FCC CFR47 PART 15 SUBPART C CERTIFICATION

TEST REPORT

FOR

802.11a/b/g COMBO MINI PCI MODULE

MODEL NUMBER: PA3297U-1MPC

BRAND NAME: TOSHIBA

FCC ID: CJ6UPA3297WL

REPORT NUMBER: 03U1876-1

ISSUE DATE: MAY 21, 2003

Prepared for

TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY
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1. TEST RESULT CERTIFICATION

COMPANY NAME: TOSHIBA CORPORATION DIGITAL MEDIA NETWORK COMPANY
2-9 SUEHIRO-CHO, OME
TOKYO, 198-8710
JAPAN

EUT DESCRIPTION: 802.11a/b/g COMBO MINI PCI MODULE

MODEL: PA3297U-1MPC

DATE TESTED: APRIL 30 – MAY 09, 2003

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 15 SUBPART C	NO NON-COMPLIANCE NOTED

Compliance Certification Services, Inc. tested the above equipment in accordance with the requirements set forth in the above standards. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: This document reports conditions under which testing was conducted and results of tests performed. This document may not be altered or revised in any way unless done so by Compliance Certification Services and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Compliance Certification Services will constitute fraud and shall nullify the document.

Note: The 2.4 and 5.8 GHz bands are applicable to this report; another band of operation (5.2 GHz) is documented in a separate report

Approved & Released For CCS By:

MIKE HECKROTTE
CHIEF ENGINEER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

THANH NGUYEN
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

2. EUT DESCRIPTION

The EUT is an 802.11a/b/g transceiver module. The EUT has a output power of 22.63 dBm (183mW) and highest antenna gain of 4.8 dBi in the 2400 - 2483.5 MHz band.

The EUT has an output power of 21.2 dBm (132 mW) and highest antenna gain of 4.8 dBi in the 5725 - 5850 MHz band.

Optionally the WLAN may be collocated with a Bluetooth transceiver, FCC ID: CJ6UPA3232BT.

Antennas filed under this report:
Hitachi Cable, Dual Band Film antenna, model: HTL008, antenna gain 4.8dBi;
Hitachi Cable, Wide band film antenna, model: HTL008, antenna gain 4.1 dBi;
Tyco Electronics AMP, Dual band film antenna, TIAN01, antenna gain 1.0dBi.

3. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.4/1992, FCC CFR 47 Part 2 and FCC CFR 47 Part 15.

4. FACILITIES AND ACCREDITATION

4.1. FACILITIES AND EQUIPMENT

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

All receiving equipment conforms to CISPR Publication 16-1, "Radio Interference Measuring Apparatus and Measurement Methods."

4.2. TABLE OF ACCREDITATIONS AND LISTINGS

Country	Agency	Scope of Accreditation	Logo
USA	FCC	3/10 meter Open Area Test Sites to perform FCC Part 15/18 measurements	1300
Japan	VCCI	CISPR 22 Two OATS and one conducted Site	R-1014, R-619, C-640
Norway	NEMKO	EN50081-1, EN50081-2, EN50082-1, EN50082-2, IEC61000-6-1, IEC61000-6-2, EN50083-2, EN50091-2, EN50130-4, EN55011, EN55013, EN55014-1, EN55104, EN55015, EN61547, EN55022, EN55024, EN61000-3-2, EN61000-3-3, EN60945, EN61326-1	ELA 117
Norway	NEMKO	EN60601-1-2 and IEC 60601-1-2, the Collateral Standards for Electro-Medical Products. MDD, 93/42/EEC, AIMD 90/385/EEC	ELA-171
Taiwan	BSMI	CNS 13438	SL2-IN-E-1012
Canada	Industry Canada	RSS210 Low Power Transmitter and Receiver	IC2324 A,B,C, and F

5. CALIBRATION AND UNCERTAINTY

5.1. MEASURING INSTRUMENT CALIBRATION

The measurement instruments utilized to perform the tests documented in this report have been calibrated in accordance with the manufacturer's recommendations, and are traceable to national standards.

5.2. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

Radiated Emission, 30 to 200 MHz	+/- 3.3 dB
Radiated Emission, 200 to 1000 MHz	+4.5 / -2.9 dB
Radiated Emission, 1000 to 2000 MHz	+4.5 / -2.9 dB
Power Line Conducted Emission	+/- 2.9 dB

Uncertainty figures are valid to a confidence level of 95%.

5.3. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

TEST EQUIPMENT LIST				
Name of Equipment	**Manufacturer**	**Model No.**	**Serial No.**	**Due Date**
SA RF Section, 1.5 GHz	**HP**	**85680A**	**2314A02604**	**7/16/04**
Quasi-Peak Adaptor	**HP**	**85650A**	**2521A01038**	**7/16/04**
SA Display Section 3	**HP**	**85662A**	**2314A04793**	**7/16/04**
LISN, 10 kHz ~ 30 MHz	**FCC**	**50/250-25-2**	**114**	**9/6/2003**
Line Filter	**Lindgren**	**LMF-3489**	**497**	**CNR**
LISN, 10 kHz ~ 30 MHz	**Solar**	**8012-50-R-24-BNC**	**837990**	**9/6/2003**
EMI Test Receiver	**R & S**	**ESHS 20**	**827129/006**	**4/17/2004**
Preamplifier, 1 ~ 26.5 GHz	**HP**	**8449B**	**3008A00369**	**6/30/2003**
Antenna, Horn 1 ~ 18 GHz	**EMCO**	**3115**	**2238**	**2/4/2004**
PSA Spectrum Analyzer	**Agilent**	**E4446A**	**424446A**	**1/13/2004**
EMI Receiver, 9 kHz ~ 2.9 GHz	**HP**	**8542E**	**3942A00286**	**11/20/2003**
RF Filter Section	**HP**	**85420E**	**3705A00256**	**11/20/2003**
BILOG ANTENNA	**A.R.A**	**LPB-2520/A**	**1185**	**6/24/2003**
Antenna, Horn 1 ~ 18 GHz	**A.R.A**	**MWH-1826**	**1049**	**11/7/2003**
Power Meter	**HP**	**E4416A**	**GB4129116**	**C.N.R**

6. SETUP OF EQUIPMENT UNDER TEST

SETUP INFORMATION FOR TRANSMITTER TESTS

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Device Type	Manufacturer	Model	Serial Number	FCC ID
Laptop	Toshiba	PP2002-00002	321029675	CJ6PA3171WL
AC Adapter	Toshiba	PA3241U-1ACA	0211A00164506	N/A

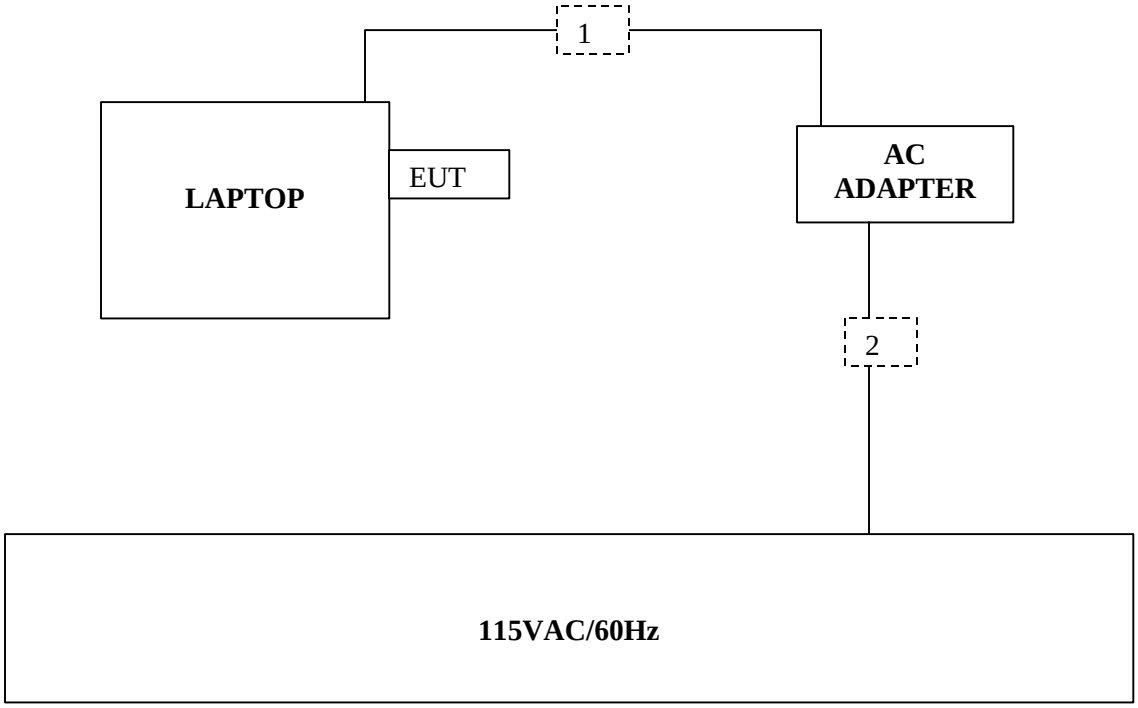
I/O CABLES

Cable No.	Port	# of Identical Ports	Connector Type	Cable Type	Cable Length	Remarks
1	DC	1	DC PWR	Unshielded	1.86 m	N/A
2	AC	1	AC PWR	Unshielded	1.86 m	N/A

TEST SETUP

The EUT is installed on extender card of laptop

SETUP DIAGRAM FOR TRANSMITTER TESTS



7. APPLICABLE LIMITS AND TEST RESULTS

7.1. 6 dB BANDWIDTH

LIMIT

§15.247 (a) (2) For direct sequence systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 100 kHz. The sweep time is coupled.

2.4 GHz BAND RESULTS

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Low	2412	12500	500
Middle	2437	12550	500
High	2462	12750	500

802.11g Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Low	2412	16600	500
Middle	2437	16700	500
High	2462	16850	500

802.11g Turbo Mode

Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Middle	2437	33050	500

5.8 GHz BAND RESULTS

802.11a Normal Mode

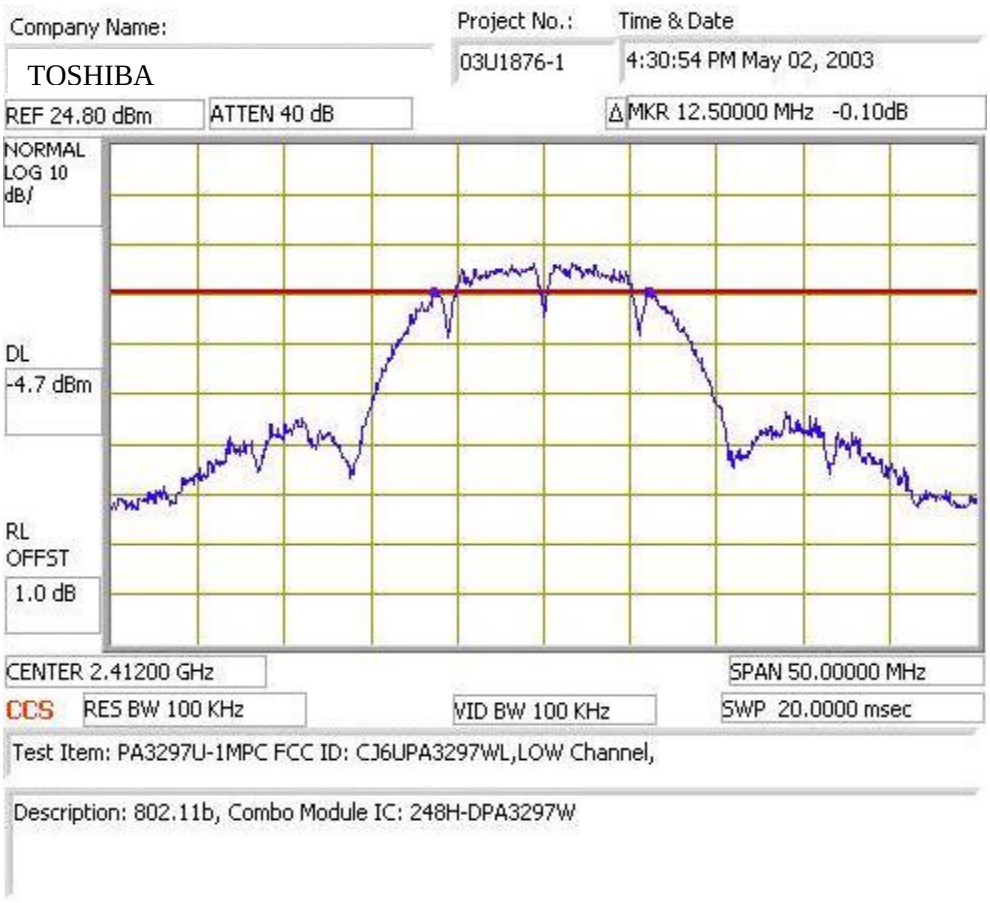
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Low	5745	16500	500
Middle	5785	16580	500
High	5825	16580	500

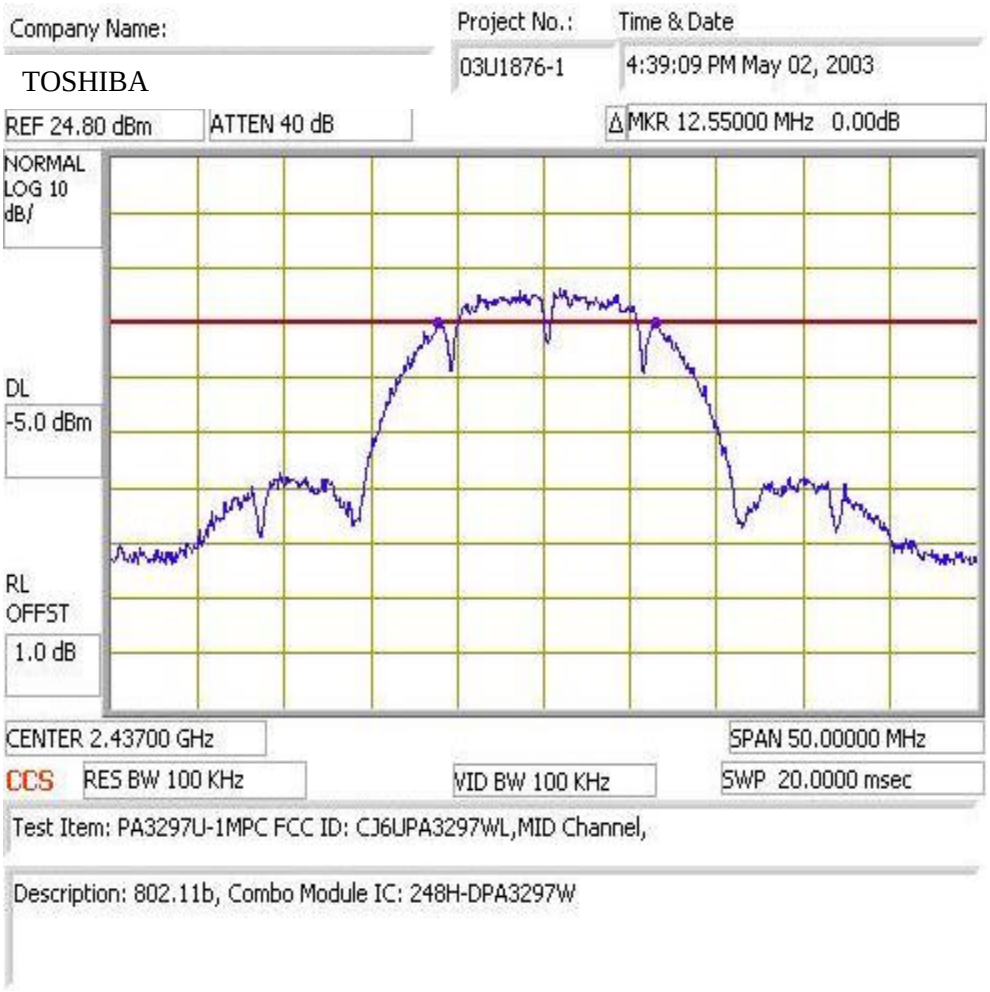
802.11a Turbo Mode

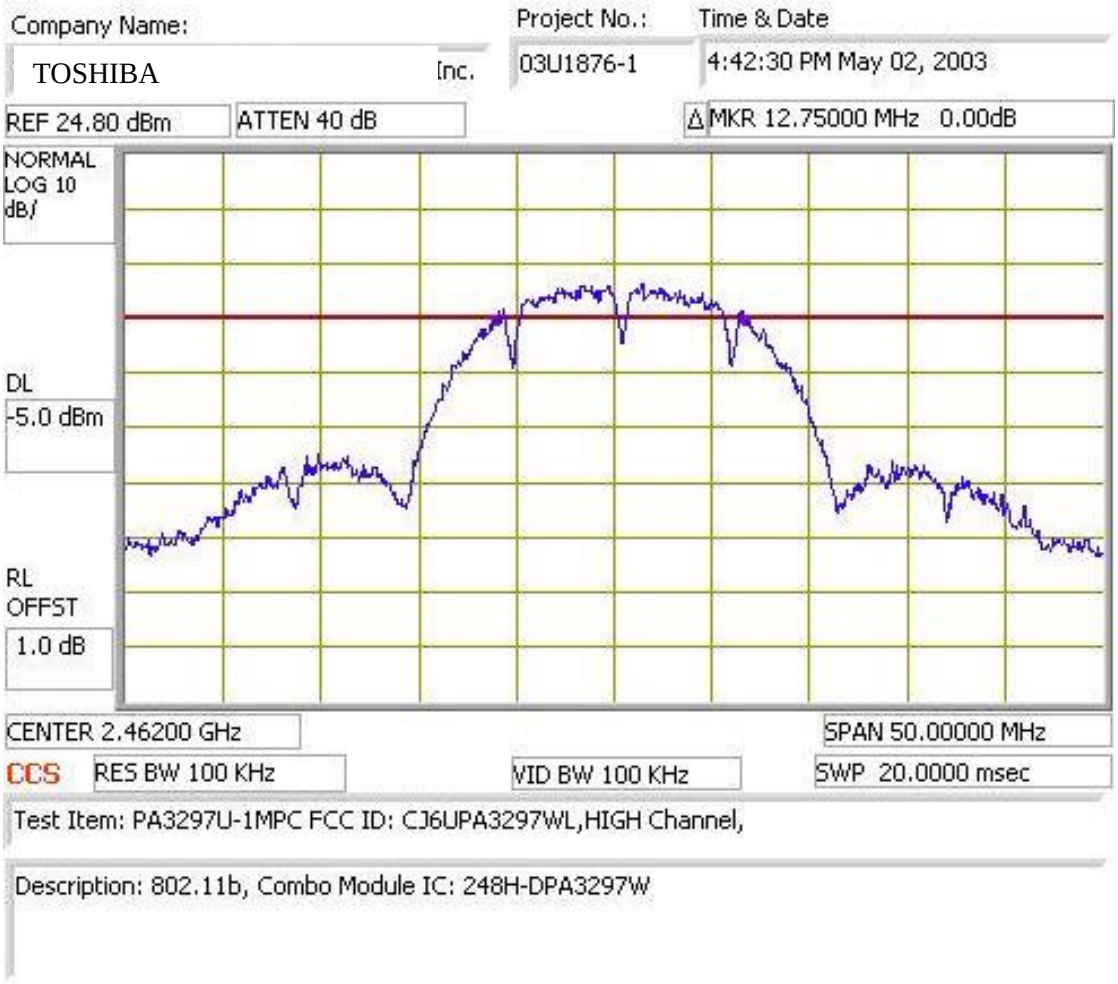
Channel	Frequency (MHz)	6 dB Bandwidth (kHz)	Minimum Limit (kHz)
Low	5760	32670	500
High	5800	32750	500

No non-compliance noted:

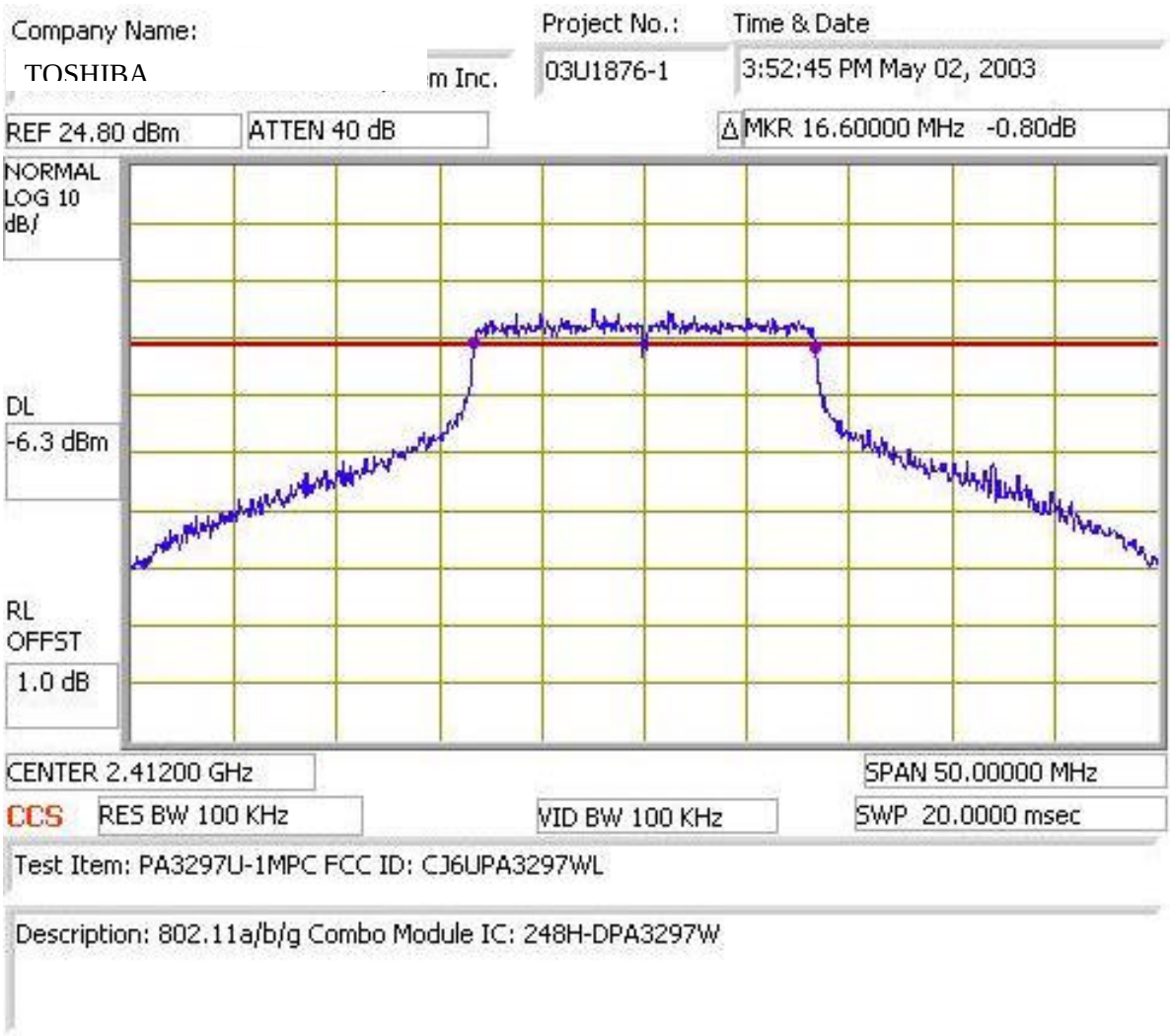
6 DB BANDWIDTH (2.4 GHZ BAND b MODE)

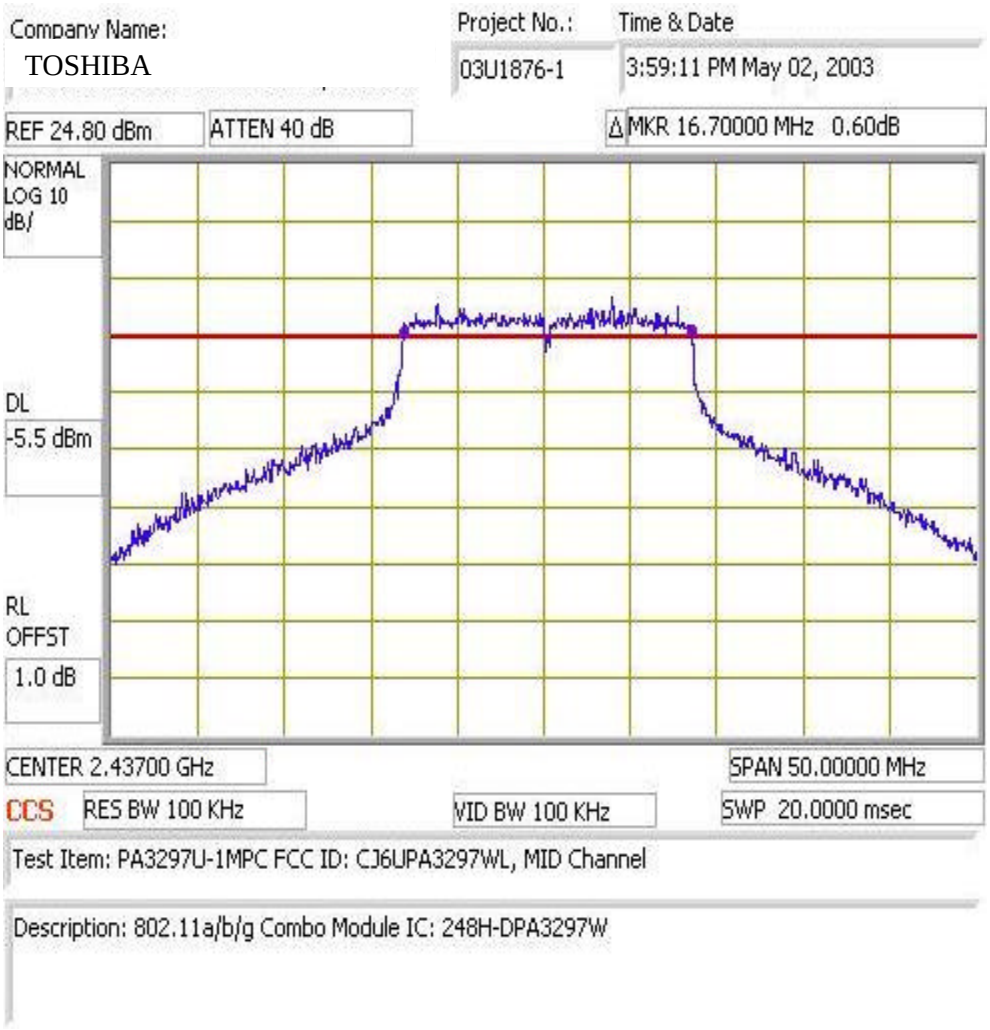


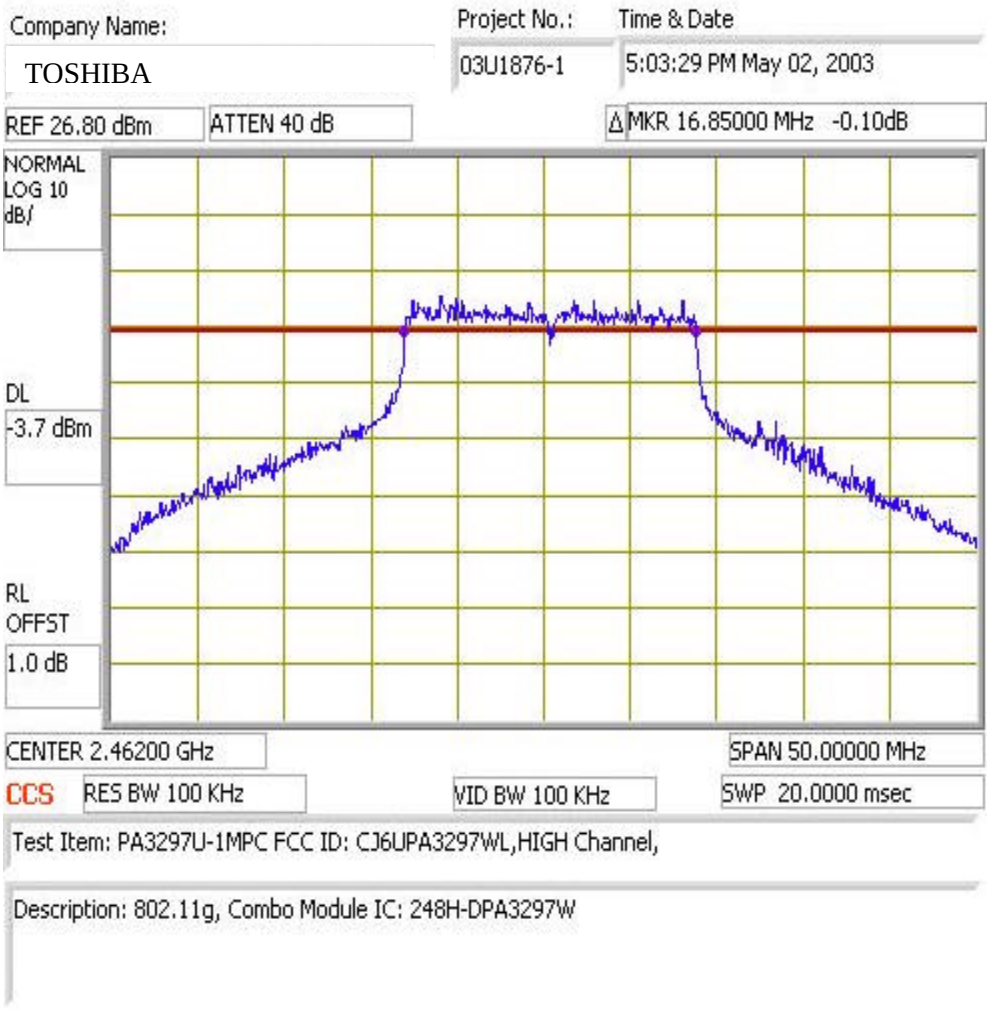




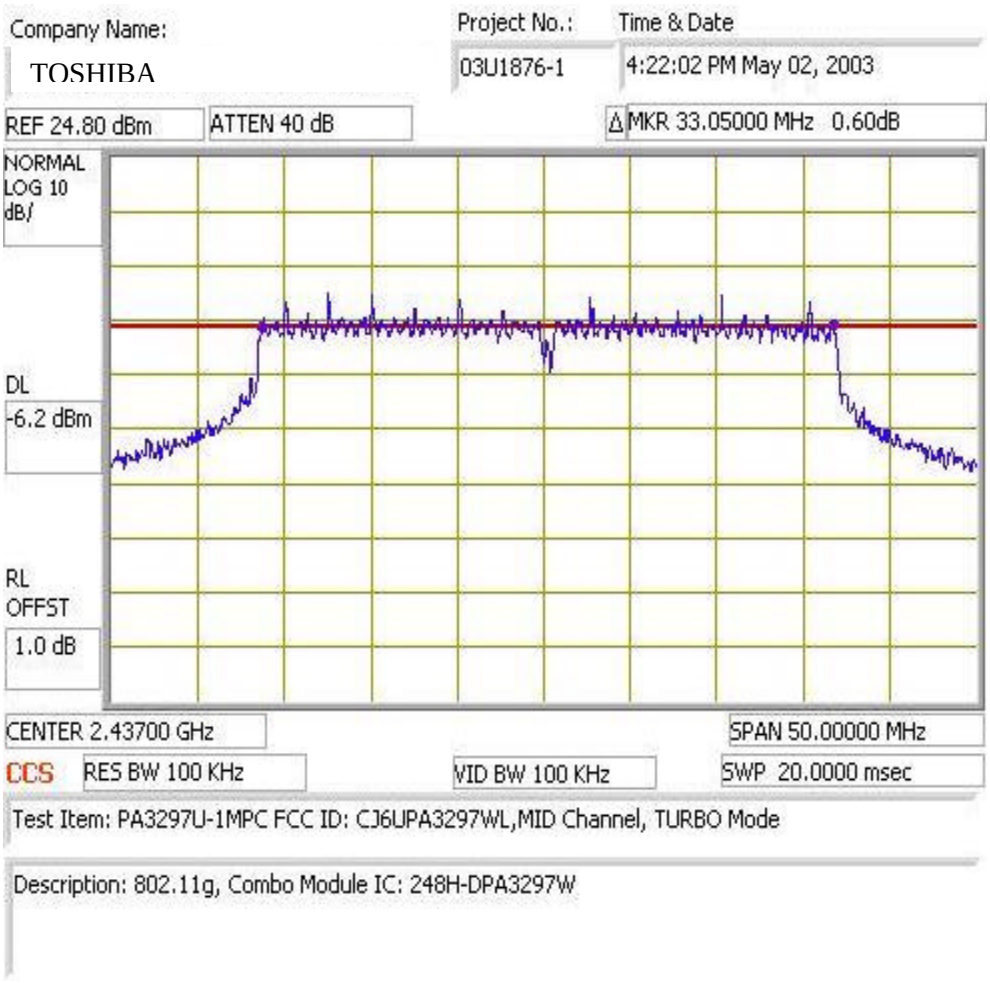
6 DB BANDWIDTH (2.4 GHZ BAND g NORMAL MODE)



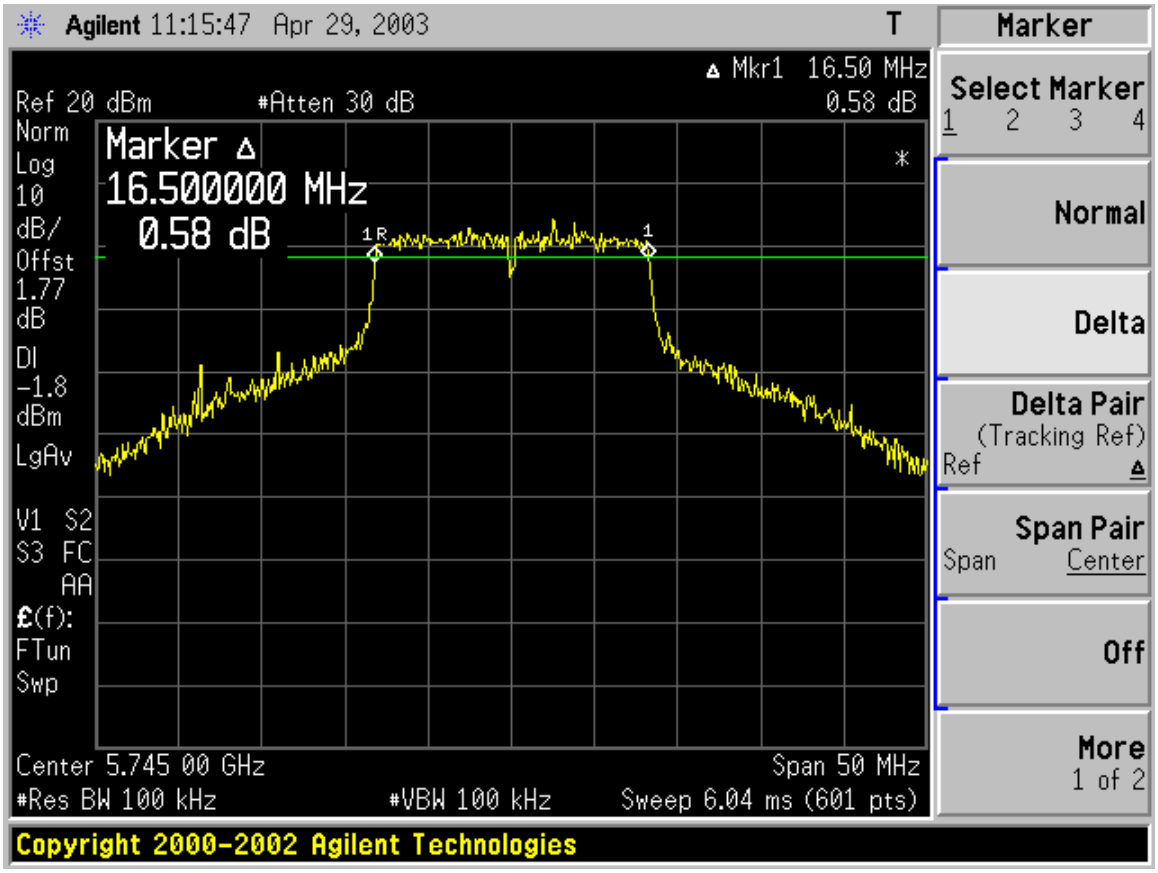


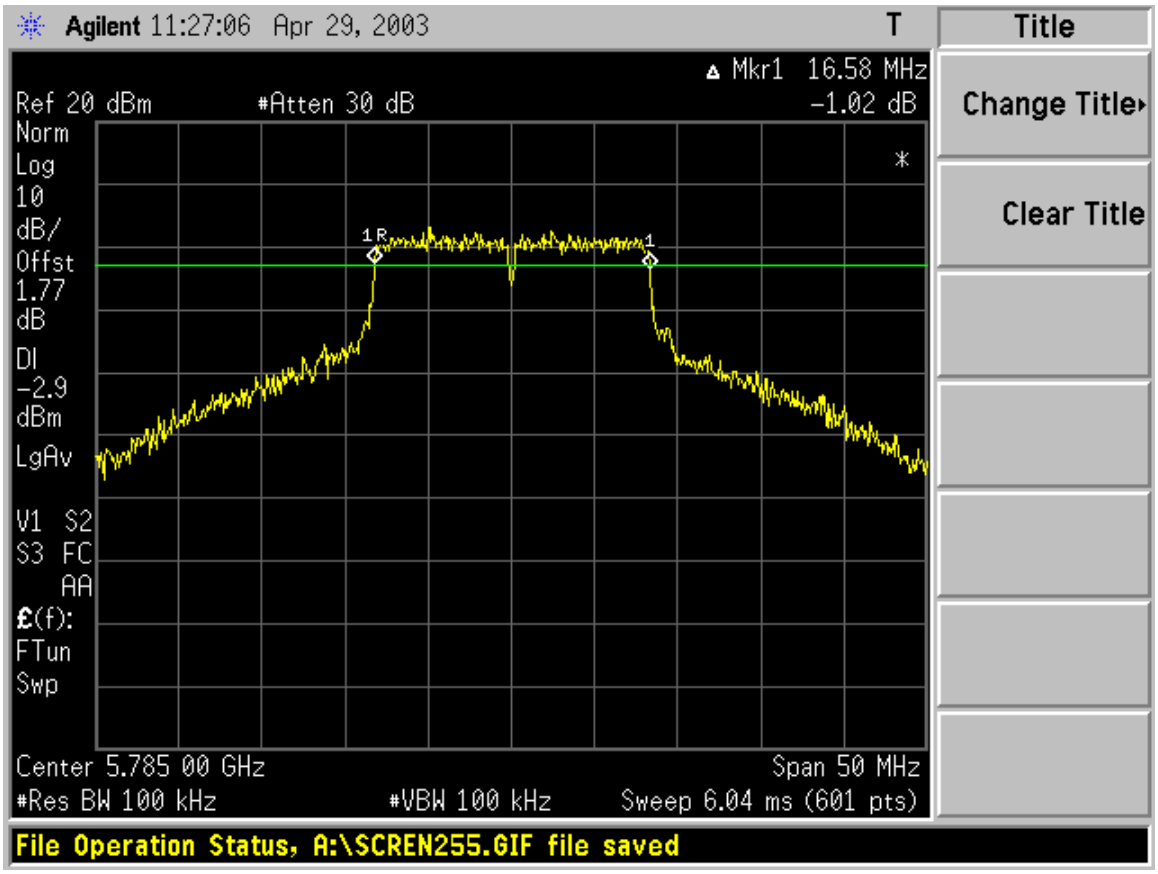


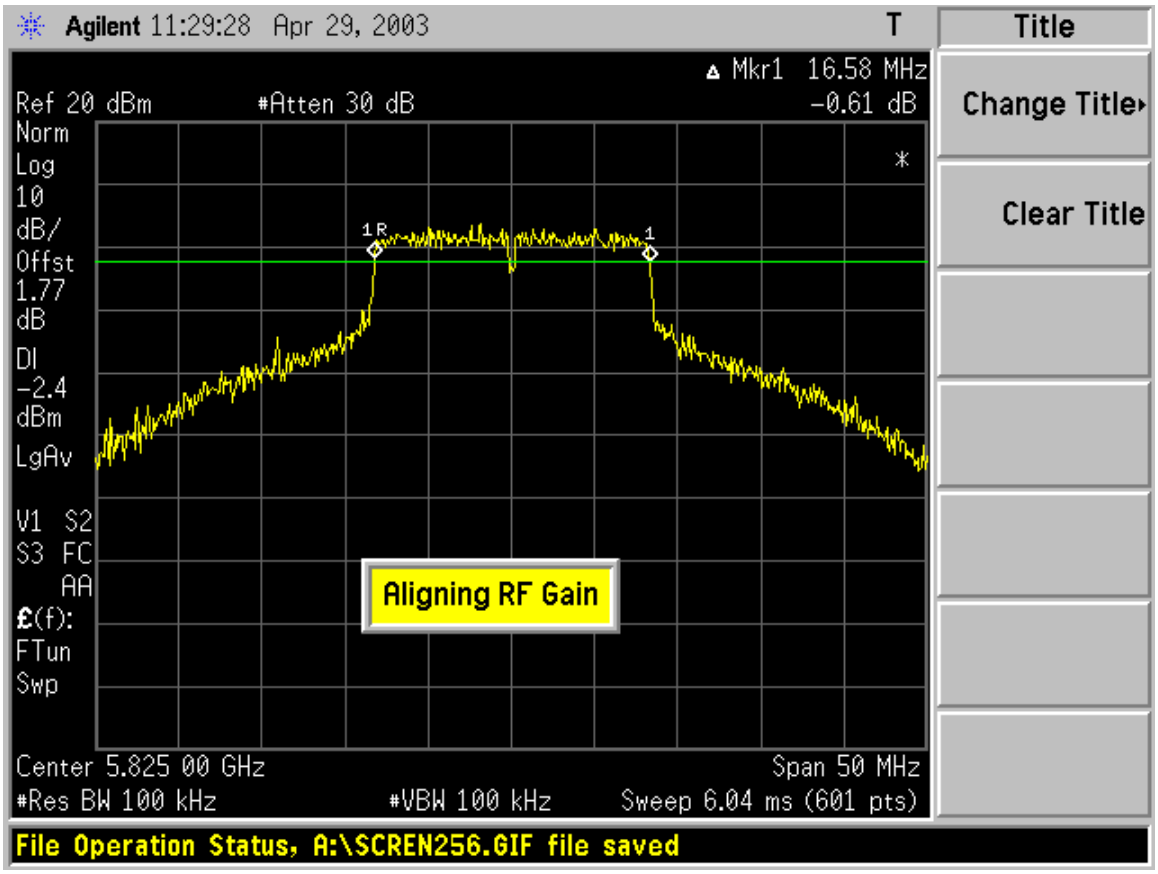
6 DB BANDWIDTH (2.4 GHZ BAND g TURBO MODE)



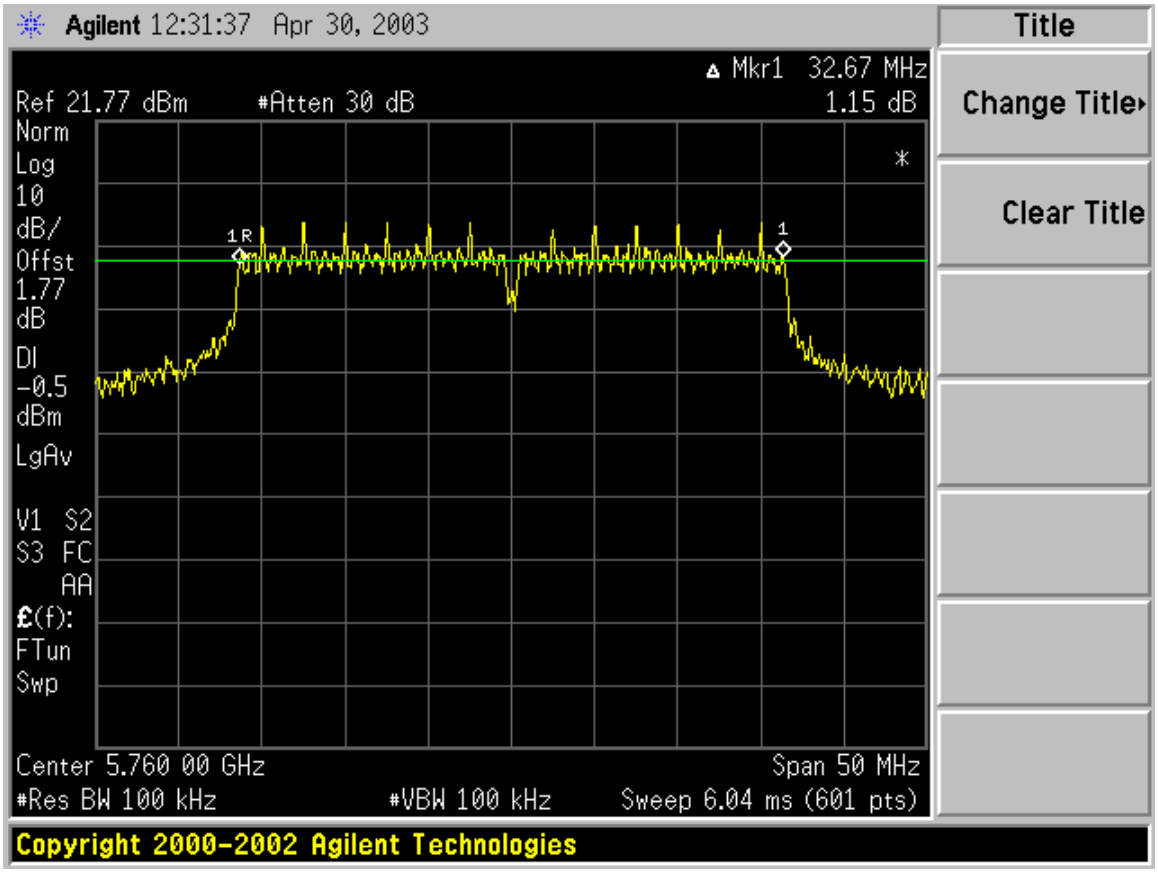
6 DB BANDWIDTH (5.8 GHZ BAND, NORMAL MODE)

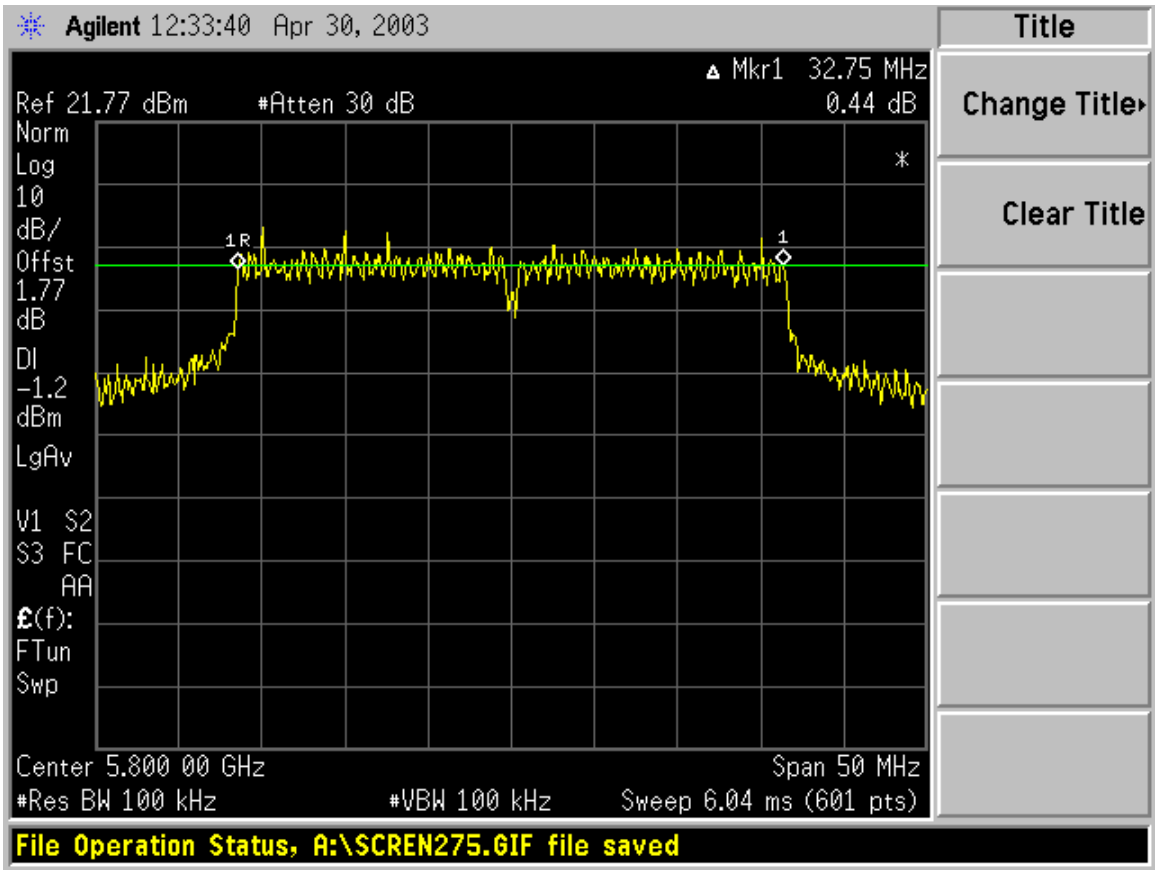






6 DB BANDWIDTH (5.8 GHZ BAND, TURBO MODE)





7.2. OUTPUT POWER

PEAK POWER LIMIT

§15.247 (b) The maximum peak output power of the intentional radiator shall not exceed the following:

§15.247 (b) (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz , and 5725-5850 MHz bands: 1 watt.

§15.247 (b) (4) Except as shown in paragraphs (b)(3) (i), (ii) and (iii) of this section, if transmitting antennas of directional gain greater than 6 dBi are used the peak output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1) or (b)(2) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The maximum antenna gain is 4.8 dBi, therefore the limit is 30 dBm.

AVERAGE POWER LIMIT

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter. The power meter is set to simultaneously read peak power and average power.

2.4 GHz BAND RESULTS

The cable assembly insertion loss of 11.02 dB (including 10 dB pad and 1.02 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

No non-compliance noted:

802.11b Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	14.9	18.21	30	-11.79
Middle	2437	15.34	18.32	30	-11.68
High	2462	15.68	18.68	30	-11.32

802.11g Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	2412	15.74	22.43	30	-7.57
Middle	2437	15.83	22.51	30	-7.49
High	2462	15.04	21.03	30	-8.97

802.11g Turbo Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	15.95	22.63	30	-7.37

5.8 GHz BAND RESULTS

The cable assembly insertion loss of 11.02 dB (including 10 dB pad and 1.02 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

No non-compliance noted:

802.11a Normal Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5745	16.65	21.02	30	-8.98
Middle	5785	16.72	21.2	30	-8.80
High	5825	16.86	21.17	30	-8.83

802.11a Turbo Mode

Channel	Frequency (MHz)	Average Power (dBm)	Peak Power (dBm)	Limit (dBm)	Margin (dB)
Low	5760	16.71	20.24	30	-9.76
High	5800	17	20.74	30	-9.26

7.3. MAXIMUM PERMISSIBLE EXPOSURE

LIMITS

§15.247 (b) (5) Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess of the Commission's guidelines. See §1.1307(b)(1) of this chapter.

CALCULATIONS

Given

$E = \sqrt{(30 * P * G)} / d$

and

$S = E \wedge 2 / 3770$

where

E = Field Strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = distance in meters
S = Power Density in milliwatts / square centimeter

Combining equations and rearranging the terms to express the distance as a function of the remaining variables yields:

$d = \sqrt{((30 * P * G) / (3770 * S))}$

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and
d (cm) =100 * d (m)

yields

$d = 100 * \sqrt{((30 * (P / 1000) * G) / (3770 * S))}$
$d = 0.282 * \sqrt{(P * G / S)}$

where

d = distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power Density in mW / cm^2

Substituting the logarithmic form of power and gain using:

P (mW) = 10 ^ (P (dBm) / 10) and

G (numeric) = 10 ^ (G (dBi) / 10)

yields

$d = 0.282 * 10 ^ ((P + G) / 20) / \sqrt{S}$ Equation (1)

where

d = MPE distance in cm

P = Power in dBm

G = Antenna Gain in dBi

S = Power Density Limit in mW / cm^2

Equation (1) and the measured peak power is used to calculate the MPE distance.

LIMITS

S = 1.0 mW / cm^2 from 1.1310 Table 1

NOTE: For mobile or fixed location transmitters, the minimum separation distance is 20 cm, even if calculations indicate that the MPE distance would be less.

2.4 GHz BAND RESULTS

Mode	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11b	1.0	18.68	4.80	4.21
802.11g Base	1.0	22.51	4.80	6.54
802.11g Turbo	1.0	22.63	4.80	6.63

No non-compliance noted:

5.8 GHz BAND RESULTS

No non-compliance noted:

Mode	Power Density Limit (mW/cm^2)	Output Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)
802.11a Base	1.0	21.20	4.80	5.63
802.11a Turbo	1.0	20.74	4.80	5.34

7.4. PEAK POWER SPECTRAL DENSITY

LIMIT

§15.247 (d) For direct sequence systems, the peak power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

TEST PROCEDURE

The transmitter output is connected to a spectrum analyzer, the maximum level in a 3 kHz bandwidth is measured with the spectrum analyzer using RBW = 3 kHz and VBW >= 3KHz, sweep time = span / 3 kHz, and video averaging is turned off. The PPSD is the highest level found across the emission in any 3 kHz band.

2.4 GHz BAND RESULTS

No non-compliance noted:

2.4 GHz Band, 802.11b Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-7.00	8	-15.00
Middle	2437	-7.60	8	-15.60
High	2462	-9.10	8	-17.10

2.4 GHz Band, 802.11g Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	2412	-8.70	8	-16.70
Middle	2437	-9.00	8	-17.00
High	2462	-9.40	8	-17.40

802.11g Turbo Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Middle	2437	-9.30	8	-17.30

5.8 GHz BAND RESULTS

No non-compliance noted:

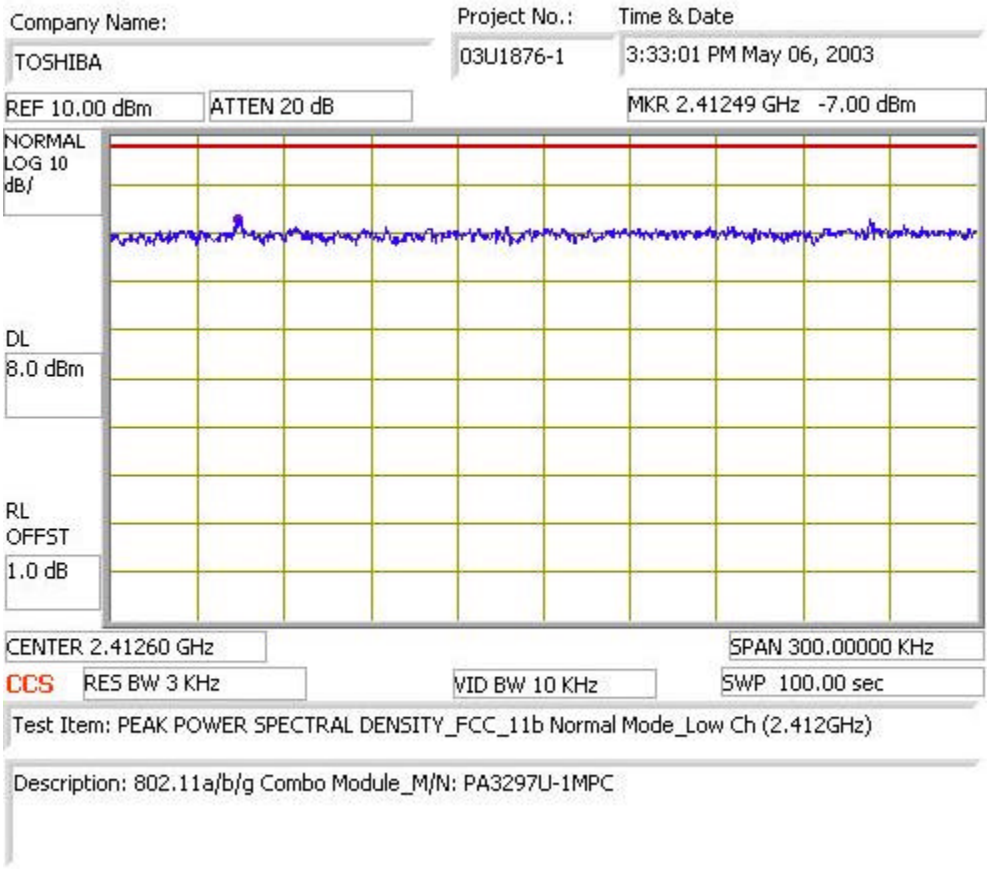
802.11a Normal Mode

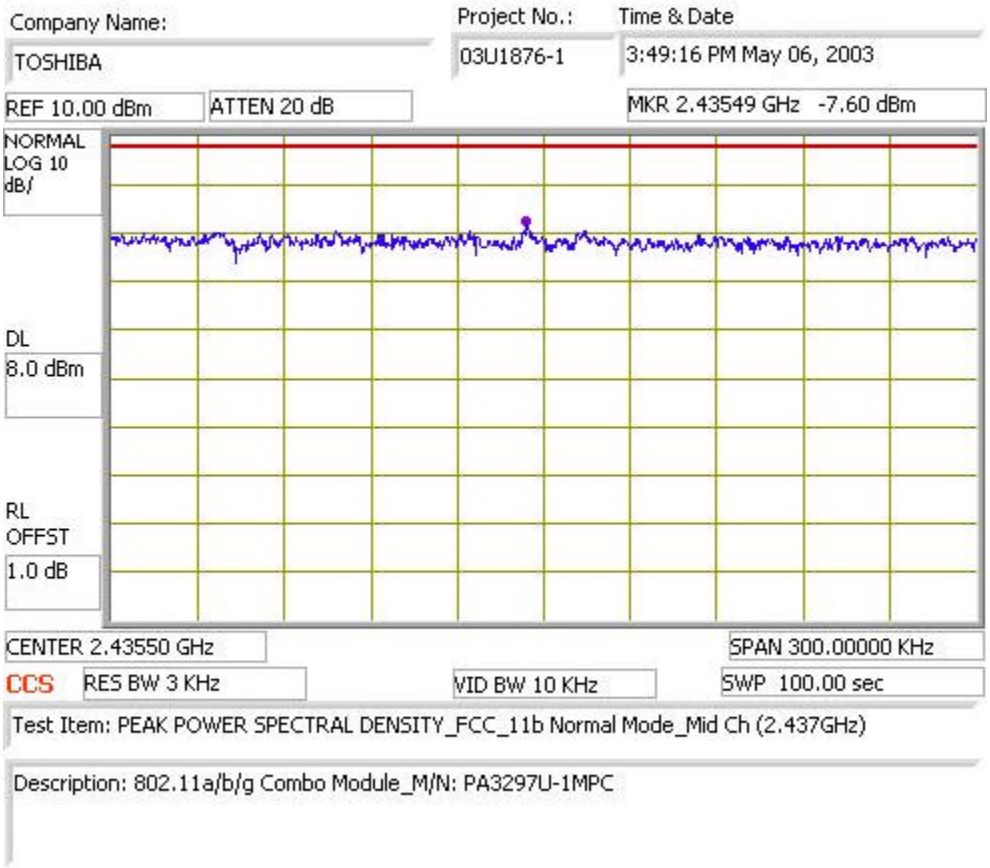
Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	-8.20	8	-16.20
Middle	5785	-8.60	8	-16.60
High	5825	-10.30	8	-18.30

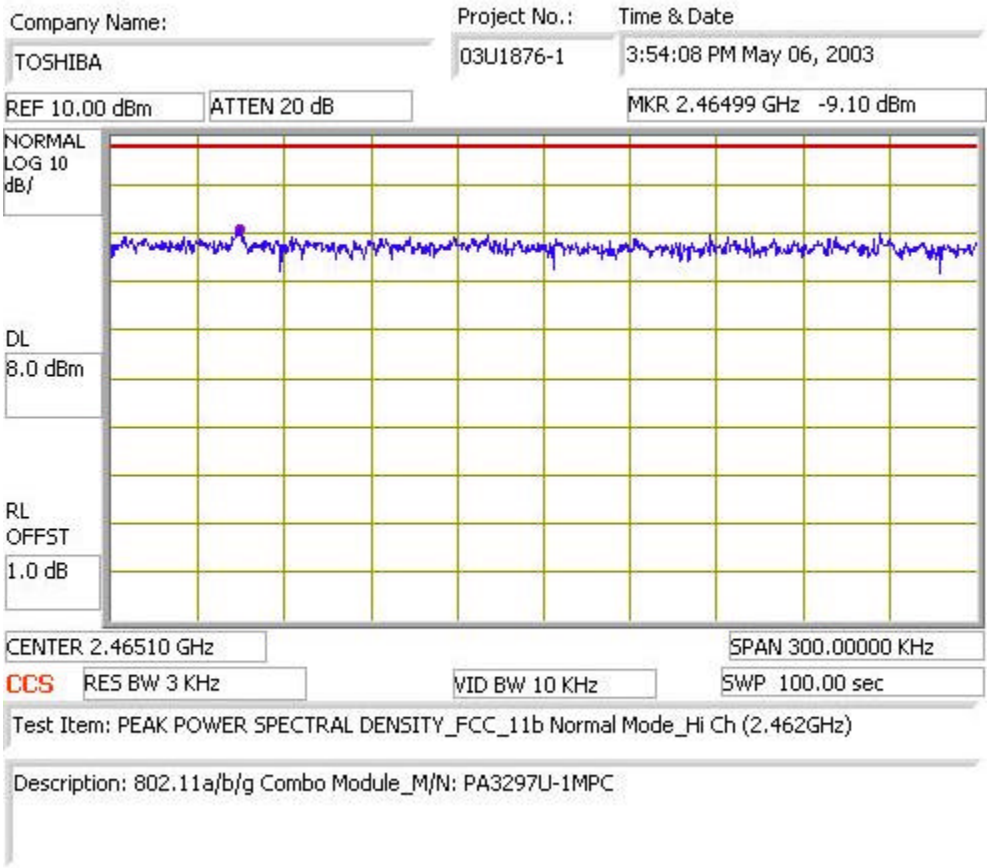
802.11a Turbo Mode

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5760	-14.30	8	-22.30
High	5800	-11.10	8	-19.10

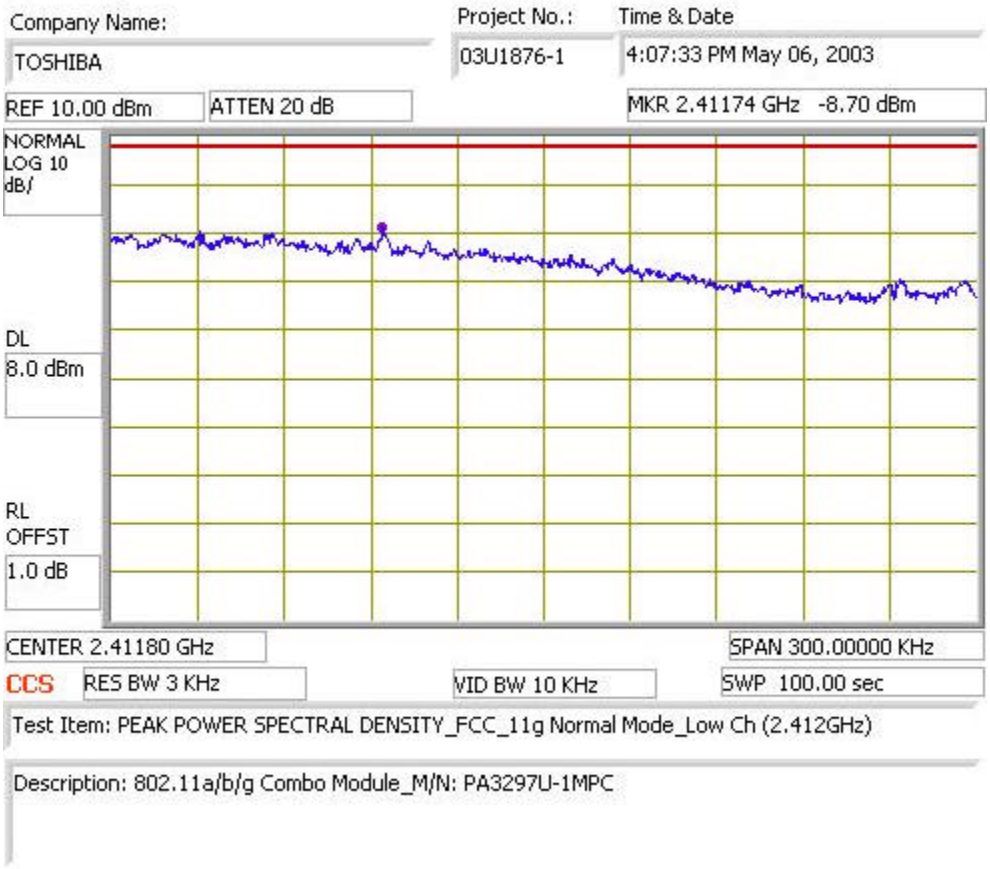
PPSD (2.4 GHZ BAND b MODE)

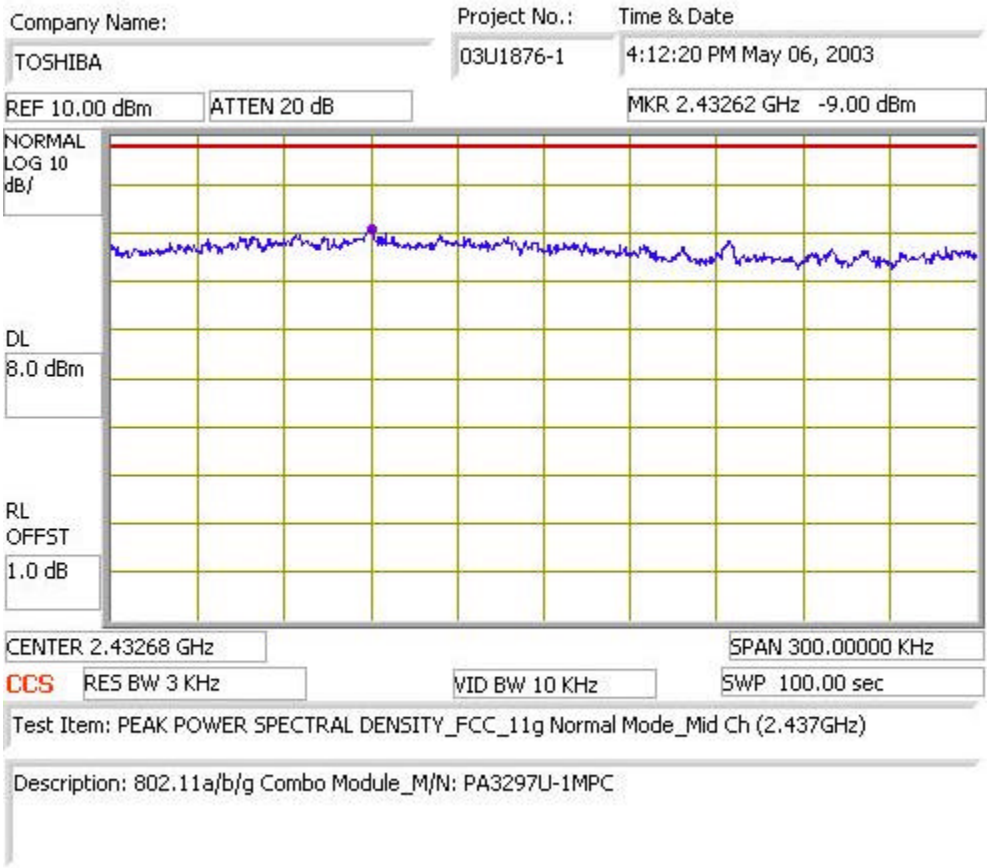


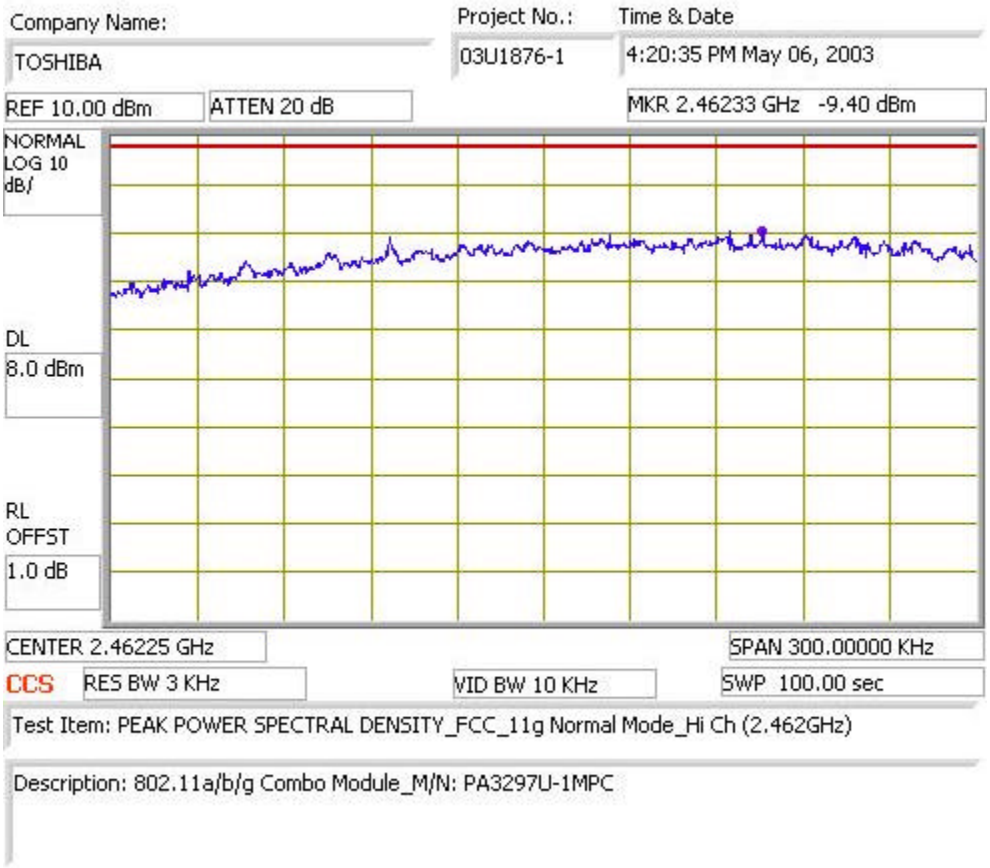




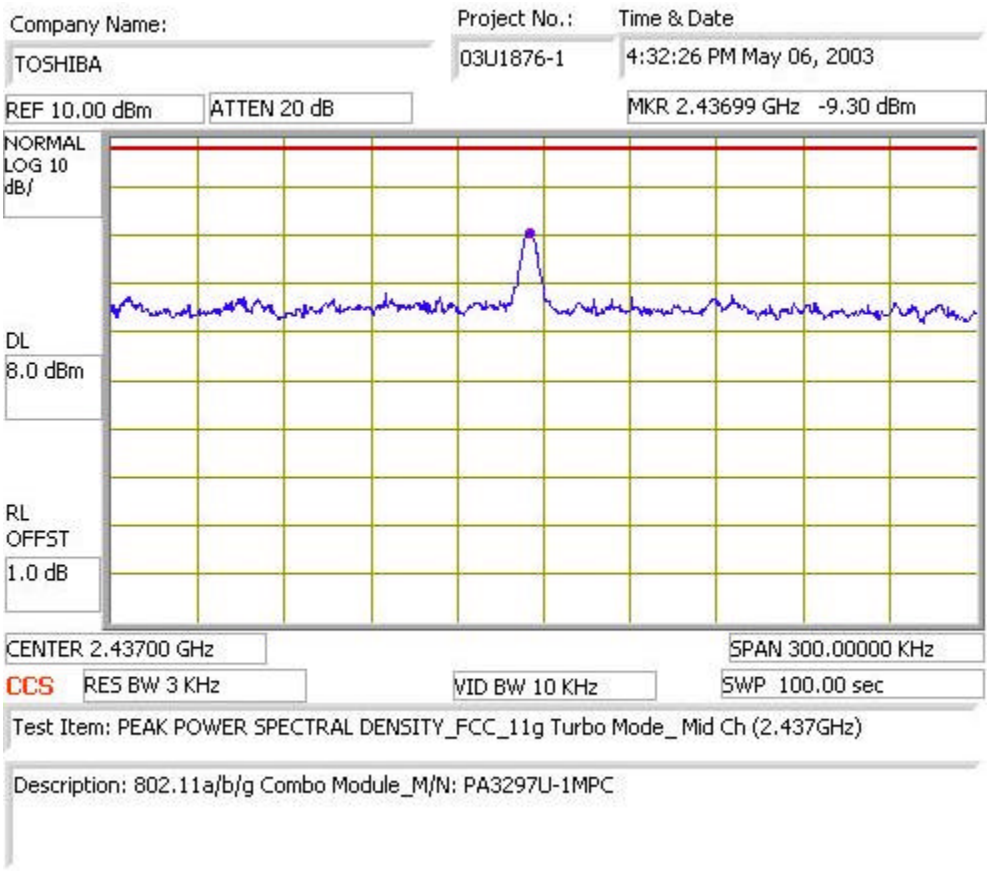
PPSD (2.4 GHZ BAND g NORMAL MODE)







PPSD (2.4 GHZ BAND g TURBO MODE)



PPSD (5.8 GHZ BAND, NORMAL MODE)