FCC Radio Test Report

FCC ID: T5U-ZM101

This report concerns (check one) : : ☐ **Original Grant** ■ **Class II Change**

Issued Date : Apr. 22, 2008
Project No. : R0803007C
Equipment : IEEE 802.15.4 transceivers module
Model Name : ZM101;ZM101-11;ZM101-21;ZM101-31
Applicant : Quanta Microsystems,Inc.
Address : 188 WenHwa 2nd Rd., Kueishan Hsiang Taoyuan,333,Taiwan, R.O.C

Tested by:
Neutron Engineering Inc. EMC Laboratory
Date of Test:
Apr. 18, 2008 ~ Apr. 22, 2008

Testing Engineer : Jeff yang (Jeff Yang)

Technical Manager : Steven Lu (Steven Lu)

Authorized Signatory : Steven Lu for (Vic Chiu)

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NVLAP Lab Code: 200145-0 ilac-MRA TAF Testing Laboratory 0659

Declaration

Neutron represents to the client that testing is done in accordance with standard procedures as applicable and that test instruments used has been calibrated with the standards traceable to National Measurement Laboratory (**NML**) of **R.O.C**., or National Institute of Standards and Technology (**NIST**) of **U.S.A.**

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1. CERTIFICATION

Equipment:	IEEE 802.15.4 transceivers module
Trade Name :	QMI
Model Name :	ZM101;ZM101-11;ZM101-21;ZM101-31
Applicant:	Quanta Microsystems,Inc.
Test Item:	ENGINEERING SAMPLE
Standards:	FCC Part15, Subpart C(15.247) / ANCI C63.4 : 2003

The above equipment has been tested and found compliance with the requirement of the relative standards by Neutron Engineering Inc. EMC Laboratory.
The test data, data evaluation, and equipment configuration contained in our test report (Ref No. NEI-FCCP-1-R0803007C) were obtained utilizing the test procedures, test instruments, test sites that has been accredited by the Authority of NVLAP and TAF according to the ISO-17025 quality assessment standard and technical standard(s).
Test result included in this report is only for the Zigbee part of the product.

2. SUMMARY OF TEST RESULTS

Test procedures according to the technical standards:

FCC Part15 (15.247) , Subpart C			
Standard Section	Test Item	Judgment	Remark
15.207	Conducted Emission	PASS	
15.247 (c)	Antenna conducted Spurious Emission	PASS	
15.247 (a)(2)	6dB Bandwidth	PASS	
15.247 (b)	Peak Output Power	PASS	
15.247 (c)	Radiated Spurious Emission	PASS	
15.247 (d)	Power Spectral Density	PASS	
15.203	Antenna Requirement	PASS	
1.1307 1.1310 2.1091 2.1093	RF Exposure Compliance	PASS	

NOTE:

(1)" N/A" denotes test is not applicable in this Test Report

2.1 TEST FACILITY

The test facilities used to collect the test data in this report is **C01/OS02** at the location of No.132-1, Lane 329, Sec. 2, Palain Road, Shijr City, Taipei, Taiwan.
Neutron's test firm number is 95335

2.2 MEASUREMENT UNCERTAINTY

The reported uncertainty of measurement **y** ± **U**，where expended uncertainty **U** is based on a standard uncertainty multiplied by a coverage factor of **k=2**，providing a level of confidence of approximately **95** %。

A. Conducted Measurement :

Test Site	Method	Measurement Frequency Range	U，(dB)	NOTE
C01	ANSI	150 KHz ~ 30MHz	1.94	

B. Radiated Measurement :

Test Site	Method	Measurement Frequency Range	Ant. H / V	U，(dB)	NOTE
OS-01	ANSI	30MHz ~ 200MHz	V	3.82	
		30MHz ~ 200MHz	H	3.60	
		200MHz ~ 1,000MHz	V	3.86	
		200MHz ~ 1,000MHz	H	3.94	
OS-02	ANSI	30MHz ~ 200MHz	V	2.48	
		30MHz ~ 200MHz	H	2.16	
		200MHz ~ 1,000MHz	V	2.50	
		200MHz ~ 1,000MHz	H	2.66	

3. GENERAL INFORMATION

3.1 GENERAL DESCRIPTION OF EUT

Equipment	IEEE 802.15.4 transceivers module
Trade Name	QMI
Model Name	ZM101;ZM101-11;ZM101-21;ZM101-31
OEM Brand/Model Name	N/A
Model Difference	ZM101-11:ANT Connector(J1) removed,and add 10pF at C3. ZM101-21:ANT Connector(J1) removed,and add 10pF at C3. Remove 6Pin Connector means CON6 and Varistors means VAR1~4. ZM101-31:ANT Connector(J1) removed,and add 10pF at C3. F/W is same as -21 version. Please refer to the Note 4.
Product Description	The EUT is a IEEE 802.15.4 transceivers module. Operation Frequency: 2405~2480 MHz Modulation Type: Offset-QPSK Bit Rate of Transmitter 256Kb/s Number Of Channel 16 CH Antenna Designation: Please see Note 3. Antenna Gain(Peak) Please see Note 3. Output Power: 1.16 dBm (Max.) Based on the application, features, or specification exhibited in User's Manual, the EUT is considered as an ITE/Computing Device. More details of EUT technical specification, please refer to the User's Manual.
Channel List	Please refer to the Note 2.
Power Source	DC Voltage supplied from System
Power Rating	DC 5V (IN) power regulation 2.0~3.4Vdc to the module
Connecting I/O Port(s)	Please refer to the User's Manual
Products Covered	N/A

Note :

1. For a more detailed features description, please refer to the manufacturer’s specifications or the User's Manual.

2.

Freqeuncy Band	Channel No.	Frequency
2400~2483.5MHz	1	2405 MHz
	2	2410 MHz
	3	2415 MHz
	4	2420 MHz
	5	2425 MHz
	6	2430 MHz
	7	2435 MHz
	8	2440 MHz
	9	2445 MHz
	10	2450 MHz
	11	2455 MHz
	12	2460 MHz
	13	2465 MHz
	14	2470 MHz
	15	2475 MHz
	16	2480 MHz

3. Table for Filed Antenna

Ant.	Brand	Model Name	Antenna Type	Connector	Gain (dBi)
1	MAG.LAYERS	LTA-3216-2G4 S3-A1	Chip Antenna	NA	1.0

4.

	ZM101	ZM101-11	ZM101-21	ZM101-31
ANT connector(J1)	Yes	No	No	No
6 Pin connector(CON6)	Yes	Yes	No	Yes
Varistor(VAR1, VAR2, VAR3, VAR4)	Yes	Yes	No	Yes
Capacitor(C3)	No	Yes	Yes	Yes

3.2 DESCRIPTION OF TEST MODES

To investigate the maximum EMI emission characteristics generates from EUT, the test system was pre-scanning tested base on the consideration of following EUT operation mode or test configuration mode which possible have effect on EMI emission level. Each of these EUT operation mode(s) or test configuration mode(s) mentioned above was evaluated respectively.

Test Items	Mode	Data Rate	Channel	Antenna
AC Power Line Conducted Emissions	Normal Link	256Kb/s	1	1
Maximum Peak Conducted Output Power Power Spectral Density 6dB Spectrum Bandwidth	Zigbee	256Kb/s	1/8/16	1
Radiated Emissions 9kHz~1GHz	Zigbee	256Kb/s	8	1
Radiated Emissions 1GHz~10th Harmonic	Zigbee	256Kb/s	1/8/16	1
Band Edge Emissions	Zigbee	256Kb/s	1/16	1

Note:

(1) The measurements are performed at the highest, middle, lowest available channels.

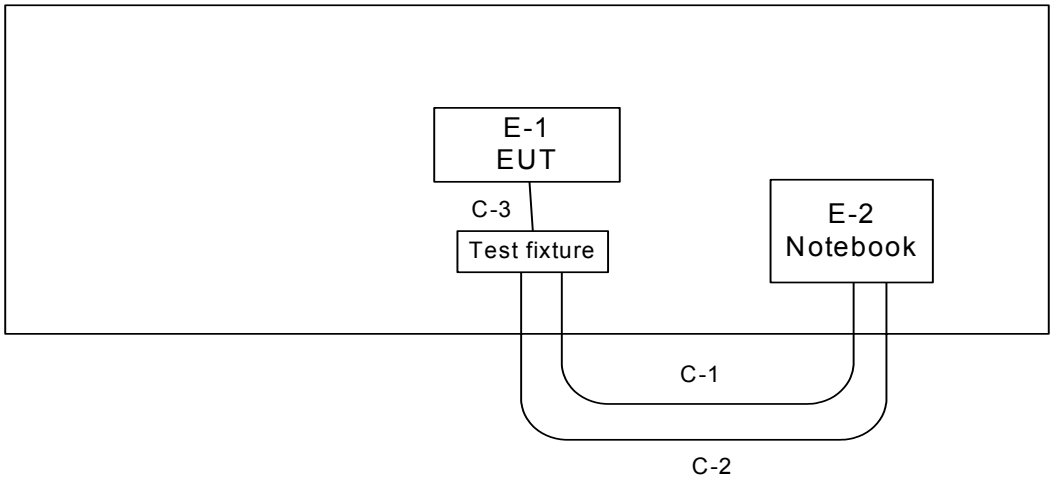
3.3 TABLE OF PARAMETERS OF TEXT SOFTWARE SETTING

During testing channel & power controlling software provided by the customer was used to control the operating channel as well as the output power level. The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product power parameters of Zigbee

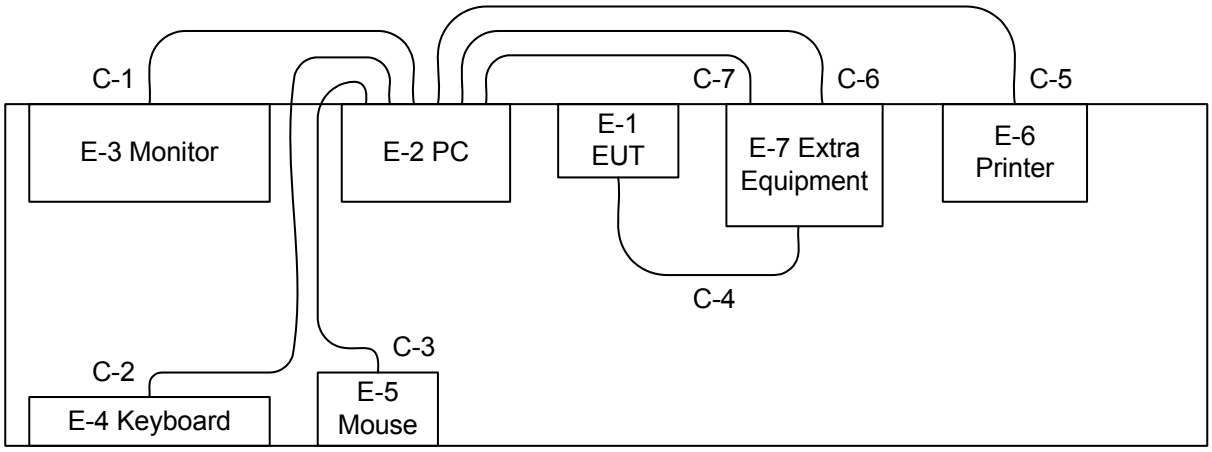
Test software Version	Test Program:Hyper Terminal(packet function)		
Frequency	2405 MHz	2440 MHz	2480 MHz
Parameters	m	m	m

3.4 BLOCK DIGRAM SHOWING THE CONFIGURATION OF SYSTEM TESTED

Radiated Mode:



Conduction Mode:



C-1 D-SUB Cable
C-2 PS/2 Cable
C-3 PS/2 Cable
C-4 Data Cable
C-5 Parallel Cable
C-6 USB Cable
C-7 RS232 Cable

3.5 DESCRIPTION OF SUPPORT UNITS(RADIATED MODE)

The EUT has been tested as an independent unit together with other necessary accessories or support units. The following support units or accessories were used to form a representative test configuration during the tests.

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	IEEE 802.15.4 transceivers module	QMI	ZM101	T5U-ZM101	N/A	EUT
E-2	Notebook PC	DELL	D600	DOC	7T390 A03	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	NO	NO	1.8M	RS-232
C-2	NO	NO	1.8M	USB
C-3	NO	NO	0.01M	Cable

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

3.5 DESCRIPTION OF SUPPORT UNITS(CONDUCTED MODE)

Item	Equipment	Mfr/Brand	Model/Type No.	FCC ID	Series No.	Note
E-1	IEEE 802.15.4 transceivers module	QMI	ZM101	T5U-ZM101	N/A	EUT
E-2	PC	HP	HP Compaq dx7400	DOC	SGH7480DKZ	
E-3	19" LCD Monitor	Samsung	SyncMaster 193P	DOC	DI19H4JXC05517A	
E-4	PS/2 K/B	Logitech	Y-SJ17(ACK260A)	DOC	SYU44664880	
E-5	PS/2 Mouse	Logitech	M-SBF69	DOC	HCA44601156	
E-6	Printer	SII	DPU-414	DOC	1045105A	
E-7	Extra Equipment	N/A	N/A	N/A	N/A	

Item	Shielded Type	Ferrite Core	Length	Note
C-1	YES	YES	1.8M	
C-2	YES	NO	1.5M	
C-3	YES	NO	1.5M	
C-4	NO	NO	0.3M	
C-5	YES	NO	1.8M	
C-6	YES	NO	0.9M	
C-7	YES	NO	1.5M	

Note:

(1) The support equipment was authorized by Declaration of Confirmation.
(2) For detachable type I/O cable should be specified the length in cm in『Length』column.

4. EMC EMISSION TEST

4.1 CONDUCTED EMISSION MEASUREMENT

4.1.1 POWER LINE CONDUCTED EMISSION Limits (Frequency Range 150KHz-30MHz)

FREQUENCY (MHz)	Class A (dBuV)		Class B (dBuV)		Standard
	Quasi-peak	Average	Quasi-peak	Average	
0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	CISPR
0.50 -5.0	73.00	60.00	56.00	46.00	CISPR
5.0 -30.0	73.00	60.00	60.00	50.00	CISPR

0.15 -0.5	79.00	66.00	66 - 56 *	56 - 46 *	FCC
0.50 -5.0	73.00	60.00	56.00	46.00	FCC
5.0 -30.0	73.00	60.00	60.00	50.00	FCC

Note:

(1) The tighter limit applies at the band edges.

(2) The limit of " * " marked band means the limitation decreases linearly with the logarithm of the frequency in the range.

4.1.2 MEASUREMENT INSTRUMENTS LIST AND SETTING

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	LISN	Rolf Heine	NNB-2/16Z	98053	Dec. 17, 2008
2	4L-V-LISN	Rolf Heine	NNB-4/63TL	02/10040	Mar. 04, 2009
3	Pulse Limiter	Electro-Metrics	EM-7600	112644	Nov. 27, 2008
4	50Ω Terminator	N/A	N/A	N/A	Apr.09, 2009
5	Test Cable	N/A	C01	N/A	Nov. 27, 2008
6	EMI Test Receiver	R&S	ESCI	100082	Jan. 30, 2009

Remark: ” N/A” denotes No Model Name. , Serial No. or No Calibration specified.

The following table is the setting of the receiver

Receiver Parameters	Setting
Attenuation	10 dB
Start Frequency	0.15 MHz
Stop Frequency	30 MHz
IF Bandwidth	9 kHz

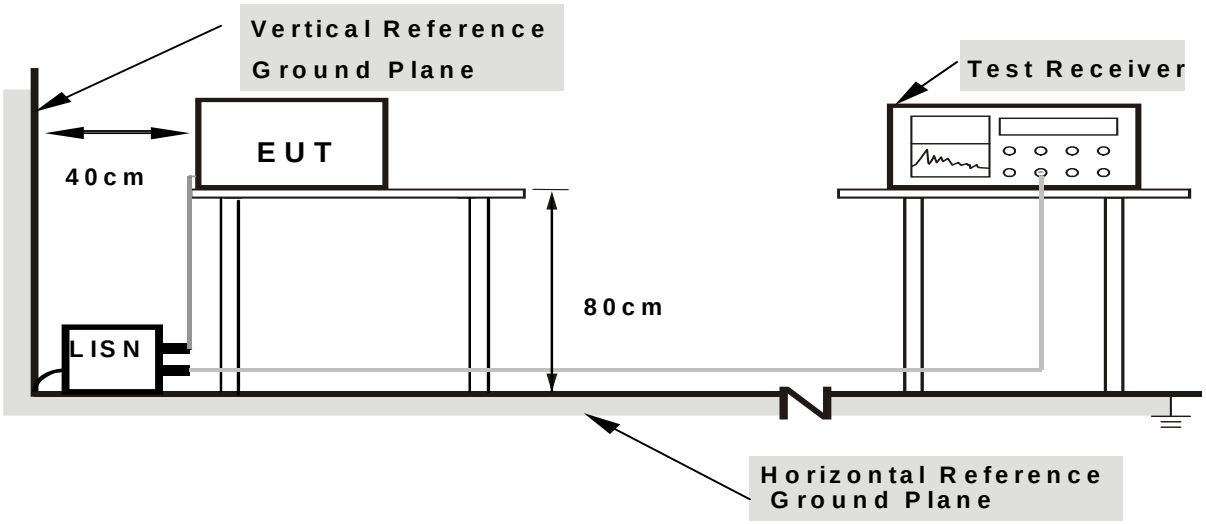
4.1.3 TEST PROCEDURE

a. The EUT was placed 0.4 meters from the horizontal ground plane with EUT being connected to the power mains through a line impedance stabilization network (LISN). All other support equipments powered from additional LISN(s). The LISN provide 50 Ohm/ 50uH of coupling impedance for the measuring instrument.
b. Interconnecting cables that hang closer than 40 cm to the ground plane shall be folded back and forth in the center forming a bundle 30 to 40 cm long.
c. I/O cables that are not connected to a peripheral shall be bundled in the center. The end of the cable may be terminated, if required, using the correct terminating impedance. The overall length shall not exceed 1 m.
d. LISN at least 80 cm from nearest part of EUT chassis.
e. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.1.4 DEVIATION FROM TEST STANDARD

No deviation

4.1.5 TEST SETUP



Note: 1.Support units were connected to second LISN.
2.Both of LISNs (AMN) are 80 cm from EUT and at least 80 from other units and other metal planes

4.1.6 EUT OPERATING CONDITIONS

The EUT was configured for testing in a typical fashion (as a customer would normally use it). The EUT has been programmed to continuously transmit during test. This operating condition was tested and used to collect the included data.

The eut power from System DC 5V (IN) power regulation 2.0~3.4Vdc to the module

4.1.7 TEST RESULTS

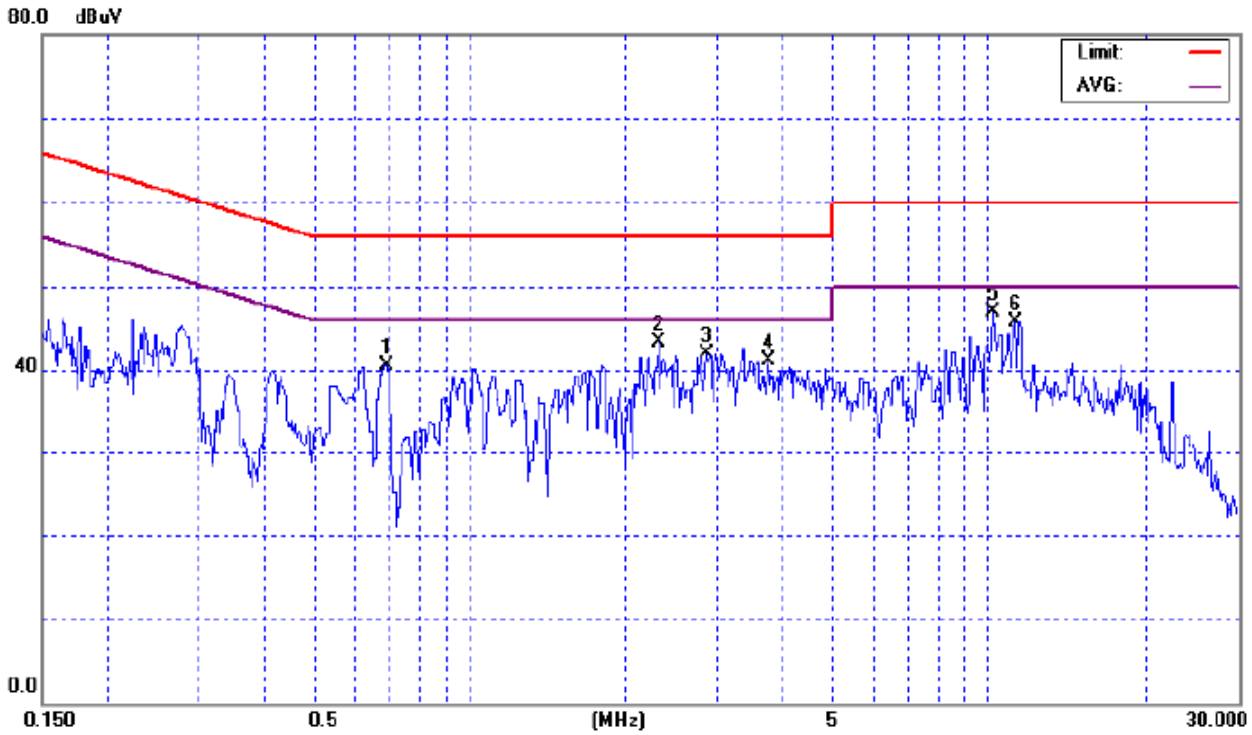
EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1011hPa	Test Power ：	AC 120V/60Hz
Test Mode ：	Mode 1		

Freq. (MHz)	Terminal L/N	Measured(dBuV)		Limits(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.69	Line	40.55	*	56.00	46.00	-15.45	(QP)
2.31	Line	43.25	*	56.00	46.00	-12.75	(QP)
2.86	Line	41.91	*	56.00	46.00	-14.09	(QP)
3.76	Line	41.13	*	56.00	46.00	-14.87	(QP)
10.20	Line	46.95	*	60.00	50.00	-13.05	(QP)
11.25	Line	45.79	*	60.00	50.00	-14.21	(QP)

Remark

(1) All readings are QP Mode value unless otherwise stated AVG in column of『Note』. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform。In this case, a " * " marked in AVG Mode column of Interference Voltage Measured。

(2) Measuring frequency range from 150KHz to 30MHz。



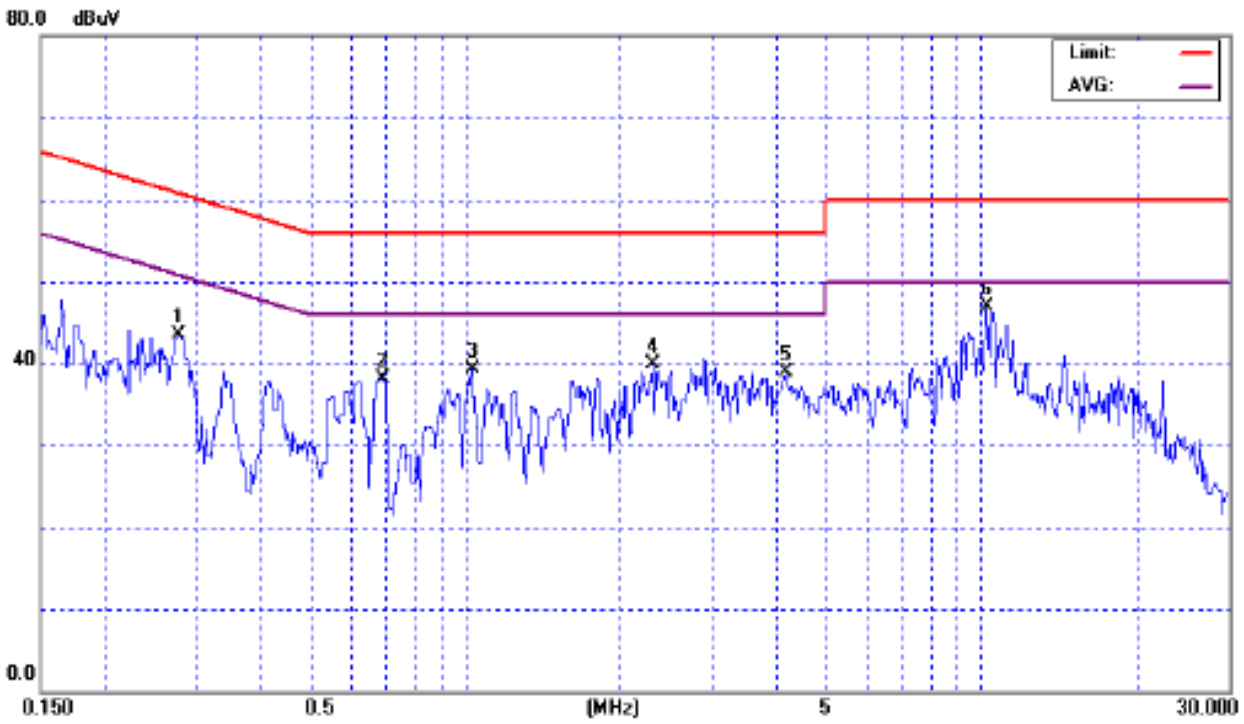
EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	24 ℃	Relative Humidity：	58%
Pressure：	1011hPa	Test Power ：	AC 120V/60Hz
Test Mode ：	Mode 1		

Freq. (MHz)	Terminal L/N	Measured(dBuV)		Limits(dBuV)		Margin (dB)	Note
		QP-Mode	AV-Mode	QP-Mode	AV-Mode		
0.28	Neutral	43.45	*	60.89	50.89	-17.44	(QP)
0.69	Neutral	38.04	*	56.00	46.00	-17.96	(QP)
1.03	Neutral	39.30	*	56.00	46.00	-16.70	(QP)
2.31	Neutral	39.98	*	56.00	46.00	-16.02	(QP)
4.19	Neutral	38.89	*	56.00	46.00	-17.11	(QP)
10.25	Neutral	46.81	*	60.00	50.00	-13.19	(QP)

Remark

(1) All readings are QP Mode value unless otherwise stated AVG in column of『Note』. If the QP Mode Measured value compliance with the QP Limits and lower than AVG Limits, the EUT shall be deemed to meet both QP & AVG Limits and then only QP Mode was measured, but AVG Mode didn't perform。In this case, a " * " marked in AVG Mode column of Interference Voltage Measured。

(2) Measuring frequency range from 150KHz to 30MHz。



4.2 RADIATED EMISSION MEASUREMENT

4.2.1 RADIATED EMISSION LIMITS (Frequency Range 9KHz-1000MHz)

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

LIMITS OF RADIATED EMISSION MEASUREMENT (Above 1000MHz)

FREQUENCY (MHz)	Class A (dBuV/m) (at 3m)		Class B (dBuV/m) (at 3m)	
	PEAK	AVERAGE	PEAK	AVERAGE
Above 1000	80	60	74	54

Notes:

(1) The limit for radiated test was performed according to FCC PART 15B.

(2) The tighter limit applies at the band edges.

(3) Emission level (dBuV/m)=20log Emission level (uV/m).

FREQUENCY RANGE OF RADIATED MEASUREMENT (For unintentional radiators)

Highest frequency generated or Upper frequency of measurement used in the device or on which the device operates or tunes (MHz)	Range (MHz)
Below 1.705	30
1.705 – 108	1000
108 – 500	2000
500 – 1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower

4.2.2 MEASUREMENT INSTRUMENTS LIST ANS SETTING

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Log-Bicon Antenna	Schwarzbeck	VULB 9160	3176	Apr. 11, 2009
2	Test Cable	N/A	10M_OS01	N/A	Oct. 10, 2008
3	Test Cable	N/A	OS01-1/-2	N/A	Oct. 10, 2008
4	Pre-Amplifier	Anritsu	MH648A(OS 01)	M09961	Oct. 10, 2008
5	Test Cable	N/A	SR03_C	N/A	Aug. 20, 2008
6	EMI Test Receiver	R&S	ESCI	100080	Mar. 08, 2009
7	Spectrum Analyzer	ADVAN TEST	R3261C	81720298	Sep. 12, 2008
8	Spectrum Analyzer	R&S	FSP_40	100129	Aug. 16, 2008
9	Horn Antenna	EMCO	3115	9120D-325	Aug. 19, 2008
10	Microwave Pre_amplifier	Agilent	8449B	3008A01714	May. 14, 2008
11	Microflex Cable	United Microwave	57793	1m	May. 13, 2008
12	Microflex Cable	United Microwave	A30A30-500 6	10M	Jul. 24, 2008

Remark: ” N/A” denotes No Model Name / Serial No. and No Calibration specified.

Spectrum Parameter	Setting
Attenuation	Auto
Start Frequency	1000 MHz
Stop Frequency	10th carrier harmonic
RB / VB (Emission in restricted band)	1MHz / 1MHz for Peak Average = Peak value + 20 log (Duty cycle)
RB / VB (other emission)	100KHz / 100KHz for peak

Receiver Parameter	Setting
Attenuation	Auto
Start ~ Stop Frequency	9kHz~150kHz / RB 200Hz for QP
Start ~ Stop Frequency	150kHz~30MHz / RB 9kHz for QP
Start ~ Stop Frequency	30MHz~1000MHz / RB 120kHz for QP

4.2.3 TEST PROCEDURE

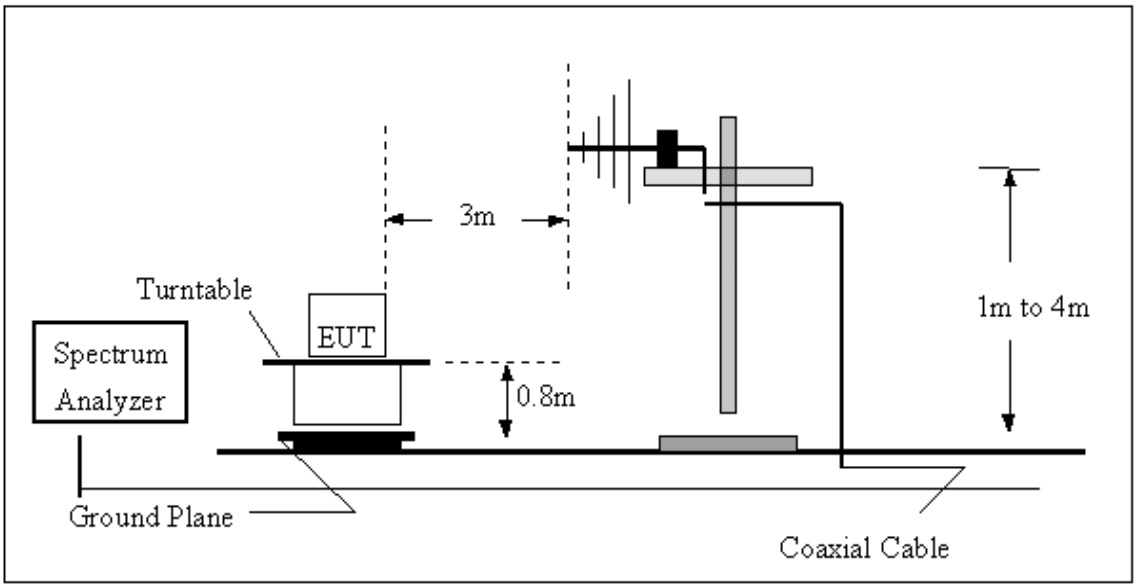
a. The measuring distance of at 3 m shall be used for measurements at frequency up to 1GHz. For frequencies above 1GHz, any suitable measuring distance may be used.
b. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter open area test site. The table was rotated 360 degrees to determine the position of the highest radiation.
c. The height of the equipment or of the substitution antenna shall be 0.8 m; the height of the test antenna shall vary between 1 m to 4 m. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d. The initial step in collecting conducted emission data is a spectrum analyzer peak detector mode pre-scanning the measurement frequency range. Significant peaks are then marked and then Quasi Peak detector mode re-measured.
e. If the Peak Mode measured value compliance with and lower than Quasi Peak Mode Limit, the EUT shall be deemed to meet QP Limits and then no additional QP Mode measurement performed.
f. For the actual test configuration, please refer to the related Item –EUT Test Photos.

4.2.4 DEVIATION FROM TEST STANDARD

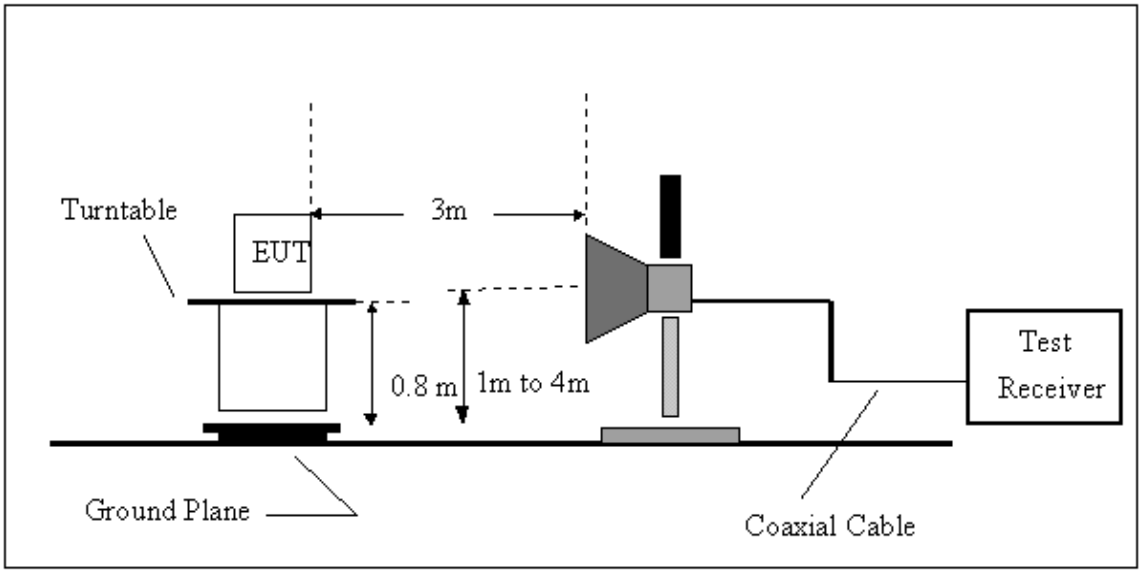
No deviation

4.2.5 TEST SETUP

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Above 1 GHz



4.2.6 EUT OPERATING CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

4.2.7 TEST RESULTS (BETWEEN30 – 1000 MHZ)

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2440MHz - CH 08		

Freq. (MHz)	Ant. H/V	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
147.93	V	22.96	-2.12	20.84	43.50	- 22.66	
166.43	V	25.89	-2.05	23.84	43.50	- 19.66	
220.20	V	25.31	-3.48	21.83	46.00	- 24.17	
500.05	V	25.45	4.78	30.23	46.00	- 15.77	
563.27	V	26.96	5.91	32.87	46.00	- 13.13	
825.04	V	24.77	10.66	35.43	46.00	- 10.57	

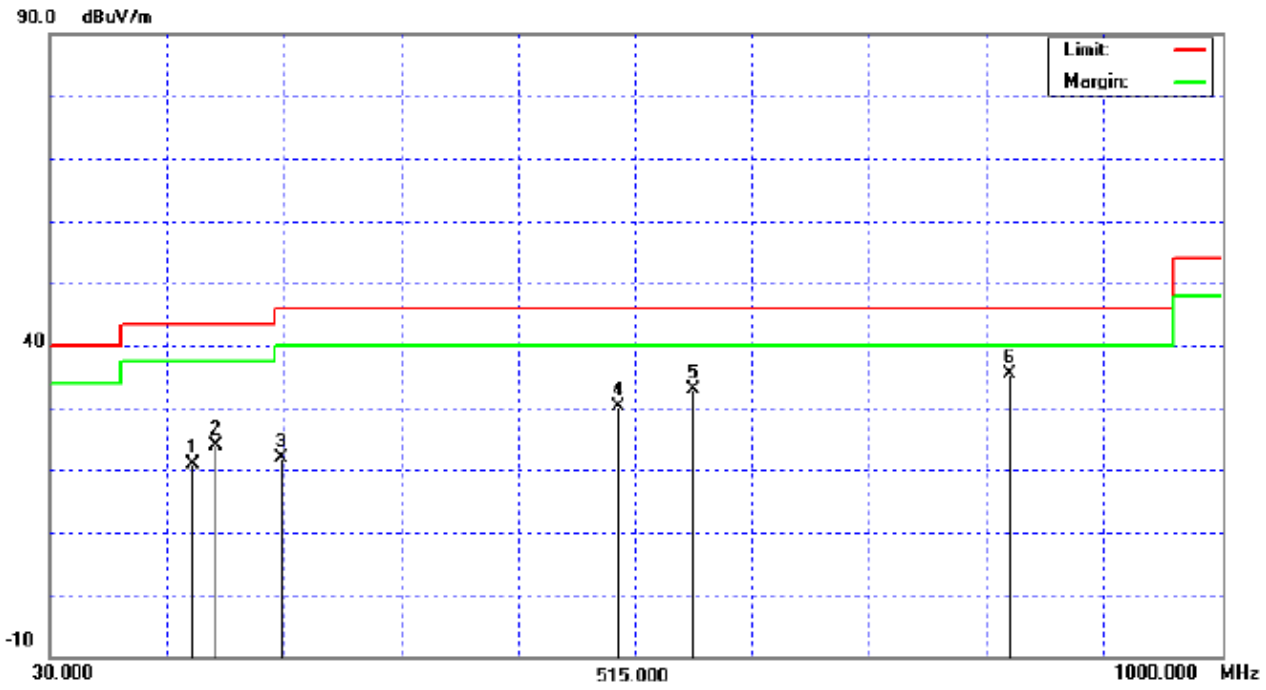
Remark：

(1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120KHz；SPA setting in RBW=120KHz, VBW =120KHz, Swp. Time = 0.3 sec./MHz。

(2) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(3) Measuring frequency range from 30MHz to 1000MHz。

(4) If the peak scan value lower limit more than 20dB, then this signal data does not show in table。



EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2440MHz - CH 08		

Freq. (MHz)	Ant. H/V	Reading(RA) (dBuV)	Corr.Factor(CF) (dB)	Measured(FS) (dBuV/m)	Limits(QP) (dBuV/m)	Margin (dB)	Note
147.23	H	28.51	-2.18	26.33	43.50	- 17.77	
160.40	H	29.13	-1.74	27.39	43.50	- 16.11	
170.71	H	31.42	-2.33	29.09	43.50	- 14.41	
215.32	H	30.08	-3.64	26.44	43.50	- 17.06	
500.00	H	31.64	4.78	36.42	46.00	- 9.58	
586.35	H	27.60	6.47	34.07	46.00	- 11.93	

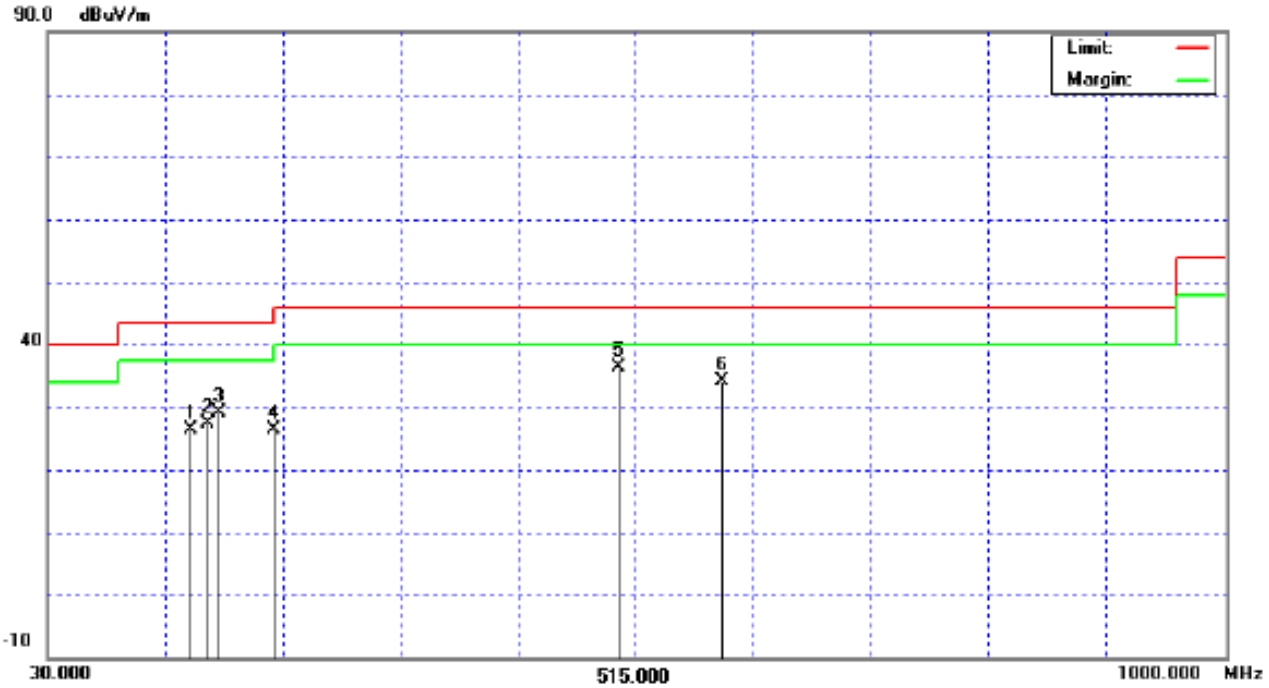
Remark：

(1) Reading in which marked as QP or Peak means measurements by using are Quasi-Peak Mode or Peak Mode with Detector BW=120KHz；SPA setting in RBW=120KHz, VBW =120KHz, Swp. Time = 0.3 sec./MHz。

(2) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(3) Measuring frequency range from 30MHz to 1000MHz。

(4) If the peak scan value lower limit more than 20dB, then this signal data does not show in table。



4.2.8 TEST RESULTS (ABOVE 1000 MHZ)

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2405MHz - CH 01		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2390.00	V	22.53	8.52	32.57	55.10	41.09	74.00	54.00	Y/E
2405.50	**V**	**63.29**	**49.28**	**32.66**	**95.95**	**81.94**			**Y/F**
4809.25	V	49.84	35.83	3.97	53.81	39.80	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

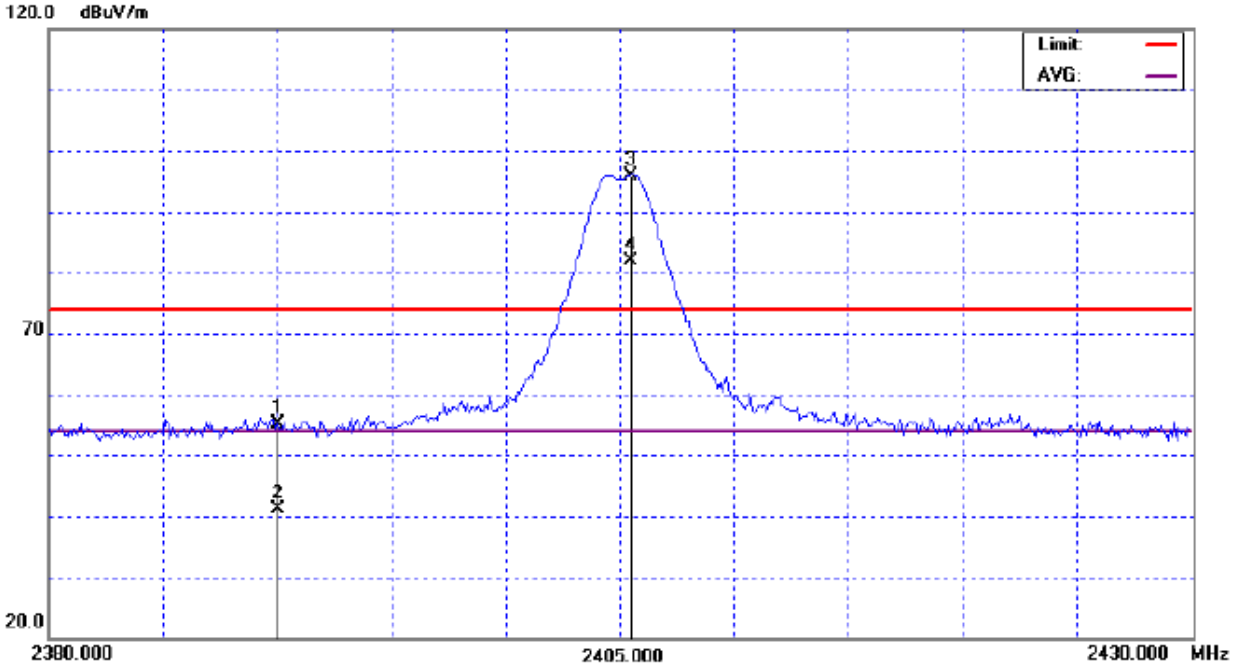
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

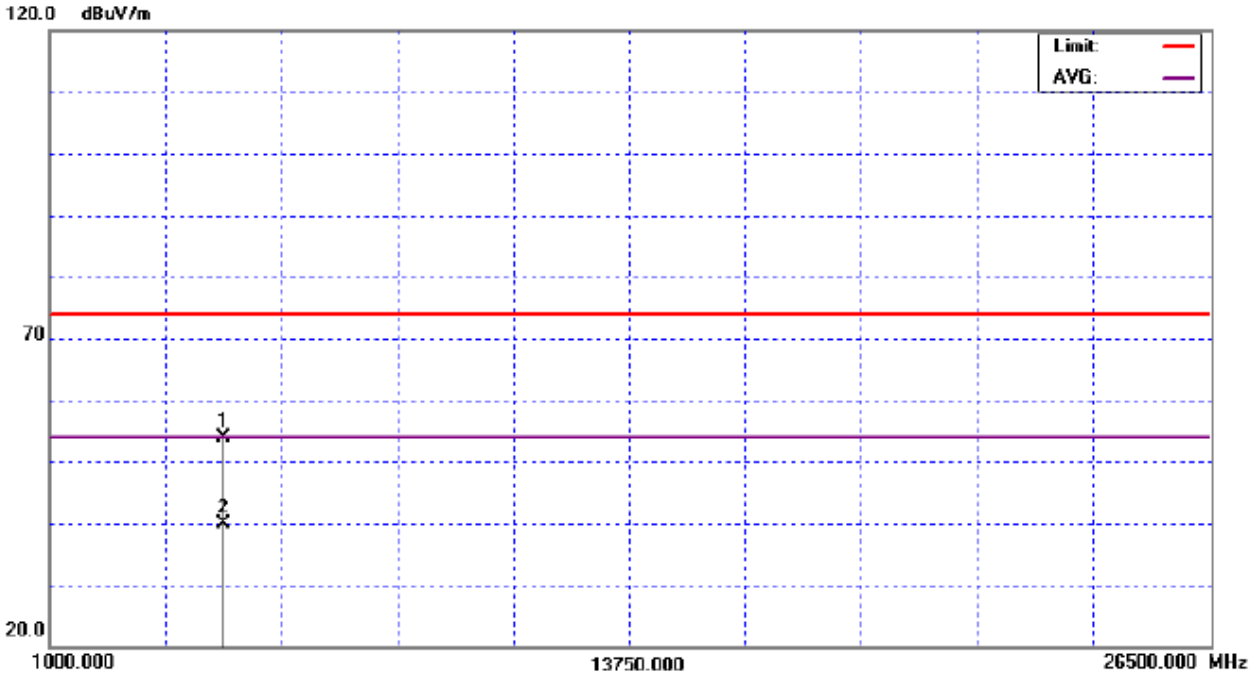
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH01 (Above 1000 MHz, Vertical)





EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2405MHz - CH 01		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2390.00	H	24.85	10.84	32.57	57.42	43.41	74.00	54.00	Y/E
2405.60	**H**	**65.53**	**51.52**	**32.66**	**98.19**	**84.18**			**Y/F**
4809.89	H	49.02	35.01	3.97	52.99	38.98	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

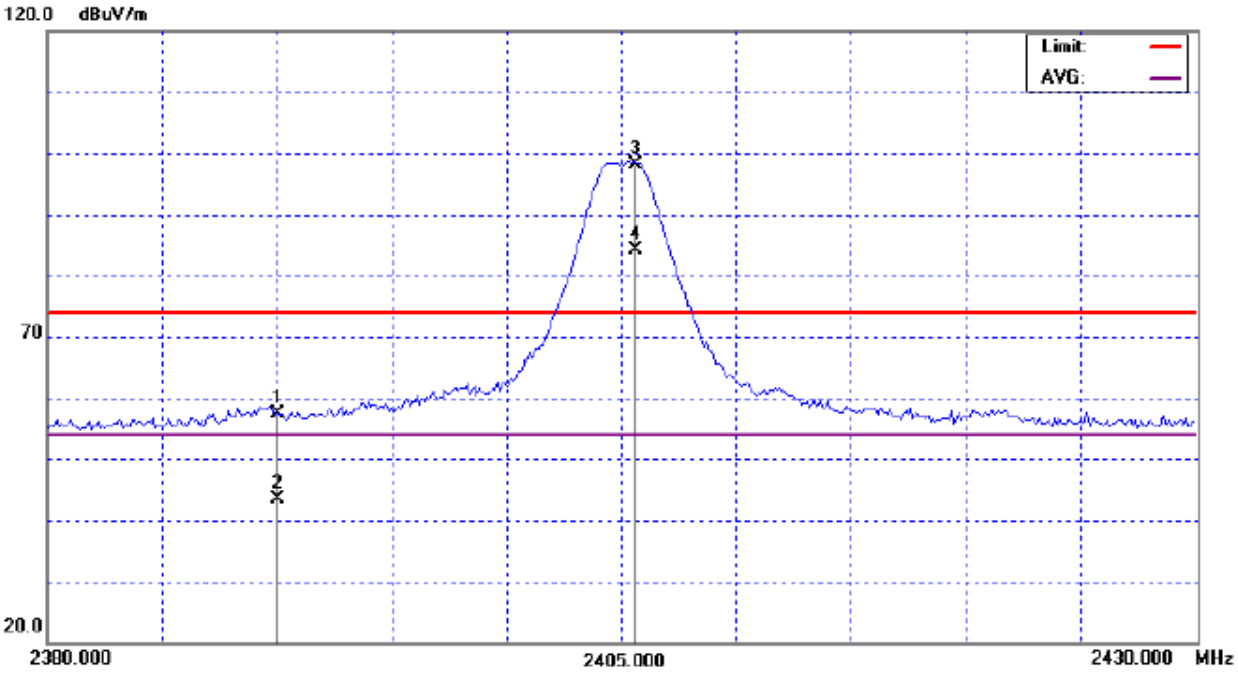
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

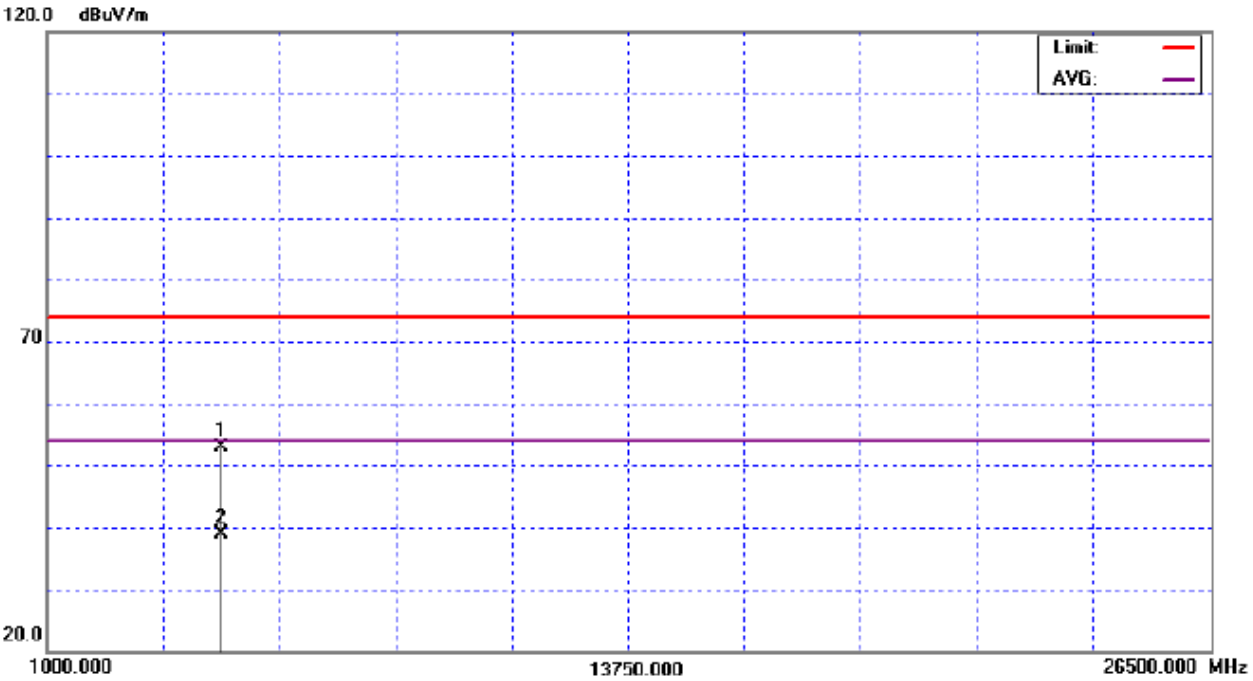
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH01 (Above 1000 MHz, Horizontal)





EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2440MHz - CH 08		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2439.60	**V**	**62.00**	**47.99**	**32.85**	**94.85**	**80.84**			**Y/F**
4880.04	V	50.32	36.31	4.32	54.64	40.63	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

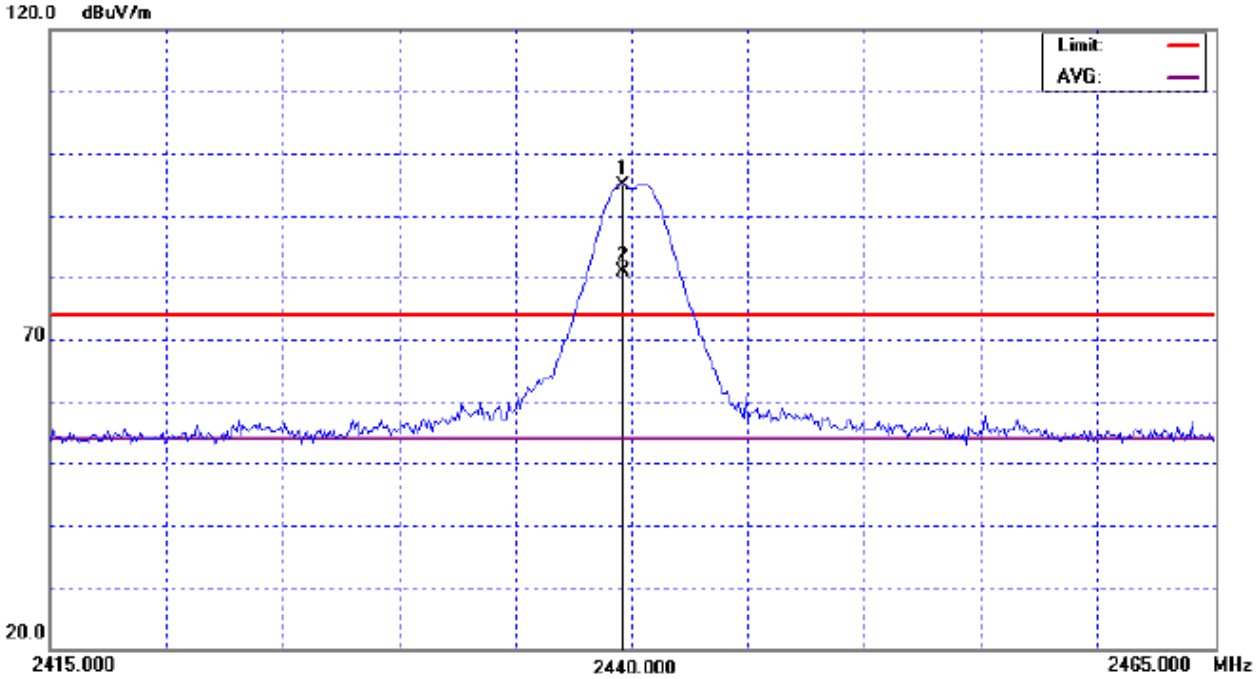
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

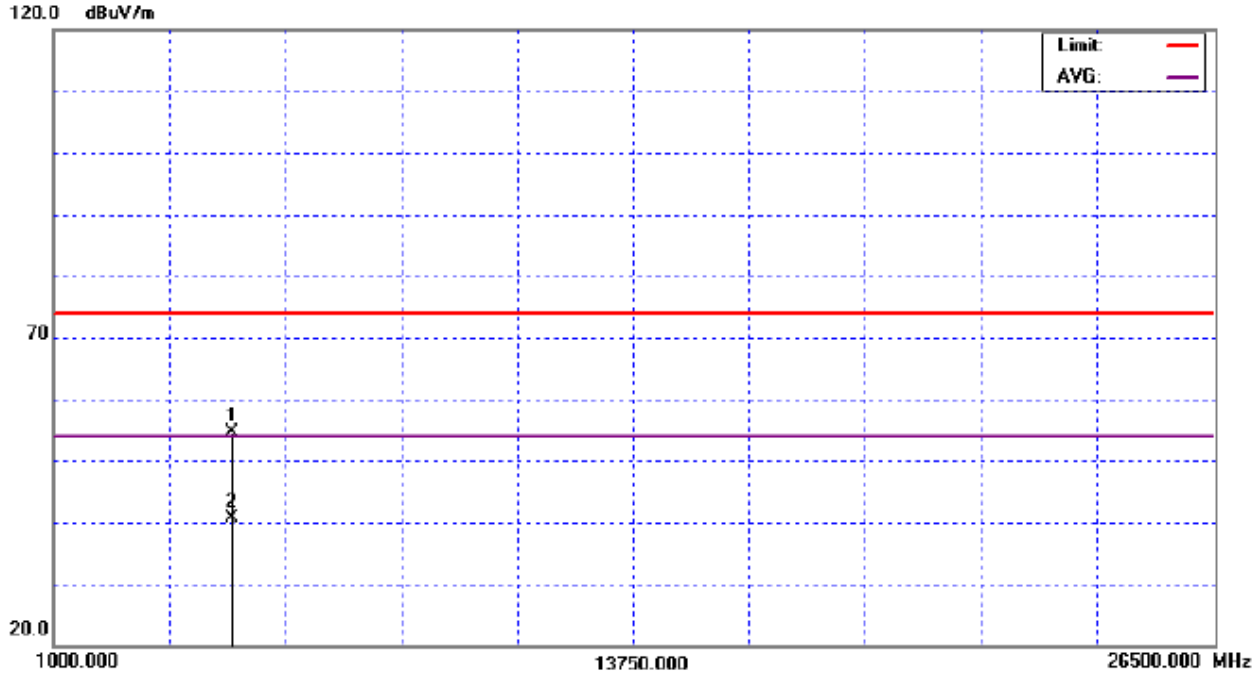
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH08 (Above 1000 MHz, Vertical)





EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2440MHz –CH 08		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2440.50	**H**	**65.42**	**51.41**	**32.86**	**98.28**	**84.27**			**Y/F**
4879.12	H	48.63	34.62	4.32	52.95	38.94	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of 『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

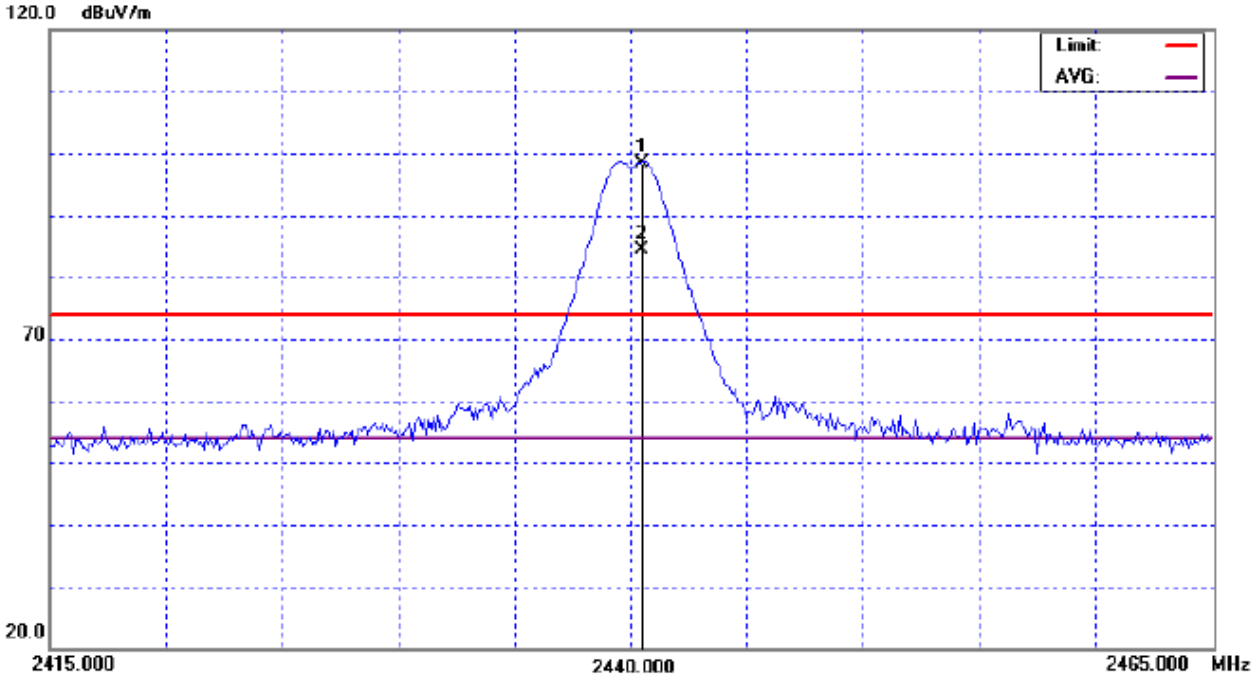
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

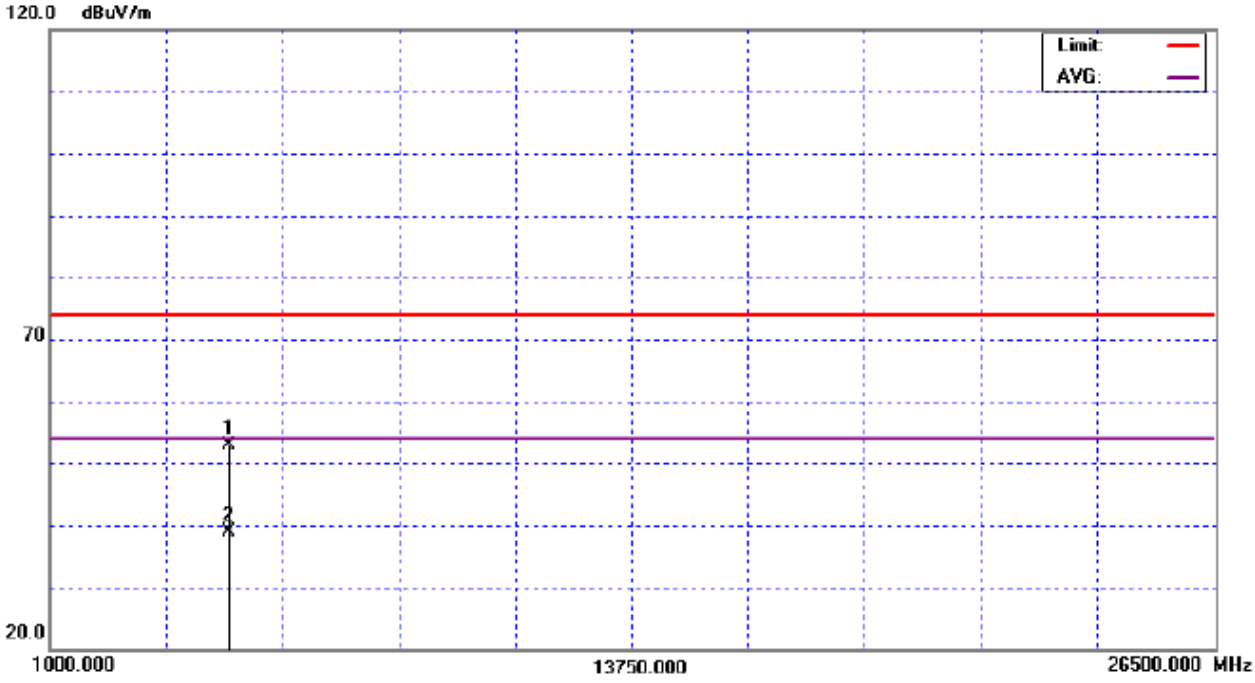
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH08 (Above 1000 MHz, Horizontal)





EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2480MHz –CH 16		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2480.50	**V**	**58.02**	**43.01**	**33.08**	**91.10**	**76.09**			**Y/F**
2483.50	V	27.27	13.26	33.10	60.37	46.36	74.00	54.00	Y/E
4960.48	V	50.31	36.30	4.71	55.02	41.01	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

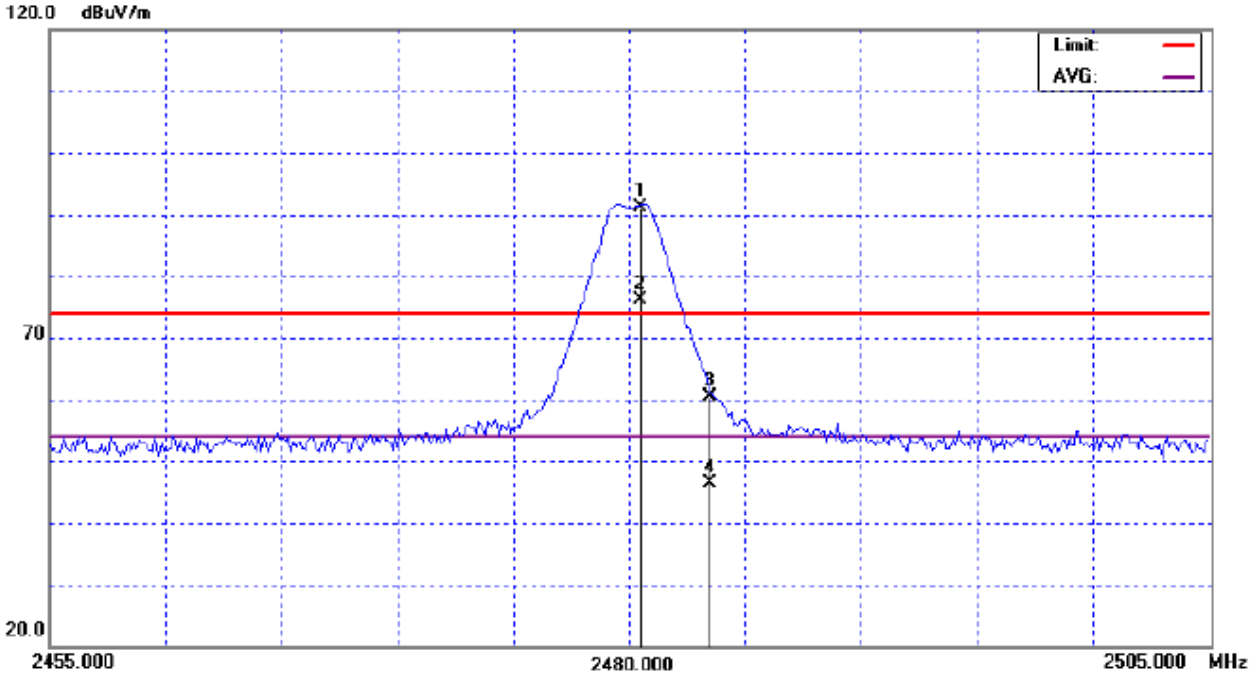
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

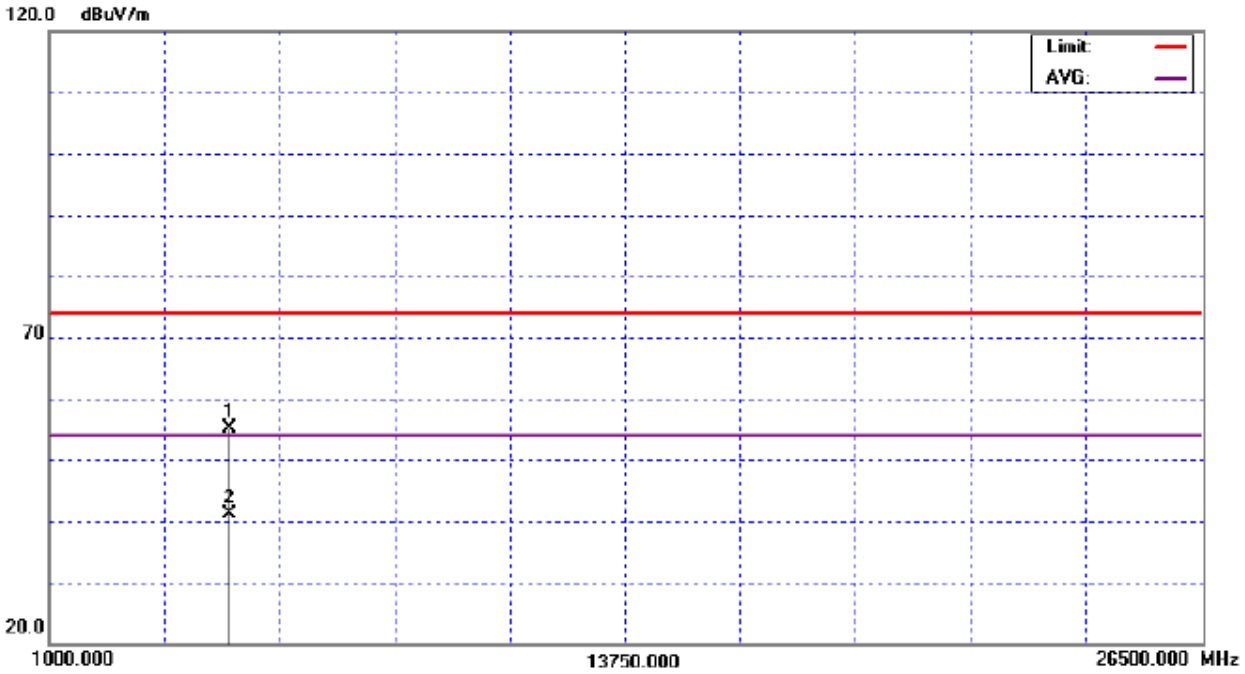
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH16 (Above 1000 MHz, Vertical)





EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2480MHz - CH 16		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2479.50	**H**	**60.34**	**46.33**	**33.08**	**93.42**	**79.41**			**Y/F**
2483.50	H	29.74	15.73	33.10	62.84	48.83	74.00	54.00	Y/E
4959.36	H	47.37	33.36	4.71	52.08	38.07	74.00	54.00	Y/H

Remark：

(1) All readings are Peak unless otherwise stated QP in column of『Note』. Peak denotes that the Peak reading compliance with the QP Limits and then QP Mode measurement didn't perform。

(2) Measuring frequency range from 30MHz to 1000MHz or the 10th harmonic of highest fundamental frequency。"F" denotes fundamental frequency; "H" denotes spurious frequency. "E" denotes band edge frequency. (This judgment method includes the Band Edge Requirement.)

(3) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

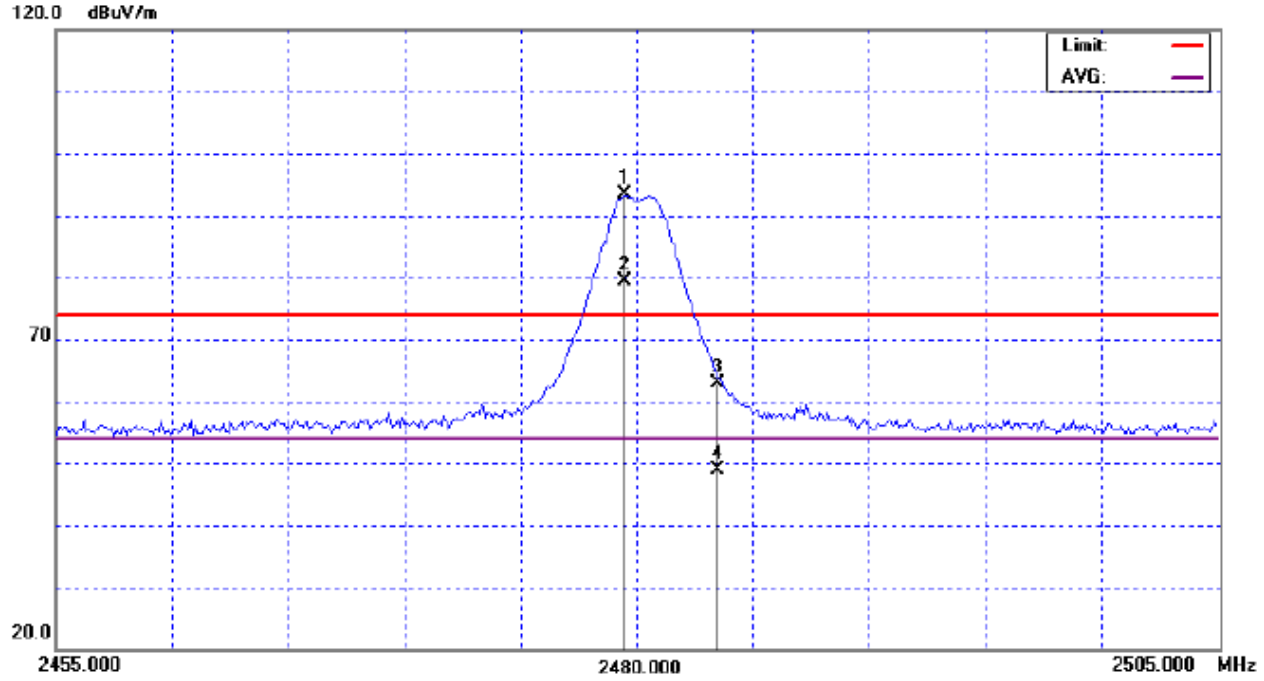
(4) Data of measurement within this frequency range shown " * " in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

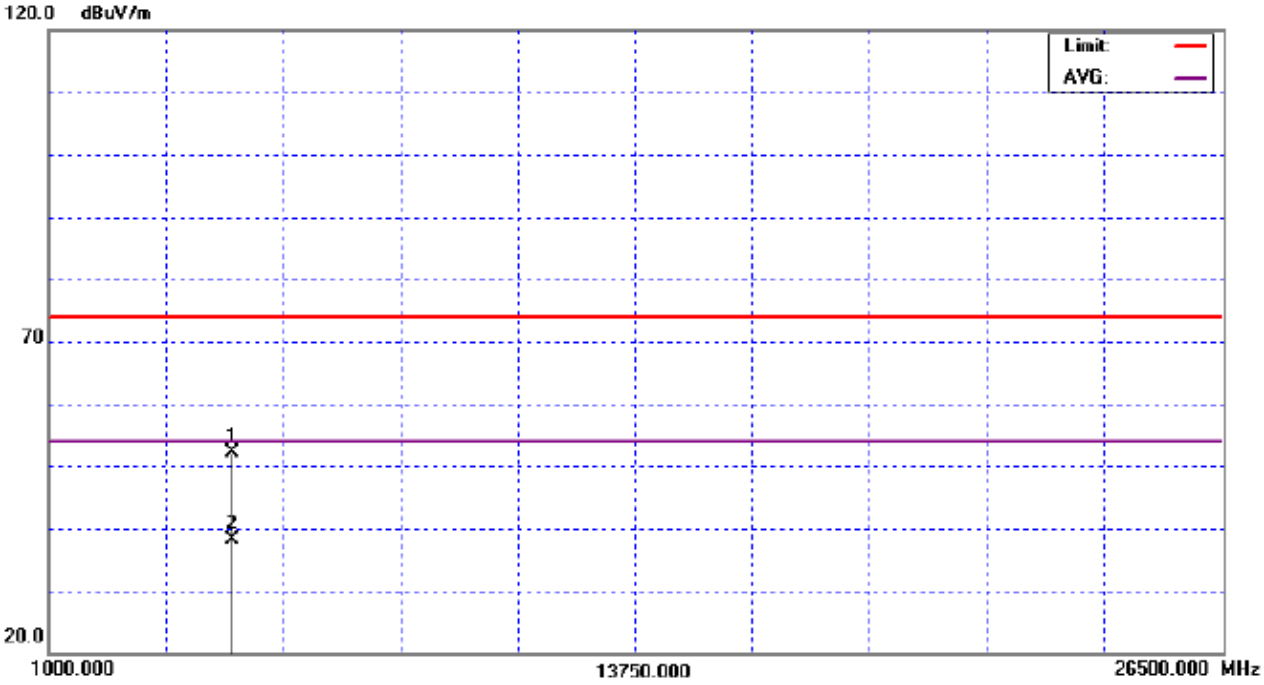
(5) A preamp and high pass filter were used for this test in order to provide sufficient measurement sensitivity.

(6) EUT Orthogonal Axis：
"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

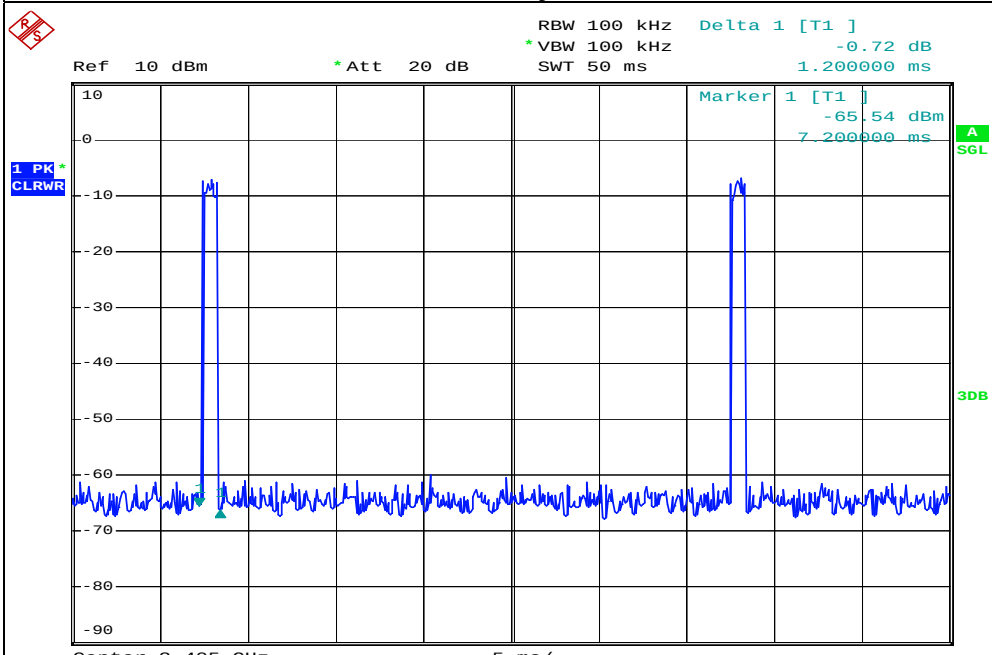
(7) The average of fundamental frequency is Average = Peak value + 20 log (Duty cycle)
Where the duty factor is calculated from following formula:
20 log (Duty cycle) = 20 log (1.2ms/30.2ms) = -28.01 dB
Please see page 36 for plotted duty

TX CH16 (Above 1000 MHz, Horizontal)



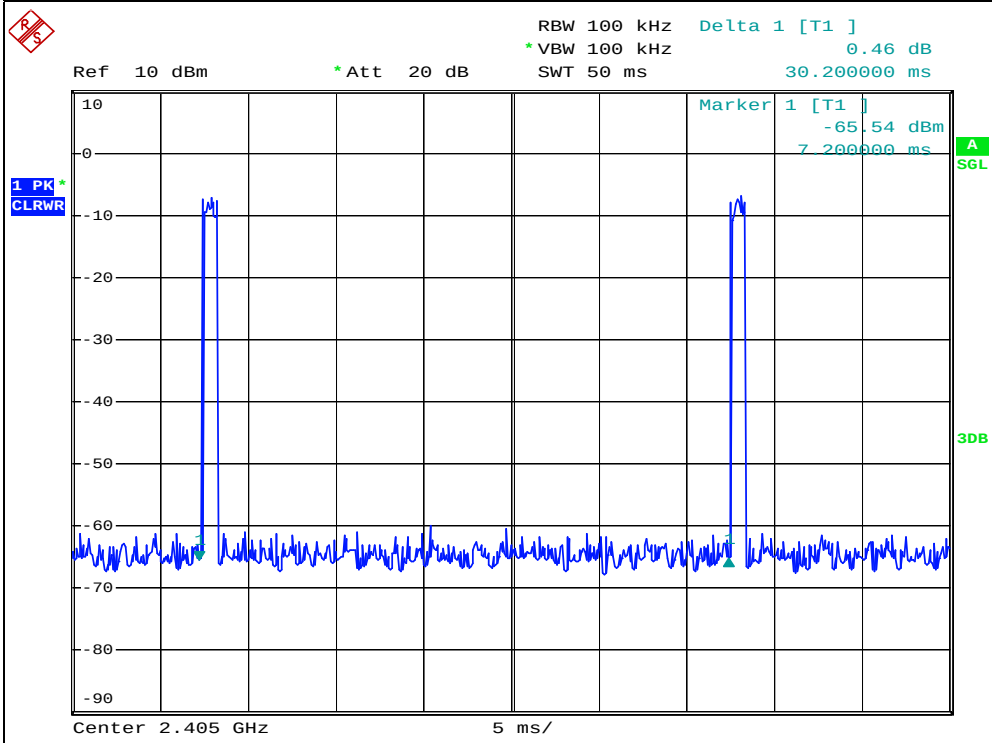


Ducty Mode 1



Date: 15.APR.2008 07:42:58

Ducty Mode 2



Date: 15.APR.2008 07:43:13

4.2.9 TEST RESULTS (RESTRICTED BANDS REQUIREMENTS)

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2405MHz/2480MHz (Vertical)		
Note：	1. The transmitter was setup to transmit at the lowest channel (CH01). Then the field strength was measured at 2310-2390 MHz. 2. The transmitter was setup to transmit at the highest channel (CH16). Then the field strength was measured at 2483.5-2500 MHz.		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2390.00	V	22.53	8.52	32.57	55.10	41.09	74.00	54.00	CH01
2483.50	V	27.27	13.26	33.10	60.37	46.36	74.00	54.00	CH16

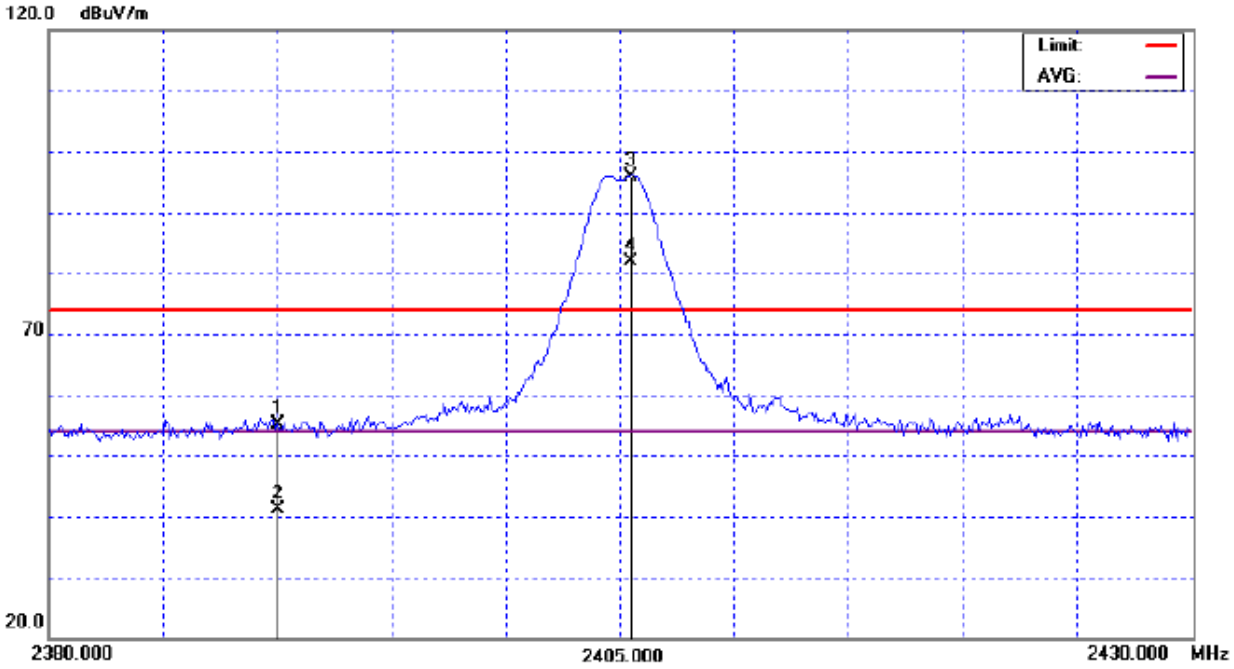
Remark：

(1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

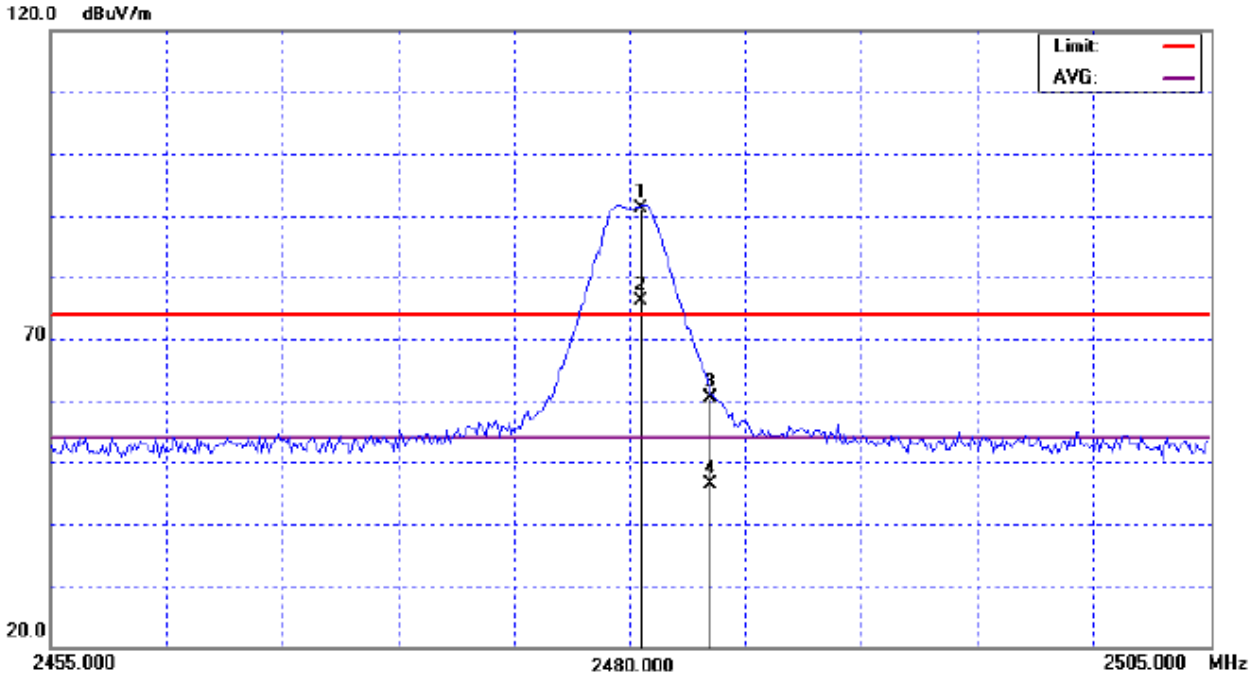
(2) EUT Orthogonal Axis：

"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

Restricted Bands Requirements, Vertical
CH01



CH16



EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1013 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	TX 2405MHz/2480MHz (Horiziontal)		
Note：	1. The transmitter was setup to transmit at the lowest channel (CH01). Then the field strength was measured at 2310-2390 MHz. 2. The transmitter was setup to transmit at the highest channel (CH16). Then the field strength was measured at 2483.5-2500 MHz.		

Freq.	Ant.Pol.	Reading		Ant./CF	Act.		Limit		Note
		Peak	AV		Peak	AV	Peak	AV	
(MHz)	H/V	(dBuV)	(dBuV)	CF(dB)	(dBuV/m)	(dBuV/m)	(dBuV/m)	(dBuV/m)	
2390.00	H	24.85	10.84	32.57	57.42	43.41	74.00	54.00	CH01
2483.50	H	29.74	15.73	33.10	62.84	48.83	74.00	54.00	CH16

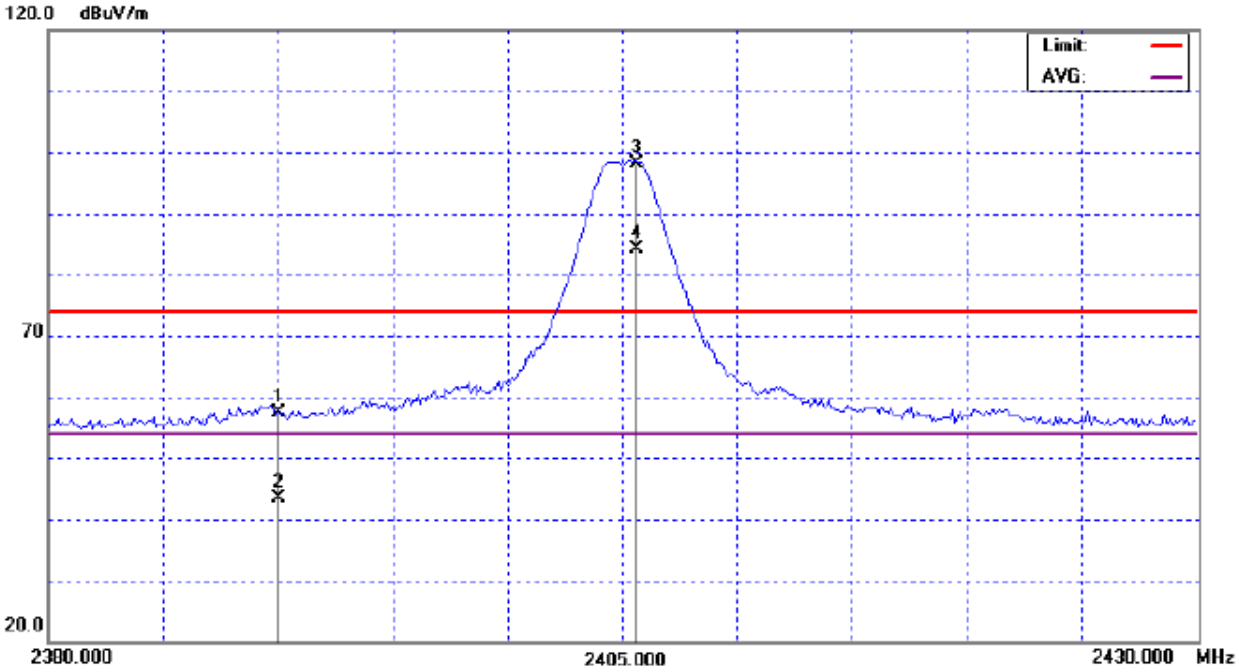
Remark：

(1) Radiated emissions measured in frequency range above 1000MHz were made with an instrument using Peak detector mode and AV detector mode of the emission 。

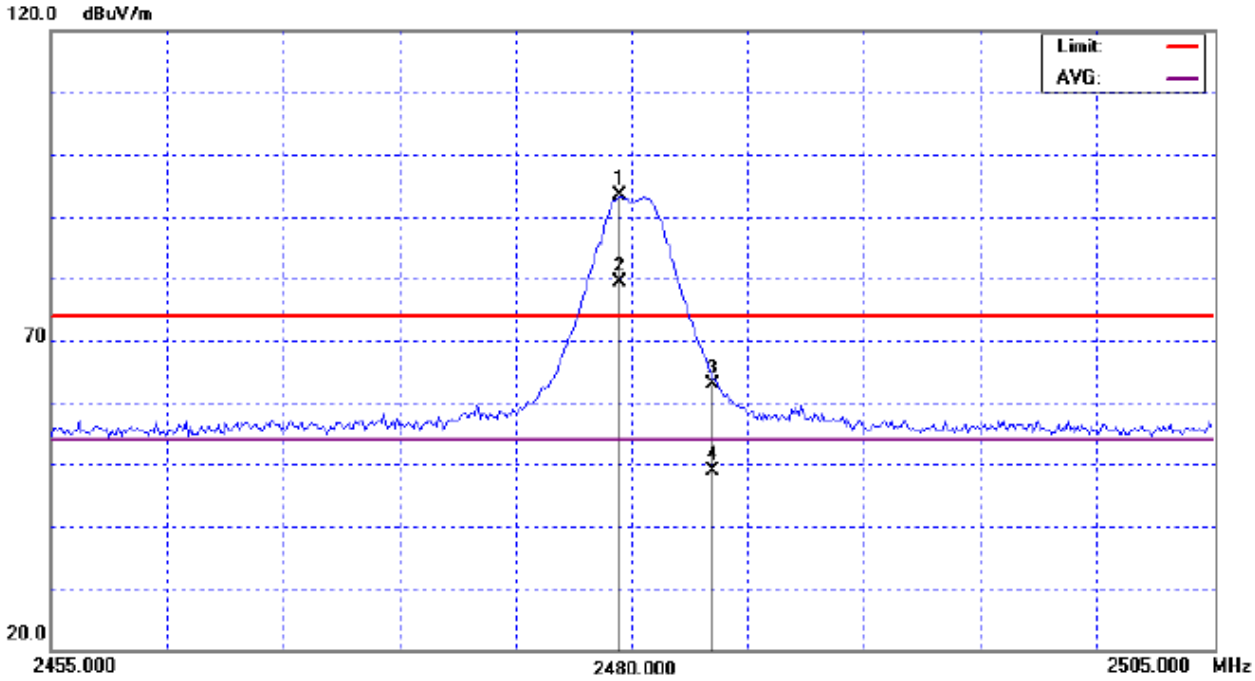
(2) EUT Orthogonal Axis：

"X" - denotes Laid on Table；"Y" - denotes Vertical Stand；"Z" - denotes Side Stand

Restricted Bands Requirements, Horizontal
CH01



CH16



5. BANDWIDTH TEST

5.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (a)(2)	Bandwidth	>= 500KHz (6dB bandwidth)	2400-2483.5	PASS

5.1.1 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP_40	100129	Aug. 16, 2008

Remark: ” N/A” denotes No Model Name. , Serial No. or No Calibration specified.

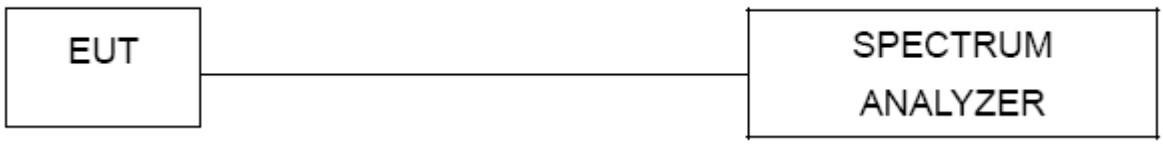
5.1.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=100KHz, Sweep time = 20 ms.

5.1.3 DEVIATION FROM STANDARD

No deviation.

5.1.4 TEST SETUP



5.1.5 EUT OPERATION CONDITIONS

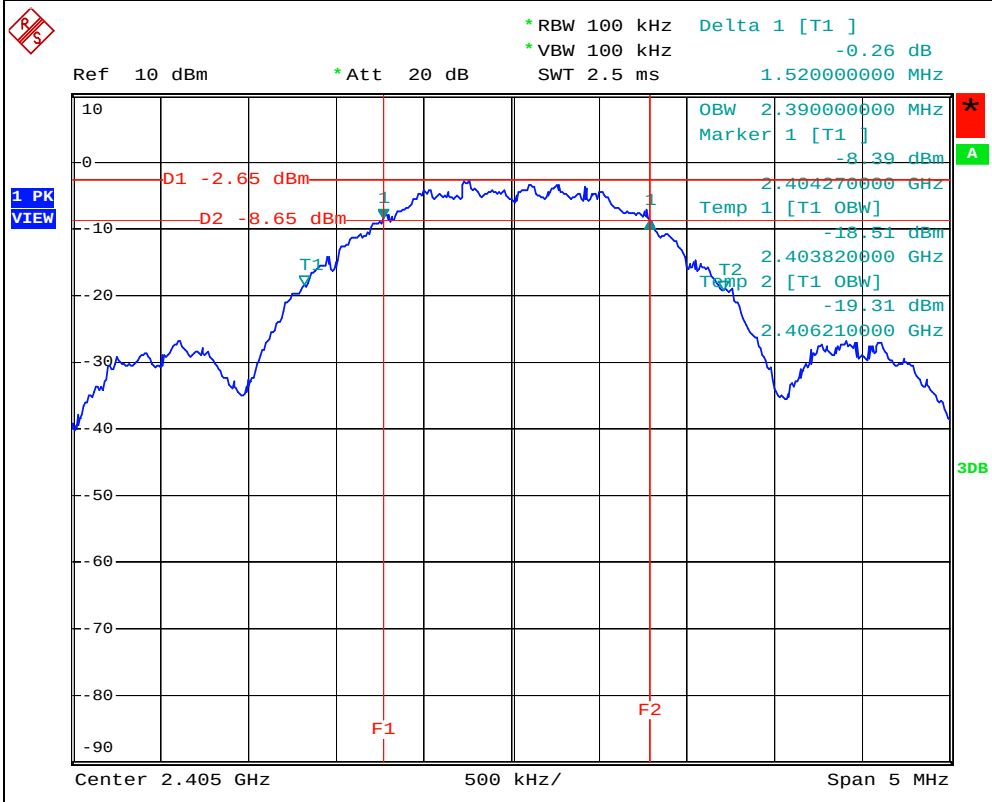
The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

5.1.6 TEST RESULTS

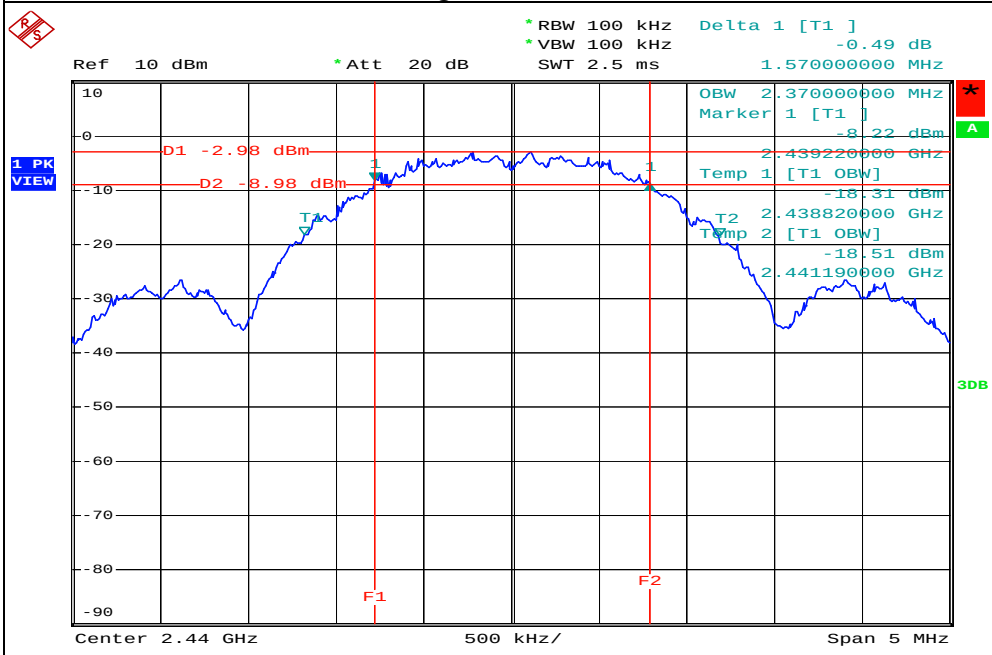
EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1016 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	Zigbee mode /CH01, CH08, CH16		

Test Channel	Frequency (MHz)	Bandwidth (MHz)	99% Occupied BW (MHz)	LIMIT (MHz)
CH01	2405	1.52	2.39	>=500KHz
CH08	2440	1.57	2.37	>=500KHz
CH16	2480	1.58	2.40	>=500KHz

Zigbee mode TX CH 01



Zigbee mode TX CH 08



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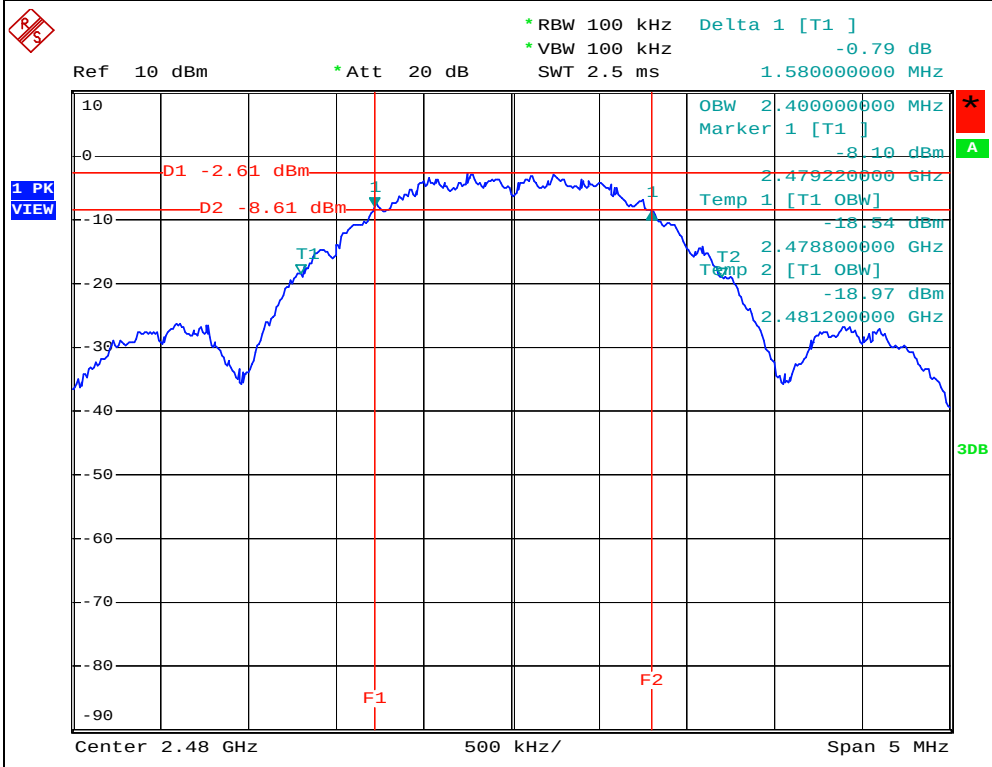
Zigbee mode TX CH 16



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6. PEAK OUTPUT POWER TEST

6.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (b)(1)	Peak Output Power	1 watt or 30dBm	2400-2483.5	PASS

6.1.1 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Power Meter	Anritsu	ML2487A	6K00004714	Feb. 12, 2009
2	Power Meter Sensor	Anritsu	MA2491A	34138	Feb. 12, 2009

Remark: ” N/A” denotes No Model Name. , Serial No. or No Calibration specified.

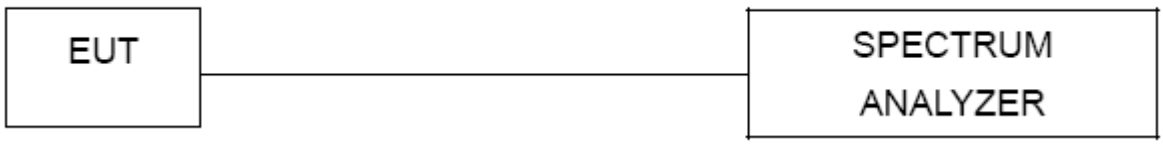
6.1.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 3MHz, VBW= 3MHz, Sweep time = 20 ms.

6.1.3 DEVIATION FROM STANDARD

No deviation.

6.1.4 TEST SETUP



6.1.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

6.1.6 TEST RESULTS

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1016 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	Zigbee mode /CH01, CH08, CH16		

Test Channel	Frequency (MHz)	Peak Output Power (dBm)	LIMIT (dBm)	LIMIT (W)
CH01	2405	0.77	30	1
CH08	2440	1.07	30	1
CH16	2480	1.16	30	1

7. ANTENNA CONDUCTED SPURIOUS EMISSION

7.1 Applied procedures / limit

20dBc in any 100 kHz bandwidth outside the operating frequency band. In case the emission fall within the restricted band specified on 15.205(a), then the 15.209(a) limit in the table below has to be followed.

Frequencies (MHz)	Field Strength (micorvolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

7.1.1 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP_40	100129	Aug. 16, 2008

Remark: ” N/A” denotes No Model Name. , Serial No. or No Calibration specified.

The following table is the setting of the spectrum analyzer.

Spectrum Parameter	Setting
Attenuation	Auto
Span Frequency	100 MHz
RB / VB (emission in restricted band)	1MHz / 1MHz for Peak, 1 MHz / 10Hz for Average
RB / VB (other emission)	100 KHz /100 KHz for Peak

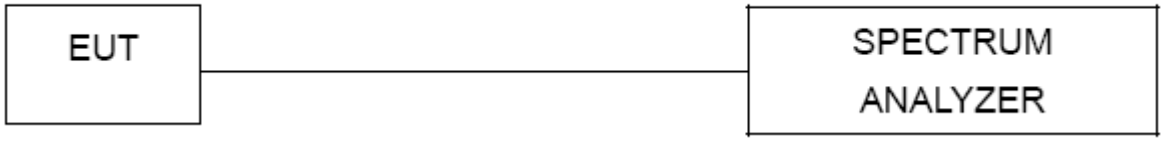
7.1.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW= 100KHz, VBW=100KHz, Sweep time = 200 ms.

7.1.3 DEVIATION FROM STANDARD

No deviation.

7.1.4 TEST SETUP



7.1.5 EUT OPERATION CONDITIONS

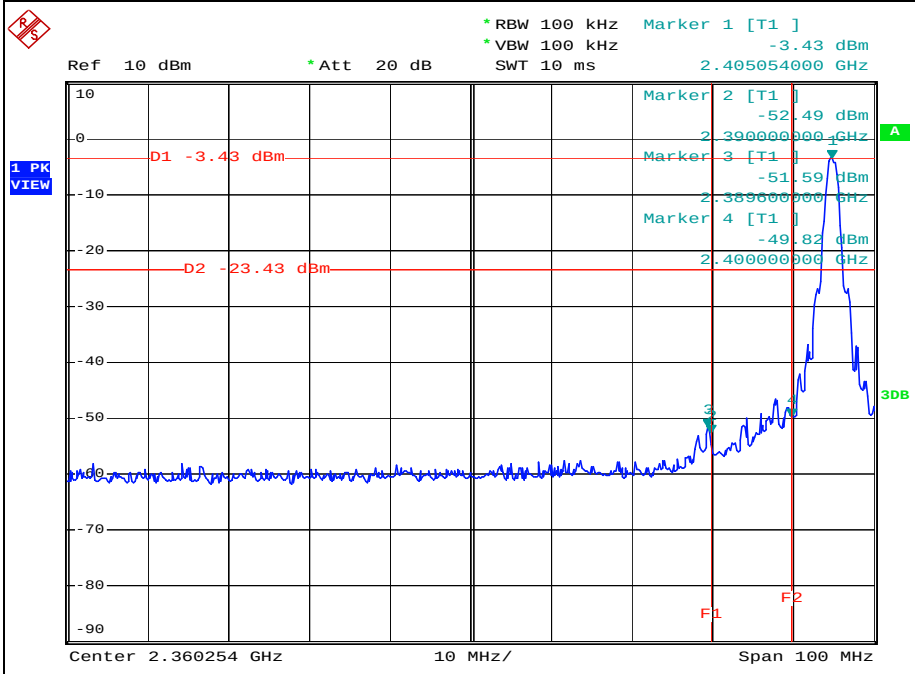
The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

7.1.6 TEST RESULTS

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1016 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	Zigbee mode CH01, CH16		

Channel of Worst Data: CH16			
The max. radio frequency power in any 100kHz bandwidth outside the frequency band		The max. radio frequency power in any 100 kHz bandwidth within the frequency band.	
FREQUENCY(MHz)	POWER(dBm)	FREQUENCY(MHz)	POWER(dBm)
2389.60	-51.59	2483.50	-42.33
Result			
In any 100kHz bandwidth outside the frequency band, the radio frequency power is at least 20dB below that in the 100kHz bandwidth within the band that contains the highest lever of the desired power.			

Zigbee mode TX CH01



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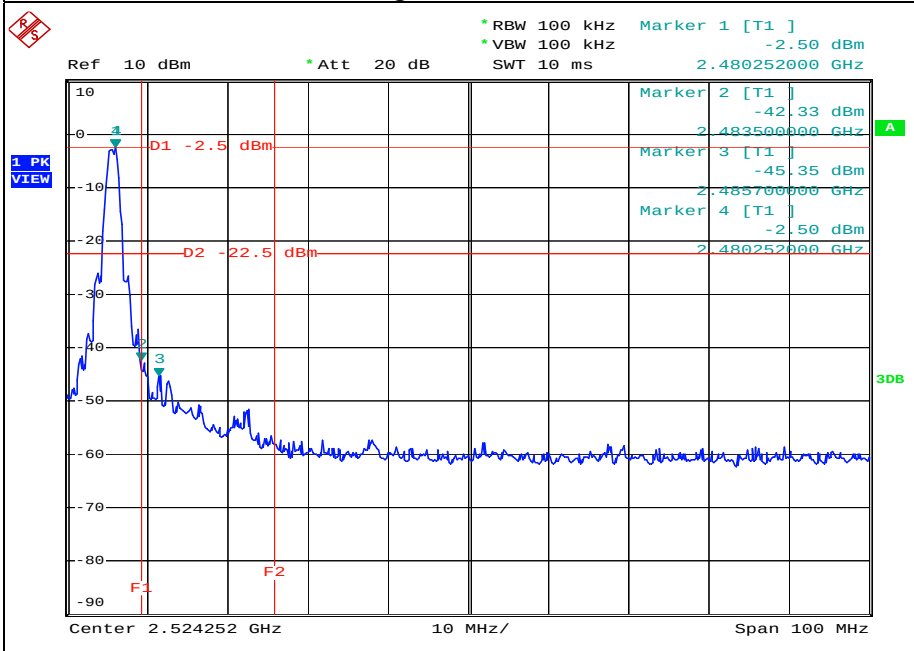
Zigbee mode TX CH16



Date: 15.APR.2008 06:06:13

8. POWER SPECTRAL DENSITY TEST

8.1 Applied procedures / limit

FCC Part15 (15.247) , Subpart C				
Section	Test Item	Limit	Frequency Range (MHz)	Result
15.247 (d)	Power Spectral Density	8 dBm (in any 3KHz)	2400-2483.5	PASS

8.1.1 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP_40	100129	Aug. 16, 2008

Remark: ” N/A” denotes No Model Name. , Serial No. or No Calibration specified.

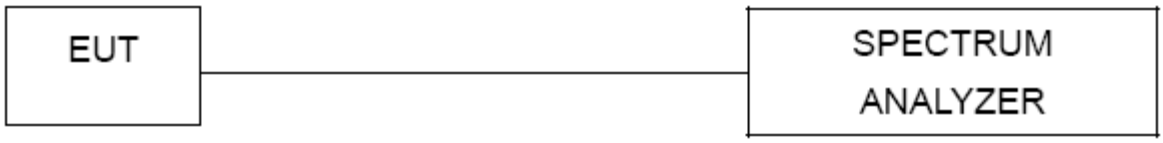
8.1.2 TEST PROCEDURE

a. The EUT was directly connected to the spectrum analyzer and antenna output port as show in the block diagram below,
b. Spectrum Setting : RBW=3KHz, VBW=30 KHz, Sweep time = 500s.

8.1.3 DEVIATION FROM STANDARD

No deviation.

8.1.4 TEST SETUP



8.1.5 EUT OPERATION CONDITIONS

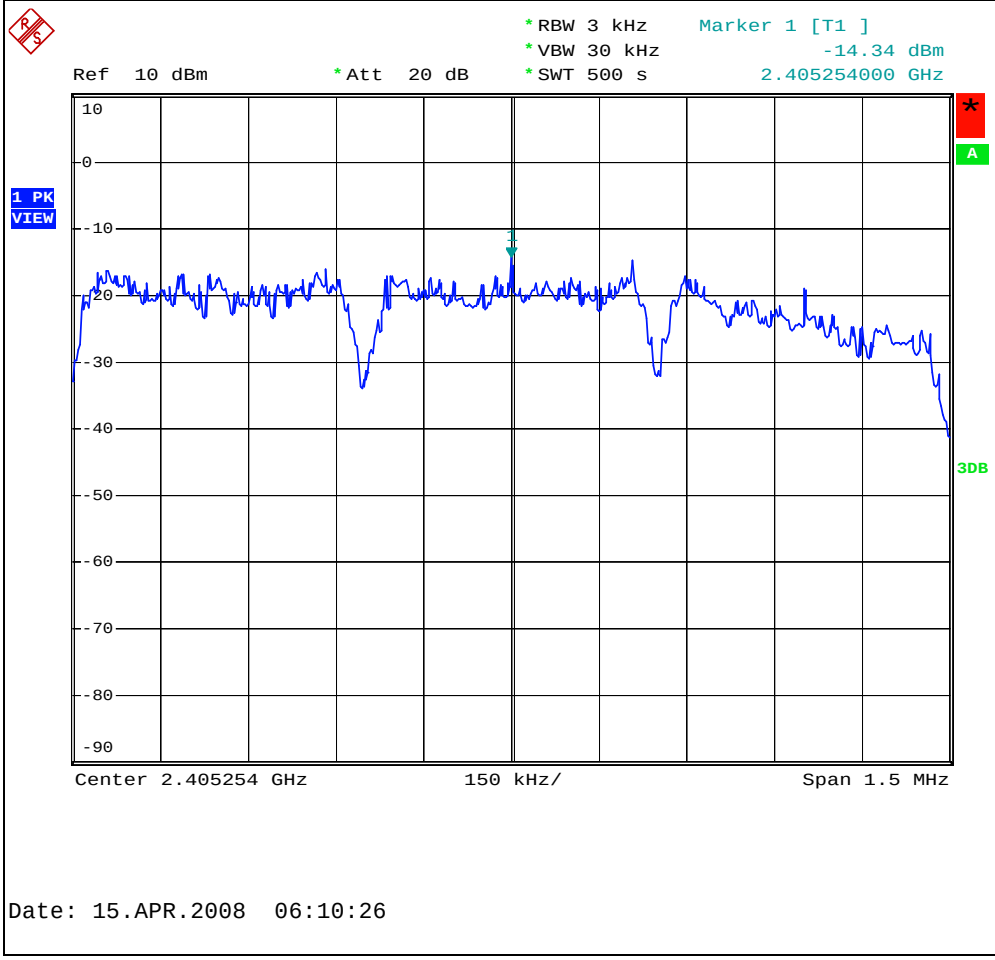
The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

8.1.6 TEST RESULTS

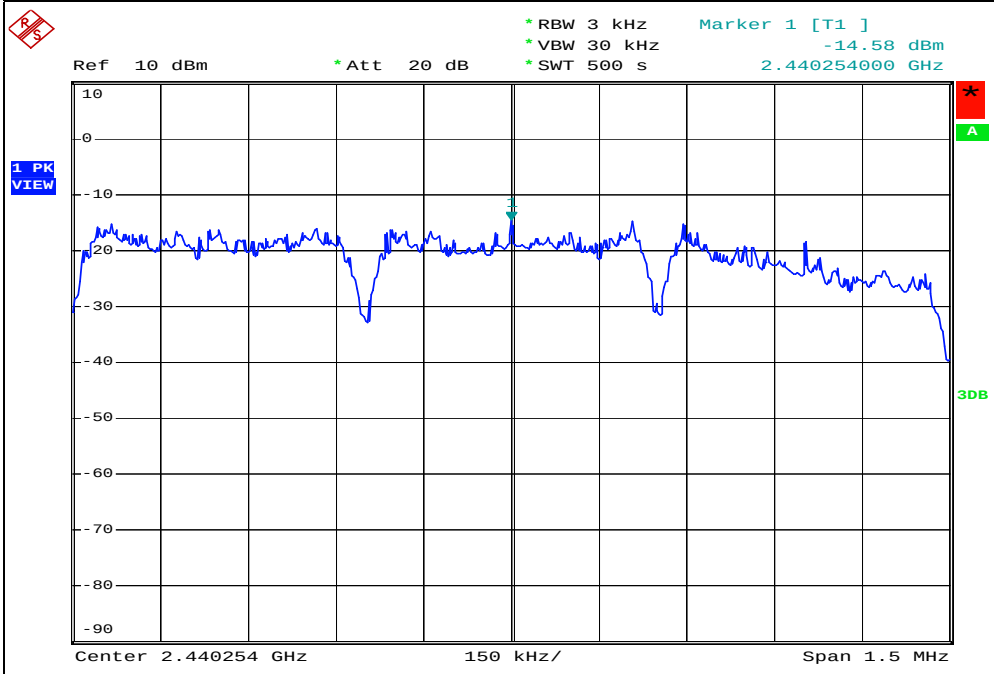
EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1016 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	Zigbee mode /CH01, CH08, CH16		

Test Channel	Frequency (MHz)	Power Density (dBm)	LIMIT (dBm)
CH01	2405	-14.34	8
CH08	2440	-14.52	8
CH16	2480	-14.36	8

Zigbee mode TX CH01



Zigbee mode TX CH08



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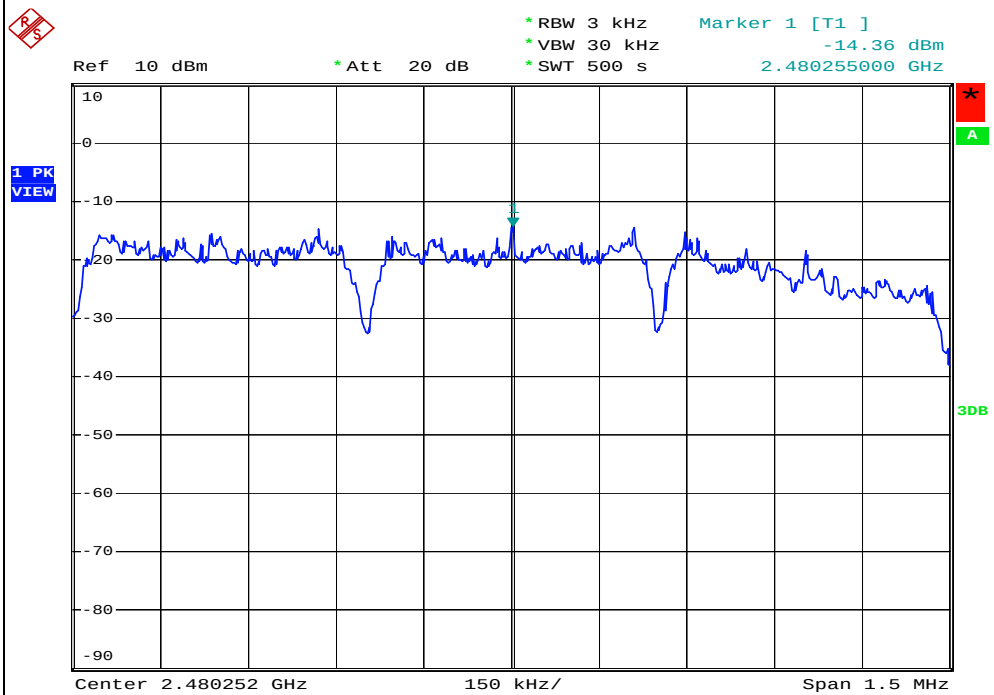
Zigbee mode TX CH16



Date: 15.APR.2008 06:05:17

9. RF EXPOSURE TEST

9.1 APPLIED PROCEDURES / LIMIT

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

9.1.1 MEASUREMENT INSTRUMENTS LIST

Item	Kind of Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Spectrum Analyzer	R&S	FSP_40	100129	Aug,16, 2008

Remark: ” N/A” denotes No Model Name , Serial No. or No Calibration specified.

9.1.2 MPE CALCULATION METHOD

E (V/m) $= \frac{\sqrt{30 \times P \times G}}{d}$ Power Density: *Pd* (W/m²) $= \frac{E^2}{377}$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

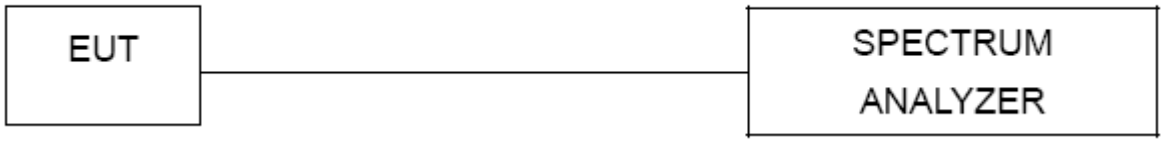
Pd $= \frac{30 \times P \times G}{377 \times d^2}$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

9.1.3 DEVIATION FROM STANDARD

No deviation.

9.1.4 TEST SETUP



9.1.5 EUT OPERATION CONDITIONS

The EUT tested system was configured as the statements of 4.1.6 Unless otherwise a special operating condition is specified in the follows during the testing.

9.1.6 TEST RESULTS

EUT：	IEEE 802.15.4 transceivers module	Model Name ：	ZM101
Temperature：	25 ℃	Relative Humidity：	60%
Pressure：	1016 hPa	Test Voltage ：	AC 120V/60Hz
Test Mode ：	**Zigbee mode** CH01, CH08, **CH16**		

Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm^2)	Limit of Power Density (S) (mW/cm^2)	Test Result
1.00	1.2589	0.77	1.1940	0.000299	1	Complies
1.00	1.2589	1.07	1.2794	0.000321	1	Complies
1.00	**1.2589**	**1.16**	**1.3062**	**0.000327**	**1**	**Complies**

10. EUT TEST PHOTO

Conducted Measurement Photos

Radiated Measurement Photos

Radiated Measurement Photos