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EMC Test Report

Application for FCC Grant of Equipment Authorization

Class II Permissive Change

FCC Part 15, Subpart E

Model: Wireless USB Adapter

FCC ID: STJ80411396001

APPLICANT: ICU Medical, Inc.
951 Calle Amanecer
San Clemente, CA 92673

TEST SITE(S): National Technical Systems
41039 Boyce Road.
Fremont, CA. 94538-2435

PROJECT NUMBER: PR092551

REPORT DATE: April 3, 2019

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REVISION HISTORY

Rev#	Date	Comments	Modified By
-	April 3, 2019	First release	
1	April 9, 2019	Removed preliminary power results	dwb

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SCOPE

An electromagnetic emissions test has been performed on the ICU Medical, Inc. model Wireless USB Adapter, pursuant to the following rules:

FCC Part 15, Subpart E requirements for UNII Devices

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 C63-10-2015

FCC General UNII Test Procedures KDB789033

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.

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

STATEMENT OF COMPLIANCE

The tested sample of ICU Medical, Inc. model Wireless USB Adapter complied with the requirements of the following regulations:

FCC Part 15, Subpart E requirements for UNII Devices

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 ICU Medical, Inc. model Wireless USB Adapter and therefore apply only to the tested sample. The sample was selected and prepared by Rishi Dandekar of ICU Medical, Inc..

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

UNII / LELAN DEVICES

OPERATION IN THE 5.725 – 5.85 GHZ BAND

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.407(e)	RSS-247 6.2.4 (1)	6dB Bandwidth	No change from original filing	≤ 500 kHz	Complies
15.407(a) (3)	RSS-210 A9.2(2)	Output Power (multipoint systems)	No change from original filing	30 dBm (1 W) EIRP ≤ 4 W	Complies
15.407(a) (3)	RSS-247 6.2.3 (1)	Power Spectral Density	No change from original filing	30 dBm / 500 kHz	Complies
15.407(b) (4) / 15.209	RSS-247 6.2.4 (2)	Spurious Emissions above 1GHz Band edge worst case was 5850MHz	62.1 dB μ V/m @ 5950.0 MHz (-6.2 dB)	Refer to the limits section (p19) for restricted bands, all others -17 dBm/MHz EIRP bandedge and -27 dBm/MHz EIRP	Complies
15.407(b) (4) / 15.209	RSS-247 6.2.4 (2)	Spurious Emissions 1 - 40 GHz Worse case emissions	51.2 dB μ V/m @ 11643.0 MHz (-2.8 dB)	Refer to the limits section (p19) for restricted bands, all others -17 dBm/MHz EIRP bandedge and -27 dBm/MHz EIRP	Complies

REQUIREMENTS FOR ALL U-NII/LELAN BANDS

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.407	RSS-247 6.1	Modulation	No change from original filing	Digital modulation is required	Complies
15.407(b) (6) / 15.209	RSS-247 6.2.1 (2)	Spurious Emissions below 1GHz	No change from original filing	Refer to page 20	Complies
15.31 (m)	RSS-247 6.4 (1) RSS-Gen 6.9	Channel Selection	Emissions tested at outermost and middle channels in each band	Device was tested on the top, bottom and center channels in each band	N/A
15.407 (c)	RSS-247 6.4 (2)	Operation in the absence of information to transmit	No change from original filing	Device shall automatically discontinue operation in the absence of information to transmit	Complies
15.407 (g)		Frequency Stability	No change from original filing	Signal shall remain within the allocated band	Complies
	RSS-247 6.4 (5)	User manual information	No change from original filing	Warning regarding Tilt angle for EIRP compliance, Indoor use for 5150-5250 MHz band and Radar are primary user of some bands	Complies

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	No change from original filing	Unique or integral antenna required	Complies
15.407 (b) (6)	RSS-Gen Table 4	AC Conducted Emissions	No change from original filing	-	Complies
15.247 (i) 15.407 (f)	RSS 102	RF Exposure Requirements	No change from original filing	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSS-Gen 8.4	User Manual	No change from original filing	Statement for all products	Complies
-	RSP-100 RSS-Gen 6.7	Occupied Bandwidth	No change from original filing	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 (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Radiated emission (field strength)	dB μ V/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB

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

The ICU Medical, Inc. model Wireless USB Adapter is a wireless USB Adapter that is designed to be used in ICU Medical products. Since the EUT could be placed in any position during operation, the EUT was treated as tabletop equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 5 VDC.

Radiated emissions' testing was performed with the Wireless USB Adapter installed in a PCA 7.X pump.

The sample was received on February 14, 2019 and tested on February 14, 2019. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
ICUMED	DWL-AG132	Wireless USB Adapter	1318A1D09969	STJ80411396001

ANTENNA SYSTEM

The antenna system consists of a surface mount antenna.

ENCLOSURE

The Host PCA 7.X device enclosure is primarily constructed of PVC/Plastic. It measures approximately 20 cm wide by 15 cm deep by 35 cm high.

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 support equipment for testing:

Company	Model	Description	Serial Number	FCC ID
Lenovo	x250	Laptop	N/A	N/A
Lenovo	ADL170NLC2A	AC adapter	11S45N0375Z1ZSAZ 47N04K	N/A

No remote support equipment was used during testing.

EUT INTERFACE PORTS

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

Port	Connected To	Description	Cable(s)	
			Shielded or Unshielded	Length(m)
USB	Dougle	Radio activation	Unshielded	2m
AC	LCPCA(EUT)	Power Source	Unshielded	2m
DC	Laptop	Power Source	Unshielded	2m
RF	Antenna	Conducted	Unshielded	0.1m

EUT OPERATION

During emissions testing, the dongle inside PCA 7.X was connected via USB cable to the laptop which activates the radio, sets it for continuous transmissions at the selected setting of the frequency and power.

PROPOSED MODIFICATION DETAILS**GENERAL**

No changes have been made to the ICU Medical, Inc. model Wireless USB Adapter. This filing is to address the change in FCC Rules for the 5725-5850 MHz band which allowed use of test results for §15.247 for a limited time to demonstrate compliance with the limits in §15.407 for spurious emissions.

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 5	US0027	2845B-5	41039 Boyce Road Fremont, CA 94538-2435

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

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

Software is used to view and convert 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 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 1m above the ground plane.

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

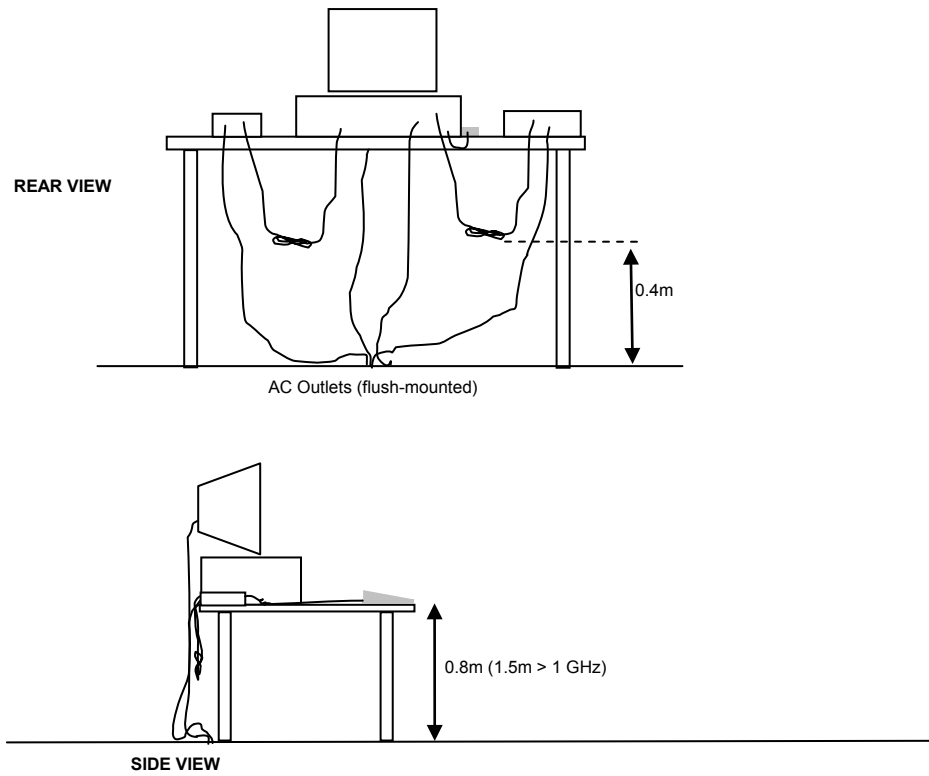
RADIATED EMISSIONS

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.

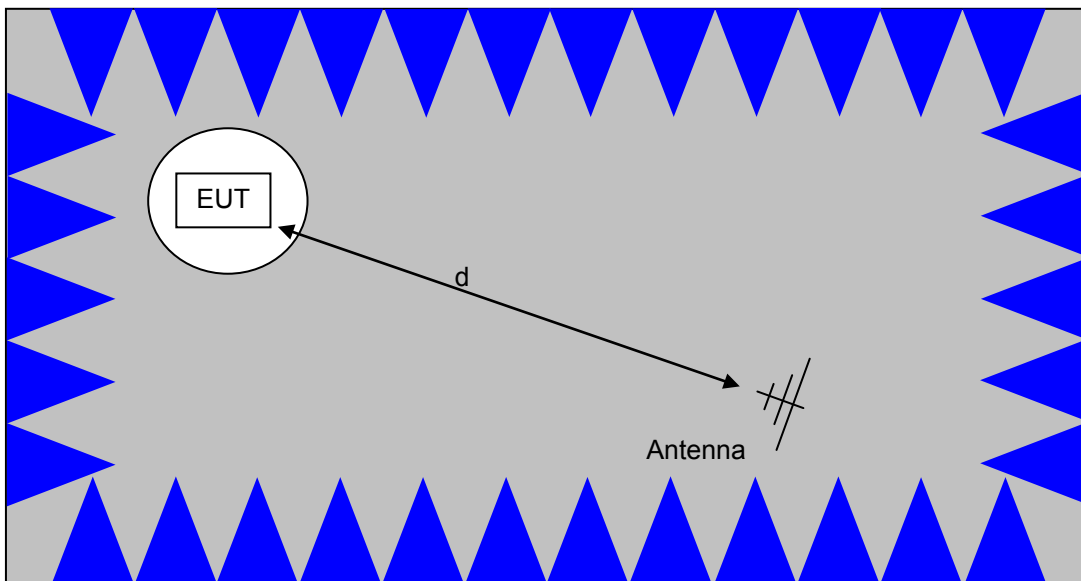
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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

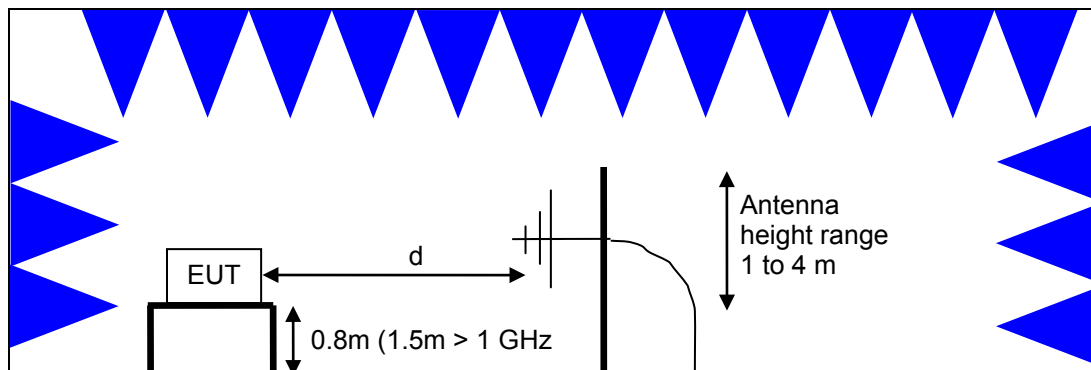


Typical Test Configuration for Radiated Field Strength Measurements



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.

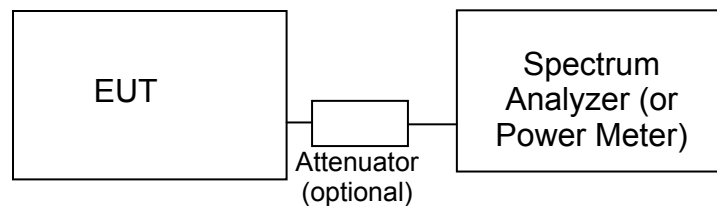
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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:

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 (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

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

FCC 15.407 (a) OUTPUT POWER LIMITS

The table below shows the limits for output power and output power density. For the 5250-5350 and 5470-5725 MHz bands, 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
5150 – 5250	1Watt (30 dBm)	17 dBm/MHz
5250 – 5350 and 5470-5725	250 mW (24 dBm)	11 dBm/MHz
5725 – 5825	1 Watt (30 dBm)	30 dBm/500kHz

For system using antennas with gains exceeding 6dBi, the output power and power spectral density limits are reduced by 1dB for every dB the antenna gain exceeds 6dBi. Fixed point-to-point applications using the 5725 – 5825 MHz band may use antennas with gains of up to 23dBi without this limitation. If the gain exceeds 23dBi then the output power limit of 1 Watt is reduced by 1dB for every dB the gain exceeds 23dBi.

SPURIOUS EMISSIONS LIMITS –UNII and LELAN DEVICES

The spurious emissions limits for signals below 1GHz are the FCC/RSS-Gen general limits. For emissions above 1GHz, signals in restricted bands are subject to the FCC/RSS-Gen general limits. All other signals have a limit of –27dBm/MHz, which is field strength of 68.3dBuV/m/MHz at a distance of 3m. For devices operating in the 5725-5850 MHz bands under the LELAN/UNII rules, the limit within 10MHz of the allocated band is increased to –17dBm/MHz.

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:

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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 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

Radiated Emissions, 13-Feb-19

<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
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
EMCO	Antenna, Horn, 1-18 GHz (SA40-Blu)	3115	1386	10/8/2018	10/8/2020
Hewlett Packard	High Pass filter, 8.2 GHz (Blu System)	P/N 84300-80039 (84125C)	1392	5/1/2018	5/1/2019
Micro-Tronics	Band Reject Filter, 5725-5875 MHz	BRC50705-02	2241	8/17/2018	8/17/2019
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB 7	9482	10/13/2018	10/13/2019
HP / Miteq	SA40 R Head HF preAmplifier, 18-40 GHz	TTA1840-45-5P-HG-S	1145	9/8/2018	9/8/2019
A. H. Systems	System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	8/4/2017	8/4/2019

Radio Antenna Port, 13-Feb-19

<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Agilent Technologies	PSA, Spectrum Analyzer, (installed options, 111, 115, 123, 1DS, B7J, HYX,	E4446A	2139	7/27/2018	7/27/2019



Appendix B Test Data

TL092551-RA Pages 25 – 37



EMC Test Data

Client:	ICU Medical	PR Number:	PR092551
Product	Wireless USB Adapter	T-Log Number:	TL092551-RA
		Project Manager:	Christine Krebill
Contact:	Rishi Dandekar	Project Engineer:	David Bare
Emissions Standard(s):	FCC §15.407		
		Environment:	Radio

EMC Test Data

For The

ICU Medical

Product

Wireless USB Adapter

Date of Last Test: 2/14/2019



EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

RSS-247 and FCC 15.407 (UNII) 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: 2/13/2019
Test Engineer: Roy Zheng
Test Location: FT Chamber #5

Config. Used: 1
Config Change: None
EUT Voltage: 120V/60Hz

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: 20 °C
Rel. Humidity: 31 %

Summary of Results

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
1	a	149 - 5745MHz	21		Band Edge 5725 MHz	15E	56.3 dBµV/m @ 5603.0 MHz (-12.0 dB)
	a	165 - 5825MHz	21		Band Edge 5850MHz	15E	62.1 dBµV/m @ 5950.0 MHz (-6.2 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:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033

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 50 traces. (method VB of KDB 789033)

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6 MB/s	1.00	Yes	1	0	0	1000

Sample Notes

Sample S/N: 1318A1D09969

Driver: ART V53 Build 24

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB $\geq$ 3MHz, peak detector). Per KDB 789033 2) c) (i), compliance can be demonstrated by meeting the average and peak limits of 15.209, as an alternative.
Note 2:	Plots of the average and peak bandedge do not account for any duty cycle correction (if needed). Refer to the tabular results for final measurements.



EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Run #1: Radiated Bandedge Measurements, 5725-5850MHz

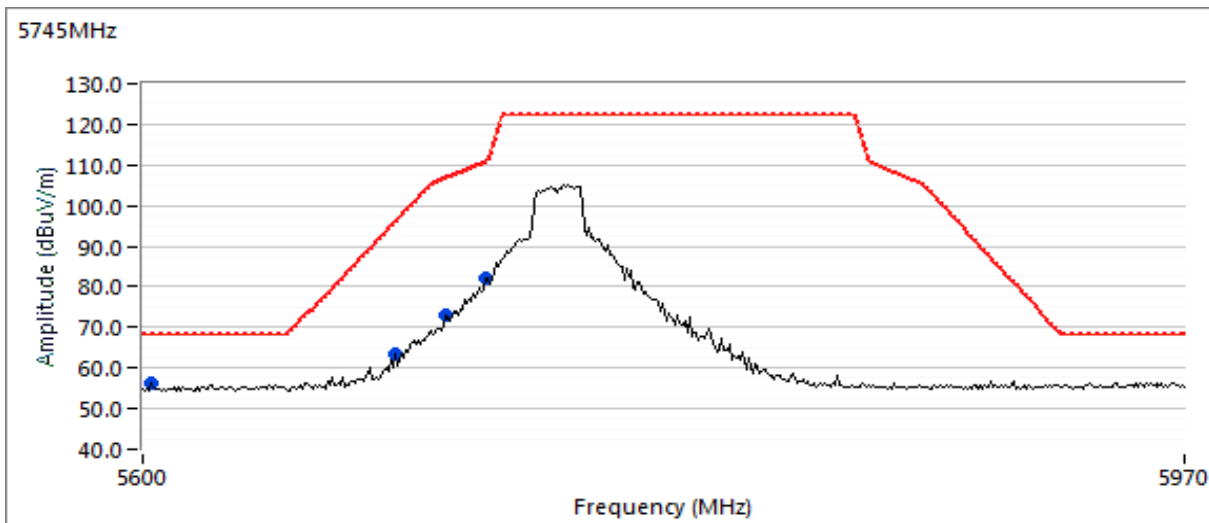
Date of Test: 2/13/2019
 Test Engineer: Roy Zheng
 Test Location: FT Chamber #5

Config. Used: 1
 Config Change: None
 EUT Voltage: 120V/60Hz

Channel: 149 - 5745MHz
 Tx Chain: 1
 Mode: a
 Data Rate: 6MB/s

5725 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5602.970	56.3	H	68.3	-12.0	Peak	139	1.0	
5719.380	82.1	V	110.7	-28.6	Peak	360	1.5	
5687.500	63.6	V	96.0	-32.4	Peak	357	1.5	
5705.290	73.2	V	106.8	-33.6	Peak	219	1.5	





EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Channel: 165 - 5825MHz

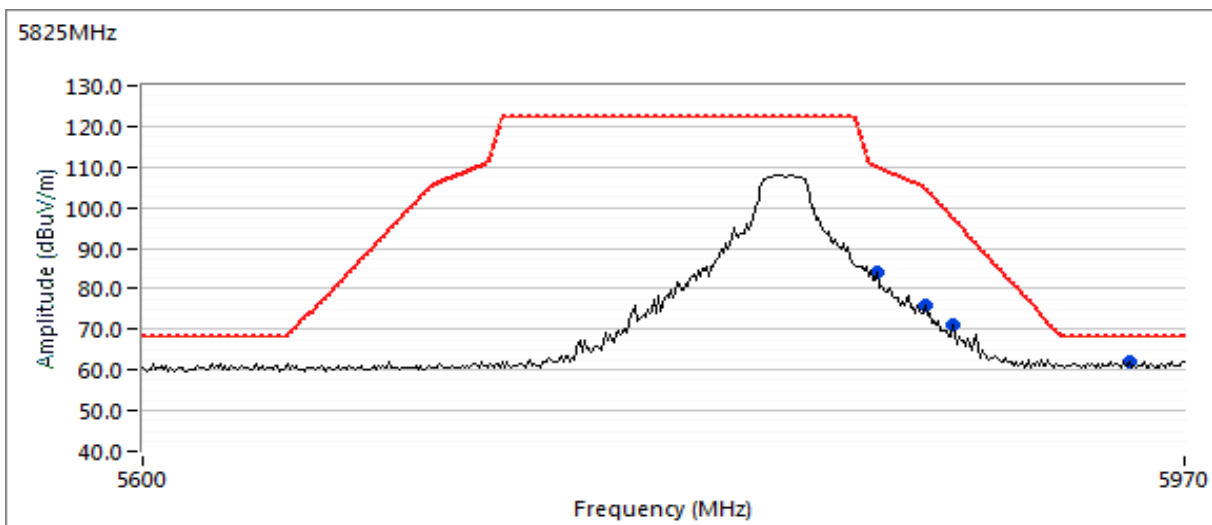
Tx Chain: 1

Mode: a

Data Rate: 6MB/s

5850 MHz Band Edge Signal Radiated Field Strength

Frequency	Level	Pol	15.E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
5949.980	62.1	H	68.3	-6.2	Peak	284	1.0	
5858.040	84.0	V	110.0	-26.0	Peak	245	2.5	
5885.470	71.2	V	97.6	-26.4	Peak	221	2.5	
5875.830	76.1	H	104.7	-28.6	Peak	208	2.5	





EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

RSS-247 and FCC 15.407 (UNII) 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: 20 °C
Rel. Humidity: 31 %

Summary of Results

Run #	Mode	Channel	Power Setting		Test Performed	Limit	Result / Margin
1	a	149 - 5745MHz	21		Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	49.3 dBµV/m @ 11489.8 MHz (-4.7 dB)
		157 - 5785MHz	21		Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	51.0 dBµV/m @ 11570.4 MHz (-3.0 dB)
		165- 5825MHz	21		Radiated Emissions, 1 - 40 GHz	FCC 15.209 / 15 E	51.2 dBµV/m @ 11643.0 MHz (-2.8 dB)

Radiated emissions below 1 GHz complied with the requirements §15.407(b)(6) as shown in test report 07U10885-1 in previous filing (6/27/2007).

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:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Procedure Comments:

Measurements performed in accordance with FCC KDB 789033

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 50 traces. (method VB of KDB 789033)

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
11a	6 MB/s	1.00	Yes	1	0	0	1000

Sample Notes

Sample S/N: 1318A1D09969

Driver: ART V53 Build 24

Measurement Specific Notes:

Note 1:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB $\geq$ 3MHz, peak detector). Per KDB 789033 2) c) (i), compliance can be demonstrated by meeting the average and peak limits of 15.209, as an alternative.
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EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Run #1, Radiated Spurious Emissions, 1,000 - 40,000 MHz.

Date of Test: 2/13/2019

Test Engineer: Roy Zheng

Test Location: FT Chamber #5

Config. Used: 1

Config Change: None

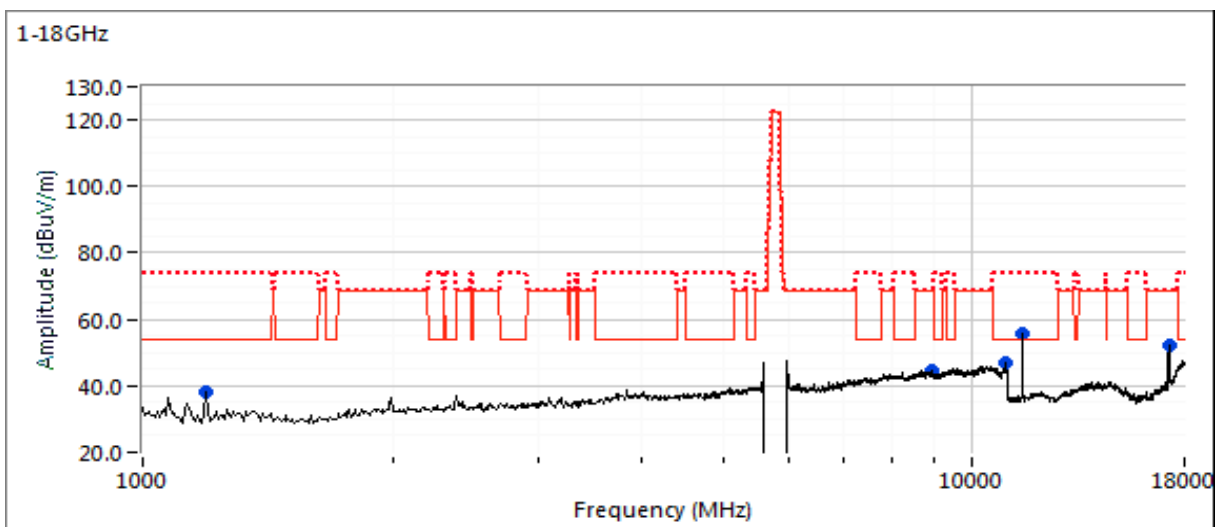
EUT Voltage: 120V/60Hz

Run #1a: Low Channel

Channel: 149
Tx Chain: 1

Mode: a
Data Rate: 6 MB/s

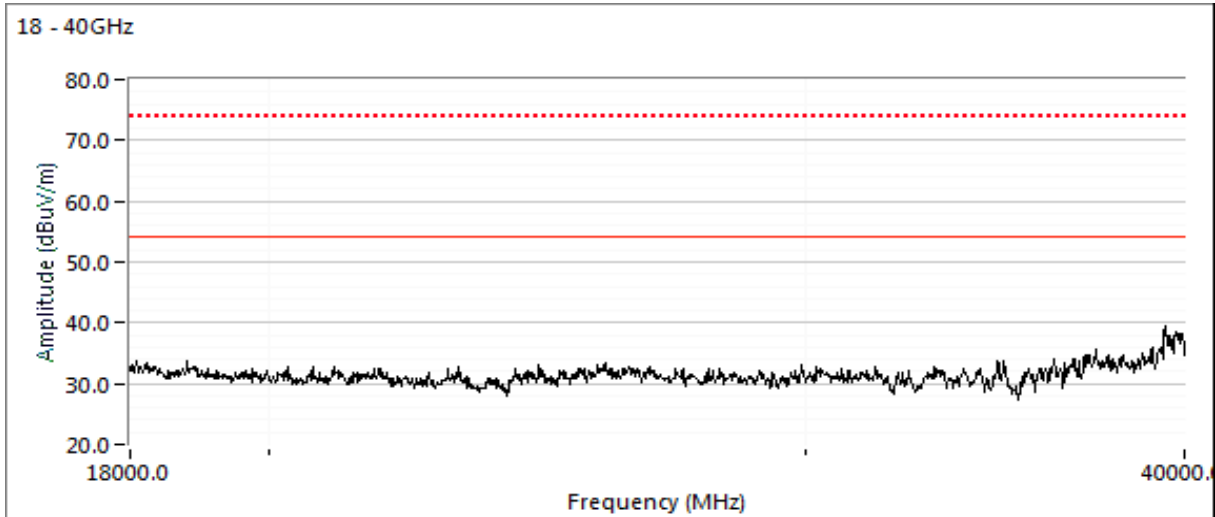
Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBμV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1191.670	38.2	H	54.0	-15.8	Peak	250	1.9	RB 1 MHz;VB 3 MHz;Peak
8925.000	44.5	H	68.3	-23.8	Peak	86	1.9	RB 1 MHz;VB 3 MHz;Peak
10967.310	41.2	V	54.0	-12.8	AVG	0	1.0	RB 1 MHz;VB 10 Hz;Peak
10967.800	53.5	V	74.0	-20.5	PK	0	1.0	RB 1 MHz;VB 3 MHz;Peak
11489.840	49.3	H	54.0	-4.7	AVG	137	1.7	RB 1 MHz;VB 10 Hz;Peak
11491.300	61.8	H	74.0	-12.2	PK	137	1.7	RB 1 MHz;VB 3 MHz;Peak
17240.180	48.8	H	68.3	-19.5	AVG	360	1.7	RB 1 MHz;VB 10 Hz;Peak
17240.190	62.0	H	68.3	-6.3	PK	360	1.7	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare



Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



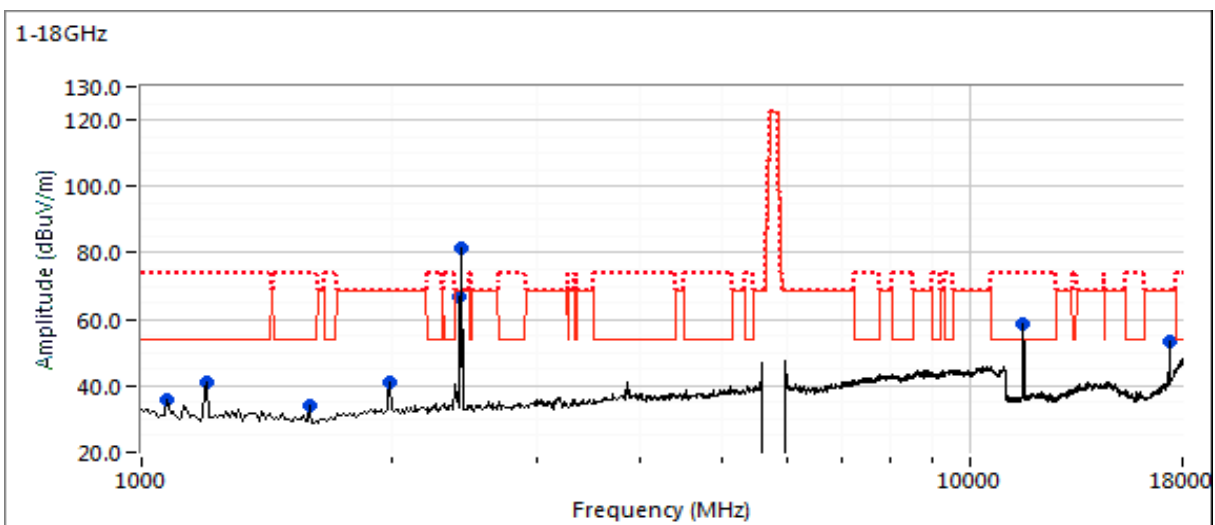
EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Run #1b: Center Channel

Channel: 157 Mode: a
Tx Chain: 1 Data Rate: 6 MB/s

Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1075.000	35.9	H	54.0	-18.1	Peak	137	1.3	RB 1 MHz;VB 3 MHz;Peak
1591.670	34.1	H	54.0	-19.9	Peak	303	1.0	RB 1 MHz;VB 3 MHz;Peak
1991.670	40.9	V	68.3	-27.4	Peak	276	1.6	RB 1 MHz;VB 3 MHz;Peak
1198.620	30.8	H	54.0	-23.2	AVG	262	1.0	RB 1 MHz;VB 10 Hz;Peak
1199.300	46.2	H	74.0	-27.8	PK	262	1.0	RB 1 MHz;VB 3 MHz;Peak
2415.820	42.4	H	68.3	-25.9	PK	107	1.0	RB 1 MHz;VB 3 MHz;Peak
2432.150	42.4	V	68.3	-25.9	PK	261	1.0	RB 1 MHz;VB 3 MHz;Peak
11570.360	51.0	H	54.0	-3.0	AVG	145	1.6	RB 1 MHz;VB 10 Hz;Peak
11572.330	63.2	H	74.0	-10.8	PK	145	1.6	RB 1 MHz;VB 3 MHz;Peak
17358.210	61.2	H	68.3	-7.1	PK	11	1.6	RB 1 MHz;VB 3 MHz;Peak

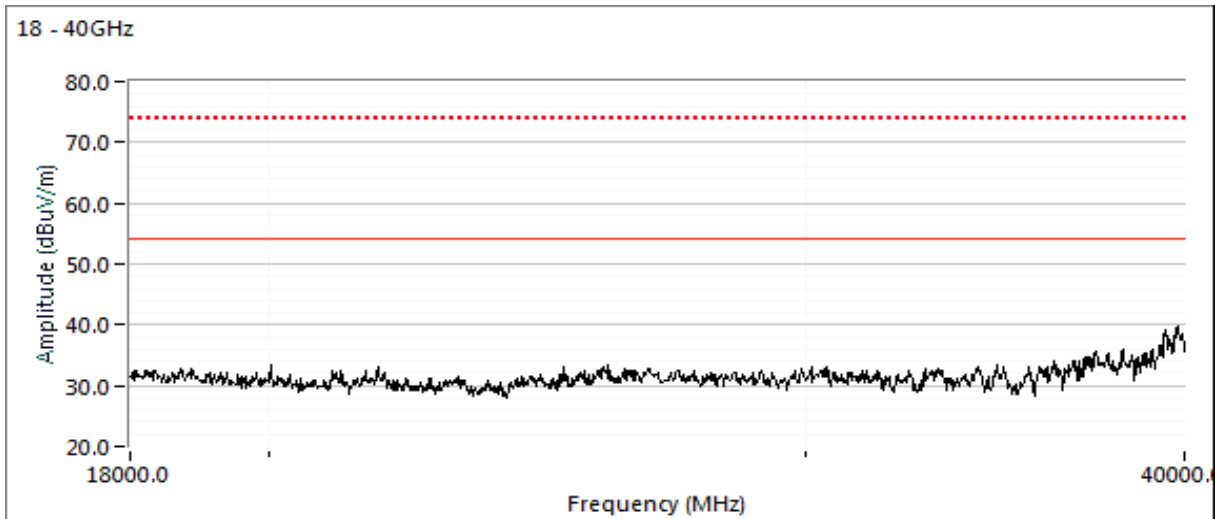


Note: Emissions at 2415 and 2432 MHz were observed during the initial scan but are not from the EUT. Signal was from another Wi-Fi device that leaked into the measurement.



EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare



Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).



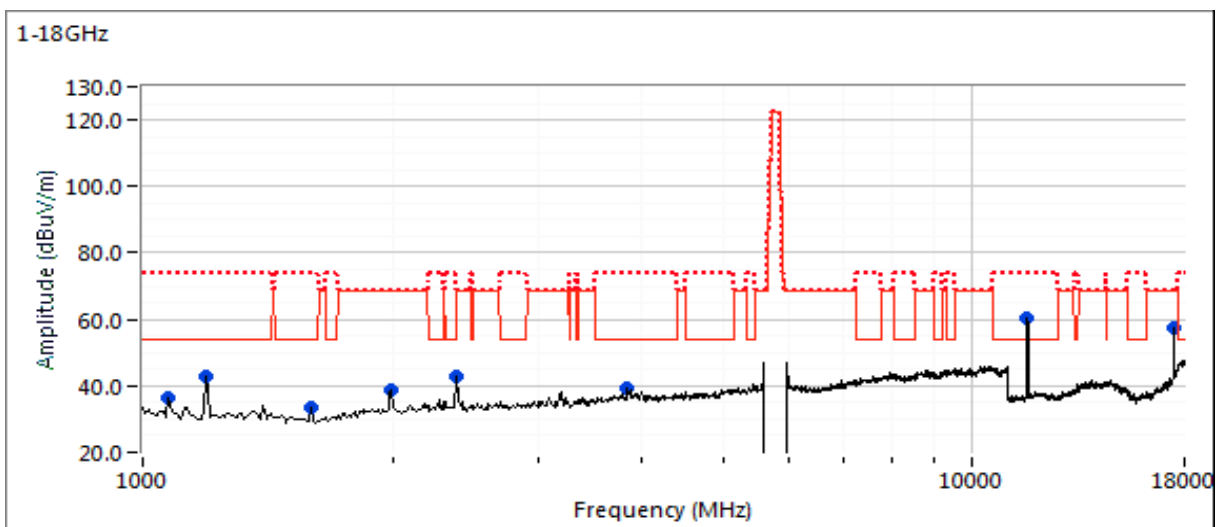
EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare

Run #1c: High Channel

Channel: 165 Mode: a
Tx Chain: 1 Data Rate: 6 MB/s

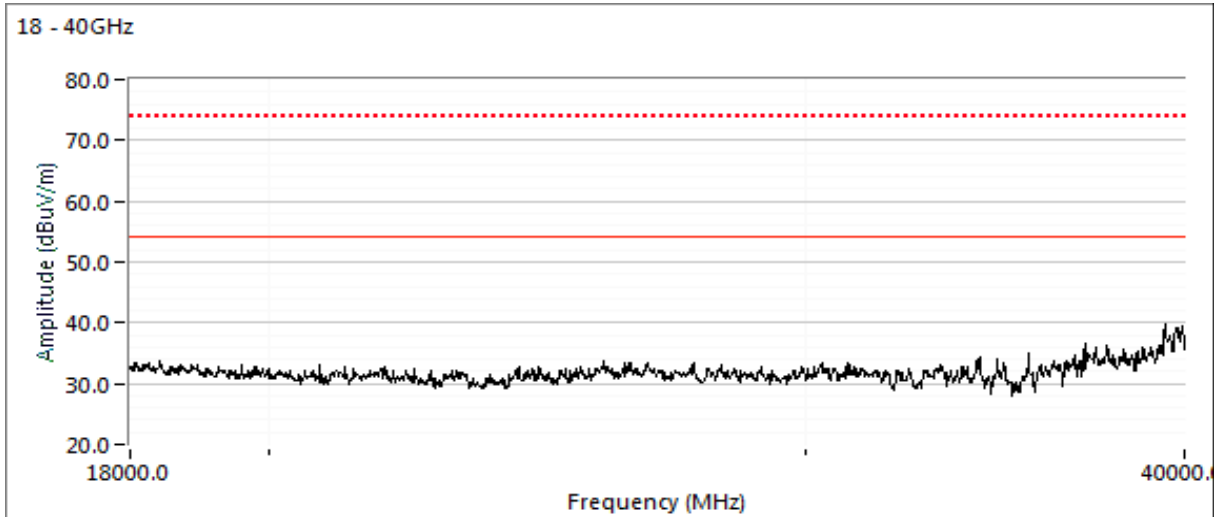
Frequency	Level	Pol	15.209 / 15E		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
1600.000	33.2	V	54.0	-20.8	Peak	292	2.5	RB 1 MHz;VB 3 MHz;Peak
1991.670	38.6	V	68.3	-29.7	Peak	265	1.3	RB 1 MHz;VB 3 MHz;Peak
2391.670	43.0	V	68.3	-25.3	Peak	287	1.6	RB 1 MHz;VB 3 MHz;Peak
1075.320	26.7	H	54.0	-27.3	AVG	331	1.0	RB 1 MHz;VB 10 Hz;Peak
1073.710	41.9	H	74.0	-32.1	PK	331	1.0	RB 1 MHz;VB 3 MHz;Peak
1192.980	29.2	H	54.0	-24.8	AVG	43	2.3	RB 1 MHz;VB 10 Hz;Peak
1192.120	43.6	H	74.0	-30.4	PK	43	2.3	RB 1 MHz;VB 3 MHz;Peak
3840.450	35.1	V	54.0	-18.9	AVG	58	2.3	RB 1 MHz;VB 10 Hz;Peak
3840.290	46.3	V	74.0	-27.7	PK	58	2.3	RB 1 MHz;VB 3 MHz;Peak
11642.950	51.2	H	54.0	-2.8	AVG	195	1.7	RB 1 MHz;VB 10 Hz;Peak
11642.660	63.9	H	74.0	-10.1	PK	195	1.7	RB 1 MHz;VB 3 MHz;Peak
17474.290	61.0	H	68.3	-7.3	PK	169	1.7	RB 1 MHz;VB 3 MHz;Peak





EMC Test Data

Client:	ICU Medical	Job Number:	PR092551
Model:	Wireless USB Adapter	T-Log Number:	TL092551-RA
Contact:	Rishi Dandekar	Project Manager:	Christine Krebill
Standard:	FCC §15.407	Project Coordinator:	David Bare



Note 1:	For emissions in restricted bands, the limit of 15.209 was used which requires average and peak measurements.
Note 2:	For emissions outside of the restricted bands the limit is -27dBm/MHz eirp (68.3dBuV/m). The measurement method required is a peak measurement (RB=1MHz, VB≥3MHz, peak detector).

End of Report

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