

## **EMISSIONS TEST REPORT FOR A LOW POWER TRANSMITTER**

### **I. GENERAL INFORMATION**

Requirement: Federal Communications Commissions

Test Requirements: 15.205, 15.207, 15.209, 15.247

Applicant: Aperto Networks  
1637 S Main Street  
Milpitas CA 95035

Product ID: **FCC ID: PS6R3000-A2**

### **II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)**

The Aperto FCC ID: PS6R3000-A2 is a DTS radio system.

#### **RF Specifications**

RF Frequency Band	5728 - 5847 MHz
RF Channels	Programmable in 1 MHz steps Power programmable in 0.2 dB steps
RF Signal Bandwidth	5.8 MHz (20 dB BW)
Modulation Type	16 QAM or QPSK (dynamically selected)
Transmitter Output Power	+20dBm maximum
Antennas	See table page 3 below

### **III. TEST LOCATION**

All emissions tests were performed at:

Compliance Certification Services  
571F Monterey Road  
Morgan Hill, CA 95037

T.N. Cokenias  
EMC Consultant/Agent for Aperto Networks Inc.

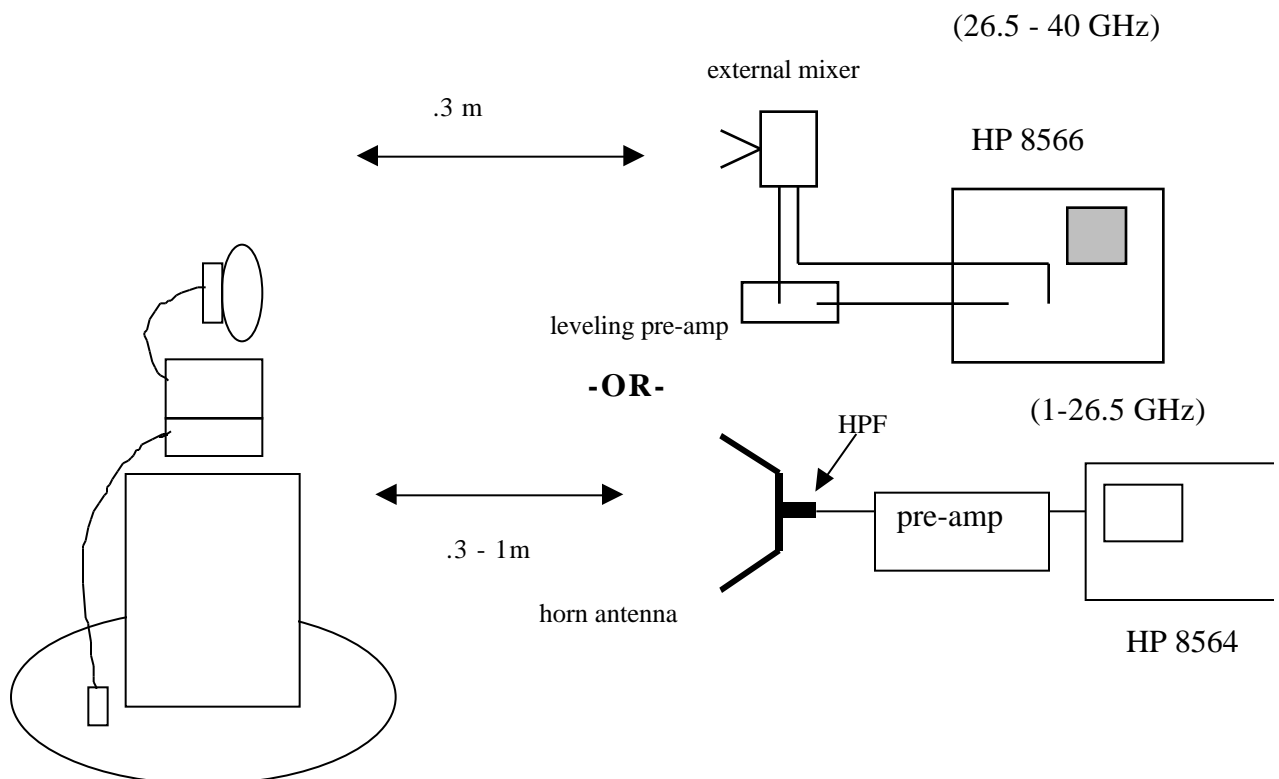
4 December 2002

**TEST PROCEDURES****Measurement Equipment Used:**

<b>TEST EQUIPMENTS LIST</b>				
<b>Name of Equipment</b>	<b>Manufacturer</b>	<b>Model No.</b>	<b>Serial No.</b>	<b>Due Date</b>
Quasi-Peak Detector	HP9K - 1GHz	85650A	3145A01654	6/1/03
Spectrum Display	HP	85662A	2152A03066	6/1/03
Spectrum Analyzer	HP100Hz - 22GHz	8566B	3014A06685	6/1/03
Microwave Amp(2- 8GHz)	HP	11975A	2517A01067	10/14/03
EMI Test Receiver	Rohde & Schwarz	ESHS 20	827129/006	4/17/03
LISN	Fischer 9k - 100MHz	C-LISN-50/250-2	114	9/6/03
Harmonic Mixer(26.5 - 40GHz)	HP	11970A	3003A04190	10/14/06
Pre-Amplifier	MITEQ1-26GHz	NSP2600-44	646456	7/10/03
Horn	EMCO	3115	6717	1/30/03
Spectrum Analyzer	HP	8564E		
Hi-Pass Filter	FSY Microwave	FM-7600-9SS	2	NCR

HP 8564E 9Khz-40 Ghz

Cal due 7-22-03

**Radiated Emissions Above 1 GHz****Test Requirement: 15.109, 15.205, 15.209, 15.247****Test Set-Up**

**Test Procedures, 1- 26 GHz:**

1. The EUT was placed on a wooden table resting on a turntable on the open air test site. The search antenna was placed 3m from the EUT. The EUT antenna was mounted vertically as per normal installation.
2. The turntable was slowly rotated to locate the direction of maximum emission at each emission falling in the restricted bands of 15.205.
3. Radiated emissions were investigated for a LOW channel, a MID channel, and HIGH channel. Emissions were investigated to the 10<sup>th</sup> harmonic.
4. Once maximum direction was determined, the search antenna was raised and lowered in both vertical and horizontal polarizations. The maximum readings so obtained are recorded in the data listed below.

**Test Procedures, 26.5 - 40 GHz**

1. The EUT was placed on a non-conductive table
2. The external mixer horn antenna was brought to within 1 foot (0.3m) of the EUT.
3. The horn antenna was moved around all surfaces of the EUT and EUT antenna in search of emissions coming from the EUT. This was done in both vertical and horizontal polarities

Testing was performed at 3 different frequencies

**Channel      Frequency, MHz**

Low	5728
Mid	5788
High	5847

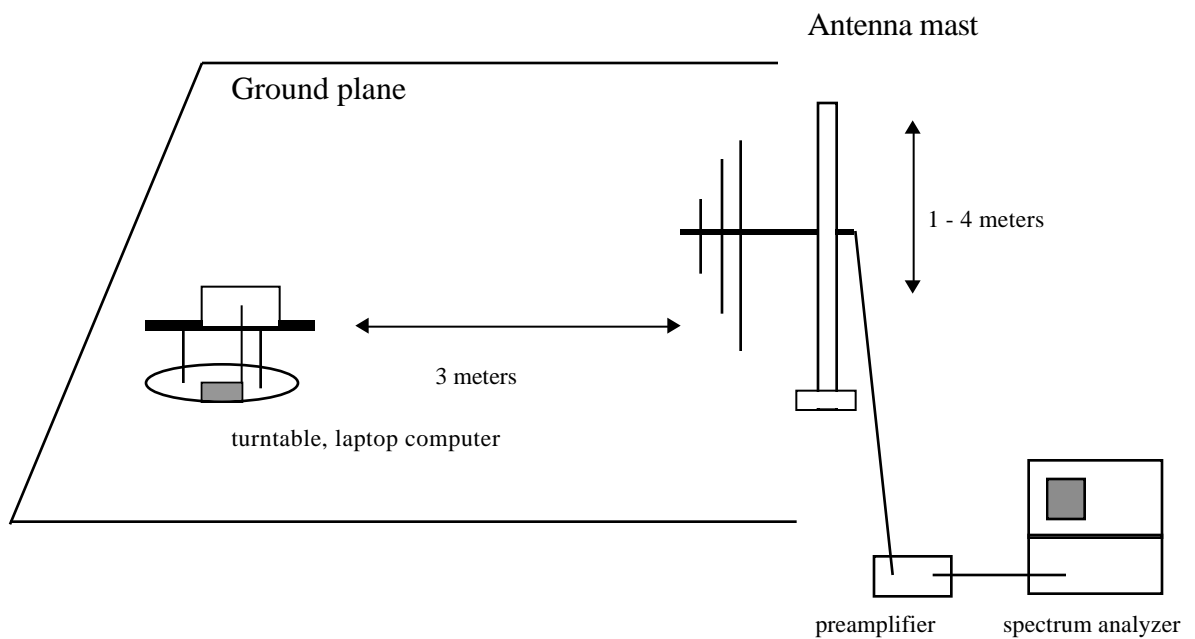
Radiated emissions were performed at each frequency for 3 different transmitter antennas.

Antennas tested:

Antenna Type	Deployment	Gain	Antenna Mfr.	Model
Panel Patch (integral antenna)	Point to Point	17 dBi	European Antennas	FPA19-55VH- APO2/821
Panel	Point to Point Point to Multipoint	24 dBi	MTi	MT-484006
90 deg. Sector	Point to Multipoint	16 dBi	RadioWaves	SEC-55-D-90-16

**Test Results:** Worst case results are presented. Refer to separate Excel spread sheet files.

## Radiated Test Set-up, 30 - 1000 MHz



## Test Procedures, 30 -1000 MHz

Emissions in 30 - 1000 MHz range were from digital circuitry of IDU ethernet section only (15.109). A separate verification report has been submitted to the client. The IDU is identical to those used for all Aperto radio product, including the previously certificated FCC ID: PS63000-A1. Refer to subscriber IDU digital and base station IDU digital data in separate attachments.

**AC Line Conducted Emissions**  
**Test Requirement: 15.107, 15.207**

**Measurement Equipment Used:**

Rohde & Schwarz EMI Receiver ESHS-20  
Fischer Custom Communication LISN, FCC-LISN-50/250-25-2

**Test Procedure**

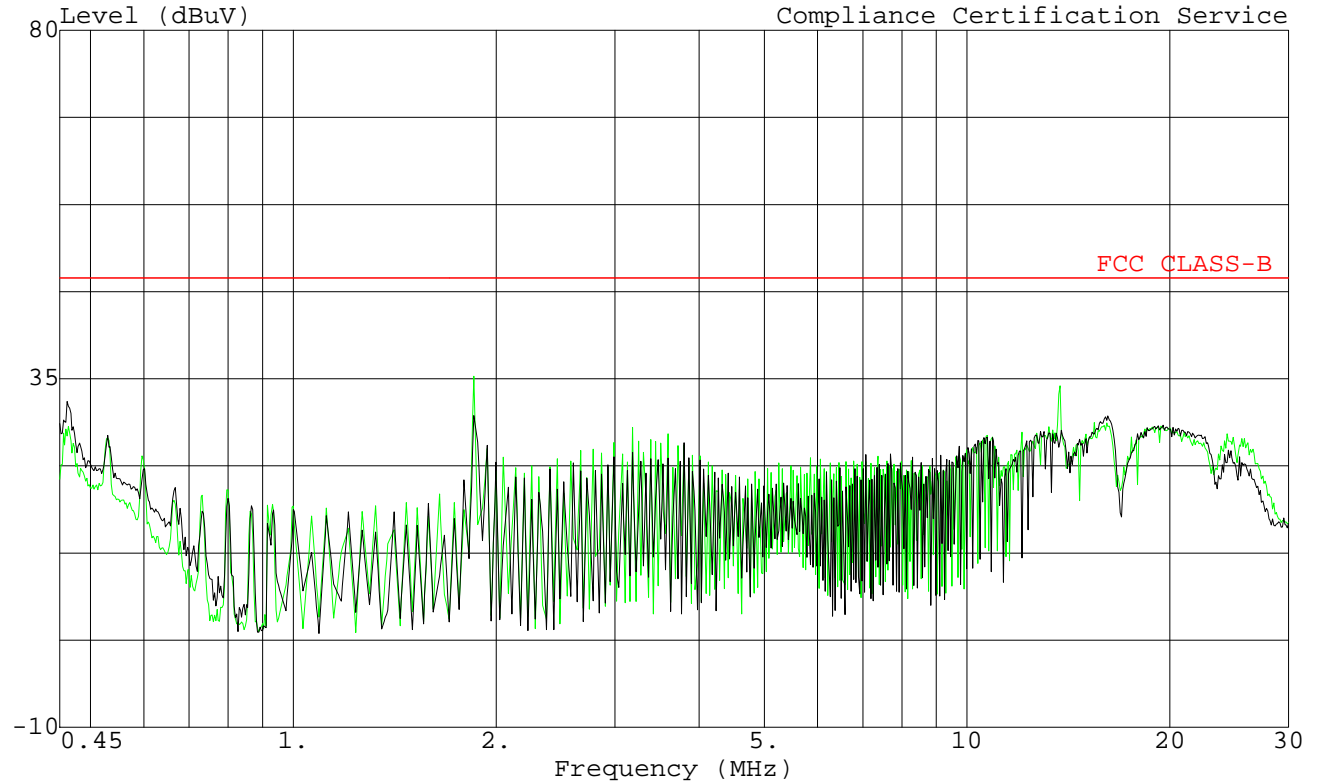
1. The EUT was placed on a wooden table 40 cm from a vertical ground plane and approximately 80 cm above the horizontal ground plane on the floor. The EUT was set to transmit in normally.
2. Line conducted data was recorded for both NEUTRAL and HOT lines.

**Test Results**

PASS. Refer to data sheets below.

Data#: 7 File#: APERTO.EMI

Date: 12-02-2002 Time: 17:06:08



Trace: 3

Ref Trace:

Project # : 02U1684-1  
Test Engineer : Chin Pang  
Company : Aperto Networks  
EUT : aperto Networks 5.8 Ghz DTS  
Model Name : Pwr 5800-GN  
Test Config. : EUT/Support Equipment  
Test of Target: FCC Class B  
Mode of Op. : Tx/Rcv  
: 115vac@60Hz  
: L1: Peak ( Green ), L2: Peak ( Black )

**Minimum 6 dB Bandwidth  
Test Requirement: 15.247(a)2**

**Measurement Equipment Used:**

Agilent E3440 Spectrum Analyzer  
3ft length low loss coaxial cable

**Test Procedures**

The EUT was configured on a test bench. The EUT was set for continuous operation . Frequency was set to LOW channel. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission occupied bandwidth.

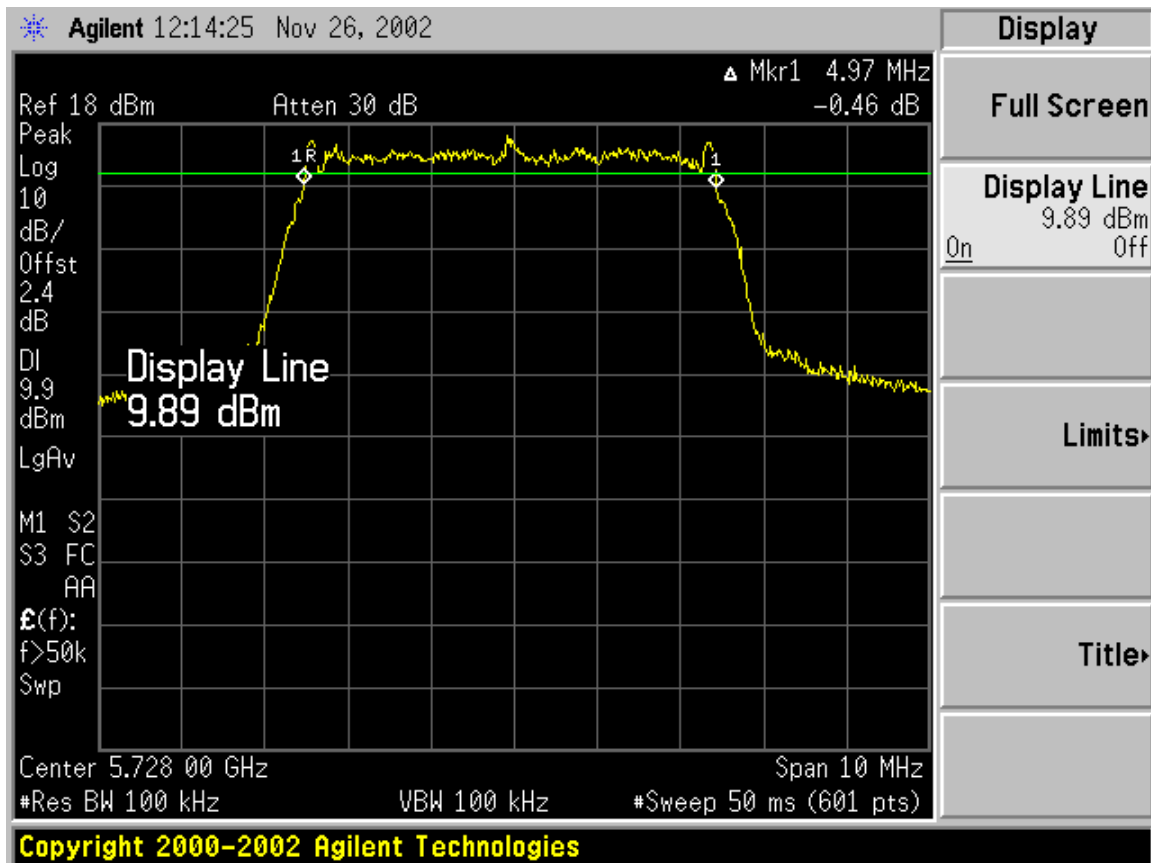
The test was repeated at MID channel and at HIGH channel.

**Test Results:** Refer to attached spectrum analyzer charts. Data taken with RES BW of 100 kHz shows minimum 6 dB BW of about 5 MHz. Minimum requirement: 500 kHz

<b>Channel</b>	<b>Frequency, MHz</b>
Low	5728
Mid	5788
High	5847

# 15.247(a)2: Minimum 6 dB Bandwidth

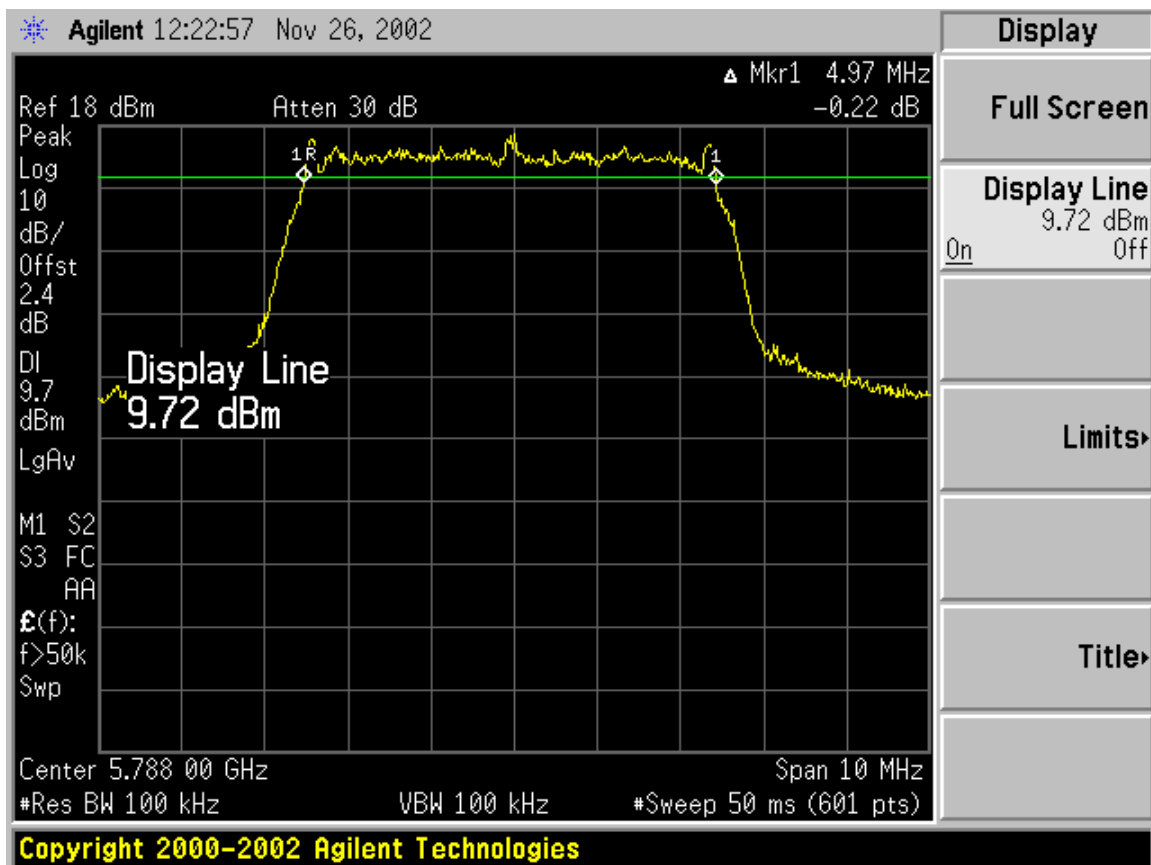
## LOWChannel





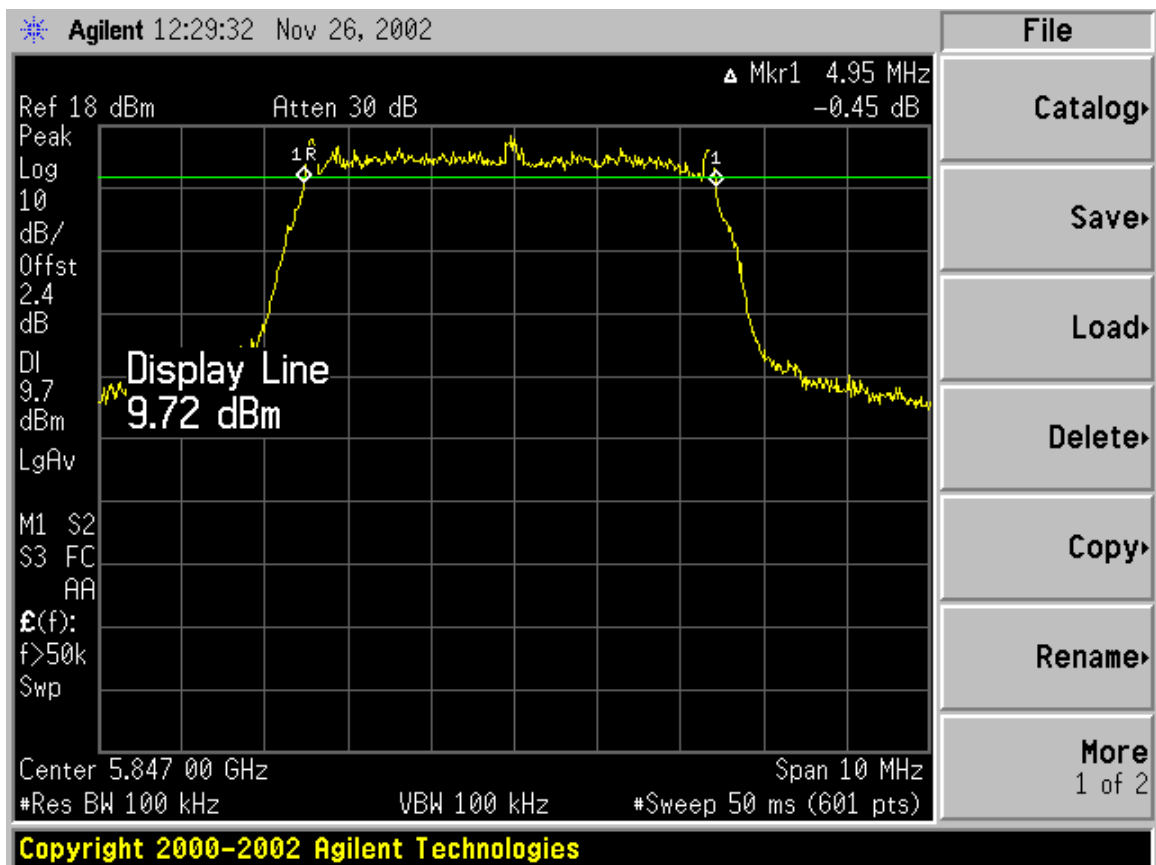
## 15.247(a)2: Minimum 6 dB Bandwidth

### MID Channel



## 15.247(a)2: Minimum 6 dB Bandwidth

### HIGH Channel



## **RF Power Output**

### **Test Requirement: 15.247(b)**

#### **Measurement Equipment Used:**

Agilent E4416A power meter  
Agilent E9327A RF sensor  
20 dB attenuator

#### **Test Procedures**

1. The EUT was configured on a test bench. The power meter was zeroed and calibrated. The control software was activated and power was set to produce highest output level.
2. The 20 dB attenuator was connected to the antenna port of the EUT. The power meter head was connected to the other end of the attenuator. Peak power was read directly off the meter, accounting for the 20 dB attenuator.
3. The process in (1) and (2) was repeated for MID channel and HIGH channel.

#### **Test Results**

Power level readings converted to dBm are shown below. Refer also to spectrum analyzer graphs. Reference level offset corrects for external attenuation and cable loss.

<b>Channel</b>	<b>Frequency, MHz</b>	<b>Output Power, dBm</b>
LOW	5728	19.5
MID	5788	20.0
HIGH	5847	20.0

Maximum output power output variation within 0.5 dBm of design 20 dBm output.

**Spurious Emissions, Conducted  
Test Requirement: 15.247(c)**

**Measurement Equipment Used:**

HP 8593EM Spectrum Analyzer  
20 dB attenuator  
3 ft length low loss A coaxial RF cable  
Agilent E3440 Spectrum Analyzer  
3ft length low loss coaxial cable

**Test Procedure**

1. The EUT was configured on a test bench. The cable was connected between the EUT antenna port and the spectrum analyzer input port.

Spectrum analyzer RES BW was set to 100 kHz. While the transmitter broadcast a steady stream of digital data, the analyzer MAX HOLD function was used to capture the envelope of the transmission.

Readings were taken out to 10fo.

2. The process in (1) was repeated for MID channel and HIGH channel.

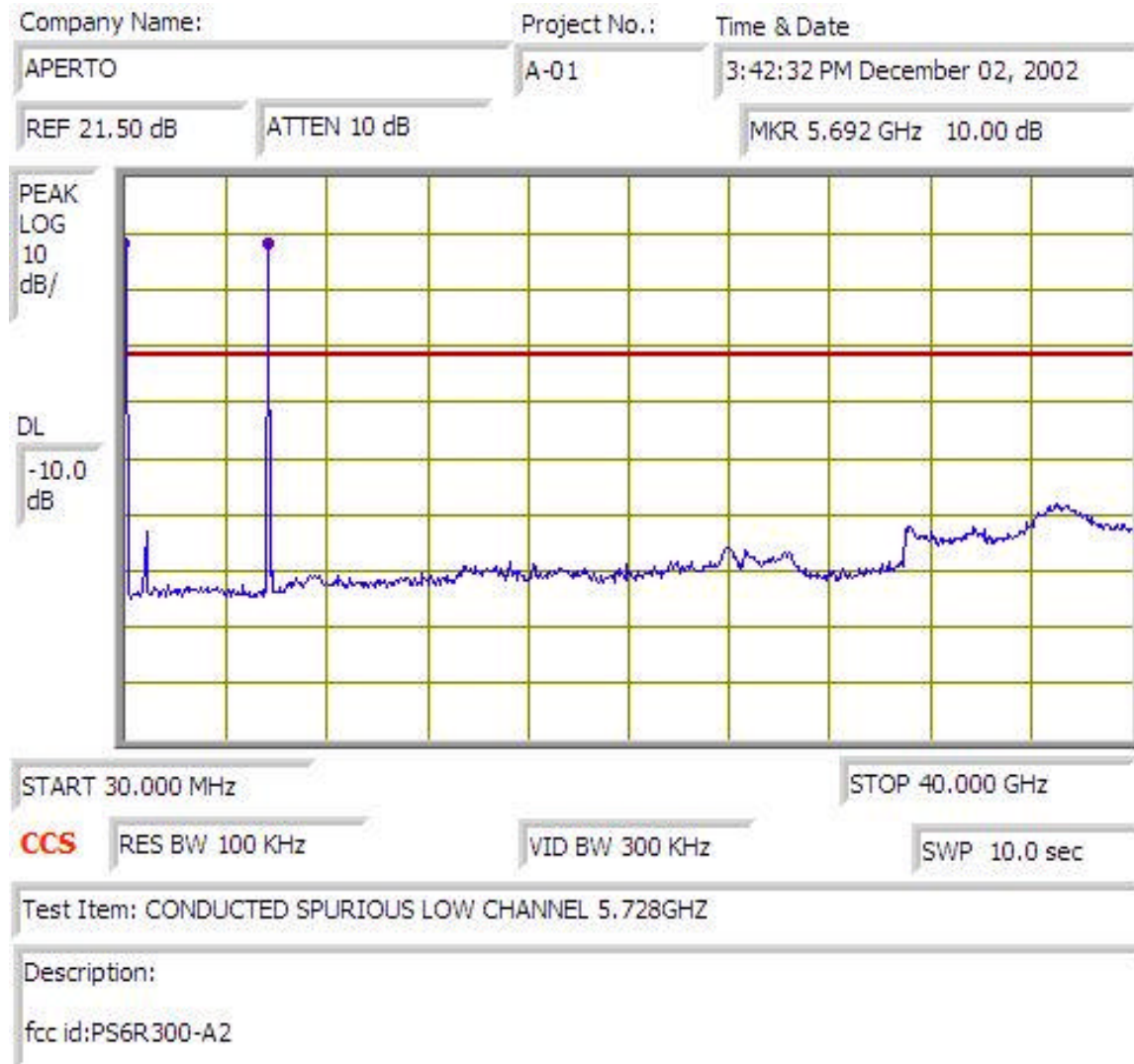
**Test Results**

Refer to attached data sheets. Data shows out of band emissions are suppressed well below the -20 dBc minimum required by the Rules.

<b>Channel</b>	<b>Frequency, MHz</b>
LOW	5728
MID	5788
HIGH	5847

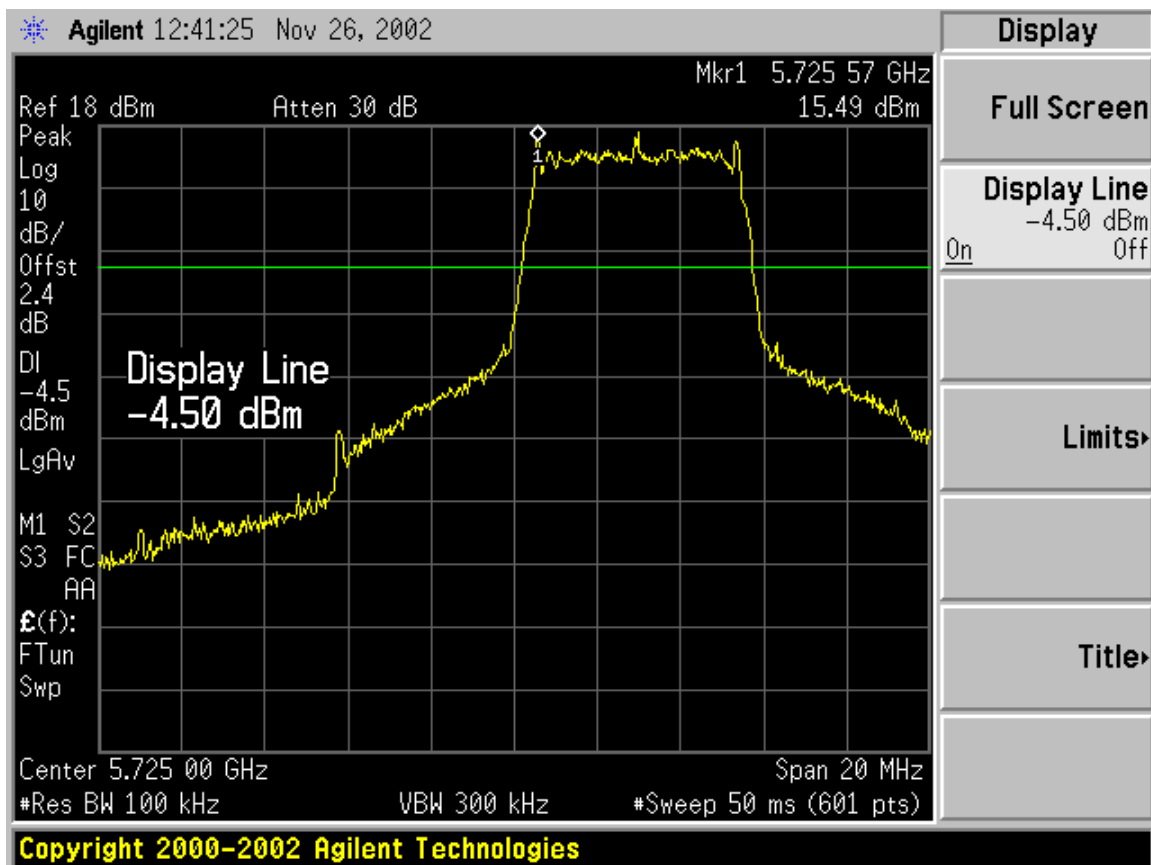
## 15.247(c): Spurious Emissions, Conducted

### LOW Channel



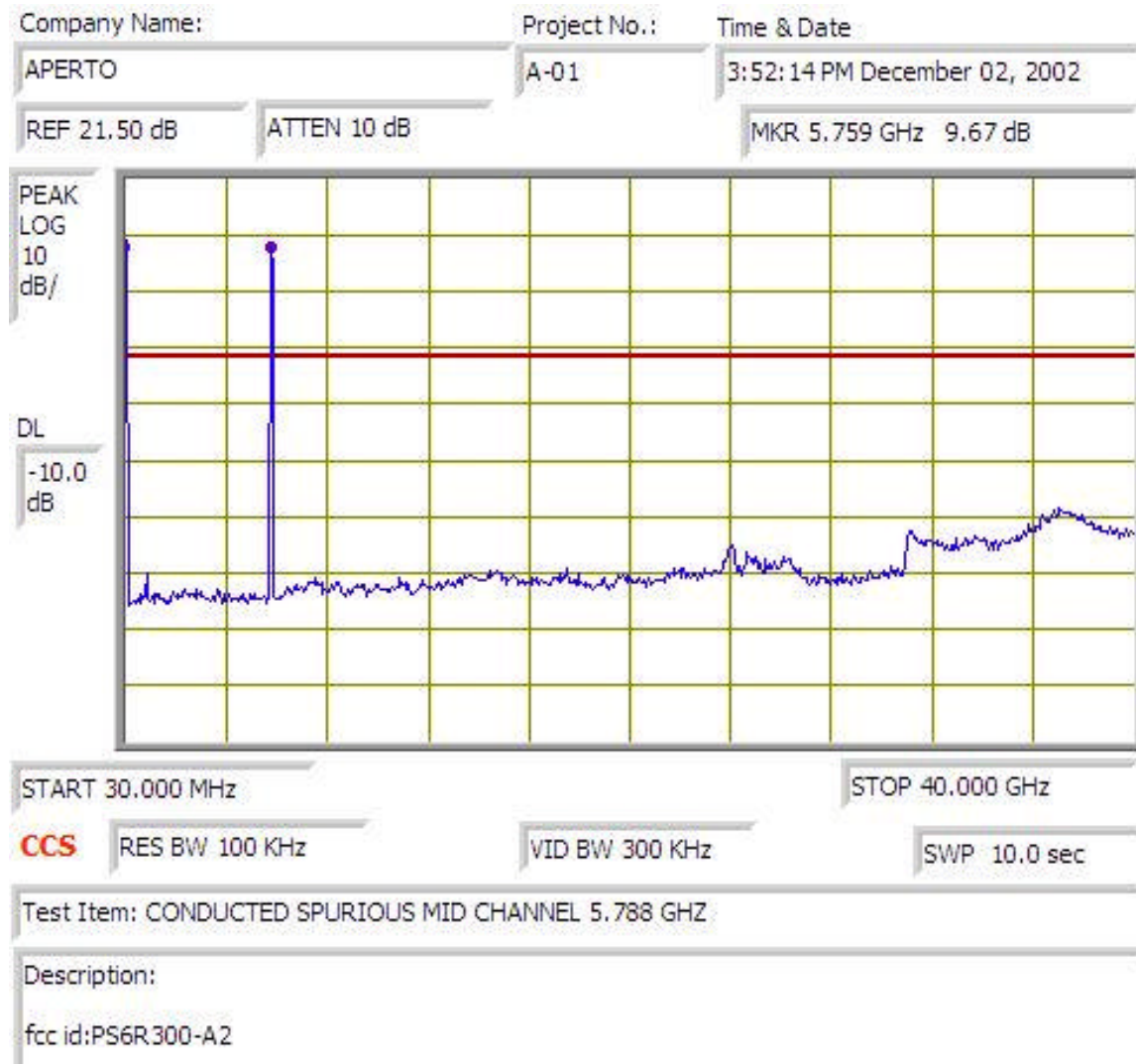
# 15.247(c): Spurious Emissions, Conducted

## LOW Channel



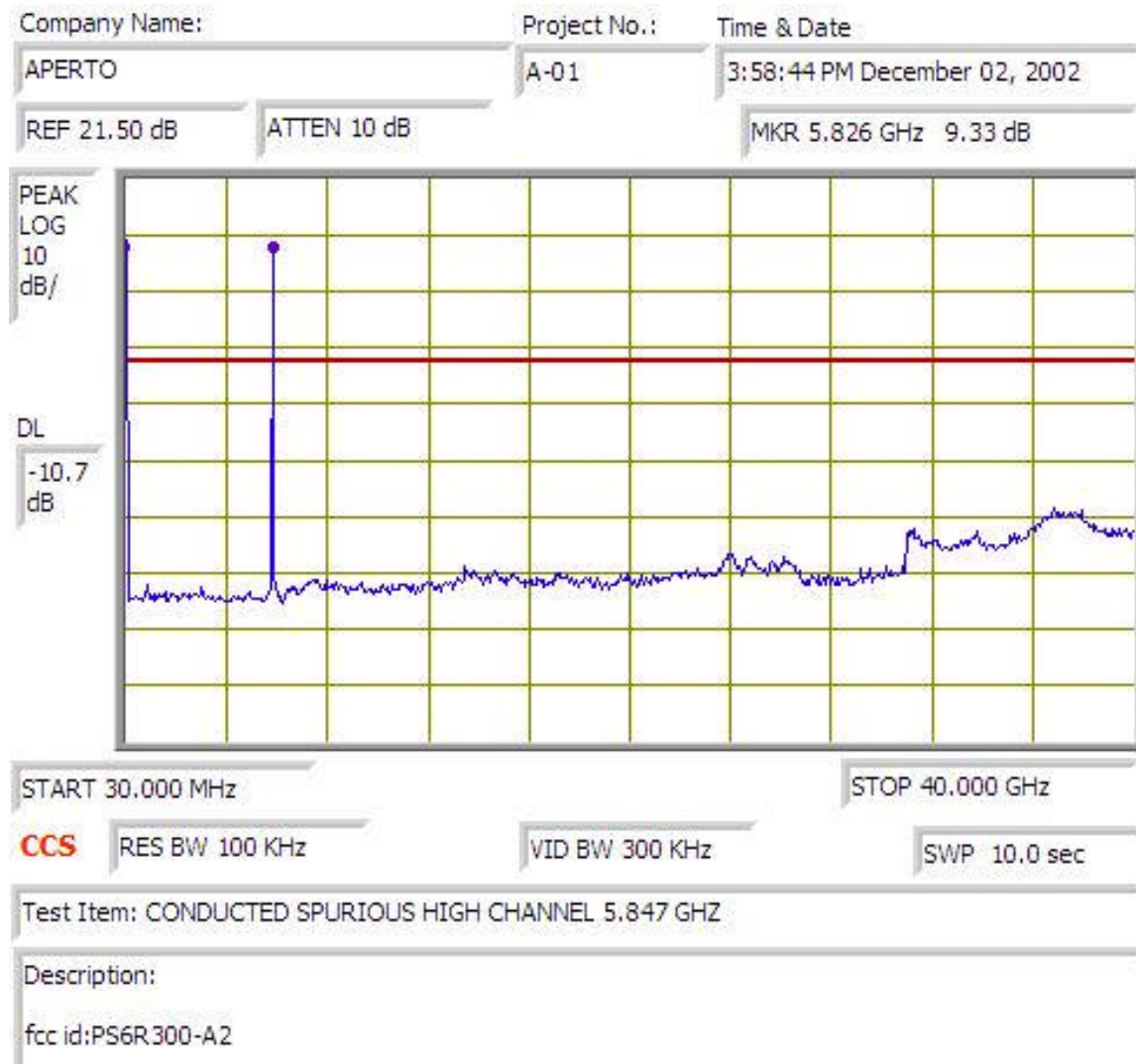
## 15.247(c): Spurious Emissions, Conducted

### MID Channel



## 15.247(c): Spurious Emissions, Conducted

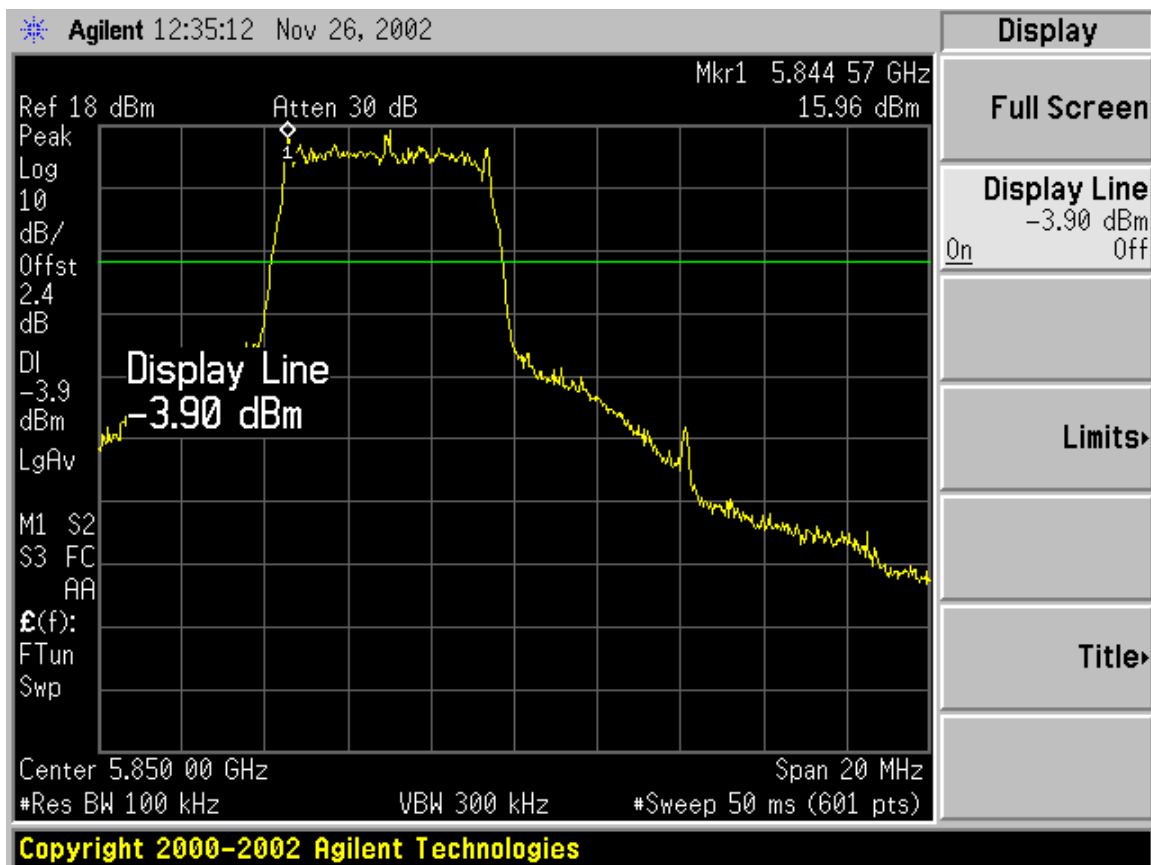
### HIGH Channel





# 15.247(c): Spurious Emissions, Conducted

## HIGH Channel



### **Power Spectral Density**

**Test Requirement: 15.247(d)**

### **Measurement Equipment Used:**

Agilent E3440 Spectrum Analyzer  
3ft length low loss coaxial cable

### **Test Procedure**

For the LOW channel, the emission peak was set to the center of the display. The SPAN was set to 300 kHz, the RES BW and VID BW were set to 3 kHz, and SWEEP TIME was set to 100 seconds. The maximum trace was recorded and compared to the 8 dBm limit.

The test was repeated for MID and HIGH channel.

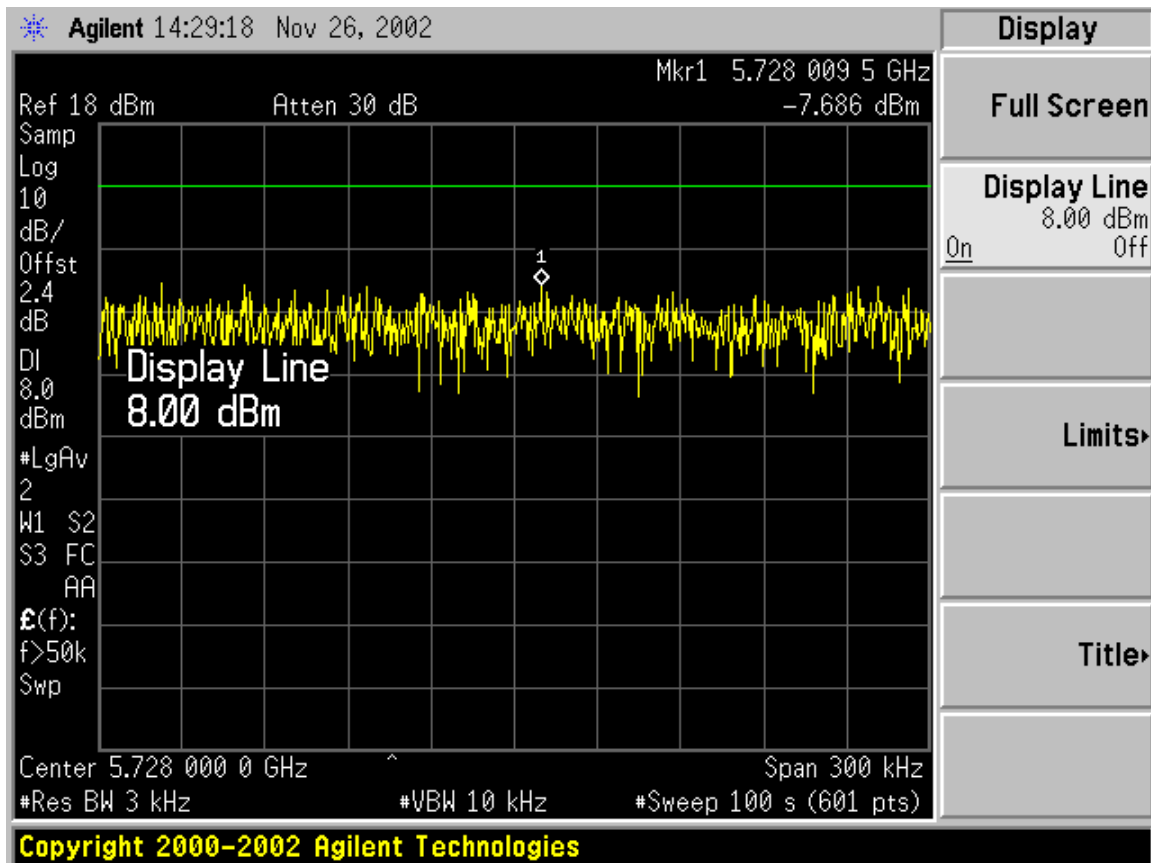
### **Test Results**

Maximum measured PSD was approximately -5.7 dBm. Refer to attached spectrum analyzer charts.

<b>Channel</b>	<b>Frequency, MHz</b>
LOW	5728
MID	5788
HIGH	5847

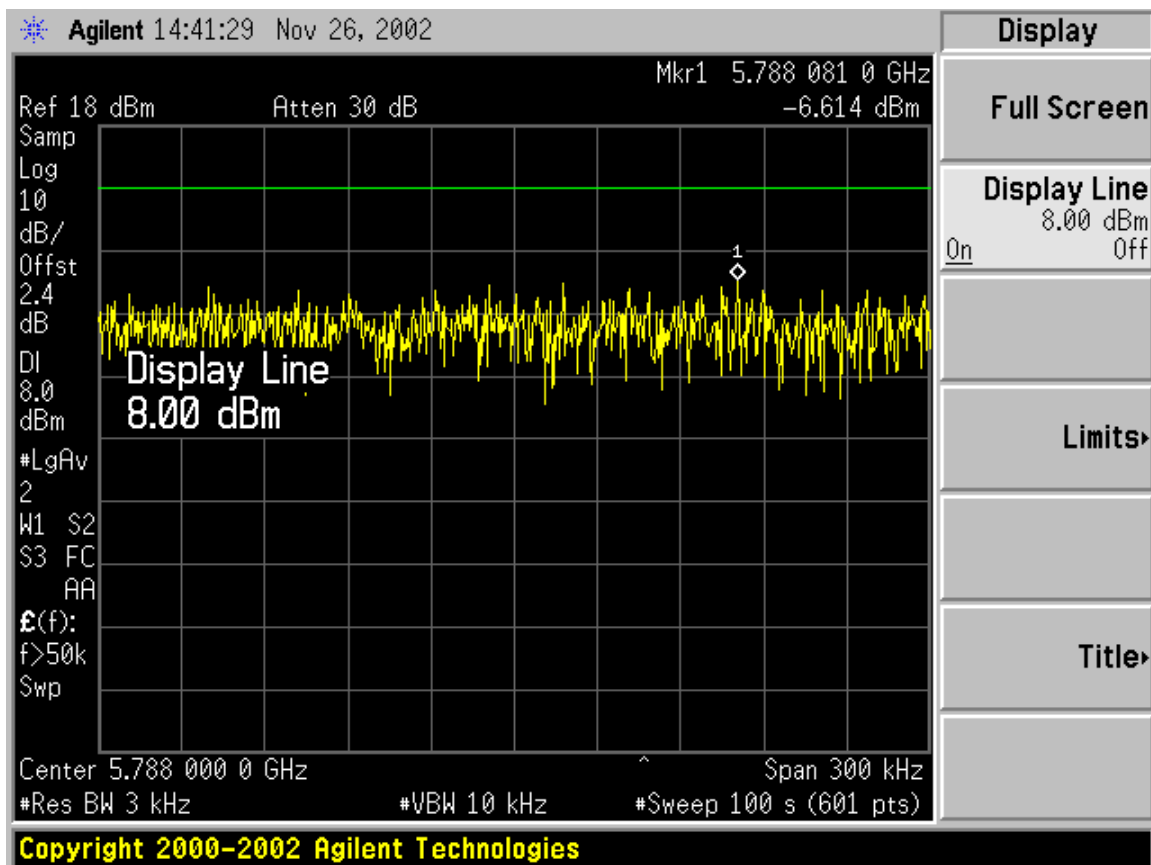
# 15.247(d): Power Spectral Density

## LOW Channel



# 15.247(d): Power Spectral Density

## MID Channel



# 15.247(d): Power Spectral Density

## HIGH Channel

