TEST REPORT # EMCC-170232ABA, 2020-11-12

This Test Report replaces Test Report # EMCC-170232AB dated 2020-10-13

EQUIPMENT UNDER TEST:

Device:	RF2K-S
Serial Number:	02/201029
Application:	Amplifier
FCC ID:	2AW84RF2K-S
Manufacturer:	RF-KIT
Address:	Heuleithe 14 91322 Graefenberg GERMANY
Phone:	+49 9192 996689
Fax:	-

RELEVANT STANDARD(S): 47 CFR §§ 97.307, 97.317

TEST REPORT PREPARED BY:

Dominik Krueger
EMCCons DR. RAŠEK GmbH & Co. KG
Boelwiese 8
91320 Ebermannstadt
Germany
Phone: +49 9194 7262-0
Fax: +49 9194 7262-199
E-Mail: d.krueger@emcc.de

TESTED:	**APPROVED:**
Dominik Krueger	Reinhard Sauerschell

CONTENTS

0 REVISION HISTORY

Project number	Issue date	Chapter	Description
170232AB	2020-10-13	n.a.	Initial issue
170232ABA	2020-11-12	3.4	Measurement values for harmonics > 52 MHz were corrected. Foot note was added.

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR §97.307 and §97.317 requirements for the certification of external RF amplifiers operating in the amateur radio service.

1.2 Limits and Reservations

The test results in this report apply only to the particular equipment under test (EUT) as declared in this report. This test report shall not be reproduced except in full without the written permission of EMCCons DR. RAŠEK GmbH & Co. KG.
Document(s) and/or information, which were provided by the customer, can affect the validity of results.

1.3 Test Location

Test Laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
Accreditation No.:	D-PL-12067-01-04
FCC Test Firm Registration No.:	368753
Address of Labs I, II, III	EMCCons DR. RAŠEK GmbH & Co. KG
and Head Office:	Boelwiese 8 91320 Ebermannstadt GERMANY
Address of Labs IV and V:	EMCCons DR. RAŠEK GmbH & Co. KG Stoernhofer Berg 15 91364 Unterleinleiter GERMANY
Phone:	+49 9194 7262-0
Fax:	+49 9194 7262-199
E-Mail:	emc.cons@emcc.de
Web:	www.emcc.de

1.4 Customer

Company Name:	RF-KIT
Street:	Heuleithe 14
City:	91322 Graefenberg
Country:	GERMANY
Phone:	+49 9192 996689
E-Mail:	reinhard@rf-kit.de

1.5 Manufacturer

Company Name:	RF-KIT
Street:	Heuleithe 14
City:	91322 Graefenberg
Country:	GERMANY

1.6 Dates and Test Location

Date of Receipt of EUT: 2020-09-23
Test Date: 2020-09-24
Test Location: Lab IV

1.7 Ordering Information

Purchase Order: signed e-mail EMCC-170232AB, dated 2020-08-06

1.8 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2020-09-24	23	51	968	IV	Mr Foertsch

2 PRODUCT DESCRIPTION

2.1 Equipment under Test (EUT)

EUT details given by the customer unless indicated on EUT.

Trade name:	RF2K-S
Serial number:	02/201029
FCC ID	2AW84RF2K-S
Firmware revision:	G36C71
Hardware revision:	V1.1
Application:	Amplifier
Power supply:	90/ 290 VAC 50/60Hz
Voltage for testing:	230 VAC / 60 Hz
Highest internally generated or used frequency:	5 GHz
Amateur Radio bands:	160 m, 80 m, 60m, 40 m, 30 m, 20 m, 17 m, 15 m, 12 m, 10 m, 6 m TX between 1.8 MHz & 30 MHz and 50 – 54.2 MHz
Output power:	1500 W
Ports:	TRX (Exciter input) ANT1 ANT2 ANT3 ANT4 PTT Power ON extern Power jack Ground connector Multifunction connector - 55 dB output CAT USB LAN
Accessories delivered with EUT:	Transceiver (with power supply), cable harness (see chapter 2.3)
Variants:	None
Remarks:	None

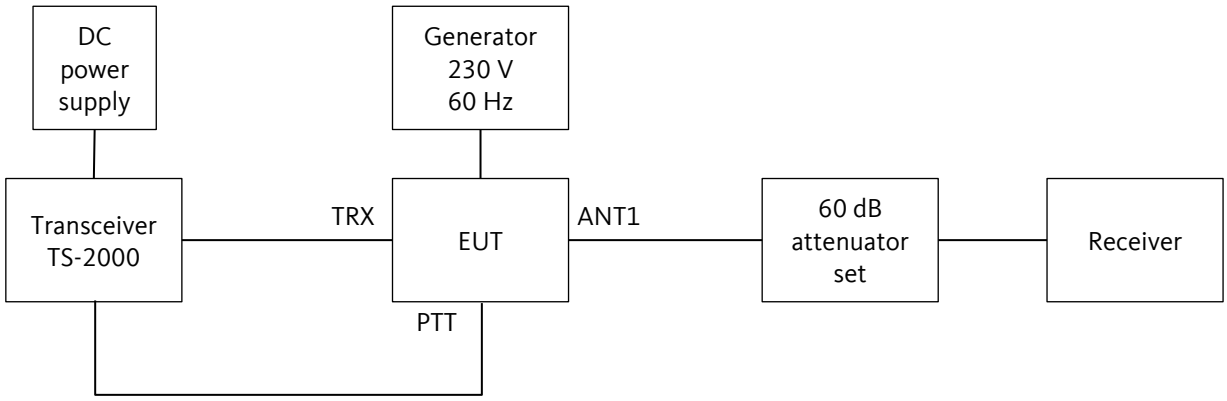
For further information concerning port description see Annex 3.

2.2 Intended Use

Amplifier for amateur radio service.

2.3 EUT Peripherals/Simulators

A Kennwood TS-2000 Transceiver was used as exciter. The complete exciter set-up was provided by the customer.



2.4 Mode of Operation during Testing and Test Setup

The EUT was supplied with 230 V / 60 Hz AC and switched on. “ANT1” was connected to a dummy load. The input of the amplifier was set to a value which equals an output power of about 1500 W.

2.5 Modifications Required for Compliance

None.
Test Results Summary
Summary of test results for the following EUT:

Manufacturer:	RF-KIT
Device:	RF2K-S
Serial No:	02/201029

Requirement	47 CFR Section	Report Section	Result
Spurious Emissions & Gain	97.307(d), 97.317(a)	4	Passed

The customer has made the determination that EUT Condition, characterization, and mode of operation are representative of production units and meet the requirements of the specifications referenced herein.
Consistent with industry practice, measurement and test equipment not directly involved in obtaining measurement results but having an impact on measurements (such as cable loss, antenna factors, etc.) are factored into the "correction factor" documented in certain test results. Instrumentation employed for testing meets tolerances consistent with known industry standards and regulations.
All requirements were found to be within the limits outlined in this report.
The test results in this report apply only to the particular equipment under test (EUT) as declared in this report.

Test Personnel: Dominik Krüger
Issuance Date: 2020-11-12

3 SPURIOUS EMISSIONS & GAIN

Test Requirement: FCC 47 CFR, § 97.307(d), § 97.307(e), § 97.317(a) & § 97.317(b)

3.1 Regulation

§ 97.307 Emission standards.

(d) For transmitters installed after January 1, 2003, the mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency below 30 MHz must be at least 43 dB below the mean power of the fundamental emission. For transmitters installed on or before January 1, 2003, the mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency below 30 MHz must not exceed 50 mW and must be at least 40 dB below the mean power of the fundamental emission. For a transmitter of mean power less than 5 W installed on or before January 1, 2003, the attenuation must be at least 30 dB. A transmitter built before April 15, 1977, or first marketed before January 1, 1978, is exempt from this requirement.

(e) The mean power of any spurious emission from a station transmitter or external RF power amplifier transmitting on a frequency between 30-225 MHz must be at least 60 dB below the mean power of the fundamental. For a transmitter having a mean power of 25 W or less, the mean power of any spurious emission supplied to the antenna transmission line must not exceed 25 µW and must be at least 40 dB below the mean power of the fundamental emission, but need not be reduced below the power of 10 µW. A transmitter built before April 15, 1977, or first marketed before January 1, 1978, is exempt from this requirement.

§ 97.317 Standards for certification of external RF power amplifiers.

(a) To receive a grant of certification, the amplifier must:
(1) Satisfy the spurious emission standards of §97.307 (d) or (e) of this part, as applicable, when the amplifier is operated at the lesser of 1.5 kW PEP or its full output power and when the amplifier is placed in the “standby” or “off” positions while connected to the transmitter.
(2) Not be capable of amplifying the input RF power (driving signal) by more than 15 dB gain. Gain is defined as the ratio of the input RF power to the output RF power of the amplifier where both power measurements are expressed in peak envelope power or mean power.
(3) Exhibit no amplification (0 dB gain) between 26 MHz and 28 MHz.

(b) Certification shall be denied when:

(1) The Commission determines the amplifier can be used in services other than the Amateur Radio Service, or

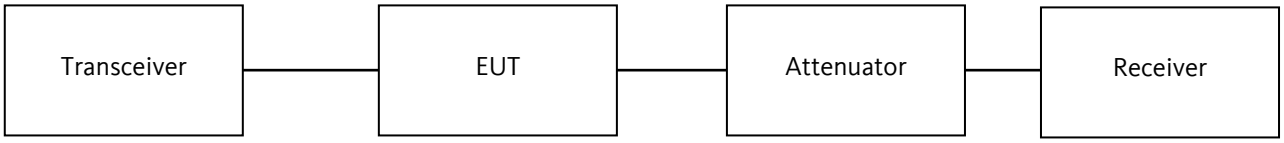
(2) The amplifier can be easily modified to operate on frequencies between 26 MHz and 28 MHz.

3.2 Test Equipment

Instrument	Manufacturer	Type	EMCC Ident No.	Last Calibration	Next Calibration
60-Hz-Converter	AEG	DAMK4/DAGK4	1	n/a	n/a
RF Power Meter	Rohde & Schwarz	NRVD	233	2019-01	2021-01
10-V-Insertion Probe	Rohde & Schwarz	URY-Z2	538	2019-09	2021-09
2000W 30 dB Attenuator	Bird	8329-300	828	2018-12	2020-12
20 W Attenuator 20dB	Narda	766-20	2428	2020-03	2022-03
10W Attenuator 10dB	JFW	50FHB-010-10	2430	2020-07	2022-07
N-Cable N/50	EMCC DR. RASEK	RG 214	2654	2020-04	2021-04
Thermo-Hygrobarograph	Wiesemann&Theis	57613 T/Rh/P	4717	2020-02	2022-02
EMI Test Receiver	Rohde & Schwarz	ESU8	5434	2019-11	2021-11
N-Cable N/50	EMCC DR. RASEK	RG214	6365	2020-04	2021-04

3.3 Test Setup

Schematic test setup for spurious emissions and gain measurement:



3.4 Test Result

Amplifier Gain § 97.317				Spurious Emissions § 97.307(d), § 97.307(e)			
Frequency f1	Input Power	Output Power	Amplifier Gain	2 * f1	3 * f1	4 * f1	5-10 * f1
[MHz]	[dBm]	[dBm]	[dB]	[dBc]	[dBc]	[dBc]	[dBc]
1.900	47.83	61.71	13.88	-52.87	-57.24	-56.53	≤ -58.36
3.650	48.09	61.75	13.66	-52.29	-62.18	<- 75 [1]	< -75 [1]
7.100	48.15	61.49	13.34	-43.95	-57.06	< -75 [1]	≤ 74.41
10.125	49.92	61.43	12.51	-65.84	-70.31	< -75 [1]	≤- 74.86
14.175	48.79	61.70	12.91	-70.01	-64.88	< -75 [1]	≤ -66.27
18.118	46.78	61.75	14.97	-71.86	-61.34	< -75 [1]	< -75 [1]
21.225	48.73	61.73	13.0	< -75 [1]	-54.68	< -75 [1]	< -75 [1]
24.945	47.32	61.65	14.33	-70.78	-60.85	< -75 [1]	< -75 [1]
28.850	47.59	61.73	14.14	-71.33	-71.45	-70.39	≤ -73.43
52.0	47.37	61.70	14.33	-73.87	-70.75	< -75 [1]	< -75 [1]

No amplification (0 dB gain) could be measured between the frequencies 24.995 MHz and 28.004 MHz. The amplifier automatically switched from operation to standby mode.

Manufacturer:	RF-KIT
Device:	RF2K-S
Serial No:	02/201029
Test Date:	2020-09-24

The EUT meets the requirements of this section.

[1] Receiver noise level

4 MEASUREMENT UNCERTAINTY

Relevant Standard	Measurement	Measurement Uncertainty
ANSI C63.23-2012	Harmonics measurement (conducted)	± 2.4 dB
ANSI C63.23-2012	Power measurement (conducted)	± 2.4 dB

The reported uncertainty values are based on a standard uncertainty multiplied by a coverage factor of k=2.0, providing a level of confidence of 95 %.

The given values have been calculated on the basis of the following documents:
ETSI TR 100 028-1:2001, Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1
ETSI TR 100 028-2:2001, Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2
CISPR 16-4-2:2011+A1:2014, Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty.
JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

5 LIST OF ANNEXES

Following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test set-up	2
Annex 2: Photographs of equipment under test (EUT)	3
Annex 3: Description of equipment under test (EUT), ports	1