CERTIFICATION TEST REPORT

FCC CFR47 PART 15 SUBPART C

Test Report File No.	14-IST-0039	■ Basic	☐ Alternate
Date of Receipt	December 02, 2013	**Begin of test date**	December 20, 2013
Date of Issue	February 03, 2014	**End of test date**	January 13, 2014

Kind of Product	Portable Music Player
Basic Model(s)	AK240
FCC ID	QDMAK240

Applicant	IRIVER LIMITED.
Address	Iriverhouse, 902-5, Bangbae-dong, Seocho-gu,
	Seoul, Korea
Manufacturer	IRIVER LIMITED.
Address	Iriverhouse, 902-5, Bangbae-dong, Seocho-gu,
	Seoul, Korea

Test Result ■ **Positive** ☐ **Negative**

Tested By

B.O.KO

Reviewed By

S.J.CHO

Comment(s)

- Investigations requested : Measurement to the relevant clauses of FCC rules and regulations Part 15 Subpart C.
- The test report is consists of 45 pages.
- The test result only responds to the tested sample.
- It is not allowed to copy this report even partly without the allowance of IST Co., Ltd.
- This equipment as for has been shown to be capable of continued compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.4 I assume full responsibility for accuracy and completeness of these data.

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INFORMATION OF TEST LABORATORY

EMC LABORATORY of IST Co., Ltd.
52-20, Sinjeong-ro 41beon-gil, Giheung-gu
Yongin-si, Gyeonggi-do, Korea.

TEL : +82 31 326 6700 FAX : +82 31 326 6797

KOLAS Testing No. : KT118
RRA Designation No. : KR0018
FCC Registration No. : 400603
VCCI Member No. : 1739

Measurement Uncertainty

Conducted Emissions	U = 2.98 [dB] (Confidence level approximately 95 %, k = 2)
Radiated Emissions (Antenna - Horizontal)	U = 3.83 [dB] (Confidence level approximately 95 %, k = 2)
Radiated Emissions (Antenna - Verical)	U = 4.50 [dB] (Confidence level approximately 95 %, k = 2)

PRODUCT INFORMATION

Portable Music Player(AK240)

Body Color	Gun Metal
Body Material	Aircraft Grade Duralumin
Display	3.31inch WVGA(480X800) AMOLED Touch Screen
Supported Audio Formats	WAV, FLAC, WMA, MP3, OGG, APE(Normal High Fast), AAC, ALAC, AIFF, DFF, DSF
Sample Rate	FLAC, WAV, ALAC, AIFF : 8kHz~192KHz(8/16/24bits per Sample) DSD Native : DSD64(1bit 2.8MHz), Stereo/ DSD128(1bit 5.6MHz), Stereo
Output Level	Unbalance 2.1Vrms/ Balance 2.3Vrms(Condition No Load)
DAC	Cirrus Logic CS4398 X 2(Dual DAC)
Decoding	Support up to 24bit/ 192kHz Bit to Bit Decoding
Input	USB Micro-B input(for charging & data transfer(PC&MAC)/ Connection Mode : MTP(Media Device)
Outputs	PHONES(3.5mm)/ Optical Out(3.5mm)/ Balanced Out(2.5mm, only 4-pole supported)
Wi-Fi	802.11 b/g/n(2.4GHz)
Bluetooth	V4.0
Dimensions	2.59” (66mm)[W] X 4.21” (107mm)[H] X0.68” (17.5mm)[D]
Weight	6.5 oz(185g)
Feature Enhancements	Firmware upgrade supported(OTA)
Audio Specification	
Frequency Response	±0.023dB(Condition:20Hz~20kHz)Unbalance & Balance/±0.3dB(Conditon:10Hz~70kHz)Unbalance & Balance
S/N	116dB @ 1kHz, Unbalance/ 117dB @ 1kHz, Balance
Crosstalk	130dB @ 1KHz, Unbalance/ 135dB @ 1kHz, Balance
THD+N	0.0007% @ 1kHz, Unbalance/ 0.0005% @ 1kHz, Balance
IMD SMPTE	0.0004% 800Hz 10kHz(4:1) Unbalance/ 0.0003% 800Hz 10kHz(4:1) Balance
Output impedance	1 ohm
Clock Jitter	50ps(Typ)
Memory	Built-in Memory : 256GB[NAND] External Memory : microSD(Max, 128GB) X 1
Battery	Capacity : 3.250 mAh 3.7V Li-Polymer Battery
Supported OS	Supported OS : Window XP, Window 7,8(32/64bit) MAC OS X 10.6.5 and up

Note: All the testing were performed according to the procedures in FCC CFR47 PART 15 SUBPART C

SUMMARY

WLAN(2412 MHz ~ 2462 MHz)

Applied Standard : FCC CRF Part 15 Subpart C

Standard Section	Description	result	remark
15.207	AC Conducted Emission	Pass	Meet the requirements
15.209	Field Strength of Harmonics	Pass	Meet the requirements
15.247(b)	Peak Power Output	Pass	Meet the requirements
15.247(d)	Conducted Band Edges	Pass	Meet the requirements
	Conducted Spurious Emission	Pass	Meet the requirements
	Radiated Band Edges	Pass	Meet the requirements
	Radiated Spurious Emission	Pass	Meet the requirements
15.247(a)(2)	6dB Bandwidth	Pass	Meet the requirements
15.247(e)	Power Spectral Density	Pass	Meet the requirements
15.203 & 15.247(b)	Antenna requirement	-	Meet the requirements

Applied Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the Following standards:

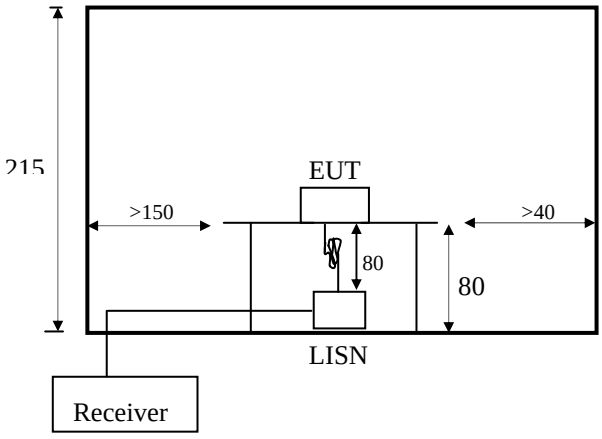
- ✧ FCC Part 15 Subpart C § 15.247
- ✧ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01
- ✧ FCC TCB Workshop 2013, April 9.
- ✧ ANSI C63.4-2003 and ANSI C63.10-2009

Conducted Emissions:

The measurement were performed over the frequency range of 0.15 MHz to 30 MHz using a 50 Ω/50 uH LISN as the input transducer to a Spectrum Analyzer or a Field Intensity Meter. The measurements were made with the detector set for "Peak" amplitude within a bandwidth of 10 kHz or for "quasi-peak" & "Average" within a bandwidth of 9 KHz.

-Procedure of Test

The line-conducted facility is located inside a shielded room No.1. A 1 m X 1.5 m wooden table 80 cm height is placed 40 cm away from the vertical wall and 1.5 m away from the other wall of the shielded room. The R/S ESCI and Hyup-Rip KNW-407 LISN are bonded to bottom of the shielded room. The EUT is located on the wooden table with distance more than 80 cm from the LISN and powered from the EMCO LISN .The peripheral equipment is powered from the other LISN. Power to the LISNs are filtered by a noise cut power line filters. All electrical cables are shielded by braided tinned steel tubing with inner ϕ 1.2 cm. If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply lines will be connected to the EMCO LISN. All interconnecting cables more than 1m were shortened by non-inductive bundling to a 1m length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating conditions. The RF output of the LISN was connected to the R/S receiver to determine the frequency producing the maximum emission from the EUT. The frequency producing the maximum level was reexamined using Quasi-Peak mode by manual measurement, after scanned by automatic Peak mode for frequency range from 0.15 to 30 MHz. The bandwidth of the receiver was set to 10 kHz. The EUT, peripheral equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission.



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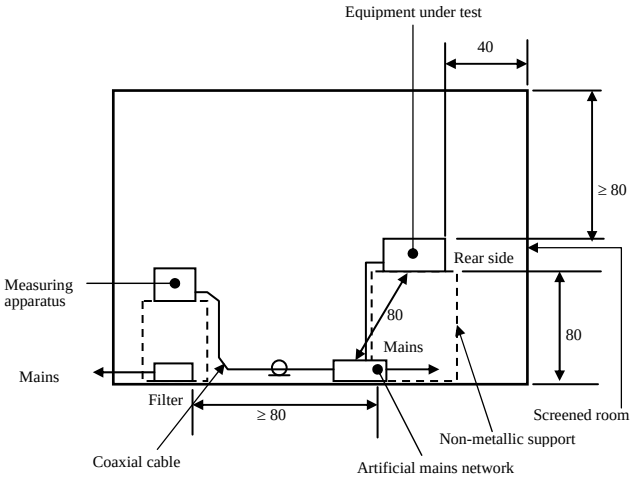


< Concept Drawing >

Limits

According to ∮15.207(a) except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50 μH/50 ohms line impedance stabilization network(LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

Frequency Range (MHz)	Limits	
	Quasi-peak	Average
0.15 to 0.50	66 to 56*	56 to 46*
0.50 to 5	56	46
5 to 30	60	50

* Decreases with the logarithm of the frequency.

Test specification.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.207

Conducted Emissions

[Applicable]

◆ Test Equipment Used

Model Name	Description	Manufacturer	Due for Cal	Serial No.
ESCI	Test Receiver	Rohde & Schwarz	Jul. 07, 2014	100373
ESH2-Z5	LISN	Rohde & Schwarz	Oct. 08, 2014	842966/014
ESH3-Z2	Pulse Limiter	Rohde & Schwarz	May. 10, 2014	357.8810.52

Note : The equipment used is calibrated in regular for every year.

◆ Test Accessories Used

Equipment	Type	Brand	Serial No.
AK240	AK240	IRIVER LIMITED.	N/A
Laptop	LGR51	LG Electronics	902QTEQ035540
Adapter(Laptop)	PA-1900-08	LG Electronics	N/A
AP	DIR-825	D-Link	F3TO2C9000588
Micro SD	N/A	SanDisk	N/A
Bluetooth Speaker	XAM11	XMI	X0035744

Connecting Interface Cables :
AC Power Cable : 1.8 m (Unshielded)
USB Cable(Micro 5pin to USB) : 1.0 m (shielded)

◆ Test Conditions

Temperature	(18.2 ± 0.2) ℃
Humidity	(40.4 ± 0.2) % R.H.
Atmosphere	(1012) mbar

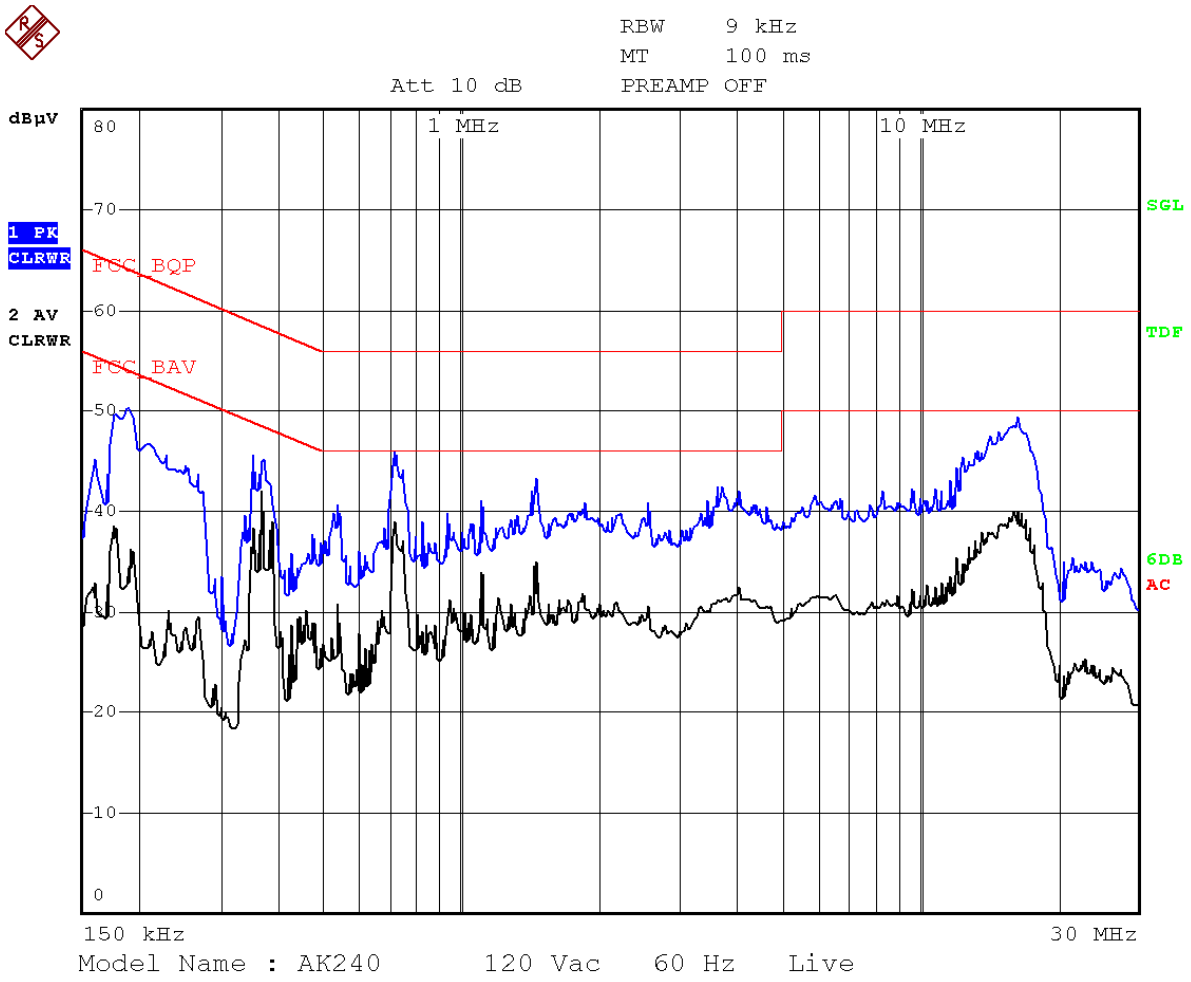
◆ Test Area Conducted Room #1

◆ Test Date December 20, 2013

Note :

Conducted Emissions result

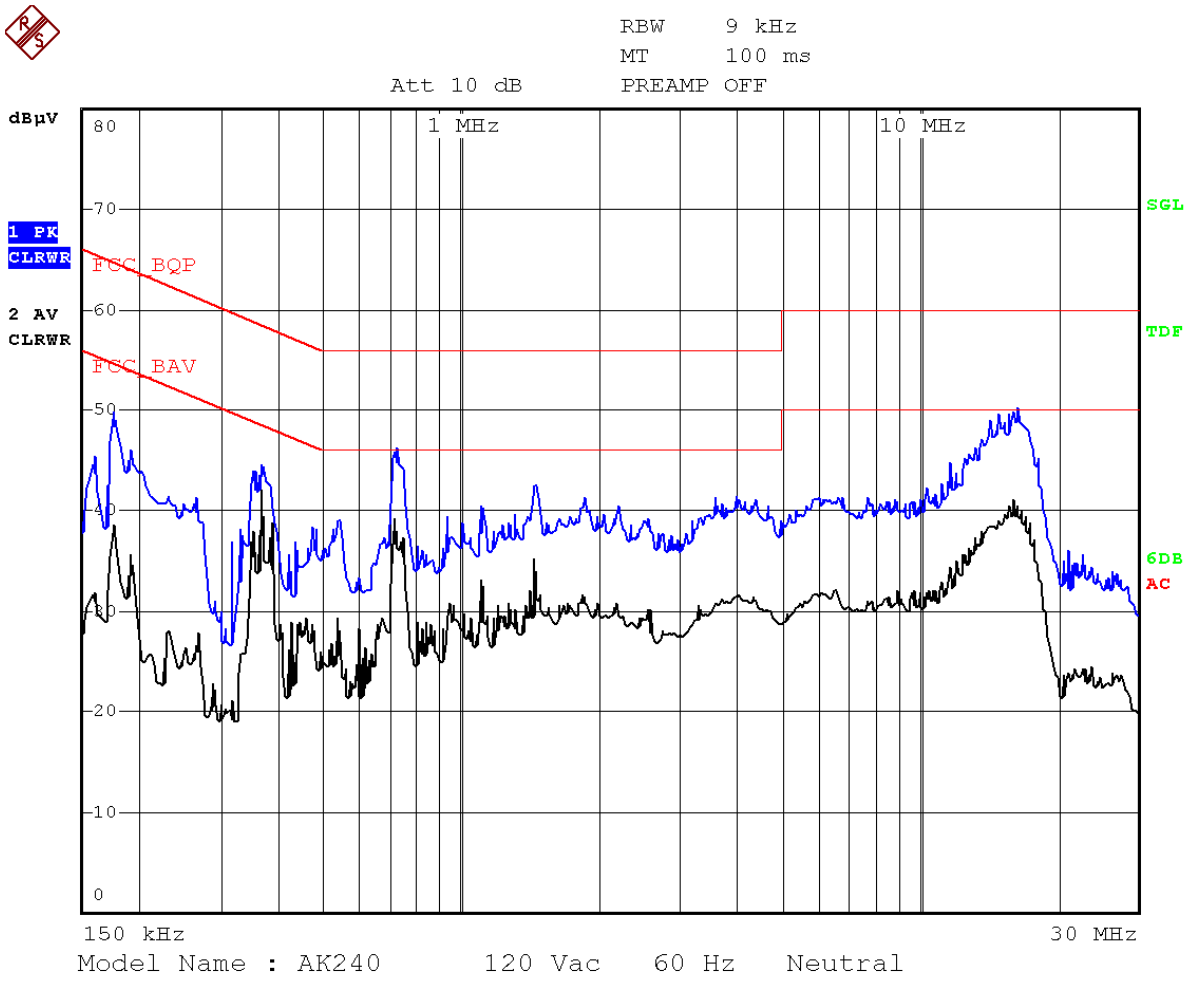
Live



Freq. [MHz]	Measurement [dB㎶]		Limit [dB㎶]		Insertion Loss	Cable Loss	Result [dB㎶]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB]	Q-peak	Average	Q-peak	Average
0.186	46.82	33.27	64.21	54.21	0.51	0.02	47.35	33.80	16.87	20.42
0.350	42.61	38.15	58.96	48.96	0.49	0.04	43.14	38.68	15.82	10.28
0.534	35.03	29.63	56.00	46.00	0.49	0.03	35.56	30.16	20.44	15.84
0.718	44.72	39.29	56.00	46.00	0.51	0.04	45.27	39.84	10.73	6.16
1.462	38.28	33.14	56.00	46.00	0.55	0.06	38.89	33.75	17.11	12.25
16.434	44.64	39.61	60.00	50.00	0.80	0.16	45.60	40.57	14.40	9.43

Conducted Emissions result

Neutral



Freq. [MHz]	Measurement [dB µV]		Limit [dB µV]		Insertion Loss	Cable Loss	Result [dB µV]		Margin [dB]	
	Q-peak	Average	Q-peak	Average	[dB]	[dB]	Q-peak	Average	Q-peak	Average
0.158	38.52	32.04	65.57	55.57	0.49	0.03	39.04	32.56	26.53	23.01
0.174	47.44	38.15	64.77	54.77	0.39	0.03	47.86	38.57	16.91	16.20
0.366	43.37	41.92	58.59	48.59	0.28	0.04	43.69	42.24	14.90	6.35
0.722	43.91	38.37	56.00	46.00	0.23	0.04	44.18	38.64	11.82	7.36
1.458	38.84	34.29	56.00	46.00	0.24	0.06	39.14	34.59	16.86	11.41
16.346	42.61	37.38	60.00	50.00	0.53	0.16	43.30	38.07	16.70	11.93

Peak Power Output

◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Due for Cal.
1	Power Meter	Agilent	N1911A/ MY53280018	Oct. 07, 2014
2	Wideband Power Sensor	Agilent	N1921A/ MY52300024	Oct. 07, 2014
3	RF ROOM			

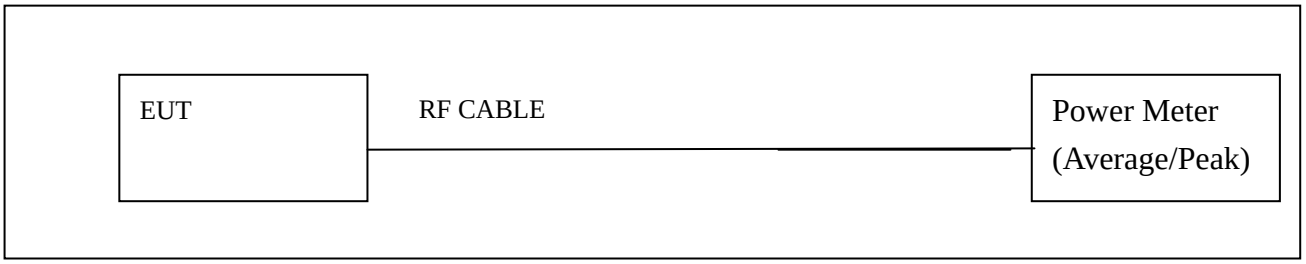
Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Limits

The maximum peak output power of the intentional radiator shall not exceed the following :

1. According to ∮15.247(b)(3), for systems using digital modulation in the bands of 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz : 1Watt.
2. According to ∮15.247(b)(4), the conducted output power limit specified in paragraph(b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph(c) of this section, is transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs(b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi

◆ Test Setup



◆ Test Procedure

1.The transmitter output is connected to the Spectrum analyzer. The Power meter is set to the Average power detection.

2. The testing follows the Measurement Procedure FCC KDB No. 558074 D01 DTS Meas. Guidance v03r01

Peak Power Test result

Product	AK240
Test Method	Measurement using an RF peak power meter
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

802.11b Mode		Rate (Mbps)	Measure Power (dBm)	Limit (dBm)
Frequency (MHz)	Channel No.			
2412	1	1 Mbps	17.74	1Watt=30dBm
		2 Mbps	17.65	1Watt=30dBm
		5.5 Mbps	17.56	1Watt=30dBm
		11 Mbps	17.56	1Watt=30dBm
2437	6	1 Mbps	17.52	1Watt=30dBm
		2 Mbps	17.49	1Watt=30dBm
		5.5 Mbps	17.57	1Watt=30dBm
		11 Mbps	17.59	1Watt=30dBm
2462	11	1 Mbps	17.47	1Watt=30dBm
		2 Mbps	17.35	1Watt=30dBm
		5.5 Mbps	17.41	1Watt=30dBm
		11 Mbps	17.44	1Watt=30dBm

Note : Measurement Power = reading level + correct factor

802.G Mode		Rate (Mbps)	Measure Power (dBm)	Limit (dBm)
Frequency (MHz)	Channel No.			
2412	1	6 Mbps	22.14	1Watt=30dBm
		9 Mbps	21.89	1Watt=30dBm
		12 Mbps	21.68	1Watt=30dBm
		18 Mbps	21.51	1Watt=30dBm
		24 Mbps	21.68	1Watt=30dBm
		36 Mbps	21.73	1Watt=30dBm
		48 Mbps	21.83	1Watt=30dBm
		54 Mbps	21.82	1Watt=30dBm
2437	6	6 Mbps	21.93	1Watt=30dBm
		9 Mbps	21.69	1Watt=30dBm
		12 Mbps	21.46	1Watt=30dBm
		18 Mbps	21.46	1Watt=30dBm
		24 Mbps	21.56	1Watt=30dBm
		36 Mbps	21.58	1Watt=30dBm
		48 Mbps	21.53	1Watt=30dBm
		54 Mbps	21.64	1Watt=30dBm
2462	11	6 Mbps	21.61	1Watt=30dBm
		9 Mbps	21.45	1Watt=30dBm
		12 Mbps	21.25	1Watt=30dBm
		18 Mbps	21.22	1Watt=30dBm
		24 Mbps	21.33	1Watt=30dBm
		36 Mbps	21.31	1Watt=30dBm
		48 Mbps	21.23	1Watt=30dBm
		54 Mbps	21.35	1Watt=30dBm

Note : Measurement Power = reading level + correct factor

802.N Mode(HT20)		Rate (Mbps)	Measure Power (dBm)	Limit (dBm)
Frequency (MHz)	Channel No.			
2412	1	6.5 Mbps	21.79	1Watt=30dBm
		13 Mbps	21.62	1Watt=30dBm
		19.5 Mbps	21.76	1Watt=30dBm
		26 Mbps	21.63	1Watt=30dBm
		39 Mbps	21.63	1Watt=30dBm
		52 Mbps	21.86	1Watt=30dBm
		58.5 Mbps	21.84	1Watt=30dBm
		65 Mbps	21.54	1Watt=30dBm
2437	6	6.5 Mbps	21.67	1Watt=30dBm
		13 Mbps	21.53	1Watt=30dBm
		19.5 Mbps	21.61	1Watt=30dBm
		26 Mbps	21.60	1Watt=30dBm
		39 Mbps	21.55	1Watt=30dBm
		52 Mbps	21.57	1Watt=30dBm
		58.5 Mbps	21.69	1Watt=30dBm
		65 Mbps	21.47	1Watt=30dBm
2462	11	6.5 Mbps	21.46	1Watt=30dBm
		13 Mbps	21.27	1Watt=30dBm
		19.5 Mbps	21.25	1Watt=30dBm
		26 Mbps	21.32	1Watt=30dBm
		39 Mbps	21.24	1Watt=30dBm
		52 Mbps	21.46	1Watt=30dBm
		58.5 Mbps	21.33	1Watt=30dBm
		65 Mbps	21.29	1Watt=30dBm

Note : Measurement Power = reading level + correct factor

Conducted Spurious Emissions & Band Edge

◆ TEST Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Last Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 07, 2014
2	RF ROOM			

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.

◆ Limits

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, based on either an RF conducted or a radiated measurement.

Attenuation below the general limits specified in section 15.209(a) is not required. In addition, radiated emission which fall in the restricted bands, as defined in section 15.205(a), must also comply with the radiated emission limits specified in section 15.209(a)(see Section 15.205(c)).

◆ Test Setup

◆ Test Procedure

1.The transmitter output is connected to the Spectrum analyzer. The Spectrum analyzer is set to the peak power detection.

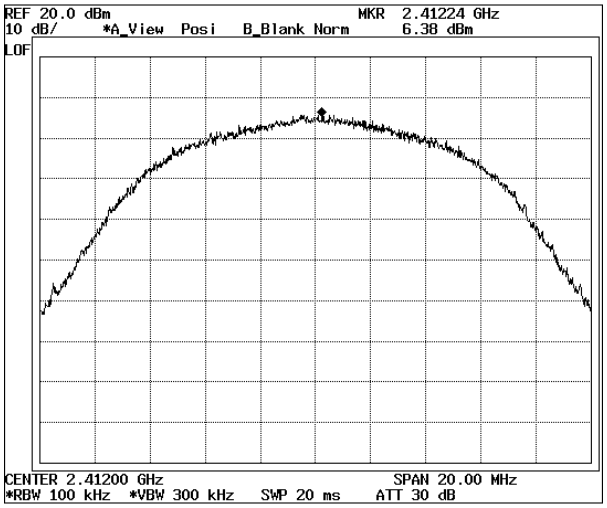
2. The testing follows the Measurement Procedure FCC KDB No. 558074 D01 DTS Meas. Guidance v03r01

Power Spectral Density in 100KHz test result

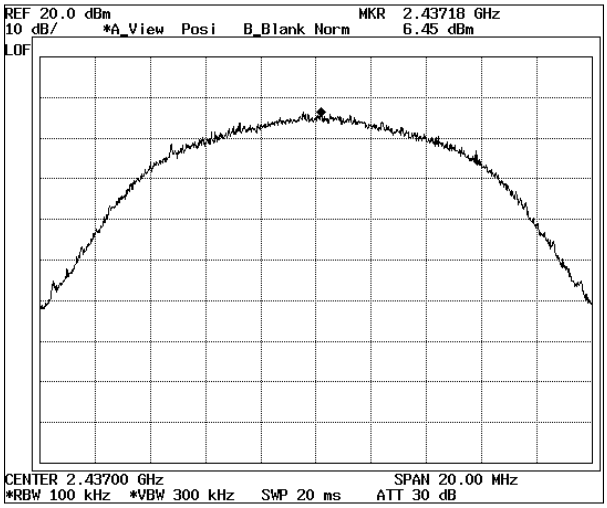
Product	AK240
Test Item	Power Spectral Density in 100KHz
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

802.11b		
Channel	Frequency (MHz)	PSD/100KHz (dBm)
Low	2412	6.38
Mid	2437	6.45
High	2462	6.80

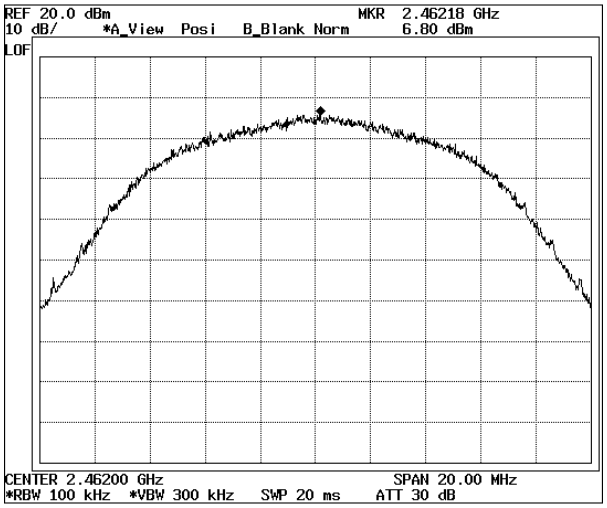
Low(2412 MHz)



Mid(2442 MHz)

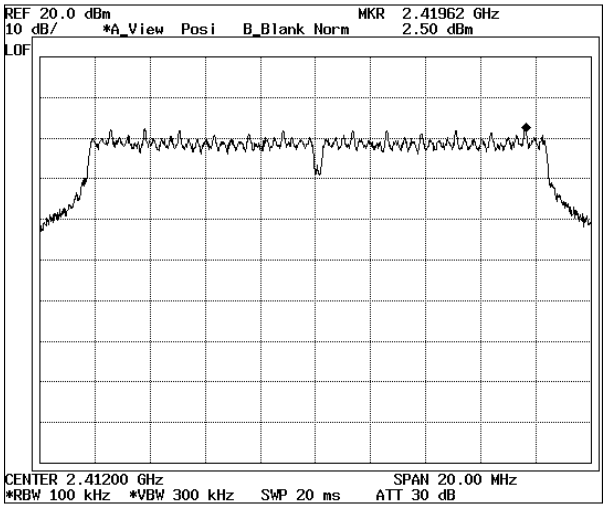


High(2462 MHz)

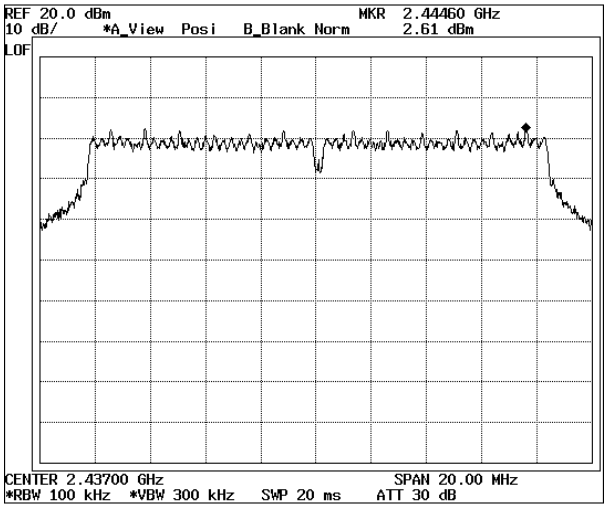


802.11g		
Channel	Frequency (MHz)	PSD/100KHz (dBm)
Low	2412	2.50
Mid	2437	2.61
High	2462	2.81

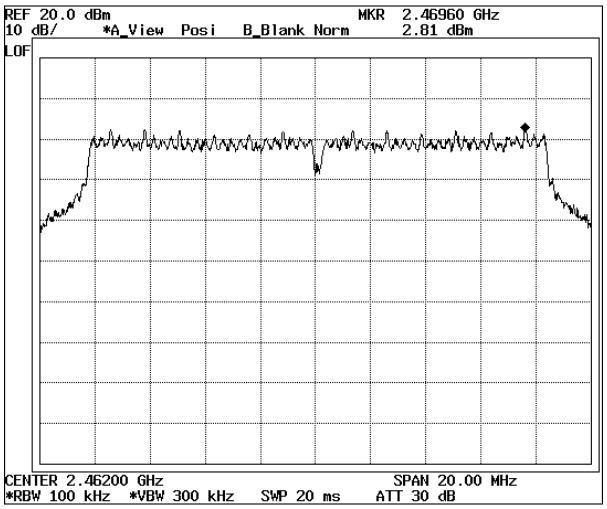
Low(2412 MHz)



Mid(2442 MHz)



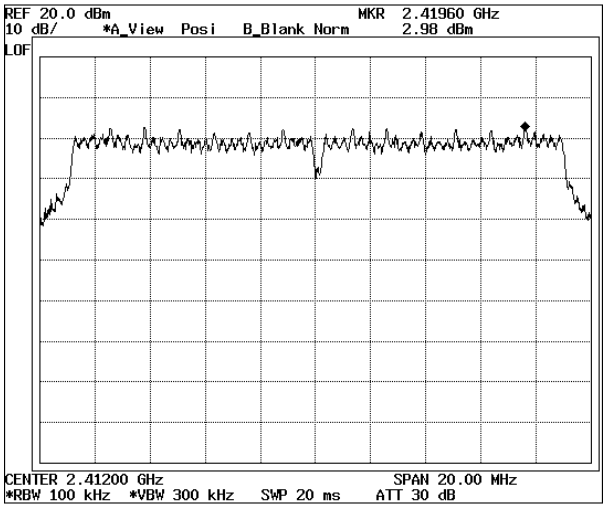
High(2462 MHz)



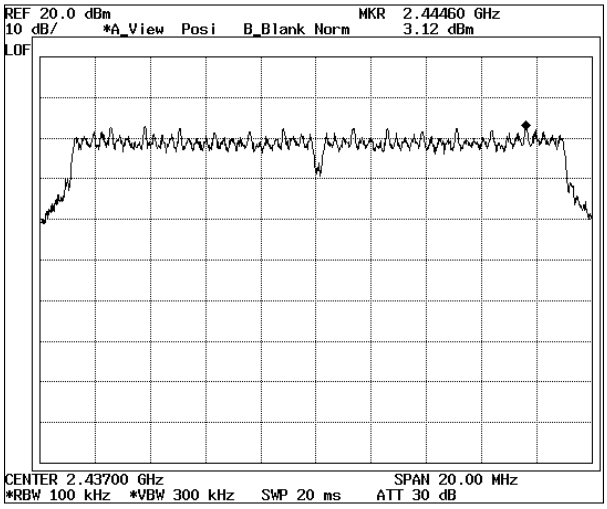
Note : Measurement level = reading level + correct factor

802.11n		
Channel	Frequency (MHz)	PSD/100KHz (dBm)
Low	2412	2.98
Mid	2437	3.12
High	2462	3.27

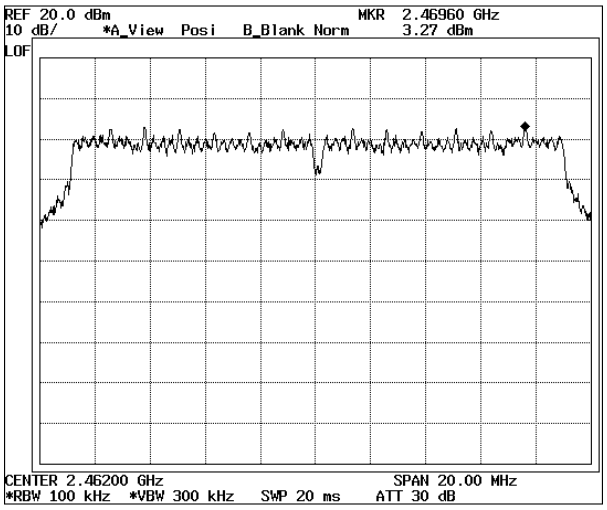
Low(2412 MHz)



Mid(2437 MHz)



High(2462 MHz)



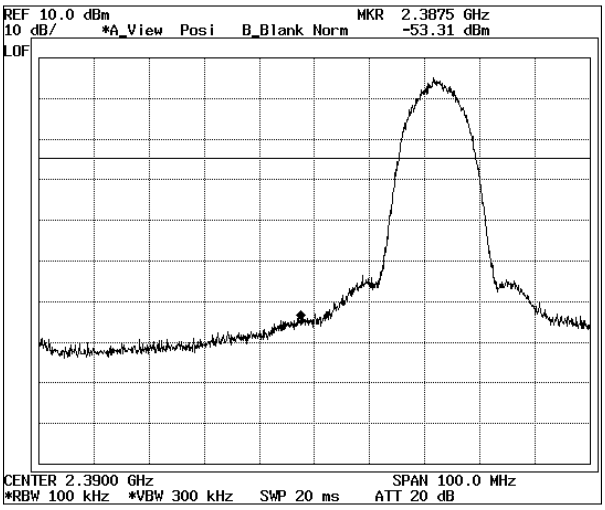
Note : Measurement level = reading level + correct factor

Band Edge Test result

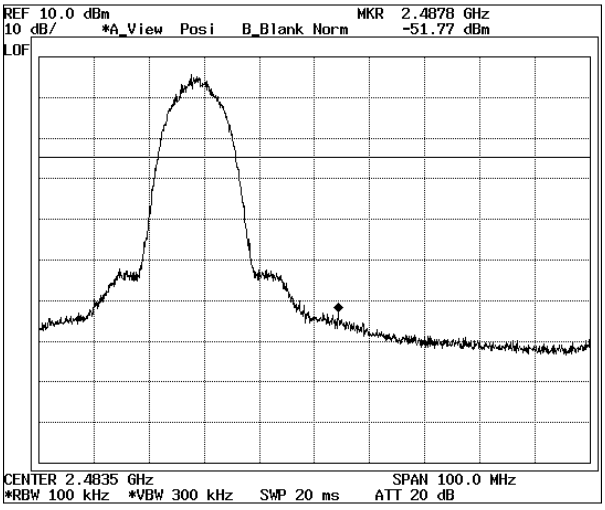
Product	AK240
Test Item	Band Edge
Test Mode	Transmit Low/High
Test Site	RF Room
Measurement Method	Conducted

● **802.11b**

Low (2412 MHz)



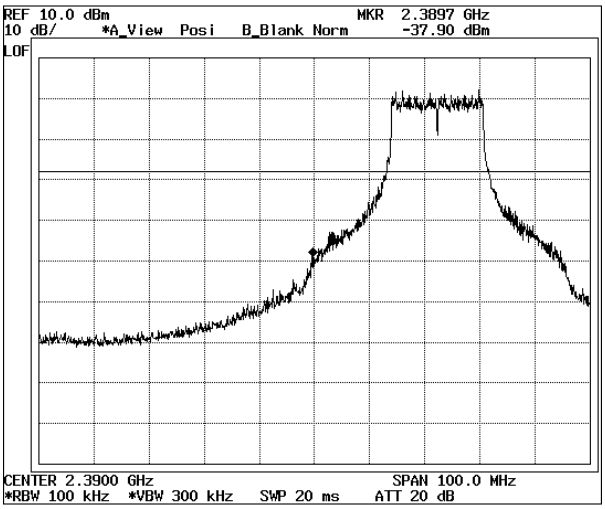
High (2462 MHz)



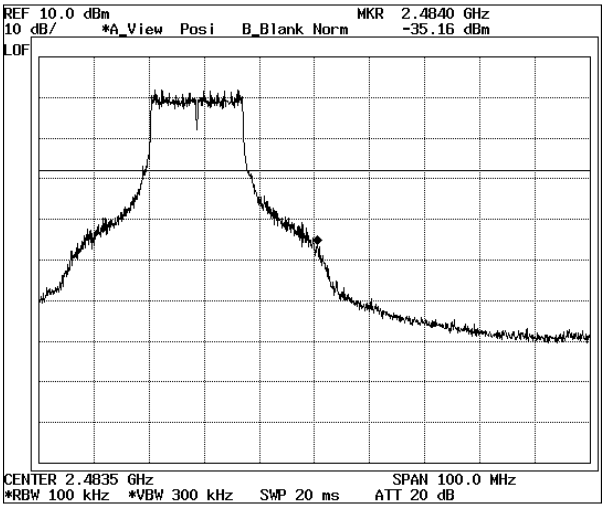
Note : Measurement level = reading level + correct factor

● **802.11g**

Low (2412 MHz)



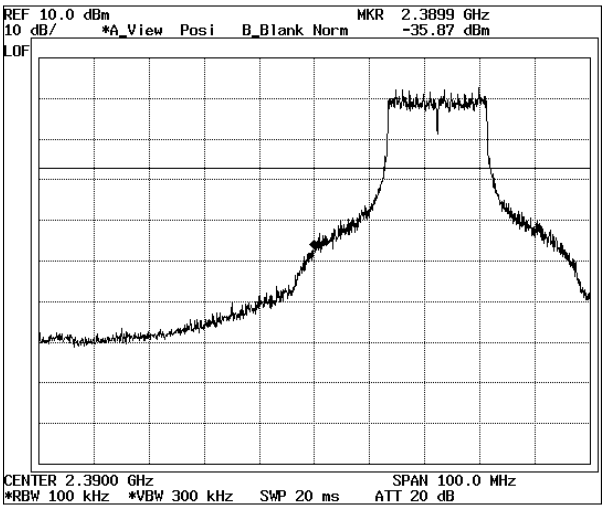
High (2462 MHz)



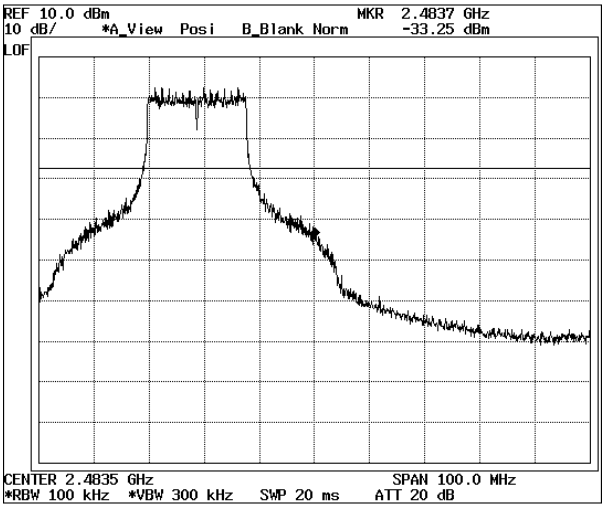
Note : Measurement level = reading level + correct factor

● 802.11n

Low (2412 MHz)



High (2462 MHz)



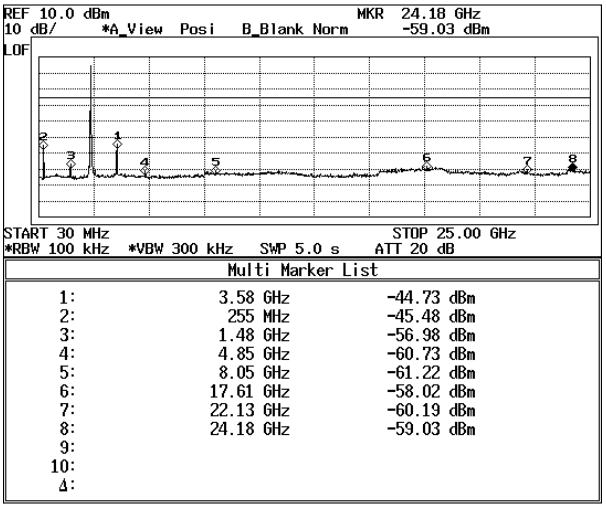
Note : Measurement level = reading level + correct factor

Spurious Emission Test result

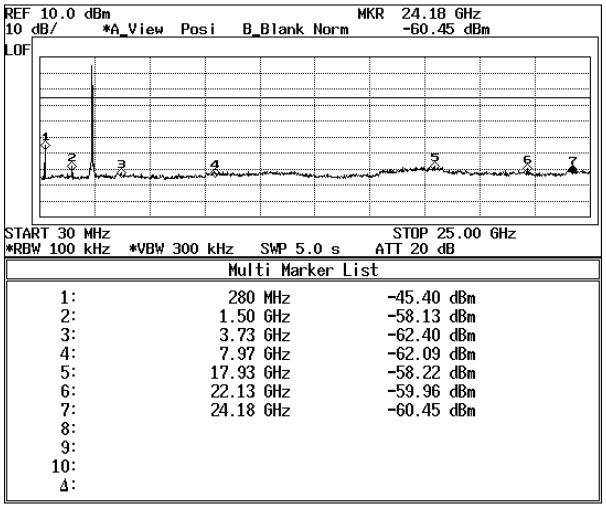
Product	AK240
Test Item	Spurious (30 MHz ~ 25 GHz)
Test Mode	Transmit Low/Mid/High
Test Site	RF Room
Measurement Method	Conducted

● 802.11b

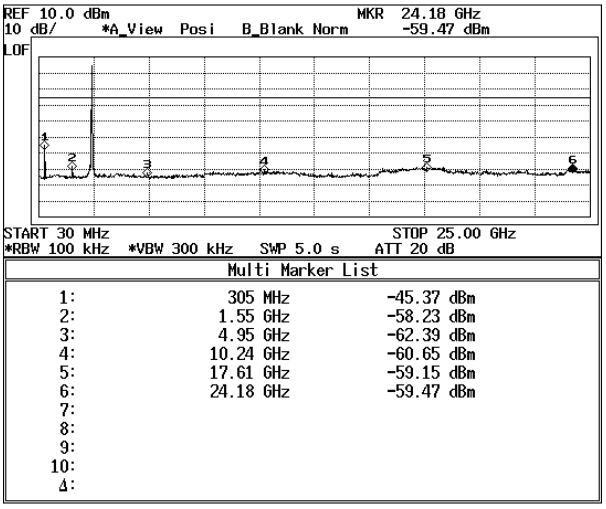
Low(2412 MHz)



Mid(2437 MHz)



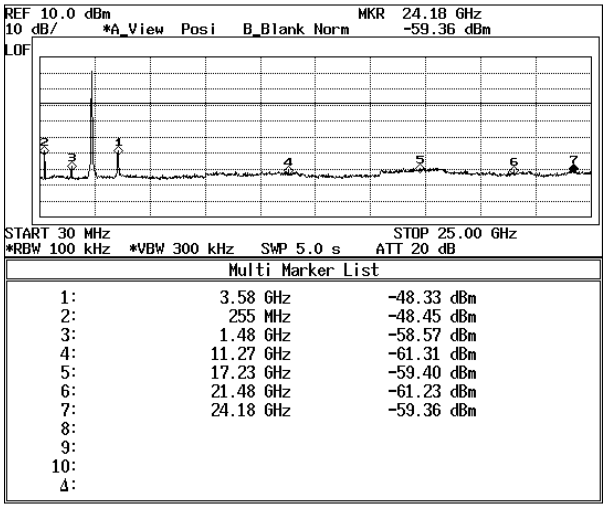
High(2462 MHz)



Note : Measurement level = reading level + correct factor

● 802.11g

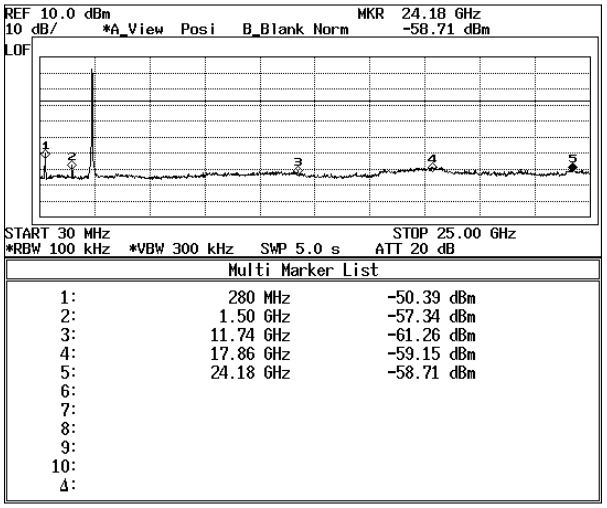
Low(2412 MHz)



Multi Marker List

1:	3.58 GHz	-48.33 dBm
2:	255 MHz	-48.45 dBm
3:	1.48 GHz	-58.57 dBm
4:	11.27 GHz	-61.31 dBm
5:	17.23 GHz	-59.40 dBm
6:	21.48 GHz	-61.23 dBm
7:	24.18 GHz	-59.36 dBm
8:		
9:		
10:		
Δ:		

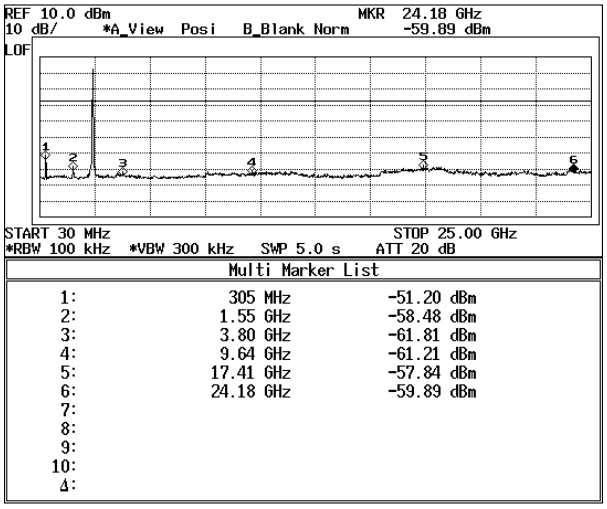
Mid(2437 MHz)



Multi Marker List

1:	280 MHz	-50.39 dBm
2:	1.50 GHz	-57.34 dBm
3:	11.74 GHz	-61.26 dBm
4:	17.86 GHz	-59.15 dBm
5:	24.18 GHz	-58.71 dBm
6:		
7:		
8:		
9:		
10:		
Δ:		

High(2462 MHz)



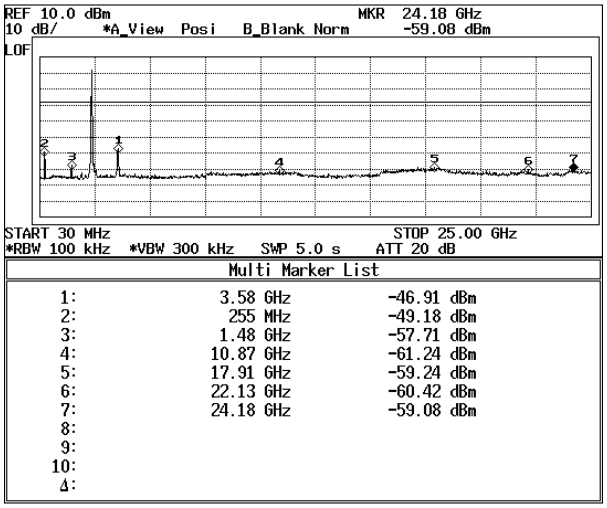
Multi Marker List

1:	305 MHz	-51.20 dBm
2:	1.55 GHz	-58.48 dBm
3:	3.80 GHz	-61.81 dBm
4:	9.64 GHz	-61.21 dBm
5:	17.41 GHz	-57.84 dBm
6:	24.18 GHz	-59.89 dBm
7:		
8:		
9:		
10:		
Δ:		

Note：Measurement level = reading level + correct factor

● 802.11n

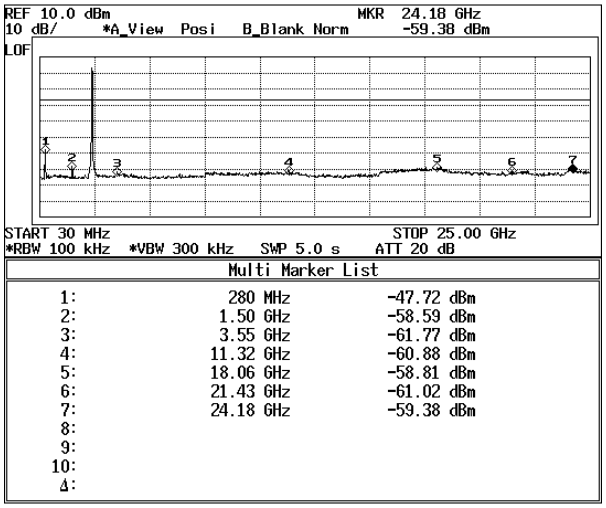
Low(2412 MHz)



Multi Marker List

1:	3.58 GHz	-46.91 dBm
2:	255 MHz	-49.18 dBm
3:	1.48 GHz	-57.71 dBm
4:	10.87 GHz	-61.24 dBm
5:	17.91 GHz	-59.24 dBm
6:	22.13 GHz	-60.42 dBm
7:	24.18 GHz	-59.08 dBm
8:		
9:		
10:		
Δ:		

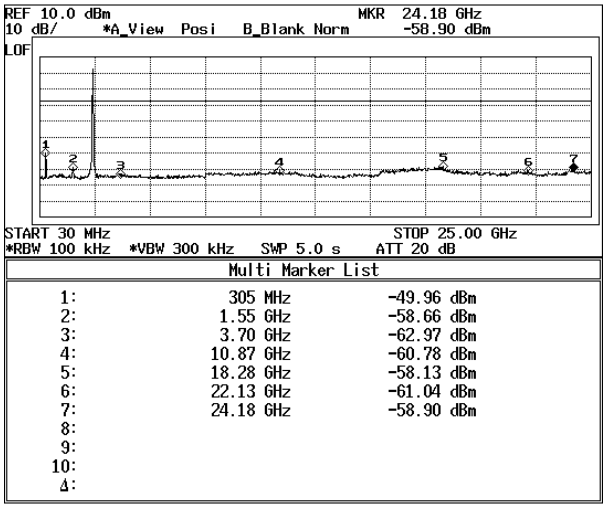
Mid(2437 MHz)



Multi Marker List

1:	280 MHz	-47.72 dBm
2:	1.50 GHz	-58.59 dBm
3:	3.55 GHz	-61.77 dBm
4:	11.32 GHz	-60.88 dBm
5:	18.06 GHz	-58.81 dBm
6:	21.43 GHz	-61.02 dBm
7:	24.18 GHz	-59.38 dBm
8:		
9:		
10:		
Δ:		

High(2462 MHz)



Multi Marker List

1:	305 MHz	-49.96 dBm
2:	1.55 GHz	-58.66 dBm
3:	3.70 GHz	-62.97 dBm
4:	10.87 GHz	-60.78 dBm
5:	18.28 GHz	-58.13 dBm
6:	22.13 GHz	-61.04 dBm
7:	24.18 GHz	-58.90 dBm
8:		
9:		
10:		
Δ:		

Note : Measurement level = reading level + correct factor

6dB BandWidth

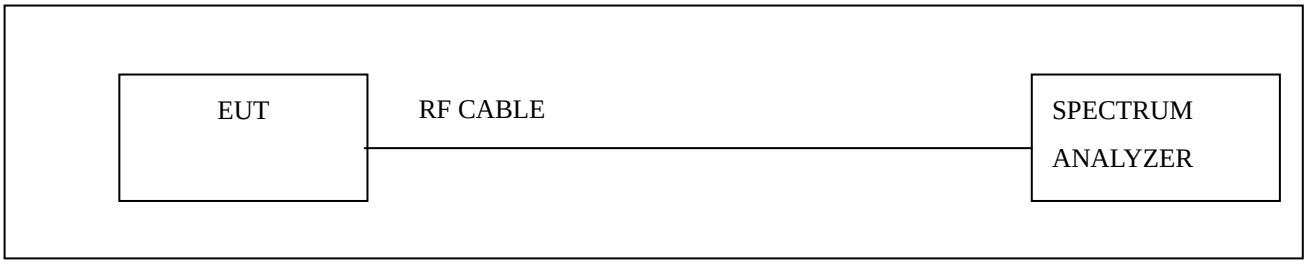
◆Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Due for Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct.07, 2014
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆Test Setup



◆Limits

(a) Operation under the provisions of this Section is limited to frequency hopping and digitally modulated intentional radiators that comply with the following provisions :

(2) systems using digital modulation techniques 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.

◆Test Procedure

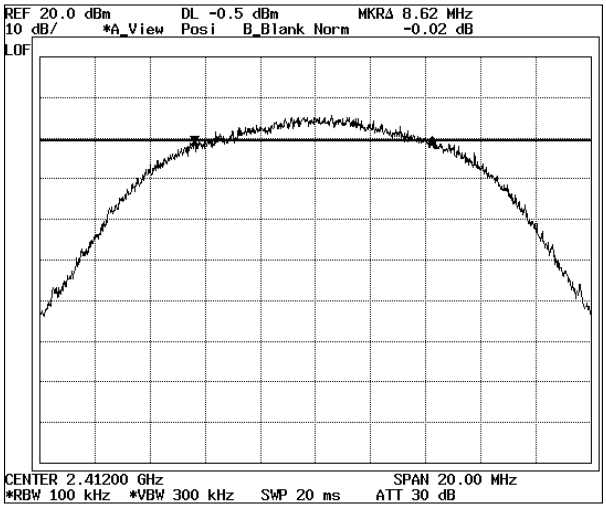
1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v03r01 and TCB Workshop 2013, April 9.
2. The RF output of EUT was connected to the spectrum analyzer by a low loss cable. The path loss was compensated to the results for each measurement.
3. Make the measurement with the spectrum analyzer`s resolution bandwidth (RBW) = 1-5% of the emission bandwidth (EBW). Set the Video bandwidth (VBW) > 3 *RBW. In order to make an accurate measurement. The 6dB bandwidth must be greater than 500 KHz
4. The marker-delta reading at this point is the 6dB bandwidth of the emission.

Test result

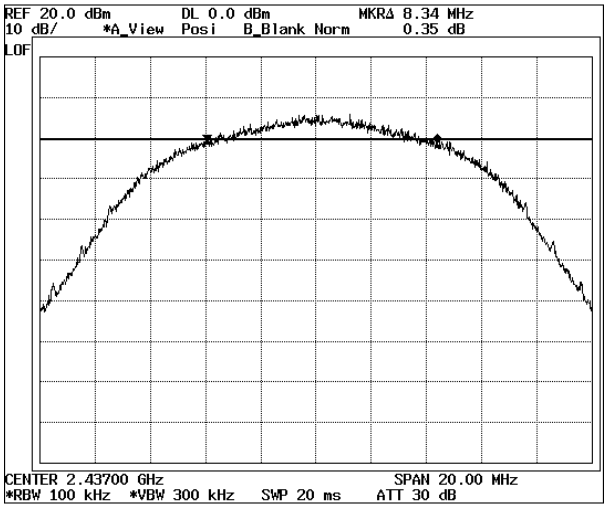
Product	AK240
Test Item	6dB BandWidth
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

802.11b				
Channel No.	Frequency (MHz)	Measure Level (MHz)	Limit (KHz)	Result
Low	2412	8.34	>500	Pass
Mid	2437	8.62	>500	Pass
High	2462	8.24	>500	Pass

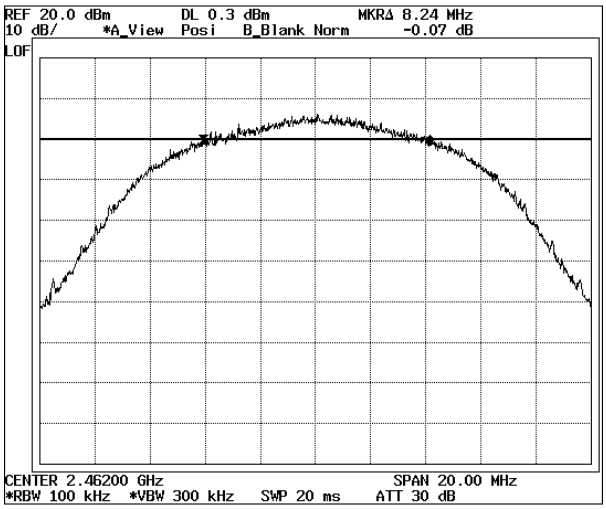
Low(2412 MHz)



Mid(2437 MHz)

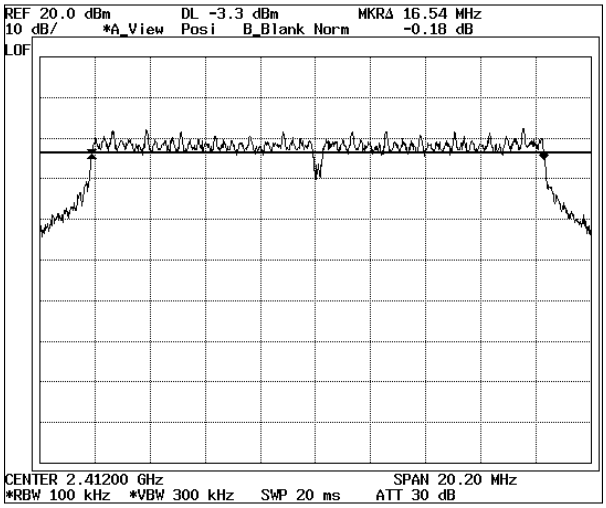


High(2462 MHz)

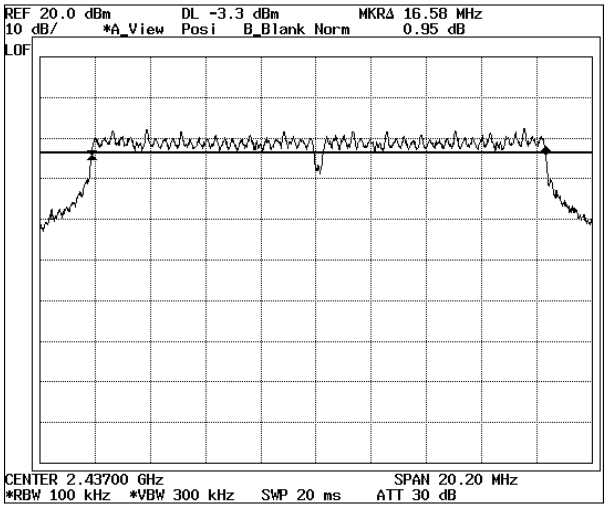


802.11g				
Channel No.	Frequency (MHz)	Measure Level (MHz)	Limit (KHz)	Result
Low	2412	16.54	>500	Pass
Mid	2437	16.58	>500	Pass
High	2462	16.58	>500	Pass

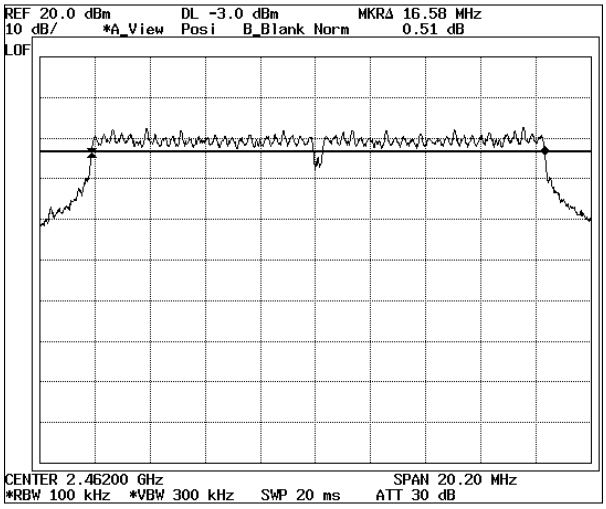
Low(2412 MHz)



Mid(2437 MHz)



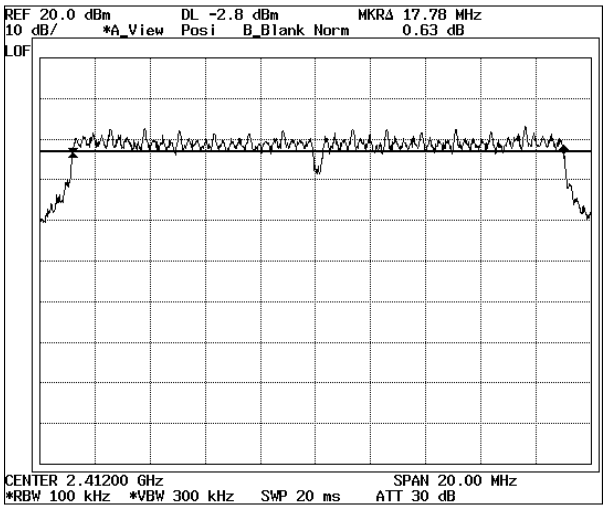
High(2462 MHz)



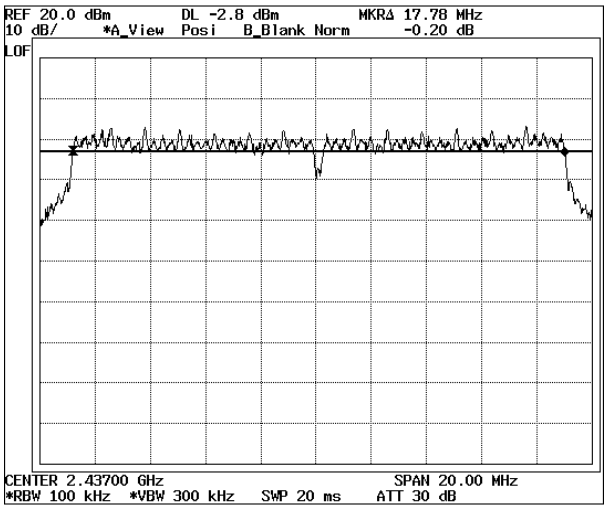
Note : Measurement level = reading level + correct factor

802.11n				
Channel No.	Frequency (MHz)	Measure Level (MHz)	Limit (KHz)	Result
Low	2412	17.78	>500	Pass
Mid	2437	17.78	>500	Pass
High	2462	17.80	>500	Pass

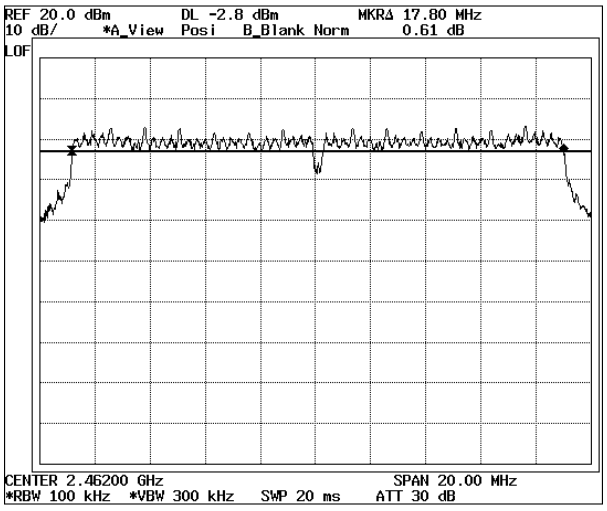
Low(2412 MHz)



Mid(2437 MHz)



High(2462 MHz)



Note : Measurement level = reading level + correct factor

Power Spectral Density

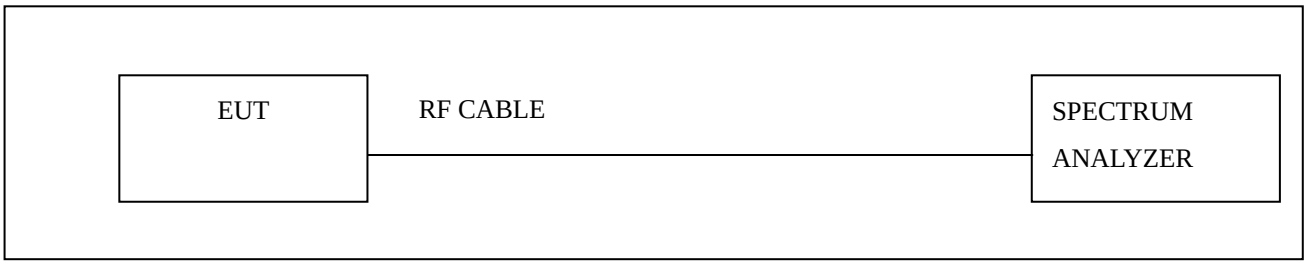
◆ Test Equipment

The following test equipment are used during the test:

Item	Equipment	Manufacturer	Model no/Serial No.	Due for Cal.
1	Spectrum Analyzer	ADVANTEST	R3273 / 95090431	Oct. 07, 2014
2	RF ROOM			

Note : All equipment upon which need to calibrated are with calibration period of 1 year.

◆ Test Setup



◆ Limits

Section 15.247 (e) For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (v) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

◆ Test Procedure

The Measurement Procedure PKPSD was set according to the FCC KDB 558074 D01 DTS Meas. Guidance v03r01. Use the peak marker function to determine the maximum power level in any 3 kHz band segment within the fundamental RBW.
(VBW ≥3 xRBW, Sweep time = auto couple, Trace mode = Max hold)

Antenna output of the EUT was coupled directly to spectrum analyzer; if an external attenuator and/or cable was used, these losses are compensated for with the analyzer OFFSET function.

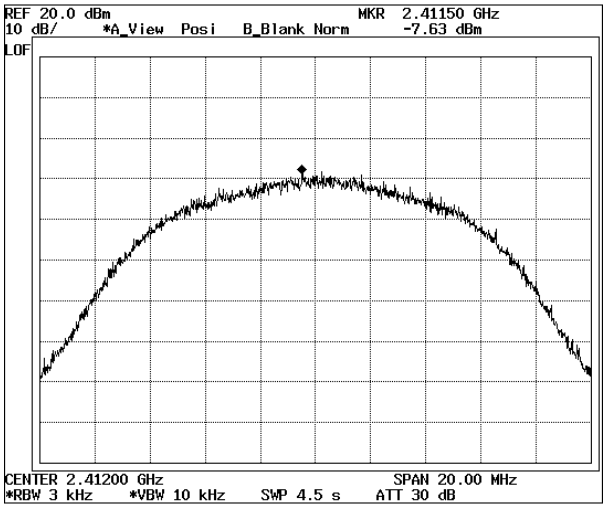
Limit: The Power Density does not exceed 8dBm/ 3 kHz.

Test result

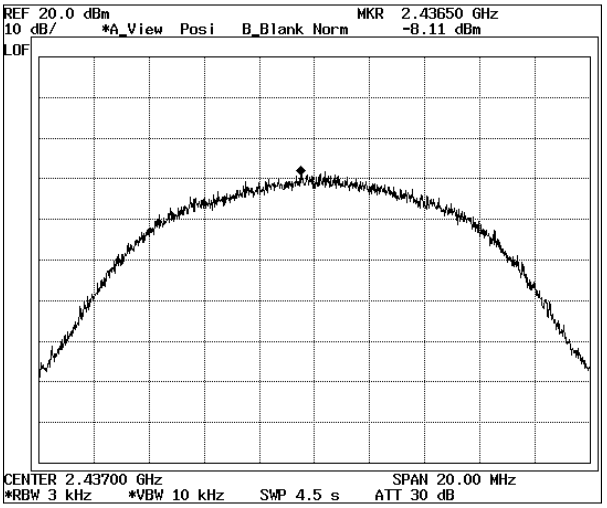
Product	AK240
Test Item	Power Spectral Density
Test Mode	Transmit
Test Site	RF Room
Measurement Method	Conducted

802.11b				
Channel	Frequency (MHz)	PSD/3KHz (dBm)	Limit (dBm)	Result
Low	2412	-7.63	< 8	Pass
Mid	2437	-8.11	< 8	Pass
High	2462	-8.32	< 8	Pass

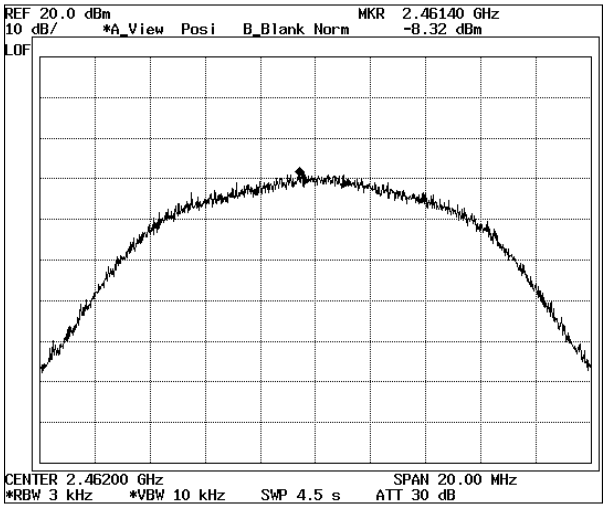
Low(2412 MHz)



Mid(2442 MHz)

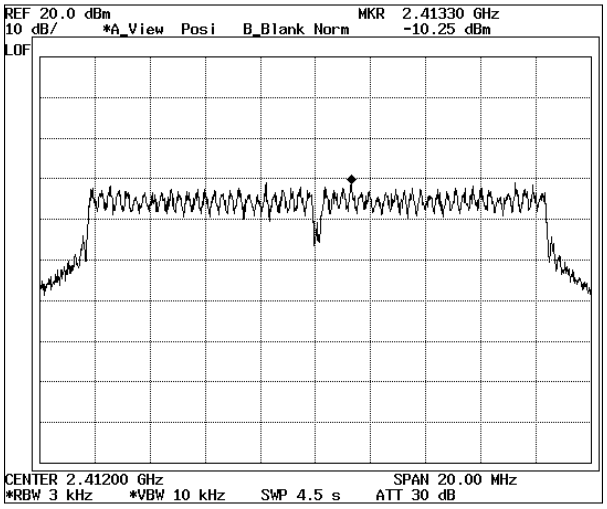


High(2462 MHz)

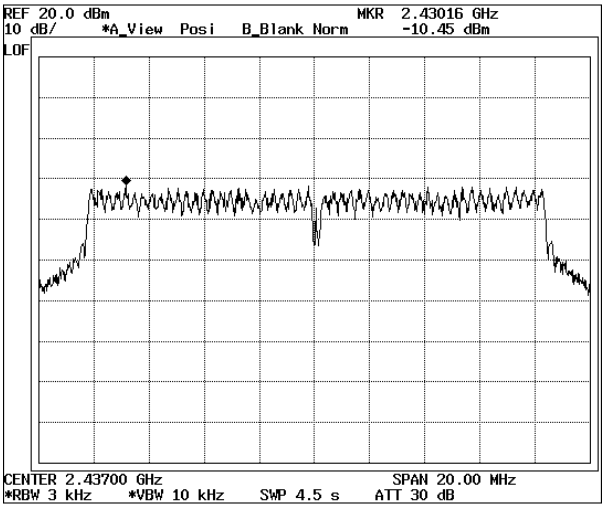


802.11g				
Channel	Frequency (MHz)	PSD/3KHz (dBm)	Limit (dBm)	Result
Low	2412	-10.25	< 8	Pass
Mid	2437	-10.45	< 8	Pass
High	2462	-12.46	< 8	Pass

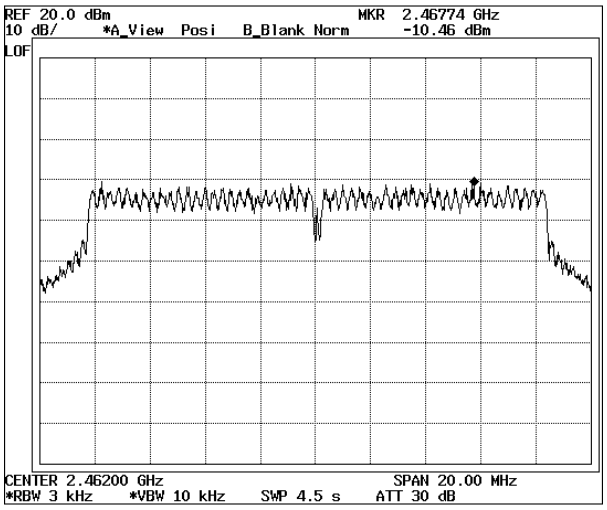
Low(2412 MHz)



Mid(2442 MHz)



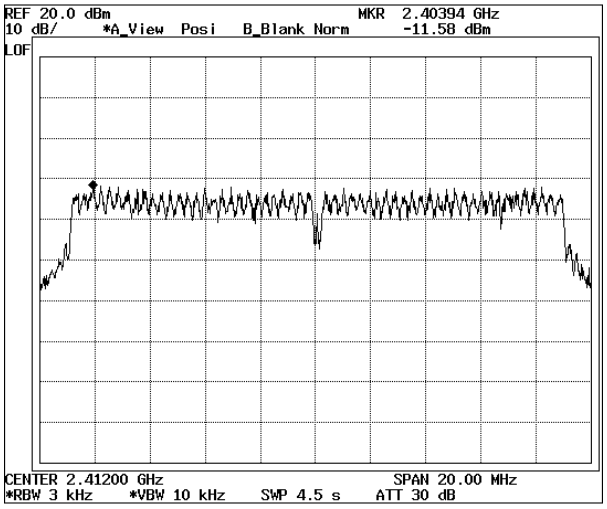
High(2462 MHz)



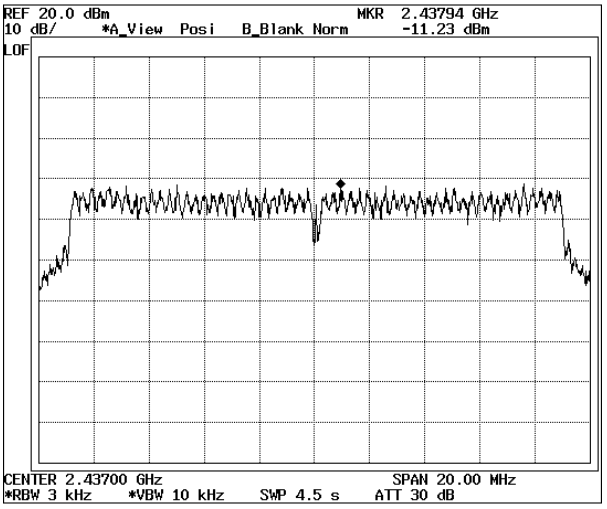
Note : Measurement level = reading level + correct factor

802.11n				
Channel	Frequency (MHz)	PSD/3KHz (dBm)	Limit (dBm)	Result
Low	2412	-11.58	< 8	Pass
Mid	2437	-11.23	< 8	Pass
High	2462	-10.93	< 8	Pass

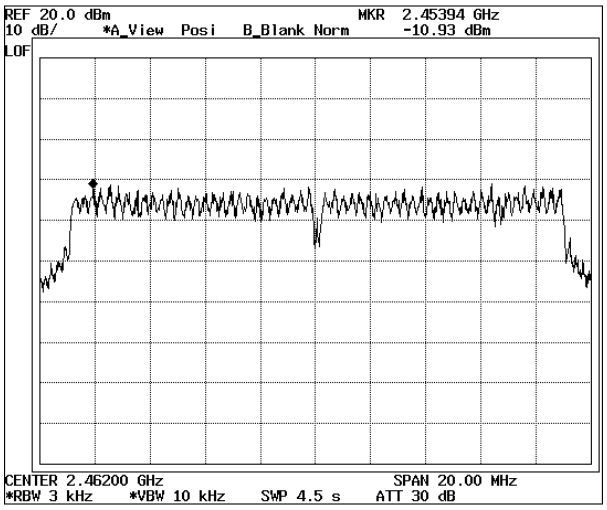
Low(2412 MHz)



Mid(2437 MHz)



High(2462 MHz)



Note : Measurement level = reading level + correct factor

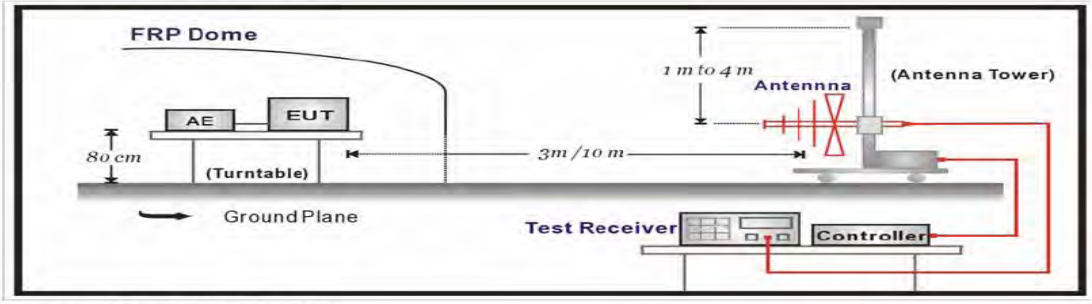
Radiated Emissions:

The measurement was performed over the frequency range of 30MHz to 1GHz using antenna as the input transducer to a Spectrum analyzer or a Field Intensity Meter. The measurement was made with the detector set for "quasi-peak" within a bandwidth of 120kHz.

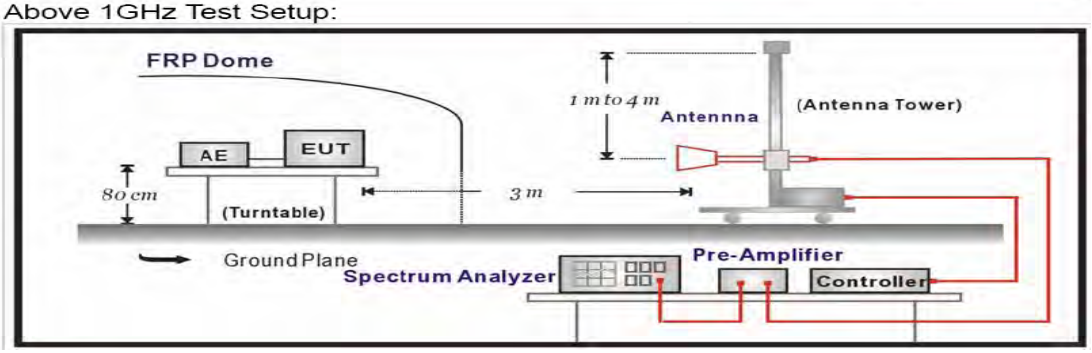
Procedure of Test

Preliminary measurements were made at 3 meter using bi-log antennas, and spectrum analyzer to determine the frequency producing the max. emission in anechoic chamber. Appropriate precaution was taken to ensure that all emission from the EUT were maximized and investigated. The system configuration, mode of operation, turn-table azimuth and height with respect to the antenna were noted for each frequency found. The spectrum was scanned from 30MHz to 1000MHz using bi-log antenna. Above 1GHz, linearly polarized double ridge horn antennas were used. Final measurements were made at open site with 3-meters test distance using bi-log antenna or horn antenna. The OATS have been verified in regular for its normalized site attenuation. The test equipment was placed on a wooden table. Sufficient time for the EUT, peripheral equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined by manual. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 120kHz or 1MHz depending on the frequency of type of signal. The EUT, peripheral equipment and interconnecting cables were re-configured to the set-up producing the max. emission for the frequency and were placed on top of a 0.8-meter high nonmetallic 1 x 1.5 meter table. The EUT, peripheral equipment, and interconnecting cables were re-arranged and manipulated to maximize each emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation to the EUT and/or peripheral equipment and changing the polarity of the antenna, whichever determined the worst-case emission.(The bandwidth below 1GHz setting on the field strength meter is 120KHz and above 1GHz is 1MHz.)

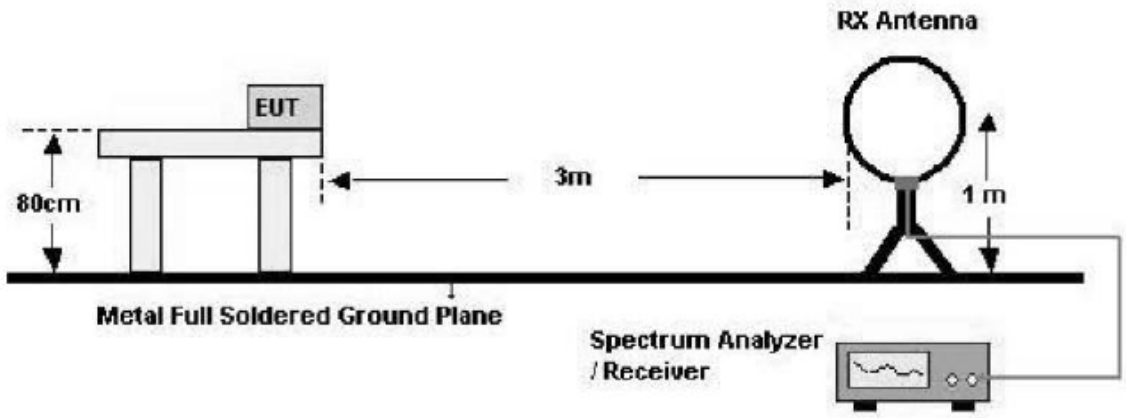
Under 1GHz Test Setup:



Above 1GHz Test Setup:



Below 30 MHz



Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, Shall be attenuated by at least 20dB below the level of the fundamental or to the General radiated emission limits in paragraph 15.209, whichever is the lesser attenuation:

FCC Part 15 Subpart C Section 15.209 Limits		
Frequency(MHz)	μV/meter	dBμV/meter(3m)
0.009-0.490	2400/F(KHz) at 300 m	20log 2400/F(KHz)+80
0.490-1.705	24000/F(KHz)at 30m	20log 24000/F(KHz)+40
1.705-30	30 at 30 m	49.5
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

Remarks :

1. RF Voltage(dBuv)=20log RF Voltage(uV)
2. dBuV/m = ERP(dBm)+106.92 dB + 20log(10m/3m) + 2.15dB(conversion Factor for E.I.R.P)
3. In the Above Table, the tighter limit applies at the band edges.
4. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

Test specification.

According to FCC CFR Title 47 Part 15 Subpart C Section 15.209

Radiated Spurious Emission & Radiated Restricted Band Edge

[Applicable]

◆ Test Equipment Used

Name	Type	Manufacturer	Due for Cal	Serial Number
EMI Receiver	ESCS30	Rohde & Schwarz	May 10, 2014	100171
EMI Receiver	ESCI7	Rohde & Schwarz	Jul. 16, 2014	100872
SPECTRUM ANALYZER	R3273	ADVANTEST	Oct. 07, 2014	95090431
Loop Antenna	HFH2-Z2	Rohde & Schwarz	Oct. 26, 2014	8620771017
Log-bicon Antenna	VULB9160	Schwarz beck	Mar. 28, 2014	3047
HORN-Antenna	3115	EMCO	Dec. 04, 2015	9012-3602
HORN-Antenna	HF906	Rohde & Schwarz	Oct. 25, 2015	100530
PRE AMPLIFIER	8449B OPT H02	HP	Oct. 08, 2014	3008A0530

Note : 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to RRL, KRISS, KTL and HCT.
2. The calibration interval of horn ant. and loop ant. is 24 months

◆ Test Conditions

Temperature (17.6 ± 0.2) ℃
Humidity (46.2 ± 0.2) % R.H.
Atmosphere (1020) mbar

◆ Test Area Full-Anechoic Room (3m)

◆ Test Date December 24, 2013

Note :

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. For the limit is employed average value, therefore the peak value can be transferred to average value by subtracting the duty factor. The basic equation with a sample calculation is as follows:

Peak = Reading + Corrected Factor

Where Corr. Factor = Antenna Factor + Cable Factor - Amplifier Gain (if any)

Radiated Emissions Test, 9 kHz to 30 MHz(Magnetic Field Test)

1. The preliminary radiated measurements were performed to determine the frequency producing the maximum emissions at a distance of 3 meters according to Section 15.31(f)(2).
2. The EUT was placed on the top of the 0.8-meter height, 1 x 1.5 meter non-metallic table.
3. Emissions from the EUT are maximized by adjusting the orientation of the Loop antenna and rotating the EUT on the turntable. Manipulating the system cables also maximizes EUT emissions if applicable.
4. To obtain the final measurement data, each frequency found during preliminary measurements was re-examined and investigated. The test-receiver system was set up to average, peak, and quasi-peak detector with specified bandwidth.
5. The result was 20dB lower than the limit line 15.31(o) was not reported.

Radiated Emission Result

Frequency MHz	Reading dBuV	P (H, V)	Ant. Factor dB	Cable Loss dB	Limit dBuV	Total dBuV	Margin dB

Note : The result was 20dB lower than the limit line 15.31(o) was not reported.

Radiated Spurious Emission Result

[Applicable]

Spurious Emissions Test (Below 1GHz) :

☒ Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, packet types and antenna ports(if EUT with antenna diversity architecture), and X,Y,Z Axis.

EUT	AK240	PROBE	Below 1 GHz
POWER	120 Vac, 60 Hz	NOTE	WLAN mode

Frequency MHz	Reading dBuV	P (H,V)	Ant. Factor dB	Cable Loss dB	Limit dBuV	Total dBuV	Margin dB
45.523	21.30	V	12.15	1.15	40.00	34.60	-5.40
65.891	20.60	V	10.70	1.38	40.00	32.68	-7.32
119.245	17.50	H	11.61	1.83	43.50	30.94	-12.56
165.802	17.90	H	12.79	2.15	43.50	32.84	-10.66
341.375	23.40	H	13.95	3.08	46.00	40.43	-5.57
*448.071	21.40	V	16.47	3.57	46.00	41.44	-4.56
608.118	15.50	V	19.44	4.40	46.00	39.34	-6.66

Note :

1. *Remark "*" means that the data is the worst emission level.*
2. *All reading levels are Quasi-peak value.*
3. *Measurement level = reading level + correct factor*

Spurious Emissions Test (Above 1GHz) :

☒ Pre-scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates, packet types and antenna ports(if EUT with antenna diversity architecture), and X,Y,Z Axis.

● **802.11b**

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	1 Channel (2412 MHz)
MODE	802.11b		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.521	37.13	24.55	V	74.00	54.00	36.87	29.45
3.153	43.54	31.31	V	74.00	54.00	30.46	22.69
3.885	43.60	31.70	V	74.00	54.00	30.40	22.30
4.832	50.12	36.83	V	74.00	54.00	23.88	17.17
5.574	45.45	33.57	V	74.00	54.00	28.55	20.43
1.518	37.57	24.69	H	74.00	54.00	36.43	29.31
3.187	42.26	31.28	H	74.00	54.00	31.74	22.72
4.821	49.28	35.41	H	74.00	54.00	24.72	18.59
5.223	45.30	33.92	H	74.00	54.00	28.70	20.08
5.675	45.42	33.82	H	74.00	54.00	28.58	20.18

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	6 Channel (2437 MHz)
MODE	802.11b		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.525	37.31	24.63	V	74.00	54.00	36.69	29.37
3.196	43.34	31.55	V	74.00	54.00	30.66	22.45
5.261	46.35	33.63	V	74.00	54.00	27.65	20.37
1.873	36.80	24.48	H	74.00	54.00	37.20	29.52
2.164	38.01	25.75	H	74.00	54.00	35.99	28.25
4.894	44.46	33.31	H	74.00	54.00	29.54	20.69
7.524	49.45	36.42	H	74.00	54.00	24.55	17.58

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11b		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.526	37.20	24.05	V	74.00	54.00	36.80	29.95
3.221	41.26	31.79	V	74.00	54.00	32.74	22.21
3.889	43.62	31.49	V	74.00	54.00	30.38	22.51
1.514	35.78	23.30	H	74.00	54.00	38.22	30.70
4.542	43.75	31.17	H	74.00	54.00	30.25	22.83
5.204	44.38	34.19	H	74.00	54.00	29.62	19.81

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

● 802.11g

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	1 Channel (2412 MHz)
MODE	802.11g		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.518	38.69	24.52	V	74.00	54.00	35.31	29.48
3.187	42.30	31.32	V	74.00	54.00	31.70	22.68
4.812	45.47	33.84	V	74.00	54.00	28.53	20.16
5.636	45.89	33.67	V	74.00	54.00	28.11	20.33
1.516	37.87	24.21	H	74.00	54.00	36.13	29.79
2.127	37.94	25.16	H	74.00	54.00	36.06	28.84
3.915	43.18	31.53	H	74.00	54.00	30.82	22.47
5.193	45.44	33.98	H	74.00	54.00	28.56	20.02

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	6 Channel (2437 MHz)
MODE	802.11g		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.113	38.11	23.97	V	74.00	54.00	35.89	30.03
5.195	46.01	34.03	V	74.00	54.00	27.99	19.97
9.524	50.52	38.31	V	74.00	54.00	23.48	15.69
1.525	38.55	24.73	H	74.00	54.00	35.45	29.27
4.895	43.63	32.78	H	74.00	54.00	30.37	21.22
5.213	45.31	33.92	H	74.00	54.00	28.69	20.08

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11g		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.524	38.42	24.93	V	74.00	54.00	35.58	29.07
3.175	42.48	31.69	V	74.00	54.00	31.52	22.31
3.923	42.96	31.40	V	74.00	54.00	31.04	22.60
5.727	45.48	33.65	V	74.00	54.00	28.52	20.35
1.521	37.69	23.94	H	74.00	54.00	36.31	30.06
3.253	42.73	31.39	H	74.00	54.00	31.27	22.61
4.265	43.14	31.18	H	74.00	54.00	30.86	22.82
8.469	50.08	38.28	H	74.00	54.00	23.92	15.72

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

● 802.11n

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	1 Channel (2412 MHz)
MODE	802.11n		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.526	36.73	23.76	V	74.00	54.00	37.27	30.24
2.135	36.89	25.47	V	74.00	54.00	37.11	28.53
4.821	46.79	34.88	V	74.00	54.00	27.21	19.12
5.253	45.63	33.68	V	74.00	54.00	28.37	20.32
1.855	37.03	24.52	H	74.00	54.00	36.97	29.48
2.134	37.45	25.63	H	74.00	54.00	36.55	28.37
3.227	43.09	31.49	H	74.00	54.00	30.91	22.51
5.632	45.28	33.41	H	74.00	54.00	28.72	20.59
7.853	49.76	37.62	H	74.00	54.00	24.24	16.38

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac, 60 Hz	CHANNEL	6 Channel (2437 MHz)
MODE	802.11n		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.528	36.74	24.05	V	74.00	54.00	37.26	29.95
1.854	36.13	23.71	V	74.00	54.00	37.87	30.29
4.895	45.26	33.97	V	74.00	54.00	28.74	20.03
1.526	35.66	23.20	H	74.00	54.00	38.34	30.80
2.824	39.73	26.52	H	74.00	54.00	34.27	27.48
3.913	42.95	31.42	H	74.00	54.00	31.05	22.58
5.731	45.66	33.74	H	74.00	54.00	28.34	20.26

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11n		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
1.523	37.15	25.55	V	74.00	54.00	36.85	28.45
2.825	39.43	26.55	V	74.00	54.00	34.57	27.45
3.177	41.91	31.12	V	74.00	54.00	32.09	22.88
5.224	44.69	33.80	V	74.00	54.00	29.31	20.20
1.518	36.46	24.16	H	74.00	54.00	37.54	29.84
2.153	37.71	25.25	H	74.00	54.00	36.29	28.75
4.949	48.51	36.03	H	74.00	54.00	25.49	17.97
5.671	45.46	33.86	H	74.00	54.00	28.54	20.14

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

Radiated Restricted Band Edge Result

● 802.11b

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	1 Channel (2412 MHz)
MODE	802.11b		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.385	38.02	26.63	V	74.00	54.00	35.98	27.37
2.388	39.54	27.07	H	74.00	54.00	34.46	26.93

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11b		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.484	43.92	33.76	V	74.00	54.00	30.08	20.24
2.484	45.62	35.53	H	74.00	54.00	28.38	18.47

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

● 802.11g

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	1 Channel (2412 MHz)
MODE	802.11g		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.389	52.86	36.80	V	74.00	54.00	21.14	17.20
2.389	51.41	33.39	H	74.00	54.00	22.59	20.61

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11g		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.484	65.56	50.58	V	74.00	54.00	8.44	3.42
2.484	64.01	48.90	H	74.00	54.00	9.99	5.10

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

● 802.11n

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	1 Channel (2412 MHz)
MODE	802.11n		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.389	55.83	37.61	V	74.00	54.00	18.17	16.39
2.389	56.17	38.52	H	74.00	54.00	17.83	15.48

EUT	AK240	PROBE	Above 1 GHz
POWER	120 Vac 60 Hz	NOTE	11 Channel (2462 MHz)
MODE	802.11n		

Test Data

Frequency GHz	Reading dBuV		P	Limit dBuV		Margin dB	
	Peak	AV		Peak	AV	Peak	AV
2.484	67.56	50.52	V	74.00	54.00	6.44	3.48
2.484	65.01	49.64	H	74.00	54.00	8.99	4.36

Note : Reading(dBuv) : Measurement Level + Ant Factor + Cable Loss - Amp Gain

Antenna requirements

According to FCC 47 CFR 15.203

"an intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached or an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section"

* the antenna of this EUT are permanently attached

* the EUT complies with the requirement of 15.203