TEST RESULT SUMMARY

FCC PART 15 SUBPART C
Section 15.209

MANUFACTURER'S NAME	Medtronic Neurological
NAME OF EQUIPMENT	Restore Charging System
TYPE OF EQUIPMENT	Battery-powered INS Recharger
MODEL NUMBER	**37751**
MANUFACTURER'S ADDRESS	800 53rd Avenue NE Columbia Heights, MN 55421
TEST REPORT NUMBER	WC402493.1 Rev B
TEST DATE	14 June & 12 July 2004

According to testing performed at TÜV Product Service Inc, the above-mentioned unit is in compliance with the electromagnetic compatibility requirements defined in FCC Part 15 Subpart C, Section 15.209.

It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical characteristics. Any modifications necessary for compliance made during testing on the above mentioned date(s) must be implemented in all production units for compliance to be maintained.

TÜV Product Service Inc, as an independent testing laboratory, declares that the equipment tested as specified above conforms to the requirements of FCC Part 15 Subpart C, Section 15.209.

Date: 26 April 2005

Location: Taylors Falls MN USA

R. M. Johnson
Tested By

T. K. Swanson
Reviewed By

Not Transferable

EMC EMISSION - T E S T R E P O R T

Test Report File No.	:	**WC402493.1 Rev B**	Date of issue:	26 April 2005

Model No.	:	**37751**
Product Name	:	Restore Charging System
Product Type	:	Battery-powered INS Recharger
Applicant	:	Medtronic Neurological
Manufacturer	:	Medtronic Neurological
License holder	:	Medtronic Neurological
Address	:	800 53rd Avenue NE
	:	Columbia Heights, MN 55421
Test Result	:	■ **Positive** ☐ **Negative**
Test Project Number Reference(s)	:	**WC402493.1 Rev B**
Total pages including Appendices		41

TÜV Product Service Inc is a subcontractor to TÜV Product Service, GmbH according to the principles outlined in ISO/IEC Guide 25 and EN 45001.

TÜV Product Service Inc reports apply only to the specific samples tested under stated test conditions. It is the manufacturer's responsibility to assure that additional production units of this model are manufactured with identical electrical and mechanical components. TÜV Product Service Inc shall have no liability for any deductions, inferences or generalizations drawn by the client or others from TÜV Product Service Inc issued reports.

This report is the confidential property of the client. As a mutual protection to our clients, the public and ourselves, extracts from the test report shall not be reproduced except in full without our written approval. This report shall not be used by the client to claim product endorsement by NVLAP or any agency of the US government.

TÜV Product Service Inc and its professional staff hold government and professional organization certifications and are members of AAMI, ACIL, AEA, ANSI, IEEE, NVLAP, and VCCI

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

REVISION RECORD

REVISION	TOTAL NUMBER OF PAGES	DATE	DESCRIPTION
	29	26 July 2004	Initial Release
A	41	22 April 2005	Revisions include: ▪ Pages 12-13: Added Test Setup Photos ▪ Page 10 - FCC 15.207 - Conducted emissions 150 kHz - 30 MHz: Added test results ▪ Page 10 - FCC 15.209 - Radiated emissions (magnetic field) 9 kHz - 30 MHz: Corrected to 48 dB/decade and added peak detection information.
B	41	26 April 2005	Revisions include: ▪ Page 10 - 52.4 dB/decade fundamental extrapolation. ▪ Page A8 - final level of 8 dBuV/m at 300 meters.

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

D I R E C T O R Y - EMISSIONS

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

EMISSIONS TEST REGULATIONS :

The emissions tests were performed according to following regulations:

☐ - EN 50081-1 / 1991

☐ - EN 55011 / 1991 ☐ - Group 1 ☐ - Group 2
☐ - Class A ☐ - Class B

☐ - EN 55013 / 1990

☐ - EN 55014 / 1987 ☐ - Household appliances and similar
☐ - Portable tools
☐ - Semiconductor devices

☐ - EN 55014 / A2:1990

☐ - EN 55014 / 1993 ☐ - Household appliances and similar
☐ - Portable tools
☐ - Semiconductor devices

☐ - EN 55015 / 1987

☐ - EN 55015 / A1:1990

☐ - EN 55015 / 1993

☐ - EN 55022 / 1987 ☐ - Class A ☐ - Class B

☐ - EN 55022 / 1994 ☐ - Class A ☐ - Class B

☐ - BS

☐ - VCCI ☐ - Class A ☐ - Class B

■ - FCC Part 15 Subpart C Section 15.209

☐ - FCC Part 15 Subpart C Section 15.207 Conducted Emission Requirements

☐ - FCC Part 15 Subpart B ☐ - Class A ☐ - Class B

☐ - CISPR 11 (1990) ☐ - Group 1 ☐ - Group 2
☐ - Class A ☐ - Class B

☐ - CISPR 22 (1993) ☐ - Class A ☐ - Class B

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Environmental conditions in the lab:

	Actual
Temperature	: 20 °C
Relative Humidity	: 40 %
Atmospheric pressure	: 97.0 kPa
Power supply system	: 8.4 VDC Battery

Sign Explanations:

☐ - not applicable
■ - applicable

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Emissions Test Conditions: CONDUCTED EMISSIONS [FCC 15.207]

The *CONDUCTED EMISSIONS (INTERFERENCE VOLTAGE*) measurements were performed at the following test location:

☐ **- Test not applicable**

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)
☐ - Wild River Lab Screen Room
■ - Wild River Lab Shield Room 1 - Anechoic ferrite-lined shielded room (7.3m x 3.67m x 3.61m) or (24' x 13' x 11')
☐ - New Brighton Lab Shielded Room

Emissions Test Conditions: RADIATED EMISSIONS (FCC 15.209 10 kHz - 30 MHz)

The *RADIATED EMISSIONS (MAGNETIC FIELD*) measurements were performed at the following test location:

☐ **- Test not applicable**

☐ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

☐ - 0.3 meters
■ - 1 meter
■ - 3 meter
■ - 10 meters
☐ - 30 meters

Test equipment used :

	TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	2534	ESHS-20	Rhode & Schwarz	EMI Receiver	837055/003	1-14-05
■ -	2517	HFH2-Z2	Polorad	Loop Antenna	879285/036	4-27-05

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Emissions Test Conditions: RADIATED EMISSIONS (FCC 15.209 Electric Field 30 - 1000 MHz)

The *RADIATED EMISSIONS (ELECTRIC FIELD)* measurements, in the frequency range of 30 MHz-1000 MHz, were tested in a horizontal and vertical polarization at the following test location:

☐ - Test not applicable

☐ - Wild River Lab Large Test Site (Open Area Test Site)
■ - Wild River Lab Small Test Site (Open Area Test Site) – NSA measurements made 2-03, due 2-05.
☐ - Oakwood Lab (Open Area Test Site)

at a test distance of :

■ - 3 meters
☐ - 10 meters
☐ - 30 meters

Test equipment used :

	TUV ID	Model Number	Manufacturer	Description	Serial Number	Cal Due
■ -	3203	EM-6917B	Electro-Metrics	Biconicalog Periodic	106	3-30-05
■-	2690	8566B	Hewlett-Packard	Spectrum Analyzer (Unit F)	2430A00930	1-28-05
■ -	2673	85662A	Hewlett-Packard	Analyzer Display (Unit A)	2152A03687	1-28-05
■	2681	85650A	Hewlett-Packard	Quasi-Peak Adapter	2430A00562	2-23-05
■ -	2671	8447D	Electro-Mechanics (EMCO)	Preamplifier	2648A04942	Code B

Cal Code B = Calibration verification performed internally. Cal Code Y = Calibration not required when used with other calibrated equipment.

All measurement instrumentation is traceable to the National Institute of Standards and Technology (NIST) and is calibrated annually.

Emissions Test Conditions: INTERFERENCE POWER

The *INTERFERENCE POWER* measurements were performed by using the absorbing clamp on the mains and interface cables in the frequency range 30 MHz - 300 MHz at the following test location:

■ - Test not applicable

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)
☐ - Wild River Lab Screen Room
☐ - New Brighton Lab Shielded Room

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Emissions Test Conditions: RADIATED EMISSIONS Electric Field 1 to 100 GHz

The *EQUIVALENT RADIATED EMISSIONS* measurements in the frequency range 1 GHz - 100 GHz were performed in a horizontal and vertical polarization at the following test location:

■ - Test not applicable

☐ - Wild River Lab Large Test Site (Open Area Test Site)
☐ - Wild River Lab Small Test Site (Open Area Test Site)
☐ - Oakwood Lab (Open Area Test Site)
☐ - Wild River Lab Screen Room

at a test distance of:

☐ - 1 meters
☐ - 3 meters
☐ - 10 meters

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Equipment Under Test (EUT) Test Operation Mode - Emission tests :

The device under test was operated under the following conditions during emissions testing:

☐ - Standby

☐ - Test program (H - Pattern)

☐ - Test program (color bar)

☐ - Test program (customer specific)

☐ - Practice operation

☐ - Normal Operating Mode

■ - RF telemetry, Recharging.

Configuration of the device under test:

■ - See Constructional Data Form in Appendix B - Page B2

☐ - See Product Information Form in Appendix B - beginning on Page B3

The following peripheral devices and interface cables were connected during the measurement:

☐ - _____ Type : _____

☐ - _____ Type : _____

☐ - _____ Type : _____

☐ - _____ Type : _____

☐ - _____ Type : _____

☐ - unshielded power cable

☐ - unshielded cables

☐ - shielded cables MPS.No.: _____

☐ - customer specific cables

☐ - _____

☐ - _____

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Emission Test Results:

FCC 15.207 - Conducted emissions 150 kHz - 30 MHz

The requirements are ■ - MET ☐ - NOT MET ☐ - N/A

Minimum margin of compliance 8 dB at 150.0 kHz

Maximum margin of non-compliance _____ dB at _____ MHz

Remarks: _____

FCC 15.209 - Radiated emissions (magnetic field) 9 kHz - 30 MHz

The requirements are ■ - MET ☐ - NOT MET

Minimum limit margin for fundamental 40 dB at 9.0 kHz

Minimum limit margin for spurious/harmonics 64 dB at 18.0 kHz

Remarks: The fundamental was measured to be 136 dBuV/m in Quasi-Peak mode at 1 meter, 111 dBuV/m (354813 microvolts/meter) at 3 meters and 83 dBuV/m (14125 microvolts/meter) at 10 meters. This extrapolates to a level of 8 dBuV/m (2.51 microvolts/meter) at 300 meters using 52.4 dB/decade as indicated by testing. The limit is 48.5 dBuV/m (266.6 microvolts/meter) at 300 meters. The peak detection mode level at 9 kHz at 10 meters was 84 dBuV/m.

FCC 15.209 - Radiated emissions (electric field) 30 MHz - 1000 MHz

The requirements are ■ - MET ☐ - NOT MET

Minimum margin of compliance 6 dB at 174.99 MHz

Minimum limit margin for spurious _____ dB at _____ MHz

Remarks: _____

Interference Power at the mains and interface cables 30 MHz - 300 MHz

The requirements are ☐ - MET ☐ - NOT MET ■ - N/A

Remarks: _____

Equivalent Radiated emissions 1 GHz - 100 GHz

The requirements are ☐ - MET ☐ - NOT MET ■ - N/A

Remarks: _____

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

DEVIATIONS FROM STANDARD:

None.

GENERAL REMARKS:

The radiated measurements from 9 kHz to 30 MHz are made in quasi-peak detection, except for the levels noted between 110-490 kHz, which are made in average detection.

SUMMARY:

The requirements according to the technical regulations are

■ - met

☐ - **not** met.

The device under test does

■ - fulfill the general approval requirements mentioned on page 3.

☐ - **not** fulfill the general approval requirements mentioned on page 3.

Testing Start Date: 14 June 2004

Testing End Date: 12 July 2004

- TÜV PRODUCT SERVICE INC -

Thomas K. Swanson

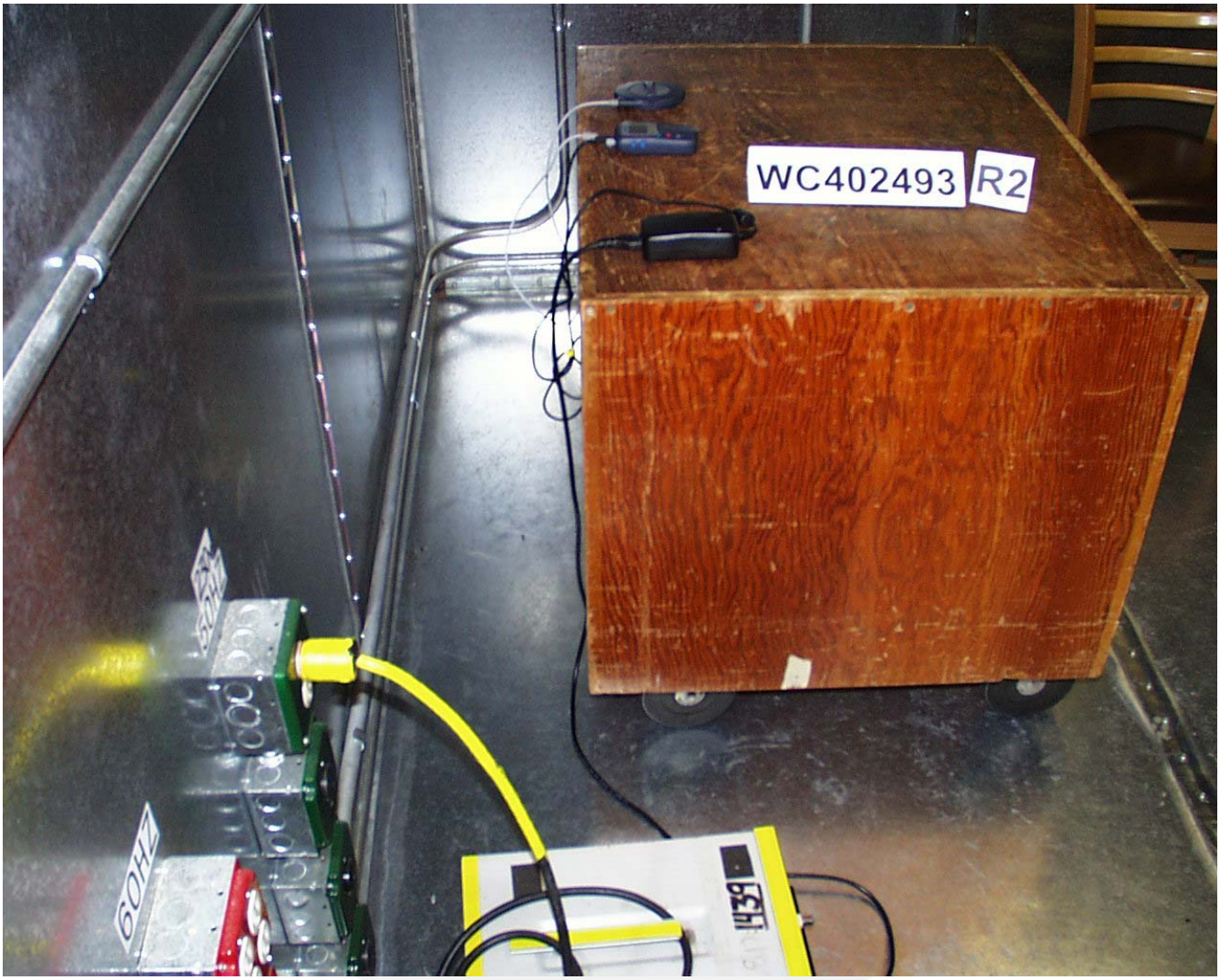
T. K. Swanson
Reviewed By

Russ M. Johnson

Tested By:
R. M. Johnson

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Test-setup photo(s):
Conducted emission 450 kHz - 30 MHz



TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Test-setup photo(s):
Radiated emission 10 kHz - 1000 MHz

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Appendix A

Test Data Sheets

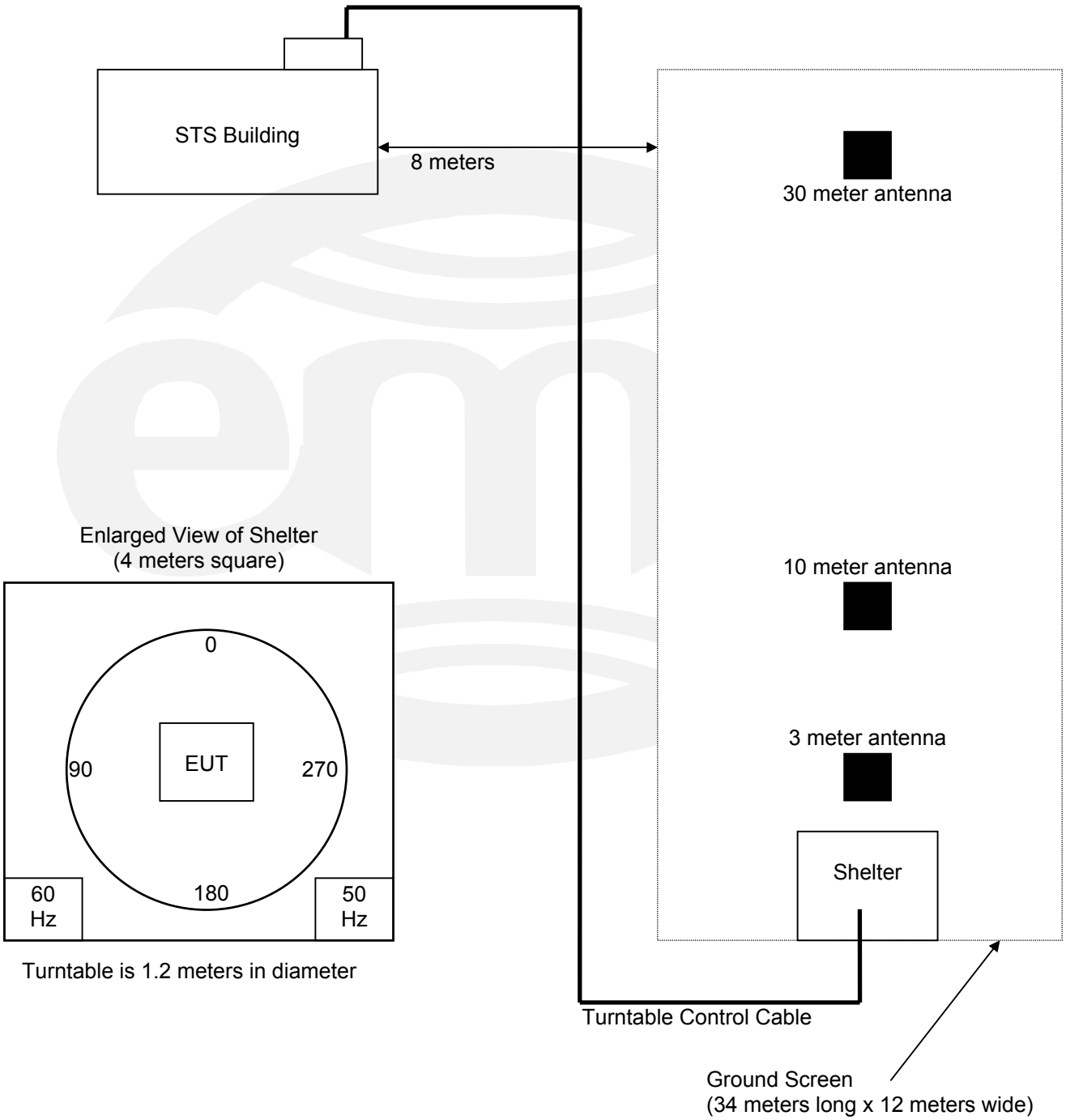
and

Test Setup Drawing(s)

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

TEST SETUP FOR EMISSIONS TESTING

WILD RIVER LAB
Small Test Site (STS)



TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

CONDUCTED EMISSIONS

TÜV PRODUCT SERVICE

Test Report #:	WC402493 Run 2	Test Area:	SCREENROOM		
EUT Model #:	37751 INSR	Date:	6/9/04		
EUT Serial #:	NKA000521	EUT Power:	50/60 HZ 230/110 VAC	Temperature:	23.0 °C
Test Method:	EN55011 B Grp 1			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:					
Data File Name:	2493.dat			Page:	1 of 5

List of measurements for run #: 2

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	EUT Lead	DELTA1 EN55011 B Grp1 Qp	DELTA2 EN55011 B Grp1 Avg
60 HZ 110 VAC TELEMETRY MODE						
150.0 kHz	43.0 Qp	0.0 / 3.0 / 0.0 / 0.0	46.0	L1	-20.0	n/a
206.0 kHz	48.0 Qp	0.0 / 1.97 / 0.0 / 0.0	49.97	L1	-13.4	n/a
225.0 kHz	32.0 Qp	0.0 / 1.88 / 0.0 / 0.0	33.88	L1	-28.76	n/a
309.0 kHz	35.0 Qp	0.0 / 1.46 / 0.0 / 0.0	36.46	L1	-23.54	n/a
722.0 kHz	38.0 Qp	0.0 / 0.5 / 0.0 / 0.0	38.5	L1	-17.5	n/a
826.0 kHz	34.0 Qp	0.0 / 0.5 / 0.0 / 0.0	34.5	L1	-21.5	n/a
1.24 MHz	34.0 Qp	0.0 / 0.5 / 0.0 / 0.0	34.5	L1	-21.5	n/a
1.96 MHz	35.0 Qp	0.1 / 0.5 / 0.0 / 0.0	35.6	L1	-20.4	n/a
2.89 MHz	38.0 Qp	0.1 / 0.5 / 0.0 / 0.0	38.6	L1	-17.4	n/a
3.51 MHz	39.0 Qp	0.1 / 0.5 / 0.0 / 0.0	39.6	L1	-16.4	n/a
4.34 MHz	41.0 Qp	0.1 / 0.5 / 0.0 / 0.0	41.6	L1	-14.4	n/a
7.13 MHz	37.0 Qp	0.1 / 0.5 / 0.0 / 0.0	37.6	L1	-22.4	n/a
11.89 MHz	39.0 Qp	0.3 / 0.55 / 0.0 / 0.0	39.85	L1	-20.15	n/a
15.92 MHz	37.0 Qp	0.3 / 0.65 / 0.0 / 0.0	37.95	L1	-22.05	n/a
17.58 MHz	40.0 Qp	0.3 / 0.69 / 0.0 / 0.0	40.99	L1	-19.01	n/a
26.48 MHz	35.0 Qp	0.4 / 0.91 / 0.0 / 0.0	36.31	L1	-23.69	n/a
206.0 kHz	31.0 Av	0.0 / 1.97 / 0.0 / 0.0	32.97	L1	n/a	-20.4
309.0 kHz	32.0 Av	0.0 / 1.46 / 0.0 / 0.0	33.46	L1	n/a	-16.54
722.0 kHz	33.0 Av	0.0 / 0.5 / 0.0 / 0.0	33.5	L1	n/a	-12.5
826.0 kHz	30.0 Av	0.0 / 0.5 / 0.0 / 0.0	30.5	L1	n/a	-15.5
1.24 MHz	30.0 Av	0.0 / 0.5 / 0.0 / 0.0	30.5	L1	n/a	-15.5
1.96 MHz	24.0 Av	0.1 / 0.5 / 0.0 / 0.0	24.6	L1	n/a	-21.4
2.89 MHz	22.0 Av	0.1 / 0.5 / 0.0 / 0.0	22.6	L1	n/a	-23.4
3.51 MHz	23.0 Av	0.1 / 0.5 / 0.0 / 0.0	23.6	L1	n/a	-22.4

Tested by: J. T. SCHNEIDER — Printed

Joel T. Schneider — Signature

Reviewed by: TKS — Printed

Thomas K. Swanson — Signature

CONDUCTED EMISSIONS

TÜV PRODUCT SERVICE

Test Report #:	WC402493 Run 2	Test Area:	SCREENROOM		
EUT Model #:	37751 INSR	Date:	6/9/04		
EUT Serial #:	NKA000521	EUT Power:	50/60 HZ 230/110 VAC	Temperature:	23.0 °C
Test Method:	EN55011 B Grp 1			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:					
Data File Name:	2493.dat			Page:	2 of 5

List of measurements for run #: 2

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	EUT Lead	DELTA1 EN55011 B Grp1 Qp	DELTA2 EN55011 B Grp1 Avg
4.34 MHz	35.0 Av	0.1 / 0.5 / 0.0 / 0.0	35.6	L1	n/a	-10.4
7.13 MHz	24.0 Av	0.1 / 0.5 / 0.0 / 0.0	24.6	L1	n/a	-25.4
11.89 MHz	31.0 Av	0.3 / 0.55 / 0.0 / 0.0	31.85	L1	n/a	-18.15
15.92 MHz	23.0 Av	0.3 / 0.65 / 0.0 / 0.0	23.95	L1	n/a	-26.05
17.58 MHz	34.0 Av	0.3 / 0.69 / 0.0 / 0.0	34.99	L1	n/a	-15.01
26.48 MHz	26.0 Av	0.4 / 0.91 / 0.0 / 0.0	27.31	L1	n/a	-22.69
309.0 kHz	37.0 Qp	0.0 / 1.46 / 0.0 / 0.0	38.46	N	-21.54	n/a
826.0 kHz	40.0 Qp	0.0 / 0.5 / 0.0 / 0.0	40.5	N	-15.5	n/a
1.24 MHz	39.0 Qp	0.0 / 0.5 / 0.0 / 0.0	39.5	N	-16.5	n/a
2.89 MHz	41.0 Qp	0.1 / 0.5 / 0.0 / 0.0	41.6	N	-14.4	n/a
4.34 MHz	43.0 Qp	0.1 / 0.5 / 0.0 / 0.0	43.6	N	-12.4	n/a
7.13 MHz	38.0 Qp	0.1 / 0.5 / 0.0 / 0.0	38.6	N	-21.4	n/a
26.48 MHz	37.0 Qp	0.4 / 0.91 / 0.0 / 0.0	38.31	N	-21.69	n/a
309.0 kHz	34.0 Av	0.0 / 1.46 / 0.0 / 0.0	35.46	N	n/a	-14.54
826.0 kHz	33.0 Av	0.0 / 0.5 / 0.0 / 0.0	33.5	N	n/a	-12.5
1.24 MHz	34.0 Av	0.0 / 0.5 / 0.0 / 0.0	34.5	N	n/a	-11.5
2.89 MHz	35.0 Av	0.1 / 0.5 / 0.0 / 0.0	35.6	N	n/a	-10.4
4.34 MHz	37.0 Av	0.1 / 0.5 / 0.0 / 0.0	37.6	N	n/a	-8.4
7.13 MHz	31.0 Av	0.1 / 0.5 / 0.0 / 0.0	31.6	N	n/a	-18.4
26.48 MHz	30.0 Av	0.4 / 0.91 / 0.0 / 0.0	31.31	N	n/a	-18.69
50 HZ 230 VAC						
150.0 kHz	55.0 Qp	0.0 / 3.0 / 0.0 / 0.0	58.0	N	-8.0	n/a
225.0 kHz	45.0 Qp	0.0 / 1.88 / 0.0 / 0.0	46.88	N	-15.76	n/a
308.0 kHz	39.0 Qp	0.0 / 1.46 / 0.0 / 0.0	40.46	N	-19.56	n/a
717.0 kHz	43.0 Qp	0.0 / 0.5 / 0.0 / 0.0	43.5	N	-12.5	n/a

Tested by: J. T. SCHNEIDER — Printed

Joel T. Schneider — Signature

Reviewed by: TKS — Printed

Thomas K. Swanson — Signature

CONDUCTED EMISSIONS

Test Report #:	WC402493 Run 2	Test Area:	SCREENROOM			
EUT Model #:	37751 INSR	Date:	6/9/04			
EUT Serial #:	NKA000521	EUT Power:	50/60 HZ 230/110 VAC	Temperature:	23.0	°C
Test Method:	EN55011 B Grp 1			Air Pressure:	98.0	kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0	%
EUT Description:	INSR PATIENT RECHARGER					
Notes:						
Data File Name:	2493.dat			Page:	3 of 5	

List of measurements for run #: 2

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	EUT Lead	DELTA1 EN55011 B Grp1 Qp	DELTA2 EN55011 B Grp1 Avg
717.0 kHz	36.0 Av	0.0 / 0.5 / 0.0 / 0.0	36.5	N	n/a	-9.5
NO HIGHER VALUES						

Measurement summary for limit1: EN55011 B Grp1 Qp (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	EUT Lead	DELTA1 EN55011 B Grp1 Qp
150.0 kHz	55.0 Qp	0.0 / 3.0 / 0.0 / 0.0	58.0	N	-8.0
4.34 MHz	43.0 Qp	0.1 / 0.5 / 0.0 / 0.0	43.6	N	-12.4
717.0 kHz	43.0 Qp	0.0 / 0.5 / 0.0 / 0.0	43.5	N	-12.5
206.0 kHz	48.0 Qp	0.0 / 1.97 / 0.0 / 0.0	49.97	L1	-13.4
2.89 MHz	41.0 Qp	0.1 / 0.5 / 0.0 / 0.0	41.6	N	-14.4
826.0 kHz	40.0 Qp	0.0 / 0.5 / 0.0 / 0.0	40.5	N	-15.5
225.0 kHz	45.0 Qp	0.0 / 1.88 / 0.0 / 0.0	46.88	N	-15.76
3.51 MHz	39.0 Qp	0.1 / 0.5 / 0.0 / 0.0	39.6	L1	-16.4
1.24 MHz	39.0 Qp	0.0 / 0.5 / 0.0 / 0.0	39.5	N	-16.5
17.58 MHz	40.0 Qp	0.3 / 0.69 / 0.0 / 0.0	40.99	L1	-19.01
308.0 kHz	39.0 Qp	0.0 / 1.46 / 0.0 / 0.0	40.46	N	-19.56
11.89 MHz	39.0 Qp	0.3 / 0.55 / 0.0 / 0.0	39.85	L1	-20.15
1.96 MHz	35.0 Qp	0.1 / 0.5 / 0.0 / 0.0	35.6	L1	-20.4
7.13 MHz	38.0 Qp	0.1 / 0.5 / 0.0 / 0.0	38.6	N	-21.4
26.48 MHz	37.0 Qp	0.4 / 0.91 / 0.0 / 0.0	38.31	N	-21.69
15.92 MHz	37.0 Qp	0.3 / 0.65 / 0.0 / 0.0	37.95	L1	-22.05

Tested by: J. T. SCHNEIDER — Printed — Joel T. Schneider — Signature

Reviewed by: TKS — Printed — Thomas K. Swanson — Signature

CONDUCTED EMISSIONS

Test Report #:	WC402493 Run 2	Test Area:	SCREENROOM		
EUT Model #:	37751 INSR	Date:	6/9/04		
EUT Serial #:	NKA000521	EUT Power:	50/60 HZ 230/110 VAC	Temperature:	23.0 °C
Test Method:	EN55011 B Grp 1			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:					
Data File Name:	2493.dat			Page:	4 of 5

Measurement summary for limit2: EN55011 B Grp1 Avg (Av)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	EUT Lead	DELTA2 EN55011 B Grp1 Avg
4.34 MHz	37.0 Av	0.1 / 0.5 / 0.0 / 0.0	37.6	N	-8.4
717.0 kHz	36.0 Av	0.0 / 0.5 / 0.0 / 0.0	36.5	N	-9.5
2.89 MHz	35.0 Av	0.1 / 0.5 / 0.0 / 0.0	35.6	N	-10.4
1.24 MHz	34.0 Av	0.0 / 0.5 / 0.0 / 0.0	34.5	N	-11.5
826.0 kHz	33.0 Av	0.0 / 0.5 / 0.0 / 0.0	33.5	N	-12.5
309.0 kHz	34.0 Av	0.0 / 1.46 / 0.0 / 0.0	35.46	N	-14.54
17.58 MHz	34.0 Av	0.3 / 0.69 / 0.0 / 0.0	34.99	L1	-15.01
11.89 MHz	31.0 Av	0.3 / 0.55 / 0.0 / 0.0	31.85	L1	-18.15
7.13 MHz	31.0 Av	0.1 / 0.5 / 0.0 / 0.0	31.6	N	-18.4
26.48 MHz	30.0 Av	0.4 / 0.91 / 0.0 / 0.0	31.31	N	-18.69
206.0 kHz	31.0 Av	0.0 / 1.97 / 0.0 / 0.0	32.97	L1	-20.4
1.96 MHz	24.0 Av	0.1 / 0.5 / 0.0 / 0.0	24.6	L1	-21.4
3.51 MHz	23.0 Av	0.1 / 0.5 / 0.0 / 0.0	23.6	L1	-22.4
15.92 MHz	23.0 Av	0.3 / 0.65 / 0.0 / 0.0	23.95	L1	-26.05

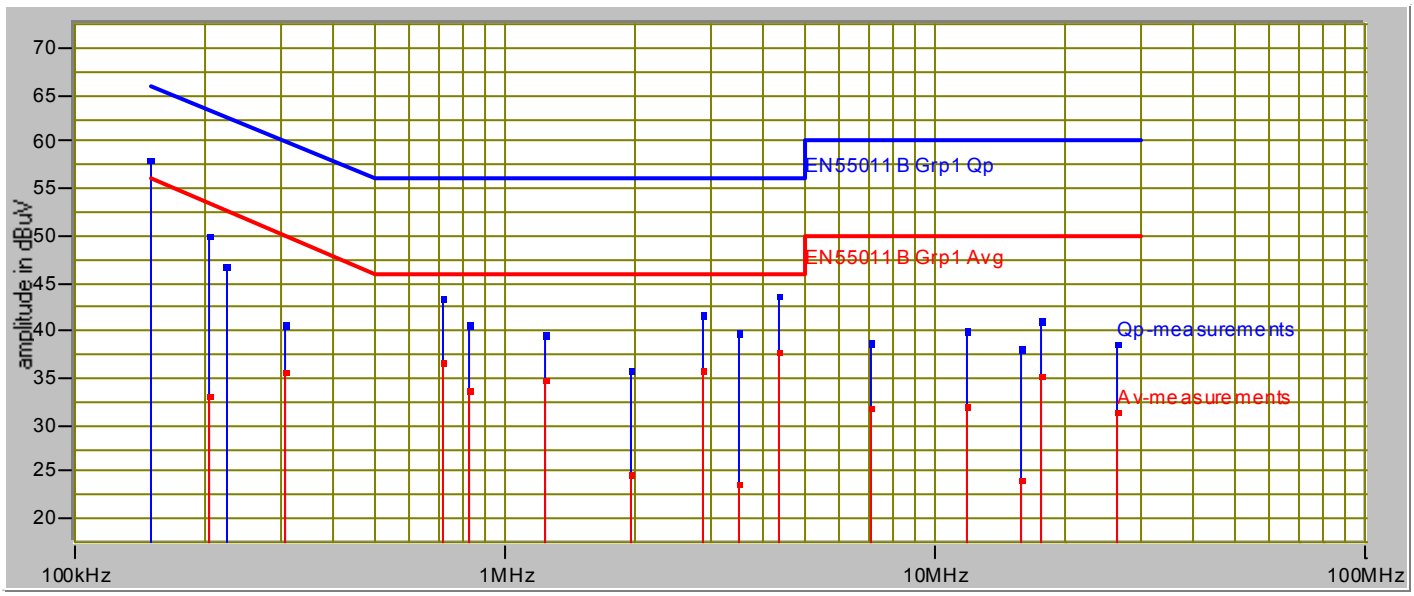
Tested by: J. T. SCHNEIDER — Printed — Signature

Reviewed by: TKS — Printed — Signature

CONDUCTED EMISSIONS

Test Report #:	WC402493 Run 2	Test Area:	SCREENROOM		
EUT Model #:	37751 INSR	Date:	6/9/04		
EUT Serial #:	NKA000521	EUT Power:	50/60 HZ 230/110 VAC	Temperature:	23.0 °C
Test Method:	EN55011 B Grp 1			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:					
Data File Name:	2493.dat			Page:	5 of 5

Graph:



Tested by: J. T. SCHNEIDER

Printed

Signature

Reviewed by: TKS

Printed

Signature

EUT -	37751							
					30 m		300 m	
					spec limit		spec limit	
	1 meter	3 meters	10 meters	30 meters	15.209	300 meters	15.209	margin
MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB
0.009	**136**	**111**	**83**	58		8	48.51937	43.51937
0.018	**103**	**78**	53	28		-22	42.49877	64.49877
0.027	**97**	**74**	46	21		-32	38.97695	70.97695
0.045	**80**	**55**	30	5		-45	34.53997	79.53997
0.063	**66**	**40**	15	-10		-60	31.61741	91.61741
0.081	**55**	**31**	6	-19		-69	29.43452	98.43452
0.099	**53**	28	3	-22		-72	27.69152	99.69152
0.108	**41**	16	-9	-34		-84	26.93575	110.9357
0.117	**34**	9	-16	-41		-91	26.24051	117.2405
Peak measurement of fundamental at 10 meters = 84 dBuV/m								
Bold numbers indicate measured values, otherwise extrapolated.								

RADIATED EMISSIONS

Test Report #:	WC402493 Run 3	Test Area:	STS		
EUT Model #:	37751 INSR	Date:	6/14/04		
EUT Serial #:	NKA000521	EUT Power:		Temperature:	23.0 °C
Test Method:	FCC B			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:	TELEMETRY ACTIVE				
Data File Name:	2493.dat			Page:	1 of 4

List of measurements for run #: 3

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC-B <1GHz 3m	DELTA2
174.99 MHz	49.93 Qp	1.91 / 9.0 / 26.9 / 0.0	33.94	V / 1.00 / 0	-9.56	n/a
138.663 MHz	40.75 Qp	1.73 / 8.66 / 26.8 / 0.0	24.34	V / 1.00 / 0	-19.16	n/a
144.634 MHz	38.8 Qp	1.73 / 9.62 / 26.8 / 0.0	23.35	V / 1.00 / 0	-20.15	n/a
147.448 MHz	39.55 Qp	1.76 / 9.8 / 26.8 / 0.0	24.31	V / 1.00 / 0	-19.19	n/a
162.01 MHz	41.15 Qp	1.9 / 8.94 / 26.8 / 0.0	25.18	V / 1.00 / 0	-18.32	n/a
174.994 MHz	48.06 Qp	1.91 / 9.0 / 26.9 / 0.0	32.07	V / 1.00 / 0	-11.43	n/a
179.913 MHz	47.0 Qp	1.95 / 9.24 / 26.9 / 0.0	31.28	V / 1.00 / 0	-12.22	n/a
184.12 MHz	46.35 Qp	1.98 / 9.54 / 26.9 / 0.0	30.97	V / 1.00 / 0	-12.53	n/a
196.592 MHz	43.4 Qp	2.07 / 10.96 / 26.9 / 0.0	29.53	V / 1.00 / 0	-13.97	n/a
216.248 MHz	41.6 Qp	2.2 / 10.7 / 26.91 / 0.0	27.59	V / 1.00 / 0	-18.41	n/a
512.295 MHz	29.7 Qp	3.62 / 17.7 / 27.8 / 0.0	23.22	V / 1.00 / 0	-22.78	n/a
138.663 MHz	42.35 Qp	1.73 / 8.66 / 26.8 / 0.0	25.94	V / 1.00 / 90	-17.56	n/a
162.01 MHz	41.4 Qp	1.9 / 8.94 / 26.8 / 0.0	25.43	V / 1.00 / 90	-18.07	n/a
512.295 MHz	31.0 Qp	3.62 / 17.7 / 27.8 / 0.0	24.52	V / 1.00 / 90	-21.48	n/a
293.706 MHz	38.95 Qp	2.55 / 12.7 / 27.25 / 0.0	26.95	V / 1.00 / 90	-19.05	n/a
138.663 MHz	43.1 Qp	1.73 / 8.66 / 26.8 / 0.0	26.69	V / 1.00 / 180	-16.81	n/a
144.634 MHz	39.8 Qp	1.73 / 9.62 / 26.8 / 0.0	24.35	V / 1.00 / 180	-19.15	n/a
147.448 MHz	40.45 Qp	1.76 / 9.8 / 26.8 / 0.0	25.21	V / 1.00 / 180	-18.29	n/a
162.01 MHz	40.3 Qp	1.9 / 8.94 / 26.8 / 0.0	24.33	V / 1.00 / 180	-19.17	n/a
MAXIMIZED.						
174.99 MHz	50.03 Qp	1.91 / 9.0 / 26.9 / 0.0	34.04	V / 1.00 / 22	-9.46	n/a
179.913 MHz	49.11 Qp	1.95 / 9.24 / 26.9 / 0.0	33.39	V / 1.00 / 42	-10.11	n/a

Tested by: RMJ

Printed

Signature

Reviewed by: TKS

Printed

Signature

RADIATED EMISSIONS

Test Report #:	WC402493 Run 3	Test Area:	STS		
EUT Model #:	37751 INSR	Date:	6/14/04		
EUT Serial #:	NKA000521	EUT Power:		Temperature:	23.0 °C
Test Method:	FCC B			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:	TELEMETRY ACTIVE				
Data File Name:	2493.dat			Page:	2 of 4

List of measurements for run #: 3

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC-B <1GHz 3m	DELTA2
MAXED ANTENNA AND ROTATED EUT 360 DEGREES.						
147.448 MHz	41.05 Qp	1.76 / 9.8 / 26.8 / 0.0	25.81	H / 3.00 / 90	-17.69	n/a
162.01 MHz	43.85 Qp	1.9 / 8.94 / 26.8 / 0.0	27.88	H / 3.00 / 90	-15.62	n/a
174.99 MHz	47.75 Qp	1.91 / 9.0 / 26.9 / 0.0	31.76	H / 3.00 / 90	-11.74	n/a
293.706 MHz	42.5 Qp	2.55 / 12.7 / 27.25 / 0.0	30.5	H / 1.00 / 180	-15.5	n/a
147.448 MHz	41.6 Qp	1.76 / 9.8 / 26.8 / 0.0	26.36	H / 1.00 / 90	-17.14	n/a
162.01 MHz	45.85 Qp	1.9 / 8.94 / 26.8 / 0.0	29.88	H / 1.00 / 90	-13.62	n/a
174.99 MHz	50.75 Qp	1.91 / 9.0 / 26.9 / 0.0	34.76	H / 1.00 / 90	-8.74	n/a
179.913 MHz	47.55 Qp	1.95 / 9.24 / 26.9 / 0.0	31.83	H / 1.00 / 90	-11.67	n/a
MAXIMIZED.						
174.99 MHz	53.11 Qp	1.91 / 9.0 / 26.9 / 0.0	37.12	H / 1.46 / 66	-6.38	n/a
179.913 MHz	49.05 Qp	1.95 / 9.24 / 26.9 / 0.0	33.33	H / 1.46 / 60	-10.17	n/a
MAXED ANTENNA AND ROTATED EUT 360 DEGREES.						
END OF SCAN 30 - 1000MHz.						

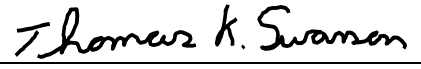
Tested by: RMJ

Printed

Signature

Reviewed by: TKS

Printed



Signature

RADIATED EMISSIONS

Test Report #:	WC402493 Run 3	Test Area:	STS		
EUT Model #:	37751 INSR	Date:	6/14/04		
EUT Serial #:	NKA000521	EUT Power:		Temperature:	23.0 °C
Test Method:	FCC B			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:	TELEMETRY ACTIVE				
Data File Name:	2493.dat			Page:	3 of 4

Measurement summary for limit1: FCC-B <1GHz 3m (Qp)

FREQ	LEVEL (dBuV)	CABLE / ANT / PREAMP / ATTEN (dB)	FINAL (dBuV / m)	POL / HGT / AZ (m)(DEG)	DELTA1 FCC-B <1GHz 3m
174.99 MHz	53.11 Qp	1.91 / 9.0 / 26.9 / 0.0	37.12	H / 1.46 / 66	-6.38
179.913 MHz	49.11 Qp	1.95 / 9.24 / 26.9 / 0.0	33.39	V / 1.00 / 42	-10.11
184.12 MHz	46.35 Qp	1.98 / 9.54 / 26.9 / 0.0	30.97	V / 1.00 / 0	-12.53
162.01 MHz	45.85 Qp	1.9 / 8.94 / 26.8 / 0.0	29.88	H / 1.00 / 90	-13.62
196.592 MHz	43.4 Qp	2.07 / 10.96 / 26.9 / 0.0	29.53	V / 1.00 / 0	-13.97
293.706 MHz	42.5 Qp	2.55 / 12.7 / 27.25 / 0.0	30.5	H / 1.00 / 180	-15.5
138.663 MHz	43.1 Qp	1.73 / 8.66 / 26.8 / 0.0	26.69	V / 1.00 / 180	-16.81
147.448 MHz	41.6 Qp	1.76 / 9.8 / 26.8 / 0.0	26.36	H / 1.00 / 90	-17.14
216.248 MHz	41.6 Qp	2.2 / 10.7 / 26.91 / 0.0	27.59	V / 1.00 / 0	-18.41
144.634 MHz	39.8 Qp	1.73 / 9.62 / 26.8 / 0.0	24.35	V / 1.00 / 180	-19.15
512.295 MHz	31.0 Qp	3.62 / 17.7 / 27.8 / 0.0	24.52	V / 1.00 / 90	-21.48

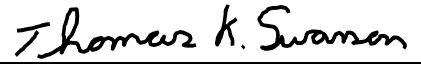
Tested by: RMJ

Printed

Signature

Reviewed by: TKS

Printed

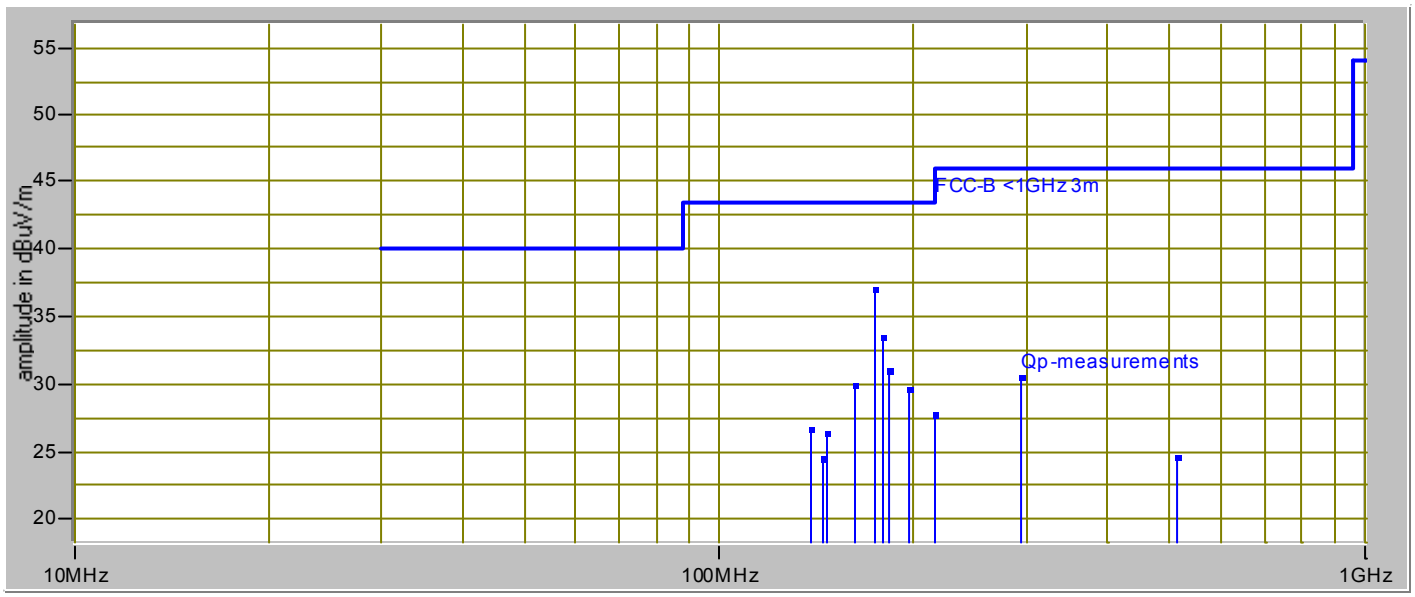


Signature

RADIATED EMISSIONS

Test Report #:	WC402493 Run 3	Test Area:	STS		
EUT Model #:	37751 INSR	Date:	6/14/04		
EUT Serial #:	NKA000521	EUT Power:		Temperature:	23.0 °C
Test Method:	FCC B			Air Pressure:	98.0 kPa
Customer:	MEDTRONIC			Rel. Humidity:	40.0 %
EUT Description:	INSR PATIENT RECHARGER				
Notes:	TELEMETRY ACTIVE				
Data File Name:	2493.dat			Page:	4 of 4

Graph:



Tested by: RMJ

Printed

Signature

Reviewed by: TKS

Printed

Signature

Appendix B

Constructional Data Form

and/or

Product Information Form(s)

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

Form

EMC Test Plan and Constructional Data Form

PLEASE COMPLETE THIS DOCUMENT IN FULL, ENTERING N/A IF THE FIELD IS NOT APPLICABLE.

Applicant -- ***NOTE: This information will be input into your test report as shown below.***
Press the F1 key at any time to get HELP for the current field selected.

Company:	Medtronic Neurological		
Address:	800 53rd Avenue NE		
	Columbia Heights, MN 55421		
Contact:	Debbie Gorski	Position:	Design Assurance Engineer
Phone:	763-514-7489	Fax:	763-514-5612
E-mail Address:	debbie.gorski@medtronic.com		

General Equipment Description -- ***NOTE: This information will be input into your test report as shown below.***

EUT Description	Battery-powered INS Recharger
EUT Name	Restore Charging System
Model No.:	37751
Serial No.:	
Product Options:	
Configurations to be tested:	37751 (recharger), 37791 (recharge antenna)

Test Objective

☐	EMC Directive 89/336/EEC (EMC)	☒	FCC:	Class	☐ A	☒ B	Part	15,C
	Std:	☐	VCCI:	Class	☐ A	☐ B		
☐	Machinery Directive 89/392/EEC (EMC)	☐	BCIQ:	Class	☐ A	☐ B		
	Std:	☐	Canada:	Class	☐ A	☐ B		
☒	Active Implantable Medical Device Directive 90/385/EEC (EMC)	☐	Australia:	Class	☐ A	☐ B		
	Std: See attachment	☐	Other:					
☐	Vehicle Directive 72/245/EEC (EMC) Std:							
☐	FDA Reviewers Guidance for Premarket Notification Submissions (EMC)							

Attendance

Test will be: ☒ Attended by the customer ☐ Unattended by the customer

Form

EMC Test Plan and Constructional Data Form

TÜV PRODUCT SERVICE

EUT Specifications and Requirements

Length: 1.25" Width: 3.0" Height: 5.0" Weight: 2.5 lbs

Power Requirements

Regulations require testing to be performed at typical power ratings in the countries of intended use. (i.e., European power is typically 230 VAC 50 Hz or 400 VAC 50 Hz, single and three phase, respectively)

Voltage: 8.4Vdc (2 non-replaceable lithium ion batteries) (If battery powered, make sure battery life is sufficient to complete testing.)

Voltage: _____ (If battery powered, make sure battery life is sufficient to complete testing.)

# of Phases: _____

Current (Amps/phase(max)): 0.35A Current (Amps/phase(nominal)): _____

Other _____

Other Special Requirements

Typical Installation and/or Operating Environment

(ie. Hospital, Small Business, Industrial/Factory, etc.)

Operating environment can be residential, business and hospital/Doctor's office.

EUT Power Cable

☐ Permanent OR ☐ Removable Length (in meters): _____

☐ Shielded OR ☐ Unshielded

☒ Not Applicable

Form

EMC Test Plan and Constructional Data Form

TÜV PRODUCT SERVICE

EUT Interface Ports and Cables

Interface				Shielding								
Type	Analog	Digital	Qty	Yes	No	Type	Termination	Connector Type	Port Termination	Length (in meters)	Removable	Permanent
EXAMPLE: *RS232*	☐	☒	*2*	☒	☐	*Foil over braid*	*Coaxial*	*Metallized 9-pin D-Sub*	*Characteristic Impedance*	*6*	☒	☐
External antenna	☒	☐	1	☒	☐	N/A	Stranded	2.5mm, 4 position moldable plug	Solder	0.9	☒	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐
	☐	☐		☐	☐						☐	☐

Form

EMC Test Plan and Constructional Data Form

TÜV PRODUCT SERVICE

EUT Software.

Revision Level: Version 2.1.0 (PEM)
Version 1.0.00 (INSR Application)

Description: **EMC Telemetry Test Menu [PEMTST-0110]**

Telemetry test menu uses the Stim On/Off keys to select the menu item.
Transmit alternating Trilogy Stim on/off commands
The Sync key on the patient programmer or the audio key on the recharger to select the highlighted item.

The telemetry test menu will provide the following:

- Transmit alternating Restore Stim on/off commands
- Transmit alternating Trilogy Stim on/off commands

Screen will display “Running” and count the number of successful transactions occurred while test is active.

Screen will display “Stopped” if telemetry is tried and failed 3 times. The success counter will display and hold the last successful transaction.

Pressing any key from the “Stopped” state will return to the telemetry test menu.

Command:
< 10 06 >< 30 01 AC 01 00 00 >< cc cc >

Responses:
[< 10 03 >< 31 01 09 >< cc cc >] = Success
[< 10 04 >< 31 02 rr ss >< cc cc >] = Failure,
rr = reason
ss = sub-reason

EUT Operating Modes to be Tested -- list the operating modes to be used during test. It is recommended the equipment be tested while operating in a typical operation mode. FCC testing of personal computers and/or peripherals requires that a simple program generate a complete line of upper case H’s. Provide a general description of all software, firmware, and PLD algorithms used in the equipment. List all code modules as described above, with the revision level used during testing. Consult with your TÜV Product Service Representative if additional assistance is required.

1. RF telemetry

2. Recharging

3.

Form

EMC Test Plan and Constructional Data Form

TÜV PRODUCT SERVICE

EUT System Components -- List and describe all components which are part of the EUT. For FCC testing a minimum configuration is required. (ie. Mouse, Printer, Monitor, External Disk Drive, Motherboard, etc.)

Description	Model #	Serial #	FCC ID #
Restore Recharger	37751	NKA000521N	LF537752
Recharge Antenna	37791		

Support Equipment -- List and describe all support equipment which is not part of the EUT. (i.e. peripherals, simulators, etc)

Description	*Model #*	*Serial #*	*FCC ID #*
Neurostimulator (Restore)	37711		

Oscillator Frequencies

Frequency	*Derived Frequency*	*Component # / Location*	*Description of Use*
9.8304 MHz	N/A	Y2 (Digital Board: 602051 C)	uP Clock
32.768 kHz	N/A	Y3 (Digital Board: 602051 C)	Real Time Clock

Power Supply

Manufacturer	*Model #*	*Serial #*	*Type*
			☐ Switched-mode: (Frequency) _____ Linear ☐ Other: _____
			☐ Switched-mode: (Frequency) _____ ☐ Linear ☐ Other: _____

Power Line Filters

Manufacturer	*Model #*	*Location in EUT*

Form

EMC Test Plan and Constructional Data Form

Critical EMI Components (Capacitors, ferrites, etc.)				
Description	***Manufacturer***	***Part # or Value***	***Qty***	***Component # / Location***
Ferrite Bead on Recharge Antenna (37791)	Steward	2880375-300	1	External Antenna Cable

EMC Critical Detail -- Describe other EMC Design details used to reduce high frequency noise.

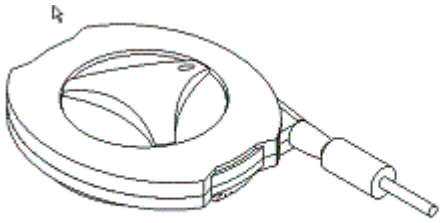
(PLEASE INSERT "**ELECTRONIC SIGNATURE**" BELOW IF POSSIBLE)

Authorization Signatures

Customer authorization to perform tests according to this test plan.	Date
Test Plan/CDF Prepared By (please print)	Date
Reviewed by TÜV Product Service Associate	Date

EMC Test Plan and Constructional Data Form

37751 INSR



37791 Recharge Antenna

Appendix C

MEASUREMENT PROTOCOL FOR FCC

GENERAL INFORMATION

Measurement Uncertainty

The test system for conducted emissions is defined as the LISN, tuned receiver or spectrum analyzer, and coaxial cable. The test system for radiated emissions is defined as the antenna, the pre-amplifier, the spectrum analyzer and the coaxial cable. These test systems have a measurement uncertainty of ±4.8 dB. The equipment comprising the test systems are calibrated on an annual basis.

Justification

The Equipment Under Test (EUT) is configured in a typical user arrangement in accordance with the manufacturer's instructions. A cable is connected to each available port and either terminated with a peripheral into it's characteristic impedance or left unterminated. When appropriate, the cables are manually manipulated with respect to each other to obtain maximum emissions from the unit.

CONDUCTED EMISSIONS

The final level, expressed in dBμV, is arrived at by taking the reading directly from the EMI receiver. This level is compared directly to the FCC limit.

To convert between dBμV and μV, the following conversions apply:

dBμV = 20(log μV)

μV = Inverse log(dBμV/20)

RADIATED EMISSIONS

The final level, expressed in dBμV/m, is arrived at by taking the reading from the spectrum analyzer (Level dBμV), adding the antenna correction factor and cable loss factor (Factor dB) to it, then subtracting the preamp gain. This result then has the FCC limit subtracted from it to provide the Delta which gives the tabular data as shown in the data sheets in Attachment A.

Example:

FREQ (MHz)	LEVEL (dBuV)		CABLE/ANT/PREAMP (dB)			FINAL (dBuV/m)		POL/HGT/AZ	(m)	(deg)	DELTA1 FCC B
60.80	42.5Qp	+	1.2	+ 10.9	- 25.5 =	29.1		V	1.0	0.0 -	-10.9

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0

DETAILS OF TEST PROCEDURES

General Standard Information

The test methods used comply with ANSI C63.4-2001 - "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz."

Conducted Emissions

Conducted emissions on the 60 Hz power interface of the EUT are measured in the frequency range of 450 kHz to 30 MHz. The measurements are performed using a receiver, which has CISPR characteristic bandwidth and quasi-peak detection, and a Line Impedance Stabilization Network (LISN), with 50 Ω/50 μH (CISPR 16) characteristics. Table top equipment is placed on a non-conducting table 80 centimeters above the floor and is positioned 40 centimeters from the vertical ground plane (wall) of the screen room. In some cases, a pre-scan using a spectrum analyzer is initially performed on the units comprising the system under test to locate the highest emissions. If the minimum passing margin appears to be less than 20 dB with a peak mode measurement, the emissions are re-measured using a tuned receiver or spectrum analyzer with quasi-peak and average detection and recorded on the data sheets.

Radiated Emissions

Radiated emissions from the EUT are measured in the frequency range of 30 to 1000 MHz using a spectrum analyzer and appropriate broadband linearly polarized antennas. Measurements between 30 MHz and 1000 MHz are made with 120 kHz/6 dB bandwidth and quasi-peak detection and measurements above 1000 MHz are made with a 1 MHz/6 dB bandwidth and peak detection. Table top equipment is placed on a 1.0 X 1.5 meter non-conducting table 80 centimeters above the ground plane. Floor standing equipment is placed directly on the turntable/ground plane. Interface cables that are closer than 40 centimeters to the ground plane are bundled in the center in a serpentine fashion so they are at least 40 centimeters from the ground plane. Cables to simulators/testers (if used in this test) are routed through the center of the table and to a screen room located outside the test area. The antenna is positioned 3 meters horizontally from the EUT. To locate maximum emissions from the test sample the antenna is varied in height from 1 to 4 meters, measurement scans are made with both horizontal and vertical antenna polarizations and the EUT are rotated 360 degrees. Intentional radiators are rotated through three orthogonal axes to determine the attitude that maximizes the emissions.

In the frequency range of 9 kHz to 30 MHz, measurements are made with quasi-peak or average detection with a loop antenna. The antenna is positioned 1 meter above the ground plane and rotated about its vertical axis for maximum response at each azimuth about the EUT. The antenna is also positioned horizontally at the specified distances.

TÜV PRODUCT SERVICE INC 19333 Wild Mountain Road Taylors Falls MN 55084-1758 Tel: 651 638 0297 Fax: 651 638 0298 Rev.No 1.0