

# FCC RF Test Report

**APPLICANT** : Dodds LLC  
**EQUIPMENT** : Tablet PC  
**MODEL NAME** : 3HT7G  
**FCC ID** : ZHS-1013  
**STANDARD** : FCC Part 15 Subpart C §15.247  
**CLASSIFICATION** : (DTS) Digital Transmission System

This is a variant report for FCC permissions change, and the product was completely tested on Jan. 09, 2013. We, SPORTON INTERNATIONAL INC., would like to declare that the tested sample has been evaluated in accordance with the procedures and shown the compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC., the test report shall not be reproduced except in full.

Reviewed by:



Jones Tsai / Manager



**SPORTON INTERNATIONAL INC.**  
No. 52, Hwa Ya 1<sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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## REVISION HISTORY

## SUMMARY OF TEST RESULT

Report Section	FCC Rule	IC Rule	Description	Limit	Result	Remark
3.1	15.247(a)(2)	RSS-210 A8.2(a)	6dB Bandwidth	$\geq 0.5\text{MHz}$	Pass	-
3.2	15.247(b)	RSS-210 A8.4	Power Output Measurement	$\leq 30\text{dBm}$	Pass	-
3.3	15.247(e)	RSS-210 A8.2(b)	Power Spectral Density	$\leq 8\text{dBm}/3\text{kHz}$	Pass	-
3.2.6	15.247(d)	RSS-210 A8.5	Conducted Band Edges	$\leq 20\text{dBc}$	Pass	-
			Conducted Spurious Emission		Pass	-
3.2.6	15.247(d)	RSS-210 A8.5	Radiated Band Edges	15.209(a) & 15.247(d)	Pass	Under limit 8.23 dB at 5850.000 MHz
			Radiated Spurious Emission		Pass	
3.6	15.203 & 15.247(b)	RSS-210 A8.4	Antenna Requirement	N/A	Pass	-

# 1 General Description

## 1.1 Applicant

Dodds LLC

Suite 400, 8040 Excelsior Drive Madison, WI 53717

## 1.2 Feature of Equipment Under Test

Product Feature	
<b>Equipment</b>	Tablet PC
<b>Model Name</b>	3HT7G
<b>FCC ID</b>	ZHS-1013
<b>EUT supports Radios application</b>	WLAN 11abgn / Bluetooth

**Remark:** The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Product Specification subjective to this standard														
<b>Tx/Rx Channel Frequency Range</b>	5745~5825MHz													
<b>Maximum Output Power to Antenna</b>	<b>&lt;Legacy Ant 2&gt;</b> 802.11a : 20.24 dBm / 0.1057 W <b>&lt;SISO Ant 2&gt;</b> 802.11n HT20 : 20.15 dBm / 0.1035 W <b>&lt;MIMO Ant 1+2&gt;</b> 802.11n HT20 : 23.48 dBm / 0.2228 W													
<b>Duty Cycle</b>	<b>&lt;Legacy Ant 2&gt;</b> 802.11a : 86.50% <b>&lt;SISO Ant 1&gt;</b> 802.11n HT20 : 86.08% <b>&lt;MIMO Ant 1+2&gt;</b> 802.11n HT20 : 76.06% for Ant 1 802.11n HT20 : 75.46% for Ant 2													
<b>Antenna Type</b>	Ant 1 : PIFA Antenna with gain 2.50 dBi Ant 2 : PIFA Antenna with gain 2.70 dBi													
<b>Type of Modulation</b>	OFDM (BPSK / QPSK / 16QAM / 64QAM)													
<b>Antenna Function for Transmitter</b>	<table border="1"><tr><td></td><td>Ant 1.</td><td>Ant 2.</td></tr><tr><td>802.11 a</td><td>-</td><td>V</td></tr><tr><td>802.11 n SISO</td><td>-</td><td>V</td></tr><tr><td>802.11 n MIMO</td><td>V</td><td>V</td></tr></table>			Ant 1.	Ant 2.	802.11 a	-	V	802.11 n SISO	-	V	802.11 n MIMO	V	V
	Ant 1.	Ant 2.												
802.11 a	-	V												
802.11 n SISO	-	V												
802.11 n MIMO	V	V												

## 1.3 Testing Site

<b>Test Site</b>	SPORTON INTERNATIONAL INC.		
<b>Test Site Location</b>	No. 52, Hwa Ya 1 <sup>st</sup> Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C. TEL: +886-3-3273456 / FAX: +886-3-3284978		
<b>Test Site No.</b>	<b>Sporton Site No.</b>		<b>FCC/IC Registration No.</b>
	TH02-HY	03CH07-HY	722060/4086B-1

## 1.4 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 v02
- FCC KDB 662911 D01 Multiple Transmitter Output v01r02.
- ANSI C63.4-2003 and ANSI C63.10-2009
- IC RSS-210 Issue 8
- IC RSS-Gen Issue 3
- NOTICE 2012-DRS0126

### Remark:

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. This EUT has also been tested and complied with the requirements of FCC Part 15, Subpart B, recorded in a separate test report.
3. Per the section 2.2.3 of Notice of 2012-DRS0126, " Receivers Excluded from Industry Canada Requirements", only radio communication receivers operating in stand-alone mode within the band 30-960 MHz and scanner receivers are subject to Industry Canada requirements.

## 1.5 Ancillary Equipment List

Item	Equipment	Trade Name	Model Name	FCC ID	Data Cable	Power Cord
1.	AC Adapter	N/A	N/A	N/A	N/A	N/A

## 2 Test Configuration of Equipment Under Test

The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: radiated emission (9 KHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in three orthogonal panels, X, Y, Z. The worst cases (Y plan in 802.11a for Legacy Ant 2 and 802.11n HT20 for SISO Ant 2; X plane in 802.11n HT20 MIMO Ant 1+2) were recorded in this report.

The final configuration from all the combinations and the worst-case data rates were investigated by measuring the maximum power across all the data rates and modulation modes under section 2.2.

Based on the worst configuration found above, the RF power setting is set individually to meet FCC compliance limit for the final conducted and radiated tests shown in section 2.3.

### 2.1 Carrier Frequency and Channel

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
2400-2483.5 MHz	1	2412	7	2442
	2	2417	8	2447
	3	2422	9	2452
	4	2427	10	2457
	5	2432	11	2462
	6	2437		

Frequency Band	Channel	Freq. (MHz)	Channel	Freq. (MHz)
5725-5850 MHz Band 4	149	5745	159	5795
	151	5755	161	5805
	157	5785	165	5825

Note: This is a variant report for adding Ch165.

## 2.2 Pre-Scanned RF Power

Preliminary tests were performed in different data rate and antenna configurations as following table and the highest power data rates were chosen for full test in the following tables. Final Output Power equals to Measured Output Power adds the duty factor.

<Legacy Ant 2>

802.11a								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	20.24	20.18	19.76	19.56	19.42	19.28	19.97	19.54

<SISO Ant 2>

802.11a								
Data Rate (MHz)	6M bps	9M bps	12M bps	18M bps	24M bps	36M bps	48M bps	54M bps
Peak Power (dBm)	20.15	20.13	19.84	20.04	19.94	19.86	20.05	19.81

<MIMO Ant 1 + 2 >

5GHz 802.11n HT20 mode								
Data Rate (MHz)	MCS8	MCS9	MCS10	MCS11	MCS12	MCS13	MCS14	MCS15
Power (dBm) MIMO – Ant 1	20.28	19.73	19.87	19.60	19.35	19.63	19.56	19.33
Power (dBm) MIMO – Ant 2	20.66	20.34	20.97	20.35	20.90	20.37	20.11	20.01
MIMO Ant 1 + 2 (Measure and Sum )	23.48	23.06	23.47	23.00	23.20	23.03	22.85	22.69

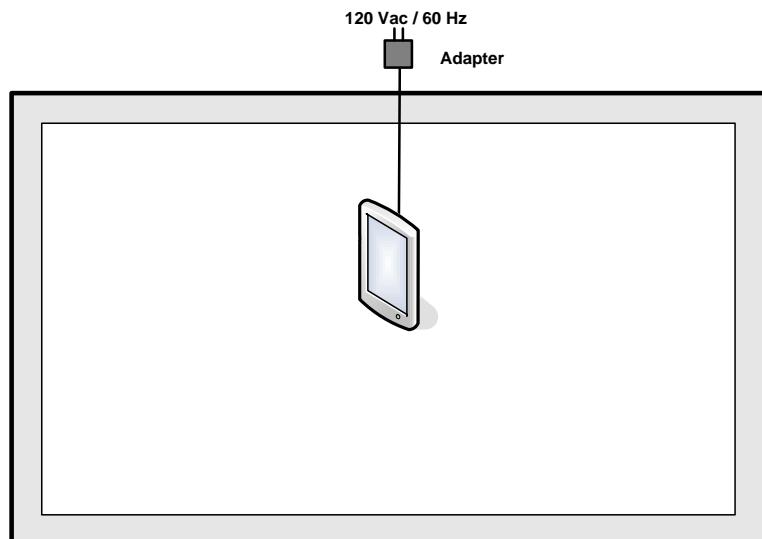
Note: MIMO Ant 1+2 is a calculated result from sum of the power MIMO Ant 1 and MIMO Ant 2.

## 2.3 Test Mode

Final results of test modes, data rates and test channels are shown as following table.

Test Cases				
	Test Items	Mode	Data Rate	Test Channel
Conducted TCs	6dB and 99% BW Power Spectral Density	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165
	Output Power	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165
	Conducted Band EDGE	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165
	Conducted Spurious Emission	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165
Radiated TCs	Radiated Band EDGE	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165
	Radiated Spurious Emission	802.11a	6 Mbps	165
		802.11n HT20	6.5 Mbps	165

## 2.4 Connection Diagram of Test System



## 2.5 RF Utility

The programmed RF utility “PUTTERY.EXE”, is installed in EUT to provide channel selection, power level, data rate and the application type. RF Utility can send transmitting signal for all testing.

## 2.6 Measurement Results Explanation Example

**For all conducted test items:**

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator factor between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10dB attenuator.

Example :

$$\begin{aligned} \text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)} \end{aligned}$$

## 3 Test Result

### 3.1 6dB Bandwidth Measurement

#### 3.1.1 Limit of 6dB Bandwidth

The minimum 6 dB bandwidth shall be at least 500 KHz.

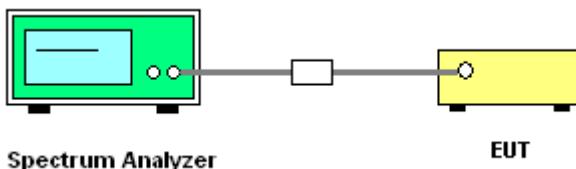
#### 3.1.2 Measuring Instruments

See list of measuring instruments of this test report.

#### 3.1.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 DTS D01 Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 KHz.
5. Measure and record the results in the test report.

#### 3.1.4 Test Setup



### 3.1.5 Test Result of 6dB Bandwidth

Test Mode :	802.11a	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Channel	Frequency (MHz)	802.11a	6dB Bandwidth Min. Limit (MHz)	Pass/Fail
		6dB Bandwidth (MHz)		
165	5825	15.12	0.5	Pass

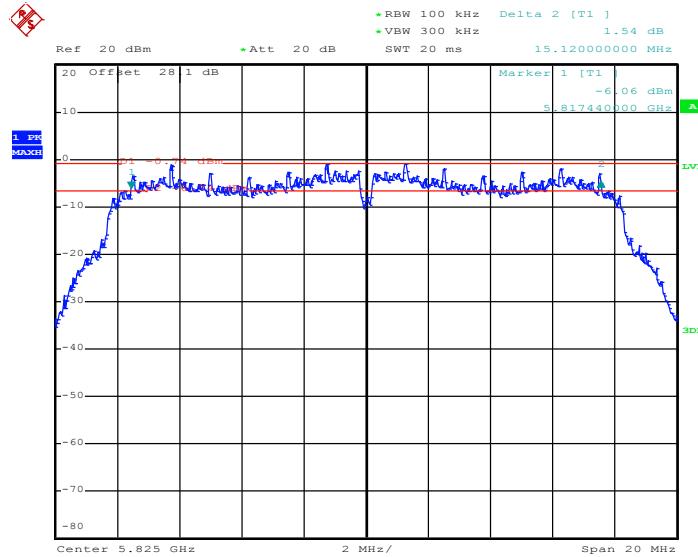
Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Channel	Frequency (MHz)	5GHz 802.11n HT20			6dB Bandwidth Min. Limit (MHz)	Pass/Fail
		SISO Ant 2	MIMO Ant 1	MIMO Ant 2		
165	5825	15.56	15.12	16.04	0.5	Pass

### 3.1.6 Test Result of 6dB Bandwidth Plots

#### 802.11a – Legacy Ant 2

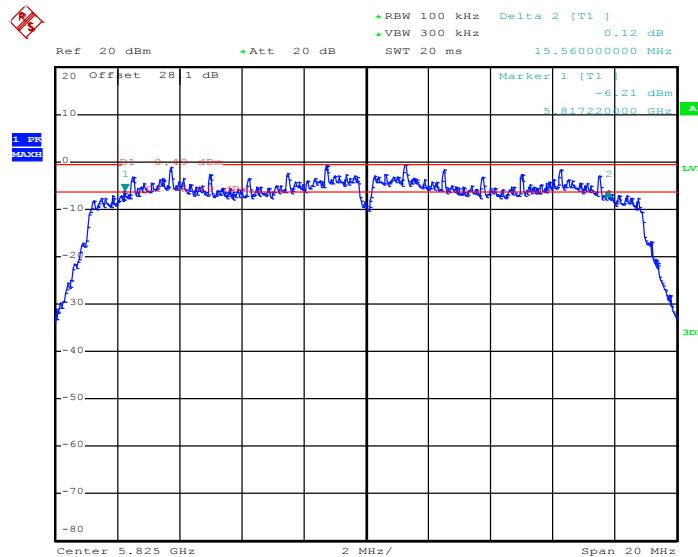
##### 6 dB Bandwidth Plot on Channel 165



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#### 802.11n HT20 – SISO Ant 2

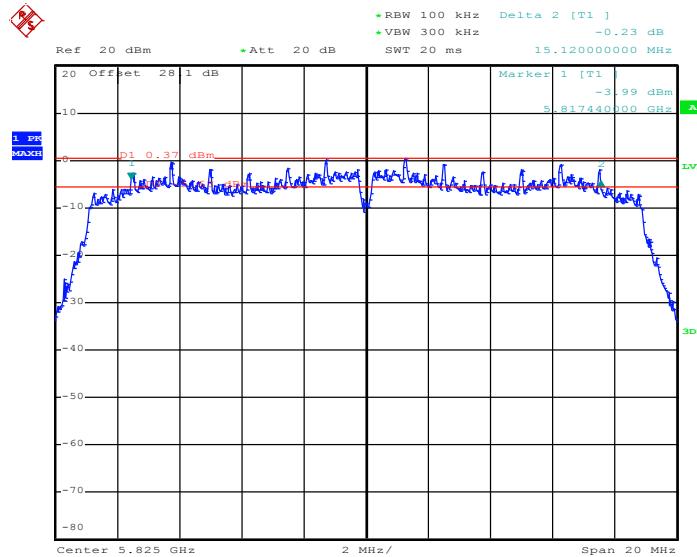
##### 6 dB Bandwidth Plot on Channel 165



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## 802.11n HT20 – MIMO Ant 1

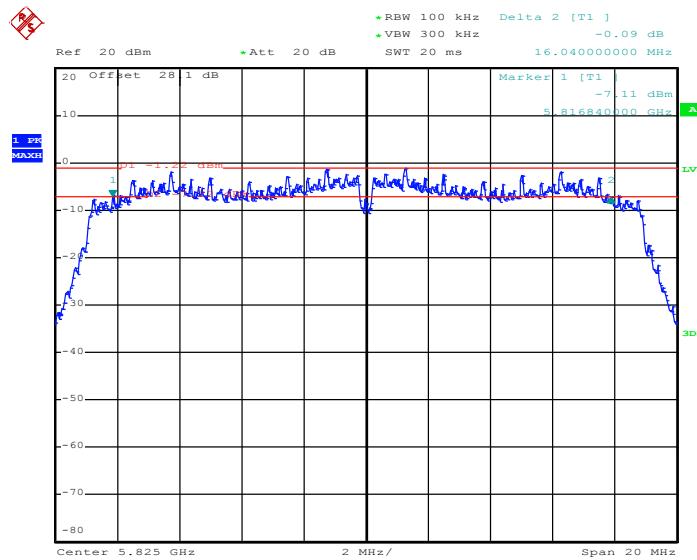
### 6 dB Bandwidth Plot on Channel 165



Date: 9.JAN.2013 15:02:03

## 802.11n HT20 – MIMO Ant 2

### 6 dB Bandwidth Plot on Channel 165



Date: 9.JAN.2013 14:57:31

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 2400-2483.5MHz and 5725-5850MHz, the limit for peak output power is 30dBm. If transmitting Antenna of directional gain greater than 6dBi are used the peak output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the Antenna exceeds 6 dBi. In case of point-to-point operation, the limit has to be reduced by 1dB for every 3dB that the directional gain of the Antenna exceeds 6dBi.

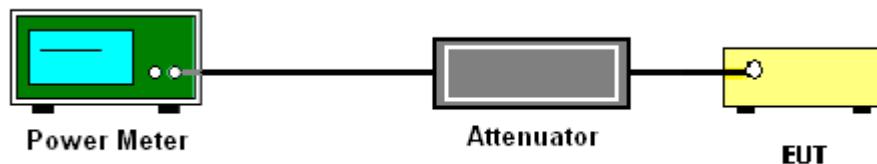
### 3.2.2 Measuring Instruments

See list of measuring instruments of this test report.

### 3.2.3 Test Procedures

1. The testing follows the Measurement Procedure of FCC KDB No. 558074 DTS D01 Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Measure the conducted output power and record the results in the test report.
5. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v01r02.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak Output Power

Test Mode :	802.11a	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Channel	Frequency (MHz)	802.11a		Max. Limits (dBm)	Pass/Fail
		Measured Output Power (dBm)			
165	5825	Legacy Ant 2		20.24	30
					Pass

Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Channel	Frequency (MHz)	802.11n HT20				Max. Limits (dBm)	Pass/Fail
		SISO Ant 2	MIMO Ant 1	MIMO Ant 2	MIMO Ant 1+2		
165	5825	20.15	20.28	20.66	23.48	30	Pass

**Note:** MIMO Ant 1+2 is a calculated result from sum of the power MIMO Ant 1 and MIMO Ant 2.

### 3.2.6 Test Result of Average output Power (Reporting Only)

<b>Test Mode :</b>	802.11a	<b>Temperature :</b>	24~26°C
<b>Test Engineer :</b>	Kenny Chen	<b>Relative Humidity :</b>	50~53%
<b>Duty Cycle:</b>	86.50%	<b>Duty Factor:</b>	0.63dB

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>802.11a</b> <b>Average Output Power (dBm)</b>	
		<b>Legacy Ant 2</b>	
165	5825	9.78	

<b>Test Mode :</b>	802.11n HT20	<b>Temperature :</b>	24~26°C
<b>Test Engineer :</b>	Kenny Chen	<b>Relative Humidity :</b>	50~53%
<b>Duty Cycle:</b>	86.08% for SISO Ant. 2 76.06% for MIMO Ant. 1 75.46% for MIMO Ant. 2	<b>Duty Factor:</b>	0.65dB for SISO Ant. 2 1.19dB for MIMO Ant. 1 1.22dB for MIMO Ant. 2

<b>Channel</b>	<b>Frequency (MHz)</b>	<b>802.11n HT20</b> <b>Average Output Power (dBm)</b>			
		<b>SISO Ant 2</b>	<b>MIMO Ant 1</b>	<b>MIMO Ant 2</b>	<b>MIMO Ant 1+2</b>
165	5825	9.73	9.32	9.75	12.55

**Note:**

1. MIMO Ant 1+2 is a calculated result from sum of the power MIMO Ant 1 and MIMO Ant 2.
2. The average power is measured by power meter with average power sensor and is reporting only.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8dBm in any 3KHz band at any time interval of continuous transmission.

#### 3.3.2 Measuring Instruments

See list of measuring instruments of this test report.

#### 3.3.3 Test Procedures

1. The testing follows Measurement Procedure 9.1 Option 1 of FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.
7. For MIMO mode, calculation method follows FCC KDB 662911 D01 Multiple Transmitter Output v01r02.

If measurements performed using method (2) plus  $10 \log (N)$  exceeds the emission limit, the test should choose method (1) before declaring that the device fails the emission limit.

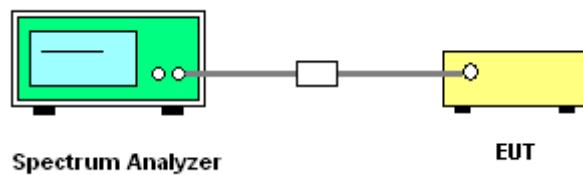
Method (1): Measure and sum the spectra across the outputs.

The total final Power Spectral Density is from a device with 2 transmitter outputs. The spectrum measurements of the individual outputs are all performed with the same span and number of points, the spectrum value in the first spectral bin of output 1 is summed with that in the first spectral bin of output 2 to obtain the value for the first frequency bin of the summed spectrum.

Method (2): Measure and add  $10 \log (N)$  dB, where N is the number of outputs. (N=2)

8. The Measured power density (dBm)/ 100KHz is a reference level and used as 20dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

### 3.3.4 Test Setup



### 3.3.5 Test Result of Power Spectral Density

Test Mode :	802.11a	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Channel	Frequency (MHz)	802.11a Power Density				Max. Limits (dBm)	Pass /Fail		
		Legacy Ant 2							
		Measured PSD/100KHz (dBm)	PSD/3KHz (dBm)						
165	5825	-0.80			-14.32	8	Pass		

Test Mode :	802.11n HT20	Temperature :	24~26°C
Test Engineer :	Kenny Chen	Relative Humidity :	50~53%

Ch.	Freq. (MHz)	802.11n HT20 Power Density						Max. Limits (dBm)	Pass /Fail		
		SISO Ant 2		MIMO Ant 1		MIMO Ant 2					
		Measured PSD/100KHz (dBm)	PSD/3KHz (dBm)	Measured PSD/100KHz (dBm)	PSD/3KHz (dBm) +10log2	Measured PSD/100KHz (dBm)	PSD/3KHz (dBm) +10log2				
165	5825	-0.43	-13.71	0.19	-10.52	-1.64	-12.12	8	Pass		

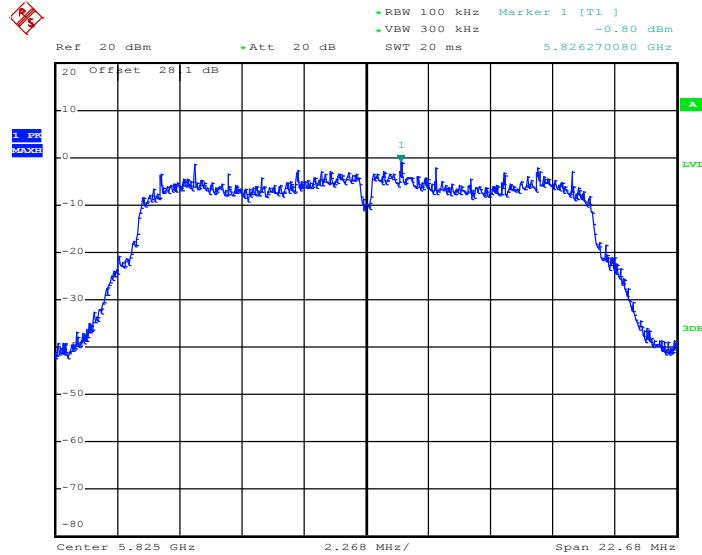
**Note:**

1. Measured power density (dBm) has offset with cable loss.
2. The Measured power density (dBm)/ 100KHz is reference level and used as 20dBc down for Conducted Band Edges and Conducted Spurious Emission limit line.

### 3.3.6 Test Result of Power Spectral Density Plots (100kHz)

#### 802.11a - Legacy Ant 2

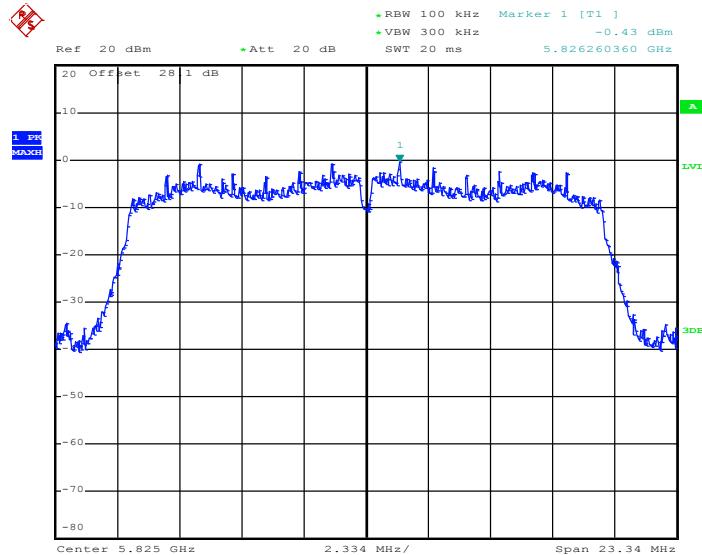
##### PSD Plot on Channel 165



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#### 802.11n HT20 – SISO Ant 2

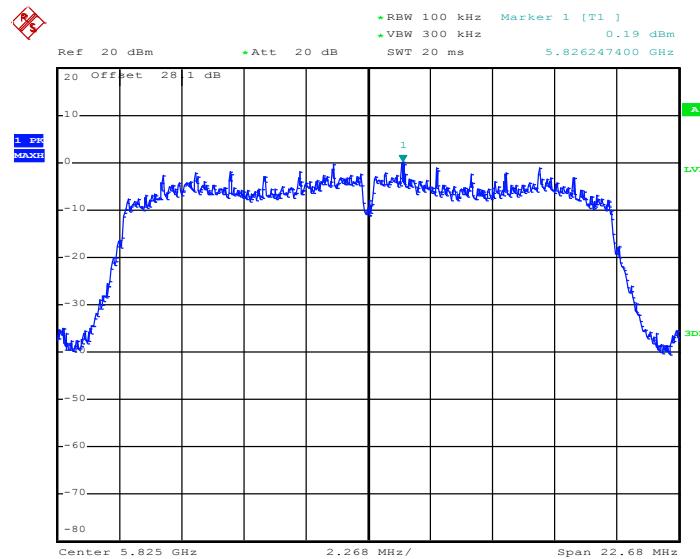
##### PSD Plot on Channel 165



Date: 9.JAN.2013 14:53:25

## 802.11n HT20 – MIMO Ant 1

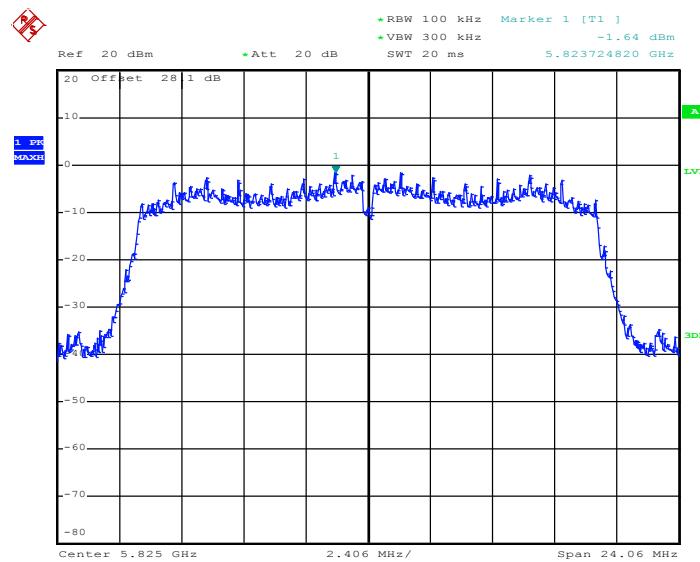
### PSD Plot on Channel 165



Date: 9.JAN.2013 15:02:39

## 802.11n HT20 – MIMO Ant 2

### PSD Plot on Channel 165

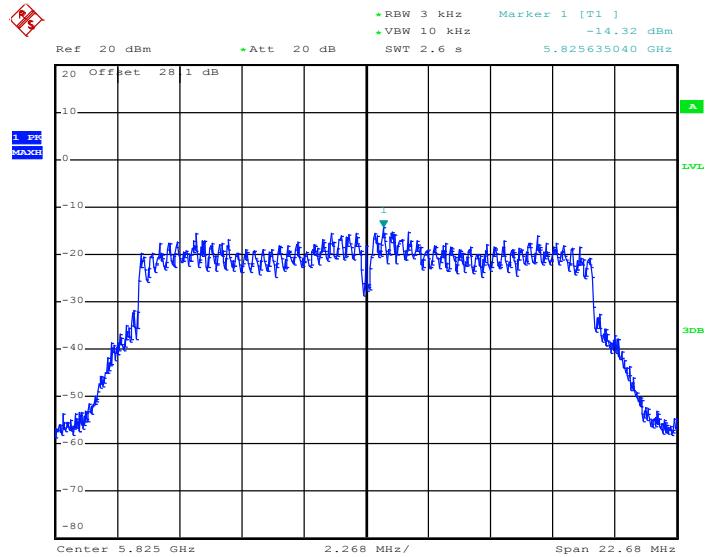


Date: 9.JAN.2013 14:58:32

### 3.3.7 Test Result of Power Spectral Density Plots (3kHz)

#### 802.11a - Legacy Ant 2

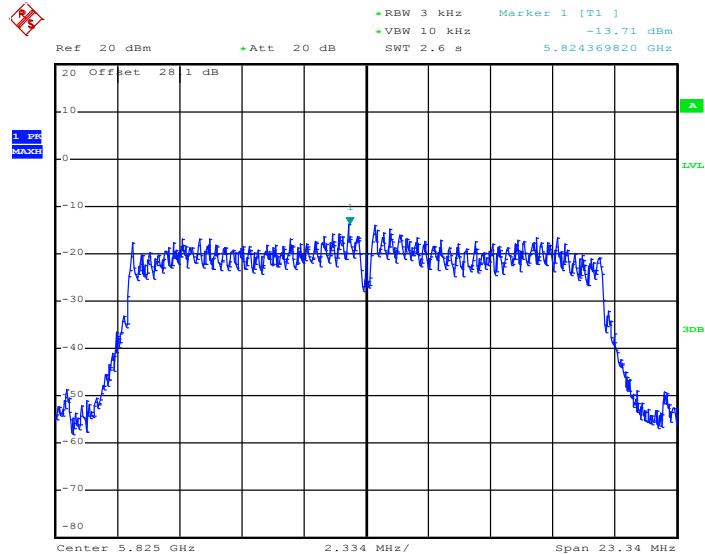
##### PSD Plot on Channel 165



Date: 9.JAN.2013 14:21:29

#### 802.11n HT20 – SISO Ant 2

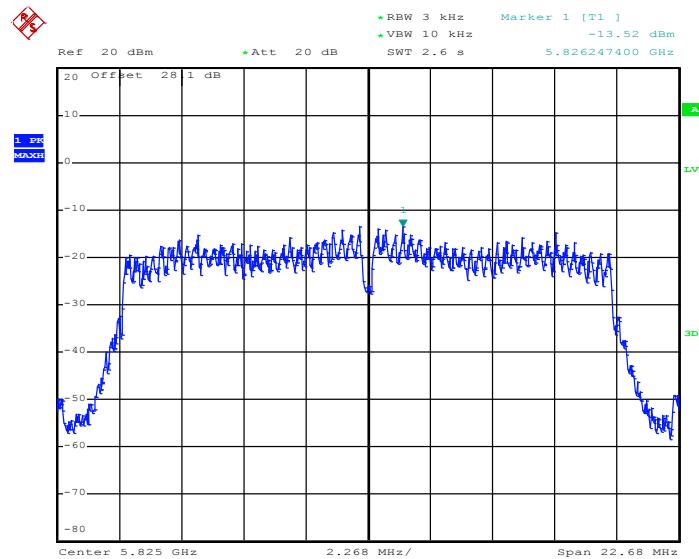
##### PSD Plot on Channel 165



Date: 9.JAN.2013 14:53:10

## 802.11n HT20 – MIMO Ant 1

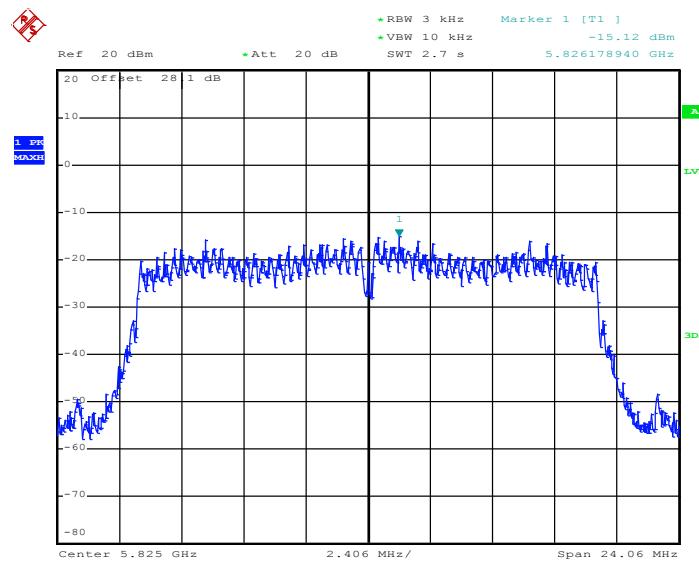
### PSD Plot on Channel 165



Date: 9.JAN.2013 15:02:27

## 802.11n HT20 – MIMO Ant 2

### PSD Plot on Channel 165



Date: 9.JAN.2013 14:58:19

## 3.4 Conducted Band Edges and Spurious Emission Measurement

### 3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement and radiated emissions 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).

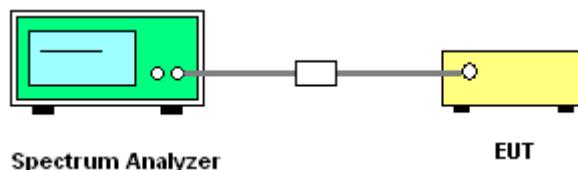
### 3.4.2 Measuring Instruments

See list of measuring instruments of this test report.

### 3.4.3 Test Procedures

1. The testing follows FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v02.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously.
4. Set RBW = 100 KHz, VBW=300 KHz, Peak Detector. Unwanted Emissions measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

### 3.4.4 Test Setup

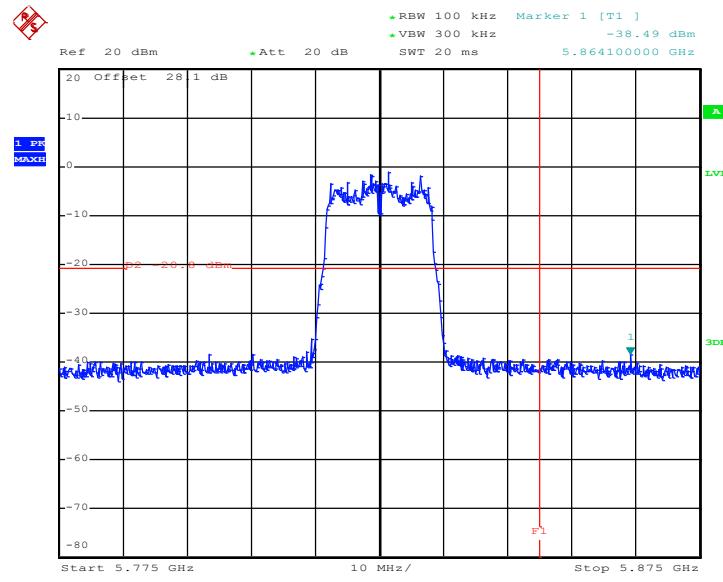


### 3.4.5 Test Result of Conducted Spurious at Band Edges

Test Mode :	802.11a - Legacy Ant 2	Temperature :	24~26°C
Test Band :	High	Relative Humidity :	50~53%
Test Channel :	165	Test Engineer :	Kenny Chen

#### 802.11a

##### High Band Edge Plot on Channel 165

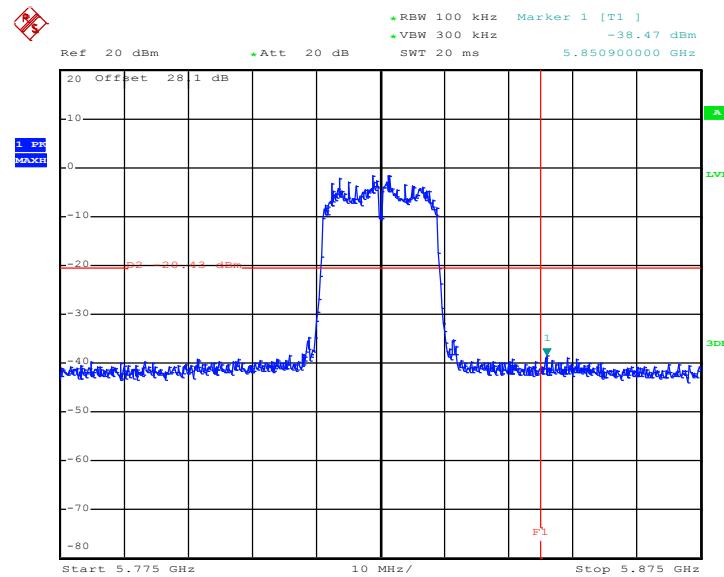


Date: 9.JAN.2013 14:22:01

<b>Test Mode :</b>	802.11n HT20 – SISO Ant 2	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	High	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

### 802.11n HT20

#### High Band Edge Plot on Channel 165

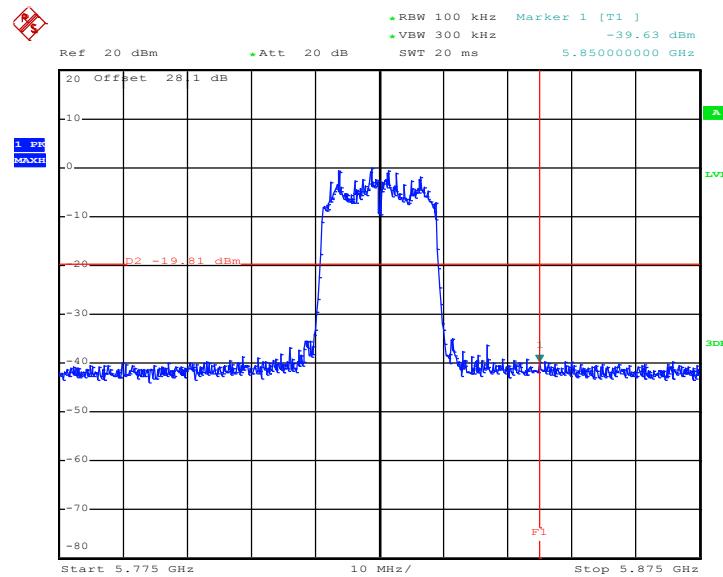


Date: 9.JAN.2013 14:53:45

<b>Test Mode :</b>	802.11a HT20 – MIMO Ant 1	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	High	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

### 802.11a

#### High Band Edge Plot on Channel 165

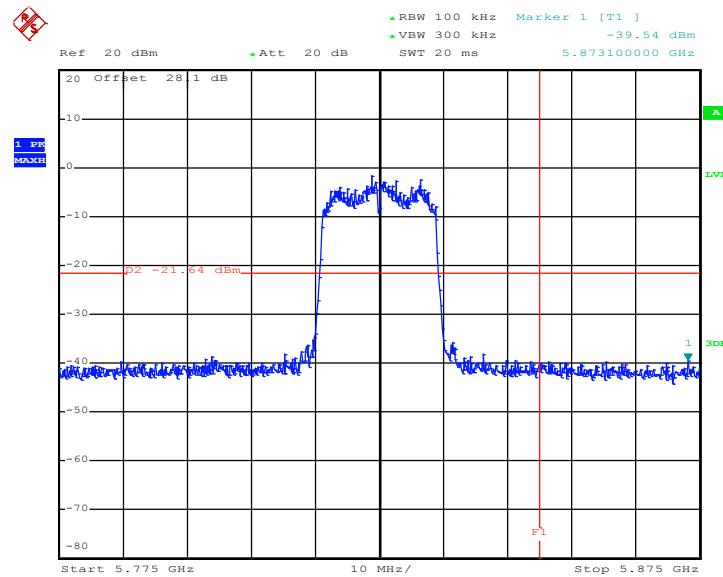


Date: 9.JAN.2013 15:02:56

<b>Test Mode :</b>	802.11n HT20 – MIMO Ant 2	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	High	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

### 802.11n HT20

#### High Band Edge Plot on Channel 165



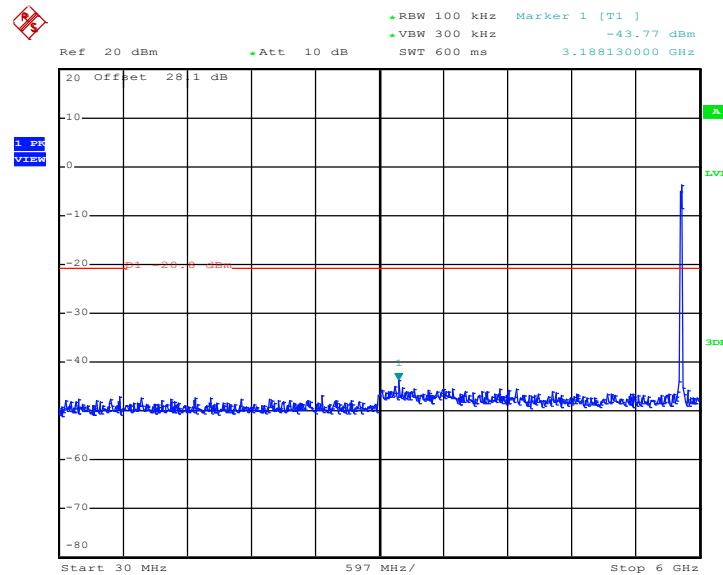
Date: 9.JAN.2013 14:58:48

### 3.4.6 Test Result of Conducted Spurious Emission

<b>Test Mode :</b>	802.11a - Legacy Ant 2	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	30MHz-6GHz and 5G-40GHz	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

802.11a 30 MHz~6 GHz

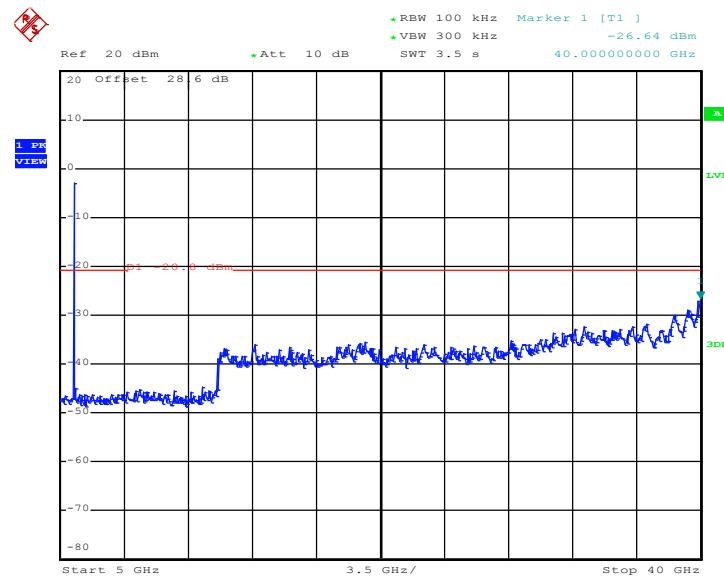
## Conducted Spurious Emission Plot on Channel 165



Date: 9.JAN.2013 14:23:24

802.11a 5 GHz~40 GHz

## Conducted Spurious Emission Plot on Channel 165

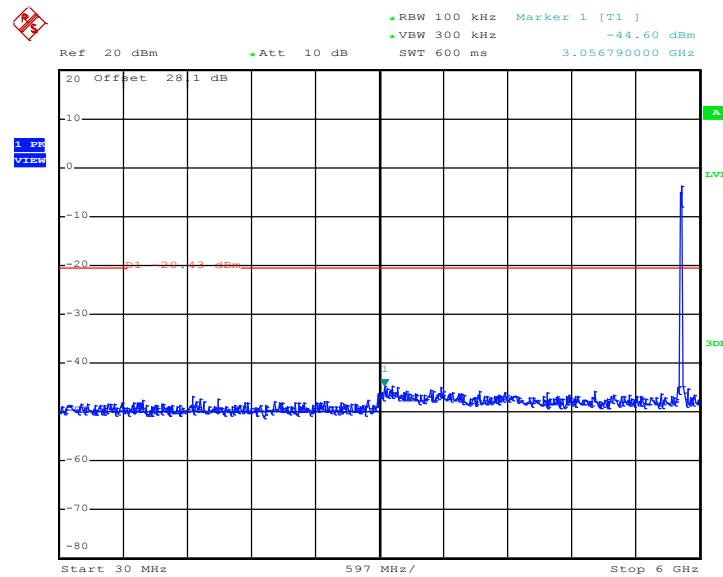


Date: 9.JAN.2013 14:23:42

<b>Test Mode :</b>	802.11n HT20 – SISO Ant 2	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	30MHz-6GHz and 5G-40GHz	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

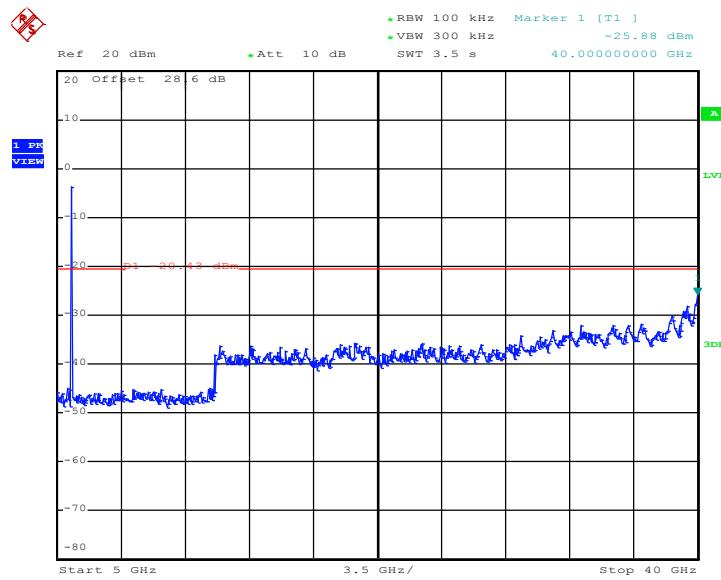
### 802.11n HT20 30 MHz~6 GHz

#### Conducted Spurious Emission Plot on Channel 165



Date: 9.JAN.2013 14:54:15

**802.11n HT20 5 GHz~40 GHz**  
**Conducted Spurious Emission Plot on Channel 165**

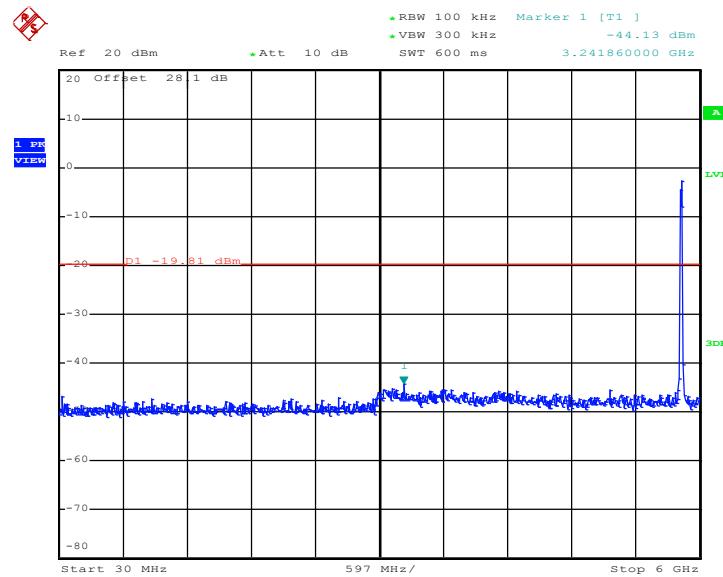


Date: 9.JAN.2013 14:54:34

<b>Test Mode :</b>	802.11n HT20 – MIMO Ant 1	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	30MHz-6GHz and 5G-40GHz	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

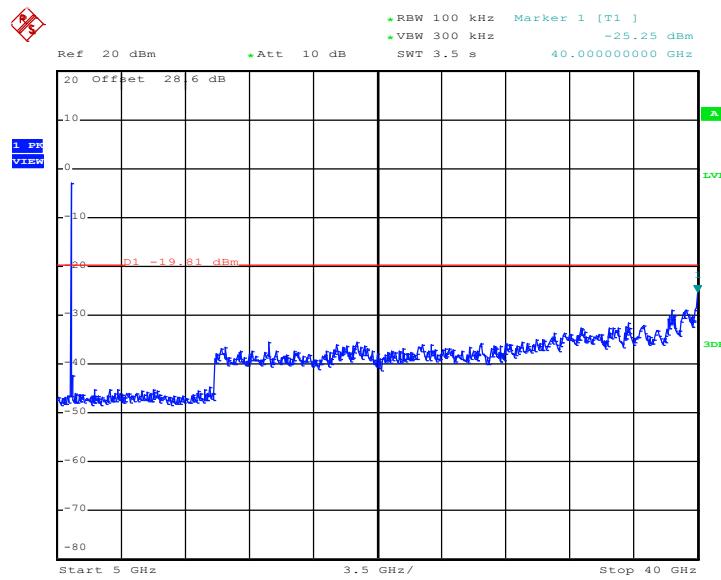
### 802.11n HT20 30 MHz~6 GHz

#### Conducted Spurious Emission Plot on Channel 165



Date: 9.JAN.2013 15:03:31

**802.11n HT20 5 GHz~40 GHz**  
**Conducted Spurious Emission Plot on Channel 165**

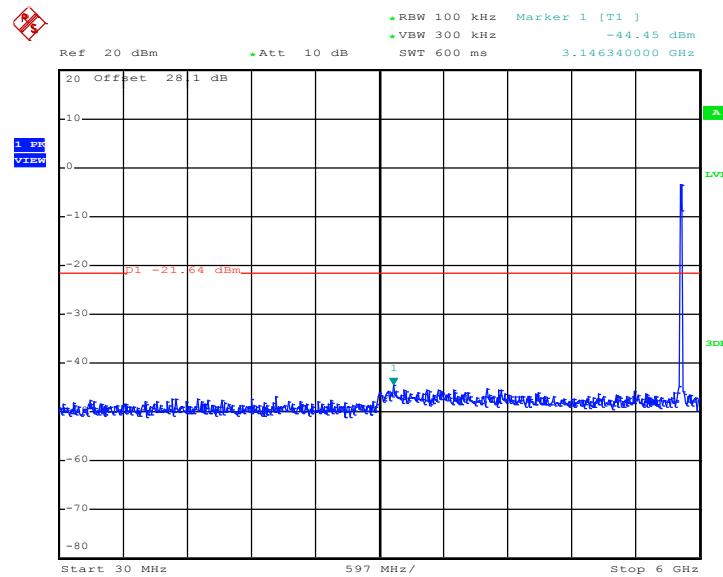


Date: 9.JAN.2013 15:03:50

<b>Test Mode :</b>	802.11n HT20 – MIMO Ant 2	<b>Temperature :</b>	24~26°C
<b>Test Band :</b>	30MHz-6GHz and 5G-40GHz	<b>Relative Humidity :</b>	50~53%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kenny Chen

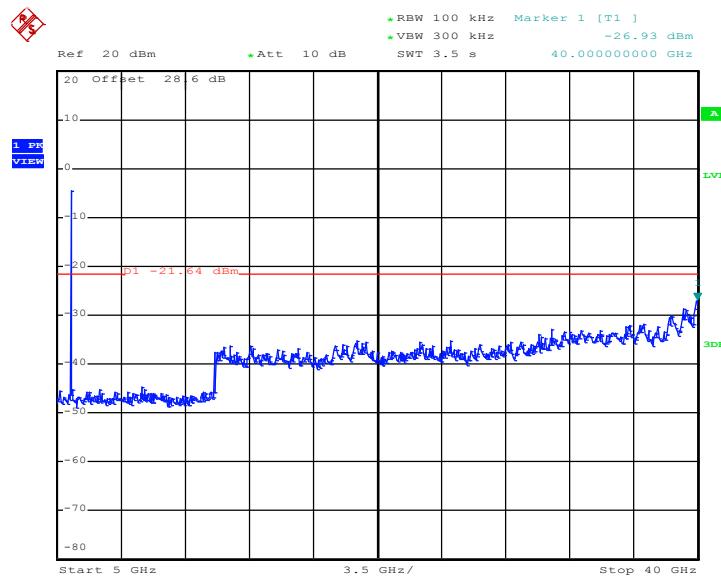
### 802.11n HT20 30 MHz~6 GHz

#### Conducted Spurious Emission Plot on Channel 165



Date: 9.JAN.2013 14:59:15

**802.11n HT20 5 GHz~40 GHz**  
**Conducted Spurious Emission Plot on Channel 165**



Date: 9.JAN.2013 14:59:34

## 3.5 Radiated Band Edges and Spurious Emission Measurement

### 3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 KHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device was measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the FCC section 15.209 limits as below.

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

### 3.5.2 Measuring Instruments

See list of measuring instruments of this test report.

### 3.5.3 Test Procedure

1. The testing follows the guidelines in ANSI C63.4-2003 and ANSI C63.10-2009.
2. The EUT was arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT was placed on a turntable with 0.8 meter above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported. Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.
7. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW=100 KHz for  $f < 1$  GHz; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak;  
Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.

For average measurement:

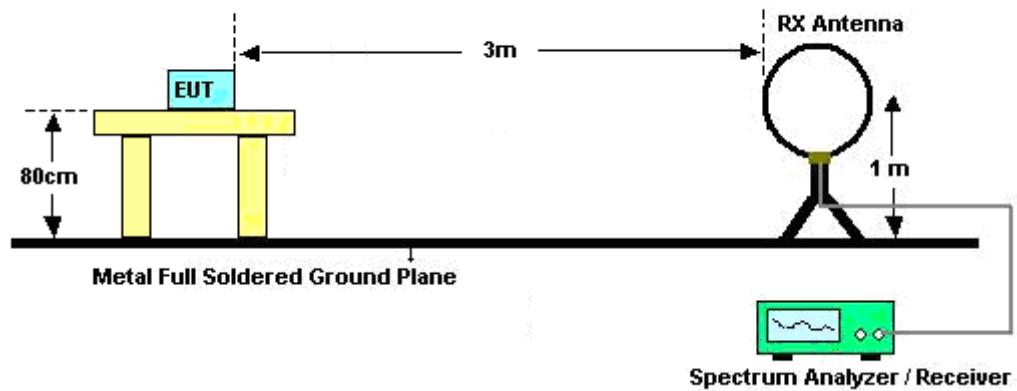
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

Antenna	Band	Duty Cycle (%)	T(us)	1/T(KHz)	VBW Setting
2	802.11a	86.50	2050	0.488	1KHz
2	5G 802.11n HT20	86.08	1904	0.525	1KHz
1+2	5G 802.11n HT20 for Ant1	76.06	972	1.029	3KHz
1+2	5G 802.11n HT20 for Ant2	75.46	966	1.035	

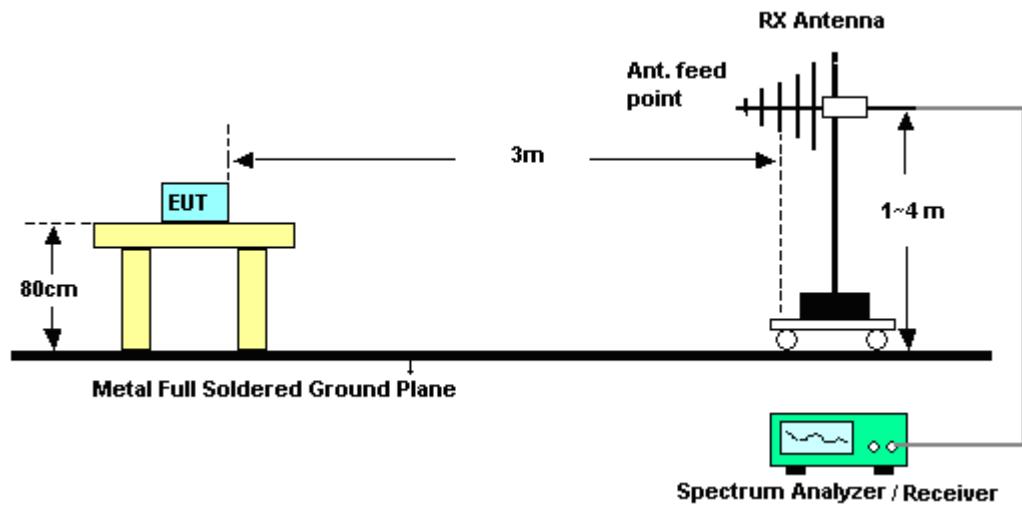
**Note:** For average measurement with duty cycle < 98%, use reduced VBW measurement method 4.2.3.2.3 in ANSI C63.10.

### 3.5.4 Test Setup

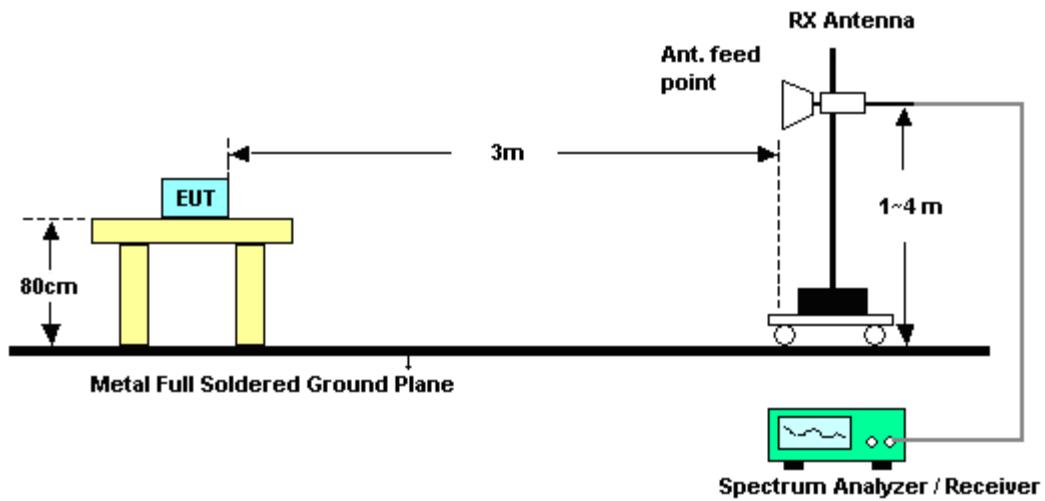
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



### 3.5.5 Test Results of Radiated Emissions (9KHz ~ 30MHz)

The low frequency, which started from 9 KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

### 3.5.6 Test Result of Radiated Spurious at Band Edges

Test Mode :	802.11a <Legacy Ant 2>			Temperature :	22~24°C			
Test Band :	High			Relative Humidity :	50~52%			
Test Channel :	165			Test Engineer :	Kyle Jhuang			

ANTENNA POLARITY : HORIZONTAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	89.24	-	-	77.82	34.96	9.88	33.42	100	302	Average
5825	106.47	-	-	95.05	34.96	9.88	33.42	100	302	Peak
5850	69.11	-17.36	86.47	57.72	34.98	9.87	33.46	100	302	Peak

ANTENNA POLARITY : VERTICAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	92.08	-	-	80.66	34.96	9.88	33.42	100	56	Average
5825	109.97	-	-	98.55	34.96	9.88	33.42	100	56	Peak
5850	75	-14.97	89.97	63.61	34.98	9.87	33.46	100	56	Peak

**Note:** 5850 MHz is not within a restricted band, and its limit line is 20dB below the highest emission level. For example, 106.47 dB $\mu$ V/m - 20dB = 86.47 dB $\mu$ V/m

Test Mode :	802.11n HT20 <SISO Ant 2>			Temperature :	22~24°C			
Test Band :	High			Relative Humidity :	50~52%			
Test Channel :	165			Test Engineer :	Kyle Jhuang			

ANTENNA POLARITY : HORIZONTAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	94.61	-	-	83.19	34.96	9.88	33.42	101	305	Average
5825	112.83	-	-	101.44	34.93	9.88	33.42	101	305	Peak
5850	83.17	-9.66	92.83	71.78	34.98	9.87	33.46	101	305	Peak

ANTENNA POLARITY : VERTICAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	84.39	-	-	72.97	34.96	9.88	33.42	100	58	Average
5825	114.31	-	-	102.89	34.96	9.88	33.42	100	58	Peak
5850	86.08	-8.23	94.31	74.69	34.98	9.87	33.46	100	58	Peak

<b>Test Mode :</b>	802.11n HT20 <MIMO Ant 1+2>	<b>Temperature :</b>	22~24°C
<b>Test Band :</b>	High	<b>Relative Humidity :</b>	50~52%
<b>Test Channel :</b>	165	<b>Test Engineer :</b>	Kyle Jhuang

ANTENNA POLARITY : HORIZONTAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	82.22	-	-	70.8	34.96	9.88	33.42	102	301	Average
5825	104.94	-	-	93.52	34.96	9.88	33.42	102	301	Peak
5850	68.67	-16.27	84.94	57.28	34.98	9.87	33.46	102	301	Peak

ANTENNA POLARITY : VERTICAL										
Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5825	87.41	-	-	75.99	34.96	9.88	33.42	100	91	Average
5825	111.09	-	-	99.67	34.96	9.88	33.42	100	91	Peak
5850	66.63	-24.46	91.09	55.24	34.98	9.87	33.46	100	91	Peak

### 3.5.7 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

<b>Test Mode :</b>	802.11a <Legacy Ant 2>			<b>Temperature :</b>	22~24°C				
<b>Test Channel :</b>	165			<b>Relative Humidity :</b>	50~52%				
<b>Test Engineer :</b>	Kyle Jhuang			<b>Polarization :</b>	Horizontal				
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. For example, 106.47 dBuV/m - 20dB = 86.47 dBuV/m. 3. All other emission found more than 20dB below limit line is not reported.								

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	53.6	-32.87	86.47	42.13	34.81	9.92	33.26	100	302	Peak
5825	89.24	-	-	77.82	34.96	9.88	33.42	100	302	Average
5825	106.47	-	-	95.05	34.96	9.88	33.42	100	302	Peak
5850	69.11	-17.36	86.47	57.72	34.98	9.87	33.46	100	302	Peak

<b>Test Mode :</b>	802.11a <Legacy Ant 2>			<b>Temperature :</b>	22~24°C				
<b>Test Channel :</b>	165			<b>Relative Humidity :</b>	50~52%				
<b>Test Engineer :</b>	Kyle Jhuang			<b>Polarization :</b>	Vertical				
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. 3. All other emission found more than 20dB below limit line is not reported.								

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	54.37	-35.6	89.97	42.9	34.81	9.92	33.26	100	56	Peak
5825	92.08	-	-	80.66	34.96	9.88	33.42	100	56	Average
5825	109.97	-	-	98.55	34.96	9.88	33.42	100	56	Peak
5850	75	-14.97	89.97	63.61	34.98	9.87	33.46	100	56	Peak

<b>Test Mode :</b>	802.11n HT20 <SISO Ant 2>	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	165	<b>Relative Humidity :</b>	50~52%
<b>Test Engineer :</b>	Kyle Jhuang	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. 3. All other emission found more than 20dB below limit line is not reported.		

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	55.15	-37.68	92.83	43.68	34.81	9.92	33.26	101	305	Peak
5825	94.61	-	-	83.19	34.96	9.88	33.42	101	305	Average
5825	112.83	-	-	101.44	34.93	9.88	33.42	101	305	Peak
5850	83.17	-9.66	92.83	71.78	34.98	9.87	33.46	101	305	Peak

<b>Test Mode :</b>	802.11n HT20 <SISO Ant 2>	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	165	<b>Relative Humidity :</b>	50~52%
<b>Test Engineer :</b>	Kyle Jhuang	<b>Polarization :</b>	Vertical
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. 3. All other emission found more than 20dB below limit line is not reported.		

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	55.63	-38.68	94.31	44.16	34.81	9.92	33.26	100	58	Peak
5825	84.39	-	-	72.97	34.96	9.88	33.42	100	58	Average
5825	114.31	-	-	102.89	34.96	9.88	33.42	100	58	Peak
5850	86.08	-8.23	94.31	74.69	34.98	9.87	33.46	100	58	Peak

<b>Test Mode :</b>	802.11n HT20 <MIMO Ant 1+2>	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	165	<b>Relative Humidity :</b>	50~52%
<b>Test Engineer :</b>	Kyle Jhuang	<b>Polarization :</b>	Horizontal
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. 3. All other emission found more than 20dB below limit line is not reported.		

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	53.23	-31.71	84.94	41.76	34.81	9.92	33.26	102	301	Peak
5825	82.22	-	-	70.8	34.96	9.88	33.42	102	301	Average
5825	104.94	-	-	93.52	34.96	9.88	33.42	102	301	Peak
5850	68.67	-16.27	84.94	57.28	34.98	9.87	33.46	102	301	Peak

<b>Test Mode :</b>	802.11n HT20 <MIMO Ant 1+2>	<b>Temperature :</b>	22~24°C
<b>Test Channel :</b>	165	<b>Relative Humidity :</b>	50~52%
<b>Test Engineer :</b>	Kyle Jhuang	<b>Polarization :</b>	Vertical
<b>Remark :</b>	1. 5825 MHz is fundamental signal which can be ignored. 2. 5725 MHz and 5850 MHz are not within a restricted band, and its limit line is 20dB below the highest emission level. 3. All other emission found more than 20dB below limit line is not reported.		

Frequency ( MHz )	Level ( dB $\mu$ V/m )	Over Limit ( dB )	Limit Line ( dB $\mu$ V/m )	Read Level ( dB $\mu$ V )	Antenna Factor ( dB )	Cable Loss ( dB )	Preamp Factor ( dB )	Ant Pos ( cm )	Table Pos ( deg )	Remark
5725	54.86	-36.23	91.09	43.39	34.81	9.92	33.26	100	91	Peak
5825	87.41	-	-	75.99	34.96	9.88	33.42	100	91	Average
5825	111.09	-	-	99.67	34.96	9.88	33.42	100	91	Peak
5850	66.63	-24.46	91.09	55.24	34.98	9.87	33.46	100	91	Peak

## 3.6 Antenna Requirements

### 3.6.1 Standard Applicable

If directional gain of transmitting Antennas is greater than 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the Antenna exceeds 6 dBi. The use of a permanently attached Antenna or of an Antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

### 3.6.2 Antenna Connected Construction

Non-standard connector used.

### 3.6.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit. The EUT supports completely uncorrelated MIMO mode. The composite antenna gain for 5GHz is 2.60 dBi as following table.

Antenna	5GHz
ANT. 1 GAIN (dBi)	2.50
ANT. 2 GAIN (dBi)	2.70
COMPOSITE GAIN (dBi)	2.60

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Unequal antenna gains, with equal transmit powers.

For antenna gains given by  $G_1, G_2, \dots, G_N$  dBi.

If all transmit signals are *completely uncorrelated*, then

$$\text{Directional gain} = 10 \log[(10^{G1/10} + 10^{G2/10} + \dots + 10^{GN/10})/N] \text{ dBi}$$

## 4 List of Measuring Equipment

Instrument	Manufacturer	Model No.	Serial No.	Characteristics	Calibration Date	Test Date	Due Date	Remark
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 13, 2011	Apr. 14, 2012	Jun. 12, 2012	Conducted (TH02-HY)
Spectrum Analyzer	R&S	FSP40	100055	9kHz~40GHz	Jun. 06, 2012	Jan. 09, 2013	Jun. 05, 2013	Conducted (TH02-HY)
Power Meter	Anritsu	ML2495A	1036004	300MHz~40GHz	Sep. 08, 2012	Jan. 09, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Power Sensor	Anritsu	MA2411B	1027253	300MHz~40GHz	Sep. 08, 2012	Jan. 09, 2013	Sep. 07, 2013	Conducted (TH02-HY)
Bilog Antenna	SCHAFFNER	CBL6111C	2726	30MHz ~ 1GHz	Oct. 22, 2011	May 09, 2012 ~ May 11, 2012	Oct. 21, 2012	Radiation (03CH07-HY)
Spectrum Analyzer	R&S	FSP30	101067	9KHz ~ 30GHz	Dec. 06, 2011	May 09, 2012 ~ May 11, 2012	Dec. 05, 2012	Radiation (03CH07-HY)
Double Ridge Horn Antenna	ESCO	3117	00075962	1GHz ~ 18GHz	Aug. 10, 2011	May 09, 2012 ~ May 11, 2012	Aug. 09, 2012	Radiation (03CH07-HY)
Pre Amplifier	Agilent	8449B	3008A023 62	1GHz ~ 26.5GHz	Dec. 05, 2011	May 09, 2012 ~ May 11, 2012	Dec. 04, 2012	Radiation (03CH07-HY)
Pre Amplifier	COM-POWER	PA-103A	161241	10-1000MHz.32 dB.GAIN	Feb. 27, 2012	May 09, 2012 ~ May 11, 2012	Feb. 26, 2013	Radiation (03CH07-HY)
EMI TEST RECEIVER	R&S	ESCI 7	100724	9kHz ~ 7GHz	Aug. 22, 2011	May 09, 2012 ~ May 11, 2012	Aug. 21, 2012	Radiation (03CH07-HY)
Pre Amplifier	MITEQ	AMF-7D-0010 1800-30-10P	159088	1GHz ~ 18GHz	Mar. 10, 2012	May 09, 2012 ~ May 11, 2012	Mar. 09, 2013	Radiation (03CH07-HY)
SHF-EHF Horn Antenna	SCHWARZBECK	BBHA9170 251		15GHz ~ 40GHz	Oct. 21, 2011	May 09, 2012 ~ May 11, 2012	Oct. 20, 2012	Radiation (03CH07-HY)
Loop Antenna	R&S	HFH2-Z2	860004/00 1	9 kHz~30 MHz	Jul. 29, 2010	May 09, 2012 ~ May 11, 2012	Jul. 28, 2012	Radiation (03CH07-HY)

## 5 Uncertainty of Evaluation

### Uncertainty of Radiated Emission Measurement (30MHz ~ 1000MHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	2.54
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### Uncertainty of Radiated Emission Measurement (1GHz ~ 40GHz)

Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))	4.72
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