


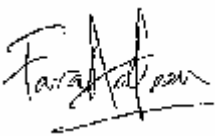

# TEST REPORT FROM RFI GLOBAL SERVICES LTD.

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002  
(Intentional Radiators)  
Section 15.247

**Test Report Serial No:**  
RFI/MPTB3/RP45349JD01A

**Supersedes Test Report Serial No:**  
RFI/MPTB2/RP45349JD01A

<p><b>This Test Report Is Issued Under The Authority Of Andrew Brown, Operations Manager:</b></p> <div style="text-align: center; margin-top: 20px;">               pp         </div>	
<p><b>Tested By: Steven Wong</b></p> <div style="text-align: center; margin-top: 20px;">               pp         </div>	<p><b>Checked By: Tony Henriques</b></p> <div style="text-align: center; margin-top: 20px;">               pp         </div>
<p><b>Report Copy No: PDF01</b></p>	
<p><b>Issue Date: 14 July 2005</b></p>	<p><b>Test Dates: 15 September 2003 to 16 September 2003</b></p>

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The results in this report apply only to the sample(s) tested.

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Registered in England and Wales. Company number: 2117901

**RADIO FREQUENCY INVESTIGATION LTD**

**TEST REPORT**

**Operations Department**

**S.No. RFI/MPTB3/RP45349JD01A**

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## **1. Client Information**

<b>Company Name:</b>	Orthogon Systems
<b>Address:</b>	Unit A1 Linhay Business Park Eastern Road Ashburton Devon TQ13 7UP
<b>Contact Name:</b>	Mr C Fisher

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## **2. Equipment Under Test (EUT)**

The following information (with the exception of the Date of Receipt) has been supplied by the client:

### **2.1. Identification Of Equipment Under Test (EUT)**

<b>Brand Name:</b>	Gemini
<b>Model Name or Number:</b>	58XX
<b>FCC ID</b>	QWP58XX-T
<b>Serial Number</b>	00:04:56:00:02:7C
<b>Country of Manufacture:</b>	UK
<b>Date of Receipt:</b>	15 September 2003

<b>Brand Name:</b>	Gemini
<b>Model Name or Number:</b>	58XX
<b>FCC ID:</b>	QWP58XX-T
<b>Serial Number:</b>	0126
<b>Country of Manufacture:</b>	UK
<b>Date of Receipt:</b>	15 September 2003

<b>Brand Name:</b>	Hitron Electronics Corporation
<b>Model Name or Number:</b>	HES51-48010
<b>FCC ID:</b>	QWP58XX-T
<b>Serial Number:</b>	0437
<b>Country of Manufacture:</b>	Taiwan
<b>Date of Receipt:</b>	15 September 2003

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### **Identification Of Equipment Under Test (EUT) (Continued)**

<b>Brand Name:</b>	Ault
<b>Model Name or Number:</b>	PW125
<b>Unique Type Identification:</b>	PW125KA4803
<b>Serial Number:</b>	A01
<b>Country of Manufacture:</b>	Korea
<b>Date of Receipt:</b>	15 September 2003

### **2.2. Description Of EUT**

The Gemini 58XX is a point to point Ethernet Bridge radio equipment operating in the band 5725MHz to 5850MHz (USA band limits) and 5725MHz to 5875MHz (European band limits).

The equipment supplied for formal testing will comprise one end of the Ethernet Bridge, although the other end will be supplied to enable the equipment to be operated in its normal operating modes.

There are 3 parts to the equipment.

Outdoor Unit, which comprises of an electronics enclosure and an integral, dual polarised antenna. The ODU contains all the main electronic components in the system and generates all the RF frequencies.

Indoor Unit, which provides an interface box between the ODU, the power supply and the customer's LAN network. This unit comprises basically of connectors, some LEDs and filters.

A mains power supply adapter from an external supplier (and which meets all normal regulatory requirements) provides all the DC supply for the rest of the system.

The system is connected by CAT5 cables, which may be screened or unscreened.

### **2.3. Modifications Incorporated In EUT**

The EUT has not been modified from what is described by the Model Number stated above.

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#### 2.4. Additional Information Related To Testing

<b>Power Supply Requirement:</b>	Nominal 115 V, 60 Hz AC Mains Supply 13 Amp (max)		
<b>Intended Operating Environment:</b>	Indoor Unit & Power Supply– intended for protected indoor environments only Outdoor Unit intended for unprotected outdoor environments		
<b>Equipment Category:</b>	Fixed Transmitter		
<b>Type of Unit:</b>	Wireless Ethernet Bridge		
<b>Weight:</b>	5.5kg including brackets for ODU; Less than 1kg for Indoor units		
<b>Dimensions:</b>	Outdoor Unit 400x400x100mm Indoor Unit 150x60x30mm		
<b>Interface Ports:</b>	Ethernet 10/100baseT via RJ45 connector to external network CAT5 Interconnects between RJ45s in system Mains Power Inlet		
<b>Transmit Frequency Range</b>	5738 MHz to 5838 MHz		
<b>Transmit Channels Tested</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	<b>Bottom</b>	1	5738
	<b>Middle</b>	6	5788
	<b>Top</b>	11	5838
<b>Receive Frequency Range</b>	5738 MHz to 5838 MHz		
<b>Receive Channels Tested</b>	<b>Channel ID</b>	<b>Channel Number</b>	<b>Channel Frequency (MHz)</b>
	<b>Bottom</b>	1	5738
	<b>Middle</b>	6	5788
	<b>Top</b>	11	5838
<b>Highest Fundamental Frequency</b>	5838 MHz		
<b>Highest Unintentionally Generated Frequency</b>	5838 MHz		
<b>Occupied Bandwidth</b>	10.2765 MHz		
<b>Antenna Gain</b>	23 dBi		
<b>Peak Output Power</b>	26.9 dBm		

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## 2.5. Support Equipment

The following support equipment was used to exercise the EUT during testing:

<b>Description: (as used in section 10)</b>	Laptop
<b>Brand Name:</b>	Compaq
<b>Model Name or Number:</b>	Armada E700, U98.003.C.00
<b>Serial Number:</b>	1J0DC64D014
<b>FCC ID Number:</b>	N/A
<b>Cable Length And Type:</b>	CAT5 Cable, in a length suitable for test site (has to be < 100m)
<b>Connected to Port:</b>	Customer RJ45 on Indoor Unit

<b>Description: (as used in section 10)</b>	SLAVE OUTDOOR UNIT
<b>Brand Name:</b>	Gemini
<b>Model Name or Number:</b>	OS58XX OUTDOOR UNIT
<b>Serial Number:</b>	00:04:56:00:02:02
<b>FCC ID Number:</b>	QWP58XX
<b>Cable Length And Type:</b>	As Required
<b>Connected to Port:</b>	Access Port

<b>Description: (as used in section 10)</b>	SLAVE INDOOR UNIT
<b>Brand Name:</b>	Gemini
<b>Model Name or Number:</b>	OS58XX INDOOR UNIT
<b>Serial Number:</b>	23
<b>FCC ID Number:</b>	QWP58XX
<b>Cable Length And Type:</b>	As Required
<b>Connected to Port:</b>	Access Port

<b>Description: (as used in section 10)</b>	Slave Rug-Top Supply
<b>Brand Name:</b>	HES51-48010
<b>Model Name or Number:</b>	N/A (System Power Supply)
<b>Serial Number:</b>	001
<b>FCC ID Number:</b>	TAIWAN
<b>Cable Length And Type:</b>	As required
<b>Connected to Port:</b>	Access Port



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### Support Equipment – Continued

<b>Description: (as used in section 10)</b>	Slave Laptop
<b>Brand Name:</b>	Sony Vaio
<b>Model Name or Number:</b>	PCG9326
<b>Serial Number:</b>	28312150 5202607
<b>FCC ID Number:</b>	N/A
<b>Cable Length And Type:</b>	As Required
<b>Connected to Port:</b>	Access Port

<b>Description: (as used in section 10)</b>	FIXED ATTENUATORS
<b>Brand Name:</b>	WEINSCHEL
<b>Model Name or Number:</b>	23-30-34      24-30-12
<b>Serial Number:</b>	BH9158      BJ6926
<b>FCC ID Number:</b>	N/A
<b>Cable Length And Type:</b>	As required
<b>Connected to Port:</b>	Access Port

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### **3. Test Specification, Methods And Procedures**

#### **3.1. Test Specifications**

<b>Reference:</b>	FCC Part 15 Subpart C: 2002 (Section 15.247)
<b>Title:</b>	Code of Federal Regulations, Part 15 (47CFR15) Radio Frequency Devices
<b>Comments:</b>	A description of the test facility used for this test is on file with, and has been accepted by, the Federal Communications Commission as required by Section 2.948 of Federal Rules.
<b>Purpose of Test:</b>	To determine whether the equipment complied with the requirements of the specification for the purposes of certification.

#### **3.2. Methods And Procedures**

The methods and procedures used were as detailed in:

ANSI C63.2 (1987)

Title: American National Standard for Instrumentation - Electromagnetic noise and field strength.

ANSI C63.4 (2001)

Title: American National Standard Methods of Measurement of Electromagnetic Emissions from Low Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz.

ANSI C63.5 (1988)

Title: American National Standard for the Calibration of antennas used for Radiated Emission measurements in Electromagnetic Interference (EMI) control.

ANSI C63.7 (1988)

Title: American National Standard Guide for Construction of Open Area Test Sites for performing Radiated Emission Measurements.

CISPR 16-1: (1999)

Title: Specification For Radio Disturbance and Immunity Measuring Apparatus and Methods. Part 1: Radio Disturbance and Immunity Measuring Apparatus.

DA00-705 (2000)

Title: Filing and Frequency Measurement Guidelines for Frequency Hopping Spread Spectrum Systems.

#### **3.3. Definition Of Measurement Equipment**

The measurement equipment used complied with the requirements of the standards referenced in the Methods & Procedures section above. Appendix 1 contains a list of the test equipment used.

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#### **4. Deviations From The Test Specification**

None.

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## **5. Operation Of The EUT During Testing**

### **5.1. Operating Conditions**

The EUT was tested in a normal laboratory environment.

During testing, the EUT was powered by a nominal 115 V, 60 Hz AC Mains power supply (13 Amp max)

### **5.2. Operating Modes**

The EUT was tested in the following operating modes, unless otherwise stated.

#### **Radiated Emissions.**

All transmitter radiated spurious pre-scan tests were performed on the middle channel of the assigned frequency block with the EUT set to BPSK modulation mode.

Final measurements were then performed on any indicated spurious emissions on the top, middle and bottom channels in both 16QAM and BPSK modulation mode.

Band edge testing was performed in both 16QAM and BPSK modulation mode.

All receiver radiated emissions were carried out with the unit set to forced receive mode.

#### **Conducted Emissions.**

All transmitter conducted spurious emissions tests and Band edge were performed with the EUT set to BPSK, QPSK, 64QAM, Acquisition and 16QAM modulation mode and on the vertical antenna port.

Transmitter peak power and peak power spectral density tests were performed with the software set to BPSK, QPSK, 64QAM, Acquisition and 16QAM modulation modes on both the vertical and horizontal ports.

Transmitter bandwidth testing was performed with the software set to BPSK, QPSK, 64QAM, Acquisition and 16QAM modulation modes on the vertical port.

#### **AC Mains Conducted Emissions.**

AC mains conducted emissions were performed at full power on the middle channel of the assigned frequency block, with the software set to the BPSK modulation mode.

The reason for choosing these modes was that the client defined it as being likely to be the worst case with regards EMC.

### **5.3. Configuration And Peripherals**

The EUT was tested in the following configuration:

The EUT has two internal antenna ports one for the vertical antenna and one for the horizontal antenna.

The EUT may be operated in BPSK, QPSK, 64QAM, Acquisition or 16QAM modulation modes; these are selected via software control. Both modes of modulation use the same hardware.

The reason for choosing this configuration was that the client defined it as being likely to be the worst case with regards EMC.

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## **6. Summary Of Test Results**

### **Part 15.247**

<b>Range Of Measurements</b>	<b>Specification Reference</b>	<b>Port Type</b>	<b>Compliance Status</b>
Receive Conducted Emissions (AC Mains)	C.F.R. 47 FCC Part 15: 2002 Section 15.107	AC Mains Terminals	Complied
Receive Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.109	Antenna	Complied
Transmitter Minimum Bandwidth	C.F.R. 47 FCC Part 15: 2002 Section 15.247(a)(2)	Antenna Terminals	Complied
Transmitter Maximum Peak Output Power	C.F.R. 47 FCC Part 15: 2002 Section 15.247(b)(3)	Antenna Terminals	Complied
Transmitter Conducted Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c)	Antenna Terminals	Complied
Transmitter Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c) Section 15.209(a)	Antenna	Complied
Transmitter Peak Power Spectral Density	C.F.R. 47 FCC Part 15: 2002 Section 15.247(d)	Antenna Terminals	Complied
Transmitter Band Edge Radiated Emissions	C.F.R. 47 FCC Part 15: 2002 Section 15.247(c) Section 15.209(a)	Antenna	Complied

### **6.1. Location Of Tests**

All the measurements described in this report were performed at the premises of Radio Frequency Investigation Ltd, Ewhurst Park, Ramsdell, Basingstoke, Hampshire, RG26 5RQ, England.

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## **7. Measurements, Examinations And Derived Results**

### **7.1. General Comments**

7.1.1. This section contains test results only. Details of the test methods and procedures can be found in Section 9 of this report.

7.1.2. Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to Section 10 for details of measurement uncertainties.

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## 8. Test Results

### 8.1. Receive Conducted Emissions AC Mains: Section 15.107

8.1.1. The EUT was configured as for AC conducted emissions measurements as described in section 9 of this report.

8.1.2. Tests were performed to identify the maximum emissions levels on the AC mains line of the EUT.

#### Quasi-Peak Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Q-P Level (dB $\mu$ V)	Q-P Limit (dB $\mu$ V)	Margin (dB)	Result
0.15127	Live	42.31	65.93	23.62	Complied
0.21782	Neutral	40.89	62.90	22.01	Complied
0.43406	Neutral	37.06	57.17	20.11	Complied
0.57896	Neutral	35.05	56.00	20.95	Complied
1.01116	Neutral	31.45	56.00	24.55	Complied
4.68775	Neutral	37.19	56.00	18.81	Complied
20.3815	Neutral	37.97	60.00	22.03	Complied

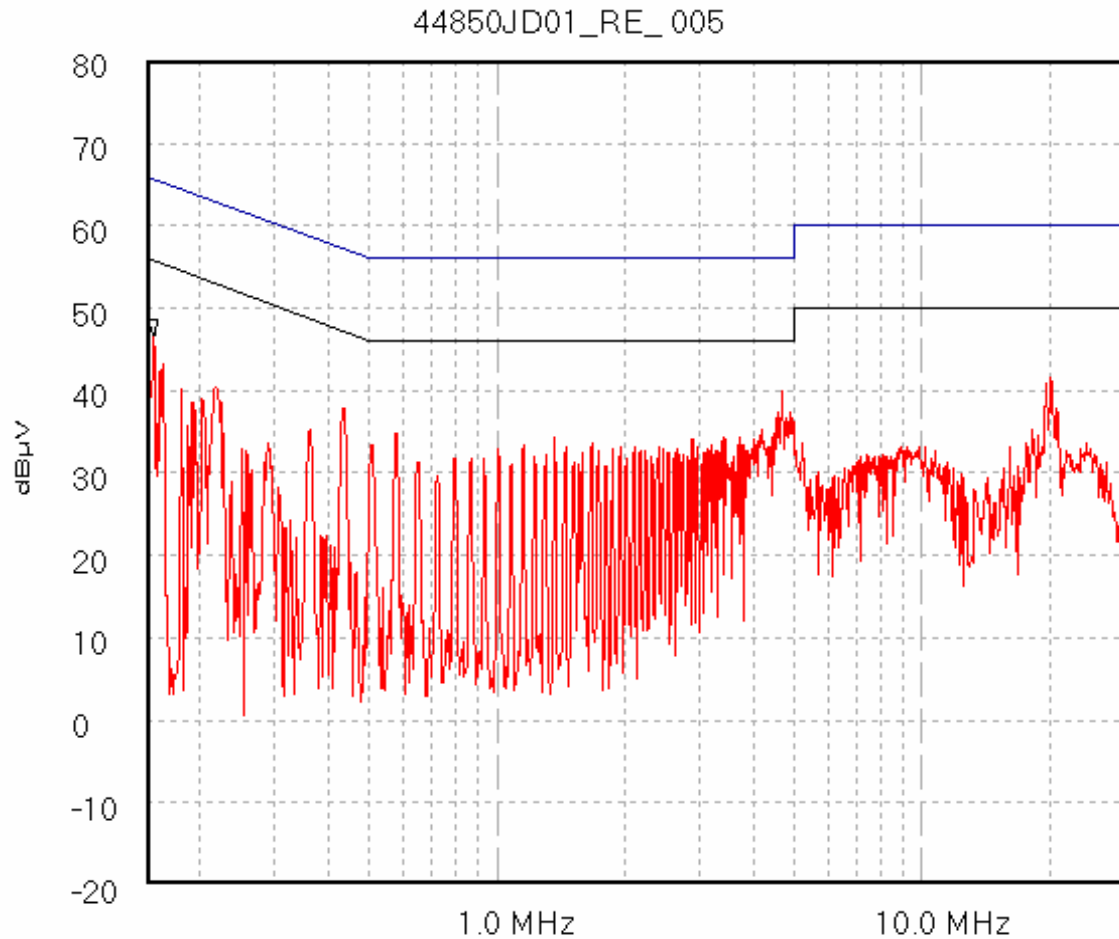
#### Average Detector Measurements on Live and Neutral Lines

Frequency (MHz)	Line	Q-P Level (dB $\mu$ V)	Q-P Limit (dB $\mu$ V)	Margin (dB)	Result
0.15127	Live	32.66	55.93	23.27	Complied
0.21782	Neutral	34.69	52.90	18.21	Complied
0.43406	Neutral	35.21	47.17	11.96	Complied
0.57896	Neutral	32.74	46.00	13.26	Complied
1.01116	Neutral	27.89	46.00	18.11	Complied
4.68775	Neutral	36.07	46.00	9.93	Complied
20.3815	Neutral	35.03	50.00	14.97	Complied

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**Receive Conducted Emissions AC Mains: Section 15.107 (Continued)**



Trace 1  
FCC\_QP — FCC\_Av

Start 150.0 kHz; Stop 30.0 MHz - Log Scale  
Ref 80 dBµV; Ref Offset 0.0 dB; 10 dB/div  
RBW 9.0 kHz; VBW 10.0 kHz; Att 10 dB; Swp 1.94 S  
Peak 155.393 kHz, 46.54 dBµV  
Limit/Mask: FCC\_QP; FCC\_Av; ; Limit Test Passed  
24/04/2003 10:57:20



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## **8.2. Receive Radiated Emissions: Section 15.109**

### **8.2.1. Electric Field Strength Measurements (Frequency Range: 30 to 1000 MHz)**

8.2.1.1. The EUT was configured as for radiated field strength emissions testing as described in Section 9 of this report.

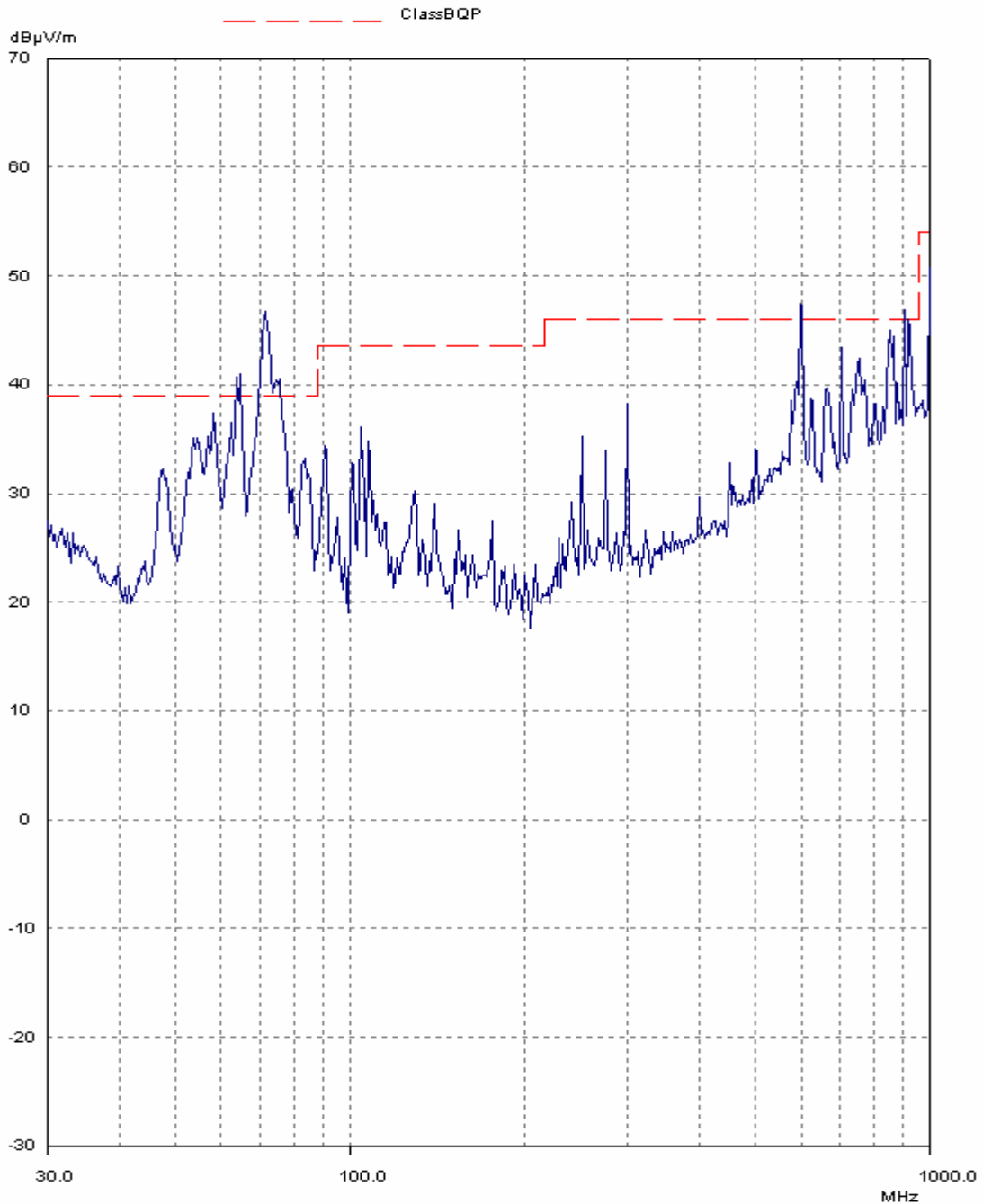
8.2.1.2. Tests were performed to identify the maximum radiated spurious emissions levels.

<b>Frequency (MHz)</b>	<b>Ant. Pol.</b>	<b>Q-P Level (dB<math>\mu</math>V/m)</b>	<b>Limit (dB<math>\mu</math>V/m)</b>	<b>Margin (dB)</b>	<b>Result</b>
54.710	Vert.	34.8	40.0	5.2	Complied
66.722	Vert.	35.1	40.0	4.9	Complied
76.497	Vert.	28.2	40.0	11.8	Complied
600.013	Horiz.	38.3	46.0	7.9	Complied
699.982	Horiz.	36.8	46.0	9.2	Complied
755.905	Vert.	33.2	46.0	12.8	Complied
755.555	Vert.	35.0	46.0	11.0	Complied
899.992	Vert.	45.9	46.0	0.1	Complied
902.744	Vert.	35.2	46.0	10.8	Complied
918.004	Vert.	40.3	46.0	5.7	Complied

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**Receive Radiated Emissions: Section 15.109 (Continued)**



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**Receiver Radiated Emissions: Section 15.109 (Continued)**

**Electric Field Strength Measurements (Frequency Range: 1.0 to 30.0 GHz)**

**Highest Average Level:**

**Highest Average Level:**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
1.100000	Vert.	6.0	22.0	1.2	29.2	54.0	24.8	Complied
1.151957	Vert.	10.3	22.0	1.2	33.5	54.0	20.5	Complied
1.199993	Vert.	12.5	22.0	1.2	35.7	54.0	18.3	Complied
1.299995	Vert.	16.6	22.0	1.2	39.8	54.0	14.2	Complied
1.400003	Vert.	9.2	22.0	1.2	32.4	54.0	21.6	Complied
1.499987	Vert.	9.1	22.0	1.2	32.3	54.0	21.7	Complied
1.599974	Vert.	12.4	22.0	1.2	35.6	54.0	18.4	Complied
1.700000	Vert.	13.6	22.0	1.2	36.8	54.0	17.2	Complied
1.499872	Horiz.	14.9	22.0	1.2	38.1	54.0	15.9	Complied
1.247985	Horiz.	9.1	22.0	1.2	32.3	54.0	21.7	Complied
3.068943	Horiz.	24.6	22.0	1.4	47.8	54.0	6.2	Complied
4.922000	Vert.	20.9	24.2	1.8	46.9	54.0	7.1	Complied
5.810000	Vert.	14.9	24.4	2.0	40.9	54.0	13.1	Complied
9.667000	Vert.	15.2	30.5	2.6	48.3	54.0	5.7	Complied
9.702000	Vert.	14.9	30.5	2.6	48.0	54.0	6.0	Complied
18.86100	Vert.	6.6	37.0	3.6	47.2	54.0	6.8	Complied

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**Receiver Radiated Emissions: Section 15.109 (Continued)**

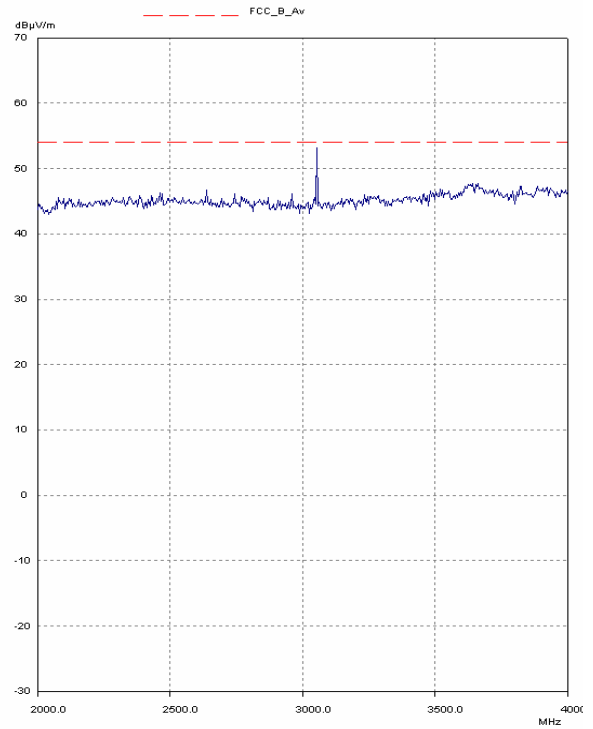
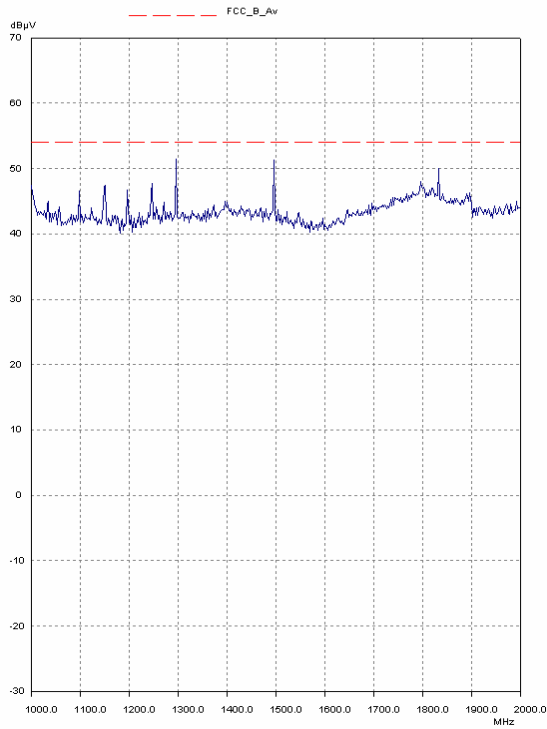
**Highest Peak Level:**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
1.100000	Vert.	14.6	22.0	1.2	37.8	74.0	36.2	Complied
1.151957	Vert.	21.8	22.0	1.2	45.0	74.0	29.0	Complied
1.199993	Vert.	24.1	22.0	1.2	47.3	74.0	26.7	Complied
1.299995	Vert.	24.6	22.0	1.2	47.8	74.0	26.2	Complied
1.400003	Vert.	20.8	22.0	1.2	44.0	74.0	30.0	Complied
1.499987	Vert.	19.3	22.0	1.2	42.5	74.0	31.5	Complied
1.599974	Vert.	24.4	22.0	1.2	47.6	74.0	26.4	Complied
1.700000	Vert.	25.0	22.0	1.2	48.2	74.0	25.8	Complied
1.499872	Horiz.	28.4	22.0	1.2	51.6	74.0	22.4	Complied
1.247985	Horiz.	20.2	22.0	1.2	43.4	74.0	30.6	Complied
3.068943	Horiz.	28.6	22.0	1.4	51.8	74.0	22.2	Complied
4.922000	Vert.	23.5	24.2	1.8	49.5	74.0	24.5	Complied
5.810000	Vert.	35.5	24.4	2.0	61.5	74.0	12.5	Complied
9.667000	Vert.	28.3	30.5	2.6	61.4	74.0	12.6	Complied
9.702000	Vert.	27.3	30.5	2.6	60.4	74.0	13.6	Complied
18.86100	Vert.	15.8	37.0	3.6	56.4	74.0	17.6	Complied

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

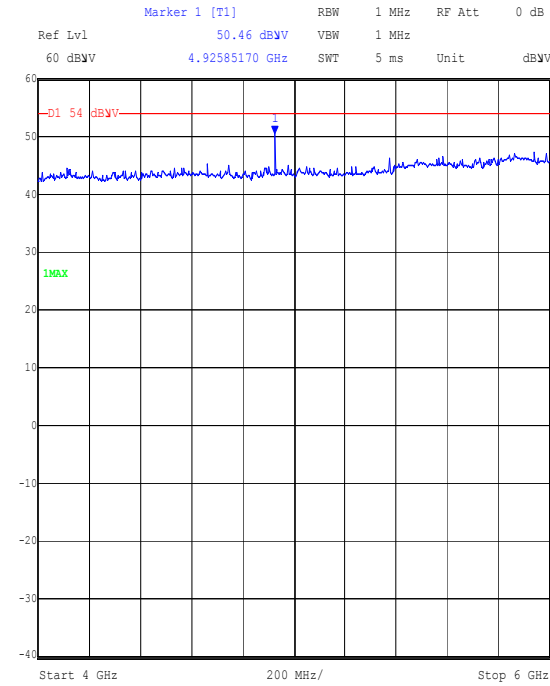
**Receiver Radiated Emissions: Section 15.109 (Continued)**



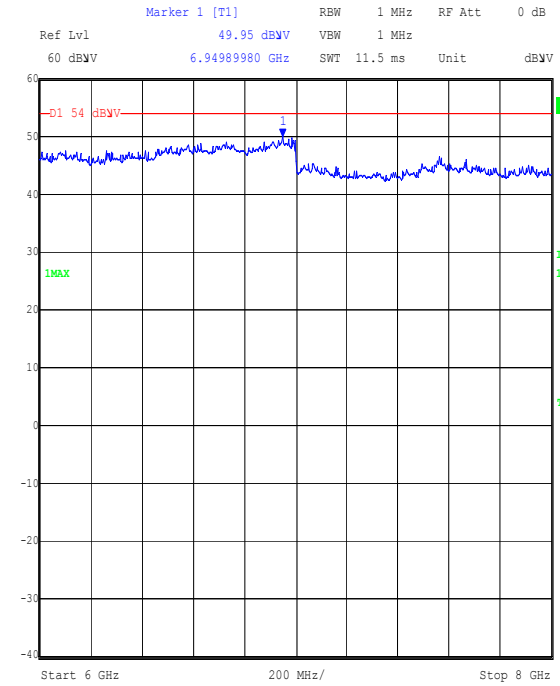
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

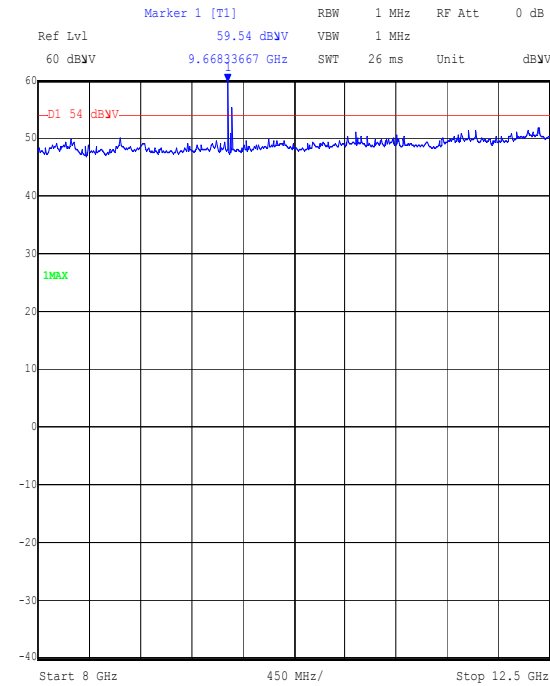
**Receiver Radiated Emissions: Section 15.109 (Continued)**



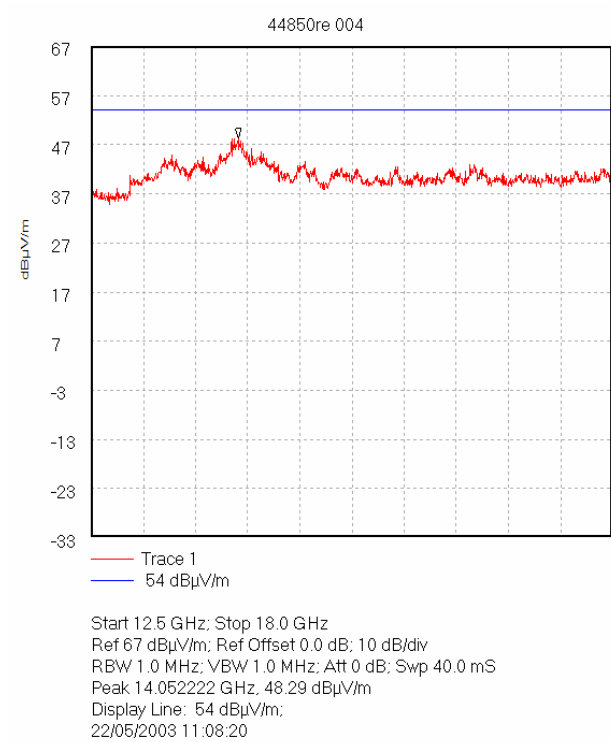
Title: Radiated Emissions.  
Comment A: 44850JD01004  
Date: 23.APR.2003 11:25:56



Title: Radiated Emissions.  
Comment A: 44850JD01005  
Date: 23.APR.2003 11:37:01



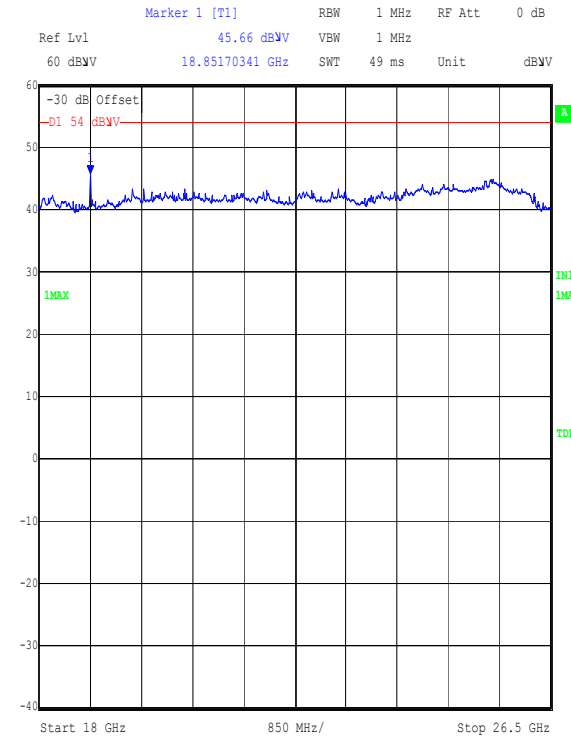
Title: Radiated Emissions.  
Comment A: 44850JD01006  
Date: 23.APR.2003 11:42:15



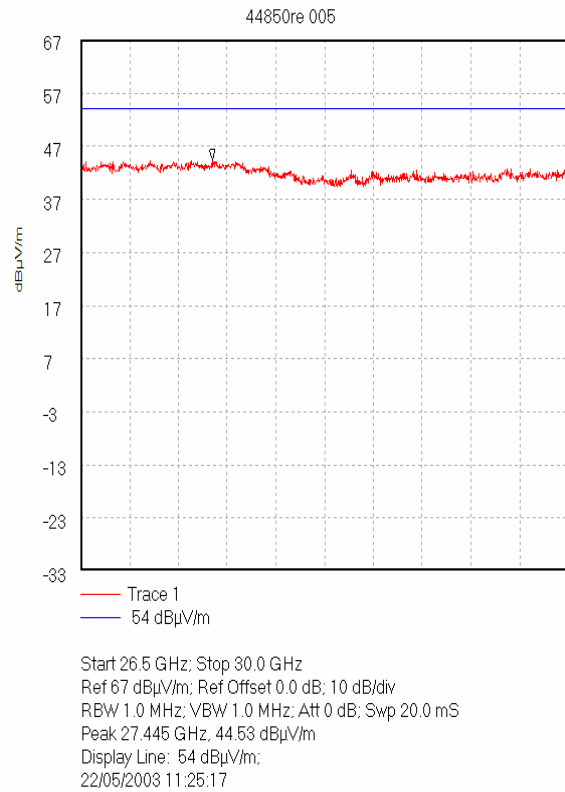
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Receiver Radiated Emissions: Section 15.109 (Continued)**



Title: Radiated Emissions.  
Comment A: 44850JD01008  
Date: 23.APR.2003 13:32:30



Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

### **8.3.Transmitter Minimum Bandwidth: Section 15.247(a)(2)**

8.3.1. The EUT was configured as for transmitter minimum bandwidth measurements as described in Section 9 of this report.

8.3.2. Tests were performed to identify the 6dB bandwidth of the fundamental signal

#### **Results: BPSK**

Channel	Transmitter 6dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Middle	9252.5	$\geq 0.5$	9252.0	Complied

#### **Results: 16QAM**

Channel	Transmitter 6dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Middle	9198.4	$\geq 0.5$	9197.9	Complied

#### **Results: 64QAM**

Channel	Transmitter 6dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Middle	9198.4	$\geq 0.5$	9197.9	Complied

#### **Results: QPSK**

Channel	Transmitter 6dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Middle	9198.4	$\geq 0.5$	9197.9	Complied

#### **Results: Acquisition**

Channel	Transmitter 6dB Bandwidth (MHz)	Limit (MHz)	Margin (MHz)	Result
Middle	9468.9	$\geq 0.5$	9468.4	Complied

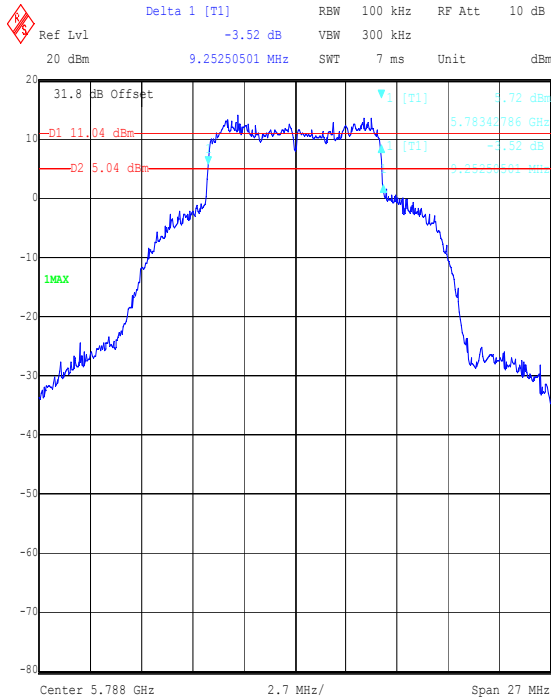


Operations Department

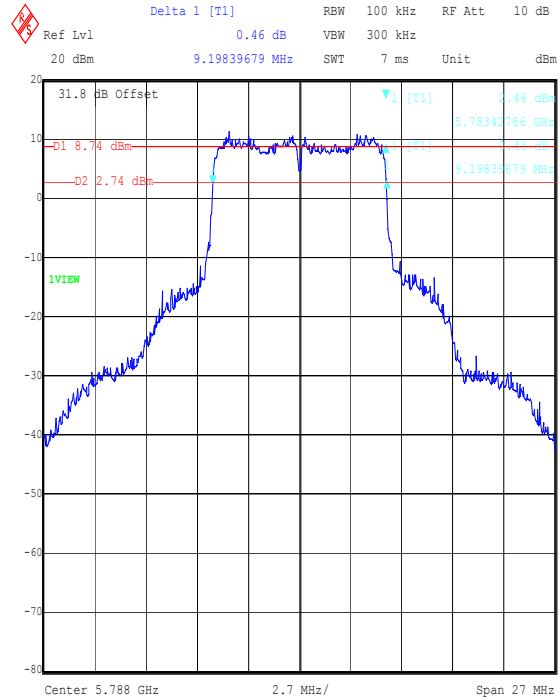
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

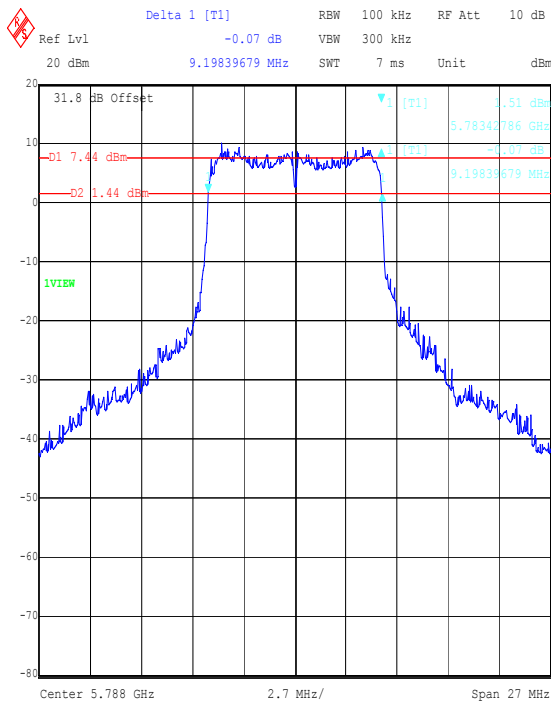
**Transmitter Minimum Bandwidth: Section 15.247(a)(2) (Continued)**



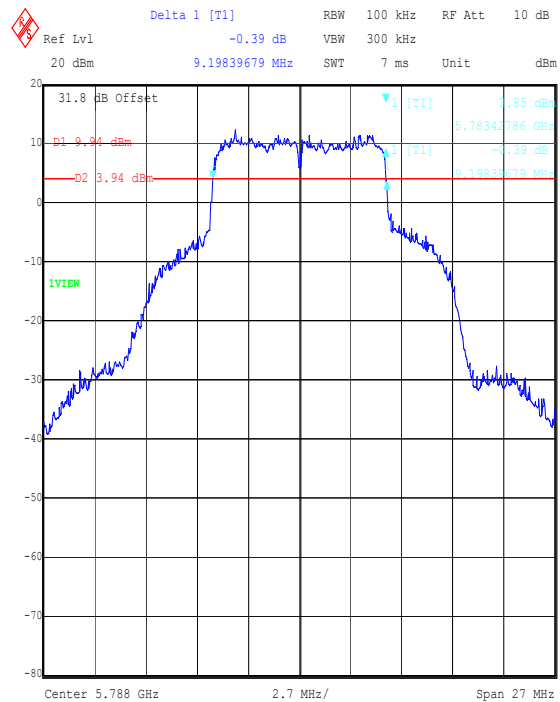
Title: Orthogon EUT: 58XX. FCC Part 15.247. Occupied Bandwidth.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_BPSK\_004  
Date: 16.SEP.2003 11:22:26



Title: Orthogon EUT: 58XX. FCC Part 15.247. Occupied Bandwidth.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_16-QAM\_002  
Date: 16.SEP.2003 11:18:26



Title: Orthogon EUT: 58XX. FCC Part 15.247. Occupied Bandwidth.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_64-QAM\_001  
Date: 16.SEP.2003 11:16:24

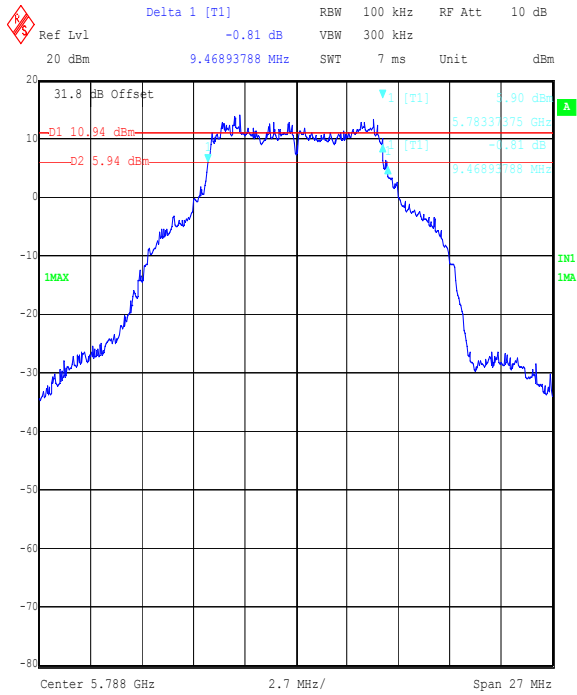


Title: Orthogon EUT: 58XX. FCC Part 15.247. Occupied Bandwidth.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_QPSK\_003  
Date: 16.SEP.2003 11:20:17

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Minimum Bandwidth: Section 15.247(a)(2) (Continued)**



Title: Orthogon EUT: 58XX, FCC Part 15.247, Occupied Bandwidth.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_ACQU\_005  
Date: 16.SEP.2003 11:24:31

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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#### **8.4. Transmitter Peak Output Power: Section 15.247(b)(3)**

8.4.1. The EUT was configured as for peak output power measurements as described in Section 9 of this report.

8.4.2. Tests were performed to identify the transmitter output power of the EUT.

#### **Results: BPSK**

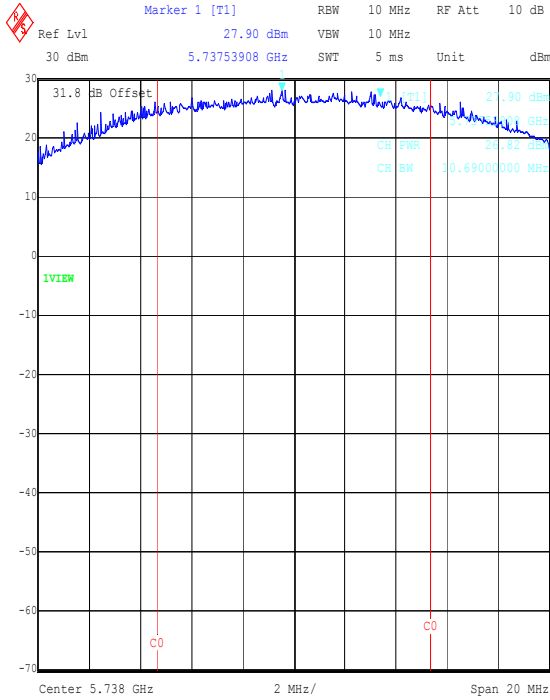
Channel	Input Voltage (AC)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	Horiz.	26.82	27.0	0.18	Complied
Bottom	Vert.	26.82	27.0	0.18	Complied
Middle	Horiz.	26.84	27.0	0.16	Complied
Middle	Vert.	26.90	27.0	0.10	Complied
Top	Horiz.	26.83	27.0	0.17	Complied
Top	Vert.	26.80	27.0	0.20	Complied

Note: Limit reduced by 3 dB as co-existence vertical and horizontal antenna may transmit simultaneously.

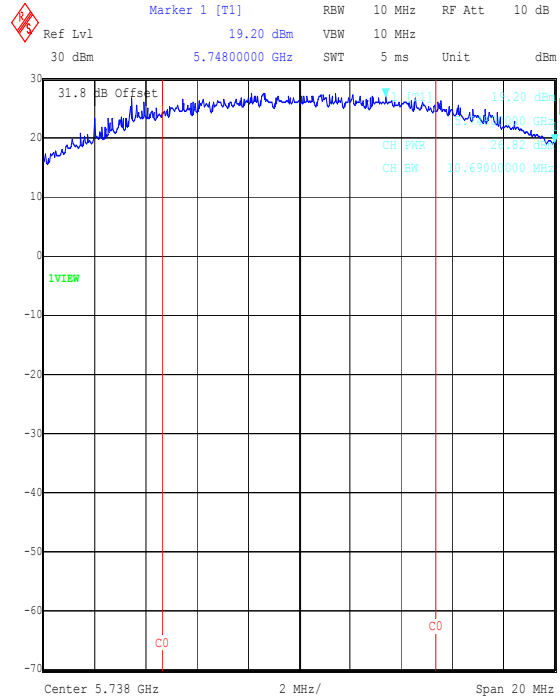
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

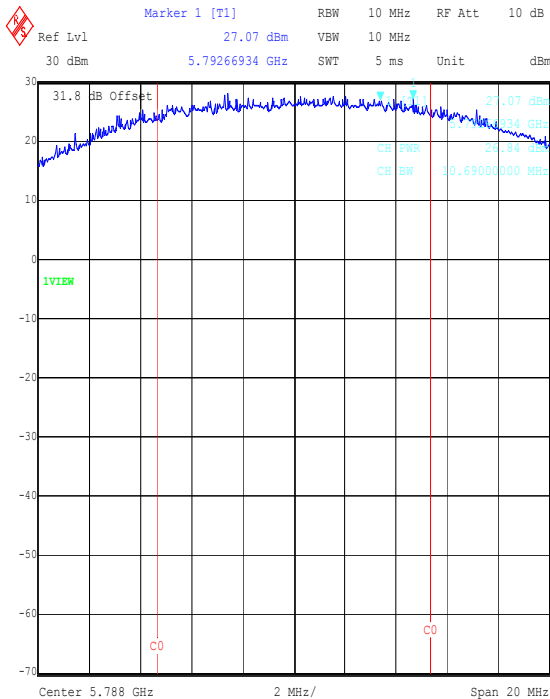
**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



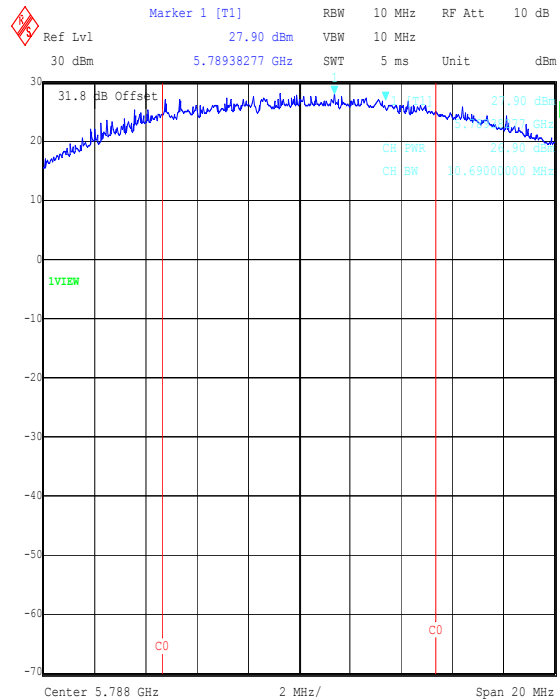
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_BFSK\_Horizontal\_006  
Date: 15.SEP.2003 12:35:05



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_BFSK\_Vertical\_002  
Date: 15.SEP.2003 12:15:38



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_BFSK\_Horizontal\_005  
Date: 15.SEP.2003 12:31:04

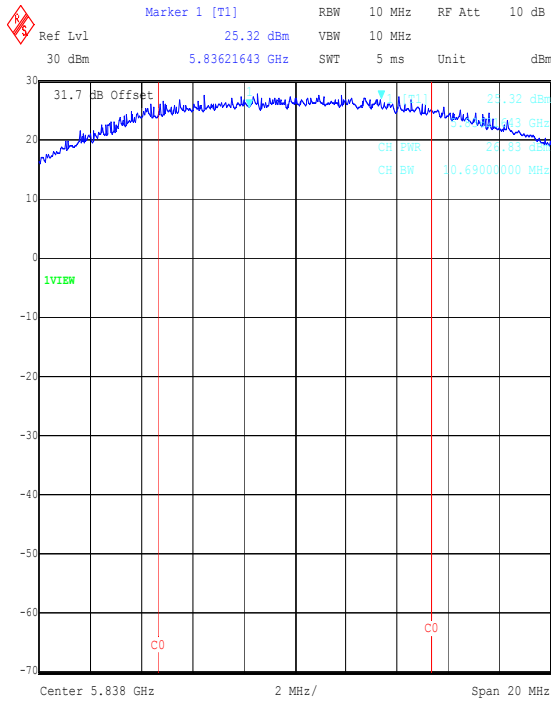


Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_BFSK\_Vertical\_001  
Date: 15.SEP.2003 12:10:51

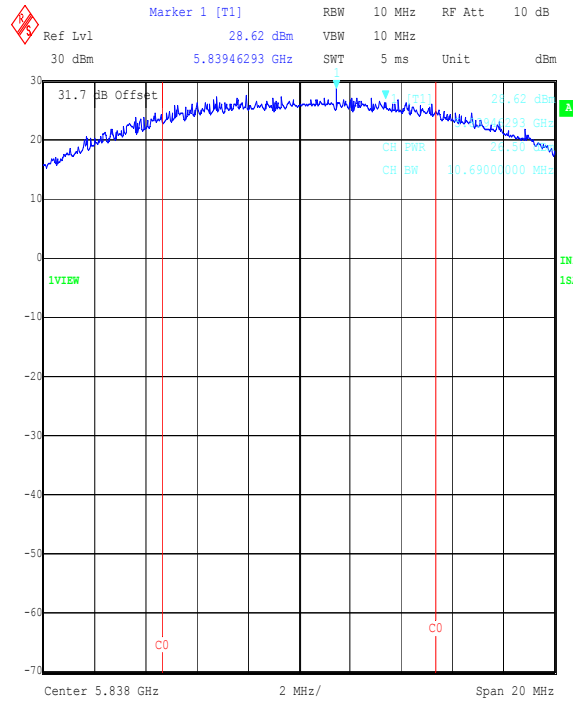
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_BPSK\_Horizontal\_004  
 Date: 15.SEP.2003 12:25:58



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_QPSK\_Vertical\_015  
 Date: 15.SEP.2003 14:37:28

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**

**Results: 16QAM**

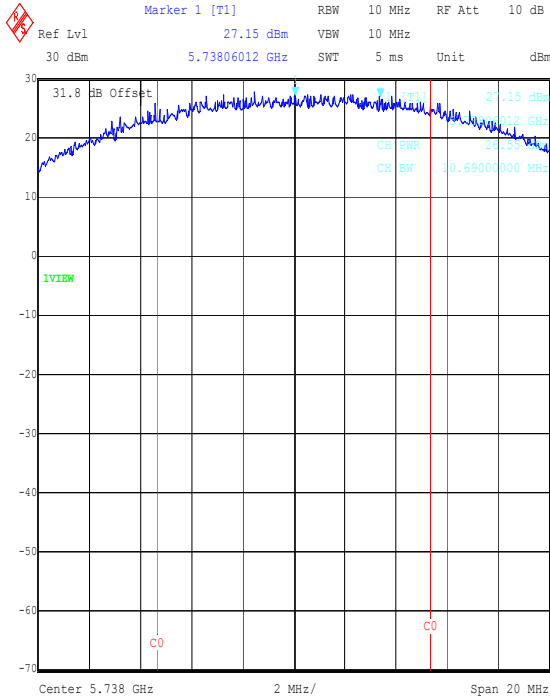
Channel	Input Voltage (AC)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	Horiz.	26.55	27.0	0.45	Complied
Bottom	Vert.	26.55	27.0	0.45	Complied
Middle	Horiz.	26.53	27.0	0.47	Complied
Middle	Vert.	26.64	27.0	0.36	Complied
Top	Horiz.	26.54	27.0	0.46	Complied
Top	Vert.	26.58	27.0	0.42	Complied

Note: Limit reduced by 3 dB as co-existence vertical and horizontal antenna may transmit simultaneously.

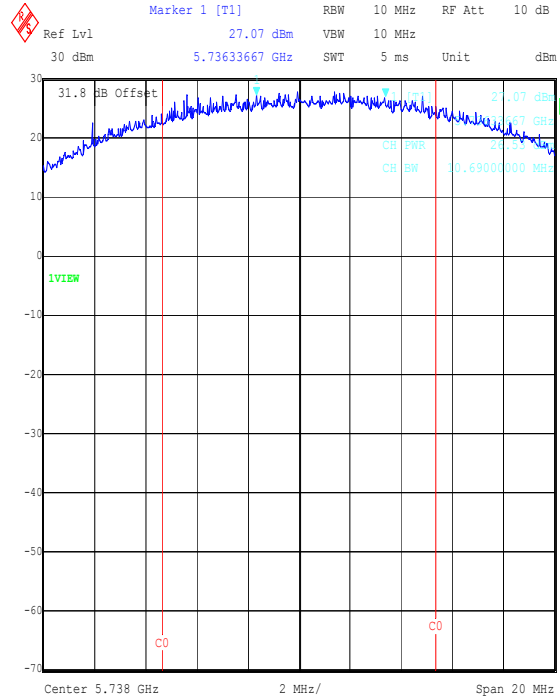
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

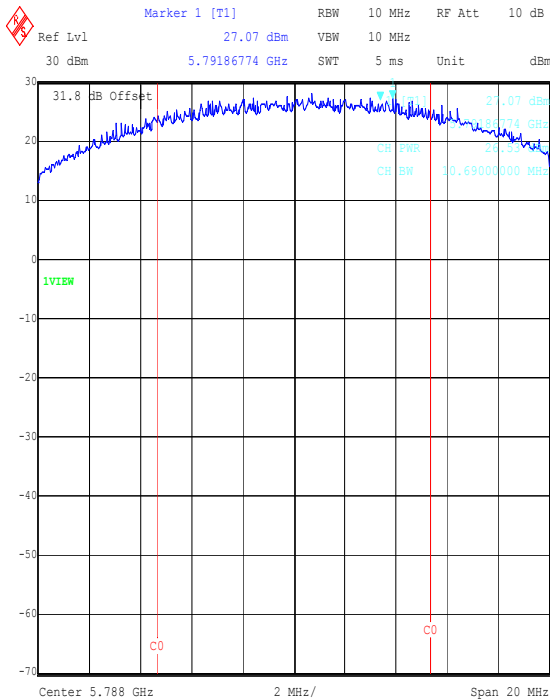
**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



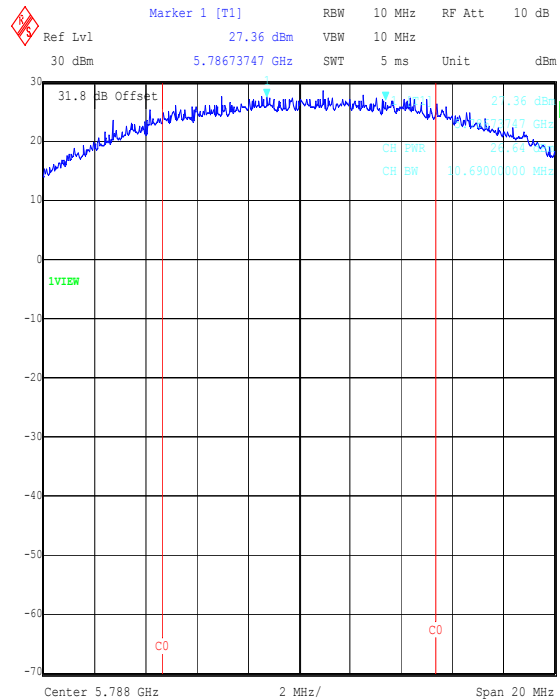
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_16-QAM\_Horizontal\_019  
 Date: 15.SEP.2003 14:56:06



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_16-QAM\_Vertical\_024  
 Date: 15.SEP.2003 15:16:41



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_16-QAM\_Horizontal\_020  
 Date: 15.SEP.2003 15:00:35

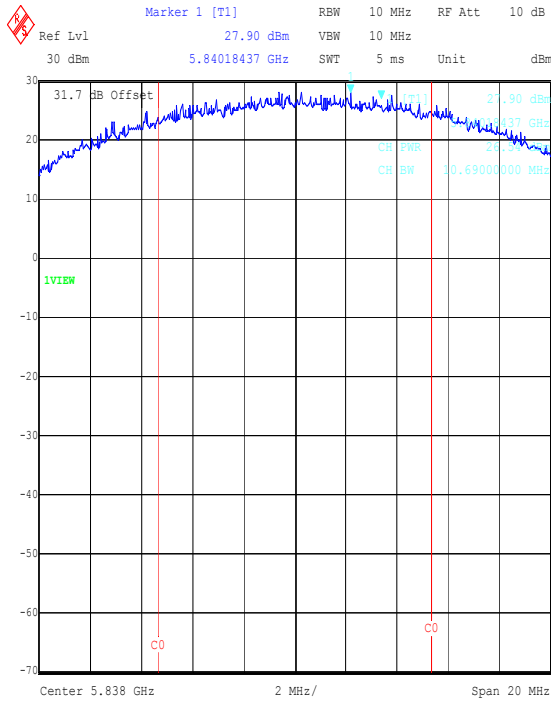


Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_16-QAM\_Vertical\_023  
 Date: 15.SEP.2003 15:13:41

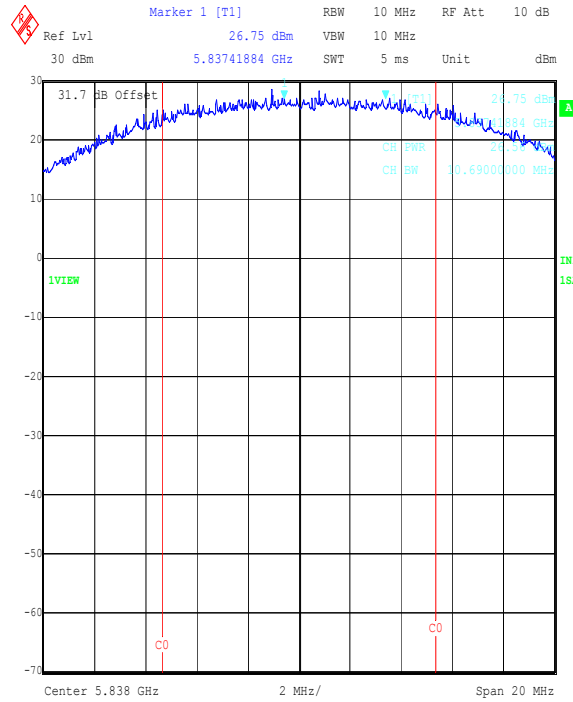
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_16-QAM\_Horizontal\_021  
 Date: 15.SEP.2003 15:04:51



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_16-QAM\_Vertical\_022  
 Date: 15.SEP.2003 15:10:19



Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**

**Results: 64QAM**

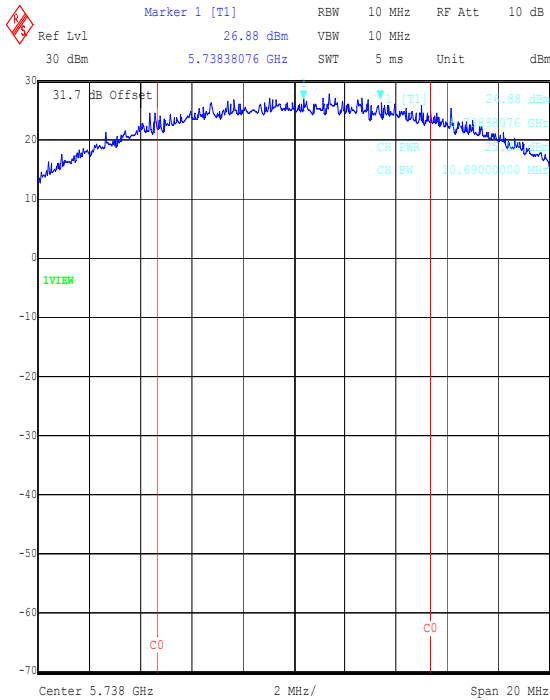
Channel	Input Voltage (AC)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	Horiz.	25.80	27.0	1.20	Complied
Bottom	Vert.	26.01	27.0	0.99	Complied
Middle	Horiz.	25.80	27.0	1.20	Complied
Middle	Vert.	25.99	27.0	1.01	Complied
Top	Horiz.	25.80	27.0	1.20	Complied
Top	Vert.	25.91	27.0	1.08	Complied

Note: Limit reduced by 3 dB as co-existence vertical and horizontal antenna may transmit simultaneously.

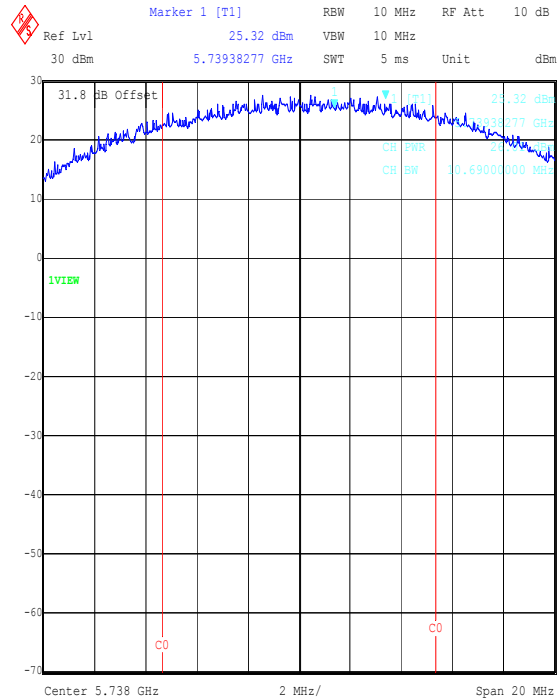
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

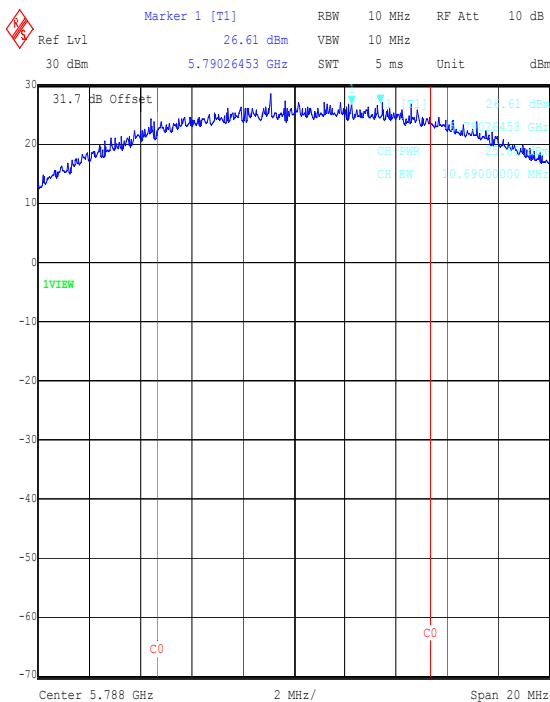
**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



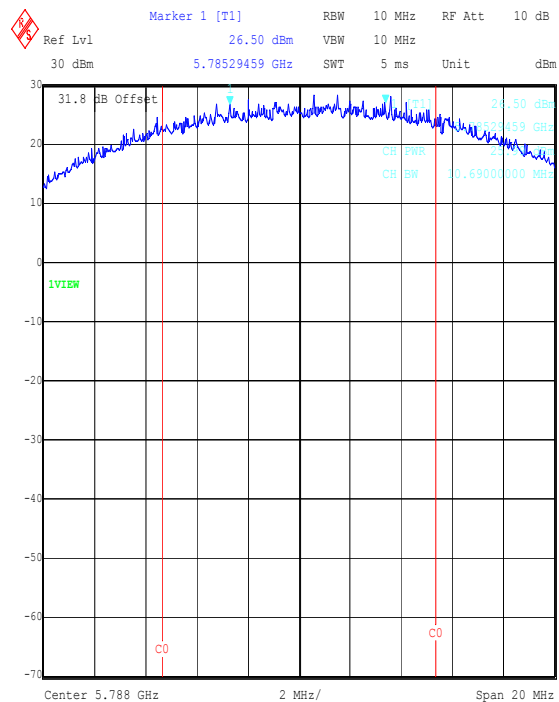
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_64-QAM\_Horizontal\_030  
 Date: 15.SEP.2003 15:55:51



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_64-QAM\_Vertical\_025  
 Date: 15.SEP.2003 15:21:38



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_64-QAM\_Horizontal\_029  
 Date: 15.SEP.2003 15:47:45

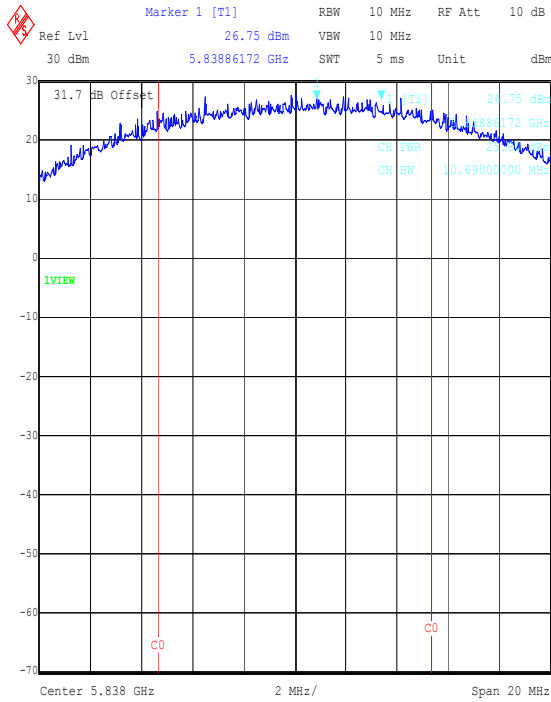


Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_64-QAM\_Vertical\_026  
 Date: 15.SEP.2003 15:25:34

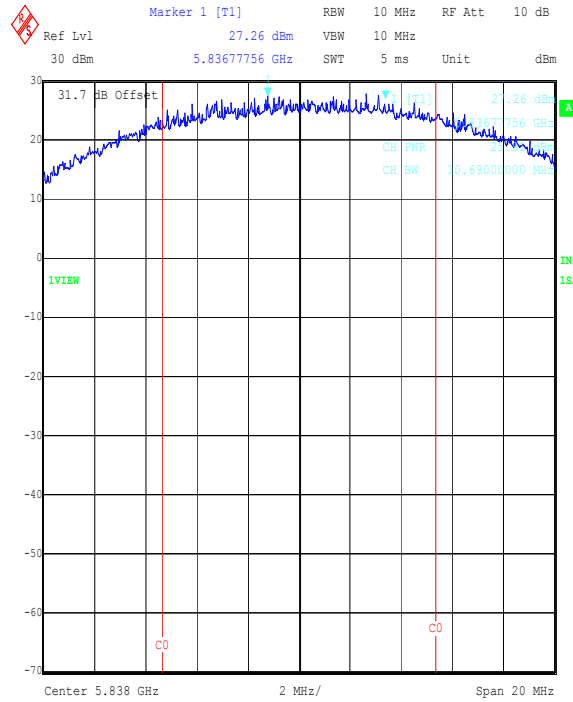
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_64-QAM\_Horizontal\_028  
Date: 15.SEP.2003 15:39:54



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_64-QAM\_Vertical\_027  
Date: 15.SEP.2003 15:31:50

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**

**Results: QPSK**

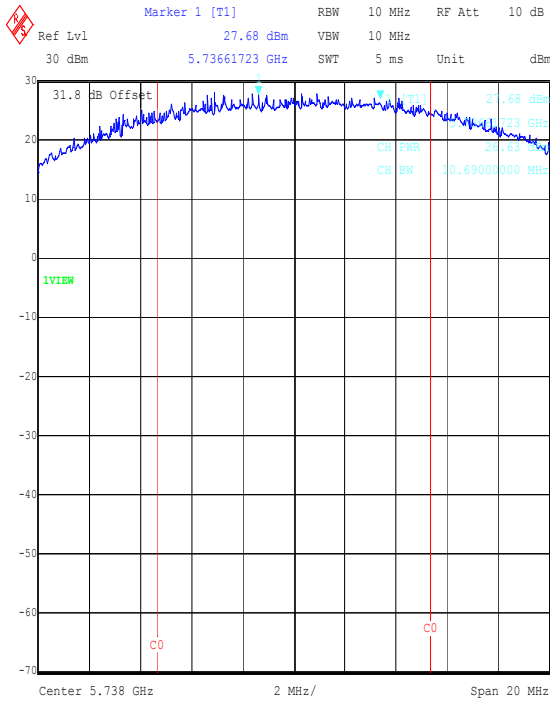
Channel	Input Voltage (AC)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	Horiz.	26.63	27.0	0.37	Complied
Bottom	Vert.	26.60	27.0	0.40	Complied
Middle	Horiz.	26.63	27.0	0.37	Complied
Middle	Vert.	26.53	27.0	0.47	Complied
Top	Horiz.	26.55	27.0	0.45	Complied
Top	Vert.	26.5	27.0	0.50	Complied

Note: Limit reduced by 3 dB as co-existence vertical and horizontal antenna may transmit simultaneously.

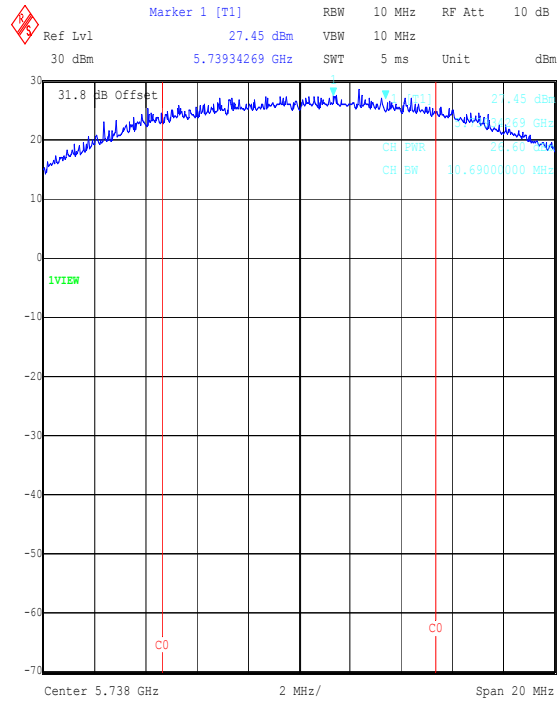
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

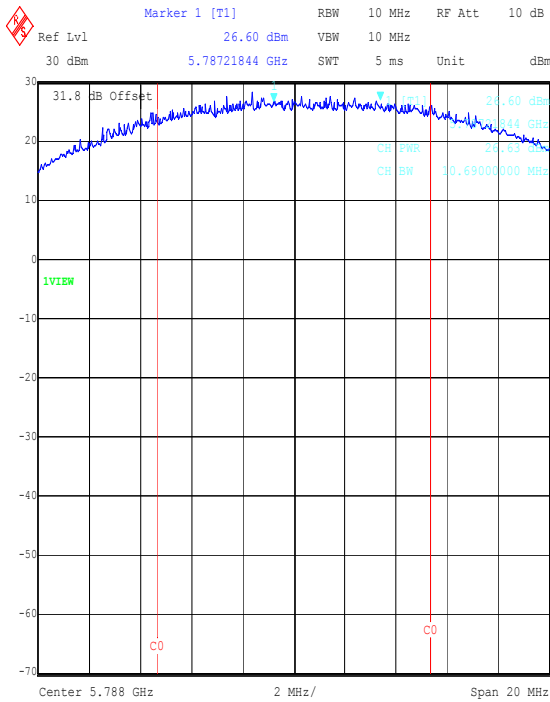
**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



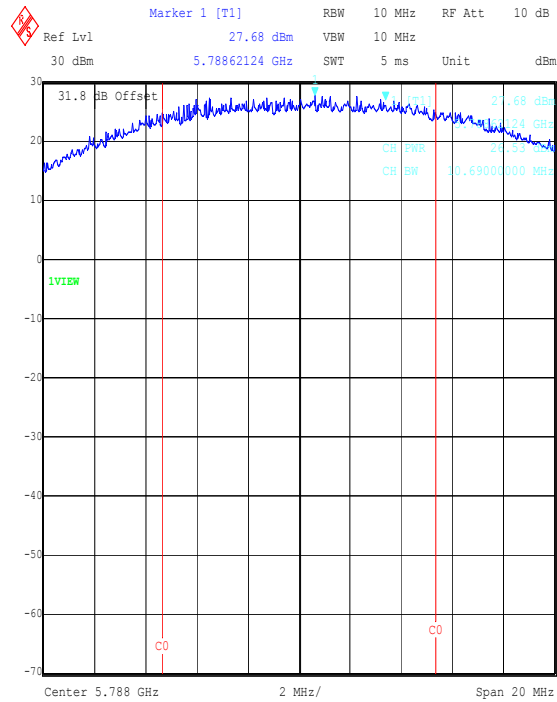
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Horizontal\_018  
 Date: 15.SEP.2003 14:51:53



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Vertical\_013  
 Date: 15.SEP.2003 14:31:37



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_QPSK\_Horizontal\_017  
 Date: 15.SEP.2003 14:48:18

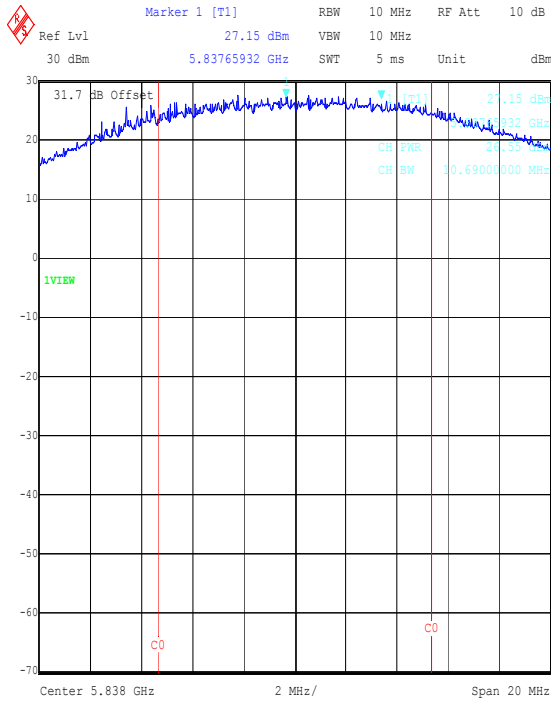


Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_QPSK\_Vertical\_014  
 Date: 15.SEP.2003 14:34:11

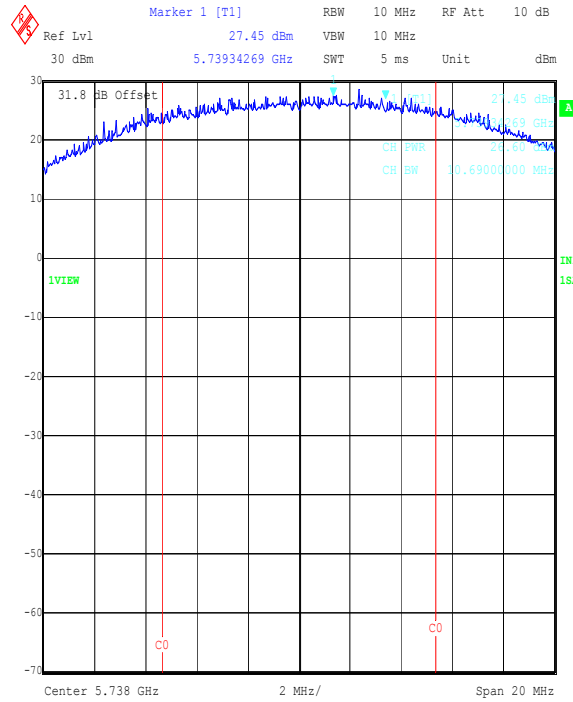
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_QPSK\_Horizontal\_016  
Date: 15.SEP.2003 14:43:11



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Vertical\_013  
Date: 15.SEP.2003 14:31:37

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**

**Results: Acquisition**

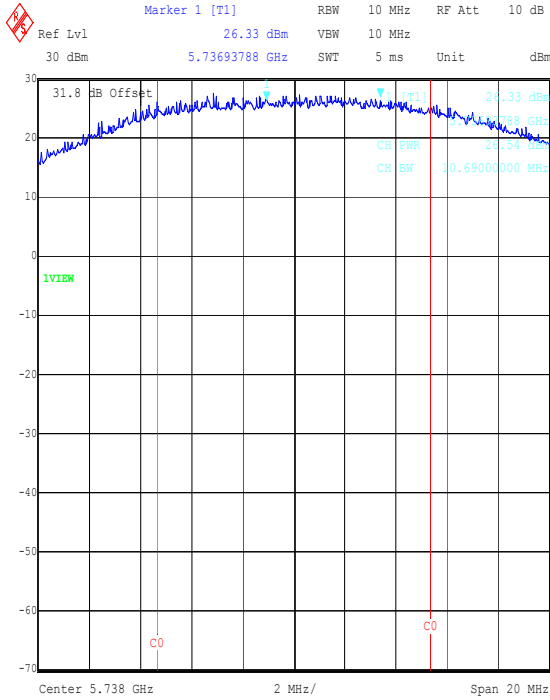
Channel	Input Voltage (AC)	Peak Output Power (dBm)	Limit (dBm)	Margin (dB)	Result
Bottom	Horiz.	26.54	27.0	0.46	Complied
Bottom	Vert.	26.83	27.0	0.17	Complied
Middle	Horiz.	26.53	27.0	0.47	Complied
Middle	Vert.	26.60	27.0	0.40	Complied
Top	Horiz.	26.57	27.0	0.43	Complied
Top	Vert.	26.56	27.0	0.44	Complied

Note: Limit reduced by 3 dB as co-existence vertical and horizontal antenna may transmit simultaneously.

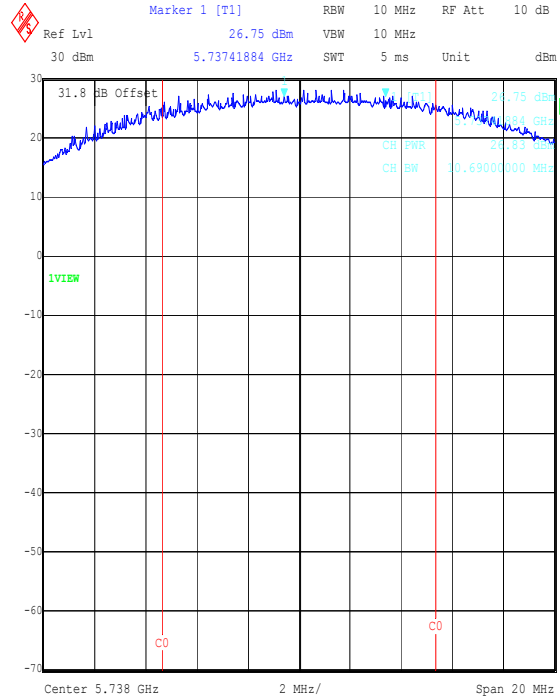
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

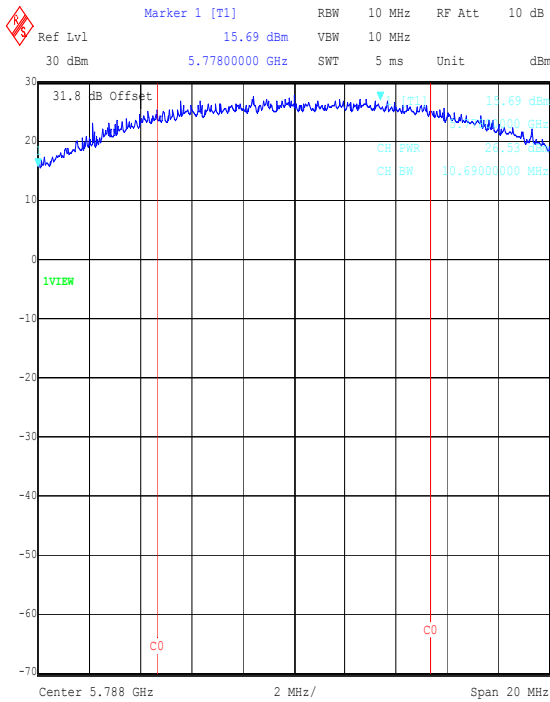
**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



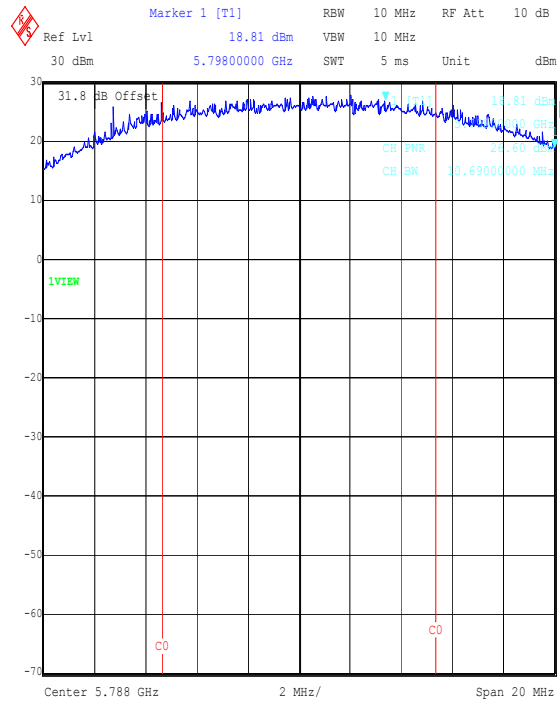
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_AQU\_Horizontal\_007  
Date: 15.SEP.2003 14:05:12



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_AQU\_Vertical\_012  
Date: 15.SEP.2003 14:27:12



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_AQU\_Horizontal\_008  
Date: 15.SEP.2003 14:09:20



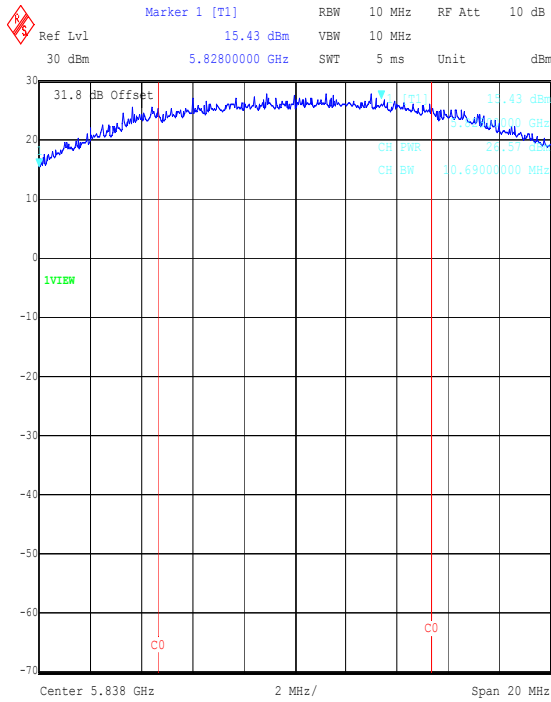
Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_AQU\_Vertical\_011  
Date: 15.SEP.2003 14:21:39



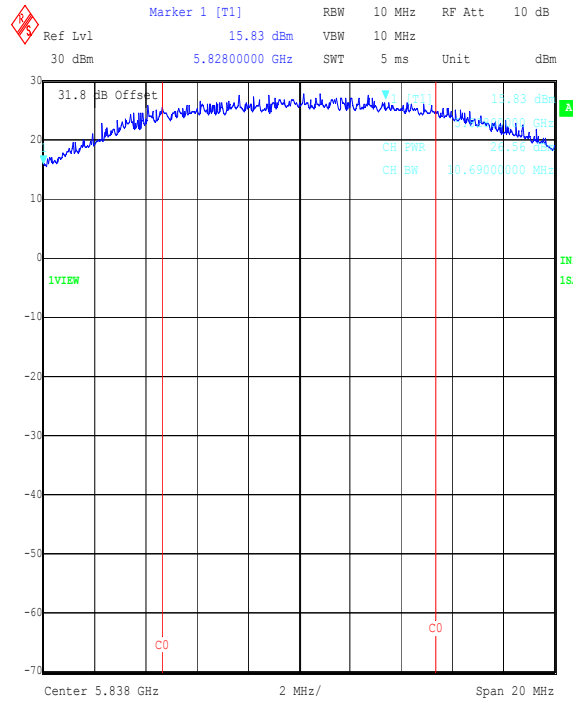
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Output Power: Section 15.247(b)(3) (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_AQU\_Horizontal\_009  
Date: 15.SEP.2003 14:13:09



Title: Orthogon EUT: 58XX. FCC Part 15.247. Peak Output Power.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_AQU\_Vertical\_010  
Date: 15.SEP.2003 14:19:08

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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### **8.5. Transmitter Conducted Emissions: Section 15.247(c)**

8.5.1. The EUT was configured as for conducted emissions measurements as described in Section 9 of this report.

8.5.2. Tests were performed to identify the maximum conducted spurious emissions levels.

#### **Middle Channel**

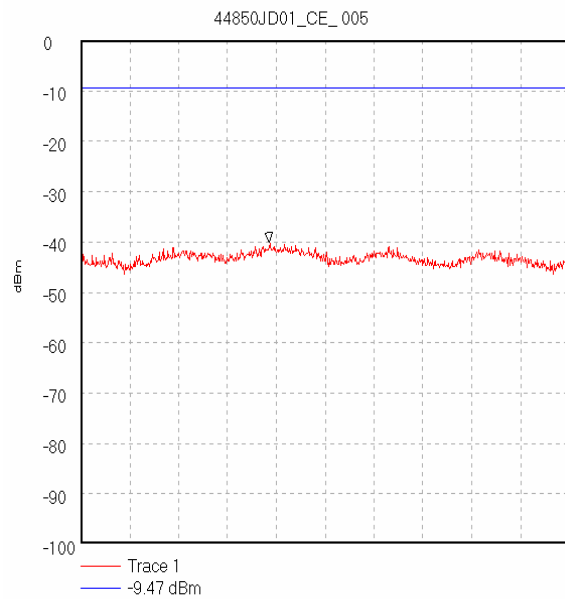
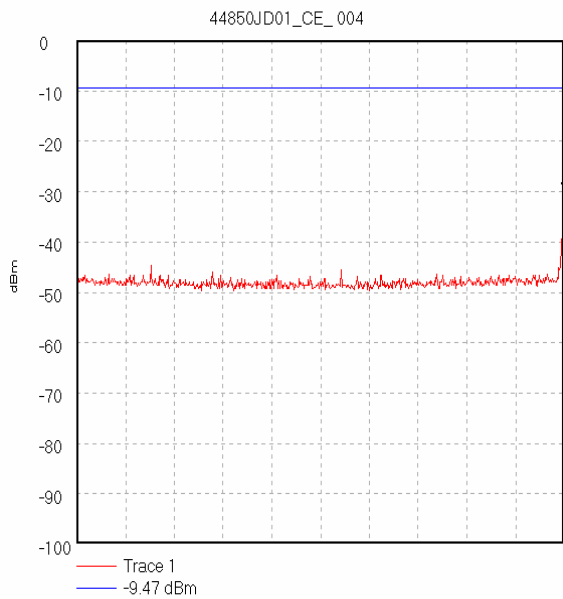
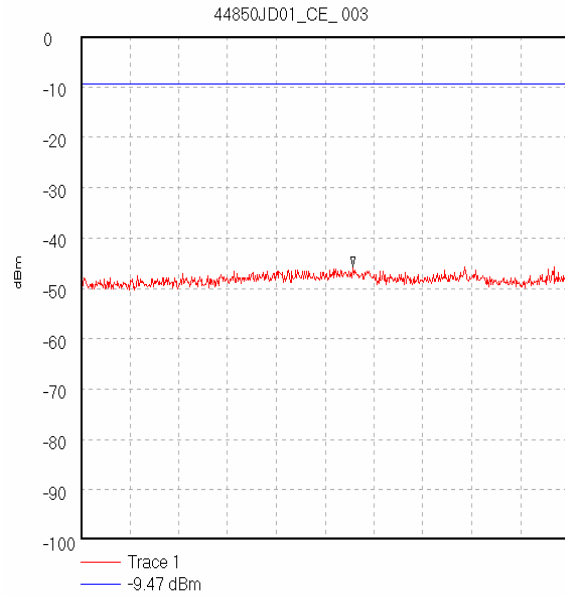
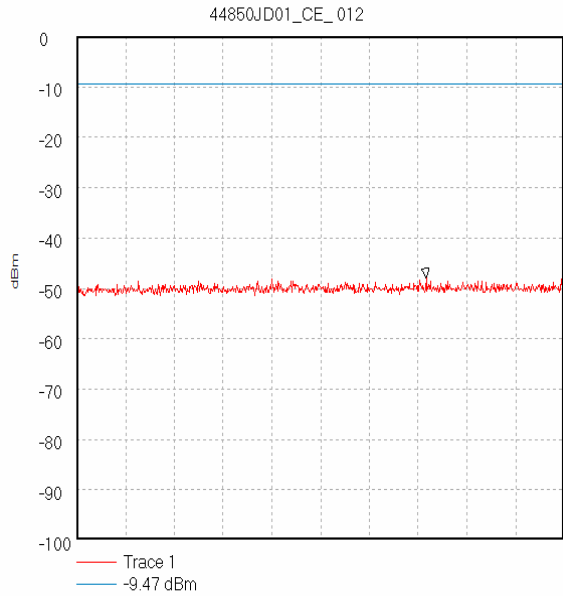
Frequency (GHz)	Peak Level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
33.292	-23.67	-9.47	14.2	Complied

**Note:** No spurious emissions were found; therefore the highest value of noise floor has been recorded.

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

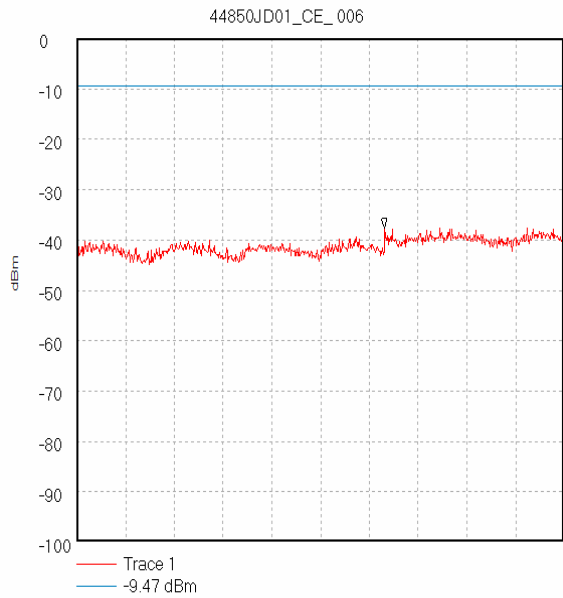
**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**



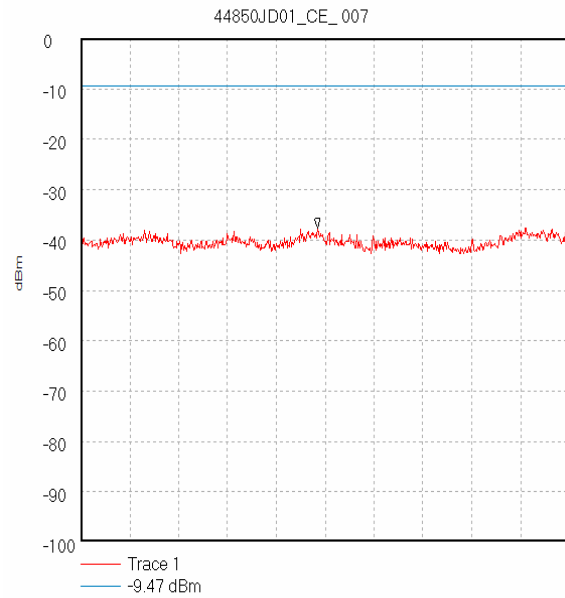
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

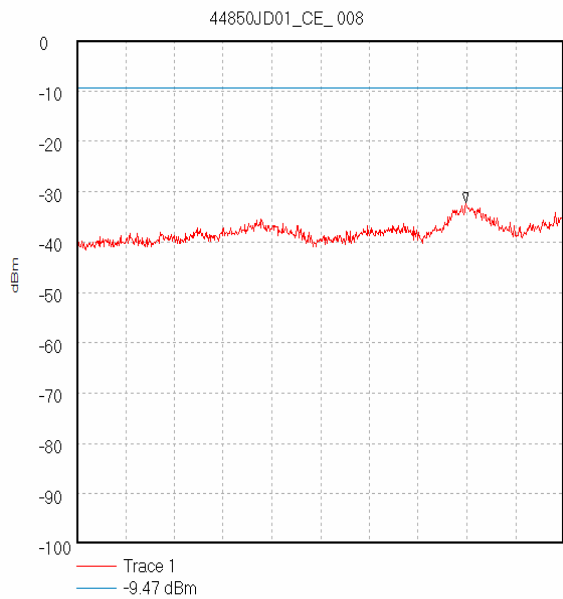
**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**



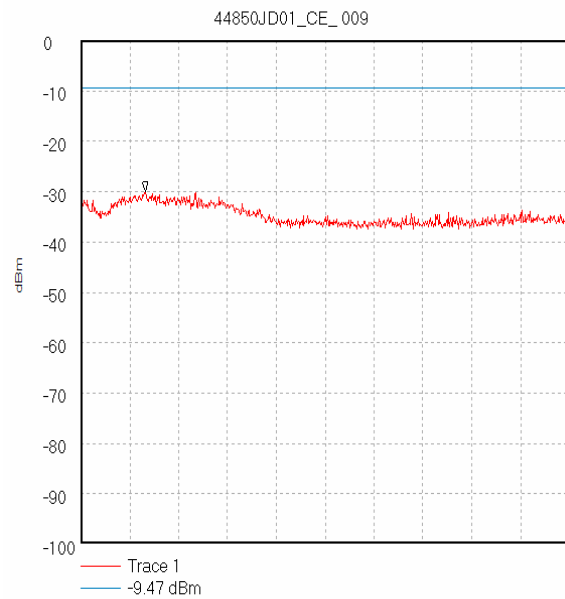
Start 10.0 GHz; Stop 15.0 GHz  
Ref 0 dBm; Ref Offset 36.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 1.3 S  
Peak 13.158333 GHz, -37.67 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:45:25



Start 15.0 GHz; Stop 20.0 GHz  
Ref 0 dBm; Ref Offset 35.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 1.3 S  
Peak 17.425 GHz, -37.67 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:47:26



Start 20.0 GHz; Stop 25.0 GHz  
Ref 0 dBm; Ref Offset 35.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 1.3 S  
Peak 23.991667 GHz, -32.17 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:48:24

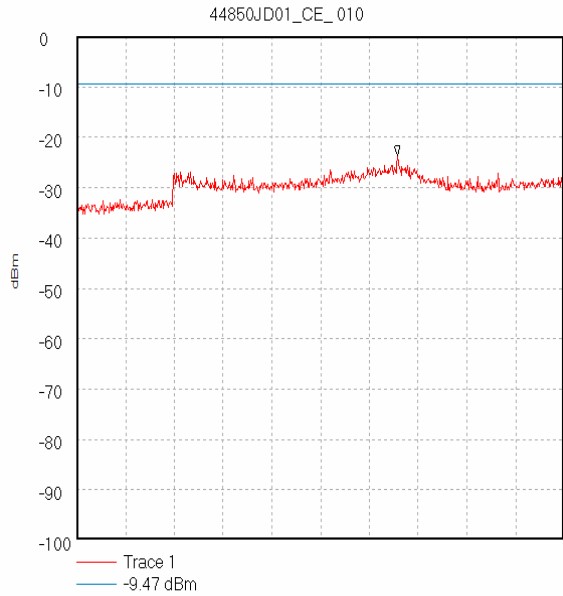


Start 25.0 GHz; Stop 30.0 GHz  
Ref 0 dBm; Ref Offset 39.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 1.3 S  
Peak 25.658333 GHz, -30.0 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:49:40

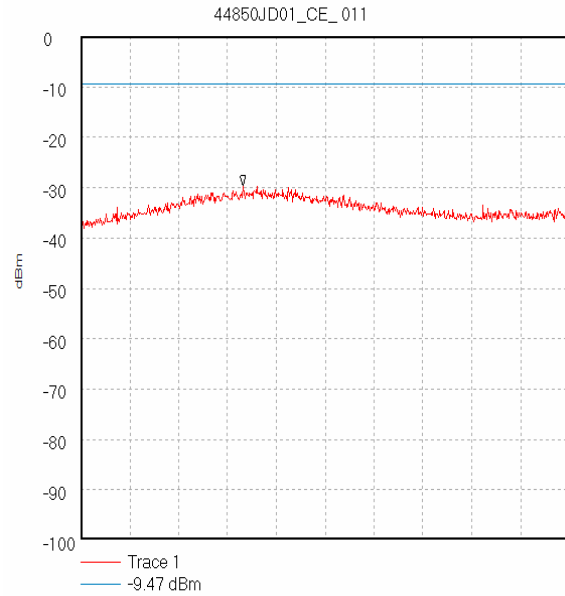
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Conducted Emissions: Section 15.247(c) (Continued)**



Start 30.0 GHz; Stop 35.0 GHz  
Ref 0 dBm; Ref Offset 39.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 10 dB; Swp 1.3 S  
Peak 33.291667 GHz, -29.67 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:51:33



Start 35.0 GHz; Stop 40.0 GHz  
Ref 0 dBm; Ref Offset 40.0 dB; 10 dB/div  
RBW 100.0 kHz; VBW 100.0 kHz; Att 0 dB; Swp 1.3 S  
Peak 36.658333 GHz, -29.67 dBm  
Display Line: -9.47 dBm;  
28/04/2003 10:52:58

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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## **8.6. Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a)**

### **8.6.1. Electric Field Strength Measurements: 30 to 1000 MHz.**

8.6.1.1. The EUT was configured as for radiated field strength measurements as described in Section 9 of this report.

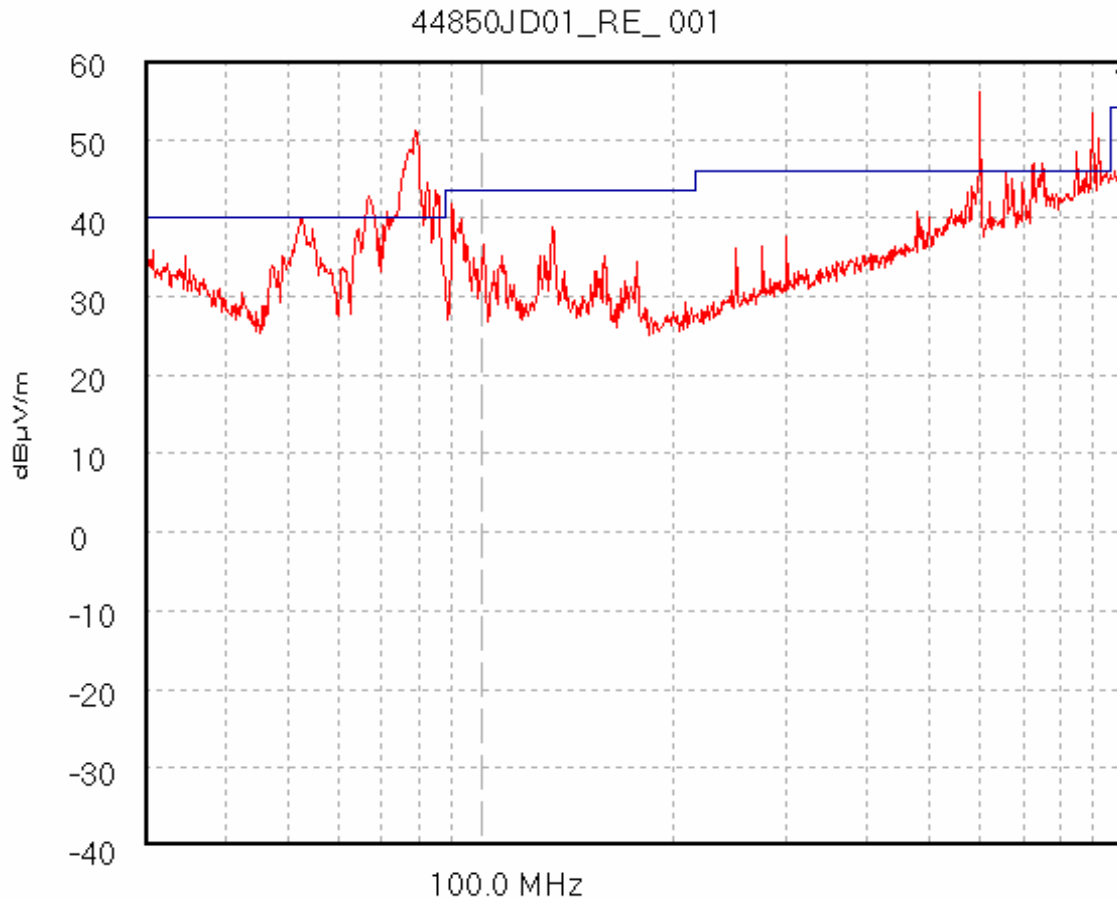
8.6.1.2. Tests were performed to identify the maximum radiated emissions levels.

<b>Frequency (MHz)</b>	<b>Antenna Polarity</b>	<b>Q-P Level (dB<math>\mu</math>V/m)</b>	<b>Limit (dB<math>\mu</math>V/m)</b>	<b>Margin (dB)</b>	<b>Result</b>
54.710	Vert.	34.8	40.0	5.2	Complied
66.722	Vert.	35.1	40.0	4.9	Complied
76.497	Vert.	28.2	40.0	11.8	Complied
600.013	Horiz.	38.3	46.0	7.9	Complied
699.982	Horiz.	36.8	46.0	9.2	Complied
755.905	Vert.	33.2	46.0	12.8	Complied
755.555	Vert.	35.0	46.0	11.0	Complied
899.992	Vert.	45.9	46.0	0.1	Complied
902.744	Vert.	35.2	46.0	10.8	Complied
918.004	Vert.	40.3	46.0	5.7	Complied

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**



Trace 1  
15\_209

Start 30.0 MHz; Stop 1.0 GHz - Log Scale  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 119.818 kHz; VBW 100.0 kHz; Att 10 dB; Swp 40.0 mS  
Peak 999.999936 MHz, 56.96 dBµV/m  
Limit/Mask: 15\_209;  
Transducer Factors: A490  
24/04/2003 09:30:37

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**

**Electric Field Strength Measurements: 1.0 to 40.0 GHz**

**Highest Average Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Average Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Average Level (dB $\mu$ V/m)	Average Limit (dB $\mu$ V/m)	Average Margin (dB)	Result
1.100000	Vert.	6.0	22	1.2	29.2	54.0	24.8	Complied
1.151957	Vert.	10.3	22	1.2	33.5	54.0	20.5	Complied
1.199993	Vert.	12.5	22	1.2	35.7	54.0	18.3	Complied
1.299995	Vert.	16.6	22	1.2	39.8	54.0	14.2	Complied
1.400003	Vert.	9.2	22	1.2	32.4	54.0	21.6	Complied
1.499987	Vert.	9.1	22	1.2	32.3	54.0	21.7	Complied
1.599974	Vert.	12.4	22	1.2	35.6	54.0	18.4	Complied
1.700000	Vert.	13.6	22	1.2	36.8	54.0	17.2	Complied
1.499872	Horiz.	14.9	22	1.2	38.1	54.0	15.9	Complied
1.247985	Horiz.	9.1	22	1.2	32.3	54.0	21.7	Complied
3.068943	Horiz.	24.6	22	1.4	47.8	54.0	6.2	Complied
4.925000	Vert.	18.2	24.2	1.8	44.2	54.0	9.8	Complied
18.86100	Vert.	6.2	37.0	3.6	46.8	54.0	7.2	Complied



Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**

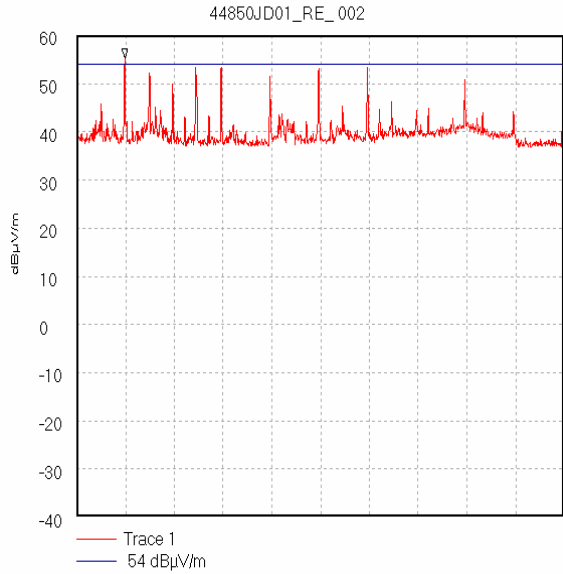
**Highest Peak Level: Bottom Channel**

Frequency (GHz)	Antenna Polarity (H/V)	Peak Detector level (dB $\mu$ V)	Antenna factor (dB)	Cable loss (dB)	Actual Peak Level (dB $\mu$ V/m)	Peak Limit (dB $\mu$ V/m)	Peak Margin (dB)	Result
1.10000	Vert.	14.6	22	1.2	37.8	74.0	36.2	Complied
1.151957	Vert.	21.8	22	1.2	45.0	74.0	29.0	Complied
1.199993	Vert.	24.1	22	1.2	47.3	74.0	26.7	Complied
1.299995	Vert.	24.6	22	1.2	47.8	74.0	26.2	Complied
1.400003	Vert.	20.8	22	1.2	44.0	74.0	30.0	Complied
1.499987	Vert.	19.3	22	1.2	42.5	74.0	31.5	Complied
1.599974	Vert.	24.4	22	1.2	47.6	74.0	26.4	Complied
1.700000	Vert.	25.0	22	1.2	48.2	74.0	25.8	Complied
1.499872	Horiz.	28.4	22	1.2	51.6	74.0	22.4	Complied
1.247985	Horiz.	20.2	22	1.2	43.4	74.0	30.6	Complied
3.068943	Horiz.	28.6	22	1.4	51.8	74.0	22.2	Complied
4.925000	Vert.	29.8	24.2	1.8	55.8	74.0	18.2	Complied
18.86100	Vert.	16.6	37.0	3.6	57.2	74.0	16.8	Complied

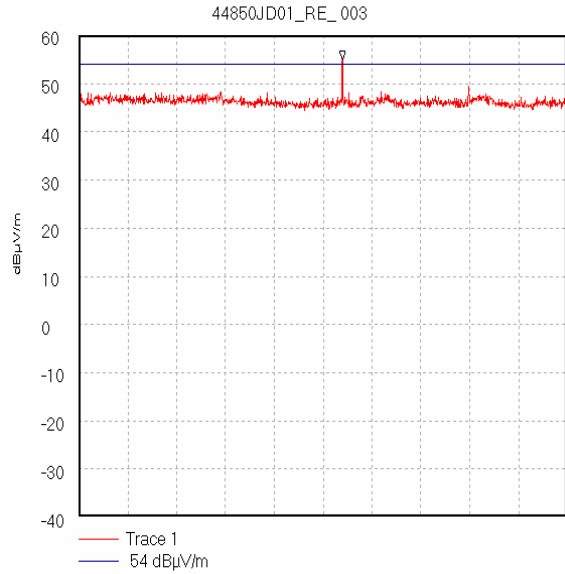
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

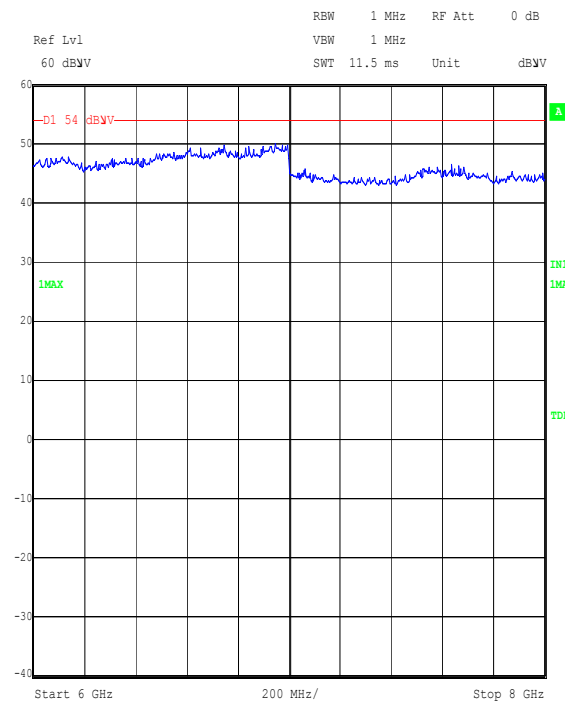
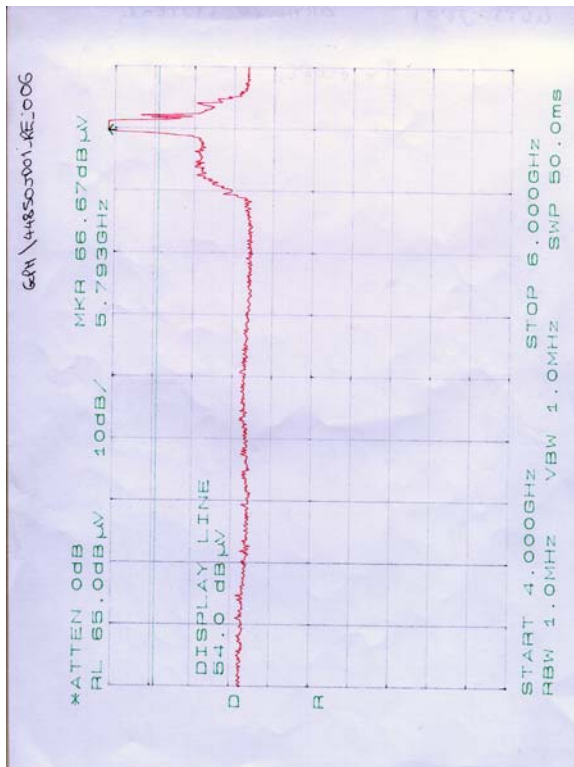
**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**



Start 1.0 GHz; Stop 2.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 0 dB; Swp 20.0 mS  
Peak 1.098889 GHz, 55.36 dBµV/m  
Display Line: 54 dBµV/m; Limit Test Failed  
Transducer Factors: 1 to 2  
24/04/2003 10:02:23



Start 2.0 GHz; Stop 4.0 GHz  
Ref 60 dBµV/m; Ref Offset 0.0 dB; 10 dB/div  
RBW 1000.0 kHz; VBW 1.0 MHz; Att 10 dB; Swp 20.0 mS  
Peak 3.08 GHz, 54.88 dBµV/m  
Display Line: 54 dBµV/m; Limit Test Failed  
Transducer Factors: 2 to 4  
24/04/2003 10:15:14

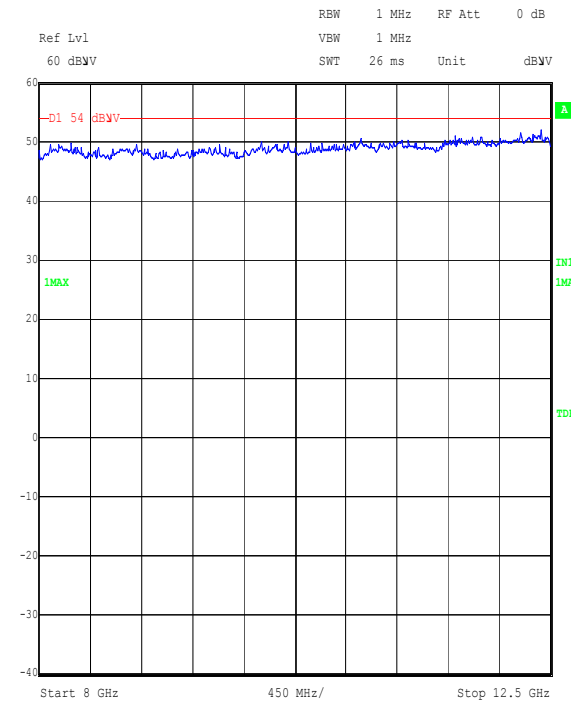


Title: Radiated Emissions.  
Comment A: 44850JD01001  
Date: 23.APR.2003 10:30:08

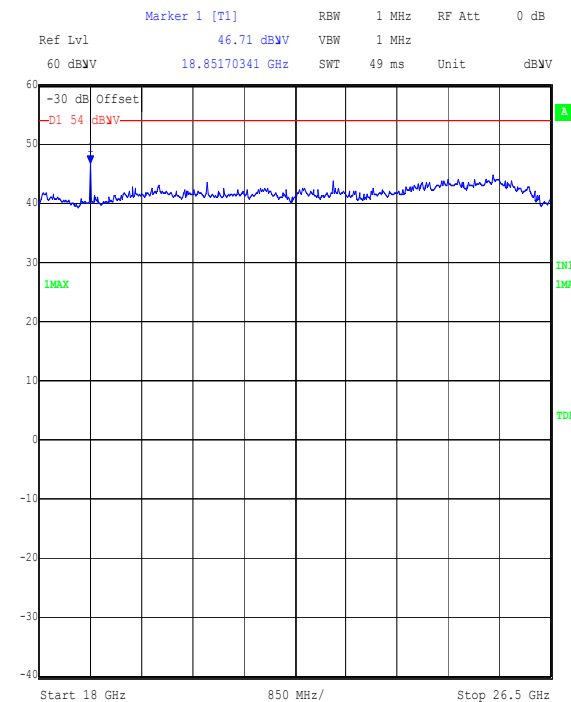
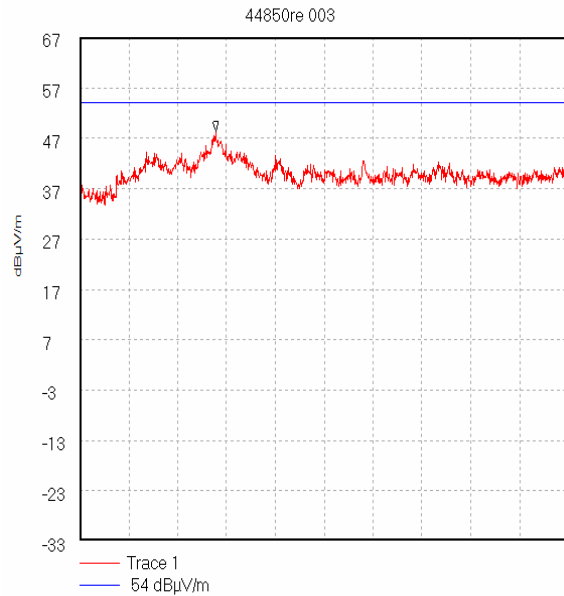
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Radiated Emissions: Section 15.247(c) and 15.209(a) (continued)**



Title: Radiated Emissions.  
Comment A: 44850JD01002  
Date: 23.APR.2003 10:35:53



Title: Radiated Emissions.  
Comment A: 44850JD01009  
Date: 23.APR.2003 13:47:46

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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### **8.7. Transmitter Peak Power Spectral Density**

8.7.1. The EUT was configured as for the transmitter peak power spectral density measurements as described in Section 9 of this report.

8.7.2. Tests were performed to identify the maximum peak power spectrum density of the fundamental.

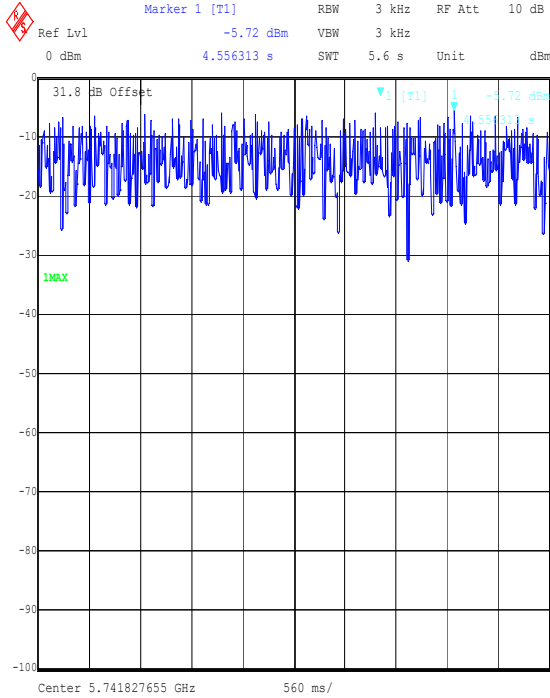
#### **Results: BPSK**

Channel	Antenna Polarity (H/V)	Output Power (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	Horiz.	-5.72	8.0	13.72	Complied
Bottom	Vert.	-4.80	8.0	12.80	Complied
Middle	Horiz.	-3.97	8.0	11.97	Complied
Middle	Vert.	-5.36	8.0	13.36	Complied
Top	Horiz.	-6.65	8.0	14.65	Complied
Top	Vert.	-8.08	8.0	16.08	Complied

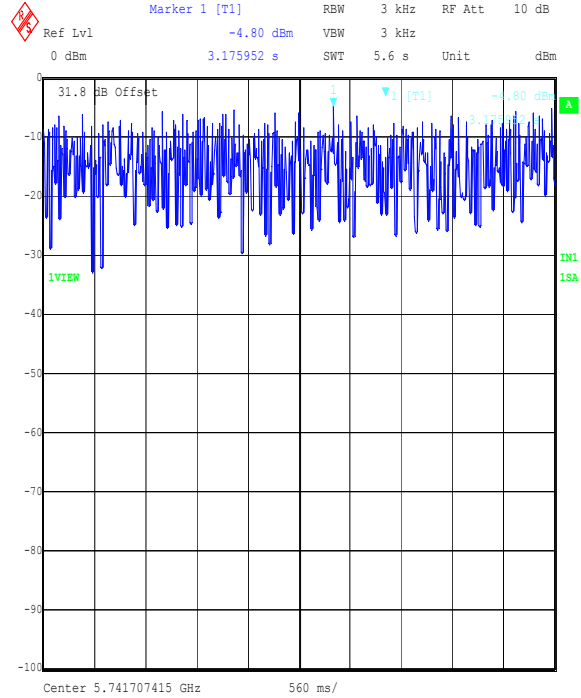
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

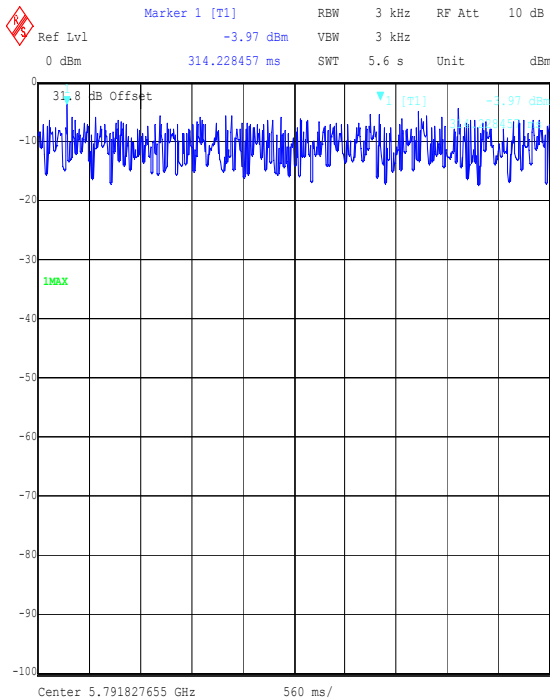
**Transmitter Peak Power Spectral Density (Continued)**



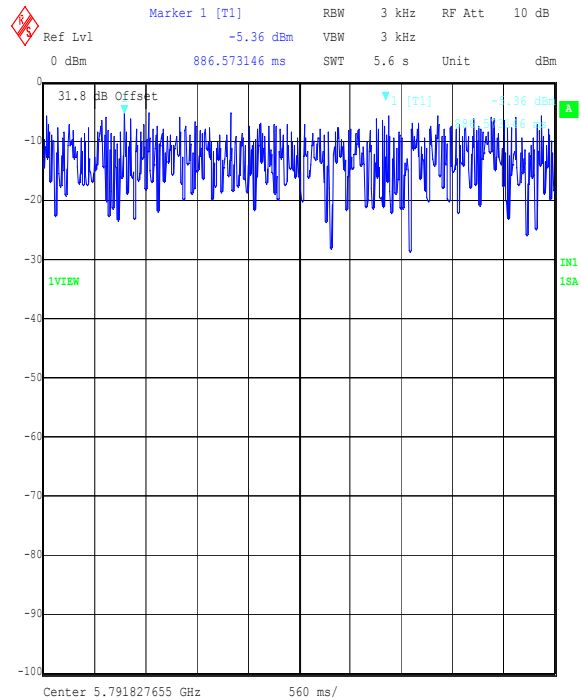
Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_BPSK\_Horizontal\_012  
 Date: 15.SEP.2003 16:28:21



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_BPSK\_Vertical\_030  
 Date: 15.SEP.2003 17:05:38



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_BPSK\_Horizontal\_011  
 Date: 15.SEP.2003 16:27:17

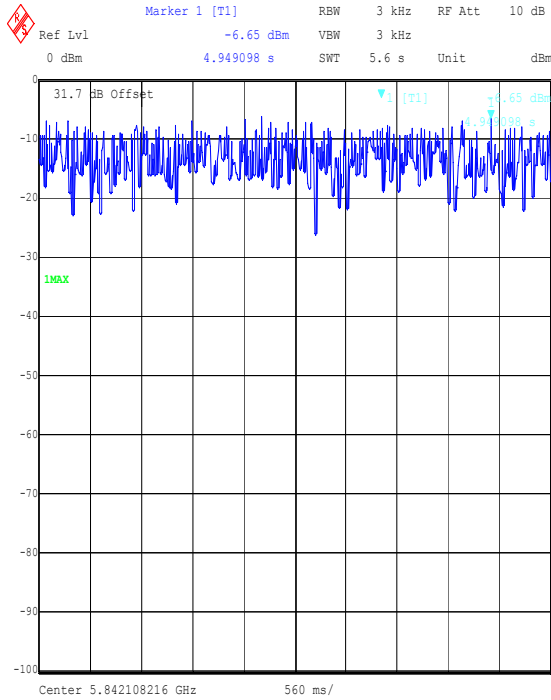


Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
 Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_BPSK\_Vertical\_029  
 Date: 15.SEP.2003 17:04:28

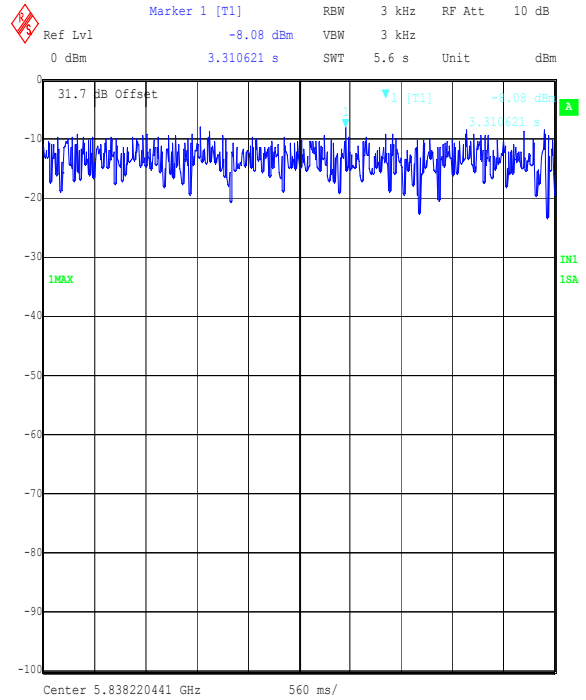
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Power Spectral Density (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_BPSK\_Horizontal\_010  
Date: 15.SEP.2003 16:25:21



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_BPSK\_Vertical\_028  
Date: 15.SEP.2003 17:03:14

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Results: 16 QAM**

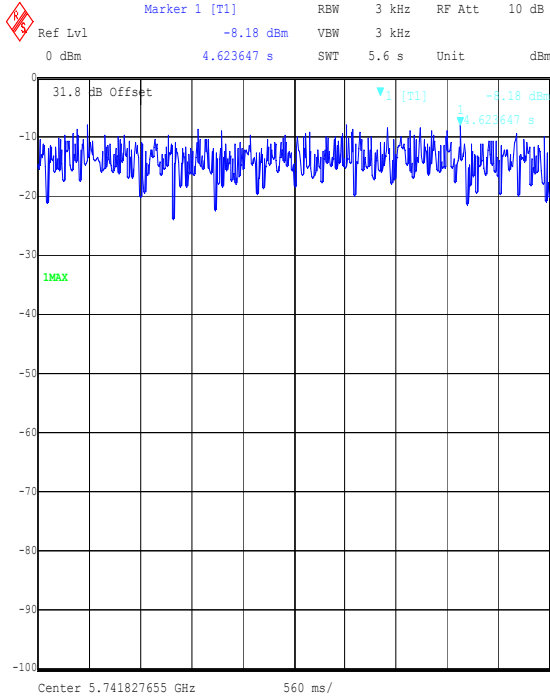
Channel	Antenna Polarity (H/V)	Output Power (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	Horiz.	-8.18	8.0	16.18	Complied
Bottom	Vert.	-7.15	8.0	15.15	Complied
Middle	Horiz.	-8.65	8.0	16.65	Complied
Middle	Vert.	-9.37	8.0	17.37	Complied
Top	Horiz.	-9.27	8.0	17.27	Complied
Top	Vert.	-8.04	8.0	16.04	Complied

Operations Department

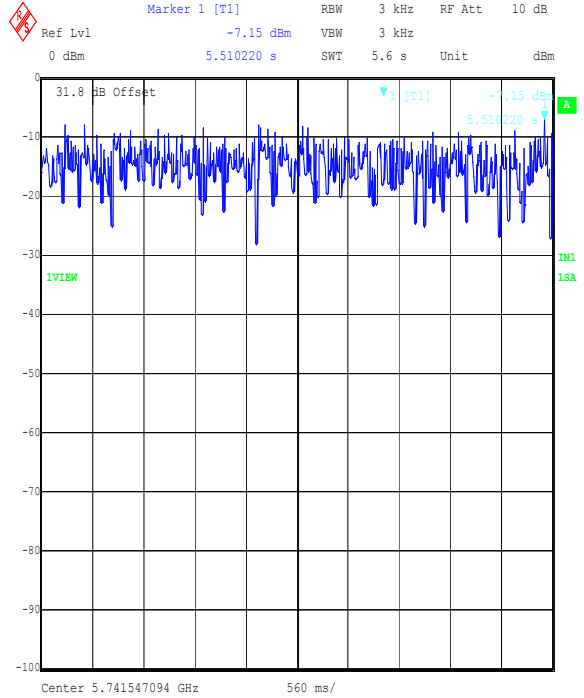
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

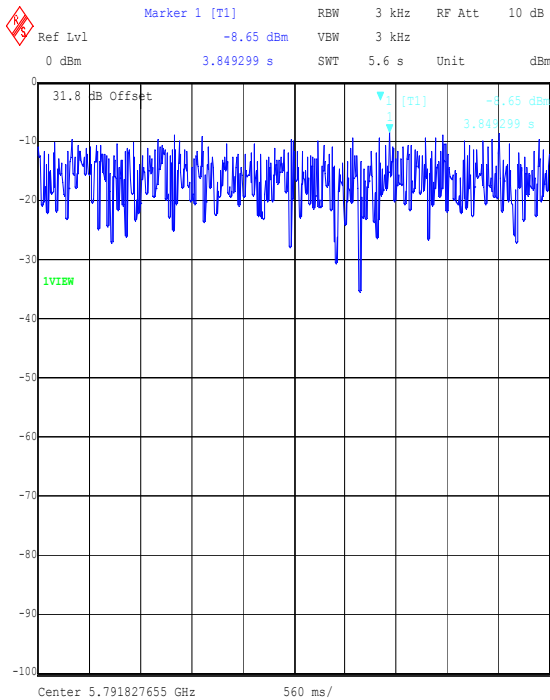
**Transmitter Peak Power Spectral Density (Continued)**



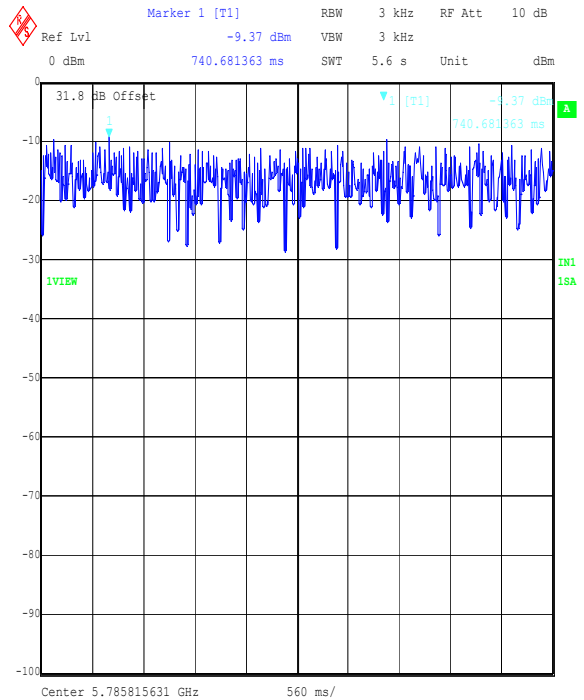
Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_16-QAM\_Horizontal\_001  
Date: 15.SEP.2003 16:30:37



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_16-QAM\_Vertical\_024  
Date: 15.SEP.2003 16:57:57



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_16-QAM\_Horizontal\_002  
Date: 15.SEP.2003 16:32:00



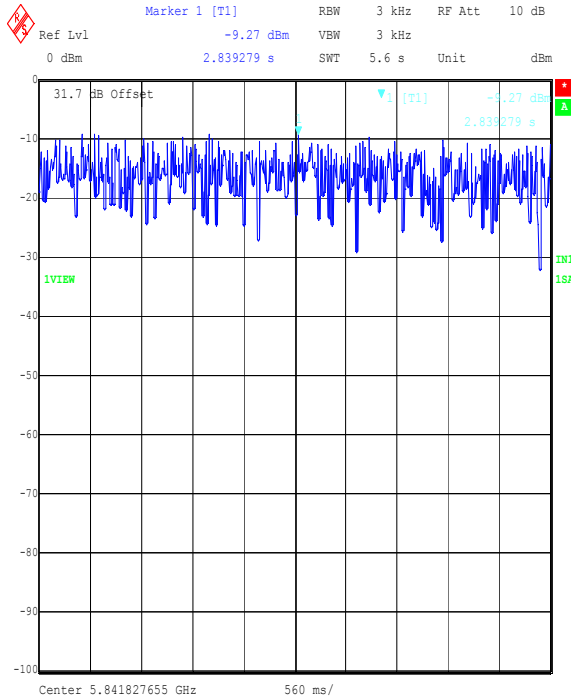
Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_16-QAM\_Vertical\_023  
Date: 15.SEP.2003 16:56:28



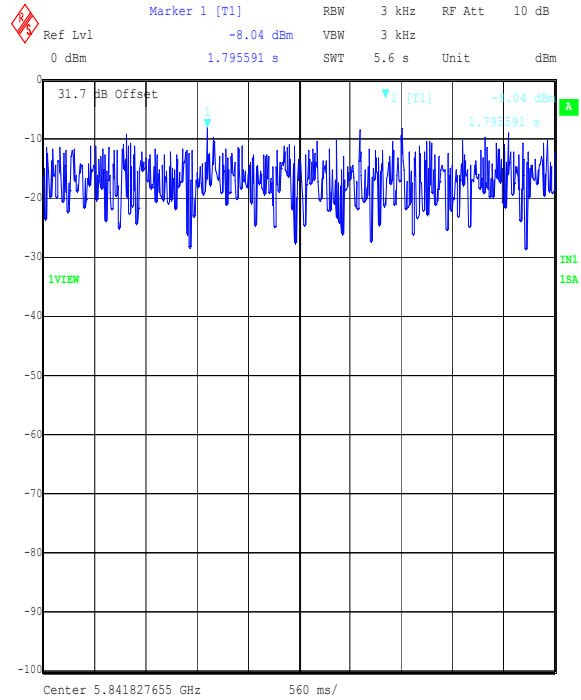
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Power Spectral Density (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_16-QAM\_Horizontal\_003  
Date: 15.SEP.2003 16:33:47



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_16-QAM\_Vertical\_022  
Date: 15.SEP.2003 16:55:01

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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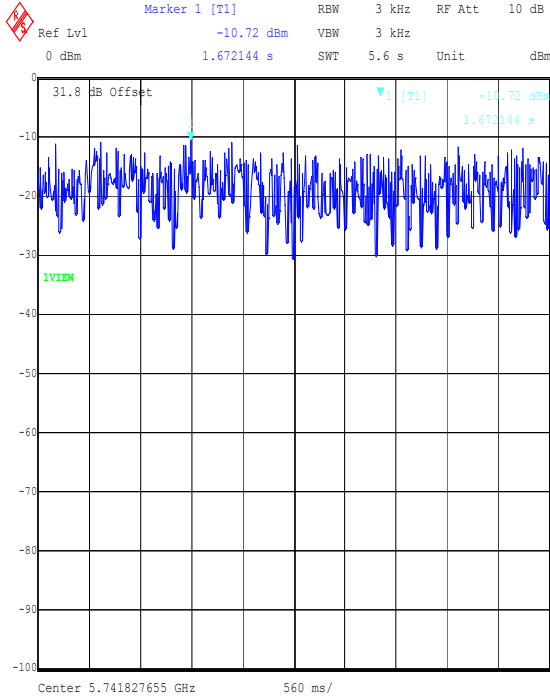
**Results: 64 QAM**

Channel	Antenna Polarity (H/V)	Output Power (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	Horiz.	-10.72	8.0	18.72	Complied
Bottom	Vert.	-10.68	8.0	18.68	Complied
Middle	Horiz.	-9.90	8.0	17.90	Complied
Middle	Vert.	-11.08	8.0	19.08	Complied
Top	Horiz.	-9.84	8.0	17.84	Complied
Top	Vert.	-9.99	8.0	17.99	Complied

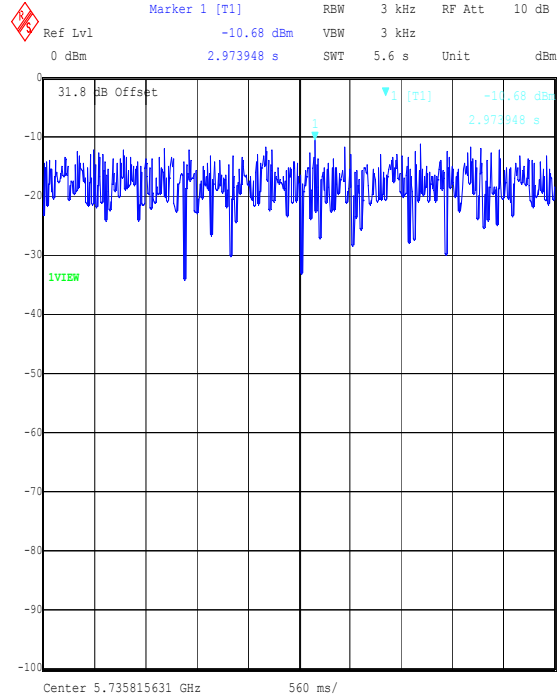
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

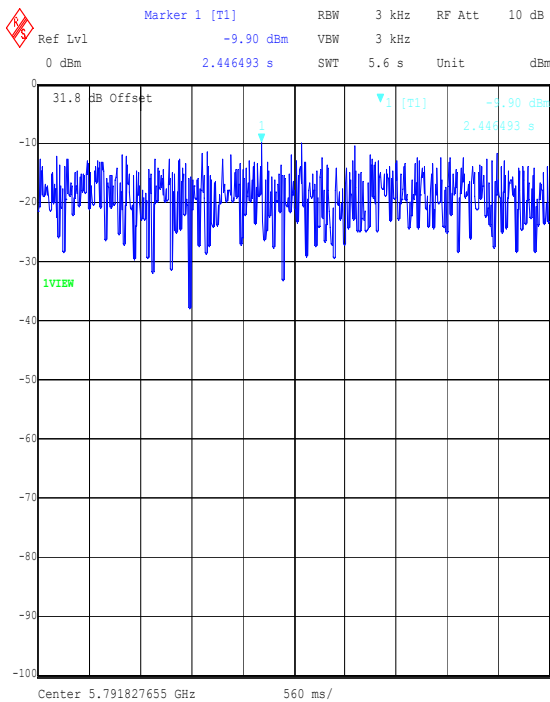
**Transmitter Peak Power Spectral Density (Continued)**



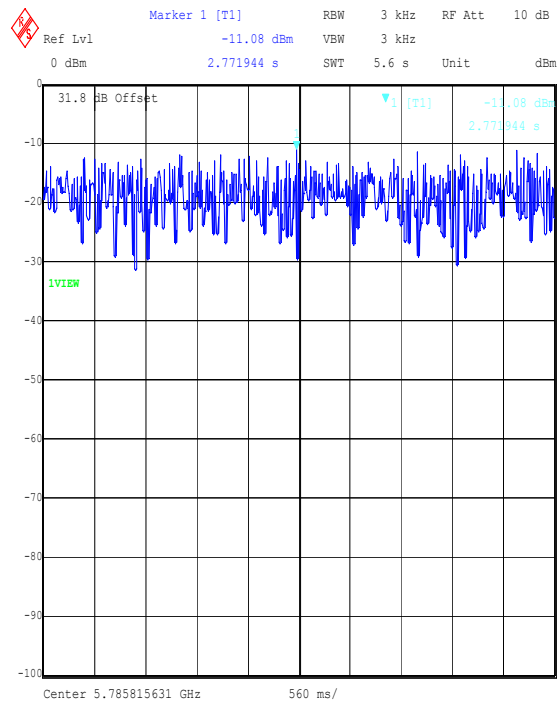
Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_64-QAM\_Horizontal\_006  
Date: 15.SEP.2003 16:40:14



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_64-QAM\_Vertical\_019  
Date: 15.SEP.2003 16:50:59



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_64-QAM\_Horizontal\_005  
Date: 15.SEP.2003 16:36:32

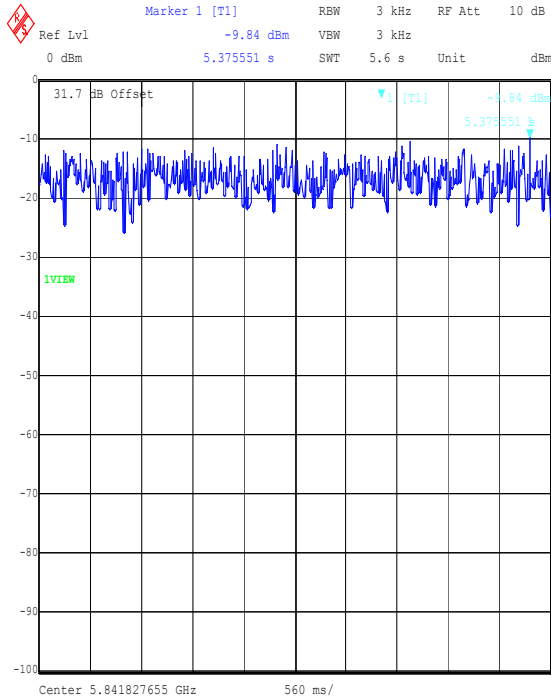


Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_64-QAM\_Vertical\_020  
Date: 15.SEP.2003 16:52:17

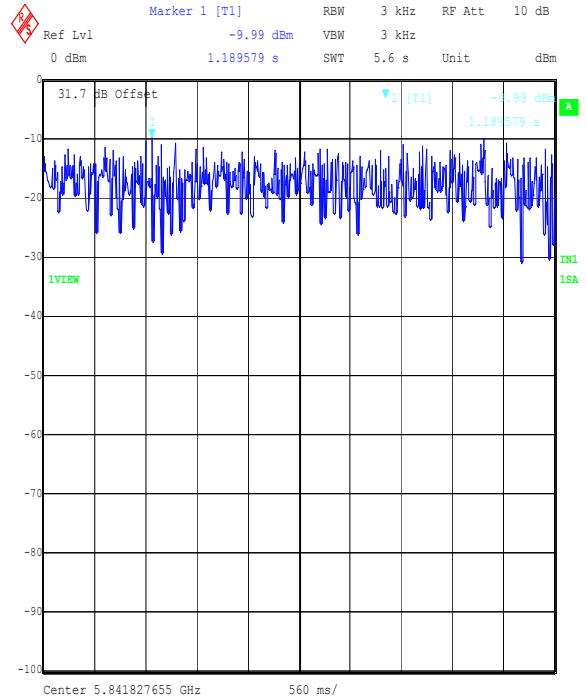
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Power Spectral Density (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_64-QAM\_Horizontal\_004  
Date: 15.SEP.2003 16:35:07



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_64-QAM\_Vertical\_021  
Date: 15.SEP.2003 16:53:45

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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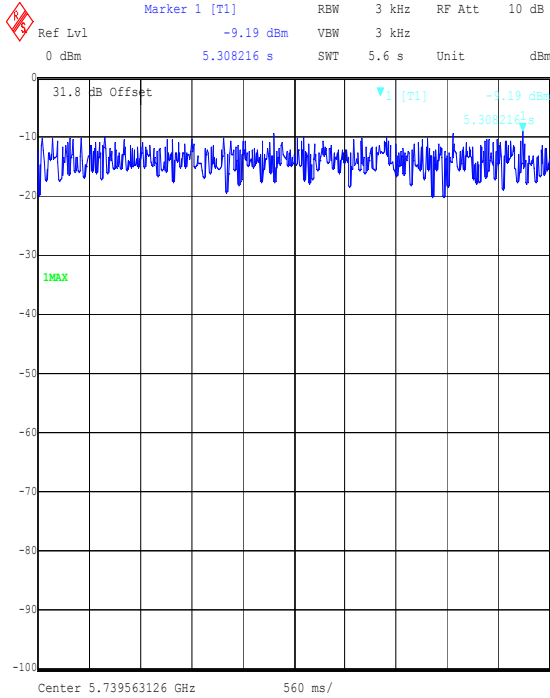
**Results: QPSK**

Channel	Antenna Polarity (H/V)	Output Power (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	Horiz.	-9.19	8.0	17.19	Complied
Bottom	Vert.	-8.40	8.0	16.40	Complied
Middle	Horiz.	-7.36	8.0	15.36	Complied
Middle	Vert.	-8.62	8.0	16.62	Complied
Top	Horiz.	-10.47	8.0	18.47	Complied
Top	Vert.	-8.66	8.0	16.66	Complied

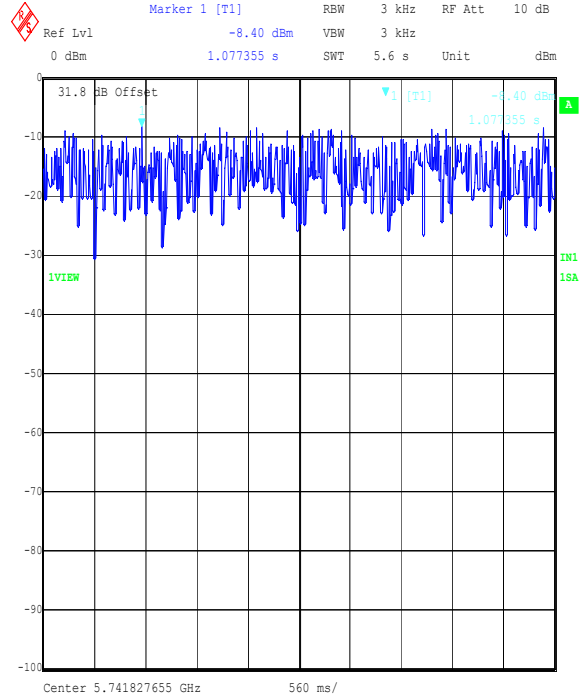
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

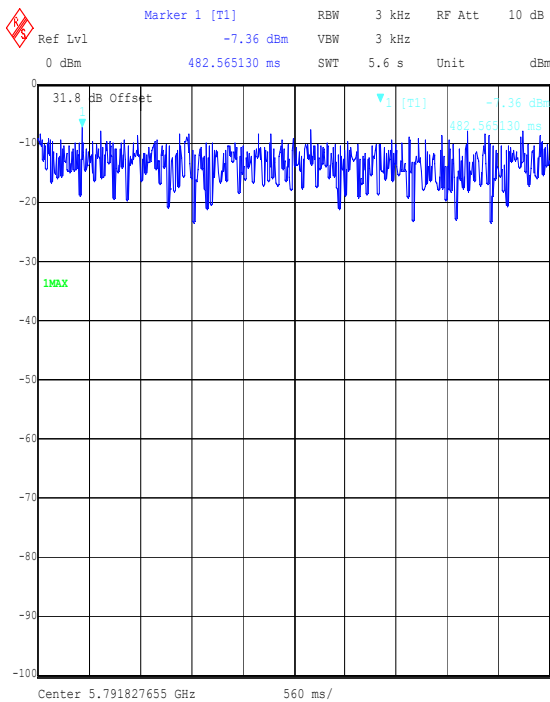
**Transmitter Peak Power Spectral Density (Continued)**



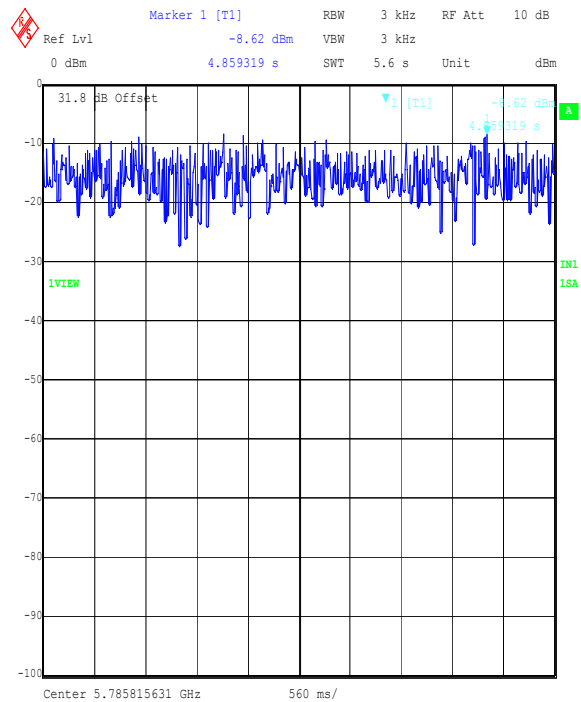
Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Horizontal\_007  
Date: 15.SEP.2003 16:20:09



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Vertical\_025  
Date: 15.SEP.2003 16:59:12



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_QPSK\_Horizontal\_008  
Date: 15.SEP.2003 16:22:04

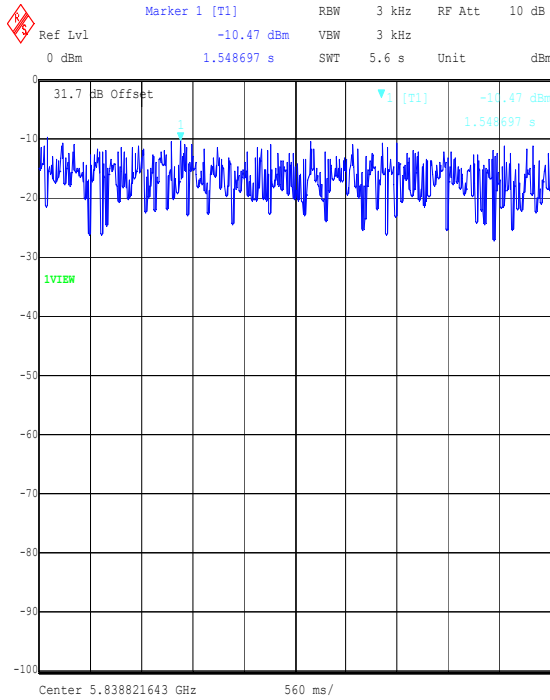


Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_QPSK\_Vertical\_026  
Date: 15.SEP.2003 17:00:21

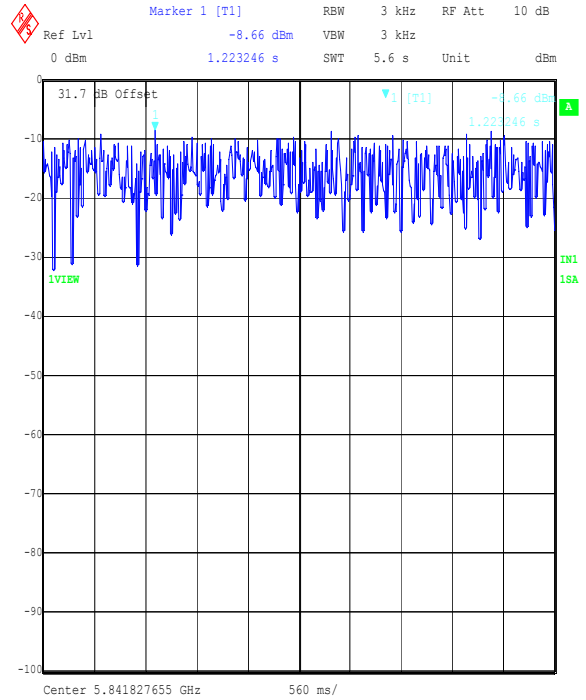
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Power Spectral Density (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_QPSK\_Horizontal\_009  
Date: 15.SEP.2003 16:24:00



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_QPSK\_Vertical\_027  
Date: 15.SEP.2003 17:01:52

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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**Results: Acquisition**

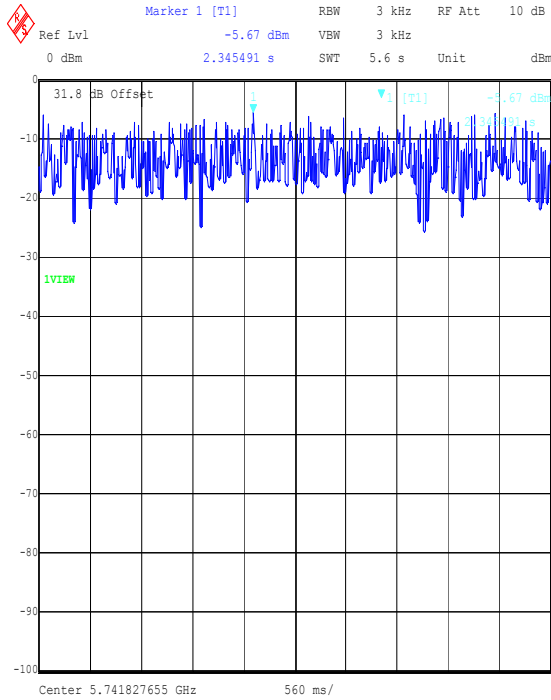
Channel	Antenna Polarity (H/V)	Output Power (dBm/3kHz)	Limit (dBm/3kHz)	Margin (dB)	Result
Bottom	Horiz.	-5.67	8.0	13.67	Complied
Bottom	Vert.	-5.44	8.0	13.44	Complied
Middle	Horiz.	-5.64	8.0	13.64	Complied
Middle	Vert.	-6.22	8.0	14.22	Complied
Top	Horiz.	-8.74	8.0	16.74	Complied
Top	Vert.	-7.79	8.0	15.79	Complied



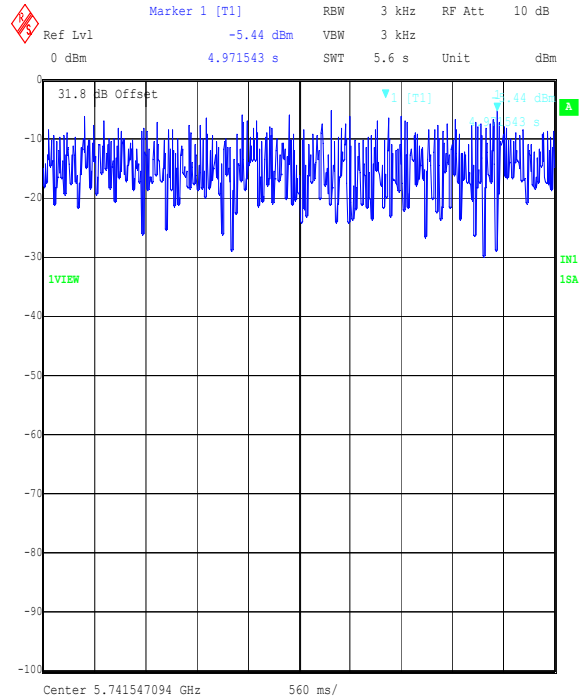
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

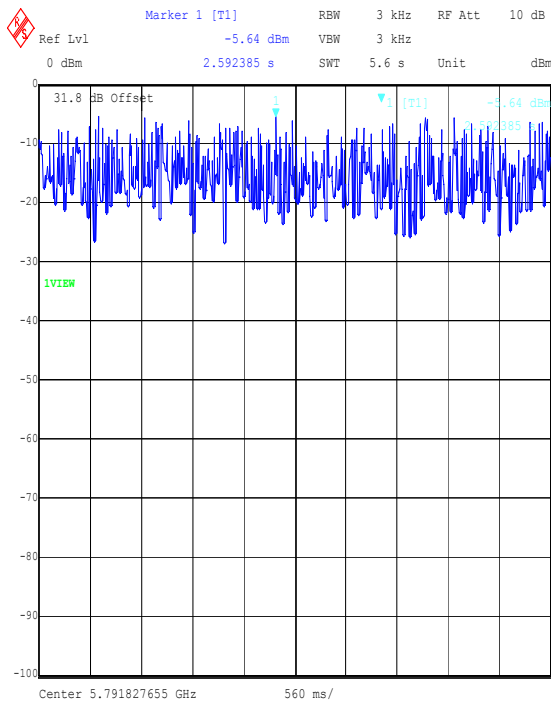
**Transmitter Peak Power Spectral Density (Continued)**



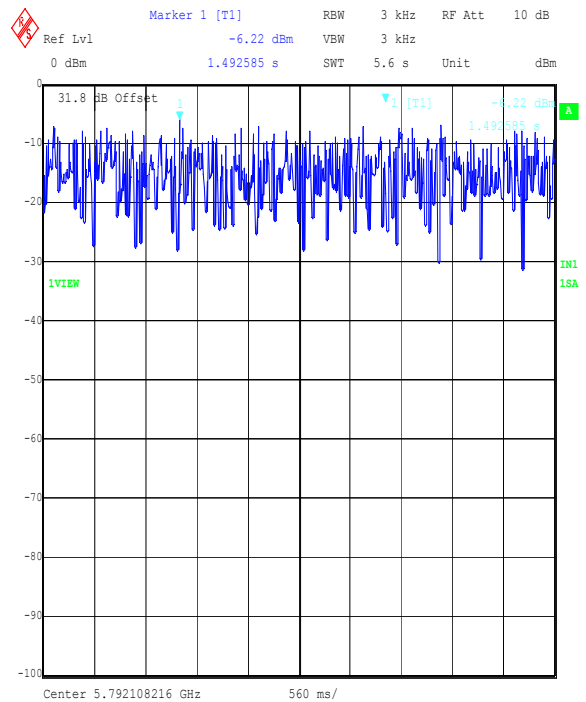
Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_ACQU\_Horizontal\_013  
Date: 15.SEP.2003 16:42:18



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_ACQU\_Vertical\_018  
Date: 15.SEP.2003 16:49:15



Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_ACQU\_Horizontal\_014  
Date: 15.SEP.2003 16:43:39

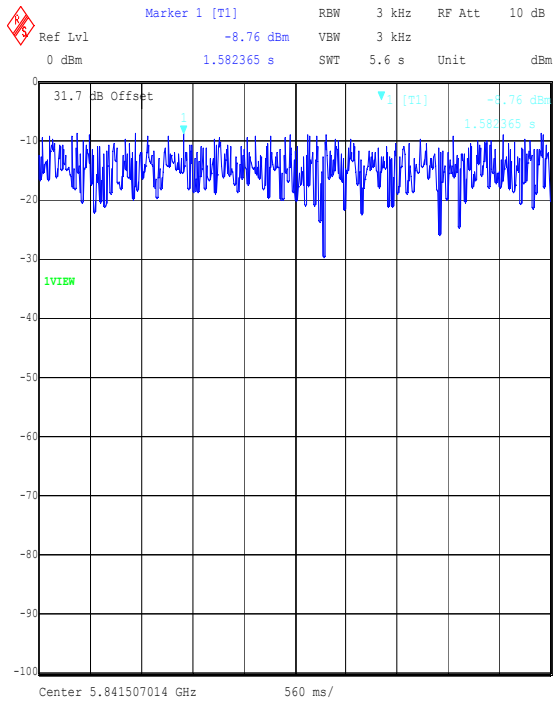


Title: Orthogon EUT: 58XX, FCC Part 15.247, Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Middle\_Channel\_ACQU\_Vertical\_017  
Date: 15.SEP.2003 16:48:07

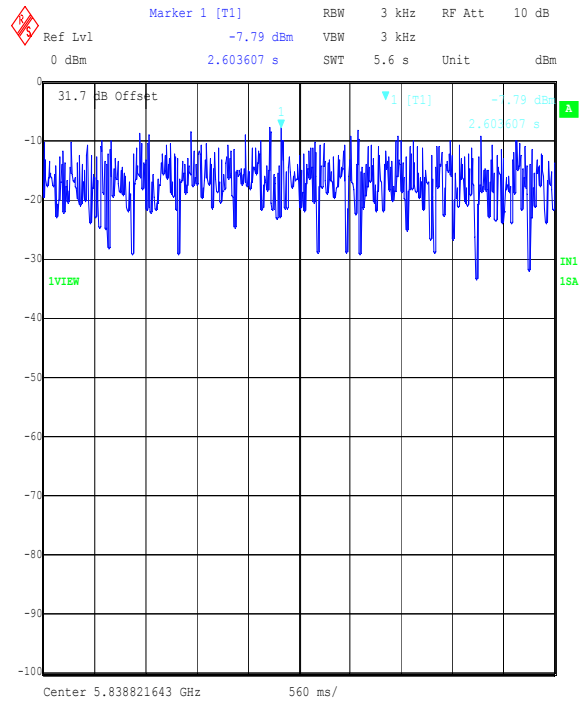
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Peak Power Spectral Density (Continued)**



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_ACQU\_Horizontal\_015  
Date: 15.SEP.2003 16:45:04



Title: Orthogon EUT: 58XX. FCC Part 15.247. Spectral Power Density.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_ACQU\_Vertical\_016  
Date: 15.SEP.2003 16:46:39

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

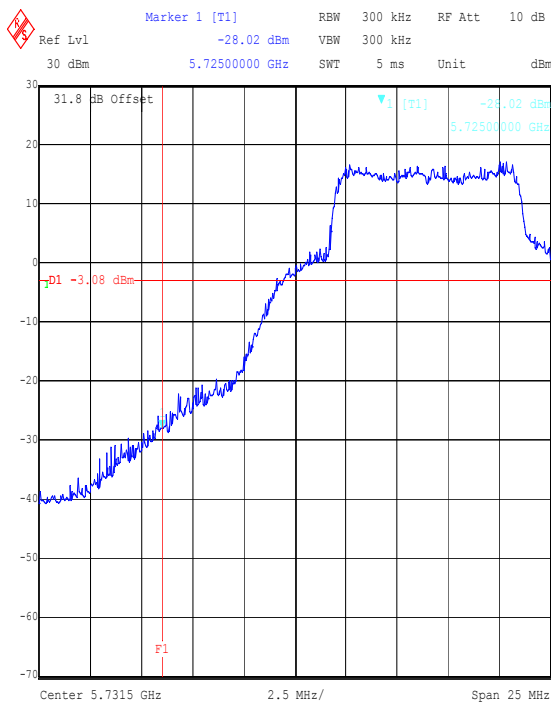
**8.8. Transmitter Band Edge Conducted Emissions: Section 15.247(c)**

8.8.1. The EUT was configured as for conducted antenna port emissions measurements as described in Section 9 of this report.

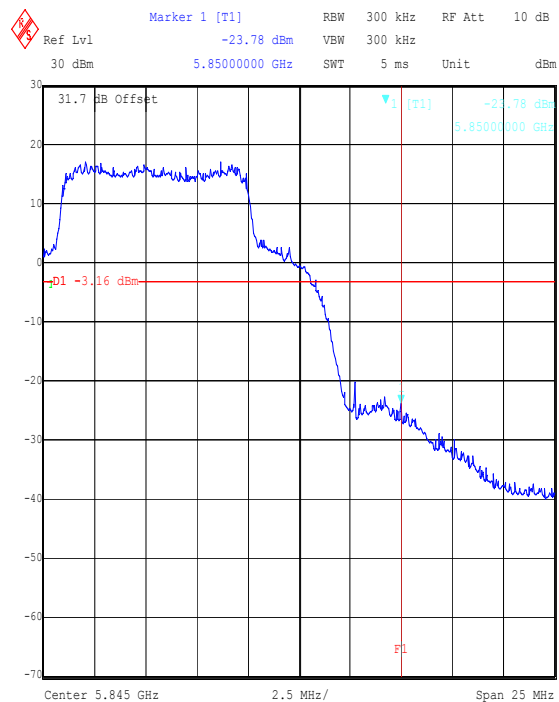
8.8.2. Tests were performed to identify the maximum conducted band edge emissions.

**Peak Level: BPSK**

Frequency (GHz)	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
5.7250	-28.0	-3.1	24.9	Complied
5.8500	-23.8	-3.2	20.6	Complied



Title: Orthogon EUT: 58XX. FCC Part 15.247. Lower Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_BPSK\_Vertical\_017  
 Date: 16.SEP.2003 10:08:42



Title: Orthogon EUT: 58XX. FCC Part 15.247. Upper Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_BPSK\_Vertical\_014  
 Date: 16.SEP.2003 09:52:57

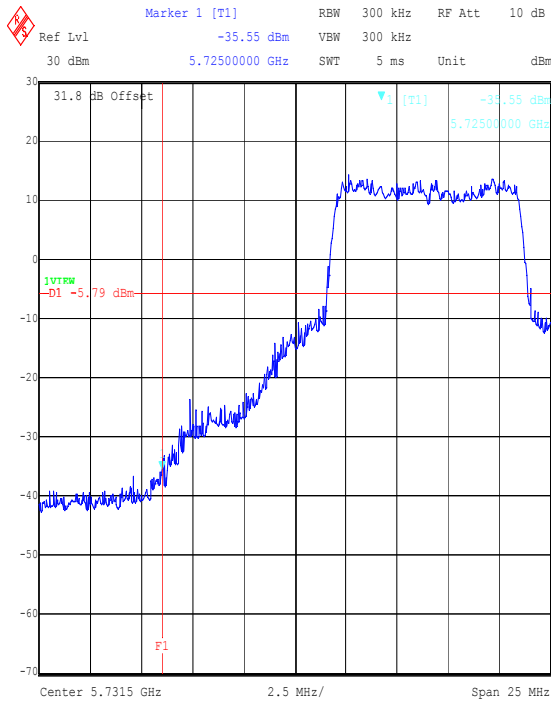
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Transmitter Band Edge Conducted Emissions: Section 15.247(c) (Continued)**

**Peak Level: 16 QAM**

Frequency (GHz)	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
5.7250	-35.6	-5.8	29.8	Complied
5.8500	-29.6	-4.6	25.0	Complied



Title: Orthogon EUT: 58XX, FCC Part 15.247, Lower Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_16-QAM\_Horizontal\_003  
 Date: 16.SEP.2003 09:26:44



Title: Orthogon EUT: 58XX, FCC Part 15.247, Upper Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_16-QAM\_Vertical\_012  
 Date: 16.SEP.2003 09:49:46

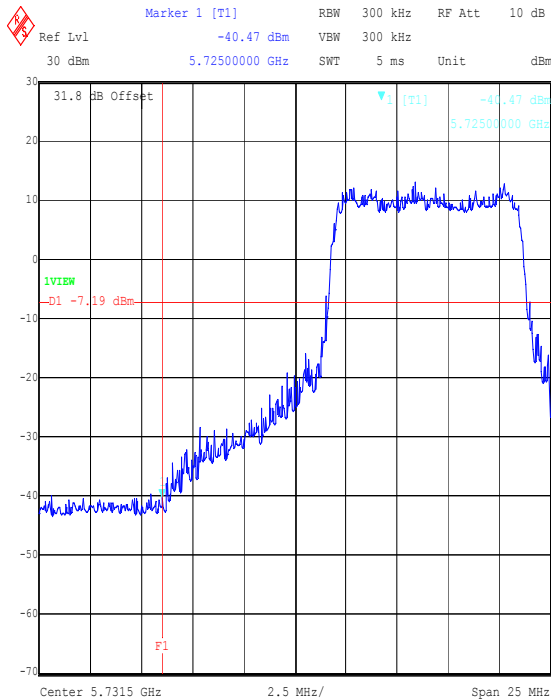
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

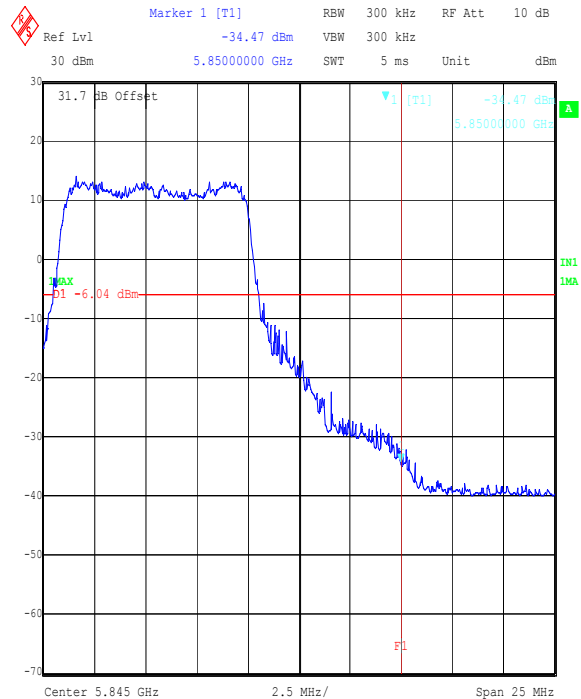
**Transmitter Band Edge Conducted Emissions: Section 15.247(c) (Continued)**

**Peak Level: 64 QAM**

Frequency (GHz)	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
5.7250	-40.5	-7.2	43.3	Complied
5.8500	-34.5	-6.0	28.5	Complied



Title: Orthogon EUT: 58XX, FCC Part 15.247, Lower Band-Edge.  
Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_64-QAM\_Vertical\_020  
Date: 16.SEP.2003 10:04:55



Title: Orthogon EUT: 58XX, FCC Part 15.247, Upper Band-Edge.  
Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_64-QAM\_Vertical\_011  
Date: 16.SEP.2003 09:47:55

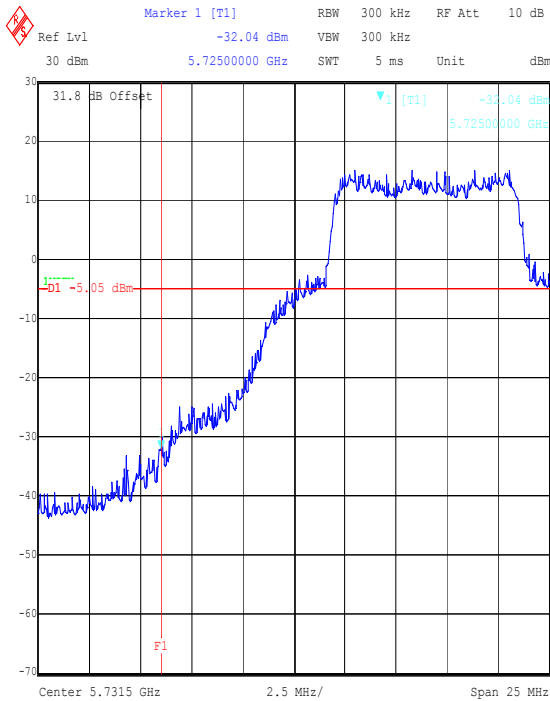
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

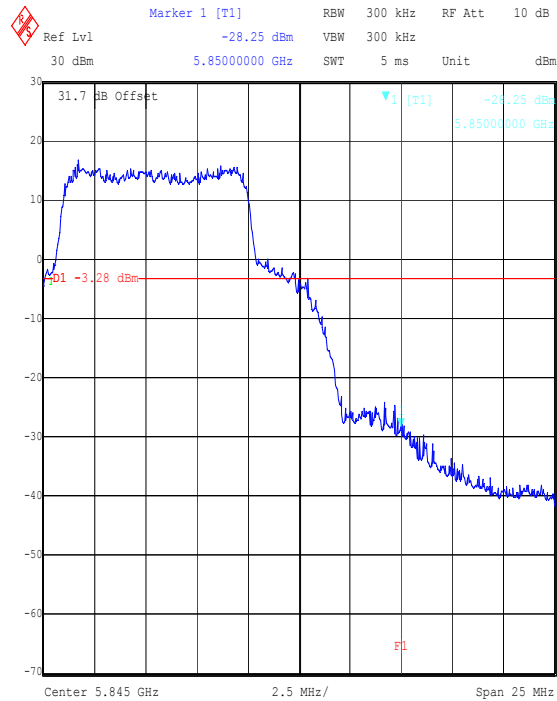
**Transmitter Band Edge Conducted Emissions: Section 15.247(c) (Continued)**

**Peak Level: QPSK**

Frequency (GHz)	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
5.7250	-32.0	-5.1	26.9	Complied
5.8500	-28.3	-3.3	25.0	Complied



Title: Orthogon EUT: 58XX. FCC Part 15.247. Lower Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_QPSK\_Vertical\_018  
 Date: 16.SEP.2003 10:06:36



Title: Orthogon EUT: 58XX. FCC Part 15.247. Upper Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_QPSK\_Vertical\_013  
 Date: 16.SEP.2003 09:51:01

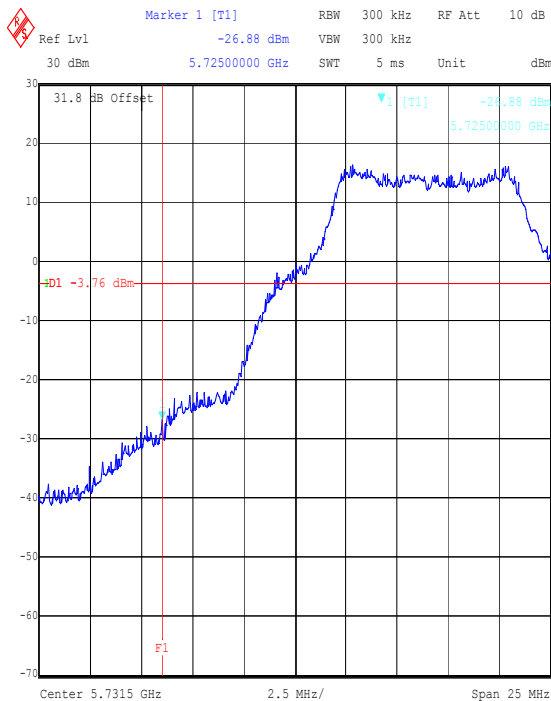
Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

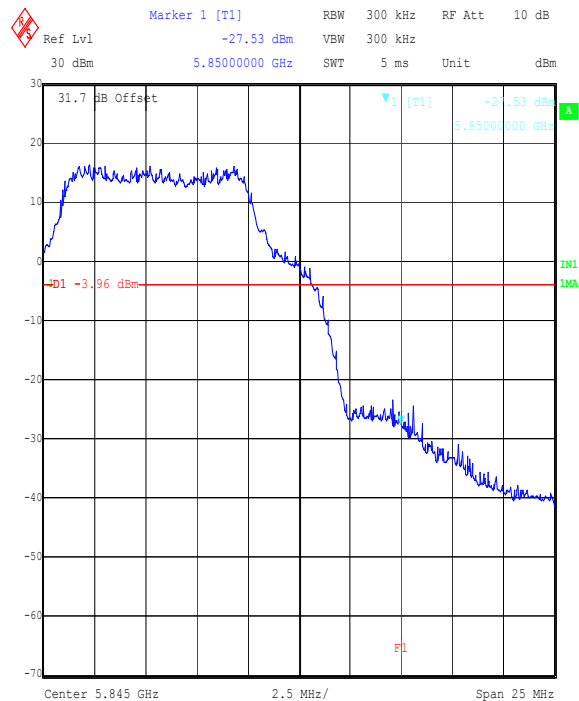
**Transmitter Band Edge Conducted Emissions: Section 15.247(c) (Continued)**

**Peak Level: Acquisition**

Frequency (GHz)	Peak Detector level (dBm)	Peak Limit (dBm)	Peak Margin (dB)	Result
5.7250	-26.9	-3.8	23.1	Complied
5.8500	-27.5	-4.0	23.5	Complied



Title: Orthogon EUT: 58XX, FCC Part 15.247, Lower Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Bottom\_Channel\_ACQU\_Horizontal\_005  
 Date: 16.SEP.2003 09:32:28



Title: Orthogon EUT: 58XX, FCC Part 15.247, Upper Band-Edge.  
 Comment A: 45349JD01\_FCC\_P15-247\_Top\_Channel\_ACQU\_Vertical\_015  
 Date: 16.SEP.2003 09:54:15

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

## 9. Measurement Methods

### AC Mains Conducted Emissions

AC mains conducted emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

The test was performed in a shielded enclosure with the equipment arranged as detailed in the standard on a wooden bench using the floor of the screened enclosure as the ground reference plane and with the EUT powered via a 115V 60 Hz AC mains supply.

Initial measurements in the form of swept scans covering the entire measurement band were performed in order to identify frequencies on which the EUT was generating interference. In order to minimise the time taken for these swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidths (see table below). Repetitive scans were performed to allow for emissions with low repetition rates, and the duty cycle of the EUT. The test configuration was the same for the initial scans as for the final measurements.

Following the initial scans, a graph was produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. A tolerance line was set 6 dB below the specification limit and levels above the tolerance line were re-tested (at individual frequencies) using the appropriate detector function.

The EUT was configured in accordance with section 5.2 of this report.

The test equipment settings for conducted emissions measurements were as follows:

Receiver Function	Initial Scan	Final Measurements
Detector Type:	Peak	Quasi-Peak (CISPR)*
Mode:	Max Hold	Not applicable
Bandwidth:	9 kHz	9 kHz
Amplitude Range:	100 dB	100 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

\* In some instances an Average detector function may also have been used.



**Test Of: Orthogon Systems.  
Gemini 58XX**

**To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247**

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### **Radiated Field Strength Emissions**

Radiated emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Initial measurements covering the entire measurement band in the form of swept scans in a shielded enclosure were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which the EUT should be re-measured in full on the open area test site. In order to minimise the time taken for the swept measurements, a Peak detector was used in conjunction with the appropriate detector IF measuring bandwidth (see table below). Repetitive scans were performed to allow for emissions with low repetition rates.

The initial scans were performed using an antenna height of 1.5 m and a measurement distance of 3 m. Following the initial scans, graphs were produced giving an overview of the emissions from the EUT plotted against the appropriate specification limit. Any emission within 20 dB of the limit were then measured on the open area test site, except in cases where the noise floor was within 20dB of the limit, in these cases the highest point of the noise floor was measured.

In either case the measurement was made at the appropriate distance using a measuring receiver with a Quasi-Peak detector for measurements below 1000 MHz and an Average and Peak detector for measurements above 1000 MHz.

All measurements on the open area test site were performed using broadband antennas.

On the open area test site, at each frequency where a signal was to be measured, the trace was maximised by rotating a turntable through 360°. The angle at which the maximum signal was observed was locked out. For frequencies below 1000 MHz the test antenna was varied in height between 1 m and 4 m in order to further maximise the target emission.

For frequencies above 1000 MHz where a horn antenna was used, height searching was performed to locate the optimal height of the horn with respect to the EUT. At this point the horn was locked off and the turntable was again rotated through 360° to maximise the target signal. It should be noted that the received signal from the EUT would diminish very quickly after it exits the beam width of the horn antenna, for this reason it may not be necessary to fully height search with the horns.

At this point, any signals found to be between the limit and a level 6 dB below it were further maximised by changing the configuration of the EUT, e.g. re-routing cables to peripherals and moving peripherals with respect to the EUT.

Scans were performed to the upper frequency limit as stated in 15.33(a)(1)

Final measurements were performed on the worst-case configuration as described in Part 15.31(i).

The EUT was configured in accordance with section 5.2 of this report for radiated emissions testing.

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

**Radiated Field Strength Emissions (Continued)**

The test equipment settings for radiated emissions measurements were as follows:

Receiver Function	Initial Scan Below 1000 MHz	Final Measurements Below 1000 MHz
Detector Type:	Peak	Quasi-Peak (CISPR)
Mode:	Max Hold	Not applicable
Bandwidth:	100 kHz	120 kHz
Amplitude Range:	100 dB	100 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Receiver Function	Initial Scan Above 1000 MHz	Final Measurements Above 1000 MHz
Detector Type:	Peak	Peak/Average
Mode:	Max Hold	Max Hold where applicable
Bandwidth:	1 MHz	1 MHz
Amplitude Range:	100 dB	100 dB
Measurement Time:	Not applicable	> 1 s
Observation Time:	Not applicable	> 15 s
Step Size:	Continuous sweep	Not applicable
Sweep Time:	Coupled	Not applicable

Test Of: Orthogon Systems.  
Gemini 58XX

To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247

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### **Conducted Antenna Port Emissions**

Conducted Antenna Port Emissions measurements were performed in accordance with the standard, against appropriate limits for each detector function.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequency range. For each measurement range the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the losses in the measurement set up.

Initial measurements covering the entire measurement band in the form of swept scans were performed in order to identify frequencies on which the EUT was generating interference. This determined the frequencies on which final measurements were necessary. To make the final measurements a peak detector was used in conjunction with the appropriate detector IF measuring bandwidth.

Repetitive scans were performed to allow for emissions with low repetition rates.

Scans were performed to the upper frequency limit as stated in 15.33(a)(1)

Final measurements were performed on the worst-case configuration as described in Part 15.31(i) for conducted emissions.

The EUT was configured in accordance with section 5.2 of this report.

**Test Of: Orthogon Systems.  
Gemini 58XX**

**To: FCC Part 15 Subpart C: 2002 (Intentional Radiators) Section 15.247**

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### **Minimum Bandwidth**

The EUT and spectrum analyser were configured for conducted RF access port measurements.

To determine the occupied bandwidth, a resolution bandwidth of 30 kHz was used, which is greater than 1% of the 6 dB bandwidth. A video bandwidth of at least the same value was used. The analyser was set for a maximum hold scan to capture the profile of the signal. The peak level was then determined, and a reference established 6 dB below the peak level. The bandwidth was determined at the points where the 6 dB reference crossed the profile of the emission.

The EUT was configured in accordance with section 5.2 of this report.

**Test Of: Orthogon Systems.  
Gemini 58XX**

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### **Peak Output Power**

The EUT and spectrum analyser were configured for conducted RF access port measurements.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequencies. For each frequency to be measured, the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the measurement set up.

To determine the transmitter output power, the EUT was operated at maximum power and a result was obtained by using the channel power calculating function incorporated within the spectrum analyser.

The EUT was configured in accordance with section 5.2 of this report

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### **Band Edge Compliance of RF Conducted Emissions**

The EUT and spectrum analyser were configured for conducted RF access port measurements.

To determine band-edge compliance, the analyser resolution bandwidth was set to  $\geq 1\%$  of the analyser span. The video bandwidth was set to be no less than the resolution bandwidth. The sweep was set to auto and the detector to peak. The trace was set to max hold and a trace was produced.

A plot of the upper band edge of the allocated frequency band was produced. A limit line was set to the level of the highest in-band emission with a further limit line set to 20 dB below this. A marker was then placed on the highest out of band emission (The specification states that either the band edge level must be measured or the highest out of band emission, whichever is the greater). The plots show that the highest out of band emission complies with the 20 dBc Limit. The above procedure was then repeated for the lower and upper band edge.

(Final measurements were performed on the worst-case configuration as described in Part 15.31(i).)

The EUT was configured in accordance with section 5.2 of this report

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### **Spectral Power Density**

The EUT and spectrum analyser were configured for conducted RF access port measurements.

Prior to testing being performed a suitable RF attenuator and cable were calibrated for the required frequencies. For each frequency to be measured, the calibrated level of the attenuator and cable were entered as an offset into the spectrum analyser to compensate for the measurement set up.

Prior to the measurement being taken the spectrum analyser was tuned to the fundamental frequency of the EUT.

A resolution bandwidth of 3KHz was selected and the analyser was set to zero span the trace was max held and a reading was taken at the peak point of the trace.

The EUT was configured in accordance with section 5.2 of this report.

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## **10. Measurement Uncertainty**

10.1. No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

10.2. The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

10.3. The uncertainty of the result may need to be taken into account when interpreting the measurement results.

10.4. The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document "approximately" is interpreted as meaning "effectively" or "for most practical purposes".

<b>Measurement Type</b>	<b>Range</b>	<b>Confidence Level (%)</b>	<b>Calculated Uncertainty</b>
AC Conducted Spurious Emissions	0.15 MHz to 30.0 MHz	95%	+/- 3.25 dB
Carrier Output Power	Not applicable	95%	+/- 0.46 dB
Conducted Emissions	0.009 kHz to 26 GHz	95%	+/- 1.2 dB
Minimum Bandwidth	Not applicable	95%	+/- 0.12 %
Radiated Spurious Emissions	30.0 MHz to 1000.0 MHz	95%	+/- 5.26 dB
Radiated Spurious Emissions	1.0 GHz to 26.0 GHz	95%	+/- 1.78 dB
Spectral Power Density	Not applicable	95%	+/- 1.2 dB

10.5. The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.



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### Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
A023	WG 22 Horn Antenna	Flann Microwave Ltd	22240-20	343
A027	Horn Antenna	Eaton	9188-2	301
A067	LISN	Rohde & Schwarz	ESH3-Z5	890603/002
A1037	Chase Bilog Antenna	Chase EMC Ltd	CBL6112B	2413
A1095	Sony MVC-FD73	Sony	MVC - FD73	29548
A197	Site 2 Controller SC144	Unknown	SC144	150720
A256	WG 18 Microwave Horn	Flann Microwave	18240-20	400
A276	OATS Positioning Controller	Rohde & Schwarz	HCC	
A427	WG 14 horn	Flann	14240-20	150
A428	WG 12 horn	Flann	12240-20	134
A429	WG 16 horn	Flann	16240-20	561
A490	Bilog Antenna	Chase	CBL6111A	1590
C1025	Rosenberger Cable	Rosenberger	FA210A-1-020m	FA00B 7564
C1078	Rosenberger 3m Cable	Rosenberger	FA210A1030M5050	28464-2
C160	Cables	Rosenberger	UFA210A-1-1181-70x70	None
C202	Rosenberger cable	Rosenberger	UFA 210A-1-1180-70X70	1543
C337	Cable	RFI	RG58	None
C461	Cable	Rosenberger	UFA210A-1-1182-704704	98H0305
C468	N-Type Coaxial Cable	Rosenberger	UFA210A-1-3937-504504	98L0440

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**Test Equipment Used (continued)**

RFI No.	Instrument	Manufacturer	Type No.	Serial No.
M003	Spectrum Monitor	Rohde & Schwarz	EZM	883 580/008
M044	ESVP Receiver	Rohde & Schwarz	ESVP	891 845/026
M069	ESMI Spectrum Analyser / Receiver	Rohde & Schwarz	ESMI	829 808/007 (DU) / 827 063/008 (RU)
M076	FSM Harmonic Mixer set	Rohde & Schwarz	FS-Z16	831 337/002
M088	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:835862/018 RU:835387/006
M090	Receiver / Spectrum Analyser System	Rohde & Schwarz	ESBI	DU:838494/005 RU:836833/001
M173	Turntable Controller	R.H.Electrical Services	RH351	3510020
M191	Thermo-Hygro	RS Components	RS212-124	M191-212-124
M244	Thermometer/Barometer/Hygrometer	Oregan Scientific	BA 116	None
S201	Site 1	RFI	1	-
S202	Site 2	RFI	2	-

**NB** In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

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## **Appendix 2. Test Configuration Drawings**

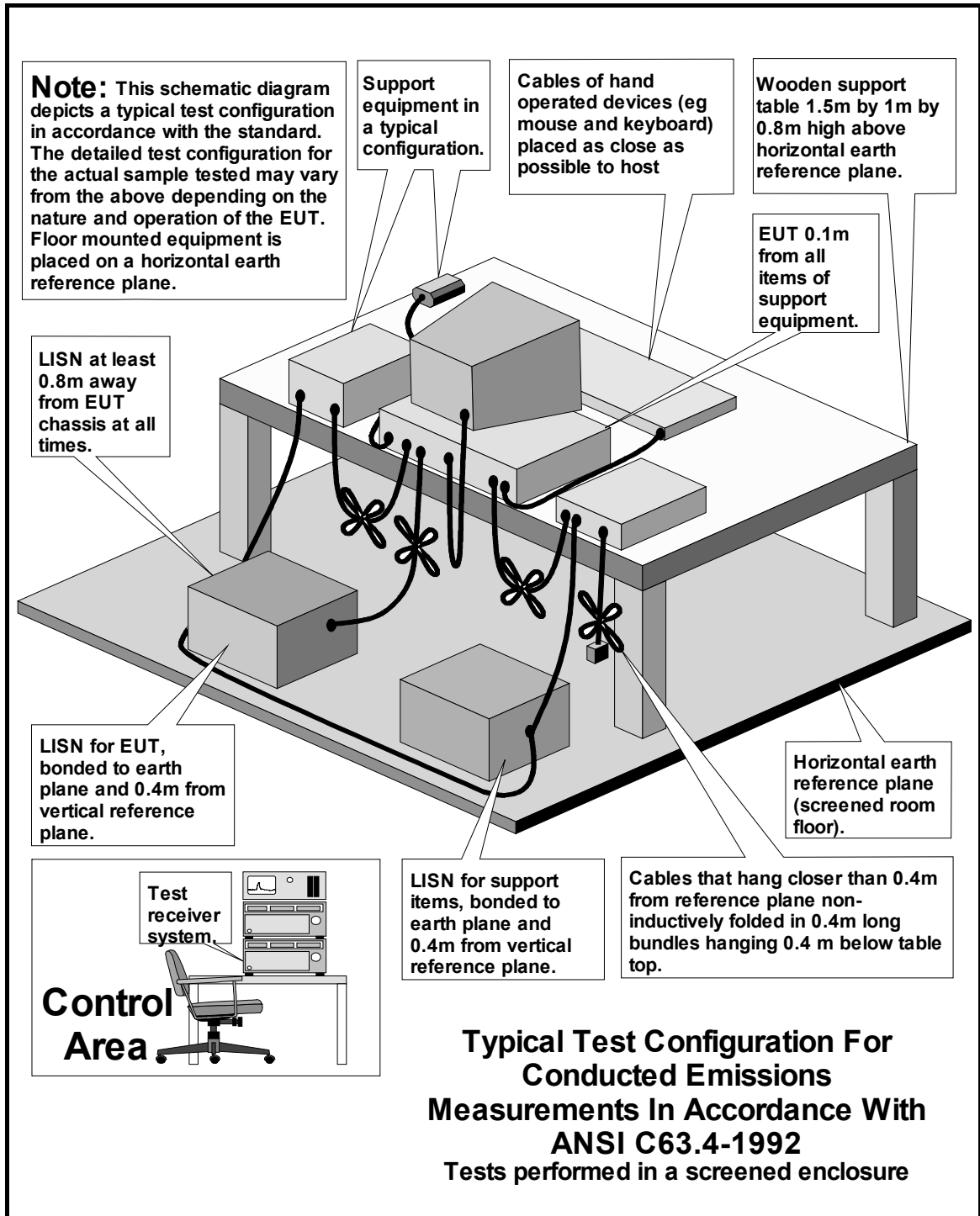
This appendix contains the following drawings:

<b>Drawing Reference Number</b>	<b>Title</b>
DRG\45349JD01\EMICON	Test configuration for measurement of conducted emissions
DRG\45349JD01\EMIRAD	Test configuration for measurement of radiated emissions

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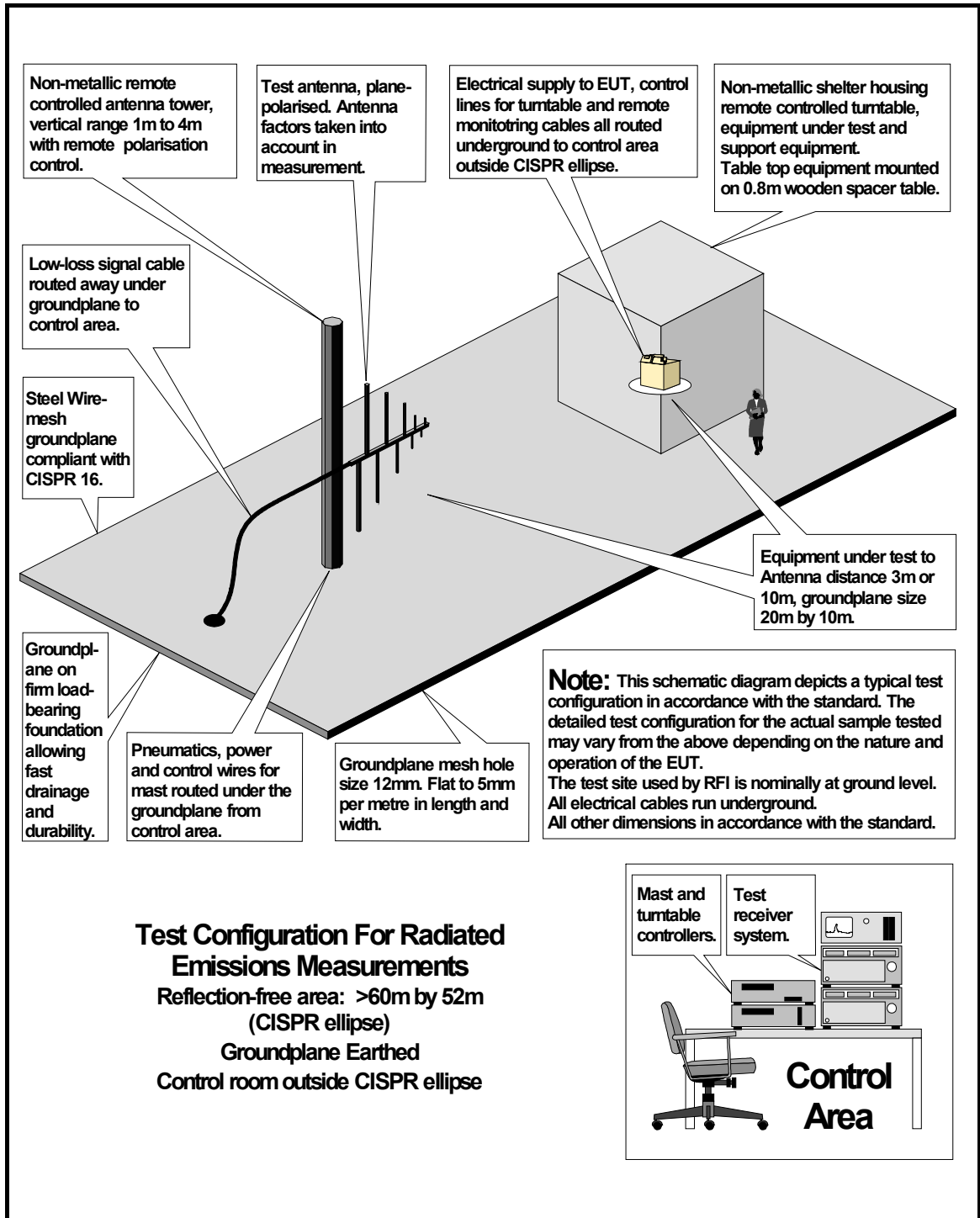
DRG\45349JD01\EMICON



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DRG\45349JD01\EMIRAD



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**Operations Department**

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