

SENA

Dates of Tests: Jan 20 ~ 29, 2010

Test Report S/N: LR500191002B

Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

S7AZBLINXZS10

APPLICANT

Sena Technologies, Inc.

| | | |
|---------------------------|---|---|
| Equipment Class | : | Digital Transmission System (DTS) |
| Manufacturing Description | : | ZigBee Serial Adapter |
| Manufacturer | : | Sena Technologies, Inc. |
| Model name | : | ZBlinx-ZS10 |
| Test Device Serial No.: | : | Identical prototype |
| Rule Part(s) | : | FCC Part 15.247 Subpart C; ANSI C-63.4-2003 |
| Frequency Range | : | 2410MHz ~ 2475MHz |
| Max. Output Power | : | Max 13.42dBm - Conducted |
| Data of issue | : | February 1, 2010 |

This test report is issued under the authority of:

The test was supervised by:



Dong -Min JUNG, Technical Manager



Kyung-Taek LEE, Test Engineer

This test result only responds to the tested sample. It is not allowed to copy this report even partly without the allowance of the test laboratory. This report must not be used by the applicant to claim product endorsement by any agency.



NVLAP LAB Code.: 200723-0

TABLE OF CONTENTS

| | |
|--|----|
| 1. GENERAL INFORMATION'S | 3 |
| 2. INFORMATION'S ABOUT TEST ITEM | 4 |
| 3. TEST REPORT | 5 |
| 3.1 SUMMARY OF TESTS | 5 |
| 3.2 TECHNICAL CHARACTERISTICS TEST | 6 |
| 3.2.1 6dB BANDWIDTH | 6 |
| 3.2.2 PEAK OUTPUT POWER | 9 |
| 3.2.3 POWER SPECTRAL DENSITY | 12 |
| 3.2.4 BAND – EDGE & SPURIOUS | 15 |
| 3.2.5 FIELD STRENGTH OF HARMONICS | 21 |
| 3.2.6 AC CONDUCTED EMISSIONS | 24 |
| APPENDIX | |
| APPENDIX TEST EQUIPMENT USED FOR TESTS | 27 |

1. General information's

1-1 Test Performed

Company name : LTA Co., Ltd.
Address : 243, Jubug-ri, Yangji-Myeon, Youngin-Si, Kyunggi-Do, Korea. 449-822
Web site : <http://www.ltalab.com>
E-mail : chahn@ltalab.com
Telephone : +82-31-323-6008
Facsimile : +82-31-323-6010

Quality control in the testing laboratory is implemented as per ISO/IEC 17025 which is the “General requirements for the competents of calibration and testing laboratory”.

1-2 Accredited agencies

LTA Co., Ltd. is approved to perform EMC testing by the following agencies:

| Agency | Country | Accreditation No. | Validity | Reference |
|--------|---------|-------------------|------------|---------------------|
| NVLAP | U.S.A | 200723-0 | 2010-09-30 | ECT accredited Lab. |
| RRL | KOREA | KR0049 | 2011-06-20 | EMC accredited Lab. |
| FCC | U.S.A | 610755 | 2011-04-22 | FCC filing |
| VCCI | JAPAN | R2133, C2307 | 2011-06-21 | VCCI registration |
| IC | CANADA | IC5799 | 2010-05-03 | IC filing |

2-1 Client & Manufacturer

3. Test Report

3.1 Summary of tests

| FCC Part Section(s) | Parameter | Limit | Test Condition | Status (note 1) |
|---------------------|------------------------------------|---------------|----------------|-----------------|
| 15.247(a) | 6 dB Bandwidth | > 500kHz | Conducted | C |
| 15.247(b) | Transmitter Peak Output Power | < 1Watt | | C |
| 15.247(d) | Transmitter Power Spectral Density | < 8dBm @ 3kHz | | C |
| 15.247(d) | Band Edge & Spurious | > 20 dBc | | C |
| 15.209 | Field Strength of Harmonics | Emission | Radiated | C |
| 15.207 | AC Conducted Emissions | Emissions | Conducted | C |
| 15.203 | Antenna requirement | - | - | C |

Note 1: C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable

Note 2: The data in this test report are traceable to the national or international standards.

→ Antenna Requirement

The Sena Technologies, Inc. FCC ID: S7AZBLINXZS10 unit complies with the requirement of §15.203. The antenna connector is the reverse polarity SMA connector.

The sample was tested according to the following specification:
FCC Parts 15.247; ANSI C-63.4-2003

3.2 Technical Characteristics Test

3.2.1 6 dB Bandwidth

Procedure:

The bandwidth at 6dB below the highest in-band spectral density was measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker 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 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 30 MHz

VBW = 100 kHz (VBW \geq RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

| Frequency (MHz) | Test Results | |
|--------------------|--------------------------|----------|
| | Measured Bandwidth (MHz) | Result |
| 2410 | 1.650 | Complies |
| 2440 | 1.577 | Complies |
| 2475 | 1.570 | Complies |

- See next pages for actual measured spectrum plots.

Minimum Standard:

6 dB Bandwidth > 500kHz

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

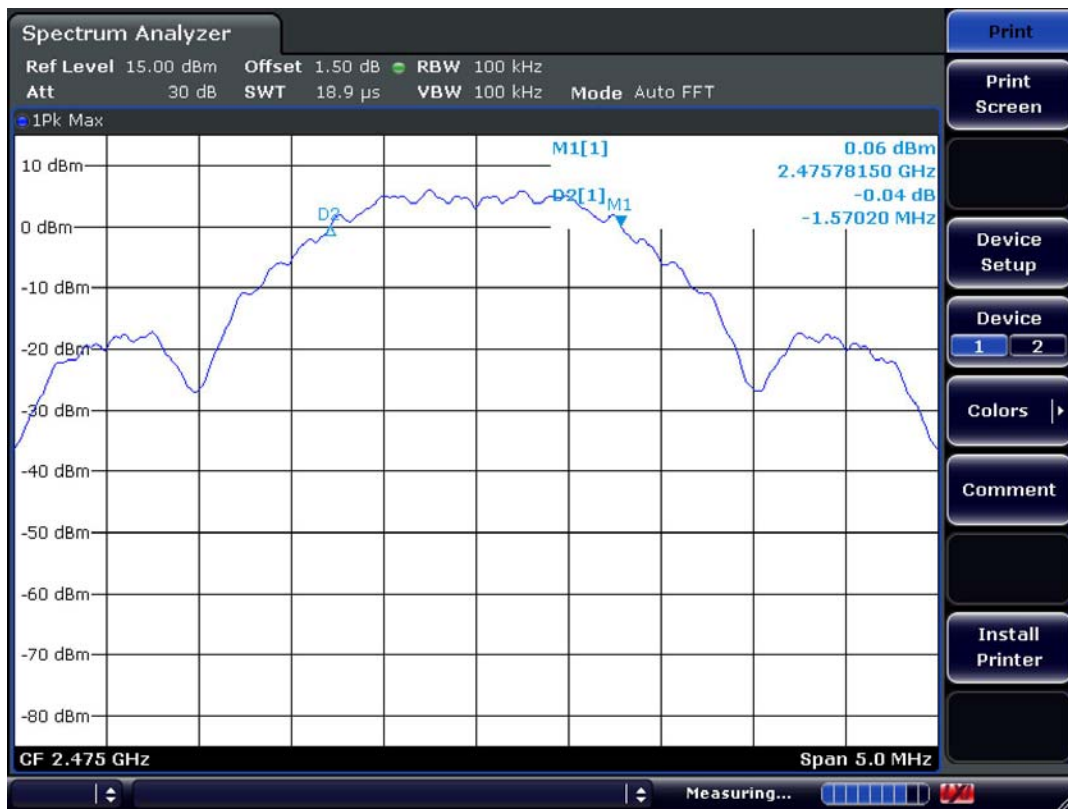
Low Channel



Mid Channel



High Channel



3.2.2 Peak Output Power Measurement

Procedure:

The maximum peak output power was measured with the spectrum analyzer connected to the antenna output of the EUT. The spectrum analyzer's internal channel power integration function is used to integrate the power over a bandwidth greater than or equal to the 99% bandwidth. The EUT was operating in transmit mode at the appropriate center frequency.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1MHz

Span = auto

VBW = 1MHz (VBW \geq RBW)

Sweep = auto

Detector function = peak

Measurement Data:

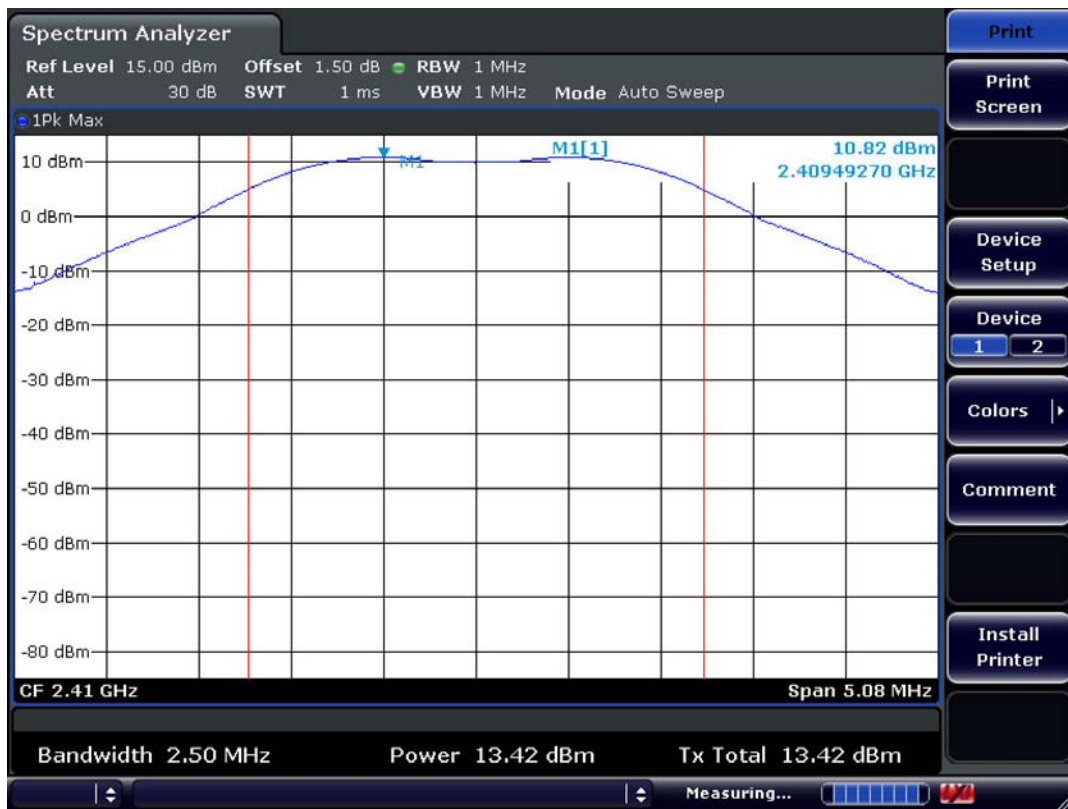
| Frequency (MHz) | Test Results | | |
|--------------------|--------------|-------|----------|
| | dBm | mW | Result |
| 2410 | 13.42 | 21.98 | Complies |
| 2440 | 12.50 | 17.78 | Complies |
| 2475 | 11.59 | 14.42 | Complies |

- See next pages for actual measured spectrum plots.

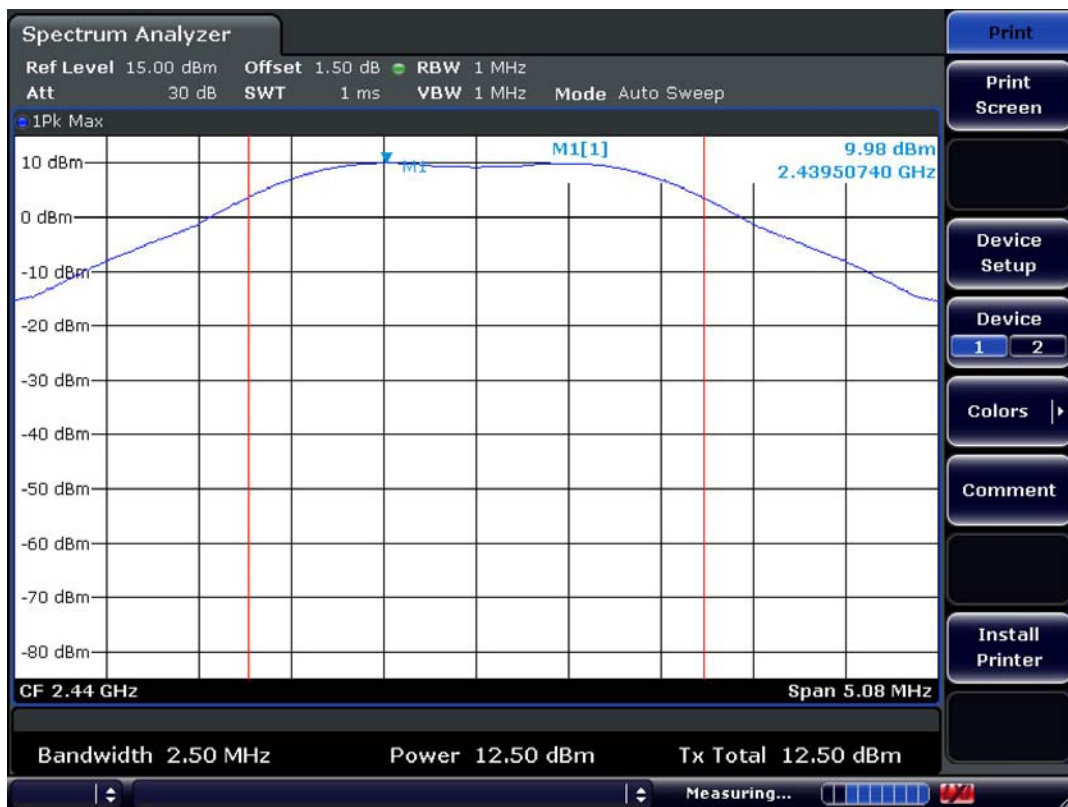
Minimum Standard:

| | |
|-------------------|------|
| Peak output power | < 1W |
|-------------------|------|

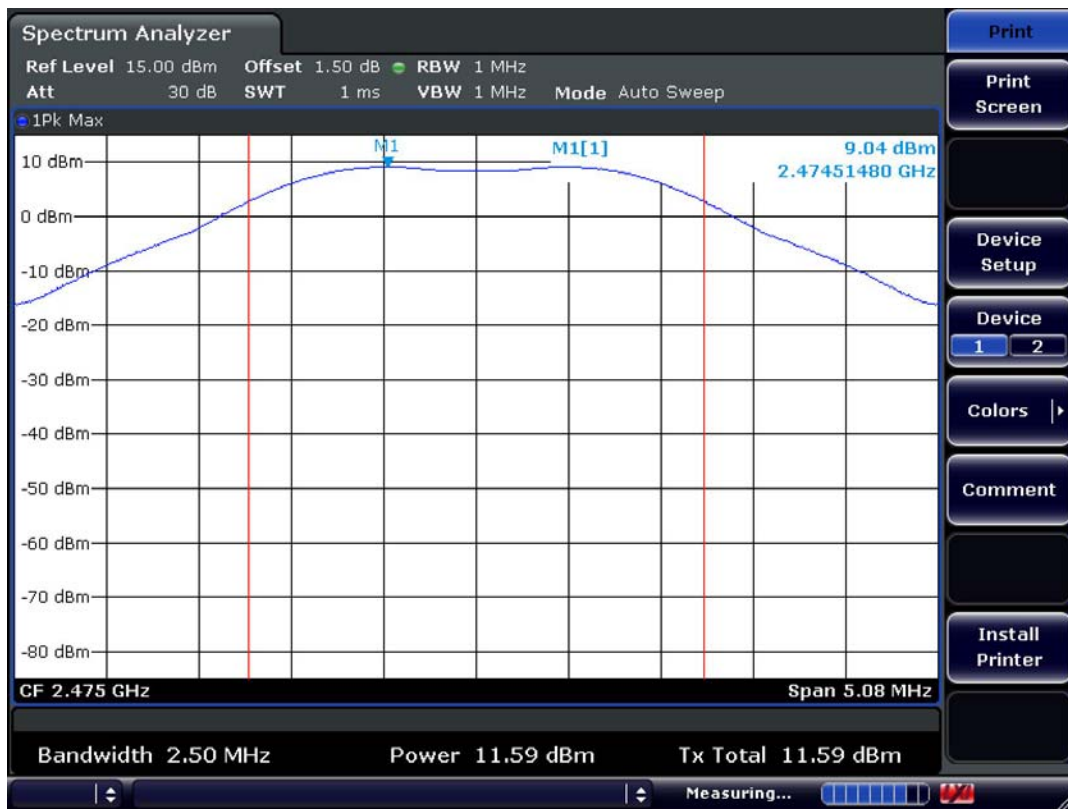
Low Channel



Mid Channel



High Channel



3.2.3 Power Spectral Density

Procedure:

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

The spectrum analyzer is set to:

RBW = 3 kHz

Span = 300 kHz

VBW = 3 kHz

Sweep = 100 sec

Detector function = peak

Trace = max hold

Measurement Data:

| Frequency (MHz) | Test Results | |
|--------------------|--------------|----------|
| | dBm | Result |
| 2410 | -4.10 | Complies |
| 2440 | -4.55 | Complies |
| 2475 | -5.88 | Complies |

- See next pages for actual measured spectrum plots.

Minimum Standard:

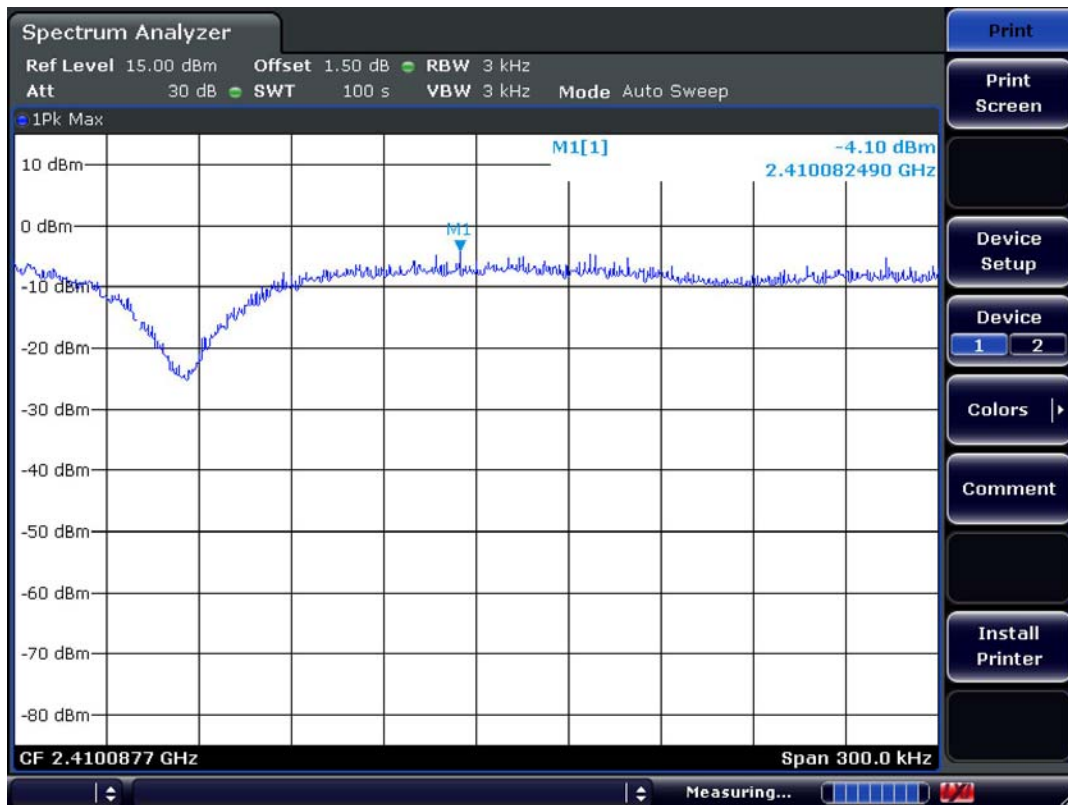
| | |
|------------------------|------------------|
| Power Spectral Density | < 8dBm @ 3kHz BW |
|------------------------|------------------|

Measurement Setup

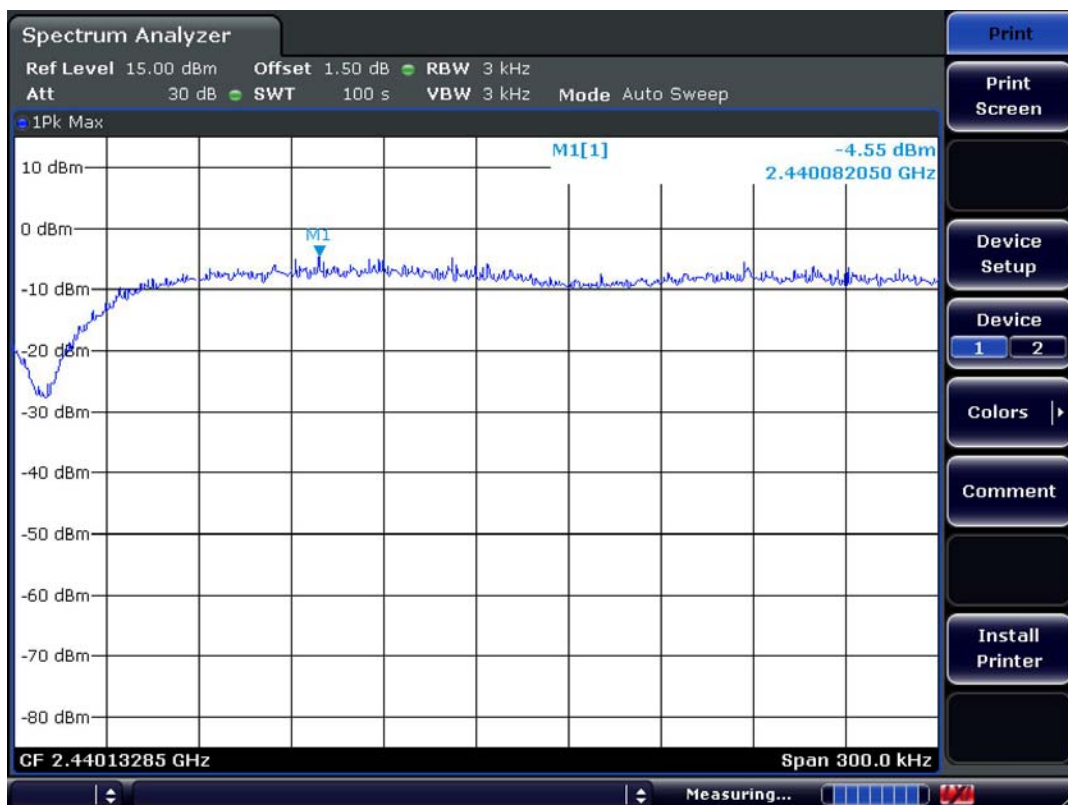
Same as the Chapter 3.2.1 (Figure 1)

Power Density Measurement

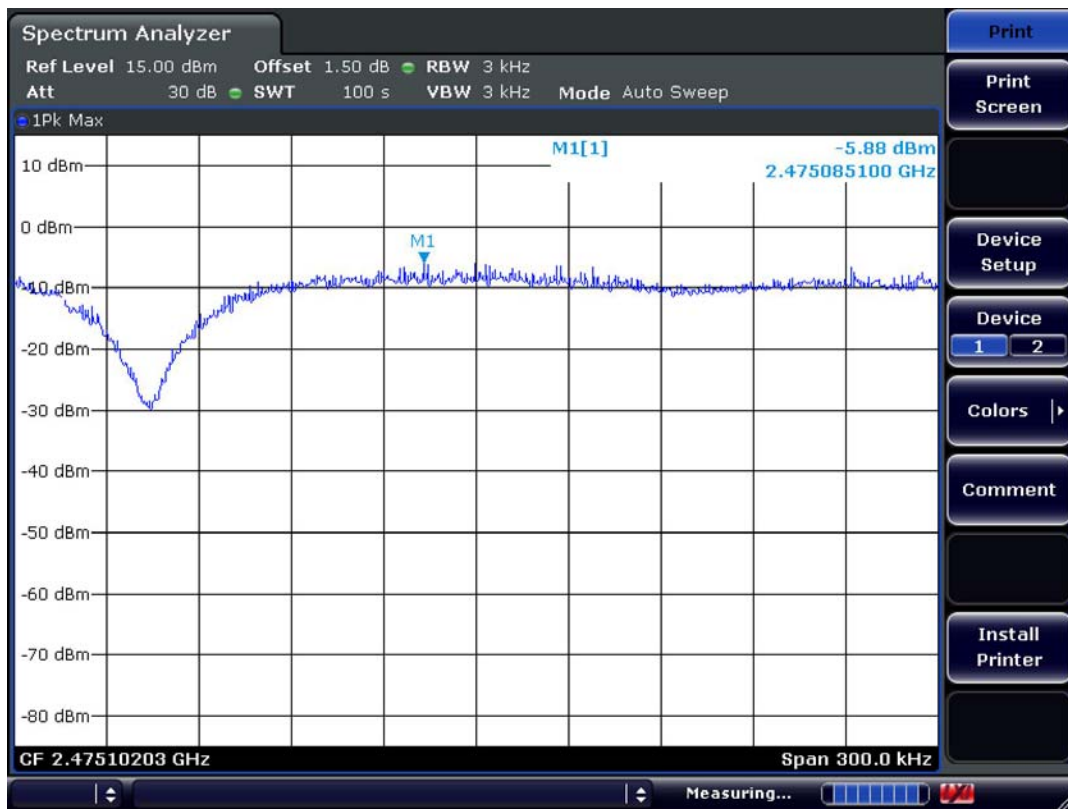
Low Channel



Mid Channel



High Channel



3.2.4 Band - edge & Spurious

Procedure:

The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT is operating in transmission mode at the appropriate frequencies.

After the trace being stable, Use the marker-to-peak function to measure 20 dB down both sides of the intentional emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 40 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Radiated emissions which fall in the restricted bands, as defined in 15.205(a), must also comply with the radiated emission limits specified in 15.209(a)

The spectrum analyzer is set to:

Center frequency = the highest, the lowest channels

PEAK:

RBW = VBW = 1MHz, Sweep=Auto

Average:

RBW = 1MHz, VBW=10Hz, Sweep=Auto

Measurement Distance:

3m

Polarization:

Horizontal / Vertical

Measurement Data: Complies

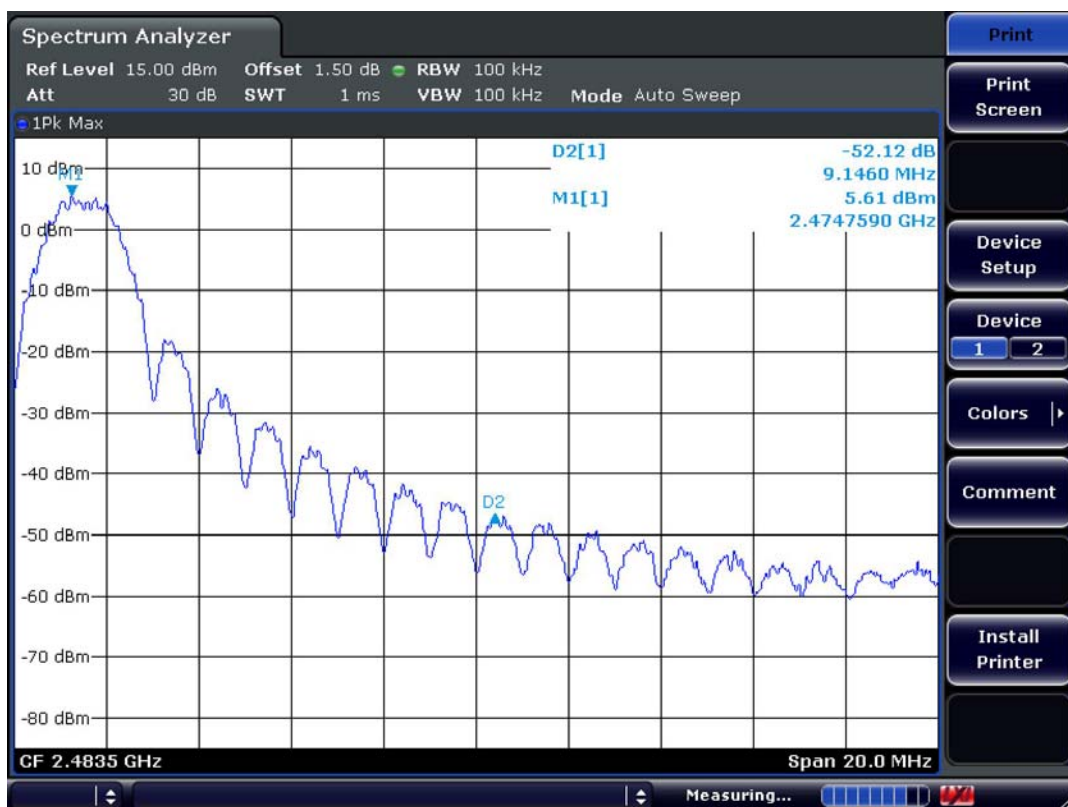
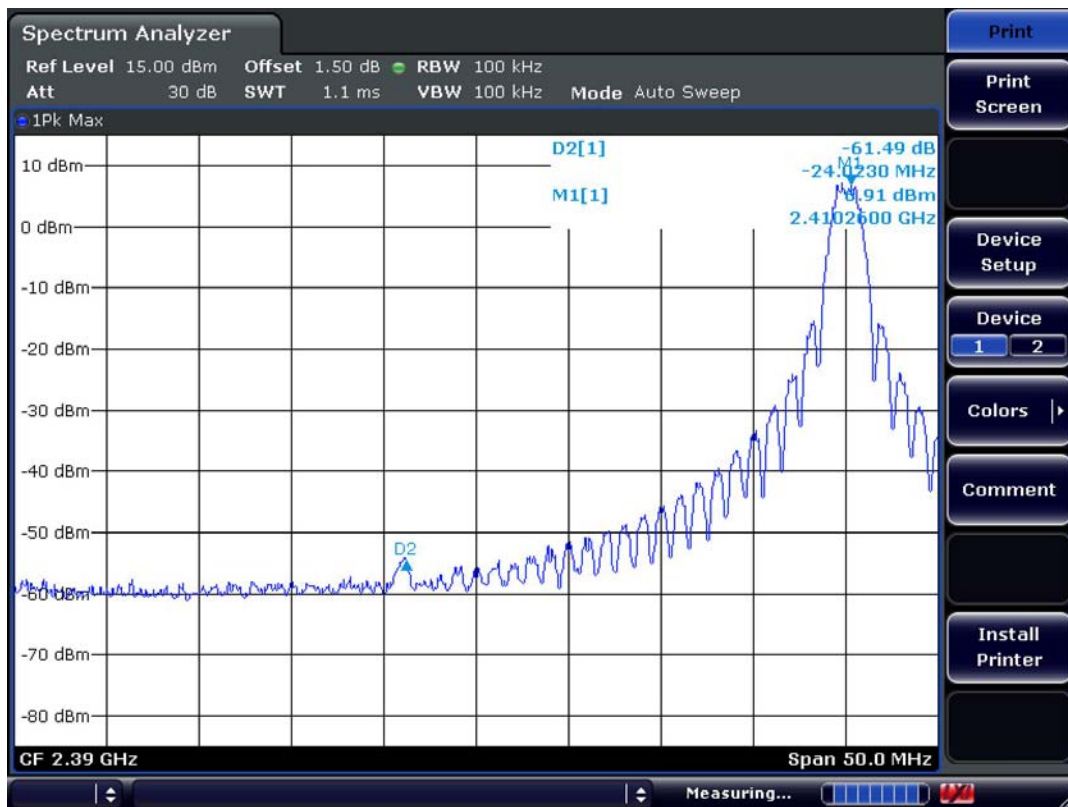
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.
- The used antenna is "R-AN2400-1901RS" and it gave the worse case emissions.

| | |
|--------------------------|----------|
| Minimum Standard: | > 20 dBc |
|--------------------------|----------|

Minimum Standard: FCC Part 15.209(a)

| Frequency (MHz) | Limit (uV/m) @ 3m |
|-----------------|-------------------|
| 30 ~ 88 | 100 ** |
| 88 ~ 216 | 150 ** |
| 216 ~ 960 | 200 ** |
| Above 960 | 500 |

Band-edge



Band-edges in the restricted band 2310-2390 MHz measurement

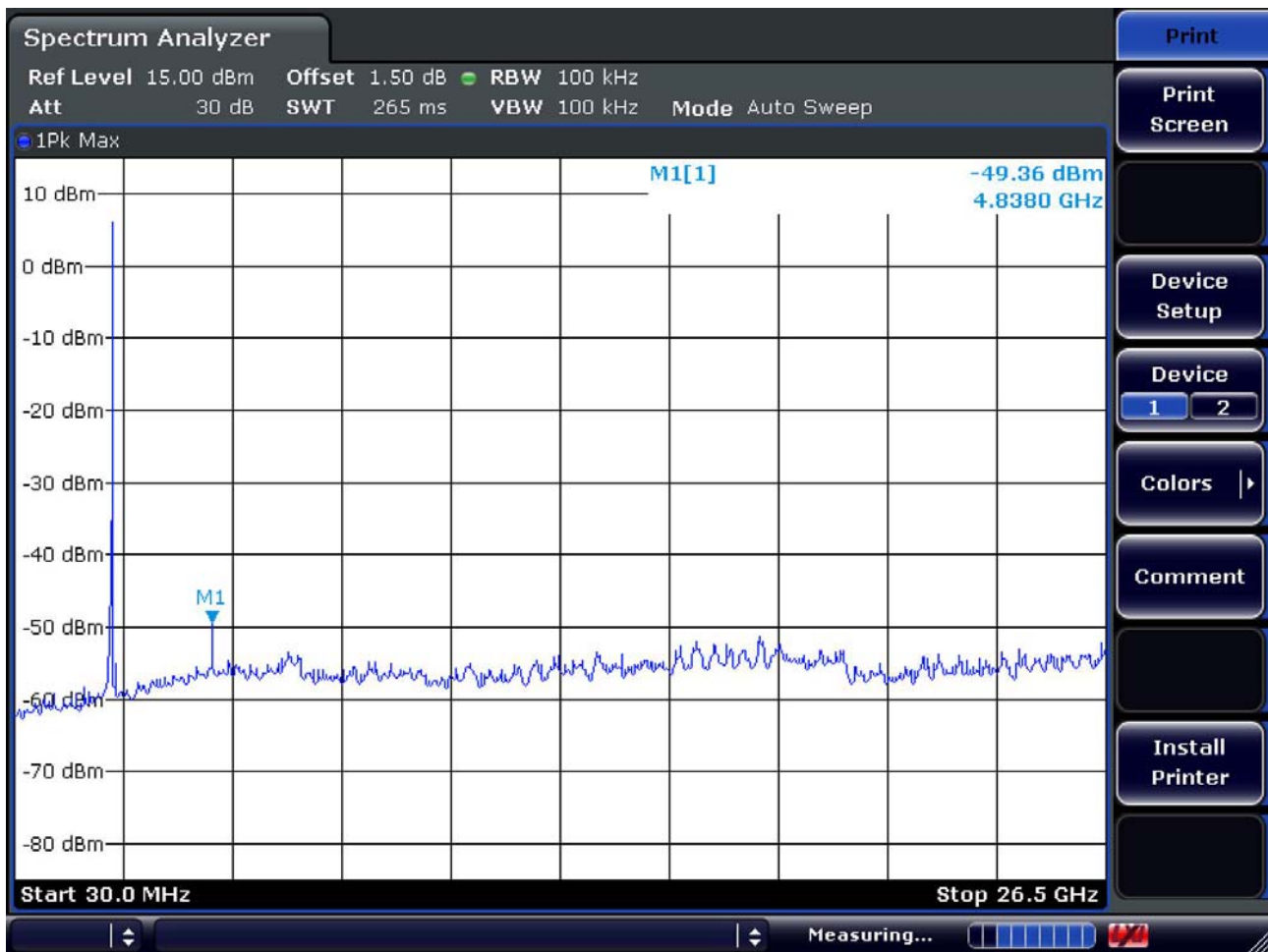
| Frequency | Reading | | Pol. | Correction | | | Limits | | Result | | Margin | |
|-----------|-----------|------|------|------------|--------------|-------|-----------|------|-----------|------|-----------|------|
| | [dBuV/m] | | | Factor | | | [dBuV/m] | | [dBuV/m] | | [dB] | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 2390.00 | 49.3 | 60.3 | H | 26.0 | 36.5 | 8.2 | 54.0 | 74.0 | 47.1 | 58.0 | 7.0 | 16.0 |

Band-edges in the restricted band 2483.5-2500 MHz measurement

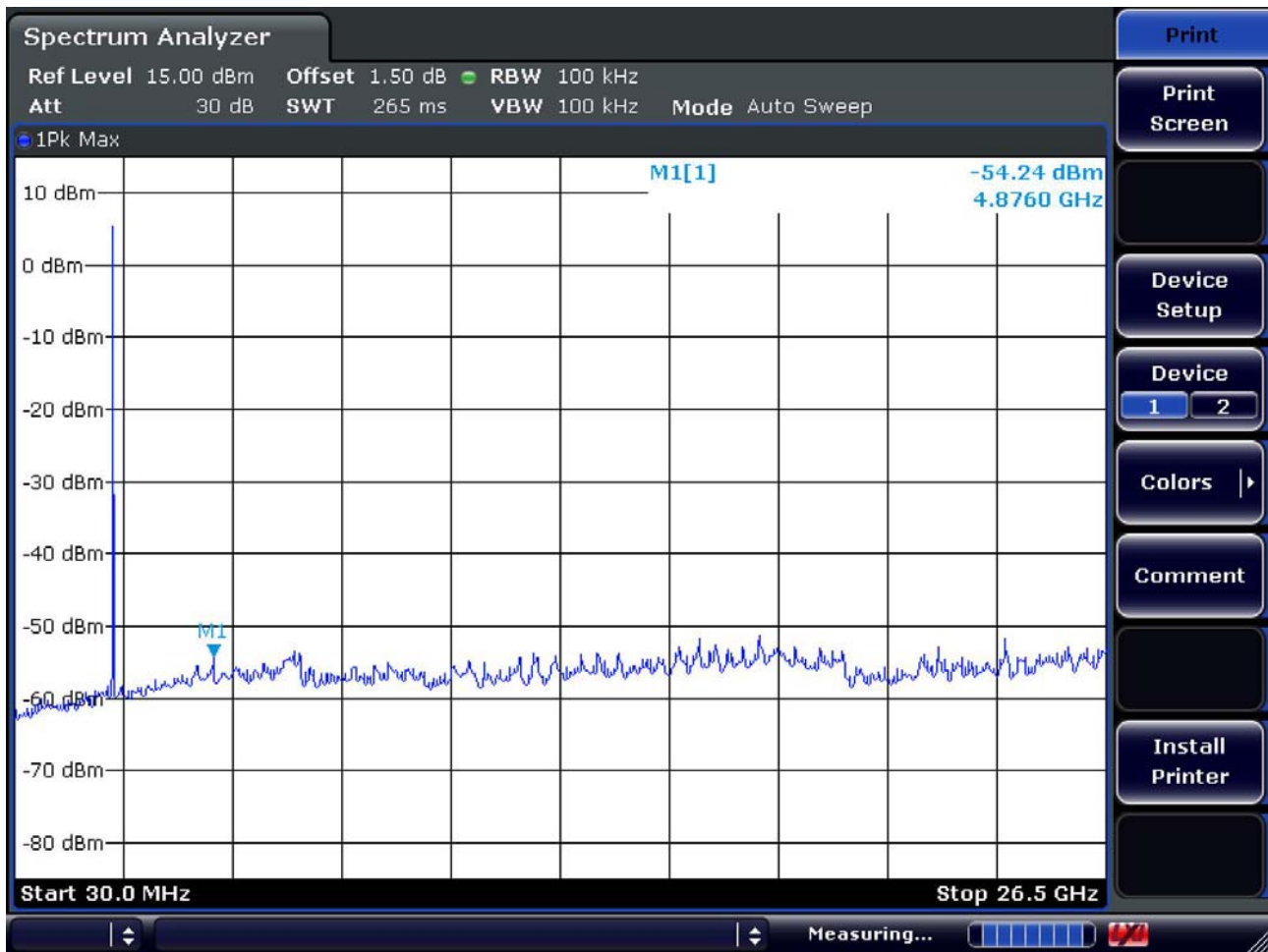
| Frequency | Reading | | Pol. | Correction | | | Limits | | Result | | Margin | |
|-----------|-----------|------|------|------------|--------------|-------|-----------|------|-----------|------|-----------|------|
| | [dBuV/m] | | | Factor | | | [dBuV/m] | | [dBuV/m] | | [dB] | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 2483.60 | 50.2 | 61.4 | H | 26.0 | 36.5 | 8.2 | 54.0 | 74.0 | 47.9 | 59.1 | 6.1 | 14.9 |

Note : This EUT was tested in 3 orthogonal positions and the worst-case data was presented.

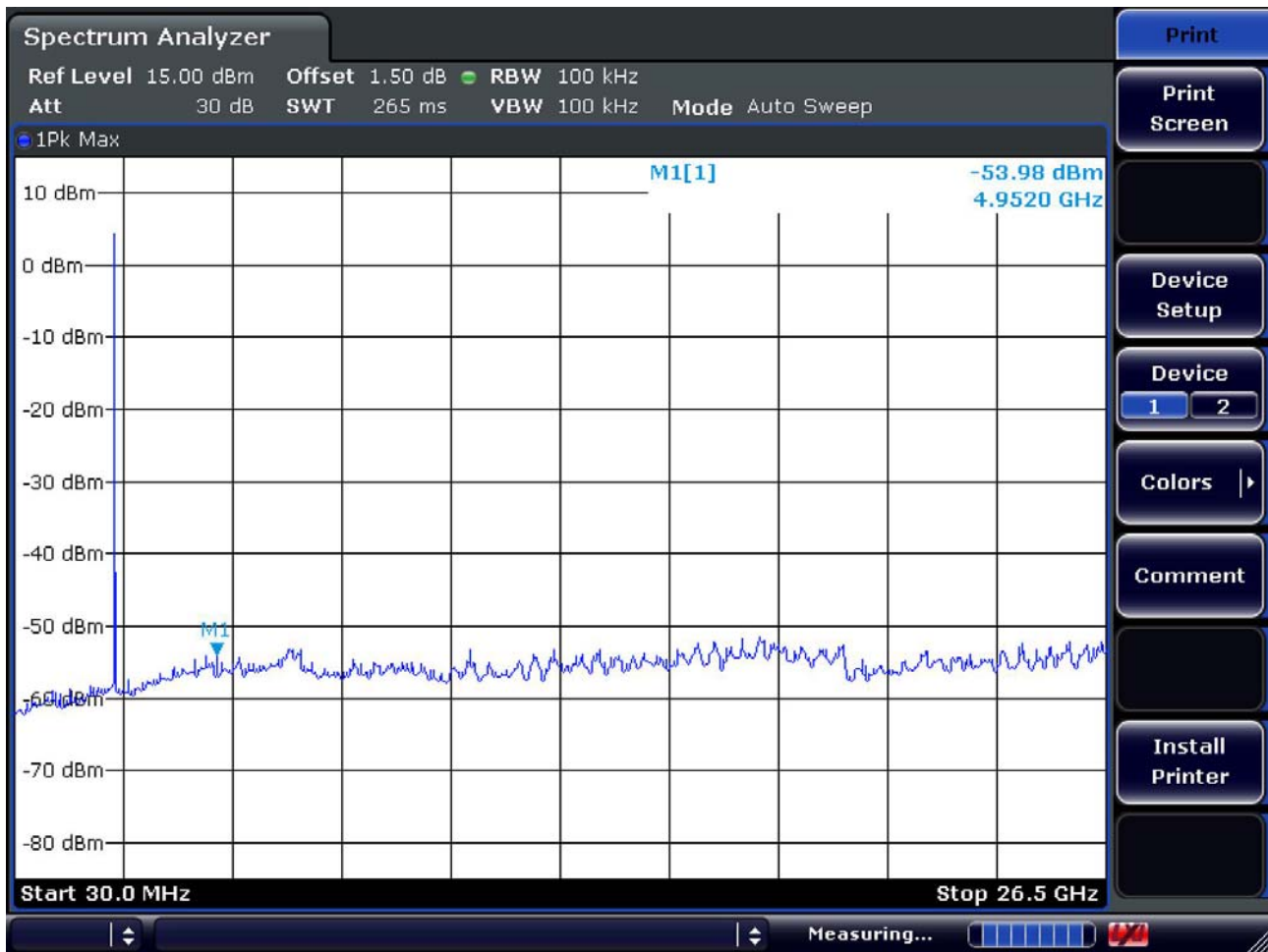
Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



High channel
Frequency Range = 30 MHz ~ 10th harmonic.



3.2.5 Field Strength of Harmonics

Procedure:

The EUT was placed on a 0.8m high wooden table inside a shielded enclosure. An antenna was placed near the EUT and measurements of frequencies and amplitudes of field strengths were recorded for reference during final measurements. For final radiated testing, measurements were performed in OATS. Measurements were performed with the EUT oriented in 3 orthogonal axis and rotated 360 degrees to determine worst-case orientation for maximum emissions.

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic.

RBW = 100 kHz (30MHz ~ 1 GHz)

VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- See next pages for actual measured data.
- The used antenna is “R-AN2400-1901RS” and it gave the worse case emissions.

Minimum Standard: FCC Part 15.209(a)

| Frequency (MHz) | Limit (uV/m) @ 3m |
|-----------------|-------------------|
| 30 ~ 88 | 100 ** |
| 88 ~ 216 | 150 ** |
| 216 ~ 960 | 200 ** |
| Above 960 | 500 |

** Except as provided in 15.209(g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88MHz, 174-216MHz or 470-806MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g. 15.231 and 15.241.

Minimum Standard: FCC Part 15.109

| Frequency (MHz) | Limit (uV/m) @ 10m |
|-----------------|--------------------|
| 30 ~ 88 | 90 |
| 88 ~ 216 | 150 |
| 216 ~ 960 | 210 |
| Above 960 | 300 |

Measurement Data:

| Frequency | Reading | | Pol. | Correction | | | Limits | | Result | | Margin | |
|-----------|-----------|------|------|------------|-----------|-------|-----------|------|-----------|------|-----------|------|
| | [dBuV/m] | | | Factor | | | [dBuV/m] | | [dBuV/m] | | [dB] | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 4820.00 | 46.8 | 52.4 | H | 31.4 | 34.6 | 8.7 | 54.0 | 74.0 | 52.3 | 57.9 | 1.8 | 16.2 |
| | | | | | | | | | | | | |
| Frequency | Reading | | Pol. | Correction | | | Limits | | Result | | Margin | |
| | [dBuV/m] | | | Factor | | | [dBuV/m] | | [dBuV/m] | | [dB] | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 4880.00 | 42.4 | 48.2 | H | 31.4 | 34.6 | 8.7 | 54.0 | 74.0 | 47.9 | 53.7 | 6.2 | 20.4 |
| | | | | | | | | | | | | |
| Frequency | Reading | | Pol. | Correction | | | Limits | | Result | | Margin | |
| | [dBuV/m] | | | Factor | | | [dBuV/m] | | [dBuV/m] | | [dB] | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | |
| 4950 | 43.2 | 49.4 | H | 31.4 | 34.6 | 8.7 | 54.0 | 74.0 | 48.7 | 54.9 | 5.3 | 19.2 |
| | | | | | | | | | | | | |

No other emissions were detected at a level greater than 20dB below limit.

Radiated Emissions – Zigbee

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Gyeonggi-do 449-822 Korea
Tel :+82-31-3236008,9
Fax:+82-31-3236010

EUT/Model No.: ZBlinx-ZS10

TEST MODE: ZigBee mode

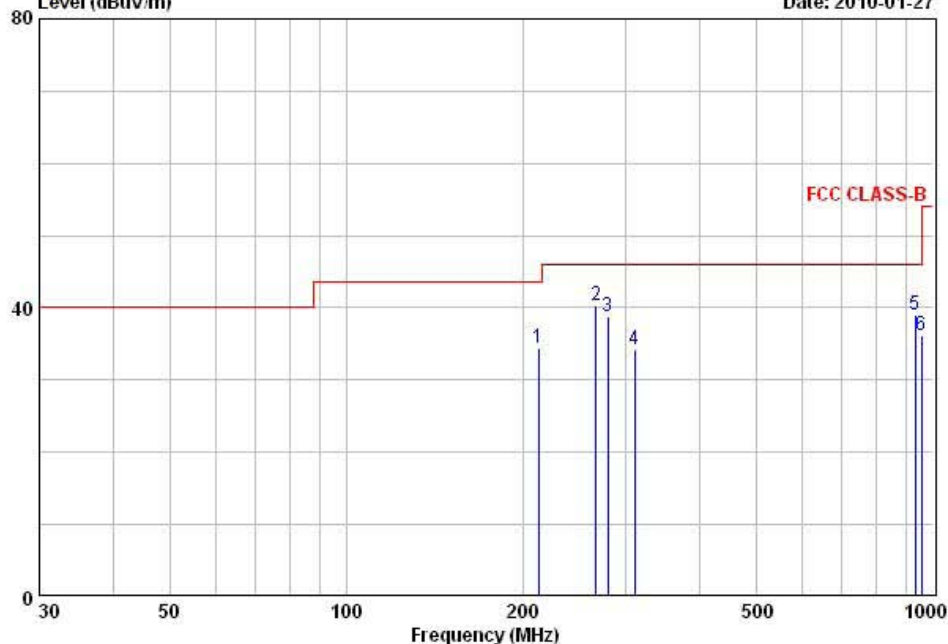
Temp Humi : 2 / 25

Tested by: PARK.H.W

Data: 73

Level (dBuV/m)

Date: 2010-01-27



| | Freq | Reading | C.F | Result | Limit QP | Margin | Height | Angle | Polarity |
|---|--------|---------|--------|--------|-------------|--------|--------|-------|------------|
| | MHz | dBuV/m | dB/m | dBuV/m | dBuV/m | dB | cm | deg | |
| 1 | 213.02 | 46.40 | -11.86 | 34.54 | 43.50 | 8.96 | 239 | 71 | HORIZONTAL |
| 2 | 266.61 | 49.90 | -9.65 | 40.25 | 46.00 | 5.75 | 241 | 28 | HORIZONTAL |
| 3 | 279.04 | 48.00 | -9.21 | 38.79 | 46.00 | 7.21 | 162 | 82 | HORIZONTAL |
| 4 | 310.00 | 42.60 | -8.31 | 34.29 | 46.00 | 11.71 | 135 | 27 | HORIZONTAL |
| 5 | 932.66 | 37.00 | 2.04 | 39.04 | 46.00 | 6.96 | 100 | 136 | HORIZONTAL |
| 6 | 955.83 | 33.80 | 2.39 | 36.19 | 46.00 | 9.81 | 106 | 247 | HORIZONTAL |

Remarks: C.F (Correction Factor) = Antenna factor + Cable loss - Preamp gain

3.2.6 AC Conducted Emissions

Procedure:

The conducted emissions are measured in the shielded room with a spectrum analyzer in peak hold. While the measurement, EUT had its hopping function disabled at the middle channels in line with Section 15.31(m). Emissions closest to the limit are measured in the quasi-peak mode (QP) with the tuned receiver using a bandwidth of 9 kHz. The emissions are maximized further by cable manipulation and Exerciser operation. The highest emissions relative to the limit are listed.

Measurement Data: Complies

- See next pages for actual measured spectrum plots.
- No emissions were detected at a level greater than 10dB below limit.
- The used antenna is “R-AN2400-1901RS” and it gave the worse case emissions.

Minimum Standard: FCC Part 15.207(a)/EN 55022

Class B

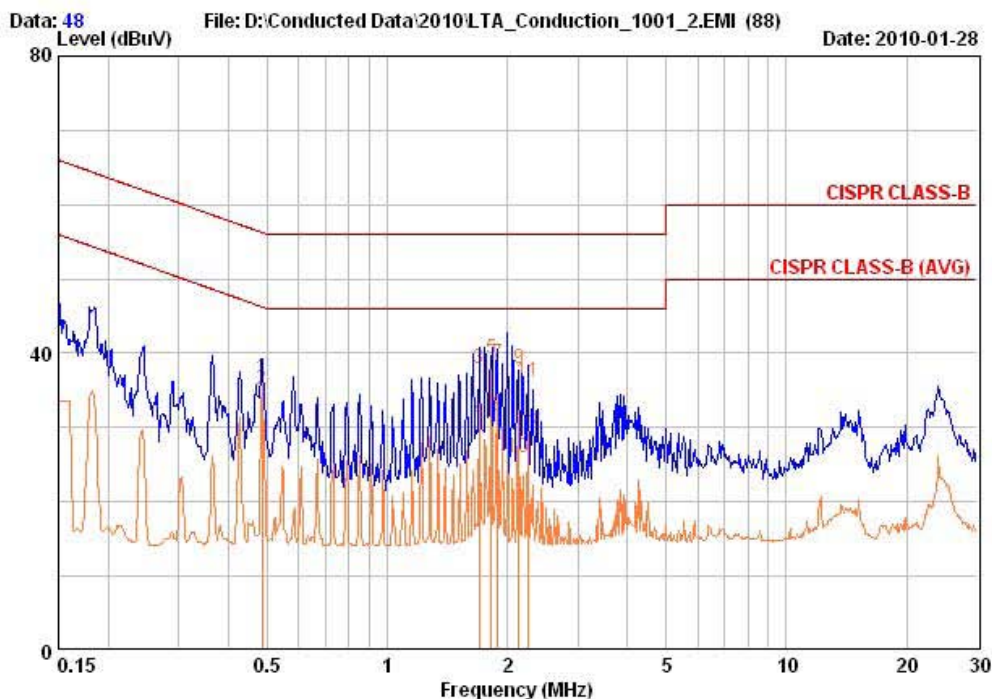
| Frequency Range | quasi-peak | Average |
|-----------------|------------|------------|
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency

AC Conducted Emissions – Zigbee – Line

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Gyeonggi-do 449-822 Korea
Tel +82-31-3236008,9
Fax: +82-31-3236010

| | |
|-------------------------------|--------------------------|
| EUT / Model No. : ZBlink-ZS10 | Phase : LINE |
| Test Mode : ZigBee mode | Test Power : 120 / 60 |
| Temp./Humi. : 24 / 33 | Test Engineer : PARK.H.W |



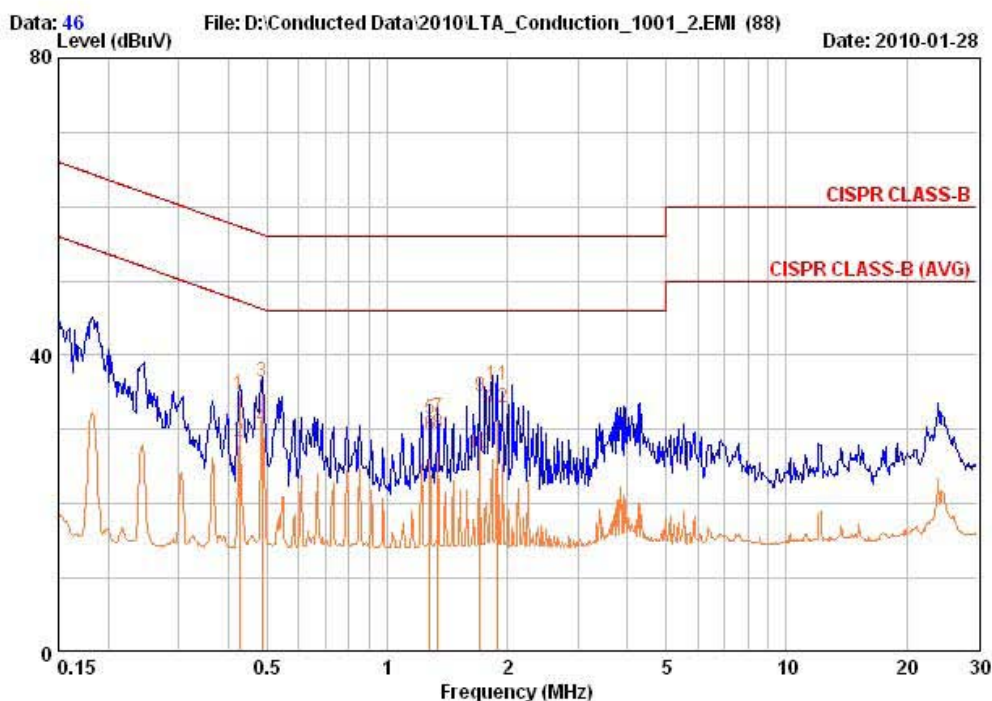
| Freq | RD | RD | C.F | Result | Result | Limit | Limit | Margin | Margin |
|-------|-------|-------|------|--------|--------|-------|-------|--------|--------|
| MHz | QP | AV | dB | QP | AV | QP | AV | QP | AV |
| | dBuV | dBuV | | dBuV | dBuV | dBuV | dBuV | dB | dB |
| 0.486 | 26.95 | 25.35 | 9.67 | 36.62 | 35.02 | 56.24 | 46.24 | 19.62 | 11.22 |
| 1.703 | 28.15 | 21.25 | 9.81 | 37.96 | 31.06 | 56.00 | 46.00 | 18.04 | 14.94 |
| 1.825 | 29.35 | 21.75 | 9.81 | 39.16 | 31.56 | 56.00 | 46.00 | 16.84 | 14.44 |
| 1.888 | 28.85 | 21.85 | 9.82 | 38.67 | 31.67 | 56.00 | 46.00 | 17.33 | 14.33 |
| 2.132 | 28.06 | 16.16 | 9.82 | 37.88 | 25.98 | 56.00 | 46.00 | 18.12 | 20.02 |
| 2.253 | 26.36 | 19.46 | 9.83 | 36.18 | 29.28 | 56.00 | 46.00 | 19.82 | 16.72 |

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

AC Conducted Emissions – Zigbee – Neutral

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Tel +82-31-3236008,9
Fax: +82-31-3236010

| | |
|-------------------------------|--------------------------|
| EUT / Model No. : ZBlink-ZS10 | Phase : NEUTRAL |
| Test Mode : ZigBee mode | Test Power : 120 / 60 |
| Temp./Humi. : 24 / 33 | Test Engineer : PARK.H.W |



| Freq | RD | RD | C.F | Result | Result | Limit | Limit | Margin | Margin |
|-------|-------|-------|------|--------|--------|-------|-------|--------|--------|
| MHz | QP | AV | dB | QP | AV | QP | AV | QP | AV |
| | dBuV | dBuV | | dBuV | dBuV | dBuV | dBuV | dB | dB |
| 0.426 | 24.95 | 18.65 | 9.66 | 34.61 | 28.31 | 57.33 | 47.33 | 22.72 | 19.02 |
| 0.485 | 26.65 | 20.65 | 9.66 | 36.31 | 30.31 | 56.25 | 46.25 | 19.94 | 15.94 |
| 1.278 | 21.65 | 19.35 | 9.79 | 31.44 | 29.14 | 56.00 | 46.00 | 24.56 | 16.86 |
| 1.339 | 21.75 | 19.55 | 9.79 | 31.54 | 29.34 | 56.00 | 46.00 | 24.46 | 16.66 |
| 1.704 | 24.65 | 17.05 | 9.81 | 34.46 | 26.86 | 56.00 | 46.00 | 21.54 | 19.14 |
| 1.889 | 26.15 | 23.15 | 9.82 | 35.97 | 32.97 | 56.00 | 46.00 | 20.03 | 13.03 |

Remarks: C.F (Correction Factor) = Insertion loss + Cable loss

APPENDIX

TEST EQUIPMENT USED FOR TESTS

| | Description | Model No. | Serial No. | Manufacturer | Next Cal. Date |
|----|--------------------------|-------------|---------------|---------------|----------------|
| 1 | Spectrum Analyzer | FSV-30 | 100757 | R&S | Feb-10 |
| 2 | Spectrum Analyzer | 8563E | 3425A02505 | HP | Apr-10 |
| 3 | Spectrum Analyzer | 8594E | 3710A04074 | HP | Oct-10 |
| 4 | Signal Generator | 8648C | 3623A02597 | HP | Apr-10 |
| 5 | Signal Generator | 83711B | US34490456 | HP | Apr-10 |
| 6 | Attenuator (3dB) | 8491A | 37822 | HP | Oct-10 |
| 7 | Attenuator (10dB) | 8491A | 63196 | HP | Oct-10 |
| 8 | Attenuator (30dB) | 8498A | 1801A06689 | HP | Oct-10 |
| 9 | EMI Test Receiver | ESVD | 843748/001 | R&S | Apr-10 |
| 10 | Horn Antenna(18 ~ 40GHz) | SAS-574 | 154 | Schwarzbeck | Nov-10 |
| 11 | Horn Antenna(18 ~ 40GHz) | SAS-574 | 155 | Schwarzbeck | Nov-10 |
| 12 | RF Amplifier | 8447D | 2949A02670 | HP | Oct-10 |
| 13 | RF Amplifier | 8449B | 3008A02126 | HP | Apr-10 |
| 14 | Test Receiver | ESHS10 | 828404/009 | R&S | Apr-10 |
| 15 | TRILOG Antenna | VULB 9160 | 9160-3212 | SCHWARZBECK | Apr-11 |
| 16 | Log.-Per. Antenna | VULP 9118 | 9118 A 401 | SCHWARZBECK | Apr-11 |
| 17 | Biconical Antenna | BBA 9106 | VHA 9103-2315 | SCHWARZBECK | Apr-11 |
| 18 | Horn Antenna | 3115 | 00055005 | ETS LINDGREN | Mar-11 |
| 19 | Horn Antenna | BBHA 9120D | 9120D122 | SCHWARZBECK | Dec-11 |
| 20 | Dipole Antenna | VHA9103 | 2116 | SCHWARZBECK | Nov-10 |
| 21 | Dipole Antenna | VHA9103 | 2117 | SCHWARZBECK | Nov-10 |
| 22 | Dipole Antenna | VHA9105 | 2261 | SCHWARZBECK | Nov-10 |
| 23 | Dipole Antenna | VHA9105 | 2262 | SCHWARZBECK | Nov-10 |
| 24 | Hygro-Thermograph | THB-36 | 0041557-01 | ISUZU | Apr-10 |
| 25 | Splitter (SMA) | ZFSC-2-2500 | SF617800326 | Mini-Circuits | - |
| 26 | RF Switch | MP59B | 6200414971 | ANRITSU | - |
| 27 | Power Divider | 11636A | 6243 | HP | Oct-10 |
| 28 | DC Power Supply | 6622A | 3448A03079 | HP | Oct-10 |
| 29 | Frequency Counter | 5342A | 2826A12411 | HP | Apr-10 |
| 30 | Power Meter | EPM-441A | GB32481702 | HP | Apr-10 |
| 31 | Power Sensor | 8481A | 2702A64048 | HP | Apr-10 |
| 32 | Audio Analyzer | 8903B | 3729A18901 | HP | Oct-10 |
| 33 | Modulation Analyzer | 8901B | 3749A05878 | HP | Oct-10 |
| 34 | TEMP & HUMIDITY Chamber | YJ-500 | LTAS06041 | JinYoung Tech | Oct-10 |
| 35 | LOOP-ANTENNA | FMZB 1516 | 151602/94 | SCHWARZBECK | Mar-11 |
| 36 | Stop Watch | HS-3 | 601Q09R | CASIO | Apr-10 |
| 37 | LISN | ENV216 | 100408 | R&S | Oct-10 |