

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: SDGOB-1506

IC CERTIFICATION #: 466D-SDGOB1506
FCC ID: B94SDGOB1506

APPLICANT: Hewlett Packard Company
3000 Hanover Street
Palo Alto, CA 94304

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

IC SITE REGISTRATION #: 2845B-5

REPORT DATE: August 27, 2015

REISSUE DATE: November 17, 2015

FINAL TEST DATES: July 31, August 6, 7, 12, 13, and 17, 2015

TOTAL NUMBER OF PAGES: 61

PROGRAM MGR /
TECHNICAL REVIEWER:



Mark E Hill
Staff Engineer

QUALITY ASSURANCE DELEGATE /
FINAL REPORT PREPARER:



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
-	August 27, 2015	First release	
1	September 23, 2015	Updated IC number	MEH
2	November 17, 2015	Removed un-necessary power vs data rate tables. Updated references to FCC Rules.	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
DIGITAL TRANSMISSION SYSTEMS (2400 – 2483.5MHZ) – BLE OPERATION	6
GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS.....	6
MEASUREMENT UNCERTAINTIES.....	7
EQUIPMENT UNDER TEST (EUT) DETAILS.....	8
GENERAL.....	8
OTHER EUT DETAILS.....	8
ANTENNA SYSTEM	8
ENCLOSURE.....	8
MODIFICATIONS.....	8
SUPPORT EQUIPMENT.....	9
EUT INTERFACE PORTS	9
EUT OPERATION	9
TEST SITE.....	10
GENERAL INFORMATION	10
CONDUCTED EMISSIONS CONSIDERATIONS	10
RADIATED EMISSIONS CONSIDERATIONS	10
MEASUREMENT INSTRUMENTATION	11
RECEIVER SYSTEM	11
INSTRUMENT CONTROL COMPUTER	11
LINE IMPEDANCE STABILIZATION NETWORK (LISN).....	11
FILTERS/ATTENUATORS	12
ANTENNAS.....	12
ANTENNA MAST AND EQUIPMENT TURNABLE.....	12
INSTRUMENT CALIBRATION.....	12
TEST PROCEDURES	13
EUT AND CABLE PLACEMENT	13
CONDUCTED EMISSIONS.....	13
RADIATED EMISSIONS	13
CONDUCTED EMISSIONS FROM ANTENNA PORT	17
BANDWIDTH MEASUREMENTS	17
SPECIFICATION LIMITS AND SAMPLE CALCULATIONS	18
CONDUCTED EMISSIONS SPECIFICATION LIMITS: FCC 15.207; FCC 15.107(A), RSS GEN	18
GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS	19
OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS	19
TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS AND DTS SYSTEMS.....	19
SAMPLE CALCULATIONS - CONDUCTED EMISSIONS	20
SAMPLE CALCULATIONS - RADIATED EMISSIONS.....	20
SAMPLE CALCULATIONS - FIELD STRENGTH TO EIRP CONVERSION.....	21
APPENDIX A TEST EQUIPMENT CALIBRATION DATA	22
APPENDIX B TEST DATA	24
END OF REPORT	61

SCOPE

An electromagnetic emissions test has been performed on the Hewlett Packard Company model SDGOB-1506, 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.).

Only results for the BLE operation are presented in this report.

STATEMENT OF COMPLIANCE

The tested sample of Hewlett Packard Company model SDGOB-1506 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 Hewlett Packard Company model SDGOB-1506 and therefore apply only to the tested sample. The sample was selected and prepared by Tarandeep Kaur of Broadcom Corporation on behalf of Hewlett Packard Company.

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) – BLE Operation

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	0.717 MHz	>500kHz	Complies
15.247 (b) (3)	RSS 247 5.4 (4)	Output Power (multipoint systems)	-1.5 dBm (0.7mW) EIRP = 1.3mW ^{Note 1}	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	RSS 247 5.2 (2)	Power Spectral Density	-10.3 dBm/10kHz	8dBm/3kHz	Complies
15.247(d)	RSS 247 5.5	Antenna Port Spurious Emissions 30MHz – 25 GHz	All emissions below -30dBc limit	< -30dBc ^{Note 2}	Complies
15.247(d) / 15.209	RSS 247 5.5 / RSS-GEN	Radiated Spurious Emissions 30MHz – 25 GHz	44.7 dBμV/m @ 4803.9 MHz (-9.3 dB)	15.207 in restricted bands, all others <-30dBc ^{Note 2}	Complies
Note 1: EIRP calculated using antenna gain of 2.5 dBi for the highest EIRP system. Note 2: Limit of -30dBc used because the power was measured using the UNII test procedure (maximum power averaged over a transmission burst).					

GENERAL REQUIREMENTS APPLICABLE TO ALL BANDS

FCC Rule Part	RSS Rule part	Description	Measured Value / Comments	Limit / Requirement	Result (margin)
15.203	-	RF Connector	Uses u.FL connector for external antenna	Unique or integral antenna required	Complies
15.207	RSS GEN Table 3	AC Conducted Emissions	40.3 dBμV @ 0.176 MHz (-14.4 dB)	Refer to page 18	15.207
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to MPE calculations in separate exhibit, RSS 102 declaration and User Manual statements.	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	1.065MHz	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)	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 Hewlett Packard Company model SDGOB-1506 is an IEEE 802.11 a/b/g/n + Bluetooth Low Energy wireless network adapter that operates in both the 2.4GHz and 5GHz bands. The card supports 802.11n modes in 20MHz and 40MHz.

The sample was received on July 13, 2015 and tested on July 31, August 6, 7, 12, 13, and 17, 2015. The EUT consisted of the following component(s):

Company	Model	Description	Serial Number	FCC ID
Hewlett Packard Company	SDGOB-1506	802.11abgn + BLE	707781A5A189	B94SDGOB1506
Hewlett Packard Company	SDGOB-1506	802.11abgn + BLE	7077816CC657	B94SDGOB1506
Hewlett Packard Company	SDGOB-1505	802.11abgn*	D85DE2000005	B94SDGOB1505

* - used for AC conducted emissions testing

OTHER EUT DETAILS**SDGOB-1506:**

USB interface

Wifi + BLE operation supported

Wifi operation 2.4GHz and 5GHz bands

802.11 a/b/g/n20 2x2 operation

40MHz bandwidths supported in 5GHz bands only

BT Low Energy only

WiFi+BT simultaneous Tx not supported

Two configurations: one using fixed internal/onboard antennas, and one with u.FL connectors to allow for external antennas.

SDGOB-1505 (FCC ID: B94SDGOB1505) is identical to the SDGOB-1506, except that the BLE function is disabled via a resistor change.

ANTENNA SYSTEM

There are two antenna options:

PCB trace antenna – 2.5dBi @ 2.4GHz, 3.5dBi @ 5GHz

External antenna, Yageo, ANT300P002B24553, 0.7dBi @ 2.4GHz, 1.9dBi @ 5GHz

ENCLOSURE

The EUT has no enclosure. It is designed to be installed within the enclosure of a host computer.

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
Dell	E6400	Laptop	FN4XJK1	-

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)
Laptop USB	USB Card Adapter	USB	Shielded	1
Card Adapter	EUT Module	-	-	-

Additional on Support Equipment

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
Laptop Ethernet	Switch	Cat-5	Unshielded	10
Laptop DC input	AC/DC Output	2Wire	Unshielded	1
AC/DC Adapter	AC Mains	3Wire	Unshielded	0.8

EUT OPERATION

During testing, the EUT was configured to continuously transmit at maximum output power and noted data rate on the channel indicated.

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.

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.

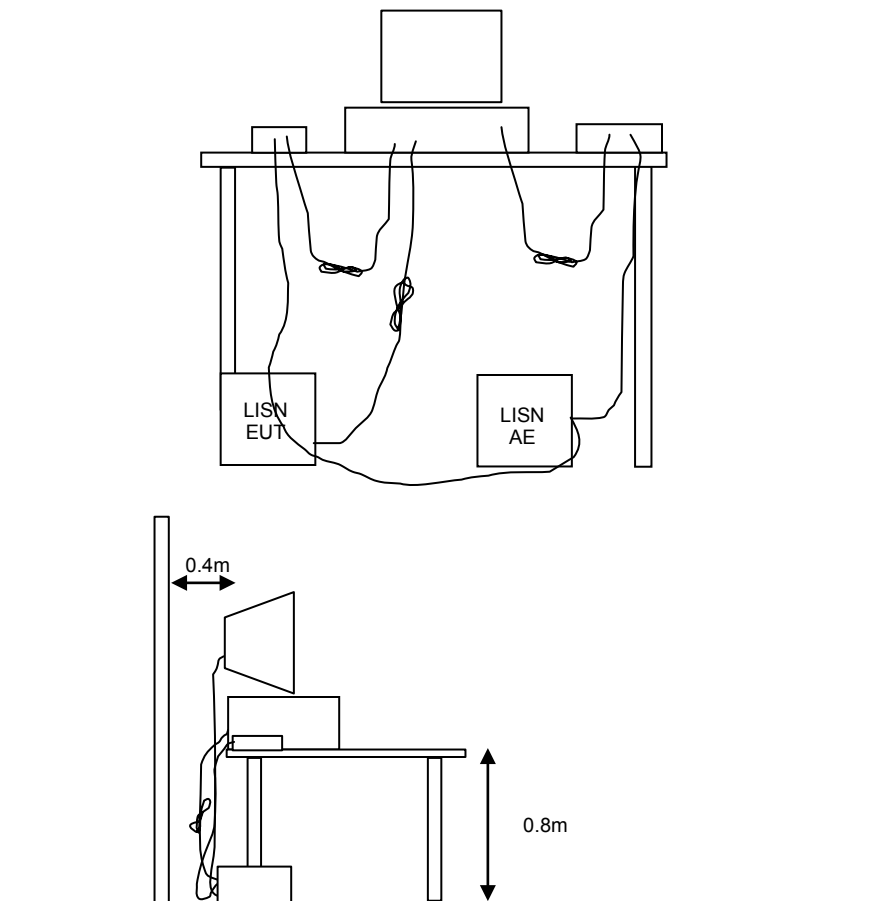


Figure 1 Typical Conducted Emissions Test Configuration

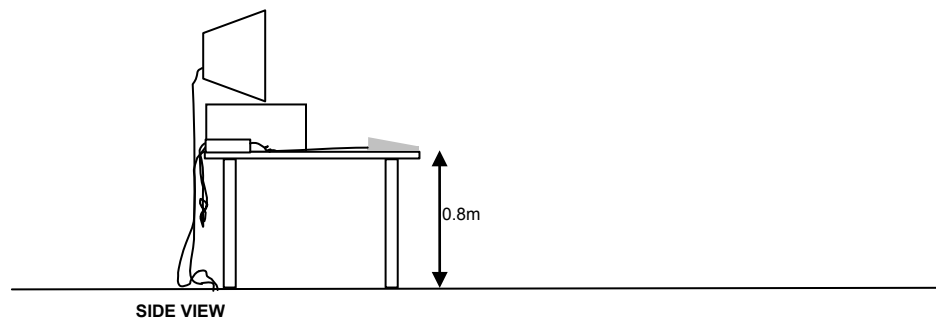
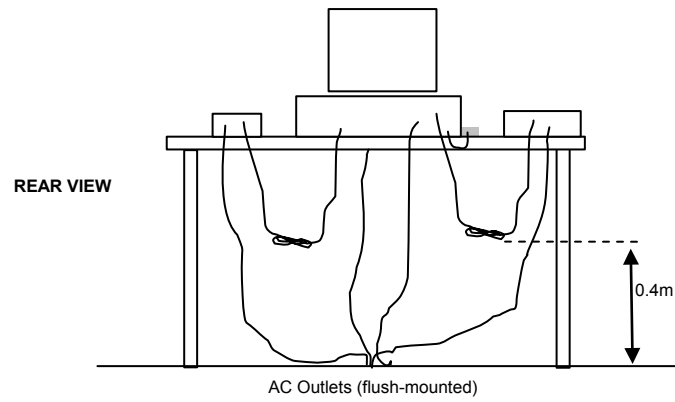
RADIATED EMISSIONS

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.

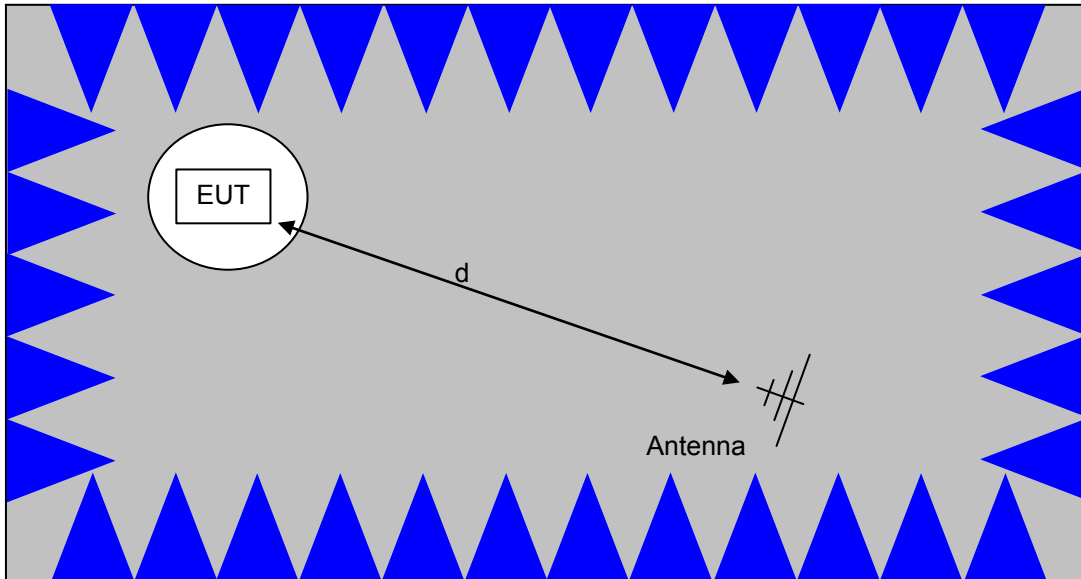
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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

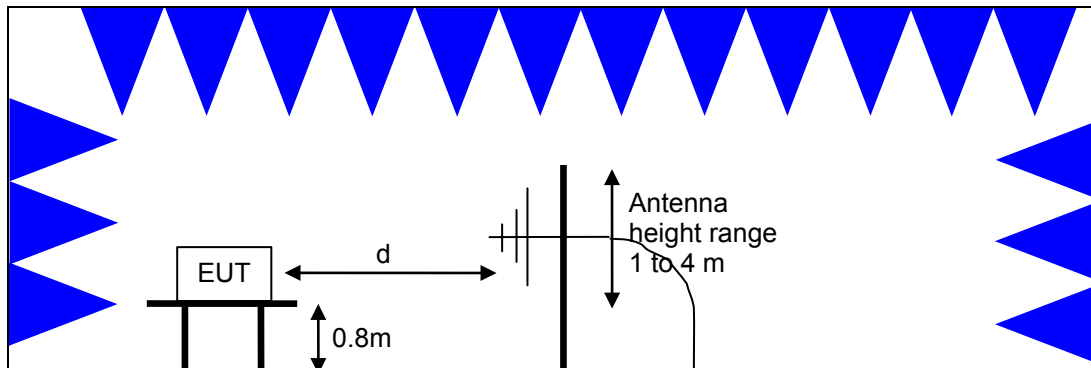


Typical Test Configuration for Radiated Field Strength Measurements



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.

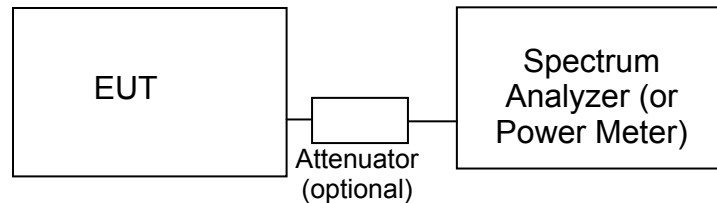
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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.

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. 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 GEN. 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 15.205, RSS-GEN Table 3

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 - 6,000 MHz, 07-Aug-15					
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
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 1000 - 18000 MHz, 07-Aug-15					
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
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	2238	9/16/2014	9/16/2015
Radiated Emissions, 1000 - 8,000 MHz, 12-Aug-15					
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
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/23/2015	1/23/2016
Radiated Emissions, 1000 - 25,000 MHz, 13-Aug-15					
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
EMCO	Antenna, Horn, 1-18 GHz	3115	1561	6/27/2014	6/27/2016
Hewlett Packard	Head (Inc flex cable, (1742,1743) Blue)	84125C	1620	6/5/2015	6/5/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
Hewlett Packard	High Pass filter, 8.2 GHz (Purple System)	P/N 84300-80039	1767	11/14/2014	11/14/2015
A. H. Systems	Red System Horn, 18-40GHz	SAS-574, p/n: 2581	2161	7/16/2015	7/16/2017
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, 13-Aug-15					
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	9/17/2014	9/17/2016
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	7/13/2015	7/13/2016
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



<u>Manufacturer</u>	<u>Description</u>	<u>Model</u>	<u>Asset #</u>	<u>Calibrated</u>	<u>Cal Due</u>
Radio Antenna Port (Power and Spurious Emissions), 17-Aug-15					
Agilent Technologies	3Hz -44GHz PSA Spectrum Analyzer	E4446A	2796	3/31/2015	3/31/2016

Conducted Emissions - AC Power Ports, 31-Jul-15

EMCO	LISN, 10 kHz-100 MHz, 25A	3825/2	1292	7/24/2015	7/24/2016
Rohde & Schwarz	Pulse Limiter	ESH3 Z2	1401	5/14/2015	5/14/2016
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	7/6/2015	7/6/2016

Appendix B Test Data

T99015 Pages 25 – 56

T98753 Pages 57 – 60



EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Product	SDGOB-1506	T-Log Number:	T99015
System Configuration:	-	Project Manager:	Sheareen Jacobs
Contact:	Tarandeep Kaur	Project Coordinator:	Irene Rademacher
Emissions Standard(s):	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Hewlett Packard Company

Product

SDGOB-1506

Date of Last Test: 8/18/2015

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Duty Cycle

Date of Test: 8/6/2015
 Test Engineer: Joseph Cadigal
 Test Location: FT Chamber#5

Sample Notes

Sample S/N: BCM943242EDUCBPE
 Duty cycle measurements performed on the worse case data rate for power.

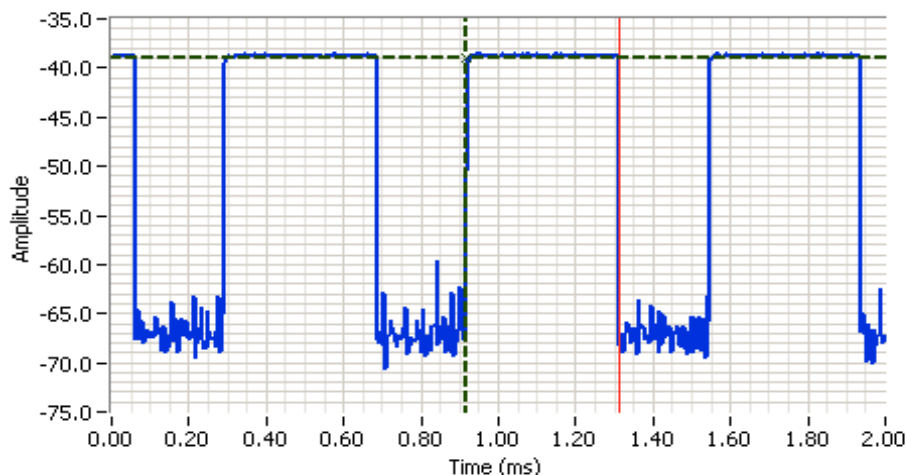
Notes: Measurements taken with maximum RBW/VBW settings allowed.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1Mb/s	0.63	Yes	0.398	2.0	4.0	2513

* Correction factor when using RMS/Power averaging - $10 \cdot \log(1/x)$

** Correction factor when using linear voltage average - $20 \cdot \log(1/x)$

T = Minimum transmission duration



Analyzer Settings

Rohde&Schwarz, ESI
 CF: 2402.000 MHz
 SPAN: 0.000 MHz
 RB: 10.000 MHz
 VB: 10.000 MHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 0.0 DB
 Sweep Time: 2.0ms
 Ref Lvl: -20.0 DBM

Comments

Time on = .398

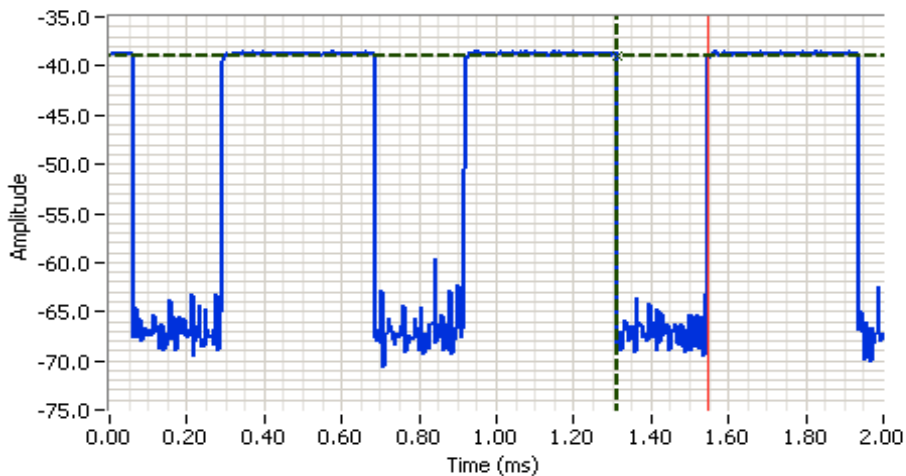
Cursor 1	0.9156	-39.0		Delta Time (ms)	0.398
Cursor 2	1.3141	0.0		Delta Amplitude	39.0

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

Rohde&Schwarz, ESI
CF: 2402.000 MHz
SPAN: 0.000 MHz
RB: 10.000 MHz
VB: 10.000 MHz
Detector: POS
Attn: 10 DB
RL Offset: 0.0 DB
Sweep Time: 2.0ms
Ref Lvl: -20.0 DBM

Comments

Time off = .235

Cursor 1	1.3115	-39.0	
Cursor 2	1.5469	0.0	

Delta Time (ms)	0.235
Delta Amplitude	39.0



Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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: 22.4 °C
Rel. Humidity: 36 %

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 - Internal Antenna	BLE	2402	-	-	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	33.6 dBµV/m @ 2354.7 MHz (-20.4 dB)
	BLE	2480	-	-	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	34.4 dBµV/m @ 2485.2 MHz (-19.6 dB)
2 - External Antenna	BLE	2402	-	-	Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	33.5 dBµV/m @ 2350.6 MHz (-20.5 dB)
	BLE	2480	-	-	Restricted Band Edge (2483.5 MHz)	FCC Part 15.209 / 15.247(c)	34.9 dBµV/m @ 2483.6 MHz (-19.1 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing

Deviations From The Standard

No deviations were made from the requirements of the standard.

Sample Notes

Sample S/N: 707781A5A189 (internal)
Sample S/N: 7077816CC657 (external)
Driver: 6.37 RC214 .12
Antenna: see notes below

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Notes

Testing performed at 1.5m per C63.10

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)
BLE	1Mb/s	0.63	Yes	0.398	2.0	4.0	2513

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 2:	Emission has duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear Voltage correction factor
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 5:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
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:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1: Radiated Bandedge Measurements

Internal Antenna

Date of Test: 8/12/2015 0:00
 Test Engineer: Rafael Varelas
 Test Location: FT Chamber #5

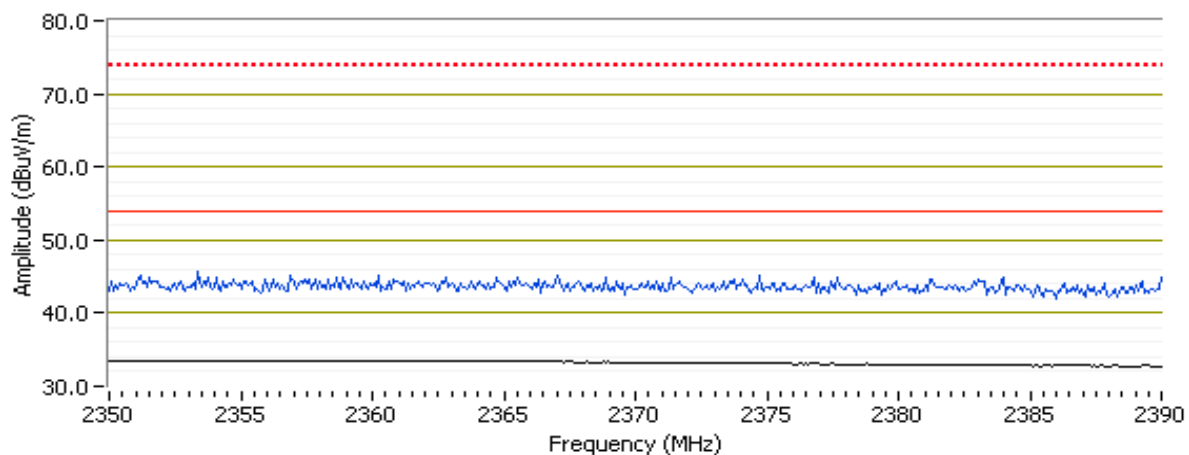
Config. Used: 1
 Config Change: None
 EUT Voltage: USB

Channel: 2402 Mode: BLE Antenna: Internal
 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	
2354.650	33.6	H	54.0	-20.4	AVG	7	1.0	Note 4
2376.450	44.3	H	74.0	-29.7	PK	7	1.0	POS; RB 1 MHz; VB: 3 MHz
2359.380	33.6	V	54.0	-20.4	AVG	346	1.2	Note 4
2371.240	44.8	V	74.0	-29.2	PK	346	1.2	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 3 kHz Avg (black); RB 1MHz VB 3MHz PK (blue); H



**NTS**

WE ENGINEER SUCCESS

EMC Test Data

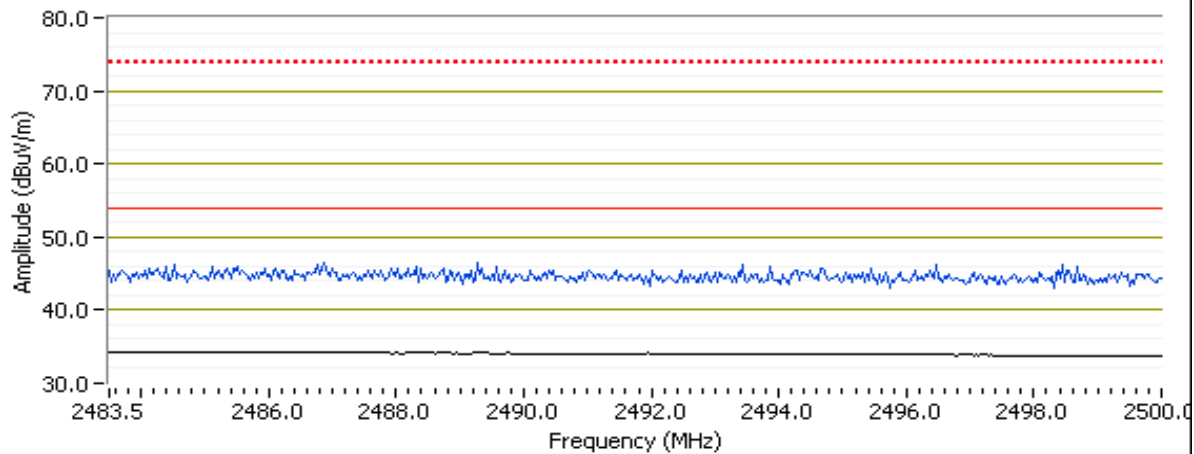
Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 2480 Mode: BLE Antenna: Internal
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	
2485.150	34.4	H	54.0	-19.6	AVG	357	1.0	Note 4
2489.850	45.9	H	74.0	-28.1	PK	357	1.0	POS; RB 1 MHz; VB: 3 MHz
2488.200	34.4	V	54.0	-19.6	AVG	360	1.0	Note 4
2485.020	45.5	V	74.0	-28.5	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 3 kHz Avg (black); RB 1MHz VB 3MHz PK (blue); H



Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #2: Radiated Bandedge Measurements

External Antenna

Date of Test: 8/13/2015 0:00
 Test Engineer: Rafael Varelas
 Test Location: FT Chamber #5

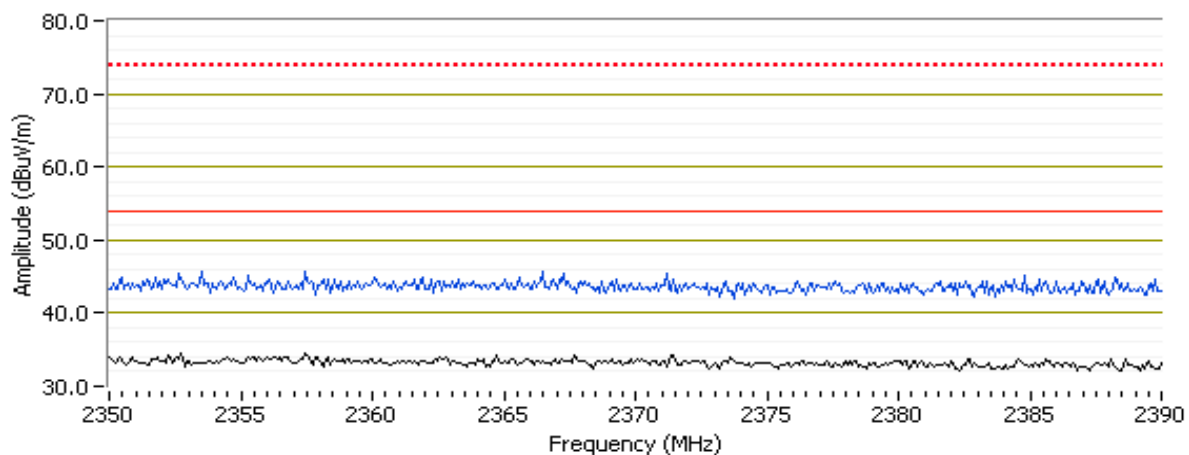
Config. Used: 1
 Config Change: None
 EUT Voltage: USB

Channel: 2402 Mode: BLE Antenna: External
 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	
2350.640	33.5	H	54.0	-20.5	AVG	360	1.9	Note 4
2353.050	45.3	H	74.0	-28.7	PK	360	1.9	POS; RB 1 MHz; VB: 3 MHz
2350.160	32.2	V	54.0	-21.8	??	294	1.0	Note 4
2372.040	46.0	V	74.0	-28.0	PK	294	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 3 kHz Avg (black); RB 1MHz VB 3MHz PK (blue); H



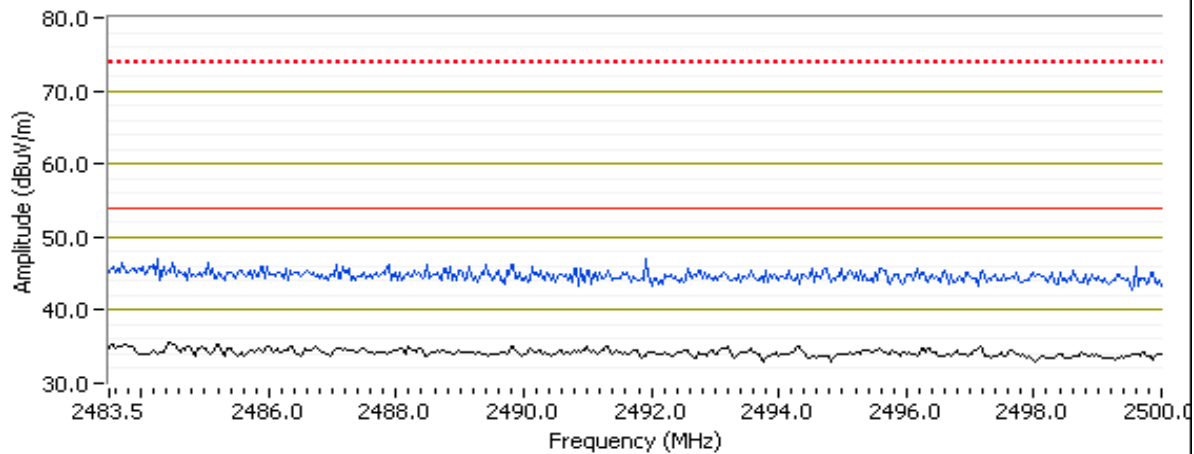
Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Channel: 2480 Mode: BLE Antenna: External
 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	
2483.570	34.9	V	54.0	-19.1	AVG	242	1.1	Note 4
2485.350	45.3	V	74.0	-28.7	PK	242	1.1	POS; RB 1 MHz; VB: 3 MHz
2486.280	34.4	H	54.0	-19.6	AVG	239	1.0	Note 4
2496.160	45.7	H	74.0	-28.3	PK	239	1.0	POS; RB 1 MHz; VB: 3 MHz

RB 1 MHz; VB 3 kHz Avg (black); RB 1MHz VB 3MHz PK (blue); V



Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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: 25 °C
 Rel. Humidity: 32 %

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 - Internal Antenna	BLE	2402MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	44.7 dBµV/m @ 4803.9 MHz (-9.3 dB)
	BLE	2440MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	44.3 dBµV/m @ 4883.9 MHz (-9.7 dB)
	BLE	2480MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	41.1 dBµV/m @ 4959.8 MHz (-12.9 dB)
2 - External Antenna	BLE	2402MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	31.1 dBµV/m @ 4803.8 MHz (-22.9 dB)
	BLE	2440MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	33.2 dBµV/m @ 4879.9 MHz (-20.8 dB)
	BLE	2480MHz	-	-	Radiated Emissions, 1 - 25 GHz	FCC Part 15.209 / 15.247(c)	31.1 dBµV/m @ 4959.6 MHz (-22.9 dB)

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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: 707781A5A189 (internal)

Sample S/N: 7077816CC657 (external)

Driver: 6.37 RC214 .12

Antenna: see notes below

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

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

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

2.4GHz band reject filter used

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
BLE	1Mb/s	0.63	Yes	0.398	2.0	4.0	2513

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 2:	Emission has duty cycle $\geq 98\%$, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=10Hz, peak detector, linear averaging, auto sweep, trace average 100 traces, measurement corrected by Linear Voltage correction factor
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 $50 \times (1/DC)$ traces
Note 5:	Emission has duty cycle $< 98\%$, but constant, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces, measurement corrected by Pwr correction factor
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: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

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

Date of Test: 8/7/2015 0:00

Config. Used: 1

Test Engineer: Eddie Mariscal

Config Change: None

Test Location: FT Chamber #5

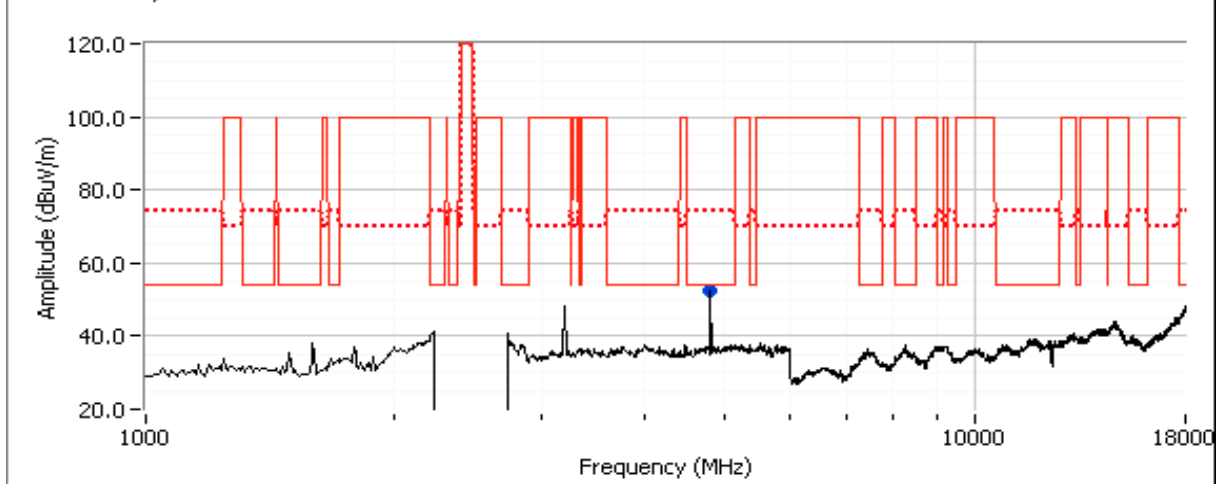
EUT Voltage: USB

Run #1a: Low Channel

Channel: 2402MHz Mode: BLE Antenna: Internal
 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	
4803.930	44.7	H	54.0	-9.3	AVG	40	1.2	Note 4
4804.450	54.0	H	74.0	-20.0	PK	40	1.2	RB 1 MHz;VB 3 MHz;Peak

BLE 2402MHz, Internal



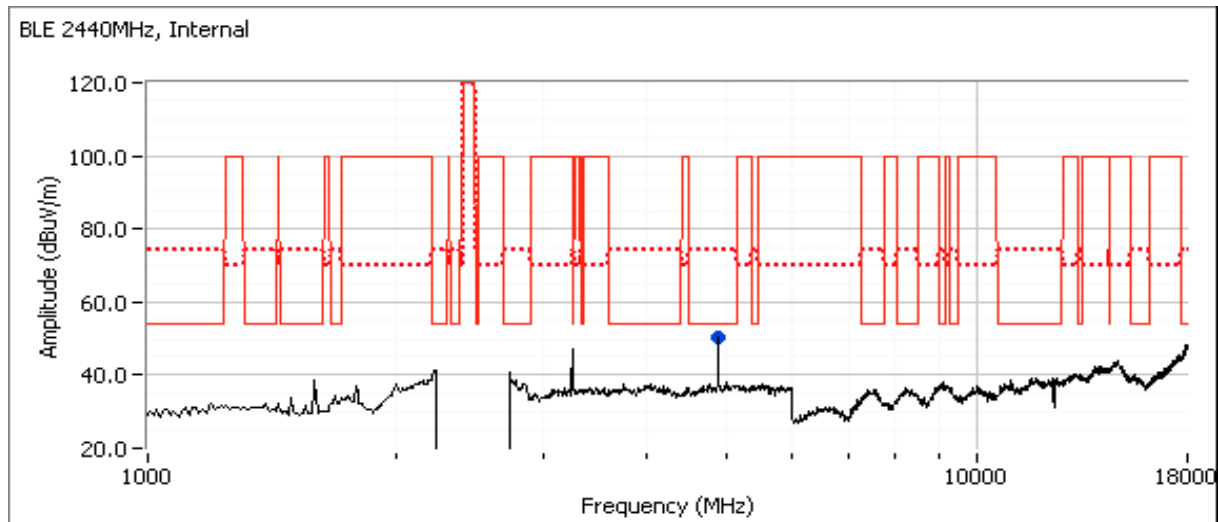
Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1b: Center Channel

Channel: 2440MHz Mode: BLE Antenna: Internal
 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	
4883.860	44.3	H	54.0	-9.7	AVG	99	1.8	Note 4
4884.170	52.3	H	74.0	-21.7	PK	99	1.8	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



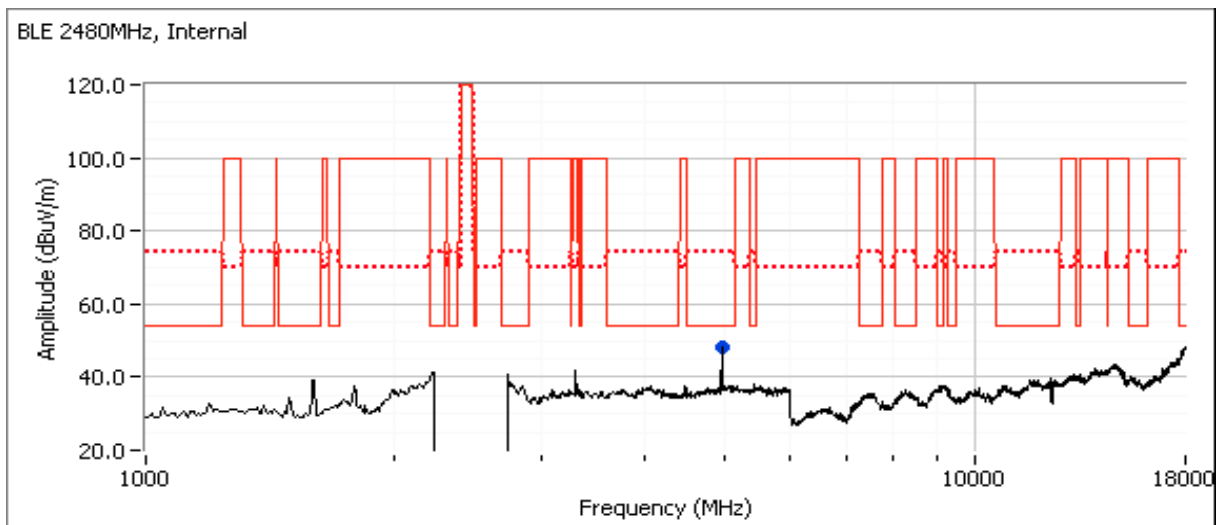
Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #1c: High Channel

Channel: 2480MHz Mode: BLE Antenna: Internal
 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	
4959.840	41.1	H	54.0	-12.9	AVG	92	1.1	Note 4
4959.370	51.4	H	74.0	-22.6	PK	92	1.1	RB 1 MHz;VB 3 MHz;Peak

BLE 2480MHz, Internal



Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

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

Date of Test: 8/13/2015 0:00

Config. Used: 1

Test Engineer: Rafael Varelas

Config Change: none

Test Location: FT Chamber#5

EUT Voltage: USB

Run #2a: Low Channel

Channel: 2402MHz

Mode: BLE

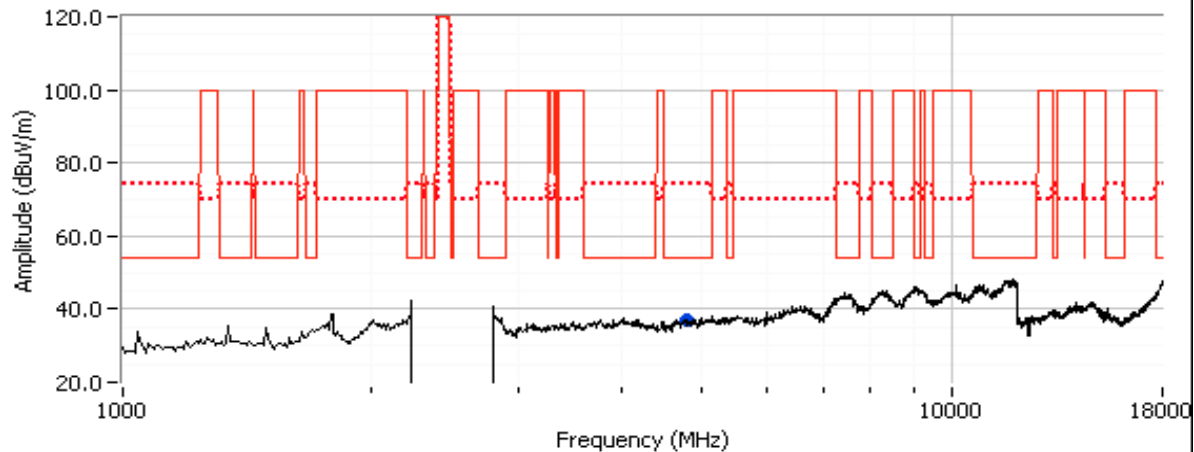
Antenna: External

Tx Chain: Main

Data Rate: 1Mb/s

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4803.830	31.1	H	54.0	-22.9	AVG	128	1.0	Note 4
4804.630	41.4	H	74.0	-32.6	PK	128	1.0	RB 1 MHz;VB 3 MHz;Peak

BLE 2402 MHz, External

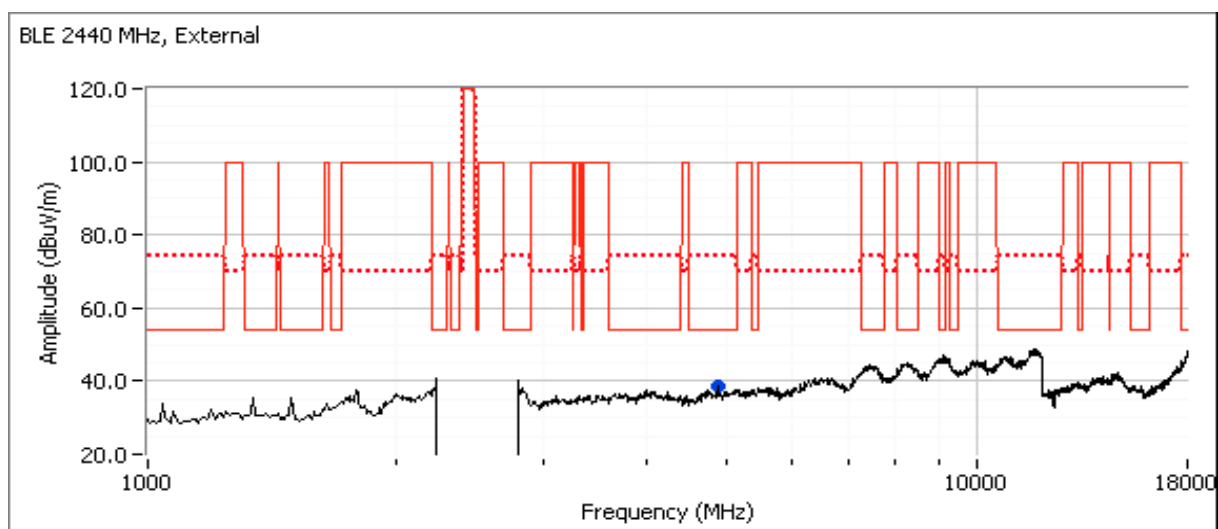


Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2b: Center Channel

Channel: 2440MHz Mode: BLE Antenna: External
 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	
4879.920	33.2	V	54.0	-20.8	AVG	172	1.0	Note 4
4879.380	43.1	V	74.0	-30.9	PK	172	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

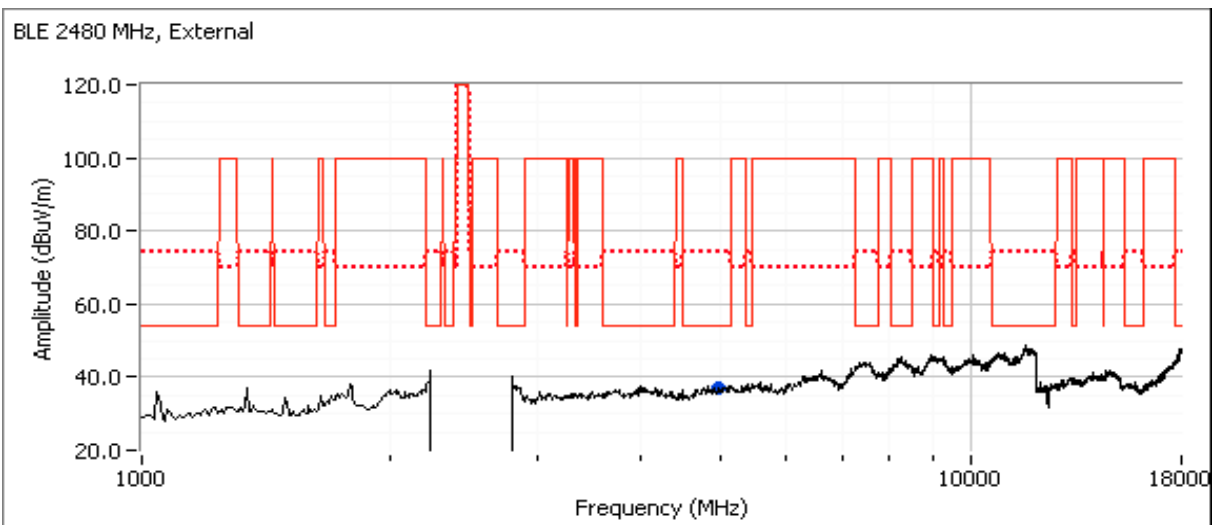
Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2c: High Channel

Channel: 2480MHz Mode: BLE Antenna: External
 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	
4959.600	31.1	H	54.0	-22.9	AVG	337	1.9	Note 4
4959.500	42.3	H	74.0	-31.7	PK	337	1.9	RB 1 MHz;VB 3 MHz;Peak

BLE 2480 MHz, External





EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

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: 8/13/2015
 Test Engineer: Rafael Varelas
 Test Location: FT Chamber #5

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

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: 21.4 °C
 Rel. Humidity: 37 %

Summary of Results (ANSI C63.4:2009)

Run #	Test Performed	Limit	Result	Margin
1	Radiated Emissions 30 - 1000 MHz, Transmit	FCC 15.209	Pass	29.8 dBμV/m @ 38.05 MHz (-10.2 dB)
2	Radiated Emissions 30 - 1000 MHz, Receive	LP 0002	Pass	36.7 dBμV/m @ 40.95 MHz (-3.3 dB)

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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: 707781A5A189 (internal)

Driver: 6.37 RC214 .12

Antenna: Internal

Notes

Testing performed at 0.8m per C63.10

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

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	0.63	Yes	0.398	2.0	4.0	2513

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Run #1: Radiated Spurious Emissions, 30 - 1000 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

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

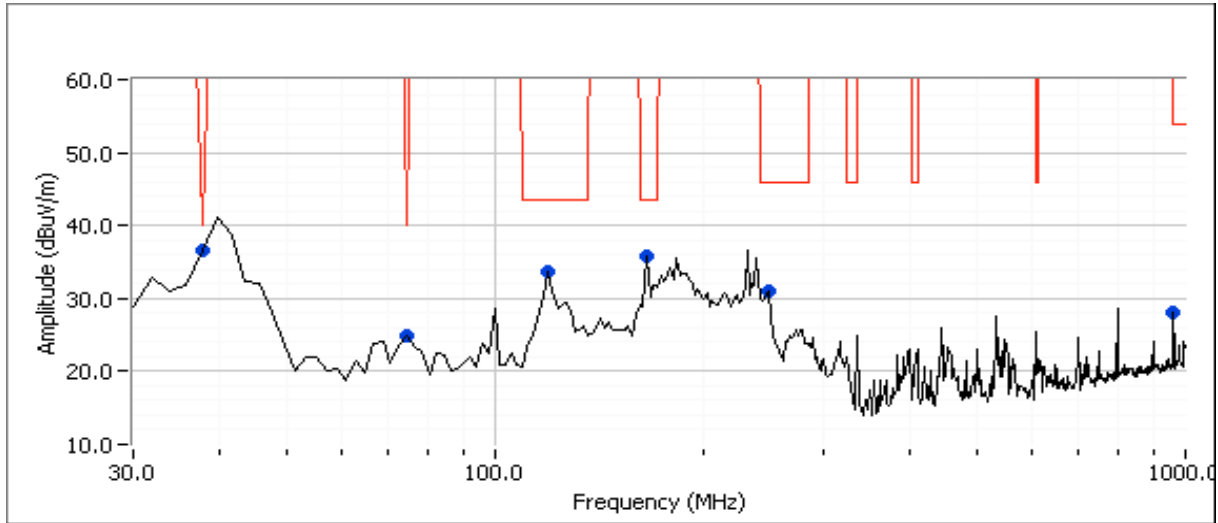
Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
38.045	36.7	V	40.0	-3.3	Peak	46	1.0	
120.007	33.8	H	43.5	-9.7	Peak	289	1.5	
166.283	35.8	H	43.5	-7.7	Peak	284	1.5	
249.812	30.9	H	46.0	-15.1	Peak	294	1.5	
73.894	24.9	V	40.0	-15.1	Peak	262	1.0	
960.434	28.0	V	54.0	-26.0	Peak	221	1.0	

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

Frequency	Level	Pol	FCC 15.209		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
38.045	29.8	V	40.0	-10.2	QP	42	1.0	QP (1.00s)
166.283	32.3	H	43.5	-11.2	QP	285	1.6	QP (1.00s)
120.007	31.5	H	43.5	-12.0	QP	285	1.7	QP (1.00s)
249.812	30.2	H	46.0	-15.8	QP	291	1.1	QP (1.00s)
73.894	17.0	V	40.0	-23.0	QP	259	1.0	QP (1.00s)
960.434	19.0	V	54.0	-35.0	QP	216	1.0	QP (1.00s)

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A



Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #2: Radiated Spurious Emissions, 30 - 1000 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

Channel: 2440MHz Mode: Rx Antenna: Internal
 Tx Chain: Main Data Rate: N/A

Preliminary peak readings captured during pre-scan

Frequency	Level	Pol	LP0002 2.8		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
40.952	42.7	V	40.0	2.7	Peak	313	3.0	
120.007	32.9	H	43.5	-10.6	Peak	257	1.5	
165.997	33.5	H	43.5	-10.0	Peak	113	1.5	
187.510	32.9	H	43.5	-10.6	Peak	291	2.0	
552.000	32.3	V	46.0	-13.7	Peak	10	1.5	
799.317	28.0	V	46.0	-18.0	Peak	0	1.0	

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

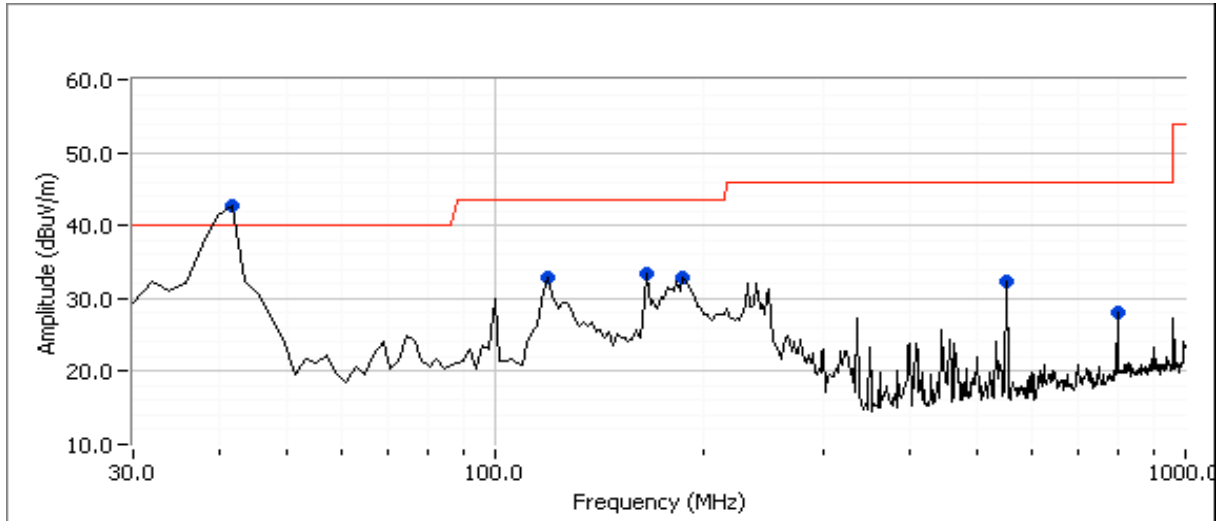
Frequency	Level	Pol	LP0002 2.8		Detector	Azimuth	Height	Comments
MHz	dB μ V/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
40.952	36.7	V	40.0	-3.3	QP	317	1.0	QP (1.00s)
165.997	30.6	H	43.5	-12.9	QP	110	1.6	QP (1.00s)
120.007	29.5	H	43.5	-14.0	QP	255	1.6	QP (1.00s)
187.510	29.3	H	43.5	-14.2	QP	288	1.8	QP (1.00s)
799.317	25.2	V	46.0	-20.8	QP	0	1.0	QP (1.00s)
552.000	16.1	V	46.0	-29.9	QP	8	1.0	QP (1.00s)

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A



Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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.

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: 25 °C
Rel. Humidity: 30 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	Max	-	Output Power	15.247(b)	Pass	-1.5 dBm
2	Max	-	Power spectral Density (PSD)	15.247(d)	Pass	-10.3 dBm/10kHz
3	Max	-	Minimum 6dB Bandwidth	15.247(a)	Pass	0.717 MHz
3	Max	-	99% Bandwidth	RSS GEN	-	1.065 MHz
4	Max	-	Spurious emissions	15.247(b)	Pass	All signal below -30dBc

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.

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Procedure Comments:

Measurements performed in accordance with FCC KDB 558074

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	0.63	Yes	0.398	2.02	4.03	2513

Sample Notes

Sample S/N: 7077816CC657 (external)

Driver: 6.37 RC214 .12

Run #1: Output Power

Date of Test: 8/17/2015

Config. Used: 1

Test Engineer: Joseph Cadigal

Config Change: none

Test Location: FT Lab #4A

Host Unit Voltage 120V/60Hz

Mode: BLE

Power Setting ²	Frequency (MHz)	Output Power		Antenna Gain (dBi)	Result	EIRP		Output Power	
		(dBm) ¹	mW			dBm	W	(dBm) ³	mW
Max	2402	-1.5	0.7	2.5	Pass	1.0	0.0013		
Max	2440	-2.3	0.6	2.5	Pass	0.2	0.0010		
Max	2480	-2.3	0.6	2.5	Pass	0.2	0.0010		

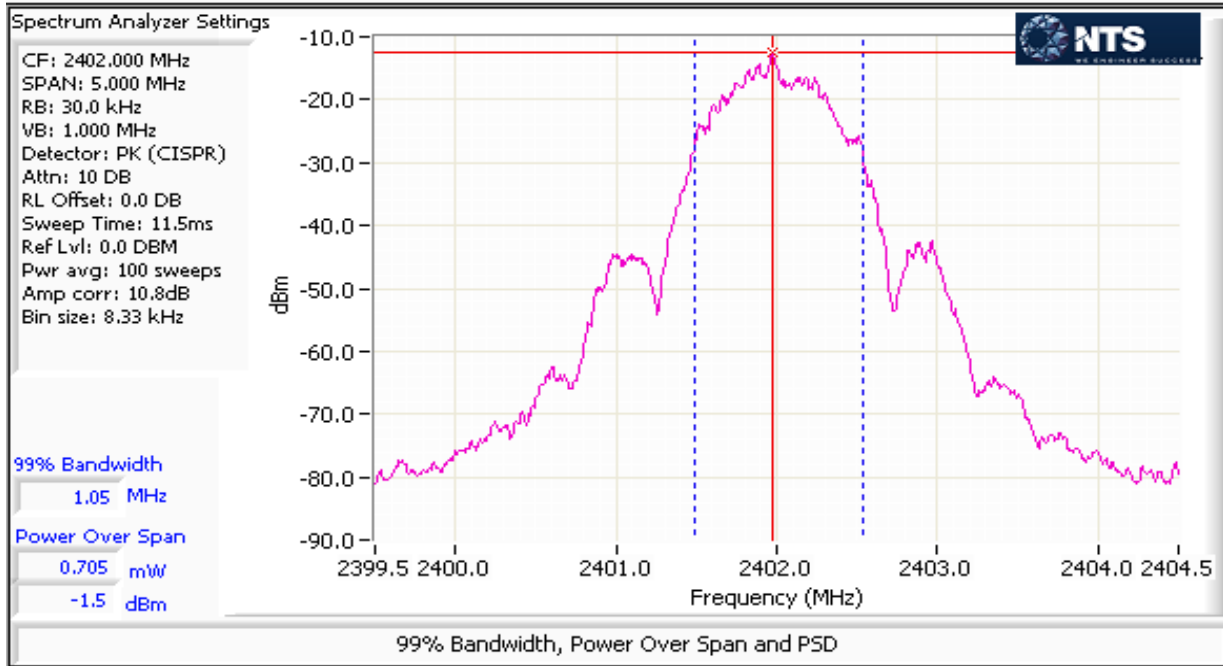
Note 1:	Duty Cycle < 98%. Output power measured using a spectrum analyzer (see plots below) with RBW= 1-5% of OBW, VBW≥3* RBW, RMS detector, power averaging on, GATING enabled, and power integration over the OBW, trace average 100 traces (option AVGSA-1, in KDB 558074). Spurious limit becomes -30dBc.
Note 2:	Power setting - the software power setting used during testing, included for reference only.
Note 3:	Power measured using average power meter (non-gated) and is included for reference only.

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A



Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Run #2: Power spectral Density

Date of Test: 8/17/2015
 Test Engineer: Joseph Cadigal
 Test Location: FT Lab #4A

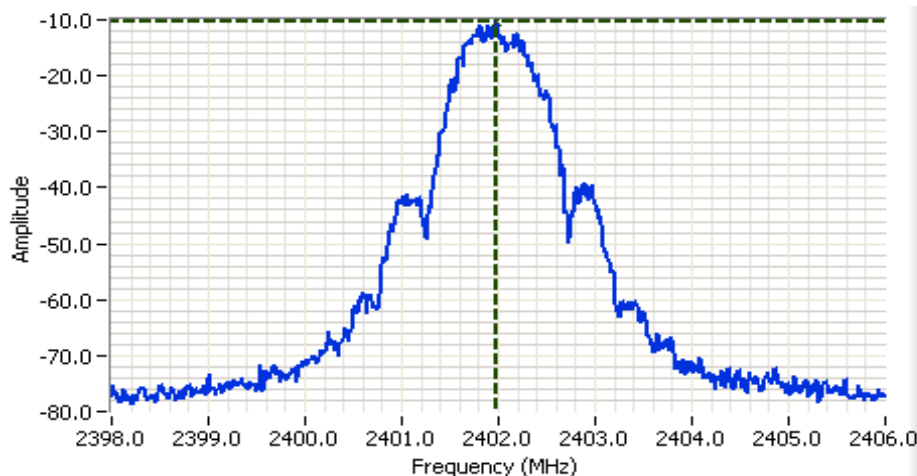
Config. Used: 1
 Config Change: none
 Host Unit Voltage 120V/60Hz

Mode: BLE

Power Setting	Frequency (MHz)	PSD (dBm/10kHz) ^{Note 1}	Limit dBm/3kHz	Result
Max	2402	-10.3	8.0	Pass
Max	2440	-11.3	8.0	Pass
Max	2480	-11.4	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.



Analyzer Settings

Agilent Technologies, E4446A
 CF: 2402.000 MHz
 SPAN: 8.000 MHz
 RB: 10.0 kHz
 VB: 30.0 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 10.9 DB
 Sweep Time: 47.8ms
 Ref Lvl: 10.9 DBM

Comments

PSD : -10.3dBm/10kHz BLE

Cursor 1	2401.9733	-10.3	
	0.0000	0.0	

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Run #3: Signal Bandwidth

Date of Test: 8/17/2015

Test Engineer: Joseph Cadigal

Test Location: FT Lab #4A

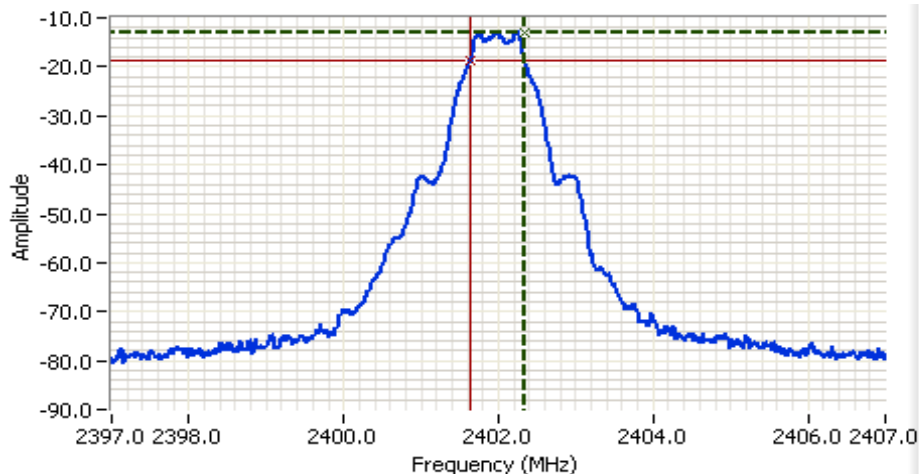
Config. Used: 1

Config Change: none

Host Unit Voltage 120V/60Hz

Mode: BLE

Power Setting	Frequency (MHz)	Bandwidth (MHz)		RBW Setting (MHz)	
		6dB	99%	6dB	99%
Max	2402	0.700	1.065	100kHz	20kHz
Max	2440	0.700	1.065	100kHz	20kHz
Max	2480	0.717	1.065	100kHz	20kHz

Note 1:DTS BW: RBW=100kHz, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.99% BW: RBW=1-5% of 99%BW, VBW $\geq 3 \times$ RBW, peak detector, max hold, auto sweep time.**Analyzer Settings**

Agilent Technologies, E4446A
 CF: 2402.000 MHz
 SPAN: 10.000 MHz
 RB: 100 kHz
 VB: 300 kHz
 Detector: POS
 Attn: 10 DB
 RL Offset: 0.0 DB
 Sweep Time: 10.2ms
 Ref Lvl: 0.0 DBM

Comments

6dB BW: 700 kHz

Cursor 1	2402.3333	-12.9	
Cursor 2	2401.6333	-18.9	

Delta Freq. 700 kHz

Delta Amplitude 6.0

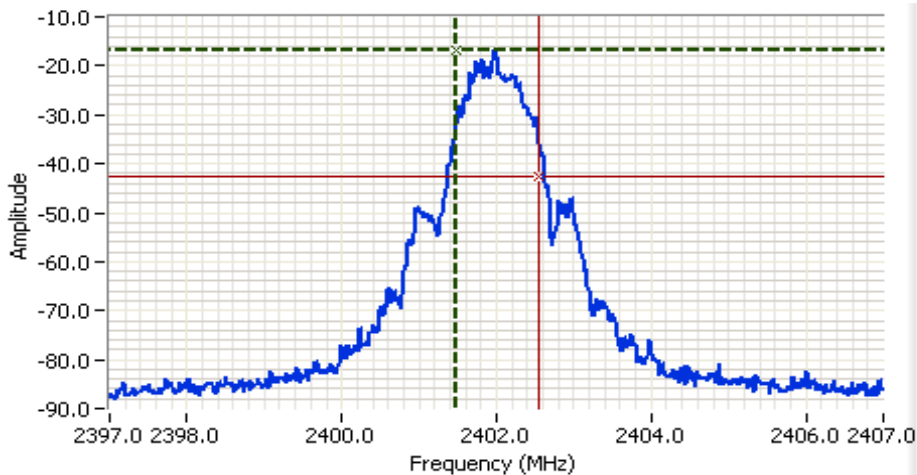


**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A



Analyzer Settings

Agilent Technologies, E4446A
CF: 2402.000 MHz
SPAN: 10.000 MHz
RB: 20.0 kHz
VB: 100 kHz
Detector: POS
Attn: 10 DB
RL Offset: 0.0 DB
Sweep Time: 39.6ms
Ref Lvl: 0.0 DBM

Comments

99% power BW: 1.065 MHz
BLE

Cursor 1	2401.4759	-16.8	
Cursor 2	2402.5408	-42.8	

Delta Freq. 1.065

Delta Amplitude 26.0

**NTS**

WE ENGINEER SUCCESS

**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Run #4a: Out of Band Spurious Emissions

Date of Test: 8/17/2015

Config. Used: 1

Test Engineer: Joseph Cadigal

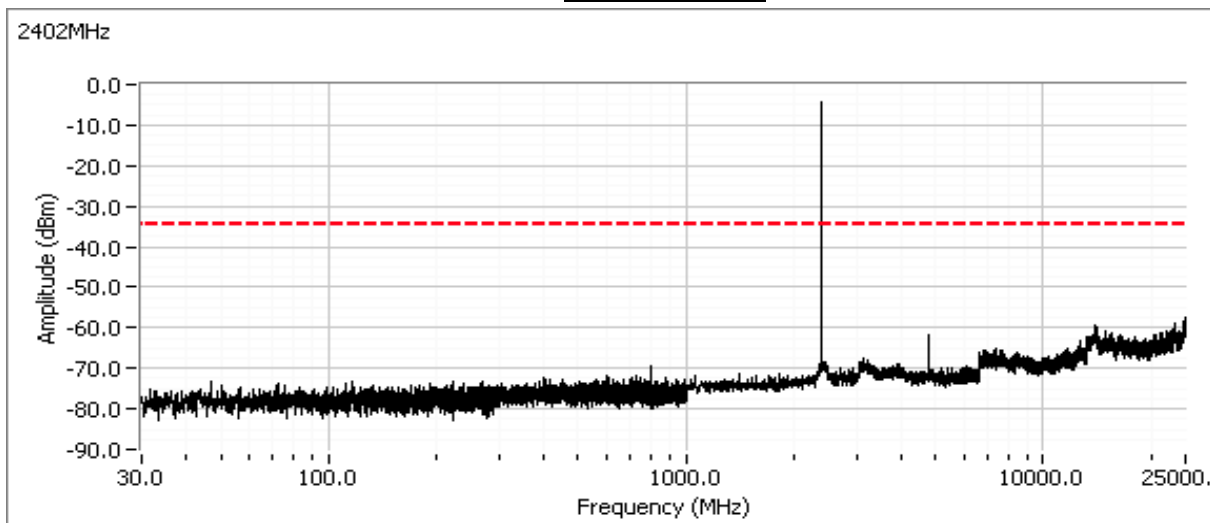
Config Change: none

Test Location: FT Lab #4A

Host Unit Voltage 120V/60Hz

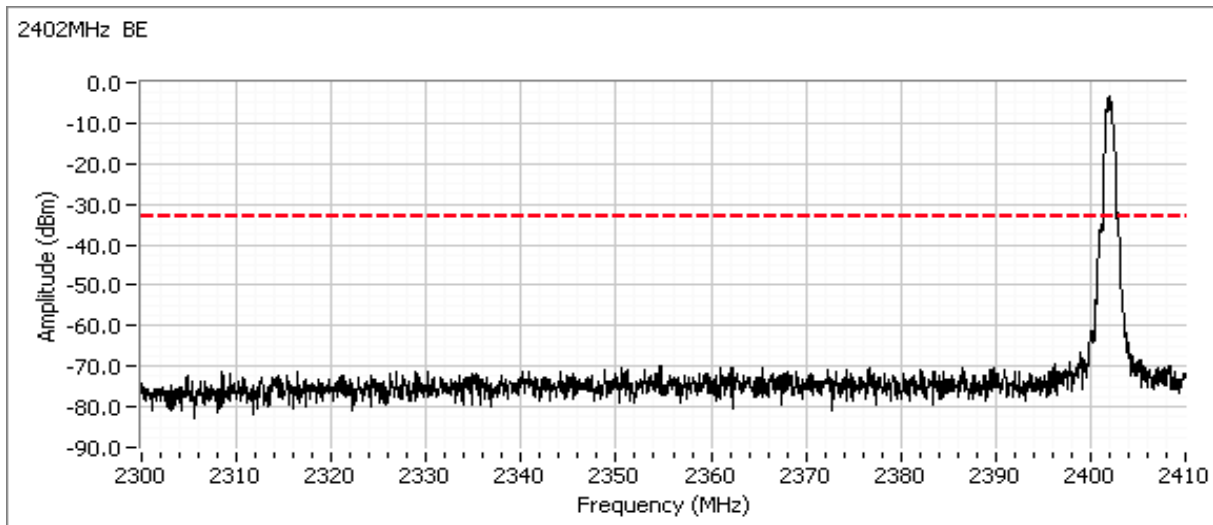
Frequency (MHz)	Power Setting	Mode	Limit	Result
2402	Max	BLE	-30dBc	Pass
2440	Max	BLE	-30dBc	Pass
2480	Max	BLE	-30dBc	Pass

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

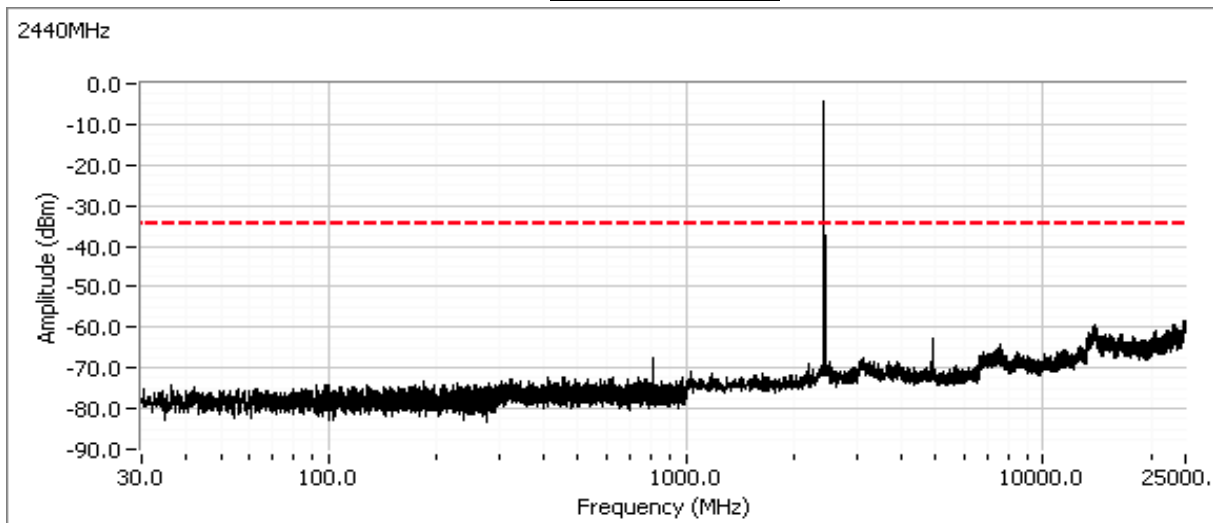
Plots for low channel

Client: Hewlett Packard Company	Job Number: J98747
Model: SDGOB-1506	T-Log Number: T99015
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: N/A

Additional plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



Plots for center channel



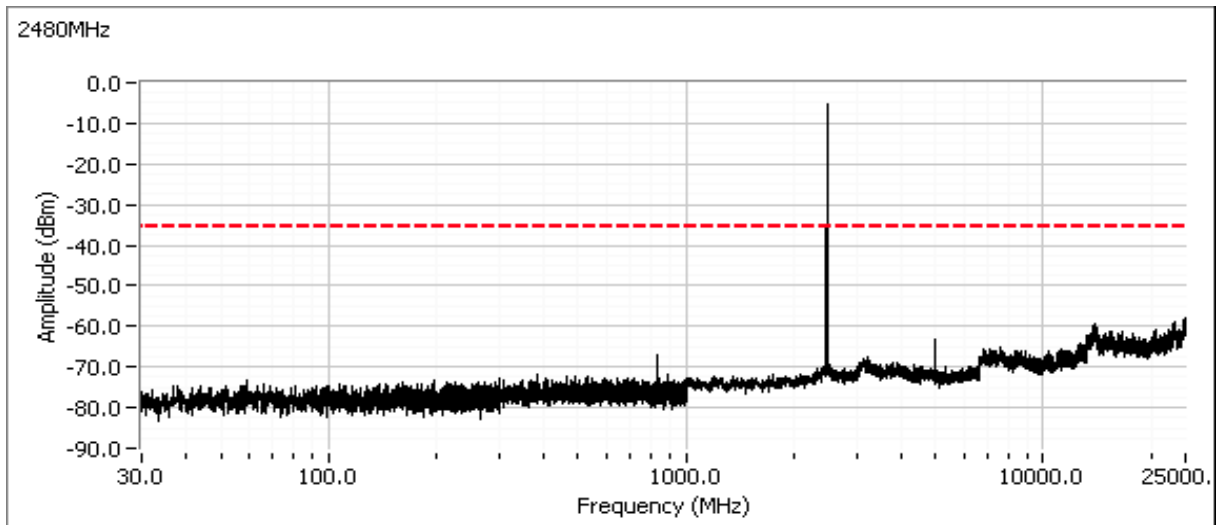
**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98747
Model:	SDGOB-1506	T-Log Number:	T99015
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	N/A

Plots for high channel





EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98746
Product	SDGOB-1505	T-Log Number:	T98753
System Configuration:	-	Project Manager:	Sheareen Jacobs
Contact:	Tarandeep Kaur	Project Coordinator:	Irene Rademacher
Emissions Standard(s):	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Class:	-
Immunity Standard(s):	-	Environment:	-

EMC Test Data

For The

Hewlett Packard Company

Product

SDGOB-1505

Date of Last Test: 8/14/2015



EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98746
Model:	SDGOB-1505	T-Log Number:	T98753
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		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: 7/31/2015
 Test Engineer: Rafael Varelas
 Test Location: FT Chamber #4

Config. Used: 2
 Config Change: None
 EUT Voltage: Laptop USB

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. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment were routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 22.5 °C
 Rel. Humidity: 38 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	FCC 15.207	Pass	40.3 dBμV @ 0.176 MHz (-14.4 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.

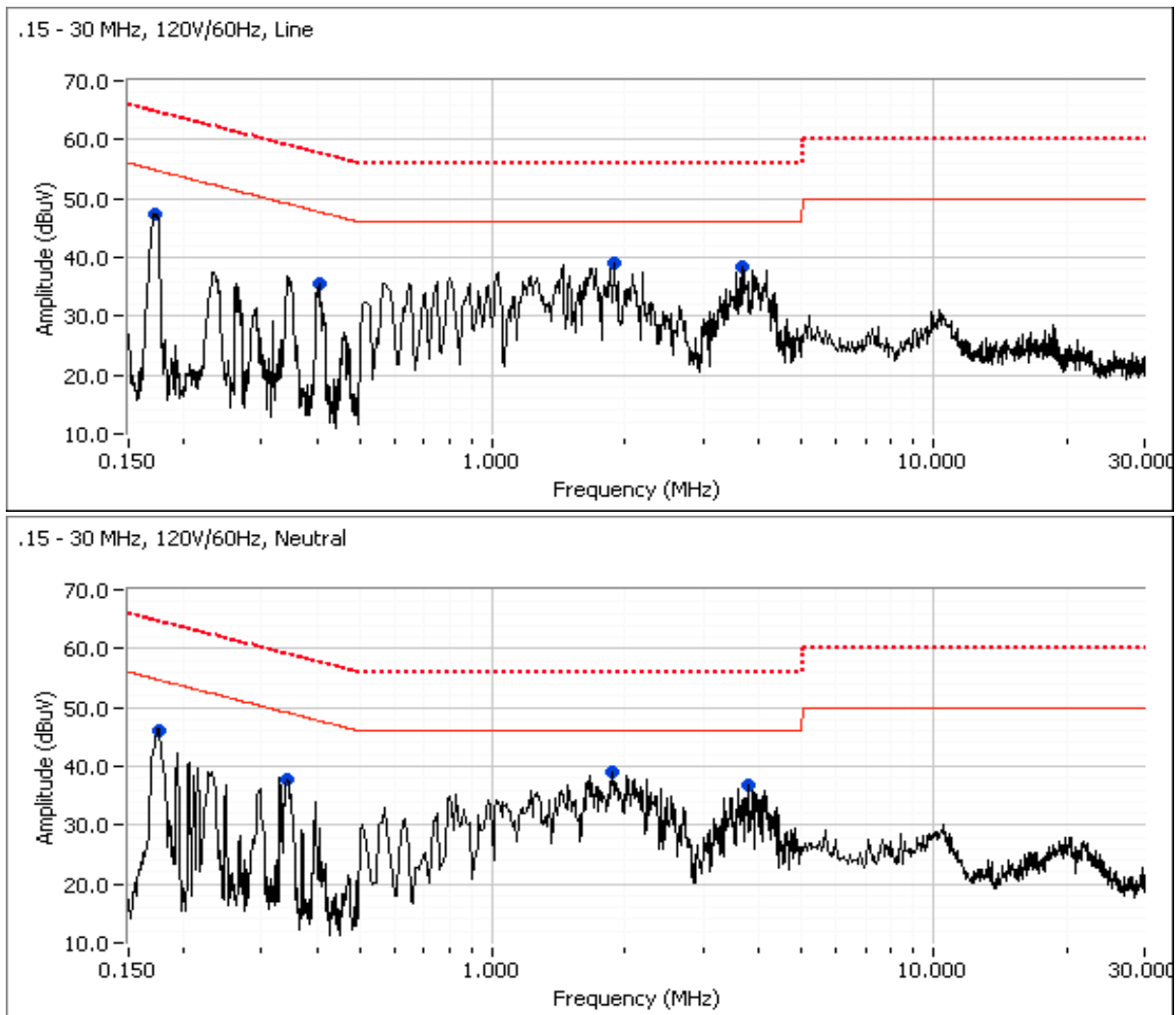
Sample Notes

Sample S/N: D85DE2000005 (MAC ID)
 Driver: 6.37 RC214 .12
 Antenna: Internal

Channel: 6 - 2437MHz
 Tx Chain: 2Tx
 Mode: n20
 Data Rate: MCS0
 Power Setting: max 1Tx setting

Client: Hewlett Packard Company	Job Number: J98746
Model: SDGOB-1505	T-Log Number: T98753
Contact: Tarandeep Kaur	Project Manager: Sheareen Jacobs
Standard: FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator: Irene Rademacher
	Class: -

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



**NTS**

WE ENGINEER SUCCESS

EMC Test Data

Client:	Hewlett Packard Company	Job Number:	J98746
Model:	SDGOB-1505	T-Log Number:	T98753
Contact:	Tarandeep Kaur	Project Manager:	Sheareen Jacobs
Standard:	FCC 15.247 / FCC 15.E / RSS-247 / LP0002	Project Coordinator:	Irene Rademacher
		Class:	-

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

Frequency MHz	Level dB μ V	AC Line	FCC 15.207		Detector QP/Ave	Comments
			Limit	Margin		
0.172	47.5	Line 1	54.9	-7.4	Peak	
0.405	35.5	Line 1	47.7	-12.2	Peak	
1.888	39.0	Line 1	46.0	-7.0	Peak	
3.661	38.5	Line 1	46.0	-7.5	Peak	
0.176	46.0	Neutral	54.7	-8.7	Peak	
0.344	37.9	Neutral	49.1	-11.2	Peak	
1.855	38.9	Neutral	46.0	-7.1	Peak	
3.817	36.8	Neutral	46.0	-9.2	Peak	

Final quasi-peak and average readings

Frequency MHz	Level dB μ V	AC Line	FCC 15.207		Detector QP/Ave	Comments
			Limit	Margin		
0.176	40.3	Neutral	54.7	-14.4	AVG	AVG (0.10s)
0.172	40.2	Line 1	54.9	-14.7	AVG	AVG (0.10s)
0.172	47.7	Line 1	64.9	-17.2	QP	QP (1.00s)
1.855	27.6	Neutral	46.0	-18.4	AVG	AVG (0.10s)
0.344	30.3	Neutral	49.1	-18.8	AVG	AVG (0.10s)
0.405	28.6	Line 1	47.8	-19.2	AVG	AVG (0.10s)
0.176	45.5	Neutral	64.7	-19.2	QP	QP (1.00s)
1.888	26.1	Line 1	46.0	-19.9	AVG	AVG (0.10s)
1.888	36.0	Line 1	56.0	-20.0	QP	QP (1.00s)
1.855	36.0	Neutral	56.0	-20.0	QP	QP (1.00s)
3.661	32.9	Line 1	56.0	-23.1	QP	QP (1.00s)
0.344	35.7	Neutral	59.1	-23.4	QP	QP (1.00s)
0.405	34.0	Line 1	57.8	-23.8	QP	QP (1.00s)
3.661	21.5	Line 1	46.0	-24.5	AVG	AVG (0.10s)
3.817	28.4	Neutral	56.0	-27.6	QP	QP (1.00s)
3.817	18.3	Neutral	46.0	-27.7	AVG	AVG (0.10s)

End of Report

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