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# EMV TESTHAUS GmbH

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## Summary of test results

System type: UWB device

47 CFR part and section	Test	Page	Result	Note(s)
15.207a)	AC power line conducted emissions 150 kHz to 30 MHz		Not applicable	1,2
15.203	Antenna requirement	21	Passed	
15.517(a)(1)	Signal deactivation	22		
15.503(a)(d) 15.517(b)	UWB bandwidth	26	Passed	
15.517(d)	Radiated emissions in GPS bands		Passed	
15.517(e) Peak emissions in a 50 MHz bandwidth		39	Passed	
15.209	Radiated emissions	44		
15.517(C)	9 kHz to 30 MHz	44	Passed	
	30 MHz to 1 GHz	47	Passed	
	Emissions from 960 MHz to 40 GHz	50	Passed	



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Notes (for information about EUT see clause 3):

- 1 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.
- 2 EUT is battery-powered.

Straubing, March 27, 2020

Lonad Gnapl

Konrad Graßl Head of radio department EMV **TESTHAUS** GmbH

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## **Referenced publications**

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Publication	Title
CFR 47 Part 2 October 2019	Code of Federal Regulations, Title 47 (Telecommunication), Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
CFR 47 Part 15 October 2019	Code of Federal Regulations, Title 47 (Telecommunication), Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.10 June 2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices



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## 3 Equipment under test (EUT)

All Information in this clause is declared by customer.

### 3.1 General remark

The EUT a passive NFC tag and UWB integrated. In this test report only UWB is in consideration.

## 3.2 General information

Product type:	Тад			
Model name:	KNX-T4.1-1.2-2:B			
Serial number(s):	CH 2: 40776/ CH 3: 40774/ CH 3: 39847/ CH 5: 40777			
Applicant:	KINEXON Inc.			
Manufacturer:	KINEXON GmbH			
Version:	Hardware:	TATS-01-04B		
	Software:	FW 4.27 with automatic (default for board version)	signal deactivation on KNX-T4.1-1.2-2:B)	
Additional modifications:	None			
FCC ID:	2ALC5-KNX-ATI1			
Power supply:	DC supply			
	Nominal voltage:	3 V		
Device type:	☑ Portable	□ Mobile	□ Fixed	



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## 3.3 Radio specifications

System type	UWB device		
Application frequency band:	3.1 GHz – 10.6 GHz		
Operating frequencies:	3.994 GHz, 4.493 GHz,	6.490 GHz	
Number of channels:	3 (channel 2, 3 and 5)		
Modulation:	BPM/BPSK (Burst Posit	ion Modulation/Binary Pl	nase Shift Keying)
Short description:	The Kinexon System is Ultra-Wideband (UWB) people or objects. The s Receivers, and a Kinexo small, transceiving device data (e.g., accelerations Receivers.	a Real-Time Location Sy technology. Its primary u system operates using ac on Sensor Network Appli ce with an integrated ant s, temperature) and trans	vstem (RTLS) based on se is for the tracking of ctive Tags, a network of cation. The Tag is a enna. It senses different mits the data to the
Antenna:	Type: Gain: Connector:	Dielectric chip antenna Peak 4.16 dBi at 6200 M c external temporary	ACS5200HFAUWB MHz □ internal ⊠ none (integral antenna)

### 3.4 Photo documentation

For external photos of the EUT see annex B, for internal ones see annex C. Photos taken during testing including EUT positions can be found in annex A.



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## Test configuration and mode of operation

## 4.1 Test configuration

Device Type designation		Serial or inventory no.	Manufacturer			
		EUT	·			
UWB Tag CH 2	UWB tag	40776	Kinexon			
UWB Tag CH 3	UWB tag	40774	Kinexon			
UWB Tag CH 3 UWB tag		39847	Kinexon			
UWB Tag CH 5 UWB tag		40777	Kinexon			
	Support equipment					
Power supply	3252.1	E00541	Statron			
Anchor	A-07-12	27801	Kinexon			
NUC	NUC6i5SYH		Intel			

#### Table 1: Devices used for testing

Port	Classification	Cable type	Fixed	Cable length	Note	
FOIL	(see note 1)	Cable type	rixeu	used	maximum	
none						

#### Table 2: Ports of EUT and appropriate cables<sup>1</sup>

Notes:

4

- 1 Ports of EUT are classified as "AC power", "DC power", "DC power connected to dedicated AC/DC power supply", "Signal/control" or "Wired network".
- 2 The serial port is used for configuration.

<sup>1</sup> As specified by manufacturer.



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## 4.2 Mode of operation

With the ecception of the signal deactivation test the EUT is forced by software configuration to transmit on a fixed frequency without any frequency hop or step function. All tests were performed with modulated signal.

Signal deactivation test:

Software is configured to show the normal behavior of the EUT.

### 5 Test procedures

### 5.1 General specifications

### 5.1.1 Test setups

Tabletop devices are placed on a non-conductive table with a height of 0.8 m. In case of AC power-line conducted emissions test, the rear of the EUT is located 40 cm to the vertical wall of the RF-shielded (screened) room which is used as vertical conducting plane. For radiated emission measurements above 1 GHz, tabletop devices are placed at a height of 1.5 m above the floor using a support made of styrene placed on top of the non-conductive table.

Floor-standing devices are placed either directly on the reference ground-plane or on insulating material (see clause 6.3.3 of ANSI C63.4-2014 for more details).

All other surfaces of tabletop or floor-standing EUTs are at least 80 cm from any other grounded conducting surface. This includes the case or cases of one or more LISNs when performing an AC power-line conducted emissions test.

Radiated emission measurements of equipment that can be used in multiple orientations (e.g. portable or handheld devices) are performed with the EUT in each of three orthogonal axis positions.



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## 5.2 AC power-line conducted emissions

AC power-line conducted emissions are measured according to clause 6.2 of ANSI C63.10 over the frequency range from 150 kHz to 30 MHz to determine the line-to-ground radio-noise voltage that is conducted from all of the EUT current-carrying power input terminals that are directly (or indirectly via separate transformers or power supplies) connected to a public power network. The tests are performed in a shielded room.

If the EUT normally receives power from another device that in turn connects to the public utility ac power lines, measurements are made on that device with the EUT in operation to demonstrate that the device continues to comply with the appropriate limits while providing the EUT with power. If the EUT is operated only from internal or dedicated batteries, with no provisions for connection to the public utility ac power lines (600 VAC or less) to operate the EUT (such as an adapter), then ac power-line conducted measurements are not required.

For direct current (dc) powered devices where the ac power adapter is not supplied with the device, an "off-the-shelf" unmodified ac power adapter is used. If the device is supposed to be installed in a host (e.g., the device is a module or PC card), then it is tested in a typical compliant host.

Frequency (f)	Measurement	Step size	Detector type		
	receiver bandwidth		Prescan	Prescan with FFT	Final scan
150 kHz ≤ f < 30 MHz	9 kHz	≤ 4.5 kHz	Peak, Average	Quasi-peak, Average	Quasi-peak, Average

Table 3: Bandwidth and detector type for AC power-line conducted emissions test

The AC power-line conducted emissions test is performed in the following steps:

- a) The EUT is arranged as tabletop or floor-standing equipment, as applicable, and connected to a line impedance stabilization network (LISN) with 50  $\mu$ H / 50  $\Omega$ . If required, a second LISN of the same type and terminated by 50  $\Omega$  is used for peripheral devices. The EUT is switched on.
- b) The measurement equipment is connected to the LISN for the EUT and set-up according to the specifications of the test (see table 3). At the LISN, the neutral line is selected to be tested.
- c) The prescan is performed with both detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescan, but not for final scan.
- d) When the prescan is completed, maximum levels with less margin than 10 dB or exceeding the limit are determined and collected in a list.
- e) With the first frequency of the list selected, a frequency zoom over a range of ten times of the measurement receiver bandwidth around this frequency is performed. If the EUT has no significant drift in frequency, the frequency zoom can be skipped.
- f) For final scan, the emission level is measured and the maximum is recorded.
- g) Steps e) to f) are repeated for all other frequencies in the list. At least the six highest EUT emissions relative to the limit have to be recorded.
- h) Steps c) to g) are repeated for all current-carrying conductors of all of the power cords of EUT, i.e. all phase and (if used) neutral line(s).





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## 5.3 Radiated emissions below 30 MHz

Radiated emissions below 30 MHz are measured according to clause 6.4 of ANSI C63.10 using an inductive shielded loop antenna. As this antenna measures the magnetic field only, its antenna factors are converted to electric field strength values assuming a free space impedance of 377  $\Omega$  as described in clause 4.3.1 of ANSI C63.10. This results in an additional correction of 51.53 dB.

According to clause 6.4.3 of ANSI C63.10, at frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the requirements. In this case, the results are extrapolated to the specified distance by using a recalculation factor determined according to one of the methods described in clause 6.4.4 of ANSI C63.10, provided that the maximum dimension of the device is equal to or less than 0.625 times the wavelength at the frequency being measured. As the minimum wavelength is 10 meters corresponding to the maximum frequency of 30 MHz, this requirement is fulfilled if the maximum dimension of the device is equal to or less than 6.25 meters.

Unless otherwise stated, the recalculation factor is determined according to clause 6.4.4.2 "Extrapolation from the measurement of a single point" of ANSI C63.10:

<b>d</b> <sub>near field</sub>	= 47.77 / f <sub>MHz</sub> , or
f <sub>MHz</sub>	= 47.77 / d <sub>near field</sub>

The frequency  $f_{MHz}$  at which the near field distance is equal to the limit and/or test distance is important for selection of the right formula to determine the recalculation factor:

<i>f<sub>MHz</sub></i> (300 m)	≈ 0.159 MHz
f <sub>MHz</sub> (30 m)	≈ 1.592 MHz
<i>f<sub>MHz</sub></i> (3 m)	≈ 15.923 MHz

Based on the test distances for the general radiated emission limits as specified in §15.209 of 47 CFR Part 15, the following formulas are used to determine the recalculation factor:

Frequency (f)	<b>d</b> <sub>limit</sub>	<i>d</i> <sub>measure</sub>	Formula for recalculation factor
9 kHz ≤ f ≤ 159 kHz 490 kHz < f ≤ 1.592 MHz	300 m 30 m	3 m	-40 log(d <sub>limit</sub> / d <sub>measure</sub> )
159 kHz < f ≤ 490 kHz 1.592 MHz < f ≤ 15.923 MHz	300 m 30 m	3 m	-40 log(d <sub>near field</sub> / d <sub>measure</sub> ) - 20 log(d <sub>limit</sub> / d <sub>near field</sub> )
f > 15.923 MHz	30 m	3 m	-20 log(d <sub>limit</sub> / d <sub>measure</sub> )

Table 4: Recalculation factors for extrapolation

Prescans for radiated measurements below 30 MHz are performed in a fully anechoic room (called "CDC"). The measurement distance is 3 meters. The emissions of the EUT are recorded with an EMI test receiver configured as described in table 5.



Frequency (f)	Measurement	urement Step size		Detector type			
	receiver bandwidth		Prescan	Prescan with FFT	Final scan		
9 kHz ≤ f < 150 kHz	200 Hz	≤ 100 Hz	Peak, Average	Peak Quasi-peak, Average	Peak Quasi-peak, Average		
150 kHz ≤ f < 30 MHz	9 kHz	≤ 4.5 kHz	Peak, Average	Peak Quasi-peak, Average	Peak Quasi-peak, Average		

Table 5: Bandwidth and detector type for radiated emissions test below 30 MHz

Sample calculation:

Frequency	Reading value	Antenna	Cable attenuation	Correction factor	Level
	-	correction		(Corr.)	
(MHz)	(dBµV)	(dB/m)	(dB)	(dB/m)	(dBµV/m)
10	20.00	19.59	0.33	19.92	39.92

Correction factor = Antenna correction + Cable attenuation

Level = Reading value + Correction factor = 20 dBµV + 19.92 dB/m = 39.92 dBµV/m

Prescans are performed with all detectors activated at the same time. If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans. If no limit is specified for certain detectors, final scan measurement with these detectors may be omitted.

The radiated emissions test below 30 MHz is performed in the following steps:

- a) The loop antenna is positioned with its plane perpendicular to the ground with the lowest height of the antenna 1 m above the ground.
- b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
- c) The measurement equipment is connected to the loop antenna and set-up according to the specifications of the test (see table 5).
- d) The EUT is turned to a position likely to get the maximum and the test antenna is rotated to detect the maximum of the fundamental in this EUT position.
- e) Then the EUT is rotated in a horizontal plane through 360° in steps of 45°. Starting at 0°, at each table position the spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the current table position is noted as the maximum position.
- f) After the last prescan, the significant maximum emissions and their table positions are determined and collected in a list.
- g) With the test receiver set to the first frequency of the list, the EUT is rotated by ±45° around the table position found during prescans while measuring the emission level continuously. For final scan, the worst-case table position is set and the maximum emission level is recorded.
- h) Step g) is repeated for all other frequencies in the list.
- i) Finally, for frequencies with critical emissions the loop antenna is rotated again to find the maximum of emission. At least, frequency and level of the six highest emissions relative to the limit have to be recorded. However, emissions more than 20 dB below the limit do not need to be reported.

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If the EUT may be used in various positions, steps a) to i) are repeated in two other orthogonal positions. If the EUT may be used in one position only, steps a) to i) are repeated in one orthogonal position.



Figure 2: Setup for radiated emissions test below 30 MHz

### 5.4 Radiated emissions from 30 MHz to 1 GHz

Radiated emissions in the frequency range 30 MHz to 1 GHz are measured according to clause 6.5 of ANSI C63.10 using a semi-anechoic chamber (SAC) with a ground plane on the floor. The measurement distance is 3 meters. The emissions of the EUT are recorded with an EMI test receiver configured as described in table 6.

Frequency (f)	Measurement	Step size	Detector type		
	receiver bandwidth		Prescan	Prescan with FFT	Final scan
30 MHz ≤ f ≤ 1 GHz	120 kHz	≤ 60 kHz	Peak	Quasi-peak	Quasi-peak

Table 6: Bandwidth and detector type for radiated emissions test from 30 MHz to 1 GHz

Sample calculation:

Frequency	Reading value	Antenna	Cable attenuation	Correction factor	Level
	_	correction		(Corr.)	
(MHz)	(dBµV)	(dB/m)	(dB)	(dB/m)	(dBµV/m)
100	30.00	11.71	1.06	12.77	42.77

Correction factor = Antenna correction + Cable attenuation

Level = Reading value + Correction factor = 30 dB $\mu$ V + 12.77 dB/m = 42.77 dB $\mu$ V/m

The measurement antenna is a combination of a biconical antenna and a logarithmic-periodic dipole array antenna. It is mounted on a support capable of allowing the antenna to be used in

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either horizontal or vertical polarization and in a height between 1 m and 4 m above the ground plane.

If the test receiver is capable of FFT analysis, it is used for prescans, but not for final scans.

The radiated emissions test from 30 MHz to 1 GHz is performed in the following steps:

- a) The measurement antenna is oriented initially for vertical polarization.
- b) The EUT is placed in its standard position on a turntable capable of rotation through 360° in the horizontal plane and arranged as tabletop or floor-standing equipment, as applicable. The EUT is switched on.
- c) The measurement equipment is connected to the measurement antenna and set-up according to the specifications of the test (see table 6).
- d) The table position is set to 0°.
- e) The antenna height is set to 1 m.
- f) The spectrum for the full frequency range is recorded. If the emission at a certain frequency is higher than the levels already recorded, the polarization and height of the measurement antenna as well as the current table position are noted as the maximum position.
- g) The antenna height is increased to 4 m in steps of 50 cm. At each height, step f) is repeated.
- h) The polarization of the measurement antenna is changed to horizontal.
- i) The antenna height is decreased from 4 m to 1 m in steps of 50 cm. At each height, step f) is repeated.
- j) The EUT is rotated in a horizontal plane through 360° in steps of 60°. At each table position, steps e) to i) are repeated.
- k) After the last prescan, the significant maximum emissions with their polarizations and heights of the measurement antenna as well as their table positions are determined and collected in a list.
- I) With the test receiver set to the first frequency of the list, the measurement antenna is set to the polarization and height and the table is moved to the position as determined during prescans.
- m) The antenna is moved by  $\pm 50$  cm around this height and the EUT is rotated by  $\pm 60^{\circ}$  around this table position while measuring the emission level continuously.
- n) For final scan, the worst-case positions of antenna and table are set and the maximum emission level is recorded.
- o) Steps I) to n) are repeated for all other frequencies in the list. At least, frequency and level of the six highest emissions relative to the limit have to be recorded. However, emissions more than 20 dB below the limit do not need to be reported.

If the EUT may be used in various positions, steps a) to o) are repeated in two other orthogonal positions.



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![](_page_17_Figure_0.jpeg)

Figure 3: Setup for radiated emissions test from 30 MHz to 1 GHz

### 5.5 Radiated emissions above 1 GHz

Radiated emissions above 1 GHz are measured according to clause 6.6 of ANSI C63.10 by conducting exploratory and final radiated emission tests. According to clause 6.6.4.1 of ANSI C63.10, measurements may be performed at a distance closer than that specified in the requirements. However, an attempt shall be made to avoid making final measurements in the near field of both the measurement antenna and the EUT.

For measurement of radiated emissions above 1 GHz, horn antennas are used.

Sample calculation:

Frequency	Reading value	Antenna	Correction	Cable	Correction	Level
		correction	pre-	attenuation	factor (Corr.)	
			amplifier			
(MHz)	(dBµV)	(dB/m)	(dB)	(dB)	(dB/m)	(dBµV/m)
2400	50.00	27.76	-34.57	3.51	-3.30	46.70

Correction factor = Antenna correction + Correction pre-amplifier + Cable attenuation

Level = Reading value + Correction factor = 50.00 dB $\mu$ V - 3.30 dB/m = 46.70 dB $\mu$ V/m

![](_page_17_Picture_9.jpeg)

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## 5.5.1 Exploratory radiated emissions measurements

Exploratory radiated emissions above 1 GHz are measured in a semi-anechoic chamber with RF absorbing material on the floor or a fully anechoic room. They are performed by moving the receiving antenna over all sides of the EUT at a closer distance (e.g. 0.5 or 1 m) while observing the display of the test receiver to find the emissions to be re-tested during final radiated emission measurements.

According to clause 5.3.3 of ANSI C63.10, 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 of distance (inverse of linear distance for field-strength measurements). To simplify testing and documentation, the limits are increased accordingly instead of decreasing the results.

The emissions of the EUT are displayed and recorded with an EMI test receiver operating in the spectrum analyzer mode using the settings as described in table 7.

Frequency (f)	Resolution bandwidth	Video bandwidth	Sweep time	Trace detector(s)	Trace mode(s)
f≥1GHz	1 MHz	3 MHz	AUTO	RMS	Max Hold

Table 7: Bandwidth and trace settings for exploratory radiated emissions test above 1 GHz

If during exploratory radiated emissions measurements no levels to be re-tested are found, the final radiated emissions measurement may be omitted. In this case, the chart of the exploratory radiated emissions measurements has to be reported.

### 5.5.2 Final radiated emissions measurements

Final radiated emissions above 1 GHz are measured in a semi-anechoic chamber (SAC) with RF absorbing material on the floor between measurement antenna and EUT. The measurement distance is shown in the appropriate tests. The emissions of the EUT are recorded with an EMI test receiver.

The horn antenna is mounted on a support capable of allowing the antenna to be used in either horizontal or vertical polarization For UWB the measurement procedure according clause 6.6.5 of ANSI C63.10-2013 is used, specified in clause 6.6.5.4 of ANSI C63.10-2013.

### 5.6 UWB Bandwidth measurement

The test is performed according the procedure described in clause 10.1 of ANSI C63.10.2013.

![](_page_18_Picture_12.jpeg)

### 6 Test results

This clause gives details about the test results as collected in the summary of test results on page 5.

The climatic conditions are recorded during the tests. It is ensured that the climatic conditions are within the following ranges:

Ambient temperature	Ambient humidity	Ambient pressure
15°C to 35°C	30 % to 75 %	86 kPa to 106 kPa

![](_page_19_Picture_4.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

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### 6.1 Antenna requirement

Section(s) in 47 CFR F	Part 15:	Requirement( Reference(s):	s):	15.203	
Result	🛛 Requii	ement kept	□ Re	quirement not kept	

## 6.1.1 Requirement

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, 15.221, or §15.236. 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.Test procedure

### 6.1.2 Result

Performed by:	Konrad Graßl	Date(s) of test:	April 17, 2019	

The EUT has an integrated antenna, therefore the antenna can not be changed by the user.

![](_page_20_Picture_7.jpeg)

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## 6.2 Signal deactivation

Section(s) in 47 CFR Part 15: Requirement(s): 15.517(a)(1)

Result<sup>2</sup>:

 $\boxtimes$  Test passed

Test not passed

## 6.2.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
□ Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
<ul> <li>Free space semi-anechoic chamber (FS-SAC)</li> </ul>	FS-SAC	EMV TESTHAUS	E00100
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier (1 GHz - 18 GHz)	ALS05749	Aldetec	W01007
Preamplifier (1 GHz - 18 GHz)	BBV9718B	Schwarzbeck	W01325
☑ Horn antenna	BBHA 9120D	Schwarzbeck	W00052
□ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
□ Cable set FS-SAC	RF cable(s)	EMCO ELEKTRONIK Huber + Suhner	W00096 E01032

 $^{2}$  For information about measurement uncertainties see page 76.

![](_page_21_Picture_8.jpeg)

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## 6.2.2 Limits

#### According 15.517(a)(1):

Indoor UWB devices, by the nature of their design, must be capable of operation only indoors. The necessity to operate with a fixed indoor infrastructure, e.g., a transmitter that must be connected to the AC power lines, may be considered sufficient to demonstrate this.

### 6.2.3 Test procedure

EUT has an active connection to a UWB anchor. The anchor is connected via LAN to a NUC. In the second step the power supply of the anchor/ the LAN connection are disconnected to show that EUT stops immediately transmissions without companion device. Only during this test the EUT was powered by a power supply (Statron).

![](_page_22_Picture_5.jpeg)

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## 6.2.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	March 16, 2020
Test distance:	□ 3 m	🗆 1.5 m	🛛 0.15 m

Power supply of anchor disconnected

Explanation:

Marker 1 is set on the red timeline when the power supply of the anchor was disconnected. The emissions of the EUT stop immediately (53.5 ms).

![](_page_23_Figure_5.jpeg)

#### LAN disconnected

#### Explanation:

Marker 1 is set on the red timeline when LAN was disconnected. The emissions of the EUT stop immediately (1.4 s).

![](_page_24_Figure_3.jpeg)

## 6.3 UWB bandwidth

Section(s) in 47 CFF	FR Part 15: Require		ent(s):	15.503(a)(d)	
		Reference	(s):	ANSI C63.10, clause 10.1	
Result <sup>3</sup> :	🖂 Test j	passed	🗆 Te	est not passed	

## 6.3.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
<ul> <li>Free space semi-anechoic chamber (FS-SAC)</li> </ul>	FS-SAC	EMV TESTHAUS	E00100
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier (1 GHz - 18 GHz)	ALS05749	Aldetec	W01007
Preamplifier (1 GHz - 18 GHz)	BBV9718B	Schwarzbeck	W01325
☑ Horn antenna	BBHA 9120D	Schwarzbeck	W00052
□ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
☑ Cable set FS-SAC	RF cable(s)	EMCO ELEKTRONIK Huber + Suhner	W00096 E01032

 $^{3}$  For information about measurement uncertainties see page 76.

![](_page_25_Picture_5.jpeg)

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## 6.3.2 Limits

#### According 15.517(b):

The UWB bandwidth of a device operating under the provisions of this section must be contained between 3100 MHz and 10,600 MHz.

#### 15.503(a)

UWB bandwidth. For the purpose of this subpart, the UWB bandwidth is the frequency band bounded by the points that are 10 dB below the highest radiated emission, as based on the complete transmission system including the antenna. The upper boundary is designated fH and the lower boundary is designated fL. The frequency at which the highest radiated emission occurs is designated fM.

#### 15.503(d)

Ultra-wideband (UWB) transmitter. An intentional radiator that, at any point in time, has a fractional bandwidth equal to or greater than 0.20 or has a UWB bandwidth equal to or greater than 500 MHz, regardless of the fractional bandwidth.

### 6.3.3 Test procedure

The UWB bandwidth is measured using the test procedure as described in clause 5.6

![](_page_26_Picture_9.jpeg)

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## 6.3.4 Test results

![](_page_27_Figure_1.jpeg)

![](_page_28_Figure_0.jpeg)

![](_page_29_Figure_0.jpeg)

## 6.4 Radiated emissions in GPS bands

Section(s) in 47 CFR Part 15: Requirement(s): 15.517(d) Reference(s):

Result<sup>4</sup>:

⊠ Test passed

Test not passed

## 6.4.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
□ Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
☑ Free space semi-anechoic chamber (FS-SAC)	FS-SAC	EMV TESTHAUS	E00100
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier (1 GHz - 18 GHz)	ALS05749	Aldetec	W01007
Preamplifier (1 GHz - 18 GHz)	BBV9718B	Schwarzbeck	W01325
⊠ Horn antenna	BBHA 9120D	Schwarzbeck	W00052
□ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
☑ Cable set FS-SAC	RF cable(s)	EMCO ELEKTRONIK Huber + Suhner	W00096 E01032

<sup>4</sup> For information about measurement uncertainties see page 48.

![](_page_30_Picture_8.jpeg)

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## 6.4.2 Limits

#### According 15.517(d):

In addition to the radiated emission limits specified in the table in paragraph (c) of this section, UWB transmitters operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of no less than 1 kHz:

Frequency	EIRP	calculated Fieldstrength at 3 m
(MHz)	(dBm)	(dBµV/m)
1164-1240	-85.3	10
1559-1610	-85.3	10

### 6.4.3 Test procedure

The radiated emissions in GPS bands are measured using the test procedure as described in clause 5.5.2.

![](_page_31_Picture_6.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

## 6.4.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	March 25, 2019
		Date(s) of test:	April 8, 2019
Test distance:	🗆 3 m	🗆 1.5 m	🖾 0.75 m
EUT elevation:	See notes		

RBW	10 kHz
Detector	RMS
Measurement distance	0.75 m

Note: With the reference level offset of -12 dB the measurement is referenced to the calculated limit at 3m.

MultiView	8 Spectrum		pectrum 2	X					
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Note: Worst case elevation: 120 °, measurement antenna horizontal

EMV	EMV <b>TESTHAUS</b> GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	KINEX Ta <b>KNX-T4</b> .	ON Inc. <sup>ag</sup> 1 <b>-1.2-2:B</b>
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				Aborte	u unitedation	16:3	7:43	
		EMV TEST	HAUS GmbH			KINEX	ON Inc.	
EN EN	$\Lambda \vee$	Gustav-Her	tz-Straße 35			KNY-TA	чу I-1 2-2·В	
		1.	Stroubing					

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Uttore       Other Local       Image: Control of the Local Action of the Loca							5			
Tigger         Tigger<	Ref Level 32		<b>∮⊠ Sp</b> ffset -12.00 dB	RBW 10 kHz     NBW 30 kHz	Mada Auto Sw	.m 3 🛛 🔊			Fraguanay	
Inclume yourse       Inclu	Input TDF	1 AC P	S Off	Notch Off	Mode Auto Swe	eep			Frequency .	1.2020000 GI
19:00-       10:00-	I Frequency 30 dBµV/m	Sweep							M1[1	●1Rm Max ] -5.77 dBµV/ 1.17939500 G
# Model       # 1 200 80%       Image: Control of the second of t	20 dBµV/m									
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9 BUVIT       0 </td <td>10 dBuV/m</td> <td></td> <td></td> <td>n an suis bhildheas star ann 11 an an suisteachtairte Mar an suis bhildheas star ann 11 an ann an Star ann an Star</td> <td>haning daranda data manda yana a</td> <td>augulus hard, findus sie a maa dat seine</td> <td>n han inn in An an an</td> <td></td> <td></td> <td>terestici di la constituci del presente di Aleria.</td>	10 dBuV/m			n an suis bhildheas star ann 11 an an suisteachtairte Mar an suis bhildheas star ann 11 an ann an Star ann an Star	haning daranda data manda yana a	augulus hard, findus sie a maa dat seine	n han inn in An an			terestici di la constituci del presente di Aleria.
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a devote       a devote <td< td=""><td>-30 dBµV/m</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></td<>	-30 dBµV/m									
20 dbu/db       1	-40 dBµV/m									
a devote	-50 dBµV/m									
164 GHz       7600 pts       7.6 MHz/       1.24 GHz         Marker Table       X Value       V value       Function       Function Result         M1       1.1793955 GHZ       -5.77 dBpV/m       Function       Function Result         5:33:10       25.03.2019       Atomic       Function       Function Result         5:33:10       25.03.2019       Figure 13: Chart of measurement 1164 MHz to 1240 MHz on channel 5       ote: Worst case elevation: 30 °, measurement antenna horizontal         6:00::       Worst case elevation: 30 °, measurement antenna horizontal       KINEXON Inc.       Tag         EMV       TESTHAUS       Gustav-Hertz-Straße 35       9315 Straubing       Germany	-60 dBµV/m									
With       Red       Trc       X-Value       V-Value       Function       Function Result         N1       1       1.1793955 GHz       -5.77 dBµV/m       Abored       Mathematical Science       2503.009       2503.009       2503.009       Mathematical Science       2503.009       2503.009       2503.009       2503.009       2503.009       2503.009       2503.009       2503.009       2503.009       2509.009       2509.009       2509.009       2509.009       2509.009       2509.009       2509.009       2509.009       2509.009       2509.00	1.164 GHz			7600 pts	S	7	.6 MHz/			1.24 Gł
Bi33:10 25.03.2019     Figure 13: Chart of measurement 1164 MHz to 1240 MHz on channel 5       ote: Worst case elevation: 30 °, measurement antenna horizontal	Z Marker Tal Type   Re M1	ef   Trc	X-Value	Hz -5.	Y-Value 77 dBuV/m		Function		Functio	n Result
Signature         Signature         Figure 13: Chart of measurement 1164 MHz to 1240 MHz on channel 5         tota: Worst case elevation: 30 °, measurement antenna horizontal         Signature         Entry         ENV TESTHAUS GmbH         Gustav-Herz-Straße 35         Signature         KINEXON Inc.         Tag         KINEXON Inc.         Tag         Signature         Signature         Signature         Signature         Tag         KINEXON Inc.         Tag         Signature         Signature						Aborte	ed	25.03	3.2019 Ref L	evel RBW
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure orst case el	e 13: Char evation: 3	rt of measu 60 °, measu	urement 11 urement an	64 MHz t tenna ho	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure orst case el	e 13: Char evation: 3	rt of measu 60 °, measu	irement 11 irement an	64 MHz t tenna ho	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	√ote: Wo	Figure orst case el	e 13: Char evation: 3	t of measu 0 °, measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	Note: Wo	Figure orst case el	e 13: Char evation: 3	t of measu 0 °, measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure orst case el	e 13: Char evation: 3	rt of measu 60 °, measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure	e 13: Char evation: 3	rt of measu 60 °, measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV       TESTHAUS       GmbH         Gustav-Hertz-Straße 35       94315       KINEXON Inc.         Yest       Tag       KNX-T4.1-1.2-2:B	Jote: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH       KINEXON Inc.         Gustav-Hertz-Straße 35       94315 Straubing         Germany       Germany	Jote: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure	e 13: Char	rt of measu 60 °, measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	lote: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	Note: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany Germany	Note: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany Germany	Note: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany Germany	Note: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
EMV     Gustav-Hertz-Straße 35 94315 Straubing Germany     KNX-T4.1-1.2-2:B	Note: Wo	Figure	e 13: Char	rt of measu	urement 11 urement an	64 MHz t	o 1240 M rizontal	Hz on ch	annel 5	
TESTHAUS Germany	Note: Wo	Figure	e 13: Char	rt of measu 30 °, measu	urement 11 urement an	64 MHz t	o 1240 M	Hz on ch	KON Inc.	
	Note: Wo	Figure	e 13: Char levation: 3	rt of measu 30 °, measu 40 V TESTHA ustav-Hertz-3 94315 Stra	urement 11 urement an US GmbH Straße 35 aubing	64 MHz t	o 1240 M	Hz on ch	KON Inc. Tag	

MultiView						_			
Deft and 22	B Spectrum	¥⊠ Sp	ectrum 2	🔆 🖾 Spectrur	n 3 🛛 🗵	S)			
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1.559 GHz 2 Marker Tab			5100 pt	ïs	5	.1 MHz/			1.61 G
Type   Re M1	f   Trc   1 <b>1</b>	X-Value .608975 GH	lz -6	Y-Value .26 dBµV/m		Function		Functio	n Result
		EN	∕\V TESTHA	.US GmbH			KINEX	ON Inc.	
	1∨ STHAUS	EM Gi	/V <b>TESTHA</b> Jstav-Hertz- 94315 Stra Germa	<b>US</b> GmbH Straße 35 aubing iny			KINEXO Ta KNX-T4.	ON Inc. ag 1-1.2-2:B	

## 6.5 Peak emissions in a 50 MHz bandwidth

Section(s) in 47 CFR Part 15: Requirement(s): 15.517(e) Reference(s):

Result⁵:

⊠ Test passed

Test not passed

## 6.5.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
☑ Free space semi-anechoic chamber (FS-SAC)	FS-SAC	EMV TESTHAUS	E00100
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier (1 GHz - 18 GHz)	ALS05749	Aldetec	W01007
Preamplifier (1 GHz - 18 GHz)	BBV9718B	Schwarzbeck	W01325
☑ Horn antenna	BBHA 9120D	Schwarzbeck	W00052
□ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
☑ Cable set FS-SAC	RF cable(s)	EMCO ELEKTRONIK Huber + Suhner	W00096 E01032

 $^{\rm 5}$  For information about measurement uncertainties see page 52.

![](_page_38_Picture_8.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag **KNX-T4.1-1.2-2:B** 

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## 6.5.2 Limits

#### According 15.517(e):

There is a limit on the peak level of the emissions contained within a 50 MHz bandwidth centered on the frequency at which the highest radiated emission occurs, fM. That limit is 0 dBm EIRP. It is acceptable to employ a different resolution bandwidth, and a correspondingly different peak emission limit, following the procedures described in §15.521.

Frequency	EIRP (within 50 MHz)	calculated Fieldstrength at 3 m
(MHz)	(dBm)	(dBμV/m)
3100-10600	0	95.3

According to §15.521(g)

If a resolution bandwidth other than 50 MHz is employed, the peak EIRP limit shall be 20 log (RBW/50) dBm where RBW is the resolution bandwidth in megahertz that is employed.

### 6.5.3 Test procedure

The Peak emissions measurements are performed using the test procedure for radiated measurements as described in clause 5.5.

![](_page_39_Picture_8.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

## 6.5.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	September 4, 2019
		Date(s) of test:	April 8, 2019
Test distance:	🗆 3 m	🗆 1.5 m	🖂 0.75 m
EUT elevation:	See notes		
RBW	50 MHz		
Detector	Peak		
Measurement distance	0.75 m		

Note: With the reference level offset of -12 dB the measurement is referenced to the calculated limit at 3m.

Input TDE Input1 "AERORG	dBµV/m Offset -120 16 dB <b>SWT</b> 1 n 1 AC <b>PS</b> 0 00"	dB ● RBW 50 MHz ns ● VBW 50 MHz Mo Off Notch Off	de Auto Sweep		Frequenc	cy 4.0000000 GH
Frequency Swee	:p					●1Pk Max
H1 95	5.300 dBµV/m		M3			M1[1] 91.39 dBµV/r
90 dBµV/m						5155500 011
ю dBµV/m						~
D dBuV/m						
0 dBµV/m						
0 dBµV/m						
0 dBµV/m						
:0 dBµ∨/m						
U авµv/m						
E 4.0 GHz		500 nts		100.0 MHz/		Snan 1.0 GH
Marker Table				10010 //// 127	-	0001110 011
Type   Ref   1 M1	frc   X-Va 1 <b>3.995</b>	GHz 91.3	∵Value ≱dBμV/m	Function	Fur	nction Result
			Ab	orted	<b>400</b> 04.09.2019 08:23:25	Ref Level RBW
	Figure 1	5: Chart of Pea	k emission me	asurement on	channel 2	
ote: Worst	case elevatio	n: 120 °, measu	rement antenna	a horizontal		

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	● 1Pk Max 1[1] 92.38 dBµV/m 4.48900 GHz
	1[1] 92.38 dBµV/m 4.48900 GHz
0 dBμV/m <t< th=""><th>4,40500 012</th></t<>	4,40500 012
0 dBμV/m <t< th=""><th></th></t<>	
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dBµV/m	
	Crop 1 0 CU
H.D GTZ     DOU DTS     TUULU MHZ/       Marker Table     Image: Control of the second sec	əpan 1.0 GHz
Type   Ref   Trc           X-Value         Y-Value         Function         Function           M1         1         4.489 GHz         92.38 dBµV/m	on Result
EMV TESTHAUS GmbH	
EMV TESTHAUS GmbH Gustav-Hertz-Straße 35	8

1Pk Max 2 dBµV/m 49300 GHz
■ 1Pk Max 52 dBµV/m 19300 GHz
52 dBµV/m 19300 GHz
~ .
mm
n 1 0 CHz
11110 0112

08:34:12 04.09.2019

![](_page_42_Figure_2.jpeg)

Note: Worst case elevation: 30 °, measurement antenna horizontal

Channel	measured fieldstrength RBW 50 MHz (dBµV/m at 3 m)	Limit RBW 50 MHz (dBµV/m at 3 m)	Margin (dB)	Result
2	91.39	95.30	3.91	passed
3	92.38	95.30	2.92	passed
5	91.52	95.30	3.78	passed

EMV	EMV <b>TESTHAUS</b> GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	KINEX Ta KNX-T4.	ON Inc. <sup>ag</sup> 1-1.2-2:B
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### 6.6 Radiated emissions 9 kHz to 40 GHz

### 6.6.1 Emissions below 30 MHz

Section(s) in 47 CFR Part 15: Requirement(s): 15.209, 15.517(c) Reference(s):

Result<sup>6</sup>:

 $\boxtimes$  Test passed

□ Test not passed

## 6.6.1.1Test equipment

Туре	Designation	Manufacturer	Inventory no.
☑ Compact Diagnostic Chamber (CDC)	VK041.0174	Albatross Projects	E00026
Open area test site (OATS)		EMV TESTHAUS	E00354
EMI test receiver (CDC)	ESCI 3	Rohde & Schwarz	E00552
EMI test receiver (OATS)	ESCI 3	Rohde & Schwarz	E00001
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
□ Field probe	RF-R 400-1	Langer EMV-Technik	E00270
☑ Loop antenna	HFH2-Z2	Rohde & Schwarz	E00060
⊠ Cable set CDC	RF cable(s)	Huber + Suhner AME HF-Technik AME HF-Technik Stabo	E00446 E00920 E00921 E01215
Test software	EMC32-EB (V10.35)	Rohde & Schwarz	E00777
Test software	EMC32-MEB (V10.35)	Rohde & Schwarz	E00778
Test software	EMC32-MEB (V10.35)	Rohde & Schwarz	E01073

<sup>6</sup> For information about measurement uncertainties see page 55.

![](_page_43_Picture_9.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag **KNX-T4.1-1.2-2:B** 

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## 6.6.1.2 Limits

#### According 15.517(c):

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency	Field s	Measurement distance	
(MHz)	(µV/m)	(dBµV/m)	(m)
0.009 - 0.490	2400/F(kHz) (266.67 – 4.90)	48.52 – 13.80	300
0.490 – 1.705	24000/F(kHz) (48.98 – 14.08)	33.80 – 22.97	30
1.705 – 30	30	29.54	30

Table 9: General radiated emission limits up to 30 MHz according to §15.209

## 6.6.1.3 Test procedure

The emissions below 30 MHz are measured using the test procedure for radiated measurements as described in clause 5.3.

![](_page_44_Picture_7.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

## 6.6.1.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	March 28, 2019
Test distance:	🖾 3 m	🗆 10 m	□ m
Antenna alignment:	$\boxtimes$ in parallel	$\Box$ in line	□ angle °
EUT position:	Position X	☑ Position Y	☑ Position Z

Frequency range	Step size	IF	De	tector	Measure	ment Time	Preamplifier
		Bandwidth	Prescan	Final scan	Prescan	Final scan	
9 kHz – 150 kHz	70.5 Hz	200 Hz	PK	PK,	2 s	1 s	Off
150 kHz – 30 MHz	7.462 kHz	9 kHz	PK	PK	2 s	1 s	Off

Note: Exploratory measurements are performed in all positions as indicated. However, the figures and result tables within this test report show only the worst case position. Pre- measurements have shown that there is no difference between the channels 2, 3 and 5, therefore representative only channel 2 was tested finally.

![](_page_45_Figure_4.jpeg)

Figure 18: Chart of emissions test below 30 MHz on channel 2 in position X

Note: No assessable values could be detected.

EMV	EMV <b>TESTHAUS</b> GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	KINEXO Tag KNX-T4.1	N Inc. ] 1 <b>.2-2:B</b>
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## 6.6.2 Emissions from 30 MHz to 960 MHz

Section(s) in 47 CFR Part 15:

Requirement(s): Reference(s): 15.209, 15.517(c)

Result<sup>7</sup>:

 $\boxtimes$  Test passed

□ Test not passed

## 6.6.2.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
<ul> <li>Free space semi-anechoic chamber (FS-SAC)</li> </ul>	FS-SAC	EMV TESTHAUS	E00100
□ EMI test receiver (CDC)	ESCI 3	Rohde & Schwarz	E00552
EMI test receiver (OATS)	ESCI 3	Rohde & Schwarz	E00001
EMI test receiver	ESR 7	Rohde & Schwarz	E00739
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
□ TRILOG broadband antenna (CDC)	VULB 9160	Schwarzbeck	E00011
□ TRILOG broadband antenna (OATS)	VULB 9163	Schwarzbeck	E00013
☑ TRILOG broadband antenna (SAC)	VULB 9162	Schwarzbeck	E00643
☑ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
□ Cable set FS-SAC	RF cable(s)	Teledyne Reynolds Huber + Suhner Teledyne Reynolds	E00435 E00307 E00433
☑ Test software	EMC32-EB (V10.35)	Rohde & Schwarz	E00777
Test software	EMC32-MEB (V10.35)	Rohde & Schwarz	E00778
Test software	EMC32-MEB (V10.35)	Rohde & Schwarz	E01073

 $^{7}$  For information about measurement uncertainties see page 54.

![](_page_46_Picture_10.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

## 6.6.2.2 Limits

#### According 15.517(c):

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency	Field s	trength	Measurement distance
(MHz)	(µV/m)	(dBµV/m)	( <i>m</i> )
30 – 88	100	40.00	3
88 – 216	150	43.52	3
216 - 960	200	46.02	3

Table 10: General radiated emission limits ≥ 30 MHz to 960 MHz according to §15.209

## 6.6.2.3 Test procedure

The emissions from 30 MHz to 1 GHz are measured using the test procedure for radiated measurements as described in clause 5.4.

![](_page_47_Picture_7.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

## 6.6.2.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	March 29, 2019
Test distance:	⊠ 3 m	🗆 10 m	□ m
EUT position <sup>8</sup> :	Position X	□ Position Y	Position Z

Frequency range	Step	IF	Dete	ector	Measure	ment Time	Preamplifier
	size	Bandwidth	Prescan	Final scan	Prescan	Final scan	
30 MHz – 1 GHz	30 kHz	120 kHz	QP	QP	1 s	1 s	20 dB

Note: Exploratory measurements are performed in all positions as indicated. However, the figures and result tables within this test report show only the worst case position. Pre- measurements have shown that there is no difference between the channels 2, 3 and 5, therefore representative only channel 2 was tested finally.

![](_page_48_Figure_4.jpeg)

![](_page_48_Figure_5.jpeg)

Note: No assessable values could be detected.

<sup>8</sup> Exploratory measurements are performed in all positions as indicated. However, the figures and result tables within this test report show the worst case position, only.

EMV	EMV <b>TESTHAUS</b> GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany	KINEXO Taر <b>KNX-T4</b> .1	9 Inc. 9 - <b>1.2-2:B</b>
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## 6.6.3 Emissions from 960 MHz to 40 GHz

Section(s) in 47 CFR Part 15: Requirement(s): 15.517(c) Reference(s):

Result<sup>9</sup>:

⊠ Test passed

Test not passed

## 6.6.3.1 Test equipment

Туре	Designation	Manufacturer	Inventory no.
Semi-anechoic chamber (SAC)	SAC3	Albatross Projects	E00716
☑ Free space semi-anechoic chamber (FS-SAC)	FS-SAC	EMV TESTHAUS	E00100
EMI test receiver	ESU 26	Rohde & Schwarz	W00002
EMI test receiver	ESW 44	Rohde & Schwarz	E00895
Preamplifier (1 GHz - 18 GHz)	ALS05749	Aldetec	W01007
Preamplifier (1 GHz - 18 GHz)	BBV9718B	Schwarzbeck	W01325
Preamplifier (16 GHz - 40 GHz)	BBV9721	Schwarzbeck	W01350
☑ Horn antenna	BBHA 9120D	Schwarzbeck	W00052
☑ Horn antenna	BBHA 9170	Schwarzbeck	W00054
□ Cable set SAC	RF cable(s)	Huber + Suhner	E00755 E01033 E01034
☑ Cable set FS-SAC	RF cable(s)	EMCO ELEKTRONIK Huber + Suhner	W00096 E01032

<sup>9</sup> For information about measurement uncertainties see page 52.

![](_page_49_Picture_8.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag **KNX-T4.1-1.2-2:B** 

190123-AU01+W01

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## 6.6.3.2 Limits

#### According 15.517(c):

The radiated emissions at or below 960 MHz from a device operating under the provisions of this section shall not exceed the emission levels in §15.209. The radiated emissions above 960 MHz from a device operating under the provisions of this section shall not exceed the following average limits when measured using a resolution bandwidth of 1 MHz:

Frequency (MHz)	EIRP (dBm)	calculated Fieldstrength at 3 m (dBμV/m)
960-1610	-75.3	20
1610-1990	-53.3	42
1990-3100	-51.3	44
3100-10600	-41.3	54
Above 10600	-51.3	44

Table 11: Radiated emission limits above 960 MHz to 40 GHz according to §15.517

### 6.6.3.3 Test procedure

The emissions from 30 MHz to 1 GHz are measured using the test procedure for radiated measurements as described in clause 5.5.

![](_page_50_Picture_7.jpeg)

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#### 6.6.3.4 Test results

Performed by:	Konrad Graßl	Date(s) of test:	March 25, 2019
		Date(s) of test:	April 8, 2019
Test distance:	960 MHz to 16.5 GHz:	□ 1 m	⊠ 0.75 m
	16.5 GHz to 40 GHz :	□ 3 m	⊠ 0.30 m
EUT elevation:	See notes		
Measurement 960 MH	z to 16.5 GHz:		
RBW	1 MHz		
Detector Measurement distance	RIVIS 0.75 m		
	0.70 m		
Note: With the referenc limit at 3m.	e level offset of -12 dB the	e measurement is ref	ferenced to the calculated
<b>Measurement 17 GHz</b> RBW	<b>to 40 GHz</b> 1 MHz		
Pre-measurement:			
Detector	Peak		
Measurement distance	0.15 m		
Note: With the referenc limit at 3m.	e level offset of -26 dB the	e measurement is re	ferenced to the calculated
Final measurement:			
Detector	RMS		
Measurement distance	0.3 m		
Note: With the referenc limit at 3m.	e level offset of -20 dB the	e measurement is ref	ferenced to the calculated
	EMV TESTHAUS GmbH		KINEXON Inc.
EMV	Gustav-Hertz-Straße 35		тад KNX-T4.1-1.2-2:В
TESTHAUS	Germany		
	•	1	

MultiView 8	Spectrun	י								V
Ref Level 90.0 Att Input	0 dBµV/m C 5 dB • S 1 AC P	0ffset -12.00 dB ● WT 12.1 s ● S Off	RBW 1 MHz VBW 3 MHz M Notch Off	1ode Auto Swee	p		Fr	equency 3	3.9800000 G	Hz
DF Frequency Sy	weep								●1Rm Ma	ах
Limit Che Line1551	ck 7		PASS PASS					M1	[1] 49.31 dBμV 3.993730 6	'/m GHz
I dBµV/m										
I dBµV/m										
I dBµV/m										
I dBµV/m				M1	<b>*</b> .					
I dBµV/m										
I dBµV/m										
517										
00pv/11										
dBJV/m	$\sim\sim$			-						
dBuV/m										
.004,00										
60.0 MHz			12100 pts		60	  4.0 MHz/			7.0 G	Hz
Marker Table Type   Ref	e   Trc	X-Value		/-Value		Function		Functio	n Result	
M1	1	3.99373 GHz	49.3	1 dBµV/m						
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °. measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M htenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 №	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 №	IHz to 7 G orizontal.	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M ntenna h	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro	m 960 M htenna h	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20 °, measu	ns test fro rement ar	m 960 M htenna h	IHz to 7 G	Hz on cha	annel 2		
ote: Wor	Figure	e 20: Chart levation: 12	of emissior 20°, measu	s test fro rement ar	m 960 M htenna h	IHz to 7 G	Hz on cha	annel 2 ON Inc.		
ote: Wor	Figure st case e	e 20: Chart levation: 12	of emission 20 °, measu V <b>TESTHAUS</b> stav-Hertz-Sti 94315 Stroub	S GmbH raße 35	m 960 M htenna h	IHz to 7 G	Hz on cha	ON Inc.		
ote: Wors	Figure st case e	e 20: Chart levation: 12  B	of emission 20 °, measu 20 °,	S GmbH raße 35 ping	m 960 M htenna h	IHz to 7 G	KINEX	ON Inc.		

MultiView	Spectrum	Sp 🖾 Sp	ectrum 2 🛛 🔆	Spectrum	13 🔆 🛛	)			
Ref Level 90.0 Att Input	00 dBµV/m 0 0 dB ● 5 1 AC P	Offset -12.00 dB SWT 20 s SS Off	<ul> <li>RBW 1 MHz</li> <li>VBW 3 MHz</li> <li>Notch Off</li> </ul>	Mode Auto Sweep	þ		Fi	requency 12	2.0000000 G
TDF 1 Frequency Sw	veep								●1Rm Ma
Limit Chec Line15517	sk 7		PASS PASS					M1[	[1] 37.92 dBμV 7.986750 (
80 dBµV/m									
70 dBµV/m									
60 dBuV/m									
.5517									
50 dBµV/m									
40 dBµV/m									
30 dBµV/m								_	
	L								~~~~
20 000000									
10 dBµV/m									
0 dBµV/m									
7.0.047			20000 pts		1	0 CH=/			17.0.0
2 Marker Table		<u>v 11 1</u>	20000 pts		1			·	17.0 G
M1	1	7.98675 GH	z 37.9	<b>9-Value</b> <b>92 dBμV/m</b>		Function		Functio	on Result
lote: Wors	Figur st case el	e 21: Char levation: 6	rt of emissio 0 °, measur	ons test froi rement ante	m 7 MHz enna hor	z to 17 G izontal.	Hz on ch	annel 2	
Jote: Wors	Figur	e 21: Char levation: 6	rt of emissio 0 °, measur	ons test froi rement ante	m 7 MHz enna hor	z to 17 G	Hz on ch	annel 2	
lote: Wors	Figur	e 21: Char levation: 6	rt of emissio 0 °, measur	ons test from	m 7 MHz	z to 17 G	Hz on ch	annel 2	
lote: Wors	Figur	e 21: Char levation: 6	rt of emissio 0 °, measur	ons test from	m 7 MHz	z to 17 G izontal.	Hz on ch	annel 2	
lote: Wors	Figur	e 21: Char levation: 6	rt of emissio 0 °, measur	ons test from	m 7 MHz enna hor	z to 17 G	Hz on ch	annel 2	
lote: Wors	Figur	e 21: Char levation: 6	rt of emissio	ons test from	m 7 MHz enna hor	z to 17 G	Hz on ch	annel 2	
lote: Wors	Figur	e 21: Char levation: 6	rt of emissio	ons test from	m 7 MHz enna hor	z to 17 G	Hz on ch	annel 2	
Note: Wors	Figur	e 21: Char levation: 6	rt of emissio 0 °, measur 0 °, measur	S GmbH	m 7 MHz enna hor	z to 17 G	Hz on ch	XON Inc. Tag 4.1-1.2-2:B	
	Figur	e 21: Char levation: 6 EN Gu	rt of emissio 0 °, measur 0 °,	S GmbH traße 35 ubing	m 7 MHz enna hor	z to 17 G	Hz on ch	XON Inc. Tag <b>4.1-1.2-2:B</b>	5

Att Input	0 dB SWT 1 AC PS	92 ms ● VBW 3 MF Off Notch C	।z Iz <b>Mode</b> Auto ९ ff	Sweep		Fr	equency 28.5	000000 GH
TDF Frequency Sw	veep							⊙1Pk Max
Limit Chec 0 dBµV/m <del>re15517</del>	k	F	ASS ASS				M1[1]	31.98 dBµV/ 39.799500 G
5517								
0 dBµV/m								
0 dBµV/m								dillore della d
المريد الالارمام	والمحاولة والطولية والمحاورة والمارية	والاعادة والماديران بالمعالم ومقارر الما	and a little distant	and an entry in the stand			n en <mark>her fallte her ett beställte ett</mark> som ander som etter s	
		terre and a place fills affer the second		and a second		in C		
0 dBu) (/m								
dBµV/m								
10 dBµV/m								
20 dBuV/m								
30 dBµV/m								
40 dBµV/m								
17.0 GHz		23000	) pts		2.3 GHz/		4 2019 ( Ref Leve	40.0 GH
7:53:09 08.0	4.2019					17	.53:09	
Table 1	2: Chart of er	nissions test f me	rom 17 GH asuremen	Hz to 40 G	Hz on cha 15 cm	annel 2, pr	e-measure	ment at
lote <sup>.</sup> Pre-r	neasurement	ts have shown	that there	is no ass	essahle e	mission of	the FLIT in	n this
equency i	range. Repre	sentative the i	neasurem	ent with e	levation 0	° measur	ement ante	enna
orizontal i	s shown.					,		

![](_page_54_Picture_1.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

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Deft avail 01 0	🗄 Spectrum	🖾 Spectri	.ım 2 🛛 🔆	Spectrum	3 🔆 🛙					
Att	0 dBµV/m Offset	-12.00 dB • RB	N 1 MHz N 3 MHz N					Frequency	. 2 05	200000 G
Input	1 AC PS	Off Not	ch Off	iode Auto Sweep				rrequency	y 3.90	
1 Frequency S	weep		LINES						M2[1]	• 1Rm Ma
Line1551	7		PASS						wiz[1]	1.896900 (
80 dBµV/m									MILI	4.648140 (
70 dBµV/m										
6U dBµV/m						M1				
50 dBµV/m						ž.				
40. dBuV/m										
to appy/in										
30 dBµV/m										
5517	M2									and the second division of the second divisio
				Joshul and						
Ì9∕dBµV/m										
0 dBµV/m										
960.0 MHz Marker Table			12100 pts		60-	4.0 MHz/				7.0 G
Type   Ref	Trc	X-Value		/-Value		Function		Func	ction Re	sult
M1 M2	1 4.6 1 1.	4814 GHZ 8969 GHZ	51.3 18.4	завµv/m 1 dBµV/m						
lote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
lote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
lote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
lote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
lote: Wor	st case eleva	ation: 0 °, n	neasurei	ment anten	na horiz	zontal.				
ote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
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ote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
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ote: Wor	st case eleva	ation: 0 °, n	neasurei	ment anten	na horiz	zontal.				
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lote: Wor	st case eleva	ation: 0 °, n	neasurer	ment anten	na horiz	zontal.				
lote: Wor	st case eleva	ation: 0 °, n EMV T Gusta	ESTHAUS	S GmbH raße 35	na horiz	zontal.	KINE	XON Inc Tag 4.1-1.2-2	с. ::В	
	st case eleva	ation: 0 °, n EMV T Gusta 94	ESTHAUS V-Hertz-St 315 Straul Germany	S GmbH raße 35 bing		zontal.	KINE KNX-T	XON Inc Tag <b>4.1-1.2-2</b>	с. ::В	

		<u> </u>	ectrum 2 📯 🖄	C Spectrun	13 🔆 🗵				
Ref Level 71.0 Att	0 dBµV/m 01 0 dB ● SV	ffset -12.00 dB ( WT 20 s (	RBW 1 MHz VBW 3 MHz Mo	de Auto Sweep	,		Freq	uency <b>12.00</b>	000000 GH
Theorem Sv	Veep	5 Off	Noten Off						●1Rm Max
Limit Cheo Line1551	ck 7		PASS PASS					M1[1]	37.36 dBµV/n 8.985750 GH
) dBµV/m									
517 ) dBµV/m									
d du u (/m	N	an							
) dBµV/m								~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
J dBpV/m									
) dBµV/m									
dBui Um									
0 dBµV/m									
0 dBµV/m									
.0 GHz			20000 pts		1	.0 GHz/			17.0 GHz
Marker Table Type   Ref	e   Trc	X-Value	Y-	Value		Function		Function Re	esult
M1	1	8.98575 GH	z 37.36	dBµV/m	·		09.04.2	D10 ( Pof Lough	
ote: wors	st case el	levation: 0	°, measurem	nent anter	nna hori	zontal.			
ote: vvors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
ote: vvors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
de: wors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
jte: wors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
ote: wors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
ote: wors	st case el	levation: 0	°, measurem	nent anter	nna hori.	zontal.			
	st case el	levation: 0	°, measurem	GmbH	nna hori.	zontal.	KINEXC	DN Inc.	
		EM Gu	°, measurem N <b>TESTHAUS</b> Istav-Hertz-Stra 94315 Straubi Germany	GmbH aße 35 ing	nna hori.	zontal.	KINEXC Ta KNX-T4.1	DN Inc. g <b>-1.2-2:B</b>	

MultiView	Spectrum								
Ref Level 54.: Att Input TDF	обавµv/m Offis OdB SW1 1 AC PS	et -26.00 dB 92 ms Off	F Notch Off	Mode Auto Swe	ер		Fre	quency <b>28.5</b>	000000 G
Frequency S Limit Che	weep ck		PAS	s				M1[1]	●1Pk Ma 32.18 dBµV
ой авру <u>у (mre 155 1</u>	7		PAS	S					39.182500 0
5517 Ю dBµV/m									M1
10 dBµV/m			bonosta		la contenna en la sul contenna	و بالارد و بالعرب الغال أول ال	and the state of t		
e ta An					a particular desired and a second second	a fan Sanaa Milanaa Jan ywyse.			
.0 dBµV/m									
dBµV/m									
10 dBµV/m									
20 dBµV/m									
30 dBµV/m									
40 dBµV/m									
10 dBµV/m 7.0 GHz ':43:38 08.0	04.2019 Table •measurem	13: Cha nents ha	rt of emission	ons test fr	om 17 GF	Iz to 40 G	Hz on cha	2019 Ref Leve annel 3 the EUT ir	40.0 C
<sup>40 dBµV/m</sup> <u>17.0 GHz</u> 7:43:38 08. lote: Pre- equency	04.2019 Table measurem range. Re	13: Cha nents ha presenta	rt of emission ve shown that the mean of t	ons test front there i easurement	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve annel 3 the EUT in ment ante	40.0 G RBW
<sup>40 dBμV/m</sup> 17.0 GHz 7:43:38 08. Iote: Pre- requency orizontal	Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emissions in the metal of	ons test front there is easurement	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve annel 3 the EUT in ment ante	40.0 C
lote: Pre- equency orizontal	Table •measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test fr hat there i easureme	om 17 GF s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve annel 3 the EUT ir ment ante	40.0 C
<sup>40 dBμV/m</sup> <u>17.0 GHz</u> 7:43:38 08.0 lote: Pre- requency orizontal	Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission ve shown the me	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve annel 3 the EUT ir ment ante	40.0 C RBW
<sup>40 dBµV/m</sup> 17.0 GHz 7:43:38 08.0 ote: Pre- equency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission we shown the me	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve annel 3 the EUT ir ment ante	40.0 C
to dBµV/m 17.0 GHz 7:43:38 08.0 ote: Pre- equency orizontal	Table Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test front there is easurement	om 17 GF s no asse nt with ele	Iz to 40 G	Hz on cha	2019 Refleve annel 3 the EUT ir ment ante	40.0 C
<sup>40 dBµV/m</sup> 17.0 GHz 7:43:38 08.0 lote: Pre- equency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test frank	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Ref Leve	40.0 C RBW
to dBµV/m 17.0 GHz 7:43:38 08.0 lote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha hents ha presenta	rt of emissioner en	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G	Hz on cha	2019 Refleve annel 3 the EUT in ment ante	40.0 C
40 dBµV/m 17.0 GHz 7:43:38 08,0 lote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test frank	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Refleve annel 3 the EUT ir ment ante	40.0 C
<sup>40 dBμV/m</sup> 17.0 GHz 7:43:38 08.0 lote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Refleve annel 3 the EUT in ment ante	40.0 G
<sup>40 dBμV/m</sup> 17.0 GHz 7:43:38 08.0 Iote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test from the there is the there is the there is the	om 17 GF s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Refleve annel 3 the EUT in ment ante	40.0 G
40 dBμV/m 17.0 GHz 7:43:38 08.0 lote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test fra	om 17 GH s no asse nt with ele	Iz to 40 G ssable em vation 0 °	Hz on cha	2019 Refleve	40.0 G RBW
40 dBμV/m 17.0 GHz 7:43:38 08.0 Prequency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission ive shown the me	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Refleve annel 3 the EUT in ment ante	40.0 G
40 dBµV/m 17.0 GHz 7:43:38 08.0 lote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emission	ons test from the there is the there is the there is the	om 17 GH s no asse nt with ele	Iz to 40 G ssable em	Hz on cha	2019 Refleve	40.0 C RBW
40 dBμV/m 17.0 GHz 7:43:38 08.0 Iote: Pre- requency orizontal	04.2019 Table measurem range. Re is shown.	13: Cha nents ha presenta	rt of emissie	ons test fr hat there i easureme	om 17 GH s no asse nt with ele	Iz to 40 G ssable em vation 0 °	Hz on cha	2019 Refleve	40.0 G

![](_page_57_Picture_1.jpeg)

EMV **TESTHAUS** GmbH Gustav-Hertz-Straße 35 94315 Straubing Germany KINEXON Inc. Tag KNX-T4.1-1.2-2:B

MultiView 😁 Spe	ctrum						
Ref Level 73.00 dBµV/           Att         0 d           Input         1 4	m Offset -12.00 dB ● RBV dB ● SWT 19.3 s ● VBV MC PS Off Not	V 1 MHz V 3 MHz Mode Auto Sw ch Off	veep		F	requency 5.	7800000 GH
IDF I Frequency Sweep		DASS				M1[1]	●1Rm Ma
Line15517		PASS				WILIJ	6,489510 G
50 dBµV/m							
50 dBµV/m							
40 dBµV/m							
30 dBµV/m							
5517,							
		~~~~					
D dBµV/m							
-10 dBµV/m							
-20 dBµV/m							
960.0 MHz		19300 pts	9	54.0 MHz/			
Marker Table Type   Ref   Trc	X-Value	Y-Value		Function		Function	Result
M1 1	6.48951 GHz	51.42 dBµV/m	) there	ad monormal	25.03	.2019 ( Ref Lev	el RBW
iote: worst ca	se elevation: 30 °,	measurement a	ntenna ho	orizontal.			
					KINFX	ON Inc	
	EMV T Gustav	ESTHAUS GmbH /-Hertz-Straße 35			T	ag	
EMV	943	315 Straubing			κΝΧ-Τ4	.1-1.2-2:B	
		Germany	1				

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MultiView 88	Spectrum	n 🖾 Spe	ectrum 2 🔌	Spectr	um 3 🛛 🔆 🛽	K)			
Ref Level 53.00 Att Input	, DdBµV/m C 0dB●S 1AC F	Dffset -12.00 dB SWT 6.4 s PS Off	<ul> <li>RBW 1 MHz</li> <li>VBW 3 MHz</li> <li>Notch Off</li> </ul>	Mode Auto Sw	/eep		Fr	requency 13.8	3000000 G
TDF I Frequency Sw	еер		DAC	2		1		M1[1]	●1Rm Ma
50 dBµV/Milt Check Line15517	<		PAS	3				WI[I]	12.978500 (
5517 Ю dBμV/m									
30 dBµV/m									
20 dBµV/m									
10 dBµV/m									
) dBµV/m									
-10 dBµV/m									
-20 dBuV/m									
-30 UBPV/M									
40 dBµV/m									
10.6 GHz Marker Table	_		6400 pts		64	10.0 MHz/	1		17.0 G
N1 N1	1 1	X-Value 12.9785 GH:	z 30.	Y-Value 43 dBuV/m		Function		Function F	Result
6:13:48 25.03 lote: Wors	Figure Figure	25: Chart ( levation: 3(	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 ( rizontal.	GHz on c	3.2019 13:48 Ref Levi	el RBV
6:13:48 25.03 lote: Wors	Figure Figure	25: Chart d	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 ( rizontal.	GHz on c	3.2019 13:48 Ref Leve	RBW
6:13:48 25.03 Jote: Wors	Figure Figure	25: Chart ( levation: 30	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 1:13:48 Ref Levi	RBW
6:13:48 25.03 lote: Wors	Figure Figure	25: Chart ( levation: 3(	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 13:48 Ref Levi	RBW
5:13:48 25.03	Figure Figure	25: Chart ( levation: 3(	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 13:48 Ref Levi	AL RBV
6:13:48 25.03	Figure t case el	25: Chart ( levation: 3(	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 13:48 Ref Levi	al RBW
6:13:48 25.03	Figure Figure	25: Chart ( levation: 3(	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 Hannel 5	el RBW
6:13:48 25.03	Figure t case el	25: Chart d	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	<sup>25.03</sup> 16 GHz on c	3.2019 13:48 Ref Levi	ai RBW
5:13:48 25.03	Figure t case el	25: Chart d	of emission 0 °, measu	ns test fro rement ar	Aborto	Hz to 17 (	25.0: 16 GHz on c	3.2019 Hannel 5	al RBV
5:13:48 25.03	Figure t case el	25: Chart (	of emissio 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	25.03 16 GHz on c	3.2019 :13:48 Ref Levi	al RBV
5:13:48 25.03	Figure Figure t case el	25: Chart ( levation: 3(	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	<sup>25.03</sup> 16 GHz on c	3.2019 1:13:48 Ref Levi	al RBV
5:13:48 25.03 lote: Wors	Figure Figure t case el	25: Chart ( levation: 3(	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	25.03 16 GHz on c	3.2019 Hannel 5	
5:13:48 25.03	Figure t case el	25: Chart (	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 Hannel 5	
6:13:48 25.03	Figure Figure t case el	25: Chart (	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 (	GHz on c	3.2019 hannel 5	
6:13:48 25.03	Figure t case el	25: Chart ( levation: 3	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 ( rizontal.	GHz on c	3.2019 hannel 5	
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6:13:48 25.03	Figure t case el	25: Chart (	of emission 0 °, measu	ns test fro rement ar	m 10.6 G	Hz to 17 ( rizontal.	GHz on c	3.2019 hannel 5 hannel 5	
5:13:48 25.03	Figure t case el	25: Chart d levation: 30	of emission 0 °, measu 10 °, measu	IS GmbH	m 10.6 G	Hz to 17 ( rizontal.	GHz on c	XON Inc.	

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TDF I Frequency Sweep	- F3 0	in Noten on						●1Pk Ma>
Limit Check 50 dBµV/m <del>e15517</del>		PASS PASS	3				M1[1]	31.35 dBµV/ 39.162500 G
5517 :0 dBμV/m								
0 dBuV/m								M1
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0 dBµV/m								
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30 dBµV/m								
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30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019		23000 pts	5	2 Aborte	:.3 GHz/	08.04.2	019 Ref Level	40.0 G RBW
30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019	able 14: Cha	23000 pts	s ons test fro	Aborte	z to 40 G	08.04.2 17:51 Hz on cha	nnel 5	40.0 G
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40 dBµV/m 17.0 GHz 7:58:37 08.04.2019 Ta lote: Pre-meas 'equency range ertical is shown	able 14: Cha urements ha e. Represent	23000 pts art of emissio ave shown th tative the me	ons test fro nat there is asureme	2 Aborte	z to 40 G ssable en vation 0 °	Hz on chanission of t , measure	nnel 5 he EUT in ment ante	40.0 G RBW
30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019 Table State St	able 14: Cha urements ha a. Represent	art of emissio ave shown th tative the me	ons test fro nat there is asureme	Aborte	z to 40 G ssable em	Hz on chanission of t	nnel 5 he EUT in ment ante	40.0 Gr RBW
30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019 Table State St	able 14: Cha urements ha a. Represent	23000 pts art of emissio ave shown th tative the me	ons test fro nat there is asureme	2 Aborte	z to 40 G ssable em vation 0 °	Hz on chanission of ti, measurei	nnel 5 he EUT in	40.0 Gr RBW
30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019 Ta lote: Pre-meas requency range ertical is shown	able 14: Cha urements ha e. Represent	23000 pts 23000 pts art of emissio ave shown th tative the me	ons test fro nat there is asuremen	2 Aborte om 17 GH s no asses nt with ele	z to 40 G ssable em	Hz on chanission of t	nnel 5 he EUT in ment ante	40.0 Gr
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ao dBµV/m to dBµV/m 17.0 GHz 7:58:37 08.04.2019 Table lote: Pre-meas requency range ertical is shown	able 14: Cha urements ha a. Represent	art of emissio ave shown th tative the me	ons test fro nat there is asureme	2 Aborte	z to 40 G ssable err vation 0 °	Hz on chanission of ti, measurei	nnel 5 he EUT in ment ante	40.0 GI RBW
au dBµV/m to dBµV/m tr.0 GHz r:58:37 08.04.2019 Tr lote: Pre-meas equency range ertical is shown	able 14: Cha urements ha e. Represent	art of emissio ave shown th tative the me	ons test fro nat there is asuremen	aborte 2 Aborte 2 2 Aborte 5 no asses nt with ele	z to 40 G ssable envation 0 °	Hz on chanission of ti	nnel 5 he EUT in ment ante	40.0 G RBW
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30 dBµV/m 40 dBµV/m 17.0 GHz 7:58:37 08.04.2019 Table Constraints of the second se	able 14: Cha urements ha e. Represent	art of emissio ave shown th tative the me	ons test fro nat there is asureme	2 Aborte	z to 40 G ssable em vation 0 °	Hz on chanission of t	nnel 5 he EUT in ment ante	40.0 Gi RBW

![](_page_60_Picture_1.jpeg)

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## Equipment calibration status

Description	Modell number	Serial number	Inventory number(s)	Last calibration	Next calibration
EMI test receiver	ESW44	101538	E00895	2019-07	2020-07
EMI test receiver	ESU26	100026	W00002	2018-06	2020-06
EMI test receiver	ESR7	101059	E00739	2019-08	2020-08
Preamplifier (1 GHz - 18 GHz)	BBV 9718 B	00032	W01325	2019-09	2020-10
Preamplifier (18 GHz - 40 GHz)	BBV 9721	43	W01350	2019-11	2020-11
Loop antenna	HFH2-Z2	871398/0050	E00060	2018-10	2020-10
TRILOG broadband antenna (SAC3)	VULB 9162	9162-041	E00643	2018-03	2021-03
Horn antenna	BBHA 9120D	9120D-592	W00052	2017-04	2020-04
Horn antenna	BBHA 9170	9170-332	W00054	2017-04	2020-04
Measuring antenna set			A00088	N	/A <sup>3</sup>
Shielded room	P92007	B 83117 C 1109 T 211	E00107	N	I/A
Compact diagnostic chamber (CDC)	VK041.0174	D62128-A502- A69-2-0006	E00026	N	I/A
Semi-anechoic chamber (SAC) with floor absorbers	FS-SAC		E00100	2018-03	2021-03
Semi-anechoic chamber (SAC)	SAC3	C62128-A520- A643-x-0006	E00716	2018-03	2021-03
Cable set CDC	RG214/U		E00446	2019-04	2020-04
	LCF12-50J		E01215	2019-04	2020-04
	LMR400	1718020006	E00920	2020-01	2021-01
	RG214 Hiflex	171802007	E00921	2020-01	2021-01
Cable set anechoic chamber	262-0942-1500	005	E00435	2019-10	2020-10
	SF104EA/2x11PC 35-42/5m	11144/4EA	E00307	2019-12	2020-12
	262-0942-1500	003	E00433	2019-10	2020-10
Cable set of semi-anechoic chamber SAC3	SF104EA/11PC35 /11PC35/10000M M	501347/4EA	E00755	2019-12	2020-12
	SF104E/11PC35/1 1PC35/2000MM	507410/4E	E01033	2019-12	2020-12
	SF104E/11PC35/1 1PC35/2000MM	507411/4E	E01034	2019-09	2020-09

![](_page_61_Picture_3.jpeg)

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#### **Measurement uncertainties**

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Description	Uncertainty	k=
AC power line conducted emission	± 4.1 dB	2
Carrier frequency separation Number of hopping frequencies Time of occupancy (dwell time)	± 5.0 %	2
Bandwidth tests	± 2.0 %	
Maximum conducted output power (conducted)	± 1.5 dB	
Power spectral density (conducted)	± 2.9 dB	
Conducted spurious emissions	± 2.9 dB	
Radiated emissions in semi-anechoic chamber		
9 kHz to 30 MHz	± 4.8 dB	2
30 MHz to 300 MHz	± 5.4 dB	2
300MHz to 1 GHz	± 4.7 dB	2
Radiated emissions in semi-anechoic chamber with RF absorbing material on the floor or fully anechoic room		
1 GHz to 40 GHz	± 4.5 dB	2

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. For a confidence level of 95 % the coverage factor k is 2.

Test related measurement uncertainties have to be taken into consideration when evaluating the test results. All used test instrument as well as the test accessories are calibrated at regular intervals.

![](_page_62_Picture_4.jpeg)

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9	Revision	history	
Revision	Date	Issued by	Description of modifications
0	2020-03-27	Konrad Graßl	First edition

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