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Dates of Tests : August 2~12, 2010

Test Report S/N: LR500191008A

Test Site : LTA CO., LTD

CERTIFICATION OF COMPLIANCE

FCC ID.

YI7HES10000R1W

APPLICANT

eZEX Corporation

Equipment Class	:	Digital Transmission System (DTS)
Manufacturing Description	:	Home Energy Gateway
Manufacturer	:	eZEX Corporation
Model name	:	HES1E000R0WW
Variant Model name	:	HES1N000R0WW
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) 2405MHz ~ 2480MHz (SPI interface) 2405MHz ~ 2470MHz (UART interface)
Max. Output Power	:	Max 14.64dBm - Conducted (802.11b) Max 16.65dBm - Conducted (802.11g) Max 22.80dBm - Conducted (SPI interface) Max 21.41dBm - Conducted (UART interface)
Data of issue	:	August 12, 2010

This test report is issued under the authority of:

The test was supervised by:

Kyung-Taek LEE, Technical Manager

Hyun-Chae You, 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(802.11b/g)	6
3.2.1 6dB BANDWIDTH	6
3.2.2 PEAK OUTPUT POWER	11
3.2.3 POWER SPECTRAL DENSITY	16
3.2.4 BAND – EDGE & SPURIOUS	21
3.2.5 FIELD STRENGTH OF HARMONICS	32
3.2.6 AC CONDUCTED EMISSIONS	36
3.3 TECHNICAL CHARACTERISTICS TEST(Zigbee for SPI/UART)	39
3.3.1 6dB BANDWIDTH	39
3.3.2 PEAK OUTPUT POWER	44
3.3.3 POWER SPECTRAL DENSITY	49
3.3.4 BAND – EDGE & SPURIOUS	54
3.3.5 FIELD STRENGTH OF HARMONICS	70
3.3.6 AC CONDUCTED EMISSIONS	75
 APPENDIX	
APPENDIX TEST EQUIPMENT USED FOR TESTS	78

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	2012-05-14	IC filing

2. Information's about test item

2-1 Applicant & Manufacturer

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 : TEL No : +82-31 - 608 - 4700 FAX No : +82-31-608 - 4701

2-2 Equipment Under Test (EUT)

Trade name : Home Energy Gateway
 FCC ID : YI7HES10000R1W
 Model name : HES1E000R0WW
 Variant Model name : HES1N000R0WW
 Serial number : Identical prototype
 Date of receipt : August 2, 2010
 EUT condition : Pre-production, not damaged
 Antenna type : Chip antenna with Max. 2.0 dBi gain
 Frequency Range : 2412MHz ~ 2462MHz (802.11b/g)
 2405MHz ~ 2480MHz (SPI interface)
 2405MHz ~ 2470MHz (UART interface)
 RF output power : Max 14.64dBm - Conducted (802.11b)
 Max 16.65dBm - Conducted (802.11g)
 Max 22.80dBm - Conducted (SPI interface)
 Max 21.41dBm - Conducted (UART interface)
 Number of channels : 802.11b/g for 11 and SPI for 16 and UART for 14
 Type of Modulation : CCK, DQPSK, DBPSK for DSSS
 64QAM, 16QAM, QPSK, BPSK for OFDM
 O-QPSK for Zigbee
 Transfer Rate : 11/5.5/2/1Mbps for 802.11b
 54/48/36/24/18/12/9/6Mbps for 802.11g
 Power Source : 120VAC

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz) for 802.11b/g	2412	2437	2462
Frequency (MHz) for Zigbee(SPI)	2405	2440	2480
Frequency (MHz) for Zigbee(UART)	2405	2440	2470

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
Notebook	SFM-3200LW	N/A	Samsung

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** FCC ID: **YI7HES10000R1W** 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

3.2 Technical Characteristics Test (802.11b/g)

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 = 300 kHz (VBW \geq RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Mode	Frequency (MHz)	Channel No.	Test Results	
			Measured Bandwidth (MHz)	Result
802.11b	2412	1	12.16	Complies
	2437	6	12.25	Complies
	2462	11	12.11	Complies
802.11g	2412	1	16.50	Complies
	2437	6	16.50	Complies
	2462	11	16.50	Complies

- See next pages for actual measured spectrum plots.

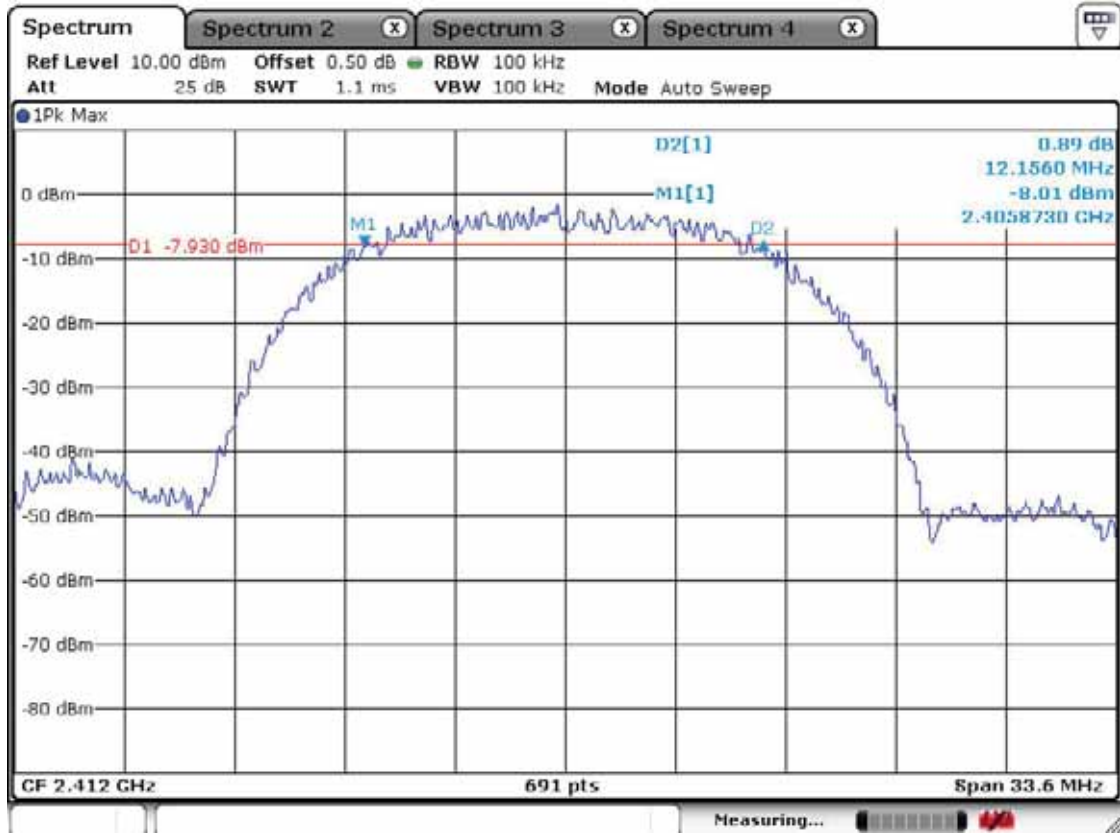
Minimum Standard:

6 dB Bandwidth > 500kHz

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

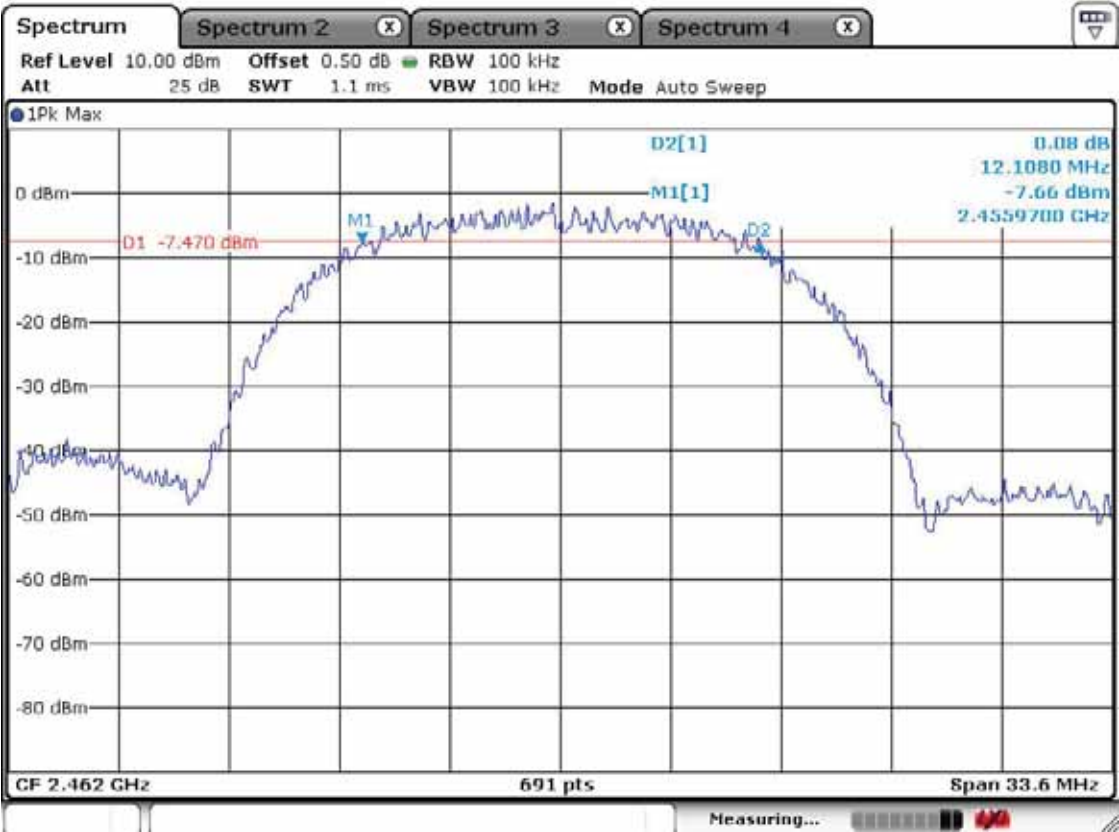
CH 1



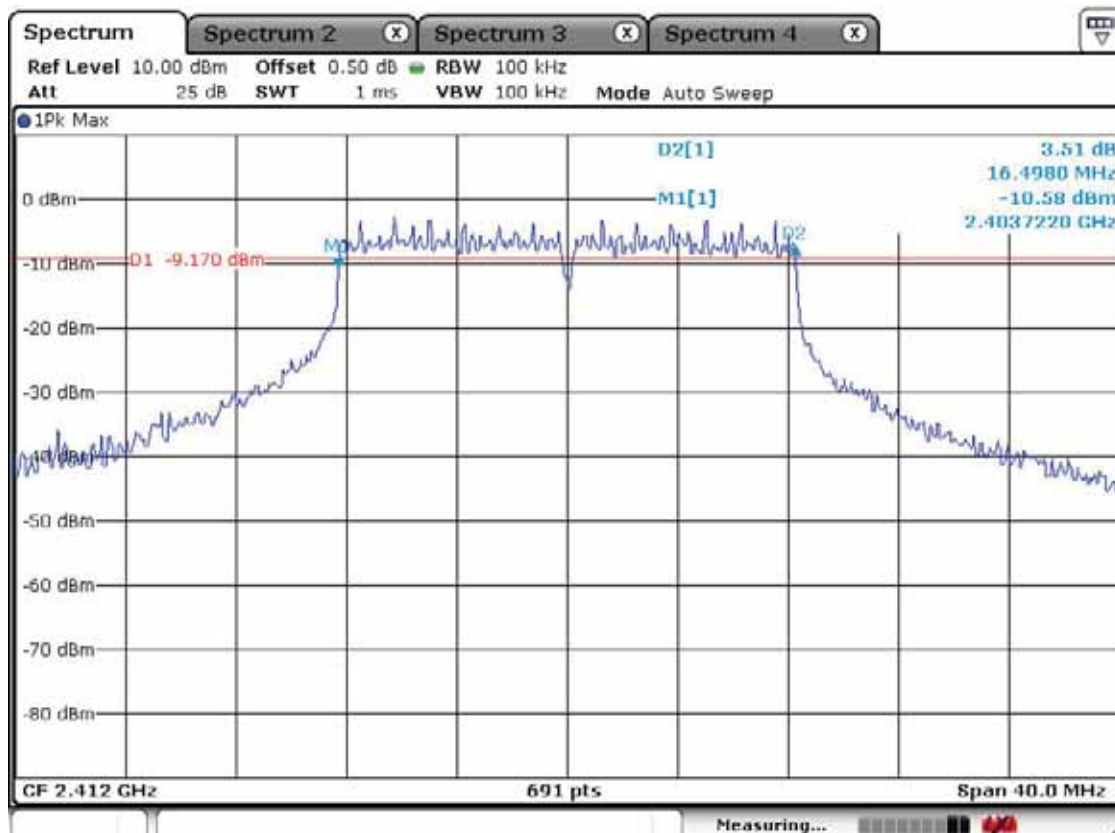
CH 6



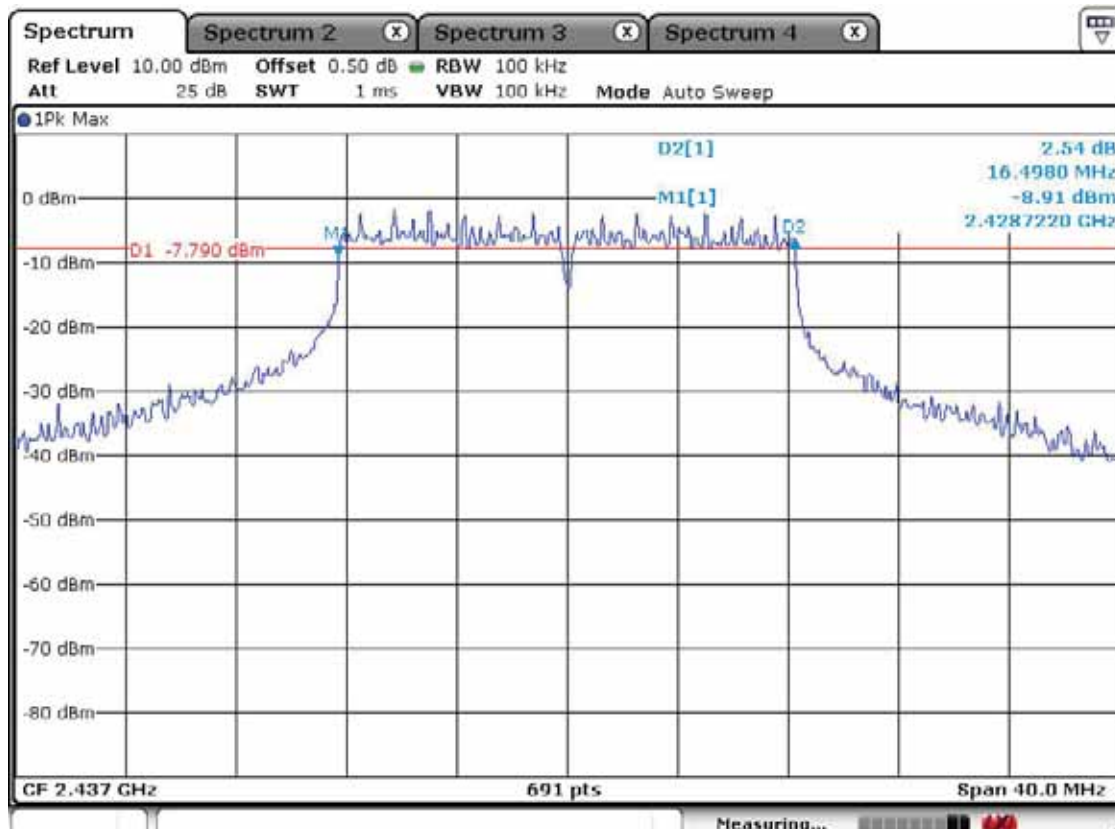
CH 11



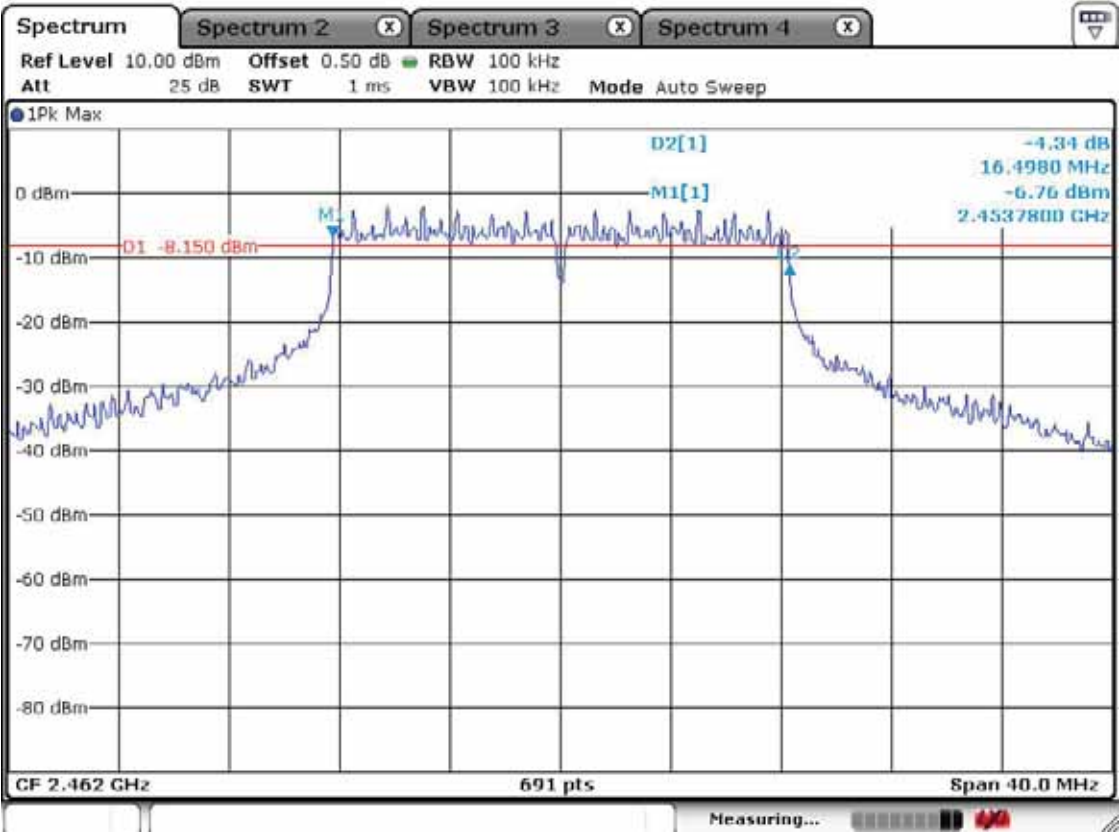
802.11g CH 1



CH 6



CH 11



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 = 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	13.88	Complies
	2437	6	14.64	Complies
	2462	11	14.15	Complies
802.11g	2412	1	15.81	Complies
	2437	6	16.65	Complies
	2462	11	16.38	Complies

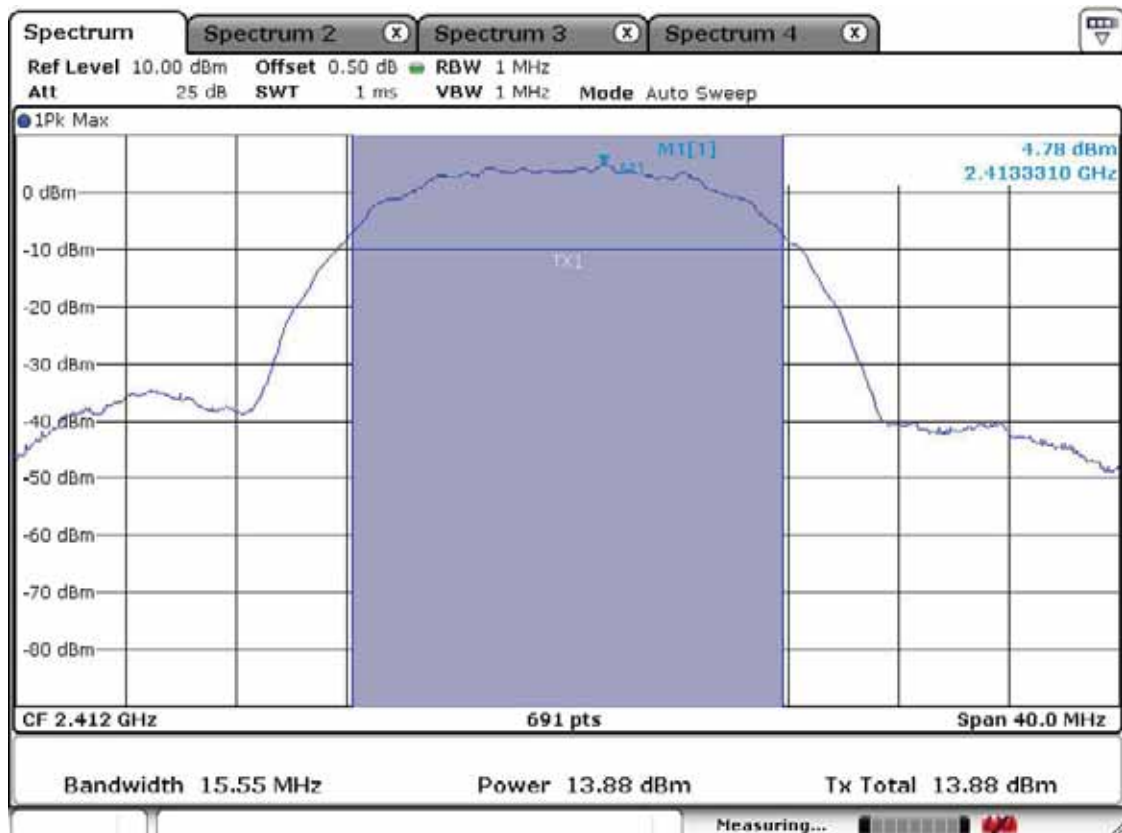
-

- See next pages for actual measured spectrum plots.

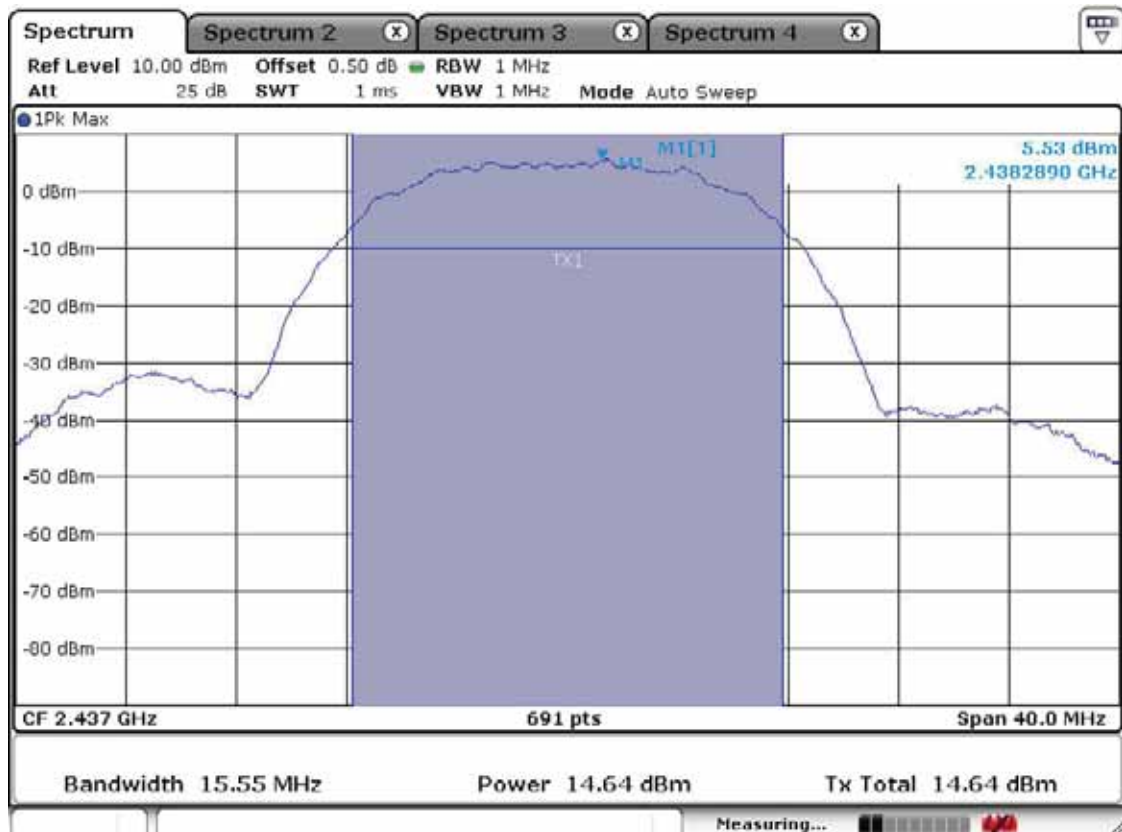
Minimum Standard:

Peak output power	< 1W
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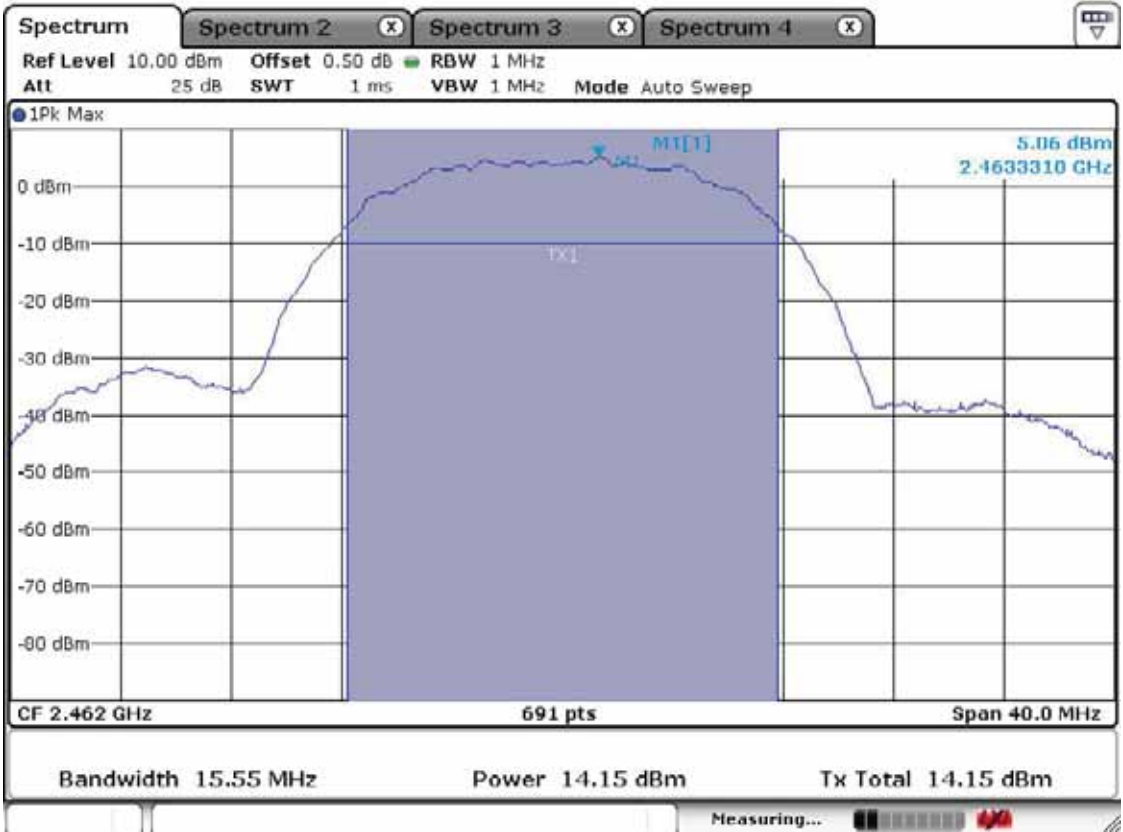
802.11b CH 1



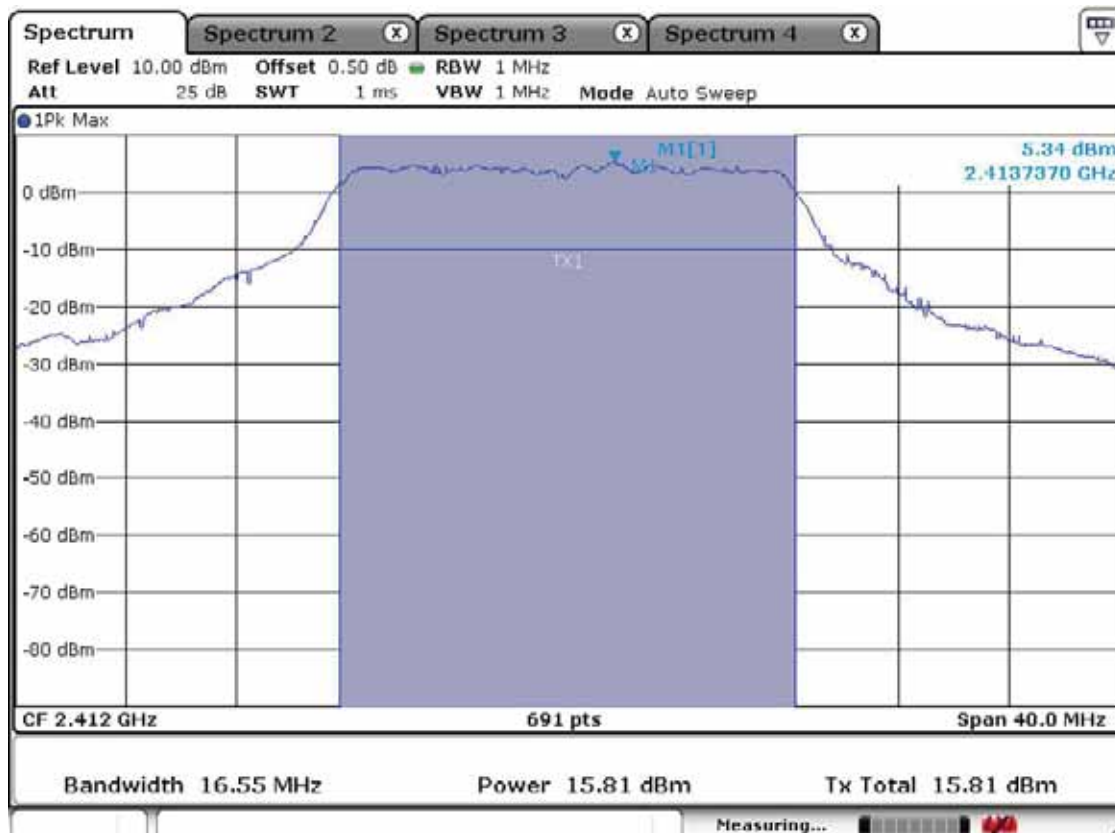
CH 6



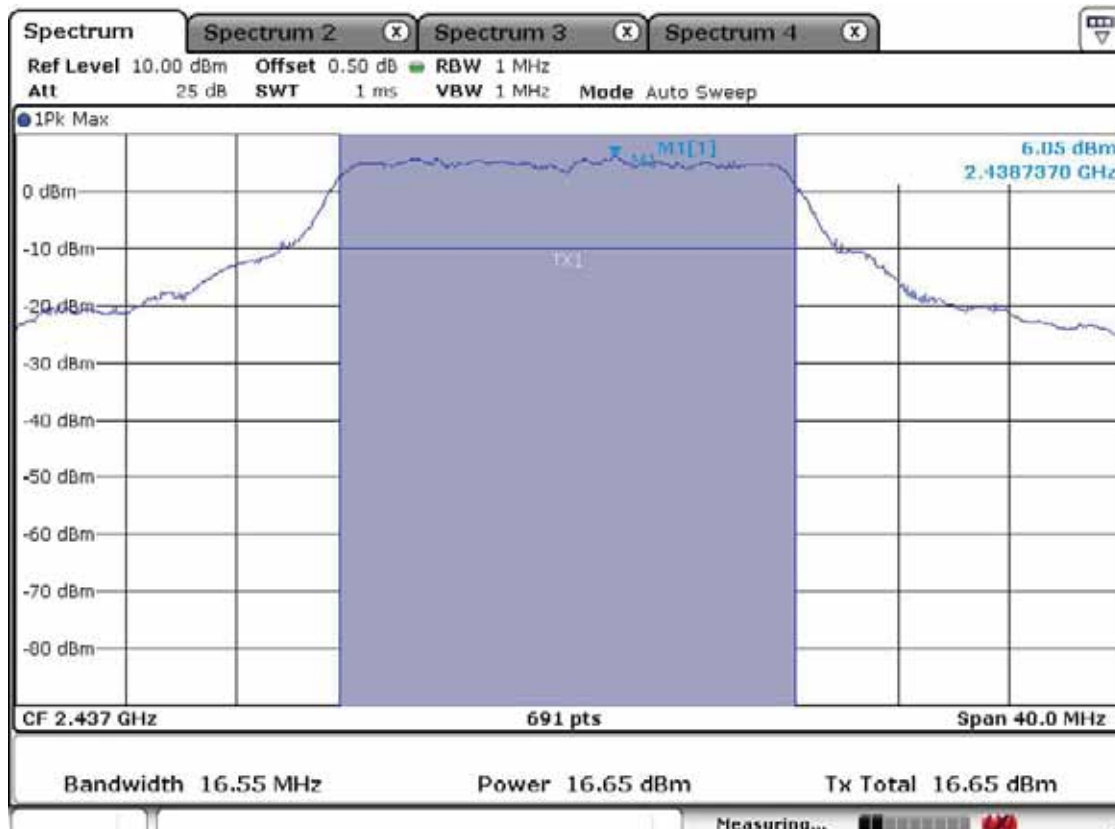
CH 11



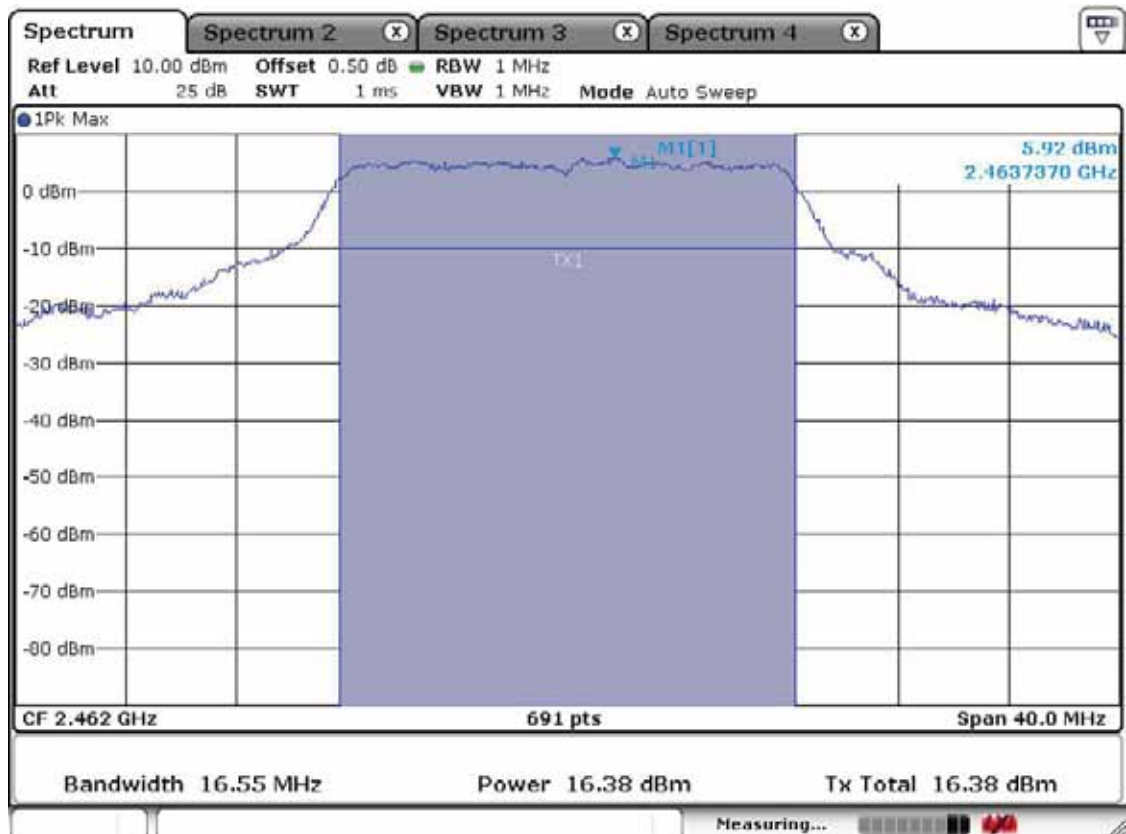
802.11g CH 1



CH 6



CH 11



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 = 10 kHz

Sweep = 1000 sec

Detector function = peak

Trace = max hold

Measurement Data:

Mode	Frequency (MHz)	Ch.	Test Results	
			dBm	Result
802.11b	2412	1	-16.74	Complies
	2437	6	-15.96	Complies
	2462	11	-15.78	Complies
802.11b	2412	1	-18.38	Complies
	2437	6	-17.41	Complies
	2462	11	-17.58	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

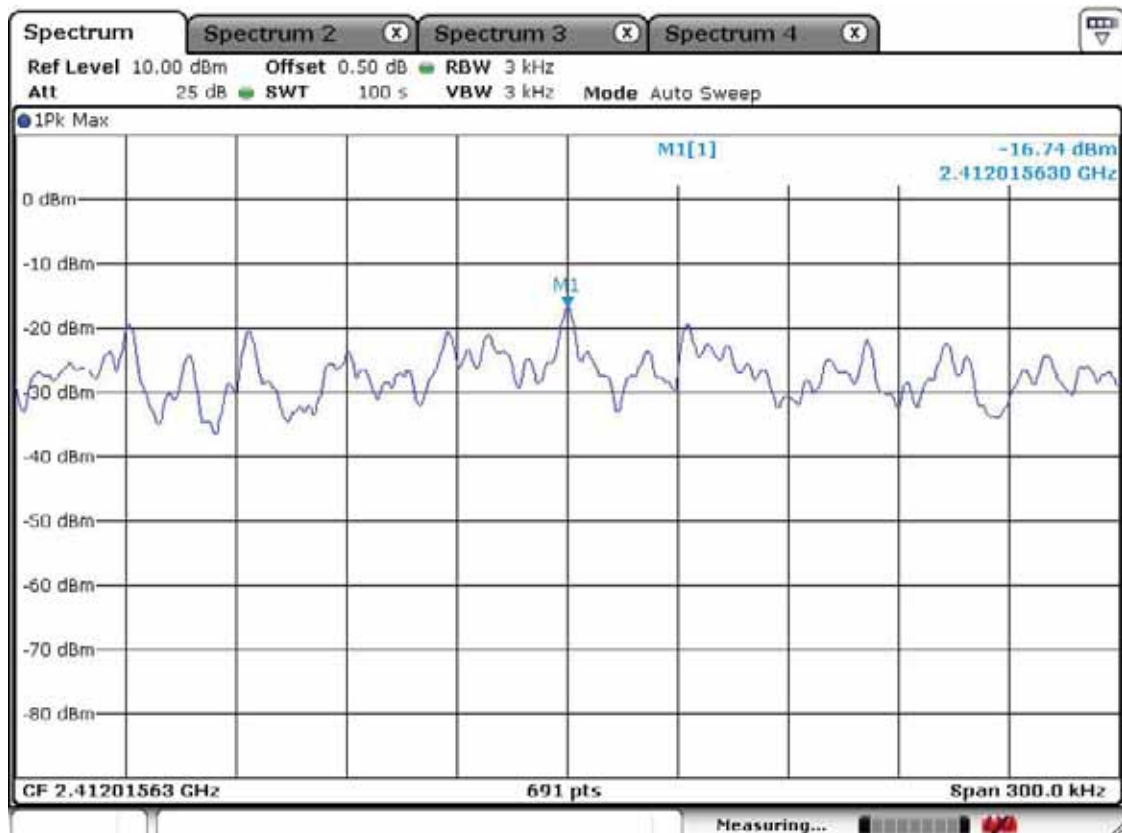
Power Spectral Density	< 8dBm @ 3kHz BW
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Measurement Setup

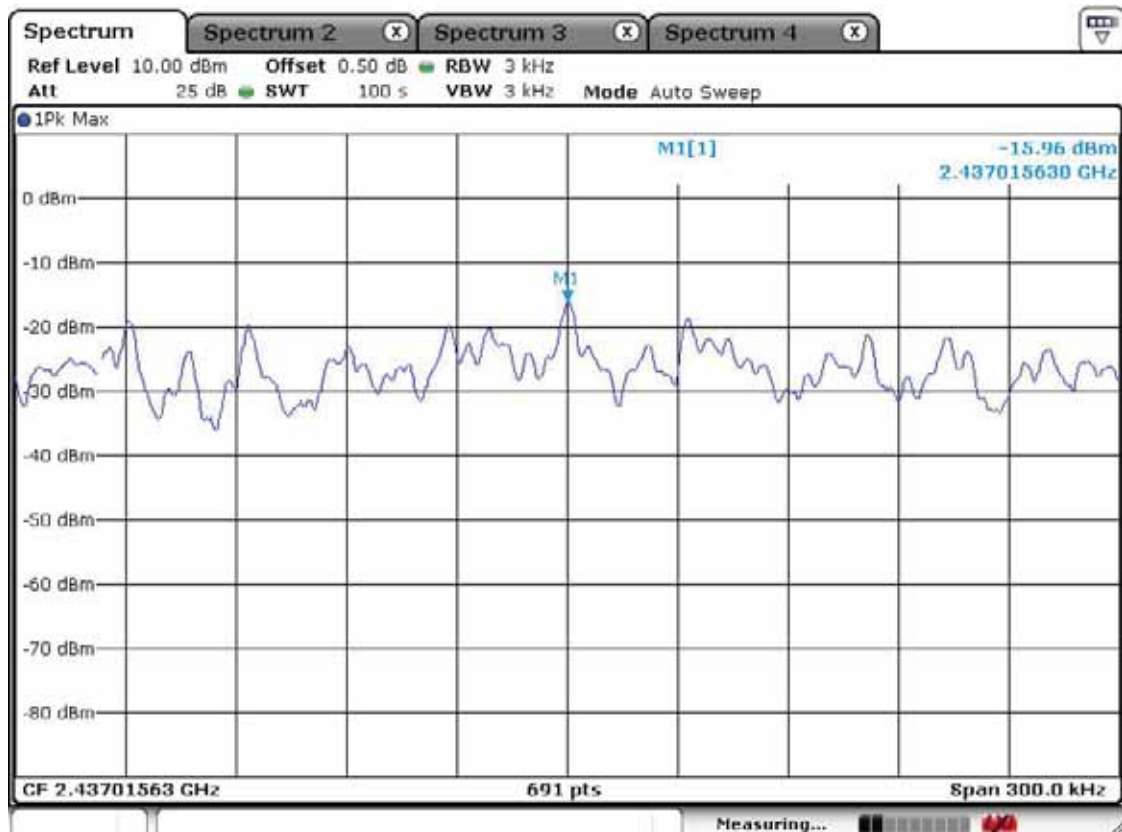
Same as the Chapter 3.2.1 (Figure 1)

802.11b Power Density Measurement

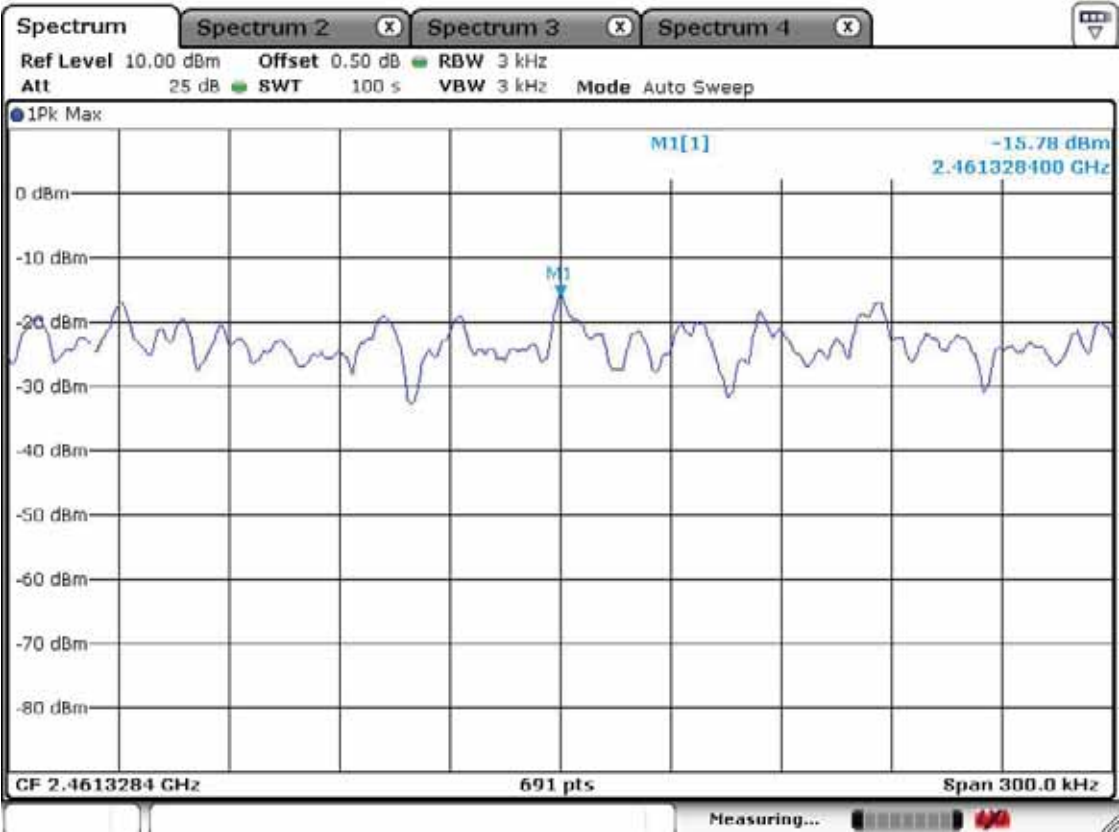
CH 1



CH 6

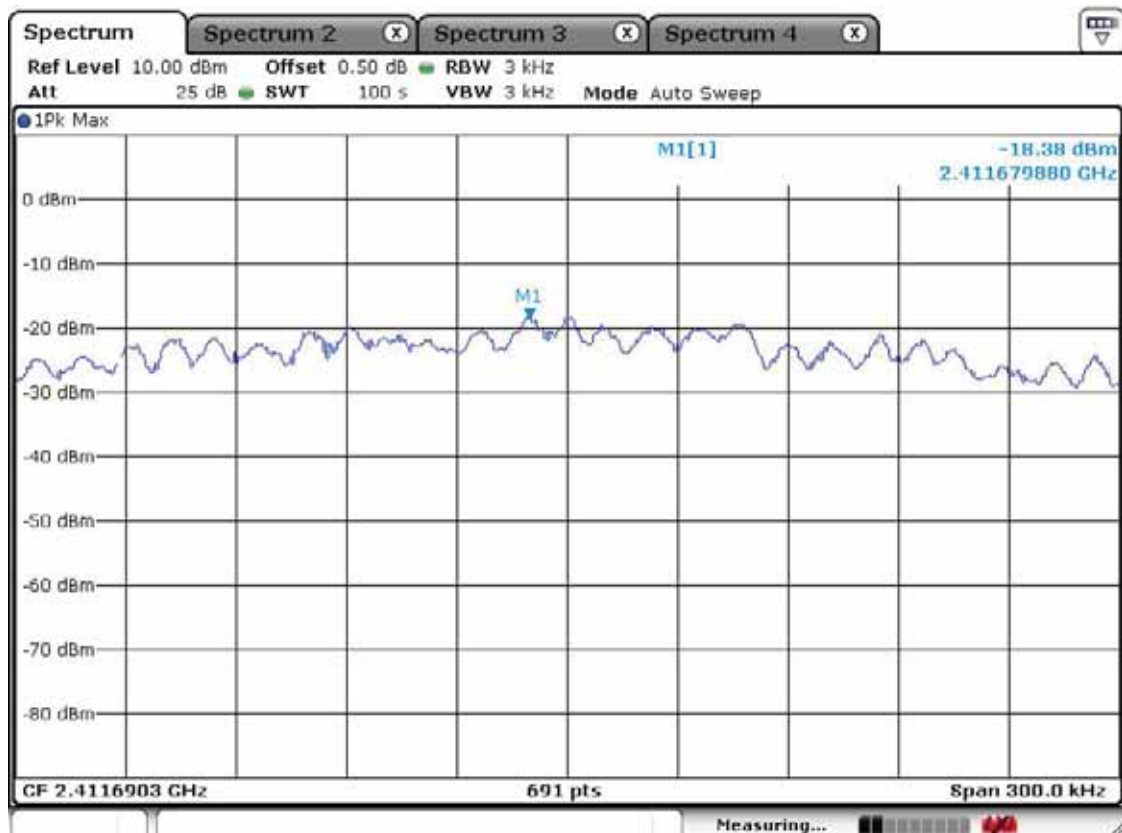


CH 11

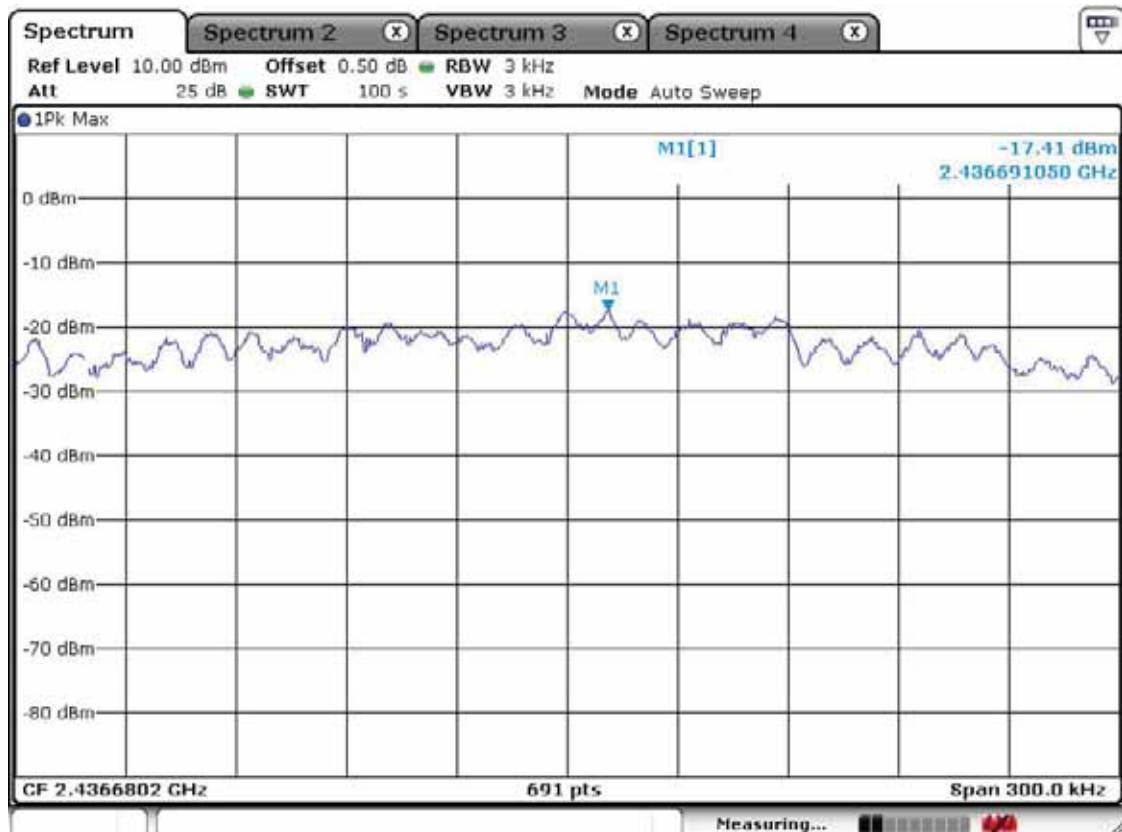


802.11g Power Density Measurement

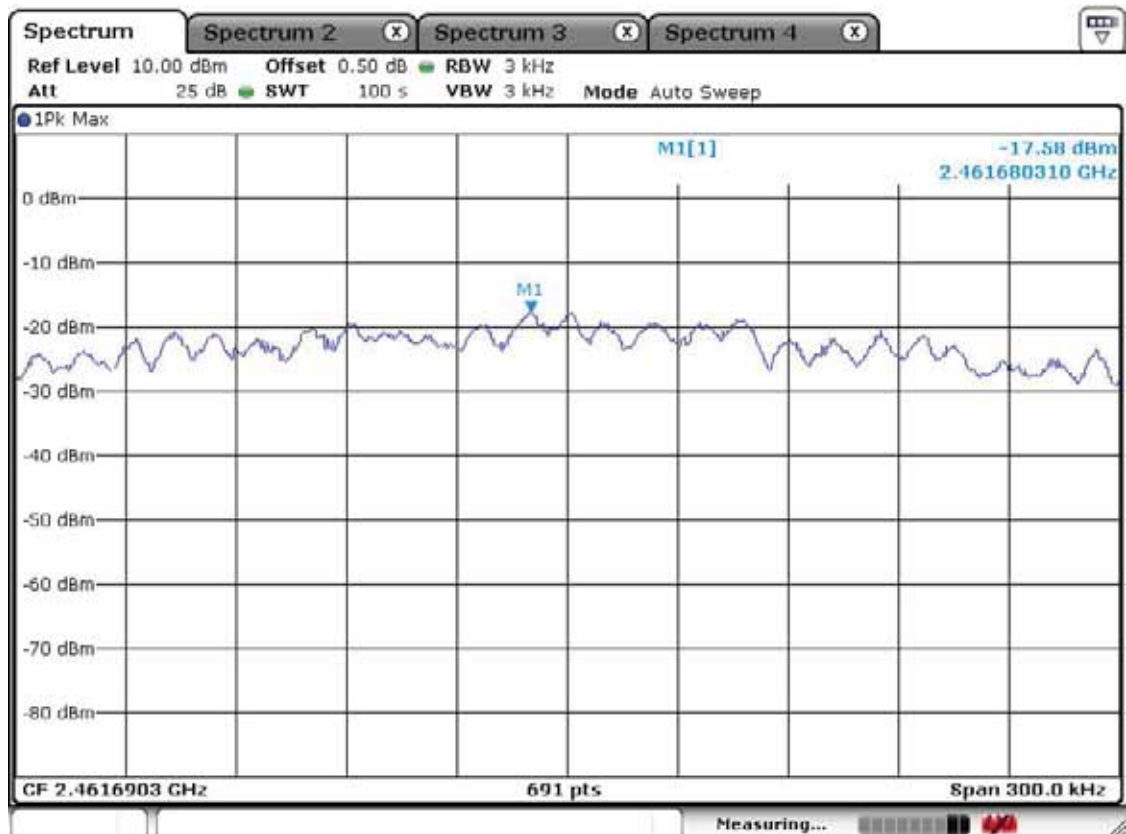
CH 1



CH 6



CH 11



3.2.4 Band - edge

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 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

RBW = 100 kHz

VBW = 100 kHz

Span = 10 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

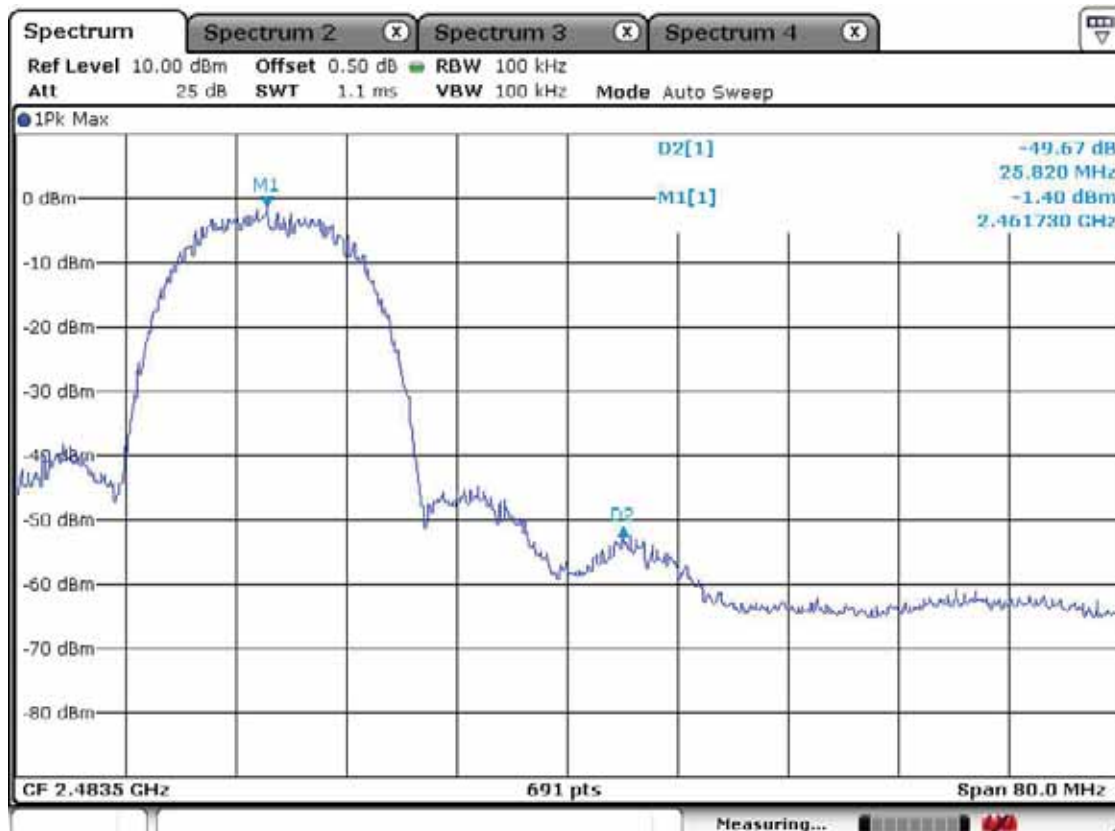
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

Minimum Standard:	> 20 dBc
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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

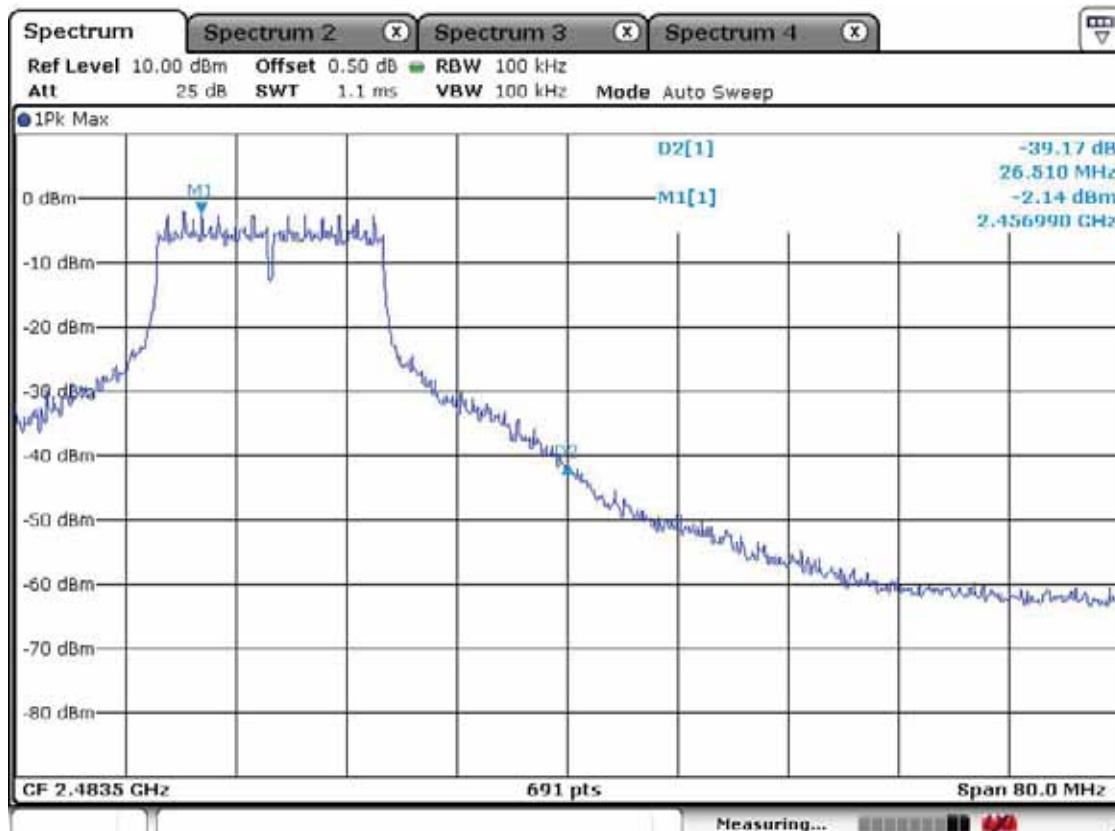
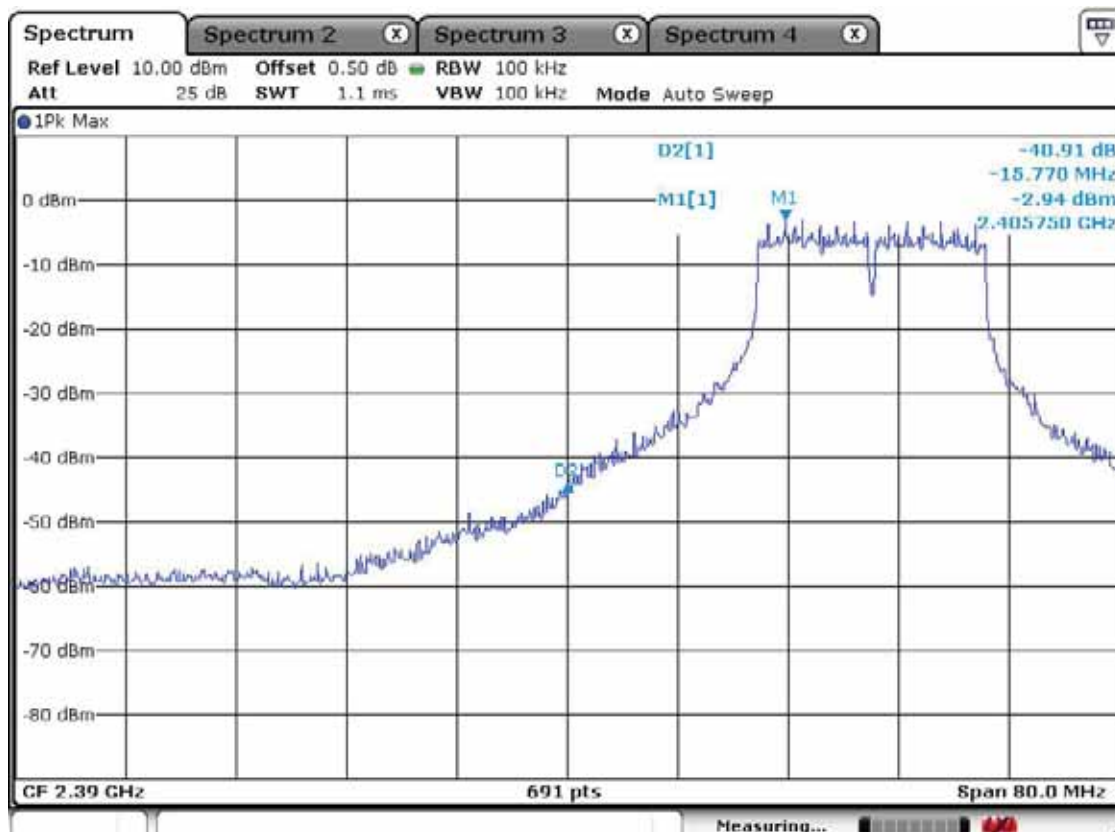
Frequency	Reading [dBuV/m]		Pol.	Correction			Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
				Factor								
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390.00	38.8	45.2	V	26.0	36.0	8.2	54.0	74.0	37.0	43.4	17.0	30.6

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	
2483.5	38.33	45.80	V	26.0	36.0	8.2	54.0	74.0	36.5	44.0	17.5	30.0

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

802.11g Band-edge : Conducted Measurements



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

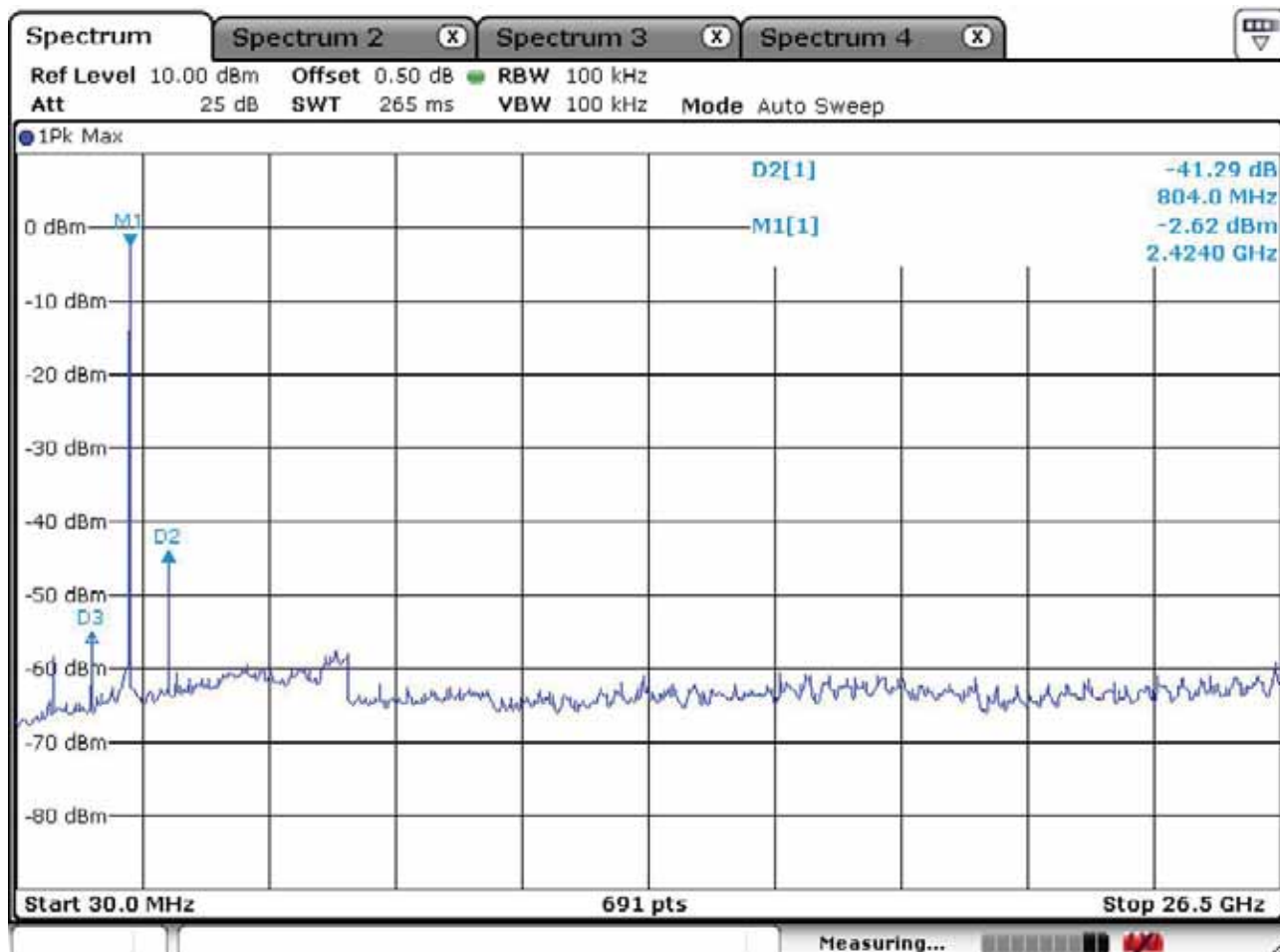
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390.00	41.2	50.3	V	26.0	36.0	8.2	54.0	74.0	39.4	48.5	14.6	25.5

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

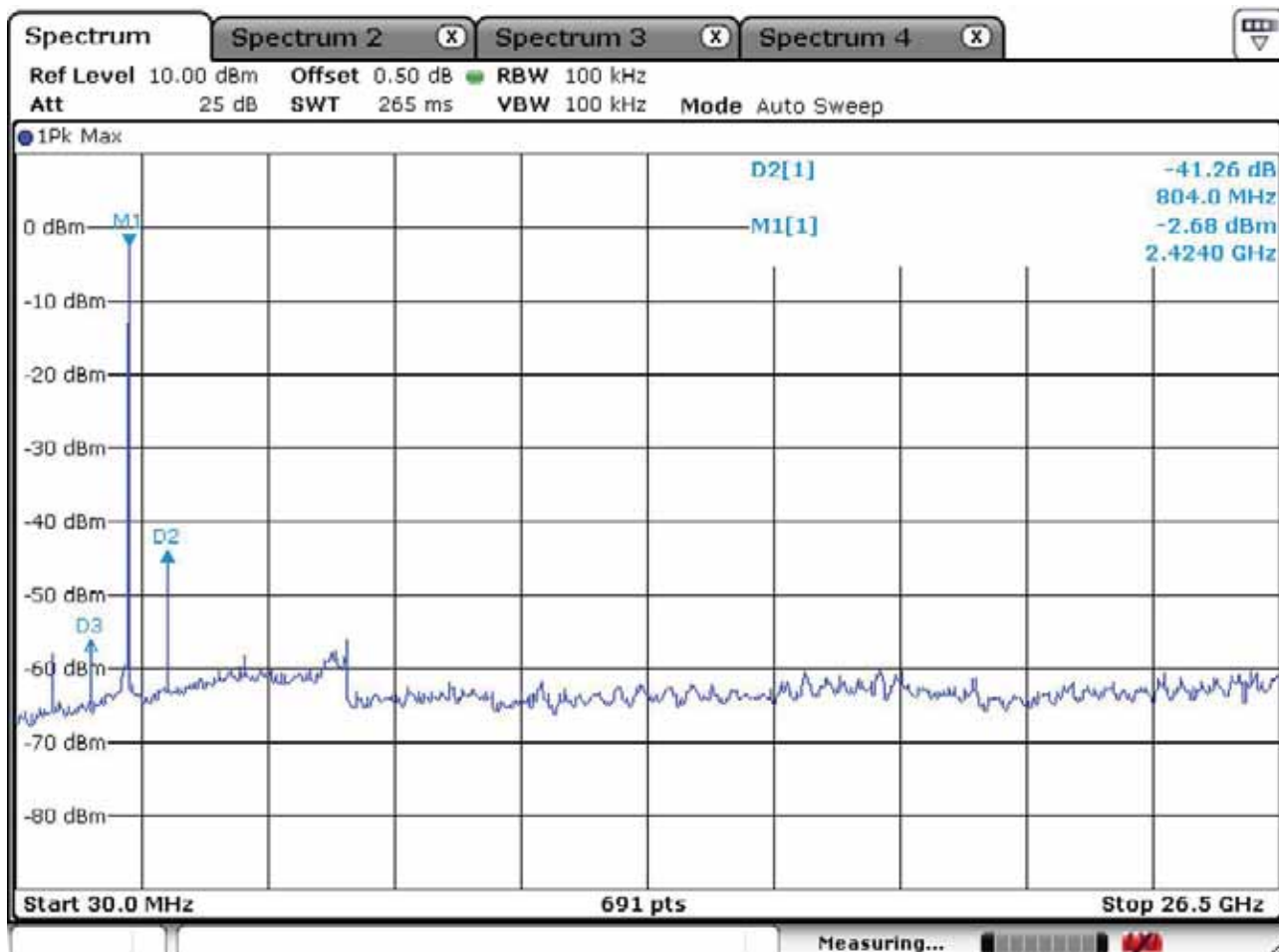
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2483.50	43.1	51.5	V	26.0	36.0	8.2	54.0	74.0	41.3	49.7	12.7	24.3

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

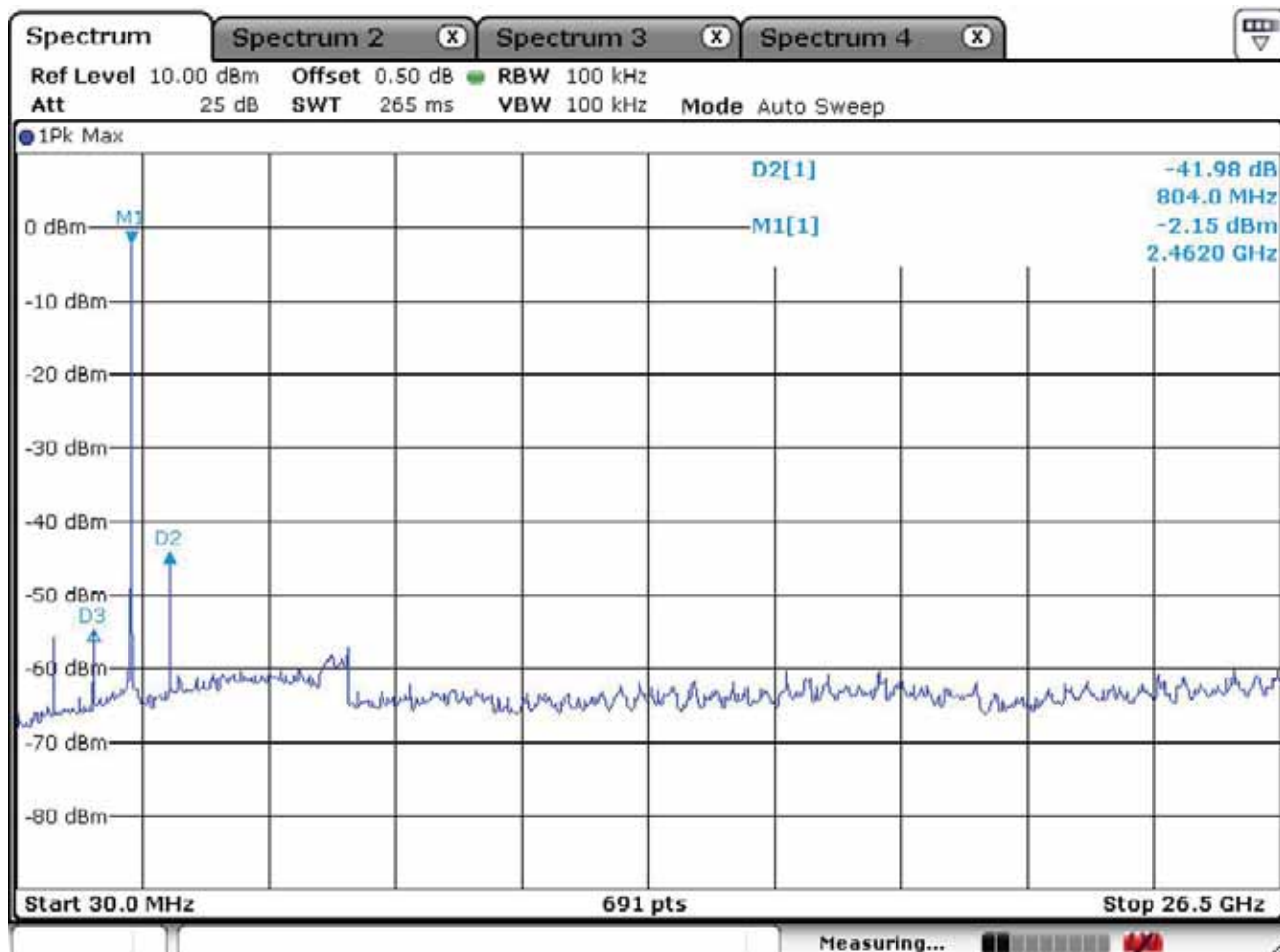
802.11b - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



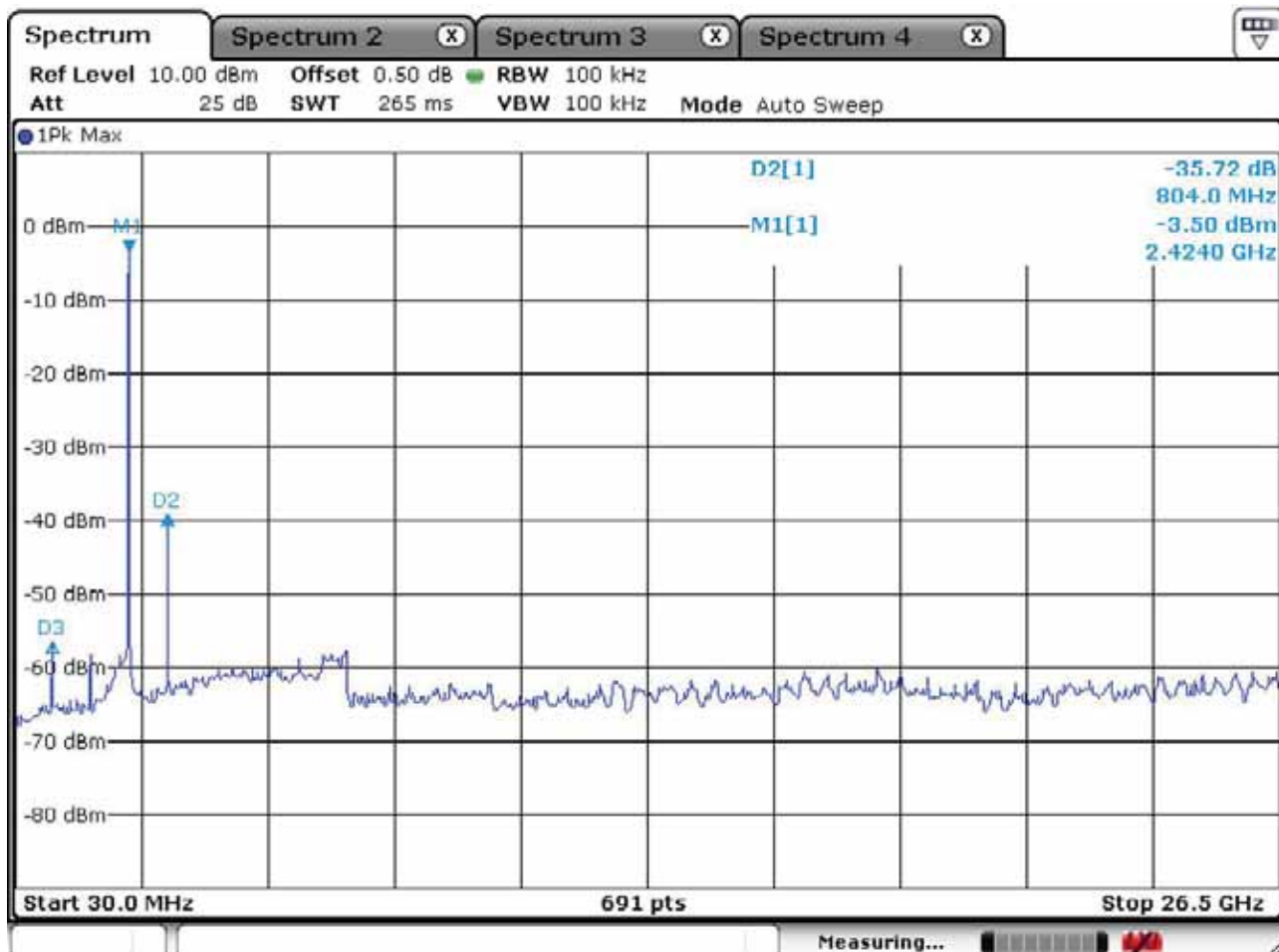
802.11b - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



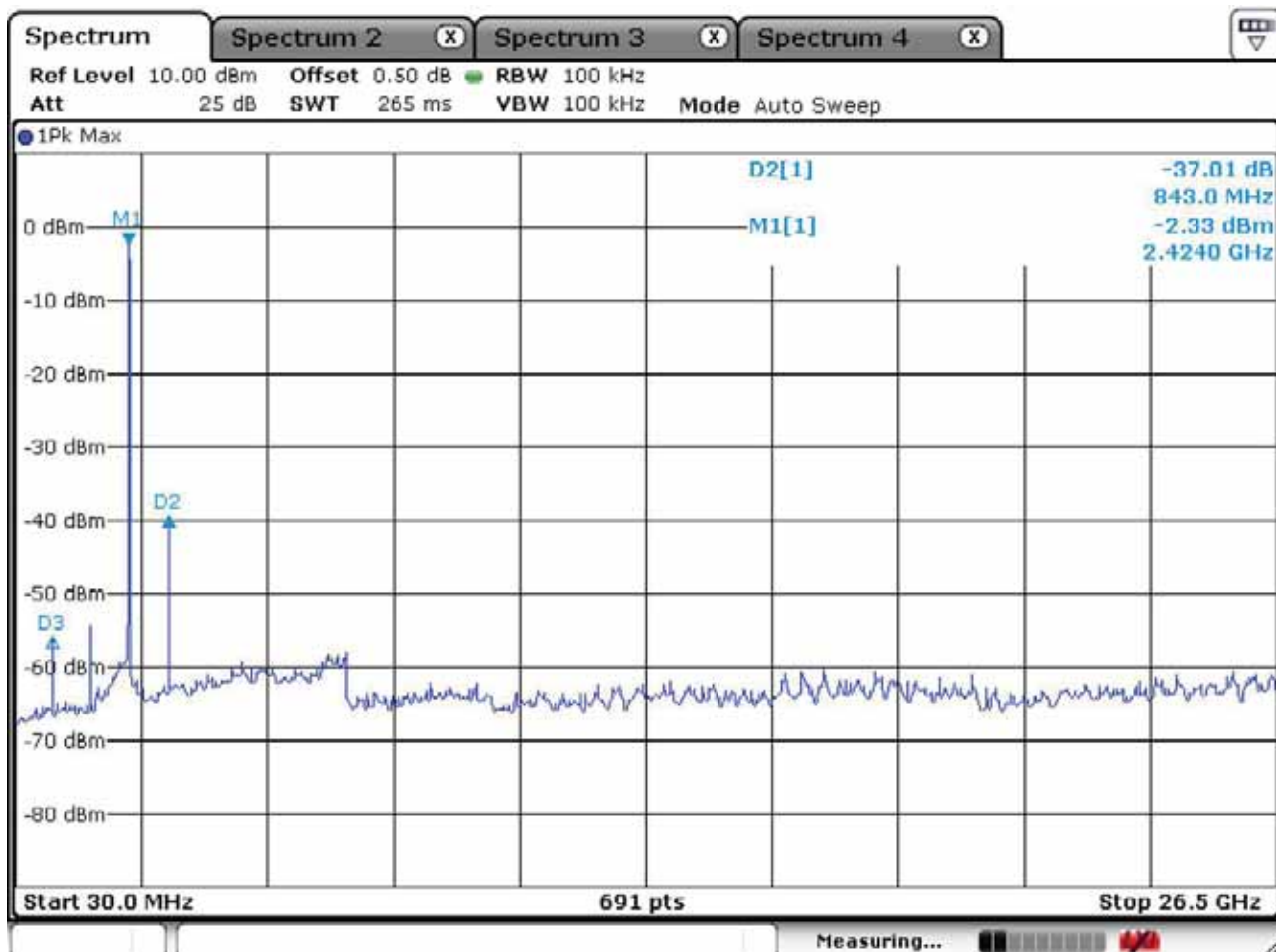
802.11b – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



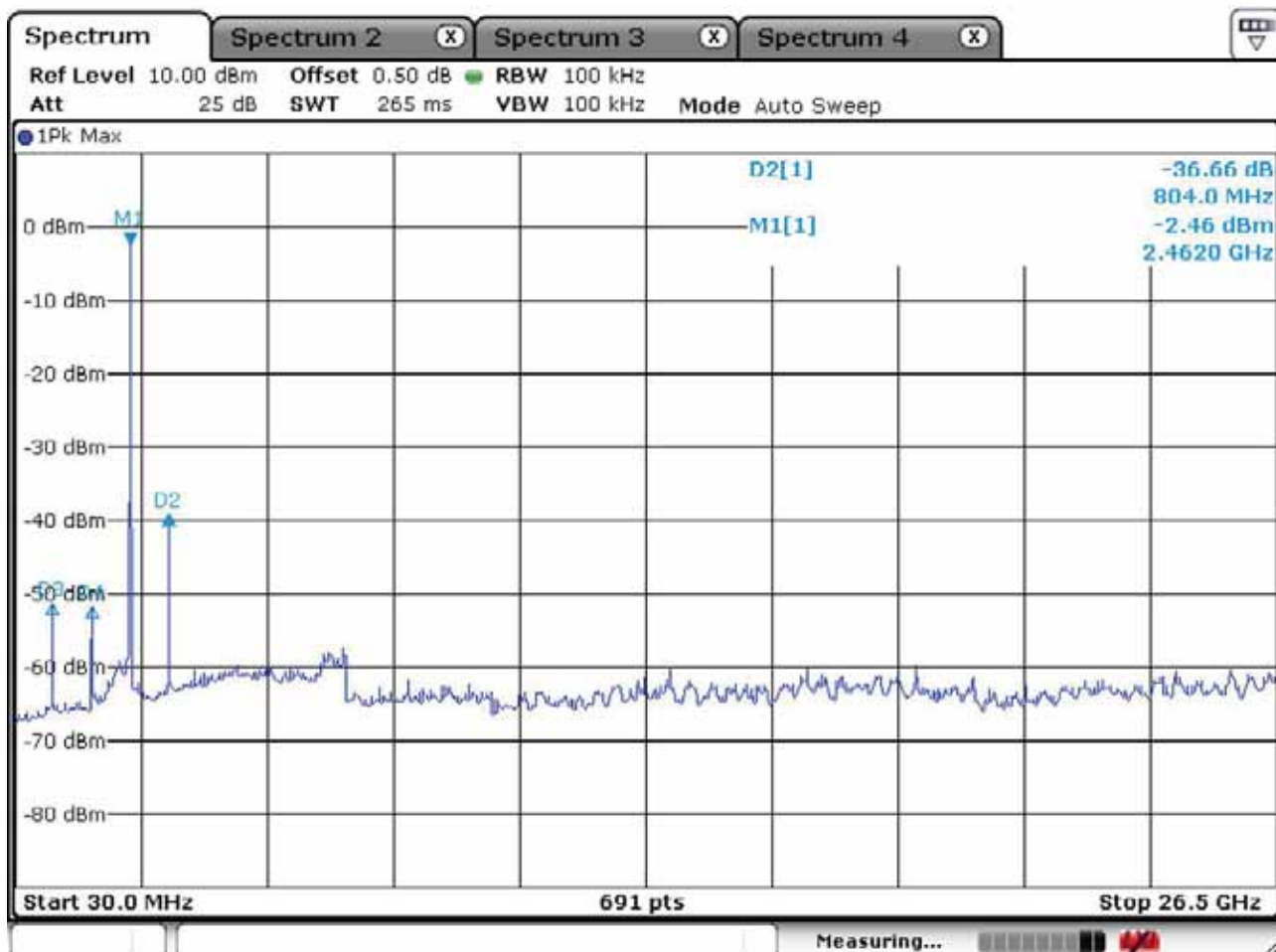
802.11g - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



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



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



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)

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Trace = max hold

Peak:VBW \geq RBW

Average:VBW=10Hz

Detector function = Peak and Average

Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 10dB 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
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:

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	
4824	27.8	40.3	V	31.4	34.6	8.7	54.0	74.0	33.3	45.8	20.8	28.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4874	28.9	41.5	V	31.4	34.6	8.7	54.0	74.0	34.4	47.0	19.7	27.1
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4924	28.5	41.3	V	31.4	34.6	8.7	54.0	74.0	34.0	46.8	20.1	27.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

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

802.11g 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	
4824	28.8	41.5	V	31.4	34.6	8.7	54.0	74.0	34.3	47.0	19.8	27.1
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4874.00	28.6	41.1	V	31.4	34.6	8.7	54.0	74.0	34.1	46.6	20.0	27.5
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4924	28.7	41.3	V	31.4	34.6	8.7	54.0	74.0	34.2	46.8	19.9	27.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

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

Radiated Emissions – PING+WLAN Mode

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

EUT/Model No.: HES1E000R0WW

TEST MODE: PING+WLAN mode

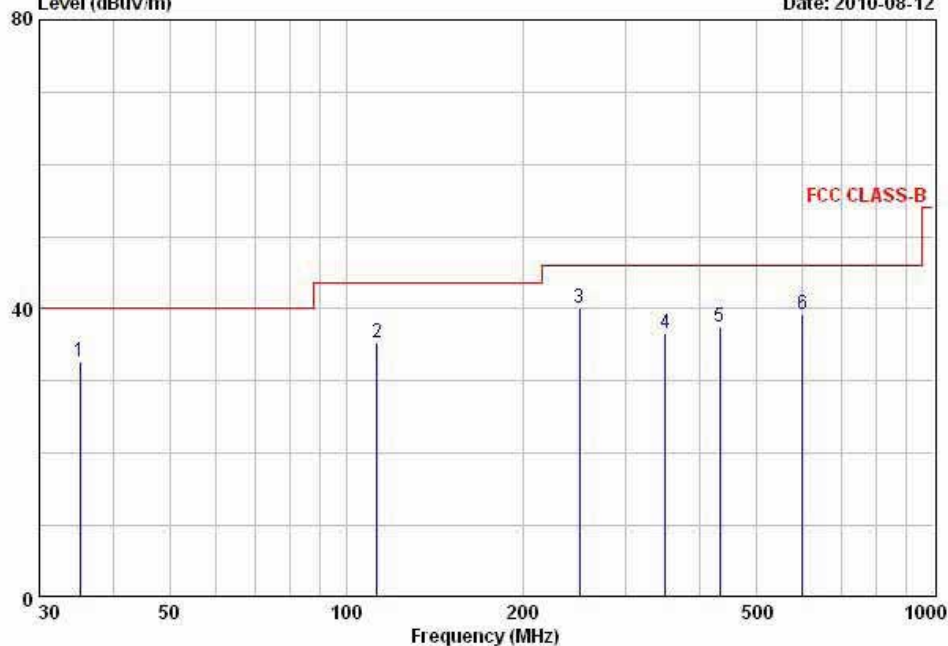
Temp Humi : 26 / 56

Tested by: PARK H W

Data: 33

Level (dBuV/m)

Date: 2010-08-12



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	35.19	48.00	-15.24	32.76	40.00	7.24	100	62	VERTICAL
2	112.81	49.90	-14.64	35.26	43.50	8.24	148	187	HORIZONTAL
3	250.02	50.30	-10.27	40.03	46.00	5.97	126	83	HORIZONTAL
4	350.19	44.20	-7.55	36.65	46.00	9.35	106	319	HORIZONTAL
5	432.75	43.80	-6.22	37.58	46.00	8.42	138	286	VERTICAL
6	599.24	41.80	-2.67	39.13	46.00	6.87	100	214	VERTICAL

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.

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 – PING +WLAN – Line

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

EUT / Model No.: HES1E000R0WW

Phase : LINE

Test Mode : PING + WLAN mode

Test Power : 120 / 60

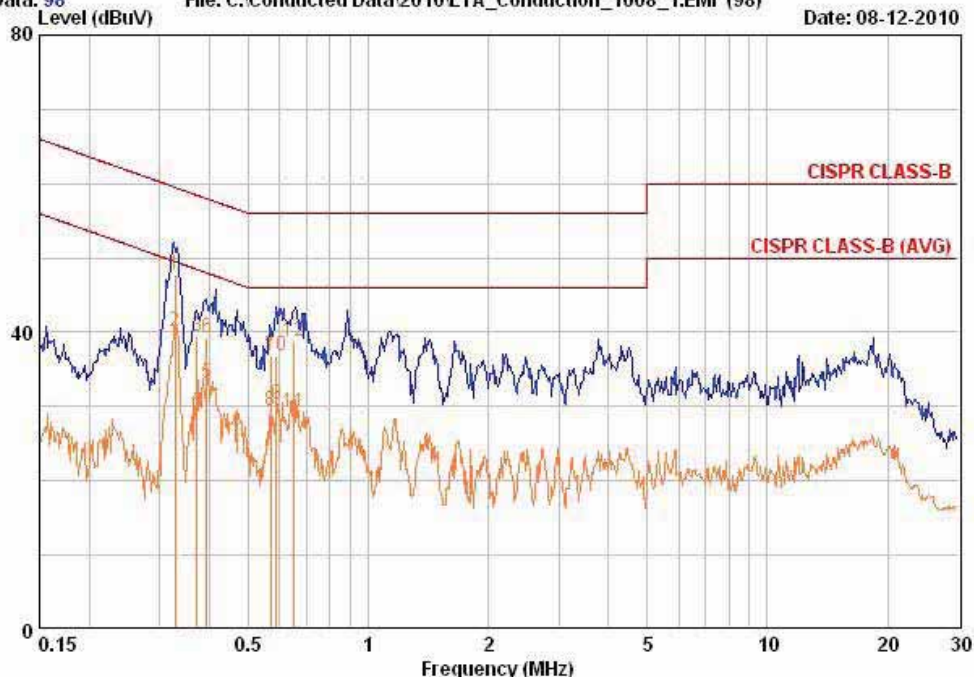
Temp./Humi. : 26 / 68

Test Engineer : PARK H W

Data: 98

File: C:\Conducted Data\2010\LTA_Conduction_1008_1.EMI (98)

Date: 08-12-2010



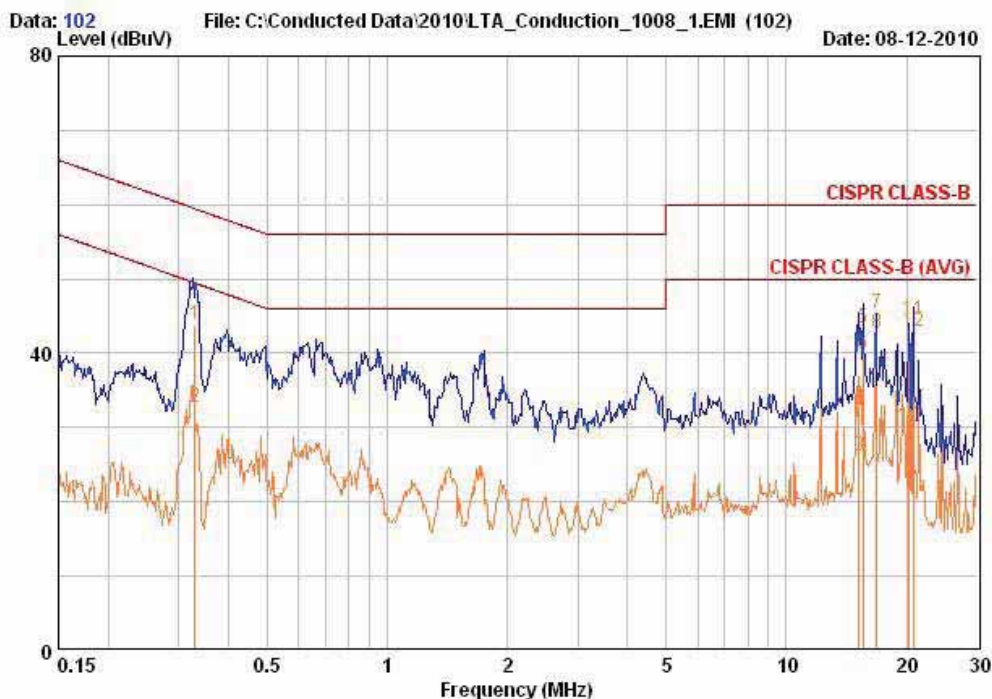
Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.328	38.16	30.46	9.66	47.81	40.11	59.50	49.50	11.69	9.39
0.372	29.75	20.15	9.66	39.42	29.82	58.46	48.46	19.04	18.64
0.394	29.65	23.45	9.67	39.32	33.12	57.98	47.98	18.66	14.86
0.570	27.05	19.65	9.71	36.76	29.36	56.00	46.00	19.24	16.64
0.587	27.05	20.65	9.72	36.77	30.37	56.00	46.00	19.23	15.63
0.653	29.06	19.46	9.75	38.81	29.21	56.00	46.00	17.19	16.79

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

AC Conducted Emissions – PING +WLAN – Neutral

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

EUT / Model No.:	HES1E000R0WW	Phase	: NEUTRAL
Test Mode	: PING + WLAN MODE	Test Power	: 120 / 60
Temp./Humi.	: 26 / 68	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
0.330	34.06	23.06	9.66	43.72	32.72	59.45	49.45	15.73	16.73
15.233	22.41	15.81	10.42	32.83	26.23	60.00	50.00	27.17	23.77
15.552	33.01	29.51	10.43	43.44	39.94	60.00	50.00	16.56	10.06
16.835	34.82	32.32	10.48	45.30	42.80	60.00	50.00	14.70	7.20
20.285	22.93	19.53	10.61	33.54	30.14	60.00	50.00	26.46	19.86
20.814	33.84	32.34	10.62	44.46	42.96	60.00	50.00	15.54	7.04

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

3.3 Technical Characteristics Test (Zigbee for SPI/UART)

3.3.1 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 = 300 kHz (VBW \geq RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Mode	Frequency (MHz)	Channel No.	Test Results	
			Measured Bandwidth (MHz)	Result
SPI	11	2405	1.56	Complies
	18	2440	1.51	Complies
	26	2480	1.57	Complies
UART	11	2405	1.56	Complies
	18	2440	1.52	Complies
	24	2470	1.55	Complies

- See next pages for actual measured spectrum plots.

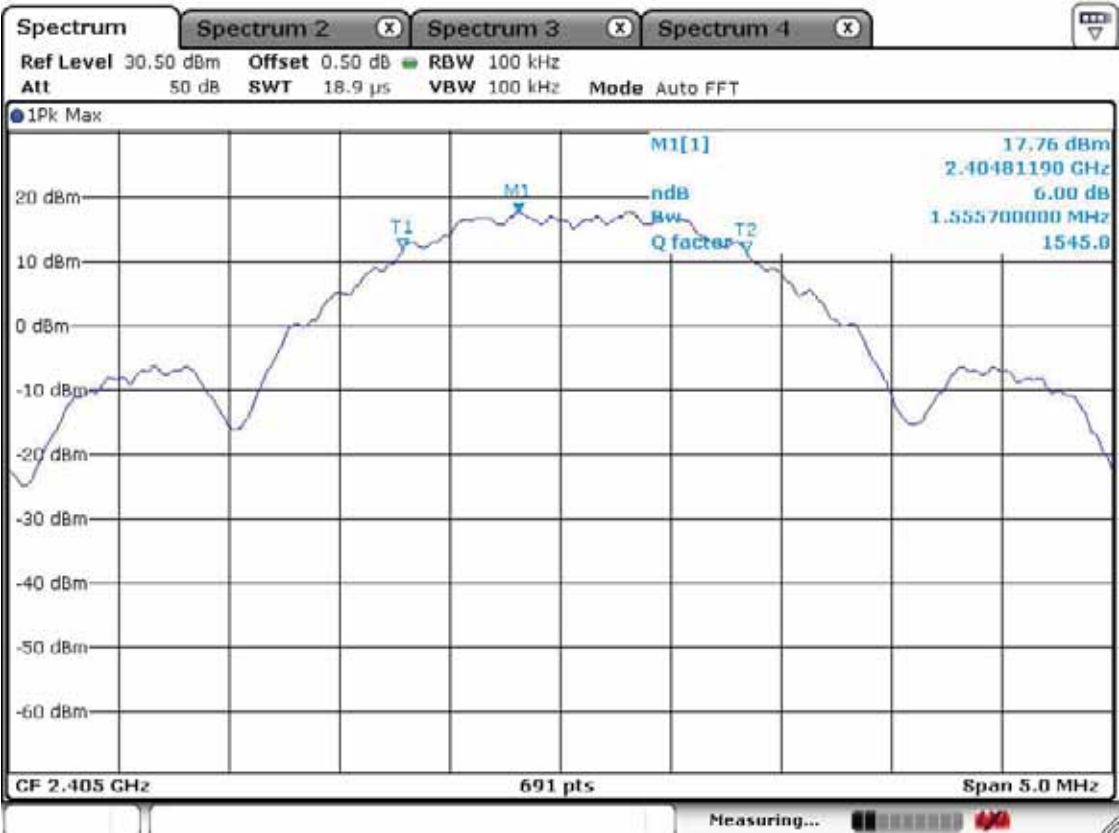
Minimum Standard:

6 dB Bandwidth > 500kHz

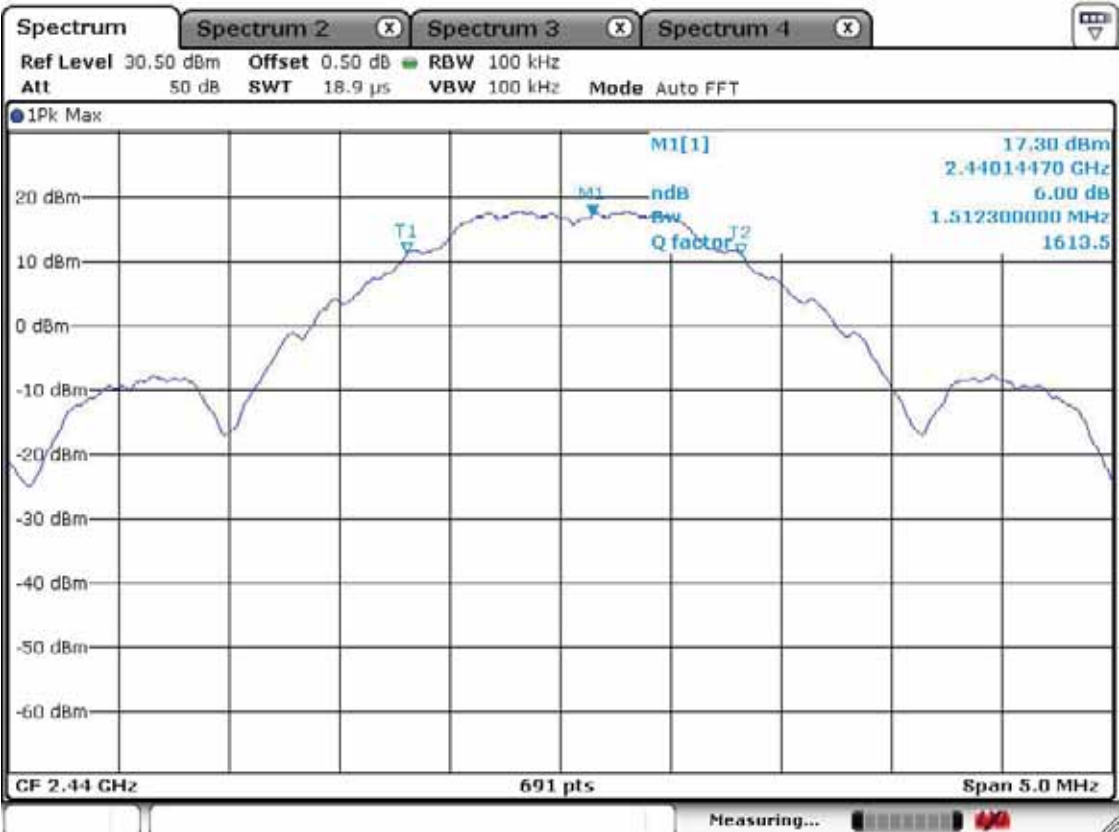
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

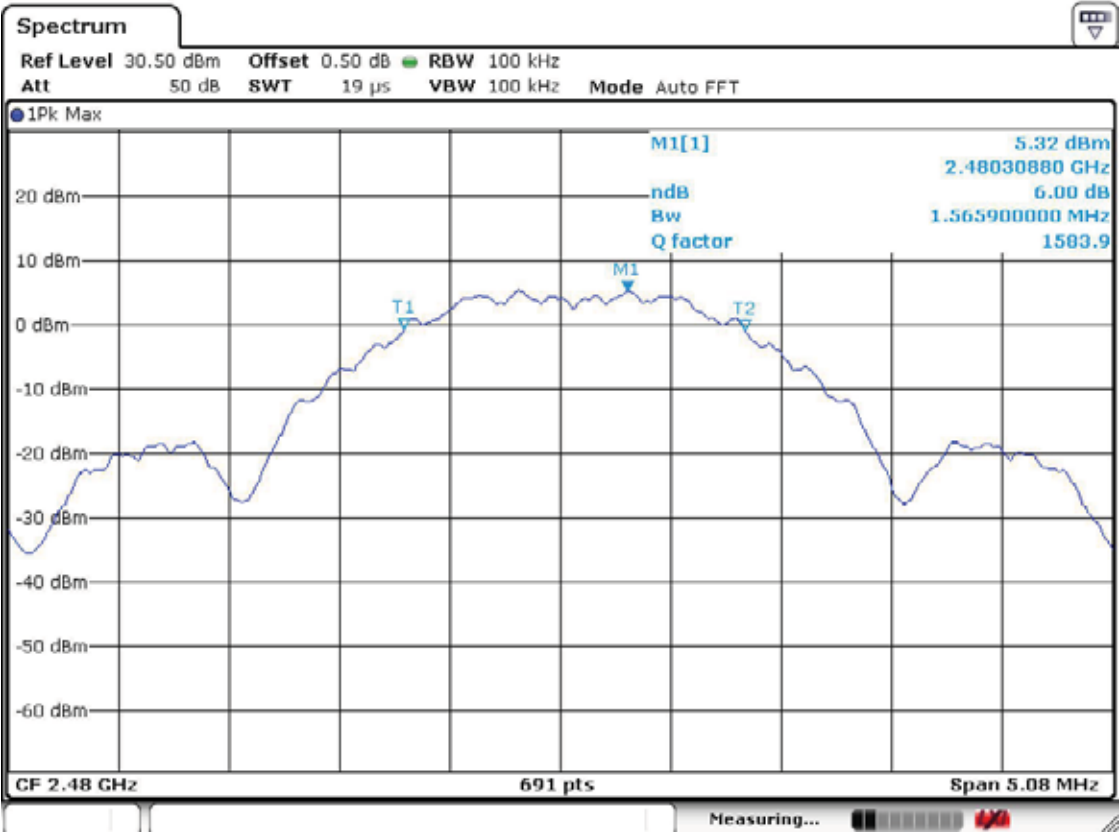
SPI interface
CH 11



CH 18



CH 26

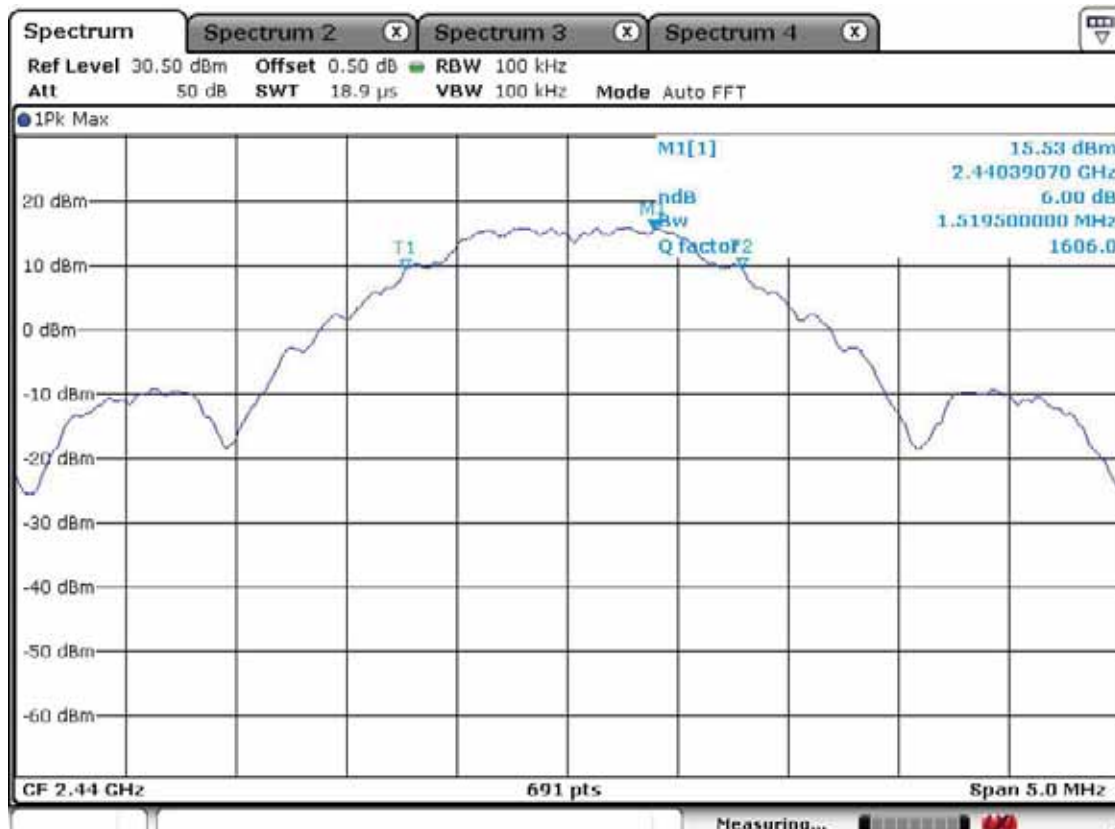


UART interface

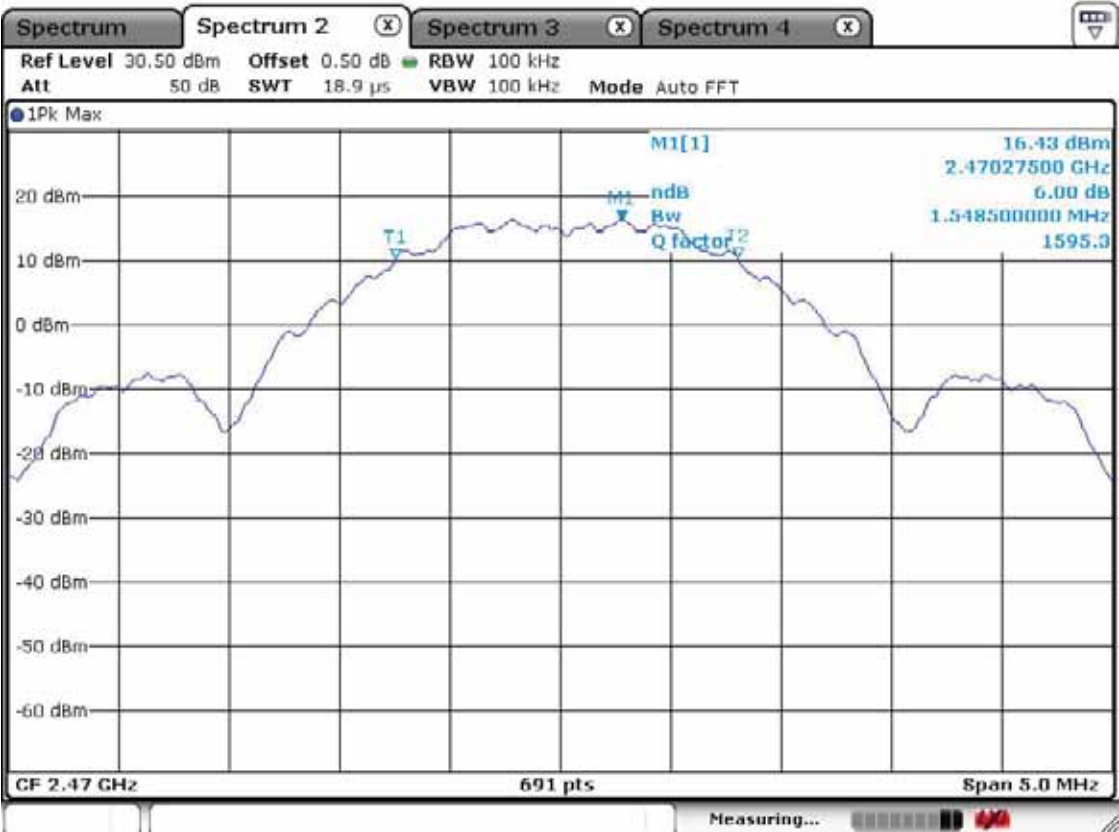
CH 11



CH 18



CH 24



3.3.2 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 = 3MHz (VBW \geq RBW)

Sweep = auto

Detector function = peak

Measurement Data:

Mode	Frequency (MHz)	Channel No.	Test Results	
			Measured Data (dBm)	Result
SPI	11	2405	22.80	Complies
	18	2440	22.74	Complies
	26	2480	11.11	Complies
UART	11	2405	21.14	Complies
	18	2440	21.18	Complies
	24	2470	21.41	Complies

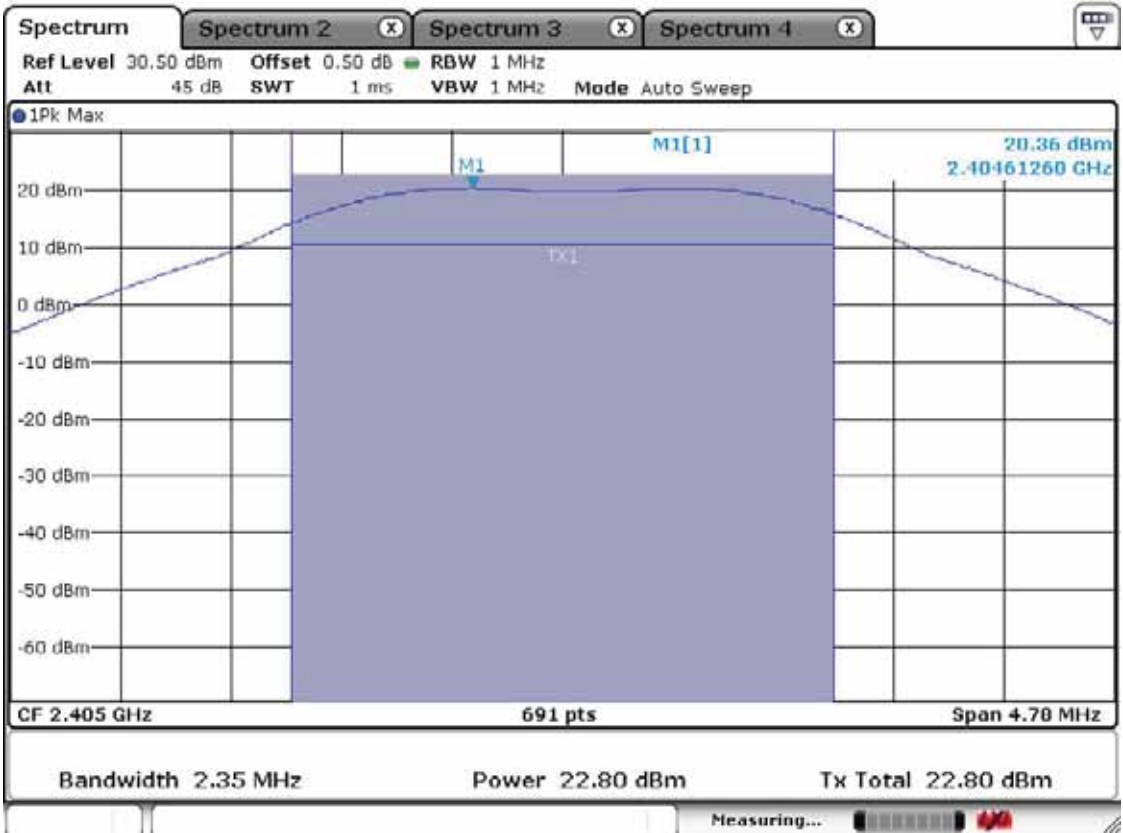
-

- See next pages for actual measured spectrum plots.

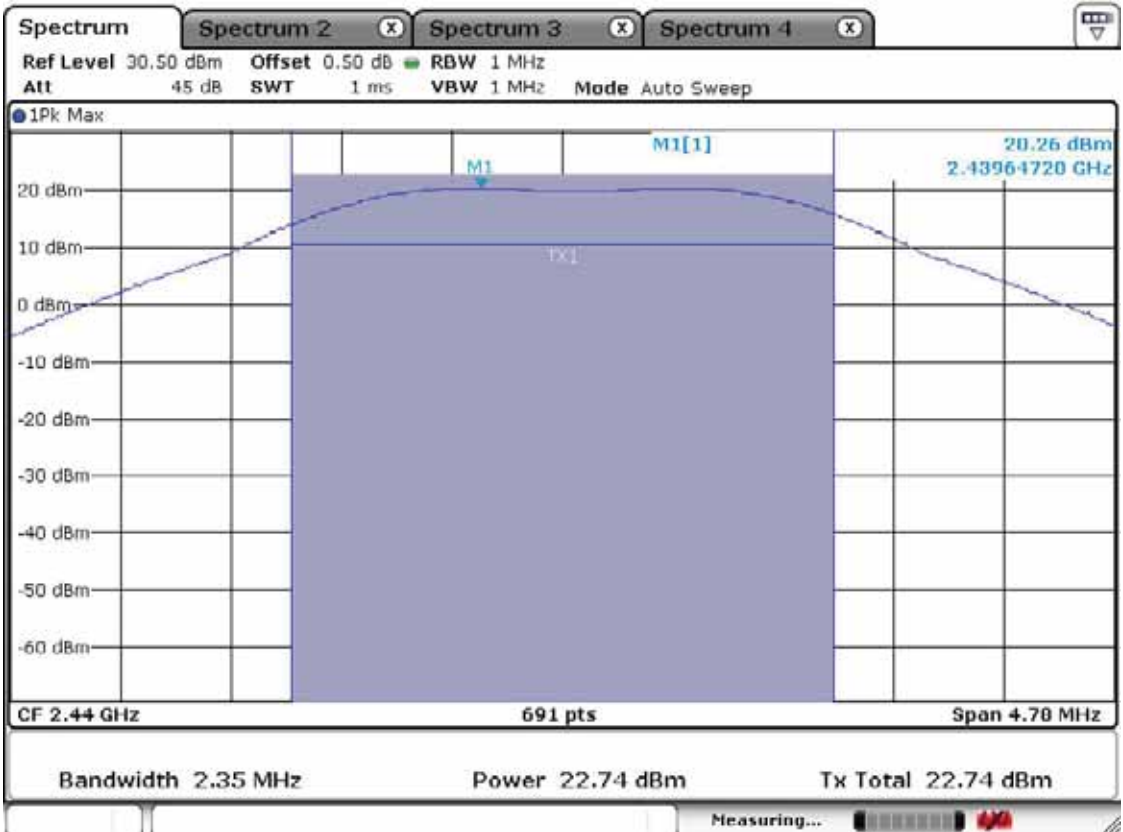
Minimum Standard:

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

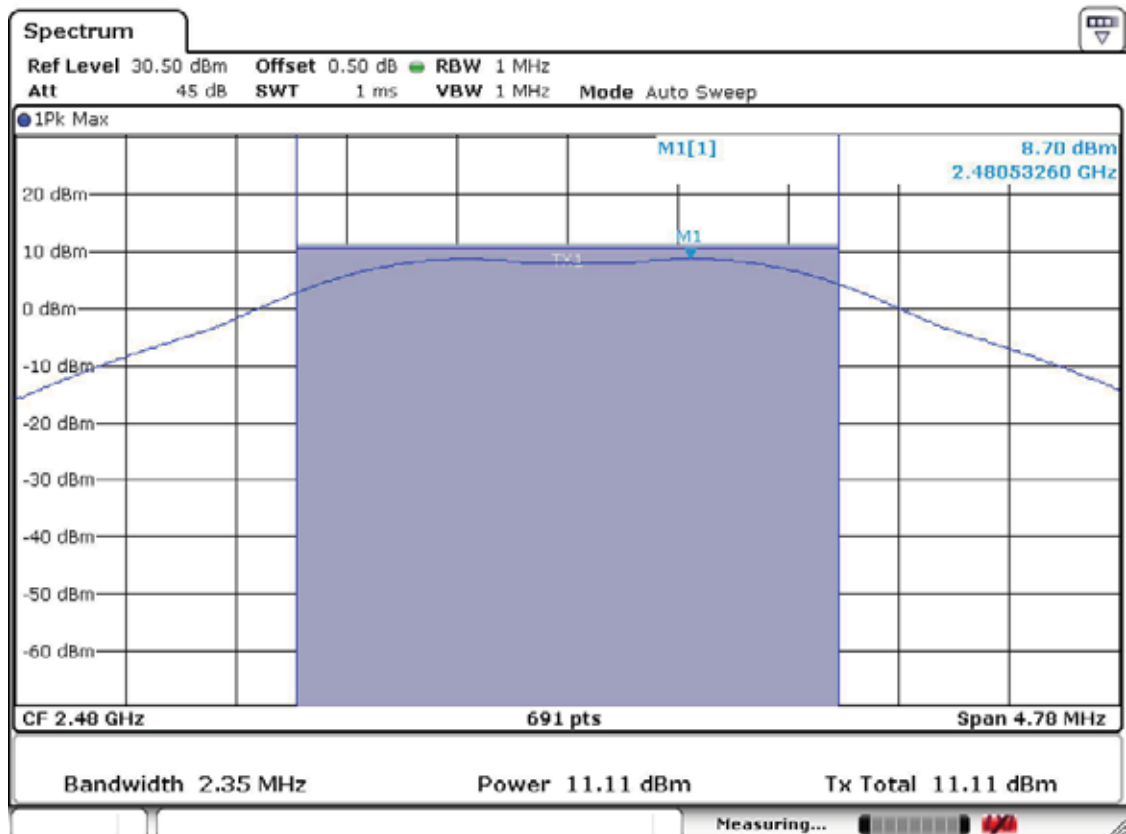
SPI interface
CH 11



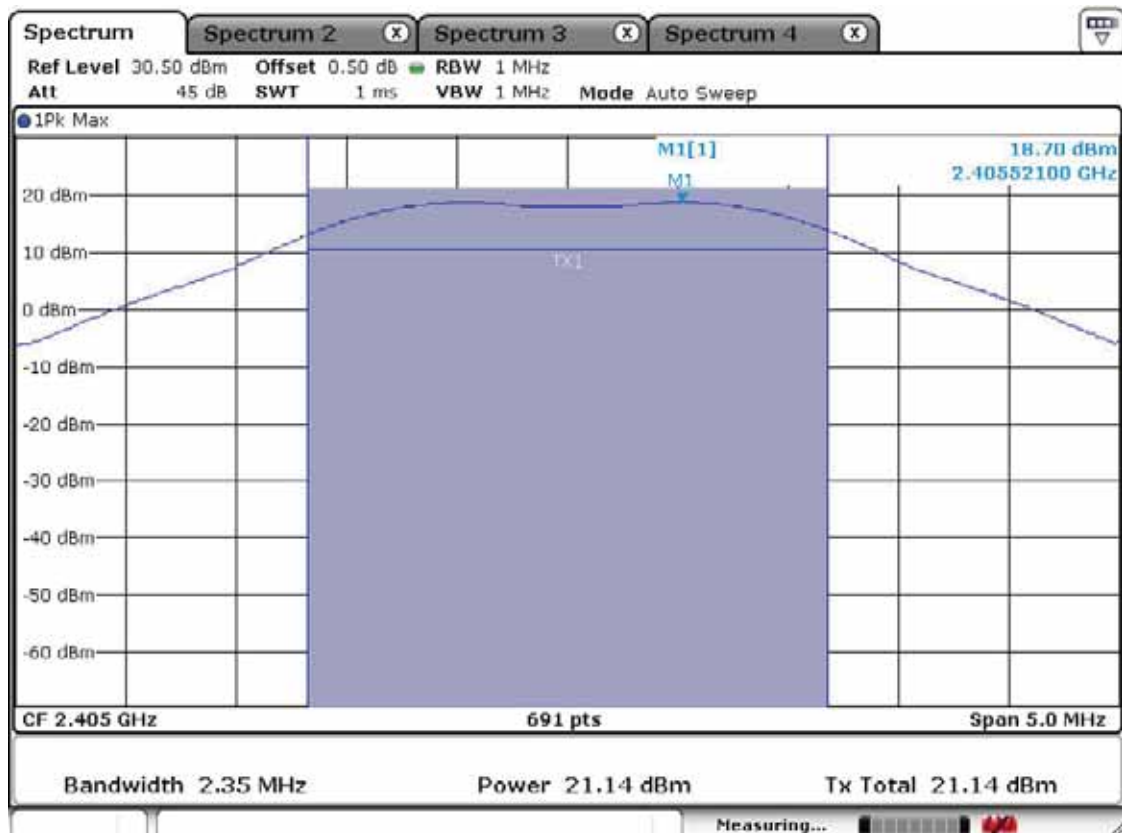
CH 18



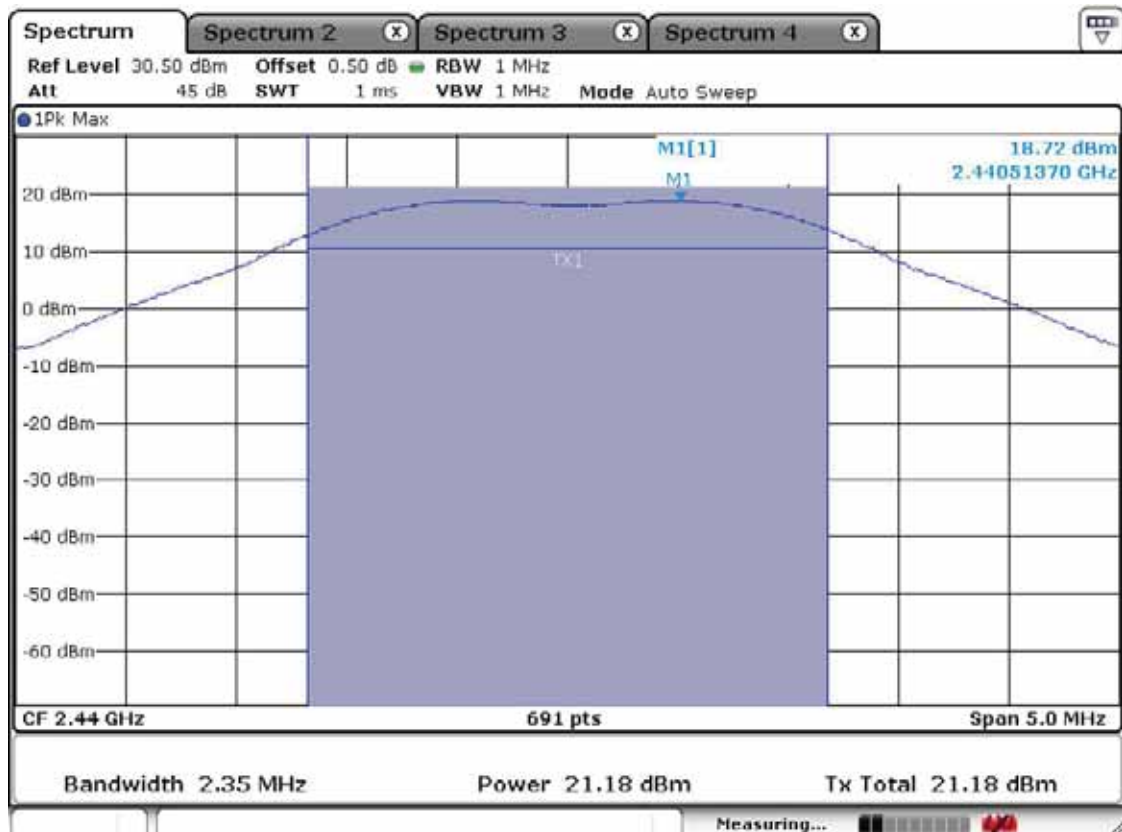
CH 26



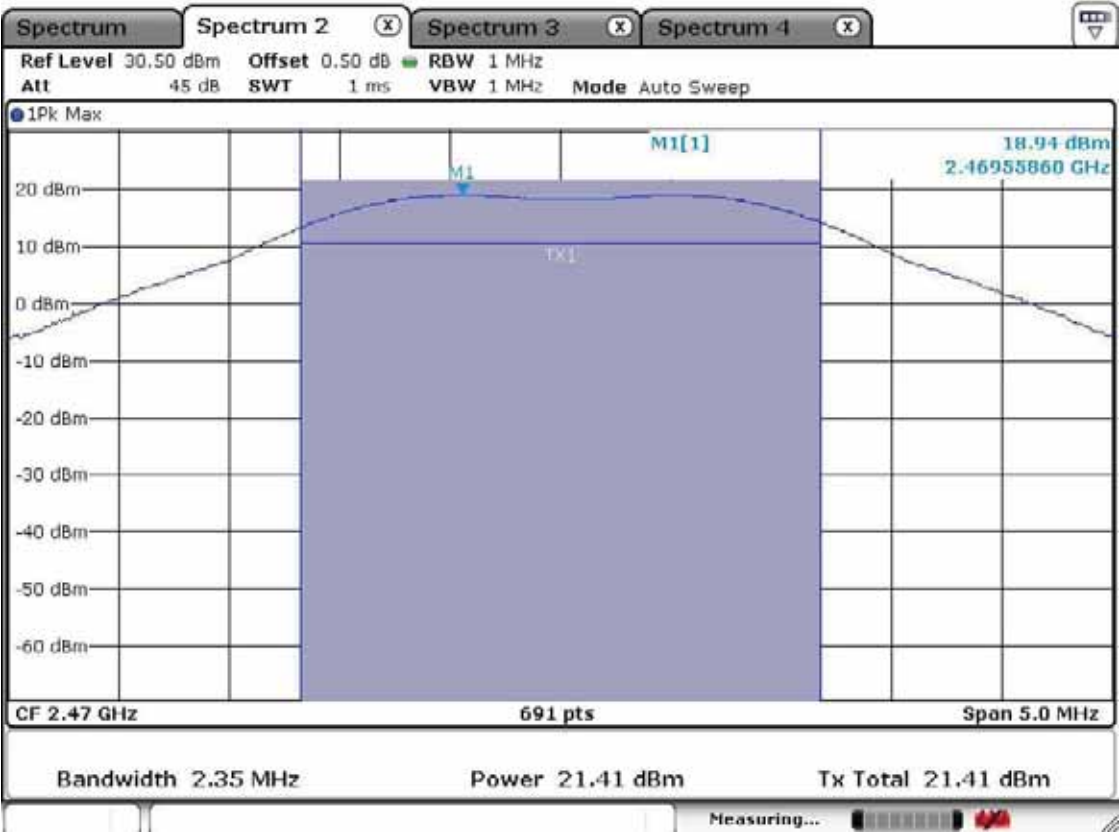
UART interface CH 11



CH 18



CH 24



3.3.3 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 = 10 kHz

Sweep = 1000 sec

Detector function = peak

Trace = max hold

Measurement Data:

Mode	Ch.	Frequency (MHz)	Test Results	
			dBm	Result
SPI	11	2405	6.31	Complies
	18	2440	7.15	Complies
	26	2480	-6.31	Complies
UART	11	2405	4.12	Complies
	18	2440	5.17	Complies
	24	2470	4.75	Complies

- See next pages for actual measured spectrum plots.

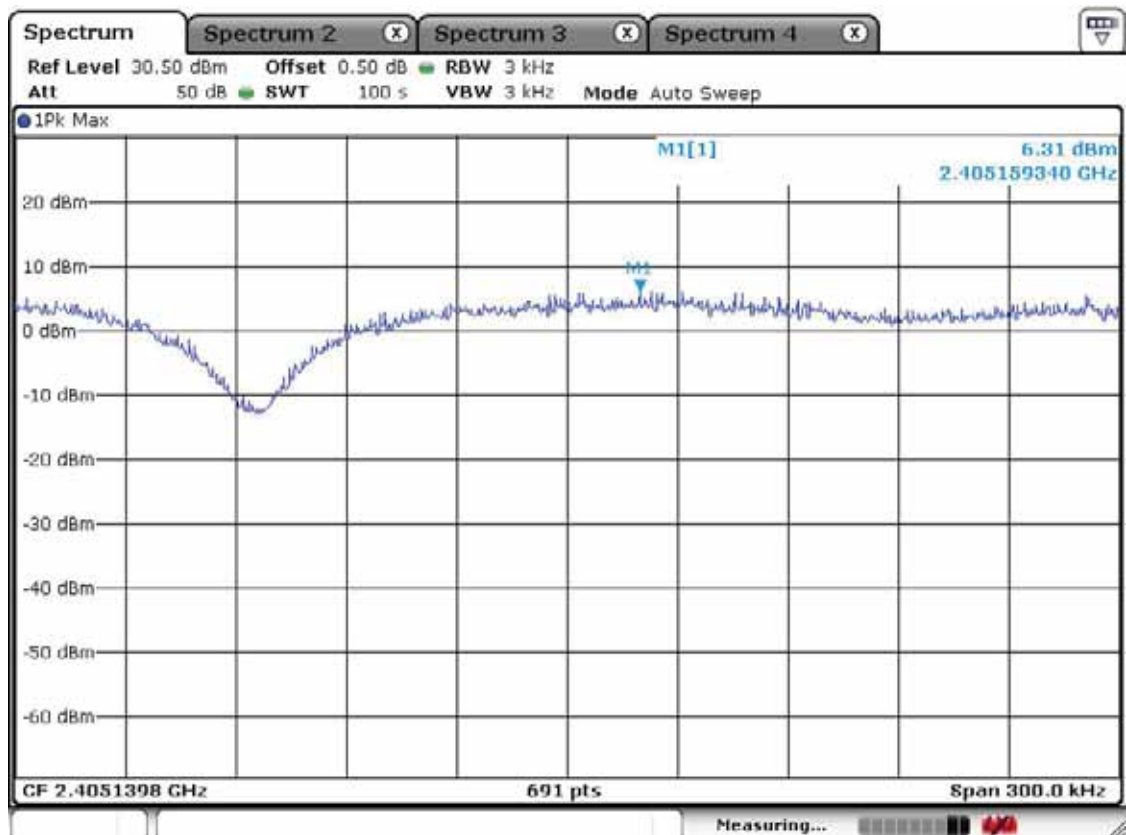
Minimum Standard:

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

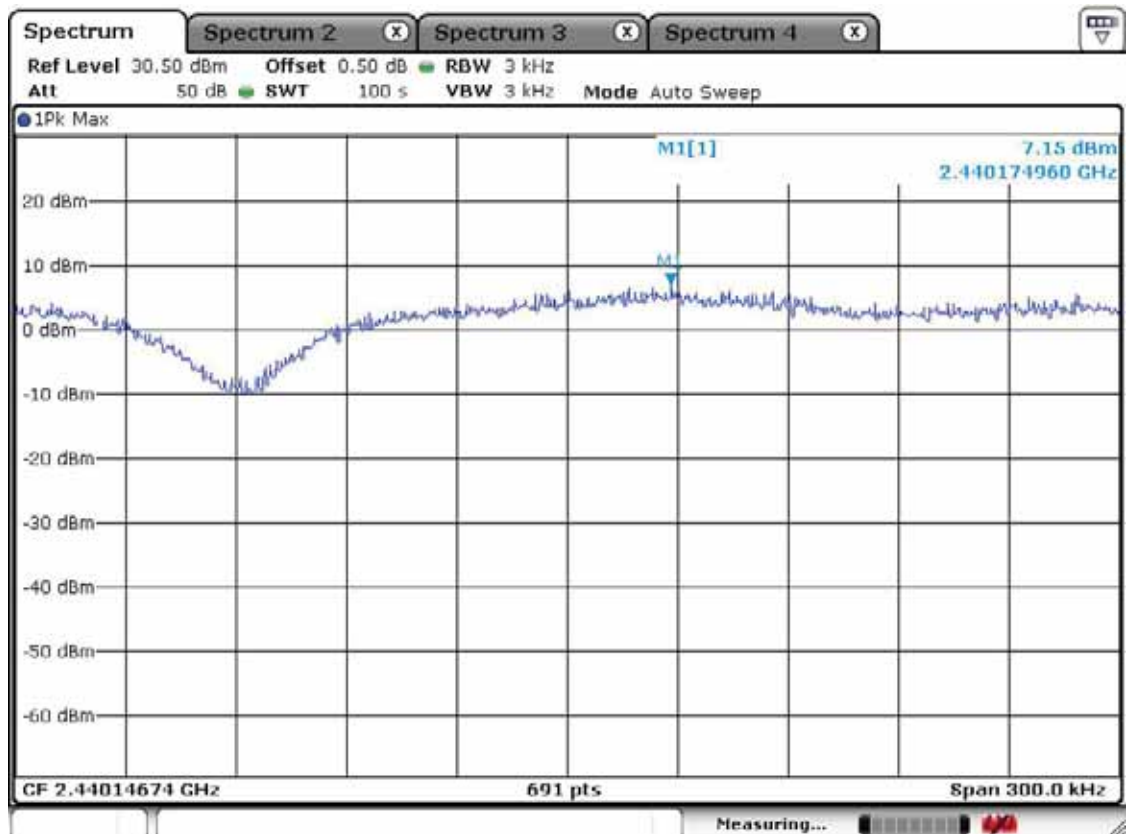
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

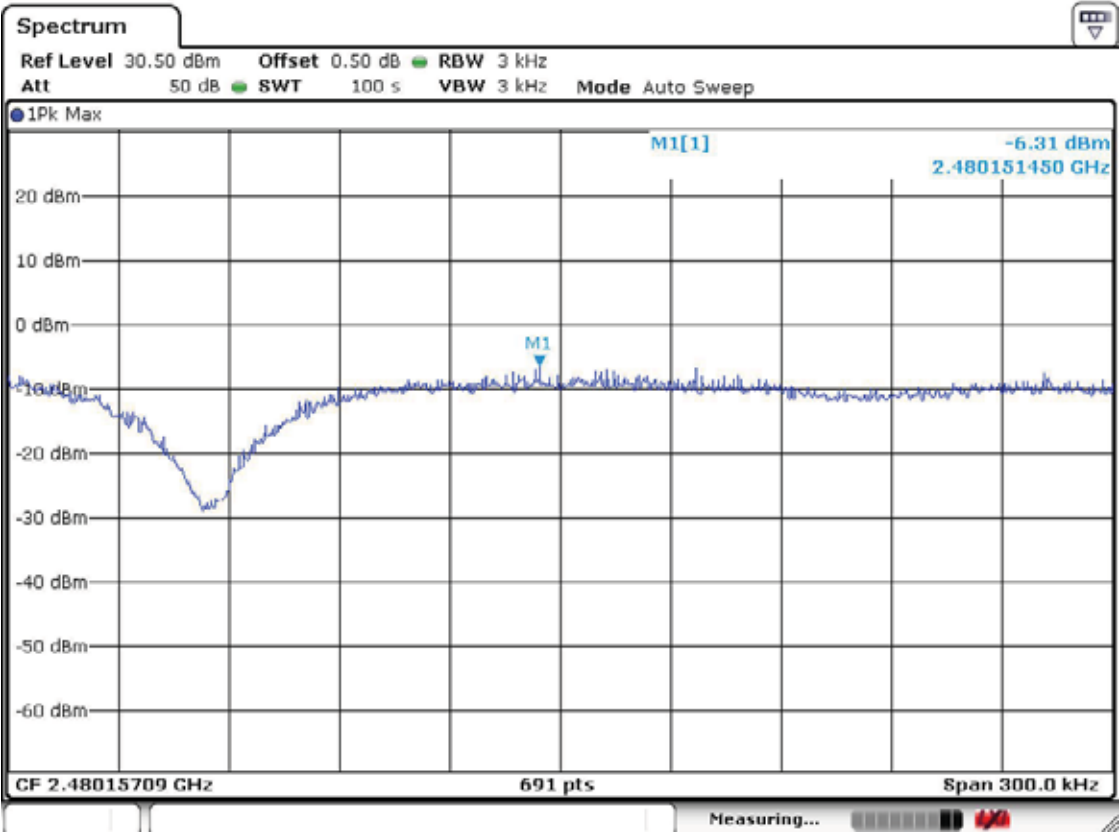
SPI interface
CH 11



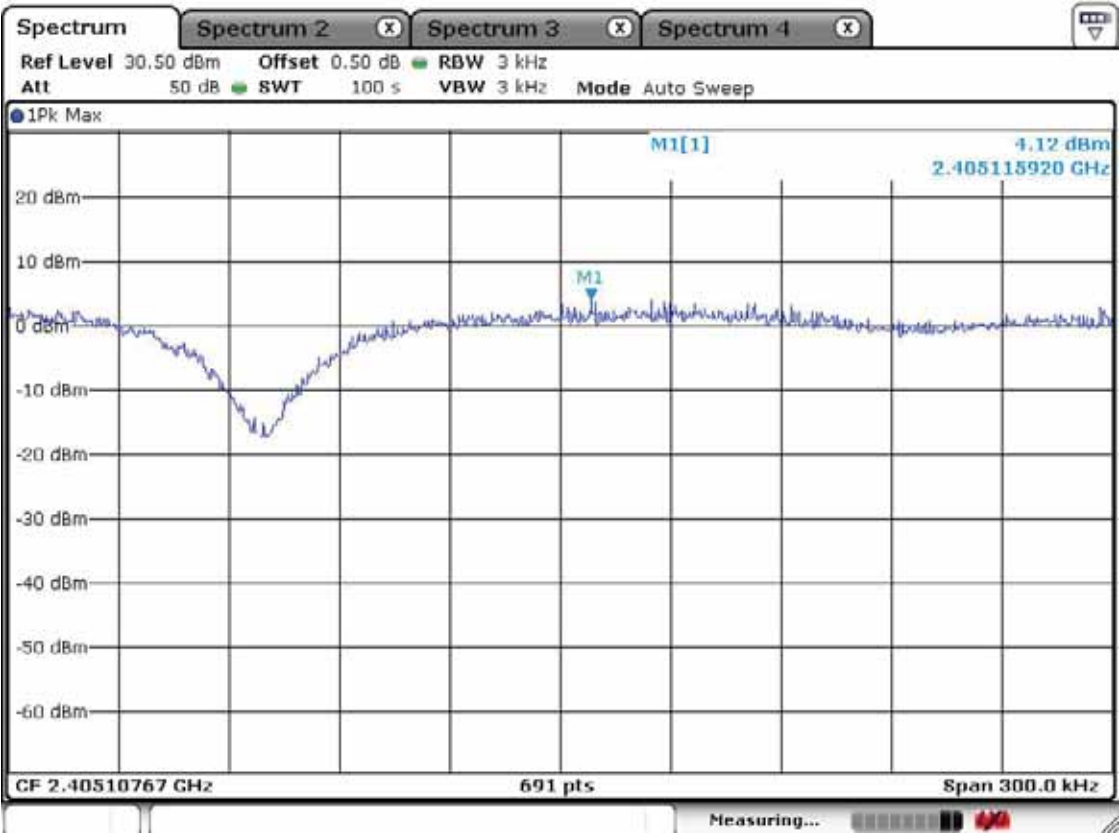
CH 18



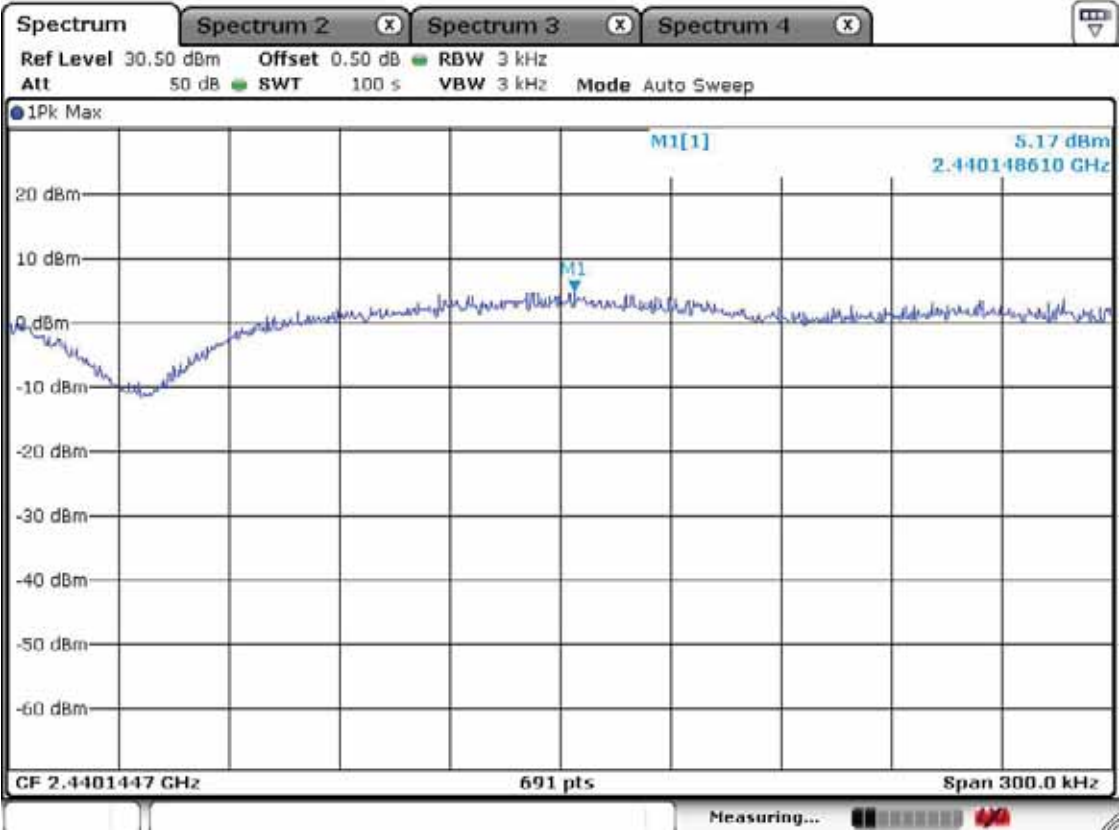
CH 26



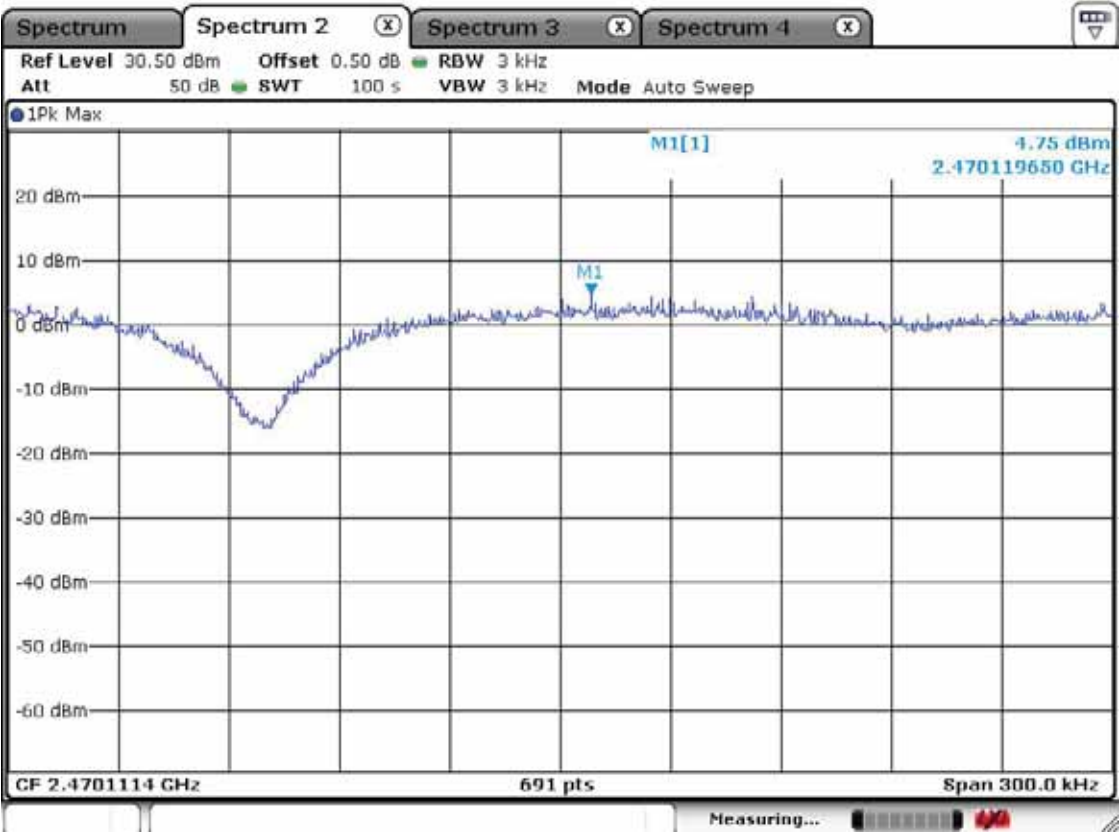
UART interface
CH 11



CH 18



CH 24



3.3.4 Band - edge

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 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

RBW = 100 kHz

VBW = 100 kHz

Span = 10 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

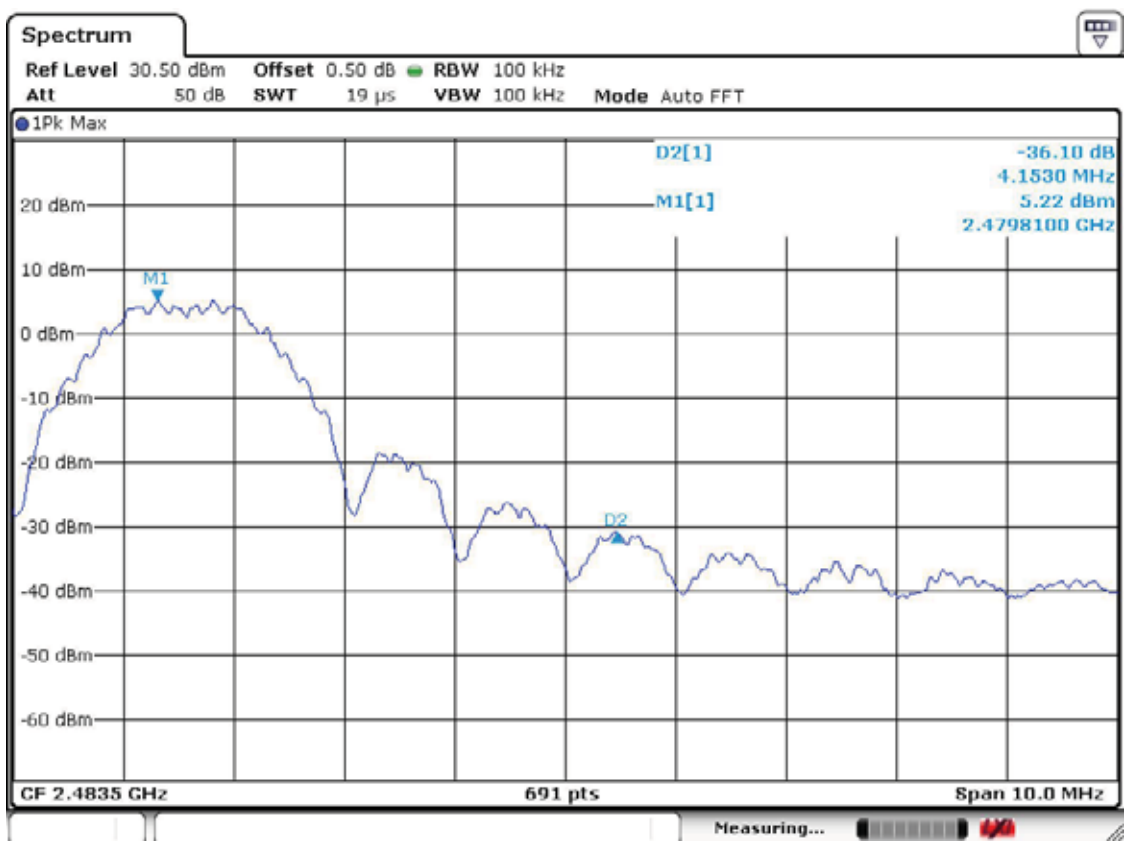
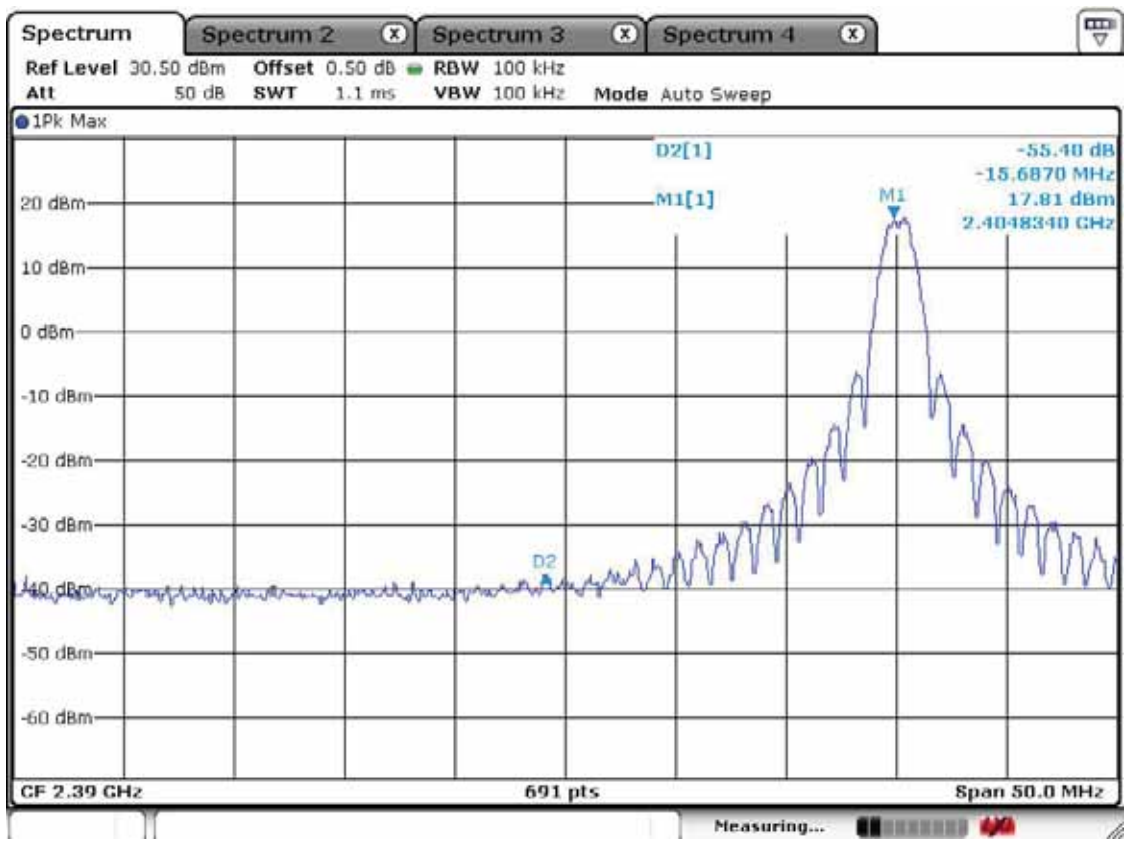
- All conducted emission in any 100kHz bandwidth outside of the spread spectrum band was at least 20dB lower than the highest inband spectral density. Therefore the applying equipment meets the requirement.
- See next pages for actual measured spectrum plots.

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

Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

SPI interface Band-edge : Conducted Measurements



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

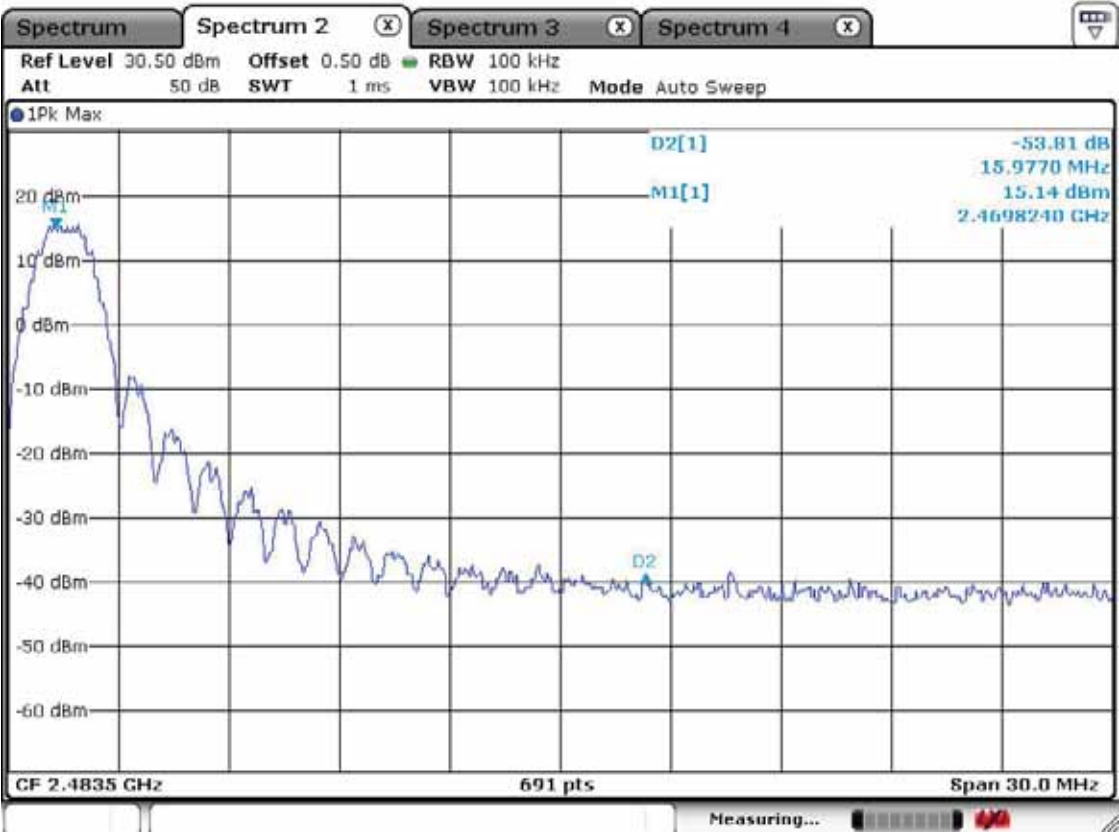
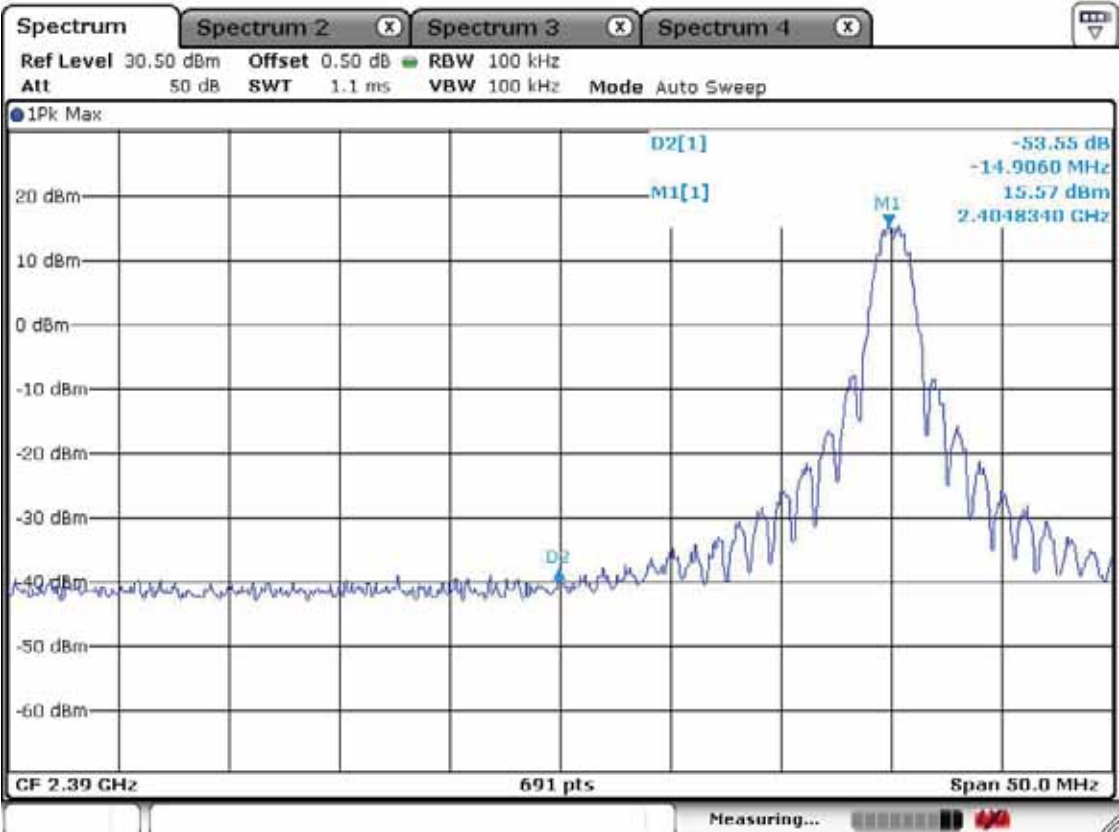
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390	50.3	62.2	V	26.0	36.0	8.2	54.0	74.0	48.5	60.4	5.5	13.6

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	
2483.5	54.2	66.3	V	26.0	36.0	8.2	54.0	74.0	52.4	64.5	1.6	9.5

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

UART interface Band-edge : Conducted Measurements



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

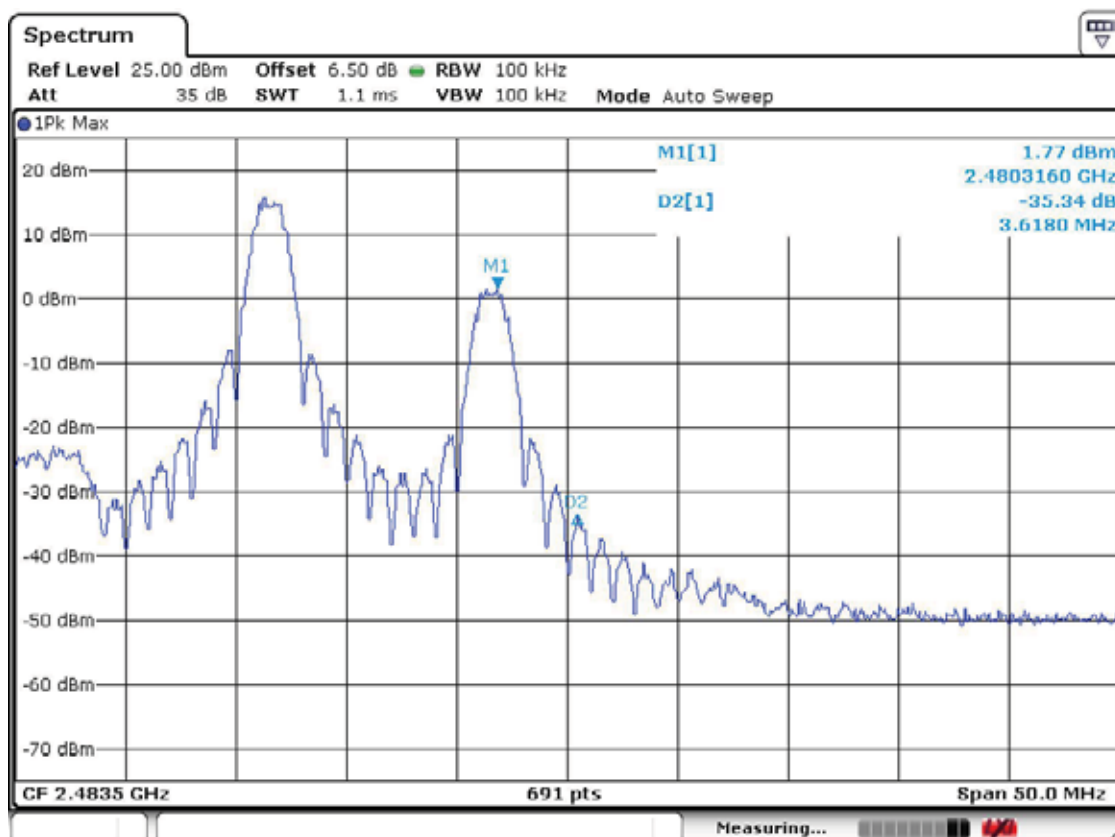
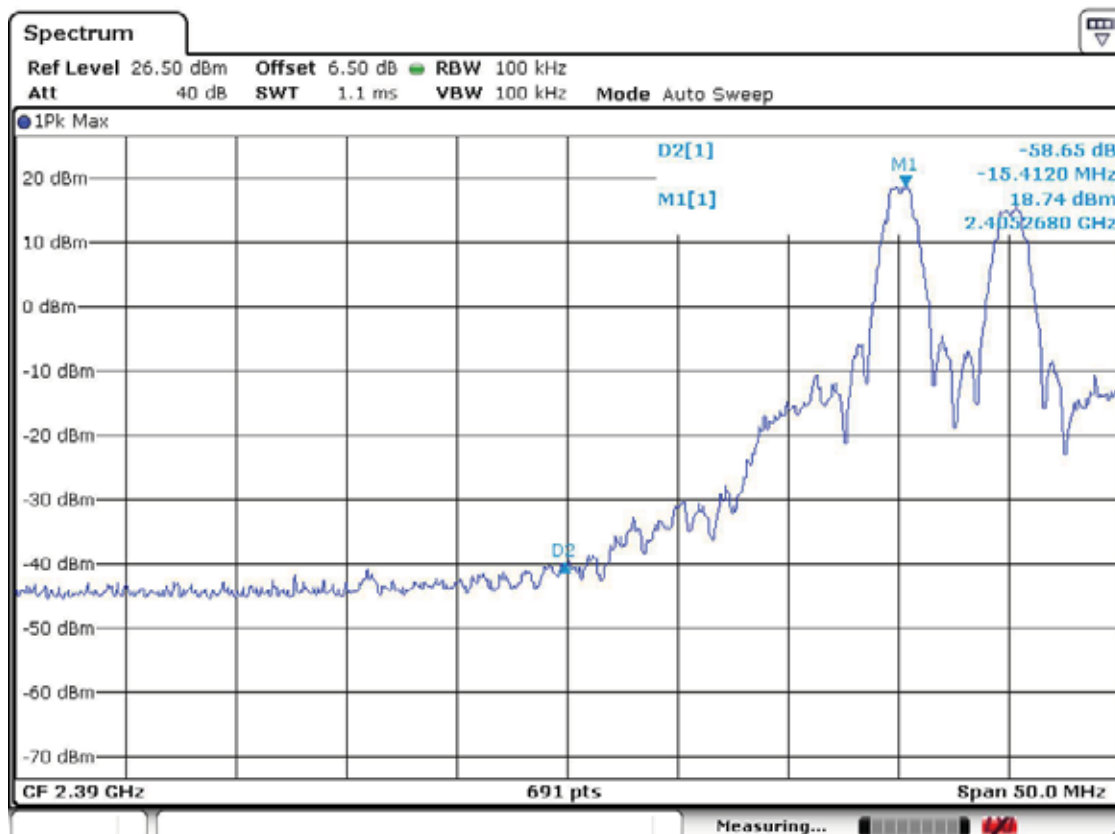
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390	51.2	63.8	V	26.0	36.0	8.2	54.0	74.0	49.4	62.0	4.6	12.0

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	
2483.5	52.8	64.6	V	26.0	36.0	8.2	54.0	74.0	51.0	62.8	3.0	11.2

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

Intermodulation Band-edge : Conducted Measurements



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

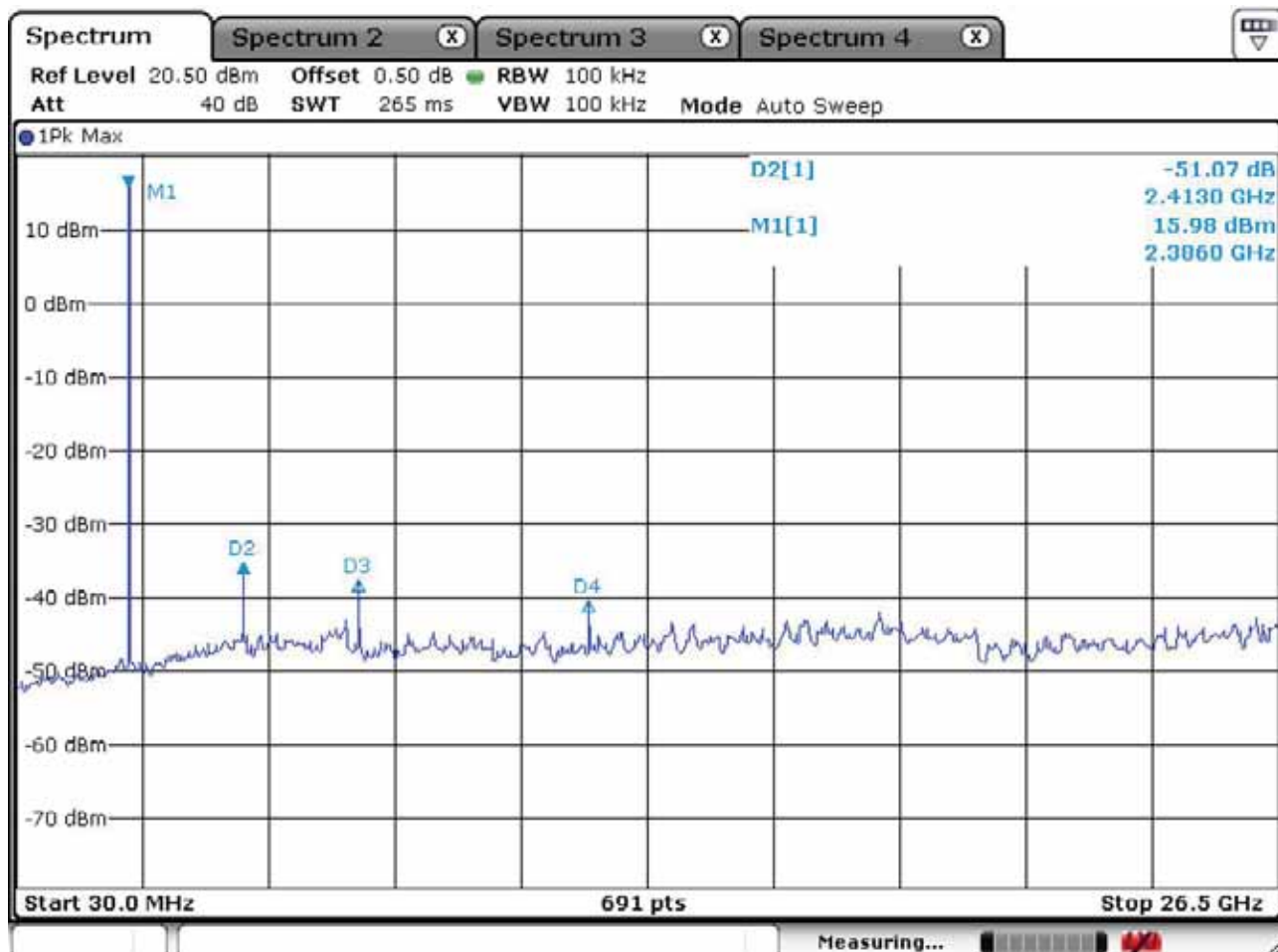
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390	50.1	62.4	V	26.0	36.0	8.2	54.0	74.0	48.3	60.6	5.7	13.4

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

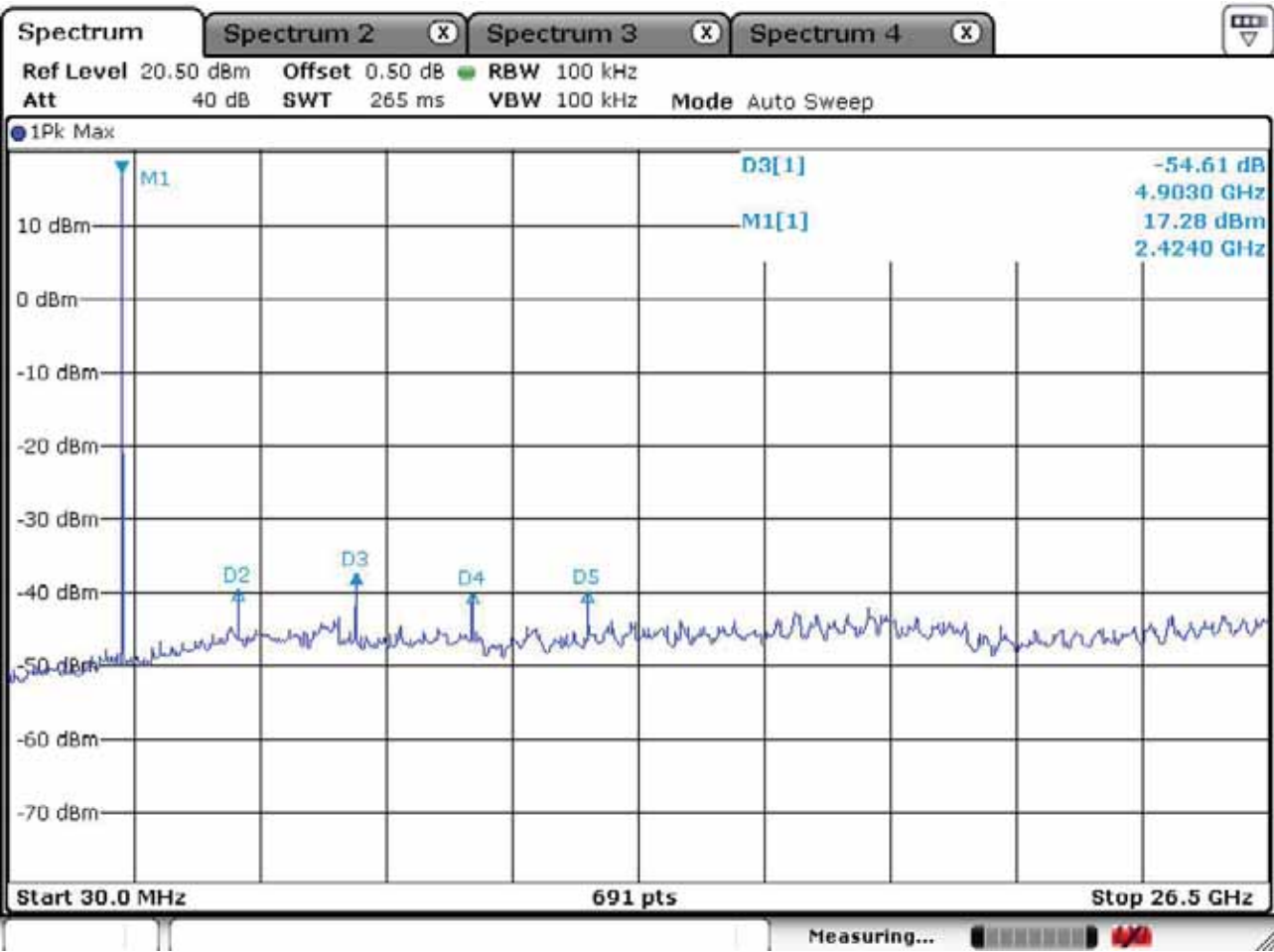
Frequency	Reading		Pol.	Correction			Limits		Result		Margin	
	[dBuV/m]			Factor			[dBuV/m]		[dBuV/m]		[dB]	
[MHz]	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2483.5	53.4	65.4	V	26.0	36.0	8.2	54.0	74.0	51.6	63.6	2.4	10.4

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

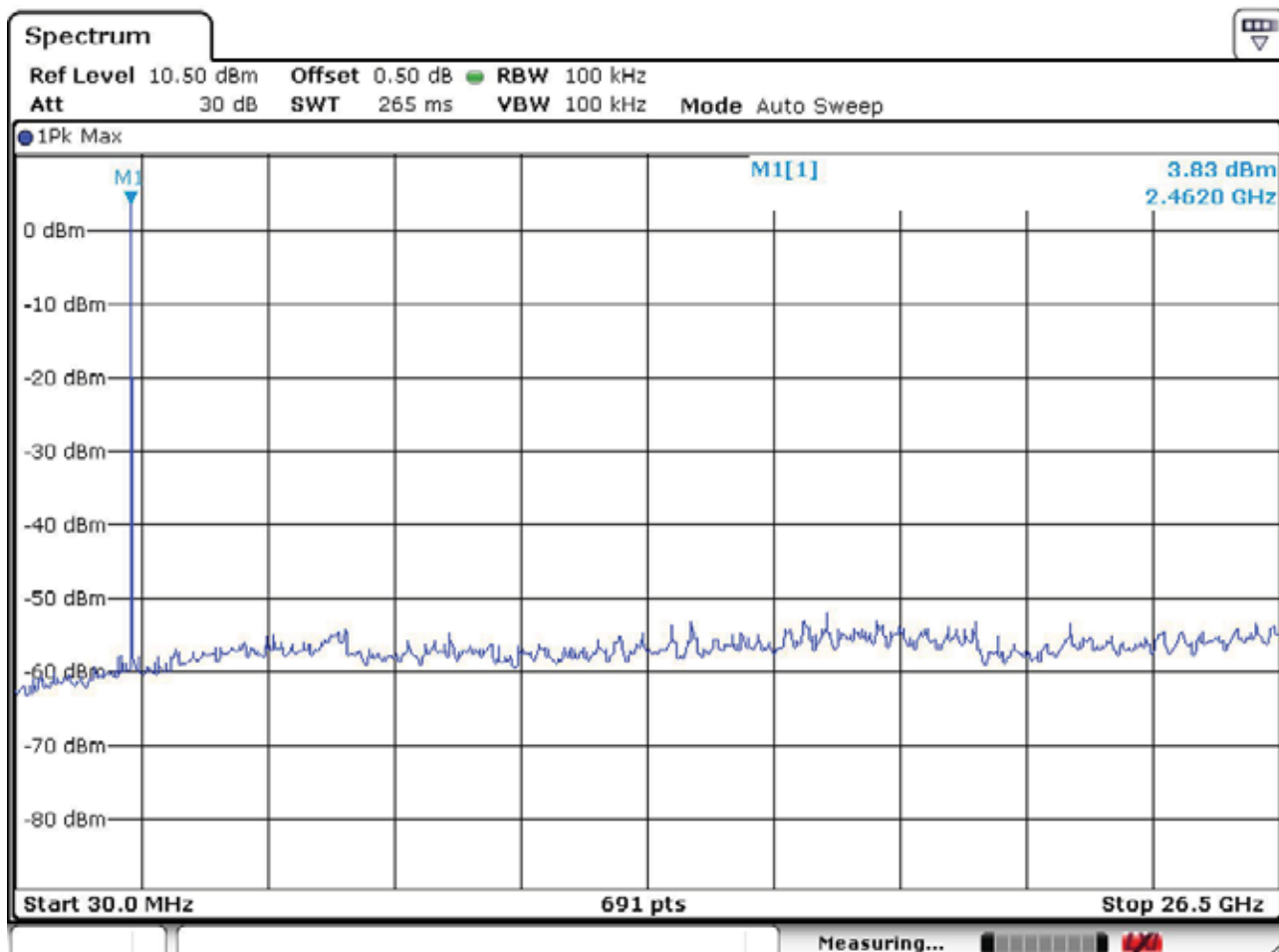
SPI interface - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



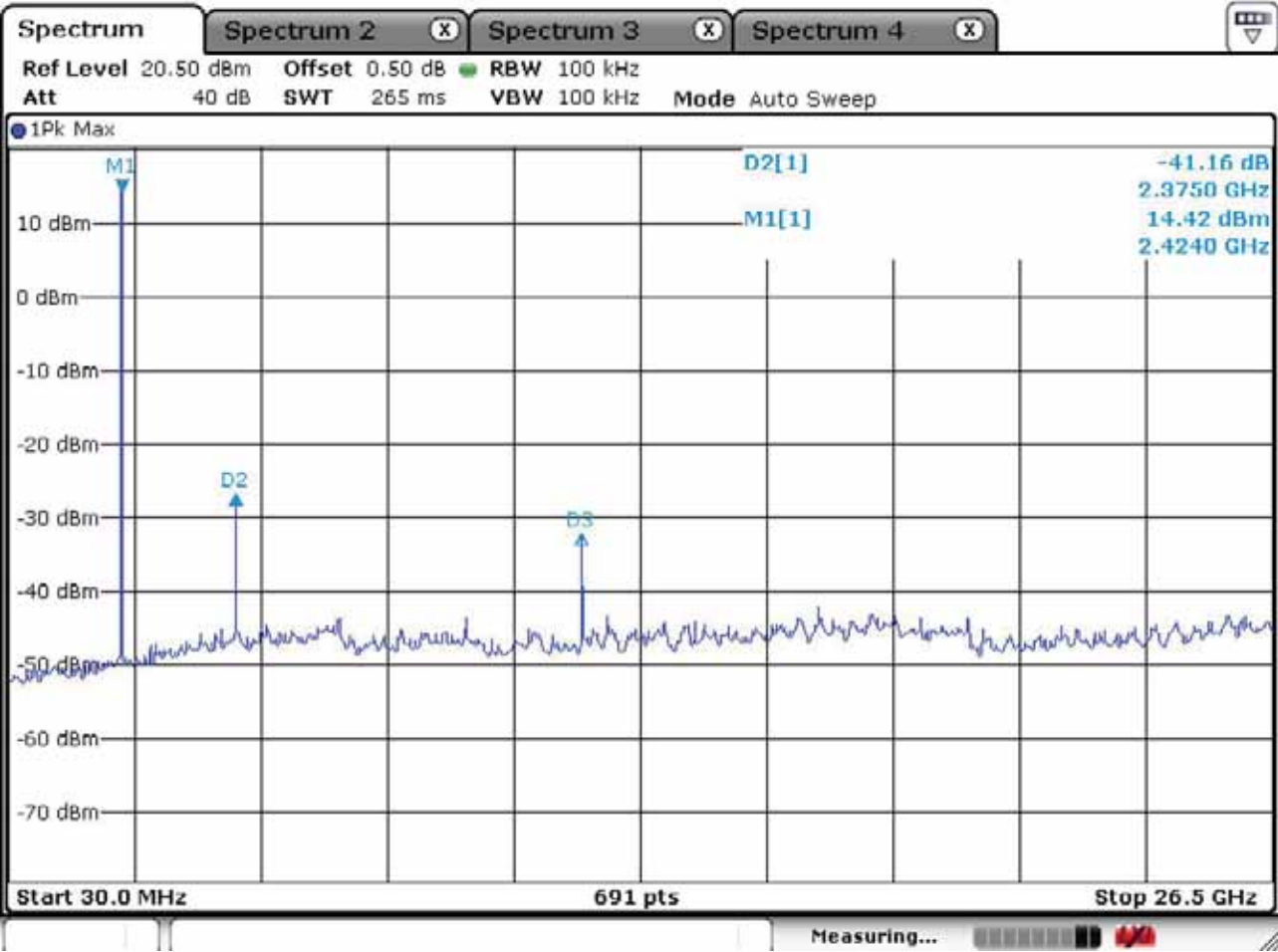
SPI interface - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



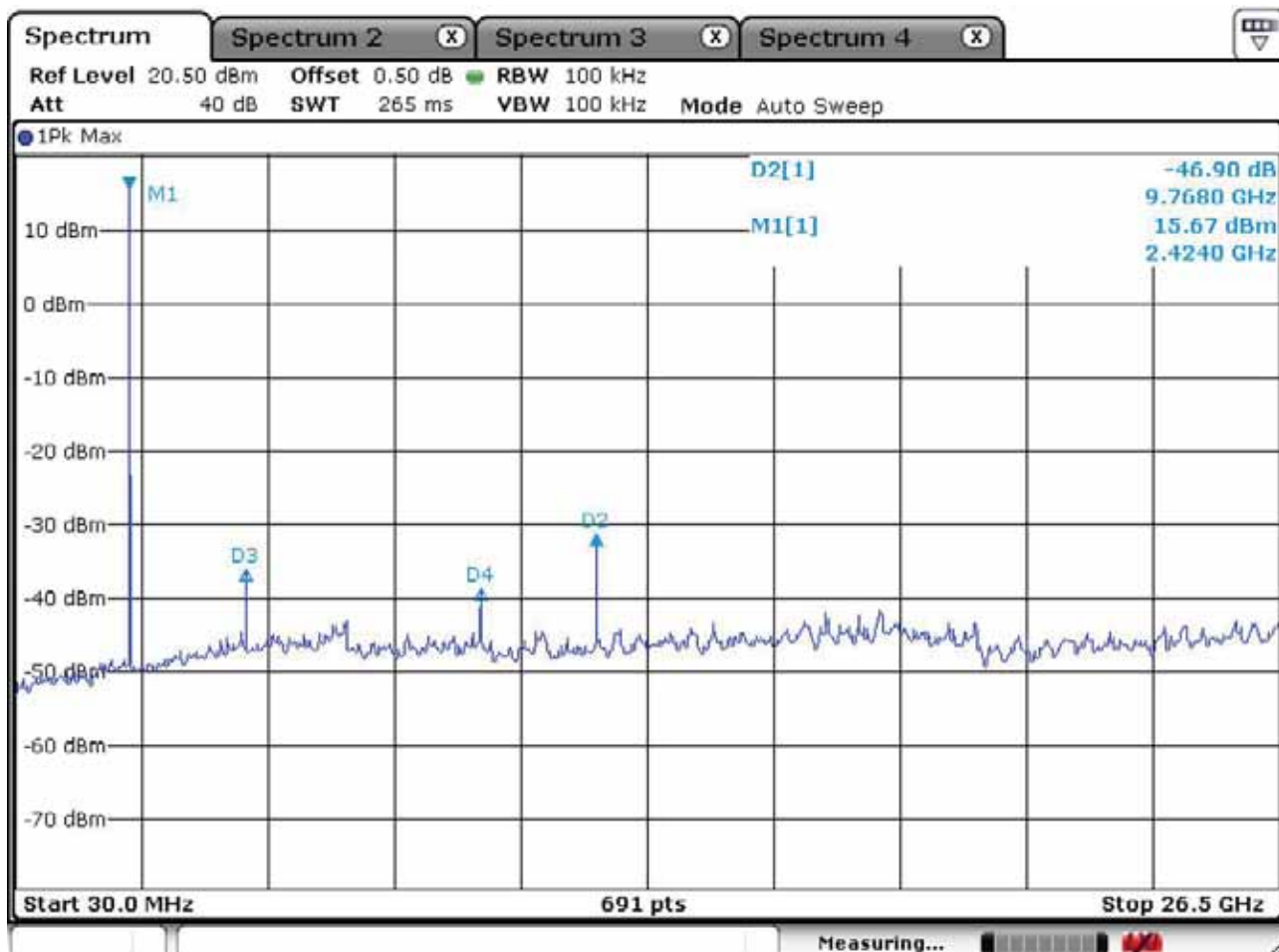
SPI interface – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



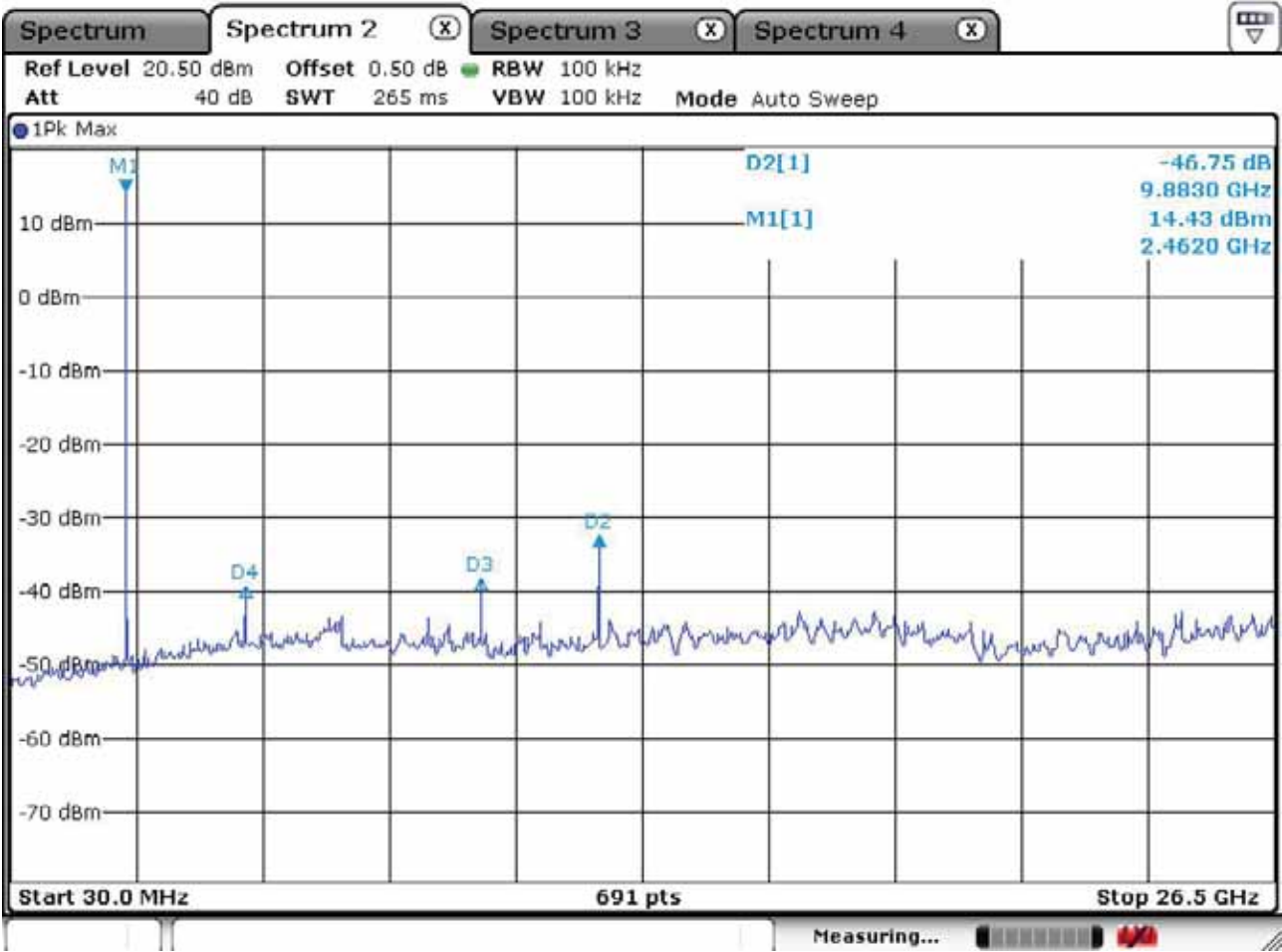
UART interface - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



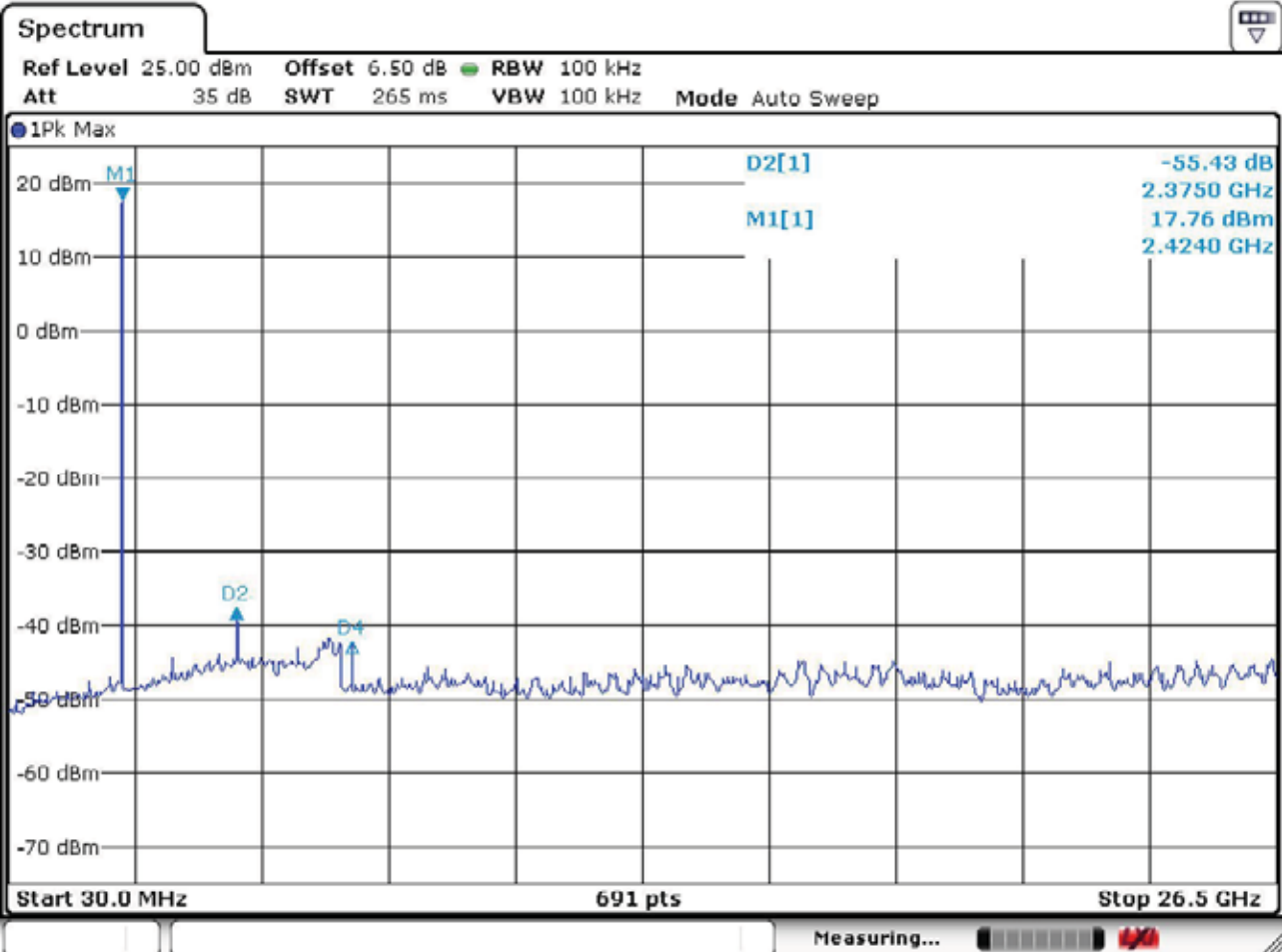
UART interface - Mid channel
Frequency Range = 30 MHz ~ 10th harmonic.



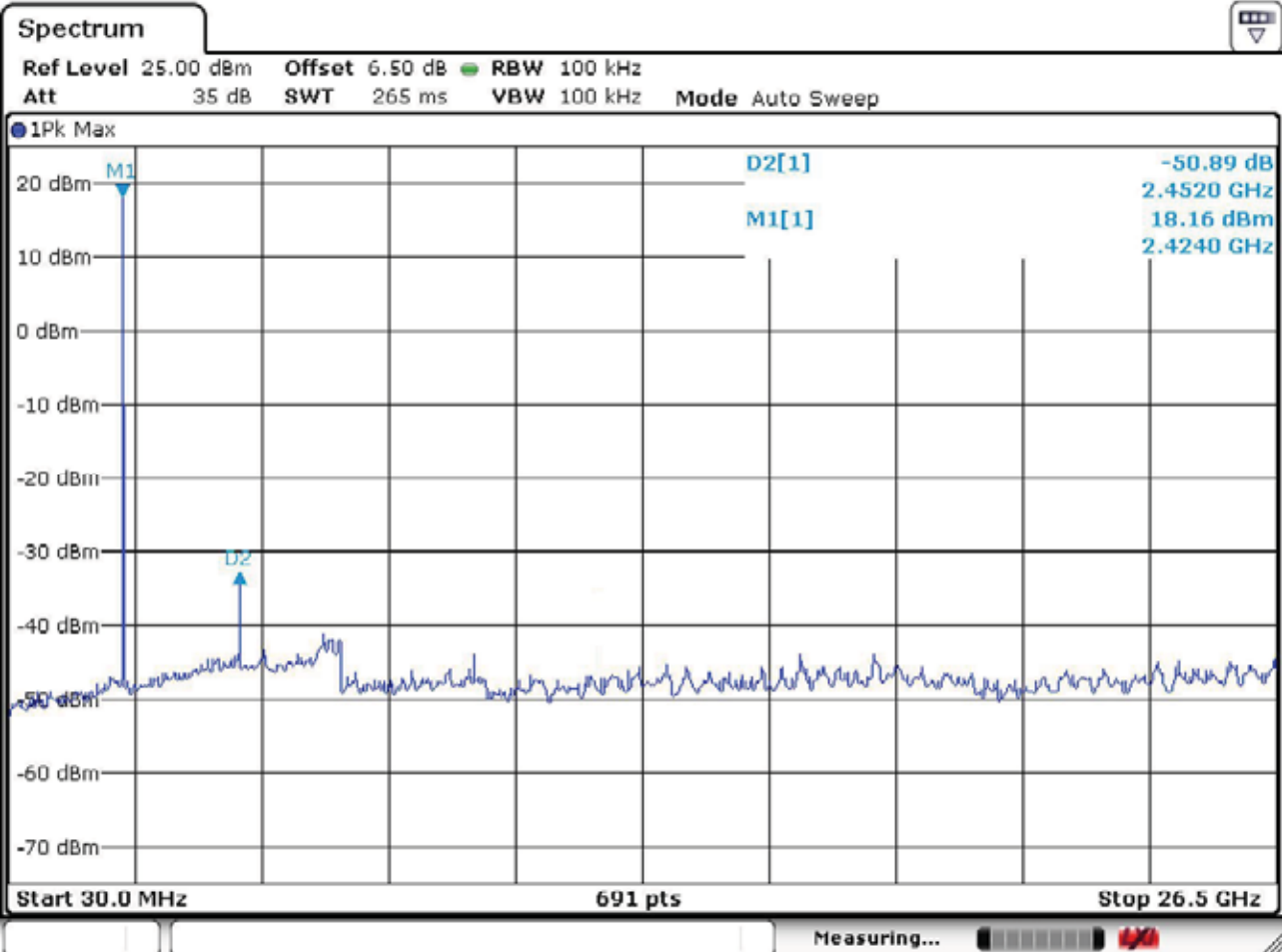
UART interface – High channel
Frequency Range = 30 MHz ~ 10th harmonic.



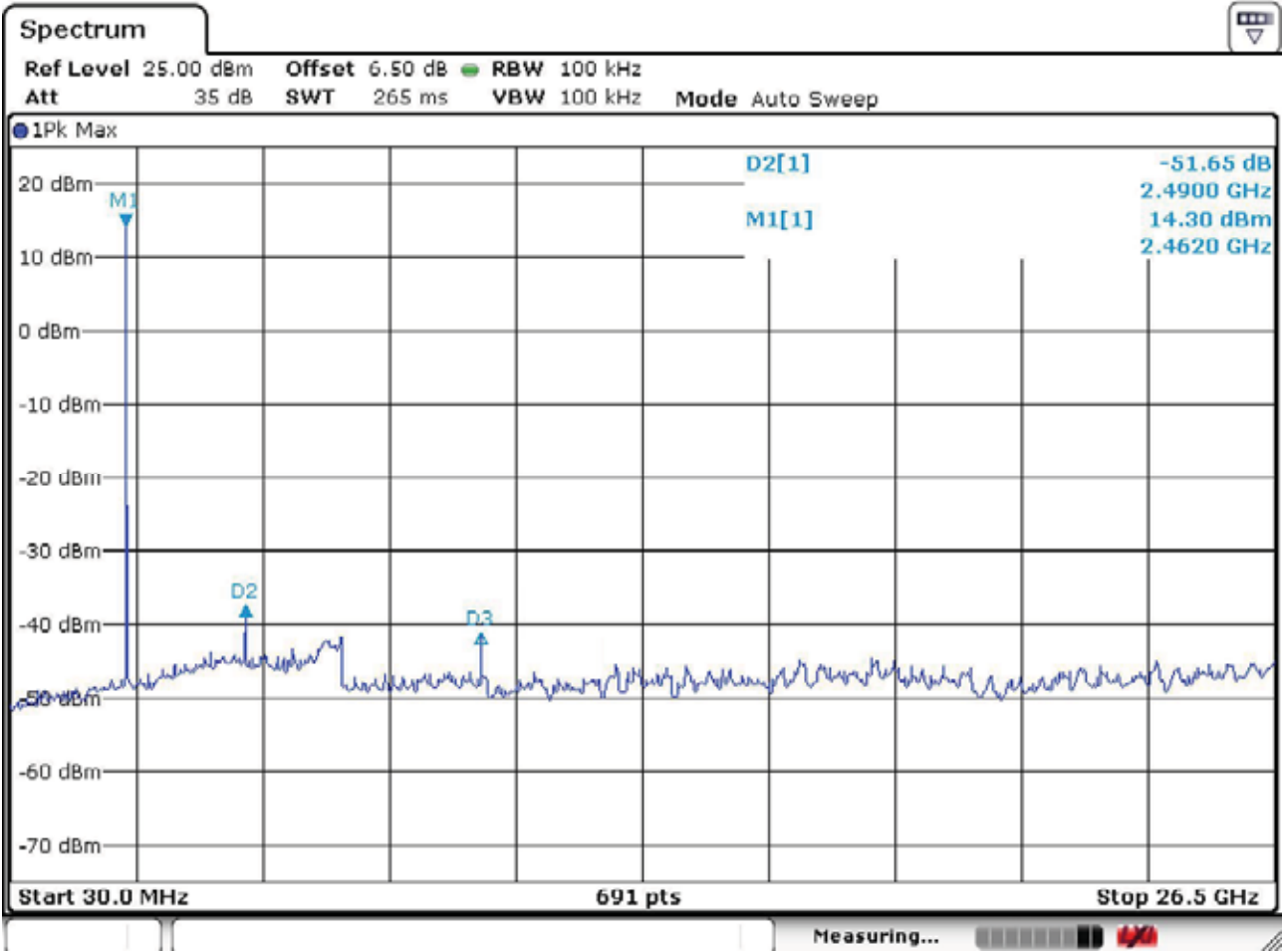
Intermodulation - Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



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



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



3.3.5 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)

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Trace = max hold

Peak:VBW \geq RBW

Average:VBW=10Hz

Detector function = Peak and Average

Sweep = auto

Measurement Data: Complies

- Refer to the next page.
- No other emissions were detected at a level greater than 10dB below limit.
- The three antennas were used with this EUT during the Testing.
- The used Test mode is “SPI Mode + UART Mode” 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.

SPI interface 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	
4810	45.3	53.3	V	31.4	34.6	8.7	54.0	74.0	50.8	58.8	3.3	15.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	45.8	54.0	V	31.4	34.6	8.7	54.0	74.0	51.3	59.5	2.8	14.6
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

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

UART interface 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	
4810	43.4	51.8	V	31.4	34.6	8.7	54.0	74.0	48.9	57.3	5.2	16.8
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	43.8	51.2	V	31.4	34.6	8.7	54.0	74.0	49.3	56.7	4.8	17.4
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4960	43.1	51.6	V	31.4	34.6	8.7	54.0	74.0	48.6	57.1	5.4	17.0
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

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

Intermodulation 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	
4810	42.5	50.1	V	31.4	34.6	8.7	54.0	74.0	48.0	55.6	6.1	18.5
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	44.5	52.7	V	31.4	34.6	8.7	54.0	74.0	50.0	58.2	4.1	15.9
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
4960	42.1	49.5	V	31.4	34.6	8.7	54.0	74.0	47.6	55.0	6.4	19.1
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

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

Radiated Emissions – PING+ZIGBEE Mode

243 Jubug-ni, yangji-Myeon, Youngin-si,
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Tel :+82-31-3236008,9
Fax:+82-31-3236010

EUT/Model No.: HES1E000R0WW

TEST MODE: PING + ZIGBEE mode

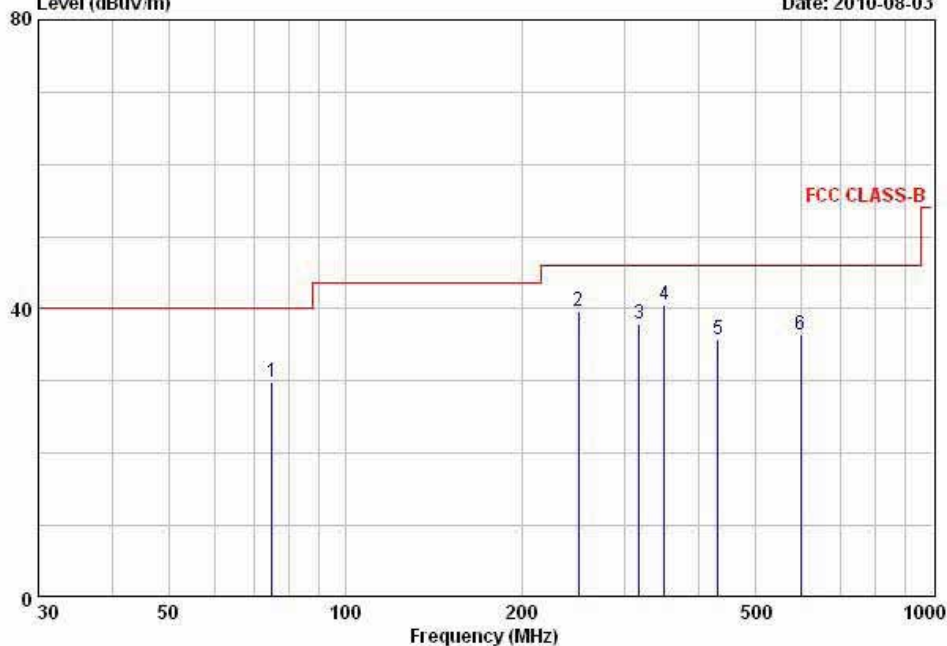
Temp Humi : 25 / 73

Tested by: PARK H W

Data: 56

Level (dBuV/m)

Date: 2010-08-03



	Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
	MHz	dBuV/m	dB/m	dBuV/m	QP	dB	cm	deg	
1	75.04	46.40	-16.45	29.95	40.00	10.05	100	215	VERTICAL
2	249.94	50.00	-10.27	39.73	46.00	6.27	100	66	HORIZONTAL
3	317.20	46.00	-8.17	37.83	46.00	8.17	120	221	HORIZONTAL
4	350.00	48.00	-7.56	40.44	46.00	5.56	100	128	HORIZONTAL
5	432.06	42.00	-6.23	35.77	46.00	10.23	100	138	VERTICAL
6	598.32	39.00	-2.69	36.31	46.00	9.69	100	247	VERTICAL

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

3.3.6 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 Test mode is “SPI Mode + UART Mode” and it gave the worse case emissions.

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

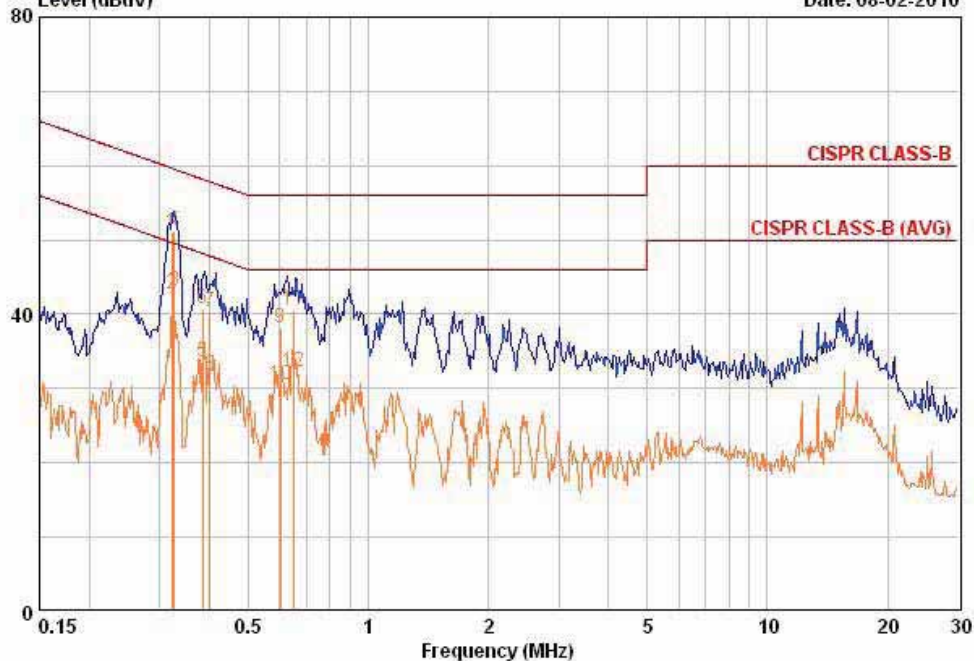
* Decreases with the logarithm of the frequency

AC Conducted Emissions – PING+ZIGBEE – Line

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Fax:+82-31-3236010

EUT / Model No.:	HES1E000R0WW	Phase	: LINE
Test Mode	: PING + ZIGBEE mode	Test Power	: 120 / 60
Temp./Humi.	: 24 / 78	Test Engineer	: PARK H W

Data: 128 File: C:\Conducted Data\2010\LTA_Conduction_1007_2.EMI (340) Date: 08-02-2010
Level (dBuV)



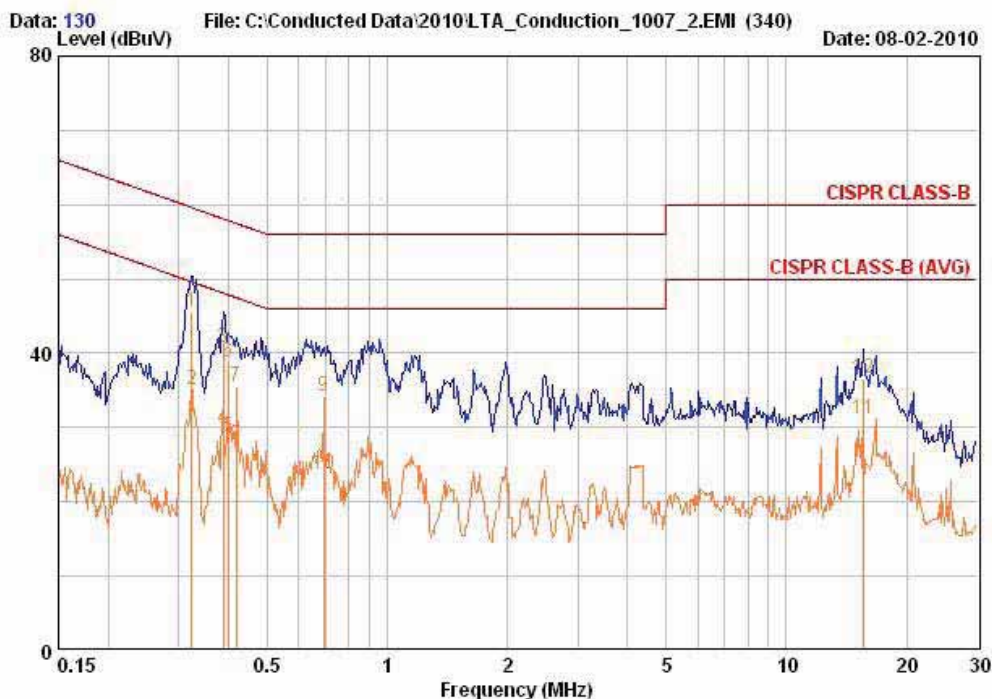
Freq	RD	RD	C.F	Result	Result	Limit	Limit	Margin	Margin
MHz	QP	AV		QP	AV	QP	AV	QP	AV
	dBuV	dBuV	dB	dBuV	dBuV	dBuV	dBuV	dB	dB
0.322	41.36	33.16	9.65	51.01	42.81	59.66	49.66	8.64	6.84
0.326	41.66	33.46	9.66	51.31	43.11	59.55	49.55	8.24	6.44
0.385	31.05	23.95	9.67	40.72	33.62	58.17	48.17	17.45	14.55
0.401	30.55	22.05	9.67	40.22	31.72	57.83	47.83	17.61	16.11
0.601	28.36	20.86	9.72	38.08	30.58	56.00	46.00	17.92	15.42
0.650	30.76	22.46	9.75	40.51	32.21	56.00	46.00	15.49	13.79

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

AC Conducted Emissions – PING+ZIGBEE – Neutral

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

EUT / Model No.:	HES1E000R0WW	Phase	: NEUTRAL
Test Mode	: PING + ZIGBEE mode	Test Power	: 120 / 60
Temp./Humi.	: 24 / 78	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
0.323	35.96	25.46	9.66	45.62	35.12	59.63	49.63	14.01	14.51
0.388	31.05	20.15	9.66	40.71	29.81	58.11	48.11	17.40	18.30
0.400	29.15	19.15	9.66	38.81	28.81	57.85	47.85	19.04	19.04
0.418	25.95	17.95	9.66	35.61	27.61	57.49	47.49	21.88	19.88
0.693	24.56	14.06	9.77	34.33	23.83	56.00	46.00	21.67	22.17
15.557	26.21	20.81	10.43	36.64	31.24	60.00	50.00	23.36	18.76

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-11
2	Spectrum Analyzer	8563E	3425A02505	HP	Mar-11
3	Spectrum Analyzer	8594E	3710A04074	HP	Oct-10
4	Signal Generator	8648C	3623A02597	HP	Mar-11
5	Signal Generator	83711B	US34490456	HP	Mar-11
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	Mar-11
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	Mar-11
14	Test Receiver	ESHS10	828404/009	R&S	Mar-11
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	Mar-11
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	Mar-11
30	Power Meter	EPM-441A	GB32481702	HP	Mar-11
31	Power Sensor	8481A	2702A64048	HP	Mar-11
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	Mar-11
37	LISN	ENV216	100408	R&S	Oct-10
38	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	May-12