radiall	309	11/21
Branching device (4X) 50 Ω	Rohde & Schwarz	320	09/22
Dummy-Load - 2 – 18 GHz | 50 Ω | 40 W	Narda - MODEL 367NF	343	09/19
RF-Amplifier	Narda	345	03/20
10d B Attenuator, up to 40 GHz	Parzich	353	09/22
20 B Attenuator, up to 20 GHz	Parzich	354	09/22
DC Block Adapter - 0.045 – 26.5 GHz	Hewlett-Packard - 11742A	356	04/21
Spectrum Analyzer 9 kHz – 40 GHz | 18 – 110 GHz	Anritsu MS2668C	359a	01/20
Insertion Unit 10V |9 kHz 1000 MHz	Rohde & Schwarz - URV 5-Z2	367	05/21
RF Probe 0.02 – 1000 MHz	Rohde & Schwarz	368	05/21
Coaxial Directional Coupler - 2– 4GHz	Narda - 3003-20	370/342	01/21
150W attenuator	Weinschel	374	09/22
Medium Power Fixed Coaxial Attenuator - DC – 18 GHz	Weinschel - 23-6-34	375	02/20
Gain Horn Antenna	Dorado - GH-22-25	383	---
Gain Horn Antenna	Dorado - GH-15-25	384	---
Gain Horn Antenna	Dorado - GH-10-25	385	---
Peak Power Sensor DC – 6 GHz	Rohde & Schwarz NRV-Z31	391	02/20
RF Signal Generator 5 kHz – 3 GHz	Rohde & Schwarz SME03	399	09/19
Coaxial High Pass Filter 185 – 3000 MHz	Mini-Circuits - NHP-200	405	05/21
Tri-Log Broadband Antennas 25 MHz – 2 GHz	Schwarzbeck- VULB 9168	406	05/21
4-Way-Power Splitter - DC – 2 GHz	Weinschel - 6503	407	10/19
Insertion Unit 9 kHz – 2000 MHz	Rohde & Schwarz - URY-Z2	416	09/19
Radio Interference Measuring Receiver 10 kHz – 30 MHz	Schwarzbeck - FMLK 1518	428	---
Interference Measuring Receiver 20 MHz – 1050 MHz	Schwarzbeck - FCVU 1534	430	---
Koax Adapter + St.Gain Horn 18 – 26.5 GHz	Flann 20240-25	431/626	09/20
Mitteq Amplifier - 18 – 26 GHz	Miteq	433	05/20
Coaxial High Pass Filter 700 – 3000 MHz	Mini-Circuits - NHP-700	435	05/21
Broadband Horn Antenna 14 – 40 GHz	Schwarzbeck - BBHA 9170	442	09/20
Microwave Log.-Per. Antenna 0.7 – 20 GHz	Schwarzbeck - STLP 9148	445a	05/22
DC-BLOCK - DC – 6.0 GHz |50 Ω	Mini Circuits - BLK-6-N+	462	08/21
Harmonic Mixer 60-90 GHz	R&S – FS-Z90	501	07/22
Signal & Spectrum Analyser 10 Hz - 30 GHz	Rohde & Schwarz - FSV-30	502	07/22
Fixed Attenuator - 0 – 40 GHz	Anritsu - 41KC-10	504	10/19
Fixed Attenuator - 0 – 40 GHz	Anritsu - 41KC-10	505	10/19
Fixed Attenuator - 0 – 40 GHz	Anritsu - 41KC-6	506	10/19
Fixed Attenuator - 0 – 40 GHz	Anritsu - 41KC-3	507	10/19
Harmonic Mixer 40-60 GHz	Rohde & Schwarz - FS-Z60	515	07/22
Surge / Hybrid Generator	Schlöder - CWG 1500	522	11/19
Electric Dummy Load	RA-NAV Lab. - DA-75U	526	02/20
Power Splitter / Combiner - 10 - 2000 MHz	Mini Circuits - ZESC-2-11	527	10/19
3 Way Power Splitter / Combiner 1 - 500 MHz	Mini Circuits - ZFSC-3-1	529	03/20
3 Way Power Splitter / Combiner 1 - 500 MHz	Mini Circuits - ZFSC-3-1	530	03/20

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Test equipment Specifications	Manufacturer / Model Type	Internal Equipment No.	Calibration/ Validation Validity
Standard Gain Horn Antenna - 26.5 - 40 GHz	Maury Microwave	532/628	09/20
RF-Attenuator - 6 dB	Haefely	540	03/20
RF-Attenuator - 1– 120 MHz | 12 dB	Haefely	541	03/20
RF-Attenuator - 1– 120 MHz | 39 dB	Haefely	542	03/20
Spectrum Analyser Mixer 90 – 140 GHz	Radiometer Physics - SAM-140	545	07/22
Spectrum Analyser Mixer 140 – 220 GHz	Radiometer Physics SAM-220	546	07/22
Dual Mode Potter Horn Antenna 90 – 140 GHz	Radiometer Physics 140-WR8	547	07/22
Dual Mode Potter Horn Antenna 140 – 220 GHz	Radiometer Physics 220-WR5.1	548	07/22
Dual Mode Potter Horn Antenna 60-90 GHz	Radiometer Physics 90-WR12	549	07/22
Line Impedance Stabilisation Network 9kHz – 30 MHz	Schwarzbeck - NNLA 8120	551	07/20
HV Probe P6013A	Tektronix – P6013A	559	05/21
Surge - Generator (Hybrid) 6 kV | 1.2 / 50 µs | 10/700µs	H & H - MIG 0603 IN 2 S-T	561	03/21
Spectrum Analyzer Mixer 220 – 325 GHz	Radiometer Physics - SAM 325	591	07/22
Dual Mode Potter Horn Antenna 220 - 325 GHz	Radiometer Physics 325-WR2	592	---
Waveguide Adapter WR8 - WR10 75 – 140 GHz	Radiometer Physics	593	---
20dB Attenuator, up to 18 GHz	Mini Circuit	594	09/22
Step Attenuator - DC-18 GHz | 0 to 11 dB	Hewlett-Packard 8494B	604	10/19
Analyser Reference System Harmonic / Flicker Analysis	Spitzenberger & Spies Type ARS 16/1	606a/b/c	01/20
Capacitive Coupling Clamp 5 kV (1.2/50 µs)|100 pF/1000 pF	Schlöder - SFT 415	608	05/20
Miniature Flat, Zero-Biased Schottky Detector - 0.1– 18 GHz	Narda - 4503A-03	613	06/20
Biconical Elements - 30-300 MHz	Schwarzbeck - BBA 9106	616/80	04/20
Diode Detector - 0.1 – 2.5 GHz	Spinner - BN 7545	617	09/20
RF Vector Signal Generator CW: MHz- 6 GHz	Rohde & Schwarz - SGT100A	636	04/21
Dual Mode Potter Horn Antenna 78 – 110 GHz	Radiometer Physics	649	12/20
Current probe TRMS	BEHA APROB	652	09/19
ESD – Generator	SESD 216 - Schlöder	653	10/19
Semi Anechoic Chamber (SAC)	COMTEST	660	05/21

Name of test software	Version	Date	Manufacturer
SPS EMC	V4.1.3	---	Spitzenberger & Spies GmbH
EMV-Soft	V11.95	09.12.2014	Schlöder GmbH
ISMISO	V3.63	---	EM Test AG

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11. List of test cables

Internal Cable Number	Connector Type	Frequency Range (MHz)	Cable Length (m)	Manufacturer
4a	BNC	10 – 1500	0.50	Telemeter
14a	BNC	10 – 1000	1.00	Telemeter
17a	APC3.5	10 – 26500	2.13	Huber + Suhner
18a	APC3.5	10 – 26500	2.13	Huber + Suhner
22	BNC	10 – 1000	1.50	---
27	BNC	10 – 1000	1.00	Fabrica Milanese Cond.
40	BNC	---	0.50	Aircell
43	SMA	10 – 18000	0.50	Rosenberger
44	SMA	---	0.50	Huber + Suhner
45	SMA	10 – 18000	0.50	Huber + Suhner
48	SMA		0.50	Huber + Suhner
49	N	10 – 18000	1.00	Huber + Suhner
50	N	10 – 18000	1.00	Huber + Suhner
51	N	10 – 18000	1.00	Huber + Suhner
52	N	10 – 18000	1.00	Huber + Suhner
54	BNC	10 – 3500	1.00	Aircell
58	N	10 – 18000	2.00	Huber + Suhner
59	N	10 – 18000	1.00	Huber + Suhner
60	N	10 – 18000	2.00	Huber + Suhner
61	N	10 – 18000	1.00	Huber + Suhner
62	SMA	---	0.50	Huber + Suhner
63	SMA	10 – 18000	0.50	Huber + Suhner
64	SMA	10 – 18000	0.50	Huber + Suhner
65	APC3.5	10 – 26500	0.60	---
66	APC3.5	10 – 26500	0.60	---
67	APC3.5	10 – 26500	0.60	---
68	APC3.5	10 – 26500	0.60	---
72	BNC	---	0.40	---
73	BNC	---	0.40	---
76	SMA	10 – 30000	3.00	Gore
79	BNC/N	10 – 1000	5.00	---
80	SMA	---	0.25	Huber + Suhner
87	SMA	10 – 18000	0.15	Huber + Suhner
88	SMA	10 – 18000	0.15	Huber + Suhner
89	SMA	10 – 18000	0.15	Huber + Suhner
90	SMA	10 – 18000	0.15	Huber + Suhner
91	SMA	---	1.50	Huber + Suhner
94	BNC	---	1.10	---
95	BNC	---	0.80	---
96	BNC	---	0.80	---
100	N	10 – 26500	6.00	Rosenberg
101	N	10 – 18000	2.90	Huber + Suhner
102	SMA	10 – 18000	2.00	Huber + Suhner
111	BNC	10 – 1000	0.50	---
112	BNC	10 – 1000	0.50	---
114	SMA	10 – 18000	0.25	Huber + Suhner
116	SMA	10 – 18000	0.25	Huber + Suhner
119	N	10 – 20000	8.00	Jyebao
121	SMA	10 – 18000	1.50	Huber + Suhner

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Internal Cable Number	Connector Type	Frequency Range (MHz)	Cable Length (m)	Manufacturer
122	SMA	10 – 18000	2.00	Huber + Suhner
123	SMA	10 – 18000	2.00	Huber + Suhner
145	SMA	10 – 26500	8.00	Huber + Suhner
147	APC3.5	10 – 40000	1.50	Jyebao
148	APC3.5	10 – 40000	3.00	Jyebao
151	SMA	10 – 18000	0.50	Rosenberger
152	SMA	10 – 18000	0.50	Rosenberger
154	BNC	10 – 1000	1.00	---
155	N/BNC	---	0.85	---
157	BNC	---	0.50	---
158	SMA	10 – 26500	2.00	Huber + Suhner
160	SMA	10 – 18000	0.40	Nortel Networks
161	SMA	10 – 18000	1.00	Huber + Suhner
162	APC35	10 – 26500	2.00	Huber + Suhner
163	APC3.5	10 - 26500	2.00	Huber + Suhner
164	APC3.5	10 – 26500	2.00	Huber + Suhner
165	APC2.9	10 – 26500	2.00	Huber + Suhner
166	APC3.5	10 – 40000	---	---
167	APC3.5	10 – 40000	1.00	Jyebao
168	APC3.5	10 – 40000	1.00	Jyebao
169	APC3.5	10 – 40000	1.00	Jyebao
170	APC3.5	10 – 40000	1.00	Jyebao
171	APC3.5	10 – 40000	1.00	Jyebao
172	SAM	---	0.90	Huber + Suhner
173	APC	10 – 26500	2.00	Huber + Suhner
174	APC	10 – 26500	---	Huber + Suhner
175	SMA	10 – 18000	0.40	Huber + Suhner
176	N-SMA	10 – 18000	0.50	Huber + Suhner
188	N	10 – 18000	5.00	Huber + Suhner
EMV 1	BNC	---	2.00	Henn
EMV 2	BNC	10 – 1000	2.00	Henn
EMV 4	BNC	---	9.70	Henn
EMV 5	BNC	---	3.80	Henn
EMV 6	BNC/N	10 – 1000	5.00	Lüthi
EMV 7	BNC	10 – 1000	1.50	Henn
EMV 8	BNC	10 – 1500	1.70	Henn
EMV 9	BNC	10 – 1000	1.70	Henn
EMV 11	BNC	---	5.20	Hasselt
EMV 12	BNC	10 – 1000	2.40	Hasselt
EMV 13	BNC	10 – 1000	4.10	Hasselt
EMV 14	BNC	10 – 1000	2.50	Hasselt
EMV 15	BNC	---	0.90	Henn
EMV 16	Fischer	---	2.00	---
EMV 18a	Fischer	---	1.00	---
EMV 19a	Fischer	---	1.50	---
KISN2	BNC	10 – 2000	4.80	---

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End of test report

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