

# Test Report 19-1-0173601T07a-C2



**GmbH** 

Number of pages: 14 Date of Report: 2020-Dec-14

Testing company: CETECOM GmbH Applicant: Continental Advanced Antenna

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Im Teelbruch 116

Test Object / RKE-Transceiver/
Tested Device(s): RKE232E1

FCC ID: 2ACC7RKE232E1 ISED ID: 11980A-RKE232E1

Testing has been carried out in accordance with:

Title 47 CFR, Chapter I

FCC Regulations, Subchapter A

Subpart B: §15.109 (Class B limits)

ISED Regulations RSS-Gen, Issue 5

ICES-003, Issue 6 (Class B limits)

Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method and limit".

Test Results: 
☐ The EUT complies with the requirements in respect of all parameters subject to the test.

The test results relate only to devices specified in this document

Test report 19-1-0173601T01a-C2, dated 2020-12-14 is replacing the original test report 19-1-0173601T01a-C1, dated 2020-11-03. The replaced test report gets invalid herewith

Signatures:

Dipl.-Ing. Ninovic Perez
Test Lab Manager
Authorization of test report

Wolfgang Markus Test manager Responsible of test report



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#### 1 General information

#### 1.1 Disclaimer and Notes

The test results of this test report relate exclusively to the test item specified in this test report as specified in chapter 2.7. CETECOM does not assume responsibility for any conclusions and generalizations drawn from the test results with regard to other specimens or samples of the type of the equipment represented by the test item.

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Also we refer on special conditions which the applicant should fulfill according §2.927 to §2.948, special focus regarding modification of the equipment and availability of sample equipment for market surveillance tests.



## 1.2 Summary of Test Results

Test case	Reference	Reference	Reference	Remark	Result
	in FCC 🛛	in ISED 🛮	in RSS-GEN 🛚		
Radiated field strength emissions 30 MHz – 1	§15.109	ICES-003,	RSS-Gen., Issue 5		
GHz	§15.33	Issue 6	Chapter 8.9,		PASS
	§15.35		Chapter 7.3		
Radiated field strength emissions above 1 GHz	§15.109	ICES-003,	RSS-Gen., Issue 5		
	§15.33	Issue 6	Chapter 8.9,		PASS
	§15.35		Chapter 7.3		

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 by the CETECOM Laboratory.

# 1.3 Summary of Test Methods

Test case	Test method
Radiated field strength emissions 30 MHz – 1 GHz	ANSI C63.4-2014 chapter 8.2.3
Radiated field strength emissions above 1 GHz	ANSI C63.4-2014 chapter 8.3



#### 2 Administrative Data

# 2.1 Identification of the Testing Laboratory

Company name: CETECOM GmbH
Address: Im Teelbruch 116

45219 Essen - Kettwig

Germany

Responsible for testing laboratory: Mr. Volker Briddigkeit

Accreditation scope: DAkkS Webpage

Test location: CETECOM GmbH; Mündelheimer Weg 35; 40472 Düsseldorf

#### 2.2 General limits for environmental conditions

Temperature:	22±2° C
Relative. humidity:	45±15% rH
Barometric Pressure:	1013 hPa

#### 2.3 Test Laboratories sub-contracted

Company name:

## 2.4 Organizational Items

Order No.: 19-1-0120301

Responsible test manager: B.Sc. Hicham Laayouni

Receipt of EUT: 03.08.2020

Date(s) of test: 2020-Aug-06

Version of template: 14.0

## 2.5 Applicant's details

Applicant's name: Continental Advanced Antenna GmbH

Address: Roemerring 1

31137 Hildesheim

Germany

Contact Person: Mr. Thomas Schuhbeck

Contact Person's Email: thomas.schuhbeck@continental.com

## 2.6 Manufacturer's details

Manufacturer's name:

See applicant's info

Address:

See applicant's info



# 2.7 EUT: Type, S/N etc. and short descriptions used in this test report

Short descrip tion*)	PMT Sample No.	EUT	Туре	S/N	HW status	SW status
EUT 1	Sample 18	RKE-Transceiver	RKE232E1		13620027B02 V02	V11.31

<sup>\*)</sup> EUT short description is used to simplify the identification of the EUT in this test report.

## 2.8 Auxiliary Equipment (AE): Type, S/N etc. and short descriptions

Short descrip tion*)	PMT Sample No.	Auxiliary Equipment	Туре	S/N	HW status	SW status
AE1	Sample 02	Reference Antenna	ANT434FCC			
AE2	Sample 22	Testbox	RKE232 FCC			
AE3 Sample 19		Adapter plate for mounting RKE module to the reference Antenna				
AE4	AE4 Shielded box for AE2					

<sup>\*)</sup> AE short description is used to simplify the identification of the auxiliary equipment in this test report.

## 2.9 Connected cables

Short descrip tion*)	PMT Sample No.	Cable	Туре	S/N	HW status	SW status
CAB 1	1 Sample 25 Cable forTestbox RKE - module		Cable			

<sup>\*)</sup> CAB short description is used to simplify the identification of the connected cables in this test report.

## 2.10 EUT set-ups

set-up no.*)	Combination of EUT and AE	Description
1	EUTA + AE1 + AE2 + AE3 + AE4 + CAB1	Used for Radiated measurements.

<sup>\*)</sup> EUT set-up no. is used to simplify the identification of the EUT set-up in this test report.

## 2.11 EUT operation modes

EUT operating mode no.*)	Operating modes	Additional information
op. 1	Polling mode	the RKE module is powered on and set in idle mode and waiting for receiving RF Signal from the car key

<sup>\*)</sup> EUT operating mode no. is used to simplify the test report.



# 3 Equipment under test (EUT)

# 3.1 General Data of Main EUT as Declared by Applicant

Product name	RKE232E1	RKE232E1		
Kind of product	RKE-Transceiver			
Operational frequency Band	Frequency range [	MHz]: 4	33.050 – 434.	790
Operational frequency band	No. of channels: (0	Ch1: 433	3.47 MHz; Ch2	l: 434.37 MHz; Ch3: 433.92 MHz)
Firmware	$\square$ for normal use		Special verified to the second seco	ersion for test execution
	☐ AC Mains	-		
	☑ DC Mains	<b>12</b> V	<b>12</b> V DC	
	☐ Battery	-		
Operational conditions	T <sub>nom</sub> =23 °C	T <sub>min</sub> = -	-40 °C	T <sub>max</sub> = 105 °C
EUT sample type	Pre-Production			
Weight				
Size				
Interfaces/Ports				
For further details refer Applicants Declaration & following technical documents				
For further details regarding radio paran	neters, please refer	to radio	Core Specifi	cation

# 3.2 Modifications on Test sample

Additions/deviations or exclusions	none



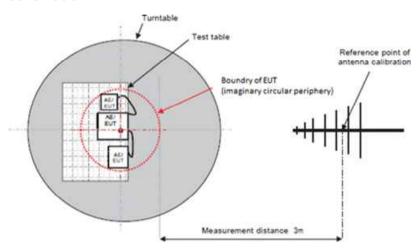
#### 4 Measurements

## 4.1 Radiated field strength emissions 30 MHz - 1 GHz

#### 4.1.1 Description of the general test setup and methodology, see below example:

Evaluating the field emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a NSA-compliant semi anechoic room (SAR) recognized by the regulatory commissions.

#### **Schematic:**



#### **Testing method:**

The measurement is made according to relevant reference clauses: (See Tables Summary of Test Results and Summary of Test Methods on page 5)

#### Exploratory, preliminary measurements

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 0.8 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 90°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

Measurement antenna: horizontal and vertical, heights: 1,0 m and 1,82 m as worst-case determined by an exploratory emission measurements. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

#### Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc. either on 10m OATS or 3m semi-anechoic room.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.

Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself either over 3-orthogonal axis (not defined usage position) or 2-orthogonal axis (defined usage position). The measurement antenna height between 1 m and 4 m.



On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out

#### Formula:

 $E_C = E_R + AF + C_L + D_F - G_A$  (1) AF = Antenna factor

C<sub>L</sub> = Cable loss

 $M = L_T - E_C$  (2)  $D_F = Distance correction factor (if used)$ 

 $E_C$  = Electrical field – corrected value

E<sub>R</sub> = Receiver reading

G<sub>A</sub> = Gain of pre-amplifier (if used)

 $L_T$  = Limit M = Margin

All units are dB-units, positive margin means value is below limit.

#### 4.1.2 Limit

Frequency Range	Class B	☑ (3 meters)	Class A 🔲 (10 meters)		Class A 🔲 (10 meters)		
[MHz]	Limit [μV/m]	Limit	Limit [μV/m]	Limit [dBµV/m]	Detector	RBW / VBW	
		[dBµV/m]				[kHz]	
30 - 88	100	40.0	90	39.0	Quasi peak	100 / 300	
88 - 216	150	43.5	150	43.5	Quasi peak	100 / 300	
216 - 960	200	46.0	210	46.4	Quasi peak	100 / 300	
960 - 1000	500	54.0	300	49.5	Quasi peak	100 / 300	

#### **4.1.3** Result

Diagram	Channel	Mode	Maximum Level [dBμV/m]	Result
			Frequency Range 30 – 1000 MHz	
3.01		op. 1 laying	38.10 dBμV/m @ 928.408 MHz	Passed
3.02		op. 1 standing	39.84 dBμV/m @ 198.008 MHz	Passed

Remark: for more informations and graphical plot see annex A1 CETECOM\_TR19\_1\_0173601T07a\_C2\_A1

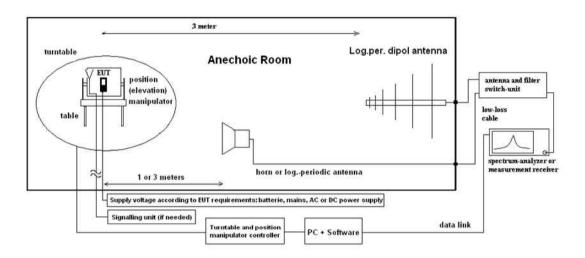


## 4.2 Radiated field strength emissions above 1 GHz

#### 4.2.1 Description of the general test setup and methodology, see below example:

Evaluating the emissions have to be done first by an exploratory emissions measurement and a final measurement for most critical frequencies. The tests are performed in a CISPR 16-1-4:2010 compliant fully anechoic room (FAR) recognized by the regulatory commission. The measurement distance was set to 3 meter for frequencies up to 18 GHz and 2 meter above 18 GHz. A logarithmic periodic antenna is used for the frequency range 30 MHz to 1 GHz. Horn antennas are used for frequency range 1 GHz to 40 GHz. The EUT is aligned within 3 dB beam width of the measurement antenna with three orthogonal axis measurements on the EUT.

#### **Schematic:**



#### **Testing method:**

The measurement is made according to relevant reference clauses: (See Tables Summary of Test Results and Summary of Test Methods on page 5)

#### **Exploratory, preliminary measurements**

The EUT and its associated accessories are placed on a non-conductive position manipulator (tipping device) of 1.55 m height which is placed on the turntable. By rotating the turntable (range 0° to 360°, step 15°) and the EUT itself either on 3-orthogonal axis (portable equipment) or 2-orthogonal axis (defined operational position of EUT) the emission spectrum and its characteristics was recorded with an EMI-receiver, broadband antenna and software.

The measurements are performed in horizontal and vertical polarization of the measurement antennas. The results are documented in a diagram. Critical frequencies (low margin to limit) are saved within a table for further investigations. If various operating modes are supported, further investigations are made to find the worst-case of them. Also the interconnection cables and equipment position were varied in order to maximize the emissions.

#### Final measurement on critical frequencies

Based on the exploratory measurements, the most critical frequencies are re-measured by main-taining the EUT's worst-case operation mode, cable position, etc.

First a frequency zoom around the critical frequency is done to locate the frequency more precisely. After this step, for all identified critical frequencies, the maximum peak was determined.



Following parameters were varied: the turntable angle continuously in the range 0 to 360 degree, the EUT itself over 3-orthogonal axis and the height for EUT with large dimensions or three axis scan for portable/small equipment.

On the determined worst-case position, a final measurement with necessary bandwidth and detector according standard has been carried out.

#### Formula:

 $E_C = E_R + A_F + C_L + D_F - G_A \quad \text{(1)} \\ E_C = \text{Electrical field} - \text{corrected value} \\ E_R = \text{Receiver reading} \\ M = L_T - E_C \quad \text{(2)} \\ M = \text{Margin} \\ L_T = \text{Limit} \\ A_F = \text{Antenna factor} \\ C_L = \text{Cable loss} \\ D_F = \text{Distance correction factor (if used)} \\ G_A = \text{Gain of pre-amplifier (if used)} \\$ 

All units are dB-units, positive margin means value is below limit.

#### 4.2.2 Limit

Radiated emissions limits (3 meters)								
Frequency Range [MHz]	Limit [μV/m]	Limit [dBμV/m]	Detector	RBW / VBW [kHz]				
Above 1000	500	54	Average	1000				
Above 1000	5000	74	Peak	1000				

#### **4.2.3** Result

Diagram	Channel	Mode	Maximum Level [dBμV/m] Frequency Range 1 – 6 GHz	Result
4.01		op. 1 standing	47.65 dBμV/m @ 5858.64 MHz	OK
4.02		op. 1 laying	47.03 dBμV/m @ 5856.32 MHz	OK

Remark: for more informations and graphical plot see annex A1 CETECOM\_TR19\_1\_0173601T07a\_C2\_A1



# 4.3 Results from external laboratory

None	-

# 4.4 Opinions and interpretations

None
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# 5 Equipment lists

ID	Description	Manufacturer	SerNo	Cal due date
	120901 - SAC - Radiated Emission <1GHz			
20574	Biconilog Hybrid Antenna BTA-L	Frankonia GmbH	980026L	03.05.2022
20620	EMI Test Receiver ESU26	Rohde & Schwarz Messgerätebau GmbH	100362	13.05.2021
20482	filter matrix Filter matrix SAR 1	CETECOM GmbH	-	
20885	Power Supply EA3632A	Agilent Technologies Deutschland GmbH	75305850	
20487	System CTC NSA-Verification SAR-EMI System EMI field (SAR) NSA	ETS-Lindgren Gmbh	-	23.03.2021
	120904 - FAC1 - Radiated Emissions			
20341	Digital Multimeter Fluke 112	Fluke Deutschland GmbH	81650455	25.05.2022
20720	EMC32 [FAC]	Rohde & Schwarz Messgerätebau GmbH	V10.xx	
20489	EMI Test Receiver ESU40	Rohde & Schwarz Messgerätebau GmbH	1000-30	13.05.2021
20868	High Pass Filter AFH-07000	AtlanTecRF	16071300004	
20291	High Pass Filter WHJ 2200-4EE (GSM 850/900)	Wainwright Instruments GmbH	14	
20020	Horn Antenna 3115 (Subst 1)	EMCO Elektronik GmbH	9107-3699	19.07.2021
20302	Horn Antenna BBHA9170 (Meas 1)	Schwarzbeck Mess-Elektronik OHG	155	15.04.2023
20549	Log.Per-Antenna HL025	Rohde & Schwarz Messgerätebau GmbH	1000060	31.07.2021
20512	Notch Filter WRCA 800/960-02/40-6EEK (GSM 850)	Wainwright Instruments GmbH	24	
20611	Power Supply E3632A	Agilent Technologies Deutschland GmbH	KR 75305854	
20338	Pre-Amplifier 100MHz - 26GHz JS4-00102600-38-5P	Miteq Inc.	838697	
20484	Pre-Amplifier 2,5GHz - 18GHz AMF-5D-02501800-25- 10P	Miteq Inc.	1244554	
20287	Pre-Amplifier 25MHz - 4GHz AMF-2D-100M4G-35-10P	Miteq Inc.	379418	
20670	Radio Communication Tester CMU200	Rohde & Schwarz Messgerätebau GmbH	106833	16.06.2022
20690	Spectrum Analyzer FSU	Rohde & Schwarz Messgerätebau GmbH	100302/026	23.05.2021
20439	UltraLog-Antenna HL 562	Rohde & Schwarz Messgerätebau GmbH	100248	10.03.2023



# 6 Measurement Uncertainty valid for conducted/radiated measurements

The reported uncertainties are calculated based on the standard uncertainty multiplied with the appropriate coverage factor  $\mathbf{k}$ , such that a confidence level of approximately 95% is achieved. For uncertainty determination, each component used in the concrete measurement set-up was taken in account and it contribution to the overall uncertainty according its statistical distribution calculated.

RF-Measurement	Reference	Frequency range	C	Calculated uncertainty based on a confidence level of 95%		Remarks			
Conducted emissions	-	9 kHz - 150 kHz	4.0 dB						-
(U <sub>CISPR</sub> )		150 kHz - 30 MHz	3.6 dB						
Power Output radiated	-	30 MHz - 4 GHz	3.17 d	В					Substitution method
Dower Output conducted		Set-up No.	Cel- C1	Cel- C2	BT1	W1	W2		
Power Output conducted	-	9 kHz - 12.75 GHz	N/A	0.60	0.7	0.25	N/A		
		12.75 - 26.5 GHz	N/A	0.82		N/A	N/A		
Conducted emissions	-	9 kHz - 2.8 GHz	0.70	N/A	0.70	N/A	0.69		
on RF-port		2.8 GHz - 12.75 GHz	1.48	N/A	1.51	N/A	1.43		N/A - not
		12.75 GHz – 18 GHz	1.81	N/A	1.83	N/A	1.77		applicable
		18 GHz - 26.5 GHz	1.83	N/A	1.85	N/A	1.79		
	0.1272 ppm (Delta Marker)			Frequency					
Occupied bandwidth -		9 kHz - 4 GHz						error	
			1.0 dB					Power	
	-		0.1272	ppm (C	elta Ma	ırker)			Frequency
Emission bandwidth		9 kHz - 4 GHz				error			
	1		See ab	See above: 0.70 dB			Power		
Frequency stability	-	9 kHz - 20 GHz	0.0636 ppm			-			
		150 kHz - 30 MHz	5.01dE	3					Magnetic
Radiated emissions									field strength
Enclosure	-	30 MHz - 1 GHz	5.83 d	В					Electrical
Litaloguic		1 GHz - 18 GHz	4.91 d						Field
		18-26.5 GHz	5.06 d	В					strength

# 7 Versions of test reports (change history)

Version	Applied changes	Date of release
	Initial release	2020-Aug-25
C1	Added operational frequency Band information to chapter 3.1	2020-Nov-03
C2	Max temperature declared in chapter "General Data of Main EUT as Declared by Applicant" changed to 105°C	2020-Dec-14

# **End Of Test Report**