

EMC TEST REPORT for Intentional Radiator

No. 130401050SHA-001

Applicant : MONITOR AUDIO LTD.
Unit 2, 24 Brook Road Rayleigh, Essex. England SS6 7XJ
United Kingdom

Manufacturer : DONGGUAN BOSUN ELECTRONIC INC.
Zheng Long Industrial District, Sicun, Tangxia Town,
Dongguan City, Guangdong Province, China.

Equipment : Powered Speaker System

Type/Model : ASB-2

SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2012): Radio Frequency Devices

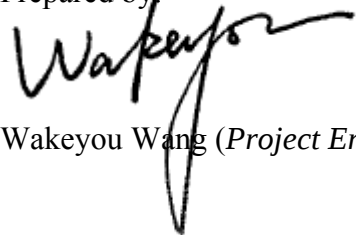
ANSI C63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

RSS-210 Issue 8 (December 2010): Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 3 (December 2010): General Requirements and Information for the Certification of Radiocommunication Equipment

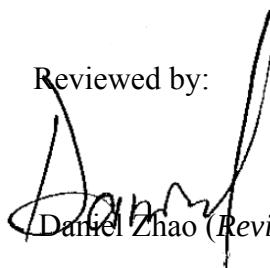
Date of issue: May 29, 2013

Prepared by:



Wakeyou Wang (*Project Engineer*)

Reviewed by:



Daniel Zhao (*Reviewer*)



FCC ID: O7VMA191522
IC: 5928A-MA191522

Description of Test Facility

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FCC ID: O7VMA191522
IC: 5928A-MA191522

1. General Information

1.1 Applicant Information

Applicant: MONITOR AUDIO LTD.
Unit 2, 24 Brook Road Rayleigh, Essex. England
SS6 7XJ United Kingdom

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Tel: 44-1268-798565

Fax: 44-1268-740589

Manufacturer: DONGGUAN BOSUN ELECTRONIC INC.
Zheng Long Industrial District, Sicun, Tangxia Town,
Dongguan City, Guangdong Province, China.

Sample received date : April 15, 2013

Sample Identification No : *0130415-27-001*

Date of test : April 15, 2013 ~ May 20, 2013

1.2 Identification of the EUT

Equipment: Powered Speaker System

Type/model: ASB-2

FCC ID: O7VMA191522

IC: 5928A-MA191522

1.3 Technical specification

Frequency Range:	2412 - 2462 MHz
Modulation:	DBPSK @1Mbps DQPSK@2Mbps CCK@5.5/11Mbps BPSK@6/9 Mbps QPSK@12/18Mbps 16-QAM@24Mbps 64-QAM@48/54Mbps and above
Gain of Antenna:	Internal antenna, 3.0dBi max
Rating:	100-120Vac/220-240Vac~50/60Hz 200W
Description of EUT:	The EUT is a wireless audio device. There are two antenna chains. Both were assessed and the worse one was listed in this report.
Channel Description:	The channel spacing is 5MHz.

1.4 Mode of operation during the test / Test peripherals used

While testing transmitting mode of EUT, the internal modulation and continuously transmission was applied.

The lowest, middle and highest channel were tested as representatives (2412MHz, 2437MHz and 2462MHz).

Test Peripherals:

PC: HP Compaq 6280 Pro Microtower

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Semi-anechoic chamber	-	Albatross project	EC 3048	2013-5-12	2014-5-11
Test Receiver	ESCS 30	R&S	EC 2107	2011-10-21	2012-10-20
A.M.N.	ESH2-Z5	R&S	EC 3119	2013-1-9	2014-1-8
A.M.N.	ENV4200	R&S	EC3558	2012-8-11	2013-8-10
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2013-1-9	2014-1-8
High Pass Filter	WHKX 2.8/18G-12SS	Wainwright	EC4297-2	2013-1-9	2014-1-8
High Pass Filter	WHKX 7.0/1.8G-8SS	Wainwright	EC4297-3	2013-1-9	2014-1-8
Band Reject Filter	WRCGV 2400/2483- 2390/2493- 35/10SS	Wainwright	EC4297-4	2013-1-9	2014-1-8
Test Receiver	FSV40	R&S	/	2012-9-30	2013-9-29
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2013-4-12	2014-4-11
Pre-amplifier	Tpa0118-40	R&S	EC 4792-2	2013-4-12	2014-4-11
Horn antenna	HF 906	R&S	EC 3049	2013-5-13	2015-5-12
Horn antenna	3117	ETS	EC 4792-1	2012-4-17	2014-4-16
Horn antenna	HAP18-26W		EC 4792-3	2012-4-10	2014-4-9
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2013-5-16	2015-5-15
Test Receiver	ESCS 30	R&S	EC 2107	2012-10-21	2013-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2012-10-21	2013-10-20
Test Receiver	ESCI 7	R&S	EC4501	2012-12-13	2013-12-12

2.2 Test Standard

47CFR Part 15 (2012)
ANSI C63.4 (2003)
RSS-210 Issue 8 (December 2010)
RSS-Gen Issue 3 (December 2010)

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	FCC REFERENCE	IC REFERENCE	RESULT
Minimum 6dB Bandwidth	15.247(a)(2)	RSS-210 Issue 8 Annex 8	Pass
Maximum peak output power	15.247(b)	RSS-210 Issue 8 Annex 8	Pass
Power spectrum density	15.247(e)	RSS-210 Issue 8 Annex 8	Pass
Radiated emission	15.205 & 15.209	RSS-210 Issue 8 Clause 2	Pass
Emission outside the frequency band	15.247(d)	RSS-210 Issue 8 Annex 8	Pass
Power line conducted emission	15.207	RSS-Gen Issue 3 Clause 7.2.4	Pass
Occupied bandwidth	-	RSS-Gen Issue 3 Clause 4.6.1	Tested

2.4 Data rate VS power

The data rate with highest power level for each mode was chosen to perform test as representative:

Mode	Data Rate (Mbps)	CH	Power of chain 1 (dBm)	Power of chain 2 (dBm)
802.11b	1	M	20.26	20.22
	2	M	21.50	21.43
	5.5	M	22.21	22.18
	11	M	22.76	22.70
802.11g	6	M	23.80	23.76
	9	M	23.62	23.59
	12	M	23.51	23.49
	18	M	23.17	23.11
	24	M	22.70	22.61
	36	M	22.93	22.79
	48	M	23.52	23.43
	54	M	23.89	23.82

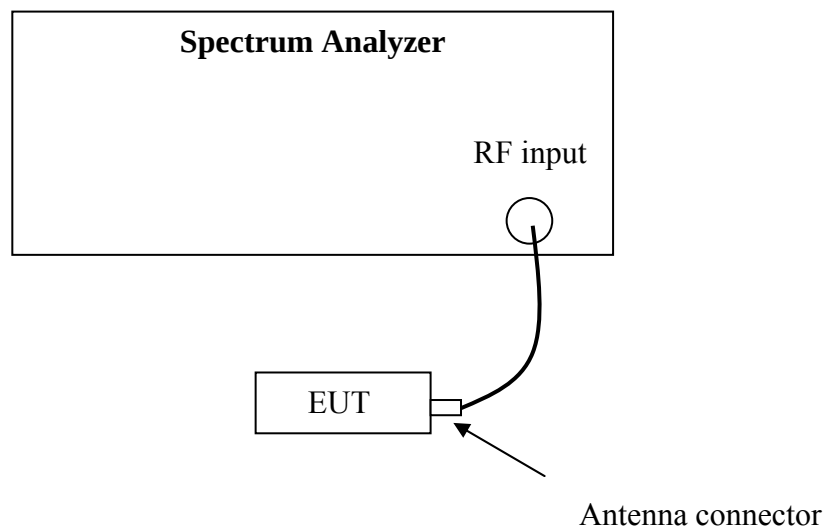
3. Minimum 6dB Bandwidth

Test result: PASS

3.1 Limit

For systems using digital modulation techniques that may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz and 5725 - 5850 MHz bands, the minimum 6 dB bandwidth shall be at least 500 kHz.

3.2 Test Configuration



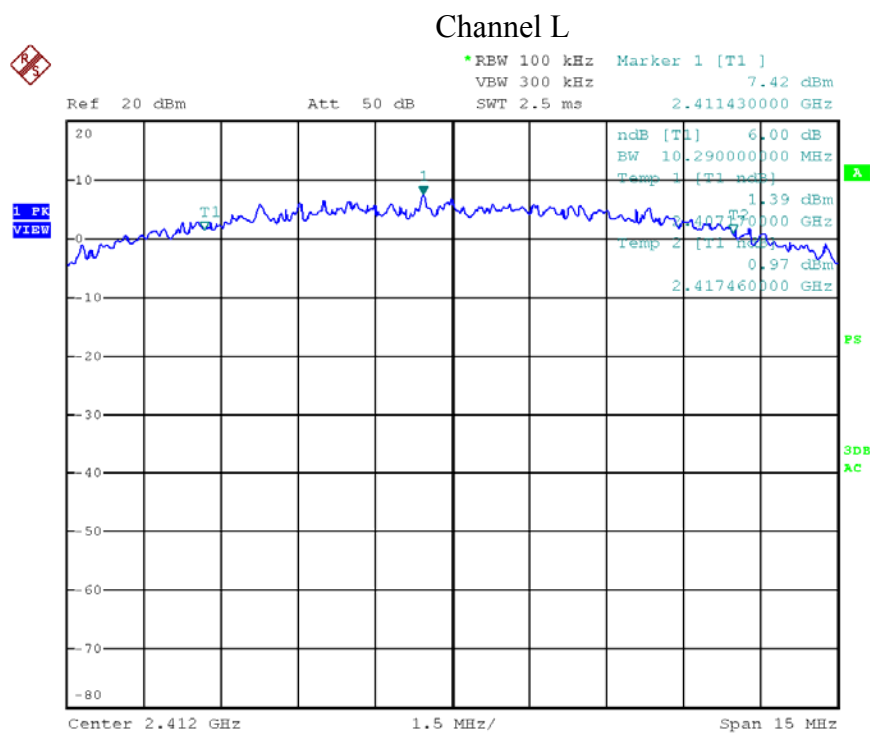
3.3 Test Procedure and test setup

The minimum 6dB bandwidth per FCC §15.247(a)(2) is measured using the Spectrum Analyzer according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r01” for compliance to FCC 47CFR 15.247 requirements.

3.4 Test Protocol

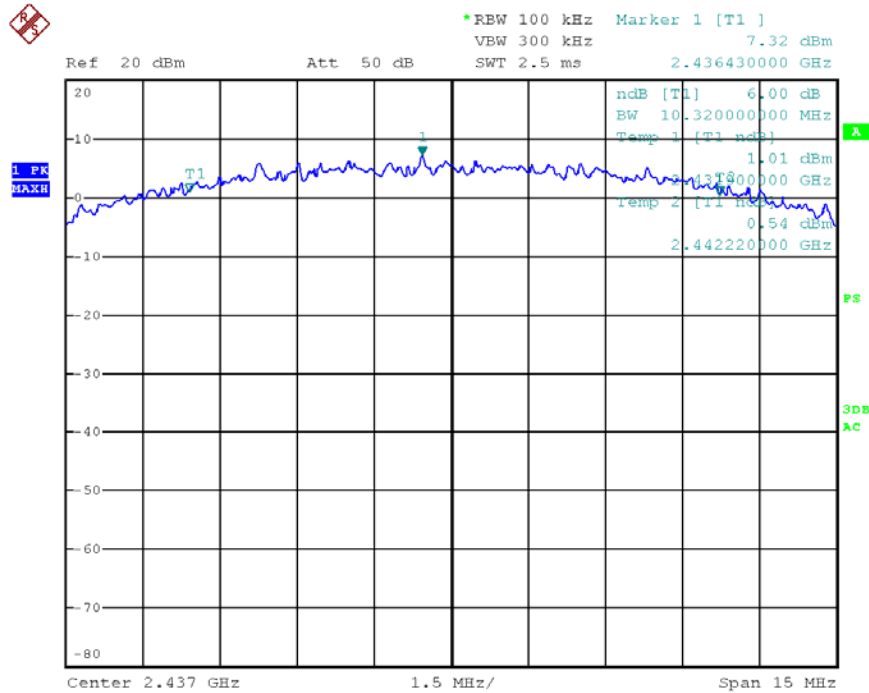
Temperature : 25°C
Relative Humidity : 55%

Mode	CH	Bandwidth (MHz)	Limit (MHz)
802.11b	L	10.29	≥0.5
	M	10.32	
	H	10.11	



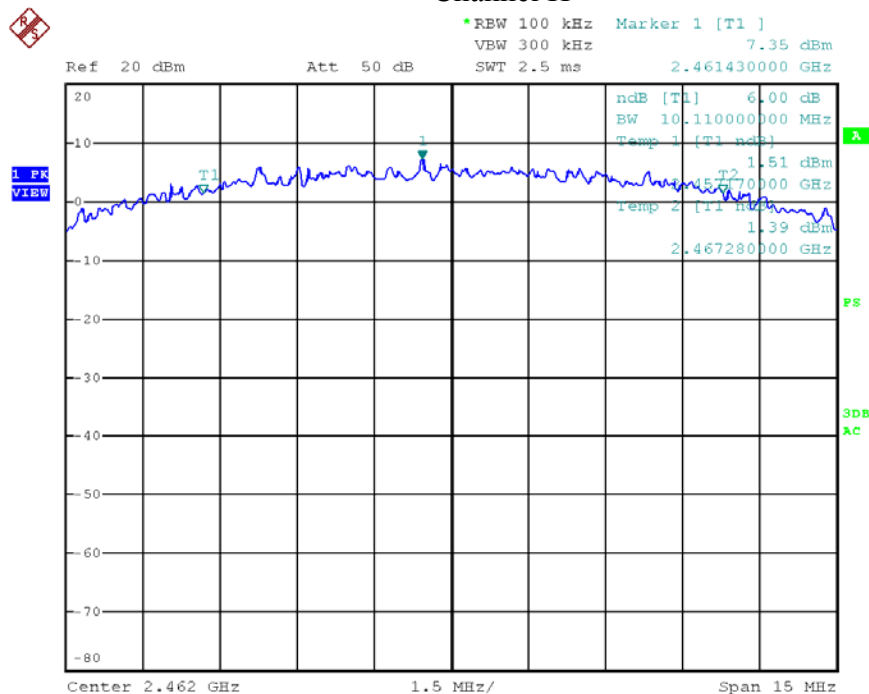
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Channel M



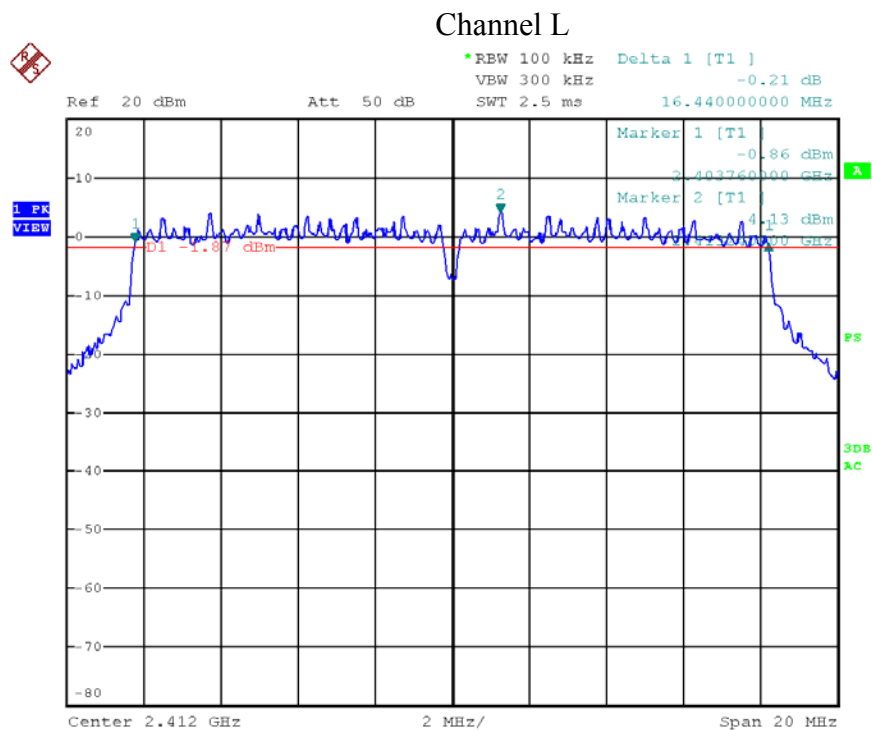
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Channel H



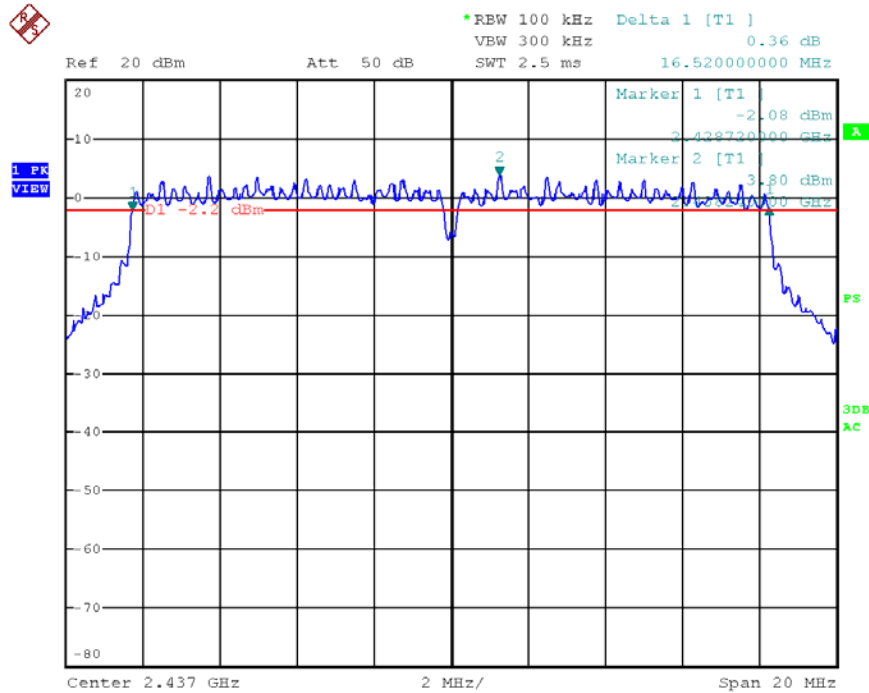
Date: 13.MAY.2013 18:22:59

Mode	CH	Bandwidth (MHz)	Limit (MHz)
802.11g	L	16.44	≥ 0.5
	M	16.52	
	H	16.52	



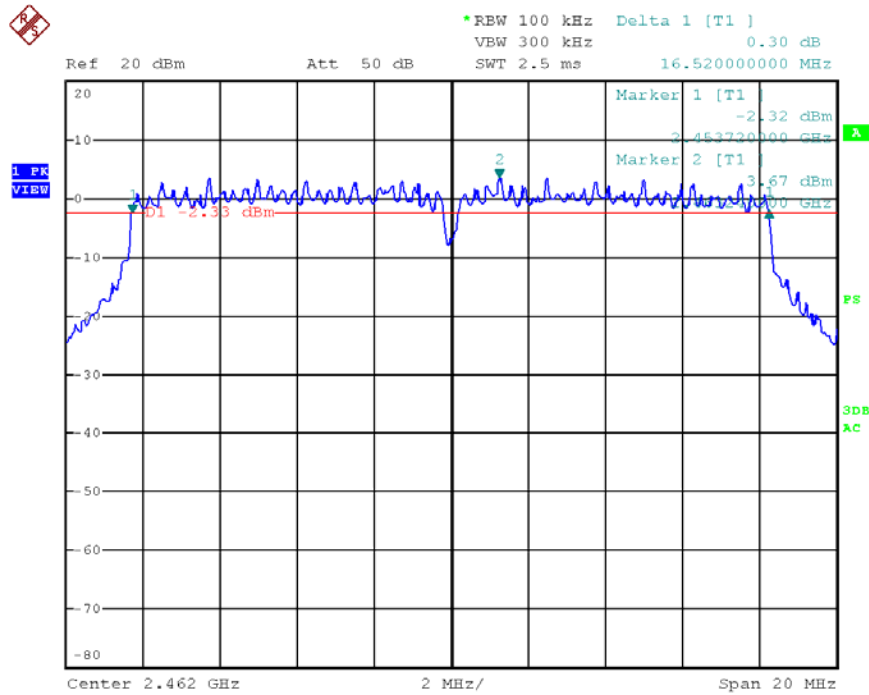
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Channel M



Date: 13.MAY.2013 18:27:43

Channel H



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4. Maximum peak output power

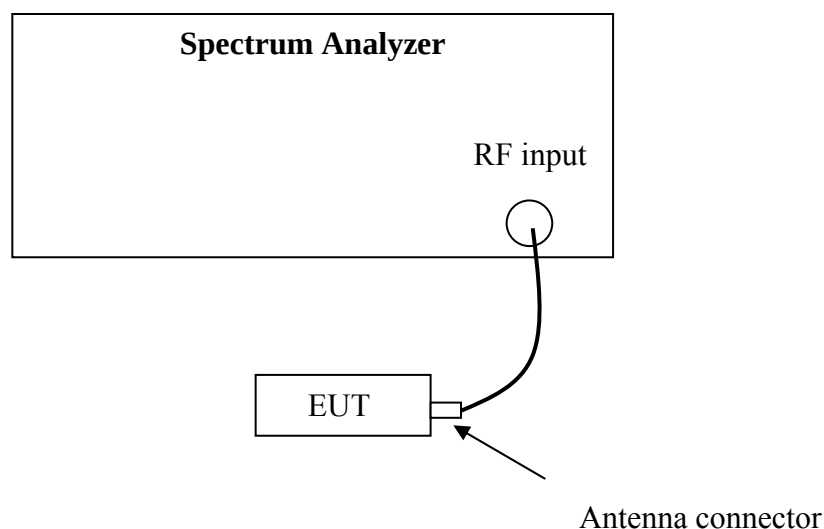
Test result: Pass

4.1 Test limit

- ☐ For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
- ☐ For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts
- ☒ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

4.2 Test Configuration



4.3 Test procedure and test setup

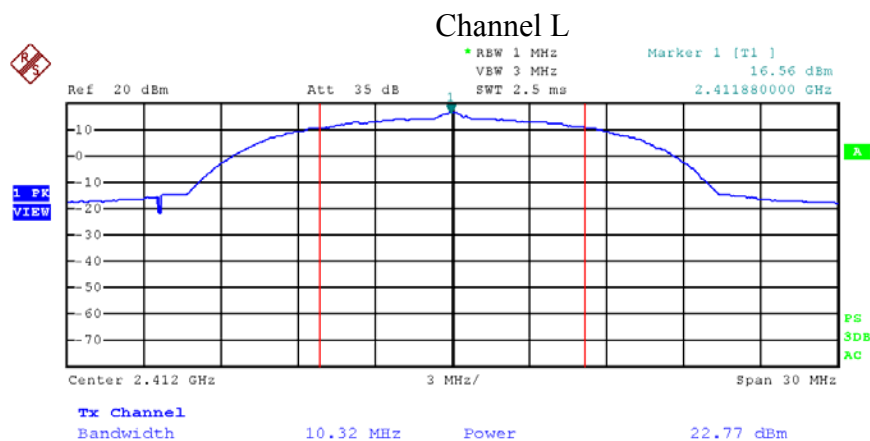
The EUT was tested according to DTS test procedure of "KDB558074 D01 DTS Meas Guidance v03r01" for compliance to FCC 47CFR 15.247 requirements (clause 9.1.2).

4.4 Test protocol

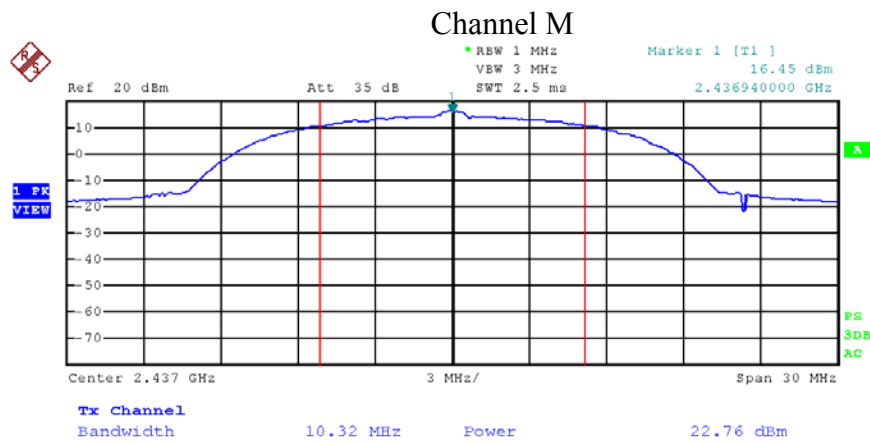
Temperature : 25 °C

Relative Humidity : 55 %

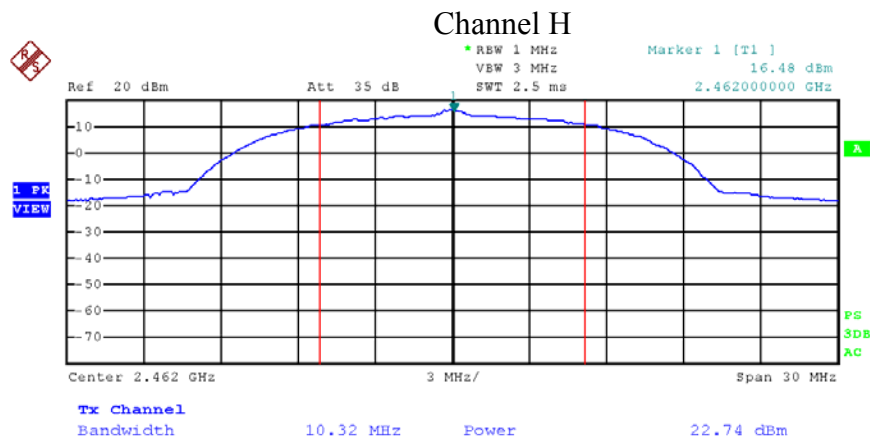
Mode	CH	Cable loss (dB)	Conducted Power (dBm)	Limit (dBm)
802.11b	L	1.00	22.77	≤30
	M	1.00	22.76	
	H	1.00	22.74	



Date: 13.MAY.2013 18:34:31



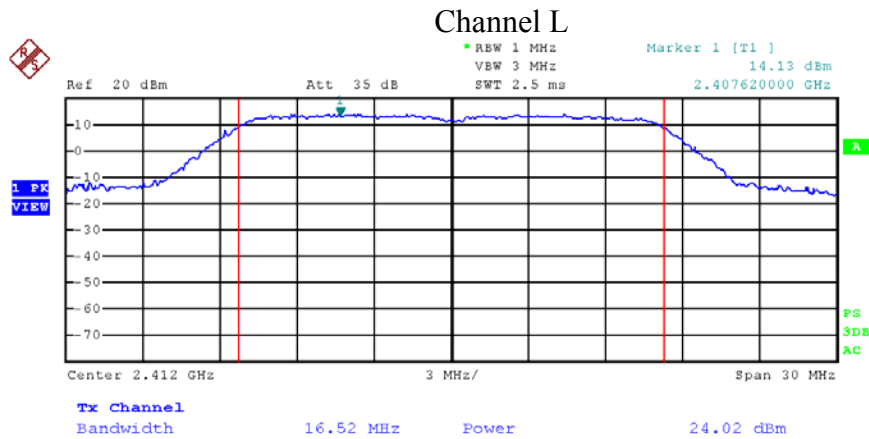
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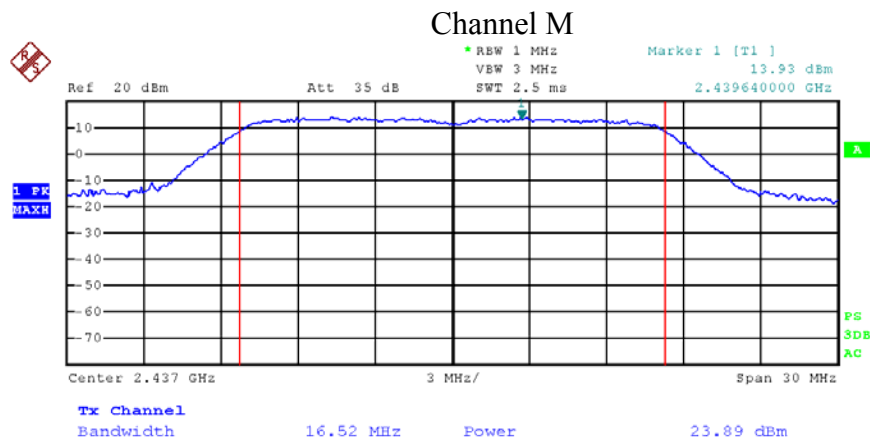
Date: 13.MAY.2013 18:36:16

Mode	CH	Cable loss (dB)	Conducted Power (dBm)	Limit (dBm)
802.11b	L	1.00	24.02	≤30
	M	1.00	23.89	
	H	1.00	23.94	

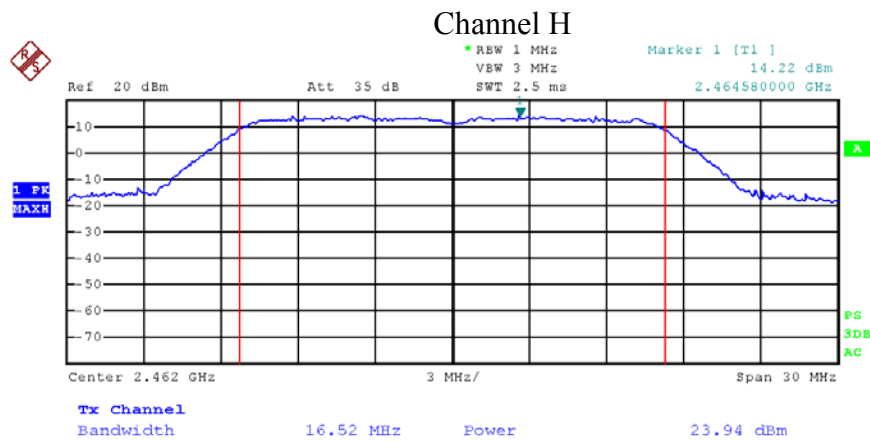
The maximum EIRP of the EUT = 24.02dBm + 3.00dBi = 27.02dBm = 0.504W which is lower than the EIRP limit of RSS-210.



Date: 13.MAY.2013 18:37:21



Date: 13.MAY.2013 18:38:09



Date: 13.MAY.2013 18:38:47

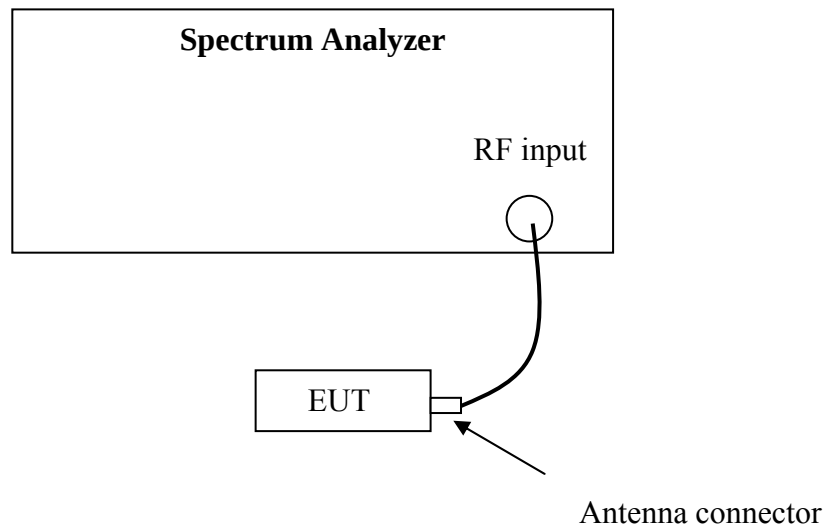
5. Power spectrum density

Test result: **Pass**

5.1 Test limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

5.2 Test Configuration



5.3 Test procedure and test setup

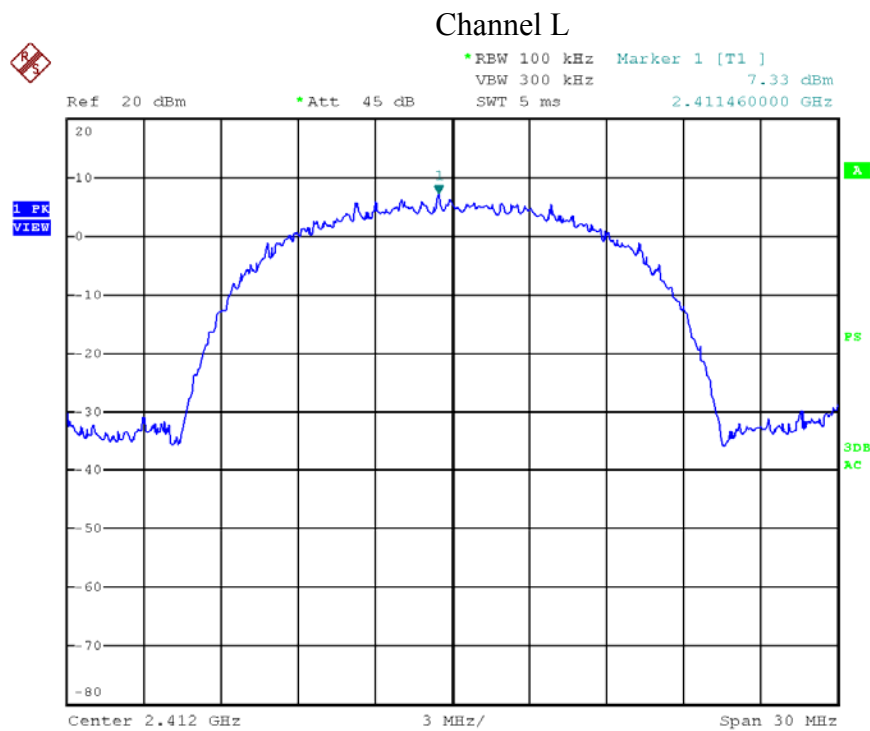
The power output per FCC §15.247(e) was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r01” (clause 10.2) for compliance to FCC 47CFR 15.247 requirements.

5.4 Test Protocol

Temperature : 25 °C

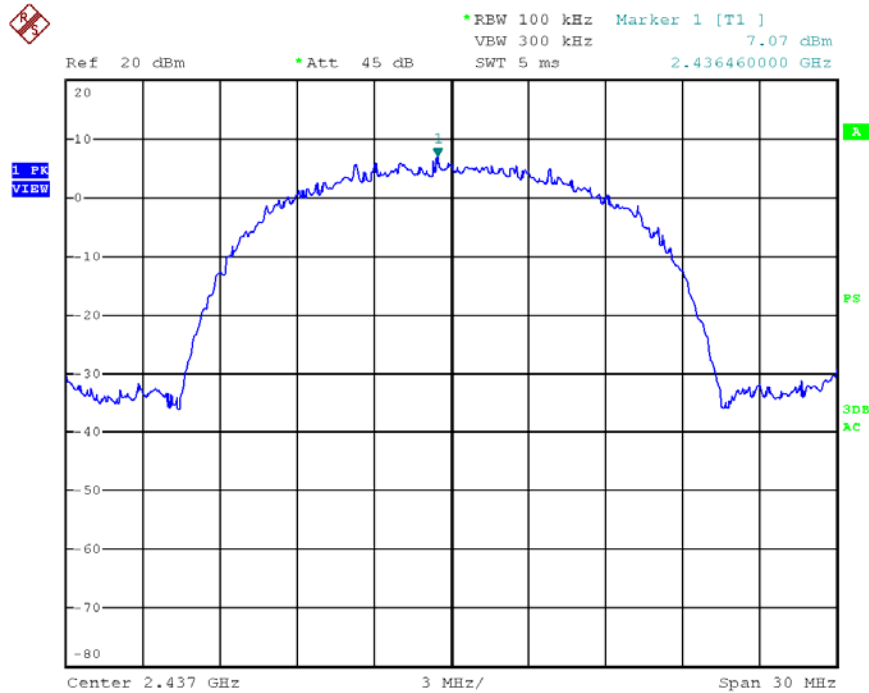
Relative Humidity: 55 %

Mode	CH	Cable loss (dB)	Spectrum Density (dBm/100kHz)	Limit (dBm/3kHz)
802.11b	L	1.00	7.33	≤8.00
	M	1.00	7.07	
	H	1.00	7.05	



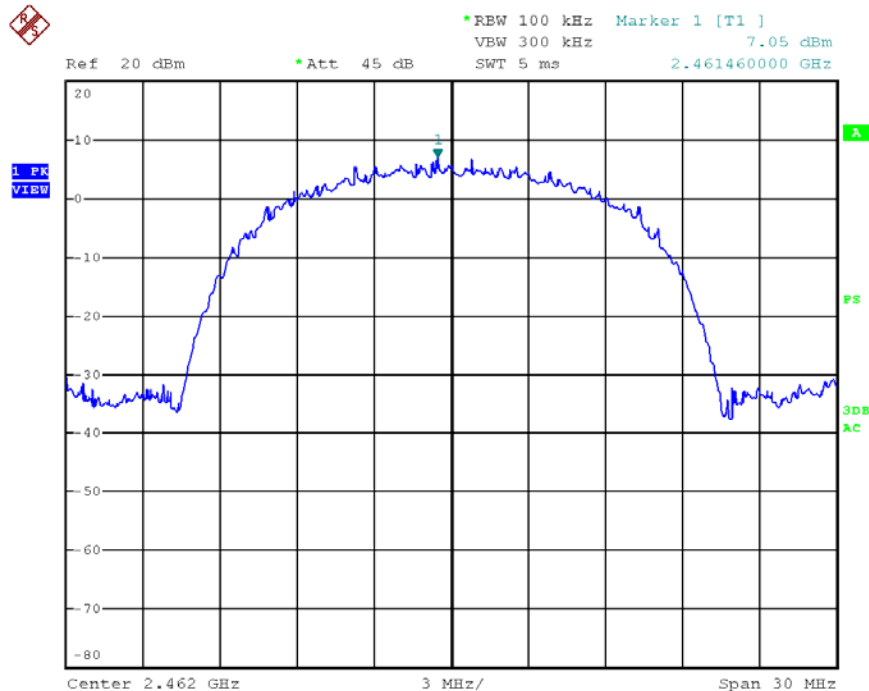
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Channel M



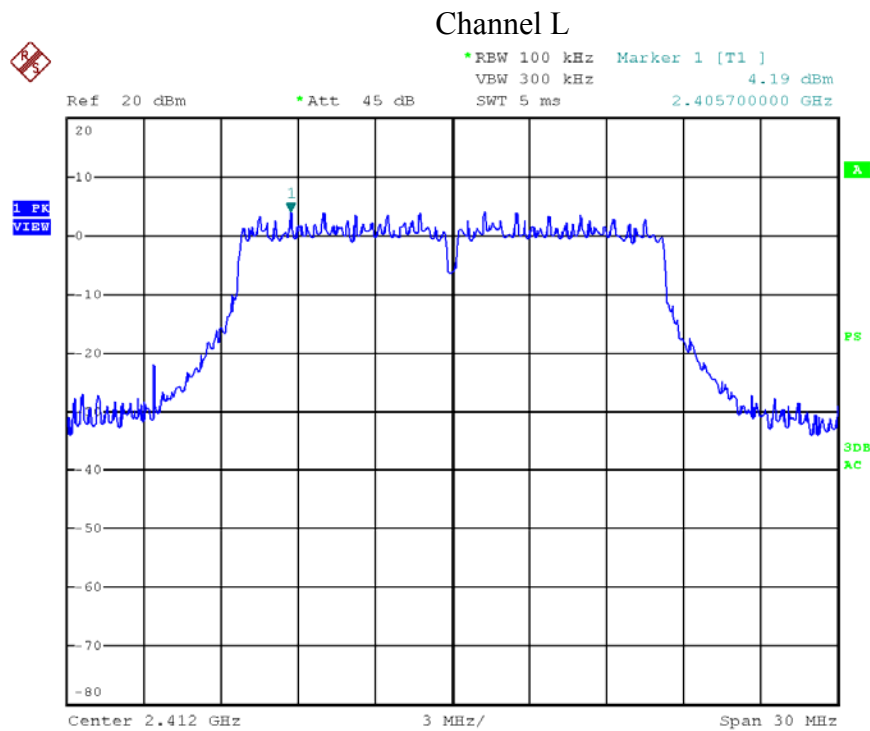
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Channel H



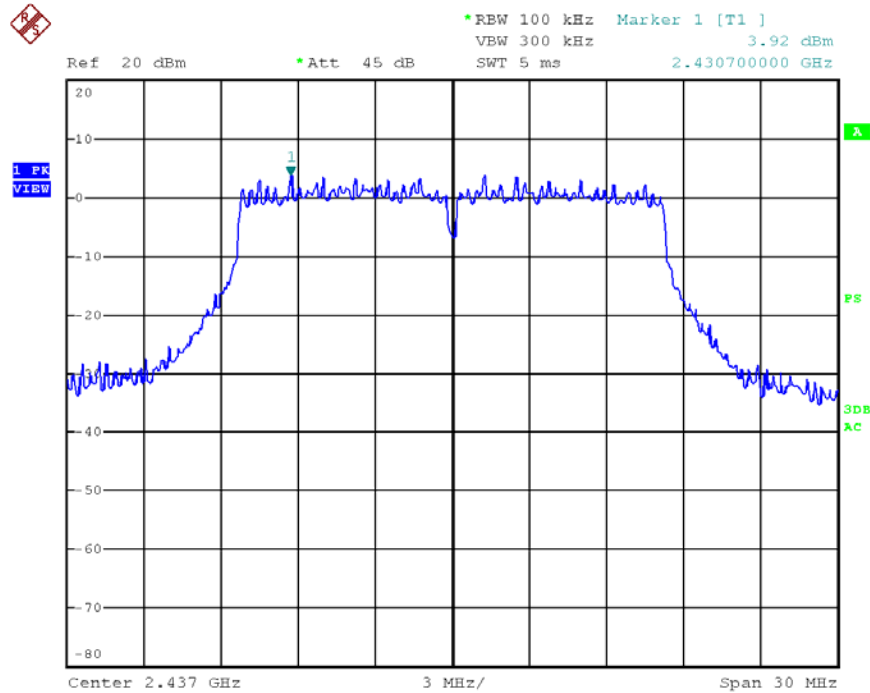
Date: 18.APR.2013 18:51:14

Mode	CH	Cable loss (dB)	Spectrum Density (dBm/100kHz)	Limit (dBm/3kHz)
802.11g	L	1.00	4.19	≤ 8.00
	M	1.00	3.92	
	H	1.00	3.72	



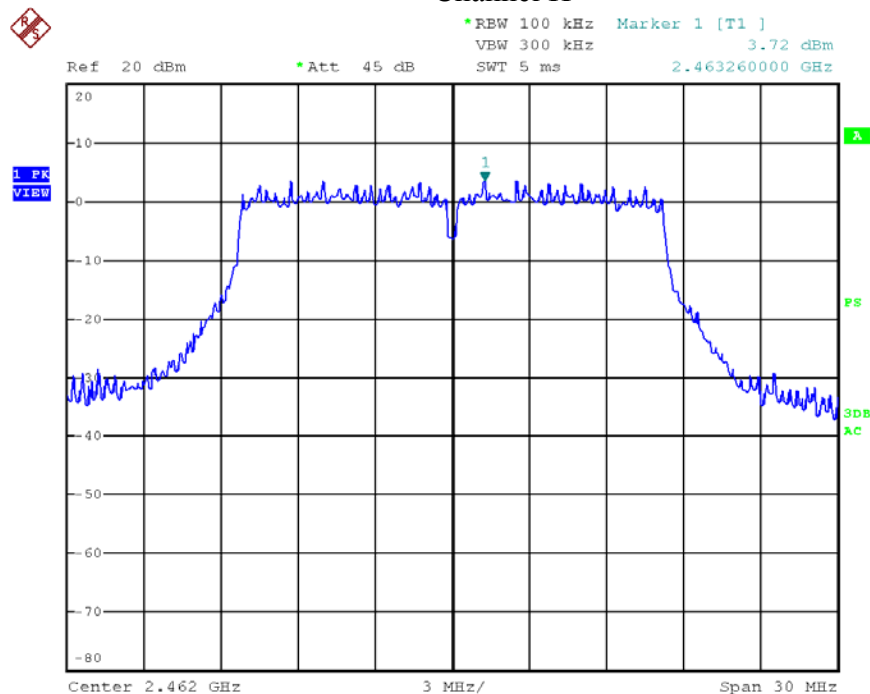
Date: 18.APR.2013 18:51:52

Channel M



Date: 18.APR.2013 18:52:28

Channel H



Date: 18.APR.2013 18:53:21

6. Radiated emission

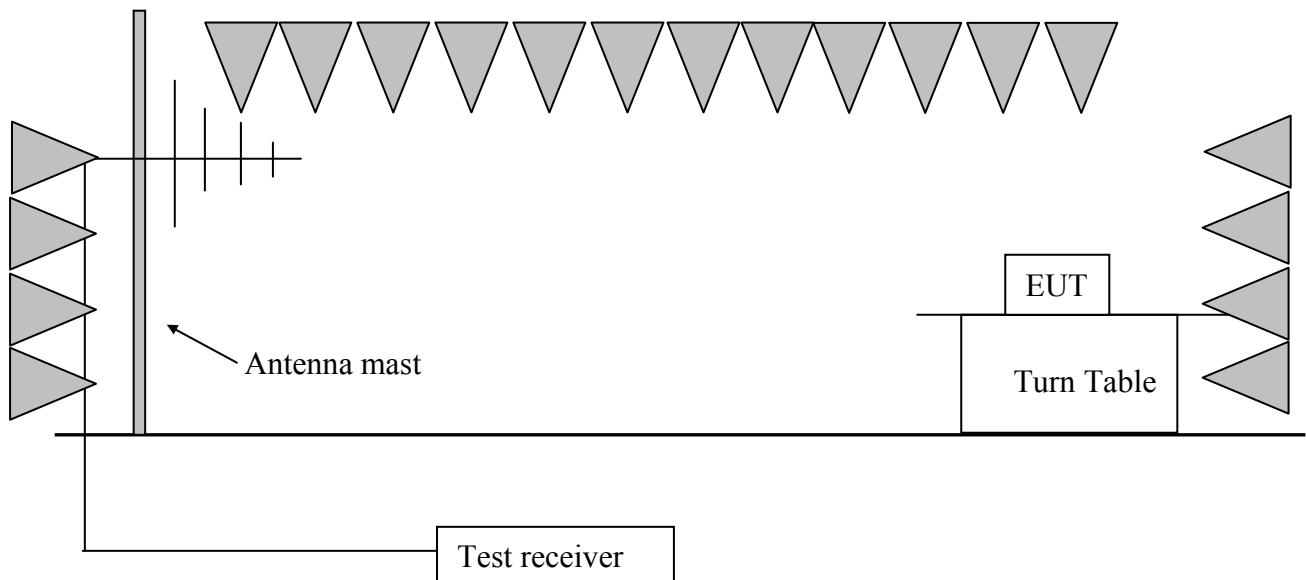
Test result: **PASS**

6.1 Test limit

The 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) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

6.2 Test Configuration



6.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna.

The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

The EUT was tested according to DTS test procedure of KDB558074 D01 DTS “Meas Guidance v03r01” (clause 12) for compliance to FCC 47CFR 15.247 requirements.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)

RBW = 1MHz, VBW = 3MHz (>1GHz for PK);

RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

6.4 Test protocol

Mode 802.11b

CH	Polarization	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2412.97	34.10	106.70	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	H	2388.98	34.00	71.40	74.00	2.60	PK
	H	2388.32	34.00	49.20	54.00	4.80	AV
	H	4824.16	-0.80	42.60	54.00	11.40	PK
	V	7236.55	6.20	43.90	54.00	10.10	PK
	H	9649.19	11.60	52.20	74.00	21.80	PK
	H	9648.60	11.60	38.90	54.00	15.10	AV
M	H	2436.65	34.20	108.30	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	H	4871.73	-0.60	43.10	54.00	10.90	PK
	V	7315.64	6.40	44.90	54.00	9.10	PK
	H	9758.52	11.70	53.30	74.00	20.70	PK
	H	9752.36	11.70	40.20	54.00	13.80	AV
H	H	2461.93	34.40	108.90	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	H	2483.97	34.50	70.80	74.00	3.20	PK
	H	2483.66	34.50	48.30	54.00	5.70	AV
	H	4927.98	-0.40	43.30	54.00	10.70	PK
	V	7389.19	7.20	44.60	54.00	9.40	PK

	H	9850.06	11.80	53.10	74.00	20.90	PK
	H	9849.62	11.80	40.00	54.00	14.00	AV

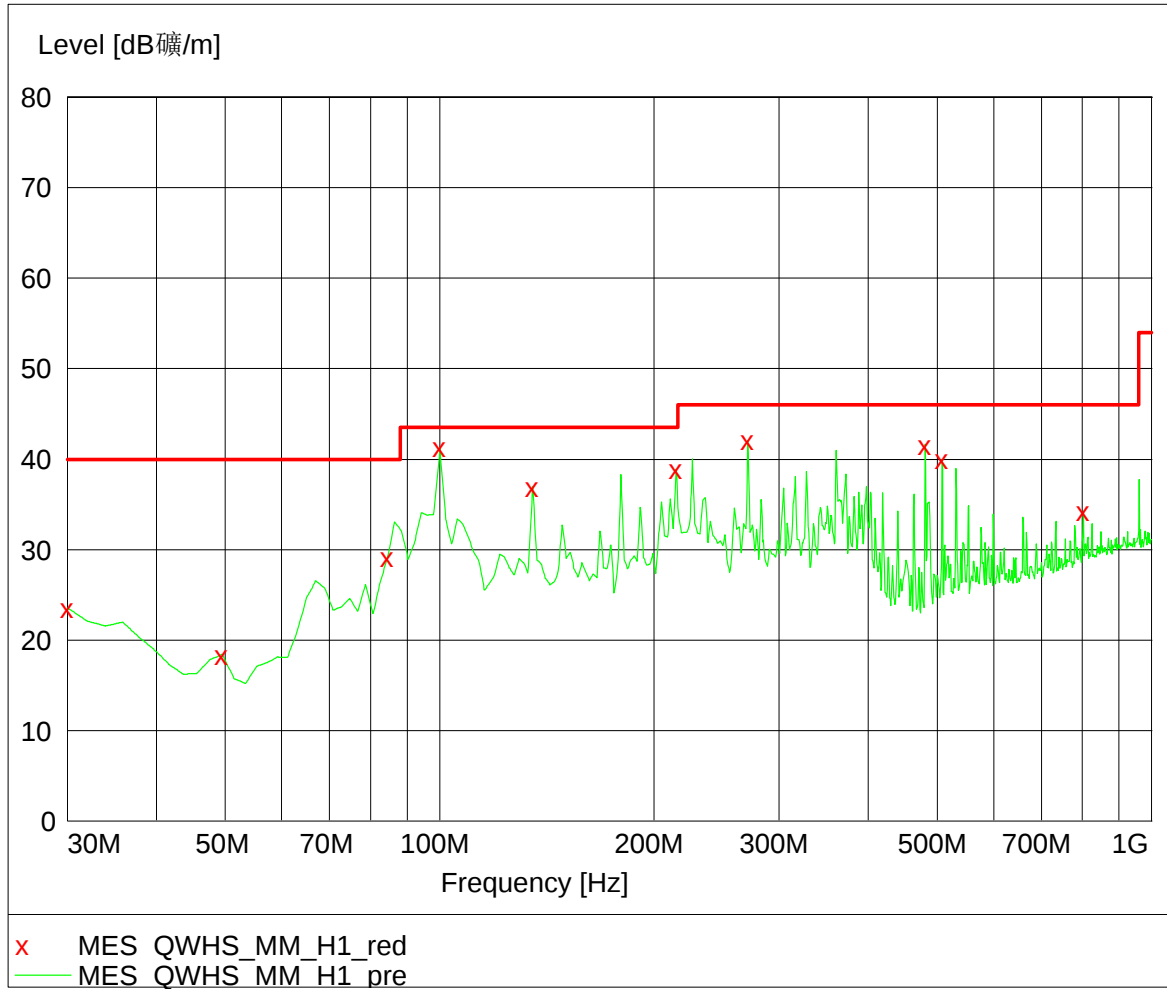
Mode 802.11g

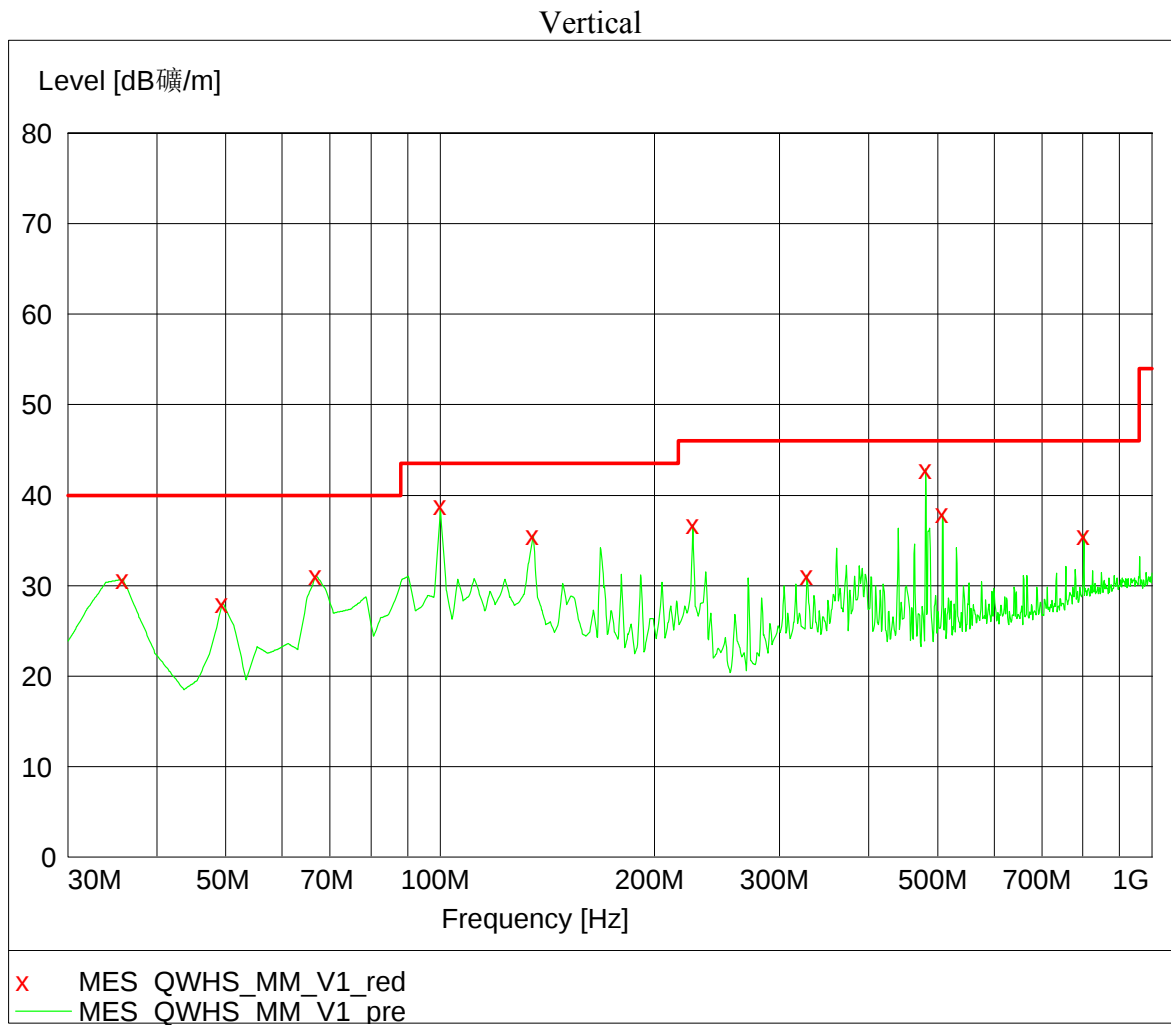
CH	Polarization	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	H	2406.41	34.10	106.40	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	H	2389.14	34.00	72.60	74.00	1.40	PK
	H	2389.31	34.00	52.30	54.00	1.70	AV
	V	4823.65	-0.80	38.10	54.00	15.90	PK
	H	7236.47	6.20	48.40	54.00	5.60	PK
	H	9649.30	11.60	51.80	54.00	2.20	PK
M	H	2436.25	34.20	108.10	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	V	4871.44	-0.60	38.60	54.00	15.40	PK
	H	7314.90	6.40	49.10	54.00	4.90	PK
	H	9756.52	11.70	52.30	54.00	1.70	PK
H	H	2458.71	34.40	108.10	Fundamental	/	PK
	H	134.97	15.00	36.90	43.50	6.60	PK
	V	480.98	19.70	42.90	46.00	3.10	PK
	H	960.00	23.60	37.60	46.00	8.40	PK
	H	2483.14	34.50	72.90	74.00	1.10	PK
	H	2483.10	34.50	53.00	54.00	1.00	AV
	V	4925.63	-0.40	38.80	54.00	15.20	PK
	H	7389.19	7.20	49.20	54.00	4.80	PK
	H	9850.06	11.80	52.50	54.00	1.50	PK

- Remark: 1. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = limit – Corrected Reading

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Correct Factor = $30.20 + 2.00 - 32.00 = 0.20\text{dB/m}$; Corrected Reading =
 $10\text{dBuV} + 0.20\text{dB/m} = 10.20\text{dBuV/m}$
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then Margin =
 $54 - 10.20 = 43.80\text{dBuV/m}$

Horizontal





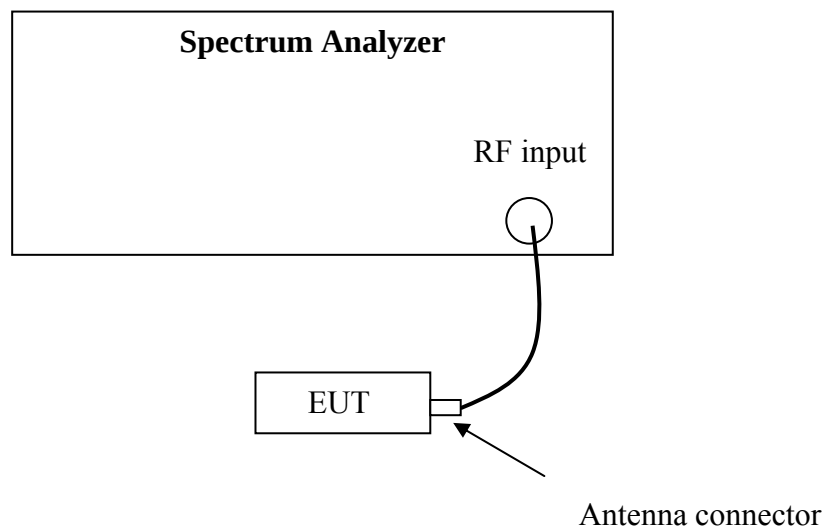
7. Emission outside the frequency Band

Test result: PASS

7.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

7.2 Test Configuration



7.3 Test procedure and test setup

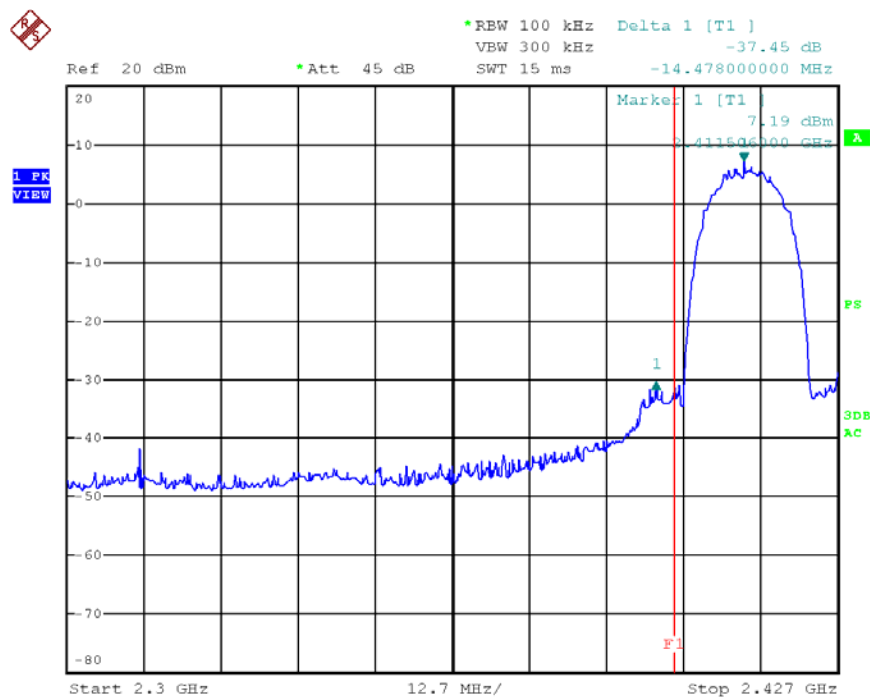
The Emission outside the frequency Band per FCC §15.247(d) is measured using the Spectrum Analyzer with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.

The EUT was tested according to DTS test procedure of “KDB558074 D01 DTS Meas Guidance v03r01” (clause 11.0) for compliance to FCC 47CFR 15.247 requirements.

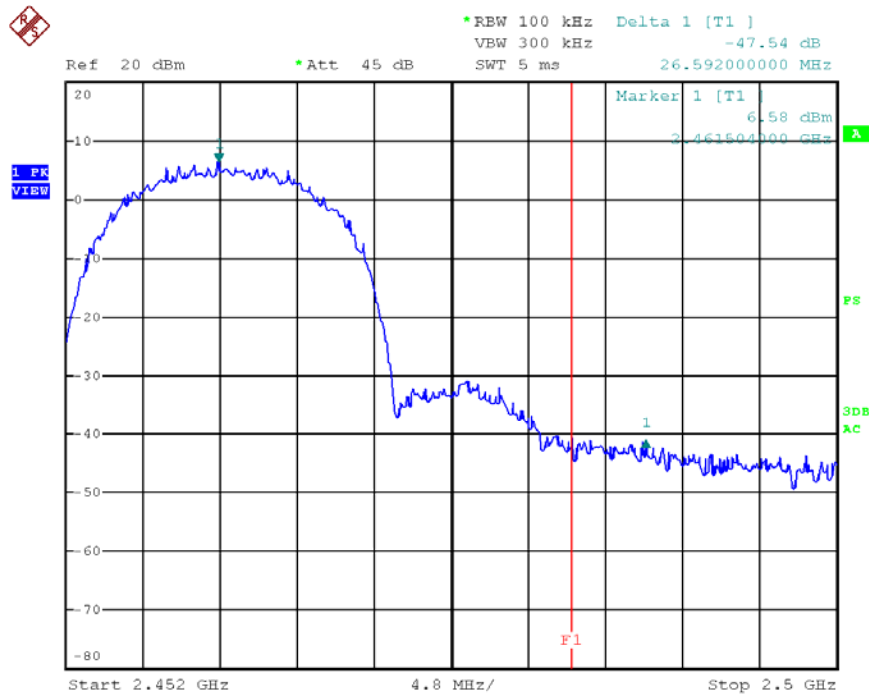
7.4 Test protocol

Mode	CH	Max reading among band (dBm)	The most restrict Attenuation outside band (dB)	Limit (dB)
802.11b	L	7.19	37.45	≥20
	M	6.82	50.69	
	H	6.58	47.54	

Note: The test was performed from 9kHz to 26GHz and the graph of band edge emission is listed below.



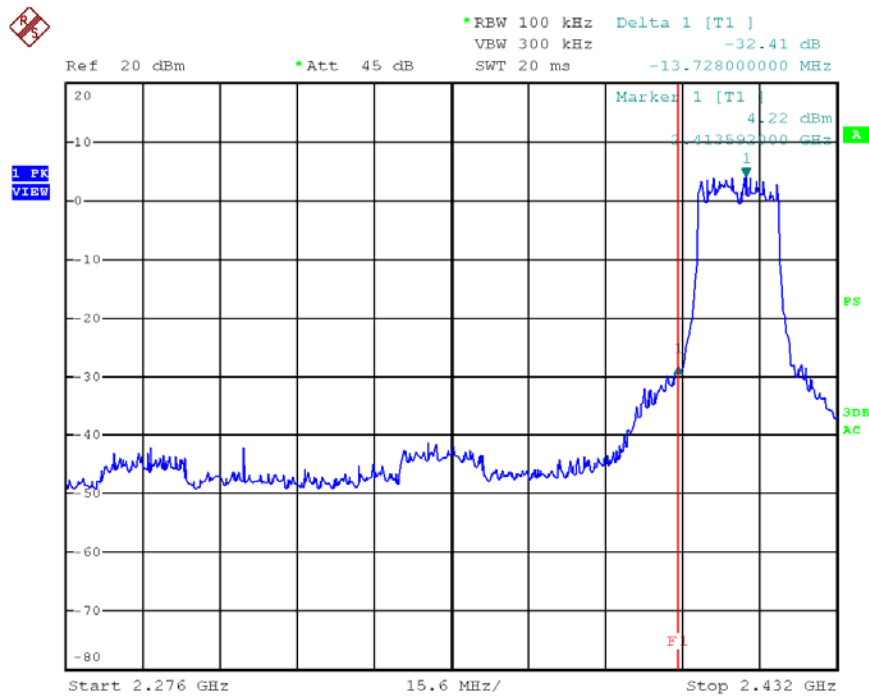
Date: 18.APR.2013 18:54:56



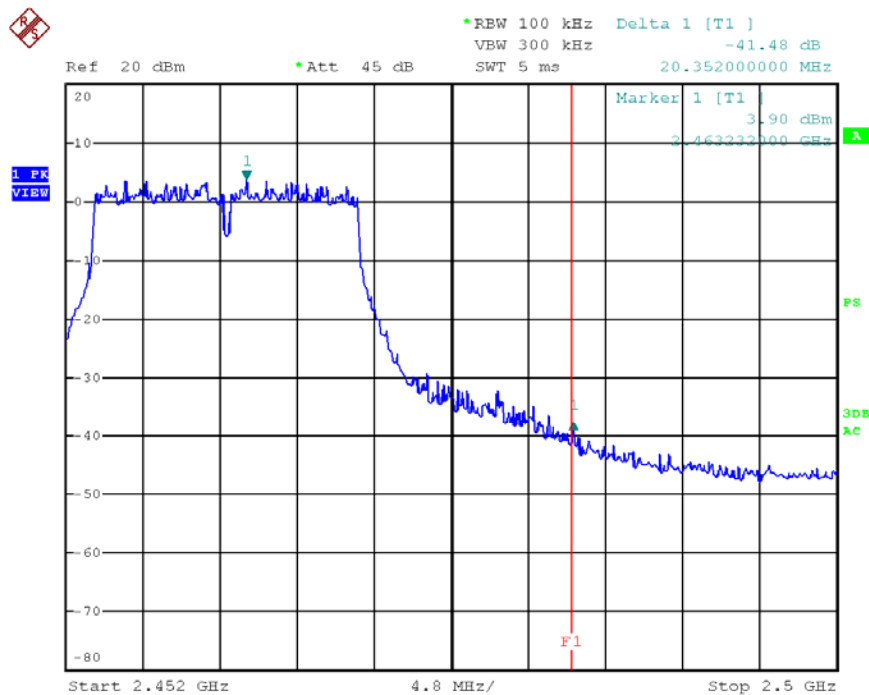
Date: 18.APR.2013 18:57:07

Mode	CH	Max reading among band (dBm)	The most restrict Attenuation outside band (dB)	Limit (dB)
802.11g	L	4.22	32.41	≥20
	M	4.06	49.50	
	H	3.90	41.48	

Note: The test was performed from 9kHz to 26GHz and the graph of band edge emission is listed below.



Date: 18.APR.2013 18:59:04



Date: 18.APR.2013 18:57:56

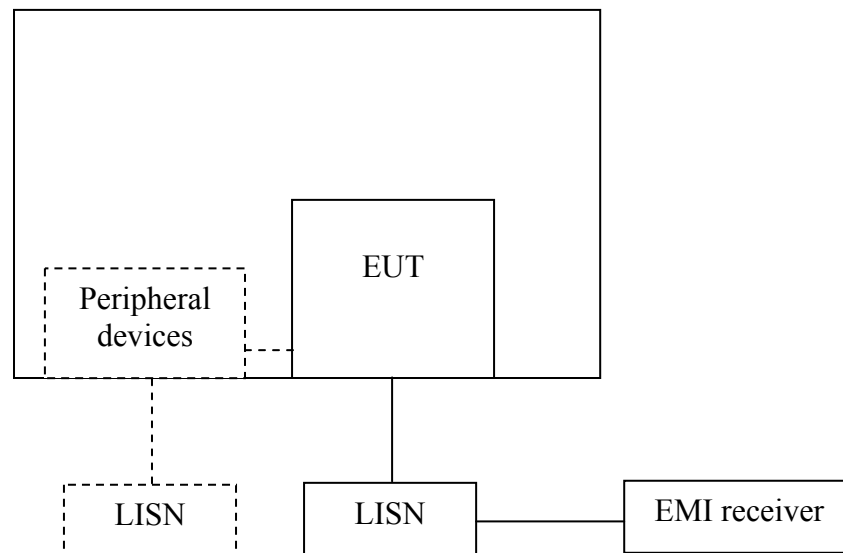
8. Power line conducted emission

Test result: Pass

8.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
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.		

8.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

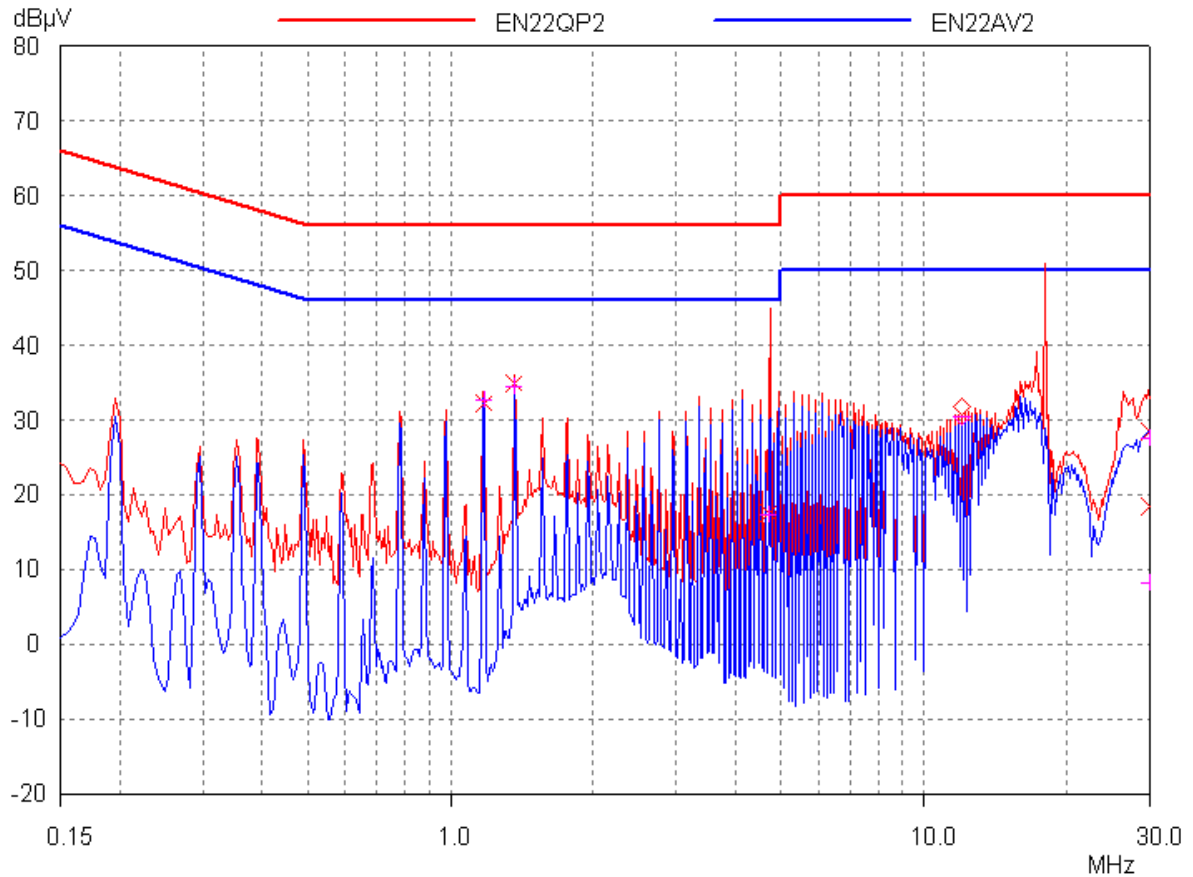
☐ For floor standing equipment, wooden support is 0.1m height rack.

8.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a $50\Omega/50\mu\text{H}$ coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a $50\Omega/50\mu\text{H}$ coupling impedance with 50Ω termination.

Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4 on conducted measurement. The bandwidth of the test receiver is set at 9 kHz.

8.4 Test protocol



Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
1.18 (N)	3.00	32.25	32.66	56.00	46.00	23.75	13.34
1.37 (N)	3.00	34.83	34.51	56.00	46.00	21.17	11.49
2.00 (L)	3.00	28.30	28.12	56.00	46.00	27.70	17.88
4.69 (N)	3.00	17.51	17.41	56.00	46.00	38.49	28.59
29.85 (N)	3.00	28.49	27.59	60.00	50.00	31.51	22.41
30.00 (L)	3.00	18.50	8.13	60.00	50.00	41.50	41.87
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading.							

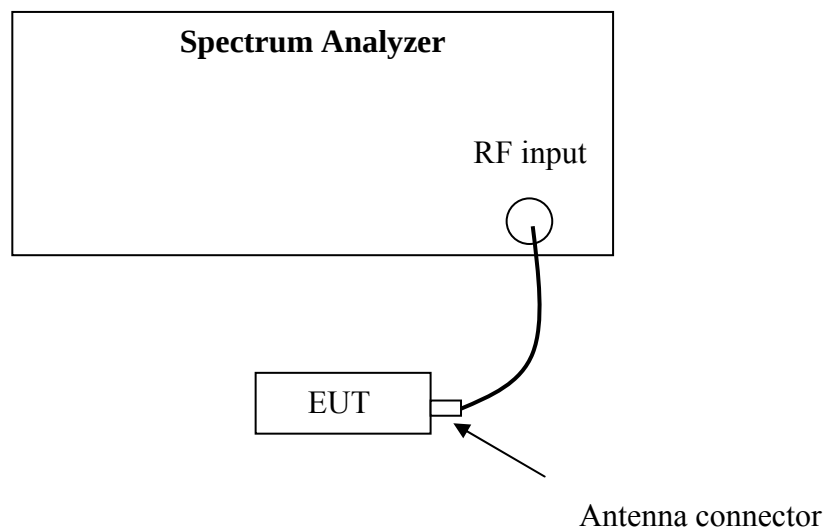
9. Occupied Bandwidth

Test Status: Tested

9.1 Test limit

None

9.2 Test Configuration



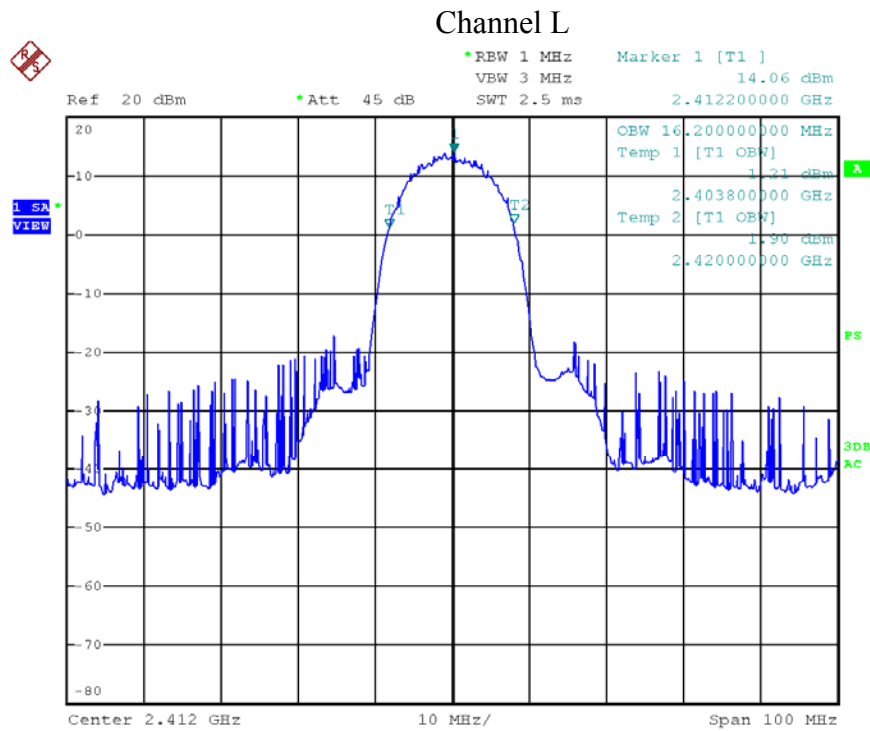
9.3 Test procedure and test setup

The occupied bandwidth per RSS-Gen Issue 3 Clause 4.6.1 was measured using the Spectrum Analyzer.

9.4 Test protocol

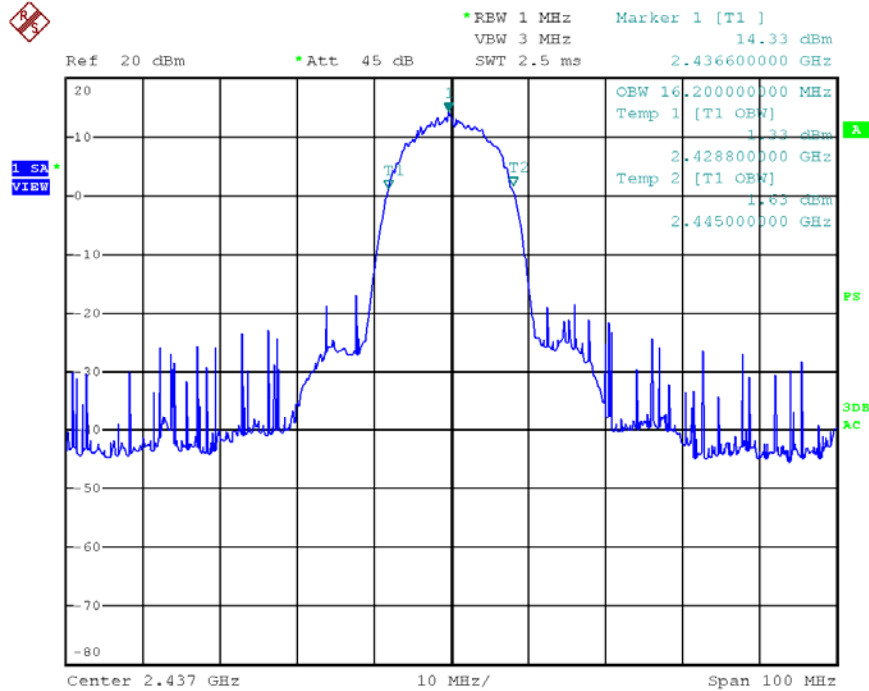
Temperature : 25 °C
Relative Humidity : 55 %

Mode	CH	99% Bandwidth (MHz)
802.11b	L	16.20
	M	16.20
	H	16.20



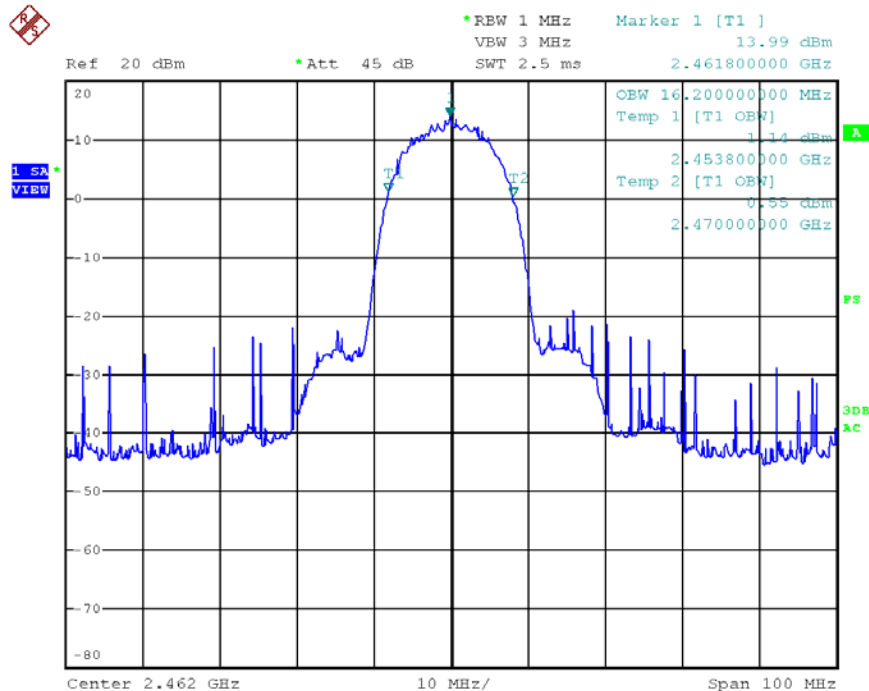
Date: 18.APR.2013 19:00:12

Channel M



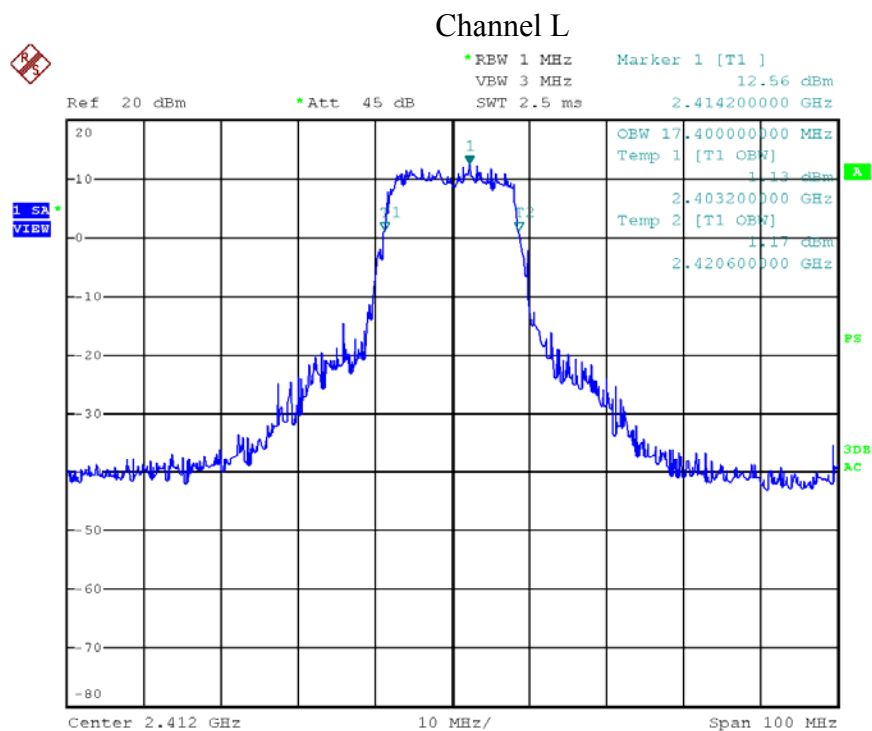
Date: 18.APR.2013 19:00:44

Channel H



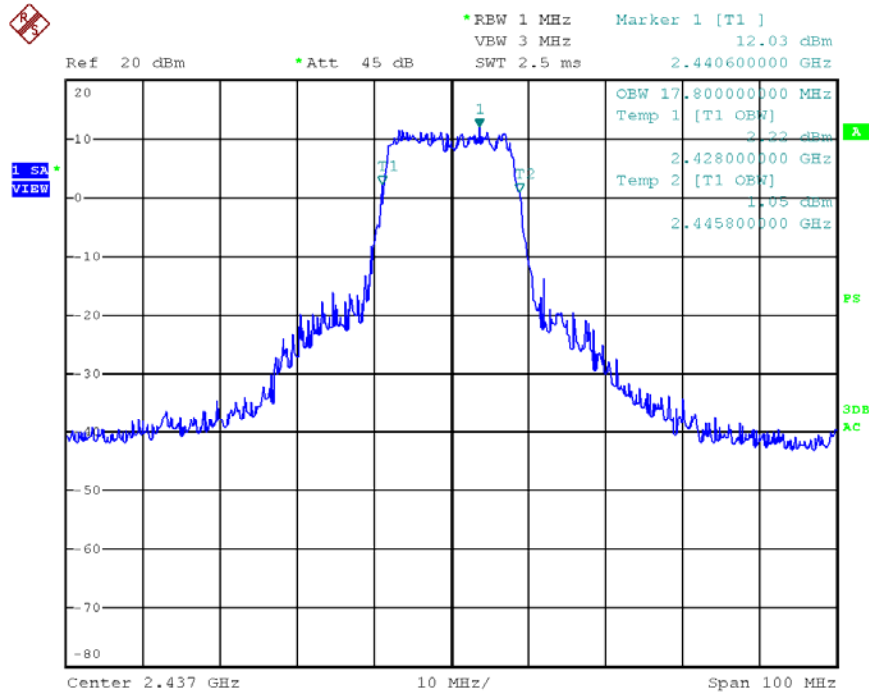
Date: 18.APR.2013 19:01:12

Mode	CH	99% Bandwidth (MHz)
802.11g	L	17.40
	M	17.80
	H	17.60



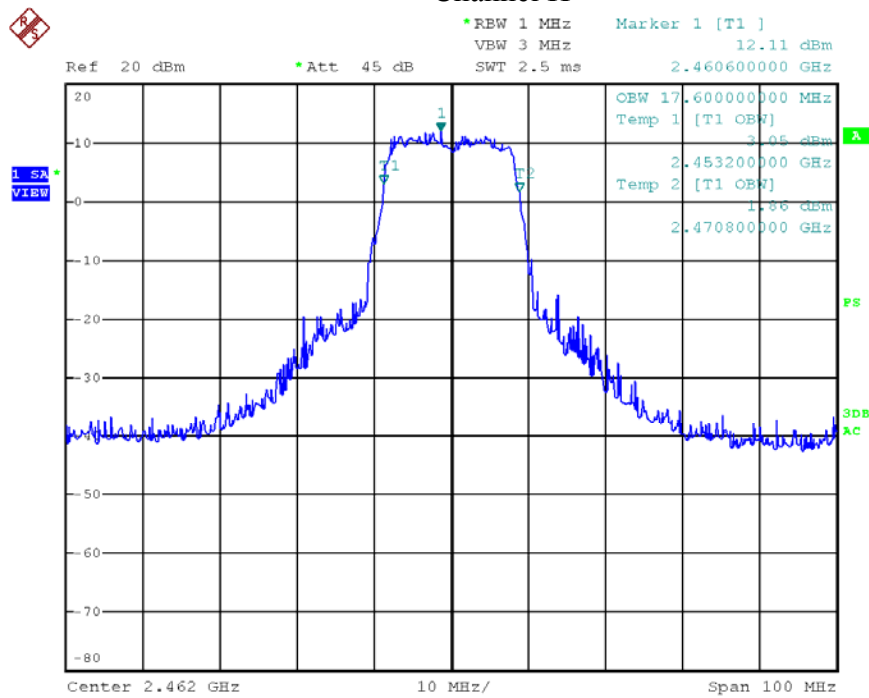
Date: 18.APR.2013 19:01:41

Channel M



Date: 18.APR.2013 19:02:13

Channel H



Date: 18.APR.2013 19:02:50