



166 South Carter, Genoa City, WI 53128

Company:	California Eastern Laboratories
Model Tested:	ZICM357SP2-1
Report Number:	17866
DLS Project:	5130

Code of Federal Regulations 47 Part 15 – Radio Frequency Devices

Subpart C – Intentional Radiators

Section 15.247

Operation within the bands 902 - 928 MHz,
2400 - 2483.5 MHz, 5725 - 5875 MHz,
and 24.0 - 24.25 GHz.

THE FOLLOWING **MEETS** THE ABOVE TEST SPECIFICATION

Formal Name:	MeshConnect ZICM357SP2-1 Zigbee Module
Kind of Equipment:	802.15.4 Wireless Module
Frequency Range:	2405-2480 MHz
Test Configuration:	Tabletop
Model Number(s):	ZICM357SP2-1
Model(s) Tested:	ZICM357SP2 Rev X2 (prototype) - nicknamed Gemini P2_X2 on data sheets
Serial Number(s):	Radiated and DC line conducted: 5 RF Conducted: 4
Date of Tests:	May 8 through May 10, 2012
Test Conducted For:	California Eastern Laboratories 4590 Patrick Henry Drive Santa Clara, CA 95054-1817, USA

NOTICE: “This test report relates only to the items tested and must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government”. Please see the "Description of Test Sample" page listed inside of this report.

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SIGNATURE PAGE

Tested By:

A handwritten signature in black ink that reads "Craig Brandt".

Craig Brandt
Test Engineer

Reviewed By:

A handwritten signature in black ink that reads "William Stumpf".

William Stumpf
OATS Manager

Approved By:

A handwritten signature in black ink that reads "Brian J. Mattson".

Brian Mattson
General Manager



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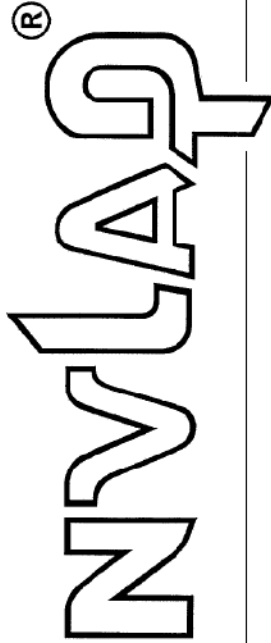


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United States Department of Commerce
National Institute of Standards and Technology



Certificate of Accreditation to ISO/IEC 17025:2005

NVLAP LAB CODE: 100276-0

D.L.S. Electronic Systems, Inc.
Wheeling, IL

is accredited by the National Voluntary Laboratory Accreditation Program for specific services,
listed on the Scope of Accreditation, for:

ELECTROMAGNETIC COMPATIBILITY AND TELECOMMUNICATIONS

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality
management system (refer to joint ISO-ILAC-IAF Communiqué dated January 2009).



2011-10-01 through 2012-09-30

Effective dates

Dolly S. Bruce
For the National Institute of Standards and Technology

NVLAP-01C (REV. 2009-01-28)



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1.0 Summary of Test Report

It was determined that the California Eastern Laboratories MeshConnect ZICM357SP2-1 Zigbee Module, Model ZICM357SP2-1, complies with the requirements of CFR 47 Part 15 Subpart C Section 15.247.

Subpart C Section 15.247 Applicable Technical Requirements Tested:

Section	Description	Procedure	Note	Compliant?
15.247(a)(2)	6 dB Emission Bandwidth	558074 D01 DTS Meas Guidance v01	1	Yes
15.247(b)(3)	Fundamental Emission Output Power	558074 D01 DTS Meas Guidance v01	1	Yes
15.247(e)	Maximum Power Spectral Density	558074 D01 DTS Meas Guidance v01	1	Yes
15.247(d)	Maximum Unwanted Emission Levels	558074 D01 DTS Meas Guidance v01	1	Yes
15.247(d) 15.205(a) 15.209(a)	Unwanted Emissions into Restricted Frequency Bands – Radiated	558074 D01 DTS Meas Guidance v01	2	Yes
15.247(d)	Band-Edge Measurements – Conducted	558074 D01 DTS Meas Guidance v01	1	Yes
15.247(d) 15.205(a) 15.209(a)	Band-Edge Measurements - Radiated	558074 D01 DTS Meas Guidance v01 & ANSI C63.10-2009	2	Yes
15.35(c)	Duty Cycle	Calculated	4	N/A
15.207	DC Power-Line Conducted Emissions	ANSI C63.10-2009	3	Yes

Note 1: RF conducted measurement.

Note 2: Radiated emission measurement.

Note 3: DC power line conducted measurement.

Note 4: Informative



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2.0 Introduction

In May, 2012 the MeshConnect ZICM357SP2-1 Zigbee Module, Model ZICM357SP2-1, as provided from California Eastern Laboratories was tested to the requirements of CFR 47 Part 15 Subpart C Section 15.247. To meet these requirements, the procedures contained within this report were performed by personnel of D.L.S Electronic Systems, Inc.

3.0 Test Facilities

D.L.S. Electronic Systems, Inc. is a full service EMC/Safety Testing Laboratory accredited to ISO 17025. NVLAP Certificate and Scope can be viewed at <http://www.dlsemc.com/certificate>. Our facilities are registered with the FCC, Industry Canada, and VCCI.

Wisconsin Test Facility:

D.L.S. Electronic Systems, Inc.
166 S. Carter Street
Genoa City, Wisconsin 53128

Wheeling Test Facility:

D.L.S. Electronic Systems, Inc.
1250 Peterson Drive
Wheeling, IL 60090

4.0 Description of Test Sample

Description:

The Test sample consists of an 802.15.4 specification compliant transceiver with a 100mW amplifier on the transmitter. The circuitry is mounted on an FR4 substrate which includes an integrated Printed circuit board antenna and shield covering the RF circuitry. Firmware was included which allowed different modes of operation to be set as the default state so that when DC power was applied, the unit would operate in that default state to facilitate testing of the DUT.

Type of Equipment / Frequency Range:

Mobile / 2405-2480 MHz

Physical Dimensions of Equipment Under Test:

1 inch x 1 inch x 1 inch



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4.0 Description of Test Sample (continued)

Power Source:

3.6 VDC (Lab DC bench power supply used for testing)

Internal Frequencies:

24 MHz

Transmit / Receive Frequencies Used For Test Purpose:

Low channel(11): 2405 MHz, Middle channel(18): 2445 MHz, High channel(26): 2480 MHz
Additional channels tested - Channel 24: 2470 MHz; Channel 25: 2475 MHz

Type of Modulation(s) / Antenna Type:

Offset QPSK / PCB Trace Antenna

Description of Circuit Board(s) / Part Number:

Host Board	0000-01-04-00-0000, Rev X2
DUT	0011-00-04-00-001, Rev X2



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5.0 Test Equipment

A list of the equipment used can be found in the table below. All primary equipment was calibrated against known reference standards with a verified traceable path to NIST.

D.L.S. Wisconsin - G1

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7/11	7/12
Preamp	Ciao	CA118-4010	101	1GHz-18GHz	2/12	2/13
Horn Antenna	EMCO	3115	6204	1-18GHz	6/11	6/13
Filter- High-Pass	Q-Microwave	100462	1	4.2GHz-18GHz	1/12	1/13
Horn Antenna	EMCO	3115	9903-5731	1-18GHz	6/11	6/13
Signal Generator	Rhode & Schwarz	SMR40	100092	1-40 GHz	2/12	2/13
Preamp	Miteq	AMF-8B-180265-40-10P-H/S	438727	18GHz-26GHz	8/11	8/12
Horn Antenna	EMCO	3116	2549	18 – 40GHz	8/10	8/12
High Pass Filter	Planar	CL22500-9000-CD-SS	PF1229/0728	15-40 GHz	8/11	8/12
20 dB attenuator	Aeroflex/weinschel	75A-20-12	1071	DC – 40 GHz	6/11	6/12
DC Power Supply	Hewlet Packard	6200B	6J4327	N/A	N/A	N/A
Multimeter	Fluke	77	43390985	N/A	8/11	8/12



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5.0 Test Equipment - continued

D.L.S. Wisconsin – OATS 3

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 26	837491/010	20 Hz – 26 GHz	1/12	1/13
Preamplifier	Rohde & Schwarz	TS-PR10	032001/005	9 kHz – 1 GHz	1/12	1/13
Antenna	EMCO	3104C	97014785	20 MHz – 200 MHz	9/10	9/12
Antenna	EMCO	3146	97024895	200 MHz – 1 GHz	9/10	9/12
Low Pass Filter	Mini-Circuits	VLFX-1125	RUU92600920	DC-1125 MHz	8/11	8/12

D.L.S. Wisconsin – Screen Room

Description	Manufacturer	Model Number	Serial Number	Frequency Range	Cal Dates	Cal Due Dates
Receiver	Rohde & Schwarz	ESI 40	837808/005	20 Hz – 40 GHz	7/11	7/12
LISN	Solar	9252-50-R-24-BNC	961019	9 kHz – 30 MHz	6/11	6/12
High Pass Filter	SOLAR	7930-120	090702	120 kHz – 30 MHz	1/12	1/13
Limiter	Electro-Metrics	EM-7600	706	9 kHz – 30 MHz	1/12	1/13



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6.0 Test Arrangements

Radiated Emissions Measurement Arrangement:

All radiated emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to FCC KDB 558074 D01 DTS Meas Guidance v01, ANSI C63.4-2009 and ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.

Unless otherwise noted, the bandwidth of the measuring receiver / analyzer used during testing is shown below.

Frequency Range	Bandwidth (-6 dB)
10 to 150 kHz	200 Hz
150 kHz to 30 MHz	9 kHz
30 MHz to 1 GHz	120 kHz
Above 1 GHz	1 MHz

RF Conducted Emissions Measurement Arrangement:

All RF conducted emission measurements were performed at D.L.S. Electronic Systems, Inc. and set up according to FCC KDB 558074 D01 DTS Meas Guidance v01, ANSI C63.4-2009 and ANSI C63.10-2009, unless otherwise noted. Description of procedures and measurements can be found in Appendix B – Measurement Data. See Appendix A for additional photos of the test set up.



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7.0 Test Conditions

Normal Test Conditions:

Temperature and Humidity:

68°F at 49% RH

Supply Voltage:

3.6 VDC

8.0 Modifications Made To EUT For Compliance

The output power setting on channel 26 was changed from -2 to -26 to meet the radiated band-edge requirement at the 2.4835 GHz restricted band edge.

The output power setting on channel 25 was changed from -2 to -6 to meet the radiated band-edge requirement at the 2.4835 GHz restricted band edge.

9.0 Additional Descriptions

The EUT was connected to the measuring equipment through a temporary SMA connector, soldered in place of the antenna, for RF conducted measurements.

The EUT was powered with an external DC bench supply.

The EUT was tested stand-alone for Single Modular Approval.

The EUT was programmed to transmit continuously at Low, Mid, and High channels.

The EUT was rotated through 3 orthogonal axis to find worst-case.

10.0 Results

Measurements were performed in accordance with FCC KDB 558074 D01 DTS Meas Guidance v01, ANSI C63.4-2009 and ANSI C63.10-2009. Graphical and tabular data can be found in Appendix B at the end of this report.



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11.0 Conclusion

The MeshConnect ZICM357SP2-1 Zigbee Module, Model ZICM357SP2-1, as provided from California Eastern Laboratories, tested in March, 2012 **meets** the requirements of CFR 47 Part 15 Subpart C Section 15.247.

Appendix A – Test Photos

Photo Information and Test Setup:

Item0: MeshConnect ZICM357SP2-1 Zigbee Module, Model ZICM357SP2-1
Item1: DC Power cable (coax) to DC bench supply, 1.4 meter long with metal SMA connector.

Radiated Emissions below 1 GHz – X Position





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Appendix A

Photo Description: Radiated Emissions below 1 GHz – Y Position





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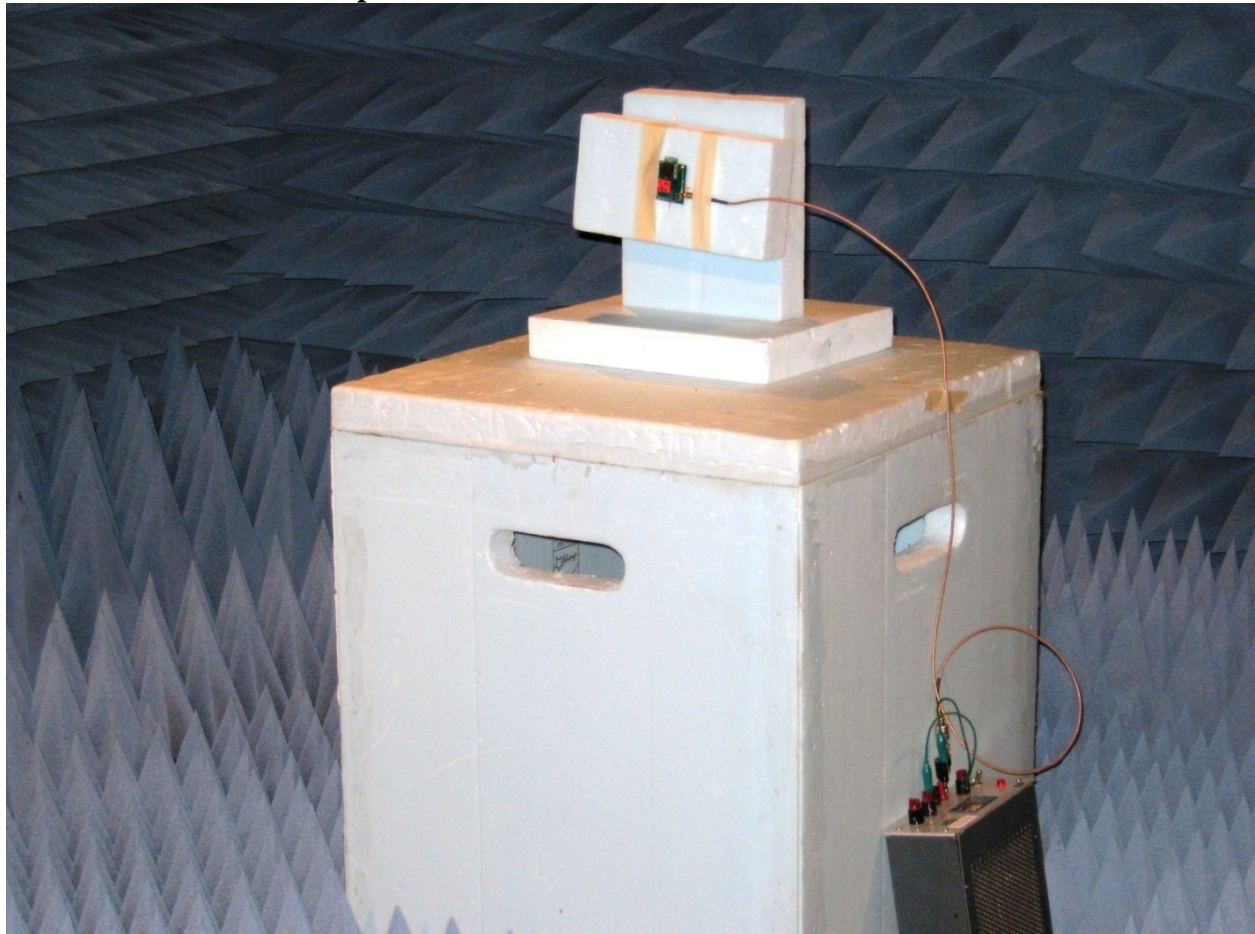
Appendix A

Photo Description: Radiated Emissions below 1 GHz – Z Position



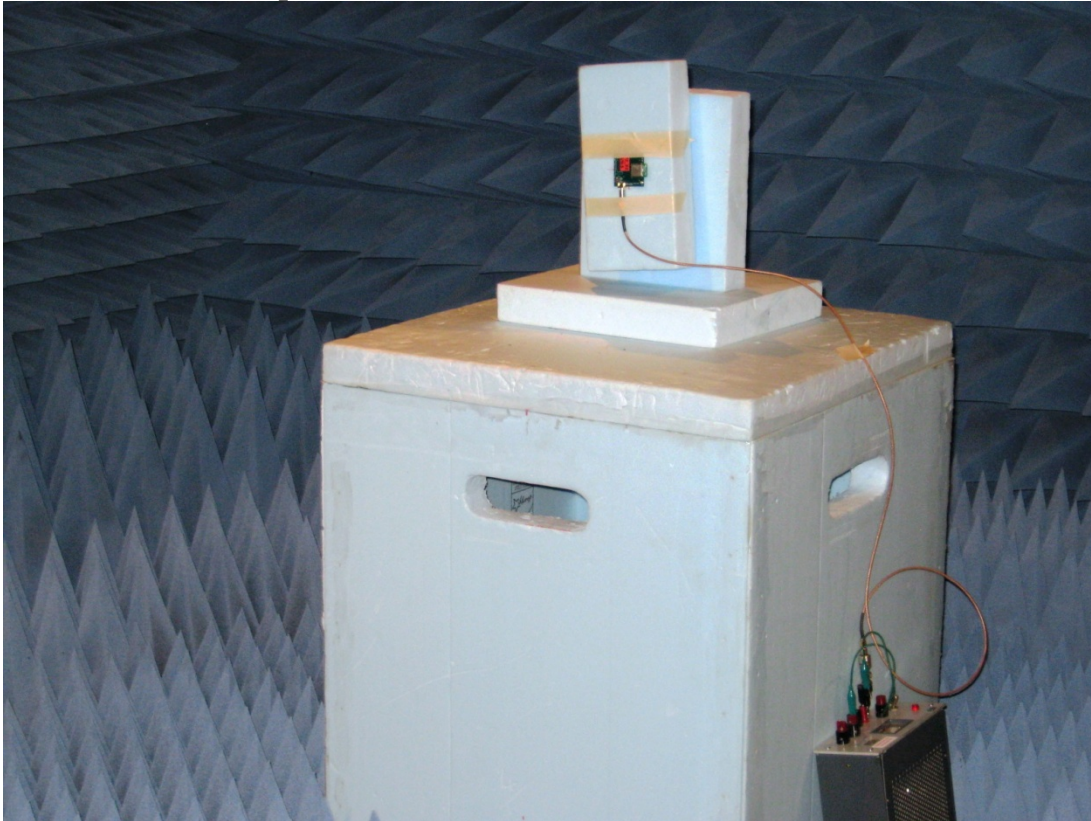
Appendix A

Photo Description: Radiated Emissions above 1 GHz – X Position



Appendix A

Photo Description: Radiated Emissions above 1 GHz – Y Position



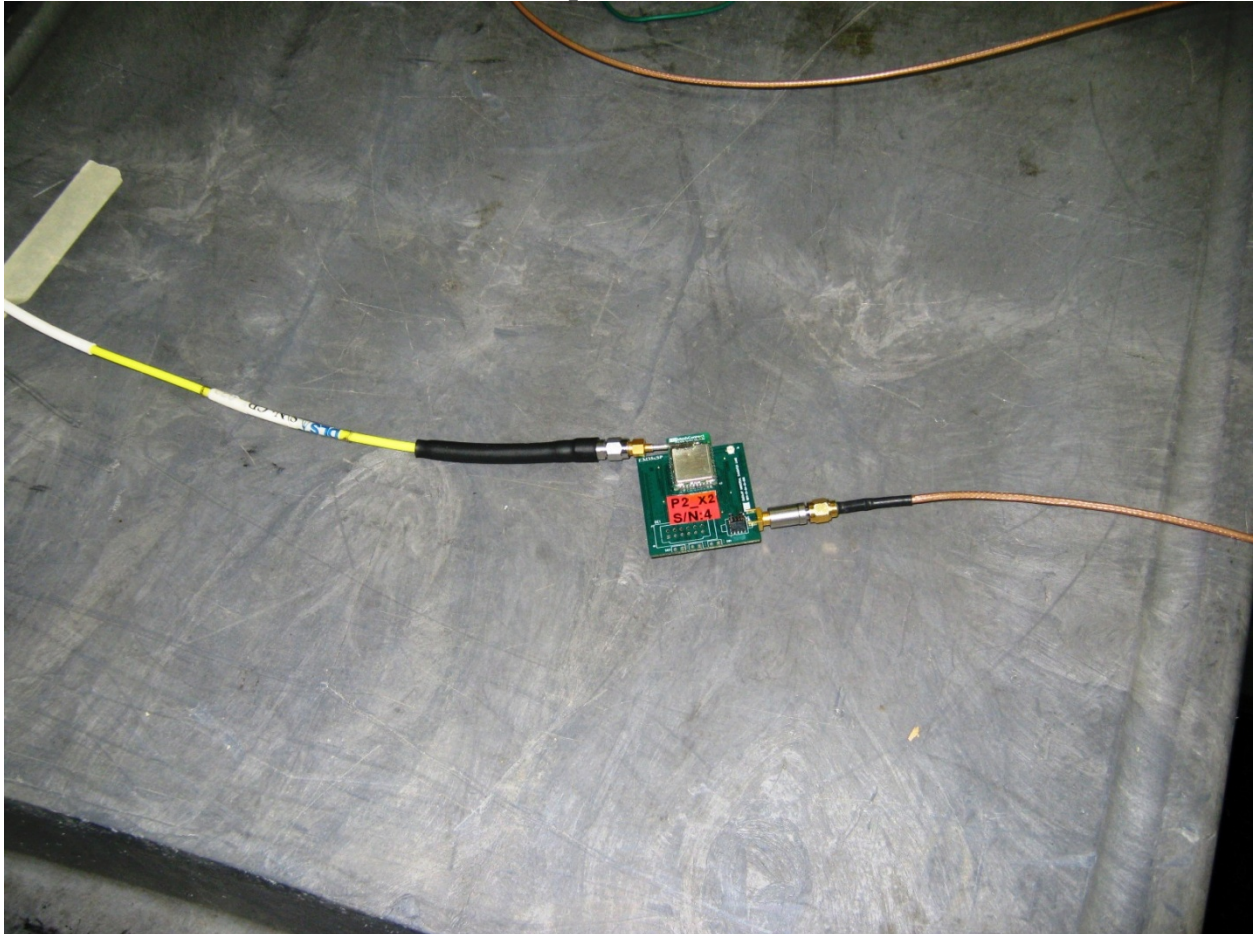
Appendix A

Photo Description: Radiated Emissions above 1 GHz – Z Position



Appendix A

Photo Description: RF Conducted



Appendix A

Photo Description: DC Line Conducted





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Appendix B – Measurement Data

1.0 6 dB Emission Bandwidth

Rule Part:

Section 15.247(a)(2)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012
Emission Bandwidth (EBW), Section 5.1
EBW Measurement Procedure, Section 5.1.1

Limit:

6 dB bandwidth shall be at least 500 kHz

Results:

Compliant
Maximum 6 dB bandwidth: **1.55 MHz**

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through an SMA connector soldered in place of the antenna. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.
The EUT was powered through a cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.



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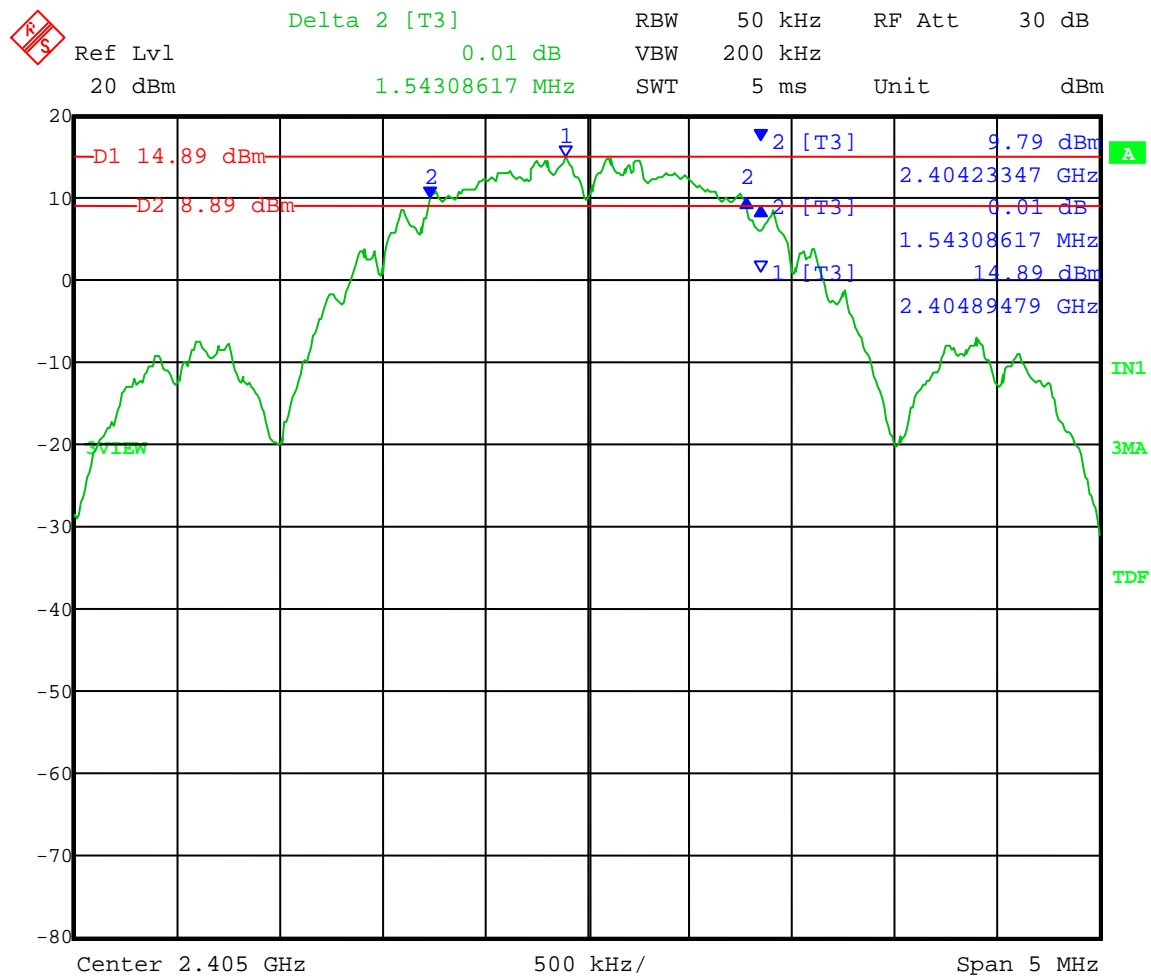
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Emission Bandwidth (6 dB) - Conducted
Operator: Craig B

Comment: RBW = 1-5% of EBW
VBW $\geq 3 \times$ RBW
Detector = Peak
Sweep = auto couple

Comment: Low Channel: Frequency – 2.405 GHz
Output power setting -2

6 dB Emission Bandwidth = 1.54 MHz



Date: 9.MAY.2012 16:12:13



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Company:
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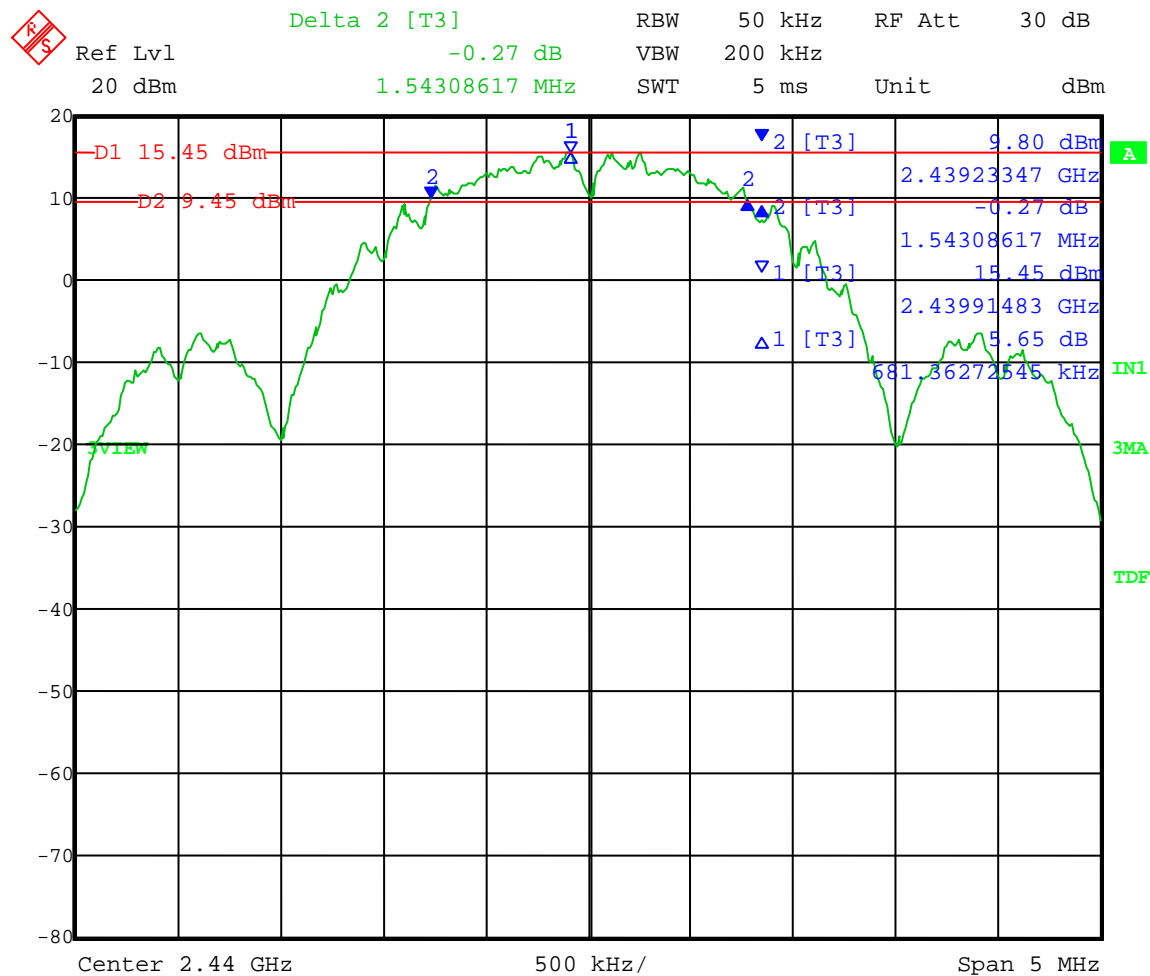
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Emission Bandwidth (6 dB) - Conducted
Operator: Craig B

Comment: RBW = 1-5% of EBW
VBW $\geq 3 \times$ RBW
Detector = Peak
Sweep = auto couple

Comment: Middle Channel: Frequency – 2.440 GHz
Output power setting -2

6 dB Emission Bandwidth = 1.54 MHz



Date: 9.MAY.2012 15:59:19



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Company:
Model Tested:
Report Number:
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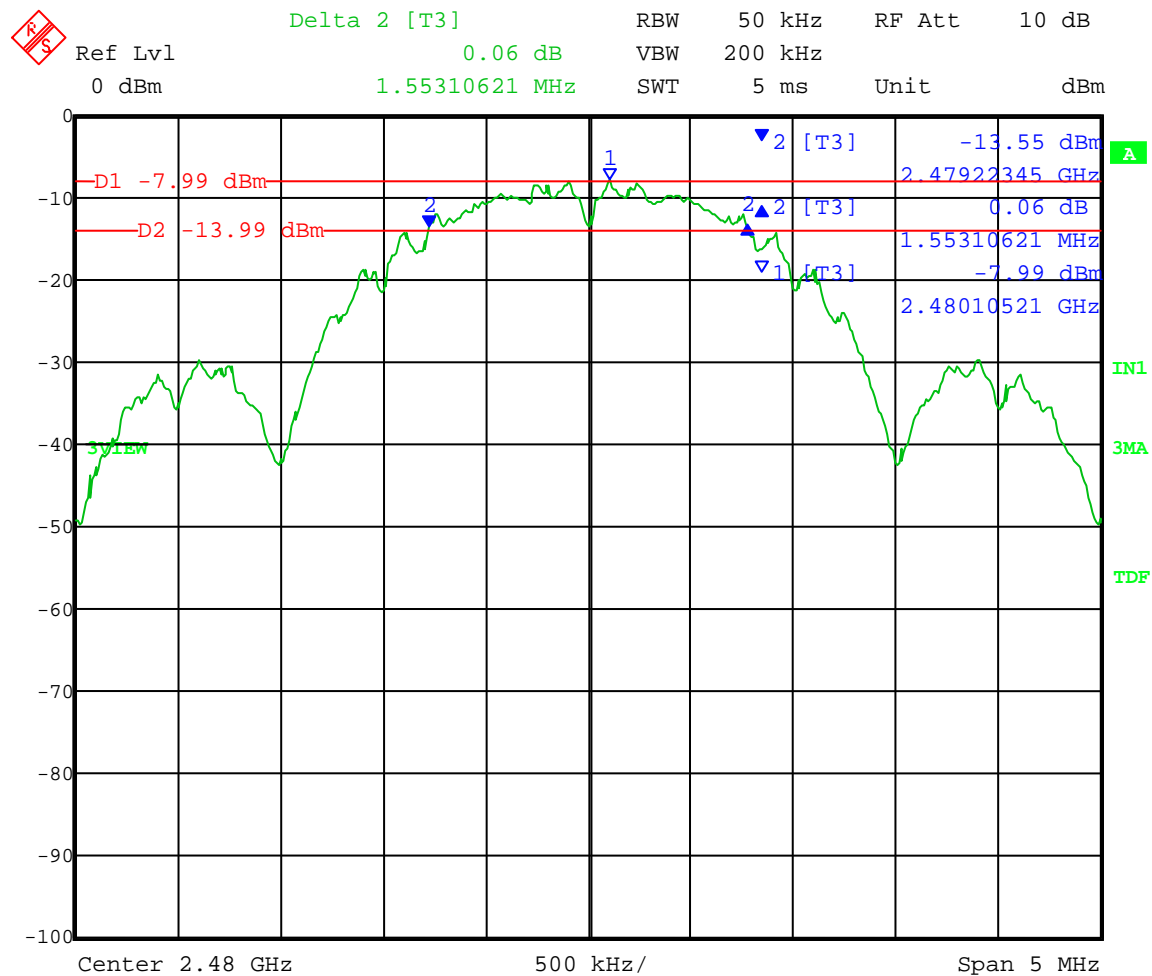
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Emission Bandwidth (6 dB) - Conducted
Operator: Craig B

Comment: RBW = 1-5% of EBW
VBW $\geq 3 \times$ RBW
Detector = Peak
Sweep = auto couple

Comment: High Channel: Frequency – 2.480 GHz
Output power setting -26

6 dB Emission Bandwidth = 1.55 MHz



Date: 9.MAY.2012 16:17:31



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Appendix B

2.0 Fundamental Emission Output Power

Rule Part:

15.247(b)(3)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012
Maximum Peak Conducted Output Power Level, Section 5.2.1
Measurement Procedure PK1, Section 5.2.1.1

Limit:

The maximum peak conducted output power is 1 watt (30 dBm).

Results:

Compliant
Maximum peak conducted output power: **119.40 mW (20.77 dBm)**

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through an SMA connector soldered in place of the antenna. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.

The EUT was powered through a cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

The highest channel (channel 26) power setting was reduced from -2 to -26 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

The next-to-highest channel (channel 25) power setting was reduced from -2 to -6 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.



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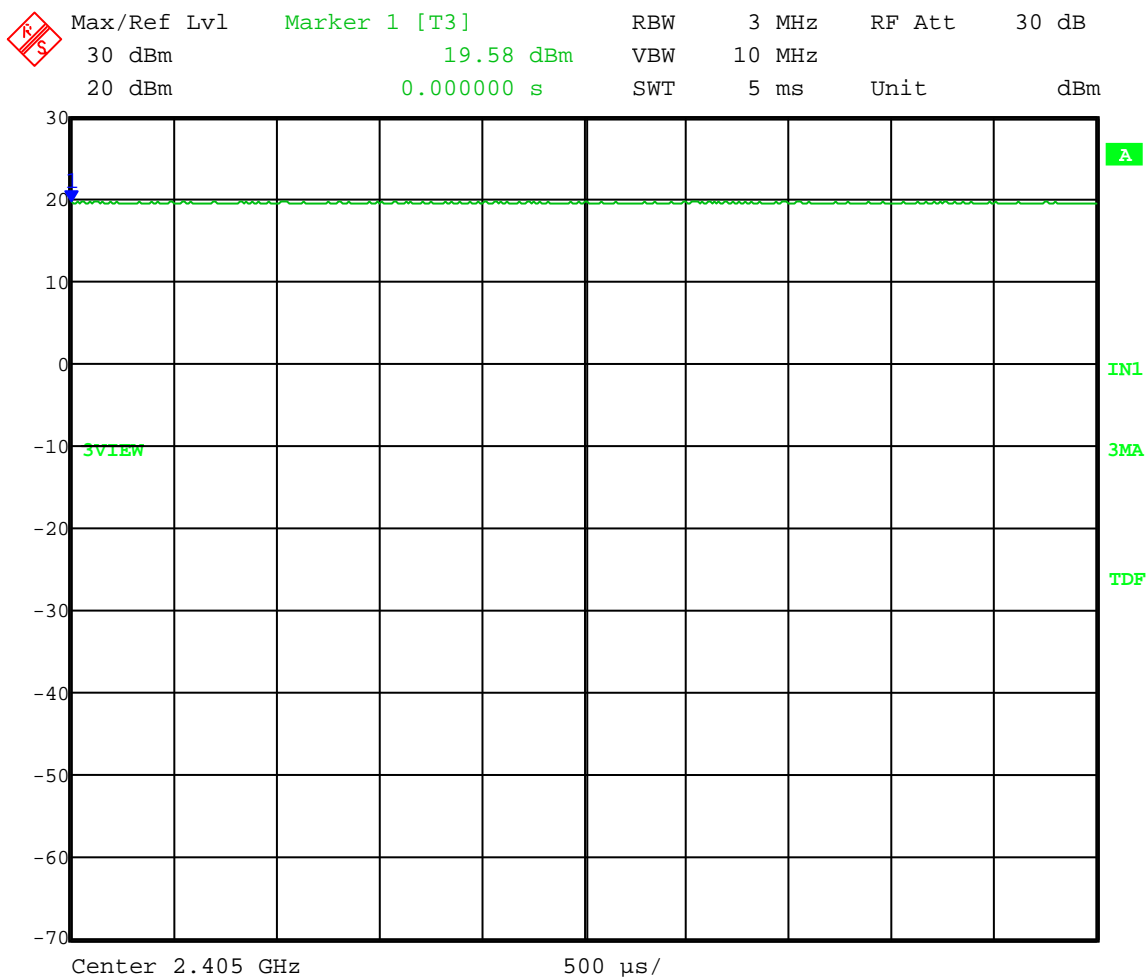
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Fundamental Emission Output Power - Conducted
Operator: Craig B

Comment: RBW \geq EBW
VBW \geq 3 x RBW
Span = zero
Sweep = auto couple
Detector = Peak
Trace = max hold

Comment: Low Channel(11): Frequency – 2.405 GHz
Output power setting -2

Fundamental Emission Output Power = 19.58 dBm = **90.78 mW**



Date: 9.MAY.2012 15:18:54



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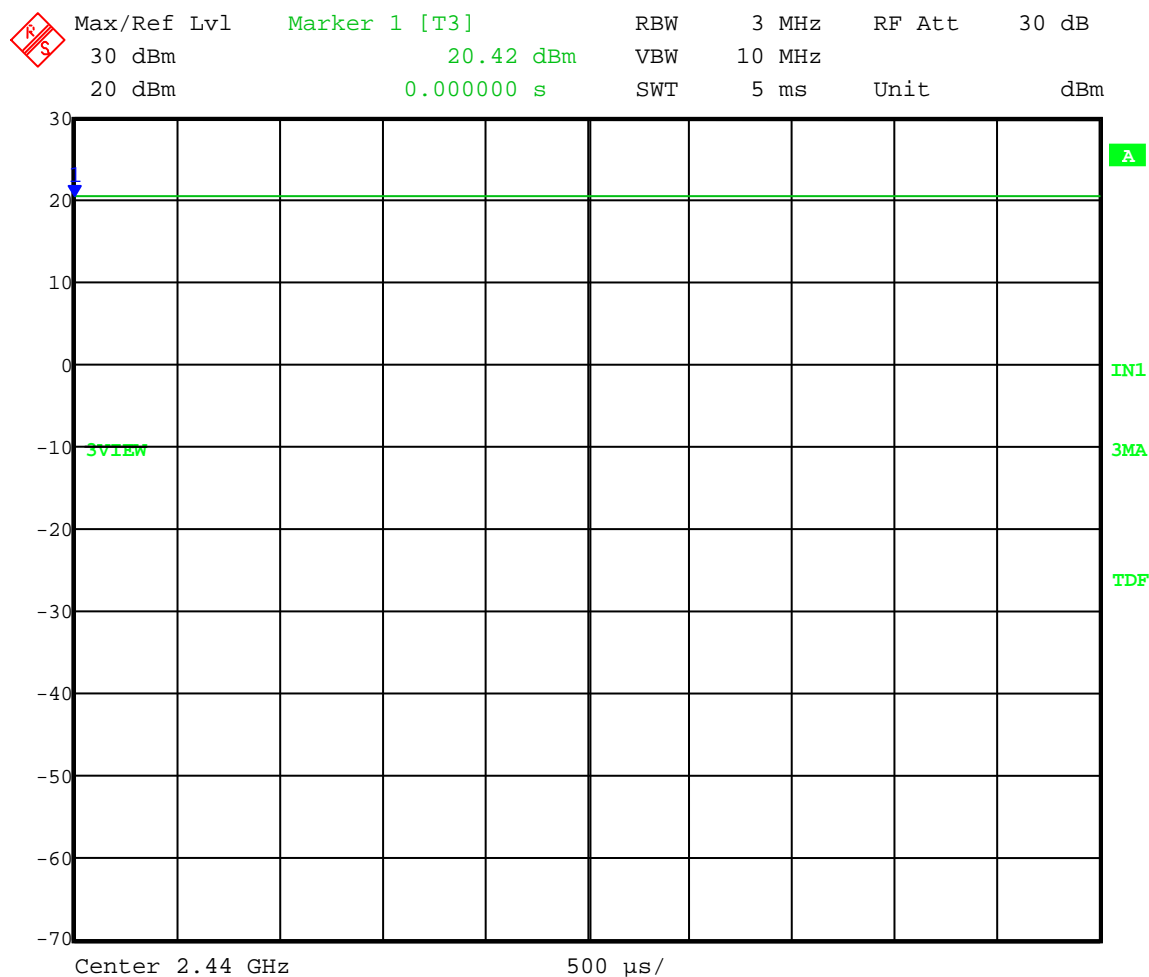
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Fundamental Emission Output Power - Conducted
Operator: Craig B

Comment: RBW \geq EBW
VBW $\geq 3 \times$ RBW
Span = zero
Sweep = auto couple
Detector = Peak
Trace = max hold

Comment: Middle Channel(18): Frequency – 2.440 GHz
Output power setting -2

Fundamental Emission Output Power = 20.42 dBm = **110.15 mW**



Date: 9.MAY.2012 15:23:17



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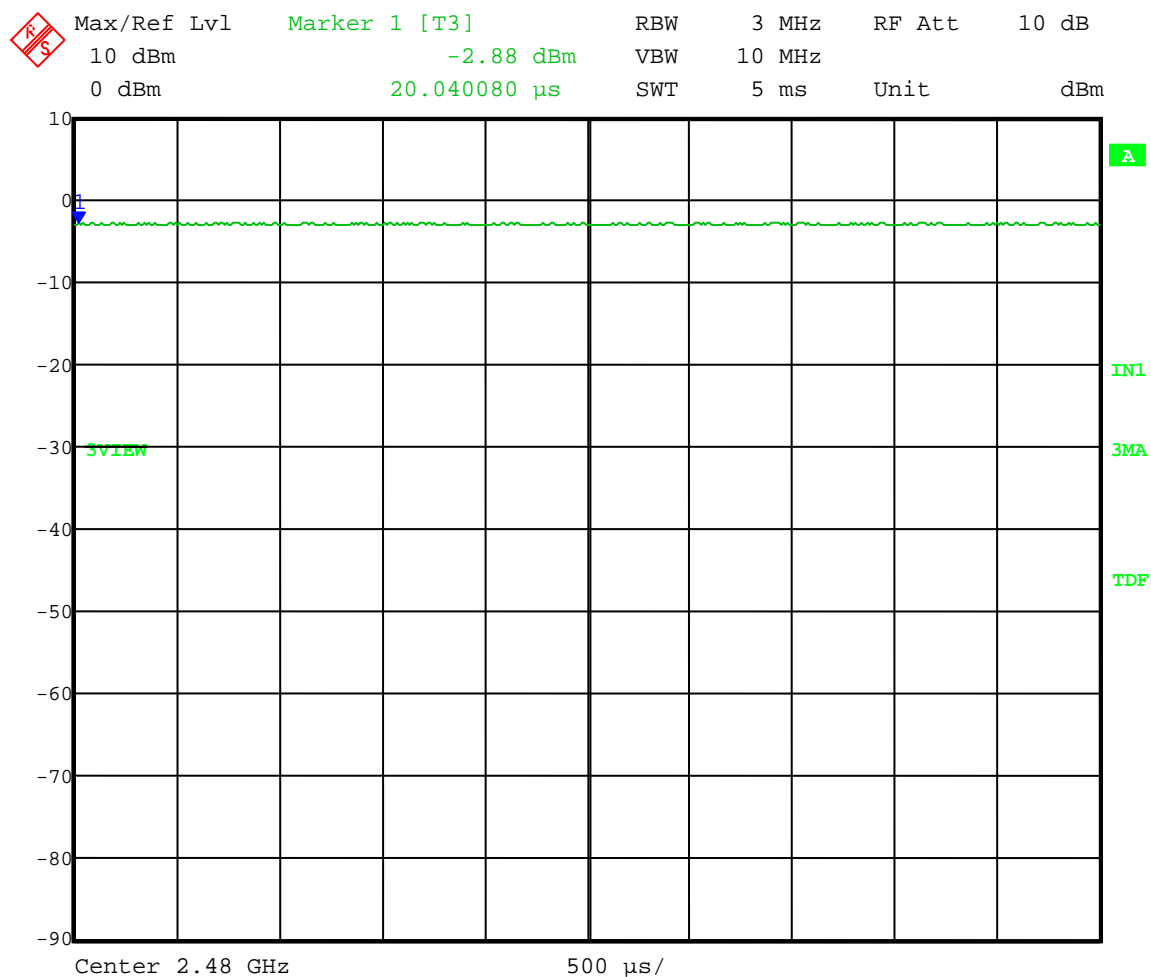
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Fundamental Emission Output Power - Conducted
Operator: Craig B

Comment: RBW \geq EBW
VBW \geq 3 x RBW
Span = zero
Sweep = auto couple
Detector = Peak
Trace = max hold

Comment: High Channel (26): Frequency – 2.480 GHz
Output power setting -26

Fundamental Emission Output Power = -2.88 dBm = **0.52 mW**



Date: 9.MAY.2012 15:36:08



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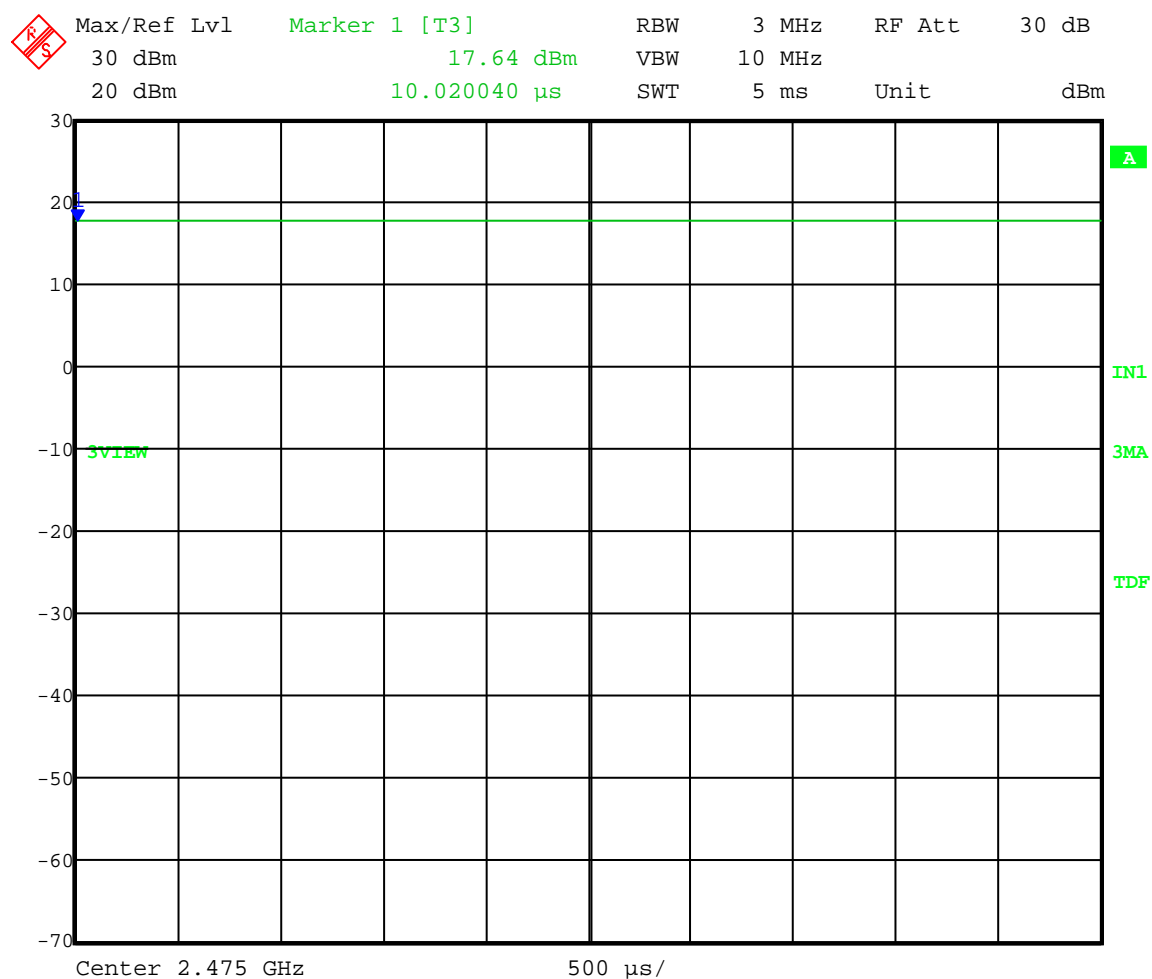
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Fundamental Emission Output Power - Conducted
Operator: Craig B

Comment: RBW \geq EBW
VBW $\geq 3 \times$ RBW
Span = zero
Sweep = auto couple
Detector = Peak
Trace = max hold

Comment: Channel 25: Frequency – 2.475 GHz
Output power setting -6

Fundamental Emission Output Power = 17.64 dBm = **58.08 mW**



Date: 9.MAY.2012 15:30:55



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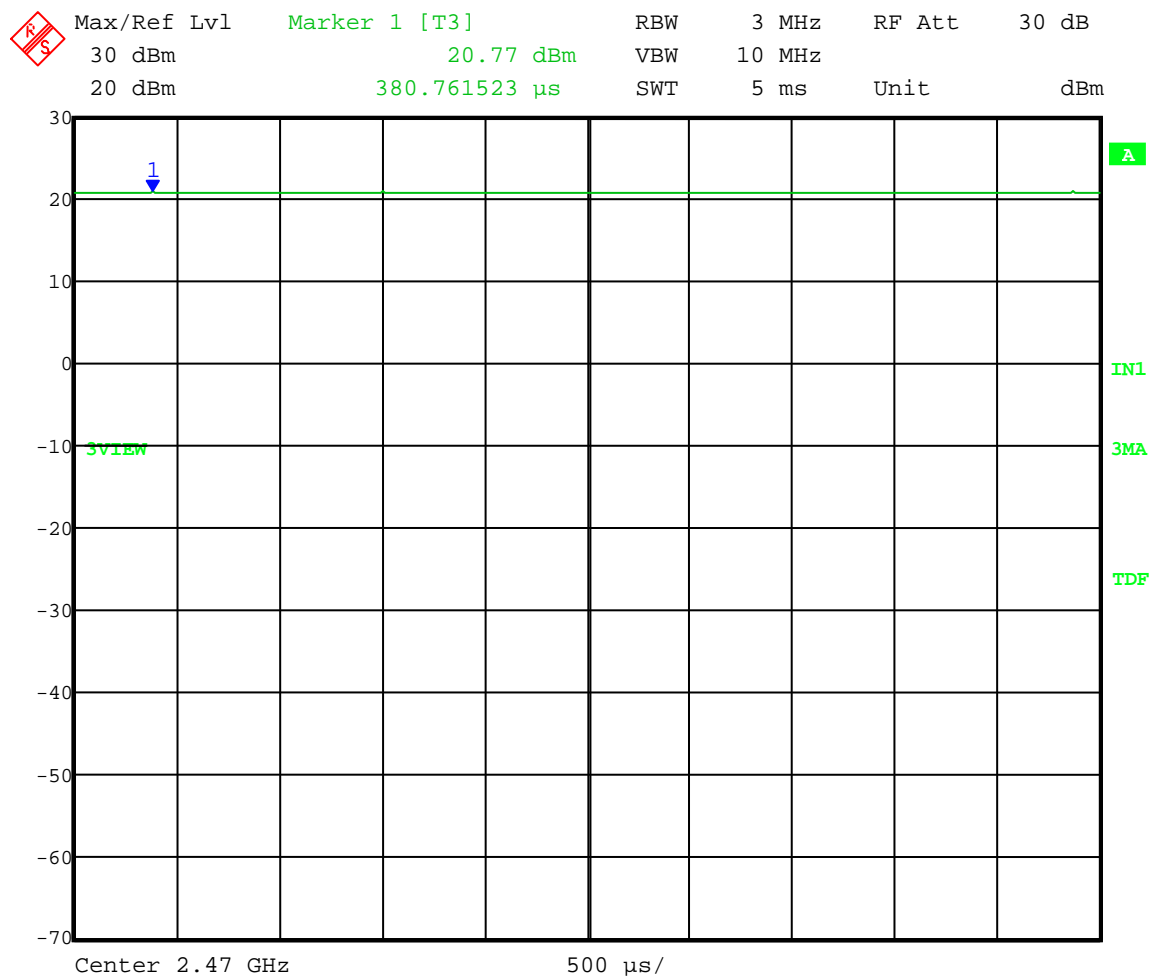
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Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Fundamental Emission Output Power - Conducted
Operator: Craig B

Comment: RBW \geq EBW
VBW $\geq 3 \times$ RBW
Span = zero
Sweep = auto couple
Detector = Peak
Trace = max hold

Comment: Channel 24: Frequency – 2.470 GHz
Output power setting -2 (full power)

Fundamental Emission Output Power = 20.77 dBm = **119.40 mW**



Date: 9.MAY.2012 15:27:09



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Appendix B

3.0 Maximum Power Spectral Density (PSD)

Rule Part:

15.247(e)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012

Maximum Power Spectral Density Level in the Fundamental Emission, Section 5.3
Measurement Procedure PKPSD, Section 5.3.1

Limit:

8 dBm in any 3 kHz band segment within the fundamental EBW during any time interval of continuous transmission.

Results:

Compliant

Maximum conducted power spectral density (PSD): **2.36 dBm**

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through an SMA connector soldered in place of the antenna. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.

The EUT was powered through a cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

The highest channel (channel 26) power setting was reduced from -2 to -26 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

The next-to-highest channel (channel 25) power setting was reduced from -2 to -6 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Power Spectral Density - Conducted
Operator: Craig B

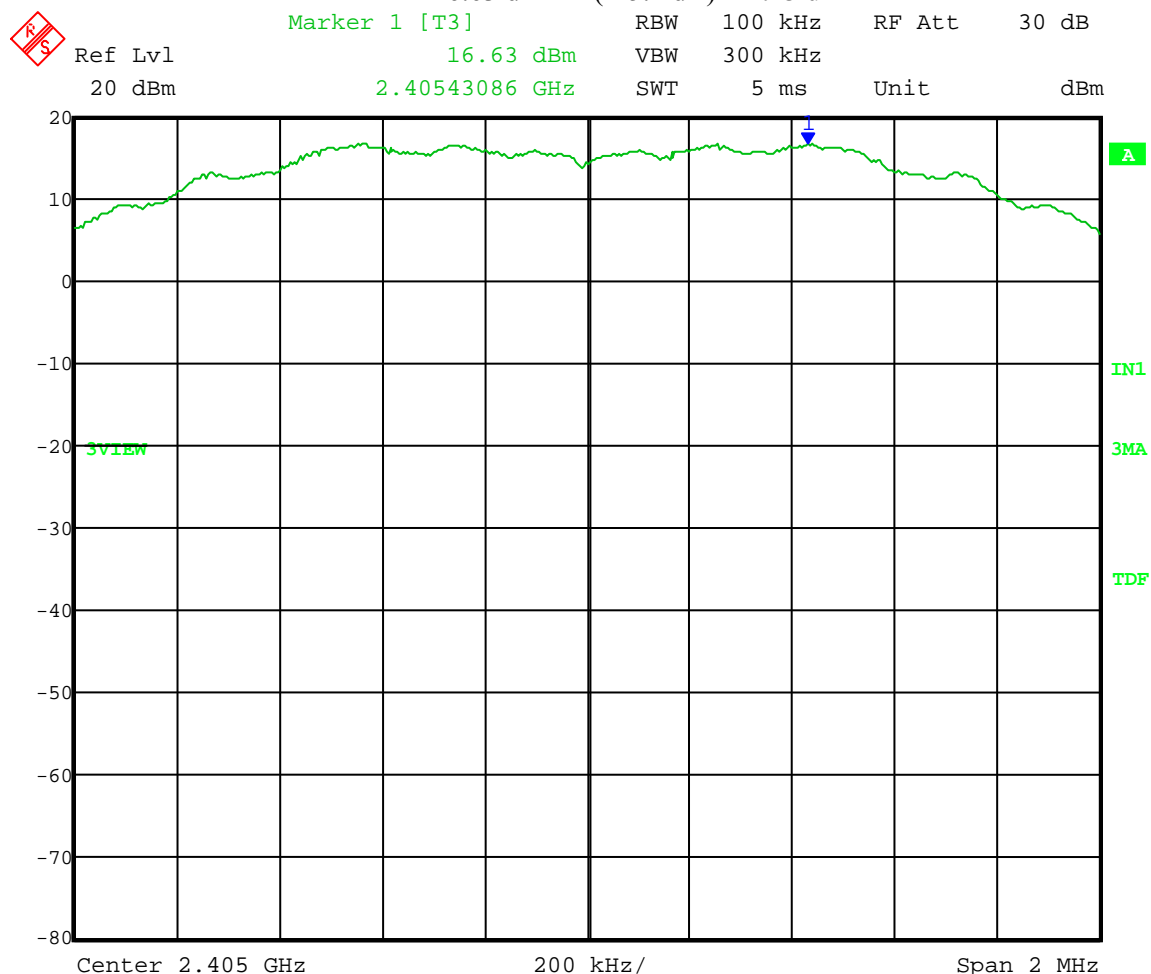
Comment: RBW = 100 kHz
VBW ≥ 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel: Frequency – 2.405 GHz

Output power setting -2

Limit: 8 dBm

Power Level in 3 kHz bandwidth = 16.63 dBm + (10log (3 kHz/100 kHz))
= 16.63 dBm + (-15.2 dB) = **1.43 dBm**



Date: 10.MAY.2012 08:51:22



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Power Spectral Density - Conducted
Operator: Craig B

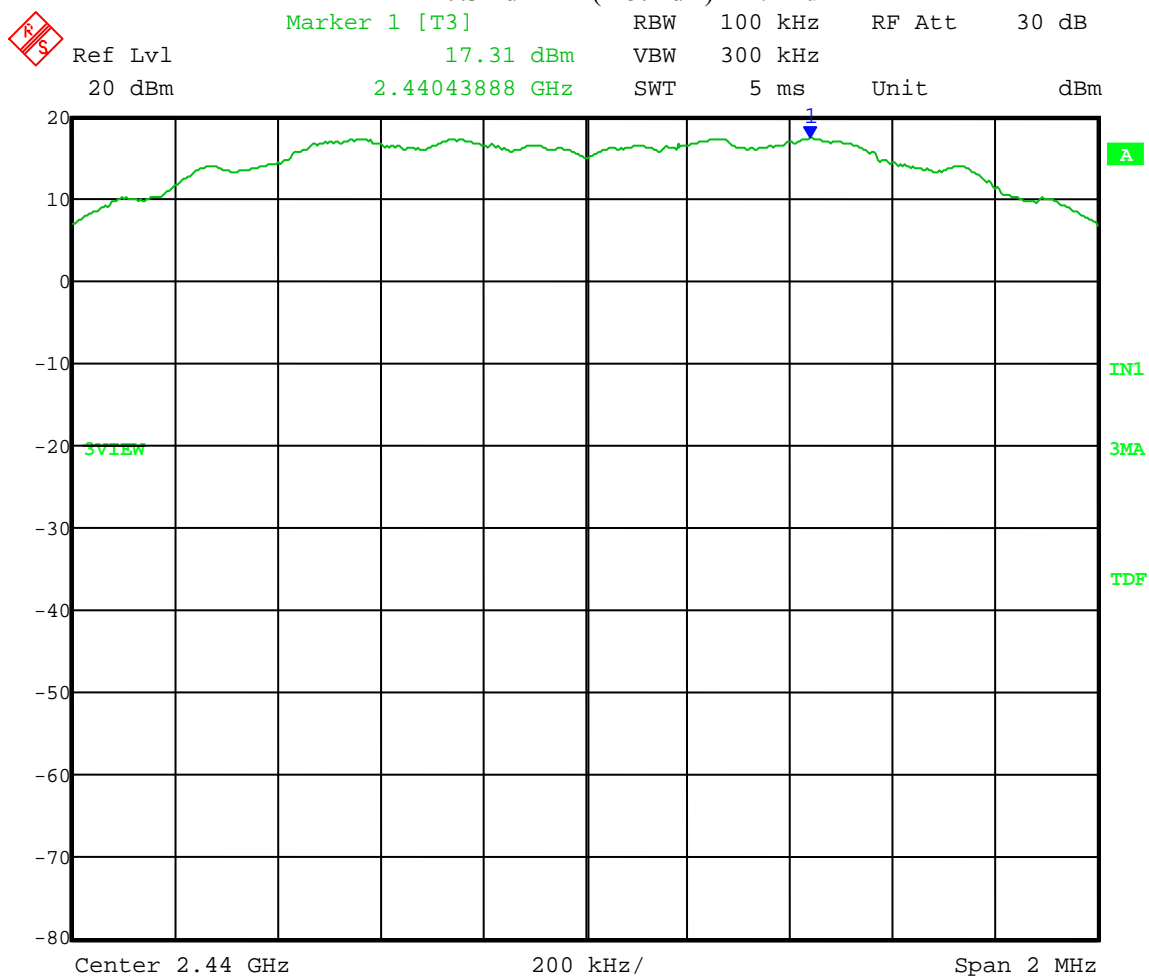
Comment: RBW = 100 kHz
VBW ≥ 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

Middle Channel: Frequency – 2.440 GHz

Output power setting -2

Limit: 8 dBm

Power Level in 3 kHz bandwidth = 17.31 dBm + (10log (3 kHz/100 kHz))
= 17.31 dBm + (-15.2 dB) = **2.11 dBm**



Date: 10.MAY.2012 09:01:50



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Power Spectral Density - Conducted
Operator: Craig B

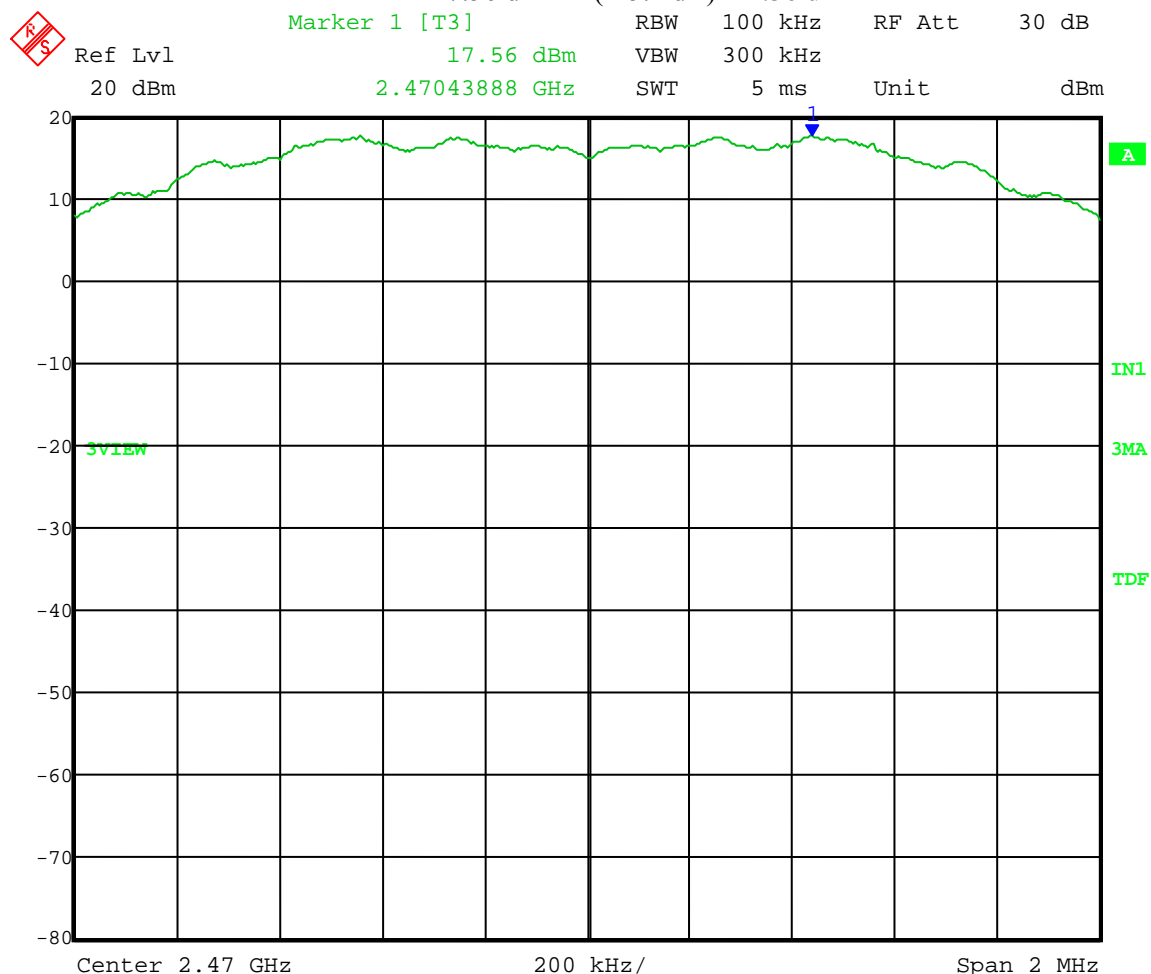
Comment: RBW = 100 kHz
VBW ≥ 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

Channel 24: Frequency – 2.470 GHz

Output power setting -2

Limit: 8 dBm

Power Level in 3 kHz bandwidth = 17.56 dBm + (10log (3 kHz/100 kHz))
= 17.56 dBm + (-15.2 dB) = **2.36 dBm**



Date: 10.MAY.2012 08:42:53



166 South Carter, Genoa City, WI 53128

Company:	California Eastern Laboratories
Model Tested:	ZICM357SP2-1
Report Number:	17866
DLS Project:	5130

Appendix B

4.0 Maximum Unwanted Emission Levels

Rule Part:

15.247(d)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012

Unwanted Emissions into Non-Restricted Frequency Bands, Section 5.4.1

Measurement Procedure – Reference Level, Section 5.4.1.1

Measurement Procedure – Unwanted Emissions, Section 5.4.1.2

Limit:

The peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Results:

Compliant

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through an SMA connector soldered in place of the antenna. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.

The EUT was powered through a cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

The highest channel (channel 26) power setting was reduced from -2 to -26 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

The next-to-highest channel (channel 25) power setting was reduced from -2 to -6 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

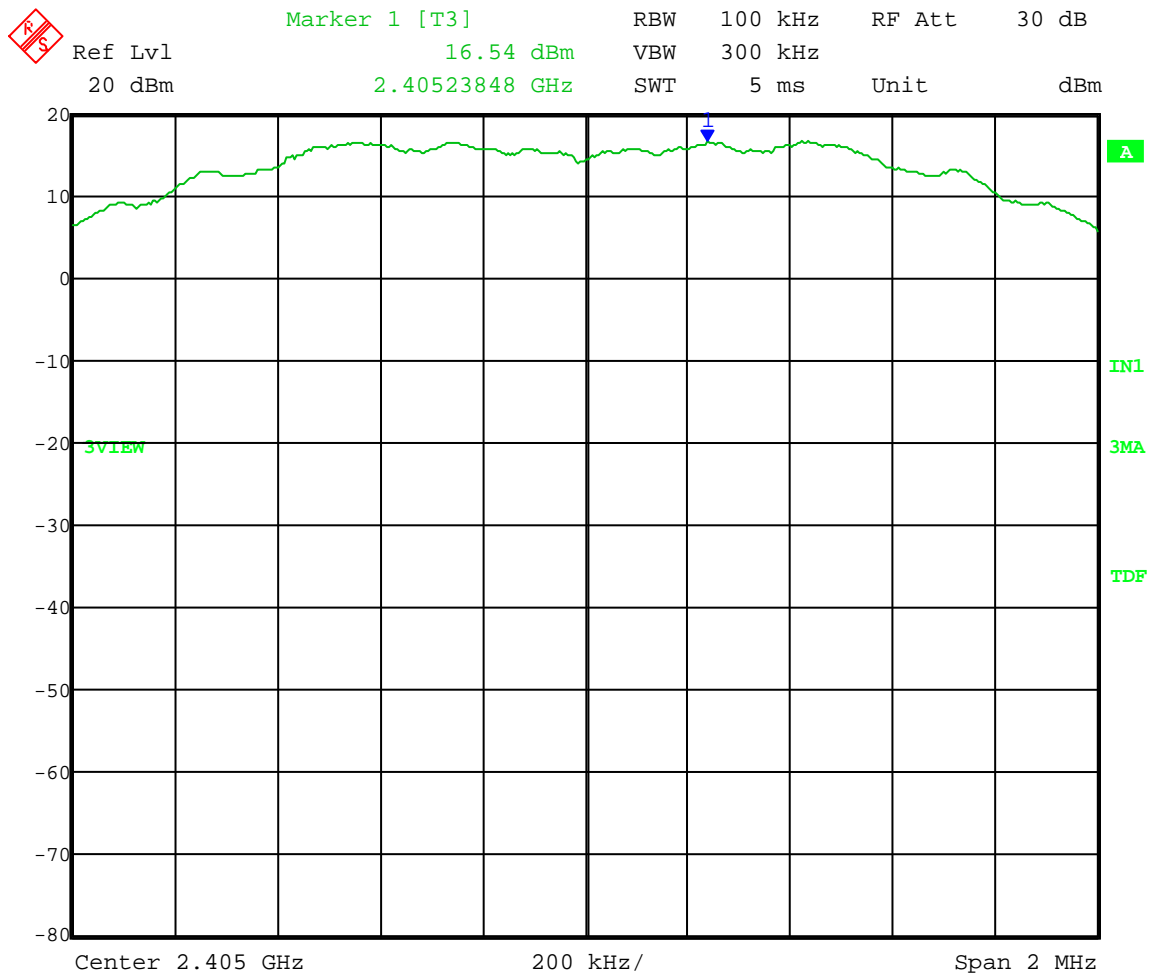
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel Transmit = 2.405 GHz

Output power setting -2

Reference Level measurement

Limit = 16.54 dBm - 20 dB = -3.46 dBm



Date: 10.MAY.2012 09:19:36



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

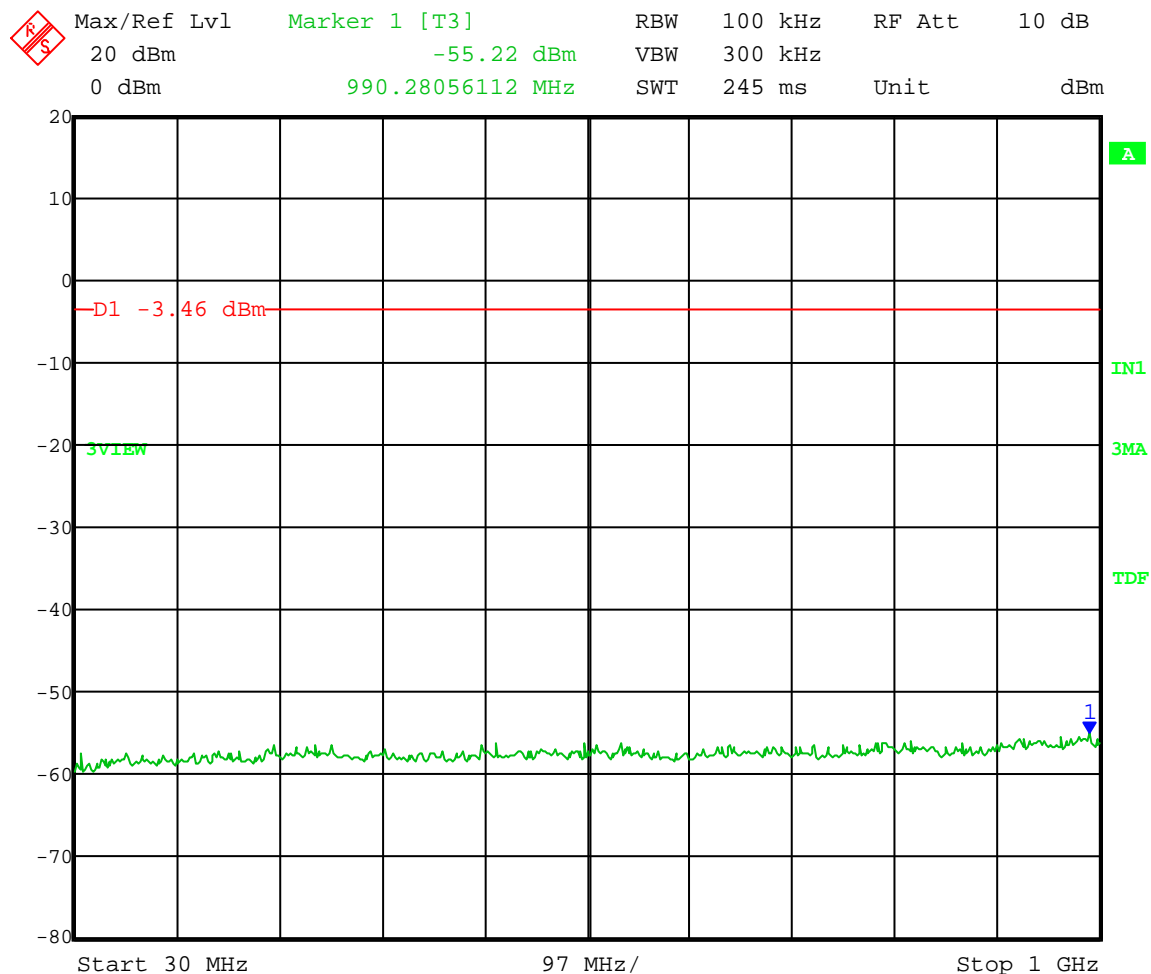
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel Transmit = 2.405 GHz

Output power setting -2

Frequency Range: 30 – 1000 MHz

Limit = 16.54 dBm – 20 dB = -3.46 dBm



Date: 10.MAY.2012 09:34:34



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

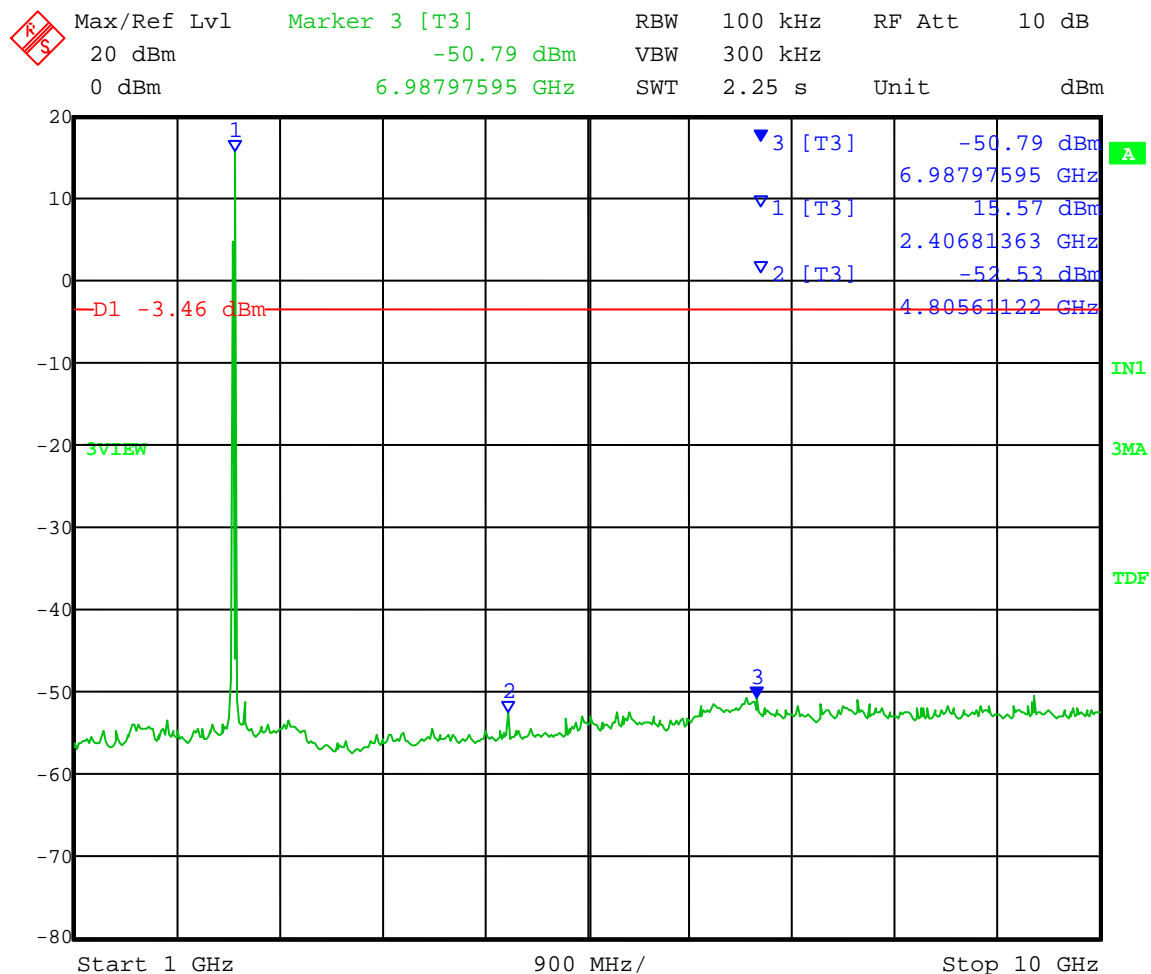
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel Transmit = 2.405 GHz

Output power setting -2

Frequency Range: 1 – 10 GHz

Limit = 16.54 dBm – 20 dB = -3.46 dBm



Date: 10.MAY.2012 09:27:09



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

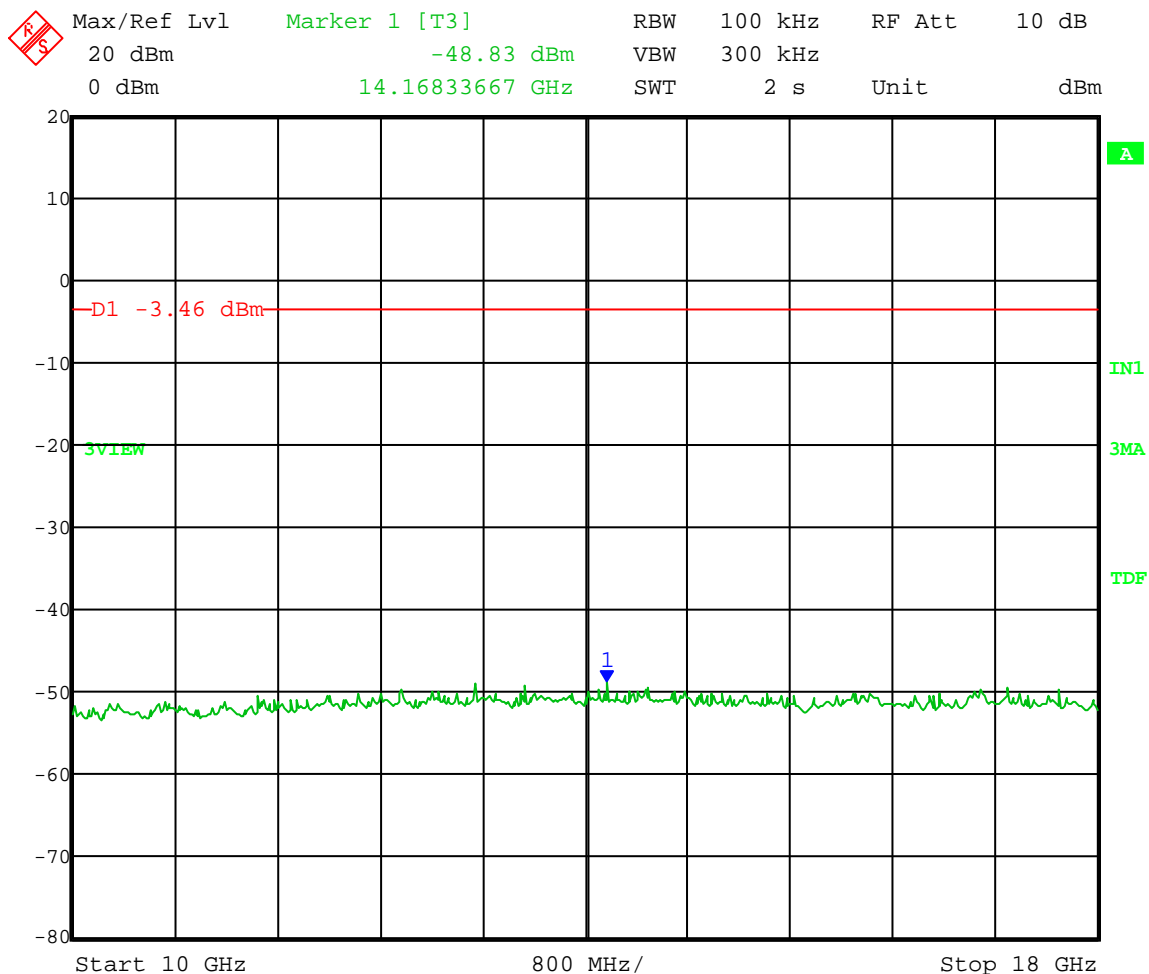
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel Transmit = 2.405 GHz

Output power setting -2

Frequency Range: 10 – 18 GHz

Limit = 16.54 dBm – 20 dB = -3.46 dBm



Date: 10.MAY.2012 09:29:40



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

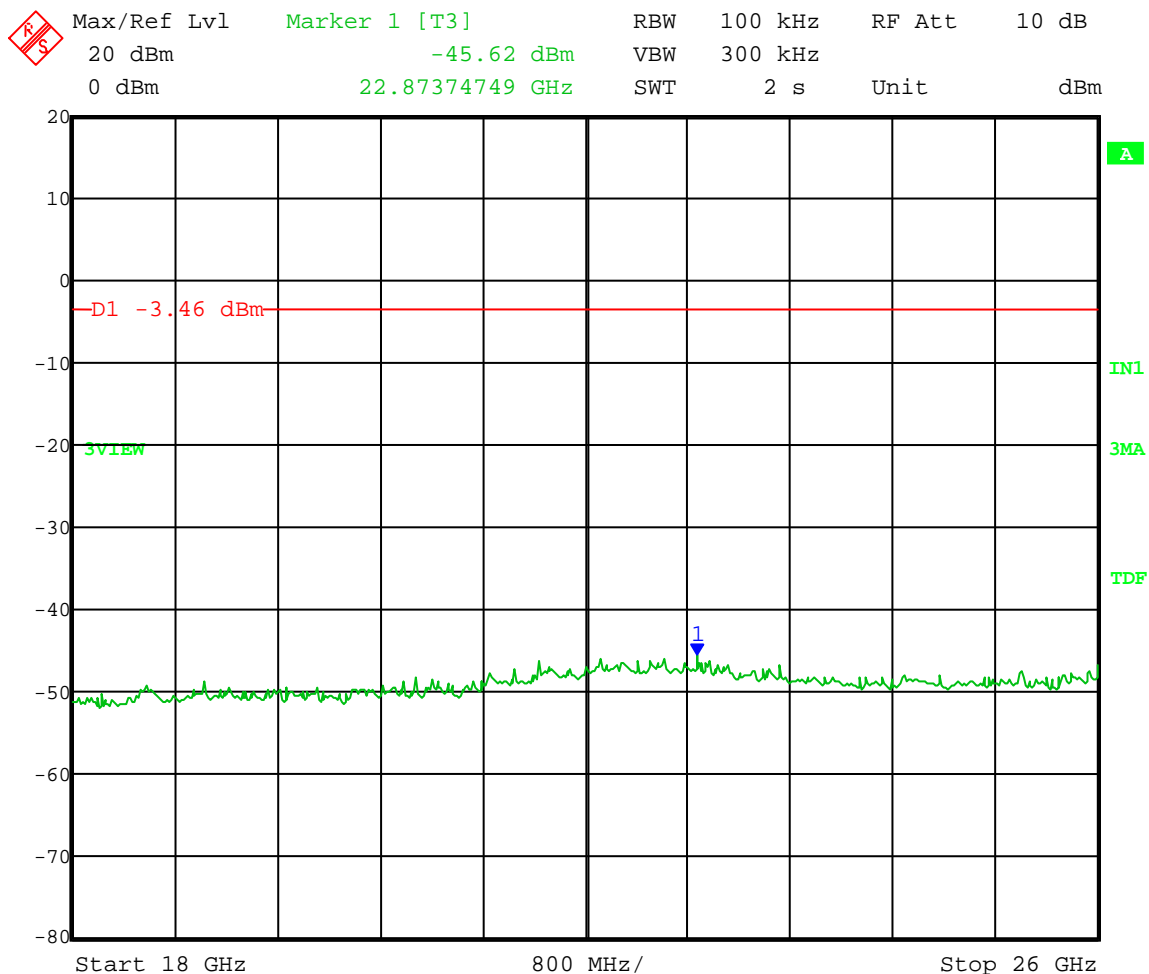
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel Transmit = 2.405 GHz

Output power setting -2

Frequency Range: 18 – 26 GHz

Limit = 16.54 dBm – 20 dB = -3.46 dBm



Date: 10.MAY.2012 09:32:04



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

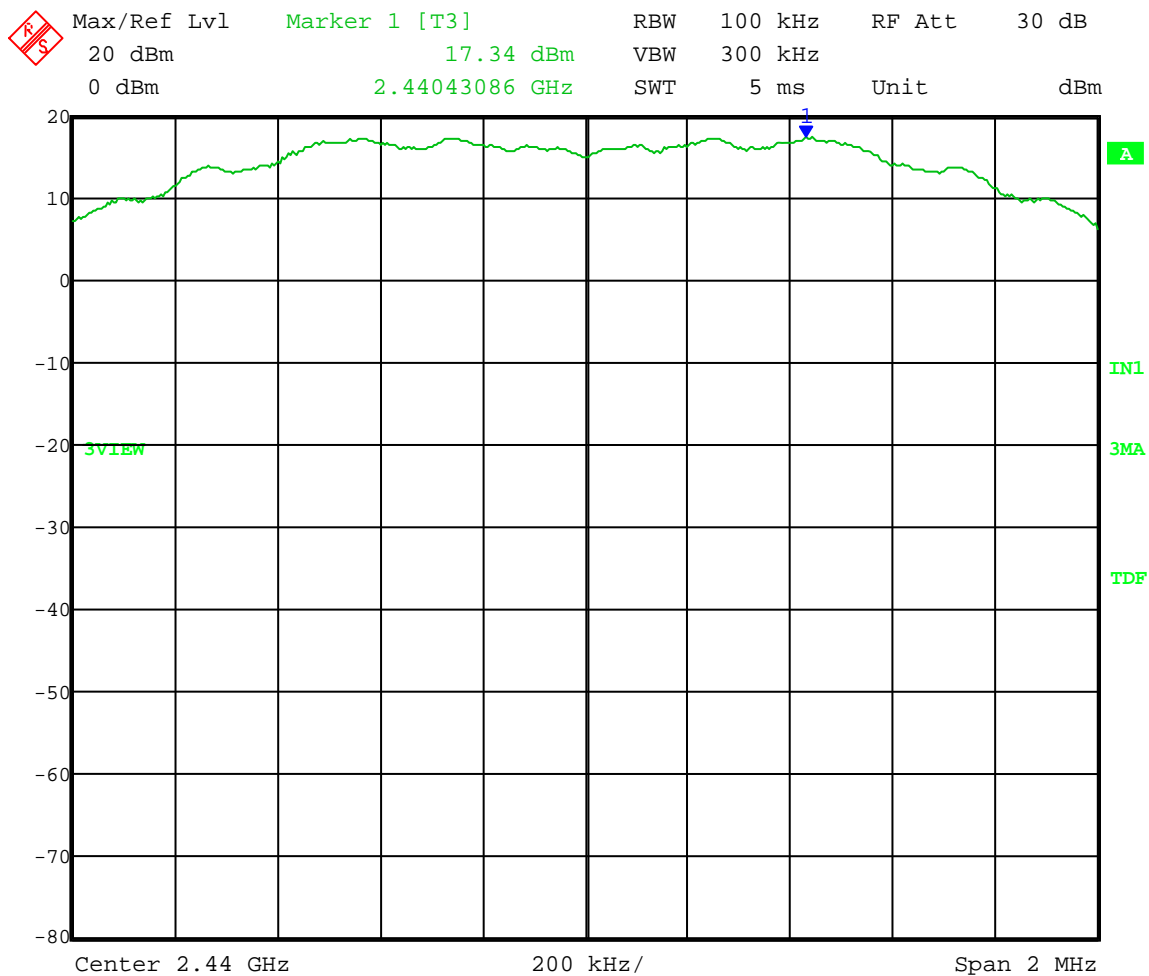
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

Middle Channel Transmit = 2.440 GHz

Output power setting -2

Reference Level measurement

Limit = 15.25 dBm – 20 dB = -4.75 dBm



Date: 10.MAY.2012 09:39:29



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

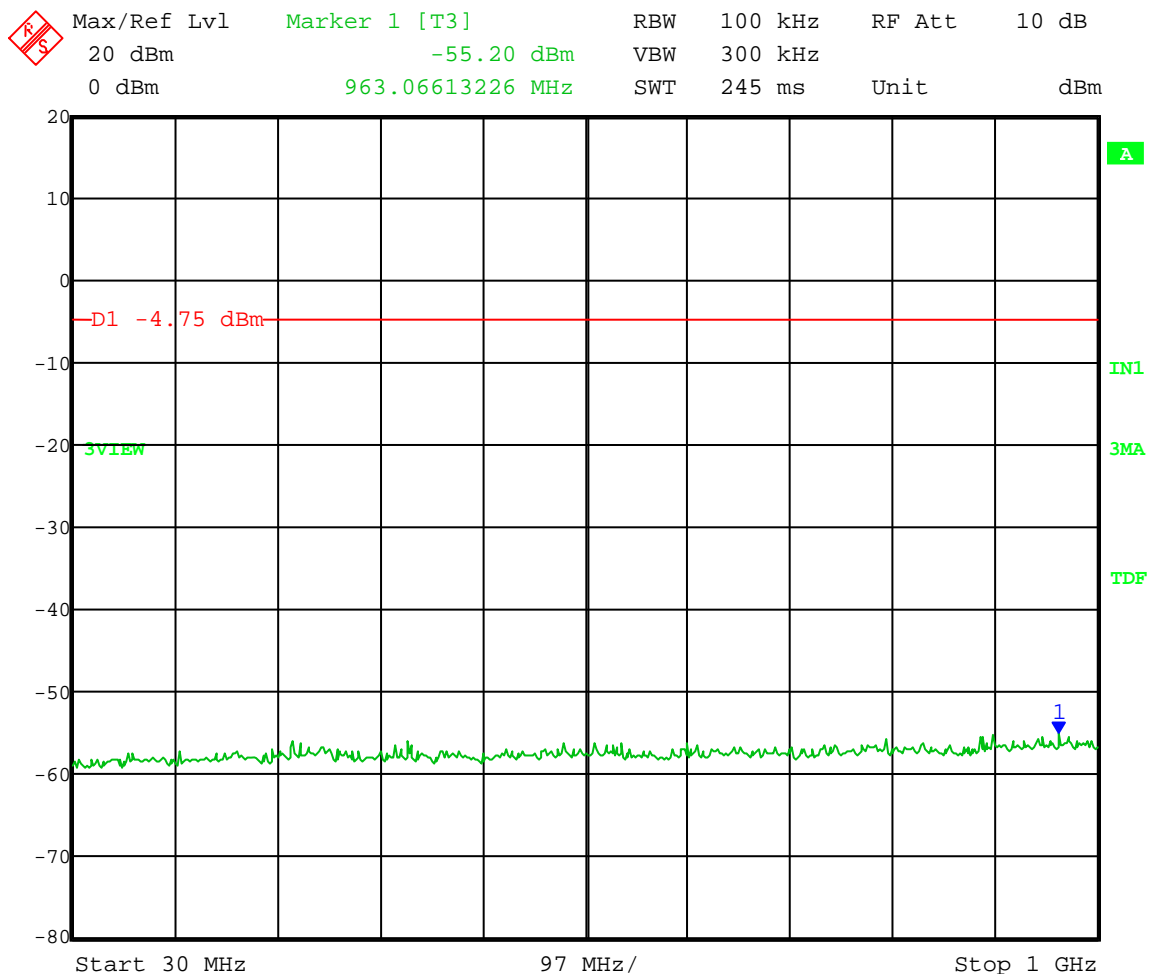
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Middle Channel Transmit = 2.440 GHz

Output power setting -2

Frequency Range: 30 – 1000 MHz

Limit = 15.25 dBm – 20 dB = -4.75 dBm



Date: 10.MAY.2012 09:52:02



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

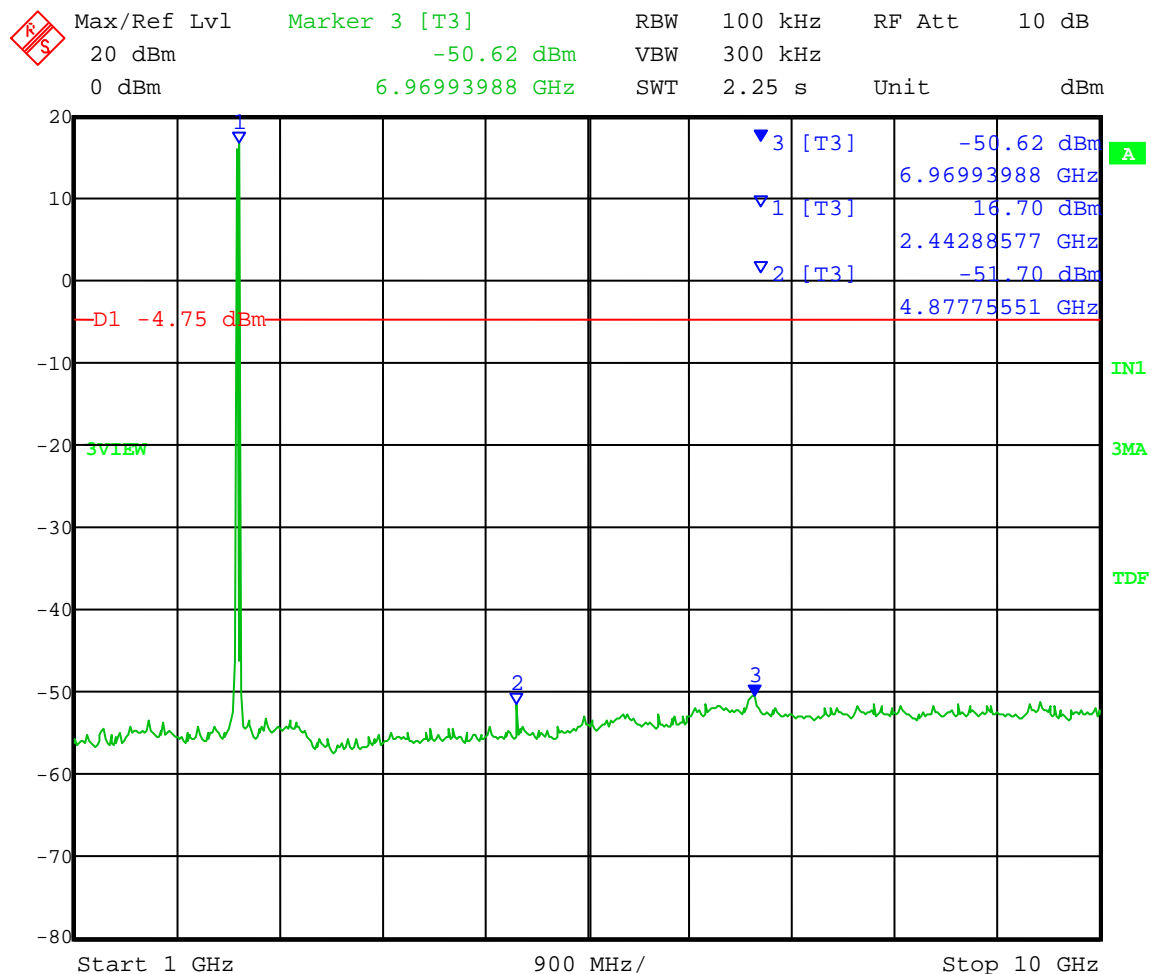
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Middle Channel Transmit = 2.440 GHz

Output power setting -2

Frequency Range: 1 – 10 GHz

Limit = 15.25 dBm – 20 dB = -4.75 dBm



Date: 10.MAY.2012 09:44:31



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B


Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

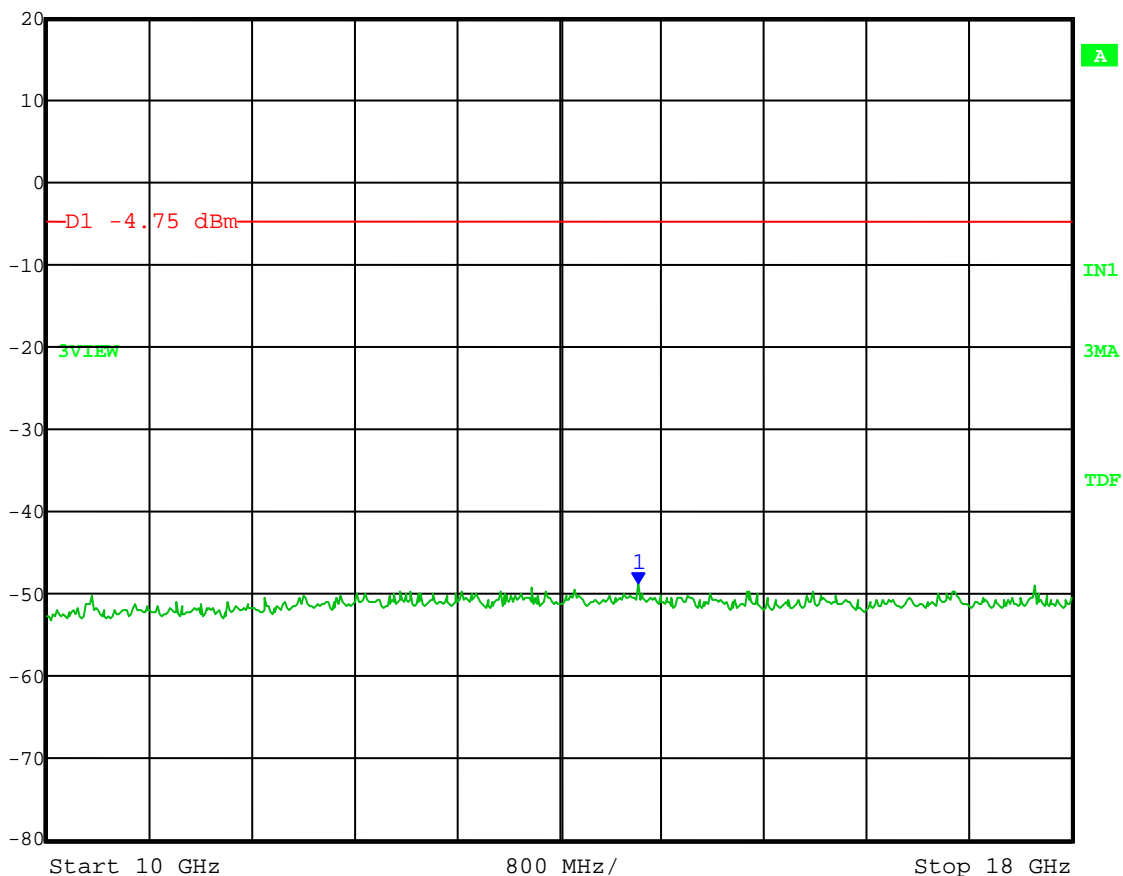
Middle Channel Transmit = 2.440 GHz

Output power setting -2

Frequency Range: 10 – 18 GHz

Limit = 15.25 dBm – 20 dB = -4.75 dBm

 Max/Ref Lvl Marker 1 [T3] RBW 100 kHz RF Att 10 dB
20 dBm -48.89 dBm VBW 300 kHz
0 dBm 14.61723447 GHz SWT 2 s Unit dBm



Date: 10.MAY.2012 09:46:59



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

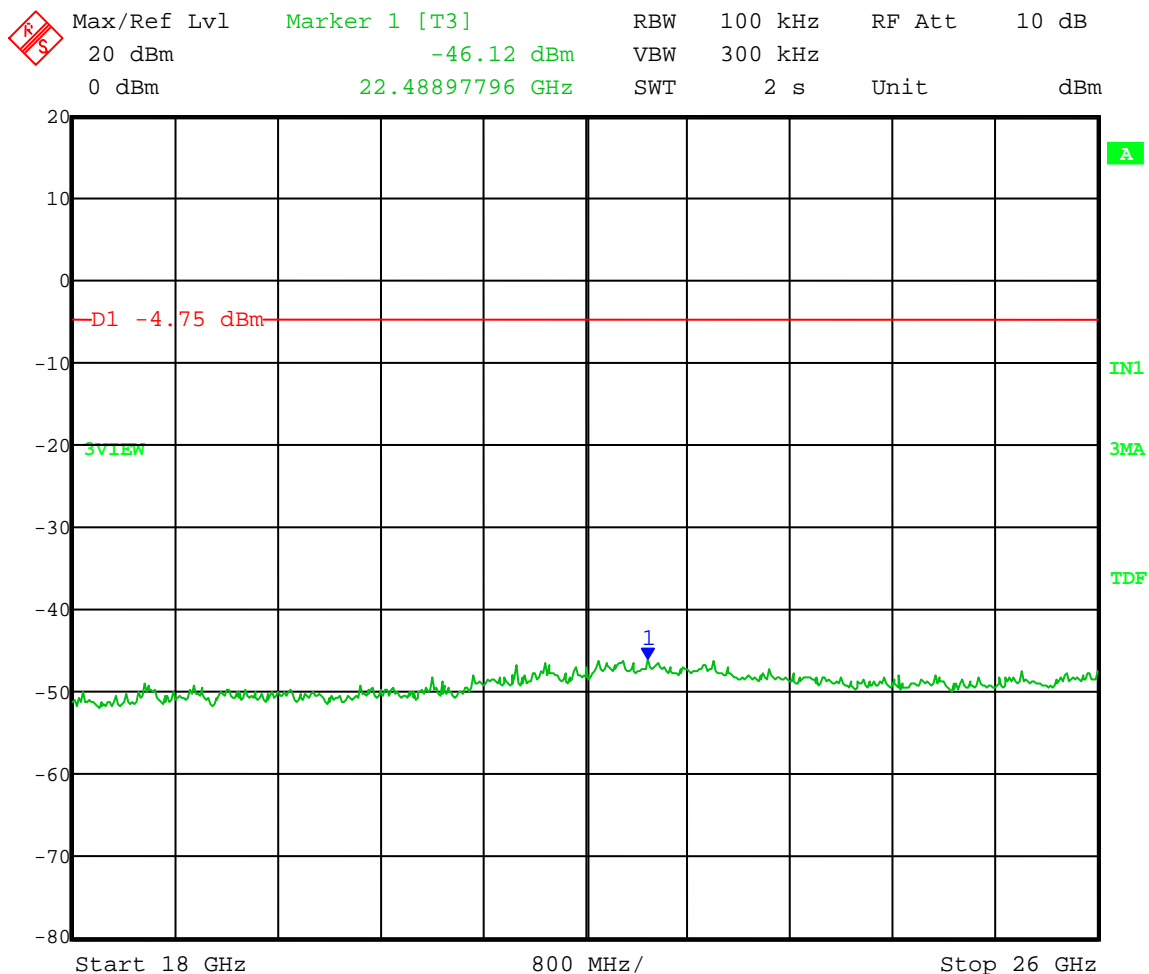
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Middle Channel Transmit = 2.440 GHz

Output power setting -2

Frequency Range: 18 – 26 GHz

Limit = 15.25 dBm – 20 dB = -4.75 dBm



Date: 10.MAY.2012 09:49:24



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

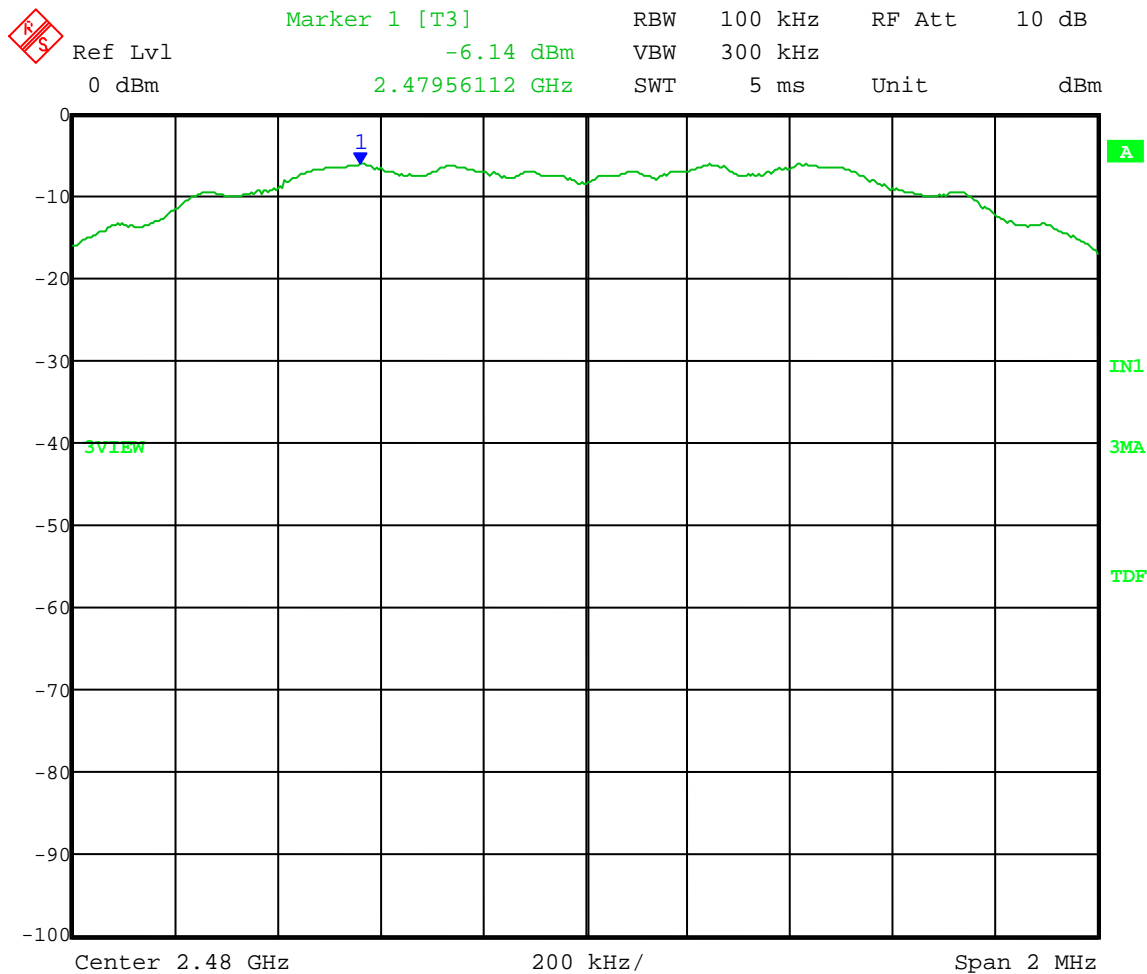
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Span = 5-30% greater than EBW
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Reference Level measurement

Limit = -6.14 dBm - 20 dB = -26.14 dBm



Date: 10.MAY.2012 09:58:16



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

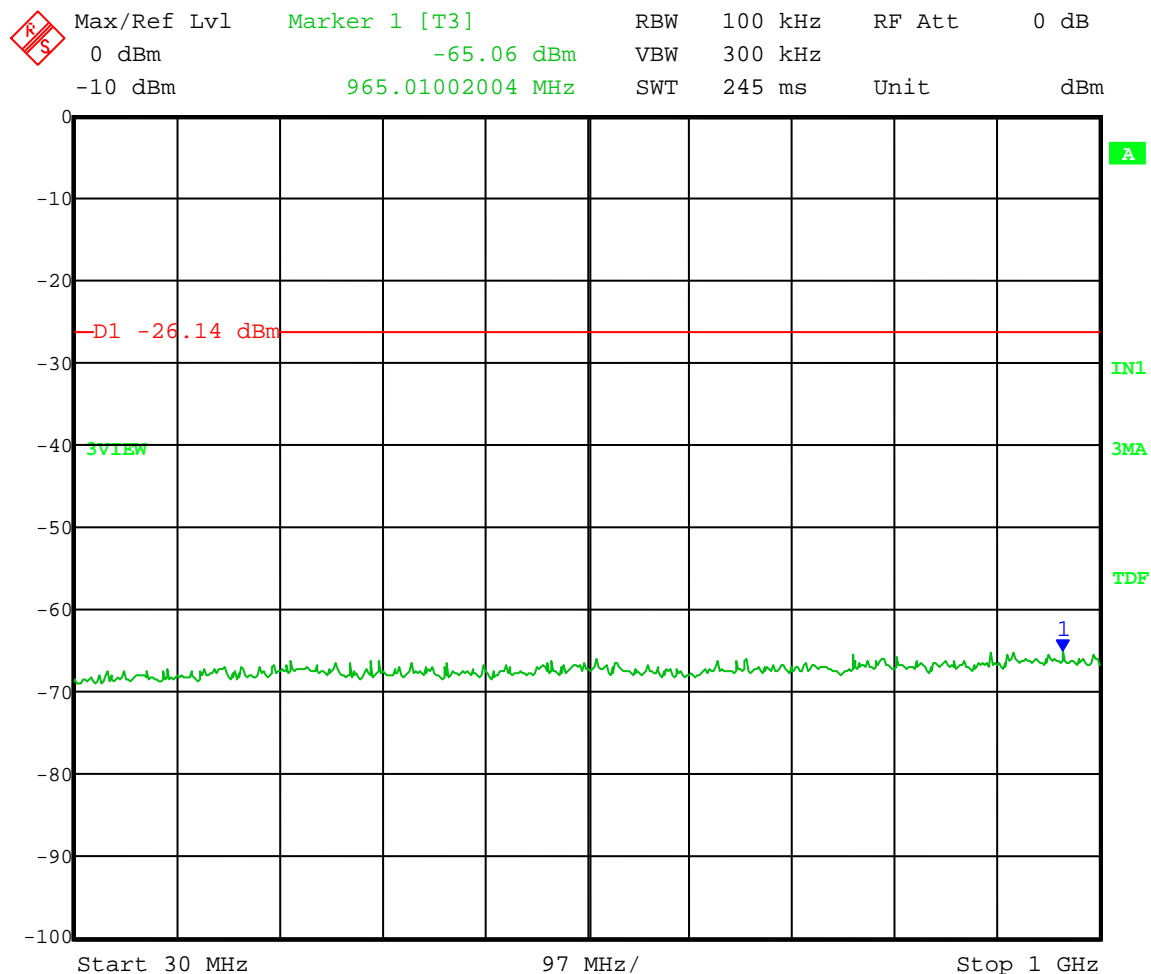
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Frequency Range: 30 – 1000 MHz

Limit = -6.14 dBm – 20 dB = -26.14 dBm



Date: 10.MAY.2012 10:11:15



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

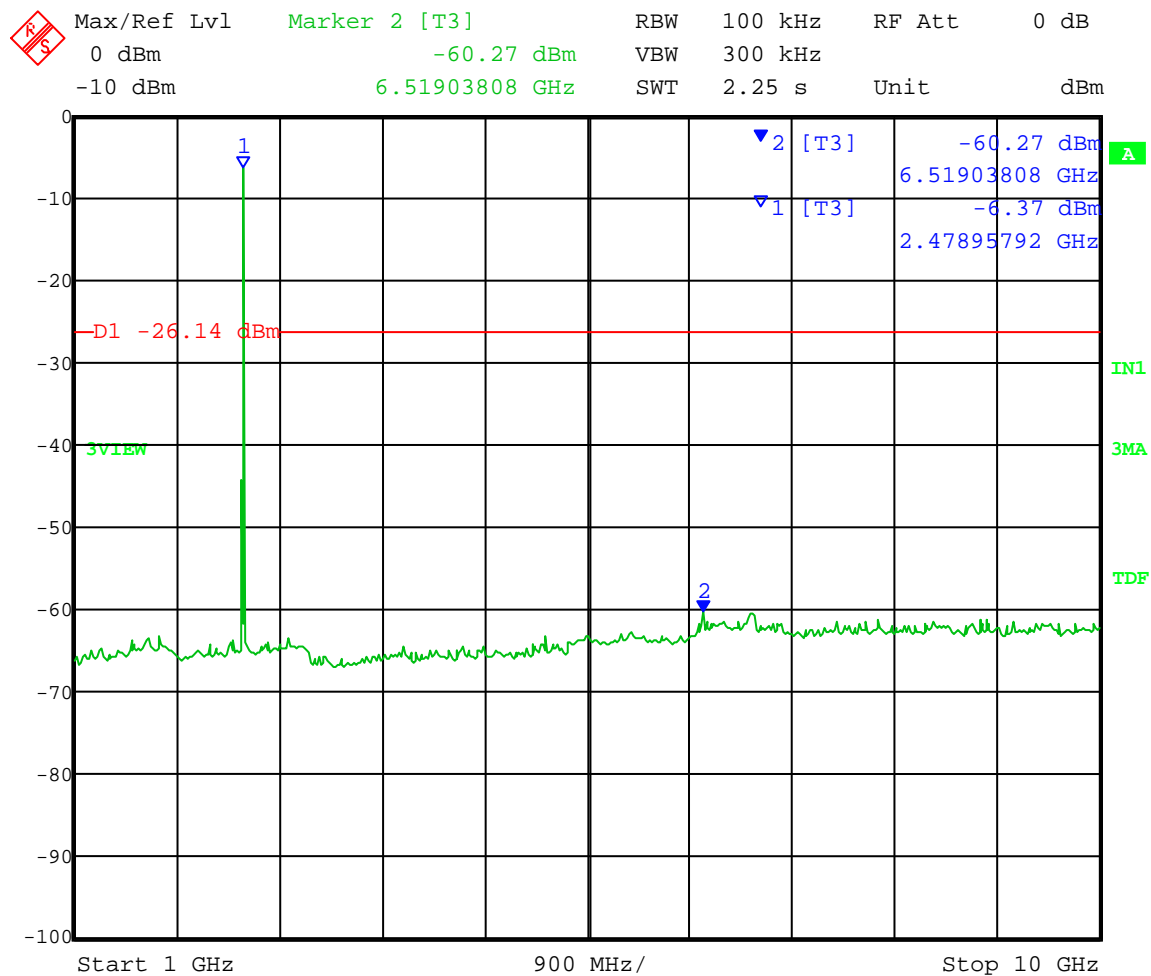
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Frequency Range: 1 – 10 GHz

Limit = -6.14 dBm – 20 dB = -26.14 dBm



Date: 10.MAY.2012 10:03:00



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

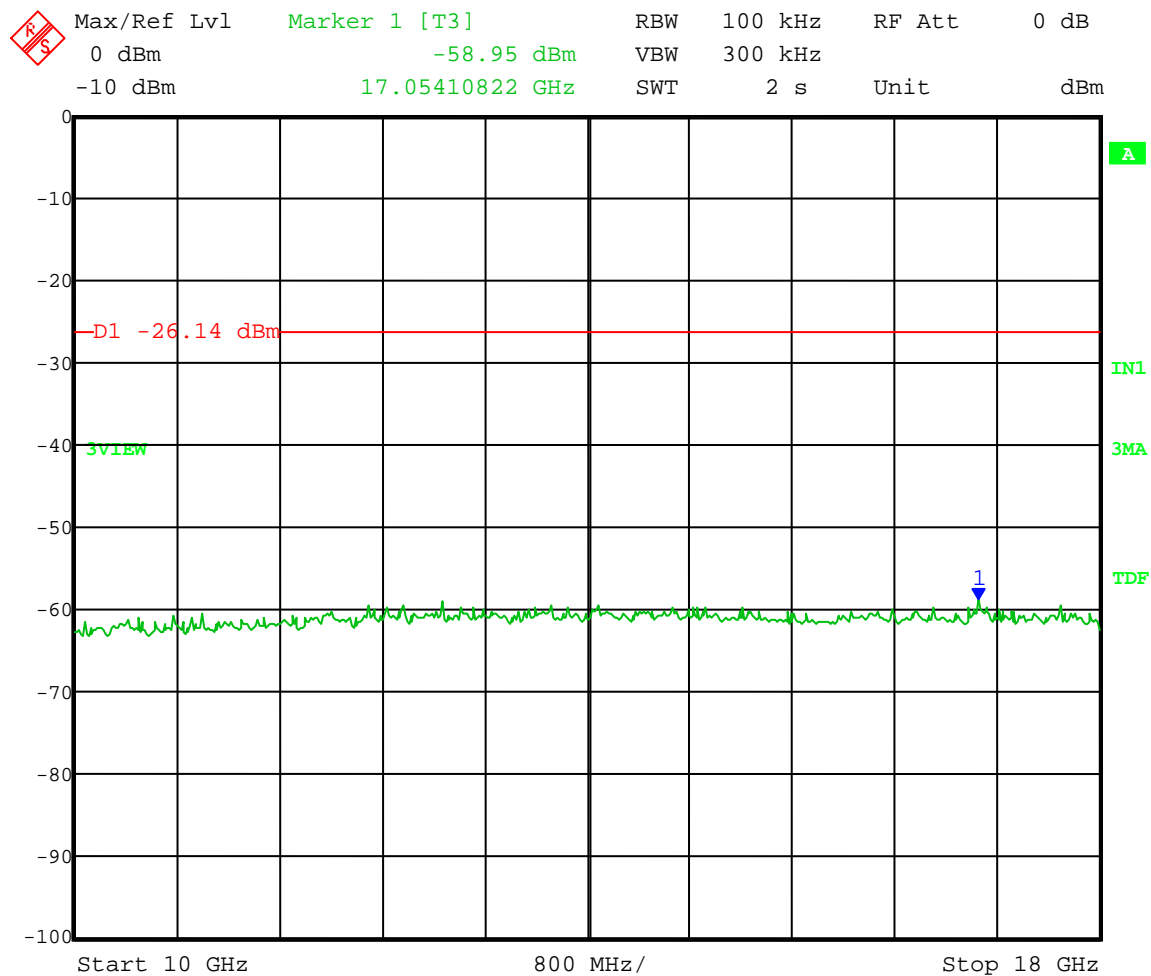
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Frequency Range: 10 – 18 GHz

Limit = -6.14 dBm – 20 dB = -26.14 dBm



Date: 10.MAY.2012 10:05:39



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Maximum Unwanted Emission Levels - Conducted
Operator: Craig B

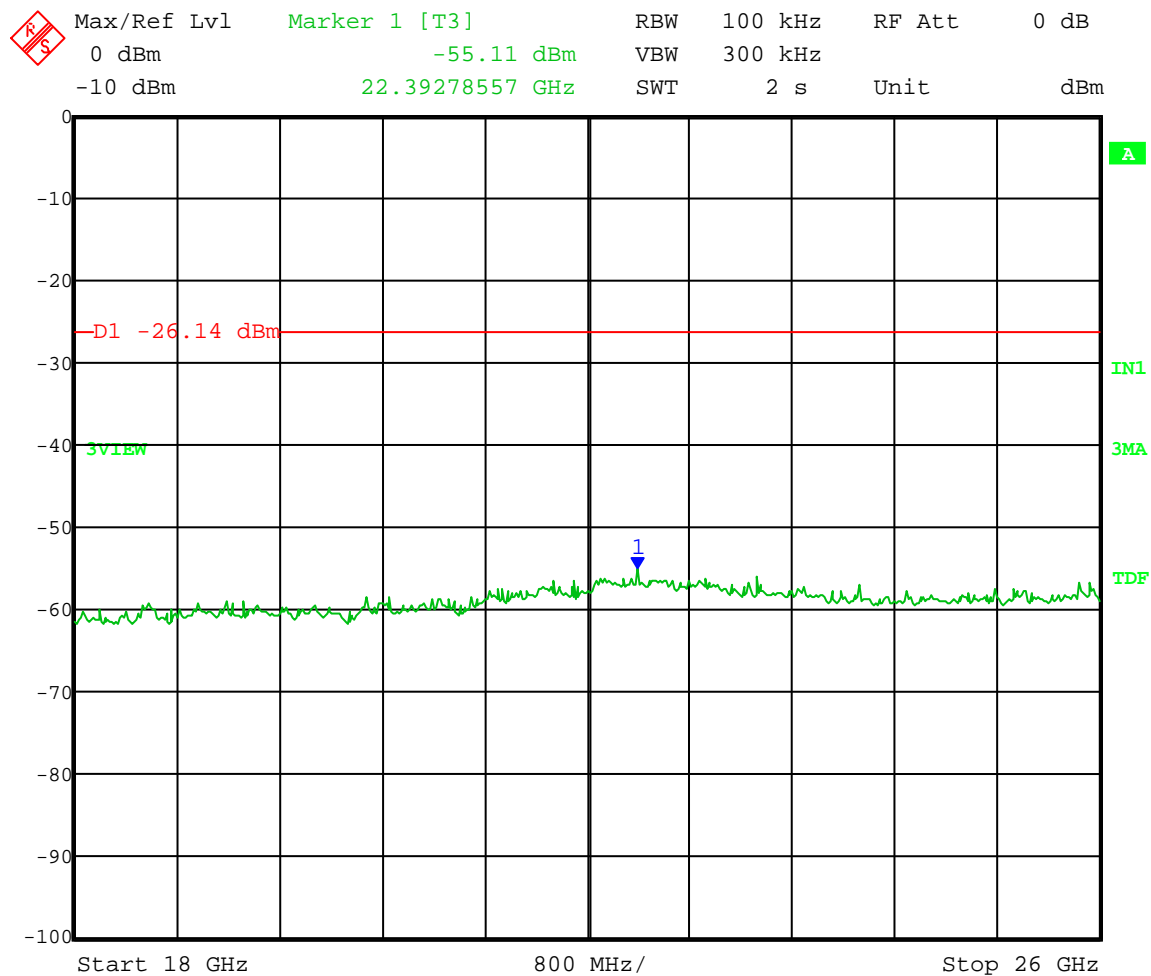
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Frequency Range: 18 – 26 GHz

Limit = -6.14 dBm – 20 dB = -26.14 dBm



Date: 10.MAY.2012 10:08:07



166 South Carter, Genoa City, WI 53128

Company:	California Eastern Laboratories
Model Tested:	ZICM357SP2-1
Report Number:	17866
DLS Project:	5130

Appendix B

5.0 Unwanted Emissions into Restricted Frequency Bands – Radiated

Rule Part:

15.247(d), 15.205(5), 15.209(a)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012
Unwanted Emissions into Restricted Frequency Bands, Section 5.4.2
Measurement Procedure – ANSI C63.10-2009

Limits:

15.209(a)

Results:

Compliant

Notes:

This was a radiated measurement. The EUT was transmitting from its integrated PCB trace antenna. The EUT was powered through a serial interface cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

FCC Part 15.209

Electric Field Strength

EUT: Gemini P2 X2
Manufacturer: California Eastern Laboratories
Operating Condition: 68 deg. F; 43% R.H.
Test Site: DLS O.F. Site 3
Operator: Craig B
Test Specification: Spurious Radiated Emissions in Restricted Bands
Comment: Continuous transmit; Channels 11, 18, and 24
Date: 05-10-2012

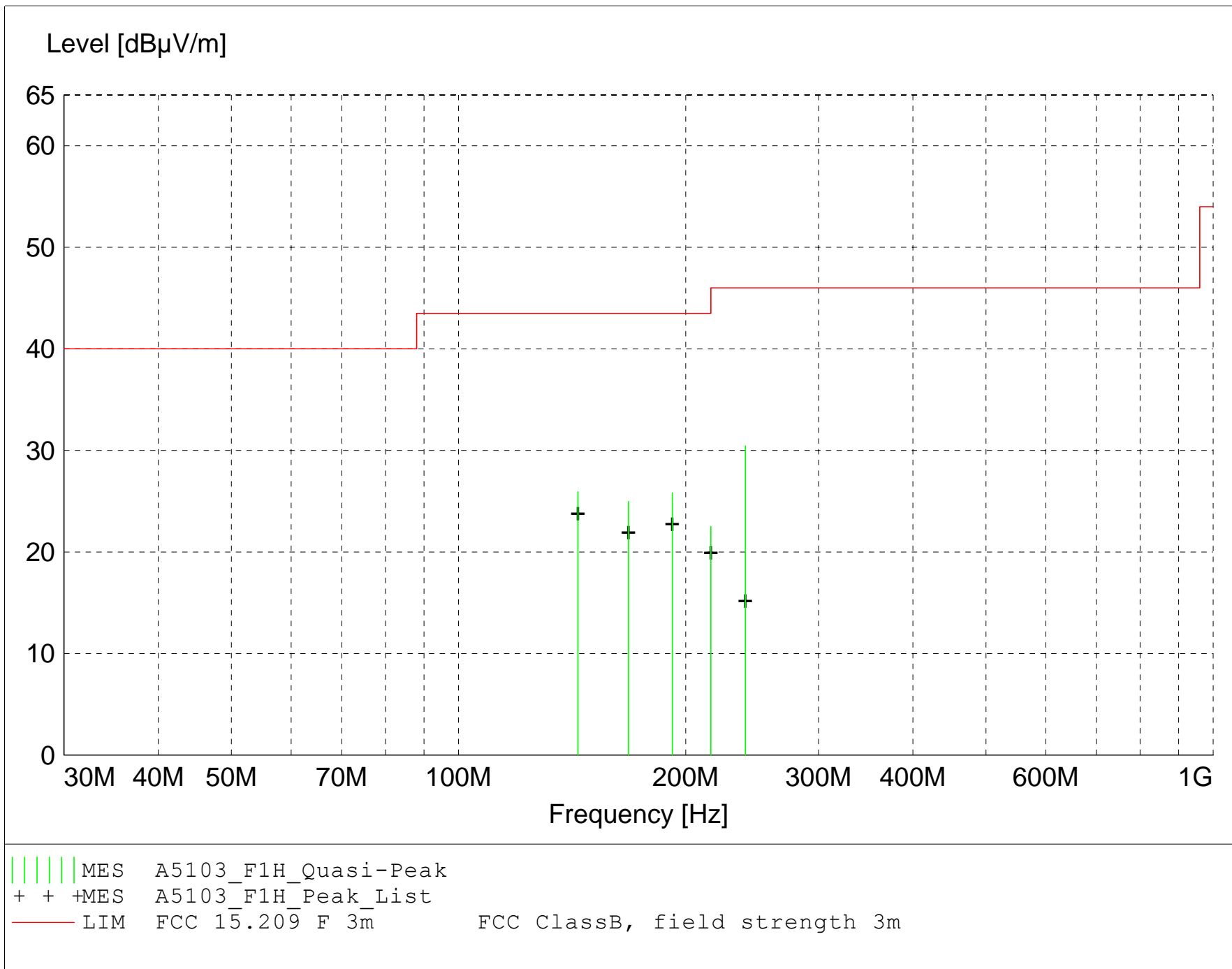
TEXT: "Horz 3 meters"

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with HORIZONTAL Antenna Polarization

Equations:
$$\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$$
$$\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$$

Graph Markers: + Frequency marker (Level of marker not related to final level)
| Final maximized level using Quasi-Peak detector
X Final maximized level using Average detector
Final maximized level using Peak detector



MEASUREMENT RESULT: "A5103_F1H_Final"

5/10/2012 2:33PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBµV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBµV/m	dB	dBµV/m	dBµV/m	dB	m	deg		
240.000000	39.91	12.00	-21.5	30.4	46.0	15.6	1.20	95	QUASI-PEAK	None
144.000000	36.31	12.10	-22.5	25.9	43.5	17.6	1.30	110	QUASI-PEAK	None
192.000000	30.44	17.40	-22.0	25.8	43.5	17.7	1.50	110	QUASI-PEAK	None
168.000000	32.94	14.20	-22.2	25.0	43.5	18.5	1.50	110	QUASI-PEAK	None
216.000000	32.42	11.76	-21.7	22.5	43.5	21.0	1.50	45	QUASI-PEAK	None

FCC Part 15.209

Electric Field Strength

EUT: Gemini P2 X2
Manufacturer: California Eastern Laboratories
Operating Condition: 68 deg. F; 43% R.H.
Test Site: DLS O.F. Site 3
Operator: Craig B
Test Specification: Spurious Radiated Emissions in Restricted Bands
Comment: Continuous transmit; Channels 11, 18, and 24
Date: 05-10-2012

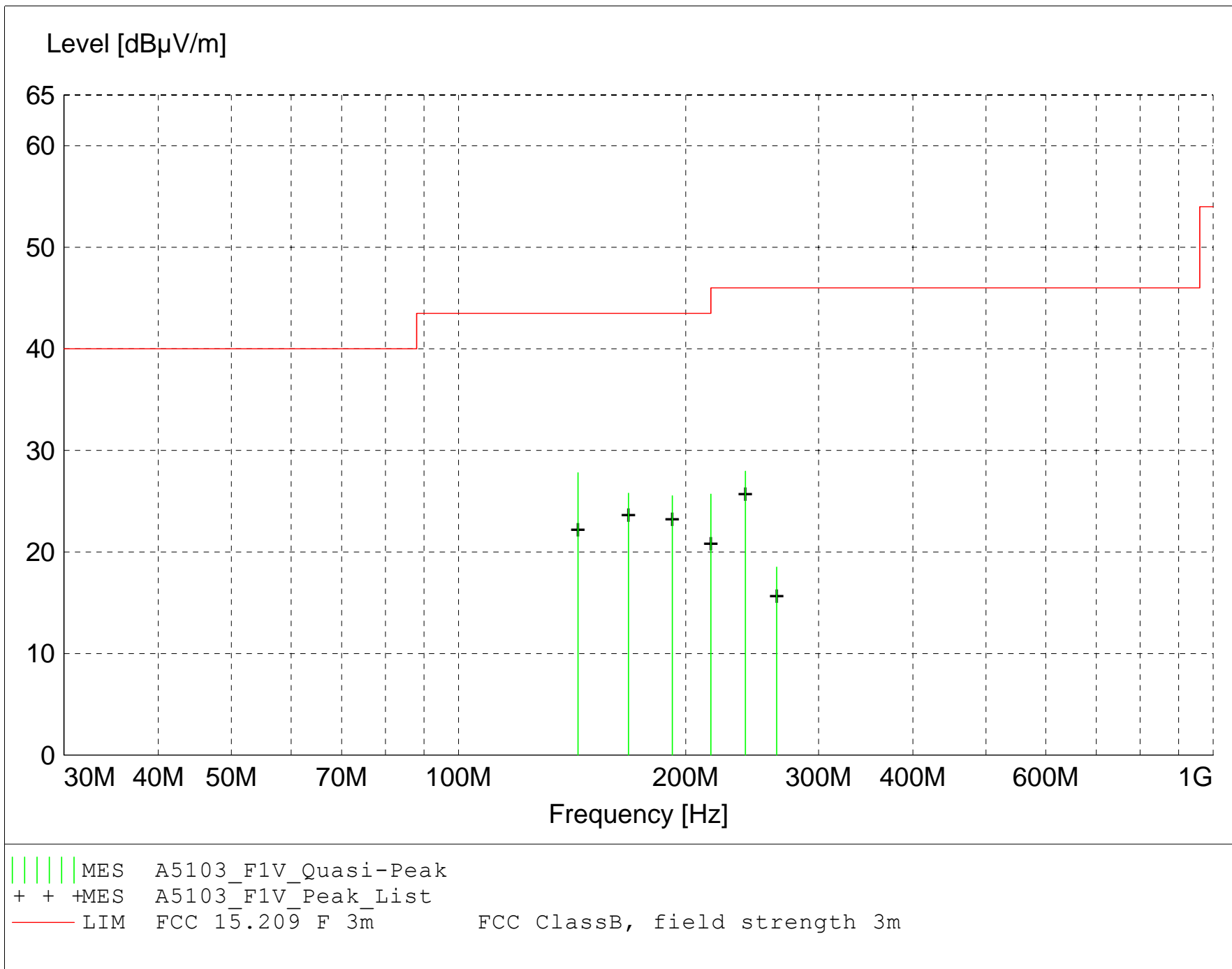
TEXT: "Vert 3 meters"

Short Description: Test Set-up

Test Set-up: EUT Measured at 3 Meters with VERTICAL Antenna Polarization

Equations: $\text{Total Level (dB}\mu\text{V/m)} = \text{Level (dB}\mu\text{V)} + \text{System Loss (dB)} + \text{Antenna Factor (dB}\mu\text{V/m)}$
 $\text{Margin (dB)} = \text{Limit (dB}\mu\text{V/m)} - \text{Total Level (dB}\mu\text{V/m)}$

Graph Markers: + Frequency marker (Level of marker not related to final level)
| Final maximized level using Quasi-Peak detector
X Final maximized level using Average detector
Final maximized level using Peak detector



MEASUREMENT RESULT: "A5103_F1V_Final"

5/10/2012 2:33PM

Frequency	Level	Antenna	System	Total	Limit	Margin	Height	EuT	Final	Comment
MHz	dBμV	Factor	Loss	Level			Ant.	Angle	Detector	
		dBμV/m	dB	dBμV/m	dBμV/m	dB	m	deg		
144.000000	38.17	12.10	-22.5	27.8	43.5	15.7	1.00	340	QUASI-PEAK	None
168.000000	33.74	14.20	-22.2	25.8	43.5	17.7	1.00	340	QUASI-PEAK	None
216.000000	35.61	11.76	-21.7	25.7	43.5	17.8	1.00	75	QUASI-PEAK	None
192.000000	30.16	17.40	-22.0	25.5	43.5	18.0	1.00	135	QUASI-PEAK	None
240.000000	37.42	12.00	-21.5	28.0	46.0	18.0	1.00	150	QUASI-PEAK	None
264.000000	26.64	13.34	-21.5	18.5	46.0	27.5	1.00	180	QUASI-PEAK	None



166 South Carter, Genoa City, WI 53128

Company: California Eastern Laboratories
Model Tested: ZICM357SP2-1
Report Number: 17866
DLS Project: 5130

Radiated Spurious Emissions in Restricted Bands

Tested at a 3 Meter Distance 1 GHz to 18 GHz

Tested at a 1 Meter Distance 18 GHz to 26 GHz

EUT: Gemini P2_X2
Manufacturer: California Eastern Laboratories
Operating Condition: 70 deg F; 62% R.H.
Test Site: Site G1
Operator: Craig B
Test Specification: FCC Part 15.247(d) and FCC Part 15.205
Comment: IEEE 802.15.4; Continuous transmit mode; Output power setting -2
Date: 05-08-2012

Notes: (1) Peak measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
(2) Average measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = CISPR Average.
(3) All other restricted band emissions at least 20 dB under the limit.

Channel 11 (2.405 GHz):

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
4.810	Average	Vert	47.44	32.94	-41.0	39.4	not used	39.4	54	14.6	Res. Band
4.810	Max Peak	Vert	55.81	32.94	-41.0	47.8	---	47.8	74	26.2	Res. Band
4.810	Average	Horz	48.50	32.94	-41.0	40.5	not used	40.5	54	13.5	Res. Band
4.810	Max Peak	Horz	56.21	32.94	-41.0	48.2	---	48.2	74	25.8	Res. Band



166 South Carter, Genoa City, WI 53128

Company: California Eastern Laboratories
 Model Tested: ZICM357SP2-1
 Report Number: 17866
 DLS Project: 5130

Radiated Spurious Emissions in Restricted Bands

Tested at a 3 Meter Distance 1 GHz to 18 GHz

Tested at a 1 Meter Distance 18 GHz to 26 GHz

EUT: Gemini P2_X2
Manufacturer: California Eastern Laboratories
Operating Condition: 70 deg F; 62% R.H.
Test Site: Site G1
Operator: Craig B
Test Specification: FCC Part 15.247(d) and FCC Part 15.205
Comment: IEEE 802.15.4; Continuous transmit mode; Output power setting -2
Date: 05-08-2012

- Notes:** (1) Peak measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
 (2) Average measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = CISPR Average.
 (3) All other restricted band emissions at least 20 dB under the limit.

Channel 18 (2.440 GHz):

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
4.880	Average	Vert	50.08	33.06	-41.5	41.7	not used	41.7	54	12.3	Res. Band
4.880	Max Peak	Vert	57.63	33.06	-41.5	49.2	---	49.2	74	24.8	Res. Band
4.880	Average	Horz	50.54	33.06	-41.5	42.1	not used	42.1	54	11.9	Res. Band
4.880	Max Peak	Horz	58.02	33.06	-41.5	49.6	---	49.6	74	24.4	Res. Band
7.320	Average	Vert	50.39	36.18	-35.2	51.4	not used	51.4	54	2.6	Res. Band
7.320	Max Peak	Vert	58.41	36.18	-35.2	59.4	---	59.4	74	14.6	Res. Band
7.320	Average	Horz	50.50	36.18	-35.2	51.5	not used	51.5	54	2.5	Res. Band
7.320	Max Peak	Horz	58.54	36.18	-35.2	59.5	---	59.5	74	14.5	Res. Band



166 South Carter, Genoa City, WI 53128

Company: California Eastern Laboratories
 Model Tested: ZICM357SP2-1
 Report Number: 17866
 DLS Project: 5130

Radiated Spurious Emissions in Restricted Bands

Tested at a 3 Meter Distance 1 GHz to 18 GHz

Tested at a 1 Meter Distance 18 GHz to 26 GHz

EUT: Gemini P2_X2
Manufacturer: California Eastern Laboratories
Operating Condition: 65 deg F; 43% R.H.
Test Site: Site G1
Operator: Craig B
Test Specification: FCC Part 15.247(d) and FCC Part 15.205
Comment: IEEE 802.15.4; Continuous transmit mode; Output power setting -2
Date: 04-20-2012

- Notes:** (1) Peak measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = Peak.
 (2) Average measurements were taken with RBW = 1 MHz, VBW = 3 MHz, Detector = CISPR Average.
 (3) All other restricted band emissions at least 20 dB under the limit.

Channel 24 (2.470 GHz):

Frequency (GHz)	Measurement Type	Ant. Pol.	Level (dBuV)	Antenna Factor (dB/m)	System Loss (dB)	Total Level (dBuV/m)	Duty Cycle Correction (dB)	Final Corrected (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Comment
4.940	Average	Vert	40.96	33.17	-42.9	31.2	not used	31.2	54	22.8	Res. Band
4.940	Max Peak	Vert	51.31	33.17	-42.9	41.6	---	41.6	74	32.4	Res. Band
4.940	Average	Horz	47.69	33.17	-42.9	37.9	not used	37.9	54	16.1	Res. Band
4.940	Max Peak	Horz	55.97	33.17	-42.9	46.2	---	46.2	74	27.8	Res. Band
7.410	Average	Vert	51.29	36.42	-36.2	51.5	not used	51.5	54	2.5	Res. Band
7.410	Max Peak	Vert	59.16	36.42	-36.2	59.4	---	59.4	74	14.6	Res. Band
7.410	Average	Horz	50.24	36.42	-36.2	50.3	not used	50.3	54	3.7	Res. Band
7.410	Max Peak	Horz	58.11	36.42	-36.2	58.2	---	58.2	74	15.8	Res. Band



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Appendix B

6.0 Band-Edge Measurements – RF Conducted

Rule Part:

15.247(d)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012
Measurement Procedure – Reference Level, Section 5.4.1.1
Measurement Procedure – Unwanted Emissions, Section 5.4.1.2
Band-Edge Measurements, Section 5.4.2.2.4

Limit:

The peak conducted output power measured within any 100 kHz outside the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum measured in-band peak PSD level.

Results:

Compliant

Notes:

This was an RF conducted measurement. The EUT was connected to the measuring equipment through an SMA connector soldered in place of the antenna. Cable loss and attenuation was accounted for in the transducer factors set in the analyzer.

The EUT was powered through a cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

The highest channel (channel 26) power setting was reduced from -2 to -26 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

The next-to-highest channel (channel 25) power setting was reduced from -2 to -6 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

Testing was also performed on channel 24 to show that the output power setting for this channel does not need to be lowered to meet the band-edge requirements.



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Band-Edge Measurements - Conducted
Operator: Craig B

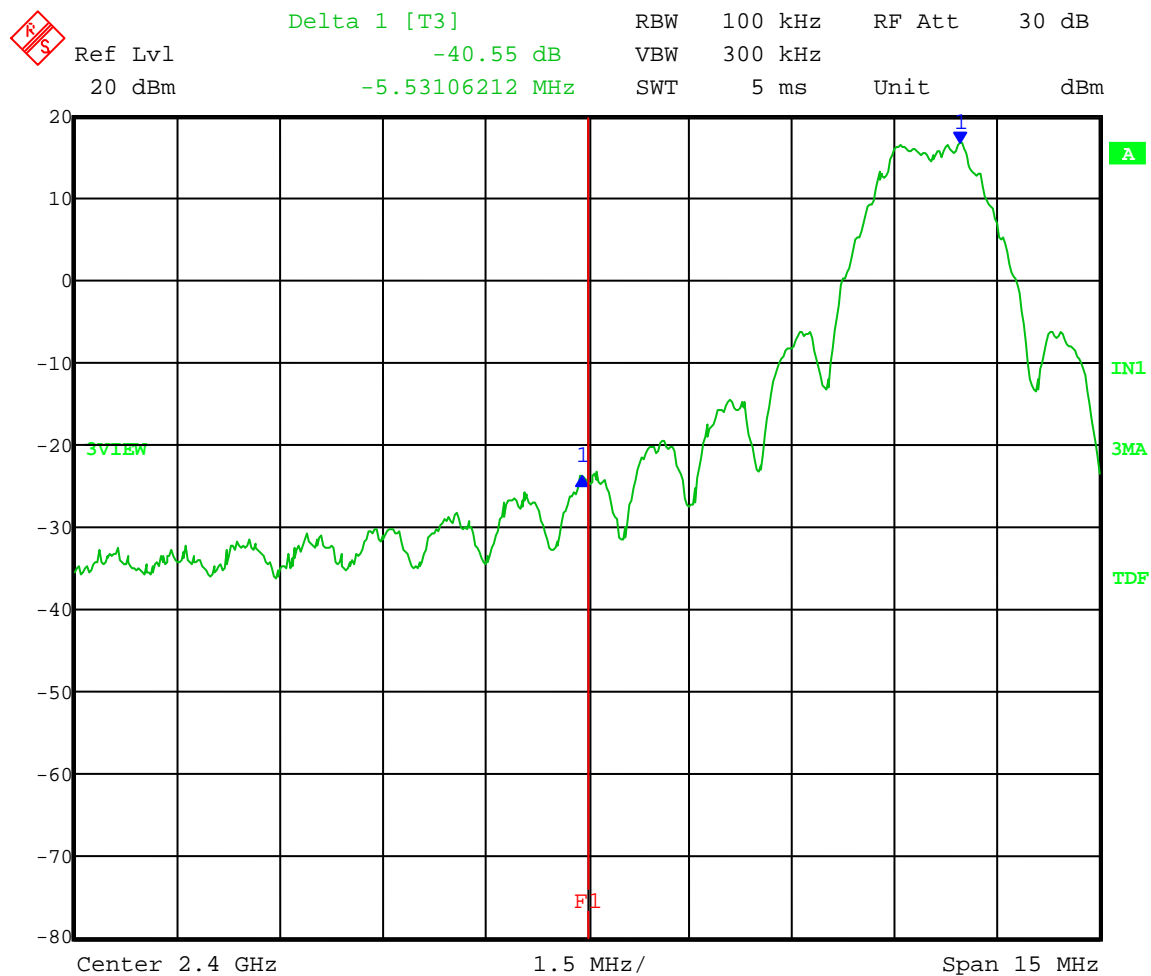
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Low Channel: Transmit = 2.405 GHz

Output power setting -2

Limit: Band-Edge > 20 dB Below Peak In-Band Emission

Band-Edge Frequency = 2.4 GHz



Date: 10.MAY.2012 09:07:59



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Band-Edge Measurements - Conducted
Operator: Craig B

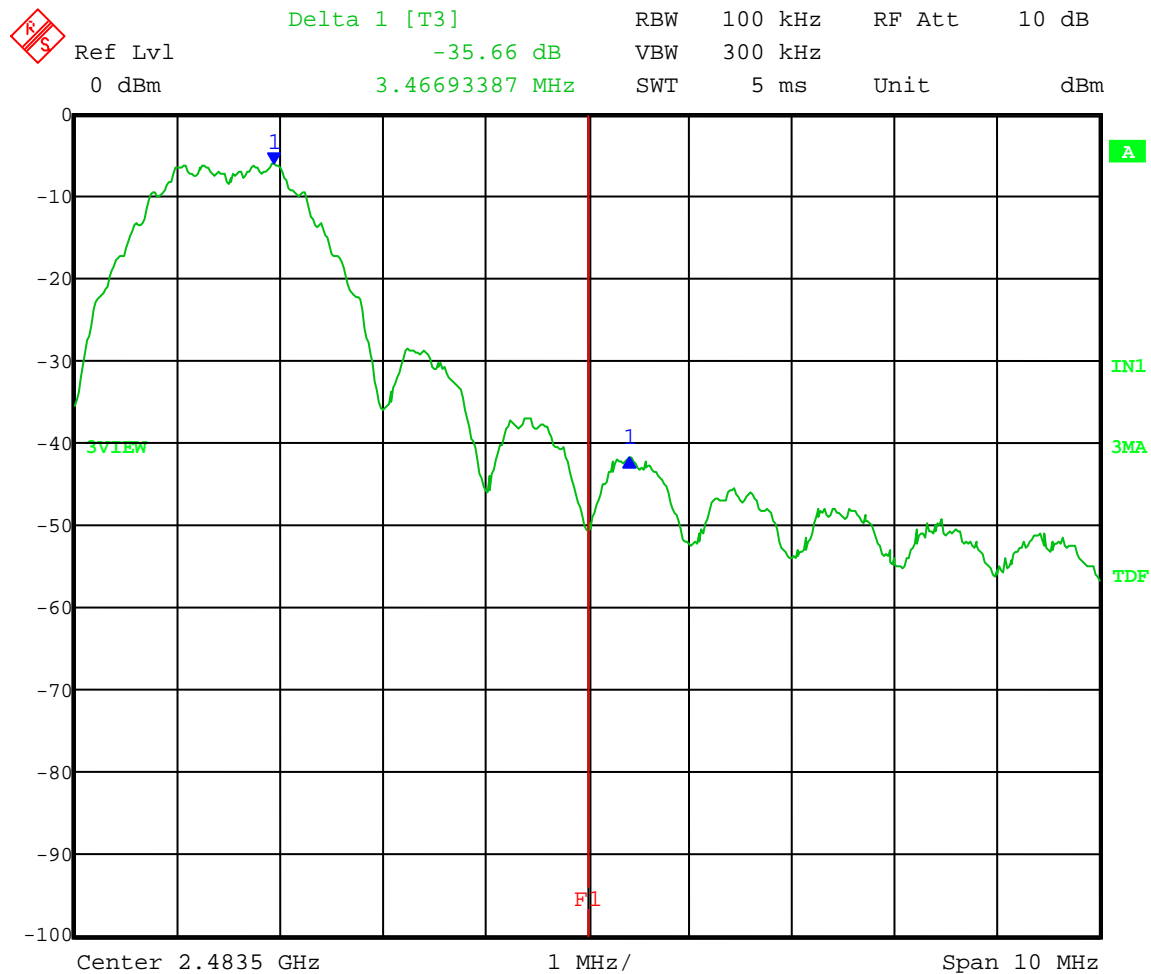
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

High Channel Transmit = 2.480 GHz

Output power setting -26

Limit: Band-Edge > 20 dB Below Peak In-Band Emission

Band-Edge Frequency = 2.4835 GHz



Date: 10.MAY.2012 09:02:32



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Band-Edge Measurements - Conducted
Operator: Craig B

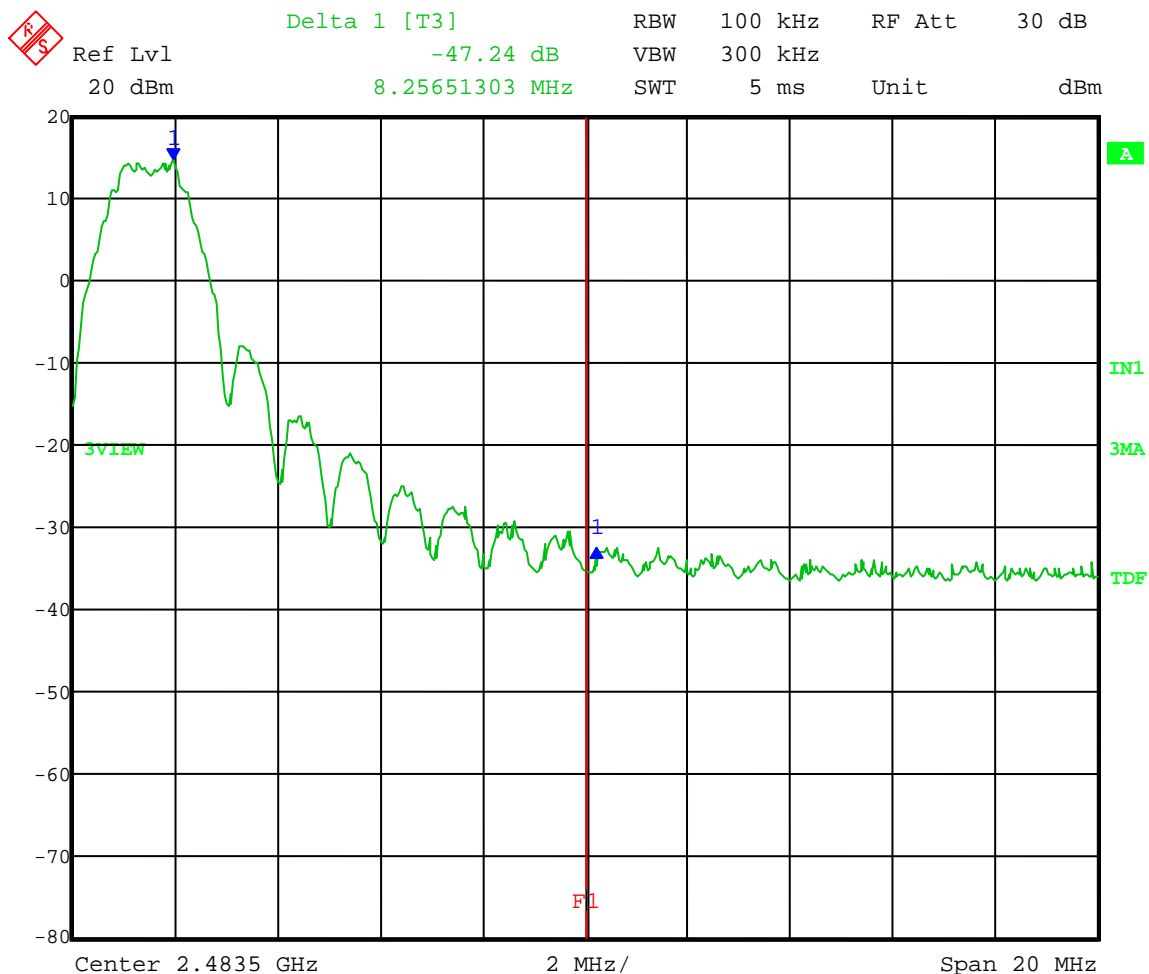
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Channel 25 Transmit = 2.475 GHz

Output power setting -6

Limit: Band-Edge > 20 dB Below Peak In-Band Emission

Band-Edge Frequency = 2.4835 GHz



Date: 10.MAY.2012 08:54:21



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-10-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Band-Edge Measurements - Conducted
Operator: Craig B

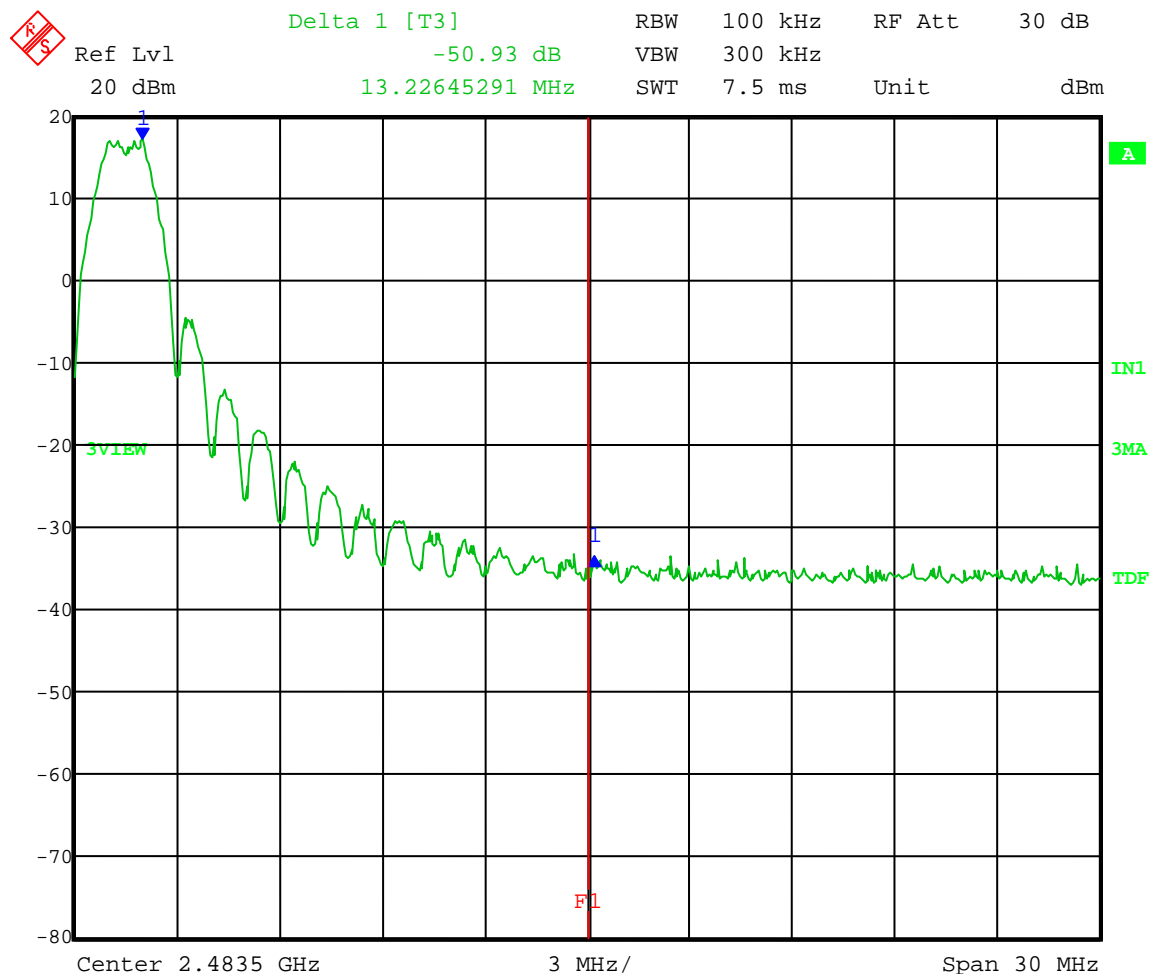
Comment: RBW = 100 kHz
VBW \geq 300 kHz
Detector = Peak
Sweep = auto couple
Trace = max hold

Channel 24 Transmit = 2.470 GHz

Output power setting -2

Limit: Band-Edge > 20 dB Below Peak In-Band Emission

Band-Edge Frequency = 2.4835 GHz



Date: 10.MAY.2012 08:48:39



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Appendix B

7.0 Band-Edge Measurements – Radiated

Rule Part:

15.247(d)

Test Procedure:

558074 D01 DTS Meas Guidance v01, 01/18/2012
Unwanted Emissions into Restricted Frequency Bands, Section 5.4.2
Measurement Procedure – ANSI C63.10-2009
Marker-Delta Method – ANSI C63.10:2009, Section 6.9.3

Limit:

15.209(a)

Results:

Compliant

Notes:

This was a radiated measurement. The EUT was transmitting from its integrated PCB trace antenna. The EUT was powered through a serial interface cable that was connected to the bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation on the low, middle, and high channels of the operating band.

The highest channel (channel 26) power setting was reduced from -2 to -26 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

The next-to-highest channel (channel 25) power setting was reduced from -2 to -6 to meet the radiated upper band-edge requirement at the 2.4835 GHz restricted frequency band edge.

Testing was also performed on channel 24 to show that the output power setting for this channel does not need to be lowered to meet the band-edge requirements.



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

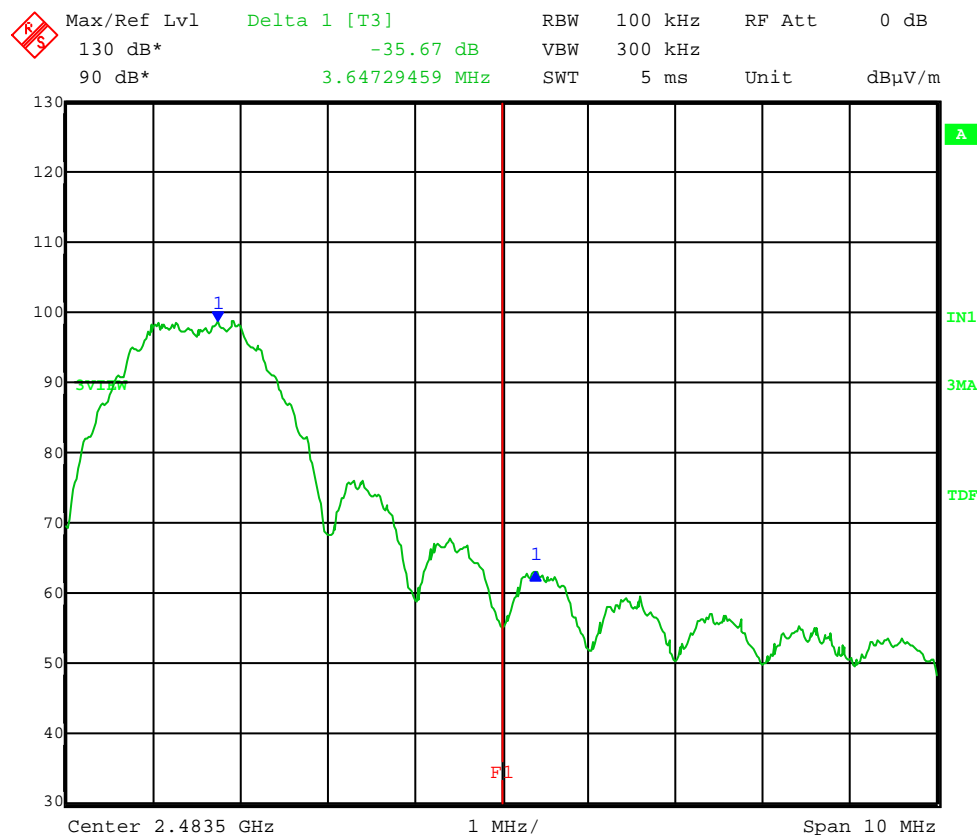
California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge Radiated – Marker Delta Method
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: **Channel 26: Frequency – 2.480 GHz**
Power setting -26

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in ANSI C63.10:2009 Section 6.9.3. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

Power setting reduced from -2 to -26.

Frequency (MHz)	Antenna Polarity (H/V)	Fundamental Field Strength (dBμV/m)	Duty Cycle Correction (dB)	Delta-Marker (dB)	Band-Edge Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2480 (Peak)	V	95.67	N/A	35.67	60.00	74	14.00
2480 (Avg)	V	91.61	3.6	35.67	52.34	54	1.66



Date: 9.MAY.2012 10:09:13



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

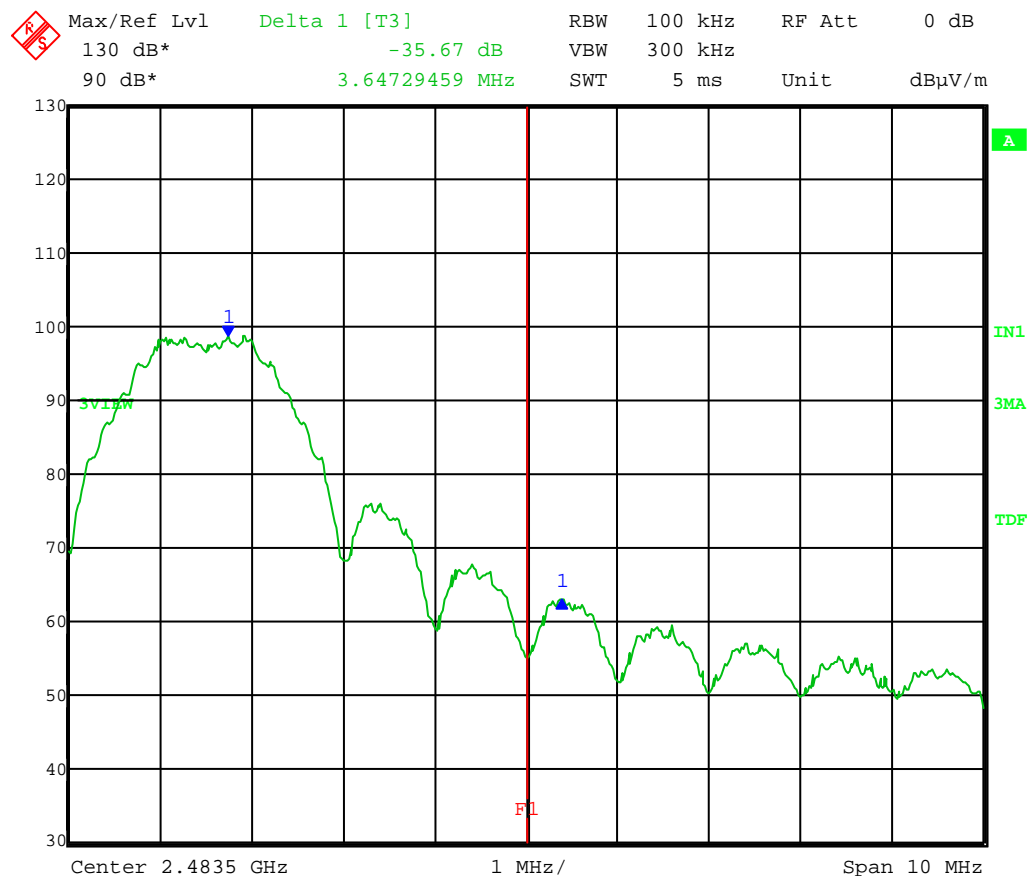
California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge Radiated – Marker Delta Method
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: **Channel 26: Frequency – 2.480 GHz**
Power setting -26

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in ANSI C63.10:2009 Section 6.9.3. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

Power setting reduced from -2 to -26.

Frequency (MHz)	Antenna Polarity (H/V)	Fundamental Field Strength (dB μ V/m)	Duty Cycle Correction (dB)	Delta-Marker (dB)	Band-Edge Field Strength (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
2480 (Peak)	H	95.35	N/A	35.67	59.68	74	14.32
2480 (Avg)	H	91.45	3.6	35.67	52.18	54	1.82



Date: 9.MAY.2012 10:09:13



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

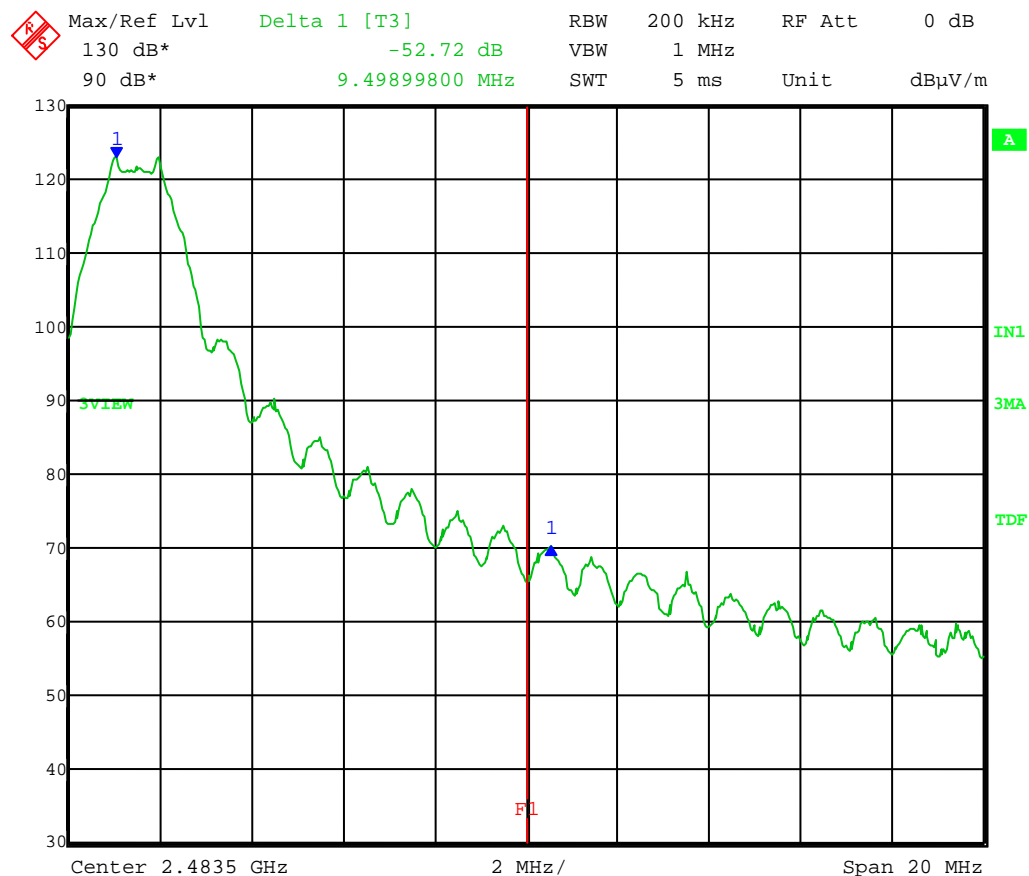
California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge Radiated – Marker Delta Method
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: **Channel 25: Frequency – 2.475 GHz**
Power setting -6

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in ANSI C63.10:2009 Section 6.9.3. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

Power setting reduced from -2 to -6.

Frequency (MHz)	Antenna Polarity (H/V)	Fundamental Field Strength (dBμV/m)	Duty Cycle Correction (dB)	Delta-Marker (dB)	Band-Edge Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2475 (Peak)	V	113.33	N/A	52.72	60.61	74	13.39
2475 (Avg)	V	109.84	3.6	52.72	53.52	54	0.48



Date: 9.MAY.2012 09:51:35



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

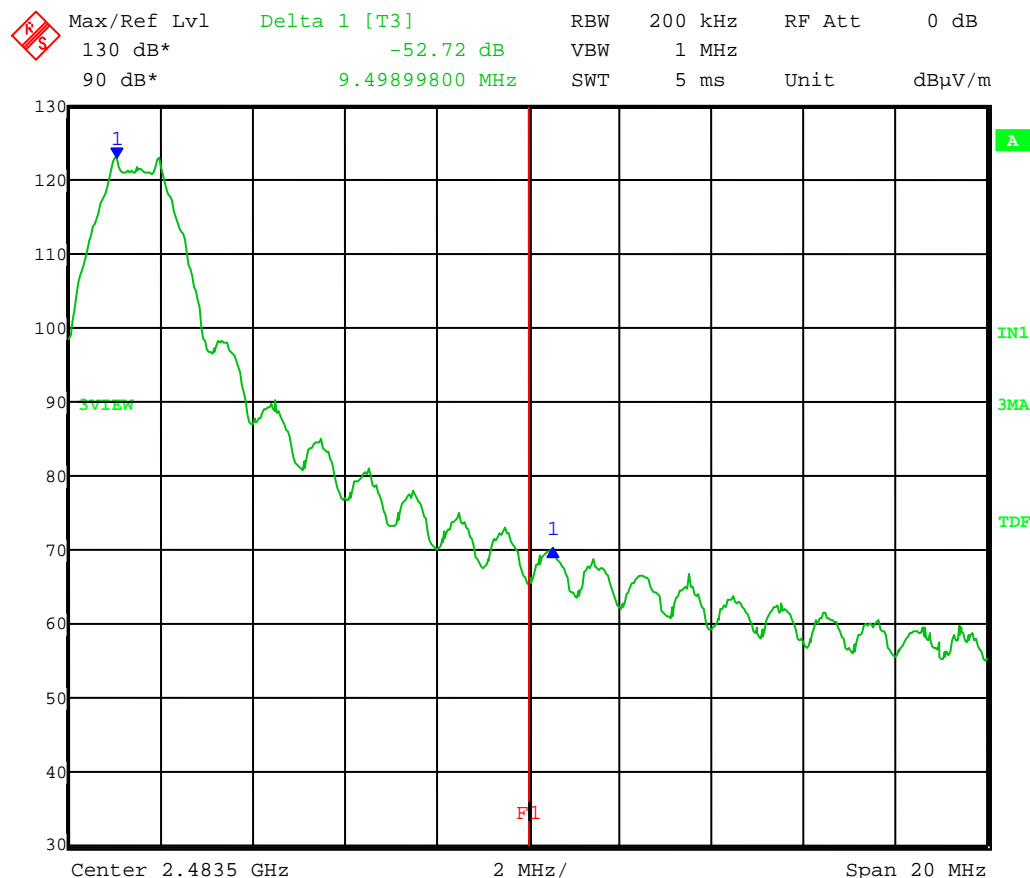
California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge Radiated – Marker Delta Method
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: **Channel 25: Frequency – 2.475 GHz**
Power setting -6

Because the upper band-edge coincides with a restricted band, band-edge compliance for the upper band-edge was determined using the radiated mark-delta method as outlined in ANSI C63.10:2009 Section 6.9.3. The radiated field strength of the fundamental emission was first determined and then the mark-delta method was used to determine the field strength of the band-edge emissions.

Power setting reduced from -2 to -6.

Frequency (MHz)	Antenna Polarity (H/V)	Fundamental Field Strength (dBμV/m)	Duty Cycle Correction (dB)	Delta-Marker (dB)	Band-Edge Field Strength (dBμV/m)	Limit (dBμV/m)	Margin (dB)
2475 (Peak)	H	113.33	N/A	52.72	60.61	74	13.39
2475 (Avg)	H	109.82	3.6	52.72	53.50	54	0.50



Date: 9.MAY.2012 09:51:35



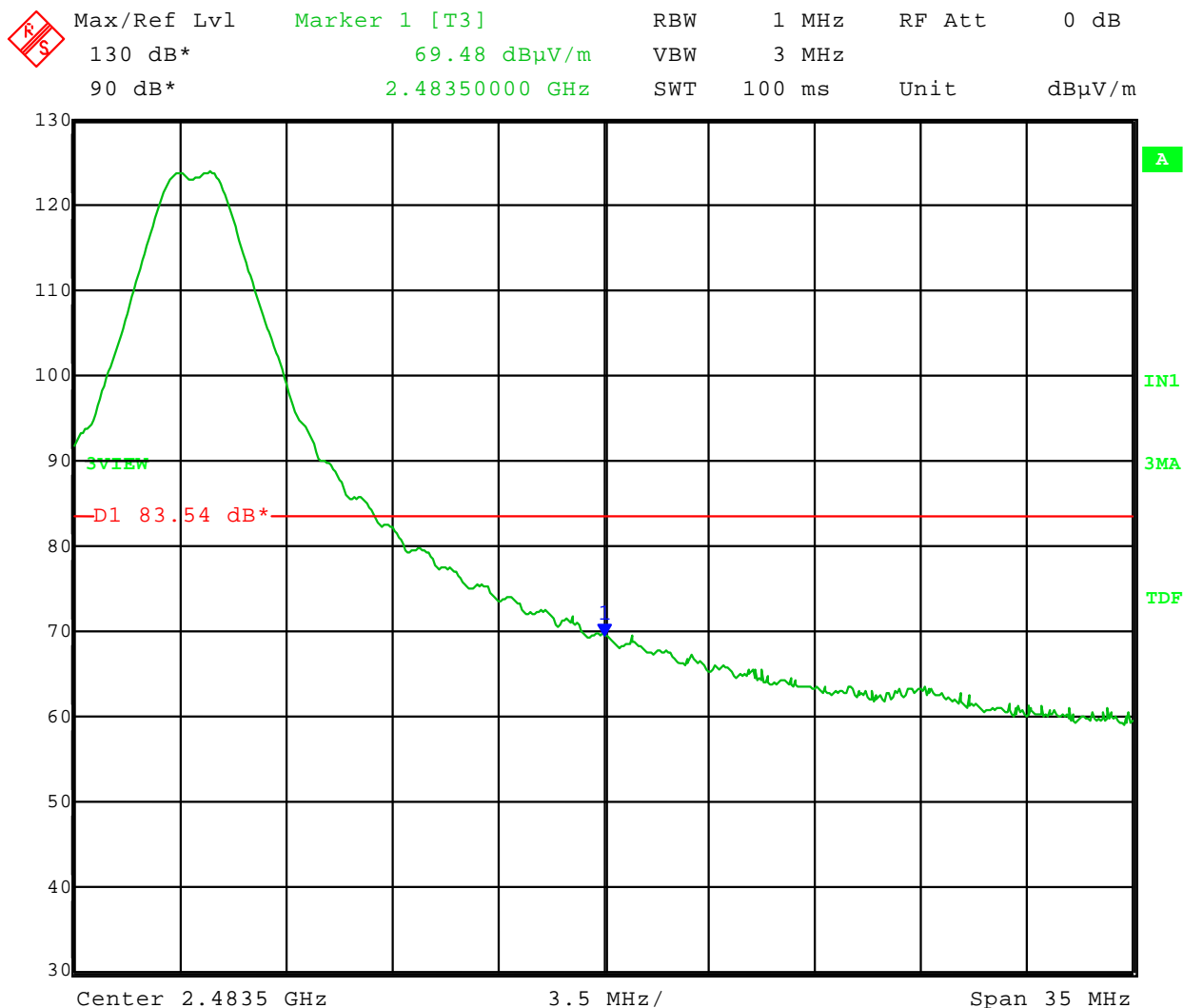
166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-08-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge - Radiated
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: Channel 24: Frequency - 2.470 GHz
Power setting -2 (full power)

Vertical polarization
Detector: Peak
Test distance: 1 meter
Limit 83.54 dB μ V/m



Date: 8.MAY.2012 15:59:02



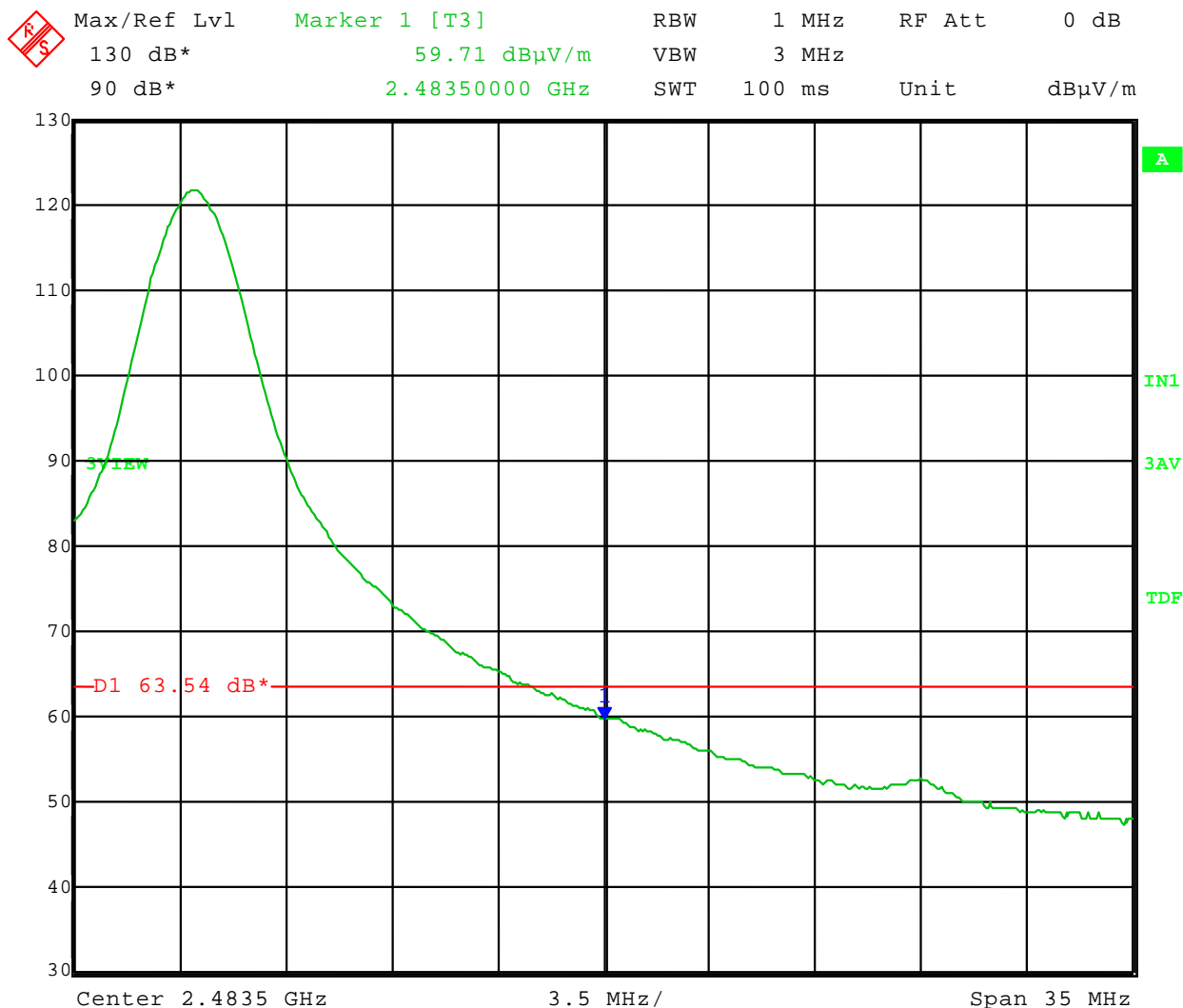
166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-08-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge - Radiated
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: Channel 24: Frequency – 2.470 GHz
Power setting -2 (full power)

Vertical polarization
Detector: Average
Test distance: 1 meter
Limit 63.54 dB μ V/m



Date: 8.MAY.2012 15:57:25



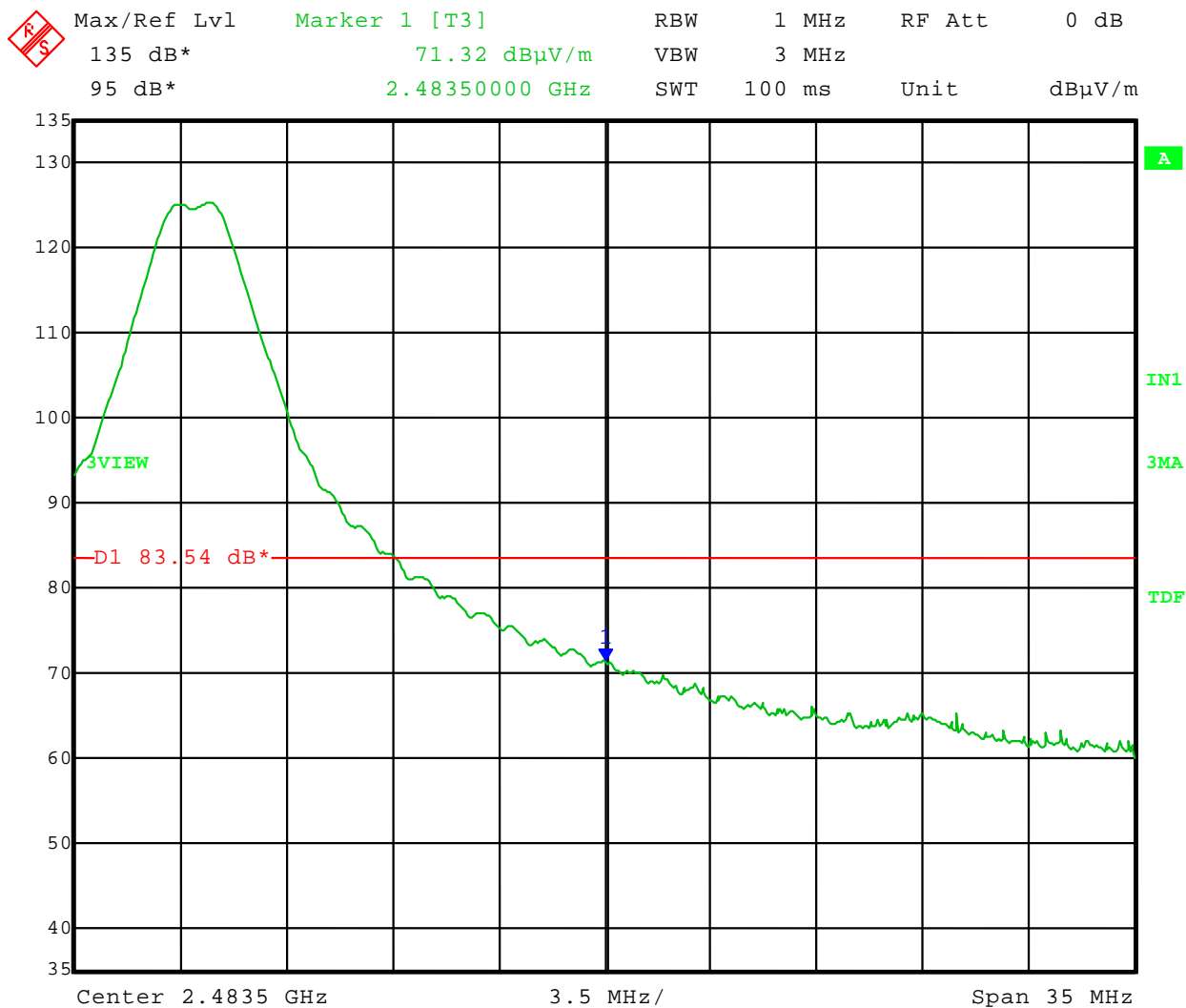
166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge - Radiated
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: Channel 24: Frequency – 2.470 GHz
Power setting -2 (full power)

Horizontal polarization
Detector: Peak
Test distance: 1 meter
Limit 83.54 dB μ V/m



Date: 9.MAY.2012 14:56:12



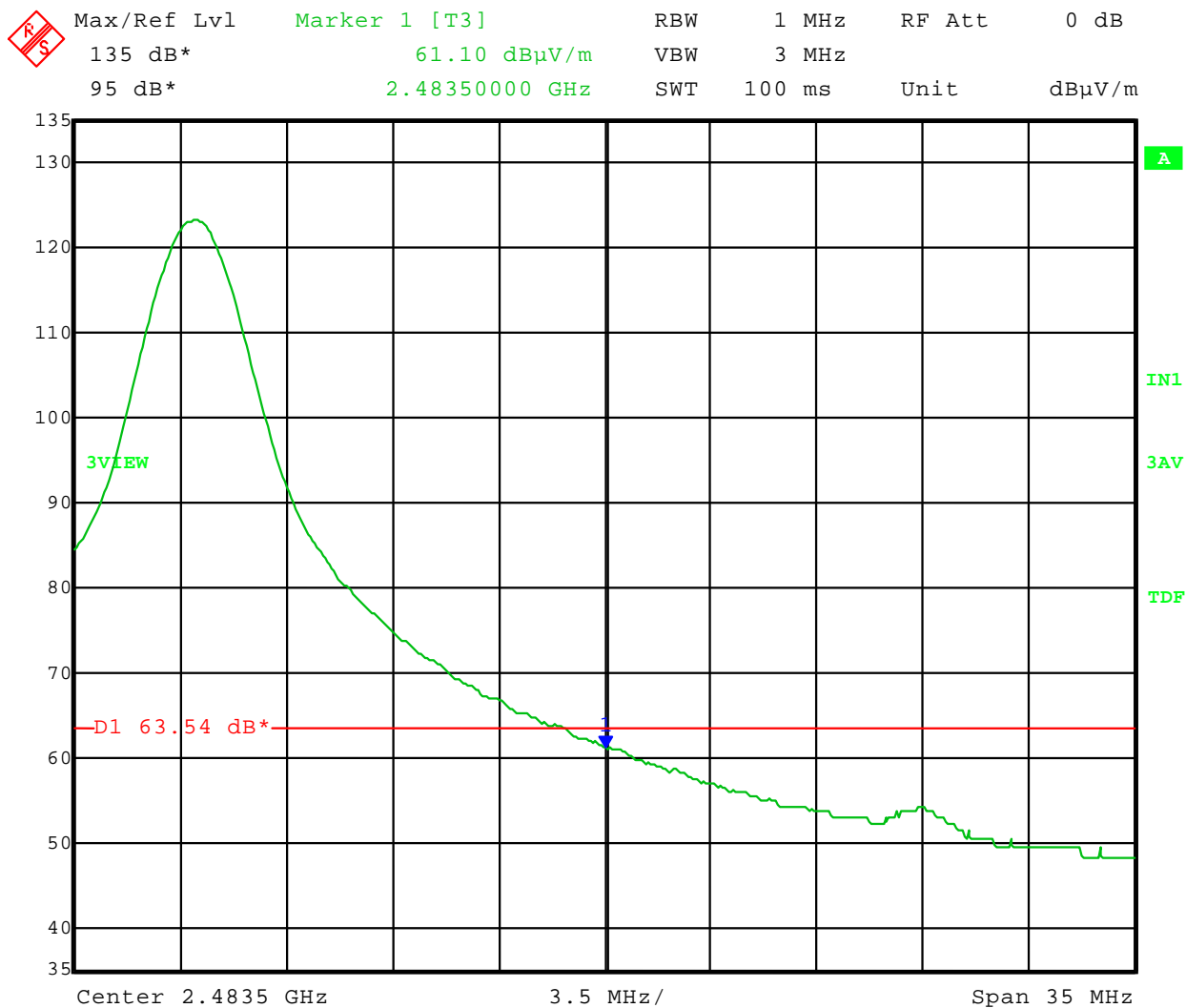
166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Test Date: 05-09-2012
Company: California Eastern Laboratories
EUT: Gemini P2_X2
Test: Upper Band-Edge - Radiated
Rule part: FCC Part 15.247(d) and FCC Part 15.205
Operator: Craig B
Comment: Channel 24: Frequency – 2.470 GHz
Power setting -2 (full power)

Horizontal polarization
Detector: Average
Test distance: 1 meter
Limit 63.54 dB μ V/m



Date: 9.MAY.2012 14:54:52



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Appendix B

8.0 Duty Cycle

Rule Part:

15.35(c)

Limit:

N/A

Results:

Duty Cycle Correction Factor: 3.6 dB

Sample Equation(s):

Next page

Notes:

Worst case duty cycle was provided by the manufacturer. It was calculated based on theoretical Zigbee/ MAC performance. "Theoretical Zigbee" allows up to 100% duty cycle. This device is designed so that it cannot use a duty cycle greater than what was used to compute the duty cycle correction factor. KDB 558074 D01 Meas Guidance v01 allows for field strength measurement reduction per FCC 15.35(c), and ANSI C63.10. ZigBee is a DTS type device, therefore the DTS measurement procedures and 15.35(c) apply. See attached documentation.

Transmit Power Duty Cycle

IEEE 802.15.4-2003 2.4 GHz PHY Constants

Data Rate	250000	bits / sec
	31250	bytes / sec
Symbols/byte	2	sym / bytes
Symbol Timing	62500	sym / sec
	0.000016	sec / sym
Byte Timing	0.000032	sec / byte

PHY PSDU	6	bytes	4 Preamble, SPD, Length
Max Length	127	bytes	
Total Packet Length	133	bytes	
Maximum Time TX PKT	0.004256	sec	

Long Frame Scenario:

- 1) TX Frame
 - 2) Wait for ACK
 - 3) RX ACK
 - 4) CPU Processing of ACK
 - 5) Wait for Backoff
 - 6) Repeat 1)
- Assume Frame is Data Frame

MAC-Level Calculation (Long Frame)

Long Frame	127	bytes	
ACK Frame	5	bytes	
tack	12	sym	
Backoff Period	20	sym	
Maximum Backoff	7		Random between 0 and 7
Backoff Required	2		
Backoff Time	70	sym	Average at 3.5

Transmit Time	
Total TX Time (sec)	0.004256

(Long Frame + PHY Header) * seconds/byte

NOT Transmit time (RX or Idle)	
Wait for ACK (tack)	0.000192
RX Time (ACK)	0.000352
Backoff Time (tbo)	0.00112
CPU Processing (tcpu)	0.0002
CCA Assessment (tcca)	0.000128
Turn Around Time (RX to TX)	0.000192
Total Off Time (sec)	0.002184

(Backoff Time * Backoff Period)
 (0.2ms average on EM2xx running EmberZNet)
 (averaged over 8 symbols in RX Mode)
 (After CCA, Radio turns over to TX in 12 symbols)

Total Time (ttotal)	0.00644
Number of RX / TX cycles in 100ms	15.5279503

Time for one complete packet including non-transmit time.

Worse Case (100ms window)

TX Frame 15.5 times	0.065968	seconds
RX or IDLE 15.5 Times	0.033852	seconds
Sum	0.09982	seconds

MAC TX Duty Cycle (On /total)	66.09%		Represents theoretical ZigBee / MAC performance
	3.59768496	dB	(This number used for FCC compliance testing.)



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

Appendix B

9.0 Measurement Data - Line Conducted Emissions

Rule Part:

15.207

Test Procedure:

ANSI C63.10-2009

Limit:

15.207(a)

Results:

Compliant

Notes:

This was power line conducted measurement. Since a representative external power supply was not available at the time of test, measurements were made on the DC power input to the EUT.

The EUT was powered through a cable that was connected to a Line Impedance Stabilization Network, which was powered from a DC bench supply set to 3.6 VDC. The EUT was set to transmit continuously at its maximum power, with a modulating signal representative of the worst-case signal encountered in a real system operation.

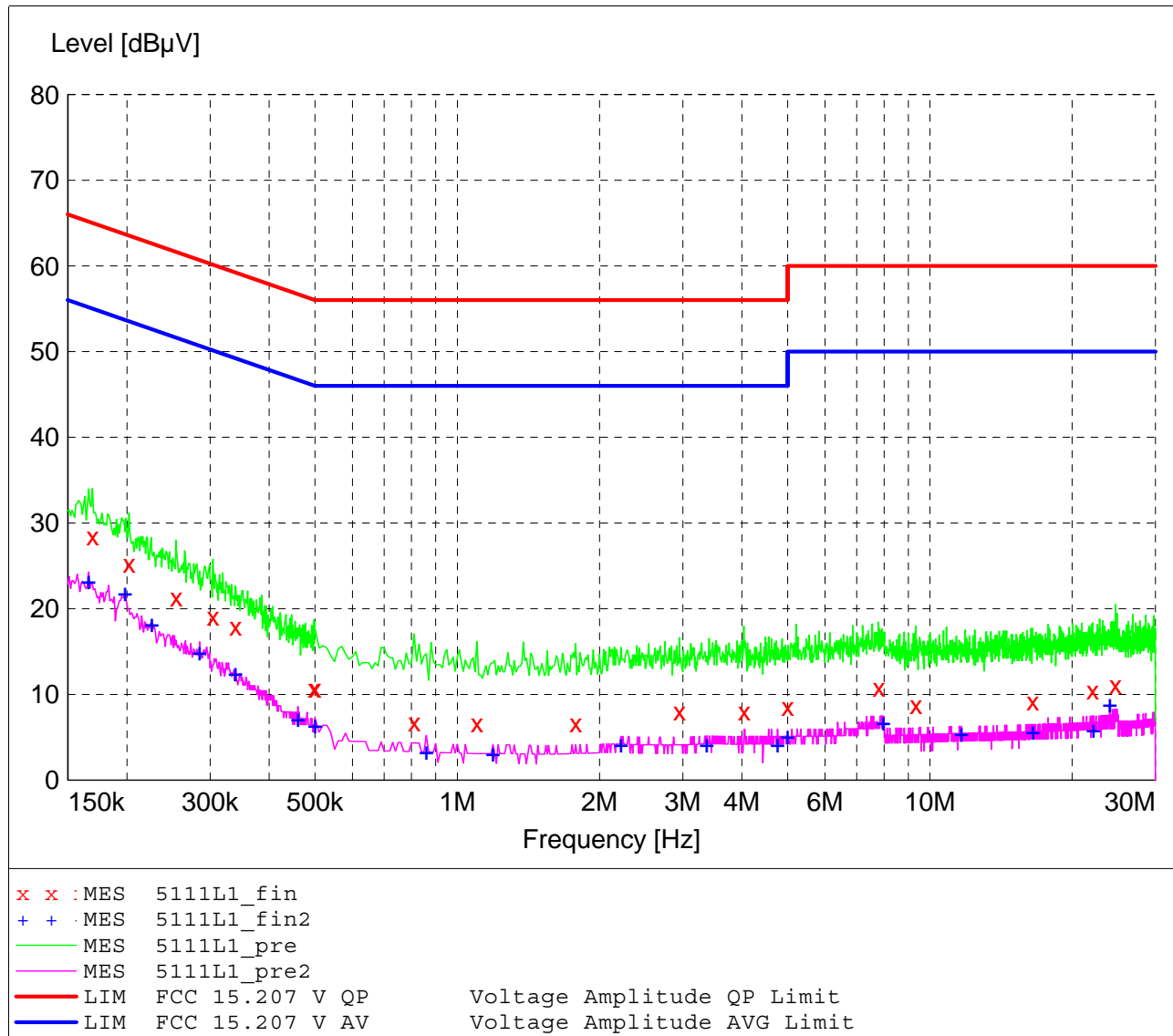
FCC Part 15.207

Voltage Mains Test

EUT: Gemini P2_X2
Manufacturer: California Eastern Laboratories
Operating Condition: 68 deg. F, 34% R.H.
Test Site: DLS O.F. Screen Room
Operator: Craig B
Test Specification: 3.6 Volts DC
Comment: Line POS
Date: 05-11-2012

SCAN TABLE: "Line Cond SR Final"

Short Description:		Line Conducted Emissions				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	2.0 s	9 kHz	LISN DLS#128
			CISPR AV			



MEASUREMENT RESULT: "5111L1_fin"

5/11/2012 9:56AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector
0.169000	28.50	13.1	65	36.5	QP
0.202000	25.30	12.6	64	38.2	QP
0.254000	21.30	12.1	62	40.3	QP
0.304000	19.10	11.8	60	41.0	QP
0.339000	17.90	11.6	59	41.3	QP
0.497000	10.70	11.2	56	45.3	QP
0.500000	10.70	11.2	56	45.3	QP
0.810000	6.80	10.8	56	49.2	QP
1.100000	6.60	10.6	56	49.4	QP
1.780000	6.60	10.6	56	49.4	QP
2.950000	8.00	10.6	56	48.0	QP
4.040000	8.00	10.7	56	48.0	QP
5.000000	8.60	10.7	56	47.4	QP
7.790000	10.80	10.8	60	49.2	QP
9.335000	8.80	10.9	60	51.2	QP
16.490000	9.20	11.2	60	50.8	QP
22.085000	10.50	11.5	60	49.5	QP
24.680000	11.10	11.6	60	48.9	QP

MEASUREMENT RESULT: "5111L1_fin2"

5/11/2012 9:56AM

Frequency MHz	Level dBμV	Transd dB	Limit dBμV	Margin dB	Detector
0.166000	23.20	13.2	55	32.0	CAV
0.198000	21.80	12.7	54	31.9	CAV
0.226000	18.20	12.4	53	34.4	CAV
0.285000	14.90	11.9	51	35.8	CAV
0.339000	12.50	11.6	49	36.7	CAV
0.460000	7.20	11.2	47	39.5	CAV
0.500000	6.40	11.2	46	39.6	CAV
0.860000	3.30	10.8	46	42.7	CAV
1.190000	3.10	10.6	46	42.9	CAV
2.220000	4.20	10.7	46	41.8	CAV
3.370000	4.20	10.7	46	41.8	CAV
4.760000	4.20	10.7	46	41.8	CAV
5.000000	5.10	10.7	46	40.9	CAV
7.970000	6.80	10.8	50	43.2	CAV
11.660000	5.50	11.0	50	44.5	CAV
16.505000	5.70	11.2	50	44.3	CAV
22.175000	5.90	11.5	50	44.1	CAV
24.005000	8.90	11.5	50	41.1	CAV

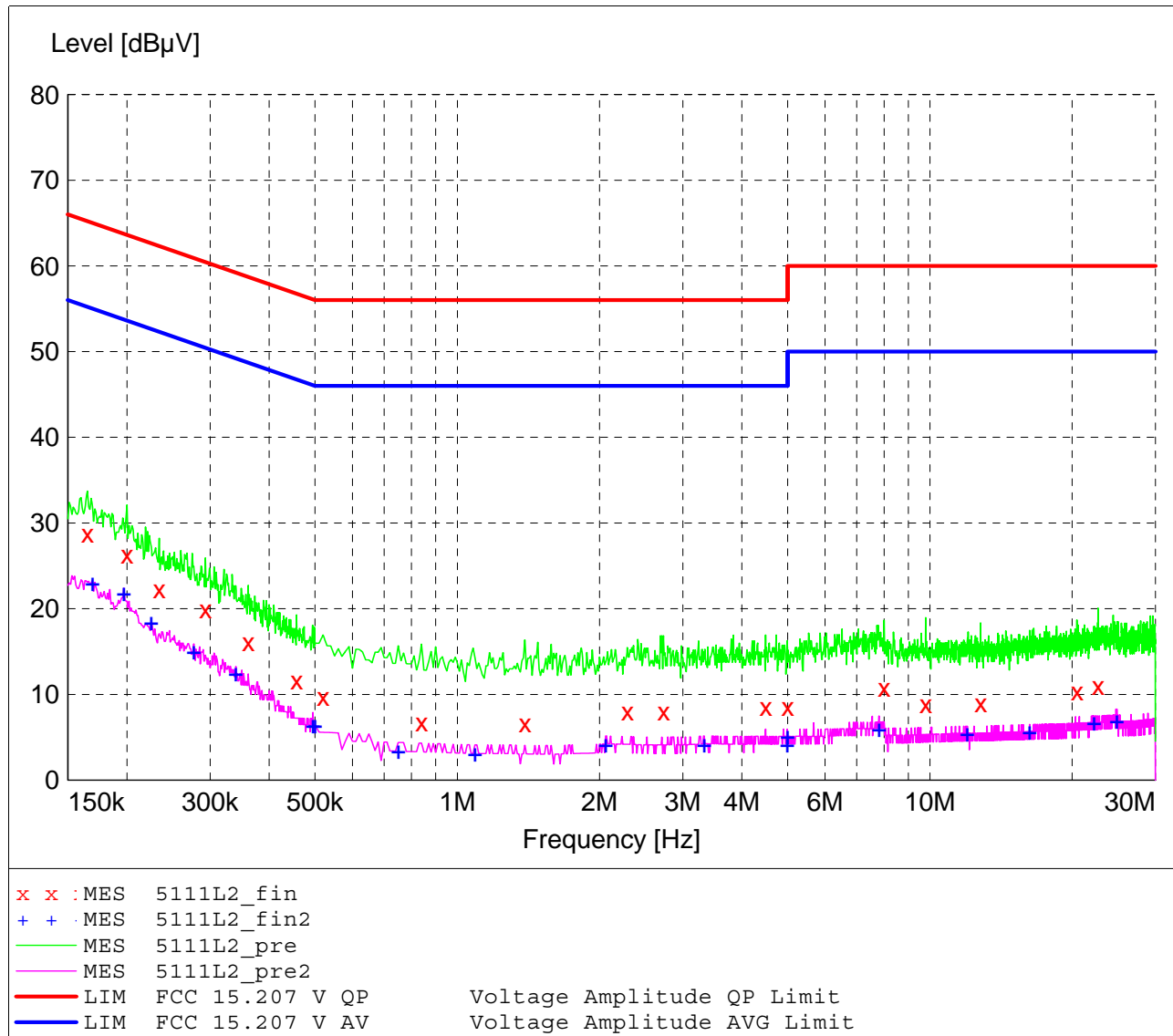
FCC Part 15.207

Voltage Mains Test

EUT: Gemini P2_X2
Manufacturer: California Eastern Laboratories
Operating Condition: 68 deg. F, 34% R.H.
Test Site: DLS O.F. Screen Room
Operator: Craig B
Test Specification: 3.6 Volts DC
Comment: Line NEG
Date: 05-11-2012

SCAN TABLE: "Line Cond SR Final"

Short Description:		Line Conducted Emissions				
Start	Stop	Step	Detector	Meas. Time	IF Bandw.	Transducer
Frequency	Frequency	Width				
150.0 kHz	30.0 MHz	4.0 kHz	QuasiPeak	2.0 s	9 kHz	LISN DLS#128
			CISPR AV			



MEASUREMENT RESULT: "5111L2_fin"

5/11/2012 10:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.165000	28.80	13.2	65	36.4	QP
0.200000	26.30	12.7	64	37.3	QP
0.234000	22.30	12.3	62	40.0	QP
0.293000	19.90	11.9	60	40.5	QP
0.361000	16.10	11.5	59	42.6	QP
0.457000	11.70	11.2	57	45.0	QP
0.520000	9.70	11.2	56	46.3	QP
0.840000	6.80	10.8	56	49.2	QP
1.390000	6.60	10.6	56	49.4	QP
2.290000	8.00	10.7	56	48.0	QP
2.730000	8.00	10.6	56	48.0	QP
4.490000	8.60	10.7	56	47.4	QP
5.000000	8.60	10.7	56	47.4	QP
8.000000	10.80	10.8	60	49.2	QP
9.800000	8.90	10.9	60	51.1	QP
12.800000	9.00	11.1	60	51.0	QP
20.465000	10.40	11.4	60	49.6	QP
22.685000	11.00	11.5	60	49.0	QP

MEASUREMENT RESULT: "5111L2_fin2"

5/11/2012 10:02AM

Frequency MHz	Level dBµV	Transd dB	Limit dBµV	Margin dB	Detector
0.169000	23.00	13.1	55	32.0	CAV
0.197000	21.90	12.7	54	31.8	CAV
0.225000	18.40	12.4	53	34.2	CAV
0.277000	15.00	11.9	51	35.9	CAV
0.340000	12.50	11.6	49	36.7	CAV
0.495000	6.40	11.2	46	39.7	CAV
0.500000	6.40	11.2	46	39.6	CAV
0.750000	3.40	10.9	46	42.6	CAV
1.090000	3.10	10.6	46	42.9	CAV
2.060000	4.20	10.7	46	41.8	CAV
3.330000	4.20	10.7	46	41.8	CAV
4.990000	4.20	10.7	46	41.8	CAV
5.000000	5.10	10.7	46	40.9	CAV
7.805000	6.00	10.8	50	44.0	CAV
12.005000	5.50	11.0	50	44.5	CAV
16.250000	5.70	11.2	50	44.3	CAV
22.250000	6.70	11.5	50	43.3	CAV
24.875000	6.90	11.6	50	43.1	CAV



166 South Carter, Genoa City, WI 53128

Company:
Model Tested:
Report Number:
DLS Project:

California Eastern Laboratories
ZICM357SP2-1
17866
5130

END OF REPORT

Revision #	Date	Comments	By
1.0	05-10-2012	Preliminary Release	JS
1.1	05-11-2012	Updated Equipment List, Data, Photos	CB
1.2	05-15-2012	Final data inserted & notes checked	JS