

FCC Test Report (Part 15C)

WPT

Test report no.:	EMC_BO_002298 (v1.0)	Date of report:	14-May-2020
Number of pages:	21	Project support engineer:	Oliver Flecke
Test period:	14-Apr to 08-May-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		
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	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.
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Approver:	Jürgen Mitterer	Technical review:	Frank Wittmann
Title:	Validation and Test Engineering Manager	Title:	Senior Test Engineer EMC

Signature:		Signature:	
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Version History

Report Number	Date	Comment
EMC_BO_002298 (v1.0)	14-May-2020	1 st approved version
-	-	-
-	-	-
-	-	-

1. Summary for FCC Part 15C Test Report

Date of receipt	14-Apr-2020
Testing completed	08-May-2020
The customer's contact person	Mr. Michael Schmidt
Test samples / setup pictures	RK7302-00_EUT_&_Test_Setup_Photos_1.0.pdf
HW change / difference document	2.1_WCH-302_Difference_document_1.0.pdf
Notes	none

1.1. EUT and accessory Information

OP1: (5 W, BPP)

The EUT is an inductive wireless power transfer device (wireless charger) with transmitter and load modulation operating at 127.55 kHz. The EUT is tested with an artificial load, continuously charging at 5 W (duty cycle of 100 %).

The following test samples provided by the customer were tested.

ID	Description	Manufacturer	Model	S/N	HW Version	SW Version
DAB200448E	WMI	Molex	WCH-302a	000002511C02	V16	RC36+
DAB200490E	WMI	Molex	WCH-302a	000002511C04	V16	RC36+

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
DAB191879E	System Cable	Molex	-	-	-	-
DAB191878E	System Cable	Molex	-	-	-	-
DAB16069E	RF Cable + Bias-T (100k)	Molex	-	-	-	-
DAB16071E	RF Cable + Bias-T (100k)	Molex	-	-	-	-
DAB200463E	External NFC Antenna	-	-	-	-	-
DAB191907E	External NFC Antenna	-	-	-	-	-
GRA180347E	Load Receiver (5 W)	Molex	-	-	1.0	-
NOV16037E	Load Receiver (5 W)	Molex	-	0013	1.0	-

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]	$U_{cut-off} = 8.8$ (wireless power transfer is stopped for $U < U_{cut-off}$)		
Temperatures Range [°C]	-40 - +60		
Radio Type	WPT transceiver		
Operating Frequency Range [kHz]	127.55		
Communication Frequency [kHz]	Same as operating frequency range		
Operating Channels	Not channelized		
Antenna Type	Integral inductive loop coils $< 0.05 \text{ m}^2$ (no customization allowed)		
Antenna gain [dBi]	n.a.		
Product Category	Category I radio apparatus (type 3)		
Modulation Type	H-field for charging is not modulated		
Modulation Technique	H-field for charging is not modulated		

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	-	May-2020
ANSI C63.10	-	Jun-2013
ISED RSS-Gen	Issue 5 + AMD1	Mar-2019
ISED RSS-216	Issue 2	Jan-2016

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.

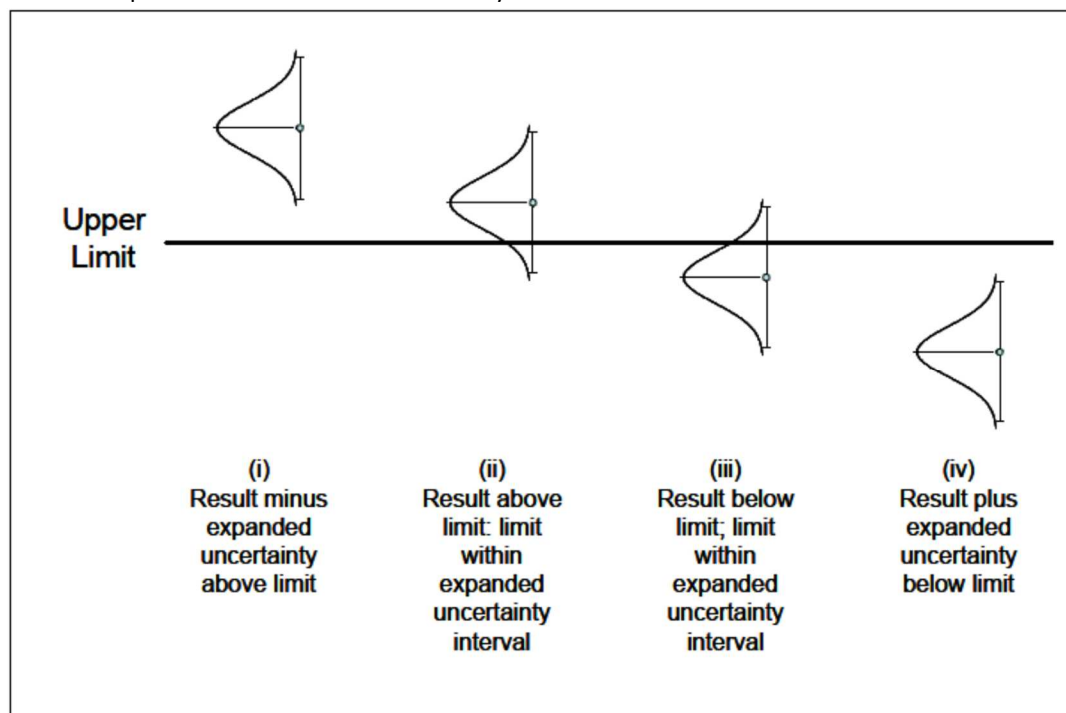


Figure 1: Assessment of Compliance with an Upper Limit (Source: EURACHEM/CITAC Guide: Use of uncertainty information in compliance assessment; First edition 2007)

- (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-216	Name of the test	Result
3 & 4	15.205, 15.209	8.9, 8.10	6.2.2.2, 6.2.3 (Type 3 WPT devices)	Radiated emissions	PASSED
-	15.207	-	6.2.2.1	AC powerline conducted emissions	NA
5	15.215 (c)	6.7	-	Occupied bandwidth	PASSED

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

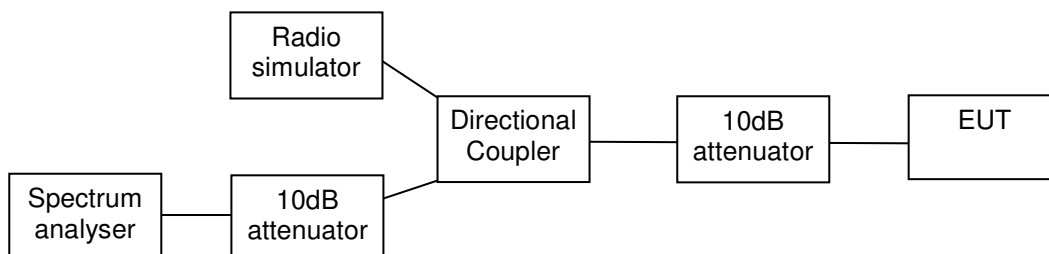
FAILED: The EUT does not comply with the essential requirements in the standard.

NP: The test was not performed.

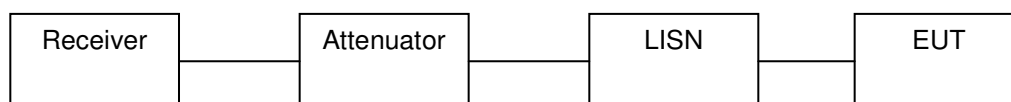
NA: The test was not applicable.

2. Test setups

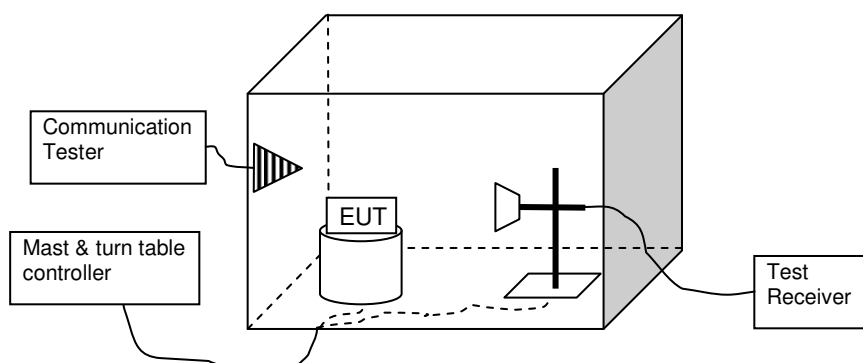
2.1. Conducted RF test setup (Setup 1)



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



2.3. Radiated emissions test setup (Setup 3)



3. Radiated emissions below 30 MHz

EUT with DUT number	DAB200448E
Accessories with DUT numbers	DAB191879E, DAB16069E, DAB200463E, GRA180347E
Operation Voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1
Temp [°C] / Humidity [%RH]	22.9 °C / 41.0 %
Date of measurement	14-Apr to 29-Apr-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 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 ($A_{\text{CF}} = L_{\text{CABLES}} + \text{AF} - G_{\text{PREAMP}}$).

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

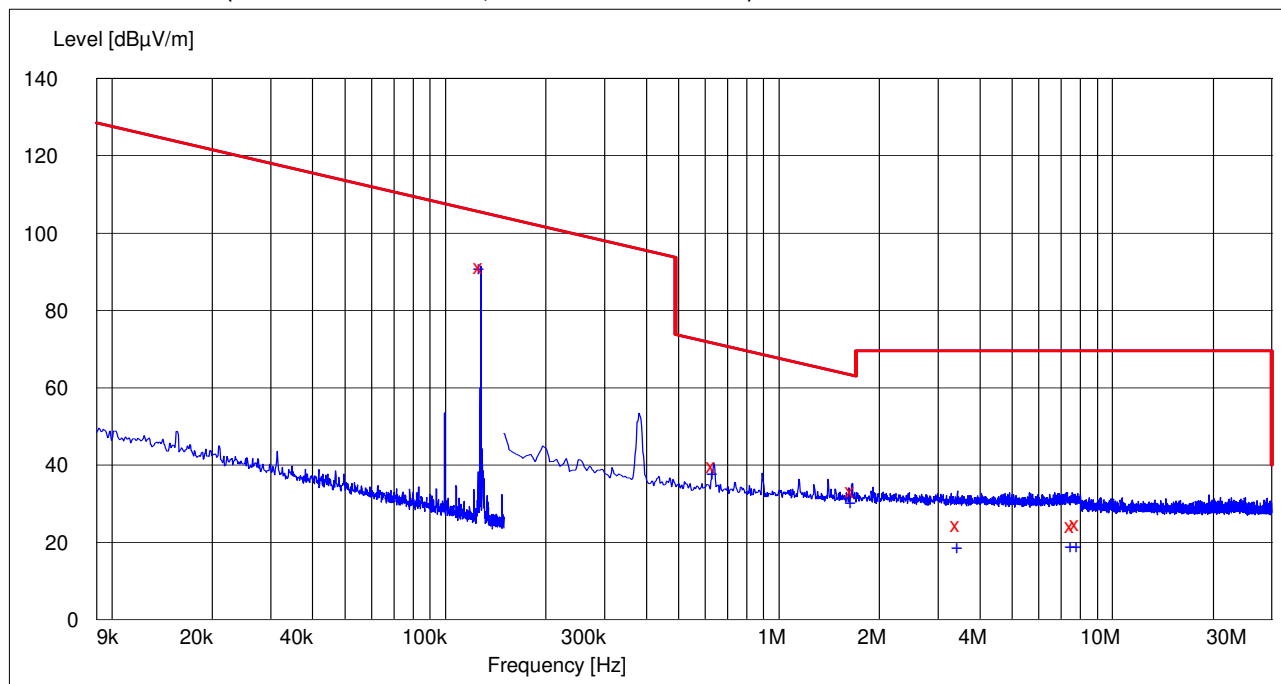
Frequency range [MHz]	Limit [$\mu\text{V}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector
0.009 - 0.09	$10000 * 2400 / f[\text{kHz}]$	128.5 - 93.8	AV
0.09 - 0.11			QP
0.11 - 0.19			AV
0.19 - 0.49			AV
0.490 - 1.705	$100 * 24000 / f[\text{kHz}]$	73.8 - 63.0	QP
1.705 - 30.0	$100 * 30$	69.5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

CISPR11 Induction cooking (group 2) limits (3 m measurement distance)

Frequency range [MHz]	Limit [$\text{dB}\mu\text{A}/\text{m}$]	Limit [$\text{dB}\mu\text{V}/\text{m}$]	Detector
0.009 - 0.070	69.0	120.5	QP
0.070 - 0.1485	69 - 39	120.5 - 90.5	QP
0.1485 - 4.0	39 - 3	90.5 - 54.5	QP
4.0 - 30	3	54.5	QP

3.2. Test results (FCC)

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
0.127561	91.30	23.20	105.50	14.20	170.0	215.00	VERTICAL	PASSED
0.636972	39.90	23.40	71.50	31.60	170.0	190.00	VERTICAL	PASSED
1.657516	33.40	23.10	63.20	29.80	170.0	13.00	VERTICAL	PASSED
3.424053	24.50	23.20	69.50	45.00	170.0	43.00	VERTICAL	PASSED
7.541300	24.40	23.50	69.50	45.10	170.0	335.00	VERTICAL	PASSED
7.834921	24.80	23.50	69.50	44.70	170.0	165.00	VERTICAL	PASSED

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

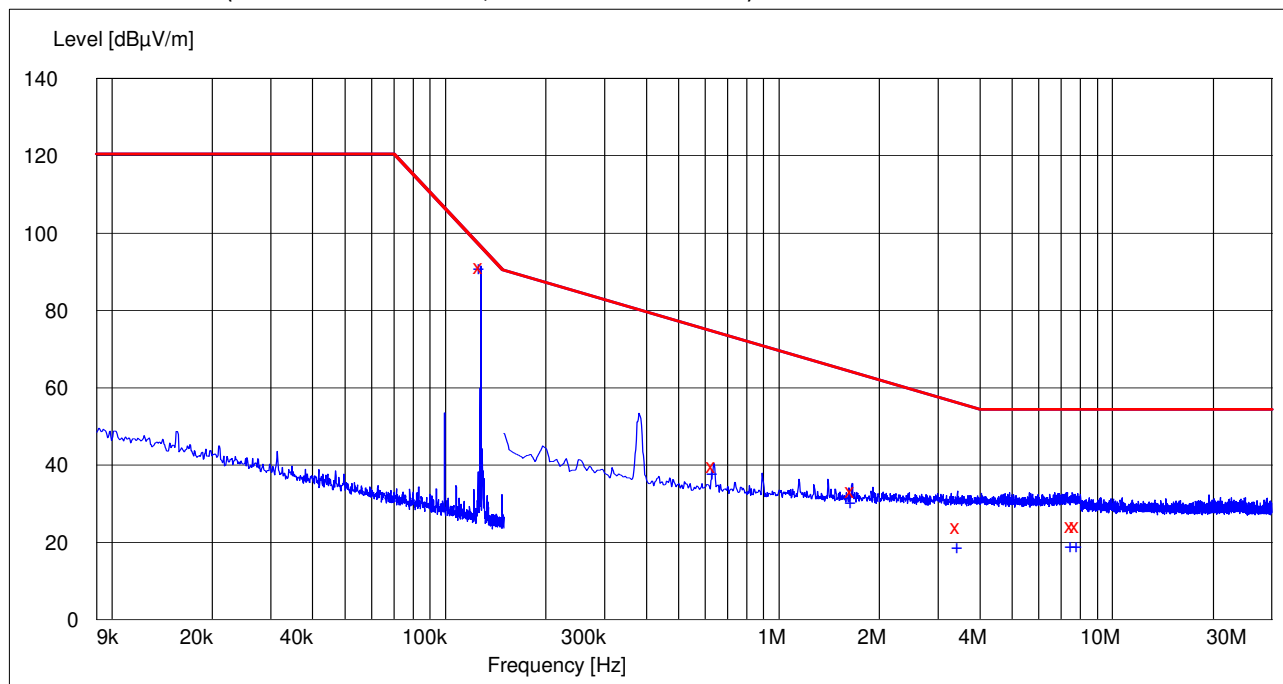
Average detector (< 150 kHz: RBW 200Hz, > 150 kHz: RBW 9 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
0.127561	91.30	23.20	105.50	14.20	170.0	215.00	VERTICAL	PASSED
0.637472	38.40	23.40	71.50	33.10	170.0	190.00	VERTICAL	PASSED
1.658516	30.80	23.10	63.20	32.40	170.0	0.00	VERTICAL	PASSED
3.458053	19.20	23.20	69.50	50.30	170.0	67.00	VERTICAL	PASSED
7.586800	19.40	23.50	69.50	50.10	170.0	320.00	VERTICAL	PASSED
7.888921	19.40	23.50	69.50	50.10	170.0	195.00	VERTICAL	PASSED

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

3.3. Test results (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
0.127561	91.30	23.20	96.60	5.30	170.0	215.00	VERTICAL	PASSED
0.636972	39.90	23.40	74.60	34.70	170.0	190.00	VERTICAL	PASSED
1.657516	33.50	23.10	64.10	30.60	170.0	13.00	VERTICAL	PASSED
3.424053	24.10	23.20	56.20	32.10	170.0	43.00	VERTICAL	PASSED
7.541300	24.40	23.50	54.50	30.10	170.0	335.00	VERTICAL	PASSED
7.834921	24.40	23.50	54.50	30.10	170.0	165.00	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
0.127561	91.30	23.20	96.60	5.30	170.0	215.00	VERTICAL	PASSED
0.637472	38.40	23.40	74.60	36.20	170.0	190.00	VERTICAL	PASSED
1.658516	30.80	23.10	64.10	33.30	170.0	0.00	VERTICAL	PASSED
3.458053	19.20	23.20	56.10	36.90	170.0	67.00	VERTICAL	PASSED
7.586800	19.40	23.50	54.50	35.10	170.0	320.00	VERTICAL	PASSED
7.888921	19.40	23.50	54.50	35.10	170.0	195.00	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 above 30 MHz

EUT with DUT number	DAB200448E
Accessories with DUT numbers	DAB191879E, DAB16069E, DAB200463E, GRA180347E
Operation Voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1
Temp [°C] / Humidity [%RH]	22.9 °C / 41.0 %
Date of measurement	14-Apr to 29-Apr-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 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 ($A_{CF} = L_{CABLES} + AF - G_{PREAMP}$).

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

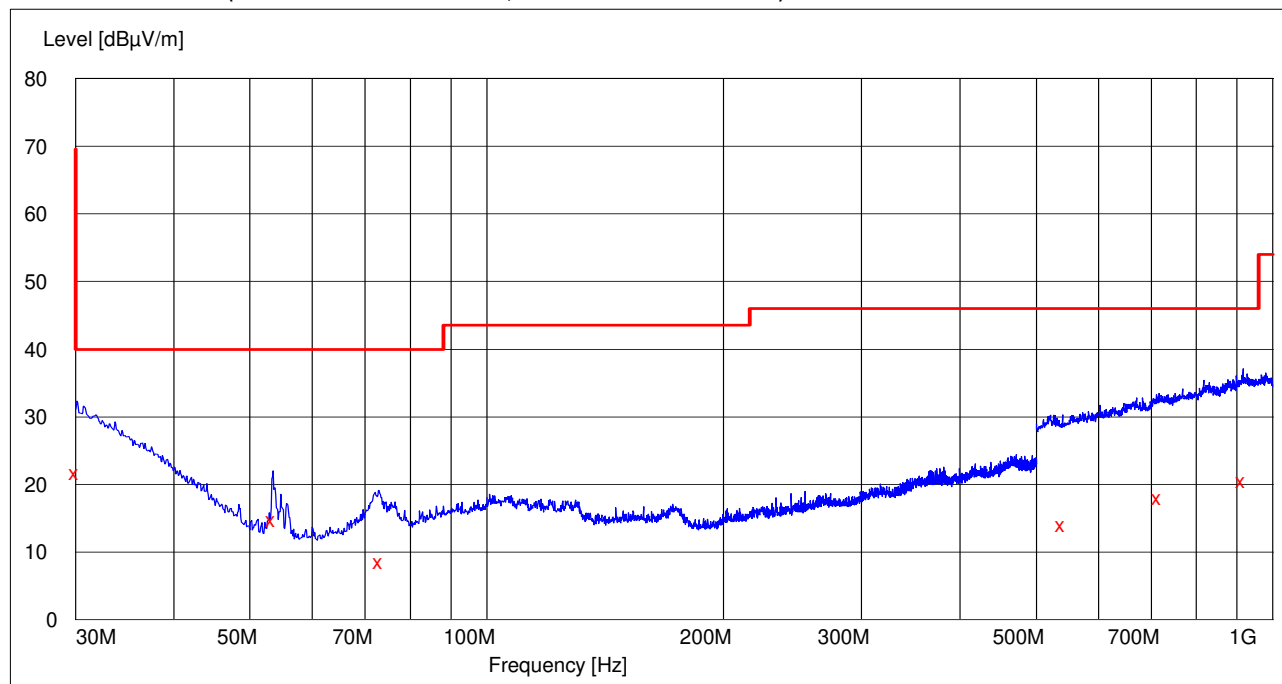
Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Limit [dB $\mu\text{V/m}$]	Detector
30 – 88	100	40	QP
88 – 216	150	43.5	QP
216 – 960	200	46	QP
960 – 1000	500	54	QP

CISPR11 Class B group 2 limits (3 m measurement distance)

Frequency range [MHz]	Limit [$\mu\text{V/m}$]	Limit [dB $\mu\text{V/m}$]	Detector
30 – 80.872	100	40	QP
80.872 – 81.848	1000	60	QP
81.848 – 134.786	100	40	QP
134.786 – 136.414	1000	60	QP
136.414 – 230	100	40	QP
230 - 1000	500	47	QP

4.2. Test results (FCC)

OP1: Peak detector (< 500 MHz: RBW 300 kHz, > 500 MHz: RBW 1 MHz)



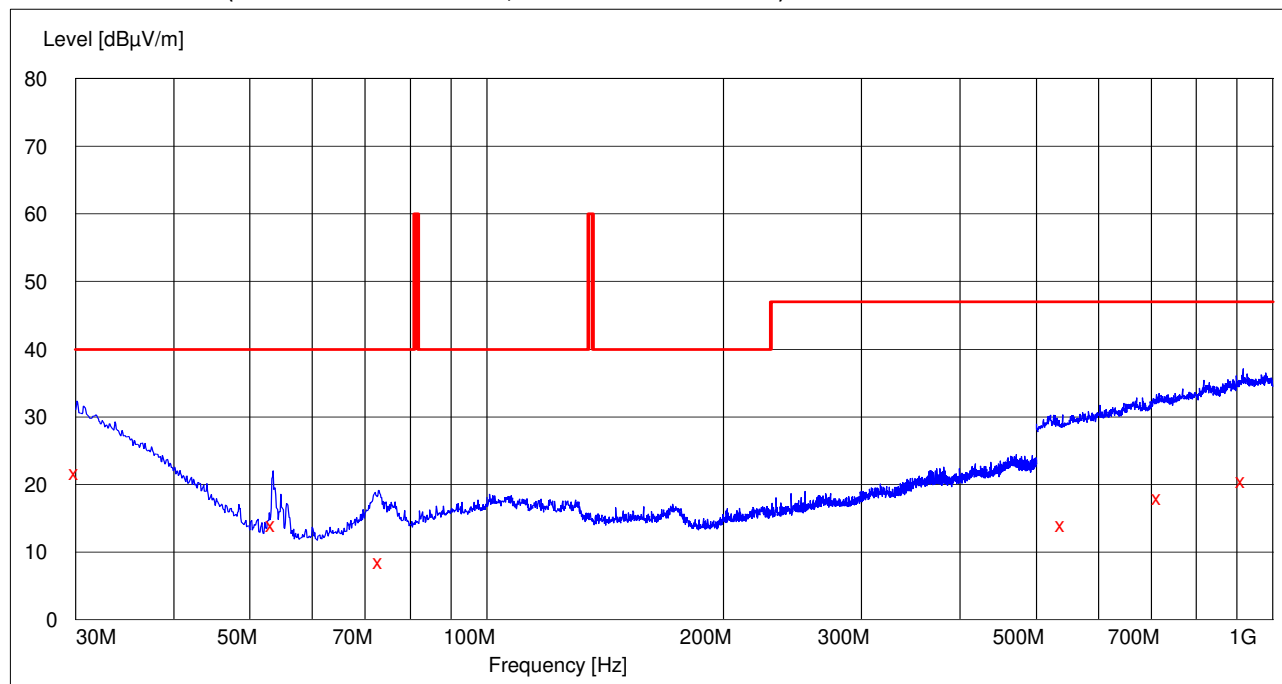
Quasi-Peak detector (RBW 120 kHz)

Frequency [MHz]	Level [dBμV/m]	Transducer [dB]	Limit [dBμV/m]	Margin [dB]	Height [cm]	Azimuth [deg]	Polarisation	Result
30.050000	21.80	-7.70	40.00	18.20	226.0	299.00	HORIZONTAL	PASSED
53.426854	14.80	-29.90	40.00	25.20	98.0	336.00	VERTICAL	PASSED
73.235571	8.50	-25.70	40.00	31.50	401.0	315.00	HORIZONTAL	PASSED
539.880160	14.10	-22.40	46.00	31.90	273.0	44.00	VERTICAL	PASSED
717.133868	18.00	-19.00	46.00	28.00	223.0	346.00	HORIZONTAL	PASSED
916.382665	20.60	-16.00	46.00	25.40	216.0	43.00	HORIZONTAL	PASSED

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

4.3. Test results (ISED)

OP1: Peak detector (< 500 MHz: RBW 300 kHz, > 500 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
30.050000	21.80	-7.70	40.00	18.20	225.0	299.00	HORIZONTAL	PASSED
53.426854	14.10	-29.90	40.00	25.90	98.0	336.00	VERTICAL	PASSED
73.235571	8.50	-25.70	40.00	31.50	401.0	315.00	HORIZONTAL	PASSED
539.880160	14.10	-22.40	47.00	32.90	273.0	44.00	VERTICAL	PASSED
717.133868	18.00	-19.00	47.00	29.00	223.0	346.00	HORIZONTAL	PASSED
916.382665	20.50	-16.00	47.00	26.50	216.0	43.00	HORIZONTAL	PASSED

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

5. Occupied bandwidth

EUT with DUT number	DAB200490E
Accessories with DUT numbers	DAB191878E, NOV16037E, DAB16071E, NOV16037E
Operation Voltage [V] / [Hz]	12 V / DC
Result	PASSED
Remarks	OP1
Temp [°C] / Humidity [%RH]	23 °C / 34.5 %
Date of measurement	06-May to 08-May-2020
Test Engineer	Bhushan Pawar
Test system SW version	V1.7

5.1. Test method and limit

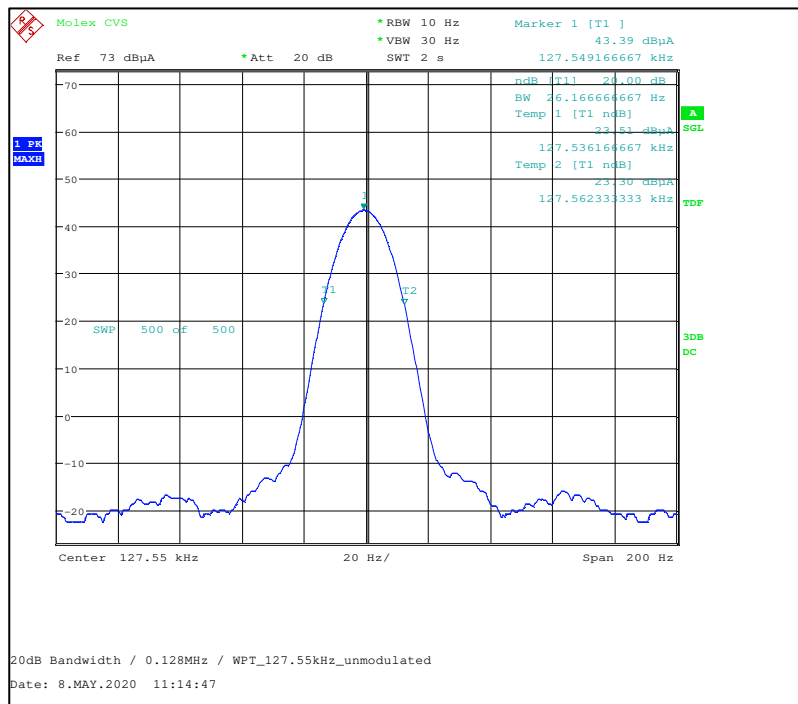
The measurement is made according to FCC 15.215(c) and RSS-Gen.

FCC and ISSED limits for occupied bandwidth measurements

20 dB Bandwidth Limit [kHz]	99 % Bandwidth Limit [kHz]
-	-

5.2. Test results (FCC)

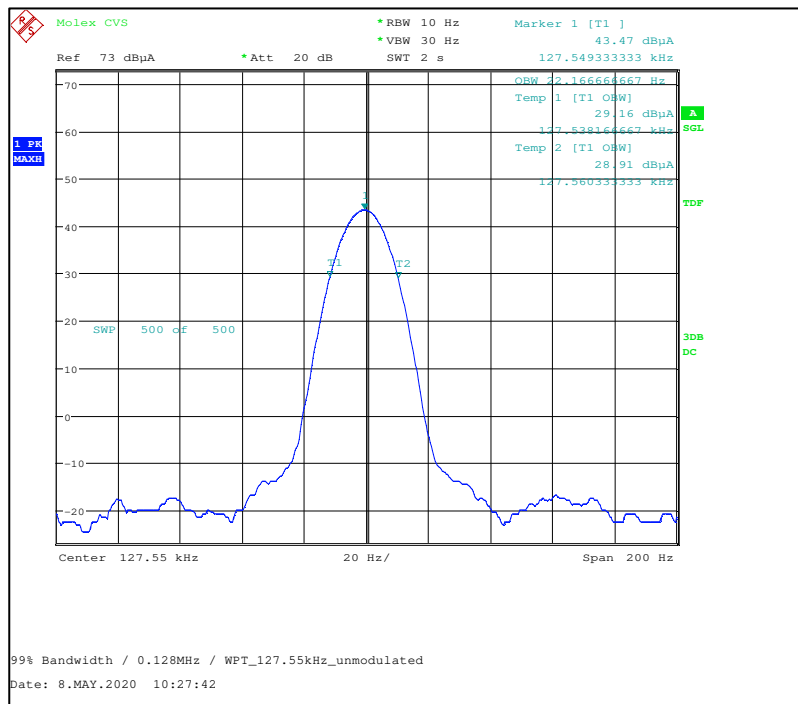
OP1:



Frequency [kHz]	20 dB Bandwidth [Hz]	Result
127.550	26.167	PASSED

5.3. Test results (ISED)

OP1:



Frequency [kHz]	99 % Bandwidth [Hz]	Result
127.550	22.167	PASSED

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	23.05.2019	23.05.2020
Signal Generator	ROHDE & SCHWARZ	SMP02	828269/008	09.08.2017	09.08.2020
Signal Generator	ROHDE & SCHWARZ	SML01	100652	06.04.2018	06.04.2021
Power Supply	Hewlett Packard - Agilent	E3632A	KR75303301	17.05.2018	17.05.2020
Radio Communication Tester	ROHDE & SCHWARZ	CMU 200	101138	22.05.2018	22.05.2020
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	20.05.2019	20.05.2020
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	08.07.2019	08.07.2020
EMI Test Receiver	ROHDE & SCHWARZ	ESW44	101733	19.08.2019	19.08.2020
Vector Signal Generator	ROHDE & SCHWARZ	SMBV100A	263158	16.05.2019	16.05.2020
Wideband Radio Comm. Tester	ROHDE & SCHWARZ	CMW500	101674	22.05.2019	22.05.2020

6.2. Conducted Radio

Equipment	Manufacturer	Type	Serial No.	Actual Calibration	Next Calibration
Signal Generator	ROHDE & SCHWARZ	SMP02	828269/008	09.08.2017	09.08.2020
Signal Generator	ROHDE & SCHWARZ	SMB100A	181275	08.07.2019	08.07.2020
Vector Signal Generator	ROHDE & SCHWARZ	SMBV100A	263158	16.05.2019	16.05.2020
EMI Test Receiver	ROHDE & SCHWARZ	ESU26	100077	20.05.2019	20.05.2020
Vector Signal Generator	ROHDE & SCHWARZ	SMJ100A	100845	16.05.2018	16.05.2020
EMI Test Receiver	ROHDE & SCHWARZ	ESW44	101733	19.08.2019	19.08.2020
Power Supply	Hewlett Packard - Agilent	E3632A	MY40011318	23.05.2018	23.05.2020
Powermeter	ETS	EMPower 7002-006	7202040	18.01.2019	18.01.2022
Climatic Chamber	Vötsch	VT4002	521/85094	23.11.2018	23.11.2020
Network Analyzer	Hewlett Packard - Agilent	8722ES	US39175320	03.11.2017	03.08.2020
BT-/W-Lan-Testsetup	Hewlett Packard - Agilent	N4010A	MY46320388	17.08.2017	17.08.2020
Radio Communication Tester	ROHDE & SCHWARZ	CMU 200	101138	22.05.2018	22.05.2020
Wideband Radio Comm.Tester	ROHDE & SCHWARZ	CMW500	101674	22.05.2019	22.05.2020

End of Report