TEST REPORT # EMCC-040197Z, 2019-06-28

EQUIPMENT UNDER TEST:

Device:	T12CV-S8
Serial Number:	Rotor: 112055552 , Stator: none
Application:	Low Power Transceiver
FCC ID:	2ADAT-T12S8
IC:	12438A-T12S8
Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Address:	Im Tiefen See 45 64293 Darmstadt Germany
Phone :	+49 6151 803-681
Fax:	+49 6151 803-9619
E-Mail :	hans.schuster@hbm.com

RELEVANT STANDARD(S) : 47 CFR 15.225
RSS-210 Issue 9

MEASUREMENT PROCEDURE:

☒ ANSI C63.10-2013 ☒ RSS-Gen Issue 5

TEST REPORT PREPARED BY:

Adem Aldogan
EMCCons DR. RAŠEK GmbH & Co. KG
Boelwiese 8
91320 Ebermannstadt
Germany
Phone: +49 9194 7262-0
Fax: +49 9194 7262-199
E-Mail: a.aldogan@emcc.de

TEST PERSONNEL: **HEAD OF LABORATORY**

Adem Aldogan Wolfgang Kiss Reinhard Sauerschell

CONTENTS **Page**

0 REVISION HISTORY

Project number	Issue date	Chapter	Description
040197Z	2019-06-28	n.a.	Initial issue

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR 15.225 and RSS-210 Issue 9 requirements for the certification of licence-exempt Intentional Radiator.

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.

1.3 Test Location

Test Laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
DAkkS Accreditation No.:	D-PL-12067-01-02
Address of Labs I, II, III and Head Office:	EMCCons DR. RAŠEK GmbH & Co. KG Boelwiese 8 91320 Ebermannstadt GERMANY
Address of Labs IV and V:	EMCCons DR. RAŠEK GmbH & Co. KG Stoernhofer Berg 15 91364 Unterleinleiter GERMANY
Laboratory:	Test Laboratory IV The 3 m & 10 m semi-anechoic chamber site has been fully described in a report submitted to ISED. This 3m/10m alternative test side is approved by Innovation, Science and Economic Development Canada under file number 3464C-1.
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:	Hottinger Baldwin Messtechnik GmbH
Street:	Im Tiefen See 45
City:	64293 Darmstadt
Country:	Germany
Name for contact purposes:	Mr Hans Schuster
Phone:	+49 6151 803-619
Fax:	+49 6151 803-9619
E-Mail:	hans.schuster@hbm.com

1.5 Manufacturer

Company Name:	Hottinger Baldwin Messtechnik GmbH
Street:	Im Tiefen See 45
City:	64293 Darmstadt
Country:	Germany
Name for contact purposes:	Mr Hans Schuster
Phone:	+49 6151 803-619
Fax:	+49 6151 803-9619
E-Mail:	hans.schuster@hbm.com

1.6 Dates and Test Location

Date of receipt of EUT:	2019-03-01
Test Date:	CW 09/2019
Test Location:	Lab IV

1.7 Ordering Information

Purchase Order:	D04-4500676865/2000
Date:	2019-01-17
Vendor Number:	806276

1.8 Climatic Conditions

Date	Temperature [°C]	Relative Humidity [%]	Air Pressure [hPa]	Lab	Customer attended tests
2019-03-01	22	31	970	IV	no

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

The following data is based on customer's information.

Trade Name:	T12
Serial Number:	112055552 (Rotor); none (Stator)
No. of Variants:	0
Application:	Low Power Transceiver
Hardware Version:	N/A
Firmware Version:	N/A
FCC ID:	2ADAT-T12S8
IC:	12438A-T12S8
Frequency:	13.56 MHz
No. of Channel(s):	1
Power Supply:	24 VDC
Ports:	Signal and supply – 7 pole binder industrial connector
Antenna:	Integrated loop antenna
Remarks:	None

2.2 Intended Use

The following information was delivered by the customer:

The EUT is a complete measuring system to measure torque on a rotating shaft. The standard use is inside a test stand.

2.3 EUT Peripherals/Simulators

The EUT was tested connected with

- Power supply TRIO-PS/1AC/24DC/5 (Phoenix Contact)
- Junction box with termination resistor and connectors for the power supply
- Ferrite (VITROPERM 500 F, Type: T60006-L2063-W517) with 3 turns at the signal and supply connector to port 1

Photograph 2.3-1: Power supply TRIO-PS/1AC/24DC/5

Photograph 2.3-2: Power supply TRIO-PS/1AC/24DC/5, front view

Photograph 2.3-3:Signal and supply cable with ferrite connected

Intentionally left blank

2.4 Mode of operation during testing and test set-up

The equipment under test (EUT) was operated during the tests under the following conditions:

Normal operating mode.

The rotor of the EUT was fixed and there was no torque applied to the EUT.

Under normal test conditions the EUT was powered with 24 VDC by the AC / DC supply TRIO-PS/1AC/24DC/5 delivered by the customer. A ferrite (VITROPERM 500 F, Type: T60006-L2063-W517) was attached with 3 turns to the signal and supply cable connected to port 1.

All peripherals/simulators were operated outside of the test environment.

2.5 Modifications required for compliance

None.

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: Hottinger Baldwin Messtechnik GmbH
Device: T12
Type(s): T12CV-S8
Serial No(s): 112055552 (Rotor); none (Stator)

Requirement	RSS, Section	47 CFR Section	Report Section	Result
Antenna Requirement	RSS-Gen, 6.8	15.203, 15.204	4	Passed
Conducted AC Power Line Emissions 150 kHz – 30 MHz	RSS-Gen, 8.8	15.207	5	Passed
Spectrum Mask	RSS-210, B.6	15.225(a)-(d)	6	Passed
Occupied Bandwidth (99%)	RSS-Gen, 6.7	15.215	7	Passed
Radiated Emissions 9 kHz – 30 MHz	RSS-210, B.6 RSS-Gen, 8.9	15.205, 15.209, 15.225(d)	8	Passed
Radiated Emissions 30 MHz – 150 MHz	RSS-210, B.6 RSS-Gen, 6.13, 8.9	15.205, 15.209, 15.225(d)	9	Passed
Carrier Frequency Stability	RSS-210, B.6 RSS-Gen 8.11	15.225(e)	10	Passed*

* Carrier Frequency Stability was measured on variant S3. Refer to section 2.1.
N.A. – not applicable; N.T. – Not tested acc. to applicant's order.

The client 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.
The measurements contained in this report were made in accordance with the procedures described in ANSI C63.10-2013 and all applicable Public Notices received prior to the date of testing.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: Adem Aldogan
Issuance Date: 2019-05-13

4 ANTENNA REQUIREMENT

Test Requirement: 47 CFR, § 15.203, § 15.204
Test Procedure: none

4.1 Regulation

§15.203 An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of Part 15C. The manufacturer may design the unit so that the user can replace a broken antenna, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of Sections 15.211, 15.213, 15.217, 15.219, or 15.221.
Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with Section 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this Part are not exceeded.

RSS-Gen: 6.8 Transmitter Antenna:

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

> *This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.*

Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

No applicable antenna requirement specified in RSS-210.

4.2 Test Procedures

None.

4.3 Test Result

The EUT is equipped with a printed patch antenna without any rf connector.

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-01

The EUT meets the requirements of this section.

5 AC POWER LINE CONDUCTED EMISSIONS TEST

Test Requirement: 47 CFR, § 15.207
RSS-Gen, 8.8
Test Procedure: ANSI C63.10-2013, ISED RSS-Gen

5.1 Regulation

§ 15.207 (a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to
30 MHz, shall not exceed the limits in the following table, as measured using a 50 µH/50 ohms line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15-0.5	66 to 56*	56 to 46*
0.5–5	56	46
0.5-30	60	50

*Decreases with the logarithm of the frequency.

(b) The limit shown in paragraph (a) of this section shall not apply to carrier current systems operating as intentional radiators on frequencies below 30 MHz.

In lieu thereof, these carrier current systems shall be subject to the following standards:

(1) For carrier current system containing their fundamental emission within the frequency band 535–1705 kHz and intended to be received using a standard AM broadcast receiver: no limit on conducted emissions.

(2) For all other carrier current systems: 1000 µV within the frequency band 535–1705 kHz, as measured using a 50 µH/50 ohms LISN.

(3) Carrier current systems operating below 30 MHz are also subject to the radiated emission limits in § 15.205, § 15.209, § 15.221, § 15.223, or § 15.227, as appropriate.

(c) Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

RSS-Gen 8.8 AC power-line conducted emissions limits
Unless stated otherwise in the applicable RSS, for radio apparatus that are designed to be connected to the public utility AC power network, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the range 150 kHz to 30 MHz shall not exceed the limits in table 4, as measured using a 50 µH / 50 Ω line impedance stabilization network. This requirement applies for the radio frequency voltage measured between each power line and the ground terminal of each AC power-line mains cable of the EUT.
For an EUT that connects to the AC power lines indirectly, through another device, the requirement for compliance with the limits in table 4 shall apply at the terminals of the AC power-line mains cable of a representative support

device, while it provides power to the EUT. The lower limit applies at the boundary between the frequency ranges. The device used to power the EUT shall be representative of typical applications.

Table 3 – AC Power Line Conducted Emissions Limits

Frequency of emission (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average**
0.15-0.5	66 to 56*	56 to 46*
0.5–5	56	46
0.5-30	60	50

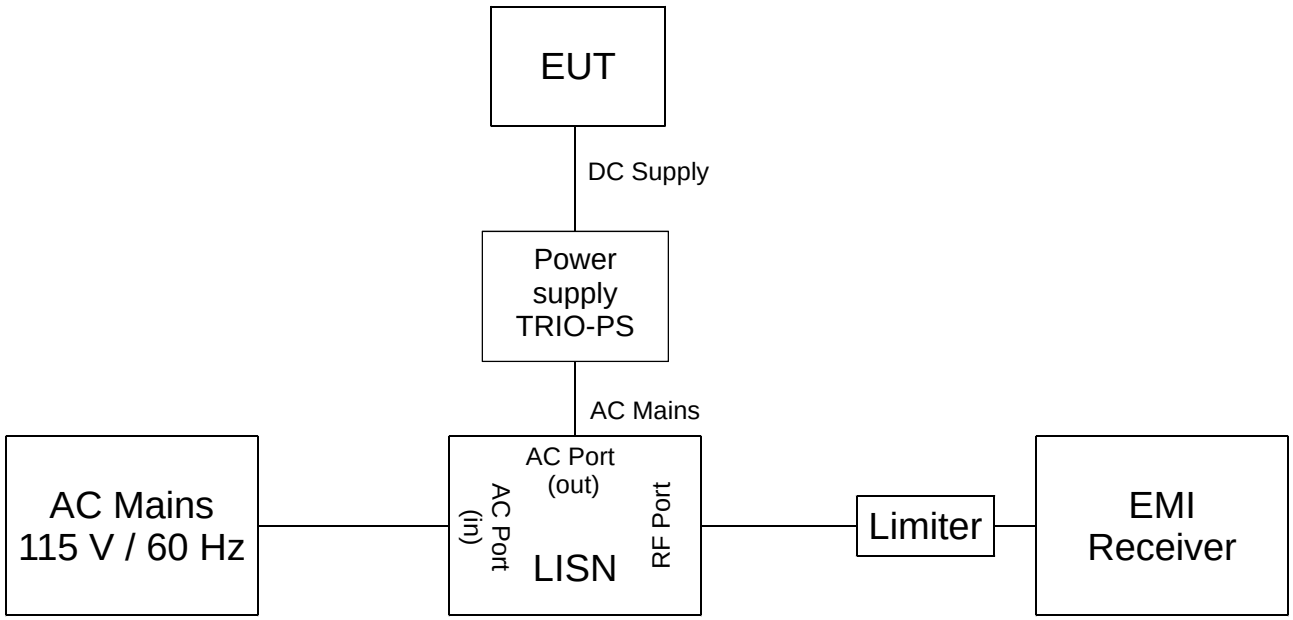
* The level decreases linearly with the logarithm of the frequency.
** A linear average detector is required.

→ The ISED limits are equal to the FCC limits.

5.2 Test Procedures

The EUT was placed on a wooden support above the reference ground plane.
The excess length of the power cord of the ac adapter to the EUT was folded back and forth at the center of the lead to form a bundle not exceeding 40 cm in length.
LISN housing, measuring instrument case and reference ground plane were bonded together.

5.3 Test Setup



SCHEMATIC TEST SETUP

Requirement: 47 CFR § 15.207, RSS-Gen 8.8
Procedure: ANSI C63.10-2013, RSS-Gen 8.8

Power Source: #1
Receiver: #3846
LISN: #1901

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 1890, 1901, 3184, 3846, 3880, 4041, 4717, 5392, 5551

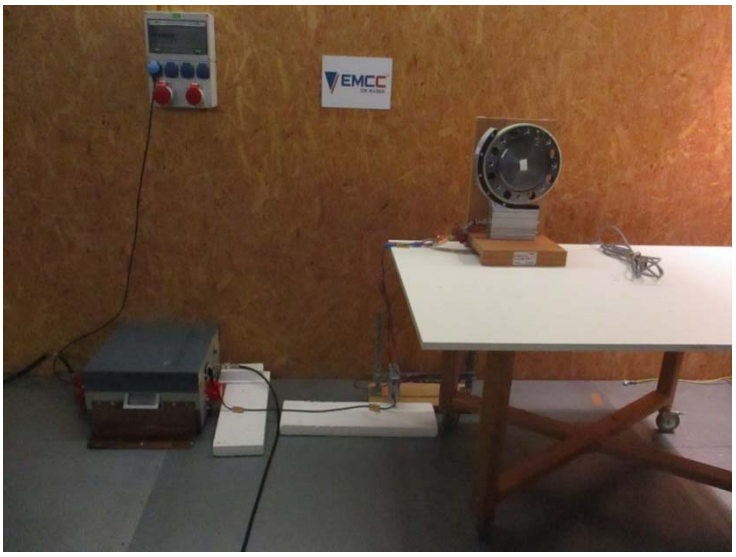
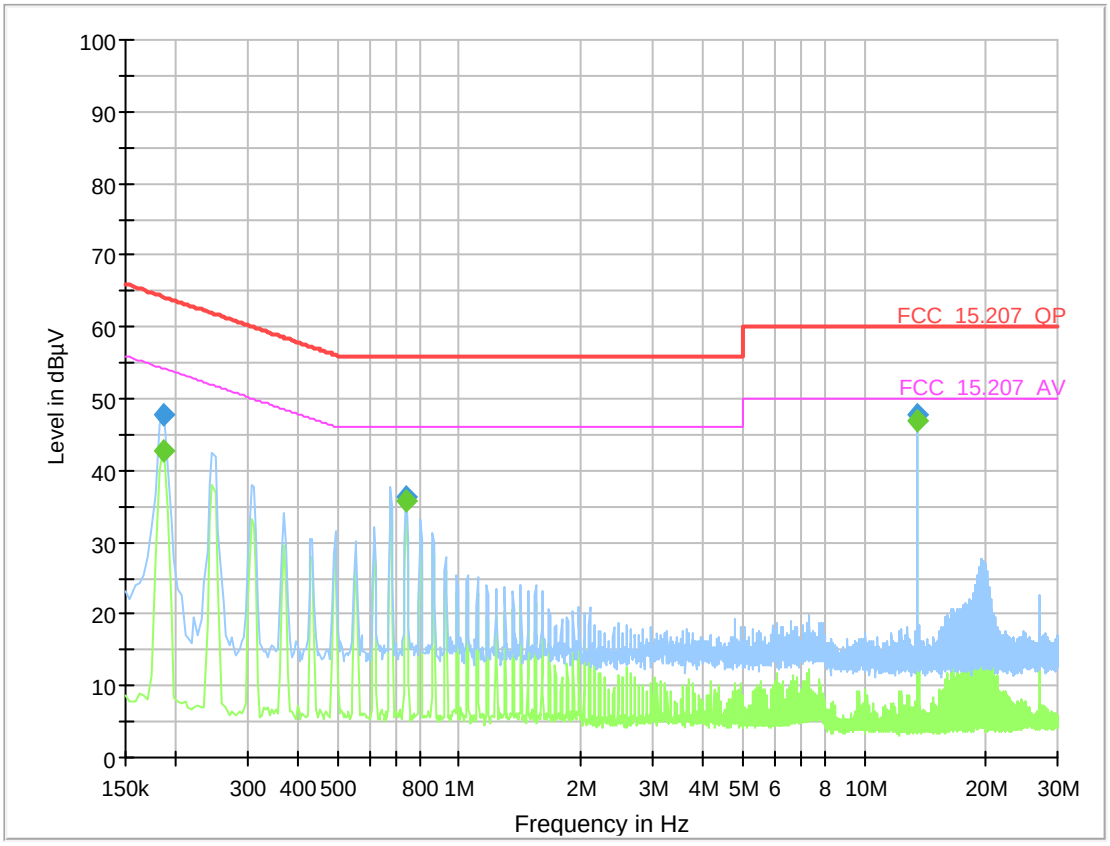


Photo of Setup

5.4 Detailed Test Data

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Type:	T12CV-S8
Serial No:	112055552 (Rotor); none (Stator)
Line:	L and N (max hold))



Final result:

Frequency (MHz)	QuasiPeak (dBµV)	CAverage (dBµV)	Limit (dBµV)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Line	PE	Corr. (dB)
0.186000	---	42.83	54.21	11.38	1000.0	9.000	L1	GND	10.0
0.186000	47.80	---	64.21	16.41	1000.0	9.000	L1	GND	10.0
0.741500	---	35.70	46.00	10.30	1000.0	9.000	L1	GND	10.0
0.741500	36.45	---	56.00	19.55	1000.0	9.000	L1	GND	10.0
13.561500	---	46.91	50.00	3.09	1000.0	9.000	L1	GND	10.0
13.561500	47.82	---	60.00	12.18	1000.0	9.000	L1	GND	10.0

Worst case results listed, only.

5.5 Test Result

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-05
Test Personnel:	Adem Aldogan

The EUT meets the requirements of this section.

6 SPECTRUM MASK

Test Requirement: 47 CFR, § 15.225(a)-(d)
ISED RSS-210, B.6

6.1 Regulation

§ 15.225 (a) The field strength of any emissions within the band 13.553–13.567 MHz shall not exceed 15,848 microvolts/ meter at 30 meters.

(b) Within the bands 13.410–13.553 MHz and 13.567–13.710 MHz, the field strength of any emissions shall not exceed 334 microvolts/meter at 30 meters.

(c) Within the bands 13.110–13.410 MHz and 13.710–14.010 MHz the field strength of any emissions shall not exceed 106 microvolts/meter at 30 meters.

(d) The field strength of any emissions appearing outside of the 13.110– 14.010 MHz band shall not exceed the general radiated emission limits in§ 15.209.

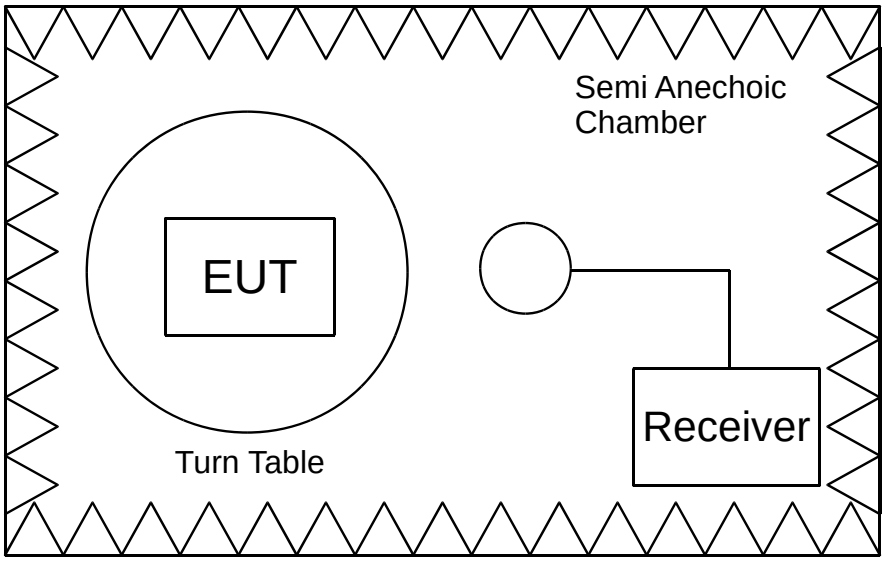
RSS-210 B.6 Band 13.110-14.010 MHz
The field strength of any emission shall not exceed the following limits:

(a) 15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
(b) 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
(c) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
(d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

→ The ISED limits are equal to the FCC limits.

6.2 Test Procedures

The measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.10 clause 4.3.2 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop antenna was 1 m above the ground.
The EUT was tested on a wooden support on the groundplane, the axis was horizontal.
The EUT was connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in normal operation mode.
Worst case emissions are listed under chapter: Final test results.



Schematic diagram

6.2.1 Test Site Correlation for H Field Measurement in Semi-Anechoic Chamber (SAC)

Test procedure following KDB 414788

The carrier at 13.56 MHz was measured in the semi-anechoic room (SAC) at a test distance of 3 m and at an open field site at a test distance of 3 m and 10 m with the same calibrated loop antenna. The measurement was performed with set-up consisting of a single turn loop antenna with a diameter of 0.85 m, feeded by a signal generator. The signal generator was set to a fixed output level with an unmodulated 13.56 MHz sinusoidal signal. In addition a correlation measurement was done with a T12 S6 (documented in the test report EMCC-040197MAE, dated 2016-09-29).
These measurements were used for evaluate a correction of the open field measurement to the semi-anechoic room measurement.

EUT	Freq	Detector	Distance	FSAC	Fopen	fc
	[MHz]		[m]	[dBµV/m]	[dBµV/m]	dB
0.85 m antenna simulation	13.56	QP	3	91.5	88.2	-3.3
S6	13.56	QP	3	71.8	68.5	-3.3

Test date: 2016-09-14/19

The EUT has an antenna diameter of 0.3 m. The fc value of - 3.3 dB was used for the calculation, because the antenna diameter of T12 S6 (diameter 0.249 m) is close to the EUT antenna.

fc = Fopen - FSAC

fc is correlation factor from SAC to open field site field strength
Fopen measured field strength at open field site
FSAC measured field strength at SAC

Radiated Emissions Test Characteristics	
Frequency range	13.11 MHz – 14.01 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical

* According to section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

6.3 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the band 13.553–13.567 MHz:
µV/m at 30 meters = 15848
15848 µV/m corresponds with 84 dBµV/m.

6.4 Field Strength Calculation

All emission measurements performed using the EMI test program's transducer factor setting capability, i.e. the field strength value measured directly without the necessity of additional correction factors.
For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(2) the field strength is calculated by adding additionally an extrapolation factor of 40 dB/decade (inverse linear-distance for field strength measurements). The basic equation with a sample calculation is as follows:
FS = FST + DF + fc
where

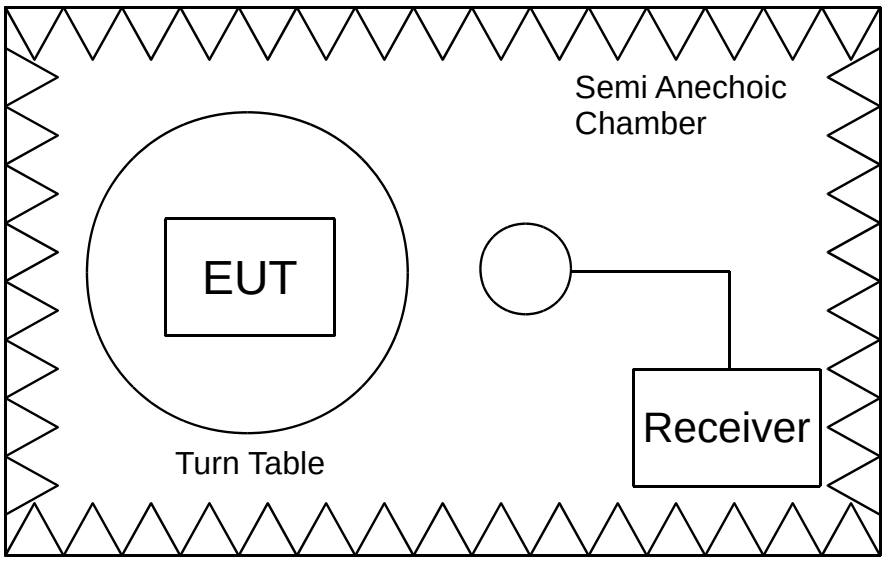
FS = Field Strength in dBµV/m
FST = Field Strength at test distance in dBµV/m
fc = correlation factor from SAC to open field site field strength

DF = Distance Extrapolation Factor in dB,
DF = Distance Extrapolation Factor in dB,
where DF = 40 log (Dtest/Dspec) where Dtest = Test Distance and Dspec = Specified Distance

Assume the tests performed at a reduced Test Distance of 3 m instead of the Specified Distance of 30 m giving a Distance Extrapolation Factor of DF = 40 log (3 m/30 m) = -40 dB.
Assuming a measured field strength level of 68.0 dBµV/m is obtained. The Distance Factor of -40 dB and the correlation factor fc of -3.3 dB is added giving a field strength of 24.7 dBµV/m. The 24.7 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 68.0 - 40 - 3.3 = 24.7 [dBµV/m]
Level in µV/m = Common Antilogarithm (24.7/20) = 17.18

6.5 Test Setup



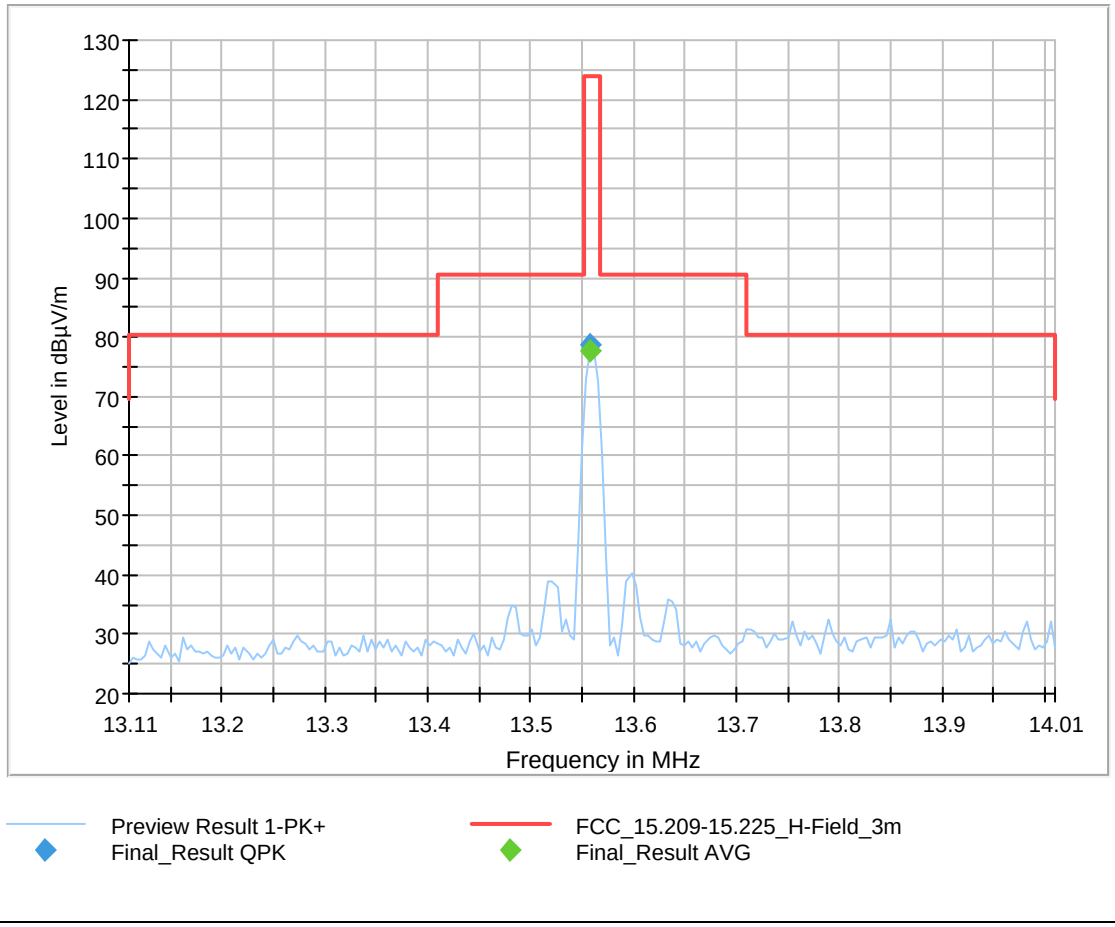
SCHEMATIC TEST SETUP

Requirement:	47 CFR, § 15.225
Procedure:	ANSI C63.10-2013
Receiver:	#3846
Antenna:	#374
Test distance:	3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 519, 1291, 1889, 3846, 4075, 4717, 5392

6.6 Detailed Test Data

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Type:	T12CV-S8
Serial No:	112055552 (Rotor); none (Stator)



Final Result

Frequency [MHz]	Detector	3m_Result [dB(µV/m)]	Distance Correction [dB]	f_c [dB]	30m_Result [dB(µV/m)]	30m_Limit [dB(µV/m)]	Margin [dB]
13.56	QP	78.7*	-40	-3.3	35.4	84	48.6

The table above contains worst-case emissions, only. For further details refer to the test plots.
** A field strength of 78.8 dBµV/m at 3 m is equal to a e.i.r.p. of 22.2 µW.*

6.7 Test Result

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-01
Test personnel:	Wolfgang Kiss

The EUT meets the requirements of this section.

7 OCCUPIED BANDWIDTH (99%)

Test Requirement: ISED RSS-Gen, 6.7
Test Procedure: ISED RSS-Gen, 6.7

7.1 Regulation

RSS-Gen 6.7
The occupied bandwidth or the "99% emission bandwidth" is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the "x dB bandwidth" is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
The detector of the spectrum analyzer shall be set to "Sample". However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or "Max Hold") may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.
Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

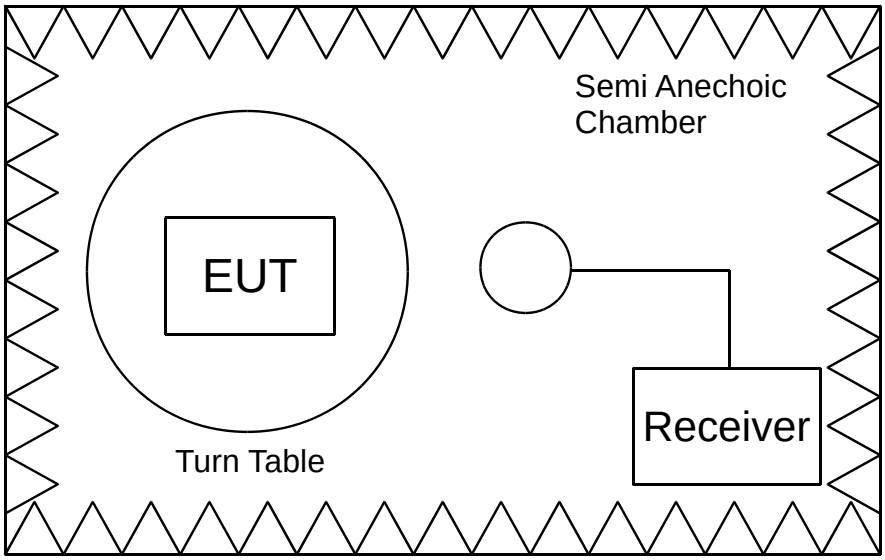
For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

7.2 Test Procedures

Measurement was performed in a semi-anechoic room. The EUT was tested on a wooden support on the groundplane and was connected to its associated peripherals. A calibrated loop antenna was positioned with its plane vertical at 3 m distance from the EUT. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. The analyzer was setup at the nominal centre frequency of the EUT. The span was 20 kHz, the resolution bandwidth 100 Hz and the video bandwidth 300 Hz. A max peak hold was used to measure the occupied bandwidth.

Radiated Emissions Test Characteristics	
Frequency range	13.1 MHz – 14.0 MHz
Test distance	3 m
Test instrumentation resolution bandwidth	100 Hz
Receive antenna height	1 m
Orientation	max. field strength position
Measurement location	Semi Anechoic Chamber (SAC)

7.3 Test Setup



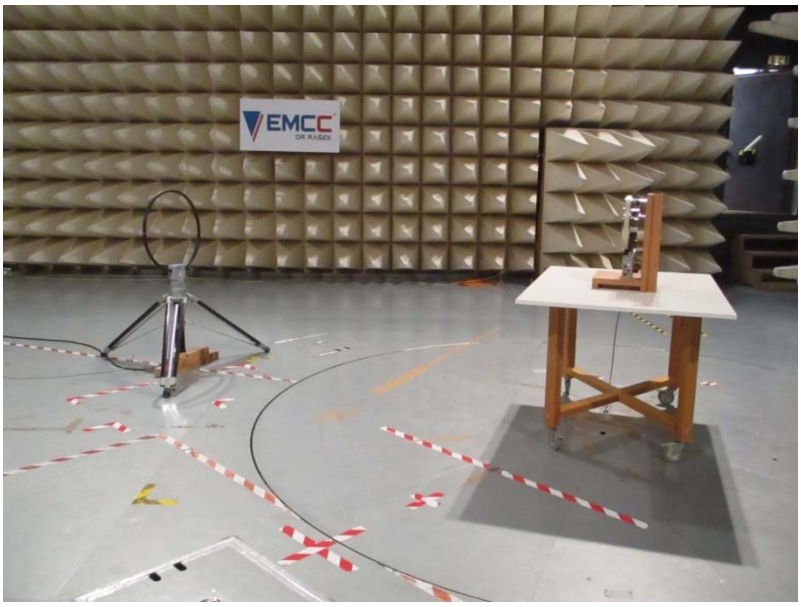
SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.215
Procedure: ANSI C63.10-2013

Receiver: #3846
Antenna: #374

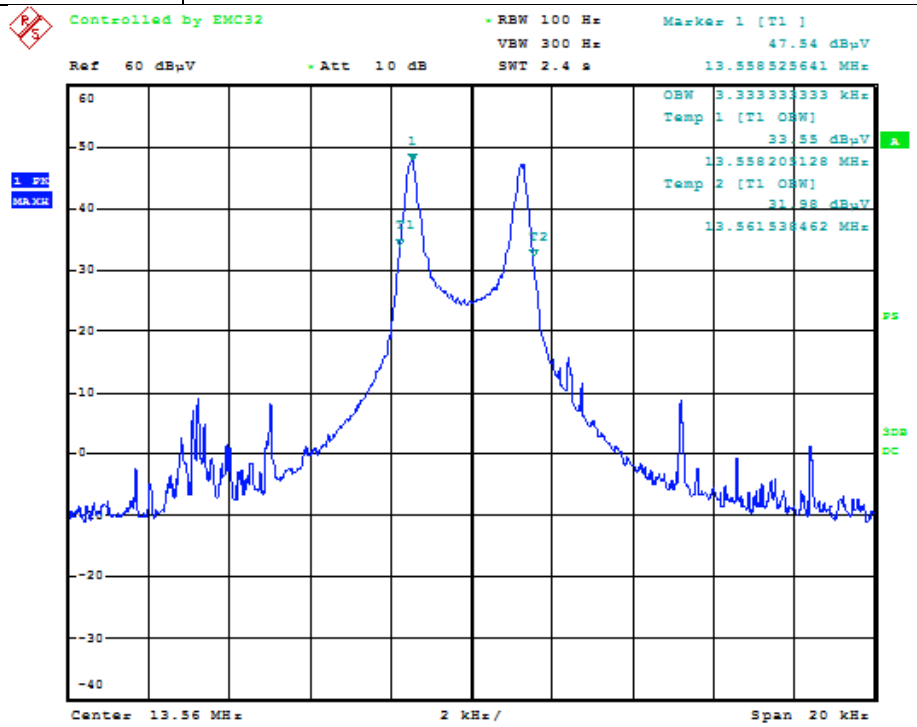
Test distance: 3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 519, 1291, 1889, 3846, 4075, 4717



7.4 Detailed Test Data

Manufacturer: Type: Serial No:	Hottinger Baldwin Messtechnik GmbH T12CV-S8 112055552 (Rotor); none (Stator)



Final Result:

Occupied Bandwidth (99%)	[kHz]	3.33

7.5 Test Result

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-01
Test Personnel:	Wolfgang Kiss

The EUT meets the requirements of this section

8 RADIATED EMISSIONS 9 kHz – 30 MHz

Test requirement: FCC 47 CFR, §15.205, 15.209, 15.225(d)
ISED RSS-Gen Issue 5, 8.9, RSS-210 B.6
Test procedure: ANSI C63.10-2013, ISED RSS-Gen

8.1 Regulation

§ 15.33 Frequency range of radiated measurements:
(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz [...]

§ 15.35 Measurement detector functions and bandwidths.

The conducted and radiated emission limits shown in this Part are based on the following, unless otherwise specified elsewhere in this Part:
(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

(c) Unless otherwise specified, e.g., §§15.255(b), and 15.256(l)(5), when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 seconds. As an alternative (provided the transmitter operates for longer than 0.1 seconds) or in cases where the pulse train exceeds 0.1 seconds, the measured field strength shall be determined from the average absolute voltage during a 0.1 second interval during which the field strength is at its maximum value. The exact method of calculating the average field strength shall be submitted with any application for certification or shall be retained in the measurement data file for equipment subject to Supplier's Declaration of Conformity.

§ 15.205(d)(7) Devices operated pursuant to § 15.225 are exempt from complying with this section for the 13.36–13.41 MHz band only.

§ 15.225 Operation within the band 13.110–14.010 MHz.
(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

§ 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement distance
[MHz]	[µV/m]	[dB(µV/m)]	[m]
0.009–0.490	2400/F[kHz]	20 log(2400/F[kHz])	300
0.490–1.705	24000/F[kHz]	20 log(24000/F[kHz])	30
1.705–30.0	30	29.54	30

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of

other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(d) The emission limits shown in the above table are based on measurements employing a CISPR quasi peak detector except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.
(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

RSS-210 B.6 Band 13.110-14.010 MHz
The field strength of any emission shall not exceed the following limits:

(a) 15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
(b) 334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
(c) 106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
(d) RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

RSS-Gen, 8.9 Transmitter Emission Limits
Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 6 – General field strength limits at frequencies below 30 MHz

Frequency	Field Strength	Equivalent Field Strength[2]	Measurement distance
	[µA/m]	[µV/m]	[m]
9 – 490 kHz[1]	6.37/F[kHz]	2401/F[kHz]	300
490 – 1705 kHz	63.7/F[kHz]	24015/F[kHz]	30
1.705–30 MHz	0.08	30.16	30

Note 1: The emission limits for the ranges 9-90 kHz and 110-490 kHz are based on measurements employing a linear average detector.

Note 2: Equivalent electrical field strength according to ANSI C63.10-2013 chapter 4.3.2:
"For the United States, the regulatory limits below 30 MHz are in terms of µV/m. By convention, magnetic field strength is converted to an electric field strength based on free-space impedance."

8.2 Test Procedures

The measurement was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.10 clause 4.3.2 was positioned with its plane vertical at the test distance from the EUT and rotated about its vertical axis for maximum response at each azimuth about the EUT. The center of the loop antenna was 1 m above the ground.
The EUT was tested on a wooden support on the groundplane, the axis was horizontal.
The EUT was connected to its associated peripherals, with any excess I/O cabling bundled to approximately 1 meter. In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.
Worst case emissions are listed under chapter: Final test results

Radiated Emissions Test Characteristics	
Frequency range	9 kHz - 30 MHz
Test distance	3 m*
Test instrumentation resolution bandwidth	200 Hz (9 kHz - 150 kHz)
	10 kHz (150 kHz - 30 MHz)
Receive antenna height	1 m
Receive antenna polarization	Vertical, two orientations
Measurement location	Semi Anechoic Chamber (SAC)

* According to Section 15.31 (f)(2): At frequencies below 30 MHz, measurements may be performed at a distance closer than that specified in the regulations; however, an attempt should be made to avoid making measurements in the near field. Pending the development of an appropriate measurement procedure for measurements performed below 30 MHz, when performing measurements at a closer distance than specified, the results shall be extrapolated to the specified distance by either making measurements at a minimum of two distances on at least one radial to determine the proper extrapolation factor or by using the square of an inverse linear distance extrapolation factor (40 dB/decade). The 40 dB/decade factor was used.

8.2.1 Test Site Correlation for H Field Measurement in Semi-Anechoic Chamber (SAC)

Refer to chapter 6.2.1

8.3 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the restricted band 2.1735 - 2.1905 MHz:

30 µV/m at 30 meters

Using the equation:

$E_{dB\mu V/m} = 20 * \log (E_{\mu V/m})$

where

$E_{dB\mu V/m}$ = Field Strength in logarithmic units (dBµV/m)

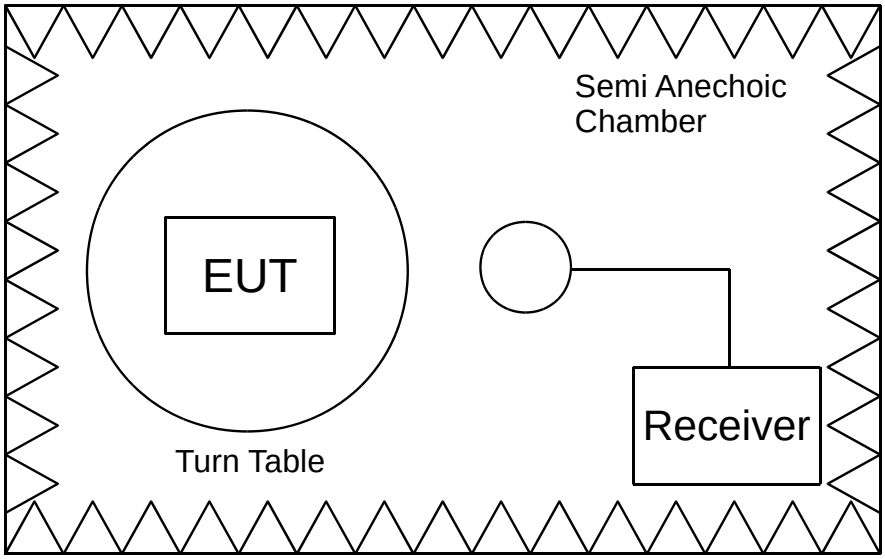
$E_{\mu V/m}$ = Field Strength in linear units (µV/m)

A field strength limit of 30 µV/m corresponds with 29.5 dBµV/m.

8.4 Field Strength Calculation

Refer to chapter 6.4.

8.5 Test setup



SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.209
Procedure: ANSI C63.10-2013

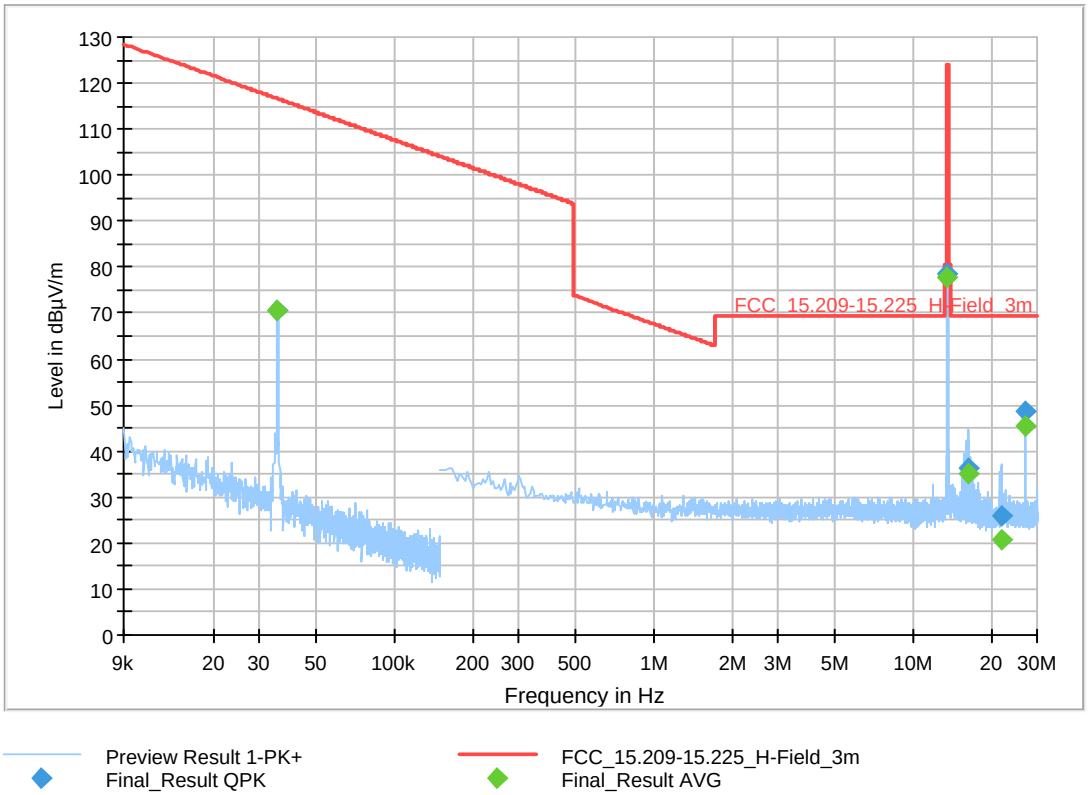
Receiver: #3846
Antenna: #374

Test distance: 3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
374, 519, 1291, 1889, 3846, 4075, 4717, 5392

8.6 Detailed Test Data

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Type:	T12CV-S8
Serial No:	112055552 (Rotor); none (Stator)
Radiated Emissions:	9 kHz – 30 MHz



Measurement was performed at 3 m distance. Plots show field strength reading at 3 m distance.
In order to compare the 3 m reading with the specified field strength limits a distance correction as described in chapter 6.4 (40 dB/decade) was applied to the limit (represented by the limit line „FCC_15.209_HField_3m“).

Final Result

Frequency [MHz]	Detector	3m_Result [dB(µV/m)]	Distance Correction [dB]	fc [dB]	30m_Result [dB(µV/m)]	30m_Limit [dB(µV/m)]	Margin [dB]
13.56	QP	78.7	-40	-3.3	35.4	84	48.6

8.7 Test Results

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-01
Test personnel:	Wolfgang Kiss

The EUT meets the requirements of this section.

9 RADIATED EMISSIONS 30 MHZ – 150 MHZ

Test Requirement: FCC 47 CFR, §15.205, 15.209, 15.225(d)
ISED RSS-Gen Issue 5, 6.13, 8.9, RSS-210 B.6
Test Procedure: ANSI C63.10-2013, ISED RSS-Gen

9.1 Regulation

§ 15.33 Frequency range of radiated measurements:
(a) For an intentional radiator, the spectrum shall be investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to at least the frequency shown in this paragraph:
(1) If the intentional radiator operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
(4) If the intentional radiator contains a digital device, regardless of whether this digital device controls the functions of the intentional radiator or the digital device is used for additional control or function purposes other than to enable the operation of the intentional radiator, the frequency range shall be investigated up to the range specified in paragraphs (a)(1) through (a)(3) of this section or the range applicable to the digital device, as shown in paragraph (b)(1) of this section, whichever is the higher frequency range of investigation.
(b) For unintentional radiators:
(1) Except as otherwise indicated in paragraphs (b)(2) or (b)(3) of this section, for an unintentional radiator, including a digital device, the spectrum shall be investigated from the lowest radio frequency signal generated or used in the device, without going below the lowest frequency for which a radiated emission limit is specified, up to the frequency shown in the following table:

Highest frequency generated or used in the device or on which the device operates or tunes	**Upper frequency of measurement range (MHz)**
[MHz]	**[MHz]**
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

§ 15.35 Measurement detector functions and bandwidths.
The conducted and radiated emission limits shown in this part are based on the following, unless otherwise specified in this part:

(a) On any frequency or frequencies below or equal to 1000 MHz, the limits shown are based on measuring equipment employing a CISPR quasi-peak detector function and related measurement bandwidths, unless otherwise specified. The specifications for the measuring instrumentation using the CISPR quasi-peak detector can be found in ANSI C63.4-2014, clause 4 (incorporated by reference, see §15.38). As an alternative to CISPR quasi-peak measurements, the responsible party, at its option, may demonstrate compliance with the emission limits using measuring equipment employing a peak detector function as long at the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

Note: For pulse modulated devices with a pulse-repetition frequency of 20 Hz or less and for which CISPR quasi-peak measurements are specified, compliance with the regulations shall be demonstrated using measuring equipment employing a peak detector function, properly adjusted for such factors as pulse desensitization, using the same measurement bandwidths that are indicated for CISPR quasi-peak measurements.

§ 15.225 Operation within the band 13.110–14.010 MHz.

(d) The field strength of any emissions appearing outside of the 13.110–14.010 MHz band shall not exceed the general radiated emission limits in § 15.209.

§ 15.209(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency	Field Strength		Measurement Distance
[MHz]	[µV/m]	[dB(µV/m)]	[m]
30–88	100	40.0	3
88–135.6	150	43.5	3

(b) In the emission table above, the tighter limit applies at the band edges.
(c) The level of any unwanted emissions from an intentional radiator operating under these general provisions shall not exceed the level of the fundamental emission. For intentional radiators which operate under the provisions of other sections within this part and which are required to reduce their unwanted emissions to the limits specified in this table, the limits in this table are based on the frequency of the unwanted emission and not the fundamental frequency. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency.
(e) The provisions in §§ 15.31, 15.33, and 15.35 for measuring emissions at distances other than the distances specified in the above table, determining the frequency range over which radiated emissions are to be measured, and limiting peak emissions apply to all devices operated under this part.

RSS-Gen 6.13
In measuring unwanted emissions, the spectrum shall be investigated from 30 MHz or the lowest radio frequency signal generated in the equipment, whichever is lower, without going below 9 kHz, up to at least the frequency given below:

(a) If the equipment operates below 10 GHz: to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

…

RSS-Gen, 8.9 Transmitter Emission Limits for Licence-Exempt Radio Apparatus
Except when the requirements applicable to a given device state otherwise, emissions from licence-exempt transmitters shall comply with the field strength limits shown in Table 4 and Table 5 below. Additionally, the level of any transmitter emission shall not exceed the level of the transmitter's fundamental emission.

Table 4 – General Field Strength Limits for Licence-Exempt Transmitters at Frequencies Above 30 MHz	
Frequency (MHz)	Field Strength (µv/m at 3 metres
30-88	100
88-216	150
216-960	200
Above 960*	500

* Unless otherwise specified, for all frequencies greater than 1 GHz, the radiated emission limits for licence-exempt radio apparatus stated in applicable RSSs (including RSS-Gen) are based on measurements using a linear average detector function having a minimum resolution bandwidth of
1 MHz. If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for such factors as pulse desensitization to ensure the peak emission is less than 20 dB above the average limit.

Note: Transmitting devices are not permitted in restricted frequency bands unless stated otherwise in the specific RSS.

…

RSS-210 B.6 Band 13.110-14.010 MHz

The field strength of any emission shall not exceed the following limits:
15.848 mV/m (84 dBµV/m) at 30 m, within the band 13.553-13.567 MHz;
334 µV/m (50.5 dBµV/m) at 30 m, within the bands 13.410-13.553 MHz and 13.567-13.710 MHz;
106 µV/m (40.5 dBµV/m) at 30 m, within the bands 13.110-13.410 MHz and 13.710-14.010 MHz; and
RSS-Gen general field strength limits for frequencies outside the band 13.110-14.010 MHz.

RSS-Gen 8.9 Transmitter emission limits

Except where otherwise indicated in the applicable RSS, radiated emissions shall comply with the field strength limits shown in table 5 and table 6. Additionally, the level of any transmitter unwanted emission shall not exceed the level of the transmitter's fundamental emission.

Table 5 – General field strength limits at frequencies above 30 MHz

Frequency	Field Strength
[MHz]	[µV/m at 3 m]
30–88	100
88–216	150
216–960	200
above 960	500

→ The ISED limits for radiated spurious emissions are equal to the FCC limits.

9.2 Test Procedures

The EUT was tested on a wooden support on the groundplane, the axis was horizontal.
In certain applications, a remotely located device may be connected to the EUT. In these cases, it is permissible for cabling from the remotely located device to the EUT or accessories to be placed directly on the reference groundplane or, if normally installed beneath the reference groundplane, beneath it. The remotely located device shall be located at a distance sufficient to ensure that it does not contribute to the measured level. This procedure evaluates the interference potential of the EUT, its accessories, and interconnecting cables or wires standing apart from the remotely located device, which in turn shall be evaluated separately, if required.
With the EUT operating in "worst case" mode, emissions from the unit are maximized by adjusting the polarization and height of the receive antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions *[Remark: Not applicable]*.

Measurement initially performed as a pre-scan in the full frequency range in order to find worst case emissions. Final measurement performed at worst-case emission frequencies in a FCC and IC listed semi-anechoic room at the specified 3 m test distance. Pre-scan and final measurement performed in modulated mode.
Final measurement performed up to the tenth harmonic of the carrier according to FCC Section 15.33 and ISED RSS-Gen 6.13 a.

Worst case emissions are listed under chapter: test results.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz - 150 MHz*
Test distance	3 m
Test instrumentation resolution bandwidth	120 kHz (30 MHz - 1,000 MHz)
Receive antenna scan height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal

* Tenth harmonic of highest fundamental frequency is 135.6 MHz

9.3 Calculation of Field Strength Limits

E.g. radiated spurious emissions field strength limits for the restricted band 108-121.94 MHz:

µV/m at 3 meters = 150

150 µV/m corresponds with 43.5 dBµV/m.

9.4 Field Strength Calculation

All emission measurements described in this chapter performed using the EMI test program transducer factor setting capability, i.e. the field strength value at the test distance was measured directly without the necessity of additional correction factors.

The field strength is calculated by adding the Antenna Factor and Cable Factor. The basic equation with a sample calculation is as follows:

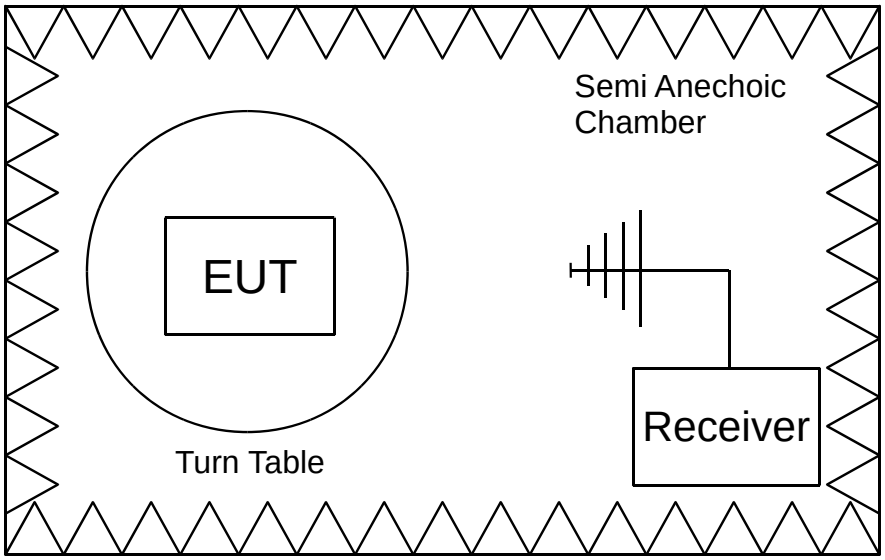
FS = RA + AF + CF
where
FS = Field Strength in dBµV/m
RA = Receiver Amplitude in dBµV
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB

Assume a receiver reading of 23.5 dBµV is obtained. The Antenna Factor of 7.4 dB(1/m) and a Cable Factor of 1.1 dB are added, giving a field strength of 32 dBµV/m. The 32 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 = 32 [dBµV/m]

Level in µV/m = Common Antilogarithm (32/20) = 39.8

9.5 Test Setup



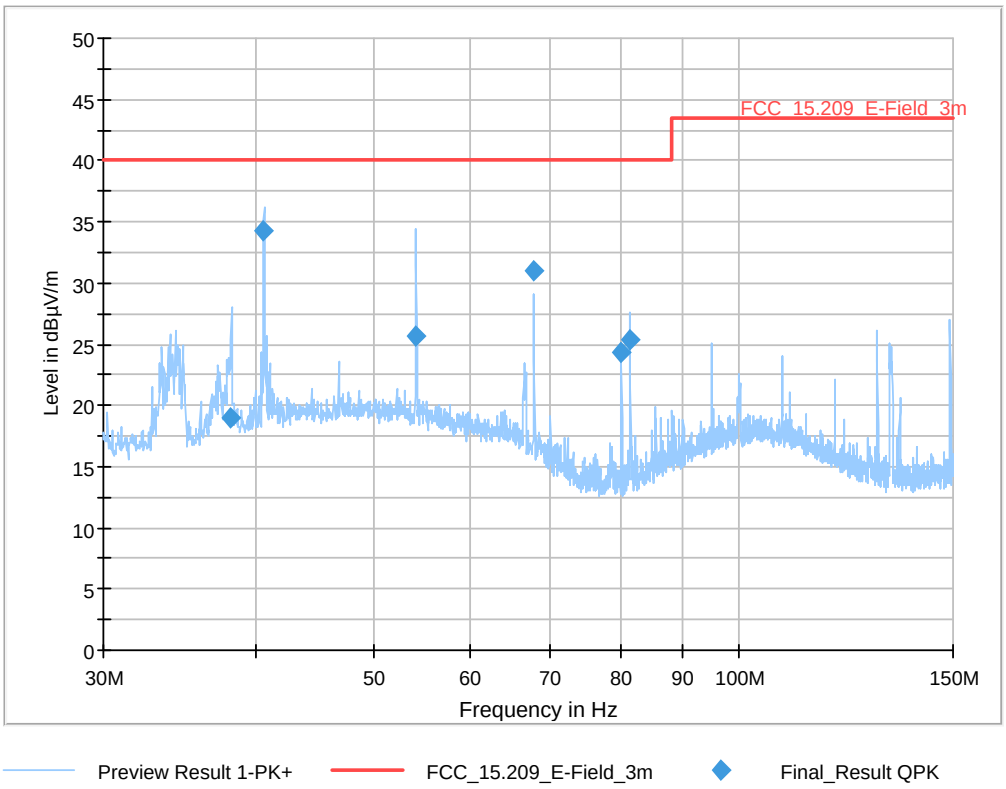
SCHEMATIC TEST SETUP

Requirement:	47 CFR, § 15.209 § 15.109, ICES-003
Procedure:	ANSI C63.10-2013 ANSI C63.4-2014
Receiver:	#3846
Antenna:	#6041
Test distance:	3 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
54, 519, 1291, 1292, 1889, 2724, 3195, 4075, 4717, 5392, 6041

9.6 Detailed Test Data

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Type:	T12CV-S8
Serial No:	112055552 (Rotor); none (Stator)
Radiated Emissions	30 MHz – 150 MHz



Final Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.22	19.0	40.0	21.0	1000	120.0	107.0	V	-162	18.2
40.66	34.3	40.0	5.7	1000	120.0	100.0	V	58	18.8
54.26	25.7	40.0	14.4	1000	120.0	114.0	V	-129	19.3
67.82	31.0	40.0	9.0	1000	120.0	100.0	V	-74	16.2
80.06	24.3	40.0	15.7	1000	120.0	155.0	V	-44	13.4
81.34	25.4	40.0	14.6	1000	120.0	100.0	V	87	13.6

All tests performed at 3 m distance. The table above contains worst-case emissions for the normal mode, only. For further details refer to the pre-scan test plots. Corr. for information, only (already included in QP result).

9.7 Test Result

Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Device:	T12
Type(s):	T12CV-S8
Serial No(s):	112055552 (Rotor); none (Stator)
Test date:	2019-03-01
Test personnel:	Wolfgang Kiss

All emissions in the range 30 MHz to 150 MHz are below the specified limits.

The EUT meets the requirements of this section.

10 TEST INSTRUMENTS

EMCC ID	Instrument	Manufacturer	Model No.	Last Calibration	Next Calibration
1	60-Hz-Converter	AEG	DAMK4/DAGK4	n/a	n/a
54	N-Cable N/50	Rohde & Schwarz	HFU2-Z5	n/a	n/a
374	Loop Antenna	Rohde & Schwarz	HFH 2-Z2	2018-11	2021-02
519	Programmable Power Source	Rohde & Schwarz	NGPE40	n/a	n/a
1291	Antenna Mast	Frankonia	FAM4	n/a	n/a
1292	Multi Device Controller	Frankonia	FC02	n/a	n/a
1889	SR-ULL-01, Semi-Anechoic Chamber (SAC)	EMCC/FRANK.	SAC-10	n/a	n/a
1890	SR-ULL-05, Absorber-Lined Shielded Chamber	EMCC / SIEM / FRANK	SC2-ULL	n/a	n/a
1901	V-LISN 50 ohms//(50 uH + 5 ohms)	Rohde & Schwarz	ESH2-Z5	2018-11	2019-11
2724	5 W Attenuator 6dB	Weinschel	2	2017-06	2019-06
3184	Pulse Limiter	MTS	MTA-IMP-136	2017-07	2019-07
3195	Notebook	Samsung	P560	n/a	n/a
3846	EMI Test Receiver	Rohde & Schwarz	ESU8	2019-02	2020-02
3880	Digital Multimeter	Agilent	U1241B	2018-07	2020-07
4041	Notebook	Dell	Latitude E6430	n/a	n/a
4075	Workstation	Dell	Optiplex 7010	n/a	n/a
4717	Web-Thermo-Hygrobarograph	Wiesemann & Theis GmbH WUT	57613 Web-T/Rh/P	2018-01	2020-01
5392	EMC Measurement Software	Rohde & Schwarz	EMC32	n/a	n/a
5551	BNC cable	EMCC	BNC003m0	n/a	n/a
6041	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	2017-09	2019-09

11 MEASUREMENT UNCERTAINTY

Measurement	Measurement Uncertainty
Conducted emissions (9 kHz – 30 MHz)	± 3.5 dB
Radiated emissions, H field (9 kHz – 30 MHz)	± 3.0 dB
Radiated Emissions (30 MHz – 1 GHz)	± 5.7 dB

The reported uncertainty values are based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of 95%.

If not otherwise stated, the given values are worst case values calculated on the basis of the following documents:
ETSI TR 100 028-1 V1.4.1 (2001-12)
ETSI TR 100 028-2 V1.4.1 (2001-12)
JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

12 LIST OF ANNEXES

Following annexes are separated parts from this test report.

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

ANNEX 1 TO TEST REPORT # EMCC-040197Z, 2019-06-28

PHOTOGRAPHS OF TEST SET-UP

EQUIPMENT UNDER TEST:

Device:	T12CV-S8
Serial Number:	112055552
Application:	Low Power Transceiver
FCC ID:	2ADAT-T12S8
IC:	12438A-T12S8
Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Address:	Im Tiefen See 45 64293 Darmstadt Germany
Phone :	+49 6151 803-619
Fax:	+49 6151 803-9619
E-Mail :	hans.schuster@hbm.com

RELEVANT STANDARD(S) : 47 CFR 15.225
RSS-210 Issue 9

MEASUREMENT PROCEDURE:

☒ ANSI C63.10-2013 ☒ RSS-Gen Issue 5

RADIATED AND CONDUCTED EMISSIONS TEST

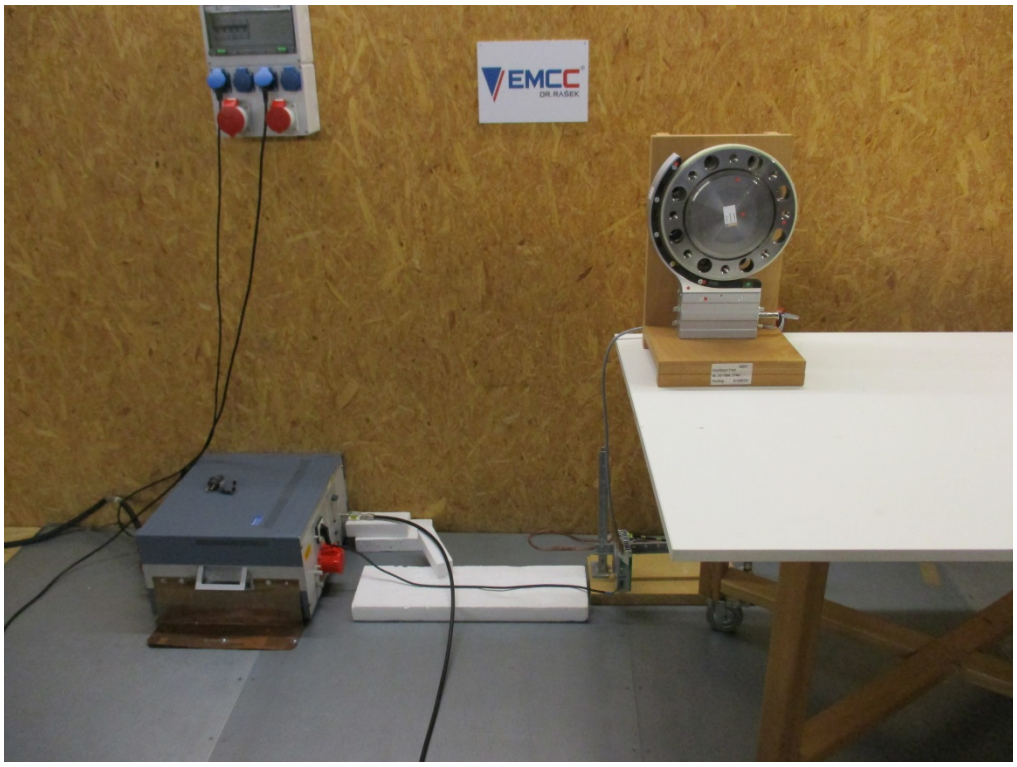


Photo A1-1: Conducted emissions measurement, 150 kHz – 30 MHz

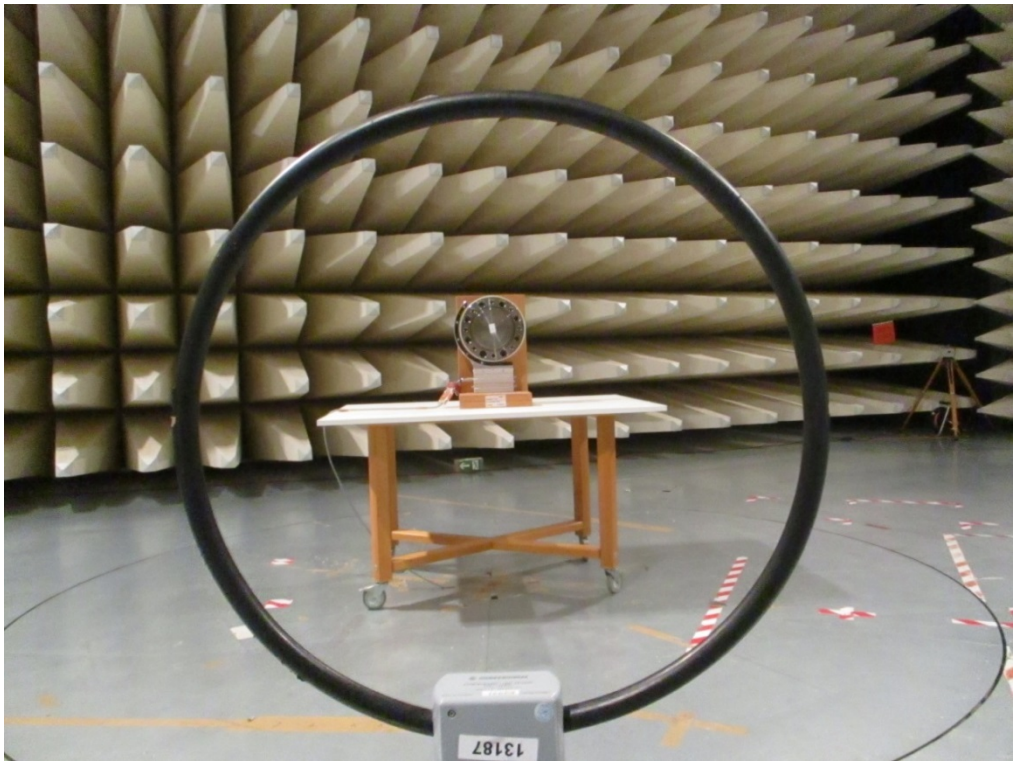


Photo A1-2: Radiated emissions measurement at 3 m distance, 9 kHz – 30 MHz

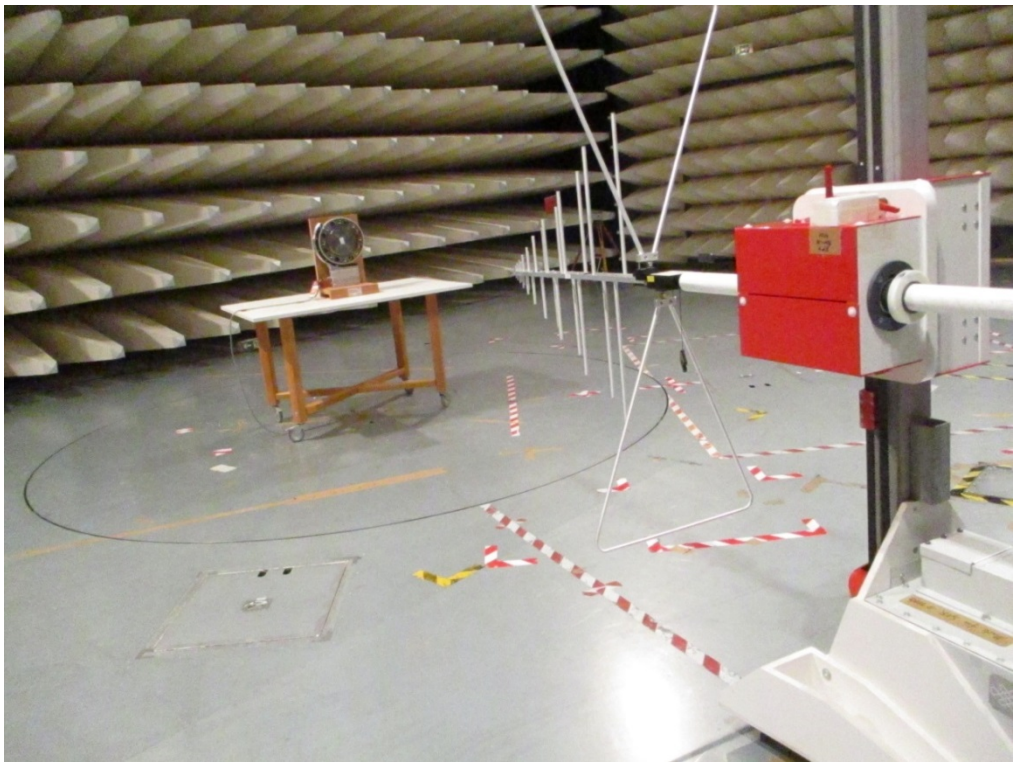


Photo A1-3: Radiated emissions measurement at 3 m distance, 30 MHz – 150 MHz

ANNEX 2 TO TEST REPORT # EMCC-040197Z, 2019-06-28

EXTERNAL PHOTOGRAPHS OF EUT

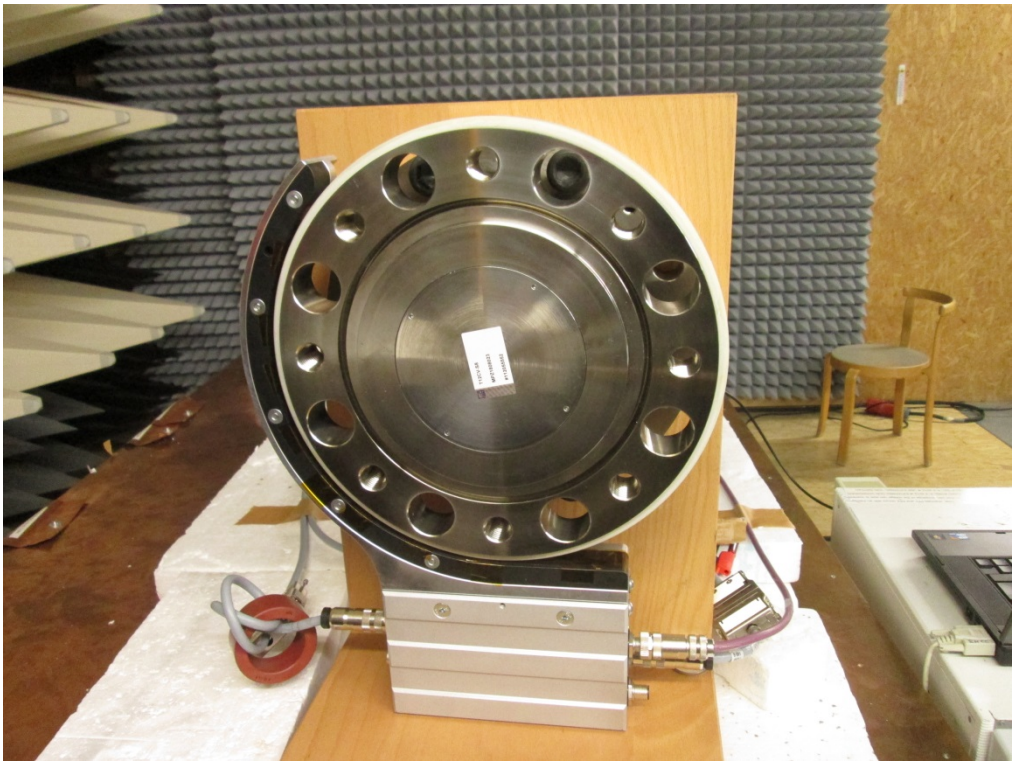
EQUIPMENT UNDER TEST:

Device:	T12CV-S8
Serial Number:	Rotor: 112055552 , Stator: none
Application:	Low Power Transceiver
FCC ID:	2ADAT-T12S8
IC:	12438A-T12S8
Manufacturer:	Hottinger Baldwin Messtechnik GmbH
Address:	Im Tiefen See 45 64293 Darmstadt Germany
Phone :	+49 6151 803-681
Fax:	+49 6151 803-98790
E-Mail :	hans.schuster@hbm.com
RELEVANT STANDARD(S) :	47 CFR 15.225 RSS-210 Issue 9

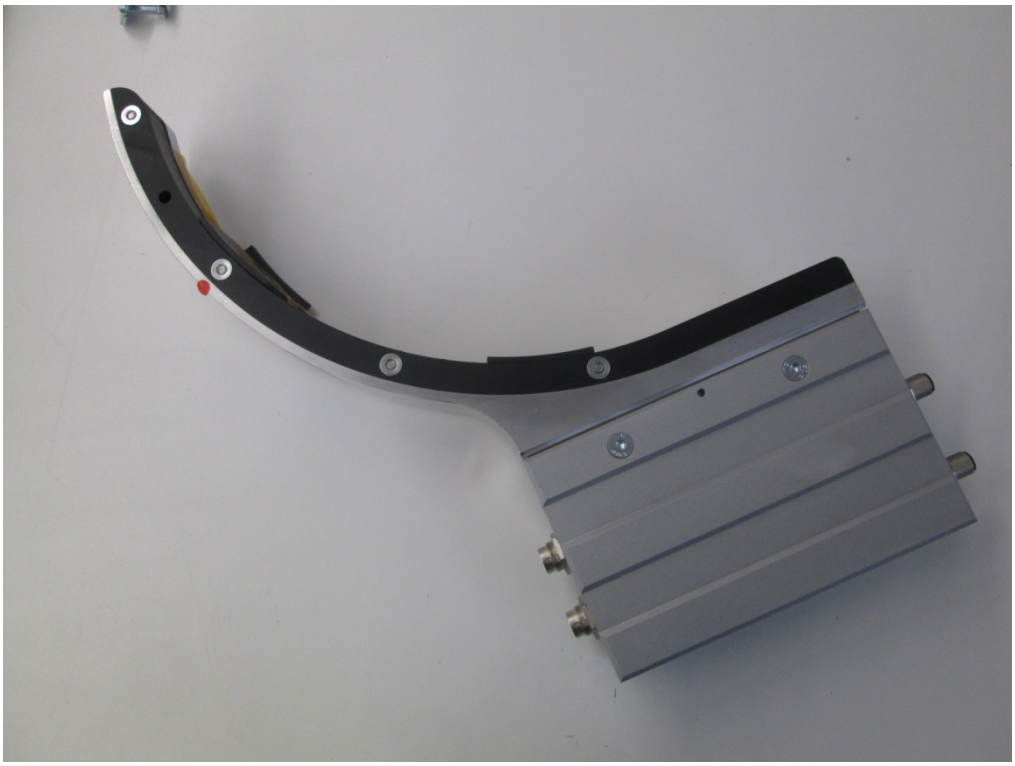
MEASUREMENT PROCEDURE:

☒ ANSI C63.10-2013 ☒ RSS-Gen Issue 5

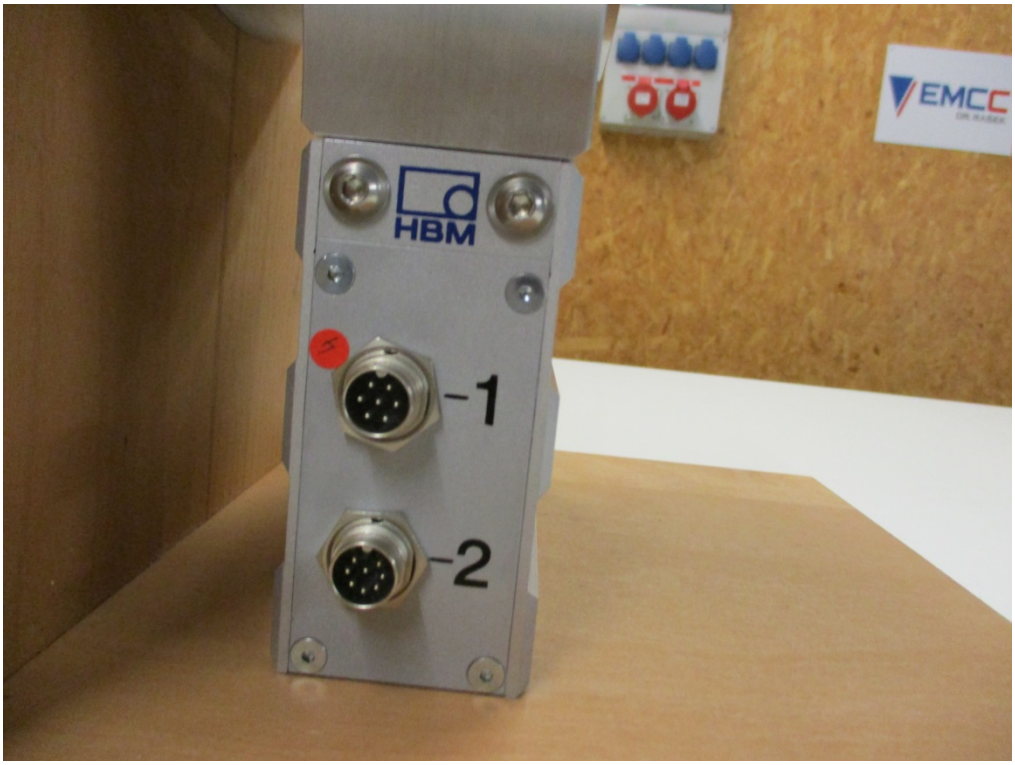
PHOTOS OF EUT



EUT T12CV S8 on wooden support



Detail on Stator



View on connector 1 and 2 on Stator

View on connector 2, 4 and 5 on Stator