

EMC Test Report

Application for Grant of Equipment Authorization

Industry Canada RSS-Gen Issue 4 / RSS 247 Issue 1 FCC Part 15 Subpart C

Olio Model One Watch (H1B)

IC CERTIFICATION #: 20282-1H1B
FCC ID: 2AEP5H1B

APPLICANT: Olio Devices
2101 Pacific Ave #303
San Francisco, CA 94115

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

IC SITE REGISTRATION #: 2845B-5

REPORT DATE: June 5, 2015

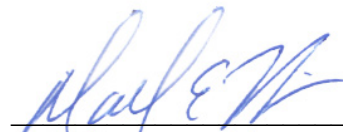
REISSUE DATE: August 12, 2015

FINAL TEST DATES: May 27, 28 and July 10, 2015

TOTAL NUMBER OF PAGES: 64

PROGRAM MGR /
TECHNICAL REVIEWER:

QUALITY ASSURANCE DELEGATE /
FINAL REPORT PREPARER:



Mark E Hill
Staff Engineer



David Guidotti
Senior Technical Writer



National Technical Systems - Silicon Valley is accredited by the A2LA, certificate number 0214.26, to perform the test(s) listed in this report, except where noted otherwise. This report and the information contained herein represent the results of testing test articles identified and selected by the client performed to specifications and/or procedures selected by the client. National Technical Systems (NTS) makes no representations, expressed or implied, that such testing is adequate (or inadequate) to demonstrate efficiency, performance, reliability, or any other characteristic of the articles being tested, or similar products. This report should not be relied upon as an endorsement or certification by NTS of the equipment tested, nor does it represent any statement whatsoever as to its merchantability or fitness of the test article, or similar products, for a particular purpose. This report shall not be reproduced except in full

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	June 5, 2015	First release	
1.0	July 29, 2015	Updated to RSS-247, Issue 1. Updated power measurements and clarified the 20dB BW measurement.	MEH
2.0	August 6, 2015	Corrected reported rf power results. Clarified the BT time of occupancy.	MEH
3.0	August 12, 2015	Additional clarification of BT time of occupancy	MEH

TABLE OF CONTENTS

REVISION HISTORY	2
TABLE OF CONTENTS	3
SCOPE.....	4
OBJECTIVE	4
STATEMENT OF COMPLIANCE.....	5
DEVIATIONS FROM THE STANDARDS.....	5
TEST RESULTS SUMMARY	6
FREQUENCY HOPPING SPREAD SPECTRUM (2400 – 2483.5 MHZ, 15 CHANNELS OR MORE)	6
GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS.....	6
MEASUREMENT UNCERTAINTIES.....	7
EQUIPMENT UNDER TEST (EUT) DETAILS.....	8
GENERAL.....	8
ANTENNA SYSTEM	8
ENCLOSURE.....	8
MODIFICATIONS.....	8
SUPPORT EQUIPMENT.....	8
EUT INTERFACE PORTS	8
EUT OPERATION	8
TEST SITE.....	9
GENERAL INFORMATION.....	9
CONDUCTED EMISSIONS CONSIDERATIONS	9
RADIATED EMISSIONS CONSIDERATIONS	9
MEASUREMENT INSTRUMENTATION	10
RECEIVER SYSTEM	10
INSTRUMENT CONTROL COMPUTER	10
LINE IMPEDANCE STABILIZATION NETWORK (LISN).....	10
FILTERS/ATTENUATORS	11
ANTENNAS.....	11
ANTENNA MAST AND EQUIPMENT TURNABLE.....	11
INSTRUMENT CALIBRATION.....	11
TEST PROCEDURES	12
EUT AND CABLE PLACEMENT	12
RADIATED EMISSIONS.....	13
CONDUCTED EMISSIONS FROM ANTENNA PORT	16
BANDWIDTH MEASUREMENTS	16
SPECIFICATION LIMITS AND SAMPLE CALCULATIONS.....	17
CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(A), RSS GEN	17
GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS	18
OUTPUT POWER LIMITS – FHSS SYSTEMS	18
TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS AND DTS SYSTEMS.....	18
SAMPLE CALCULATIONS - CONDUCTED EMISSIONS	19
SAMPLE CALCULATIONS - RADIATED EMISSIONS.....	19
SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION.....	20
APPENDIX A TEST EQUIPMENT CALIBRATION DATA	21
APPENDIX B TEST DATA	22
END OF REPORT	64

SCOPE

An electromagnetic emissions test has been performed on the Olio Devices Olio Model One Watch (H1B), pursuant to the following rules:

FCC Part 15 Subpart C

Industry Canada RSS-GEN Issue 4

RSS 247 Issue 1 “Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) 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 - Silicon Valley test procedures:

ANSI C63.10-2013

FHSS test procedure DA 00-0705A1

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.

OBJECTIVE

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

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

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

Maintenance of compliance is the responsibility of the manufacturer. Any modification

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

STATEMENT OF COMPLIANCE

The tested sample of Olio Devices Olio Model One Watch (H1B) complied with the requirements of the following regulations:

FCC Part 15 Subpart C

Industry Canada RSS-Gen Issue 4

RSS 247 Issue 1 “Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) 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 Olio Devices Olio Model One Watch (H1B) and therefore apply only to the tested sample. The sample was selected and prepared by AJ Cooper of Olio Devices.

DEVIATIONS FROM THE STANDARDS

The following deviation was made from the published requirements listed in the scope of this report:

1. The 20dB BW was measured using RBW=100 kHz, instead of 1-5% of the BW.

TEST RESULTS SUMMARY

FREQUENCY HOPPING SPREAD SPECTRUM (2400 – 2483.5 MHz, 15 channels or more)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247 (a) (1)	5.1 (2)	20dB Bandwidth	Basic: 1102kHz EDR: 1393 kHz	Channel spacing > 20dB bandwidth	Complies
		Channel Separation	1 MHz		Complies
15.247 (a) (1) (iii)	5.1 (4)	Channel Dwell Time (average time of occupancy)	Device complies with Bluetooth specifications with a minimum of 20 hopping channels	<0.4 second within a period of 0.4 x number of channels	Complies
15.247 (a) (1) (iii)	5.1 (4)	Number of Channels			Complies
15.247 (a) (1)	5.1 (4)	Channel Utilization	The system uses the Bluetooth algorithm and, therefore, meets all requirements for channel utilization.	All channels shall, on average, be used equally	Complies
15.247 (b) (3)	5.1 (2)	Output Power (multipoint systems)	Basic: 3.4dBm (0.0022W) EDR: 6.3dBm (0.0043W) EIRP = 1.1 mW ^{Note 1}	1Watt, EIRP limited to 4 Watts.	Complies
15.247(c)	5.5	Spurious Emissions – 30MHz – 25GHz	All spurious emissions < -20dBc	< -20dBc	Complies
15.247(c) / 15.209	5.5 RSS GEN Table 3	Radiated Spurious Emissions 30MHz – 25GHz	41.9 dBμV/m @ 10826.1 MHz (-12.1 dB)	15.207 in restricted bands, all others < -20dBc	Complies
15.247 (a) (1)	-	Receiver bandwidth	Refer to operational description	Shall match the channel bandwidth	Complies

Note 1: EIRP calculated using antenna gain of -6.0 dBi

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Antenna is integral to the device	Unique or integral antenna required	Complies
15.207	RSS GEN Table 3	AC Conducted Emissions	N/A – the EUT is battery powered. It is recharged via a wireless power function		
15.247 (b) (5) / 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to SAR Exclusion calculations in separate exhibit	Refer to OET 65, FCC Part 1 and RSS 102	Complies

MEASUREMENT UNCERTAINTIES

ISO/IEC 17025 requires that an estimate of the measurement uncertainties associated with the emissions test results be included in the report. The measurement uncertainties given below are based on a 95% confidence level and were calculated in accordance with UKAS document LAB 34.

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 to 7000 MHz	± 0.52 dB
RF power, conducted (Spectrum analyzer)	dBm	25 to 7000 MHz	± 0.7 dB
Conducted emission of transmitter	dBm	25 to 26500 MHz	± 0.7 dB
Conducted emission of receiver	dBm	25 to 26500 MHz	± 0.7 dB
Radiated emission (substitution method)	dBm	25 to 26500 MHz	± 2.5 dB
Radiated emission (field strength)	dB μ V/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dB μ V	0.15 to 30 MHz	± 2.4 dB

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

The Olio Devices model Olio Model One Watch (H1B) is a wrist watch that is designed to be worn by a consumer. It utilizes an Bluetooth 4.0 radio. The EUT was treated as tabletop equipment during testing for purpose of testing. The electrical rating of the EUT is battery power via a magnetic coil.

The sample was received on May 27, 2015 and tested on May 27, 28 and July 10, 2015. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Olio	Model One	Watch	H1B	2AEP5H1B

ANTENNA SYSTEM

The antenna consist of a slot radiator formed by the sheet metal and steel housing. The antenna gain is -6.0dBi @ 2.4GHz.

ENCLOSURE

The EUT enclosure is primarily constructed of steel. It measures approximately 25 x 4.5 x 1.5cm.

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
Camelion	AD3127	USB Power Adapter	NA	-

The following equipment was used as remote support equipment for emissions testing:

Company	Model	Description	Serial Number	FCC ID
Dell	Inspiron 14	laptop	1ZL5832	DoC

EUT INTERFACE PORTS

The EUT has no interface ports.

EUT OPERATION

Unless otherwise noted, the EUT configured for continuous transmission at the maximum output power. The modulation used is noted for each test.

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

CONDUCTED EMISSIONS CONSIDERATIONS

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

RADIATED EMISSIONS CONSIDERATIONS

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

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

An EMI receiver as specified in CISPR 16-1-1 is used for emissions measurements. The receivers used can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the CISPR detector used during measurements. If the repetition frequency of the signal being measured is below 20Hz, peak measurements are made in lieu of Quasi-Peak measurements.

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

INSTRUMENT CONTROL COMPUTER

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

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

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

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

FILTERS/ATTENUATORS

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

ANTENNAS

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

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height. Measurements below 30 MHz are made with the loop antenna at a fixed height of 1m above the ground plane.

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

INSTRUMENT CALIBRATION

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

TEST PROCEDURES**EUT AND CABLE PLACEMENT**

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

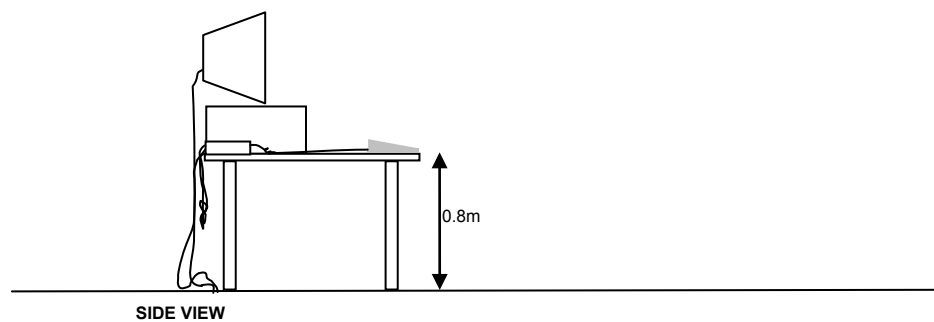
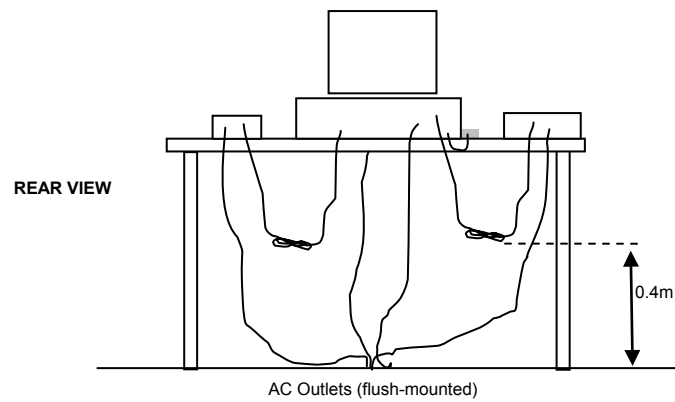
RADIATED EMISSIONS

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.

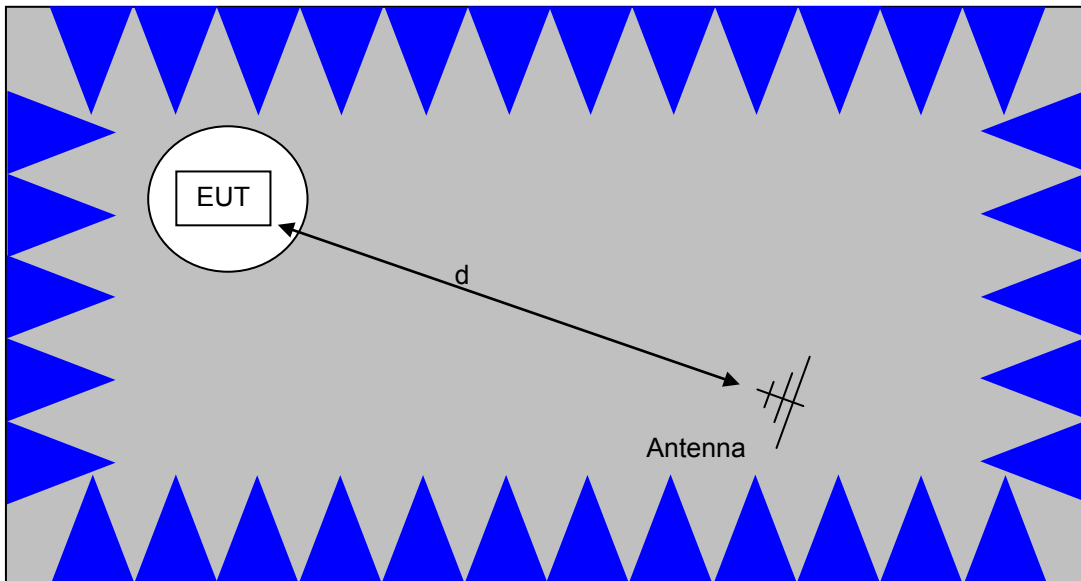
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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.

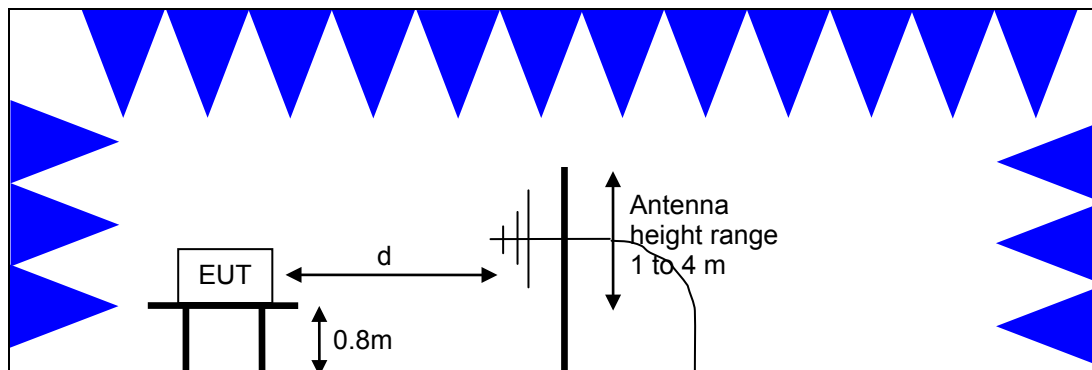


Typical Test Configuration for Radiated Field Strength Measurements



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.

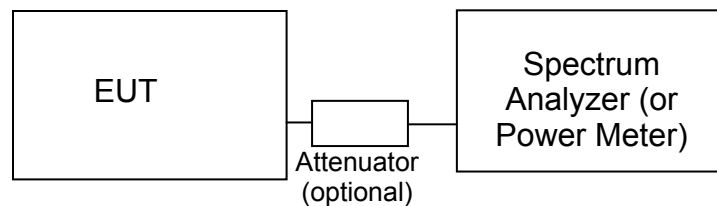
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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:

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

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

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

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands¹ (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

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

OUTPUT POWER LIMITS – FHSS SYSTEMS

The table below shows the limits for output power based on the number of channels available for the hopping system.

Operating Frequency (MHz)	Number of Channels	Output Power
902 – 928	≥ 50	1 Watt (30 dBm)
902 – 928	25 to 49	0.25 Watts (24 dBm)
2400 – 2483.5	≥ 75	1 Watt (30 dBm)
2400 – 2483.5	< 75	0.125 Watts (21 dBm)
5725 – 5850	75	1 Watt (30 dBm)

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

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

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

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

A distance factor, when used for electric field measurements above 30MHz, is calculated by using the following formula:

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_C = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

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

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

where P is the eirp (Watts)

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

Appendix A Test Equipment Calibration Data

<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Radiated Emissions, 1000 - 25,000 MHz, 27-May-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014	10/31/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, FT (SA40) Blue	8564E (84125C)	1393	5/2/2015	5/2/2016
Hewlett Packard	Head (Inc flex cable, (1742,1743) Blue)	84125C	1620	5/6/2014	6/6/2015
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/4/2014	8/4/2015
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	7/24/2014	7/24/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	11/14/2014	11/14/2015
Radiated Emissions, 1,000 - 25,000 MHz, 28-May-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/20/2013	12/20/2015
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	Head (Inc flex cable, 1143, 2198) Red	84125C	1145	6/17/2014	6/17/2015
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/20/2014	9/20/2015
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/4/2014	8/4/2015
A. H. Systems	Red System Horn, 18-40GHz	SAS-574, p/n: 2581	2161	7/9/2014	7/9/2015
Radio Antenna Port (Power and Spurious Emissions), 28-May-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	786	12/20/2013	12/20/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 30 - 1,000 MHz, 01-Jun-15					
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	9/17/2014	9/17/2016
Com-Power	Preamplifier, 30-1000 MHz	PA-103A	2359	12/22/2014	12/22/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 100 - 26,000 MHz, 10-Jul-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	786	20-Dec-13	20-Dec-15
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	06-Jul-15	06-Jul-16

Appendix B Test Data

T98220 Pages 23 – 63

Client:	Olio	Job Number:	J98176
Product:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
		Project Manager:	Irene Rademacher
Contact:	AJ Cooper	Project Coordinator:	
Emissions Standard(s):	FCC 15.247 / 15.B / RSS-247	Class:	B
Immunity Standard(s):	-	Environment:	

EMC Test Data

For The

Olio

Product

Wireless Watch (H1B) & charger

Date of Last Test: 7/13/2015

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Radiated Emissions

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

Test Specific Details

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

Date of Test: 6/1/2015
 Test Engineer: Rafael Varelas
 Test Location: Fremont Chamber #5

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

General Test Configuration

The EUT and any local support equipment were located on the turntable for radiated emissions testing.

The test distance and extrapolation factor (if applicable) are detailed under each run description.

Note, preliminary testing indicates that the emissions were maximized by orientation of the EUT and elevation of the measurement antenna. Maximized testing indicated that the emissions were maximized by orientation of the EUT, elevation of the measurement antenna, and manipulation of the EUT's interface cables.

Ambient Conditions:

Temperature: 21.8 °C
 Rel. Humidity: 37 %

Summary of Results (ANSI C63.4:2009)

Run #	Test Performed	Limit	Result	Margin
2 (GFSK -2402MHz)	Radiated Emissions 30 - 1000 MHz, Maximized	FCC 15.209/ Class B	Pass	20.4 dBμV/m @ 30.00 MHz (-19.6 dB)
4 (GFSK -2480MHz)	Radiated Emissions 30 - 1000 MHz, Maximized	FCC 15.209/ Class B	Pass	20.3 dBμV/m @ 30.00 MHz (-19.7 dB)

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

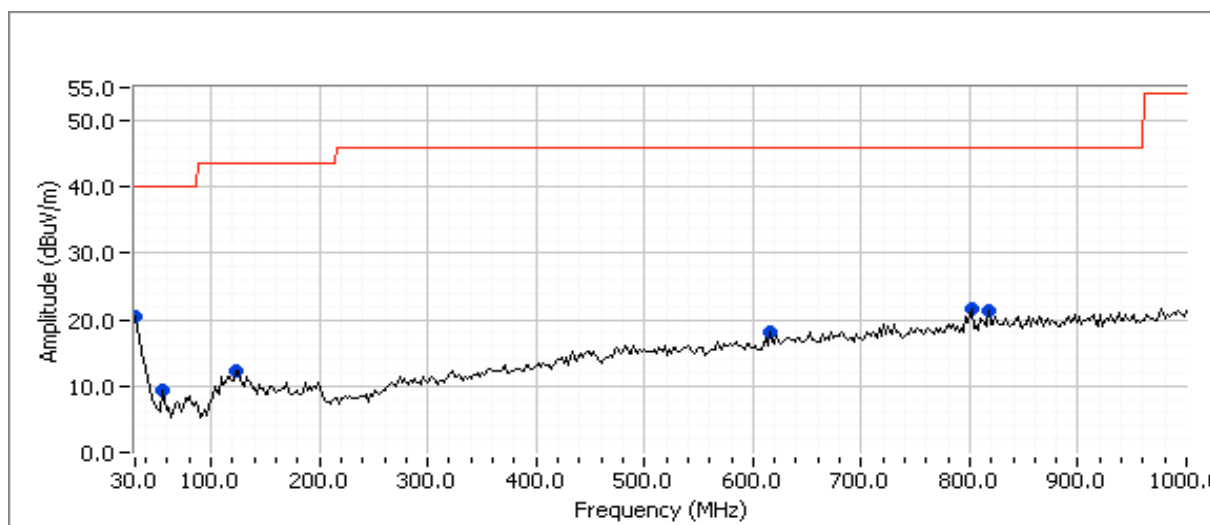
No deviations were made from the requirements of the standard.

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Run #1: Preliminary Radiated Emissions, 30 - 1000 MHz

GFSK - 2402 MHz

Test Parameters for Preliminary Scan(s)			
Frequency Range (MHz)	Prescan Distance (meters)	Limit Distance (meters)	Extrapolation Factor (dB, applied to data)
30 - 1000	3	3	0.0



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	20.4	H	40.0	-19.6	Peak	228	4.0	
55.271	9.5	V	40.0	-30.5	Peak	6	3.5	
123.307	12.2	V	43.5	-31.3	Peak	197	3.0	
615.110	18.0	H	46.0	-28.0	Peak	12	3.5	
801.723	21.7	H	46.0	-24.3	Peak	262	1.0	
817.275	21.3	H	46.0	-24.7	Peak	302	1.0	

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Run #2: Maximized Readings From Run #1

Test Parameters for Maximized Reading(s)			
Frequency Range (MHz)	Test Distance (meters)	Limit Distance (meters)	Extrapolation Factor (dB, applied to data)
30 - 1000	3	3	0.0

Maximized Peak readings (includes manipulation of EUT interface cables)

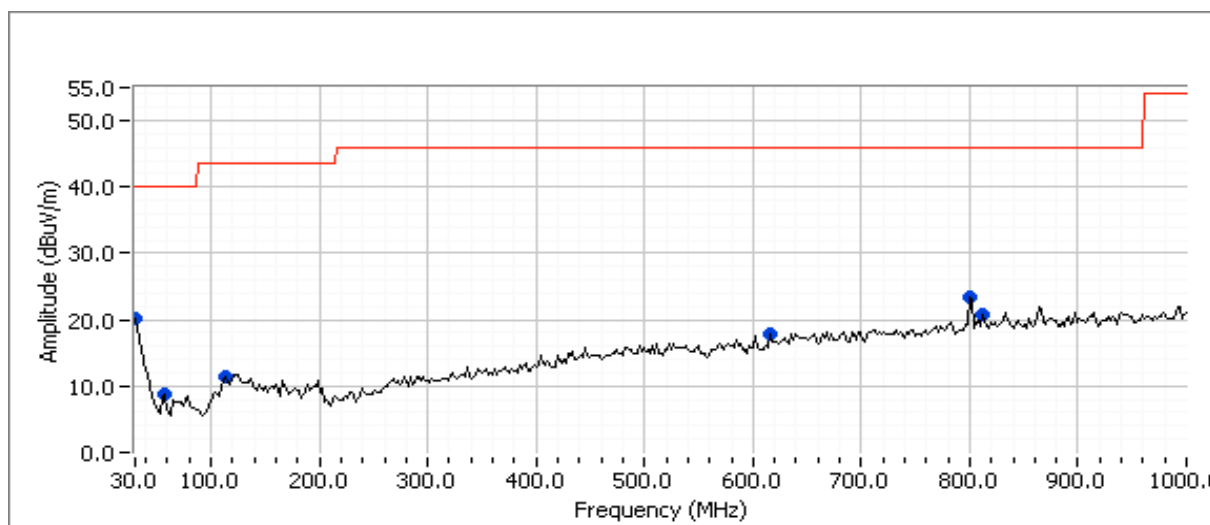
Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	20.4	H	40.0	-19.6	Peak	228	4.0	
55.271	9.5	V	40.0	-30.5	Peak	6	3.5	
123.307	12.2	V	43.5	-31.3	Peak	197	3.0	
615.110	18.0	H	46.0	-28.0	Peak	12	3.5	
801.723	21.7	H	46.0	-24.3	Peak	262	1.0	
817.275	21.3	H	46.0	-24.7	Peak	302	1.0	

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Run #3: Preliminary Radiated Emissions, 30 - 1000 MHz

GFSK - 2480 MHz

Test Parameters for Preliminary Scan(s)			
Frequency Range (MHz)	Prescan Distance (meters)	Limit Distance (meters)	Extrapolation Factor (dB, applied to data)
30 - 1000	3	3	0.0



Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	20.3	H	40.0	-19.7	Peak	210	2.5	
57.214	8.8	V	40.0	-31.2	Peak	10	3.5	
113.587	11.5	H	43.5	-32.0	Peak	164	3.0	
615.110	17.7	V	46.0	-28.3	Peak	345	2.0	
799.780	23.4	H	46.0	-22.6	Peak	243	1.0	
811.443	20.8	H	46.0	-25.2	Peak	71	1.0	

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	B

Run #4: Maximized Readings From Run #3

Test Parameters for Maximized Reading(s)			
Frequency Range (MHz)	Test Distance (meters)	Limit Distance (meters)	Extrapolation Factor (dB, applied to data)
30 - 1000			

Maximized quasi-peak readings (includes manipulation of EUT interface cables)

Frequency	Level	Pol	Class B		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
30.000	20.3	H	40.0	-19.7	Peak	210	2.5	
57.214	8.8	V	40.0	-31.2	Peak	10	3.5	
113.587	11.5	H	43.5	-32.0	Peak	164	3.0	
615.110	17.7	V	46.0	-28.3	Peak	345	2.0	
799.780	23.4	H	46.0	-22.6	Peak	243	1.0	
811.443	20.8	H	46.0	-25.2	Peak	71	1.0	

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

FCC 15.247 FHSS - Power, 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: 5/28/2015 15:25
 Test Engineer: Jack Liu / R. Varelas
 Test Location: Fremont Chamber #5

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

General Test Configuration

The EUT and all local support equipment were located on the turntable for testing.

Unless stated otherwise the EUT was operating such that it constantly hopped on either the low, center or high channels.

Ambient Conditions:

Temperature: 24 °C
 Rel. Humidity: 38 %

Summary of Results

Run #	Test Performed	Limit	Pass / Fail	Result / Margin
1	Band Edge 2390 -2400MHz - Transmitter Radiated Spurious Emissions	FCC Part 15.247(c)	Pass	Refer to plots
2	Output Power	15.247(b)	Pass	Basic: 3.4dBm (0.0022W) EDR: 6.3dBm (0.0043W)
3	20dB Bandwidth	15.247(a)	Pass	Basic: 1102kHz EDR: 1393 kHz
3	99% bandwidth	15.247(a)	Pass	Basic: 920kHz EDR: 1220 kHz
3	Channel Occupancy	15.247(a)	Pass	Complies with Bluetooth protocol
3	Number of Channels	15.247(a)	Pass	Max: 79 Channels Min: 20



EMC Test Data

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Sample Notes

Sample S/N: Bluetooth#1

Driver: -

Antenna: Internal

Modifications Made During Testing:

No modifications were made to the EUT during testing

Deviations From The Standard

The 20dB BW was measured using 100kHz, instead of 1-5% of the BW. This is a worse case measurement.

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #1: Band Edge 2390 -2400MHz - Transmitter Radiated Spurious Emissions

Date of Test: 5/28/2015

Test Engineer: Rafael Varelas

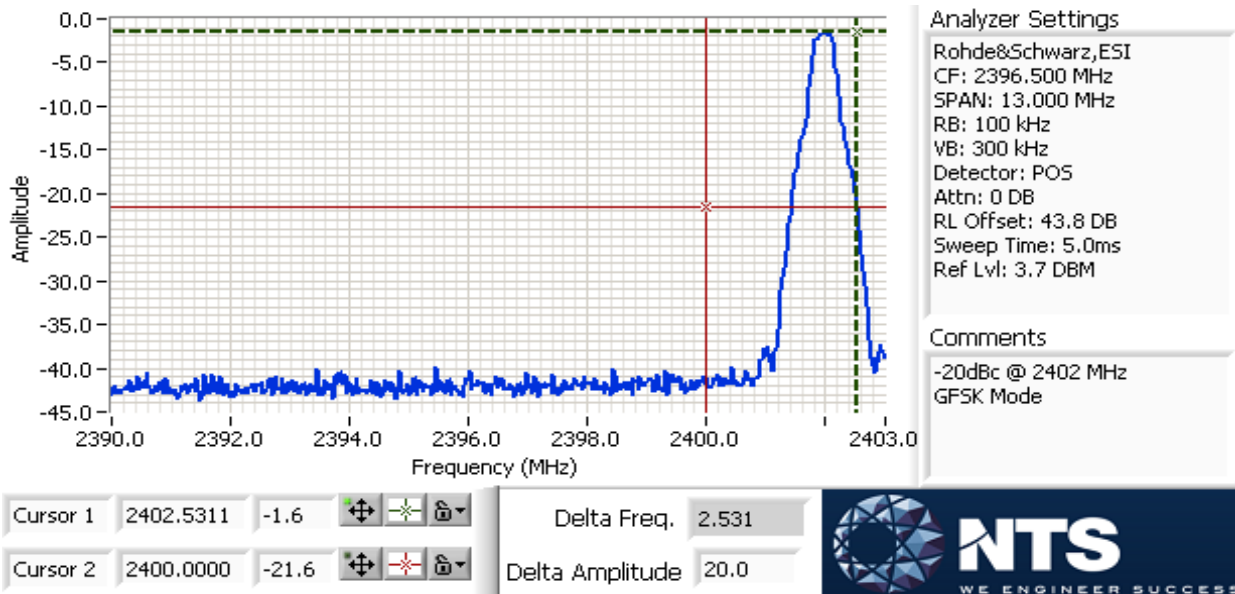
Test Location: FT Chamber #5

Refer to plots below. Scans made using RBW=100kHz, VBW=300 KHz with the limit line set at 20dB below the highest in-band signal level with the hopping feature disabled.

Low channel

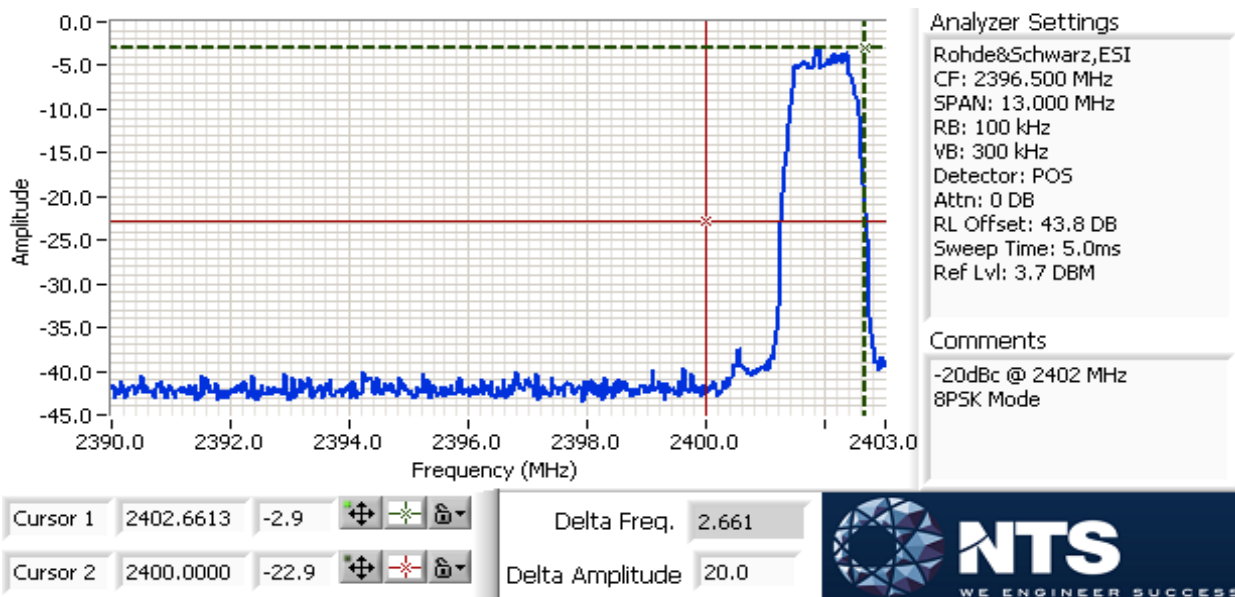
Plot showing -20dBc at the lower band edge

GFSK



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

8PSK



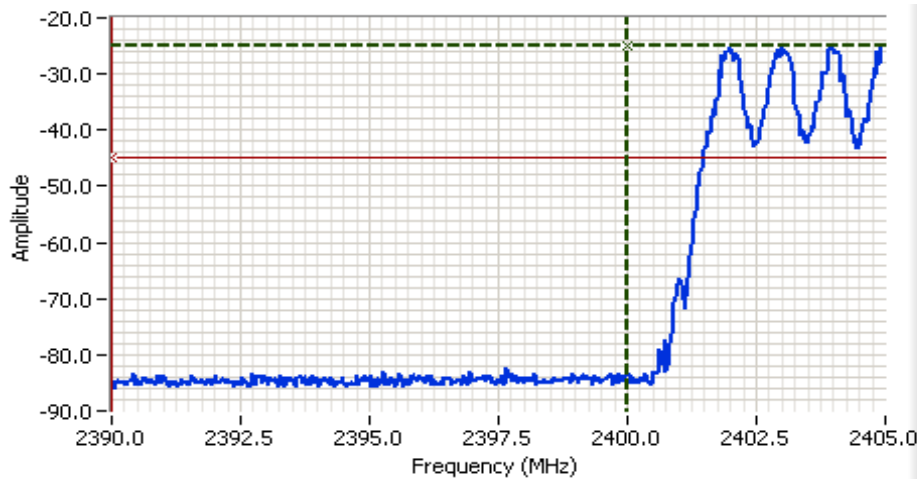
Refer to plots below. Scans made using RBW=100kHz, VBW=300 KHz with the limit line set at 20dB below the highest in-band signal level with the hopping feature enabled to show compliance with the -20dBc requirement at the allocated band edge. The spectrum analyzer is left in max hold mode until the trace stabilizes.

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Low channel, hopping enabled

Plot showing -20dBc at the lower band edge

GFSK



Analyzer Settings

Rohde&Schwarz,ESI
 CF: 2397.500 MHz
 SPAN: 15.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 0.0 DB
 Sweep Time: 5.0ms
 Ref Lvl: -22.1 DBM

Comments

Lower Bandedge
 Hopping Mode
 GFSK Mode

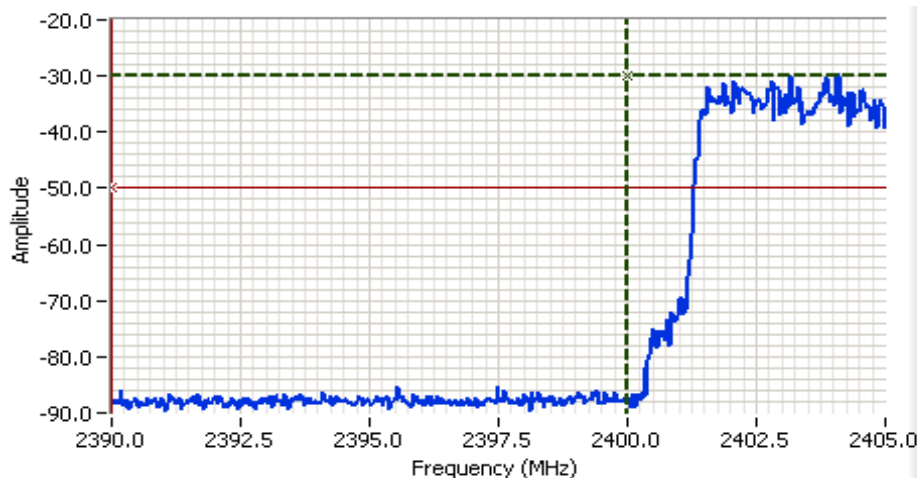
Cursor 1 2400.0000 -24.9
 Cursor 2 2390.0000 -44.9

Delta Freq. 10.000

Delta Amplitude 20.0



8PSK



Analyzer Settings

Rohde&Schwarz,ESI
 CF: 2397.500 MHz
 SPAN: 15.000 MHz
 RB: 100 kHz
 VB: 30.0 kHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 0.0 DB
 Sweep Time: 12.5ms
 Ref Lvl: -22.1 DBM

Comments

Low Bandedge
 Hopping Mode
 8PSK Mode

Cursor 1 2400.0000 -29.9
 Cursor 2 2390.0000 -49.9

Delta Freq. 10.000

Delta Amplitude 20.0

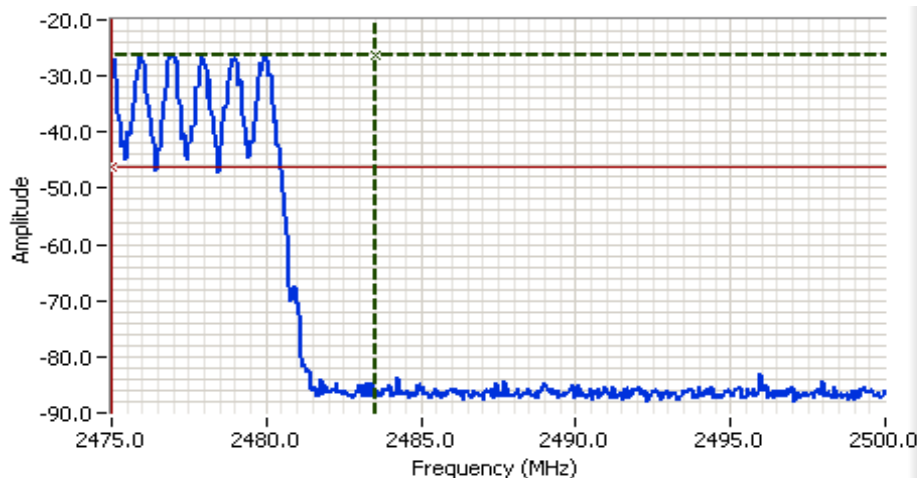


Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

High channel, hopping enabled

Plot showing -20dBc at the upper band edge

GFSK



Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2487.500 MHz
 SPAN: 25.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 0.0 DB
 Sweep Time: 6.5ms
 Ref Lvl: -22.1 DBM

Comments

High Bandedge
 Hopping Mode
 GFSK Mode

Cursor 1	2483.5000	-26.1	
Cursor 2	2475.0000	-46.1	

Delta Freq. 8.500

Delta Amplitude 20.0



8PSK



Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2487.500 MHz
 SPAN: 25.000 MHz
 RB: 100 kHz
 VB: 30.0 kHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 0.0 DB
 Sweep Time: 21.0ms
 Ref Lvl: -22.1 DBM

Comments

High Bandedge
 Hopping Mode
 8PSK Mode

Cursor 1	2483.5000	-29.2	
Cursor 2	2475.0000	-49.2	

Delta Freq. 8.500

Delta Amplitude 20.0



Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Run #2: Output Power

Date of Test: 7/10/2015

Test Engineer: Rafael Varelas

Test Location: FT Chamber #5

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt.

For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts.

Peak power measured using: RBW >2MHz, VBW = 3xRBW, peak detector, max hold

EUT Side

Mode: GFSK

Power Setting ²	Frequency (MHz)	Output Power (EIRP) (dBm) ¹	mW	Antenna Gain (dBi)	Result	Power (dBm)	W	Output Power (dBm)	mW
Vertical									
default	2402	-4.4	0.4	-6.0	Pass	1.6	0.0014		
default	2441	-5.0	0.3	-6.0	Pass	1.0	0.0013		
default	2480	-4.0	0.4	-6.0	Pass	2.0	0.0016		
Horizontal									
default	2402	-3.0	0.5	-6.0	Pass	3.0	0.0020		
default	2441	-2.6	0.5	-6.0	Pass	3.4	0.0022	0.2	1.0
default	2480	-3.6	0.4	-6.0	Pass	2.4	0.0017		

Mode: 8PSK

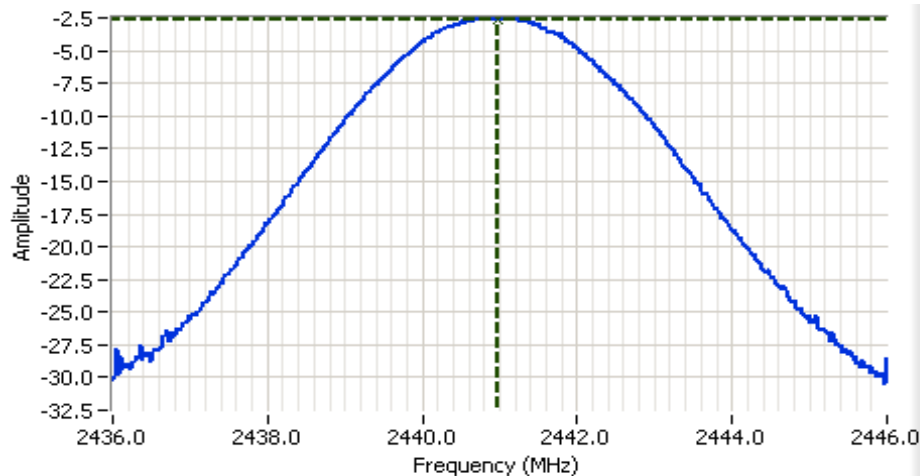
Power Setting ²	Frequency (MHz)	Output Power (EIRP) (dBm) ¹	mW	Antenna Gain (dBi)	Result	Power (dBm)	W	Output Power (dBm) ³	mW
Vertical									
default	2402	-0.8	0.8	-6.0	Pass	5.2	0.0033		
default	2441	-1.2	0.8	-6.0	Pass	4.8	0.0030		
default	2480	-0.4	0.9	-6.0	Pass	5.6	0.0036		
Horizontal									
default	2402	0.1	1.0	-6.0	Pass	6.1	0.0041		
default	2441	0.1	1.0	-6.0	Pass	6.1	0.0041		
default	2480	0.3	1.1	-6.0	Pass	6.3	0.0043	2.9	1.9

Note 2: Power setting - the software power setting used during testing, included for reference only.

Note: Plots show EIRP, not conducted power

Note 3: Average power calculated from the peak-to-average ratio observed (3.2dB for GFSK, 3.4dB for 8PSK). Measured using near field probe. Provided for RF exposure considerations.

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A



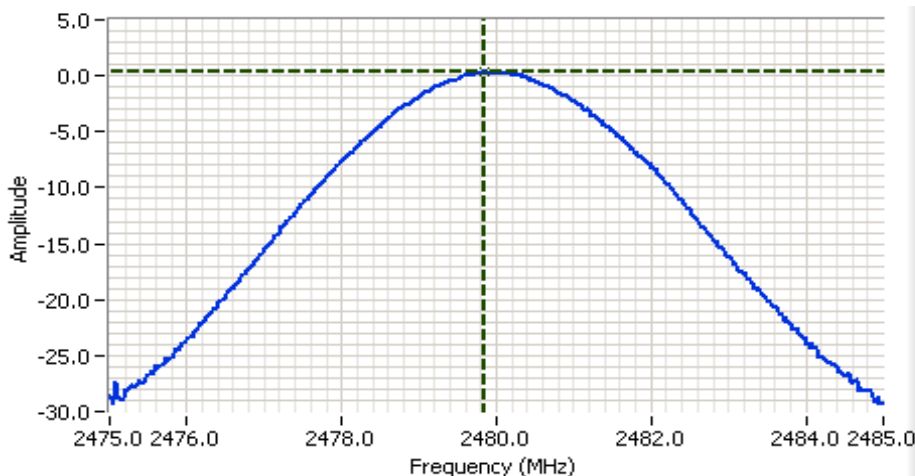
Analyzer Settings

Rohde&Schwarz,ESI
 CF: 2441.000 MHz
 SPAN: 10.000 MHz
 RB: 3.000 MHz
 VB: 10.000 MHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 43.8 DB
 Sweep Time: 5.0ms
 Ref Lvl: 2.8 DBM

Comments

2441 MHz
 EUT Side, H
 GFSK

Cursor 1 2440.9699 -2.6
 0.0000 0.0



Analyzer Settings

Rohde&Schwarz,ESI
 CF: 2480.000 MHz
 SPAN: 10.000 MHz
 RB: 3.000 MHz
 VB: 10.000 MHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 43.8 DB
 Sweep Time: 5.0ms
 Ref Lvl: 2.8 DBM

Comments

2480 MHz
 EUT Side, H
 8PSK

Cursor 1 2479.8497 0.3
 0.0000 0.0



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #3: Bandwidth, Channel Occupancy, Spacing and Number of Channels

Date of Test: 5/28/2015

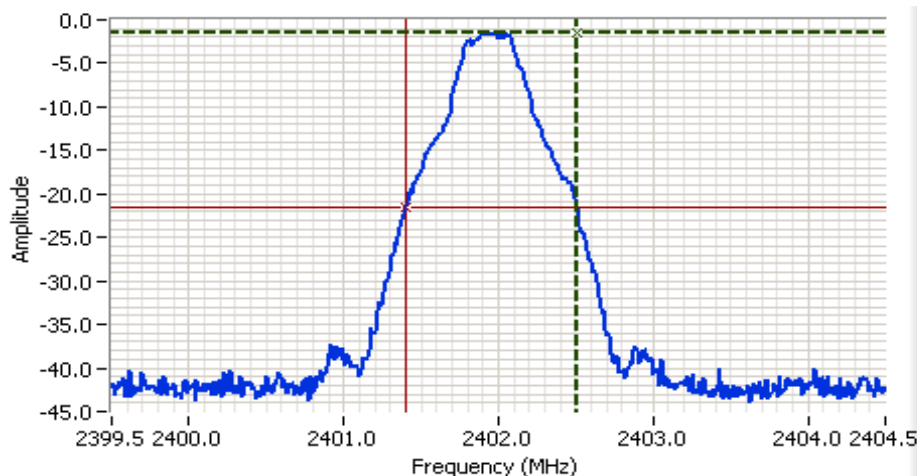
Test Engineer: Rafael Varelas

Test Location: FT Chamber #5

Channel	Frequency (MHz)	Resolution Bandwidth	20dB Bandwidth (kHz)	Resolution Bandwidth	99% Bandwidth (kHz)
GFSK					
Low	2402	100kHz	1102	30kHz	920
Mid	2441	100kHz	1082	30kHz	910
High	2480	100kHz	1092	30kHz	910
8PSK					
Low	2402	100kHz	1393	30kHz	1220
Mid	2441	100kHz	1393	30kHz	1220
High	2480	100kHz	1383	30kHz	1220

Note 1: 20dB bandwidth measured using RB = 100kHz, VB = 300kHz (VB > RB)

Note 2: 99% bandwidth measured using RB = 30kHz, VB = 100kHz (VB >= 3RB)



Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2402.000 MHz
 SPAN: 5.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 0 dB
 RL Offset: 43.8 dB
 Sweep Time: 5.0ms
 Ref Lvl: 3.7 DBM

Comments

20dB BW: 1.102 MHz
 GFSK Mode

Cursor 1	2402.5060	-1.5	
Cursor 2	2401.4038	-21.5	

Delta Freq. 1.102

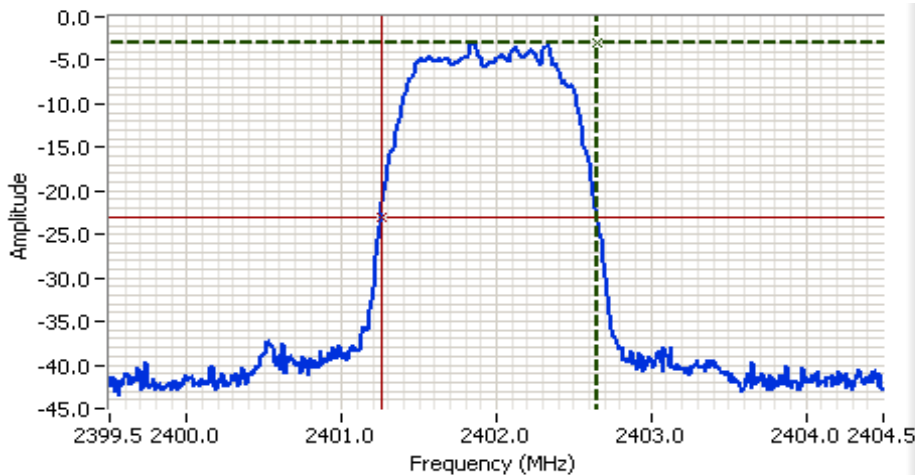
Delta Amplitude 20.0

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A



Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2402.000 MHz
 SPAN: 5.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 0 dB
 RL Offset: 43.8 dB
 Sweep Time: 5.0ms
 Ref Lvl: 3.7 DBM

Comments

20dB BW: 1.393 MHz
 8PSK Mode

Cursor 1	2402.6463	-3.0	
Cursor 2	2401.2535	-23.0	

Delta Freq. 1.393

Delta Amplitude 20.0



Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. (Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.)

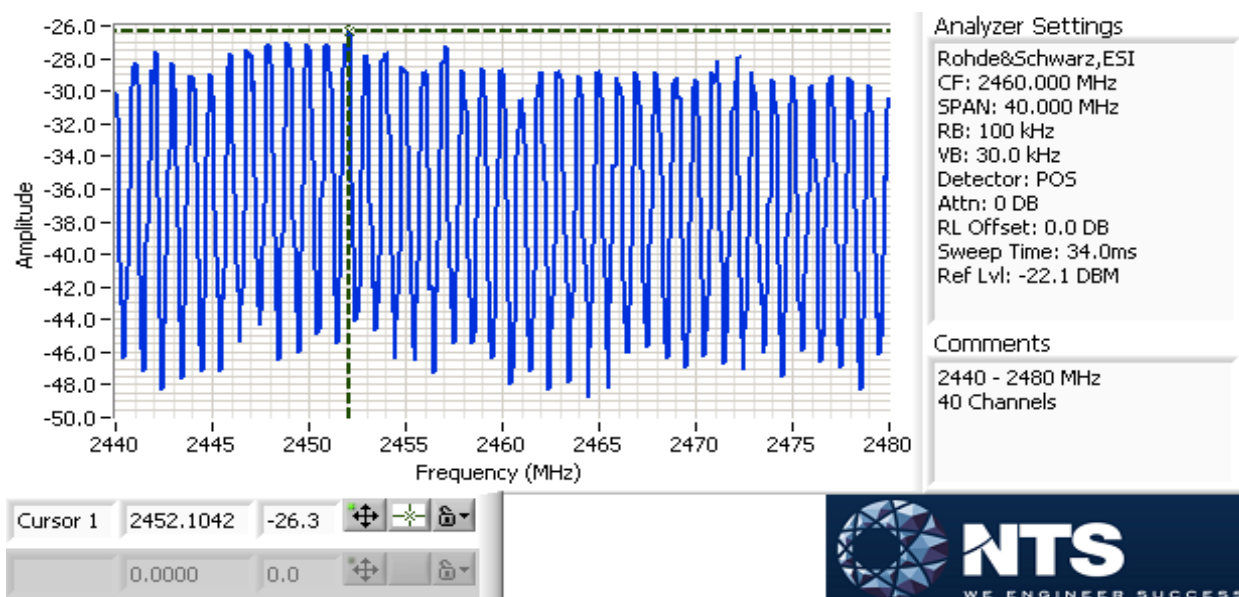
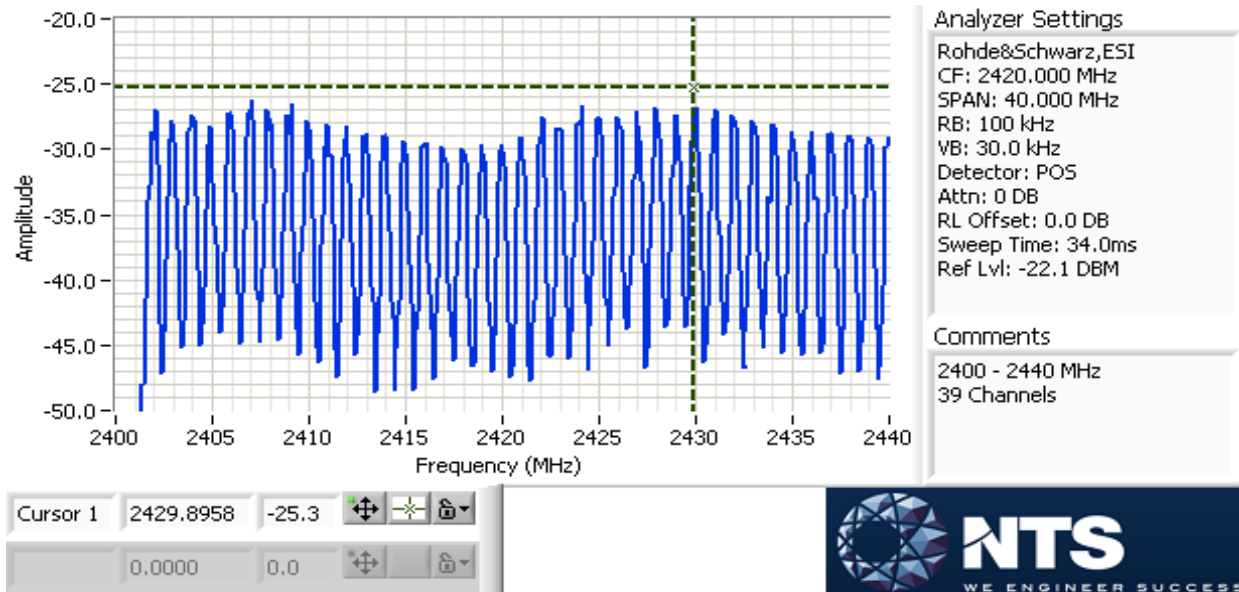
The device complies with the Bluetooth protocol and employs a minimum of 20 of the available 79 hopping channels when employing adaptive frequency hopping and all 79 channels when not. Channels are selected in a pseudo random manner to ensure, on average, all channels are used equally.

The hopping rate is 1600 hops per second although any new channel may be used for a single hop slot, 3 hop slots or 5 hop slots. The dwell time per channel is, therefore either 0.625ms (single slot), 1.875ms (three slot) or 3.125ms (five slot). The average time of occupancy will not exceed 0.4s in any time interval of 0.4s multiplied by the number of channels being used.

Maximum 20dB bandwidth:	1393 kHz	
Channel spacing:	1000 kHz	
Transmission time per hop:	2.9 ms	max single tx on time
Max Number of channels (N):	79	
Min Number of channels (N):	20	

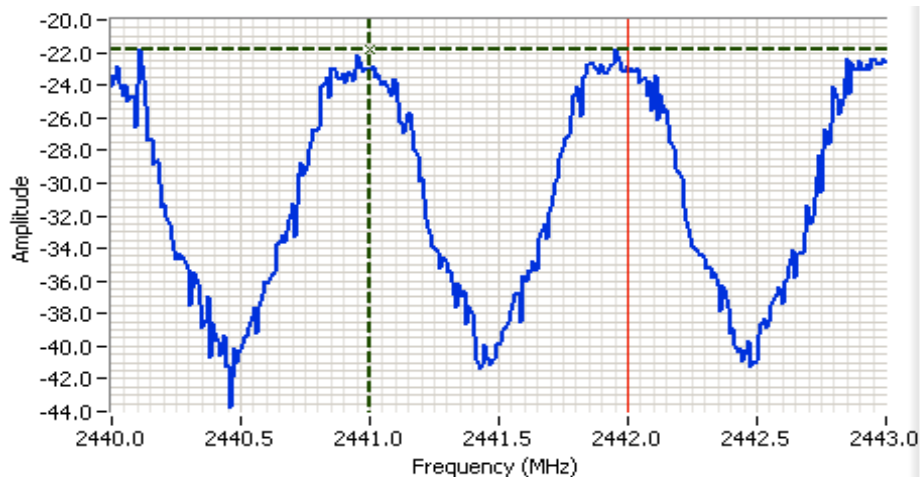
Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Plots showing number of channels



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Plot showing channel spacing

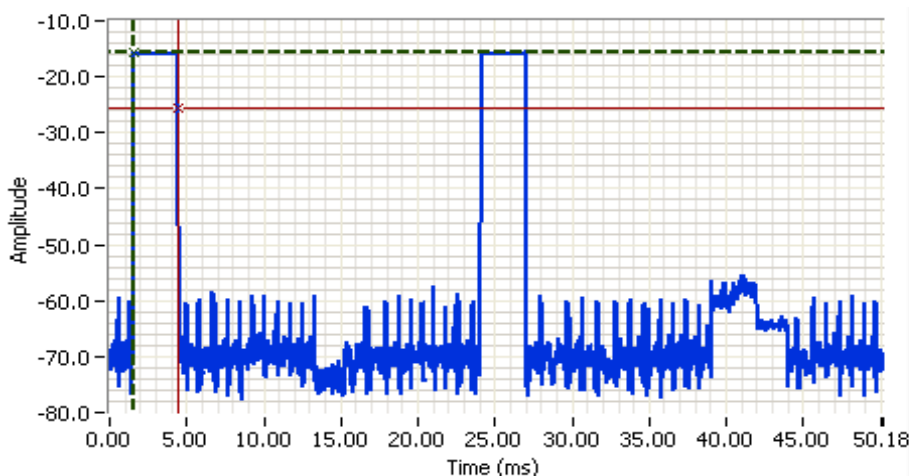


Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2441.000 MHz
 SPAN: 5.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 0 DB
 RL Offset: 0.0 DB
 Sweep Time: 5.0ms
 Ref Lvl: -27.1 DBM

Comments

Channel Spacing
 GFSK Mode



Analyzer Settings

Agilent Technologies, E4446A
 CF: 2441.000 MHz
 SPAN: 0.000 MHz
 RB: 1.000 MHz
 VB: 3.000 MHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 0.0 DB
 Sweep Time: 50.2ms
 Ref Lvl: -2.0 DBM

Comments

GFSK Mode
 time per Hop = 2.875ms



Note: Plot shows time of actual transmission on a given channel per hop. Time between hops does not represent actual operation

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

The EUT 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: 22.3 °C
 Rel. Humidity: 38 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
Scans on center channel in all three Orientations to determine the worst case mode.							
1	GFSK EUT Flat	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	41.9 dBµV/m @ 10826.1 MHz (-12.1 dB)
	GFSK EUT Side	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	32.6 dBµV/m @ 4882.1 MHz (-21.4 dB)
	GFSK Upright	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	36.1 dBµV/m @ 4881.9 MHz (-17.9 dB)
Measurements on low and high channels in worst-case Orientation.							
2	GFSK EUT Flat	0 - 2402MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	41.5 dBµV/m @ 4804.0 MHz (-12.5 dB)
	GFSK EUT Flat	39 - 2480MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	39.8 dBµV/m @ 4960.0 MHz (-14.2 dB)
Scans on center channel in all three Orientation to determine the worst case mode.							
3	8PSK EUT Flat	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	41.2 dBµV/m @ 11060.5 MHz(-12.8 dB)
	8PSK EUT Side	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	32.3 dBµV/m @ 4881.9 MHz (-21.7 dB)
	8PSK Upright	19 - 2441MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	34.2 dBµV/m @ 4881.9 MHz (-19.8 dB)
Measurements on low and high channels in worst-case Orientation.							
4	8PSK EUT Flat	0 - 2402MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	41.0 dBµV/m @ 4804.0 MHz (-13.0 dB)
	8PSK EUT Flat	39 - 2480MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	39.9 dBµV/m @ 4960.0 MHz (-14.1 dB)

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

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: Bluetooth#1

Driver: -

Antenna: Internal

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)
GFSK	1Mb/s	100%	yes	-	0	0	-
8PSK	3Mb/s	100%	yes	-	0	0	-

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:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

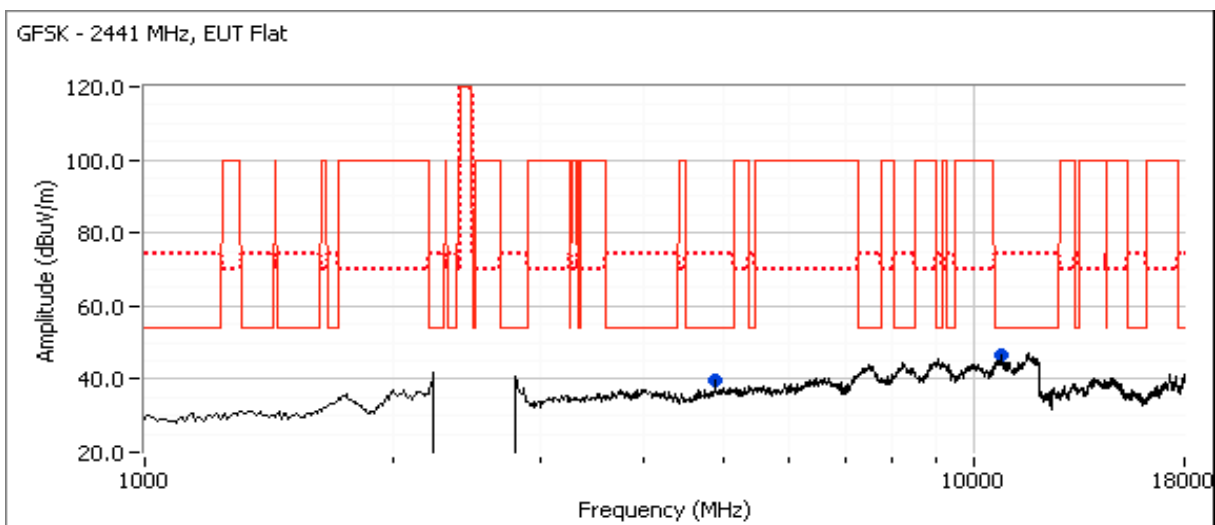
Run #1: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Bluetooth
 Date of Test: 5/26/2015 0:00 Config. Used: 1
 Test Engineer: Rafael Varelas Config Change: None
 Test Location: FT Chamber #5 EUT Voltage: Battery

Run #1a: Center Channel

Channel: 19 Mode: GFSK Orientation: Flat
 Tx Chain: Main Data Rate: 1Mb/s

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	
10826.070	41.9	H	54.0	-12.1	AVG	169	1.0	RB 1 MHz;VB 10 Hz;Peak
10826.300	53.2	H	74.0	-20.8	PK	169	1.0	RB 1 MHz;VB 3 MHz;Peak
4881.890	34.1	V	54.0	-19.9	AVG	74	1.3	RB 1 MHz;VB 10 Hz;Peak
4881.530	43.9	V	74.0	-30.1	PK	74	1.3	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



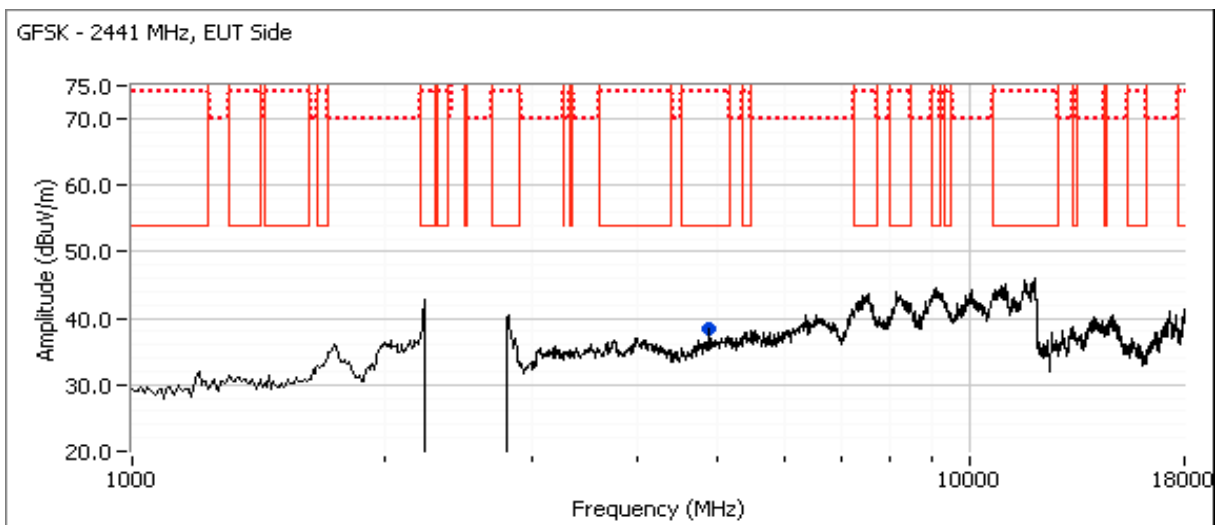
Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #1b: Center Channel

Channel: 19 Mode: GFSK Orientation: Side
 Tx Chain: Main Data Rate: 1Mb/s

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	
4882.050	32.6	V	54.0	-21.4	AVG	346	1.0	RB 1 MHz;VB 10 Hz;Peak
4881.710	42.4	V	74.0	-31.6	PK	346	1.0	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



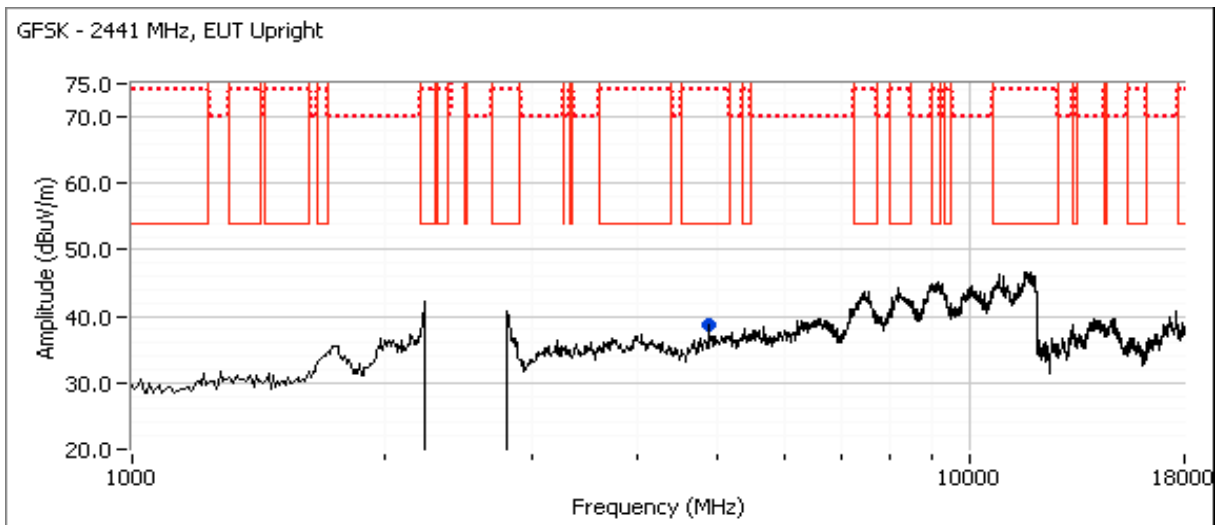
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Run #1c: Center Channel

Channel: 19 Mode: GFSK Orientation: Upright
 Tx Chain: Main Data Rate: 1Mb/s

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	
4881.930	36.1	H	54.0	-17.9	AVG	29	1.1	RB 1 MHz;VB 10 Hz;Peak
4882.000	43.6	H	74.0	-30.4	PK	29	1.1	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Run #2: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Worse case from Run #1

Date of Test: 5/28/2015 0:00

Config. Used: 1

Test Engineer: Jack Liu

Config Change: None

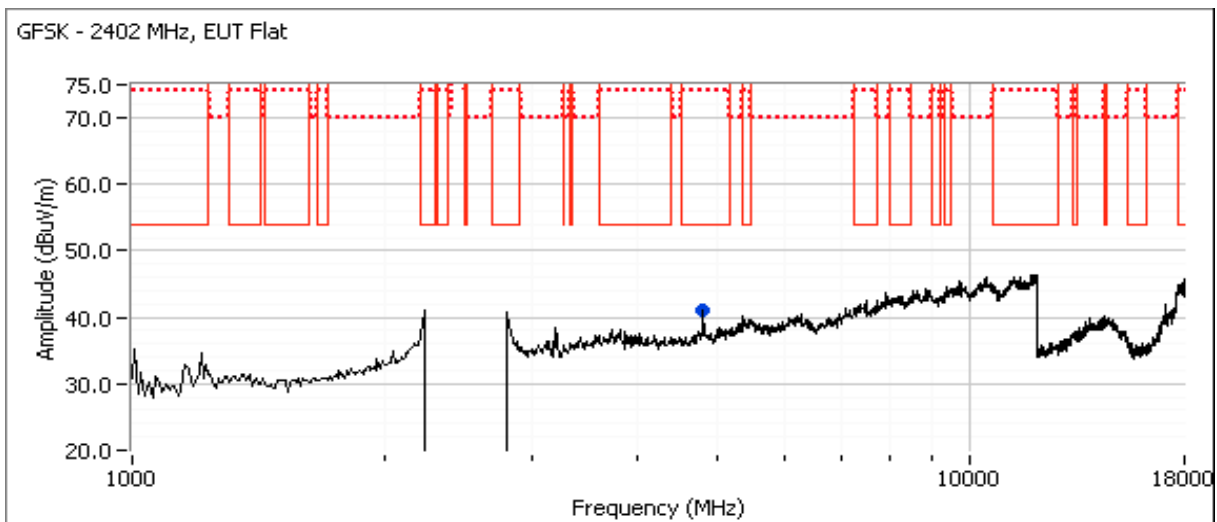
Test Location: FT Chamber#5

EUT Voltage: Battery

Run #2a: Low Channel

Channel: 0 Mode: GFSK Orientation: Flat
 Tx Chain: Main Data Rate: 1Mb/s

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	
4804.030	41.5	V	54.0	-12.5	AVG	334	1.3	RB 1 MHz;VB 10 Hz;Peak
4803.900	48.7	V	74.0	-25.3	PK	334	1.3	RB 1 MHz;VB 3 MHz;Peak

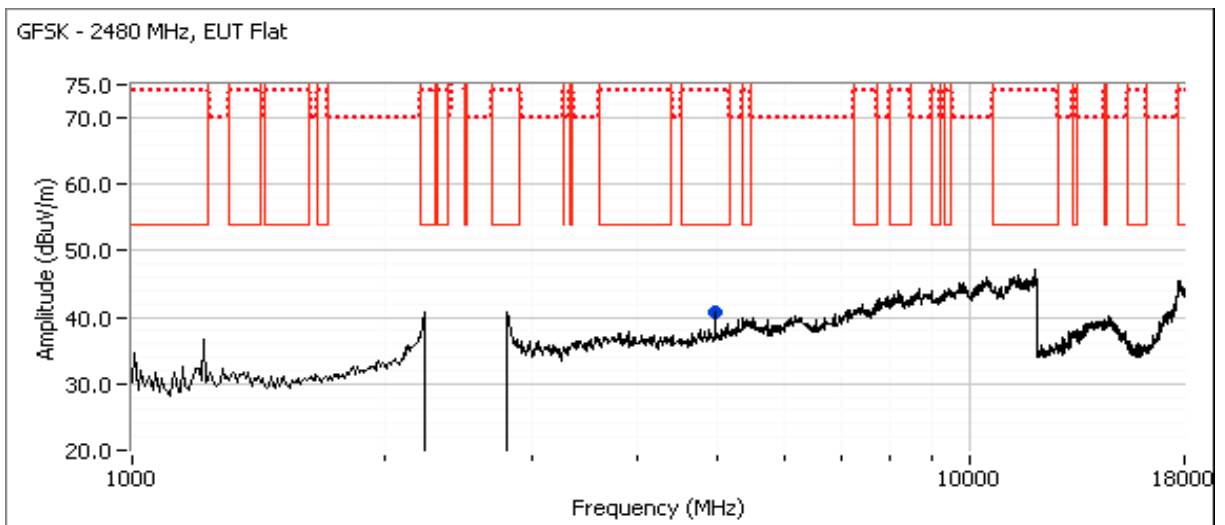


Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #2b: High Channel

Channel: 39 Mode: GFSK Orientation: Flat
 Tx Chain: Main Data Rate: 1Mb/s

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	
4959.960	39.8	V	54.0	-14.2	AVG	1	1.6	RB 1 MHz;VB 10 Hz;Peak
4959.780	48.6	V	74.0	-25.4	PK	1	1.6	RB 1 MHz;VB 3 MHz;Peak



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

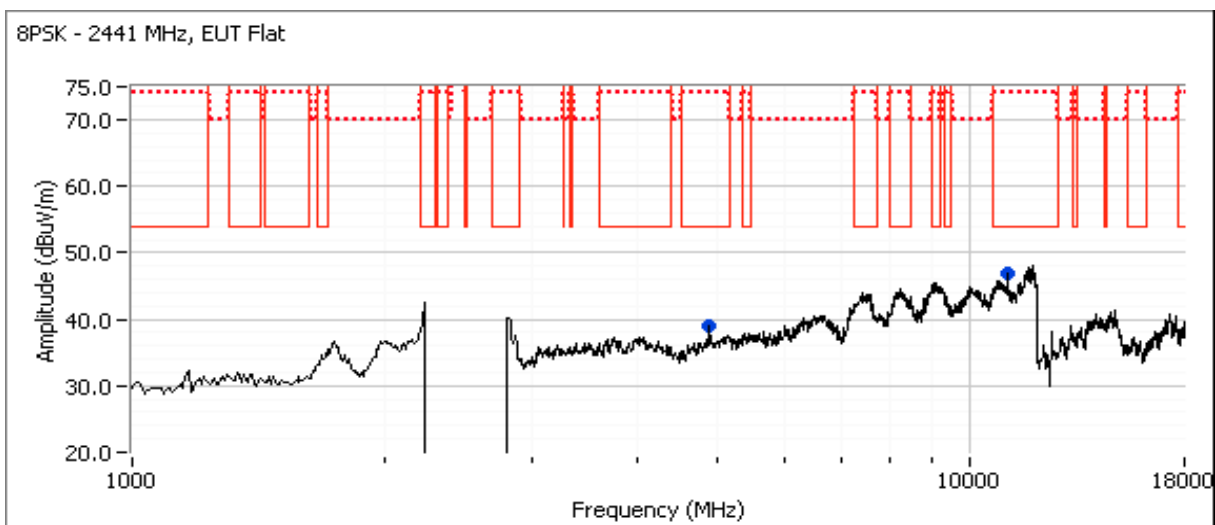
Run #3: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Bluetooth
 Date of Test: 5/26/2015 0:00 Config. Used: 1
 Test Engineer: Rafael Varelas Config Change: None
 Test Location: FT Chamber #5 EUT Voltage: Battery

Run #3a: Center Channel

Channel: 19 Mode: 8PSK Orientation: Flat
 Tx Chain: Main Data Rate: 3Mb/s

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	
11060.510	41.2	V	54.0	-12.8	AVG	201	1.0	RB 1 MHz;VB 10 Hz;Peak
11061.710	52.5	V	74.0	-21.5	PK	201	1.0	RB 1 MHz;VB 3 MHz;Peak
4881.920	35.4	V	54.0	-18.6	AVG	314	1.6	RB 1 MHz;VB 10 Hz;Peak
4881.790	43.8	V	74.0	-30.2	PK	314	1.6	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



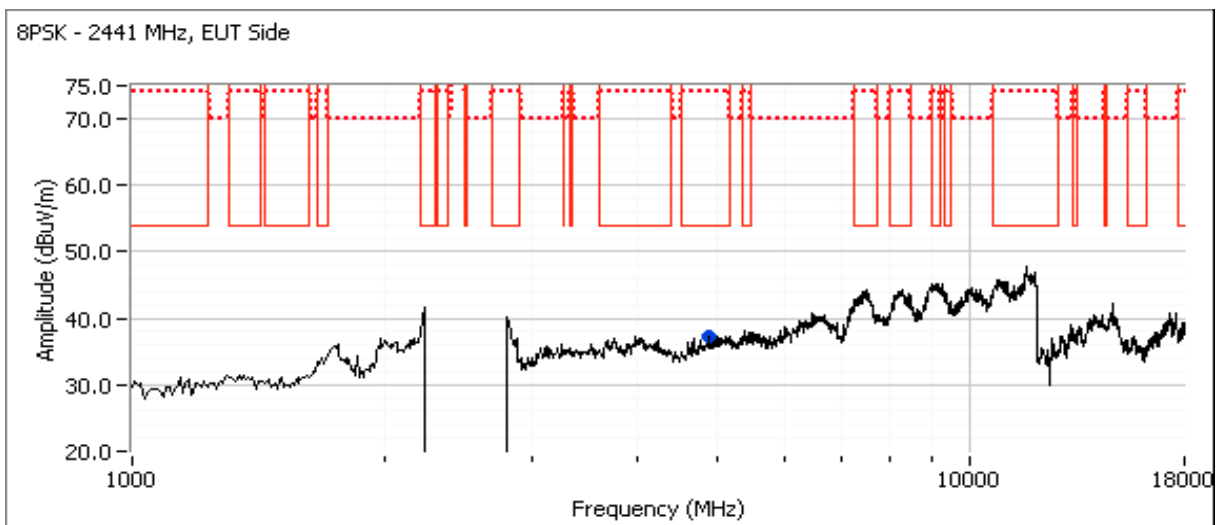
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Run #3b: Center Channel

Channel: 19 Mode: 8PSK Orientation: Side
 Tx Chain: Main Data Rate: 3Mb/s

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	
4881.850	32.3	H	54.0	-21.7	AVG	199	1.0	RB 1 MHz;VB 10 Hz;Peak
4882.120	42.9	H	74.0	-31.1	PK	199	1.0	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



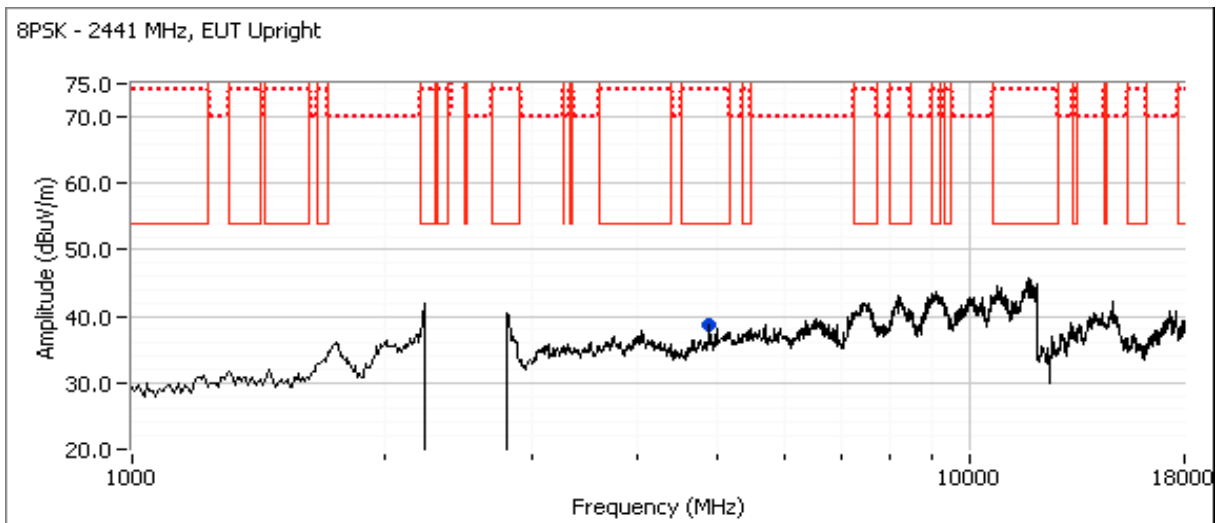
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Run #3c: Center Channel

Channel: 19 Mode: 8PSK Orientation: Upright
 Tx Chain: Main Data Rate: 3Mb/s

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	
4881.900	34.2	H	54.0	-19.8	AVG	318	1.0	RB 1 MHz;VB 10 Hz;Peak
4881.750	44.0	H	74.0	-30.0	PK	318	1.0	RB 1 MHz;VB 3 MHz;Peak

Note: Scans made between 18 - 25 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #4: Radiated Spurious Emissions, 1,000 - 25000 MHz. Operating Mode: Worse case from Run #3

Date of Test: 5/28/2015 0:00

Config. Used: 1

Test Engineer: Jack Liu

Config Change: None

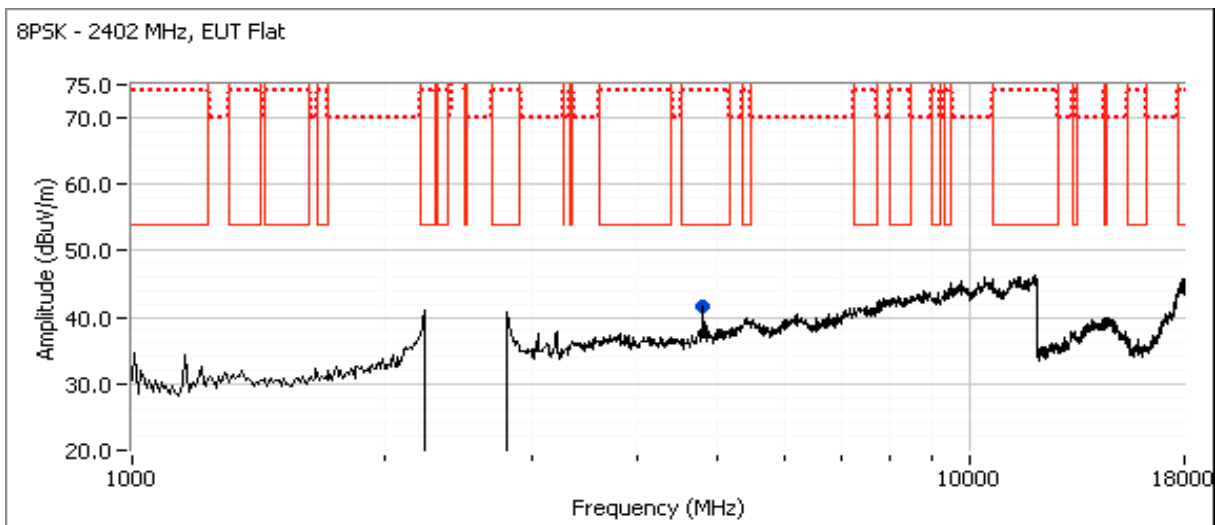
Test Location: FT Chamber#5

EUT Voltage: Battery

Run #4a: Low Channel

Channel: 0 Mode: 8PSK Orientation: Flat
 Tx Chain: Main Data Rate: 3Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4804.030	41.0	V	54.0	-13.0	AVG	327	1.6	RB 1 MHz;VB 10 Hz;Peak
4804.000	50.2	V	74.0	-23.8	PK	327	1.6	RB 1 MHz;VB 3 MHz;Peak

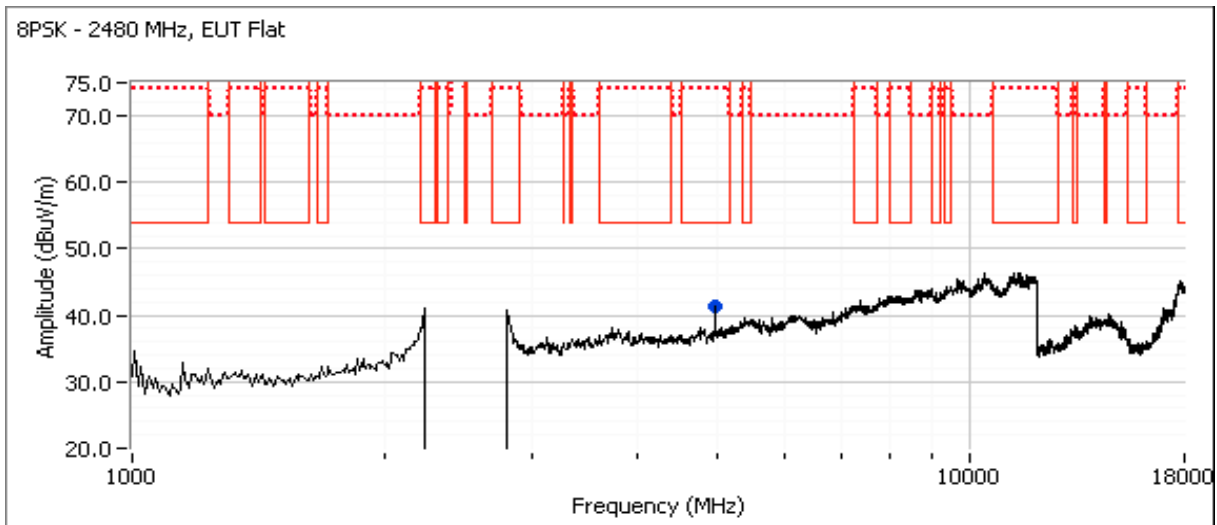


Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #4b: High Channel

Channel: 39 Mode: 8PSK Orientation: Flat
 Tx Chain: Main Data Rate: 3Mb/s

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	
4960.020	39.9	V	54.0	-14.1	AVG	349	1.3	RB 1 MHz;VB 10 Hz;Peak
4960.090	50.3	V	74.0	-23.7	PK	349	1.3	RB 1 MHz;VB 3 MHz;Peak



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

The EUT 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: 22.3 °C
 Rel. Humidity: 38 %

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	GFSK	0 - 2402MHz	Default	Default	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	33.2 dBµV/m @ 2382.0 MHz (-20.8 dB)
	GFSK	39 - 2480MHz	Default	Default	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	34.8 dBµV/m @ 2500.0 MHz (-19.2 dB)
2	8PSK	0 - 2402MHz	Default	Default	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	33.3 dBµV/m @ 2382.0 MHz (-20.7 dB)
	8PSK	39 - 2480MHz	Default	Default	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	34.4 dBµV/m @ 2483.5 MHz (-19.6 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: Bluetooth #1
 Driver: -
 Antenna: Internal

Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

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.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
GFSK	1Mb/s	100%	yes	-	0	0	-
8PSK	3Mb/s	100%	yes	-	0	0	-

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:	Plots of the average and peak bandedge do not account for any duty cycle correction. Refer to the tabular results for final measurements.

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #1: Radiated Bandedge Measurements

Date of Test: 5/26/2015 0:00

Test Engineer: Rafael Varelas

Test Location: FT Chamber #5

Config. Used: 1

Config Change: None

EUT Voltage: Battery

Channel: 0

Mode: GFSK

Orientation: Flat

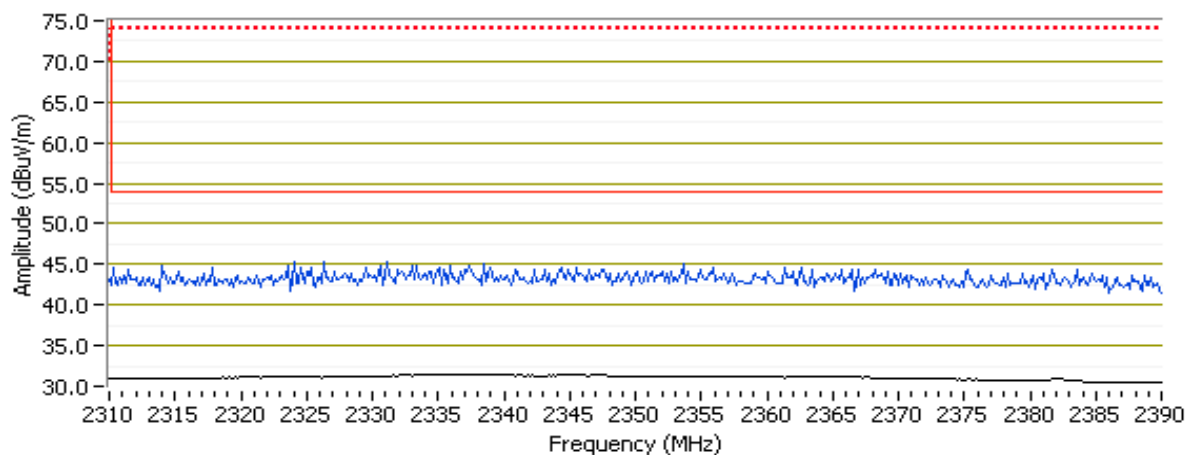
Tx Chain: Main

Data Rate: 1Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2389.540	32.4	V	54.0	-21.6	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2388.820	44.6	V	74.0	-29.4	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz
2389.950	32.4	H	54.0	-21.6	AVG	52	1.0	POS; RB 1 MHz; VB: 10 Hz
2387.780	44.8	H	74.0	-29.2	PK	52	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; V



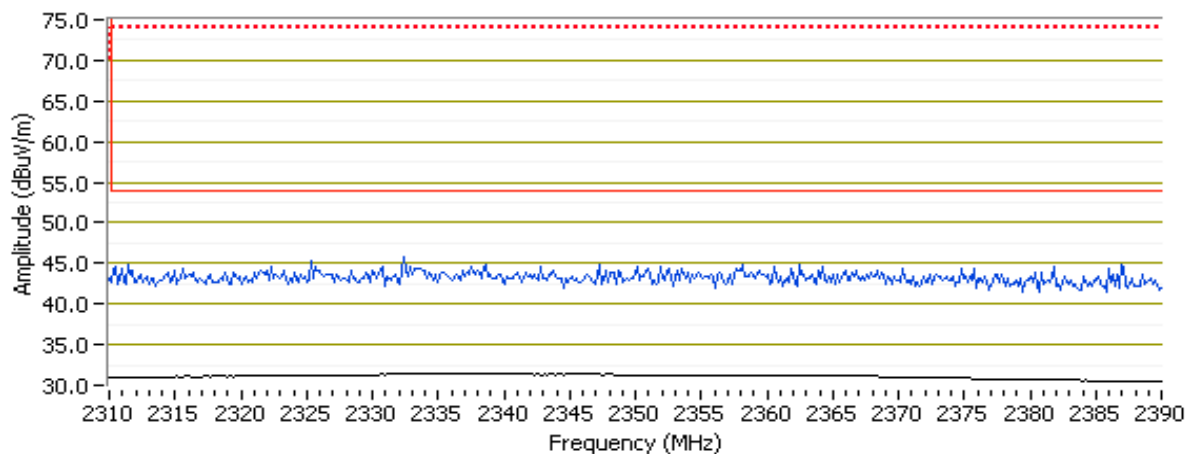
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 0 Mode: GFSK Orientation: Side
 Tx Chain: Main Data Rate: 1Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2388.360	32.4	V	54.0	-21.6	AVG	1	1.5	POS; RB 1 MHz; VB: 10 Hz
2389.930	44.0	V	74.0	-30.0	PK	1	1.5	POS; RB 1 MHz; VB: 3 MHz
2389.780	32.4	H	54.0	-21.6	AVG	360	1.5	POS; RB 1 MHz; VB: 10 Hz
2388.940	44.1	H	74.0	-29.9	PK	360	1.5	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; V



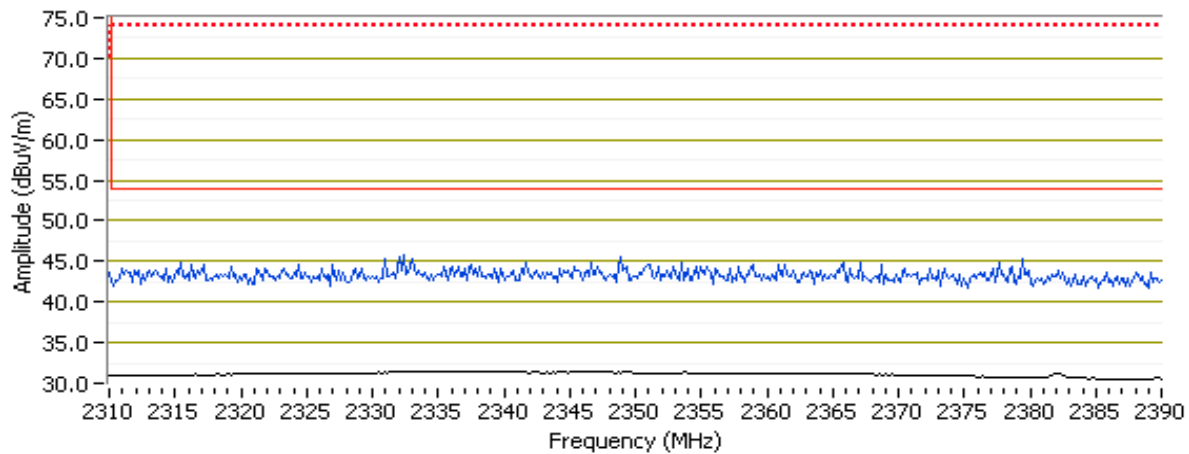
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 0 Mode: GFSK Orientation: Upright
 Tx Chain: Main Data Rate: 1Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2381.960	33.2	V	54.0	-20.8	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2386.250	44.0	V	74.0	-30.0	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz
2388.970	32.4	H	54.0	-21.6	AVG	0	1.0	POS; RB 1 MHz; VB: 10 Hz
2387.220	44.2	H	74.0	-29.8	PK	0	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; V



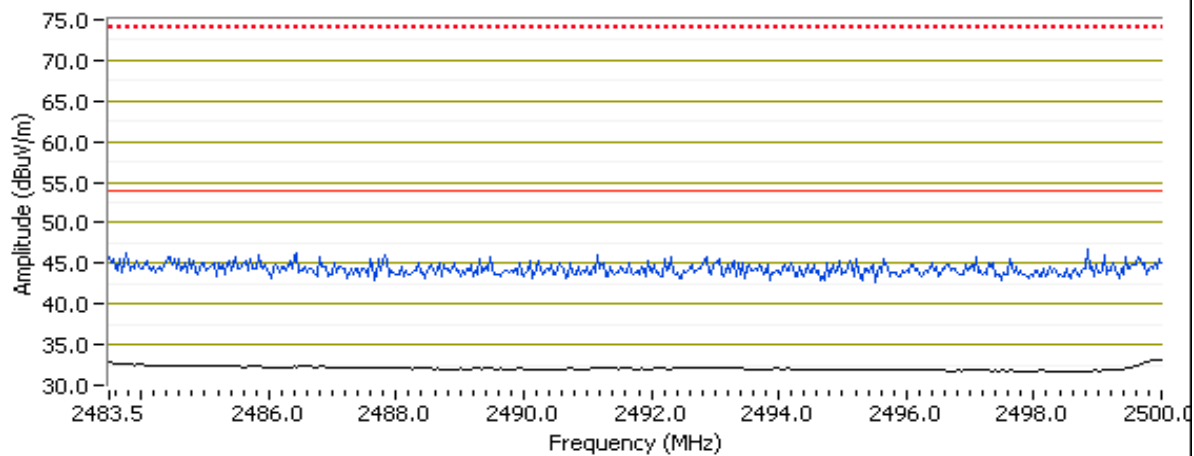
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 39 Mode: GFSK Orientation: Upright
 Tx Chain: Main Data Rate: 1Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2500.000	34.8	H	54.0	-19.2	AVG	0	1.1	POS; RB 1 MHz; VB: 10 Hz
2499.670	45.7	H	74.0	-28.3	PK	0	1.1	POS; RB 1 MHz; VB: 3 MHz
2499.930	34.1	V	54.0	-19.9	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2499.900	45.6	V	74.0	-28.4	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; H



Client: Olio	Job Number: J98176
Model: Wireless Watch (H1B) & charger	T-Log Number: T98220
Contact: AJ Cooper	Project Manager: Irene Rademacher
Standard: FCC 15.247 / 15.B / RSS-247	Project Coordinator: -
	Class: N/A

Run #2: Radiated Bandedge Measurements

Date of Test: 5/26/2015 0:00

Test Engineer: Rafael Varelas

Test Location: FT Chamber #5

Config. Used: 1

Config Change: None

EUT Voltage: Battery

Channel: 0

Mode: 8PSK

Orientation: Upright

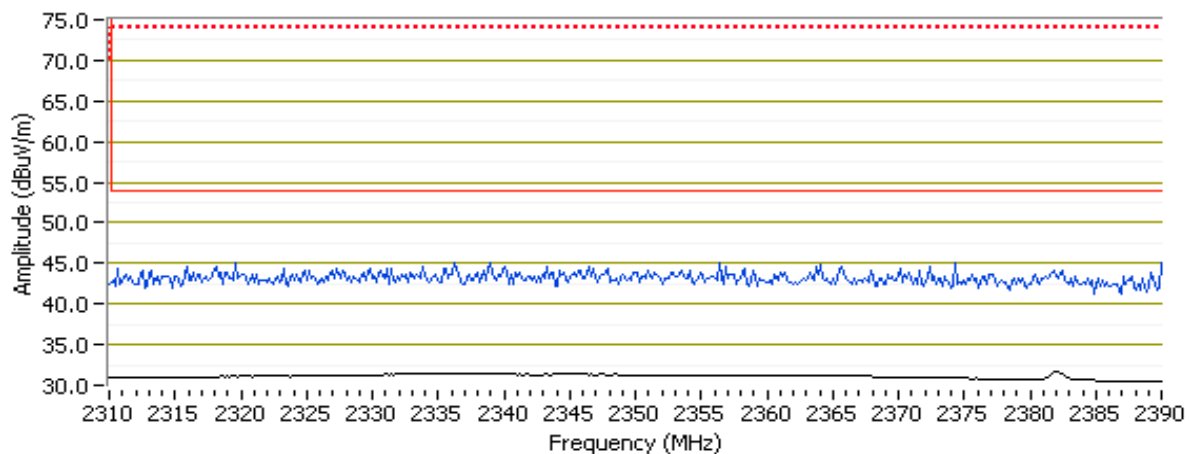
Tx Chain: Main

Data Rate: 3Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2381.980	33.3	H	54.0	-20.7	AVG	0	1.4	POS; RB 1 MHz; VB: 10 Hz
2353.610	44.2	H	74.0	-29.8	PK	0	1.4	POS; RB 1 MHz; VB: 3 MHz
2353.850	33.0	V	54.0	-21.0	AVG	353	1.8	POS; RB 1 MHz; VB: 10 Hz
2350.800	43.9	V	74.0	-30.1	PK	353	1.8	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; H



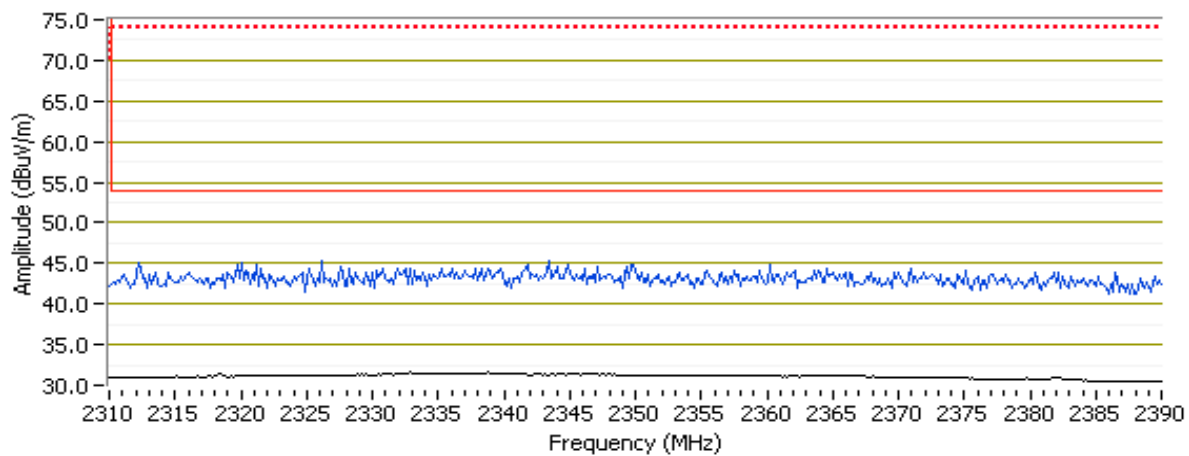
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 0 Mode: 8PSK Orientation: Side
 Tx Chain: Main Data Rate: 3Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2354.330	33.0	H	54.0	-21.0	AVG	360	1.3	POS; RB 1 MHz; VB: 10 Hz
2365.230	45.1	H	74.0	-28.9	PK	360	1.3	POS; RB 1 MHz; VB: 3 MHz
2356.490	33.1	V	54.0	-20.9	AVG	175	1.0	POS; RB 1 MHz; VB: 10 Hz
2372.040	45.1	V	74.0	-28.9	PK	175	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; V



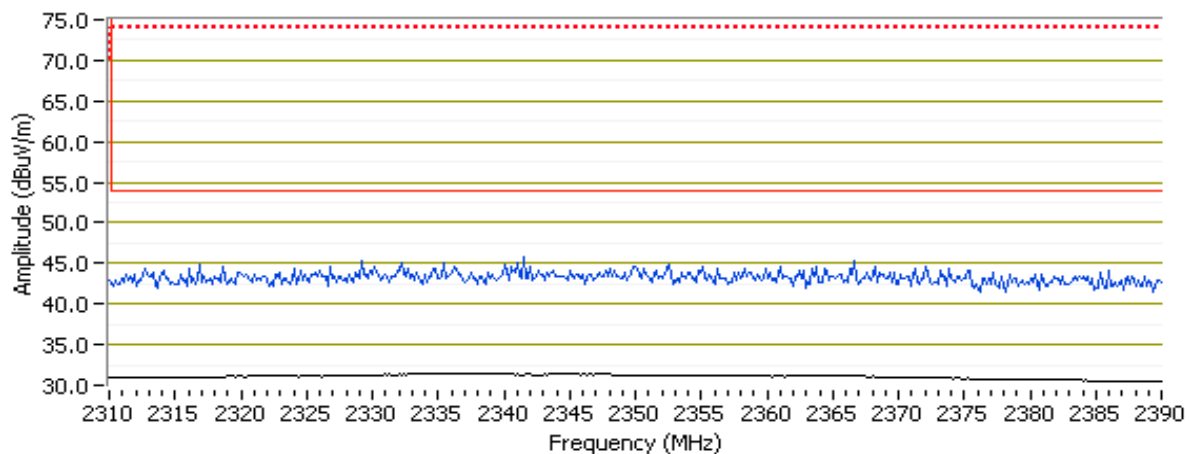
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 0 Mode: 8PSK Orientation: Flat
 Tx Chain: Main Data Rate: 3Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

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	
2367.390	33.0	V	54.0	-21.0	AVG	235	1.3	POS; RB 1 MHz; VB: 10 Hz
2356.010	45.5	V	74.0	-28.5	PK	235	1.3	POS; RB 1 MHz; VB: 3 MHz
2354.970	33.0	H	54.0	-21.0	AVG	215	1.0	POS; RB 1 MHz; VB: 10 Hz
2355.050	44.8	H	74.0	-29.2	PK	215	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; V



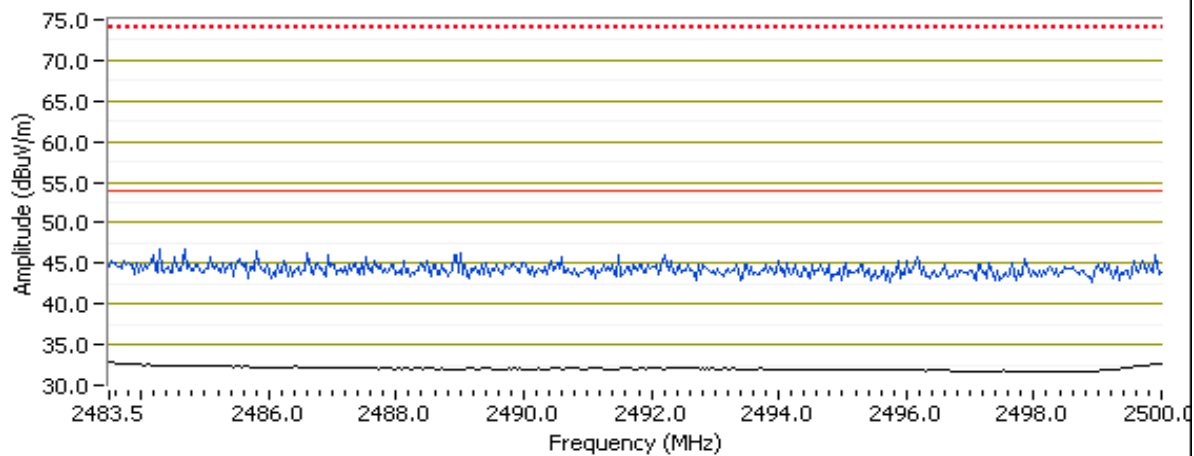
Client:	Olio	Job Number:	J98176
Model:	Wireless Watch (H1B) & charger	T-Log Number:	T98220
Contact:	AJ Cooper	Project Manager:	Irene Rademacher
Standard:	FCC 15.247 / 15.B / RSS-247	Project Coordinator:	-
		Class:	N/A

Channel: 39 Mode: 8PSK Orientation: Upright
 Tx Chain: Main Data Rate: 3Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	34.4	H	54.0	-19.6	AVG	351	1.0	POS; RB 1 MHz; VB: 10 Hz
2487.670	44.9	H	74.0	-29.1	PK	351	1.0	POS; RB 1 MHz; VB: 3 MHz
2483.500	34.1	V	54.0	-19.9	AVG	262	1.6	POS; RB 1 MHz; VB: 10 Hz
2485.680	46.0	V	74.0	-28.0	PK	262	1.6	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 10 Hz Avg, Black Trace; RB 1MHz VB 3MHz, Blue Trace; H



End of Report

This page is intentionally blank and marks the last page of this test report.