510(K) SUMMARY

JAN 0 7 2013

BRAINSWAY DEEP TMS SYSTEM

510(k) Number K122288

Applicant Name:

Company Name: Brainsway Ltd.
Address: 19 Hartum St. (Bynet Bldg)
Har Hotzvim, Jerusalem, ISRAEL 91451
Tel: +972-2-5813140
Fax: +972-2-5812517
E-mail: hila@Brainsway.com

Contact Person:

Official Correspondent: Ahava Stein
Company Name: A. Stein – Regulatory Affairs Consulting Ltd.
Address: 20 Hata'as Str., Suite 102
Kfar Saba 44425
Israel
Tel: +972-9-7670002
Fax: +972-9-7668534
E-mail: ahava@asteinrac.com

Date Prepared: July 10, 2012

Trade Name: Repetitive Transcranial Magnetic Stimulator

Classification Name: CFR Classification section 882.5805 (Product code OBP)

Classification: Class II Medical Device

Predicate Device:

The Brainsway Deep TMS System is substantially equivalent to the following predicate device:

Manufacturer	Device	510(k) No.	Product Code
Neuronetics	NEUROSTAR TMS SYSTEM	K061053	OBP
Neuronetics	NEUROSTAR TMS THERAPY SYSTEM, MODEL 1.1	K083538	OBP

Device Description:

The Brainsway Deep TMS (DTMS) System is intended for the treatment of depressive episodes in patients suffering from MDD. Transcranial magnetic stimulation (TMS) is a non-invasive technique used to apply brief magnetic pulses to the brain. The pulses are administered by passing high currents through an electromagnetic coil placed adjacent to a patient's scalp. The pulses induce an electric field in the underlying brain tissue. When the induced field is above a certain threshold, and is directed in an appropriate orientation relative the brain's neuronal pathways, localized axonal depolarizations are produced, thus activating neurons in the targeted brain structure.

The electromagnetic radiation emitted is at a low frequency of the order of 1-10 kHz. The only interaction with the human body is caused by the briefly changing magnetic field, and its effect may be neuronal activation.

Many neurological and psychiatric disorders are associated with abnormal neuronal activity patterns in deep brain regions. These regions cannot be affected directly, but only indirectly, through secondary processes involving cortical structures, which are directly activated by TMS and then affect the deeper structures.

The Brainsway DTMS System's unique design enables to produce directed electromagnetic fields that can induce excitation or inhibition of neurons deep inside the brain non-invasively.

The Brainsway Deep TMS (DTMS) System is composed of the following main components:

1. An Electromagnetic Coil (H1 Coil)
2. A TMS Neurostimulator
3. A Cooling System
4. A Positioning Device
5. A cart

Intended Use/Indication for Use:

The Brainsway Deep TMS System is indicated for the treatment of depressive episodes in adult patients suffering from Major Depressive Disorder who failed to achieve satisfactory improvement from previous anti-depressant medication treatment in the current episode.

Performance Standards:

The Brainsway Deep TMS System has been tested and complies with the following voluntary recognized standards:

- Electrical & Mechanical Safety testing according to IEC 60601-1
- Electromagnetic Compatibility testing according to IEC 60601-1-2
- ETSI EN 301 489-1 V1.8.1 Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) Standard for Radio Equipment and Services; Part 1: Common Technical Requirements (2008) Immunity

Non-Clinical Performance Data:

The non-clinical performance testing with the Brainsway Deep TMS System included testing of the magnetic field characteristics of the system, as required by the FDA Guidance document for TMS systems, *Class II Special Controls Guidance Document: Repetitive Transcranial Magnetic Stimulation (rTMS) Systems,* as follows:

- Output Waveform

The output waveform produced by the H-coil was measured in a human head phantom model. The probe was located in the head model in a position analogous to the left lateral prefrontal cortex, where the coil's induced field is maximal according to the electric field distribution mapping. The electric field pulse outputs and waveforms were measured at predefined stimulator outputs.

- Electric Field Spatial Distribution

The field distribution produced by the H-coil was measured in a human head phantom model. The probe was moved in three directions inside the phantom model using a displacement system with 1 mm resolution, and the field distribution of the H1-coil was measured in the whole head model volume in 1cm resolution. Axial and coronal field maps were produced. The field maps were superimposed on anatomical T1-weighted MRI coronal slices, to show the induced field in each anatomical brain region.

- Magnetic Field Strength Gradient

The magnetic field strength was also measured in a human head phantom model. The magnetic field strength at the H-coil surface and at certain points at various distances from the coil was measured. The probe was located in the head model at a distance of 0 and 2 cm from the coil edge, in a position analogous to the left lateral prefrontal cortex, where the coil's induced field is maximal according to the electric field distribution mapping. The stimulator was operated at 50% and at 100% output and the magnetic field output waveform was measured along three orthogonal axes: X- Anterior-posterior, Y- Lateral-medial, and Z- Superior-inferior. These results demonstrate the ability of the H-coil to stimulate deeper brain structures without overstimulation of superficial regions.

- Cooling System Testing

The cooling system tests included measurement of the air flow, suction pressure, compression pressure and currents measured at different voltage levels. The temperature of the cooling system was measured over an extended period of time to test the life expectancy of the system. Life expectancy testing demonstrated that the cooling system thermostat temperature remains consistent during a continuous operation of >180 days.

The performance tests, along with the clinical study validation demonstrate that the Brainsway DTMS System may be safely and effectively used for treatment of Major Depressive Disorder.

Clinical Performance Data:

The safety and effectiveness of the Brainsway Deep TMS System for treatment of Major Depressive Disorder was demonstrated in a prospective, double blind, randomized, controlled, multi-center trial. The study was conducted at 20 study sites in the United States (13 sites), Israel (4 sites), Germany (2 sites) and Canada (1 site). During the initial treatment phase, TMS sessions were performed daily for 4 weeks and during the maintenance phase, subjects were treated twice a week for another 12 weeks.

The study results were summarized for three patient analysis sets, the ITT analysis set (n=229, 108 DTMS and 121 Sham), the mITT analysis set (n=212, 101 DTMS and 111 Sham) and the PP analysis set (n=181, 89 DTMS and 92 Sham). The most appropriate analysis set for the purpose of assessing the effectiveness of the Brainsway Deep TMS System is the PP analysis set. The reason for this is that the ITT analysis set and the mITT analysis set include 31 subjects (12 DTMS and 19 Sham) who did not receive the adequate DTMS treatment regimen. Furthermore, the ITT analysis set also includes subjects who did not meet the inclusion/exclusion criteria for the study. The IFU contains clear instructions under the Warnings and Precautions section regarding the appropriate subjects who may be treated with the Brainsway Deep TMS System and clear instructions how to administer the treatment so that subjects will receive the appropriate stimulation intensity during the treatment. The efficacy results for the PP analysis set reflect the intended patient population and therefore are most relevant and presented below. The PP analysis set includes 181 subjects (89 DTMS and 92 Sham) between the ages of 22 and 68, diagnosed with Major Depressive Disorder, with an episode of less than 7 years, with an HDRS-21 score of greater than 20, did not receive benefit from 1 to 4 antidepressant treatments or were intolerant to at least 2 antidepressant treatments, and met the safety screening questionnaire for TMS. These subjects did not have MDD with psychotic features, another primary psychotic disorder or significant neurological disorder, were not at risk of seizure or suicide, did not fail to respond to previous ECT treatment and did not have any metal implants in or around the head or any other implants which could be affected by TMS.

The model estimated mean change from baseline in HDRS-21 scores in the Deep TMS group was -6.39 points across 5 weeks compared to only -3.28 points in the sham group in the PP analysis set. This difference of 3.11 points was statistically significant (p=0.0080). This change was found almost statistically significant in the mITT analysis set (p=0.0578), but was not found statistically significant in the ITT analysis set. The response rate was significantly better in the Deep TMS group (38.4% and 37.0%) compared to the sham group (21.4% and 22.8%) (p=0.0138 and p=0.0310) in the PP analysis set and the mITT analysis set, respectively. The remission rate was significantly better in the Deep TMS group (32.6% and 30.4%) compared to the sham group (14.6% and 15.8%) (p=0.0051 and p=0.0158) in the PP analysis set and the mITT analysis set, respectively. The response and remission rates were not found statistically significant in the ITT analysis set.

The efficacy of the Deep TMS Treatment was maintained at 16 weeks, based on a statistically significant change from baseline in HDRS-21 scores (p=0.0259) in the PP analysis set. This was not shown in the mITT or ITT analysis sets. The efficacy of the Deep TMS Treatment was further maintained at 16 weeks based on a significantly better response rate in the Deep TMS group compared to the sham group (p=0.0086 and

p=0.0276), in the PP analysis set and the mITT analysis set. This was not shown in the ITT analysis set. The efficacy of the Deep TMS Treatment, based on statistically significant differences in the CGI-S scores, was demonstrated at 5 weeks and also maintained at 16 weeks in the PP analysis set and the mITT analysis set. The efficacy of the Deep TMS Treatment, based on statistically significant differences in the CGI-I, PGI and GAF scores, was demonstrated at 16 weeks in the PP analysis set and the mITT analysis set. These scores were also statistically significantly lower in the Deep TMS treatment group at 5 weeks in the PP analysis set. These scores were not found to be statistically significantly different in the ITT analysis set. No significant differences were found in the SF-36 scores, however all the SF-36 Quality of Life parameters were better in the Deep TMS group than in the sham group in all the analysis sets.

The results of the cognitive tests (MMSE, BSRT and AMI-SF) demonstrated that the Deep TMS treatment does not have a negative cognitive effect on MDD subjects in all the analysis sets.

The following table summarizes the main adverse events reported in the study for all the study subjects.

Table 1: Anticipated Events

	Deep TMS Treatment (N=111 Subjects)		Sham Treatment (N-122 Subjects)		
Anticipated Event	**No of Subjects**	**Incidence**	**No of Subjects**	**Incidence**	**p-value**
Eye Pain	2	1.9%	4	3.3%	0.6864
Dental Pain	3	2.8%	2	1.7%	0.6687
Pain in Jaw	11	10.2%	1	0.8%	0.0017
Application Site Discomfort	21	19.4%	5	4.1%	0.0003
Application Site Pain	27	25.0%	1	0.8%	<.0001
Muscle Twitching	7	6.5%	2	1.7%	0.0878
Headache	51	47.2%	44	36.4%	0.1079
Anxiety	6	5.6%	9	7.4%	0.6042
Insomnia	8	7.4%	9	7.4%	1.0000
Upper Respiratory Tract Infection Nos	9	8.3%	7	5.8%	0.6049
Allergy	6	5.6%	3	2.5%	0.3128

The adverse events reported with the Deep TMS System are typical to TMS treatments and were reported with similar or lower incidence rates compared to these events reported with other TMS devices.

There was one serious adverse reported in the study that was device related. The event was reported in a subject who experienced a seizure, following drinking at least a half a bottle of wine the night before the treatment. This SAE is considered device related, albeit with the caveat that withdrawal from alcohol forms a strong hazard for application of TMS due to the resulting significant seizure threshold lowering potential.

In summary, the safety and efficacy results of the Multicenter Deep TMS clinical study demonstrated the safety and effectiveness of the Brainsway Deep TMS System for treatment of Major Depressive Disorder.

Substantial Equivalence:

The Brainsway DTMS System is substantially equivalent to the NeuroStar TMS Therapy® System (manufactured by Neuronetics Ltd., and the subject of 510(k) document nos. K061053 and K083538). The Brainsway DTMS System is similar to the NeuroStar TMS Therapy® System (K061053 and K083538) regarding intended use and basic technological characteristics.

The Brainsway DTMS System and the NeuroStar TMS Therapy® System are both intended for the treatment of adult patients with Major Depressive Disorder.

The design of the Brainsway DTMS System is similar to the design of the NeuroStar TMS Therapy® System, as both systems are based on applying transcranial magnetic stimulation by means of repetitive pulse trains at a predetermined frequency. Both systems use the same mechanism of action, i.e., an electromechanical instrument that produces and delivers brief duration, rapidly alternating (pulsed) magnetic fields to induce electrical currents in localized regions of the prefrontal cortex.

Transcranial magnetic stimulation is enabled in the Brainsway DTMS System and in the NeuroStar TMS Therapy® System, as both devices have the same system components, consisting of a mobile cart or console, an electromagnetic coil, a positioning arm, a TMS stimulator and software. The basic operational procedure is the same in both the Brainsway DTMS System and the NeuroStar TMS Therapy® System consisting of system setup, patient preparation, determination of patient's motor threshold, coil positioning and administration of treatment at predefined treatment stimulation parameters. The main differences between the Brainsway DTMS System and the NeuroStar TMS Therapy® System are the design of the electromagnetic coil enabling activation of deep brain regions with the Brainsway DTMS coil and the pulse sequence parameters administered during treatment, as described in the table below:

Device Treatment Parameters & Specifications	Brainsway DTMS Treatment	NeuroStar TMS Therapy
Magnetic Field Intensity:	120% of the MT	120% of the MT
Frequency:	18 Hz	10 Hz
Train duration:	2 sec	4 sec
Inter-train interval:	20 sec	26 sec
Number of trains:	55	75
Magnetic Pulses per Session:	1980	3000
Treatment Session Duration:	20.2 min	37.5 min
Sessions per Week:	5	5
Treatment Schedule:	5 daily sessions for 4 weeks Bi-weekly sessions for another 12 weeks (optional maintenance treatments)	5 daily sessions for 6 weeks
Area of brain to be stimulated:	Prefrontal Cortex	Prefrontal Cortex
Applicator: Configuration Core material	 Biphasic H-Coil Air	 Biphasic Figure 8 Coil Ferromagnetic
Output Stimulation Parameters: Amplitude in Standard Motor Threshold (SMT) units Pulse width (usec) Frequency range (Hz) Pulse train duration range (sec) Inter-train interval range (sec) Maximum trains per session Maximum # of pulses per session (cumulative exposure)	 0.6 - 1.4 370 0.02 - 30 1 - 20 10 - 60 ~140 5000	 0.22 - 1.6 185 0.1 - 30 1 – 20 10-60 ~140 5000

Treatment is administered in each system according to a standard pulse sequence that has been demonstrated to be effective during the clinical trials performed with the system.

The basic software capabilities related to treatment administration are the same in the Brainsway DTMS System and in the NeuroStar TMS Therapy® System. This is enabled in the Brainsway DTMS System using the commercial TMS stimulator software. The NeuroStar TMS Therapy® System has its own system software that provides capabilities beyond setting the treatment administration parameters.

Both the Brainsway DTMS System and the NeuroStar TMS Therapy® System meet the same electrical and mechanical safety standards (IEC 60601-1) and the same EMC standards (IEC 60601-1-2).

Conclusions:

In summary, the indications for use, anatomical sites and treatment environment for the Brainsway DTMS System and for the NeuroStar TMS Therapy® System are similar. Furthermore, the technological characteristics of the Brainsway DTMS System and the NeuroStar TMS Therapy® System, including basic design, mechanism of action, components, specifications, treatment procedure, etc. are the same. The minor differences in the system components and software do not affect the treatment procedure or outcome. The differences in the coil and the treatment stimulation

parameters have been demonstrated in a clinical study as safe and effective and therefore, do not raise new questions of safety and effectiveness.

As aforementioned, the Brainsway DTMS System has been validated in performance testing, including a clinical study. The complete clinical study report is provided in Section 20 (Clinical) of this 510(k) submission. The clinical performance data supports the safety and effectiveness of the Brainsway DTMS System. Consequently, the Brainsway DTMS System is substantially equivalent to the previously cleared NeuroStar TMS Therapy® System (K061053 and K083538).

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Food and Drug Administration
10903 New Hampshire Avenue
Document Control Center – WO66-G609
Silver Spring, MD 20993-002

January 7, 2013

Brainsway, Ltd
c/o Ahava Stein
A. Stein Regulatory Affairs Consulting
20 Hata'as St. (POB 124)
44425 Kfar Saba
ISRAEL

Re: K122288
Trade/Device Name: Brainsway Deep TMS System
Regulation Number: 21 CFR 882.5805
Regulation Name: Repetitive Transcranial Magnetic Stimulator for Treatment of Major Depressive Disorder
Regulatory Class: Class II
Product Code: OBP
Dated: October 29, 2012
Received: November 1, 2012

Dear Ms. Stein:

We have reviewed your Section 510(k) premarket notification of intent to market the device referenced above and have determined the device is substantially equivalent (for the indications for use stated in the enclosure) to legally marketed predicate devices marketed in interstate commerce prior to May 28, 1976, the enactment date of the Medical Device Amendments, or to devices that have been reclassified in accordance with the provisions of the Federal Food, Drug, and Cosmetic Act (Act) that do not require approval of a premarket approval application (PMA). You may, therefore, market the device, subject to the general controls provisions of the Act. The general controls provisions of the Act include requirements for annual registration, listing of devices, good manufacturing practice, labeling, and prohibitions against misbranding and adulteration. Please note: CDRH does not evaluate information related to contract liability warranties. We remind you, however, that device labeling must be truthful and not misleading.

If your device is classified (see above) into either class II (Special Controls) or class III (PMA), it may be subject to additional controls. Existing major regulations affecting your device can be found in the Code of Federal Regulations, Title 21, Parts 800 to 898. In addition, FDA may publish further announcements concerning your device in the Federal Register.

Please be advised that FDA's issuance of a substantial equivalence determination does not mean that FDA has made a determination that your device complies with other requirements of the Act or any Federal statutes and regulations administered by other Federal agencies. You must comply with all the Act's requirements, including, but not limited to: registration and listing (21

CFR Part 807); labeling (21 CFR Part 801); medical device reporting (reporting of medical device-related adverse events) (21 CFR 803); good manufacturing practice requirements as set forth in the quality systems (QS) regulation (21 CFR Part 820); and if applicable, the electronic product radiation control provisions (Sections 531-542 of the Act); 21 CFR 1000-1050.

If you desire specific advice for your device on our labeling regulation (21 CFR Part 801), please go to http://www.fda.gov/AboutFDA/CentersOffices/CDRH/CDRHOffices/ucm115809.htm for the Center for Devices and Radiological Health's (CDRH's) Office of Compliance. Also, please note the regulation entitled, "Misbranding by reference to premarket notification" (21CFR Part 807.97). For questions regarding the reporting of adverse events under the MDR regulation (21 CFR Part 803), please go to http://www.fda.gov/MedicalDevices/Safety/ReportaProblem/default.htm for the CDRH's Office of Surveillance and Biometrics/Division of Postmarket Surveillance.

You may obtain other general information on your responsibilities under the Act from the Division of Small Manufacturers, International and Consumer Assistance at its toll-free number (800) 638-2041 or (301) 796-7100 or at its Internet address http://www.fda.gov/MedicalDevices/ResourcesforYou/Industry/default.htm.

Sincerely yours,

Victor Krauthamer -S

Victor Krauthamer, Ph.D.
Acting Director
Division of Neurological
and Physical Medicine Devices
Office of Device Evaluation
Center for Devices and
Radiological Health

Enclosure

INDICATIONS FOR USE

510(k) Number (if known): K122288

Device Name: Brainsway Deep TMS System

Indications For Use:

The Brainsway Deep TMS System is indicated for the treatment of depressive episodes in adult patients suffering from Major Depressive Disorder who failed to achieve satisfactory improvement from previous anti-depressant medication treatment in the current episode.

Prescription Use __√__ (Part 21 CFR 801 Subpart D) AND/OR Over-The-Counter Use___ (21 CFR 801 Subpart C)

(PLEASE DO NOT WRITE BELOW THIS LINE - CONTINUE ON ANOTHER PAGE IF NEEDED)

Concurrence of CDRH, Office of Device Evaluation (ODE)

Brian D. Pullin -S

(Division Sign Off)
Division of Neurological and Physical Medicine Devices (DNPMD)

510(k) Number K122288