Electromagnetic Compatibility Test Report

Tests Performed on an ACLARA Power-Line Systems

ZigBee Module Transciever, Model Y70080-1

Radiometrics Document RP-6256

ACCREDITED
Certification # 1495.01

Product Detail: FCC ID: PN3Y70080-1 IC: 7100A-Y700801 Equipment type: 2.4 GHz DTS Transmitter
Test Standards: US CFR Title 47, Chapter I, FCC Part 15 Subpart C FCC Part 15 CFR Title 47: 2007 Industry Canada RSS-210, Issue 7: 2007 as required for Category I Equipment This report concerns: Original Grant for Certification FCC Part 15.247

Tests Performed For:	*Test Facility:*
ACLARA Power-Line Systems 945 Hornet Drive Hazelwood, Mo 63042-2338	**Radiometrics Midwest Corporation** 12 East Devonwood Romeoville, IL 60446

Test Date(s): (Month-Day-Year)
March 10 to April 18, 2008

Document RP-6256 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	May 9, 2008		

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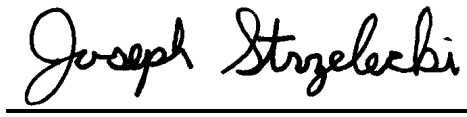
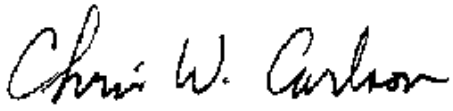
1 ADMINISTRATIVE DATA

Equipment Under Test: An ACLARA Power-Line Systems, ZigBee Module Model: Y70080-1 Serial Number: None This will be referred to as the EUT in this Report	
Date EUT Received at Radiometrics: (Month-Day-Year) March 10, 2008	*Test Date(s): (Month-Day-Year)* March 10 to April 18, 2008
Test Report Written By: Joseph Strzelecki Senior EMC Engineer	*Test Witnessed By:* The tests were not witnessed by ACLARA Power-Line Systems ACLARA Power-Line Systems
Radiometrics' Personnel Responsible for Test:  Joseph Strzelecki Senior EMC Engineer NARTE EMC-000877-NE	*Test Report Approved By*  Chris W. Carlson Director of Engineering NARTE EMC-000921-NE

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a Zigbee Module, Model Y70080-1, manufactured by ACLARA Power-Line Systems. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Environmental Phenomena	Frequency Range	Basic Standard	Test Result
RF Radiated Emissions	30-25,000 MHz	RSS-210 & FCC Part 15	Pass
Conducted Emissions AC Mains	0.15 - 30 MHz	RSS-210 & FCC Part 15	Pass

Spread Spectrum Transmitter Requirements

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section	Test Result
Time of Occupancy (Dwell Time)	2400 to 2483 MHz	15.247 a	A8.1 (2)	Pass
6 dB Bandwidth Test;	2400 to 2483 MHz	15.247 a	A8.1 (4)	Pass
20 dB Bandwidth Test;	2400 to 2483 MHz	15.247 a	A8.1 (4)	Pass
Peak Output Power	2400 to 2483 MHz	15.247 b	A8.1 (1)	Pass
Band-edge Compliance of RF Conducted Emissions	2400 to 2483 MHz	15.247 d	A8.4 (2)	Pass
Spurious RF Conducted Emissions	30 MHz to 25 GHz	15.247 d	A8.5	Pass
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 d	A8.5	Pass
Power Spectral Density	2400 to 2483 MHz	15.247 e	A8.2 (1)	Pass

2.1 RF Exposure Compliance Requirements

The power output is 100 mW, The EUT meets the FCC requirement for RF exposure. Since the EUT is less than 200 mW, it is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a Zigbee Module, Model Y70080-1, manufactured by ACLARA Power-Line Systems. The EUT was in good working condition during the tests, with no known defects.

3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is a planar inverted 'F' structure etched on the PCB. The antenna is internal to the EUT and it is not readily available to be modified by the end user. Therefore it meets the 15.203 Requirement.

3.2 Related Submittals

ACLARA Power-Line Systems is not submitting any other products simultaneously for equipment authorization related to the EUT.

4 TESTED SYSTEM DETAILS

4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

Since the EUT is wall mounted, it was placed in an upright configuration during the tests.

The EUT was tested as a stand-alone device. Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply.

The identification for all equipment, plus descriptions of all cables used in the tested system, are:

Tested System Configuration List

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	ZigBee Module	E	ACLARA Power-Line Systems	Y70080-1	None
2	Power Supply	S	Air Stack	DV-530R	None
3	Notebook PC	H	Dell	Latitude D600	CN0G5152-48643-48D-0155
4	Notebook PC Power Supply (Latitude)	H	Dell	NADP-90KB A	TH-0C2894-17971-37J-0BU5

* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	DC Cord	#1 and #2	No
1	1.8	Serial cable	#1 and #3	Yes

4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2007	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 7	2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 2	2007	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the FCC 558074, Industry Canada RSS-212 and ANSI document C63.4-2003, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site (www.radiomet.com). Radiometrics accreditation status can be verified at A2LA's web site (www.a2la2.org).

The following is a list of shielded enclosures located in Romeoville, Illinois:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber B: Is a shielded enclosure that measures 24' L X 12' W X 8' H. Erik A. Lindgren & Associates of Chicago, Illinois manufactured the enclosure.

Chamber C: Is a shielded enclosure that measures 20' L X 10' W X 8' H. Lindgren RF Enclosures Inc. of Addison, Illinois manufactured the enclosure.

Chamber D: Is a fully anechoic chamber that measures 22' L X 10' W X 10' H. The walls, ceiling and floor are fully lined with ferrite absorber tiles. Braden Shielding Systems of Tulsa, Oklahoma manufactured the chamber.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as file number IC3124.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	01/30/08
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo	01/30/08
AMP-33	Anritsu	20dB pre-amp	MA8610A	M42554	9kHz-2.2GHz	12 Mo.	01/31/08
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/24/06

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/26/07
HPF-03	Mini-Circuits	High Pass Filter	VHP-39	HPF-03	3-10 GHz	12 Mo.	01/31/08
LSN-01	Electrometrics	50 uH LISN	FCC/VDE 50/2	1001	0.01-30MHz	24 Mo.	05/03/07
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	05/03/07
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	10/18/07
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	02/13//08
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	01/11/08
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	12 Mo.	07/31/07
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	12 Mo.	01/18/08

Note: All calibrated equipment is subject to periodic checks.

10 TEST SECTIONS

10.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 7.2.2.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

Broadband conducted emissions may exceed the following limits by no more than 13 dB. An emission is defined as broadband if the average detector amplitude is 6 dB or more under the quasi-peak detector amplitude.

FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 – 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer (with the EUT connected) power cord, after testing all modes of operation.

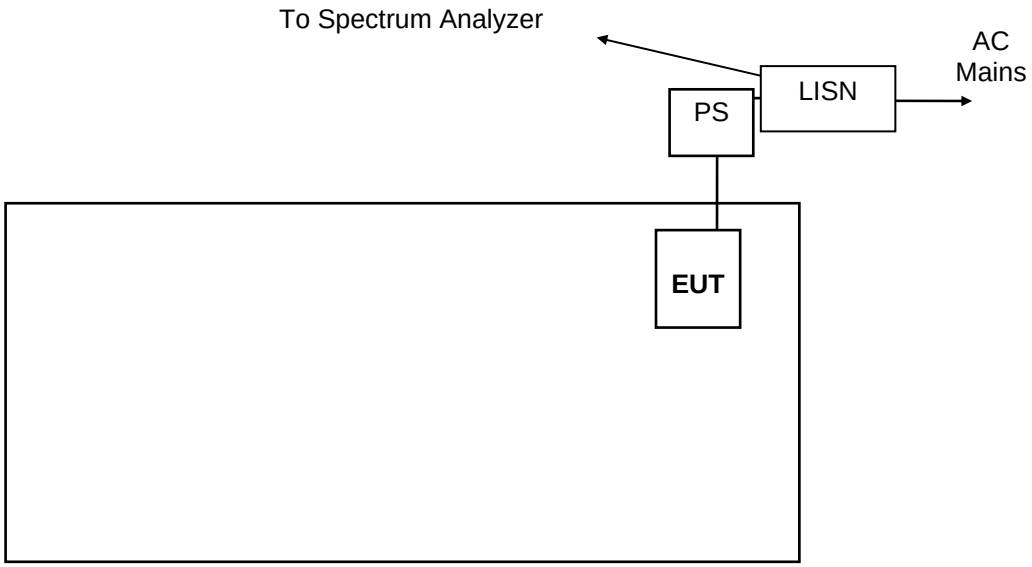
Test Date : March 10 to 18, 2008
The Amplitude is the final corrected value with cable and LISN Loss.

EUT	Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
2.405 GHz	AC Neutral	0.143	48.7	66.4	32.4	56.4
2.405 GHz	AC Neutral	4.036	27.9	56.0	15.7	46.0
2.405 GHz	AC Neutral	17.677	31.2	60.0	19.5	50.0
2.44 GHz	AC Neutral	0.150	48.4	66.0	33.3	56.0
2.44 GHz	AC Neutral	5.203	27.6	60.0	18.2	50.0
2.44 GHz	AC Neutral	17.861	31.0	60.0	19.5	50.0
2.48 GHz	AC Neutral	0.150	49.1	66.0	33.7	56.0
2.48 GHz	AC Neutral	4.743	27.1	56.0	15.7	46.0
2.48 GHz	AC Neutral	17.841	29.1	60.0	19.5	50.0
2.405 GHz	AC Hot	0.152	49.0	65.9	31.4	55.9
2.405 GHz	AC Hot	4.297	29.3	56.0	18.2	46.0
2.405 GHz	AC Hot	15.461	30.1	60.0	17.1	50.0
2.44 GHz	AC Hot	0.150	49.3	66.0	31.3	56.0
2.44 GHz	AC Hot	5.051	27.8	60.0	18.2	50.0
2.44 GHz	AC Hot	18.309	30.7	60.0	19.6	50.0
2.48 GHz	AC Hot	0.165	49.1	65.2	32.3	55.2
2.48 GHz	AC Hot	4.789	22.8	56.0	15.7	46.0
2.48 GHz	AC Hot	16.929	31.1	60.0	19.2	50.0

The above are the worst case results with three frequencies test for each EUT
* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by 16.1 dB

Figure 1. Conducted Emissions Test Setup

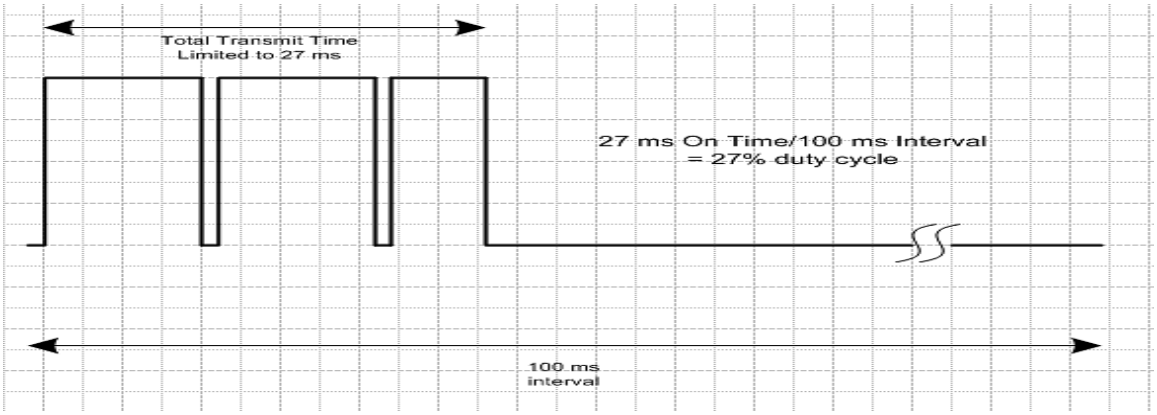


Notes:
- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

10.2 Time of Occupancy (Dwell Time)

The spectrum analyzer was set to the MAX HOLD mode to read peak emissions. The span was set to zero. The marker-delta function to determine the dwell time. The Peak to average factor is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

The transmitter operates for a maximum duration of 27 ms in a 100 ms interval for a 27% maximum duty cycle, as shown below:



The the maximum total on time for any 100 mSec time period is 27 mSec. The peak to average factor is 20*Log(27/100) = -11.4 dB. This is Peak to average Correction factor

This factor is only used for Average measurements.

10.3 Occupied Bandwidth

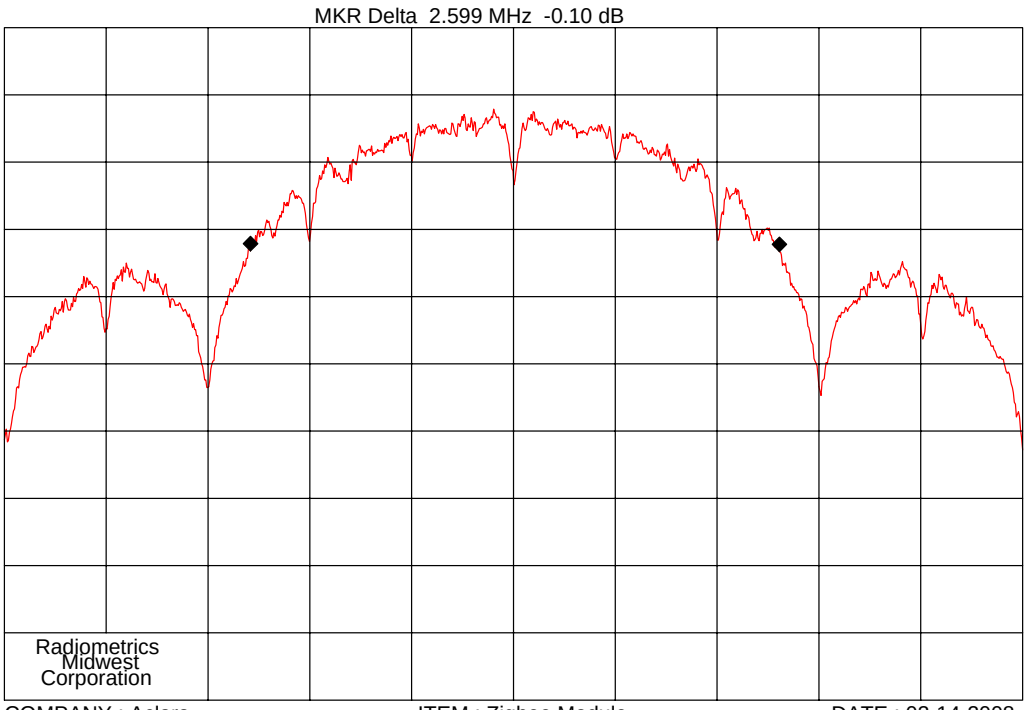
The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

Analyzer RBW	100 kHz RBW	30 kHz RBW
Channel	6 dB EBW MHz	20 dB EBW MHz
2405	1.62	2.60
2440	1.59	2.55
2480	1.59	2.59

The bandwidth must be at least 0.5 MHz

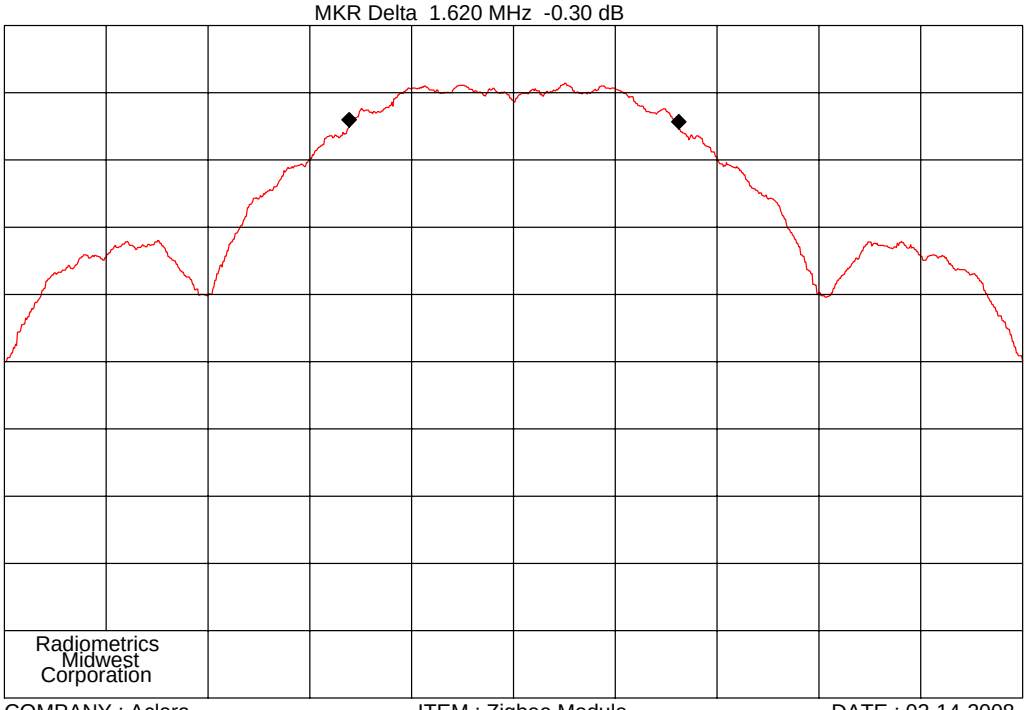
Judgement: Pass by 1.09 MHz



COMPANY : Aclara
CENTER 2.405 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Channel 1

ITEM : Zigbee Module
REF 20.0 dBm
VBW 100 kHz
TIME : 10:47

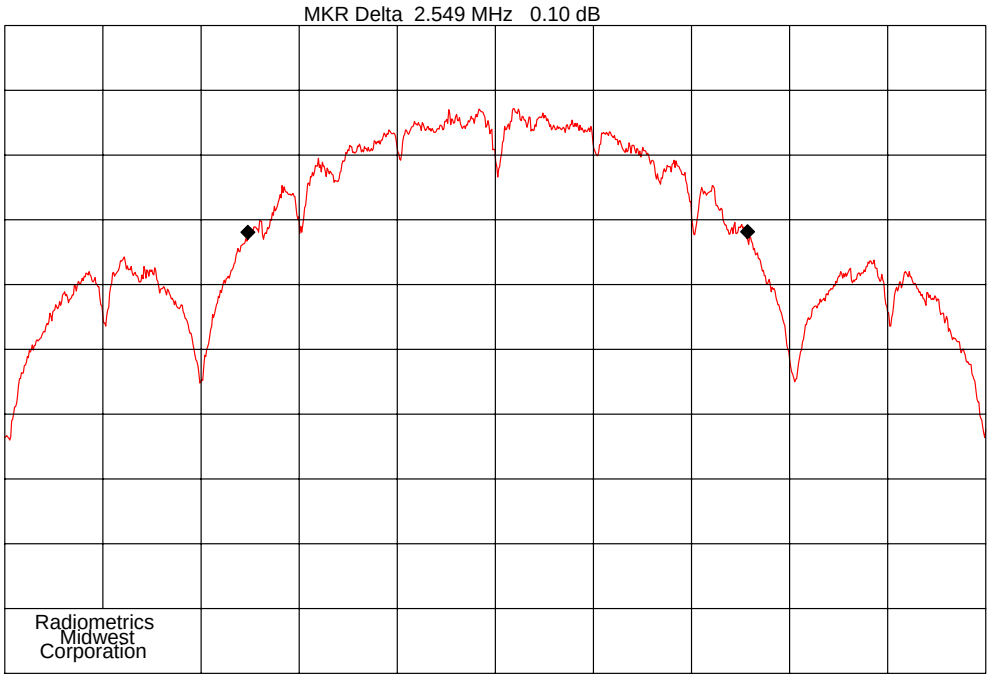
DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec



COMPANY : Aclara
CENTER 2.405 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Channel 1

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 10:45

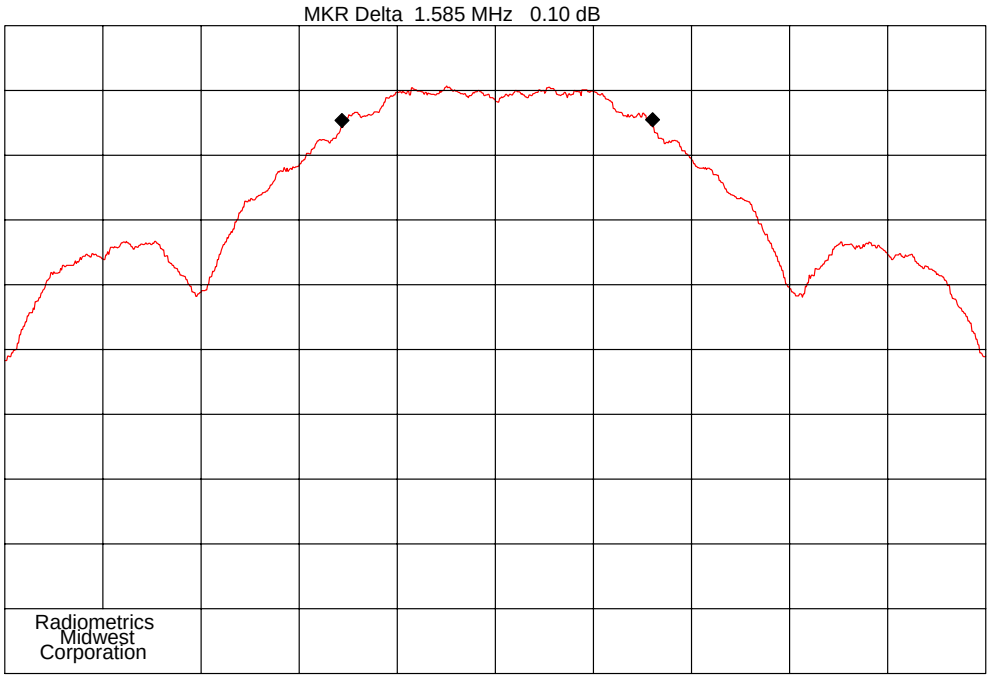
DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec



COMPANY : Aclara
CENTER 2.440 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Mid Channel

ITEM : Zigbee Module
REF 20.0 dBm
VBW 100 kHz
TIME : 10:51

DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec

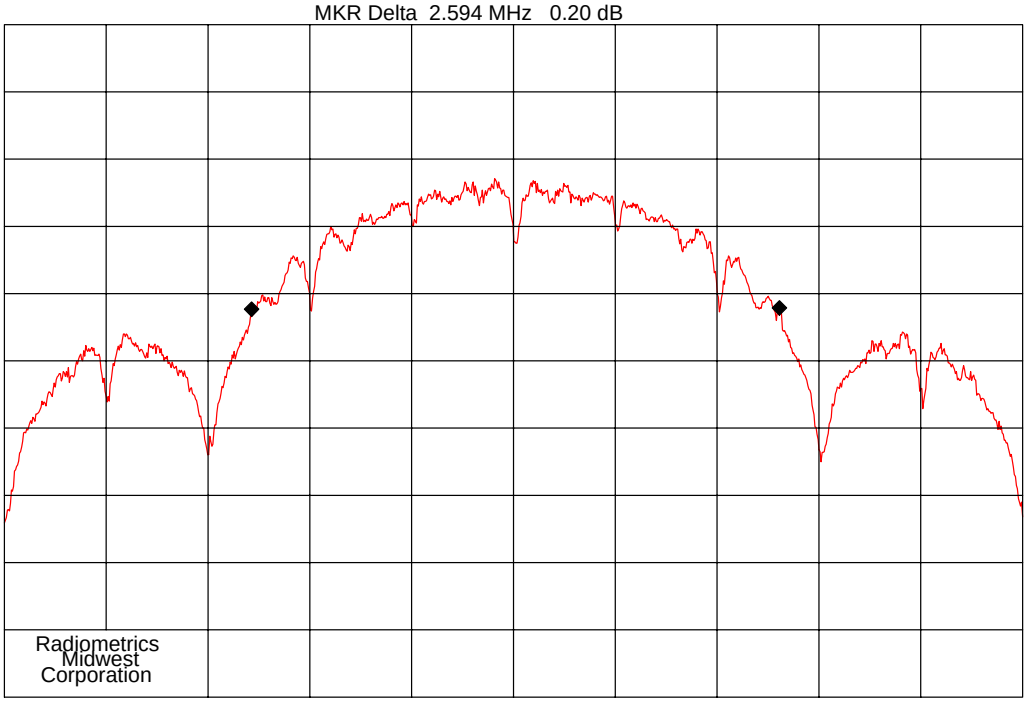


COMPANY : Aclara
CENTER 2.440 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Mid Channel

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 10:53

DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec

MKR Delta 2.594 MHz 0.20 dB

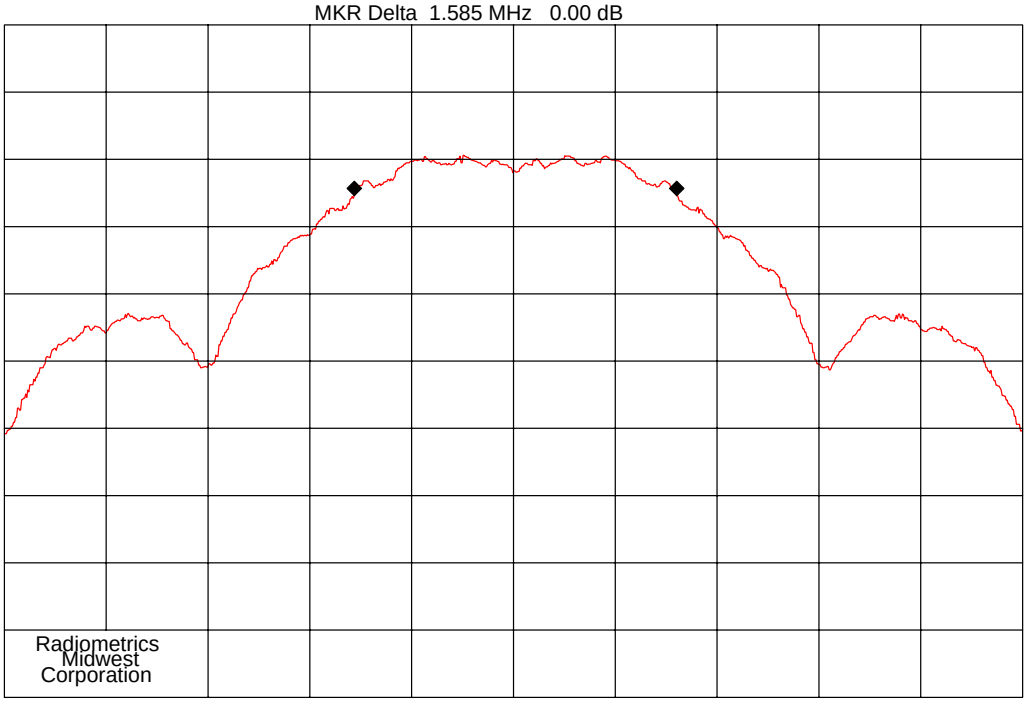


COMPANY : Aclara
CENTER 2.480 00 GHz
RES BW 30 kHz
10 dB/
NOTES : 20 dB Bandwidth, Upper Channel (26)

ITEM : Zigbee Module
REF 20.0 dBm
VBW 100 kHz
TIME : 11:04

DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec

MKR Delta 1.585 MHz 0.00 dB



COMPANY : Aclara
CENTER 2.480 00 GHz
RES BW 100 kHz
10 dB/
NOTES : 6 dB Bandwidth, Upper Channel (26)

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:05

DATE : 03-14-2008
SPAN 5.00 MHz
ATTEN 30 dB
SWP 20.0 msec

10.4 Peak Output Power

The EUT antenna port was connected to the Spectrum analyzer Via a low loss coaxial cable.

The power output option 1 from FCC rules 558074 was used for this test. The spectrum analyzer was set to the following settings:

Span = 2 MHz
RBW = 3 MHz
VBW = 3 MHz
Sweep = auto
Detector function = peak
Trace = max hold

The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. The indicated level is the peak output power. The BW correction factor is 10*Log(BW). Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6 dB, the limit is not reduced.

Freq. (MHz)	Reading (dBm)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
			dBm	Watts	
2405	18.9	0.5	19.4	0.087	30
2440	19	0.5	19.5	0.089	30
2475	18.7	0.5	19.2	0.083	30
2480	2	0.5	2.5	0.002	30

Judgement: Pass by 10.5 dB

Note that this test was performed on the Lowest, middle channel, the Highest channel and the second highest channel. The extra test was performed since the highest channel has a lower power than the rest of the channels.

10.5 Power Spectral Density

PSD option 1 was used for this test. No external attenuator was used. The spectrum analyzer was set to the following settings:

Span = 500 kHz ; RBW = 3 kHz ; VBW = 10 kHz; Sweep = 167 Seconds
Detector function = Peak

Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
2405	0.8	0.5	1.3	8.0
2440	0.1	0.5	0.6	8.0
2475	-0.3	0.5	0.2	8.0
2480	-10	0.5	-9.5	8.0

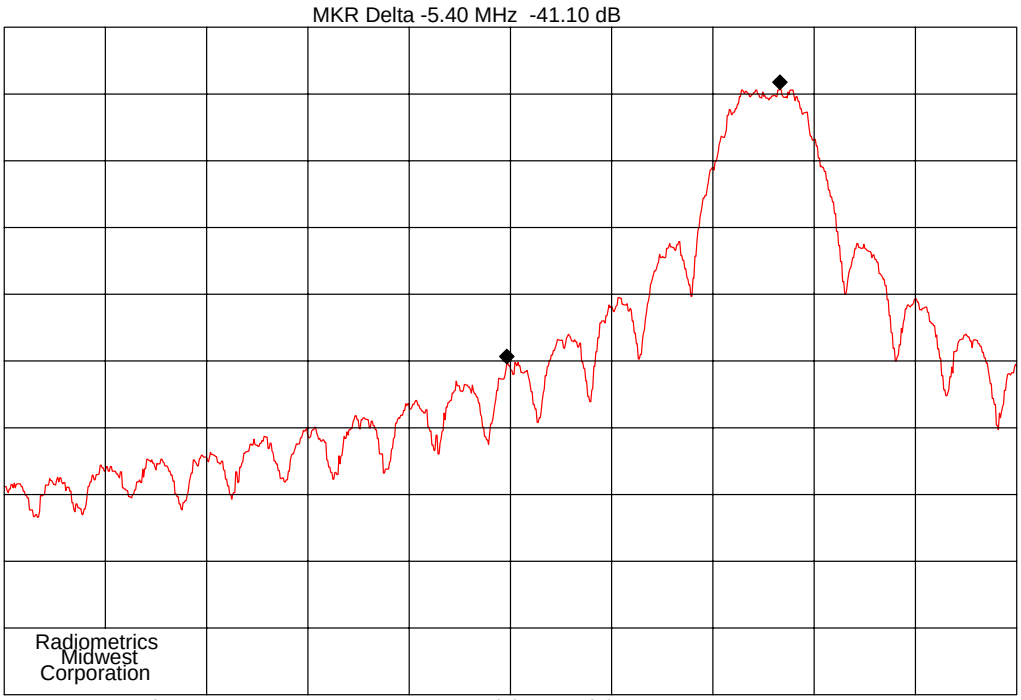
Judgement: Pass by 6.7 dB

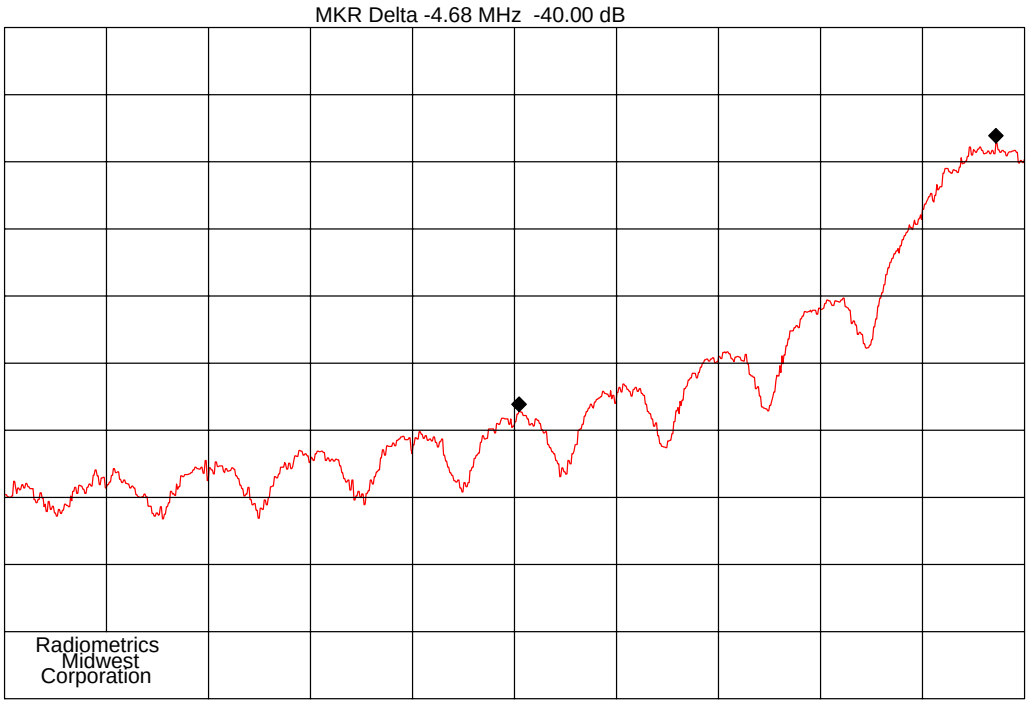
Note that this test was performed on the Lowest, middle channel, the Highest channel and the second highest channel. The extra test was performed since the highest channel has a lower power than the rest of the channels.

10.6 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.

Note that the Band edge was performed on the Lowest channel, the Highest channel and the second highest channel. The extra test was performed since the highest channel has a lower power than the rest of the channels.

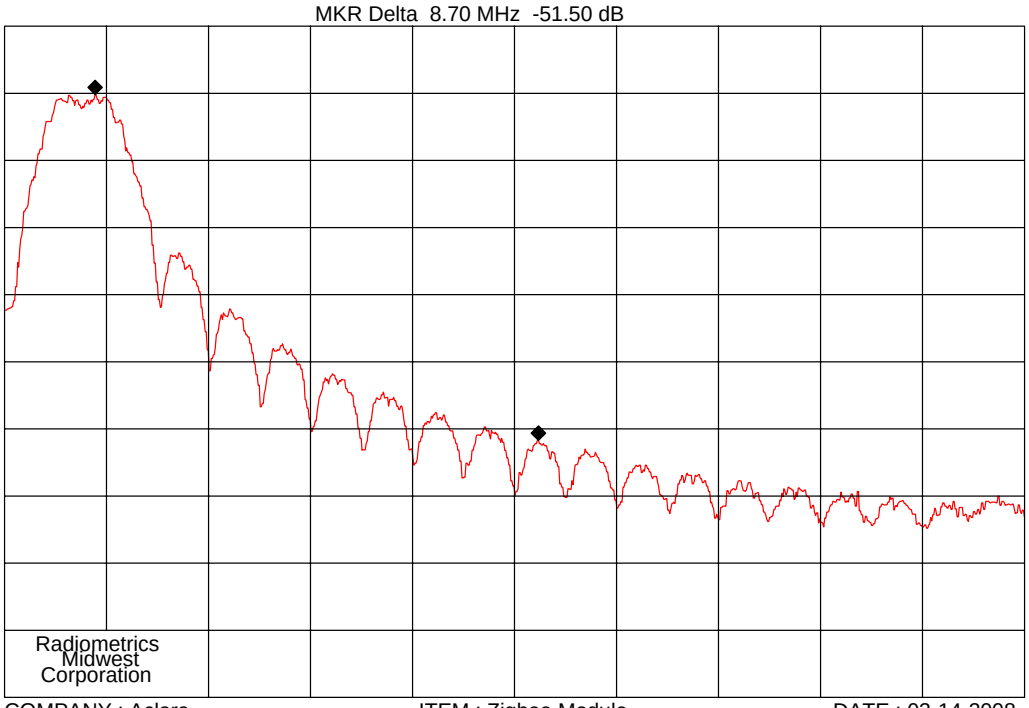




COMPANY : Aclara
CENTER 2.400 0 GHz
RES BW 100 kHz
10 dB/
NOTES : Lower Band Edge Test, Channel 1

ITEM : Transmitter
REF 107.0 dBuV
VBW 1 MHz
TIME : 11:10

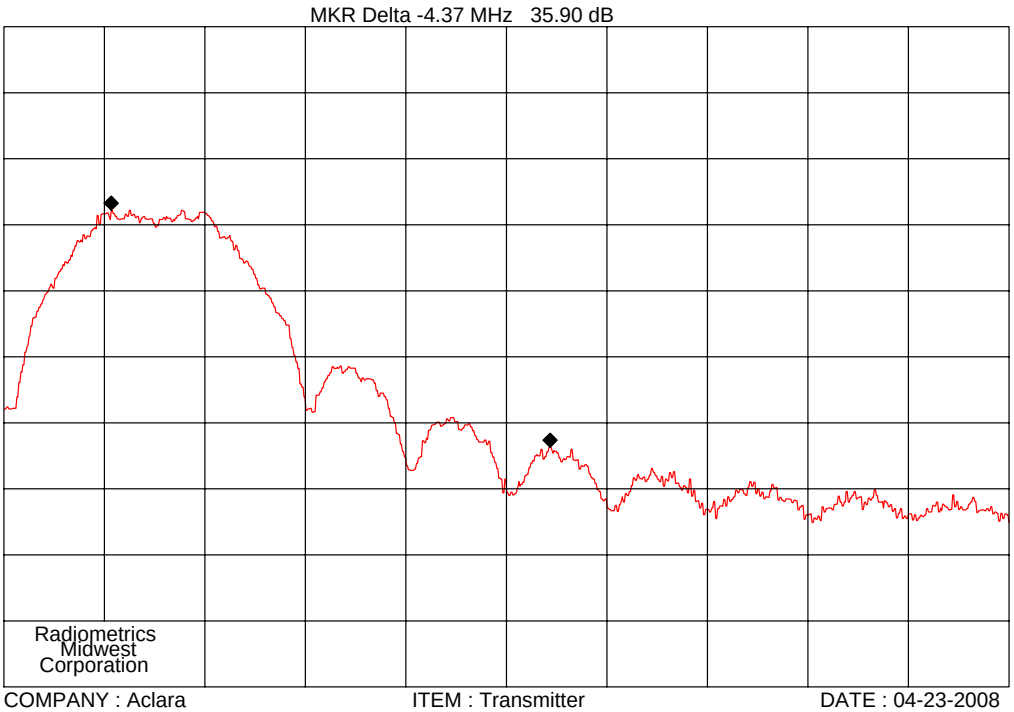
DATE : 04-23-2008
SPAN 10.0 MHz
ATTEN 10 dB
SWP 20.0 msec



COMPANY : Aclara
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge, Upper Channel (25)

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:25

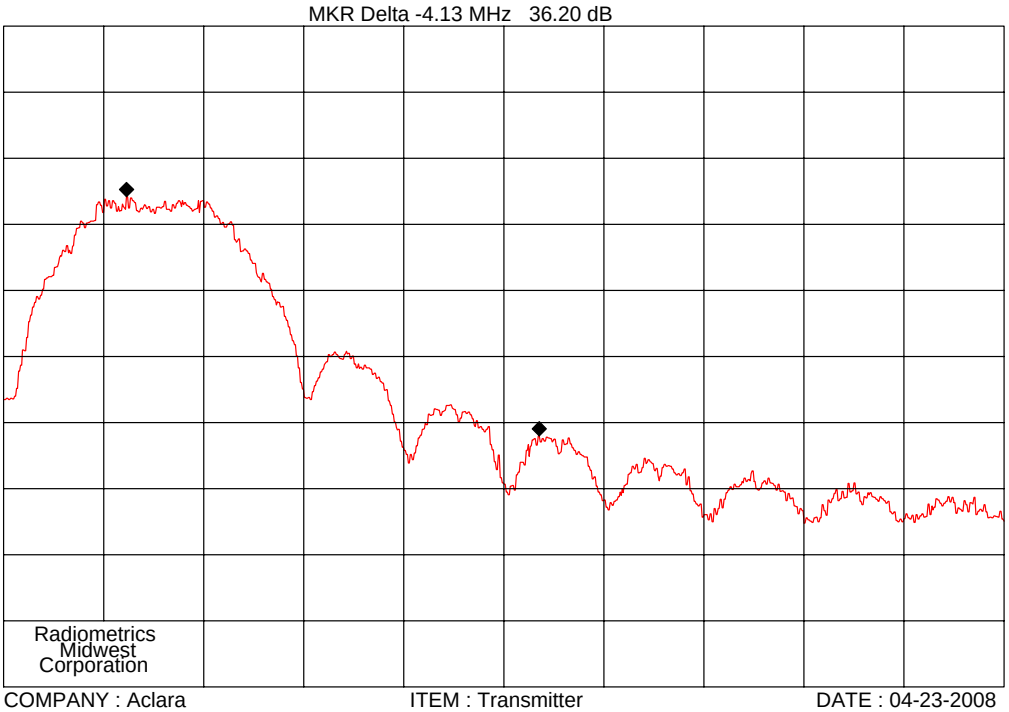
DATE : 03-14-2008
SPAN 20.0 MHz
ATTEN 30 dB
SWP 20.0 msec



COMPANY : Aclara
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge for Radiated emissions, Channel 26;

ITEM : Transmitter
REF 97.0 dBuV
VBW 1 MHz
TIME : 10:36

DATE : 04-23-2008
SPAN 10.0 MHz
ATTEN 0 dB
SWP 20.0 msec



COMPANY : Aclara
CENTER 2.483 5 GHz
RES BW 100 kHz
10 dB/
NOTES : Band Edge for Radiated emissions, Channel 26; Horizontal

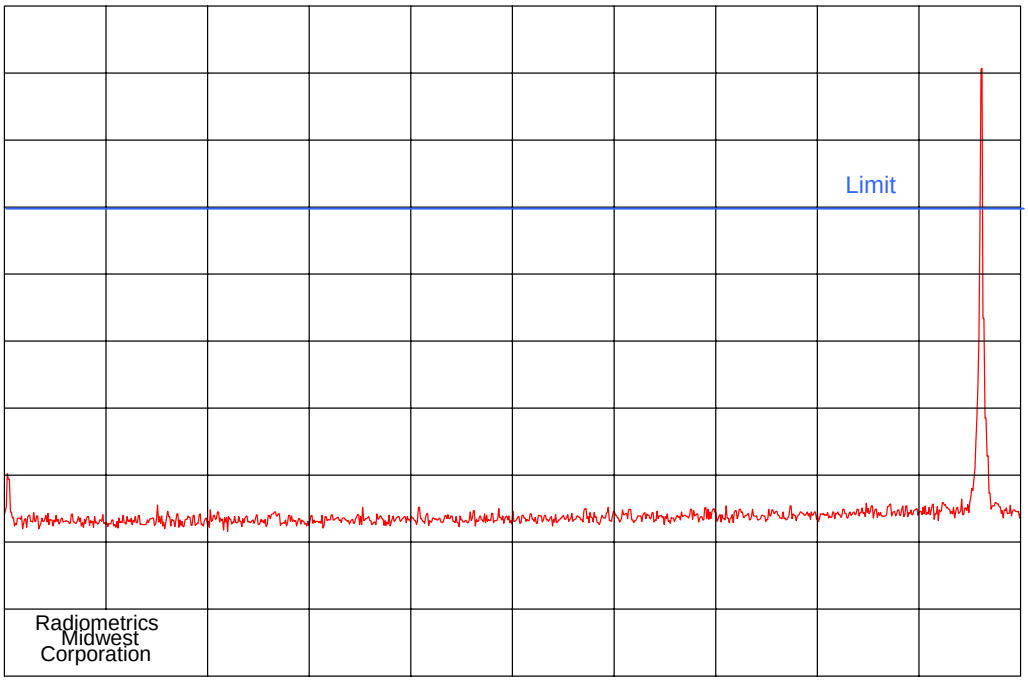
ITEM : Transmitter
REF 97.0 dBuV
VBW 1 MHz
TIME : 10:33

DATE : 04-23-2008
SPAN 10.0 MHz
ATTEN 0 dB
SWP 20.0 msec

Judgement Pass by 15.9 dB

10.7 Spurious RF Conducted Emissions

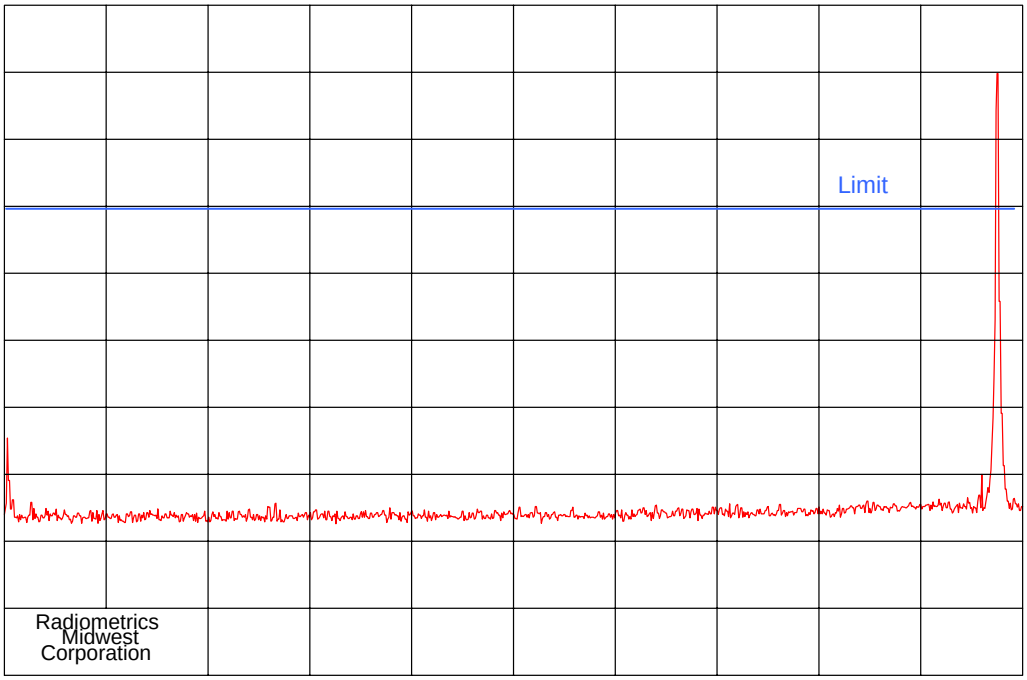
The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10th harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high).



COMPANY : Aclara
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, Chan 1

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:38

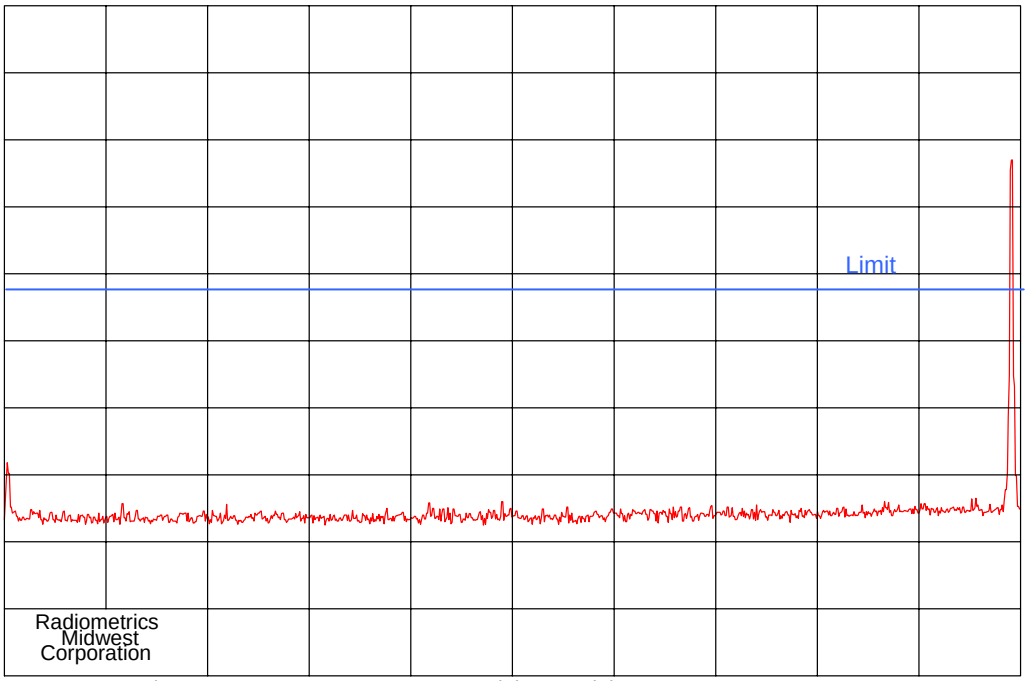
DATE : 03-14-2008
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Aclara
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, Chan 18 Mid

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:40

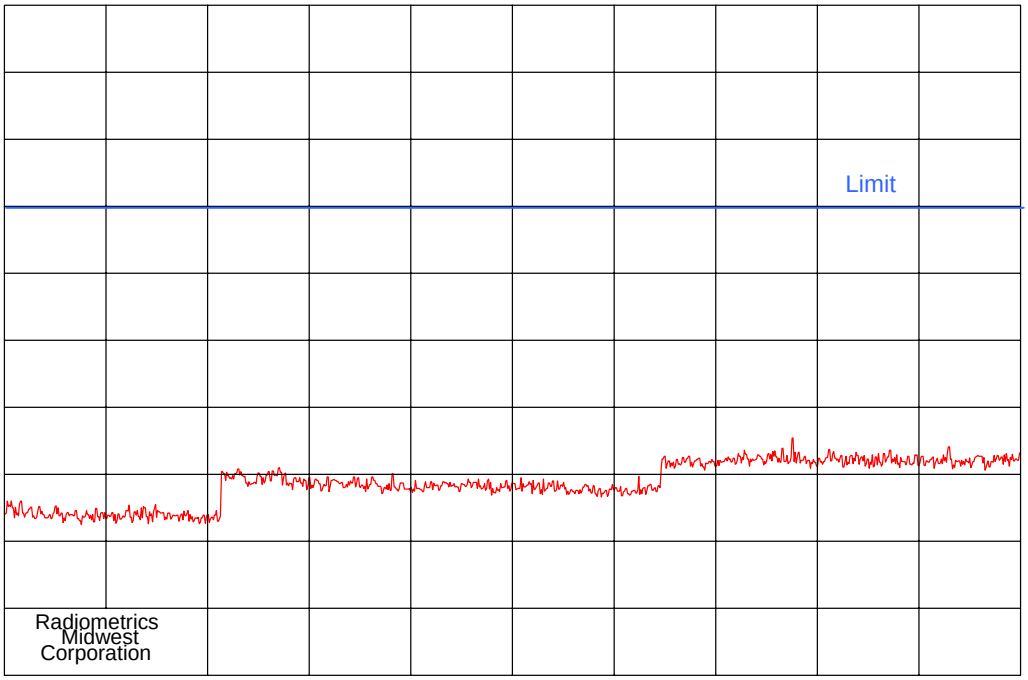
DATE : 03-14-2008
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Aclara
START 1 MHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, Chan 26 High

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:44

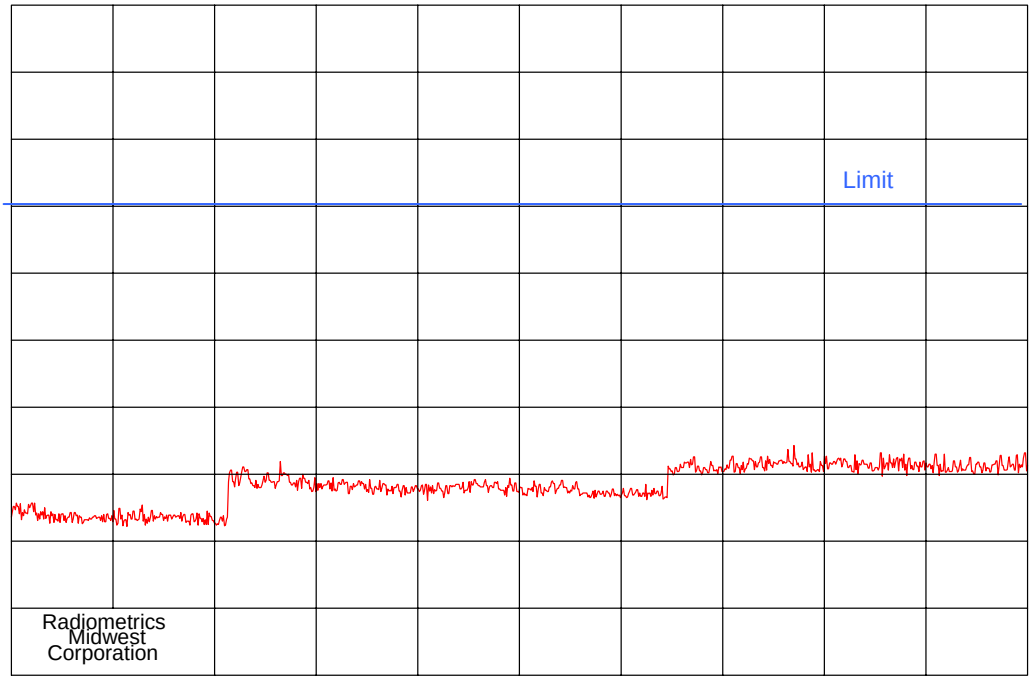
DATE : 03-14-2008
STOP 2.50 GHz
ATTEN 30 dB
SWP 750 msec



COMPANY : Aclara
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, Chan 11 (Low)

ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:54

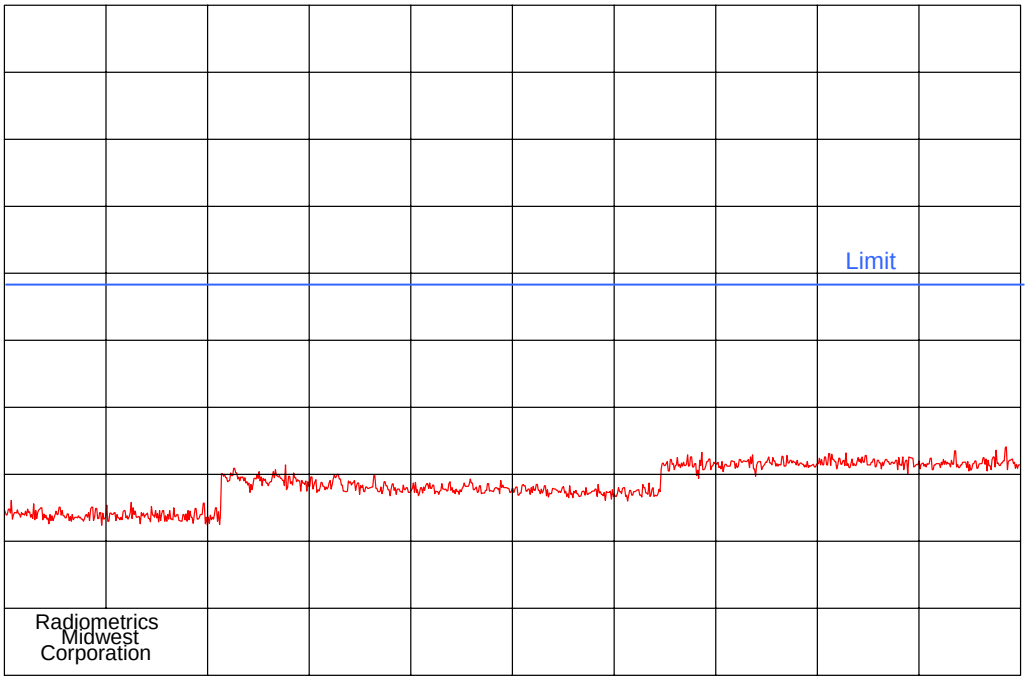
DATE : 03-14-2008
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec



COMPANY : Aclara
START 2.5 GHz
RES BW 100 kHz
10 dB/
NOTES : Antenna Conducted Emissions, Chan 18 (Mid)

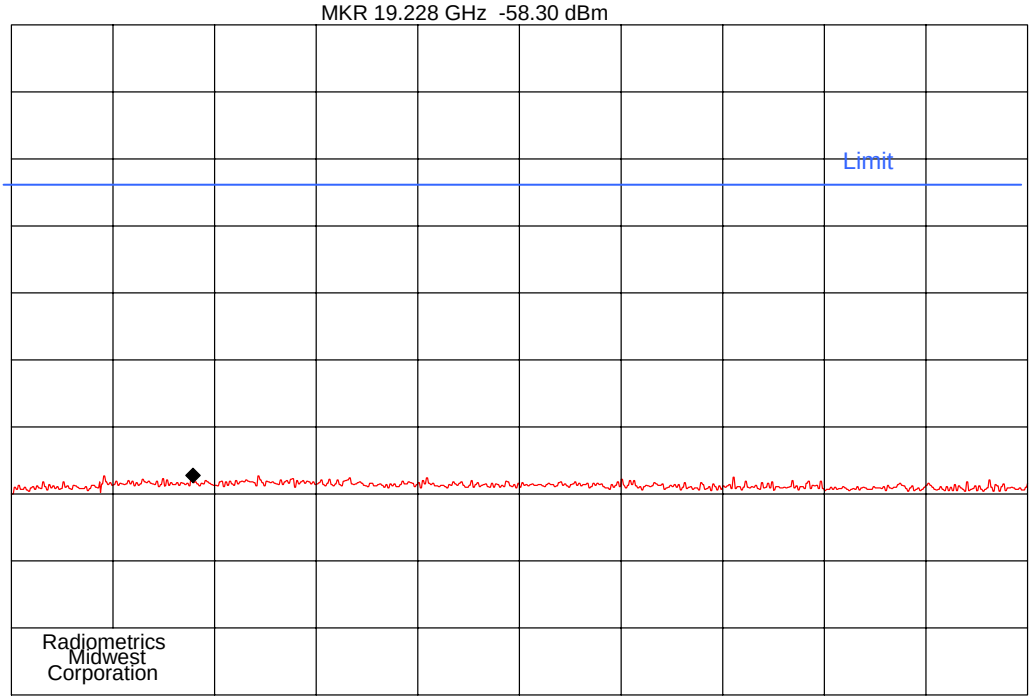
ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:53

DATE : 03-14-2008
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec

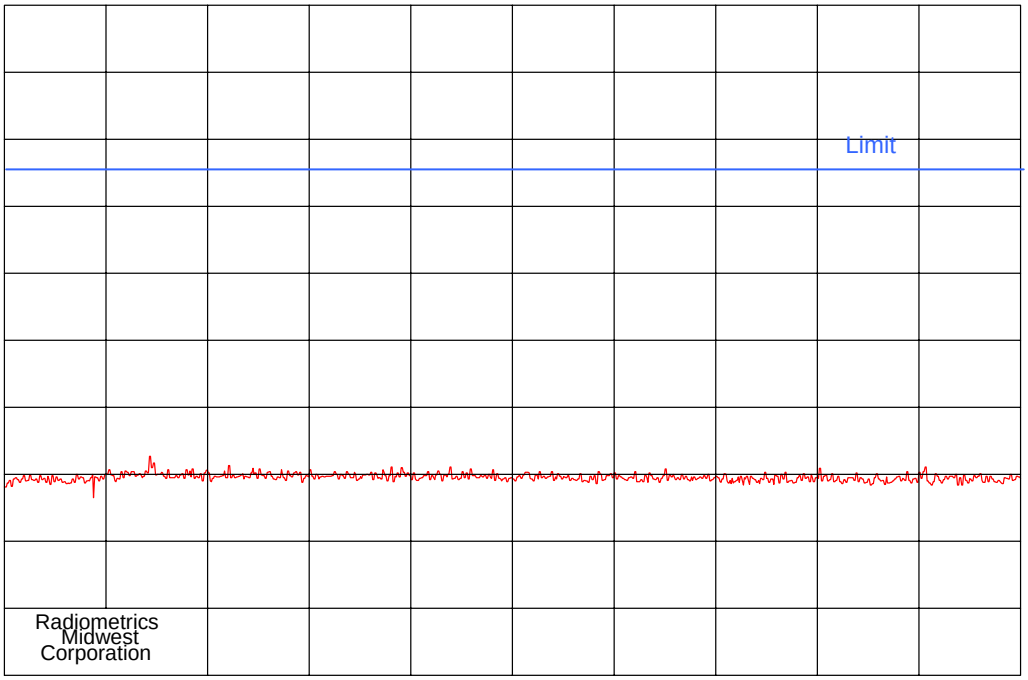


COMPANY : Aclara
START 2.5 GHz
RES BW 100 kHz
10 dB/
ITEM : Zigbee Module
REF 20.0 dBm
VBW 300 kHz
TIME : 11:48
DATE : 03-14-2008
STOP 18.0 GHz
ATTEN 30 dB
SWP 4.65 sec
NOTES : Antenna Conducted Emissions, Chan 26 (High)

MKR 19.228 GHz -58.30 dBm



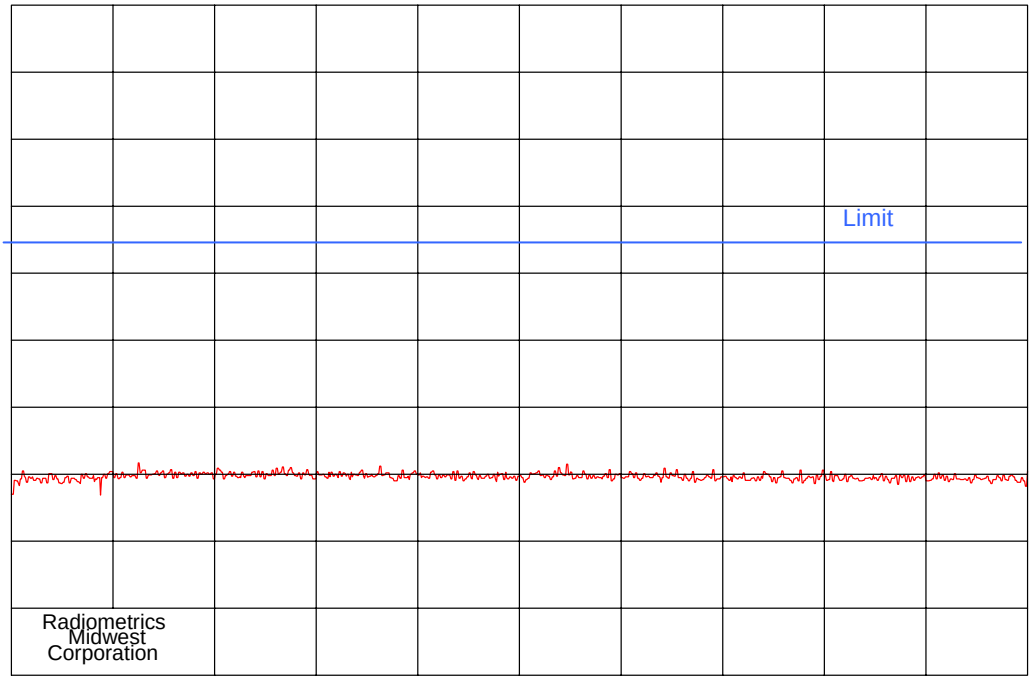
COMPANY : Aclara
START 18.00 GHz
RES BW 3 MHz
10 dB/
ITEM : Zigbee Transmitter
REF 10.0 dBm
VBW 3 MHz
TIME : 16:27
DATE : 03-14-2008
STOP 24.90 GHz
ATTEN 10 dB
SWP 23.0 msec
NOTES : Antenna Conducted emissions, Low channel (1)



COMPANY : Aclara
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Antenna Conducted Emissions, Mid Channel

ITEM : Zigbee Module
REF 10.0 dBm
VBW 3 MHz
TIME : 16:35

DATE : 03-14-2008
STOP 24.90 GHz
ATTEN 10 dB
SWP 23.0 msec



COMPANY : Aclara
START 18.00 GHz
RES BW 3 MHz
10 dB/
NOTES : Antenna Conducted emissions, Upper Channel (26)

ITEM : Zigbee Module
REF 10.0 dBm
VBW 3 MHz
TIME : 16:33

DATE : 03-14-2008
STOP 24.90 GHz
ATTEN 10 dB
SWP 23.0 msec

Judgement: Pass by 24 dB

10.8 Spurious Radiated Emissions (Restricted Band)

Radiated emission measurements in the Restricted bands were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. Below 1 GHz, when a radiated emission is detected approaching the specification limit, the measurement of the emission is repeated using a tuned dipole antenna with a Roberts Balun. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded.

From 30 to 1000 MHz, an Anritsu Spectrum analyzer and a preamplifier with a 10 dB attenuator connected to the input were used. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

For tests from 1 to 25 GHz, an HP8566 spectrum analyzer was used with a preamplifier. The out of band emissions and the ambient emissions were below the level of input overload (72 dBuV). In addition, a high pass filter was used to reduce the fundamental emission.

Final radiated emissions measurements were performed in the Anechoic Chamber at a test distance of 3 meters. The entire frequency range from 30 to 25 MHz was slowly scanned and the emissions in the restricted frequency bands were recorded. Measurements were performed using the peak detector function. The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground. The open field test site has a metal ground screen. All other tests are performed at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The was device was rotated through three orthogonal axis as per 13.1.4.1 of ANSI C63.4 during the prescans and during final radiated tests.

10.8.1 Radiated Emissions Field Strength Sample Calculation

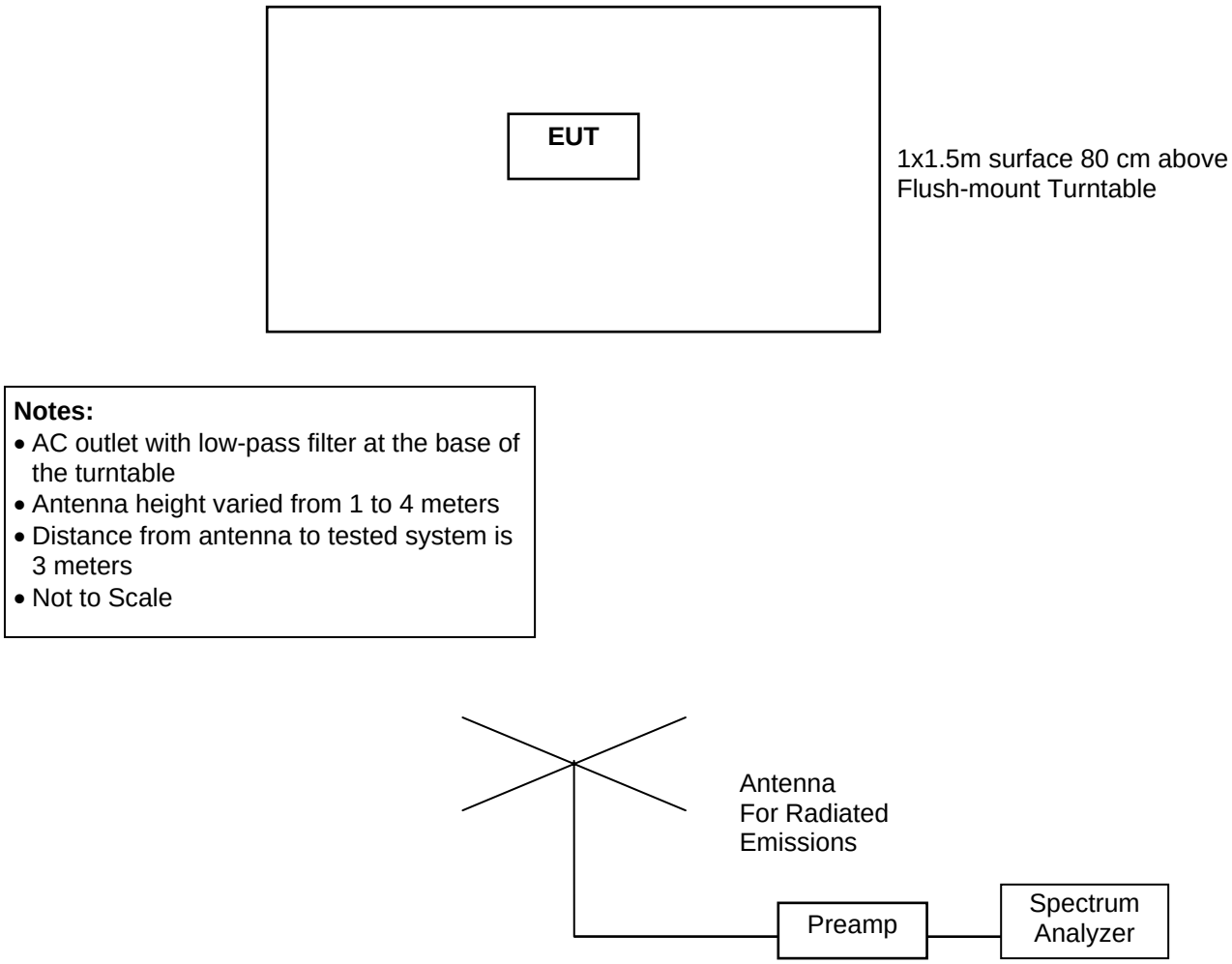
The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength
RA = Receiver Amplitude
AF = Antenna Factor
CF = Cable Attenuation Factor
AG = Amplifier Gain
HPF = High pass Filter Loss
PKA = Peak to Average Factor (This is zero for non-average measurements)

The Peak to average factor is used when average measurements are required. It is calculated by the highest duty cycle in percent over any 100mS transmission. The factor in dB is 20 * Log(Duty cycle/100).

Figure 2. Drawing of Radiated Emissions Setup



10.8.2 Spurious Radiated Emissions Test Results (Restricted Band)

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
A Video Bandwidth of 10 Hz was used for Average measurements above 1 GHz.

Manufacturer	ACLARA Power-Line Systems	Specification	FCC Part 15 Subpart C & RSS-210
Model	Y70080-1	Test Date	March 10, 2008
Serial Number	None	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain – Duty Cycle Factor + HP Filter Loss		

Freq. MHz	Meter Reading dBuV	Antenna Factor dB	Antenna Pol/ Type	Corr. Factors dB	Field Strength dBuV/m EUT	Field Strength dBuV/m Limit	Margin Under Limit dB
48.7	27.4 P	15.3	H/44	-19.9	22.9	40.0	17.1
159.5	28.9 P	10.4	H/44	-18.7	20.6	43.5	22.9
207.9	25.3 P	10.8	H/44	-18.2	17.9	43.5	25.6
313.5	25.6 P	14.1	H/44	-17.5	22.2	46.0	23.8
152.4	27.3 P	10.7	V/44	-18.7	19.3	43.5	24.2
190.1	26.3 P	10.1	V/44	-18.4	18.0	43.5	25.5
1262.0	23.1 P	24.0	V/44	-12.6	34.6	54.0	19.4
773.0	21.7 P	20.1	V/44	-14.7	27.1	46.0	18.9

Emissions above 1 GHz

hrm	Transmit Freq	Ant	EUT Emission Frequency	Peak Tot. FS	Ave Tot. FS	Peak Limit	Ave Limit	Worst Case Margin Under limit
#	MHz	Pol.	MHz	dBuV/m	dBuV/m	dBuV/m	dBuV/m	dB
be	2405	V	2390	56.7	45.3	74	54	8.7
be	2405	H	2390	54.9	43.5	74	54	10.5
2	2405	V	4810	55.3	43.9	74	54	10.1
2	2405	H	4810	57.1	45.7	74	54	8.3
3	2405	V	7215	56.1	44.7	74	54	9.3
3	2405	H	7215	56.0	44.6	74	54	9.4
5	2405	V	12025	54.9	43.5	74	54	10.5
5	2405	H	12025	55.8	44.4	74	54	9.6
2	2440	V	4880	53.4	42.0	74	54	12
2	2440	H	4880	55.0	43.6	74	54	10.4
3	2440	V	7320	57.1	45.7	74	54	8.3
3	2440	H	7320	57.7	46.3	74	54	7.7
5	2440	V	12200	60.8	49.4	74	54	4.6
5	2440	H	12200	59.9	48.5	74	54	5.5
be	2480	V	2483.5	60.6	47.8	74	54	6.2
be	2480	H	2484	63.0	50.2	74	54	3.8
2	2480	V	4960	43.0	31.6	74	54	22.4
2	2480	H	4960	42.4	31.0	74	54	23.0
3	2480	V	7440	45.9	34.5	74	54	19.5
3	2480	H	7440	44.9	33.5	74	54	20.5
5	2480	V	12400	37.9	26.5	74	54	27.5
5	2480	H	12400	40.4	29.0	74	54	25
be	2475	V	2483.5	56.8	45.4	74	54	8.6
be	2475	H	2483.5	59.8	48.4	74	54	5.6
2	2475	V	4950	50.3	38.9	74	54	15.1
2	2475	H	4950	51.1	39.7	74	54	14.3
3	2475	V	7425	56.9	45.5	74	54	8.5
3	2475	H	7425	57.0	45.6	74	54	8.4
5	2475	V	12375	59.3	47.9	74	54	6.1
5	2475	H	12375	60.9	49.5	74	54	4.5

Judgment: Passed by 3.8 dB
No other emissions were detected in the restricted bands.