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EMC Test Report

Application for Grant of Equipment Authorization

FCC Part 15 Subpart C

Model: DynaSense Patient Sensor

FCC ID:	2AAG7-1116AG
APPLICANT:	Centauri Medical, Inc. 37100 Central Court Newark, CA 94560
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
REPORT DATE:	July 9, 2013
FINAL TEST DATES:	June 7 and 10, 2013
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ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	07-09-2013	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Centauri Medical, Inc. model DynaSense Patient Sensor, pursuant to the following rules:

FCC Part 15 Subpart C

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 - Silicon Valley test procedures:

ANSI C63.10-2009
FCC DTS Measurement Guidance KDB 558074

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

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

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.

OBJECTIVE

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

Prior to marketing in the USA, all unlicensed transmitters and transceivers require certification. Receive-only devices operating between 30 MHz and 960 MHz are subject to either certification or a manufacturer's declaration of conformity, with all other receive-only devices exempt from the technical requirements.

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 Centauri Medical, Inc. model DynaSense Patient Sensor complied with the requirements of the following regulations:

FCC Part 15 Subpart C

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.

The test results recorded herein are based on a single type test of Centauri Medical, Inc. model DynaSense Patient Sensor and therefore apply only to the tested sample. The sample was selected and prepared by Matt Hammond of Centauri Medical, Inc.

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 210 A8.2	Digital Modulation	Systems uses DSSS techniques, Refer to operational description	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	1.5 MHz	>500kHz	Complies
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	2.0 dBm (0.0016 Watts) EIRP = 0.0016 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(d)	RSS 210 A8.2 (2)	Power Spectral Density	-12.2 dBm / 3kHz	8dBm/3kHz	Complies
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	53.7 dBµV/m @ 9916.7 MHz (-4.3 dB)	15.207 in restricted bands, all others <-30dBc Note 2	Complies

Note 1: EIRP calculated using antenna gain of 0dBi for the highest EIRP system.
Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Integral antenna	Unique or integral antenna required	Complies
15.207	RSS GEN Table 2	AC Conducted Emissions	-	Refer to page 15	n/a
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Meets standalone SAR exclusion for 5mm separation Calculation yields 0.5 which is less than 3.0 per KDB 447498	Refer to OET 65, FCC Part 1 and RSS 102	Complies

MEASUREMENT UNCERTAINTIES

ISO/IEC 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 and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
Radiated emission (field strength)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Centauri Medical, Inc. model DynaSense Patient Sensor is the Patient Sensor portion of the DynaSense system that is designed to monitor the orientation of a patient and relay this orientation information along with an identifier associated with the Patient Sensor's serial number to a computer running the user interface to track patients. Since the EUT could be placed in any position during use, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The Patient Sensor runs off of a 3 V coin-cell battery and consumes < 100 mA peak.

The sample was received on May 29, 2013 and tested on June 7 and 10, 2013. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Centauri Medical, Inc.	DynaSense Patient Sensor	Patient Sensor	-	2AAG7-1116AG

ANTENNA SYSTEM

The antenna system consists of an on board 0dBi chip antenna.

ENCLOSURE

The Patient Sensor enclosure is primarily constructed of Polystyrene. It measures approximately 9.8 cm wide by 1.0 cm deep by 6.0 cm deep.

MODIFICATIONS

No modifications were made to the EUT during the time the product was at NTS Silicon Valley.

SUPPORT EQUIPMENT

An external battery was used to facilitate testing as the internal battery has very low capacity as the device does not transmit continuously in use.

EUT OPERATION

During emissions testing the EUT was set to transmit continuously (>99%) at the maximum power on the selected channel.

TEST SITE

GENERAL INFORMATION

Final test measurements were taken at the test sites listed below. Pursuant to section 2.948 of the FCC's Rules and section 3.3 of RSP-100, construction, calibration, and equipment data has been filed with the Commission and with industry Canada.

Site	Registration Numbers		Location
	FCC	Canada	
Chamber 4	211948	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 7	A2LA accreditation	2845B-7	

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. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent requirements of ANSI C63.4.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.10. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment or in a semi-anechoic chamber. The test sites are maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines and meet the Normalized Site Attenuation (NSA) requirements of ANSI C63.4.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 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. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz, unless the signal is pulsed in which case the average (or video) bandwidth of the measuring instrument is reduced to onset of pulse desensitization and then increased.

INSTRUMENT CONTROL COMPUTER

The receivers utilize either a Rohde & Schwarz EZM Spectrum Monitor/Controller or contain an internal Spectrum Monitor/Controller to view and convert the receiver measurements to the field strength at an antenna or voltage developed at the LISN measurement port, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate. A personal computer is used to record all measurements made with the receivers.

The Spectrum Monitor provides a visual display of the signal being measured. In addition, the controller or a personal computer run automated data collection programs which control the receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The LISN used also contains a 250 uH CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

FILTERS/ATTENUATORS

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

ANTENNAS

A loop antenna is used below 30 MHz. For the measurement range 30 MHz to 1000 MHz either a combination of a biconical antenna and a log periodic or a bi-log antenna is used. Above 1000 MHz, horn antennas are used. The antenna calibration factors to convert the received voltage to an electric field strength are included with appropriate cable loss and amplifier gain factors to determine an overall site factor, which is then programmed into the test receivers or incorporated into the test software.

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. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An exhibit of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The regulations require that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.10, and the worst-case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

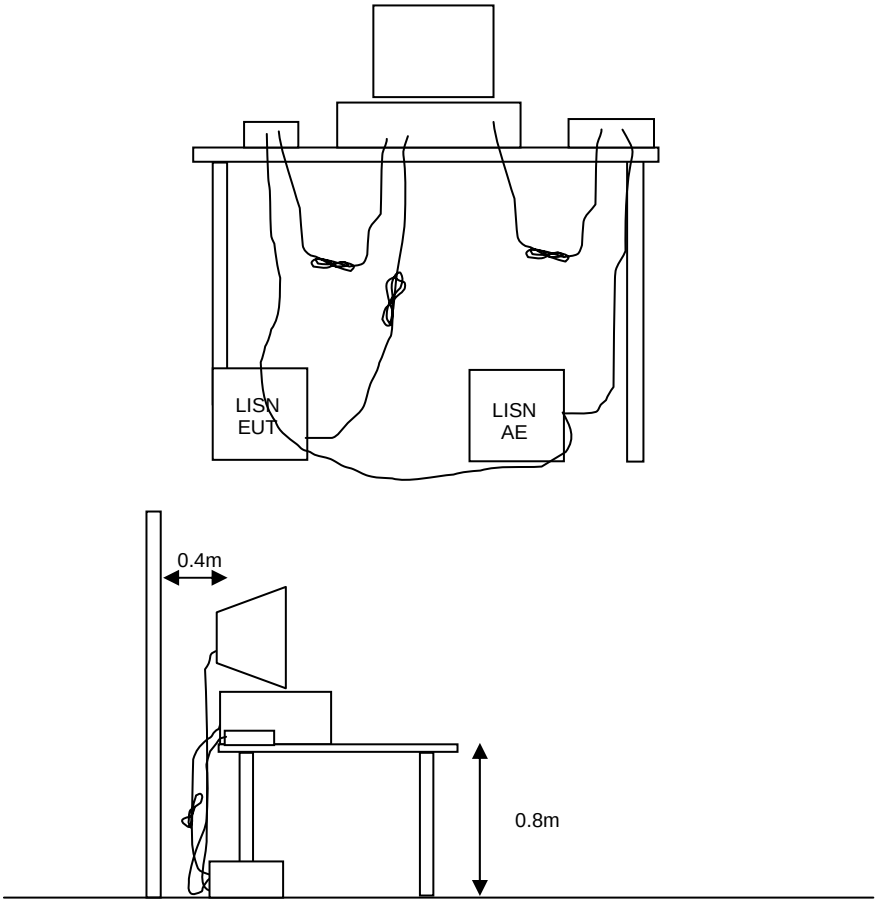


Figure 1 Typical Conducted Emissions Test Configuration

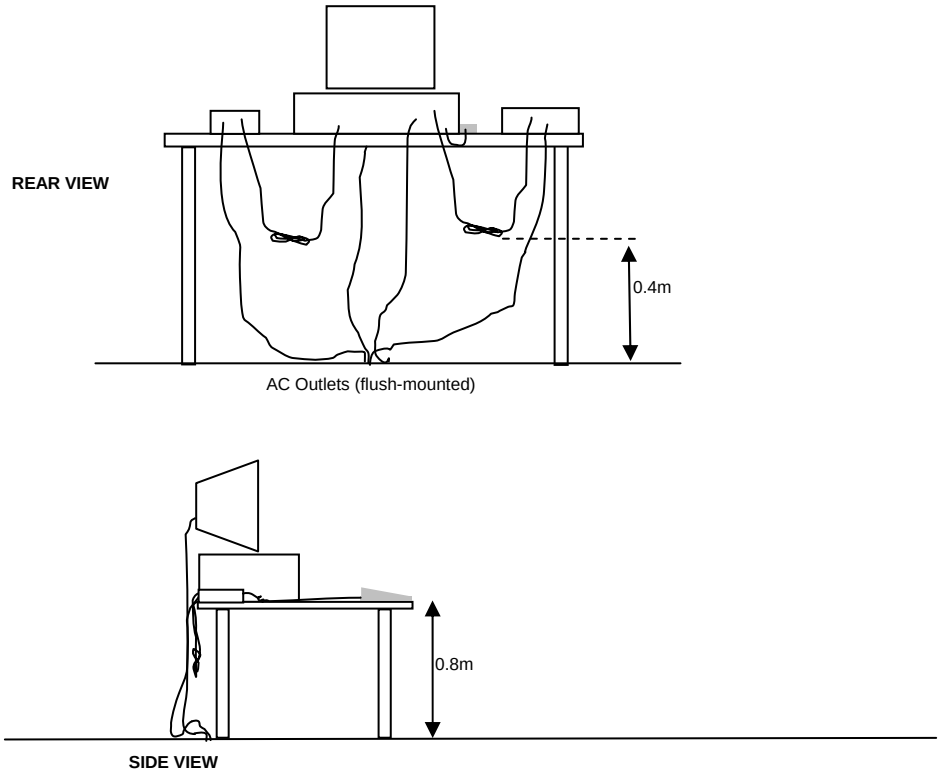
RADIATED EMISSIONS

A preliminary scan of the radiated emissions is performed in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed, one scan for each antenna polarization (horizontal and vertical; loop parallel and perpendicular to the EUT). During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied (for measurements above 30 MHz) and cable positions are varied to determine the highest emission relative to the limit. Preliminary scans may be performed in a fully anechoic chamber for the purposes of identifying the frequencies of the highest emissions from the EUT.

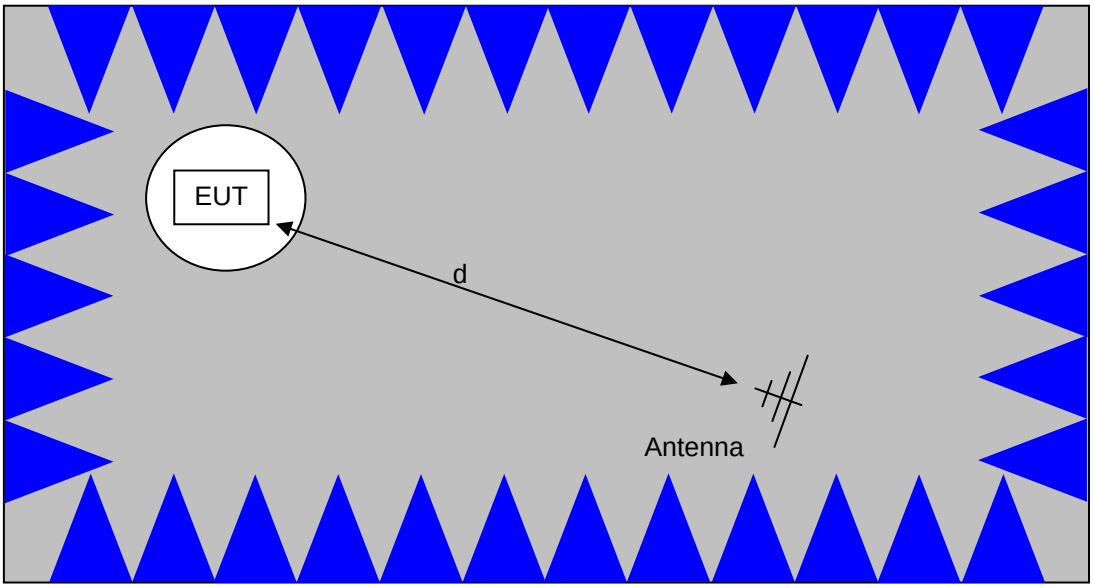
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth, which results in the highest emission is then maintained while varying the antenna height from one to four meters (for measurements above 30 MHz, measurements below 30 MHz are made with the loop antenna at a fixed height of 1m). The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain.

When testing above 18 GHz, the receive antenna is located at 1meter from the EUT and the antenna height is restricted to a maximum of 2.5 meters.

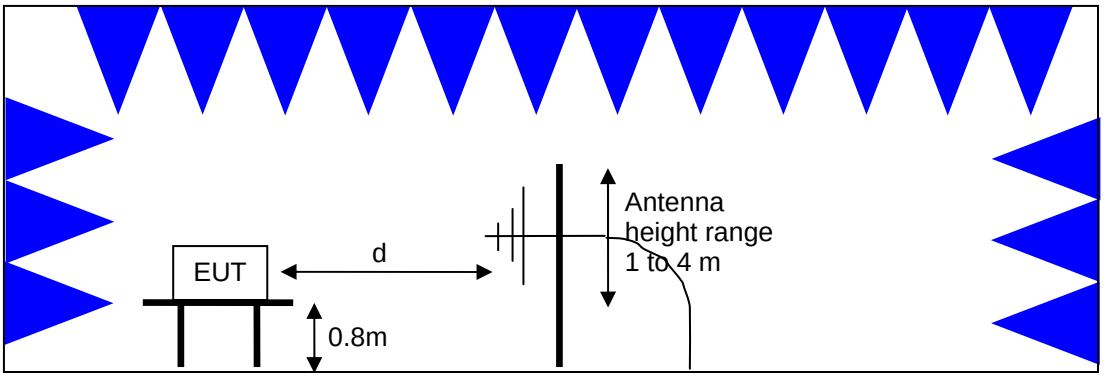


Typical Test Configuration for Radiated Field Strength Measurements



The anechoic materials on the walls and ceiling ensure compliance with the normalized site attenuation requirements of CISPR 16 / CISPR 22 / ANSI C63.4 for an alternate test site at the measurement distances used.

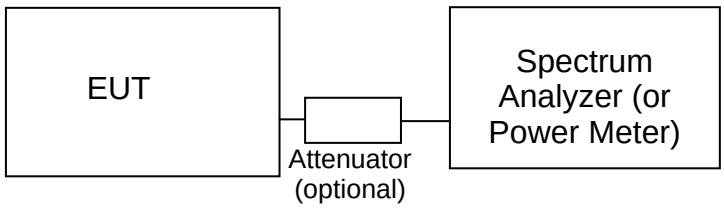
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



Test Configuration for Radiated Field Strength Measurements
Semi-Anechoic Chamber, Plan and Side Views

CONDUCTED EMISSIONS FROM ANTENNA PORT

Direct measurements of power, bandwidth and power spectral density are performed, where possible, with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.



Test Configuration for Antenna Port Measurements

Measurement bandwidths (video and resolution) are set in accordance with the relevant standards and NTS Silicon Valley's test procedures for the type of radio being tested. When power measurements are made using a resolution bandwidth less than the signal bandwidth the power is calculated by summing the power across the signal bandwidth using either the analyzer channel power function or by capturing the trace data and calculating the power using software. In both cases the summed power is corrected to account for the equivalent noise bandwidth (ENBW) of the resolution bandwidth used.

If power averaging is used (typically for certain digital modulation techniques), the EUT is configured to transmit continuously. Power averaging is performed using either the built-in function of the analyzer or, if the analyzer does not feature power averaging, using external software. In both cases the average power is calculated over a number of sweeps (typically 100). When the EUT cannot be configured to continuously transmit then either the analyzer is configured to perform a gated sweep to ensure that the power is averaged over periods that the device is transmitting or power averaging is disabled and a max-hold feature is used.

If a power meter is used to make output power measurements the sensor head type (peak or average) is stated in the test data table.

BANDWIDTH MEASUREMENTS

The 6dB, 20dB, 26dB and/or 99% signal bandwidth are measured using the bandwidths recommended by ANSI C63.10 and RSS GEN.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(a), RSS GEN

The table below shows the limits for the emissions on the AC power line from an intentional radiator and a receiver.

Frequency (MHz)	Average Limit (dBuV)	Quasi Peak Limit (dBuV)
0.150 to 0.500	Linear decrease on logarithmic frequency axis between 56.0 and 46.0	Linear decrease on logarithmic frequency axis between 66.0 and 56.0
0.500 to 5.000	46.0	56.0
5.000 to 30.000	50.0	60.0

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

Frequency Range (MHz)	Limit (uV/m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100 @ 3m	40 @ 3m
88 to 216	150 @ 3m	43.5 @ 3m
216 to 960	200 @ 3m	46.0 @ 3m
Above 960	500 @ 3m	54.0 @ 3m

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3kHz

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5850 MHz band are not subject to this restriction.

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

The limits for unwanted (spurious) emissions from the transmitter falling in the restricted bands are those specified in the general limits sections of FCC Part 15 and RSS 210. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

[1] The restricted bands are detailed in FCC 15.203, RSS 210 Table 1 and RSS 310 Table 2

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally 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, when used for electric field measurements above 30MHz, is calculated 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:

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

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

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 - FIELD STRENGTH TO EIRP CONVERSION

Where the radiated electric field strength is expressed in terms of the equivalent isotropic radiated power (eirp), or where a field strength measurement of output power is made in lieu of a direct measurement, the following formula is used to convert between eirp and field strength at a distance of d (meters) from the equipment under test:

$$E = \frac{1000000 \sqrt{30 P}}{d} \quad \text{microvolts per meter}$$

where P is the eirp (Watts)

For a measurement at 3m the conversion from a logarithmic value for field strength (dBuV/m) to an eirp power (dBm) is -95.3dB.

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Cal Due
Radiated Emissions, 1,000 - 26,500 MHz, 07-Jun-13				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/9/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/12/2013
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	10/4/2013
Radiated Emissions, 30 - 26,500 MHz, 10-Jun-13				
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/9/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/12/2013
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	8/9/2014
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	1780	12/5/2013
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	10/4/2013
Com-Power	Preamplifier, 30-1000 MHz	PA-103A	2359	2/20/2014

Appendix B Test Data

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Client:	Centauri Medical, Inc.	Job Number:	J92426
Product	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	-
Emissions Standard(s):	FCC 15.247	Class:	-
Immunity Standard(s):	-	Environment:	Radio

EMC Test Data

For The

Centauri Medical, Inc.

Product

DynaSense Patient Sensor

Date of Last Test: 6/13/2013

Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

RSS 210 and FCC 15.247 (DTS) Radiated Measurements

Power, PSD, Bandwidth

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: 6/7/2013
Test Engineer: M. Birgani
Test Location: Chamber #4

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

General Test Configuration

The EUT was located on a turntable in a semi-anechoc chamber for testing.

All measurements have been corrected to allow for the external attenuators used.

Ambient Conditions:

Temperature: 20-23 °C
Rel. Humidity: 35-40 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	14		Output Power	15.247(b)	PASS	2.0 dBm
2	14		Power spectral Density (PSD)	15.247(d)	PASS	-12.2 dBm/3kHz
3	14		Minimum 6dB Bandwidth	15.247(a)	PASS	1.5 MHz
3	14		99% Bandwidth	RSS GEN	-	3.0 MHz

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.

Test Notes

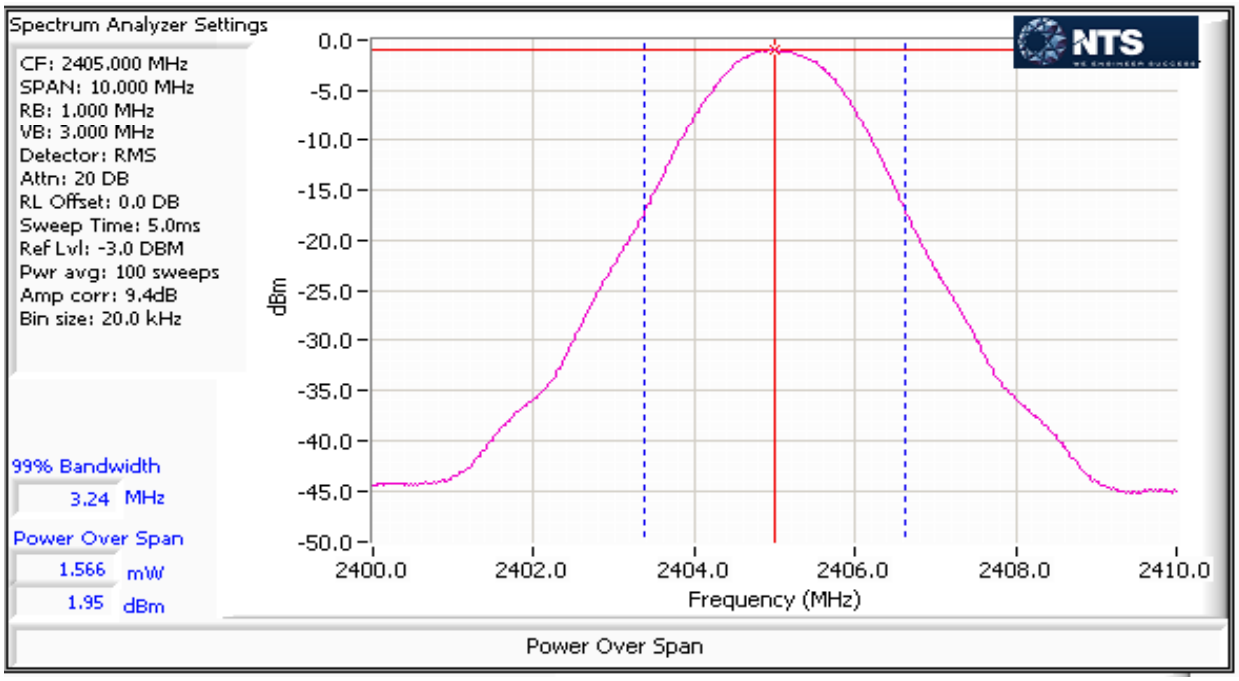
Measurements performed using a radiated setup and converted to radiated power using the relationship E = Square root of 30 times EIRP divided by the test distance. (i.e. $PSD_{(EIRP)}$ = E-95.2 for 3 meter test distance.). Conducted power is computed from radiated power by subtracting the antenna gain. Duty cycle is > 99%.

Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #1: Output Power

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[1]	Output Power mW	Antenna Gain (dBi)	Result	EIRP[Note 3] dBm	EIRP W
14	2405	2.0	1.6	0.0	Pass	2.0	0.002
14	2445	-0.8	0.8	0.0	Pass	-0.8	0.001
14	2480	-2.8	0.5	0.0	Pass	-2.8	0.001

Note 1:	Output power measured using a spectrum analyzer (see plots below) with RBW=1MHz, VB=3 MHz, RMS detector, power averaging on (transmitted signal duty cycle ≥ 98%) and power integration over 10MHz (method AVGSA-1 in KDB 558074). Spurious limit becomes -30dBc. The 1 MHz RBW is greater than 5% of the 99% BW. This gives a higher value than would be obtained using the 5% value.
Note 2:	Power setting - the software power setting used during testing, included for reference only.
Note 3:	Measured. May not exceed the de-facto EIRP limit.
Note 4:	EUT oriented Flat as this orientation produced the highest measured radiated power.

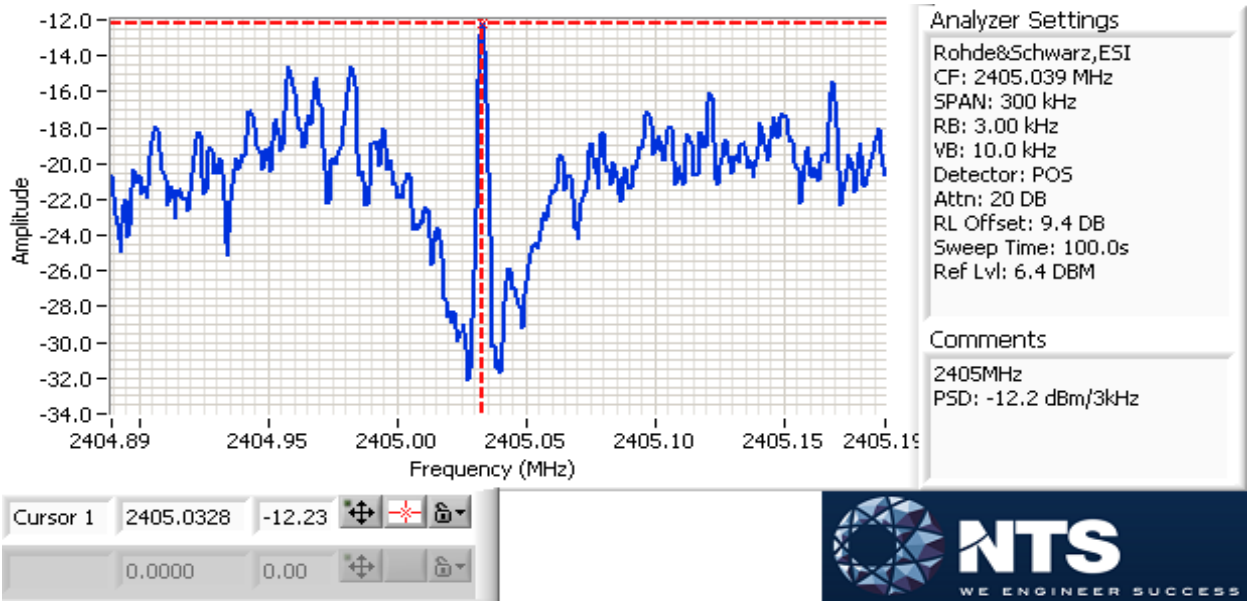


Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #2: Power spectral Density

Power Setting	Frequency (MHz)	PSD (dBm/3kHz) Note 1	Limit dBm/3kHz	Result
14	2405	-12.2	8.0	Pass
14	2445	-17.6	8.0	Pass
14	2480	-19.7	8.0	Pass

Note 1:	Power spectral density measured using RB=3 kHz, VB=10kHz, analyzer with peak detector and with a sweep time set to ensure a dwell time of at least 1 second per 3kHz. The measurement is made at the frequency of PPSD determined from preliminary scans using RB=3kHz using multiple sweeps at a faster rate over the 6dB bandwidth of the signal.



Client:	Centauri Medical, Inc.	Job Number:	J92426
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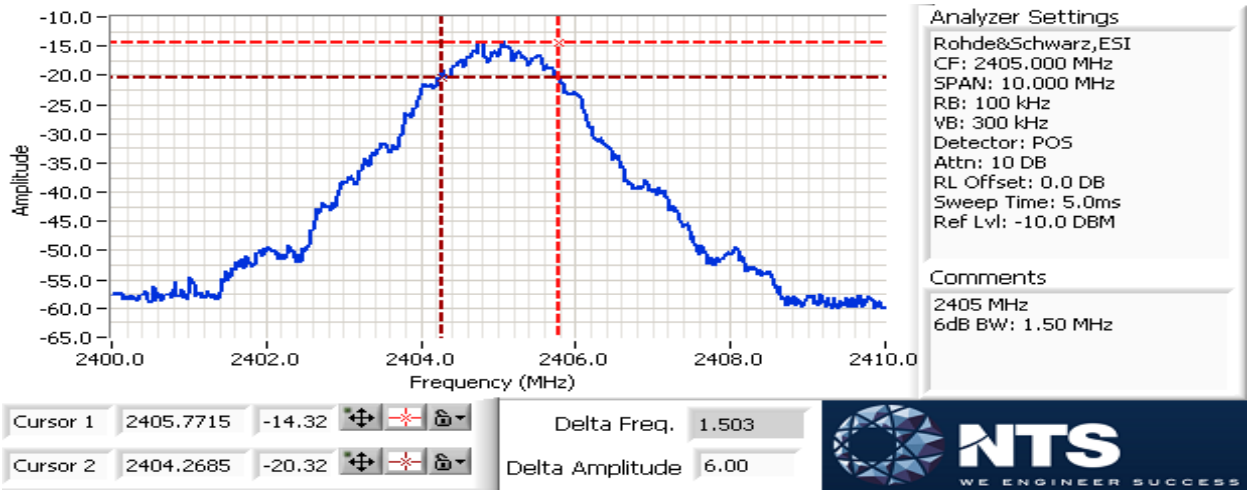
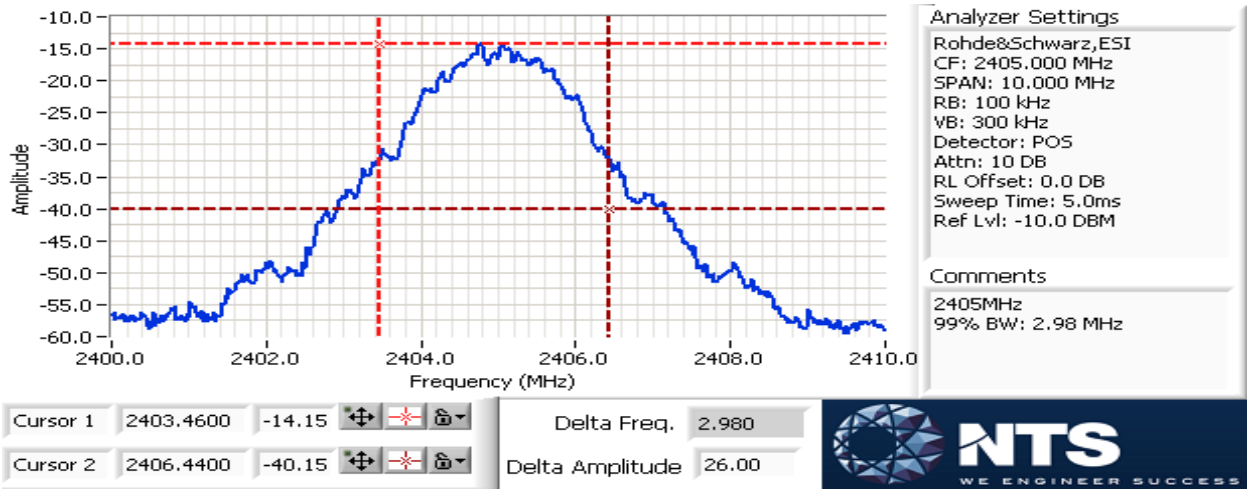
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #3: Signal Bandwidth

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz) 6dB	Resolution Bandwidth	Bandwidth (MHz) 99%
Max	2405	100 kHz	1.5	100 kHz	3.0
Max	2440	100 kHz	1.5	100 kHz	2.7
Max	2480	100 kHz	1.6	100 kHz	2.7

Note 1:	6dB bandwidth measured in accordance with KDB 558074, with RB = 100kHz and VB ≥ 3 x RB. See sample plot below.
Note 2:	99% bandwidth measured in accordance with RSS GEN, with RB > 1% of the span and VB ≥ 3 x RB. See sample plot below.





Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

RSS 210 and FCC 15.247 (DTS) Radiated Spurious 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 spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT.

Ambient Conditions:

Temperature: 20-23 °C

Rel. Humidity: 35-40 %

Summary of Results - Device Operating in the 2400-2483.5 MHz Band

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1a		11	14		Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	45.5 dBµV/m @ 2373.2 MHz (-8.5 dB)
			14		Radiated Emissions 30 - 25 GHz	FCC Part 15.209 / 15.247(c)	44.8 dBµV/m @ 4811.0 MHz (-9.2 dB)
1b		19	14		Radiated Emissions 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	46.9 dBµV/m @ 4891.1 MHz (-7.1 dB)
1c		26	14		Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	48.4 dBµV/m @ 2483.5 MHz (-5.6 dB)
			14		Radiated Emissions 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	53.7 dBµV/m @ 9916.7 MHz (-4.3 dB)

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:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #1: Radiated Spurious Emissions, 30 - 25000 MHz.

Run #1a: Low Channel @ 2405 MHz

Date of Test: 6/7/2013 and 6/10/2013 Test Location: Chamber #4

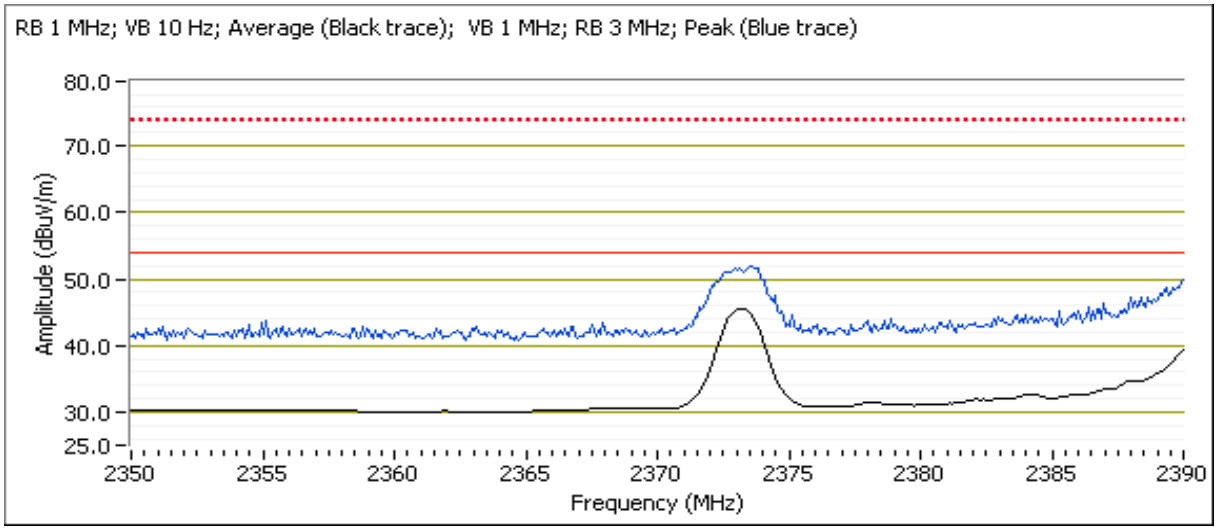
Test Engineer: M. Birgani

2405MHz

Fundamental emission level @ 3m in 100kHz RBW:	90.9	dBµV/m	
Limit for emissions outside of restricted bands:	60.9	dBµV/m	Limit is -30dBc (Average power measurement)

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
2373.170	45.5	H	54.0	-8.5	AVG	327	1.0	POS; RB 1 MHz; VB: 10 Hz
2372.770	51.8	H	74.0	-22.2	PK	327	1.0	POS; RB 1 MHz; VB: 3 MHz



Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Other Spurious Emissions

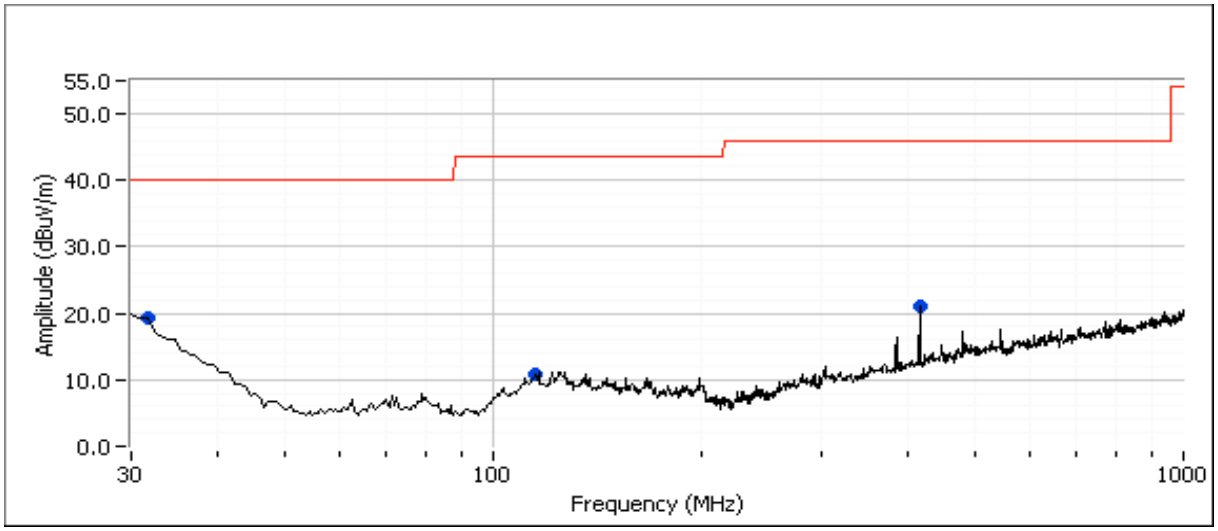
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
115.491	6.2	V	43.5	-37.3	QP	360	4.0	Side	Power: 14
415.030	7.7	V	46.0	-38.3	QP	98	0.9	Side	Power: 14
31.623	13.9	H	40.0	-26.1	QP	0	0.9	Side	Power: 14
4811.040	44.8	V	54.0	-9.2	AVG	148	1.0	Side	Power: 14
4809.310	51.5	V	74.0	-22.5	PK	148	1.0	Side	Power: 14
4811.050	44.8	H	54.0	-9.2	AVG	311	1.0	Side	Power: 14
4810.890	52.4	H	74.0	-21.6	PK	311	1.0	Side	Power: 14
9625.000	51.6	V	60.9	-9.3	PK	78	1.0	Side	Power: 14 Unrestricted

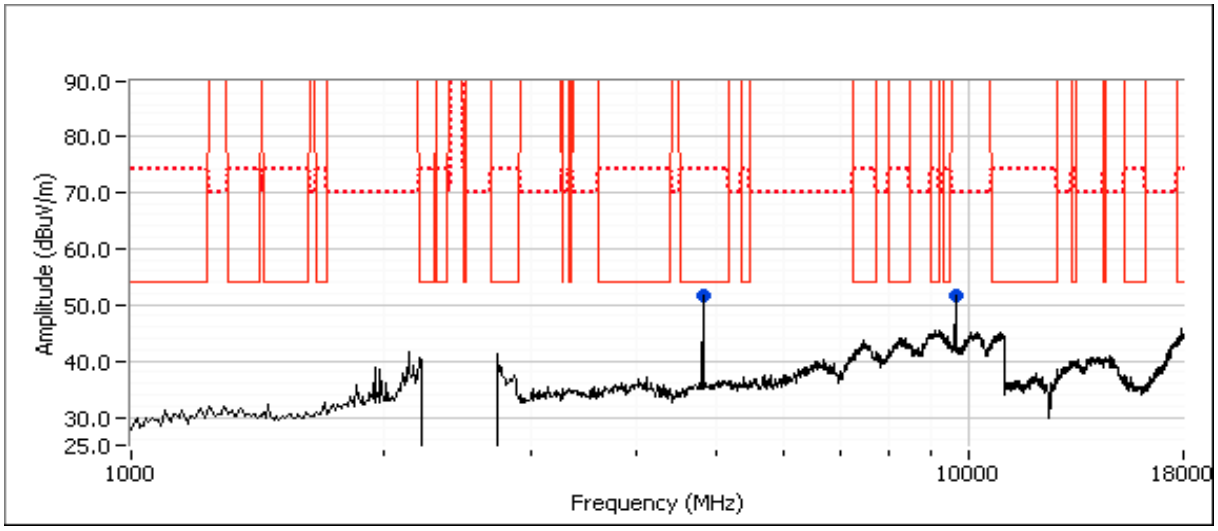
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
4808.620	43.2	V	54.0	-10.8	AVG	346	1.0	Upright	Power: 14
4811.380	47.8	V	74.0	-26.2	PK	346	1.0	Upright	Power: 14
4811.030	42.4	H	54.0	-11.6	AVG	20	1.0	Upright	Power: 14
4809.400	49.9	H	74.0	-24.1	PK	20	1.0	Upright	Power: 14

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
4811.050	40.0	V	54.0	-14.0	AVG	128	0.9	Flat	Power: 14
4811.250	47.8	V	74.0	-26.2	PK	128	0.9	Flat	Power: 14
4811.000	44.0	H	54.0	-10.0	AVG	72	1.0	Flat	Power: 14
4809.520	51.0	H	74.0	-23.0	PK	72	1.0	Flat	Power: 14

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	18-26GHz was tested with antenna 30cm away from the unit, no significant signal was found.

Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-





Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #1b: Center Channel @ 2445 MHz

Date of Test: 6/10/2013 Test Location: Chamber #4

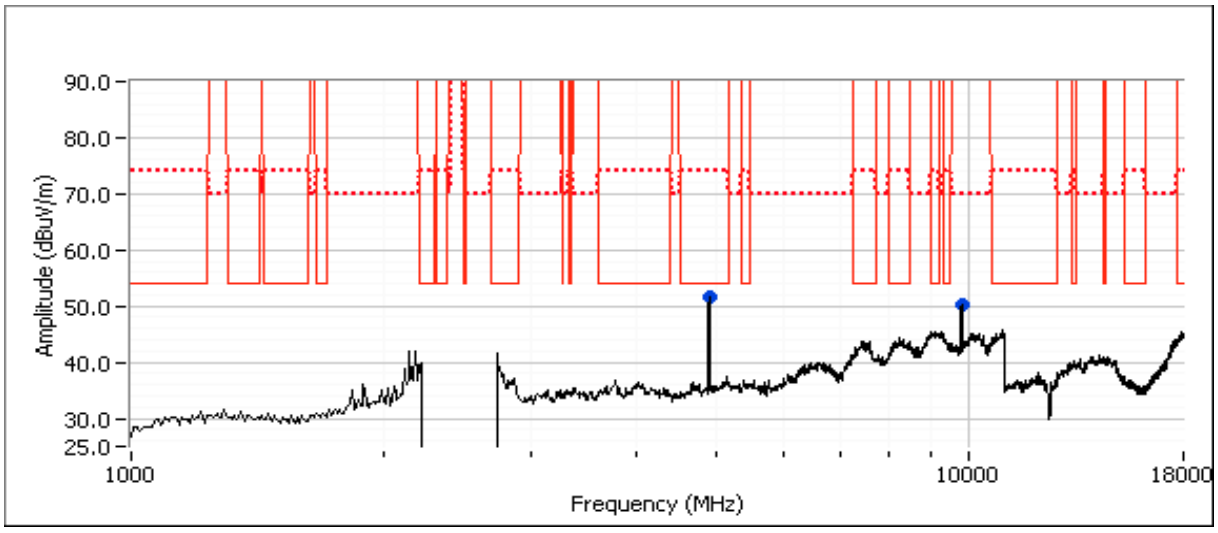
Test Engineer: M. Birgani

2445MHz

Fundamental emission level @ 3m in 100kHz RBW:	87.3	dBµV/m	
Limit for emissions outside of restricted bands:	57.3	dBµV/m	Limit is -30dBc (Average power measurement)

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
4891.050	46.9	H	54.0	-7.1	AVG	359	1.3	Side	Power: 14
4891.270	54.4	H	74.0	-19.6	PK	359	1.3	Side	Power: 14
9783.330	50.2	H	57.3	-7.1	PK	46	1.0	Side	Power: 14 Unrestricted

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	18-26GHz was tested with antenna 30cm away from the unit, no significant signal was found.
Note 4:	No emissions observed from the radio in the 30-1000 MHz band.



Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Run #1c: High Channel @ 2480 MHz

Date of Test: 6/10/2013 Test Location: Chamber #4

Test Engineer: M. Birgani

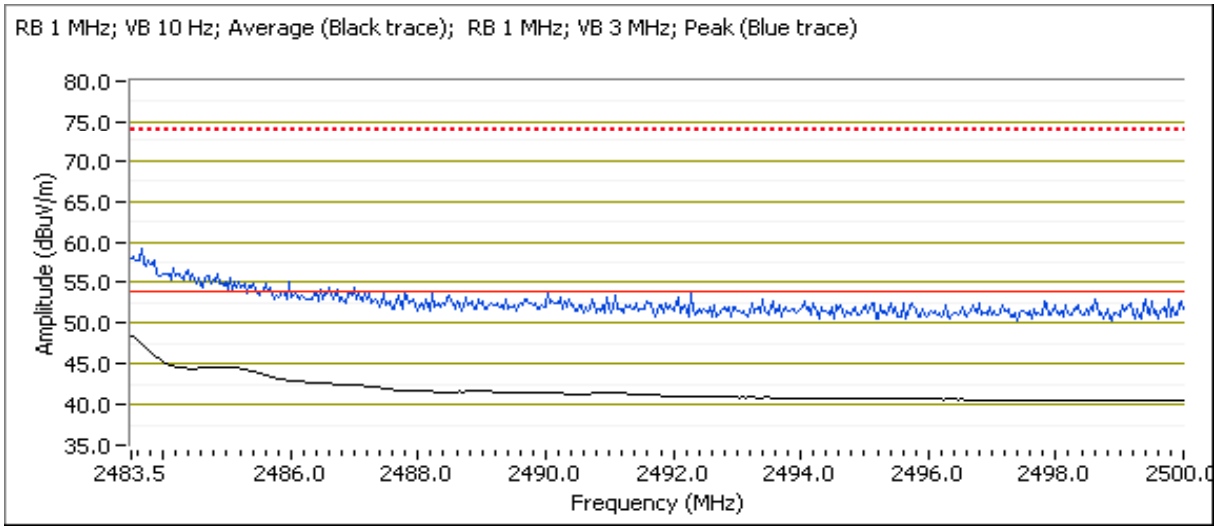
2445MHz

Fundamental emission level @ 3m in 100kHz RBW:	88	dBµV/m
Limit for emissions outside of restricted bands:	58	dBµV/m

Limit is -30dBc (Average power measurement)

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
2483.500	48.4	H	54.0	-5.6	AVG	305	1.2	Side	Power: 14
2483.500	42.2	V	54.0	-11.8	AVG	27	1.2	Side	Power: 14
2483.700	58.0	H	74.0	-16.0	PK	305	1.2	Side	Power: 14
2483.830	51.6	V	74.0	-22.4	PK	27	1.2	Side	Power: 14

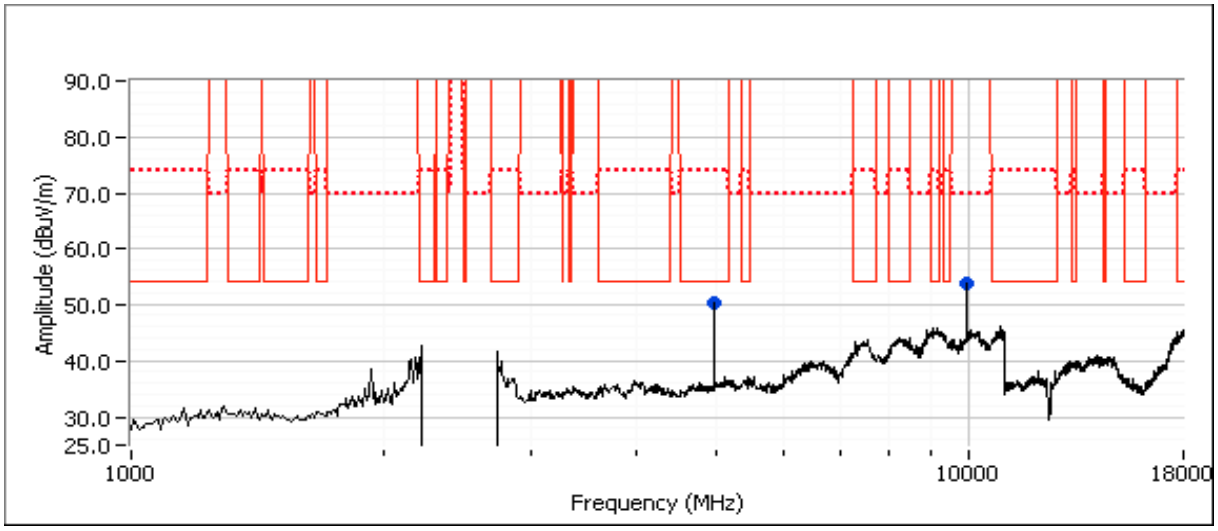


Client:	Centauri Medical, Inc.	Job Number:	J92426
Model:	DynaSense Patient Sensor	T-Log Number:	T92475
		Project Manager:	Christine Krebill
Contact:	Matt Hammond	Project Coordinator:	
Standard:	FCC 15.247	Class:	-

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments	
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters		
9916.670	53.7	H	58.0	-4.3	Peak	45	1.0	Side	Power: 14 Unrestricted
4961.060	46.6	H	54.0	-7.4	AVG	1	1.0	Side	Power: 14
4961.070	53.3	H	74.0	-20.7	PK	1	1.0	Side	Power: 14

Note 1:	For emissions in restricted bands, the limit of 15.209 was used. For all other emissions, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 2:	Signal is not in a restricted band but the more stringent restricted band limit was used.
Note 3:	18-26GHz was tested with antenna 30cm away from the unit, no significant signal was found.
Note 4:	No emissions observed from the radio in the 30-1000 MHz band.



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