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Radio Test Report

FCC Part 95
MedRadio Transmitter

Nevro Senza IPG model IPG1500

COMPANY:	Nevro Corporation 4040 Campbell Ave. Suite 210 Menlo Park, CA 94125
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	April 10, 2013
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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	04-10-2013	Initial release	
1	12-19-2014	Revised to add notes concerning emissions 250 kHz from the band edges	DMG
2	01-13-2015	Revised to change radiated power emissions calculation and clarify in band and band edge emissions results	DWB

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SCOPE

Tests have been performed on the Nevro Corporation Nevro Senza IPG model IPG1500, pursuant to the relevant requirements of the following standard(s) in order to obtain device certification against the regulatory requirements of the Federal Communications Commission and Industry Canada.

- Code of Federal Regulations (CFR) Title 47 Part 2
- CFR 47 Part 95 (Medical Device Radiocommunication Service) Subpart I

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in NTS Silicon Valley test procedures:

ANSI C63.4:2003
ANSI TIA-603-C August 17, 2004

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant Industry Canada performance and procedural standards.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Nevro Corporation Nevro Senza IPG model IPG1500 and therefore apply only to the tested sample. The sample was selected and prepared by Jon Parker of Nevro Corporation.

OBJECTIVE

The primary objective of the manufacturer is compliance with the regulations outlined in the previous section.

Prior to marketing in the USA, the device requires certification. Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units, which are subsequently manufactured.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

STATEMENT OF COMPLIANCE

The tested sample of Nevro Corporation Nevro Senza IPG model IPG1500 complied with the requirements of the standards and frequency bands declared in the scope of this test report.

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

DEVIATIONS FROM THE STANDARDS

No deviations were made from the published requirements listed in the scope of this report.

TEST RESULTS

FCC Part 95

Rule Part	Description	Measured	Limit	Result
Transmitter frequency, power, bandwidth, modulation and unwanted emissions				
§2.1033 (c) (5) § 95.628(c)	Frequency range(s)	402.45 – 404.55 MHz	402-405 MHz	Complies
§2.1033 (c) (6) §2.1033 (c) (7) §2.1046 § 95.639(f)	EIRP (Calculated from Field Strength)	0.048µW -43.2dBm	25µW –16dBm	Complies
§2.1033 (c) (4) §2.1047 §95.635(d)(4) & (5)	Emission types	F1D	-	-
	Unwanted emissions (-20dBc)	0.3nW -65.2dBm	0.48nW -63.2dBm	Complies
§2.1049 §95.628(d), §95.633(e)(1)	Authorized Bandwidth	240 kHz	300 kHz	Complies
Transmitter spurious emissions				
§2.1053 §2.1057 §95.635(d)(1)	Field strength	41.2 dBµV/m @ 2871.72 MHz (-12.8 dB)	See table	Complies
Receiver spurious emissions				
15.109		41.2 dBµV/m @ 2871.72 MHz (-12.8 dB)	See table	Complies
Other details				
95.628(a)	Frequency Monitoring	-	-	N/A
§2.1055 §95.628(g)(2)	Frequency stability	36 ppm	100 ppm	Complies
§2.1093	RF Exposure	Refer to separate exhibit	-	Complies
§2.1033 (c) (8)	Final radio frequency amplifying circuit's dc voltages and currents for normal operation over the power range	2.5V, 6.5mA	-	-
Notes				

EXTREME CONDITIONS

Frequency stability is determined over extremes of temperature and voltage. As the device is hand carried, battery powered equipment; the supply voltage was reduced to the battery operating end point of 3.3Vdc as specified by the manufacturer.

The extremes of temperature were 25°C to 45°C as specified in FCC §95.628(e)(1).

MEASUREMENT UNCERTAINTIES

ISO Guide 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level (based on a coverage factor (k=2) and were calculated in accordance with NAMAS document NIS 81 and M3003.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF frequency	Hz	25 to 7,000 MHz	1.7×10^{-7}
Radiated emission (field strength)	dBμV/m	25 to 1,000 MHz 1 to 40 GHz	± 3.6 dB ± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Nevro Corporation Nevro Senza IPG model IPG1500 is an implantable pulse generator that is designed to deliver electrical stimulation to the spinal cord. Since the EUT would be placed in the body during operation, the EUT was placed in a human torso simulator during emissions testing. The electrical rating of the EUT is 3.7 Volts DC provided from a battery.

The sample was received on March 25, 2013 and tested on March 25 and 28, 2013. The following samples of the EUT were tested:

Company	Model	Description	Serial Number	FCC ID
Nevro	IPG1500	Implantable pulse generator	SN15001 (SN15004*)	XKYIPG1500

* SN15004 was used for a portion of the stability testing

OTHER EUT DETAILS

The EUT is powered by a non-removable, rechargeable battery.

ENCLOSURE

The EUT enclosure is primarily constructed of titanium. It measures approximately 5 cm wide by 7 cm deep by 1 cm high.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at National Technical Systems - Silicon Valley.

SUPPORT EQUIPMENT

No support equipment was used during testing.

EUT INTERFACE PORTS

The I/O cabling configuration during testing was as follows:

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Leads	Unterminated	Single wires	Unshielded	0.4

EUT OPERATION

During emissions testing the EUT was set to transmit in a continuous modulated mode on the selected frequency for transmit modes tests except for frequency stability when an unmodulated carrier mode was used and set to receive mode for all other tests.

TESTING

GENERAL INFORMATION

Radiated spurious emissions measurements were taken at the NTS Silicon Valley Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2003 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* and CISPR 16-1-4:2007 - *Specification for radio disturbance and immunity measuring apparatus and methods Part 1-4: Radio disturbance and immunity measuring apparatus Ancillary equipment Radiated disturbances*. They are on file with the FCC and industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 3	769238	IC 2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 4	211948	IC 2845B-4	
Chamber 5	211948	IC 2845B-5	

Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements.

FREQUENCY STABILITY

The EUT is placed inside a temperature chamber with all support and test equipment located outside of the chamber. The temperature is varied across the specified frequency range in 10 degree increments with frequency measurements made at each temperature step. The EUT is allowed enough time to stabilize at each temperature variation.

The spectrum analyzer is configured to give a 5- or 6-digit display for the marker-frequency function. The spectrum analyzer's built-in frequency counter is used to measure the maximum deviation of the fundamental frequency at each temperature. Where possible the device is set to transmit an unmodulated signal. Where this is not possible the frequency drift is determined by finding a stable point on the signal (e.g. the null at the centre of an OFDM signal) or by calculating a centre frequency based on the upper and lower XdB points (where X is typically 6dB or 10dB) on the signal’s skirts.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB and/or 26dB signal bandwidth is measured in using the bandwidths recommended by ANSI C63.4. When required, the 99% bandwidth is measured using the methods detailed in RSS GEN. The measurement bandwidth is set to be at least 1% of the instrument’s frequency span.

RADIATED EMISSIONS MEASUREMENTS

Receiver radiated spurious emissions measurements are made in accordance with ANSI ANSI C63.4:2003 by measuring the field strength of the emissions from the device at a specific test distance and comparing them to a field strength limit. Where the field strength limit is specified at a longer distance than the measurement distance the measurement is extrapolated to the limit distance.

Transmitter radiated spurious emissions are initially measured as a field strength. The eirp or erp limit as specified in the relevant rule part(s) is converted to a field strength at the test distance and the emissions from the EUT are then compared to that limit. Emissions within 20dB of this limit are the subjected to a substitution measurement.

All radiated emissions measurements are performed in two phases. A preliminary scan of emissions is conducted in either an anechoic chamber or on an OATS during which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed across the complete frequency range of interest and at each operating frequency identified in the reference standard. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. Initial scans are made using a peak detector (RBW=VBW) and using scan rates to ensure that the EUT transmits before the sweep moves out of each resolution bandwidth (for transmit mode).

During the preliminary scans, the EUT is rotated through 360°, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit. For transmitter spurious emissions, where the limit is expressed as an effective radiated power, the eirp or erp is converted to a field strength limit.

Final measurements are made on an OATS or in a semi-anechoic chamber at the significant frequencies observed during the preliminary scan(s) using the same process of rotating the EUT and raising/lowering the measurement antenna to find the highest level of the emission. The field strength is recorded and, for receiver spurious emissions, compared to the field strength limit. For the final measurement the appropriate detectors (average, peak, normal, sample, quasi-peak) are used. For receiver measurements below 1GHz the detector is a Quasi-Peak detector, above 1GHz a peak detector is used and the peak value (RB=VB=1MHz) and average value (RB=1MHz, VB=10Hz) are recorded.

For transmitter spurious emissions, the radiated power of all emissions within 20dB of the calculated field strength limit are determined using a substitution measurement. The substitution measurement is made by replacing the EUT with an antenna of known gain (typically a dipole antenna or a double-ridged horn antenna), connected to a signal source. The output power of the signal generator is adjusted until the maximum field strength from the substitution antenna is similar to the field strength recorded from the EUT. The erp of the EUT is then calculated.

INSTRUMENTATION

An EMI receiver as specified in CISPR 16-1-1 is used for radiated emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 7000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary.

For measurements above the frequency range of the receivers and for all conducted measurements a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis.

Measurement bandwidths for the test instruments are set in accordance with the requirements of the standards referenced in this document.

Software control is used to correct the measurements for transducer factors (e.g. antenna) and the insertion loss of cables, attenuators and other series elements to obtain the final measurement value. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are exported in a graphic and/or tabular format, as appropriate.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the EUT antenna port or receiving antenna and the test receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A combination of biconical, log periodic or bi-log antennas are used to cover the range from 30 MHz to 1000 MHz. Broadband antennas or tuned dipole antennas are used over the entire 25 to 1000 MHz frequency range as the reference antenna for substitution measurements.

Above 1000 MHz, a dual-ridge guide horn antenna or octave horn antenna are used as reference and measurement antennas.

The antenna calibration factors are included in site factors that are programmed into the test receivers and instrument control software when measuring the radiated field strength.

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

Body worn devices are placed at a height of 1.5 meters above the floor in a torso simulator 6cm form the surface of the simulator. The EUT is positioned on a motorized turntable to allow it to be rotated during testing to determine the angel with the highest level of emissions.

SAMPLE CALCULATIONS

SAMPLE CALCULATIONS - CONDUCTED SPURIOUS EMISSIONS

Measurements are compared directly to the conducted emissions specification limit (decibel form). The calculation is as follows:

$$R_r - S = M$$

where:

R_r = Measured value in dBm
S = Specification Limit in dBm
M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH

Measurements of radiated field strength are compared directly to the specification limit (decibel form). The receiver and/or control software corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

A distance factor is sued when measurements are made at a test distance that is different to the specified limit distance by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB
D_m = Measurement Distance in meters
D_s = Specification Distance in meters

For electric field measurements below 30MHz the extrapolation factor is either determined by making measurements at multiple distances or a theoretical value is calculated using the formula:

$$F_d = 40*LOG_{10} (D_m/D_s)$$

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_C = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS –RADIATED POWER

The erp/eirp limits for transmitter spurious measurements are converted to a field strength in free space using the following formula and adding 6dB for sites using a reflective ground plane (per FCC 95.627(g)(3):

$$E = \frac{\sqrt{30\ P\ G}}{d}$$

where:

E = Field Strength in V/m
P = Power in Watts
G = Gain of isotropic antenna (numeric gain) = 1
D = measurement distance in meters

The field strength limit is then converted to decibel form (dBuV/m) and the margin of a given emission peak relative to the limit is calculated (refer to *SAMPLE CALCULATIONS –RADIATED FIELD STRENGTH*).

When substitution measurements are required (all signals with less than 20dB of margin relative to the calculated field strength limit) the eirp of the spurious emission is calculated using:

$$P_{EUT} = P_S - (E_S - E_{EUT})$$

and

$$P_S = G + P_{in}$$

where:

P_S = effective isotropic radiated power of the substitution antenna (dBm)
P_{in} = power input to the substitution antenna (dBm)
G = gain of the substitution antenna (dBi)
E_S = field strength the substitution antenna (dBm) at eirp P_S
E_{EUT} = field strength measured from the EUT

Where necessary the effective isotropic radiated power is converted to effective radiated power by subtracting the gain of a dipole (2.2dBi) from the eirp value.

RECEIVER RADIATED SPURIOUS EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from receivers as detailed in FCC Part 15.109. Note that receivers operating outside of the frequency range 30 MHz – 960 MHz are exempt from the requirements of 15.109.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

For MedRadio, the above limits also apply to the transmitter per §95.635(d).

Appendix A Test Equipment Calibration Data

Radiated Emissions, 30 - 4,100 MHz, 25-Mar-13

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	263	3/29/2013
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/19/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	6/4/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/21/2013

Environmental Stability, 25-Mar-13

Manufacturer	Description	Model	Asset #	Cal Due
Watlow	Temp Chamber (w/ F4 Watlow Controller)	Watlow F4	2170	7/11/2013
Agilent	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Radiated Emissions, 30 - 4,100 MHz, 25-Mar-13

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/19/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/1/2013
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1657	6/4/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1756	5/21/2013
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/19/2014
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	5/25/2013

Environmental Stability, 25-Mar-13

Manufacturer	Description	Model	Asset #	Cal Due
Watlow	Temp Chamber (w/ F4 Watlow Controller)	Watlow F4	2170	7/11/2013
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	1/28/2014

Appendix B Test Data

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Client:	Nevro	Job Number:	J91442
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		-
Emissions Standard(s):	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-
Immunity Standard(s):	EN 301 489-1 & -27	Environment:	-

EMC Test Data

For The

Nevro

Model

Nevro Senza IPG model IPG1500

Date of Last Test: 3/28/2013

Client:	Nevro	Job Number:	J91442
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

Radiated Emissions

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. The EUT was tested in all three orthogonal orientations. The test distance and extrapolation factor (if applicable) are detailed under each run description.
Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 23 °C
Rel. Humidity: 45 %

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
2	Fundamental Signal Field Strength	FCC Part 95	Pass	58.0 dBµV/m @ 402.39 MHz (-27.2 dB)
2	Transmitter Radiated Spurious Emissions, 30 - 4,050 MHz	FCC Part 95	Pass	All emissions are more than 10dB below the limit
3	20dB Bandwidth	FCC Part 95	Pass	240kHz
3	20dBc Frequencies	FCC Part 95	Pass	402.344 MHz and 404.680 MHz
3	Highest emission within 150kHz of fundamental	FCC Part 95	Pass	-65.2 dBm
4	Receiver Radiated Spurious Emissions, 30 - 1,000 MHz	FCC 15.209	-	Not necessary as all emissions except the fundamental must be below the Part 15 receiver limit for a Part 95 transmitter

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Nevro	Job Number:	J91442
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

Run #1: Preliminary Radiated Emissions, 30-4050 MHz, Fundamental and Transmitter Spurious Emissions
Test in three orientations to determine orientation with highest emissions

Date of Test: 3/25/2013 Config. Used: 1
Test Engineer: Jack Liu Config Change: None
Test Location: Fremont Chamber #7 EUT Voltage: Battery

Low Channel

Frequency	Level	Pol	FCC Part 95		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
402.450	78.3	H	85.2	-6.9	Pk	262	1.2	EUT on its back
402.450	66.6	V	85.2	-18.6	Pk	344	2.6	EUT on its back
402.450	77.2	H	85.2	-8.0	Pk	316	1.3	EUT on its Side
402.450	72.3	V	85.2	-12.9	Pk	25	1.0	EUT on its Side
402.450	81.9	H	85.2	-3.3	Pk	254	1.2	EUT Upright
402.450	69.8	V	85.2	-15.4	Pk	131	1.0	EUT Upright

Note 1:	Testing performed outside of phantom to aid in varying the orientation of the EUT.

Client:	Nevro	Job Number:	J91442
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

Run #2: Radiated Emissions, 30-4050 MHz, Fundamental and Transmitter Spurious Emissions
EUT installed in phantom

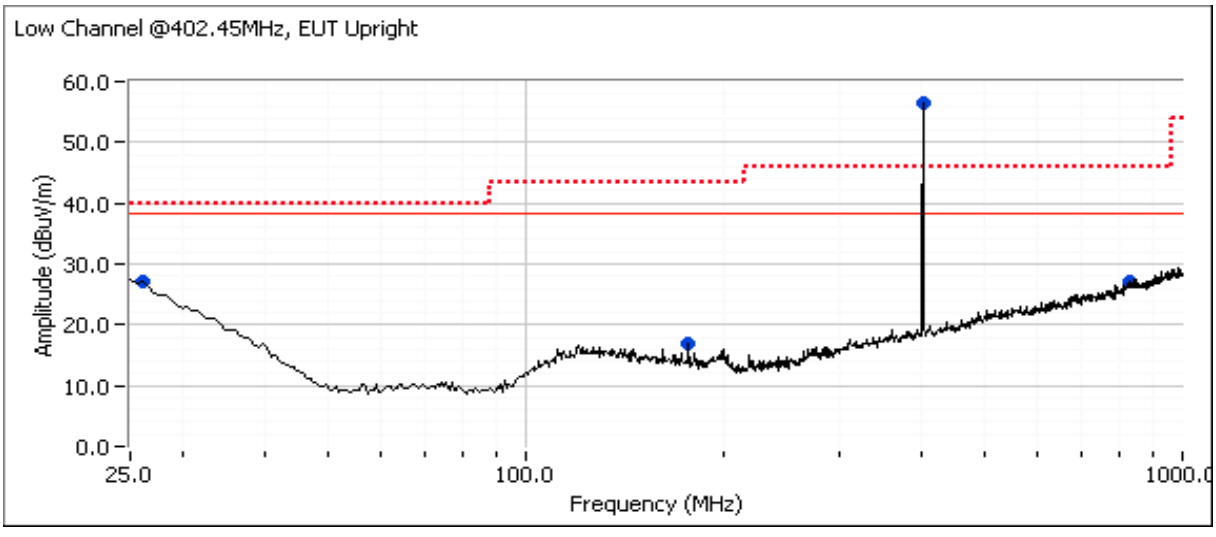
Date of Test: 3/25/2013
Test Engineer: Jack Liu
Test Location: Fremont Chamber #7
Config. Used: 1
Config Change: None
EUT Voltage: Battery

Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 4,050 MHz	3	3	0.0

Note:	The limit in part 95 for the fundamental signal is 85.2dBuV/m Peak. Spurious emissions must comply with the Part 95 limits which are the same as 15.209 limits except in the 250 kHz range adjacent to the 402-405 MHz band (65.2 dBuV/m in 3kHz RB).
Note:	The field strength of any spurious emissions may not exceed the field strength of the fundamental signal.

Low Channel 402.45MHz

Frequency	Level	Pol	FCC Part 95		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
402.450	58.0	V	85.2	-27.2	PK	82	1.7	POS; RB 1 MHz; VB: 3 MHz
402.450	56.5	H	85.2	-28.7	PK	343	1.1	POS; RB 1 MHz; VB: 3 MHz
176.426	15.1	H	43.5	-28.4	PK	230	1.0	POS; RB 100 kHz; VB: 300 kHz
828.837	26.5	H	46.0	-19.5	PK	232	4.0	POS; RB 100 kHz; VB: 300 kHz
26.097	24.2	H	40.0	-15.8	PK	290	4.0	POS; RB 100 kHz; VB: 300 kHz
2871.720	41.2	V	54.0	-12.8	PK	4	1.6	RB 1 MHz;VB 3 MHz;Peak



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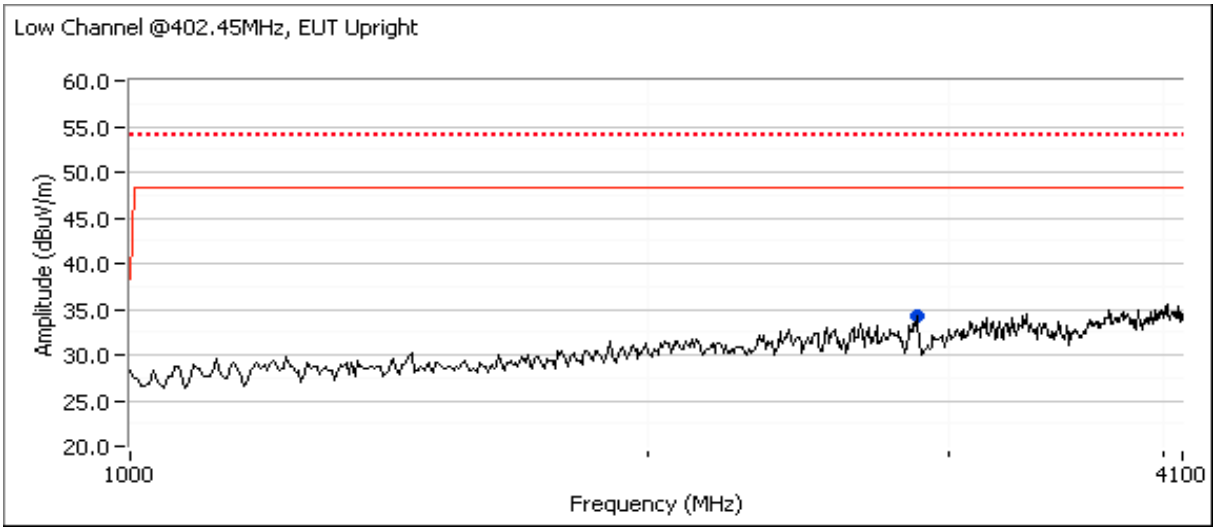
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-



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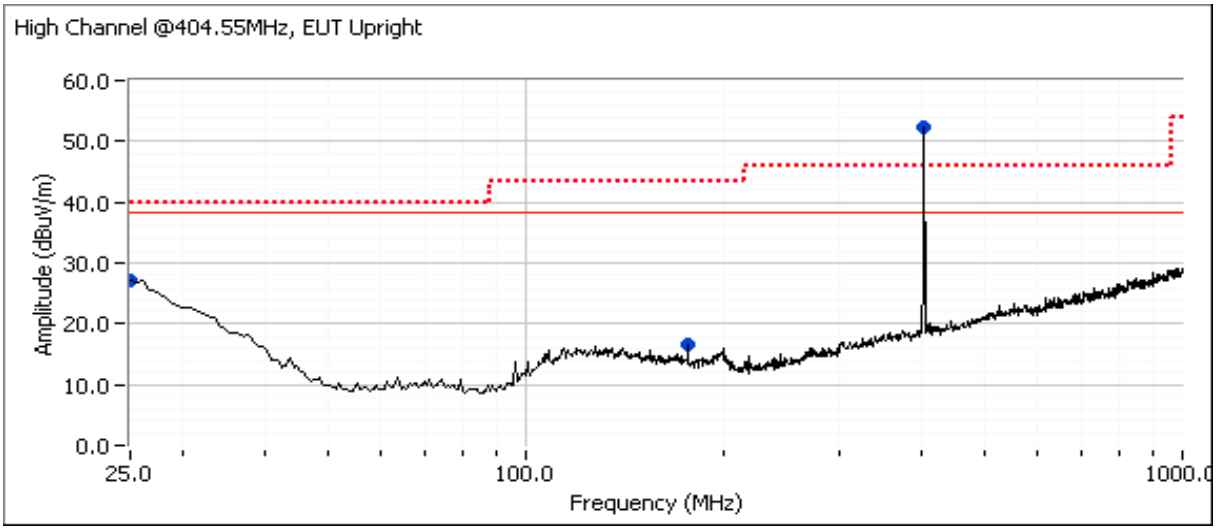
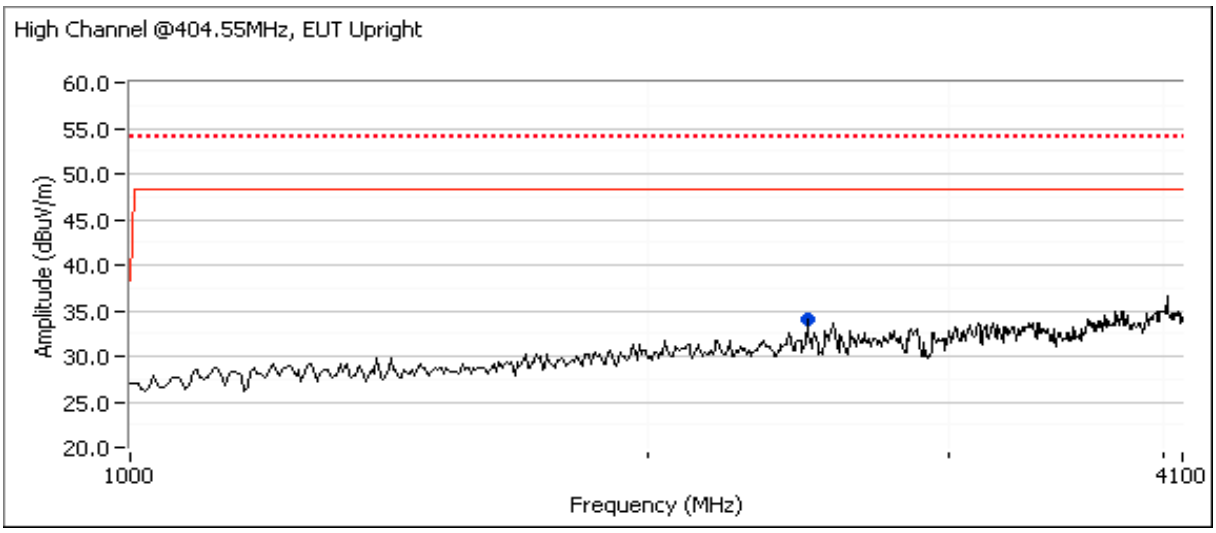
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

High Channel 404.55MHz

Frequency	Level	Pol	FCC Part 95		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
404.550	54.4	H	85.2	-30.8	PK	110	1.1	POS; RB 1 MHz; VB: 3 MHz
404.550	52.1	V	85.2	-33.1	PK	141	1.6	POS; RB 1 MHz; VB: 3 MHz
176.472	13.6	H	43.5	-29.9	PK	194	1.0	POS; RB 100 kHz; VB: 300 kHz
25.008	25.1	V	40.0	-14.9	PK	246	1.5	POS; RB 100 kHz; VB: 300 kHz
2479.040	39.5	V	54.0	-14.5	PK	236	1.9	RB 1 MHz;VB 3 MHz;Peak





Client:	Nevro	Job Number:	J91442
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		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

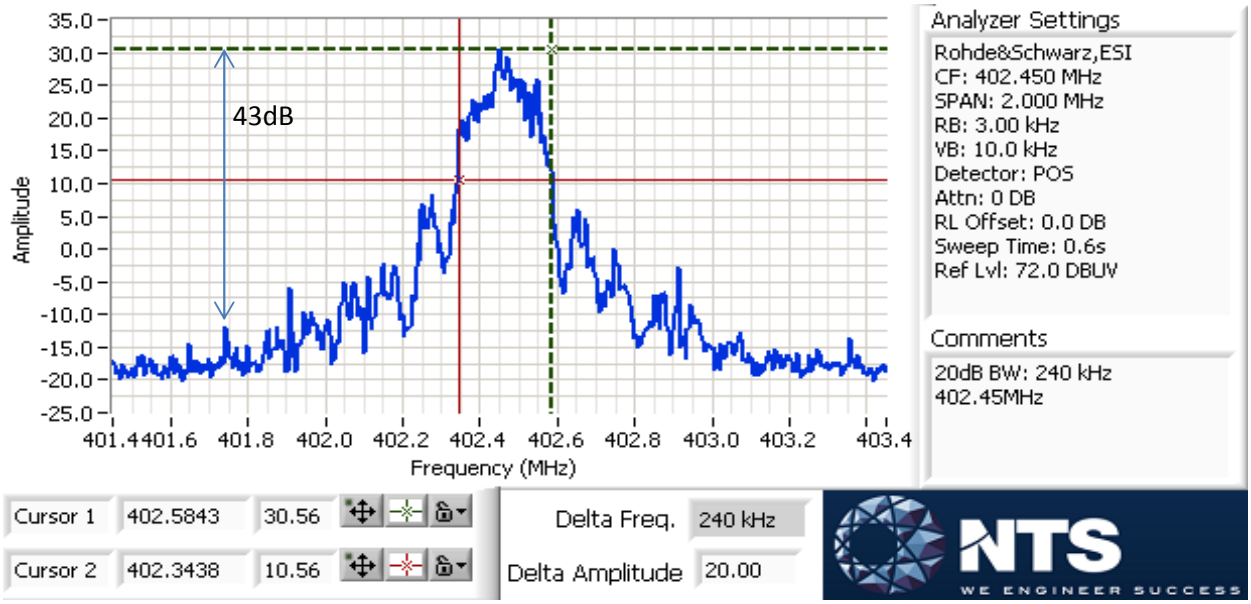
Run #3: Bandwidth Measurement(s)

Date of Test: 3/25/2013
Test Engineer: Jack Liu
Test Location: Fremont Chamber #7

Config. Used: 1
Config Change: None
EUT Voltage: Battery

	Frequency (MHz)	Resolution Bandwidth	Video Bandwidth	20dB Bandwidth
	402.45	3 kHz	10 kHz	240kHz
	404.55	3 kHz	10 kHz	240kHz

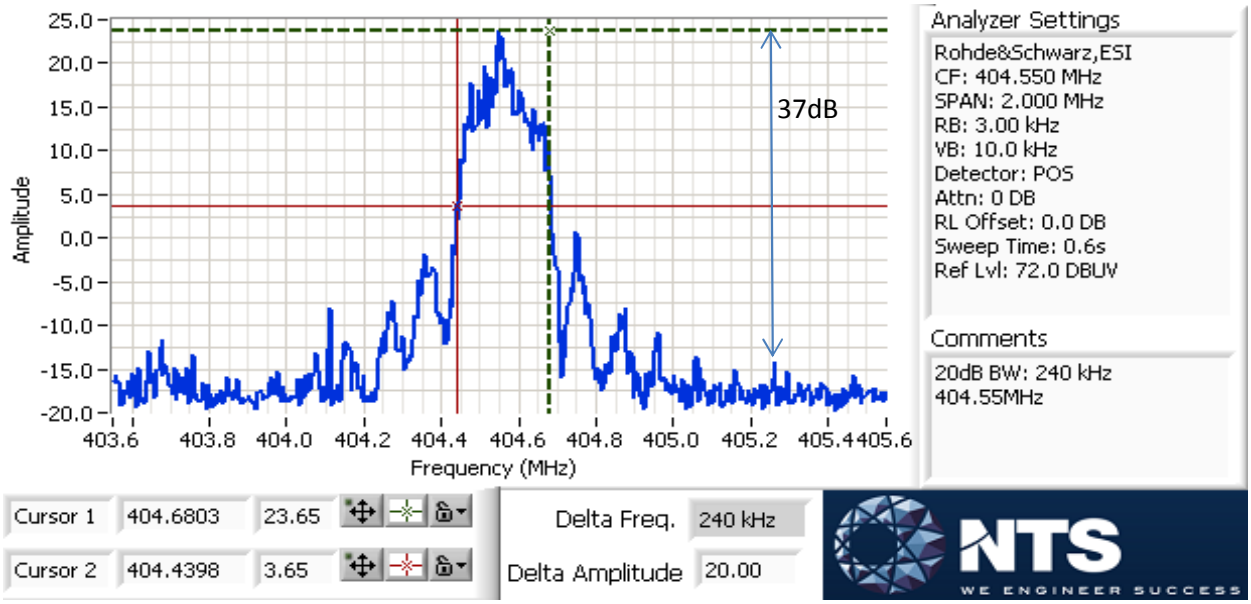
Note 1:	20dB bandwidth measured with RB > 1% and < 2% of the actual bandwidth and VB > 3xRB



The delta in emissons level from the inband level to the level at 401.75 is 43 dB. Subtracting this from the field strength of the fundamental at 1 MHz gives a value of 15.0 dBuV/m which complies with the spurious limit of 46 dBuV/m.

The delta in emissons level from the inband level to the highest level >150 kHz from the center is 22 dB. The power of this unwanted emmission is thus -65.2 dBm since the power of the wanted emisisosn is -43.2 dBm calculated from the 58.0 dBuV/m FS.

Client:	Nevro	Job Number:	J91442
Model:	Nevro Senza IPG model IPG1500	T-Log Number:	T91525
		Account Manager:	Christine Krebil
Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-



The delta in emissons level from the inband level to the level at 405.25 is 37 dB. Subtracting this from the field strength of the fundamental at 1 MHz gives a value of 17.4 dBuV/m which complies with the spurious limit of 46 dBuV/m.

Run #4: Receiver Spurious Emissions

Not necessary as all emissions except the fundamental must be below the Part 15 receiver limit for a Part 95 transmitter

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Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

FCC Part 95.628 and EN 301 839-1
Frequency Stability

Test Specific Details

Objective: The objective of this test session is to perform final qualification testing of the EUT with respect to the specification listed above.

General Test Configuration

With the exception of the radiated spurious emissions tests, all measurements are made with a probe. For frequency stability measurements the EUT was place inside an environmental chamber.

Radiated measurements are made with the EUT located on a non-conductive table, 3m from the measurement antenna.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 34 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result
1	Frequency Stability	100 ppm	Pass	36 ppm

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

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Contact:	Jon Parker		
Standard:	EN 301 839, FCC Part 15B, Part 95 Subpart I	Class:	-

Run #1: Frequency Stability

Date: 3/25/2013 Engineer: Rafael Varelas Location: FT Lab 4A
Date: 3/28/2013 Engineer: Mehran Birgani Location: FT Lab 4A

Nominal Frequency: 403.65 MHz

Frequency Stability Over Temperature

The EUT was soaked at each temperature for a minimum of 30 minutes prior to making the measurements to ensure the EUT and chamber had stabilized at that temperature.

Nominal Battery Voltage (3.7 Vdc)

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
25	403.664116	14116	35
37	403.663732	13732	34
45	403.663316	13316	33
	Worst case:	14116	35

RB=VB=1kHz, Span 10kHz

Battery endpoint (3.3 Vdc) for EN 301 839-1

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
25	403.664541	14541	36
37	403.661021	11021	27
45	403.662967	12967	32
	Worst case:	14541	36

Frequency Stability Over Input Voltage

Voltage	Frequency Measured	Drift	
(Dc)	(MHz)	(Hz)	(ppm)
3.7	403.663732	13732	34
3.3	403.664541	14541	36

Note 1:	Maximum drift of fundamental frequency before it shut down at 3.1 Vdc was to 403.662467 MHz.

End of Report

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