



Dates of Tests : August 01~20, 2012

Test Report S/N: LR500111208E

Test Site : LTA CO., LTD

CERTIFICATION OF COMPLIANCE

FCC ID

YI7HES2E4A0T

APPLICANT

eZEX Corporation

| | | |
|----------------------------------|---|---|
| Equipment Class | : | Digital Transmission System (DTS) |
| Manufacturing Description | : | Home Energy Gateway |
| Manufacturer | : | SEP CO., LTD. |
| Brand Name | : | General Electric (GE) |
| Model Name | : | HES2E4A0T |
| Test Device Serial No.: | : | Identical prototype |
| Rule Part(s) | : | FCC Part 15.247 Subpart C; ANSI C-63.4-2003 |
| Frequency Range | : | 2412MHz ~ 2462MHz (802.11b/g/n) 2405MHz ~ 2480MHz (Zigbee 1, 2) |
| Max. Output Power | : | Max 20.92dBm - Conducted (802.11b) Max 22.09dBm - Conducted (802.11g) Max 20.87dBm - Conducted (802.11n) Max 21.67dBm - Conducted (Zigbee 1) Max 21.57dBm - Conducted (Zigbee 2) |
| Data of issue | : | August 16, 2012 |

This test report is issued under the authority of:



Kyu-Hyun Lee, Manager

The test was supervised by:



Jung-Moo Her, Test Engineer

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NVLAP LAB Code.: 200723-0

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1. General information

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 | 2013-09-30 | ECT accredited Lab. |
| RRL | KOREA | KR0049 | 2013-04-24 | EMC accredited Lab. |
| FCC | U.S.A | 610755 | 2014-04-27 | FCC filing |
| FCC | U.S.A | 649054 | 2013-04-13 | FCC CAB |
| VCCI | JAPAN | R2133(10m), C2307 | 2014-06-21 | VCCI registration |
| VCCI | JAPAN | T-2009 | 2013-12-23 | VCCI registration |
| VCCI | JAPAN | G-563 | 2015-05-28 | VCCI registration |
| IC | CANADA | 5799A-1 | 2015-06-21 | IC filing |

2. Product Information

2-1 Applicant

Company name : eZEX Corporation
 Address : Rm 508, Ssangyong IT Twin-tower 2, 442-5, Sangdaewon-dong, Jungwon-gu,
 Seongnam-si, Gyeonggi-do, South Korea
 Tel / Fax : +82-31-608-4700 / +82-31-608-4701

2-2 Manufacturer

Company name : SEP CO., LTD.
 Address : 2B-19LOT, 930, Gosaek-Dong, Gwonseon-gu, Suwon-si
 Gyeonggi-do, 441-813
 Tel / Fax : +82-31-546-2200 / +82-31-546-2201

2-3 Equipment Under Test (EUT)

Trade name : Home Energy Gateway
 Brand name : General Electric (GE)
 Model name : HES2E4A0T
 Serial number : Identical prototype
 Date of receipt : August 1, 2012
 EUT condition : Pre-production, not damaged
 Antenna type : Chip antenna (M/N: SDBPTR3015) with Max. 3.75 dBi gain
 Frequency Range : 2412MHz ~ 2462MHz (802.11b/g/n)
 2405MHz ~ 2480MHz (Zigbee 1, 2)
 RF output power : Max 20.92dBm - Conducted (802.11b)
 Max 22.09dBm - Conducted (802.11g)
 Max 20.87dBm - Conducted (802.11n)
 Max 21.67dBm - Conducted (Zigbee 1)
 Max 21.57dBm - Conducted (Zigbee 2)
 Number of channels : 802.11b/g/n for 11 and Zigbee 1, 2 for 16
 Type of Modulation : CCK, DQPSK, DBPSK for DSSS
 64QAM, 16QAM, QPSK, BPSK for OFDM
 O-QPSK for Zigbee
 Transfer Rate : 11, 5.5, 2, 1 Mbps for 802.11b
 54, 48, 36, 24, 18, 12, 9, 6 Mbps for 802.11g
 65/72.2, 58.5/65, 52/57.8, 39/43.3, 26/28.9, 19.5/21.7,
 13/14.4, 6.5/7.2Mbps for 802.11n
 Power Source : 120VAC
 Firmware Version : V1.0.0

2-4 Tested frequency

| | LOW | MID | HIGH |
|---------------------------------|------|------|------|
| Frequency (MHz) for 802.11b/g/n | 2412 | 2442 | 2462 |
| Frequency (MHz) for Zigbee 1, 2 | 2405 | 2440 | 2480 |

2-5 Ancillary Equipment

| Equipment | Model No. | Serial No. | Manufacturer |
|-----------|-------------|------------|--------------|
| Notebook | VOSTRO 1015 | DN9RBN1 | DELL |

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 **eZEX Corporation HES2E4A0T** unit complies with the requirement of §15.203. The antenna is connected to inside of EUT. And type is **Chip antenna**.

The sample was tested according to the following specification:

*FCC Parts 15.247; ANSI C-63.4-2003

*FCC KDB Publication No. 558074 D01 DTS Meas. Guidance V01

*FCC TCB Workshop 2012, April

3.2 Technical Characteristics Test (802.11b/g/n)

3.2.1 6 dB Bandwidth

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April.

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 = 300 kHz (VBW \geq RBW) Sweep = auto

Trace = max hold Detector function = peak

Measurement Data: 802.11b

| Frequency (MHz) | Channel No. | Test Results(MHz) | |
|-----------------|-------------|-------------------|---------------|
| | | 6dB Bandwidth | 99% Bandwidth |
| 2412 | 1 | 9.667 | 13.719 |
| 2442 | 7 | 9.783 | 13.604 |
| 2462 | 11 | 9.957 | 13.604 |

Measurement Data: 802.11g

| Frequency (MHz) | Channel No. | Test Results(MHz) | |
|-----------------|-------------|-------------------|---------------|
| | | 6dB Bandwidth | 99% Bandwidth |
| 2412 | 1 | 16.498 | 16.498 |
| 2442 | 7 | 16.590 | 16.440 |
| 2462 | 11 | 16.556 | 16.440 |

Measurement Data: 802.11n

| Frequency (MHz) | Channel No. | Test Results(MHz) | |
|-----------------|-------------|-------------------|---------------|
| | | 6dB Bandwidth | 99% Bandwidth |
| 2412 | 1 | 17.771 | 17.656 |
| 2442 | 7 | 17.829 | 17.656 |
| 2462 | 11 | 17.771 | 17.656 |

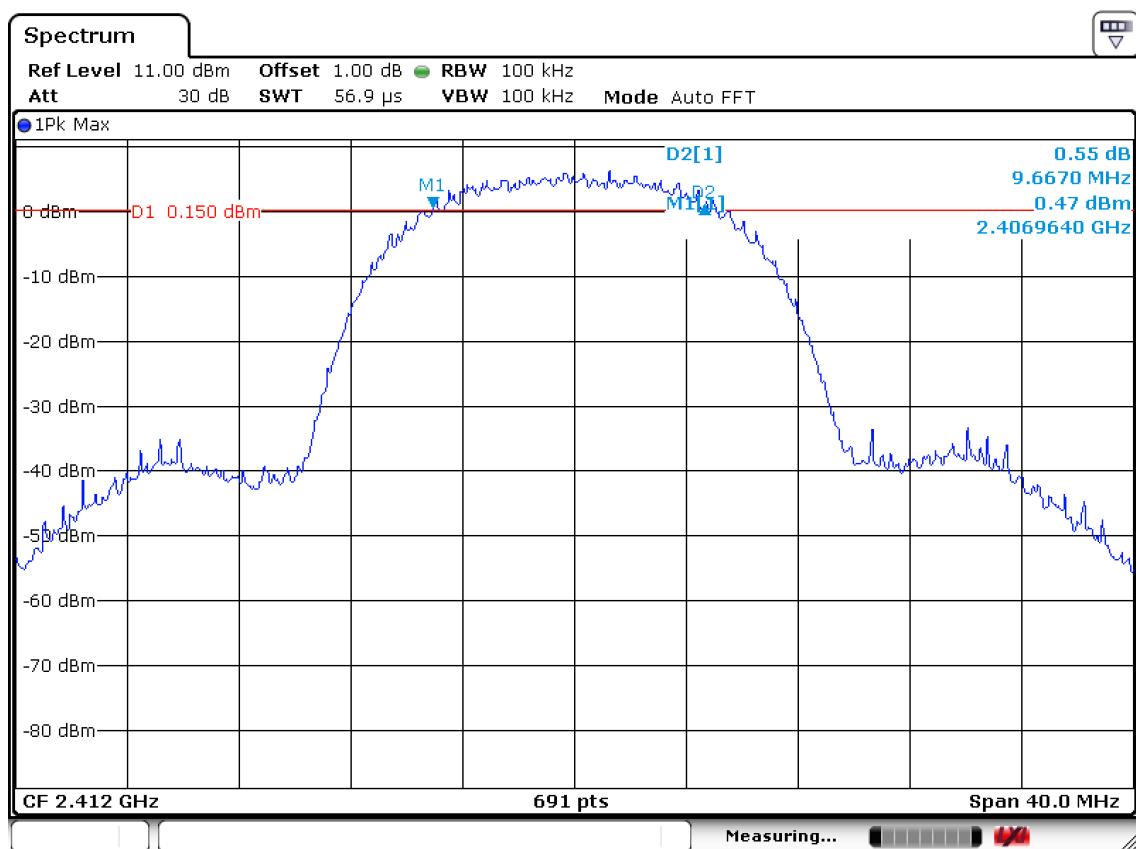
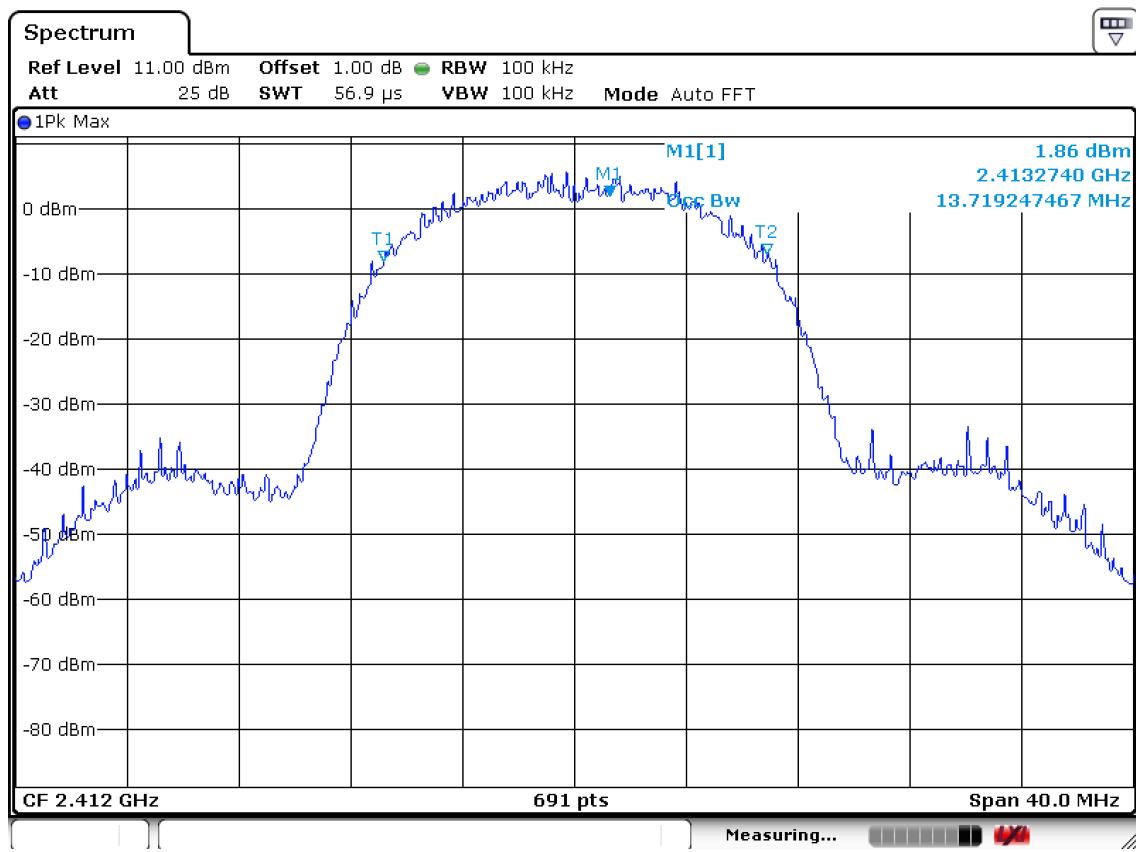
- See next pages for actual measured spectrum plots.

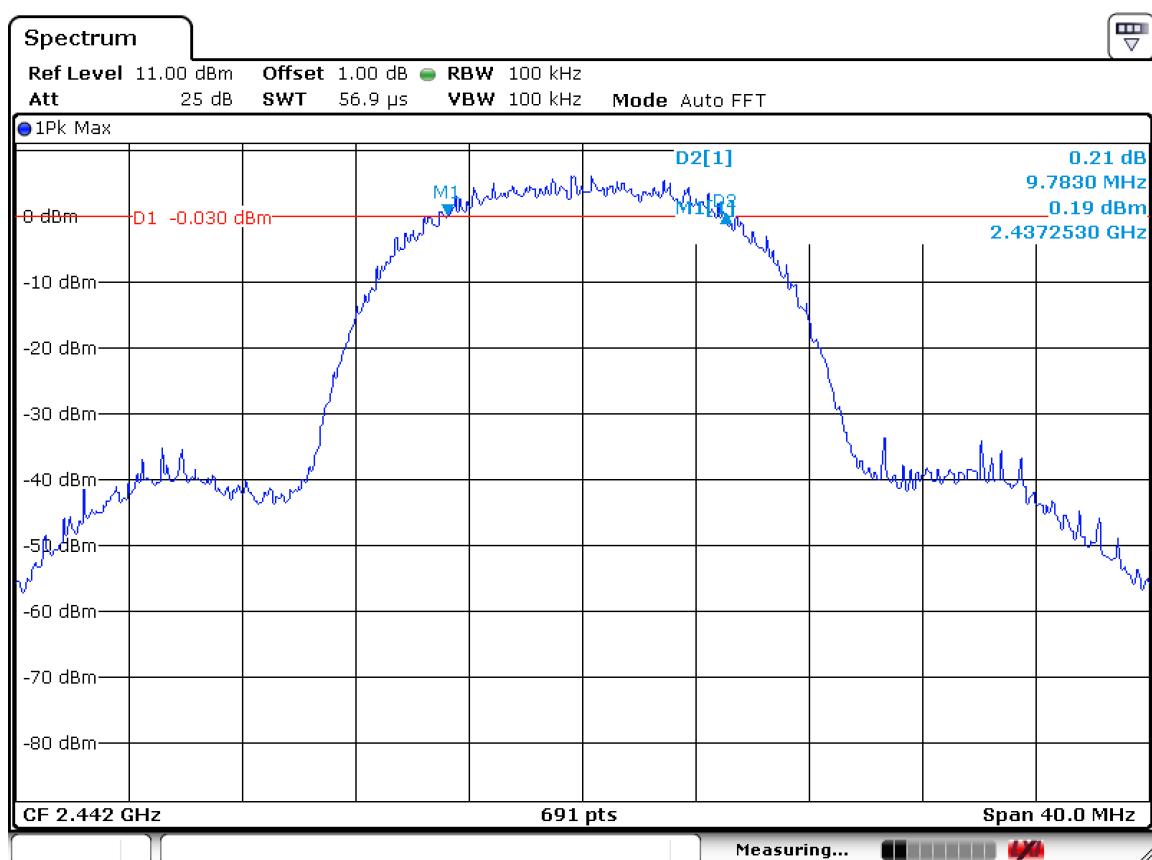
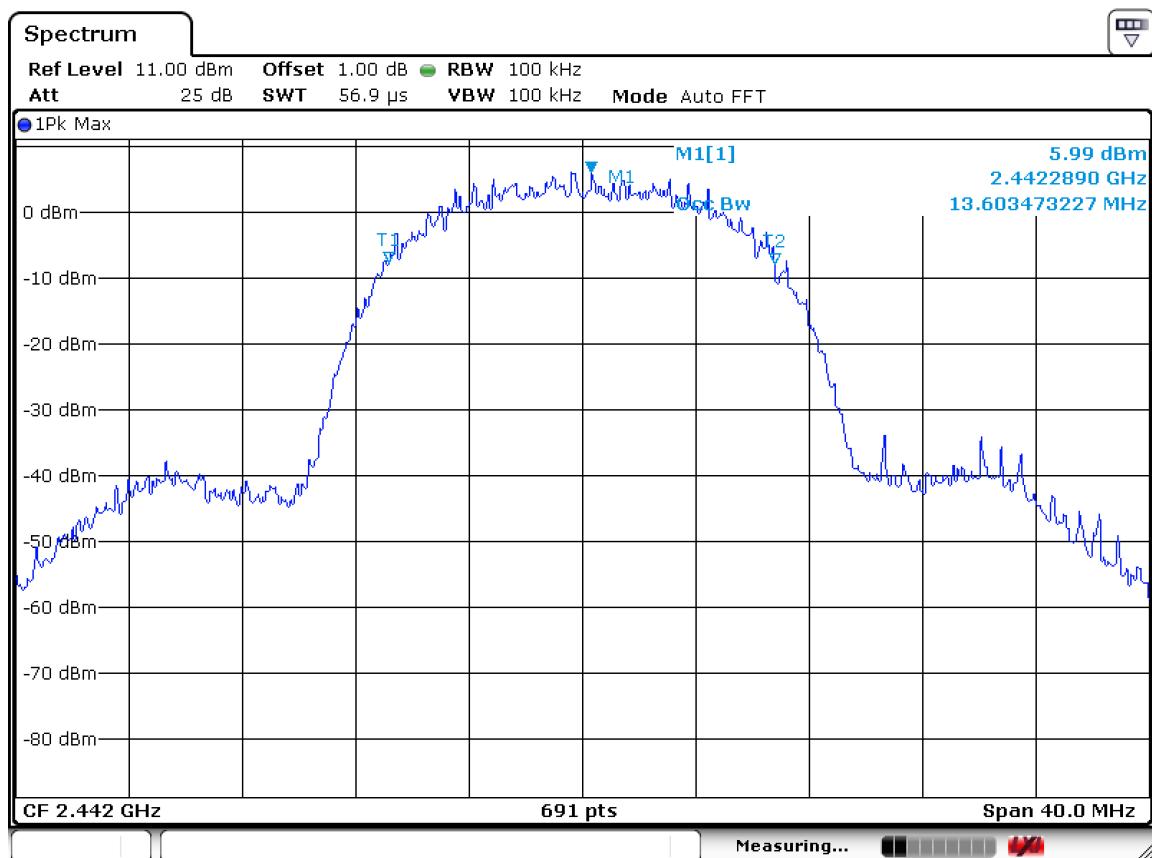
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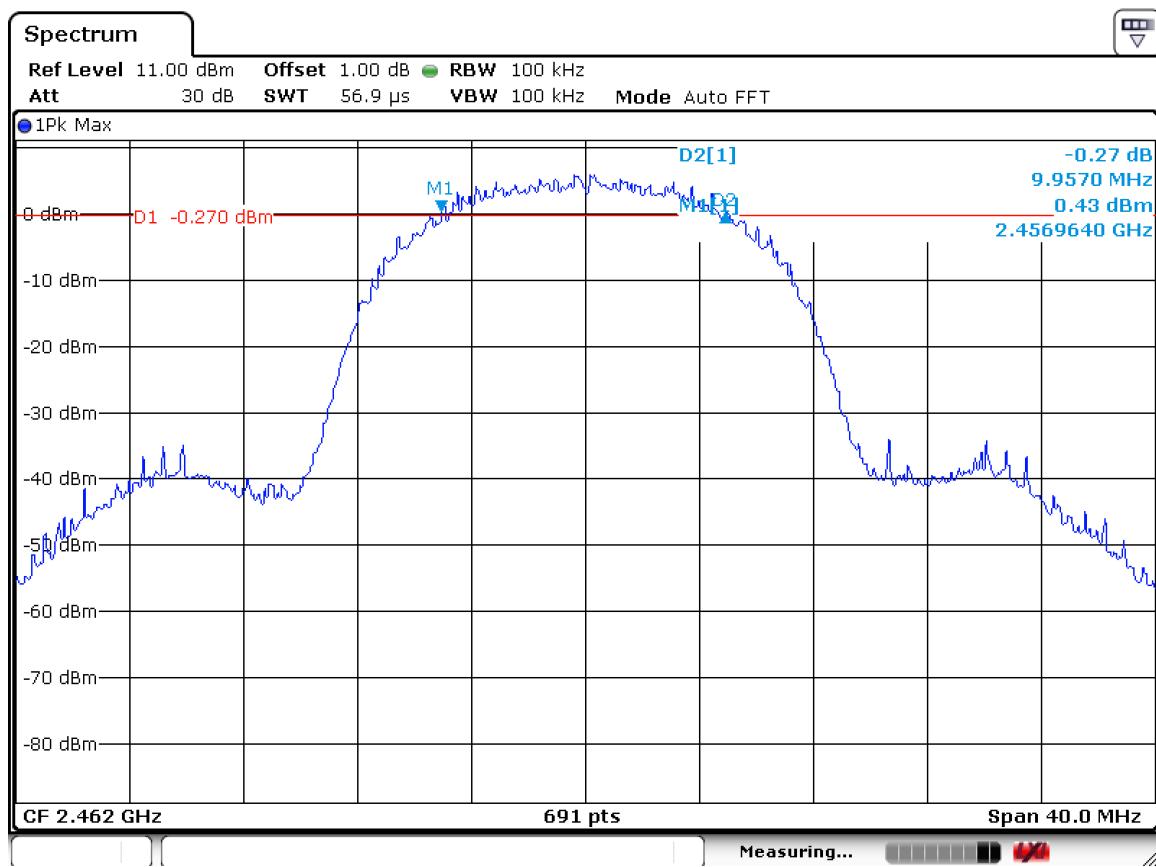
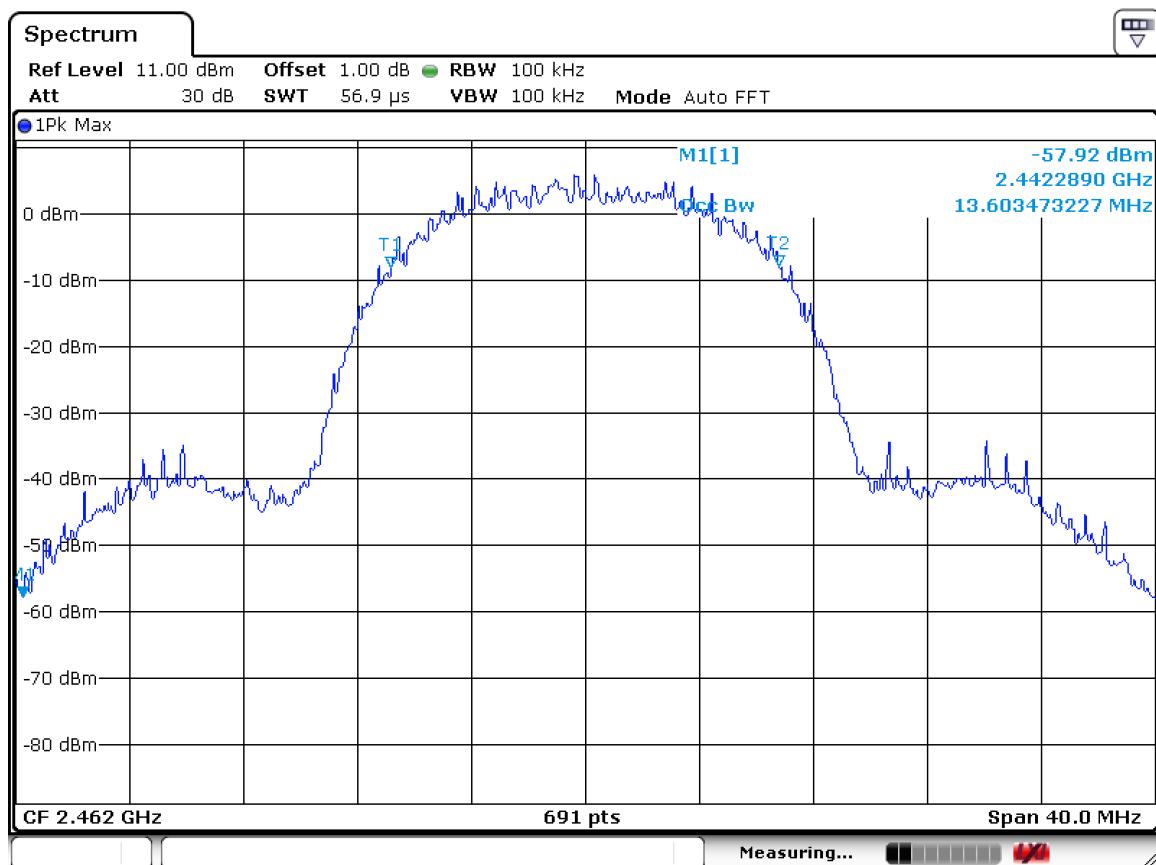
6 dB Bandwidth $>$ 500kHz

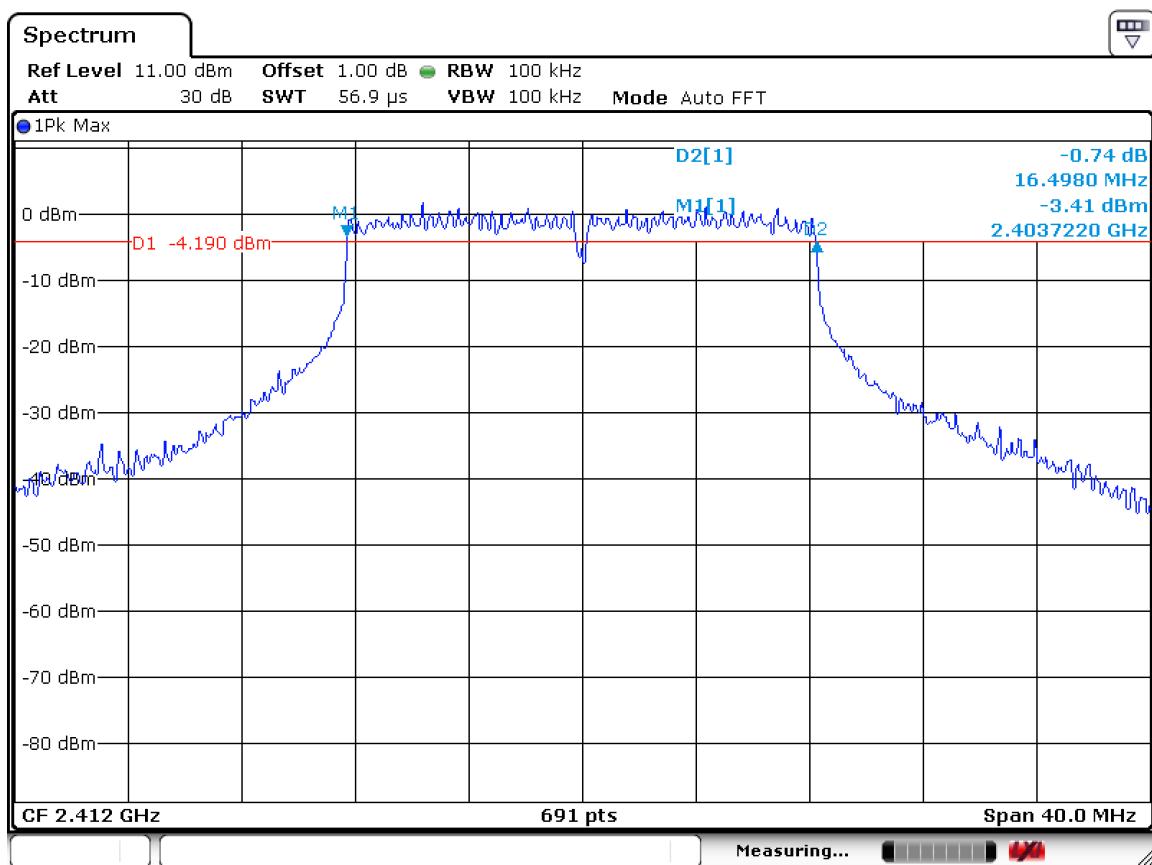
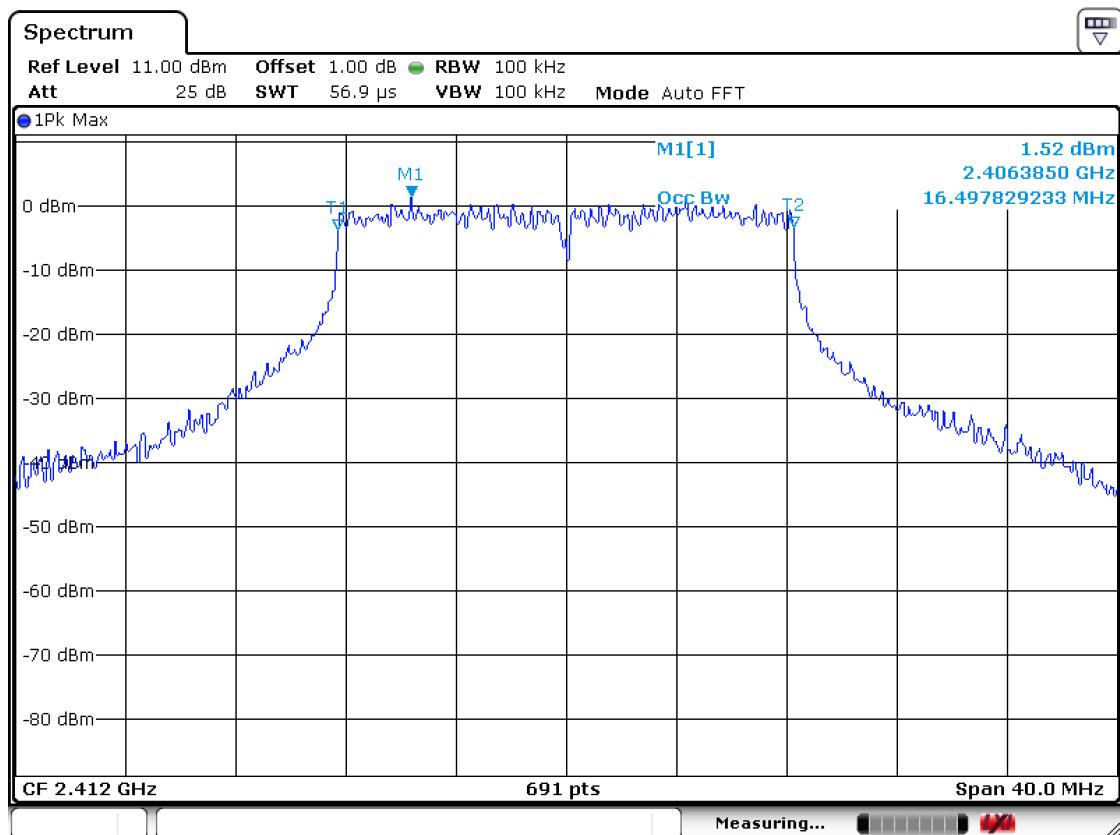
Measurement Setup

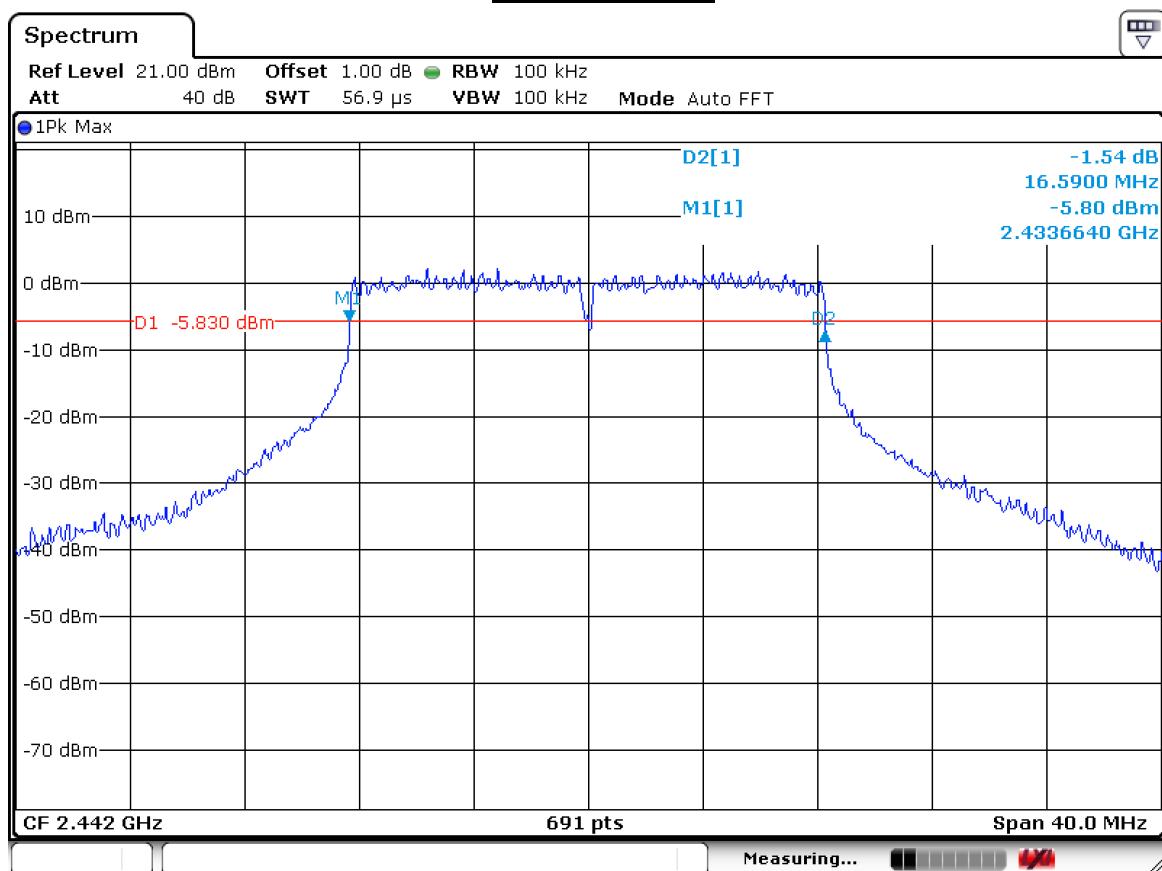
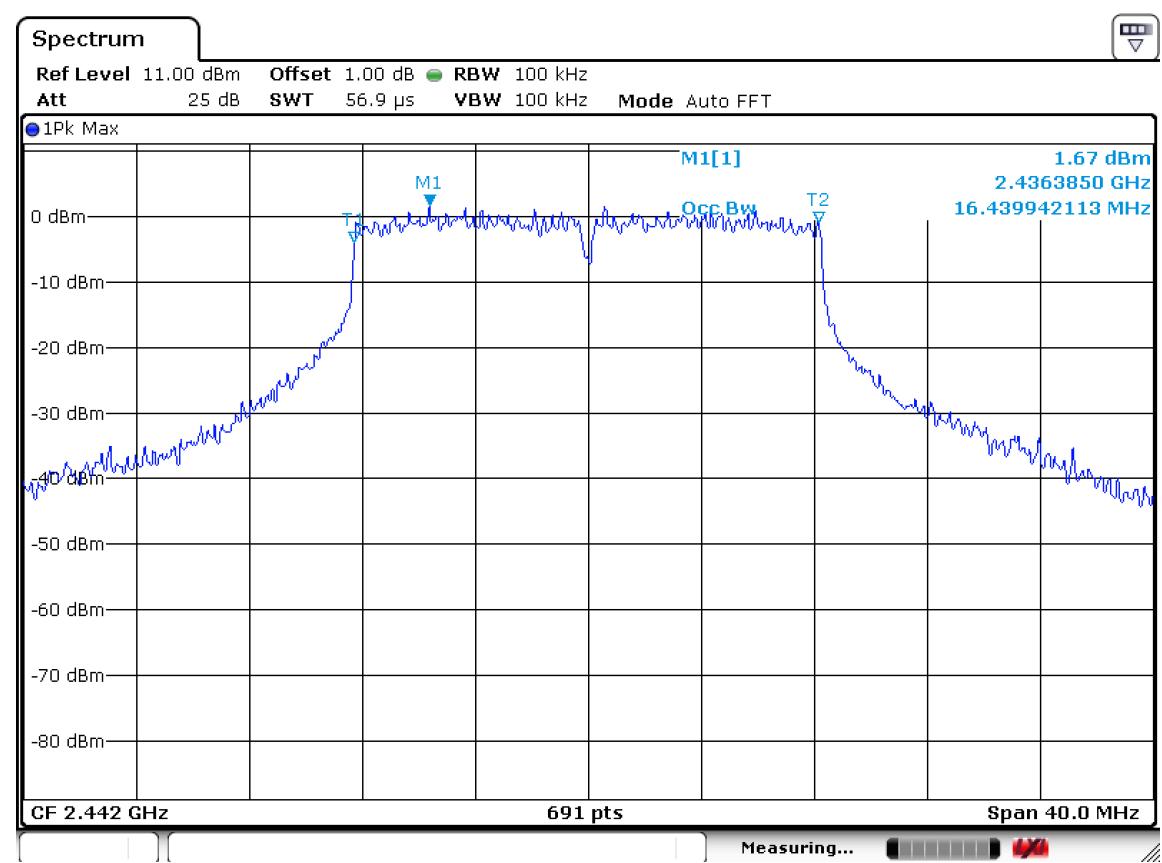
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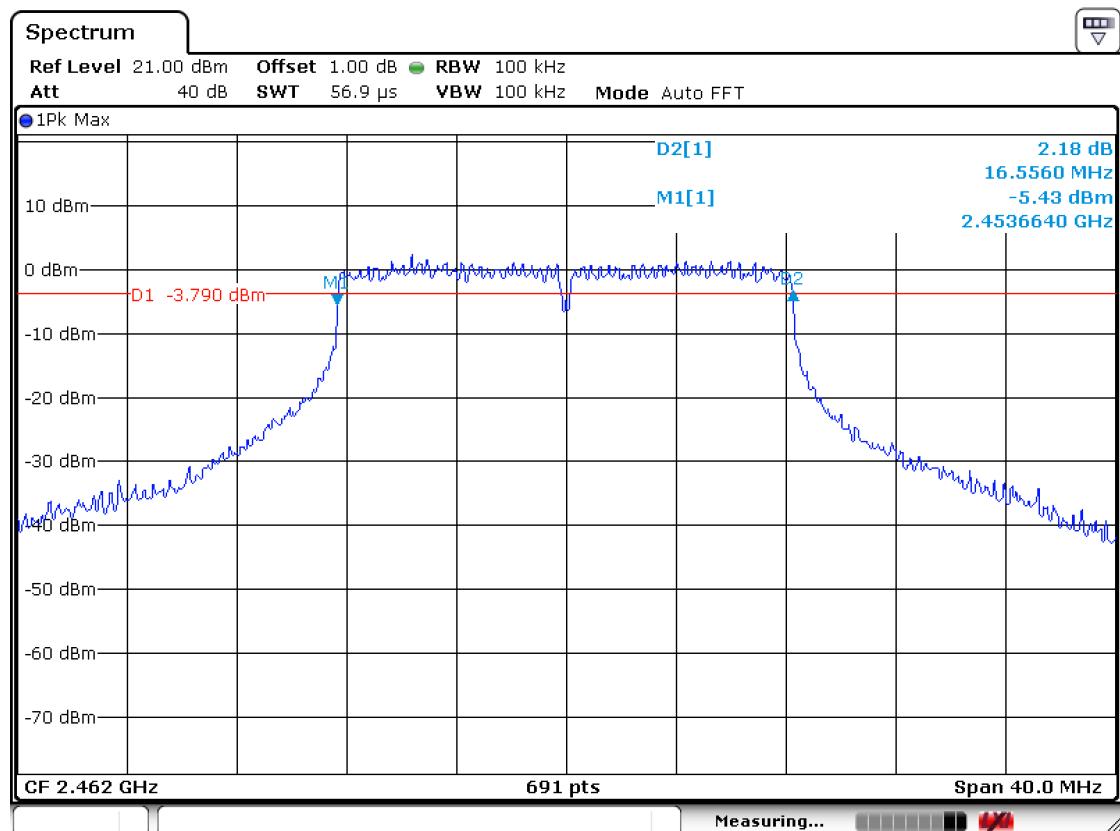
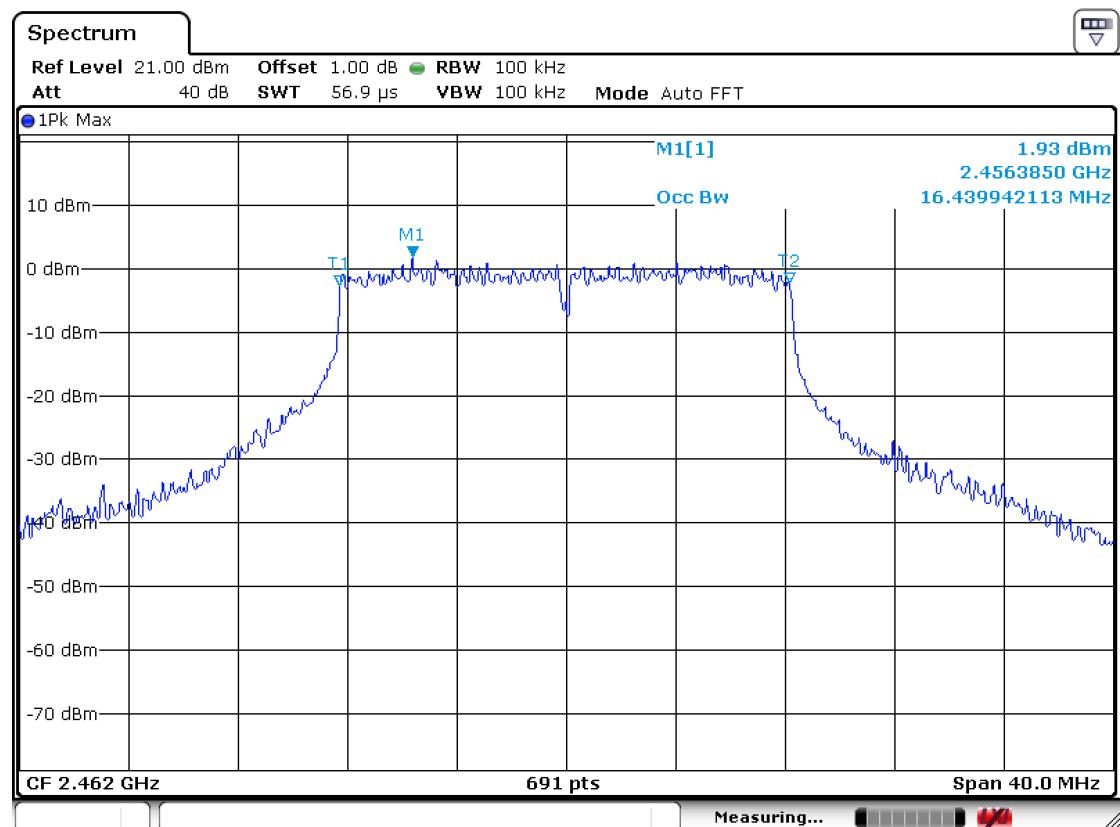
Channel 1 802.11b mode6dB Bandwidth99% Bandwidth

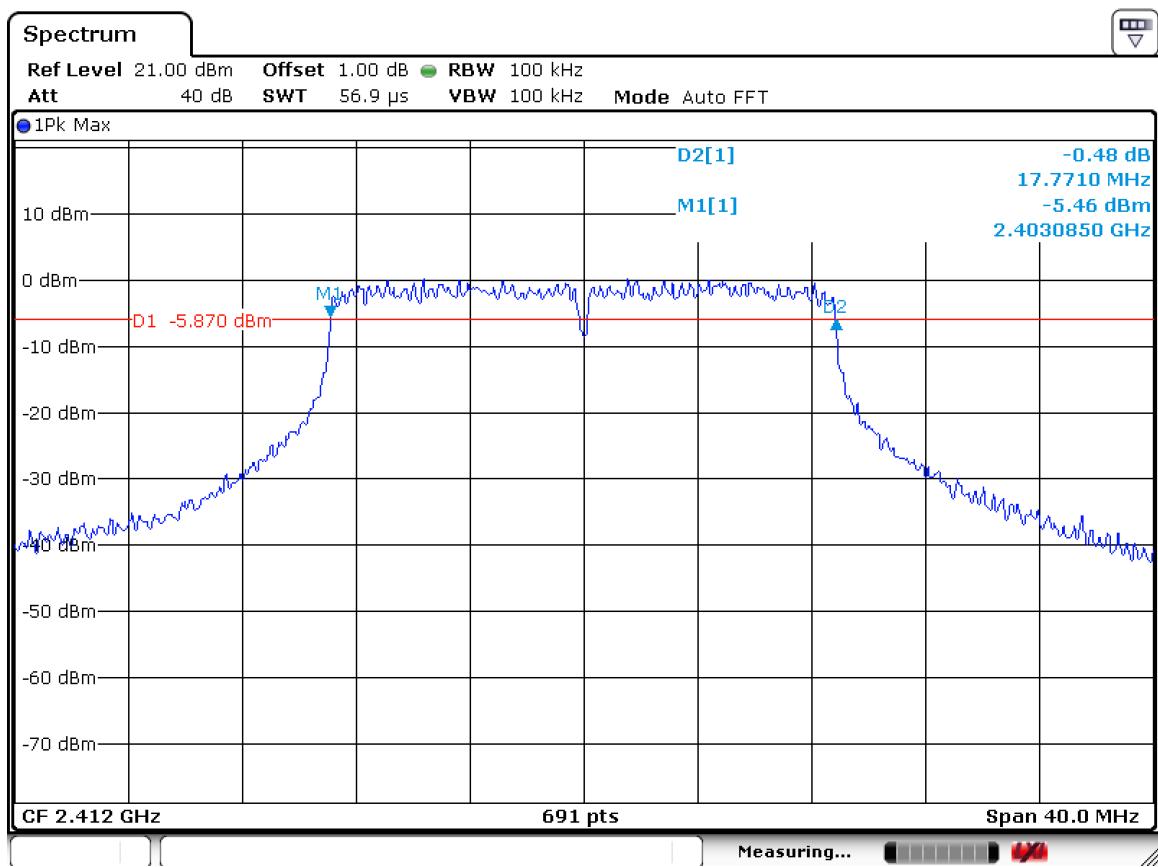
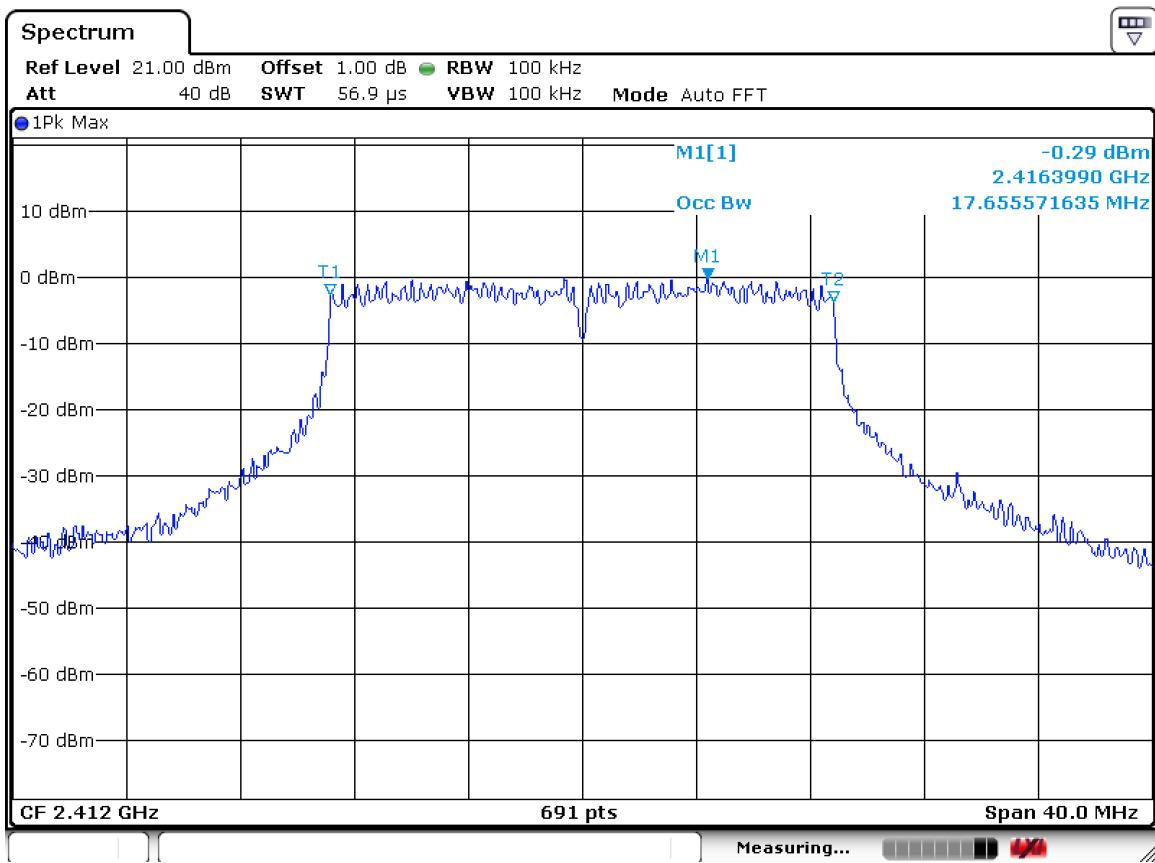
Channel 6 of 802.11b mode6 dB Bandwidth99% Bandwidth

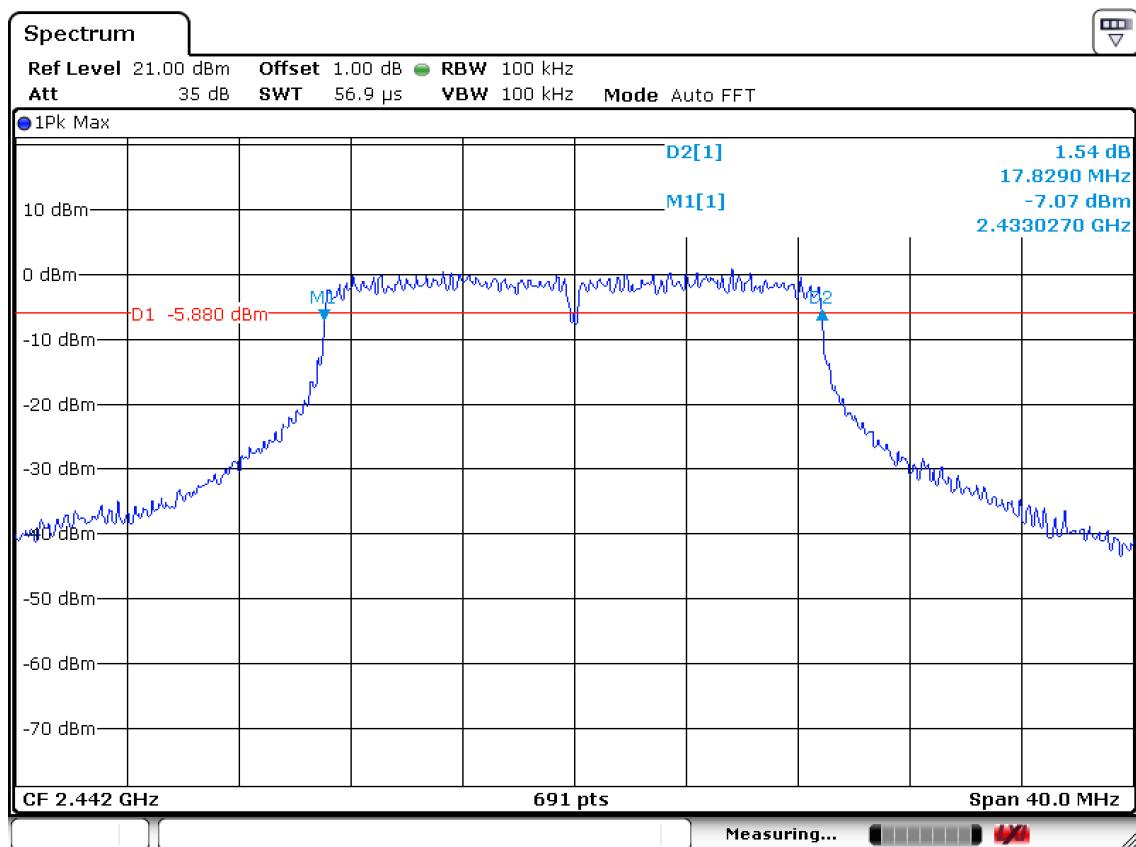
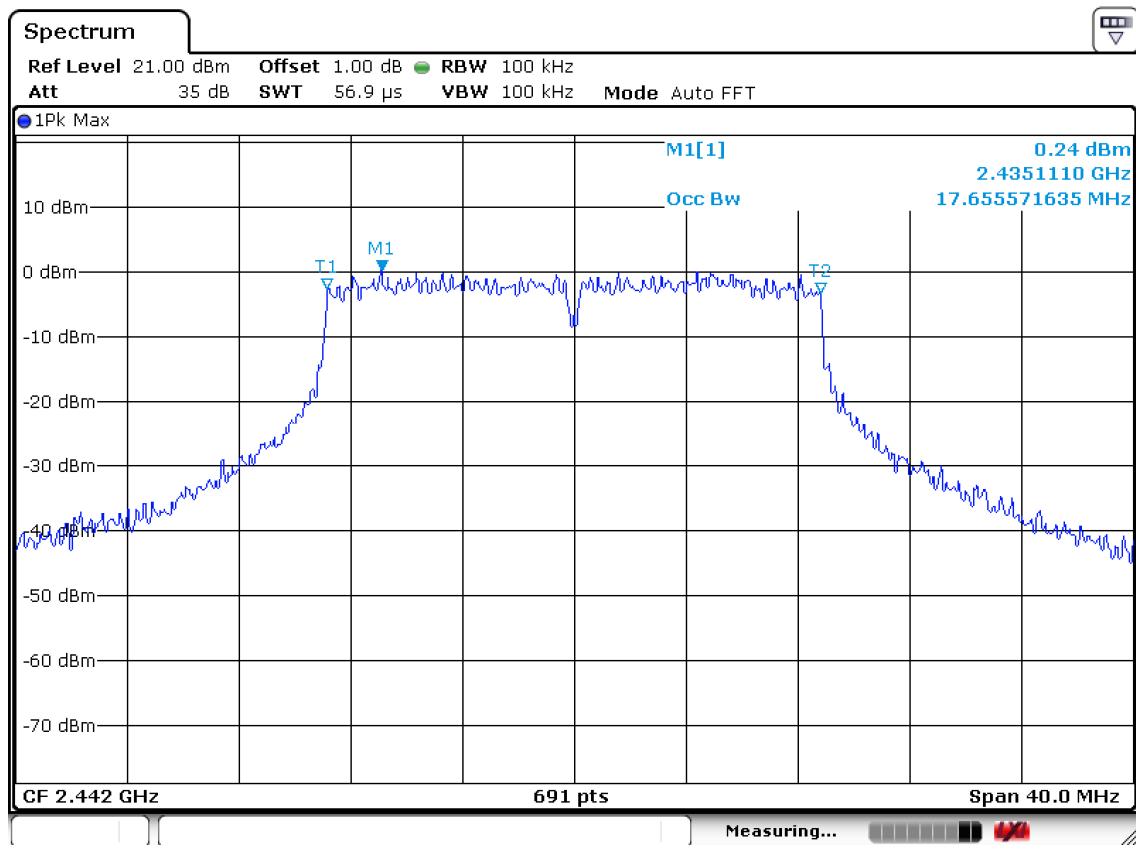
Channel 11 of 802.11b mode6 dB Bandwidth99% Bandwidth

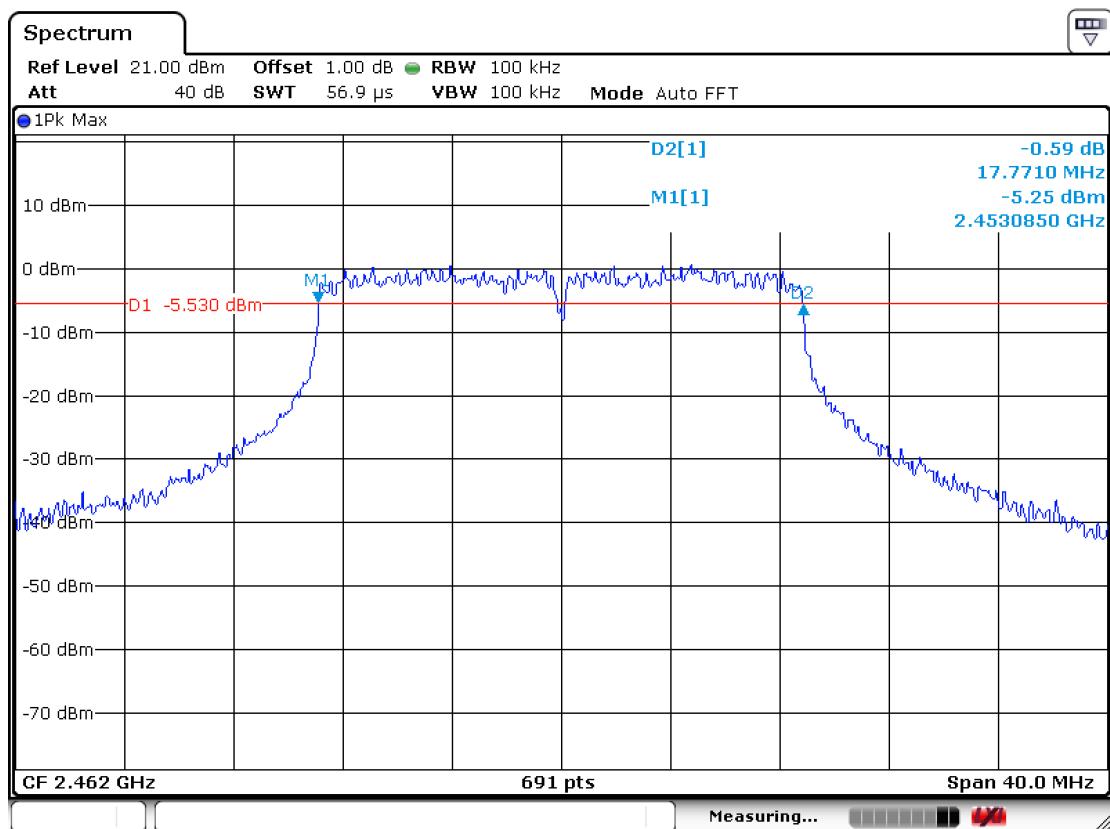
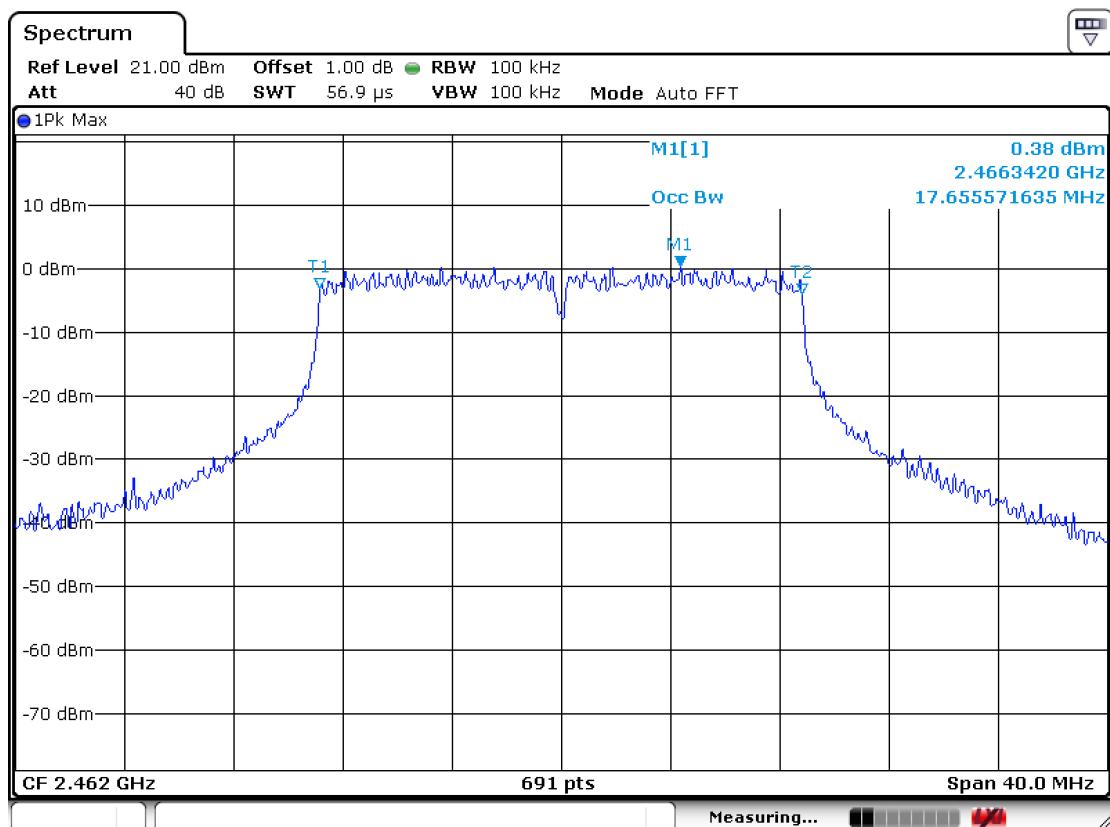
Channel 1 of 802.11g mode6 dB Bandwidth99% Bandwidth

Channel 7 of 802.11g mode6 dB Bandwidth99% Bandwidth

Channel 11 of 802.11g mode6 dB Bandwidth99% Bandwidth

Channel 1 of 802.11n mode6 dB Bandwidth99% Bandwidth

Channel 7 of 802.11n mode6 dB Bandwidth99% Bandwidth

Channel 11 of 802.11n mode6 dB Bandwidth99% Bandwidth

3.2.2 Peak Output Power Measurement

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. 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 = 3MHz (VBW \geq RBW) Sweep = auto

Detector function = peak

Measurement Data:

| Mode | Frequency (MHz) | Channel No. | Test Results | |
|---------|-----------------|-------------|---------------------|----------|
| | | | Measured Data (dBm) | Result |
| 802.11b | 2412 | 1 | 20.53 | Complies |
| | 2442 | 7 | 20.92 | Complies |
| | 2462 | 11 | 20.86 | Complies |
| 802.11g | 2412 | 1 | 22.09 | Complies |
| | 2442 | 7 | 21.94 | Complies |
| | 2462 | 11 | 21.97 | Complies |
| 802.11n | 2412 | 1 | 20.87 | Complies |
| | 2442 | 7 | 20.79 | Complies |
| | 2462 | 11 | 20.62 | Complies |

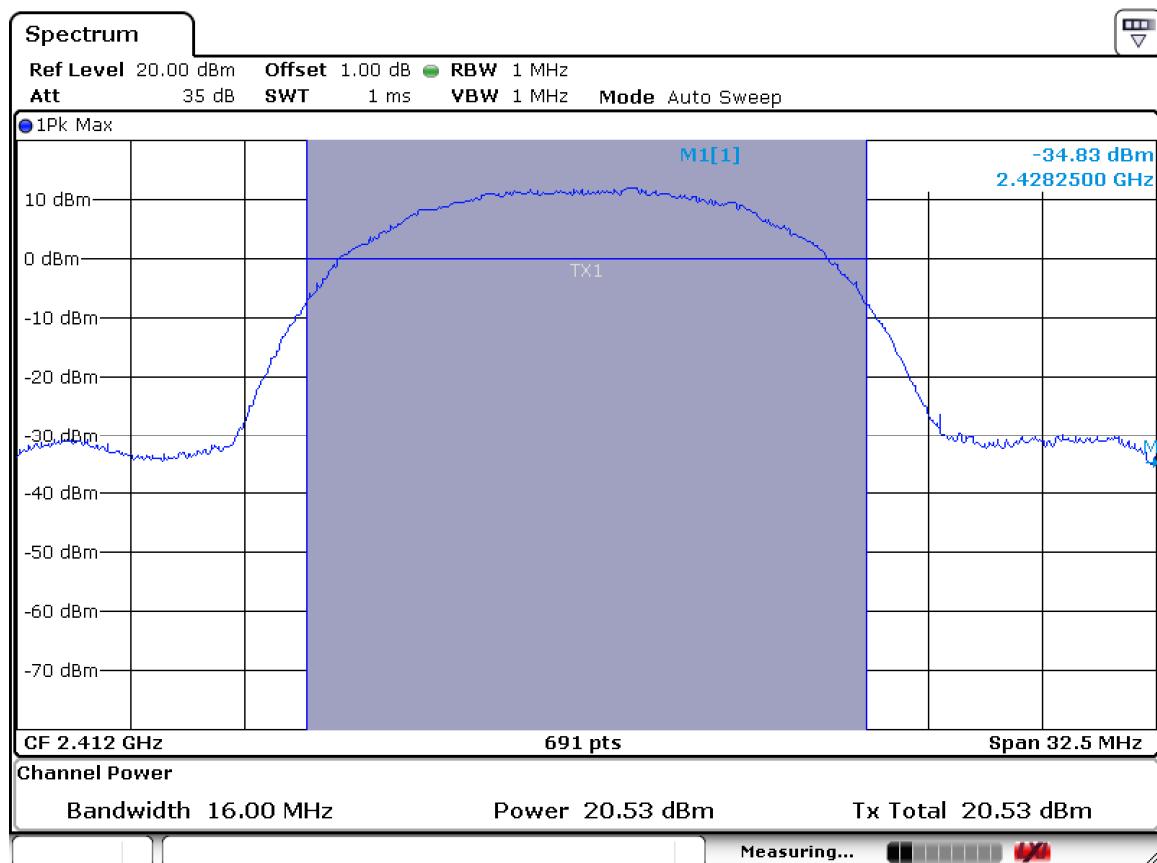
- See next pages for actual measured spectrum plots.

Minimum Standard:

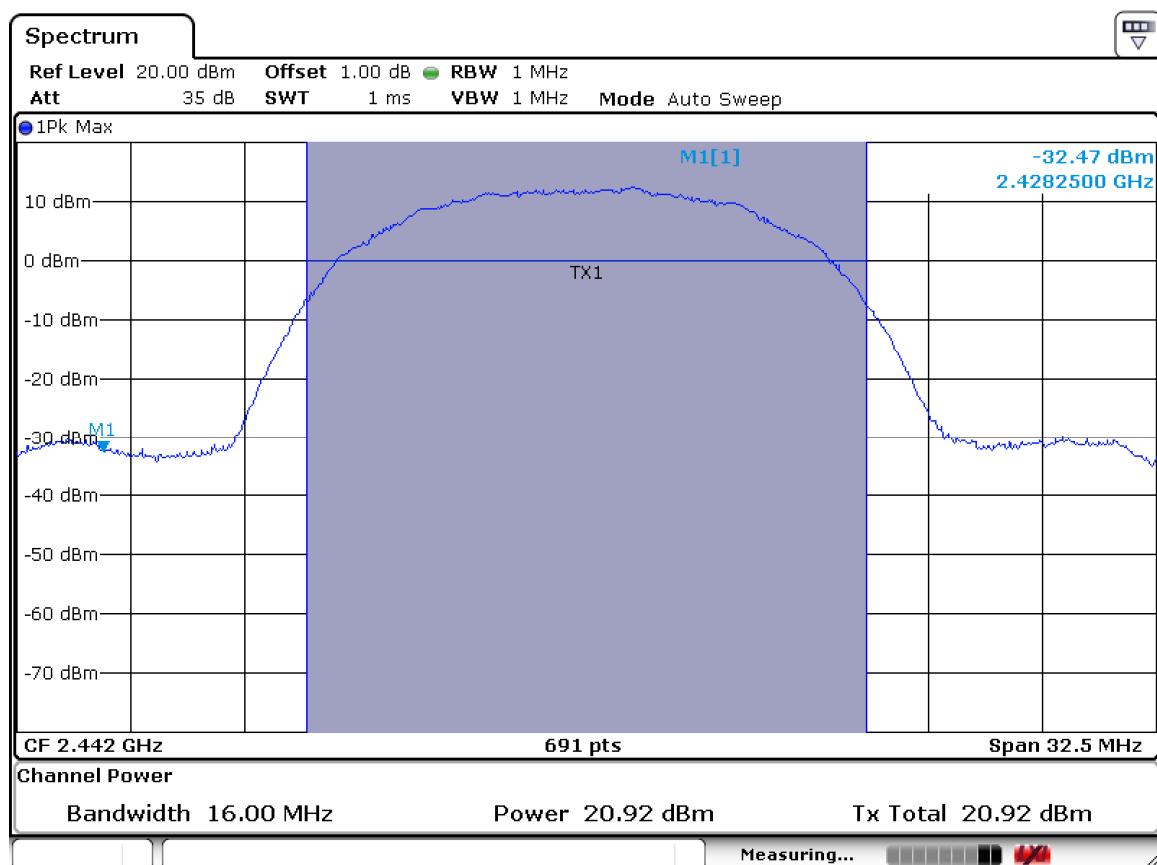
| | |
|-------------------|------|
| Peak output power | < 1W |
|-------------------|------|

802.11b

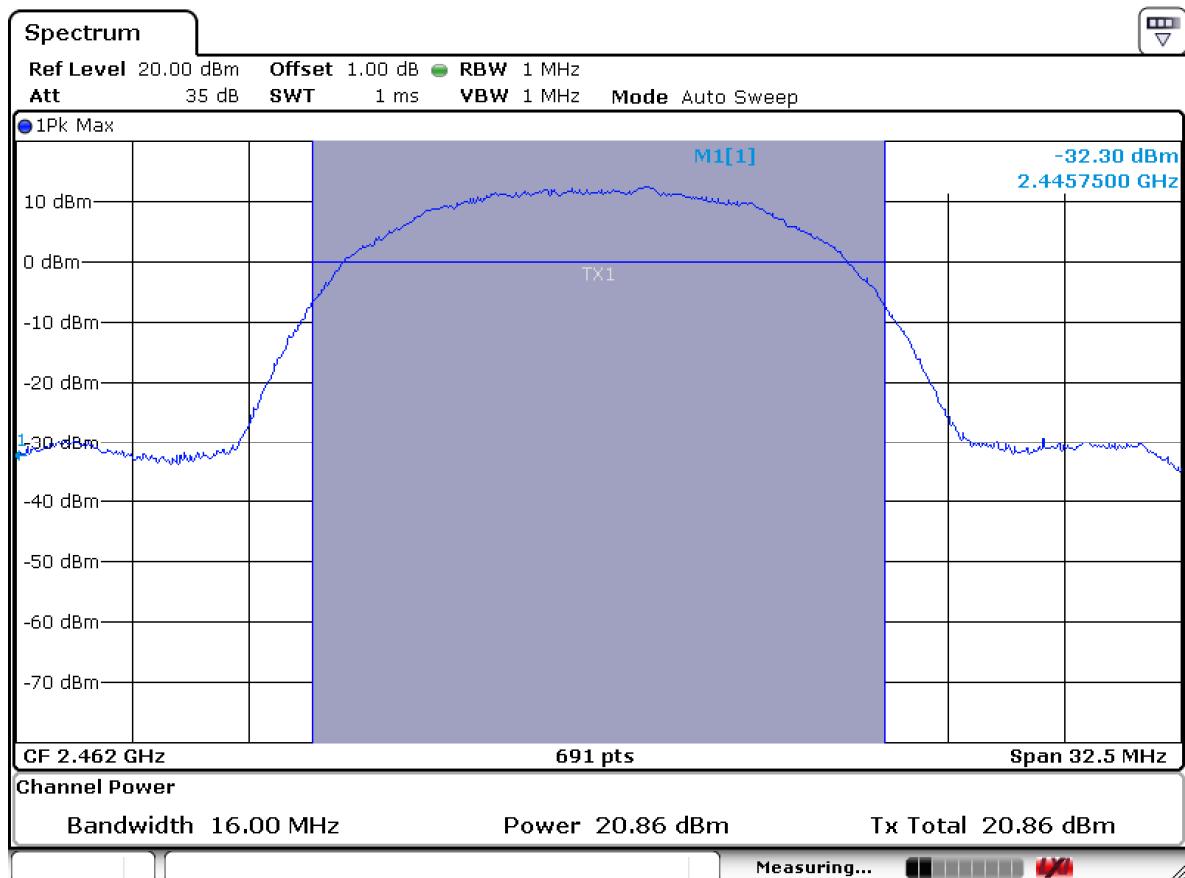
CH 1



CH 7

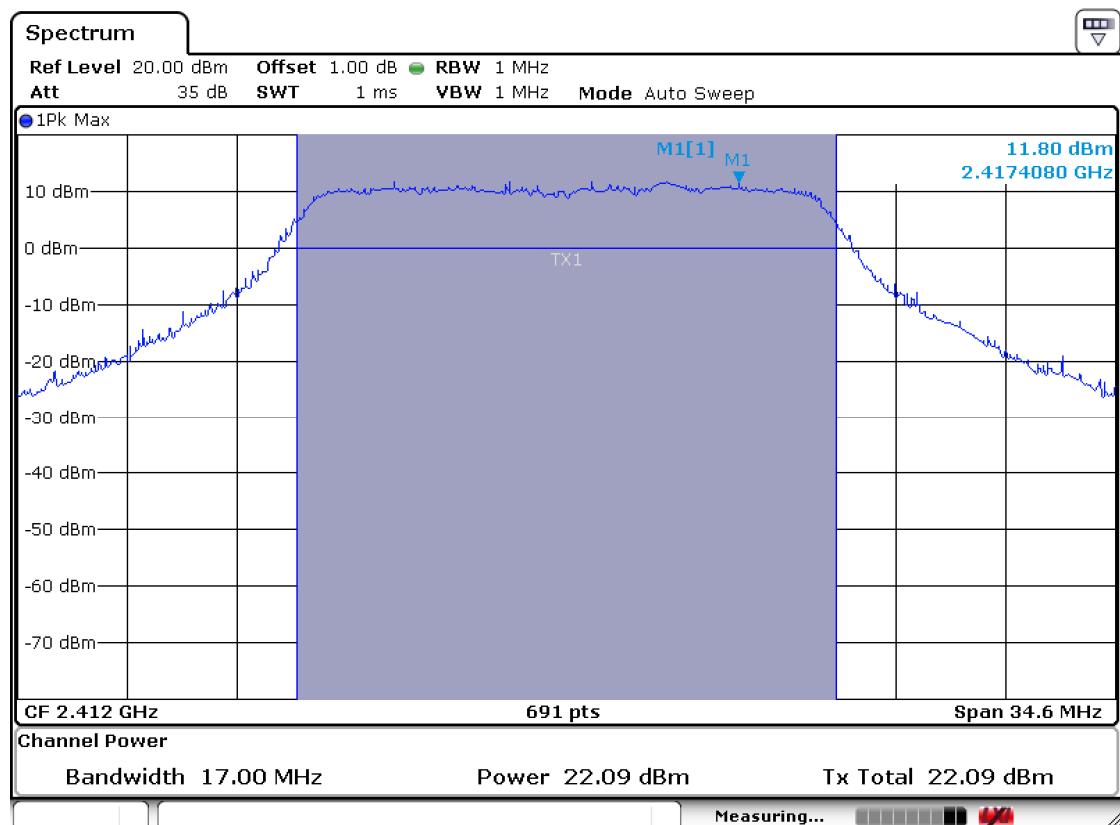


CH 11

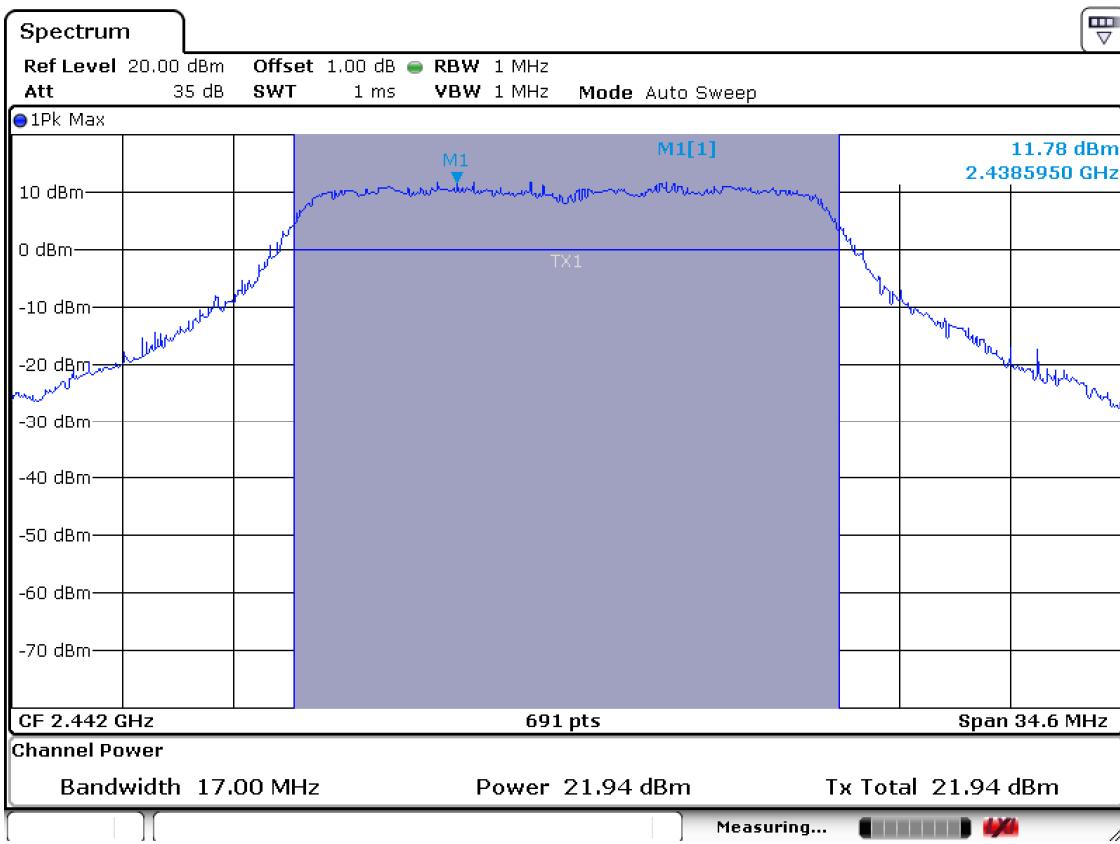


802.11g

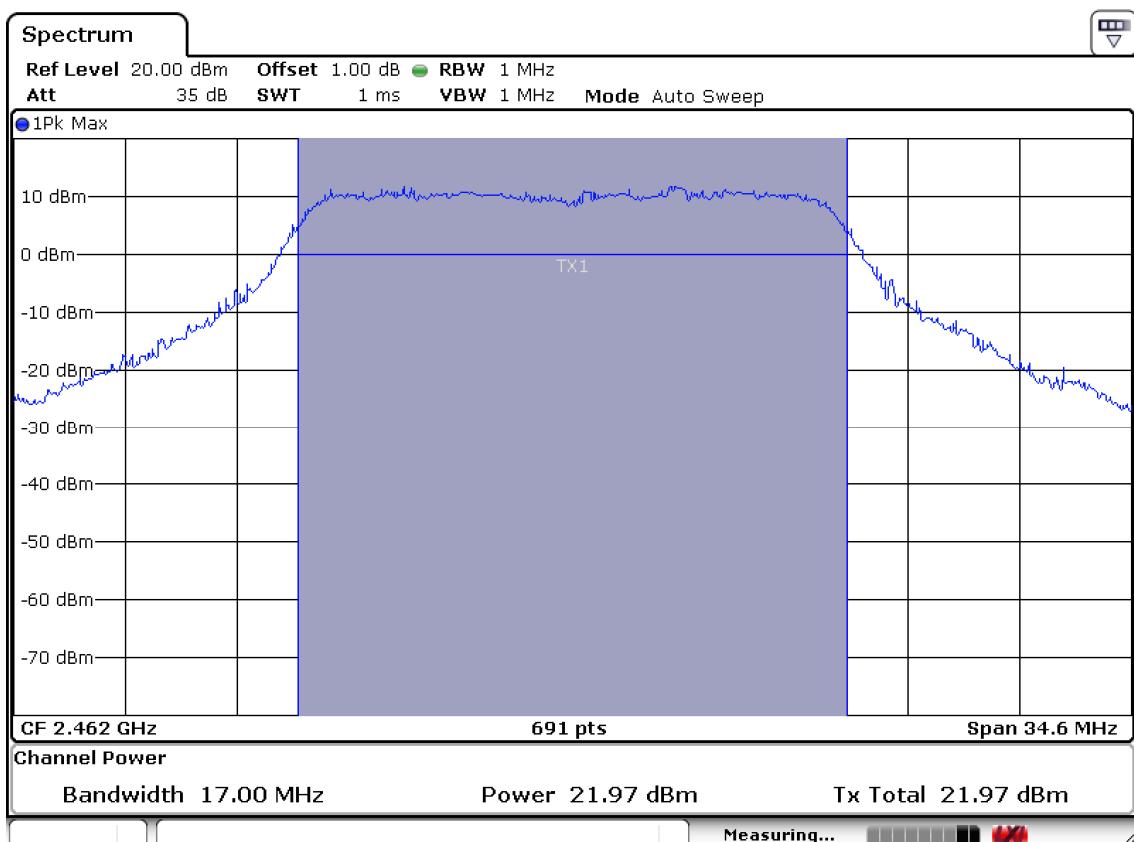
CH 1



CH 7

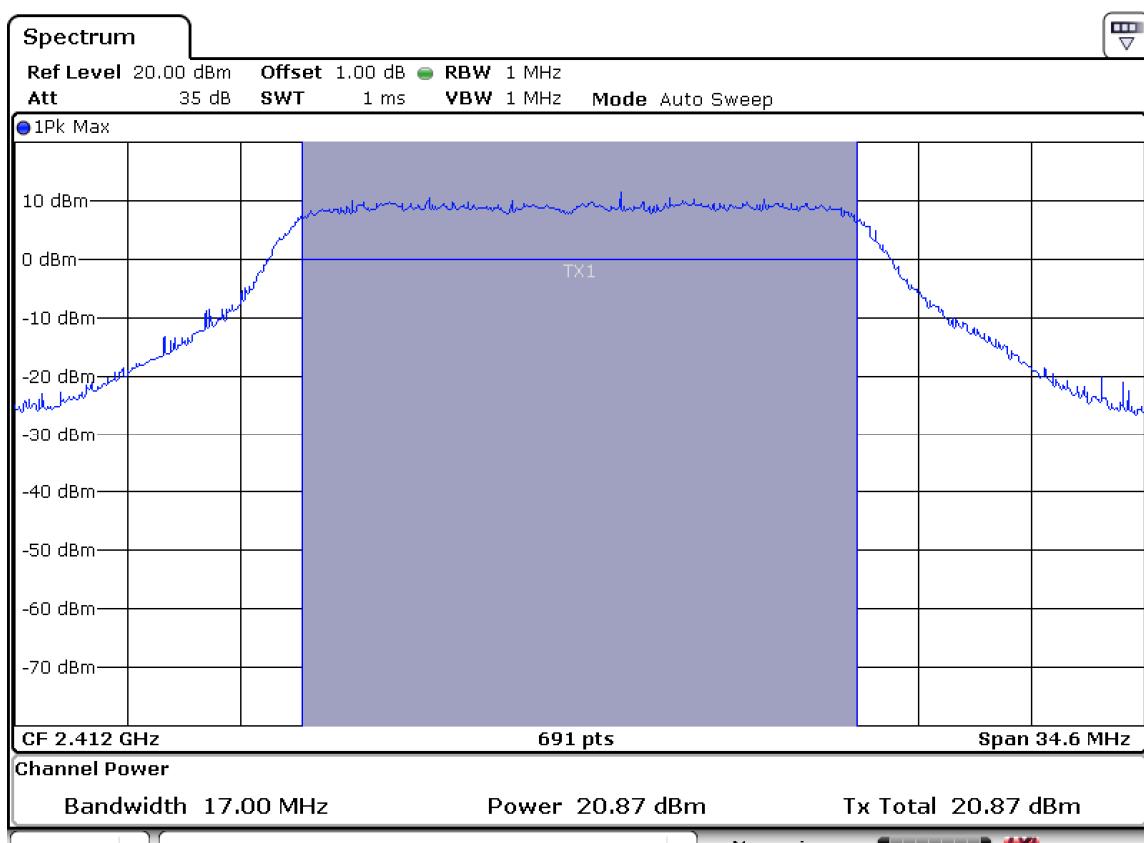


CH 11

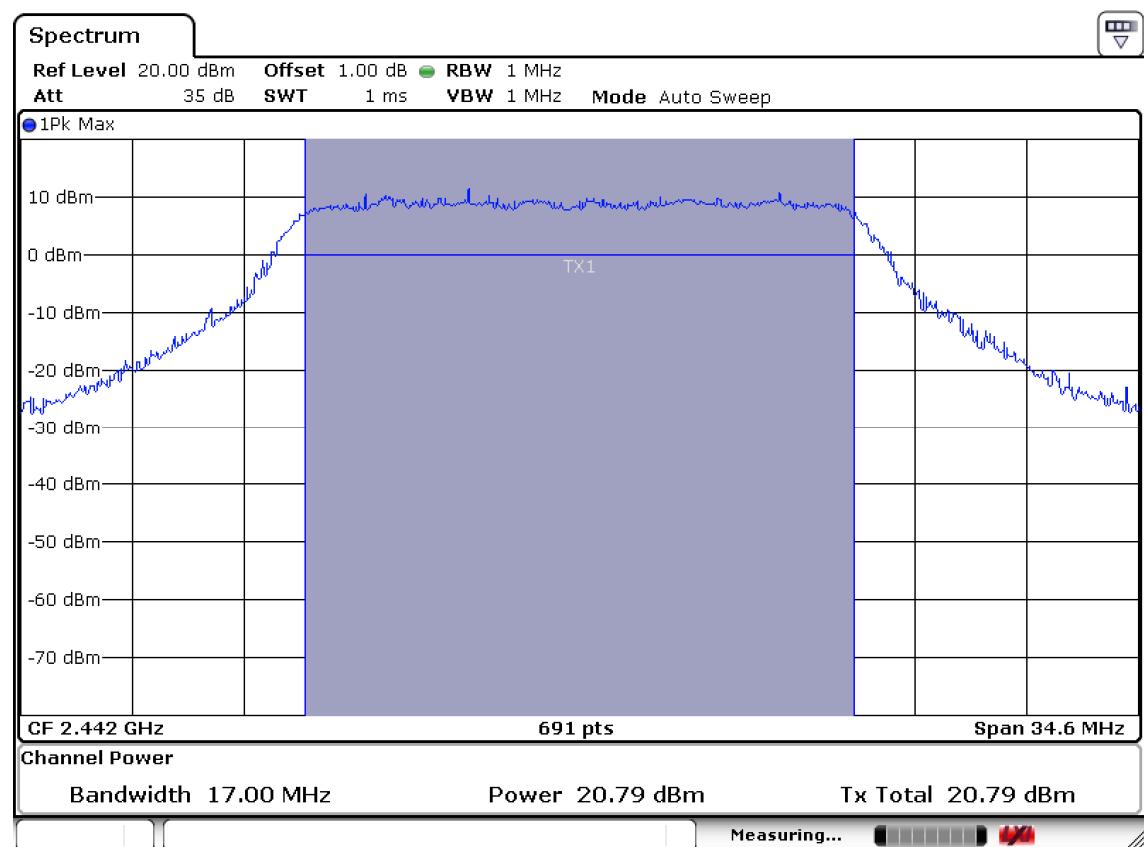


802.11n

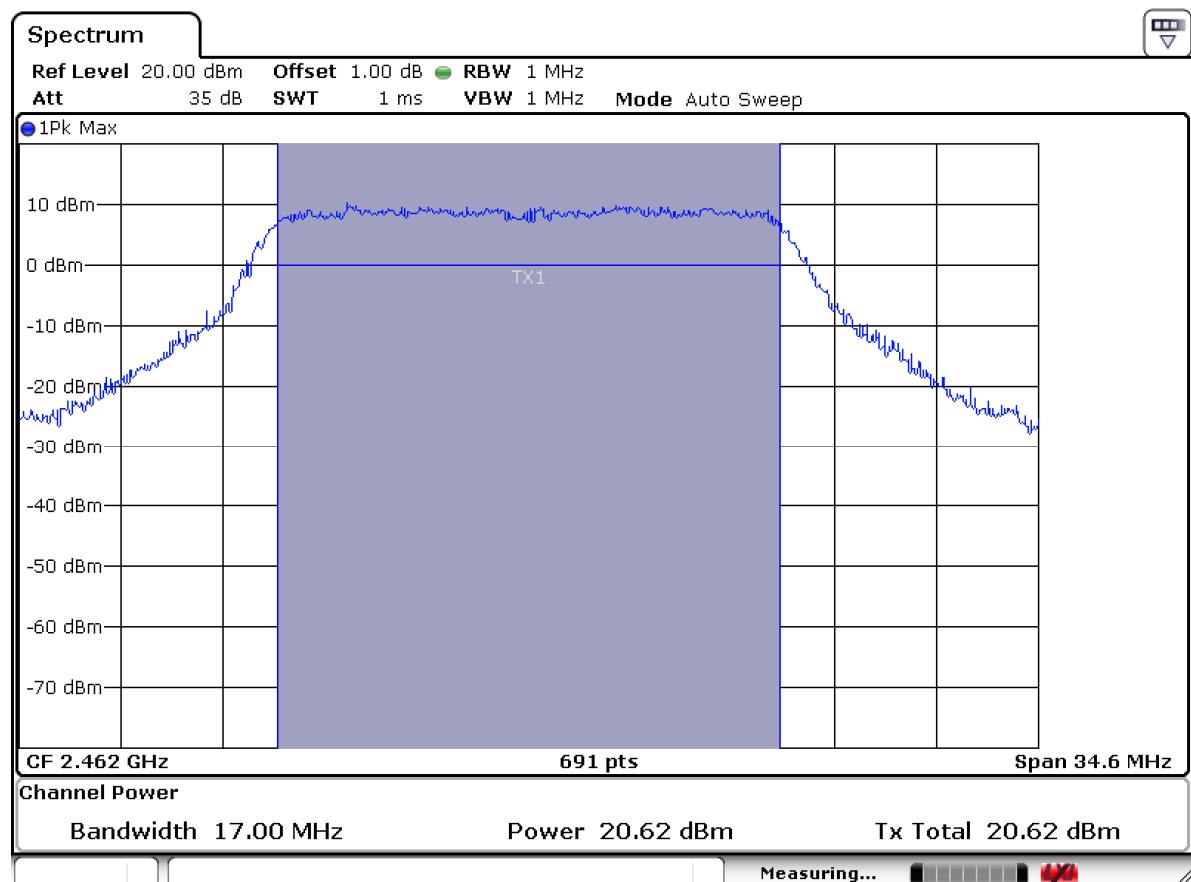
CH 1



CH 7



CH 11



3.2.3 Power Spectral Density

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April.

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:

| Mode | Frequency (MHz) | Ch. | Test Results | |
|---------|-----------------|-----|--------------|----------|
| | | | dBm | Result |
| 802.11b | 2412 | 1 | -7.42 | Complies |
| | 2442 | 7 | -7.49 | Complies |
| | 2462 | 11 | -6.91 | Complies |
| 802.11b | 2412 | 1 | -12.52 | Complies |
| | 2442 | 7 | -11.25 | Complies |
| | 2462 | 11 | -11.92 | Complies |
| 802.11n | 2412 | 1 | -14.76 | Complies |
| | 2442 | 7 | -12.86 | Complies |
| | 2462 | 11 | -11.58 | Complies |

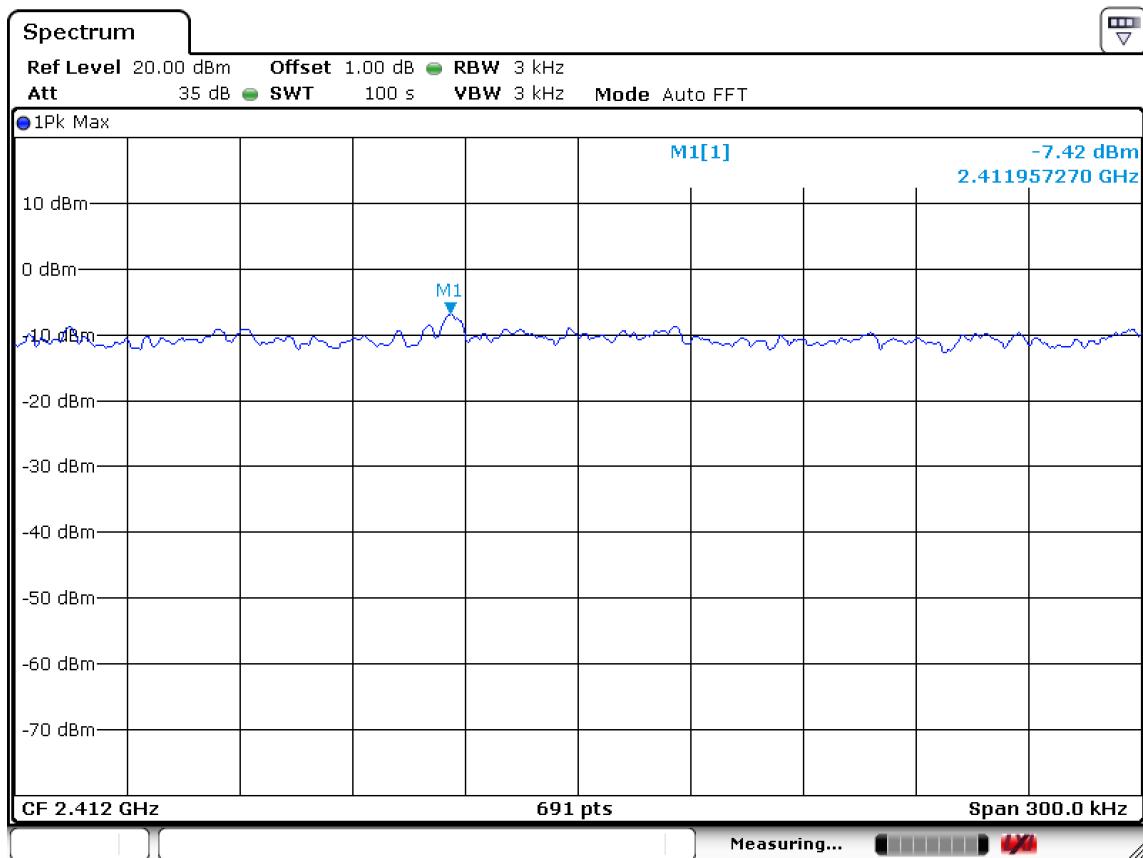
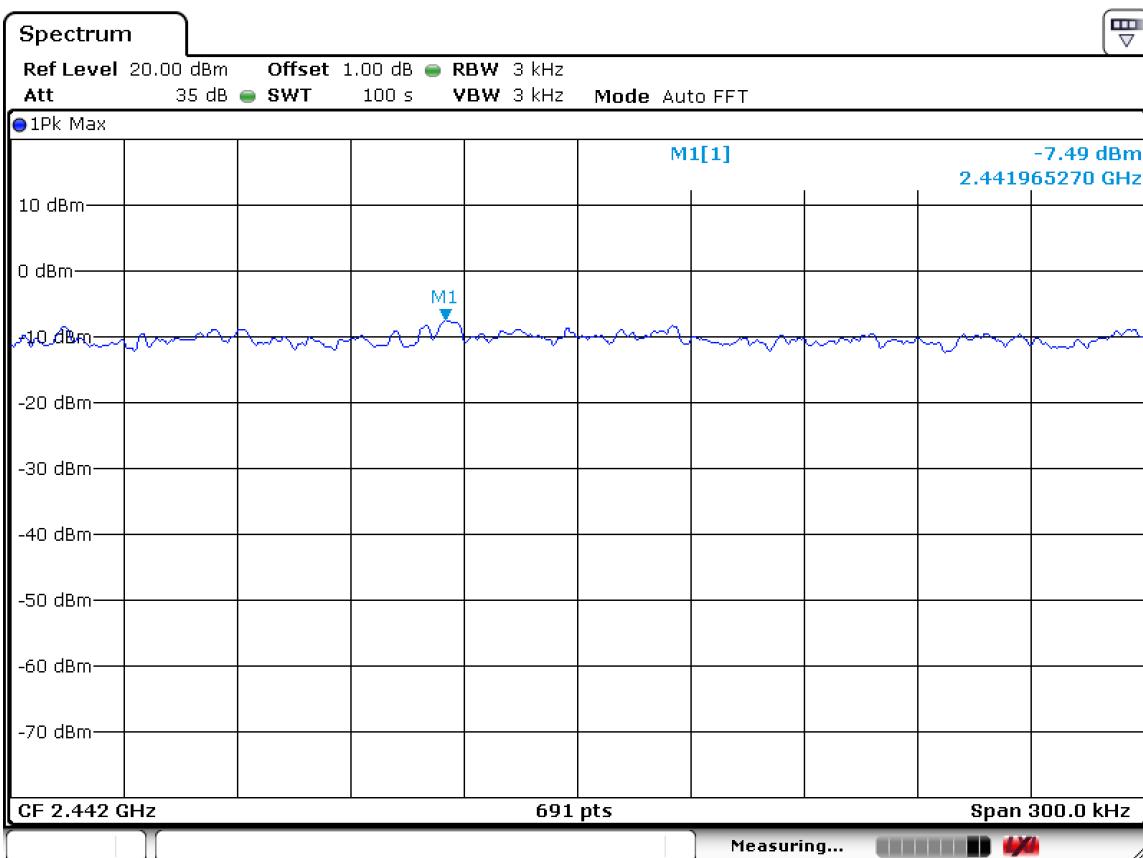
- See next pages for actual measured spectrum plots.

Minimum Standard:

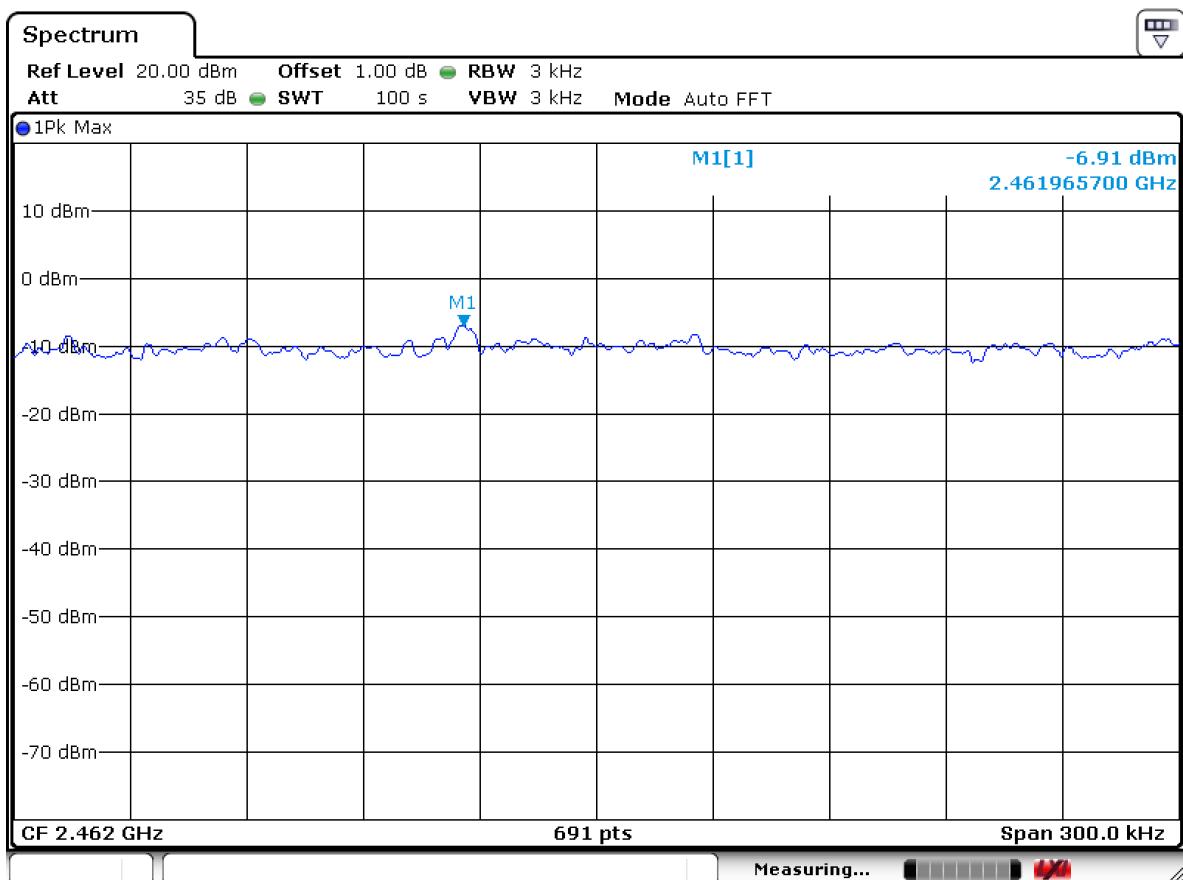
| | |
|------------------------|------------------|
| Power Spectral Density | < 8dBm @ 3kHz BW |
|------------------------|------------------|

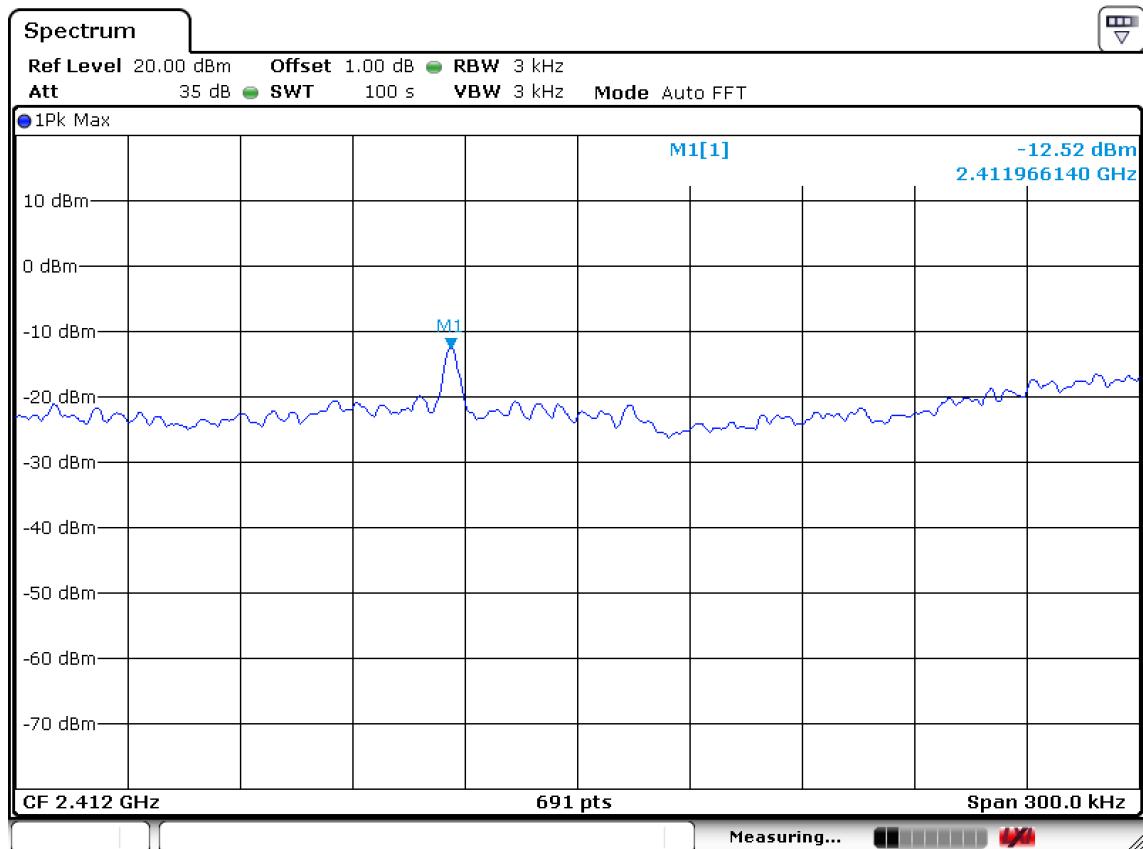
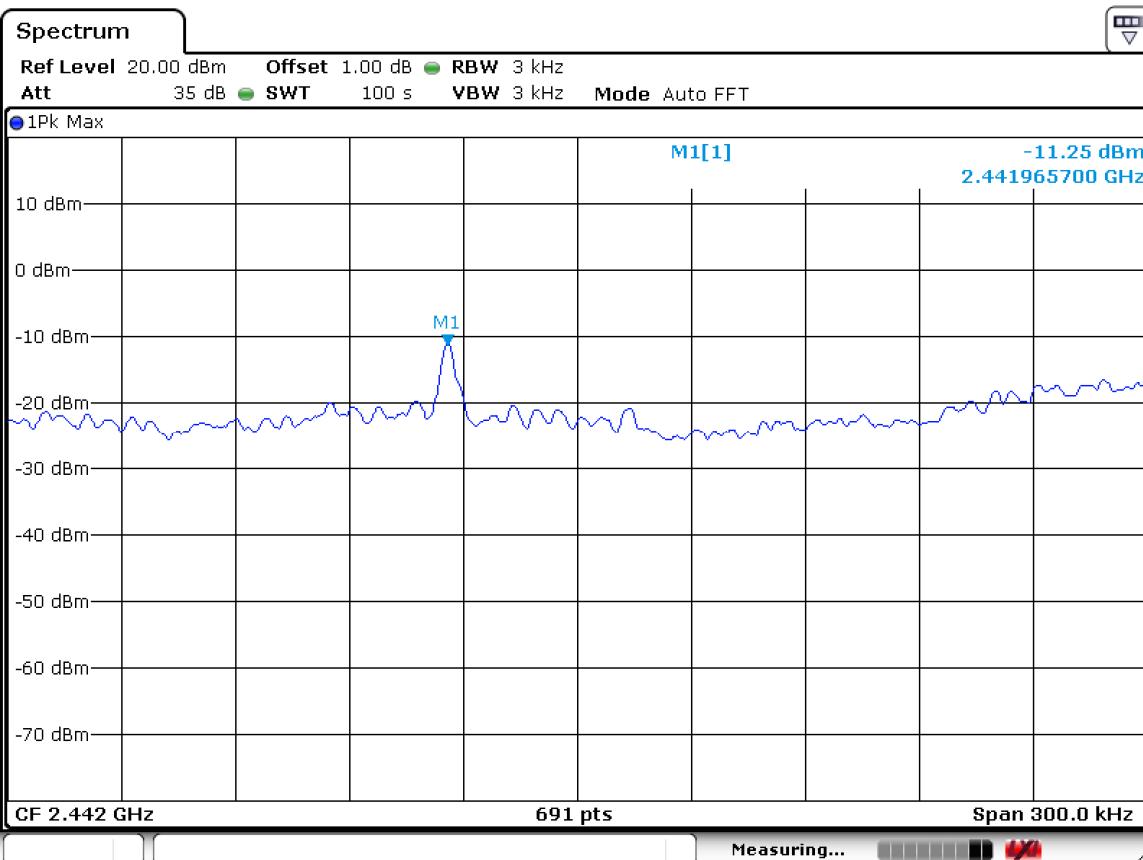
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

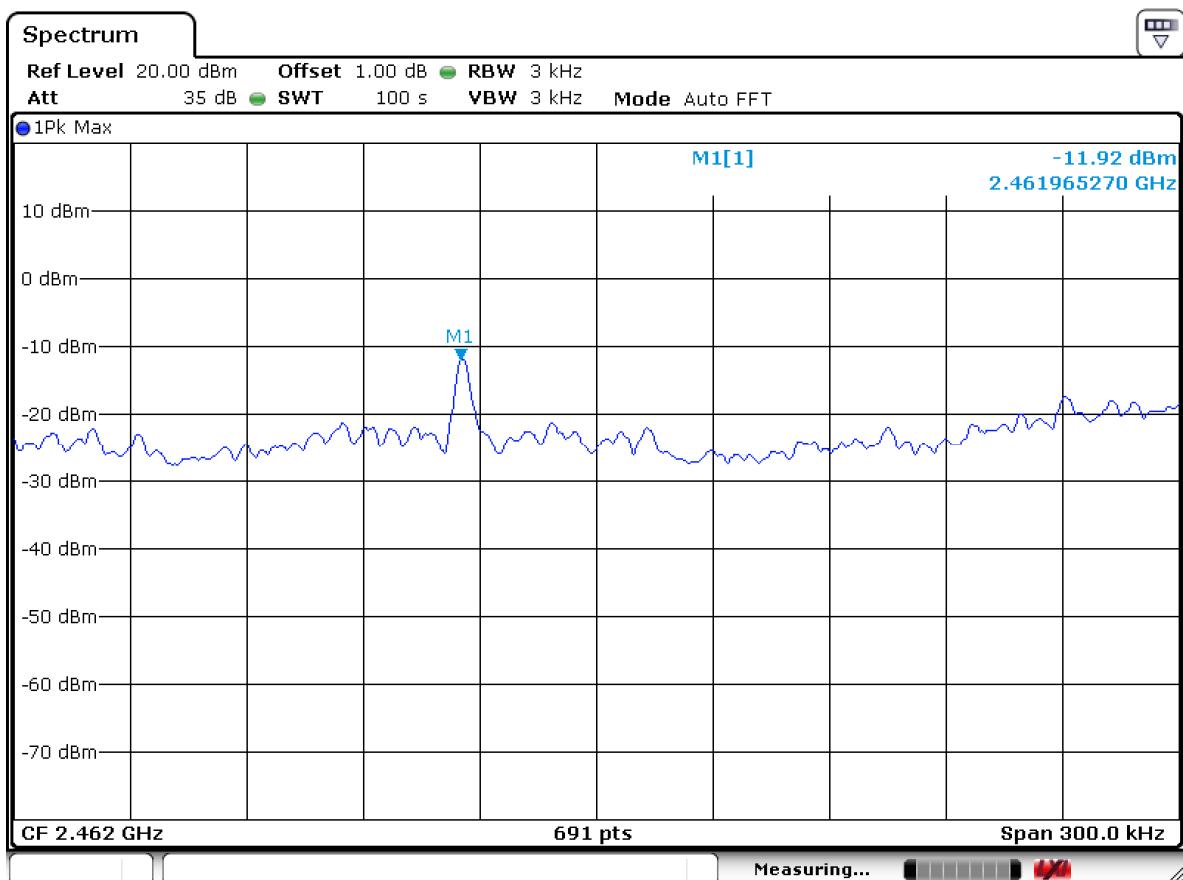
802.11b Power Density Measurement**CH 1****CH 7**

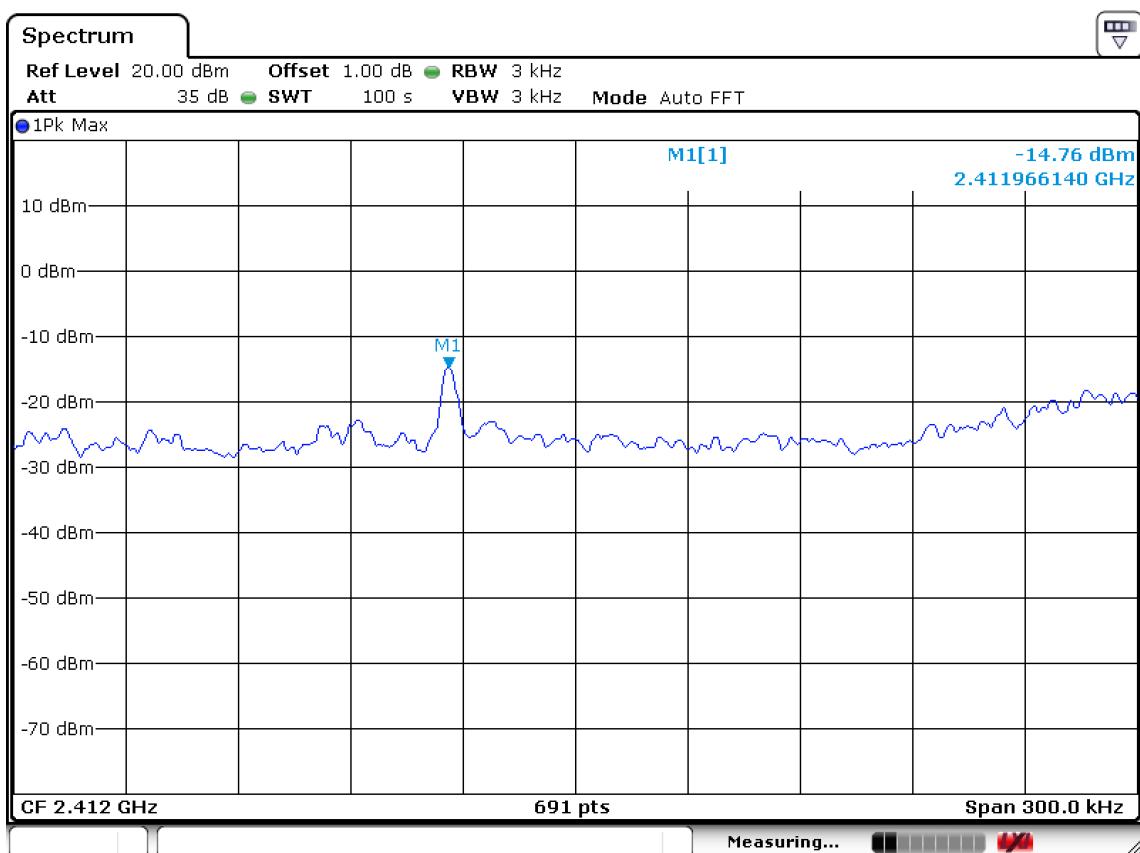
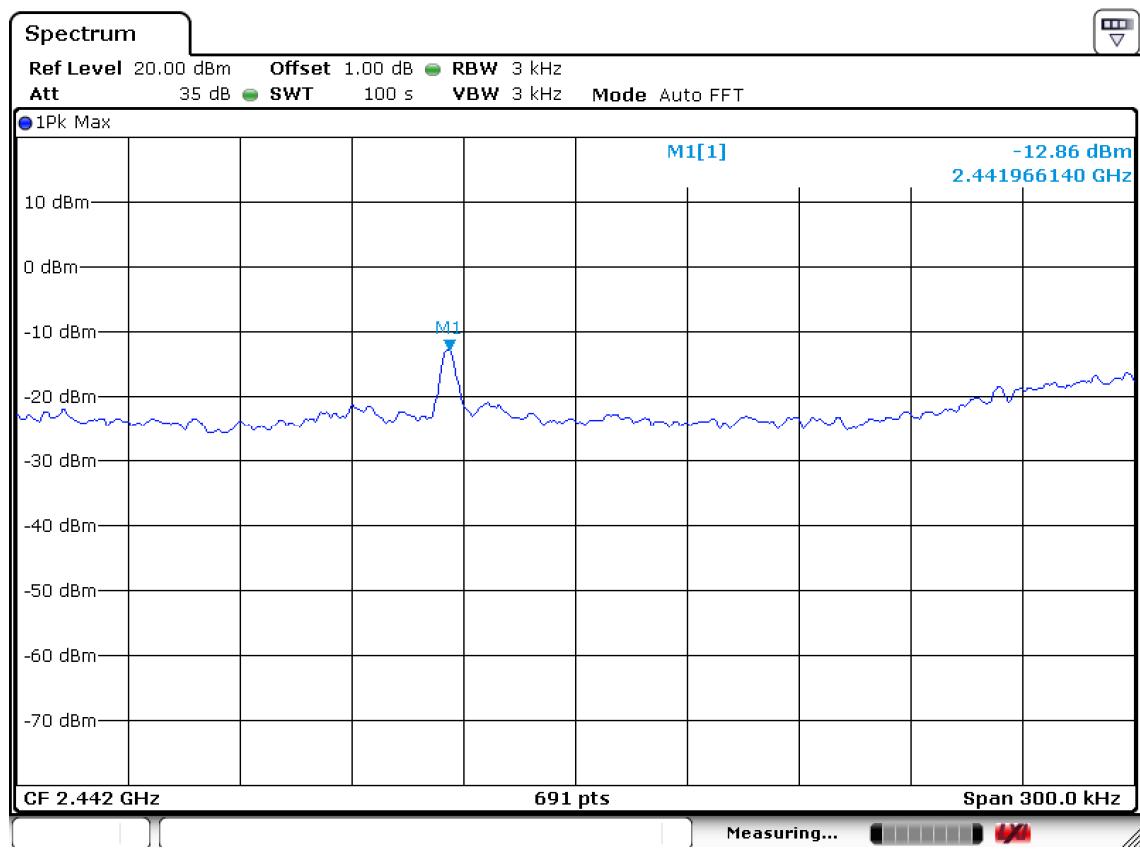
CH 11



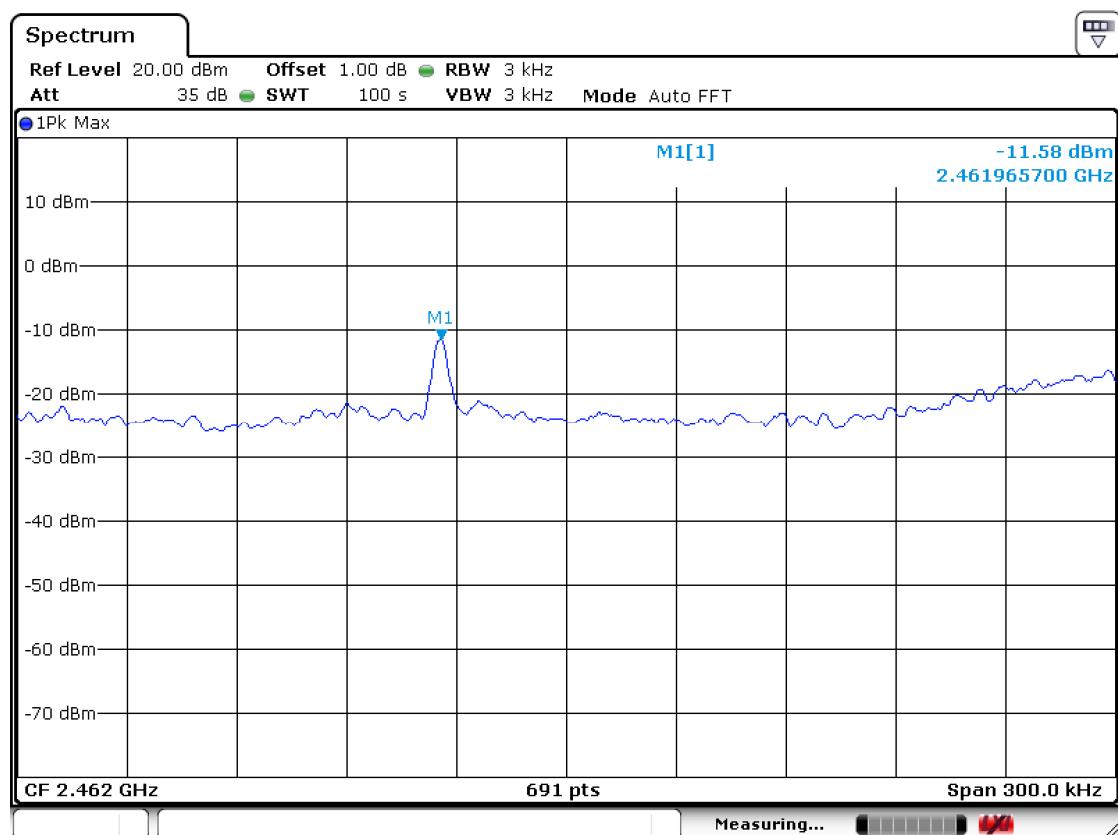
802.11g Power Density Measurement**CH 1****CH 7**

CH 11



802.11n Power Density Measurement**CH 1****CH 7**

CH 11



3.2.4 Band - edge

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

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

Span = 80 MHz Detector function = peak

Measurement Data: Complies

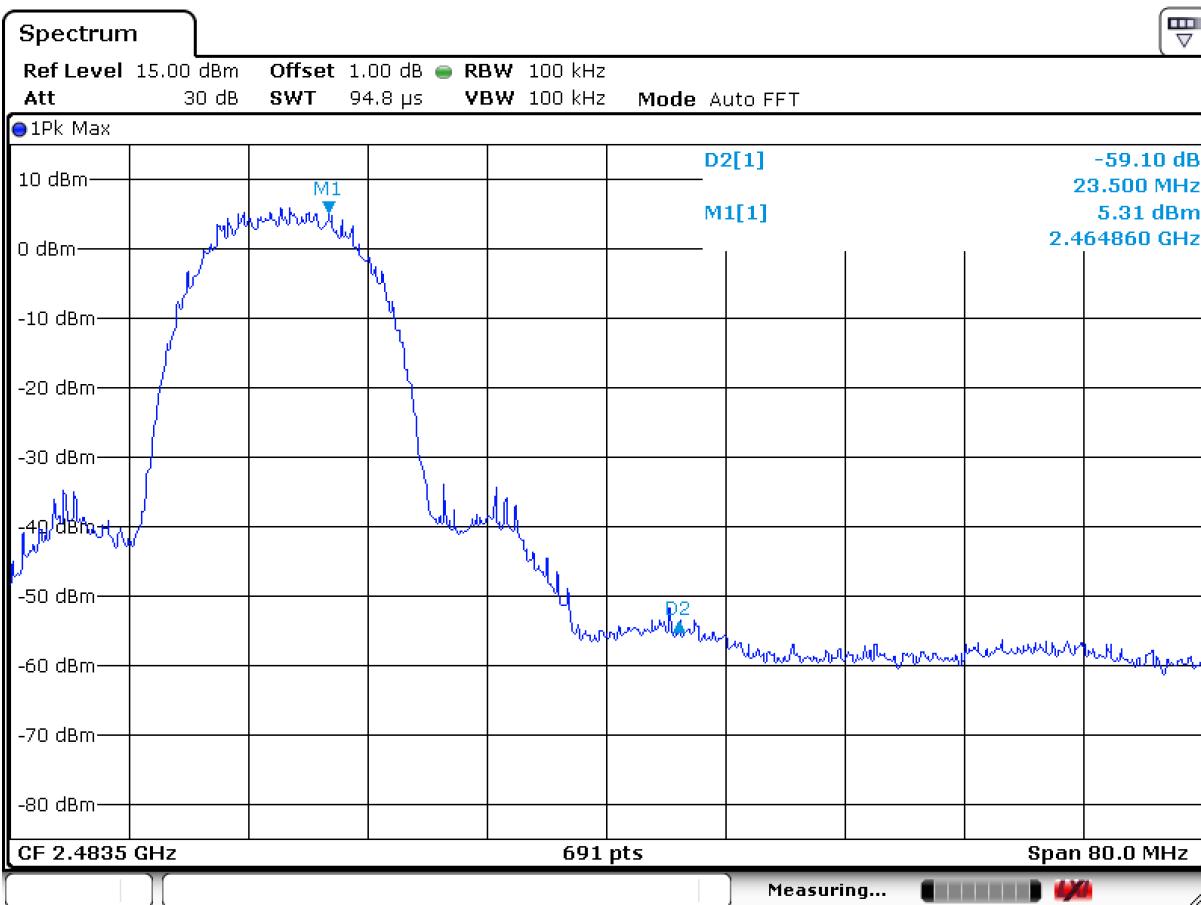
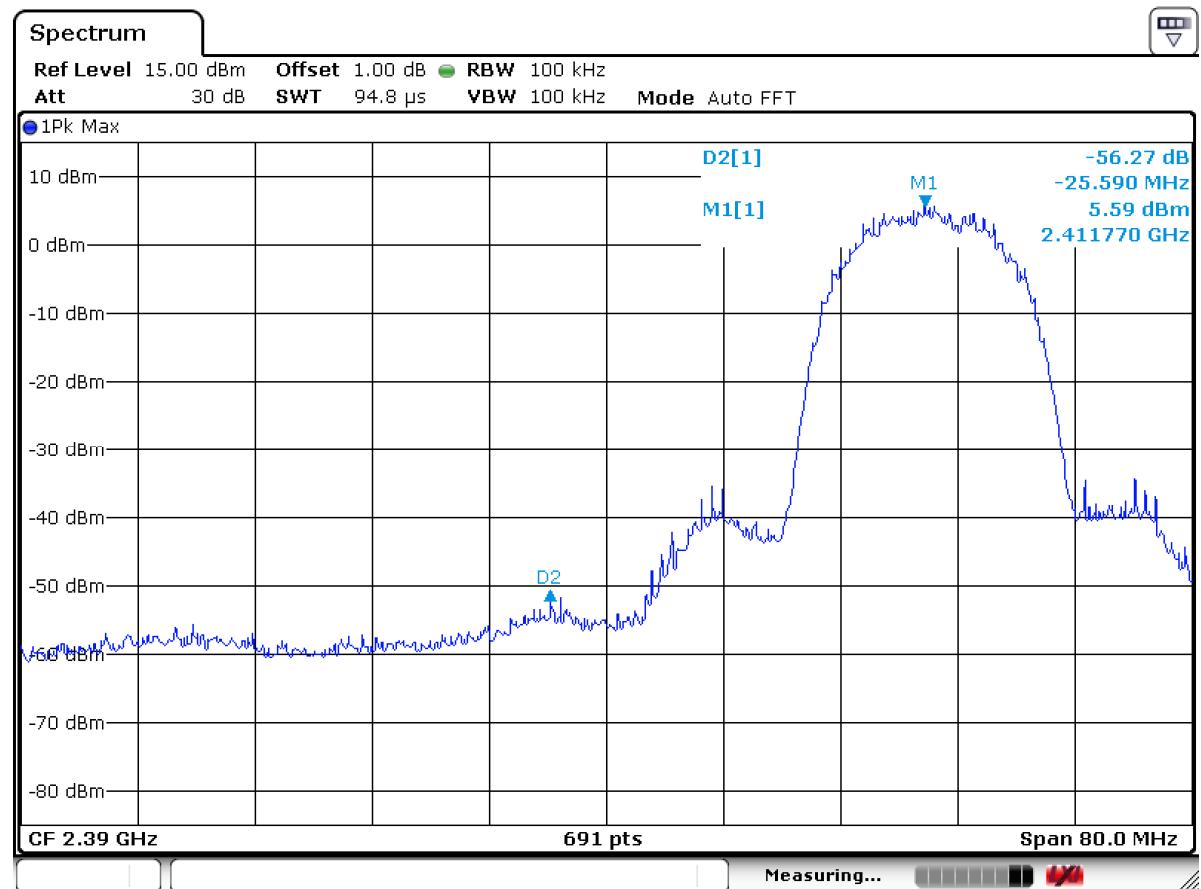
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

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

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

802.11b Band-edge : Conducted Measurements



Band-edges in the restricted band 2310-2390 MHz measurement (802.11b mode)

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2390.0 | 46.69 | 55.78 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 38.9 | 48.0 | 15.1 | 26.0 | |

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

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2483.9 | 47.55 | 57.97 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 39.8 | 50.2 | 14.2 | 23.8 | |

Band-edges in the restricted band 2310-2390 MHz measurement (802.11g mode)

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2390.0 | 49.56 | 60.22 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 41.8 | 52.5 | 12.2 | 21.5 | |

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

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2483.5 | 48.84 | 60.15 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 41.1 | 52.4 | 12.9 | 21.6 | |

Band-edges in the restricted band 2310-2390 MHz measurement (802.11n mode)

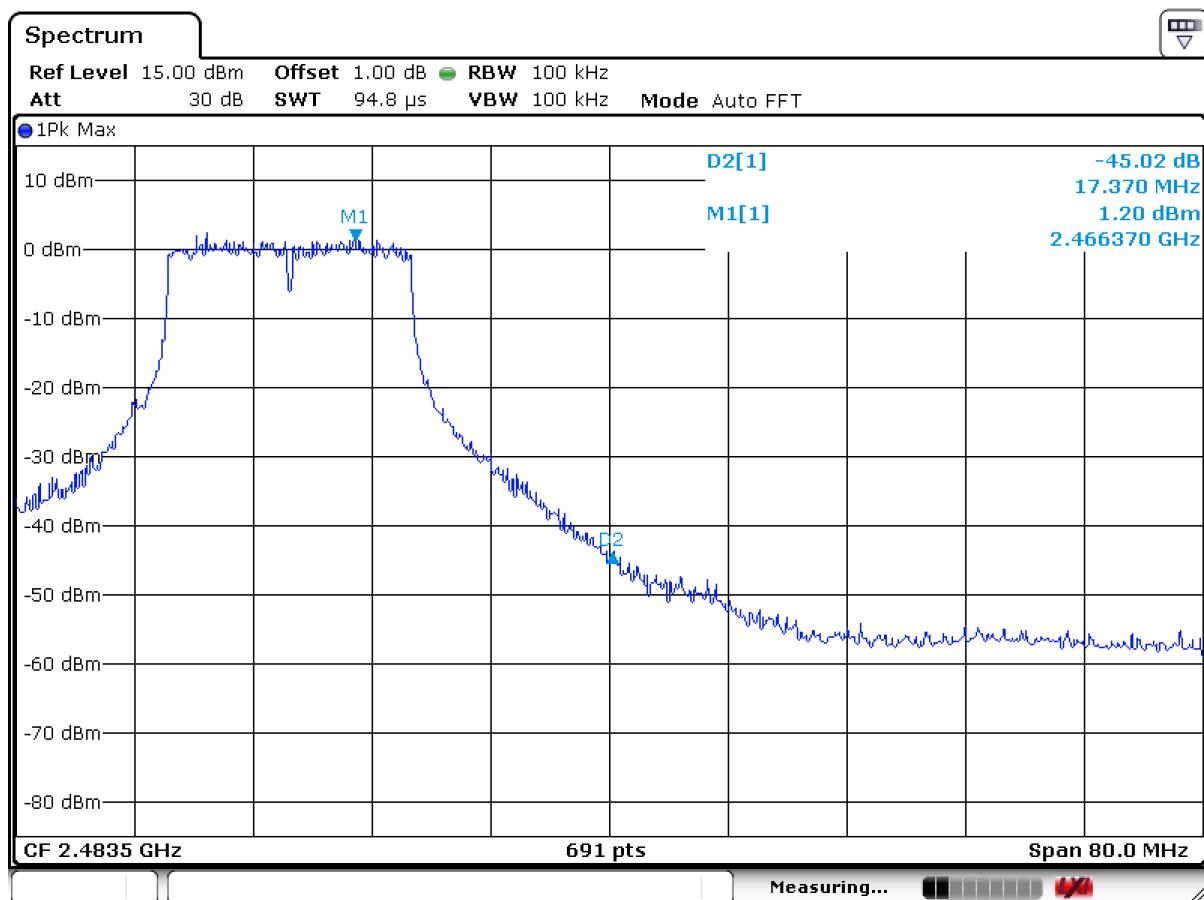
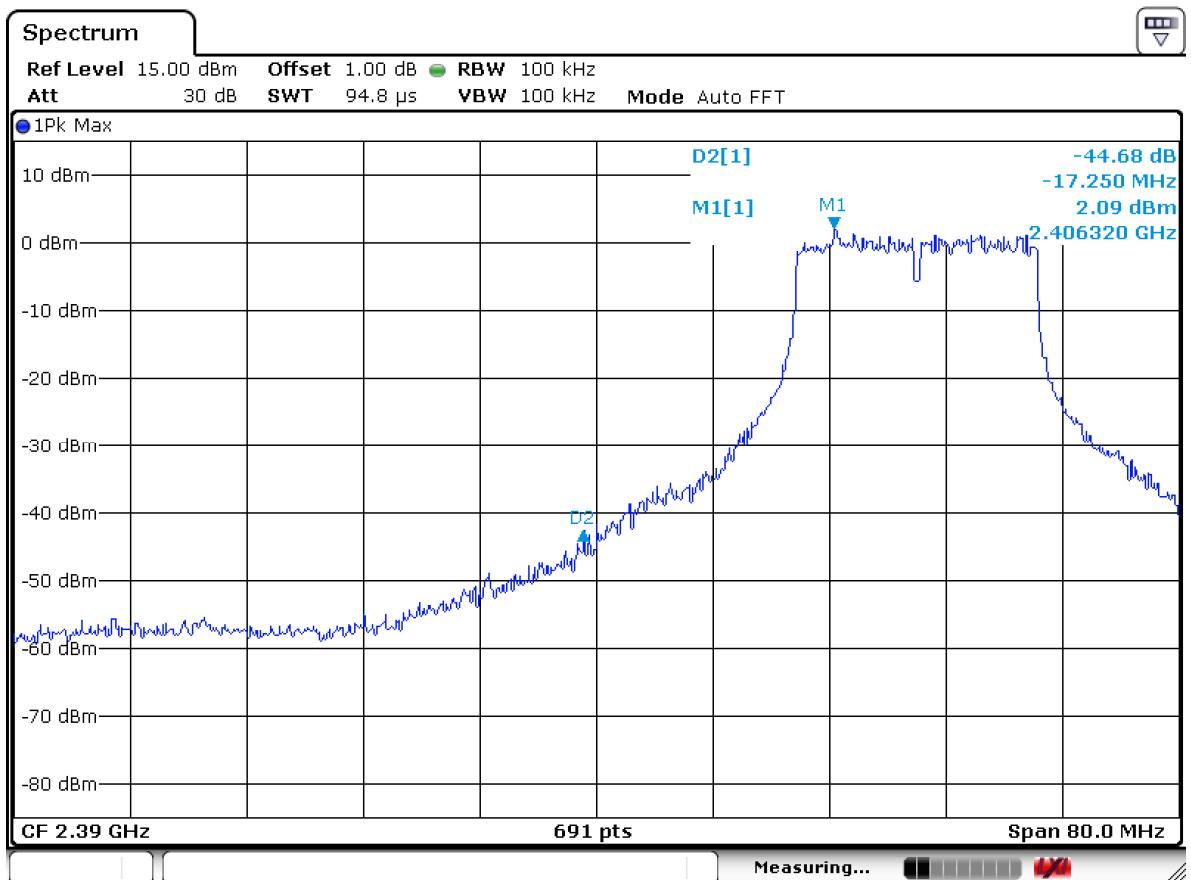
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2389.9 | 45.82 | 56.26 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 38.1 | 48.5 | 15.9 | 25.5 | |

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

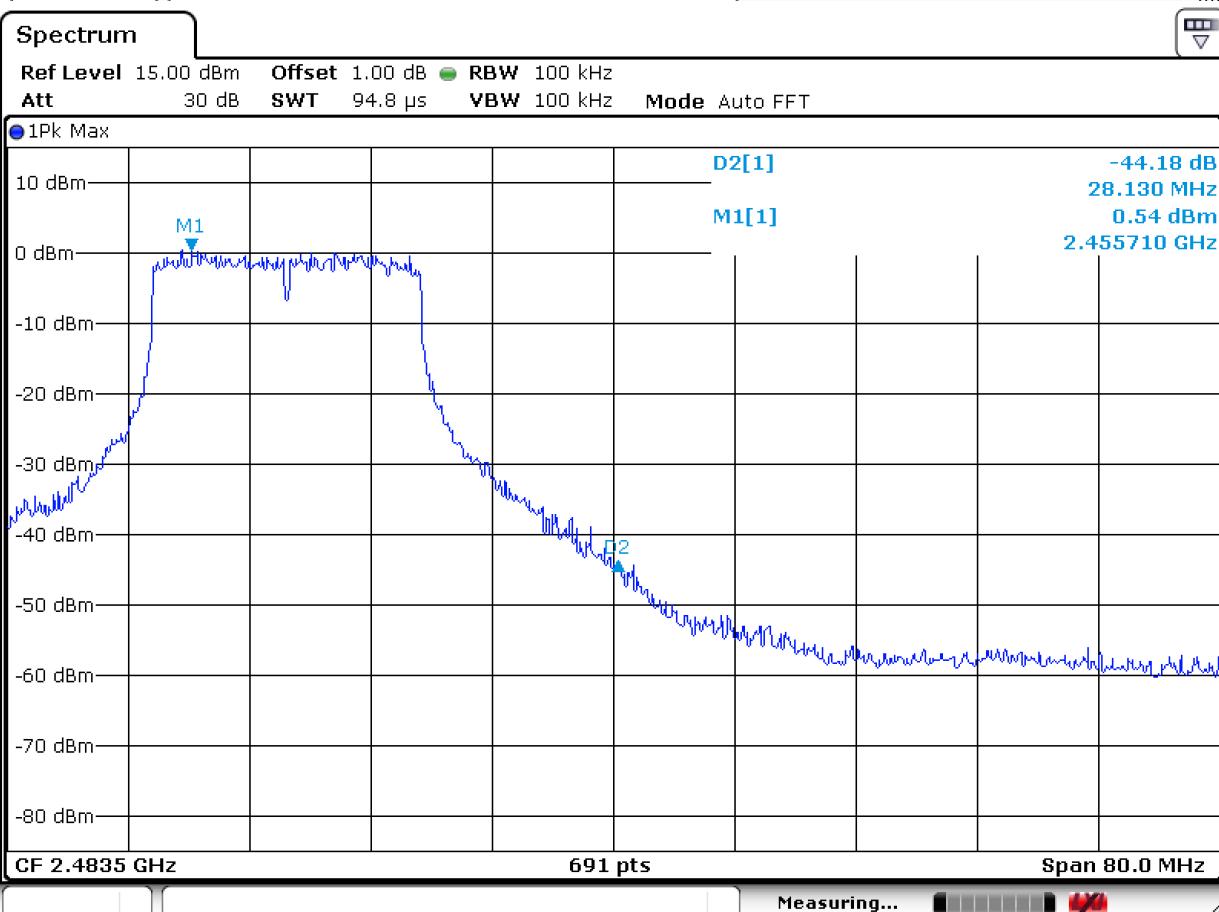
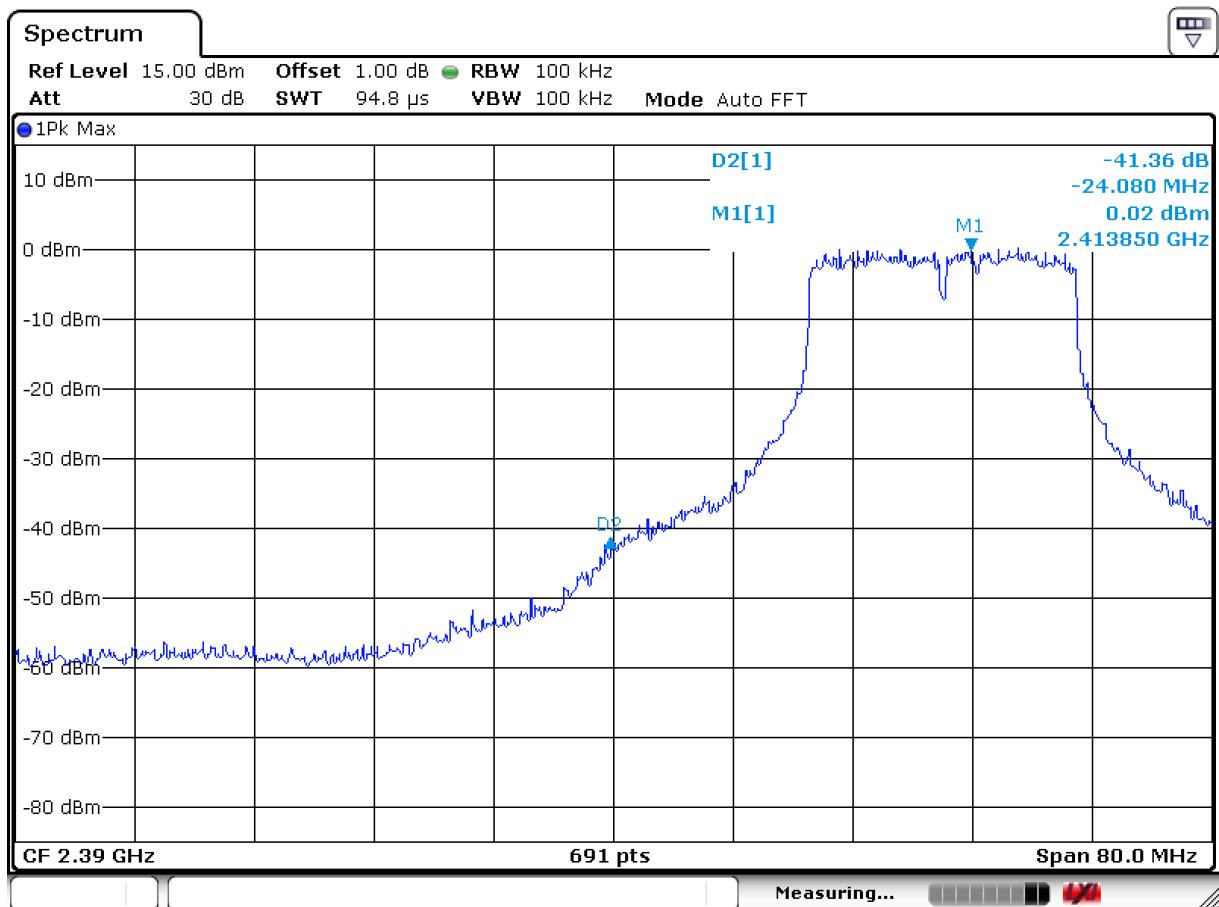
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | | |
|--------------------|---------------------|-------|------|----------------------|-----------|-------|--------------------|------|--------------------|------|----------------|------|--|
| | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | | AV / Peak | | AV / Peak | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak | |
| 2483.5 | 44.14 | 53.83 | V | 25.4 | 37.1 | 4.0 | 54.0 | 74.0 | 36.4 | 46.1 | 17.6 | 27.9 | |

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

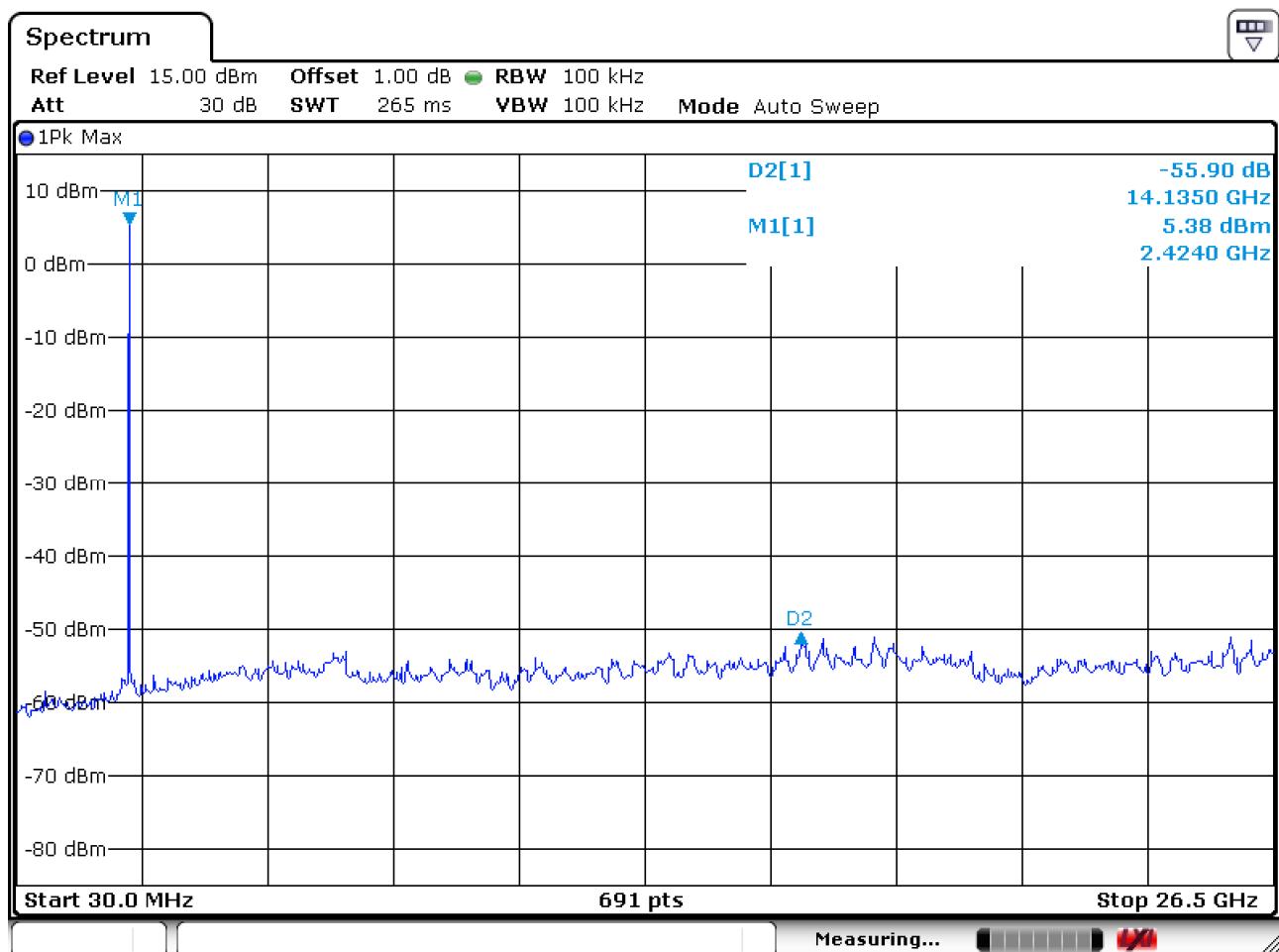
802.11g Band-edge : Conducted Measurements



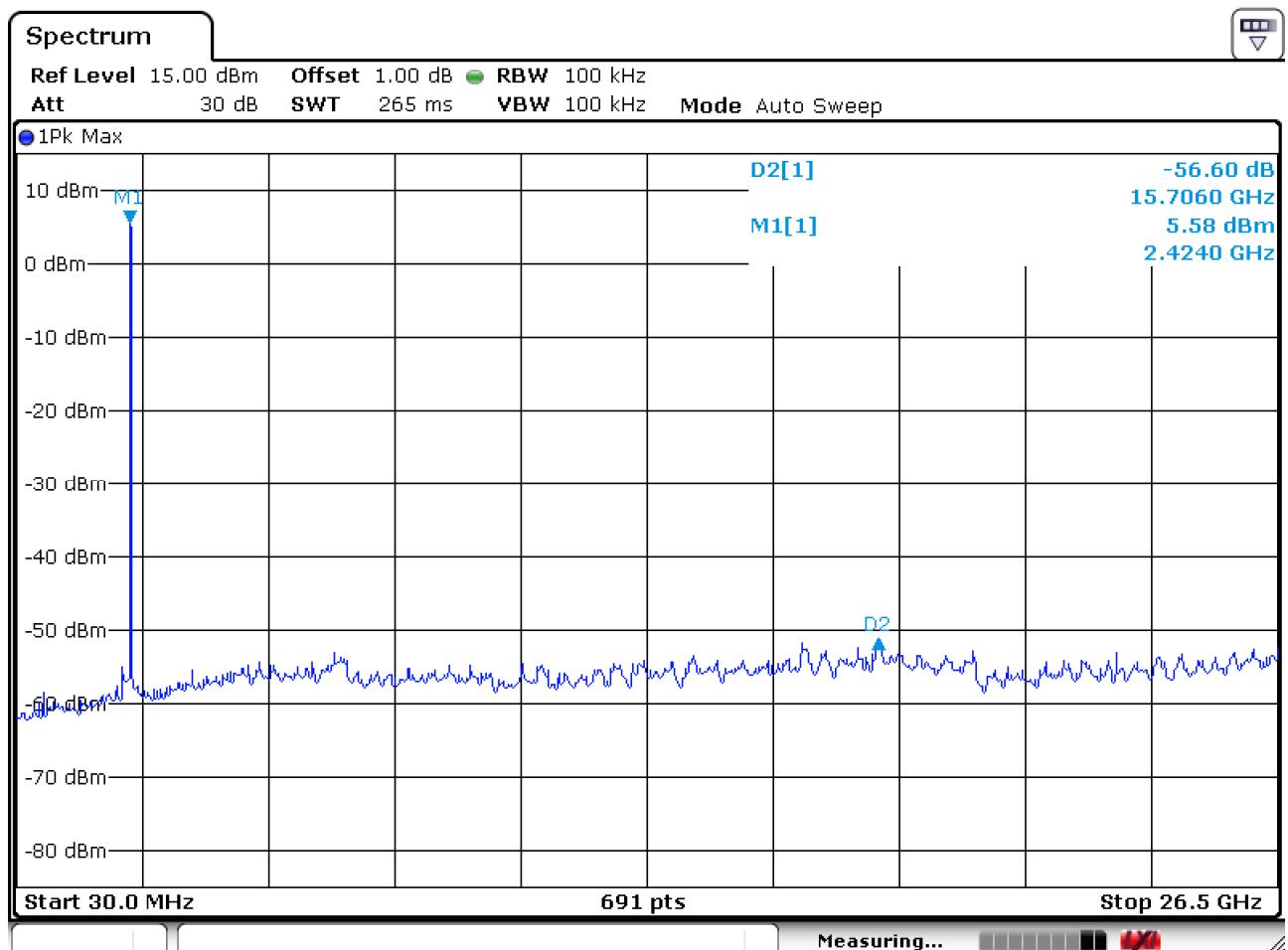
802.11n Band-edge : Conducted Measurements



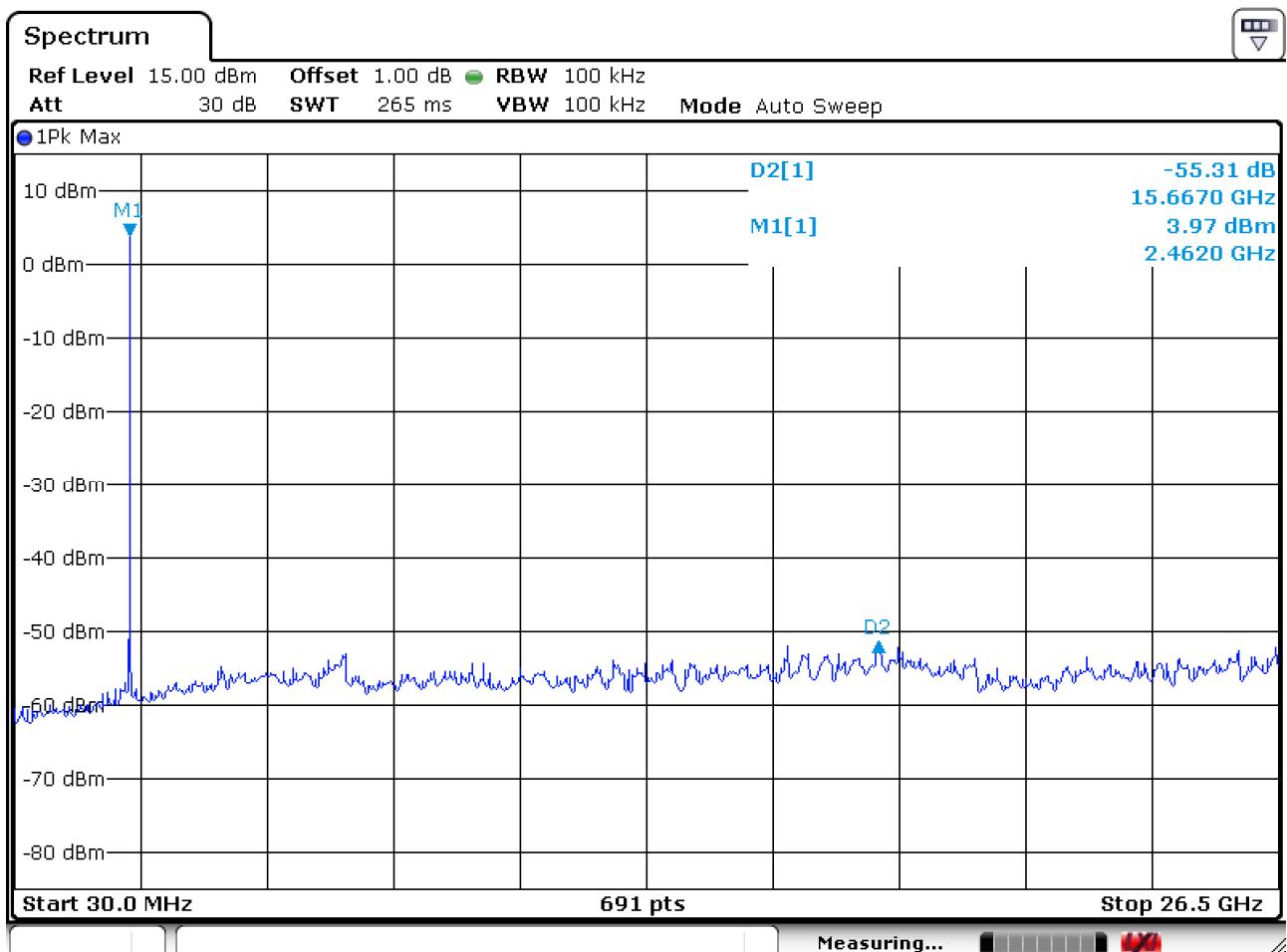
802.11b - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



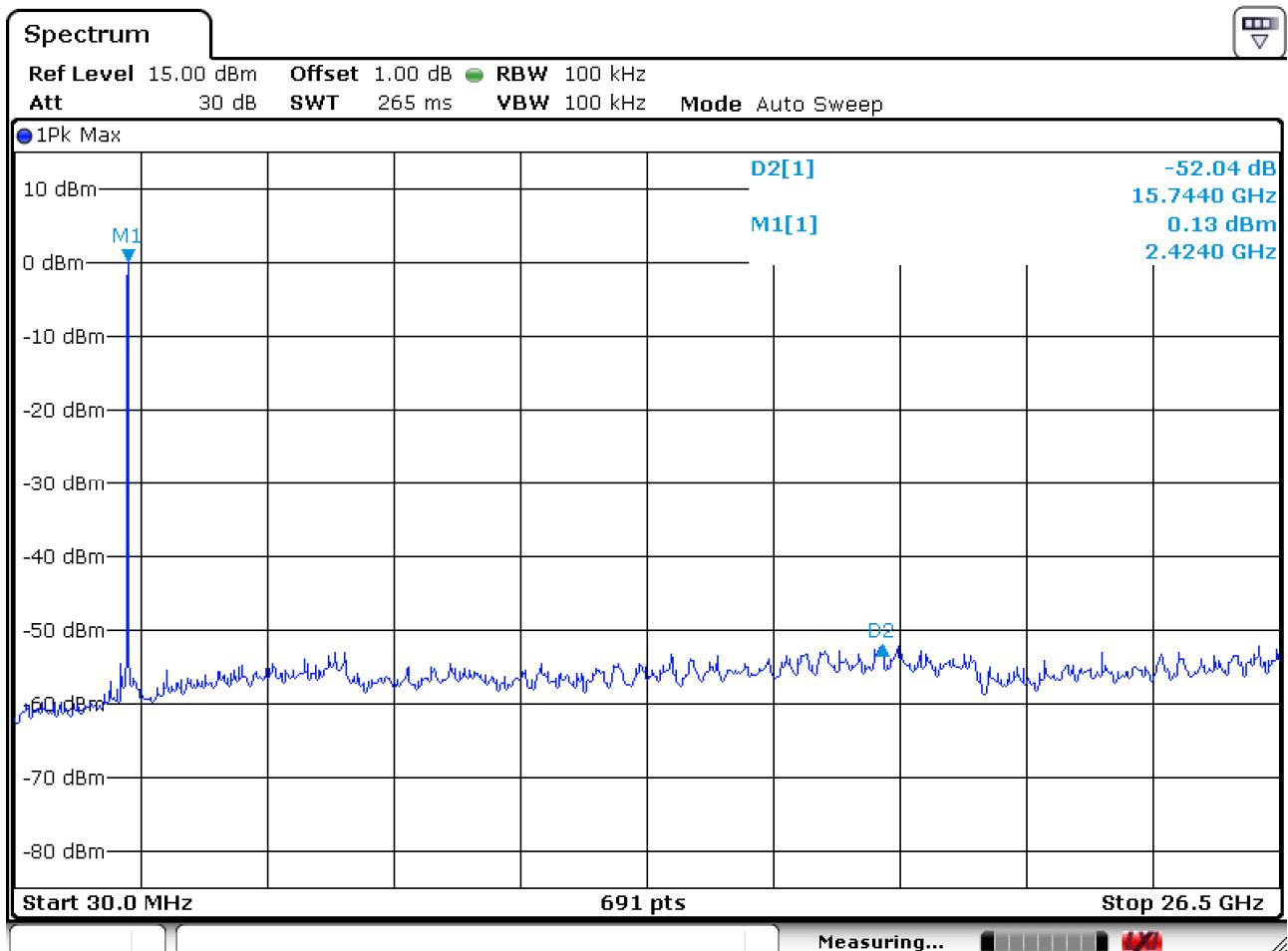
802.11b - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



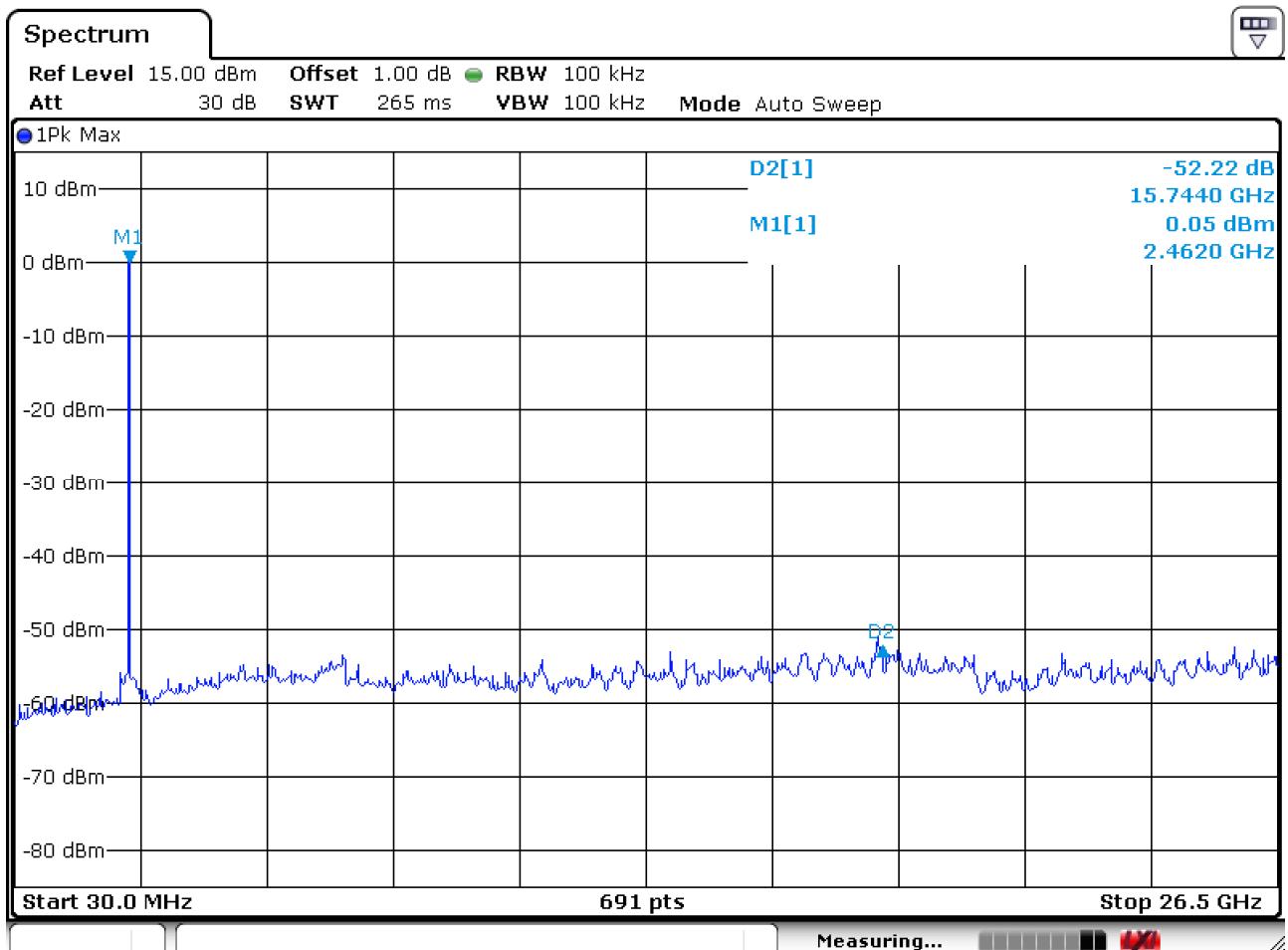
802.11b – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



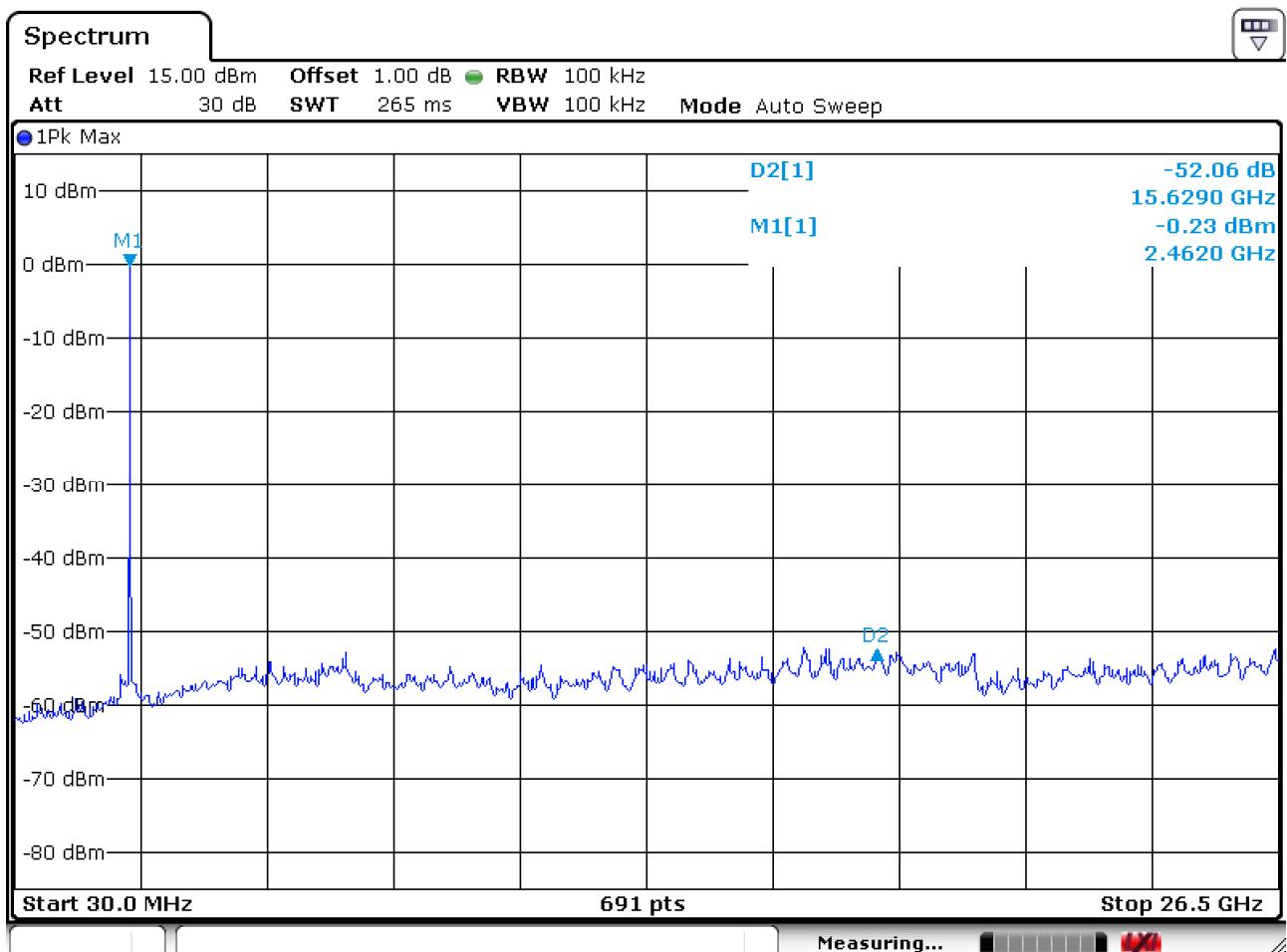
802.11g - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



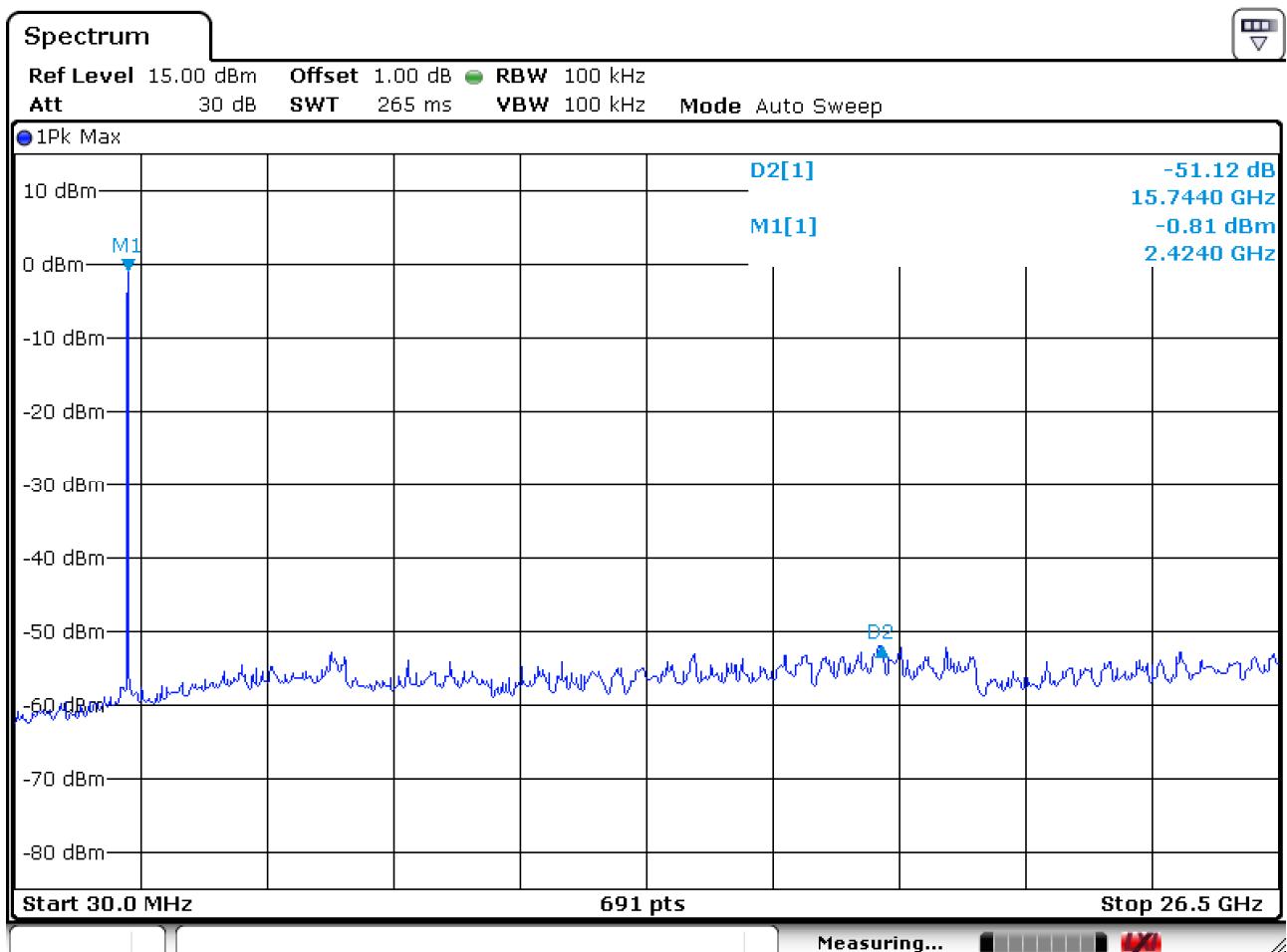
802.11g - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



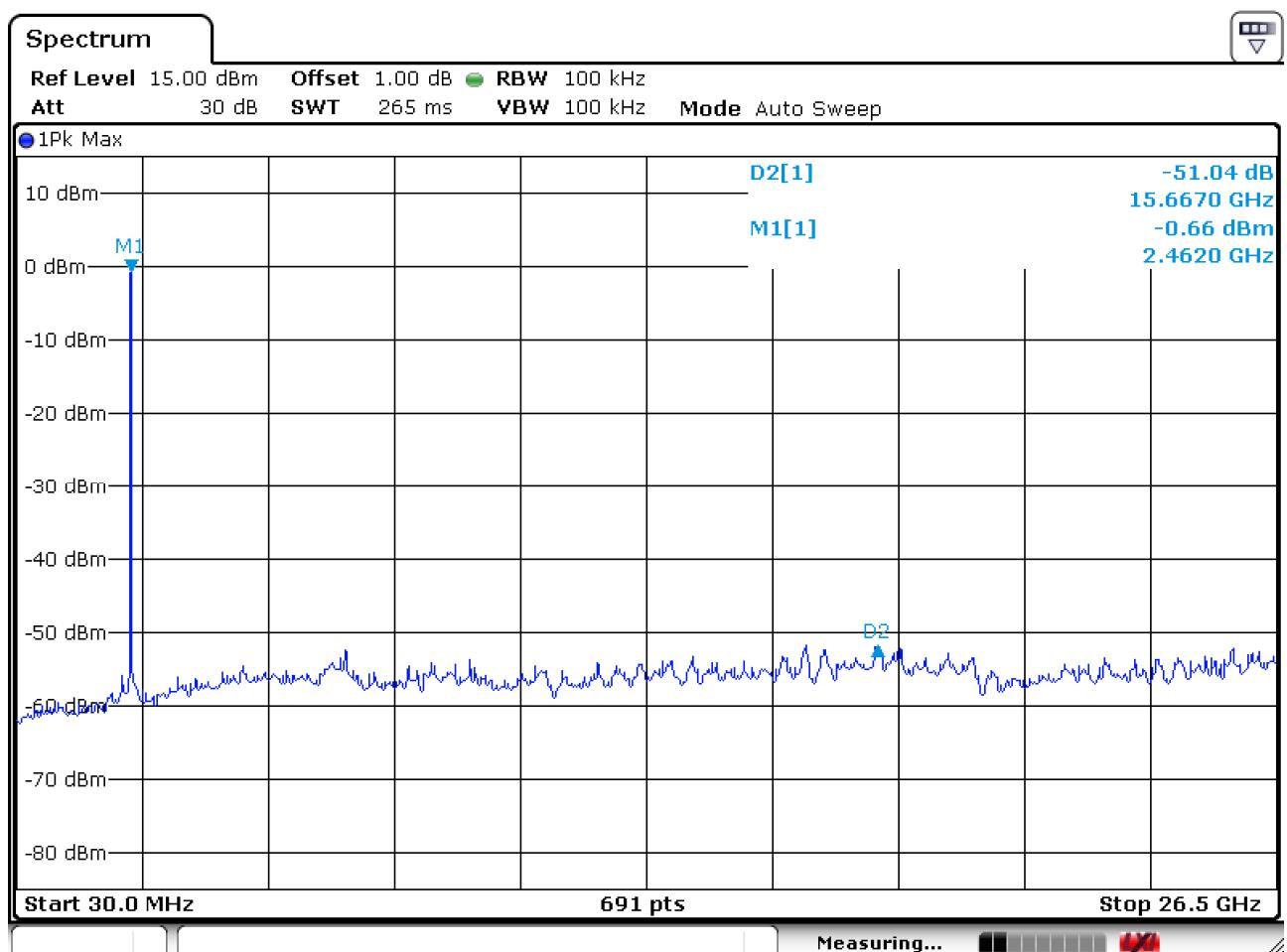
802.11g – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



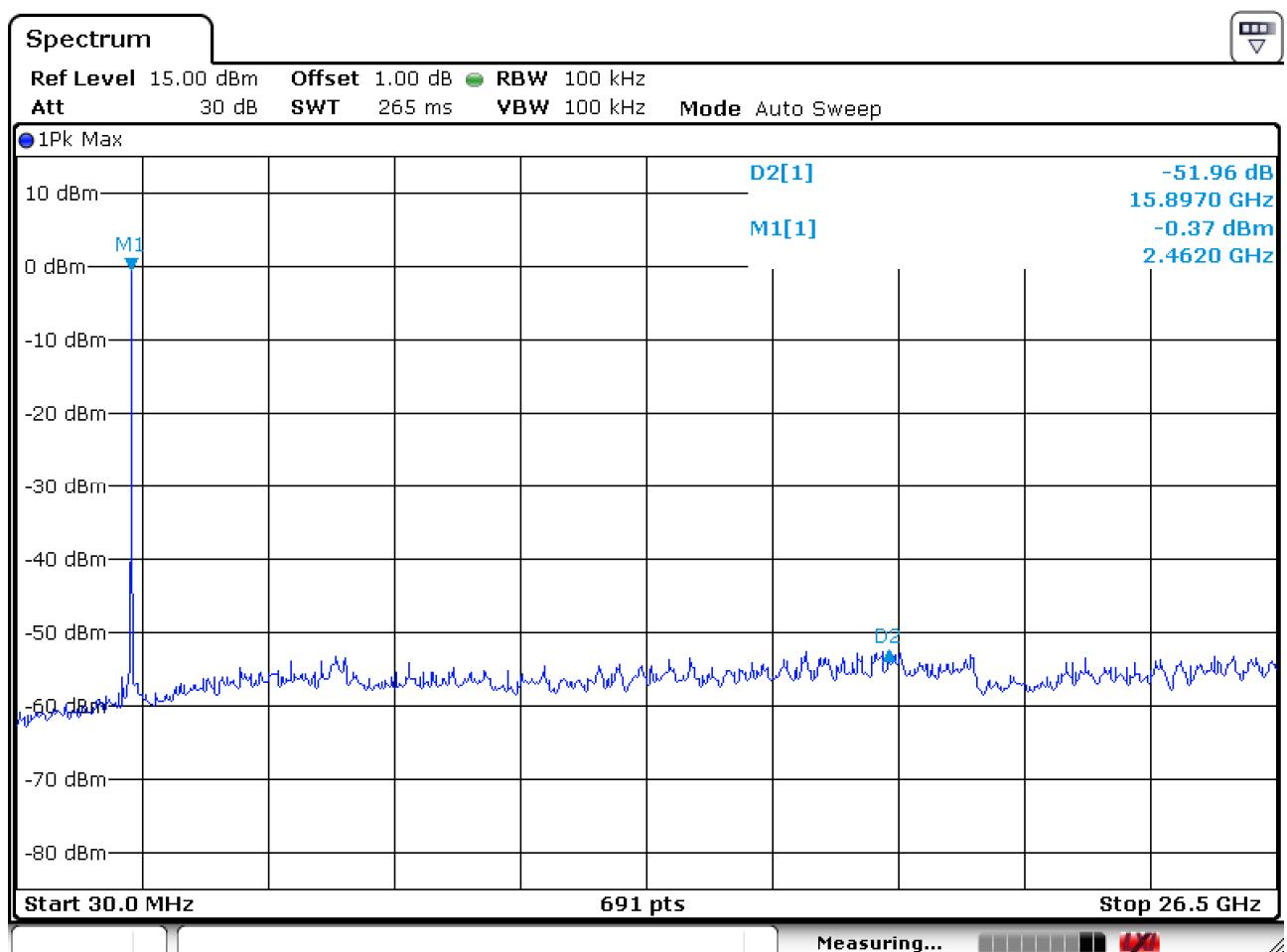
802.11n - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



802.11n - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



802.11n – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



3.2.5 Field Strength of Harmonics-Transmitter

Procedure:

*The testing follows TCB Workshop 2012, April and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test requirement. 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)

Peak:VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Average:VBW=10Hz

Span = 100 MHz

Detector function = Peak and Average

Trace = max hold

Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 20dB below limit.
- The three antennas were used with this EUT during the Testing.

Minimum Standard: FCC Part 15.209(a)

| Frequency (MHz) | Limit (uV/m) @ 3m |
|-----------------|---------------------|
| 0.009 ~ 0.490 | 2400/F (kHz) @ 300m |
| 0.490 ~ 1.705 | 24000/F (kHz) @ 30m |
| 1.705 ~ 30 | 30 @ 30m |
| 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.

***802.11b Measurement Data: (Above 1GHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|---------------------------|----------------------------|-------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| 4824 | 41.15 | 56.69 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 41.8 | 57.4 | 12.2 | 16.6 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4884 | 45.88 | 57.91 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 46.6 | 58.6 | 7.5 | 15.4 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4924 | 47.11 | 58.89 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 47.8 | 59.6 | 6.2 | 14.4 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

***802.11b Measurement Data: (9kHz - 30MHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--|----------------------------|------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

***802.11g Measurement Data: (Above 1GHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|---------------------------|----------------------------|-------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| 4823 | 43.23 | 57.11 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 43.9 | 57.8 | 10.1 | 16.2 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4884 | 41.91 | 53.47 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 42.6 | 54.1 | 11.4 | 19.9 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4923 | 43.32 | 55.25 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 44.0 | 55.9 | 10.0 | 18.1 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

***802.11g Measurement Data: (9kHz - 30MHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--|----------------------------|------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

***802.11n Measurement Data: (Above 1GHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|---------------------------|----------------------------|-------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| 4824 | 40.31 | 52.27 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 41.0 | 52.9 | 13.0 | 21.1 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4883 | 39.69 | 50.18 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 40.4 | 50.9 | 13.6 | 23.2 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| 4924 | 41.15 | 52.32 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 41.8 | 53.0 | 12.2 | 21.0 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

***802.11n Measurement Data: (9kHz - 30MHz)**

| Frequency [MHz] | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--|----------------------------|------|-------------|------------------------------------|----------------------------|--------------|---------------------------|------|---------------------------|------|-----------------------|------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| | AV | Peak | | | | | AV | Peak | AV | Peak | AV | Peak |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Radiated Emissions – WLAN mode (Worst case, G mode)

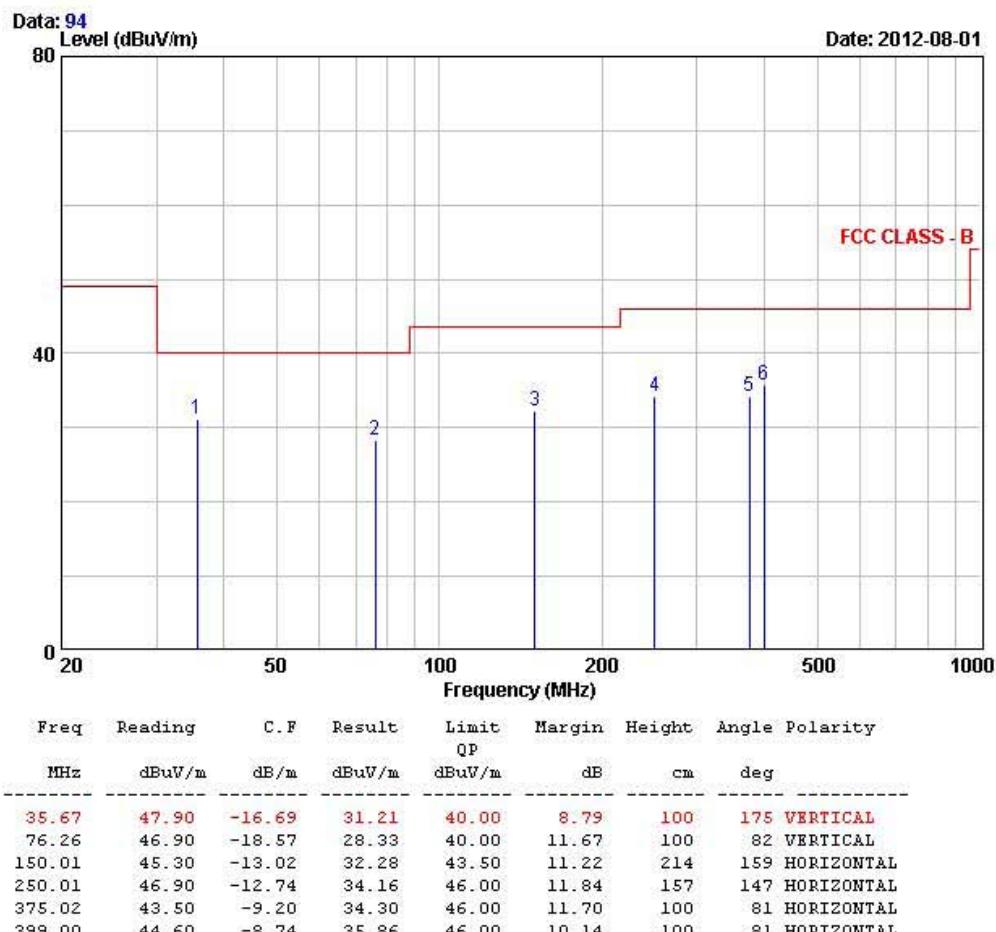
243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel :+82-31-3236008,9
Fax:+82-31-3236010

EUT/Model No.: HES2E4A0T

TEST MODE: WLAN g mode

Temp Humi : 27 / 49

Tested by: PARK H W



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

3.2.6 AC Conducted Emissions

Procedure:

*The testing follows the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009. 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 20dB below limit.

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

| Frequency Range (MHz) | Conducted Limit (dBuV) | |
|--------------------------|------------------------|------------|
| | Quasi-Peak | Average |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

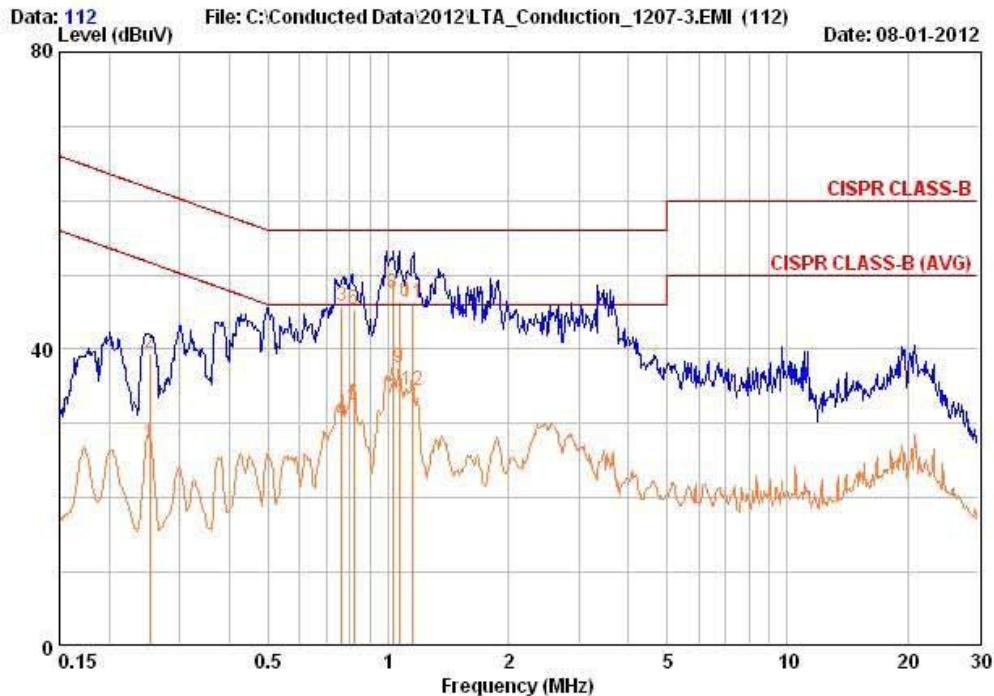
* Decreases with the logarithm of the frequency

AC Conducted Emissions –WLAN – Line (Worst case, G mode)

243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel :+82-31-3236008,9
Fax :+82-31-3236010

EUT / Model No. : HES2E4AOT Phase : LINE

Test Mode : WLAN mode Test Power : 120 / 60
Temp./Humi. : 25 / 52 Test Engineer : PARK H W



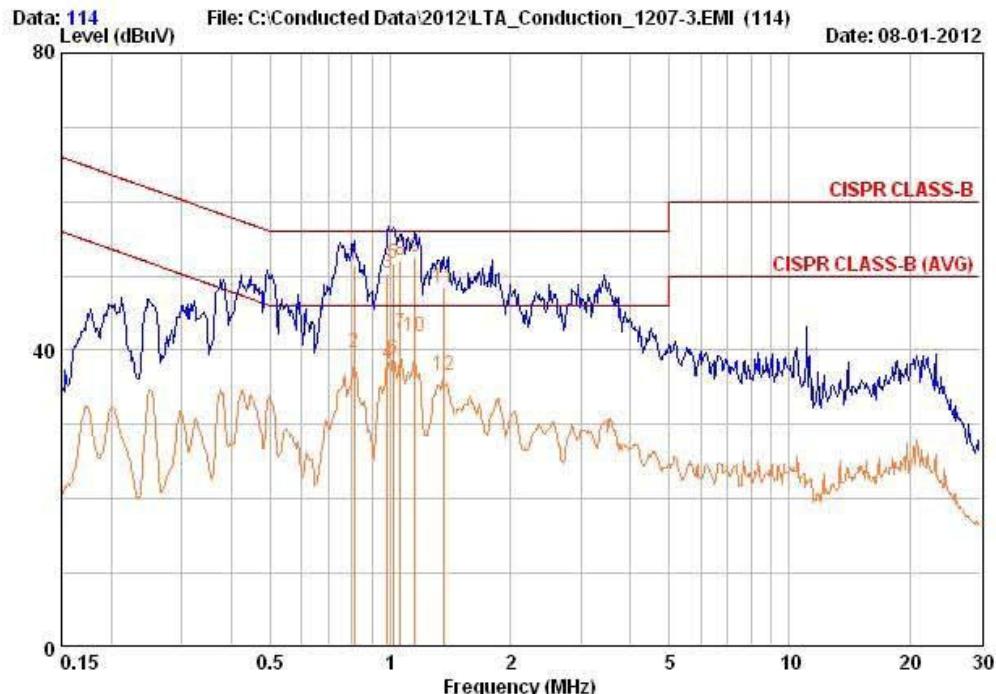
| Freq MHz | RD QP | | RD AV | | C. F dB | Result dBuV | Result QP | | Result AV | | Limit QP | Limit AV | Margin dB | Margin dB |
|-------------|----------|-------|----------|-------|------------|----------------|--------------|-------|--------------|-------|-------------|-------------|--------------|--------------|
| | dBuV | dBuV | dBuV | dBuV | | | dBuV | dBuV | dBuV | dBuV | | | | |
| 0.253 | 29.93 | 17.73 | 9.57 | 39.50 | 39.50 | 27.30 | 61.66 | 51.66 | 51.66 | 22.16 | 22.16 | 24.36 | 24.36 | |
| 0.766 | 36.02 | 20.72 | 9.67 | 45.70 | 45.70 | 30.40 | 56.00 | 46.00 | 46.00 | 10.30 | 10.30 | 15.60 | 15.60 | |
| 0.818 | 35.72 | 22.72 | 9.68 | 45.41 | 45.41 | 32.41 | 56.00 | 46.00 | 46.00 | 10.59 | 10.59 | 13.59 | 13.59 | |
| 1.025 | 37.83 | 23.73 | 9.71 | 47.54 | 47.54 | 33.44 | 56.00 | 46.00 | 46.00 | 8.46 | 8.46 | 12.56 | 12.56 | |
| 1.066 | 36.73 | 27.73 | 9.71 | 46.45 | 46.45 | 37.45 | 56.00 | 46.00 | 46.00 | 9.55 | 9.55 | 8.55 | 8.55 | |
| 1.150 | 36.53 | 24.73 | 9.72 | 46.25 | 46.25 | 34.45 | 56.00 | 46.00 | 46.00 | 9.75 | 9.75 | 11.55 | 11.55 | |

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

AC Conducted Emissions – PING +WLAN – Neutral (Worst case, G mode)

243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel. +82-31-3236008,9
Fax. +82-31-3236010

EUT / Model No. : HES2E4AOT Phase : NEUTRAL
Test Mode : WLAN mode Test Power : 120 / 60
Temp./Humid. : 25 / 52 Test Engineer : PARK H W



| Freq MHz | RD QP dBuV | RD AV dBuV | C. F dB | Result | | Limit | | Margin | |
|-------------|------------------|------------------|------------|------------|------------|------------|------------|----------|----------|
| | | | | QP dBuV | AV dBuV | QP dBuV | AV dBuV | QP dB | AV dB |
| 0.813 | 41.82 | 30.02 | 9.61 | 51.43 | 39.63 | 56.00 | 46.00 | 4.57 | 6.37 |
| 0.983 | 40.73 | 28.43 | 9.64 | 50.37 | 38.07 | 56.00 | 46.00 | 5.63 | 7.93 |
| 1.016 | 42.03 | 29.13 | 9.64 | 51.67 | 38.77 | 56.00 | 46.00 | 4.33 | 7.23 |
| 1.059 | 42.53 | 32.73 | 9.64 | 52.17 | 42.37 | 56.00 | 46.00 | 3.83 | 3.63 |
| 1.151 | 42.93 | 32.13 | 9.64 | 52.58 | 41.78 | 56.00 | 46.00 | 3.42 | 4.22 |
| 1.360 | 38.84 | 26.94 | 9.65 | 48.49 | 36.59 | 56.00 | 46.00 | 7.51 | 9.41 |

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

3.3 Technical Characteristics Test (Zigbee 1, 2)

3.3.1 6 dB Bandwidth

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. 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 = 300 kHz (VBW \geq RBW) Sweep = auto

Measurement Data: (Zigbee 1)

| Frequency (MHz) | Channel No. | Test Results(MHz) | |
|--------------------|-------------|-------------------|---------------|
| | | 6dB Bandwidth | 99% Bandwidth |
| 2405 | 11 | 1.599 | 2.452 |
| 2440 | 18 | 1.599 | 2.417 |
| 2480 | 26 | 1.585 | 2.410 |

Measurement Data: (Zigbee 2)

| Frequency (MHz) | Channel No. | Test Results(MHz) | |
|--------------------|-------------|-------------------|---------------|
| | | 6dB Bandwidth | 99% Bandwidth |
| 2405 | 11 | 1.570 | 2.393 |
| 2440 | 18 | 1.599 | 2.402 |
| 2480 | 26 | 1.591 | 2.402 |

Measurement Data:

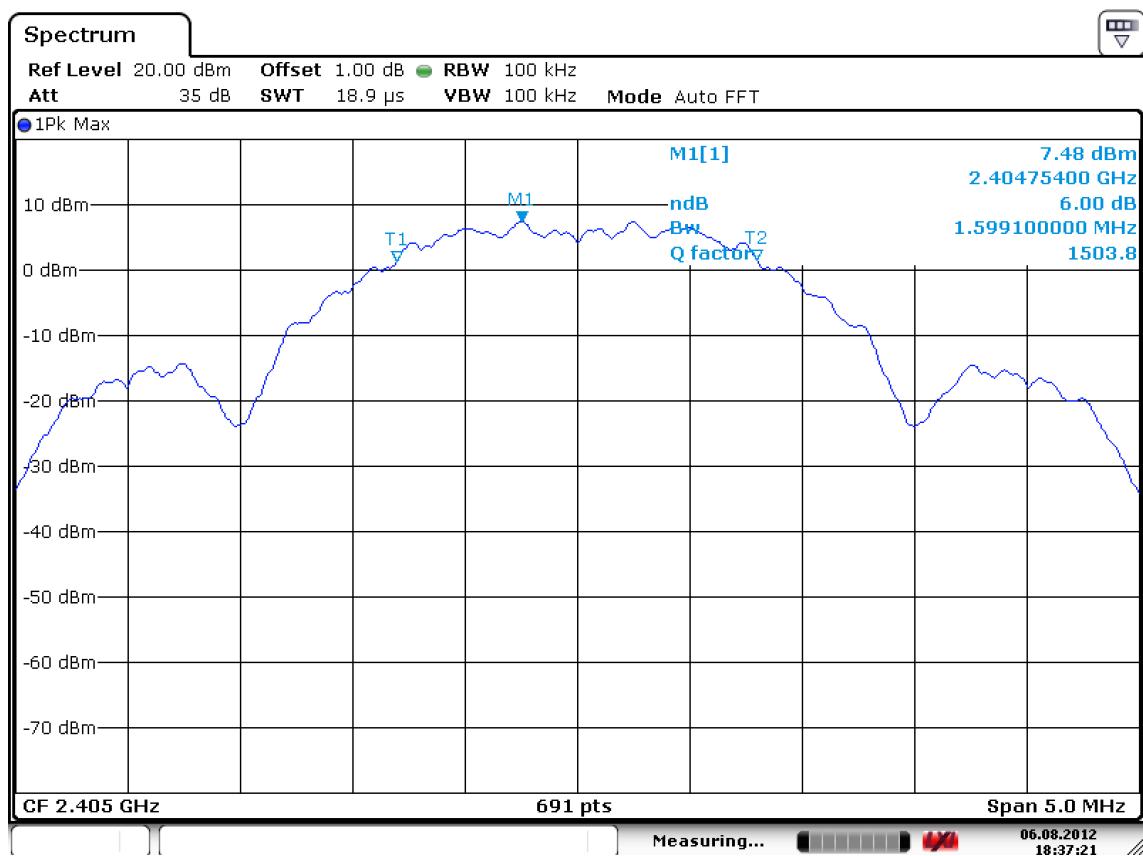
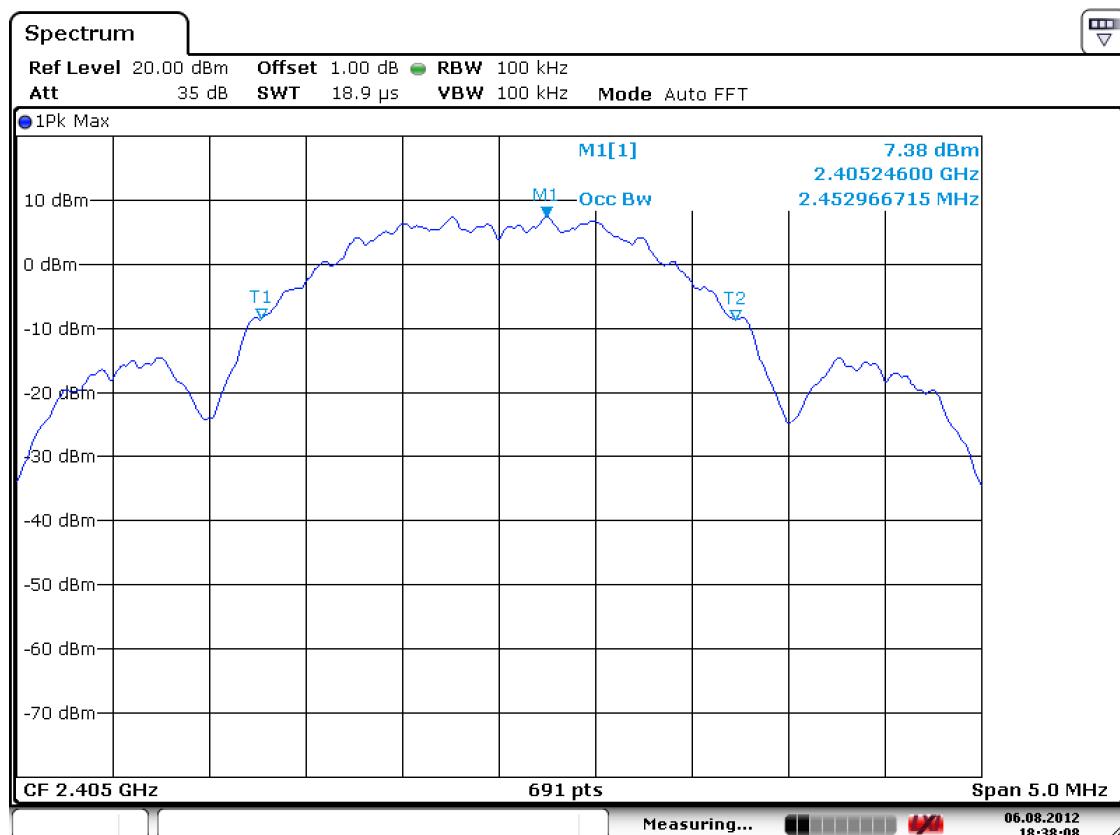
- See next pages for actual measured spectrum plots.

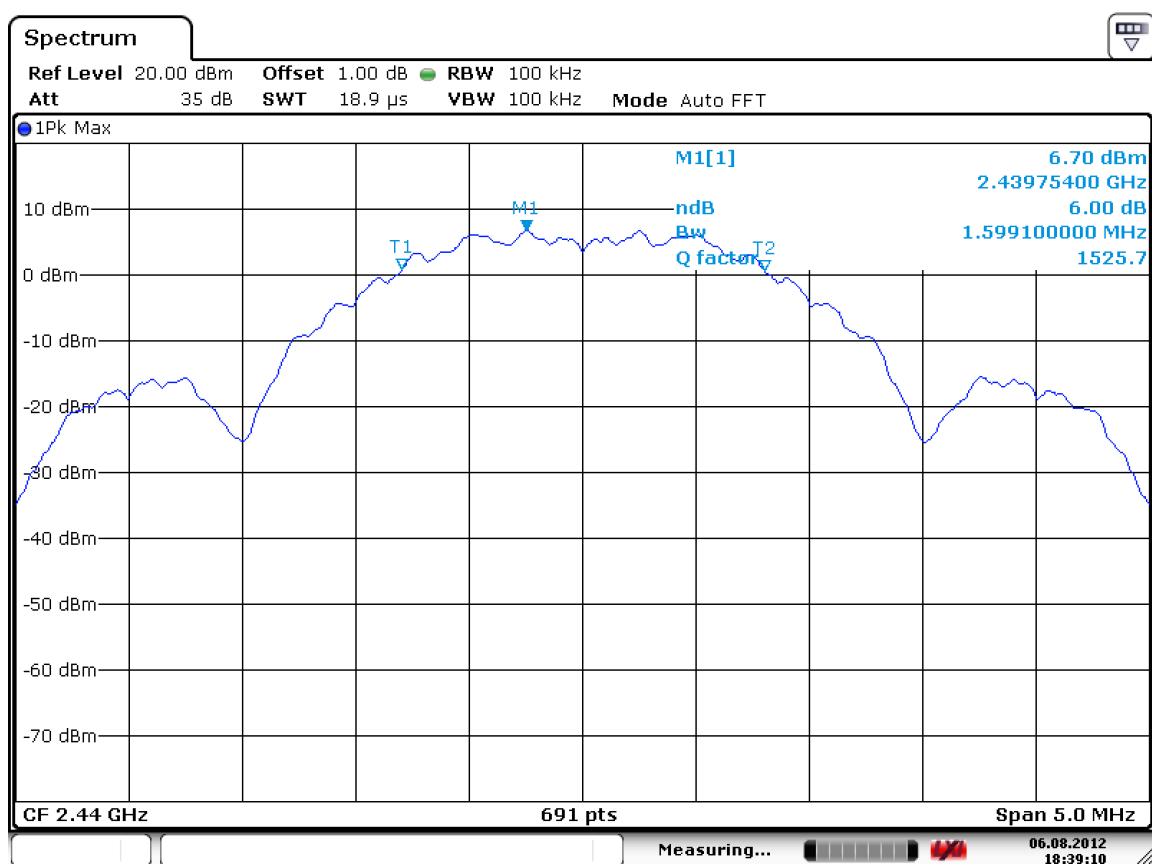
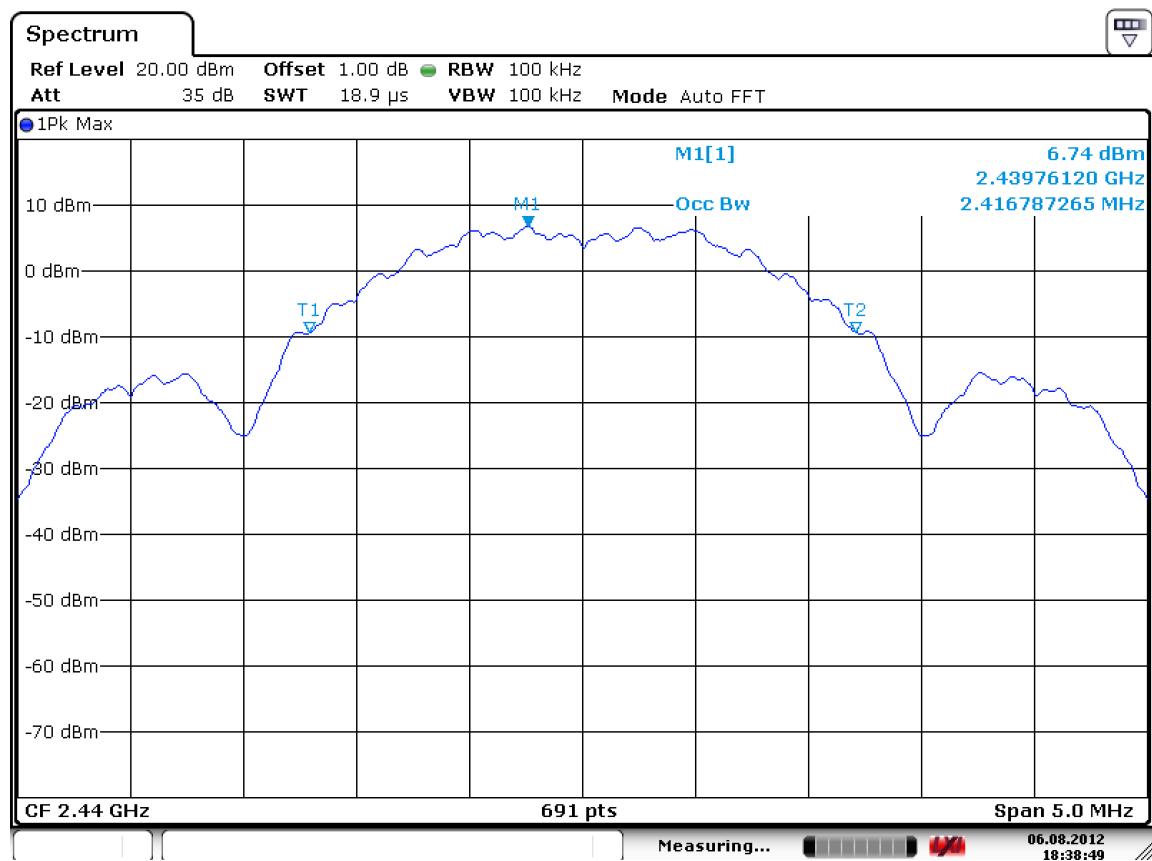
Minimum Standard:

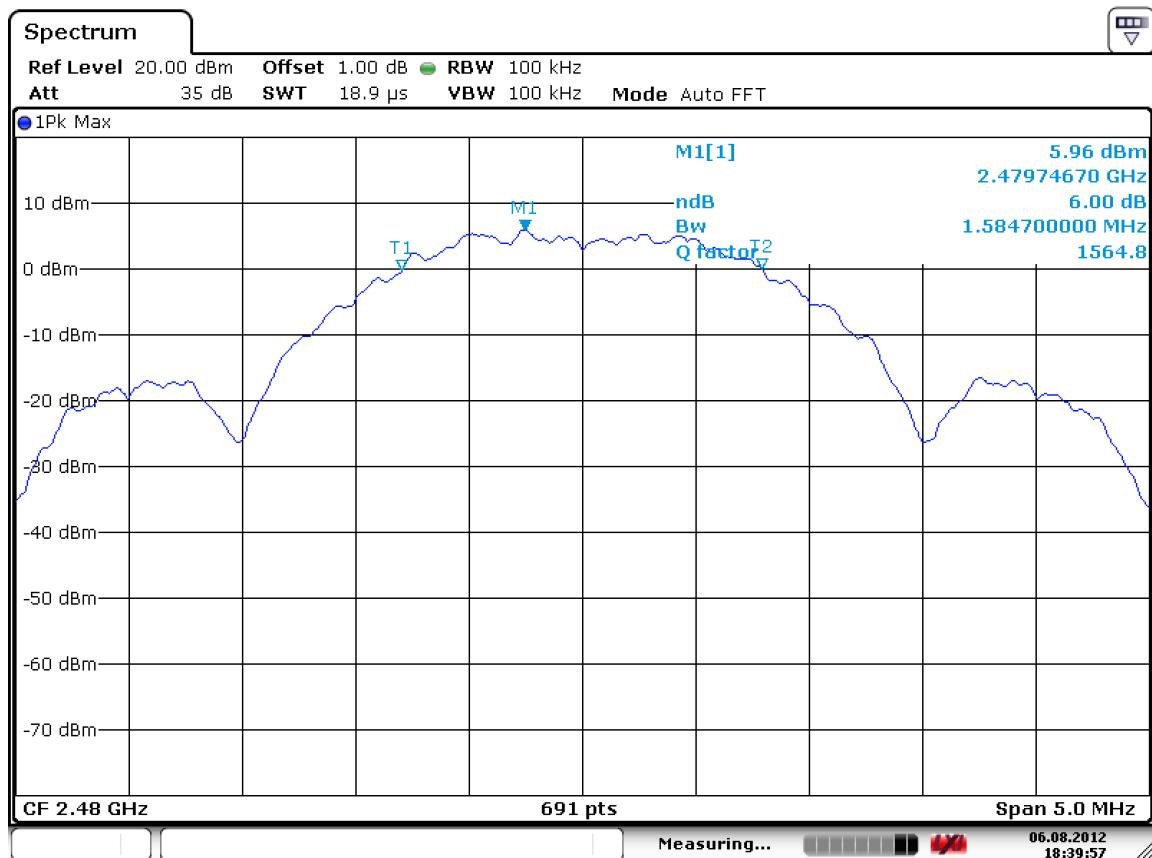
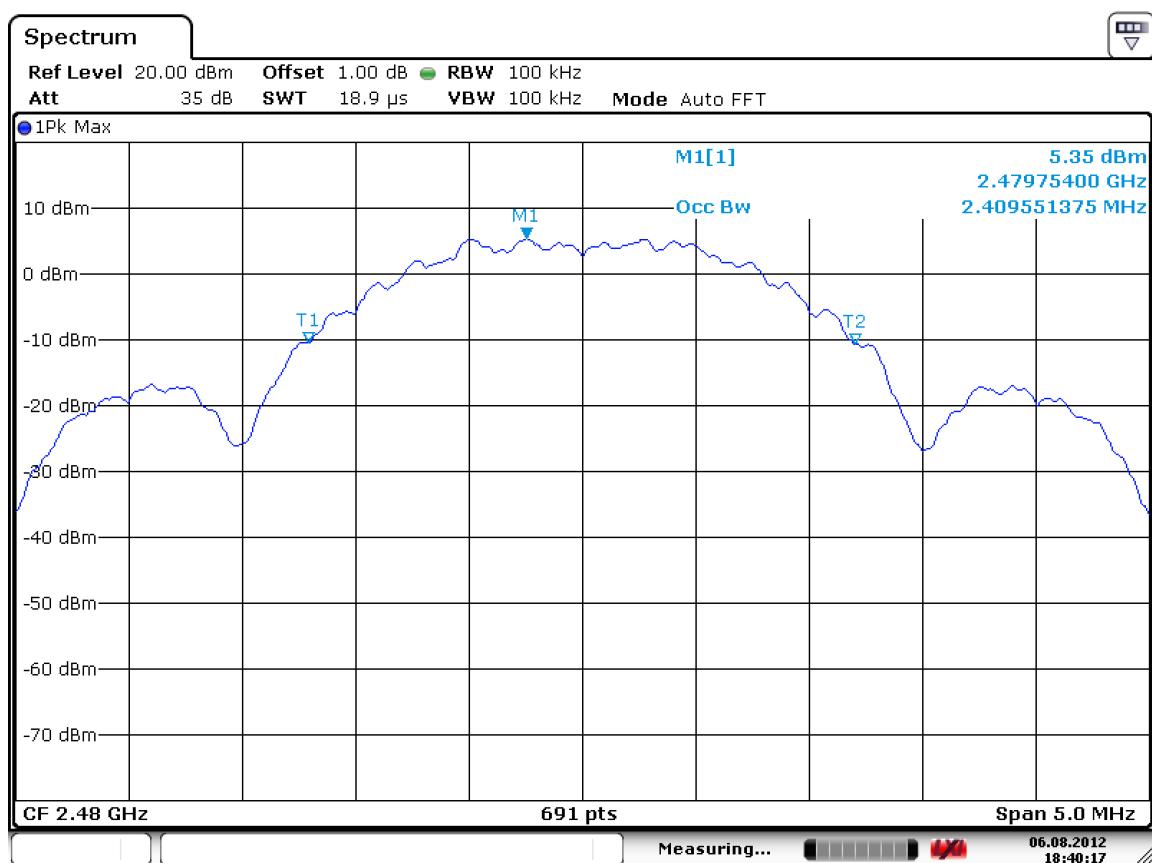
6 dB Bandwidth \geq 500 kHz

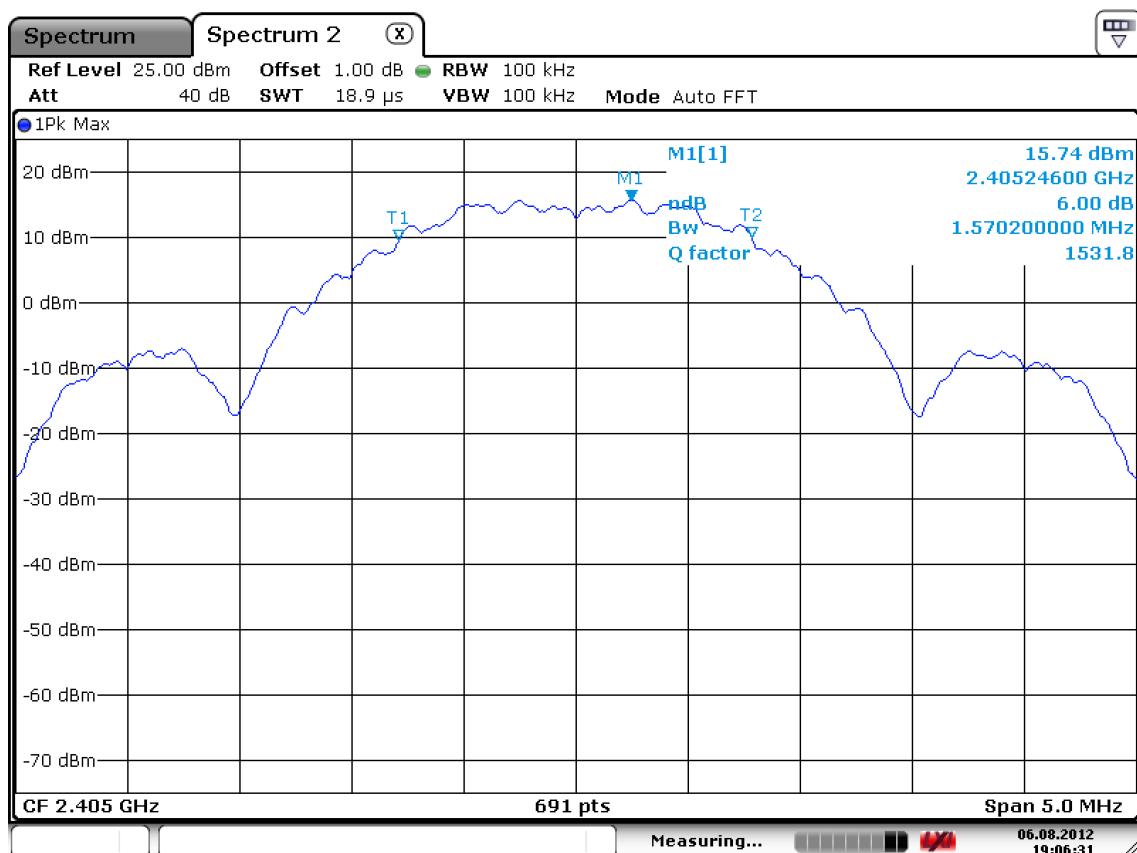
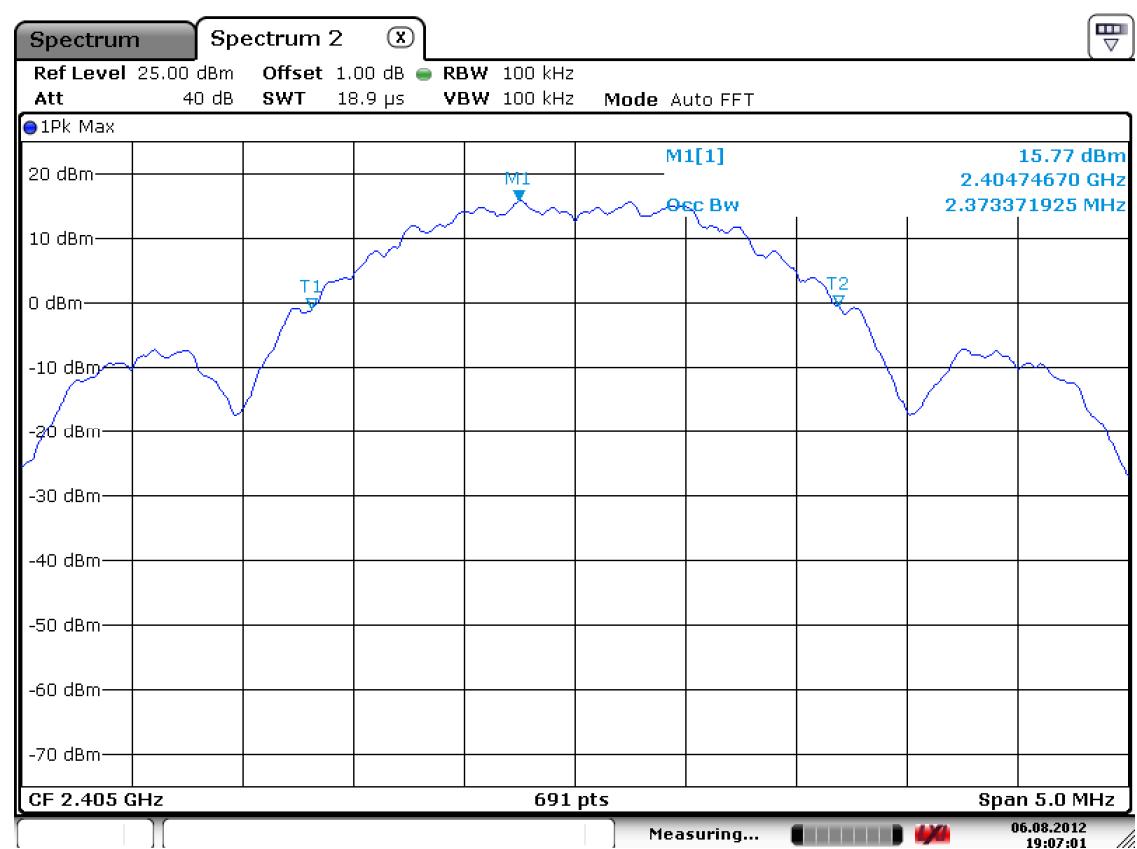
Measurement Setup

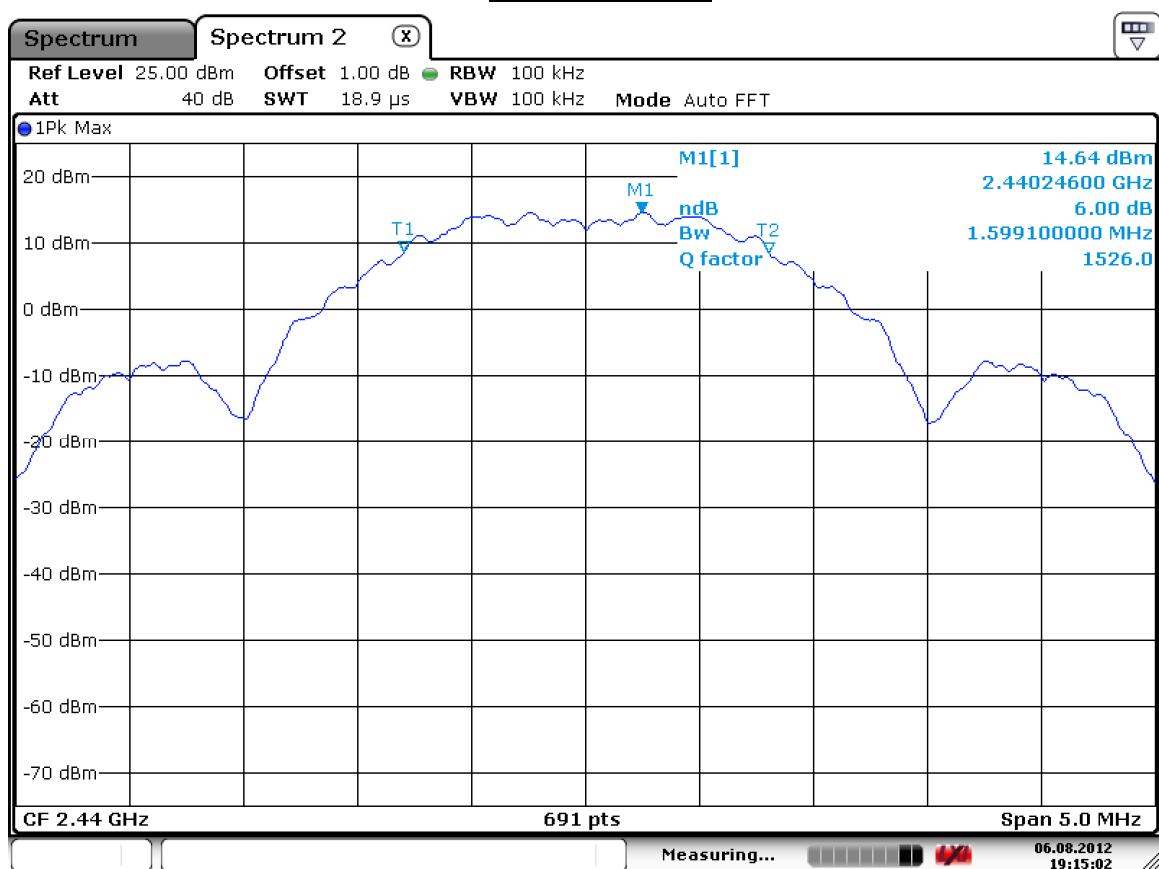
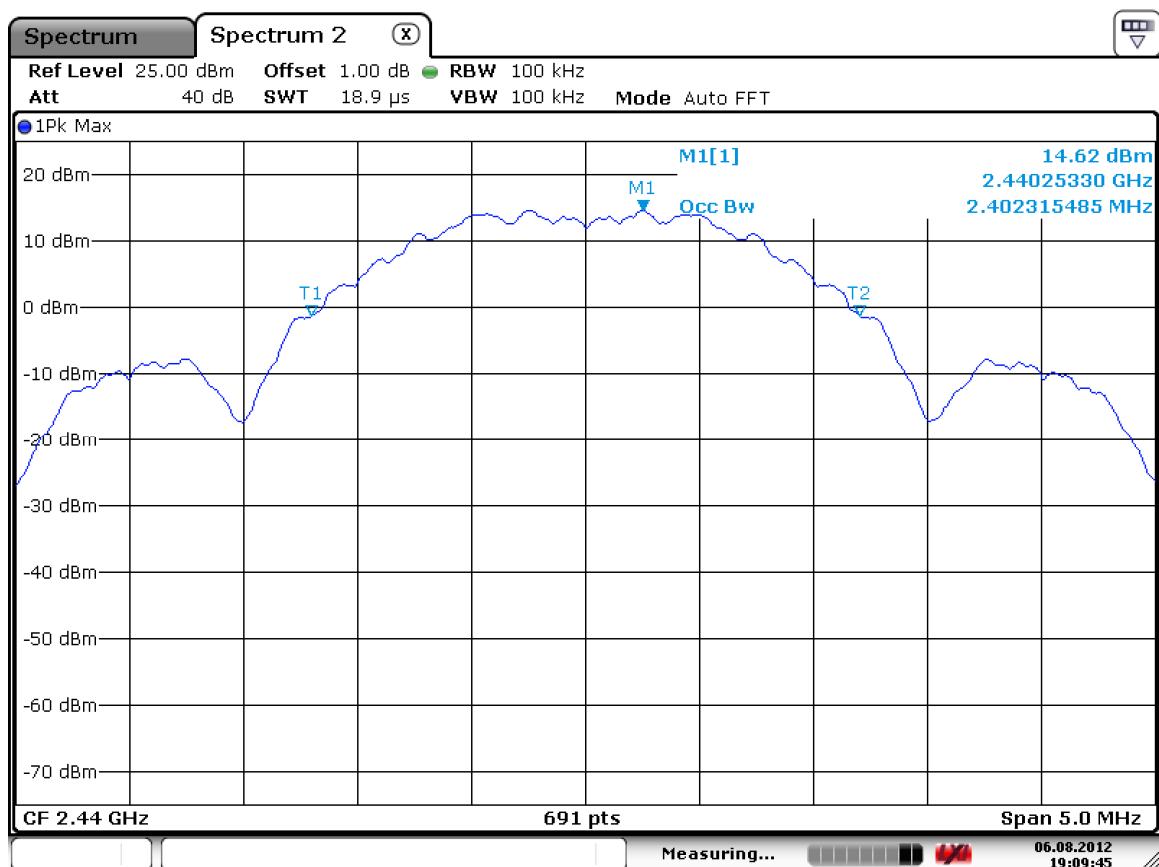
Same as the Chapter 3.2.1 (Figure 1)

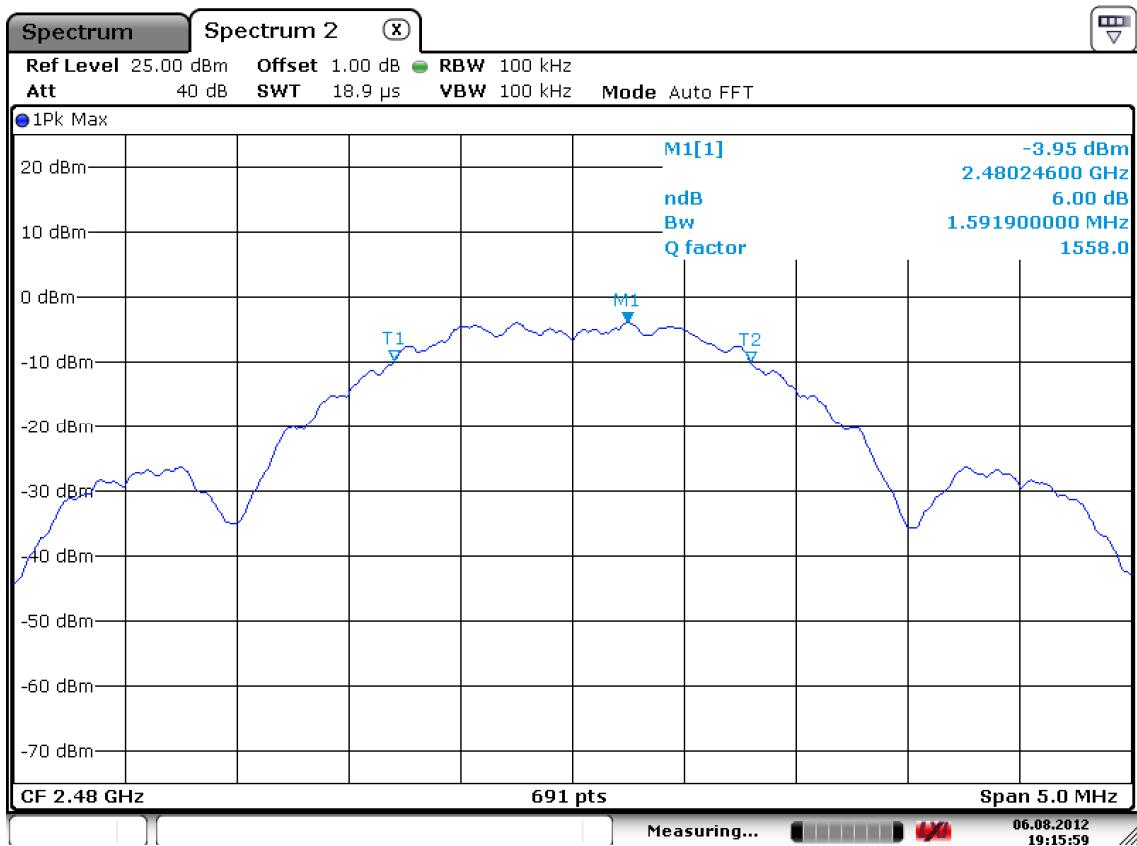
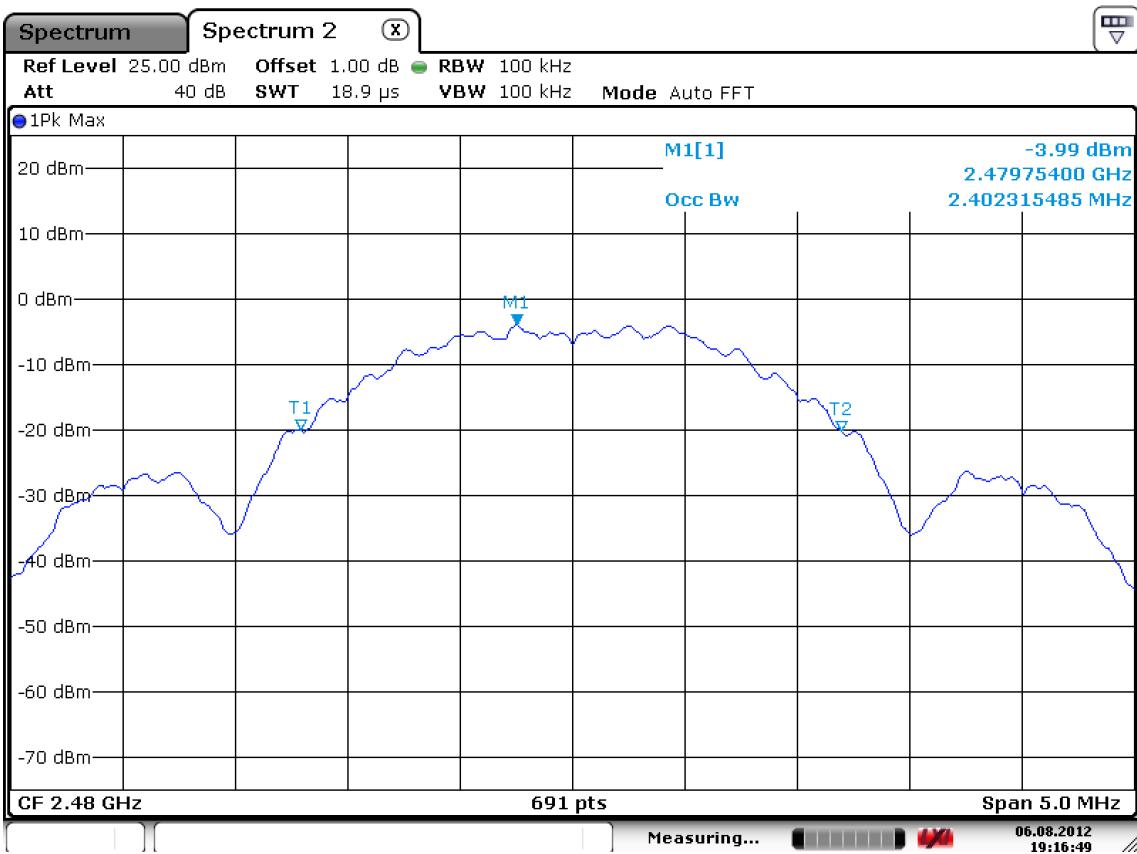
Channel 11 of Zigbee 1 mode6 dB Bandwidth99% Bandwidth

Channel 18 of Zigbee 1 mode6 dB Bandwidth99% Bandwidth

Channel 26 of Zigbee 1 mode6 dB Bandwidth99% Bandwidth

Channel 11 of Zigbee 2 mode6 dB Bandwidth99% Bandwidth

Channel 18 of Zigbee 2 mode6 dB Bandwidth99% Bandwidth

Channel 26 of Zigbee 2 mode6 dB Bandwidth99% Bandwidth

3.3.2 Peak Output Power Measurement

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. 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 = 3MHz (VBW \geq RBW) Sweep = auto

Detector function = peak

Measurement Data: (Zigbee 1)

| Mode | Frequency (MHz) | Channel No. | Test Results | |
|----------|-----------------|-------------|---------------------|----------|
| | | | Measured Data (dBm) | Result |
| Zigbee 1 | 11 | 2405 | 21.67 | Complies |
| | 18 | 2440 | 20.60 | Complies |
| | 26 | 2480 | 2.95 | Complies |

Measurement Data: (Zigbee 2)

| Mode | Frequency (MHz) | Channel No. | Test Results | |
|----------|-----------------|-------------|---------------------|----------|
| | | | Measured Data (dBm) | Result |
| Zigbee 2 | 11 | 2405 | 21.57 | Complies |
| | 18 | 2440 | 20.48 | Complies |
| | 26 | 2480 | 1.98 | Complies |

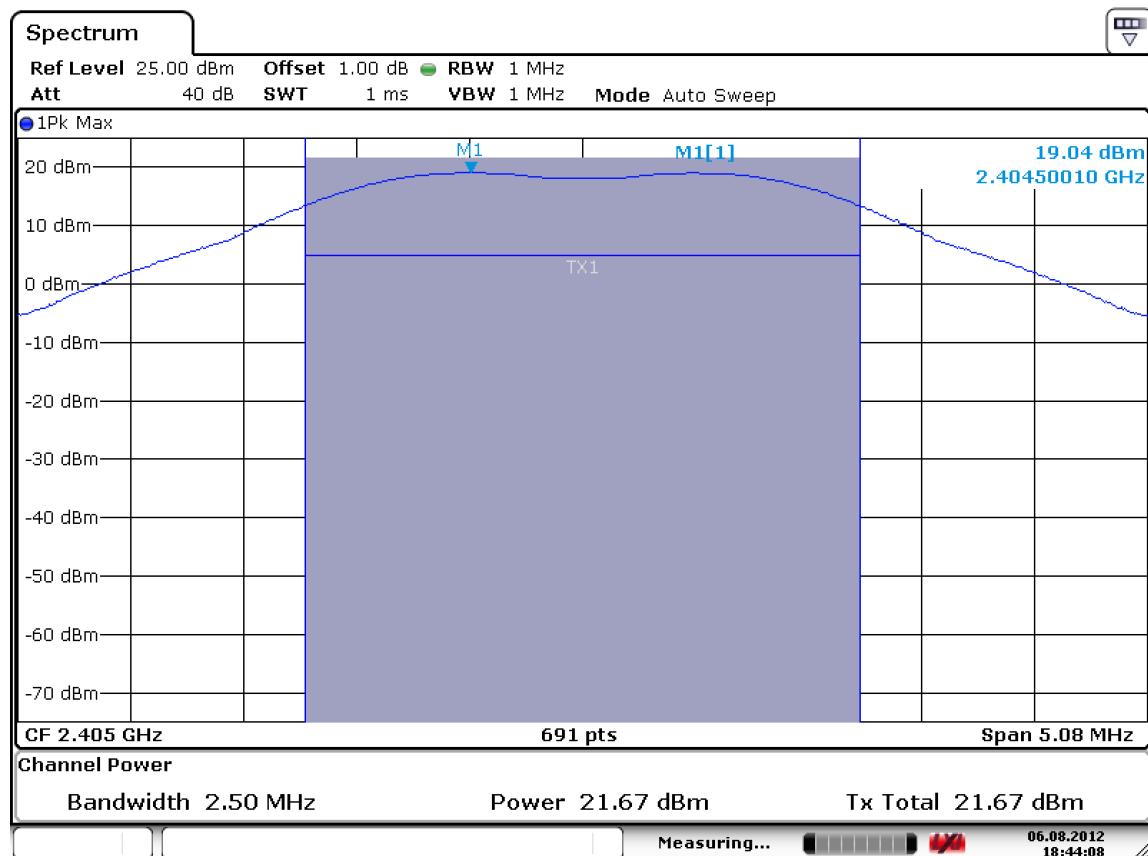
- See next pages for actual measured spectrum plots.

Minimum Standard:

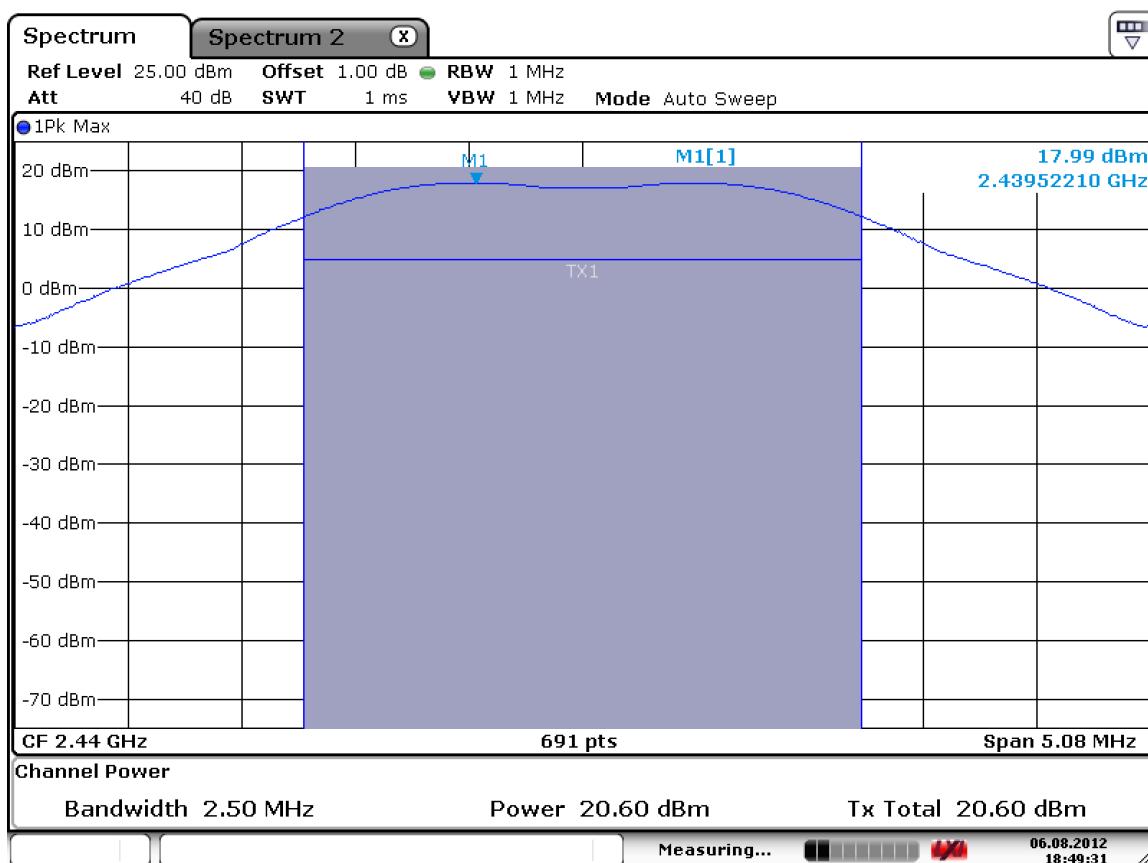
| | |
|-------------------|------|
| Peak output power | < 1W |
|-------------------|------|

Zigbee 1 mode

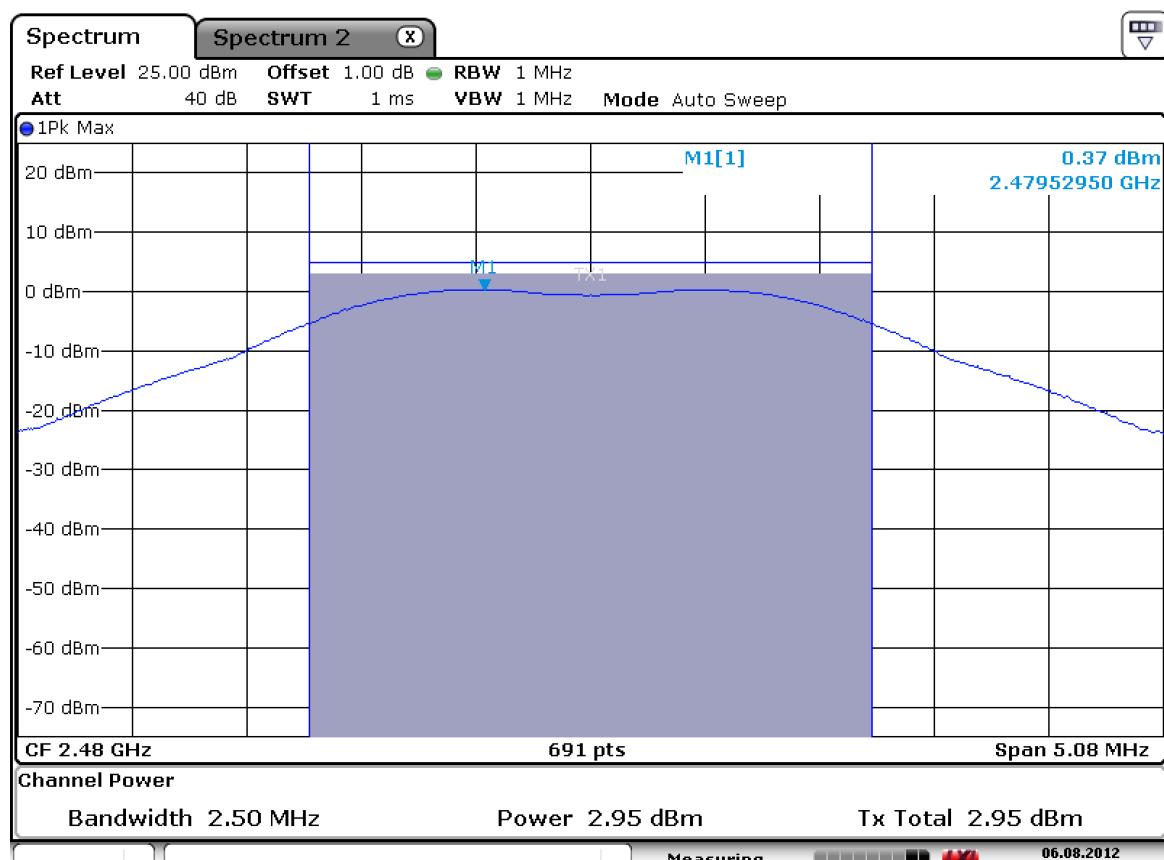
CH 11



CH 18

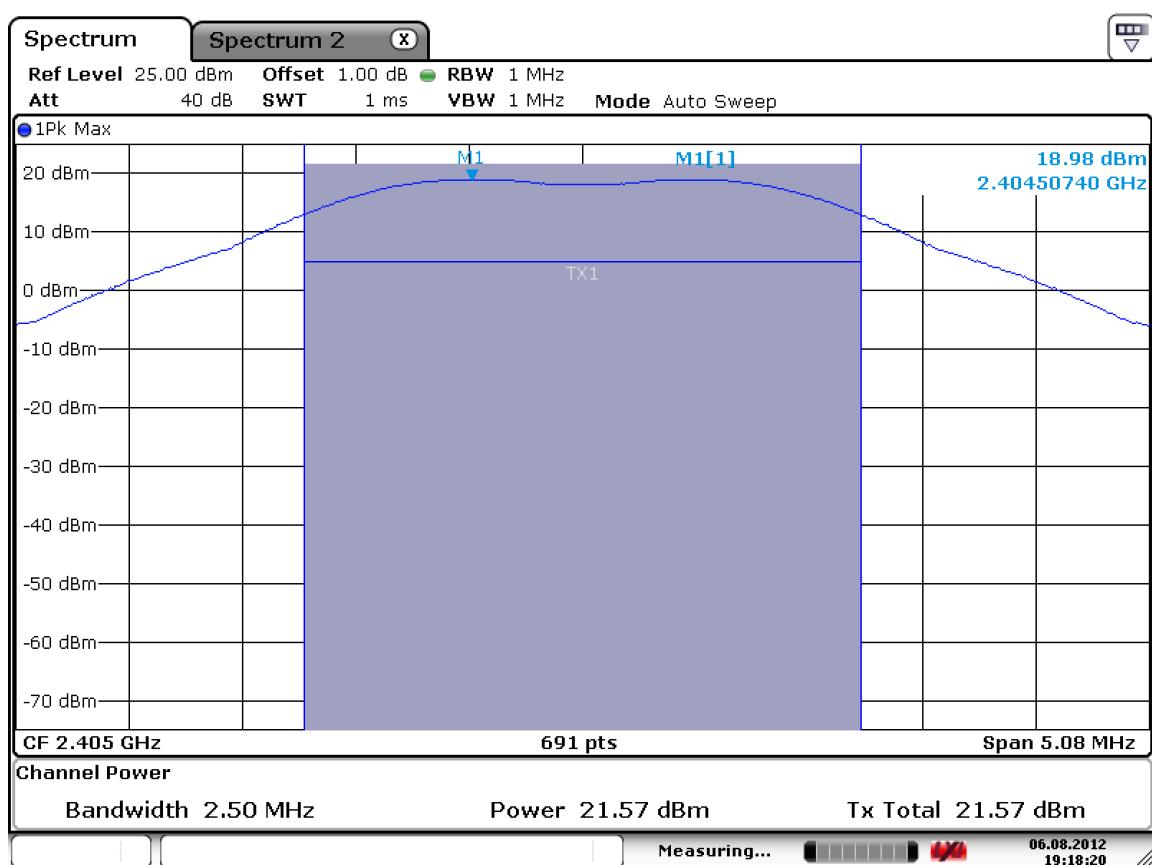


CH 26

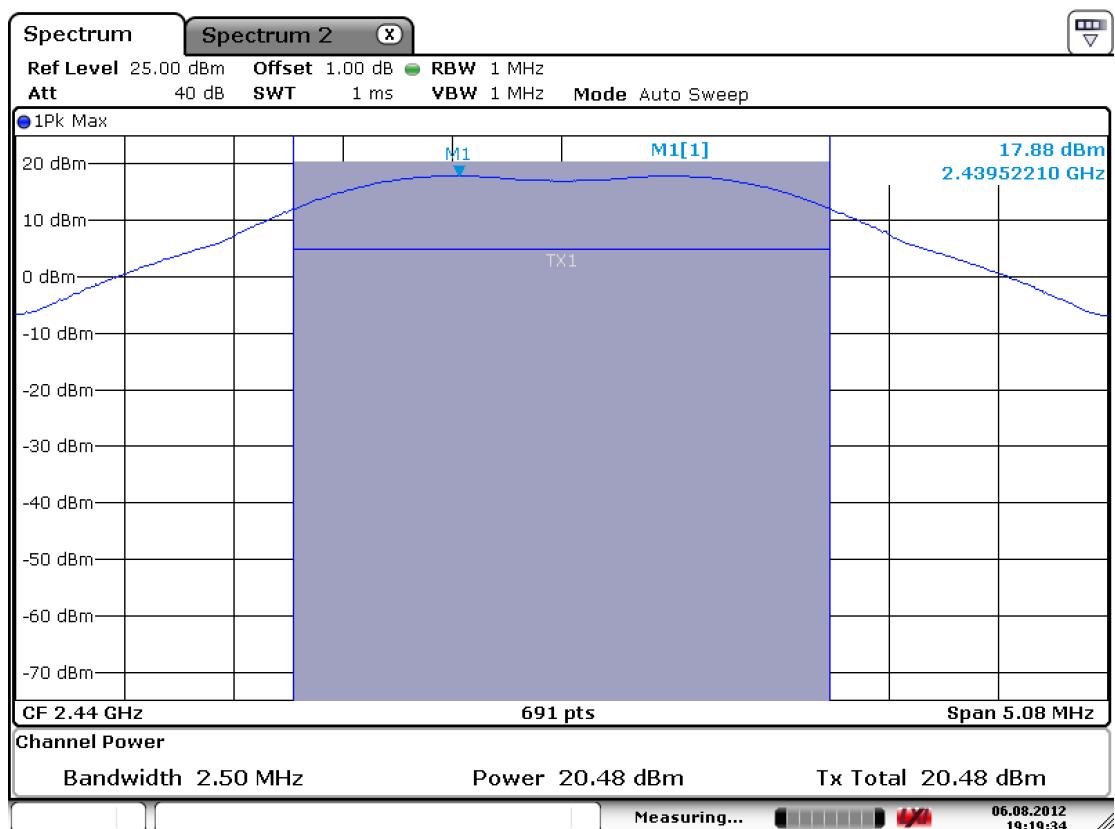


Zigbee 2 mode

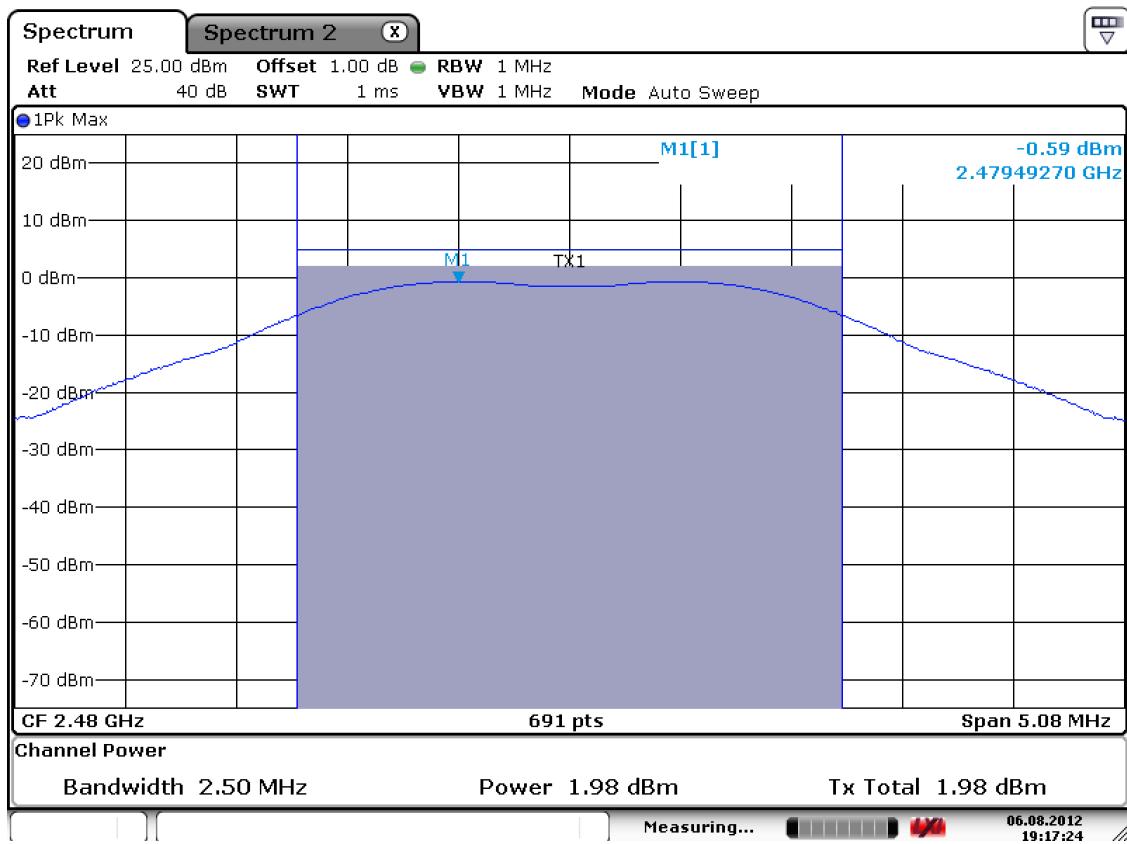
CH 11



CH 18



CH 26



3.3.3 Power Spectral Density

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April.

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: (Zigbee 1)

| Mode | Ch. | Frequency (MHz) | Test Results | |
|--------|-----|-----------------|--------------|----------|
| | | | dBm | Result |
| Zigbee | 11 | 2405 | 3.83 | Complies |
| | 18 | 2440 | 3.02 | Complies |
| | 26 | 2480 | -13.95 | Complies |

Measurement Data: (Zigbee 2)

| Mode | Ch. | Frequency (MHz) | Test Results | |
|--------|-----|-----------------|--------------|----------|
| | | | dBm | Result |
| Zigbee | 11 | 2405 | 3.93 | Complies |
| | 18 | 2440 | 3.59 | Complies |
| | 26 | 2480 | -14.89 | Complies |

- See next pages for actual measured spectrum plots.

Minimum Standard:

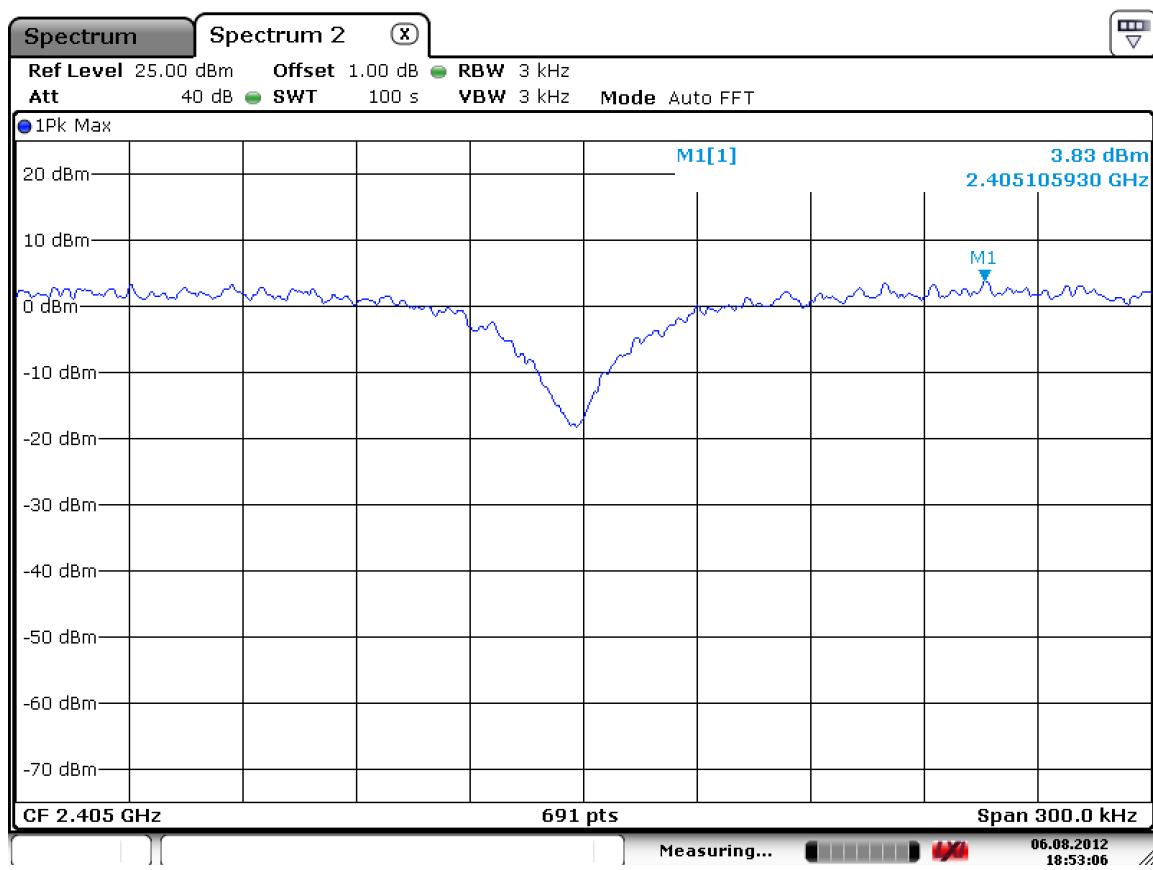
| | |
|------------------------|------------------|
| Power Spectral Density | < 8dBm @ 3kHz BW |
|------------------------|------------------|

Measurement Setup

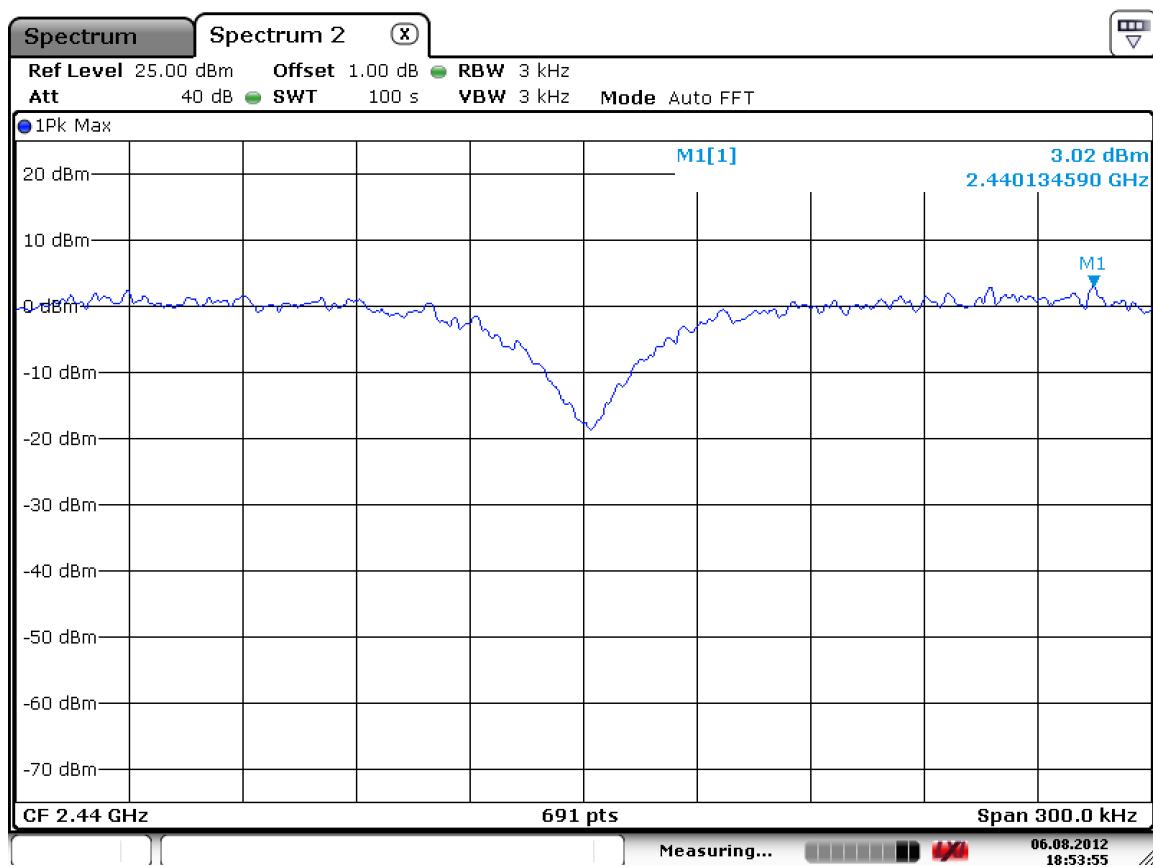
Same as the Chapter 3.2.1 (Figure 1)

Zigbee 1 mode

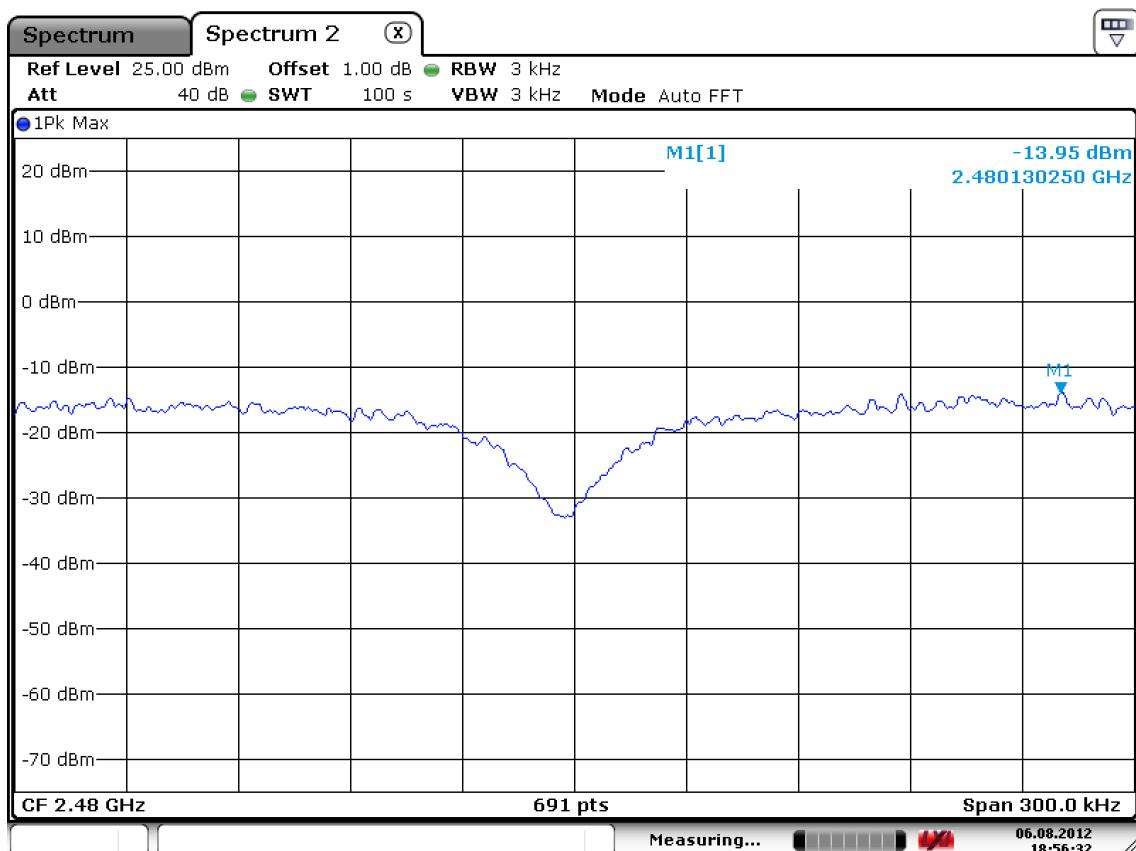
CH 11



CH 18

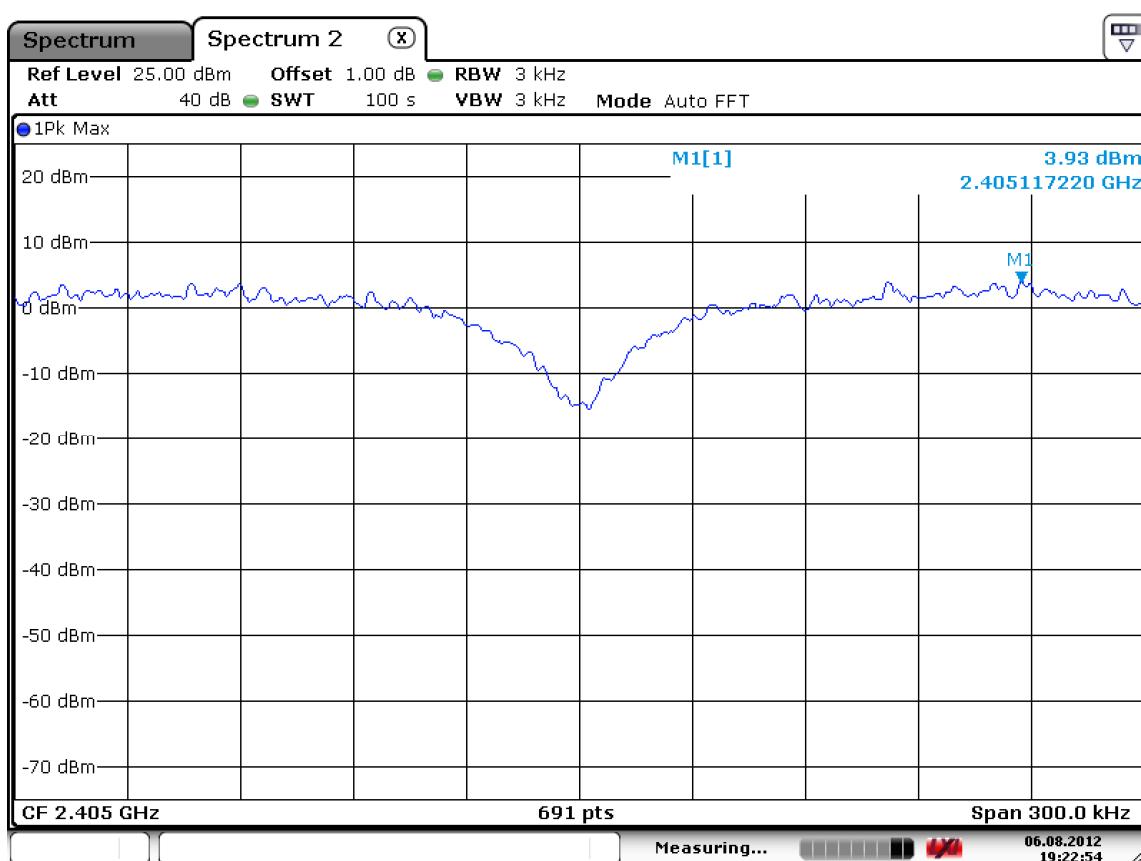


CH 26

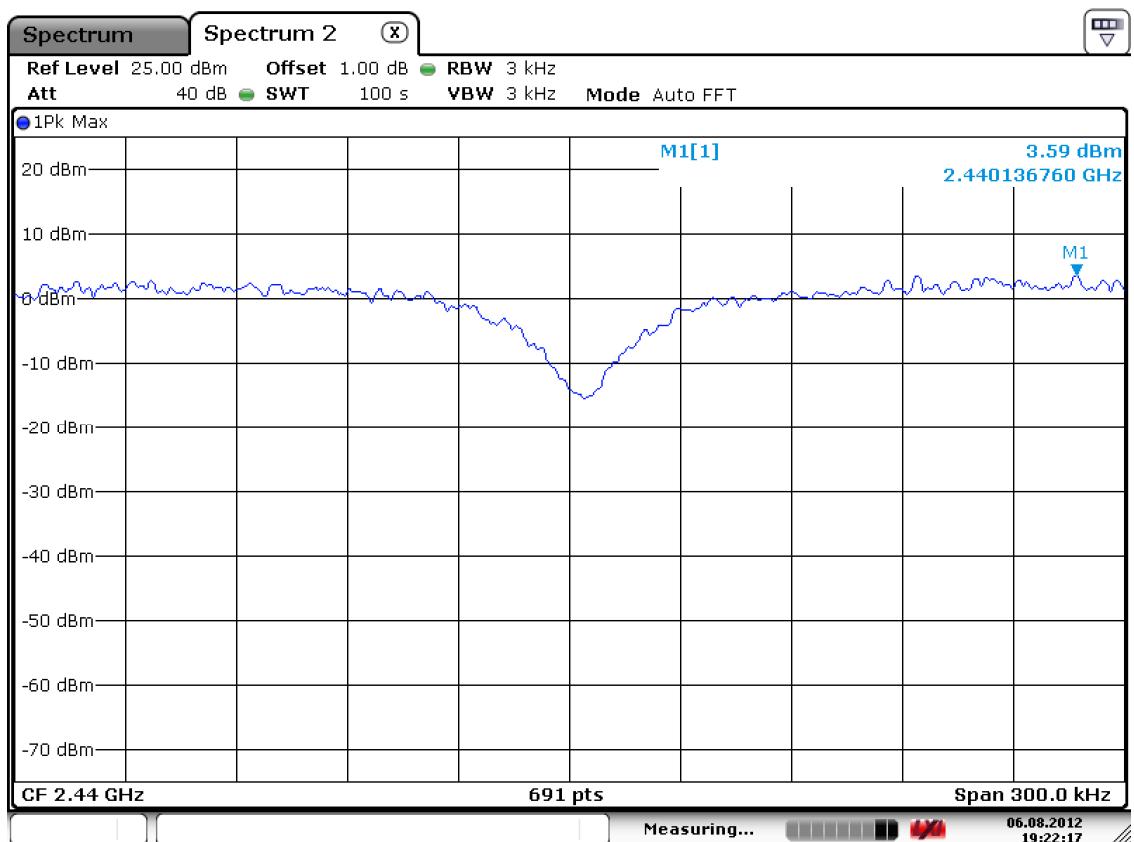


Zigbee 2 mode

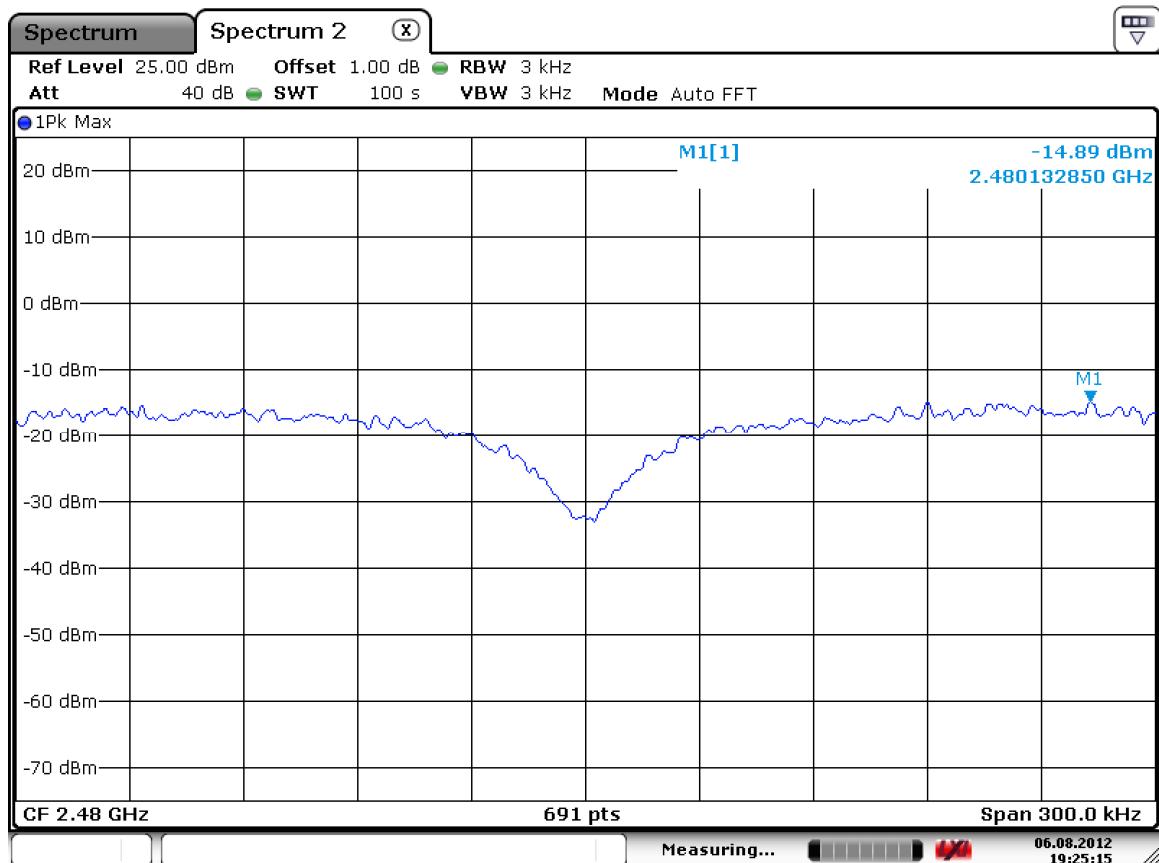
CH 11



CH 18



CH 26



3.3.4 Band - edge

Procedure:

*The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance and TCB Workshop 2012, April. The bandwidth at 20dB down from the highest inband spectral density is measured with a spectrum analyzer connected to the antenna terminal, while EUT had its hopping function disabled at the highest, middle and the lowest available channels.

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

Span = 20 MHz / 50MHz Detector function = peak

Trace = max hold Sweep = auto

Measurement Data: Complies

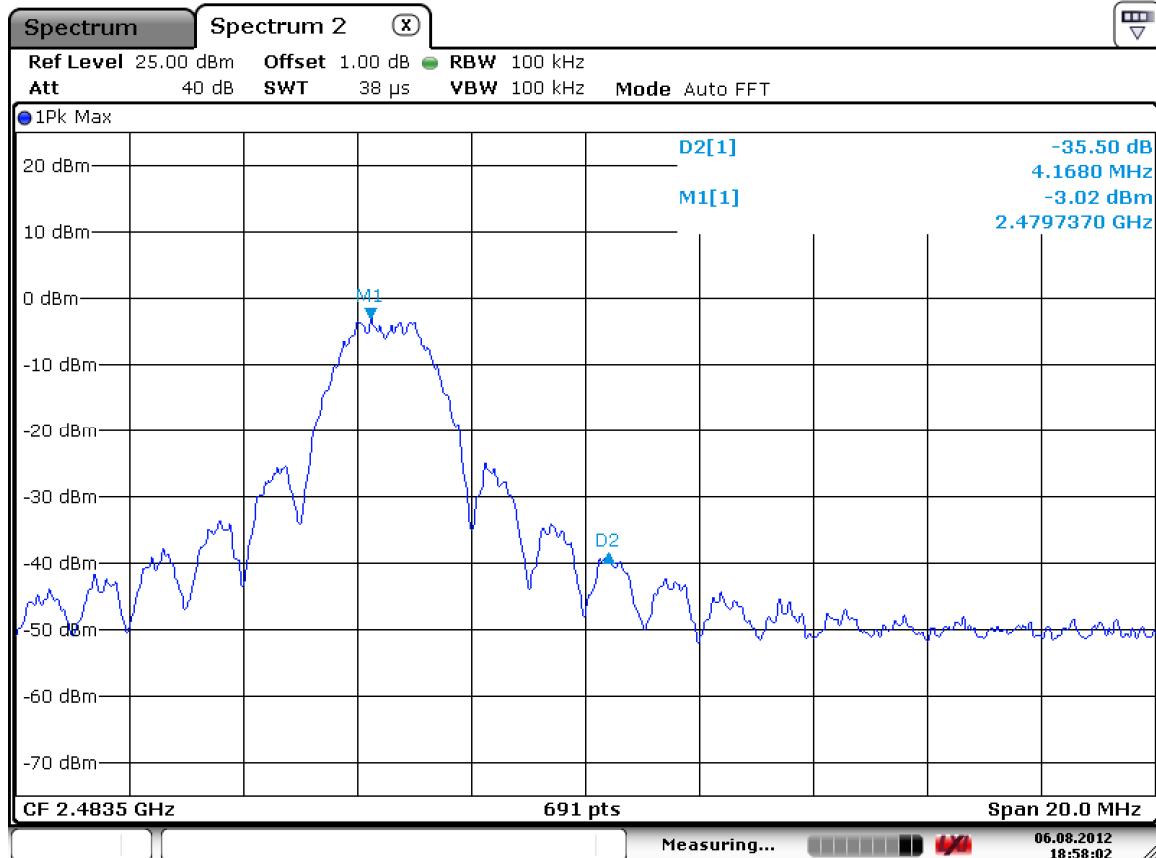
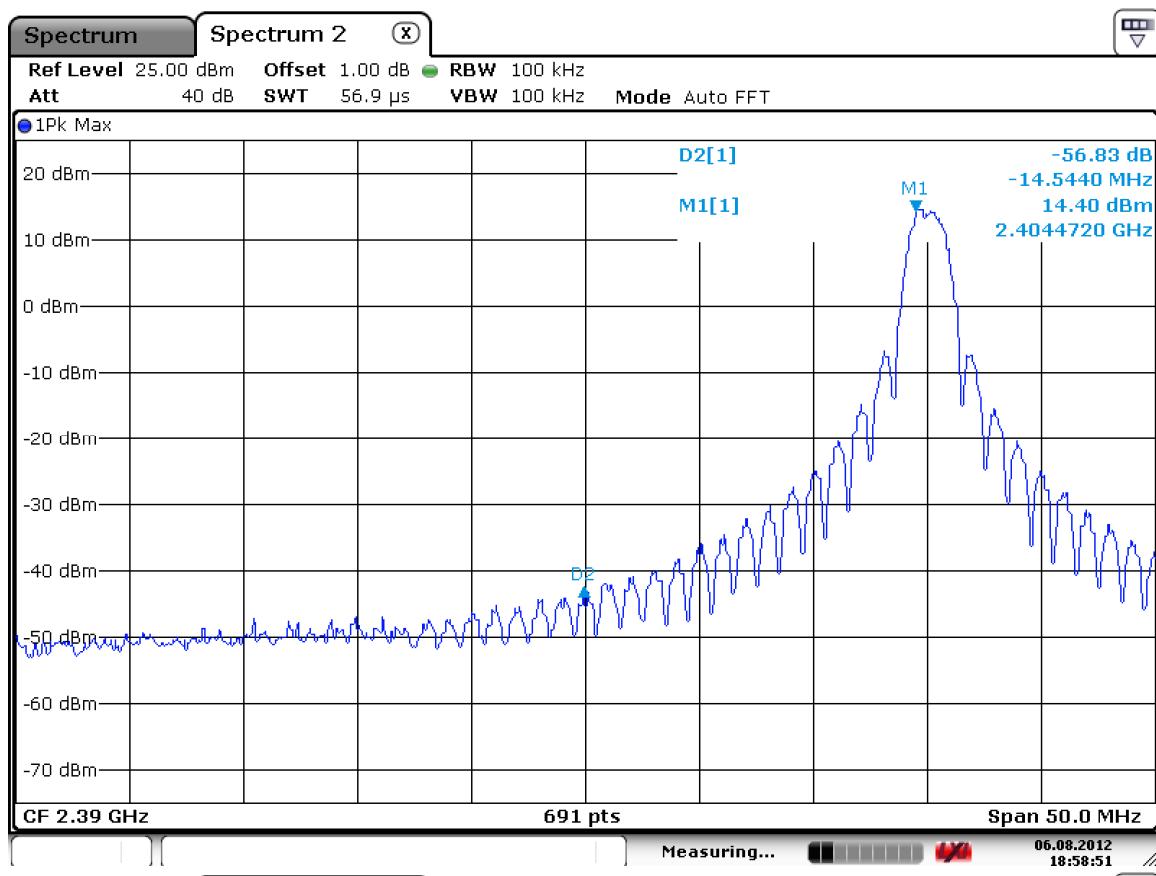
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

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

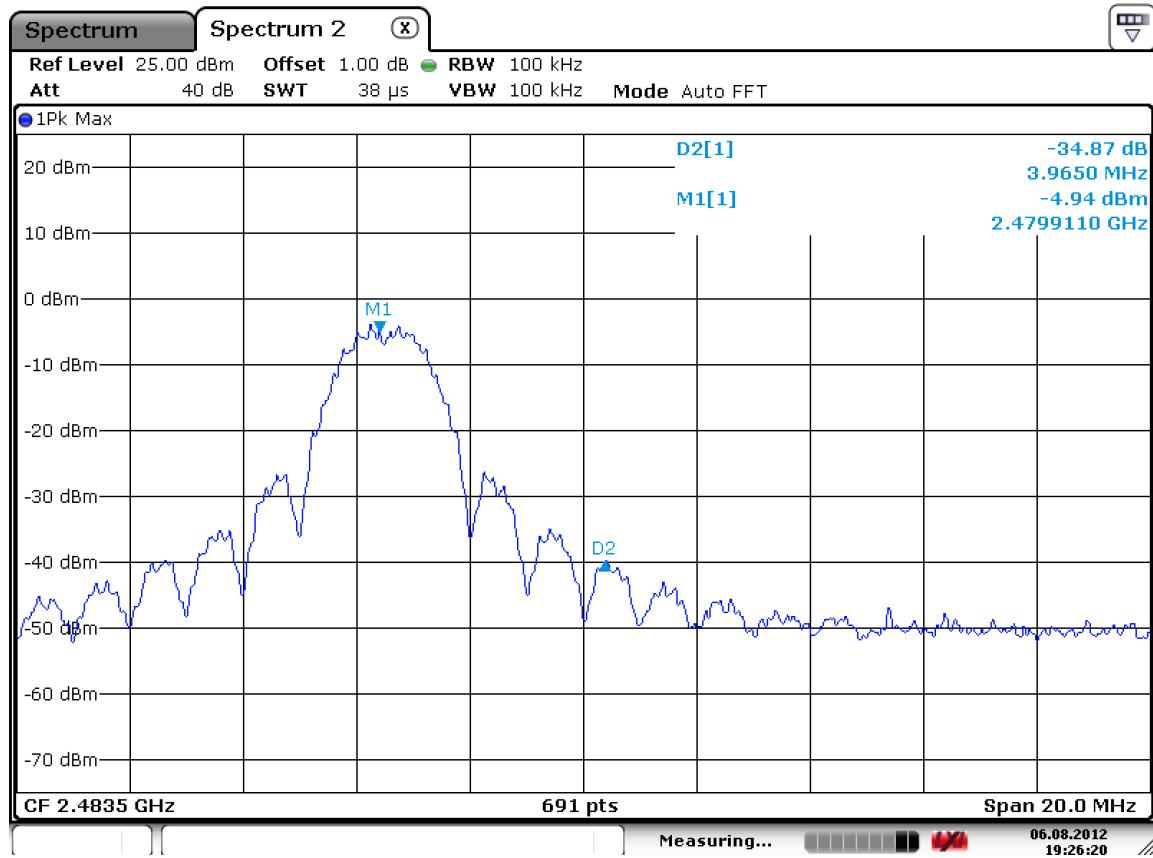
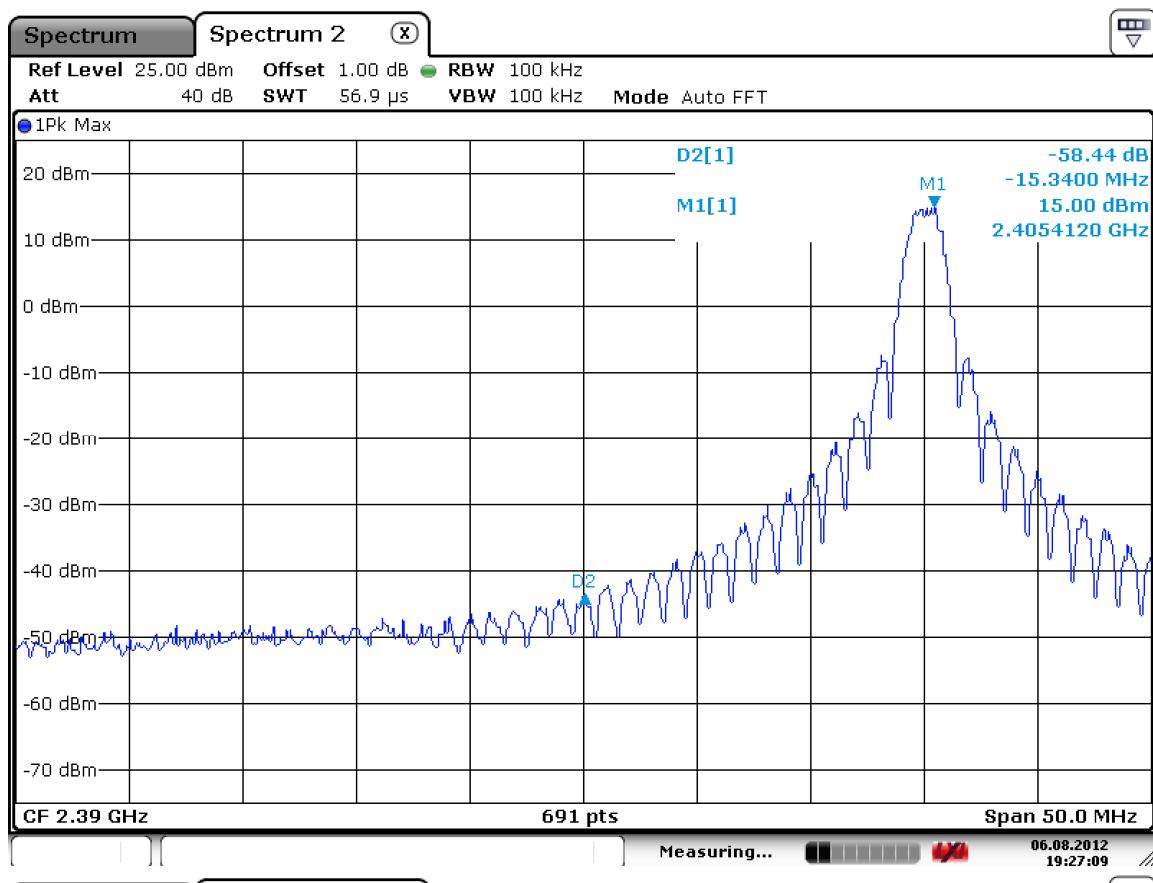
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

Zigbee 1 mode Band-edge : Conducted Measurements



Zigbee 2 mode Band-edge : Conducted Measurements



Zigbee 1 Mode*Band-edges in the restricted band 2310-2390 MHz measurement**

| Frequency [MHz] | Reading [dBuV/m] AV / Peak | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|----------------------------------|------|----------------------|--------------|-------|--------------------|-------------|--------------------|-----------|----------------|-----------|
| | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 2389.9 | 50.12 65.49 | V | 25.4 | 37.1 | 4.0 | 54.0 74.0 | 42.4 57.7 | 11.6 16.3 | | | |

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

| Frequency [MHz] | Reading [dBuV/m] AV / Peak | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|----------------------------------|------|----------------------|--------------|-------|--------------------|-------------|--------------------|-----------|----------------|-----------|
| | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 2483.5 | 49.48 63.21 | V | 25.4 | 37.1 | 4.0 | 54.0 74.0 | 41.7 55.5 | 12.3 18.5 | | | |

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

Zigbee 2 Mode*Band-edges in the restricted band 2310-2390 MHz measurement**

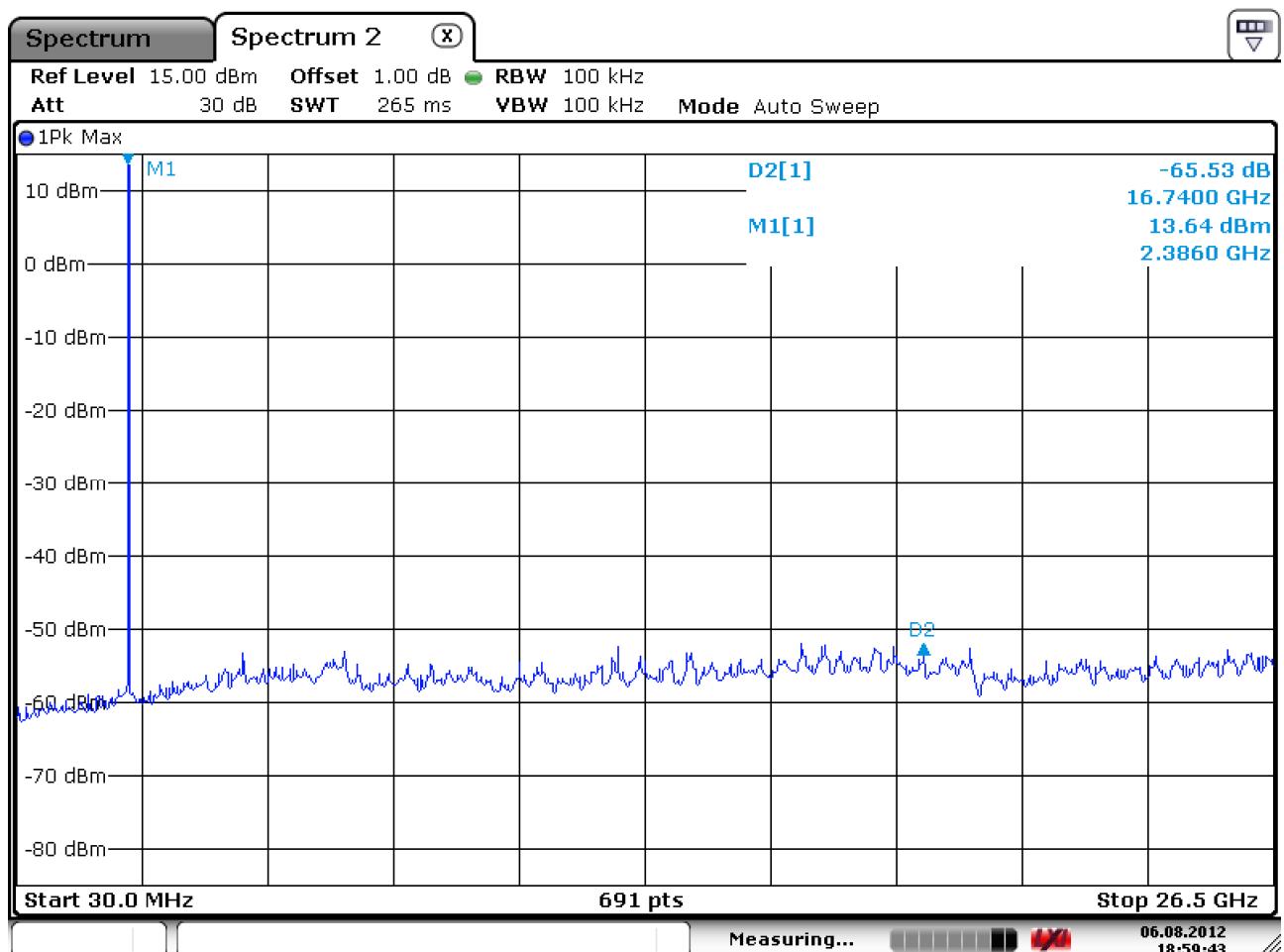
| Frequency [MHz] | Reading [dBuV/m] AV / Peak | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|----------------------------------|------|----------------------|--------------|-------|--------------------|-------------|--------------------|-----------|----------------|-----------|
| | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 2390 | 51.21 65.41 | V | 25.4 | 37.1 | 4.0 | 54.0 74.0 | 43.5 57.7 | 10.5 16.3 | | | |

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

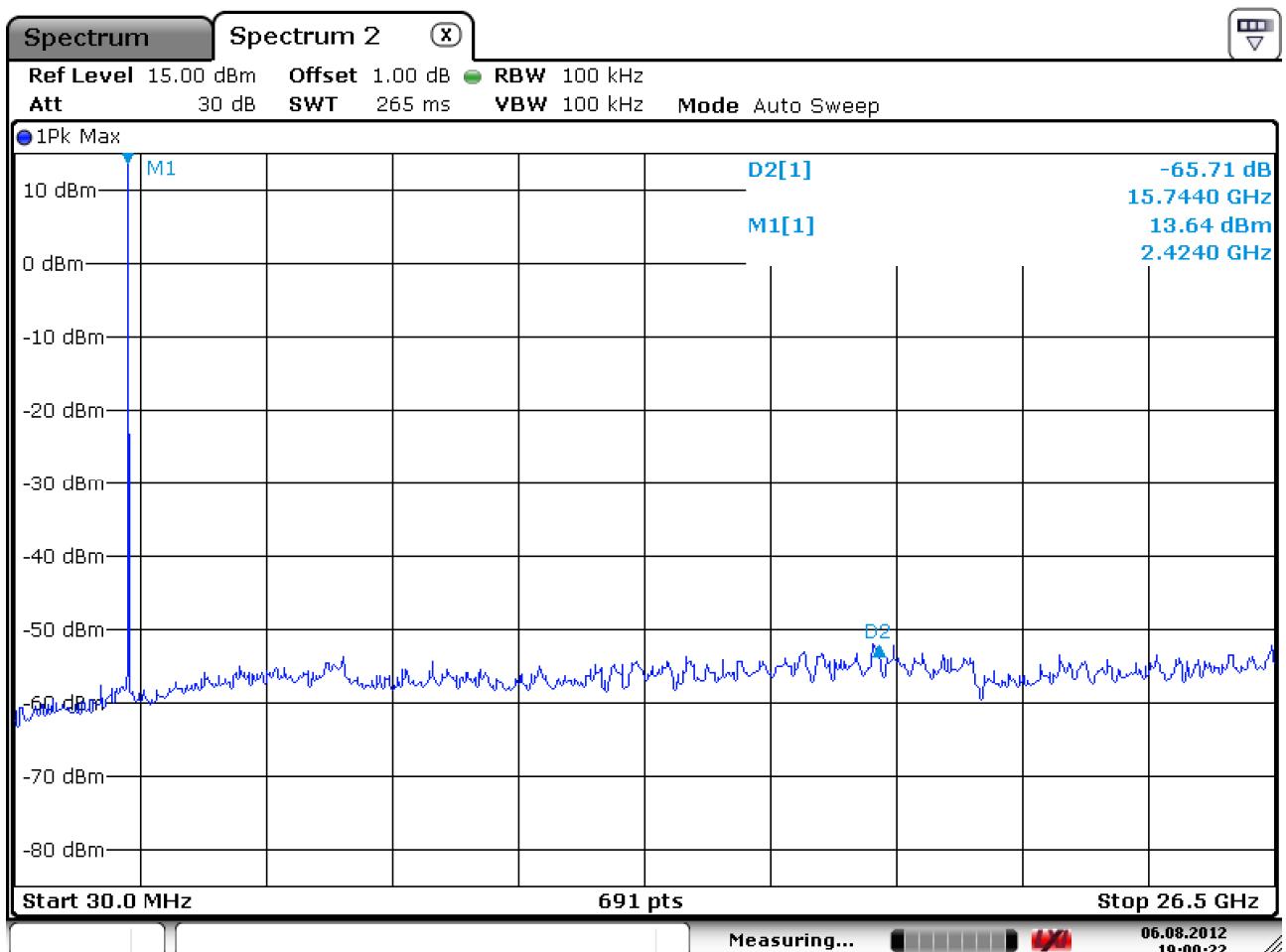
| Frequency [MHz] | Reading [dBuV/m] AV / Peak | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--------------------|----------------------------------|------|----------------------|--------------|-------|--------------------|-------------|--------------------|-----------|----------------|-----------|
| | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 2483.5 | 50.84 64.43 | V | 25.4 | 37.1 | 4.0 | 54.0 74.0 | 43.1 56.7 | 10.9 17.3 | | | |

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

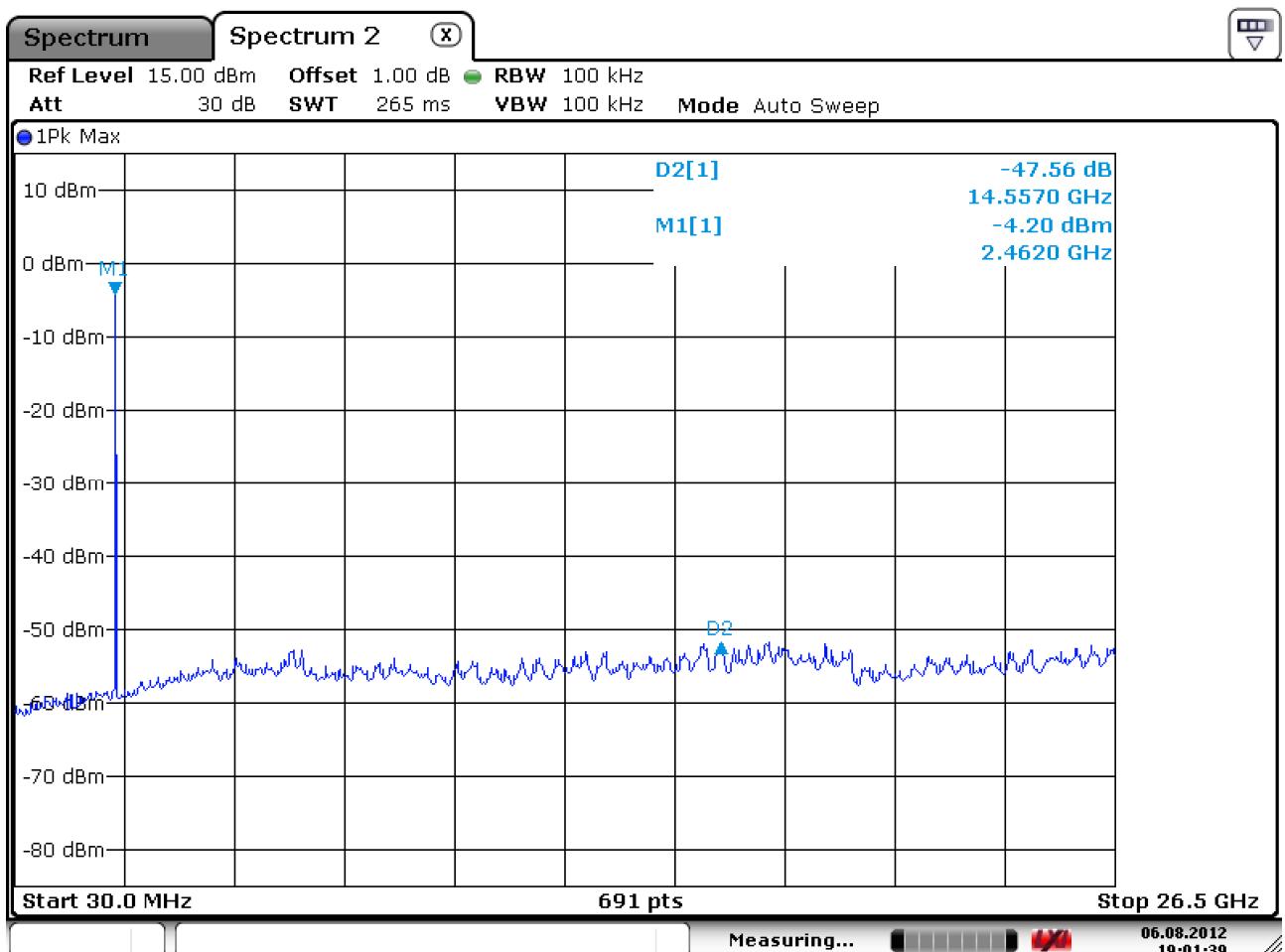
Zigbee 1 mode - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



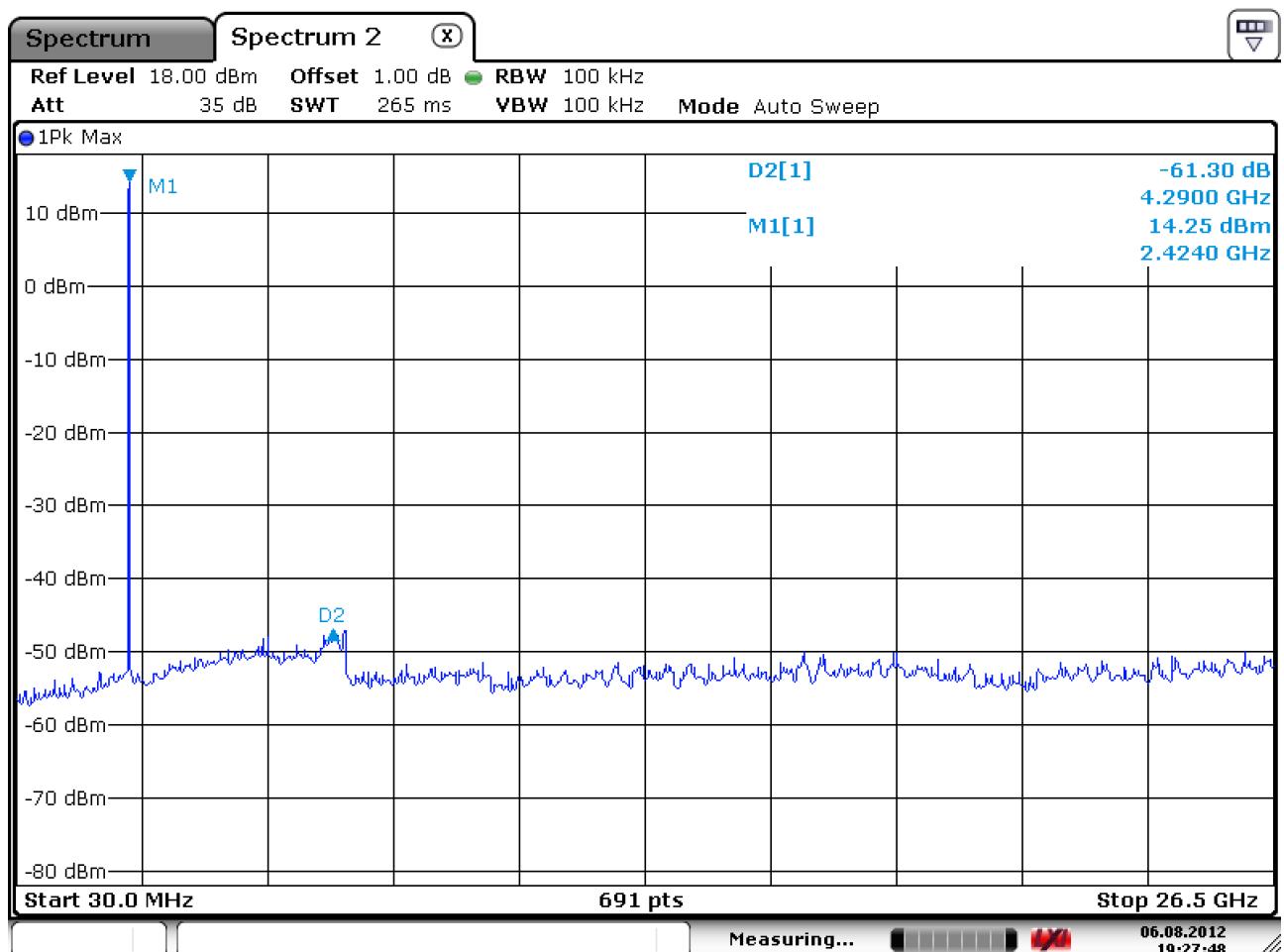
Zigbee 1 mode - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



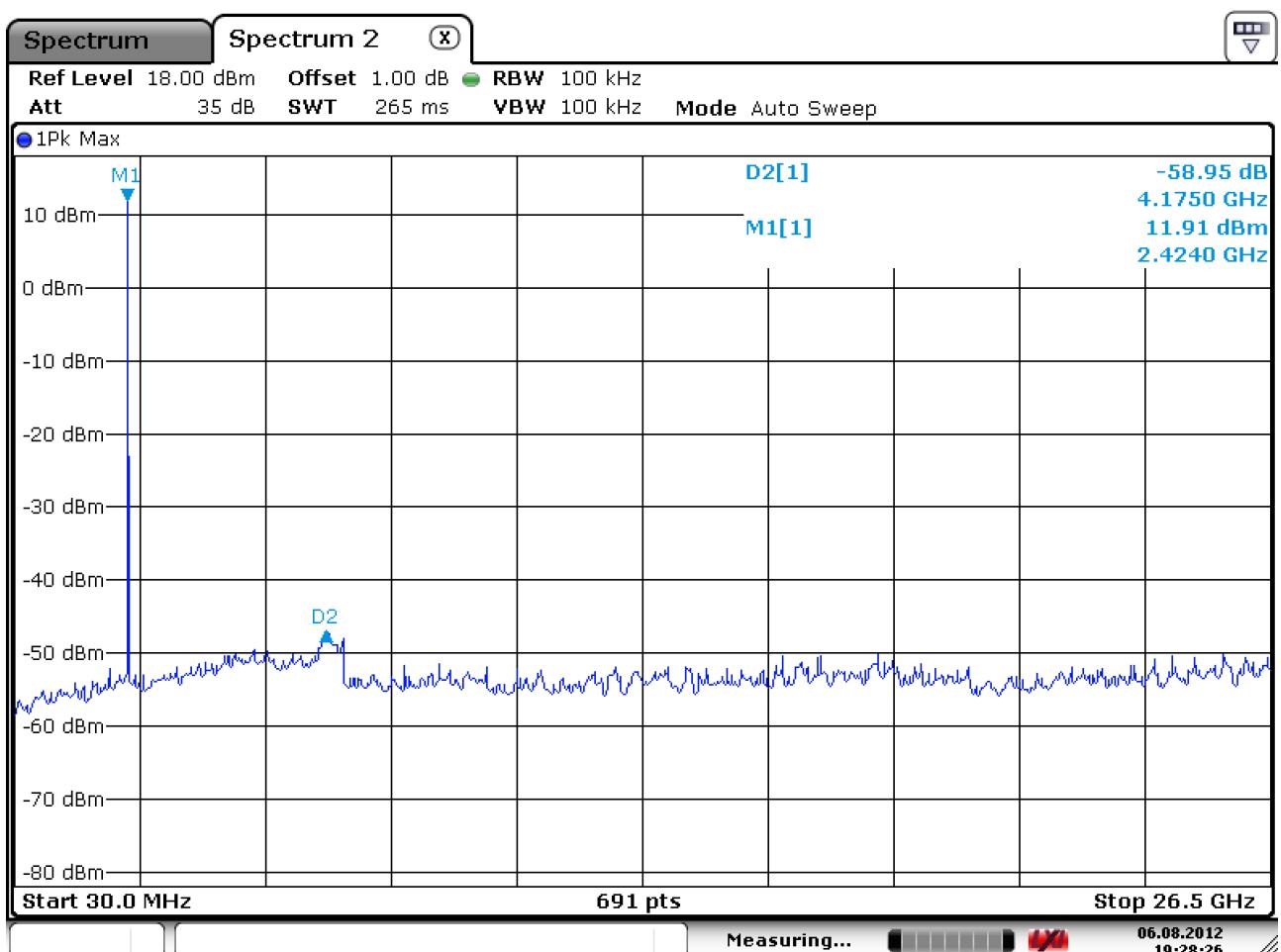
Zigbee 1 mode – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



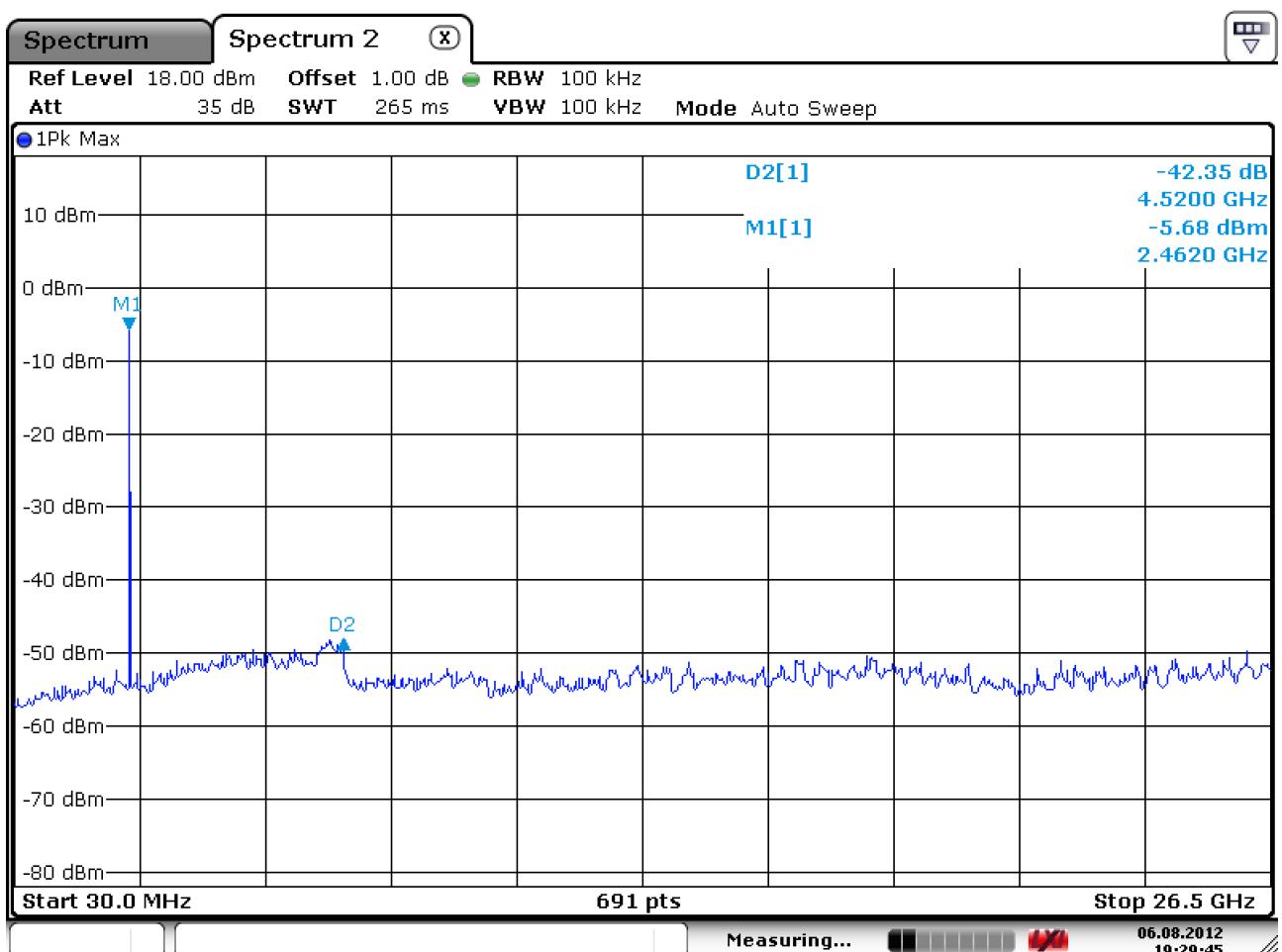
Zigbee 2 mode - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



Zigbee 2 mode - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



Zigbee 2 mode – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



3.3.5 Field Strength of Harmonics

Procedure:

*The testing follows TCB Workshop 2012, April and fulfills ANSI C63.4-2003 and the guidelines in ANSI C63.10-2009 test requirement. 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)

Peak:VBW ≥ RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Average:VBW=10Hz

Span = 100 MHz

Detector function = Peak and Average

Trace = max hold

Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 20dB below limit.
- The three antennas were used with this EUT during the Testing.

Minimum Standard: FCC Part 15.209(a)

| Frequency (MHz) | Limit (uV/m) @ 3m |
|-----------------|---------------------|
| 0.009 ~ 0.490 | 2400/F (kHz) @ 300m |
| 0.490 ~ 1.705 | 24000/F (kHz) @ 30m |
| 1.705 ~ 30 | 30 @ 30m |
| 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.

*Zigbee 1 Mode

Zigbee 1 mode Measurement Data: (Above 1GHz)

| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|-----------|---------------------|-------|------|----------------------|--------------------|-------|--------------------|----------------|--------------------|-----------|----------------|-----------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| [MHz] | AV / Peak | | | | | | AV / Peak | AV / Peak | AV / Peak | AV / Peak | | |
| 4810 | 45.35 | 58.97 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 46.0 | 59.6 | 8.0 | 14.4 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | Limits [dBuV/m] | | Result [dBuV/m] | Margin [dB] | | | | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 4880 | 44.31 | 58.09 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 45.0 | 58.8 | 9.0 | 15.2 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | Limits [dBuV/m] | | Result [dBuV/m] | Margin [dB] | | | | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 4960 | 39.59 | 50.35 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 40.3 | 51.0 | 13.7 | 23.0 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Zigbee 1 mode Measurement Data: (9kHz - 30MHz)

| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--|---------------------|---|------|----------------------|--------------|-------|--------------------|-----------|--------------------|-----------|----------------|-----------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| [MHz] | AV / Peak | | | | | | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Zigbee 2 Mode*Zigbee 2 mode Measurement Data: (Above 1GHz)**

| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|-----------|---------------------|-------|------|----------------------|--------------------|-------|--------------------|----------------|--------------------|-----------|----------------|-----------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| [MHz] | AV / Peak | | | | | | AV / Peak | AV / Peak | AV / Peak | AV / Peak | | |
| 4810 | 42.88 | 54.51 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 43.6 | 55.2 | 10.5 | 18.8 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | Limits [dBuV/m] | | Result [dBuV/m] | Margin [dB] | | | | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 4880 | 43.66 | 56.54 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 44.3 | 57.2 | 9.7 | 16.8 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | Limits [dBuV/m] | | Result [dBuV/m] | Margin [dB] | | | | |
| [MHz] | AV / Peak | | | Antenna | Amp. Gain | Cable | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| 4960 | 37.22 | 49.38 | V | 31.4 | 36.5 | 5.7 | 54.0 | 74.0 | 37.9 | 50.1 | 16.1 | 24.0 |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Zigbee 2 mode Measurement Data: (9kHz - 30MHz)

| Frequency | Reading [dBuV/m] | | Pol. | Correction Factor | | | Limits [dBuV/m] | | Result [dBuV/m] | | Margin [dB] | |
|--|---------------------|---|------|----------------------|--------------|-------|--------------------|-----------|--------------------|-----------|----------------|-----------|
| | | | | Antenna | Amp. Gain | Cable | | | | | | |
| [MHz] | AV / Peak | | | | | | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak | AV / Peak |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| No emissions were detected at a level greater than 20dB below limit. | | | | | | | | | | | | |
| - | - | - | - | - | - | - | - | - | - | - | - | - |
| - | - | - | - | - | - | - | - | - | - | - | - | - |

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

Radiated Emissions – Zigbee 1 mode

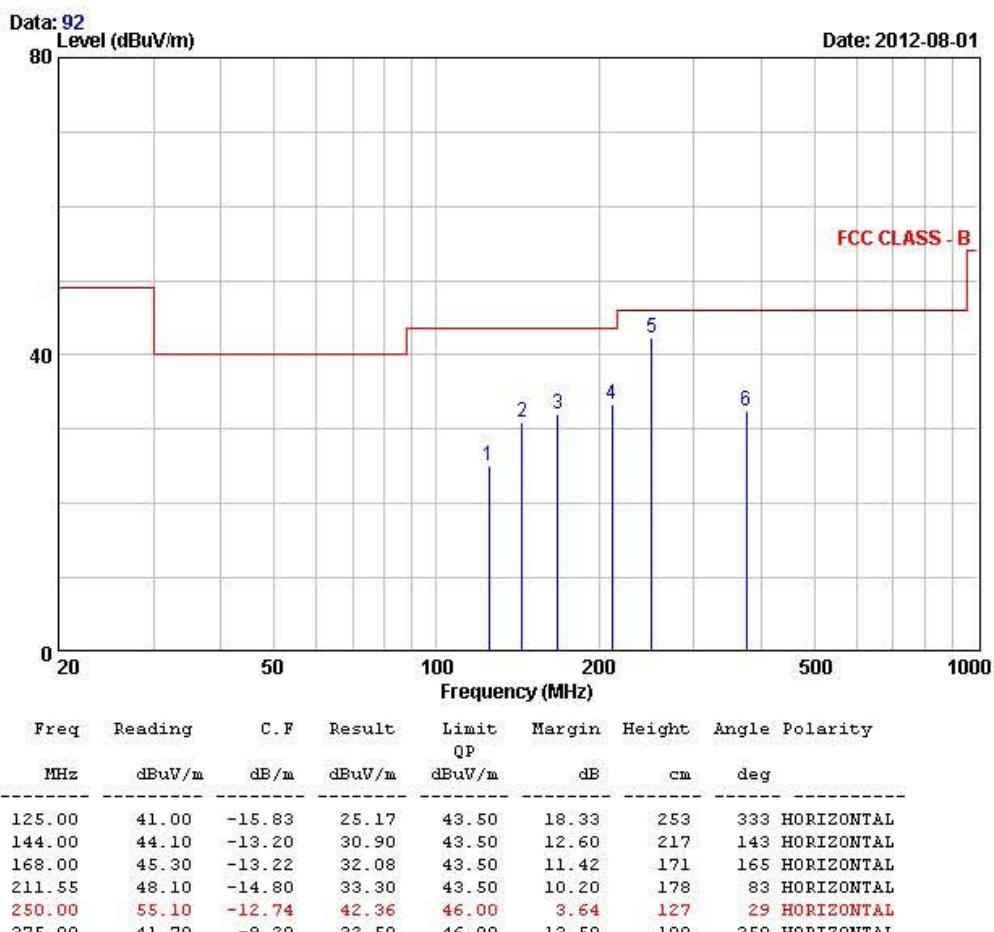
243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel. +82-31-3236008,9
Fax. +82-31-3236010

EUT/Model No.: HES2E4AOT

TEST MODE: ZIGBEE 1 mode

Temp Humi : 27 / 49

Tested by: PARK H W



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

Radiated Emissions – Zigbee 2 mode

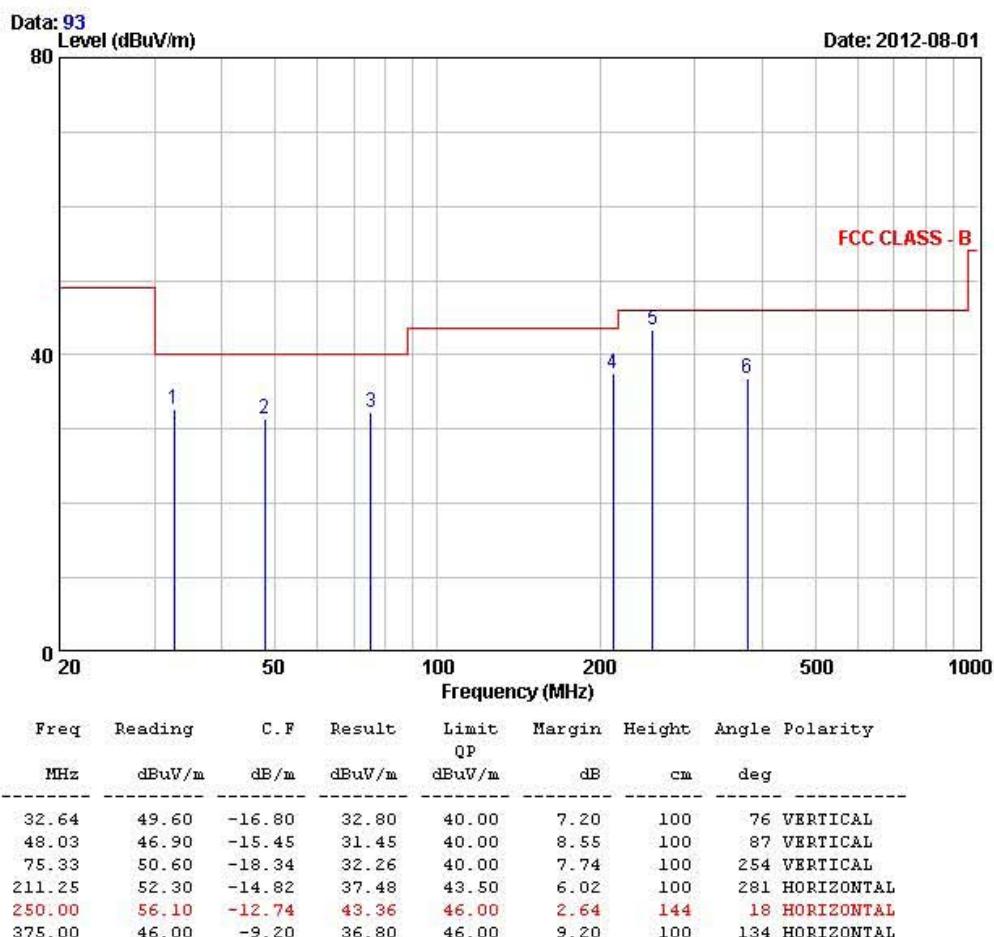
243 Jibug-ri, yangji-Myeon, Youngin-si,
Gyeonggi-do 449-822 Korea
Tel. +82-31-3236008,9
Fax. +82-31-3236010

EUT/Model No.: HES2EAOT

TEST MODE: ZIGBEE 2 mode

Temp Humi : 27 / 49

Tested by: PARK H W



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

3.3.6 AC Conducted Emissions

Procedure:

*The testing follows the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009. 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 20dB below limit.

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

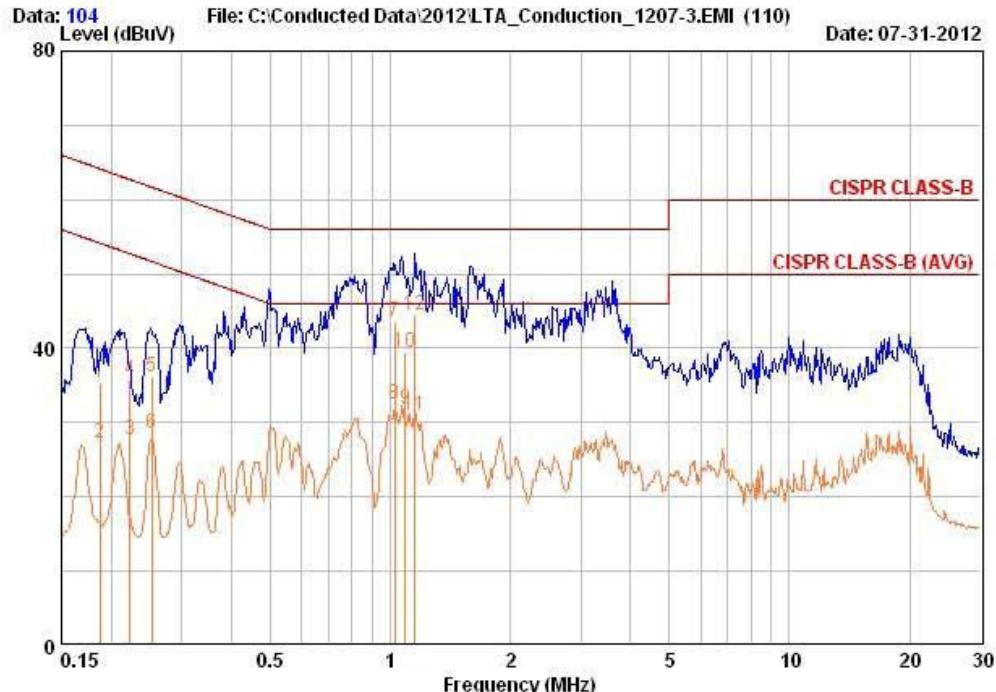
| Frequency Range (MHz) | Conducted Limit (dBuV) | |
|--------------------------|------------------------|------------|
| | Quasi-Peak | Average |
| 0.15 ~ 0.5 | 66 to 56 * | 56 to 46 * |
| 0.5 ~ 5 | 56 | 46 |
| 5 ~ 30 | 60 | 50 |

* Decreases with the logarithm of the frequency

AC Conducted Emissions – ZIGBEE 1 mode – Line

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Fax. +82-31-3236010

EUT / Model No. : HES2E4AOT Phase : LINE
 Test Mode : ZIGBEE1 mode Test Power : 120 / 60
 Temp./Humid. : 25 / 52 Test Engineer : PARK H W



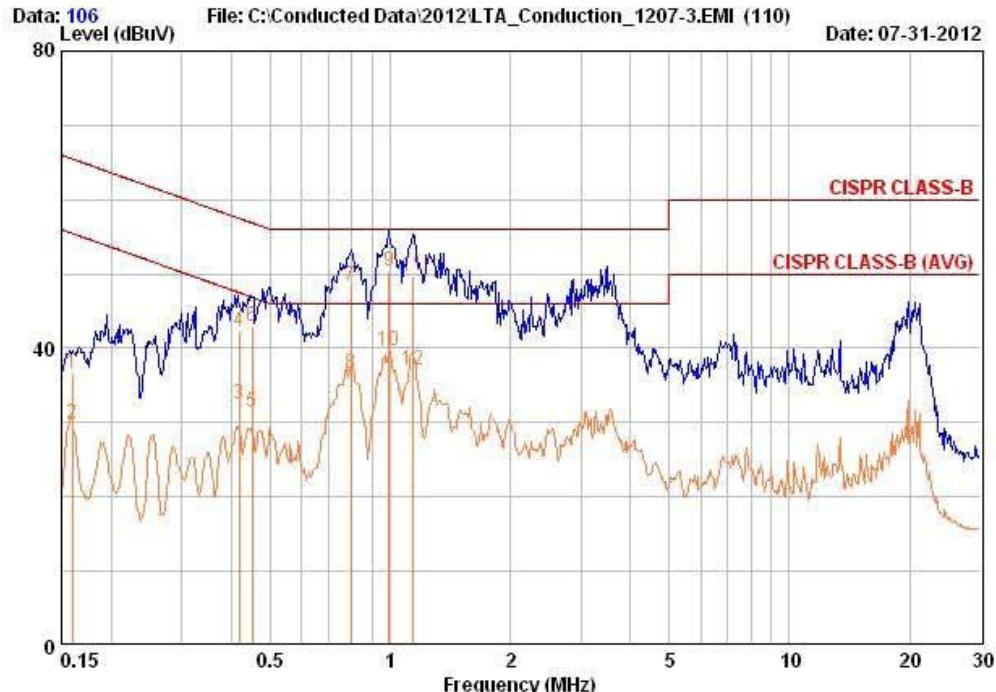
| Freq MHz | RD QP | | RD AV | | C. F dB | Result QP | | Result AV | | Limit QP | | Limit AV | | Margin dB | Margin dB |
|-------------|----------|-------|----------|-------|------------|--------------|-------|--------------|-------|-------------|-------|-------------|-------|--------------|--------------|
| | dBuV | dBuV | dBuV | dBuV | | dBuV | dBuV | dBuV | dBuV | dBuV | dBuV | dBuV | dBuV | | |
| 0.187 | 25.74 | 17.54 | 9.63 | 35.37 | 35.37 | 27.17 | 64.17 | 54.17 | 54.17 | 28.80 | 28.80 | 27.00 | 27.00 | | |
| 0.223 | 26.24 | 18.04 | 9.59 | 35.82 | 35.82 | 27.62 | 62.71 | 52.71 | 52.71 | 26.88 | 26.88 | 25.08 | 25.08 | | |
| 0.253 | 26.53 | 19.03 | 9.57 | 36.10 | 36.10 | 28.60 | 61.69 | 51.69 | 51.69 | 25.59 | 25.59 | 23.09 | 23.09 | | |
| 1.028 | 33.83 | 22.73 | 9.71 | 43.54 | 43.54 | 32.44 | 56.00 | 46.00 | 46.00 | 12.46 | 12.46 | 13.56 | 13.56 | | |
| 1.091 | 29.83 | 22.03 | 9.71 | 39.55 | 39.55 | 31.75 | 56.00 | 46.00 | 46.00 | 16.45 | 16.45 | 14.25 | 14.25 | | |
| 1.147 | 34.83 | 21.33 | 9.72 | 44.55 | 44.55 | 31.05 | 56.00 | 46.00 | 46.00 | 11.45 | 11.45 | 14.95 | 14.95 | | |

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

AC Conducted Emissions – PING+ZIGBEE 1 mode – Neutral

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EUT / Model No. : HES2E4AOT Phase : NEUTRAL
 Test Mode : ZIGBEE1 mode Test Power : 120 / 60
 Temp./Humi. : 25 / 52 Test Engineer : PARK H W



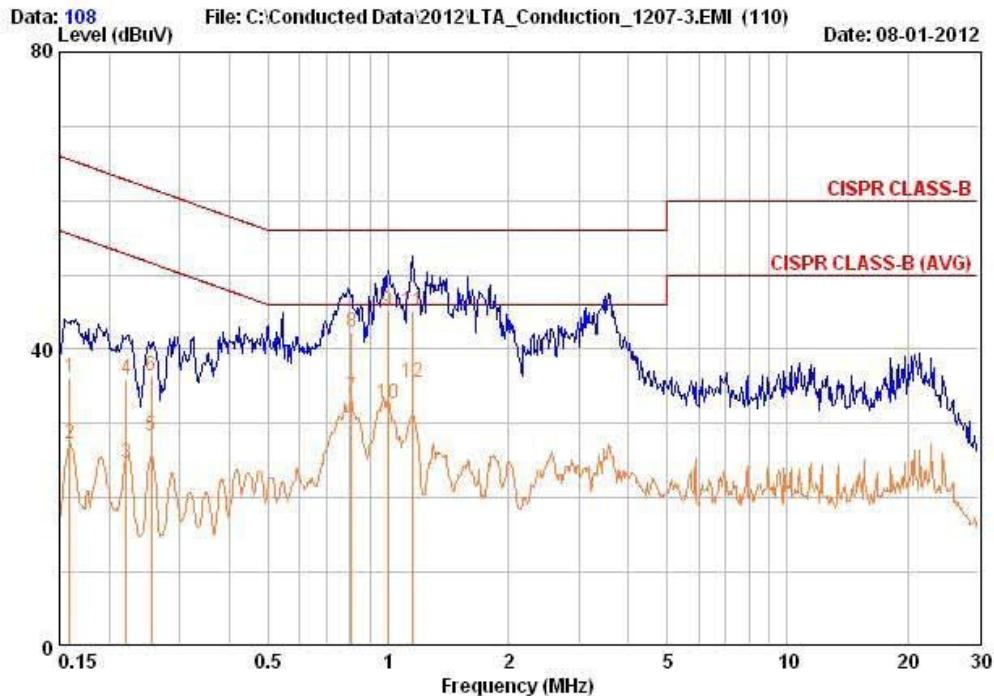
| Freq MHz | RD QP dBuV | RD AV dBuV | C. F dB | Result | | Limit | | Margin | |
|-------------|------------------|------------------|------------|------------|------------|------------|------------|----------|----------|
| | | | | QP dBuV | AV dBuV | QP dBuV | AV dBuV | QP dB | AV dB |
| 0.160 | 26.94 | 20.34 | 9.58 | 36.52 | 29.92 | 65.46 | 55.46 | 28.94 | 25.54 |
| 0.418 | 32.53 | 22.73 | 9.66 | 42.19 | 32.39 | 57.49 | 47.49 | 15.30 | 15.10 |
| 0.450 | 33.32 | 21.72 | 9.68 | 43.00 | 31.40 | 56.88 | 46.88 | 13.87 | 15.47 |
| 0.798 | 38.72 | 26.92 | 9.60 | 48.33 | 36.53 | 56.00 | 46.00 | 7.67 | 9.47 |
| 0.991 | 40.63 | 30.13 | 9.64 | 50.27 | 39.77 | 56.00 | 46.00 | 5.73 | 6.23 |
| 1.136 | 40.03 | 27.33 | 9.64 | 49.68 | 36.98 | 56.00 | 46.00 | 6.32 | 9.02 |

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

AC Conducted Emissions –ZIGBEE 2 mode – Line

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Fax :+82-31-3236010

EUT / Model No. : HES2E4AOT Phase : LINE
 Test Mode : ZIGBEE2 mode Test Power : 120 / 60
 Temp./Humi. : 25 / 52 Test Engineer : PARK H W



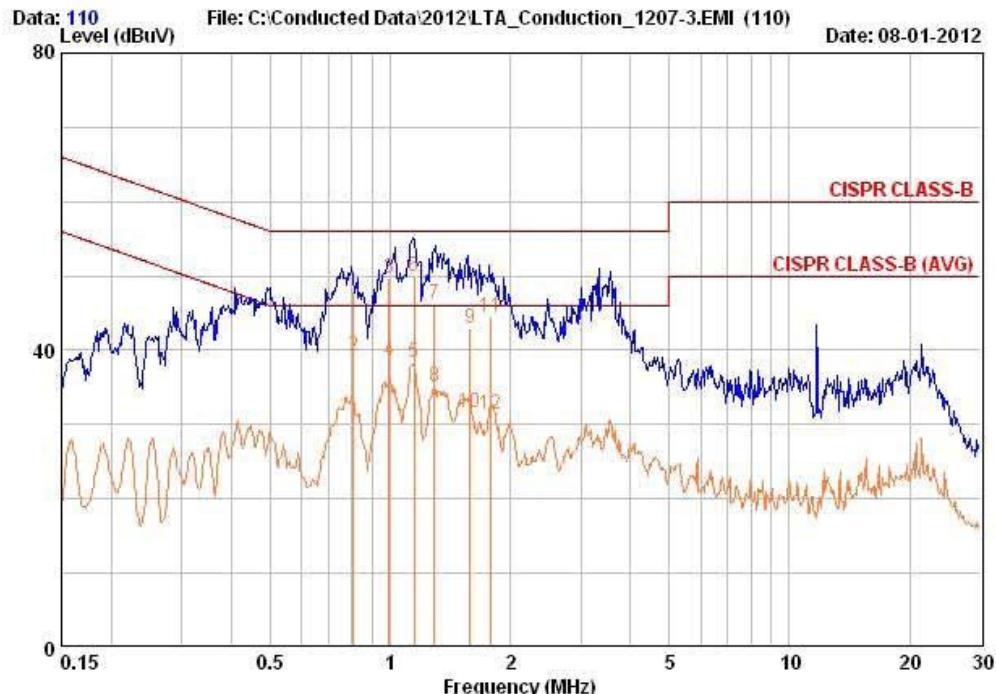
| Freq MHz | RD QP | | RD AV | | C. F dB | Result dBuV | Result dBuV | Limit dBuV | Limit dBuV | Margin dB | Margin dB |
|-------------|----------|-------|----------|-------|------------|----------------|----------------|---------------|---------------|--------------|--------------|
| | QP | AV | QP | AV | | | | | | | |
| 0.159 | 26.44 | 17.64 | 9.66 | 36.10 | 36.10 | 27.30 | 65.52 | 55.52 | 29.42 | 28.22 | |
| 0.221 | 26.44 | 14.94 | 9.59 | 36.03 | 36.03 | 24.53 | 62.78 | 52.78 | 26.75 | 28.25 | |
| 0.255 | 26.83 | 18.73 | 9.57 | 36.40 | 36.40 | 28.30 | 61.59 | 51.59 | 25.19 | 23.29 | |
| 0.808 | 32.52 | 23.82 | 9.68 | 42.20 | 42.20 | 33.50 | 56.00 | 46.00 | 13.80 | 12.50 | |
| 0.998 | 35.43 | 22.93 | 9.71 | 45.14 | 45.14 | 32.64 | 56.00 | 46.00 | 10.86 | 13.36 | |
| 1.146 | 35.43 | 25.73 | 9.72 | 45.15 | 45.15 | 35.45 | 56.00 | 46.00 | 10.85 | 10.55 | |

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

AC Conducted Emissions -ZIGBEE 2 mode – Neutral

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Fax.+82-31-3236010

EUT / Model No. : HES2E4AOT Phase : NEUTRAL
 Test Mode : ZIGBEE2 mode Test Power : 120 / 60
 Temp./Humid. : 25 / 52 Test Engineer : PARK H W



| Freq MHz | RD QP dBuV | RD AV dBuV | C. F dB | Result | | Limit | | Margin | |
|-------------|------------------|------------------|------------|------------|------------|------------|------------|----------|----------|
| | | | | QP dBuV | AV dBuV | QP dBuV | AV dBuV | QP dB | AV dB |
| 0.809 | 29.72 | --- | 9.60 | 39.33 | 0.00 | 56.00 | 0.00 | 16.67 | 0.00 |
| 0.994 | 40.13 | 28.93 | 9.64 | 49.77 | 38.57 | 56.00 | 46.00 | 6.23 | 7.43 |
| 1.149 | 40.23 | 28.73 | 9.64 | 49.88 | 38.38 | 56.00 | 46.00 | 6.12 | 7.62 |
| 1.290 | 36.54 | 25.54 | 9.65 | 46.19 | 35.19 | 56.00 | 46.00 | 9.81 | 10.81 |
| 1.583 | 33.24 | 21.84 | 9.66 | 42.91 | 31.51 | 56.00 | 46.00 | 13.09 | 14.49 |
| 1.783 | 34.75 | 21.75 | 9.68 | 44.42 | 31.42 | 56.00 | 46.00 | 11.58 | 14.58 |

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

APPENDIX

TEST EQUIPMENT USED FOR TESTS

| | Description | Model No. | Serial No. | Manufacturer | Interval | Last Cal. Date |
|----|----------------------------|------------------|-------------------|------------------------|-----------------|-----------------------|
| 1 | Spectrum Analyzer (~30GHz) | FSV-30 | 100757 | R&S | 1 year | 2012-01-10 |
| 2 | Signal Generator (~3.2GHz) | 8648C | 3623A02597 | HP | 1 year | 2012-03-26 |
| 3 | Signal Generator (1~20GHz) | 83711B | US34490456 | HP | 1 year | 2012-03-26 |
| 4 | Attenuator (3dB) | 8491A | 37822 | HP | 2 year | 2012-09-22 |
| 5 | Attenuator (10dB) | 8491A | 63196 | HP | 2 year | 2012-09-22 |
| 6 | Attenuator (30dB) | 8498A | 3318A10929 | HP | 2 year | 2011-01-05 |
| 7 | Test Receiver (~30MHz) | ESHS10 | 828404/009 | R&S | 1 year | 2012-03-26 |
| 8 | EMI Test Receiver (~1GHz) | ESCI7 | 100722 | R&S | 1 year | 2011-10-07 |
| 9 | RF Amplifier (~1.3GHz) | 8447D | 2439A09058 | HP | - | - |
| 10 | RF Amplifier (1~18GHz) | 8449B | 3008A02126 | HP | 2 year | 2012-03-26 |
| 11 | Horn Antenna (1~18GHz) | BBHA 9120D | 9120D122 | SCHWARZBECK | 2 year | 2010-12-24 |
| 12 | Horn Antenna (18 ~ 40GHz) | SAS-574 | 154 | Schwarzbeck | 2 year | 2010-11-25 |
| 13 | Horn Antenna (18 ~ 40GHz) | SAS-574 | 155 | Schwarzbeck | 2 year | 2010-11-25 |
| 14 | TRILOG Antenna | VULB 9160 | 9160-3242 | SCHWARZBECK | 2 year | 2011-06-09 |
| 15 | Dipole Antenna | VHA9103 | 2116 | SCHWARZBECK | 2 year | 2010-11-25 |
| 16 | Dipole Antenna | VHA9103 | 2117 | SCHWARZBECK | 2 year | 2010-11-25 |
| 17 | Dipole Antenna | VHA9105 | 2261 | SCHWARZBECK | 2 year | 2010-11-25 |
| 18 | Dipole Antenna | VHA9105 | 2262 | SCHWARZBECK | 2 year | 2010-11-25 |
| 19 | Hygro-Thermograph | THB-36 | 0041557-01 | ISUZU | 2 year | 2013-04-26 |
| 20 | Splitter (SMA) | ZFSC-2-2500 | SF617800326 | Mini-Circuits | - | - |
| 21 | DC Power Supply | 6622A | 3448A03079 | HP | - | - |
| 22 | Frequency Counter | 5342A | 2826A12411 | HP | 1 year | 2012-03-26 |
| 23 | Power Meter | EPM-441A | GB32481702 | HP | 1 year | 2012-03-26 |
| 24 | Power Sensor | 8481A | US41030291 | HP | 1 year | 2011-10-07 |
| 25 | Audio Analyzer | 8903B | 3729A18901 | HP | 1 year | 2011-10-07 |
| 26 | Modulation Analyzer | 8901B | 3749A05878 | HP | 1 year | 2011-10-07 |
| 27 | TEMP & HUMIDITY Chamber | YJ-500 | LTAS06041 | JinYoung Tech | 1 year | 2011-10-07 |
| 28 | Stop Watch | HS-3 | 601Q09R | CASIO | 2 year | 2012-03-26 |
| 29 | LISN | ENV216 | 100408 | R&S | 1 year | 2011-10-07 |
| 30 | Highpass Filter | WHKX1.5/15G-10SS | 74 | Wainwright Instruments | - | - |
| 31 | Highpass Filter | WHKX3.0/18G-10SS | 118 | Wainwright Instruments | - | - |
| 32 | Loop Antenna | FMZB 1516 | 151602/94 | SCHWARZBECK | 2 year | 2011-04-05 |