

Intentional Radiator Test Report

Test Standards:
FCC Part 15 (Subpart C – Intentional Radiators)
Industry Canada RSS-210

Prepared For:

Plantronics, Inc.
345 Encinal Street
Santa Cruz, CA 95060

Equipment Under Test:
Bluetooth Headset

Model:
D645

Prepared by:



44366 S. Grimmer Blvd.
Fremont, CA 94538
USA

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1.0 CUSTOMER INFORMATION

Test Laboratory:	EMCE Engineering 44366 S. Grimmer Blvd. Fremont, CA 94538 USA Tel: 510-490-4307 Fax: 510-490-3441 bob@universalcompliance.com
FCC registration number	0007-1981-20
Customer:	Plantronics, Inc. 37400 Central Court Newark, CA Tel: 510-744-2700 Fax: 510-744-2701
Contact Person:	Myhassan Bakrim
Receipt of EUT:	10/12/05
Test plan reference:	FCC Part 2, 15 (15.247) / IC RSS-210
Date of testing:	10/12/05 – 10/25/05
Date of Report:	10/26/05

The tests listed in this report have been completed to demonstrate compliance to the CFR 47 Section 15.247, as well as Industry Canada Radio Standard RSS-210, Issue 5.

Contents approved:


Name: Bob Cole Title: President

2.0 EUT AND ACCESSORY INFORMATION

EUT description

The EUT is a Plantronics, Inc. **Discovery 645 M/N: D645**.

EUT and accessories

The table below lists all EUTs and accessories used in the tests. Later in this report, only numbers in the last column are used to refer to the devices in each test.

Software

The computers were equipped with test software provided by the customer. The software was used to control the EUT in the tests.

	Name	Type	S/N	Number
EUT	D645	D645	N/A	E0001
Accessories	Laptop Computer	Compaq Presario M/N: 1694	3882A744	S0001
Software	CSR Bluesuite 1.20	Bluetest, BlueChat	N/A	N/A

EUT Information

Product Specification	Description
Model Name	D645
Type of Modulation	Frequency Hopping Spread Spectrum (FHSS)
Number of Hopping Channels	79
Operating Frequency Range	2480 – 2483.5 MHz
Type of Equipment	Combined, Battery Powered
Extreme Operating Temperature Range	-20 C – 55 C
Extreme Operating Voltage Range	Fully Charged Battery
Type of Antenna	Integral
Antenna Gain (dBi)	-3.0
Transmitter Method of Frequency Generation	Synthesized
Transmitter Aggregate Data Rate	>250kbps
Transmitter Duty Type	Intermittant
Transmitter Duty Cycle	Tx ON: .326 ms, Tx OFF: .924 ms: Duty Cycle = .261
Continuous Operation for Testing Purposes?	Yes
Transmit Emissions Designator	1M00 Q1D

3.0 SUMMARY OF TEST RESULTS

Section in CFR 47	Section in RSS-210	Description	Results
15.245 (b)(1)	6.2.2(o) (a2)	Peak output power (Radiated Emissions)	<i>PASSED</i>
15.247 (a)(1)	6.2.2(o) (a3)	CF Separation	<i>PASSED</i>
15.247 (a)(1)(ii)	6.2.2(o) (a3)	Number of Hopping Frequencies	<i>PASSED</i>
15.247 (a)(1)(ii)	6.2.2(o) (a3)	Dwell Time	<i>PASSED</i>
15.247 (a)(1)(ii)	6.2.2(o) (a3)	20 dB Bandwidth	<i>PASSED</i>
15.247, c	6.2.2(o) (e1)	Band-edge compliance of RF Radiated emission	<i>PASSED</i>
15.247, c	6.2.2(o) (e1)	Restricted Band (Radiated Emissions)	<i>PASSED</i>
15.247(d)	6.2.2(o) (e1)	Spurious radiated emissions	<i>PASSED</i>
15.247(d)	6.2.2(o) (e1)	Spurious Antenna Conducted emissions	<i>PASSED</i>

PASS The EUT passed that particular test.
FAIL The EUT failed that particular test.

4.0 STANDARDS AND MEASUREMENT METHODS

The tests were performed in guidance of CFR 47 section 15.247, FCC Public Notice DA 00-705 (March 30, 2000), FCC Report & Order 97-114 (April 10, 1997), and ANSI C63.4 (2003). Deviations, modifications or clarifications (if any) to above mentioned documents are written in each section under "Test method". For the test equipment, see device list in the end of this test.

4.1 Selection of operation mode for tests

Before tests, several operation modes, and modulation patterns were tried. The worst case was selected for each test and those results reported.

5.0 TEST SETUPS

To fulfill all requirements for the testing, total of two different test setups were used. One EUT was used, unmodified for radiated tests.

SMA connector added in place of internal antenna for Antenna Conducted measurements.

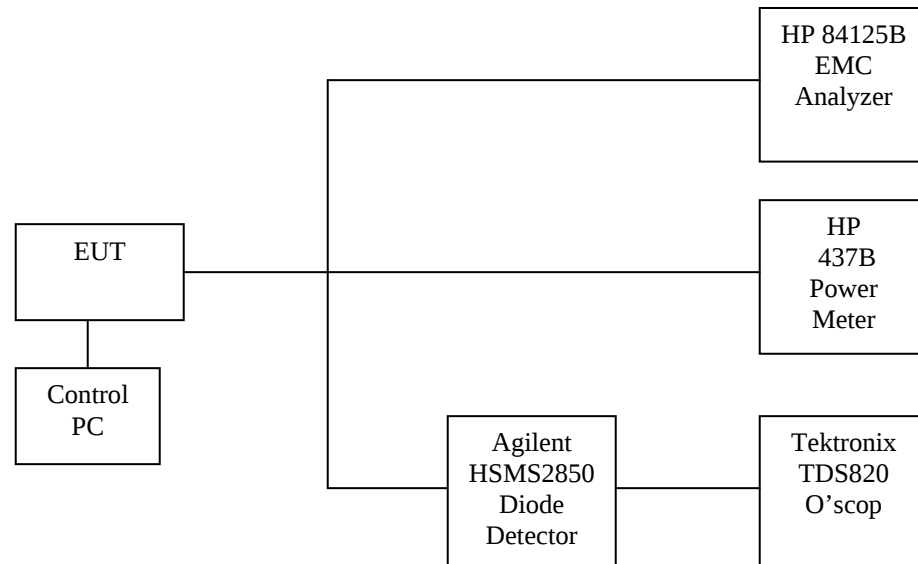
Setup A (Antenna Conducted measurements)

Operational description

ANTENNA CONDUCTED EMISSIONS MEASUREMENTS

The EUT was connected to the Laptop Computer through the serial port (COM1), the antenna bypassed and the SMA Cable connected to the Spectrum Analyzer. This setup was used for the **PEAK POWER OUTPUT, CF SEPARATION, NUMBER OF HOPPING FREQUENCIES, 20 dB BW, and RESTRICTED BAND** measurements.

Block Diagram



The solid lines are coaxial cables and the dashed lines are either EUT insertion to the test board or control cables between test setup devices. The measurement results were adjusted with the attenuation of the coaxial cable.

Setup B (Radiated measurements)

Operational description

RADIATED EMISSIONS MEASUREMENTS

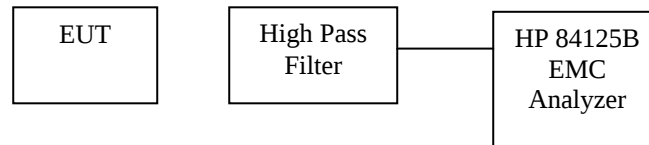
This setup was used in radiated emissions measurements with hopping enabled.

The EUT was tested in 3 orthogonal orientations.

Worst case data is presented.

THIS SETUP USED FOR ***RADIATED SPURIOUS EMISSIONS***

Block diagram



Note: The high –pass filter is used for the Radiated Spurious emissions above 2.4835 GHz. A pass-thru connector is used for Radiated Spurious emissions measurements from 30 MHz – 2.4 GHz.

The solid lines are coaxial cables and the dashed lines are either EUT insertion to the test board or control cables between test setup devices.

6.0 TEST RESULTS

The measurement results were adjusted for the attenuation of the cable between the EUT connector and receiver.

PEAK OUTPUT POWER

Peak Output Power [CFR 47, 15.247(b)(1) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	A (conducted – hopping DISABLED)
Temp, Humidity, Air Pressure	78° F, 30.28
Date of Measurement	10/13/05
Measured by	Bob Cole
Result	PASSED

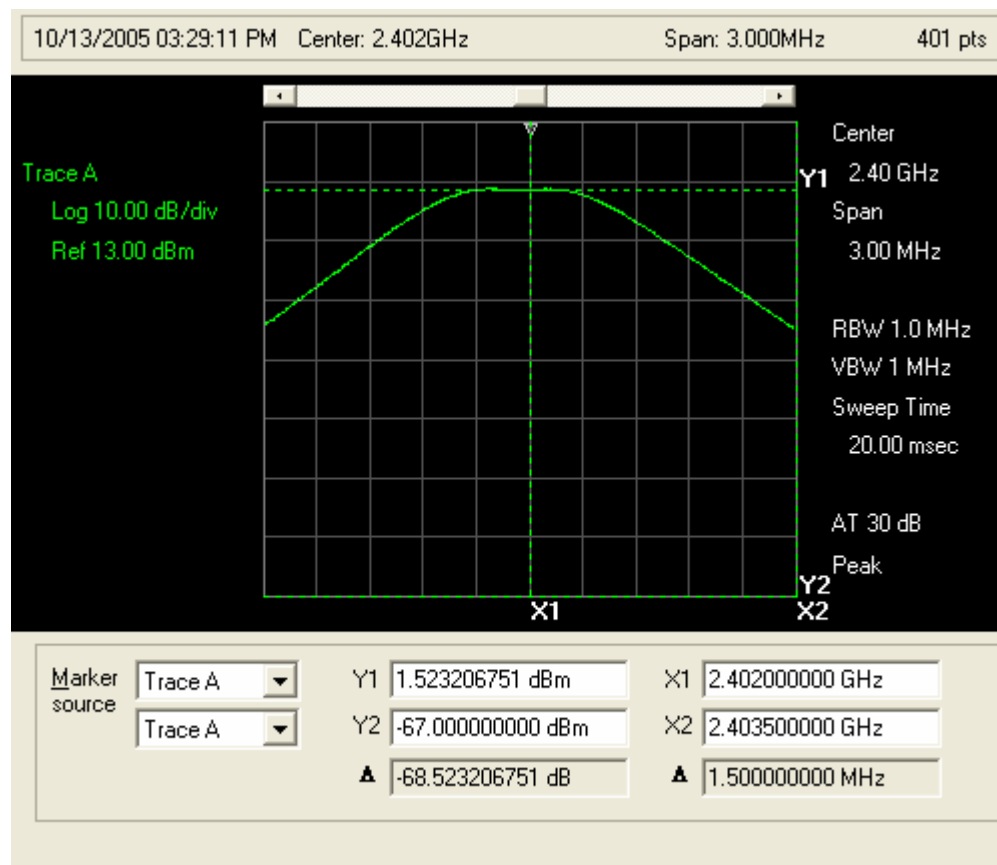
Limits and results

PEAK OUTPUT POWER

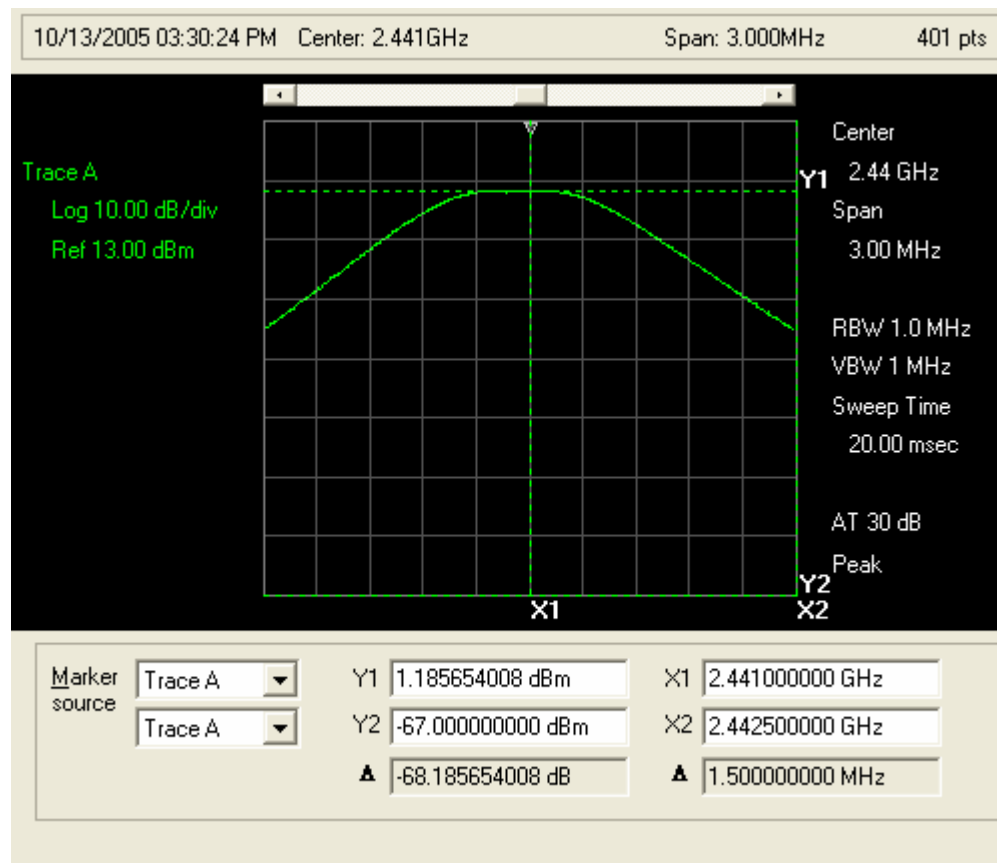
EUT Channel	Limit (dBm)	Test results (dBm)
2	30.0	1.523
40	30.0	1.186
80	30.0	1.186

Screen shots

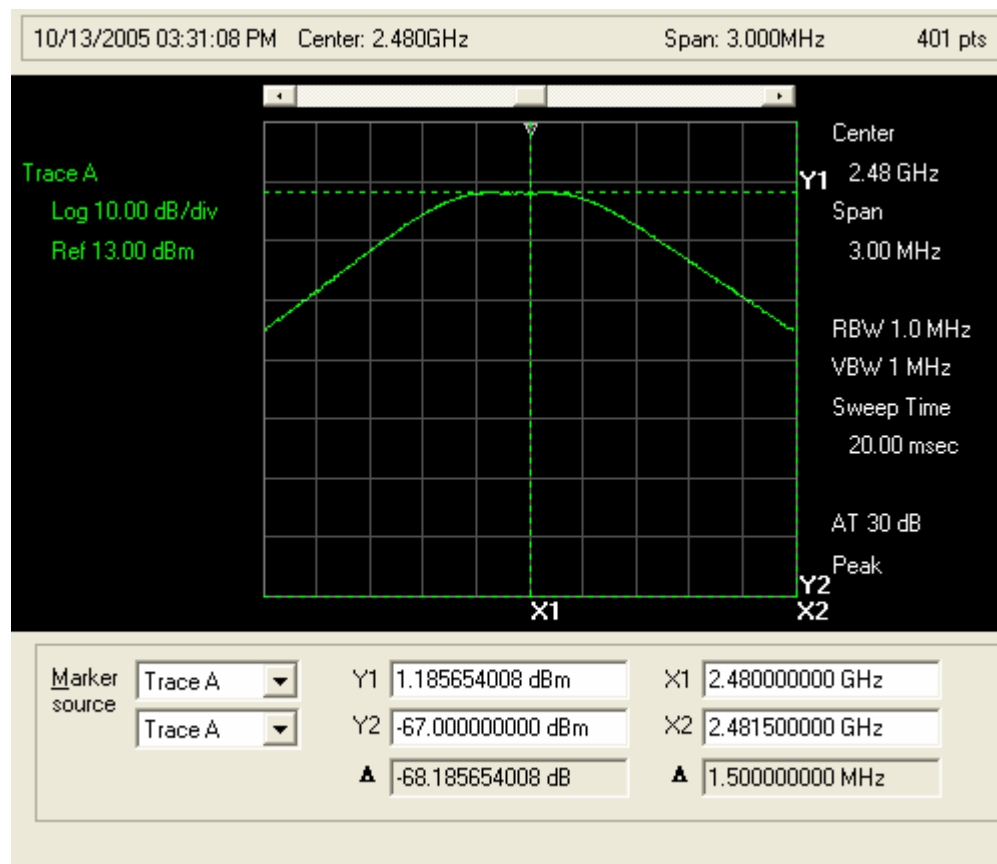
Plot 1: Peak output power 2402 MHz



Plot 2: Peak output power 2441 MHz



Plot 3: Peak output power 2480 MHz



CENTER FREQUENCY SEPARATION

CF Separation [CFR 47, 15.247 (a)(1) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	A (conducted – hopping enabled)
Temp, Humidity, Air Pressure	76° F, 29.96
Date of Measurement	10/13/05
Measured by	Bob Cole
Result	PASSED

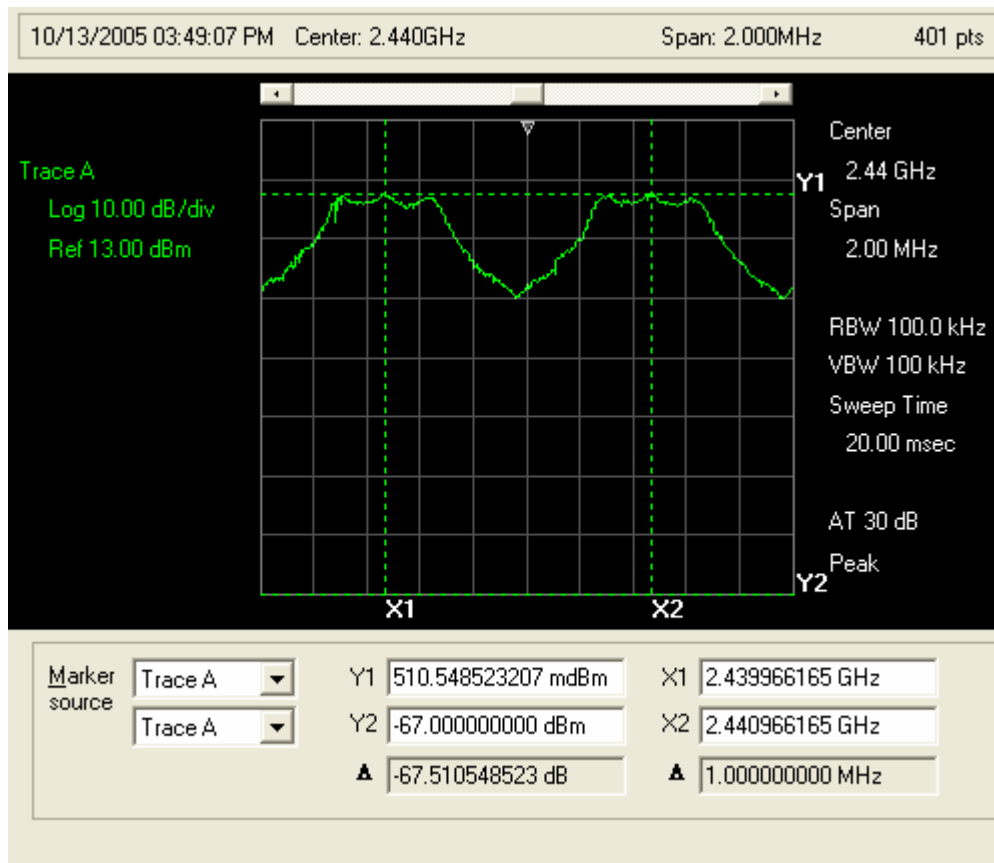
Limits and results

CENTER FREQUENCY SEPARATION

EUT Channel	Limit (MHz)	Test results (MHz)
41-42	≤ 1.0	1.000

Screen Shot:

Plot 4: CF separation



NUMBER OF HOPPING FREQUENCIES

Number of Hopping Frequencies [CFR 47, 15.247 (a)(1)(ii) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	A (conducted – hopping enabled)
Temp, Humidity, Air Pressure	80° F, 29.92
Date of Measurement	10/13/05
Measured by	Bob Cole
Result	PASSED

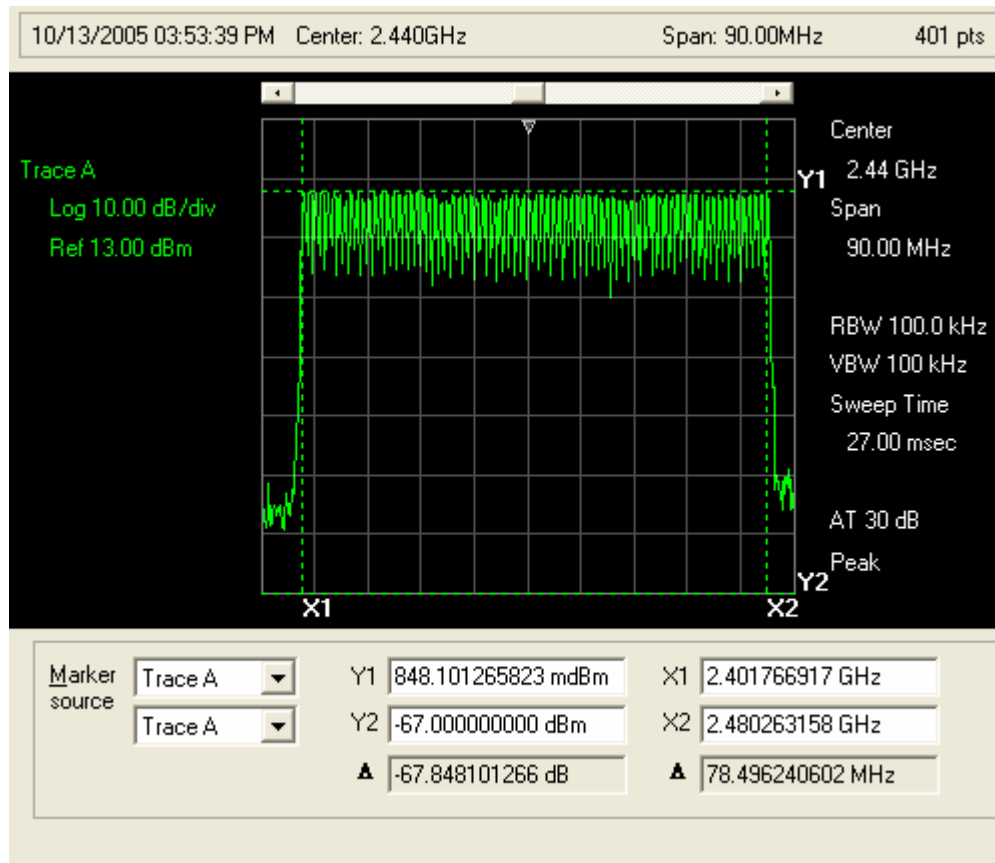
Limits and results

NUMBER OF HOPPING FREQUENCIES

EUT Channel	Limit (MHz)	Test results (MHz)
2-80	<= 75	79

Screen Shot:

Plot 5: Number of Hopping Frequencies



DWELL TIME

Dwell Time

EUT	D645
Test setup	N/A
Temp, Humidity, Air Pressure	N/A
Date of Measurement	N/A
Measured by	Bob Cole
Result	PASSED – see Bluetooth Specification below

Limits and results

DWELL TIME

EUT Channel	Limit	Test results
2	400 ms per 30 second of operation	PASSED <i>See description that follows</i>

There are five hopping sequences (section 11, Bluetooth Spec. 1.1):

- 1) A **page hopping sequence** with 32 unique wake-up frequencies distributed equally over the 79 MHz, with a period length of 32; The basic slot time can be 312.5 uS or 625 uS. Min. hop repeat rate = $32 \times 312.5\text{mS} = 10\text{mS}$.
- 2) A **page response sequence (page scan)** covering 32 unique response frequencies that all are in a one-to-one correspondence to the current page hopping sequence. The master and slave use different rules to obtain the same sequence. The basic slot time can be 312.5 uS or 625 uS and the period is 1.28s.
- 3) An **inquiry sequence** with 32 unique wake-up frequencies distributed equally over the 79 MHz, with a period length of 32; The basic slot time can be 312.5 uS or 625 uS. Min. hop repeat rate = $32 \times 312.5\text{mS} = 10\text{mS}$.
- 4) An **inquiry response sequence (inquiry scan)** covering 32 unique response frequencies that all are in a one-to-one correspondence to the current inquiry hopping sequence. The basic slot time can be 312.5 uS or 625 uS and the period is 1.28s.
- 5) A **channel hopping sequence** which has a very long period length, which does not show repetitive patterns over a short time interval, but which distributes the hop frequencies equally over the 79 MHz during a short time interval; The basic slot time is 625 uS.

Worst case dwell times (largest dwell value) would be found with #5, the Channel Hopping (or data) sequence. The other hopping sequences may short shorter time sequences; however they are not repeated as often and hence have a lower overall dwell or duty cycle.

In normal transactions one may see occasional short periods between a chosen frequency due to inquiry and page scans possibly be interleaved during data transactions. It's my understanding that this would not create a dwell cycle result worse than the Channel hopping or data sequence.

Channel Hopping Sequence (Data sequence) Dwell Calculation

Cycle time for complete hopping sequence of a 79 hop cycle (data transmission mode) =

$$(1.1) \text{ Time slot period} * 79 \text{ slots} = 625\mu\text{S} * 79 = 49.375 \text{ mS}$$

See page below from Bluetooth spec. Rev 1.1, section 2, for a depiction of the hopping sequence versus packet size. Figure 2.1 shows a DH1 cycle. Figure 2.2 shows a DH1, DH3 and DH5 sequence (resp.).

Every time slot has a frequency assignment, and the frequency used for a packet remains the same as the slot it started in, if the packet is longer than one time slot.

For a DH1 packet this does not have an impact. The channel selector steps thru the entire list of 79 pseudo-random channels and then start over from the beginning.

For a DH5 (5 Slot packet), the starting frequency will be used for all 5 time slots ($f(k)$ in this example), and 4 following frequencies will not be used during that hopping cycle. Therefore instead of stepping sequential thru the 79 frequency channel list, only every 5th channel is used. Each time the 79 frequency channel list is started, is it a new randomized list of 79 channels. The probability that it will use the same frequency channel in the next list is 1/5.

Therefore even though the DH5 is at one frequency for 5 times longer than a DH1 packet, it repeats itself 1/5 as often, with the effective dwell time (averaged over a long period over a long period of time – for instance the 30 sec FCC dwell test) being the same.

For the “duty cycle correction factor”, my “read” of the FCC doc says that one should take the “worst” 100mS period found, in contrast to the average 30 sec dwell time just mentioned. As a result the DH1 and DH5 numbers for the 100 mS dwell case will be different. For a worst case DH5 packet sequence, the same frequency channel could appear in two successive 79 channel sequences.

DH1 calculation: DH1 uses 1 time slot of 0.625 mS per hopping cycle.

Dwell time per 100mS – since one 79 hop sequence is approx 50mS, there will be approx. two hop sequences in 100 mS (more accurately $100/49.375$).

$$(1.2) \text{ DH1 dwell time} = 0.625 \text{ mS} * (100\text{ms}/49.375\text{mS}) = 1.26 \text{ mS (per 100 mS)}$$

DH5 calculation: DH5 uses 5 time slots of 0.625 mS per hopping cycle.

Dwell time per 100mS – since one 79 hop sequence is approx 50mS and there could be two appearances of a frequency channel in 100 mS (more accurately $100\text{mms}/49.375\text{ms}$).

$$(1.3) \text{ DH5 dwell time} = 5 * 0.625 \text{ mS} * (100\text{ms}/49.375\text{mS}) = 6.3 \text{ mS (per 100 mS)}$$

Using the FCC duty cycle correction factor:

$$(1.4) \text{ DH1 Dwell correction} = 20 \log (\text{DH1 dwell time}/100\text{mS}) = 20 \log (0.0126) = -38 \text{ dB}$$

$$(1.5) \text{ DH5 Dwell correction} = 20 \log (\text{DH5 dwell time}/100\text{mS}) = 20 \log (0.0633) = -24 \text{ dB}$$

Therefore the worst case duty cycle adjustment condition will be for the DH5 packet.

The calculation shows us that we can subtract 24 dB from our 2nd harmonic measurement to compensate for this duty cycle adjustment.

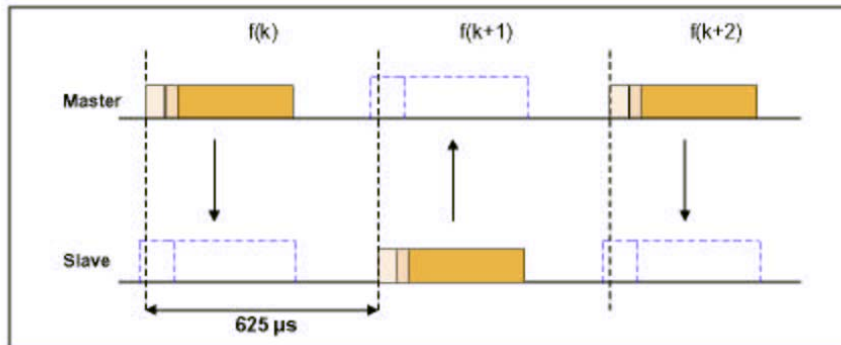


Figure 2.1: TDD and timing

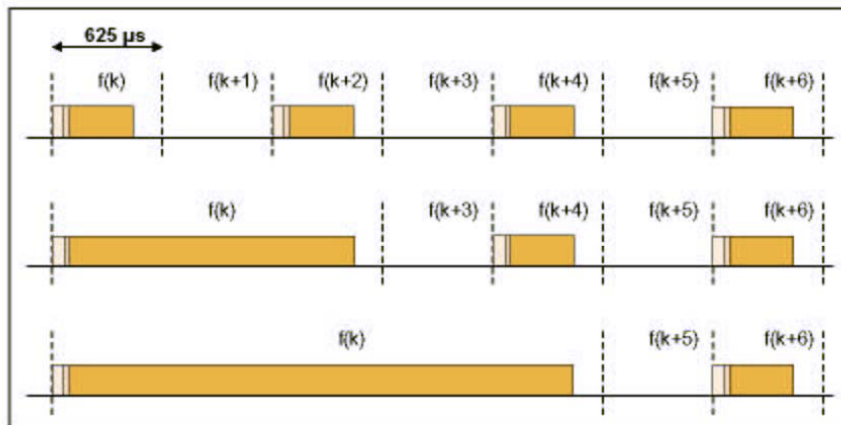


Figure 2.2: Multi-slot packets

20 dB Bandwidth

20 dB Bandwidth [CFR 47 15.247 (a)(1)(ii) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	A (conducted – hopping DISABLED)
Temp, Humidity, Air Pressure	78° F, 30.87
Date of Measurement	10/13/05
Measured by	Bob Cole
Result	PASSED

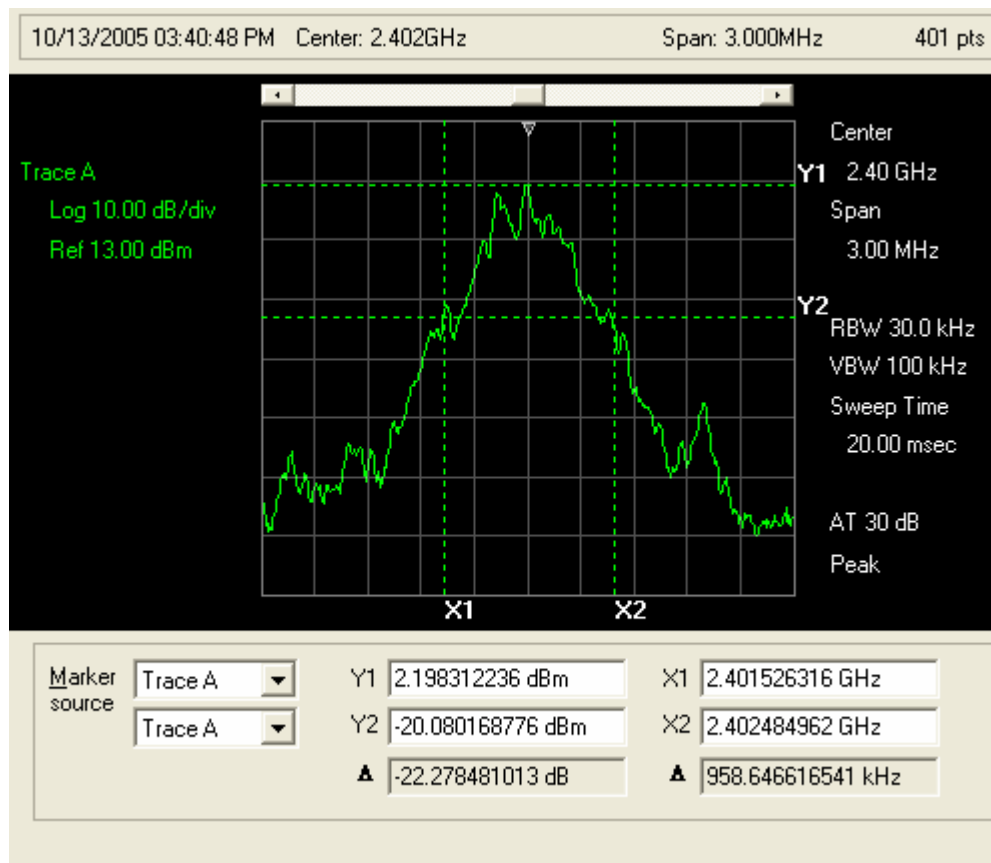
Limits and Results

20 dB BANDWIDTH

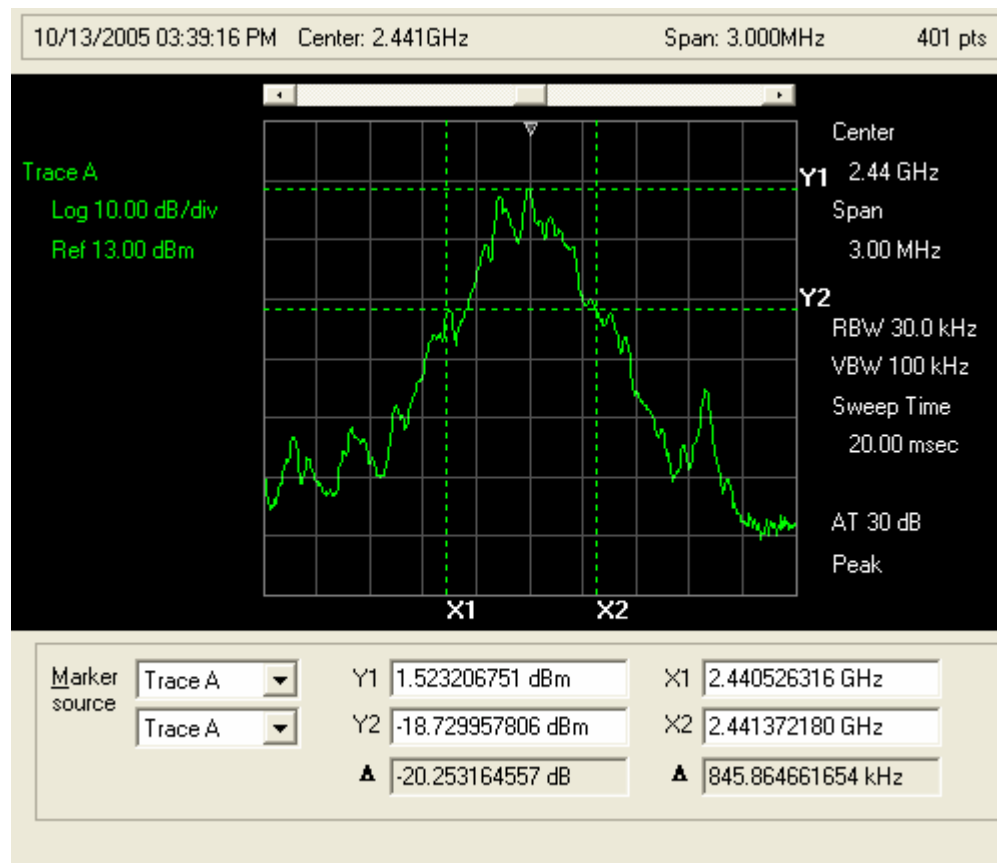
EUT Channel	Limit (MHz)	Test results (MHz)
2	≤ 1.0	0.958
40	≤ 1.0	0.845
80	≤ 1.0	0.947

Screen Shots

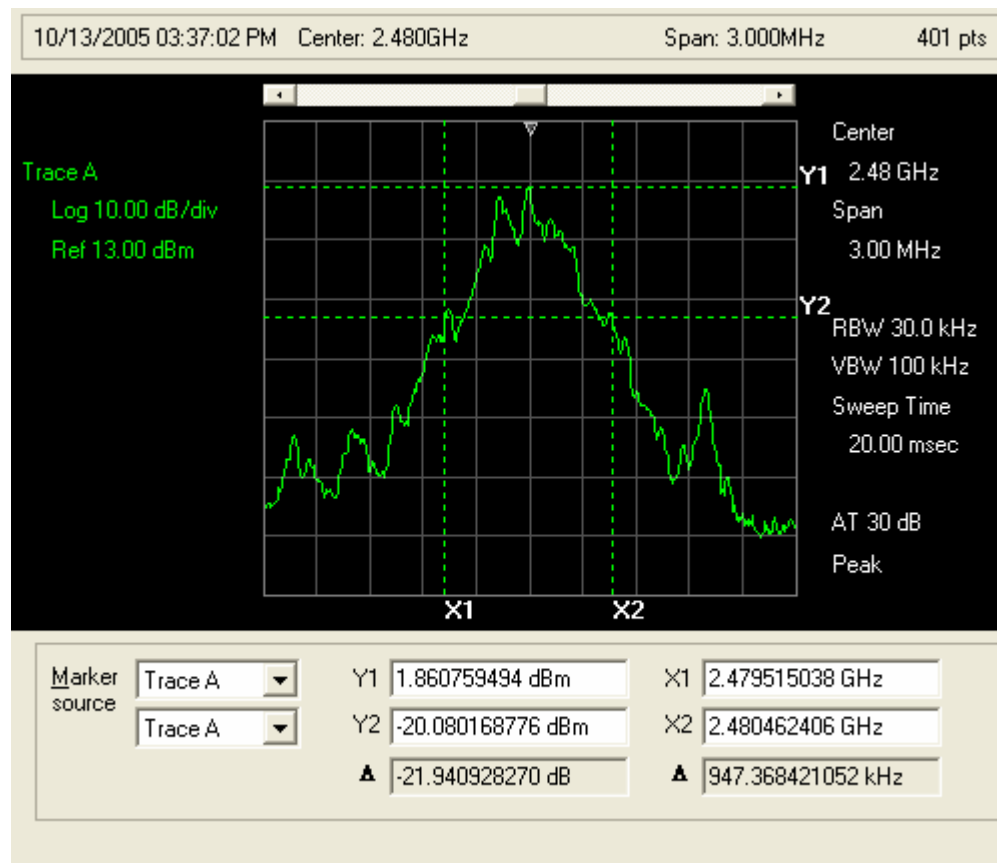
Plot 6: 20 dB BW 2402 MHz



Plot 7: 20 dB BW 2441 MHz



Plot 8: 20 dB BW 2480 MHz



BAND-EDGE COMPLIANCE

Band-edge compliance of RF Radiated emissions [CFR 47, 15.247c(1) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	A (conducted – hopping enabled & Disabled)
Temp, Humidity, Air Pressure	79° F, 30.72
Date of Measurement	10/24/05
Measured by	Bob Cole
Result	PASSED

EUT operation mode

EUT operation mode	Hopping Enabled / Disabled
EUT channel	2, 80
EUT TX power level	Maximum

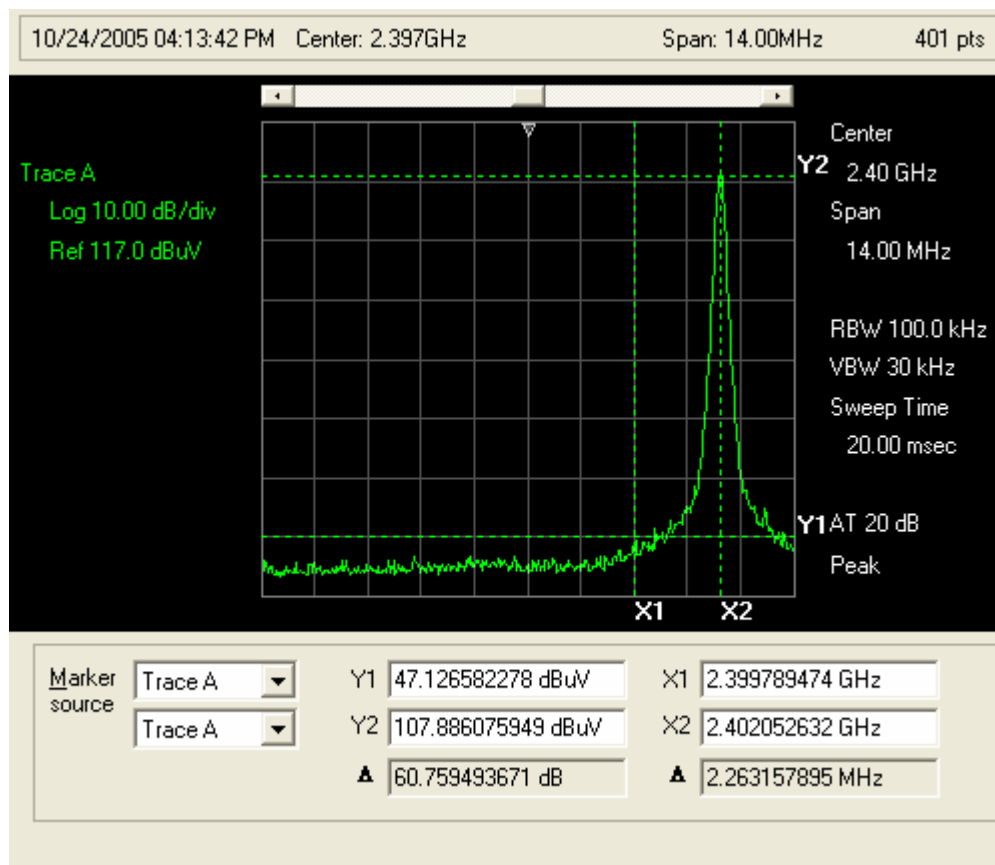
Limits and results

BAND-EDGE COMPLIANCE

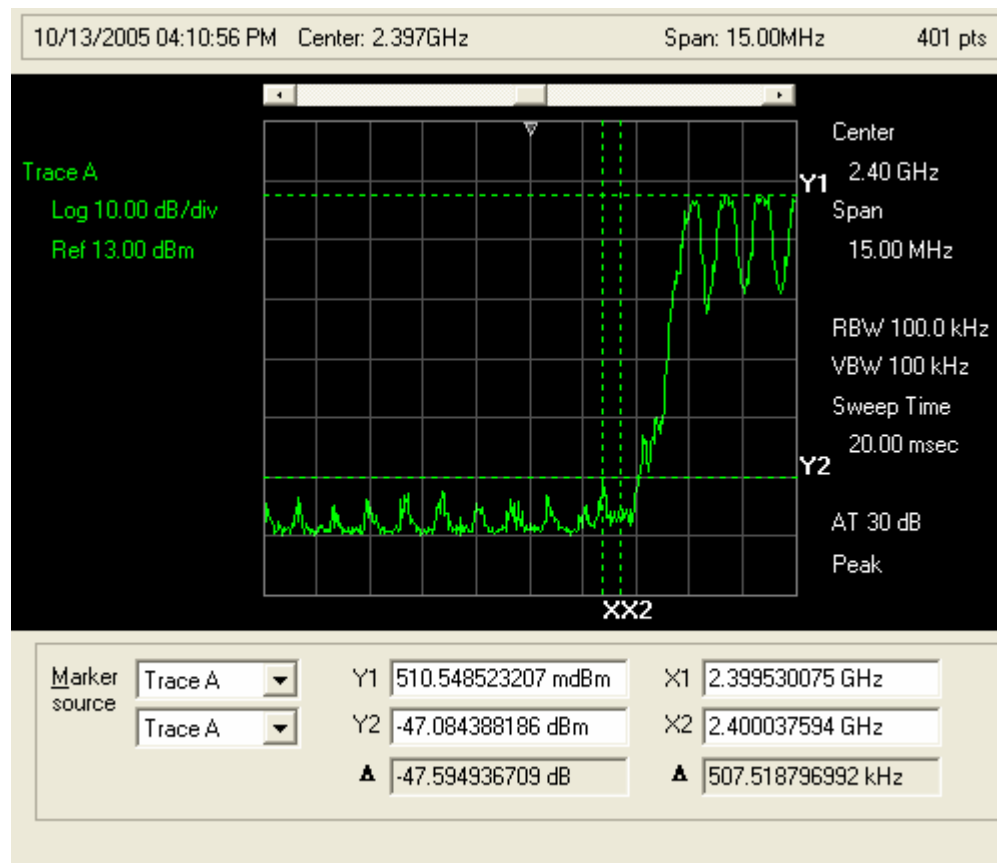
Channel	Limit (dBm)	Results (dBm)
2	-6.0	-47.38
80	-6.0	-47.04

Screen shots:

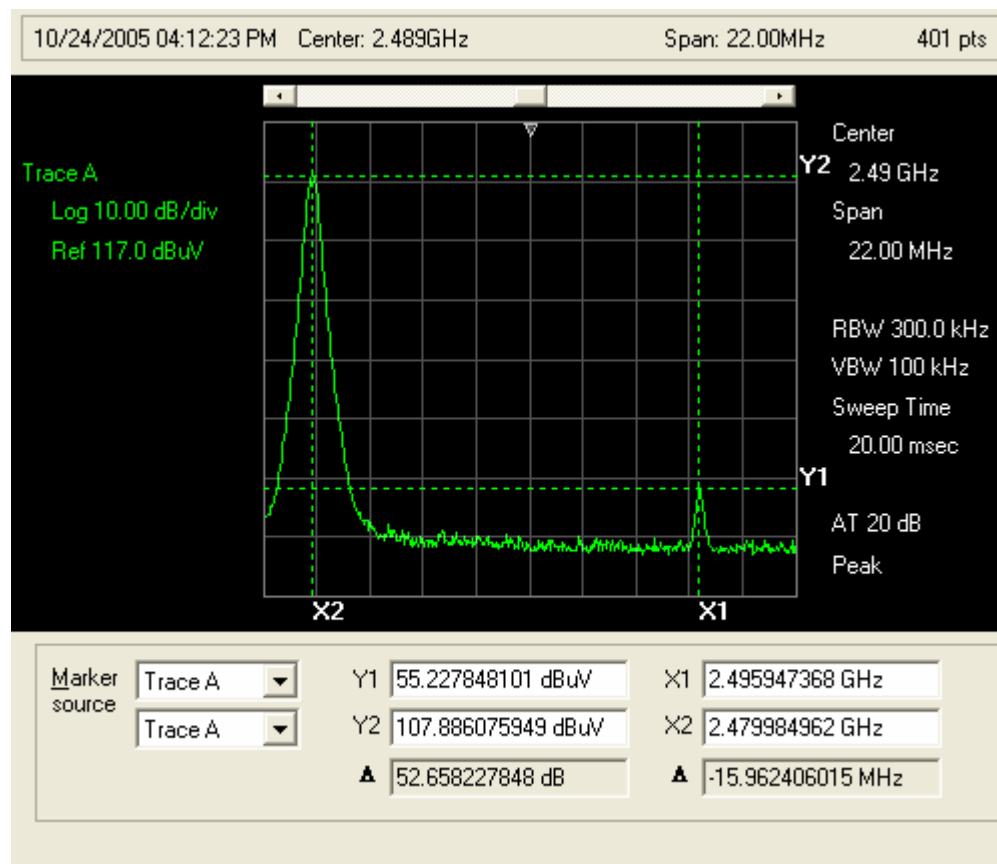
Plot 9: Band-edge Compliance, Lower Band-edge (Hopping Disabled)



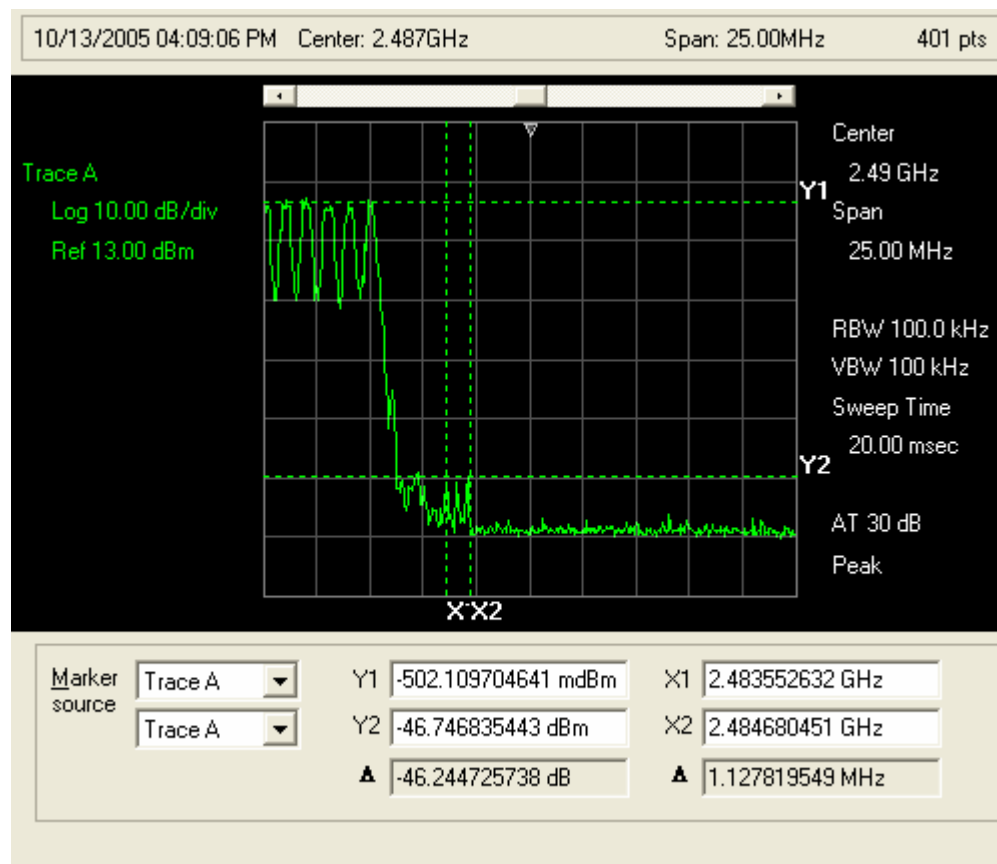
Plot 10: Band-edge Compliance, Lower Band-edge (Hopping Enabled)



Plot 11: Band-edge compliance, Upper Band-edge (Hopping Disabled)



Plot 12: Band-edge Compliance, Upper Band-edge (Hopping Enabled)



RESTRICTED BAND MEASUREMENTS

Restricted Band Measurements [CFR 47, 15.247(c) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	B (Radiated – hopping enabled)
Temp, Humidity, Air Pressure	78° F, 30.02
Date of Measurement	10/13/05
Measured by	Bob Cole
Result	PASSED

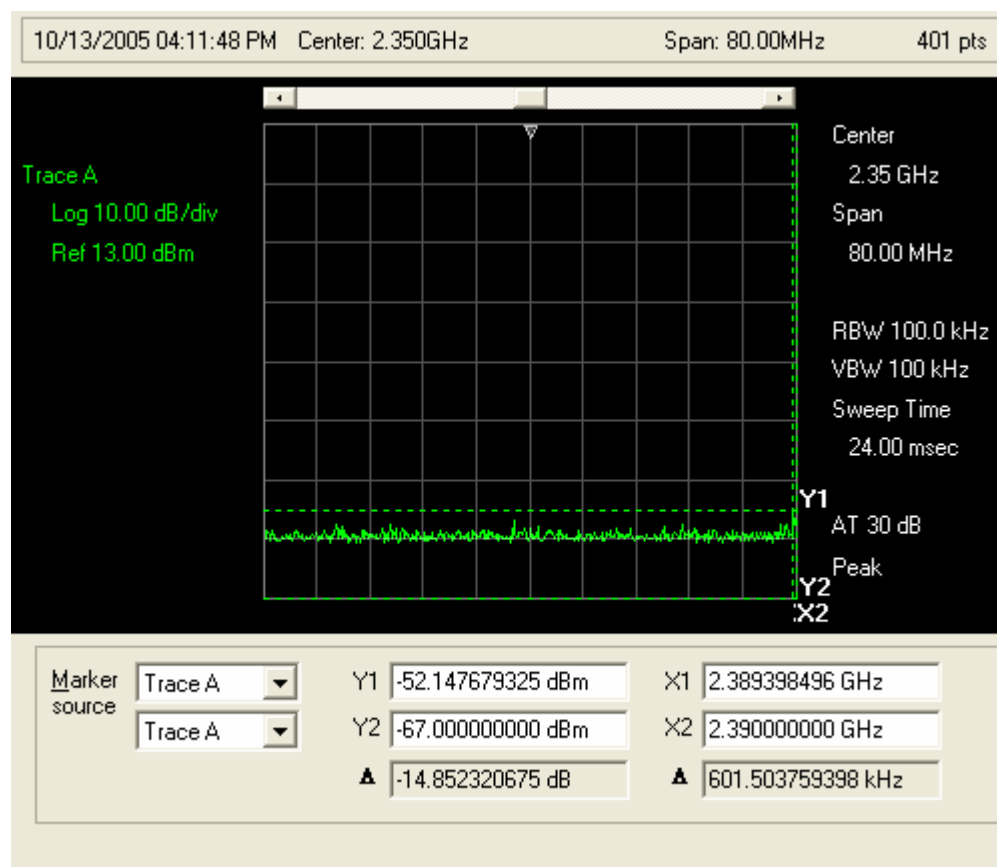
Limits and results

RESTRICTED BANDS

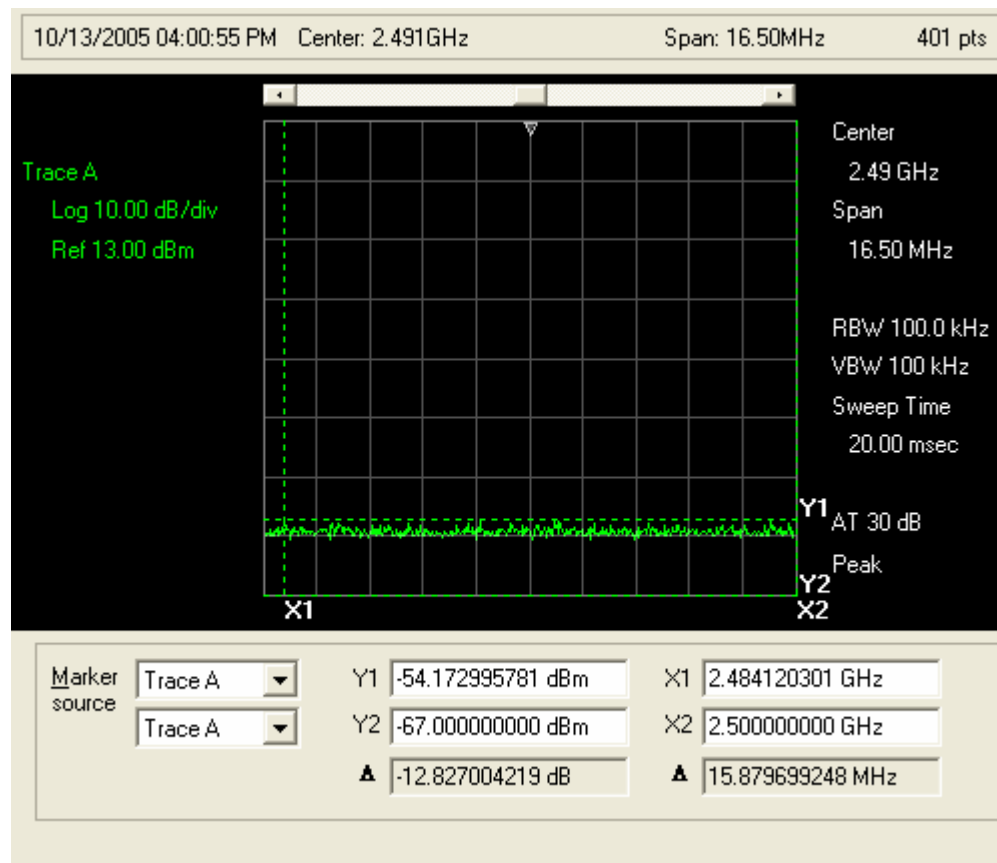
Frequency (MHz)	Limit (dBm)	Results (dBuV)
2310 - 2390	-6.0	-52.15
2483.5-2500	-6.0	-54.17

Note: All restricted Bands from 30 MHz to 18 GHz were examined.

Plot 13: 2310 - 2390 MHz Restricted Band



Plot 14: 2483.5 – 2500 MHz Restricted Band



SPURIOUS RF RADIATED EMISSIONS

Spurious RF Radiated Emissions [CFR 47, 15.247c1) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	B (Radiated – hopping enabled)
Temp, Humidity, Air Pressure	77° F, 30.38
Date of Measurement	10/24/05
Measured by	Bob Cole
Result	PASSED

CLASS B LIMIT (10M MEASURING DISTANCE)

Frequency Band (MHz)	Limit (dBµV/m)	Detector
30-88	40	Q-Peak
88-230	43.5	Q-Peak
230-960	46	Q-Peak
960-1000	54	Q-Peak
1000-25000	54	Average

Emission measurement data, 30 MHz – 1GHz

The measurement results were obtained as described below.

$$E[\mu\text{V/m}] = U_{RX} + A_{CABLE} + AF - G_{PREAMP}$$

Where:

U_{RX}	receiver reading
A_{CABLE}	Attenuation of the cable
AF	Antenna Factor
G_{PREAMP}	Gain of the preamplifier

RADIATED EMISSIONS, 30-1000 MHz (10 meter Measurement Distance)
CFR 47, 15.209 Limits

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
Specification: **FCC 15_209 RADIATED**
Work Order #: **2460** Date: 10/14/2005
Test Type: **Radiated Scan** Time: 12:33:04
Equipment: **Bluetooth Headset** Sequence#: 1
Manufacturer: Plantronics Tested By: Bob Cole
Model: D645
S/N: N/A

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Bluetooth Headset*	Plantronics	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

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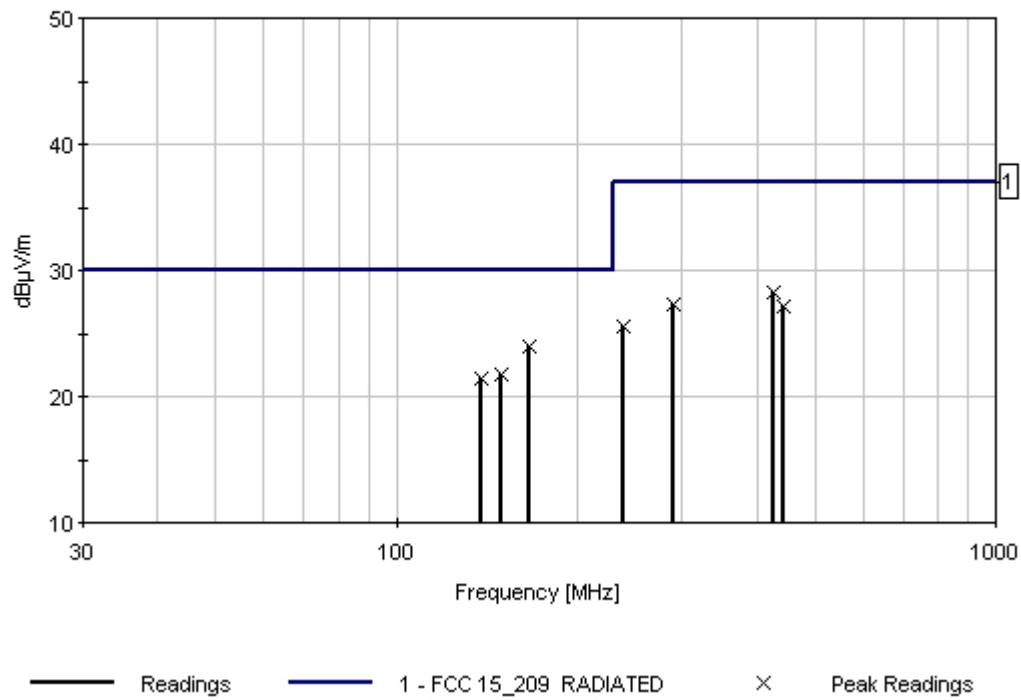
Transducer Legend:

T1=AH SAS-200/543 S/N: 199	T2=AH Log P SAS-200_510 S-N853
T3=EMCE Y1 Cable - Radiated Site	T4=8447 Pre-Amp

Measurement Data: Reading listed by margin. Test Distance: 10 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	166.870M	35.5	+12.7	+0.0	+2.4	+26.6	+0.0	24.0	30.0	-6.0	Horiz
2	149.995M	34.4	+11.6	+0.0	+2.3	+26.6	+0.0	21.7	30.0	-8.3	Horiz
3	138.400M	34.5	+11.3	+0.0	+2.2	+26.6	+0.0	21.4	30.0	-8.6	Vert
4	425.750M	35.2	+0.0	+16.0	+3.9	+26.8	+0.0	28.3	37.0	-8.7	Horiz
5	290.045M	33.3	+17.6	+0.0	+3.1	+26.7	+0.0	27.3	37.0	-9.7	Vert
6	443.220M	33.1	+0.0	+17.0	+3.9	+26.8	+0.0	27.2	37.0	-9.8	Vert
7	240.045M	34.0	+15.4	+0.0	+2.8	+26.7	+0.0	25.5	37.0	-11.5	Vert

EMCE Engineering Plantronics W/O#: 2460
FCC 15_209 RADIATED Test Distance: 10 Meters Sequence#: 1



1.0 - 2.4835 GHz Test Data

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: Plantronics	
Specification: BT FCC Radiated 1--2.4 GHz	
Work Order #: 2460	Date: 10/25/2005
Test Type: Radiated Scan	Time: 11:50:04 AM
Equipment: Bluetooth Headset	Sequence#: 5
Manufacturer: Plantronics	Tested By: Bob Cole
Model: D645	
S/N: N/A	

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Bluetooth Headset*	Plantronics	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
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Test Conditions / Notes:

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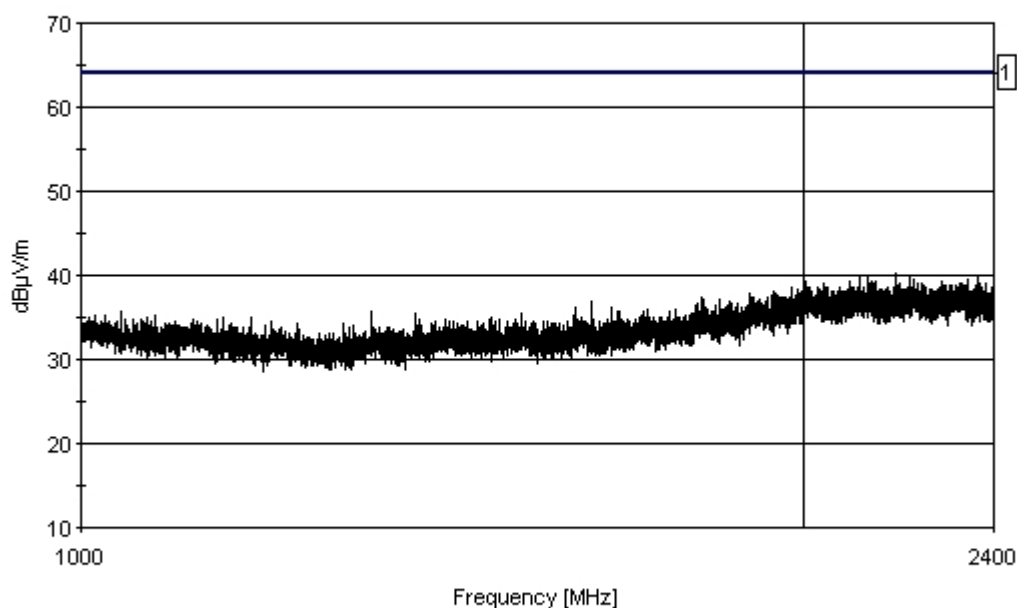
Transducer Legend:

T1=Chamber Receive Cable	T2=EMCO LPA-30 Log Periodic 1 meter
T3=A.H. SAS-200/571 Horn 1 meter	T4=HP 83051A RF Preamp

Measurement Data: Reading listed by margin. Test Distance: 1 Meter

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
2	2185.084M	33.5	+4.3	+0.0	+28.9	+26.5	+0.0	40.2	64.0	-23.8	Horiz
3	2363.876M	33.0	+4.4	+0.0	+29.0	+26.5	+0.0	39.9	64.0	-24.1	Horiz
4	2111.610M	33.2	+4.3	+0.0	+28.8	+26.5	+0.0	39.8	64.0	-24.2	Horiz
5	2216.015M	33.0	+4.3	+0.0	+28.9	+26.5	+0.0	39.7	64.0	-24.3	Horiz
6	2341.273M	32.7	+4.4	+0.0	+29.0	+26.5	+0.0	39.6	64.0	-24.4	Horiz
7	2223.322M	32.8	+4.3	+0.0	+28.9	+26.5	+0.0	39.5	64.0	-24.5	Horiz
8	2142.942M	32.8	+4.3	+0.0	+28.8	+26.5	+0.0	39.4	64.0	-24.6	Horiz
9	2285.084M	32.6	+4.4	+0.0	+28.9	+26.5	+0.0	39.4	64.0	-24.6	Horiz
10	2089.889M	32.7	+4.3	+0.0	+28.8	+26.5	+0.0	39.3	64.0	-24.7	Horiz

EMCE Engineering Date: 10/25/2005 Time: 11:50:04 AM Plantronics W/O#: 2460
BT FCC Radiated 1--2.4 GHz Test Distance: 1 Meter Sequence#: 5



— Sweep Data — 1 - BT FCC Radiated 1--2.4 GHz

2.4835 – 25 GHz Test Data

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: Plantronics	
Specification: BT FCC Radiated 2483-12750 MHz	
Work Order #: 2460	Date: 10/19/2005
Test Type: Radiated Scan	Time: 12:19:12 PM
Equipment: BT Headset	Sequence#: 6
Manufacturer: Plantronics, Inc.	Tested By: Bob Cole
Model: D645	
S/N: N/A	

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
BT Headset*	Plantronics, Inc.	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

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Transducer Legend:

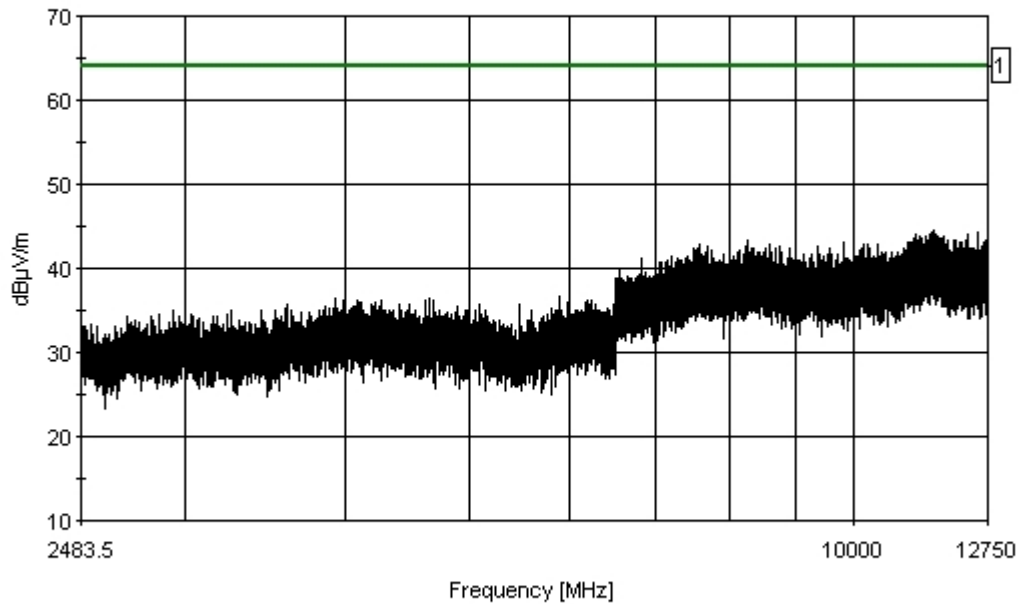
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Measurement Data: Reading listed by margin. Test Distance: 1 Meter

#	Freq MHz	Rdng dB μ V					Dist Table	Corr dB μ V/m	Spec dB μ V/m	Margin dB	Polar Ant
1	11583.170 M	44.6					+0.0	44.6	64.0	-19.4	Maxim
2	11581.910 M	44.4					+0.0	44.4	64.0	-19.6	Maxim
3	11532.620 M	44.2					+0.0	44.2	64.0	-19.8	Maxim
4	12515.590 M	44.2					+0.0	44.2	64.0	-19.8	Maxim
5	11600.430 M	44.1					+0.0	44.1	64.0	-19.9	Maxim
6	12278.110 M	44.1					+0.0	44.1	64.0	-19.9	Maxim
7	11212.800 M	44.0					+0.0	44.0	64.0	-20.0	Maxim

8	11467.800 M	44.0	+0.0	44.0	64.0	-20.0	Maxim
9	11787.120 M	43.8	+0.0	43.8	64.0	-20.2	Maxim
10	5150.751M	35.1	+0.0	35.1	64.0	-28.9	Maxim

EMCE Engineering Date: 10/19/2005 Time: 12:19:12 PM Plantronics W/O#: 2460
BT FCC Radiated 2483-12750 MHz Test Distance: 1 Meter Sequence#: 6



— Sweep Data — 1 - BT FCC Radiated 2483-12750 MHz

RECEIVER SPURIOUS RADIATED EMISSIONS

Spurious RF Radiated Emissions [CFR 47, 15.247c1) and RSS-210 6.2.2(o)]

EUT	D645
Test setup	B (Radiated – hopping enabled)
Temp, Humidity, Air Pressure	74° F, 30.38
Date of Measurement	10/19/05
Measured by	Bob Cole
Result	PASSED

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
 Specification: **BT RX Radiated 1000-12750**
 Work Order #: **2460**
 Test Type: **Radiated Scan**
 Equipment: **BT Headset**
 Manufacturer: Plantronics, Inc.
 Model: D645
 S/N: N/A

Date: 10/25/2005
 Time: 11:36:09 AM
 Sequence#: 8
 Tested By: Bob Cole

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
BT Headset*	Plantronics, Inc.	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

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Transducer Legend:

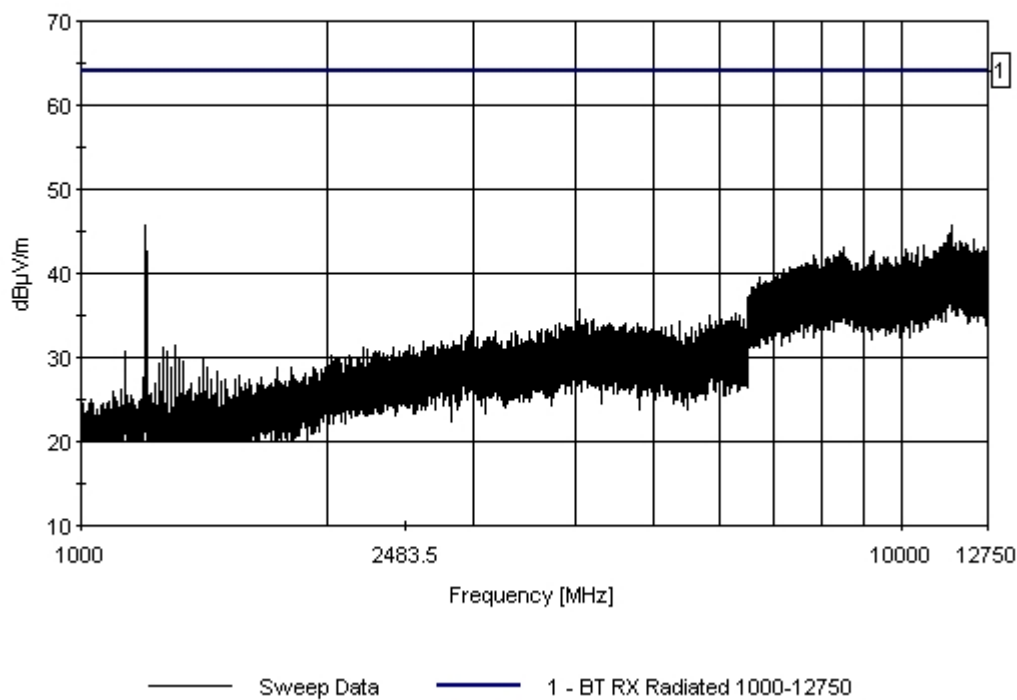
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Measurement Data: Reading listed by margin. Test Distance: 1 Meter

#	Freq MHz	Rdng dBµV	dB	dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	1200.200M	45.6					+0.0	45.6	64.0	-18.4	Maxim
2	11494.720 M	45.6					+0.0	45.6	64.0	-18.4	Maxim
3	11438.170 M	44.8					+0.0	44.8	64.0	-19.2	Maxim

4	11371.100 M	44.5	+0.0	44.5	64.0	-19.5	Maxim
5	12223.950 M	44.0	+0.0	44.0	64.0	-20.0	Maxim
6	11419.150 M	43.8	+0.0	43.8	64.0	-20.2	Maxim
7	11764.490 M	43.8	+0.0	43.8	64.0	-20.2	Maxim
8	11368.850 M	43.7	+0.0	43.7	64.0	-20.3	Maxim
9	11376.610 M	43.6	+0.0	43.6	64.0	-20.4	Maxim
10	11488.720 M	43.6	+0.0	43.6	64.0	-20.4	Maxim

EMCE Engineering Date: 10/25/2005 Time: 11:36:09 AM Plantronics WVO#: 2460
BT RX Radiated 1000-12750 Test Distance: 1 Meter Sequence#: 8



TRANSMITTER SPURIOUS CONDUCTED EMISSIONS

Spurious Conducted Emissions 1 GHz - 26 GHz – Worst Case Emission

Spurious Antenna Conducted Emissions 1.0 – 2.4 GHz

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
 Specification: **BT Spurious Cond. 1 - 2.4GHz**
 Work Order #: **2460** Date: 10/24/2005
 Test Type: **Conducted Emissions** Time: 1:03:49 PM
 Equipment: **BT Headset** Sequence#: 17
 Manufacturer: Plantronics, Inc. Tested By: Bob Cole
 Model: D645 120V 60Hz
 S/N: N/A

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
BT Headset*	Plantronics, Inc.	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

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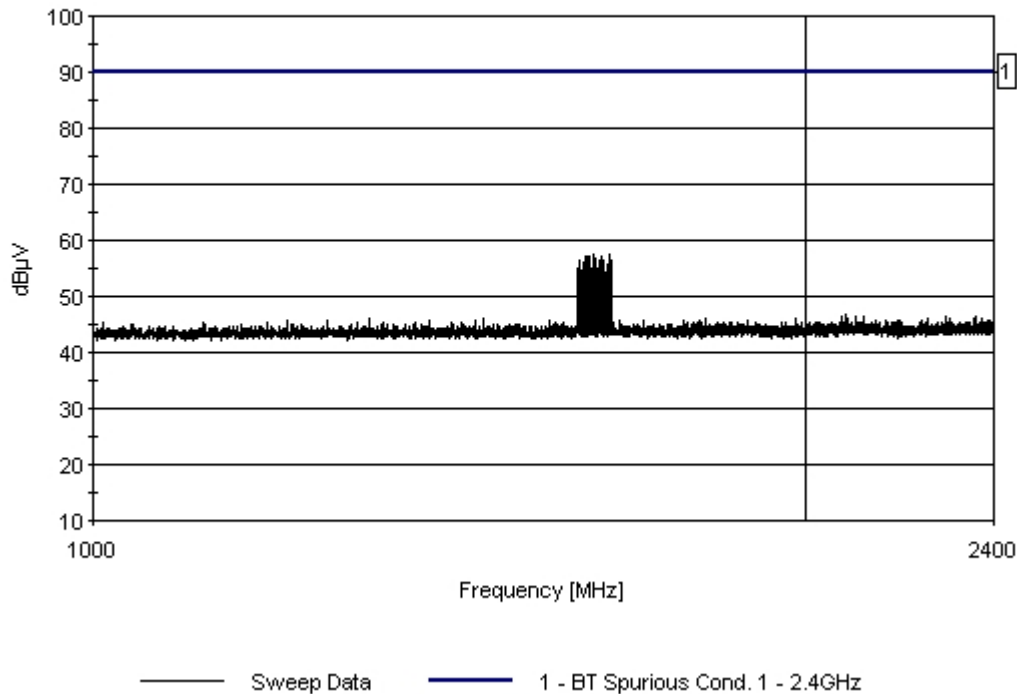
Transducer Legend:

T1=HP 83051A RF Preamp

Measurement Data:			Reading listed by margin.					Test Lead: Antenna Terminal				
#	Freq MHz	Rdng dBµV	T1 dB					Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1626.125M	84.0	+26.5					+0.0	57.5	90.0	-32.5	Anten
2	1650.650M	83.9	+26.5					+0.0	57.4	90.0	-32.6	Anten
3	1614.614M	83.8	+26.5					+0.0	57.3	90.0	-32.7	Anten
4	1616.866M	83.8	+26.5					+0.0	57.3	90.0	-32.7	Anten
5	1652.652M	83.8	+26.5					+0.0	57.3	90.0	-32.7	Anten
6	1620.870M	83.7	+26.5					+0.0	57.2	90.0	-32.8	Anten
7	1639.389M	83.7	+26.5					+0.0	57.2	90.0	-32.8	Anten
8	1630.129M	83.2	+26.5					+0.0	56.7	90.0	-33.3	Anten

9	1628.127M	83.1	+26.5	+0.0	56.6	90.0	-33.4	Anten
10	1637.387M	83.1	+26.5	+0.0	56.6	90.0	-33.4	Anten

EMCE Engineering Date: 10/24/2005 Time: 1:03:49 PM Plantronics WO#: 2460
BT Spurious Cond. 1 - 2.4GHz Test Lead: Antenna Terminal 120V 60Hz Sequence#: 17



Spurious Antenna Conducted Emissions 2.4835-18 GHz

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
Specification: **BT Ant Spur Cond Upper**
Work Order #: **2460**
Test Type: **Conducted Emissions**
Equipment: **BT Headset**
Manufacturer: Plantronics, Inc.
Model: D645
S/N: N/A

Date: 10/24/2005
Time: 1:08:24 PM
Sequence#: 18
Tested By: Bob Cole
120V 60Hz

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
BT Headset*	Plantronics, Inc.	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

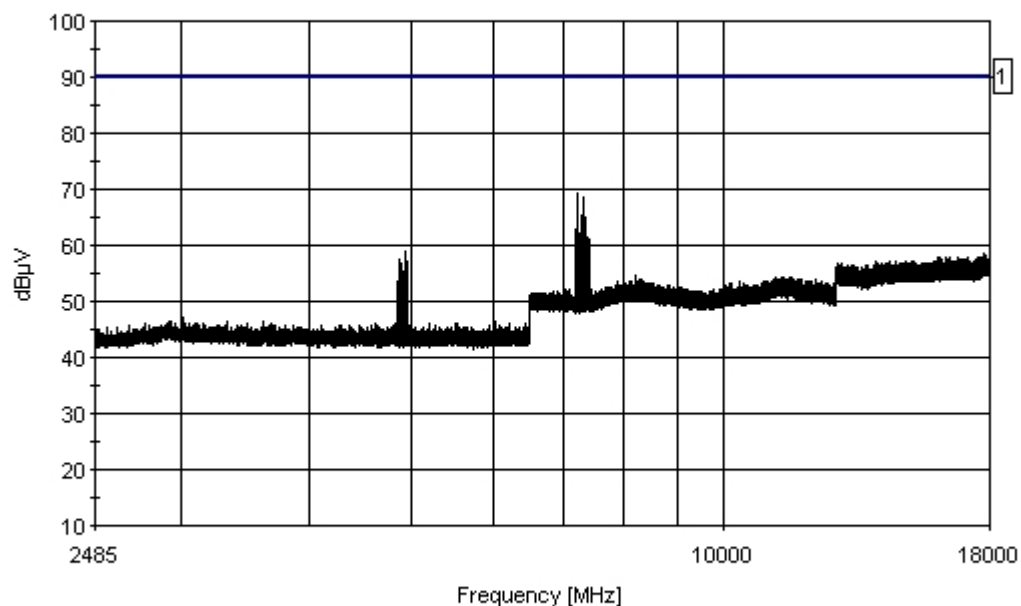
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Transducer Legend:

T1=HP 83051A RF Preamp

Measurement Data:		Reading listed by margin.				Test Lead: Antenna Terminal					
#	Freq MHz	Rdng dBμV	T1 dB				Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	7227.242M	95.8	+26.5				+0.0	69.3	90.0	-20.7	Anten
2	7221.236M	95.6	+26.5				+0.0	69.1	90.0	-20.9	Anten
3	7317.082M	95.1	+26.5				+0.0	68.6	90.0	-21.4	Anten
4	7323.088M	94.8	+26.5				+0.0	68.3	90.0	-21.7	Anten
5	7311.076M	94.2	+26.5				+0.0	67.7	90.0	-22.3	Anten
6	7329.094M	94.0	+26.5				+0.0	67.5	90.0	-22.5	Anten
7	7233.249M	93.9	+26.5				+0.0	67.4	90.0	-22.6	Anten
8	7214.980M	93.7	+26.5				+0.0	67.2	90.0	-22.8	Anten
9	7305.070M	91.9	+26.5				+0.0	65.4	90.0	-24.6	Anten
10	7335.100M	91.9	+26.5				+0.0	65.4	90.0	-24.6	Anten

EMCE Engineering Date: 10/24/2005 Time: 1:08:24 PM Plantronics W/O#: 2460
BT Ant Spur Cond Upper Test Lead: Antenna Terminal 120V 60Hz Sequence#: 18



— Sweep Data — 1 - BT Ant Spur Cond Upper

RECEIVER CONDUCTED EMISSIONS

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: Plantronics	Date: 10/24/2005
Specification: BT RX Conducted 30M-18G	Time: 3:20:29 PM
Work Order #: 2460	Sequence#: 23
Test Type: Conducted Emissions	Tested By: Bob Cole
Equipment: BT Headset	120V 60Hz
Manufacturer: Plantronics, Inc.	
Model: D645	
S/N: N/A	

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
BT Headset*	Plantronics, Inc.	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
Laptop Computer	Compaq Presario	1649	3882A744

Test Conditions / Notes:

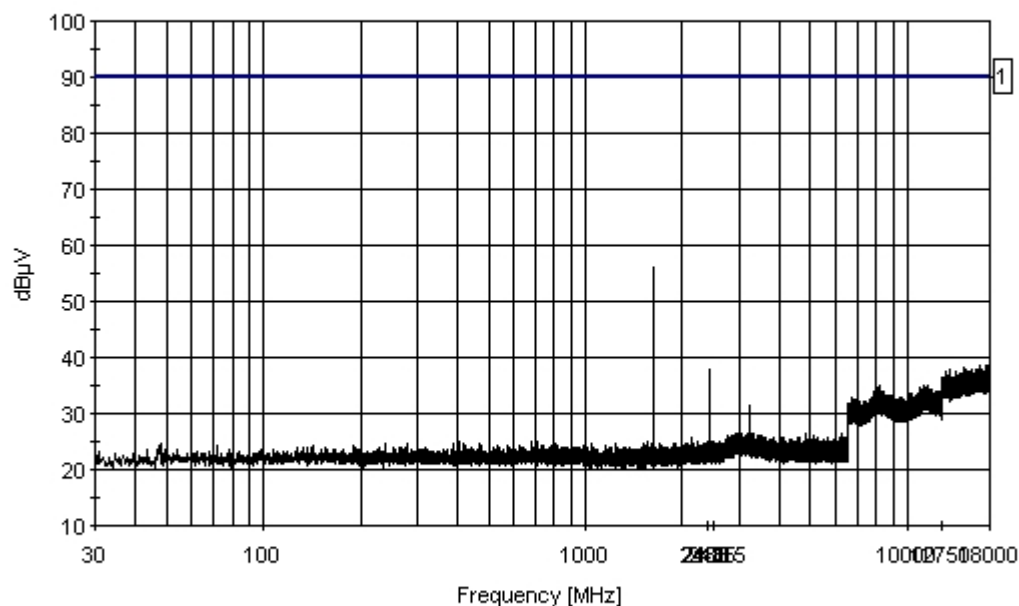
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Transducer Legend:

T1=HP 83051A RF Preamp

Measurement Data:		Reading listed by margin.					Test Lead: Antenna Terminal				
#	Freq MHz	Rdng dBµV	T1 dB				Dist Table	Corr dBµV	Spec dBµV	Margin dB	Polar Ant
1	1626.376M	82.7	+26.5				+0.0	56.2	90.0	-33.8	Anten
2	16852.840M	65.2	+26.5				+0.0	38.7	90.0	-51.3	Anten
3	17982.750M	65.1	+26.5				+0.0	38.6	90.0	-51.4	Anten
4	17562.050M	65.0	+26.5				+0.0	38.5	90.0	-51.5	Anten
5	17683.170M	65.0	+26.5				+0.0	38.5	90.0	-51.5	Anten
6	17718.700M	65.0	+26.5				+0.0	38.5	90.0	-51.5	Anten
7	17878.360M	64.7	+26.5				+0.0	38.2	90.0	-51.8	Anten
8	14877.360M	64.6	+26.5				+0.0	38.1	90.0	-51.9	Anten
9	2439.688M	64.5	+26.5				+0.0	38.0	90.0	-52.0	Anten
10	15194.430M	64.5	+26.5				+0.0	38.0	90.0	-52.0	Anten

EMCE Engineering Date: 10/24/2005 Time: 3:20:29 PM Plantronics W/O#: 2460
BT RX Conducted 30M-18G Test Lead: Antenna Terminal 120V 60Hz Sequence#: 23



AC LINE CONDUCTED EMISSIONS MEASUREMENT

AC Line Conducted Emissions Measurement 150 kHz – 30 MHz

EUT	D645 – US Version AC Adaptor
Test setup	C (conducted – hopping enabled)
Temp, Humidity, Air Pressure	74° F, 30.69
Date of Measurement	10/25/05
Measured by	Bob Cole
Result	PASSED

CLASS B LIMIT

Frequency Band (MHz)	EN 55022 B Limit (dBµV/m)	Detector
0.15 – 0.5	66 to 56	QP
0.5 – 5.0	56	QP
5.0 – 30.0	60	QP

EUT operation mode

EUT operation mode	Hopping Enabled
EUT channel	Hopping
EUT TX power level	Maximum
EUT operation voltage	230 VAC

LINE CONDUCTED EMISSIONS, .15 - 30 MHz EN 55022 Class B Limits

LINE 1 - HOT

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
 Specification: **EN55022 B COND [AVE]**
 Work Order #: **2460**
 Test Type: **Conducted Emissions**
 Equipment: **Bluetooth Headset**
 Manufacturer: **Plantronics**
 Model: **D645**
 S/N: **N/A**

Date: 10/27/2005
 Time: 12:20:14 PM
 Sequence#: 7
 Tested By: Bob Cole
 230V 50Hz

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Bluetooth Headset*	Plantronics	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
AC Adaptor	Plantronics	EU	N/A

Test Conditions / Notes:

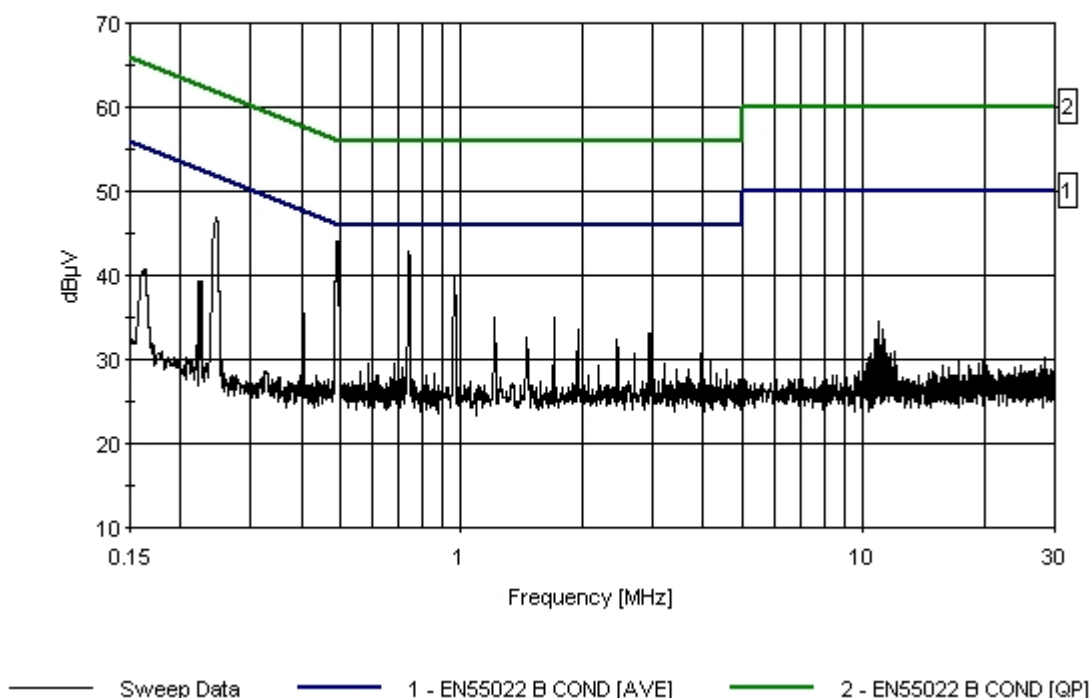
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Transducer Legend:

T1=LISN 1	T2=Chamber Receive Cable
T3=HP 11947A Transient Limiter	

Measurement Data:		Reading listed by margin.					Test Lead: Line 1				
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	Dist dB	Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	486.694k	33.6	+0.7	+0.4	+10.0		+0.0	44.7	46.2	-1.5	Line
2	730.306k	32.6	+0.6	+0.4	+10.0		+0.0	43.6	46.0	-2.4	Line
3	240.900k	37.1	+1.0	+0.4	+9.9		+0.0	48.4	52.1	-3.7	Line
4	945.048k	29.4	+0.5	+0.4	+10.0		+0.0	40.3	46.0	-5.7	Line
5	523.054k	28.6	+0.7	+0.4	+10.0		+0.0	39.7	46.0	-6.3	Line
6	525.235k	28.6	+0.7	+0.4	+10.0		+0.0	39.7	46.0	-6.3	Line
7	1.681M	28.6	+0.6	+0.4	+10.0		+0.0	39.6	46.0	-6.4	Line
8	527.417k	27.9	+0.7	+0.4	+10.0		+0.0	39.0	46.0	-7.0	Line
9	1.434M	27.2	+0.6	+0.4	+10.0		+0.0	38.2	46.0	-7.8	Line
10	517.236k	27.0	+0.7	+0.4	+10.0		+0.0	38.1	46.0	-7.9	Line

EMCE Engineering Date: 10/27/2005 Time: 12:04:01 PM Plantronics WO#: 2460
EN55022 B COND [AVE] Test Lead: Line 1 120V 60Hz Sequence#: 3



LINE CONDUCTED EMISSIONS, .15 - 30 MHz
EN 55022 Class B Limits

LINE 2 – Neutral

Test Location: EMCE Engineering • 44366 S. Grimmer Blvd • Fremont, CA 94538 • 510-490-4307

Customer: **Plantronics**
Specification: **EN55022 B COND [AVE]**
Work Order #: **2460**
Test Type: **Conducted Emissions**
Equipment: **Bluetooth Headset**
Manufacturer: Plantronics
Model: D645
S/N: N/A

Date: 10/27/2005
Time: 12:07:16 PM
Sequence#: 3
Tested By: Bob Cole
120V 60Hz

Test Equipment:

Function	S/N	Calibration Date	Cal Due Date	Asset #
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Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Bluetooth Headset*	Plantronics	D645	N/A

Support Devices:

Function	Manufacturer	Model #	S/N
AC Adaptor	Plantronics	US	N/A

Test Conditions / Notes:

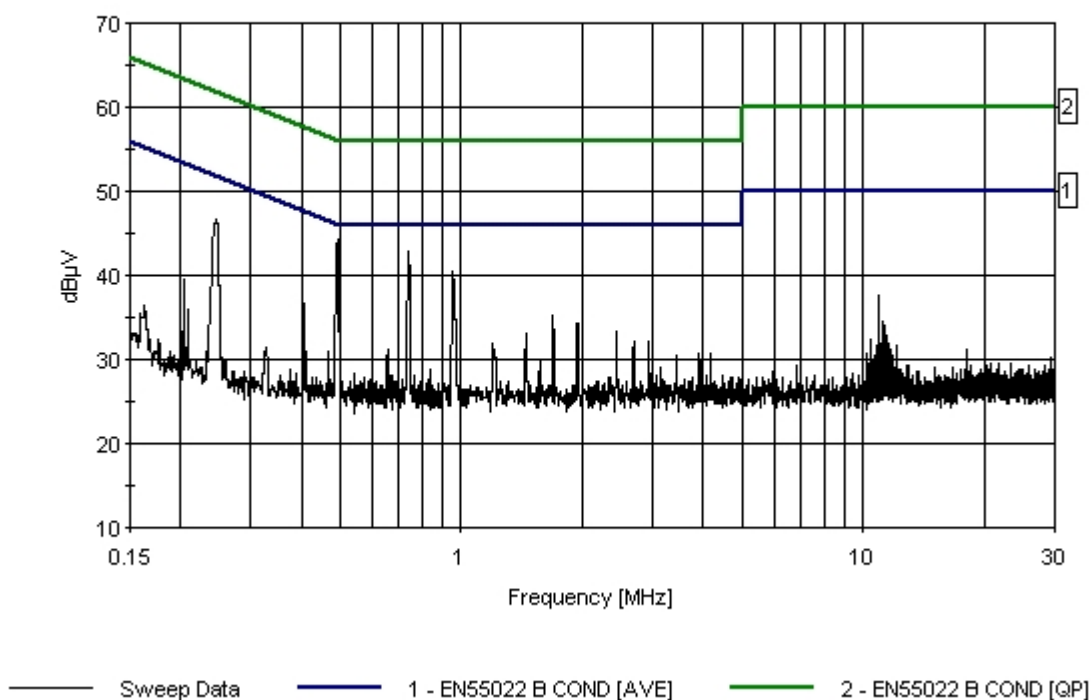
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Transducer Legend:

T1=LISN 1	T2=Chamber Receive Cable
T3=HP 11947A Transient Limiter	

Measurement Data:		Reading listed by margin.					Test Lead: Line 2				
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB		Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	492.511k	33.1	+0.7	+0.4	+10.0		+0.0	44.2	46.1	-1.9	Line
2	739.759k	31.9	+0.6	+0.4	+10.0		+0.0	42.9	46.0	-3.1	Line
3	245.263k	35.5	+0.9	+0.4	+9.9		+0.0	46.7	51.9	-5.2	Line
4	953.554k	29.5	+0.5	+0.4	+10.0		+0.0	40.4	46.0	-5.6	Line
5	1.694M	24.2	+0.6	+0.4	+10.0		+0.0	35.2	46.0	-10.8	Line
6	405.974k	25.5	+0.8	+0.4	+10.0		+0.0	36.7	47.7	-11.0	Line
7	1.945M	23.3	+0.6	+0.4	+10.0		+0.0	34.3	46.0	-11.7	Line
8	10.926M	26.2	+0.9	+0.5	+10.0		+0.0	37.6	50.0	-12.4	Line
9	2.434M	22.2	+0.6	+0.5	+10.0		+0.0	33.3	46.0	-12.7	Line
10	1.451M	22.1	+0.6	+0.4	+10.0		+0.0	33.1	46.0	-12.9	Line

EMCE Engineering Date: 10/27/2005 Time: 12:07:16 PM Plantronics WVO#: 2460
EN55022 B COND [AVE] Test Lead: Line 2 120V 60Hz Sequence#: 3



7.0 TEST EQUIPMENT

Antenna Conducted Measurements:

Equipment	Type	Manufacturer	Device Number
EMI Analyzer	84125B	Hewlett-Packard	E01
Oscilloscope	TDS820	Tektronix	E02
Coaxial cable	SMA Male – Reverse SMA Male (Length = 20 cm)	Own	C1

Spurious RF radiated emissions:

Equipment	Type	Manufacturer	Device Number
EMI Analyzer System	84125B	Hewlett-Packard	E01
Pre-Amp	83051A	Hewlett-Packard	E01
Pre-Amp	83017A	Hewlett-Packard	E01
High Pass Filter	9701	CMT	E01
Horn Antenna	3115	EMCO	E01
Cable		Hewlett Packard	E01

Note: The HP 84125B EMC Analyzer System is calibrated as a system, including the analyzer, pre-amps, filters, and cable.

EN 55022 (AC powerline conducted emissions)

Equipment	Type	Manufacturer	Device number
EMI Analyzer System	84125B	Hewlett-Packard	E01
LISN	3810/2	EMCO	E03
Coaxial cable	N Type – BNC (5 Meters)	Own	C2