

TEST REPORT # EMCC-981261EID, 2019-08-20

EQUIPMENT UNDER TEST:

Trade Name: HandyStep electronic
Type/Model: HandyStep@touch
Serial Number(s): 19B22619
Application: Electronic Dispenser
FCC ID: 2ATKA-HST7052X0
Manufacturer: BRAND GMBH & CO. KG
Address: Otto-Schott-Strasse 25
97877 Wertheim
GERMANY
Phone: +49 9342 808 1130
E-Mail: juergen.schraut@brand.de

RELEVANT STANDARD(S):

47 CFR §§ 15.107 / 15.109
ICES-003 Issue 6

MEASUREMENT PROCEDURE:

ANSI C63.4-2014

TEST REPORT PREPARED BY:


Wolfgang Kiss
EMCCons DR. RAŠEK GmbH & Co. KG
Boelwiese 8
91320 Ebermannstadt
Germany
Phone: +49 9194 7262-0
Fax: +49 9194 7262-199
E-Mail: w.kiss@emcc.de

Tested:



Wolfgang Kiss

Checked:



Reinhard Sauerschell
- Head of Laboratory -

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

CONTENTS	PAGE
0 REVISION HISTORY	3
1 GENERAL INFORMATION	4
1.1 Purpose	4
1.2 Limits and Reservations	4
1.3 Test Laboratory	4
1.4 Customer	4
1.5 Manufacturer	4
1.6 Dates and Test Location	5
1.7 Ordering Information	5
1.8 Climatic Conditions	5
2 PRODUCT DESCRIPTION	6
2.1 Equipment Under Test (EUT)	6
2.2 Intended Use	7
2.3 EUT Peripherals/Simulators	7
2.4 Mode of operation during testing and test setup	8
2.5 Modifications required for compliance	8
3 TEST RESULTS SUMMARY	9
4 DETAILED TEST RESULTS	10
4.1 AC Power Line Conducted Emissions	10
4.1.1 Regulation	10
4.1.2 Test Procedures	10
4.1.3 Test Setup	11
4.1.4 Detailed Test Data	12
4.1.5 Test Result	13
4.2 Radiated Emissions	14
4.2.1 Regulation	14
4.2.2 Calculation of Field Strength Limits	16
4.2.3 Field Strength Calculation	17
4.2.4 Radiated Emissions 30 MHz – 1000 MHz	18
4.2.5 Radiated Emissions above 1000 MHz	25
5 TEST INSTRUMENTS	31
6 MEASUREMENT UNCERTAINTY	32
7 LIST OF ANNEXES	33

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

0 REVISION HISTORY

Project number	Issue date	Chapter	Description
981261EID	2019-08-20	n.a.	Initial issue

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

1 GENERAL INFORMATION

1.1 Purpose

The purpose of this report is to show compliance with the 47 CFR §15.107 and § 15.109 and ICES-003 issue 6 requirements applicable to unintentional radiators.

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 Laboratory

Test laboratory:	EMCCons DR. RAŠEK GmbH & Co. KG
Accreditation No.:	D-PL-12067-01-03 D-PL-12067-01-04
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
Phone:	+49 9194 7262-0
Fax:	+49 9194 7262-199
E-Mail:	info@emcc.de
Web:	www.emcc.de

1.4 Customer

Company name:	BRAND GMBH & CO. KG
Street:	Otto-Schott-Strasse 25
City:	97877 Wertheim
Country:	GERMANY
Name:	Juergen Schraut
Phone:	+49 9342 808 1130
Fax:	+49 9342 808 91011
E-Mail:	juergen.schraut@brand.de

1.5 Manufacturer

Company name:	BRAND GMBH & CO. KG
Street:	Otto-Schott-Strasse 25
City:	97877 Wertheim
Country:	GERMANY
Phone:	+49 9342 808 1130
E-Mail:	juergen.schraut@brand.de

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

1.6 Dates and Test Location

Date of receipt of EUT: 2019-05-02
Test date: 2019-05-10, 2019-06-04
Test location: Lab IV

1.7 Ordering Information

Purchase order: 1/45259685
Date: 2019-05-02
Vendor number: 27344

1.8 Climatic Conditions

Date	Temperature	Relative Humidity	Air Pressure	Lab	Customer attended tests
--	°C	%	hPa	--	--
2019-05-10	23	41	969	IV	No
2019-06-04	23	49	972	IV	No

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

2 PRODUCT DESCRIPTION

2.1 Equipment Under Test (EUT)

The following data is based on customer's information.

Manufacturer:	BRAND GMBH & CO. KG
Type:	HandyStep®touch
Application:	Electronic Dispenser
No of variants:	0
Serial No(s):	EUT #1: 19B22619
Firmware version:	HSe2 Firmware (Dispenser), Version: 01.00 Bootloader, Version: 1.2 HST Firmware, Version 0.28
Hardware version:	Electronic Dispenser, Version 01.00
FCC ID:	2ATKA-HST7052X0
Equipment class:	A
Highest internal frequency:	320 MHz
Power source:	5 VDC in USB charging mode Internal battery
Voltage for testing:	5 V _{DC}
Ports:	DC Power Supply, max cable length < 3 m, DC power for charging purposes provided via USB-C
Remarks:	None

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

2.2 Intended Use

The following description was taken from the multi-lingual user manual 997886_V1 of HandyStep electronic:

*The HandyStep® touch and the HandyStep® touch S are microprocessor-controlled, battery-powered hand dispensers operated by touchscreen.
BRAND precision dispenser tips (PD tips) with type coding are automatically recognized by the device according to their nominal volumes and allow quick volume selection. Compatible dispenser tips from other manufacturers can also be used after manually selecting the corresponding volume.*

2.3 EUT Peripherals/Simulators

The EUT peripheral consists of a switching power supply with USB-C cable, Model No.: BI12T-050140-IU.
The input of the power supply is AC 100 - 240 V at 50/60 Hz, the output is DC 5V, 1.4 A.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

2.4 Mode of operation during testing and test setup

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

Mode 1: EUT running in normal dispense mode on battery.

Mode 2: EUT running in normal dispense mode while battery was being charged by the external power supply.

The EUT was operated in multi-dispense mode with a step size of 0.5 ml, 100 steps in total, step duration = 0.5 s, step delay = 0.5 s.

The multi-dispense mode was carried out with a device specifically manufactured by EMCC. The step duration and step delay was controlled by an electronic timer.

Note: AC Power Line Conducted Emissions could only be measured in Mode 2.

2.5 Modifications required for compliance

None.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

3 TEST RESULTS SUMMARY

Summary of test results for the following EUT:

Manufacturer: BRAND GMBH & CO. KG
Type: HandyStep®touch
Serial No.: 19B22619

Requirement	47 CFR Section	ICES Section	Report Section	Tested EUT	Result
AC Power Line Conducted Emissions 150 kHz - 30 MHz	§ 15.107	ICES-003, 6.1	4.1	19B22619	Class A, Passed
Radiated Emissions 30 MHz – 1000 MHz	§ 15.109	ICES-003, 6.2	4.2.4	19B22619	Class A, Passed
Radiated Emissions above 1 GHz	§ 15.109	ICES-003, 6.2	4.2.5	19B22619	Class A, Passed

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 C63.4-2014 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: Wolfgang Kiss
Issuance date: 2019-08-20

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4 DETAILED TEST RESULTS

4.1 AC Power Line Conducted Emissions

Test Requirement: FCC 47 CFR §15.107 and ICES-003 6.1
Test Procedure: ANSI C63.4-2014

4.1.1 Regulation

47 CFR § 15.107 Conducted limits

(b) For a Class A digital device 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 μ H/50 ohms 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 / dB μ V	
	Quasi-peak	Average
0.15-0.5	79	66
0.5-30	73	60

ICES-003 6.1 conducted emissions limits

Class A: ITE that meets the conditions for Class A operation defined in Section 2.2 shall comply with the Class A conducted limits set out below in Table 1.

Table 1 – Class A Conducted Limits

Frequency (MHz)	Class A Conducted limit (dB μ V)	
	Quasi-peak	Average
0.15 to 0.5	79	66
0.5 to 30	73	60

The ISSED limits are identical with the FCC limits.

4.1.2 Test Procedures

Testing is performed acc. to ANSI C63.4-2014.

Tabletop and their ancillary devices are placed on a nonconducting table with nominal dimension of 1.0 m by 1.5 m, height 0.8 m above the ground plane. The EUT is centered laterally (left to right facing the tabletop) on the tabletop and its rear is flush with the rear of the table. Accessories or peripherals that are part of a system tested on a tabletop are being placed in a test arrangement on one or both sides of the host with a 10 cm separation between the nearest points of the cabinets.

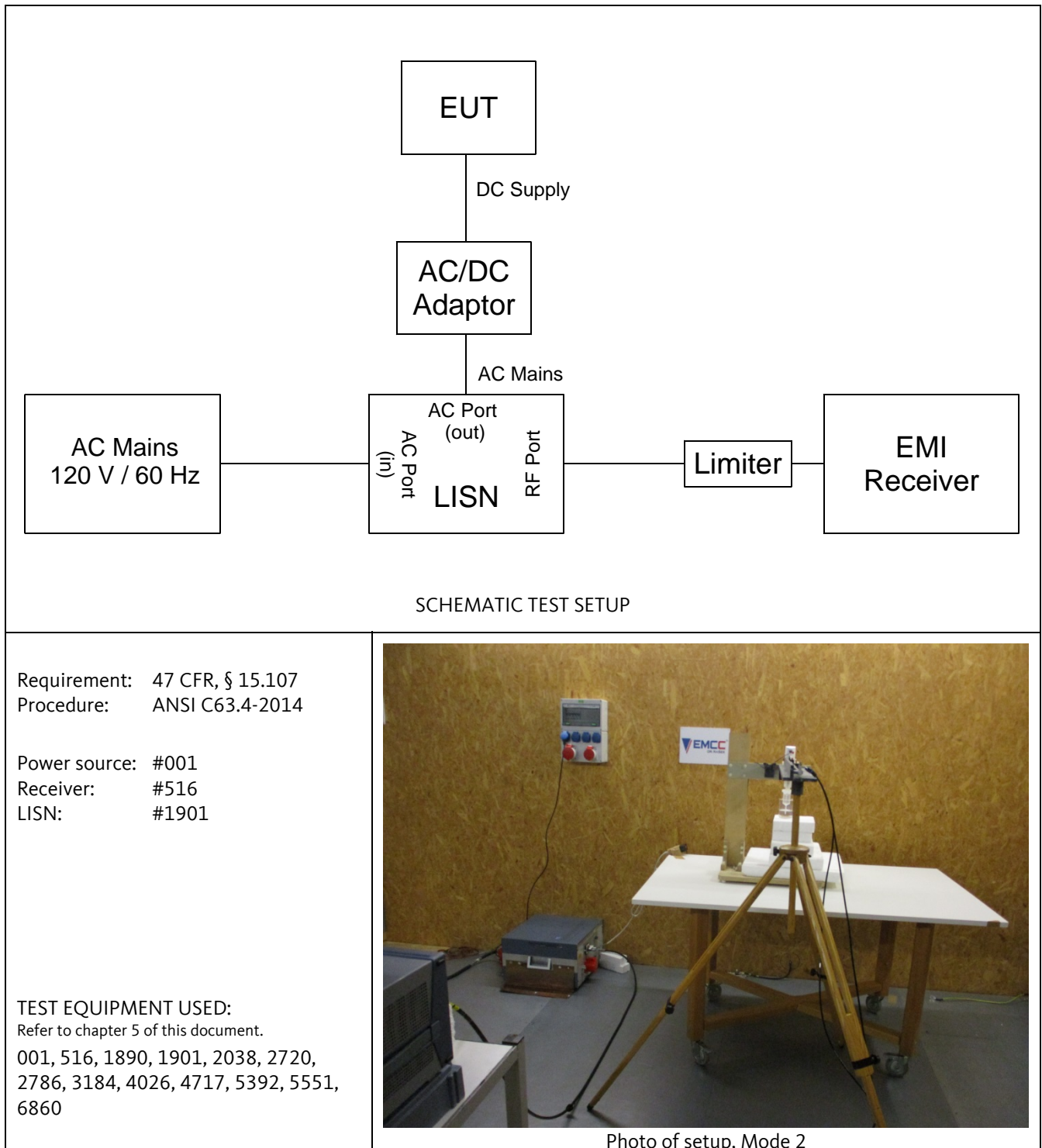
Interconnecting cables that hang closer than 40 cm to the ground plane are folded back and forth in the center forming a bundle 30 cm to 40 cm long.

The EUT's AC mains or the EUT's AC/DC adaptor is connected to a LISN. Ancillaries having an AC mains connector are connected to a separate LISN.

The measurement receiver is connected to the 50 Ω RF port of the LISN.

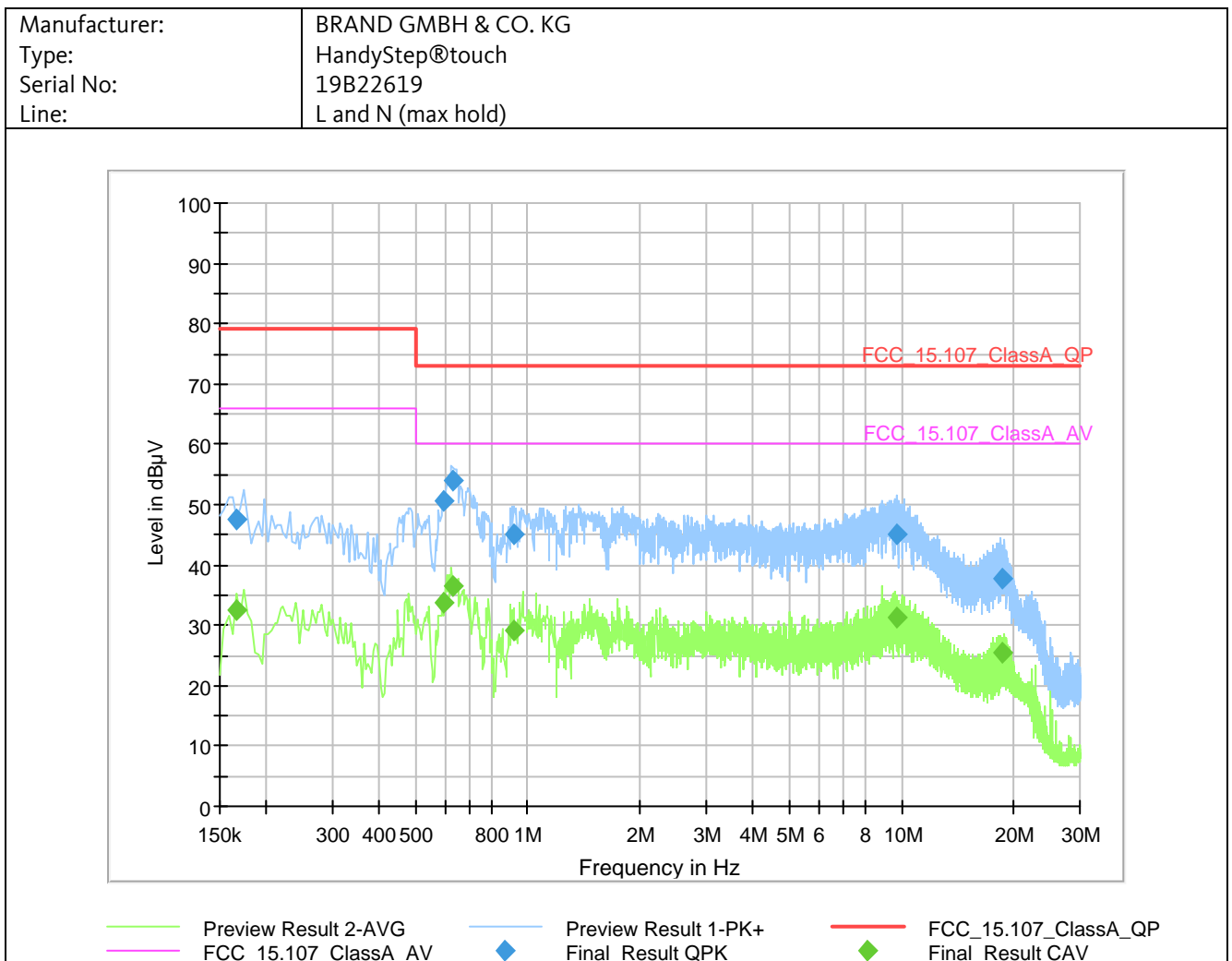
Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.1.3 Test Setup



Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.1.4 Detailed Test Data



Frequency MHz	Detector	Result dBµV	Margin dB
0.166	QP	47.5	31.5
0.5935	QP	50.8	22.3
0.6295	QP	54.0	19.0
0.9175	QP	45.2	27.8
9.6895	QP	45.1	27.9
18.5255	QP	37.8	35.3

Frequency MHz	Detector	Result dBµV	Margin dB
0.166	AV	32.5	33.5
0.5935	AV	33.6	26.4
0.6295	AV	36.5	23.5
0.9175	AV	29.2	30.8
9.6895	AV	31.4	28.6
18.5255	AV	25.4	34.6

Worst case results listed, only.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.1.5 Test Result

Manufacturer:	BRAND GMBH & CO. KG
Type:	HandyStep®touch
Serial No.:	19B22619
Test date:	2019-06-04
Test personnel:	Wolfgang Kiss

The EUT meets the requirements of this section.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2 Radiated Emissions

Test Requirement: FCC 47 CFR §15.109 and ICES-003 6.2

Test Procedure: ANSI C63.4-2014

4.2.1 Regulation

47CFR § 15.33 Frequency range of radiated measurements

(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:

(3) Except for a CB receiver, a receiver employing superheterodyne techniques shall be investigated from 30 MHz up to at least the second harmonic of the highest local oscillator frequency generated in the device. If such receiver is controlled by a digital device, the frequency range shall be investigated up to the higher of the second harmonic of the highest local oscillator frequency generated in the device or the upper frequency of the measurement range specified for the digital device in paragraph (b)(1) of this section.

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

ICES-003 6.2 Frequency Range of Measurement

Highest Frequency Generated or Used in Device	Upper Frequency of Radiated Measurement
Below 1.705 MHz	No radiated testing required.
1.705 MHz – 108 MHz	1 GHz
108 MHz – 500 MHz	2 GHz
500 MHz – 1 GHz	5 GHz
Above 1 GHz	5 th harmonic of the highest frequency or 40 GHz, whichever is lower.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

47 CFR § 15.109 Radiated emission limits.

(b) The field strength of radiated emissions from a Class A digital device, as determined at a distance of 10 meters, shall not exceed the following:

Frequency of emission / MHz	Field strength / $\mu\text{V/m}$	Field strength / dB $\mu\text{V/m}$
30 – 88	90	39
88 – 216	150	43.5
216 – 960	210	46.4
Above 960	300	49.5

(c) In the emission tables above, the tighter limit applies at the band edges. Sections 15.33 and 15.35 which specify the frequency range over which radiated emissions are to be measured and the detector functions and other measurement standards apply.

ICES-003 6.2.1 Radiated emissions limits below 1 GHz

Class A: ITE that meets the conditions for Class A operation defined in Section 2.2 shall comply with the Class A radiated limits set out in Table 4 determined at a distance of 10 metres.

Table 4 – Class A Radiated Limits Below 1 GHz

Frequency (MHz)	Class A Radiated Limit (dB $\mu\text{V/m}$)
	Quasi-peak
30 to 88	39
88 to 216	43.5
216 to 960	46.4
960 to 1000	49.5

ICES-003 6.2.2 Radiated emissions limits above 1 GHz

Class A: ITE that meets the conditions for Class A equipment shall comply with the Class A radiated limits set out in Table 6 determined at a distance of 10 metres.

Table 6 – Class A Radiated Limits Above 1 GHz

Frequency (MHz)	Class A Radiated Limit (dB $\mu\text{V/m}$)	
	Linear Average Detector	Peak Detector
> 1000	49.5	69.5

The ISSED limits are identical with the FCC limits.

47 CFR § 15.35 Measurement detector functions and bandwidths.

(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 as the same bandwidth as indicated for CISPR quasi-peak measurements are employed.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.2 Calculation of Field Strength Limits

E.g. radiated emissions field strength limits for the frequency band 88 - 216 MHz:

150 µV/m at 10 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 (in dBµV/m)

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

A field strength limit of 150 µV/m corresponds with 43.5 dBµV/m.

Distance correction (limit)

Remark: The preferred method is the correction of the measured field strength (refer to 4.2.3) instead of limit correction. Only one correction method shall be applied to a particular measurement.

If a measurement is performed in a distance other than specified, the limit may be adjusted by a Distance Extrapolation Factor DF of 20 dB per decade, which is calculated by the following equation:

$$DF = 20 \log (D_{test}/D_{specification})$$

where

DF = Distance Extrapolation Factor (in dB)

D_{test} = Distance, where measurement was performed (in m)

$D_{specification}$ = Distance acc. to specification (in m)

Example: Assume a limit specified in 10 m and a measurement performed at 3 m: The distance correction factor is $20 \log (10 / 3) = 10.5$. This factor is mathematically added to the limit by the following equation:

$$E_{dB\mu V/m_new} = E_{dB\mu V/m} + DF$$

where

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

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

DF = Distance Extrapolation Factor (in dB)

Example: Assume a limit of 49.5 dBµV/m specified in 10 m distance and the measurement performed at 3 m. The limit is adjusted by the distance correction factor of 10.5 dB to the new limit of 60 dBµV/m.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.3 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)

If the measurement unit is dBm instead of dBμV, the conversation constant of 107 dB has to be added to the reading in dBm.

Assume a receiver reading of -30.1 dBm is obtained. The Antenna Factor of 39.2 dB(1/m) and a Cable Factor of 1.2 dB are added, giving a field strength of 117.3 dBμV/m in the measurement distance. The field strength of 117.3 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

$$FS = -30.1 + 39.2 + 1.2 + 107 = 117.3$$

$$\text{Level (in } \mu\text{V/m)} = \text{Common Antilogarithm } (117.3/20) = 732825$$

Distance correction (field strength)

Remark: The preferred method is the correction of the measured field strength instead of limit correction (refer to 4.2.2). Only one correction method shall be applied to a particular measurement..

If a measurement is performed at a different distance other than specified, the field strength at the specified distance can be obtained by the following equation:

$$FS_{\text{Dspecified}} = FS_{\text{Dtest}} + 20 \log (D_{\text{test}}/D_{\text{specified}})$$

where

$FS_{\text{Dspecified}}$ = Field Strength at specified distance $D_{\text{specified}}$ (in dBμV/m)

FS_{Dtest} = Field Strength at specified distance D_{test} (in dBμV/m)

D_{test} = Measurement distance where test was performed (in m)

$D_{\text{specified}}$ = Measurement distance as specified by the rules (in m)

Assuming a recorded field strength of 117.3 dBμV/m in a distance of 1 m. If the rules are specifying a limit in a distance of 3 m, the field strength recorded in 1 m is corrected by the distance. Therefore, the field strength $FS_{\text{Dspecified}}$ is $117.3 + 20 \log (1 / 3) = 107.8$ (in dBμV/m).

Remark: Using EMC32 software corrections are combined in the Corr. Factor as listed in the results' table.

"Result" represents the FS Result, "Corr." is the combined correction factor.

4.2.4 Radiated Emissions 30 MHz – 1000 MHz

4.2.4.1 Test Procedures

ANSI C63.4-2014, 8.2.3 Electric field radiated emissions (30 MHz to 1 GHz)

Electric field measurements are made in the frequency range of 30 MHz to 1000 MHz using a calibrated linearly polarized antenna as specified in 4.5.4, which shall be positioned at the specified distance from the periphery of the EUT. The specified distance is the distance between the horizontal projection onto the ground plane of the closest periphery of the EUT and the projection onto the ground plane of the center of the axis of the elements of the receiving antenna. However, if the receiving antenna is an LPDA antenna, the specified distance shall be the distance between the closest periphery of the EUT and the front-to-back center (midpoint along boom/feeder transmission line) of the array of elements.

Measurements shall be made with the antenna positioned in both the horizontal and vertical planes of polarization. The measurement antenna shall be varied in height above the reference ground plane to obtain the maximum signal strength. Unless otherwise specified, the measurement distance shall be 3 m or 10 m. At either measurement distance, the antenna height shall be varied from 1 m to 4 m.

These height scans apply for both horizontal and vertical polarizations, except that for vertical polarization, the minimum height of the center of the antenna shall be increased so that the lowest point of the bottom of the lowest antenna element clears the site reference ground plane by at least 25 cm. For a tuned dipole, the minimum heights as measured from the center of the antenna are shown in Table D.3.

ANSI C63.4-2014, 8.3.1.1 Exploratory radiated emission measurements (9 kHz to 1 GHz)

- a) Exploratory radiated measurements shall be performed at the measurement distance or at a closer distance than that specified for compliance to determine the emission characteristics of the EUT (see also 10.2.8 and Annex E) and recorded in tabular or graphical form. Significant emissions are identified using a remote-controlled turntable and antenna positioner and monitoring the spectrum while changing the EUT (turntable) azimuth, antenna polarity, and height. This spectrum exploratory monitoring can also be performed by manually moving the receiving antenna around the EUT to pick up significant emissions. A shielded room may be used for exploratory testing, but care must be taken to account for shielded room reflections that can lead to significant errors in amplitude measurements.
- b) Broadband antennas and a spectrum analyzer or an EMI receiver with a panoramic display are most often used in this type of testing. It is recommended that either a headset or loudspeaker be connected as an aid in detecting ambient signals and finding frequencies of significant emission from the EUT when the exploratory and final testing is performed at an OATS with strong ambient signals. Caution should be taken if either antenna heights between 1 m and 4 m or EUT azimuth is not fully explored. Not fully exploring these parameters during exploratory testing may require complete testing at the OATS or semi-anechoic chamber when the final full spectrum testing is conducted.
- c) The EUT should be set up in its typical configuration and arrangement and operated in its various modes. For tabletop systems, cables or wires not bundled in the initial setup shall be manipulated within the range of likely arrangements. For floor-standing equipment, the cables or wires should be located in the same manner as the user would install them and no further manipulation is made. For combination EUTs, the tabletop and floor-standing portions of the EUT shall follow the procedures for their respective setups and cable manipulation. If the manner of cable installation is not known, or if it changes with each installation, cables or wires for floor-standing equipment shall be manipulated to the extent possible to reduce the maximum level of emissions.
- d) Exploratory radiated emissions testing of handheld and/or body-worn devices shall include rotation of the EUT through three orthogonal axes to determine the orientation (attitude) that maximizes the emissions. Subclause 6.3.6 applies for exploratory radiated emissions testing of ceiling-mounted devices. This equipment arrangement shall be used in the final measurements of radiated emission from the EUT.
- e) For each mode of operation required to be tested, the frequency spectrum shall be monitored. Variations in antenna height between 1 m and 4 m, antenna polarization, EUT azimuth, and cable or wire placement (each variable within bounds specified elsewhere) shall be explored to produce the emission that has the highest amplitude relative to the limit. A suggested step-by-step technique for determining maximum radiated emission is given in Annex E.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

ANSI C63.4-2014, 8.3.2.1 Final radiated emission measurements (9 kHz to 1 GHz)

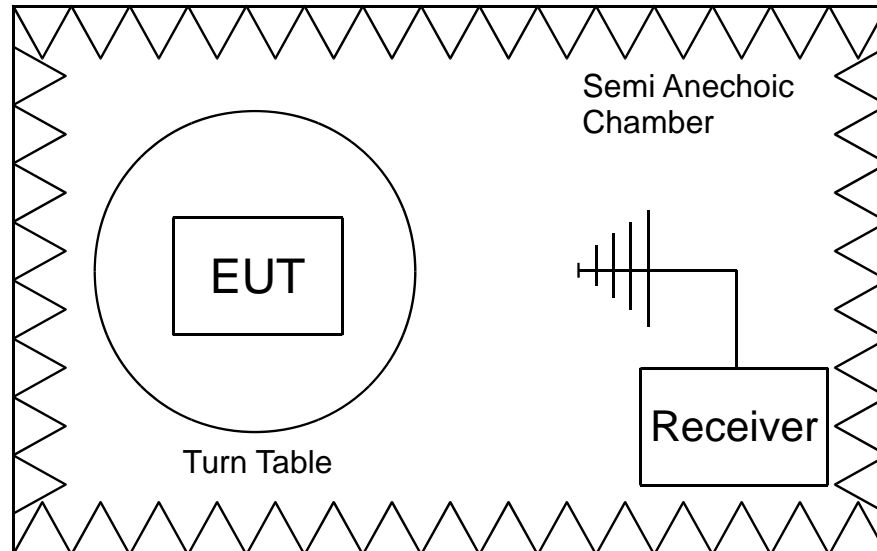
Based on the exploratory radiated emissions measurement results (i.e., see 8.3.1.1), the single EUT, cable and wire arrangement, and mode of operation that produces the emission that has the highest amplitude relative to the limit are selected for the final measurement. The final measurements are then performed on a site meeting the requirements of 5.3 or 5.4, as appropriate. If the EUT is relocated from an exploratory test site to a final test site, the highest emission relative to the limit shall be remaximized at the final test location before final radiated emissions measurements are performed. However, antenna height and polarization and EUT azimuth are to be varied. In addition, the full frequency range to be checked for meeting compliance shall be investigated.

This investigation is performed with the EUT rotated 360°, the antenna height scanned between 1 m and 4 m, and the antenna rotated by 90° relative to the ground plane to repeat the measurements for both the horizontal and vertical antenna polarizations. During the full frequency range investigation, particular focus should be made on the frequencies found in exploratory testing that were used to find the final test configuration, mode of operation, and arrangement (associated with achieving the least margin with respect to the limit). This full range test constitutes the compliance measurement.

Radiated Emissions Test Characteristics	
Frequency range	30 MHz – 1000 MHz
Test distance	10 m
Test instrumentation resolution bandwidth	120 kHz
Receive antenna height	1 m - 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement location	Semi Anechoic Chamber (SAC)

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.4.2 Test Setup



SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.109
Procedure: ANSI C63.4-2014

Receiver: #516
Antenna: #6041

Test distance: 10 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 54, 516, 1291, 1292, 1889, 2038,
2724, 2786, 4075, 4717, 5392, 6041

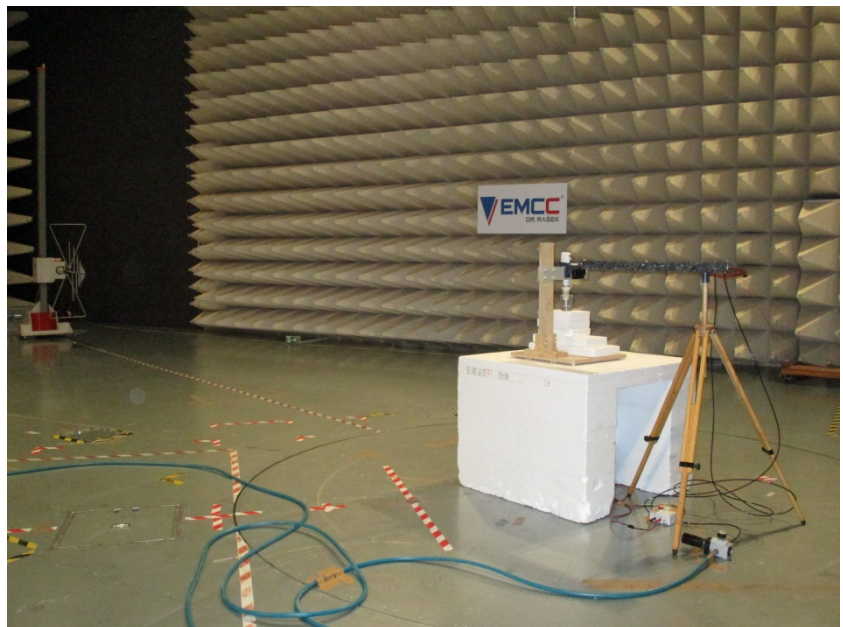


Photo of setup, Mode 1

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

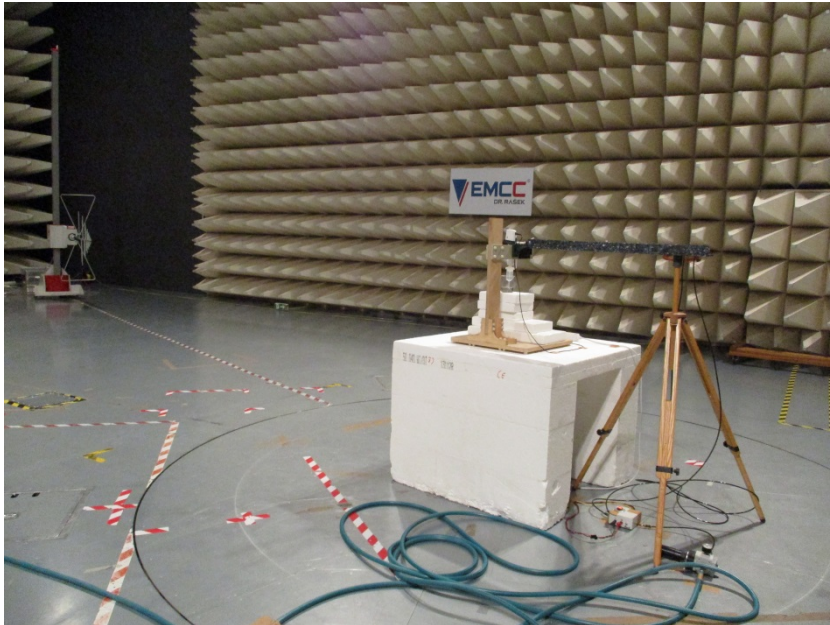
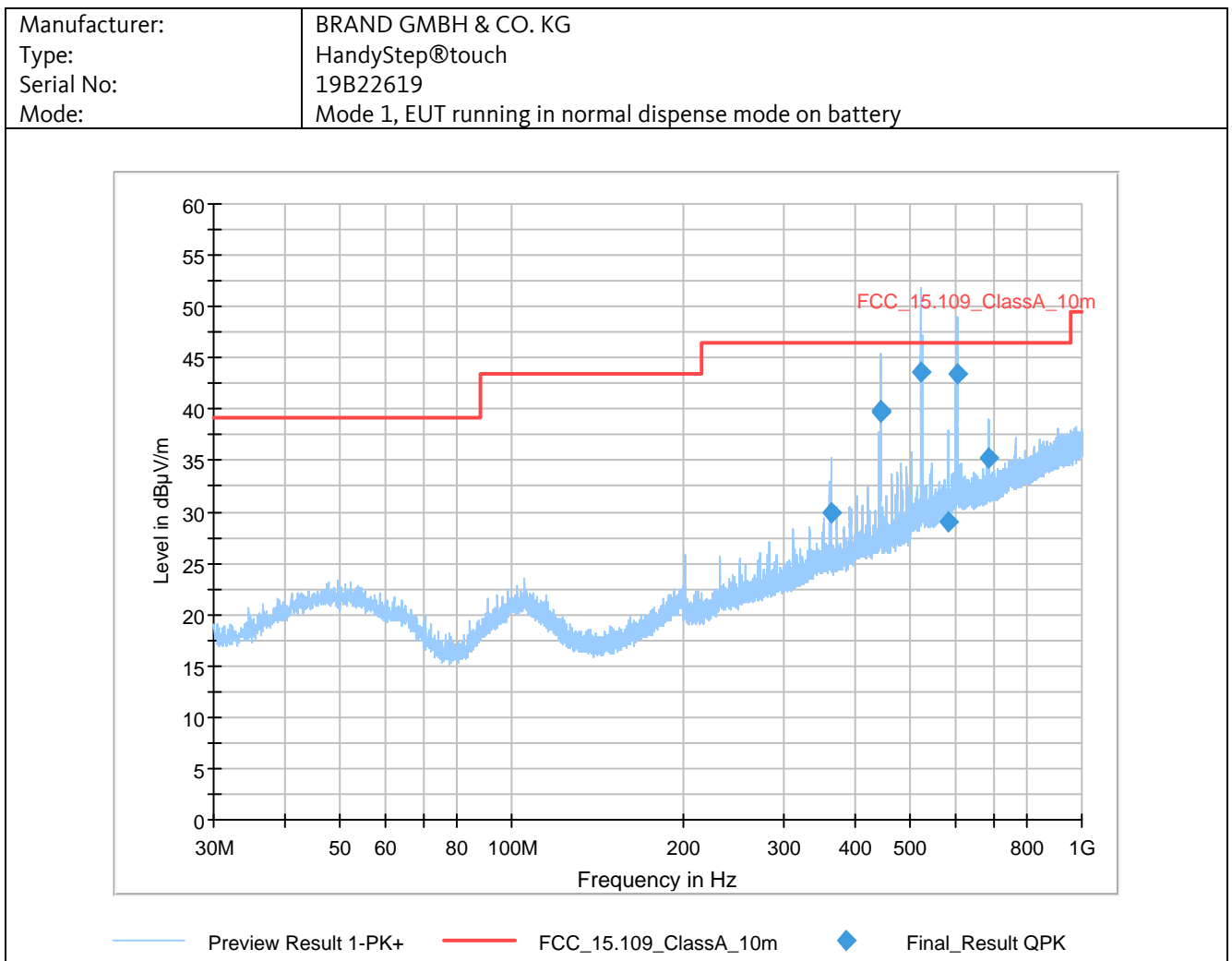


Photo of setup, Mode 2

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.4.3 Detailed Test Data

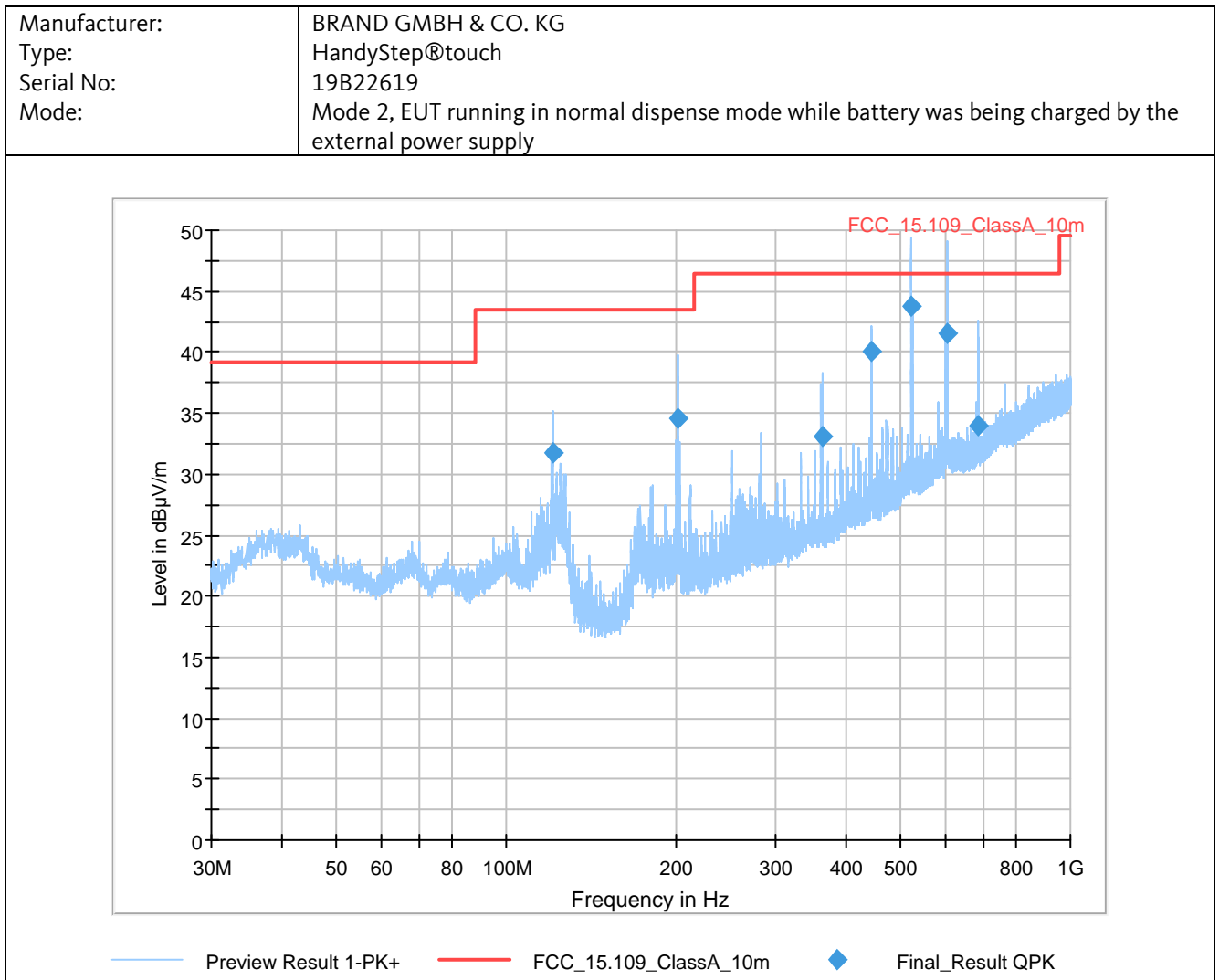


Final Result:

Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dB	ms	Hz	cm	--	deg	dB/m
362.66	30.0	46.4	16.4	1000	120.0	325.0	V	-176	21.7
443.10	39.8	46.4	6.6	1000	120.0	209.0	V	156	23.2
523.98	43.7	46.4	2.7	1000	120.0	231.0	V	129	24.8
583.74	29.1	46.4	17.4	1000	120.0	223.0	V	-130	26.0
604.14	43.4	46.4	3.0	1000	120.0	164.0	V	-121	26.5
686.10	35.2	46.4	11.2	1000	120.0	157.0	V	-174	27.2

All tests performed at 10 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Final Result:

Frequency	QuasiPeak	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dB	ms	Hz	cm	--	deg	dB/m
120.82	31.7	43.5	11.8	1000	120.0	100.0	V	-9	15.5
201.62	34.6	43.5	8.9	1000	120.0	104.0	V	26	17.5
362.50	33.1	46.4	13.3	1000	120.0	302.0	V	-93	21.7
442.86	40.1	46.4	6.3	1000	120.0	252.0	V	176	23.2
524.02	43.8	46.4	2.6	1000	120.0	222.0	V	-79	24.8
604.58	41.6	46.4	4.8	1000	120.0	164.0	V	-72	26.5
685.02	34.0	46.4	12.4	1000	120.0	323.0	V	151	27.2

All tests performed at 10 m distance. The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.4.4 Test Result

Manufacturer:	BRAND GMBH & CO. KG
Type:	HandyStep®touch
Serial No.:	19B22619
Test date:	2019-05-10
Test Personnel:	Wolfgang Kiss

The EUT meets the requirements of this section.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.5 Radiated Emissions above 1000 MHz

According to customer information the highest fundamental frequency of the EUT is 320 MHz.

With this frequency and taking into account 47CFR § 15.33 (b) (1) and ICES-003, 6.2 the spectrum shall be investigated up to 2 GHz.

4.2.5.1 Test Procedures

ANSI C63.4-2014, 8.2.4 Electric field radiated emissions (1 GHz to 40 GHz)

Radiated emission measurements above 1 GHz are made using calibrated linearly polarized antennas as specified in 4.5.5, which may have a smaller beamwidth (main lobe) than do the antennas used for frequencies below 1 GHz. Because the source of emissions from the EUT is generally limited to relatively small-angle cones of radiation in any elevation above the ground plane including angles above the height of the EUT, the antenna beamwidth shall be known so that when EUT emissions are measured, the area of coverage of the EUT emissions can be determined. Moving the measurement antenna over the surfaces of the four sides of the EUT or another method of scanning of the EUT is required when the EUT is larger than the area covered by the beamwidth of the measuring antenna at the specified distance.

For any EUT, the frequencies of emission should first be detected. Then the amplitudes of the emissions are measured at the specified measurement distance using the required antenna height, polarization, and detector characteristics.

In performing these measurements, the sensitivity of the complete measurement system relative to the limit shall be determined before the test. If the overall measurement sensitivity is inadequate, then low-noise preamplifiers, closer measurement distances, higher gain antennas, and/or narrower bandwidths may be used. Also, measurement system overload levels shall be determined to be adequate when preamplifiers are used. The effects of using bandwidths different from those specified shall also be determined. Any changes from the specific measurement conditions shall be described in the report of the measurements. (See also 10.2.4 and 10.2.9.)

ANSI C63.4-2014, 8.3.1.2 Exploratory radiated emissions measurements (1 GHz to 40 GHz)

When measuring emissions above 1 GHz, the frequencies of maximum emission shall be determined by manually (or with an articulated antenna positioner) positioning the antenna close to the EUT and then moving the measurement antenna over the surfaces of the EUT while observing a spectral display. It will be advantageous to have prior knowledge of the frequencies of emissions above 1 GHz to help in the search for emissions at those frequencies.

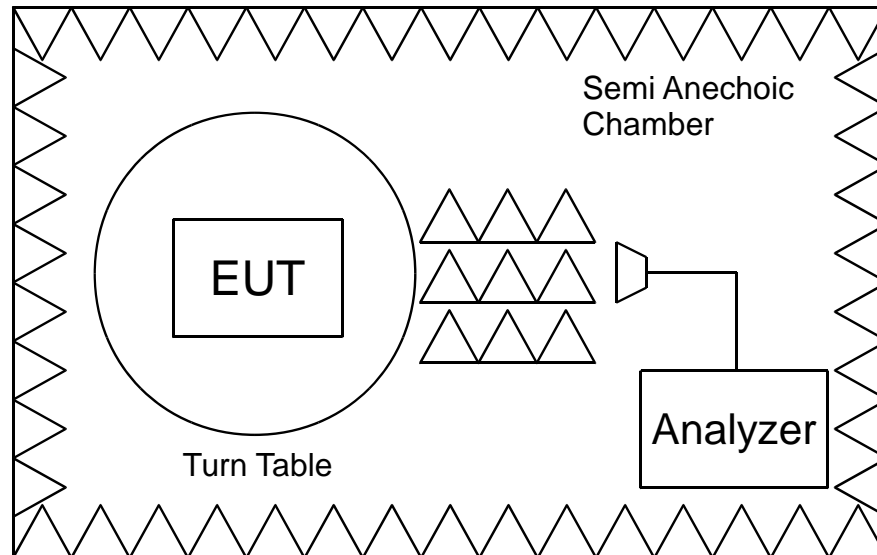
ANSI C63.4-2014, 8.3.2.2 Final radiated emission measurements (1 GHz to 40 GHz)

The final measurements are performed on a site meeting the requirements of 5.5. For measurements above 1 GHz, use the cable, EUT arrangement, and mode of operation determined in the exploratory testing to produce the emission that has the highest amplitude relative to the limit. Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The data collected shall satisfy the report requirements of Clause 10.

Radiated Emissions Test Characteristics	
Frequency range	1 GHz – 2 GHz
Test distance	4.5 m
Test instrumentation resolution bandwidth	1 MHz
Receive antenna height	1 m – 4 m
Receive antenna polarization	Vertical/Horizontal
Measurement chamber	Semi anechoic chamber (SAC) with rf absorbers on the floor

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.5.2 Test Setup



SCHEMATIC TEST SETUP

Requirement: 47 CFR, § 15.109
Procedure: ANSI C63.4-2014

Receiver: #516
Antenna: #3235

Test distance: 4.5 m

TEST EQUIPMENT USED:
Refer to chapter 5 of this document.
1, 516, 1292, 1889, 2038, 2786,
3235, 4075, 4717, 5392, 5544, 5545,
5616

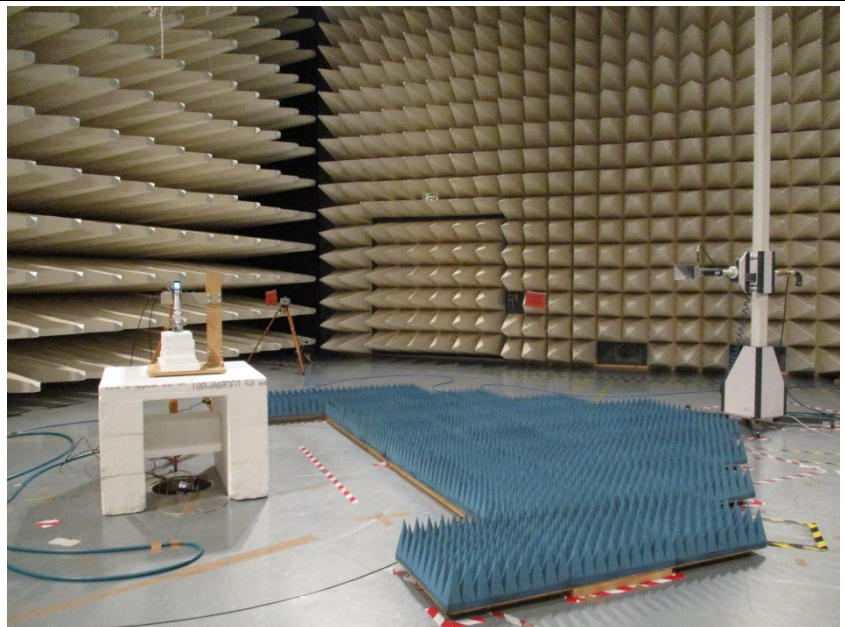


Photo of setup, Mode 1

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

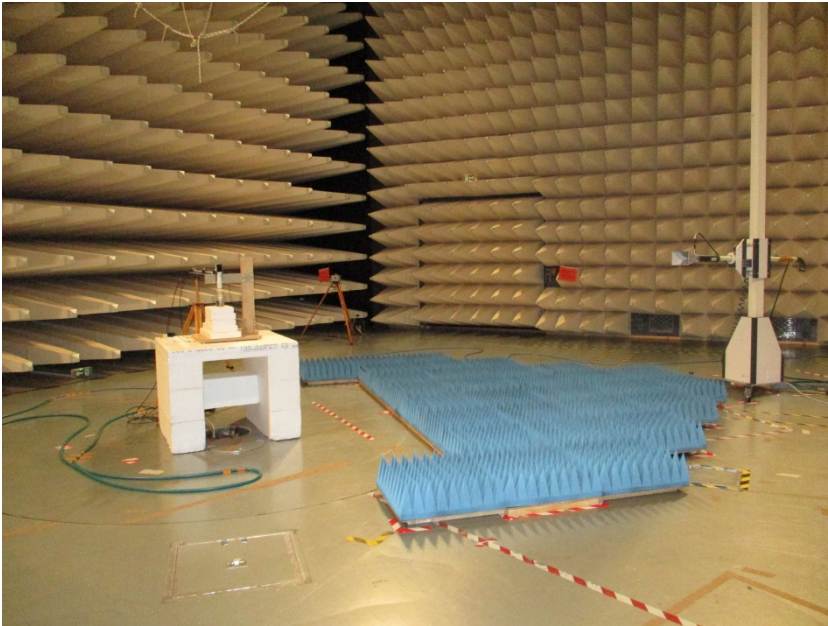
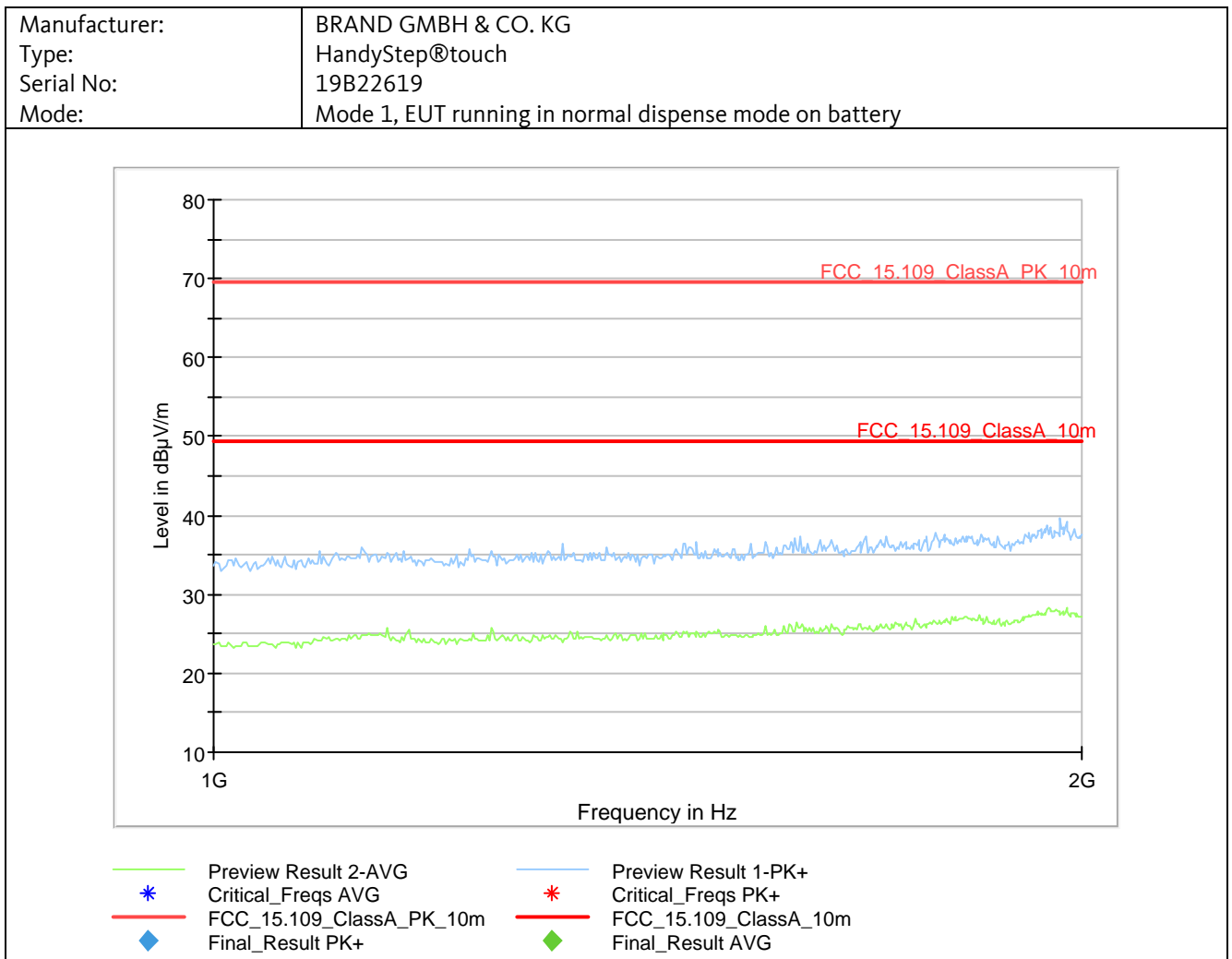


Photo of setup, Mode 2

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.5.3 Detailed Test Data



Final Result:

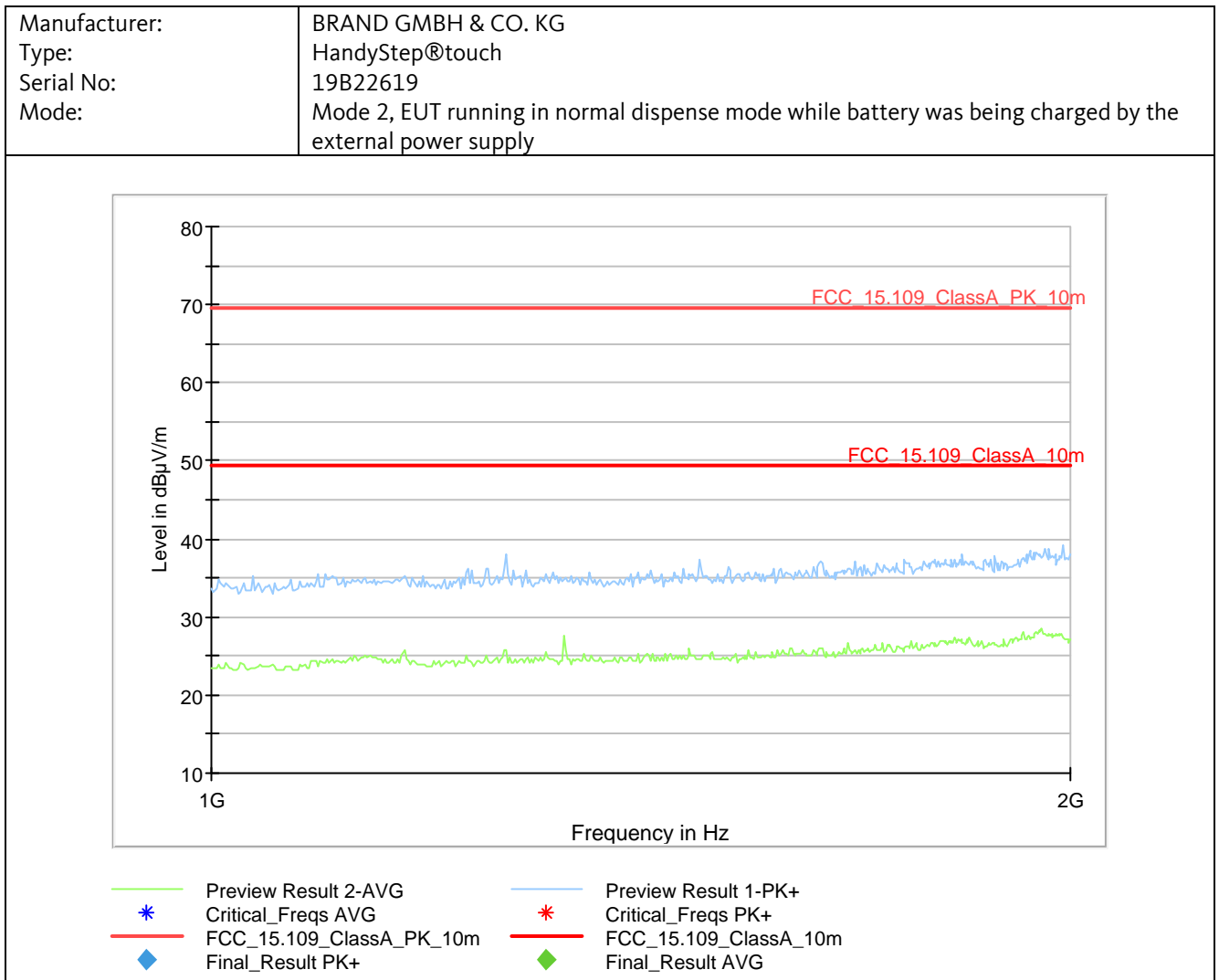
Frequency	MaxPeak	Average	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm	--	deg	dB/m

No final measurement since all peaks were far below the limit.

All tests performed at the distance denoted in chapter 4.2.5.2.

The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Final Result:

Frequency	MaxPeak	Average	Limit	Margin	Meas. Time	Bandwidth	Height	Pol	Azimuth	Corr.
MHz	dBµV/m	dBµV/m	dBµV/m	dB	ms	kHz	cm	--	deg	dB/m
No final measurement since all peaks were far below the limit.										

All tests performed at the distance denoted in chapter 4.2.5.2.

The table above contains worst-case emissions, only. For further details refer to the pre-scan test plot above.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

4.2.5.4 Test Result

Manufacturer:	BRAND GMBH & CO. KG
Type:	HandyStep®touch
Serial No.:	19B22619
Test date:	2019-05-10
Test Personnel:	Wolfgang Kiss

The EUT meets the requirements of this section.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

5 TEST INSTRUMENTS

EMCC ID #	Instrument	Manufacturer	Type	Last Calibration	Calibration valid until
1	60-Hz-Converter	AEG	DAMK4/DAG K4	n/a	n/a
54	N-Cable N/50	Rohde & Schwarz	HFU2-Z5	n/a	n/a
516	EMI Test Receiver	Rohde & Schwarz	ESIB40	2019-04	2020-04
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
2038	DC Power Supply	Oltronix	LABPAC 100R	n/a	n/a
2720	Digital Multimeter	Agilent	U1241A	2019-04	2021-04
2724	5 W Attenuator 6dB	Weinschel	2	2019-07	2021-07
2786	Pulse Generator	EMCC DR. RASEK	TG 1000	n/a	n/a
3184	Pulse Limiter	MTS	MTA-IMP-136	2019-07	2021-07
3235	Double Ridged Guide Antenna	Schwarzbeck	BBHA 9120D	2019-01	2021-01
4026	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 V10.28.00 and V10.35.02	Rohde & Schwarz	EMC32	n/a	n/a
5544	Antenna Mast	innco systems GmbH	MA 5000-XPET	n/a	n/a
5545	Antenna Mast Controller	innco systems GmbH	CO 3000-1D	n/a	n/a
5551	BNC cable	EMCC	BNC003m0	n/a	n/a
5616	RF cable assembly	Rosenberger	LA2-025-7000	n/a	n/a
6041	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	2017-09	2019-09
6860	pneumatics switch	EMCC	n/a	n/a	n/a

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

6 MEASUREMENT UNCERTAINTY

Measurement	Measurement Uncertainty
Conducted Emissions, AC mains (150 kHz – 30 MHz)	±3.5 dB
Radiated Emissions 30 – 1000 MHz	±5.6 dB
Radiated Emissions above 1000 MHz	±4.6 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%.

The given values have been calculated on the basis of the following documents:

CISPR 16-4-2:2011+A1:2014, Specification for radio disturbance and immunity measuring apparatus and methods - Part 4-2: Uncertainties, statistics and limit modelling - Measurement instrumentation uncertainty.

JCGM 100:2008, Evaluation of measurement data - Guide to the expression of uncertainty in measurement.

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

7 LIST OF ANNEXES

The following annexes are separated parts from this test report.

Description	Pages
Annex 1: Photographs of test setup	6
Annex 2: External photographs of equipment under test	3
Annex 3: Internal photographs of equipment under test	2
Annex 4: Photographs of ancillary equipment	3

ANNEX 1 TO TEST REPORT # EMCC-981261EID, 2019-08-20**PHOTOGRAPHS OF TEST SETUP****EQUIPMENT UNDER TEST:**

Trade Name:	HandyStep electronic
Type/Model:	HandyStep®touch
Serial Number(s):	19B22619
Application:	Electronic Dispenser
FCC ID:	2ATKA-HST7052X0
Manufacturer:	BRAND GMBH & CO. KG
Address:	Otto-Schott-Strasse 25 97877 Wertheim GERMANY
Phone:	+49 9342 808 1130
E-Mail:	juergen.schraut@brand.de

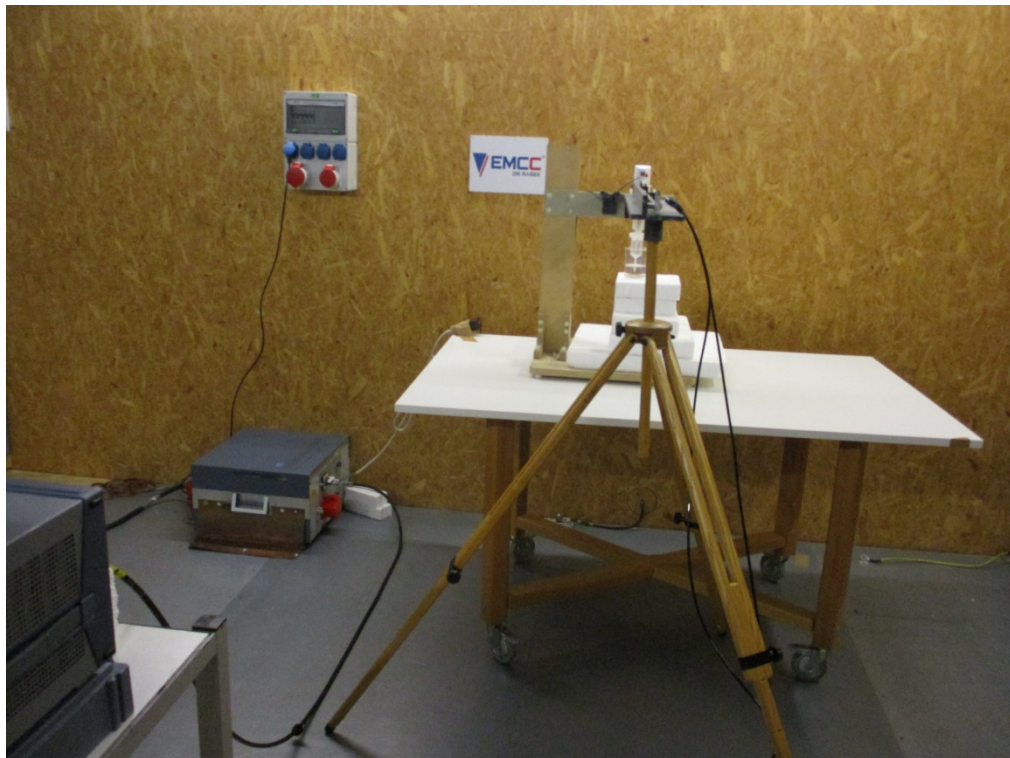
RELEVANT STANDARD(S): 47 CFR §§ 15.107 / 15.109
ICES-003 Issue 6

MEASUREMENT PROCEDURE: ANSI C63.4-2014

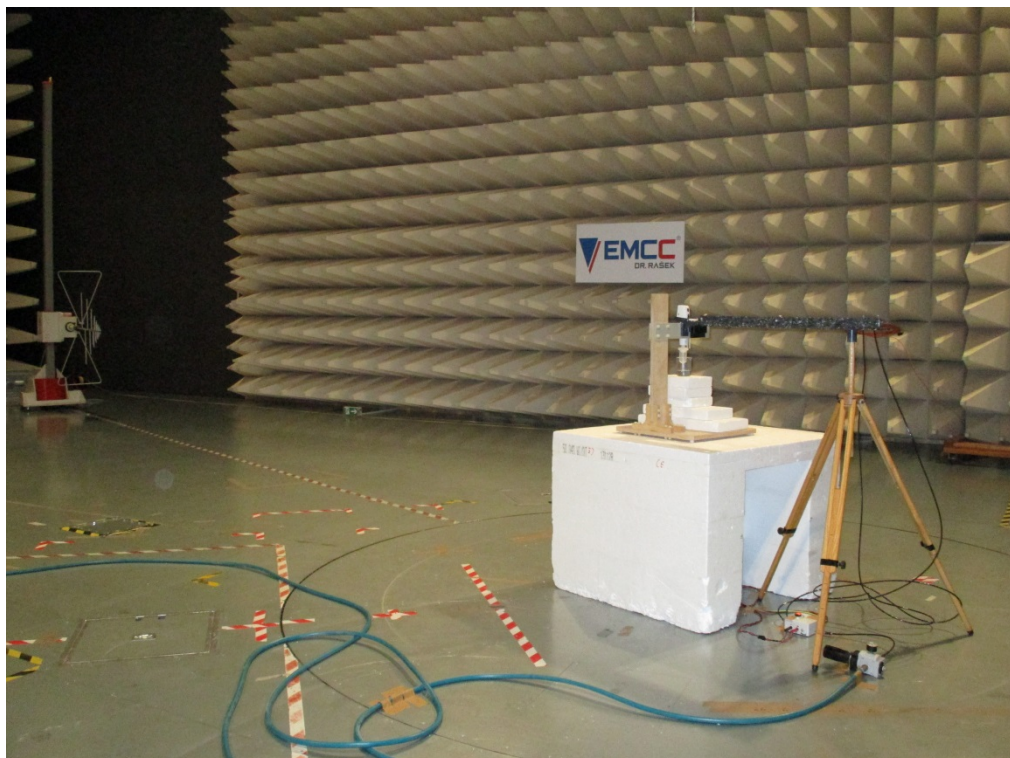
ILLUSTRATION LIST ANNEX 1

Photograph A1-1: Conducted Emissions, Mode 2	2
Photograph A1-2: Radiated Emissions 30 – 1000 MHz at 10 m distance, Mode 1	2
Photograph A1-3: Radiated Emissions 30 – 1000 MHz at 10 m distance, Mode 2	3
Photograph A1-4: Radiated Emissions above 1 GHz at 4.5 m distance, Mode 1	3
Photograph A1-5: Radiated Emissions above 1 GHz at 4.5 m distance, Mode 2	4
Photograph A1-6: Setup of mechanical control of dispenser	4
Photograph A1-7: Detail of mechanical control	5
Photograph A1-8: Principal setup of timer	5
Photograph A1-9: Detailed setup of timer	6
Photograph A1-10: Detailed setup of dispenser in multi-dispense mode	6

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

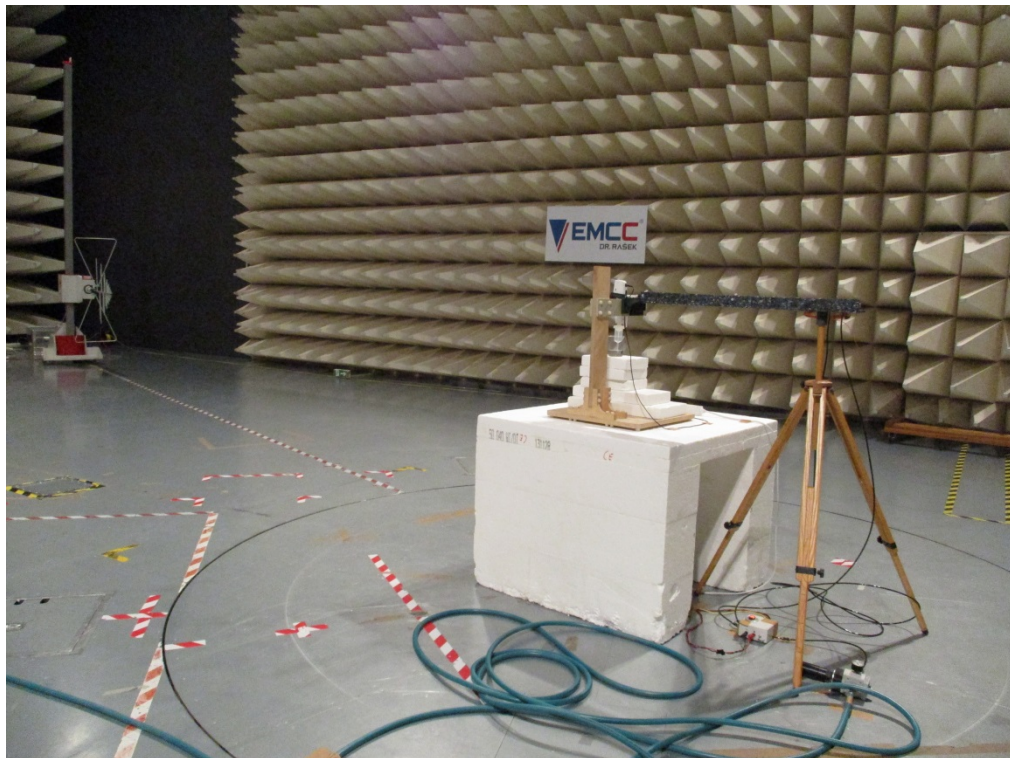


Photograph A1-1: Conducted eEmissions, Mode 2

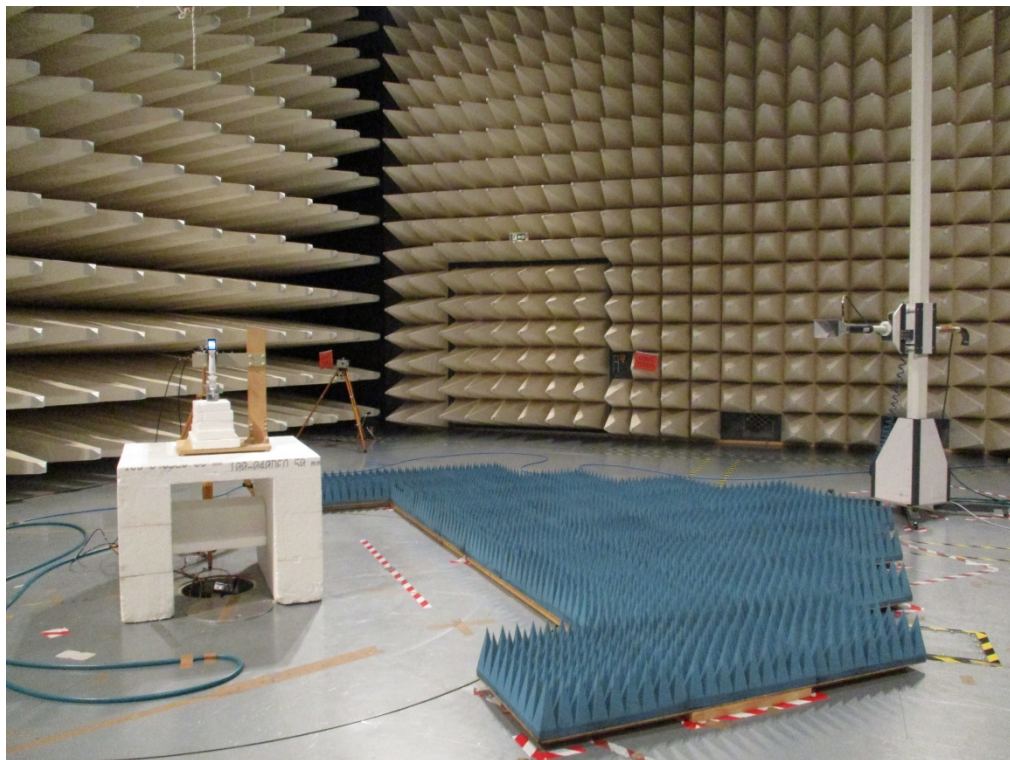


Photograph A1-2: Radiated Emissions 30 – 1000 MHz at 10 m distance, Mode 1

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

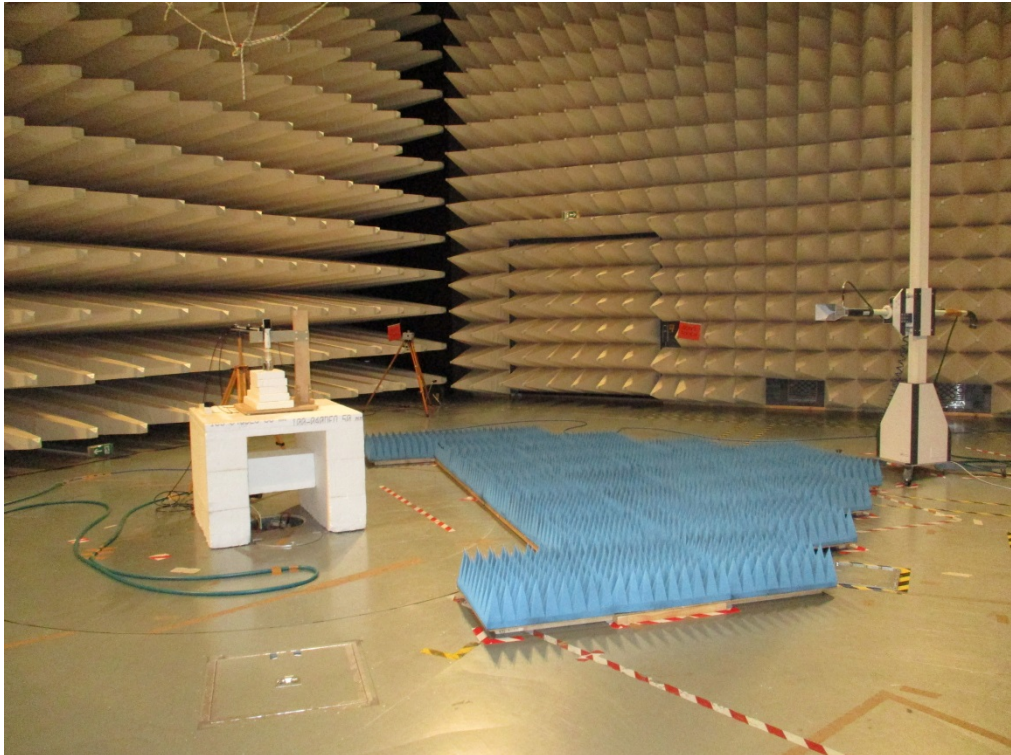


Photograph A1-3: Radiated Emissions 30 – 1000 MHz at 10 m distance, Mode 2

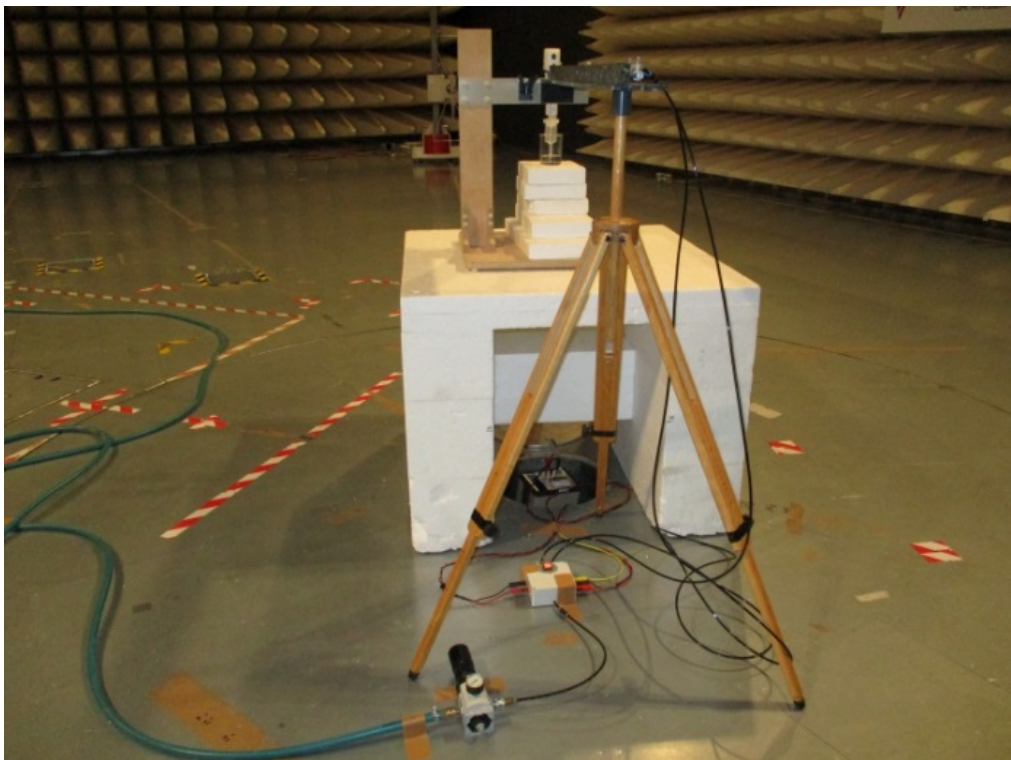


Photograph A1-4: Radiated Emissions above 1 GHz at 4.5 m distance, Mode 1

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6

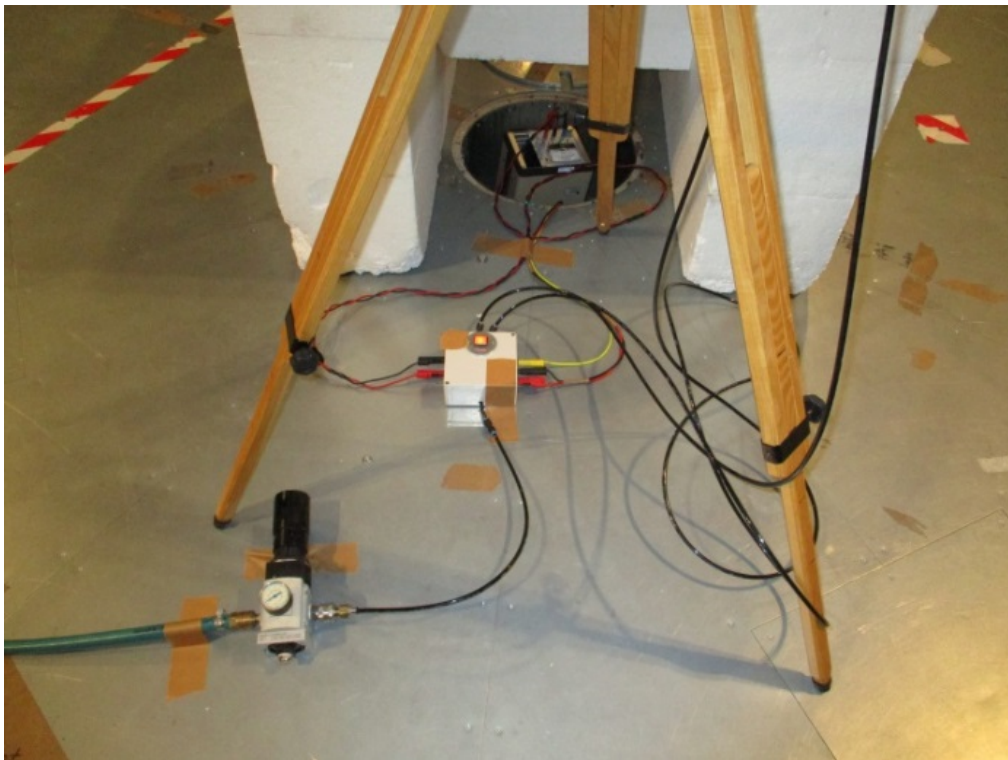


Photograph A1-5: Radiated Emissions above 1 GHz at 4.5 m distance, Mode 2

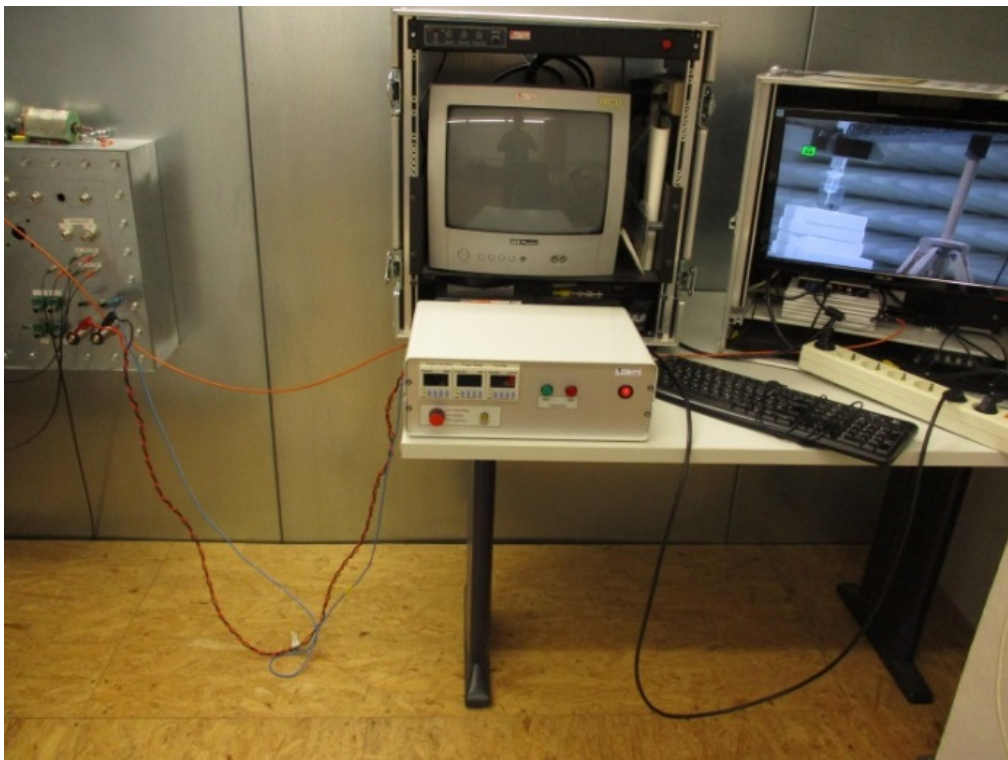


Photograph A1-6: Setup of mechanical control of dispenser

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Photograph A1-7: Detail of mechanical control



Photograph A1-8: Principal setup of timer

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Photograph A1-9: Detailed setup of timer



Photograph A1-10: Detailed setup of dispenser in multi-dispense mode

ANNEX 2 TO TEST REPORT # EMCC-981261EID, 2019-08-20

EXTERNAL PHOTOGRAPHS OF EQUIPMENT UNDER TEST**EQUIPMENT UNDER TEST:**

Trade Name:	HandyStep electronic
Type/Model:	HandyStep®touch
Serial Number(s):	19B22619
Application:	Electronic Dispenser
FCC ID:	2ATKA-HST7052X0
Manufacturer:	BRAND GMBH & CO. KG
Address:	Otto-Schott-Strasse 25 97877 Wertheim GERMANY
Phone:	+49 9342 808 1130
E-Mail:	juergen.schraut@brand.de

RELEVANT STANDARD(S): 47 CFR §§ 15.107 / 15.109
ICES-003 Issue 6

MEASUREMENT PROCEDURE: ANSI C63.4-2014

ILLUSTRATION LIST ANNEX 2

Photograph A2-1: EUT front	2
Photograph A2-2: EUT back	2
Photograph A2-3: EUT (SN: 19B22619), label	3

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Photograph A2-1: EUT front



Photograph A2-2: EUT back

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Photograph A2-3: EUT (SN: 19B22619), label

ANNEX 3 TO TEST REPORT # EMCC-981261EID, 2019-08-20

INTERNAL PHOTOGRAPHS OF EQUIPMENT UNDER TEST

EQUIPMENT UNDER TEST:

Trade Name:	HandyStep electronic
Type/Model:	HandyStep®touch
Serial Number(s):	19B22619
Application:	Electronic Dispenser
FCC ID:	2ATKA-HST7052X0
Manufacturer:	BRAND GMBH & CO. KG
Address:	Otto-Schott-Strasse 25 97877 Wertheim GERMANY
Phone:	+49 9342 808 1130
E-Mail:	juergen.schraut@brand.de

RELEVANT STANDARD(S): 47 CFR §§ 15.107 / 15.109
ICES-003 Issue 6

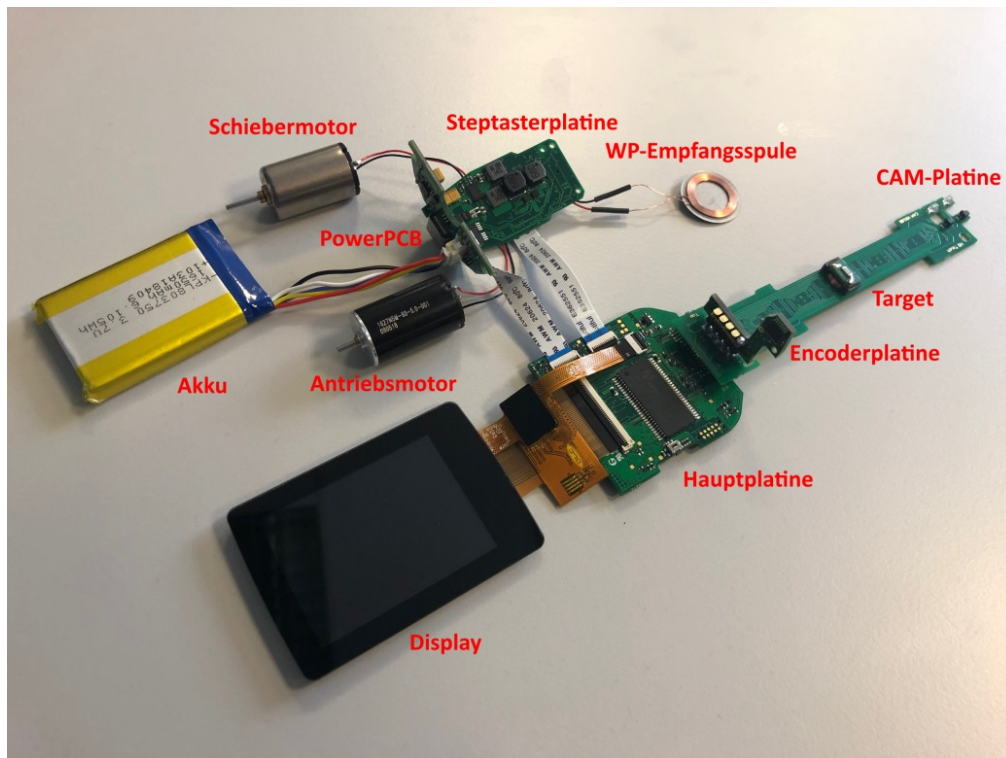
MEASUREMENT PROCEDURE: ANSI C63.4-2014

ILLUSTRATION LIST ANNEX 3

Photograph A3-1: EUT (SN: 19B22619), Internal view, picture delivered by the customer

2

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109 and ICES-003 Issue 6



Photograph A3-1: EUT (SN: 19B22619), Internal view, picture delivered by the customer

ANNEX 4 TO TEST REPORT # EMCC-981261EID, 2019-08-20

PHOTOGRAPHS OF ANCILLARY EQUIPMENT

EQUIPMENT UNDER TEST:

Trade Name:	HandyStep electronic
Type/Model:	HandyStep®touch
Serial Number(s):	19B22619
Application:	Electronic Dispenser
FCC ID:	2ATKA-HST7052X0
Manufacturer:	BRAND GMBH & CO. KG
Address:	Otto-Schott-Strasse 25 97877 Wertheim GERMANY
Phone:	+49 9342 808 1130
E-Mail:	juergen.schraut@brand.de

RELEVANT STANDARD(S): 47 CFR §§ 15.107 / 15.109
ICES-003 Issue 6

MEASUREMENT PROCEDURE: ANSI C63.4-2014

ILLUSTRATION LIST ANNEX 4

Photograph A4-1: EUT DC power supply with cable	2
Photograph A4-2: Detailed view of EUT DC power supply	2
Photograph A4-3: EUT, used dispense tip	3

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109



Photograph A4-1: EUT DC power supply with cable



Photograph A4-2: Detailed view of EUT DC power supply

Test on BRAND GMBH & CO. KG HandyStep®touch to 47 CFR §§ 15.107 / 15.109



Photograph A4-3: EUT, used dispense tip