



Test Report EMC

FCC listed test laboratory; Registration No. 91098
A description of the test site pursuant to 47 CFR 2.948 has
been filed with the Federal Communications Commission.

Test Laboratory:

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Equipment under Test

Applicant:	Braun GmbH; Frankfurter Straße 145, 61476 Kronberg
Manufacturer:	Braun GmbH; Baumhofstrasse 40, 97828 Marktheidenfeld
File number:	263300-2570-0076/142493
EUT:	Tooth-brush with RF, rechargeable battery-powered
Brand/model:	BRAUN 3762
EUT received:	2010-07-05

Applied standards



Main Standard	Basic Standards
Standards that have been applied to the radio transmitter:	
47 CFR 15, Subpart C: Intentional Radiators § 15.249 (Operation within the band 2400 - 2483.5 MHz) as an alternative to the general radiated emission as provided in § 15.209	ANSI C63.4:2003
Standards that are applicable to the non-radio equipment:	
47 CFR 15, Subpart B: Unintentional Radiators in conjunction with CISPR Pub.22: 1997 Limits for class B equipment	ANSI C63.4:2003

Remarks: ---

Information about modifications to the EUT at the test laboratory:

In order to achieve compliance with the regulations, no modifications were made to the EUT in the course of the tests.

Result: Pass

Date of issue:	2011-04-13	
Tested by:	Mr. Wolfgang Klos EMC Test Engineer	
Reviewed:	Mr. Stephan Kloska, Dr.-Ing. Head of the Laboratory	



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1 Description of the sample (EUT)

1.1 General description

Type of EUT:	<p>The object of this test report is a tooth brush handle with built-in radio transmitter operating in the 2400 - 2483,5 MHz band. It is part of a rechargeable power tooth brush application with external display unit (SmartGuide) consisting of</p> <ul style="list-style-type: none"> • Hand piece (with 2,4 GHz transmitter) Type 3762 • Display Unit (SmartGuide) with built-in 2,4 GHz receiver Type 3741 • Charger, Type 3757 <p>The battery-powered display unit (3741) and the Charger (3757) are not objects of this test report. These devices are objects of other reports.</p>
Intended use, typical applications:	<p>Electric tooth brush for domestic dental care. It will be used indoors only. The 2,4 GHz radio transmitter utilized in the tooth brush is intended to transmit information about</p> <ul style="list-style-type: none"> • brushing mode, • brushing time, • brushing force, • low battery, • brushhead replacement etc. <p>to the receiver built in the SmartGuide.</p>
Brand name:	BRAUN
Model/Type Designation:	3762
Serial Number:	None (Prototype)
Equipment Type:	Fix or mobile
Signal flow direction:	Operation in the 2400 - 2483,5 MHz band: Simplex
Construction of the equipment:	<p>Operation in the 2400 - 2483,5 MHz band Two units: One transmitter in the hand piece (Model 3762) and one receiver in the display unit (Model 3741)</p> <p><i>Note: "UNIT" means a physically separate item of the equipment. The equipment under test may consist of two separate units.</i></p>

1.2 Technical Specifications

1.2.1 Transmitter

1.2.1.1 Transmitter components

The 2,4 GHz ISM transmitter is integrated into the PCB.

1.2.1.2 Ports of the transmitter

Power ports:	Battery operated with rechargeable NiMH battery, charged on SmartCharger
Antenna ports:	No external antenna connector
Earth port:	Not applicable
Signal/control ports:	No external ports
Telecommunications ports:	No external ports

1.2.1.3 Transmitter (Transceiver) power supply

Type of power source:	DC/DC converter steps up battery voltage from 0.9 to 1.5V to a stabilized 3 Volt supply voltage for the electronic circuits.
Rated battery voltage:	DC 1.2 V
Lower extreme test source voltage:	DC 0.9 V in agreement with the applicant
Upper extreme test source voltage:	DC 1.5 V in agreement with the applicant
Automatic transmitter shut-off facility (of the final product):	No. Hand piece transmits in the 2400 MHz to 2483,5 MHz band only when motor is running and for 1 sec after motor has stopped or for 1 sec when toothbrush is put on the charger. Also when a button is pressed or when toothbrush is in setup mode.

Rated power consumption:	Not specified
Number of phases (if applicable):	N/A

Rated current:	
Protection class:	III

1.2.1.4 RF characteristics of the 2.4 GHz ISM transmitter

Operating frequency:	Uses 4 channels (2403 MHz, 2425 MHz, 2427 MHz, 2452 MHz) which are changed sequentially. Sequence repeats after 36 channel changes. Single packet is transmitted on all 4 channels at least one time before information will be updated.
Channel separation (if applicable):	Not applicable
Method of frequency generation:	Integrated PLL system to achieve self adaptive carrier frequency to antenna resonant frequency
Type of modulation:	Binary Frequency Shift Keying (2-FSK) for details refer to the specification of the front end IC
Modulation input signal characteristics:	The modulation signal is generated internally.
Duty cycle of the transmitter:	Duty cycle: in practical use approx. 18% while transmitting at each frequency Total length of one active transmission period: approx. 2 minutes per user, typically not more than 4 users per hour. Toothbrush transmits only when motor is running and for 1 sec after motor has stopped or for 1 sec when toothbrush is put on the charger. Also when a button is pressed or when toothbrush is in setup mode.
Intended temperature range:	For normal indoor use (5°C to +35°C)
Maximum rated transmitter output power (as stated by the manufacturer):	< 0,75 mW e.i.r.p.
Variable transmitter carrier output:	No, the output power of the transmitter is fix.
Product variants with alternate power levels:	None

1.2.1.5 Other constructional details

Oscillators, generated frequencies:	- Charge circuitry: 27 .. 39 kHz - DC/DC converter: approx. 600 kHz - Microprocessor and ISM Transmitter clock: 26,00 MHz (crystal oscillator)
Miscellaneous information	Integrated circuits: IC1 STM8L151G4U6 WFQFPN28 IC2 CC2500 IC5 TPS61070DDCR TSOT23

Disturbance sources/Components:

No.	Description	Manufacturer	Type designation	Remarks
1	PCB in the hand piece	Braun	D34	Drawing No. 99465360
2	DC motor			Braun Spec. 64729054

EMC-measures

No.	Location	Description	Specification	Manufacturer	Type designation
1	PCB, C28	SMD Capacitor	1000 pF ceramic		
2	PCB, L101	SMD Choke	2, 7 nH, $f_{res} = 9$ GHz		
3	PCB, L111	SMD Choke	2, 7 nH, $f_{res} = 11$ GHz		

Description of shield- and contacting measures for emc

No.	Description of the measure
1	None

2 Summary of test results

2.1 Transmitter test results

2.1.1 Evaluation against §15.249 (Operation within the 2400-2483.5 MHz band)

Test		Frequency range	Page	Remarks	Result
a)	Electric field strength, fundamental frequency	2400 MHz - 2483,5 MHz	8	---	Pass
a)	Electric field strength, Harmonics	1 GHz - 25 GHz ⁺⁾	8	---	Pass
Band edge compliance §15.215 c)		Band edges at 2400 MHz and 2483,5 MHz	12	---	Pass

⁺⁾ The upper value of the investigated frequency band was determined according to § 15.33 (b)(1).

2.1.2 Evaluation against §15.209 (Limits for radiated emissions of intentional radiators, general requirements)

Test		Frequency range	Page	Remarks	Result
a)	Electric field strength	9 kHz - 490 kHz 0,49 MHz - 1,705 MHz 1,705 MHz - 30 MHz	16	---	Pass
		30 MHz - 88 MHz 88 MHz - 216 MHz 216 MHz - 960 MHz 960 MHz - 1 GHz	12	---	Pass
		1 GHz - 25 GHz ⁺⁾	8	---	Pass

⁺⁾ The upper value of the investigated frequency band was determined according to § 15.33 (b)(1).

2.1.3 Evaluation against §15.207 (Limits for conducted emissions of intentional radiators)

Test		Frequency range	Page	Remarks	Result
a)	Conducted emissions	150 kHz - 500 kHz 0,5 MHz - 5 MHz 5 MHz - 30 MHz	---	---	Not applicable

2.2 Receiver test results

Not applicable

3 Test and measuring results

3.1 Radiated emissions in the frequency range 1 GHz to 25 GHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2010-11-16

Instruments:		Test location: Semi-anechoic chamber (Building M)		
Inventory number	Description	Manufacturer	Type	Date of Last Calibration
1800118	Test receiver/Spectrum analyzer 20 Hz ... 26.5 GHz	R&S	ESI 26	2009-06-09 (2 years)
1810066	Log.-per. Antenna 1-26.5 GHz	R&S	HL 025	2009-10-08 (3 years)
1800129	Amplifier	AML	AML0123L3702	2009-05-25 (2 years)
1800133	Amplifier	AML	AML0518L3203	2009-05-25 (2 years)

1800104	Spectrum-Analyzer 20 Hz ... 40 GHz	R&S	FSEK	2010-06-11 (2 years)
1810064	Horn Antenna 15 GHz ... 40 GHz	Schwarzbeck	BBHA 9170	2007-03-05 (5 years)
1800128	Amplifier 15 GHz ... 40 GHz	MITEQ	JS3-18004000-50-8A	2009-05-25 (2 years)

Information concerning the test:

Test set-up:	The EUT was operated in the center on top of a non-conductive table of 80 cm height. The table was located in the center of the turntable. The measurement distance was 3 m.
Operating modes used:	Toothbrush operated with variable speed, transmitter on All 4 possible channel frequencies were tested.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result: Pass

The radiated emissions of the EUT in the frequency range 1 GHz to 25 GHz were found to be equal or below the specified limits. The minimum margin of a measurement value to the limit was 30,5 dB at a fundamental frequency and 8,9 dB at a harmonic frequency.

Protocol:

Prior to the final measurements, exploratory measurements with a spectrum analyzer were made in order to determine the mode of operation and the arrangement of the EUT causing highest readings relative to the limit. These measurements were carried out with the EUT standing on the bottom, lying on the rear and lying on the side (brush tip to the left when display is facing the antenna). A freshly charged battery was used.

Emissions above the noise floor of the measuring system were only found while the brush was in operation. The motor speed did not have an influence to the level of emissions.

Final measurement:

The disturbance spectrum of the EUT was investigated by manually tuning the receiver to the disturbance frequencies detected with the preliminary measurements. The procedure according to Annex C of ANSI C63.4:2003 was applied for obtaining the maximum level of emissions. The orientation of the EUT causing the highest readings during the prescan was used. The final measurements were made using a freshly charged battery.

Receiver settings:

RBW/IF-Bandwidth: 1 MHz Detectors: PK and AV Meas. time: 100 ms

Measurement data sheets including summarizing tables showing the highest readings relative to the limit can be found on the following pages.

3.1.1 Summarizing tables of the highest measurement values relative to the limit, fundamental frequencies

Average

Fre- quency	Distance	Antenna Height	Polari- zation	EUT Angle	Measured Value	Limit	Margin	Measured value	Limit	Result
MHz	m	m		1°	dB(μV)	dB(μV/m)	dB	mV/m	mV/m	
2403	3	1,73	V	0	63,48	94	30,52	1,49	50	Pass
2425	3	1,72	V	0	63,29	94	30,71	8,35	50	Pass
2427	3	1,72	V	0	63,26	94	30,74	1,46	50	Pass
2452	3	1,72	V	0	63,46	94	30,54	8,05	50	Pass

Peak

Fre- quency	Distance	Antenna Height	Polari- zation	EUT Angle	Measured Value	Limit	Margin	Measured value	Limit	Result
MHz	m	m		1°	dB(μV)	dB(μV/m)	dB	mV/m	mV/m	
2403	3	1,73	V	0	78,44	114	35,56	1,46	500	Pass
2425	3	1,72	V	0	78,12	114	35,88	8,06	500	Pass
2427	3	1,72	V	0	78,13	114	35,87	1,49	500	Pass
2452	3	1,72	V	0	78,70	114	35,30	8,61	500	Pass

3.1.2 Summarizing tables of the six highest measurement values relative to the limit, Harmonics

Average

Fre- quency	Distance	Antenna Height	Polari- zation	EUT Angle	Measured Value	Limit	Margin	Measured value	Limit	Result
MHz	m	m		1°	dB(μV)	dB(μV/m)	dB	μV/m	μV/m	
9612	3	1,18	H	0	45,13	54	8,87	180,5	500	Pass
4806	3	1,10	V	0	34,40	54	19,60	52,5	500	Pass
4850	3	1,10	V	0	34,16	54	19,84	51,0	500	Pass
7281	3	1,16	H	0	34,00	54	20,00	50,1	500	Pass
7275	3	1,16	H	0	33,77	54	20,23	48,8	500	Pass
4854	3	1,10	V	0	33,77	54	20,23	48,8	500	Pass

Peak

Fre- quency	Distance	Antenna Height	Polari- zation	EUT Angle	Measured Value	Limit	Margin	Measured value	Limit	Result
MHz	m	m		1°	dB(μV)	dB(μV/m)	dB	μV/m	μV/m	
4904	3	1,13	H	0	50,57	74	23,43	337,9	5000	Pass
4850	3	1,15	H	350	50,56	74	23,44	337,2	5000	Pass
4854	3	1,15	H	350	50,37	74	23,63	329,8	5000	Pass
4806	3	1,15	H	350	50,18	74	23,82	322,8	5000	Pass
9612	3	1,18	H	0	49,03	74	24,97	282,8	5000	Pass
7275	3	1,18	H	0	48,37	74	25,63	262,2	5000	Pass

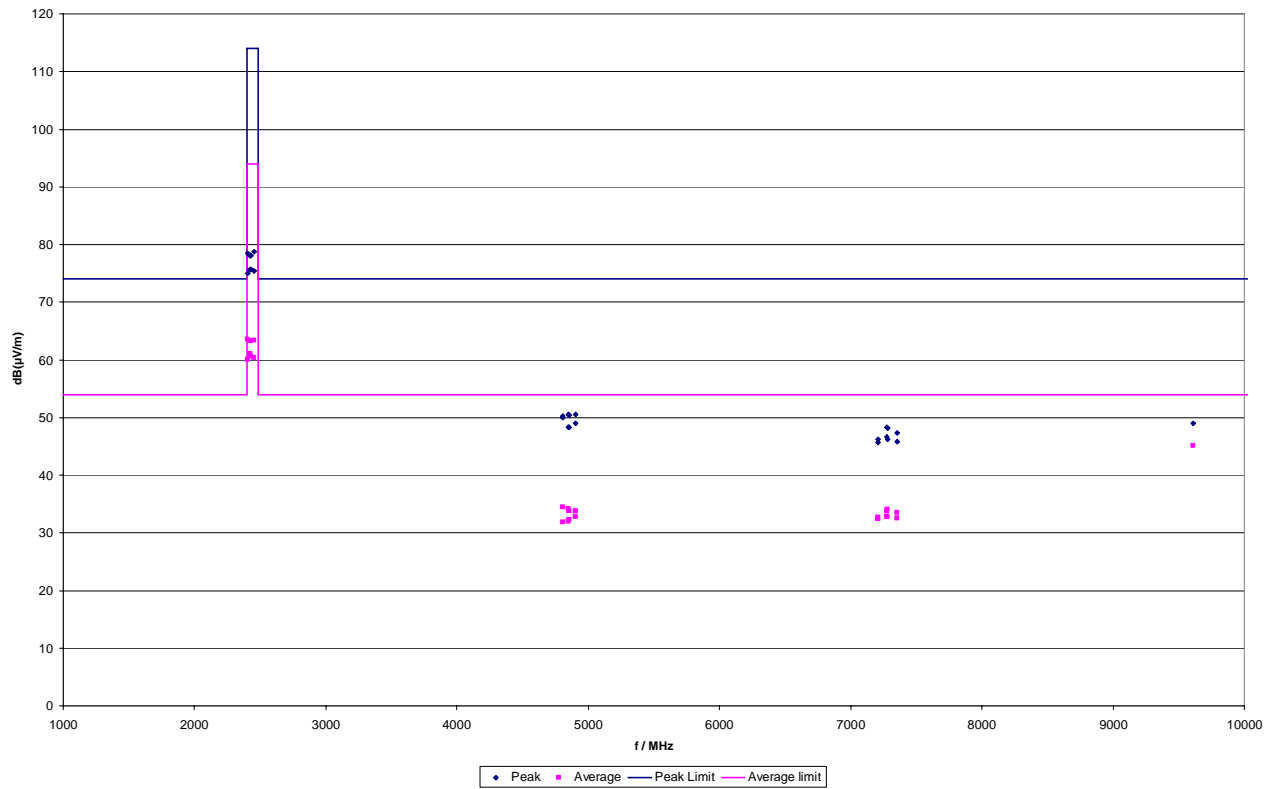
3.1.3 Complete measurement data

Frequency MHz	Test distance m	Antenna height RX m	Polarisation -	Turntable azimuth °	Instrument reading dBµV	Detector type -	Antenna factor dB(1/m)	Correction for cables and amplifier dB	Electrical field strength dB(µV/m)	Limit FCC Class B, 3 m dB(µV/m)	Margin dB	Result -
2403	3	1,73	V	0	41,07	PK	29,61	7,76	78,44	114	35,56	PASS
2403	3	1,73	V	0	26,11	AV	29,61	7,76	63,48	94	30,52	PASS
2425	3	1,72	V	0	40,65	PK	29,66	7,81	78,12	114	35,88	PASS
2425	3	1,72	V	0	25,82	AV	29,66	7,81	63,29	94	30,71	PASS
2427	3	1,72	V	0	40,65	PK	29,67	7,81	78,13	114	35,87	PASS
2427	3	1,72	V	0	25,78	AV	29,67	7,81	63,26	94	30,74	PASS
2452	3	1,72	V	0	41,10	PK	29,73	7,86	78,70	114	35,30	PASS
2452	3	1,72	V	0	25,86	AV	29,73	7,86	63,46	94	30,54	PASS
2403	3	1,50	H	350	37,60	PK	29,61	7,76	74,97	114	39,03	PASS
2403	3	1,50	H	350	22,70	AV	29,61	7,76	60,07	94	33,93	PASS
2425	3	1,75	H	350	38,20	PK	29,66	7,81	75,67	114	38,33	PASS
2425	3	1,75	H	350	23,60	AV	29,66	7,81	61,07	94	32,93	PASS
2427	3	1,75	H	350	38,20	PK	29,67	7,81	75,68	114	38,32	PASS
2427	3	1,75	H	350	23,20	AV	29,67	7,81	60,68	94	33,32	PASS
2452	3	1,72	H	350	37,90	PK	29,73	7,86	75,50	114	38,50	PASS
2452	3	1,72	H	350	22,80	AV	29,73	7,86	60,40	94	33,60	PASS
4806	3	1,10	V	0	41,83	PK	35,60	-27,42	50,01	74	23,99	PASS
4806	3	1,10	V	0	26,22	AV	35,60	-27,42	34,40	54	19,60	PASS
4850	3	1,10	V	0	40,10	PK	35,63	-27,37	48,36	74	25,64	PASS
4850	3	1,10	V	0	25,90	AV	35,63	-27,37	34,16	54	19,84	PASS
4854	3	1,10	V	0	40,10	PK	35,63	-27,36	48,37	74	25,63	PASS
4854	3	1,10	V	0	25,50	AV	35,63	-27,36	33,77	54	20,23	PASS
4904	3	1,07	V	0	40,64	PK	35,65	-27,30	48,99	74	25,01	PASS
4904	3	1,07	V	0	25,40	AV	35,65	-27,30	33,75	54	20,25	PASS
4806	3	1,15	H	350	42,00	PK	35,60	-27,42	50,18	74	23,82	PASS
4806	3	1,15	H	350	23,60	AV	35,60	-27,42	31,78	54	22,22	PASS
4850	3	1,15	H	350	42,30	PK	35,63	-27,37	50,56	74	23,44	PASS
4850	3	1,15	H	350	23,70	AV	35,63	-27,37	31,96	54	22,04	PASS
4854	3	1,15	H	350	42,10	PK	35,63	-27,36	50,37	74	23,63	PASS
4854	3	1,15	H	350	24,00	AV	35,63	-27,36	32,27	54	21,73	PASS
4904	3	1,13	H	0	42,22	PK	35,65	-27,30	50,57	74	23,43	PASS
4904	3	1,13	H	0	24,43	AV	35,65	-27,30	32,78	54	21,22	PASS
7209	3	1,48	V	60	29,50	PK	38,44	-22,28	45,66	74	28,34	PASS
7209	3	1,48	V	60	16,20	AV	38,44	-22,28	32,36	54	21,64	PASS
7275	3	1,48	V	190	30,20	PK	38,74	-22,27	46,67	74	27,33	PASS
7275	3	1,48	V	190	16,33	AV	38,74	-22,27	32,80	54	21,20	PASS
7281	3	1,48	V	190	29,73	PK	38,77	-22,27	46,23	74	27,77	PASS
7281	3	1,48	V	190	16,27	AV	38,77	-22,27	32,77	54	21,23	PASS
7356	3	1,48	V	190	29,00	PK	39,10	-22,25	45,86	74	28,14	PASS
7356	3	1,48	V	190	15,68	AV	39,10	-22,25	32,54	54	21,46	PASS
7209	3	1,14	H	0	30,10	PK	38,44	-22,28	46,26	74	27,74	PASS
7209	3	1,14	H	0	16,55	AV	38,44	-22,28	32,71	54	21,29	PASS
7275	3	1,16	H	0	31,90	PK	38,74	-22,27	48,37	74	25,63	PASS
7275	3	1,16	H	0	17,30	AV	38,74	-22,27	33,77	54	20,23	PASS
7281	3	1,16	H	0	31,60	PK	38,77	-22,27	48,10	74	25,90	PASS
7281	3	1,16	H	0	17,50	AV	38,77	-22,27	34,00	54	20,00	PASS
7356	3	1,16	H	0	30,50	PK	39,10	-22,25	47,36	74	26,64	PASS
7356	3	1,16	H	0	16,60	AV	39,10	-22,25	33,46	54	20,54	PASS
9612	3	1,18	H	0	27,10	PK	41,42	-19,49	49,03	74	24,97	PASS
9612	3	1,18	H	0	23,20	AV	41,42	-19,49	45,13	54	8,87	PASS

Measurements were made up to 25 GHz.

Above 9,612 GHz, no disturbances above the instrumentation noise floor were found.

Electric field strength, measured at 3 m





3.2 Band edge compliance

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2011-04-12
Environmental conditions:	23° C, 45 % r.h.

Instruments:		Test location: Laboratory		
Inventory number	Description	Manufacturer	Type	Date of Last Calibration
1800124	Test Receiver/Spectrum-Analyzer	R&S	ESIB 7	2010-09-22 (2 years)

Information concerning the test:

Test set-up:	<p>The EUT was operated on the surface of a non-conductive table of 80 cm height. It was supplied from the internal battery (fully charged).</p> <p>By using some adhesive tape, an open stub from a coaxial cable was attached to the enclosure of the EUT in the vicinity of the integral antenna contained in the EUT.</p>
Operating modes used:	Continuous operation of the toothbrush with transmitter on
Test procedure:	<p>The -20 dB bandwidth of the emissions at the lowest and the highest operating frequencies was measured under normal operating conditions by using the appropriate measuring function of the spectrum analyzer.</p> <p>Spectrum analyzer settings: Span: 2 MHz RBW: 100 kHz VBW: 300 kHz SWT: AUTO (5 ms) Detector type: Sample Trace: Repeated sweeps, max. hold over 500 sweeps min.</p> <p>Prior to the final measurements with 2 MHz span, a verification measurement with 10 MHz span and MaxPeak detector was made in order to verify that no higher peaks than shown in the plots with 2 MHz span are contained in the spectrum envelope.</p>

Result: Pass

The measured results indicate that the 20 dB bandwidth of the emission is contained within the frequency band designated in the rule section 15.249 under which the equipment is operated.

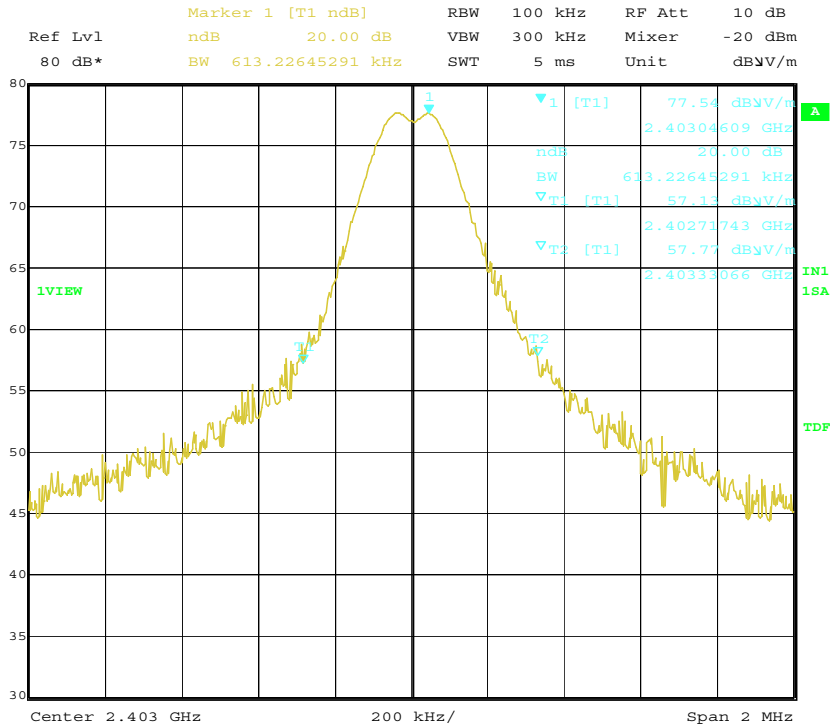
Protocol:

Lower edge frequency (-20 dB) of the emission at 2403 MHz: 2402,72 MHz
 Margin to the lower band edge at 2400 MHz: 2,72 MHz

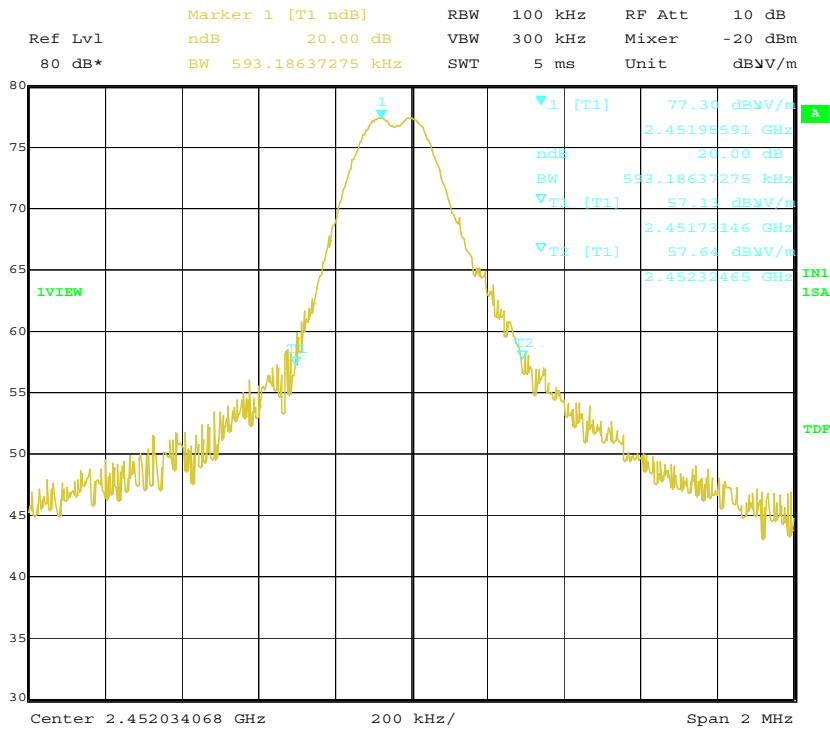
Upper edge frequency (-20 dB) of the emission at 2452 MHz: 2452,32 MHz
 Margin to the upper band edge at 2483,5 MHz: 31,18 MHz

Considering that the transmitter frequency is quartz-controlled and the supply voltage for the frequency-determining circuitry of the EUT is stabilized, good confidence is given that the device complies with the requirement to contain the designated bandwidth of the emission within the specified frequency band including the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage.

Spectrum analyzer plots are shown on the following page.



Date: 12.APR.2011 16:15:21
20 dB bandwidth at 2403 MHz



Date: 12.APR.2011 16:51:53
20 dB bandwidth at 2452 MHz

3.3 Radiated emissions in the frequency range 30 MHz – 1000 MHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2010-12-07

Instruments:		Test location: Semi-anechoic chamber (Building M)		
Inventory number	Description	Manufacturer	Type	Date of Last Calibration
1800118	Test receiver/Spectrum analyzer 20 Hz ... 26.5 GHz	R&S	ESI 26	2009-06-09 (2 years)
1800145	Test instrument 150 kHz ... 1 GHz	GAUSS	TDEMI 1G	2009-12-17
1810061	Trilog Antenna	Schwarzbeck	VULB 9163	2009-05-26 (2 years)
1810071	Amplifier	Schwarzbeck	BBV9743	2010-07-26 (1 year)
1850133	Relay switch matrix	MTS	KRE-4000	2010-07-26 (1 year)
1850125	Relay switch matrix	MTS	KRE-3000	2010-07-26 (1 year)
SAC1-1 + SAC1-2 + CP4-1	Cable set	n/a	n/a	2010-07-26 (1 year)

Information concerning the test:

Test set-up:	The EUT was operated in the center on top of a non-conductive table of 80 cm height. The table was located in the center of the turntable. The measurement distance was 3 m.
Operating modes:	Toothbrush operated with variable speed, transmitter on. All 4 possible channel frequencies were tested.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result:	Pass
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The measured radiated emissions of the EUT in the frequency range of 30 MHz to 1 GHz were found to be equal or below the specified limits.

The minimum margin of a measurement value to the limit was 16,8 dB.

Protocol:

Exploratory measurements

Prior to the final measurements, exploratory measurements were made in order to determine the mode of operation and the arrangement of the EUT causing highest readings relative to the limit. These measurements were carried out with the EUT standing on the bottom, lying on the rear and lying on the side (brush tip to the left when display is facing the antenna). The highest levels of emissions were found with the brush standing upright on the table. A freshly charged battery was used.

Emissions above the noise floor of the measuring system were only found while the brush was in operation. The motor speed did not have an influence to the level of emissions.

Final measurement

To obtain the final results, an automated scan sequence was run which followed the procedure according to Annex C of ANSI C63.4:2003 for obtaining the maximum level of emissions.

A CISPR-compliant test receiver was utilized for the final measurements.

At the beginning of the test sequence, the battery was freshly charged.

The highest reading found with the automated measurement was verified later using a freshly charged battery.

Receiver settings:

RBW/IF-Bandwidth: 120 kHz

Detector: QP

Meas. time: 2 s

Measurement data from the final test sequence can be found on the following page.

Limit / Class	FCC 15.209 (a) / --
Equipment under test (EUT)	Electric tooth brush with RF
Manufacturer	Braun 3762
Serial number	None (Prototype)
Comment on EUT	EUT standing upright
Operating mode	Brush mode, max speed, RF on
Tested by	W. Klos
Comment on test / measurement	Test distance 3 m
Test date	07.12.2010
Test place	Semi-anechoic chamber, Building M
Result	PASS

Instruments:

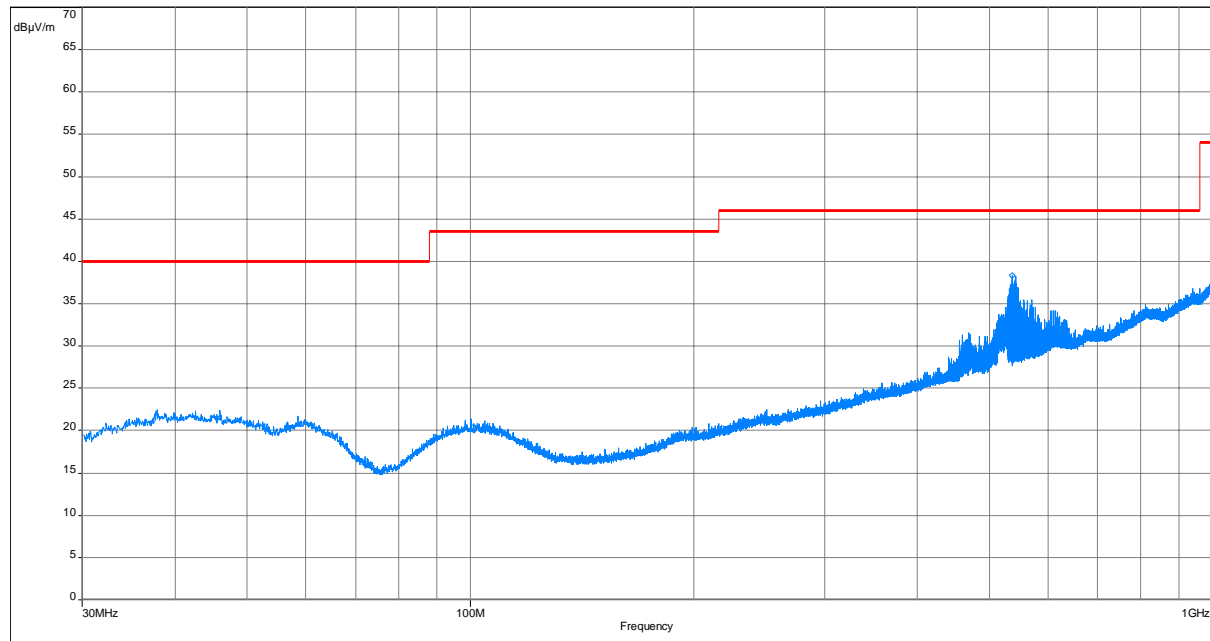
Inventory number	Description	Manufacturer	Type
--	Cable	--	SAC1-1 + SAC1-2 + CP4-1
1800118	EMI Test Receiver	Rohde & Schwarz	ESI 26
1800145	Time-Domain EMI Receiver	Gauss Instruments	TDEMI 1G

Prescan settings:

Subrange	Line	Frequency step	IF Bandwidth	Measurement time	RF Attenuation	Preamplifier	Presel. Multisampling
30MHz - 1GHz	H/V	50kHz	120kHz	10 ms/Pts	0 dB	OFF	ON

Frequency: 30 MHz - 1 GHz (Step: 50 kHz)
 Settings: RBW: 120 kHz, VBW: Auto, Holding time: 10 ms/Pt, sweep count 1
 Polarization: HV
 Distance: 3 m

— FCC/FCC 15.209 (a) - Class:-- - QPeak/3.0mV
 — Meas.Peak
 ◊ PeakLimQPeak
 ◆ Maximisation



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Results:

Maximisation (1)

Frequency	SR	Q-peak [dBµV/m]	Angle max [deg.]	Height max [m]	Margin [dB]	Limit [dBµV/m]	Polarisation	Comments
536.75	1	29.25	175.5	1.49	16.75	46	Vertical	Pass



3.4 Measurement of radiated emissions in the frequency range 9 kHz – 30 MHz

General information about the test:

Tested by:	Klos, Wolfgang
Test date:	2011-01-03

Instruments:		Test location: Semi-anechoic chamber (Building M)		
Inventory number	Description	Manufacturer	Type	Date of Last Calibration
1810009	Shielded Loop Antenna	R&S	HFH2-Z2	2010-11-01
1800118	Test receiver/Spectrum analyzer	R&S	ESI 26	2009-06-09 (2 years)
1850133	Relay switch matrix	MTS	KRE-4000	2010-07-26 (1 year)
1850125	Relay switch matrix	MTS	KRE-3000	2010-07-26 (1 year)
SAC1-3 + SAC1-2 + CP4-1	Cable set	n/a	n/a	2010-09-03

Information concerning the test:

Test set-up:	The EUT was operated in the center on top of a non-conductive table of 80 cm height. The table was located in the center of the turntable.
Operating modes:	Toothbrush operated with variable speed, transmitter on All 4 possible channel frequencies were tested.
Test procedure:	ANSI C63.4:2003, Clauses 8.3 and 13.1.4 and Annexures H.3 and H.4

Result: **Pass**

**The measured radiated emissions of the EUT in the frequency range of 9 kHz to 30 MHz were found to be equal or below the specified limits.
The minimum margin of any measurement value to the limit was higher than 20 dB.**

Protocol:

Prior to the final measurements, exploratory measurements were made in order to determine the mode of operation and the arrangement of the EUT causing highest readings relative to the limit. A freshly charged battery was used.

The magnetic field strength was measured under normal operating conditions at a distance of 3 m. A distance correction factor of 40 dB/decade was applied.

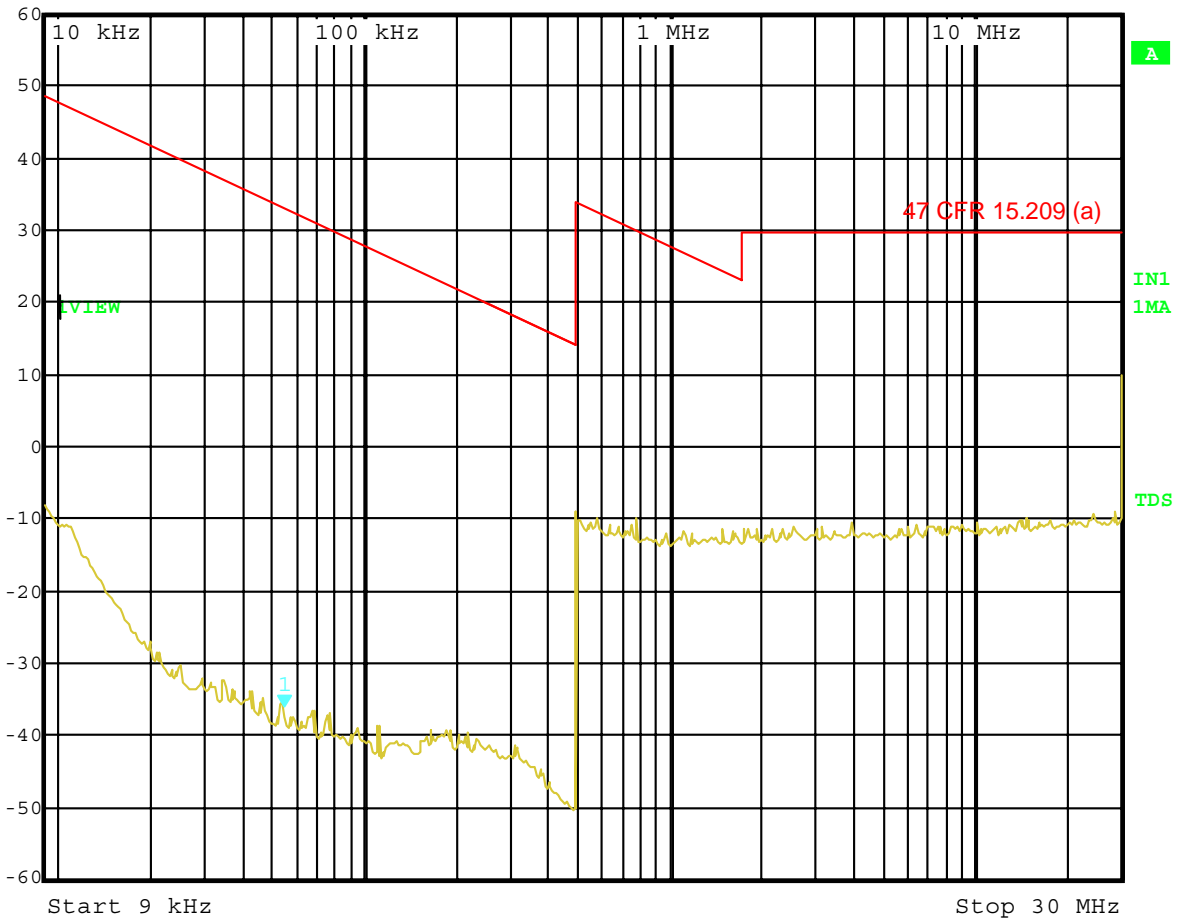
Preliminary scans with the peak detector and MaxHold function of a spectrum analyzer employed, and with the loop antenna oriented parallel and perpendicular to the measurement axis were made to capture the overall spectrum. Scans were run while the EUT was standing upright, lying on the rear and lying on the side.

A graphical representation of the results of one of these prescans is shown on the following page. It is representative for all scans made in this frequency range.

During these prescans, no readings above the noise floor of the test system were found. Therefore, no final measurement was made.



Marker 1 [T1] RBW 9 kHz RF Att 10 dB
Ref Lvl -36.25 dBµV/m VBW 100 kHz Mixer -20 dBm
60 dB* 55.00000000 kHz SWT 940 ms Unit dBµV/m



Date: 3.JAN.2011 17:38:35

4 Photographs

4.1 Photos of test arrangements

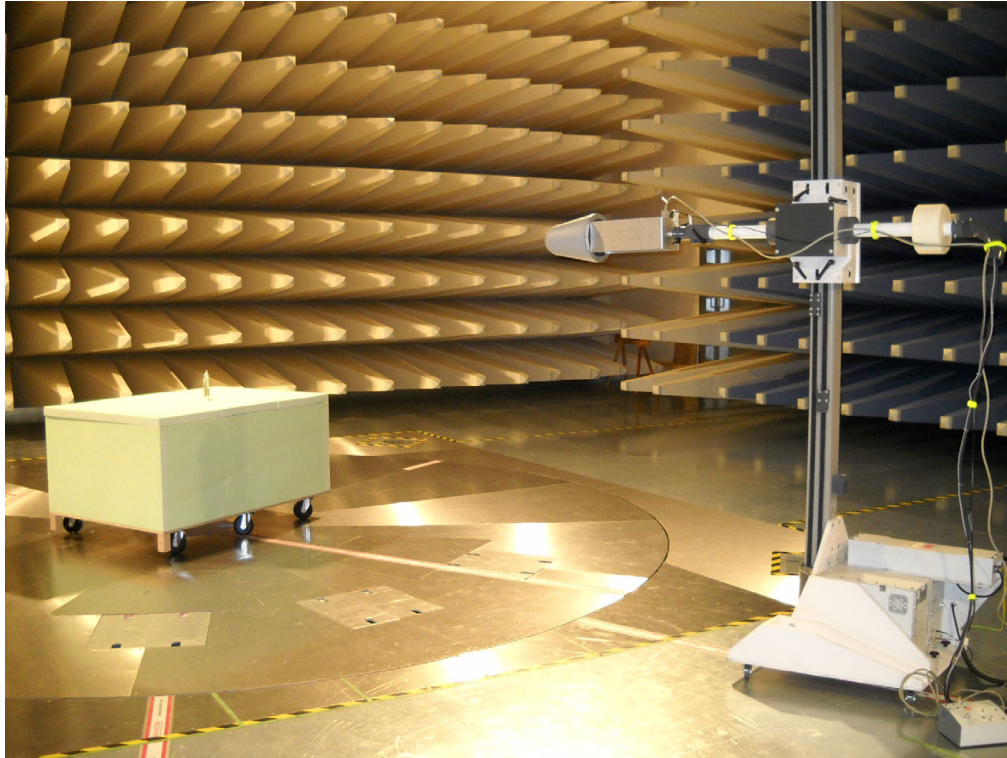


Figure 1 Radiated emissions at frequencies above 1 GHz

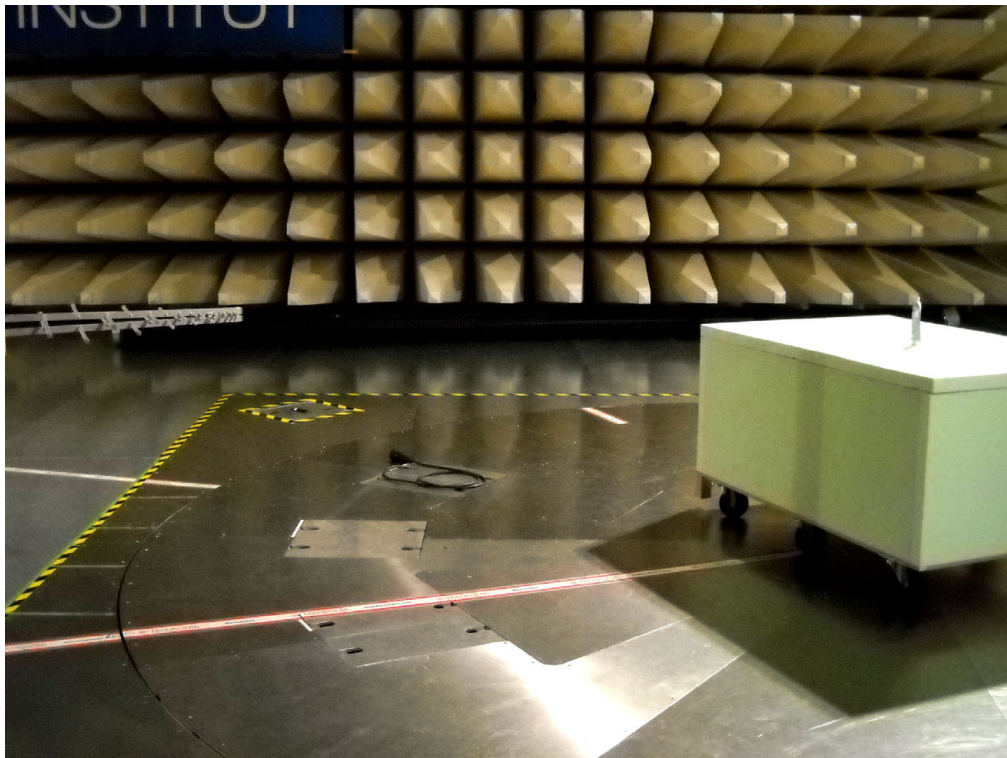


Figure 2 Radiated emissions in the frequency range 30 MHz to 1000 MHz

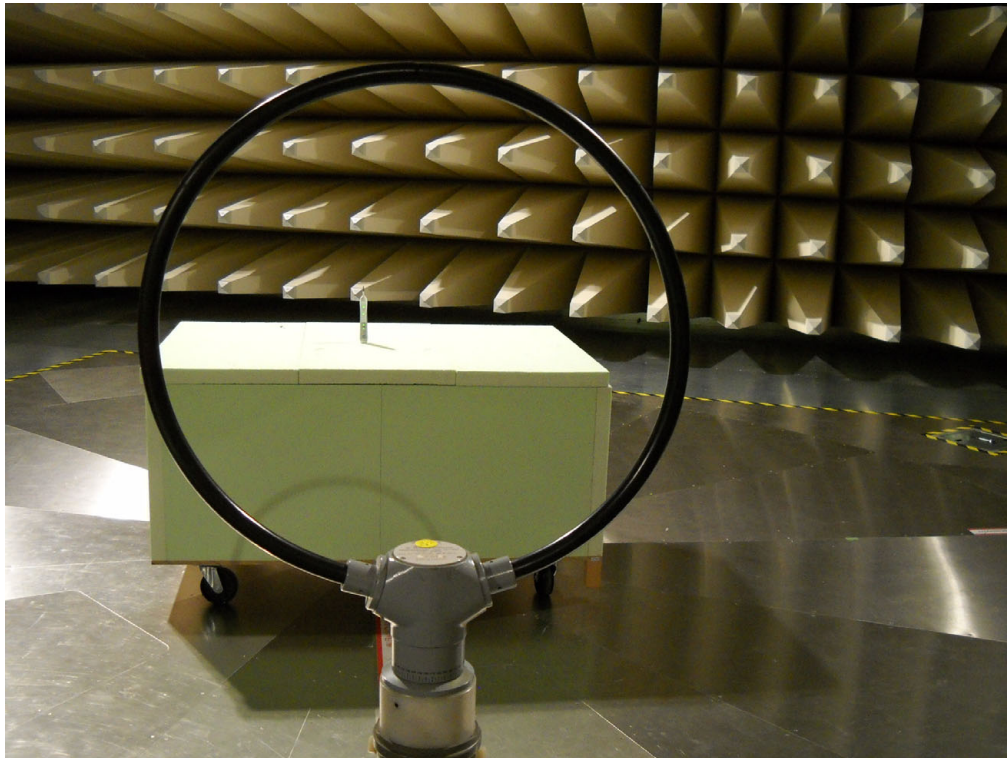


Figure 3 Radiated emissions in the frequency range from 9 kHz to 30 MHz

4.2 Photos of the EUT



Figure 4 Tooth brush handle 3762 in brushing mode with RF transmitter on



Figure 5 Tooth brush handle 3762 indicating the battery level immediately after brushing



Figure 6 Tooth brush handle 3762, rear view



Figure 7 Tooth brush handle 3762, rear view



Figure 8 Tooth brush handle 3762, view from the side



Figure 9 Tooth brush handle 3762, view from the side



Figure 10 Tooth brush handle 3762, bottom view



Figure 11 Tooth brush handle 3762, bottom view



Figure 12 Tooth brush handle 3762, top view