MEASUREMENT REPORT of WIRELESS LAN PCI CARD

Applicant : ASUSTeK COMPUTER INC.

Model No. : WL-230

EUT : ASUS SpaceLink WL-230 PCI Card

FCC ID : MSQWL230

Report No. : A5415072

Tested by :

Training Research Co., Ltd.

TEL : 886-2-26935155 **FAX : 886-2-26934440**

255, Nanyang St., Shijr, Taipei Hsien 221, Taiwan, R.O.C.

CERTIFICATION

We here by verify that:

The test data, data evaluation, test procedures and equipment configurations shown in this report were made mainly in accordance with the procedures given in ANSI C63.4 (1992) as a reference. All test were conducted by ***Training Research Co., Ltd.*** - 255, Nanyang St., Shijr, Taipei Hsien 221, Taiwan, R.O.C. Also, we attest to the accuracy of each.

We further submit that the energy emitted by the sample EUT tested as described in the report is **in compliance with** the technical requirements for the *Unlicensed National Information Infrastructure (UNII)* set forth in the FCC Rules Part 15 Subpart E.

Applicant	:	ASUSTeK COMPUTER INC.
Model No.	:	WL-230
EUT	:	ASUS SpaceLink WL-230 PCI Card
FCC ID	:	MSQWL230
Report No.	:	A5415072
Test Date	:	Nov 16th, 2002

Prepared by: *Eric Wong*

Approved by: *Frank Tsai*

Tested by :

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Ⅰ. GENERAL

1.1 Introduction

The following measurement report is submitted on behalf of Applicant in support of a *WLAN PCI card* certification in accordance with Part 2 Subpart J and Part 15 Subpart E (15.407) of the Commission's Rules and Regulations.

1.2 Description of EUT

EUT	:	ASUS SpaceLink WL-230 PCI Card
Model No.	:	WL-230
FCC ID	:	MSQWL230
Frequency Range	:	5.15GHz ~ 5.25GHz / 5.25GHz ~ 5.35GHz (UNII Band)
Modulation Skill	:	OFDM
Interface	:	PCI Interface
Power Type	:	By PCI slot of the client’s device
Applicant	:	ASUSTeK COMPUTER INC.
		4/F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan, R.O.C.

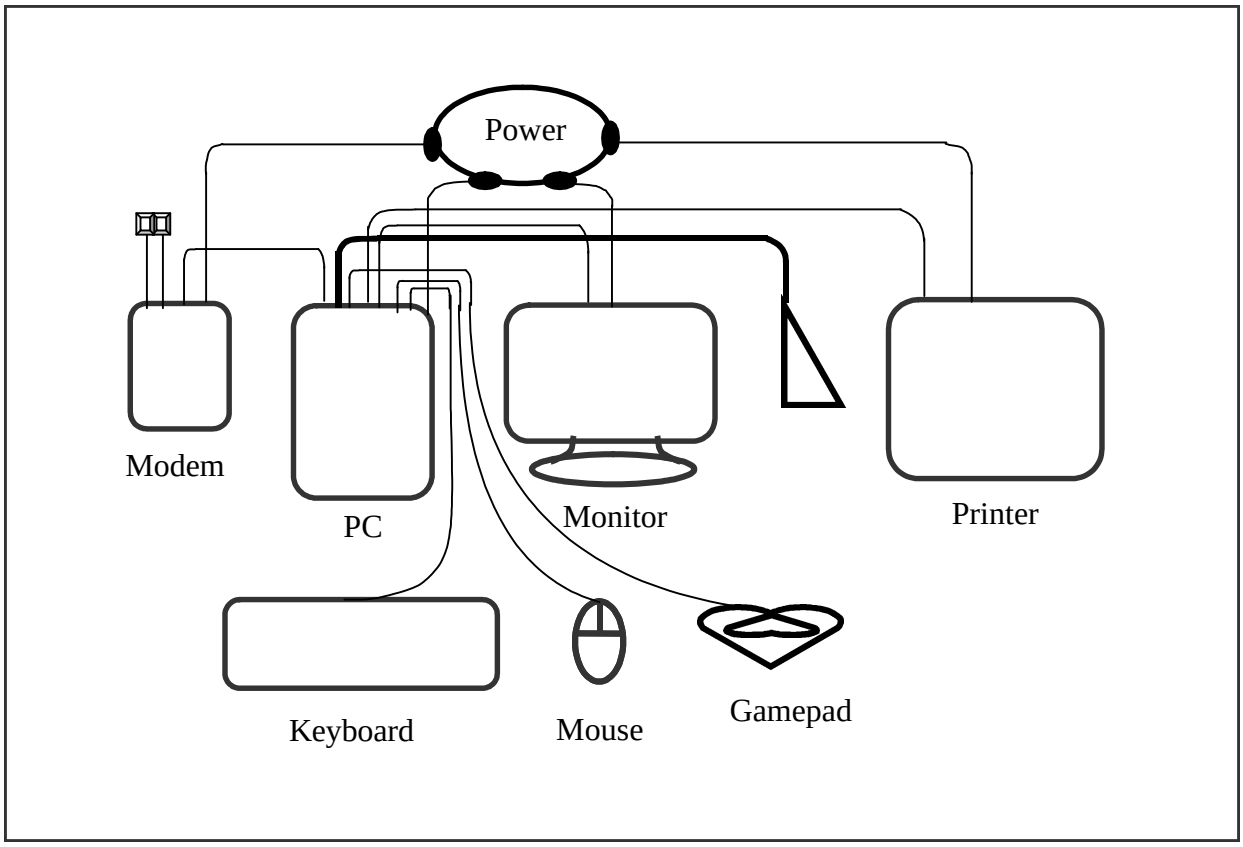
1.3 Description of Support Equipment

In order to construct the minimum testing, following equipment were used as the support units.

PC	**:**	**HP Brio 85xx 6/350**
Model No.	:	D6928A
Serial No.	:	SG91801535
FCC ID	:	N/A, DoC (Declaration of Confirmation) Approved
檢磁	:	3872H013
Power type	:	100 ~ 230VAC / 50 ~ 60Hz, 5A, Switching
Power cord	:	Non-shielded, 2.33m long, Plastic, No ferrite core
Monitor	**:**	**HP 15’ Color Monitor**
Model No.	:	D2827A
Serial No.	:	KR91161717
FCC ID	:	C5F7NFCMC1518X
檢磁	:	3872B039
Power type	:	100 ~ 240 VAC / 50 ~ 60 Hz, Switching
Power cord	:	Shielded, 1.83m long, No ferrite core
Data cable	:	Shielded, 1.46m long, with two ferrite cores
Keyboard	**:**	**HP**
Model No.	:	SK-2501K
Serial No.	:	M990308909
FCC ID	:	GYUR38SK
檢磁	:	3862A621
Power type	:	By PC
Data cable	:	Shielded, 1.73m long, with ferrite core
Mouse	**:**	**HP**
Model No.	:	M-S34
Serial No.	:	LZB90714122
FCC ID	:	DZL211029
檢磁	:	4862A011
Power type	:	By PC
Power cord	:	Non-shielded, 1.88m long, No ferrite core

USB Gamepad	**:**	**Padix**
Model No.	:	QF-606U
Serial No.	:	None
FCC ID	:	DoC Approval
Power type	:	Powered by PC
Power Cable	:	Shielded, 1.5m long, No ferrite bead data cable
Prineter	**:**	**HEWLETT-PACKARD**
Type No.	:	C4562A (Deskjet 690C)
Serial No.	:	SG73E1B2GY
FCC ID	:	B94C2164X
AC Adaptor	**:**	**NMB**
Model No.	:	C2175A
Serial No.	:	1607496
FCC ID	:	DoC Approved
Power Core	:	Shielded, Plastic hoods, w/o ferrite bead
Power type	:	120VAC, 60Hz, 0.22A / 30VDC, 400mA
Modem	**:**	**Acer Communication & Multimedia Inc**
Model No.	:	AcerModem 56K Surf
Serial No.	:	None
FCC ID	:	DoC Approval
Power type	:	Powered by AC Adapter (120VAC 60Hz / 9VAC 800mA

1.4 Configuration of System Under Test



The EUT was inserted into the PCI slot of the personal computer. The EUT is controlled in selection of output power level and channel number by the utilities installed in the personal computer.

The setting up procedure was recorded in <Appendix A>.

1.5 Test Procedure

All measurements contained in this report were performed mainly according to the techniques described in ANSI C63.4 (1992) and the pre-setup was written on Appendix A, the detail setup was written on each test item.

1.6 Location of the Test Site

The radiated emissions measurements required by the rules were performed on the **three-meter**, **Anechoic Chamber (Registration Number: 93906)** maintained by *Training Research Co., Ltd.* - 255, Nanyang St., Shijr, Taipei Hsien 221, Taiwan, R.O.C. Complete description and measurement data have been placed on file with the commission. The conducted power line emissions tests and other test items were performed in a anechoic chamber also located at Training Research Co., Ltd.

255, Nanyang St., Shijr, Taipei Hsien 221, Taiwan, R.O.C. *Training Research Co., Ltd.* is listed by the FCC as a facility available to do measurement work for others on a contract basis.

1.7 General Test Condition

The conditions under which the EUT operates were varied to determine their effect on the equipment's emission characteristics. The final configuration of the test system and the mode of operation used during these tests were chosen as that which produced the highest emission levels. However, only those conditions, which the EUT was considered likely to encounter in normal uses were investigated.

II. Section 15.405: Cross Reference

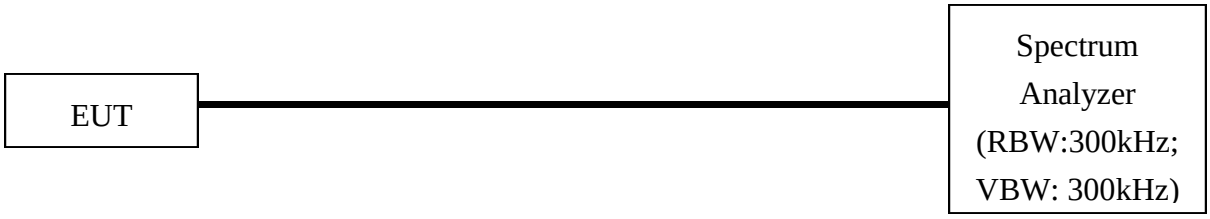
The EUT is set out for complying the Rules subpart E – Unlicensed National Information Infrastructure (UNII) devices operating in the 5.15GHz-5.35GHz and 5.725GHz-5.825GHz. Section 15.405 requires the complement about the conformity with the subparts A, B and C, if applicable. Items required on each part are all performed respectively and prepared in their issue separately. We dropped this part as the results will be repeated as the parts we've mentioned above.

III. Section 15.407(a)(1)/(2): Bandwidth Measurement

3.1 Test Condition & Setup

The transmitter bandwidth measurements were performed by the contact manner. The EUT was set to transmit continuously, also various channels were investigated to find the maximum occupied bandwidth. The output of the EUT was connected to the spectrum analyzer. The bandwidth of the fundamental frequency is observed by the spectrum analyzer with 300kHz RBW and 300kHz VBW.

3.2 Test Instruments Configuration



Test Configuration of Bandwidth Measurement

(P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit)

3.3 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum Analyzer	8592A	H P	3003AD1401	Jan/02/02	Jan/01/03

3.4 Test Result of Bandwidth Measurement

Lowest Channel

	Base Mode (5180 MHz)	**Turbo Mode (5210 MHz)**
6 dB Bandwidth	16.53 MHz	32.92MHz
26dB Bandwidth	28.42 MHz	46.50 MHz

Middle Channel

	Base Mode (5260 MHz)	**Turbo Mode (5250 MHz)**
6 dB Bandwidth	16.47 MHz	32.83MHz
26dB Bandwidth	27.75MHz	45.70 MHz

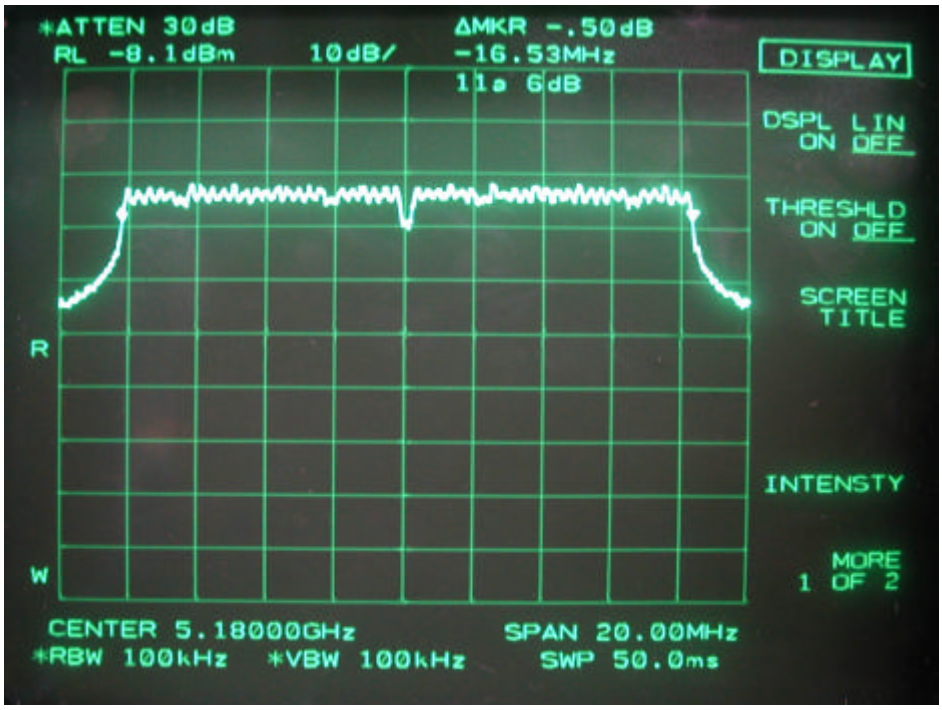
Highest Channel

	Base Mode (5320 MHz)	**Turbo Mode (5290 MHz)**
6 dB Bandwidth	16.50 MHz	32.92 MHz
26dB Bandwidth	26.92MHz	47.70 MHz

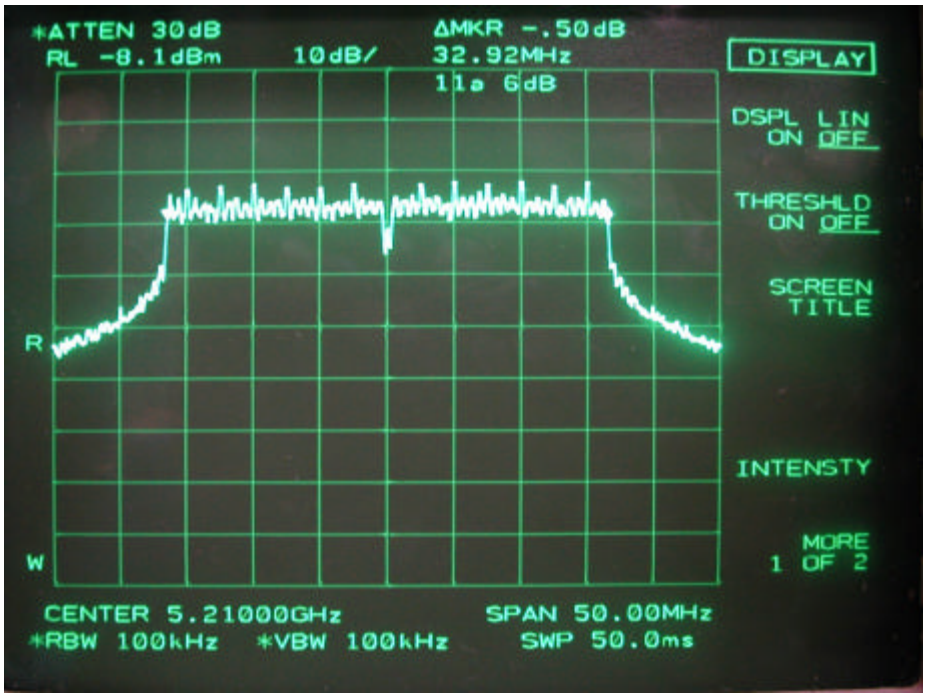
Note:

1. The data in the above table are summarizing the following attachment spectrum analyzer hard copy. According to the guidance, we'd made the measurement with the spectrum analyzer's resolution bandwidth *(RBW)=300kHz* and set the *span>>RBW*.
2. The attachments show these on the following pages.

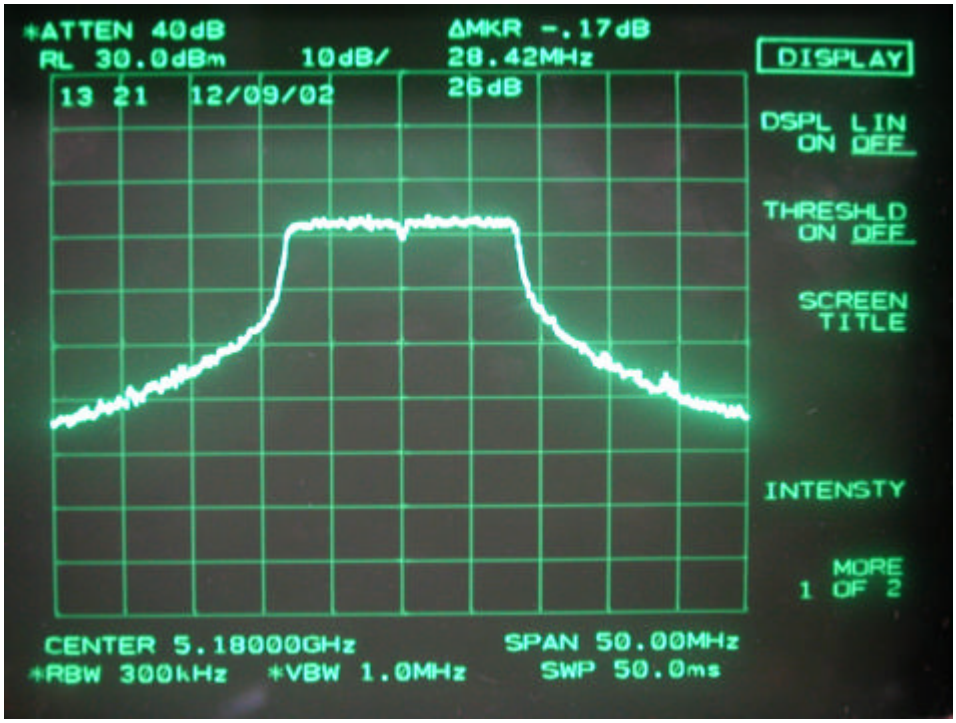
6 dB Bandwidth of Lowest Channel (Base mode)



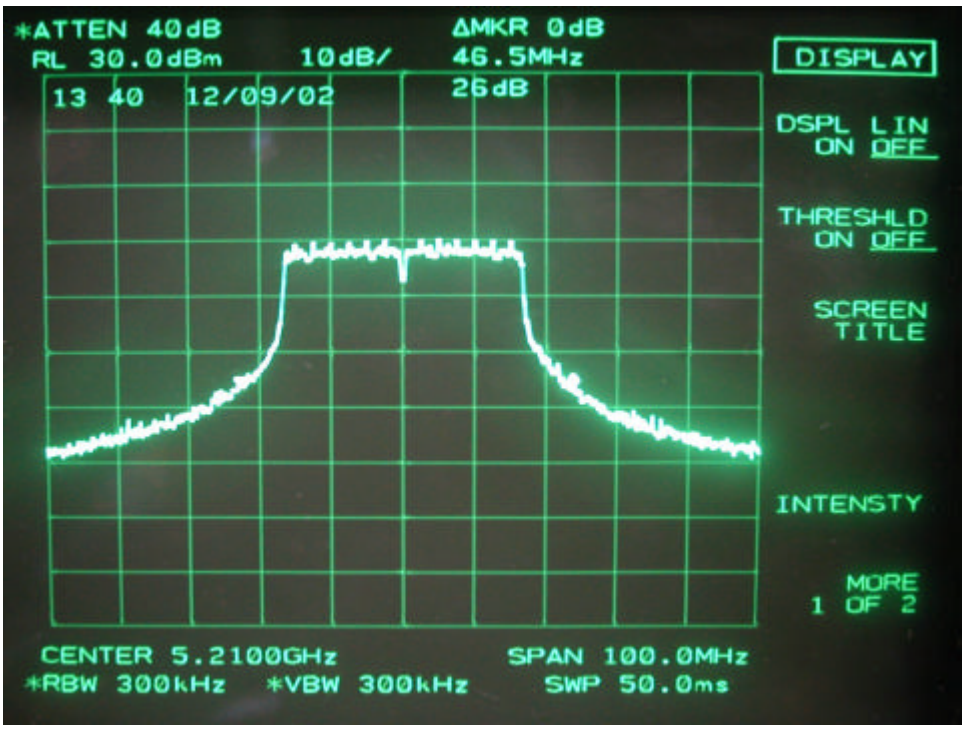
6 dB Bandwidth of Lowest Channel (Turbo mode)



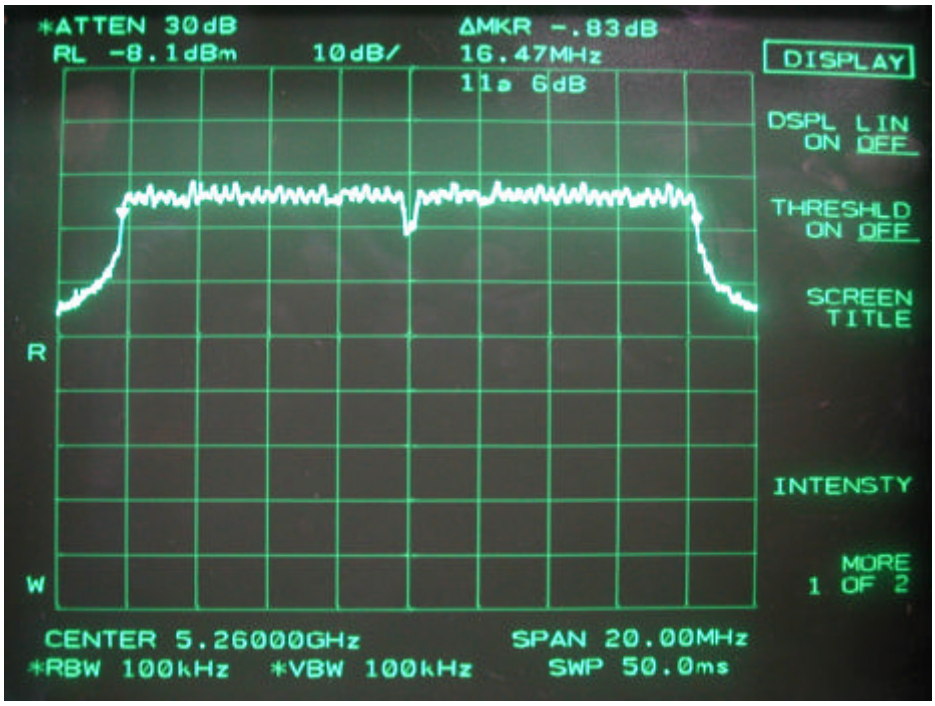
26 dB Bandwidth of Lowest Channel (Base mode)



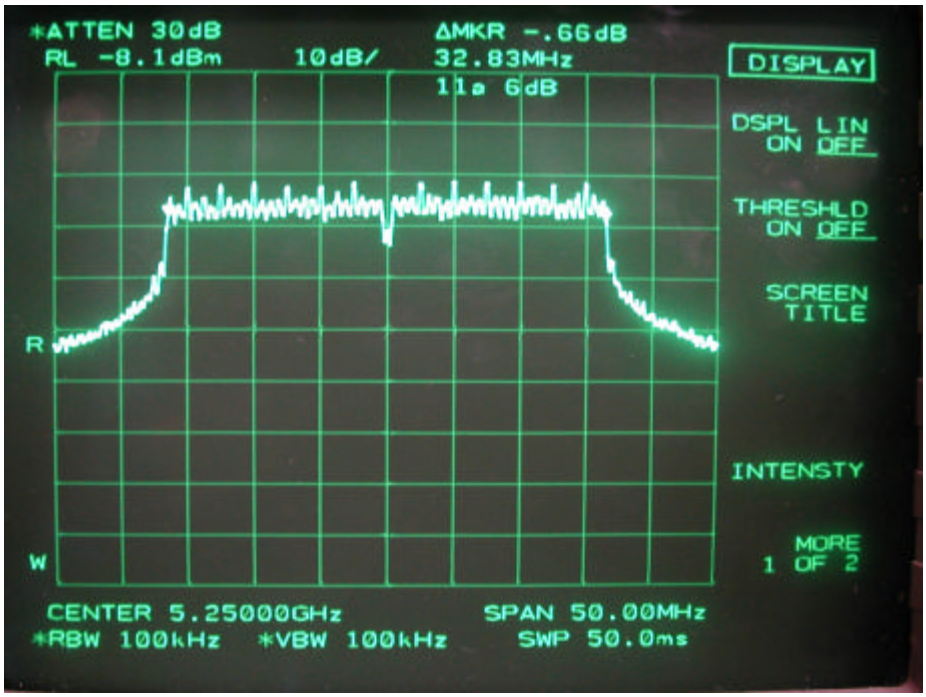
26 dB Bandwidth of Lowest Channel (Turbo mode)



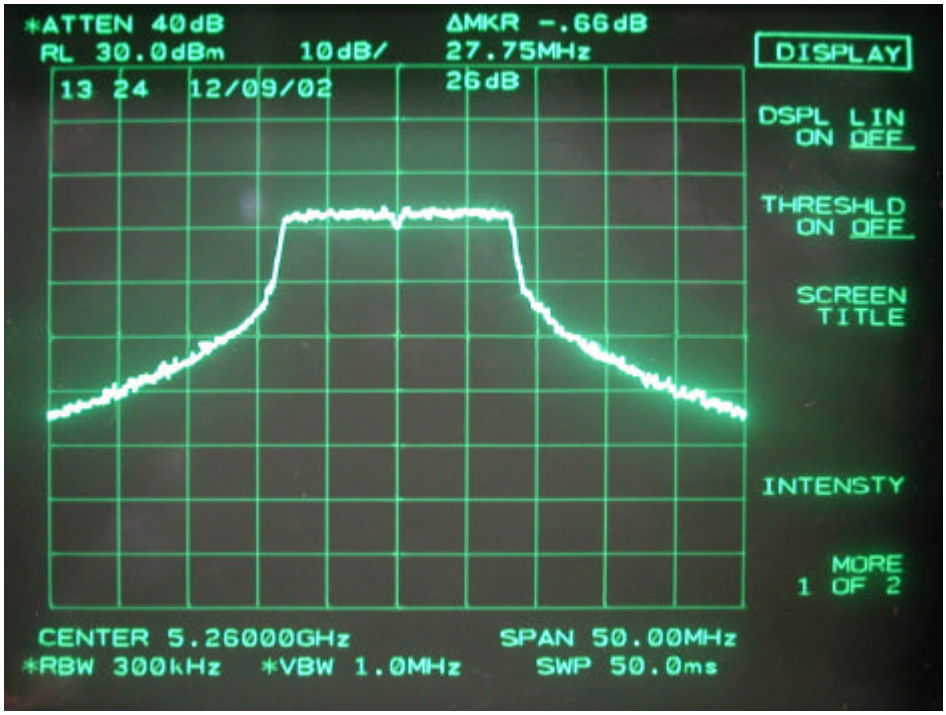
6 dB Bandwidth of Middle Channel (Base mode)



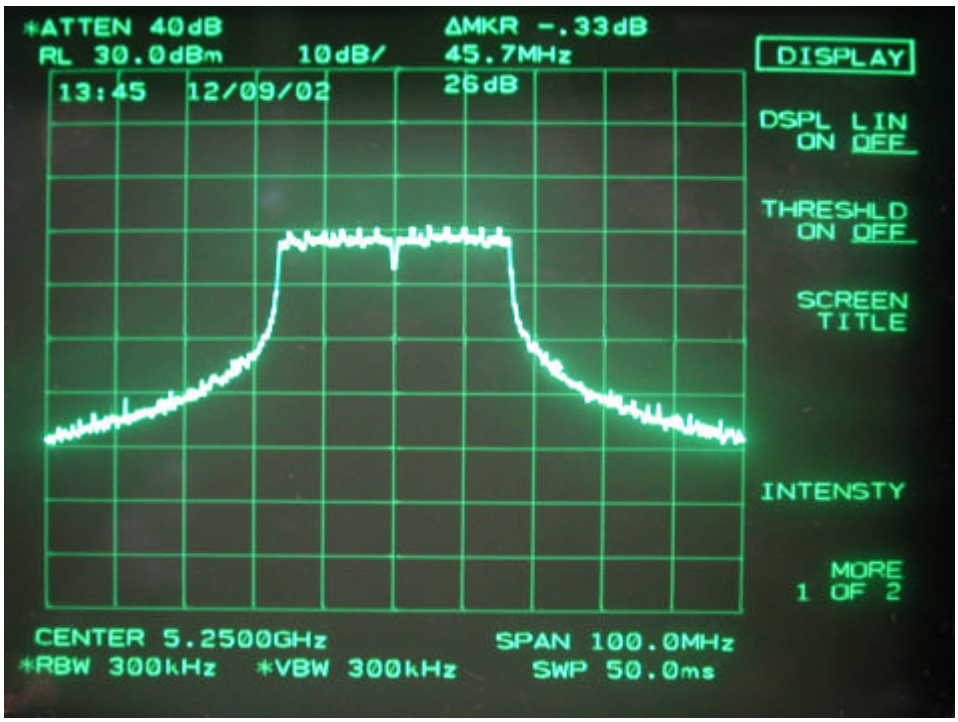
6 dB Bandwidth of Middle Channel (Turbo mode)



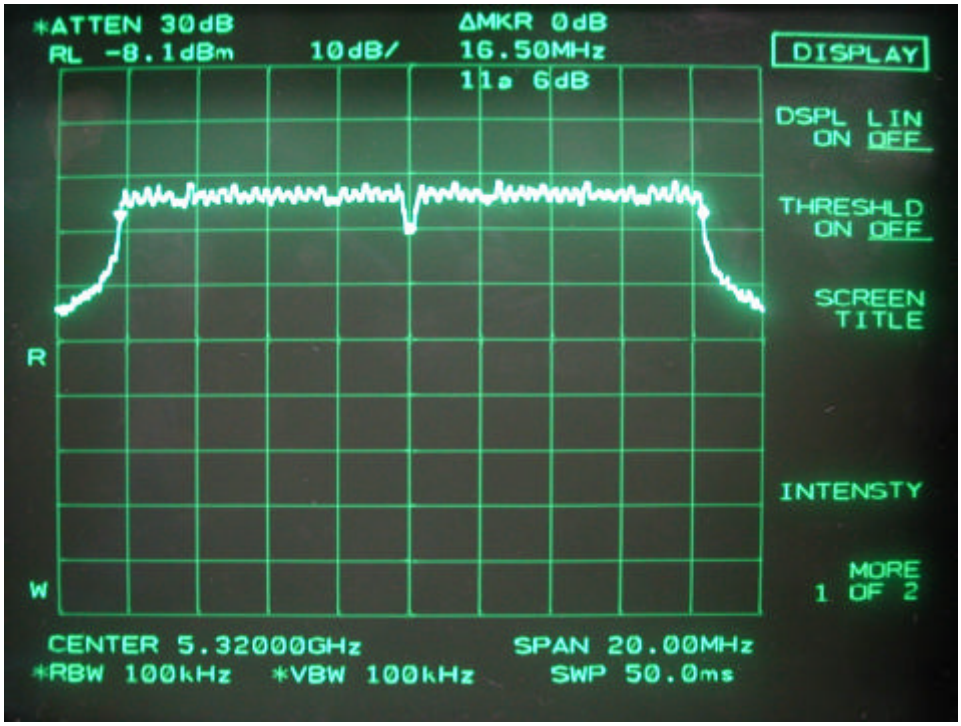
26 dB Bandwidth of Middle Channel (Base mode)



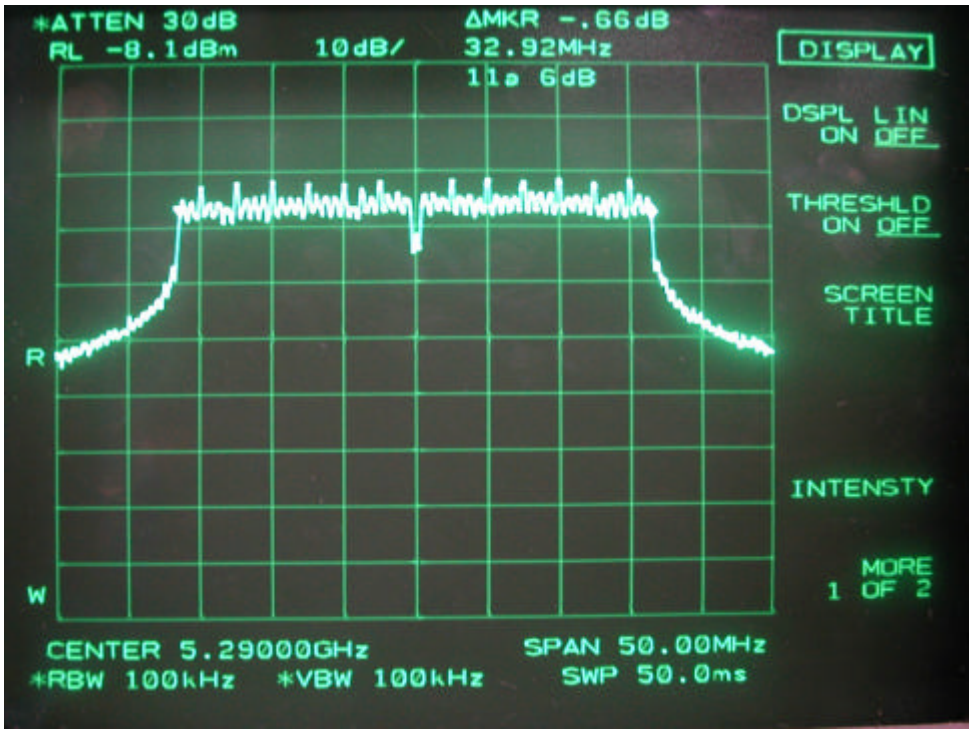
26 dB Bandwidth of Middle Channel (Turbo mode)



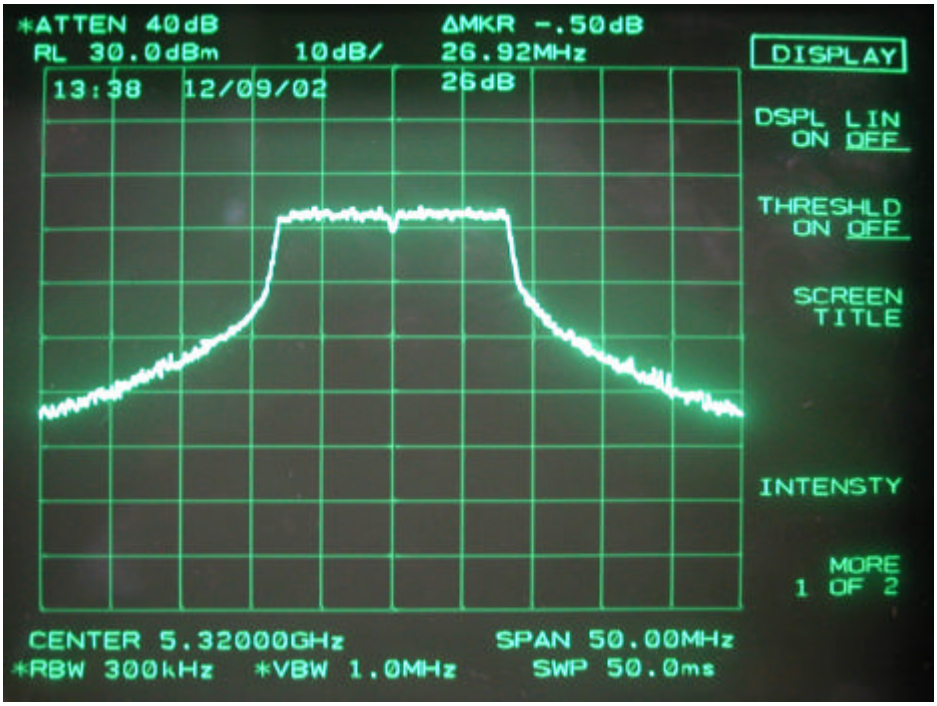
6 dB Bandwidth of Highest Channel (Base mode)



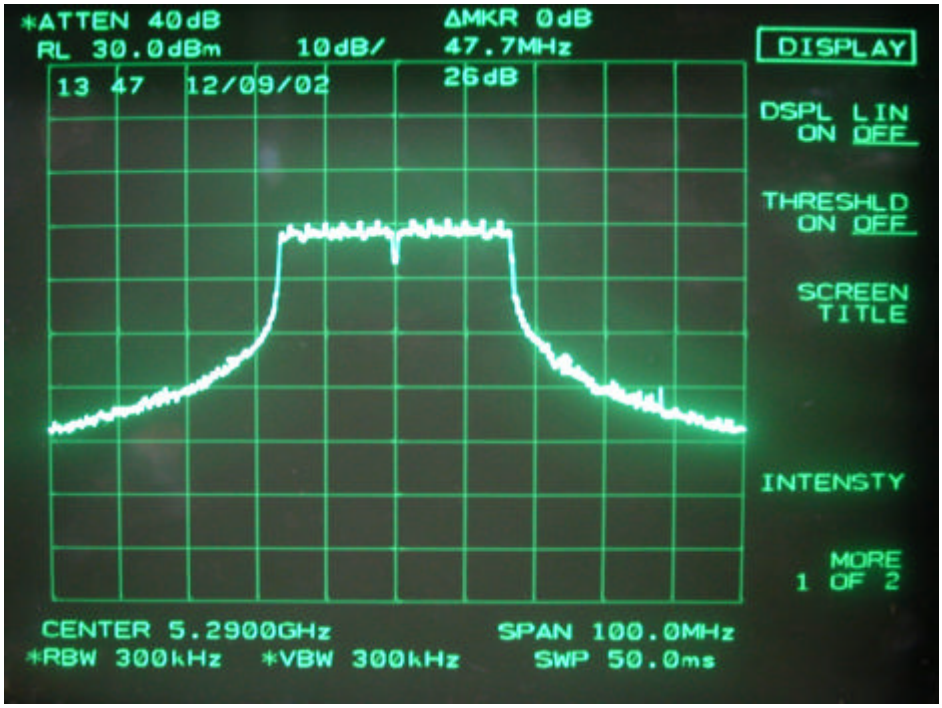
6 dB Bandwidth of Highest Channel (Turbo mode)



26 dB Bandwidth of Highest Channel (Base mode)

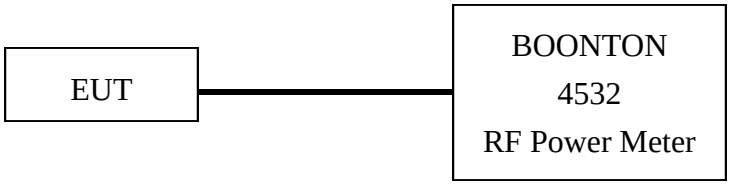


26 dB Bandwidth of Highest Channel (Turbo mode)



IV. Section 15.407(a)(1)/(2): Power Output Measurement

4.1 Test Condition & Setup



1. The output of the transmitter is connected to the BOONTON RF Power Meter.
2. The calibration is performed before every tests. The values of the output power of the EUT will shown in the dBm directly are the transmitter output peak power. Recorded as follows.

4.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last Cali.	Due On
RF Power Meter	4532	BOONTON	117501	Mar/21/02	Mar/21/03

4.3 Test Result of Power Output Measurement

Base Mode

Channel	Frequency	Power Meter Reading	Cable Loss	Limit	Output peak power	
	MHz	dBm	dBi	dBm	dBm	mW
Lowest	5180	16.25	0.20	17.00	16.45	44.16
Middle	5260	16.64	0.20	24.00	16.84	48.31
Highest	5320	16.84	0.20	24.00	17.04	50.58

Turbo Mode

Channel	Frequency	Power Meter Reading	Cable Loss	Limit	Output peak power	
	MHz	dBm	dBi	dBm	dBm	mW
Lowest	5210	16.21	0.20	17.00	16.41	43.75
Middle	5250	15.91	0.20	17.00	16.11	40.83
Highest	5290	16.48	0.20	24.00	16.68	46.56

Note:

1. The readings are all under the limits.

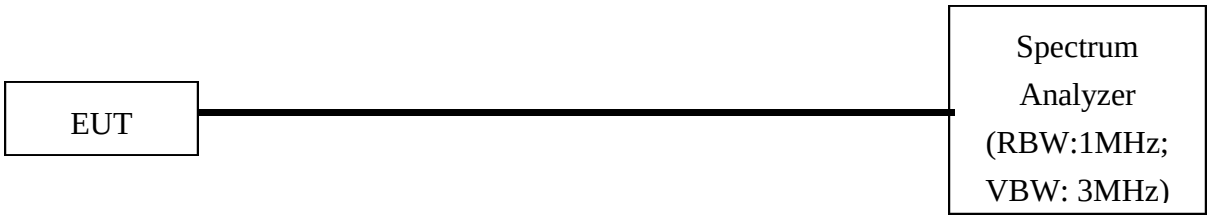
V. Section 15.407(a)(1)/(2): Power Spectral Density

5.1 Test Condition & Setup

The tests below are running with the EUT transmitter set at high power in TDD mode .A LAN port from a notebook computer connect to the EUT. The EUT is needed to force selection of output power level and channel number. While testing, the EUT was set to transmit continuously and to be tested by the contact manner with the spectrum analyzer.

The attachments below show our observation.

5.2 Test Instruments Configuration



Test Configuration of Power Spectral Density

(P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit)

5.3 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
Spectrum Analyzer	8592A	H P	3003AD1401	Jan/02/02	Jan/01/03

5.4 Test Result of Peak Power Spectral Density

The following table shows a summary of the test results of the Power Spectral Density.

Base Mode

Channel	Frequency (MHz)	PPSD (dBm)	Cable Loss (dB)	Ppq (dBm)	Limit (dB)	Margin (dB)
Lowest	5180	-4.67	0.20	-4.47	4.00	-8.47
Middle	5260	-4.17	0.20	-3.97	11.00	-14.97
Highest	5320	-3.50	0.20	-3.30	11.00	-14.30

Turbo Mode

Channel	Frequency (MHz)	PPSD (dBm)	Cable Loss (dB)	Ppq (dBm)	Limit (dB)	Margin (dB)
Lowest	5210	-7.17	0.20	-6.97	4.00	-10.97
Middle	5250	-6.33	0.20	-6.13	4.00	-10.13
Highest	5290	-7.17	0.20	-6.97	11.00	-17.97

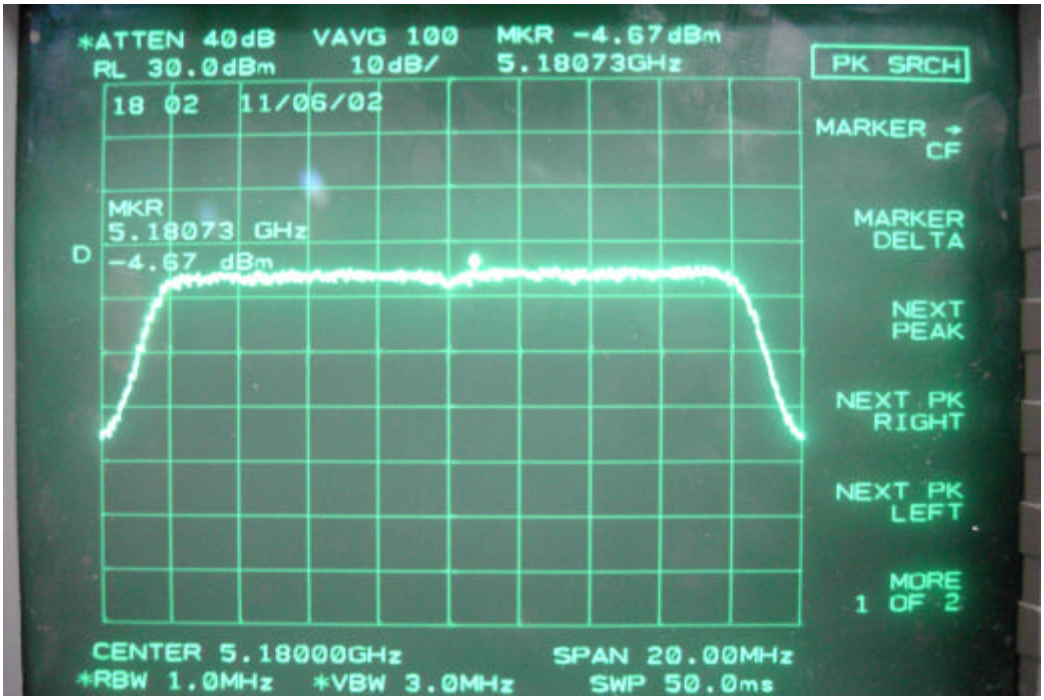
Note:

1.Ppr: spectrum read power density (using peak search mode),

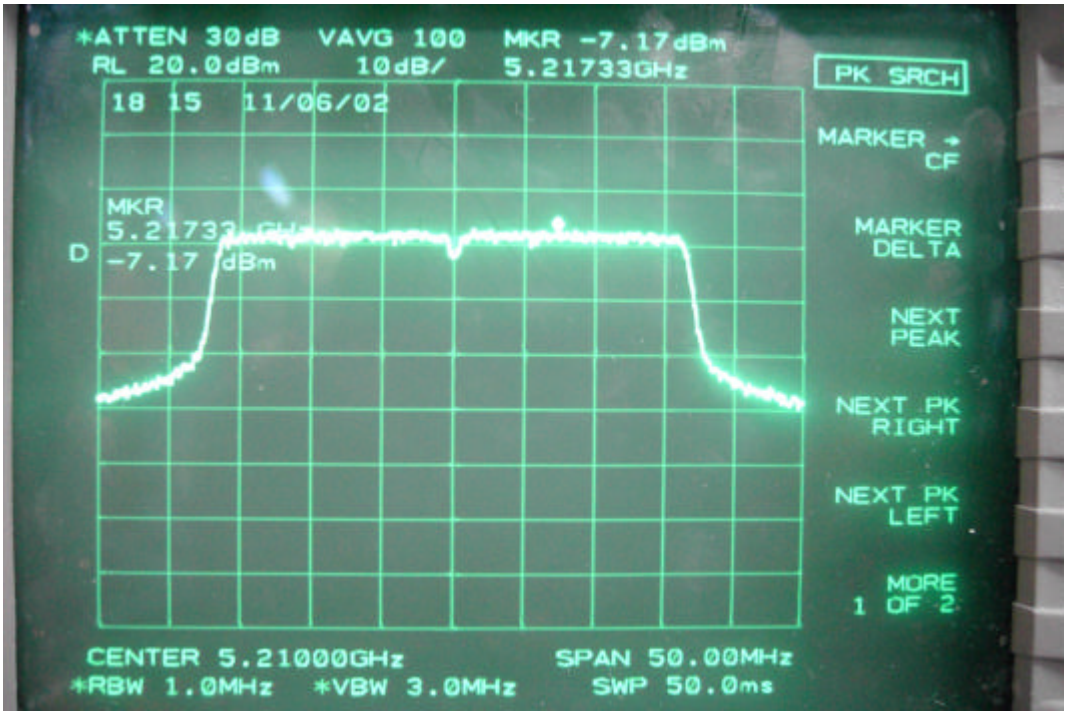
Ppq: actual peak power density in the spread spectrum band.

2.Ppq = Ppr + |Cable Loss|

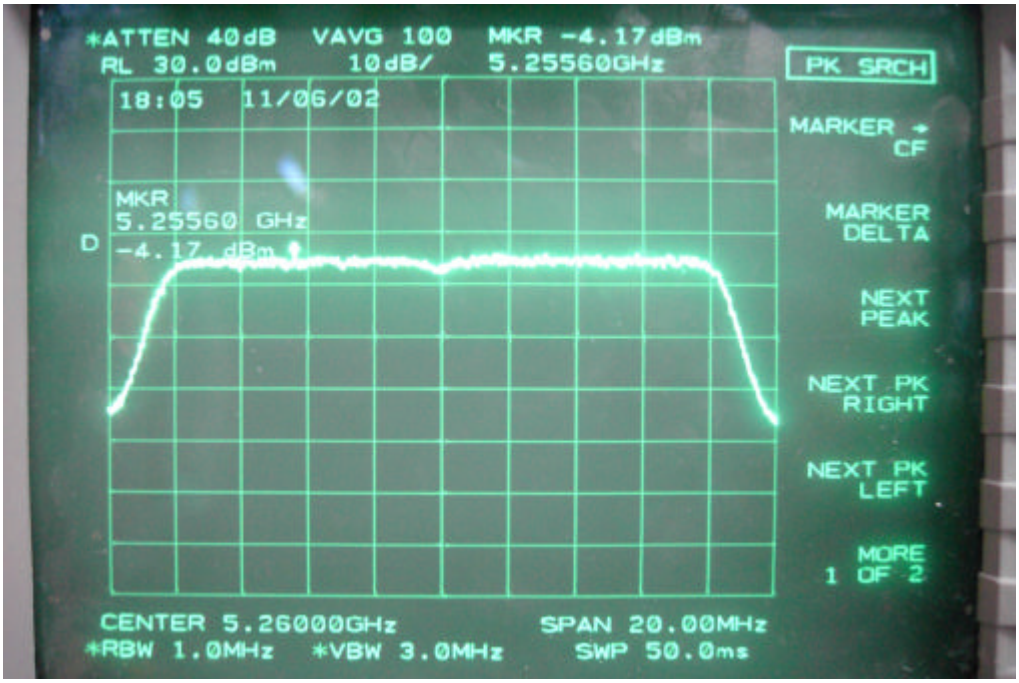
Lowest Channel (Base mode)



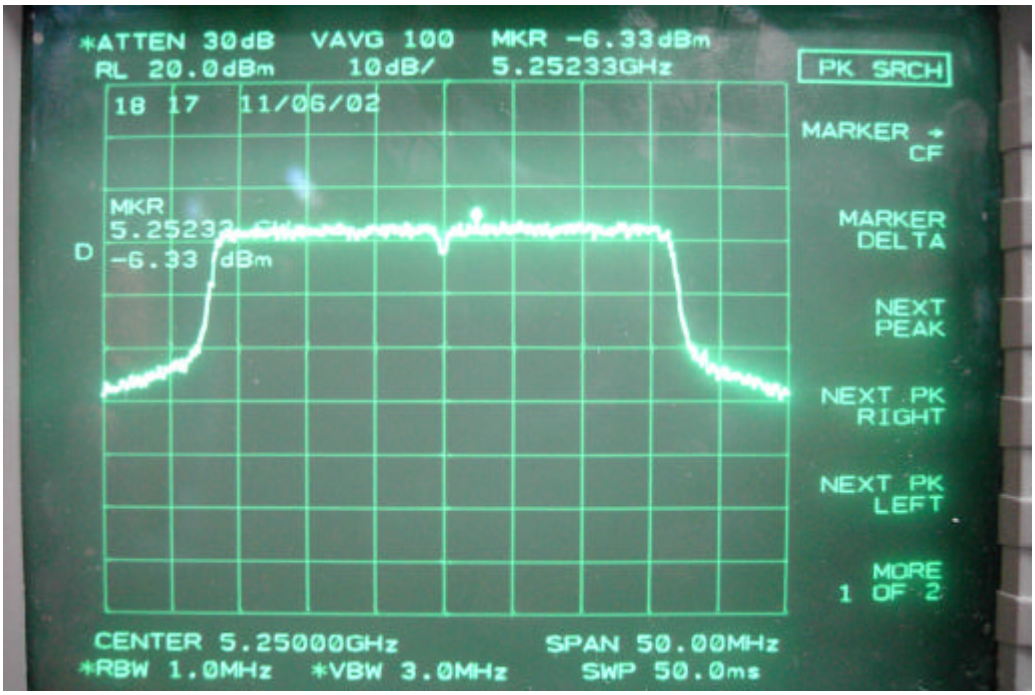
Lowest Channel (Turbo mode)



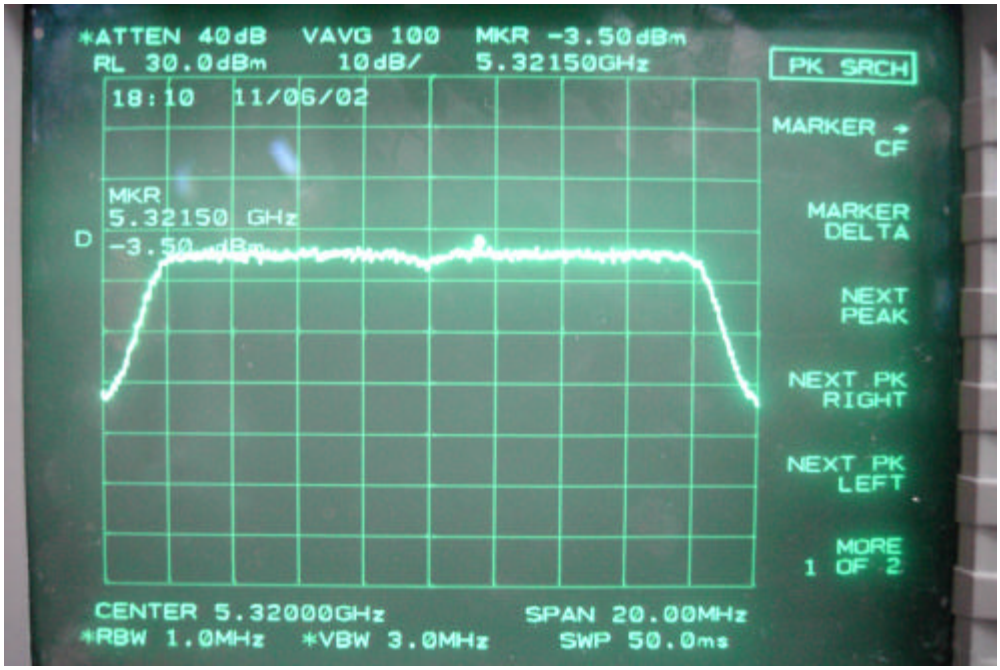
Middle Channel (Base mode)



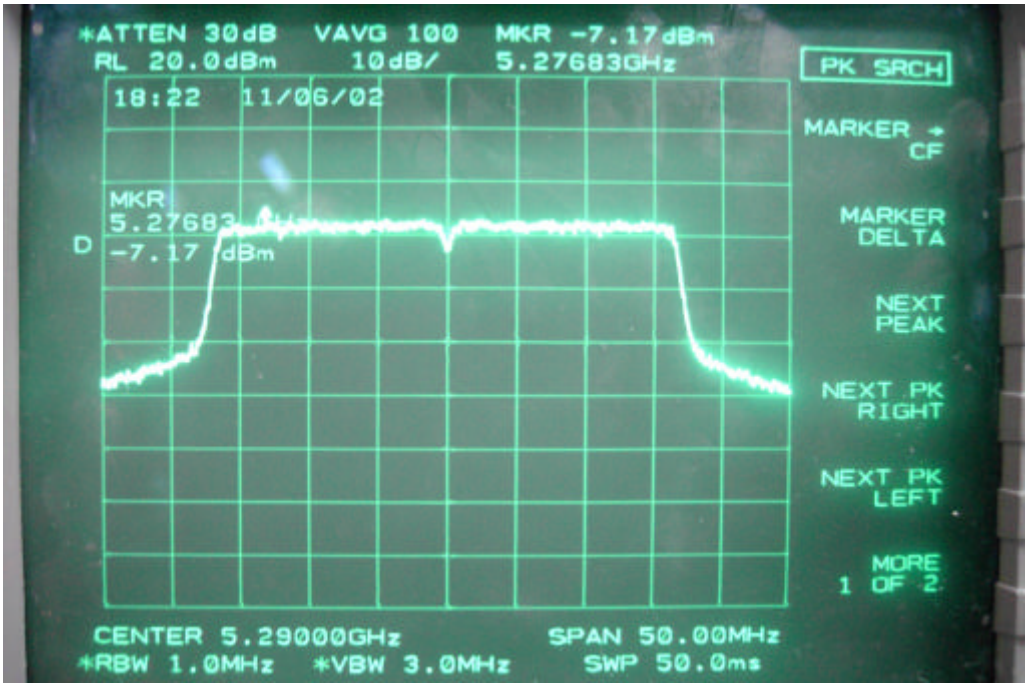
Middle Channel (Turbo Mode)



Highest Channel (Base mode)



Highest Channel (Turbo mode)



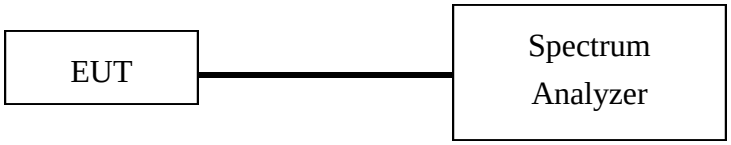
VI. Section 15.407(a)(6): Peak Excursion Ratio

6.1 Test Condition & Setup

This test is performed by connecting the EUT to the spectrum analyzer by the contact manner. The RBW is set at 1 MHz with the VBW at 1 MHz at first, then VIEW and HOLD the trace named A. By VIEW the other trace named B with the VBW 30kHz.

Place the marker between these 2 traces. The Peak Excursion will be found by the differences between these 2 traces.

6.2 Test Instruments Configuration



Test Configuration of Peak Excursion Ratio

(P.S.: Notebook computer to control the EUT at maximal power output and channel number and set antenna kit)

6.3 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last Cali.	Due on
Spectrum Analyzer	8564A	H P	U536433002	Jan/01/02	Jan/01/03

6.4 Test Result of Peak Excursion Ratio

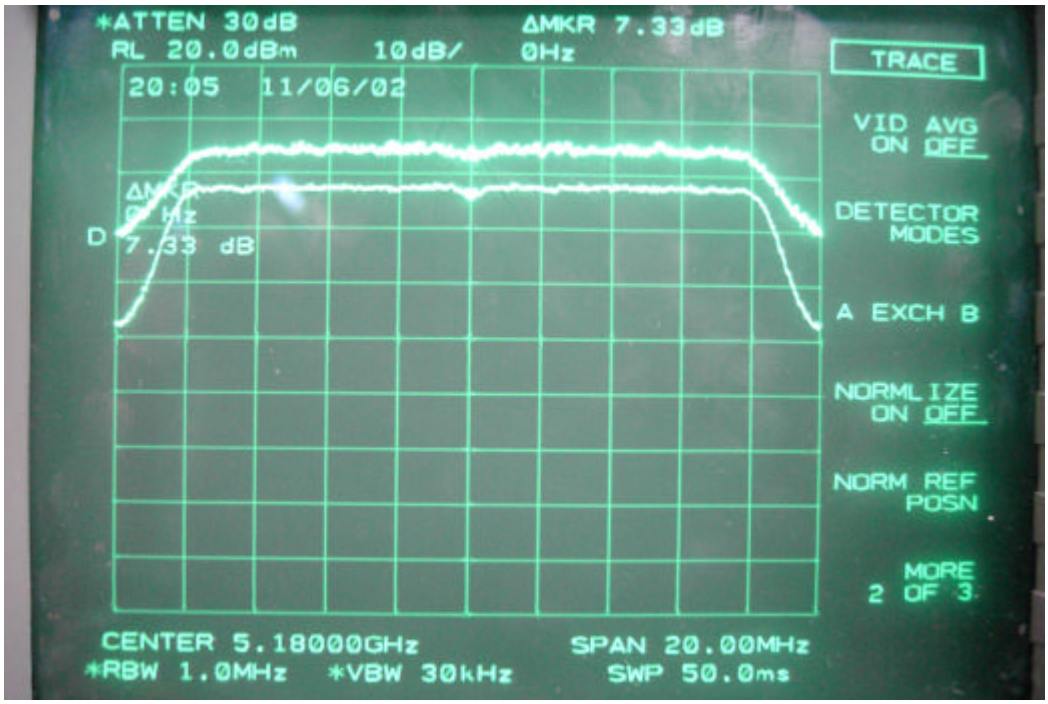
Base Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Lowest	5180	7.33	13.00	-5.67
Middle	5260	7.00	13.00	-6.00
Highest	5320	7.50	13.00	-5.50

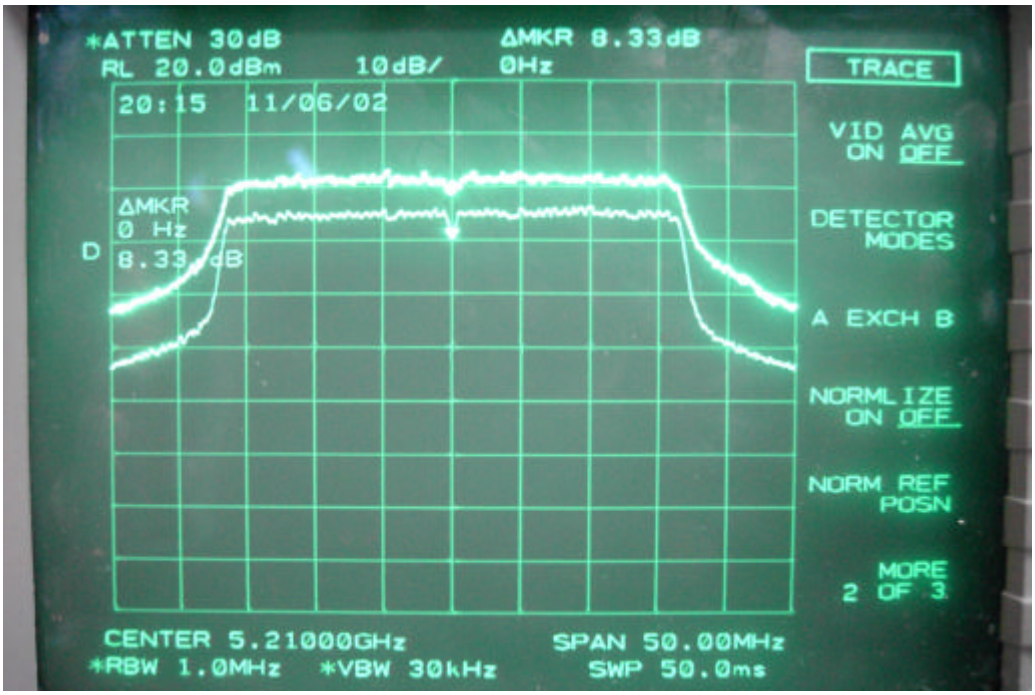
Turbo Mode

Channel	Frequency (MHz)	Peak Excursion (dB)	Limit (dB)	Margin (dB)
Lowest	5210	8.33	13.00	-4.67
Middle	5250	7.17	13.00	-5.83
Highest	5290	9.00	13.00	-4.00

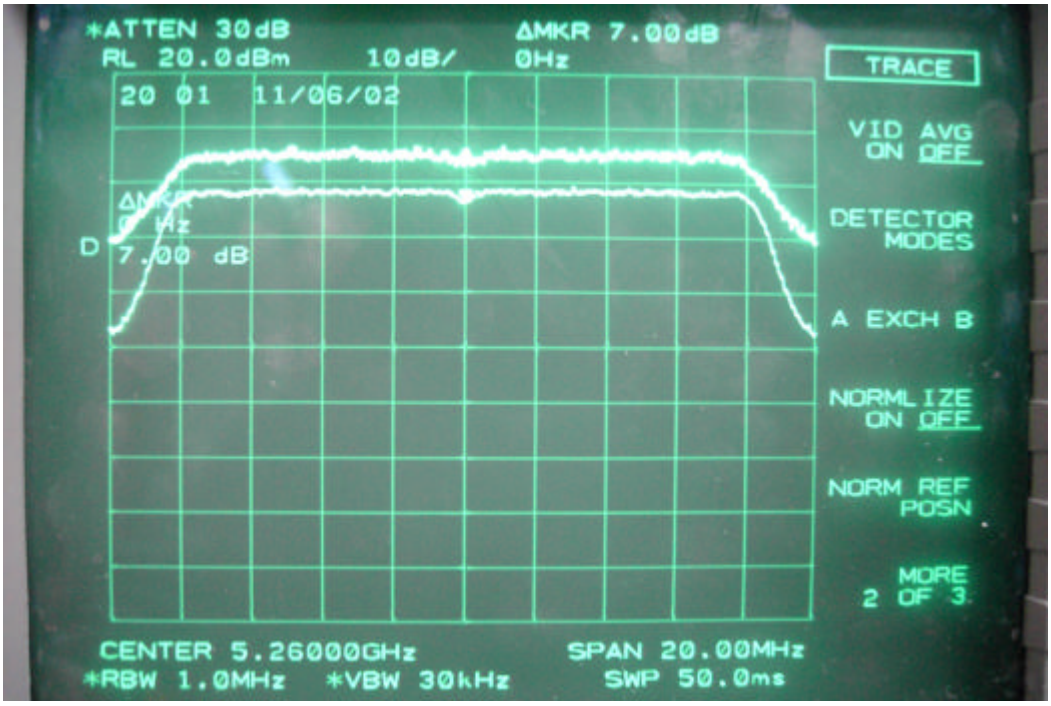
Lowest Channel (Base mode)



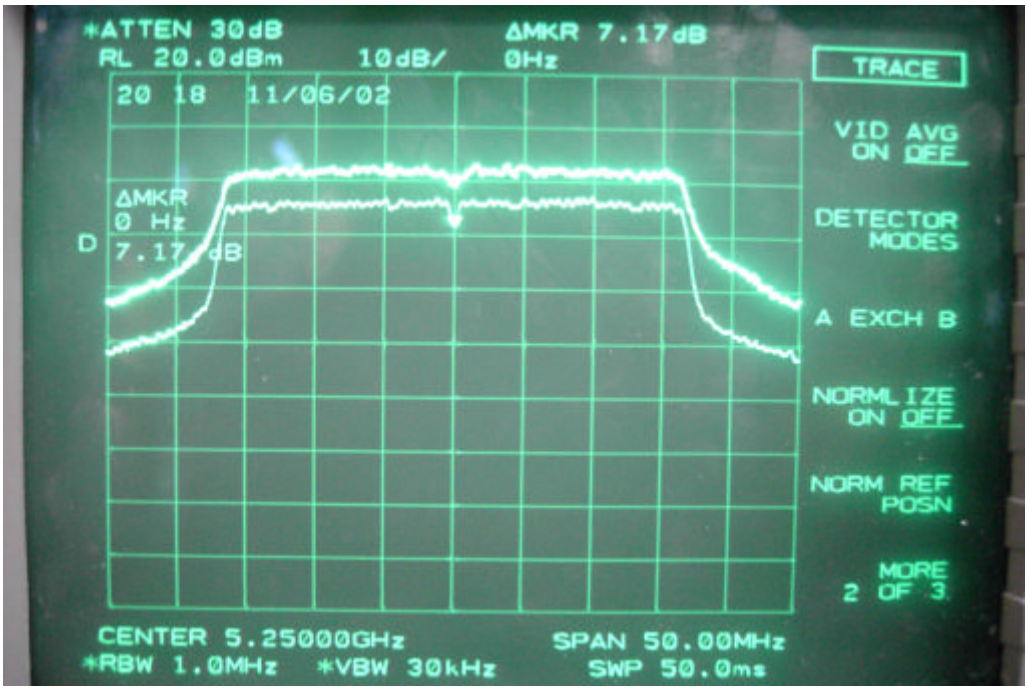
Lowest Channel (Turbo mode)



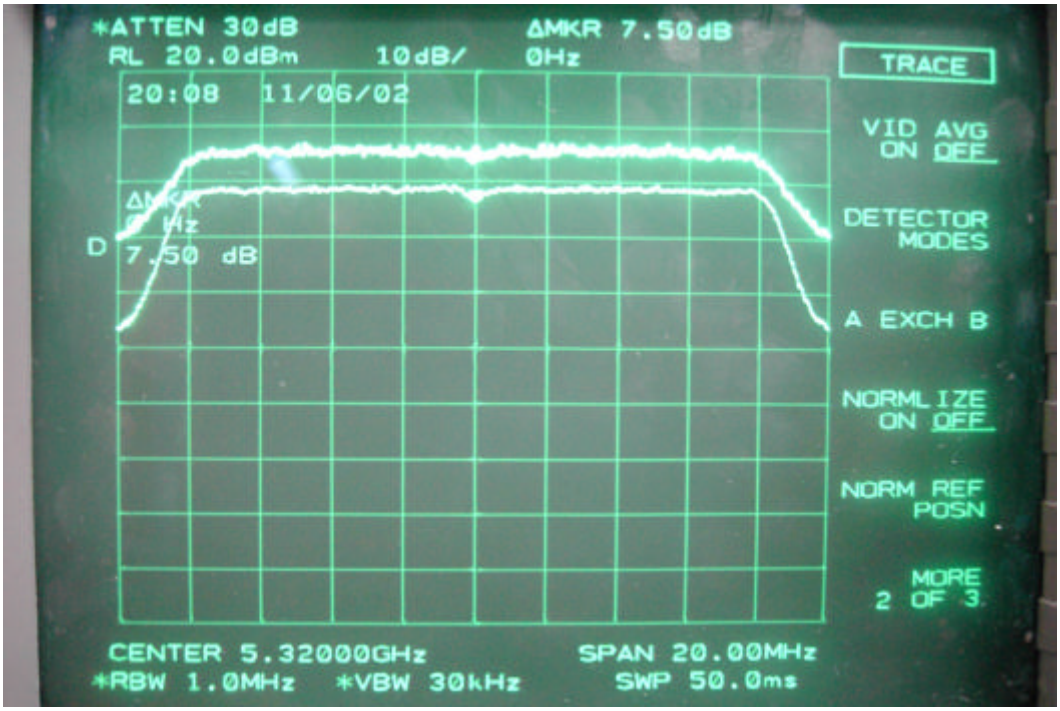
Middle Channel (Base mode)



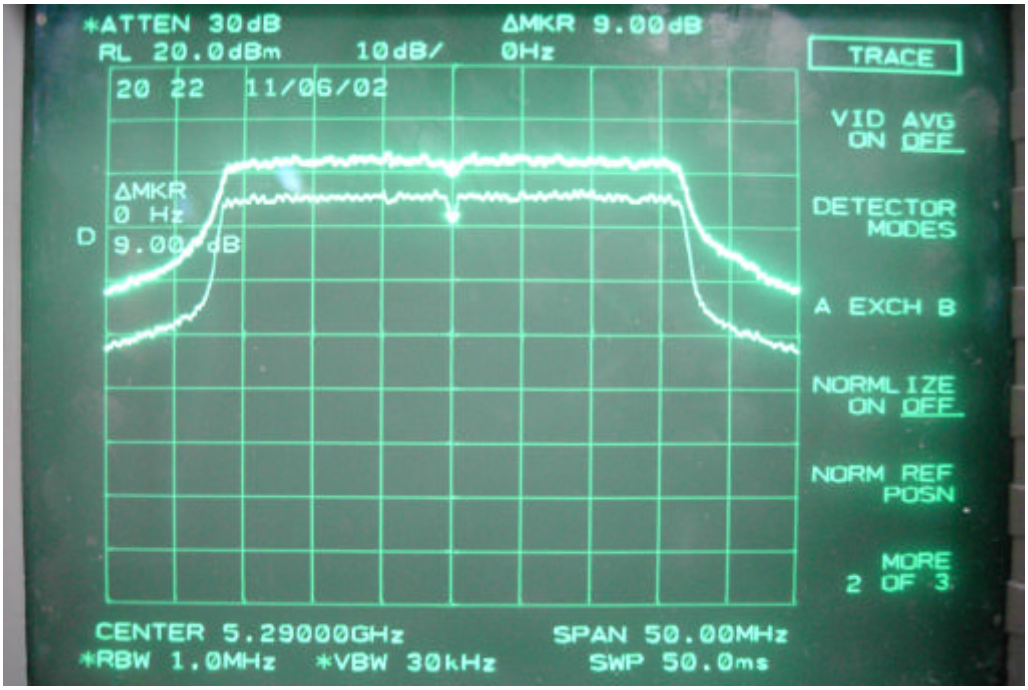
Middle Channel (Turbo mode)



Highest Channel (Base mode)



Highest Channel (Turbo mode)



VII. Section 15.407(b): Power Line Conducted Emissions for AC Powered Units

7.1 Test Condition & Setup

The power line conducted emission measurements were performed in an anechoic chamber. The EUT was assembled on a wooden table, which is 80 centimeters high, was placed 40 centimeters from the backwall and at least 1 meter from the sidewall.

Power was fed to the EUT from the public utility power grid through a line filter and Line Impedance Stabilization Networks (LISNs). The LISN housing, measuring instrumentation case, ground plane, etc., were electrically bonded together at the same RF potential. The Spectrum analyzer (or EMI receiver) was connected to the AC line through an isolation transformer. The 50-ohm output of the LISN was connected to the spectrum analyzer directly. Conducted emission levels were in the CISPER quasi-peak detection mode. The analyzer's 6 dB bandwidth was set to 9 KHz. No post-detector video filter was used.

The spectrum was scanned from 150 KHz to 30 MHz. The physical arrangement of the test system and associated cabling was varied (within the scope of arrangements likely to be encountered in actual use) to determine the effect on the unit's emanations in amplitude and frequency. All spurious emission frequencies were observed. The highest emission amplitudes relative to the appropriate limit were measured and have been recorded in paragraph 2.4.

There is a test condition apply in this test item, the test procedure description as the following:

EUT transmit only:

Using the PCMCIA slot of notebook computer and software to control the EUT. Then making access to the mode of continuous transmission and setting the testing channel.

The setting up procedure is recorded on <Appendix A>.

7.2 List of Test Instruments

Instrument Name	Model No.	Brand	Serial No.	Last time	Next time
EMI Receiver	8546A	H P	3520A00242	Jun/29/02	Jun/29/03
RF Filter Section	85460A	H P	3448A00217	Jun/29/02	Jun/29/03
LISN (EUT)	LISN-01	TRC	9912-03,04	Dec/09/02	Dec/09/03
LISN (Support E.)	LISN-01	TRC	9912-05	Jan/04/02	Jan/04/03
Switch/Control Unit (< 30MHz)	3488A	HP	N/A	Nov/20/02	Nov/20/03
Auto Switch Box (< 30MHz)	ASB-01	TRC	9904-01	11/20/02	11/20/03

7.3 Test configuration

Conducted Emissions Test Configuration

7.4 Test Result of Conducted Emissions

Testing Condition: Temperature: 22.5° C Humidity: 55.8 % RH

Line 1

Frequency (KHz)	*READING AMPLITUDE*			*LIMIT*		*Margin (dB)*
	Peak (dBmV/m)	*Quasi-Peak (dBmV/m)*	*Average (dBmV/m)*	*Quasi-Peak (dBmV/m)*	*Average (dBmV/m)*	
183.000	51.22	---	---	65.06	55.06	-3.84
208.000	43.22	---	---	64.34	54.34	-11.12
277.000	38.24	---	---	62.37	52.37	-14.13
370.000	38.34	---	---	59.71	49.71	-11.37
461.000	37.93	---	---	57.11	47.11	-9.18
738.000	31.05	---	---	56.00	46.00	-14.95
1477.000	32.59	---	---	56.00	46.00	-13.41
2480.000	32.73	---	---	56.00	46.00	-13.27
4327.000	30.02	---	---	56.00	46.00	-15.98
18500.000	34.94	---	---	60.00	50.00	-15.06

Line 2

Frequency (KHz)	*READING AMPLITUDE*			*LIMIT*		*Margin (dB)*
	Peak (dBmV/m)	*Quasi-Peak (dBmV/m)*	*Average (dBmV/m)*	*Quasi-Peak (dBmV/m)*	*Average (dBmV/m)*	
185.000	46.82	---	---	65.00	55.00	-8.18
210.000	39.49	---	---	64.29	54.29	-14.80
370.000	33.33	---	---	59.71	49.71	-16.38
461.000	34.78	---	---	57.11	47.11	-12.33
552.000	31.33	---	---	56.00	46.00	-14.67
824.000	27.35	---	---	56.00	46.00	-18.65
1113.000	29.46	---	---	56.00	46.00	-16.54
1477.000	30.75	---	---	56.00	46.00	-15.25
2394.000	29.67	---	---	56.00	46.00	-16.33
4406.000	28.58	---	---	56.00	46.00	-17.42

(NOTE: Margin = Peak Amplitude – Limit)

VIII. Section 15.407(c): Automatic Discontinuation of Operation Specifications

In order to comply the rules, the operational should be terminated when the information is absent. For the issue about this, please refer to the <Theory of the operations> for the detailed information.

IX. Section 15.407(g): Frequency Stability Specifications

The rules requests that stability of frequency should be within the -20ppm.. Further info about the compliance can be found in the <Theory of the operations>.

X. Section 15.407 (f): RF Exposure Requirements

The EUT with an external integral antenna deems not to be intended for the use as a portable device (The typically setup can be referred to the cover page of the Manual attached) It is fallen into the catalogue of the Mobile device as the separation between the user and the antenna is always greater than 20cm. Upon the Rules, the MPE evaluation is sufficient to show the compliance with the RF Exposure Requirement – Please find the MPE evaluation issue with our separate exhibit.

Appendix A

Setting up Procedure

1. The EUT inserted into the PCI slot of the personal computer..
2. Use the software that is given by the manufacturer to control the EUT at specific mode of transmission.
3. Then making access to the mode of continuous transmission and set the testing channel.