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EMC Test Report

Application for Grant of Equipment Authorization

Industry Canada RSS-Gen Issue 3 / RSS 210 Issue 8
FCC Part 15 Subpart C

Model: TCDA93000

IC CERTIFICATION #:	4672A-TCDA93000
FCC ID:	TGN-TCDA93000
APPLICANT:	Tivo Inc. 2160 Gold St. Alviso, CA 95002, USA
TEST SITE(S):	National Technical Systems - Silicon Valley 41039 Boyce Road. Fremont, CA. 94538-2435
IC SITE REGISTRATION #:	2845B-4, 2845B-5, 2845B-7
REPORT DATE:	August 21, 2014
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A2LA ACCREDITED
Testing Cert #0214.26

REVISION HISTORY

Rev#	Date	Comments	Modified By
-	August 21, 2014	First release	
1	September 3, 2014	Added power adapter information and changed PSD results to 10 kHz BW	dwb

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SCOPE

An electromagnetic emissions test has been performed on the Tivo Inc. model TCDA93000, pursuant to the following rules:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
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 C63.10-2009
FCC DTS Measurement Guidance KDB 558074

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 Tivo Inc. model TCDA93000 complied with the requirements of the following regulations:

Industry Canada RSS-Gen Issue 3
RSS 210 Issue 8 "Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment"
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 Tivo Inc. model TCDA93000 and therefore apply only to the tested sample. The sample was selected and prepared by Jim Inokuchi of Tivo 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 210 A8.2	Digital Modulation	Systems uses DSSS coding and OQPSK Modulation	System must utilize a digital transmission technology	Complies
15.247 (a) (2)	RSS 210 A8.2 (1)	6dB Bandwidth	1.579 MHz	>500kHz	Complies
15.247 (b) (3)	RSS 210 A8.2 (4)	Output Power (multipoint systems)	-2.7 dBm EIRP = 0.001 W Note 1	1Watt, EIRP limited to 4 Watts.	Complies
15.247(e)	RSS 210 A8.2 (2)	Power Spectral Density	-11.9 dBm / 10kHz	8dBm/3kHz	Complies
15.247(d)	RSS 210 A8.5	Antenna Port Spurious Emissions 2390-2400 MHz	All emissions < -30dBc	< -30dBc Note 2	Complies
15.247(c) / 15.209	RSS 210 A8.5	Radiated Spurious Emissions 30MHz – 25 GHz	40.3 dBuV/m @ 116.92MHz (-3.2dB)	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	Integral antenna	Unique or integral antenna required	Complies
15.207	RSS GEN Table 4	AC Conducted Emissions	47.7 dBµV @ 2.353 MHz (-8.3 dB)	Refer to standard	Complies
15.247 (b) (5) 15.407 (f)	RSS 102	RF Exposure Requirements	Refer to calculations in separate exhibit, RSS 102 declaration and statements in the instructions to the user.	Refer to OET 65, FCC Part 1 and RSS 102	Complies
-	RSP 100 RSS GEN 7.1.3	User Manual	See statements in the instructions to user	Statement required regarding non-interference	Complies
-	RSP 100 RSS GEN 4.6.1	99% Bandwidth	2.504 MHz	Information only	N/A

MEASUREMENT UNCERTAINTIES

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

Measurement Type	Measurement Unit	Frequency Range	Expanded Uncertainty
RF power, conducted (power meter)	dBm	25 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 Tivo Inc. model TCDA93000 is a set top box that is designed to provide video streaming. Since the EUT would be placed on a table top during operation, the EUT was treated as table-top equipment during testing to simulate the end-user environment. The electrical rating of the EUT is 120-240 Volts, 50-60 Hz, 2 Amps.

The samples were received on June 23, 2014 and tested on June 23, July 8 & July 15, 2014. The following EUT was tested:

Company	Model	Description	Serial Number	FCC ID
Tivo	TiVo Mini TCDA93000	Set top box	P6-1 2117 AE20000001E2593	TGN-TCDA93000
Tivo	TiVo Mini TCDA93000	Set top box	P6-1 2117 AE20001907E924C	TGN-TCDA93000
Delta	ADP-12AWBA	Power Adapter	-	-

ANTENNA SYSTEM

The antenna system consists of an integral inverted F type antenna.

ENCLOSURE

The EUT enclosure is primarily constructed of plastic. It measures approximately 15.5 cm wide by 15.5 cm deep by 4.5 cm high.

MODIFICATIONS

Mod. #	Test	Date	Modification
1	Radiated Emissions	7/8/2014	Copper tape grounding added on sample with s/n ending with 924C
2	Radiated Emissions	7/15/2014	Copper tape removed and DDR clock changed in software to spread the clock output

SUPPORT EQUIPMENT

The following equipment was used as support equipment for testing:

Manufacturer	Model	Description	Serial Number	FCC ID
Vizio	VISIO VX200E	HDTV	LSMFBAK2001522	DoC

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

Manufacturer	Model	Description	Serial Number	FCC ID
Tivo	TCD750500	Helium DVR	n/a	DoC
Netgear	GS605	5 port Hub	n/a	DoC

EUT INTERFACE PORTS

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

Port	Connected To	Cable(s)		
		Description	Shielded or Unshielded	Length(m)
USB	Not connected	-	-	-
HDMI	HDTV	Multi-wire	Shielded	1.0
Component Video	HDTV	Multi-Coax	Shielded	1.0
AV	HDTV	MultiCoax	Unshielded	1.0
RJ45	4 port Hub	Cat. 5	Unshielded	10.0
Coax	Helium DVR	Cat. 6	Shielded	10.0
DC Power	2 wire Wall Wart	2 wire	Unshielded	1.5

EUT OPERATION

During emission testing the EUT was exercised by observing the LCD display. The display was continuously displaying the boot up screen. The EUT was transmitting at either the low, center and high channels of 2425-2475MHz.

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 4	US0027	2845B-4	41039 Boyce Road Fremont, CA 94538-2435
Chamber 5	US0027	2845B-5	
Chamber 7	US0027	2845B-7	

ANSI C63.4 recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement. The test site(s) contain separate areas for radiated and conducted emissions testing. 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.

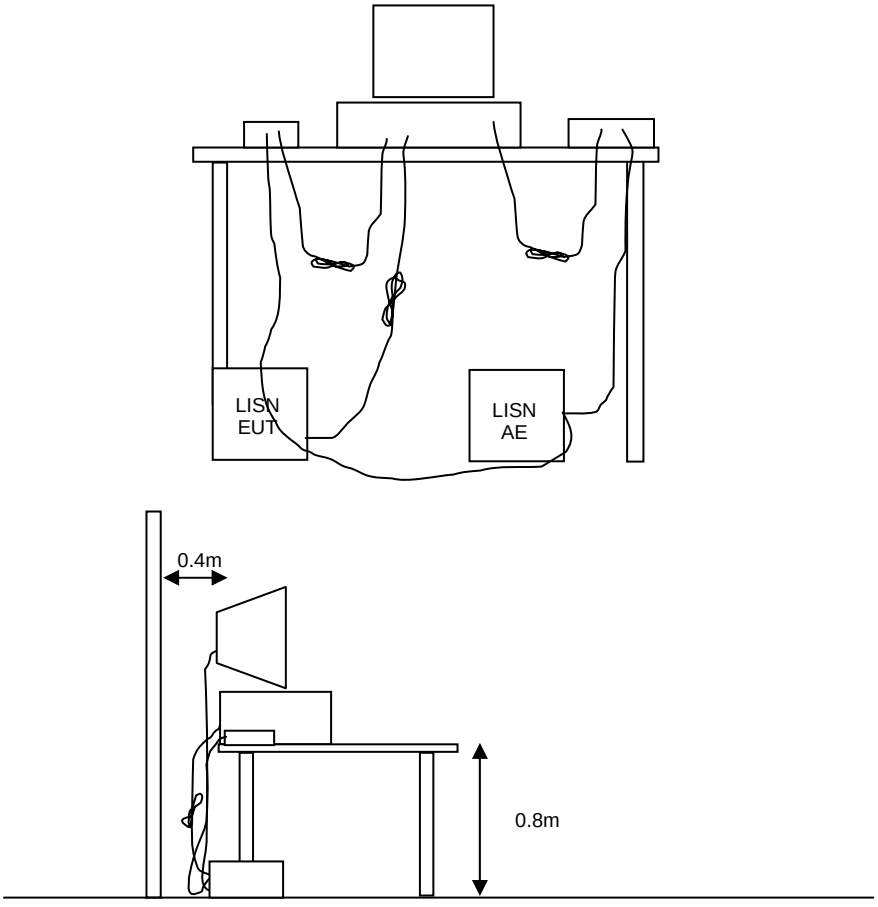


Figure 1 Typical Conducted Emissions Test Configuration

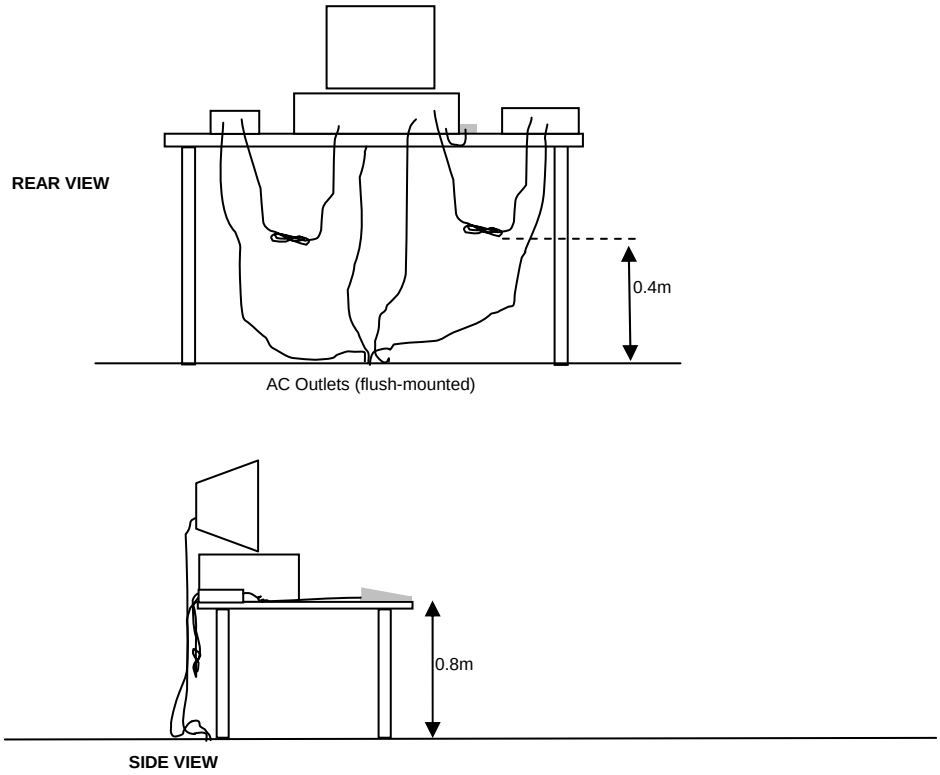
RADIATED EMISSIONS

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.

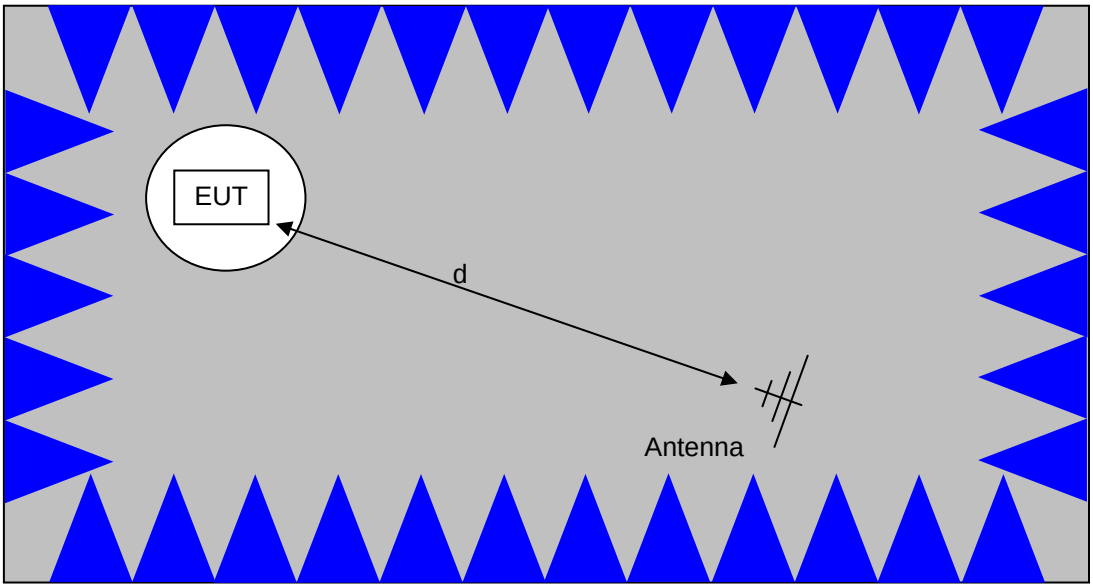
A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

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

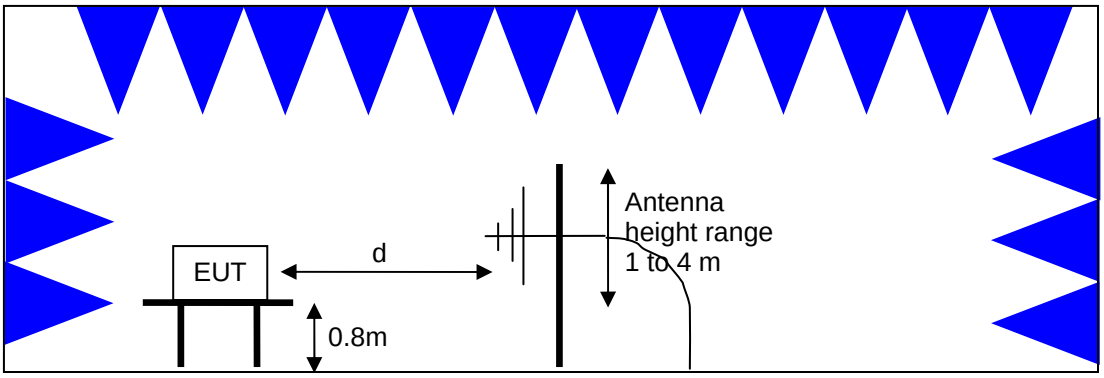


Typical Test Configuration for Radiated Field Strength Measurements



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.

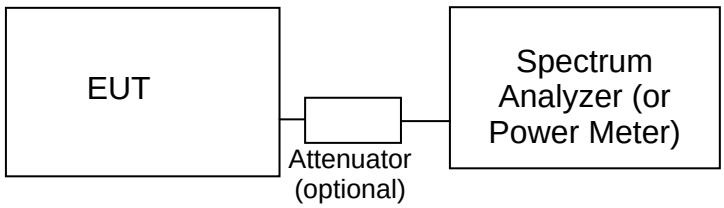
Floor-standing equipment is placed on the floor with insulating supports between the unit and the ground plane.



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:

GENERAL TRANSMITTER RADIATED EMISSIONS SPECIFICATION LIMITS

The table below shows the limits for the spurious emissions from transmitters that fall in restricted bands[1] (with the exception of transmitters operating under FCC Part 15 Subpart D and RSS 210 Annex 9), the limits for all emissions from a low power device operating under the general rules of RSS 310 (tables 3 and 4), RSS 210 (table 2) and FCC Part 15 Subpart C section 15.209.

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

OUTPUT POWER LIMITS – DIGITAL TRANSMISSION SYSTEMS

The table below shows the limits for output power and output power density. Where the signal bandwidth is less than 20 MHz the maximum output power is reduced to the power spectral density limit plus 10 times the log of the bandwidth (in MHz).

Operating Frequency (MHz)	Output Power	Power Spectral Density
902 – 928	1 Watt (30 dBm)	8 dBm/3kHz
2400 – 2483.5	1 Watt (30 dBm)	8 dBm/3kHz
5725 – 5850	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.

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

TRANSMIT MODE SPURIOUS RADIATED EMISSIONS LIMITS – FHSS and DTS SYSTEMS

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

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 - 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.

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

Appendix A Test Equipment Calibration Data

Conducted Emissions - AC Power Ports, 23-Jun-14

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	LISN, 10 kHz-100 MHz, 25A	3825/2	1292	2/13/2015
EMCO	LISN, 10 kHz-100 MHz	3825/2	1293	2/13/2015
Bird Electronic	6 dB, 100 W Attenuator	100-A-FFN-06	1596	6/26/2015
Rohde & Schwarz	EMI Test Receiver, 20 Hz-40 GHz	ESIB40 (1088.7490.40)	2493	1/11/2015

Radiated Emissions, 30 - 26,000 MHz, 08-Jul-14

Manufacturer	Description	Model	Asset #	Cal Due
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	10/31/2014
EMCO	Antenna, Horn, 1-18 GHz (SA40-Red)	3115	1142	8/23/2014
Hewlett Packard	SpecAn 30 Hz -40 GHz, SV (SA40) Red	8564E (84125C)	1148	9/14/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1538	12/14/2014
Micro-Tronics	Band Reject Filter, 2400-2500 MHz	BRM50702-02	1683	8/2/2014
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	2197	2/13/2016
Com-Power	Preamplifier, 30-1000 MHz	PA-103	2465	9/13/2014

Radiated Emissions, 30 - 26,000 MHz, 15-Jul-14

Manufacturer	Description	Model	Asset #	Cal Due
EMCO	Antenna, Horn, 1-18 GHz	3115	487	7/19/2014
Sunol Sciences	Biconilog, 30-3000 MHz	JB3	1548	8/9/2014
Rohde & Schwarz	EMI Test Receiver, 20 Hz-7 GHz	ESIB7	1630	6/21/2015
A. H. Systems	Purple System Horn, 18-40GHz	SAS-574, p/n: 2581	2160	7/28/2014
Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	2199	2/20/2015
Hewlett Packard	SpecAn 9 kHz - 40 GHz, (SA40) Purple	8564E (84125C)	2415	2/27/2015
Com-Power	Preamplifier, 1-1000 MHz	PAM-103	2885	11/1/2014

Appendix B Test Data

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Client:	Tivo	Job Number:	J94776
Product	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	
Emissions Standard(s):	FCC Part 15	Class:	B
Immunity Standard(s):	EN 55024	Environment:	Consumer with RF

EMC Test Data

For The

Tivo

Product

TCDA93000

Date of Last Test: 8/29/2014

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

RSS 210 and FCC 15.247 (DTS) Radiated Spurious Emissions

Test Specific Details

Objective: The objective of this test session is to perform engineering evaluation 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: 31 %

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

Run #	Mode	Channel	Power Setting	Measured Power	Test Performed	Limit	Result / Margin
1a	low	2425			Restricted Band Edge (2390 MHz)	FCC Part 15.209 / 15.247(c)	35.6 dBµV/m @ 2385.6 MHz (-18.4 dB)
					Radiated Emissions 1 - 26 GHz		51.7 dBµV/m @ 4850.0 MHz (-2.3 dB)
1b	center	2450			Radiated Emissions 1 - 26 GHz		49.3 dBµV/m @ 4900.0 MHz (-4.7 dB)
1c	high	2475			Restricted Band Edge (2483.5 MHz)		33.2 dBµV/m @ 2484.6 MHz (-20.8 dB)
					Radiated Emissions 1 - 26 GHz		53.0 dBµV/m @ 4950.0 MHz (-1.0 dB)
2a	low	2425			Radiated Emissions 30 - 1000 MHz		39.2 dBµV/m @ 117.89 MHz (-4.3 dB)
2b	center	2450					39.7 dBµV/m @ 117.48 MHz (-3.8 dB)
2c	high	2475					40.3 dBµV/m @ 116.92 MHz (-3.2 dB)

Modifications Made During Testing

No modifications were made to the EUT during testing. Prior to testing, the DDR clock was changed to spread spectrum from CW.

Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	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.

Mode	Data Rate	Duty Cycle (x)	Constant DC?	T (ms)	Pwr Cor Factor*	Lin Volt Cor Factor**	Min VBW for FS (Hz)
Zigbee	-	100%	Constant				

Sample Notes

Sample S/N: AE20000001E924C
Driver: N/A
Antenna:

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 ≥ 98%, average measurement performed: RBW=1MHz, VBW=3MHz, RMS, Power averaging, auto sweep, trace average 100 traces
Note 3:	Plots of the average bandedge do not account for any duty cycle correction. Refer to the tabluar results for final measurements.

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

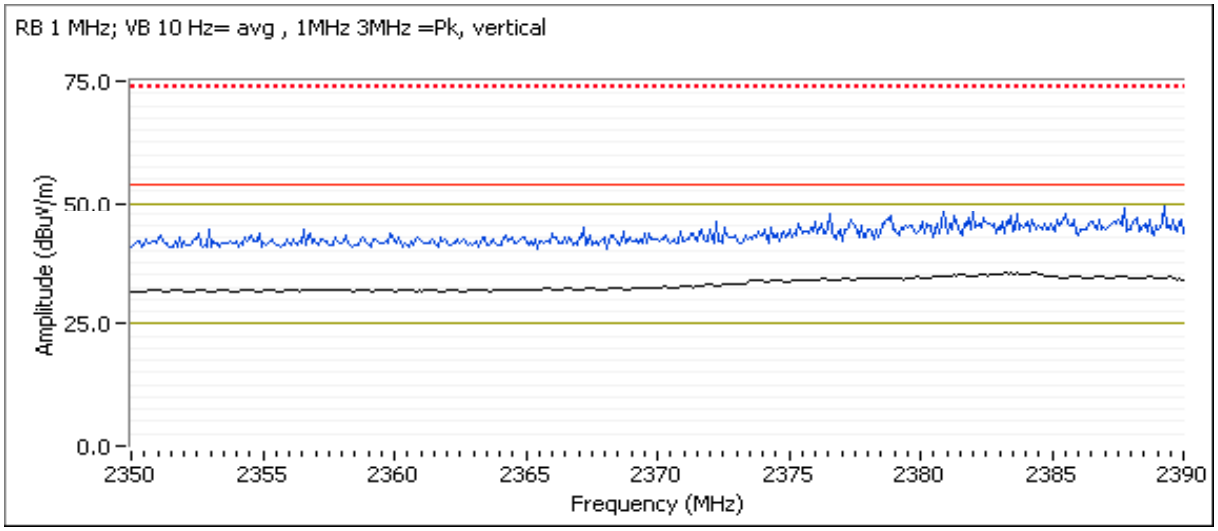
Run #1: Radiated Spurious Emissions, 30 - 18000MHz. Operating Mode: Zigbee

Config 1: Leo3 P6-1 as built (hw unchanged) but software change for 2% 27KHz DDR Clock (800MHz) spread spectrum

Date of Test: 7/15/2014 0:00
Test Engineer: Joseph Cadigal
Test Location: FT Chamber#4
Config. Used: 2
Config Change: none
EUT Voltage: 120V/60Hz

Run #1a: Low Channel @ 2425 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2385.590	35.6	V	54.0	-18.4	AVG	191	0.9	POS; RB 1 MHz; VB: 10 Hz
2378.780	50.5	V	74.0	-23.5	PK	191	0.9	POS; RB 1 MHz; VB: 3 MHz
2389.040	34.2	H	54.0	-19.8	AVG	360	1.0	POS; RB 1 MHz; VB: 10 Hz
2384.630	48.7	H	74.0	-25.3	PK	360	1.0	POS; RB 1 MHz; VB: 3 MHz

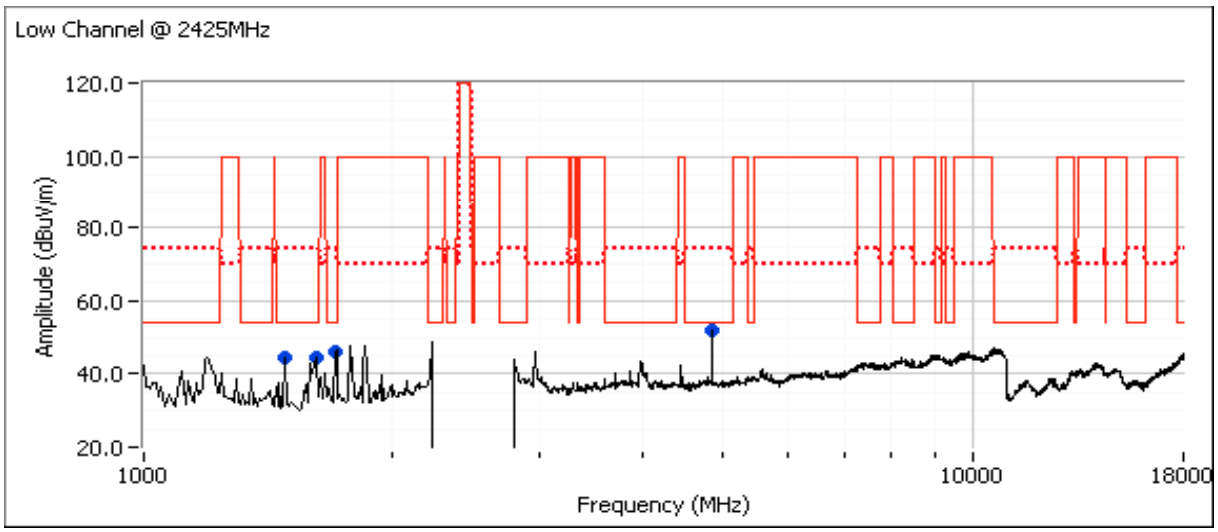


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4849.970	51.7	H	54.0	-2.3	AVG	310	1.0	RB 1 MHz;VB 10 Hz;Peak
4850.020	53.9	H	74.0	-20.1	PK	310	1.0	RB 1 MHz;VB 3 MHz;Peak
1483.560	44.6	H	54.0	-9.4	AVG	48	1.0	RB 1 MHz;VB 10 Hz;Peak
1483.490	47.7	H	74.0	-26.3	PK	48	1.0	RB 1 MHz;VB 3 MHz;Peak
1706.170	32.5	V	54.0	-21.5	AVG	179	1.0	RB 1 MHz;VB 10 Hz;Peak
1706.050	42.0	V	74.0	-32.0	PK	179	1.0	RB 1 MHz;VB 3 MHz;Peak
1609.750	32.7	V	54.0	-21.3	AVG	207	1.6	RB 1 MHz;VB 10 Hz;Peak
1609.460	51.1	V	74.0	-22.9	PK	207	1.6	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 26 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

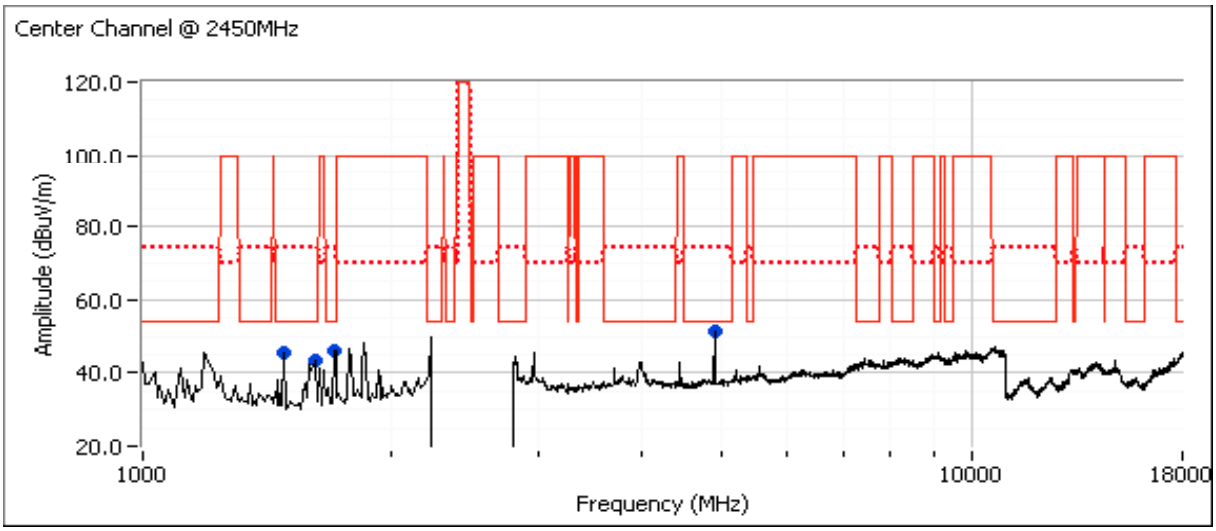


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Run #1b: Center Channel @ 2450 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4899.980	49.3	H	54.0	-4.7	AVG	232	1.0	RB 1 MHz;VB 10 Hz;Peak
4900.020	52.1	H	74.0	-21.9	PK	232	1.0	RB 1 MHz;VB 3 MHz;Peak
1706.090	43.1	V	54.0	-10.9	AVG	8	1.3	RB 1 MHz;VB 10 Hz;Peak
1705.910	48.0	V	74.0	-26.0	PK	8	1.3	RB 1 MHz;VB 3 MHz;Peak
1483.510	45.3	H	54.0	-8.7	AVG	53	1.0	RB 1 MHz;VB 10 Hz;Peak
1483.380	47.9	H	74.0	-26.1	PK	53	1.0	RB 1 MHz;VB 3 MHz;Peak
1613.280	32.4	V	54.0	-21.6	AVG	53	1.0	RB 1 MHz;VB 10 Hz;Peak
1615.940	52.8	V	74.0	-21.2	PK	53	1.0	RB 1 MHz;VB 3 MHz;Peak

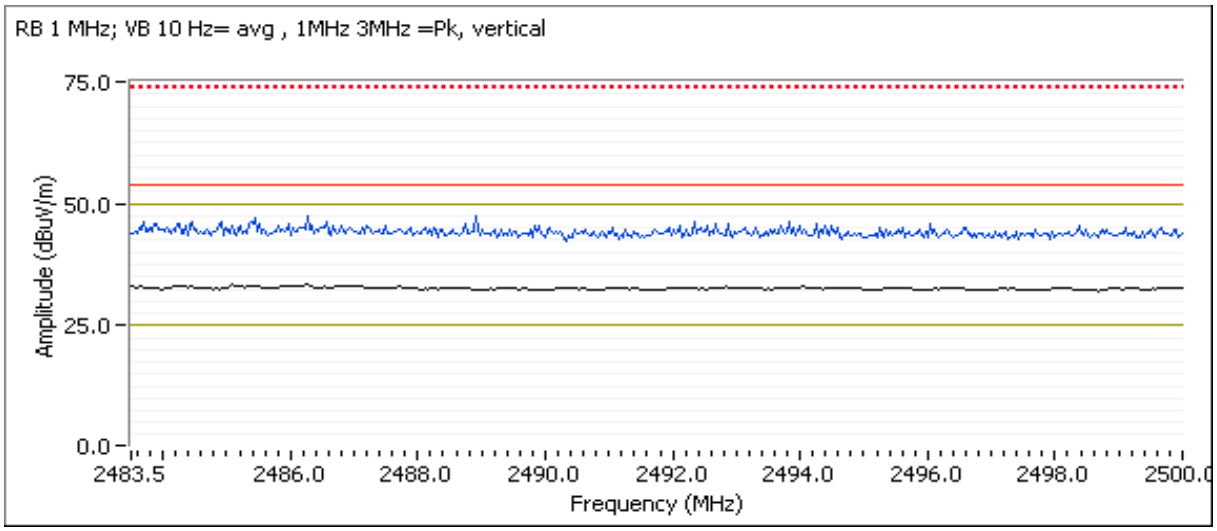
Note:	Scans made between 18 - 26 GHz with the measurement antenna moved around the card and its antennas 20-50cm from the device indicated there were no significant emissions in this frequency range



Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Run #1c: High Channel @ 2475 MHz

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2484.560	33.2	V	54.0	-20.8	AVG	204	1.2	POS; RB 1 MHz; VB: 10 Hz
2485.550	45.1	V	74.0	-28.9	PK	204	1.2	POS; RB 1 MHz; VB: 3 MHz
2483.630	32.6	H	54.0	-21.4	AVG	9	1.0	POS; RB 1 MHz; VB: 10 Hz
2488.160	43.8	H	74.0	-30.2	PK	9	1.0	POS; RB 1 MHz; VB: 3 MHz

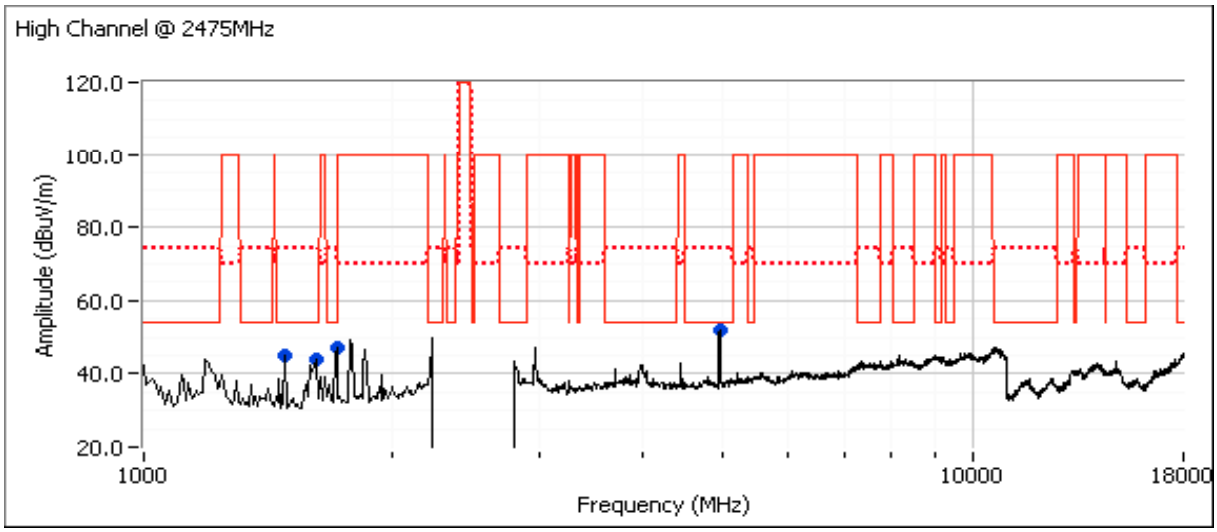


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Other Spurious Emissions

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4949.990	53.0	V	54.0	-1.0	AVG	258	1.0	RB 1 MHz;VB 10 Hz;Peak
4950.010	54.9	V	74.0	-19.1	PK	258	1.0	RB 1 MHz;VB 3 MHz;Peak
1483.540	45.4	H	54.0	-8.6	AVG	54	1.0	RB 1 MHz;VB 10 Hz;Peak
1483.580	48.6	H	74.0	-25.4	PK	54	1.0	RB 1 MHz;VB 3 MHz;Peak
1706.030	43.8	V	54.0	-10.2	AVG	161	1.6	RB 1 MHz;VB 10 Hz;Peak
1705.980	48.3	V	74.0	-25.7	PK	161	1.6	RB 1 MHz;VB 3 MHz;Peak
1611.810	33.7	V	54.0	-20.3	AVG	197	1.6	RB 1 MHz;VB 10 Hz;Peak
1613.210	53.6	V	74.0	-20.4	PK	197	1.6	RB 1 MHz;VB 3 MHz;Peak

Note:	Scans made between 18 - 26 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



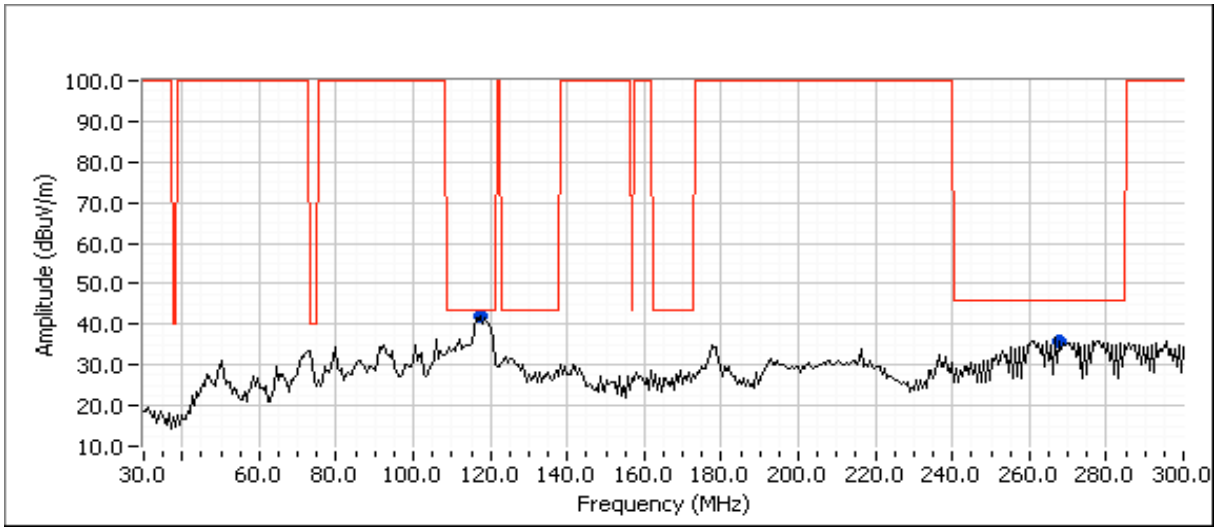
Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

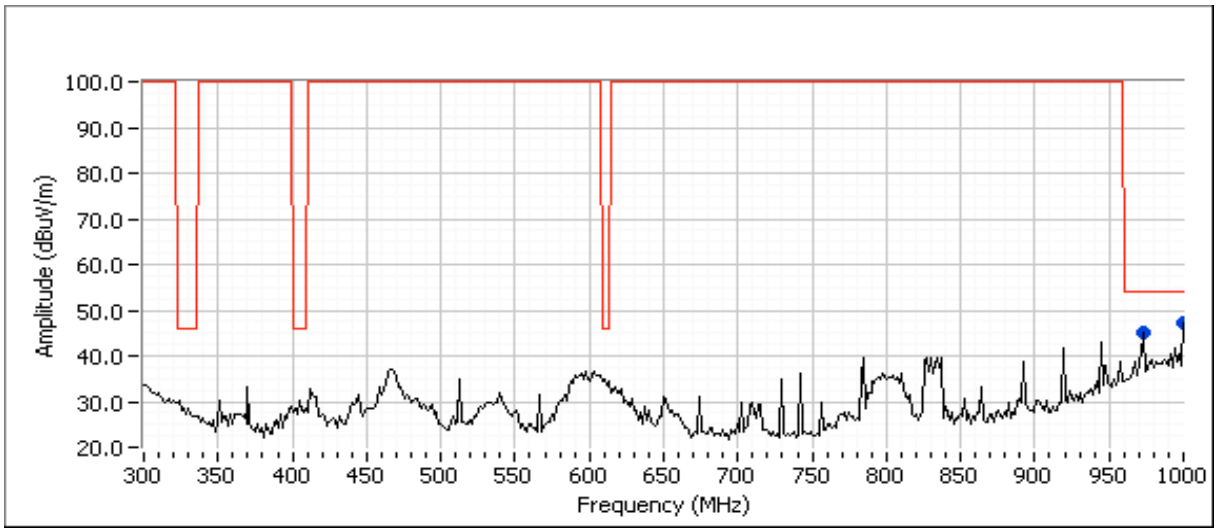
Run #2: Radiated Spurious Emissions, 30-1000 MHz. Operating Mode: Zigbee

Config 1: Leo3 P6-1 as built (hw unchanged) but software change for 2% 27KHz DDR Clock (800MHz) spread spectrum

AE20000001E924C

Run #2a: Low Channel @ 2425 MHz

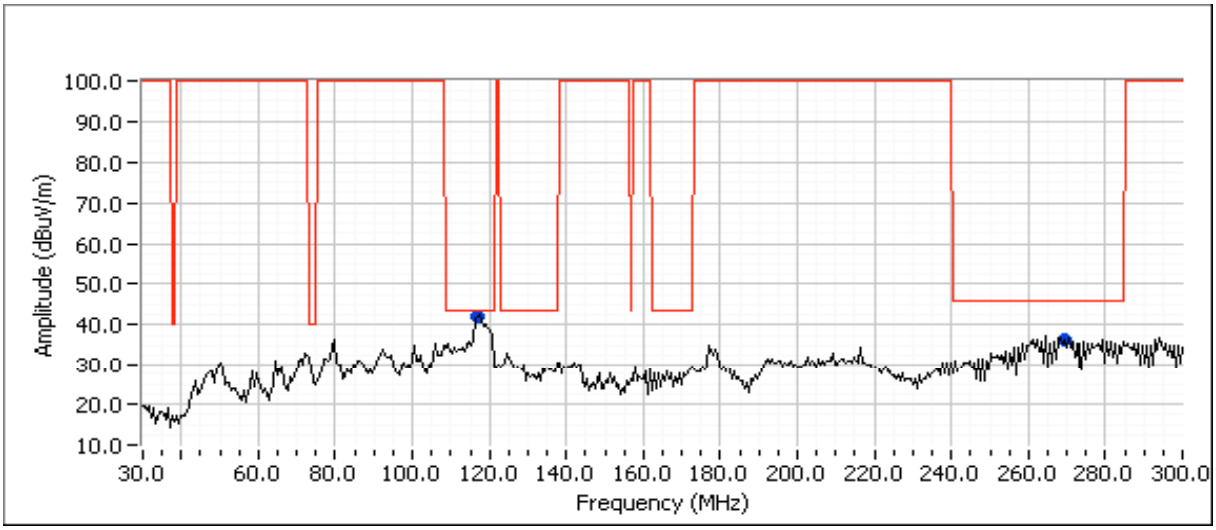


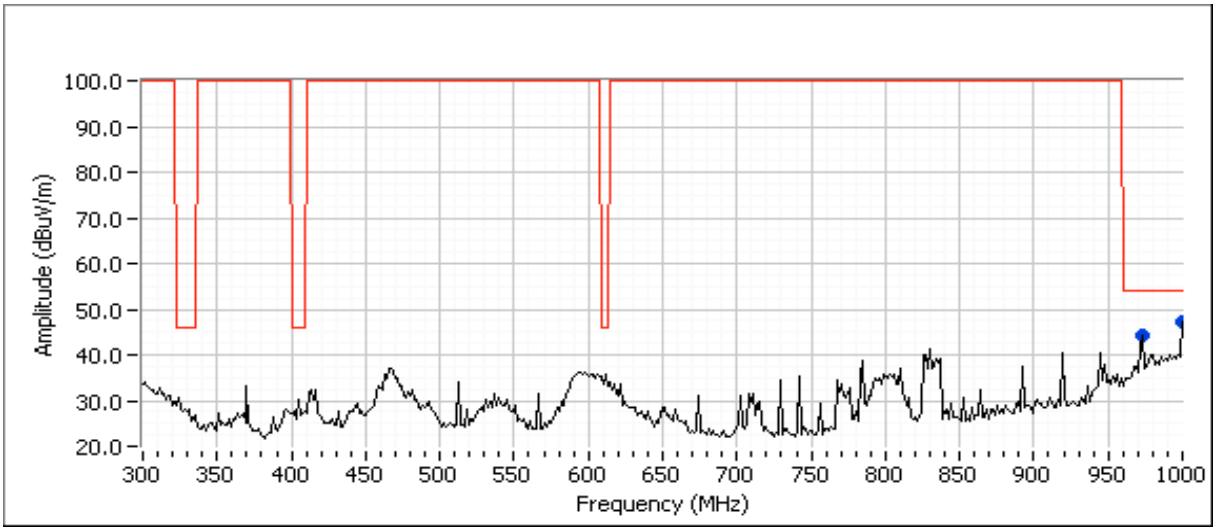


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
117.885	39.2	V	43.5	-4.3	QP	70	1.0	QP (1.00s)
999.010	47.4	H	54.0	-6.6	QP	360	1.5	QP (1.00s)
267.488	34.7	V	46.0	-11.3	QP	124	1.0	QP (1.00s)
972.009	42.4	H	54.0	-11.6	QP	111	1.0	QP (1.00s)

Run #2b: Center Channel @ 2450 MHz

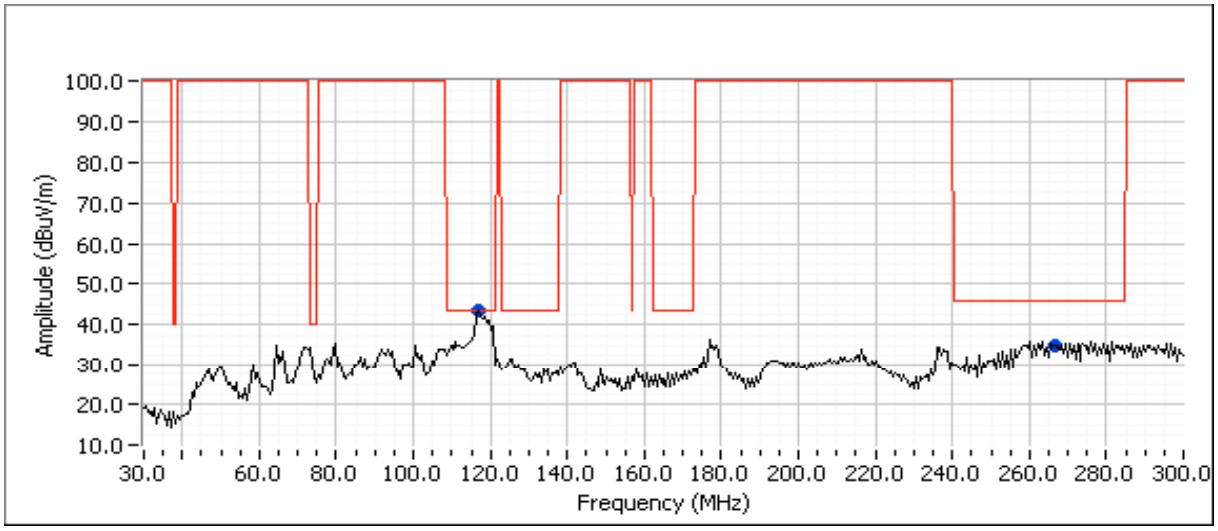


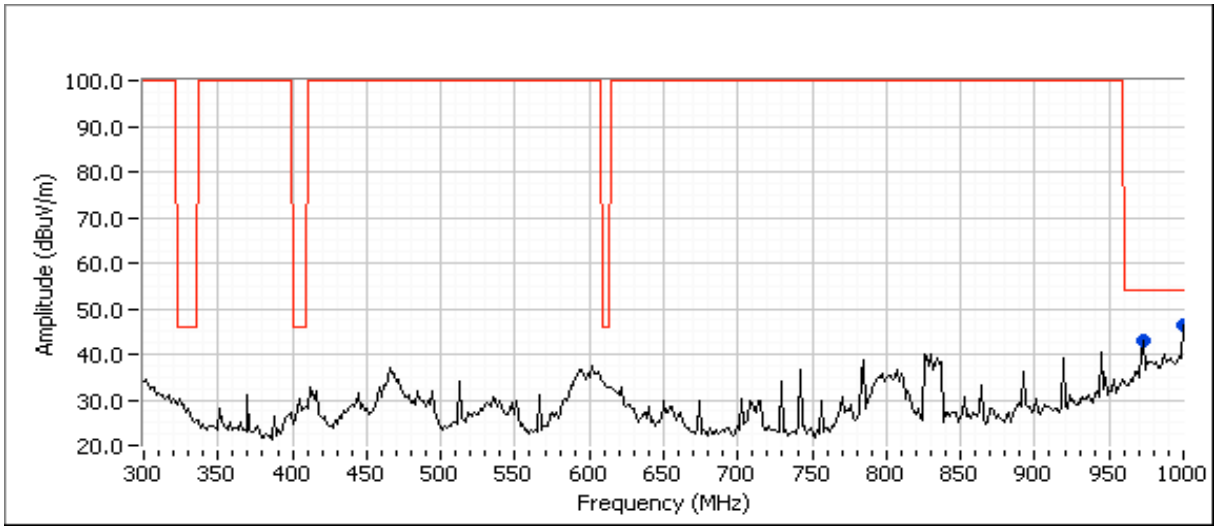


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Frequency	Level	Pol	15.209 / 15.247		Detector	Azimuth	Height	Comments
MHz	dBµV/m	V/H	Limit	Margin	Pk/QP/Avg	degrees	meters	
117.477	39.7	V	43.5	-3.8	QP	86	1.0	QP (1.00s)
999.012	46.0	H	54.0	-8.0	QP	0	1.5	QP (1.00s)
268.726	34.7	V	46.0	-11.3	QP	141	1.0	QP (1.00s)
972.009	42.3	H	54.0	-11.7	QP	343	3.0	QP (1.00s)

Run #2c: High Channel @ 2475 MHz





Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	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	
116.922	40.3	V	43.5	-3.2	QP	91	1.0	QP (1.00s)
266.454	34.1	V	46.0	-11.9	QP	146	1.0	QP (1.00s)
972.009	42.0	H	54.0	-12.0	QP	352	3.0	QP (1.00s)
999.010	46.9	H	54.0	-7.1	QP	339	2.5	QP (1.00s)

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

RSS 210 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: 7/8/2014
Test Engineer: Joseph Cadigal
Test Location: Fremont Chamber #7

Config. Used: 2
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: 25 °C
Rel. Humidity: 31 %

Summary of Results

Run #	Pwr setting	Avg Pwr	Test Performed	Limit	Pass / Fail	Result / Margin
1	default		Output Power	15.247(b)	Pass	-2.7 dBm
2	default		Power spectral Density (PSD)	15.247(d)	Pass	-11.9 dBm/3kHz
3	default		Minimum 6dB Bandwidth	15.247(a)	Pass	1.579 MHz
3	default		99% Bandwidth	RSS GEN	-	2.504 MHz
4	default		Spurious emissions	15.247(b)	Pass	< 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.

Test Notes

Measurements performed using a radiated setup and converted to radiated power using the relationship E = Square root of 30 times EIRP divided by the test distance. (i.e. $PSD_{(EIRP)}$ = E-95.2 for 3 meter test distance.). Conducted power is computed from radiated power by subtracting the antenna gain.

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	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)
Zigbee	-	100%	Constant				

Sample Notes

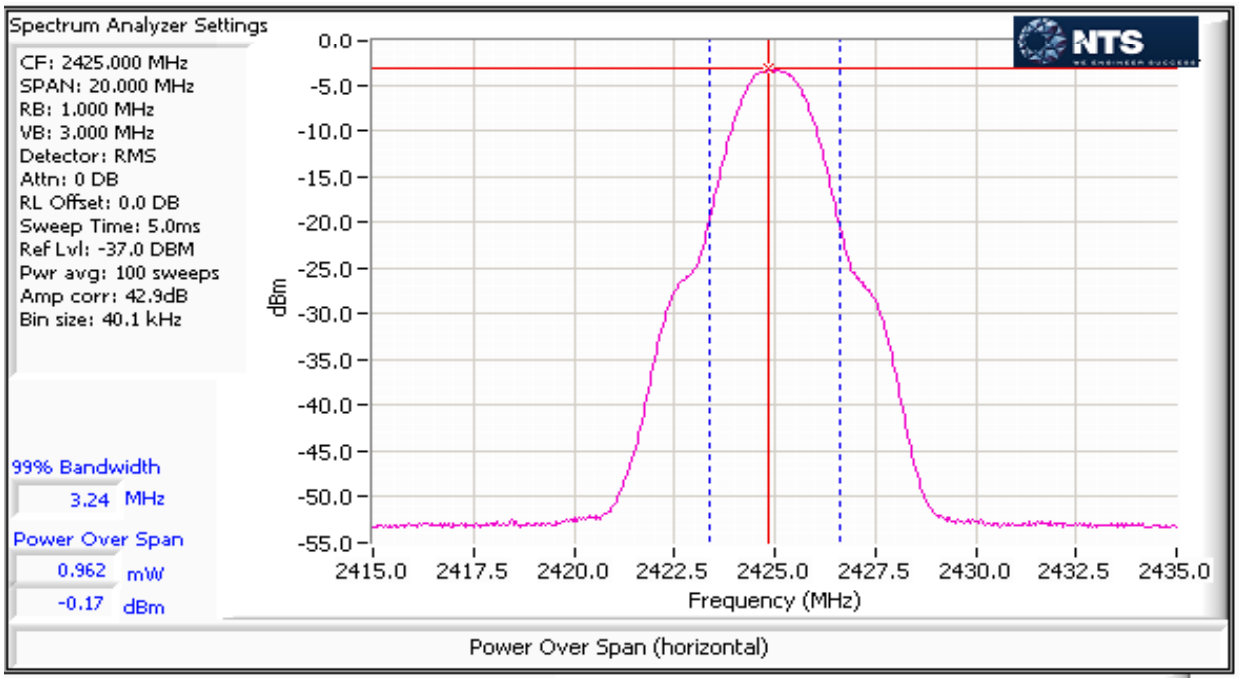
Sample S/N: AE20000001E924C
Driver: N/A

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Run #1: Output Power

Power Setting[2]	Frequency (MHz)	Output Power (dBm)[3]	Output Power mW	Antenna Gain (dBi)	Result	EIRP[1] dBm	EIRP[1] W
Vertical	2425	-12.5	0.1	2.5	Pass	-10.0	0.000
Horizontal	2425	-2.7	0.5	2.5	Pass	-0.2	0.001
Vertical	2450	-14.5	0.0	2.5	Pass	-12.0	0.000
Horizontal	2450	-3.8	0.4	2.5	Pass	-1.3	0.001
Vertical	2475	-16.4	0.0	2.5	Pass	-13.9	0.000
Horizontal	2475	-4.9	0.3	2.5	Pass	-2.4	0.001

Note 1:	EIRP power measured using a spectrum analyzer (see plots below) with RBW=1MHz, VB=3 MHz, RMS detector, power averaging on (transmitted signal duty cycle ≥ 98%) and power integration over the OBW (method 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:	Calculated from the diference of the EIRP and antenna gain in dB.

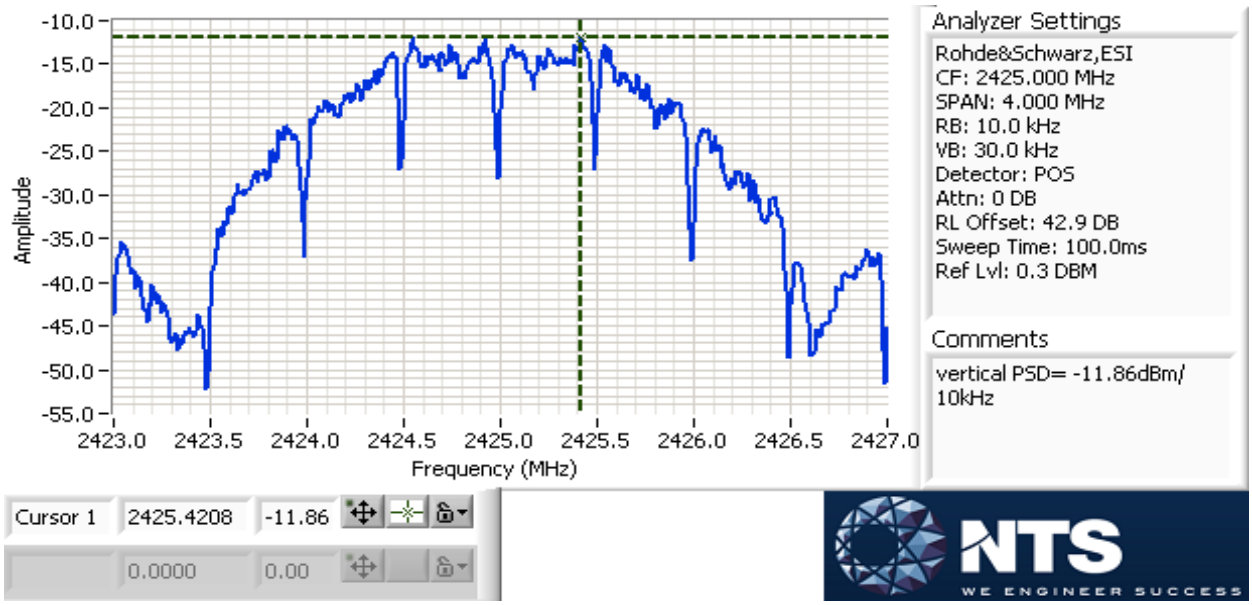


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Run #2: Power spectral Density

Power Setting	Frequency (MHz)	PSD (dBm/10kHz) Note 1	Limit dBm/3kHz	Result
Vertical	2425	-22.6	8.0	Pass
Horizontal	2425	-11.9	8.0	Pass
Vertical	2450	-26.3	8.0	Pass
Horizontal	2450	-15.6	8.0	Pass
Vertical	2475	-26.2	8.0	Pass
Horizontal	2475	-14.0	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.

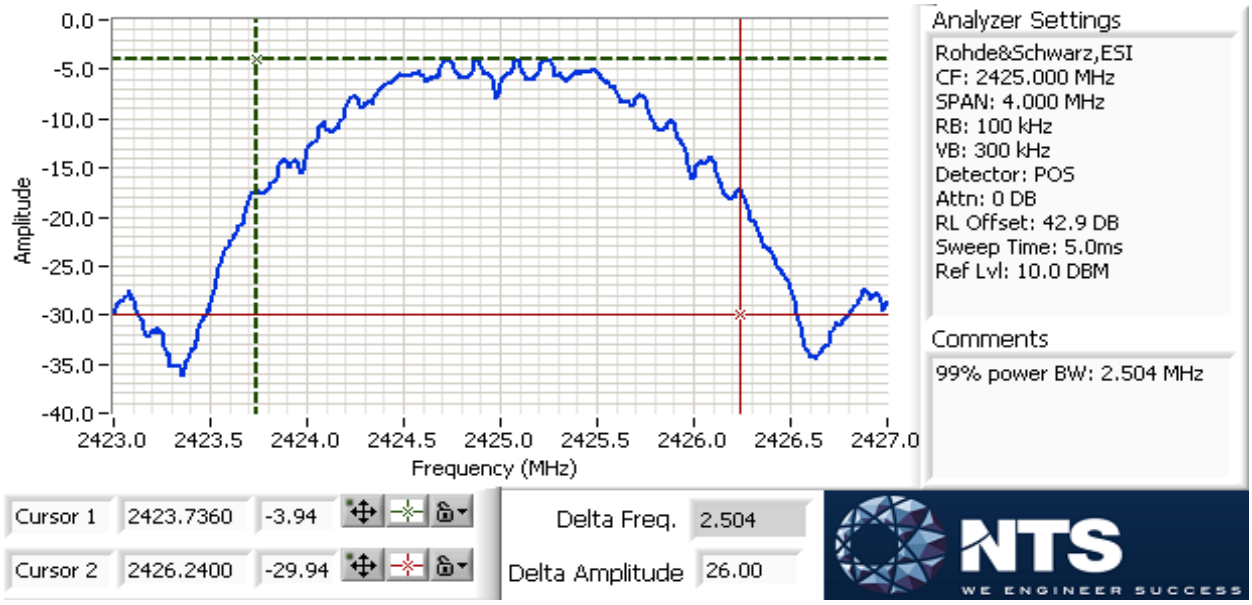


Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

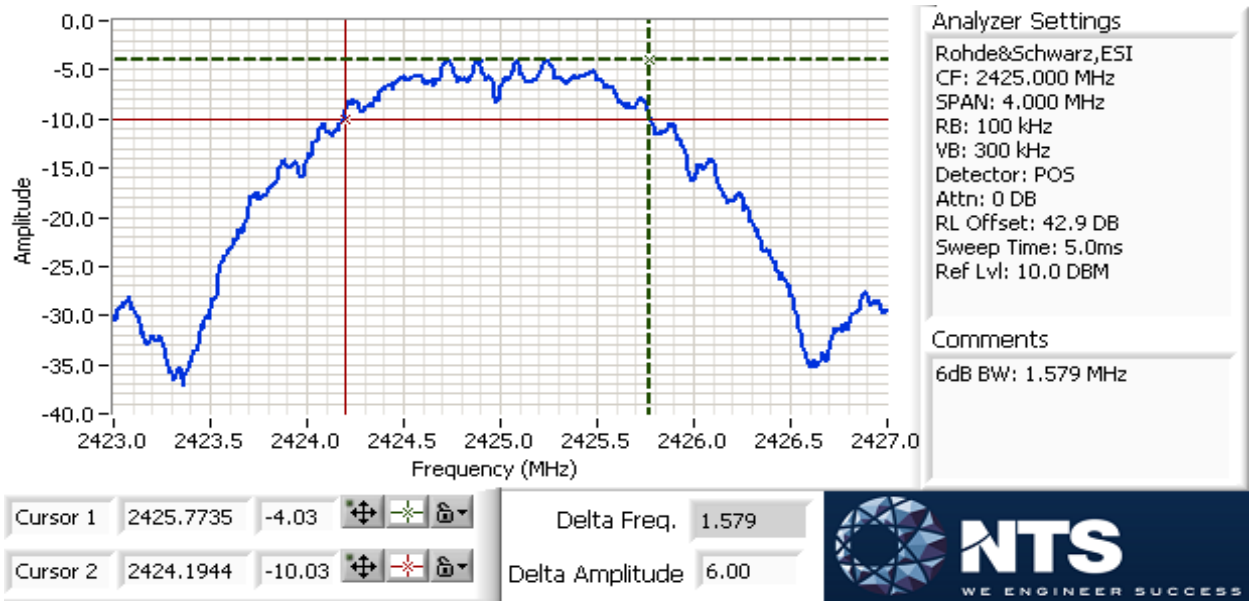
Run #3: Signal Bandwidth

Power Setting	Frequency (MHz)	Resolution Bandwidth	Bandwidth (MHz) 6dB	Resolution Bandwidth	Bandwidth (MHz) 99%
default	2425	100 kHz	1.579	100 kHz	2.504
default	2450	100 kHz	1.579	100 kHz	2.496
default	2475	100 kHz	1.579	100 kHz	2.504

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.



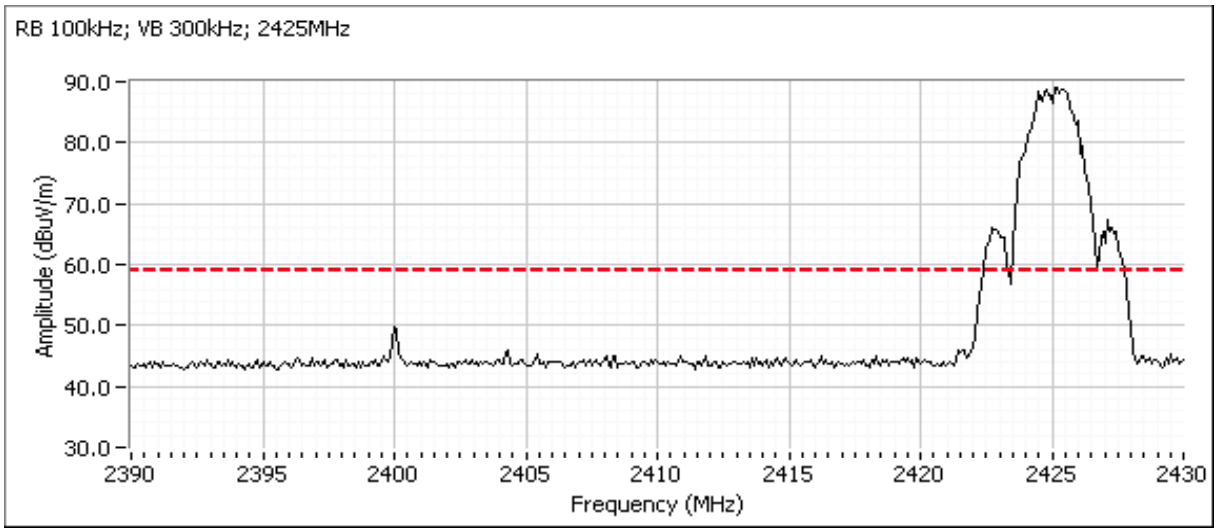
Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A



Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	N/A

Run #4a: Out of Band Spurious Emissions

Plot showing compliance with -30dBc limit from 2390 MHz to 2400 MHz with EUT on lowest channel. Radiated measurements used to show compliance with the limits in the restricted band below 2390 MHz.



Radiated measurements used to show compliance with the limits in the restricted band above 2483.5 MHz.

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	B

Conducted Emissions

(Elliott Laboratories Fremont Facility, Semi-Anechoic Chamber)

Test Specific Details

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

Date of Test: 6/23/2014
Test Engineer: Fred Leffingwell
Test Location: Fremont Chamber #5

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

General Test Configuration

For tabletop equipment, the EUT and host system was located on a wooden table inside the semi-anechoic chamber, 40 cm from a vertical coupling plane and 80cm from the LISN. A second LISN was used for all local support equipment. Remote support equipment was located outside of the semi-anechoic chamber. Any cables running to remote support equipment where routed through metal conduit and when possible passed through a ferrite clamp upon exiting the chamber.

Ambient Conditions:

Temperature: 23 °C
Rel. Humidity: 37 %

Summary of Results

Run #	Test Performed	Limit	Result	Margin
1	CE, AC Power, 120V/60Hz	Class B	Pass	47.7 dBµV @ 2.353 MHz (-8.3 dB)

Modifications Made During Testing

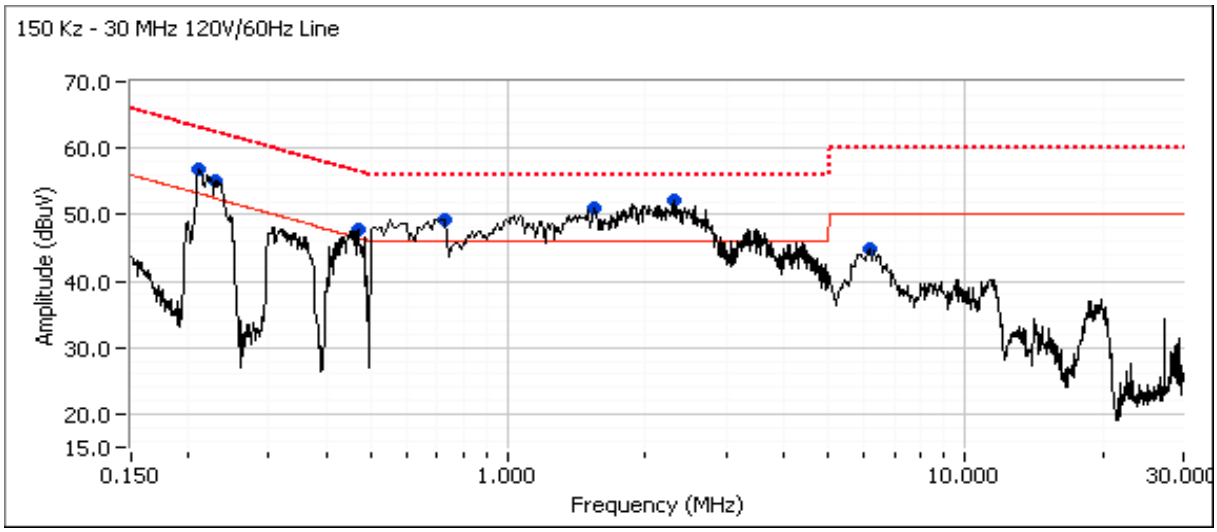
No modifications were made to the EUT during testing

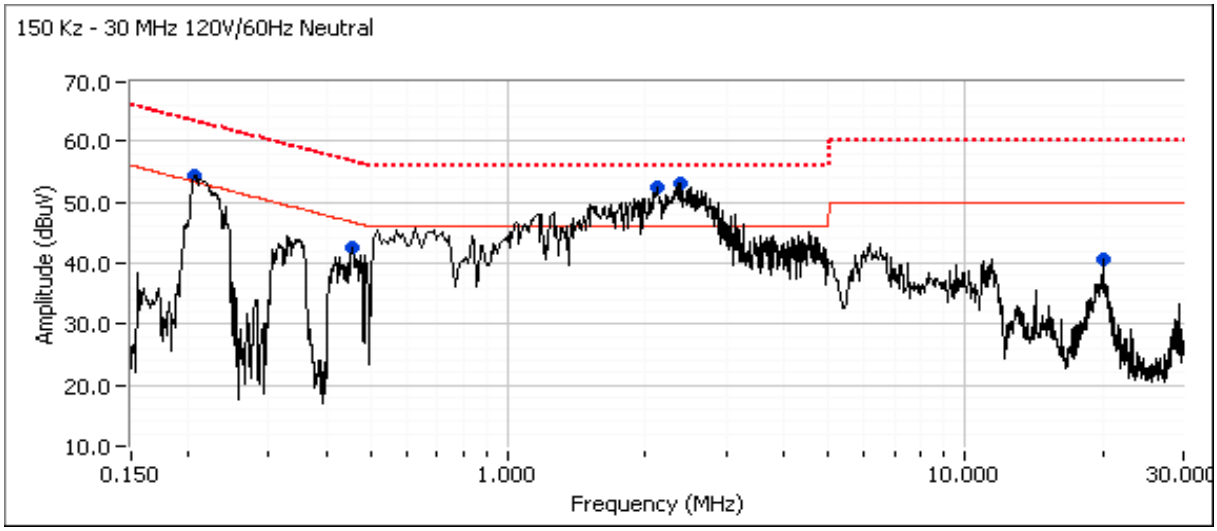
Deviations From The Standard

No deviations were made from the requirements of the standard.

Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	B

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





Client:	Tivo	Job Number:	J94776
Model:	TCDA93000	T-Log Number:	T95026
		Project Manager:	Sheareen Jacobs
Contact:	Jim Inokuchi	Project Coordinator:	-
Standard:	FCC Part 15	Class:	B

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

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.210	56.7	Line	53.2	3.5	Peak	
0.230	55.2	Line	52.5	2.7	Peak	
0.467	47.8	Line	46.5	1.3	Peak	
0.720	49.2	Line	46.0	3.2	Peak	
1.528	50.9	Line	46.0	4.9	Peak	
2.324	52.3	Line	46.0	6.3	Peak	
6.334	44.9	Line	50.0	-5.1	Peak	
0.213	54.2	Neutral	53.1	1.1	Peak	
0.464	42.6	Neutral	46.6	-4.0	Peak	
2.148	52.6	Neutral	46.0	6.6	Peak	
2.353	53.1	Neutral	46.0	7.1	Peak	
19.956	40.6	Neutral	50.0	-9.4	Peak	

Final quasi-peak and average readings

Frequency	Level	AC	Class B		Detector	Comments
MHz	dBµV	Line	Limit	Margin	QP/Ave	
0.209	37.5	Line	53.2	-15.7	AVG	
0.209	51.6	Line	63.2	-11.6	QP	
0.230	39.8	Line	52.4	-12.6	AVG	
0.230	50.8	Line	62.4	-11.6	QP	
0.467	25.9	Line	46.6	-20.7	AVG	
0.467	41.9	Line	56.6	-14.7	QP	
0.720	24.1	Line	46.0	-21.9	AVG	
0.720	43.7	Line	56.0	-12.3	QP	
1.528	29.9	Line	46.0	-16.1	AVG	
1.528	47.5	Line	56.0	-8.5	QP	
2.324	28.8	Line	46.0	-17.2	AVG	
2.324	46.4	Line	56.0	-9.6	QP	
0.213	27.9	Neutral	53.1	-25.2	AVG	
0.213	50.6	Neutral	63.1	-12.5	QP	
0.464	25.0	Neutral	46.6	-21.6	AVG	
0.464	36.9	Neutral	56.6	-19.7	QP	
2.148	29.5	Neutral	46.0	-16.5	AVG	
2.148	46.6	Neutral	56.0	-9.4	QP	
2.353	29.4	Neutral	46.0	-16.6	AVG	
2.353	47.7	Neutral	56.0	-8.3	QP	
19.956	19.0	Neutral	50.0	-31.0	AVG	
19.956	30.8	Neutral	60.0	-29.2	QP	

End of Report

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