

Test Report

19-1-0069003T33a-C1



Deutsche
Akkreditierungsstelle
D-PL-12047-01-01
D-PL-12047-01-03
D-PL-12047-01-04

Number of pages: 17 **Date of Report:** 2020-Nov-19

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Applicant: WAGO KONTAKTECHNIK GMBH
& CO. KG

Test Object / Tested Device(s): 4PORT IOL-A FLD PN DC 24V 2.0A
SlimLine 765-4103/0100-0000
WAGO I/O System Field

Listing FCC ID: 2AKUE-SLIMLINE **ISED:** 22322-SLIMLINE

Testing has been carried out in accordance with: FCC Regulations
PART 15—RADIO FREQUENCY DEVICES
Subpart B—UNINTENTIONAL RADIATORS

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".

Test Results: ☒ The EUT complies with the requirements in respect of all parameters subject to the test.
The test results relate only to devices specified in this document

Signatures:

Mr. Volker Briddigkeit
Test Lab Manager
Authorization of test report



Ahmed Ben Cheikh
Test Manager
Responsible of test report

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1 General information

1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory. The documentation of the testing performed on the tested devices is archived for 10 years at CETECOM.

Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.

1.1. Summary of Test Results

Test case	Reference in FCC ☒	Reference in ISED ☐	Reference in RSS-GEN ☐	Remark	Result
AC-Power Lines Conducted Emissions	§15.107	ICES-003, Issue 6	RSS Gen, Issue 5, Chapter 8.8		N/A
Radiated field strength emissions 30 MHz – 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3		PASS
Radiated field strength emissions above 1 GHz	§15.109 §15.33 §15.35	ICES-003, Issue 6	RSS-Gen., Issue 5 Chapter 8.9, Chapter 7.3		PASS

PASSED

The EUT complies with the essential requirements in the standard.

FAILED

The EUT does not comply with the essential requirements in the standard.

NP

The test was not performed by the CETECOM Laboratory.

The current version of the Test Report 19-1-0069003T33-C1 replaces the Test Report 19-1-006903T33 dated 2020-Sep-03.

The replaced Test Report is herewith invalid.

1.2. Summary of Test Methods

Test case	Test method
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 chapter 8.2.3
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 chapter 8.3

2 Administrative Data

2.1 Identification of the Testing Laboratory

Company name:	CETECOM GmbH
Address:	Im Teelbruch 116 45219 Essen - Kettwig Germany
Responsible for testing laboratory:	Mr. Volker Briddigkeit
Accreditation scope:	DAkS Webpage
Test location:	CETECOM GmbH; Mündelheimer Weg 35; 40472 Düsseldorf

2.2 General limits for environmental conditions

Temperature:	22±2° C
Relative. humidity:	45±15% rH
Barometric Pressure:	1013 hPa

2.3 Test Laboratories sub-contracted

Company name:

2.4 Organizational Items

Order No.:	3
Responsible test manager:	Ahmed Ben Cheikh
Receipt of EUT:	2020-Mar-30
Date(s) of test:	2020-Jun-30
Version of template:	14.0

2.5 Applicant's details

Applicant's name:	WAGO Kontakttechnik GmbH & Co. KG
Address:	Hansastraße 27 32423 Minden Germany
Contact Person:	Mr. Achim Brinkmann

2.6 Manufacturer's details

Manufacturer's name:	WAGO Kontakttechnik GmbH & Co. KG
Address:	see chapter 2.5

2.7 EUT: Type, S/N etc. and short descriptions used in this test report

Short description*)	PMT Sample No.	EUT	Type	HW status	Firmware	SW status
EUT 1	19-1-00690S132	4PORT IOL-A FLD PN DC 24V 2.0A	SlimLine 765-4103/0100-0000	Rev. 2	BT-FW: V1.2.0.0	V1.0.2.0

*) EUT short description is used to simplify the identification of the EUT in this test report.

2.8 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

Short description*)	PMT Sample No.	Auxiliary Equipment	Type	S/N	HW status	SW status
AE 1	--	Working Station	DELL Precision 3630	I.18.11.1487	--	--
AE2	--	netFIELD Technology EUT Testplate	--	--	--	--
AE3	--	Mobile Phone	Iphone 7	DNPT3NTSHG80	--	--
AE4	--	DC Power Supply	--	0718340214931	--	--

*) AE short description is used to simplify the identification of the auxiliary equipment in this test report.

2.9 Connected cables

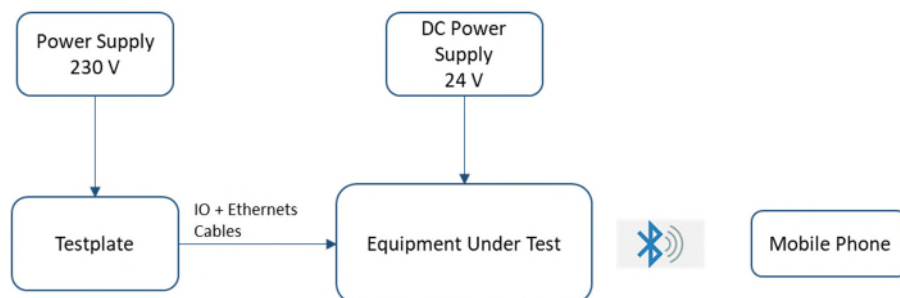
Short description*)	PMT Sample No.	Cable	Type	Schielded	Length
CAB 1	--	Mains power supply	Banana Plug	No	< 1 m
CAB 2	--	IO cables	M12 – 5 Pol	Yes	20 m
CAB 3	--	Ethernet ETH 1	RJ45 end	Yes	20 m
CAB 4	--	Ethernet ETH 2	M12 end	Yes	20 m

*) CAB short description is used to simplify the identification of the connected cables in this test report.

2.10 EUT set-ups

set-up no. *)	Combination of EUT and AE	Description
1	EUT1 + AE1 + AE2 + AE3 + AE4	--

*) EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.



2.11 EUT operation modes

EUT operating mode no. *)	Operating modes	Additional information
OP 1	Continuous Data transmission between the Test plate and EUT. Permanent Bluetooth connection (Mobile Phone + EUT).	--

*) EUT operating mode no. is used to simplify the test report.

3 Equipment under test (EUT)

3.1 General Data of Main EUT as Declared by Applicant

Product name	SLIMLINE		
Kind of product	I/O Module with Bluetooth		
Firmware	☐ for normal use	☒ Special version for test execution	
	☐ AC Mains		
	☒ DC	24 V	
	☐ Battery	--	
Operational conditions	$T_{nom} = 21\text{ }^{\circ}\text{C}$	$T_{min} = --\text{ }^{\circ}\text{C}$	$T_{max} = --\text{ }^{\circ}\text{C}$
EUT sample type	Pre-Production		
Weight	--		
Size	--		
Interfaces/Ports	IO M12 and ethernet ports		
For further details refer Applicants Declaration & following technical documents			

3.2 Modifications on Test sample

Additions/deviations or exclusions	none
---	------

4 Measurements

4.1 AC-Power Lines Conducted Emissions

4.1.1 Description of the general test setup and methodology, see below example:

The radio frequency voltage conducted back into the AC power line in the frequency range 150 kHz to 30 MHz has to be investigated.

Compliance should be tested by measuring the radio frequency voltage between each power line and ground at the power terminals in the stated frequency range.

A 50 Ohm / 50 μ H line impedance stabilization network (LISN) is used coupling the interface to the measurement equipment.

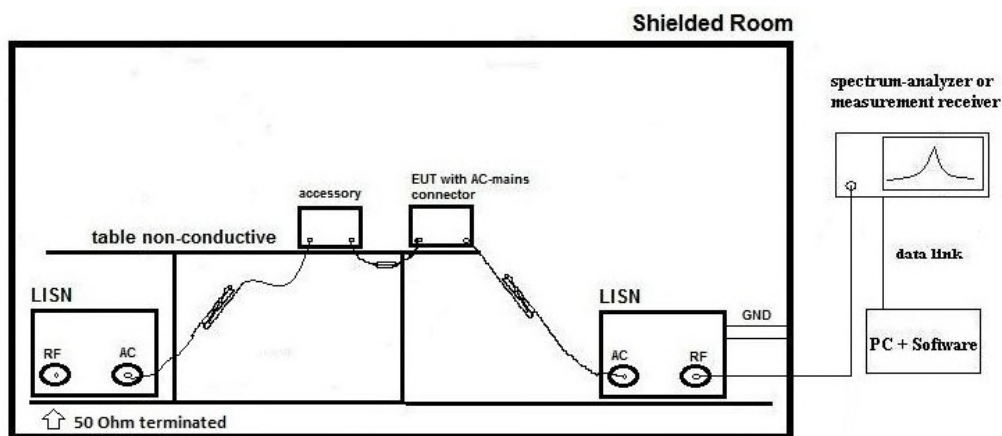
The EUT power input leads are connected through the LISN to the AC-power source. The LISN enclosure is electrically connected to the ground plane. The measuring instrument is connected to the coaxial output of the LISN.

Tabletop devices were set-up on an 80 cm height above reference ground plane, floor standing equipment 10 cm raised above ground plane.

Measurements have been performed on each phase line and neutral line of the devices AC-power lines.

The EUT was power supplied with 120 V/60 Hz. The EUT was tested in the defined operating mode and installed (connected) to accessory equipment according to the general description of use given by the applicant.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:

(See *Tables Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

As a first step, determines the worst-case phase line (neutral or phase) as well as the most critical operating mode of the equipment. A complete frequency-sweep with PK-Detector is performed on each current-carrying conductor.

Final measurement on critical frequencies

For power phases and critical frequencies (Margin to AV- or QP limit lower than 3 dB) as a second step includes measurements with receivers detector set to Quasi-Peak and Average.

Formula:

$$V_C = V_R + C_L \quad (1)$$

$$M = L_T - V_C \quad (2)$$

V_C = measured Voltage –corrected value

V_R = Receiver reading

C_L = Cable loss

M = Margin

L_T = Limit

All units are dB-units, positive margin means value is below limit.

4.1.2 Limit

Frequency Range [MHz]	Class B ☐		Class A ☐	
	QUASI-Peak [dBμV]	AVERAGE [dBμV]	QUASI-Peak [dBμV]	AVERAGE [dBμV]
0.15 – 0.5	66 to 56*	56 to 46*	79	66
0.5 – 5	56	46	73	60
5 – 30	60	50	73	60

4.1.3 Result

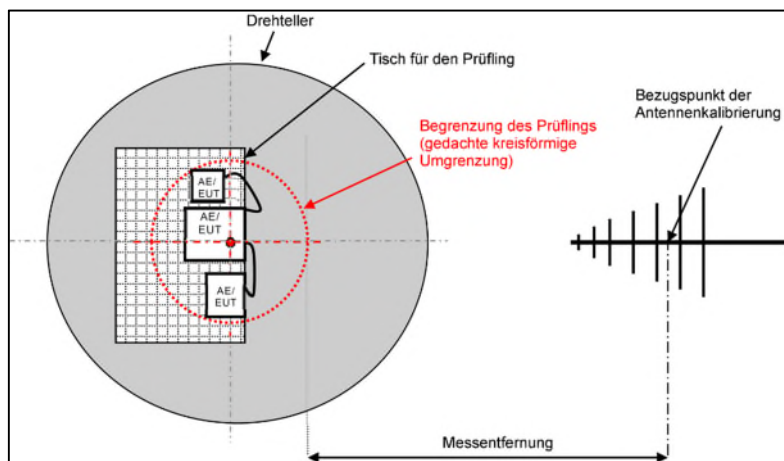
Diagram	Mode	Power Line	Max [dBμV]	Detector	Result
--	--	--	--	Average	--

4.2 Radiated field strength emissions 30 MHz – 1 GHz

4.2.1 Description of the general test setup and methodology, see below example:

Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:
(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc. either on 10m OATS or 3m semi-anechoic room.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out

Formula:

$$E_C = E_R + AF + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

AF = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

E_C = Electrical field – corrected value

E_R = Receiver reading

G_A = Gain of pre-amplifier (if used)

L_T = Limit

M = Margin

All units are dB-units, positive margin means value is below limit.

4.2.2 Limit

Frequency Range [MHz]	Class A ☒ (3 meters)		Class A ☒ (10 meters)		Detector	RBW / VBW [kHz]
	Limit [μ V/m]	Limit [dB μ V/m]	Limit [μ V/m]	Limit [dB μ V/m]		
30 - 88	282	49.0	90	39.0	Quasi peak	120
88 - 216	473	53.5	150	43.5	Quasi peak	120
216 - 960	660	56.4	210	46.4	Quasi peak	120
960 - 1000	944	59.5	300	49.5	Quasi peak	120

4.2.3 Result

Diagram	Channel	Mode	Maximum Level [dB μ V/m] Frequency Range 30 – 1000 MHz	Result
Diagram No. 3.01	--	OP 1	24.58 at 762.492 MHz (10 m distance)	OK

Remark: for more informations and graphical plot see annex A1 **CETECOM_19_1_0069003T33a-C1_A1**

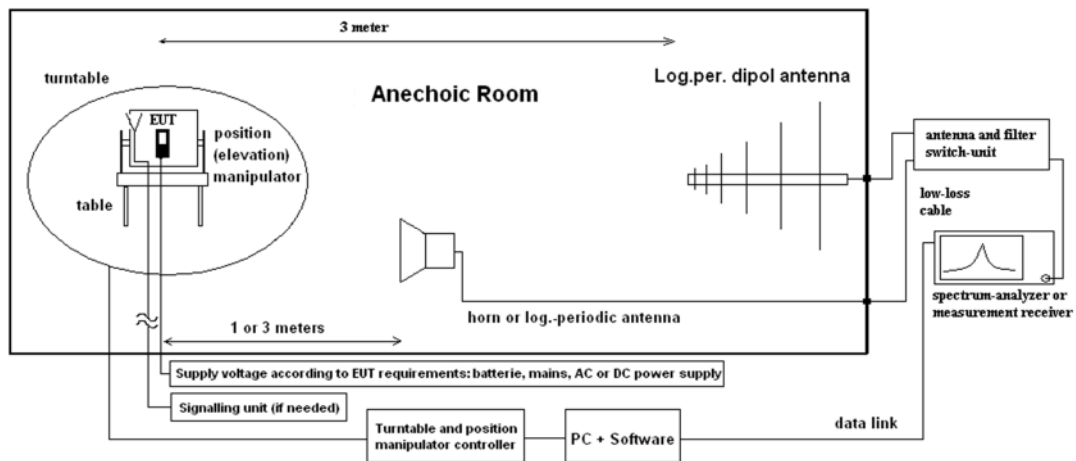
- The preliminary measurement has done inside the 3-meters semi-anechoic chamber.
- The final measurement of the critical frequencies has done in 10-meters Open Area Test Site (OATS).

4.3 Radiated field strength emissions above 1 GHz

4.3.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

Schematic:



Testing method:

The measurement is made according to relevant reference clauses:

(See Tables *Summary of Test Results* and *Summary of Test Methods* on page 5)

Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions or three axis scan for portable/small equipment.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

Formula:

$$E_C = E_R + A_F + C_L + D_F - G_A \quad (1)$$

$$M = L_T - E_C \quad (2)$$

E_C = Electrical field – corrected value

E_R = Receiver reading

M = Margin

L_T = Limit

A_F = Antenna factor

C_L = Cable loss

D_F = Distance correction factor (if used)

G_A = Gain of pre-amplifier (if used)

All units are dB-units, positive margin means value is below limit.

4.3.2 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [$\mu\text{V/m}$]	Limit [$\text{dB}\mu\text{V/m}$]	Detector	RBW / VBW [kHz]
Above 1000	940	59.5	Average	1000
Above 1000	9400	79.5	Peak	1000

4.3.3 Result

Diagram	Channel	Mode	Maximum Level [$\text{dB}\mu\text{V/m}$] Frequency Range 1 – 12.75 GHz	Result
Diagram No. 4.01	--	OP 1	No conspicuous frequencies detected – Margin to limit > 10 dB	OK
Diagram No. 4.02	--	OP 1	No conspicuous frequencies detected – Margin to limit > 10 dB	OK

Remark: for more informations and graphical plot see annex A1 **CETECOM_19_1_0069003T33a-C1_A1**

Diagram	Channel	Mode	Maximum Level [$\text{dB}\mu\text{V/m}$] Frequency Range 18 – 26.5 GHz	Result
			N/A	N/A

Remark: for more informations and graphical plot see annex A1 **CETECOM_19_1_0069003T33a-C1_A1**

4.4 Results from external laboratory

None

-

4.5 Opinions and interpretations

None

-

5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal Date
	Shielded Room - Conducted Emission			
25348	EMI Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH	--	31.05.2021
25261	Artificial Network (LISN) 9 kHz – 30 MHz	Rohde & Schwarz ESH 2 -Z5	--	31.07.2021
	225911 - SAC5 - Radiated Emission <1GHz			05.04.2026
25348	EMI Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH	101600	21.05.2021
25352	Open Switch and control Platform OSP120	Rohde & Schwarz Messgerätebau GmbH	101542-rV	
25358	Semi Anechoic Chamber SAC5	Albatross Projects GmbH	P27281-016	30.06.2026
25357	Ultra-broadband antenna HL562E	Rohde & Schwarz Messgerätebau GmbH	100824	13.09.2020
	225912 - SAC5 - Radiated Emission >1GHz			04.05.2026
25311	EMI Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH	100285	21.05.2021
25309	Double Ridged Horn Antenna HF907	Rohde & Schwarz Messgerätebau GmbH	100333	31.08.2022
25358	Semi Anechoic Chamber SAC5	Albatross Projects GmbH	P27281-016	30.06.2026
	25211 - Open Area Test Site - Radiated Emission <1GHz			31.08.2020
25348	EMI Test Receiver ESR7	Rohde & Schwarz Messgerätebau GmbH	--	31.05.2021
25178	Biconical Antenna	Schwarzbeck BBA9106	--	31.07.2021

Tools used in 'P1M1'

6 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor k , such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and its contribution to the overall uncertainty according its statistical distribution calculated.

RF-Measurement	Reference	Frequency range	Calculated uncertainty based on a confidence level of 95%						Remarks
Conducted emissions (U _{CISPR})	CISPR 16-2-1	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
Radiated emissions Enclosure	CISPR 16-2-3	30 MHz - 1 GHz 1 GHz - 18 GHz	4.2 dB 5.1 dB						E-Field
Disturbance power	CISPR 16-2-2	30 MHz - 300 MHz	-						-
Power Output radiated	-	30 MHz - 4 GHz	3.17 dB						Substitution method
Power Output conducted	-	Set-up No.	Cel-C1	Cel-C2	BT1	W1	W2	--	
		9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A	--	-
		12.75 - 26.5 GHz	N/A	0.82	--	N/A	N/A	--	
Conducted emissions on RF-port	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69	--	N/A - not applicable
		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43	--	
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77	--	
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79	--	
Occupied bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
			1.0 dB						Power
Emission bandwidth	-	9 kHz - 4 GHz	0.1272 ppm (Delta Marker)						Frequency error
	-		See above: 0.70 dB						Power
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm						-
Radiated emissions Enclosure	-	150 kHz - 30 MHz	5.0 dB						Magnetic field E-field Substitution
		30 MHz - 1 GHz	4.2 dB						
		1 GHz - 20 GHz	3.17 dB						

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2020-Sep-03
C1	Correction of limit in 4.3.2	2020-Nov-19
--	--	--

End Of Test Report