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Radio Test Report

FCC Part 95
MedRadio Transmitter

Model: Nevro Patient Remote

COMPANY:	Nevro Corporation 1800 Bridge Parkway Redwood City, CA 94065
TEST SITE(S):	National Technical Systems 41039 Boyce Road. Fremont, CA. 94538-2435
PROJECT NUMBER:	PR089302
REPORT DATE:	January 8, 2019
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ACCREDITED
Testing Cert #0214.26

VALIDATING SIGNATORIES

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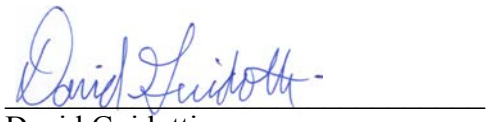

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REVISION HISTORY

Rev #	Date	Comments	Modified By
-	January 8, 2019	First release	-
1	February 19, 2019	Revised report to change model number from PTR2500 to PTR2300	David Guidotti

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SCOPE

Tests have been performed on the Nevro Corporation model Nevro Patient Remote, 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 Subpart I (Medical Device Radio Communication Service)

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 National Technical Systems test procedures:

ANSI C63.26:2015

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.

National Technical Systems is accredited by the A2LA, certificate number 0214.26, to perform the test(s) listed in this report, except where noted otherwise.

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.

STATEMENT OF COMPLIANCE

The tested samples of Nevro Corporation model Nevro Patient Remote complied with the requirements of the standards and frequency bands declared in the scope of this test report.

The test results recorded herein are based on a single type test of the Nevro Corporation model Nevro Patient Remote and therefore apply only to the tested samples. The samples were selected and prepared by Susan McGill of Nevro Corporation.

Testing was performed only on the PTR2300. This model was considered representative of the PTR2500. The PTR2500 has two additional program LEDs.

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) § 95.2563(a)	Frequency range(s)	402.45 – 404.55 MHz	402-405 MHz	Complied
§2.1033(c) (6) §2.1033(c) (7) §2.1046 §95.2567(a)(1)	EIRP (Calculated from Field Strength)	-25.6 dBm	–16dBm (25µW) Measured over a ground plane	Complied
§2.1033(c) (4)	Emission types	F1D	-	-
§2.1047 §95.2579(c)	Unwanted emissions	More than 20 dBc	> 20 dBc	Complied
§2.1049 §95.2573(a)	Authorized Bandwidth	250 kHz	300 kHz	Complied
Transmitter spurious emissions				
§2.1053 §2.1057 §95.2579(a)	Field strength	18.1 dBµV/m @ 30.00 MHz (-21.9 dB)	See table	Complied
Other details				
95.2559	Frequency Monitoring	LBT Threshold power level -109.3 dBm Monitoring system bandwidth > 20 dB EBW Monitoring system scan cycle time 1 second Monitoring system Minimum Channel monitoring period 0.1 ms / 10 ms Channel access based on ambient level above PTh Correct channel selection Discontinuation of MICS session < 5 seconds	LBT Threshold power level -109.3 dBm Monitoring system bandwidth > 20 dB EBW Monitoring system scan cycle time < 5 seconds Monitoring system Minimum Channel monitoring period 0.1 ms / 10 ms Channel access based on ambient level above PTh Correct channel selection Discontinuation of MICS session < 5 seconds	Complied
§2.1055 §95.2565	Frequency stability	14.1 ppm	100 ppm	Complied
§2.1093	RF Exposure	Refer to separate exhibit for SAR exemption	-	Complied
§2.1033 (c) (8)	Final radio frequency amplifying circuit's dc voltages and currents for normal operation over the power range	3V, 50mA		

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 2.2 Vdc as specified by the manufacturer.

The extremes of temperature were 0°C to +55°C as specified in FCC §95.2565(b) for stations in the Medical Device Radio Communication Service.

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}
RF power, conducted	dBm	25 to 7,000 MHz	± 0.52 dB
Conducted emission of transmitter	dBm	25 to 40,000 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 40,000 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 40,000 MHz	± 2.5 dB
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 model Nevro Patient Remote is a battery powered, hand-held transceiver that that is designed to communicate with either the IPG or the Trial Stimulator. Since the EUT could be placed in any position during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3 VDC supplied from replaceable batteries.

The samples were received on December 11, 2018 and tested on December 11 and 12, 2018. The following samples of the EUT were used for testing:

Company	Model	Description	Serial Number	FCC ID
Nevro Corporation	Nevro Patient Remote	Patient Remote	100120	XKYPTRD2500
Nevro Corporation	Nevro Patient Remote	Patient Remote	100101	XKYPTRD2500
Nevro Corporation	Nevro Patient Remote	Patient Remote	100118	XKYPTRD2500

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 3.3 cm wide by 2 cm deep by 14 cm high.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Nevro Corporation	NIPG2000	Implant	100912	XKYIPG2000

No remote 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)
None	-	-	-	-

EUT OPERATION

During emissions testing the EUT was commanded to transmit a modulated signal on the selected channel.

TESTING

GENERAL INFORMATION

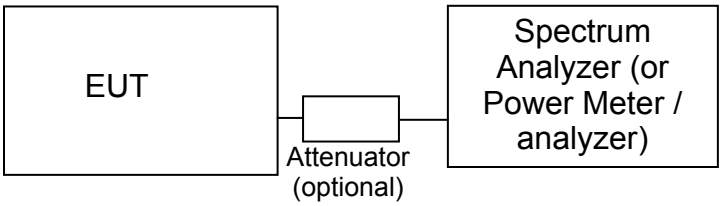
Radiated spurious emissions measurements were taken at the National Technical Systems Anechoic Chambers and/or Open Area Test Site(s) listed below. The sites conform to the requirements of ANSI C63.4: 2014 *American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage 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 5	769238	IC 2845B-5	41039 Boyce Road Fremont, CA 94538-2435

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. Results from testing performed in this chamber have been correlated with results from an open area test site. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

RF PORT MEASUREMENT PROCEDURES

Conducted measurements are performed with the EUT's rf input/output connected to the input of a spectrum analyzer, power meter or modulation analyzer. When required an attenuator, filter and/or dc block is placed between the EUT and the spectrum analyzer to avoid overloading the front end of the measurement device. Measurements are corrected for the insertion loss of the attenuators and cables inserted between the rf port of the EUT and the measurement equipment.



Test Configuration for Antenna Port Measurements

OUTPUT POWER

Output power is measured using a power meter and an average sensor head, a spectrum analyzer or a power meter and peak power sensor head as required by the relevant rule part(s). Where necessary measurements are gated to ensure power is only measured over periods that the device is transmitting.

Power measurements made directly on the rf power port are, when appropriate, converted to an EIRP by adding the gain of the highest gain antenna that can be used with the device under test, as specified by the manufacturer.

For devices with an integral antenna the output power is measured as a field strength at a test distance of (typically) 3m and then converted to an eirp using far field equations as shown in SAMPLE CALCULATIONS – RADIATED POWER.

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.

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.

RADIATED EMISSIONS MEASUREMENTS

Radiated spurious emissions measurements are made in accordance with ANSI C63.10:2015 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.

Table mounted devices are placed on a non-conductive table at a height of 80 or 150 centimeters above the floor depending on the frequency range. 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 –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 - 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 POWER

The erp/eirp limits for transmitter spurious measurements are converted to a field strength in free space using the following formula:

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

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.

Appendix A Test Equipment Calibration Data

Radiated Emissions, 25 - 4,050 MHz, 11-Dec-18

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	9/18/2018	9/18/2020
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	5/30/2017	5/30/2019
Com-Power	Preamplifier, 1-1000 MHz	PAM-103	2885	8/21/2018	8/21/2019
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/13/2018	10/13/2019

LBT, 12-Dec-18

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	5/31/2018	5/31/2019
Agilent Technologies	PSG, Vector Signal Generator, (250kHz - 20GHz)	E8267D	3011	2/26/2018	2/26/2019
Keysight Technologies	ESG Vector Signal Generator	E4438C	3254		N/A

Frequency Stability, 12-Dec-18

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	7/27/2018	7/27/2019
Agilent Technologies	Data Acquisition Unit	34972A	WC065127	6/20/2018	6/20/2019
Thermotron Corp.	Oven	S-1.2 Mini-Max	-		N/A

Appendix B Test Data

TL089302-RA Pages 20 - 37

Client:	Nevro Corporation	PR Number:	PR089302
Product	PTR2300	T-Log Number:	T089302-RA
System Configuration:	-	Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Engineer:	David Bare
Emissions Standard(s):	FCC Part 95 and EN 301 839	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Nevro Corporation

Product

PTR2300

Date of Last Test: 12/12/2018

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Radiated Emissions

(NTS Silicon Valley, Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

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

Date of Test: 12/11/2018
Test Engineer: David Bare
Test Location: Fremont Chamber #5
Config. Used: 1
Config Change: None
EUT Voltage: Battery

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: 20 °C
Rel. Humidity: 43 %

Summary of Results

Run #	Test Performed	Limit	Result	Value / Margin
2	Fundamental Signal Field Strength	FCC Part 95	Pass	75.6 dBuV/m (-25.6 dBm eirp)
2	Transmitter Radiated Spurious Emissions, 30 - 4,050 MHz	FCC Part 95	Pass	18.1 dBµV/m @ 30.00 MHz (-21.9 dB)
3	Spurious Emissions Receive/Stand-By Mode 30 - 1,300 MHz	FCC Part 15	Pass	18.1 dBµV/m @ 30.00 MHz (-21.9 dB)
4	Bandwidth	FCC Part 95	Pass	250 kHz (Limit is 300 kHz)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

Deviations, if any, are detailed under each run description.

Sample Notes

Sample S/N: 100120

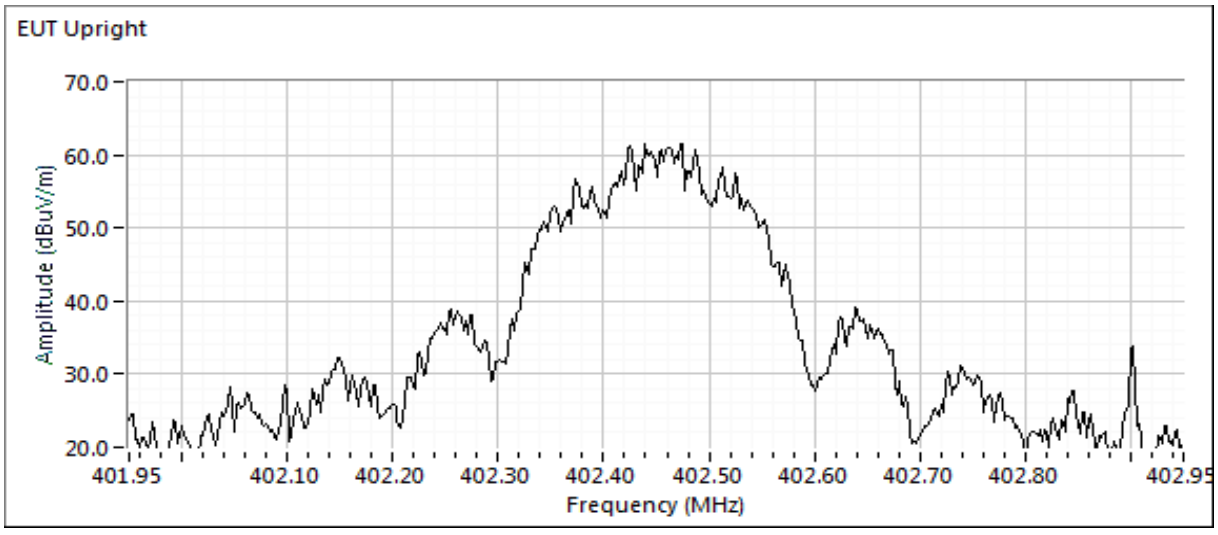
Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #1: Radiated Emissions, 30-4050 MHz, Fundamental and Transmitter Spurious Emissions
Tests were performed on the sample in three orientations to determine orientation with highest emissions.
The resuls showed that the highest emssions are with the device side on the support so the device was placed in this orientation for final tests.

Run #2: Radiated Emissions, 30-4050 MHz, Fundamental and Transmitter Spurious Emissions

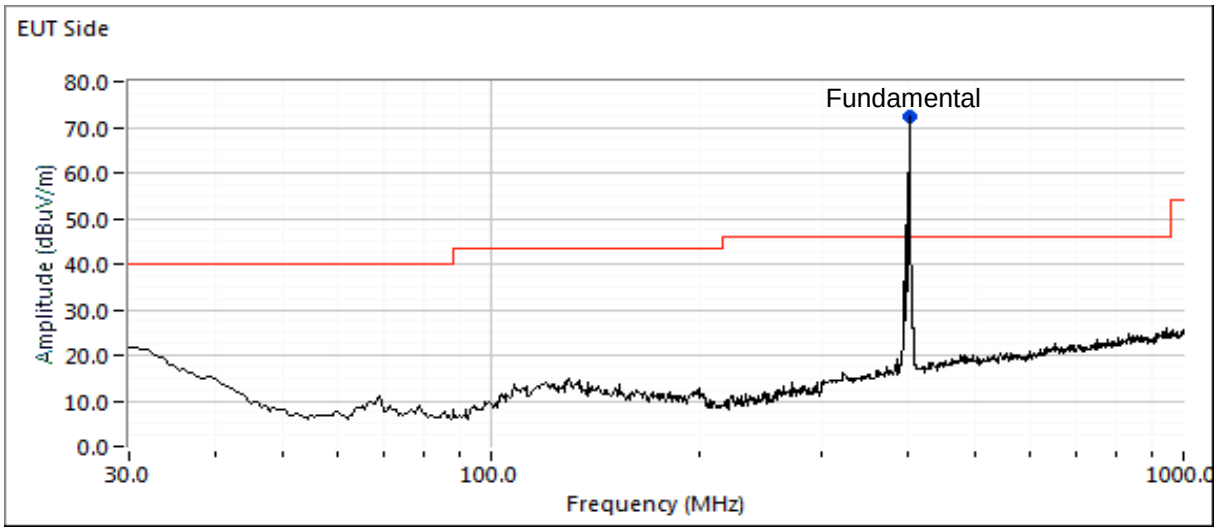
Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
30 - 4,050 MHz	3	3	0.0

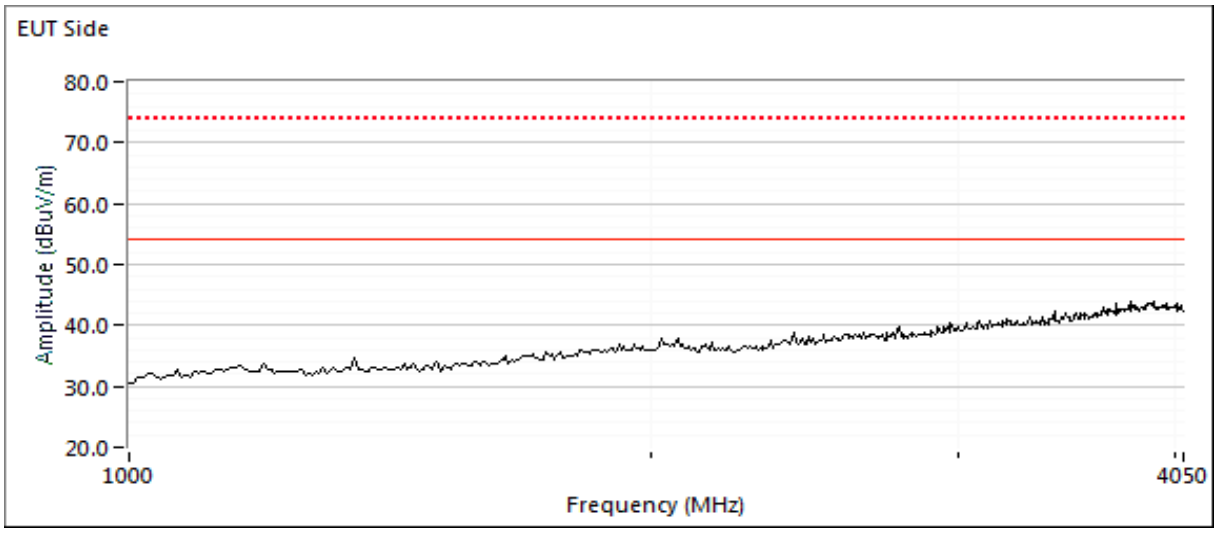
Note:	The limit in part 95 for the fundamental signal is 85.2 dBuV/m Peak. Spurious emissions must comply with the Part 95 limits which are the same as 15.209 limits except in the 250 kHz range adjacent to the 402-405 MHz band and in-band more than 150kHz from the fundamental frequency (65.2 dBuV/m in 3kHz RB).
Note:	The field strength of any spurious emissions may not exceed the field strength of the fundamental signal.
Note:	The frequency scans plot below are obtained using a peak detector. Final measurments are made at spedific frequecies observed during the scans using the detector specified after maximizing the amplitude of each emission.



In-band with RB=3 kHz, VB=10 kHz

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A





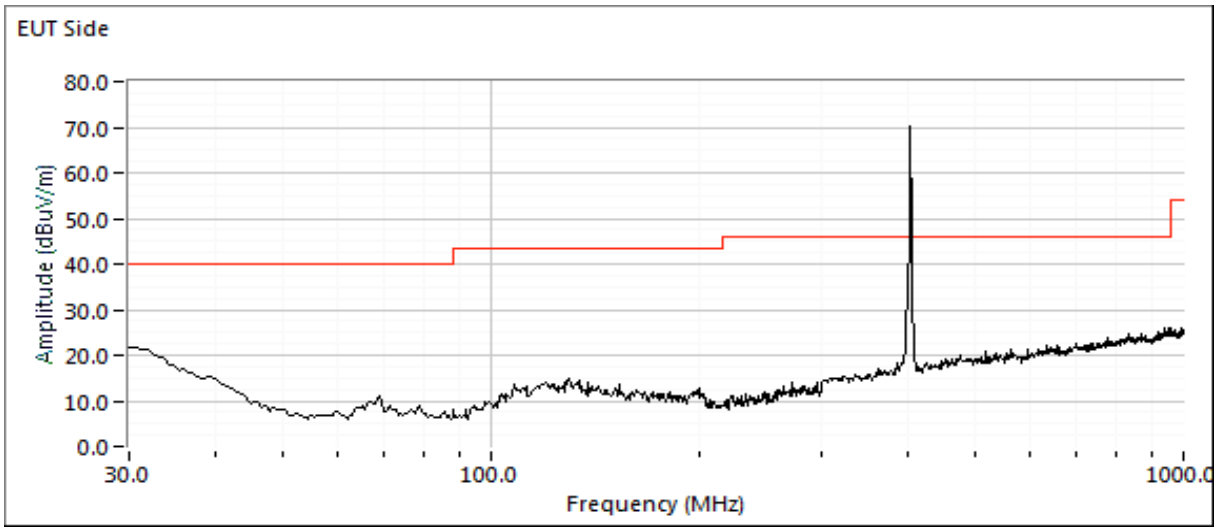
Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

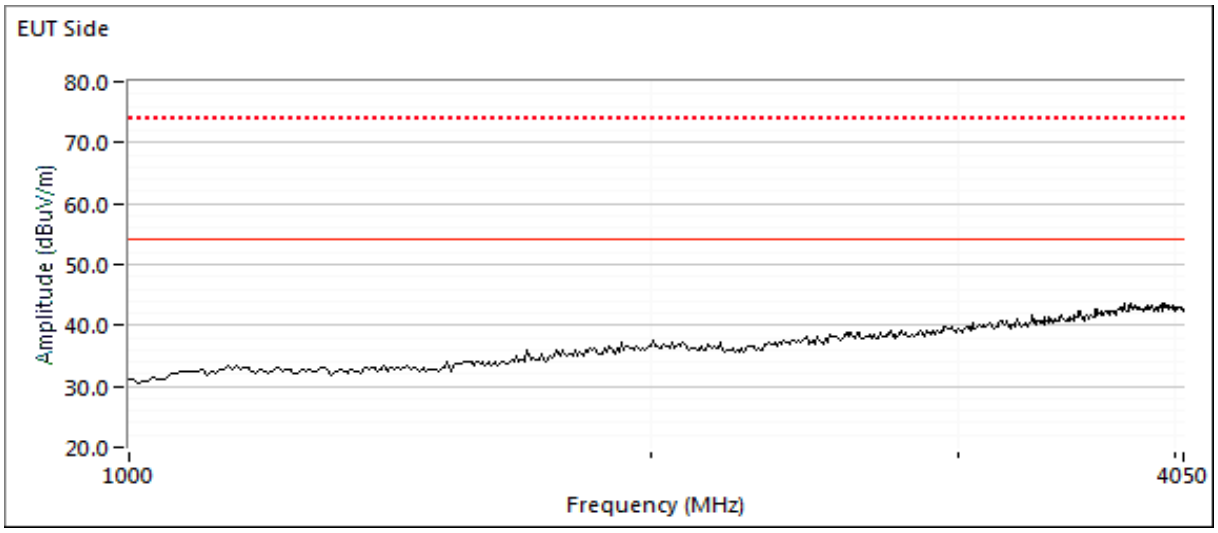
Low Channel 402.45MHz

Frequency	Level	Pol	FCC Part 95		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
Fundamental and inband maximized								
402.450	75.6	H	85.2	-9.6	Peak	12	1.0	RB=1 MHz
402.450	62.9	H	85.2	-22.3	Peak	12	1.0	RB=3 kHz
402.225	40.1	H	65.2	-25.1	Peak	12	1.0	RB=3 kHz; Note 1
402.675	40.4	H	65.2	-24.8	Peak	12	1.0	RB=3 kHz; Note 1
Preliminary spurious								
30.000	21.3	V	46.0	-24.7	Peak	143	1.5	RB=100 kHz
863.934	25.8	H	46.0	-20.2	Peak	224	3.5	RB=100 kHz
Final maximized spurious								
30.000	18.1	V	40.0	-21.9	QP	146	1.3	QP (1.00s)
863.934	19.5	H	46.0	-26.5	QP	228	3.3	QP (1.00s)

Note 1: Highest emission within 402-405 MHz band more than 150 kHz from the operating frequency.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A





Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

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	
Fundamental maximized								
404.550	73.6	H	85.2	-11.6	Peak	14	2.6	RB=1 MHz
404.550	62.0	H	85.2	-23.2	Peak	14	2.6	RB=3 kHz
404.250	38.4	H	65.2	-26.8	Peak	14	2.6	RB=3 kHz; Note 1
404.850	39.0	H	65.2	-26.2	Peak	14	2.6	RB=3 kHz; Note 1
Preliminary spurious								
829.907	24.7	H	46.0	-21.3	Peak	260	3.0	RB=100 kHz
30.000	21.8	V	40.0	-18.2	Peak	21	1.0	RB=100 kHz
Final maximized spurious								
30.000	18.0	V	40.0	-22.0	QP	18	1.0	QP (1.00s)
829.907	19.2	H	46.0	-26.8	QP	262	3.0	QP (1.00s)

Note 1:	Highest emission within 402-405 MHz band more than 150 kHz from the operating frequency.

Run #3: Radiated Spurious Emissions, Receive Mode, 30 - 1,300 MHz

Since all of the emisisons except the fundamental when the radio is transmitting must meet the receiver limits of Part 15, no additional test is required for receive mode.

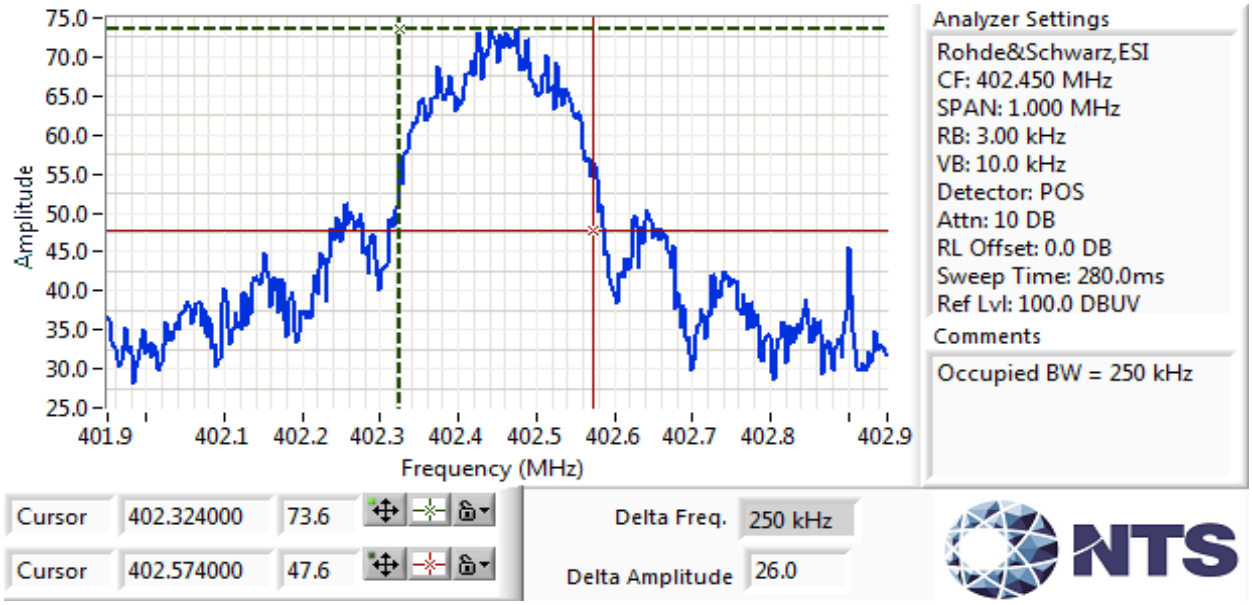
Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #4: Bandwidth Measurement

Date of Test:
Test Engineer:
Test Location: Fremont Chamber #

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

Frequency (MHz)	Resolution Bandwidth	Video Bandwidth	Bandwidth (kHz) 99%
402.45	3 kHz	10 kHz	250



Note 1:	99% bandwidth measured in accordance with ANSI C63.10, with RB between 1% and 5% of the measured bandwidth and VB ≥ 3*RB and Span ≥ 1.5% and ≤ 5% of measured bandwidth.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

FCC Part 95.2565 & EN 301 839
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

All measurements are made with the EUT's rf port connected to the measurement instrument via an attenuator or dc-block if necessary. For frequency stability measurements the EUT was placed inside an environmental chamber.

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 43 %

Summary of Results

Run #			Test Performed	Limit	Pass / Fail	Result / Margin
1			Frequency Stability	100ppm	Pass	14.1 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.

Sample Notes

Sample S/N: 100118

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #1: Frequency Stability

Date of Test: 12/12/2018 Config. Used: 1

Test Engineer: David Bare Config Change: None

Test Location: Frement EMC Lab #4B EUT Voltage: Battery

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.

Temperature	Frequency Measured	Drift	
(Celsius)	(MHz)	(Hz)	(ppm)
0	403.654417	4417	10.9
10	403.654200	4200	10.4
20	403.654250	4250	10.5
30	403.655700	5700	14.1
40	403.655000	5000	12.4
50	403.651467	1467	3.6
55	403.652900	2900	7.2
	Worst case:	5700	14.1

Frequency Stability Over Input Voltage

Nominal Voltage is 3.0 Vdc

Voltage	Frequency Measured	Drift		
(DC)	(MHz)	(Hz)	(ppm)	
2.2	403.653717	3717	9.2	Minimum designed operating voltage
2.55	403.653367	3367	8.3	85%
3.45	403.653150	3150	7.8	115%
	Worst case:	3367	8.3	

Note 1:	Maximum drift of fundamental frequency before it shut down at 0.4VDC was 2250 Hz

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

LBT, FCC Part 95 and EN 301 839

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.

Date of Test: 12/12/2018
Test Engineer: David Bare
Test Location: Fremont Chamber #2
Config. Used: 1
Config Change: None
EUT Voltage: Battery

General Test Configuration

All measurements are made with the EUT's temporary rf port connected to the signal generating and measurement instruments via combiners.

Ambient Conditions:

Temperature: 21 °C
Rel. Humidity: 43 %

Summary of Results

Run #		Test	Requirement / Limit	Result
1		LBT threshold power level	EUT shall select only the Least Interferred Channel (LIC)	Pass
2		Monitoring system bandwidth	>= 20 dB EBW	Pass
3		Monitoring system scan cycle time	<= 5 s	Pass
4		Monitoring system Minimum Channel monitoring period	0.1 ms / 10 ms	Pass
5		Channel access based on ambient level above PTh	Correct channel selection	Pass
6		Discontinuation of MICS session	<= 5 seconds	Pass
7		Use of pre-scanned alternative channel	The EUT does not use this feature	N/A

Modifications Made During Testing

The following modifications were made to the EUT prior to testing in order to facilitate testing:

The internal antenna was removed and a short coax to an SMA connector was connected instead to allow conducted testing. Special firmware was used to allow continuous attempts to establish a communication session.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

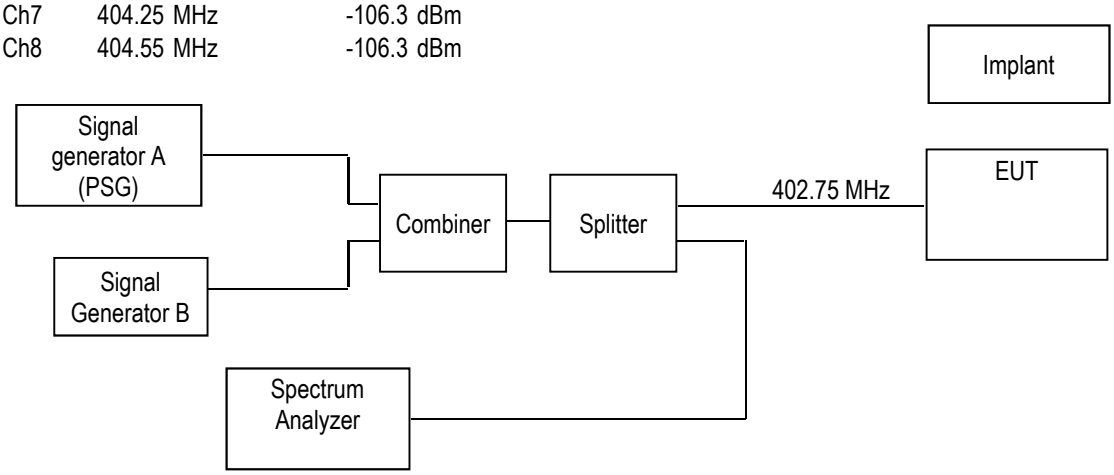
Sample S/N: 100101

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #1: LBT Threshold power level

Test Configuration Details:
Signal Generator A (PSG vector signal generator) was configured to produce 7 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45 MHz	-106.3 dBm	3 dB above minimum LBT threshold level
Ch2	402.75 MHz	Turned off	
Ch3	403.05 MHz	-106.3 dBm	
Ch4	403.35 MHz	-106.3 dBm	
Ch5	403.65 MHz	-106.3 dBm	
Ch6	403.95 MHz	-106.3 dBm	
Ch7	404.25 MHz	-106.3 dBm	
Ch8	404.55 MHz	-106.3 dBm	



EIRP = -19.6 dBm
Measured Power = -6.3 dBm

Calculated Antenna Gain: -13.3 dBi
Minimum LBT threshold power = 10 Log B (Hz) - 150 + G (dBi)
When B: 251000 Hz (20 dB bandwidth)
Minimum LBT threshold power = -109.3 dBm

EUT Mode:
The EUT was placed in search mode looking for an implanted device. At this amplitude, the EUT must initiate communications only on the channel 2 (402.75 MHz) not generated by the signal generator.

Test result:
The EUT complies with this requirement. EUT starts to initiate communication only at channel 2.
Note:
The EUT continued to seleect only channel 2 even with the output of the signal generator at 402.75 MHz switched on at a level of -107.3 dBm.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #2: Monitoring system bandwidth

Test Configuration Details:
A PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45 MHz	-106.3 dBm	3 dB above minimum LBT threshold level
Ch2	402.75 MHz	-103.3 dBm	Pa
Ch3	403.05 MHz	-106.3 dBm	
Ch4	403.35 MHz	-106.3 dBm	
Ch5	403.65 MHz	-106.3 dBm	
Ch6	403.95 MHz	-106.3 dBm	
Ch7	404.25 MHz	-106.3 dBm	
Ch8	404.55 MHz	-106.3 dBm	

Pa:	-102.3 dBm	@402.750 MHz			
Pb:	-94.3 dBm	@402.625 MHz	D1:	8.0 dB	Pass
Pc:	-92.3 dBm	@402.876 MHz	D2:	10.0 dB	Pass

Test Result
Pb – Pa = 8dB and Pc – Pa = 10dB, the EUT complies with the 20 dB monitoring bandwidth requirement.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #3: Monitoring system scan cycle time

Note: The EUT performs a clear channel assessment prior to initiating any transmission

Test Configuration Details:

A PSG signal generator was configured to produce 7 un-modulated carriers at 7 of the 8 channels with -82.7+3 dBm. An ESG signal generator was configured to produce 1 un-modulated carrier at channel 2 (402.75 MHz). The output of the generators were combined. The amplitude of the ESG generator was adjusted to be 3dB above the amplitude of the PSG generator.

Ch1	402.45 MHz	-106.3 dBm	3 dB above minimum LBT threshold level
Ch2	402.75 MHz	-103.3 dBm	Turned off after starting a communication session
Ch3	403.05 MHz	-106.3 dBm	
Ch4	403.35 MHz	-106.3 dBm	
Ch5	403.65 MHz	-106.3 dBm	
Ch6	403.95 MHz	-106.3 dBm	
Ch7	404.25 MHz	-106.3 dBm	
Ch8	404.55 MHz	-106.3 dBm	

The ESG generator output was switched off and the EUT was set to initiate a transmission. The EUT only transmitted at 402.75 MHz.

Test result:

The EUT transmitted on the clear channel 2 (402.75 MHz) within 1 second after the signal on that channel is switched off.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #4: Monitoring system Minimum Channel monitoring period

Test Configuration Details:
A PSG signal generator was configured to produce 8 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45 MHz	-103.3 dBm		
Ch2	402.75 MHz	-106.3 dBm	ESG	3 dB above minimum LBT threshold level
Ch3	403.05 MHz	-103.3 dBm		
Ch4	403.35 MHz	-103.3 dBm		
Ch5	403.65 MHz	-103.3 dBm		
Ch6	403.95 MHz	-103.3 dBm		
Ch7	404.25 MHz	-103.3 dBm		
Ch8	404.55 MHz	-103.3 dBm		

An ESG signal generator was configured to produce 1 un-modulated carrier at channel 2 (402.75 MHz). The output of the generators were combined. The amplitude of the ESG generator was adjusted to be equal to the amplitude of the PSG generator.
The output of the PSG generator was switched off and the EUT was set to initiate a transmission. The EUT did not transmit at 402.75 MHz. The output of the PSG was switched back on and the amplitude increased by 3 dB. The EUT was set to initiate a transmission. The EUT only transmitted at 402.75 MHz. The PSG generator was configured with pulse modulation on all the carriers. The modulation was 0.1 ms pulse with a repetition rate of 10 ms corresponding to a silent period between pulses of 9.9 ms. The EUT was set to initiate a transmission 10 times.

Test result:
The test has been repeated 10 times and the channel selection occurred only on channel 2 (402.75 MHz) in each test run.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #5: Channel access based on ambient level above PTh

Test Configuration Details:

The PSG signal generator was configured to produce 8 un-modulated carriers at 7 of the 8 channels at;

Ch1	402.45 MHz	-99.3 dBm	10 dB above minimum LBT threshold level
Ch2	402.75 MHz	-112.3 dBm	Increased: -103.3 dBm (ESG)
Ch3	403.05 MHz	-99.3 dBm	
Ch4	403.35 MHz	-99.3 dBm	
Ch5	403.65 MHz	-99.3 dBm	
Ch6	403.95 MHz	-99.3 dBm	
Ch7	404.25 MHz	-106.3 dBm	3 dB above minimum LBT threshold l
Ch8	404.55 MHz	-99.3 dBm	

An ESG signal generator was configured to produce 1 un-modulated carrier at channel 2 (402.75 MHz) with 3 dB below the threshold level.

The EUT was set to initiate a transmission, it only transmitted at 402.75 MHz. The amplitude of the ESG generator was increased 9 dB and the EUT was set to initiate a transmission. The EUT only selected channel 7 (404.25 MHz)

Test result:

The EUT complies with this requirement.

Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #6: Discontinuation of MICS session

MIC systems shall cease transmission in the event the communications session is interrupted for a period of 5 seconds or more. Once a MICS session is established, it may continue as long as a silent period in two-way communication between co-operating devices does not exceed 5 seconds

Test Configuration Details:

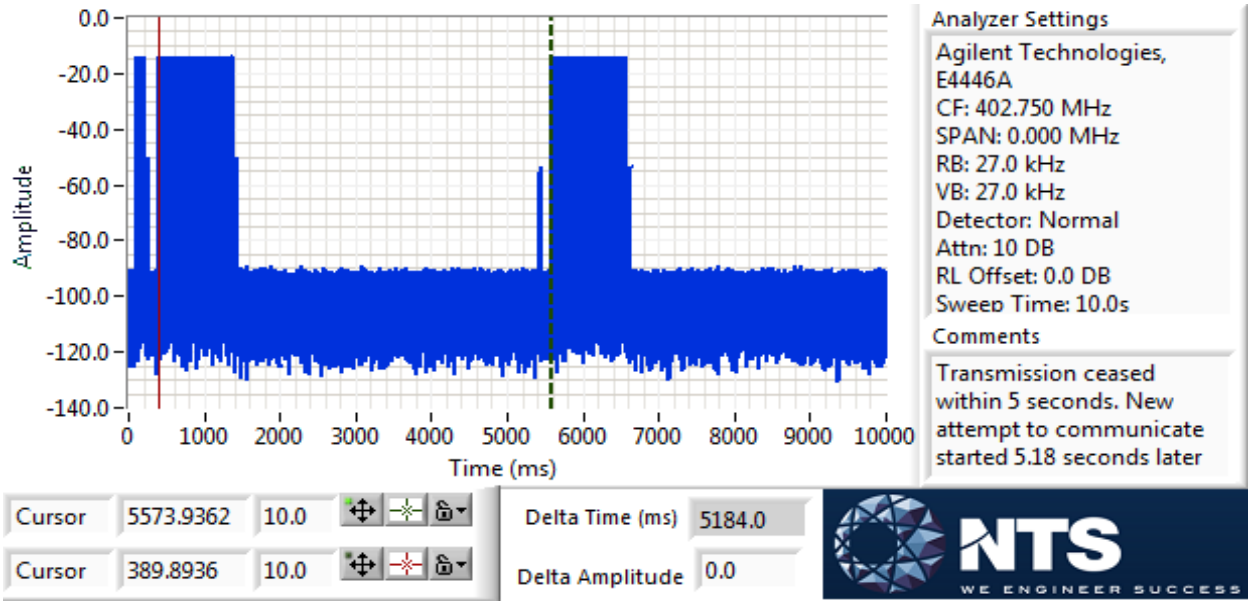
A PSG signal generator was configured to produce 8 un-modulated carriers at 7 of the 8 channels

Ch1	402.45 MHz	-99.3 dBm
Ch2	402.75 MHz	-112.3 dBm
Ch3	403.05 MHz	-99.3 dBm
Ch4	403.35 MHz	-99.3 dBm
Ch5	403.65 MHz	-99.3 dBm
Ch6	403.95 MHz	-99.3 dBm
Ch7	404.25 MHz	-106.3 dBm
Ch8	404.55 MHz	-99.3 dBm

An ESG signal generator was configured to produce 1 un-modulated carrier at channel 2 (402.75 MHz)
The EUT was set to initiate a transmission to communicate with the implant. The EUT transmitted at 402.75 MHz. The Implant was removed from the test setup to block the communications.. From the point in time when the Implant was blocked to the end of transmissions from the EUT was 5 seconds. After the implant is introduced to the test setup, no transmissions were observed.

Test result:

The transmissions from the EUT has stopped in less than 5 seconds and did not re-initiate, the EUT complied with this requirement



Client:	Nevro Corporation	Job Number:	PR089302
Model:	PTR2300	T-Log Number:	T089302-RA
		Project Manager:	Christine Krebill
Contact:	Susan McGill	Project Coordinator:	David Bare
Standard:	FCC Part 95 and EN 301 839	Class:	N/A

Run #7: Use of pre-scanned alternative channel

The test is not applicable, The EUT does not use this feature

Test result: N/A

End of Report

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