



**FCC CFR47 PART 15 SUBPART C  
INDUSTRY CANADA RSS-210 ISSUE 8**

**CERTIFICATION TEST REPORT**

**FOR**

**WIFI MODULE**

**MODEL NUMBER: DWM-W081**

**FCC ID: EW4DWMW081  
IC: 4250A-DWMW081**

**REPORT NUMBER: 12J14490-2**

**ISSUE DATE: JULY 18, 2012**

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Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/18/12	Initial Issue	

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## 1. ATTESTATION OF TEST RESULTS

**COMPANY NAME:** MITSUMI ELECTRIC CO., LTD.  
1601, SAKAI, ASUGI-SHI,  
KANAGAWA, 243-8533 JAPAN

**EUT DESCRIPTION:** WIFI MODULE

**MODEL:** DWM-W081

**SERIAL NUMBER:** 40F40732630A

**DATE TESTED:** JUNE 29 TO JULY 8, 2012

APPLICABLE STANDARDS	
STANDARD	TEST RESULTS
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 3	Pass

UL CCS tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL CCS based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

**Note:** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL CCS will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

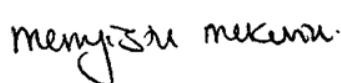
Approved & Released For UL CCS By:



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THU CHAN  
EMC SUPERVISOR  
UL CCS

Tested By:



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MENGISTU MEKURIA  
EMC ENGINEER  
UL CCS

## 2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with ANSI C63.10-2009, FCC CFR 47 Part 2, FCC CFR 47 Part 15, RSS-GEN Issue 3, and RSS-210 Issue 8.

## 3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 47173 Benicia Street, Fremont, California, USA.

UL CCS is accredited by NVLAP, Laboratory Code 200065-0. The full scope of accreditation can be viewed at <http://www.ccsemc.com>.

## 4. CALIBRATION AND UNCERTAINTY

### 4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

### 4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

$$\begin{aligned} \text{Field Strength (dBuV/m)} &= \text{Measured Voltage (dBuV)} + \text{Antenna Factor (dB/m)} + \\ &\text{Cable Loss (dB)} - \text{Preamp Gain (dB)} \\ 36.5 \text{ dBuV} + 18.7 \text{ dB/m} + 0.6 \text{ dB} - 26.9 \text{ dB} &= 28.9 \text{ dBuV/m} \end{aligned}$$

### 4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.52 dB
Radiated Disturbance, 30 to 1000 MHz	4.94 dB

Uncertainty figures are valid to a confidence level of 95%.

## 5. EQUIPMENT UNDER TEST

### 5.1. DESCRIPTION OF EUT

The EUT is WiFi module with 802.11n (HT20)

The radio module is manufactured by Mitsumi Electric Co., Ltd.

### 5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum peak conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5745 - 5825	802.11n HT20	19.49	88.92

### 5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a PIFA antenna for TX/RX diversity, with a maximum peak gain of 2.55 dBi.

### 5.4. SOFTWARE AND FIRMWARE

The EUT driver software installed in the host computer during testing was Broadcom driver revision : 4.219.148.

## 5.5. WORST-CASE CONFIGURATION AND MODE

Radiated emission and power line conducted emission were performed with the EUT set to transmit at the channel with highest output power as worst-case scenario.

The fundamental of the EUT was investigated in three orthogonal orientations X,Y,Z, it was determined that X-orientation was worst-case orientation; therefore, all final radiated testing was performed with the EUT in X-orientation.

Worst-case data rates as provided by the client were:

802.11n HT20mode: MCS0

## 5.6. DESCRIPTION OF TEST SETUP

### SUPPORT EQUIPMENT

Support Equipment List					
Description	Manufacturer	Model	Serial Number		FCC ID
Laptop	Dell	Latitude D430	42657130221		DoC
AC Adapter	Dell	DA90PS0-00	CN-0XD757-48661-7CK-IJ0P		DoC
AC Adapter	V-INFINITY	HK-C113-A05	EPS050250UPS-P5P-KH		DoC
Test Jig	Mitsumi	N/A	N/A		N/A

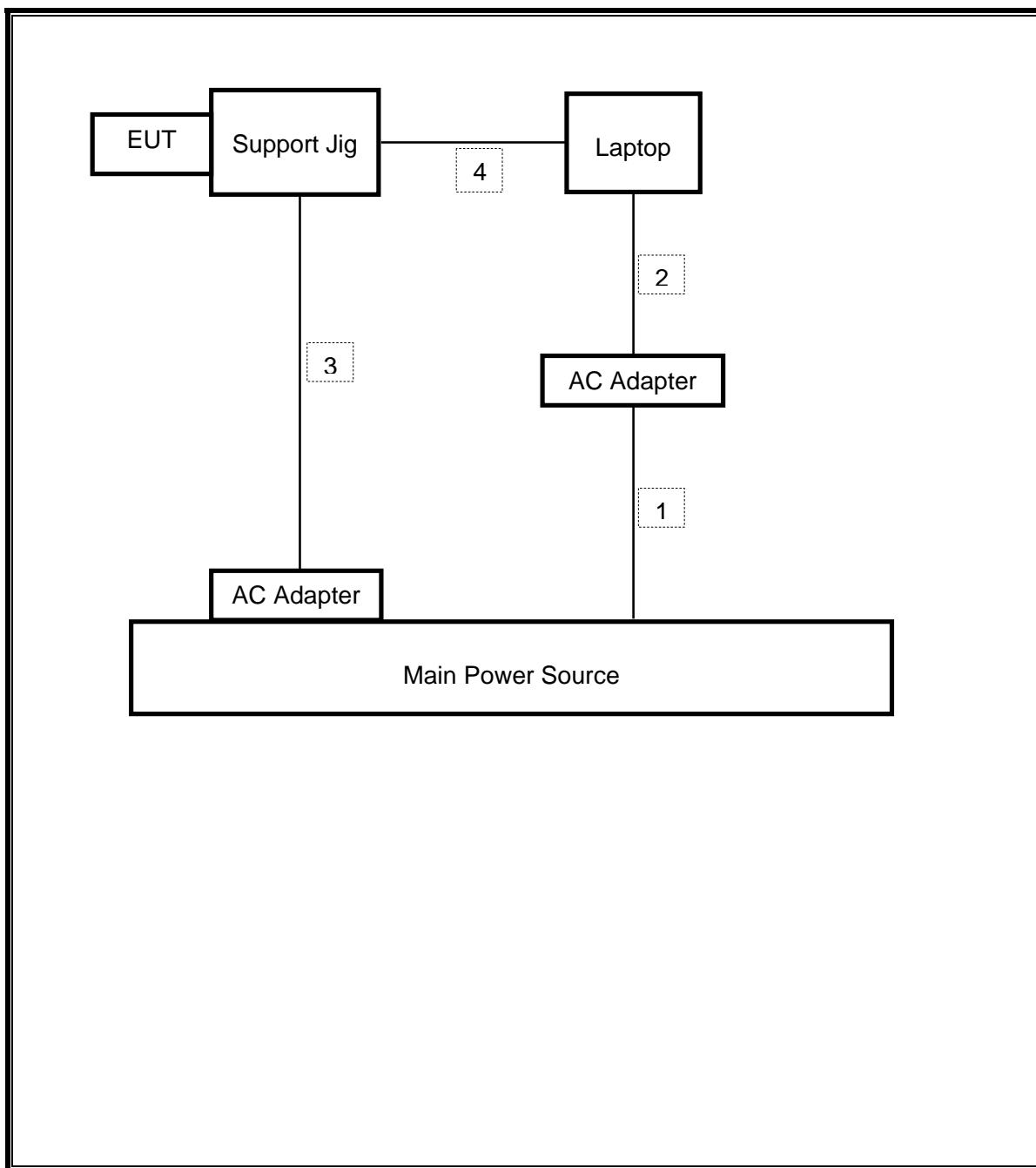
### I/O CABLES

I/O Cable List						
Cable No	Port	# of identical ports	Connector Type	Cable Type	Cable Length (m)	Remarks
1	AC	1	2 Pong	Un-Shielded	1.0m	N/A
2	DC	1	DC	Un-Shielded	2.0m	Ferrite Core at one End
3	DC	1	DC	Un-Shielded	2.0m	N/A
4	Data	1	20 Pins	Un-Shielded	0.5m	Ribbon Cable

### TEST SETUP

The EUT is attached to a host laptop computer via ribbon cable during the tests. Test software exercised the radio card.

**SETUP DIAGRAM FOR TESTS**



## 6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	Manufacturer	Model	Asset	Cal Due
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01179	2/16/2013
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00986	3/22/2013
Spectrum Analyzer, 44 GHz	Agilent / HP	E4446A	C00996	5/11/2013
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	8/19/2013
Power Meter	Agilent / HP	437B	N/A	7/29/2012
Power Sensor, 18 GHz	Agilent / HP	8481A	N/A	8/4/2012
Preamplifier, 1000MHz	Sonoma	310N	N02891	2/21/2013
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01052	8/12/2012
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	8/12/2012
Preamplifier, 40 GHz	Miteq	NSP4000-SP2	C00990	8/2/2012
Antenna, Horn, 18 GHz	EMCO	3115	C00945	10/6/2012
Antenna, Bilog, 30MHz-1 GHz	Sunol Sciences	JB1	C01011	3/23/2013
Antenna, Horn, 26.5 GHz	ARA	MWH-1826/B	C00980	7/28/2012
Antenna, Horn, 40 GHz	ARA	MWH-2640/B	C00981	6/14/2013
LISN, 30 MHz	FCC	50/250-25-2	C00626	12/13/2012
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	3/7/2013
Reject Filter, 5.725-5.825 GHz	Micro-Tronics	BRC13192	N02676	CNR

## 7. ANTENNA PORT TEST RESULTS

### 7.1. 802.11n HT20 MODE IN THE 5.8 GHz BAND

#### 7.1.1. 6 dB BANDWIDTH

##### LIMITS

FCC §15.247 (a) (2)

IC RSS-210 A8.2 (a)

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

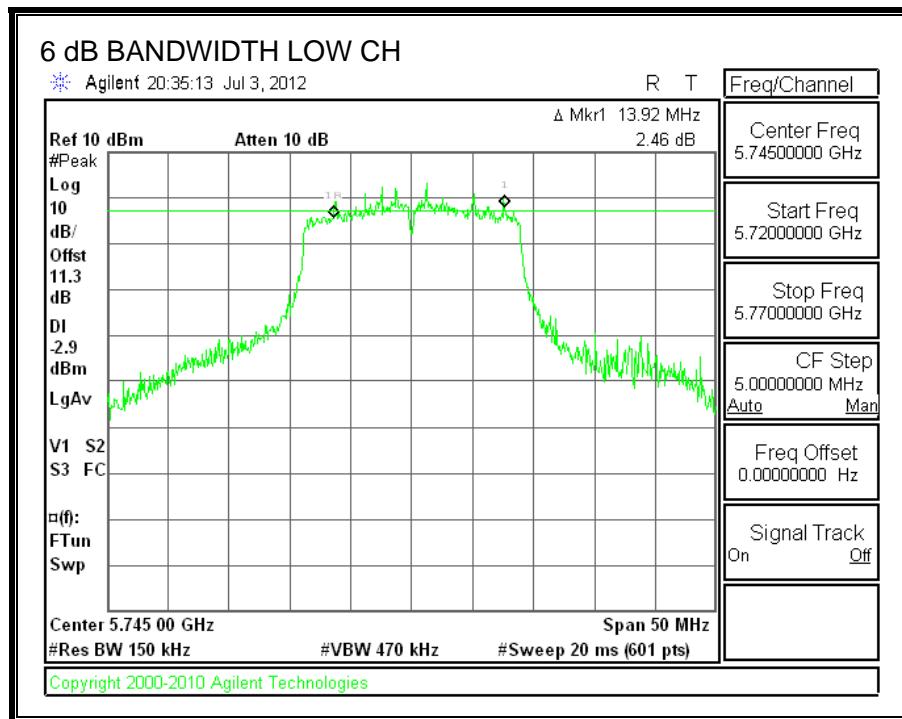
##### TEST PROCEDURE

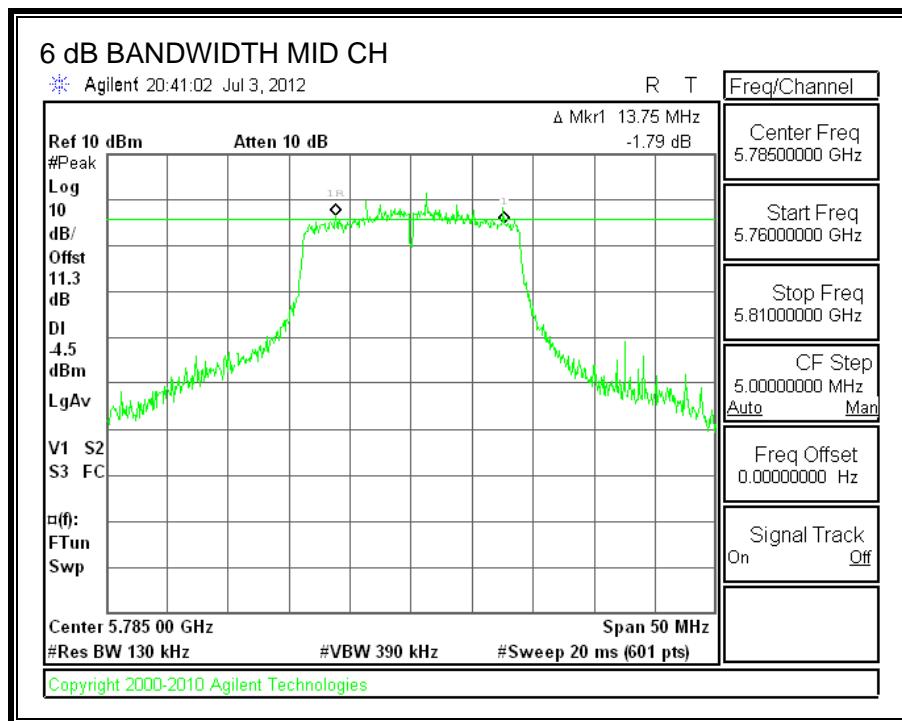
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

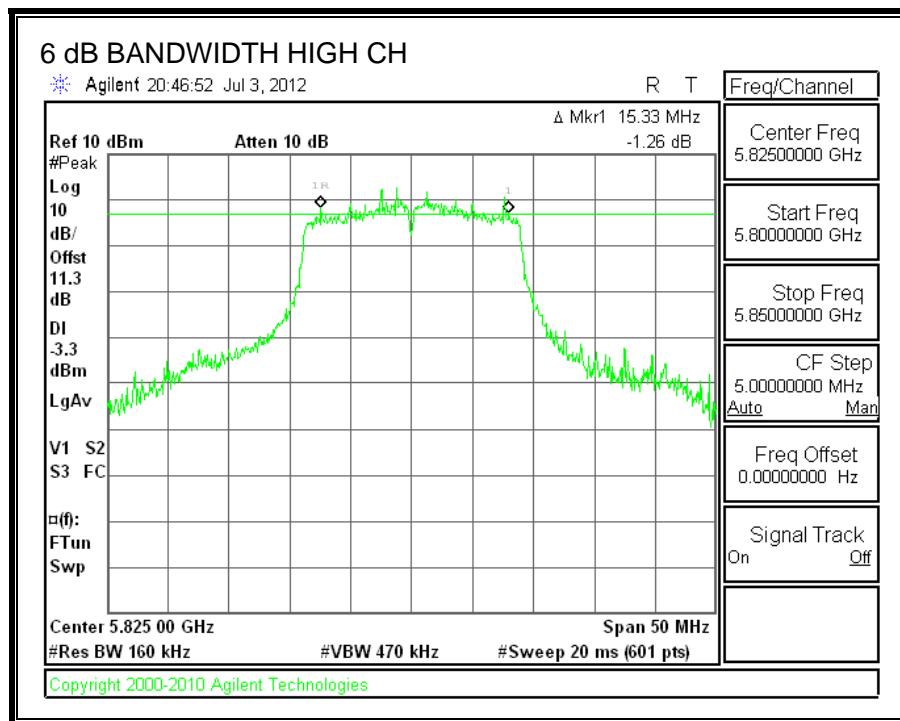
##### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	4.50	8	-3.50
Middle	5785	2.09	8	-5.91
High	5825	2.37	8	-5.63

## 6 dB BANDWIDTH







### 7.1.2. 99% BANDWIDTH

#### LIMITS

None; for reporting purposes only.

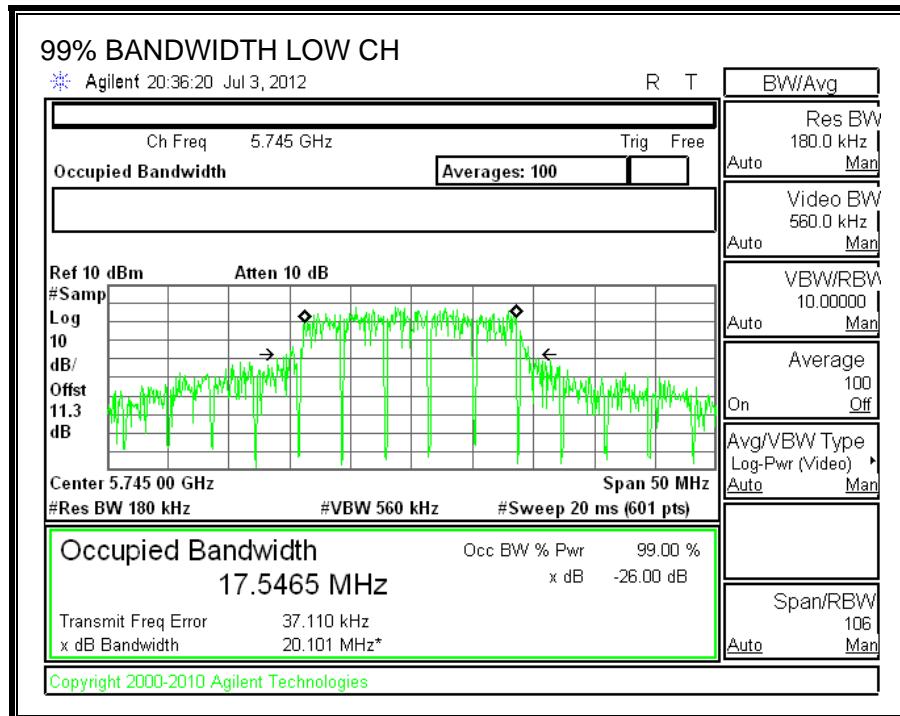
#### TEST PROCEDURE

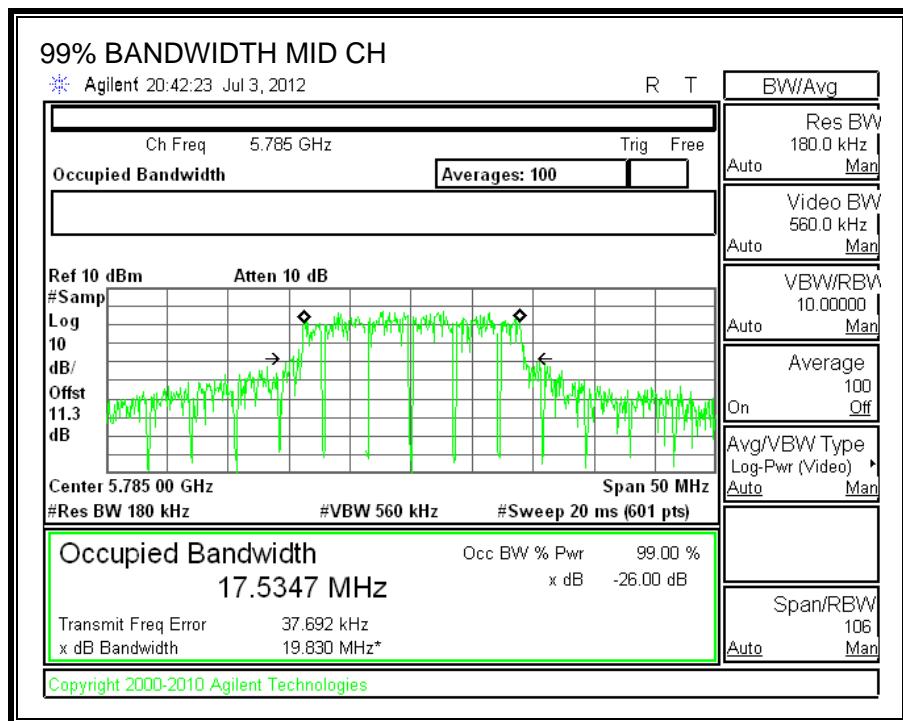
The transmitter output is connected to the spectrum analyzer. The RBW is set to 1% to 3% of the 99 % bandwidth. The VBW is set to 3 times the RBW. The sweep time is coupled. The spectrum analyzer internal 99% bandwidth function is utilized.

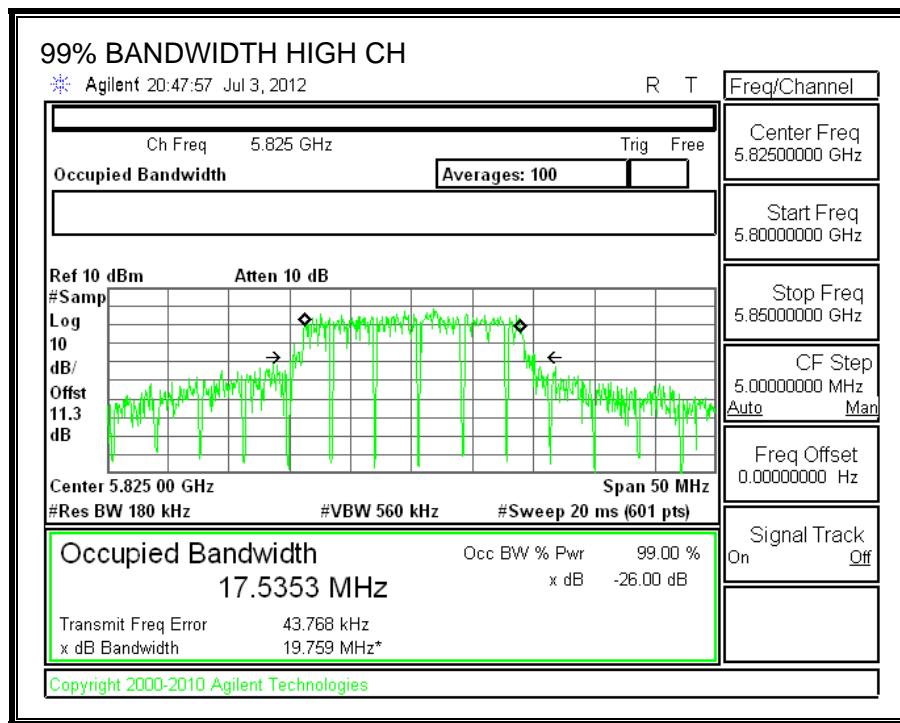
#### RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5745	17.5465
Middle	5785	17.5347
High	5825	17.5353

**99% BANDWIDTH**







### 7.1.3. OUTPUT POWER

#### LIMITS

FCC §15.247 (b)

IC RSS-210 A8.4

The maximum antenna gain is less than or equal to 6 dBi, therefore the limit is 30 dBm.

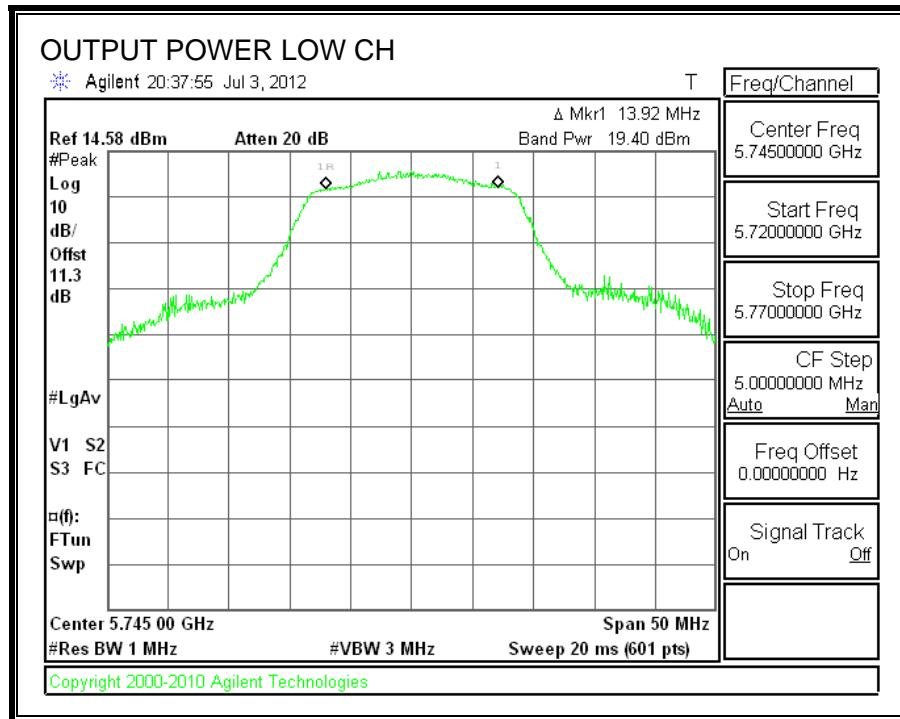
#### TEST PROCEDURE

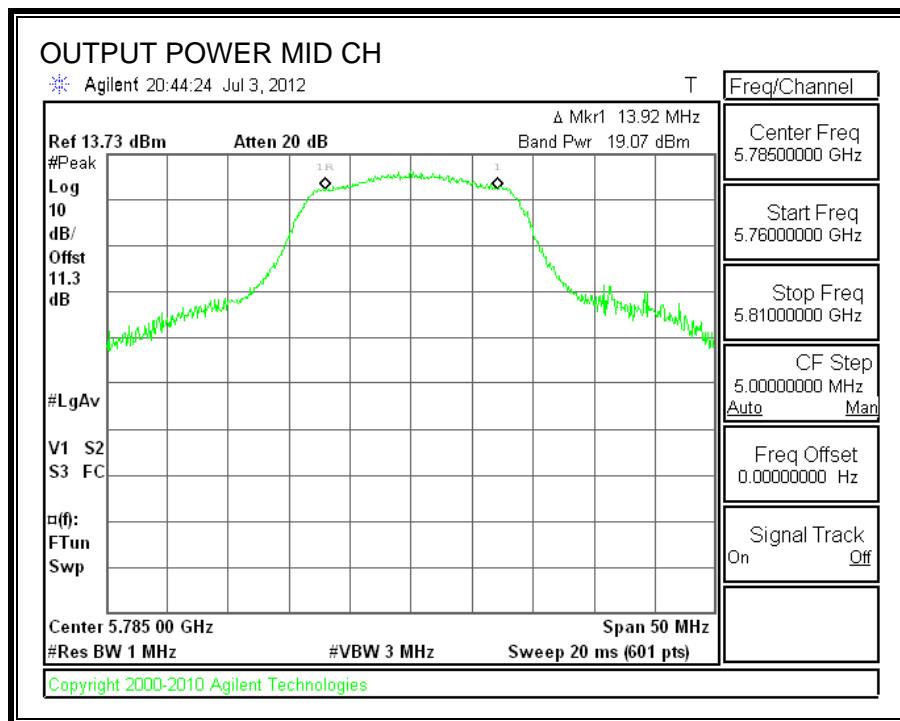
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

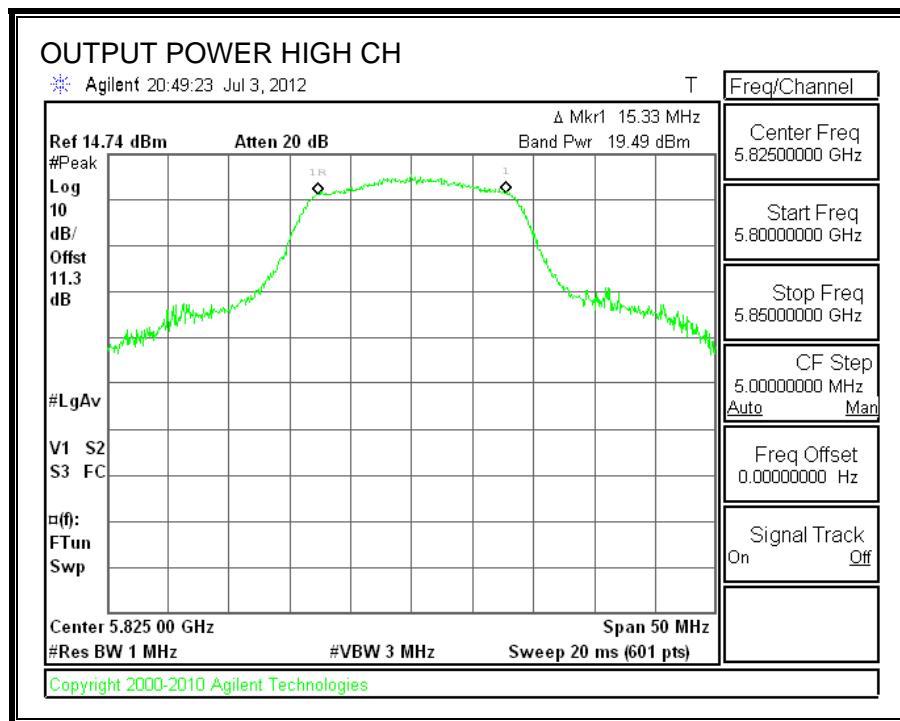
#### RESULTS

Channel	Frequency (MHz)	Peak Power Reading (dBm)	Limit (dBm)	Margin (dB)
Low	5745	19.40	30	-10.60
Middle	5785	19.07	30	-10.93
High	5825	19.49	30	-10.51

**OUTPUT POWER**







#### 7.1.4. AVERAGE POWER

##### LIMITS

None; for reporting purposes only.

##### TEST PROCEDURE

The transmitter output is connected to a power meter.

##### RESULTS

The cable assembly insertion loss of 1.3 dB (including 10 dB pad and 11.3 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Channel	Frequency (MHz)	Power (dBm)
Low	5745	10.90
Middle	5785	10.24
High	5825	10.46

### 7.1.5. POWER SPECTRAL DENSITY

#### LIMITS

FCC §15.247 (e)

IC RSS-210 A8.2 (b)

The power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

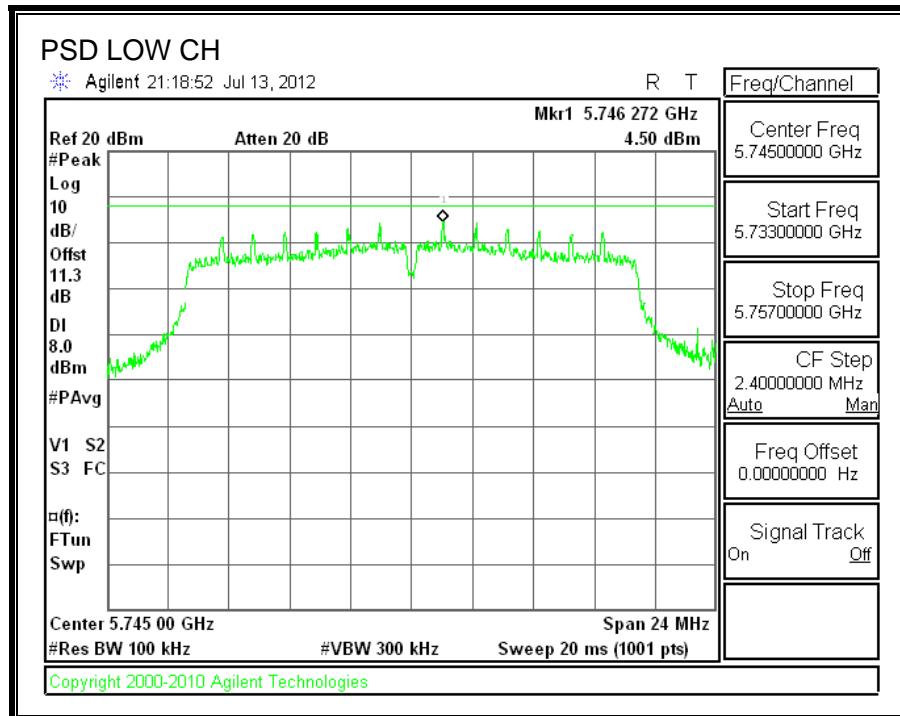
#### TEST PROCEDURE

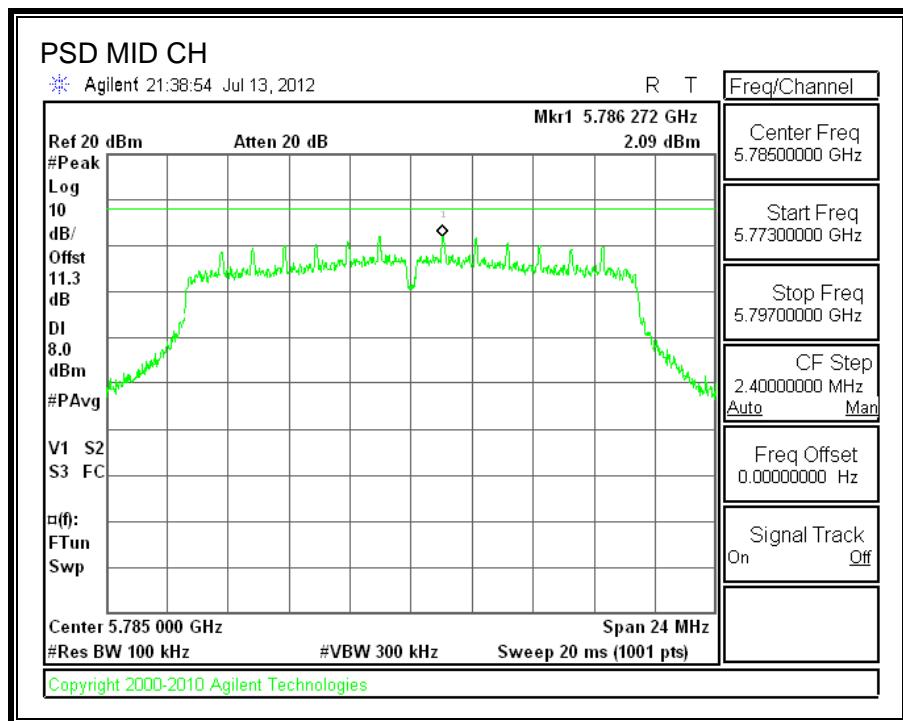
KDB 558074 D01 DTS Measurement Guidance V01 dated 01-18-12.

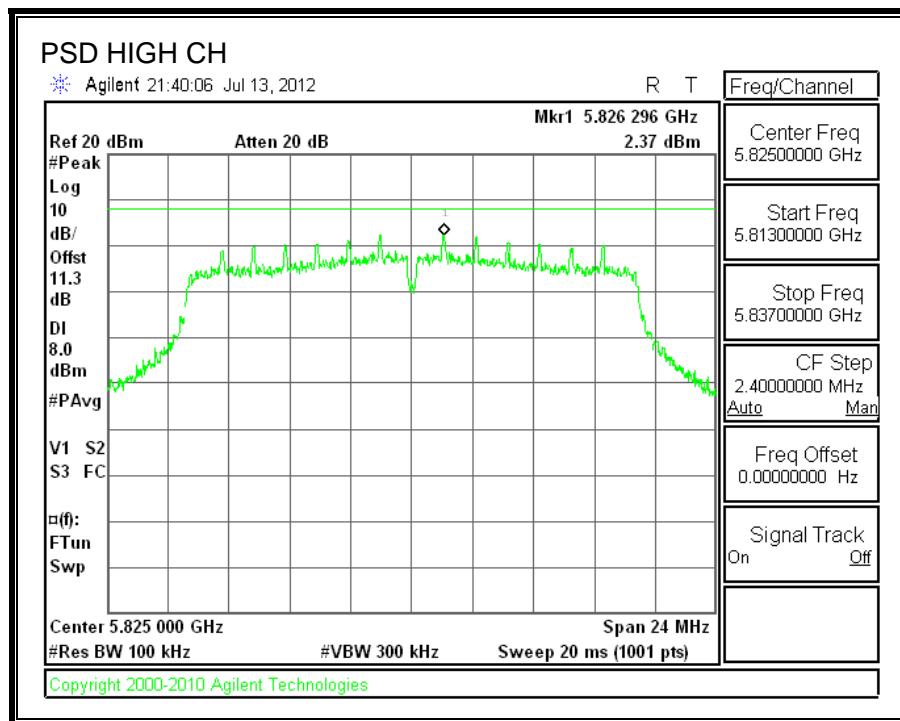
#### RESULTS

Channel	Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
Low	5745	4.50	8	-3.50
Middle	5785	2.09	8	-5.91
High	5825	2.37	8	-5.63

**POWER SPECTRAL DENSITY**







### 7.1.6. CONDUCTED SPURIOUS EMISSIONS

#### LIMITS

FCC §15.247 (d)

IC RSS-210 A8.5

Output power was measured based on the use of a peak measurement, therefore the required attenuation is 20 dB.

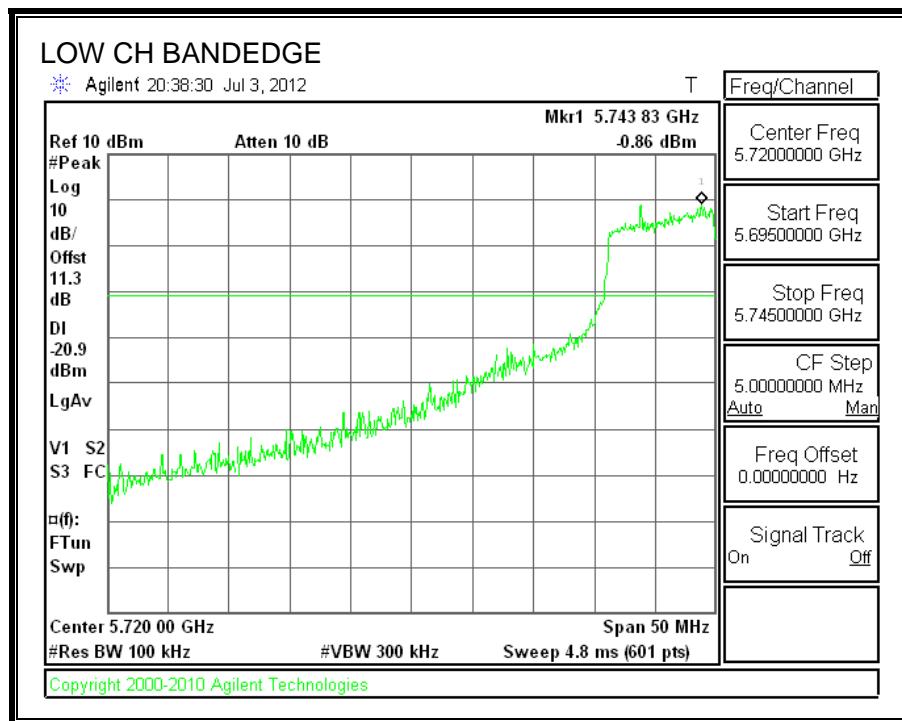
#### TEST PROCEDURE

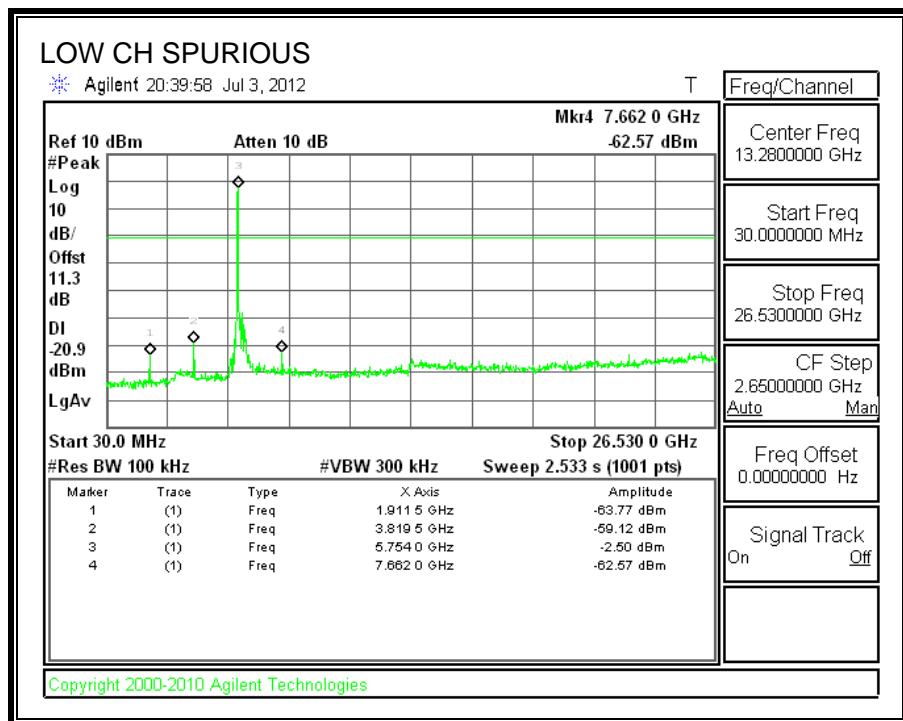
The transmitter output is connected to a spectrum analyzer. The resolution bandwidth is set to 100 kHz. The video bandwidth is set to 300 kHz.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

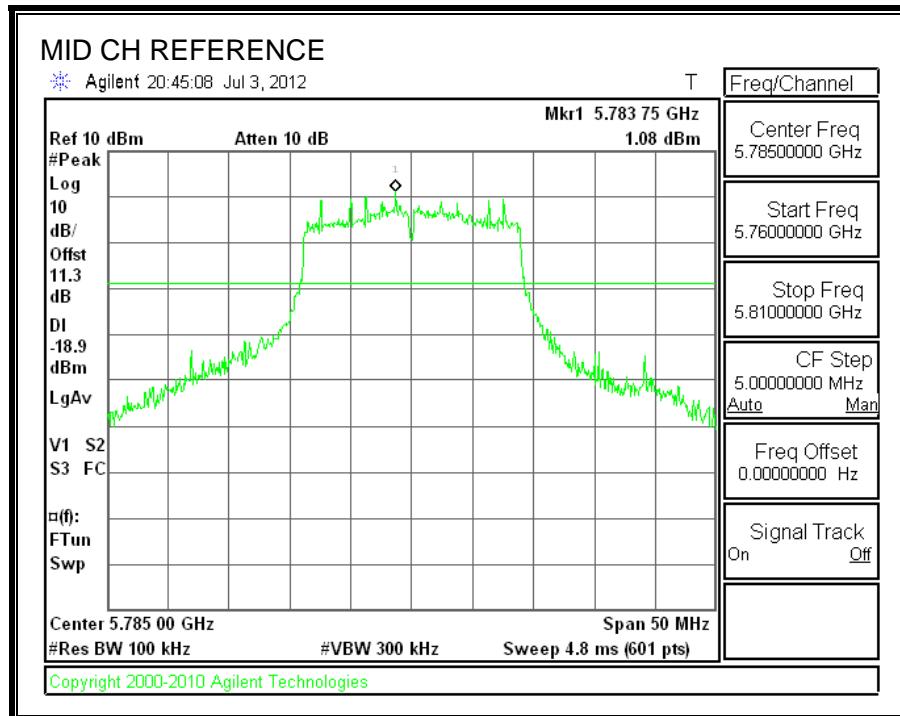
## RESULTS

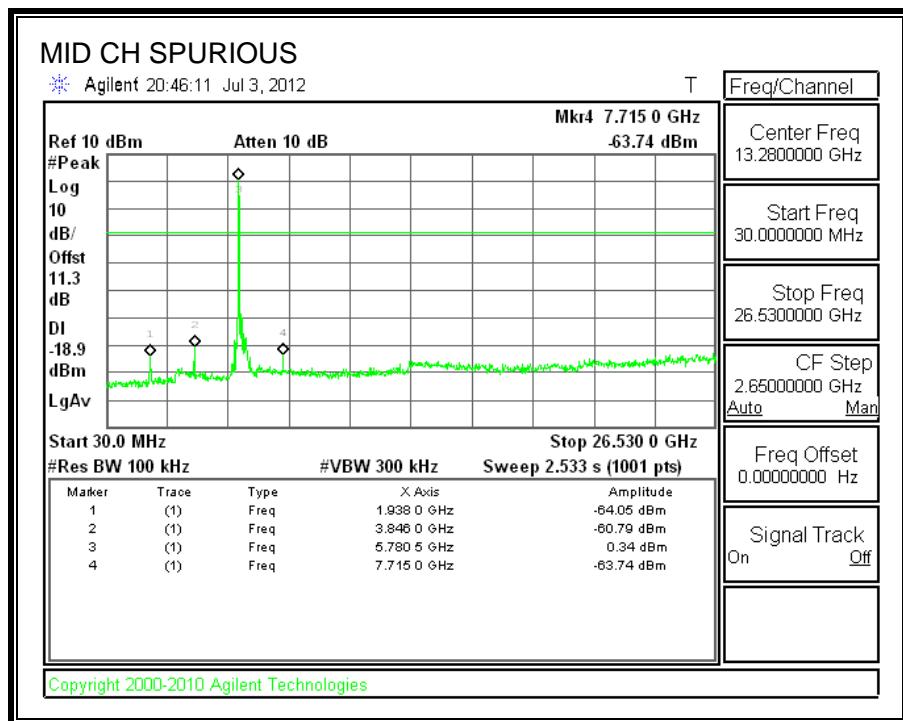
### SPURIOUS EMISSIONS, LOW CHANNEL



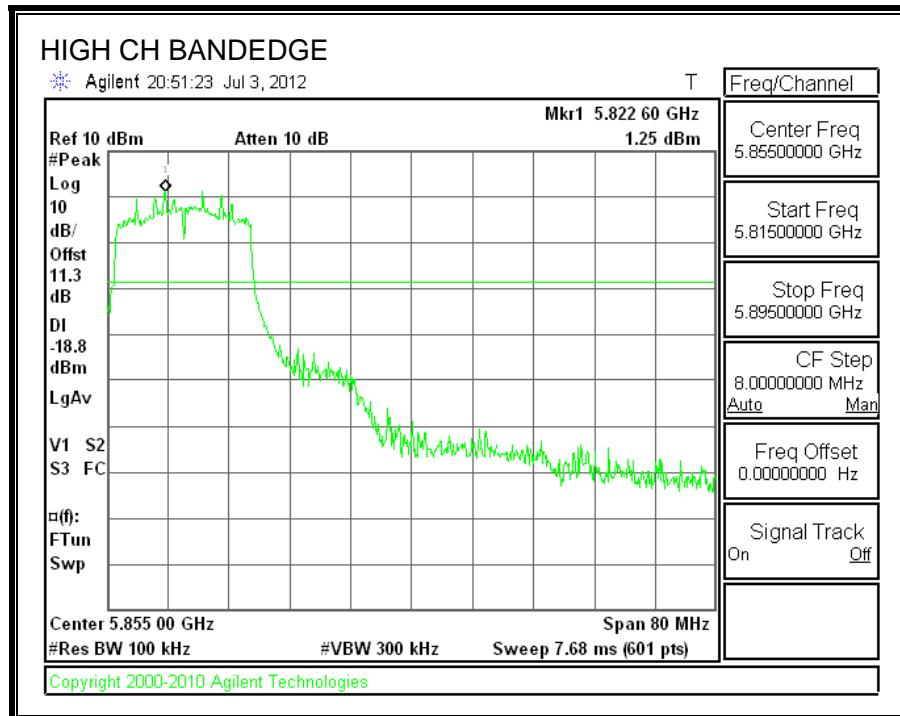


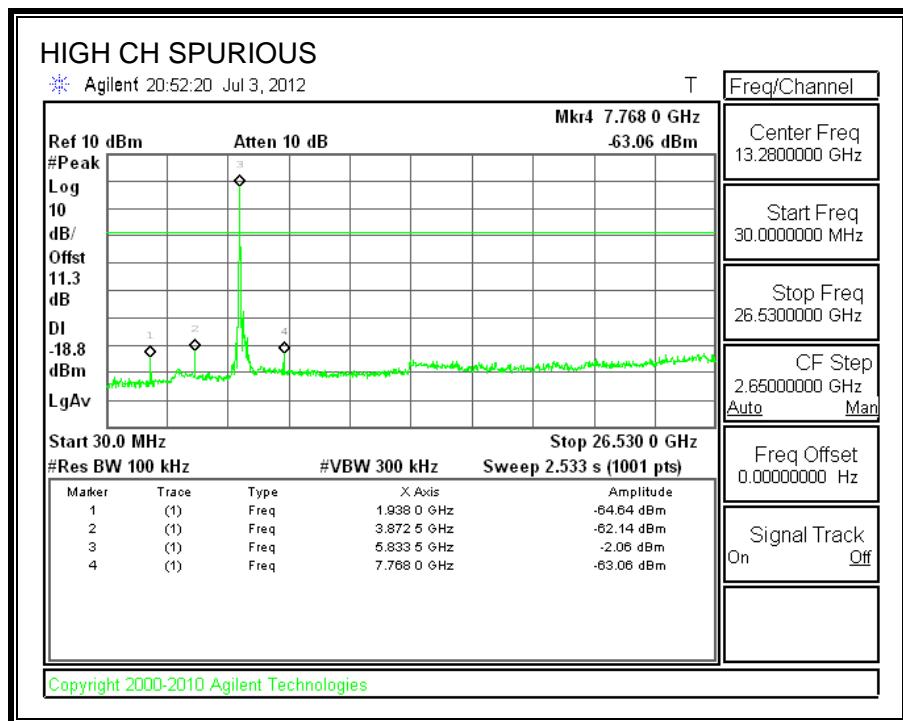
**SPURIOUS EMISSIONS, MID CHANNEL**





**SPURIOUS EMISSIONS, HIGH CHANNEL**





## 8. RADIATED TEST RESULTS

### 8.1. LIMITS AND PROCEDURE

#### LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 7.2.5 (Transmitter)

IC RSS-GEN Clause 6 (Receiver)

Frequency Range (MHz)	Field Strength Limit (uV/m) at 3 m	Field Strength Limit (dBuV/m) at 3 m
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
Above 960	500	54

#### TEST PROCEDURE

The EUT is placed on a non-conducting table 80 cm above the ground plane. The antenna to EUT distance is 3 meters. The EUT is configured in accordance with ANSI C63.4. The EUT is set to transmit in a continuous mode.

For measurements below 1 GHz the resolution bandwidth is set to 100 kHz for peak detection measurements or 120 kHz for quasi-peak detection measurements. Peak detection is used unless otherwise noted as quasi-peak.

For measurements above 1 GHz the resolution bandwidth is set to 1 MHz, then the video bandwidth is set to 1 MHz for peak measurements and 10 Hz for average measurements.

The spectrum from 30 MHz to 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in the 2.4 GHz band.

The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

The frequency range of interest is monitored at a fixed antenna height and EUT azimuth. The EUT is rotated through 360 degrees to maximize emissions received. The antenna is scanned from 1 to 4 meters above the ground plane to further maximize the emission. Measurements are made with the antenna polarized in both the vertical and the horizontal positions.

## 8.2. TRANSMITTER ABOVE 1 GHz

### 8.2.1. TRANSMITTER ABOVE 1 GHz FOR 802.11n HT20 MODE IN THE 5.8 GHz BAND

#### HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement Compliance Certification Services, Fremont 5m Chamber-A															
Company: MITSUMI ELECRTONIC CO. LTD. Project #: 12J14490 Date: 7/5/2012 Test Engineer: MENGISTU MEKURIA Configuration: EUT AND SUPPORT EQUIPMENT Mode: TX, HT20 MODE															
Test Equipment:															
Horn 1-18GHz		Pre-amplifier 1-26GHz		Pre-amplifier 26-40GHz		Horn > 18GHz		Limit							
T73; S/N: 6717 @3m		T144 Miteq 3008A00931				T89; ARA 18-26GHz; S/N:1049		FCC 15.205							
Hi Frequency Cables															
3' cable 22807700		12' cable 22807600		20' cable 22807500		HPF		Reject Filter		Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz					
3' cable 22807700		12' cable 22807600		20' cable 22807500											
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Peak dBuV/m	Avg dBuV/m	Pk Lim dBuV/m	Avg Lim dBuV/m	Pk Mar dB	Avg Mar dB	Notes (V/H)
Low Channel (5745 MHz)															
11.490	3.0	35.9	22.3	38.8	10.7	-35.5	0.0	0.0	49.9	36.3	74	54	-24.1	-17.7	H
11.490	3.0	34.6	21.9	38.8	10.7	-35.5	0.0	0.0	48.6	35.9	74	54	-25.4	-18.1	V
Mid Chanle (5785 MHz)															
11.570	3.0	35.4	22.0	38.9	10.8	-35.5	0.0	0.0	49.6	36.2	74	54	-24.4	-17.8	H
11.570	3.0	36.1	22.7	38.9	10.8	-35.5	0.0	0.0	50.3	36.9	74	54	-23.7	-17.1	V
High Channel (5825 MHz)															
11.650	3.0	37.4	22.6	39.0	10.9	-35.5	0.0	0.0	51.8	37.0	74	54	-22.2	-17.0	H
11.650	3.0	36.9	22.8	39.0	10.9	-35.5	0.0	0.0	51.3	37.2	74	54	-22.7	-16.8	V
Rev. 11.10.11															
f	Measurement Frequency			Amp	Preamp Gain						Avg Lim	Average Field Strength Limit			
Dist	Distance to Antenna			D Corr	Distance Correct to 3 meters						Pk Lim	Peak Field Strength Limit			
Read	Analyzer Reading			Avg	Average Field Strength @ 3 m						Avg Mar	Margin vs. Average Limit			
AF	Antenna Factor			Peak	Calculated Peak Field Strength						Pk Mar	Margin vs. Peak Limit			
CL	Cable Loss			HPF	High Pass Filter										

## 8.1. WORST-CASE BELOW 1 GHz

### SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION)

#### HORIZONTAL AND VERTICAL DATA

Project No:12J14490									
Client Name:Mitsumi Electronic Co. Ltd.									
Model / Device:DWM-W081									
Config / Other:EUT and Support Equipment									
Test By:M. Mekuria									
Horizontal 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	25MHz-1GHz ChnbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
95.9073	46.38	PK	-26.9	9.1	28.58	43.5	-14.92	200	Horz
186.0452	41.45	PK	-26.4	11.2	26.25	43.5	-17.25	100	Horz
407.8038	39.52	PK	-25.3	15.9	30.12	46	-15.88	100	Horz
428.3513	43.77	PK	-25.3	16.5	34.97	46	-11.03	100	Horz
Vertical 30 - 1000MHz									
Test Frequency	Meter Reading	Detector	25MHz-1GHz ChnbrA Amplified.TX (dB)	T243 Sunol Bilog.TXT (dB)	dBuV/m	CFR 47 Part 15 Class B 3m	Margin	Height [cm]	Polarity
191.8605	38.99	PK	-26.3	11.4	24.09	43.5	-19.41	200	Vert
270.1739	38.94	PK	-25.8	13	26.14	46	-19.86	100	Vert
407.9976	37.06	PK	-25.3	15.9	27.66	46	-18.34	200	Vert

## 9. AC POWER LINE CONDUCTED EMISSIONS

### LIMITS

FCC §15.207 (a)

RSS-Gen 7.2.2

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	Quasi-peak	Average
0.15-0.5	66 to 56 <sup>*</sup>	56 to 46 <sup>*</sup>
0.5-5	56	46
5-30	60	50

<sup>\*</sup> Decreases with the logarithm of the frequency.

### TEST PROCEDURE

The EUT is placed on a non-conducting table 40 cm from the vertical ground plane and 80 cm above the horizontal ground plane. The EUT is configured in accordance with ANSI C63.4.

The receiver is set to a resolution bandwidth of 9 kHz. Peak detection is used unless otherwise noted as quasi-peak or average.

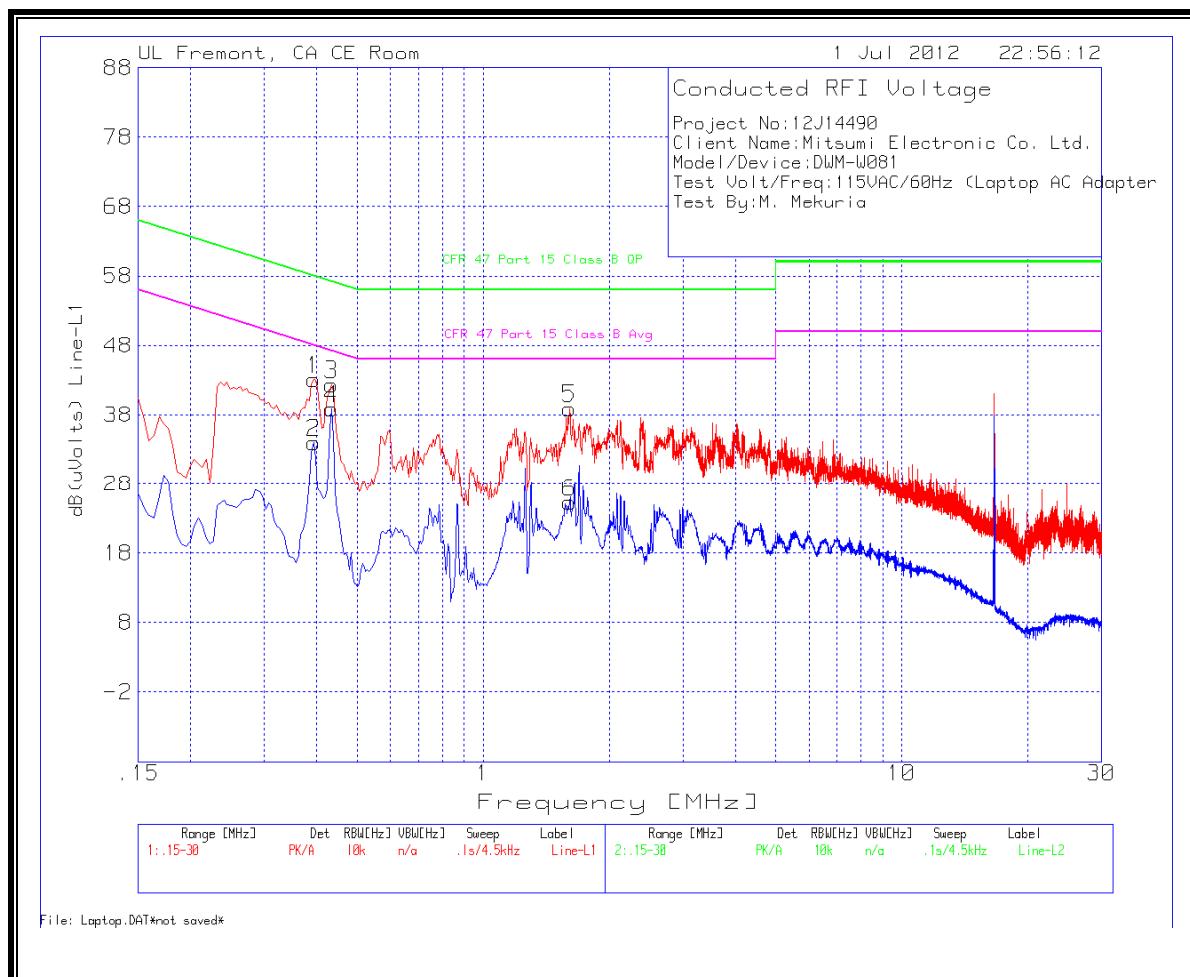
Line conducted data is recorded for both NEUTRAL and HOT lines.

### RESULTS

## **6 WORST EMISSIONS FOR SUPPORT LAPTOP**

Project No:12J14490									
Client Name:Mitsumi Electronic Co. Ltd.									
Model/Device:DWM-W081									
Test Volt/Freq:115VAC/60Hz (Laptop AC Adapter									
Test By:M. Mekuria									
Line-L1 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.393	43.05	PK	0.1	0	43.15	58	-14.85	-	-
0.393	33.96	Av	0.1	0	34.06	-	-	48	-13.94
0.4335	42.29	PK	0.1	0	42.39	57.2	-14.81	-	-
0.4335	38.76	Av	0.1	0	38.86	-	-	47.2	-8.34
1.608	38.74	PK	0.1	0.1	38.94	56	-17.06	-	-
1.608	25.15	Av	0.1	0.1	25.35	-	-	46	-20.65
e-L2 .15 - 30MHz									
Test Frequency	Meter Reading	Detector	T24 IL L1.TXT (dB)	LC Cables 1&3.TXT (dB)	dB(uVolts)	CFR 47 Part 15 Class B QP	Margin	CFR 47 Part 15 Class B Avg	Margin
0.429	45.18	PK	0.1	0	45.28	57.3	-12.02	-	-
0.429	37.3	Av	0.1	0	37.4	-	-	47.3	-9.9
0.5415	42.87	PK	0.1	0	42.97	56	-13.03	-	-
0.5415	18.93	Av	0.1	0	19.03	-	-	46	-26.97
0.699	40.43	PK	0.1	0	40.53	56	-15.47	-	-
0.699	23.11	Av	0.1	0	23.21	-	-	46	-22.79

**LINE 1 RESULTS**



**LINE 2 RESULTS**

