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EMC Test Report

Application for Grant of Equipment Authorization

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

Model: FB502

IC CERTIFICATION #:	8542A-FB502
FCC ID:	XRAFB502
APPLICANT:	Fitbit, Inc. 405 Howard Street, Suite 550 San Francisco, CA 94105
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-7
REPORT DATE:	October 7, 2015
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FINAL TEST DATES:	August 4, 6, 7, 10, 11 and 14, 2015
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A2LA ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
	October 7, 2015	First release	
1	December 14, 2015	Revised to update EUT Description. Removed test configuration photograph from test data.	David Guidotti

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SCOPE

An electromagnetic emissions test has been performed on the Fitbit, Inc. model FB502, pursuant to the following rules:

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"
FCC Part 15 Subpart C

Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in the following reference standards and as outlined in National Technical Systems - Silicon Valley test procedures:

ANSI C63.10-2013
FCC DTS Measurement Guidance KDB558074

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

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

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

OBJECTIVE

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

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

Prior to marketing in Canada, Class I transmitters, receivers and transceivers require certification. Class II devices are required to meet the appropriate technical requirements but are exempt from certification requirements.

Certification is a procedure where the manufacturer submits test data and technical information to a certification body and receives a certificate or grant of equipment authorization upon successful completion of the certification body's review of the submitted documents. Once the equipment authorization has been obtained, the label

indicating compliance must be attached to all identical units, which are subsequently manufactured.

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

STATEMENT OF COMPLIANCE

The tested sample of Fitbit, Inc. model FB502 complied with the requirements of the following regulations:

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"
FCC Part 15 Subpart C

Maintenance of compliance is the responsibility of the manufacturer. Any modifications to the product should be assessed to determine their potential impact on the compliance status of the device with respect to the standards detailed in this test report.

The test results recorded herein are based on a single type test of Fitbit, Inc. model FB502 and therefore apply only to the tested sample. The sample was selected and prepared by Sachin Sawalapurkar of Fitbit, Inc.

DEVIATIONS FROM THE STANDARDS

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

TEST RESULTS SUMMARY

DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHz)

FCC Rule Part	RSS Rule Part	Description	Measured Value / Comments	Limit / Requirement	Result
15.247(a)	RSS 247 5.2	Digital Modulation	Systems uses DSSS techniques	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 247 5.2 (1)	6dB Bandwidth	658 kHz	>500kHz	Complies
15.247 (b) (3)	RSS 247 5.4 (4)	Output Power (multipoint systems)	5.7 dBm (3.7mW) EIRP = 0.3mW Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	RSS 247 5.2 (2)	Power Spectral Density	5.2 dBm/30kHz	8dBm/3kHz	Complies
15.247(d)	RSS 247 5.5	Antenna Port Spurious Emissions 30MHz – 25 GHz	< -20 dBc	< -20dBc	Complies
15.247(d) / 15.209	RSS 247 5.5 / RSS-GEN	Radiated Spurious Emissions 30MHz – 25 GHz	52.8 dBµV/m @ 7319.6 MHz (-1.2 dB)	15.207 in restricted bands, all others < -20dBc	Complies
Note 1: EIRP calculated using antenna gain of -1.2 dBi for the highest EIRP system.					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Antenna is internal	Unique or integral antenna required	Complies
15.207	RSS GEN Table 3	AC Conducted Emissions	47.5 dBµV @ 0.153 MHz (-18.3 dB)	Refer to page 18	Complies
15.247 (b) (5)	RSS 102	RF Exposure Requirements	Refer to SAR exclusion calculations in separate exhibit and RSS 102 declaration	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSS GEN 8.3	User Manual	-	Statement for products with detachable antenna	Complies
-	RSP 100 RSS GEN 6.6	Occupied Bandwidth	1.02MHz	Information only	N/A

MEASUREMENT UNCERTAINTIES

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

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 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)	dBµV/m	25 to 1000 MHz	± 3.6 dB
		1000 to 40000 MHz	± 6.0 dB
Conducted Emissions (AC Power)	dBµV	0.15 to 30 MHz	± 2.4 dB

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Fitbit, Inc. model FB502 is a wearable fitness tracker. The EUT was treated as handheld equipment during testing to simulate the end-user environment. The EUT is powered via a rechargeable Li battery.

The sample was received on July 27, 2015 and tested on August 4, 6, 7, 10, 11 and 14, 2015. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Fitbit, Inc.	FB502	Fitness Tracker	EVT2-181	XRAFB502
Fitbit, Inc.	NA	USB charge cable	NA	

OTHER EUT DETAILS

The following EUT details should be noted: in normal use, the USB connection is used only to charge the EUT's internal battery.

ANTENNA SYSTEM

Internal Antenna, -1.15dBi

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 3.5 cm wide by 1.2 cm deep by 3.2 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	T430	Laptop Computer	A2113440	DoC
Lenovo	42T4418	AC/DC Adapter	11S42T4418Z1ZGW G25C49K	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	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Lenovo Laptop - USB	EUT	Multiconductor	Shielded	0.86

Additional on Support Equipment

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Lenovo Laptop - Ethernet	Remote Switch	CAT5	Unshielded	10
Lenovo Laptop - DC In	AC/DC Adapter	Multiconductor	Shielded	1.5
Lenovo AC/DC Adapter	AC Mains	2wire	Unshielded	1

EUT OPERATION

During emissions testing the EUT was continuously transmitting at maximum power on the channel called out in the individual test. The modulation used was 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 7	US0027	2845B-7	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 1.5m for measurements above 1GHz, and 0.8m for measurements below 1GHz. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor as specified in ANSI C63.4. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

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

TEST PROCEDURES

EUT AND CABLE PLACEMENT

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

CONDUCTED EMISSIONS

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

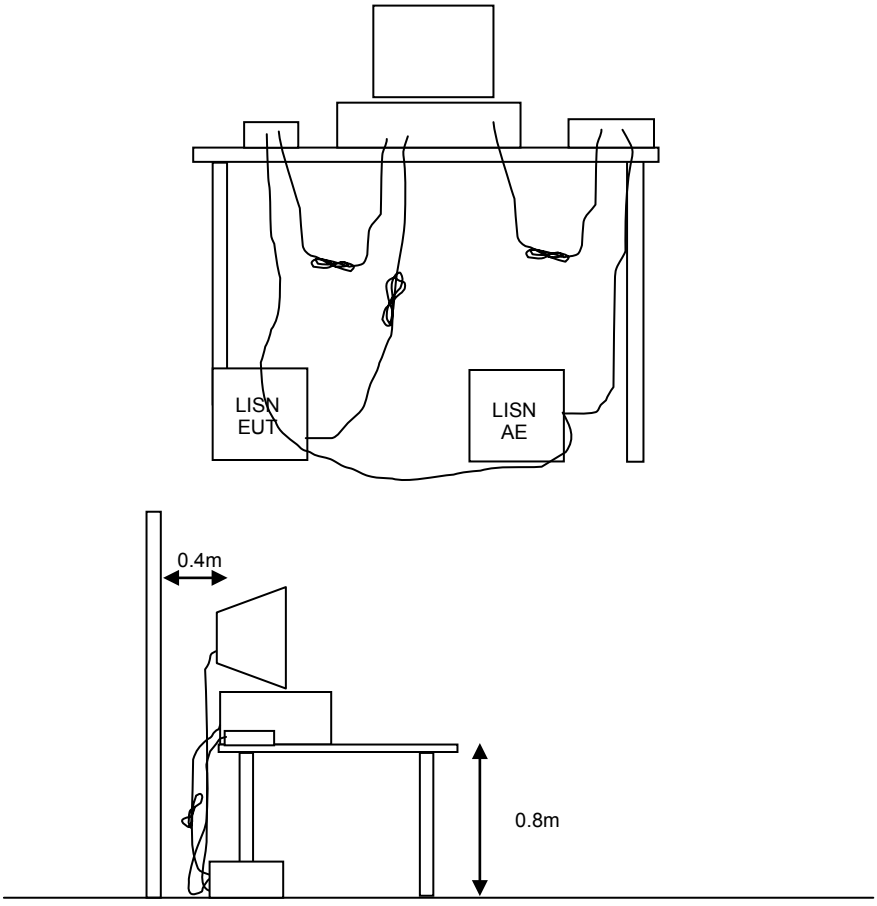


Figure 1 Typical Conducted Emissions Test Configuration

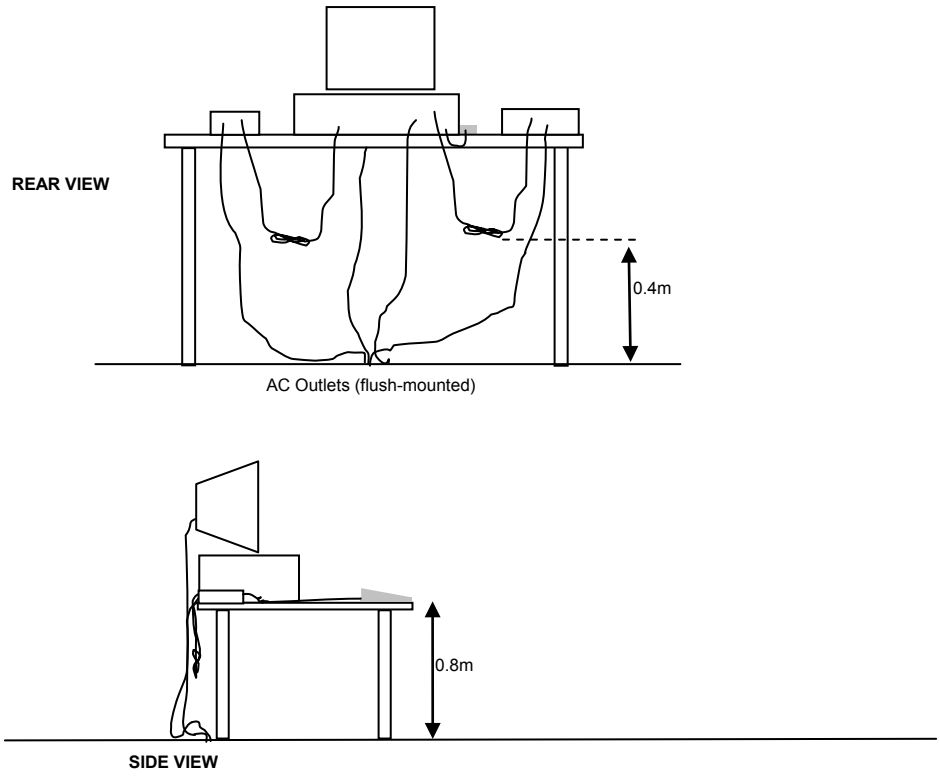
RADIATED EMISSIONS

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

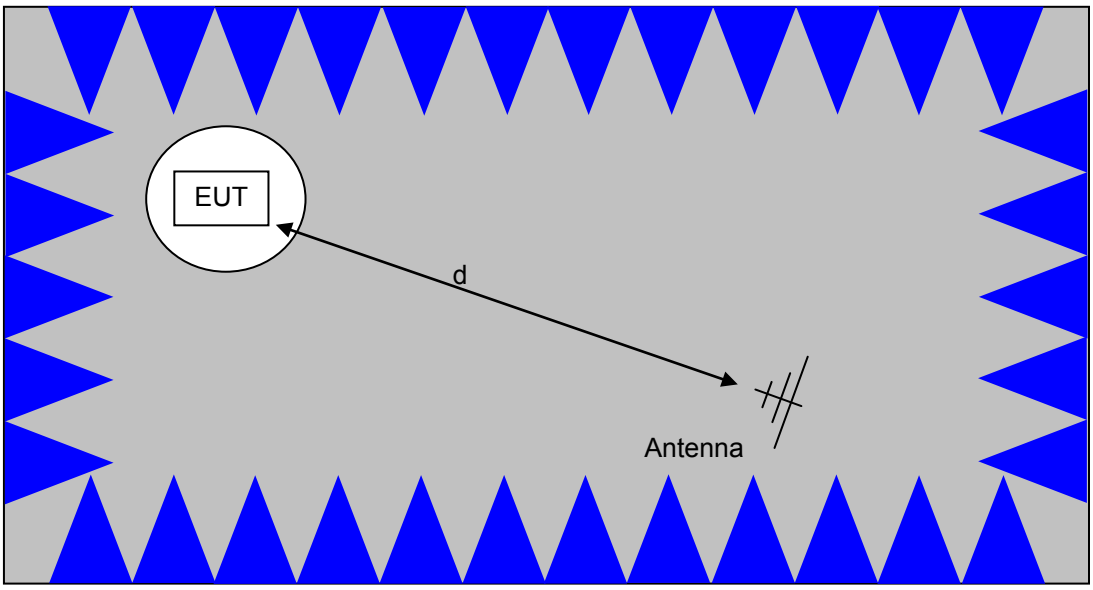
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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

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

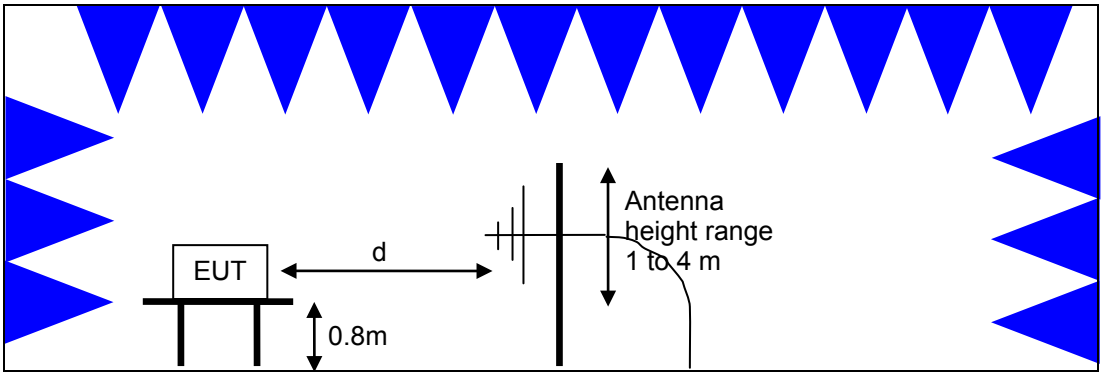


Typical Test Configuration for Radiated Field Strength Measurements



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

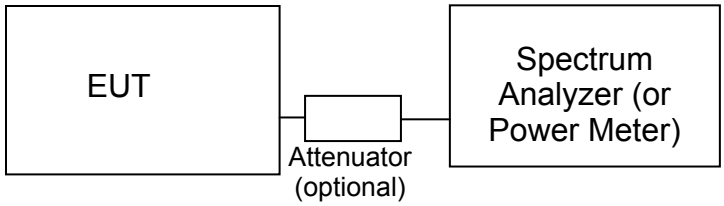
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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

CONDUCTED EMISSIONS FROM ANTENNA PORT

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



Test Configuration for Antenna Port Measurements

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

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

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

BANDWIDTH MEASUREMENTS

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

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

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

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

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

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

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

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1].

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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density.

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

The maximum permitted output power is reduced by 1dB for every dB the antenna gain exceeds 6dBi.

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 247. All other unwanted (spurious) emissions shall be at least 20dB below the level of the highest in-band signal level (30dB if the power is measured using the sample detector/power averaging method).

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

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

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

$$R_r - S = M$$

where:

R_r = Receiver Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

SAMPLE CALCULATIONS - RADIATED EMISSIONS

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

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

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

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

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

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

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

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

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_C = Corrected Reading in dBuV/m

L_S = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION

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

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

where P is the eirp (Watts)

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

Appendix A Test Equipment Calibration Data

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Radiated Emissions, 1000 - 25,000 MHz, 04-Aug-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
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	7/1/2015	7/17/2016
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	7/13/2015	7/13/2016
A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	9/2/2014	9/2/2015
Radiated Emissions, 1000 - 18,000 MHz, 06-Aug-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
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	7/13/2015	7/13/2016
Radiated Spurious Emissions, 1000 - 25,000 MHz, 07-Aug-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/20/2014	9/20/2015
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A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	9/2/2014	9/2/2015
Miteq, Inc.	HF Amplifier, 18-40 GHz (with 1145) Red	TTA1840-45-5P-HG-S	3169	7/1/2015	2/1/2016
Radiated Spurious Emissions, 1000 - 25,000 MHz, 10-Aug-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
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	7/13/2015	7/13/2016
A. H. Systems	Blue System Horn, 18-40GHz	SAS-574, p/n: 2581	2159	9/2/2014	9/2/2015
Miteq, Inc.	HF Amplifier, 18-40 GHz (with 1145) Red	TTA1840-45-5P-HG-S	3169	7/1/2015	2/1/2016
Radiated Spurious Emissions, 30 - 1,000 MHz, 11-Aug-15					
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1549	6/2/2015	6/2/2017
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	9/16/2014	9/16/2015

Manufacturer	Description	Model	Asset #	Calibrated	Cal Due
Hewlett Packard	9KHz-1300MHz pre-amp	8447F	2777	3/4/2015	3/5/2016
Conducted Emissions - AC Power Ports, 14-Aug-15					
EMCO	LISN, 10 kHz-100 MHz	3825/2	1293	6/2/2015	6/2/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/20/2014	12/20/2015
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1594	5/14/2015	5/14/2016
Radiated Emissions, Metal Band, 14-Aug-15					
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/29/2014	7/29/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	870	2/20/2015	2/20/2016
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	2249	10/3/2014	10/3/2015
Radiated Emissions, Substitutions, 14-Aug-15					
Agilent Technologies	USB Average Power Sensor	U2001A	2442	12/19/2014	12/19/2015
EMCO	Antenna, Horn, 1-18 GHz	3115	2733	11/18/2014	11/18/2016
Agilent Technologies	PSG, Vector Signal Generator, (250kHz - 20MHz)	E8267D	3011	1/8/2015	1/8/2016
Radio Antenna Port (Power and Spurious Emissions), 14-Aug-15					
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	3/31/2015	3/31/2016
Radiated Emissions, 1,000 - 6,500 MHz, 20-Aug-15					
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/26/2014	6/26/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016
Radiated Emissions, 1,000 - 6,500 MHz, 21-Aug-15					
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/26/2014	6/26/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016
Radiated Emissions, 1,000 - 10,000 MHz, 04-Sep-15					
EMCO	Antenna, Horn, 1-18GHz	3115	868	6/26/2014	6/26/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
A. H. Systems	Spare System Horn, 18-40GHz	SAS-574, p/n: 2581	2162	7/29/2015	7/29/2017
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015	2/20/2016
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	3/7/2015	3/7/2016

Appendix B Test Data

T98212 Pages 25 – 55

Client:	Fitbit, Inc.	Job Number:	J97928
Product	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Emissions Standard(s):	FCC 15.247, IC RSS-247, LP 0002	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Fitbit, Inc.

Product

FB502

Date of Last Test: 9/29/2015

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Duty Cycle

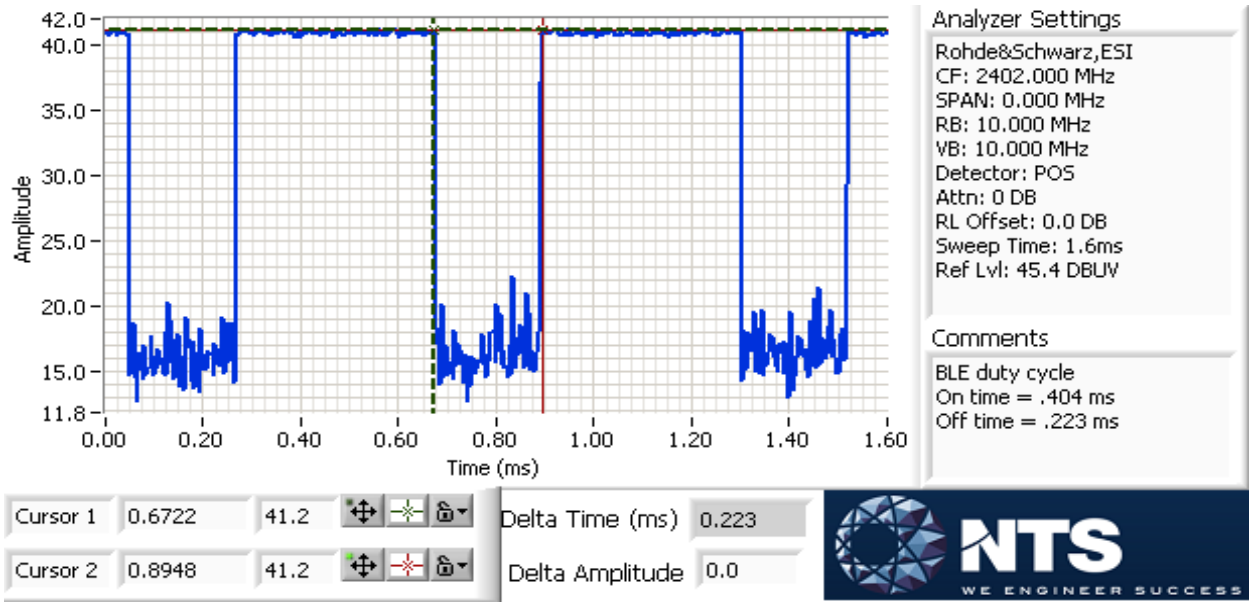
Date of Test: 8/3/2015
Test Engineer: John Caizzi
Test Location: Chamber 7

Duty cycle measurements performed on the worse case data rate for power.

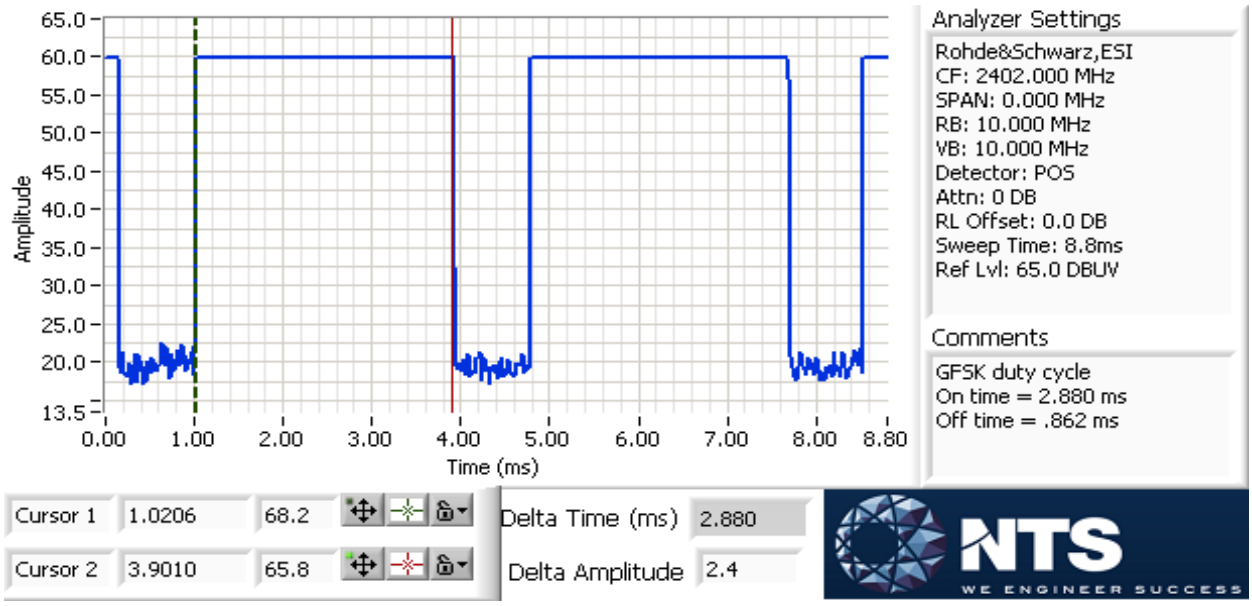
Notes: Measurements taken with maximum RBW/VBW settings allowed.

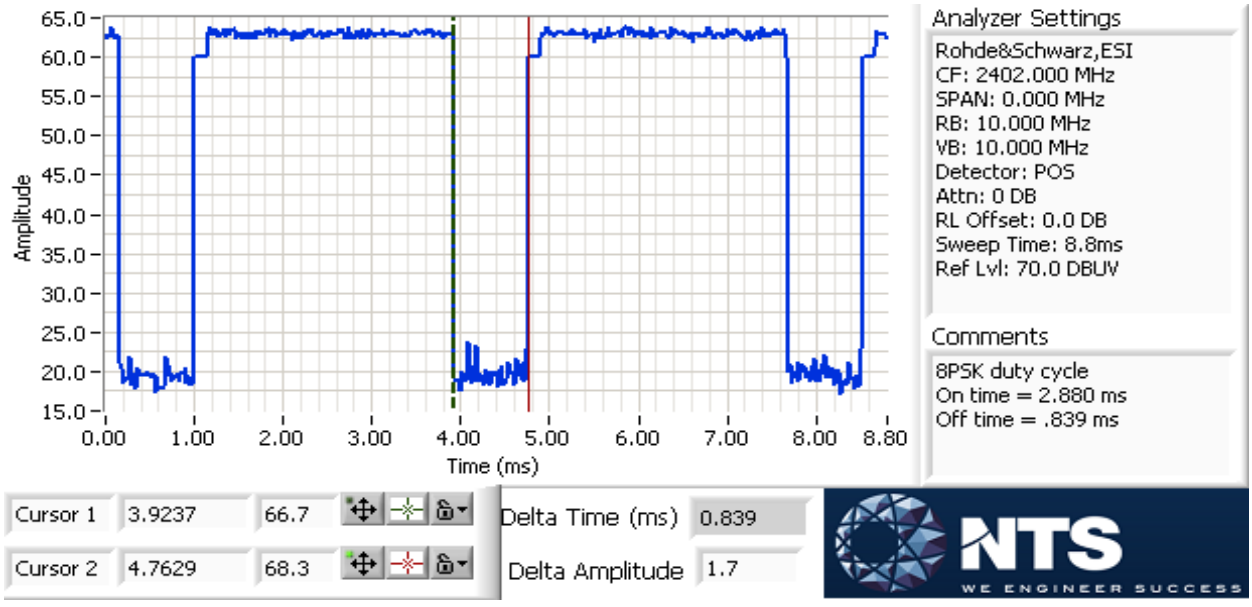
Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1Mbs	0.64	Yes	0.404	1.9	3.8	2475
BT - GFSK	1Mbs	0.77	Yes	2.88	1.1	2.3	347
BT - 8PSK	3Mbs	0.77	Yes	2.88	1.1	2.2	347

* Correction factor when using RMS/Power averaging - 10*log(1/x)
** Correction factor when using linear voltage average - 20*log(1/x)
T = Minimum transmission duration



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A





Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

RSS 247 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

The EUT and all local support equipment were located on the turntable for radiated spurious emissions testing.
For radiated emissions testing the measurement antenna was located 3 meters from the EUT, unless otherwise noted.

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	BLE	2402MHz	Default	Default	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	31.4 dBµV/m @ 2377.7 MHz (-22.6 dB)
		2480MHz		Default	Restricted Band Edge (2483.5 MHz)		32.2 dBµV/m @ 2485.0 MHz (-21.8 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: EVT2-181
Driver: v17.7.0.10
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 ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mb/s	0.64	Yes	0.404	1.9	3.8	2475

Measurement Specific Notes:

Note 4:	Emission has duty cycle < 98% and is NOT constant, average measurement performed: RBW=1MHz, VBW> 1/T, peak detector, linear average mode, sweep time auto, max hold. Max hold for 50*(1/DC) traces
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.

Note - Preliminary testing was performed to determine worse case orienation.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #1: Radiated Bandedge Measurements

Date of Test: 8/3/2015 0:00
Test Engineer: John Caizzi
Test Location: Chamber 7

Config. Used: 1
Config Change: none
EUT Voltage: USB

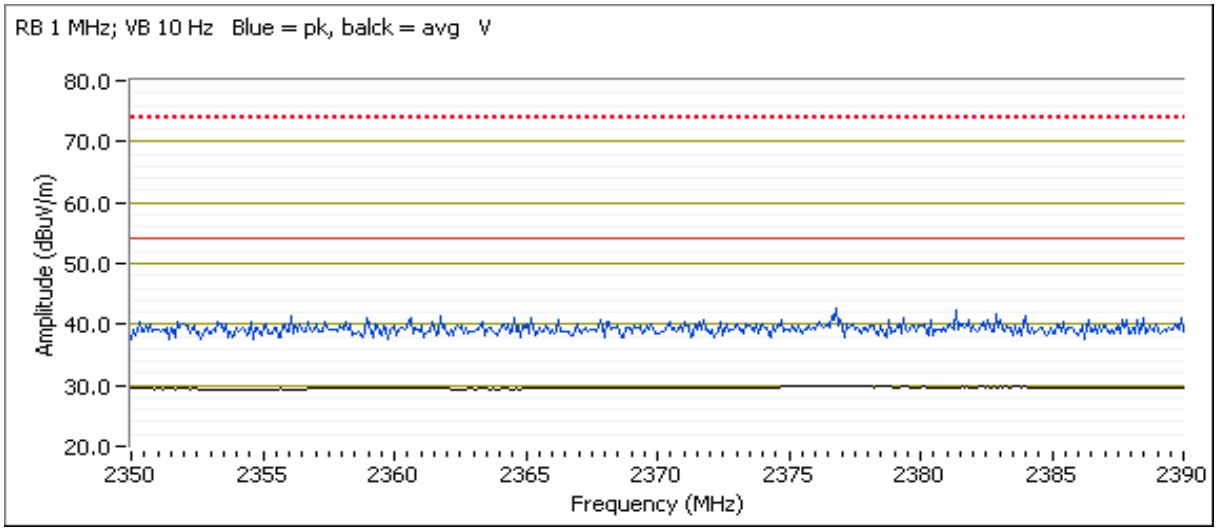
Channel: 2402MHz
Tx Chain: Main

Mode: LE
Data Rate: 1 Mb/s

Orientation: Side

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2383.590	31.4	H	54.0	-22.6	AVG	196	1.75	Note 4, RB 1 MHz; VB: 3 kHz
2356.970	42.0	H	74.0	-32.0	PK	196	1.75	
2377.660	31.4	V	54.0	-22.6	AVG	0	2.50	Note 4, RB 1 MHz; VB: 3 kHz
2374.530	42.5	V	74.0	-31.5	PK	0	2.50	

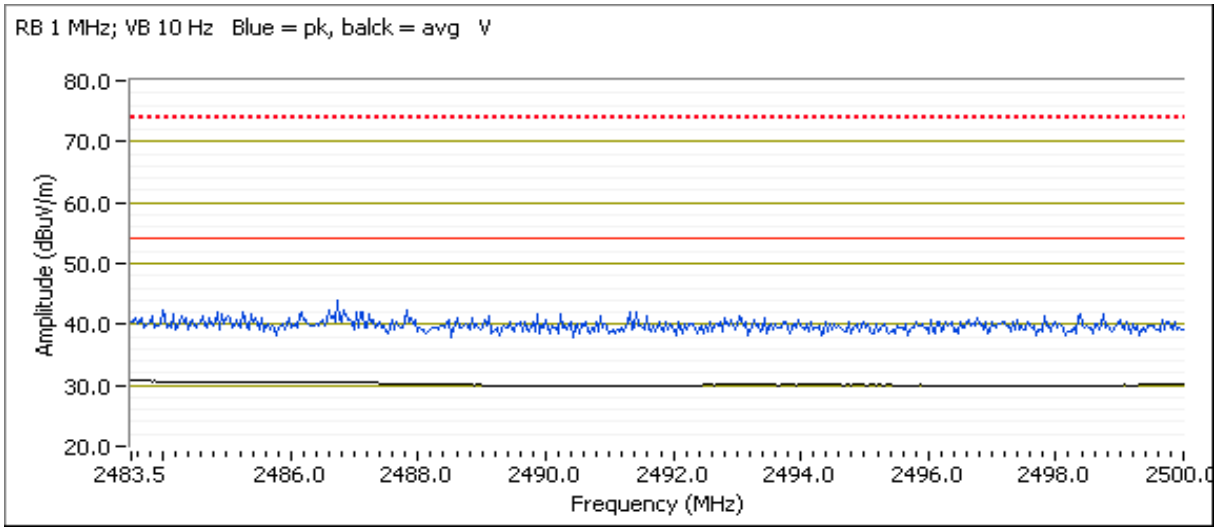


Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Channel: 2480MHz Mode: LE
Tx Chain: Main Data Rate: 1 Mb/s

Band Edge Signal Field Strength - Direct measurement of field strength

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	31.9	H	54.0	-22.1	AVG	318	2.17	Note 4, RB 1 MHz; VB: 3 kHz
2495.470	43.2	H	74.0	-30.8	PK	318	2.17	
2485.020	32.2	V	54.0	-21.8	AVG	343	1.78	Note 4, RB 1 MHz; VB: 3 kHz
2487.140	42.5	V	74.0	-31.5	PK	343	1.78	



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

RSS 247 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 24 °C
Rel. Humidity: 35 %

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

Run #	Mode	Channel	Target Power	Power Setting	Test Performed	Limit	Result / Margin
1	BLE	2402 MHz	Default	Default	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	51.8 dBµV/m @ 7205.5 MHz (-2.2 dB)
		2440 MHz		Default			52.8 dBµV/m @ 7319.6 MHz (-1.2 dB)
		2480 MHz		Default			52.1 dBµV/m @ 7439.5 MHz (-1.9 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: EVT2-181
Driver: v17.7.0.10
Antenna: internal

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	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 ≥ 98% and was measured using RBW=1MHz, VBW=10Hz, peak detector, linear average mode, auto sweep time, max hold.
2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1Mb/s	0.64	Yes	0.404	1.9088618	3.8177235	2475

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 4:	Emission has duty cycle < 98% and is NOT constant, average measurement performed: RBW=1MHz, VBW> 1/T, peak detector, linear average mode, sweep time auto, max hold. Max hold for 50*(1/DC) traces
Note 6:	Emission in non-restricted band, evaluated during conducted antenna port measurements.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #1: Radiated Spurious Emissions, 1,000 - 25000 MHz

Date of Test: 8/4/15, 8/6/15, 8/7/15, 8/10/15
Test Engineer: John Caizzi
Test Location: Chamber 7

Config. Used: 1
Config Change: USB wall charger substituted for laptop.
EUT Voltage: USB

Run #1a: Low Channel

Channel: 2402 MHz
Tx Chain: Main

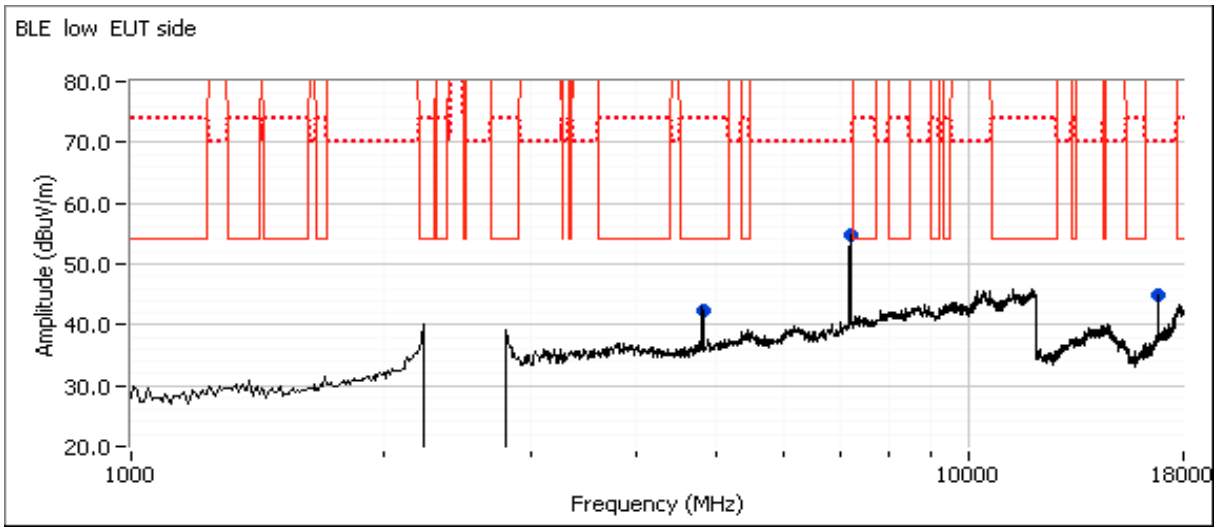
Mode: BLE
Data Rate: 1Mb/s

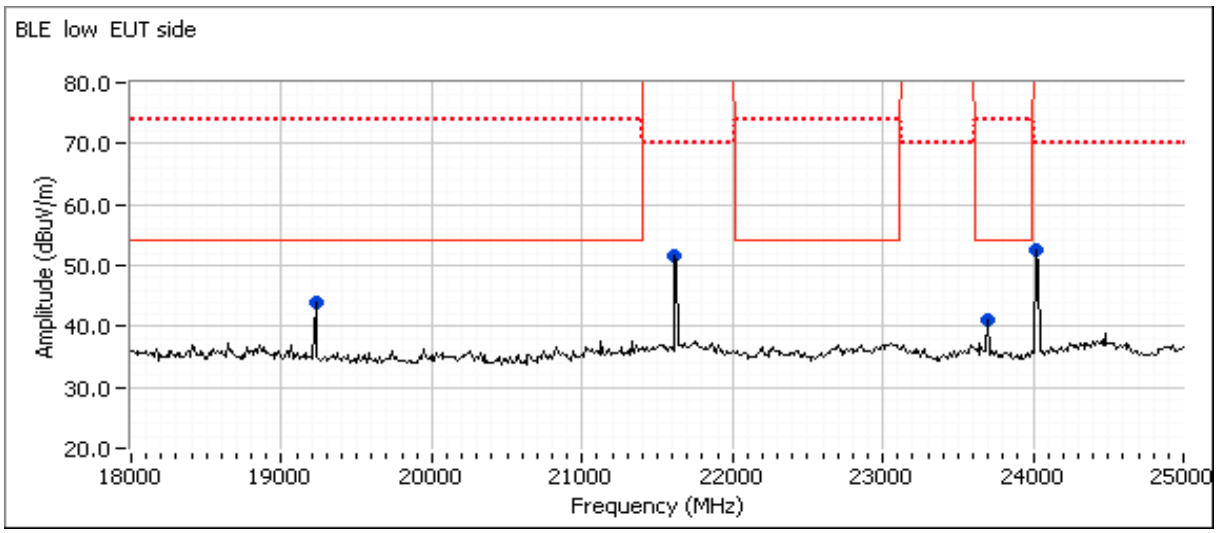
Orientation: Side

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4804.210	45.1	H	54.0	-8.9	AVG	170	1.44	RB 1 MHz;VB 3 kHz, note 1, 4
4803.750	50.6	H	74.0	-23.4	PK	170	1.44	
7205.520	51.8	H	54.0	-2.2	AVG	212	1.00	RB 1 MHz;VB 3 kHz, note 1, 4
7206.080	57.3	H	74.0	-16.7	PK	212	1.00	
19214.300	44.2	H	54.0	-9.8	AVG	318	1.41	RB 1 MHz;VB 3 kHz, note 4
19214.250	53.9	H	74.0	-20.1	PK	318	1.41	
23712.930	41.8	H	54.0	-12.2	AVG	336	1.55	RB 1 MHz;VB 3 kHz. Note 7
23709.260	53.6	H	74.0	-20.4	PK	336	1.55	Note 7
16810.000	44.8	H	-	-	Peak	135	1.5	Note 6
21616.670	51.7	H	-	-	Peak	332	1.5	Note 6
24020.000	52.4	H	-	-	Peak	357	1.5	Note 6

Note 7	Emission below noise floor of measurement system.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A





Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #1b: Center Channel

Channel: 2440 MHz Mode: BLE
Tx Chain: Main Data Rate: 1Mb/s

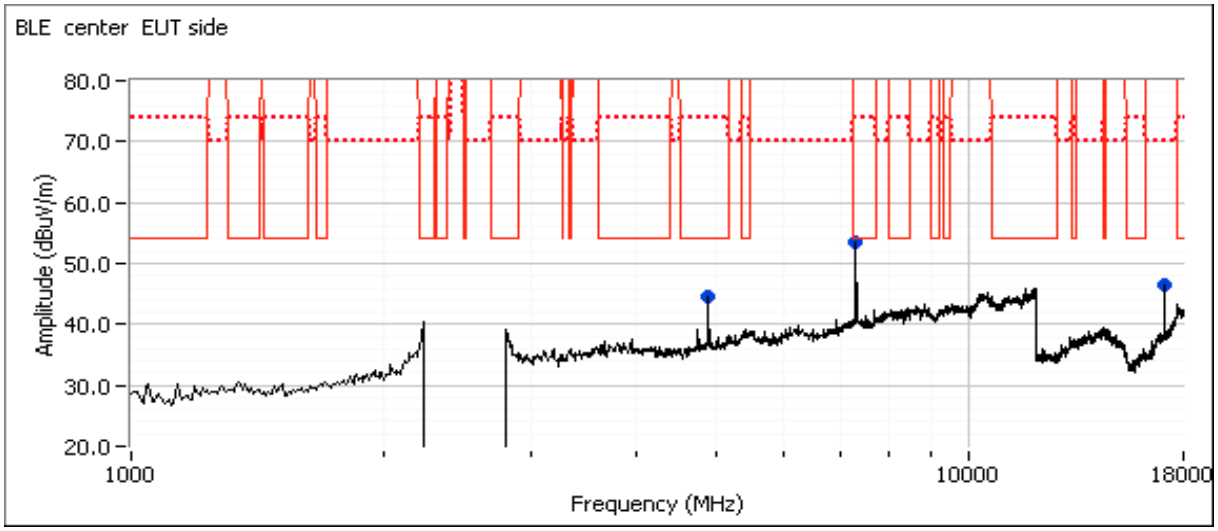
Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT side								
4879.930	44.4	H	54.0	-9.6	AVG	165	1.56	RB 1 MHz;VB 3 kHz
4879.970	50.1	H	74.0	-23.9	PK	165	1.56	
7319.600	52.8	H	54.0	-1.2	AVG	214	1.02	RB 1 MHz;VB 3 kHz
7319.370	58.0	H	74.0	-16.0	PK	214	1.02	
19518.300	45.4	H	54.0	-8.6	AVG	322	1.25	RB 1 MHz;VB 3 kHz
19521.960	55.0	H	74.0	-19.0	PK	322	1.25	
21957.870	49.4	H	54.0	-4.6	AVG	326	1.59	RB 1 MHz;VB 3 kHz. Note 1
21958.030	58.0	H	74.0	-16.0	PK	326	1.59	Note 1
24397.830	52.1	H	54.0	-1.9	AVG	322	1.42	RB 1 MHz;VB 3 kHz. Note 1
24397.600	60.8	H	74.0	-13.2	PK	322	1.42	Note 1
EUT horizontal								
4879.920	45.1	H	54.0	-8.9	AVG	222	1.62	RB 1 MHz;VB 3 kHz
4880.580	50.9	H	74.0	-23.1	PK	222	1.62	
4879.920	43.1	V	54.0	-10.9	AVG	156	1.13	RB 1 MHz;VB 3 kHz
4879.370	49.5	V	74.0	-24.5	PK	156	1.13	
7319.650	48.3	H	54.0	-5.7	AVG	228	1.53	RB 1 MHz;VB 3 kHz
7319.250	55.1	H	74.0	-18.9	PK	228	1.53	
7319.620	51.4	V	54.0	-2.6	AVG	113	1.00	RB 1 MHz;VB 3 kHz
7319.180	57.1	V	74.0	-16.9	PK	113	1.00	
21957.970	44.4	H	54.0	-9.6	AVG	313	1.27	RB 1 MHz;VB 3 kHz. Note 1
21961.200	54.7	H	74.0	-19.3	PK	313	1.27	Note 1
21958.170	49.4	V	54.0	-4.6	AVG	158	1.15	RB 1 MHz;VB 3 kHz. Note 1
21962.100	58.2	V	74.0	-15.8	PK	158	1.15	Note 1

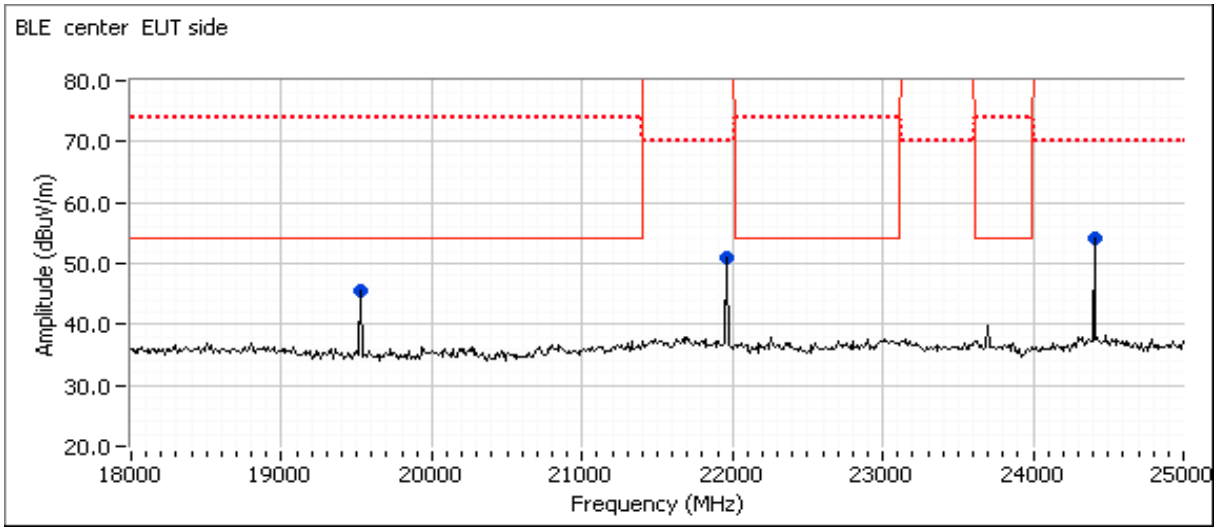
Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
EUT vertical								
4879.930	43.7	H	54.0	-10.3	AVG	196	1.53	RB 1 MHz;VB 3 kHz
4879.480	50.1	H	74.0	-23.9	PK	196	1.53	
4880.020	45.3	V	54.0	-8.7	AVG	212	1.06	RB 1 MHz;VB 3 kHz
4880.480	50.6	V	74.0	-23.4	PK	212	1.06	
7319.650	51.3	H	54.0	-2.7	AVG	211	1.00	RB 1 MHz;VB 3 kHz
7320.800	56.9	H	74.0	-17.1	PK	211	1.00	
7319.580	52.3	V	54.0	-1.7	AVG	235	1.00	RB 1 MHz;VB 3 kHz
7320.750	57.7	V	74.0	-16.3	PK	235	1.00	
21957.930	47.5	H	54.0	-6.5	AVG	284	1.84	RB 1 MHz;VB 3 kHz. Note 1
21957.830	57.4	H	74.0	-16.6	PK	284	1.84	Note 1
21958.100	48.2	V	54.0	-5.8	AVG	21	1.51	RB 1 MHz;VB 3 kHz. Note 1
21957.800	56.9	V	74.0	-17.1	PK	21	1.51	Note 1

Note 5	In assessing worst case orientation of the EUT, the following method was used. The 10th harmonic was not measured because it does not fall in a restricted band, and it would be measured during antenna port conducted measurements. All other harmonics from the scan either fall, or can fall, in a restricted band. The highest harmonic from the scan, the 3rd, was measured in all 3 orientations, and worst case orientation was determined. This orientation was used for all subsequent measurements on all other harmonics.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A





Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

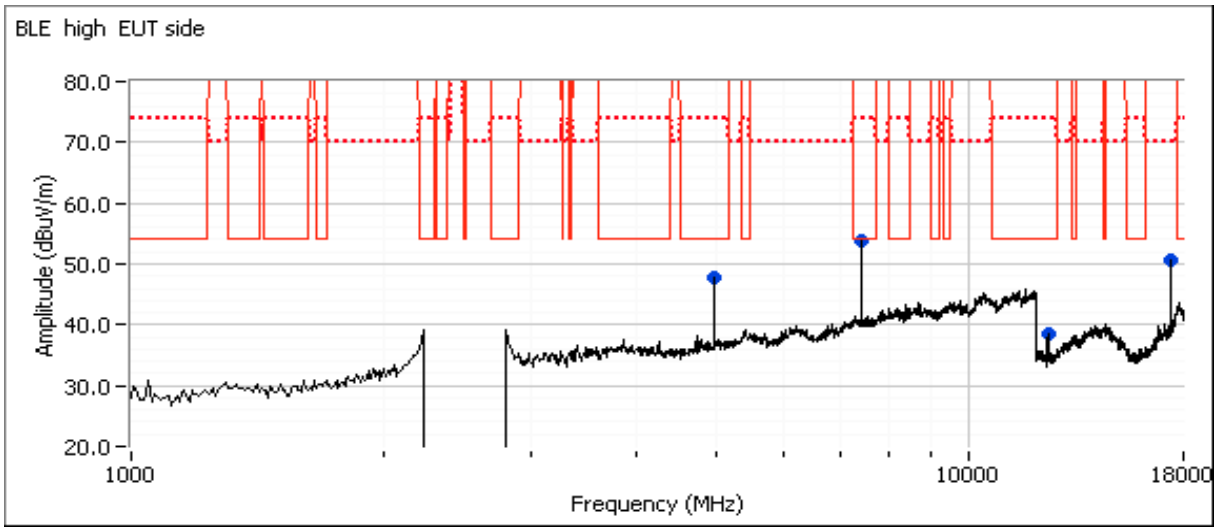
Run #1c: High Channel

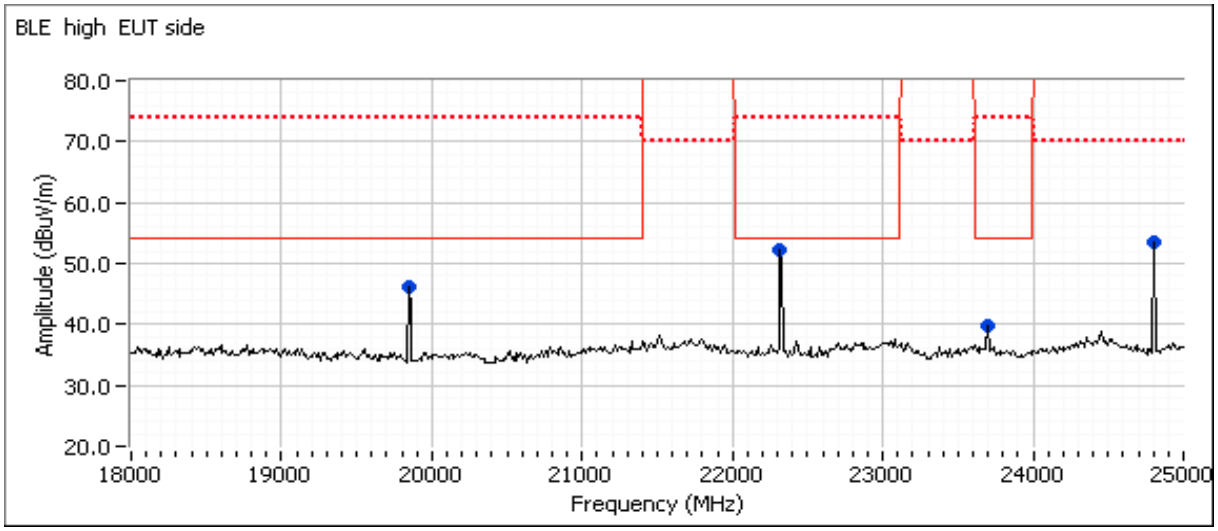
Channel: 2480 MHz Mode: BLE Orientation: Side
Tx Chain: Main Data Rate: 1Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4960.000	48.3	H	54.0	-5.7	AVG	170	1.54	RB 1 MHz;VB 3 kHz
4960.560	52.6	H	74.0	-21.4	PK	170	1.54	
7439.480	52.1	H	54.0	-1.9	AVG	211	1.32	RB 1 MHz;VB 3 kHz
7440.950	57.6	H	74.0	-16.4	PK	211	1.32	
12399.220	40.7	V	54.0	-13.3	AVG	190	1.00	RB 1 MHz;VB 3 kHz. Note 7.
12400.940	51.5	V	74.0	-22.5	PK	190	1.00	Note 7
19838.330	45.8	H	54.0	-8.2	AVG	321	1.38	RB 1 MHz;VB 3 kHz
19840.330	55.1	H	74.0	-18.9	PK	321	1.38	
22317.880	49.6	H	54.0	-4.4	AVG	315	1.59	RB 1 MHz;VB 3 kHz
22317.650	58.6	H	74.0	-15.4	PK	315	1.59	
23683.460	41.9	H	54.0	-12.1	AVG	309	1.00	RB 1 MHz;VB 3 kHz. Note 7.
23687.660	53.5	H	74.0	-20.5	PK	309	1.00	Note 7

Note 7	Emission below noise floor of measurement system.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A





Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

RSS 247 and FCC 15.247 (DTS) Antenna Port Measurements

Power, PSD, Bandwidth and Spurious Emissions

Test Specific Details

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

Date of Test: 8/14/2015 & 8/17/15
Test Engineer: John Caizzi
Test Location: Lab 4A

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

General Test Configuration

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

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

Ambient Conditions:

Temperature: 22 °C
Rel. Humidity: 32 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	Default		Output Power	15.247(b)	Pass	5.7 dBm (3.7mW)
2			Power spectral Density (PSD)	15.247(d)	Pass	5.2 dBm/30kHz
3			Minimum 6dB Bandwidth	15.247(a)	Pass	658 kHz
3			99% Bandwidth	RSS GEN	-	1.02 MHz
4			Spurious emissions	15.247(b)	Pass	< -20 dBc

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1 Mb/s	0.64	Yes	0.404	1.9088618	3.8177235	2475

Sample Notes

Sample S/N: EVT2-2242
Driver: v17.7.0.10

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #1: Output Power

Mode: BLE

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[1]	Output Power mW	Antenna Gain (dBi)	Result	EIRP dBm	EIRP W	Output Power (dBm)[3]	Output Power mW
Default	2402	4.6	2.9	-1.2	Pass	3.5	0.002	4.4	2.8
	2440	5.7	3.7	-1.2	Pass	4.6	0.003	5.3	3.4
	2480	5.7	3.7	-1.2	Pass	4.6	0.003	5.3	3.4

Note 1:	Output power measured using a peak power meter, spurious limit is -20dBc.
Note 2:	Power setting - the software power setting used during testing, included for reference only.
Note 3:	Average power measurements using gated average power meter for information purposes only.

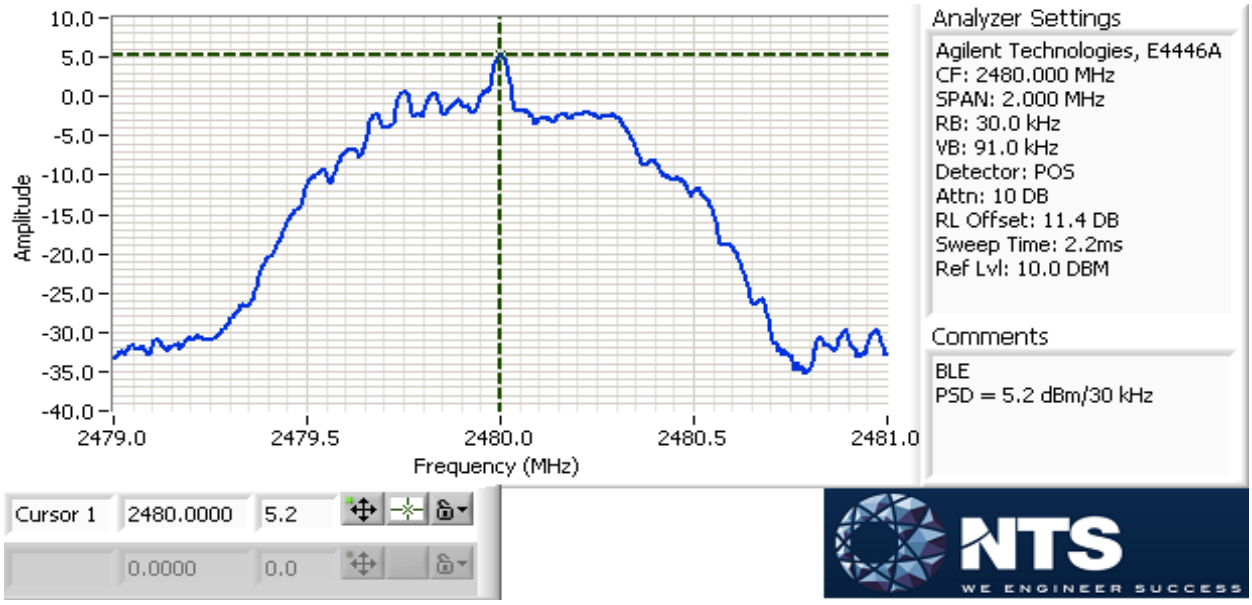
Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #2: Power spectral Density

Mode: BLE

Power Setting	Frequency (MHz)	PSD (dBm/30kHz) Note 1	Limit dBm/3kHz	Result
Default	2402	4.1	8.0	Pass
	2440	4.9	8.0	Pass
	2480	5.2	8.0	Pass

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



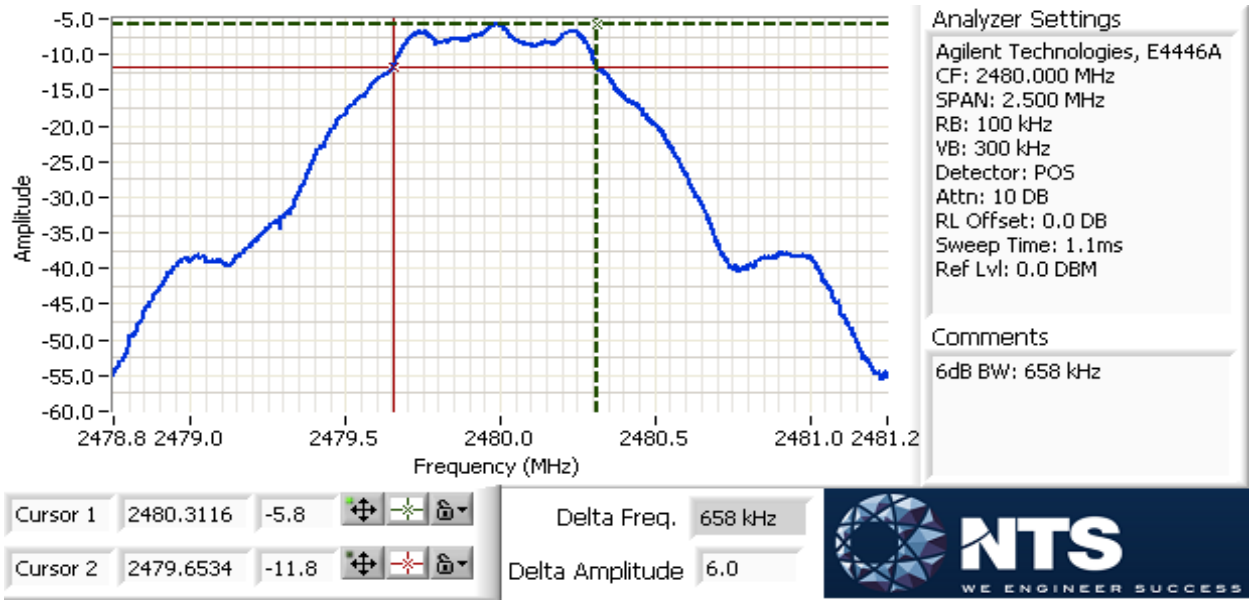
Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #3: Signal Bandwidth

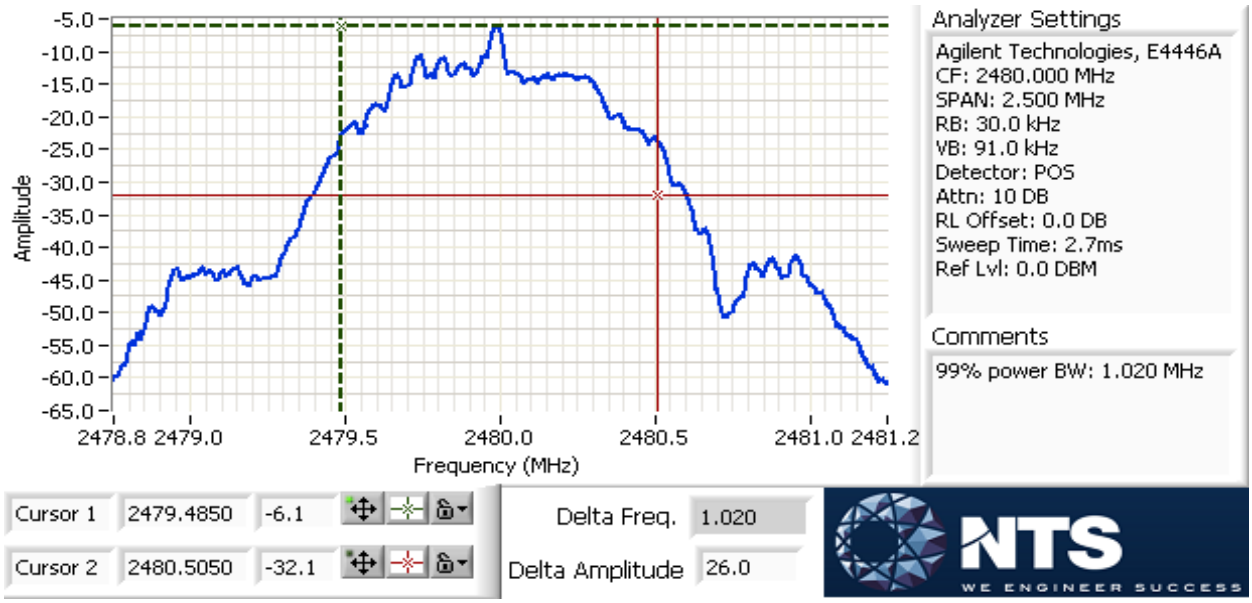
Mode: BLE

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (kHz)	
		6dB	99%	6dB	99%
Default	2402	0.663	1.02	100	30
	2440	0.661	1.02		
	2480	0.658	1.02		

Note 1:	DTS BW: RBW=100kHz, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time. 99% BW: RBW=1-5% of of 99%BW, VBW ≥ 3*RBW, peak detector, max hold, auto sweep time.



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A



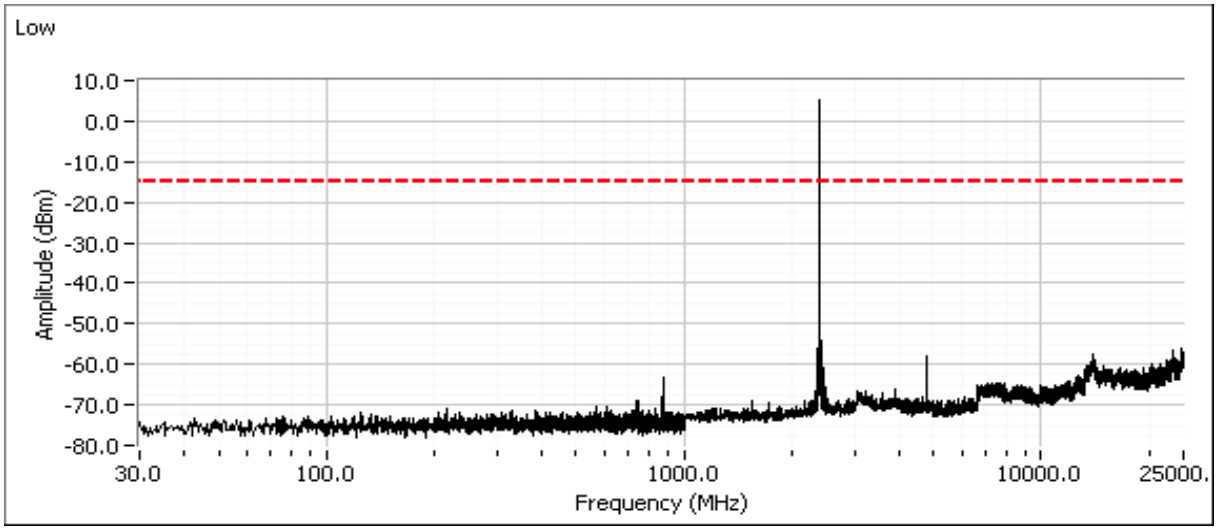
Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Run #4a: Out of Band Spurious Emissions

Frequency (MHz)	Power Setting	Mode	Limit	Result
2402	Default	BLE	-20dBc	Pass
2440				Pass
2480				Pass

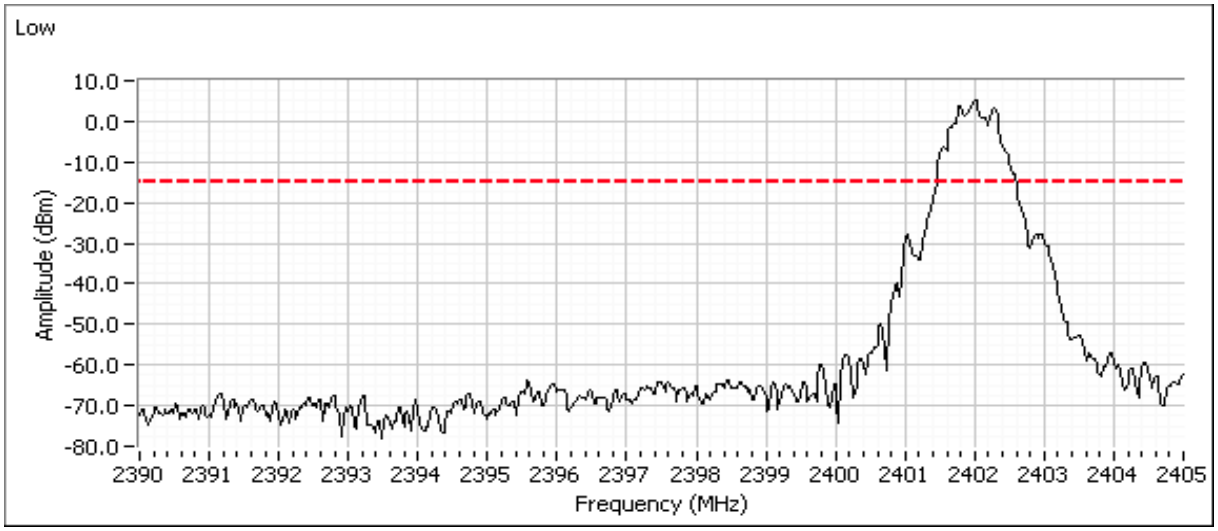
Note: All plots performed using RBW=100kHz, VBW=300kHz, peak detector, max hold

Plots for low channel

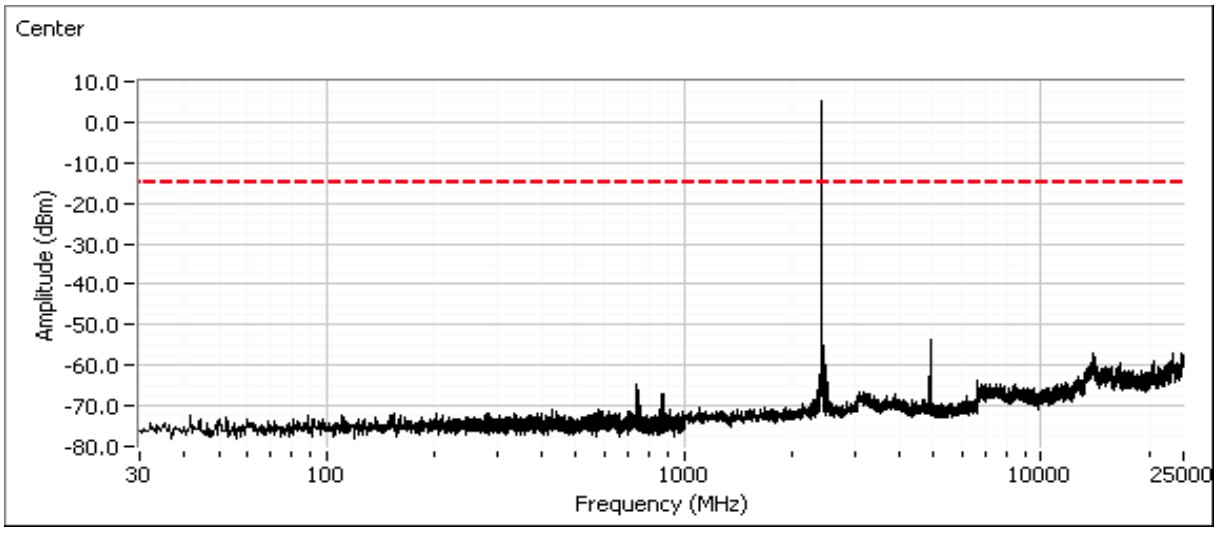


Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

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

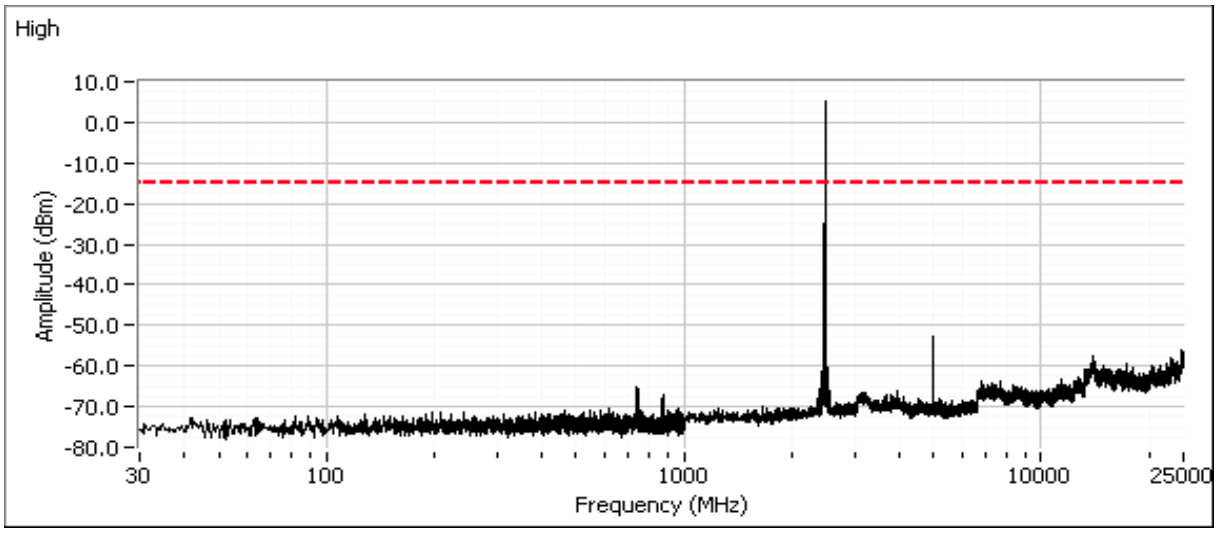


Plot for center channel



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	N/A

Plot for high channel



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

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: 8/14/2015 0:00
Test Engineer: John Caizzi
Test Location: Chamber 7

Config. Used: 1
Config Change: USB wall charger substituted for laptop.
EUT Voltage: USB

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 indicates 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: 23 °C
Rel. Humidity: 40 %

Summary of Results

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1	Tx - BLE	center	Default	-	Radiated Emissions, 30-1000 MHz	FCC 15.209	24.8 dBµV/m @ 33.43 MHz (-15.2 dB)
2	Rx		-	-		LP 0002 2.8	24.5 dBµV/m @ 31.83 MHz (-15.5 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

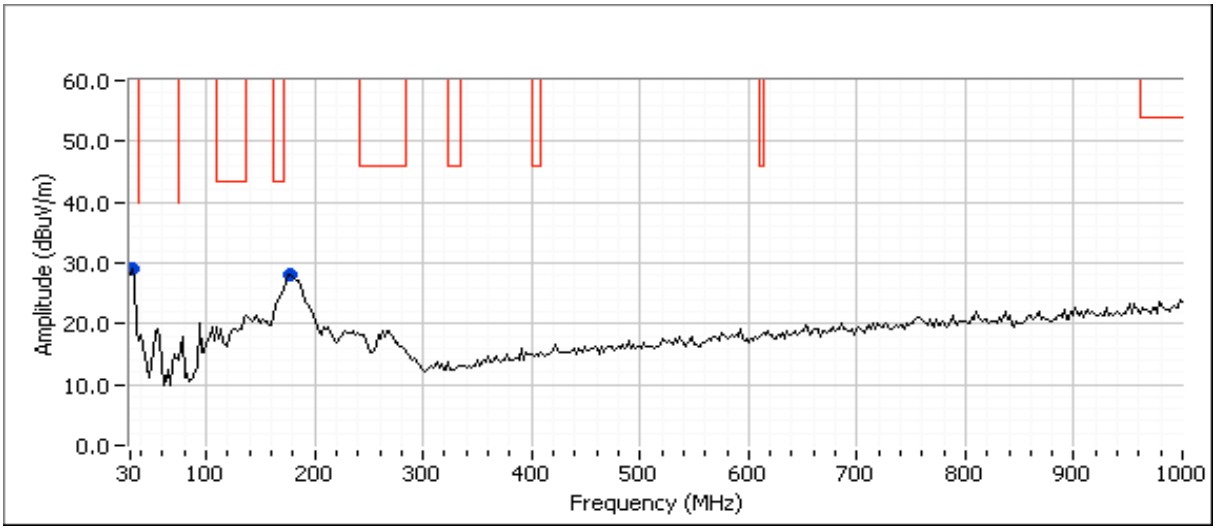
Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

Run #1: Radiated Spurious Emissions, 30 - 1000 MHz. Operating Mode: Tx - BLE

Center Channel @ 2440 MHz

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
33.429	24.8	V	40.0	-15.2	QP	223	1.00	Note 1
176.967	26.6	H	43.5	-16.9	QP	178	3.40	Note 1

Note 1:	Emission in non-restricted band, but limit of 15.209 used.

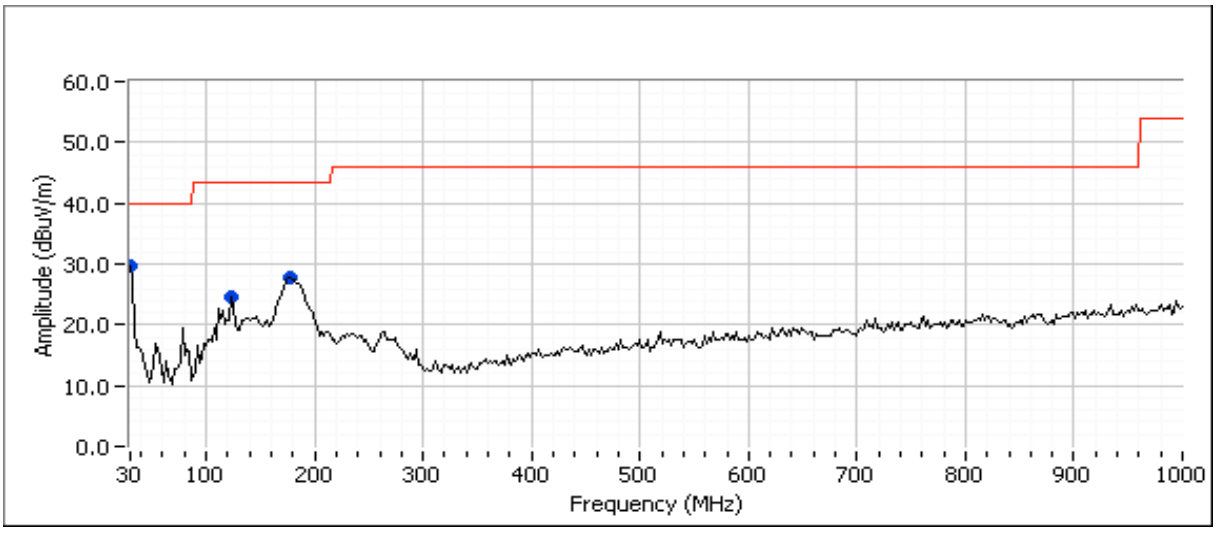


Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

Run #2: Radiated Spurious Emissions, 30 - 1000 MHz. Operating Mode: Rx

Center Channel @ 2440 MHz

Frequency	Level	Pol	LP 0002 2.8		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
31.829	24.5	V	40.0	-15.5	QP	360	1.00	
176.577	26.5	H	43.5	-17.0	QP	360	3.41	
124.227	10.5	V	43.5	-33.0	QP	271	1.95	



Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

Conducted 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: 8/14/2015
Test Engineer: John Caizzi
Test Location: Chamber 7

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

General Test Configuration

For tabletop equipment, the EUT was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN.

Ambient Conditions:

Temperature: 25 °C
Rel. Humidity: 35 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	FCC 15.207	Pass	47.5 dBµV @ 0.153 MHz (-18.3 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

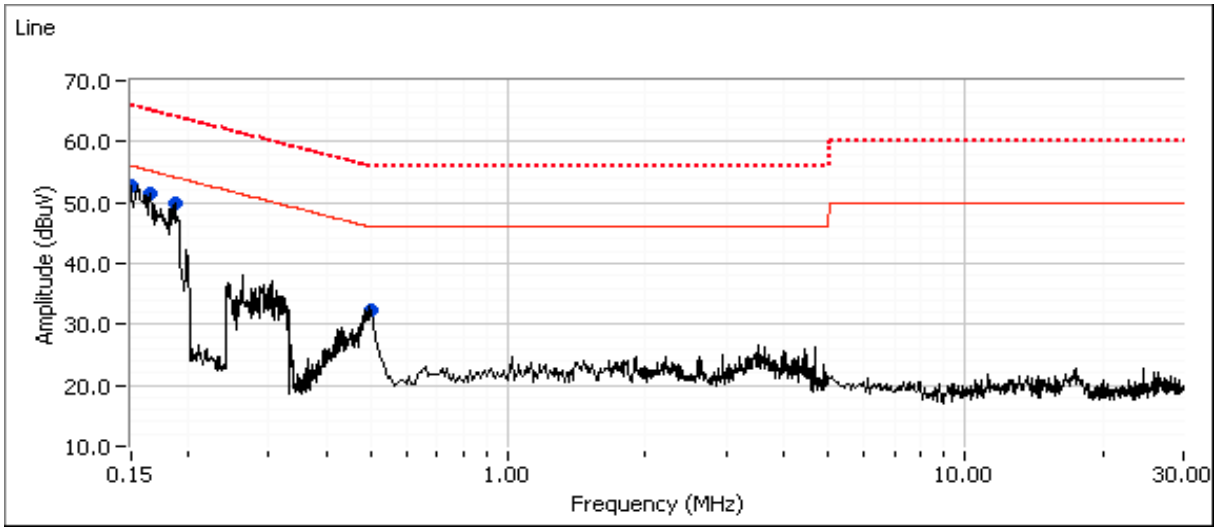
No deviations were made from the requirements of the standard.

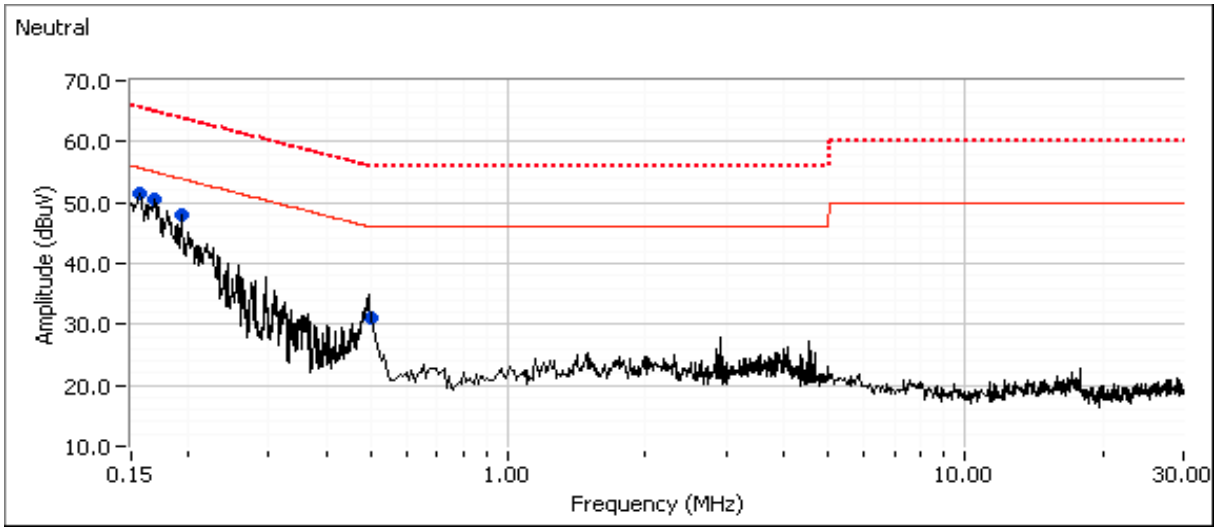
Notes

Radio operation: EUT configured for continuous transmit on 2441MHz, basic rate, maximum power.

Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

Run #1: AC Power Port Conducted Emissions, 0.15 - 30MHz, 120V/60Hz





Client:	Fitbit, Inc.	Job Number:	J97928
Model:	FB502	T-Log Number:	T98212
		Project Manager:	Deepa Shetty
Contact:	Sachin Sawalapurkar	Project Coordinator:	-
Standard:	FCC 15.247, IC RSS-247, LP 0002	Class:	-

Preliminary peak readings captured during pre-scan (peak readings vs. average limit)

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.153	52.7	Line	56.0	-3.3	Peak	
0.165	51.4	Line	55.2	-3.8	Peak	
0.182	49.8	Line	54.2	-4.4	Peak	
0.500	*32.3*	*Line*	*46.0*	*-13.7*	*Peak*	
0.151	51.6	Neutral	55.6	-4.0	Peak	
0.167	50.4	Neutral	55.0	-4.6	Peak	
0.192	47.9	Neutral	53.9	-6.0	Peak	
0.500	*31.1*	*Neutral*	*46.0*	*-14.9*	*Peak*	

Final quasi-peak and average readings

Frequency	Level	AC	FCC 15.207		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.153	47.5	Line	65.8	-18.3	QP	
0.151	47.4	Neutral	65.9	-18.5	QP	
0.165	45.7	Line	65.2	-19.5	QP	
0.167	44.3	Neutral	65.1	-20.8	QP	
0.182	43.0	Line	64.4	-21.4	QP	
0.192	41.0	Neutral	63.9	-22.9	QP	
0.151	30.7	Neutral	55.9	-25.2	AVG	
0.153	29.6	Line	55.8	-26.2	AVG	
0.165	28.3	Line	55.2	-26.9	AVG	
0.167	27.5	Neutral	55.1	-27.6	AVG	
0.182	26.3	Line	54.4	-28.1	AVG	
0.192	24.2	Neutral	53.9	-29.7	AVG	

End of Report

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