

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: PS6R3001-A1**

II. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)

The Aperto FCC ID: PS6R3001-A1 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	+27 dBm 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

20 November 2002

FCC ID: PS6R3001-A1

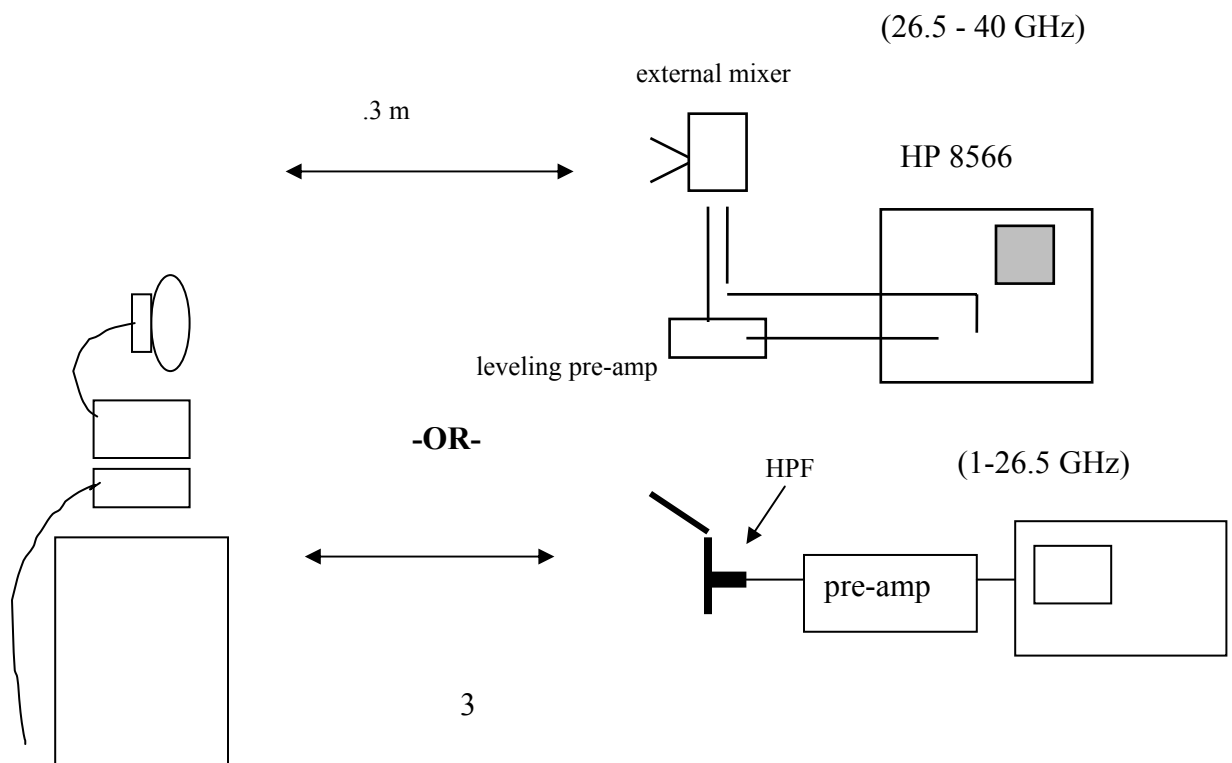
EMC Consultant/Agent for Aperto Networks Inc.

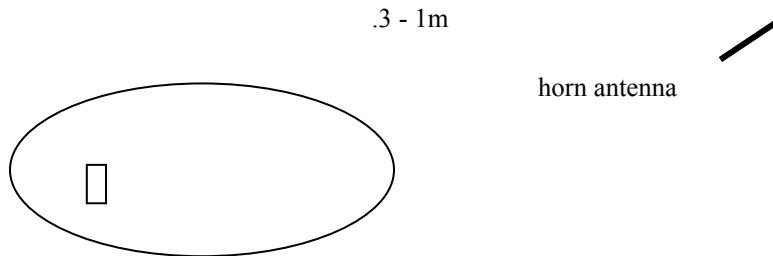
TEST PROCEDURES**Measurement Equipment Used:**

TEST EQUIPMENTS LIST				
Name of Equipment	Manufacturer	Model No.	Serial No.	Due Date
Quasi-Peak Detector	HP9K - 1 GHz	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**



HP 8564

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 10th 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

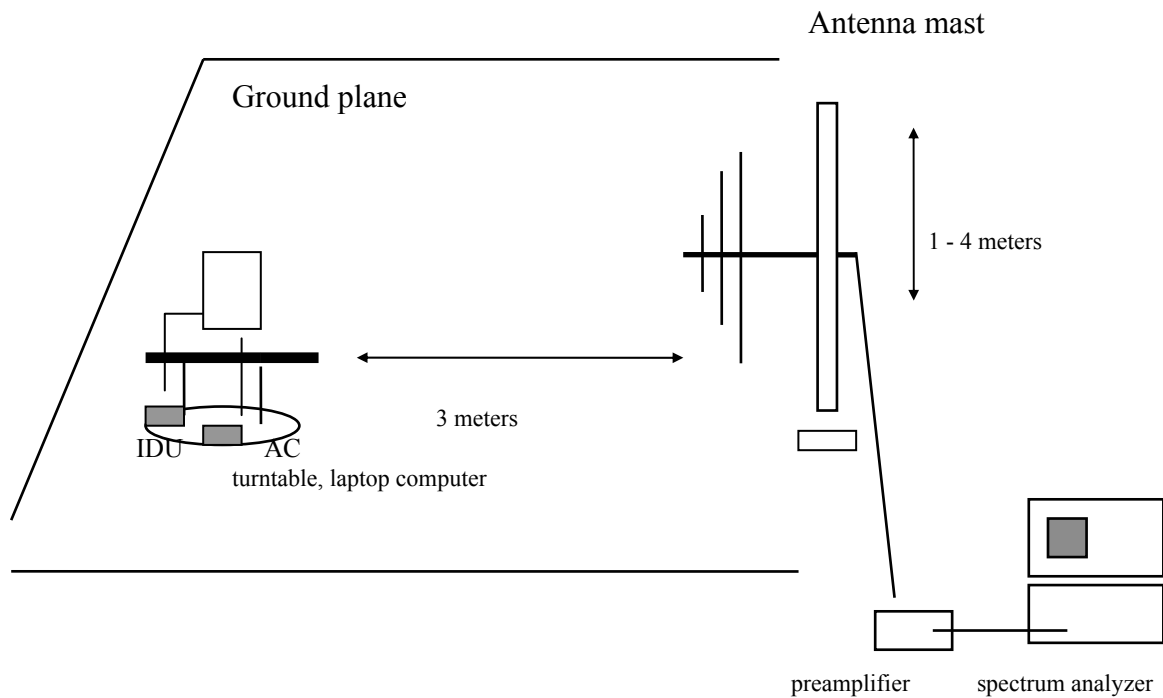
Radiated emissions were performed at each frequency for 6 different transmitter antennas.

Antennas tested:

Antenna Type	Deployment	Gain	Antenna Mfr.	Model
Integral antenna	Point to Point	17 dBi	European Antennas	FPA19-55VH-APO2/821
Dish antenna	Point to Point	28 dBi	Radiowaves	SP2-52
Panel antenna	Point to Point	23.5 dBi	Mobilemark	FP-24-5800
Panel	Point to Point Point to Multipoint	16 dBi	MTi	MT-484006
120 deg. Sector	Point to Multipoint	14 dBi	Radiowaves	SEC-55-D-120-14
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 harmonic and spurious emissions levels were almost identical from antenna to antenna. Detected emissions appeared to emanate from case and not from antennas.

Radiated Test Set-up, 30 - 1000 MHz



Test Procedures, 30 -1000 MHz

Test procedures were performed per ANSI C63.4 for ITE equipment.

FCC ID: PS6R3001-A1

Emissions in 30 - 1000 MHz range were from radio local oscillators and digital circuitry of IDU ethernet section (15.109). Refer to data sheet below.



FCC, VCCI, CISPR, CE, AUSTEL, NZ
UL, CSA, TUV, BSMI, DHHS, NVLAP

561F MONTEREY ROAD, SAN JOSE, CA 95037-9001
PHONE: (408) 463-0885 FAX: (408) 463-0888

Project #: 02U1652-1
Report #: 021121A1
Date & Time: 11/21/02 9:49 AM
Test Engr: Chin Pang

Company: Thomas N. Cokenias RF/EMI Consultant
EUT Description: Aperto 5.8Ghz ISM Device w/5 antennas
Test Configuration: EUT/Support Equipment
Type of Test: FCC Class B
Mode of Operation: TX/Rcv

☒ A-Site

☐ B-Site

☐ C-Site

☐ F-Site

☐ 6 Worst Data

☐ Descending

Freq.	Reading	AF	Class	Pre-amp	Level	Limit	Margin	Pol	Az	Height	Mark
(MHz)	(dBuV)	(dB)	(dB)	(dB)	(dBuV/m)	FCC_B	(dB)	(H/V)	(Deg)	(Meter)	(P/Q/A)
10Mhz, 974Mhz & 975Mhz Local oscillator											
50.00	43.00	10.94	1.11	27.02	28.03	40.00	-11.97	3mV	0.00	1.00	P
60.00	46.50	7.55	1.22	27.02	28.25	40.00	-11.75	3mV	0.00	1.00	P
70.00	48.80	5.78	1.34	27.01	28.91	40.00	-11.09	3mV	0.00	1.20	P
75.00	48.00	6.58	1.36	27.02	28.92	40.00	-11.08	3mV	0.00	1.20	P
100.00	47.00	10.71	1.55	26.96	32.30	43.50	-11.20	3mV	0.00	1.20	P
125.00	44.30	11.07	1.74	26.91	30.20	43.50	-13.30	3mV	0.00	1.00	P
150.00	45.00	16.46	1.93	26.83	36.56	43.50	-6.94	3mV	0.00	1.00	P
190.00	45.20	15.68	2.18	26.70	36.36	43.50	-7.15	3mV	0.00	1.00	P
50.00	44.20	10.94	1.11	27.02	29.23	40.00	-10.77	3mV	0.00	1.50	P
70.00	43.50	5.78	1.34	27.01	23.61	40.00	-16.39	3mV	0.00	1.50	P
125.00	46.50	11.07	1.74	26.91	32.40	43.50	-11.10	3mV	0.00	2.00	P
130.00	45.00	12.29	1.77	26.90	32.15	43.50	-11.35	3mV	0.00	2.00	P
150.00	45.30	16.46	1.93	26.83	36.86	43.50	-6.64	3mV	0.00	2.00	P
190.00	45.20	15.68	2.18	26.70	36.36	43.50	-7.15	3mV	0.00	2.00	P
210.00	51.00	10.29	2.29	26.64	36.94	43.50	-6.56	3mV	0.00	1.20	P
220.00	45.10	10.67	2.35	26.61	31.51	46.00	-14.49	3mV	0.00	1.00	P
225.00	56.20	10.86	2.38	26.60	42.85	46.00	-3.15	3mV	0.00	1.00	P
230.00	50.90	11.06	2.41	26.58	37.79	46.00	-8.21	3mV	0.00	1.00	P
240.00	45.50	11.44	2.47	26.55	32.86	46.00	-13.14	3mV	0.00	1.00	P
250.00	54.00	11.83	2.53	26.52	41.84	46.00	-4.16	3mV	0.00	1.00	P
250.00	54.00	11.83	2.53	26.52	41.84	46.00	-4.16	3mV	0.00	1.00	P
270.00	50.00	12.98	2.64	26.53	39.09	46.00	-6.91	3mV	0.00	1.00	P
275.00	53.10	13.27	2.67	26.53	42.51	46.00	-3.49	3mV	0.00	1.00	P
290.00	50.00	14.13	2.75	26.54	40.34	46.00	-5.66	3mV	0.00	1.00	P
300.00	51.00	14.71	2.80	26.54	41.97	46.00	-4.03	3mV	0.00	1.00	P
310.00	48.00	14.80	2.85	26.61	39.03	46.00	-6.97	3mV	0.00	1.00	P
325.00	50.30	14.94	2.91	26.72	41.43	46.00	-4.57	3mV	0.00	1.00	P
375.00	47.80	15.39	3.14	27.09	39.24	46.00	-6.76	3mV	0.00	1.20	P
720.00	42.00	21.39	4.45	28.19	39.65	46.00	-6.35	3mV	0.00	1.00	P

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.

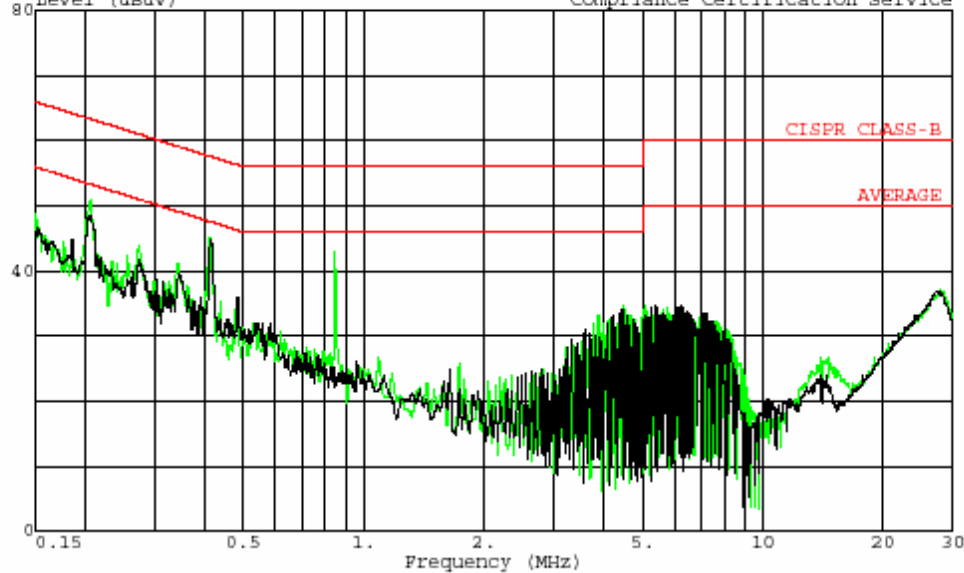
Test Results

PASS. Refer to data sheet below.



561F Monterey Road,
San Jose, CA 95037 USA
Tel: (408) 463-0885
Fax: (408) 463-0888

Data#: 7 File#: 1652LC2.EMI Date: 12-17-2002 Time: 12:25:06
Level (dBuV) Compliance Certification Service



Trace: 3
Project # : 02U1652-1
Test Engineer : Chin Pang
Company : Thomas N. Cokenias RFI/EMI Consultant
EUT : Aperto 5.8GHZ ISM Device w/5 Antennas
with Sunny Co. AC Power Adapter
FCC ID: PS6R3001-A1
Model Name : SYS1097-4018
Test Config. : EUT/Support Equipment
Test of Target: EN55022, Class B
Mode of Op. : TX /RCV
: 115VAC, 60Hz
: L1: Peak (Green), L2: Peak (Black)

Ref Trace:

CONDUCTED EMISSIONS DATA (115VAC 60Hz)

Freq. (MHz)	Reading			Class	Limit	EN B		Margin		Remark
	PK (dBuV)	QP (dBuV)	AV (dBuV)			QP	AV	QP (dB)	AV (dB)	
0.21	52.55	--	--	0.00	64.40	54.40		-11.85	-1.85	L1
0.41	45.12	--	--	0.00	58.49	48.49		-13.37	-3.37	L1
0.86	43.38	--	--	0.00	56.00	46.00		-12.62	-2.62	L1
0.21	48.58	--	--	0.00	64.43	54.43		-15.85	-5.85	L2
0.41	44.80	--	--	0.00	58.49	48.49		-13.69	-3.69	L2
27.71	37.82	--	--	0.00	60.00	50.00		-22.18	-12.18	L2
6 Worst Data										

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.

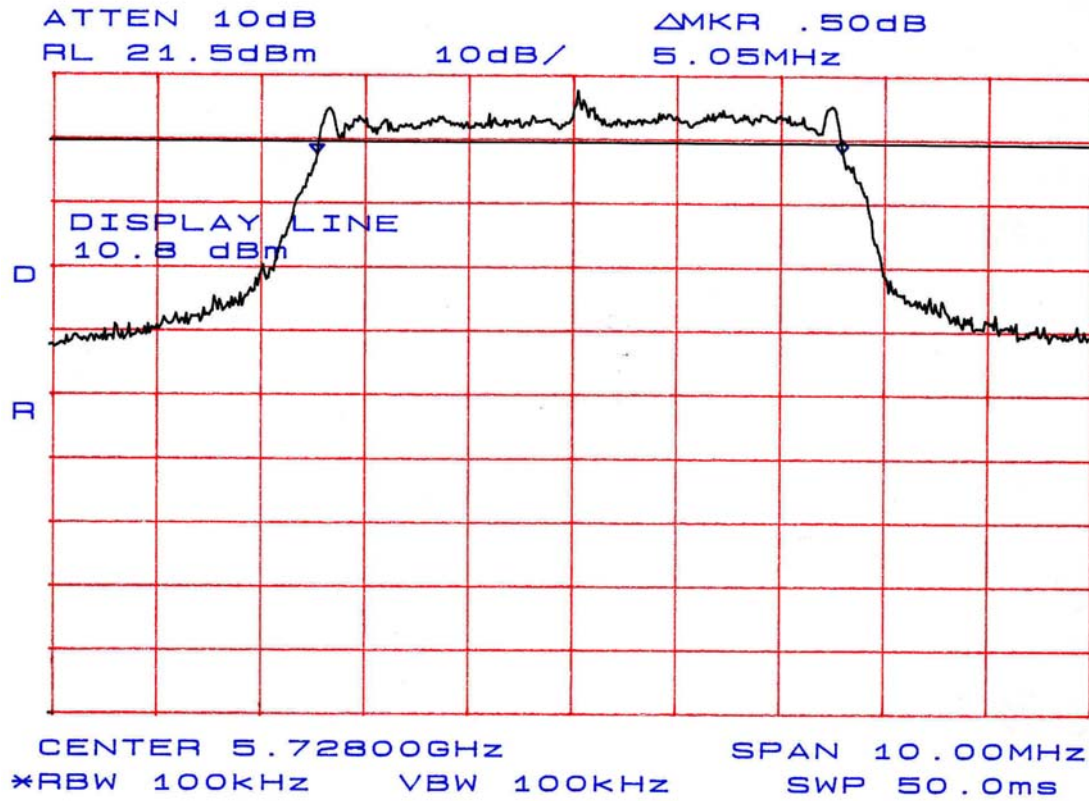
The test was repeated at MID channel and at HIGH channel.

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

Channel	Frequency, MHz
Low	5728
Mid	5788
High	5847

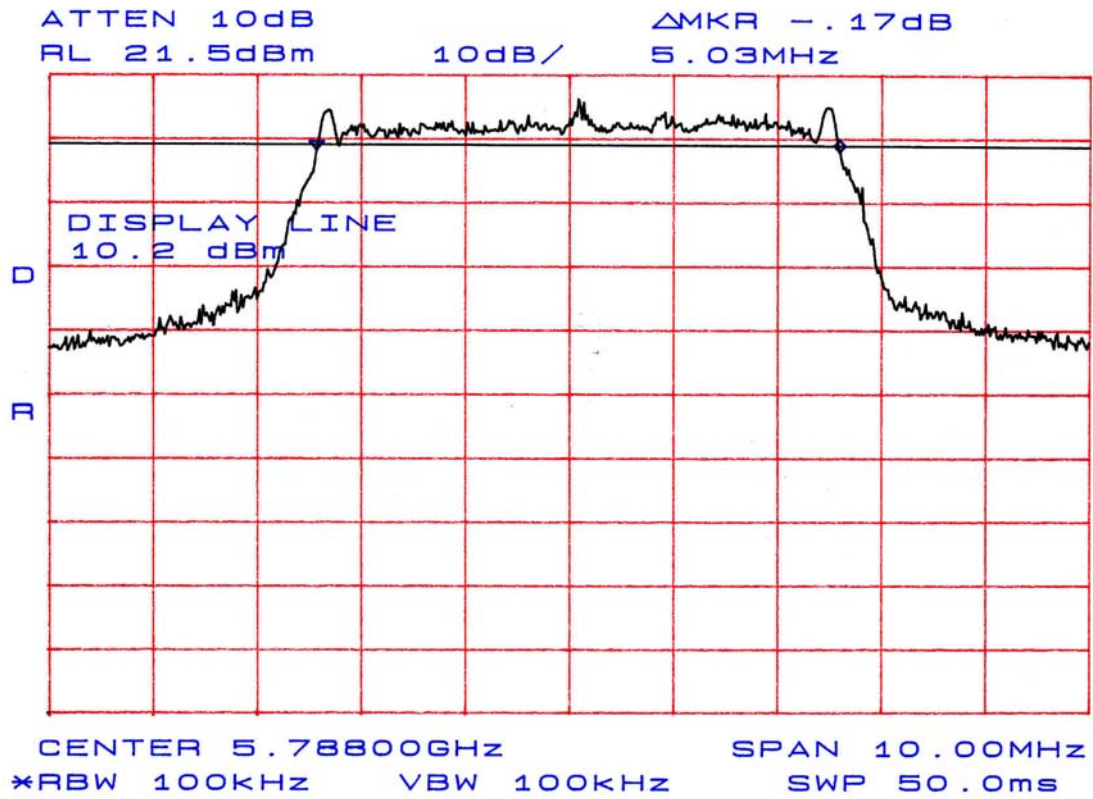
15.247(a)2: Minimum 6 dB Bandwidth

LOWChannel



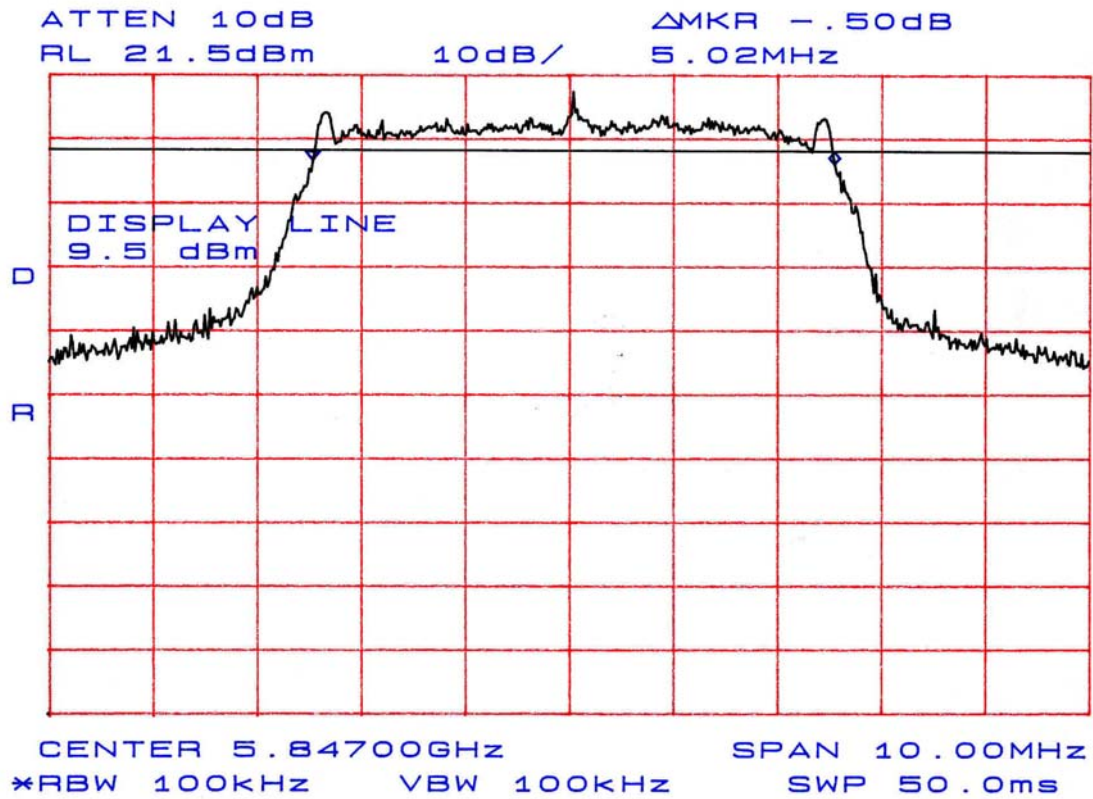
15.247(a)2: Minimum 6 dB Bandwidth

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.

Channel	Frequency, MHz	Output Power, dBm
LOW	5728	27.0
MID	5788	26.9
HIGH	5847	26.5

Maximum output power output variation within 0.5 dBm of design 27 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.

Channel	Frequency, MHz
LOW	5728
MID	5788
HIGH	5847

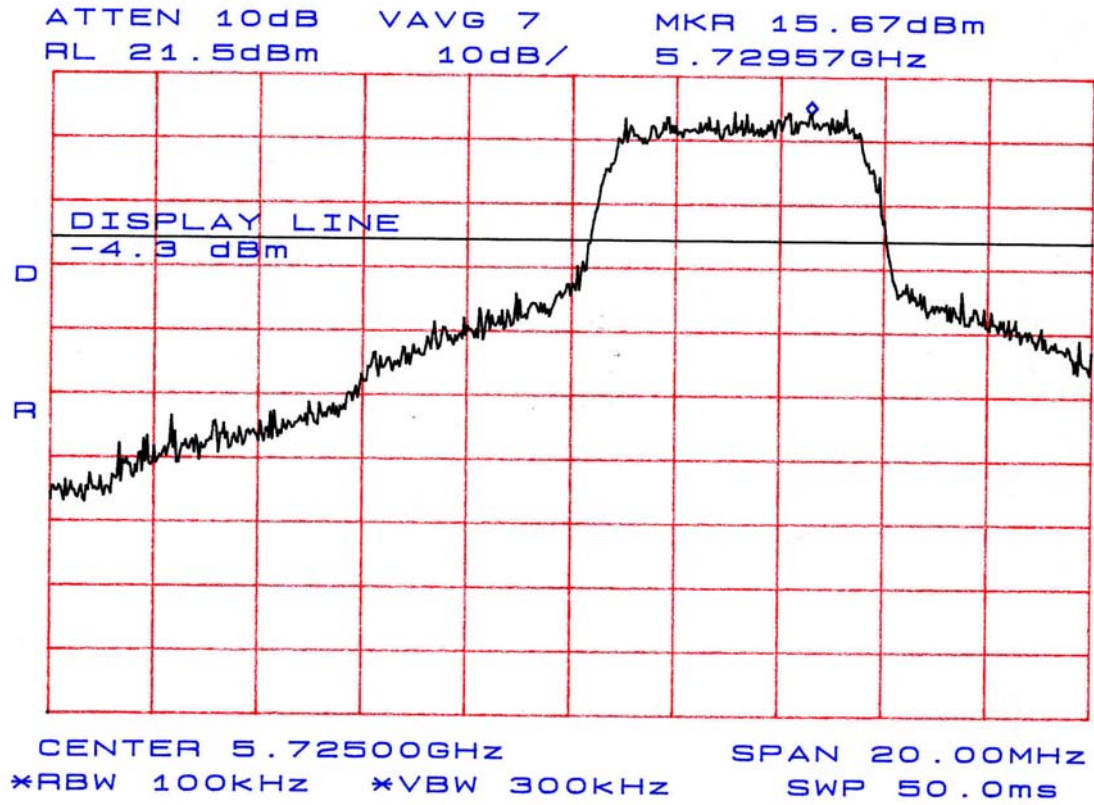
15.247(c): Spurious Emissions, Conducted

LOW Channel



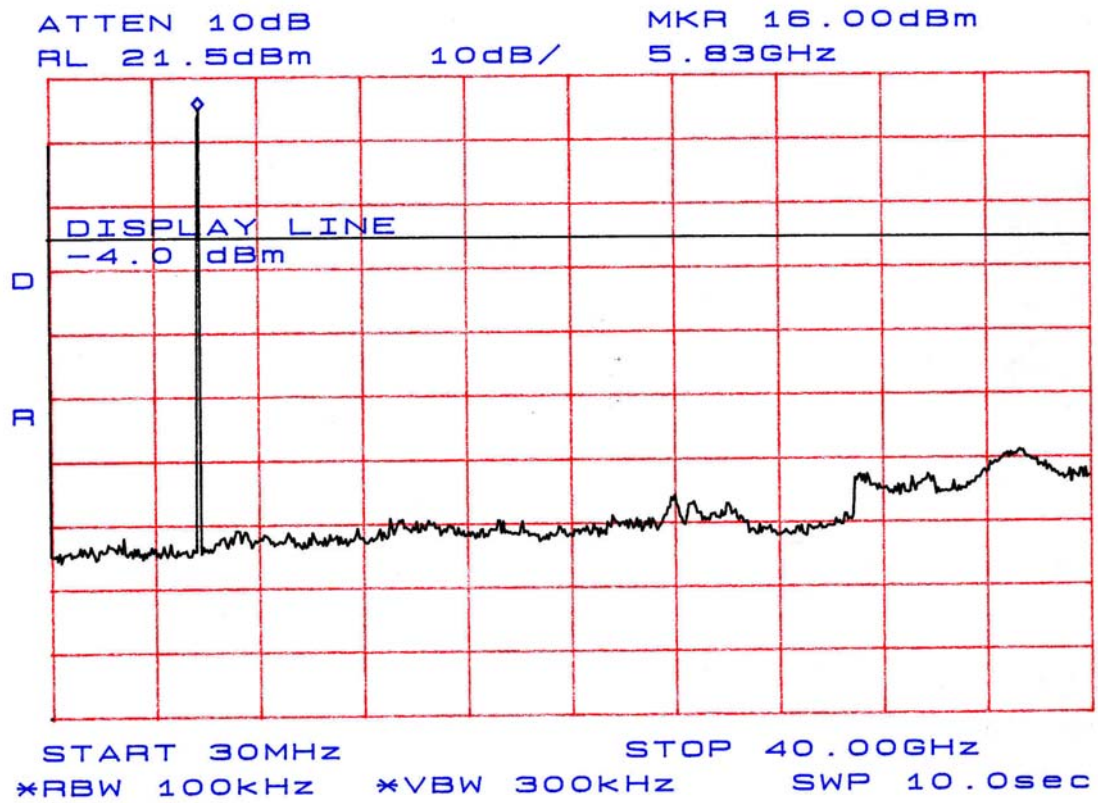
15.247(c): Spurious Emissions, Conducted

LOW Channel



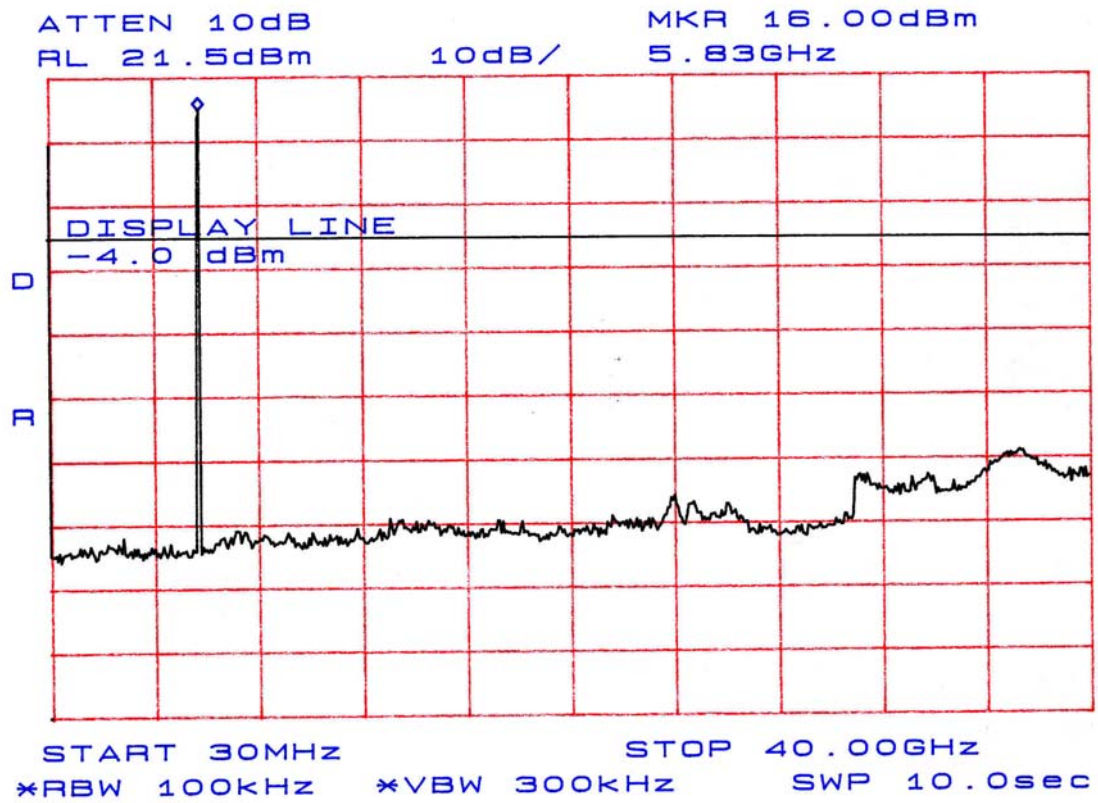
15.247(c): Spurious Emissions, Conducted

MID Channel



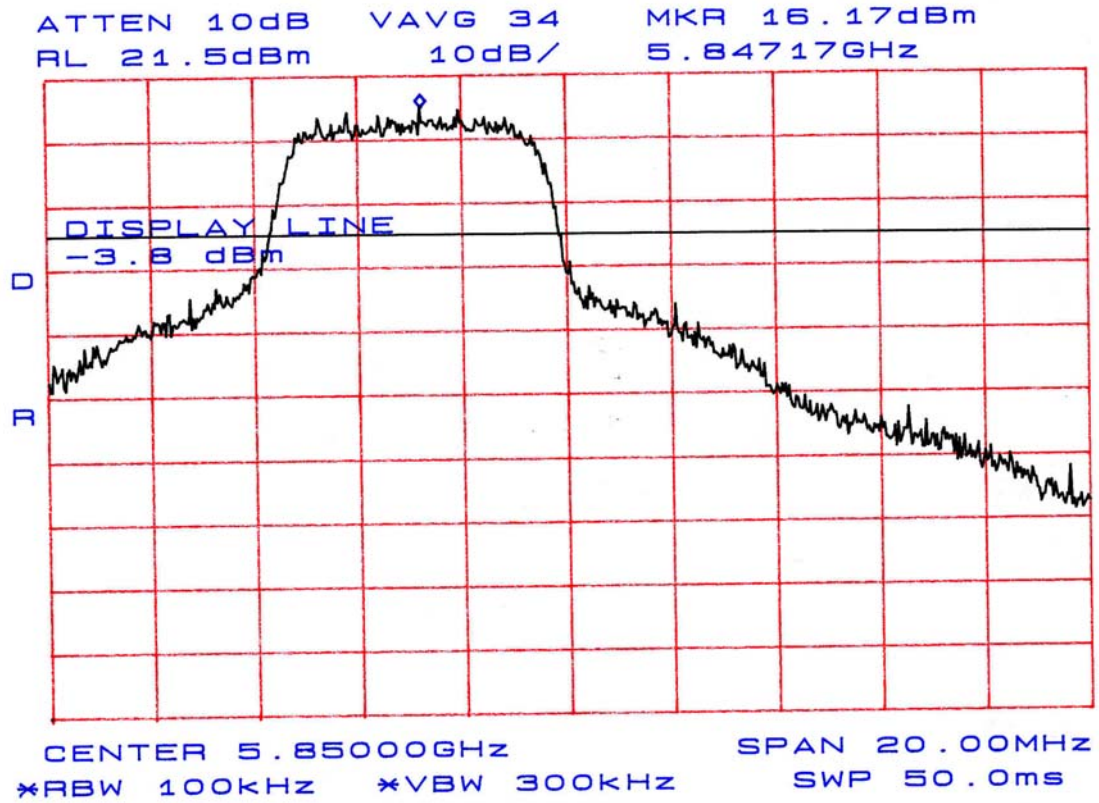
15.247(c): Spurious Emissions, Conducted

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.

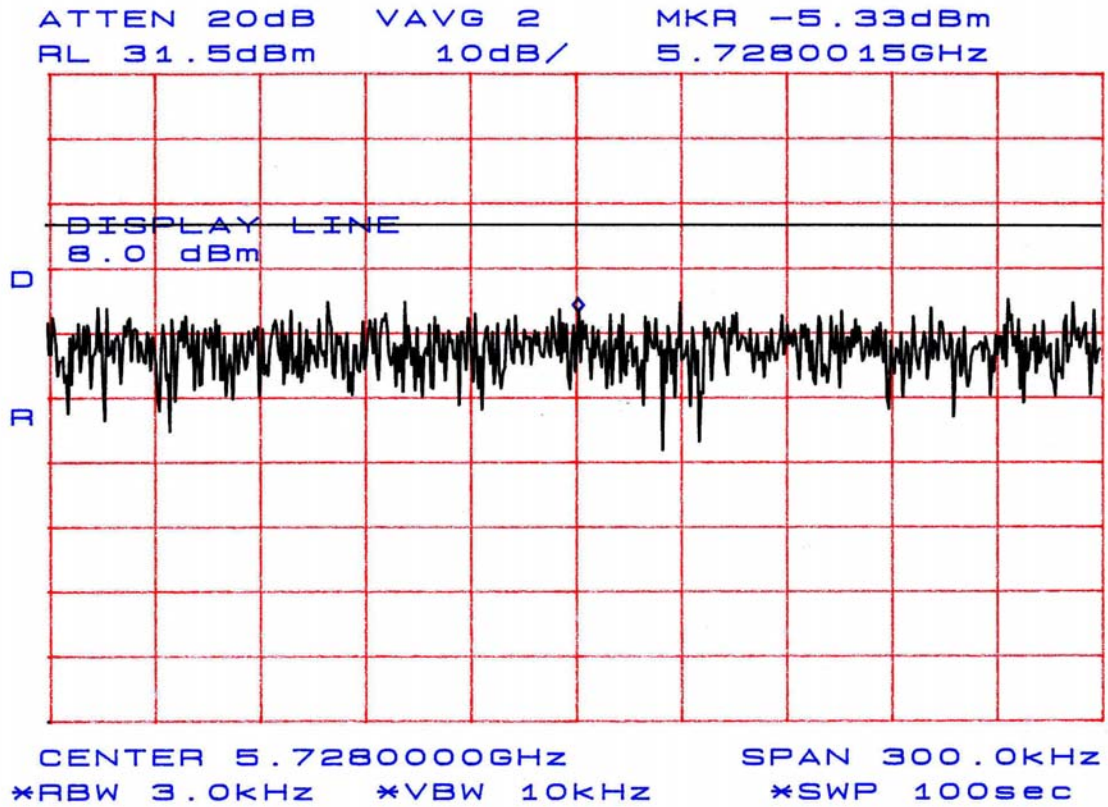
Test Results

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

Channel	Frequency, MHz
LOW	5728
MID	5788
HIGH	5847

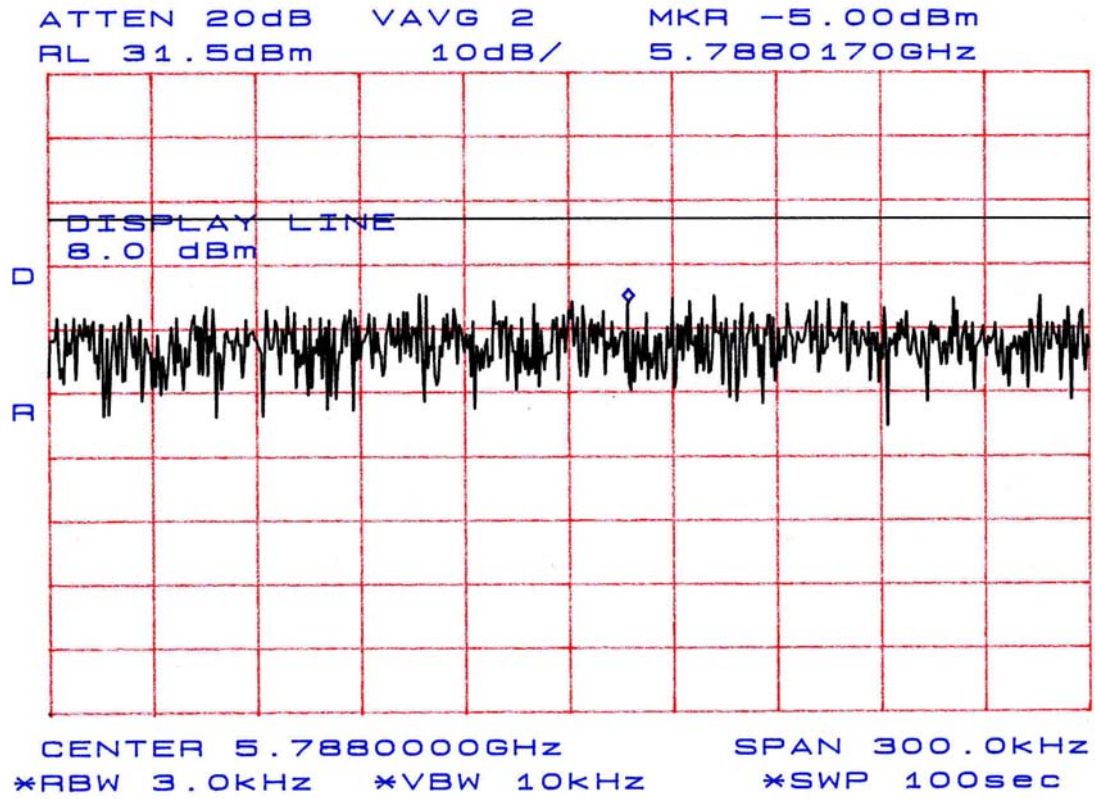
15.247(d): Power Spectral Density

LOW Channel



15.247(d): Power Spectral Density

MID Channel



15.247(d): Power Spectral Density

HIGH Channel

