

FCC Test Report (Part 15C)

NFC

Test report no.:	EMC_BO_002315 (v1.0)	Date of report:	28-Jul-2020
Number of pages:	26	Project support engineer:	Oliver Flecke
Test period:	06-Jul to 10-Jul-2020		

Applicant:	Molex CVS Dabendorf GmbH, Märkische Straße 72, 15806 Zossen, Germany, Mr. Michael Schmidt		
Manufacturer:	Molex CVS Dabendorf GmbH, Märkische Straße 72, 15806 Zossen, Germany		
EUT identification:	Wireless Mobile Interface (WMI), WCH-302 (WCH-302a, WCH-302b, WCH-302c, WCH-302d, WCH-302e, WCH-302f, WCH-302g, WCH-302h, WCH-302i)		
FCC ID:	RK7WCH-302	ISED ID:	4774A-WCH302

Testing laboratory:	Molex CVS Lab, Molex CVS Bochum GmbH, Meesmannstr.103, 44807 Bochum, Germany		
Tel.:	+49 234 51668-0		
e-mail:	Product.Validation.Bochum@molex.com		
FCC designation no.:	DE0017	ISED recognition no.:	DE0015
Laboratory manager:	Robert Müller		

Test result:	The EUT complies with the requirements made in the referred test documents.
---------------------	---

Approver:	Robert Müller	Technical review:	Frank Wittmann
Title:	Laboratory Manager	Title:	Senior Test Engineer EMC

Signature:		Signature:	
-------------------	---	-------------------	---

This test report may not be reproduced, except in full, without written permission of testing laboratory. The test result in this test report relates only to the tested sample, which is mentioned in this test report. Molex cannot be made responsible for any generalisations or conclusions drawn from this test report. Modification of the tested sample is prohibited and leads to invalidity of this test report.

Table of contents

VERSION HISTORY	3
1. SUMMARY FOR FCC PART 15C TEST REPORT	4
1.1. EUT AND ACCESSORY INFORMATION.....	4
1.2. TECHNICAL CHARACTERISTICS	5
1.3. APPLIED STANDARDS	6
1.4. MEASUREMENT UNCERTAINTIES	7
1.5. DECISION RULE	7
1.6. SUMMARY OF TEST RESULTS	8
2. TEST SETUPS	9
2.1. CONDUCTED RF TEST SETUP (SETUP 1)	9
2.2. CONDUCTED AC POWER LINE EMISSIONS TEST SETUP (SETUP 2)	9
2.3. RADIATED EMISSIONS TEST SETUP (SETUP 3)	9
3. FIELD STRENGTH IN THE 13.56 MHZ BAND	10
3.1. TEST METHOD AND LIMIT	10
3.2. TEST RESULTS (FCC/ISED)	11
4. RADIATED EMISSIONS BELOW 30 MHZ	15
4.1. TEST METHOD AND LIMIT	15
4.2. TEST RESULTS (FCC/ISED)	16
5. RADIATED EMISSIONS ABOVE 30 MHZ	20
5.1. TEST METHOD AND LIMIT	20
5.2. TEST RESULTS (FCC/ISED)	21
6. TEST EQUIPMENT	25
6.1. RADIATED EMISSION	25

Version History

Report Number	Date	Comment
EMC_BO_002315 (v1.0)	28-Jul-2020	1 st approved version
-	-	-
-	-	-
-	-	-

1. Summary for FCC Part 15C Test Report

Date of receipt	06-Jul-2020
Testing completed	10-Jul-2020
The customer's contact person	Mr. Michael Schmidt
Test samples / setup pictures	RK7WCH-302_EUT_&_Test_Setup_Photos_1.0.pdf
HW change / difference document	2.1_WCH-302_Difference_document_1.0.pdf 2.2_WCH-302_HW_change_description_V16 to V19_1.0.pdf 2.2_WCH-302_HW_change_description_V19 to V20_1.0.pdf
Notes	none

1.1. EUT and accessory information

OP1, OP2:

The EUT is an inductive wireless power transfer device (wireless charger) with RFID system (NFC) operating at 13.56 MHz. The EUT is tested with a commercially available mobile phone with a continuous NFC data read/write cycle (duty cycle of > 95 %). This test is performed with the integrated NFC antenna (OP1: loop antenna included in charging pad) and in addition with the external NFC antenna (OP2: separate loop antenna), which cannot be used simultaneously.

OP3, OP4:

In addition, the EUT is tested without mobile phone in a continuous NFC transmission mode with active modulation, configured via UART interface (duty cycle of 100 %). As well this test is performed with the integrated NFC antenna (OP3: loop antenna included in charging pad) and in addition with the external NFC antenna (OP4: separate loop antenna), which cannot be used simultaneously.

The following test samples provided by the customer were tested.

ID	Description	Manufacturer	Model	S/N	HW Version	SW Version
DAB200792E	WMI	Molex	WCH-302a	000002511CC2	V20	RC49

The following accessories have been provided by the customer and belong to the equipment under test (EUT).

ID	Description	Manufacturer	Type	S/N	HW Version	SW Version
DAB191880E	System Cable	Molex	-	-	-	-
DAB200856E	RF Cable + Bias-T (100k)	Molex	-	-	-	-
DAB200462E	External NFC Antenna + External LED	-	-	-	-	-
Galaxy S10	Mobile Phone	Samsung	Galaxy S10	RF8N11GL RPK	-	-

1.2. Technical characteristics

Power Supply [V]	Lead-acid battery (vehicle regulated) – 12 V DC		
Voltage Range [V]	$U_{nom} = 12.0$	$U_{min} = 10.2$	$U_{max} = 13.8$
Charging cut-off Voltage [V]	$U_{cut-off} = 6.2$ (NFC is stopped for $U < U_{cut-off}$)		
Temperatures Range [°C]	-40 - +85		
Radio Type	NFC transceiver		
Operating Frequency [MHz]	13.56		
Operating Channels	Not channelized		
Antenna Type	Integral (1x internal, 1x external)		
Antenna gain [dBi]	n.a.		
Product Category	RFID		
Modulation Type	ASK		
RFID Classification	Wideband (ISO14443, NFC...)		

Above technical information was provided by the applicant. For more details, please refer to the User's manual of the EUT.

1.3. Applied standards

Standard / Rule Part	Version	Year
CFR 47, FCC Part 15C	-	Jul-2020
ANSI C63.10	-	Jun-2013
ISED RSS-Gen	Issue 5 + AMD1	Mar-2019
ISED RSS-210	Issue 10	Dec-2019

Deviations or clarifications to these standards are noted in the related test result under “test method and limit”.

1.4. Measurement uncertainties

Parameter	Measurement Uncertainty	Maximum Uncertainty
Radio Frequency	$\pm 3.6 \times 10^{-7}$	$\pm 1 \times 10^{-5}$
Total RF Power, conducted	± 0.79 dB	± 1.5 dB
RF Power density, conducted	± 0.79 dB	± 3.0 dB
Spurious emissions, conducted	± 1.67 dB	± 3.0 dB
All emissions, radiated	± 5.38 dB	± 6.0 dB
Temperature	± 1.0 °C	± 3 °C
Humidity	± 2.0 %	± 5.0 %

These uncertainties represent an expanded uncertainty expressed approximately at the 95% confidence level using a coverage factor of k=2

1.5. Decision rule

In this test report the measurement uncertainty is not included in the test result.

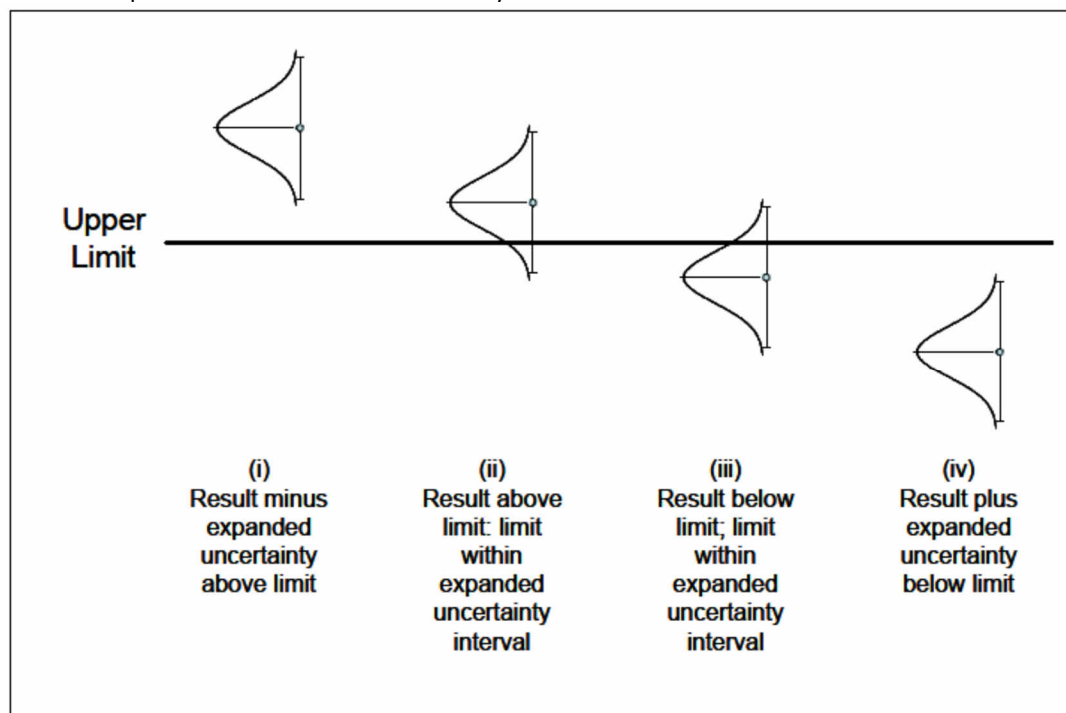


Figure 1: Assessment of Compliance with an Upper Limit (Source: EURACHEM/CITAC Guide: Use of uncertainty information in compliance assessment; First edition 2007)

- (i) measurement value is clearly above the limit, result is failed
- (ii) measurement value is above the limit, result is failed
- (iii) measurement value is below the limit, result is passed
- (iv) measurement value is clearly below the limit, result is passed

1.6. Summary of test results

Section	Section in CFR 47	Section in RSS-Gen	Section in RSS-210	Name of the test	Result
3	15.225 (a)(b)(c)	-	B.6 (a)	Field strength in the 13.56 MHz band	PASSED
4	15.225 (d), 15.209	8.9	-	Radiated emissions below 30 MHz	PASSED
5	15.225 (d), 15.209	8.9	-	Radiated emissions above 30 MHz	PASSED
-	15.225 (e)	8.11	B.6 (b)	Frequency stability, temperature variation	NP
-	15.225 (e)	8.11	B.6 (b)	Frequency stability, voltage variation	NP
-	15.207	8.8	-	AC powerline conducted emissions	NA
-	15.215 (c)	6.7	-	Occupied bandwidth	NP

PASSED: The EUT complies with the essential requirements in the standard.

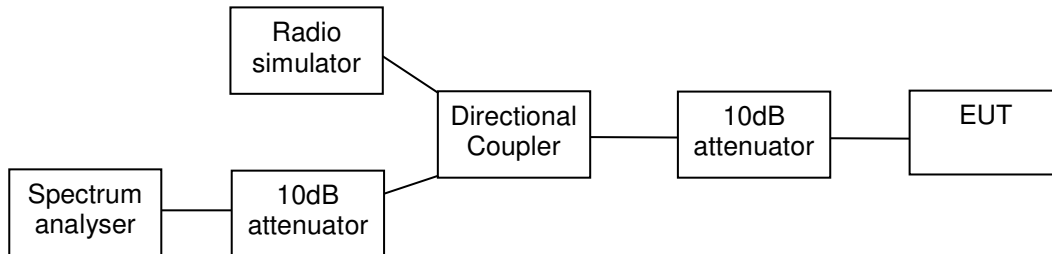
FAILED: The EUT does not comply with the essential requirements in the standard.

NP: The test was not performed for the given HW changes.

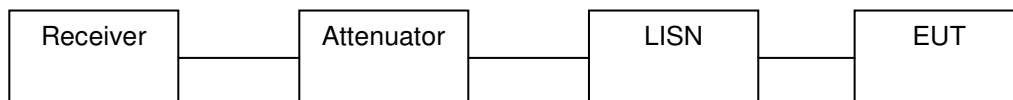
NA: The test was not applicable.

2. Test setups

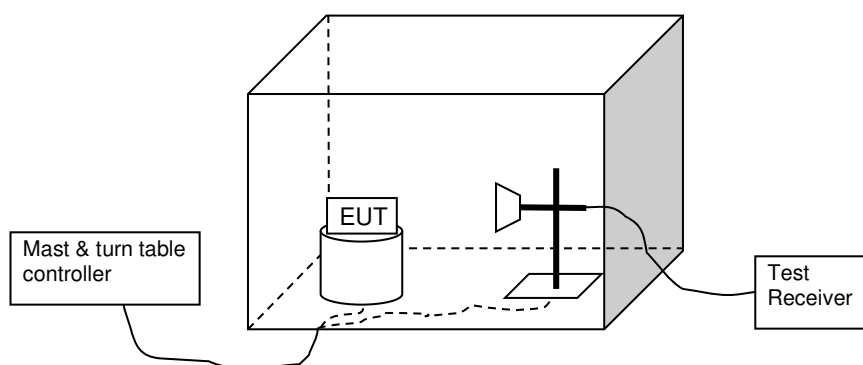
2.1. Conducted RF test setup (Setup 1)



2.2. Conducted AC power line emissions test setup (Setup 2)



2.3. Radiated emissions test setup (Setup 3)



3. Field strength in the 13.56 MHz band

EUT with DUT number	DAB200792E
Accessories with DUT numbers	DAB191880E, DAB200462E, DAB200856E, Galaxy S10
Operation voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1, OP2, OP3, OP4
Temp [°C] / humidity [%RH]	23.7 °C / 51.0 %
Date of measurement	06-Jul to 10-Jul-2020
Test engineer	Frank Wittmann
Test system SW version	V1.7.1

3.1. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-Gen as follows:

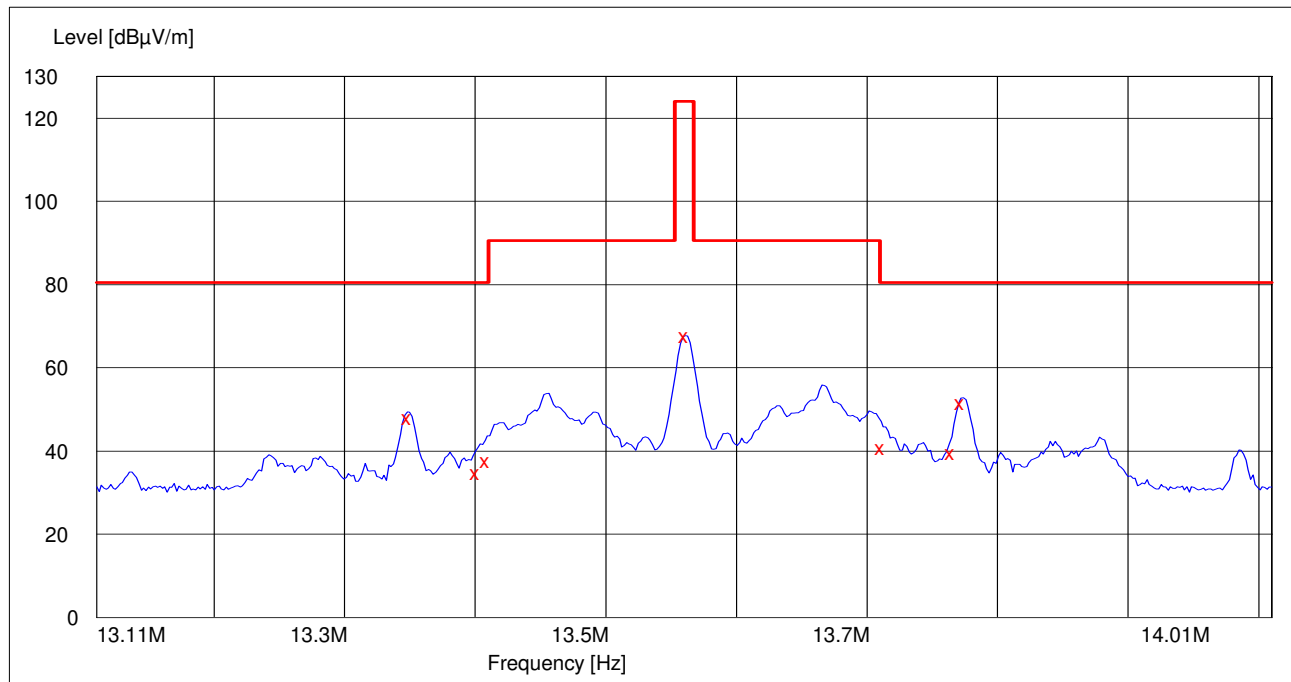
- ⇒ The measurement distance is 3 m with a shielded loop antenna. The magnetic field to electric field conversion factor is 51.5 dB ($\text{dB}\mu\text{A}/\text{m} = \text{dB}\mu\text{V}/\text{m} - 51.5 \text{ dB}$).
- ⇒ The Limit has been adjusted with the distance correction factor according to 15.31(f)(2). (+40 dB for 30 m distance and +80 dB for 300 m distance)
- ⇒ The measurement is divided into the Preliminary Measurement and the Final Measurement.
The Preliminary Measurement and the Final Measurement are performed with the measuring antenna at fixed height using a 2-axis EUT position system, set on the turntable, which is rotated by 360 degrees.
- ⇒ During the Preliminary Measurement, the suspected frequencies are searched by using the PK detector. In the Final Measurement the exact frequency and amplitude of these emissions are re-measured by using the applicable QP detector.
- ⇒ The Final Measurement is performed if the Preliminary Measurement results are closer than 20 dB to the permissible limit.
- ⇒ The measurement results are obtained as described in the following formula: $E [\text{dB}\mu\text{V}/\text{m}] = U_{\text{RX}} + A_{\text{CF}}$
Where U_{RX} is receiver reading and A_{CF} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{\text{CF}} = L_{\text{CABLES}} + \text{AF} - G_{\text{PREAMP}}$).
- ⇒ Example values and calculation for one final QP measurement frequency at 13.56 MHz, see result in 3.2:
 $E [\text{dB}\mu\text{V}/\text{m}] = 44.40 + 23.40 = 67.80$

Limits for field strength (13.56 MHz band) measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\text{dB}\mu\text{A}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector
13.553 - 13.567	15.848 * 100	84 + 40 dB	QP
13.410 - 13.553	334 * 100	50.5 + 40 dB	QP
13.567 - 13.710			QP
13.110 - 13.410	106 * 100	40.5 + 40 dB	QP
13.710 - 14.010			QP

3.2. Test results (FCC/ISED)

OP1: Peak detector (RBW 10 kHz)

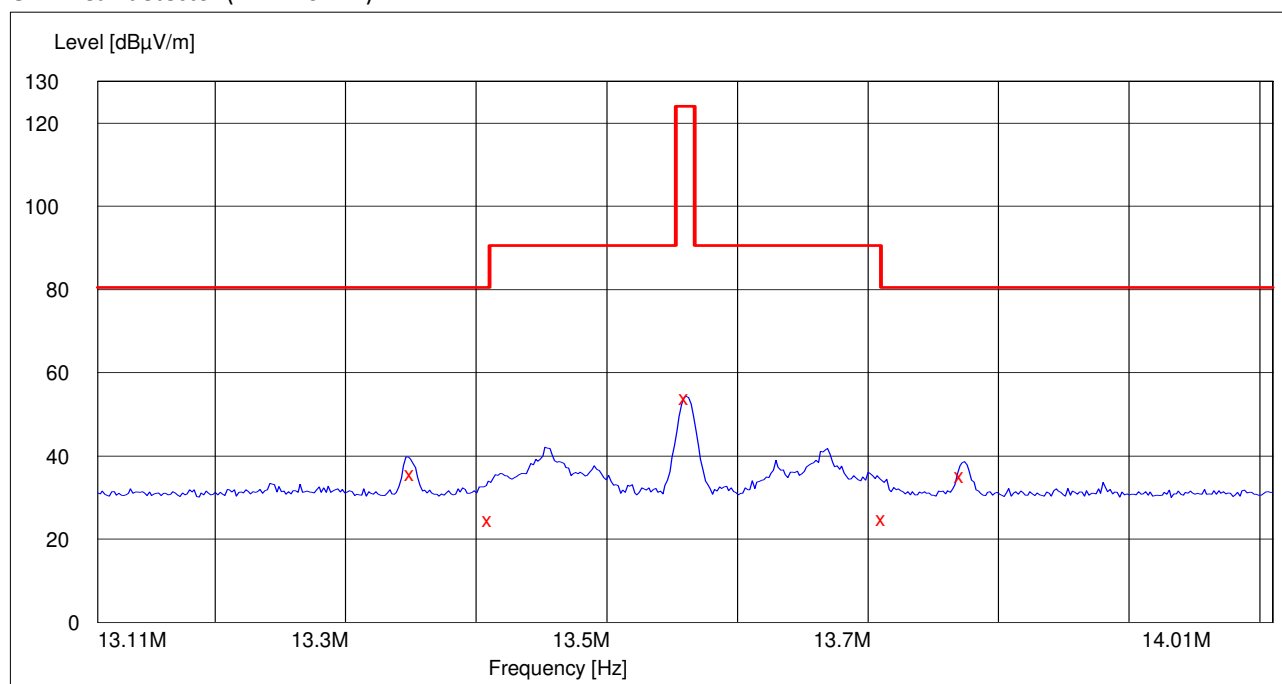


Quasi-Peak detector (RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
13.349000	48.10	23.40	80.50	32.40	170.0	199.00	VERTICAL	PASSED
13.402000	34.80	23.40	80.50	45.70	170.0	189.00	VERTICAL	PASSED
13.409000	37.70	23.40	80.50	42.80	170.0	195.00	VERTICAL	PASSED
13.561000	67.80	23.40	124.00	56.20	170.0	203.00	VERTICAL	PASSED
13.712000	40.70	23.40	80.50	39.80	170.0	195.00	VERTICAL	PASSED
13.765500	39.70	23.40	80.50	40.80	170.0	199.00	VERTICAL	PASSED
13.773000	51.70	23.40	80.50	28.80	170.0	206.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP2: Peak detector (RBW 10 kHz)

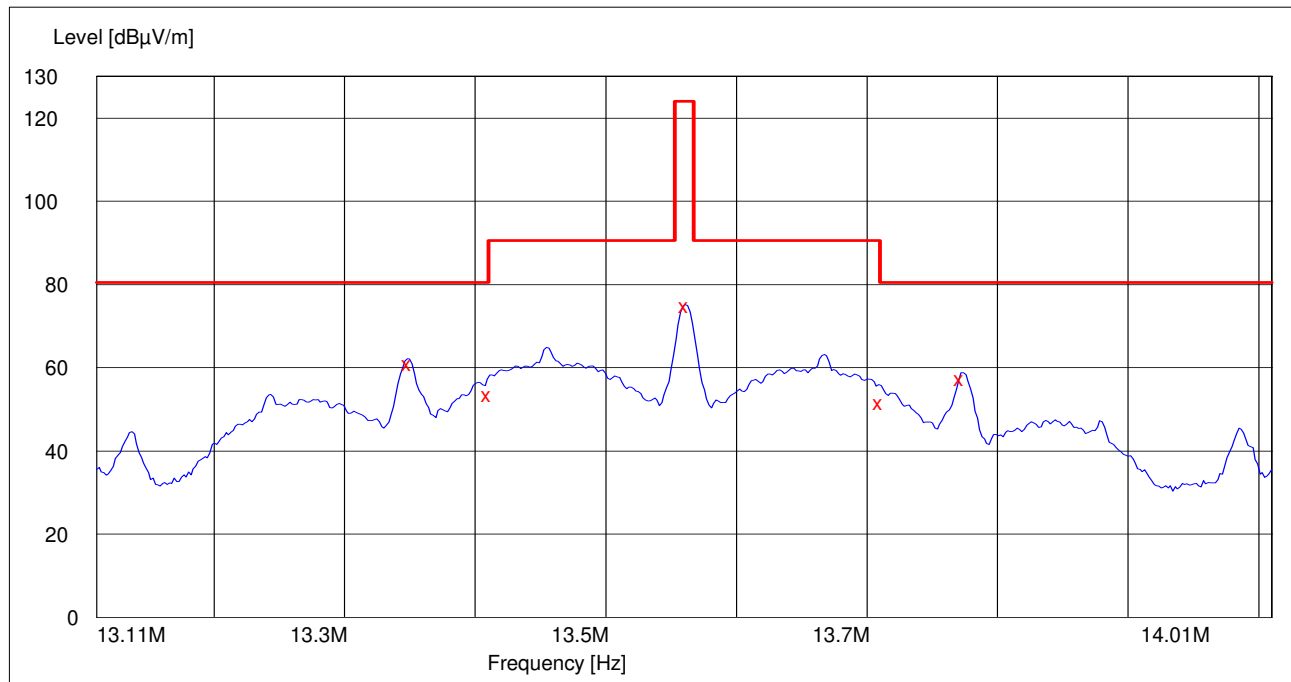


Quasi-Peak detector (RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
13.350500	35.90	23.40	80.50	44.60	170.0	357.00	VERTICAL	PASSED
13.410000	24.70	23.40	80.50	55.80	170.0	20.00	VERTICAL	PASSED
13.560500	54.00	23.40	124.00	70.00	170.0	0.00	VERTICAL	PASSED
13.712000	25.10	23.40	80.50	55.40	170.0	342.00	VERTICAL	PASSED
13.772000	35.40	23.40	80.50	45.10	170.0	355.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP3: Peak detector (RBW 10 kHz)

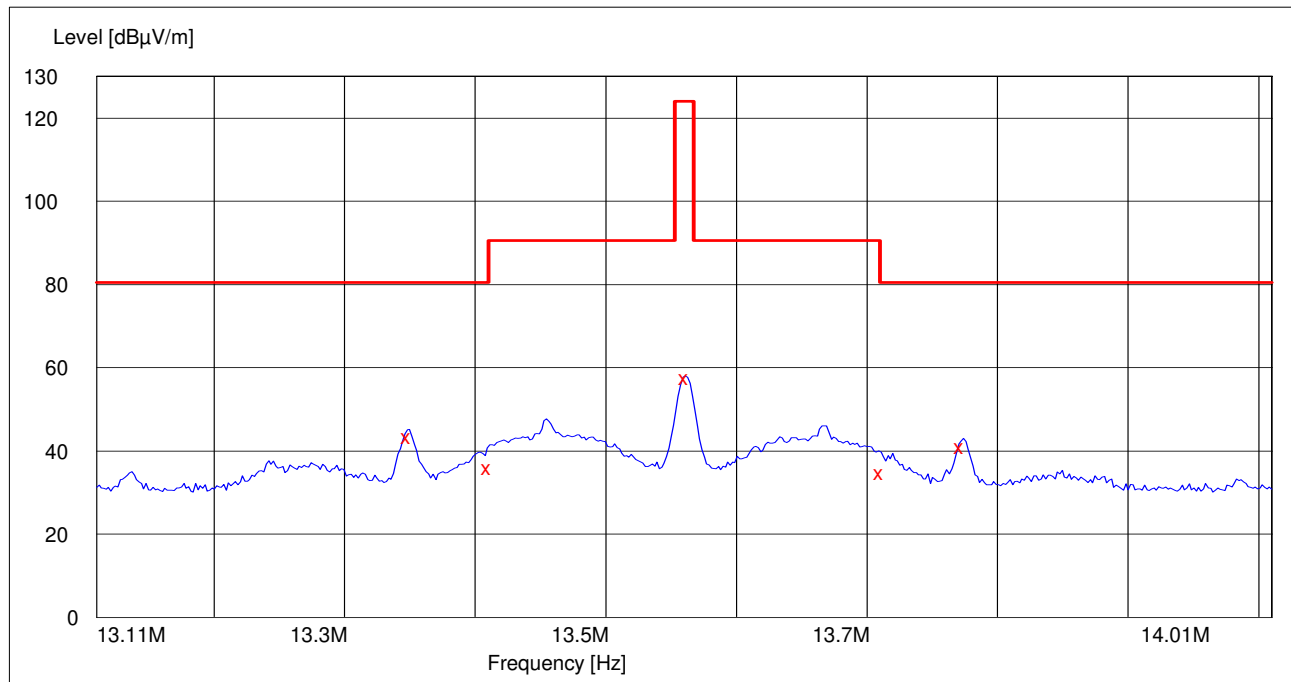


Quasi-Peak detector (RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
13.349000	60.90	23.40	80.50	19.60	170.0	23.00	VERTICAL	PASSED
13.410000	53.60	23.40	80.50	26.90	170.0	26.00	VERTICAL	PASSED
13.561000	75.00	23.40	124.00	49.00	170.0	23.00	VERTICAL	PASSED
13.710500	51.80	23.40	80.50	28.70	170.0	24.00	VERTICAL	PASSED
13.772500	57.50	23.40	80.50	23.00	170.0	22.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP4: Peak detector (RBW 10 kHz)



Quasi-Peak detector (RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
13.348500	43.40	23.40	80.50	37.10	170.0	224.00	VERTICAL	PASSED
13.410000	36.00	23.40	80.50	44.50	170.0	228.00	VERTICAL	PASSED
13.561000	57.80	23.40	124.00	66.20	170.0	227.00	VERTICAL	PASSED
13.711000	34.80	23.40	80.50	45.70	170.0	235.00	VERTICAL	PASSED
13.772500	41.00	23.40	80.50	39.50	170.0	224.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

4. Radiated emissions below 30 MHz

EUT with DUT number	DAB200792E
Accessories with DUT numbers	DAB191880E, DAB200462E, DAB200856E, Galaxy S10
Operation voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1, OP2, OP3, OP4
Temp [°C] / humidity [%RH]	23.7 °C / 51.0 %
Date of measurement	06-Jul to 10-Jul-2020
Test engineer	Frank Wittmann
Test system SW version	V1.7.1

4.1. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-Gen as follows:

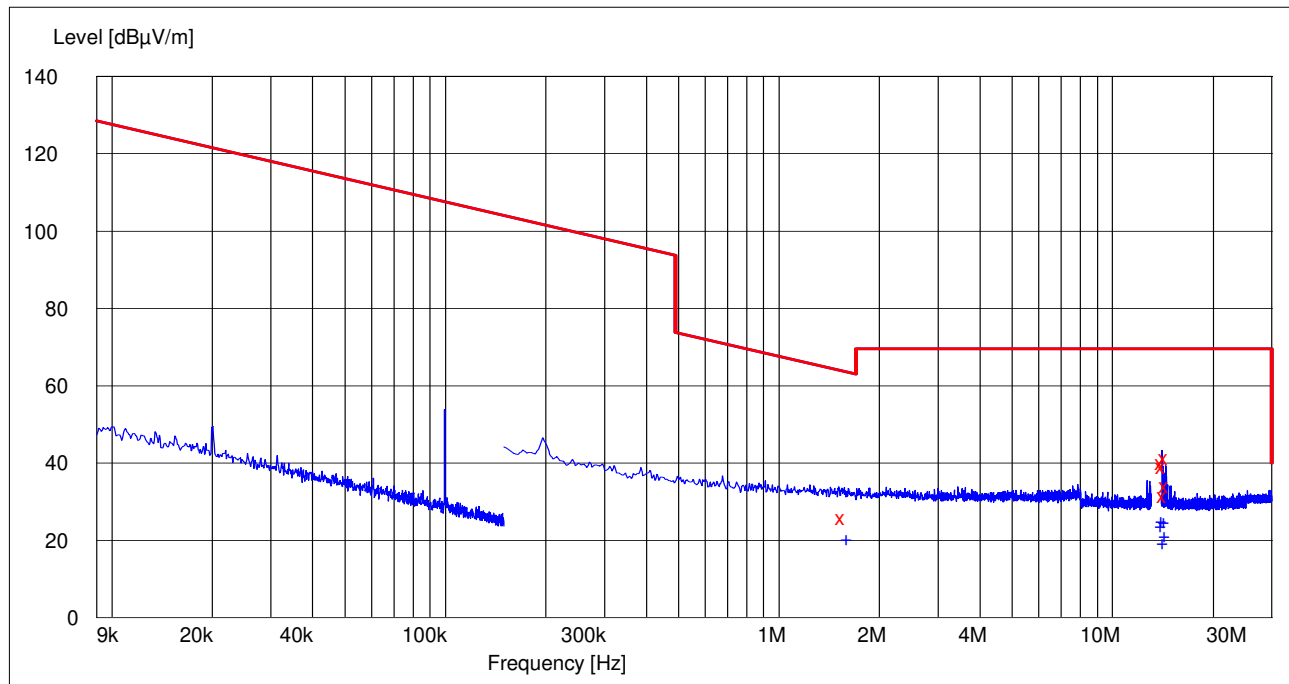
- ⇒ The measurement distance is 3 m with a shielded loop antenna. The magnetic field to electric field conversion factor is 51.5 dB ($\text{dB}\mu\text{A}/\text{m} = \text{dB}\mu\text{V}/\text{m} - 51.5 \text{ dB}$).
- ⇒ The Limit has been adjusted with the distance correction factor according to 15.31(f)(2). (+40 dB for 30 m distance and +80 dB for 300 m distance)
- ⇒ The measurement is divided into the Preliminary Measurement and the Final Measurement.
The Preliminary Measurement and the Final Measurement are performed with the measuring antenna at fixed height using a 2-axis EUT position system, set on the turntable, which is rotated by 360 degrees.
- ⇒ During the Preliminary Measurement, the suspected frequencies are searched by using the PK detector. In the Final Measurement the exact frequency and amplitude of these emissions are re-measured by using the applicable QP and AV detector.
- ⇒ The Final Measurement is performed if the Preliminary Measurement results are closer than 20 dB to the permissible limit.
- ⇒ The measurement results are obtained as described in the following formula: $E [\text{dB}\mu\text{V}/\text{m}] = U_{\text{RX}} + A_{\text{CF}}$
Where U_{RX} is receiver reading and A_{CF} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{\text{CF}} = L_{\text{CABLES}} + \text{AF} - G_{\text{PREAMP}}$).
- ⇒ Example values and calculation for one final QP measurement frequency at 14.41 MHz, see result in 4.2:
 $E [\text{dB}\mu\text{V}/\text{m}] = 18.00 + 23.40 = 41.40$

FCC and ISSED limits for radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector
0.009 - 0.09	$10000 * 2400 / f[\text{kHz}]$	128.5 - 93.8	AV
0.09 - 0.11			QP
0.11 - 0.19			AV
0.19 - 0.49			AV
0.490 - 1.705	$100 * 24000 / f[\text{kHz}]$	73.8 - 63.0	QP
1.705 - 30.0	$100 * 30$	69.5	QP

4.2. Test results (FCC/ISED)

OP1: Peak detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 10 kHz)



Quasi-Peak detector (< 150 kHz: RBW 200 Hz, >150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBµV/m]	Transducer [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.549000	25.80	23.10	63.80	38.00	170.0	162.00	VERTICAL	PASSED
14.090000	40.00	23.40	69.50	29.50	170.0	200.00	VERTICAL	PASSED
14.196000	39.10	23.40	69.50	30.40	170.0	27.00	VERTICAL	PASSED
14.301500	31.70	23.40	69.50	37.80	170.0	25.00	VERTICAL	PASSED
14.408500	41.40	23.40	69.50	28.10	170.0	165.00	VERTICAL	PASSED
14.514500	34.00	23.40	69.50	35.50	170.0	197.00	VERTICAL	PASSED

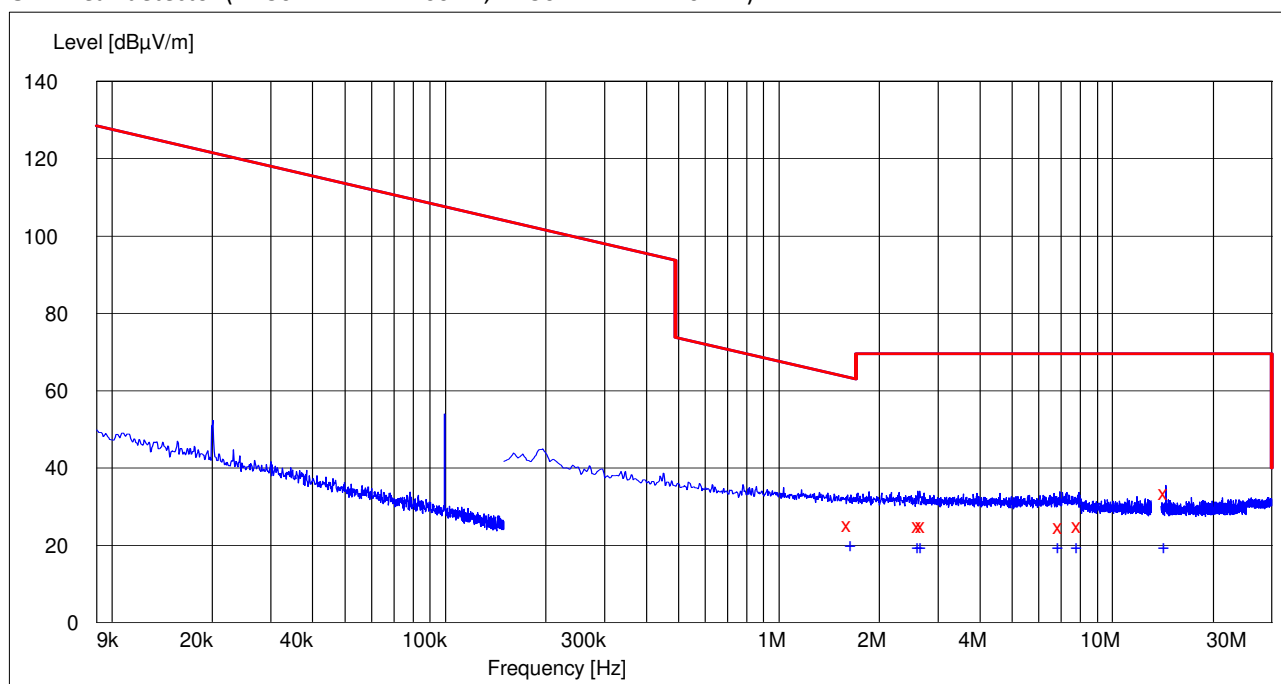
No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

Average detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBµV/m]	Transducer [dB]	Limit [dBµV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.612500	20.60	23.10	63.50	42.90	170.0	150.00	VERTICAL	PASSED
14.090500	24.20	23.40	69.50	45.30	170.0	194.00	VERTICAL	PASSED
14.196500	25.30	23.40	69.50	44.20	170.0	27.00	VERTICAL	PASSED
14.303500	19.60	23.40	69.50	49.90	170.0	21.00	VERTICAL	PASSED
14.408500	25.00	23.40	69.50	44.50	170.0	165.00	VERTICAL	PASSED
14.514000	21.60	23.40	69.50	47.90	170.0	208.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP2: Peak detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 10 kHz)



Quasi-Peak detector (< 150 kHz: RBW 200 Hz, >150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.620500	25.50	23.10	63.40	37.90	170.0	315.00	VERTICAL	PASSED
2.631500	25.10	23.10	69.50	44.40	170.0	109.00	VERTICAL	PASSED
2.694000	25.10	23.10	69.50	44.40	170.0	218.00	VERTICAL	PASSED
6.968000	24.80	23.50	69.50	44.70	170.0	19.00	VERTICAL	PASSED
7.916500	25.20	23.50	69.50	44.30	170.0	142.00	VERTICAL	PASSED
14.407000	33.70	23.40	69.50	35.80	170.0	9.00	VERTICAL	PASSED

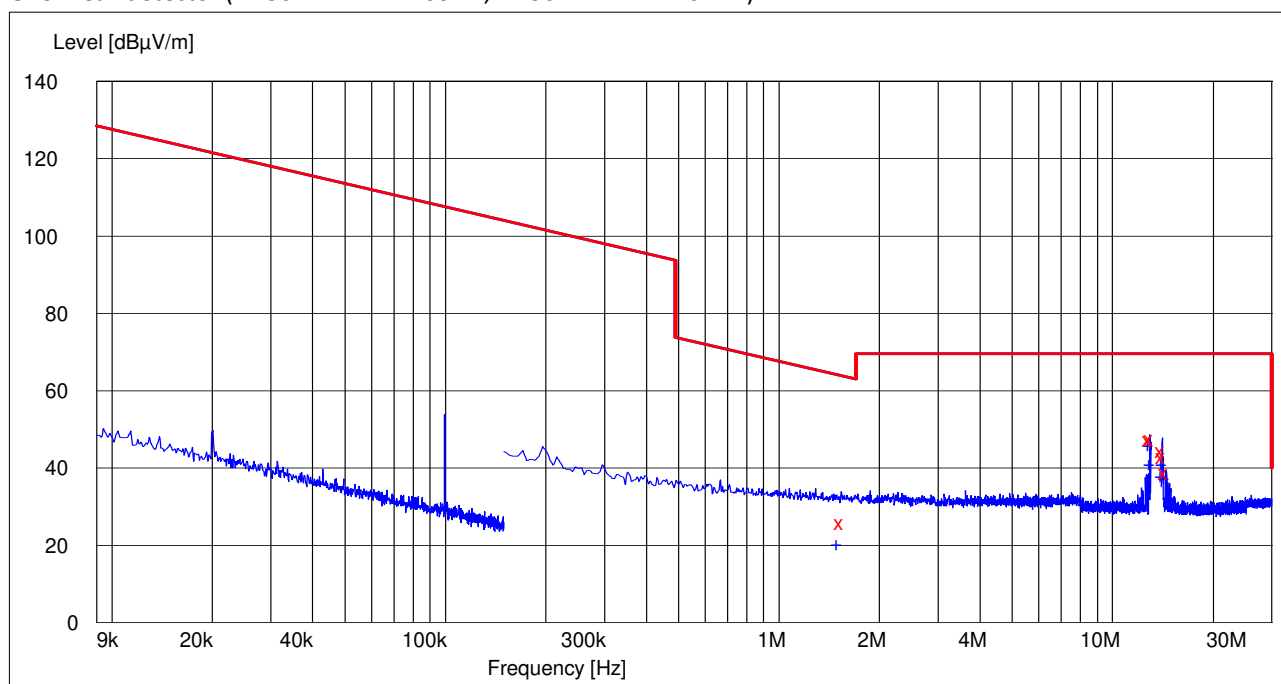
No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

Average detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.659500	20.50	23.10	63.20	42.70	170.0	320.00	VERTICAL	PASSED
2.627000	20.00	23.10	69.50	49.50	170.0	133.00	VERTICAL	PASSED
2.683500	20.00	23.10	69.50	49.50	170.0	224.00	VERTICAL	PASSED
6.939500	19.90	23.50	69.50	49.60	170.0	29.00	VERTICAL	PASSED
7.903000	20.10	23.50	69.50	49.40	170.0	165.00	VERTICAL	PASSED
14.409000	19.80	23.40	69.50	49.70	170.0	14.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP3: Peak detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 10 kHz)



Quasi-Peak detector (< 150 kHz: RBW 200 Hz, >150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.539000	25.80	23.10	63.90	38.10	170.0	322.00	VERTICAL	PASSED
12.925500	47.40	23.40	69.50	22.10	170.0	27.00	VERTICAL	PASSED
13.031000	47.50	23.40	69.50	22.00	170.0	17.00	VERTICAL	PASSED
14.090500	44.50	23.40	69.50	25.00	170.0	195.00	VERTICAL	PASSED
14.197000	42.80	23.40	69.50	26.70	170.0	31.00	VERTICAL	PASSED
14.408000	39.00	23.40	69.50	30.50	170.0	226.00	VERTICAL	PASSED

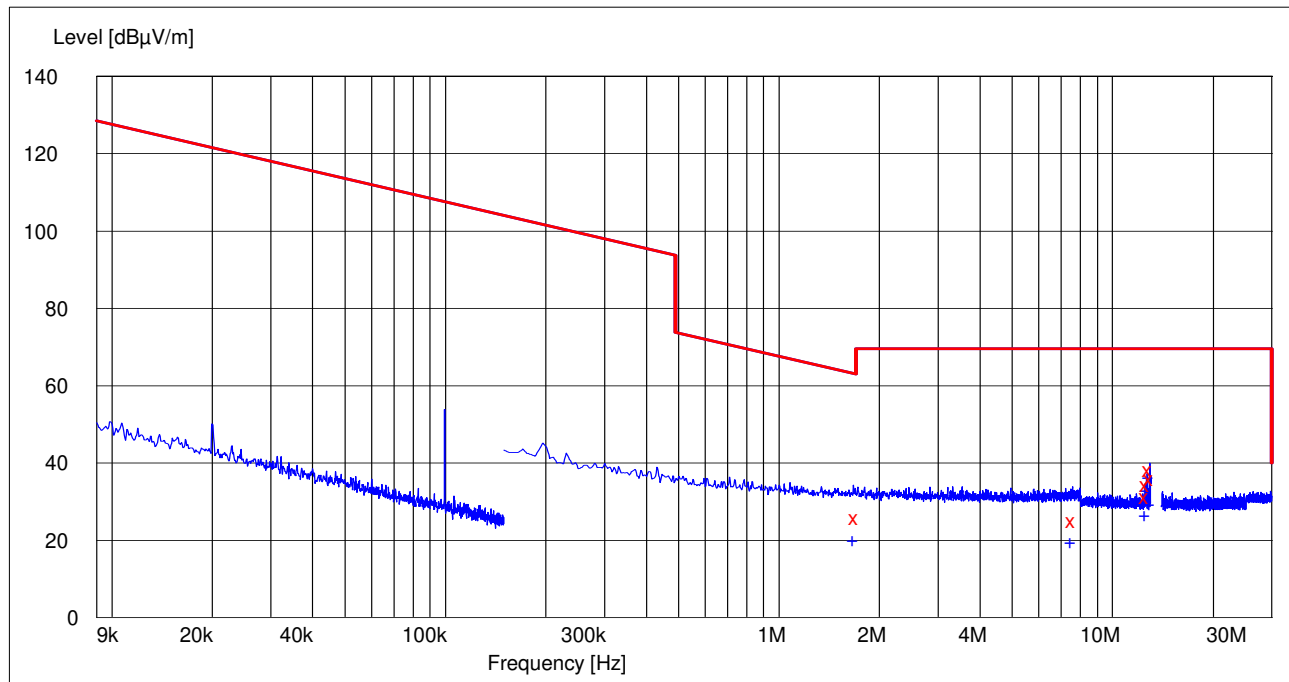
No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

Average detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.503000	20.70	23.10	64.10	43.40	170.0	342.00	VERTICAL	PASSED
12.925500	46.40	23.40	69.50	23.10	170.0	21.00	VERTICAL	PASSED
13.031000	41.40	23.40	69.50	28.10	170.0	25.00	VERTICAL	PASSED
14.091000	38.40	23.40	69.50	31.10	170.0	195.00	VERTICAL	PASSED
14.196000	41.60	23.40	69.50	27.90	170.0	21.00	VERTICAL	PASSED
14.408000	37.80	23.40	69.50	31.70	170.0	224.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP4: Peak detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 10 kHz)



Quasi-Peak detector (< 150 kHz: RBW 200 Hz, >150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.701500	25.80	23.10	63.00	37.20	170.0	11.00	VERTICAL	PASSED
7.617500	25.20	23.50	69.50	44.30	170.0	29.00	VERTICAL	PASSED
12.609000	31.30	23.50	69.50	38.20	170.0	336.00	VERTICAL	PASSED
12.712000	34.40	23.40	69.50	35.10	170.0	358.00	VERTICAL	PASSED
12.925000	38.20	23.40	69.50	31.30	170.0	226.00	VERTICAL	PASSED
13.030500	35.90	23.40	69.50	33.60	170.0	231.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

Average detector (< 150 kHz: RBW 200 Hz, > 150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
1.680000	20.50	23.10	63.10	42.60	170.0	0.00	VERTICAL	PASSED
7.552000	20.00	23.50	69.50	49.50	170.0	13.00	VERTICAL	PASSED
12.606500	26.90	23.50	69.50	42.60	170.0	344.00	VERTICAL	PASSED
12.713000	33.30	23.40	69.50	36.20	170.0	11.00	VERTICAL	PASSED
12.925500	36.80	23.40	69.50	32.70	170.0	224.00	VERTICAL	PASSED
13.032500	29.80	23.40	69.50	39.70	170.0	229.00	VERTICAL	PASSED

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

5. Radiated emissions above 30 MHz

EUT with DUT number	DAB200792E
Accessories with DUT numbers	DAB191880E, DAB200462E, DAB200856E, Galaxy S10
Operation voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1, OP2, OP3, OP4
Temp [°C] / humidity [%RH]	23.7 °C / 51.0 %
Date of measurement	06-Jul to 10-Jul-2020
Test engineer	Frank Wittmann
Test system SW version	V1.7.1

5.1. Test method and limit

The measurement is made according to ANSI C63.10 and RSS-Gen as follows:

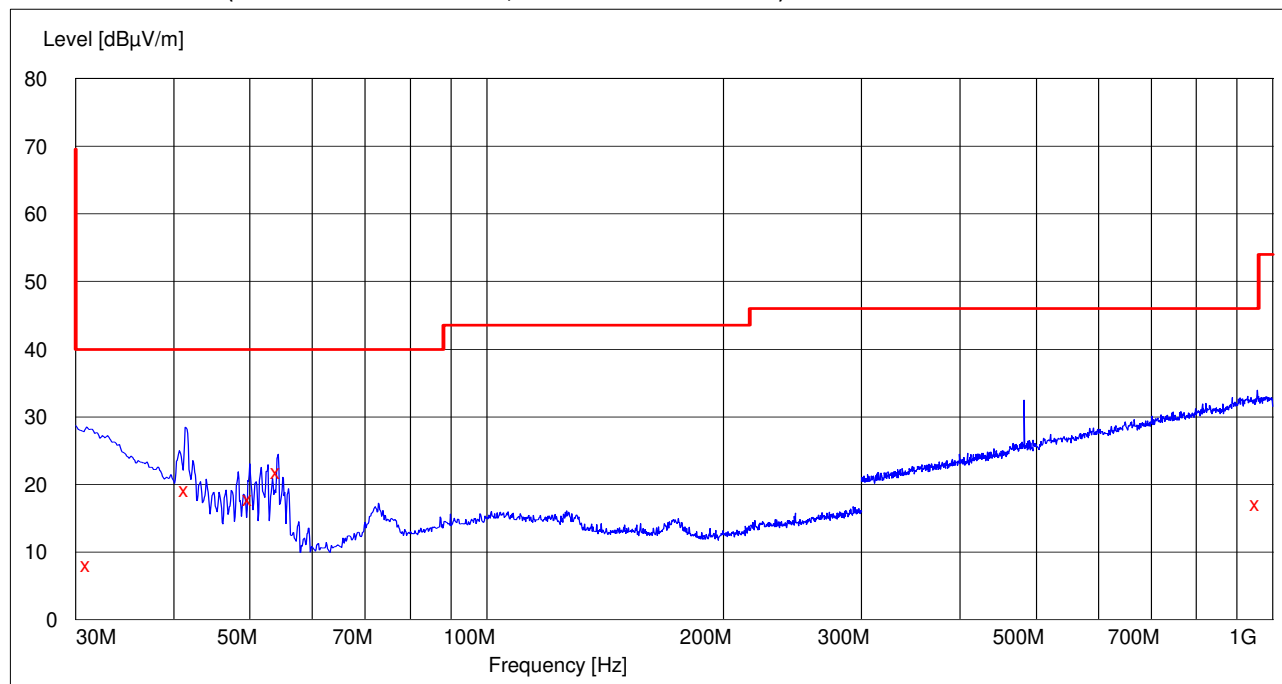
- ⇒ The EUT is placed on a nonconductive plate in the centre of the turntable.
- ⇒ The measurement is divided into the Preliminary Measurement and the Final Measurement.
The Preliminary Measurement and the Final Measurement is performed in 3 m distance without floor absorbers by rotating the turntable of 360 degrees and moving the antenna height between 1-4 m.
- ⇒ During the Preliminary Measurement, the suspected frequencies are searched by using the PK detector.
In the Final Measurement the exact frequency and amplitude of these emissions are re-measured by using the applicable QP detector.
- ⇒ The Final Measurement is performed if the Preliminary Measurement results are closer than 20 dB to the permissible limit.
- ⇒ The measurement results are obtained as described in the following formula: $E \text{ [dB}\mu\text{V/m]} = U_{RX} + A_{CF}$
Where U_{RX} is receiver reading and A_{CF} is total correction factor including cable loss, antenna factor and preamplifier gain ($A_{CF} = L_{CABLES} + AF - G_{PREAMP}$).
- ⇒ Example values and calculation for one final QP measurement frequency at 54.29 MHz, see result in 5.2:
 $E \text{ [dB}\mu\text{V/m]} = 53.70 - 31.80 = 21.90$

FCC and ISSED limits for radiated emissions measurements (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Limit [dB $\mu\text{V/m}$]	Detector
30 – 88	100	40	QP
88 – 216	150	43.5	QP
216 – 960	200	46	QP
960 – 1000	500	54	QP

5.2. Test results (FCC/ISED)

OP1: Peak detector (< 300 MHz: RBW 300 kHz, > 300 MHz: RBW 1 MHz)

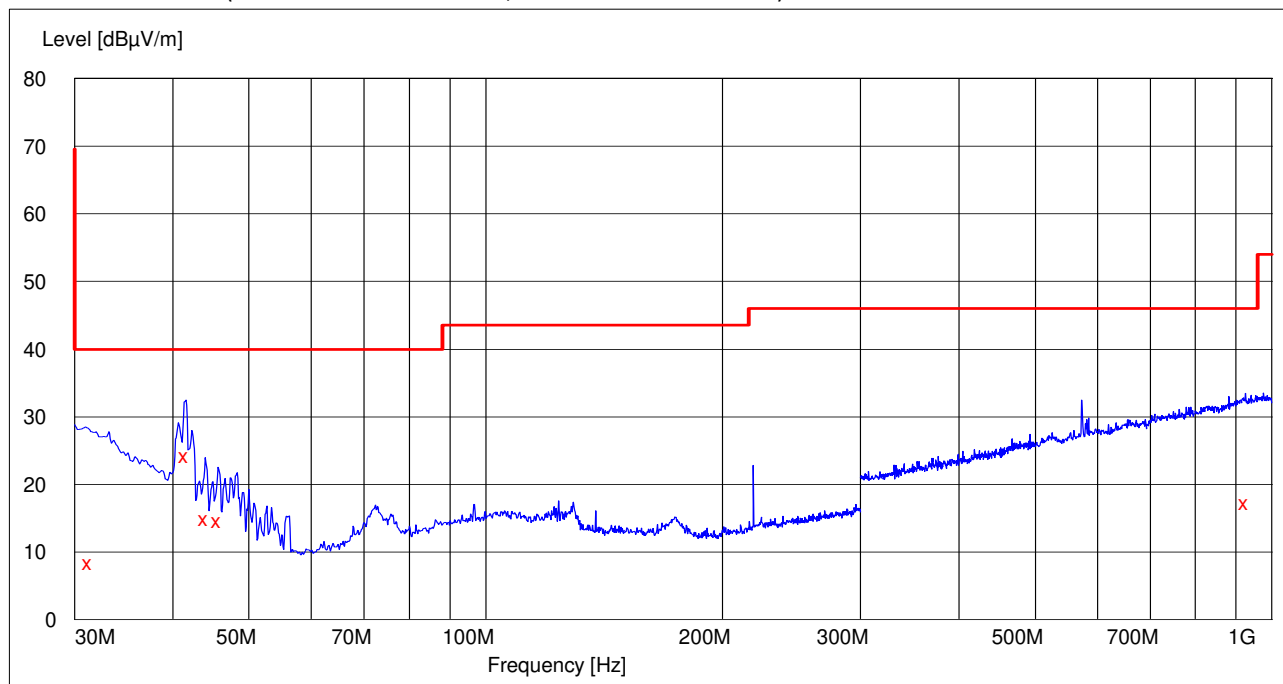


Quasi-Peak detector (RBW 120 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
31.100000	8.20	-26.50	40.00	31.80	276.0	73.00	HORIZONTAL	PASSED
41.502605	19.20	-29.70	40.00	20.80	98.0	195.00	VERTICAL	PASSED
49.959920	17.90	-31.40	40.00	22.10	98.0	14.00	VERTICAL	PASSED
54.288577	21.90	-31.80	40.00	18.10	101.0	345.00	VERTICAL	PASSED
955.611824	17.20	-16.40	46.00	28.80	124.0	75.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP2: Peak detector (< 300 MHz: RBW 300 kHz, > 300 MHz: RBW 1 MHz)

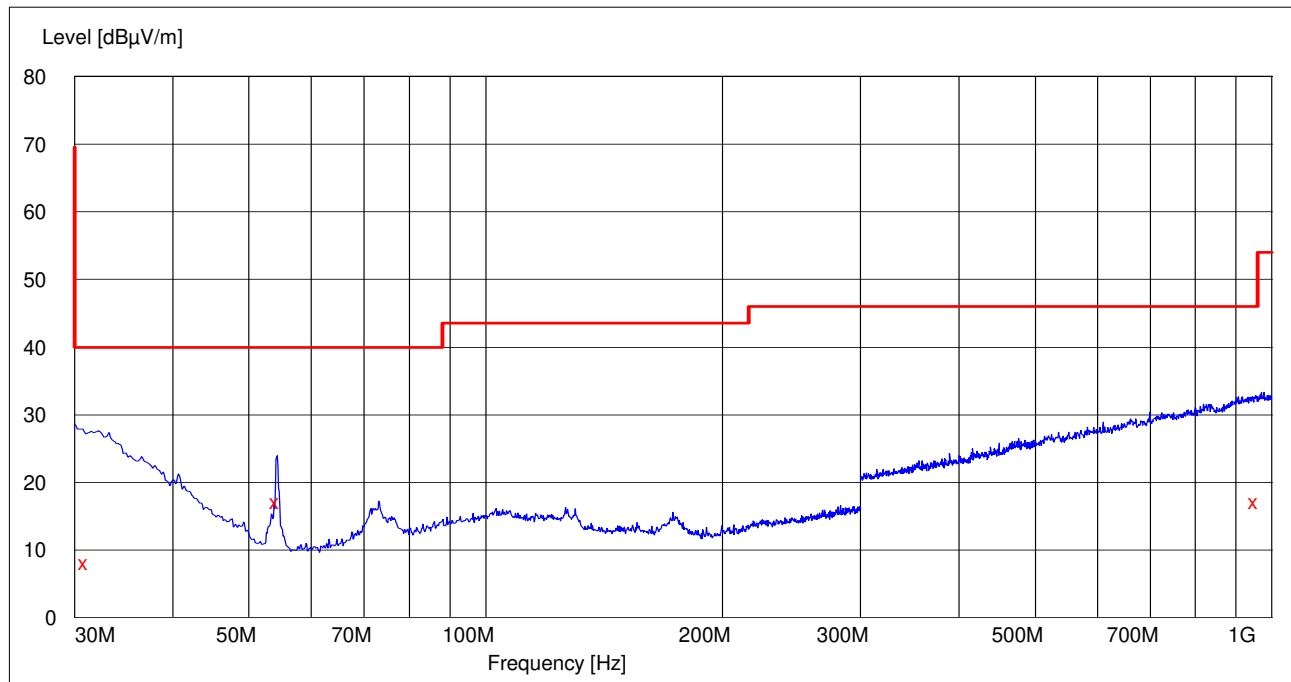


Quasi-Peak detector (RBW 120 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
31.300000	8.40	-26.60	40.00	31.60	176.0	74.00	VERTICAL	PASSED
41.543086	24.20	-29.70	40.00	15.80	98.0	312.00	VERTICAL	PASSED
44.047896	14.90	-30.20	40.00	25.10	124.0	200.00	VERTICAL	PASSED
45.731263	14.60	-30.50	40.00	25.40	98.0	131.00	VERTICAL	PASSED
926.651703	17.30	-16.30	46.00	28.70	266.0	284.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP3: Peak detector (< 300 MHz: RBW 300 kHz, > 300 MHz: RBW 1 MHz)

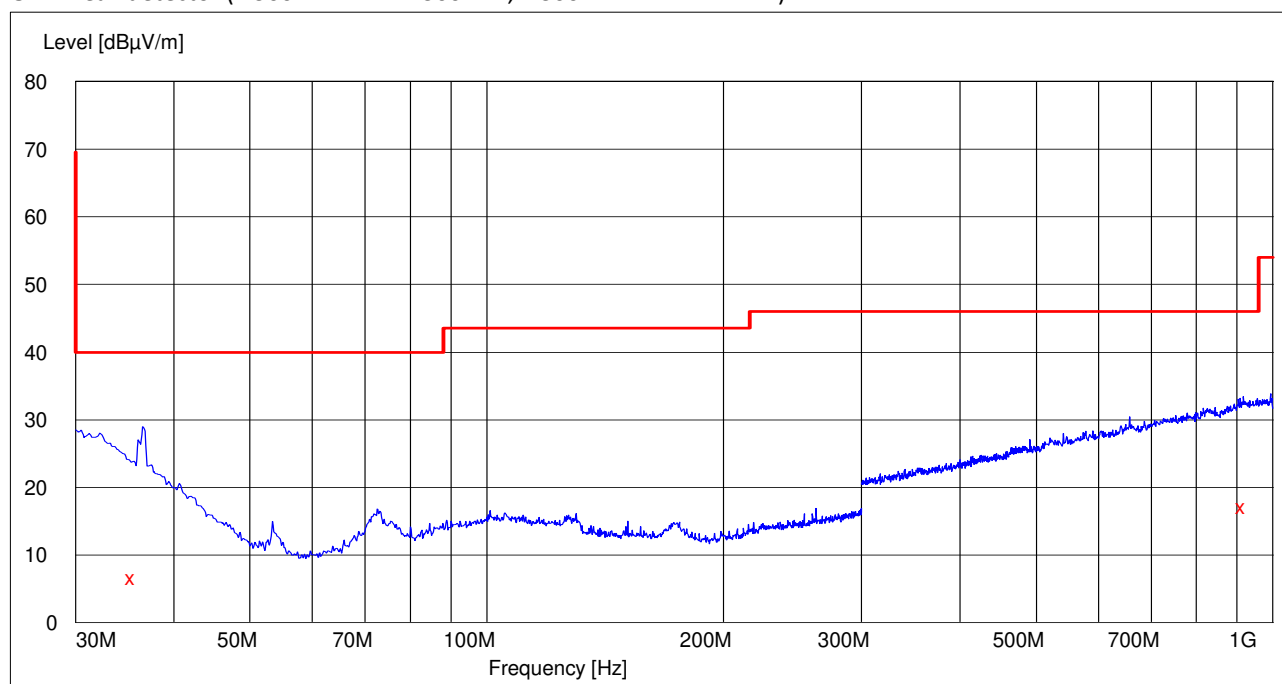


Quasi-Peak detector (RBW 120 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
31.000000	8.20	-26.50	40.00	31.80	101.0	223.00	VERTICAL	PASSED
54.288577	17.20	-31.80	40.00	22.80	123.0	345.00	VERTICAL	PASSED
954.707816	17.20	-16.40	46.00	28.80	126.0	44.00	HORIZONTAL	PASSED
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

OP4: Peak detector (< 300 MHz: RBW 300 kHz, > 300 MHz: RBW 1 MHz)



Quasi-Peak detector (RBW 120 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
35.492986	6.70	-28.00	40.00	33.30	176.0	312.00	HORIZONTAL	PASSED
917.835671	17.10	-16.40	46.00	28.90	176.0	105.00	VERTICAL	PASSED
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-

No further emissions found less than 20 dB to the regulatory limit and no emission found in the restricted bands of operation.

6. Test Equipment

6.1. Radiated Emission

Equipment	Manufacturer	Type	Serial No.	Actual Calibration	Next Calibration
Antenna	Schwarzbeck Mess-Elektronik	FMZB_1519	1519-056	14.07.2017	14.07.2020
EMI Test Receiver	ROHDE & SCHWARZ	ESIB26	827769/010	14.05.2020	14.05.2021
Signal Generator	ROHDE & SCHWARZ	SMP02	828269/008	12.05.2020	12.05.2023
Signal Generator	ROHDE & SCHWARZ	SML01	100652	06.04.2018	06.04.2021
Power Supply	Hewlett Packard - Agilent	E3632A	KR75303301	11.05.2020	11.05.2022
Radio Communication Tester	ROHDE & SCHWARZ	CMU 200	101138	13.05.2020	13.05.2022
Field Analyzer	Wandel & Goltermann	EMR20	P-0030	23.11.2017	23.11.2020
Antenna	ROHDE & SCHWARZ	HL025	359012/006	-	-
EMI Test Receiver	ROHDE & SCHWARZ	ESU26	100077	14.05.2020	14.05.2021
Temp. / Humidity Logger	Lufft	Opus 10	13262	21.01.2020	21.01.2023
Antenna	ROHDE & SCHWARZ	HL562	100191	26.10.2018	26.10.2021
Antenna	ROHDE & SCHWARZ	HK-116: 20-300MHz	825177/0017	21.07.2017	21.07.2020
Antenna	ROHDE & SCHWARZ	HK-116: 20-300MHz	100401	21.07.2017	21.07.2020
Antenna	ROHDE & SCHWARZ	HL223	832369/006	26.04.2019	26.04.2022
Antenna	Schwarzbeck	UBA 9116	9116-396	28.07.2017	28.07.2020
Antenna	Emco	3115	9810-5588	24.04.2018	24.04.2021
Antenna	Schwarzbeck	BBHA-9120-D	01617	09.04.2019	09.04.2022
Antenna	ROHDE & SCHWARZ	HL223	100731	07.12.2018	07.12.2021
H-Field Probe 100 cm ²	Narda Safety Test Solutions GmbH	Probe	M-0823	07.12.2017	07.12.2020
H-field Probe 3cm ²	Narda Safety Test Solutions GmbH	2300/90.20	C-0150	23.04.2018	23.04.2021
Antenna	Schwarzbeck Mess-Elektronik	VAMP 9243	9243-486	23.05.2018	23.05.2021
Exposure Level Tester	Narda Safety Test Solutions GmbH	ELT-400	N-0385	07.12.2017	07.12.2020
Antenna	Emco	3160-09	1232	07.08.2017	07.08.2020
Isotropic Electric Field Probe	Wandel & Goltermann	Type 8	M-0082	23.11.2017	23.11.2020
Signal Generator	ROHDE & SCHWARZ	SMB100A	181275	12.05.2020	12.05.2021
EMI Test Receiver	ROHDE & SCHWARZ	ESW44	101733	12.05.2020	12.05.2021
Vector Signal Generator	ROHDE & SCHWARZ	SMBV100A	263158	16.05.2020	16.05.2021
Wideband Radio Comm. Tester	ROHDE & SCHWARZ	CMW500	101674	13.05.2020	13.05.2021

End of Report