

Test Report

18-1-0173201T46a



Number of pages:	16	Date of Report:	2020-Nov-02
Testing company:	CETECOM GmbH Im Teelbruch 116 45219 Essen Germany Tel. + 49 (0) 20 54 / 95 19-0 Fax: + 49 (0) 20 54 / 95 19-150	Applicant:	Actia Nordic AB
Test Object / Tested Device(s):	Telematics Device / 103250101		
FCC ID:	2AGKK103250101		
Testing has been carried out in accordance with:	Title 47 CFR, Chapter I FCC Regulations, Subchapter A Subpart B: §15.109 (Class B limits) ISED Regulations ICES-003, Issue 6 (Class B limits) 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:	Dipl.-Ing. Ninovic Perez Test Lab Manager Authorization of test report B.Sc. Hicham Laayouni Test manager Responsible of test report		

Table of Contents

1	General information	4
1.1	Disclaimer and Notes.....	4
1.2	Summary of Test Results	5
1.3	Summary of Test Methods	5
2	Administrative Data	6
2.1	Identification of the Testing Laboratory	6
2.2	General limits for environmental conditions.....	6
2.3	Test Laboratories sub-contracted.....	6
2.4	Organizational Items	6
2.5	Applicant's details	6
2.6	Manufacturer's details	6
2.7	EUT: Type, S/N etc. and short descriptions used in this test report	7
2.8	Auxiliary Equipment (AE): Type, S/N etc. and short descriptions.....	7
2.9	Connected cables	7
2.10	Softwares	7
2.11	EUT set-ups	7
2.12	EUT operation modes.....	8
3	Equipment under test (EUT)	9
3.1	General Data of Main EUT as Declared by Applicant.....	9
3.2	Modifications on Test sample.....	9
4	Measurements.....	10
4.1	Radiated field strength emissions 30 MHz – 1 GHz	10
4.2	Radiated field strength emissions above 1 GHz	12
4.3	Results from external laboratory.....	14
4.4	Opinions and interpretations	14
5	Equipment lists	14
6	Measurement Uncertainty valid for conducted/radiated measurements	16
7	Versions of test reports (change history)	16

Table of Annex			
Annex No.	Contents	Reference Description	Total Pages
Annex 1	Test result diagrams	CETECOM_TR18_1_0173201T46a_A1	4
Annex 2	Internal photographs of EUT	N/A	--
Annex 3	External photographs of EUT	CETECOM_TR18_1_0173201T46a_A3	9
Annex 4	Test set-up photographs	CETECOM_TR18_1_0173201T46a_A4	3
The listed attachments are separate documents.			

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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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.

1.2 Summary of Test Results

Test case	Reference in FCC ☒	Reference in ISED ☒	Reference in RSS-GEN ☐	Remark	Result
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

PASS

The EUT complies with the essential requirements in the standard.

FAIL

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

NP

The test was not performed by the CETECOM Laboratory.

1.3 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:	Dipl.-Ing. Ninovic Perez
Accreditation scope:	DAkkS Webpage
Test location:	CETECOM GmbH; Im Teelbruch 116; 45219 Essen - Kettwig

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:	
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2.4 Organizational Items

Order No.:	18-1-01732
Responsible test manager:	B.Sc. Hicham Laayouni
Receipt of EUT:	03.08.2020
Date(s) of test:	2020-Aug-06
Version of template:	14.0

2.5 Applicant's details

Applicant's name:	Actia Nordic AB
Address:	Hammarbacken 4A, 3tr 191 49 Sollentuna Sweden
Contact Person:	Salah Alazawi
Contact Person's Email:	salah.alazawi@actia.se

2.6 Manufacturer's details

Manufacturer's name:	See applicant's info
Address:	See applicant's info

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

Short description*)	PMT Sample No.	Model Name	Type	S/N	HW status	SW status
EUT 01	18-1-01732S32_C01	103250101	Telematics Device	--	H1	1

*) 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 01	18-1-01732S17_C01	Jinchang Electronic, GNSS+LTE Combination Antenna	1570718**)	--	--	--
AE 02	18-1-01732S10_C01	CAN Simulator	ACU-II BoB	BoB 14	--	--
AE 03	--	LAPTOP	DELL	CTC522013	Intel core i5-3340M	Windows 7

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

**)157071x: This is the part number depending on cable length as stated below.

→0.2 m cable: 1570718, 1.05 m cable: 1570719, 1.7 m cable: 1570720, 3.5 m cable: 1570721,

4.3 m cable: 1570722, 5 m cable: 1570723

2.9 Connected cables

Short description*)	PMT Sample No.	Cable type	Connectors	Lenght
CAB 01	18-1-01732S06_C01	Cable Harness	--	< 3 meter
CAB 02	18-1-01732S89_C01	USB Cable	--	< 3 meter

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

2.10 Softwares

Short description*)	PMT Sample No.	Software	Type	S/N	HW status	SW status
--	--	--	--	--	--	--

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

2.11 EUT set-ups

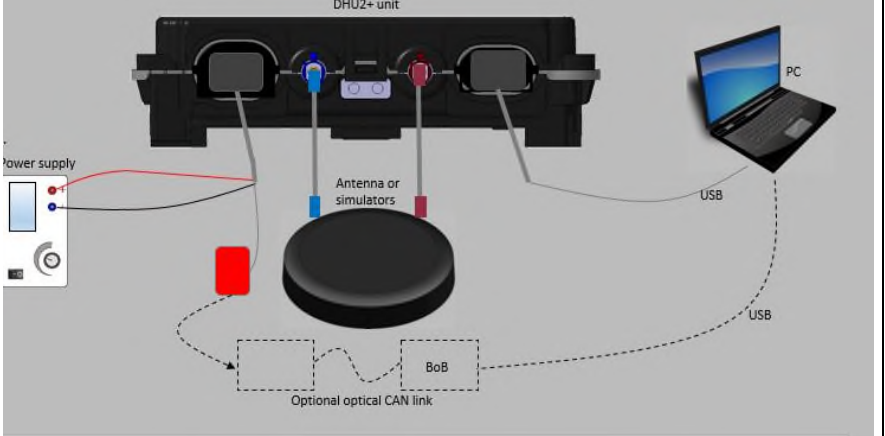
set-up no. *)	Combination of EUT and AE	Description
set 01	EUT 01 + AE 01 + AE 02 + CAB 01 + CAB 02	➤ Used for Radiated measurements ➤ AE 02 has been used to configure the Cellular mode and to check the CAN Communication

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

*) AE 02 and a software(provided by Customer) has been used to configure the Cellular mode.

*)

2.12 EUT operation modes

EUT operating mode no. *)	Operating modes	Additional information
op. 1	GSM850 IDLE + CAN communication	GSM 850 (GPRS) IDLE ➤ The mobile station is synchronized to the Broadcast Control Channel (BCCH) and listening to the Common Control Channel (CCCH) CAN Communication: Can Communication is established between EUT 01 und CAN Signal simulator AE2 

*) 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	103250101		
Kind of product	Telematics Device		
Firmware	☐ for normal use	☒ Special version for test execution:	
Test firmware version:	--	1.0.0.4	
Power Supply	☐ AC Mains	--	
	☒ DC Mains	12 V DC	
	☐ Battery	--	
EUT sample type	Pre-Production		
Weight	please check the document "5586_40030_RFQ ACU-C Certification_1.0"		
Size	please check the document" ACU-C updated version for North America 20190321"		
Interfaces/Ports	please check the document" ACU-C updated version for North America 20190321"		
For further details refer Applicants Declaration & following technical documents ➤ ACU-C updated version for North America 20190321 ➤ 5586_40030_RFQ ACU-C Certification_1.0 ➤ 1032-501-01 User Manual_ver1.1 ➤ Product Information - Model 103250101			

3.2 Modifications on Test sample

Additions/deviations or exclusions	none
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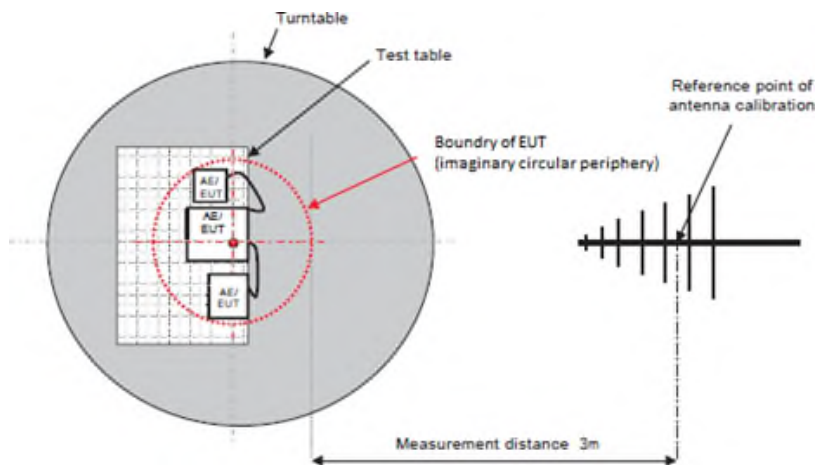
4 Measurements

4.1 Radiated field strength emissions 30 MHz – 1 GHz

4.1.1 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.

4.1.2 Limit

Frequency Range [MHz]	Class B ☒ (3 meters)		Class A ☐ (10 meters)		Detector	RBW / VBW [kHz]
	Limit [$\mu\text{V/m}$]	Limit [dB $\mu\text{V/m}$]	Limit [$\mu\text{V/m}$]	Limit [dB $\mu\text{V/m}$]		
30 - 88	100	40.0	90	39.0	Quasi peak	100 / 300
88 - 216	150	43.5	150	43.5	Quasi peak	100 / 300
216 - 960	200	46.0	210	46.4	Quasi peak	100 / 300
960 - 1000	500	54.0	300	49.5	Quasi peak	100 / 300

4.1.3 Result

Diagram	Channel	Mode	Maximum Level [dB $\mu\text{V/m}$] Frequency Range 30 – 1000 MHz	Result
3.01a_laying	--	op. 1	40.64 dB $\mu\text{V/m}$ @ 192.490 MHz	Passed
3.01b_standing	--	op. 1	40.33 dB $\mu\text{V/m}$ @ 671.30 MHz	Passed

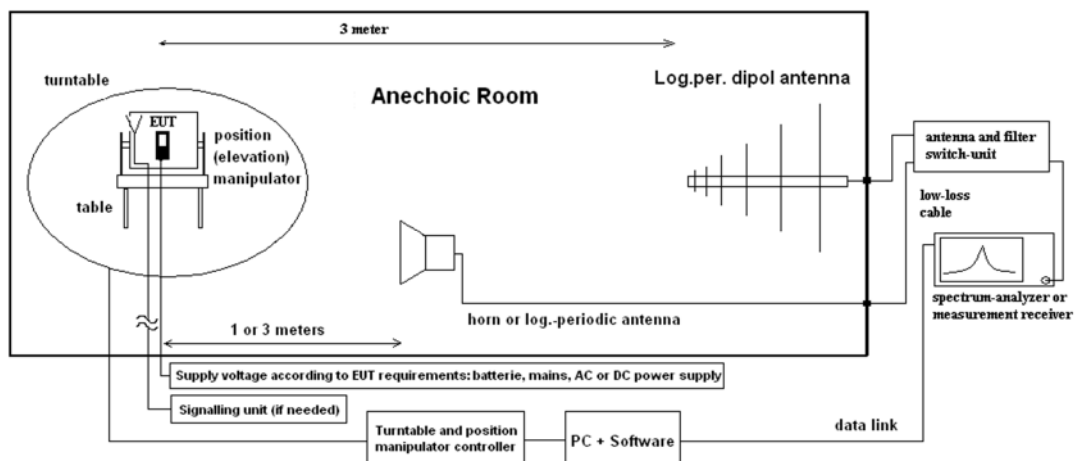
Remark: for more informations and graphical plot see annex A1 **CETECOM_TR18_1_0173201T46a_A1**

4.2 Radiated field strength emissions above 1 GHz

4.2.1 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.

4.2.2 Limit

Radiated emissions limits (3 meters)				
Frequency Range [MHz]	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector	RBW / VBW [kHz]
Above 1000	500	54	Average	1000
Above 1000	5000	74	Peak	1000

4.2.3 Result

Diagram	Channel	Mode	Maximum Level [$\text{dB}\mu\text{V}/\text{m}$] Frequency Range 1 – 6 GHz	Result
4.01	--	op. 1	No peaks	OK

Remark: for more informations and graphical plot see annex A1 **CETECOM_TR18_1_0173201T46a_A1**

4.3 Results from external laboratory

None

-

4.4 Opinions and interpretations

None

-

5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal due date
120901 - SAC - Radiated Emission <1GHz				
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH	980026L	03.05.2022
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	13.05.2021
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	
20487	System CTC NSA-Verification SAR-EMI System EMI field (SAR) NSA	ETS-Lindgren GmbH	-	23.03.2021
120904 - FAC1 - Radiated Emissions				
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	25.05.2022
20720	EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.xx	
20489	EMI Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH	1000-30	13.05.2021
20254	High Pass Filter 5HC 2600/12750-1.5KK (GSM1800/1900/DECT)	Trilithic	23042	
20868	High Pass Filter AFH-07000	AtlanTecRF	16071300004	
20291	High Pass Filter WHJ 2200-4EE (GSM 850/900)	Wainwright Instruments GmbH	14	
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	19.07.2021
20302	Horn Antenna BBHA9170 (Meas 1)	Schwarzbeck Mess-Elektronik OHG	155	15.04.2023
20549	Log.Per-Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	31.07.2021
20512	Notch Filter WRCA 800/960-02/40-6EEK (GSM 850)	Wainwright Instruments GmbH	24	
20290	Notch Filter WRCA 901,9/903,1SS (GSM 900)	Wainwright Instruments GmbH	3RR	
20122	Notch Filter WRCB 1747/1748 (GSM 1800)	Wainwright Instruments GmbH	12	
20121	Notch Filter WRCB 1879,5/1880,5EE (GSM 1900)	Wainwright Instruments GmbH	15	
20448	Notch Filter WRCT 1850.0/2170.0-5/40-10SSK (WCDMA-FDD II)	Wainwright Instruments GmbH	5	
20066	Notch Filter WRCT 1900/2200-5/40-10EEK (WCDMA-FDDI)	Wainwright Instruments GmbH	5	

ID	Description	Manufacturer	SerNo	Cal due date
20449	Notch Filter WRCT 824.0/894.0-5/40-8SSK (WCDMA FDD V)	Wainwright Instruments GmbH	1	
20611	Power Supply E3632A	Agilent Technologies Deutschland GmbH	KR 75305854	
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25-10P	Miteq Inc.	1244554	
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	
20670	Radio Communication Tester CMU200	Rohde & Schwarz Messgerätebau GmbH	106833	16.06.2022
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	23.05.2021
20439	UltraLog-Antenna HL 562	Rohde & Schwarz Messgerätebau GmbH	100248	10.03.2023
20828	Netgear Nighthawk x45	NETGEAR Ireland International Ltd	5K5188590067B	
20732	Signal- and Spectrum Analyzer FSW67	Rohde & Schwarz Messgerätebau GmbH	104023	27.05.2021

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})	-	9 kHz - 150 kHz 150 kHz - 30 MHz	4.0 dB 3.6 dB						-
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	5.01dB						Magnetic field strength
		30 MHz - 1 GHz	5.83 dB						Electrical
		1 GHz - 18 GHz	4.91 dB						Field
		18-26.5 GHz	5.06 dB						strength

7 Versions of test reports (change history)

Version	Applied changes	Date of release
--	Initial release	2020-Nov-02
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End Of Test Report