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Dates of Tests: Feb 23 ~Mar 11, 2011
 Test Report S/N: LR50011103E
 Test Site : LTA CO., LTD.

CERTIFICATION OF COMPLIANCE

FCC ID.

U8D-FZ100BS

APPLICANT

Firmtech co., Ltd

Equipment Class	:	Digital Transmission System (DTS)
Manufacturing Description	:	Zigbee Serial Adapter
Manufacturer	:	Firmtech co.,Ltd
Model name	:	FZ100BS
Variant Model name	:	FZ110BS,FZ120BS
Test Device Serial No.:	:	Identical prototype
Rule Part(s)	:	FCC Part 15.247 Subpart C ; ANSI C-63.4-2003
Frequency Range	:	2405MHz ~ 2475MHz
Max. Output Power	:	Max 9.89dBm – Conducted
Data of issue	:	Mar 14, 2011

This test report is issued under the authority of:

The test was supervised by:

Hyun-Chae You, Manager

Il-Shin kim, 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. The report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.



NVLAP LAB Code.: 200723-0

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1. General information's

1-1 Test Performed

Company name : LTA Co., Ltd.
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 Web site : <http://www.ltalab.com>
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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	2011-09-30	ECT accredited Lab.
RRL	KOREA	KR0049	2011-09-01	EMC accredited Lab.
FCC	U.S.A	610755	2011-04-22	FCC filing
FCC	U.S.A	649054	2011-05-26	FCC CAB
VCCI	JAPAN	R2133(10m), C2307	2011-06-21	VCCI registration
VCCI	JAPAN	T-2009	2013-12-23	VCCI registration
IC	CANADA	IC5799	2012-05-14	IC filing

2. Information's about test item

2-1 Client & Manufacturer

Company name : Firmtech co., Ltd.
 Address : B-606, Ssangyong IT Twin Tower, Sangdaewon-dong, 442-5,
 Jungwon-gu, Seongnam-si, Gyeonggi-do, Korea 462-120
 Tel / Fax : TEL No : +82-31-719-4812 / FAX No : +82-31-719-4834

2-2 Equipment Under Test (EUT)

Trade name : Zigbee Serial Adapter
 FCC ID : U8D-FZ100BS
 Model name : FZ100BS
 Variant Model name : FZ110BS,FZ120BS
 Serial number : Identical prototype
 Date of receipt : Feb 22, 2011
 EUT condition : Pre-production, not damaged
 Antenna type : Dipole antenna (M/N: WE-2405TO) Max Gain 4.966 dBi
 Frequency Range : 2405MHz ~ 2475MHz (DSSS)
 RF output power : Max 9.89dBm - Conducted
 Number of channels : 15
 Type of Modulation : O-QPSK
 Channel spacing : 5MHz
 Power Source : 5.0Vdc
 Firmware Version : V2.0

2-3 Tested frequency

	LOW	MID	HIGH
Frequency (MHz)	2405	2440	2475

2-4 Ancillary Equipment

Equipment	Model No.	Serial No.	Manufacturer
PC	HP Compaq dx7400	CNG8330J9R	HP

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 Firmtech co., Ltd. FCC ID: U8D-FZ750BS unit complies with the requirement of §15.203.

The antenna connector is the reverse SMA connector.

The sample was tested according to the following specification:

FCC Parts 15.247; ANSI C-63.4-2003

3.2 Technical Characteristics Test

3.2.1 6 dB Bandwidth

Procedure:

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

After the trace being stable, Use the marker-to-peak function to set the marker to the peak of the emission. Use the marker-delta function to measure 6dB down one side of the emission. Reset the marker-delta function, and move the marker to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 6 dB bandwidth of the emission.

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

Span = 10 MHz

VBW = 100 kHz (VBW \geq RBW)

Sweep = auto

Trace = max hold

Detector function = peak

Measurement Data:

Frequency (MHz)	Test Results	
	Measured Bandwidth (MHz)	Result
2405	1.621	Complies
2440	1.664	Complies
2475	1.635	Complies

- See next pages for actual measured spectrum plots.

Minimum Standard:

6 dB Bandwidth > 500kHz

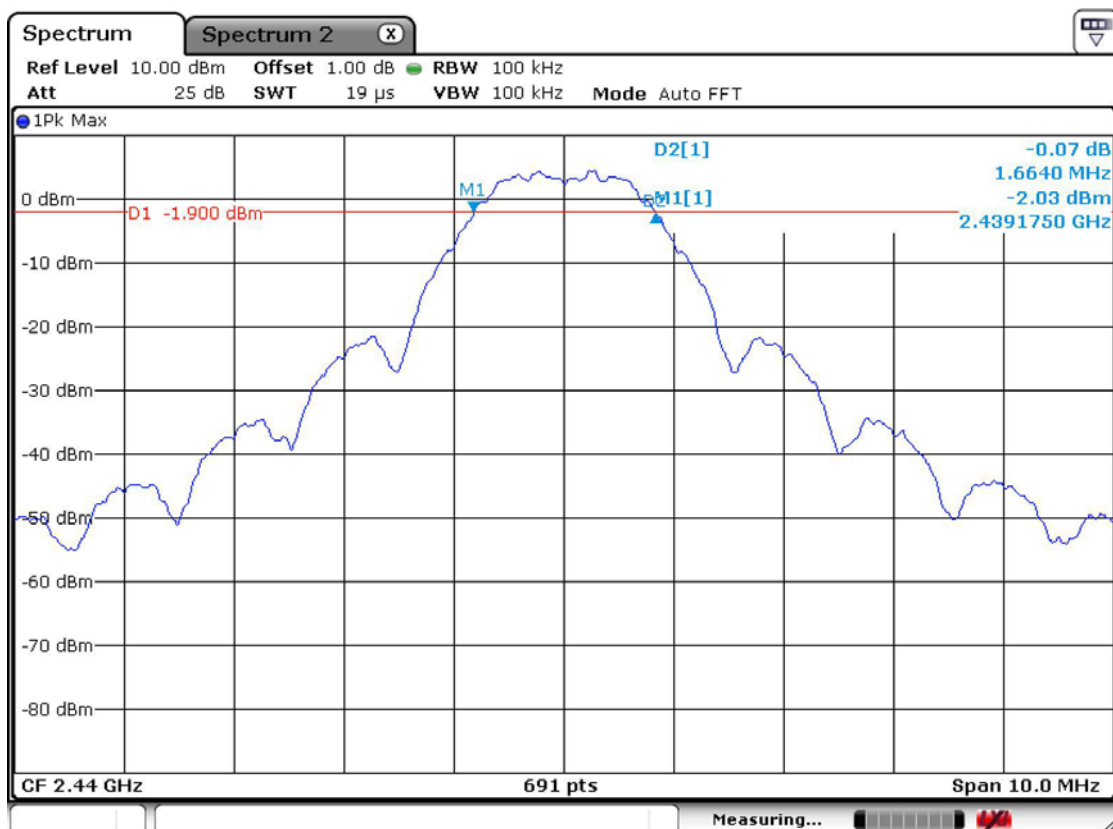
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

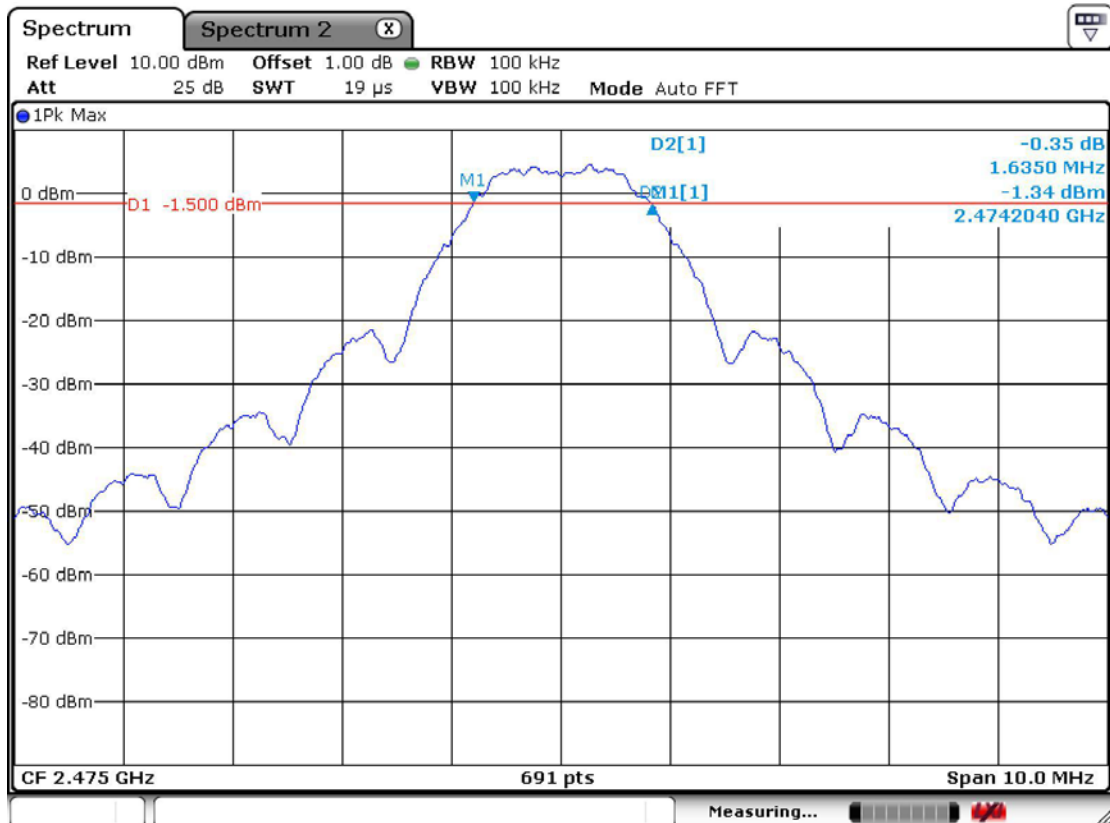
Low Channel



Mid Channel



High Channel



3.2.2 Peak Output Power Measurement

Procedure:

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

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 1MHz

Span = auto

VBW = 1MHz (VBW ≥ RBW)

Sweep = auto

Detector function = peak

Measurement Data:

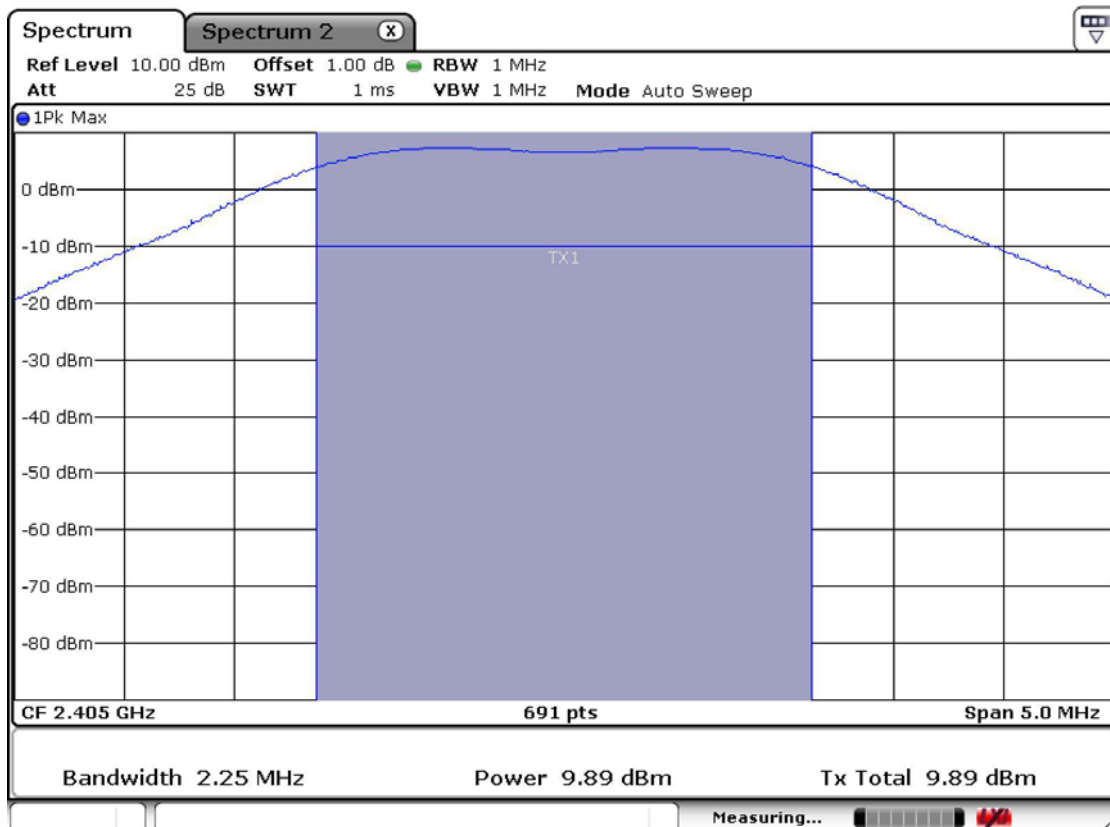
Frequency (MHz)	Test Results		
	dBm	mW	Result
2405	9.89	9.75	Complies
2440	9.79	9.53	Complies
2475	9.81	9.57	Complies

- See next pages for actual measured spectrum plots.

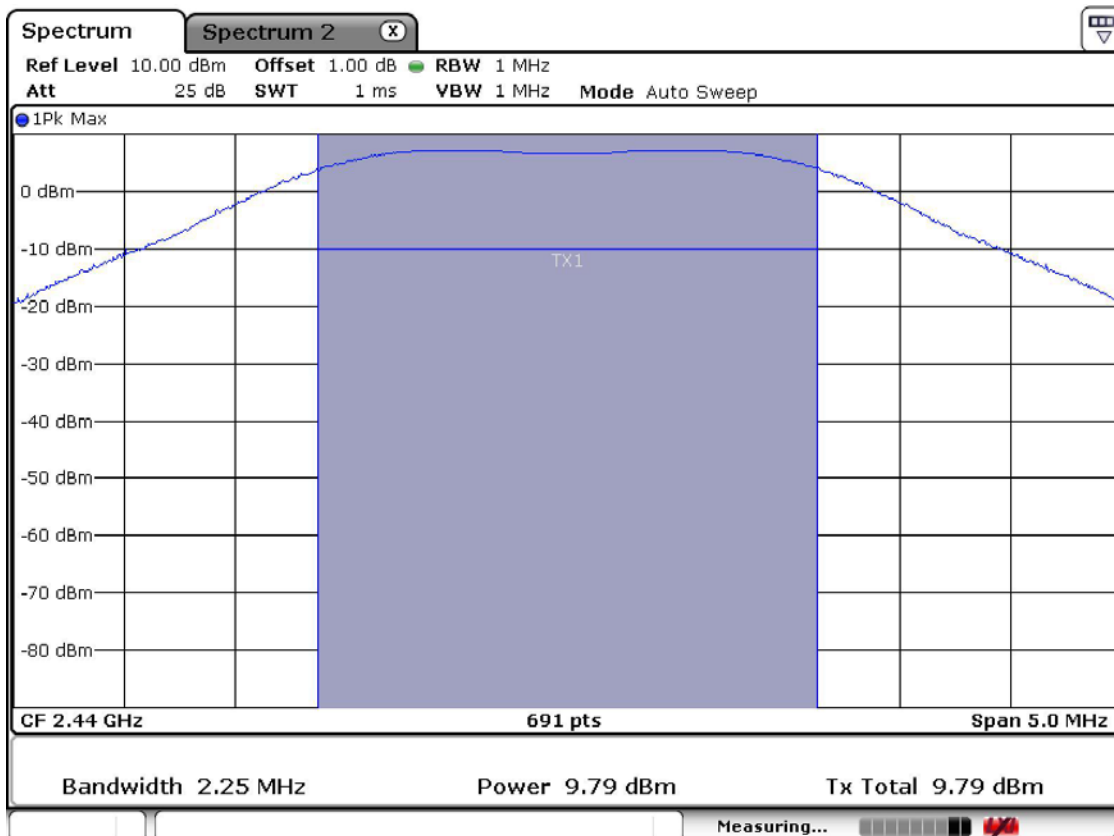
Minimum Standard:

Peak output power	< 1W
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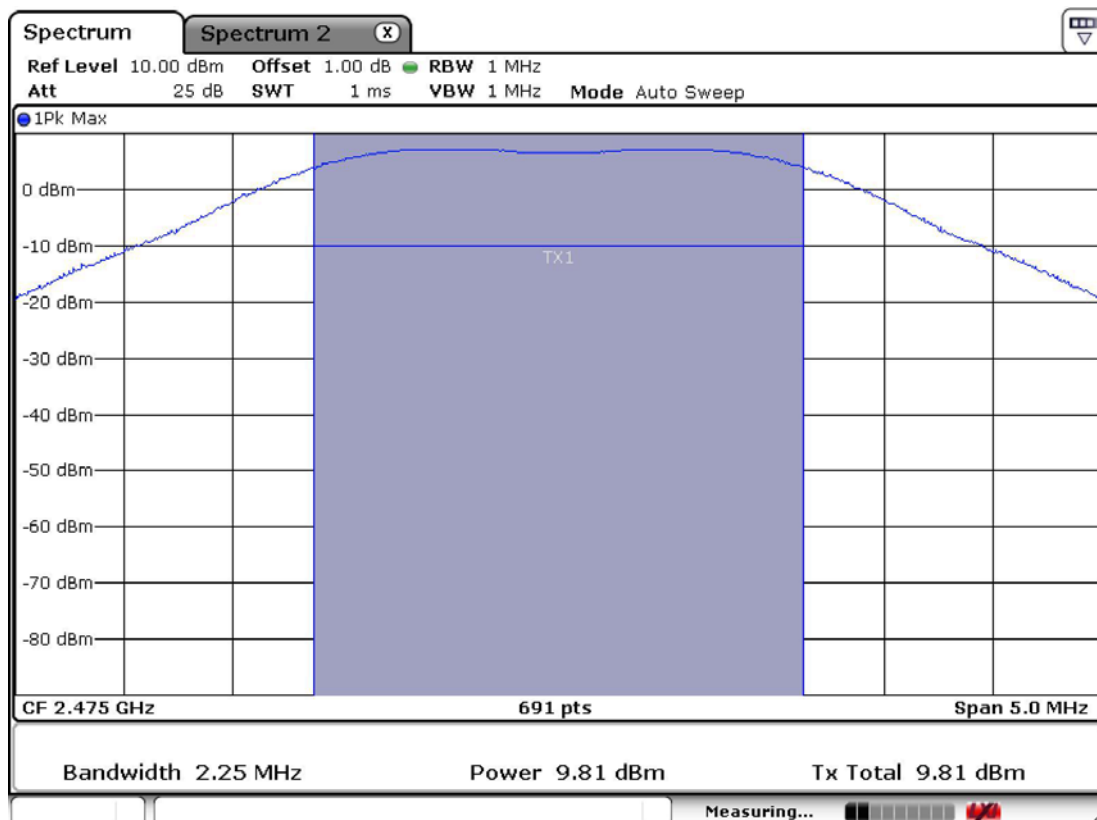
Low Channel



Mid Channel



High Channel



3.2.3 Power Spectral Density

Procedure:

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

The spectrum analyzer is set to:

RBW = 3 kHz

Span = 300 kHz

VBW = 10 kHz

Sweep = 100 sec

Detector function = peak

Trace = max hold

Measurement Data:

Frequency (MHz)	Test Results	
	dBm	Result
2405	-4.65	Complies
2440	-4.53	Complies
2475	-4.16	Complies

- See next pages for actual measured spectrum plots.

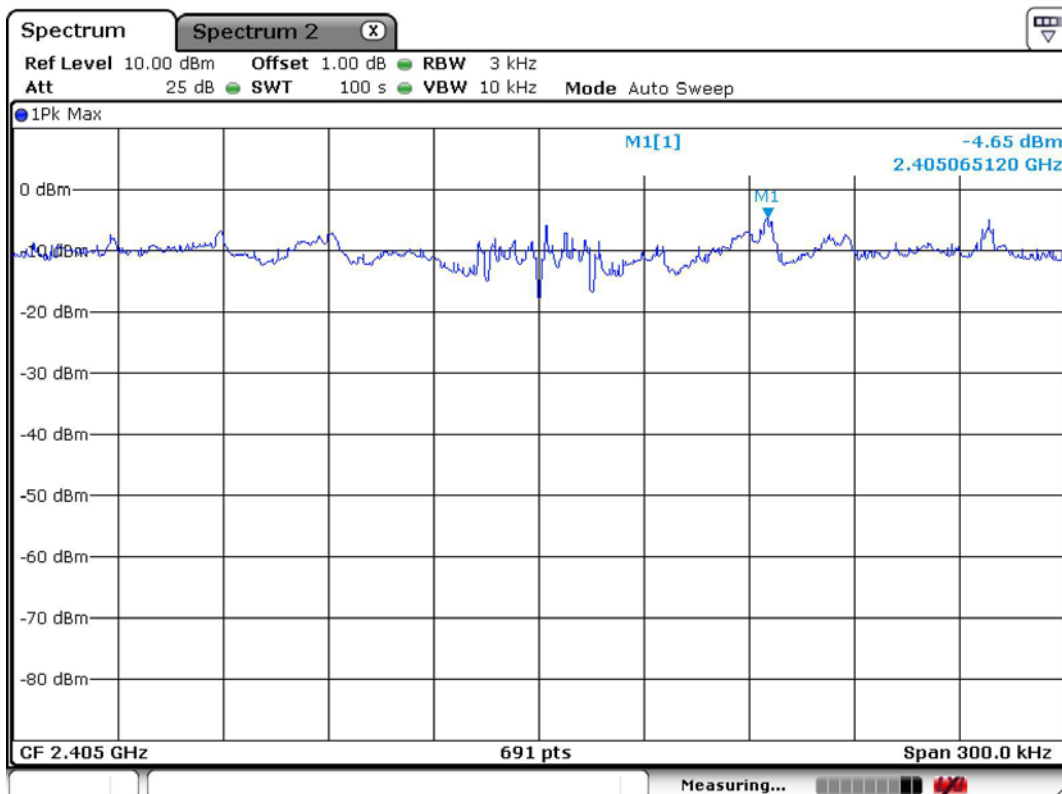
Minimum Standard:

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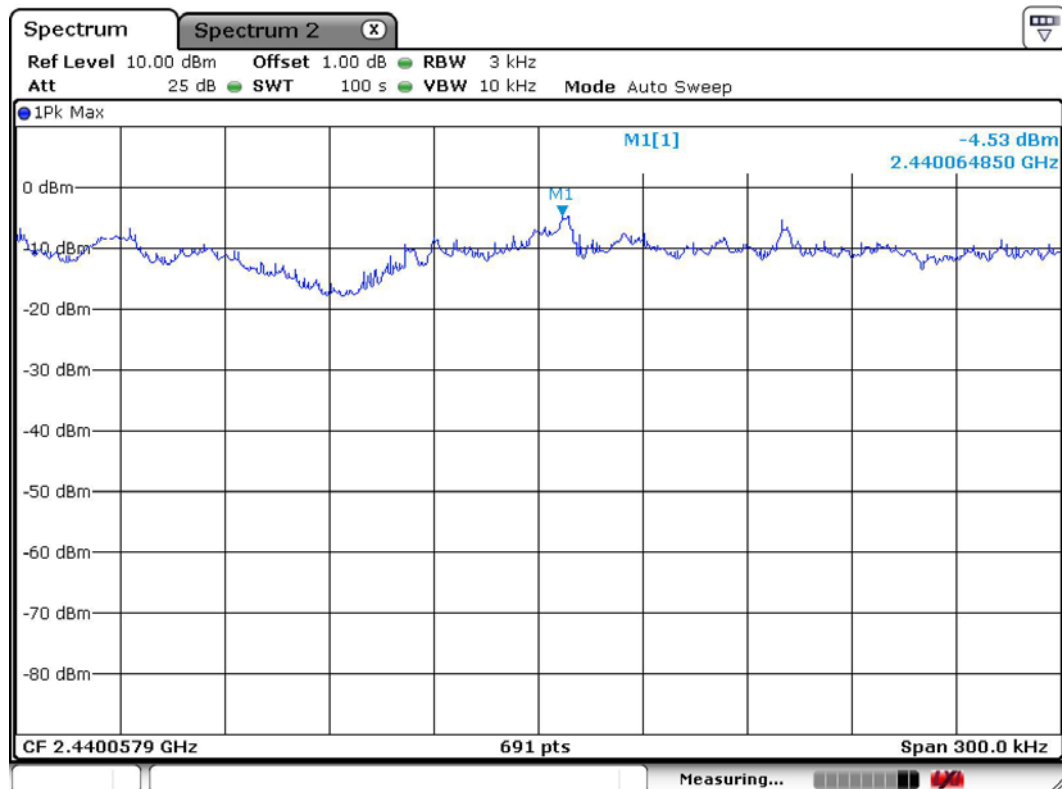
Measurement Setup

Same as the Chapter 3.2.1 (Figure 1)

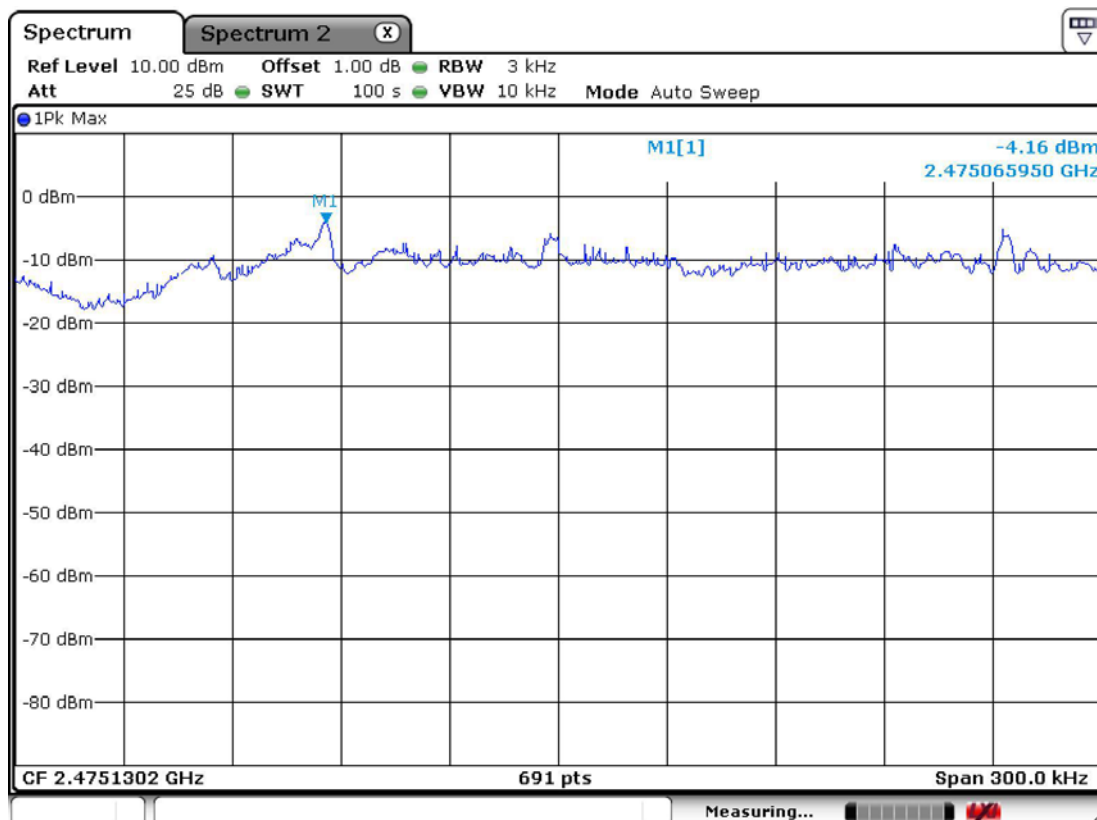
Power Density Measurement Low Channel



Mid Channel



High Channel



3.2.4 Band - edge & Spurious

Procedure:

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

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

The spectrum analyzer is set to:

Center frequency = the highest, middle and the lowest channels

RBW = 100 kHz

VBW = 100 kHz

Span = 50 MHz

Detector function = peak

Trace = max hold

Sweep = auto

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

The spectrum analyzer is set to:

Center frequency = the highest, the lowest channels

PEAK:

RBW = VBW = 1MHz, Sweep=Auto

Average:

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

Measurement Distance:

3m

Polarization:

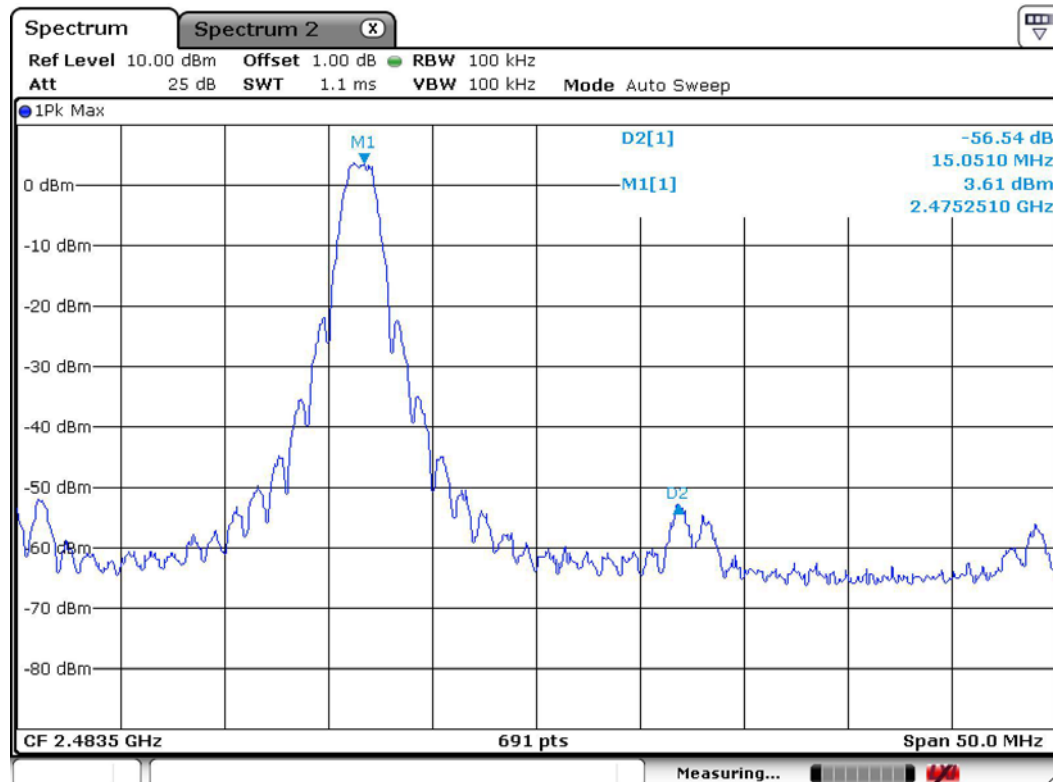
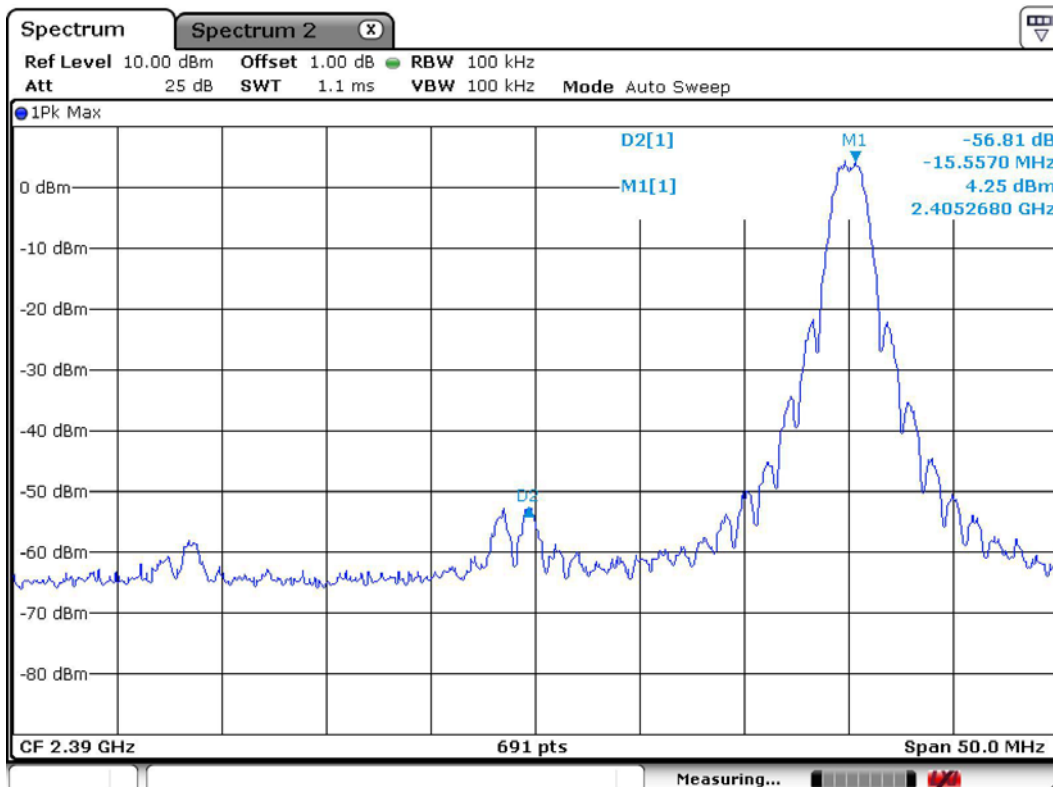
Horizontal / Vertical

Measurement Data: Complies

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

Minimum Standard:	> 20 dBc
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Band-edge



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

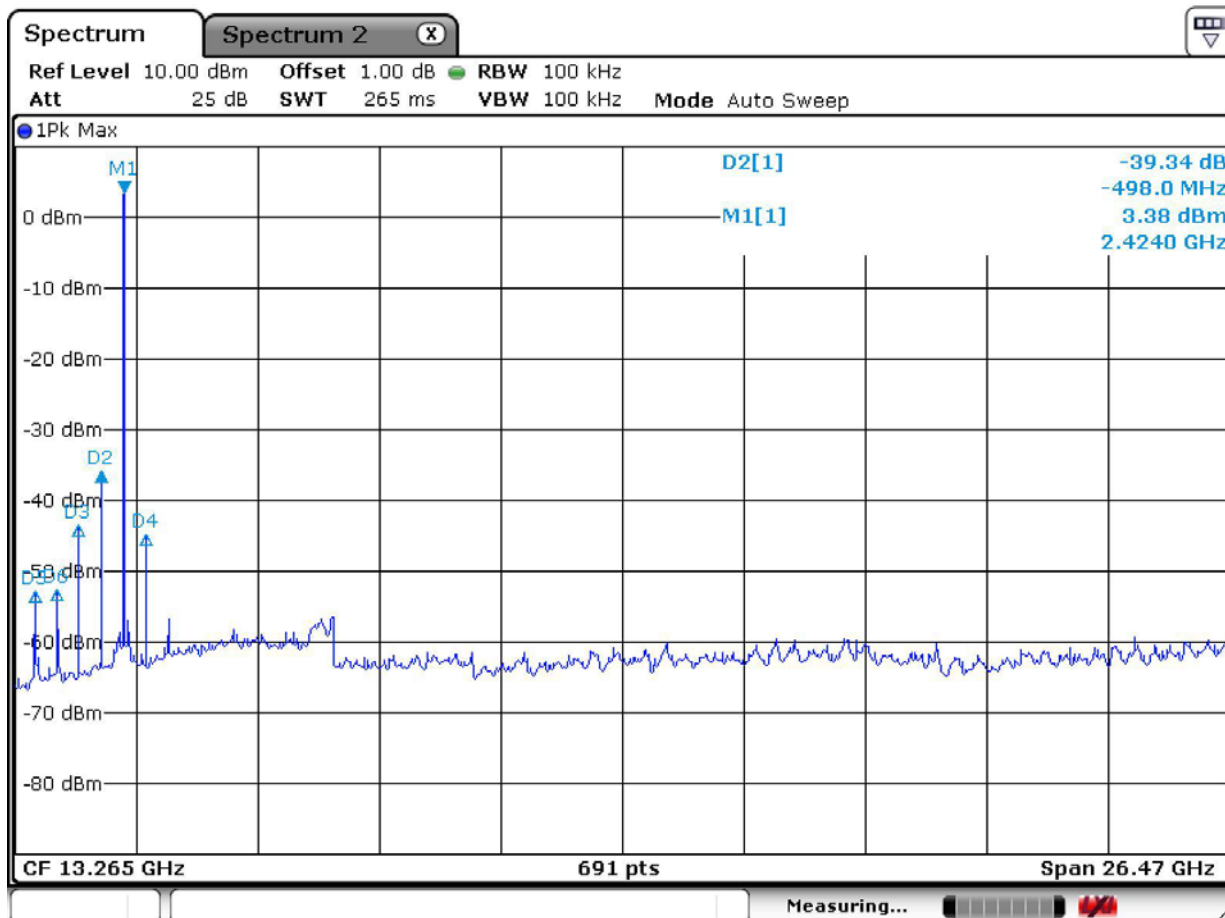
Frequency [MHz]	Reading [dBuV/m]		Pol.	Correction Factor			Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2390	52.4	68.4	V	25.4	37.1	4.0	54.0	74.0	44.7	60.7	9.4	13.4

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

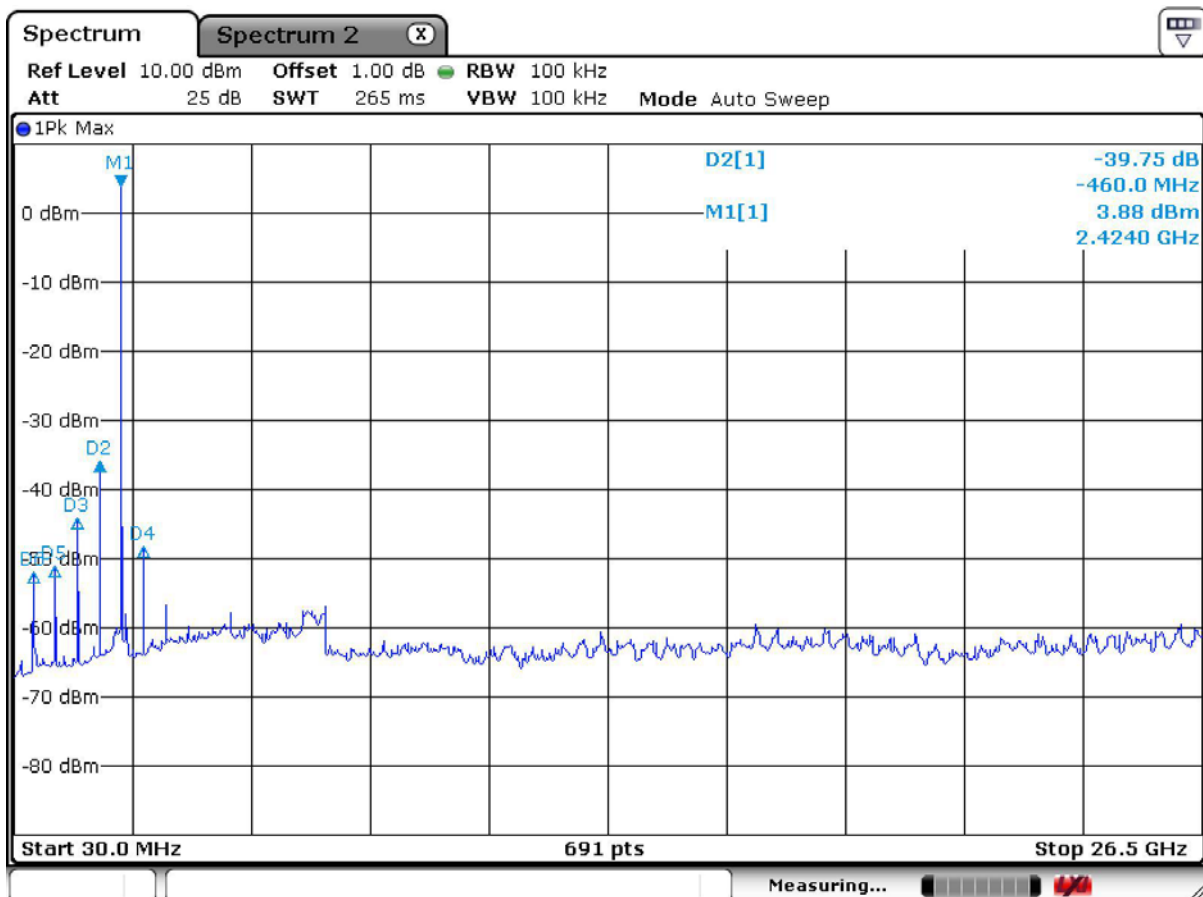
Frequency [MHz]	Reading [dBuV/m]		Pol.	Correction Factor			Limits [dBuV/m]		Result [dBuV/m]		Margin [dB]	
	AV / Peak			Antenna	Amp. Gain	Cable	AV / Peak		AV / Peak		AV / Peak	
2483.5	58.1	72.1	V	25.4	37.1	4.0	54.0	74.0	50.4	64.4	3.6	9.7

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

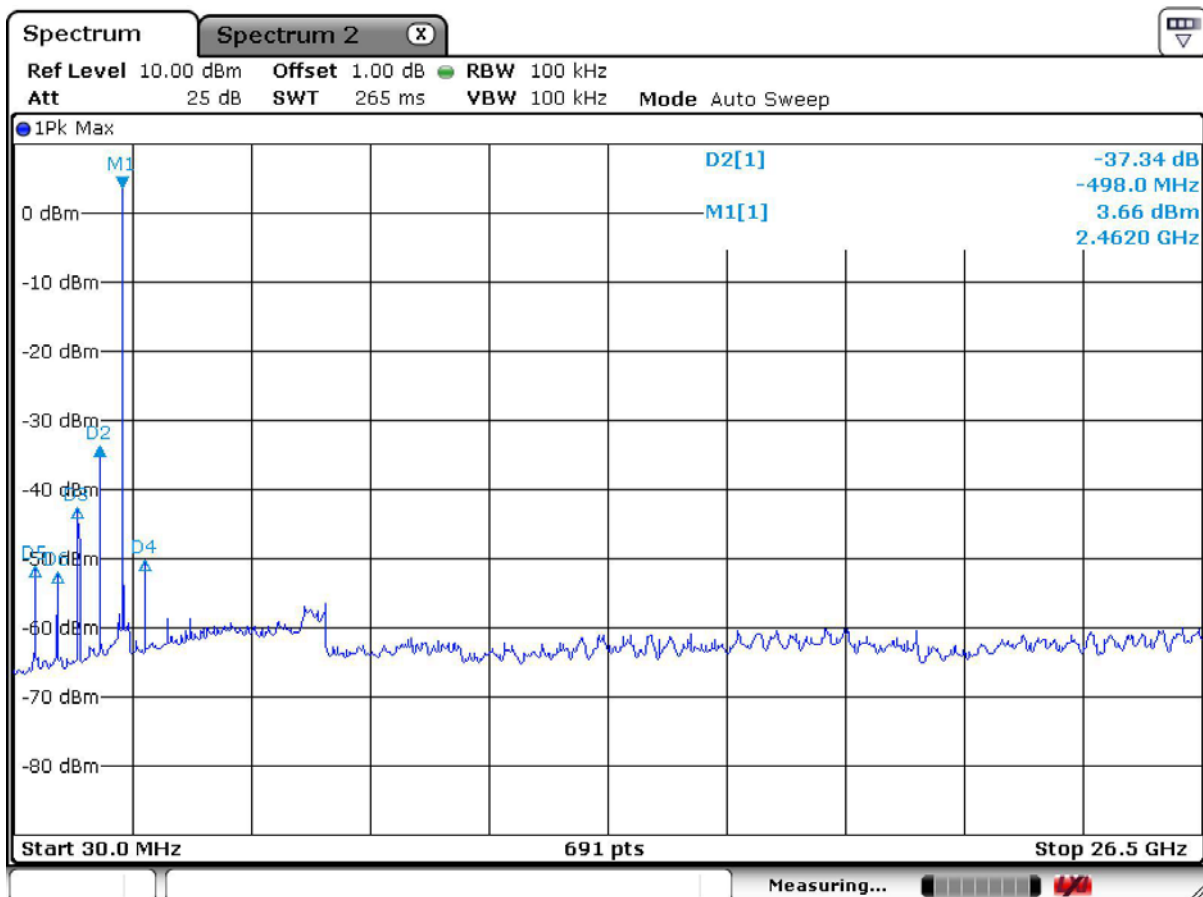
Low channel
Frequency Range = 30 MHz ~ 10th harmonic.



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



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



3.2.5 Field Strength of Harmonics

Procedure:

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

The spectrum analyzer is set to:

Center frequency = the worst channel

Frequency Range = 30 MHz ~ 10th harmonic.

RBW = 100 kHz (30MHz ~ 1 GHz)

VBW \geq RBW

= 1 MHz (1 GHz ~ 10th harmonic)

Span = 100 MHz

Detector function = peak

Trace = max hold

Sweep = auto

Measurement Data: Complies

- See next pages for actual measured data.

Minimum Standard: FCC Part 15.209(a)

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

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

Minimum Standard: FCC Part 15.109

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

Measurement Data:

Frequency [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	
1926	55.4	69.7	H	25.4	38.4	3.0	54.0	74.0	45.4	59.7	8.6	14.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
1964	55.1	69.2	H	25.4	38.4	3.0	54.0	74.0	45.1	59.2	8.9	14.8
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
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	
2003	58.7	72.5	H	25.4	37.1	4.0	54.0	74.0	51.0	64.8	3.1	9.3
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-

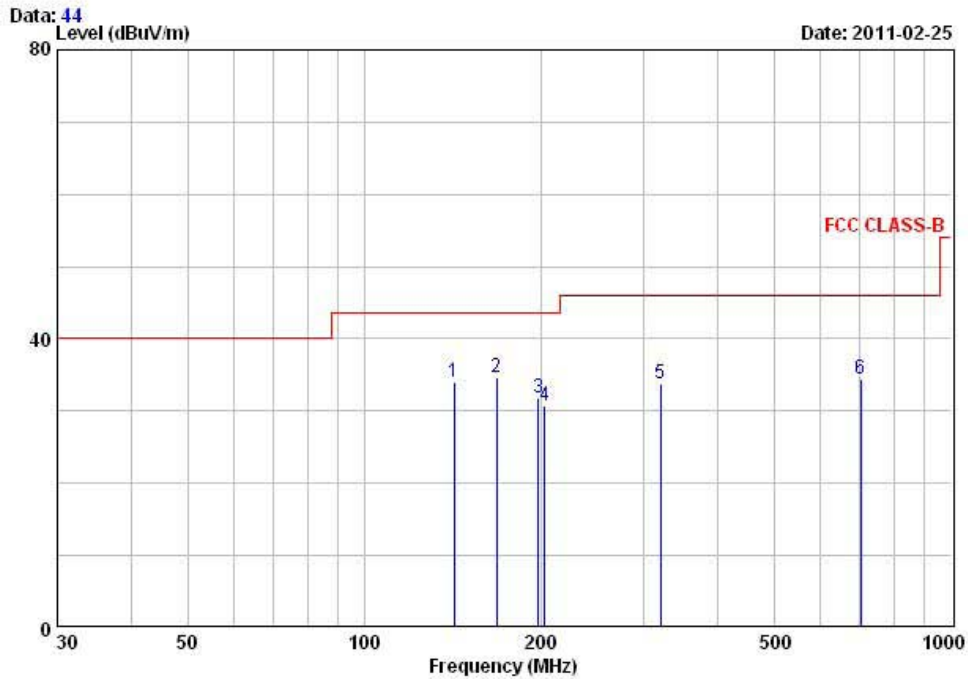
No other emissions were detected at a level greater than 20dB below limit.

Radiated Emissions – Zigbee



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EUT/Model No.: F2100BS TEST MODE: Zigbee mode
Temp Humi : 3 / 34 Tested by: PARK H W



Freq	Reading	C.F	Result	Limit	Margin	Height	Angle	Polarity
MHz	dBuV/m	dB/m	dBuV/m	dBuV/m	dB	cm	deg	
1 142.14	43.20	-9.11	34.09	43.50	9.41	126	197	HORIZONTAL
2 168.25	44.00	-9.24	34.76	43.50	8.74	182	63	HORIZONTAL
3 198.24	43.30	-11.47	31.83	43.50	11.67	107	332	VERTICAL
4 203.18	42.10	-11.43	30.67	43.50	12.83	180	254	HORIZONTAL
5 320.32	40.50	-6.73	33.77	46.00	12.23	100	293	VERTICAL
6 702.04	32.60	1.80	34.40	46.00	11.60	100	177	HORIZONTAL

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

3.2.6 AC Conducted Emissions

Procedure:

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

Measurement Data: Complies

- See next pages for actual measured spectrum plots.
- No emissions were detected at a level greater than 20dB below limit.

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

Class B

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

* Decreases with the logarithm of the frequency

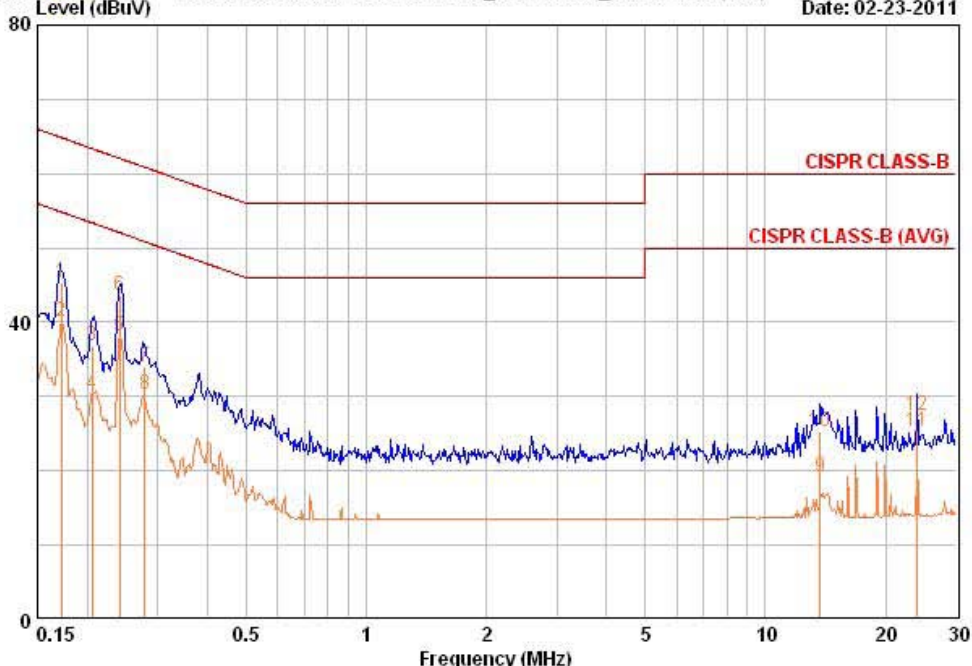
AC Conducted Emissions – Zigbee – Line



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EUT / Model No. : FZ100BS Phase : LINE
 Test Mode : Zigbee mode Test Power : 120 / 60
 Temp./Humi. : 12 / 49 Test Engineer : PARK H W

Data: 118 File: C:\Conducted Data\2011\LTA_Conduction_1102-1.EMI (136) Date: 02-23-2011



Freq MHz	RD		C.F	Result		Limit		Margin	
	QP dBuV	AV dBuV		QP dBuV	AV dBuV	QP dBuV	AV dBuV	QP dB	AV dB
0.172	35.65	30.35	9.65	45.31	40.01	64.86	54.86	19.56	14.86
0.206	27.16	20.76	9.64	36.80	30.40	63.37	53.37	26.57	22.97
0.241	34.05	28.55	9.64	43.69	38.19	62.06	52.06	18.37	13.87
0.278	24.46	20.66	9.65	34.10	30.30	60.88	50.88	26.77	20.57
13.741	15.30	9.30	9.90	25.20	19.20	60.00	50.00	34.80	30.80
24.014	17.36	15.16	10.10	27.46	25.26	60.00	50.00	32.54	24.74

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

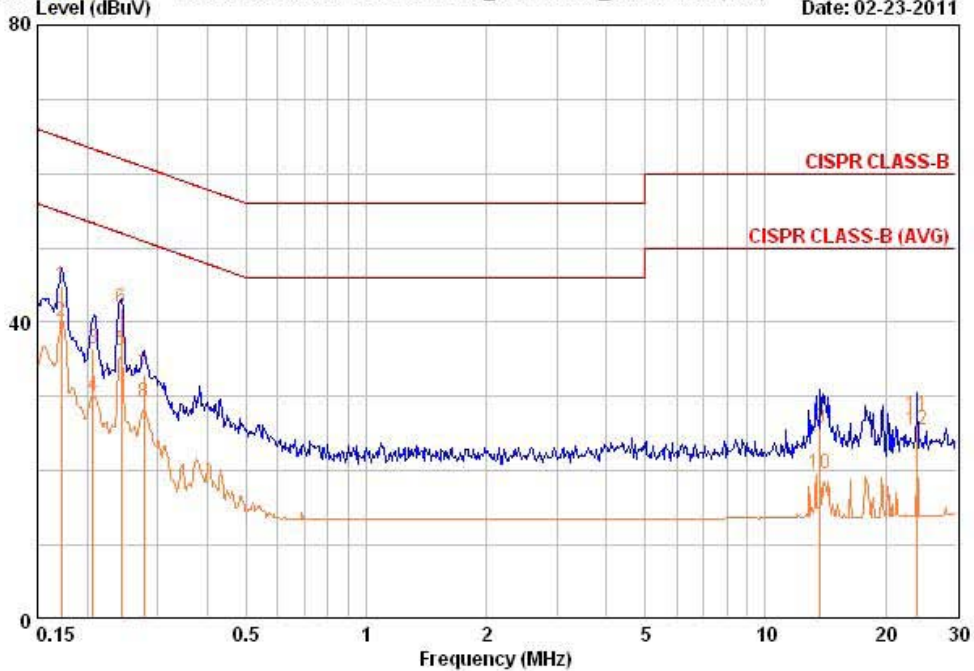
AC Conducted Emissions – Zigbee – Neutral



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EUT / Model No. : FZ100BS Phase : NEUTRAL
 Test Mode : Zigbee mode Test Power : 120 / 60
 Temp./Humi. : 12 / 49 Test Engineer : PARK H W

Data: 116 File: C:\Conducted Data\2011\LTA_Conduction_1102-1.EMI (136) Date: 02-23-2011



Freq MHz	RD		C.F	Result		Limit		Margin	
	QP dBuV	AV dBuV		QP dBuV	AV dBuV	QP dBuV	AV dBuV	QP dB	AV dB
0.172	35.15	30.55	9.66	44.81	40.21	64.86	54.86	20.05	14.65
0.207	26.76	20.36	9.64	36.40	30.00	63.32	53.32	26.92	23.32
0.243	32.15	26.45	9.65	41.80	36.10	61.99	51.99	20.19	15.89
0.277	23.36	19.56	9.65	33.01	29.21	60.91	50.91	27.90	21.70
13.746	15.70	9.80	9.91	25.61	19.71	60.00	50.00	34.39	30.29
24.015	17.26	15.26	10.14	27.40	25.40	60.00	50.00	32.60	24.60

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	FSV-30	100757	R&S	1 year	2011-01-24
2	Spectrum Analyzer	8563E	3425A02505	HP	2 year	2010-03-29
3	Spectrum Analyzer	8594E	3710A04074	HP	2 year	2009-10-12
4	Signal Generator	8648C	3623A02597	HP	1 year	2010-03-30
5	Signal Generator	83711B	US34490456	HP	1 year	2010-03-30
6	Attenuator (3dB)	8491A	37822	HP	2 year	2010-10-08
7	Attenuator (10dB)	8491A	63196	HP	2 year	2010-10-08
8	EMI Test Receiver	ESCI7	100722	R&S	1 year	2010-10-08
9	Horn Antenna(18 ~ 40GHz)	SAS-574	154	Schwarzbeck	2 year	2010-11-25
10	Horn Antenna(18 ~ 40GHz)	SAS-574	155	Schwarzbeck	2 year	2010-11-25
11	RF Amplifier	8447D	2439A09058	HP	2 year	2010-10-08
12	RF Amplifier	8449B	3008A02126	HP	2 year	2010-03-29
13	Test Receiver	ESHS10	828404/009	R&S	1 year	2010-03-29
14	TRILOG Antenna	VULB 9160	9160-3172	SCHWARZBECK	2 year	2010-10-07
15	Log Periodic Antenna	VULP 9118	9118 A 401	SCHWARZBECK	2 year	2009-04-13
16	Biconical Antenna	BBA 9106	VHA 9103-2315	SCHWARZBECK	2 year	2009-04-13
17	Horn Antenna	BBHA 9120D	9120D122	SCHWARZBECK	2 year	2010-12-24
18	Dipole Antenna	VHA9103	2116	SCHWARZBECK	2 year	2010-11-25
19	Dipole Antenna	VHA9103	2117	SCHWARZBECK	2 year	2010-11-25
20	Dipole Antenna	VHA9105	2261	SCHWARZBECK	2 year	2010-11-25
21	Dipole Antenna	VHA9105	2262	SCHWARZBECK	2 year	2010-11-25
22	Hygro-Thermograph	THB-36	0041557-01	ISUZU	2 year	2010-04-12
23	Splitter (SMA)	ZFSC-2-2500	SF617800326	Mini-Circuits	-	-
24	Power Divider	11636A	6243	HP	2 year	2010-10-08
25	DC Power Supply	6622A	3448A03079	HP	-	-
26	Frequency Counter	5342A	2826A12411	HP	1 year	2010-03-30
27	Power Meter	EPM-441A	GB32481702	HP	1 year	2010-03-29
28	Power Sensor	8481A	US41030291	HP	1 year	2010-10-08
29	Audio Analyzer	8903B	3729A18901	HP	1 year	2010-10-08
30	Modulation Analyzer	8901B	3749A05878	HP	1 year	2010-10-08
31	TEMP & HUMIDITY Chamber	YJ-500	LTAS06041	JinYoung Tech	1 year	2010-10-08
32	Stop Watch	HS-3	601Q09R	CASIO	2 year	2010-03-31
33	LISN	ENV216	100408	R&S	1 year	2010-10-08
34	UNIVERSAL RADIO COMMUNICATION TESTER	CMU200	106243	R&S	2 year	2010-05-13
35	Attenuator (30dB)	8498A	3318A10929	HP	2 year	2011-01-05