

Test laboratory accredited according to ISO 17025 by the Swiss Accreditation Service SAS
Laboratoire d'essai accrédité selon ISO 17025 par le Service d'accréditation suisse SAS
Prüflabor akkreditiert nach ISO 17025 durch die Schweizerische Akkreditierungsstelle SAS

Registration number
Numéro d'accréditation
Akkreditierungsnummer

STS 0001

Schweizerischer Prüfstellendienst
Service suisse d'essai
Swiss testing service



Report:	Electromagnetic compatibility	Report no:	17-MO-0015.E01
Test item (EUT):	NB800		
Applicant:	NetModule AG; Meriedweg11; 3172 Niederwangen bei Bern; Switzerland		
Manufacturer:	NetModule AG; Meriedweg11; 3172 Niederwangen bei Bern; Switzerland		
Model/Type:	NB800-LWWtSu: LTE, WLAN & USB (Base) NB800-LWWtScSu: Base & RS232/485 & DIO NB800-LWWtSu2C: Base & DualCAN	Serial no:	NB800-LWWtSu: 00112BFFDEF9 NB800-LWWtScSu: 00112B018492 NB800-LWWtSu2C: 00112B0185D1
Trade mark:	NetModule AG	Date of tests:	January 24 to 25 & April 6, 2017 September 8 & November 7, 2017

Standards		Result
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	Information technology equipment - Immunity characteristics - Limits and methods of measurement	Pass
EN 55032:2015 CISPR 32:2015	Electromagnetic compatibility of multimedia equipment - Emission requirements	Pass
EN 61000-6-3:2007 + A1:2011+AC:2012 IEC 61000-6-3:2011 (ed. 2.1)	Electromagnetic compatibility (EMC) – Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments	Pass
EN 61000-6-2:2005 IEC 61000-6-2:2005 (ed2.0)	Electromagnetic compatibility (EMC) – Part 6-2: Generic standards - Immunity for industrial environments	Pass
ETSI EN 301 489-1 V2.1.1:2017	(Common requirements)	Pass
ETSI EN 301 489-7 V1.3.1:2005	(Digital cellular radio telecommunication)	Pass
ETSI EN 301 489-17:2017 /-24:2010	(Broadband Data Transmission Systems) / (CDMA)	Pass
47 CFR, Part 15	(Subpart B, Class B digital device)	Pass

Test performed by
Mr F. Wyler
EMC test-engineer

Report prepared by
Mr F. Wyler
EMC test-engineer

Report controlled and approved by
Mr J. Biner
EMC test-engineer





Bern, Dezember 5, 2017

(Issue Date)

Main language : English

The present document results from tests on one specimen and does not prejudice to the conformity of all the manufactured products.

Eurofins Electrosuisse Product Testing AG

EEPT Lab Rossens
route de Montena 75
1728 Rossens
Switzerland
phone +41 58 220 33 33
www.eurofins.ch
labrossens@eurofins.ch

EEPT Lab Bern
Ostermundigenstrasse 93
3006 Bern
Switzerland
phone +41 79 256 21 55
johannes.biner@eurofins.ch

Contents

	Page
FOREWORD	2
1. SUMMARY OF TEST RESULTS	3
1.1 EN 61000-6-3 & -2	3
1.2 EN 55024	4
1.3 EN 55032	4
1.4 FCC / Canada	4
1.5 ETSI EN 301 489-1, -7, -17, & -24	5
2. APPLIED STANDARDS	6
3. ABBREVIATIONS	6
4. APPLICANT	7
5. EQUIPMENT UNDER TEST	7
5.1 Identification	7
5.2 Product family	8
5.3 Pictures of the EUT	10
5.4 Classification	10
5.5 Ports	11
6. TEST CONDITIONS	12
6.1 Climatic conditions, location and date	12
6.2 Test facility and methodology	12
6.3 Attendant persons	12
6.4 Test configuration	12
6.5 Operating conditions	12
6.6 Monitoring of the EUT	13
6.7 Auxiliary equipment	13
6.8 Performance criteria	13
7. EMISSION TESTS	14
7.1 Interference voltage	15
7.2 Conducted emission on I/O and telecommunication ports	20
7.3 Radiated electromagnetic field	30
7.4 Radiated emission - Electromagnetic field according CFR 47 15 (radiated – 30 MHz to 6 GHz)	37
8. IMMUNITY TESTS	44
8.1 Immunity to electrostatic discharge (ESD) (EN 61000-4-2)	45
8.2 Immunity to electromagnetic fields (antenna) (EN 61000-4-3)	52
8.3 Immunity to fast electric transients (EN 61000-4-4)	56
8.4 Immunity to surge (EN 61000-4-5: 1.2/50 µs)	60
8.5 Immunity to conducted disturbances induced by radio-frequency fields (EN 61000-4-6)	65
9. MODIFICATIONS ON THE EUT	69
9.1 Level: 1	70

Foreword

According to NetModule AG, the radio modules for mobile and WLAN which are included in the EUT, has been tested by its manufacturer in accordance with the RED, FCC, CSA and the relevant standards. Therefore, these tests have not been carried out. According to NetModule AG, the radio modules are integrated in accordance with the instructions of its manufacturer. The tests of the EUT performed according to EN/ETSI 301 489-1, -7, -17 and -24 and documented in this report only refer to the functional application of the EUT.

1. Summary of test results

1.1 EN 61000-6-3 & -2

§	Test Type	Result
7	Emission	EN 61000-6-3
7.1	Interference voltage EN 55016-2-1:2014 CISPR 16-2-1:2014	Pass ¹
7.2	Conducted emission on I/O or other ports EN 55022:2010 CISPR 22:2008	Pass
---	Discontinuous disturbances (clicks) EN 55014-1:2006 + A1:2009 + A2:2011 CISPR 14-1:2015	Not required ¹
7.3	Radiated electromagnetic field EN 55016-2-3:2010 + A1 + A2 CISPR 16-2-3:2010 + A1 + A2	Pass
---	Harmonics EN 61000-3-2:2014 IEC 61000-3-2:2014	Not required ¹
---	Voltage fluctuations (flicker) EN 61000-3-3:2013 IEC 61000-3-3:2013	Not required ¹

§	Test Type	Result
8	Immunity	EN 61000-6-2
8.1	Electrostatic discharges EN 61000-4-2:2009 IEC 61000-4-2:2008	Pass
8.2	Electromagnetic fields EN 61000-4-3:2006 +A1 +A2 IEC 61000-4-3:2006 +A1 +A2	Pass
8.3	Fast electric transients (Burst) EN 61000-4-4:2012 IEC 61000-4-4:2012	Pass
8.4	Surges EN 61000-4-5:2014 IEC 61000-4-5:2014	Pass
8.5	Radio frequency common mode EN 61000-4-6:2014 IEC 61000-4-6:2013	Pass
---	Magnetic fields (industrial frequencies) EN 61000-4-8:2010 IEC 61000-4-8:2009	Not required ²
---	Voltage dips and interruptions EN 61000-4-11:2004 IEC 61000-4-11:2004	Not required ¹

1. Powered with: 12 up to 24 VDC
2. Does not contain any devices susceptible to magnetic fields.

1.2 EN 55024

§	Test Type	Result
8	Immunity	EN 55024
8.1	Electrostatic discharges EN 61000-4-2:2009 IEC 61000-4-2:2008	Pass
8.2	Electromagnetic fields EN 61000-4-3:2006 +A1 +A2 IEC 61000-4-3:2006 +A1 +A2	Pass
8.3	Fast electric transients (Burst) EN 61000-4-4:2012 IEC 61000-4-4:2012	Pass
8.4	Surges EN 61000-4-5:2014 IEC 61000-4-5:2014	Pass
8.5	Radio frequency common mode EN 61000-4-6:2014 IEC 61000-4-6:2013	Pass
---	Magnetic fields (industrial frequencies) EN 61000-4-8:2010 IEC 61000-4-8:2009	Not required ¹
---	Voltage dips and interruptions EN 61000-4-11:2004 IEC 61000-4-11:2004	Not required ²

1. Does not contain any devices susceptible to magnetic fields.
2. Powered with: 12 up to 24 VDC

1.3 EN 55032

§	Test Type	Result
7	Emission	EN 55032
7.1	Interference voltage EN 55016-2-1:2014 CISPR 16-2-1:2014	Pass ¹
7.2	Conducted emission on I/O or other ports EN 55016-2-1:2014 CISPR 16-2-1:2014	Pass
7.3	Radiated electromagnetic field EN 55016-1-2:2014 CISPR 16-1-2:2014 EN 55016-2-3:2010/A2:2014 CISPR 16-2-3:2010/A2:2014	Pass

1. Powered with: 12 up to 24 VDC

1.4 FCC / Canada

§	Test Type	Result
7	Emission	CFR 47 ICES-003 RSS-310 Industry Canada
---	Conducted emission CFR 47 § 15.107 (Class B) ICES-003 §5.3 (Class B)	Not required ¹
7.4	Radiated emission – EM-field CFR 47 § 15.109 (Class B) ICES-003 §5.5 (Class B)	Pass

1. Powered with: 12 up to 24 VDC

1.5 ETSI EN 301 489--1, -7, -17, & -24

§	Test Type	Result
7	Emission	EN 301 489-1, -7, -17, & -24 fixed use
7.1	Conducted emission on AC ports EN 55032:2015 CISPR 32:2015	Pass ¹
7.2	Conducted emission on I/O or other ports EN 55032:2015 CISPR 32:2015	Pass
7.3	Radiated electromagnetic field EN 55032:2015 CISPR 32:2015	Pass
---	Harmonics EN 61000-3-2:2014 IEC 61000-3-2:2014	Not required ¹
---	Voltage fluctuations (flicker) EN 61000-3-3:2013 IEC 61000-3-3:2013	Not required ¹
8	Immunity	EN 301 489-1, -7, -17, & -24 fixed use
8.1	Electrostatic discharges EN 61000-4-2:2009 IEC 61000-4-2:2008	Pass
8.2	Electromagnetic fields EN 61000-4-3:2006 +A1 +A2 IEC 61000-4-3:2006 +A1 +A2	Pass
8.3	Fast electric transients (Burst) EN 61000-4-4:2012 IEC 61000-4-4:2012	Pass
8.4	Surges EN 61000-4-5:2014 IEC 61000-4-5:2014	Pass
8.5	Radio frequency common mode EN 61000-4-6:2014 IEC 61000-4-6:2013	Pass
---	Voltage dips and interruptions EN 61000-4-11:2004 IEC 61000-4-11:2004	Not required ¹

1. Powered with: 12 up to 24 VDC

2. Applied standards

47 CFR Part 15 Subpart B	Code of Federal Regulations - Title 47 - Telecommunication, Part 15, Subpart B: "Unintentional Radiators"
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	Information technology equipment Immunity characteristics – Limits and methods of measurement
EN 55032:2015 CISPR 32:2015	Electromagnetic compatibility of multimedia equipment - Emission requirements
EN 61000-6-2:2005 IEC 61000-6-2:2005 (ed 2.0) & IEC 61000-6-2:2016	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments
EN 61000-6-3:2007 + A1:2011+AC:2012 IEC 61000-6-3:2011 (ed 2.1)	Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments
ETSI EN 301 489-1 V2.1.1:2017	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 1: Common technical requirements
ETSI EN 301 489-7 V1.3.1:2005	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 7: Specific conditions for mobile and portable radio and ancillary equipment of digital cellular radio telecommunications systems (GSM and DCS)
ETSI EN 301 489-17 V3.2.0:2017	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment; Part 17: Specific conditions for Broadband Data Transmission Systems
ETSI EN 301 489-24 V1.5.1:2010	Electromagnetic compatibility and Radio spectrum Matters (ERM); ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment

3. Abbreviations

Electromagnetic compatibility and radio spectrum matters:

AC	Alternating current
AFA	Adaptive Frequency Agility
AM	Amplitude Modulation
AN	Artificial Network
AV	Average
BW	Bandwidth
CDN	Coupling Decoupling Network
CW	Continuous Wave
d(t)	Relative voltage change characteristic
DAA	Detect And Avoid spectrum access technique
dB	Decibel
dBi	Gain in decibels relative to an isotropic antenna
DC	Direct current
dmax	Maximum relative voltage change
DS	Defined State
DSSS	Direct Sequence Spread Spectrum
e.i.r.p.	equivalent isotropic radiated power
EMC	ElectroMagnetic Compatibility
ERC	European Radiocommunication Committee
ESD	Electro Static Discharge
EUT	Equipment under Test
GBSAR	Ground Based Synthetic Aperture Radar
GRP	Ground reference plane
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ISM	Industrial Scientific Medical (frequency band)
ITU-R	International Telecommunications Union, Radio Sector

ITU-T	International Telecommunications Union, Telecommunications Sector
ITU	International Telecommunications Union
L1,L2,L3	Phase
LBT	Listen Before Talk
LISN	Line impedance stabilization network
N	Neutral
NRI	National Radio Interfaces
PE	Protective earth
PK	Peak
Plt	Long-term flicker indicator
PM	Pulse Modulation
Pst	Short-term flicker Indicator
R&TTE	Radio and Telecommunications Terminal Equipment
RF	Radio Frequency
RFID	Radio Frequency Identification
RU	Remote Unit
Rx	Receiver
SCU	System Control Unit
SF-CW	Step Frequency Continuous Wave (spread spectrum)
SND/ND	Signal + Noise + Distortion divided by Noise + Distortion
SRD	Short Range Device
TEM	Transverse ElectroMagnetic cell
QFE	Local atmospheric pressure (Field Elevation)

General vocabulary: <http://www.electropedia.org>

4. Applicant

Applicant name and address	NetModule AG; Meriedweg11; 3172 Niederwangen bei Bern; Switzerland
Contact Person	Mr. R. Straub
Telephone	+41 31 985 25 10
File no	17-MO-0015

5. Equipment under test

5.1 Identification

Manufacturer name and address	NetModule AG; Meriedweg11; 3172 Niederwangen bei Bern; Switzerland																							
Production country	Switzerland																							
Trade mark	NetModule																							
Test item description	NB800																							
Use description	Industrial Router with Mobile & WLAN.																							
Model/Type reference	NB800-LWWtS: LTE, WLAN & USB (Base) NB800-LWWtScSu: Base & RS232/485 & DIO NB800-LWWtSu2C: Base & DualCAN																							
Serial no	NB800-LWWtS: 00:11:2B:FF:DE:F9 NB800-LWWtScSu: 00:11:2B:01:84:92 NB800-LWWtSu2C: 00:11:2B:01:85:D1																							
Software version	0.0.1																							
Highest frequency	<table><tr><td>CPU Core</td><td>600 MHz</td></tr><tr><td>Crystal Q100</td><td>25 MHz</td></tr><tr><td>CPU DDR3 RAM</td><td>400 MHz</td></tr><tr><td>USB</td><td>480 MHz</td></tr><tr><td>Ethernet</td><td>125 MHz</td></tr><tr><td>eMMC</td><td>48 MHz</td></tr><tr><td colspan="2"> </td></tr><tr><td>DC/DC Main N1400</td><td>750 kHz</td></tr><tr><td>DC/DC USB N1401</td><td>1 MHz</td></tr><tr><td>DC/DC GSM N900</td><td>1.5 MHz</td></tr><tr><td>PMIC U1500</td><td>2.4 MHz</td></tr></table>		CPU Core	600 MHz	Crystal Q100	25 MHz	CPU DDR3 RAM	400 MHz	USB	480 MHz	Ethernet	125 MHz	eMMC	48 MHz			DC/DC Main N1400	750 kHz	DC/DC USB N1401	1 MHz	DC/DC GSM N900	1.5 MHz	PMIC U1500	2.4 MHz
CPU Core	600 MHz																							
Crystal Q100	25 MHz																							
CPU DDR3 RAM	400 MHz																							
USB	480 MHz																							
Ethernet	125 MHz																							
eMMC	48 MHz																							
DC/DC Main N1400	750 kHz																							
DC/DC USB N1401	1 MHz																							
DC/DC GSM N900	1.5 MHz																							
PMIC U1500	2.4 MHz																							
Supply	U = 12 ... 24 VDC P = 5 W																							
Dimension	10.0 cm x 9.0 cm x 3.2 cm (l x w x h)																							
Weight	<1 kg																							
Technical documentation	None. The equipment is completely identified by the above-mentioned information. NetModule AG assures the traceability of the documentation and is responsible for the product identification.																							

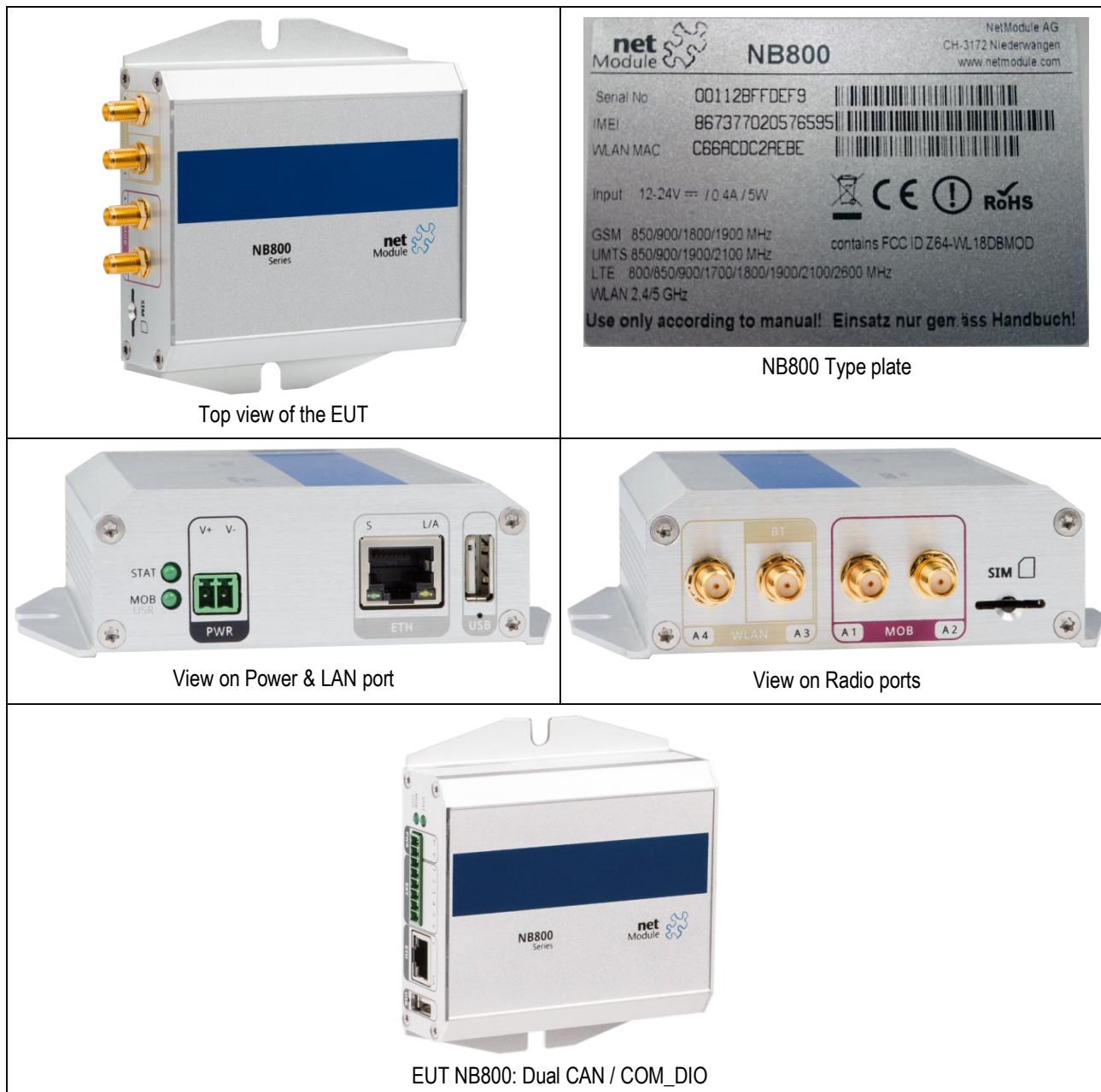
5.2 Product family

Tested Equipment	Covered Variants	Explanation ¹⁾																																																																																		
NB800-LWWtSu NB800-LWWtScSu NB800-LWWtSu2C (working sample)	NB800-H ₁ ...H _n - S ₁ ...S _n -S-O ₁ ...O _n	<p>All covered NB800 variants contain the same mainboard (PCB), have the same case and the same form factor.</p> <p>They can provide 3G or 4G mobile network access. Optionally WLAN, Bluetooth and USB functionality can be included. Optionally, different interfaces can be included as extension boards called 'shields' (order code Sc for COMIO, 2C for 2xCAN).</p> <p>There can be up to 4 antenna connectors.</p> <p>The wireless communication modules applied have been CE and FCC certified in an independent way of the tested equipment.</p> <p>'H₁...H_n' is a sequence of the following letters that identify the communication modules included:</p> <table><tr><td>B</td><td>basic device</td><td></td></tr><tr><td>R</td><td>none</td><td></td></tr><tr><td>U</td><td>3G+ = 2G + UMTS/HSPA/HSPA+</td><td>UMTS</td></tr><tr><td>Ub</td><td>3G North America</td><td>UMTS-NA</td></tr><tr><td>L</td><td>4G = 3G+ + LTE</td><td>LTE</td></tr><tr><td>Lb</td><td>4G North America</td><td>LTE-NA</td></tr><tr><td>W</td><td>WLAN a/b/g/n 2.4/5 GHz</td><td>WLAN</td></tr><tr><td>11a/b/g/n</td><td></td><td></td></tr><tr><td>Wb</td><td>WLAN b/g 2.4 GHz</td><td>WLAN 11b/g</td></tr><tr><td>Wt</td><td>Bluetooth + BLE</td><td>BT</td></tr><tr><td>Wz</td><td>Zigbee</td><td></td></tr><tr><td>Su</td><td>USB Host Port</td><td>USB</td></tr><tr><td>Ra</td><td>256MB RAM (Standard for UMTS)</td><td></td></tr><tr><td>Rb</td><td>512MB RAM (Standard for LTE)</td><td></td></tr><tr><td>Sc</td><td>RS232/485 + Digital IO (shield)</td><td>COMIO</td></tr><tr><td>2C</td><td>Dual CAN (shield)</td><td>2xCAN</td></tr></table> <p>'S₁...S_n' indicate software options activated:</p> <table><tr><td>V</td><td>VoIP Gateway</td></tr><tr><td>Y</td><td>Plain Linux</td></tr><tr><td>Vi</td><td>Virtualisation, LXC</td></tr></table> <p>'O' indicates OEM options, typ. customer brand labeling e.g.:</p> <table><tr><td>TAG</td><td>Tagfinder</td></tr><tr><td>OEMa</td><td>Customer A</td></tr><tr><td>OEMb</td><td>Customer B</td></tr></table> <p>The following NB800 variants are currently available or <i>planned</i>:</p> <p><u>UMTS Modem with Options:</u></p> <table><tr><td>NB800-U</td><td>UMTS</td></tr><tr><td>NB800-USu</td><td>+ USB</td></tr><tr><td>NB800-USc</td><td>+ COMIO</td></tr><tr><td>NB800-U2C</td><td>+ 2xCAN</td></tr><tr><td>NB800-UScSu</td><td>+ COMIO + USB</td></tr><tr><td>NB800-USu2C</td><td>+ USB + 2xCAN</td></tr></table> <table><tr><td>NB800-UWWt</td><td>UMTS + WLAN + BT</td></tr><tr><td>NB800-UWWtSu</td><td>+ USB</td></tr><tr><td>NB800-UWWtSc</td><td>+ COMIO</td></tr><tr><td>NB800-UWWt2C</td><td>+ 2xCAN</td></tr><tr><td>NB800-UWWtScSu</td><td>+ COMIO + USB</td></tr></table>	B	basic device		R	none		U	3G+ = 2G + UMTS/HSPA/HSPA+	UMTS	Ub	3G North America	UMTS-NA	L	4G = 3G+ + LTE	LTE	Lb	4G North America	LTE-NA	W	WLAN a/b/g/n 2.4/5 GHz	WLAN	11a/b/g/n			Wb	WLAN b/g 2.4 GHz	WLAN 11b/g	Wt	Bluetooth + BLE	BT	Wz	Zigbee		Su	USB Host Port	USB	Ra	256MB RAM (Standard for UMTS)		Rb	512MB RAM (Standard for LTE)		Sc	RS232/485 + Digital IO (shield)	COMIO	2C	Dual CAN (shield)	2xCAN	V	VoIP Gateway	Y	Plain Linux	Vi	Virtualisation, LXC	TAG	Tagfinder	OEMa	Customer A	OEMb	Customer B	NB800-U	UMTS	NB800-USu	+ USB	NB800-USc	+ COMIO	NB800-U2C	+ 2xCAN	NB800-UScSu	+ COMIO + USB	NB800-USu2C	+ USB + 2xCAN	NB800-UWWt	UMTS + WLAN + BT	NB800-UWWtSu	+ USB	NB800-UWWtSc	+ COMIO	NB800-UWWt2C	+ 2xCAN	NB800-UWWtScSu	+ COMIO + USB
B	basic device																																																																																			
R	none																																																																																			
U	3G+ = 2G + UMTS/HSPA/HSPA+	UMTS																																																																																		
Ub	3G North America	UMTS-NA																																																																																		
L	4G = 3G+ + LTE	LTE																																																																																		
Lb	4G North America	LTE-NA																																																																																		
W	WLAN a/b/g/n 2.4/5 GHz	WLAN																																																																																		
11a/b/g/n																																																																																				
Wb	WLAN b/g 2.4 GHz	WLAN 11b/g																																																																																		
Wt	Bluetooth + BLE	BT																																																																																		
Wz	Zigbee																																																																																			
Su	USB Host Port	USB																																																																																		
Ra	256MB RAM (Standard for UMTS)																																																																																			
Rb	512MB RAM (Standard for LTE)																																																																																			
Sc	RS232/485 + Digital IO (shield)	COMIO																																																																																		
2C	Dual CAN (shield)	2xCAN																																																																																		
V	VoIP Gateway																																																																																			
Y	Plain Linux																																																																																			
Vi	Virtualisation, LXC																																																																																			
TAG	Tagfinder																																																																																			
OEMa	Customer A																																																																																			
OEMb	Customer B																																																																																			
NB800-U	UMTS																																																																																			
NB800-USu	+ USB																																																																																			
NB800-USc	+ COMIO																																																																																			
NB800-U2C	+ 2xCAN																																																																																			
NB800-UScSu	+ COMIO + USB																																																																																			
NB800-USu2C	+ USB + 2xCAN																																																																																			
NB800-UWWt	UMTS + WLAN + BT																																																																																			
NB800-UWWtSu	+ USB																																																																																			
NB800-UWWtSc	+ COMIO																																																																																			
NB800-UWWt2C	+ 2xCAN																																																																																			
NB800-UWWtScSu	+ COMIO + USB																																																																																			

Tested Equipment	Covered Variants	Explanation ¹⁾
		<p>NB800-UWWtSu2C + USB + 2xCAN</p> <p>NB800-Ub... UMTS modem for North America, and any of above options (replace U with Ub)</p> <p><u>LTE Modem with Options:</u></p> <p>NB800-L LTE</p> <p>NB800-LSu + USB</p> <p>NB800-LSc + COMIO</p> <p>NB800-L2C + 2xCAN</p> <p>NB800-LScSu + COMIO + USB</p> <p>NB800-LSu2C + USB + 2xCAN</p> <p>NB800-LWWt LTE + WLAN + BT</p> <p>NB800-LWWtSu + USB</p> <p>NB800-LWWtSc + COMIO</p> <p>NB800-LWWt2C + 2xCAN</p> <p>NB800-LWWtScSu + COMIO + USB</p> <p>NB800-LWWtSu2C + USB + 2xCAN</p> <p>NB800-Lb... LTE modem for North America, and any of above options (replace L with Lb)</p> <p><u>Base-Devices (no wireless interfaces):</u></p> <p>NB800-B no modem, no WLAN, but Ethernet</p> <p>NB800-BSu + USB</p> <p>NB800-BSc + COMIO</p> <p>NB800-B2C + 2xCAN</p> <p>NB800-BScSu + COMIO + USB</p> <p>NB800-BSu2C + USB + 2xCAN</p> <p>NB800-R... and any of above options (replace B with R in above options)</p> <p><u>No Cellular Modem:</u></p> <p>NB800-WWt WLAN + BT</p> <p>NB800-WWtSu + USB</p> <p>NB800-WWtSc + COMIO</p> <p>NB800-WWt2C + 2xCAN</p> <p>NB800-WWtScSu + COMIO + USB</p> <p>NB800-WWtSu2C + USB + 2xCAN</p> <p><u>SW Options:</u></p> <p>Add suffix for any SW option, e.g. -Y for plain Linux, -Vi for LX Container</p> <p>Examples:</p> <p>NB800-LWWtSu-Y</p> <p>NB800-LWWtSu-Vi</p> <p>NB800-LWWtScSu-Y</p> <p>NB800-LWWtSu2C-Vi</p> <p><u>OEM Options:</u></p> <p>Add suffix -TAG, -OEM1, -OEM2 for OEM branding options (logo print), e.g. NB800-LWWt-TAG</p>

1) According to information of the customer and not verified by Eurofins Electrosuisse

5.3 Pictures of the EUT



5.4 Classification

EN 55032:2015 CISPR 32:2015	<ul style="list-style-type: none"> <input type="checkbox"/> Class A (suitable for use in all establishments other than domestic and those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes) <input checked="" type="checkbox"/> Class B (suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes) <input type="checkbox"/> The highest frequency of the internal sources of the EUT is less than 108 MHz (measurement shall be made up to 1 GHz). <input type="checkbox"/> The highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz (measurement shall be made up to 2 GHz). <input checked="" type="checkbox"/> The highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz (measurement shall be made up to 5 GHz).
--------------------------------	--

	<input type="checkbox"/> The highest frequency of the internal sources of the EUT is above 1 GHz (measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less).
EN 61000-6-3: 2007 + A1: 2011 IEC 61000-6-3 2006 + A1:2010	<input type="checkbox"/> The highest frequency of the internal sources of the EUT is less than 108 MHz (measurement shall be made up to 1 GHz). <input type="checkbox"/> The highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz (measurement shall be made up to 2 GHz). <input checked="" type="checkbox"/> The highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz (measurement shall be made up to 5 GHz). <input type="checkbox"/> The highest frequency of the internal sources of the EUT is above 1 GHz (measurement shall be made up to 5 times the highest frequency or 6 GHz, whichever is less).
EN 301 489	<input checked="" type="checkbox"/> Radio and ancillary equipment for fixed use (e.g. base station equipment) <input type="checkbox"/> Radio and ancillary equipment for vehicular use (e.g. mobile equipment) <input type="checkbox"/> Radio and ancillary equipment for portable use (portable equipment) <input type="checkbox"/> Ancillary equipment <input checked="" type="checkbox"/> Radio services: GSM, UMTS, LTE & WLAN:
CFR 47 Part 15	<input type="checkbox"/> Unintentional radiator (Subpart B) <input type="checkbox"/> Class A digital device <input checked="" type="checkbox"/> Class B digital device <input type="checkbox"/> The highest frequency of the internal sources of the EUT is less than 108 MHz (measurement shall be made up to 1 GHz). <input type="checkbox"/> The highest frequency of the internal sources of the EUT is between 108 MHz and 500 MHz (measurement shall be made up to 2 GHz). <input checked="" type="checkbox"/> The highest frequency of the internal sources of the EUT is between 500 MHz and 1 GHz (measurement shall be made up to 5 GHz). <input type="checkbox"/> The highest frequency of the internal sources of the EUT is above 1 GHz (measurement shall be made up to 5 times the highest frequency or 40 GHz, whichever is lower). <input type="checkbox"/> Intentional radiator (Subpart C)

5.5 Ports

Port	Cable			Remark
	Max. length	Type	Screen	
DC Supply	< 30 m	2 wires	No	If not stated otherwise, powered with AC/DC power supply of Dr. Widmer
Ethernet 1	< 100 m	RJ45 cat 5e	Yes	Connected to Test-PC
USB	< 3 m	USB	Yes	Connected to USB memory stick (for radiated tests connected with 3 m USB standard cable)
Digital Input	< 100 m	2 wire	No	Cables connected
Digital Output	< 100 m	2 wire	No	Cables connected
RS232/485	< 100 m	3 wire	No	Cables connected
CAN 1	< 100 m	3 wire	No	Cables connected to CAN 2
CAN 2	< 100 m	3 wire	No	Cables connected to CAN 1
WLAN 1 (Main)	< 30 m	SMA (Coax)	Yes	Connected to multiband-antenna
WLAN 2 (Aux)	< 30 m	SMA (Coax)	Yes	Connected to multiband-antenna
Mobile 1 (Main) (GSM, UMTS, LTE)	< 30 m	SMA (Coax)	Yes	Connected to multiband-antenna
Mobile 2 (Aux) (GSM, UMTS, LTE)	< 30 m	SMA (Coax)	Yes	Connected to multiband-antenna

6. Test conditions

6.1 Climatic conditions, location and date

Location	Date	Temp	Pressure (QFE)	Rel. humidity
Electrosuisse Montena EMC 3006 Bern Switzerland	January 24 to 25 & April 6, 2017 September 8 & November 7, 2017		See § 7 and § 8	

6.2 Test facility and methodology

The alternate test site (ferrite chamber) is accepted by FCC (Reg. No. 90808) and by Industry Canada (Site number 3625A-2).
Conducted and radiated measurements are performed according to the ANSI C63.4 (2003) procedure.

6.3 Attendant persons

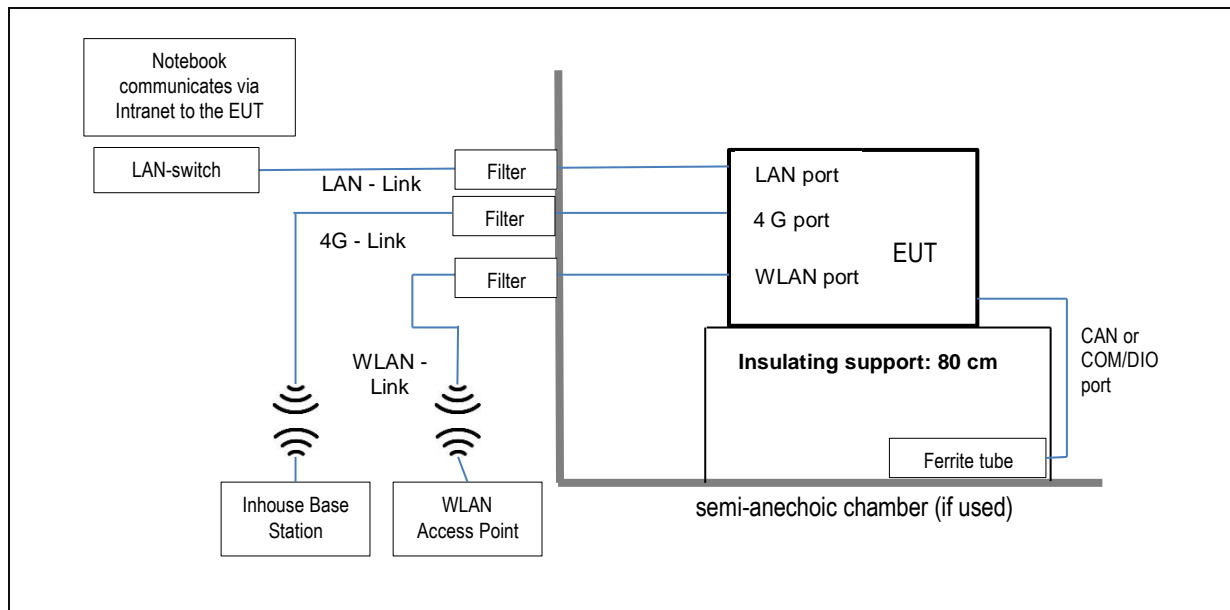
Test Engineer(s):

Mr F. Wyler

Other(s):

Name	Company
Mr R. Straub	NetModule AG
Mr. N. Gugger	NetModule AG

6.4 Test configuration



6.5 Operating conditions

Power supply during tests if not stated otherwise in § 7 and § 8 : 12 VDC

Routing mode:

- Ping over WLAN
- Ping over WWAN (UMTS/LTE)
- Ping over Ethernet cable

- Access to USB stick
- Memory Test
- CAN Loopback Test

6.6 Monitoring of the EUT

The performance of the EUT during the test is monitored as following:

Monitor of all Ping-outputs on the Test-PC
Monitor memory test
Monitor CAN loopback test

6.7 Auxiliary equipment

The following pieces of equipment are used for the monitoring of the EUT or are necessary for the EUT but they are not part of the EUT.

Product	Brand	Model No.	SN	Remark
Test-PC / Notebook	Dell	E5540	1PF9M12	--
USB Stick	n/a	--	--	--
WWAN Antenna	n/a	Antenna-Roof-2L DL-9	A140812300036	--
WLAN Antenna	--	Antenna-Roof-2W	--	--
Power supply	Dr. K. Witwer	von Electrosuisse	--	See tests

6.8 Performance criteria

General requirements:	Requirements according to the EUT:
Criterion A (Continuous phenomena for receivers / transmitters according EN 301 489):	
The apparatus shall continue to operate as intended. No degradation of performance or loss of function is allowed.	No transmission loss on LAN, WWAN (UMTS/LTE), WLAN
Criterion B (Transient phenomena for receivers / transmitters according EN 301 489):	
The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed. During the test, degradation of performance is however allowed. No change of actual operating state or stored data is allowed.	During the test: <ul style="list-style-type: none"> - short interruptions of the communication allowed - LED's may flicker - System may reboot (Surge test)
	After the test the EUT shall operate as in normal mode
Criterion C:	
Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.	Not applied. No specific requirements

7. Emission tests

7.1 Interference voltage

Test site: Shielded room

Meas. uncertainty: ± 3.6 dB

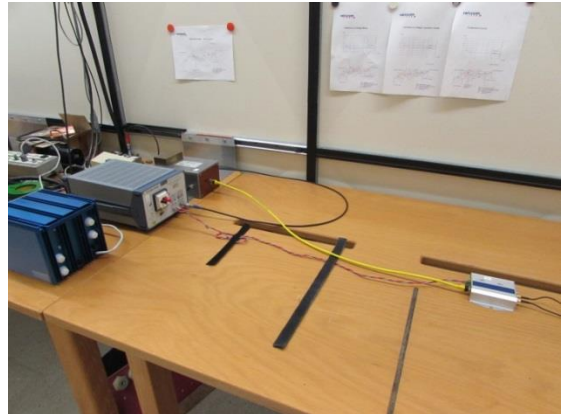
Measuring method: The conducted disturbance is measured using a spectrum analyser and a line impedance substitution network (LISN). The measurement of the voltage against the earth is carried out successively. The peak values are recorded continuously on the graph. The values that exceed the limit shall be re-measured with a measuring receiver.

Climatic: Temperature: 23.8 °C Humidity: 33 % Pressure QFE: 953 hPa

Test set-up:



Overview



Power port & LAN port

Remarks: None

Test equipment:

Spectrum analyser	<input type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input checked="" type="checkbox"/> 25953			
Receiver	<input type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input checked="" type="checkbox"/> 25953			
Relais-Matrix	<input checked="" type="checkbox"/> 25202					
LISN (=VNNB)	<input type="checkbox"/> 182186	<input checked="" type="checkbox"/> 10540	<input type="checkbox"/> 15840	<input type="checkbox"/> 25203	<input type="checkbox"/> 168517	<input type="checkbox"/> 168560
Coupling network	<input type="checkbox"/> 17414	<input type="checkbox"/> 25721	<input type="checkbox"/> 10539	<input type="checkbox"/> 25970	<input type="checkbox"/> 16386	
Coupling network	<input type="checkbox"/> 25971	<input type="checkbox"/> 105487	<input checked="" type="checkbox"/> 16562	<input checked="" type="checkbox"/> 16559	<input type="checkbox"/> 10539	
Coupling Network	<input type="checkbox"/> 168515	<input type="checkbox"/> 168516				
Coupling Network	<input checked="" type="checkbox"/> 25786	<input checked="" type="checkbox"/> 25949	<input type="checkbox"/> 25718			
Coupling Network	<input type="checkbox"/> 25715	<input type="checkbox"/> 25716				
Coupling Network	<input type="checkbox"/> 181762	<input checked="" type="checkbox"/> 17-LaBe-02				
Coupling Network	<input type="checkbox"/> 181764					
Decoupling clamp	<input type="checkbox"/> 25781	<input type="checkbox"/> 17901	<input type="checkbox"/> 17902	<input type="checkbox"/> 17013		
Current clamp	<input type="checkbox"/> 7525					
Cables	<input checked="" type="checkbox"/> 16140					
Artificial hand	<input type="checkbox"/> 184450					
Software and Revision	<input type="checkbox"/> Vitam, Rev. 2.4.13		<input checked="" type="checkbox"/> RadiMation 2016.1.6			

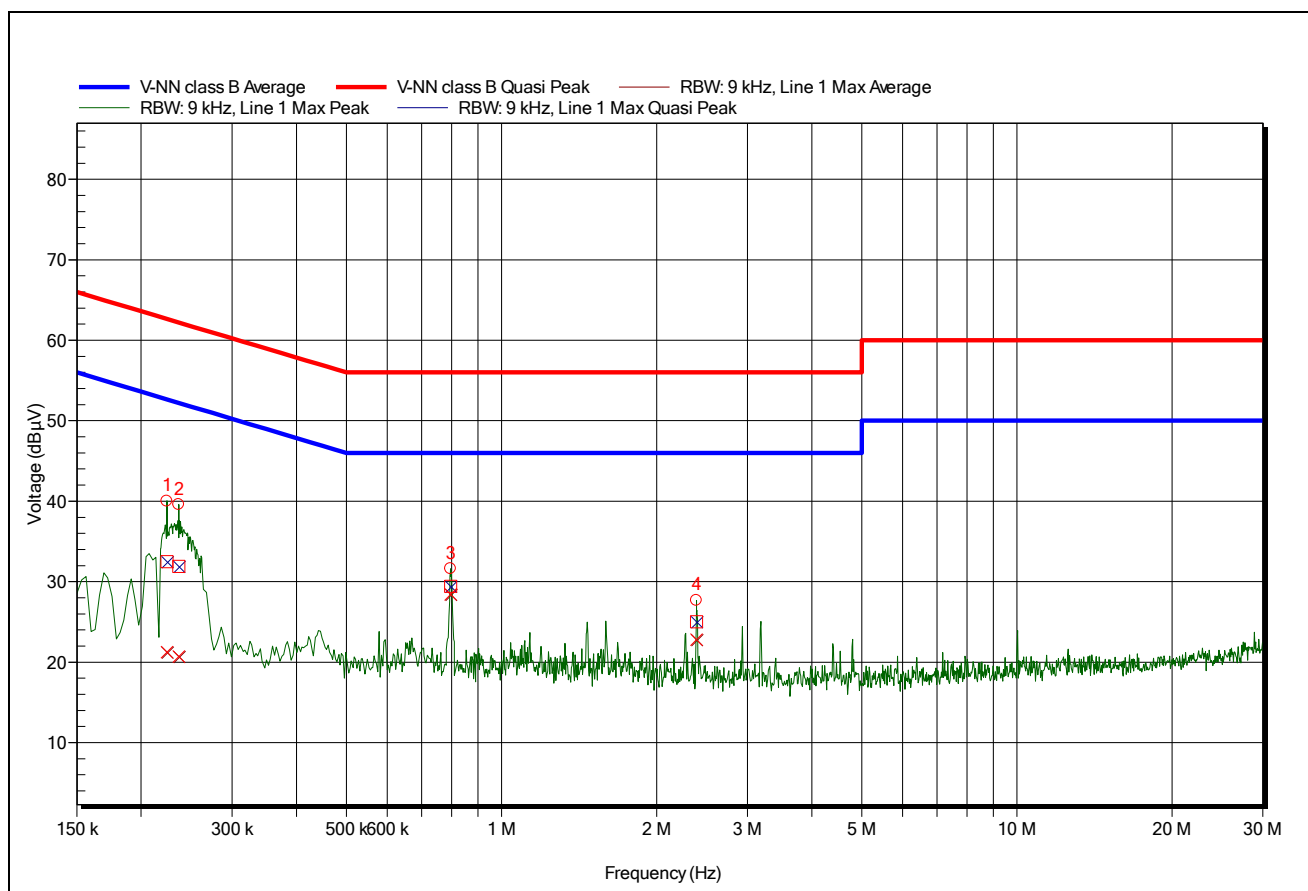
Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement 1:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Power port 12 VDC, Plus
 Set-up / CDN: Table-top / ESH3-Z5 182186 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
224.353 kHz	40.01 dBμV	21.22 dBμV	-31.43 dB	32.49 dBμV	-30.16 dB	Pass
236.482 kHz	39.58 dBμV	20.71 dBμV	-31.51 dB	31.91 dBμV	-30.31 dB	Pass
796.19 kHz	31.6 dBμV	28.4 dBμV	-17.6 dB	29.44 dBμV	-26.56 dB	Pass
2.39 MHz	27.64 dBμV	22.77 dBμV	-23.23 dB	25 dBμV	-31 dB	Pass

Place and date of test:
Operator:

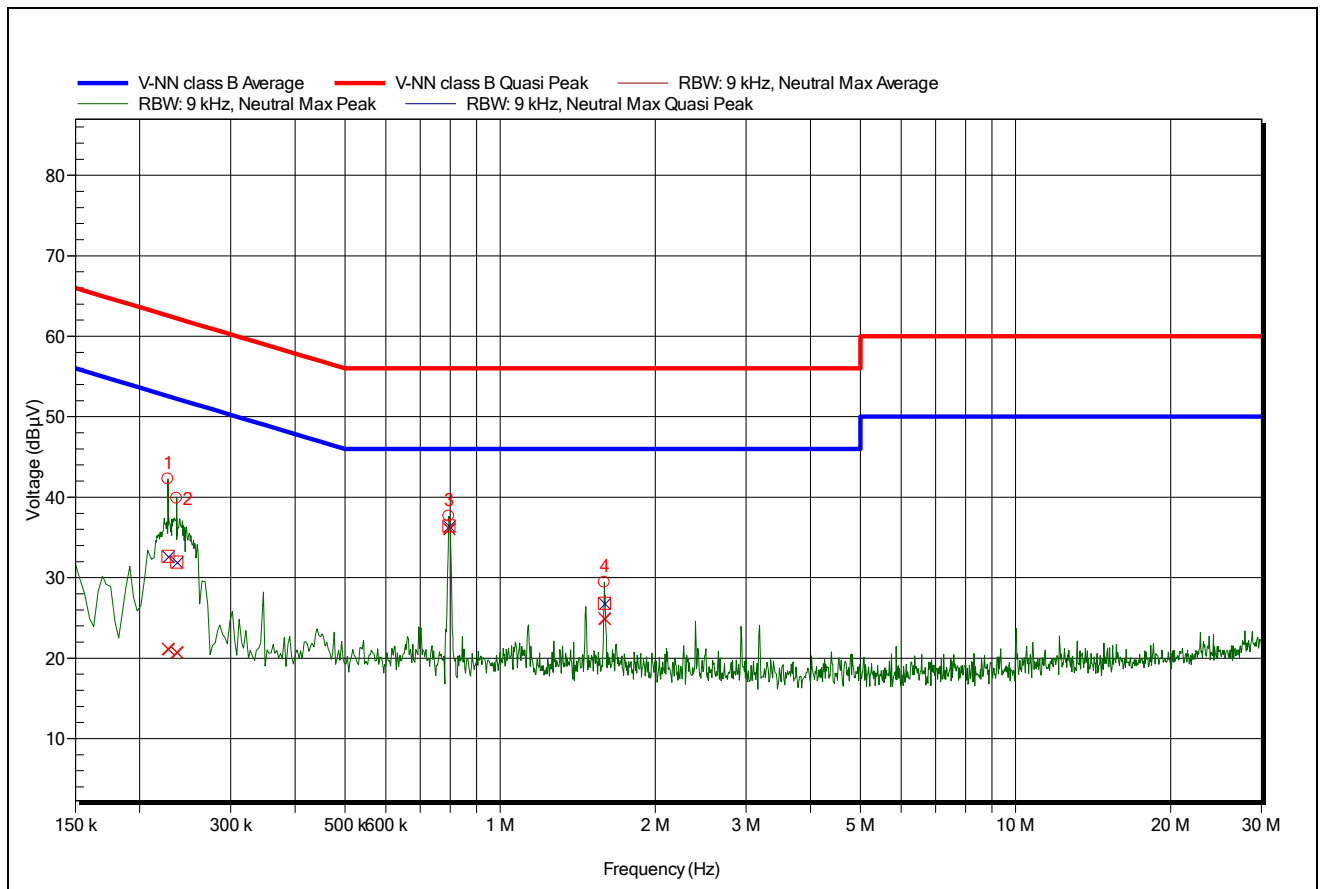
Bern, November 7, 2017
F. Wyler

Measurement 2:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Power port 12 VDC, Minus
 Set-up / CDN: Table-top / ESH3-Z5 182186 (N)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
226.982 kHz	42.27 dBµV	21.17 dBµV	-31.39 dB	32.67 dBµV	-29.89 dB	Pass
236.007 kHz	39.88 dBµV	20.74 dBµV	-31.49 dB	31.94 dBµV	-30.29 dB	Pass
796.158 kHz	37.64 dBµV	36.09 dBµV	-9.91 dB	36.42 dBµV	-19.58 dB	Pass
1.593 MHz	29.42 dBµV	24.93 dBµV	-21.07 dB	26.83 dBµV	-29.17 dB	Pass

Place and date of test:
 Operator:

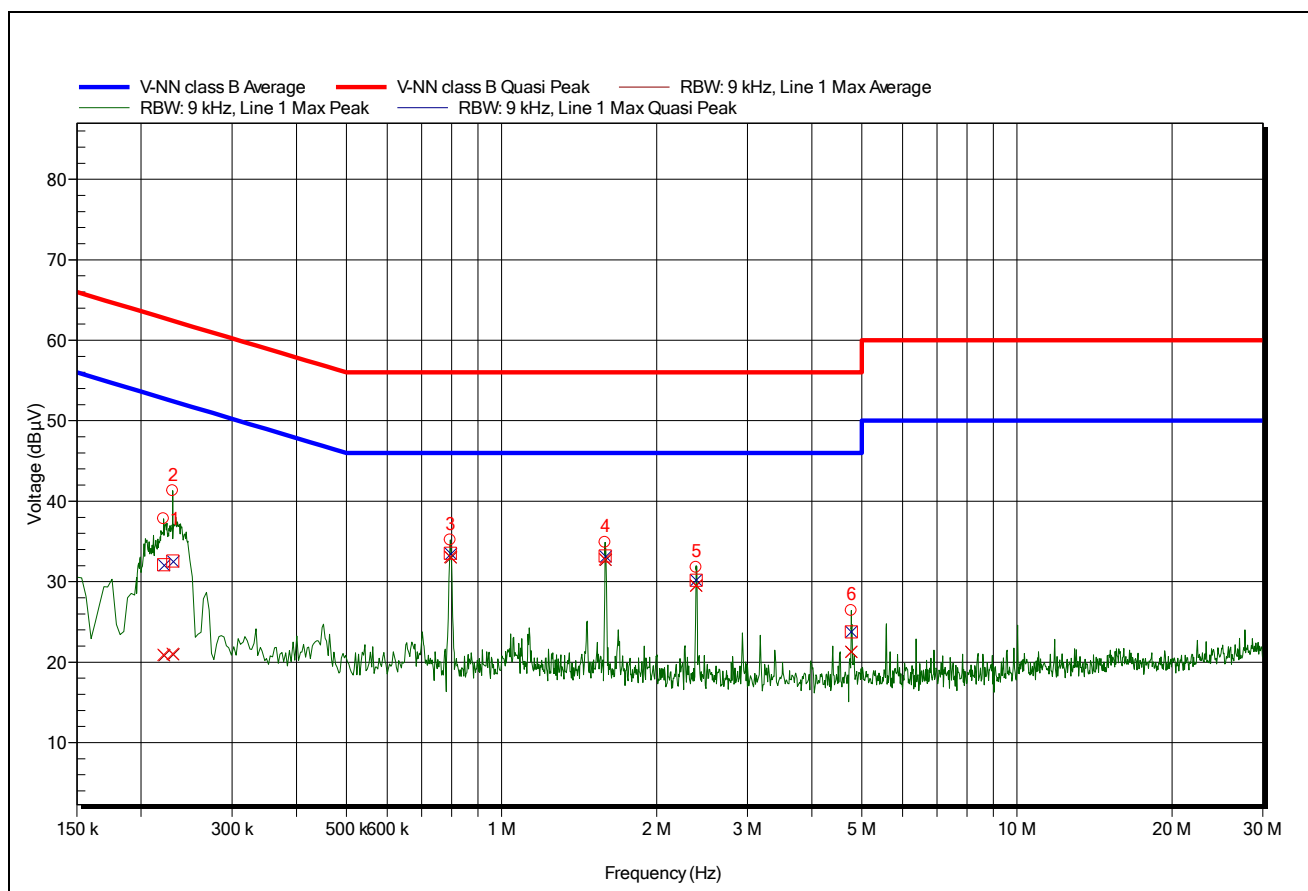
Bern, November 7, 2017
 F. Wyler

Measurement 3:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Power port 24 VDC, Plus
 Set-up / CDN: Table-top / ESH3-Z5 182186 (L1)
 Cables connected: Power 24 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
221.25 kHz	37.8 dBμV	20.89 dBμV	-31.88 dB	32.09 dBμV	-30.68 dB	Pass
230.148 kHz	41.28 dBμV	21.04 dBμV	-31.4 dB	32.57 dBμV	-29.87 dB	Pass
795.145 kHz	35.16 dBμV	33.07 dBμV	-12.93 dB	33.53 dBμV	-22.47 dB	Pass
1.589 MHz	34.89 dBμV	32.78 dBμV	-13.22 dB	33.21 dBμV	-22.79 dB	Pass
2.385 MHz	31.76 dBμV	29.5 dBμV	-16.5 dB	30.19 dBμV	-25.81 dB	Pass
4.771 MHz	26.4 dBμV	21.29 dBμV	-24.71 dB	23.78 dBμV	-32.22 dB	Pass

Place and date of test:
 Operator:

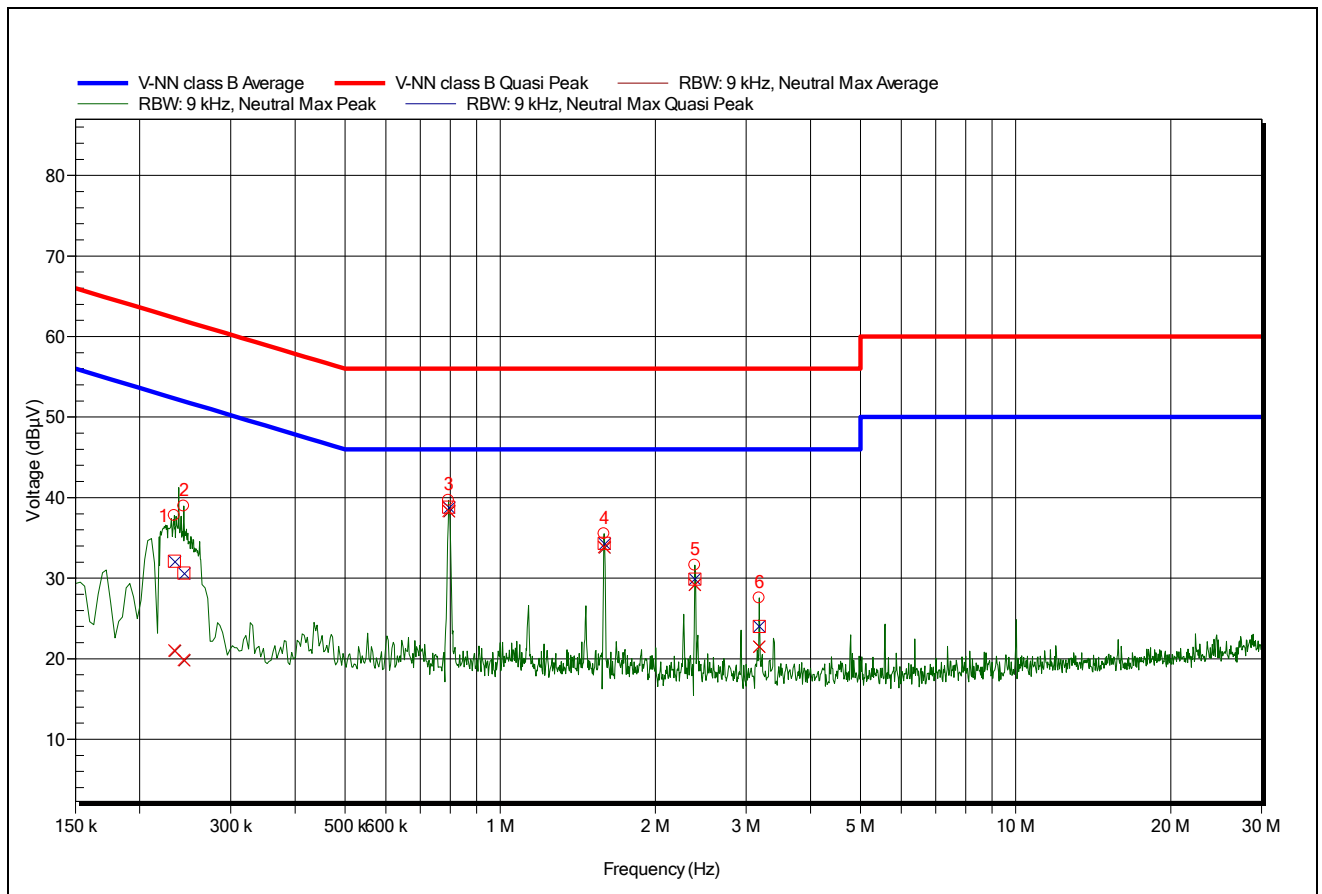
Bern, November 7, 2017
 F. Wyler

Measurement 4:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Power port 24 VDC, Minus
 Set-up / CDN Table-top / ESH3-Z5 182186 (N)
 Cables connected: Power 24 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
233.347 kHz	37.78 dBµV	21.02 dBµV	-31.31 dB	32.11 dBµV	-30.22 dB	Pass
243.353 kHz	38.92 dBµV	19.85 dBµV	-32.13 dB	30.62 dBµV	-31.36 dB	Pass
794.892 kHz	39.67 dBµV	38.37 dBµV	-7.63 dB	38.81 dBµV	-17.19 dB	Pass
1.591 MHz	35.5 dBµV	33.87 dBµV	-12.13 dB	34.31 dBµV	-21.69 dB	Pass
2.385 MHz	31.61 dBµV	29.17 dBµV	-16.83 dB	29.87 dBµV	-26.13 dB	Pass
3.181 MHz	27.54 dBµV	21.49 dBµV	-24.51 dB	24.01 dBµV	-31.99 dB	Pass

Place and date of test:
 Operator:

Bern, November 7, 2017
 F. Wyler

7.2 Conducted emission on I/O and telecommunication ports

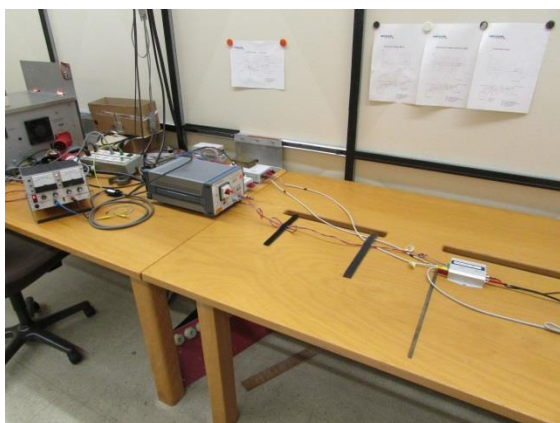
Test site: Shielded room

Meas. uncertainty: ± 3.6 dB

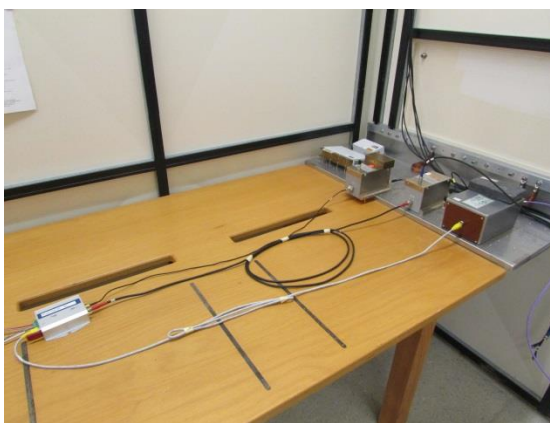
Measuring method: The conducted disturbance is measured using a spectrum analyser and a voltage probe. The peak values are recorded continuously on the graph. The values that exceed the limit shall be re-measured with a measuring receiver.

Climatic conditions: Temperature: 22.2 °C Humidity: 33 % Pressure QFE: 959 hPa (2017-04-06)
 Temperature: 23.8 °C Humidity: 33 % Pressure QFE: 953 hPa (2017-11-07)

Test set-up:



Power port & LAN port



CAN, COM & I/O port

Remarks: None

Test equipment:

Spectrum analyser	<input type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input checked="" type="checkbox"/> 25953			
Receiver	<input type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input checked="" type="checkbox"/> 25953			
Relais-Matrix	<input checked="" type="checkbox"/> 25202					
LISN (=VNNB)	<input type="checkbox"/> 182186	<input checked="" type="checkbox"/> 10540	<input type="checkbox"/> 15840	<input type="checkbox"/> 25203	<input type="checkbox"/> 168517	<input type="checkbox"/> 168560
Coupling network	<input type="checkbox"/> 17414	<input type="checkbox"/> 25721	<input type="checkbox"/> 10539	<input type="checkbox"/> 25970	<input type="checkbox"/> 16386	
Coupling network	<input type="checkbox"/> 25971	<input type="checkbox"/> 105487	<input checked="" type="checkbox"/> 16562	<input checked="" type="checkbox"/> 16559	<input type="checkbox"/> 10539	
Coupling Network	<input type="checkbox"/> 168515	<input type="checkbox"/> 168516				
Coupling Network	<input checked="" type="checkbox"/> 25786	<input checked="" type="checkbox"/> 25949	<input type="checkbox"/> 25718			
Coupling Network	<input type="checkbox"/> 25715	<input type="checkbox"/> 25716				
Coupling Network	<input type="checkbox"/> 181762	<input checked="" type="checkbox"/> 17-LaBe-02				
Coupling Network	<input type="checkbox"/> 181764					
Decoupling clamp	<input type="checkbox"/> 25781	<input type="checkbox"/> 17901	<input type="checkbox"/> 17902	<input type="checkbox"/> 17013		
Current clamp	<input type="checkbox"/> 7525					
Cables	<input checked="" type="checkbox"/> 16140					
Artificial hand	<input type="checkbox"/> 184450					
Software and Revision	<input type="checkbox"/> Vitam, Rev. 2.4.13		<input checked="" type="checkbox"/> RadiMation 2016.1.6			

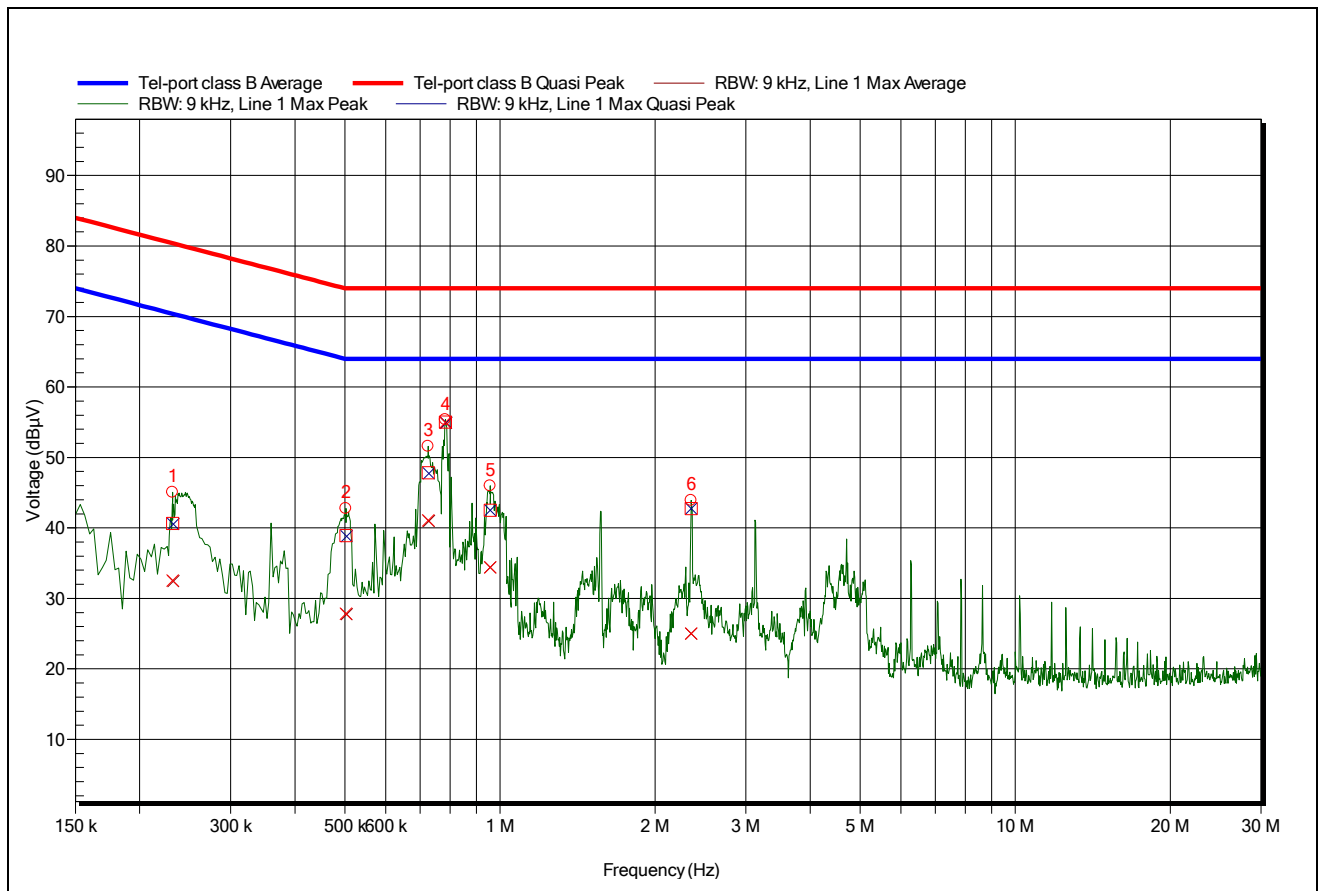
Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement 1:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Measured interface: Ethernet (L1)
 Set-up / CDN: Table-top / T-ISO 181763 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
231.763 kHz	45 dBμV	32.5 dBμV	-37.87 dB	40.6 dBμV	-39.77 dB	Pass
502.64 kHz	42.7 dBμV	27.8 dBμV	-36.18 dB	38.9 dBμV	-35.08 dB	Pass
726.048 kHz	51.6 dBμV	41.1 dBμV	-22.93 dB	47.8 dBμV	-26.17 dB	Pass
783.523 kHz	55.3 dBμV	55 dBμV	-9.05 dB	55 dBμV	-19 dB	Pass
957.5 kHz	45.9 dBμV	34.4 dBμV	-29.58 dB	42.5 dBμV	-31.51 dB	Pass
2.349 MHz	43.9 dBμV	25 dBμV	-39.01 dB	42.7 dBμV	-31.26 dB	Pass

Place and date of test:
 Operator:

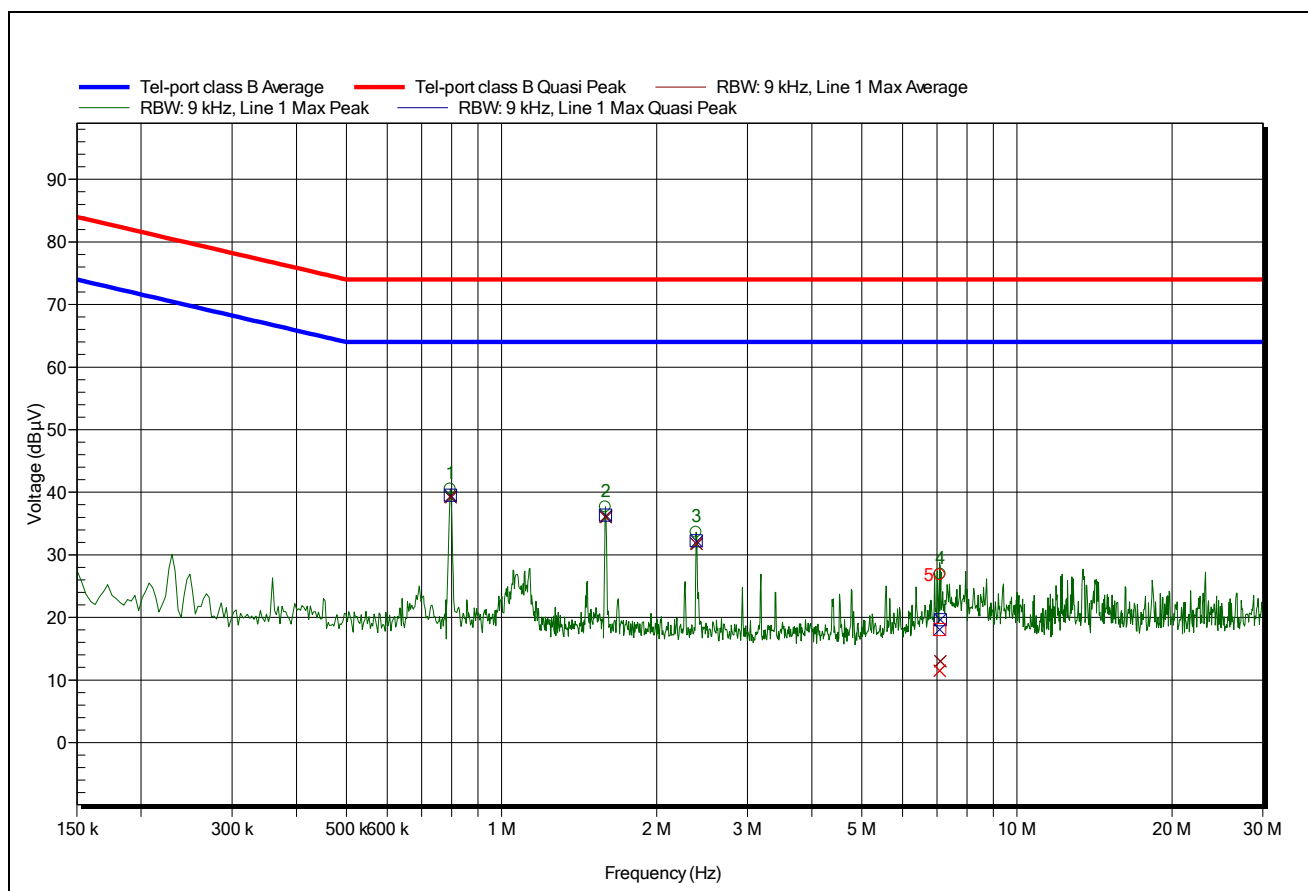
Bern, April 6, 2017
 F. Wyler

Measurement 2:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Ethernet (L1)
 Set-up / CDN: Table-top / T-ISO 181763 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
795.145 kHz	40.5 dBμV	39.3 dBμV	-24.71 dB	39.5 dBμV	-34.45 dB	Pass
1.59 MHz	37.6 dBμV	36.1 dBμV	-27.91 dB	36.4 dBμV	-37.63 dB	Pass
2.386 MHz	33.6 dBμV	31.8 dBμV	-32.2 dB	32.2 dBμV	-41.77 dB	Pass
7.097 MHz	26.9 dBμV	13 dBμV	-51.03 dB	19.6 dBμV	-54.37 dB	Pass
7.084 MHz	26.8 dBμV	11.5 dBμV	-52.52 dB	18.1 dBμV	-55.92 dB	Pass

Place and date of test:
Operator:

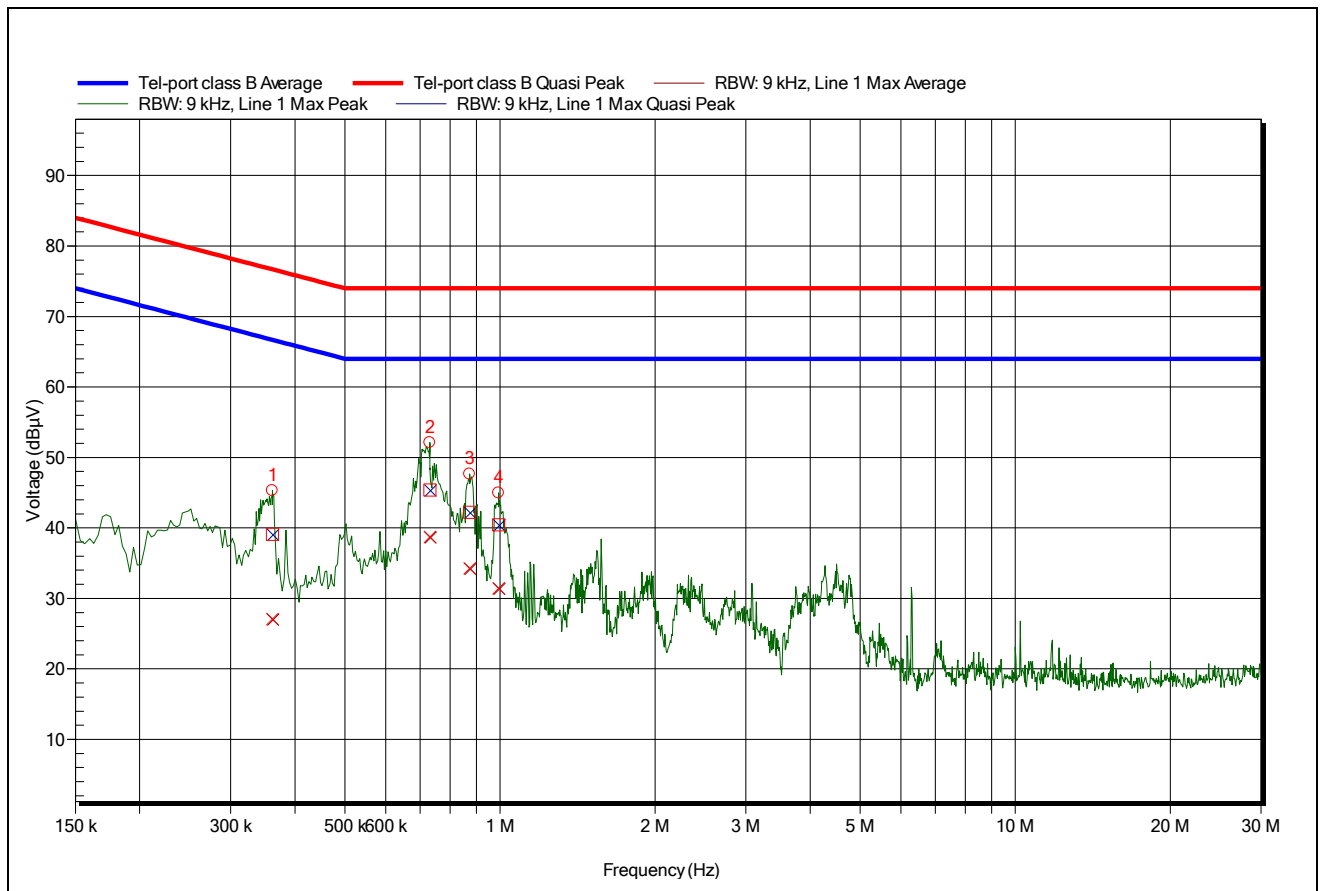
Bern, November 7, 2017
F. Wyler

Measurement 3:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Measured interface: Radio port WIFI on Coax (L1)
 Set-up / CDN: Table-top / S1-ISO 25786 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
361.692 kHz	45.3 dBμV	27 dBμV	-39.65 dB	39.1 dBμV	-37.59 dB	Pass
730.988 kHz	52.1 dBμV	38.7 dBμV	-25.29 dB	45.4 dBμV	-28.61 dB	Pass
873.203 kHz	47.6 dBμV	34.2 dBμV	-29.75 dB	42.2 dBμV	-31.77 dB	Pass
993.727 kHz	44.9 dBμV	31.4 dBμV	-32.56 dB	40.4 dBμV	-33.57 dB	Pass

Place and date of test:
Operator:

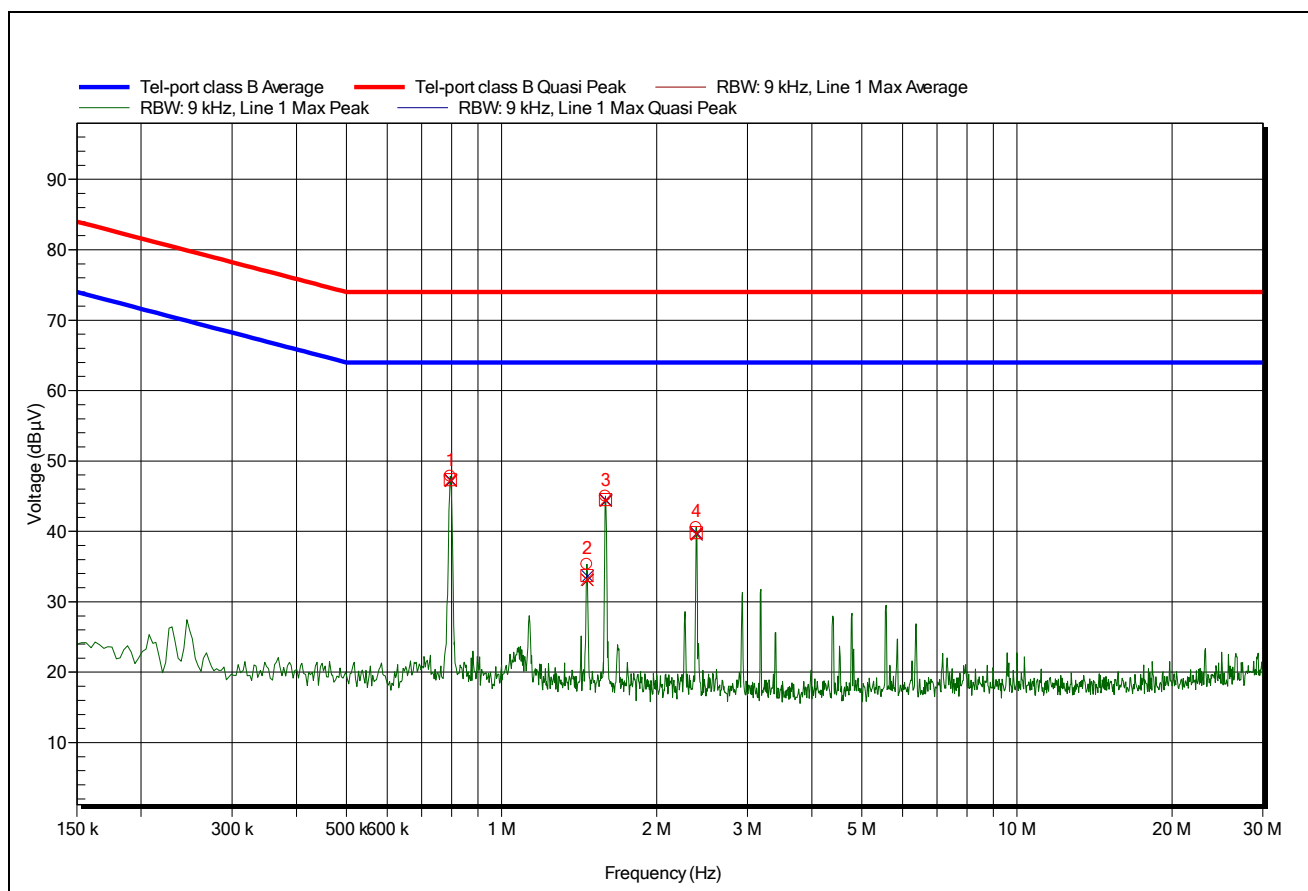
Bern, April 6, 2017
F. Wyler

Measurement 4:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Radio port WIFI on Coax (L1)
 Set-up / CDN: Table-top / S1-ISO 25786 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
795.367 kHz	47.8 dBμV	47.3 dBμV	-16.73 dB	47.3 dBμV	-26.66 dB	Pass
1.464 MHz	35.3 dBμV	33.1 dBμV	-30.86 dB	33.7 dBμV	-40.27 dB	Pass
1.591 MHz	45 dBμV	44.4 dBμV	-19.58 dB	44.5 dBμV	-29.48 dB	Pass
2.385 MHz	40.5 dBμV	39.6 dBμV	-24.38 dB	39.8 dBμV	-34.2 dB	Pass

Place and date of test:
Operator:

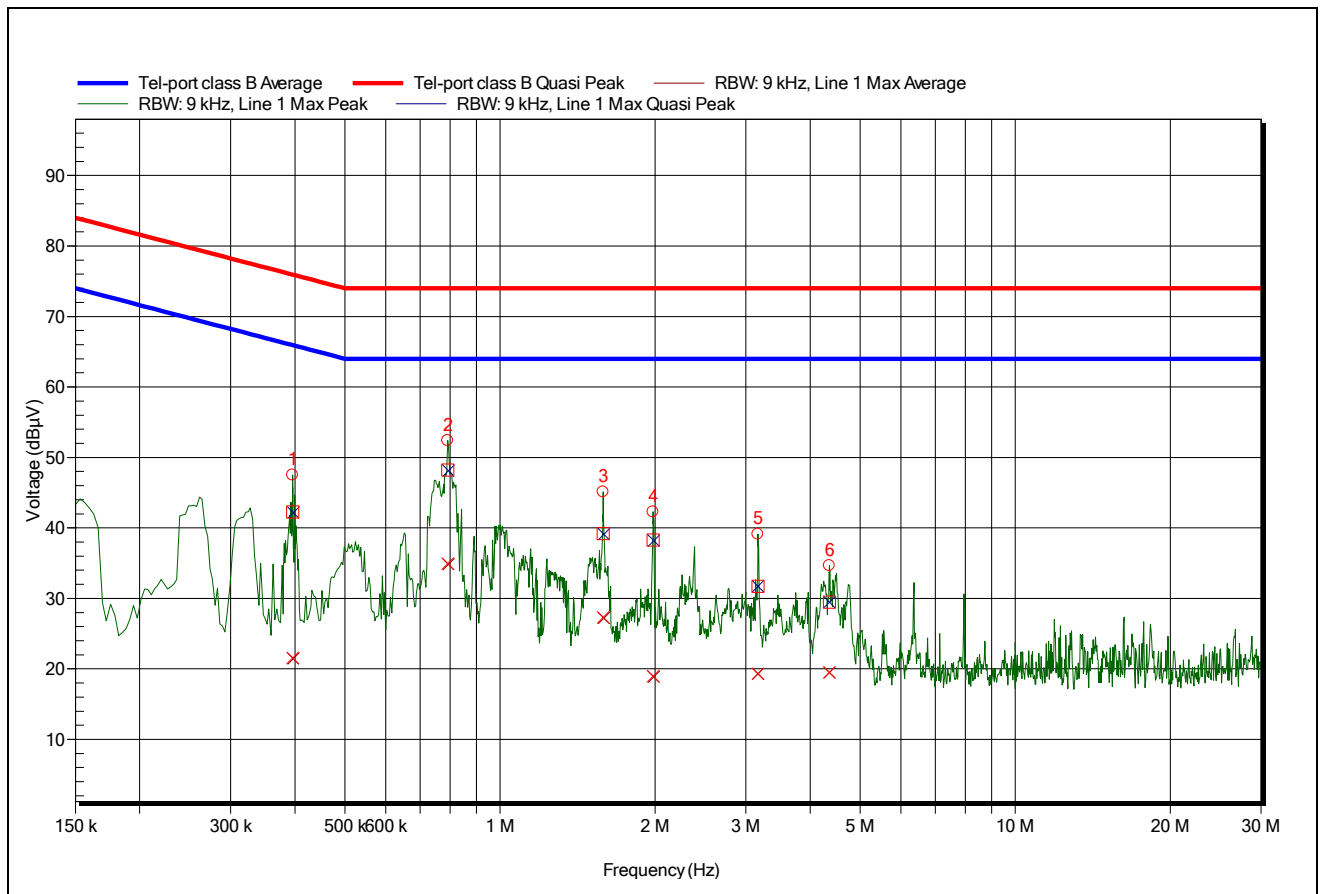
Bern, November 7, 2017
F. Wyler

Measurement 5:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Measured interface: Radio port Mobile Link on Coax (L1)
 Set-up / CDN: Table-top / S1-1SN 25949 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
396.018 kHz	47.5 dBμV	21.5 dBμV	-44.4 dB	42.3 dBμV	-33.65 dB	Pass
792.517 kHz	52.4 dBμV	34.9 dBμV	-29.08 dB	48.2 dBμV	-25.78 dB	Pass
1.585 MHz	45.1 dBμV	27.3 dBμV	-36.72 dB	39.2 dBμV	-34.81 dB	Pass
1.981 MHz	42.2 dBμV	19 dBμV	-45.02 dB	38.3 dBμV	-35.7 dB	Pass
3.169 MHz	39.1 dBμV	19.3 dBμV	-44.68 dB	31.7 dBμV	-42.29 dB	Pass
4.358 MHz	34.7 dBμV	19.5 dBμV	-44.51 dB	29.5 dBμV	-44.53 dB	Pass

Place and date of test:
 Operator:

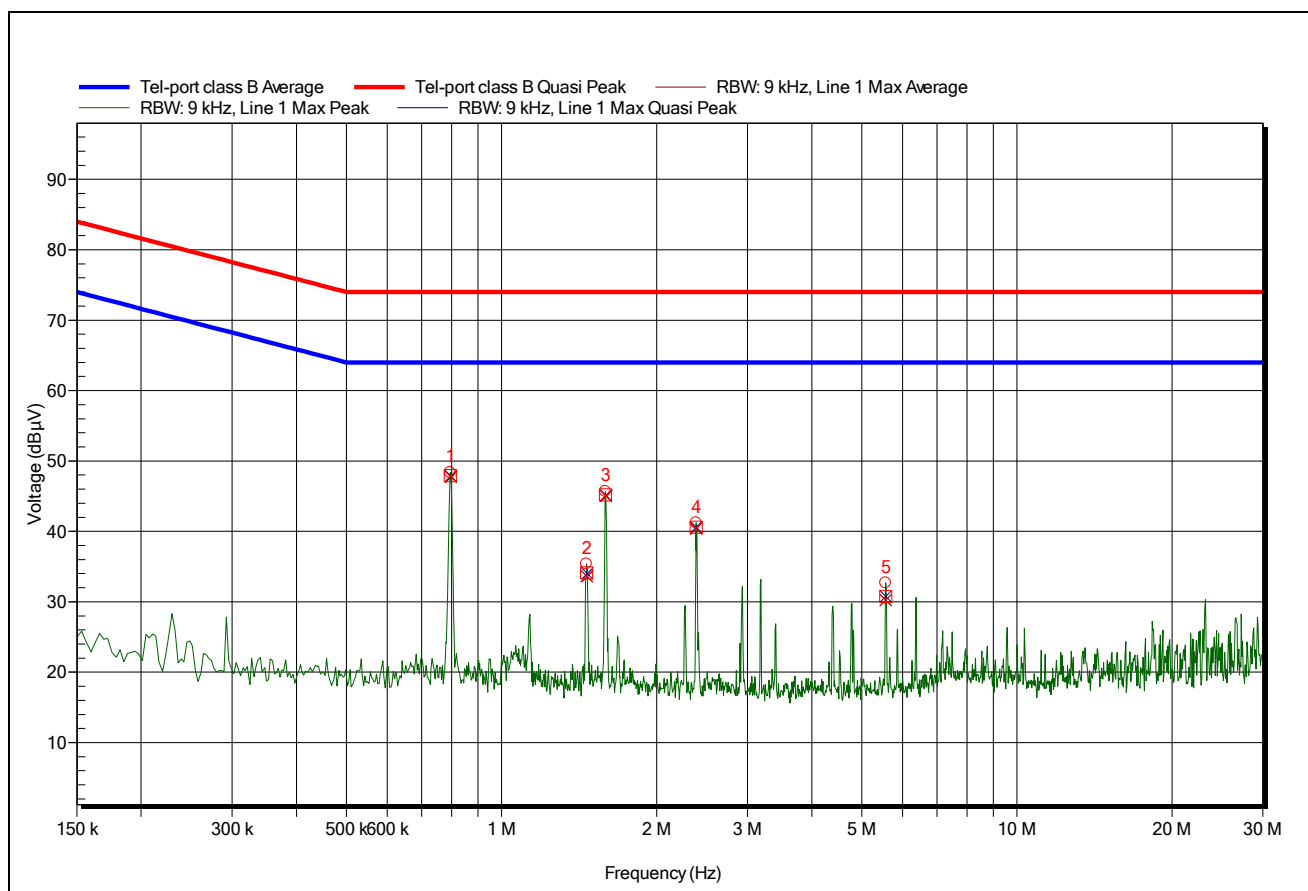
Bern, April 6, 2017
 F. Wyler

Measurement 6:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: Radio port Mobile Link on Coax (L1)
 Set-up / CDN: Table-top / S1-ISO 25949 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
795.018 kHz	48.3 dBμV	47.8 dBμV	-16.17 dB	47.9 dBμV	-26.1 dB	Pass
1.462 MHz	35.4 dBμV	33.7 dBμV	-30.32 dB	34.1 dBμV	-39.89 dB	Pass
1.59 MHz	45.7 dBμV	45.1 dBμV	-18.9 dB	45.2 dBμV	-28.8 dB	Pass
2.385 MHz	41.2 dBμV	40.4 dBμV	-23.6 dB	40.6 dBμV	-33.42 dB	Pass
5.566 MHz	32.7 dBμV	30.2 dBμV	-33.75 dB	30.8 dBμV	-43.24 dB	Pass
795.018 kHz	48.3 dBμV	47.8 dBμV	-16.17 dB	47.9 dBμV	-26.1 dB	Pass

Place and date of test:
Operator:

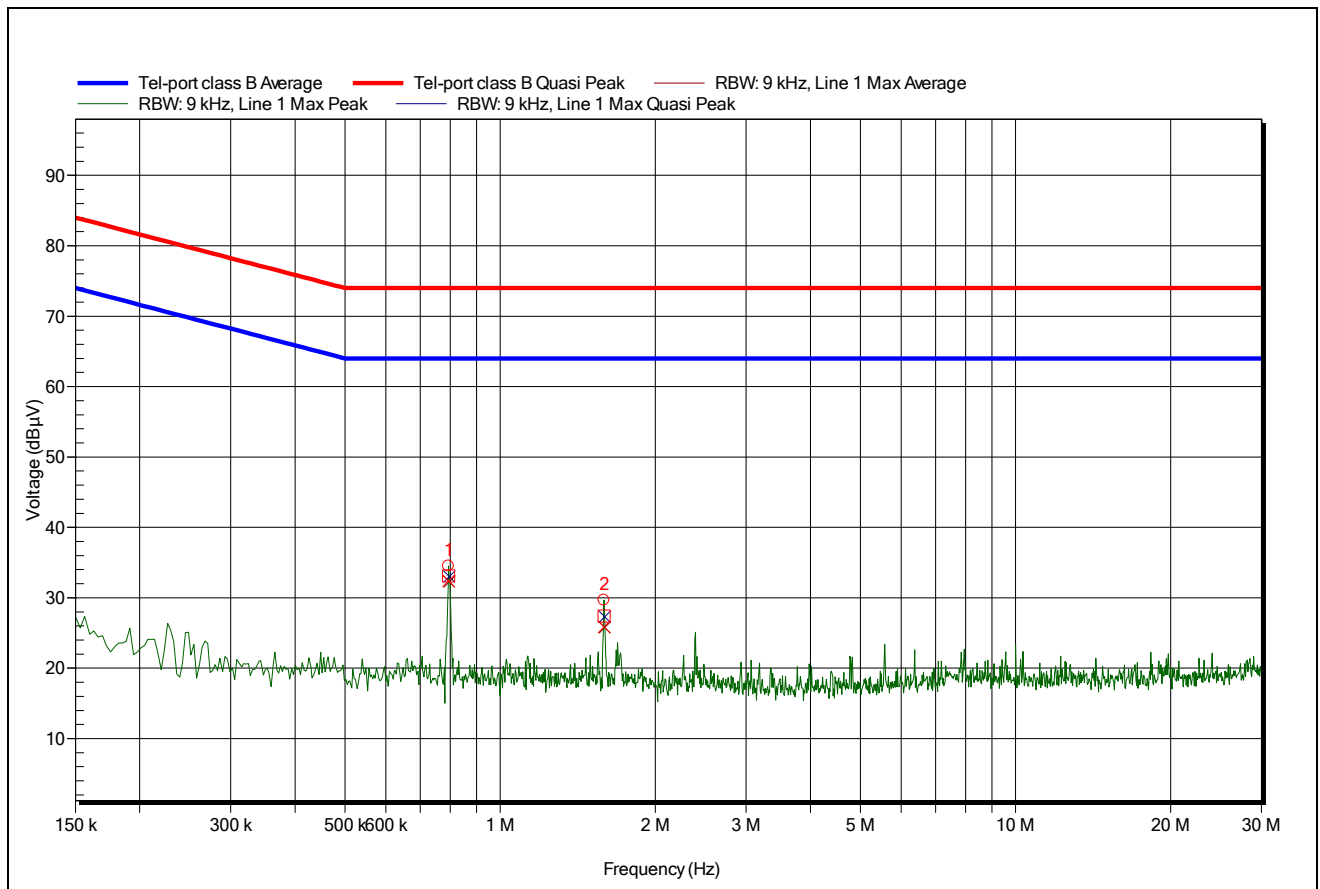
Bern, November 7, 2017
F. Wyler

Measurement 7:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Measured interface: CAN port (L1)
 Set-up / CDN: Table-top / T-ISN 16562 (L1)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; CAN loop back, see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s



Detected peaks

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
794.892 kHz	34.5 dBµV	32.4 dBµV	-31.59 dB	33.1 dBµV	-40.9 dB	Pass
1.591 MHz	29.7 dBµV	25.9 dBµV	-38.15 dB	27.4 dBµV	-46.58 dB	Pass

Place and date of test:
Operator:

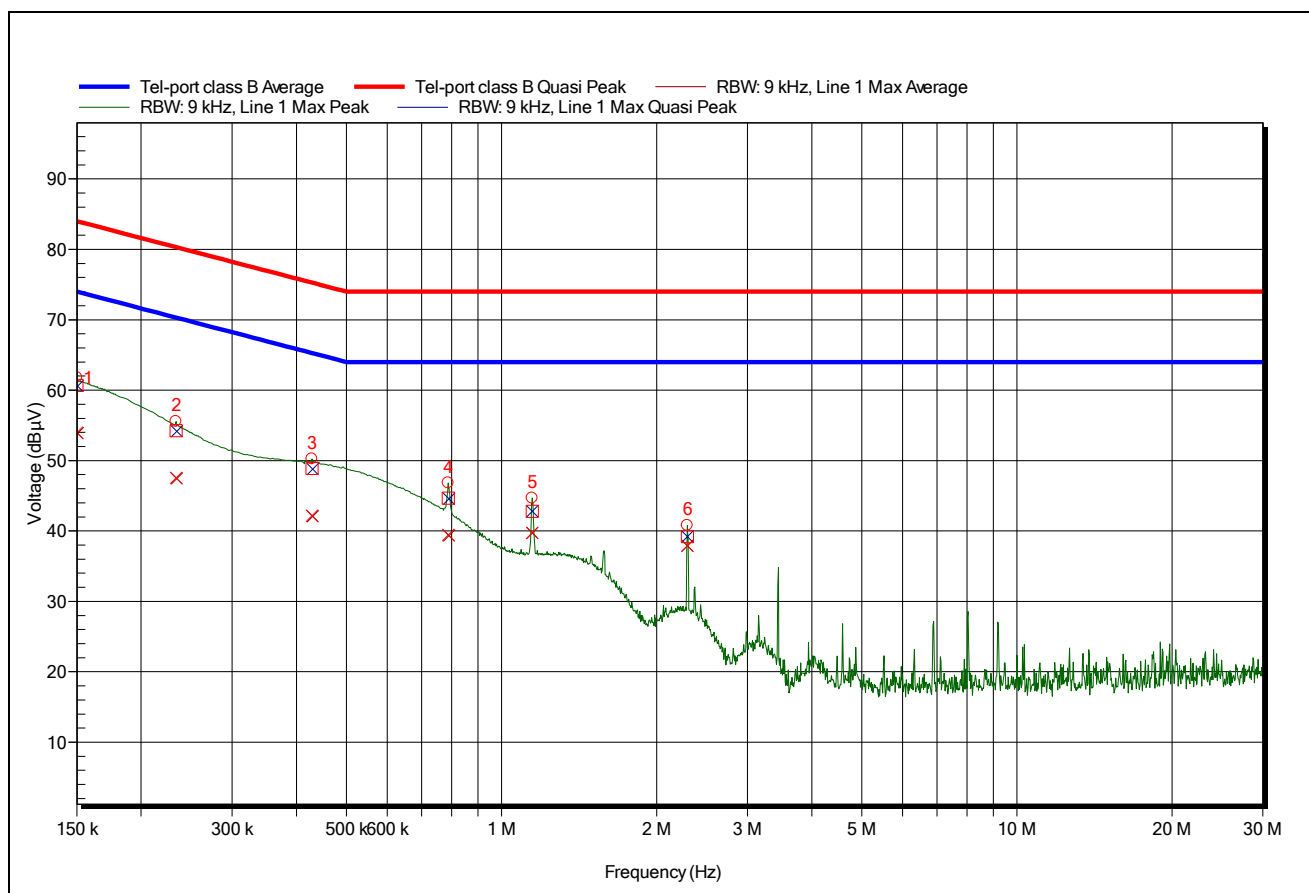
Bern, November 7, 2017
F. Wyler

Measurement 8:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Measured interface: RS485/RS232 (L1)
 Set-up / CDN: Table-top / T-ISO 25721 (L1)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

Frequency	Peak	Average	Average Difference	Quasi-Peak	Quasi-Peak Difference	Status
150 kHz	61.8 dBµV	54 dBµV	-20.01 dB	60.7 dBµV	-23.31 dB	Pass
233.917 kHz	55.5 dBµV	47.5 dBµV	-22.78 dB	54.3 dBµV	-26.05 dB	Pass
428.667 kHz	50.2 dBµV	42.2 dBµV	-23.11 dB	48.9 dBµV	-26.38 dB	Pass
787.83 kHz	46.8 dBµV	39.4 dBµV	-24.55 dB	44.6 dBµV	-29.35 dB	Pass
1.147 MHz	44.6 dBµV	39.7 dBµV	-24.28 dB	42.8 dBµV	-31.23 dB	Pass
2.293 MHz	40.8 dBµV	37.9 dBµV	-26.08 dB	39.2 dBµV	-34.79 dB	Pass

Place and date of test:
 Operator:

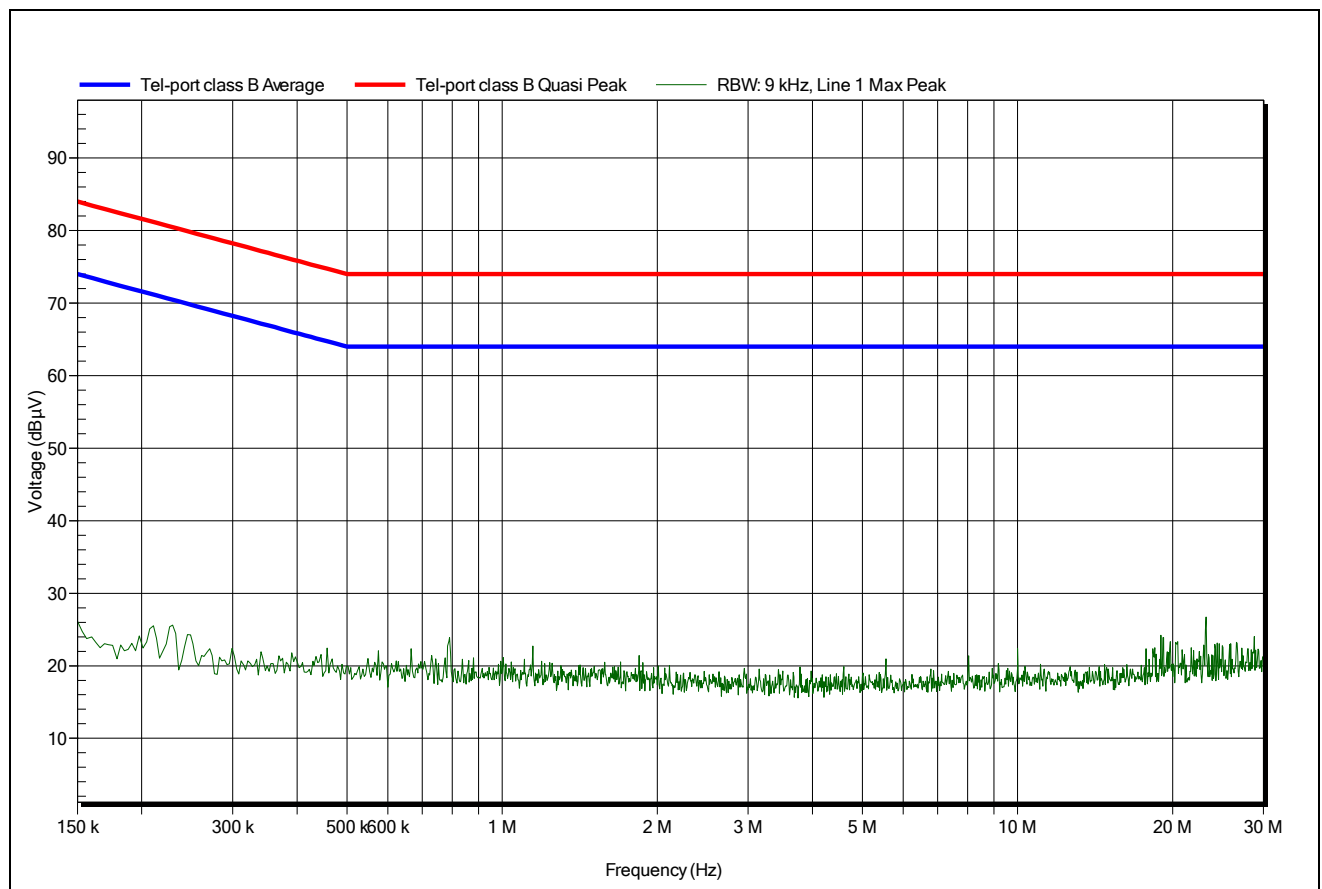
Bern, November 7, 2017
 F. Wyler

Measurement 9:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Measured interface: Digital In/out (L1)
 Set-up / CDN: Table-top / T-ISN 25721 (L1)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	150 kHz ... 30 MHz
Coarse measurements:	Peak	Resolution / Video Bandwidth	9 kHz / 30 kHz
Sweep time:	500ms/1000ms/2000ms	Number of sweeps:	20/20/20
Receiver measurement	Peak, Quasi-Peak & Average	Measure / Observation Time	1 s / 5 s

**Detected peaks**

None

Place and date of test:
Operator:

Bern, November 7, 2017
F. Wyler

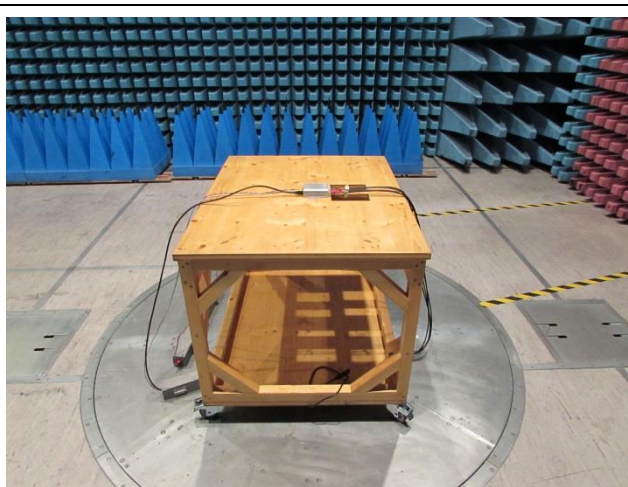
7.3 Radiated electromagnetic field

Test site: Semi-anechoic chamber (hybrid)
 Distance: 3 m
 Position of EUT: 80 cm (height of the equipment under test above floor)
 Meas. uncertainty: ± 4.6 dB (30 - 300 MHz) / ± 3.7 dB (300 - 1000 MHz) / ± 4.7 dB (1 - 18 GHz)
 Measuring method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit shall be re-measured manually using a receiver.
 Climatic conditions: Temperature: 23.1 °C Humidity: 18 % Pressure QFE: 960 hPa (2017-01-24)
 Temperature: 24.5 °C Humidity: 34 % Pressure QFE: 951 hPa (2017-11-07)

Test set-up:



Overview



Close view

Remarks: None

Test equipment:

Spectrum analyser	<input checked="" type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input type="checkbox"/> 25953
Receiver	<input checked="" type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input type="checkbox"/> 25953
Preamplifier	<input checked="" type="checkbox"/> 184451	<input type="checkbox"/> 168520	
Antenna, (log-per)	<input type="checkbox"/> 168585	<input type="checkbox"/> 26021	
Antenna, (bi-con-log)	<input checked="" type="checkbox"/> 181955		
Antenna, (bi-log)	<input type="checkbox"/> 26933		
Antenna, (log-per dir)	<input type="checkbox"/> 168591		
Cables	<input checked="" type="checkbox"/> 184452	<input type="checkbox"/> 168547	
Software and Revision	<input checked="" type="checkbox"/> RadiMation 2016.1.6		

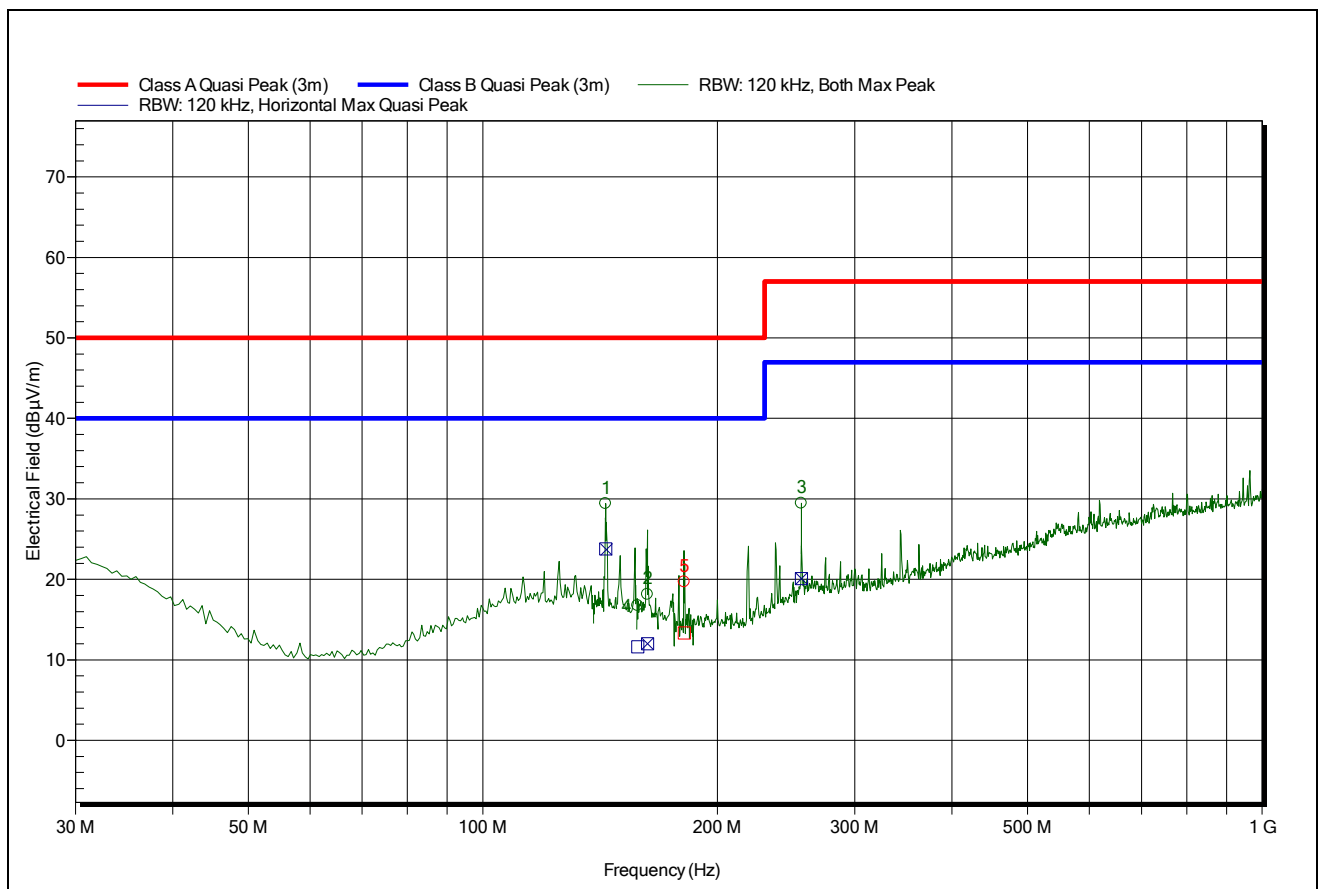
Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement 1:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
143,728 MHz	29,42 dBµV/m	23,8 dBµV/m	-16,2 dB	Pass	270 Degree	2 m	Horizontal
162,73 MHz	18,14 dBµV/m	11,98 dBµV/m	-28,02 dB	Pass	67 Degree	3 m	Horizontal
256,209 MHz	29,43 dBµV/m	20,11 dBµV/m	-26,89 dB	Pass	67 Degree	1 m	Horizontal
158,035 MHz	16,72 dBµV/m	11,63 dBµV/m	-28,37 dB	Pass	67 Degree	1 m	Vertical
181,301 MHz	19,69 dBµV/m	13,34 dBµV/m	-26,66 dB	Pass	67 Degree	1 m	Vertical

Place and date of test:
 Operator:

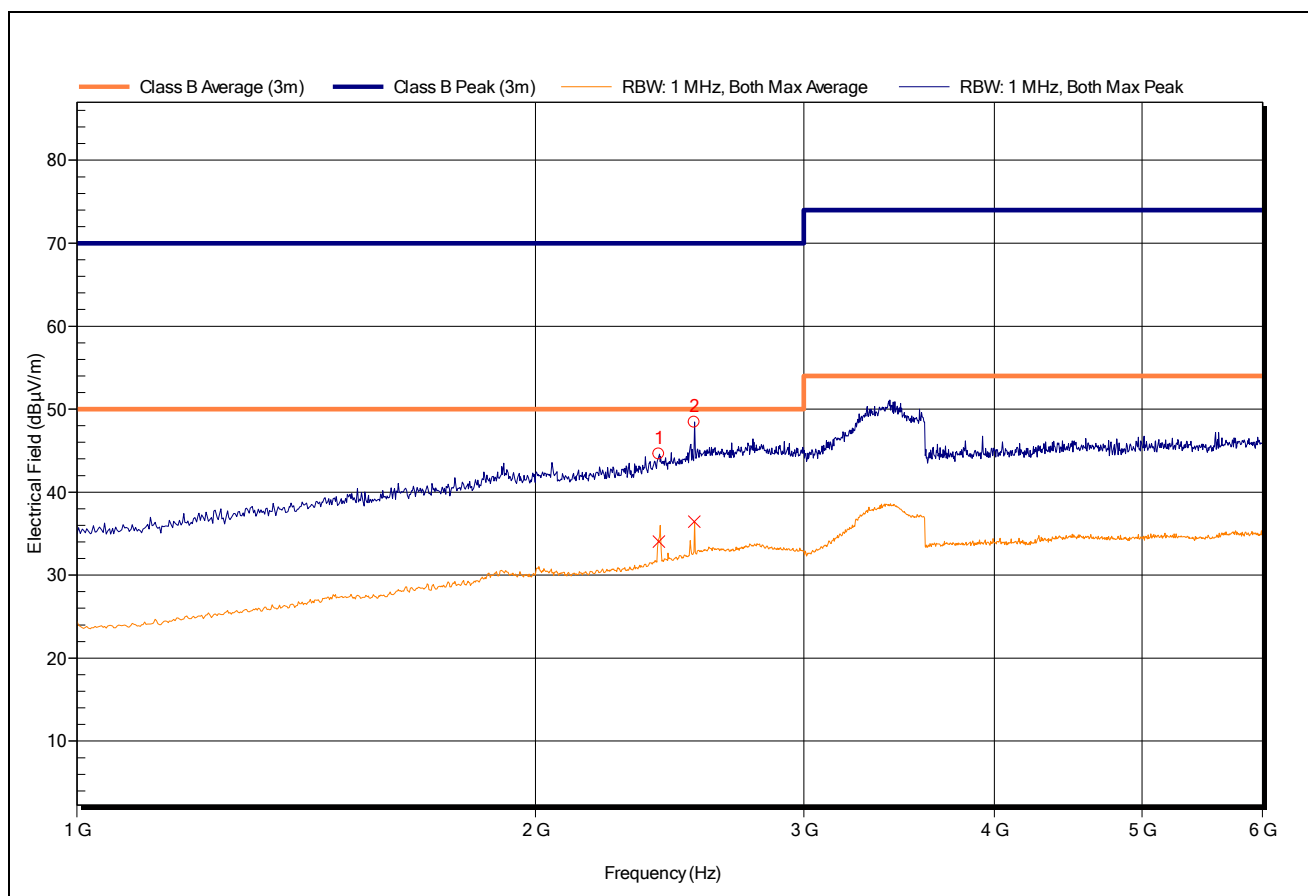
Bern, January 24, 2017
 F. Wyler

Measurement 2:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
2,41 GHz 1)	44,58 dBµV/m	-25,42 dB	34,03 dBµV/m	-15,97 dB	Pass	90 Degree	1 m	Vertical
2,543 GHz 2)	48,44 dBµV/m	-21,56 dB	36,45 dBµV/m	-13,55 dB	Pass	135 Degree	2 m	Vertical

1): This is the carrier of the radio service WLAN.

2): This is the carrier of the radio service LTE.

Place and date of test:
 Operator:

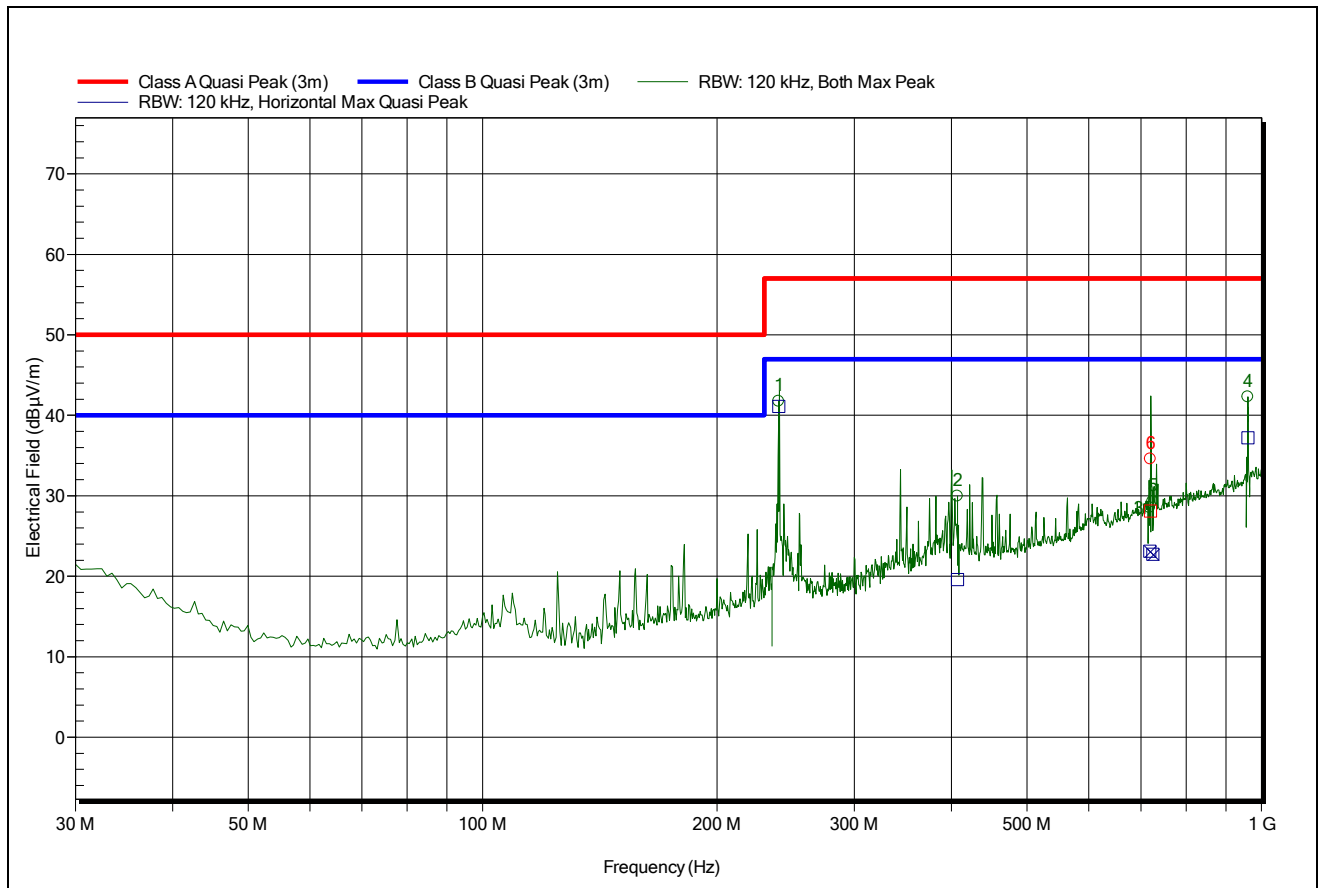
Bern, January 24, 2017
 F. Wyler

Measurement 3:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; CAN loop back; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
240.01 MHz	41.74 dBµV/m	41.1 dBµV/m	-5.9 dB	Pass	157 Degree	1 m	Vertical
406.957 MHz	29.94 dBµV/m	19.59 dBµV/m	-27.41 dB	Pass	90 Degree	1 m	Vertical
718.671 MHz	28.52 dBµV/m	23.09 dBµV/m	-23.91 dB	Pass	157 Degree	1 m	Horizontal
959.968 MHz	42.29 dBµV/m	37.2 dBµV/m	-9.8 dB	Pass	292 Degree	1 m	Vertical
724.695 MHz	29.29 dBµV/m	22.72 dBµV/m	-24.28 dB	Pass	45 Degree	2 m	Horizontal
720.155 MHz	34.56 dBµV/m	28.11 dBµV/m	-18.89 dB	Pass	180 Degree	1 m	Vertical

Place and date of test:
 Operator:

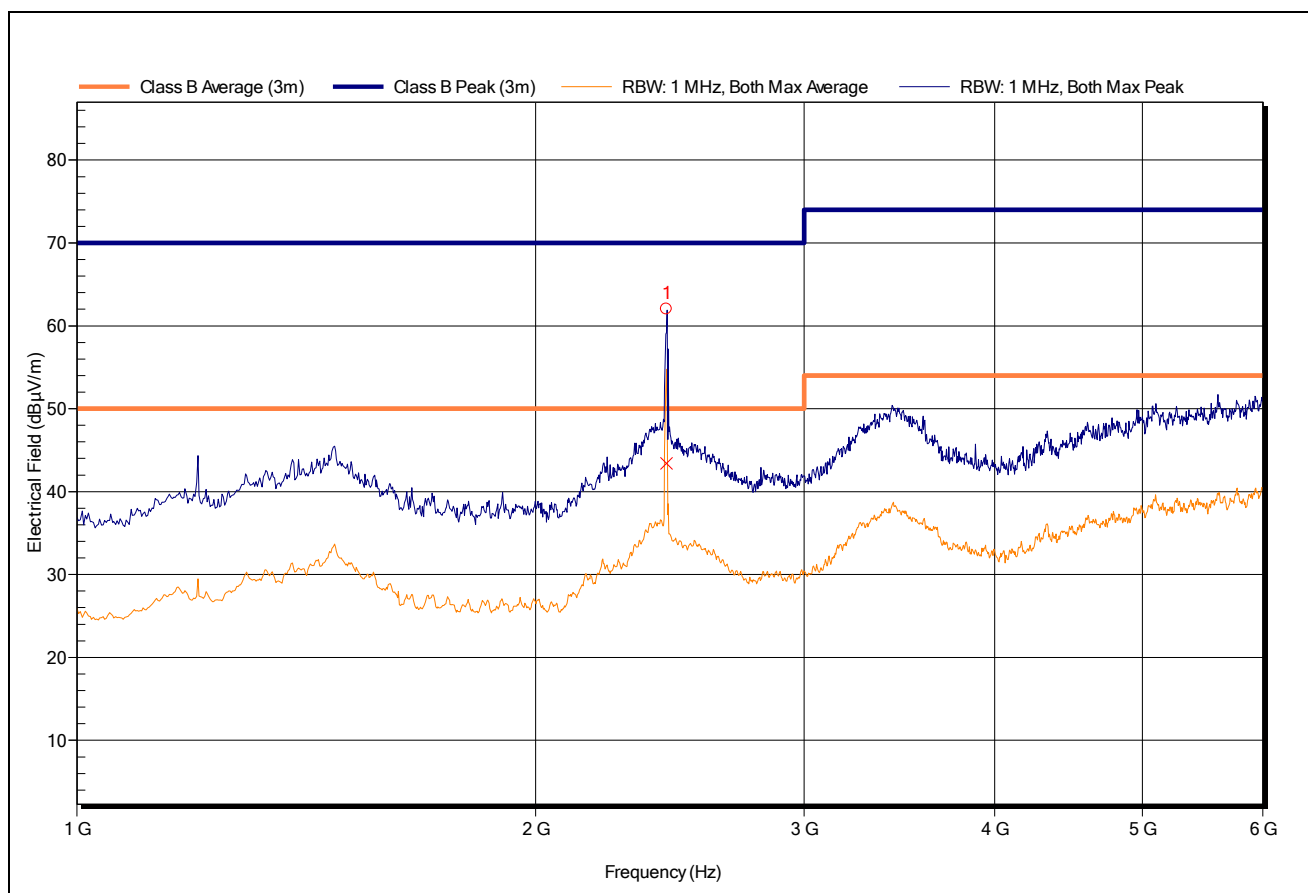
Bern, November 7, 2017
 F. Wyler

Measurement 4:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write, CAN loop back; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
2.438 GHz 1)	62.01 dBµV/m	-7.99 dB	43.4 dBµV/m	-6.6 dB	Pass	0 Degree	1 m	Vertical

1): This is the carrier of the radio service WLAN.

Place and date of test:
 Operator:

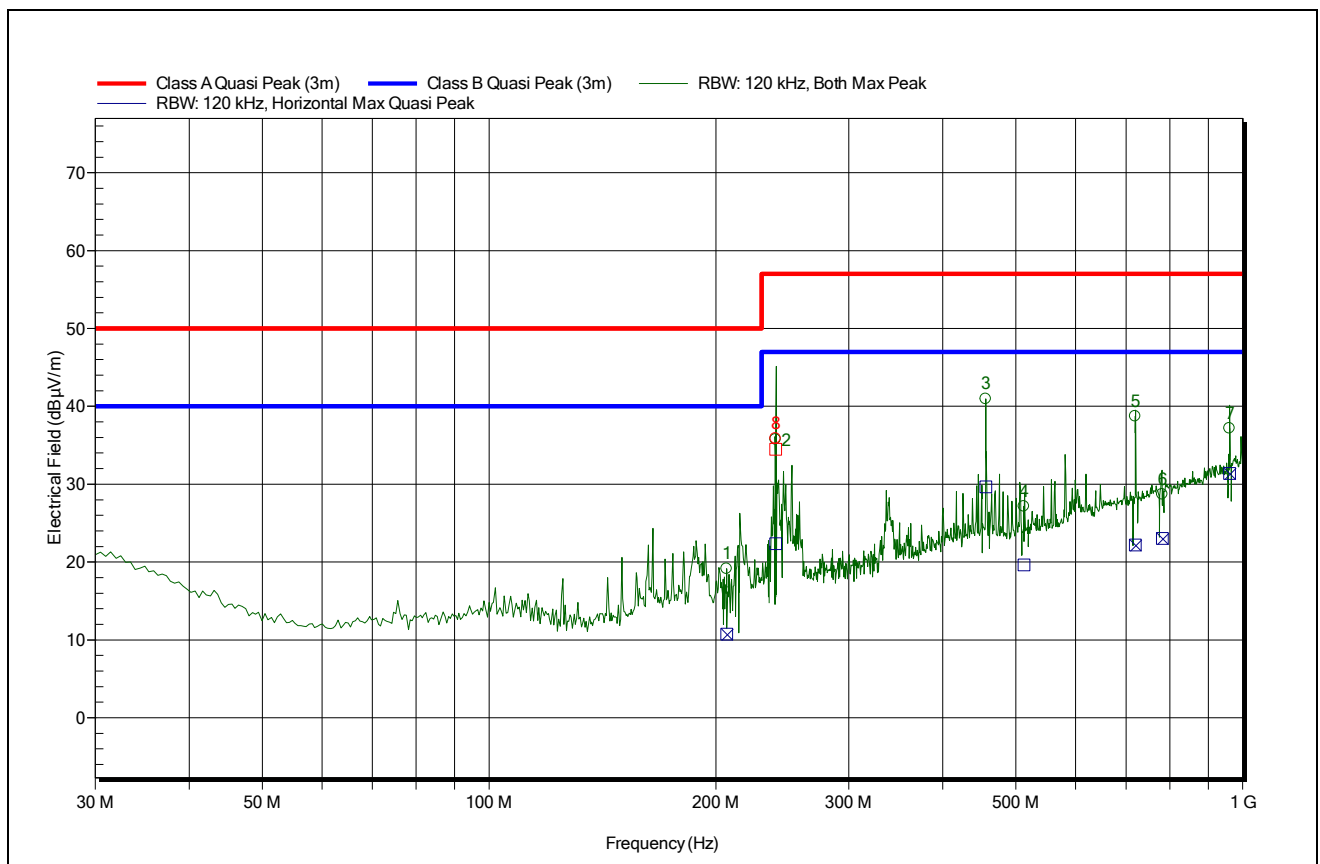
Bern, November 7, 2017
 F. Wyler

Measurement 5:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
206.613 MHz	19.11 dBµV/m	10.74 dBµV/m	-29.26 dB	Pass	135 Degree	2 m	Horizontal
239.966 MHz	35.73 dBµV/m	22.36 dBµV/m	-24.64 dB	Pass	67 Degree	2 m	Vertical
456.237 MHz	40.96 dBµV/m	29.64 dBµV/m	-17.36 dB	Pass	337 Degree	1 m	Vertical
512.284 MHz	27.16 dBµV/m	19.65 dBµV/m	-27.35 dB	Pass	270 Degree	1 m	Vertical
719.99 MHz	38.72 dBµV/m	22.18 dBµV/m	-24.82 dB	Pass	315 Degree	2 m	Horizontal
782.269 MHz	28.7 dBµV/m	23.05 dBµV/m	-23.95 dB	Pass	180 Degree	1 m	Horizontal
959.973 MHz	37.17 dBµV/m	31.38 dBµV/m	-15.62 dB	Pass	315 Degree	2 m	Horizontal
240.005 MHz	35.88 dBµV/m	34.46 dBµV/m	-12.54 dB	Pass	180 Degree	2 m	Vertical

Place and date of test:
 Operator:

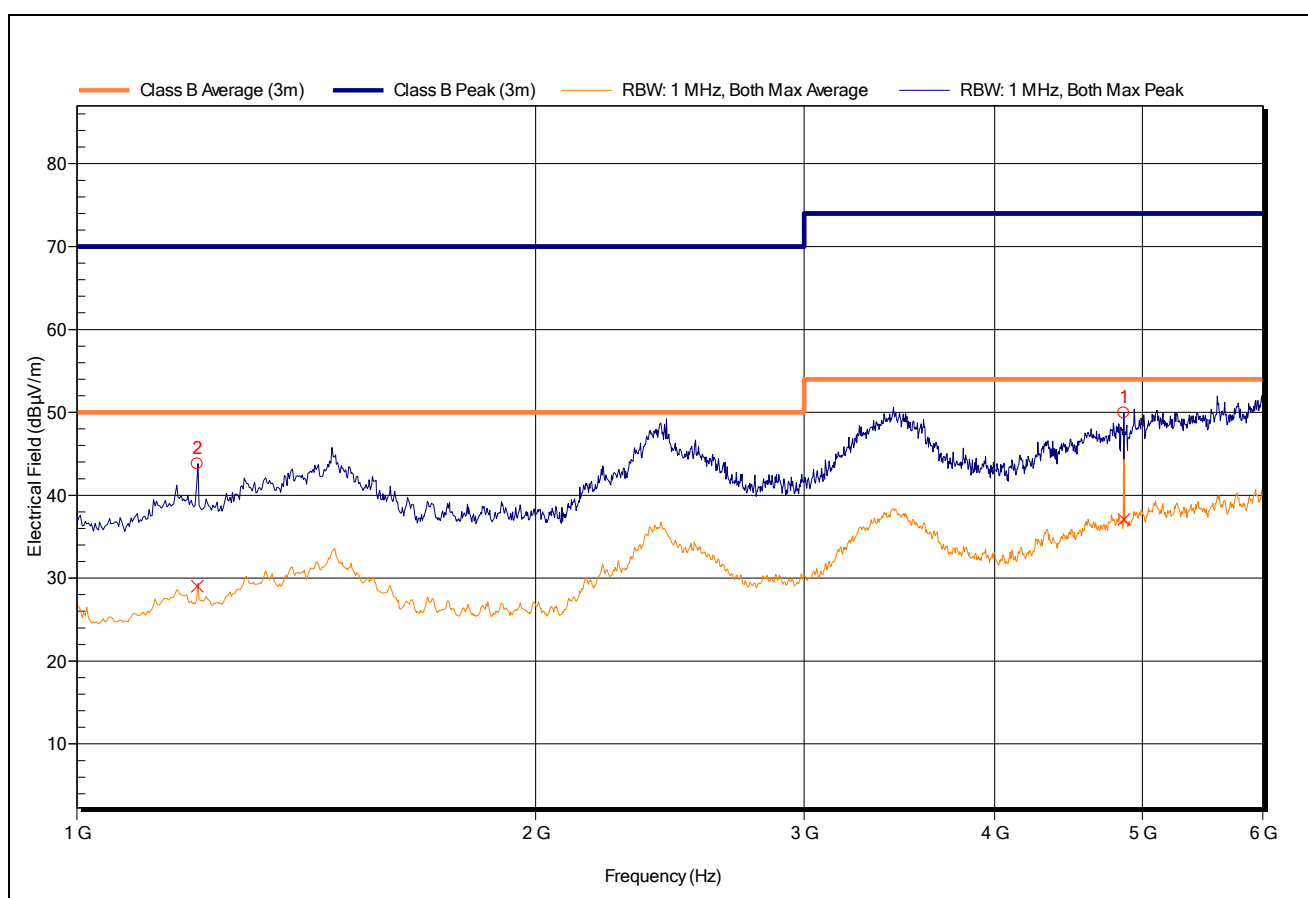
Bern, November 7, 2017
 F. Wyler

Measurement 6:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	EN 55032 (Cl. B)	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
4.863 GHz	49.94 dBµV/m	-24.06 dB	37.08 dBµV/m	-16.92 dB	Pass	315 Degree	1 m	Horizontal
1.2 GHz	43.77 dBµV/m	-26.23 dB	29.02 dBµV/m	-20.98 dB	Pass	45 Degree	1 m	Vertical

Place and date of test:
 Operator:

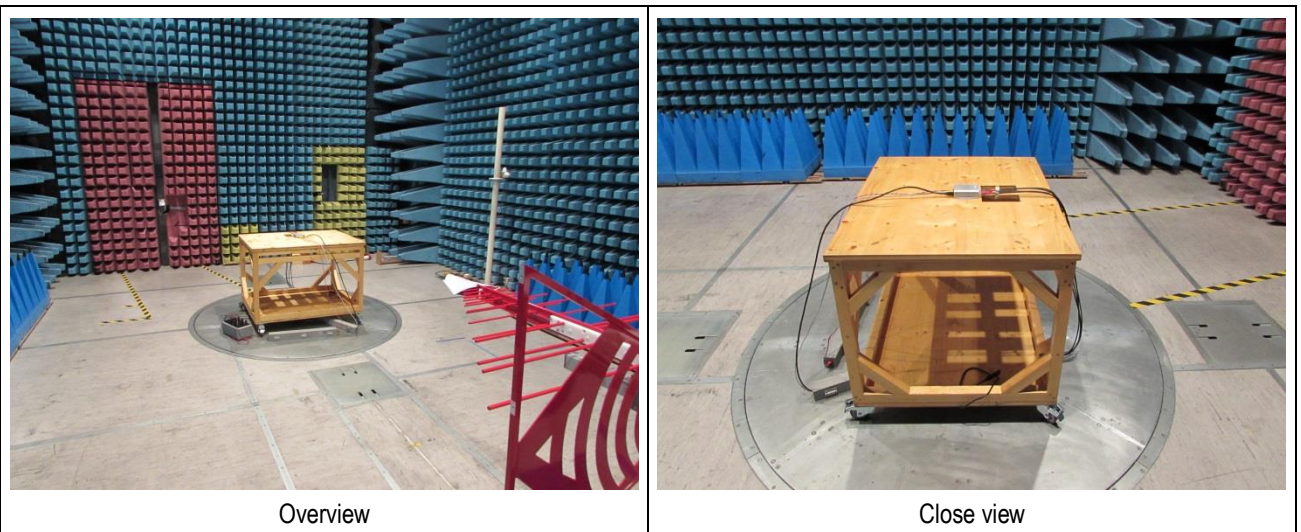
Bern, November 7, 2017
 F. Wyler

7.4 Radiated emission - Electromagnetic field according CFR 47 15 (radiated – 30 MHz to 6 GHz)

Test site: Semi-anechoic chamber (hybrid)
 Distance: 3 m
 Position of EUT: 80 cm (height of the equipment under test above floor)
 Meas. uncertainty: ± 4.6 dB (30 - 300 MHz) / ± 3.7 dB (300 - 1000 MHz) / ± 4.7 dB (1 - 18 GHz)
 Measuring method: The electromagnetic disturbance radiated by the equipment is measured using a spectrum analyser and a wide band antenna. The antenna is moved from 1 to 4 m in height successively with horizontal and vertical polarisations. The turning table is operated through 360° during the measurements. The recordings are carried out taking into account the maximum value of all the disturbances appearing while the apparatus is under test. The peak values are recorded continuously on the graph. The values exceeding a limit shall be re-measured manually using a receiver.

Climatic conditions: Temperature: 23.1 °C Humidity: 18 % Pressure QFE: 960 hPa (2017-01-24)
 Temperature: 23.8 °C Humidity: 33 % Pressure QFE: 953 hPa (2017-11-07)

Test set-up:



Remarks: None

Test equipment:

Spectrum analyser	<input checked="" type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input type="checkbox"/> 25953
Receiver	<input checked="" type="checkbox"/> 168593	<input type="checkbox"/> 184454	<input type="checkbox"/> 25953
Preamplifier	<input checked="" type="checkbox"/> 184451	<input type="checkbox"/> 168520	
Antenna, (log-per)	<input type="checkbox"/> 168585	<input type="checkbox"/> 26021	
Antenna, (bi-con-log)	<input checked="" type="checkbox"/> 181955		
Antenna, (bi-log)	<input type="checkbox"/> 26933		
Antenna, (log-per dir)	<input type="checkbox"/> 168591		
Cables	<input checked="" type="checkbox"/> 184452	<input type="checkbox"/> 168547	
Software and Revision	<input checked="" type="checkbox"/> RadiMation 2016.1.6		

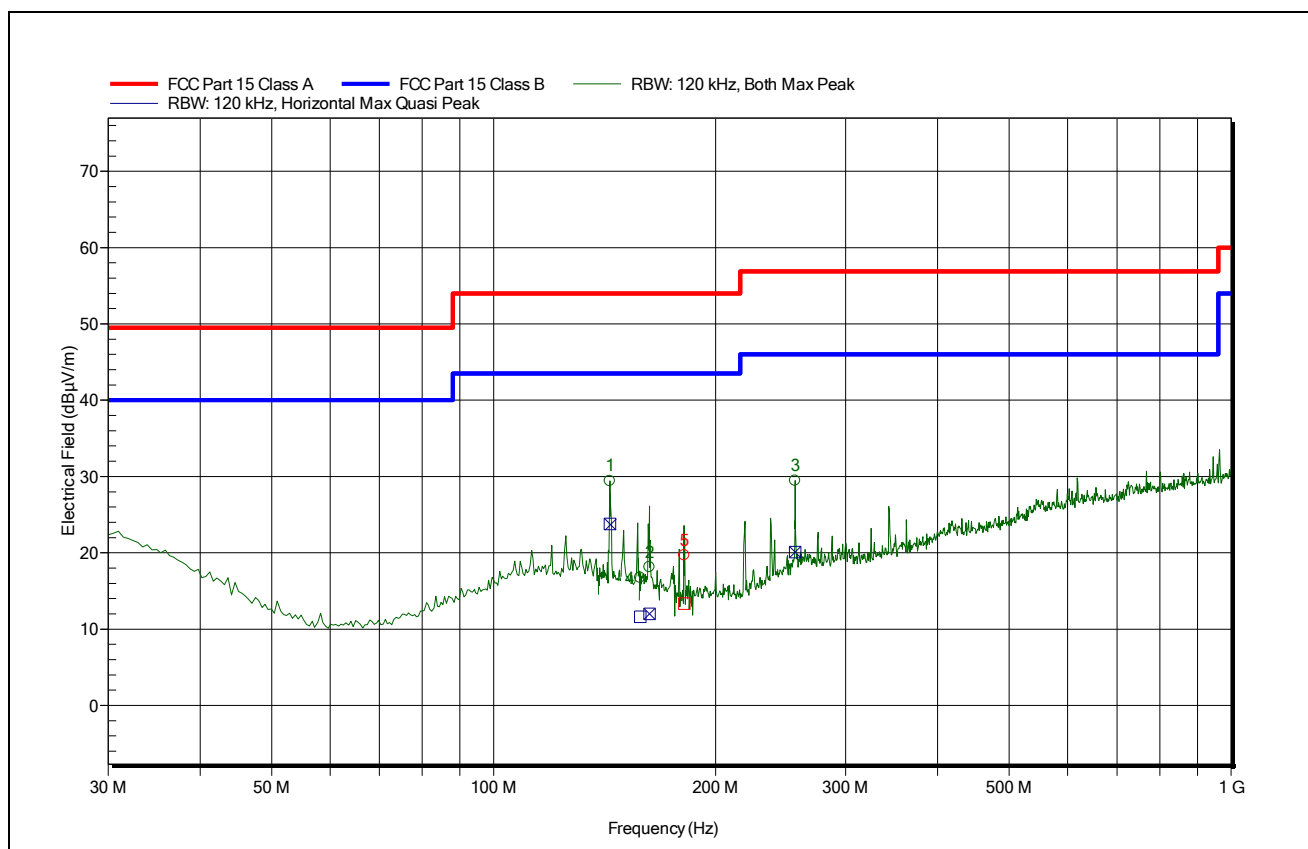
Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Measurement 1:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
143,728 MHz	29,42 dBµV/m	23,8 dBµV/m	-16,2 dB	Pass	270 Degree	2 m	Horizontal
162,73 MHz	18,14 dBµV/m	11,98 dBµV/m	-28,02 dB	Pass	67 Degree	3 m	Horizontal
256,209 MHz	29,43 dBµV/m	20,11 dBµV/m	-26,89 dB	Pass	67 Degree	1 m	Horizontal
158,035 MHz	16,72 dBµV/m	11,63 dBµV/m	-28,37 dB	Pass	67 Degree	1 m	Vertical
181,301 MHz	19,69 dBµV/m	13,34 dBµV/m	-26,66 dB	Pass	67 Degree	1 m	Vertical

Place and date of test:
 Operator:

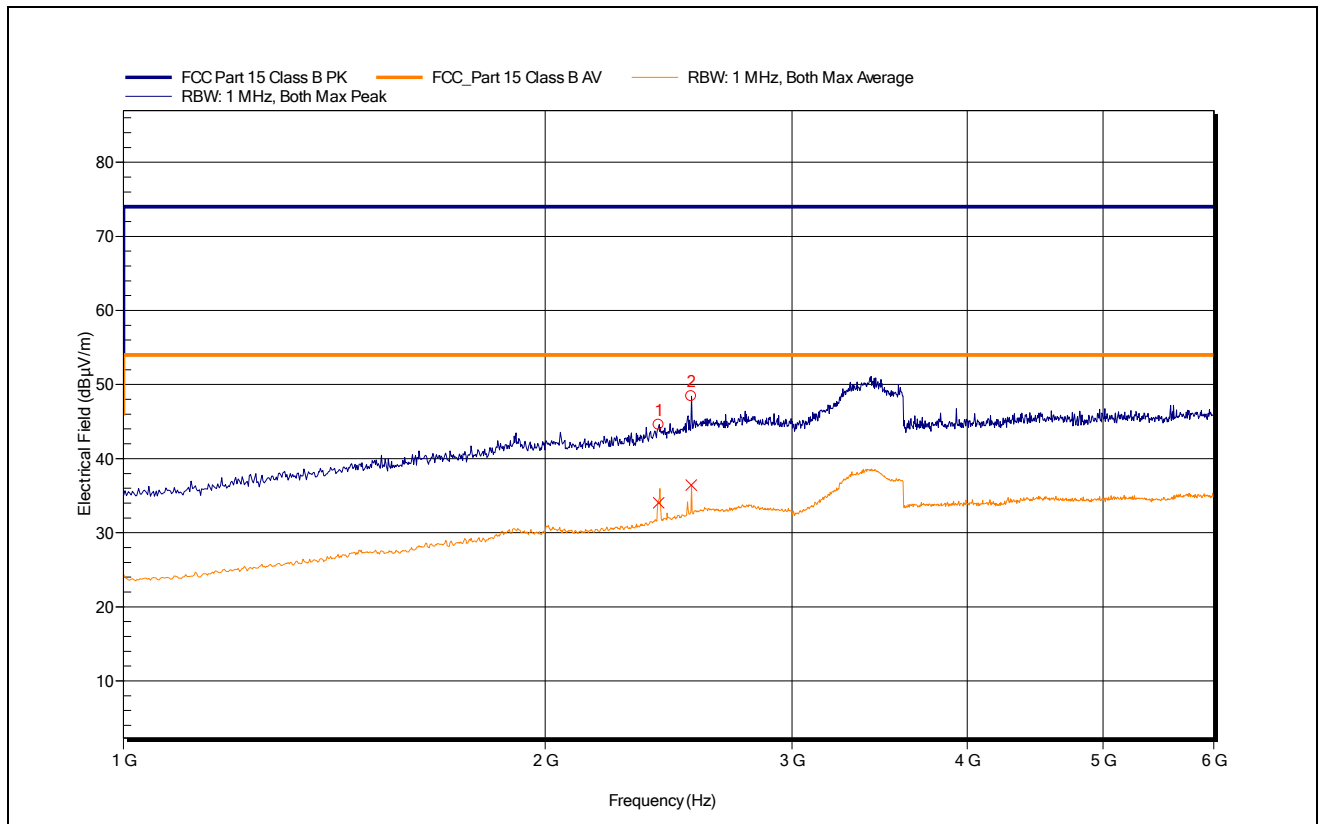
Bern, January 24, 2017
 F. Wyler

Measurement 2:

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Modification: None
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
2,41 GHz	44,58 dBμV/m	-25,42 dB	34,03 dBμV/m	-15,97 dB	Pass	90 Degree	1 m	Vertical
2,543 GHz	48,44 dBμV/m	-21,56 dB	36,45 dBμV/m	-13,55 dB	Pass	135 Degree	2 m	Vertical

1): This is the carrier of the radio service WLAN.

2): This is the carrier of the radio service LTE.

Place and date of test:
 Operator:

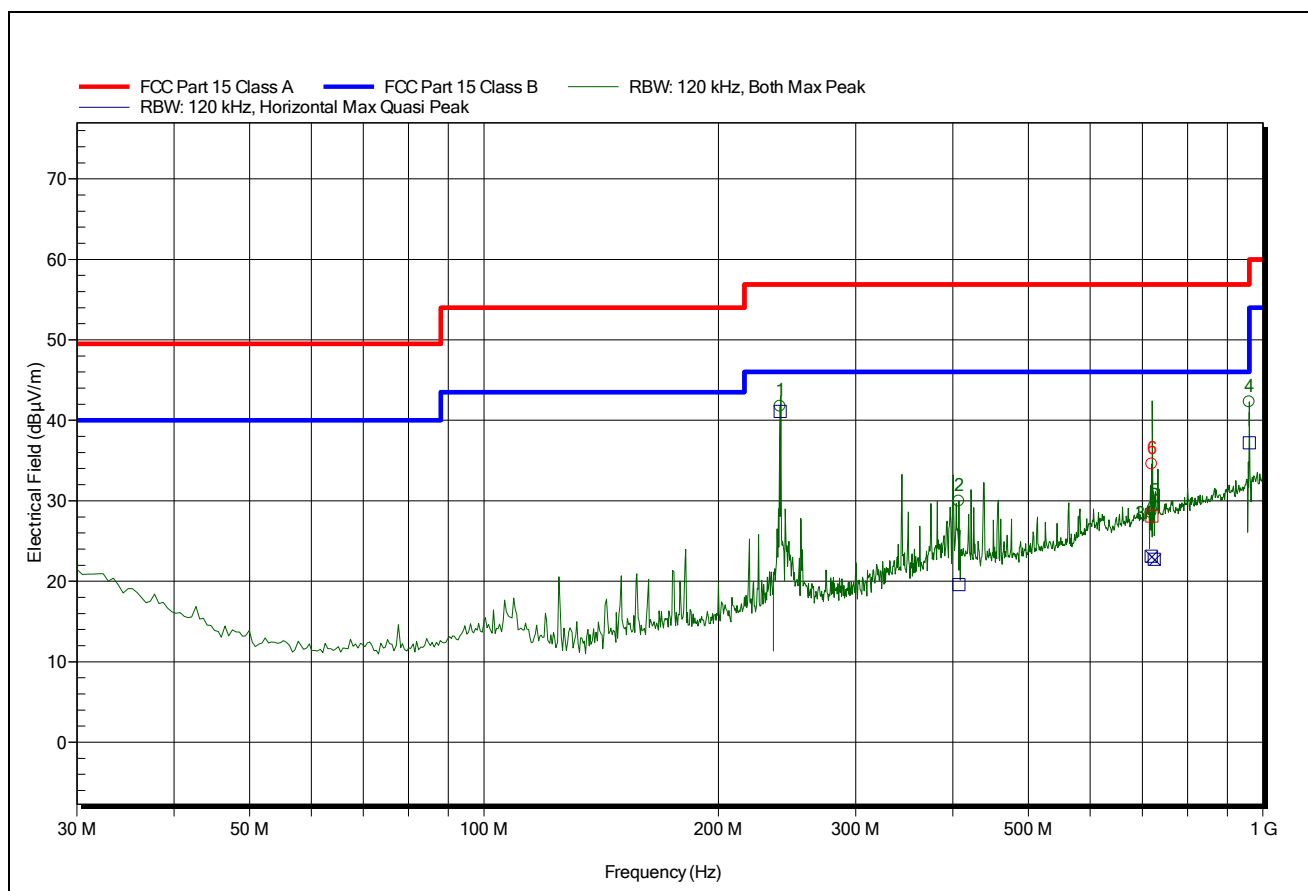
Bern, January 24, 2017
 F. Wyler

Measurement 3:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; CAN loop back; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
240.01 MHz	41.74 dBµV/m	41.1 dBµV/m	-4.9 dB	Pass	157 Degree	1 m	Vertical
406.957 MHz	29.94 dBµV/m	19.59 dBµV/m	-26.41 dB	Pass	90 Degree	1 m	Vertical
718.671 MHz	28.52 dBµV/m	23.09 dBµV/m	-22.91 dB	Pass	157 Degree	1 m	Horizontal
959.968 MHz	42.29 dBµV/m	37.2 dBµV/m	-8.8 dB	Pass	292 Degree	1 m	Vertical
724.695 MHz	29.29 dBµV/m	22.72 dBµV/m	-23.28 dB	Pass	45 Degree	2 m	Horizontal
720.155 MHz	34.56 dBµV/m	28.11 dBµV/m	-17.89 dB	Pass	180 Degree	1 m	Vertical

Place and date of test:
 Operator:

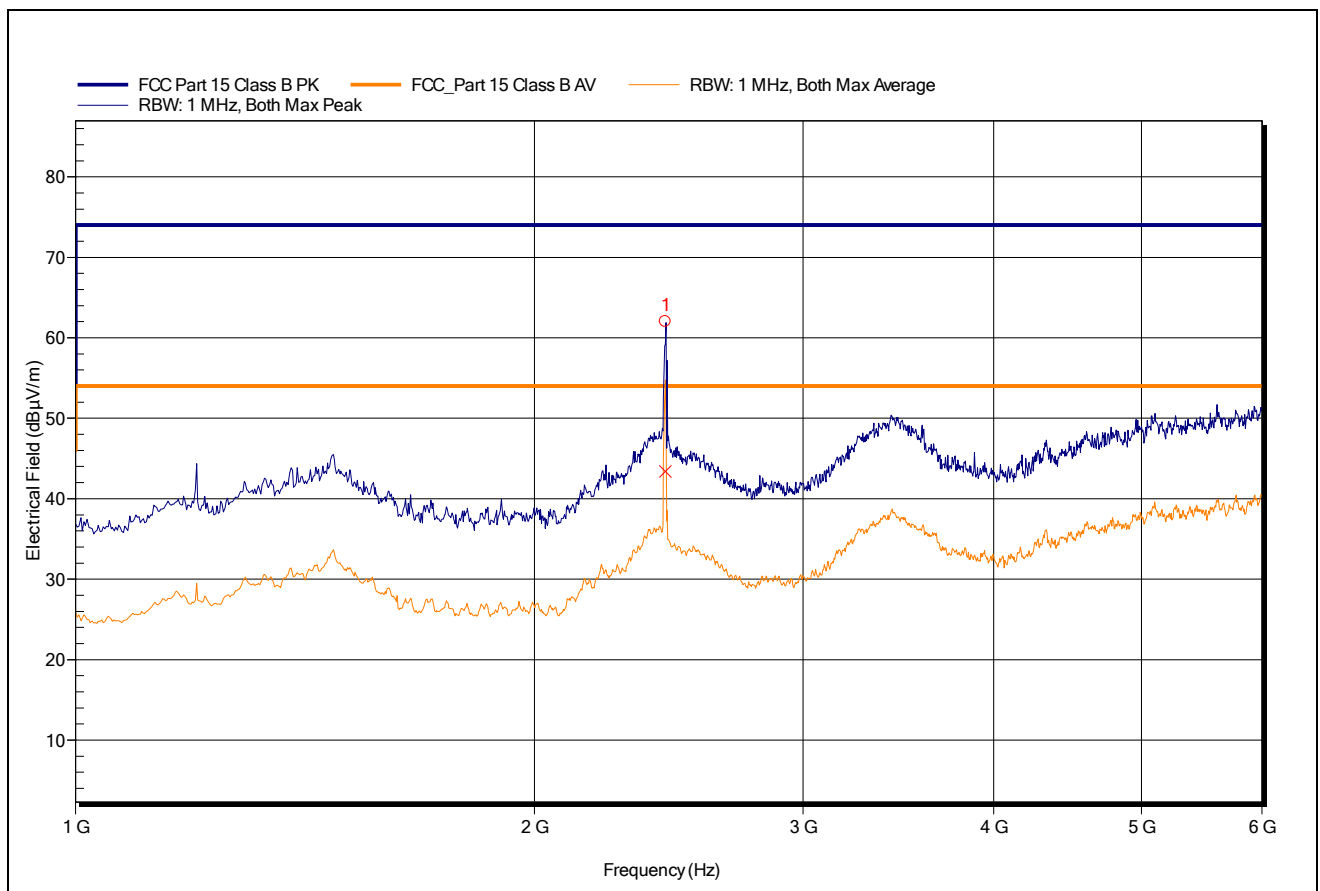
Bern, November 7, 2017
 F. Wyler

Measurement 4:

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; CAN loop back; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
2.438 GHz 1)	62.01 dBµV/m	-11.99 dB	43.4 dBµV/m	-10.6 dB	Pass	0 Degree	1 m	Vertical

1): This is the carrier of the radio service WLAN.

Place and date of test:
 Operator:

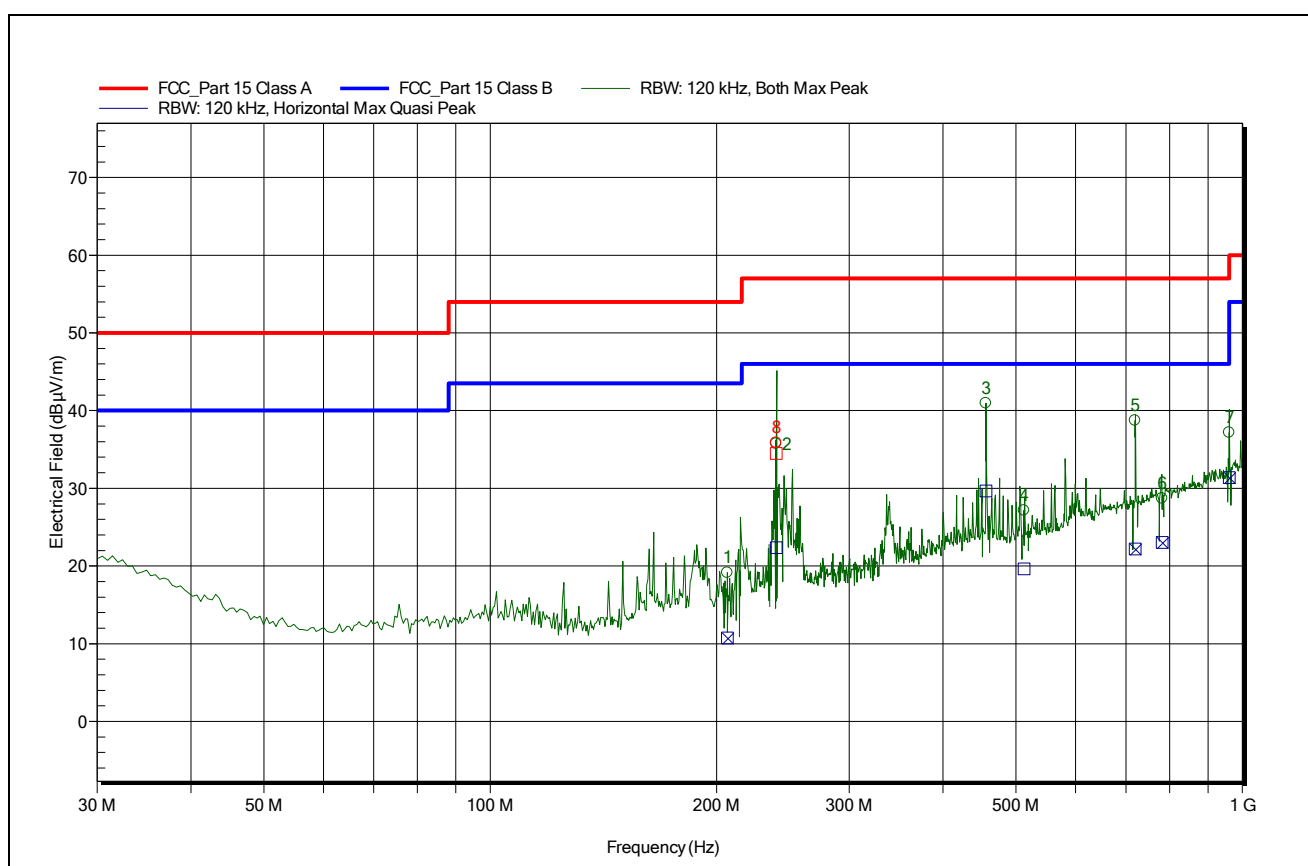
Bern, November 7, 2017
 F. Wyler

Measurement 5:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	30 MHz ... 1000 MHz
Pre-scan measurement	Peak	Resolution / Video Bandwidth	120 kHz / 1 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Quasi-Peak	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Quasi-Peak	Quasi-Peak Difference	Status	Angle	Height	Polarization
206.613 MHz	19.11 dBµV/m	10.74 dBµV/m	-32.76 dB	Pass	135 Degree	2 m	Horizontal
239.966 MHz	35.73 dBµV/m	22.36 dBµV/m	-23.64 dB	Pass	67 Degree	2 m	Vertical
456.237 MHz	40.96 dBµV/m	29.64 dBµV/m	-16.36 dB	Pass	337 Degree	1 m	Vertical
512.284 MHz	27.16 dBµV/m	19.65 dBµV/m	-26.35 dB	Pass	270 Degree	1 m	Vertical
719.99 MHz	38.72 dBµV/m	22.18 dBµV/m	-23.82 dB	Pass	315 Degree	2 m	Horizontal
782.269 MHz	28.7 dBµV/m	23.05 dBµV/m	-22.95 dB	Pass	180 Degree	1 m	Horizontal
959.973 MHz	37.17 dBµV/m	31.38 dBµV/m	-14.62 dB	Pass	315 Degree	2 m	Horizontal
240.005 MHz	35.88 dBµV/m	34.46 dBµV/m	-11.54 dB	Pass	180 Degree	2 m	Vertical

Place and date of test:
 Operator:

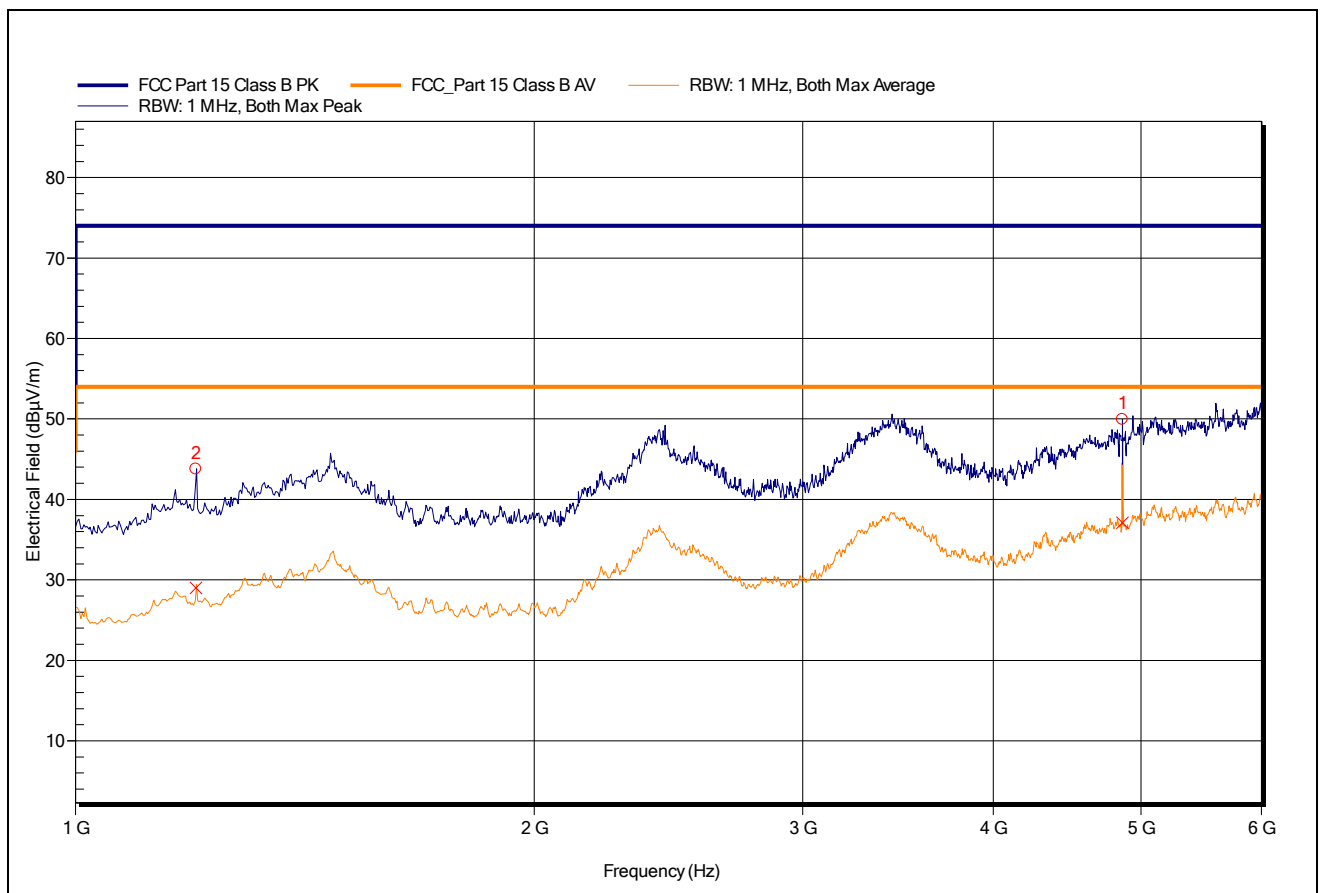
Bern, November 7, 2017
 F. Wyler

Measurement 6:

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 1 Mobile Cable, 1 WIFI Cable, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick read/write; see § 6.5
 Modification: Level 1; see §9.1
 Remarks: None

Settings of the measurement equipment

Limits	CFR 47 15B / ICES-003	Frequency range	1 GHz .6 GHz
Pre-scan measurement	Peak & Average	Resolution / Video Bandwidth	1 MHz / 3 MHz
Sweep time:	200 ms	Number of sweeps:	20
Geometry:	Height: 1 - 4 m, 4 steps; Azimuth: 0° – 360°, 16 steps; Polarisation: Horizontal & Vertical		
Receiver measurement:	Peak & Average	Measure / Observation Time	1 s / 5 s
Geometry:	On the position of the maximum		

**Detected peaks**

Frequency	Peak	Peak Difference	Average	Average Difference	Status	Angle	Height	Polarization
4.863 GHz	49.94 dBμV/m	-24.06 dB	37.08 dBμV/m	-16.92 dB	Pass	315 Degree	1 m	Horizontal
1.2 GHz	43.77 dBμV/m	-30.23 dB	29.02 dBμV/m	-24.98 dB	Pass	45 Degree	1 m	Vertical

Place and date of test:
 Operator:

Bern, November 7, 2017
 F. Wyler

8. Immunity tests

8.1 Immunity to electrostatic discharge (ESD) (EN 61000-4-2)

Introduction: The aim of this test is to determine the reaction of the material to electrostatic discharges (ESD) produced for example by walking on a carpet made of synthetic fibre. The humidity of the air has an influence on the discharge time and therefore on the severity of the discharge that could appear.

Coupling: ☒ 150 pF / 330 Ohm ☐ 150 pF / 2000 Ohm

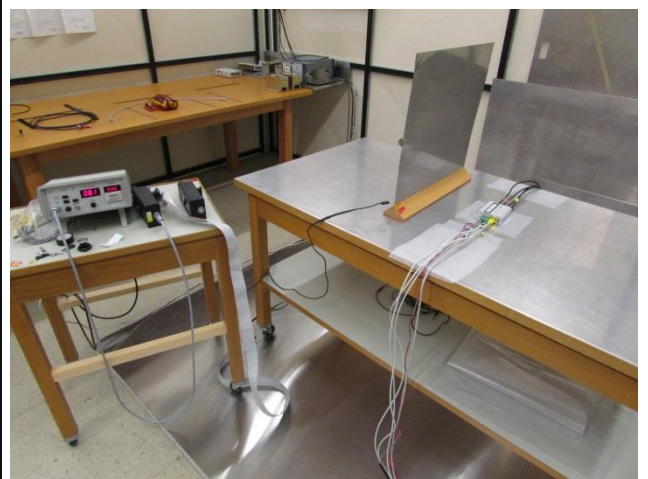
Meas. uncertainty: $\pm 10 \%$

Test method: All the points accessible to the operator are tested successively. Contact discharges are carried out on conducting surfaces as well as indirect discharges on a vertical or horizontal coupling plate. Air discharges are carried out on insulated surfaces. A minimum of 10 discharges for each voltage level and polarity are applied to each test point.

Test set-up:



Set-up of NB800-LWWtSu (24.1.17)



Set-up of NB800-LWWtSu COM_IO or Dual CAN (7.11.17)

Remarks: None

Test equipment:

Test generator	<input checked="" type="checkbox"/> 25943
Table with horizontal coupling plate	<input checked="" type="checkbox"/> 25950
Vertical coupling plate	<input checked="" type="checkbox"/> 25941
Ground plane	<input checked="" type="checkbox"/> 25951

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Protocol: Base



Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Semi-anechoic chamber
 Test set-up: ☒ table-top equipment ☐ floor-standing equipment
 Climatic conditions: Temperature: 23.1 °C Humidity: 31 % (raised by humidifier) Pressure QFE: 960 hPa

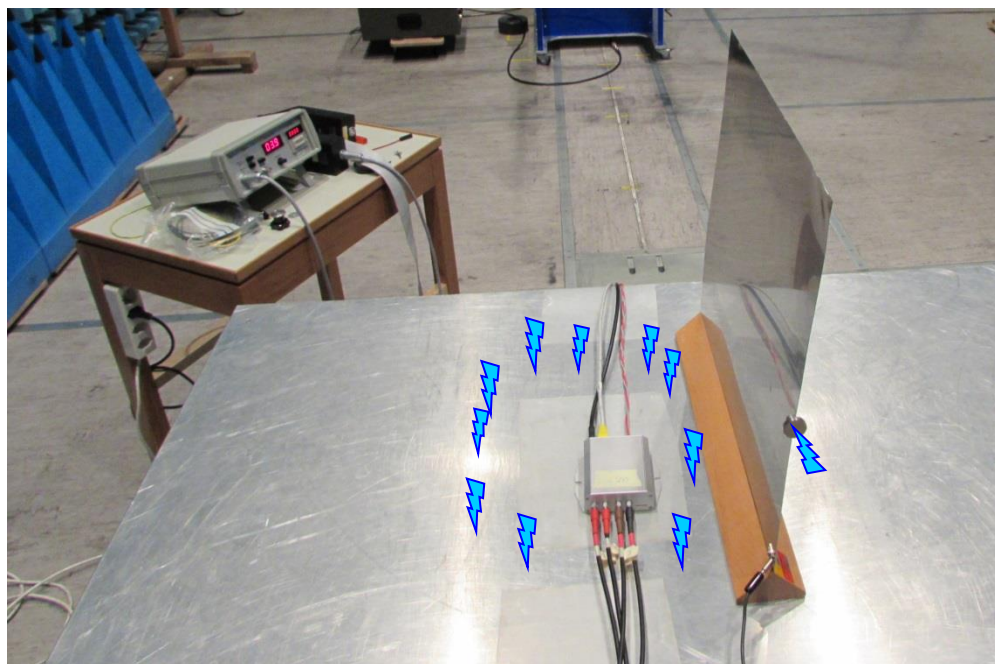
Requirements

Standard:	Required level Air discharge:	Required level Contact discharge:	Impulses per point, level and polarity:	Perf. criterion:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±8 kV	±4 kV	10 (total: min 200)	B
EN 61000-6-2:2005	±8 kV	±4 kV	10	B
ETSI EN 301 489-1: 2017	±8 kV	±4 kV	10	B
Additional requirement	±15 kV	±8 kV	10	B

Results



Protocol: Indirect discharges

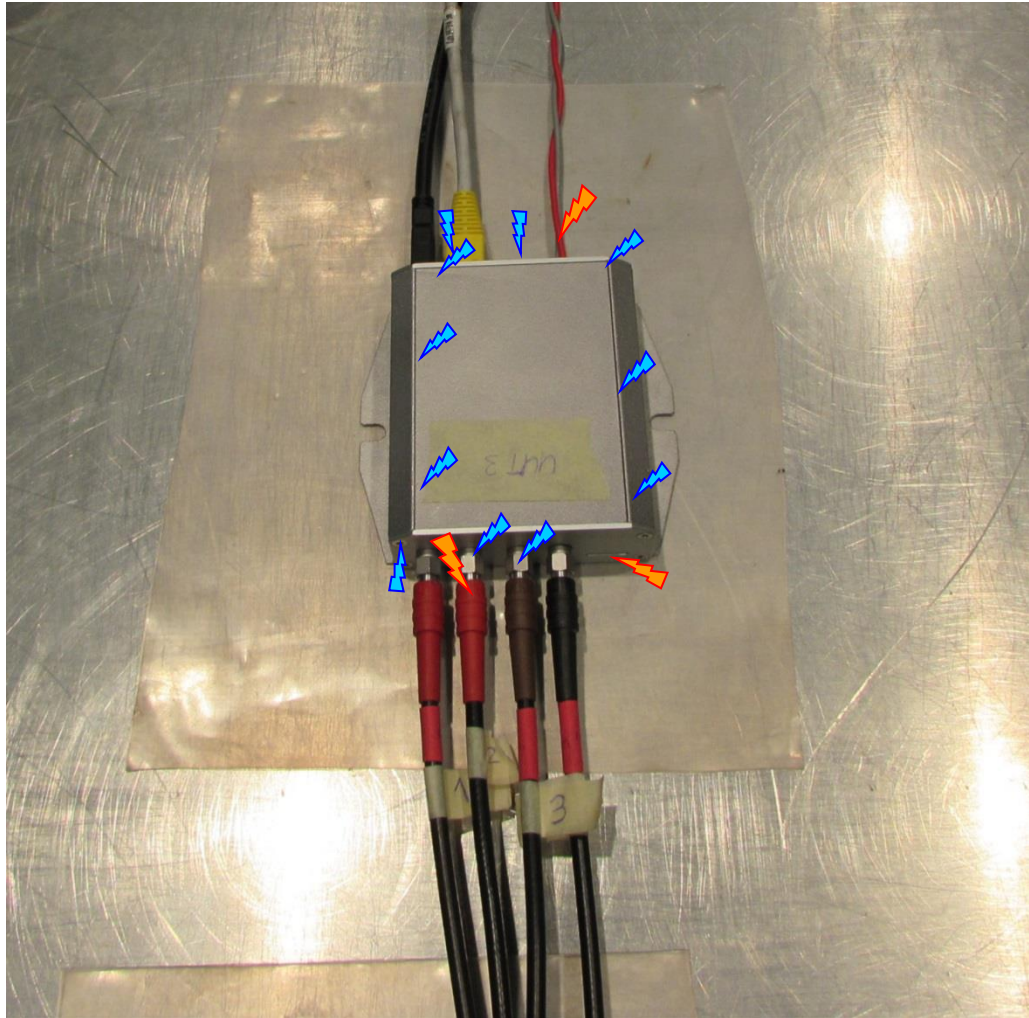
Level [kV]	No of discharges for each point, level and polarity	Discharge air 	cont. 	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
±4; ±6; ±8 (on all sides of the EUT)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
±4; ±6; ±8 (on vertical coupling plane)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass



Tested points

Protocol: direct discharges

Level [kV]	No of discharges for each point, level and polarity	Discharge air 	cont. 	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass



Tested points

Tested points

Results

Tested point	Level [kV]	No of discharges for each point, level and polarity	Discharge		Result, observation, behaviour of EUT	Fulfilled criterion	Result
			air	cont.			
Housing	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Screws	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Connectors	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
LEDs	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass
SIM-card slot	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Place and date of test:
Operator:

Bern, January 24, 2017
Mr F. Wyler

Protocol: Dual CAN



Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB, 2xCAN, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; CAN loop back; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Semi-anechoic chamber
 Test set-up: ☒ table-top equipment ☐ floor-standing equipment
 Climatic conditions: Temperature: 24.4 °C Humidity: 33 % Pressure QFE: 952 hPa

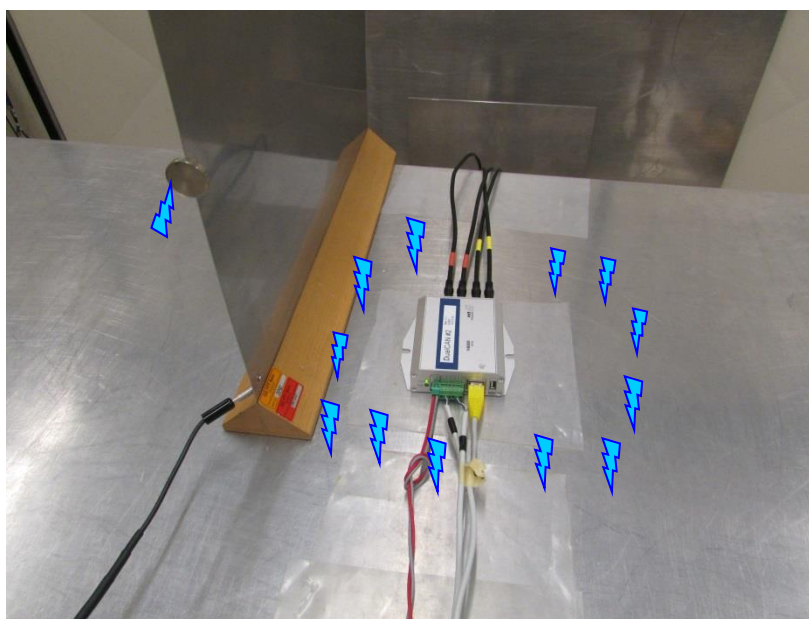
Requirements

Standard:	Required level Air discharge:	Required level Contact discharge:	Impulses per point, level and polarity:	Perf. criterion:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±8 kV	±4 kV	10 (total: min 200)	B
EN 61000-6-2:2005	±8 kV	±4 kV	10	B
ETSI EN 301 489-1: 2017	±8 kV	±4 kV	10	B
Additional requirement	±15 kV	±8 kV	10	B

Results



Protocol: Indirect discharges

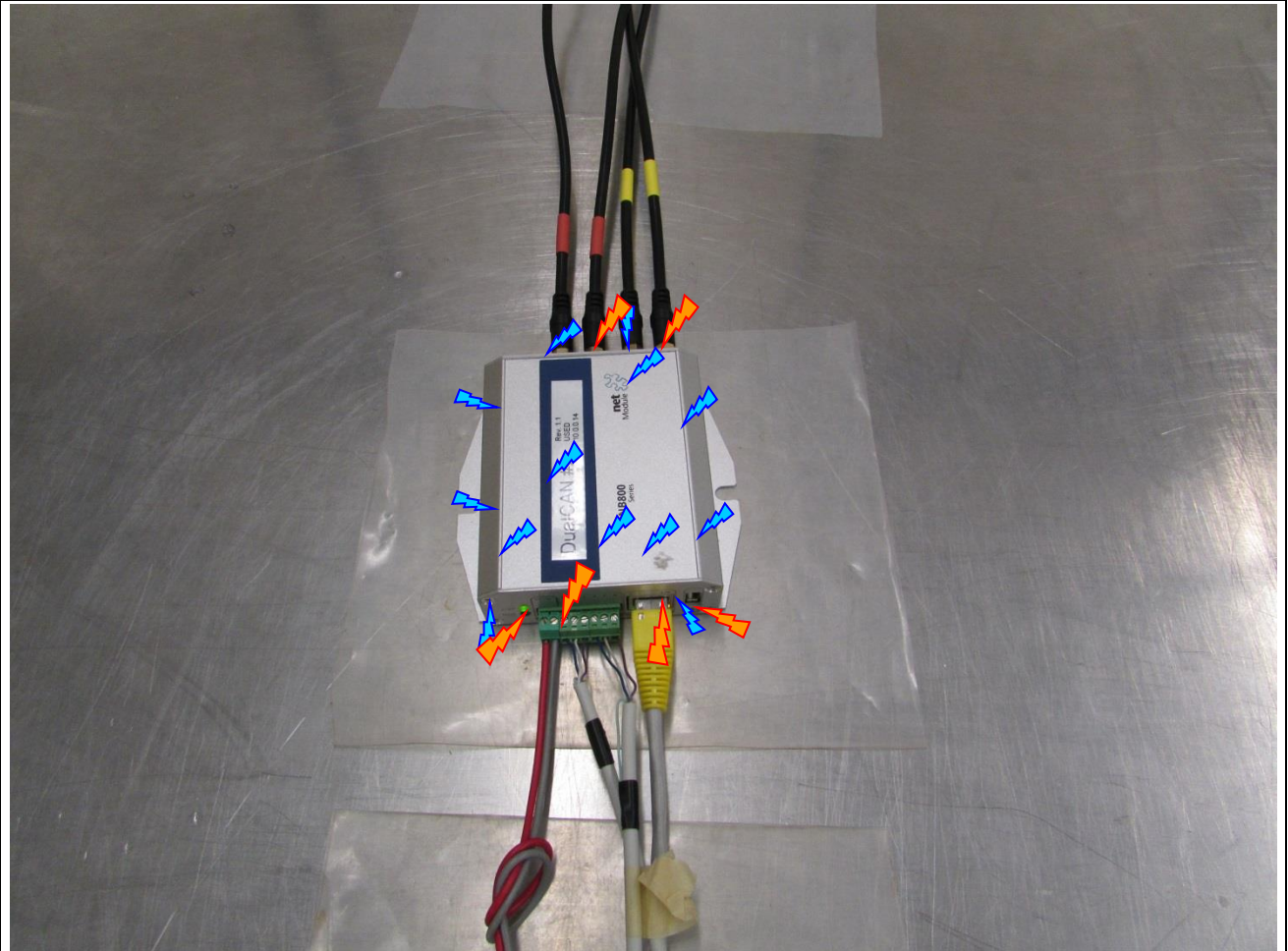
Level [kV]	No of discharges for each point, level and polarity	Discharge air 	cont. 	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
±4; ±6; ±8 (on all sides of the EUT)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
±4; ±6; ±8 (on vertical coupling plane)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass



Tested points

Protocol: direct discharges

Level [kV]	No of discharges for each point, level and polarity	Discharge		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
		air 	cont. 			
$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass



Tested points

Tested points

Results

Tested point	Level [kV]	No of discharges for each point, level and polarity	Discharge		Result, observation, behaviour of EUT	Fulfilled criterion	Result
			air	cont.			
Housing	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Screws	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Connectors	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
LEDs	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass
SIM-card slot	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Place and date of test:
Operator:

Bern, November 7, 2017
Mr F. Wyler

Protocol: COM_I/O



Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB Stick, , 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Semi-anechoic chamber
 Test set-up: ☒ table-top equipment ☐ floor-standing equipment
 Climatic conditions: Temperature: 24.4 °C Humidity: 33 % Pressure QFE: 952 hPa

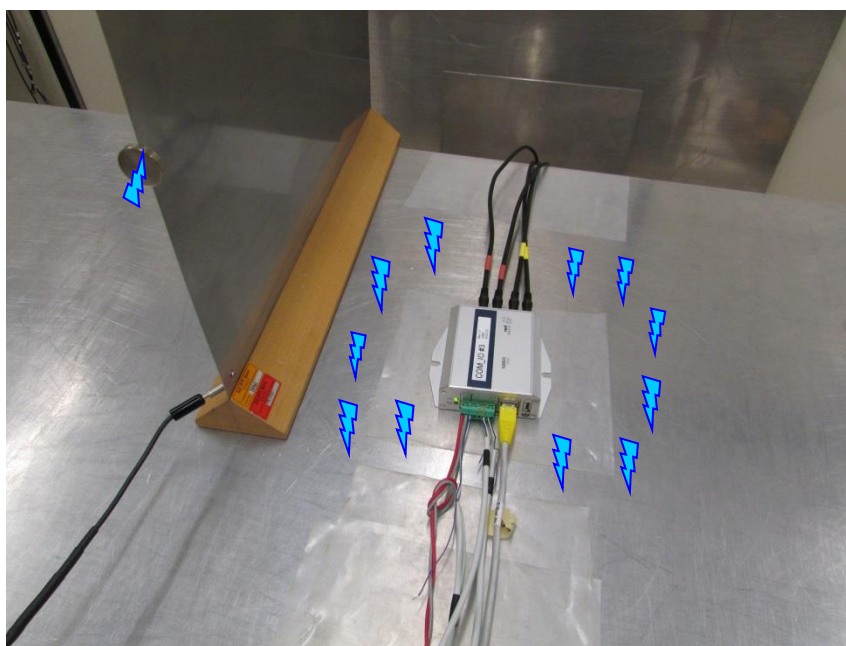
Requirements

Standard:	Required level Air discharge:	Required level Contact discharge:	Impulses per point, level and polarity:	Perf. criterion:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±8 kV	±4 kV	10 (total: min 200)	B
EN 61000-6-2:2005	±8 kV	±4 kV	10	B
ETSI EN 301 489-1: 2017	±8 kV	±4 kV	10	B
Additional requirement	±15 kV	±8 kV	10	B

Results



Protocol: Indirect discharges

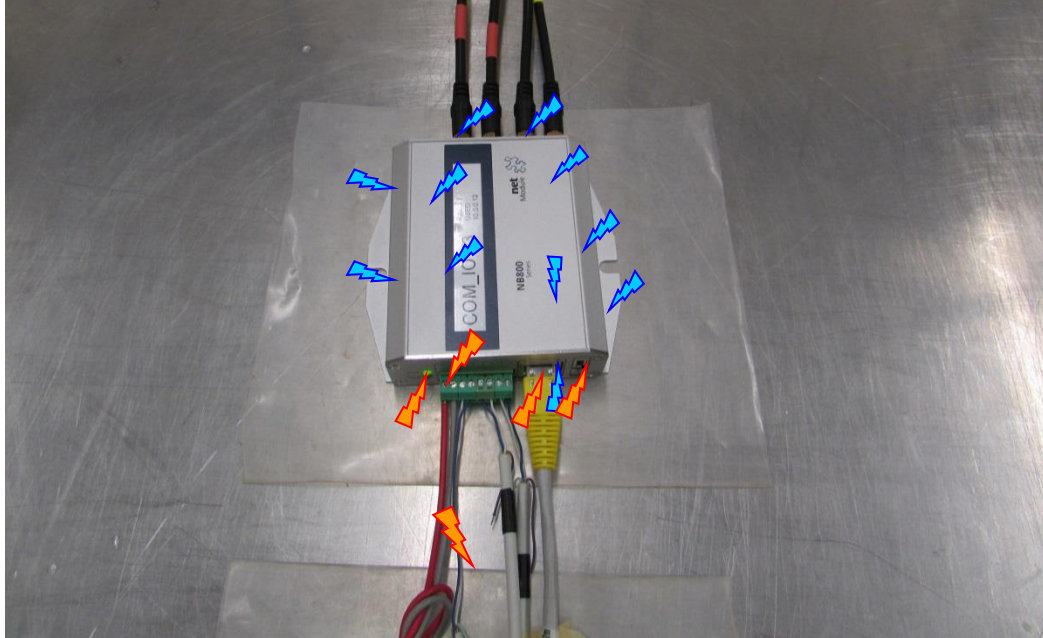
Level [kV]	No of discharges for each point, level and polarity	Discharge air 	cont. 	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
±4; ±6; ±8 (on all sides of the EUT)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
±4; ±6; ±8 (on vertical coupling plane)	>10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass



Tested points

Protocol: direct discharges

Level [kV]	No of discharges for each point, level and polarity	Discharge air 	cont. 	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass



Tested points

Tested points

Results

Tested point	Level [kV]	No of discharges for each point, level and polarity	Discharge		Result, observation, behaviour of EUT	Fulfilled criterion	Result
			air	cont.			
Housing	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Screws	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Connectors	$\pm 4; \pm 6; \pm 8$	> 10	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
LEDs	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass
SIM-card slot	$\pm 2; \pm 4; \pm 8; \pm 15$	> 10	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Place and date of test:
Operator:

Bern, November 7, 2017
Mr F. Wyler

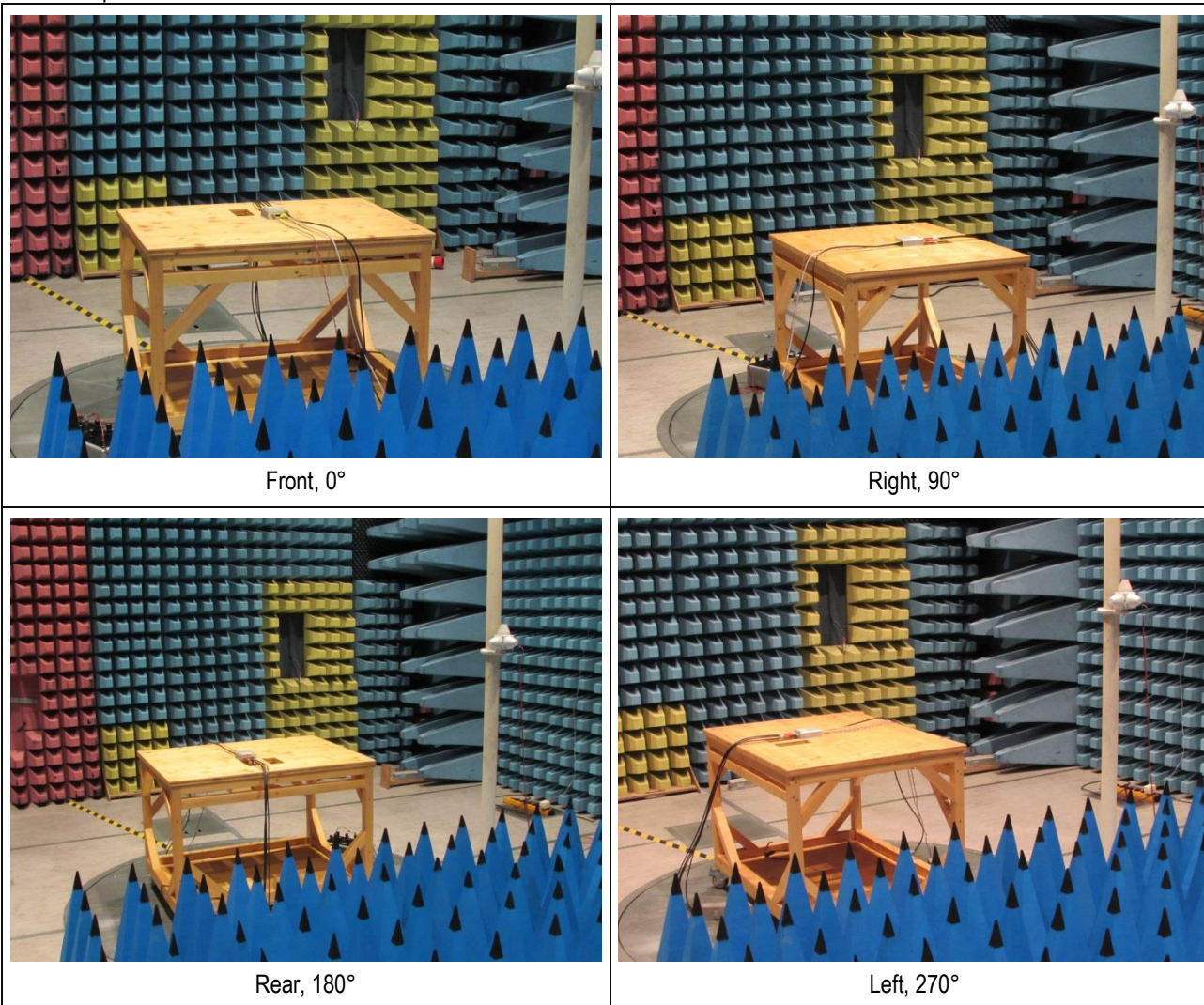
8.2 Immunity to electromagnetic fields (antenna) (EN 61000-4-3)

Introduction: The aim of this test is to evaluate the performance of the equipment when in the presence of electromagnetic fields created by the transmission of radio or television, by cellular phones or by any other system producing electromagnetic radiation in continuous waves

Meas. uncertainty: ± 2.2 dB

Test method: The field is emitted from one or different antennas placed successively in vertical and then in horizontal polarisation. The field is calibrated without the EUT using an isotropic probe.

Test set-up:



Remarks: None

Test equipment:

HF-generator	<input checked="" type="checkbox"/> 166388	<input type="checkbox"/> 25200			
Amplifier	<input checked="" type="checkbox"/> 17921	<input checked="" type="checkbox"/> 166639	<input type="checkbox"/> 18230	<input type="checkbox"/> 105488	<input type="checkbox"/> 168576
Field probe	<input type="checkbox"/> 18366	<input type="checkbox"/> 25961	<input type="checkbox"/> 25962	<input checked="" type="checkbox"/> 25963	
Field strength meter	<input checked="" type="checkbox"/> 17009				
Antenna	<input checked="" type="checkbox"/> 181955	<input type="checkbox"/> 182185			
Field calibration	<input checked="" type="checkbox"/> 168548				
Software and Revision	<input type="checkbox"/> Labview Rev.		<input checked="" type="checkbox"/> RadiMation 2016.1.6		
Multimeter	<input type="checkbox"/> 10812	<input type="checkbox"/> 14846	<input type="checkbox"/> 26712	<input type="checkbox"/> 9879	
Audioanalyzer	<input type="checkbox"/> 105491				

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

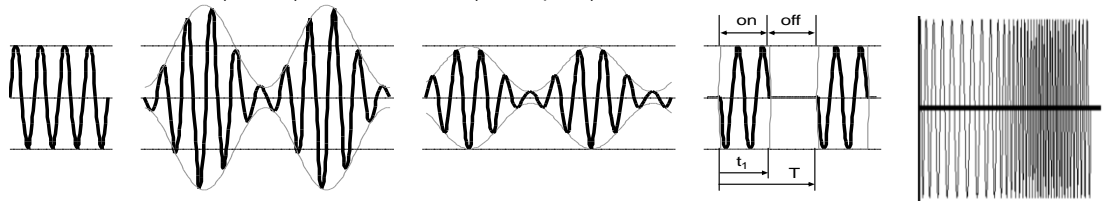
Protocol: Base

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks / Modifications: None / None
 Test site: Semi-anechoic chamber
 Position of EUT: 80 cm (height of the equipment under test above floor)
 Climatic conditions: Temperature: 23.1 °C Humidity: 18 % Pressure QFE: 960 hPa

Requirements

Standard:	Frequency range: [MHz]	Req. level [V/m]:	Test dist.: [m]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	80 – 1000 80, 120, 160, 230, 434, 460, 600, 863, 900	3*	3.0	AM, 1 kHz, 80%	1	1*	A
EN 61000-6-2:2005	80 – 1000 1400 – 2000 2000 – 2700	10	3.0	AM, 1 kHz, 80 %	1	1	A
		3	3.0	AM, 1 kHz, 80 %	1	1	A
		1	3.0	AM, 1 kHz, 80 %	1	1	A
ETSI EN 301 489-1:2017	80 – 1000 1400 – 2700	3	3.0	AM, 1 kHz, 80 %	1	1	A
		3	3.0	AM, 1 kHz, 80 %	1	1	A
Additional requirement	80 – 1000 1000 – 6000	20	3.0	AM, 1 kHz, 80 %	1	1	A
		10	3.0	AM, 1 kHz, 80 %	1	1	A

Modulation: ☐ CW ☒ AM (normal) ☐ AM (const. peak) ☐ PM ☐ FM

**Results: Frequency sweep**

Frequency [MHz]	E [V/m]	Polarisation	Direction	Dwell time [s]	Freq. step [%]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80 – 1000	20	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass

*) On the carrier frequencies of the radio services packet losses occurred. These frequencies belong to the exclusion band of EN 301 489-x.

Results: discrete frequencies

Frequency [MHz]	E [V/m]	Polarisation	Direction	Test dist. [m]	Dwell time [s]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80, 120, 160, 230, 434, 460, 600, 863, 900	20	hor. & vert.	Front 0°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Right 90°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Rear 180°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Left 270°	3	1	No influence observed	A	Pass

Place and date of test:
Operator:

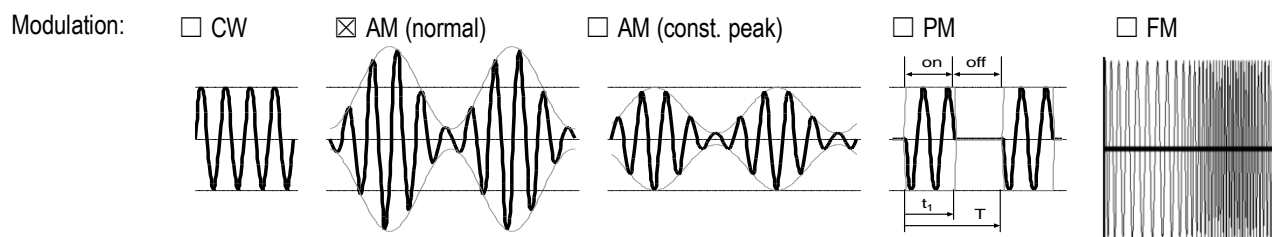
Bern, January 24, 2017
Mr F. Wyler

Protocol: Dual CAN

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2xCAN, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; CAN loop back; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks / Modifications: None / Level 1; see §9.1
 Test site: Semi-anechoic chamber
 Position of EUT: 80 cm (height of the equipment under test above floor)
 Climatic conditions: Temperature: 24.5 °C Humidity: 34 % Pressure QFE: 952 hPa

Requirements

Standard:	Frequency range: [MHz]	Req. level [V/m]:	Test dist.: [m]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	80 – 1000 80, 120, 160, 230, 434, 460, 600, 863, 900	3*	3.0	AM, 1 kHz, 80%	1	1*	A
EN 61000-6-2:2005	80 – 1000	10	3.0	AM, 1 kHz, 80 %	1	1	A
	1400 – 2000	3	3.0	AM, 1 kHz, 80 %	1	1	A
	2000 – 2700	1	3.0	AM, 1 kHz, 80 %	1	1	A
ETSI EN 301 489-1:2017	80 – 6000	3	3.0	AM, 1 kHz, 80 %	1	1	A
Additional requirement	80 – 1000	20	3.0	AM, 1 kHz, 80 %	1	1	A
	1000 – 6000	10	3.0	AM, 1 kHz, 80 %	1	1	A

**Results: Frequency sweep**

Frequency [MHz]	E [V/m]	Polarisation	Direction	Dwell time [s]	Freq. step [%]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80 – 1000	20	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass

*) On the carrier frequencies of the radio services packet losses occurred. These frequencies belong to the exclusion band of EN 301 489-x.

Results: discrete frequencies

Frequency [MHz]	E [V/m]	Polarisation	Direction	Test dist. [m]	Dwell time [s]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80, 120, 160, 230, 434, 460, 600, 863, 900	20	hor. & vert.	Front 0°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Right 90°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Rear 180°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Left 270°	3	1	No influence observed	A	Pass

Place and date of test:
 Operator:

Bern, November 7, 2017
 Mr F. Wyler

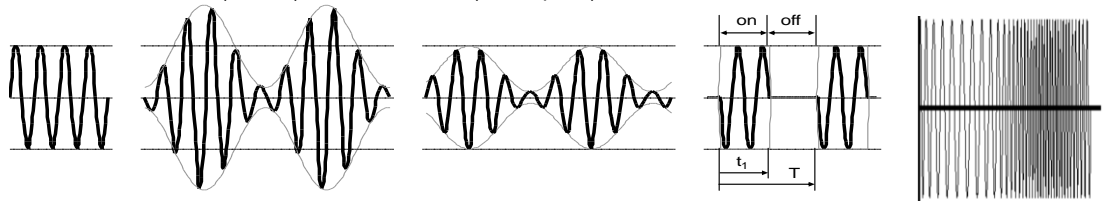
Protocol: COM_I/O

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 2 Mobile Antennas, 2 WIFI Antennas, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks / Modifications: None / Level 1; see §9.1
 Test site: Semi-anechoic chamber
 Position of EUT: 80 cm (height of the equipment under test above floor)
 Climatic conditions: Temperature: 24.5 °C Humidity: 34 % Pressure QFE: 952 hPa

Requirements

Standard:	Frequency range: [MHz]	Req. level [V/m]:	Test dist.: [m]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	80 – 1000 80, 120, 160, 230, 434, 460, 600, 863, 900	3*	3.0	AM, 1 kHz, 80%	1	1*	A
EN 61000-6-2:2005	80 – 1000	10	3.0	AM, 1 kHz, 80 %	1	1	A
	1400 – 2000	3	3.0	AM, 1 kHz, 80 %	1	1	A
	2000 – 2700	1	3.0	AM, 1 kHz, 80 %	1	1	A
ETSI EN 301 489-1:2017	80 – 1000	3	3.0	AM, 1 kHz, 80 %	1	1	A
	1400 – 2700	3	3.0	AM, 1 kHz, 80 %	1	1	A
Additional requirement	80 – 1000	20	3.0	AM, 1 kHz, 80 %	1	1	A
	1000 – 6000	10	3.0	AM, 1 kHz, 80 %	1	1	A

Modulation: ☐ CW ☒ AM (normal) ☐ AM (const. peak) ☐ PM ☐ FM

**Results: Frequency sweep**

Frequency [MHz]	E [V/m]	Polarisation	Direction	Dwell time [s]	Freq. step [%]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80 – 1000	20	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
80 – 1000	20	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Front 0°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Right 90°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Rear 180°	1	1	No influence observed *)	A	Pass
1000 – 6000	10	hor. & vert.	Left 270°	1	1	No influence observed *)	A	Pass

*) On the carrier frequencies of the radio services packet losses occurred. These frequencies belong to the exclusion band of EN 301 489-x.

Results: discrete frequencies

Frequency [MHz]	E [V/m]	Polarisation	Direction	Test dist. [m]	Dwell time [s]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
80, 120, 160, 230, 434, 460, 600, 863, 900	20	hor. & vert.	Front 0°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Right 90°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Rear 180°	3	1	No influence observed	A	Pass
	20	hor. & vert.	Left 270°	3	1	No influence observed	A	Pass

Place and date of test:
Operator:

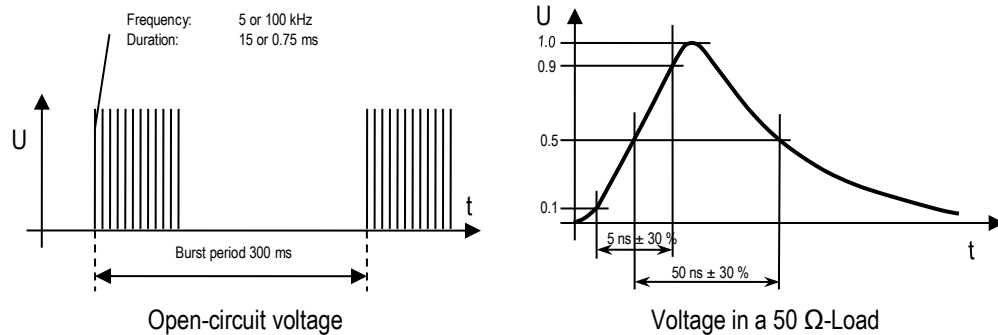
Bern, November 7, 2017
Mr F. Wyler

8.3 Immunity to fast electric transients (EN 61000-4-4)

Introduction:

The test is intended to demonstrate the immunity when subjected to types of transient disturbances such as those originating from switching transients (interruption of inductive loads, relay contact bounce, etc.). This test is also known as "burst".

Pulse:



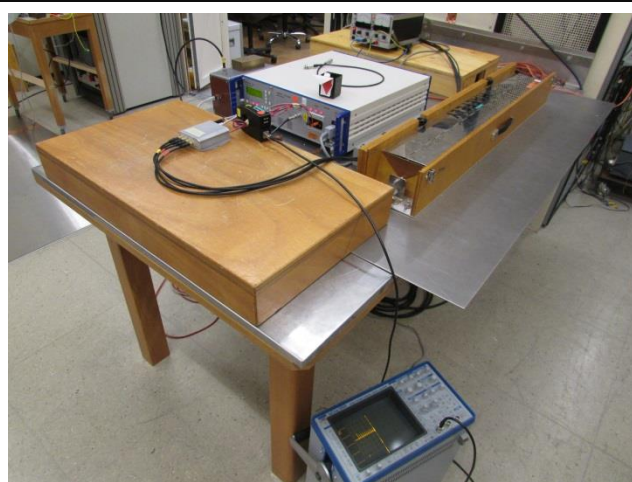
Meas. Uncertainty:

$\pm 10 \%$

Test method:

The transient coupling is carried out using a coupling network for the supply cables and a capacitive coupling clamp for the other cables. The two voltage polarities and all the intermediate levels are tested.

Test set-up:



Coupling with CDN



Coupling with clamp

Remarks:

None

Test equipment:

Burst generator	<input checked="" type="checkbox"/> 26825 incl. CDN	<input type="checkbox"/> 27137 incl. CDN
Capacitive coupling clamp	<input checked="" type="checkbox"/> 17905	
Decoupling clamp	<input checked="" type="checkbox"/> 25781	<input type="checkbox"/> 17901
Coupling network	<input type="checkbox"/> 181762	<input checked="" type="checkbox"/> 181763
CDN 100 Ω	<input type="checkbox"/> 181946	<input type="checkbox"/> 181759
Artificial hand	<input type="checkbox"/> 184450	<input type="checkbox"/> 17902
Multimeter	<input type="checkbox"/> 10812	<input type="checkbox"/> 14846
Audio analyser	<input type="checkbox"/> 25199	<input type="checkbox"/> 26712
		<input type="checkbox"/> 17013
		<input type="checkbox"/> 181764
		<input type="checkbox"/> 25787
		<input type="checkbox"/> 9879

Result:

☒ pass

☐ fail

☐ not applicable

☐ partly tested

Protocol: Base

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB-Stick, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Shielded room
 Climatic conditions: Temperature: 21.6 °C Humidity: 24 % Pressure QFE: 960 hPa

Requirements

Standard :	Req. level AC supply: [kV]	Req. level DC supply: [kV]	Req. level Signal: [kV]	Burst- freq. [kHz]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±0.5	±0.5	5	B
EN 61000-6-2:2005	±2	±2	±1	5	B
ETSI EN 301 489-1 V1.9.2:2011	±1	±0.5	±0.5	5	B
Additional requirement	---	±3	±1	5, 100	B

Results

Operation mode: Routing, Ping via Ethernet & Mobile (Settings: Duration 1 min, Burst-Frequency 5 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 12 VDC	±2, ±3	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Ethernet	± 1	Sig > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
2xMobile, 2xWIFI	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Operation mode: Routing, Ping via Ethernet & Mobile (Settings: Duration 1 min, Burst-Frequency 100 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 12 VDC	±2, ±3	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
Ethernet	± 1	Sig > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
2xMobile, 2xWIFI	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Not tested port	Explanation
USB	Shorter than 3m

Place and date of test:
 Operator:

Bern, January 25, 2017
 Mr F. Wyler

Protocol: Dual CAN

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, USB Cable, 2xCAN, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; CAN loop back; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Shielded room
 Climatic conditions: Temperature: 25.5 °C Humidity: 40 % Pressure QFE: 949 hPa

Requirements

Standard :	Req. level AC supply: [kV]	Req. level DC supply: [kV]	Req. level Signal: [kV]	Burst- freq. [kHz]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±0.5	±0.5	5	B
EN 61000-6-2:2005	±2	±2	±1	5	B
ETSI EN 301 489-1 V1.9.2:2011	±1	±0.5	±0.5	5	B
Additional requirement	---	±3	±1	5, 100	B

Results

Operation mode: Routing, Ping via Ethernet (Settings: Duration 1 min, Burst-Frequency 5 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	±2	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
2x CAN	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Operation mode: Routing, Ping via Ethernet (Settings: Duration 1 min, Burst-Frequency 100 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	±2	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
2x CAN	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Not tested port	Explanation
USB	Shorter than 3m
Ethernet, Mobile & WIFI	Already tested on Base

Place and date of test:
Operator:

Bern, November 7, 2017
Mr F. Wyler

Protocol: COM_I/O

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB Stick, 2 Mobile Antennas, 2 WIFI Antennas, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Shielded room
 Climatic conditions: Temperature: 25.5 °C Humidity: 39 % Pressure QFE: 949 hPa

Requirements

Standard :	Req. level AC supply: [kV]	Req. level DC supply: [kV]	Req. level Signal: [kV]	Burst- freq. [kHz]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±0.5	±0.5	5	B
EN 61000-6-2:2005	±2	±2	±1	5	B
ETSI EN 301 489-1 V1.9.2:2011	±1	±0.5	±0.5	5	B
Additional requirement	---	±3	±1	5, 100	B

Results

Operation mode: Routing, Ping via Ethernet (Settings: Duration 1 min, Burst-Frequency 5 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	±2	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
1x RS485	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No supervision during test. Configuration after test still o.k.	A	Pass
Input & Output	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Operation mode: Routing, Ping via Ethernet (Settings: Duration 1 min, Burst-Frequency 100 kHz)

Tested port	Level [kV]	Coupling path	Coupling clamp direct		Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	±2	L+N > Ref	<input type="checkbox"/>	<input checked="" type="checkbox"/>	No influence observed	A	Pass
1x RS485	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No supervision during test. Configuration after test still o.k.	A	Pass
Input & Output	± 1	Sig > Ref	<input checked="" type="checkbox"/>	<input type="checkbox"/>	No influence observed	A	Pass

Not tested port	Explanation
USB	Shorter than 3m
Ethernet, Mobile & WIFI	Already tested on Base

Place and date of test:
Operator:

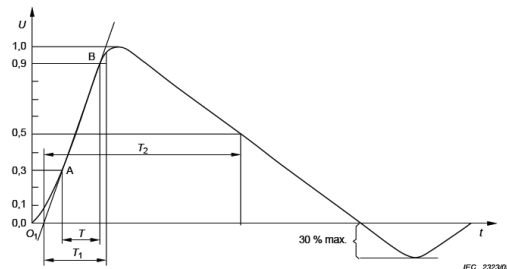
Bern, September, 2017
Mr F. Wyler

8.4 Immunity to surge (EN 61000-4-5: 1.2/50 μ s)

Introduction:

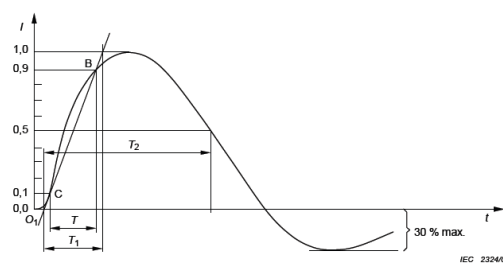
The aim of the test is to determine the immunity of the material submitted to non-repetitive transient overvoltage created by lightning.

Impulses:



Front time: $T_1 = 1,67 \times T = 1,2 \mu\text{s} \pm 30 \%$
Time to half-value: $T_2 = 50 \mu\text{s} \pm 20 \%$

Open-circuit voltage



Front time: $T_1 = 1,25 \times T = 8 \mu\text{s} \pm 20 \%$
Time to half-value: $T_2 = 20 \mu\text{s} \pm 20 \%$

Short-circuit current

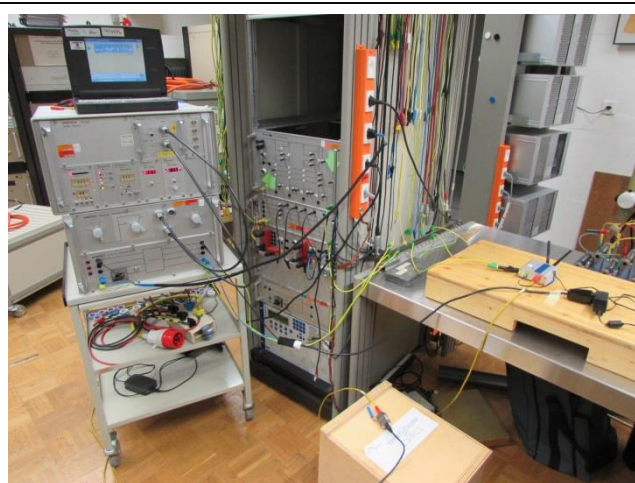
Meas. Uncertainty:

$\pm 10 \%$

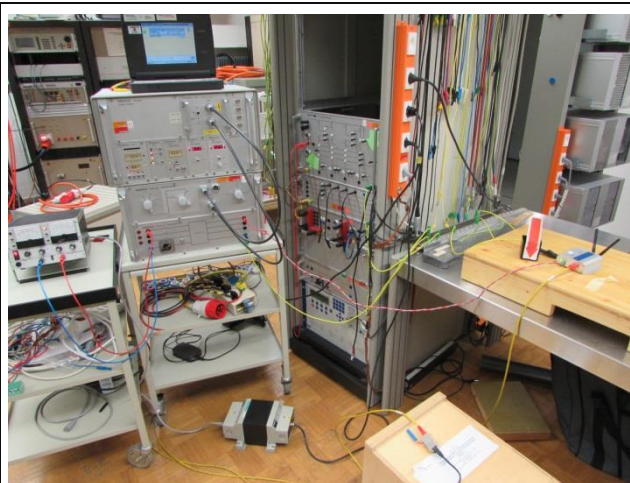
Measuring method:

The impulses are coupled using the coupling network where the supply lines and unshielded cables are concerned. The shielded cables are coupled directly. The two polarities and different phase angles are tested for all the test levels up until the specified level.

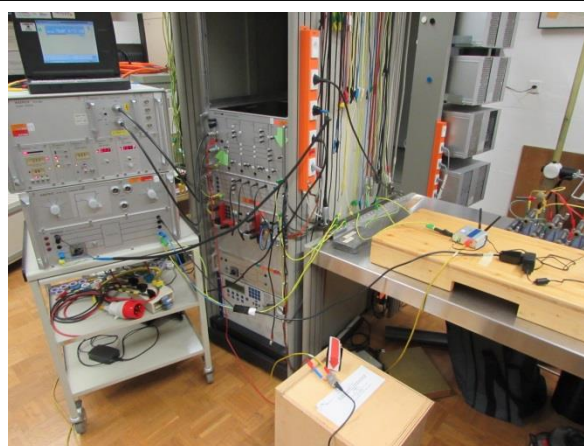
Test set-up:



Coupling on AC power port of power adapter



Coupling on DC power port



Coupling on Ethernet

Remarks:

None

Result:

☒ pass

☐ fail

☐ not applicable

☐ partly tested

Test equipment:

Generator	<input type="checkbox"/> 15-LaBe-01	<input checked="" type="checkbox"/> 25195	
Coupling network	<input type="checkbox"/> 15-LaBe-02	<input checked="" type="checkbox"/> 25194	<input type="checkbox"/> 25193
Decoupling network	<input type="checkbox"/> 25193		

Protocol: Base

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Laboratory
 Climatic conditions: Temperature: 22.8 °C Humidity: 32 % Pressure QFE: 959 hPa

Requirements

Standard :	Required level AC-supply: [kV]		Required level DC-supply: [kV]		Required level Signal: [kV]		Perf. crit.:
	L – L 2 Ω + 18 μF	L – PE 12 Ω + 9 μF	L – L 2 Ω + 18 μF	L – PE 12 Ω + 9 μF	L – L 42 Ω + 0.5 μF N/A to shielded cables	L – PE 42 Ω + 0.5 μF Shield – PE 2 Ω + 18 μF	
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±2	---	±0.5 ¹⁾	---	±1 / ±4 ²⁾	B
EN 61000-6-2:2005	±1	±2	±0.5	±0.5	---	±1 kV	B
ETSI EN 301 489-1 V1.9.2:2011	±1 In telecom centres: ±0.5	±2 In telecom centres: ±1.0	---	---	---	In telecom centres: ±0.5 Outdoor cables: ±1	B

Results:

Tests on AC power ports with 12 V Power Adapter, operating mode Routing, Ping via Ethernet & Mobile

Tested port	Level [kV]	Coupling	Number of pulses*				Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
			0°	90°	180°	270°			
AC power port, L - N	±0.5; ±1	2 Ω + 18 μF	5	5	5	5	No influence observed	A	Pass
AC power port, L – Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass
AC power port, N - Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass

* Number of pulses for each voltage level and each polarity

Tests on AC power ports with 24 V Power Supply, operating mode Routing, Ping via Ethernet & Mobile

Tested port	Level [kV]	Coupling	Number of pulses*				Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
			0°	90°	180°	270°			
AC power port, L - N	±0.5; ±1	2 Ω + 18 μF	5	5	5	5	No influence observed	A	Pass
AC power port, L – Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass
AC power port, N - Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass

* Number of pulses for each voltage level and each polarity

Tests on DC power ports, operating mode: Routing, Ping via Ethernet & Mobile

Tested port	Level [kV]	Coupling mode	Coupling network	Number of pulses *	Remarks	Fulfilled Criterion	Result
Power 18V DC	±0.5	Plus – Minus	2 Ω + 18 μ F	5	The EUT reboots at -500 V Surge	B	Pass
	±0.5	P, M – Ref	12 Ω + 9 μ F	5	One time the EUT reboots at -500 V Surge	B	Pass

* Number of pulses for each voltage level and each polarity

Tests on LAN ports with shielded cable

Tested port	Level [kV]	Coupling mode	Coupling network	Number of pulses *	Remarks	Fulfilled Criterion	Result
LAN port	±0.5; ±1	Screen - PE	2 Ω	5	No influence observed	A	Pass

* Number of pulses for each voltage level and each polarity

Not tested port	Explanation
USB, 2xMobile, 2xWIFI	Shorter than 30 m

Place and date of test:
Operator:

Bern, April 6, 2017
Mr F. Wyler

Protocol: Dual CAN

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 12 VDC, Ethernet, 2xCAN, 1 Mobile Antenna, 1 WIFI Antenna, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile; USB-Stick connected; CAN loop back; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Laboratory
 Climatic conditions: Temperature: 25.5 °C Humidity: 39 % Pressure QFE: 949 hPa

Requirements

Standard :	Required level AC-supply: [kV]		Required level DC-supply: [kV]		Required level Signal: [kV]		Perf. crit.:
	L – L 2 Ω + 18 µF	L – PE 12 Ω + 9 µF	L – L 2 Ω + 18 µF	L – PE 12 Ω + 9 µF	L – L 42 Ω + 0.5 µF N/A to shielded cables	L – PE 42 Ω + 0.5 µF Shield – PE 2 Ω + 18 µF	
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±2	---	±0.5 ¹⁾	---	±1 / ±4 ²⁾	B
EN 61000-6-2:2005	±1	±2	±0.5	±0.5	---	±1 kV	B
ETSI EN 301 489-1:2017	±1 In telecom centres: ±0.5	±2 In telecom centres: ±1.0	---	---	---	In telecom centres: ±0.5 Outdoor cables: ±1	B

Tests on AC power ports with 12 V Power Supply, operating mode Routing, Ping via Ethernet & Mobile

Tested port	Level [kV]	Coupling	Number of pulses*				Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
			0°	90°	180°	270°			
AC power port, L - N	±0.5; ±1	2 Ω + 18 µF	5	5	5	5	Not retested	---	---
AC power port, L – Ref	±0.5; ±1; ±2	12 Ω + 9 µF	5	5	5	5	No earth connection	A	Pass
AC power port, N - Ref	±0.5; ±1; ±2	12 Ω + 9 µF	5	5	5	5	No earth connection	A	Pass

* Number of pulses for each voltage level and each polarity

Tests on signal ports / powered signal ports, operating mode Routing

Tested port	Level [kV]	Coupling mode	Coupling network	Number of pulses *	Remarks	Fulfilled Criterion	Result
CAN	±0.5; ±1	Plus – Ref	42 Ω + 0.5 µF	5	No influence observed	A	Pass
	±0.5; ±1	Minus - Ref	42 Ω + 0.5 µF	5	No influence observed	A	Pass
	±0.5; ±1	GND – Ref	42 Ω + 0.5 µF	5	No influence observed	A	Pass

* Number of pulses for each voltage level and each polarity

Not tested port	Explanation
USB, 1xMobile, 1xWIFI	Shorter than 30 m
DC power port & LAN port	Already tested on Base

Place and date of test:
Operator:

Bern, November 7, 2017
Mr F. Wyler

Protocol: COM_I/O

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 2 Mobile Antennas, 2 WIFI Antennas, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Laboratory
 Climatic conditions: Temperature: 25.5 °C Humidity: 39 % Pressure QFE: 949 hPa

Requirements

Standard :	Required level AC-supply: [kV]		Required level DC-supply: [kV]		Required level Signal: [kV]		Perf. crit.:
	L – L 2 Ω + 18 μF	L – PE 12 Ω + 9 μF	L – L 2 Ω + 18 μF	L – PE 12 Ω + 9 μF	L – L 42 Ω + 0.5 μF N/A to shielded cables	L – PE 42 Ω + 0.5 μF Shield – PE 2 Ω + 18 μF	
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	±1	±2	---	±0.5 ¹⁾	---	±1 / ±4 ²⁾	B
EN 61000-6-2:2005	±1	±2	±0.5	±0.5	---	±1 kV	B
ETSI EN 301 489-1 V1.9.2:2011	±1 In telecom centres: ±0.5	±2 In telecom centres: ±1.0	---	---	---	In telecom centres: ±0.5 Outdoor cables: ±1	B

Results:

Tests on AC power ports with 12 V Power Supply, operating mode Routing, Ping via Ethernet & Mobile

Tested port	Level [kV]	Coupling	Number of pulses*				Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
			0°	90°	180°	270°			
AC power port, L - N	±0.5; ±1	2 Ω + 18 μF	5	5	5	5	Not done	---	---
AC power port, L – Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass
AC power port, N - Ref	±0.5; ±1; ±2	12 Ω + 9 μF	5	5	5	5	No earth connection	A	Pass

* Number of pulses for each voltage level and each polarity

Tests on signal ports / powered signal ports, operating mode: Routing.

Tested port	Level [kV]	Coupling mode	Coupling network	Number of pulses *	Remarks	Fulfilled Criterion	Result
COM	±0.5; ±1	Plus – Ref	42 Ω + 0.5 μF	5	No influence observed	A	Pass
	±0.5; ±1	Minus – Ref	42 Ω + 0.5 μF	5	No influence observed	A	Pass
Input Output	±0.5; ±1	Pin3 – Ref	42 Ω + 0.5 μF	5	No influence observed	A	Pass
	±0.5; ±1	Pin5 - Ref	42 Ω + 0.5 μF	5	No influence observed	A	Pass

* Number of pulses for each voltage level and each polarity

Pin 4 zu GND verbunden, Pin 6 zu GND verbunden

Not tested port	Explanation
USB, 1xMobile, 1xWIFI	Shorter than 30 m
DC power port & LAN port	Already tested on Base

Place and date of test:
Operator:

Bern, September 8, 2017
Mr F. Wyler

8.5 Immunity to conducted disturbances induced by radio-frequency fields (EN 61000-4-6)

Introduction: The object of this test is to determine the immunity of equipment when subjected to conducted disturbances coming from intended radiofrequency transmitters. These disturbances can be found as common mode currents on the conductors and the screens of the cables.

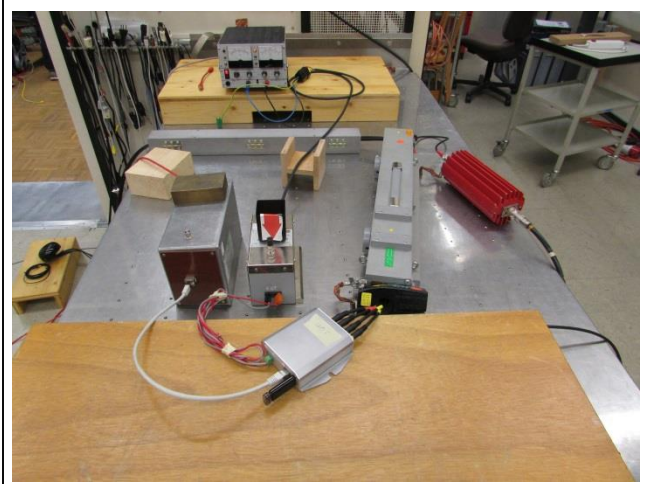
Meas. Uncertainty: ± 1.85 dB

Measuring method: The HF voltage is injected on the cables using different coupling/decoupling networks. All connected cables shall be provided with the appropriate coupling and decoupling devices. The voltage is calibrated without the equipment under test. The Dwell time is depending on the reaction time of the tested equipment.

Test set-up:



Coupling with CDN



Coupling with clamp

Remarks: None

Test equipment:

HF-generator	<input checked="" type="checkbox"/> 25200	<input type="checkbox"/> 166388	<input type="checkbox"/> 13751	<input type="checkbox"/> 13318	
HF-Millivoltmeter	<input checked="" type="checkbox"/> 13726				
Amplifier	<input checked="" type="checkbox"/> 25205				
Power attenuator	<input checked="" type="checkbox"/> 25643	<input type="checkbox"/> 181751			
Coupling networks	<input type="checkbox"/> 17414	<input type="checkbox"/> 25721	<input type="checkbox"/> 10539	<input type="checkbox"/> 25970	<input type="checkbox"/> 16386
Coupling networks	<input type="checkbox"/> 25971	<input type="checkbox"/> 105487	<input type="checkbox"/> 16562	<input type="checkbox"/> 16559	<input type="checkbox"/> 10539
Coupling networks	<input checked="" type="checkbox"/> 25948	<input type="checkbox"/> 26007			
Coupling networks	<input type="checkbox"/> 25947	<input type="checkbox"/> 26008			
Coupling networks	<input type="checkbox"/> 25786	<input type="checkbox"/> 25949	<input type="checkbox"/> 26009		
Coupling networks	<input type="checkbox"/> 181762	<input checked="" type="checkbox"/> 181763			
Coupling networks	<input type="checkbox"/> 181764				
CDN 100Ω	<input type="checkbox"/> 181946	<input type="checkbox"/> 181759	<input type="checkbox"/> 25787		
EM clamp	<input checked="" type="checkbox"/> 25645	<input type="checkbox"/> 14833			
Decoupling clamp	<input checked="" type="checkbox"/> 17901	<input type="checkbox"/> 17902			
Multimeter	<input type="checkbox"/> 10812	<input type="checkbox"/> 14846	<input type="checkbox"/> 26712	<input type="checkbox"/> 9879	
Audioanalyzer	<input type="checkbox"/> 25199				
Artificial Hand	<input type="checkbox"/> 184450				
Calibration	<input checked="" type="checkbox"/> 25648				
Software and Revision	<input type="checkbox"/> LabView Rev. 2014		<input checked="" type="checkbox"/> RadiMation 2016.1.6		

Result: ☒ pass ☐ fail ☐ not applicable ☐ partly tested

Protocol: Base

Client: NetModule AG
 Equipment: NB800 (NB800-LWWtSu)
 Cables connected: Power 12 VDC, Ethernet, USB stick, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: None
 Test site: Shielded room
 Climatic conditions: Temperature: 21.7 °C Humidity: 24 % Pressure QFE: 960 hPa

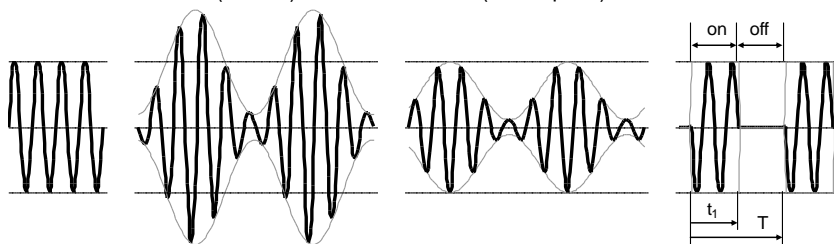
Requirements

Standard:	Frequency range: [MHz]	Required level: [V _{EMF}]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	0.15 – 80 0.2, 1.0, 7.1, 13.56, 21.0, 27.12, 40.68	3	AM, 1 kHz, 80 %	1	1***	A
EN 61000-6-2:2005	0.15 – 80	10	AM, 1 kHz, 80 %	1	1	A
EN 301 489-1: 2017	0.15 – 80	3	AM, 1 kHz, 80 %	1	1	A**
Additional requirement	0.15 – 80	12	AM, 1 kHz, 80 %	1	1	A

Dwell time:

☐ 0.5 s☒ 1 s☐ 3 s

Signal modulation:

☐ CW☒ AM (normal)☐ AM (const. peak)☐ PM**Test Results** (Frequency scan 0.15 – 80 MHz, Dwell Time 1 sec):

Coupling	CDN	Terminated (50 Ω)	CDN	Level [V]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 12 VDC	25948	Ethernet	181763	12	No influence observed	A	Pass
Ethernet	181763	Power 12 VDC	25948	12	No influence observed	A	Pass
2xMobile & 2xWIFI	25645	Power 12 VDC	25948	12	No influence observed	A	Pass

Test Results (Discrete frequencies: 0.2; 1.0; 7.1; 13.56; 21.0; 27.12 & 40.68 MHz , Dwell Time 1 sec):

Coupling	CDN	Terminated (50 Ω)	CDN	Level [V]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 12 VDC	25948	Ethernet	181763	12	No influence observed	A	Pass
Ethernet	181763	Power 12 VDC	25948	12	No influence observed	A	Pass
2xMobile & 2xWIFI	25645	Power 12 VDC	25948	12	No influence observed	A	Pass

Not tested port	Explanation
USB	Cable not longer than 3 m

Place and date of test:
 Operator:

Bern, January 25, 2017
 Mr F. Wyler

Protocol: Dual CAN

Client: NetModule AG
 Equipment: NB800 (LWWtSu2C Dual CAN)
 Cables connected: Power 24 VDC, Ethernet, USB stick, 2xCAN, 2 cables on Mobile Antenna port, 2 cables on WIFI Antenna port, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; CAN loop back; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Shielded room
 Climatic conditions: Temperature: 24.3 °C Humidity: 33 % Pressure QFE: 952 hPa

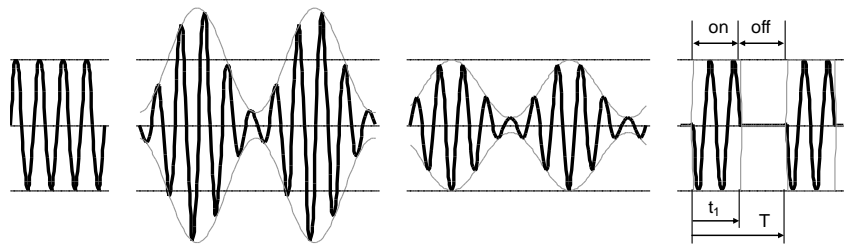
Requirements

Standard:	Frequency range: [MHz]	Required level: [V _{EMF}]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	0.15 – 80 0.2, 1.0, 7.1, 13.56, 21.0, 27.12, 40.68	3	AM, 1 kHz, 80 %	1	1***	A
EN 61000-6-2:2005	0.15 – 80	10	AM, 1 kHz, 80 %	1	1	A
EN 301 489-1: 2017	0.15 – 80	3	AM, 1 kHz, 80 %	1	1	A**
Additional requirement	0.15 – 80	12	AM, 1 kHz, 80 %	1	1	A

Dwell time:

☐ 0.5 s☒ 1 s☐ 3 s

Signal modulation:

☐ CW☒ AM (normal)☐ AM (const. peak)☐ PM**Test Results** (Frequency 0.15 – 80 MHz, Dwell Time 1 sec): Operating mode: Routing, Ping via Ethernet & Mobile

Coupling	CDN	Terminated (50 Ω)	CDN	Level [V]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	25948	Ethernet	17-LaBe-02	10	No influence observed	A	Pass
2xCAN	16559	Power 24 VDC	25948	10	No influence observed	A	Pass
2xCAN Signal Ground	25721	Power 24 VDC	25948	10	No influence observed	a	Pass

Not tested port	Explanation
USB	Not longer than 3 m
Ethernet, WIFI, GSM	Already tested on Base

Place and date of test:
 Operator:

Bern, November 7, 2017
 Mr F. Wyler

Protocol: COM_I/O

Client: NetModule AG
 Equipment: NB800 (LWWtScSu COM_IO)
 Cables connected: Power 24 VDC, Ethernet, RS485/RS232, Digital In/out, USB-Stick, 2 Mobile Antennas, 2 WIFI Antennas, see § 5.5 & § 6.4
 Operating mode: Routing, RAM-Test, Ping via Ethernet & Mobile, USB-Stick connected; see § 6.5
 Observation of EUT: Visually, see § 6.6
 Remarks: None
 Modifications: Level 1; see §9.1
 Test site: Shielded room
 Climatic conditions: Temperature: 24.3 °C Humidity: 33 % Pressure QFE: 952 hPa

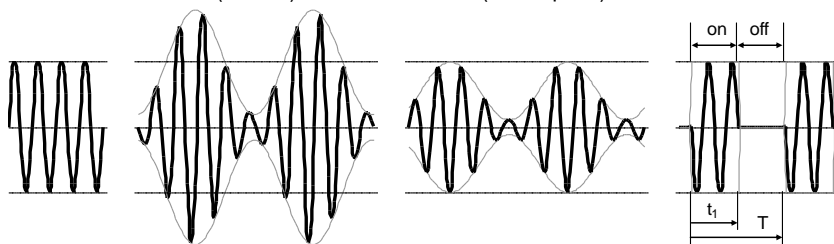
Requirements

Standard:	Frequency range: [MHz]	Required level: [V _{EMF}]	Modulation:	Dwell time: [s]	Freq. step: [%]	Perf. crit.:
EN 55024:2010 + A1:2015 CISPR 24:2010/AMD1:2015	0.15 – 80 0.2, 1.0, 7.1, 13.56, 21.0, 27.12, 40.68	3	AM, 1 kHz, 80 %	1	1***	A
EN 61000-6-2:2005	0.15 – 80	10	AM, 1 kHz, 80 %	1	1	A
EN 301 489-1: 2017	0.15 – 80	3	AM, 1 kHz, 80 %	1	1	A**
Additional requirement	0.15 – 80	12	AM, 1 kHz, 80 %	1	1	A

Dwell time:

☐ 0.5 s☒ 1 s☐ 3 s

Signal modulation:

☐ CW☒ AM (normal)☐ AM (const. peak)☐ PM**Test Results** (Frequency 0.15 – 80 MHz, Dwell Time 1 sec): Operating mode: Routing, Ping via Ethernet & Mobile

Coupling	CDN	Terminated (50 Ω)	CDN	Level [V]	Result, Observation, Behaviour of EUT	Fulfilled criterion	Result
Power 24 VDC	25948	Ethernet	17-LaBe-02	10	No influence observed	A	Pass
RS485/RS232	25721	Power 24 VDC	25948	10	No influence observed	A	Pass
Digital In / Out	16559	Power 24 VDC	25948	10	No influence observed	A	Pass

Not tested port	Explanation
USB	Not longer than 3 m
Ethernet, WIFI, GSM	Already tested on Base

Place and date of test:
 Operator:

Bern, November 7, 2017
 Mr F. Wyler

9. Modifications on the EUT

9.1 Level: 1

<p>In order to improve the results for conducted emission the following inductor has changed L1401.</p> <p>Old: TDK VLS6045EX-4R7M, Semi Shielded</p> <p>New: Coilcraft XAL5030-472ME, Fully Shielded</p> <p>Date: November 6, 2017</p>	<p>In order to improve the results for conducted emission the following inductor has changed L1402.</p> <p>Old: Taiyo Yuden NR5040T3R3N, Semi Shielded</p> <p>New: Coilcraft XAL4030-332ME, Fully Shielded</p> <p>Date: November 6, 2017</p>
---	--