# TEST REPORT # EMCC-950432.1TBA, 2011-04-12

**EQUIPMENT UNDER TEST:**

| | |
|---|---|
| Trade Name: | Wireless Keypad, AM 310 MHz |
| Model: | TX45-310-10 |
| Serial No: | FFFFE1 |
| Equipment Category: | Transmitter |
| Manufacturer: | SOMMER Antriebs- und Funktechnik GmbH |
| Address: | Hans-Boeckler-Strasse 21-27<br>73230 Kirchheim/Teck<br>Germany |
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**RELEVANT STANDARD(S):** 47 CFR Part 15C

RSS-210 Issue 8 (2010-12)

**MEASUREMENT PROCEDURE USED:**

☒ ANSI C63.4-2003 ☐ FCC/OET MP-4 (1987) ☐ Other

**TEST REPORT PREPARED BY:**

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**TEST PERSONNEL:** **HEAD OF LABORATORY:**

Wolfgang Döring Karlheinz Kraft Reinhard Sauerschell

**Test of SOMMER Wireless Keypad, AM 310 MHz Model TX45-310-10 to 47 CFR Part 15C and RSS-210 Issue 8 (2010-12)**

## CONTENTS Page

# 1 GENERAL INFORMATION

## 1.1 Purpose

The purpose of this report is to show compliance to the FCC regulations for unlicensed devices operating under section 15.231 of the Code of Federal Regulations title 47.
Further the report addresses compliance with the Industry Canada RSS-210 requirements for the certification of licence-exempt (i.e. unlicensed) low-power radiocommunication devices (LPDs) defined as Category I equipment.

## 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.

This test report substitutes Test Report # 950432.1TB, 2011-03-21.

## 1.3 Test Location

| | |
|---|---|
| Test Laboratory: | EMCCons DR. RAŠEK GmbH & Co. KG |
| Accreditation No.: | DAT-P-204/95-03 |
| Address of Labs I, II, III and Head Office: | EMCCons DR. RAŠEK GmbH & Co. KG<br>Moggast, Boelwiese 8<br>91320 Ebermannstadt<br>GERMANY |
| Address of Labs IV and V: | EMCCons DR. RAŠEK GmbH & Co. KG<br>Stoernhofer Berg 15<br>91364 Unterleinleiter<br>GERMANY |
| Laboratory: | Test Laboratory IV,<br>The 3m & 10m semi-anechoic chamber site has been fully described in a report submitted to the FCC, and accepted in the letter dated January 18, 2008, Registration Number 878769. This 3m/10m alternative test site is approved by Industry Canada under file number 3464C. |
| Phone: | +49 9194 9016 |
| Fax: | +49 9194 8125 |
| E-Mail: | emc.cons@emcc.de |
| Web: | www.emcc.de |

## 1.4 Manufacturer

| | |
|---|---|
| Company Name: | SOMMER Antriebs- und Funktechnik GmbH |
| Street: | Hans-Boeckler-Strasse 21-27 |
| City: | 73230 Kirchheim/Teck |
| Country: | Germany |
| | |
| Name for contact purposes: | Mr Dominik Schwarz |
| Phone: | +49 7021 8001-411 |
| Fax: | +49 7021 8001-403 |
| E-mail: | d.schwarz@sommer.eu |

## 1.5 Dates and Test Location

Date of receipt of EUT: CW 08/2011
Test date: CW 08/2011
Test Location: Lab IV; The 3m & 10m semi-anechoic chamber site has been fully described in a report submitted to the FCC, and accepted in the letter dated January 18, 2008, Registration Number 878769. This 3m/10m alternative test site is approved by Industry Canada under file number 3464C.

## 1.6 Ordering Information

Purchase Order and Date: SB 102757, 2011-02-04
Vendor Number: none

## 1.7 Climatic Conditions

| Date | Temperature [°C] | Relative Humidity [%] | Air Pressure [hPa] | Lab | Customer attended tests |
|---|---|---|---|---|---|
| 2011-02-24 | 24 | 20 | 982 | IV | Yes |
| 2011-02-25 | 24 | 21 | 985 | IV | Yes |

Mr Dominik Schwarz and Mr Ali Badran of Sommer Antriebs- und Funktechnik GmbH attended the tests.

# 2 PRODUCT DESCRIPTION

## 2.1 Equipment Under Test (EUT)

| | |
|---|---|
| Trade Name: | Wireless Keypad, AM 310 MHz |
| Model: | TX45-310-10 |
| Revision: | 3EW |
| Serial Number: | FFFFE1 |
| FCC ID: | T8C104 |
| Industry Canada Certification Number: | 6496A-104 |
| Application: | wireless telecommand |
| Power: | 3 V, 2 pcs. 1.5 V battery, AAA type |
| Transmit Frequency: | 310 MHz, one RF channel |
| Modulation: | ASK |
| Emission designator: | A1D |
| Lowest frequency in EUT: | 9.6875 MHz (clock frequency), 4 MHz (processor) |
| Antenna: | internal, integral antenna |
| Interface ports: | none |
| Variants: | none |
| Remarks: | none |

## 2.2 EUT Peripherals

None.

## 2.3 Mode of Operation During Testing

The transmitter was tested in a typical fashion. During preliminary and final emission tests all transmitter channels (buttons) were activated to investigate a worst case emission mode.

## 2.4 Modifications Required for Compliance

TX output power was reduced in order to meet the fundamental emission limit.

# 3 TEST RESULTS SUMMARY

Summary of Test Results for the following EUT:

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

| Requirement | 47 CFR Section | RSS, Section | Report Section | Test Result |
|---|---|---|---|---|
| Antenna Requirement | 15.203 | RSS-Gen Issue 3 (2010-12), 7.1.2 | 4 | Pass |
| AC Line Conducted Emissions | 15.207 | RSS-Gen Issue 3 (2010-12), 7.2.4 | 5 | N.A. |
| Radiated Spurious Emissions | 15.231, 15.209, 15.205(b) | RSS-210 Issue 8 (2010-12), A1.1.2(3) | 6 | Pass |
| Periodic Operation Characteristics | 15.231(a) | RSS-210 Issue 7 (2007-06), A1.1.1 | 7 | Pass |
| Field Strength Limits (Fundamental) | 15.231(b) | RSS-210 Issue 8 (2010-12), A1.1.2(2) | 6 | Pass |
| 20 dB Bandwidth (Occupied Bandwidth) | 15.231(c) | | 8 | Pass |
| 99% Power Bandwidth (Occupied Bandwidth) | | RSS-210 Issue 8 (2010-12), A1.1.3 | 8 | Pass |

N.A. – Not applicable. The EUT is battery powered, only.

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 procedure ANSI C63.4 - 2003 and all applicable Public Notices received prior to the date of testing. All emissions from the device 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: Wolfgang Döring, Karlheinz Kraft
Issuance Date: 2011-04-12

# 4 ANTENNA REQUIREMENT

Test Requirement: FCC 47 CFR, Part 15C, Industry Canada RSS-Gen Section 7.1.2

## 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.

According to DA 00-2225 "OET Extends Effective Date of Antenna Connector Requirement Indefinitely", dated September 28, 2000, the OET extends the effective date of Public Notice, DA 00-1087, indefinitely.

## 4.2 Result

| | |
|---|---|
| Manufacturer: | SOMMER Antriebs- und Funktechnik GmbH |
| Device: | Wireless Keypad, AM 310 MHz |
| Model No.: | TX45-310-10 |
| Serial Number: | FFFFE1 |
| Rev. | 3EW |

The antenna is a permanently attached internal antenna (trace on the PCB).

The EUT meets the requirements of this section.

# 5 CONDUCTED EMISSIONS TEST

Test Requirement: FCC 47 CFR, Part 15C, Industry Canada RSS-Gen Section 7.2.1
Test Procedure: ANSI C63.4-2003, Industry Canada RSS-Gen

## 5.1 Regulation

Section 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 (dBuV) | |
|---|---|---|
| | Quasi-peak (QP) | Average (AV) |
| 0.15-0.5 | 66 to 56 * | 56 to 46 * |
| 0.5-5 | 56 | 46 |
| 5-30 | 60 | 50 |

* Decreases with the logarithm of the frequency.

Section 15.207 (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 provision for, the use of battery chargers which permit operating while charging, AC adaptors 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.

## 5.2 Test Equipment

Not applicable.

## 5.3 Test Procedures

Not applicable.

## 5.4 Test Results

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

The EUT is battery powered only. Therefore - according to Section 15.207 (c) - conducted emissions measurements to demonstrate compliance with the conducted limits are not required.

# 6 RADIATED EMISSIONS TESTS

Test Requirement: FCC 47 CFR, Part 15C, Industry Canada RSS-210 Annex 1
Test Procedure: ANSI C63.4-2003, Industry Canada RSS-Gen

## 6.1 Regulation

Section 15.33 Frequency range of radiated measurements:
(a) Unless otherwise noted in the specific rule section under which the equipment operates 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)-(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.

Section 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 instrument using the CISPR quasi-peak detector can be found in Publication 16 of the International Special Committee on Radio Interference (CISPR) of the International Electrotechnical Commission. 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, properly adjusted for such factors as pulse desensitization, as long as the same bandwidths 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.
(b) Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz. When average radiated emission measurements are specified in this part, including average emission measurements below 1000 MHz, there also is a limit on the peak level of the radio frequency emissions. Unless otherwise specified, e.g., see §§ 15.250, 15.252, 15.255, and 15.509–15.519, the limit on peak radio frequency emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device, e.g., the total peak power level. Note that the use of a pulse desensitization correction factor may be needed to determine the total peak emission level. The instruction manual or application note for the measurement instrument should be consulted for determining pulse desensitization factors, as necessary.
(c) Unless otherwise specified, e.g. § 15.255(b), 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 notification or verification.

Section 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) | (microvolts/meter) | (meters) |
| 0.009–0.490 | 2400/F(kHz) | 300 |
| 0.490–1.705 | 24000/F(kHz) | 30 |
| 1.705–30.0 | 30 | 30 |
| 30–88 | 100 | 3 |
| 88–216 | 150 | 3 |
| 216–960 | 200 | 3 |
| Above 960 | 500 | 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.
(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.
(f) In accordance with Section 15.33(a), in some cases the emissions from an intentional radiator must be measured to beyond the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator because of the incorporation of a digital device. If measurements above the tenth harmonic are so required, the radiated emissions above the tenth harmonic shall comply with the general radiated emission limits applicable to the incorporated digital device, as shown in Section 15.109 and as based on the frequency of the emission being measured, or, except for emissions contained in the restricted frequency bands shown in Section 15.205, the limit on spurious emissions specified for the intentional radiator, whichever is the higher limit. Emissions which must be measured above the tenth harmonic of the highest fundamental frequency designed to be emitted by the intentional radiator and which fall within the restricted bands shall comply with the general radiated emission limits in Section 15.109 that are applicable to the incorporated digital device.

Section 15.231(b) In addition to the provisions of Section 15.205, the field strength of emissions from intentional radiators operated under this Section shall not exceed the following:

| Fundamental Frequency (MHz) | Field Strength of Fundamental (microvolts/meter) | Field Strength of Spurious Emissions (microvolts/meter) |
|---|---|---|
| 40.66 - 40.70 | 2,250 | 225 |
| 70 - 130 | 1,250 | 125 |
| 130 - 174 | 1,250 to 3,750 ** | 125 to 375 ** |
| 174 - 260 | 3,750 | 375 |
| 260 - 470 | 3,750 to 12,500 ** | 375 to 1,250 ** |
| Above 470 | 12,500 | 1,250 |

** Linear interpolations

[Where F is the frequency in MHz, the formulas for calculating the maximum permitted fundamental field strengths are as follows: for the band 130-174 MHz, μV/m at 3 meters = 56.81818(F) - 6136.3636; for the band 260-470 MHz, μV/m at 3 meters = 41.6667(F) - 7083.3333. The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level.]

(1) The above field strength limits are specified at a distance of 3 meters. The tighter limits apply at the band edges.

(2) Intentional radiators operating under the provisions of this Section shall demonstrate compliance with the limits on the field strength of emissions, as shown in the above table, based on the average value of the measured emissions. As an alternative, compliance with the limits in the above table may be based on the use of measurement instrumentation with a CISPR quasi-peak detector. The specific method of measurement employed shall be specified in the application for equipment authorization. If average emission measurements are employed, the provisions in Section 15.35 for averaging pulsed emissions and for limiting peak emissions apply. Further, compliance with the provisions of Section 15.205 shall be demonstrated using the measurement instrumentation specified in that section.

(3) The limits on the field strength of the spurious emissions in the above table are based on the fundamental frequency of the intentional radiator. Spurious emissions shall be attenuated to the average (or, alternatively, CISPR quasi-peak) limits shown in this table or to the general limits shown in Section 15.209, whichever limit permits a higher field strength.

## 6.2 Test Equipment

| Type | Manufacturer/ Model No. | EMCC Ident No. | Last Calibration | Calibration Interval |
|---|---|---|---|---|
| Loop Antenna (3.5 MHz - 30 MHz) | Rohde & Schwarz HFH2-Z2 | 374 | 2008-09 | 36 months |
| Antenna (30 MHz - 1 GHz) | EMCO Model 3143 | 898 | 2008-11 | 36 months |
| Receiver (3.5 MHz - 1 GHz) | Rohde & Schwarz ESS | 304 | 2009-12 | 18 months |
| Antenna (1 GHz – 3.2 GHz) | Schwarzbeck BBHA 9120 D | 3235 | 2009-12 | 36 months |
| EMI Receiver / Analyzer (30 MHz - 1 GHz prescan) (1 GHz – 3.2 GHz) | Rohde & Schwarz ESIB | 516 | 2010-02 | 24 months |

## 6.3 Test Procedures

Portable, small, lightweight, or modular devices that may be hand-held, worn on the body, or placed on a table during operation shall be positioned on a nonconducting platform, the top of which is 80 cm above the reference groundplane. Ceiling and wall-mounted devices shall also be positioned on a tabletop for testing purposes.

The EUT was tested on a 0.8 meter high platform.

Preview tests are performed to determine the "worst case" mode of operation. 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]*. All tests performed with the EUT placed in 3 axis on the nonconductive platform. Worst case emissions are listed under chapter: test results.

New batteries were installed at the beginning of the tests.

| **Radiated Emissions Test Characteristics** | |
|---|---|
| Frequency range | 3.5 MHz – 3,200 MHz |
| Test distance | 3 m* |
| Test instrumentation resolution bandwidth | 10 kHz (3.5 MHz - 30 MHz) |
| | 120 kHz (30 MHz - 1,000 MHz) |
| | 1 MHz (1,000 MHz - 3,200 MHz) |
| Receive antenna scan height | 1 m - 4 m |
| Receive antenna polarization | Horizontal (H-field, f < 30 MHz) |
| | Vertical/Horizontal (E-field, f > 30 MHz) |

* According to Section 15.31 (f)(1): At frequencies at or above 30 MHz, measurements may be performed at a distance other than what is specified provided: measurements are not made in the near field except where it can be shown that near field measurements are appropriate due to the characteristics of the device; and it can be demonstrated that the signal levels needed to be measured at the distance employed can be detected by the measurement equipment. (...) When performing measurements at a distance other than that specified, the results shall be extrapolated to the specified distance using an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements; inverse-linear-distance-squared for power density measurements).
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).

H-field measurement up to 30 MHz was performed in a semi-anechoic room at a test distance of 3 m. A calibrated loop antenna as specified in ANSI C63.4 clause 4.1.5.1 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. For certain applications, the loop antenna may also need to be positioned horizontally at the specified distance from the EUT. Instead of changing the loop antenna polarization to horizontal the EUT antenna was rotated by 90 degrees. I.e. tests performed for 2 EUT antenna polarizations. The center of the loop antenna was 1 m above the ground.

## 6.4 Calculation of Field Strength Limits

Fundamental field strength limits for the band 260 – 470 MHz (fundamental frequency F = 310 MHz):

µV/m at 3 meters = 41.6667(F[MHz]) – 7083.3333 = 41.6667* 310 – 7083.3333 = 5833.3

5833.3 µV/m corresponds with 75.3 dBµV/m.

The maximum permitted unwanted emission level is 20 dB below the maximum permitted fundamental level, i.e. 55.3 dBµV/m.

## 6.5 Calculation of Average Correction Factor

The average correction factor is computed by analyzing the "worst case" on time in any 100 mSec time period and using the formula:

Corrections Factor (dB) = 20*log (worst case on time/100 mSec)

***Procedure during test:***
*The relationship between average and peak mode reading has been confirmed by direct measurement using the receiver's average and peak detectors.*

*All emission measurements performed using the test receiver's average detector and the max. hold facility; i.e. the average value measured directly without the necessity of additional correction factor.*

## 6.6 Field Strength Calculation

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

*Note: For measurement up to 1000 MHz the Antenna Factor already includes the cable attenuation.*
For test distance other than what is specified, but fulfilling the requirements of Section 15.31 (f)(1) the field strength is calculated by adding additionally an extrapolation factor of 20 dB/decade (inverse linear-distance for field strength measurements). The basic equation with a sample calculation is as follows:
FS = FST + DF
where
FS = Field Strength in dBµV/m
FST = Field Strength at test distance in dBµV/m
DF = Distance Extrapolation Factor in dB,
where DF = 20 log (Dtest/Dspec) where Dtest = Test Distance and Dspec = Specified Distance
Assume the tests performed at a reduced Test Distance of 1.5 m instead of the Specified Distance of 3 m giving a Distance Extrapolation Factor of DF = 20 log(1.5m/3m) = -6 dB.
Assuming a measured field strength level of 32 dBµV/m is obtained. The Distance Factor of -6 dB is added, giving a field strength of 26 dBµV/m. The 26 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = 23.5 + 7.4 + 1.1 - 6 = 26 [dBµV/m]
Level in µV/m = Common Antilogarithm (26/20) = 20

*Note: Emissions above 1 GHz measured with a receiver reading in dBm.*
For the 50 Ohms system a conversion factor of +107 dB is applicable to convert dBm into dBµV.

The field strength is calculated as follows:
$FS = RA_{dBm} + 107 + AF + CF$
where
FS = Field Strength in dBµV/m
$RA_{dBm}$ = Receiver Amplitude in dBm
AF = Antenna Factor in dB(1/m)
CF = Cable Attenuation Factor in dB
Assume a receiver reading of -89 dBm is obtained. The Conversion Factor of +107 dB, the Antenna Factor of 27.9 dB(1/m) and a Cable Factor of 0.6 dB are added, giving a field strength of 46.5 dBµV/m. The 46.5 dBµV/m value can be mathematically converted to its corresponding level in µV/m.

FS = -89 + 107 + 27.9 + 0.6 = 46.5 [dBµV/m]

## 6.7 Test Results

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

The EUT meets the requirements of this section.

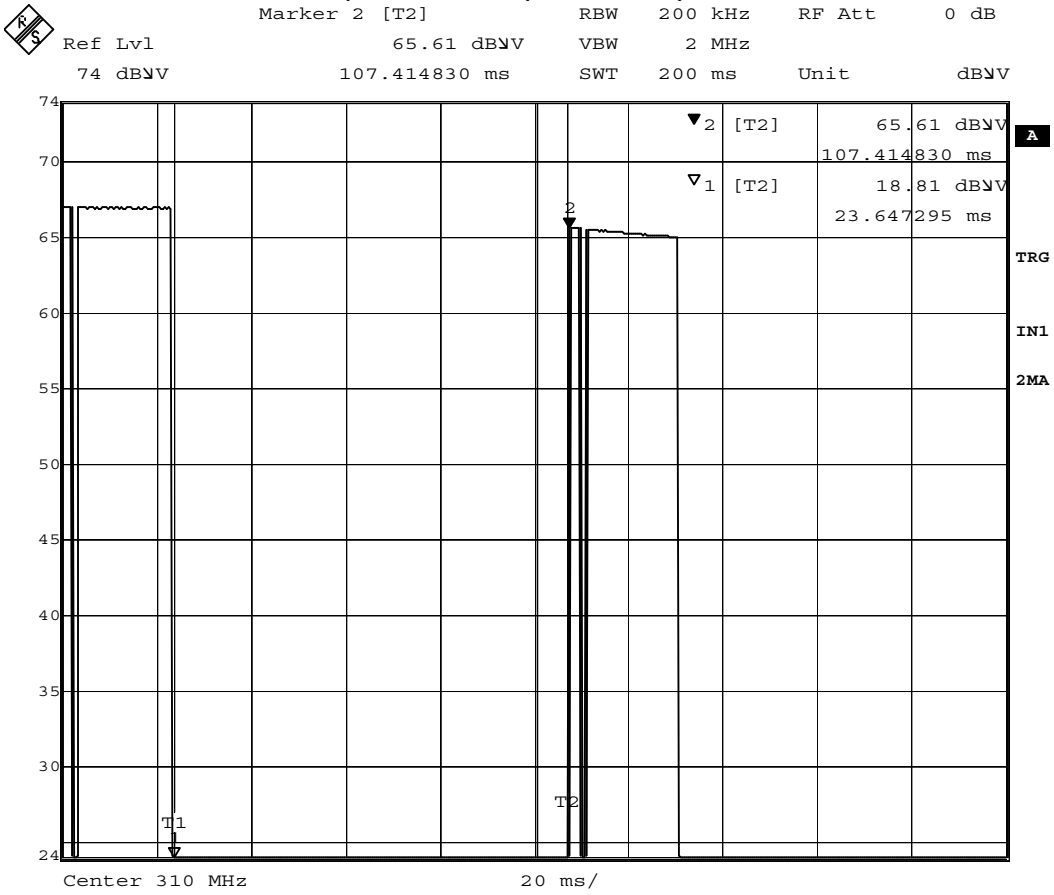
Test Personnel: Wolfgang Döring, Karlheinz Kraft

Test Date: 2011-02-24, -25

Detailed test data please refer to the following pages.

## 6.7.1 Duty Cycle

*informative measurement (code block repetition rate)*




Title: TX45-310-10
Comment A: Duty Cycle
Date: 25.FEB.2011 14:06:23

**Plot 6.7.1: Duty cycle - ton = 23.6 ms; T = 107.4 ms → duty cycle = 0.22**

## 6.7.2 Magnetic Field (f = 3.5 MHz to 30 MHz)

The magnetic field test was performed in a distance of 3 m. Therefore a distance correction factor of 40 dB is applicable (= correction from 30 m to 3 m).
The plot below shows the worst case emissions of the EUT.
The noise is ≤ 40 dBµV/m (worst case), which means a corrected result of ≤ 0 dBµV/m at 30 m.
The limit to §15.209 (a) is 30 µV/m (= 29.5 dBµV/m) at 30 m.

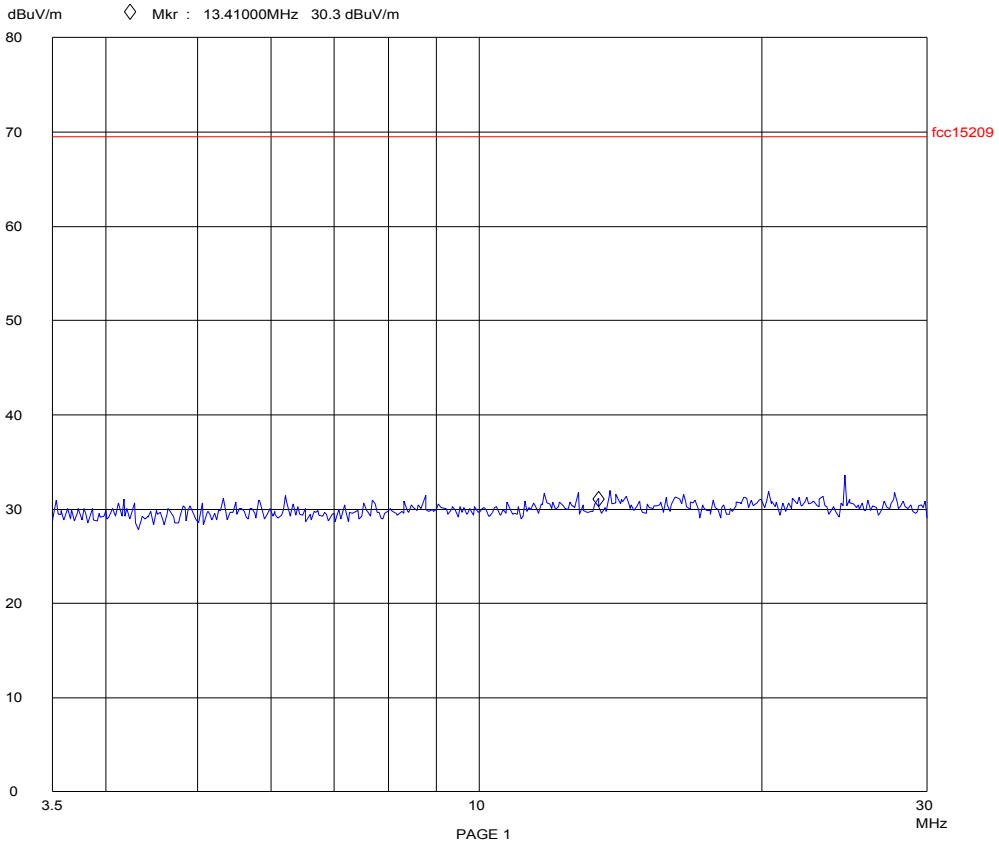
EMCCons DR. RASEK 25. Feb 11 11:46
Radiated Emissions H Field in SAR, d=3m

| | |
|---|---|
| EUT: | TX45-310-10 |
| Manuf: | Sommer |
| Op Cond: | cont. tx |
| Operator: | Doering, K.Kraft |
| Test Spec: | FCC 15, RSS-210 |
| Comment: | 4 sides, ant: I, _ |
| | EUT 4 orientations |

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | |
|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten Preamp OpRge |
| 3.5M | 30M | 5k | 10k | PK | 5ms AUTO | LD OFF 30dB |

Final Measurement: x Hor-Max / + Vert-Max
Meas Time: 1 s
Subranges: 25
Acc Margin: 30dB




**Plot 6.7.2: Magnetic Field emissions at 3m distance**

## 6.7.3 Electric Field (f = 30 MHz to 3.5 GHz)

EMCCons DR. RASEK 24. Feb 11 10:22
Radiated Emissions in SAR, d=3m

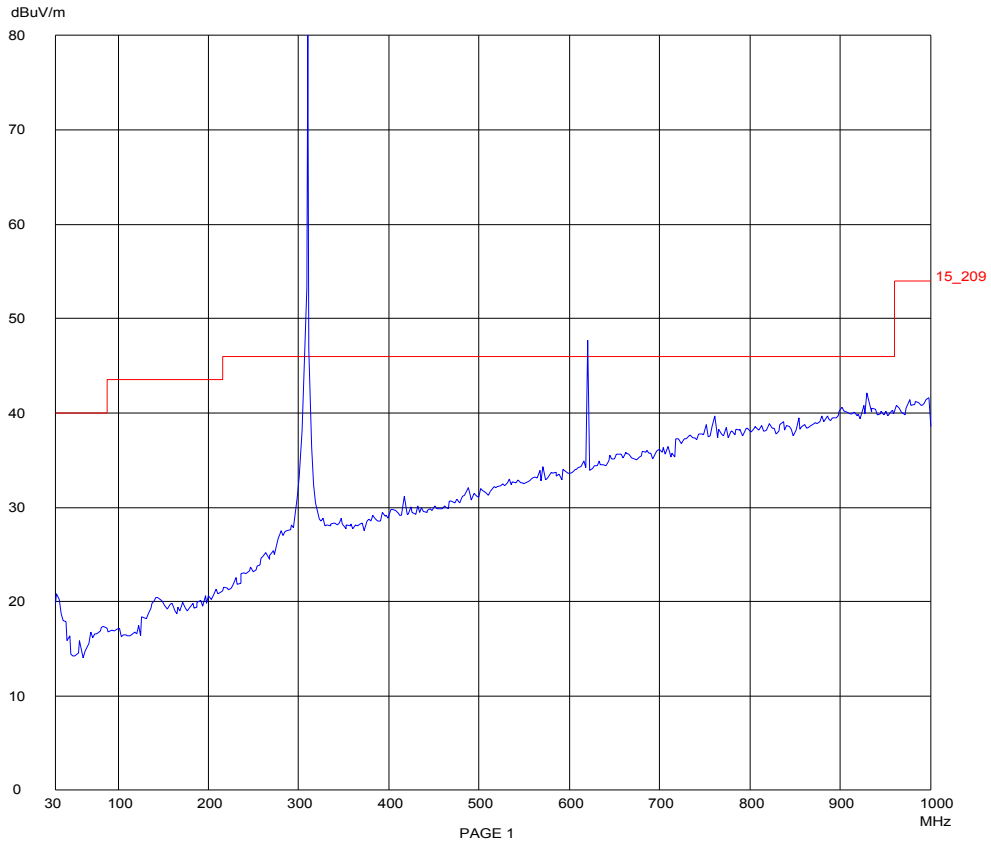
EUT: TX45
Manuf: SOMMER
Op Cond: cont. tx
Operator: Doering, K.Kraft
Test Spec: FCC 15, RSS-210
Comment: 4 sides, 3 heights, 1, 1.5, 2m, vert. hor.
EUT wallmount position

Scan Settings (1 Range)

| Frequencies | | | Receiver Settings | | | | |
|---|---|---|---|---|---|---|---|
| Start | Stop | Step | IF BW | Detector | M-Time | Atten | Preamp | OpRge |
| 30M | 1000M | 50k | 120k | PK | 1ms AUTO LN | OFF | 60dB | |

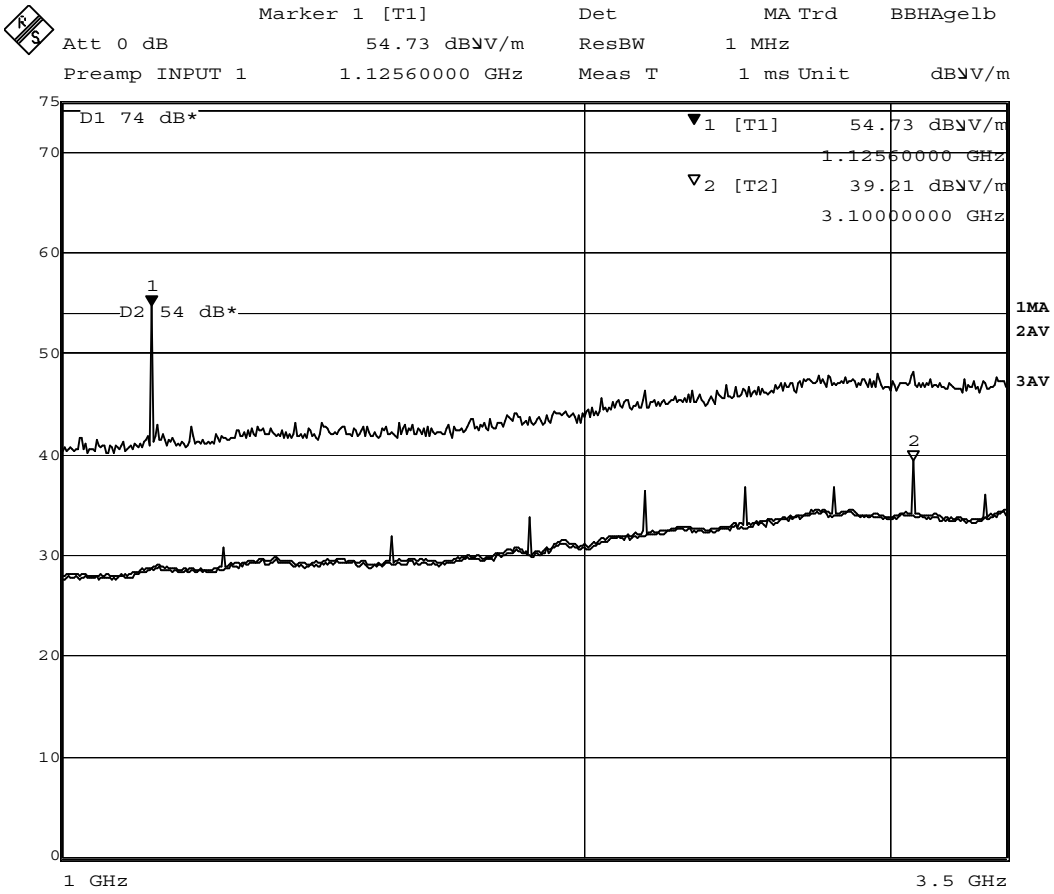
Final Measurement: x Hor-Max / + Vert-Max
Meas Time: 1 s
Subranges: 25
Acc Margin: 30dB

| Transducer No. | Start | Stop | Name |
|---|---|---|---|
| 22 | 30M | 1000M | 89826K33 |




**Plot 6.7.3-1: representative pre-scan plot (30 MHz to 1 GHz)**

**Test of SOMMER Wireless Keypad, AM 310 MHz Model TX45-310-10 to 47 CFR Part 15C and RSS-210 Issue 8 (2010-12)**




Title: TX45-310-10
Comment B: EUT wallmount position, max, vert/hor 1m + 1.5m
Date: 25.FEB.2011 10:16:24

**Plot 6.7.3-2: representative pre-scan plot (1 GHz to 3.5 GHz)**

**Test of SOMMER Wireless Keypad, AM 310 MHz Model TX45-310-10 to 47 CFR Part 15C and RSS-210 Issue 8 (2010-12)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **EMCCons DR. RAŠEK** | | | | | | | Project# | 950432.1T | Date | Name |
| **Moggast, Boelwiese 8** | | | | | | | gemessen, tested: | | 2011-02-24 | Kraft, Doering |
| **D-91320 Ebermannstadt** | | | | | | | | | | |
| **Emissions, Field Strength** | FCC Section 15.231 | | | | | | | | | |
| | emissions, harmonics up to 1 GHz | | | | | | Meßabstand, Test Distance: | | | 3 m |
| Messplatz, Test Site: | SAC ID 1889 | | | | | | Antenna: | EMCO 3143 ID 898 (3m AF, std SAC ant; CP3; 26m cable) | | |
| Gerätetyp, Unit type: | TX45-310-10 | | | | | | Bemerkungen, Remarks: | | | |
| Ser.-Nr., S/N: | FFFFE1 | | | | | | | | | |
| Betr.-Zustand, Oper. condition: | transmitting, modulated | | | | | | | | | |
| Hersteller, Manufacturer: | SOMMER | | | | | | | | | |

| Frequency<br>Frequenz | Detector<br>Detektor | Reading<br>Anzeigewert | Ant. Factor<br>Ant.-Faktor | Result<br>Ergebnis | Result<br>Ergebnis | Limit<br>Grenzwert | Limit<br>Grenzwert | Margin<br>Marge | Polarisation | Remarks<br>Bemerkungen |
|---|---|---|---|---|---|---|---|---|---|---|
| MHz | | dBµV | dB(1/m) | dBµV/m | µV/m | µV/m | dBµV/m | dB | | |
| 310.00 | AV | 42.4 | 18.3 | 60.7 | 1079.6 | 5833.34 | 75.3 | 14.7 | v | fundamental |
| 310.00 | Peak | 67.7 | 18.3 | 86.0 | 19873.4 | 58333.4 | 95.3 | 9.4 | v | fundamental |
| 620.00 | AV | 5.5 | 24.6 | 30.1 | 32.0 | 583.3 | 55.3 | 25.2 | v | harmonics, AV |
| 620.00 | Peak | 23.1 | 24.6 | 47.7 | 242.6 | 5833.3 | 75.3 | 27.6 | v | harmonics, Pk |
| 930.00 | AV | 1.8 | 29.4 | 31.2 | 36.2 | 583.3 | 55.3 | 24.1 | v | harmonics, AV |
| 930.00 | Peak | 17.8 | 29.4 | 47.2 | 228.6 | 5833.3 | 75.3 | 28.1 | v | harmonics, Pk |

**Table 6.7.3-1: Final results, emissions up to 1 GHz, receiver bandwidth 120 kHz, worst-case results listed, only**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **EMCCons DR. RASEK** | | | | | | | Project# | 950432.1T | Date | Name |
| **Moggast, Boelwiese 8** | | | | | | | gemessen, tested: | | 2011-02-24 | Döring, Kraft |
| **D-91320 Ebermannstadt** | | | | | | | | | | |
| **Emissions, Field Strength** | FCC Section 15.231 | | | | | | | | | |
| | spurious emissions, harmonics above 1 GHz | | | | | | Meßabstand, Test Distance d (m): | | | 3 |
| | | | | | | | BBHA9120D_S/N797 Range: 1 to 6 GHz | | | |
| Messplatz, Test Site: | SAC ID 1889 | | | | | | | | | |
| Gerätetyp, Unit type: | TX45-310-10 | | | | | | Bemerkungen, Remarks: | | | |
| Ser.-Nr., S/N: | FFFFE1 | | | | | | | | | |
| Betr.-Zustand, Oper. condition: | transmitting, modul. ftx: | 310 | MHz | | | | | | | |
| Hersteller, Manufacturer: | SOMMER | | | | | | | | | |

| Frequency<br>Frequenz | Detector<br>Detektor | Reading<br>Anzeigewer | Ant. Factor<br>Ant. Faktor | Cable Att.<br>Dämpfung | Result @ d<br>Ergebnis in d | Dist. Corr.<br>Abst.Korr. | Result<br>Ergebnis | Result<br>Ergebnis | Limit<br>Grenzwert | Limit<br>Grenzwert | Margin<br>Marge | Polari-<br>sation | Remarks<br>Bemerkungen |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| MHz | | dBµV/m | dB(1/m) | dB | dBµV/m | dB | dBµV/m | µV/m | dBµV/m | µV/m | dB | EUT/ANT | |
| 3100 | AV | 35.52 | | | 35.52 | 0.00 | 35.52 | 59.70 | 55.32 | 583.34 | 19.8 | v/h | |
| 3100 | Peak | 50.75 | | | 50.75 | 0.00 | 50.75 | 344.75 | 75.32 | 5833.44 | 24.6 | v/h | |
| RB - restricted band | | Antenna Factor and Cable Att. included in Transducer Factor –> Reading = Result. | | | | | | | | | | | |

**Table 6.7.3-2: Final results, emissions above 1 GHz, receiver bandwidth 1000 kHz, worst-case results listed, only**

# 7 PERIODIC OPERATION CHARACTERISTICS

Test Requirement: FCC CFR47 Part 15C, Industry Canada RSS-210 Annex 1

## 7.1 Periodic Operation

### 7.1.1 Regulation

15.231(a) The provisions of this Section are restricted to periodic operation within the band 40.66 - 40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this Section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Radio control of toys is not permitted. Continuous transmissions, such as voice or video, and data transmissions are not permitted. The prohibition against data transmissions does not preclude the use of recognition codes. Those codes are used to identify the sensor that is activated or to identify the particular component as being part of the system.

### 7.1.2 Result

| | |
|---|---|
| Manufacturer: | SOMMER Antriebs- und Funktechnik GmbH |
| Device: | Wireless Keypad, AM 310 MHz |
| Model No.: | TX45-310-10 |
| Serial Number: | FFFFE1 |
| Rev. | 3EW |

The EUT meets the requirements of this section.

## 7.2 Manually Operated Transmitter Deactivation

### 7.2.1 Regulation

15.231(a1) A manually operated transmitter shall employ a switch that will automatically deactivate the transmitter within not more than 5 seconds of being released.

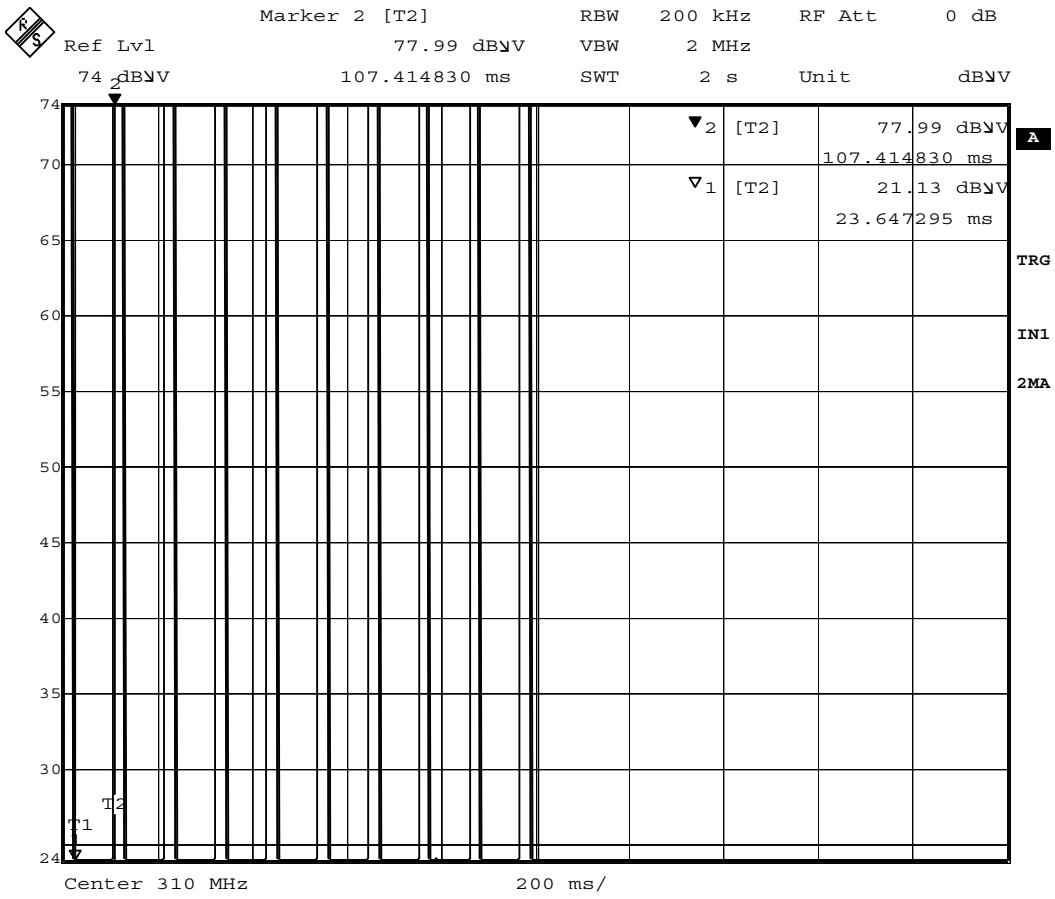
### 7.2.2 Result

| | |
|---|---|
| Manufacturer: | SOMMER Antriebs- und Funktechnik GmbH |
| Device: | Wireless Keypad, AM 310 MHz |
| Model No.: | TX45-310-10 |
| Serial Number: | FFFFE1 |
| Rev. | 3EW |

Transmitter ceases transmission within 1 second after being released. The EUT meets the requirements of this section.

Detailed test data please refer to the following page.

**Test of SOMMER Wireless Keypad, AM 310 MHz Model TX45-310-10 to 47 CFR Part 15C and RSS-210 Issue 8 (2010-12)**




Title: TX45-310-10
Comment A: Duty Cycle
Date: 25.FEB.2011 14:07:32

**Plot 7.2: Manually Operated Transmitter Deactivation – 10 telegrams transmitted per key activation (→ maximum release time is 1 second)**

## 7.3 Automatically Operated Transmitter Deactivation

### 7.3.1 Regulation

15.231(a2) A transmitter activated automatically shall cease transmission within 5 seconds after activation.

### 7.3.2 Result

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

The EUT does not have automatic transmission.

## 7.4 Prohibition of Periodic Transmission

### 7.4.1 Regulation

15.231(a3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions to determine system integrity of transmitters used in security or safety applications are allowed if the periodic rate of transmission does not exceed one transmission of not more than one second duration per hour for each transmitter.

### 7.4.2 Result

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

The EUT does not employ periodic transmission.

## 7.5 Continuous Transmission During an Alarm Condition

### 7.5.1 Regulation

15.231(a4) Intentional radiators which are employed for radio control purposes during emergencies involving fire, security, and safety of life, when activated to signal an alarm, may operate during the pendency of the alarm condition.

### 7.5.2 Result

Manufacturer: SOMMER Antriebs- und Funktechnik GmbH
Device: Wireless Keypad, AM 310 MHz
Model No.: TX45-310-10
Serial Number: FFFFE1
Rev. 3EW

This section is not applicable to the EUT.

# 8 BANDWIDTH

Test Requirement: FCC CFR47 Part 15C, Industry Canada RSS-210 Annex 1
Test Procedure: ANSI C63.4:2003, Industry Canada RSS-Gen

## 8.1 Regulation

FCC 15.231(c) The bandwidth of the emission shall be no wider than 0.25 % of the center frequency for devices operating above 70 MHz and below 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the center frequency. Bandwidth is determined at the points 20 dB down from the modulated carrier.

IC RSS-210 A1.1.3
For the purpose of Section A1.1, the 99 % bandwidth shall be no wider than 0.25 % of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the emission shall be no wider than 0.5 % of the centre frequency.

## 8.2 Calculation of Bandwidth Limit

bandwidth limit = 0.0025 * 310 MHz = 0.775 MHz = 775 kHz

## 8.3 Test Equipment

| Type | Manufacturer/ Model No. | EMCC Ident No. | Last Calibration | Calibration Interval |
|---|---|---|---|---|
| Antenna | EMCO Model 3142 | 1448 | n.a. | n.a. |
| EMI Receiver / Analyzer | Rohde & Schwarz ESIB | 516 | 2010-02 | 24 months |

## 8.4 Test Procedure

ANSI C63.4-2003 Section 13.1.7 Occupied Bandwidth Measurements.
(...) The bandwidth is measured at an amplitude level reduced from the reference level by a specified ratio. The reference level is the level of the highest amplitude signal observed from the transmitter at either the fundamental frequency or first-order modulation products in all typical modes of operation, including the unmodulated carrier, even if atypical. Once the reference level is established, the equipment is conditioned with typical modulating signals to produce worst-case (i.e., the widest) bandwidth. (...) In order to measure the modulated signal properly, a resolution bandwidth that is small compared to the bandwidth required by the procuring or regulatory agency shall be used on the measuring instrument. However, the 6 dB resolution bandwidth of the measuring instrument shall be set to a value greater than 5 % of the bandwidth requirements. When no bandwidth requirements are specified, the minimum resolution bandwidth of the measuring instrument is given in the following table:

| **Fundamental frequency** | **Minimum resolution bandwidth** |
|---|---|
| 9 kHz to 30 MHz | 1 kHz |
| 30 to 1000 MHz | 10 kHz |
| 1000 MHz to 40 GHz | 100 kHz |

IC RSSGEN Chapter 4.6.1 Occupied Bandwidth
When an occupied bandwidth value is not specified in the applicable RSS, the transmitted signal bandwidth to be reported is to be its 99% emission bandwidth, as calculated or measured.
The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts. The resolution bandwidth shall be set to as close to 1% of the selected span as is possible without being below 1%. The video bandwidth shall be set to 3 times the resolution bandwidth. Video averaging is not permitted. Where practical, a sampling detector shall be used given that a peak or peak hold may produce a wider bandwidth than actual.
The trace data points are recovered and directly summed in linear 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. This frequency is recorded. The span between the two recorded frequencies is the occupied bandwidth.

## 8.5 Test Result

| | |
|---|---|
| Manufacturer: | SOMMER Antriebs- und Funktechnik GmbH |
| Device: | Wireless Keypad, AM 310 MHz |
| Model No.: | TX45-310-10 |
| Serial Number: | FFFFE1 |
| Rev. | 3EW |

The measured 20 dB bandwidth is: ..... **485 kHz**
The measured 99 % bandwidth (according to RSSGen) is: ..... **195 kHz**

For detailed bandwidth plots refer to the following page.

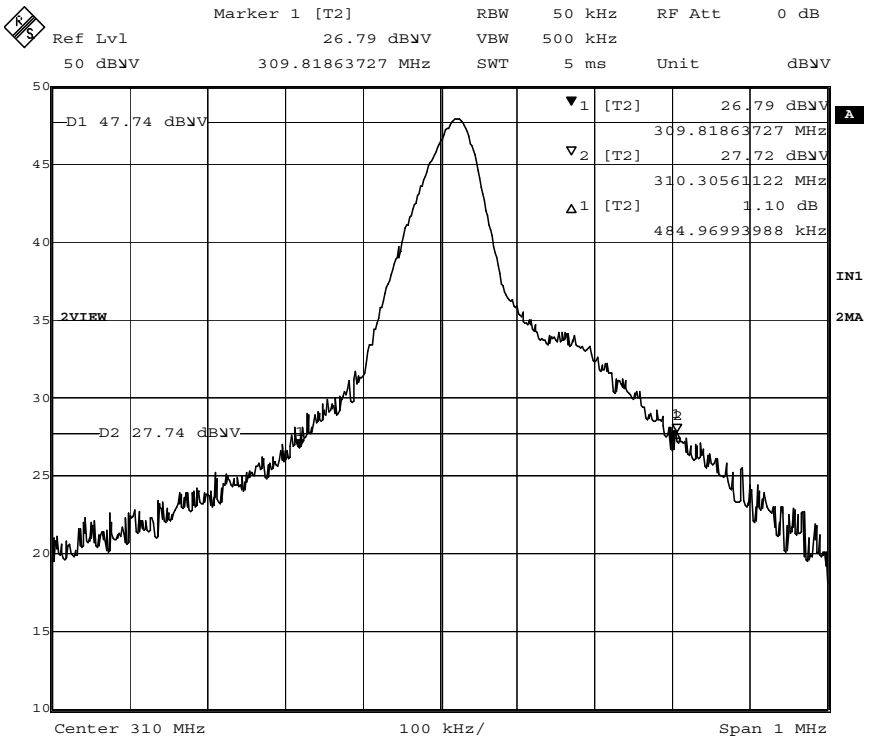
The EUT meets the requirements of this section.

Test Personnel: Wolfgang Döring

Test Date: 2011-02-25

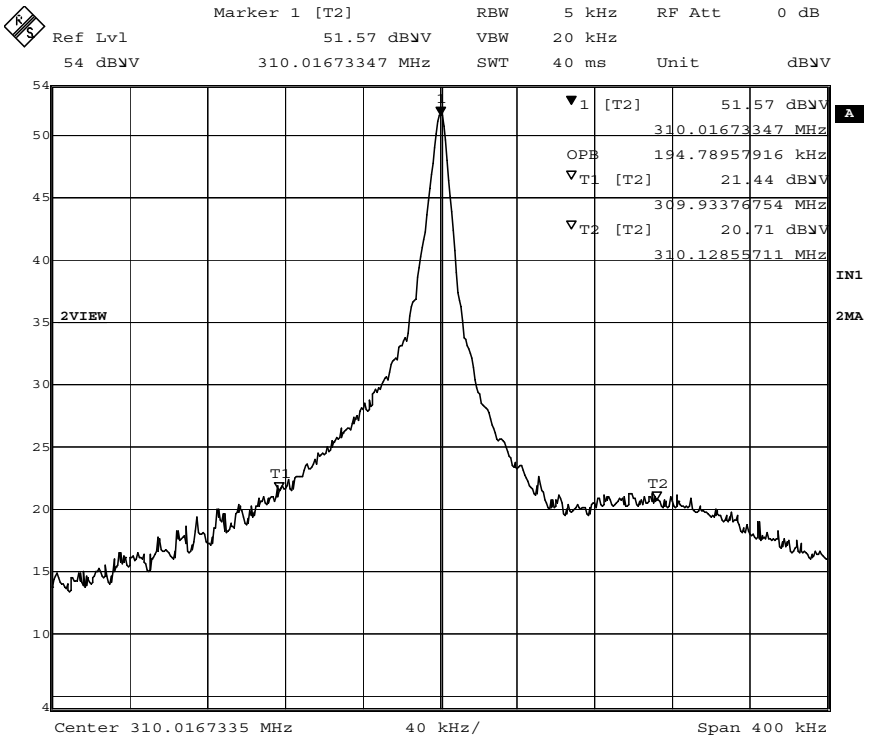
Detailed test data plots refer to the following pages.

**Test of SOMMER Wireless Keypad, AM 310 MHz Model TX45-310-10
to 47 CFR Part 15C and RSS-210 Issue 8 (2010-12)**




Title: TX45-310-10
Comment A: Occupied bandwidth 20dBc /FCC
Date: 25.FEB.2011 12:19:19

**Plot 8.5-1: bandwidth plot – 20 dB bandwidth**




Title: TX45-310-10
Comment A: Occupied bandwidth 99% / IC
Date: 25.FEB.2011 12:37:13

**Plot 8.5-2: bandwidth plot – 99 % bandwidth**

# 9 MISCELLANEOUS COMMENTS AND NOTES

None.

# 10 LIST OF ANNEXES

The following annexes are separated parts to this test report. These annexes may be file attachments for electronic filing.

| Annex | Description | Pages |
|---|---|---|
| Annex 1 | Photographs of test setups | 5 |
| Annex 2 | Photographs of equipment under test (EUT) external views | 3 |
| Annex 3 | Photographs of equipment under test (EUT) internal views | 3 |