

# TEST REPORT

of

FCC Part 15 Subpart C §15.247

FCC ID: O6ZGFHD100

Equipment Under Test : IP-set top BOX  
Model Name : GFHD100  
Serial No. : N/A  
Applicant : HUMAX CO., Ltd.  
Manufacturer : HUMAX CO., Ltd.  
Date of Test(s) : 2012. 04. 20 ~ 2012. 05. 22  
Date of Issue : 2012. 06. 05

In the configuration tested, the EUT complied with the standards specified above.

Tested By:



Alvin Kim

Date

2012. 06. 05

Approved By:



Feel Jeong

Date

2012. 06. 05

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## 1. General information

### 1.1. Testing laboratory

SGS Korea Co., Ltd.(Gunpo Laboratory)

- 705, Dongchun-Dong Sooji-Gu, Yongin-Shi, Kyungki-Do, South Korea.
- Wireless Div. 2FL, 18-34, Sanbon-dong, Gunpo-si, Gyeonggi-do, Korea 435-040

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### 1.2 Details of applicant

Applicant : HUMAX CO., Ltd.

Address : HUMAX Village, 11-4, Sunae-dong, Bundang-gu, Seongnam-si, Gyeonggi-do, 463-875, Korea

Contact Person : Im, Byung-Suk

Phone No. : +82 31 776 6341

### 1.3 Description of EUT

<b>Kind of Product</b>		IP-set top BOX	
<b>Model Name</b>		GFHD100	
<b>Serial Number</b>		N/A	
<b>Power Supply</b>		AC 110 V	
<b>Frequency Range</b>		2 402 MHz ~ 2 480 MHz (BT, BT LE), 2 412 MHz ~ 2 462 MHz (11b/g/n_HT20), 2 422 MHz ~ 2 452 MHz (11n_HT40), 5 745 MHz ~ 5 825 MHz (11a/n_HT20), 5 755 MHz ~ 5 795 MHz (11n_HT40), 5 180 MHz ~ 5 240 MHz (11a/n_HT20 – Non DFS), 5 190 MHz ~ 5 230 MHz (11n_HT40 – Non DFS)	
<b>Modulation Technique</b>		DSSS, OFDM	
<b>Number of Channels</b>		79 channel(BT), 40 channel(BT LE), 11 channel(11b/g/n_HT20), 7 channel(11n_HT40), 5 channel(11a/n_HT20), 2 channel(11n_HT40), 4 channel(11a/n_HT20 – Non DFS), 2 channel(11n_HT40 – Non DFS)	
<b>Antenna Type</b>		Fixed type (2 Tx / 2 Rx)	
<b>Antenna Gain</b>	<b>WLAN</b>	<b>ANT0</b> 2 412 MHz ~ 2 462 MHz: 3.42 dB i, 5 745 MHz ~ 5 825 MHz: 4.94 dB i, 5 180 MHz ~ 5 240 MHz: 4.71 dB i	<b>ANT1</b> 2 412 MHz ~ 2 462 MHz: 4.40 dB i, 5 745 MHz ~ 5 825 MHz: 5.20 dB i, 5 180 MHz ~ 5 240 MHz: 4.13 dB i
	<b>Bluetooth</b>	2 402 MHz ~ 2 480 MHz: 4.40 dB i (Same to ANT1 of WLAN)	

### 1.4. Declaration by the manufacturer

- EUT does not use 11b of ANT1 port.

- WLAN & BT can not transmit simultaneously.

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## 1.5. Test equipment list

Equipment	Manufacturer	Model	S/N	Cal Date	Cal Interval	Cal Due.
Signal Generator	R&S	SMR40	100272	Jul. 15, 2011	Annual	Jul. 15, 2012
Spectrum Analyzer	Agilent	N9030A	US51350132	Oct. 28, 2011	Annual	Oct. 28, 2012
Spectrum Analyzer	Agilent	E4440A	MY43362142	Mar. 29, 2012	Annual	Mar. 29, 2013
Spectrum Analyzer	R&S	FSV30	100768	Mar. 29, 2012	Annual	Mar. 29, 2013
Power Sensor	R&S	NRP-Z81	100669	Apr. 03, 2012	Annual	Apr. 03, 2013
Power Divider	Wainchel	1575	1537	Sep. 27, 2011	Annual	Sep. 27, 2012
Attenuator	Agilent	8490D	50449	Jan. 11, 2012	Annual	Jan. 11, 2013
Low Pass Filter	Mini-Circuits	NLP-1200+	V8979400903-1	Jul. 11, 2011	Annual	Jul. 11, 2012
High Pass Filter	Wainwright	WHK3.0/18G-10SS	344	Jul. 07, 2011	Annual	Jul. 07, 2012
High Pass Filter	Wainwright	WHK6.0/18G-10SS	11	Jul. 07, 2011	Annual	Jul. 07, 2012
DC Power Supply	Agilent	U8002A	MY50020026	Mar. 29, 2012	Annual	Mar. 29, 2013
Preamplifier	H.P.	8447F	2944A03909	Jul. 04, 2011	Annual	Jul. 04, 2012
Preamplifier	R&S	SCU18	10117	Jan. 12, 2012	Annual	Jan. 12, 2013
Preamplifier	MITEQ Inc.	JS44-18004000-35-8P	1546891	Jul. 04, 2011	Annual	Jul. 04, 2012
Test Receiver	R&S	ESU26	100109	Feb. 21, 2012	Annual	Feb. 21, 2013
Bilog Antenna	SCHWARZBECK MESSELEKTRONIK	VULB9163	396	May. 12, 2011	Biennial	May. 12, 2013
Horn Antenna	R&S	HF906	100326	Nov. 23, 2010	Biennial	Nov. 23, 2012
Horn Antenna	SCHWARZBECK MESSELEKTRONIK	BBHA9170	BBHA9170223	Jun. 30, 2010	Biennial	Jun. 30, 2012
Antenna Master	INNCO	MM4000	N/A	N/A	N/A	N.C.R.
Turn Table	INNCO	DS 1200S	N/A	N/A	N/A	N.C.R.
Anechoic Chamber	SY Corporation	L × W × H (6.5 m × 3.5 m × 3.5 m)	N/A	N/A	N/A	N.C.R.
EMI Test Receiver	R&S	ESHSI0	863365/018	Jul. 07, 2011	Annual	Jul. 07, 2012
Two-Line V-Network	R&S	ENV216	100190	Jan. 09, 2011	Biennial	Jan. 09, 2013
Anechoic Chamber	SY Corporation	L × W × H (9.6 m × 6.4 m × 6.4 m)	N/A	N/A	N/A	N.C.R.

### ► Support equipment

Description	Manufacturer	Model	Serial Number
N/A	-	-	-

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## 1.6. Summary of test result

The EUT has been tested according to the following specifications:

APPLIED STANDARD:FCC Part15 subpart B&C		
Standard section	Test Item	Result
15.205(a) 15.209 15.247(d)	Transmitter Radiated Spurious Emissions Conducted Spurious Emission	Complied
15.247(a)(2)	6 dB Bandwidth	Complied
15.247(b)(3)	Maximum Peak Output Power	Complied
15.247(e)	Power Spectral Density	Complied
15.207	Transmitter AC Power Line Conducted Emission	Complied

## 1.7. Test Procedure(s)

The measurement procedures described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz (ANSI C63.4-2003) and the guidance provided in KDB 558074 were used in the measurement of the DUT.

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## 1.8. Sample calculation

Where relevant, the following sample calculation is provided:

### 1.8.1. Conducted test

Offset value (dB) = Power Divider (dB) + Attenuator (dB) + Cable loss (dB)

### 1.8.2. Radiation test

Field strength level (dB  $\mu$ V/m) = Measured level (dB  $\mu$ V) + Antenna factor (dB) + Cable loss (dB) - amplifier (dB)

## 1.9. Test report revision

Revision	Report number	Description
0	F690501/RF-RTL005567	Initial
1	F690501/RF-RTL005567-1	Modify 2.3.2 Test Procedures for Conducted Spurious Emission
2	F690501/RF-RTL005567-2	Modify power limit
3	F690501/RF-RTL005567-3	Modify FCC ID

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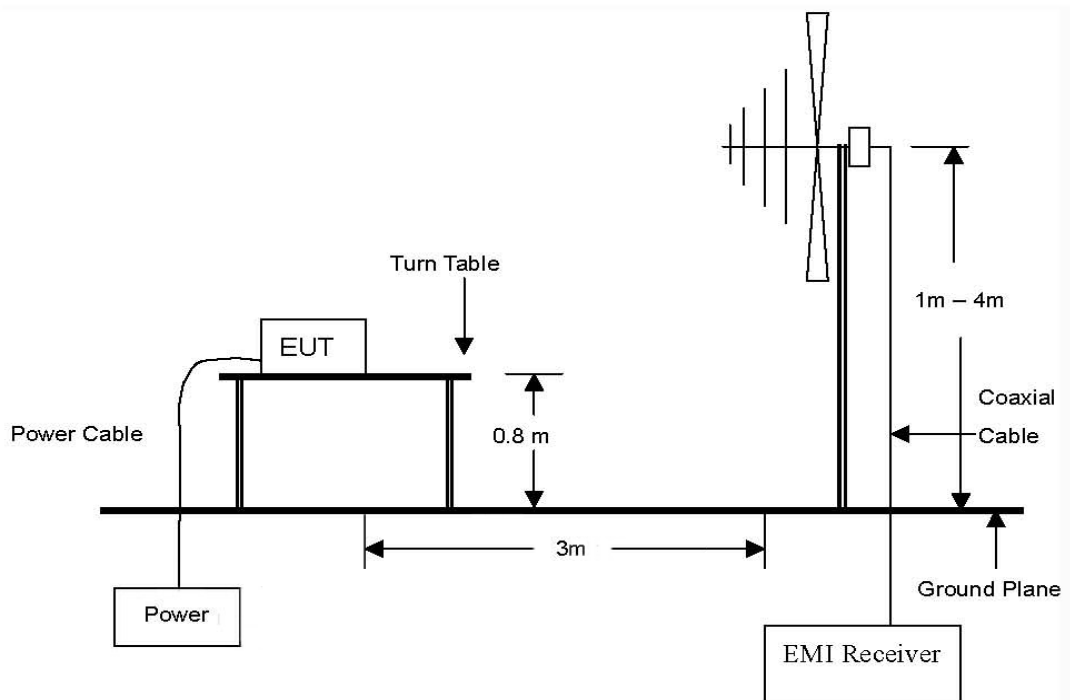
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## 2. Transmitter radiated spurious emissions and conducted spurious emission

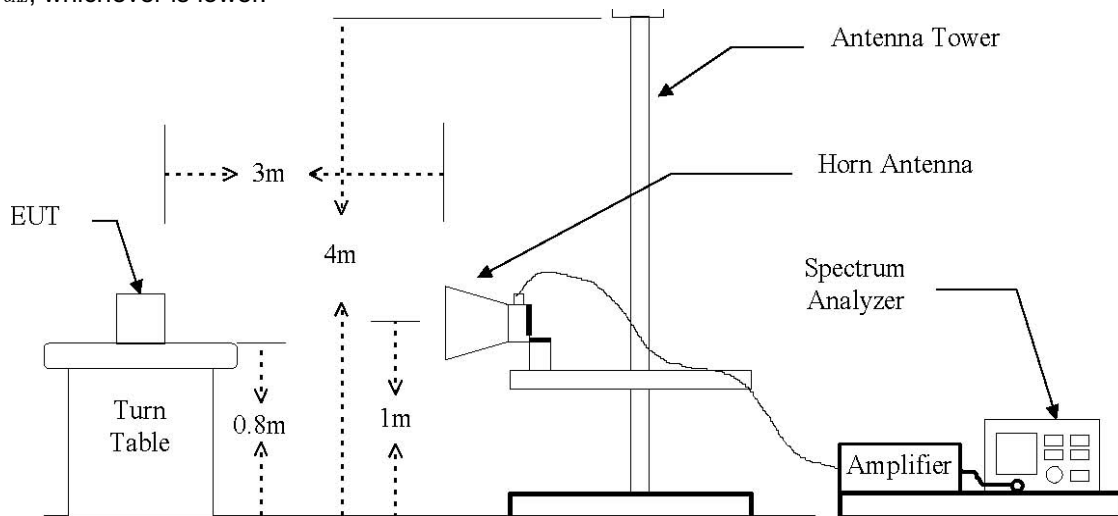
### 2.1. Test setup

#### 2.1.1. Transmitter radiated spurious emissions

The diagram below shows the test setup that is utilized to make the measurements for emission from 30 MHz to 1 GHz Emissions.

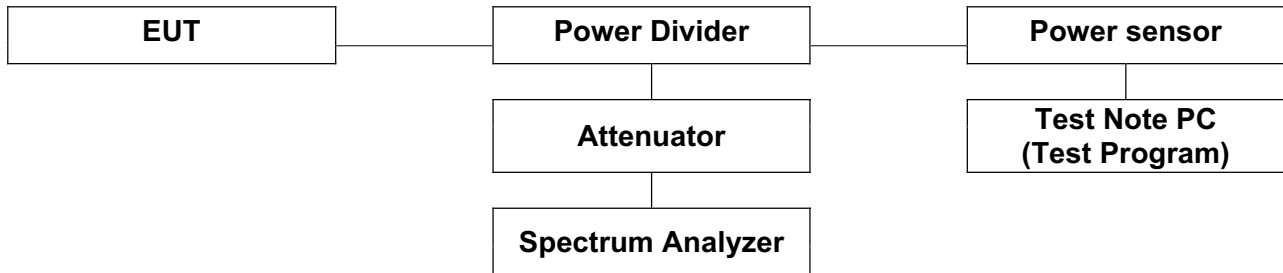


The diagram below shows the test setup that is utilized to make the measurements for emission. The spurious emissions were investigated from 1 GHz to the 10th harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.



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### 2.1.2. Conducted Spurious Emission



## 2.2. Limit

According to §15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph(b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in section §15.209(a) is not required. In addition, radiated emission which in the restricted band, as define in section §15.205(a), must also comply the radiated emission limits specified in section §15.209(a) (see section §15.205(c))

According to § 15.209(a), Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table :

Frequency (MHz)	Distance (Meters)	Field Strength (dBμV/m)	Field Strength (μV/m)
30 - 88	3	40.0	100
88 – 216	3	43.5	150
216 – 960	3	46.0	200
Above 960	3	54.0	500

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## 2.3. Test Procedures

Radiated emissions from the EUT were measured according to the dictates in section 5.4 of KDB 558074

### 2.3.1. Test Procedures for Radiated Spurious Emissions

1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter anechoic chamber test site. The table was rotated 360 degrees to determine the position of the highest radiation.
2. During performing radiated emission below 1 GHz, the EUT was set 3 meters away from the interference receiving antenna, which was mounted on the top of a variable-height antenna tower. During performing radiated emission above 1 GHz, the EUT was set 3 meter away from the interference-receiving antenna.
3. The antenna is a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
6. If the emission level of the EUT in peak mode was 10 dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

NOTE ;

All data rates and modes were investigated for radiated spurious emissions. Only the radiated emissions of the configuration that produced the worst case emissions are reported in this section.

1. The measurements for below 1 GHz

Set the RBW = 100 - 120 kHz and VBW  $\geq 3 \times$  RBW of test receiver/spectrum analyzer for Peak detection (PK) or Quasi-peak detection (QP)

2. The measurements for above 1 GHz

Average measurements are recorded using the RBAVG1 measurement procedure of KDB 558074.

Peak measurements are recorded using RBW = 1 MHz, VBW = 3 MHz

3. To get a maximum emission level from the EUT, the EUT is manipulated through three orthogonal planes.

### 2.3.2. Test Procedures for Conducted Spurious Emissions

All data rates and modes were investigated for conducted spurious emissions. Only the conducted emissions of the configuration that produced the worst case emissions are reported in this section.

Per the guidance of KDB 558074, section 5.4.1.1, the reference level for out of band emissions is established from the plots of this section since the band edge emissions are measured with a RBW of 100 kHz. This reference level is then used as the limit in subsequent plots for out of band spurious emissions shown in section 2.4.3. The limit for out of band spurious emission at the band edge is 20 dB below the fundamental emission level measured in a 100 kHz bandwidth.

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## 2.4. Test result

Ambient temperature : (24 ± 2) °C  
Relative humidity : 49 % R.H.

### 2.4.1. Spurious radiated emission (Worst case configuration\_11n\_HT20 mode – MCS0)

The frequency spectrum from 30 MHz to 1 000 MHz was investigated. Emission levels are not reported much lower than the limits by over 30 dB. All reading values are peak values.

Radiated emissions			Ant	Correction factors		Total	Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	Amp gain+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
285.68	51.10	Peak	H	12.60	-24.70	39.00	46.00	7.00
287.21	50.80	Peak	H	12.60	-24.70	38.70	46.00	7.30
289.56	55.50	Peak	H	12.60	-24.70	43.40	46.00	2.60
290.41	54.70	Peak	H	12.60	-24.70	42.60	46.00	3.40
292.06	52.80	Peak	H	12.60	-24.70	40.70	46.00	5.30
293.48	51.20	Peak	H	12.60	-24.70	39.10	46.00	6.90
294.24	51.20	Peak	H	12.60	-24.70	39.10	46.00	6.90
295.90	49.60	Peak	H	12.60	-24.70	37.50	46.00	8.50
800.02	48.40	Peak	H	20.90	-24.90	44.40	46.00	1.60
800.02	40.10	Peak	V	20.90	-24.90	36.10	46.00	9.90

#### ■ Remark:

1. All spurious emission at channels are almost the same below 1 GHz, so that the middle channel was chosen at representative in final test.
2. Actual = Reading + AF + AMP + CL

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## 2.4.2. Spurious radiated emission for above 1 GHz

The frequency spectrum above 1000 MHz was investigated. Emission levels are not reported much lower than the limits by over 30 dB.

### ANT0

#### 802.11b – 1Mbps

Low Channel (2 412 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 390.00	26.07	Peak	H	28.05	5.14	59.26	74.00	14.74
*2 390.00	15.92	Average	H	28.05	5.14	49.11	54.00	4.89

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 823.49	42.01	Peak	H	32.30	-34.98	39.33	74.00	34.67
*4 823.49	31.88	Average	H	32.30	-34.98	29.20	54.00	24.80
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 873.74	43.08	Peak	H	32.79	-34.97	40.90	74.00	33.10
*4 873.74	33.59	Average	H	32.79	-34.97	31.41	54.00	22.59
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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High Channel (2 462 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 483.50	25.52	Peak	H	28.31	5.19	59.02	74.00	14.98
*2 483.50	16.06	Average	H	28.31	5.19	49.56	54.00	4.44

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 924.36	44.18	Peak	H	33.11	-34.87	42.42	74.00	31.58
*4 924.36	35.88	Average	H	33.11	-34.87	34.12	54.00	19.88
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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## 802.11g – 6 Mbps

Low Channel (2 412 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 390.00	27.62	Peak	H	28.05	5.14	60.81	74.00	13.19
*2 390.00	15.96	Average	H	28.05	5.14	49.15	54.00	4.85

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 823.59	42.33	Peak	H	32.30	-34.98	39.65	74.00	34.35
*4 823.59	32.60	Average	H	32.30	-34.98	29.92	54.00	24.08
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 874.13	42.97	Peak	H	32.79	-34.96	40.80	74.00	33.20
*4 874.13	33.56	Average	H	32.79	-34.96	31.39	54.00	22.61
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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High Channel (2 462 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 483.50	27.54	Peak	H	28.31	5.19	61.04	74.00	12.96
*2 483.50	16.94	Average	H	28.31	5.19	50.44	54.00	3.56

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 924.09	43.58	Peak	H	33.10	-34.87	41.81	74.00	32.19
*4 924.09	34.39	Average	H	33.10	-34.87	32.62	54.00	21.38
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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## ANT1

### 802.11b

- The EUT does not use 11b of ANT1 port.

### 802.11g – 6 Mbps

Low Channel (2 412 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 390.00	28.26	Peak	H	28.05	5.14	61.45	74.00	12.55
*2 390.00	17.94	Average	H	28.05	5.14	51.13	54.00	2.87

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 822.37	52.39	Peak	H	32.28	-34.97	49.70	74.00	24.30
*4 822.37	37.25	Average	H	32.28	-34.97	34.56	54.00	19.44
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 872.35	53.22	Peak	H	32.77	-34.97	51.02	74.00	22.98
*4 872.35	37.78	Average	H	32.77	-34.97	35.58	54.00	18.42
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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High Channel (2 462 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 483.50	28.38	Peak	H	28.31	5.19	61.88	74.00	12.12
*2 483.50	18.00	Average	H	28.31	5.19	51.50	54.00	2.50

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 922.32	51.40	Peak	H	33.09	-34.87	49.62	74.00	24.38
*4 922.32	37.45	Average	H	33.09	-34.87	35.67	54.00	18.33
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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**ANT0+ANT1**
**802.11n\_HT20- MCS0**

Low Channel (2 412 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 390.00	27.08	Peak	H	28.05	5.14	60.27	74.00	13.73
*2 390.00	18.80	Average	H	28.05	5.14	51.99	54.00	2.01

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 826.85	50.65	Peak	H	32.35	-34.99	48.01	74.00	25.99
*4 826.85	36.03	Average	H	32.35	-34.99	33.39	54.00	20.61
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 873.36	49.28	Peak	H	32.78	-34.97	47.09	74.00	26.91
*4 873.36	36.86	Average	H	32.78	-34.97	34.67	54.00	19.33
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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High Channel (2 462 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 483.50	27.79	Peak	H	28.31	5.19	61.29	74.00	12.71
*2 483.50	18.97	Average	H	28.31	5.19	52.47	54.00	1.53

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 922.59	51.98	Peak	H	33.09	-34.87	50.20	74.00	23.80
*4 922.59	37.46	Average	H	33.09	-34.87	35.68	54.00	18.32
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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# 802.11n\_HT40 – MCS0

Low Channel (2 422 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 390.00	27.50	Peak	H	28.05	5.14	60.69	74.00	13.31
*2 390.00	18.01	Average	H	28.05	5.14	51.20	54.00	2.80

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 848.42	50.28	Peak	H	32.59	-35.07	47.80	74.00	26.20
*4 848.42	36.43	Average	H	32.59	-35.07	33.95	54.00	20.05
Above 4 900.00	Not detected	-	-	-	-	-	-	-

Middle Channel (2 437 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 858.81	50.33	Peak	H	32.66	-35.03	47.96	74.00	26.04
*4 858.81	36.21	Average	H	32.66	-35.03	33.84	54.00	20.16
Above 4 900.00	Not detected	-	-	-	-	-	-	-

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High Channel (2 452 MHz)

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*2 483.50	28.06	Peak	H	28.31	5.19	61.56	74.00	12.44
*2 483.50	18.78	Average	H	28.31	5.19	52.28	54.00	1.72

Radiated Emissions			Ant	Correction Factors		Total	FCC Limit	
Frequency (MHz)	Reading (dB $\mu$ V)	Detect Mode	Pol.	AF (dB/m)	AMP+CL (dB)	Actual (dB $\mu$ V/m)	Limit (dB $\mu$ V/m)	Margin (dB)
*4 904.00	50.25	Peak	H	33.00	-34.86	48.39	74.00	25.61
*4 904.00	50.25	Average	H	33.00	-34.86	34.57	54.00	19.43
Above 5 000.00	Not detected	-	-	-	-	-	-	-

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## ANT0

### 802.11a – 6 Mbps

#### A. Low Channel (5 745 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 745.00	50.87	Peak	H	34.16	8.18	93.21	-	-
5 745.00	47.99	Peak	V	34.16	8.18	90.33	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 486.84	36.11	Peak	H	38.36	-30.20	44.27	74.00	29.73
*11 486.84	24.38	Average	H	38.36	-30.20	32.54	54.00	21.46
Above 11 500.00	Not detected	-	-	-	-	-	-	-

#### B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 785.00	50.94	Peak	H	34.08	8.09	93.11	-	-
5 785.00	46.84	Peak	V	34.08	8.09	89.01	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 554.30	36.23	Peak	H	38.46	-30.06	44.63	74.00	29.37
*11 554.30	24.25	Average	H	38.46	-30.06	32.65	54.00	21.35
Above 11 600.00	Not detected	-	-	-	-	-	-	-

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## C. High Channel (5 825 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 825.00	48.92	Peak	H	34.10	8.09	91.11	-	-
5 825.00	49.19	Peak	V	34.10	8.09	91.38	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 650.13	36.15	Peak	H	38.36	-29.91	44.60	74.00	29.40
*11 650.13	24.13	Average	H	38.36	-29.91	32.58	54.00	21.42
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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## ANT1

### 802.11a – 6 Mbps

#### A. Low Channel (5 745 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 745.00	55.34	Peak	H	34.16	8.18	42.34	-	-
5 745.00	48.57	Peak	V	34.16	8.18	90.91	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 490.33	36.37	Peak	H	38.39	-30.20	44.56	74.00	29.44
*11 490.33	24.11	Average	H	38.39	-30.20	32.30	54.00	21.70
Above 11 500.00	Not detected	-	-	-	-	-	-	-

#### B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 785.00	55.02	Peak	H	34.08	8.09	97.19	-	-
5 785.00	46.36	Peak	V	34.08	8.09	88.53	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 567.15	36.48	Peak	H	38.43	-30.05	44.86	74.00	29.14
*11 567.15	24.23	Average	H	38.43	-30.05	32.61	54.00	21.39
Above 11 600.00	Not detected	-	-	-	-	-	-	-

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## C. High Channel (5 825 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 825.00	55.68	Peak	H	34.10	8.09	97.87	-	-
5 825.00	45.21	Peak	V	34.10	8.09	87.40	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 648.23	35.92	Peak	H	38.36	-29.91	44.37	74.00	29.63
*11 648.23	25.02	Average	H	38.36	-29.91	33.47	54.00	20.53
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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## ANT0 + ANT1

### 802.11n\_HT20 – MCS0

#### A. Low Channel (5 745 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 745.00	56.95	Peak	H	34.16	8.18	99.29	-	-
5 745.00	45.61	Peak	V	34.16	8.18	87.95	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 490.00	36.20	Peak	H	38.39	-30.20	44.39	74.00	29.61
*11 490.00	24.05	Average	H	38.39	-30.20	32.24	54.00	21.76
Above 11 500.00	Not detected	-	-	-	-	-	-	-

#### B. Middle Channel (5 785 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 785.00	57.46	Peak	H	34.08	8.09	99.63	-	-
5 785.00	48.20	Peak	V	34.08	8.09	90.37	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 569.88	36.88	Peak	H	38.43	-30.05	45.26	74.00	28.74
*11 569.88	24.10	Average	H	38.43	-30.05	32.48	54.00	21.52
Above 11 600.00	Not detected	-	-	-	-	-	-	-

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## C. High Channel (5 825 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 825.00	56.47	Peak	H	34.10	8.09	98.66	-	-
5 825.00	49.83	Peak	V	34.10	8.09	92.02	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 649.73	36.05	Peak	H	38.36	-29.91	44.50	74.00	29.50
*11 649.73	24.56	Average	H	38.36	-29.91	33.01	54.00	20.99
Above 11 700.00	Not detected	-	-	-	-	-	-	-

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## 802.11n\_HT40 –MCS0

### A. Low Channel (5 755 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 755.00	53..13	Peak	H	34.11	8.18	95.42	-	-
5 755.00	43.13	Peak	V	34.11	8.18	85.42	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 511.72	36.43	Peak	H	38.47	-30.18	44.72	74.00	29.28
*11 511.72	25.00	Average	H	38.47	-30.18	33.29	54.00	20.71
Above 11 600.00	Not detected	-	-	-	-	-	-	-

### B. High Channel (5 795 MHz)

Radiated Emissions			Ant	Correction Factors		Total	Limit	
Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
5 795.00	52.13	Peak	H	34.03	8.06	95.08	-	-
5 795.00	45.52	Peak	V	34.03	8.06	87.61	-	-

Frequency (MHz)	Reading (dB uV)	Detect Mode	Pol.	AF (dB/m)	Amp Gain +CL (dB)	Actual (dB uV/m)	Limit (dB uV/m)	Margin (dB)
*11 588.73	36.30	Peak	H	38.40	-30.02	44.68	74.00	29.32
*11 588.73	24.85	Average	H	38.40	-30.02	33.23	54.00	20.77
Above 11 600.00	Not detected	-	-	-	-	-	-	-

#### ■ Remarks

1. “\*” means the restricted band.
2. Radiated emissions measured in frequency above 1 000 MHz were made with an instrument using peak/average detector mode.
3. Average test would be performed if the peak result were greater than the average limit.
4. Actual = Reading + AF + AMP + CL

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## 2.4.3. Spurious RF Conducted Emissions: Plot of Spurious RF Conducted Emission

ANT0

2.4GHz

802.11b – 1Mbps

Low Channel

-20.27 dB m

-20.27 dB m



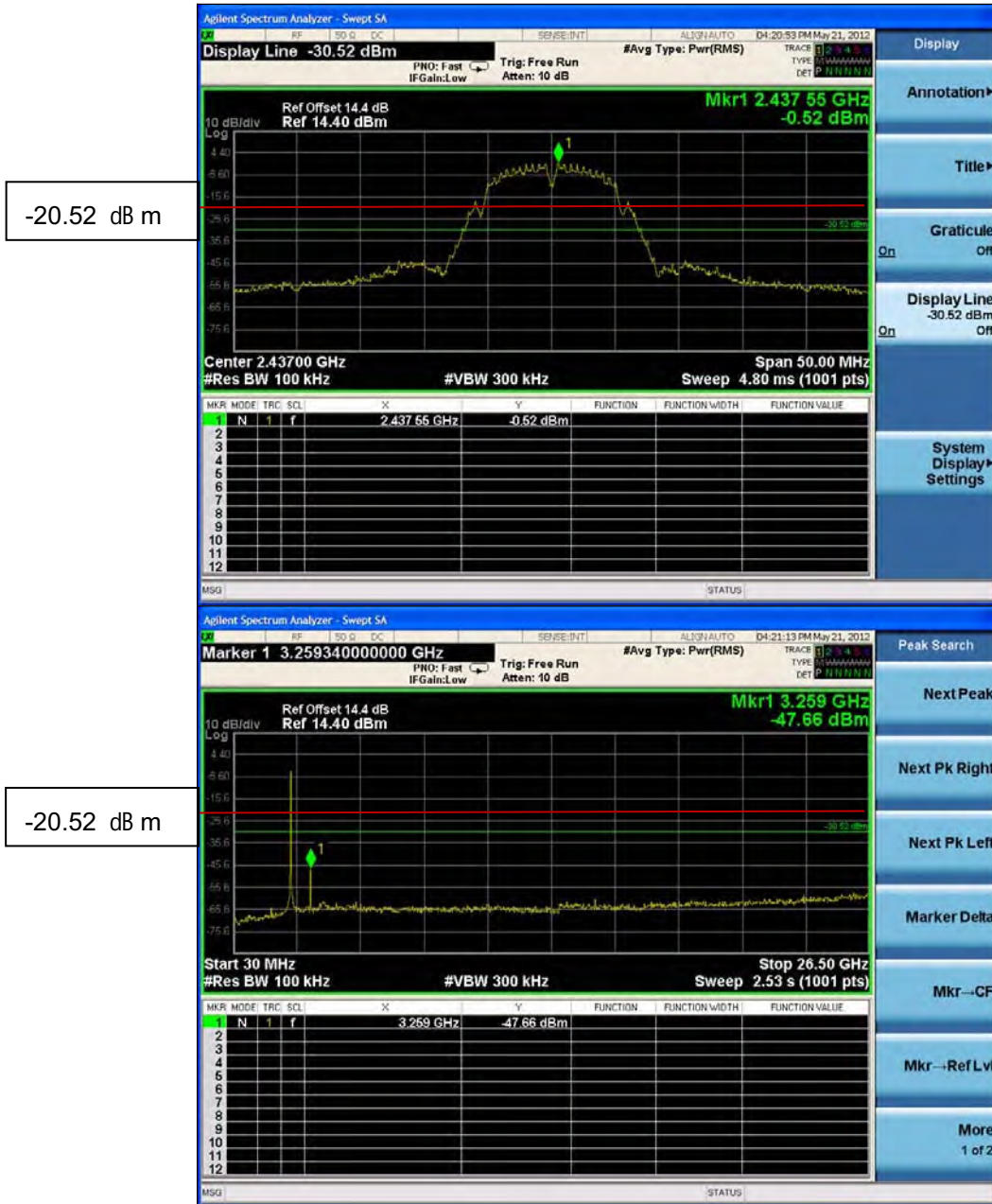
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## Middle Channel



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## High Channel



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## 802.11g – 6 Mbps

### Low Channel

-21.67 dB m



-21.67 dB m

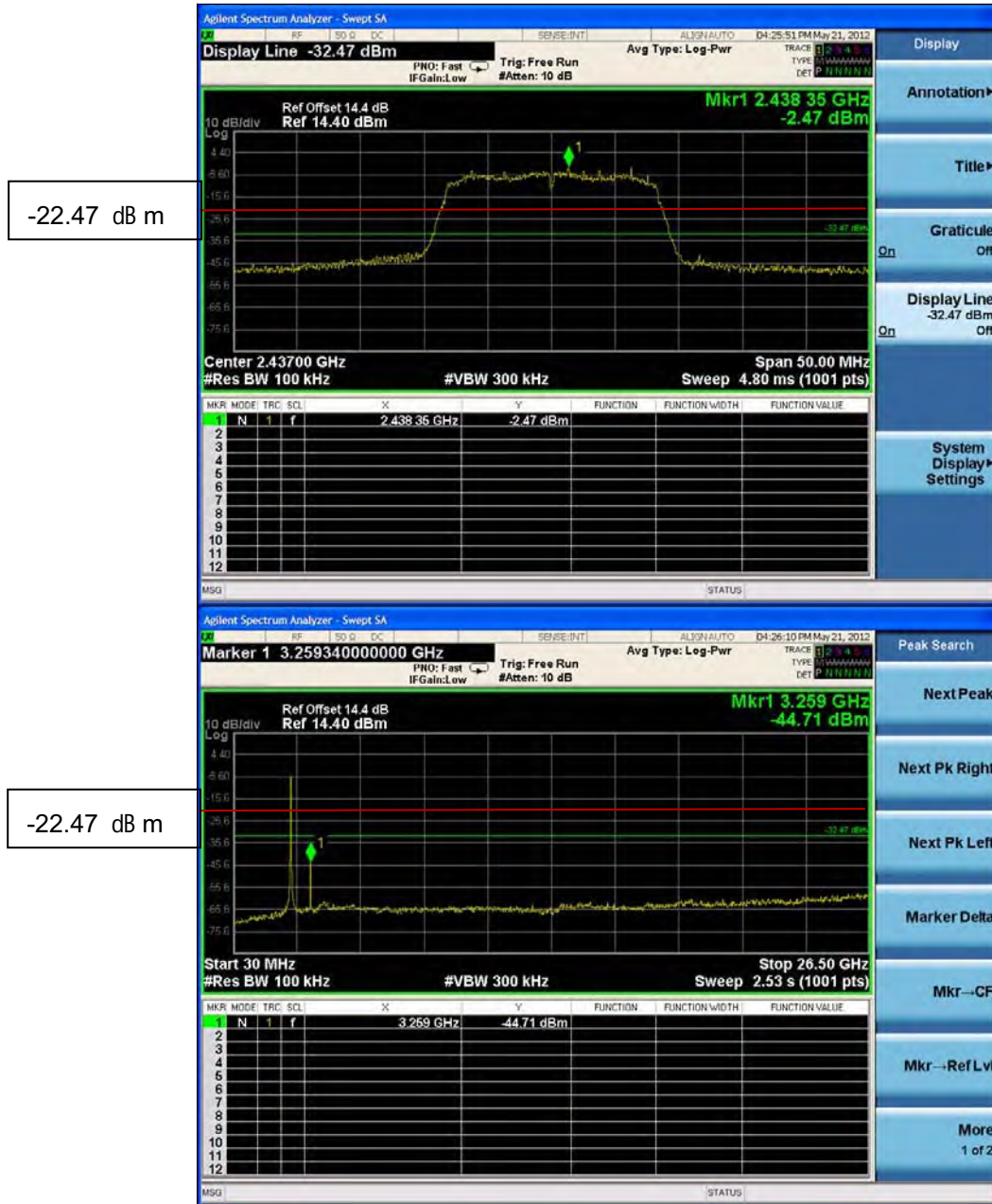
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## Middle Channel



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## High Channel

-22.96 dB m



-22.96 dB m

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## 802.11n\_HT20 – MCS0

### Low Channel

-22.08 dB m



-22.08 dB m

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## Middle Channel



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## High Channel

-21.86 dB m



-21.86 dB m

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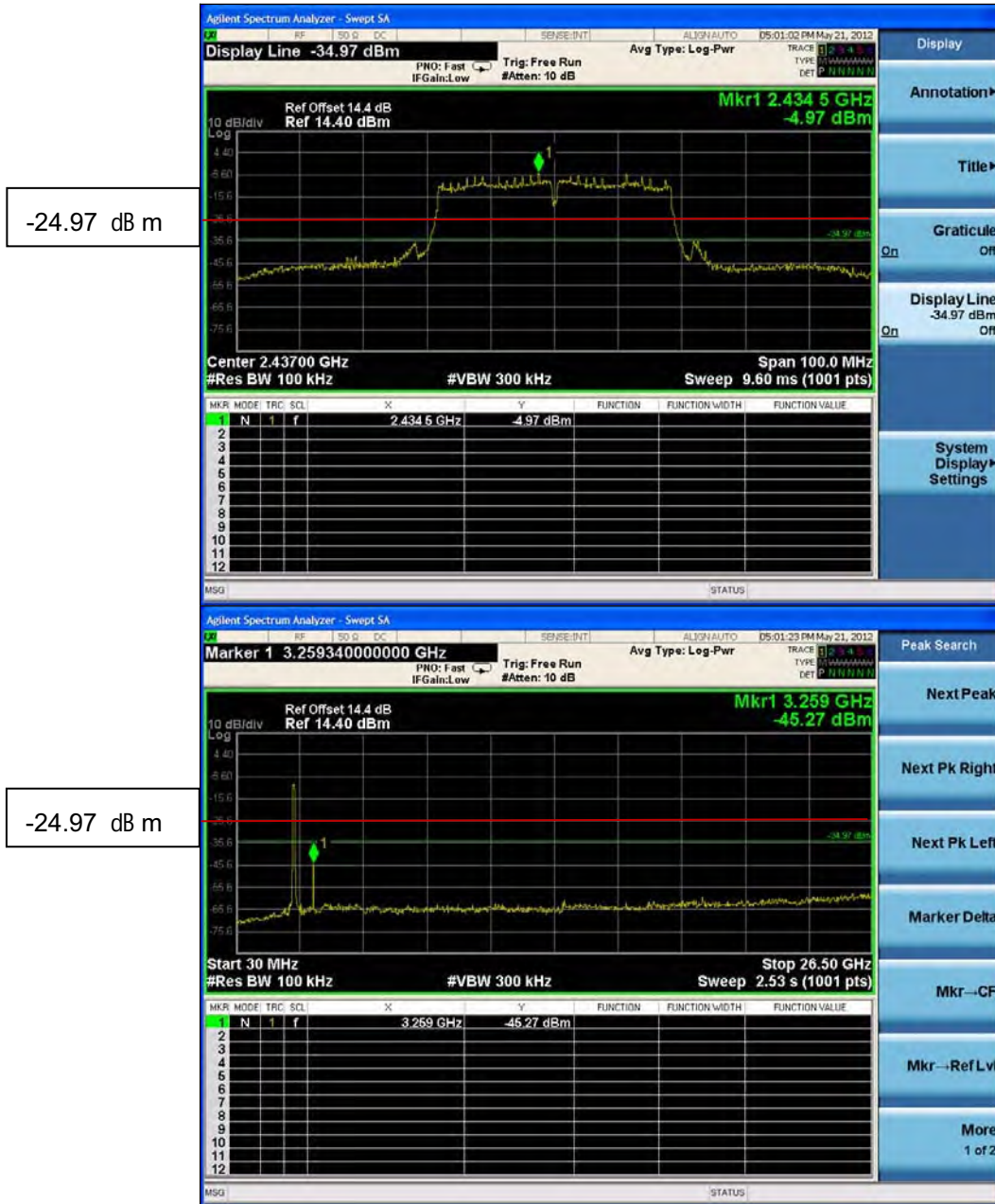
## 802.11n\_HT40 – MCS0

### Low Channel



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## Middle Channel



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## High Channel

-25.27 dB m



-25.27 dB m

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5.8 GHz

802.11a – 6 Mbps

Low Channel

-22.98 dBm



-22.98 dBm

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## Middle Channel

-21.82 dB m

-21.82 dB m



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## High Channel

-24.10 dBm



-24.10 dBm

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## 802.11n\_HT20 – MCS0

### Low Channel

-21.84 dBm



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## Middle Channel



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## High Channel

-22.30 dB m



-22.30 dB m

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## 802.11n\_HT40 – MCS0

### Low Channel

-24.22 dB m



-24.22 dB m

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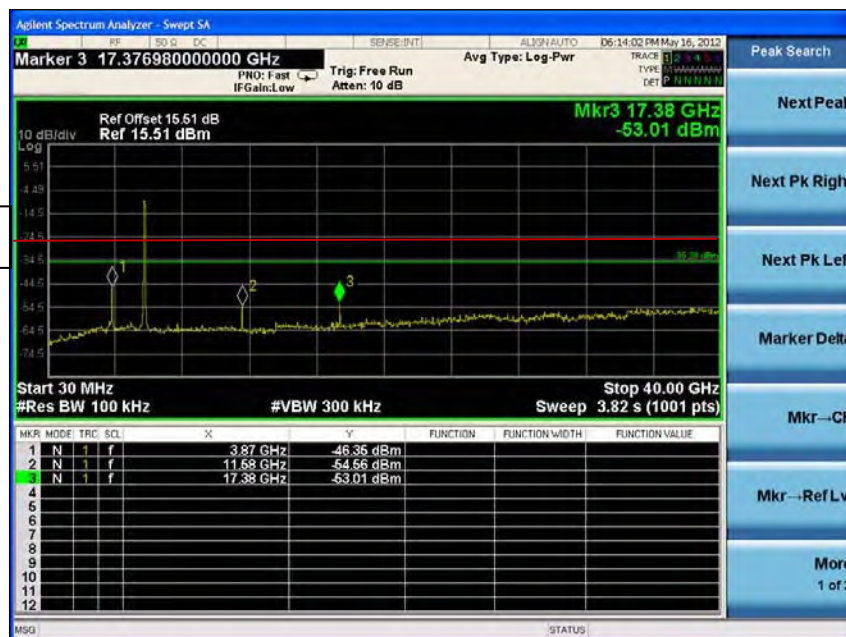


## High Channel

-25.28 dB m



-25.28 dB m



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## ANT1

### 2.4GHz

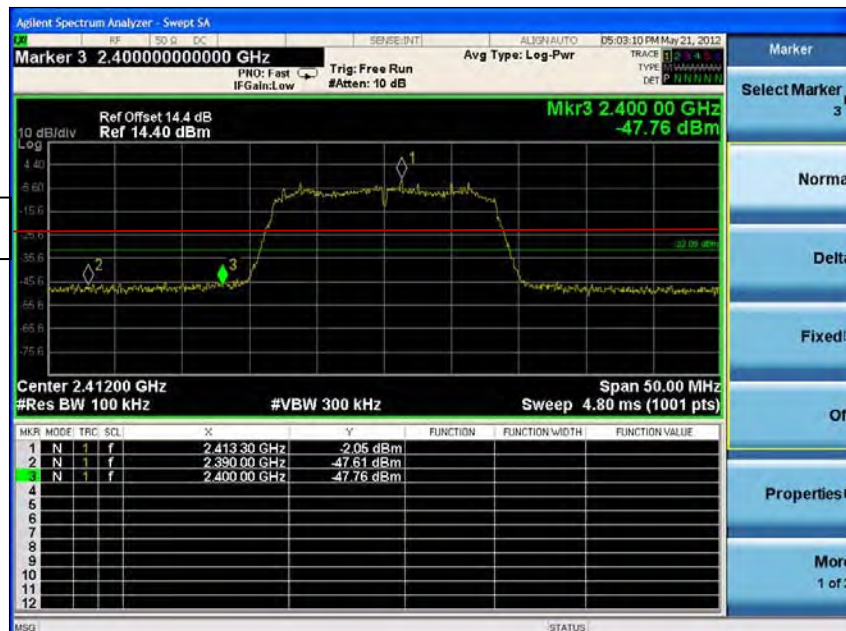
#### 802.11b

- The EUT does not use 11b of ANT1 port.

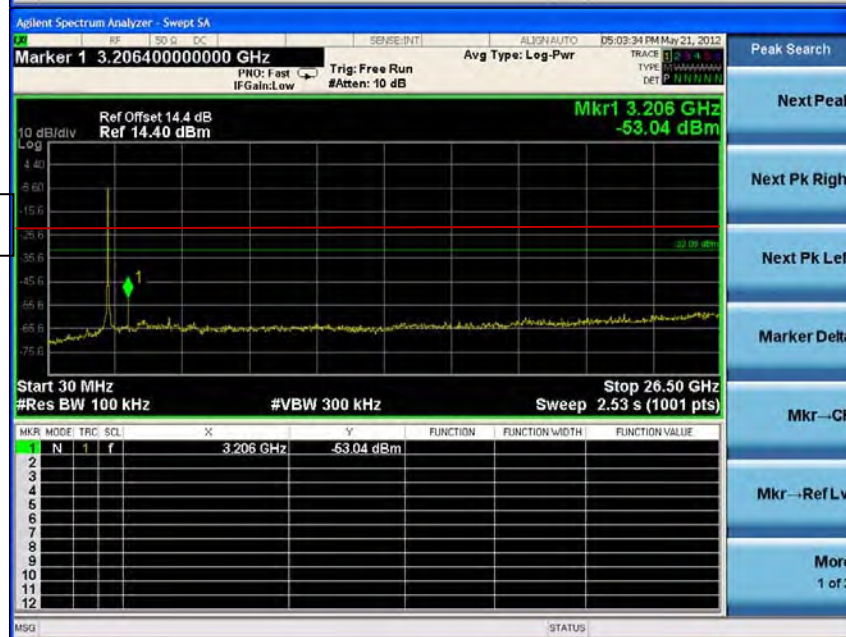
#### 802.11g – 6Mbps

#### Low Channel

-22.05 dB m



-22.05 dB m



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## Middle Channel

-22.63 dB m



-22.63 dB m

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## High Channel

-22.93 dB m



-22.93 dB m

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## 802.11n\_HT20 - MCS0

### Low Channel

-22.80 dB m



-22.80 dB m

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## Middle Channel

-23.56 dB m



-23.56 dB m

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## High Channel

-23.06 dB m



-23.06 dB m

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## 802.11n\_HT40 – MCS0

### Low Channel



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## Middle Channel



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## High Channel

-25.56 dB m



-25.56 dB m

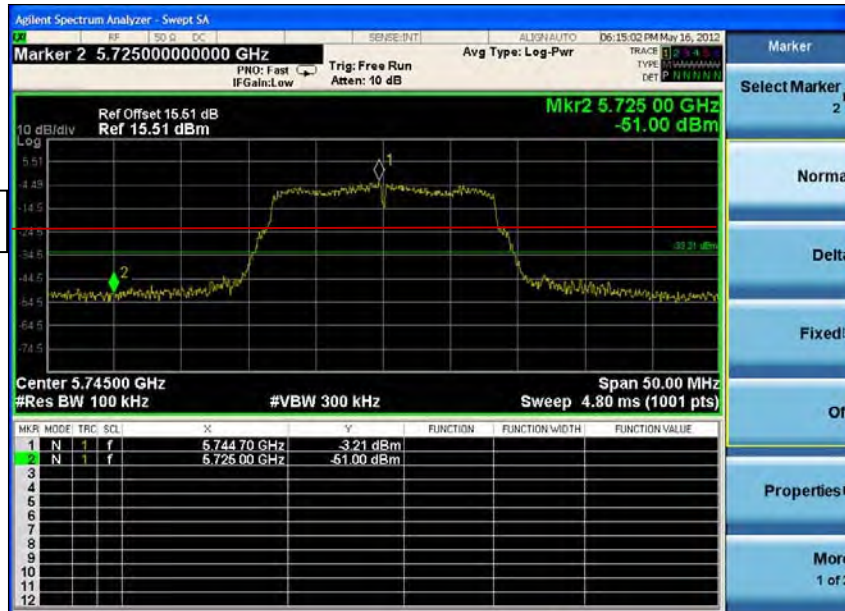
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5.8 GHz

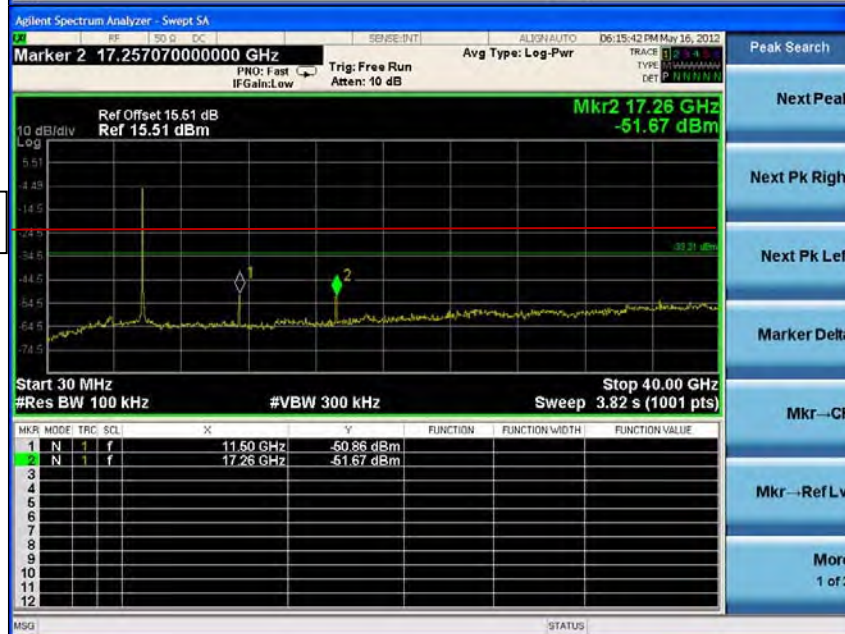
802.11a – 6Mbps

Low Channel

-23.21 dB m



-23.21 dB m



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## Middle Channel



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## High Channel

-22.98 dBm



-22.98 dBm



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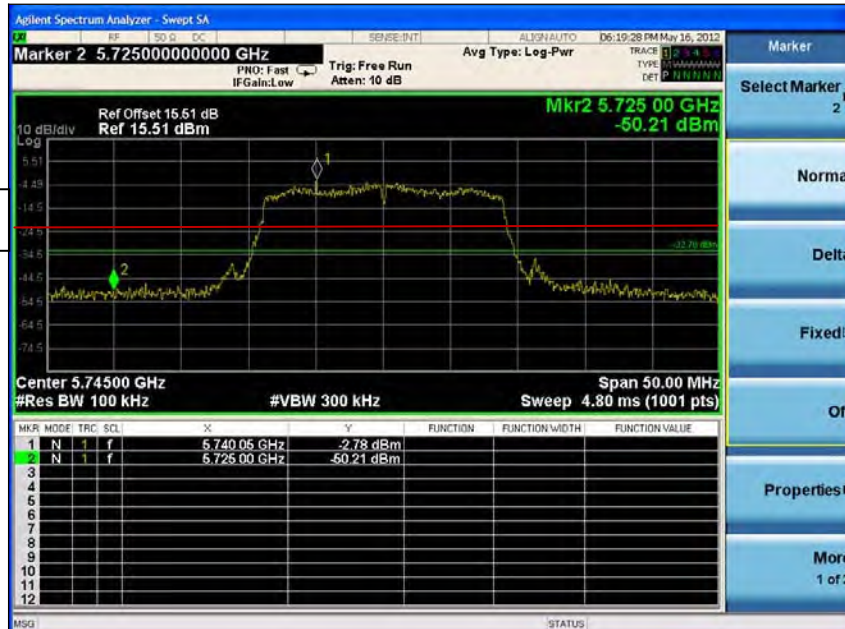
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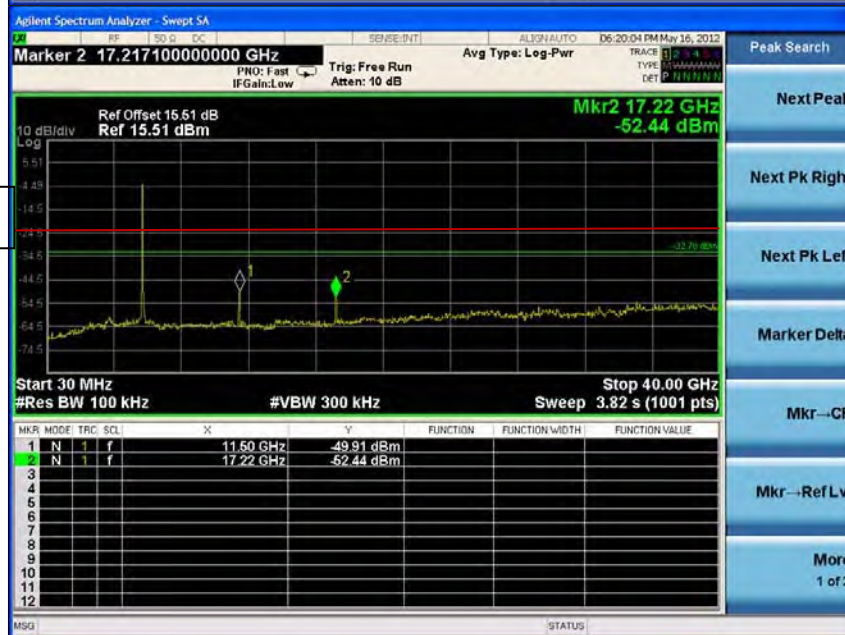
## 802.11n\_HT20 – MCS0

### Low Channel

-22.78 dB m



-22.78 dB m



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## Middle Channel

-22.11 dB m



-22.11 dB m

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## High Channel

-20.15 dB m



-20.15 dB m

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## 802.11n\_HT40 – MCS0

### Low Channel

-26.05 dB m



-26.05 dB m

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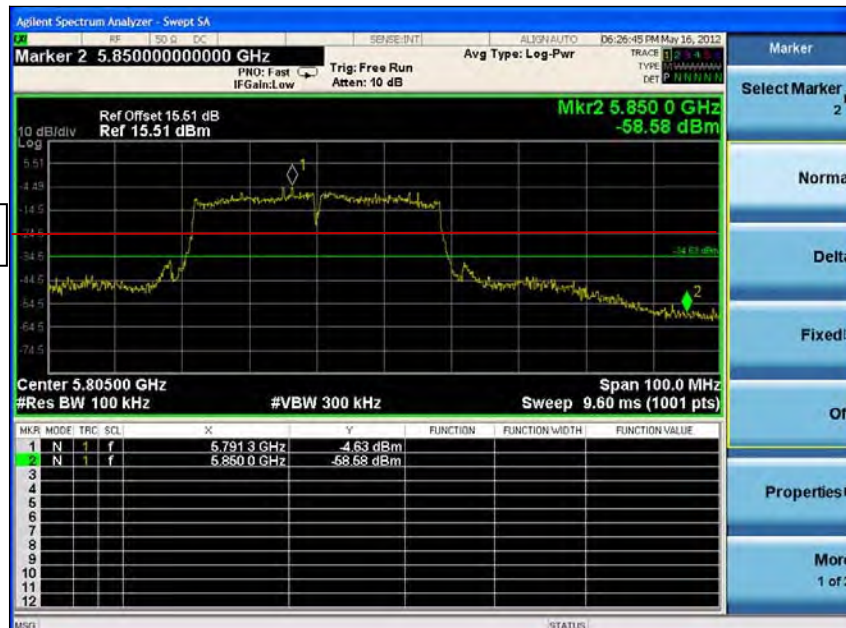
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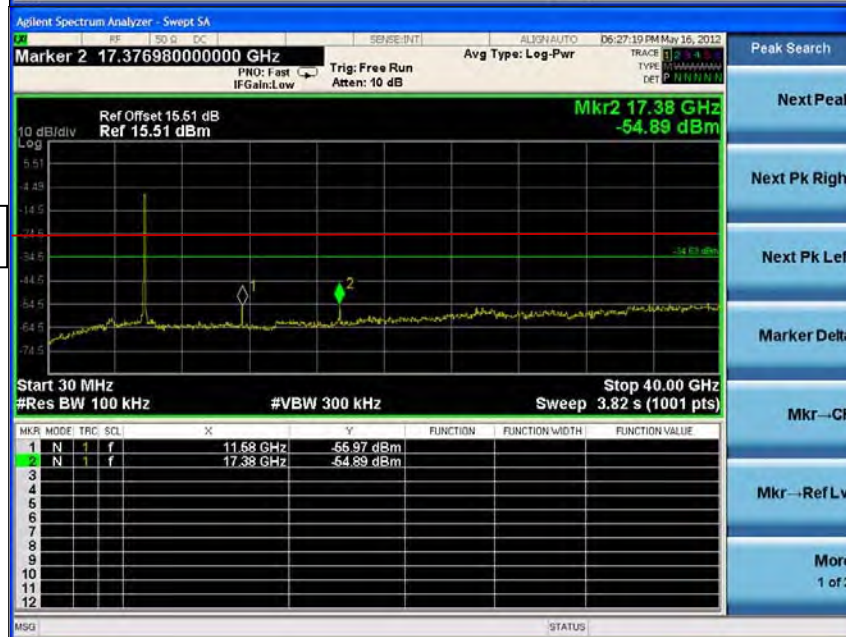
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## High Channel

-24.63 dB m



-24.63 dB m



### Remarks

1. The EUT has 2 outputs and  $10 \log(2) = 3.01$  dB
2. The Limit of conducted emission was adjusted under 20 dBc of fundamental frequency.
3. Emission levels are not reported much lower than the limits by approximately 10 dB.

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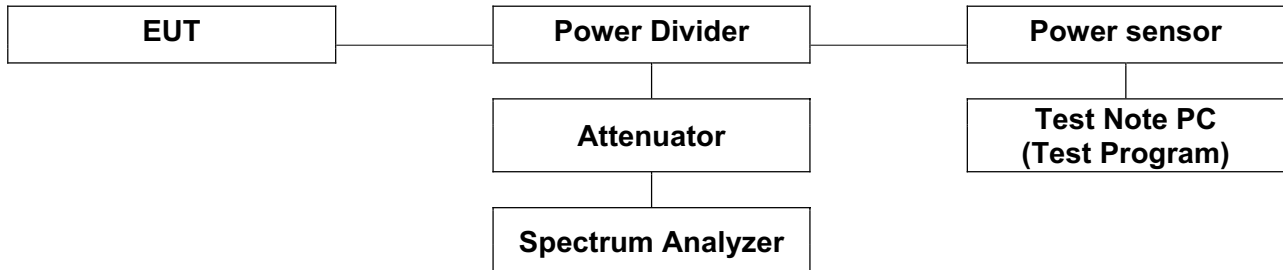
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### 3. 6 dB Bandwidth measurement

#### 3.1. Test setup



#### 3.2. Limit

According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 ~928 MHz, 2 400 ~ 2 483.5 MHz, and 5 725 ~ 5 825 MHz bands. The minimum of 6 dB Bandwidth shall be at least 500 kHz

#### 3.3. Test Procedure

All data rates and modes were investigated for this test. The full data for the worst case data rate are reported in this section.

The test follows section 5.1 of FCC KDB Publication 558074

1. Set resolution bandwidth (RBW) = 1 – 5 % of the emission bandwidth (EBW).
2. Set the video bandwidth (VBW)  $\geq 3 \times$  RBW.
3. Detector = Peak.
4. Trace mode = max hold.
5. Sweep = auto couple.
6. Allow the trace to stabilize.
7. Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude point (upper and lower) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission. Compare the resultant bandwidth with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is 1 – 5 %.

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### 3.4. Test result

Ambient temperature : (24 ± 2) °C  
Relative humidity : 49 % R.H.

#### ANT0

Operation Mode	Data Rate (Mbps)	Frequency (MHz)	6 dB Bandwidth (MHz)
DSSS 802.11b	1	2 412	9.20
	1	2 437	9.20
	1	2 462	9.20
OFDM 802.11g	6	2 412	16.05
	6	2 437	15.85
	6	2 462	16.00
OFDM 802.11n_HT20	MCS0	2 412	17.30
	MCS0	2 437	17.45
	MCS0	2 462	17.45
OFDM 802.11n_HT40	MCS0	2 422	36.40
	MCS0	2 437	36.45
	MCS0	2 452	36.65
OFDM 802.11a	6	5 745	15.45
	6	5 785	15.90
	6	5 825	15.95
OFDM 802.11n_HT20	MCS0	5 745	16.90
	MCS0	5 785	17.40
	MCS0	5 825	17.15
OFDM 802.11n_HT40	MCS0	5 755	36.05
	MCS0	5 795	36.35

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**ANT1**

Operation Mode	Data Rate (Mbps)	Frequency (MHz)	6 dB Bandwidth (MHz)
DSSS 802.11b	1	2 412	Not support
	1	2 437	
	1	2 462	
OFDM 802.11g	6	2 412	15.80
	6	2 437	15.90
	6	2 462	16.10
OFDM 802.11n_HT20	MCS0	2 412	17.40
	MCS0	2 437	17.35
	MCS0	2 462	17.30
OFDM 802.11n_HT40	MCS0	2 422	36.55
	MCS0	2 437	36.45
	MCS0	2 452	36.75
OFDM 802.11a	6	5 745	15.95
	6	5 785	16.05
	6	5 825	16.00
OFDM 802.11n_HT20	MCS0	5 745	16.80
	MCS0	5 785	17.25
	MCS0	5 825	17.25
OFDM 802.11n_HT40	MCS0	5 755	35.60
	MCS0	5 795	36.25

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6 dB Bandwidth

ANT0

2.4 GHz

802.11b

Low channel



Middle channel



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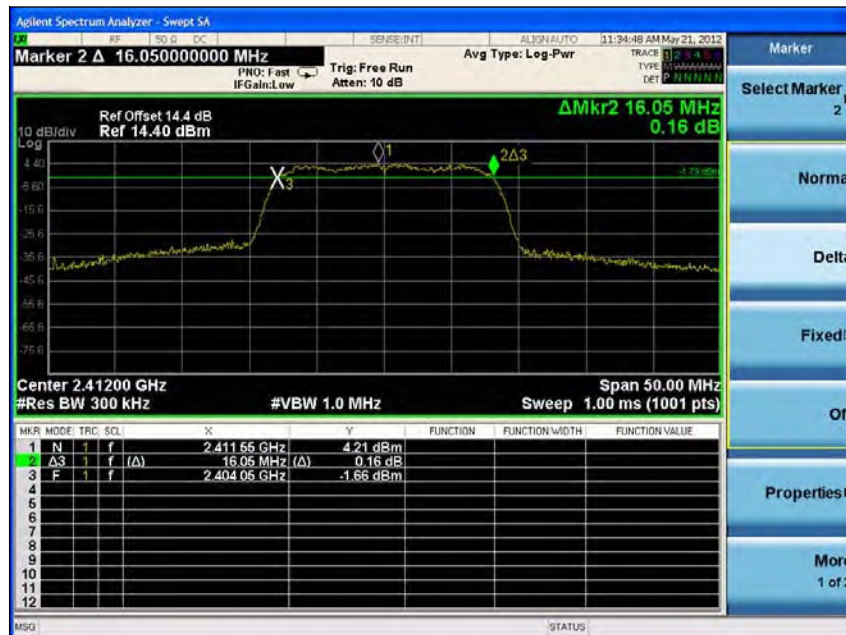


## High channel



## 802.11g

## Low channel



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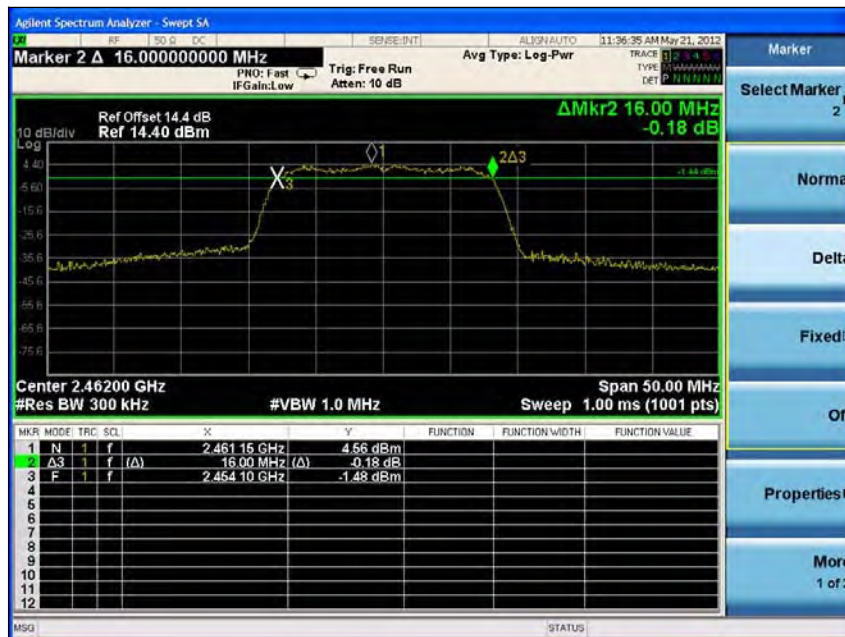
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## Middle channel



## High channel



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