

EMC Test Report**Application for FCC Grant of Equipment Authorization
Canada Certification****Innovation, Science and Economic Development Canada
RSS-Gen Issue 5 / RSS-247 Issue 2
FCC Part 15 Subpart C****Model: A0001659**

FCC ID: 2AQ9D-A0001659
IC CERTIFICATION #: 24335-A0001659

APPLICANT: Enovate Medical
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TEST SITE(S): National Technical Systems
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Fremont, CA. 94538-2435

IC SITE REGISTRATION #: 2845B-3; 2845B-5, 2845B-7

PROJECT NUMBER: PR085203

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FINAL TEST DATES: September 18, October 5, 9, 22, 23 and 24, 2018

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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	May 23, 2019	First release	

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SCOPE

An electromagnetic emissions test has been performed on the Enovate Medical model A0001659, pursuant to the following rules:

RSS-Gen Issue 5 “General Requirements for Compliance of Radio Apparatus”

RSS 247 Issue 2 “Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices”

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 test procedures:

ANSI C63.10-2013

FCC DTS Measurement Guidance KDB558074

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

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, 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.

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification 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 Enovate Medical model A0001659 complied with the requirements of the following regulations:

- RSS-Gen Issue 5 "General Requirements for Compliance of Radio Apparatus"
- RSS 247 Issue 2 "Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSS) and Licence-Exempt Local Area Network (LE-LAN) Devices"
- 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 Enovate Medical model A0001659 and therefore apply only to the tested sample. The sample was selected and prepared by Steven Godbey of Enovate Medical.

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 247 5.2	Digital Modulation	Systems uses DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 247 5.2 (1)	6 dB Bandwidth	0.805 MHz	>500 kHz	Complies
15.247 (b) (3)	RSS 247 5.4 (4)	Output Power (multipoint systems)	3.2 dBm (0.002 Watts) EIRP = 0.002 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	RSS 247 5.2 (2)	Power Spectral Density	1.3 dBm/30 kHz	8 dBm/3 kHz	Complies
15.247(d)	RSS 247 5.5	Antenna Port Spurious Emissions	-38.8 dBc	< -20 dBc	Complies
15.247(d) / 15.209	RSS 247 5.5	Radiated Spurious Emissions 9 kHz – 25 GHz	45.1 dBμV/m @ 4804.0 MHz (-8.9 dB)	Refer to the limits section (p18) for restricted bands, all others < -20 dBc	Complies
Note 1: EIRP calculated using antenna gains of 0 dBi () for the highest EIRP system.					

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
15.407 (b) (6)	RSS-Gen Table 4	AC Conducted Emissions	Testing was not performed as the EUT is DC powered.		
15.247 (i) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE / SAR Exclusion calculations in separate exhibit, RSS 102 declaration and User Manual statements.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSS-Gen 6.8	User Manual	N/A – Integral antenna	Statement for products with detachable antenna	Complies
-	RSS-Gen 8.4	User Manual	Refer to user manual	Statement for all products	Complies
-	RSP-100 RSS-Gen 6.7	Occupied Bandwidth	1.81 MHz	Information only	N/A

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
RF power, conducted (power meter)	dBm	25 MHz to 7 GHz	± 0.5 dB
Conducted emission of transmitter (Spectrum analyzer)	dBm	25 MHz to 26.5 GHz	± 0.7 dB
Radiated emission (field strength)	dB μ V/m	9 kHz to 1 GHz	± 3.6 dB
		1 GHz to 40 GHz	± 6.0 dB

EQUIPMENT UNDER TEST (EUT) DETAILS**GENERAL**

The Enovate Medical model A0001659 is a coin cell powered Bluetooth low energy transceiver that is designed to transmit location information. The EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 3 Volts (CR2032 battery).

The sample was received on September 18, 2018 and tested on September 18, October 5, 9, 22, 23 and 24, 2018. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Enovate Medical	Emtag	BLE transceiver	B77742 0002 LF	2AQ9D-A0001659
			B78543 0004 LF	2AQ9D-A0001659

ANTENNA SYSTEM

PCB trace antenna (0 dBi)

ENCLOSURE

The EUT enclosure measures approximately 35 mm diameter by 7 mm thick. It is primarily constructed of plastic.

MODIFICATIONS

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

SUPPORT EQUIPMENT

The following equipment was used as remote support equipment to configure the radio:

Company	Model	Description	Serial Number	FCC ID
Raspberry PI	PI 3	Support computer	-	2ABCB-RPI3BP
Planar	PLL2470W	Support monitor	PL747NSS04381	-
SIIG, Inc.	AXP1930X2074	Support keyboard	-	-
Agilent	E3610A	AC/DC power supply	NTS asset #3004	-

EUT OPERATION

During testing, the EUT was transmitting with maximum RF power in the required channels.

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	Designation / Registration Numbers		Location
	FCC	Canada	
Chamber 3	US0027	2845B-3	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	US0027	2845B-5	
Chamber 7	US0027	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. 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.

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 20 Hz, 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 1000 MHz 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

Software is used to view and convert receiver measurements to the field strength at an antenna, 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 software used for radiated and conducted emissions measurements is NTS EMI Test Software (rev 2.10)

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 1 m above the ground plane.

ANSI C63.10 specifies that the test height above ground for table mounted devices shall be 80 cm for testing below 1 GHz and 1.5 m for testing above 1 GHz. 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.

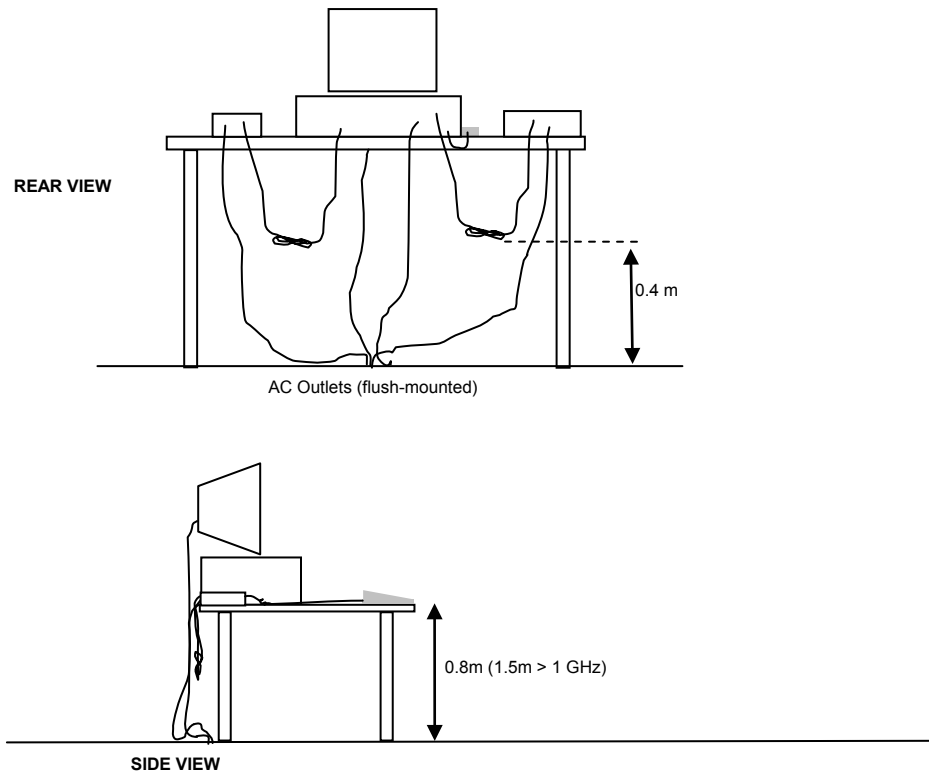
RADIATED EMISSIONS

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.

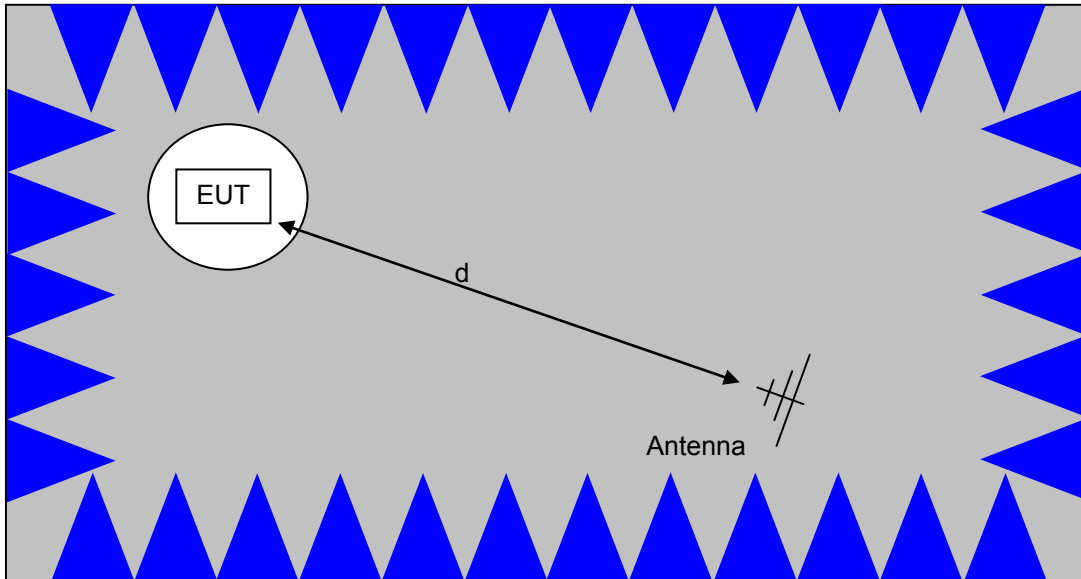
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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 1 m). 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 1 meter from the EUT and the antenna height is restricted to a maximum of 2.5 m.

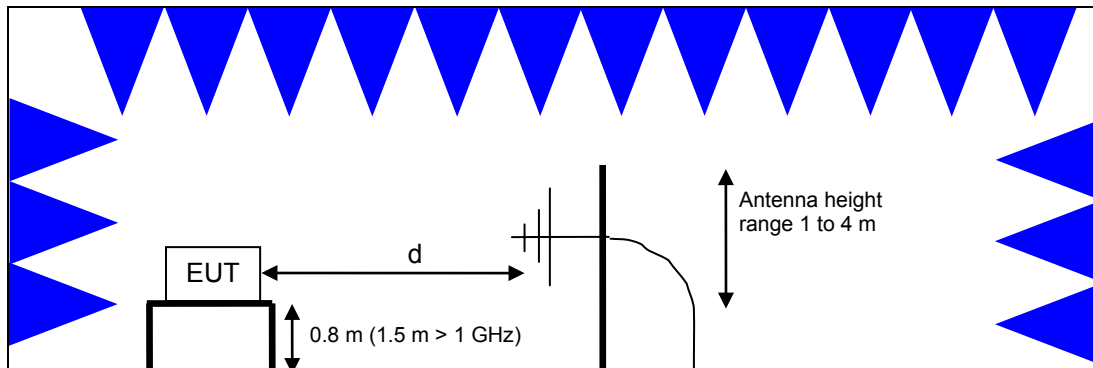


Typical Test Configuration for Radiated Field Strength Measurements



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.

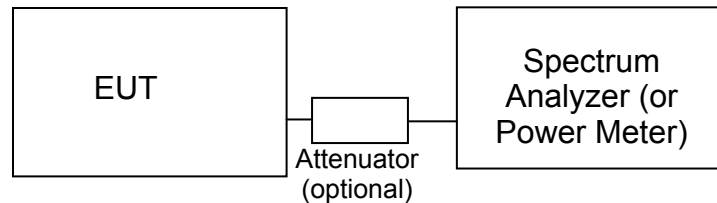
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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 6 dB, 20 dB, 26 dB 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 (dB μ V). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dB μ V/m). The results are then converted to the linear forms of μ V and μ V/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:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands¹.

Frequency Range (MHz)	Limit (μV/m)	Limit (dBμV/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/3 kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3 kHz
5725 – 5850	1 Watt (30 dBm)	8 dBm/3 kHz

The maximum permitted output power is reduced by 1 dB for every dB the antenna gain exceeds 6 dBi. 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 20 dB below the level of the highest in-band signal level (30 dB if the power is measured using the sample detector/power averaging method).

¹ The restricted bands are detailed in FCC 15.205 and RSS-Gen Table 7

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 30 MHz, is calculated by using the following formula:

$$F_d = 20 * \text{LOG}_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

$$F_d = 40 * \text{LOG}_{10} (D_m/D_s)$$

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 dB μ V/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dB μ V/m

L_s = Specification Limit in dB μ V/m

M = Margin in dB Relative to Spec

Appendix A Test Equipment Calibration Data

<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Antenna port measurements, 18-Sep-18					
National Technical Systems	NTS Capture Analyzer Software (rev 3.8)	N/A	0		N/A
Rohde & Schwarz	Power Meter, Dual Channel	NRVD	1071	4/4/2018	4/4/2019
Rohde & Schwarz	Peak Power Sensor 100 uW - 2 Watts (w/ 20 dB pad, SN BJ5155)	NRV-Z32	1536	6/21/2018	6/21/2019
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HXX,	E4446A	2139	7/27/2018	7/27/2019
Radiated Spurious Emissions, 1 GHz - 25 GHz, 05-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	9/5/2018	9/5/2019
Hewlett Packard	Spectrum Analyzer (SA40) Blue 9 kHz - 40 GHz	8564E (84125C)	1393	12/8/2017	12/8/2018
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	4/18/2018	4/18/2019
EMCO	Antenna, Horn, 1-18 GHz	3115	2870	8/24/2017	8/24/2019
Radiated Spurious Emissions, 30 MHz - 18 GHz, 09-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	9/5/2018	9/5/2019
Hewlett Packard	Spectrum Analyzer (SA40) Red 30 Hz -40 GHz	8564E (84125C)	1148	9/27/2018	9/27/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	4/18/2018	4/18/2019
EMCO	Antenna, Horn, 1-18 GHz	3115	2870	8/24/2017	8/24/2019
Radiated Spurious Emissions, 1 GHz - 25 GHz, 22-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
EMCO	Antenna, Horn, 1-18GHz	3115	868	7/9/2018	7/9/2020
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	1538	2/10/2018	2/10/2019
HP / Miteq	SA40 P Head HF preAmplifier, 18-40 GHz (w/2415)	TTA1840-45-5P-HG-S	1772	9/12/2018	N/A
A. H. Systems	System Horn, 18-40GHz	SAS-574, p/n: 2581	2161	7/21/2017	7/21/2019
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	8/30/2018	8/30/2019
Micro-Tronics	Band Reject Filter, 2400-2500 MHz 18GHz	BRM50702-02	2238	5/1/2018	5/1/2019
Hewlett Packard	Spectrum Analyzer (SA40) Purple 9 kHz - 40 GHz,	8564E (84125C)	2415	2/16/2018	2/16/2019



<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Radiated Spurious Emissions, 9 kHz - 1 GHz, 23-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	1538	2/10/2018	2/10/2019
Com-Power	Preamplifier, 30-1000 MHz	PA-103	1632	1/30/2018	1/30/2019
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	10/4/2017	10/4/2019
Rhode & Schwarz	Magnetic Loop Antenna, 9 kHz-30 MHz	HFH2-Z2	WC062 457	1/5/2018	1/5/2020
Radiated Spurious Emissions, 9 kHz - 1 GHz, 24-Oct-18					
National Technical Systems	NTS EMI Software (rev 2.10)	N/A	0		N/A
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	1538	2/10/2018	2/10/2019
Com-Power	Preamplifier, 30-1000 MHz	PA-103	1632	1/30/2018	1/30/2019
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	10/4/2017	10/4/2019
Rhode & Schwarz	Magnetic Loop Antenna, 9 kHz-30 MHz	HFH2-Z2	WC062 457	1/5/2018	1/5/2020

Appendix B Test Data

TL085203-RA Pages 23 – 55



EMC Test Data

Client:	Enovate Medical	PR Number:	PR085203
Product	BLE LE Tag	T-Log Number:	TL085203
System Configuration:		Project Manager:	Deepa Shetty
Contact:	Cameron Boone	Project Engineer:	Deniz Demirci
Emissions Standard(s):	FCC 15.247, RSS-247	Class:	B
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Enovate Medical

Product

BLE LE Tag

Date of Last Test: 10/23/2018



EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

RSS-247 and FCC 15.247 (DTS) Antenna Port Measurements Power, PSD, Bandwidth and 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.

Date of Test: 9/18/2018
Test Engineer: Deniz Demirci
Test Location: Fremont EMC Lab #4B

Config. Used: 1
Config Change: None
EUT Voltage: 3.3 Vdc

General Test Configuration

The EUT was connected to the spectrum analyzer or power meter via a suitable attenuator. All measurements were made on a single chain.

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

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 39 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	Max	-	Output Power	15.247(b)	Pass	3.2 dBm
2	Max	-	Power spectral Density (PSD)	15.247(d)	Pass	1.3 dBm/30 kHz
3	Max	-	Minimum 6 dB Bandwidth	15.247(a)	Pass	0.805 MHz
3	Max	-	99% Bandwidth	RSS GEN	-	1.81 MHz
4	Max	-	Spurious emissions	15.247(b)	Pass	-38.8 dBc

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: B77742 0002 LF
Driver: Minicom



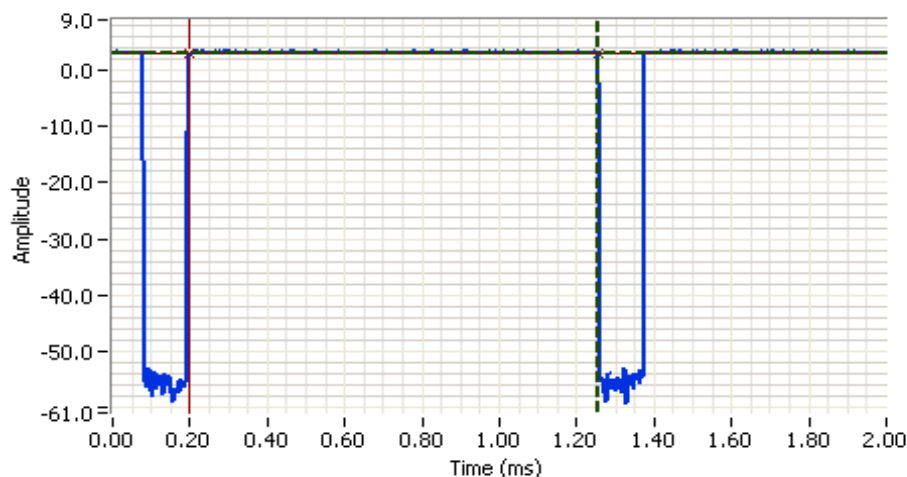
EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074 and ANSI C63.10

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mb/s	0.89	Yes	1.052	0.5	1.0	951



Analyzer Settings

Agilent Technologies, E4446A
CF: 2440.000 MHz
SPAN: 0.000 MHz
RB: 8.000 MHz
VB: 8.000 MHz
Detector: POS
Attn: 10 DB
RL Offset: 10.0 DB
Sweep Time: 2.0ms
Ref Lvl: 10.0 DBM

Comments

BLE
Off time: 0.13 ms
On time: 1.057 ms

Cursor 1	1.2533	3.2		Delta Time (ms)	1.057
Cursor 2	0.1967	3.1		Delta Amplitude	0.1





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #1: Output Power

Mode: BLE

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Output Power	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
Max	2402	3.2	2.1	0.0	Pass	3.2	0.002		
Max	2440	3.2	2.1	0.0	Pass	3.2	0.002		
Max	2480	3.1	2.0	0.0	Pass	3.1	0.002		

Note 1: Output power measured using a peak power meter, spurious limit is -20 dBc.



EMC Test Data

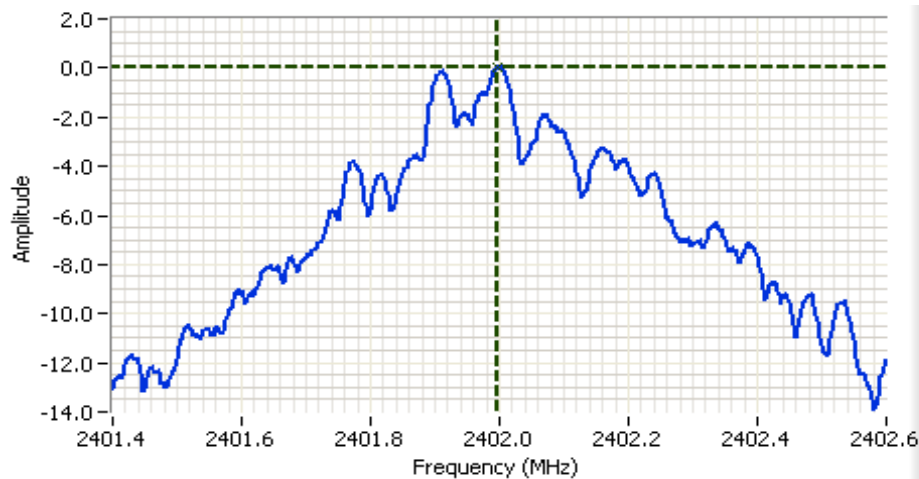
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #2: Power spectral Density

Mode: BLE

Power Setting	Frequency (MHz)	PSD (dBm/30kHz) Note 1	Limit dBm/3kHz	Result
Max	2401.998	0.0	8.0	Pass
Max	2440.004	-0.2	8.0	Pass
Max	2480.010	1.3	8.0	Pass

Note 1: Test performed per method PKSPD, in KDB 558074. Power spectral density measured using: $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$, $\text{VBW}=3*\text{RBW}$, peak detector, span = $1.5*\text{DTS BW}$, auto sweep time, max hold.



Analyzer Settings

Agilent Technologies, E4446A
CF: 2402.000 MHz
SPAN: 1.200 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.3ms
Ref Lvl: 20.0 DBM

Comments

PSD: 0 dBm/30 kHz

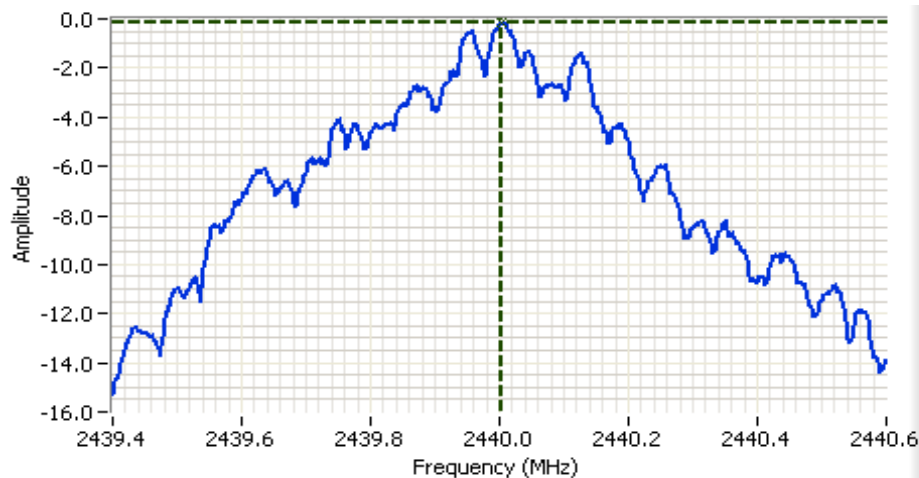
Cursor 1	2401.9980	0.0	
	0.0000	0.0	





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

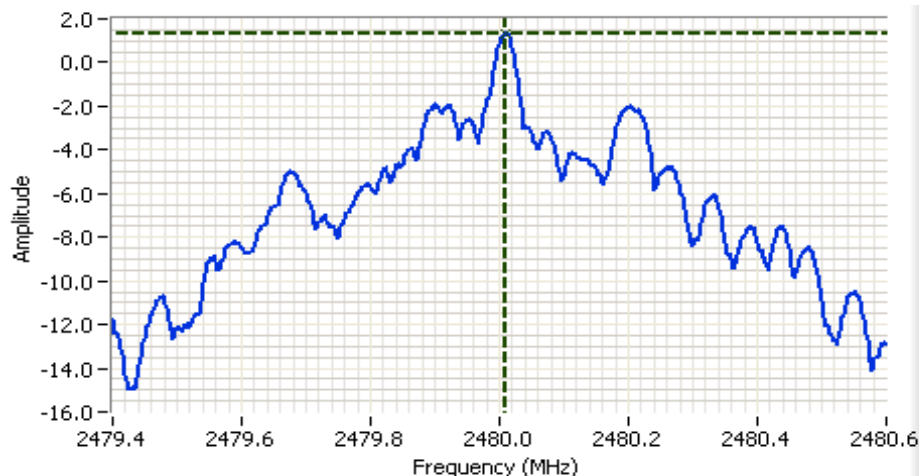
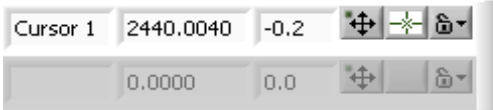


Analyzer Settings

Agilent Technologies, E4446A
CF: 2440.000 MHz
SPAN: 1.200 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.3ms
Ref Lvl: 20.0 DBM

Comments

PSD: -0.2 dBm/30 kHz

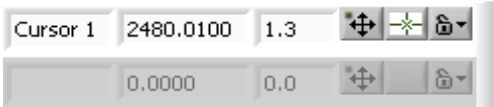


Analyzer Settings

Agilent Technologies, E4446A
CF: 2480.000 MHz
SPAN: 1.200 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.3ms
Ref Lvl: 20.0 DBM

Comments

PSD: 1.3 dBm/30 kHz





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #3: Signal Bandwidth

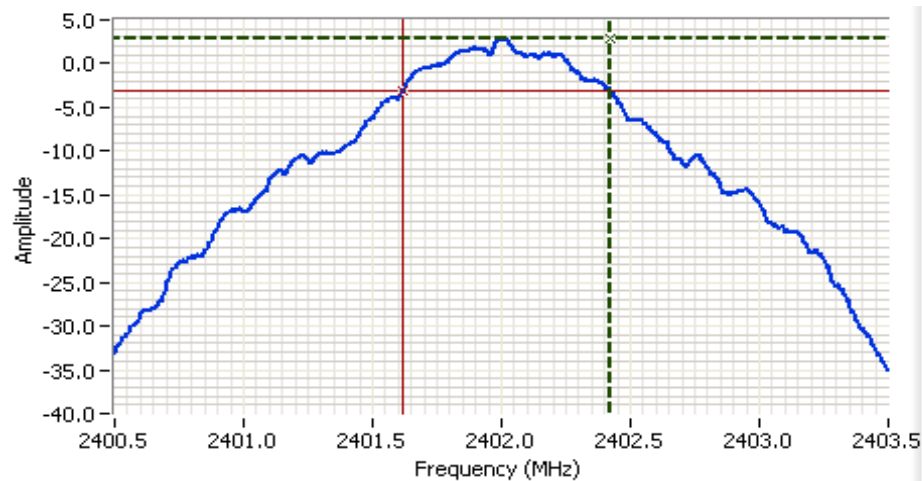
Mode:

BLE

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6 dB	99%	6 dB	99%
Max	2402	0.805	1.81	0.1	0.03
Max	2440	0.805	1.79	0.1	0.03
Max	2480	0.830	1.78	0.1	0.03

Note 1:

DTS BW: RBW=100 kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time, Span 2-5 times measured BW.
 99% BW: RBW=1-5% of 99%BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time. Span 1.5-5 times OBW.



Analyzer Settings

Agilent Technologies, E4446A
 CF: 2402.000 MHz
 SPAN: 3.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 20 DB
 RL Offset: 10.0 DB
 Sweep Time: 1.0ms
 Ref Lvl: 20.0 DBM

Comments

6dB BW: 805 kHz
 BLE

Cursor 1	2402.4200	2.8	
Cursor 2	2401.6150	-3.2	

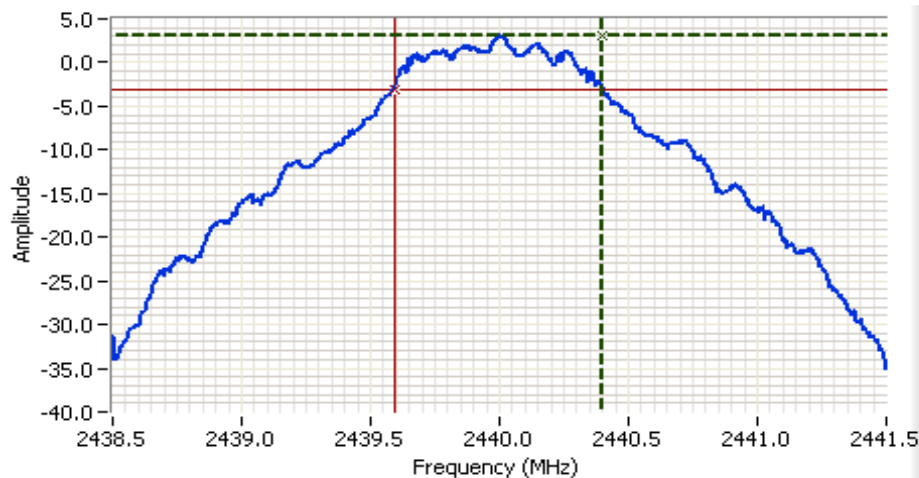
Delta Freq. 805 kHz
 Delta Amplitude 6.0





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

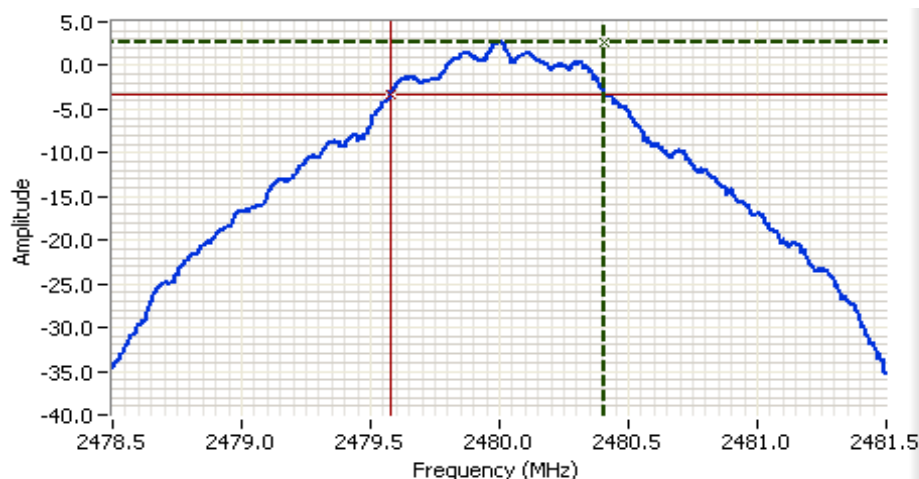


Analyzer Settings

Agilent Technologies, E4446A
CF: 2440.000 MHz
SPAN: 3.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.0ms
Ref Lvl: 20.0 DBM

Comments

6dB BW: 805 kHz
BLE



Analyzer Settings

Agilent Technologies, E4446A
CF: 2480.000 MHz
SPAN: 3.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.0ms
Ref Lvl: 20.0 DBM

Comments

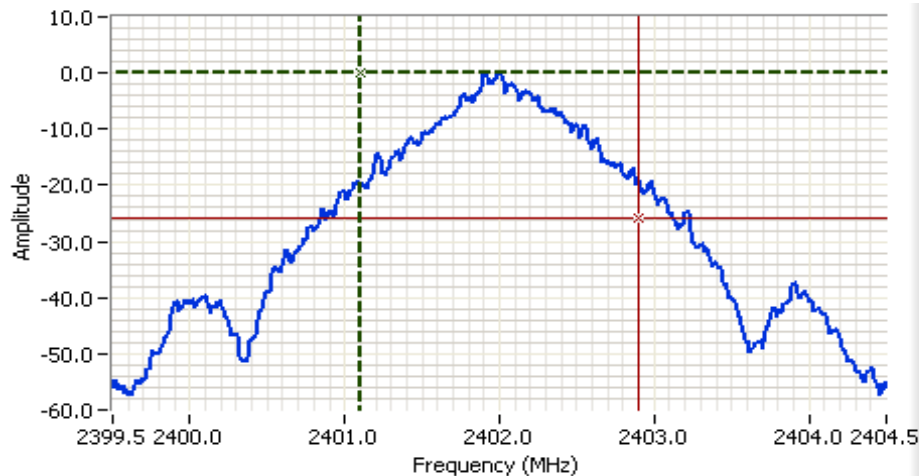
6dB BW: 830 kHz
BLE





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

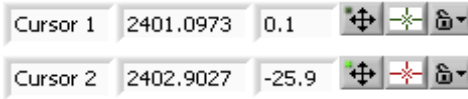


Analyzer Settings

Agilent Technologies, E4446A
CF: 2402.000 MHz
SPAN: 5.000 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 5.3ms
Ref Lvl: 20.0 DBM

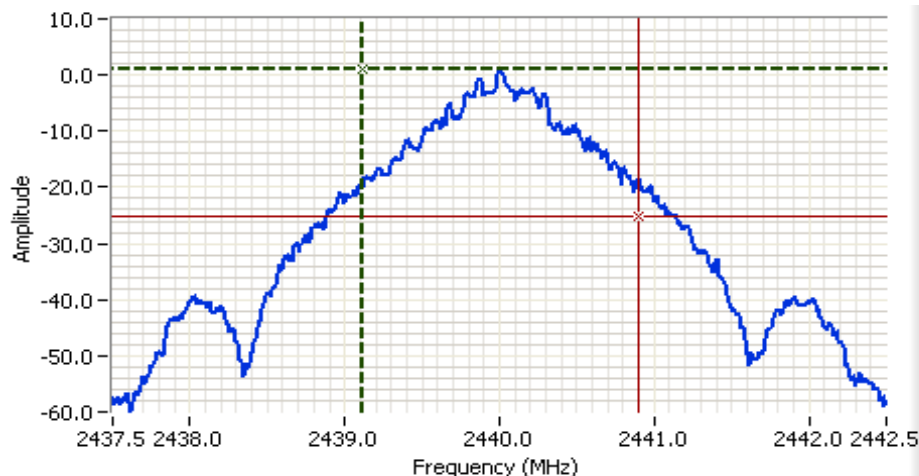
Comments

99% power BW: 1.805 MHz
BLE



Delta Freq. 1.805

Delta Amplitude 26.0

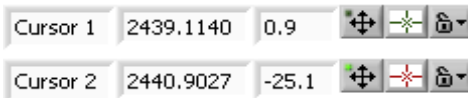


Analyzer Settings

Agilent Technologies, E4446A
CF: 2440.000 MHz
SPAN: 5.000 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 5.3ms
Ref Lvl: 20.0 DBM

Comments

99% power BW: 1.789 MHz
BLE



Delta Freq. 1.789

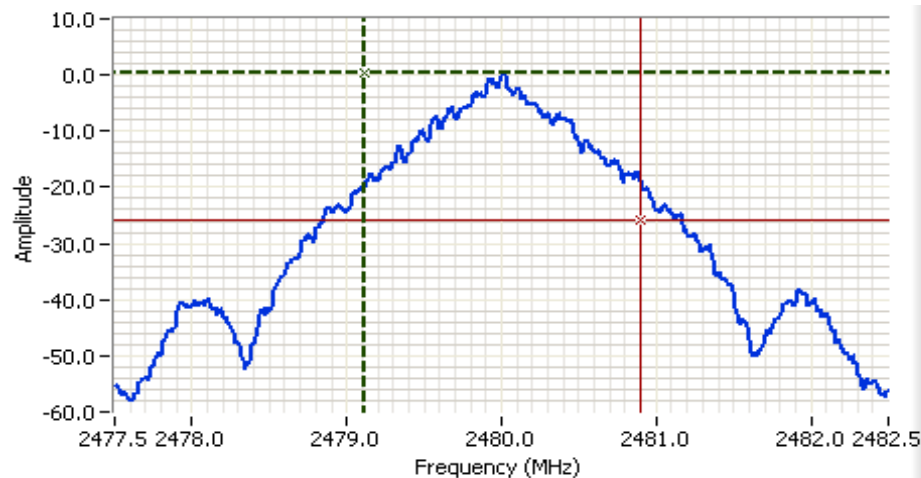
Delta Amplitude 26.0





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A



Analyzer Settings

Agilent Technologies, E4446A
CF: 2480.000 MHz
SPAN: 5.000 MHz
RB: 30.0 kHz
VB: 100 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 5.3ms
Ref Lvl: 20.0 DBM

Comments

99% power BW: 1.780 MHz
BLE

Cursor 1	2479.1140	0.3	
Cursor 2	2480.8943	-25.7	

Delta Freq. 1.780
Delta Amplitude 26.0





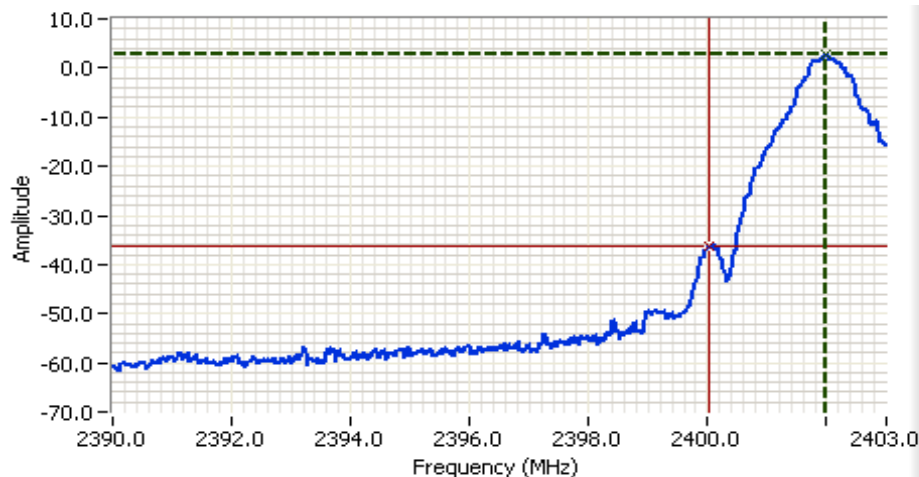
EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #4: Out of Band Spurious Emissions

Frequency (MHz)	Power Setting	Mode	Limit	Result
2402	Max	BLE	-20 dBc	Pass

Additional plot showing compliance with -20 dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



Analyzer Settings

Agilent Technologies, E4446A
CF: 2396.500 MHz
SPAN: 13.000 MHz
RB: 100 kHz
VB: 300 kHz
Detector: POS
Attn: 20 DB
RL Offset: 10.0 DB
Sweep Time: 1.3ms
Ref Lvl: 20.0 DBM

Comments

BA @ 2.4 GHz: -38.8 dBc

Cursor 1	2401.9817	2.6	
Cursor 2	2400.0100	-36.2	

Delta Freq. 1.972
Delta Amplitude 38.8





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

RSS-247 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 and all local support equipment were located on the turntable for radiated spurious emissions testing.

For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 47 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	BLE EUT Flat	17 2440 MHz	Max	Max	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	42.1 dBµV/m @ 7319.0 MHz (-11.9 dB)
	BLE EUT Side1						41.4 dBµV/m @ 7320.9 MHz (-12.6 dB)
	BLE EUT Side2						41.3 dBµV/m @ 7319.0 MHz (-12.7 dB)
Scans on low and high channel on the worst case EUT orientation.							
2	BLE EUT Flat	37 - 2402 MHz	Max	Max	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	45.1 dBµV/m @ 4804.0 MHz (-8.9 dB)
	BLE EUT Flat	39 - 2480 MHz					42.3 dBµV/m @ 7439.1 MHz (-11.7 dB)
2	BLE EUT Flat	37 - 2402 MHz	Max	Max	Band Edge 2390 - 2483.5 MHz	15.247(c)	41.8 dBµV/m @ 2389.6 MHz (-12.2 dB)
	BLE EUT Flat	39 - 2480 MHz					43.1 dBµV/m @ 2483.5 MHz (-10.9 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.



EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Sample Notes

Sample S/N: B78543 0004 LF (P0001304)

Driver: Minicom

Antenna: Integral

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Peak measurements performed with: RBW=1MHz, VBW=3MHz, peak detector, max hold, auto sweep time

Unless otherwise stated/noted, emission has duty cycle $\geq 98\%$ and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mb/s	0.89	Yes	1.052	0.5	1.0	951

Measurement Specific Notes:

Note 1:	Emission in non-restricted band, but limit of 15.209 used.
Note 2:	Emission in non-restricted band, the limit was set 30dB below the level of the fundamental and measured in 100kHz.
Note 6:	Emission has non constant duty cycle $< 98\%$, average measurement performed: RBW=1MHz, VBW $> 1/T$, peak detector, linear average mode, sweep time auto, max hold. Max hold for $50 \cdot (1/DC)$ traces



EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #1a: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: BLE

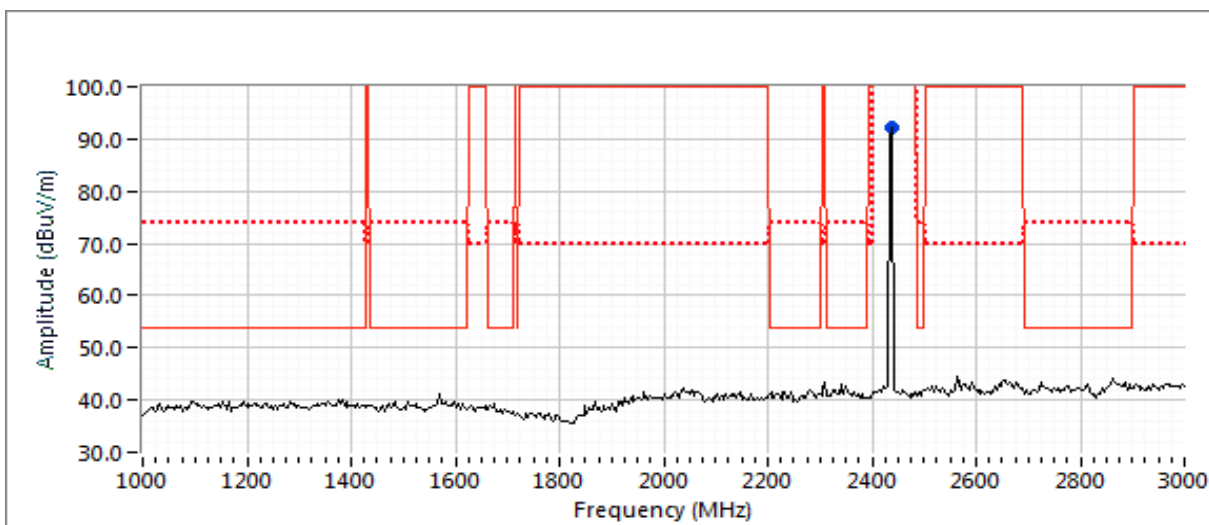
Date of Test: 10/5/2018 & 10/9/18
 Test Engineer: John Caizzi
 Test Location: Chambers 5 & 7

Config. Used: 1
 Config Change: none
 EUT Voltage: 3.0 VDC

Run #1a: Center Channel, EUT Flat

Channel: 17
 Tx Chain: Main
 Mode: BLE
 Data Rate: 1 Mbps

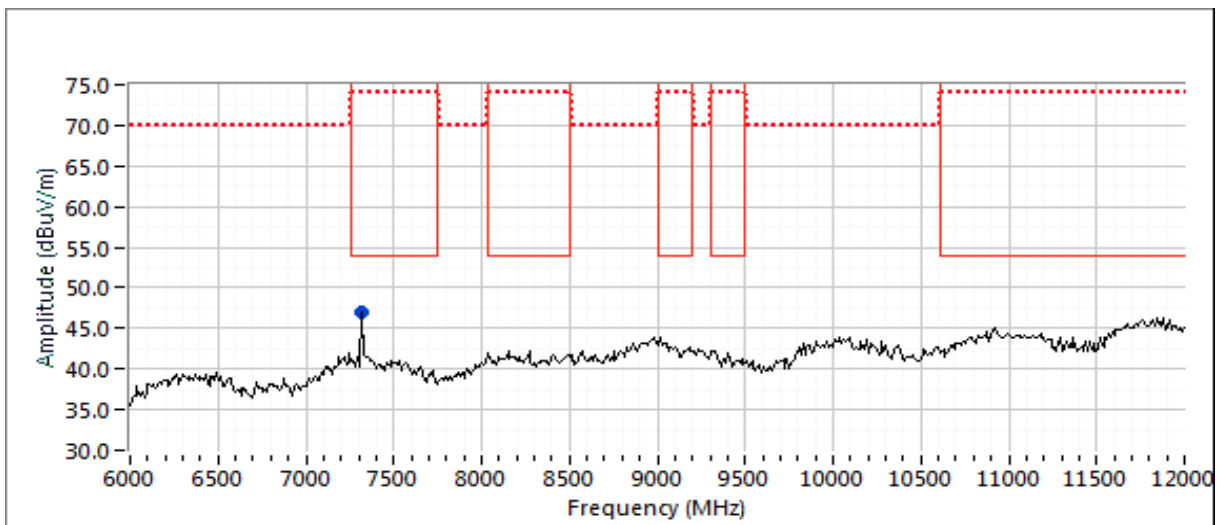
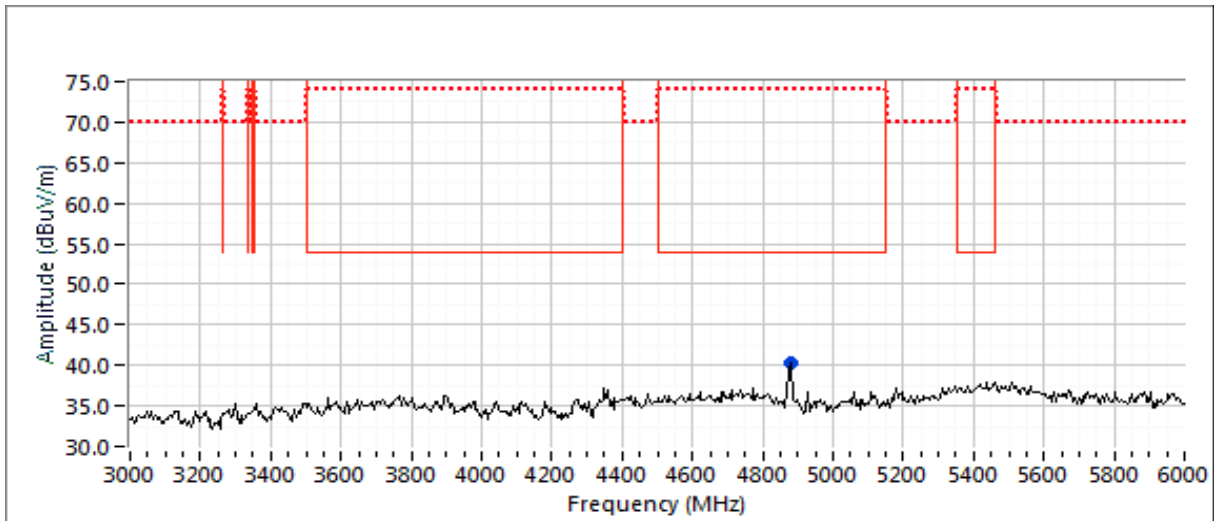
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2436.670	92.2	V	-	-	Peak	127	1.5	Fundamental
4880.050	37.2	V	54.0	-16.8	Avg	291	1.00	VB 1 kHz, note 6
4880.620	46.8	V	74.0	-27.2	Pk	291	1.00	RB 1 MHz;VB 3 MHz;Peak
7318.990	42.1	V	54.0	-11.9	Avg	216	2.29	VB 1 kHz, note 6
7320.510	52.7	V	74.0	-21.3	Pk	216	2.29	RB 1 MHz;VB 3 MHz;Peak
12198.700	37.1	V	54.0	-16.9	Avg	260	1.30	VB 1 kHz, note 6
12198.370	47.3	V	74.0	-26.7	Pk	260	1.30	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

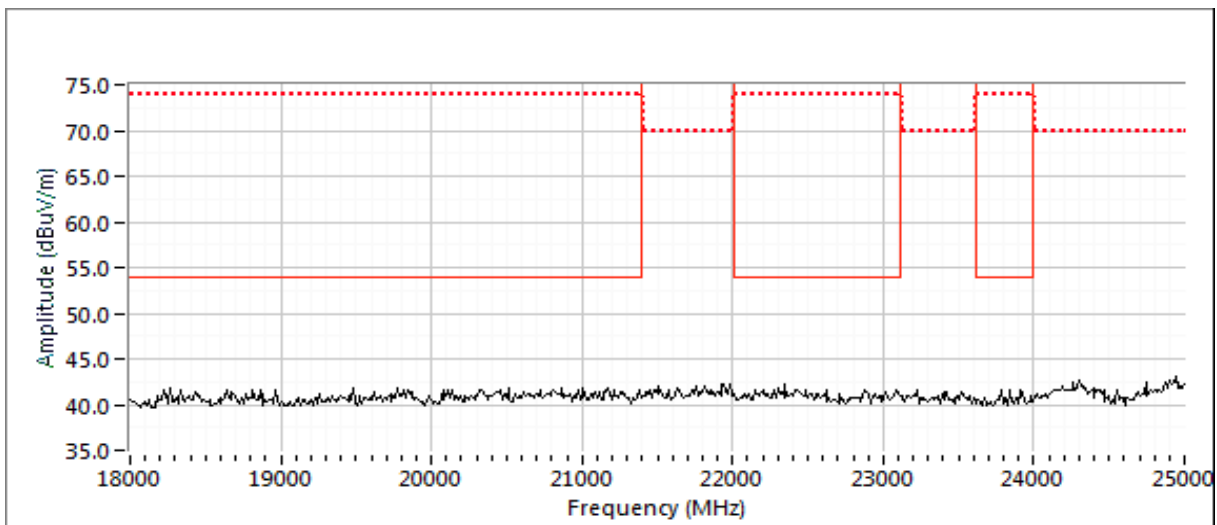
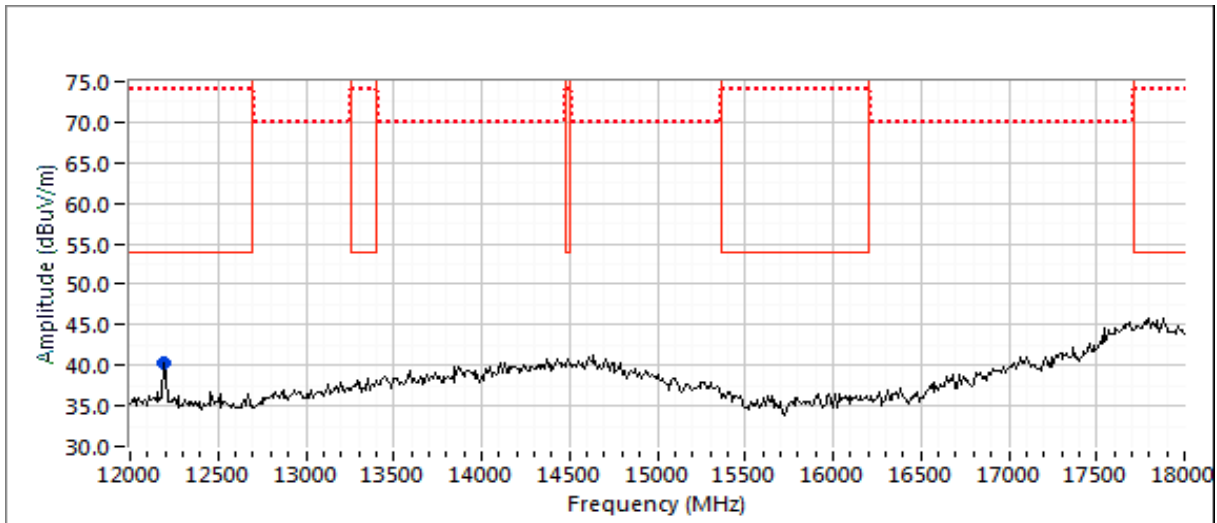
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





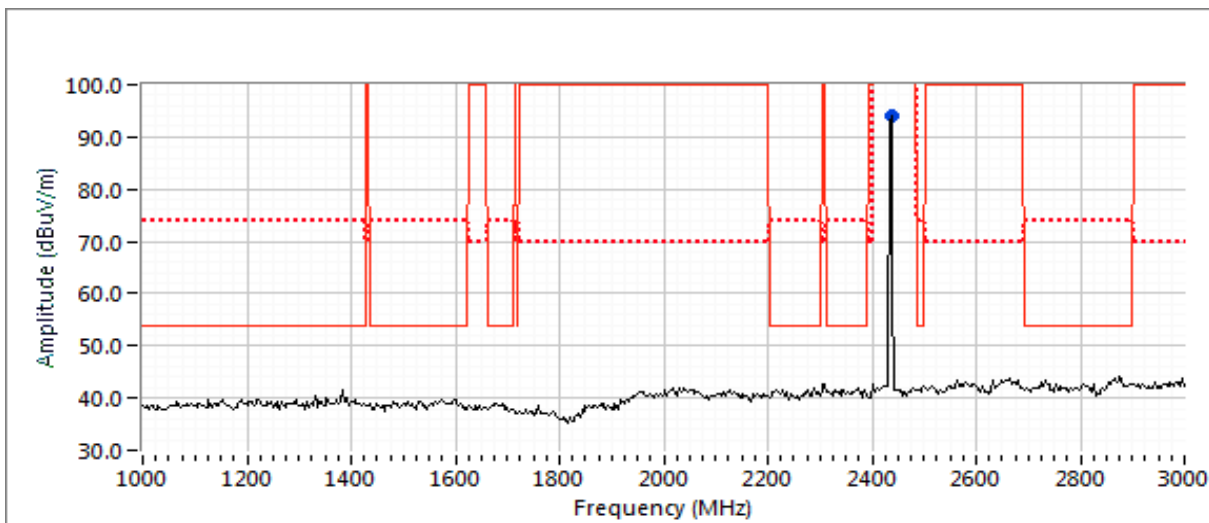
EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #1b: Center Channel, EUT Side 1

Channel: 17 Mode: BLE
Tx Chain: Main Data Rate: 1 Mbps

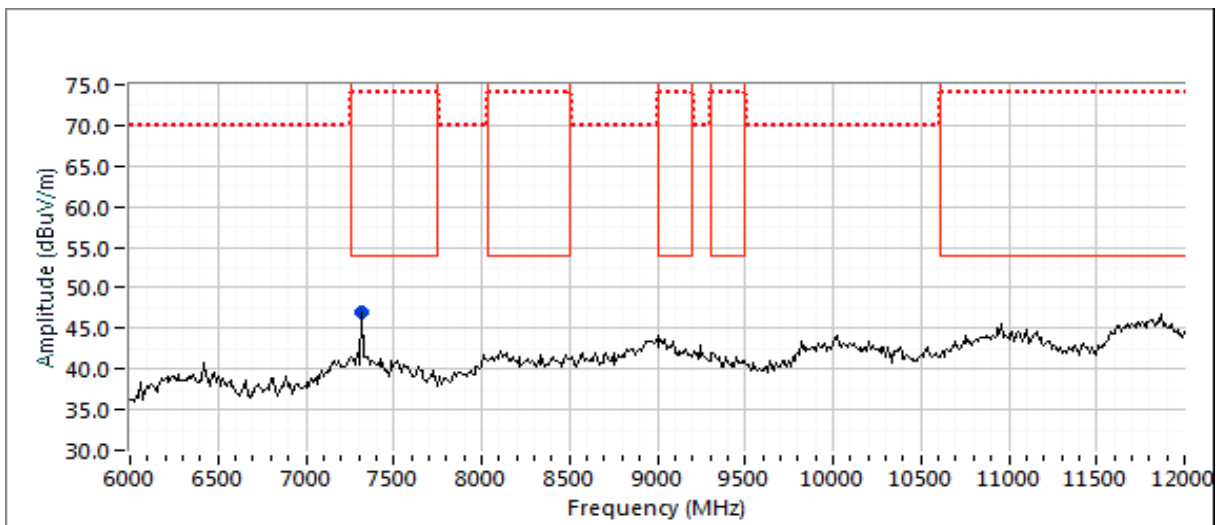
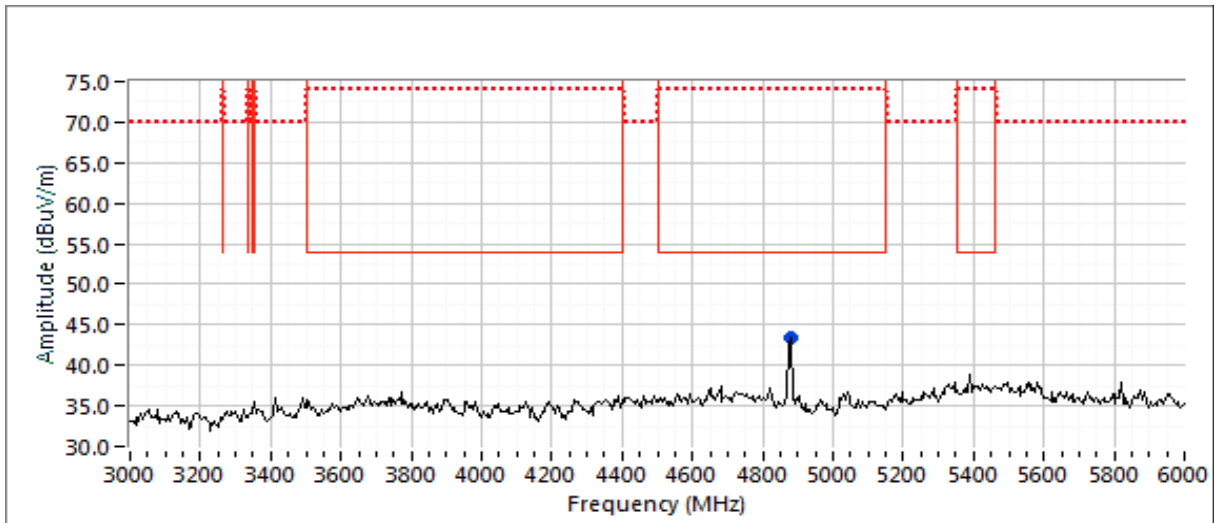
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2436.670	93.9	H	-	-	Peak	240	2.0	Fundamental
4880.000	39.4	H	54.0	-14.6	Avg	331	1.57	VB 1 kHz, note 6
4880.070	47.9	H	74.0	-26.1	Pk	331	1.57	RB 1 MHz;VB 3 MHz;Peak
7320.910	41.4	H	54.0	-12.6	Avg	103	1.00	VB 1 kHz, note 6
7318.850	50.2	H	74.0	-23.8	Pk	103	1.00	RB 1 MHz;VB 3 MHz;Peak
12198.700	40.6	V	54.0	-13.4	Avg	122	1.58	VB 1 kHz, note 6
12201.120	49.6	V	74.0	-24.4	Pk	122	1.58	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

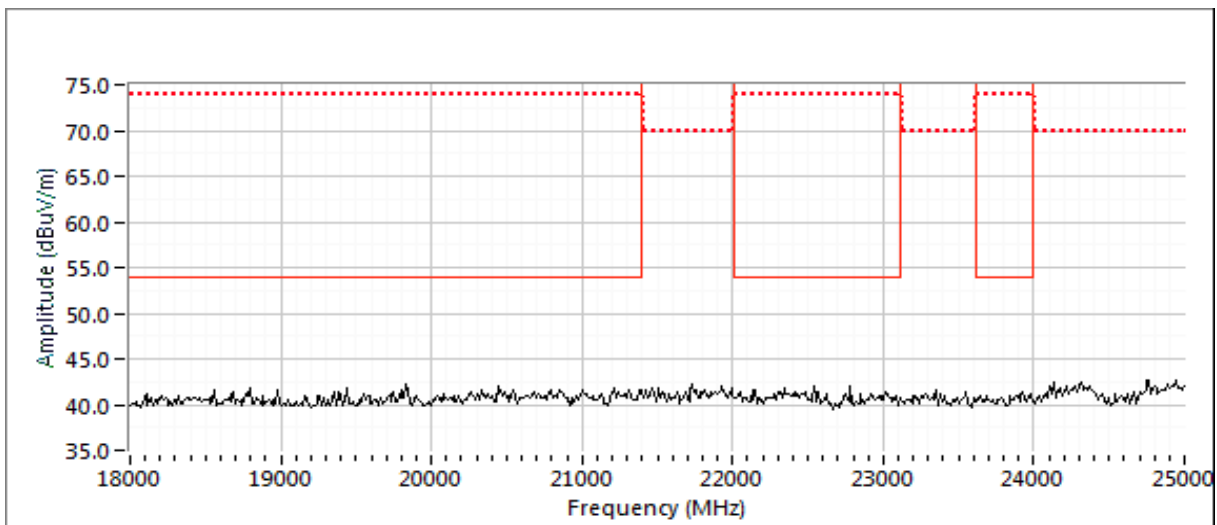
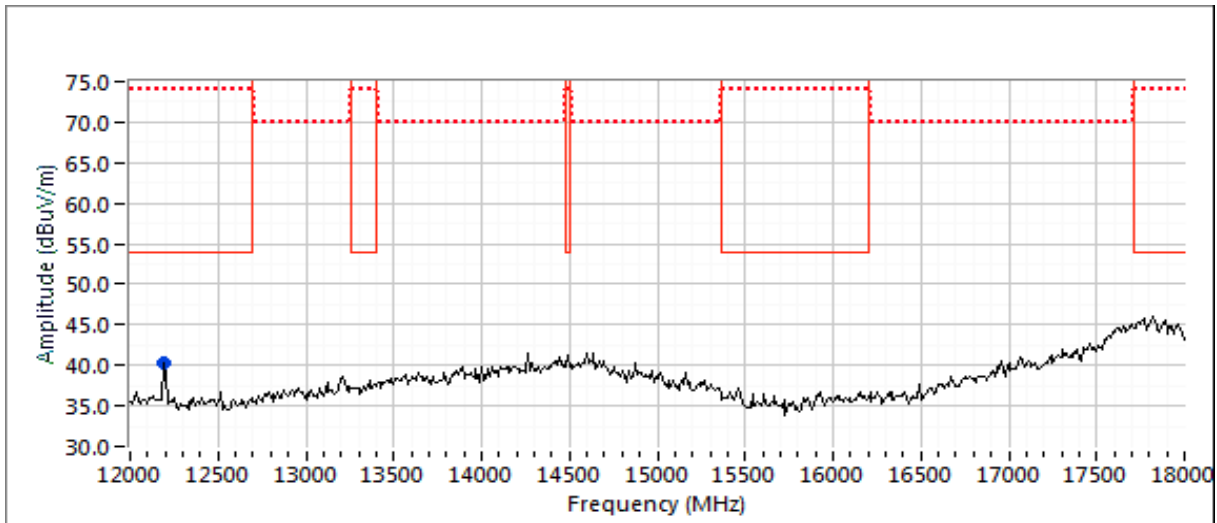
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





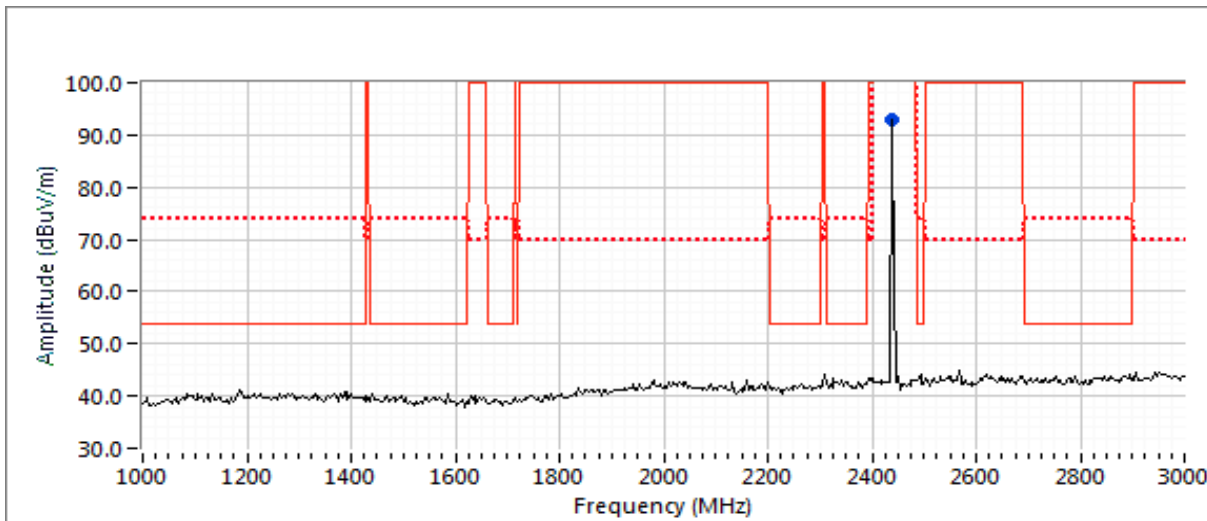
EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #1c: Center Channel, EUT Side 2

Channel: 17 Mode: BLE
Tx Chain: Main Data Rate: 1 Mbps

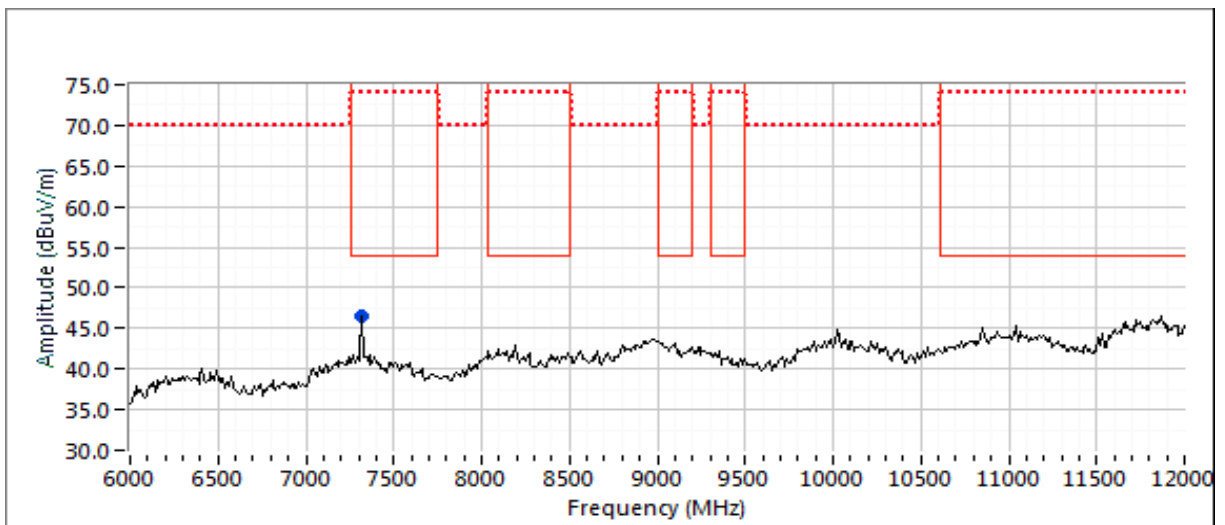
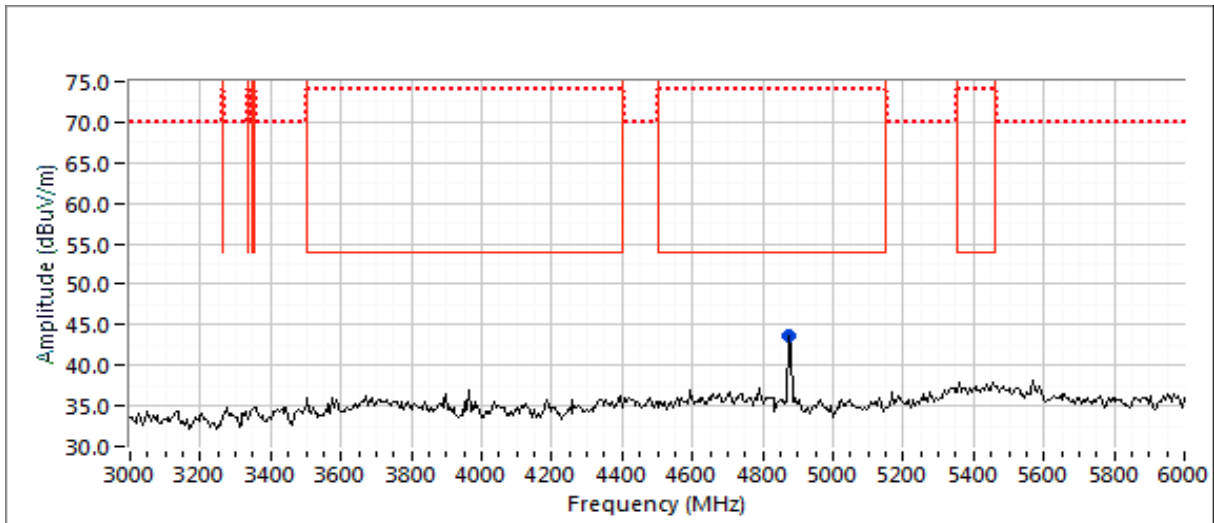
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2440.000	93.0	H	120.0	-27.0	Peak	259	2.5	Fundamental
4876.830	39.6	H	54.0	-14.4	Avg	212	1.33	VB 1 kHz, note 6
4879.320	46.5	H	74.0	-27.5	Pk	212	1.33	RB 1 MHz;VB 3 MHz;Peak
7319.000	41.3	V	54.0	-12.7	Avg	48	1.09	VB 1 kHz, note 6
7319.020	50.2	V	74.0	-23.8	Pk	48	1.09	RB 1 MHz;VB 3 MHz;Peak
12198.730	38.0	V	54.0	-16.0	Avg	245	1.56	VB 1 kHz, note 6
12198.430	48.5	V	74.0	-25.5	Pk	245	1.56	RB 1 MHz;VB 3 MHz;Peak
14540.000	42.9	V	70.0	-27.1	Pk	86	2.00	Intermittent signal





EMC Test Data

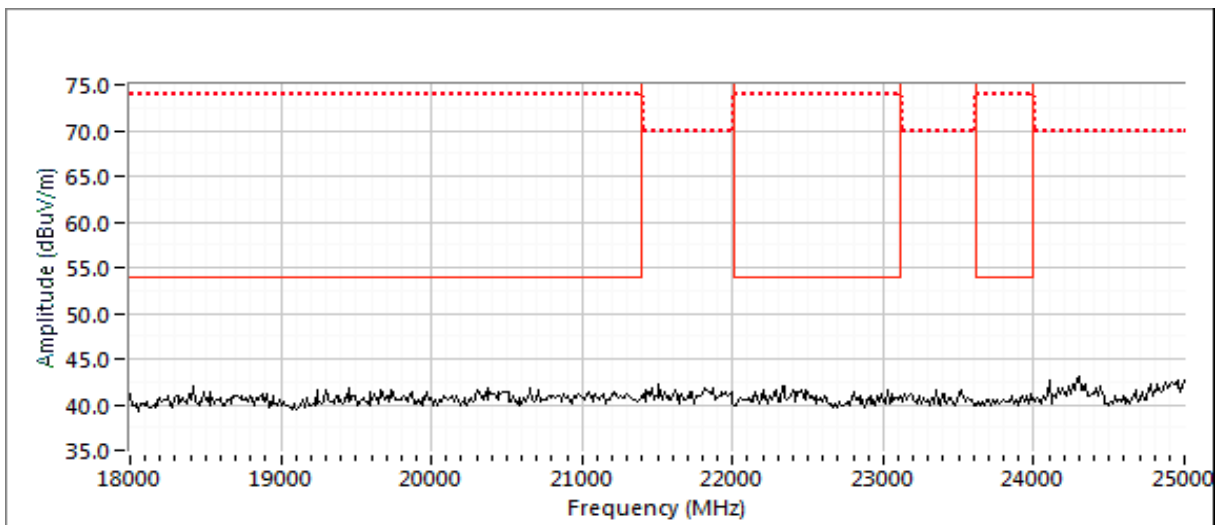
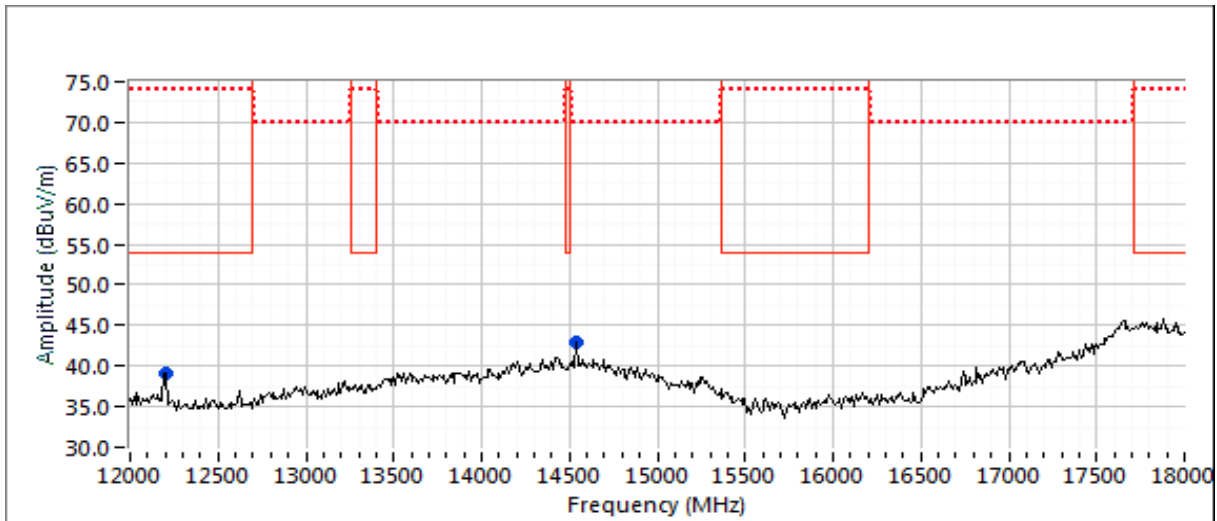
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #2: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: BLE, EUT Flat

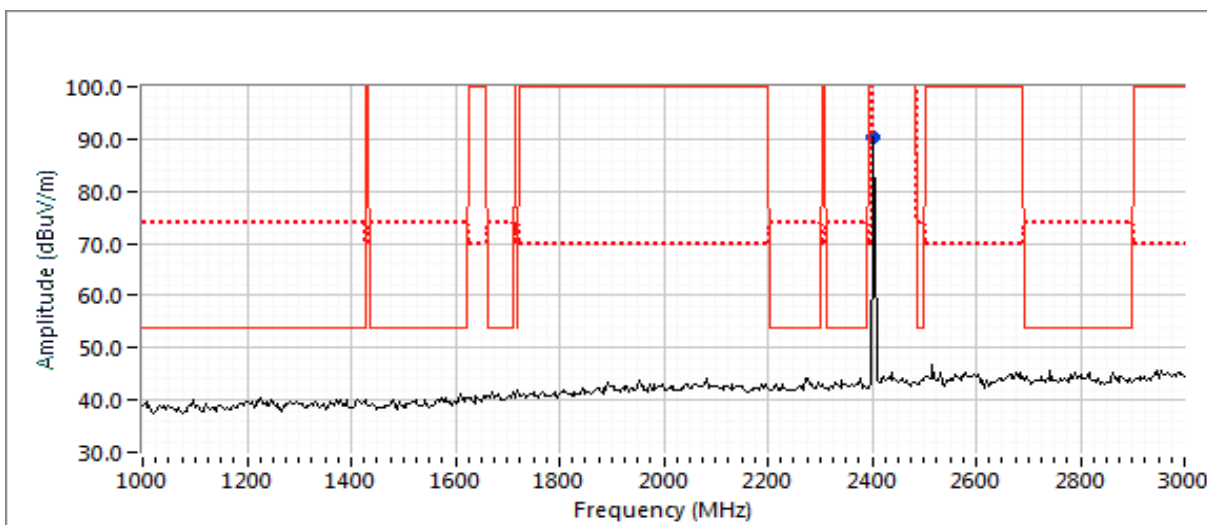
Date of Test: 10/22/2018
 Test Engineer: Deniz Demirci
 Test Location: FT Ch #3

Config. Used: 1
 Config Change: none
 EUT Voltage: 3.0 VDC

Run #2a: Low Channel

Channel: 37
 Tx Chain: Main
 Mode: BLE
 Data Rate: 1 Mbps

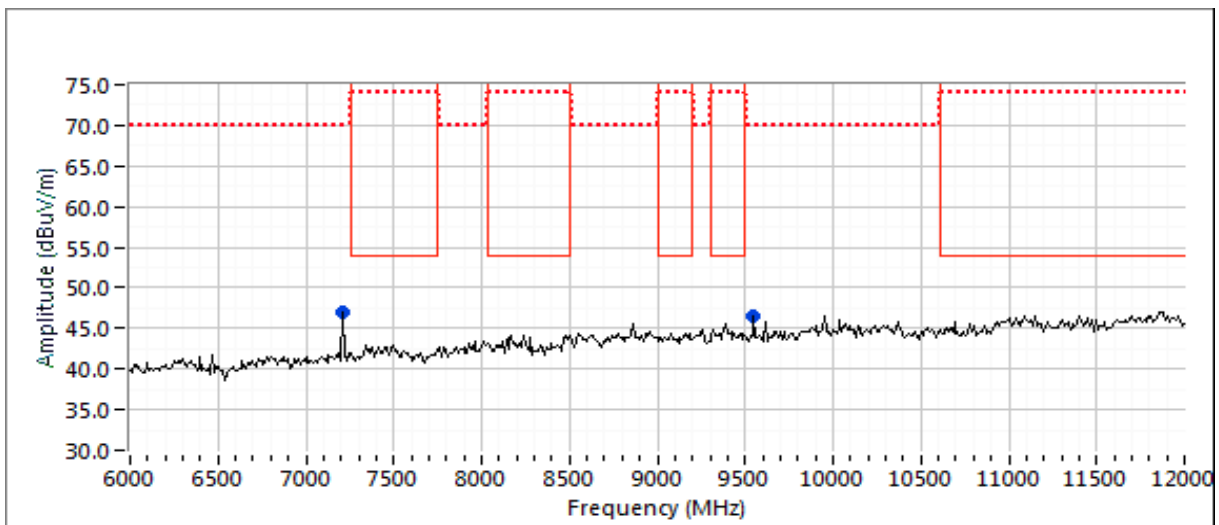
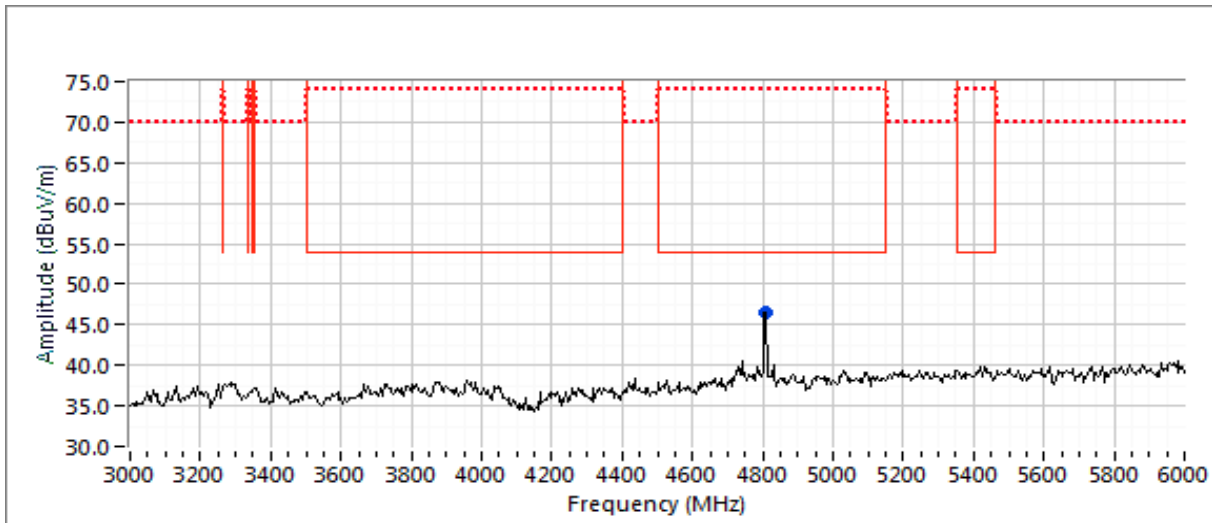
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2403.330	92.4	V	-	-	Peak	91	2.0	Fundamental
4803.980	45.1	V	54.0	-8.9	Avg	325	1.6	Note 6 - RB 1 MHz;VB 1 kHz;Peak
4803.950	53.1	V	74.0	-20.9	PK	325	1.6	RB 1 MHz;VB 3 MHz;Peak
7205.060	43.2	H	54.0	-56.8	Avg	36	1.0	Note 1 - RB 1 MHz;VB 1 kHz;Peak
7205.090	55.3	H	74.0	-14.7	PK	36	1.0	Note 1 - RB 1 MHz;VB 3 MHz;Peak
9608.740	39.9	V	100.0	-60.1	Avg	134	1.6	Note 1 - RB 1 MHz;VB 1 kHz;Peak
9608.330	53.5	V	70.0	-16.5	PK	134	1.6	Note 1 - RB 1 MHz;VB 3 MHz;Peak
12011.410	35.2	H	54.0	-18.8	Avg	195	1.5	Note 6 - RB 1 MHz;VB 1 kHz;Peak
12010.090	46.5	H	74.0	-27.5	PK	195	1.5	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

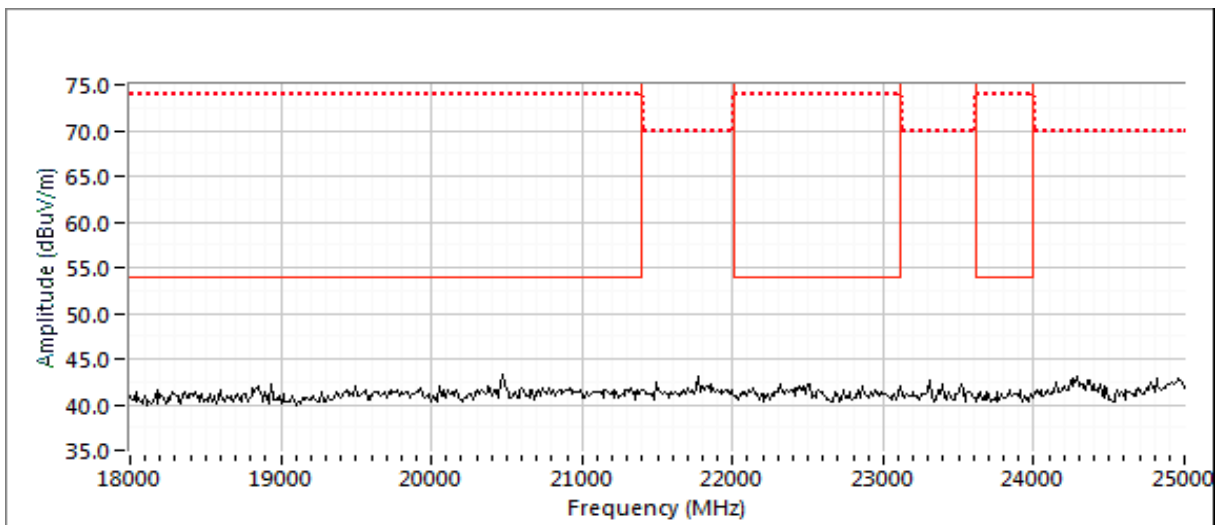
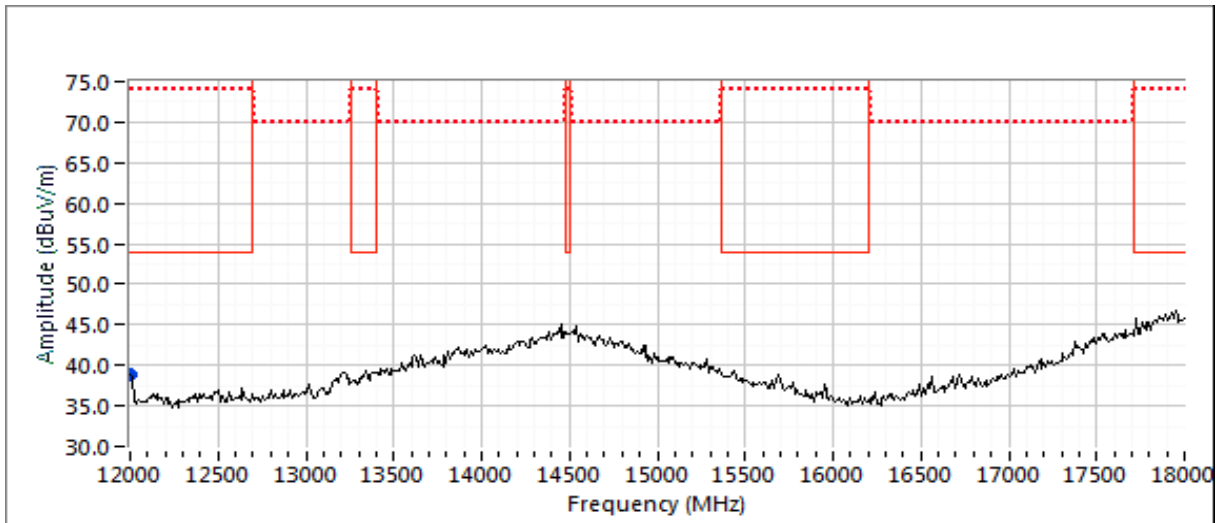
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

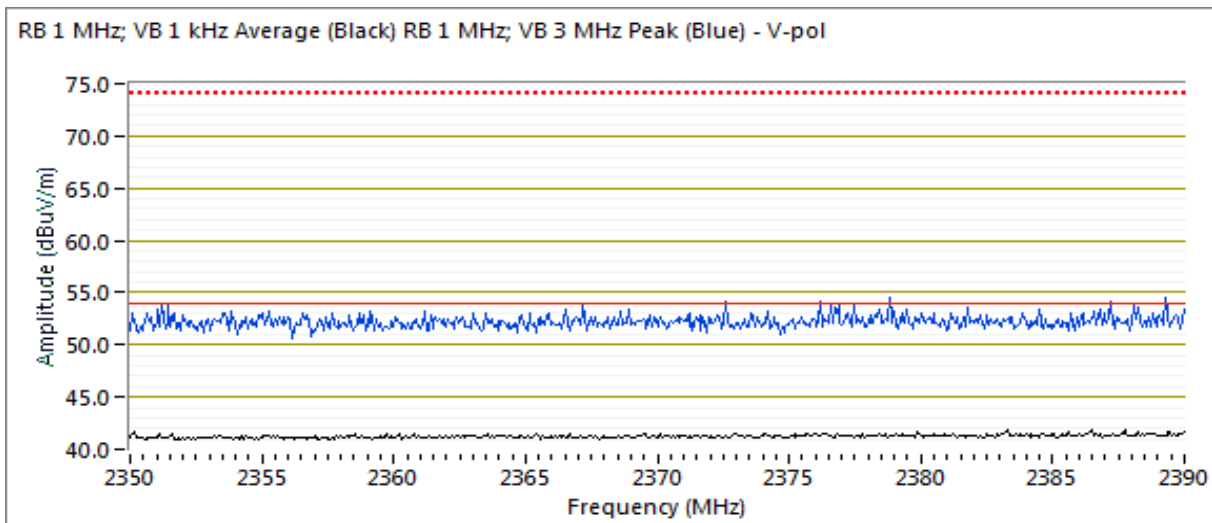
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #2a: Low Channel

Channel: 37 Mode: BLE
Tx Chain: Main Data Rate: 1 Mbps

Band Edge

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2389.630	41.8	V	54.0	-12.2	Avg	99	2.0	Note 6 - RB 1 MHz;VB 1 kHz;Peak
2389.960	55.4	V	74.0	-18.6	PK	99	2.0	RB 1 MHz;VB 3 MHz;Peak
2389.940	41.8	H	54.0	-12.2	Avg	3	1.6	Note 6 - RB 1 MHz;VB 1 kHz;Peak
2389.310	55.3	H	74.0	-18.7	PK	3	1.6	RB 1 MHz;VB 3 MHz;Peak





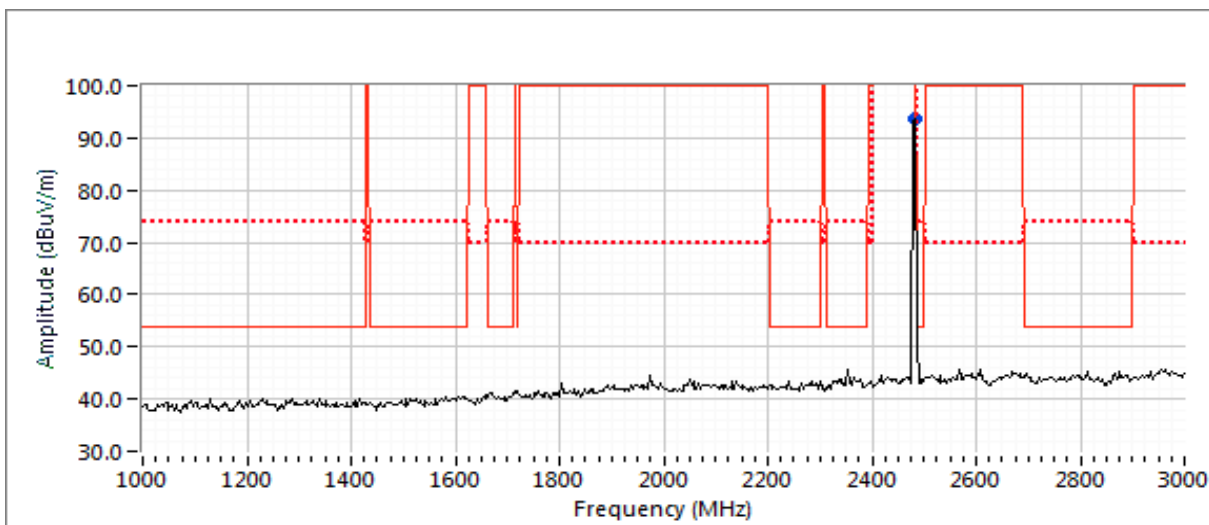
EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #2b: High Channel

Channel: 39 Mode: BLE
Tx Chain: Main Data Rate: 1 Mbps

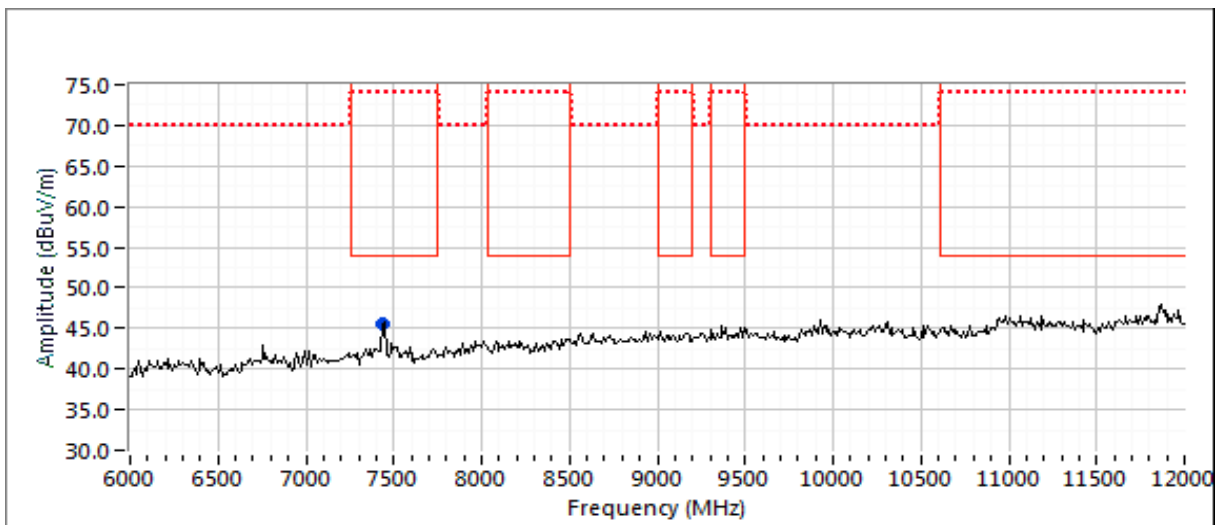
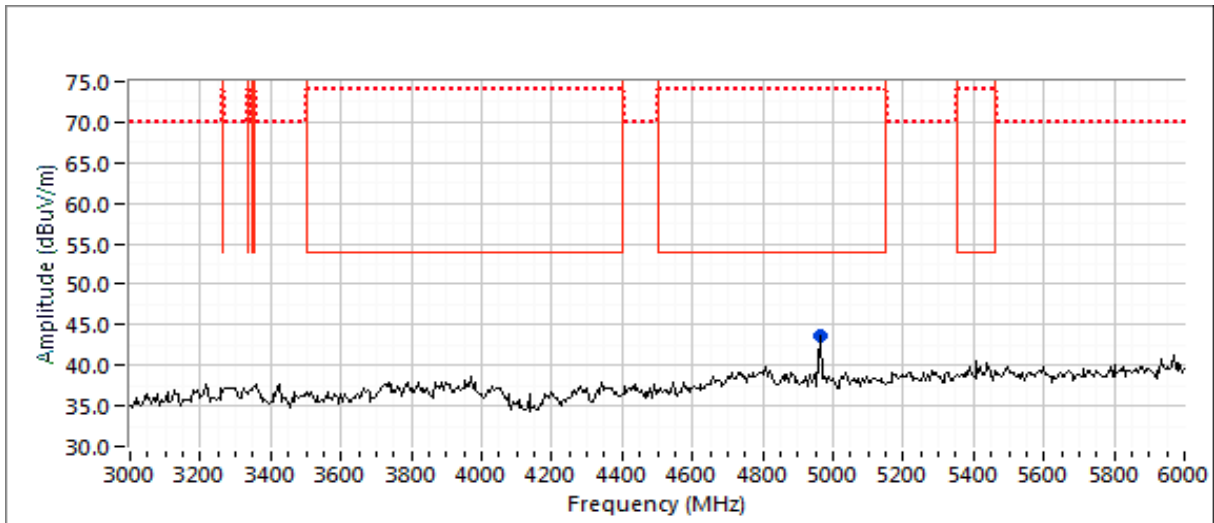
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.330	94.9	V	-	-	Peak	123	1.0	Fundamental
4960.120	39.1	V	54.0	-14.9	Avg	142	1.7	Note 6 - RB 1 MHz;VB 1 kHz;Peak
4960.480	49.2	V	74.0	-24.8	PK	142	1.7	RB 1 MHz;VB 3 MHz;Peak
7439.120	42.3	V	54.0	-11.7	Avg	210	1.0	Note 6 - RB 1 MHz;VB 1 kHz;Peak
7439.830	54.5	V	74.0	-19.5	PK	210	1.0	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

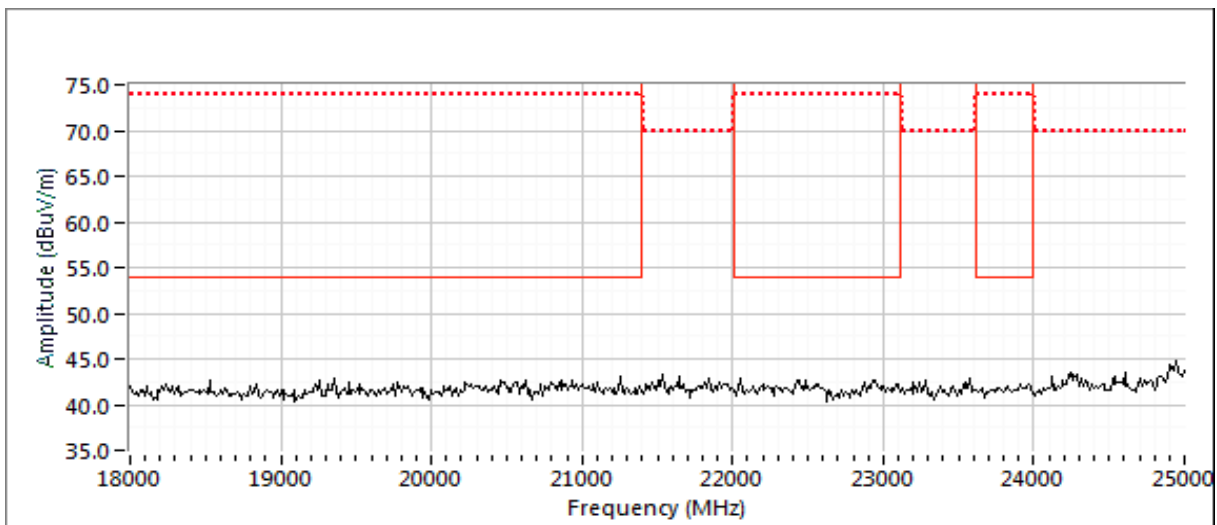
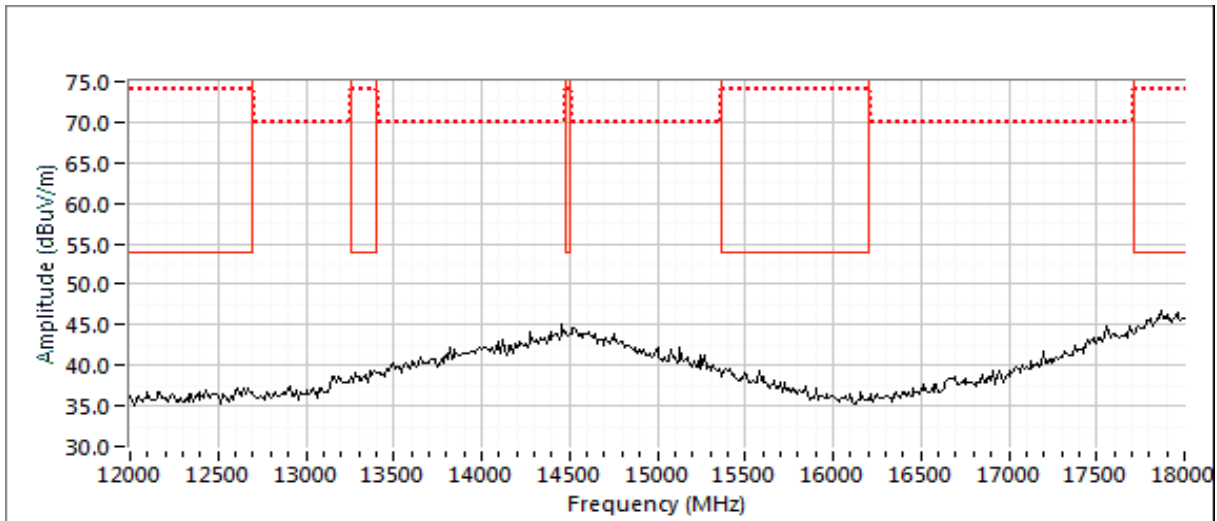
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A





EMC Test Data

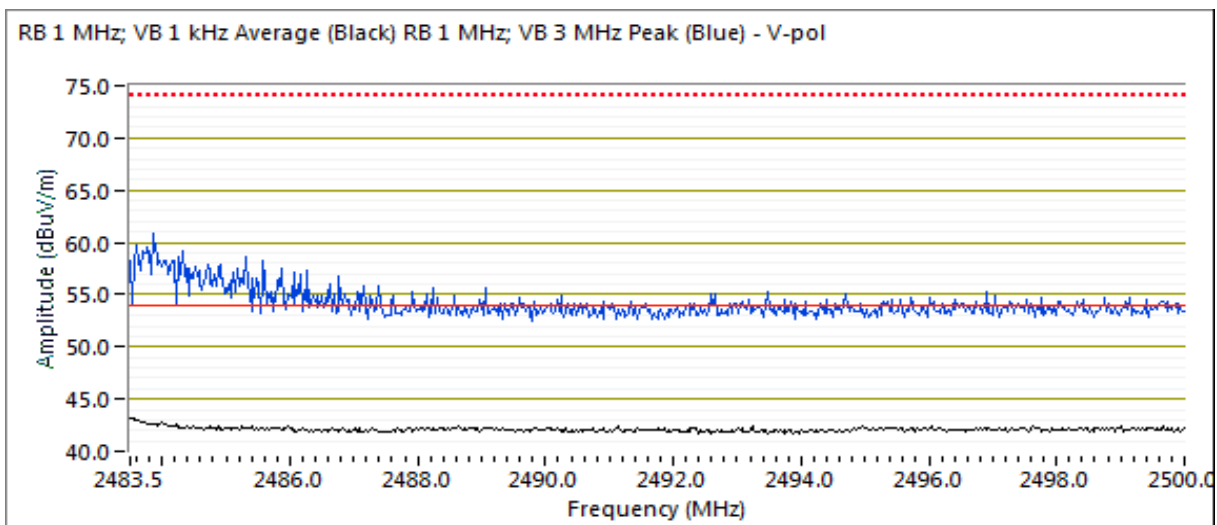
Client:	Enovate Medical	Job Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Coordinator:	Deniz Demirci
		Class:	N/A

Run #2b: High Channel

Channel: 39 Mode: BLE
Tx Chain: Main Data Rate: 1 Mbps

Band Edge

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.540	43.1	V	54.0	-10.9	Avg	255	1.6	Note 6 - RB 1 MHz;VB 1 kHz;Peak
2484.170	60.3	V	74.0	-13.7	PK	255	1.6	RB 1 MHz;VB 3 MHz;Peak
2483.550	42.8	H	54.0	-11.2	Avg	152	1.7	Note 6 - RB 1 MHz;VB 1 kHz;Peak
2484.130	59.3	H	74.0	-14.7	PK	152	1.7	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

Client:	Enovate Medical	PR Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Engineer:	Deniz Demirci
		Class:	B

RSS-247 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.

Date of Test: 10/23/2018, 10/24/2018
Test Engineer: Deniz Demirci
Test Location: Fremont Chamber #3

Config. Used: 1
Config Change: None
EUT Voltage: 3 Vdc battery powered.

General Test Configuration

The EUT was located on the turntable for radiated emissions testing. No support equipment was used
The test distance and extrapolation factor (if used) are detailed under each run description.

Ambient Conditions:
Temperature: 25 °C
Rel. Humidity: 39 %

Summary of Results

Run #		Test Performed			Limit	Result	Margin
Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	BLE EUT Flat	17- 2440MHz	Max	Max	Radiated Emissions, 9 kHz - 1 GHz	FCC Part 15.209	27.9 dBµV/m @ 30.00 MHz (-12.1 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.

Sample Notes

Sample S/N: B78543 0004 LF (P0001304)
Driver: Minicom
Antenna: Integral



EMC Test Data

Client:	Enovate Medical	PR Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Engineer:	Deniz Demirci
		Class:	B

Run #1: Radiated Emissions, 9 kHz - 1000 MHz, FCC 15.209

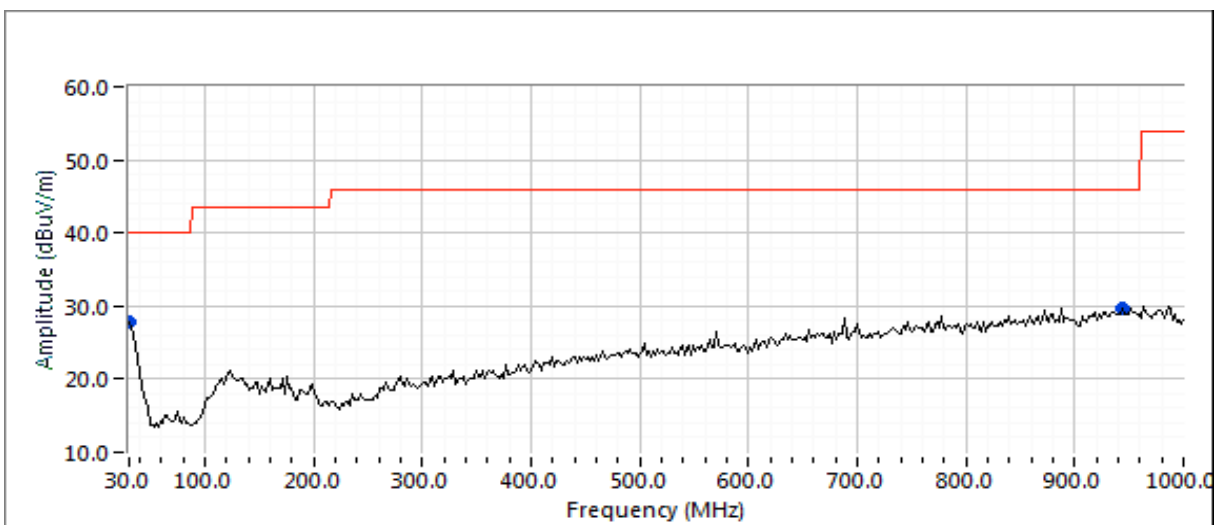
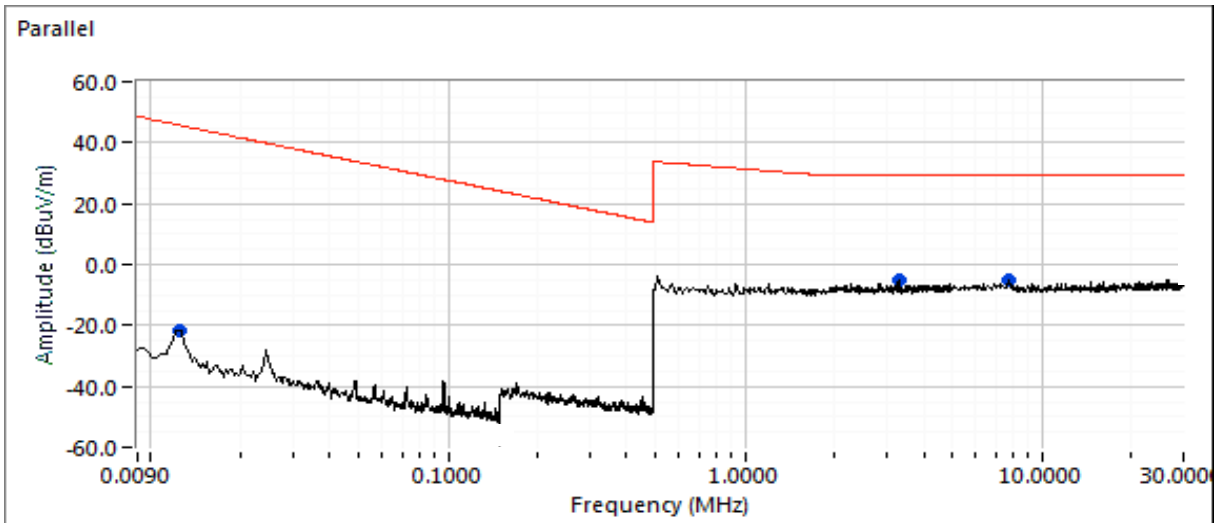
Frequency Range	Test Distance	Limit Distance	Extrapolation Factor
0.009 - 0.490 MHz	3	300	-80.0
0.490 - 1.705 MHz	3	30	-40.0
1.705 - 30.0 MHz	3	30	-40.0
30 - 1000 MHz	3	3	0.0

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
0.012	-28.3	H	45.9	-74.2	Peak	124	1.0	
3.292	-5.3	H	29.5	-34.8	Peak	67	1.0	Noise floor reading
7.705	-5.4	H	29.5	-34.9	Peak	38	1.0	Noise floor reading
30.000	27.9	V	40.0	-12.1	Peak	300	1.0	Noise floor reading
943.627	29.8	H	46.0	-16.2	Peak	52	1.0	Noise floor reading



EMC Test Data

Client:	Enovate Medical	PR Number:	PR085203
Model:	BLE LE Tag	T-Log Number:	TL085203
Contact:	Cameron Boone	Project Manager:	Deepa Shetty
Standard:	FCC 15.247, RSS-247	Project Engineer:	Deniz Demirci
		Class:	B



End of Report

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