

Königswinkel 10
32825 Blomberg
Germany
Phone +49 5235 9500-0
Fax +49 5235 9500-10

Test Report

Report Number: F144375E1

Applicant:

NT-ware Systemprogrammierung GmbH

Manufacturer:

NT-ware Systemprogrammierung GmbH

Equipment under Test (EUT):

Printer terminal interface

uniFLOW Release Station Multi



Laboratory (CAB) accredited by
Deutsche Akkreditierungsstelle GmbH (DAkkS)
in compliance with DIN EN ISO/IEC 17025
under the Reg. No. D-PL-17186-01-02,
FCC Test site registration number 90877 and
Industry Canada Test site registration IC3469A-1

REFERENCES

- [1] **ANSI C63.4:2009** American National Standard for Methods of Measuring of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.
- [2] **FCC 47 CFR Part 15** Radio Frequency Devices
- [3] **RSS-210 Issue 8 (December 2010)** Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment
- [4] **RSS-Gen Issue 3 (December 2010)** General Requirements and Information for the Certification of Radiocommunication Equipment

TEST RESULT

The requirements of the tests performed as shown in the overview (chapter 4 of this test report) were fulfilled by the equipment under test.

The complete test results are presented in the following.

Test engineer:	Michael DINTER		16 September 2014
	_____ Name	_____ Signature	_____ Date
Authorized reviewer:	Bernd STEINER		16 September 2014
	_____ Name	_____ Signature	_____ Date

RESERVATION

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1 Identification

1.1 Applicant

Name:	NTware Systemprogrammierung GmbH
Address:	Niedersachsenstraße 6 49186 Bad Iburg
Country:	Germany
Name for contact purposes:	Mr H. Bauszus
Tel:	+49-(0)-5403-7243-220
Fax:	+49-(0)-5403-780103
e-mail address:	hbauszus@nt-ware.com

1.2 Manufacturer

Name:	NTware Systemprogrammierung GmbH
Address:	Niedersachsenstraße 6 49186 Bad Iburg
Country:	Germany
Name for contact purposes:	Mr H. Bauszus
Tel:	+49-(0)-5403-7243-220
Fax:	+49-(0)-5403-780103
e-mail address:	hbauszus@nt-ware.com

1.3 Test laboratory

The tests were carried out at: **PHOENIX TESTLAB GmbH**
Königswinkel 10
32825 Blomberg
Germany

Test Laboratory (CAB) accredited by Deutsche Akkreditierungsstelle GmbH (DAkS) in compliance with DIN EN ISO/IEC 17025 under the Reg. No. D-PL-17186-01-02,
 recognized by Bundesnetzagentur under the Reg.-No. BNetzA-CAB-02/21-104.
 CAB Designation Number DE0004, listed by FCC 31040/SIT1300F2, IC OATS Listing 3469A-1.

1.4 EUT (Equipment Under Test)

Type of equipment:	universal touch LCD printer interface with integrated RF-Card reader
Type designation / model name:	uniFLOW Release Station Multi
Serial No.*:	D0FF5047EAE0
FCC ID:	WG7URSMULTI01
IC:	7900A-URSMULTI01
Lowest internal frequency:	12 MHz
Highest internal frequency:	96 MHz RF reader 720 MHz CPU clock
Antenna type:	Loop antenna

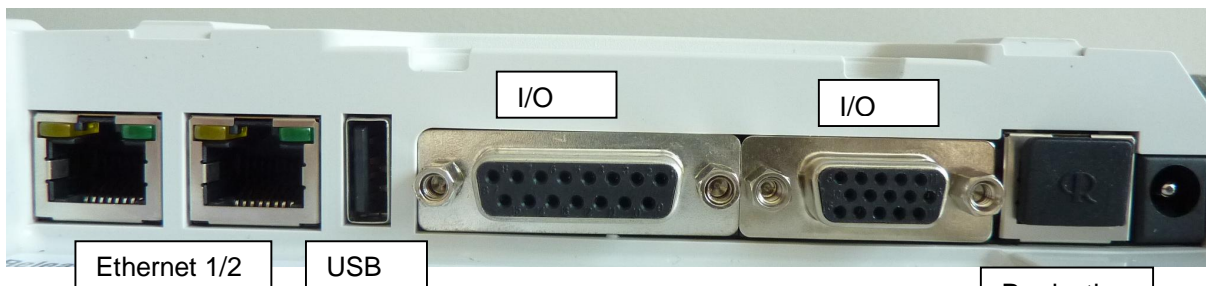
Remark*: The serial number on the type plate in the annex is different to the tested sample, because the FCC ID was not correct on the type plate of the tested sample.



1.5 Technical data of equipment

Power supply: *	12 V DC supplied by external wall mount power supply		
Supply voltage: *	Unom= 12 V DC	Umin= 10 V	Umax= 14 V
Type of modulation: *	ASK		
Frequency deviation: *	± 150 Hz		
Operating frequency range: *	13.56 MHz		
Number of channels: *	1		
Antenna type: *	Internal loop antenna 3364 mm ²		
Duty cycle: *	100%		
Rated RF power: *	< 250 mW		
Data rate: *	12.5 kbaud up to 424 kbaud		
Temperature range: *	0 to 35°C		

* declared by the applicant.

Ports / Connectors			
Identification	Connector		Length during test
	EUT	Ancillary	
AC Adapter Powersupply	customized	-	1.5 m
Ethernet 1	RJ 45	RJ 45	2 m
Ethernet 2	RJ 45	Left open	2 m
I/O	D Sub 15 PIN	D Sub 15 PIN Left open	2 m
I/O	D Sub 9 PIN	Left open	-
Production interface	RJ 45	Left open	-
USB	USB	Left open	-



Power Supply:	The power supply must be a limited power source (LPS), which delivers a voltage of 12 V DC and a min. current of 1.0 A. A polarized plug 2.1/5.5 mm is to be used, with positive wire to the inner jack.
Rated Voltage:	12 V  LPS
Ethernet:	2x RJ-45 Ethernet connection with a built in 10/100 MBit switch.
USB:	USB Type A connection with USB 2.0 (Hi-Speed) to connect a USB identification device.
D-SUB-15:	Digital I/O Connector to lock / unlock the machine for copy accounting.
D-SUB-15HD:	Digital I/O Connector to lock / unlock the machine for copy accounting.
Ambient temperature:	0 ... +35 °C (32 ... +95 °F)
Safety restrictions:	 Use only in closed rooms.
uniFLOW:	uniFLOW and/or RPS V5.3 or higher
Status LEDs:	The uniFLOW Release Station is equipped with different LEDs depending on the built in card reader. See chapter LED/Beep Status (on page 8) for more info.

Production interface

1.6 Dates

Date of receipt of test sample:	1 August 2014
Start of test:	12 August 2014
End of test:	18 September 2014

2 Operational states and physical boundaries

The EUT is a universal printer interface with touch screen and embedded card reader used for releasing personal secure print jobs on almost any printer.

All tests were carried out with an unmodified test sample, which operates with a test-software. This software sets the EUT in continuous awaiting a TAG mode and if a TAG was identified the transponder data were displayed on the computers display only one time after replace the TAG another reading was possible.

The conducted emission measurement on the power supply line was carried out on the AC/DC adapter of the EUT Model No.: UE15WCP-120125SPA.

During all tests the EUT was supplied with 12 DC via an AC/DC adapter by an AC-mains network with 120 V AC / 60 Hz.

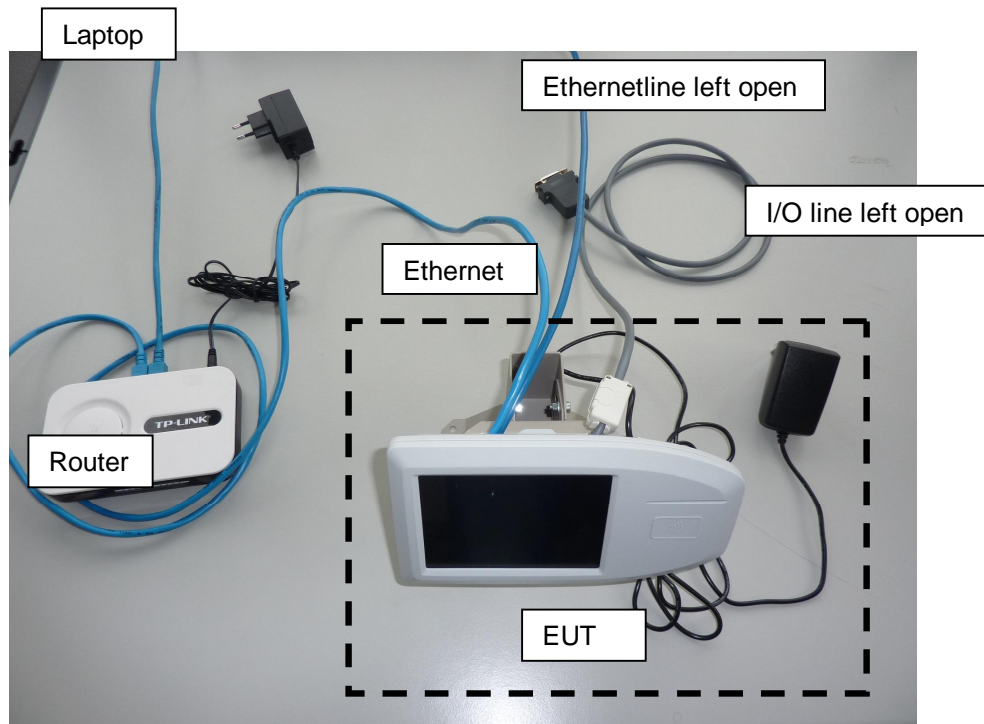
All tests were carried out without reading a TAG (awaiting a TAG) because a TAG was reading only one time and there was no mode delivered by the applicant for continuous reading a TAG without replace it. Additionally a ping was send via Ethernet connection from a laptop PC.

No spurious emission measurement of the receiver was carried out, because the co located transmitter transmits continuously.

During the tests, the EUT was not labelled with a FCC-label.

The physical boundaries of the EUT are shown below.

Physical boundaries of the EUT



3 Additional information

To fulfil the radiated emission tests a snap ferrite Würth No.742 718 33 was added at the Line of the I/O port.

The following Laptop PC was used for the measurements.

Lenovo Think Pad x201 tablet

TP Link Router TL-WR340WD

4 Overview

Application	Frequency range [MHz]	FCC 47 CFR Part 15 section [2]	ICES 003, Issue 5 [3] and RSS-Gen, Issue 3 [4]	Status	Refer page
Conducted emissions on supply line	0.15 - 30	15.107 (a) 15.207 (a)	ICES 003 [3] 7.2.4 [4]	Passed	10 et seq.
Radiated emissions	0.009 - 1,000	15.109(a) 15.205 (a) 15.209 (a)	ICES 003 [3] 7.2.5 [4]	Passed	13 et seq.
20 dB bandwidth	13.560	15.215 (c)	-	Passed	28 et seq.
99 % bandwidth	13.560	-	4.6.1 [4]	Passed	Annex D

5 Test results

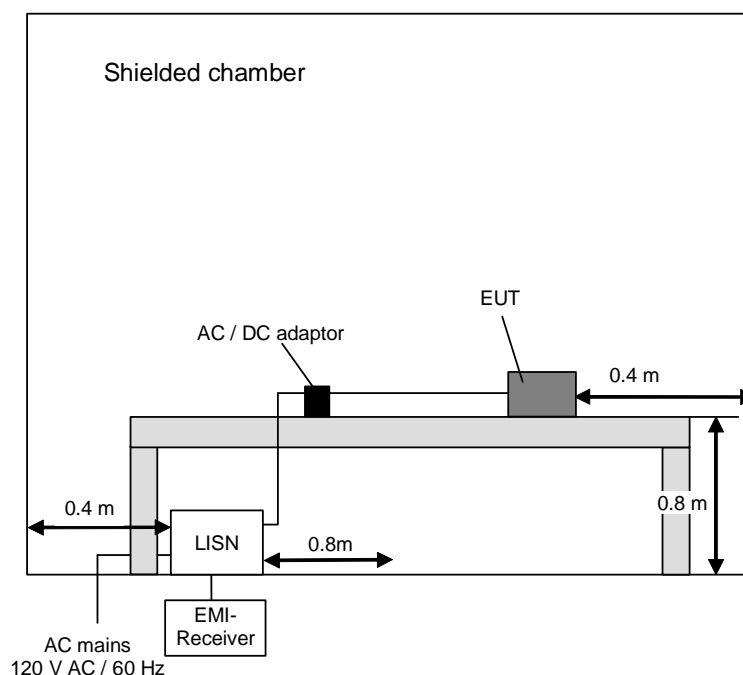
5.1 Conducted emission measurement on AC mains (150 kHz to 30 MHz)

5.1.1 Method of measurement conducted emission

This test will be carried out in a shielded chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm above the ground plane. Floor-standing devices will be placed directly on the ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 150 kHz to 30 MHz will be measured with an EMI Receiver set to MAX Hold mode with peak and average detector and a resolution bandwidth of 9 kHz. A scan will be carried out on the phase (or plus pole in case of DC powered devices) of the AC mains network. If levels detected 10 dB below the appropriable limit, this emission will be measured with the average and quasi-peak detector on all lines.

Frequency range	Resolution bandwidth
150 kHz to 30 MHz	9 kHz

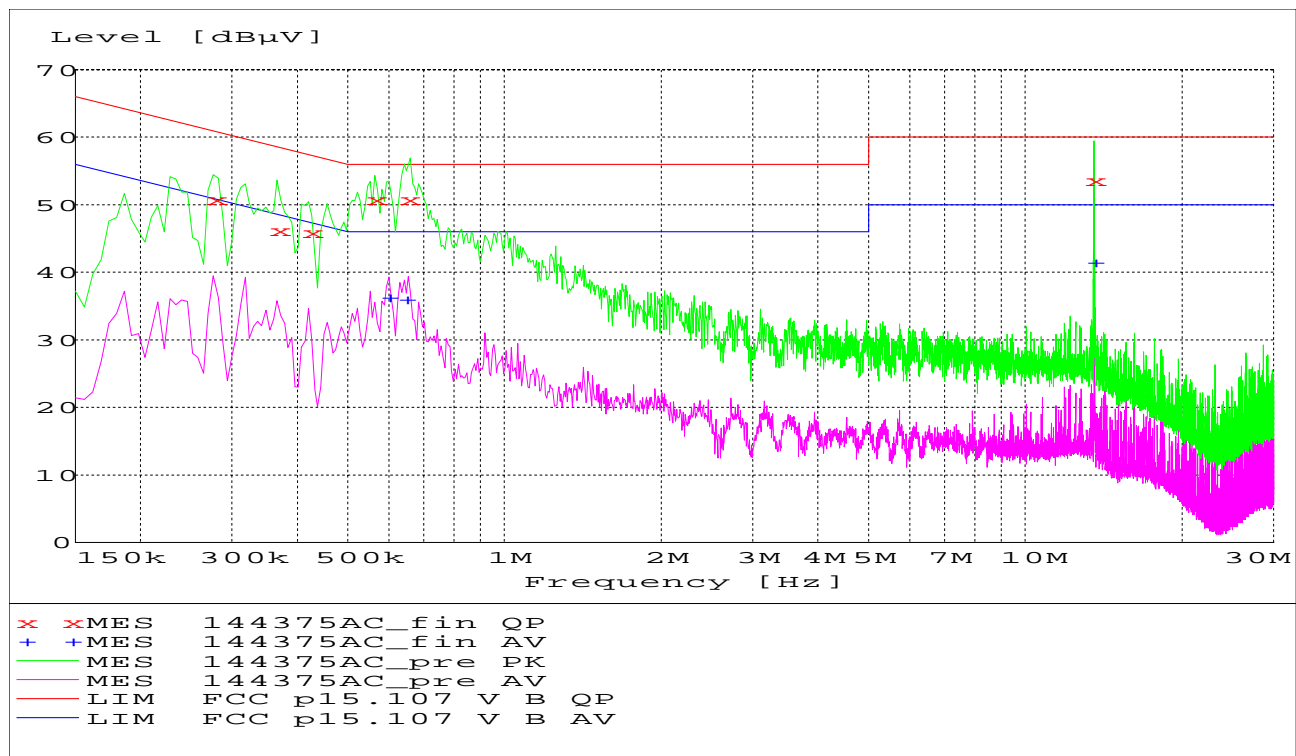


5.1.2 Test result (conducted emission measurement on AC mains)

Ambient temperature:	20 °C	Relative humidity:	45 %
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Position of EUT:	The EUT was set-up on a wooden table of a height of 0.8 m.
Cable guide:	The cable of the EUT was fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	The test was carried out in normal operation mode of the EUT (awaiting a TAG). All results are shown in the following.
Power supply:	During this test the EUT was powered with 12 V DC via an AC adapter with 120 V AC / 60 Hz AC-mains network.
Operation states:	As described in chapter 2.

The curves in the diagram only represent for each frequency point the maximum measured value of all preliminary measurements which were made for each power supply line. The top measured curve represents the peak measurement and the bottom measured curve the average measurement. The quasi-peak measured points are marked by "x" and the average measured points by "+".



Data record name: 144375AC

Result measured with the quasipeak detector (marked by an x):

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
0.277800	50.90	1.0	60.9	10.0	N	GND
0.367800	46.30	0.8	58.6	12.3	N	GND
0.424500	45.90	0.9	57.4	11.5	N	FLO
0.563100	50.80	0.9	56.0	5.2	L1	GND
0.653100	50.90	0.8	56.0	5.1	L1	FLO
13.561800	53.70	1.9	60.0	6.3	L1	GND

Result measured with the average detector (marked by a +):

Frequency MHz	Level dB μ V	Transducer dB	Limit dB μ V	Margin dB	Line	PE
0.598200	36.30	0.8	46.0	9.7	N	GND
0.646800	36.10	0.8	46.0	9.9	L1	GND
13.560900	41.40	1.9	50.0	8.6	N	FLO

Test: Passed

TEST EQUIPMENT USED:

20 - 23

5.2 Radiated emissions

5.2.1 Method of measurement (radiated emissions)

The radiated emission measurement is subdivided into five stages.

- A preliminary measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 9 kHz to 1 GHz.
- A final measurement carried out on an outdoor test side without reflecting ground plane and a fixed antenna height in the frequency range 9 kHz to 30 MHz.
- A final measurement carried out on an open area test side with reflecting ground plane and various antenna height in the frequency range 30 MHz to 1 GHz.
- A preliminary measurement carried out in a fully anechoic chamber with a variable antenna distance and height in the frequency range 1 GHz to 110 GHz.
- A final measurement carried out in a fully anechoic chamber with a fixed antenna height in the frequency range 1 GHz to 110 GHz.

All measurements will be carried out with the EUT working on the middle and upper and lower edge of the assigned frequency band.

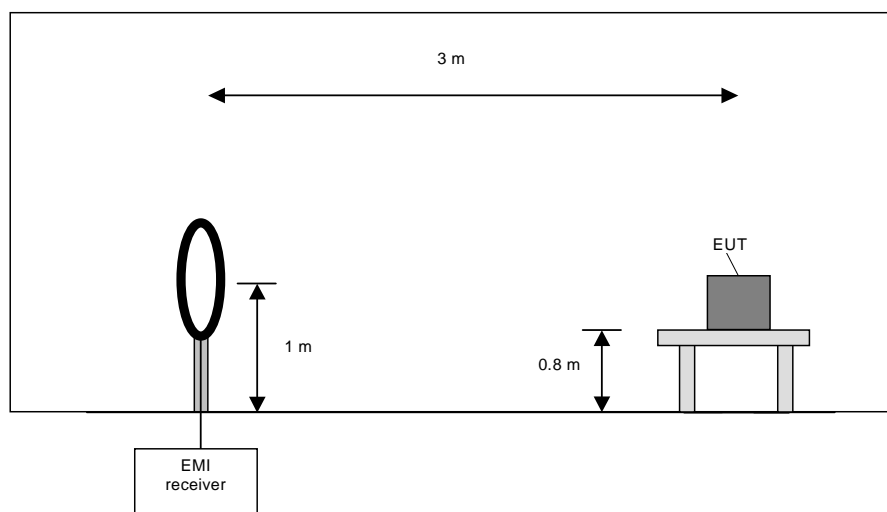
Preliminary measurement (9 kHz to 30 MHz):

In the first stage a preliminary measurement will be performed in a shielded room with a measuring distance of 3 meters. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 9 kHz to 30 MHz will be monitored with a spectrum analyser while the system and its cables will be manipulated to find out the configuration with the maximum emission levels if applicable. The EMI Receiver will be set to MAX Hold mode. The EUT and the measuring antenna will be rotated around their vertical axis to found the maximum emissions.

The resolution bandwidth of the spectrum analyser will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	10 kHz



Preliminary measurement procedure:

Prescans were performed in the frequency range 9 kHz to 150 kHz and 150 kHz to 30 MHz.

The following procedure will be used:

- 1) Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
- 2) Manipulate the system cables within the range to produce the maximum level of emission.
- 3) Rotate the EUT by 360 ° to maximize the detected signals.
- 4) Make a hardcopy of the spectrum.
- 5) Measure the frequencies of highest detected emission with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 6) Repeat steps 1) to 5) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
- 7) Rotate the measuring antenna and repeat steps 1) to 5).

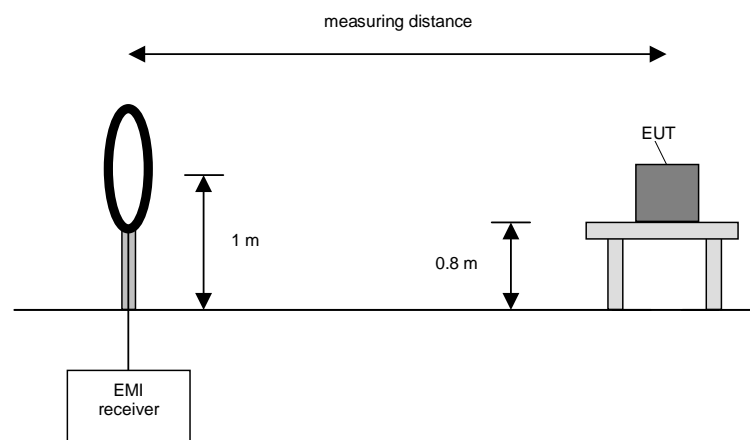
Final measurement (9 kHz to 30 MHz):

In the second stage a final measurement will be performed on an open area test site with no conducting ground plane in a measuring distances of 3 m, 10 m and 30 m. In the case where larger measuring distances are required the results will be extrapolated based on the values measured on the closer distances according to Section 15.31 (f) (2) [2]. The final measurement will be performed with a EMI Receiver set to Quasi Peak detector except for the frequency bands 9 kHz to 90 kHz and 110 kHz to 490 kHz where an average detector will be used according Section 15.209 (d) [2].

On the during the preliminary measurement detected frequencies the final measurement will be performed while rotating the EUT and the measuring antenna in the range of 0 ° to 360 ° around their vertical axis until the maximum value is found.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
9 kHz to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz



Final measurement procedure:

The following procedure will be used:

- 1) Monitor the frequency range with the measuring antenna at vertical orientation parallel to the EUT at an azimuth of 0 °.
- 2) Rotate the EUT by 360 ° to maximize the detected signals and note the azimuth and orientation.
- 3) Rotate the measuring antenna to find the maximum and note the value.
- 4) Rotate the measuring antenna and repeat steps 1) to 3) until the maximum value is found.
- 5) Repeat steps 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

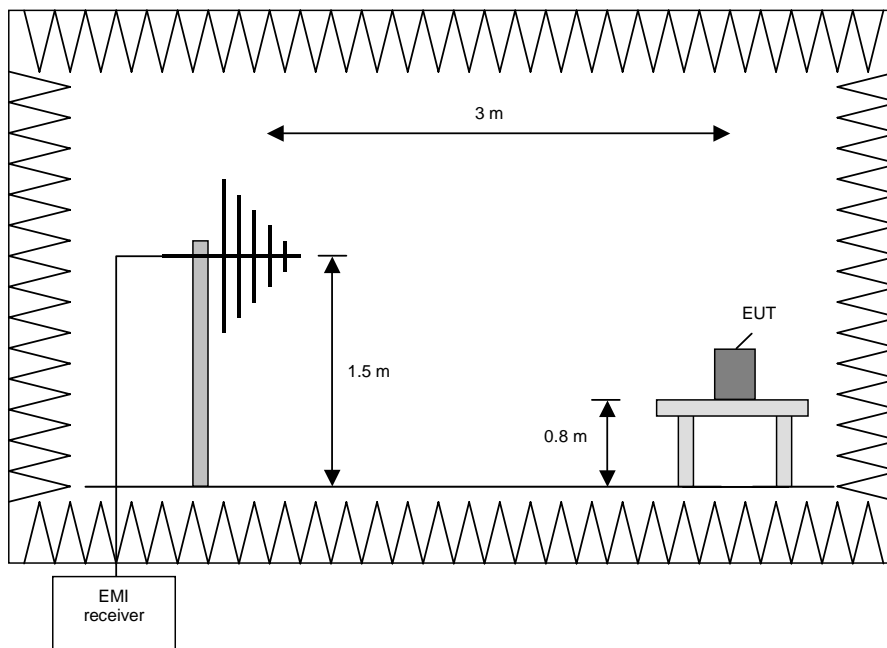
Preliminary measurement (30 MHz to 1 GHz)

In the first stage a preliminary measurement will be performed in a fully anechoic chamber with a measuring distance of 3 meter. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

The frequency range 30 MHz to 1 GHz will be measured with an EMI Receiver set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 °.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 230 MHz	100 kHz
230 MHz to 1 GHz	100 kHz



Procedure preliminary measurement:

Prescans were performed in the frequency range 30 MHz to 230 MHz and 230 MHz to 1 GHz.

The following procedure will be used:

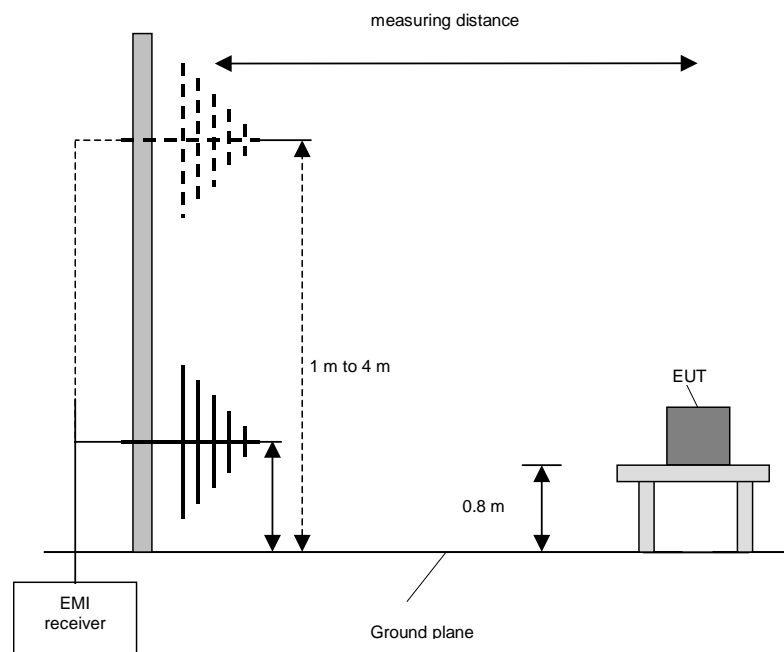
1. Monitor the frequency range at horizontal polarisation and a EUT azimuth of 0 °.
2. Manipulate the system cables within the range to produce the maximum level of emission.
3. Rotate the EUT by 360 ° to maximize the detected signals.
4. Make a hardcopy of the spectrum.
5. Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
6. Repeat 1) to 4) with the other orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).
7. Repeat 1) to 5) with the vertical polarisation of the measuring antenna.

Final measurement (30 MHz to 1 GHz)

A final measurement on an open area test site will be performed on selected frequencies found in the preliminary measurement. During this test the EUT will be rotated in the range of 0 ° to 360 °, the measuring antenna will be set to horizontal and vertical polarisation and raised and lowered in the range from 1 m to 4 m to find the maximum level of emissions.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
30 MHz to 1 GHz	120 kHz



Procedure final measurement:

The following procedure will be used:

- 1) Measure on the selected frequencies at an antenna height of 1 m and a EUT azimuth of 23 °.
- 2) Move the antenna from 1 m to 4 m and note the maximum value at each frequency.
- 3) Rotate the EUT by 45 ° and repeat 2) until an azimuth of 337 ° is reached.
- 4) Repeat 1) to 3) for the other orthogonal antenna polarization.
- 5) Move the antenna and the turntable to the position where the maximum value is detected.
- 6) Measure while moving the antenna slowly +/- 1 m.
- 7) Set the antenna to the position where the maximum value is found.
- 8) Measure while moving the turntable +/- 45 °.
- 9) Set the turntable to the azimuth where the maximum value is found.
- 10) Measure with Final detector (QP and AV) and note the value.
- 11) Repeat 5) to 10) for each frequency.
- 12) Repeat 1) to 11) for each orthogonal axes of the EUT (because of EUT is a module and might be used in a handheld equipment application).

Preliminary and final measurement (1 GHz to 110 GHz)

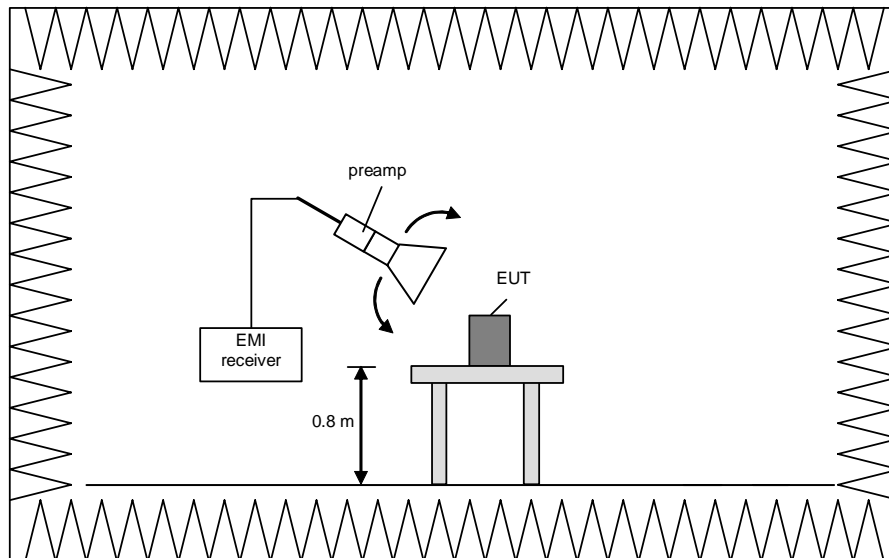
This measurement will be performed in a fully anechoic chamber. Tabletop devices will set up on a non-conducting support with a size of 1 m by 1.5 m and a height of 80 cm. Floor-standing devices will be placed directly on the turntable/ground plane. The set up of the Equipment under test will be in accordance to ANSI C63.4-2009 [1].

Preliminary measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The spectrum analyser set to MAX Hold mode and a resolution bandwidth of 100 kHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna, the antenna close to the EUT and while moving the antenna over all sides of the EUT. With the spectrum analyser in CLEAR / WRITE mode the cone of the emission should be found and then the measuring distance will be set to 3 m with the receiving antenna moving in this cone of emission. At this position the final measurement will be carried out.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	100 kHz
4 GHz to 12 GHz	100 kHz
12 GHz to 18 GHz	100 kHz
18 GHz to 26.5 GHz	100 kHz
26.5 GHz to 40 GHz	100 kHz
40 GHz to 60 GHz	100 kHz
50 GHz to 75 GHz	100 kHz
75 GHz to 110 GHz	100 kHz

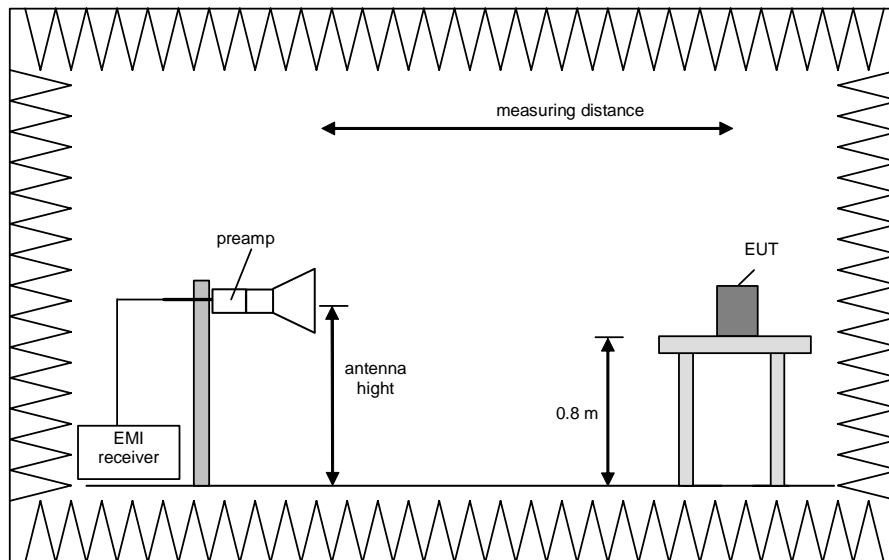


Final measurement (1 GHz to 110 GHz)

The frequency range will be divided into different sub ranges depending of the frequency range of the used horn antenna. The EMI Receiver set to peak and average mode and a resolution bandwidth of 1 MHz. The measurement will be performed in horizontal and vertical polarisation of the measuring antenna and while rotating the EUT in its vertical axis in the range of 0 ° to 360 ° in order to have the antenna inside the cone of radiation.

The resolution bandwidth of the EMI Receiver will be set to the following values:

Frequency range	Resolution bandwidth
1 GHz to 4 GHz	1 MHz
4 GHz to 12 GHz	1 MHz
12 GHz to 18 GHz	1 MHz
18 GHz to 26.5 GHz	1 MHz
26.5 GHz to 40 GHz	1 MHz
40 GHz to 60 GHz	1 MHz
50 GHz to 75 GHz	1 MHz
75 GHz to 110 GHz	1 MHz



Procedure of measurement:

The measurements were performed in the frequency range 1 GHz to 4 GHz, 4 GHz to 12 GHz, 12 GHz to 18 GHz, 18 GHz to 26.5 GHz, 26.5 GHz to 40 GHz, 40 GHz to 60 GHz, 60 GHz to 75 GHz and 75 GHz to 110 GHz.

The following procedure will be used:

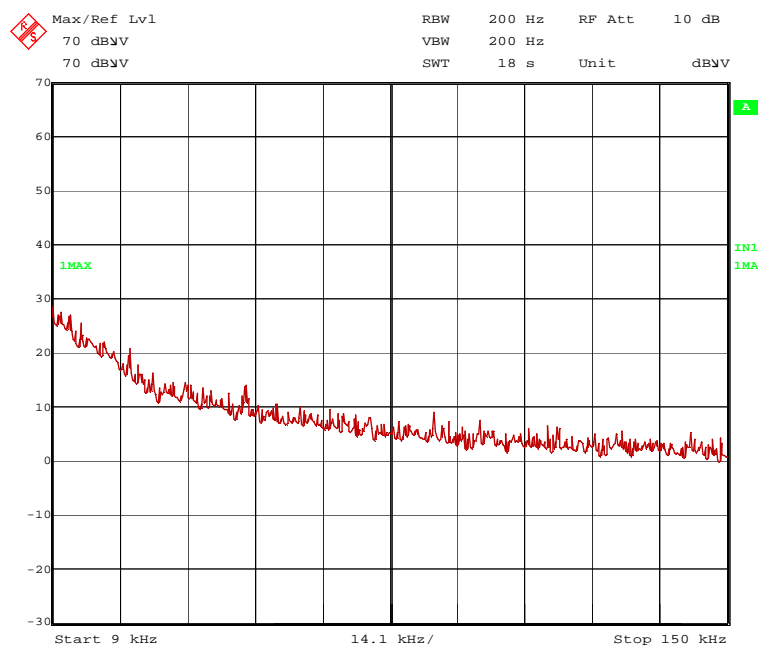
- 1) Monitor the frequency range at horizontal polarisation and move the antenna over all sides of the EUT (if necessary move the EUT to another orthogonal axis).
- 2) Change the antenna polarisation and repeat 1) with vertical polarisation.
- 3) Make a hardcopy of the spectrum.
- 4) Measure the frequency of the detected emissions with a lower span and resolution bandwidth to increase the accuracy and note the frequency value.
- 5) Change the analyser mode to Clear / Write and found the cone of emission.
- 6) Rotate and move the EUT, so that the measuring distance can be enlarged to 3 m and the antenna will be still inside the cone of emission.
- 7) Measure the level of the detected frequency with the correct resolution bandwidth, with the antenna polarisation and azimuth and the peak and average detector, which causes the maximum emission.
- 8) Repeat steps 1) to 7) for the next antenna spot if the EUT is larger than the antenna beamwidth.

Step 1) to 6) are defined as preliminary measurement.

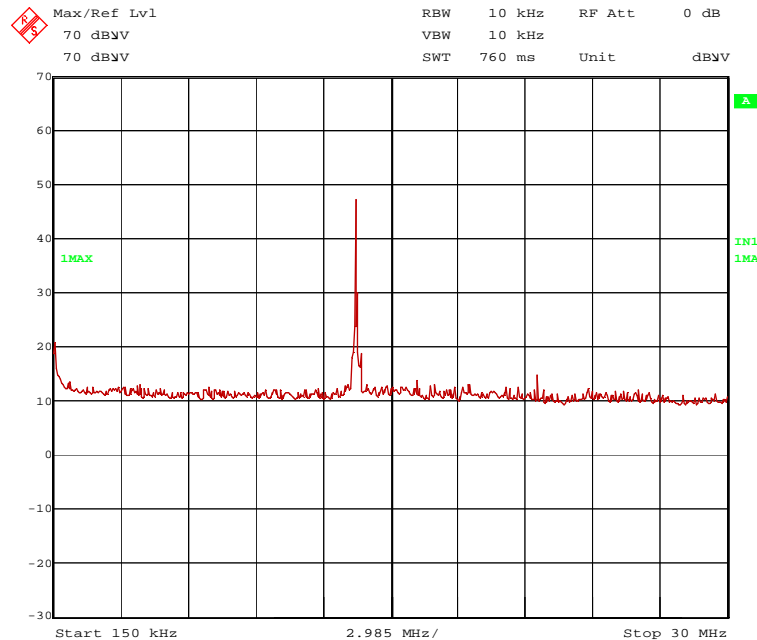
5.2.2 Preliminary radiated emission tests (9 kHz to 30 MHz)

Ambient temperature:	20 °C	Relative humidity:	45 %
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Position of EUT:	The EUT was set-up on a wooden table of a height of 0.8 m.
Cable guide:	The cable of the EUT was fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	The test was carried out in normal operation mode of the EUT (awaiting a TAG). All results are shown in the following.
Power supply:	During this test the EUT was powered with 120 V AC 60 Hz.



144375_a.wmf: Spurious emissions from 9 kHz to 150 kHz



144375_b.wmf: Spurious emissions from 1 MHz to 30 MHz

The following emission was found according to FCC 47 CFR Part 15 section 15.209 (a).

13.560 MHz (wanted signal is according to FCC 47 CFR Part 15)

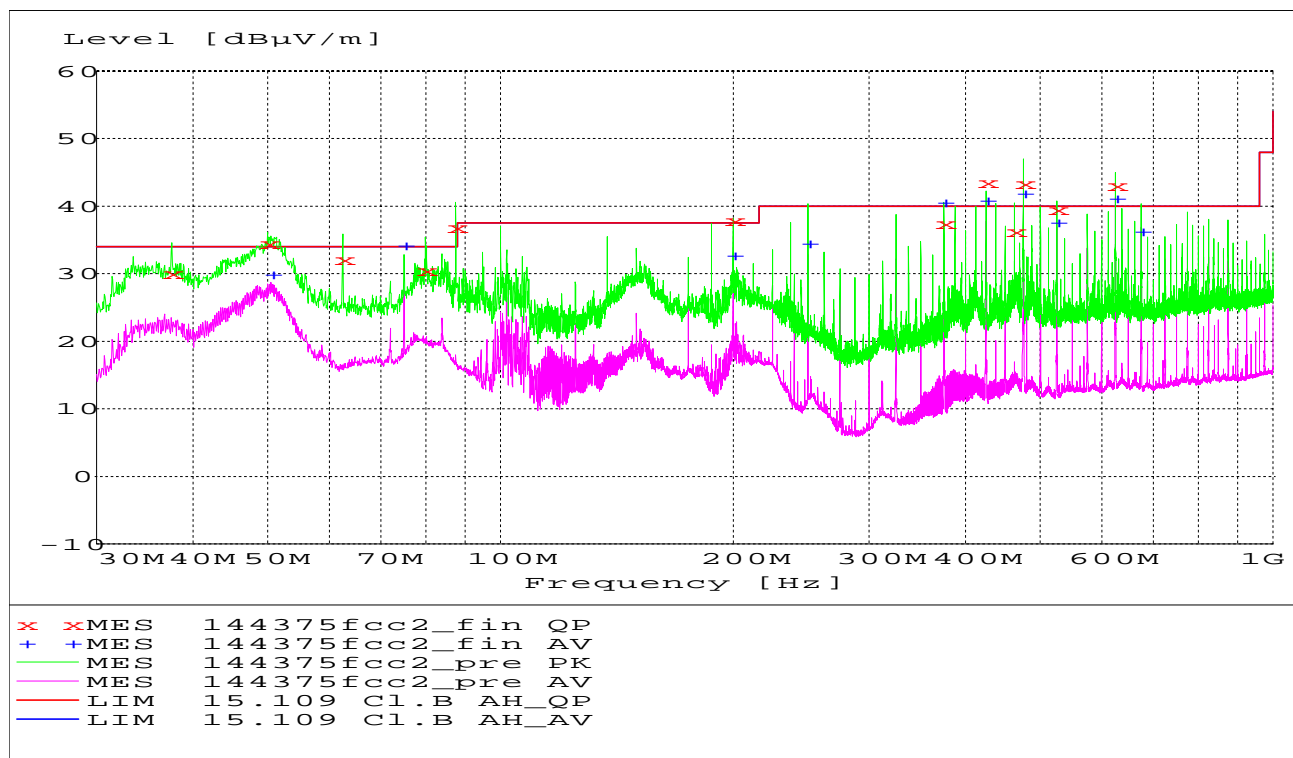
This frequency has to be measured on the outdoor test site. The results were presented in the following.

Test equipment used the test:

1 – 4, 8

5.2.3 Preliminary radiated emission tests (30 MHz to 1 GHz)

Title: Emission measurement according to CFR47 part 15
EMI Test receiver ESI Rohde & Schwarz
EUT: uniFLOW Release Station Multi
Manufacturer: NTware Systemprogrammierung GmbH
Operating Condition: Continuous transmitt awaiting a TAG
Test site: fully anechoic chamber M20; PHOENIX TEST LAB GmbH
Operator: M. DINTER
Test Specification: 120 V AC 60 Hz AC Adapter
Comment: Ancillary outside



The following emission inside the restricted bands was found according to FCC 47 CFR Part 15 section 15.209.
75.000 MHz; 137.520 MHz and 325.040 MHz

The following emission outside the restricted bands was found according to FCC 47 CFR Part 15 section 15.209.

37.488 MHz, 50.004 MHz, 62.508 MHz, 79.872 MHz, 87.516 MHz, 187.520 MHz, 200.004 MHz, 237.520 MHz, 250.000 MHz, 375.004 MHz, 425.032 MHz, 462.544 MHz, 475.036 MHz, 525.052 MHz, 625.012 MHz, 775.040 MHz, 825.040 MHz and 875.040 MHz.

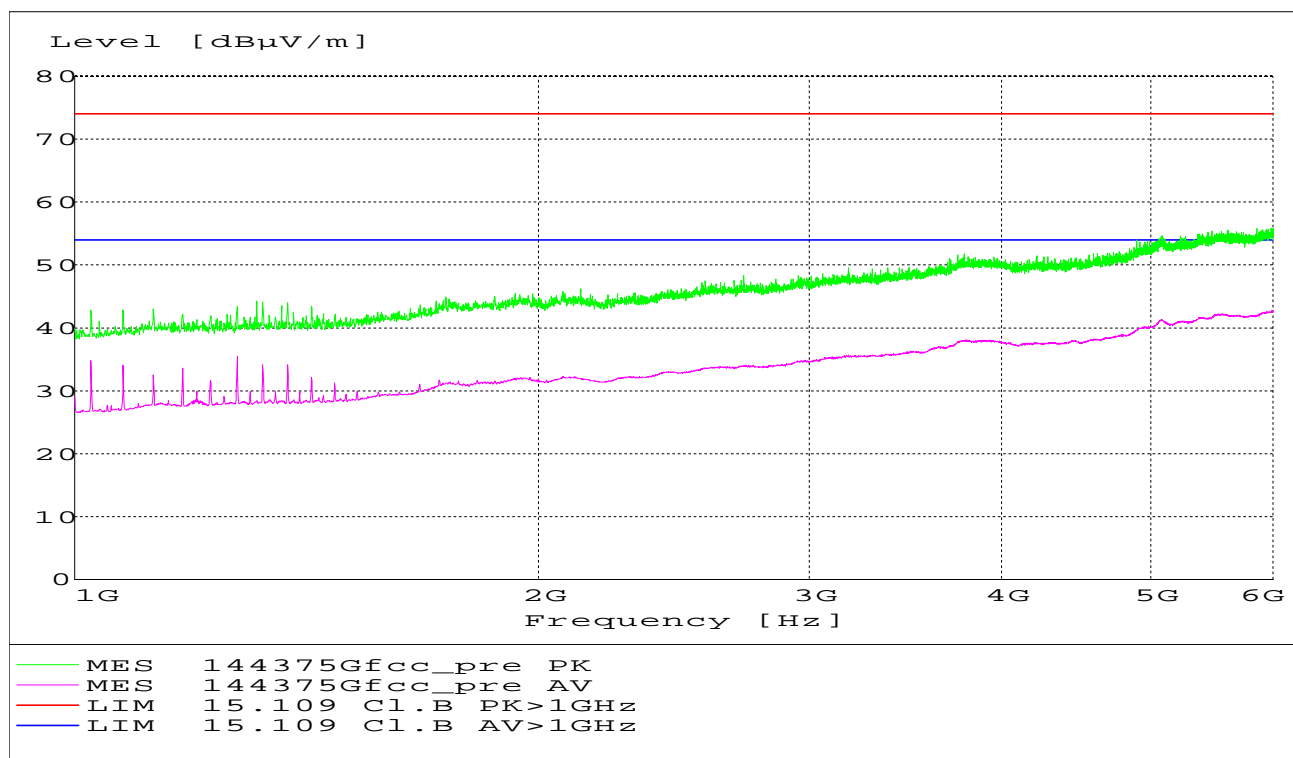
These frequencies have to be measured on the open area test site. The results were presented in the following.

Test equipment used the test:

1 – 7

5.2.4 Preliminary radiated emission tests (1 GHz to 6 GHz)

Title: Emission measurement according to CFR47 part 15
EMI Test receiver ESI Rohde & Schwarz
EUT: uniFLOW Release Station Multi
Manufacturer: NTware Systemprogrammierung GmbH
Operating Condition: Continuous transmitt awaiting a TAG
Test site: fully anechoic chamber M20; PHOENIX TEST LAB GmbH
Operator: M. DINTER
Test Specification: 120 V AC 60 Hz AC Adapter
Comment: Ancillary outside



No significant emissions were found during the preliminary radiated emission test.
Therefore no final measurement was done.

Test equipment used the test:

1 – 5 , 7, 19

5.2.5 Final radiated emission test (9 kHz to 30 MHz)

Ambient temperature:	15 °C	Relative humidity:	56 %
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Position of EUT: The EUT was set-up on a non-conducting table of a height of 0.8 m. The distance between EUT and antenna was 3 m, 10 m and 30 m.

Cable guide: The cable of the EUT was fixed on the non-conducting table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out in normal operation mode of the EUT (awaiting a TAG). All results are shown in the following.

Power supply: During this test the EUT was supplied with 12 V_{DC} via AC Adapter powered with 120 V AC / 60 Hz.

Test results: The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{antenna factor [dB/m]}$$

Results with measuring distance of 3 m						
Frequency	Result dB μ V/m	Limit(* dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * dB/m
13.560	57.8	70.0	12.2	QP	37.8	20.0
Results with measuring distance of 10 m						
Frequency MHz	Result dB μ V/m	Limit(* dB μ V/m	Margin dB	Detector	Readings dB μ V	Antenna factor * dB/m
13.560	49.7	50.0	0.3	QP	29.7	20.0
Signal was below the noise floor of the measuring system						
Measurement uncertainty			+2.2 dB / -3.6 dB			

*: Cable loss included

(*: Limits according to 15.209

(*: Level extrapolated with a factor (40dB/decade) from the result at 3 m and 10 m according to Part 15.31 (f)(2)

Remark: At the 30 m distance the tx level was too low for measuring the signal of the 13.56 MHz.

Test: Passed

Test equipment used for the test:

8 – 9, 11

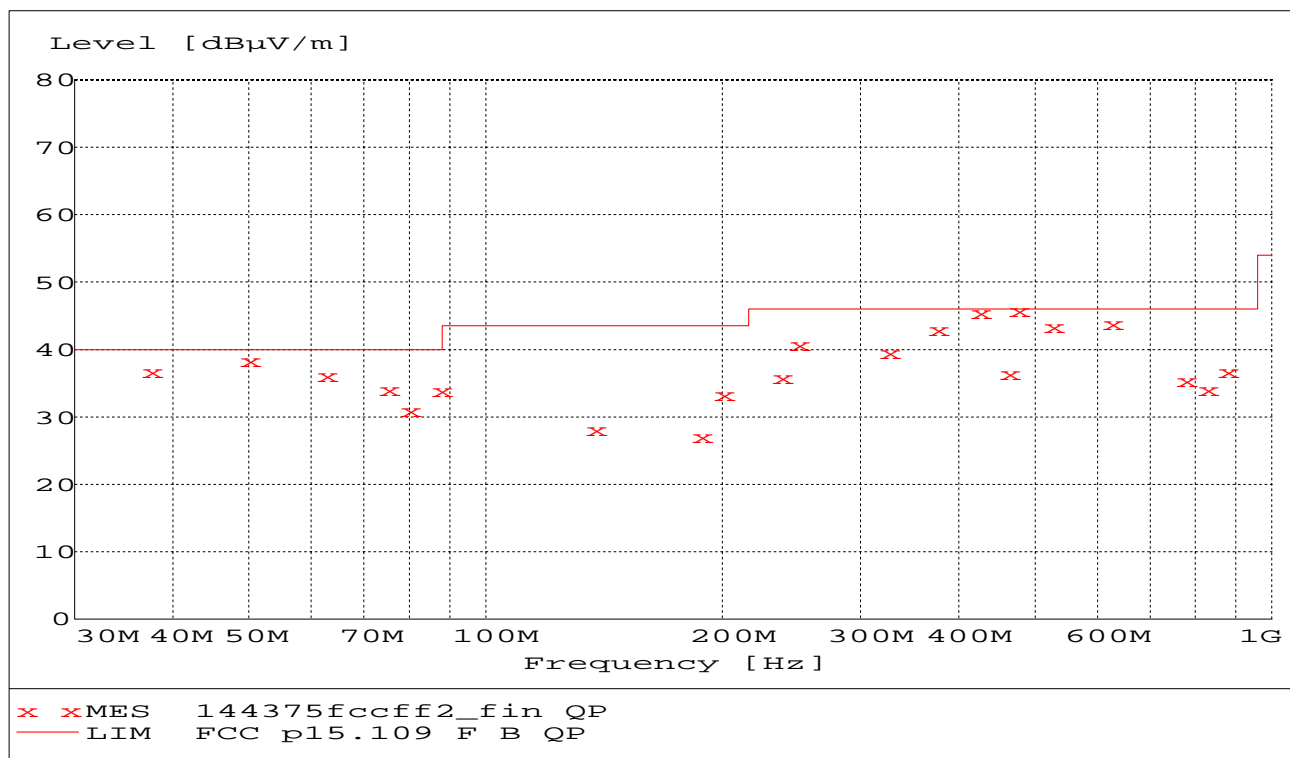
5.2.6 Final radiated emission test (30 MHz to 1 GHz)

Ambient temperature:	20 °C	Relative humidity:	47 %
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Position of EUT:	The EUT was set-up on a wooden table of a height of 0.8 m.
Cable guide:	The cable of the EUT was fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.
Test record:	The test was carried out in normal operation mode of the EUT (awaiting a TAG). All results are shown in the following.
Power supply:	During this test the EUT was supplied with 12 V _{DC} via AC Adapter powered with 120 V AC / 60 Hz.
Test results:	The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

The measured points and the limit line in the following diagram refer to the standard measurement of the emitted interference in compliance with the above mentioned standard. The measured points marked with x are the measured results of the standard subsequent measurement on the open area test site.



The results of the standard subsequent measurement on the open area test site are indicated in the table below. The limits as well as the measured results (levels) refer to the above mentioned standard while taking account of the specified requirements for a 3 m measuring distance.

Result measured with the quasipeak detector:
(These values are marked in the above diagram by an x)

Spurious emissions in restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
75.000	34.00	40.0	6.0	25.7	7.4	0.9	122	301	vertical
137.520	28.00	43.5	15.5	14.7	12.0	1.3	100	225	vertical
325.040	39.5	46.0	6.5	24.1	13.5	1.9	100	245	horizontal
-	-	-	-	-	-	-	-	-	-
Spurious emissions outside restricted bands									
Frequency MHz	Result dBμV/m	Limit dBμV/m	Margin dB	Readings dBμV	Antenna factor dB/m	Cable loss dB	Height cm	Azimuth deg	Pol.
37.488	36.7	40.0	3.3	19.9	16.2	0.6	100	180	vertical
50.004	38.3	40.0	1.7	28.5	9.1	0.7	100	339	vertical
62.508	36.10	40.0	3.9	29.1	6.1	0.9	106	67	vertical
79.872	30.90	40.0	9.1	21.7	8.2	1.0	149	219	vertical
87.516	33.80	40.0	6.2	23.3	9.4	1.1	120	165	vertical
187.520	27.10	43.5	16.4	16.6	9.0	1.5	118	128	horizontal
200.004	33.40	43.5	10.1	23.0	8.9	1.5	100	0	vertical
237.520	35.90	46.0	10.1	23.3	10.9	1.7	128	283	horizontal
250.000	40.70	46.0	5.3	26.8	12.1	1.8	118	228	horizontal
375.004	42.9	46.0	3.1	25.9	14.8	2.2	211	281	horizontal
425.032	45.50	46.0	0.5	27.1	16.1	2.3	125	47	vertical
462.544	36.50	46.0	9.5	17.4	16.7	2.4	107	0	vertical
475.036	45.70	46.0	0.3	26.5	16.8	2.4	100	0	vertical
525.052	43.40	46.0	2.6	23.0	17.8	2.6	100	33	vertical
625.012	43.80	46.0	2.2	21.3	19.7	2.8	220	14	horizontal
775.040	35.40	46.0	10.6	10.7	21.5	3.2	150	340	vertical
825.040	34.00	46.0	12.0	8.5	22.3	3.2	106	71	vertical
875.040	36.70	46.0	9.3	11.3	22.0	3.4	100	225	vertical
-	-	-	-	-	-	-	-	-	-
Measurement uncertainty				+2.2 dB / -3.6 dB					

Test: Passed

Test equipment used for the test:

12 - 18

Ambient temperature:	20 °C
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Relative humidity:	47 %
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Position of EUT: The EUT was set-up on a wooden table of a height of 0.8 m.

Cable guide: The cable of the EUT was fixed on the wooden table. For further information of the cable guide refer to the pictures in annex A of this test report.

Test record: The test was carried out in normal operation mode of the EUT (awaiting a TAG). All results are shown in the following.

Power supply: During this test the EUT was supplied with 12 V_{DC} via AC Adapter powered with 120 V AC / 60 Hz.

Test results: The test results were calculated with the following formula:

$$\text{Result [dB}\mu\text{V/m]} = \text{reading [dB}\mu\text{V]} + \text{cable loss [dB]} + \text{antenna factor [dB/m]}$$

Result measured with the average detector:

Spurious emissions in restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
-	-	No significant emissions were found, all other emission are more than 20 dB below the limit.					-	-	-
-	-						-	-	-
-	-						-	-	-
Spurious emissions outside restricted bands									
Frequency	Result	Limit	Margin	Readings	Antenna factor	Cable loss	Height	Azimuth	Pol.
MHz	dBµV/m	dBµV/m	dB	dBµV	dB/m	dB	cm	deg	
-	-	No significant emissions were found, all other emission are more than 20 dB below the limit.					-	-	-
-	-						-	-	-
-	-						-	-	-
Measurement uncertainty				+2.2 dB / -3.6 dB					

Test: Passed

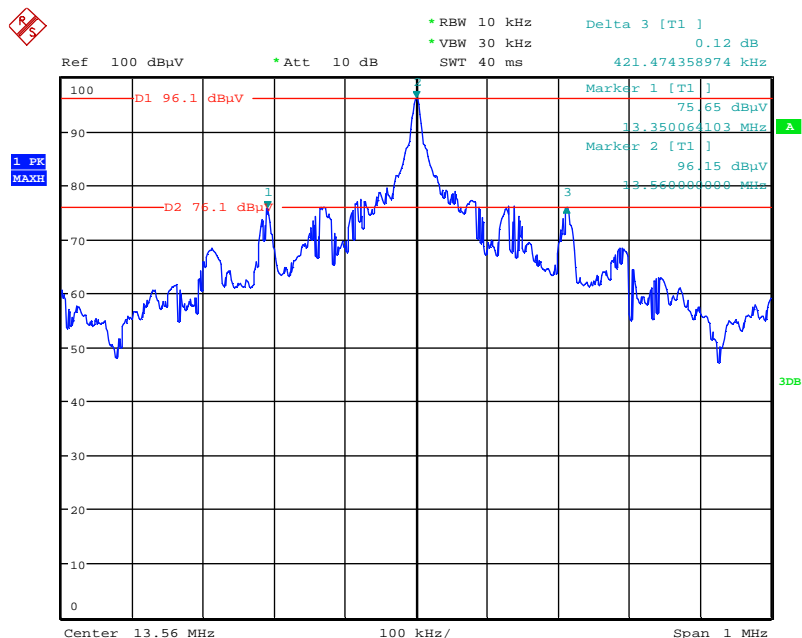
5.3 Test results (20 dB bandwidth)

Ambient temperature	21 °C	Relative humidity	55 %
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Power supply: During this test the EUT was supplied with 12 V_{DC} via AC Adapter powered with 120 V AC / 60 Hz.

Test record: The test was carried out while the EUT was awaiting a TAG.

144375MULTI20DB.wmf: 20 dB Bandwidth:



f_L	f_U	BW ($f_U - f_L$)
13.350 MHz	13.771 MHz	421 kHz
Measurement uncertainty		$< \pm 1 \cdot 10^{-7}$

Test equipment used for the test:

27 - 28

6 Report history

Report Number	Date	Comment
F144375E1	16 September 2014	Document created

7 Test equipment and ancillaries used for tests

No.	Test equipment	Type	Manufacturer	Serial No.	PM. No.	Cal. Date	Cal. due
1	Fully anechoic chamber M20	-	Albatross Projects	B83107-E2439-T232	480303	Weekly verification (system cal.)	
2	Measuring receiver	ESI 40	Rohde & Schwarz	100064	480355	26/02/2014	02/2016
3	Controller	HD100	Deisel	100/670	480326	-	-
4	Turntable	DS420HE	Deisel	420/620/80	480315	-	-
5	Antenna support	AS615P	Deisel	615/310	480187	-	-
6	Antenna	CBL6112 B	Chase	2688	480328	14/04/2014	04/2017
7	RF-cable No. 30	RTK 081	Rosenberger	-	410141	Weekly verification (system cal.)	
8	Loop antenna	HFH2-Z2	Rohde & Schwarz	832609/014	480059	18/02/2012	02/2016
9	EMI test receiver	ESPC	Rohde & Schwarz	843756/006	480150	24/02/2014	02/2016
10	RF-cable No. 10	RG223	Phoenix-Test-Lab	-	410102	Weekly verification	
11	Outdoor test site	-	Phoenix-Test-Lab	-	480293	-	
12	Open area test site	-	Phoenix Test-Lab	-	480085	Weekly verification (system cal.)	
13	Measuring receiver	ESIB7	Rohde & Schwarz	100304	480521	06/02/2013	02/2015
14	Controller	HD100	Deisel	100/670	480139	-	
15	Turntable	DS420HE	Deisel	420/620/80	480087	-	
16	Antenna support	AS615P	Deisel	615/310	480086	-	-
17	Antenna	CBL6111 D	Chase	25761	480894	28/09/2011	09/2014
18	EMI Software	ES-K1	Rohde & Schwarz	-	480111	-	
19	Horn Antenna	3115 A	EMCO	9609-4918	480183	9/11/2011	11/2014
20	Shielded chamber M4	-	Siemens	B83117S1-X158	480088	Weekly verification (system cal.)	
21	EMI Software	ES-K1	Rohde & Schwarz	-	480111	not necessary	
22	LISN	NSLK8128	Schwarzbeck	8128155	480058	20/12/2012	12/2014
23	LISN	MN2050B	Chase	1133	480146	2/12/2012	12/2014
26	Spectrum analyser	FSW43	Rohde & Schwarz	100586	481720	10/09/2013	09/2015
27	Loop Antenna Ø = 225 mm	-	Phoenix Test-Lab	-	410085	Weekly verification	
28	Spectrum analyser	FSU	Rohde & Schwarz	100586	480956	24/02/2014	02/2016

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	Test setup open area test site (E-Field)	144375_emi4.jpg
	Test setup open area test site (E-Field)	144375_emi5.jpg
	Test setup fully anechoic chamber (H-Field)	144375_emi6.jpg
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