

# Test Report

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## RF Test Report 160701-AU01+W02



**ACD Elektronik GmbH**

RF-module

X1310-ISM



The test result refers exclusively to the tested model.  
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Revision: 1.0



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## Accreditation:



FCC facility registration number: 221458  
Test Firm Type "2.948 listed": Valid until 2017-04-22  
Test Firm Type "accredited": Valid until 2017-06-09  
MRA US-EU, FCC designation number: DE0010  
BnetzA-CAB-02/21-02/04 Valid until 2018-11-27

Industry Canada test site numbers with registration expiry date:  
3472A-1, expiring 2018-11-09  
3472A-2, expiring 2018-11-12

## Test Laboratory:

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EMV **TESTHAUS** GmbH



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# 1 Test regulations

47 CFR Part 2: 10-2016	Code of Federal Regulations Part 2 (Frequency allocation and radio treaty matters; General rules and regulations) of the Federal Communication Commission (FCC)
47 CFR Part 15: 10-2016	Code of Federal Regulations Part 15 (Radio Frequency Devices) of the Federal Communication Commission (FCC)
ANSI C63.10:2013-06	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC KDB 174176 D01 June 3, 2015	AC power-line conducted emissions Frequently Asked Questions
FCC KDB 447498 D01 February 7, 2014	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
RSS-Gen Issue 4, November 2014	General Requirements for Compliance of Radio Apparatus
RSS-102 Issue 5, March 2015	Radio Frequency Exposure Compliance of Radiocommunications Apparatus
RSS-210 Issue 9, August 2016	Spectrum Management and Telecommunications Radio Standards Specification Licence-exempt Radio Apparatus (All Frequency Bands): Category I Equipment



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## 1.1 Cross reference of FCC and Industry Canada standards

47 CFR Part and Section	Test	Page	Equivalent to IC
15.207	AC power line conducted emissions 150 kHz to 30 MHz	11	RSS-Gen Issue 4 section 8.8
15.249(a)	Transmitter field strength of emissions	17	RSS-Gen Issue 4, section 6.12 RSS-210 Issue 9, B.10(a)
15.249(d) 15.209	Band-edge compliance	21	RSS-Gen Issue 4, section 6.12 RSS-210 Issue 9, B.10(b)
15.249(d) 15.209	Emissions radiated outside of the specified frequency bands 9 kHz to 10 <sup>th</sup> harmonic	27 41	RSS-Gen Issue 4, section 6.12 RSS-210 Issue 9, B.10(b)
---	6 dB bandwidth	48	RSS-Gen Issue 4, section 6.6
15.215(c)	20 dB bandwidth	52	RSS-Gen Issue 4, section 6.6
2.202(a)	Occupied bandwidth	54	RSS-Gen Issue 4, section 6.6
2.1093	Radiofrequency radiation exposure evaluation: portable devices.	58	RSS-Gen Issue 4, section 3.2 Exempted from SAR and RF evaluation

## 1.2 Summary of test results

Standard	Test result
FCC 47 CFR Part 15, section 15.249	Passed
RSS-210 Issue 9, Annex B.10 and RSS-Gen Issue 4	Passed



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## 2 Equipment under Test (EUT)

Product type:	RF-module	
Model Name:	X1310-ISM	
Manufacturer:	ACD Elektronik GmbH	
Serial number(s):	#2	
FCC ID:	O2F-X1310TC915	
IC:	9137A-X1310TC915	
Application frequency band:	902.000 MHz to 928.000 MHz	
Frequency range <sup>1)</sup> :	903.500 MHz to 926.750 MHz	
Operating frequencies <sup>1)</sup> :	903.500 MHz to 926.750 MHz	
Number of RF-channels <sup>1)</sup> :	32	
Type of modulation <sup>1)</sup> :	GFSK	
Maximum conducted output power:	-8.18 dBm	
Antenna type <sup>1)</sup> :	Dipole antenna "CTA 915/0/WS/SM/H1"	- detachable - gain: 0 dBi
	Swivel dipole antenna "CTA 920/0/WR/SM/W1"	- detachable - gain: 1 dBi
Antenna connectors:	Yes	
Antenna diversity:	<input type="checkbox"/> yes <input checked="" type="checkbox"/> no	
Power supply <sup>1)</sup> :	DC supplied Nominal voltage: 12.0 V DC Minimum voltage: 4.0 V DC Maximum voltage: 15.0 V DC	
Temperature range <sup>1)</sup> :	-30°C to +70°C	

<sup>1)</sup> As declared by manufacturer.



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## 2.1 Photo documentation

For photos taken during testing see annex A.  
For photos of the EUT see annex B.  
For internal photos of the EUT see annex C.

## 2.2 Short description of the EUT

RF-module for data transmission within frequency band from 902 MHz to 928 MHz.

During pre-measurements it was investigated which EUT position is the respective worst-case. The EUT positions are documented in annex A.

## 2.3 Operation mode

The EUT was set to the measured channels. Further the following adjustments were set:

Tx-mode: Channel 1 -> 903.500 MHz  
Channel 16 -> 914.750 MHz  
Channel 32 -> 926.750 MHz  
continuous carrier (modulated/unmodulated)

Reference point for all conducted measurements is at plug of antenna connector.



## 2.4 Configuration

The following peripheral devices and interface cables were connected during the tests:

Device	Model	Serial or inventory number
RF-module	X1310-ISM	#2
Dipole antenna	CTA 915/0/WS/SM/H1	----
Swivel dipole antenna	CTA 920/0/WR/SM/W1	----
Antenna reference plane	----	----
DC power supply	Statron 3252.1	E00541
DC power supply	Statron 3231.1	E00528
Switching mode power supply <sup>1)</sup>	GPE125-12100-Z	A/1206EA
AC power source 230V/50 Hz to 120V/60 Hz	Chroma 61602	E00633

Note 1): Only used for measurement "AC power line conducted emissions 150 kHz to 30 MHz".

### Used cables

Count:	Description: (type / lengths / remarks)	Serial or inventory number
1	combined DC power and data cable / unshielded / 1.5 m	N/A
1	test cable no. 14 / coax, SMA <-> UFL / 0.2 m	E00437



# 3 AC power line conducted emissions

according to 47 CFR Part 15, section 15.207, and  
RSS-Gen, section 8.8

## 3.1 Test location

Description	Manufacturer	Inventory No.
Shielded room	Siemens - Matsushita	E00107

## 3.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESCS 30	Rohde & Schwarz	E00003
<input type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI	Rohde & Schwarz	E00001
<input type="checkbox"/>	ESH3-Z2	Rohde & Schwarz	E00028
<input checked="" type="checkbox"/>	ESH2-Z5	Rohde & Schwarz	E00004
<input type="checkbox"/>	ESH2-Z5	Rohde & Schwarz	E00005

## 3.3 Limits

Frequency [MHz]	Quasi-peak [dB $\mu$ V]	Average [dB $\mu$ V]
0.15 – 0.5	66 – 56	56 – 46
0.5 – 5.0	56	46
5 – 30	60	50



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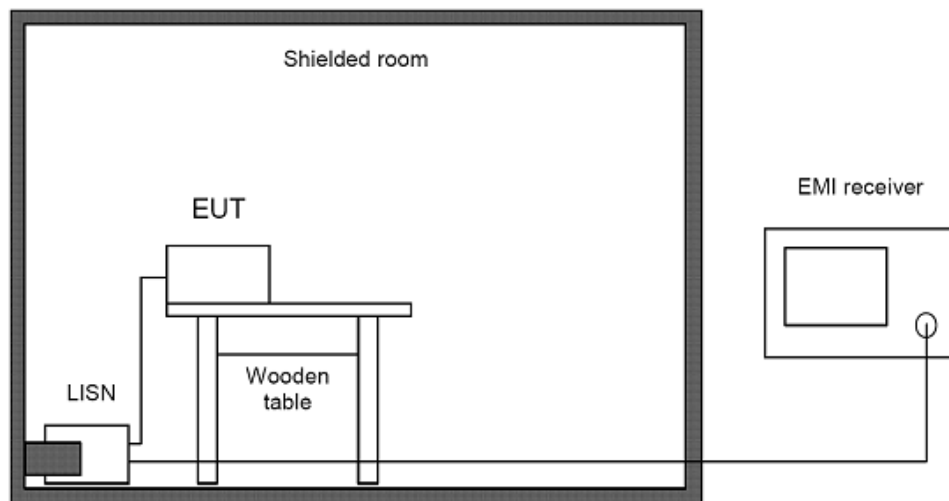
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### 3.4 Test procedure

1. The tests of conducted emission were carried out in a shielded room using a line impedance stabilization network (LISN) 50  $\mu$ H/50 Ohms and an EMI test receiver.
2. The EMI test receiver was connected to the LISN and set to a measurement bandwidth of 9 kHz in the frequency range from 0.15 MHz to 30 MHz.
3. The EUT was placed on a wooden table and connected to the LISN.
4. To accelerate the measurement the detector of the EMI test receiver was set to peak and the whole frequency range from 0.15 MHz to 30 MHz was scanned.
5. After that all peaks values with less margin than 10 dB to quasi-peak limit or exceeding the limit were marked and re-measured with quasi-peak detector.
6. If after that all values are under the average limit no addition measurement is necessary. In case there are still values between quasi-peak and average limit then these values were re-measured with average detector.
7. These measurements were done on all power lines.

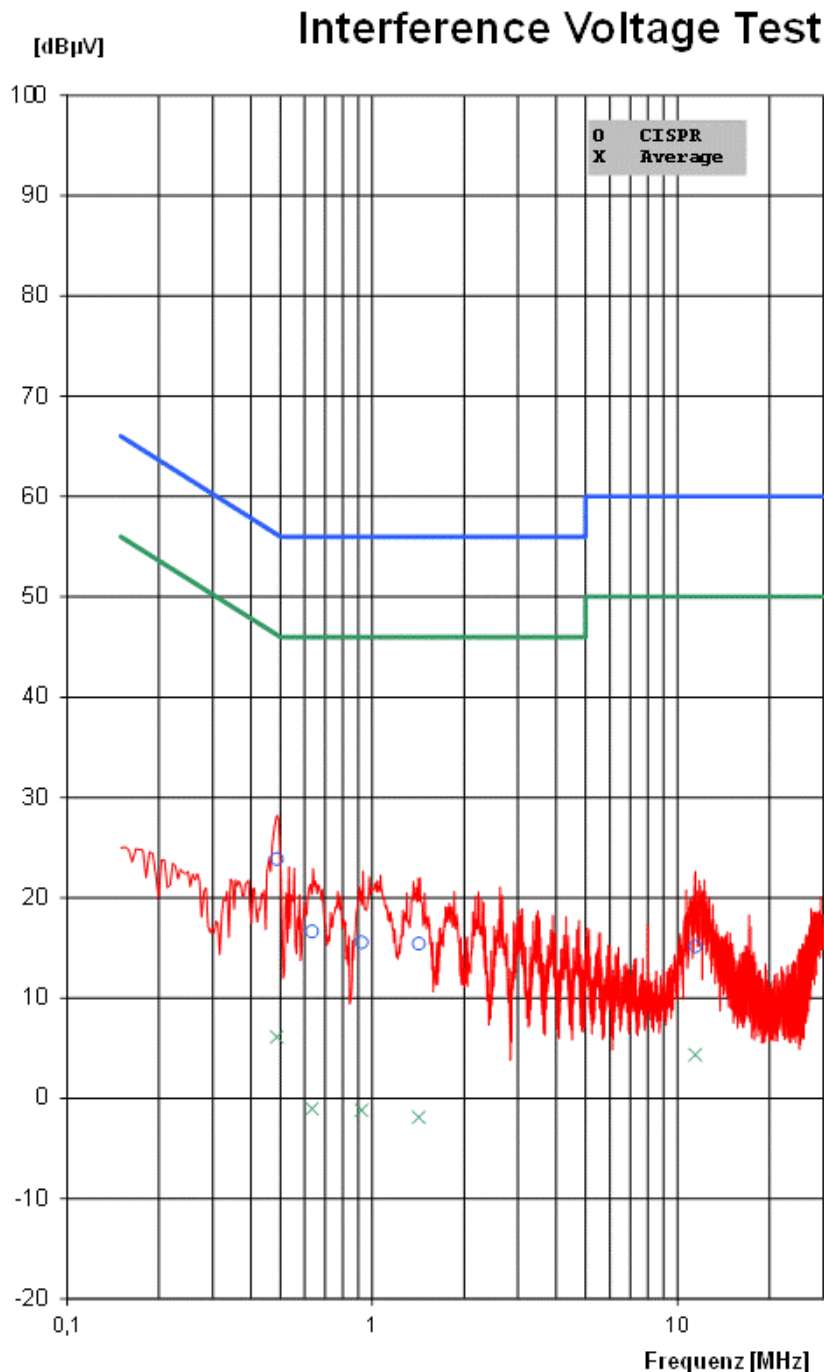
### 3.5 Test setup



Picture 1: Outline of conducted emission test setup

### 3.6 Test results

Temperature:	22°C	Humidity:	44%
Tested by:	Martin Müller	Test date:	2016-10-12



**REGULATIONS:**  
 47 CFR, 15.207  
 PEAK / CISPR / AV

**TEST EQUIPMENT:**  
 R&S ESCS30 (E00003)  
 R&S ESH2-Z5 (E00004)

**ORDER NO.:**  
 160701-AU01+W02

**EUT:**  
 Ingenieurbüro Lutz Konstroffer  
 RF module 915 MHz  
 X1310-ISM  
 #2

**OPERATION MODE:**  
 continuous wave  
 unmodulated

**Mains 120V AC /60Hz  
 Phase**

**TEST FACILITY:**  
 EMV TESTHAUS GmbH  
 Gustav-Hertz-Straße 35  
 94315 Straubing

**DATE / TIME:**  
 2016-10-12 11:04:38  
 22°C 44% 98kPa

**TEST ENGINEER:**  
 Martin Müller

StoSp\_L1.E10

Picture 2: Graphic - Conducted emission on mains, phase 1 (without termination)



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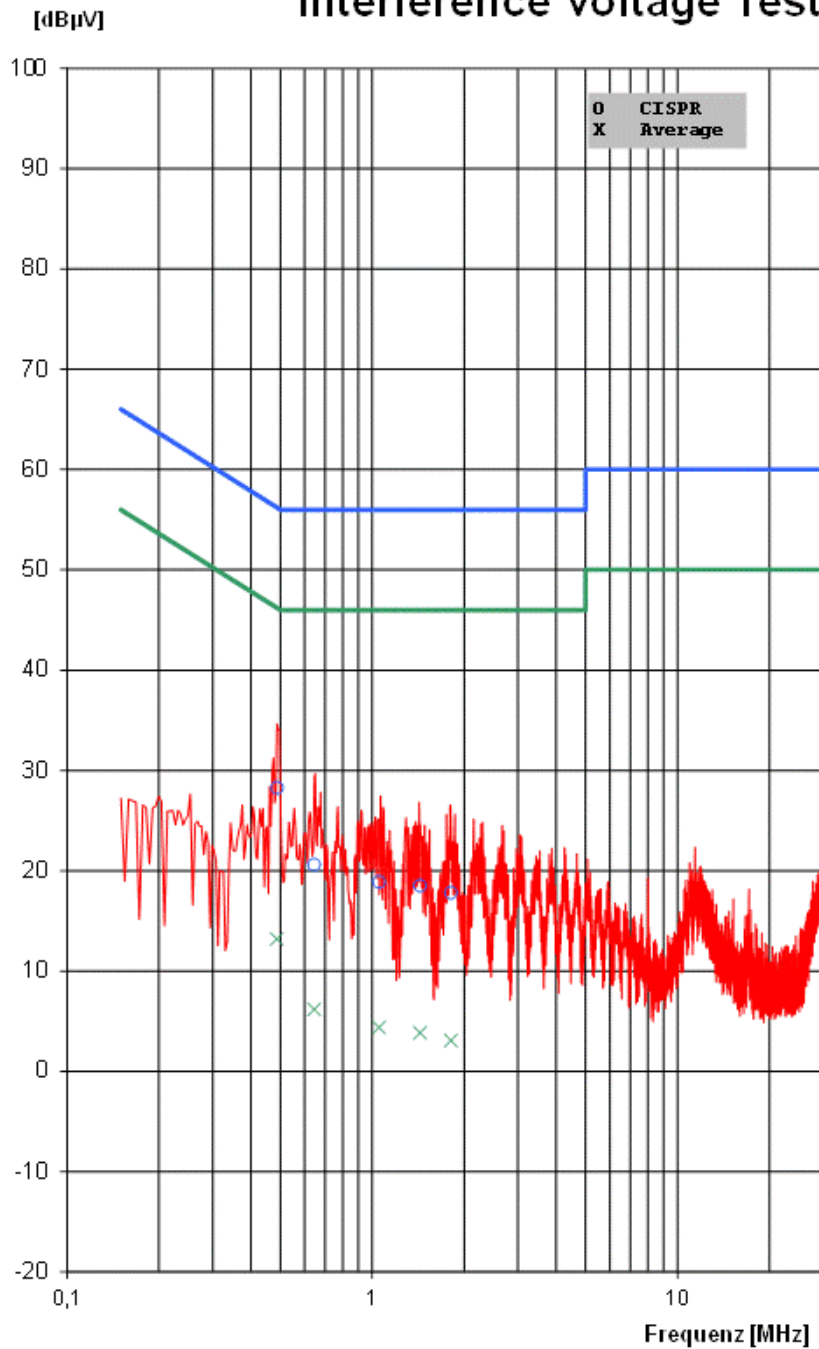
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## Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,49	23,8	56,2	32,4	6,1	46,2	40,1	0,0	
0,64	16,6	56,0	39,4	-1,1	46,0	47,1	0,0	
0,92	15,5	56,0	40,5	-1,2	46,0	47,2	0,0	
1,42	15,4	56,0	40,6	-1,9	46,0	47,9	0,0	
11,44	15,2	60,0	44,9	4,3	50,0	45,7	0,0	

Picture 3: Table - Conducted emission on mains, phase 1 (without termination)

# Interference Voltage Test



REGULATIONS:  
47 CFR, 15.207  
PEAK / CISPR / AV

TEST EQUIPMENT:  
R&S ESCS30 (E00003)  
R&S ESH2-Z5 (E00004)

ORDER NO.:  
160701-AU01+W02

EUT:  
Ingenieurbüro Lutz Konstroffer  
RF module 915 MHz  
X1310-ISM  
#2

OPERATION MODE:  
continuous wave  
unmodulated

Mains 120V AC /60Hz  
Neutral

TEST FACILITY:  
EMV TESTHAUS GmbH  
Gustav-Hertz-Straße 35  
94315 Straubing

DATE / TIME:  
2016-10-12 11:04:38  
22°C 44% 98kPa

TEST ENGINEER:  
Martin Müller

StoSp\_N.E10

Picture 4: Graphic - Conducted emission on mains, neutral (without termination)



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## Interference Voltage Test

Freq. [MHz]	U_CISPR [dBµV]	Limit [dBµV]	delta_U [dB]	U_AV [dBµV]	Limit [dBµV]	delta_U [dB]	Corr. [dB]	Remark
0,49	28,3	56,2	28,0	13,2	46,2	33,0	0,0	
0,64	20,6	56,0	35,4	6,2	46,0	39,8	0,0	
1,05	18,9	56,0	37,1	4,4	46,0	41,6	0,0	
1,43	18,5	56,0	37,5	3,8	46,0	42,2	0,0	
1,81	17,8	56,0	38,2	3,1	46,0	43,0	0,0	

Picture 5: Table - Conducted emission on mains, neutral (without termination)



# 4 Transmitter radiated field strength

according to 47 CFR Part 15, section 15.249(a) and  
RSS-Gen Issue 4, section 6.12 with RSS-210 Issue 9, B.10(a)

## 4.1 Test location

Description	Manufacturer	Inventory No.
Semi anechoic chamber	Albatross Projects	E00716

## 4.2 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESR 7	Rohde & Schwarz	E00739
<input type="checkbox"/>	AMF-5D-00501800-28-13P	Miteq	W00089
<input type="checkbox"/>	AMF-6F-16002650-25-10P	Miteq	W00090
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00054
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input checked="" type="checkbox"/>	VULB 9162	Schwarzbeck	E00634
<input type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

## 4.3 Limits

For systems operating within the band 902.0 MHz - 928.0 MHz: 94 dB $\mu$ V/m (50 mV/m)

## 4.4 Test procedure

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. Set frequency to lowest channel
4. Maximize carrier by moving turntable and antenna height with horizontal and vertical antenna polarization. Perform test for all of the 3 orthogonal positions.
5. Record this trace(s) and set appropriate markers
6. Set frequency to middle channel
7. Repeat steps 4 and 5
8. Set frequency to highest channel
9. Repeat steps 4 and 5



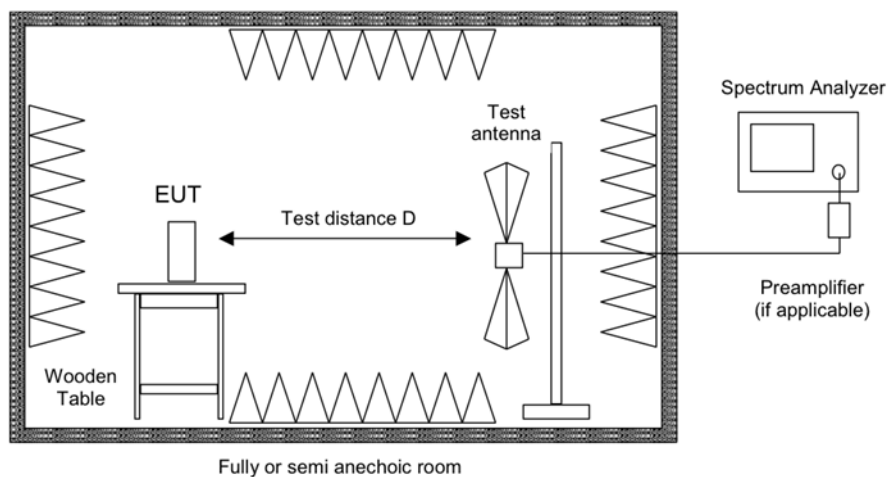
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## 4.5 Test setup



Picture 6: Test setup for transmitter radiated field strength measurement

## 4.6 Test deviation

There is no deviation with the original standard.

## 4.7 EUT operation during Test

The EUT was programmed to be in continuously transmitting mode.

## 4.8 Test results CTA 915/0/WS/SM/H1

Temperature:	20°C	Humidity:	43%
Tested by:	A. Grill	Test date:	2016-09-06

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
903.500	1	V	90.95	QP	94	Pass
903.500	2	H	91.91	QP	94	Pass
903.500	3	H	91.26	QP	94	Pass

Picture 7: Transmitter radiated field strength, results channel 1

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
914.750	1	V	89.81	QP	94	Pass
914.750	2	H	90.43	QP	94	Pass
914.750	3	H	90.64	QP	94	Pass

Picture 8: Transmitter radiated field strength, results channel 16

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
926.750	1	V	88.72	QP	94	Pass
926.750	2	H	89.99	QP	94	Pass
926.750	3	H	88.43	QP	94	Pass

Picture 9: Transmitter radiated field strength, results channel 32

Note: For the respective EUT-position the polarisation with the highest amplitude of the transmitter was documented.



## 4.9 Test results CTA 920/0/WR/SM/W1

Temperature:	20°C	Humidity:	43%
Tested by:	A. Grill	Test date:	2016-09-07

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
903.500	1	H	86.63	QP	94	Pass
903.500	2	V	89.03	QP	94	Pass
903.500	3	H	89.01	QP	94	Pass

Picture 10: Transmitter radiated field strength, results channel 1

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
914.750	1	H	85.59	QP	94	Pass
914.750	2	V	87.72	QP	94	Pass
914.750	3	H	88.41	QP	94	Pass

Picture 11: Transmitter radiated field strength, results channel 16

$f_{\text{meas}}$ [MHz]	EUT-Pos	Ant.-Pol.	$E_{\text{meas}}$ [dB $\mu$ V/m]	Detector	Limit [dB $\mu$ V/m]	Result
926.750	1	H	84.80	QP	94	Pass
926.750	2	H	86.73	QP	94	Pass
926.750	3	H	88.33	QP	94	Pass

Picture 12: Transmitter radiated field strength, results channel 32

Note: For the respective EUT-position the polarisation with the highest amplitude of the transmitter was documented.



## 5 Band-edge compliance

according to 47 CFR Part 15, section 15.249(d) with section 15.209 and RSS-Gen Issue 4, section 6.12 with RSS-210 Issue 9, B.10(b)

### 5.1 Test location

Description	Manufacturer	Inventory No.
Semi anechoic chamber	Albatross Projects	E00716

### 5.2 Test Instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESR 7	Rohde & Schwarz	E00739
<input type="checkbox"/>	AMF-5D-00501800-28-13P	Miteq	W00089
<input type="checkbox"/>	AMF-6F-16002650-25-10P	Miteq	W00090
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00054
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input checked="" type="checkbox"/>	VULB 9162	Schwarzbeck	E00634
<input type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

### 5.3 Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Limit for field strength of harmonics is 54 dB $\mu$ V/m (500  $\mu$ V/m).

In case of emission falling into restricted bands specified on 15.205(a), limit according to 15.209(a) in table below applies. For emissions above 1 GHz the limits are:

54 dB $\mu$ V/m (video average)

74 dB $\mu$ V/m (peak detector)

### 5.4 Test procedure

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. Set frequency to lowest channel
4. Maximize radiated emission at band edges by moving turntable and antenna height with horizontal and vertical antenna polarization.
5. Record this trace(s) and set appropriate markers
6. Set frequency to highest channel



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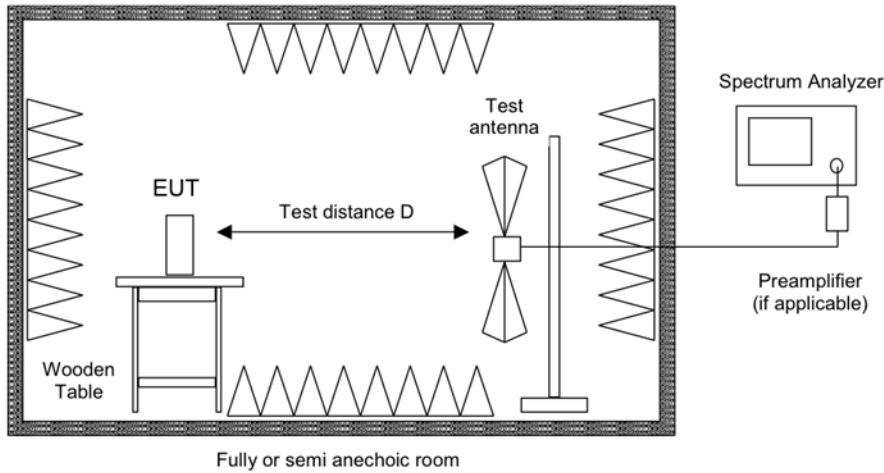
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7. Repeat steps 4 and 5

## 5.5 Test setup



Picture 13: Test setup for band-edge compliance measurement

## 5.6 Test deviation

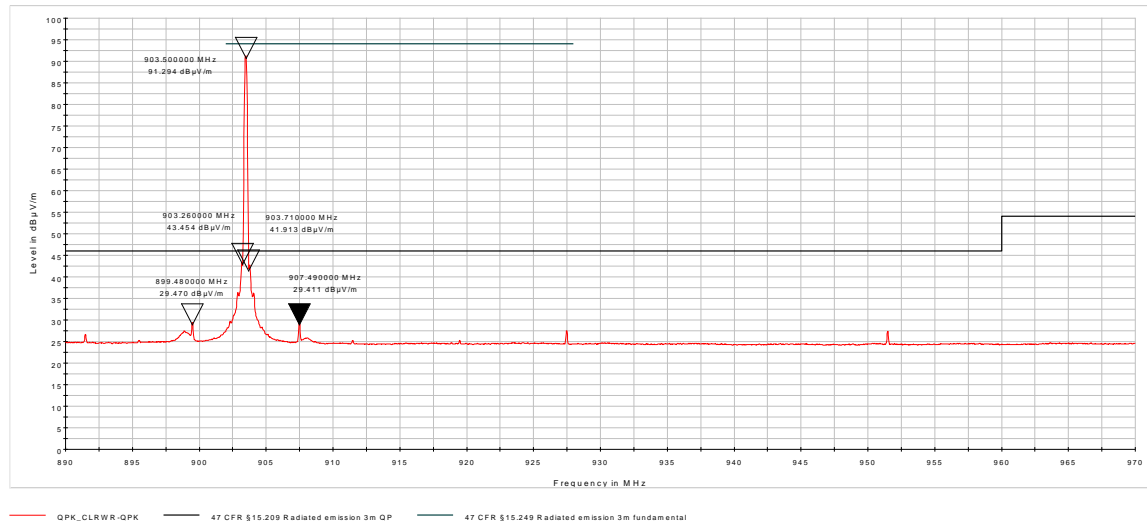
There is no deviation with the original standard.

## 5.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.  
The respective worst-case for this test was noted.

## 5.8 Test results CTA 915/0/WS/SM/H1

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2016-09-29

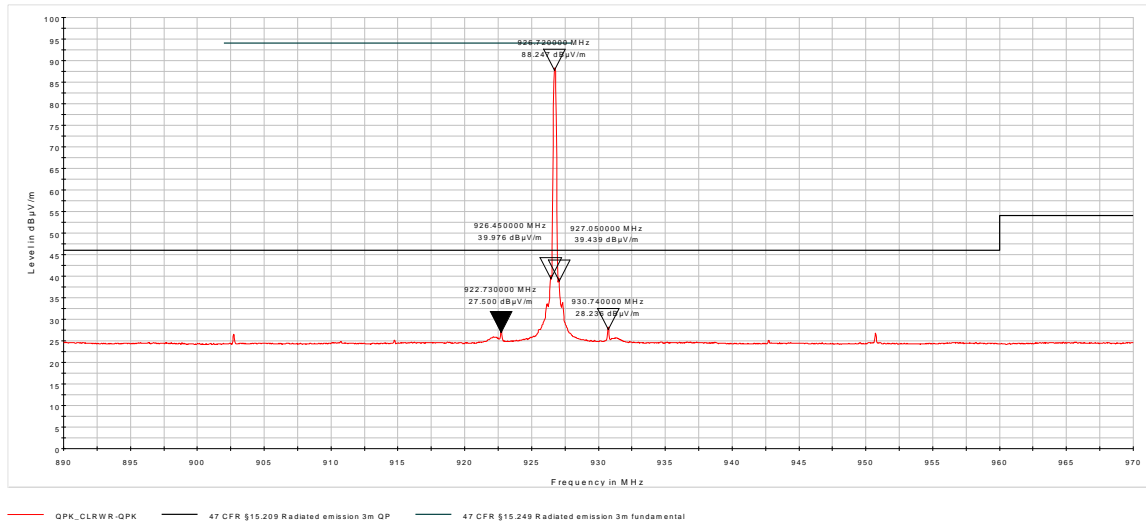


Picture 14: Band edge compliance – lower edge, chart

f[MHz]	$E_{meas}$ [dBµV/m]	Detector	Application frequency band	Limit [dBµV/m]	Result
899.480	29.47	QP	No	46	Pass
903.260	43.45	QP	Yes	94	Pass
903.500	91.29	QP	Yes	94	Pass
903.710	41.91	QP	Yes	94	Pass
907.490	29.41	QP	Yes	94	Pass

Picture 15: Band edge compliance – lower edge, table

Note: Measured at EUT-position2, horizontal



Picture 16: Band edge compliance – upper edge, chart

f[MHz]	$E_{meas}$ [dBµV/m]	Detector	Application frequency band	Limit [dBµV/m]	Result
922.730	27.50	QP	Yes	94	Pass
926.450	39.98	QP	Yes	94	Pass
926.720	88.25	QP	Yes	94	Pass
927.050	39.44	QP	Yes	94	Pass
930.740	28.24	QP	No	46	Pass

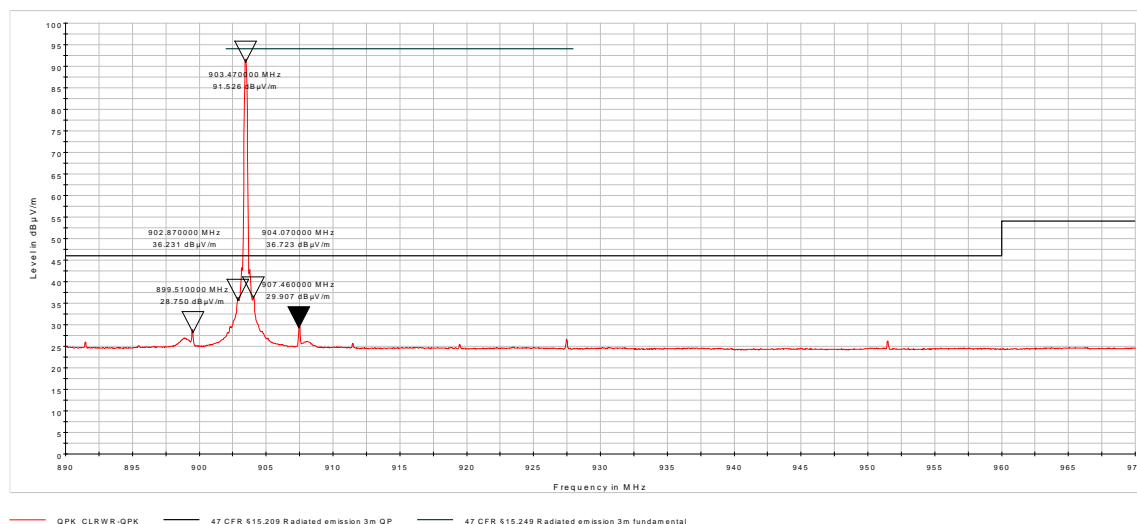
Picture 17: Band edge compliance – upper edge, table

Note: Measured at EUT-position2, horizontal



## 5.9 Test results CTA 920/0/WR/SM/W1

Temperature:	22°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2016-09-29

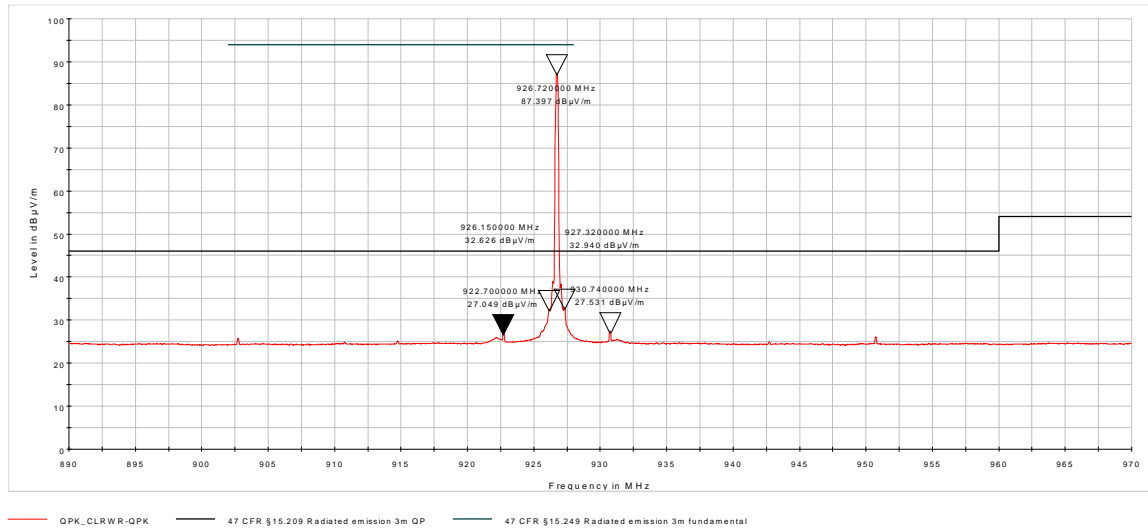


Picture 18: Band edge compliance – lower edge, chart

f[MHz]	$E_{meas}$ [dBµV/m]	Detector	Application frequency band	Limit [dBµV/m]	Result
899.510	28.75	QP	No	46	Pass
902.870	36.23	QP	Yes	94	Pass
903.470	91.53	QP	Yes	94	Pass
904.070	36.72	QP	Yes	94	Pass
907.460	29.91	QP	Yes	94	Pass

Picture 19: Band edge compliance – lower edge, table

Note: Measured at EUT-position2, vertical



Picture 20: Band edge compliance – upper edge, chart

f[MHz]	E <sub>meas</sub> [dBµV/m]	Detector	Application frequency band	Limit [dBµV/m]	Result
922.700	27.05	QP	Yes	94	Pass
926.150	32.63	QP	Yes	94	Pass
926.720	87.40	QP	Yes	94	Pass
927.320	32.94	QP	Yes	94	Pass
930.740	27.53	QP	No	46	Pass

Picture 21: Band edge compliance – upper edge, table

Note: Measured at EUT-position3, horizontal

## 6 Radiated emission measurement (<1 GHz)

according to 47 CFR Part 15, section 15.249(d) with section 15.209 and RSS-Gen Issue 4, section 6.12 with RSS-210 Issue 9, B.10(b)

### 6.1 Test location for tests from 9 kHz to 30 MHz

- Scan with peak detector in 3 m CDC.
- Final measurement with average/quasi peak detector on 3 m open area test site.

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open site area	EMV <b>TESTHAUS</b> GmbH	E00354

### 6.2 Test location for tests from 30 MHz to 1 GHz

- Scan with quasi peak detector in 3 m SAC.
- Final CISPR measurement with quasi peak detector in 3 m SAC.

Description	Manufacturer	Inventory No.
Semi anechoic chamber	Albatross Projects	E00716

### 6.3 Test instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCI	Rohde & Schwarz	E00552
<input checked="" type="checkbox"/>	ESR 7	Rohde & Schwarz	E00739
<input type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	ESCI	Rohde & Schwarz	E00001
<input type="checkbox"/>	VULB 9163 (OATS)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011
<input checked="" type="checkbox"/>	VULB 9162 (SAC)	Schwarzbeck	E00634
<input checked="" type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input checked="" type="checkbox"/>	Feedline OATS	Huber & Suhner	200024



## 6.4 Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Limit for field strength of harmonics is 54 dB $\mu$ V/m (500  $\mu$ V/m).

In case of emission falling into restricted bands specified on 15.205(a), limit according to 15.209(a) in table below applies.

Frequency [MHz]	Field strength Fs [ $\mu$ V/m]	Field strength [dB $\mu$ V/m]	Measurement distance d [m]
0.009 – 0.490	266.6 – 4.9	48.5 – 13.8	300
0.490 – 1.705	48.98 – 14.08	33.8 – 22.97	30
1.705 – 30.0	30	29.54	30
30 – 88	100	40	3
88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3

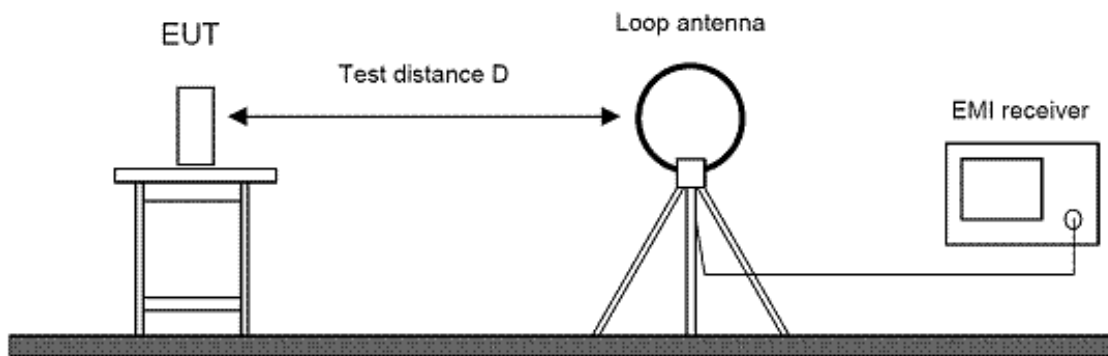


## 6.5 Test procedure

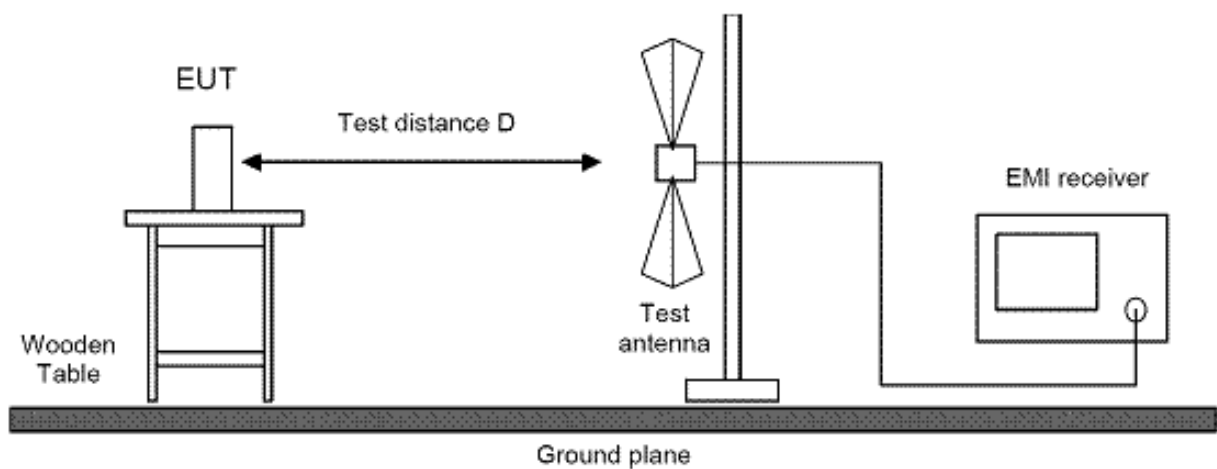
1. Configure the EUT according to ANSI C63.10. The EUT is placed on the top of the turntable 0.8 meter above ground. The receiving antenna is placed 3 meters from the turntable. For prescan measurements the test setup is placed inside a compact diagnostic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna is set to vertical polarization.
4. The EMI receiver performs a scan from 9 kHz to 30 MHz or 30MHz to 1000MHz with the detector set to peak. Appropriate CISPR measurement bandwidths are used, i. e. 200 Hz for the frequency range 9 kHz to 150 kHz, 10 kHz for 150 kHz to 30 MHz and 120 kHz for 30MHz to 1000MHz.
5. The turn table is rotated to 6 different positions ( $360^\circ / 6$ ) and the antenna polarization is changed to horizontal.
6. Repeat the test procedure at step 4 and 5.
7. Then the test setup is placed in an OATS at 3 m distance and all peak values over or with less than 6dB margin to the limit are re-measured with quasi-peak detector (except for the frequency bands 9–90 kHz and 110–490 kHz where average detector is used). If the margin of all emissions recorded prescan in the compact diagnostic chamber is more than 6 dB no final test in OATS is performed.
8. The turntable is rotated by 360 degrees to determine the position of the highest radiation.
9. The height of the broadband receiving antenna is varied between one meter and four meters above ground to find the maximum emissions field strength of both horizontal and vertical polarization. The highest value is recorded.
10. For emissions below 30MHz, measurements are performed with a loop antenna. The antenna height is not changed during this test.



## 6.6 Test setup



Picture 22: Test setup for radiated emission measurement from 9 kHz to 30 MHz



Picture 23: Test setup for radiated emission measurement from 30 MHz to 1 GHz

## 6.7 Test deviation

There is no deviation with the original standard.

## 6.8 EUT operation during test

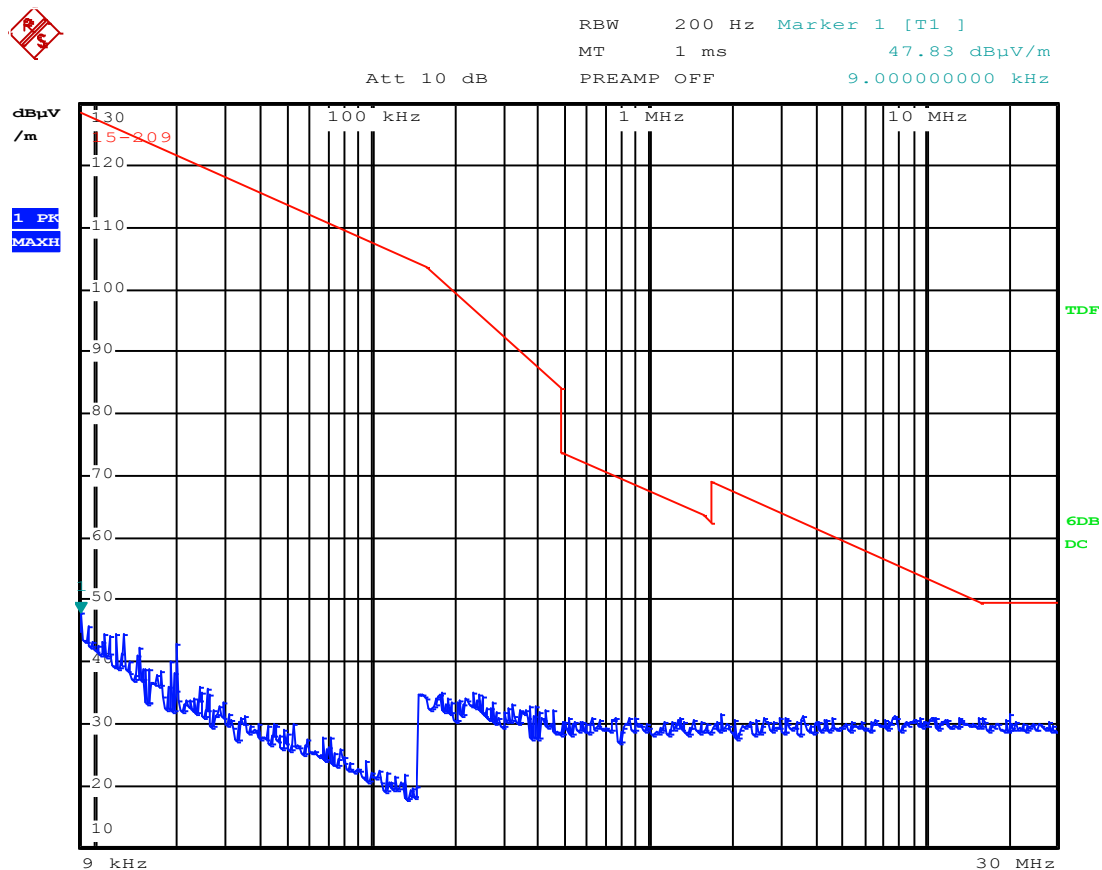
The EUT was programmed to be in continuously transmitting mode.

## 6.9 Test results CTA 915/0/WS/SM/H1

### Radiated Emission Measurement 9 kHz – 30 MHz

Temperature:	22°C	Humidity:	46%
Tested by:	M. Müller	Test date:	2016-09-26

During pre-measurements it was investigated that for the radiated emission measurement from 9kHz to 30MHz the worst-case-position is EUT-position 1 in combination with the loop-antenna parallel.



Picture 24: Radiated emission 9 kHz – 30MHz (Channel 1)

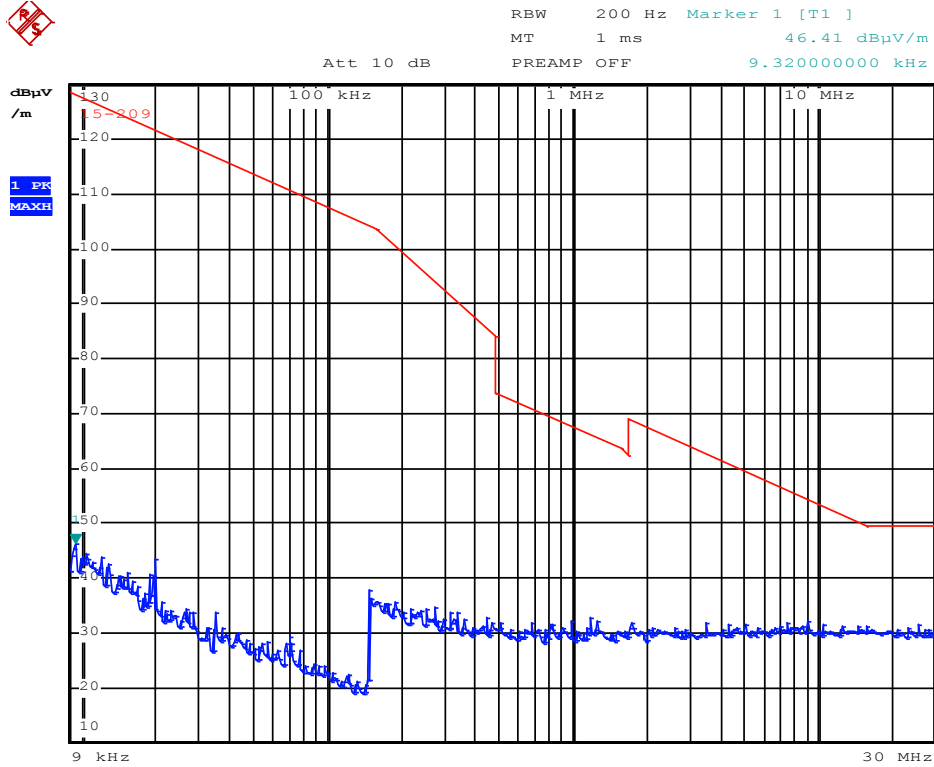


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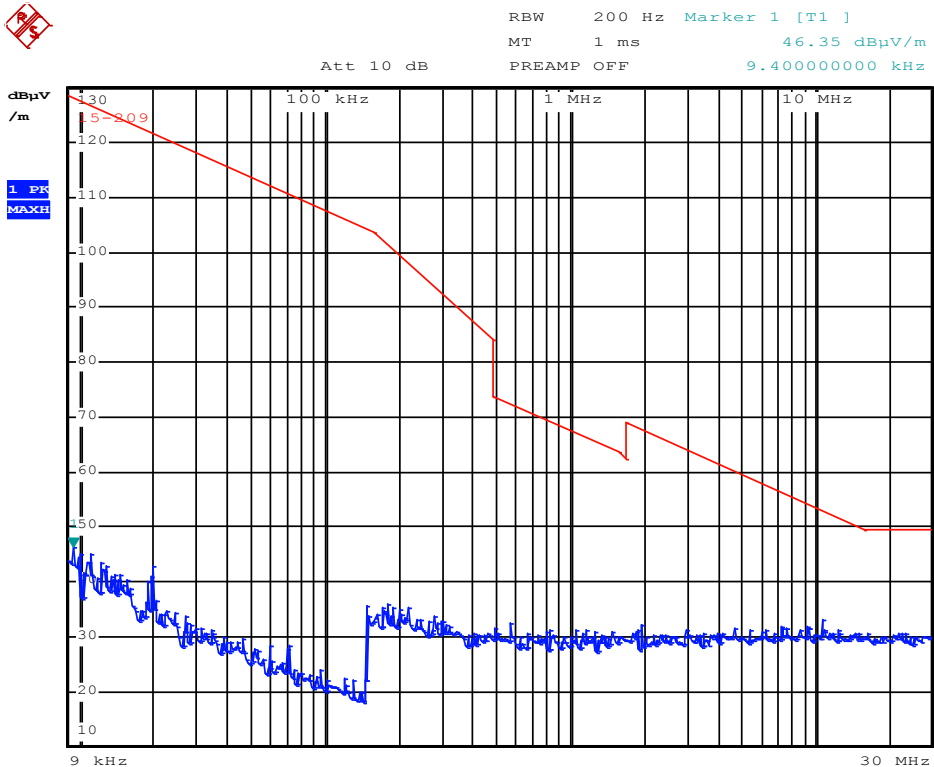
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Picture 25: Radiated emission 9 kHz – 30MHz (Channel 16)



Picture 26: Radiated emission 9 kHz – 30MHz (Channel 32)



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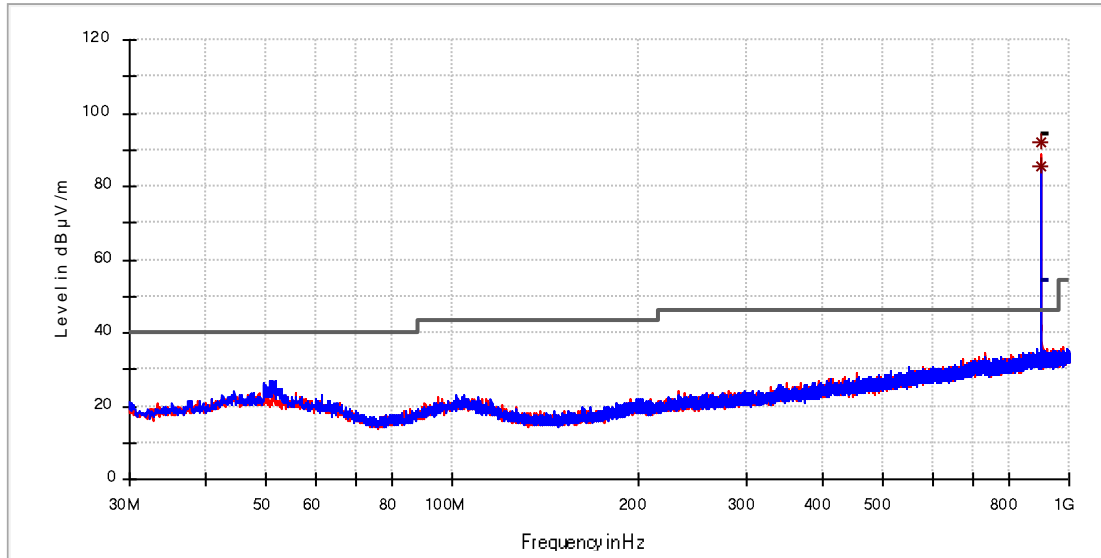
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# Radiated Emission Measurement 30 MHz - 1 GHz

Temperature:	21°C	Humidity:	48%
Tested by:	A. Grill	Test date:	2016-09-07

The respective worst-case is noted within captions.



- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

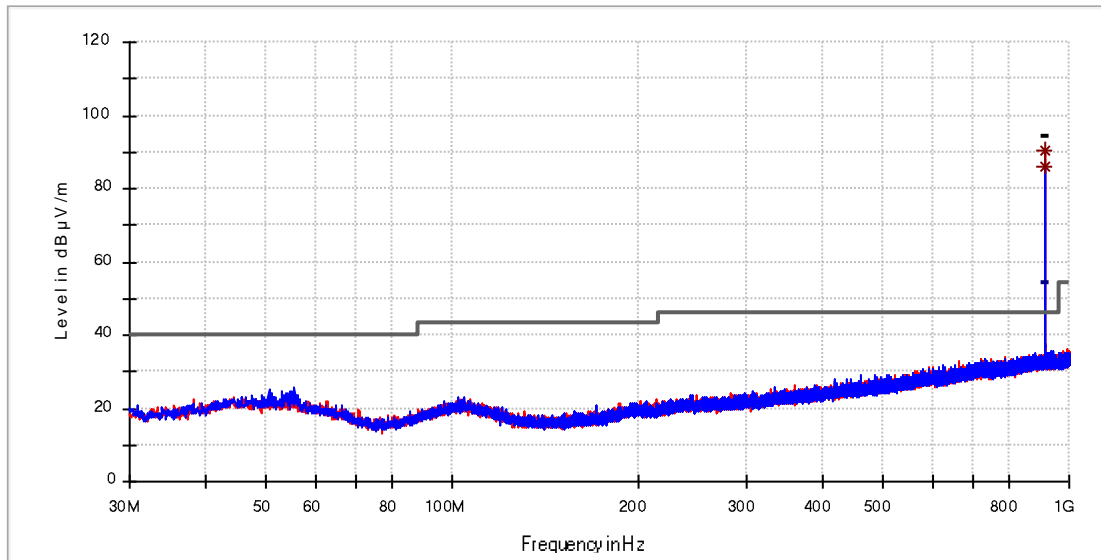
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
903.500000	91.91	93.98	2.07	1000.0	120.000	149.0	H	87.0	24.8
903.500001	85.57	93.98	8.41	1000.0	120.000	163.0	V	230.0	24.8

Picture 27: Radiated emission 30 MHz – 1 GHz (Channel 1, EUT-position2)



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- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

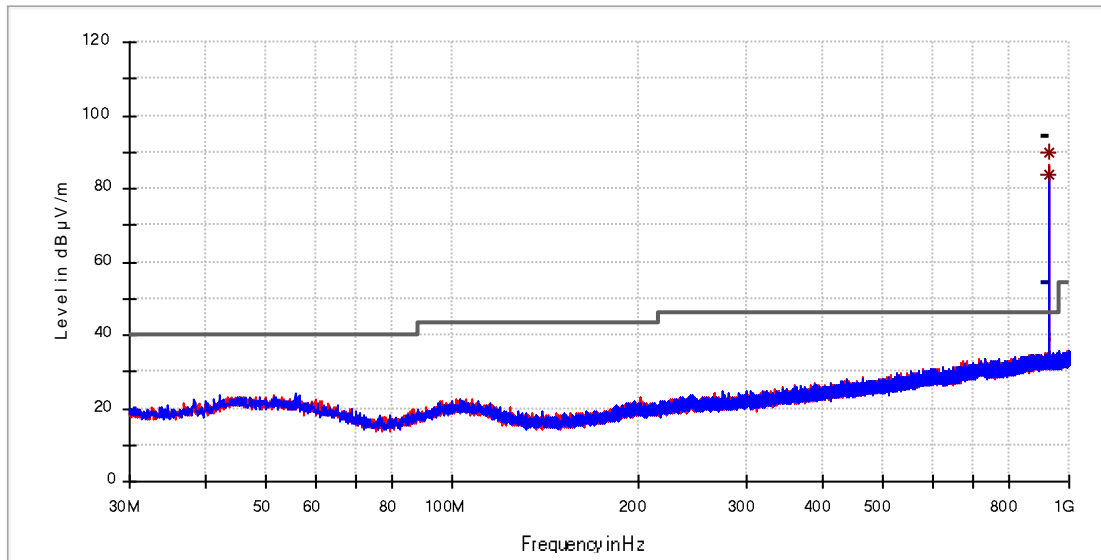
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
914.750000	90.64	93.98	3.34	1000.0	120.000	100.0	H	246.0	24.8
914.750000	85.88	93.98	8.10	1000.0	120.000	100.0	V	171.0	24.8

Picture 28: Radiated emission 30 MHz – 1 GHz (Channel 16, EUT-position3)



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- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
926.750000	89.99	93.98	3.99	1000.0	120.000	142.0	H	97.0	24.8
926.750000	83.79	93.98	10.19	1000.0	120.000	102.0	V	3.0	24.8

Picture 29: Radiated emission 30 MHz – 1 GHz (Channel 32, EUT-position2)



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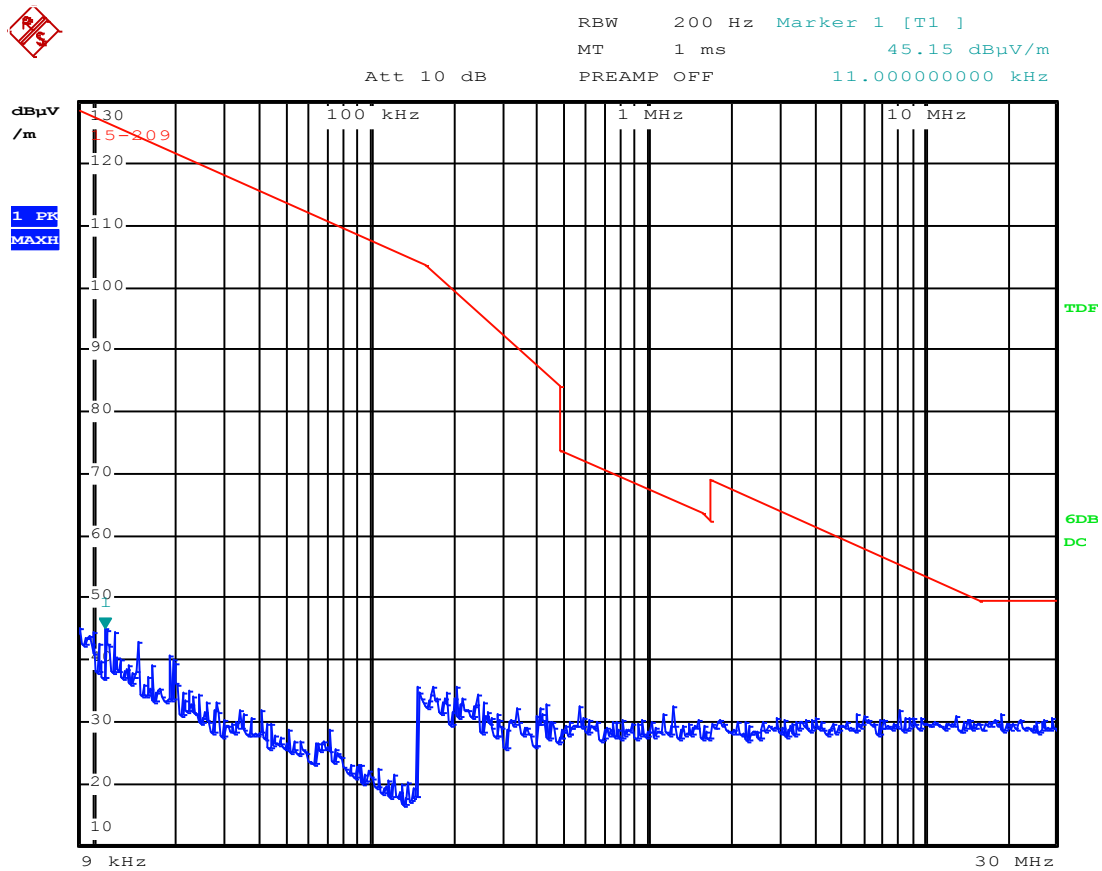
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## 6.1 Test results CTA 920/0/WR/SM/W1

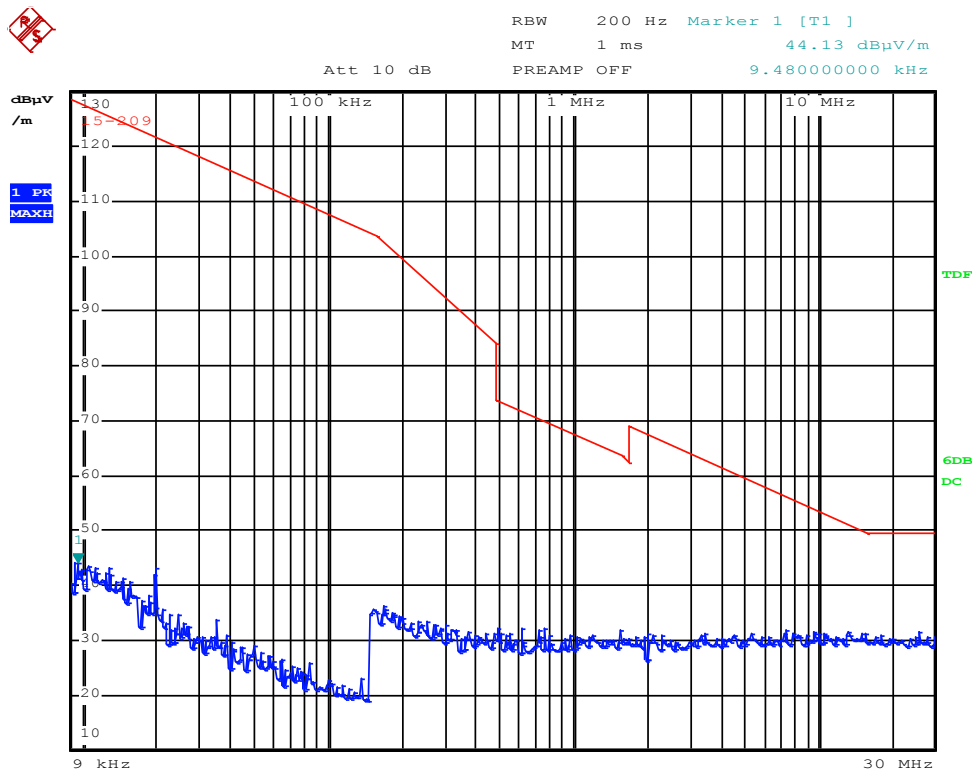
### Radiated Emission Measurement 9 kHz – 30 MHz

Temperature:	22°C	Humidity:	46%
Tested by:	M. Müller	Test date:	2016-09-26

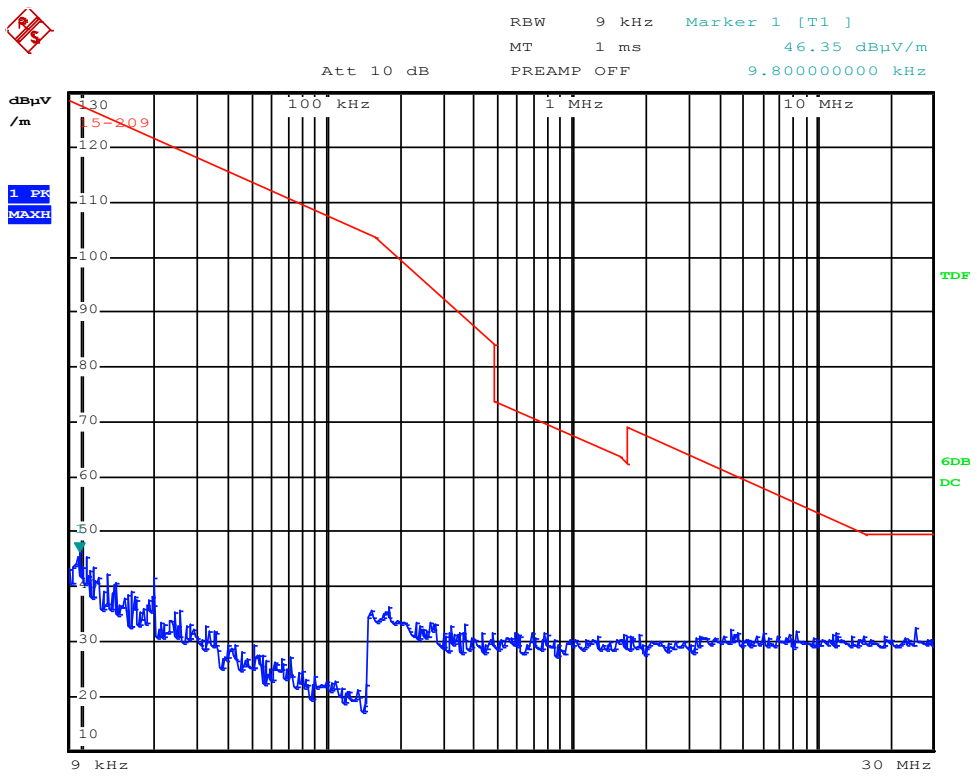
During pre-measurements it was investigated that for the radiated emission measurement from 9kHz to 30MHz the worst-case-position is EUT-position 1 in combination with the loop-antenna parallel.



Picture 30: Radiated emission 9 kHz – 30MHz (Channel 1)



Picture 31: Radiated emission 9 kHz – 30MHz (Channel 16)



Picture 32: Radiated emission 9 kHz – 30MHz (Channel 32)



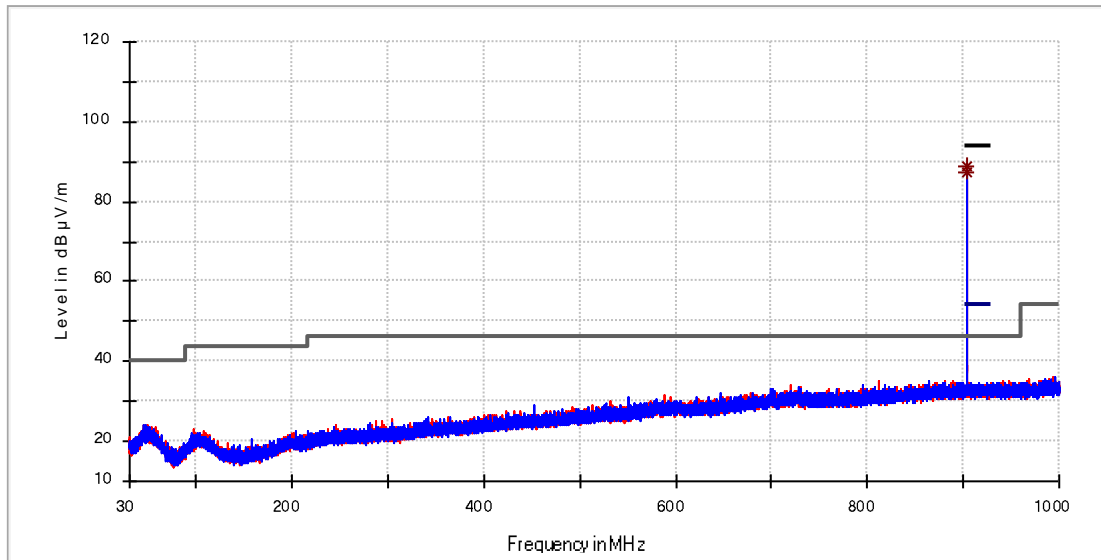
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# Radiated Emission Measurement 30 MHz - 1 GHz

Temperature:	21°C	Humidity:	48%
Tested by:	A. Grill	Test date:	2016-09-07

The respective worst-case is noted within captions.



- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

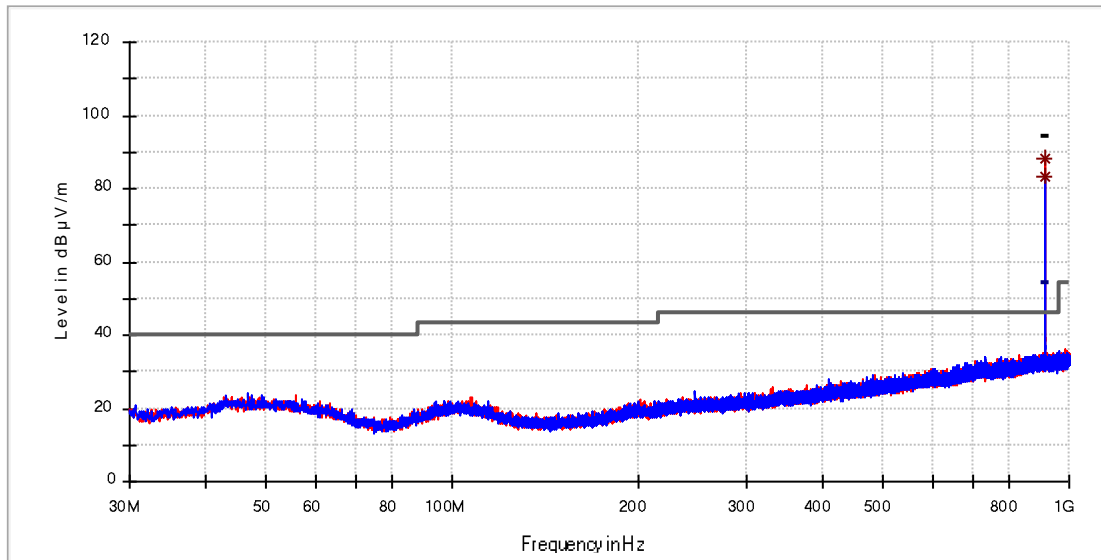
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
903.500000	89.03	93.98	4.95	1000.0	120.000	100.0	V	205.0	24.8
903.500001	87.50	93.98	6.48	1000.0	120.000	150.0	H	105.0	24.8

Picture 33: Radiated emission 30 MHz – 1 GHz (Channel 1, EUT-position2)



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- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

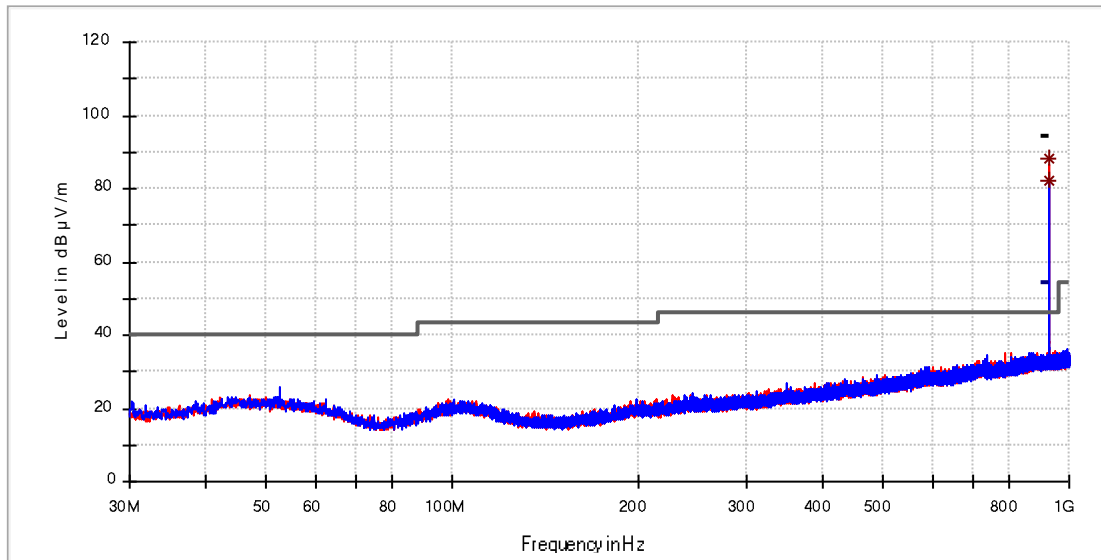
Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
914.750000	83.17	93.98	10.81	1000.0	120.000	103.0	V	171.0	24.8
914.750000	88.41	93.98	5.57	1000.0	120.000	209.0	H	168.0	24.8

Picture 34: Radiated emission 30 MHz – 1 GHz (Channel 16, EUT-position3)



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- PreviewResult 1H-PK+
- PreviewResult 1V-PK+
- 47 CFR §15.249 Radiated emission 3m fundamental
- 47 CFR §15.209 Radiated emission 3m QP
- 47 CFR §15.249 Radiated emission 3m harmonics
- \* Final\_Result QPK

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
926.750000	88.33	93.98	5.65	1000.0	120.000	141.0	H	164.0	24.8
926.750000	82.44	93.98	11.54	1000.0	120.000	103.0	V	58.0	24.8

Picture 35: Radiated emission 30 MHz – 1 GHz (Channel 32, EUT-position3)



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# 7 Radiated emission measurement (>1 GHz)

according to 47 CFR Part 15, section 15.249(d) with section 15.209 and RSS-Gen Issue 4, section 6.12 with RSS-210 Issue 9, B.10(b)

## 7.1 Test location

- Scan with average and max peak detector in 3 m semi anechoic chamber
- Final measurement with average and max peak detector in 3 m semi anechoic chamber.

Description	Manufacturer	Inventory No.
Semi anechoic chamber	Albatross Projects	E00716

## 7.2 Test instruments

	Description	Manufacturer	Inventory No.
<input checked="" type="checkbox"/>	ESU26	Rohde & Schwarz	W00002
<input checked="" type="checkbox"/>	AMF-5D-00501800-28-13P	Miteq	W00089
<input type="checkbox"/>	AMF-6F-16002650-25-10P	Miteq	W00090
<input checked="" type="checkbox"/>	BBHA 9120D	Schwarzbeck	W00053
<input type="checkbox"/>	BBHA 9170	Schwarzbeck	W00055
<input type="checkbox"/>	COSB 4-1-26	Conformitas	W00091

## 7.3 Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Limit for field strength of harmonics is 54 dB $\mu$ V/m (500  $\mu$ V/m).

In case of emission falling into restricted bands specified on 15.205(a), limit according to 15.209(a) in table below applies.

Frequency [MHz]	Field strength Fs [ $\mu$ V/m]	Field strength [dB $\mu$ V/m]	Measurement distance d [m]
30 – 88	100	40	3
88 – 216	150	43.5	3
216 - 960	200	46	3
Above 960	500	54	3



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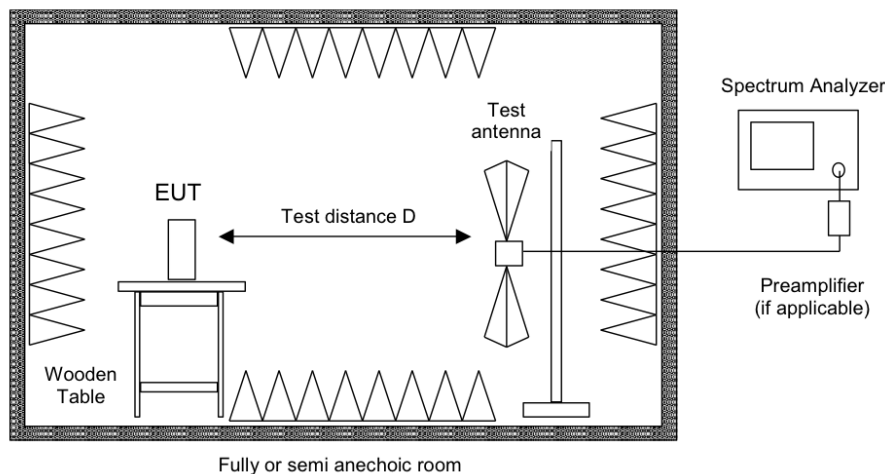
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## 7.4 Test procedure

1. Configure the EUT according to ANSI C63.10. The EUT was placed on the top of the turntable 1.5 meter above ground. The receiving antenna was placed 3 meters from the turntable. The test setup was placed inside a fully anechoic chamber.
2. Power on the EUT and all peripherals.
3. The broadband antenna was set to vertical polarization.
4. The EMI receiver performed a scan from 1000 MHz to 10<sup>th</sup> harmonic of the fundamental frequency with the detector set to peak and the measurement bandwidth set to 1 MHz (VBW  $\geq$  3 MHz). The trace data was recorded with the receiver Max Hold function.
5. The turn table was rotated in intervals of 15°.
6. After a full 360°-turn the antenna polarization was changed to horizontal and the test was repeated at step 4 and 5.
7. After the scan suspicious frequencies were selected and maximized by moving turntable and variation of antenna height until maximum of emission was found.
8. Then the RBW was set to 1 MHz and the VBW was reduced to a minimum of 10 Hz (1 kHz by default) to get average values determined by video averaging.
9. The receiving antenna was set to vertical polarization.
10. The turntable was rotated by 360 degrees to determine the position of the highest radiation.
11. The receiving antenna was then set to horizontal polarization and the measurement was repeated at step 9.
12. The highest recorded level was noted.

## 7.5 Test setup



Picture 36: Test setup for radiated emission measurement (> 1 GHz)

## 7.6 Test deviation

There is no deviation with the original standard.

## 7.7 EUT operation during test

The EUT was programmed to be in continuously transmitting mode.

For these measurements it was investigated that EUT-position1 is the respective worst-case.



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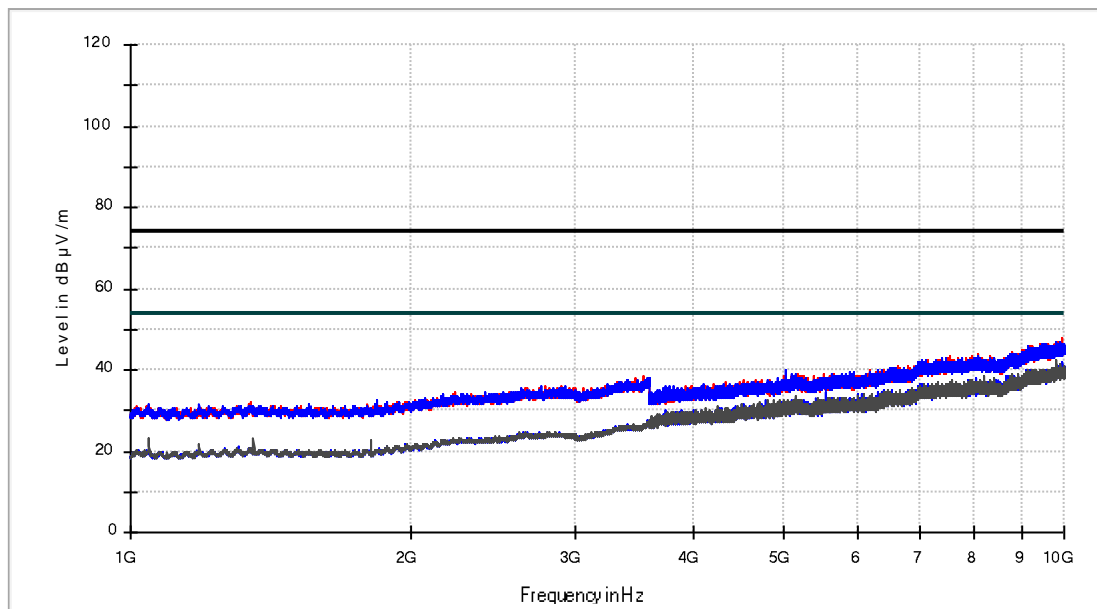
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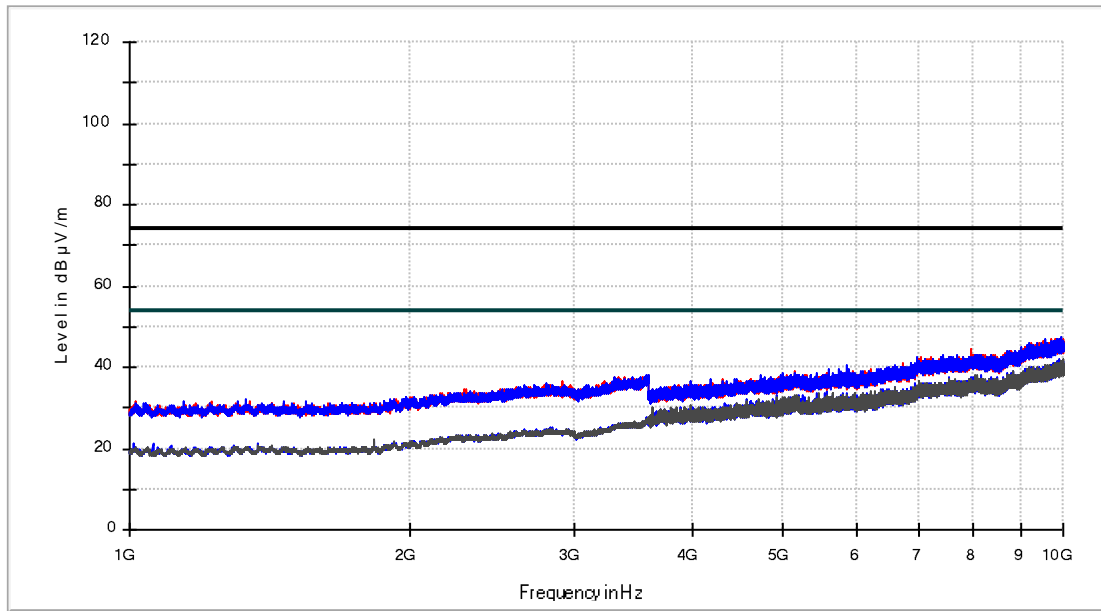
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## 7.8 Test results CTA 915/0/WS/SM/H1

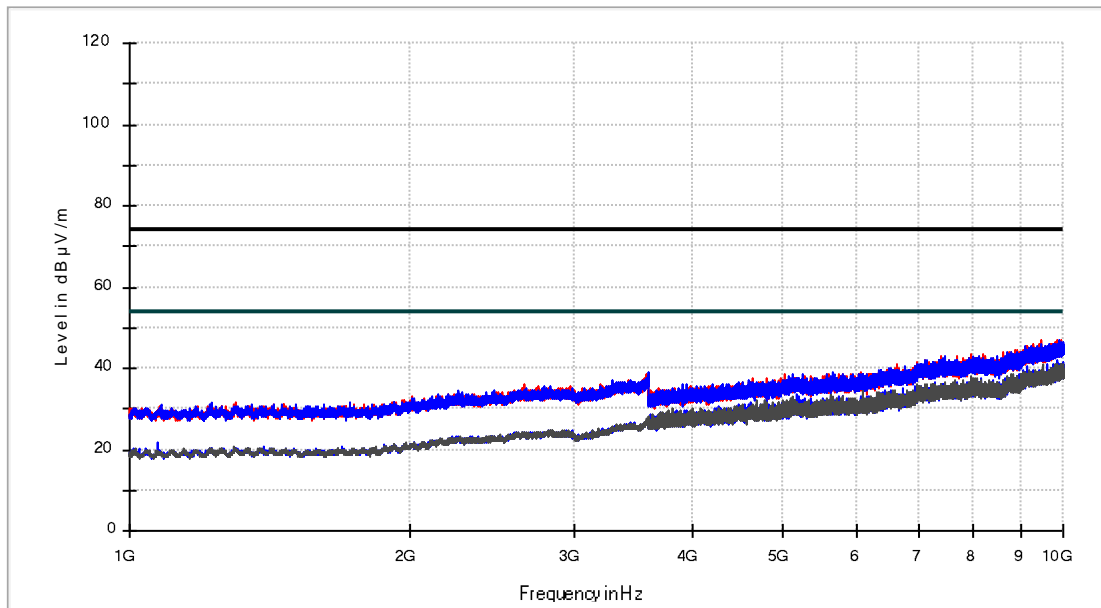
Temperature:	19°C	Humidity:	47%
Tested by:	A. Grill	Test date:	2016-09-09



Picture 37: Radiated emission - Channel 1



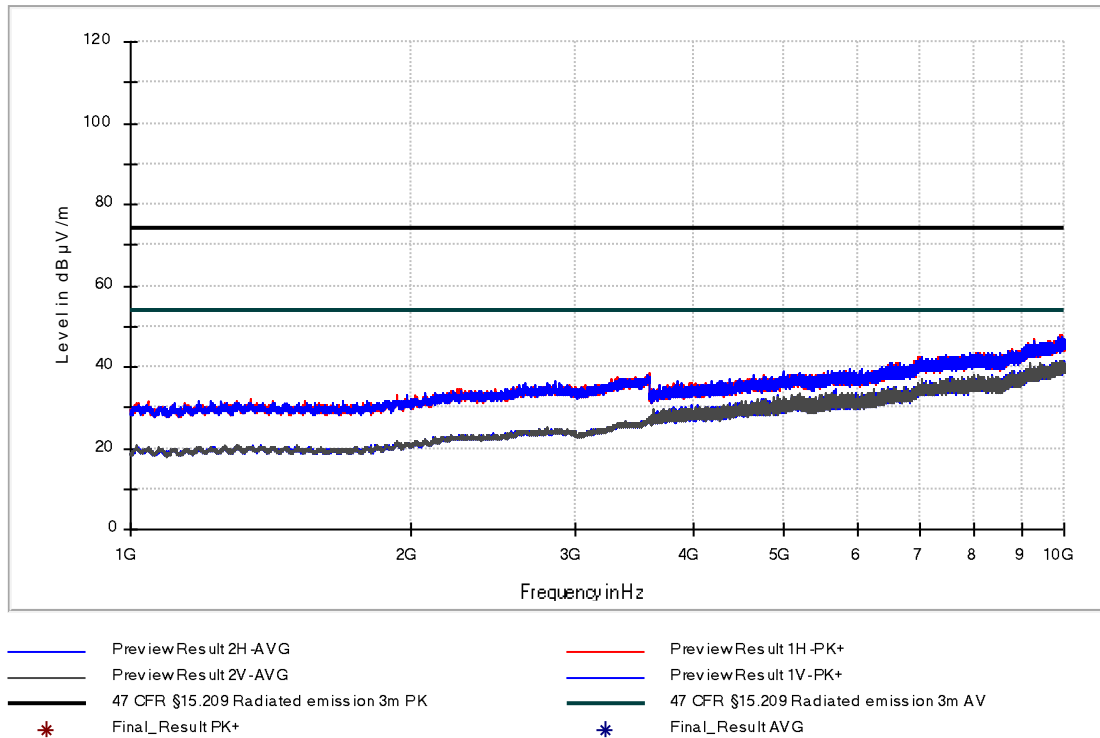
Picture 38: Radiated emission - Channel 16



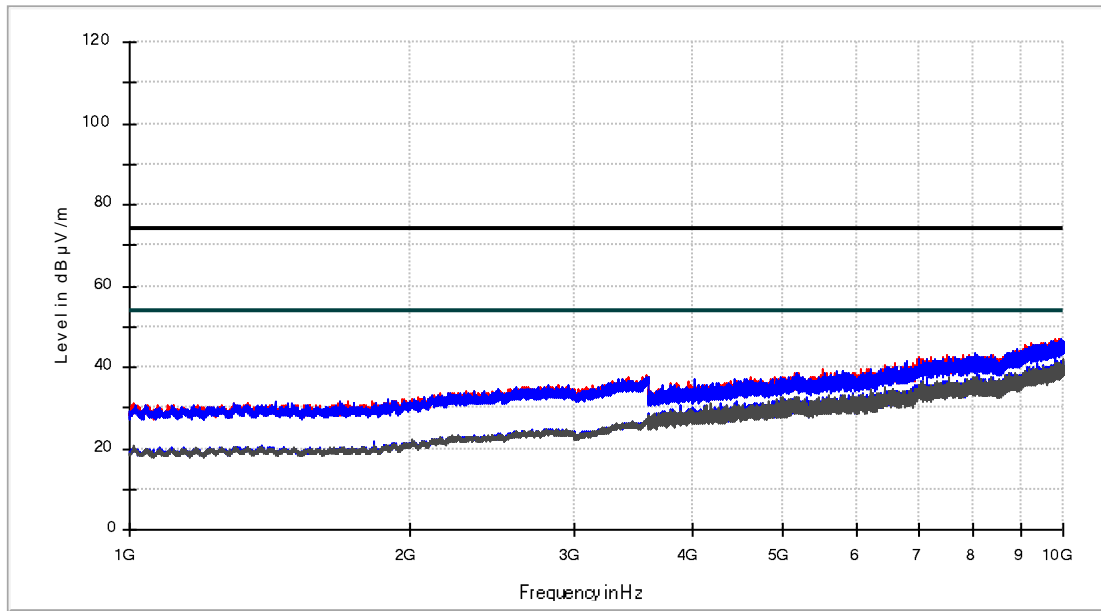
Picture 39: Radiated emission - Channel 32

## 7.9 Test results CTA 920/0/WR/SM/W1

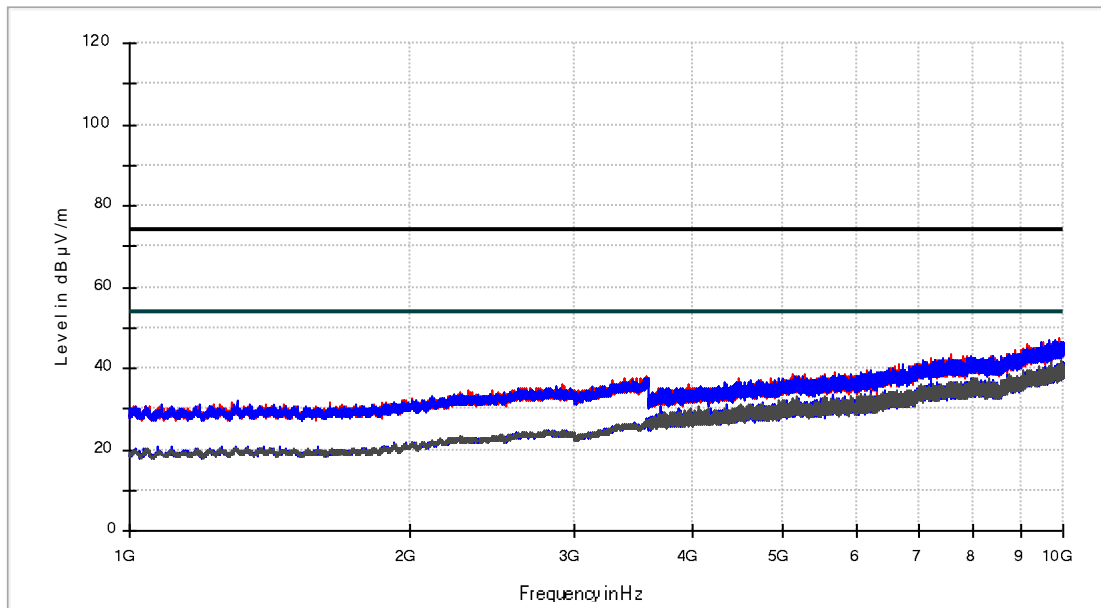
Temperature:	19°C	Humidity:	47%
Tested by:	A. Grill	Test date:	2016-09-09



Picture 40: Radiated emission - Channel 1



Picture 41: Radiated emission - Channel 16



Picture 42: Radiated emission - Channel 32

# 8 6 dB bandwidth

according to 47 CFR Part 15, section 15.215(c) and  
RSS-Gen Issue 4, section 6.6

## 8.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV <b>TESTHAUS</b> GmbH	E00354

## 8.2 Test Instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

## 8.3 Limits

As not specified in the specific rule section the 6 dB bandwidth is measured and reported for information only.

## 8.4 Test procedure

1. The test is performed in accordance with FCC KDB publication no. 558074 for testing digital transmission system (DTS)
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. The unit was operated in continuous transmit mode with modulation.
4. The resolution bandwidth was set to 100 kHz with video bandwidth at least equal to three times the resolution bandwidth.
5. The maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission were recorded.



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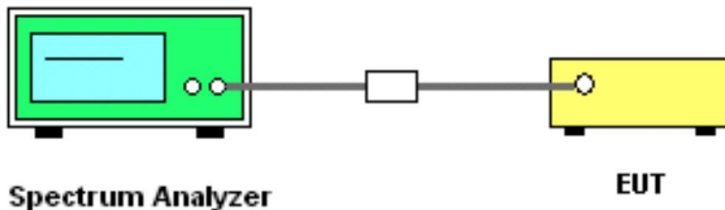
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## 8.5 Test setup



Picture 43: Test setup for 6 dB bandwidth measurement

## 8.6 Test deviation

There is no deviation with the original standard.

## 8.7 EUT operation during test

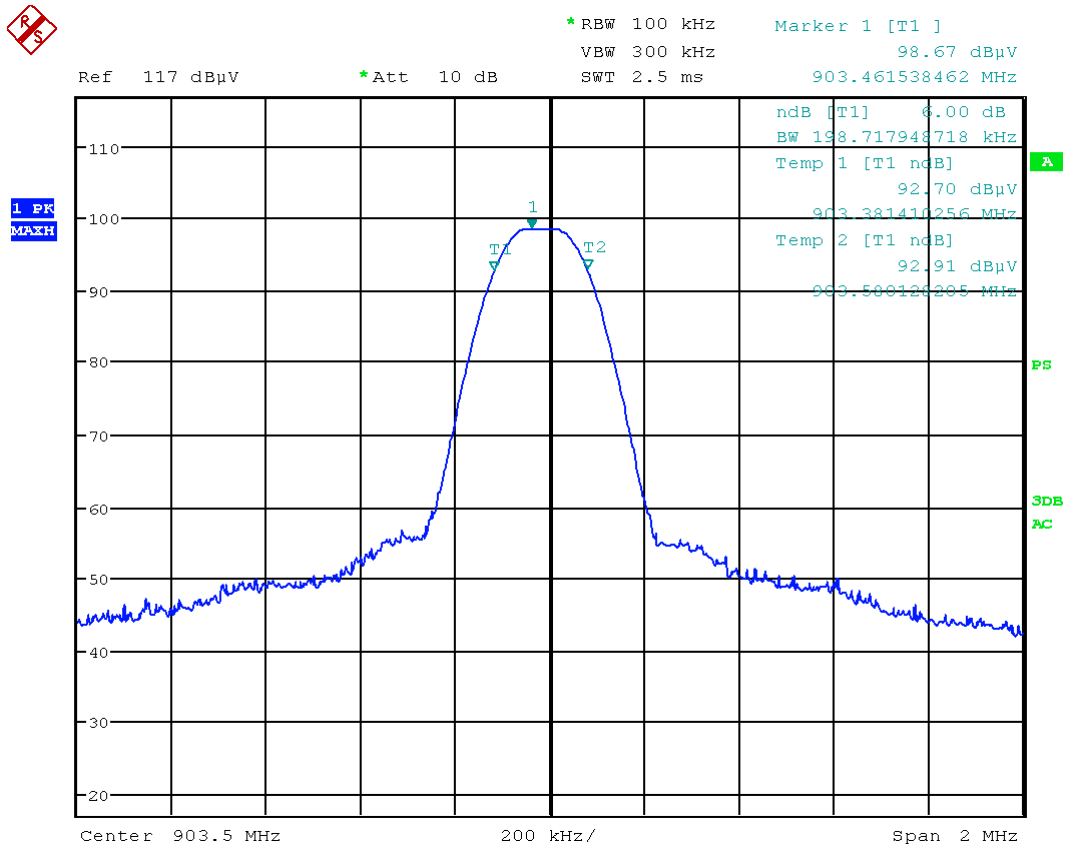
The EUT was programmed to be in continuously transmitting mode.

## 8.8 Test results

Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2016-10-04

Designated frequency band: 902.000 MHz to 928.000 MHz

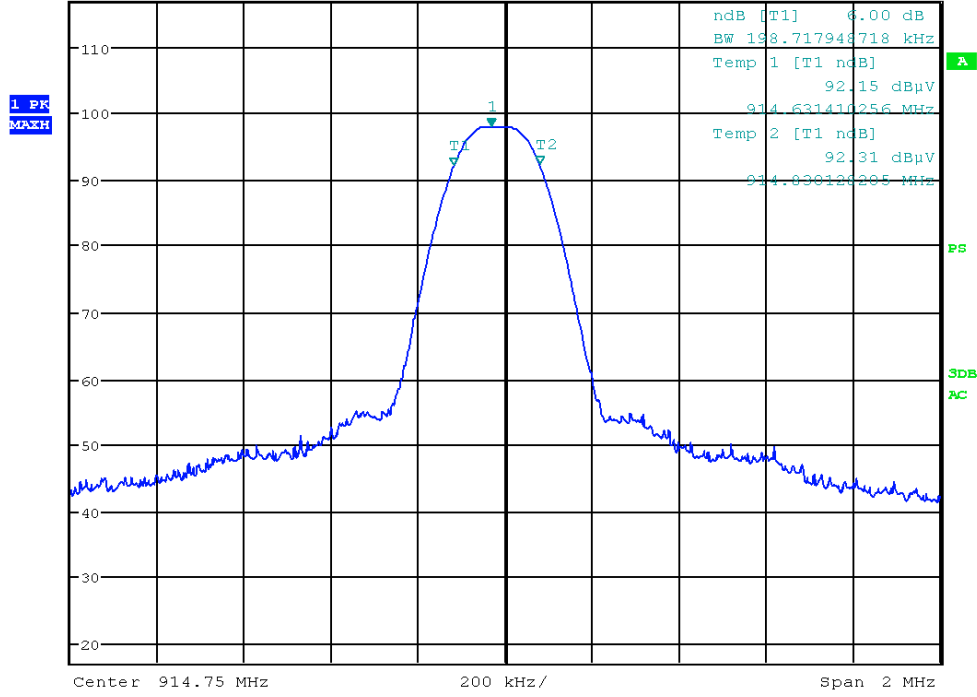
Channel	Frequency (MHz)			6 dB bandwidth (kHz)	Result
	peak	low	high		
1	903.462	903.381	903.580	198.718	within band
16	914.718	914.631	914.830	198.718	within band
32	926.718	926.631	926.833	201.923	within band



Picture 44: 6dB bandwidth, channel 1



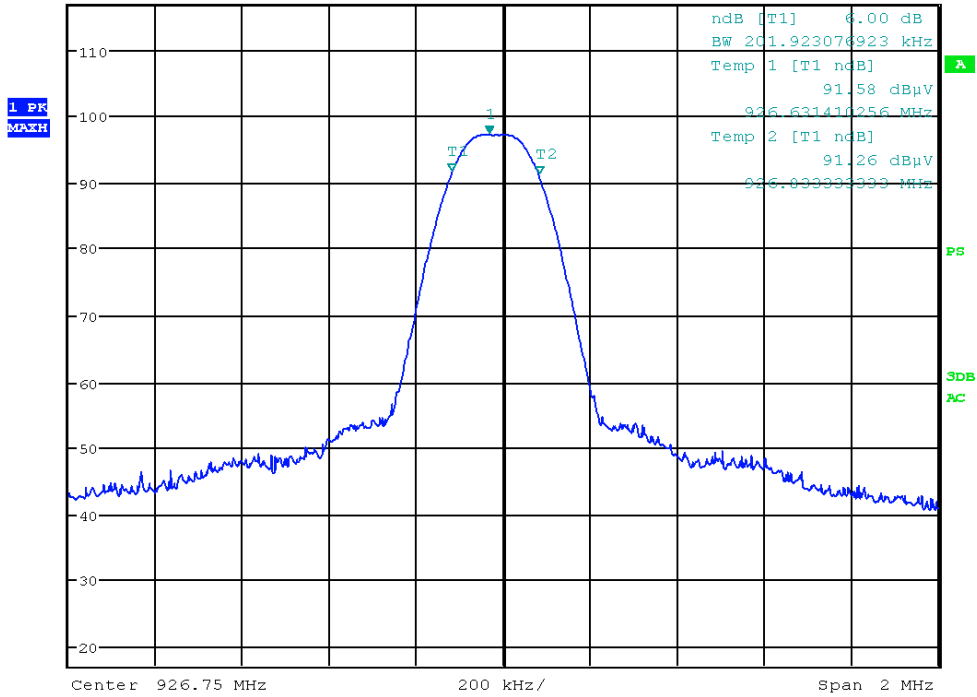
Ref 117 dBµV \*Att 10 dB \*RBW 100 kHz Marker 1 [T1] VBW 300 kHz 98.04 dBµV  
 SWT 2.5 ms 914.717948718 MHz



Picture 45: 6dB bandwidth, channel 16



Ref 117 dBµV \*Att 10 dB \*RBW 100 kHz Marker 1 [T1] VBW 300 kHz 97.34 dBµV  
 SWT 2.5 ms 926.717948718 MHz



Picture 46: 6dB bandwidth, channel 32



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# 9 20 dB bandwidth

according to 47 CFR Part 15, section 15.215(c) and  
RSS-Gen Issue 4, section 6.6

## 9.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV <b>TESTHAUS</b> GmbH	E00354

## 9.2 Test Instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

## 9.3 Limits

20 dB bandwidth must be contained within the designated frequency band.

## 9.4 Test procedure

1. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
2. The unit was operated in continuous transmit mode with modulation.
3. The resolution bandwidth was set to equal or greater than 1.0% of the emission bandwidth with video bandwidth at least equal to resolution bandwidth.
4. The maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 20 dB relative to the maximum level measured in the fundamental emission were recorded.



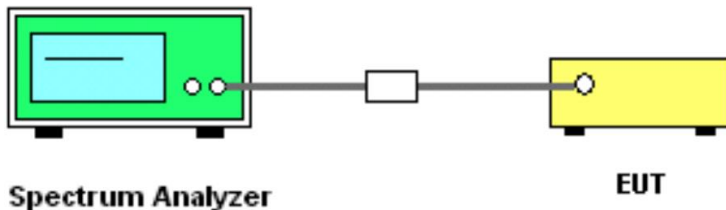
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## 9.5 Test setup



Picture 47: Test setup for 20 dB bandwidth measurement

## 9.6 Test deviation

There is no deviation with the original standard.

## 9.7 EUT operation during test

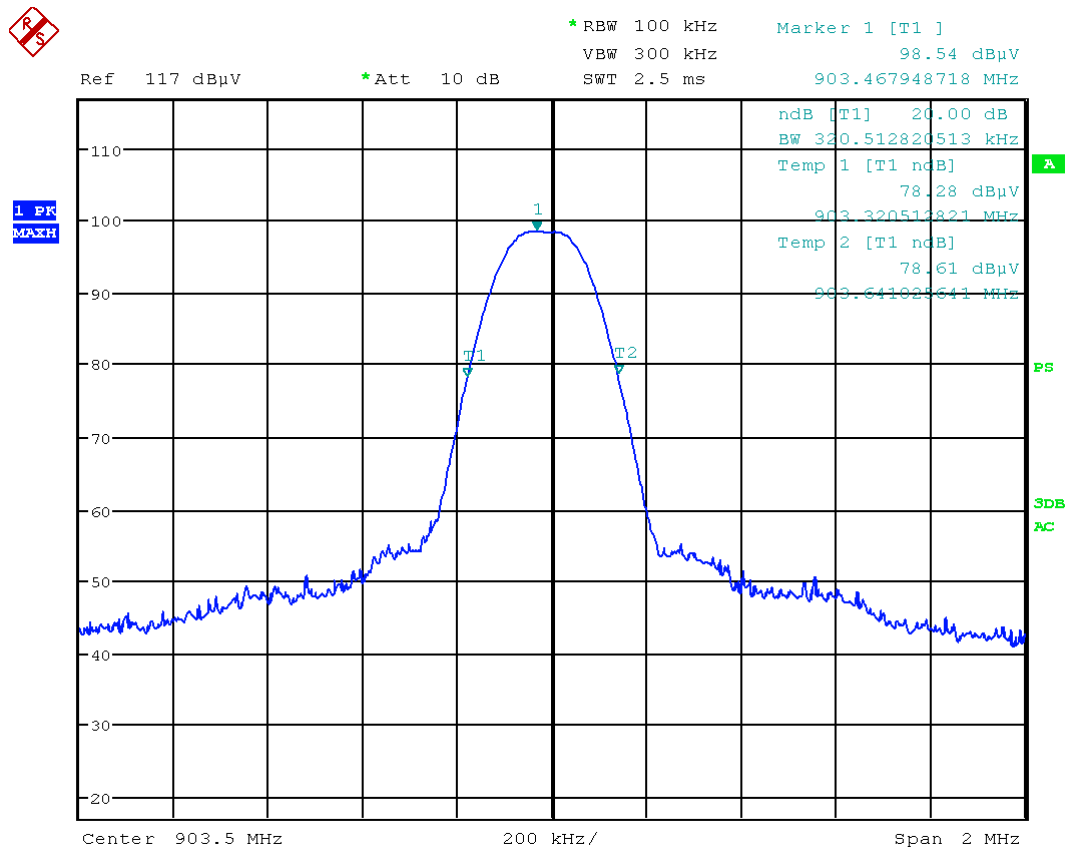
The EUT was programmed to be in continuously transmitting mode.

## 9.8 Test results

Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2016-10-04

Designated frequency band: 902.000 MHz to 928.000 MHz

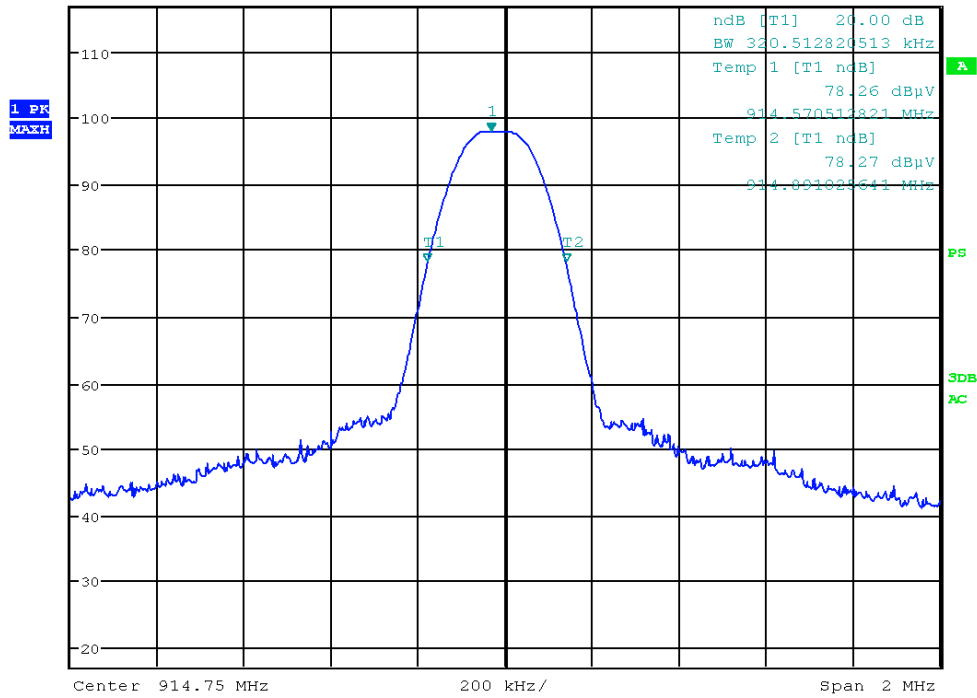
Channel	Frequency (MHz)			20 dB bandwidth (kHz)	Result
	peak	low	high		
1	903.468	903.321	903.641	320.513	within band
16	914.718	914.571	914.891	320.513	within band
32	926.718	926.567	926.891	323.718	within band



Picture 48: 20dB bandwidth, channel 1



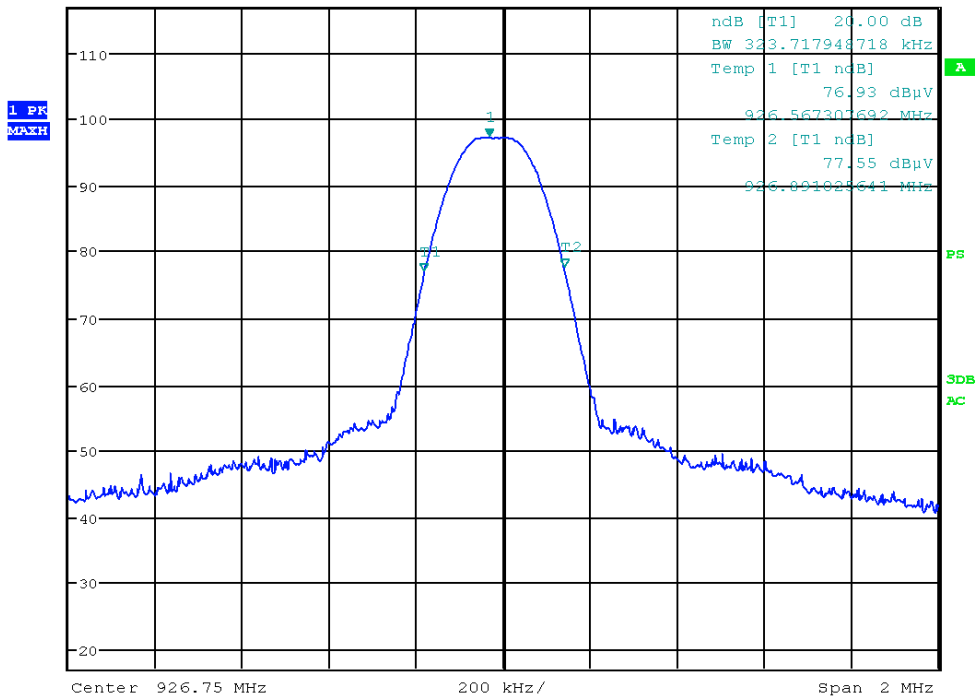
Ref 117 dBµV \*Att 10 dB \*RBW 100 kHz VBW 300 kHz SWT 2.5 ms Marker 1 [T1] 98.04 dBµV  
 914.717948718 MHz



Picture 49: 20dB bandwidth, channel 16



Ref 117 dBµV \*Att 10 dB \*RBW 100 kHz VBW 300 kHz SWT 2.5 ms Marker 1 [T1] 97.34 dBµV  
 926.717948718 MHz



Picture 50: 20dB bandwidth, channel 32



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# 10 Occupied bandwidth

according to 47 CFR Part 2, section 2.202(a) and  
RSS-Gen Issue 4, section 6.6

## 10.1 Test location

- Conducted measurement
- Scan with peak detector in 3 m CDC
- CISPR measurement with quasi peak detector on 10m open area test site.
- Measurement with peak detector on 3m open area test site

Description	Manufacturer	Inventory No.
CDC	Albatross Projects	E00026
Open area test site	EMV <b>TESTHAUS</b> GmbH	E00354

## 10.2 Test Instruments

	Description	Manufacturer	Inventory No.
<input type="checkbox"/>	ESCS 30 (FF)	Rohde & Schwarz	E00003
<input checked="" type="checkbox"/>	ESU 26	Rohde & Schwarz	W00002
<input type="checkbox"/>	ESCI (CDC)	Rohde & Schwarz	E00001
<input type="checkbox"/>	HFH2-Z2	Rohde & Schwarz	E00060
<input type="checkbox"/>	VULB 9163 (FF)	Schwarzbeck	E00013
<input type="checkbox"/>	VULB 9160 (CDC)	Schwarzbeck	E00011

## 10.3 Limits

As not specified in the specific rule section the occupied bandwidth is measured and reported for information only.

## 10.4 Test procedure

1. The test is performed in accordance with 47 CFR Part 2, section 2.202(a)
2. The transmitter output (antenna port) was connected to the spectrum analyzer in peak hold mode.
3. The unit was operated in continuous transmit mode with modulation.
4. The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately three times the RBW.
5. The 99 % frequency bandwidth was measured so that, below its lower and above its upper frequency limits, the mean powers radiated were each equal to 0.5 percent of the total mean power radiated by a given emission.



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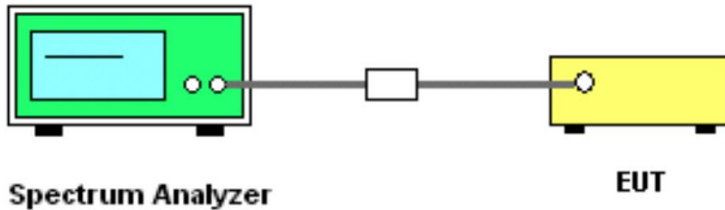
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## 10.5 Test setup



Picture 51: Test setup for occupied bandwidth measurement

## 10.6 Test deviation

There is no deviation with the original standard.

## 10.7 EUT operation during test

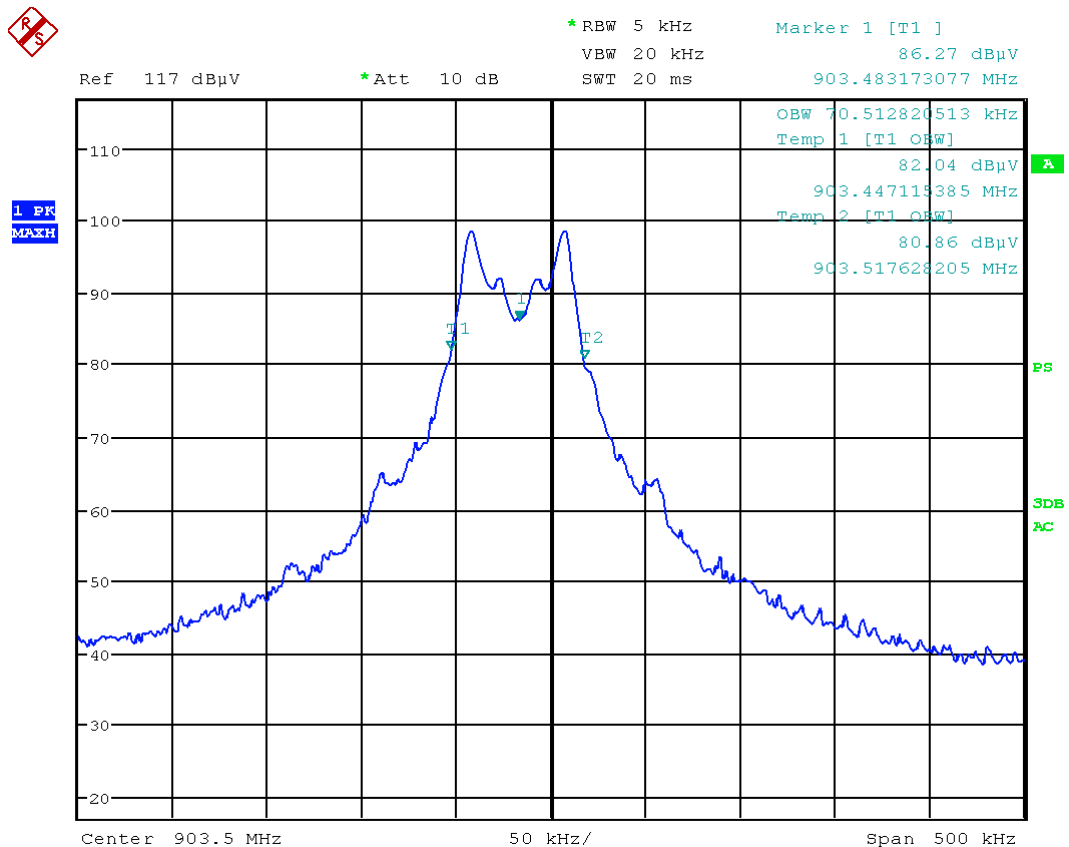
The EUT was programmed to be in continuously transmitting mode.

## 10.8 Test results

Temperature:	19°C	Humidity:	44%
Tested by:	M. Müller	Test date:	2016-10-04

Designated frequency band: 902.000 MHz to 928.000 MHz

Channel	Frequency (MHz)			Occupied bandwidth (kHz)	Result
	middle	low	high		
1	903.483	903.447	903.518	70.513	within band
16	914.730	914.696	914.768	71.314	within band
32	926.731	926.696	926.768	71.314	within band



Picture 52: Occupied bandwidth, channel 1

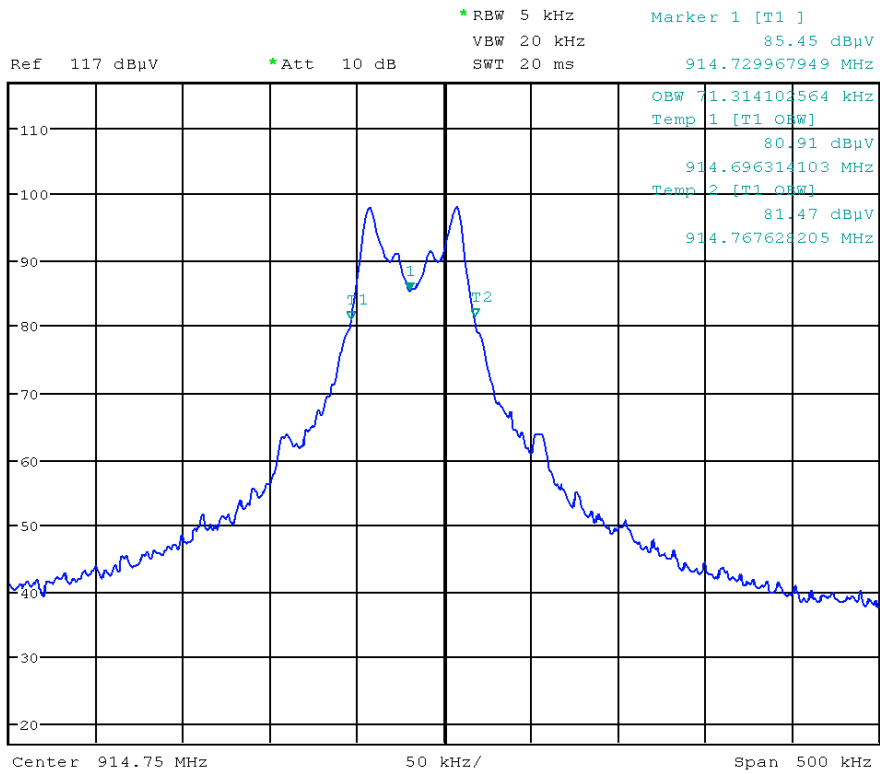


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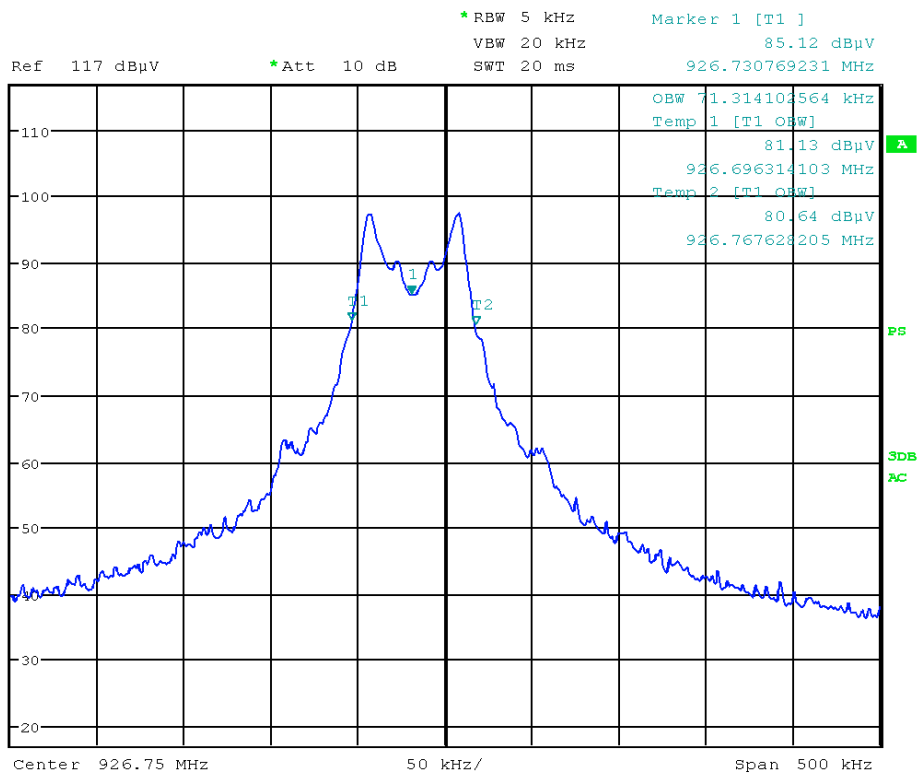
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Picture 53: Occupied bandwidth, channel 16



Picture 54: Occupied bandwidth, channel 32



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# 11 Radio frequency radiation exposure evaluation for portable devices

Reference(s): 47 CFR Part 2, §2.1093  
 KDB 447498 D01, section 4.3.1  
 RSS Gen Issue 4, section 3.2  
 RSS-102 Issue 5, section 2.5.1

## 11.1 Data of equipment under test (EUT)

Antenna connector (see clause 2):	<input checked="" type="checkbox"/> permanent	<input type="checkbox"/> temporary
	<input type="checkbox"/> none	
Antenna detachable:	<input checked="" type="checkbox"/> yes	<input type="checkbox"/> no
Tune-up function:	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
Maximum antenna gain (see clause 2):	logarithmic 1.0 dBi	numeric 1.26
Maximum conducted output power (see clause 2):	logarithmic -8.18 dBm	numeric 0.15 mW
Maximum equivalent isotropically radiated power:	logarithmic -7.18 dBm	numeric 0.19 mW
Maximum operation frequency (see clause 2):	926.750 MHz	
Minimum test separation distance:	5 mm	

## 11.2 Requirements

To be excluded from SAR tests set out in 47 CFR Part 2, §2.1093, the limits of the general guidelines for RF Exposure as described in KDB 447498 D01, section 4.3.1, have to be kept. For 100 MHz to 6 GHz and test separation distances  $\leq 50$  mm, the 1 g and 10 g SAR test exclusion thresholds are determined by the following equation:

$$\frac{P_{conducted}(mW) \cdot \sqrt{f(GHz)}}{d_{min}(mm)} \leq 3.0$$



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with:  $P_{conducted}$  = source-based time-averaged maximum conducted output power in mW, adjusted for tune-up tolerance  
 $f$  = RF channel transmit frequency in GHz  
 $d_{min}$  = minimum test separation distance in mm determined by the smallest distance from the antenna and radiating structures or outer surface of the device, according to the host form factor, exposure conditions and platform requirements, to any part of the body or extremity of a user or bystander

According to RSS-102, section 2.5.1, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in table 1 of RSS-102 (see table 1). Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power.

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of $\leq 5$ mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
$\leq 300$	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	52 mW
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemption Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of $\geq 50$ mm
$\leq 300$	223 mW	254 mW	284 mW	315 mW	345 mW
450	141 mW	159 mW	177 mW	195 mW	213 mW
835	80 mW	92 mW	105 mW	117 mW	130 mW
1900	99 mW	153 mW	225 mW	316 mW	431 mW
2450	83 mW	123 mW	173 mW	235 mW	309 mW
3500	86 mW	124 mW	170 mW	225 mW	290 mW
5800	56 mW	71 mW	85 mW	97 mW	106 mW

Table 1: Limits for exemption from SAR evaluation



## 11.3 Results

### 11.3.1 Test results according to KDB 447498 D01

$$\frac{P_{conducted}(mW) \cdot \sqrt{f(GHz)}}{d_{min}(mm)} \leq 3.0 \quad \Leftrightarrow \quad \frac{1 \cdot \sqrt{0.92675}}{5} \leq 3.0$$
$$\Leftrightarrow \quad 0.2 \leq 3.0 \quad \checkmark$$

Notes:

- 1 Power and distance are rounded to the nearest mW and mm before calculation.
- 2 The result is rounded to one decimal place for comparison

### 11.3.2 Test results according to RSS-102

Calculation of exemption limit at maximum operation frequency using linear interpolation for the applicable separation distance:

$$P_{limit}(f) = P_{limit}(f_n) + \frac{f - f_n}{f_{n+1} - f_n} \cdot (P_{limit}(f_{n+1}) - P_{limit}(f_n))$$

- with:
- $P_{limit}(f)$  = exemption limit at maximum operation frequency
  - $P_{limit}(f_n)$  = exemption limit at lower frequency listed in table closest to maximum operation frequency
  - $P_{limit}(f_{n+1})$  = exemption limit at upper frequency listed in table closest to maximum operation frequency
  - $f$  = maximum operation frequency
  - $f_n$  = lower frequency listed in table closest to maximum operation frequency
  - $f_{n+1}$  = upper frequency listed in table closest to maximum operation frequency

$$P_{limit}(926.750 \text{ MHz}) = 17 \text{ mW} + \frac{926.750 \text{ MHz} - 835 \text{ MHz}}{1900 \text{ MHz} - 835 \text{ MHz}} \cdot (7 \text{ mW} - 17 \text{ mW})$$

$$P_{limit}(926.750 \text{ MHz}) = 16.14 \text{ mW}$$

As the maximum output power is defined as the higher level of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) it results in 0.19 mW which is below the exemption limit at maximum operation frequency.



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## 12 Equipment calibration status

Description	Modell number	Serial number	Inventory number(s)	Last calibration	Next calibration
Test receiver	ESCS 30		E00003		
Test receiver	ESCI	100013	E00001	2016-02	2018-02
Test receiver	ESR7	101059	E00739	2016-02	2018-02
Test receiver	ESU 26	100026	W00002	2016-03	2018-03
LISN	ESH2-Z5	893406/009	E00005	2016-02	2018-02
Broadband antenna	VULB 9162	9162-041	E00634	2015-11	2017-11
Broadband horn antenna	BBHA 9120D	9120D-593	E00053	2014-03	2017-03
Loop antenna	HFH2-Z2	871398/0050	E00060	2016-09	2018-09
Preamplifier	AMF-5D-00501800	1319793	W00089	2015-05	2017-05
Shielded room	P92007	B83117C1109T211	E00107	N/A	
Compact diagnostic chamber (CDC)	VK041.0174	D62128-A502-A69-2-0006	E00026	N/A	
Open area test site (OATS)	OATS	---	E00354	2015-10	2017-10
Semi-anechoic chamber (SAC)	P26726	C62128-A520-A643-x-0006	E00716	2015-03	2017-03
Cable set CDC	Cables no. 37 and 38	---	E00459 E00460	2015-05	2017-05
Cable set OATS 3 m	Cables no. 19, 34 and 36	---	E00453 E00456 E00458	2015-11	2017-11
Cable set SAC 3 m	Cables no. 57, 58 and 59	---	E00453 E00455 E00458	2015-10	2017-10

Table 2: Equipment calibration status

Note: Expiration date of measurement facility registration (OATS) by

- FCC (registration number 221458): 2017-04
- Industry Canada (test site numbers 3472A-1 and 3472A-2): 2018-11



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# 13 Measurement uncertainty

Description	Max. deviation	k=
Conducted emission AMN (9kHz to 30 MHz)	± 4.0 dB	2
Radiated emission open field (30 MHz to 1 GHz)	± 4.5 dB	2
Radiated emission absorber chamber (> 1000 MHz)	± 5.4 dB	2

Table 3: Measurement uncertainty

Comment: The uncertainty stated is the expanded uncertainty obtained by multiplying the standard uncertainty by the coverage factor k. If k=2 the value of the measurements lies within the assigned range of values with a probability of 95 %.



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# 14 Summary

The EMC Regulations according to the marked specifications are

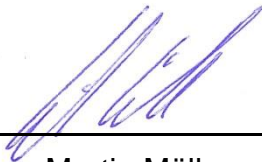
**KEPT**

The EUT does fulfill the general approval requirements mentioned.

**NOT KEPT**

The EUT does not fulfill the general approval requirements mentioned.

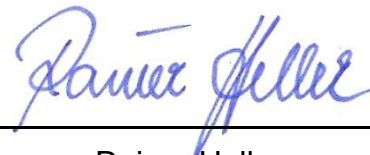
Place, Date:      Straubing, November 24<sup>th</sup>, 2016



Martin Müller

Test engineer

EMV **TESTHAUS** GmbH



Rainer Heller

Head of EMC / radio department

EMV **TESTHAUS** GmbH



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# 15 Revision History

Date	Description	Person	Revision
2016-11-24	First edition	M. Müller	----



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