



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

CERTIFICATION TEST REPORT

FOR

WIFI MODULE

MODEL NUMBER: DWM-W081

FCC ID: EW4DWMW081

IC: 4250A-DWMW081

REPORT NUMBER: 12J14490-1, REVISION

ISSUE DATE: JULY 24, 2012

Prepared for
**MITSUMI ELECTRIC CO., LTD.
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NVLAP LAB CODE 200065-0

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 E	Pass
INDUSTRY CANADA RSS-210 Issue 8 Annex 9	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.

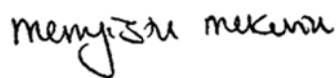
Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL CCS and all revisions are duly noted in the revisions section. Any alteration of this 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:



THU CHAN
EMC SUPERVISOR
UL CCS

Tested By:



MENGISTU MEKURIA
EMC ENGINEER
UL CCS

2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with FCC CFR 47 Part 2, FCC CFR 47 Part 15, FCC 06-96, FCC KDB 789033, ANSI C63.10-2009, 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 conducted output power as follows:

Frequency Range (MHz)	Mode	Output Power (dBm)	Output Power (mW)
5180 – 5240	802.11n HT20	11.49	14.09

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

Radiated emissions for EUT with antenna was performed and passed; therefore, antenna port spurious was not performed.

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

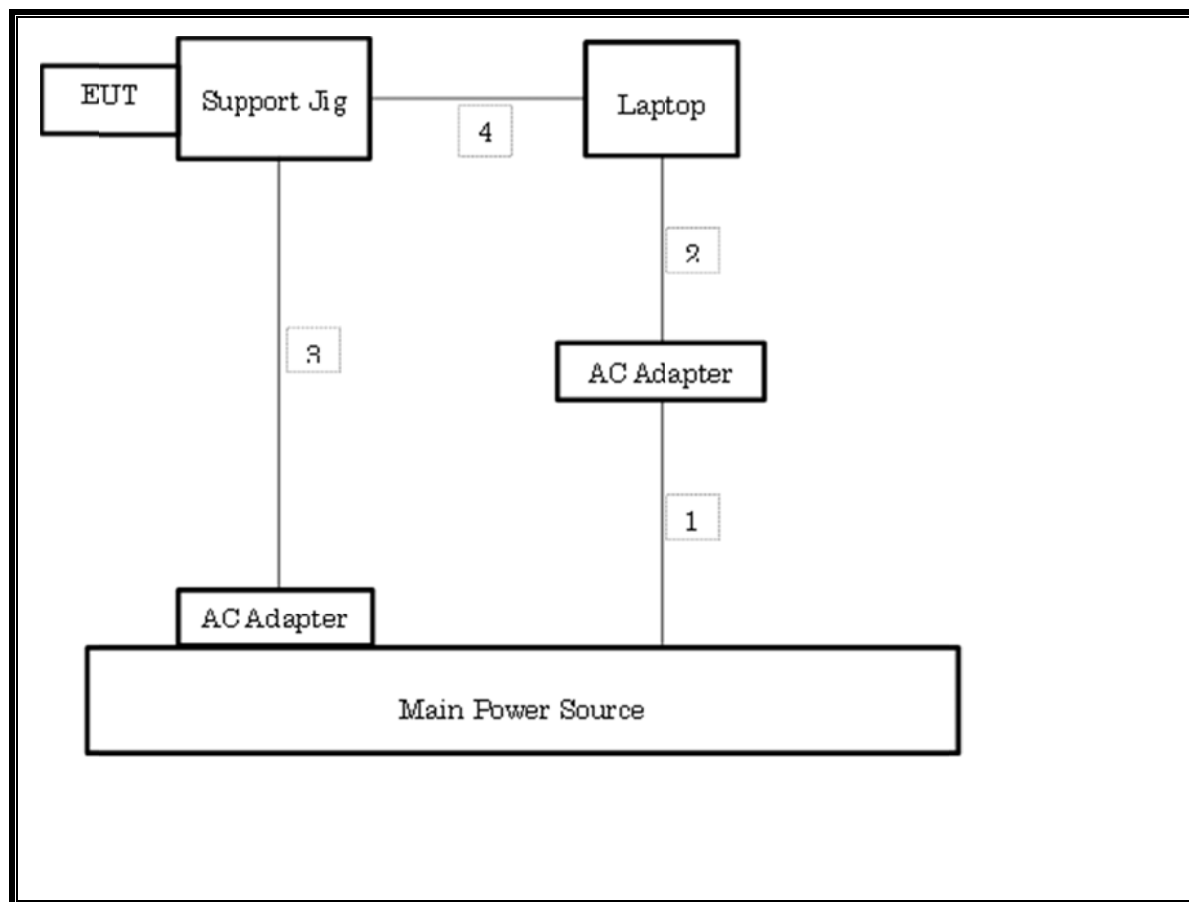
I/O CABLES

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
Preamp, 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, 5.15-5.35 GHz	Micro-Tronics	BRC13190	N02680	CNR

7. ON TIME, DUTY CYCLE AND MEASUREMENT METHODS

LIMITS

None; for reporting purposes only.

PROCEDURE

KDB 789033 Zero-Span Spectrum Analyzer Method.

7.1.1. ON TIME AND DUTY CYCLE RESULTS

Mode	ON Time B (msec)	Period (msec)	Duty Cycle x (linear)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)	1/B Minimum VBW (kHz)
802.11n HT20	1.34	1.44	0.931	93.1%	0.31	0.746

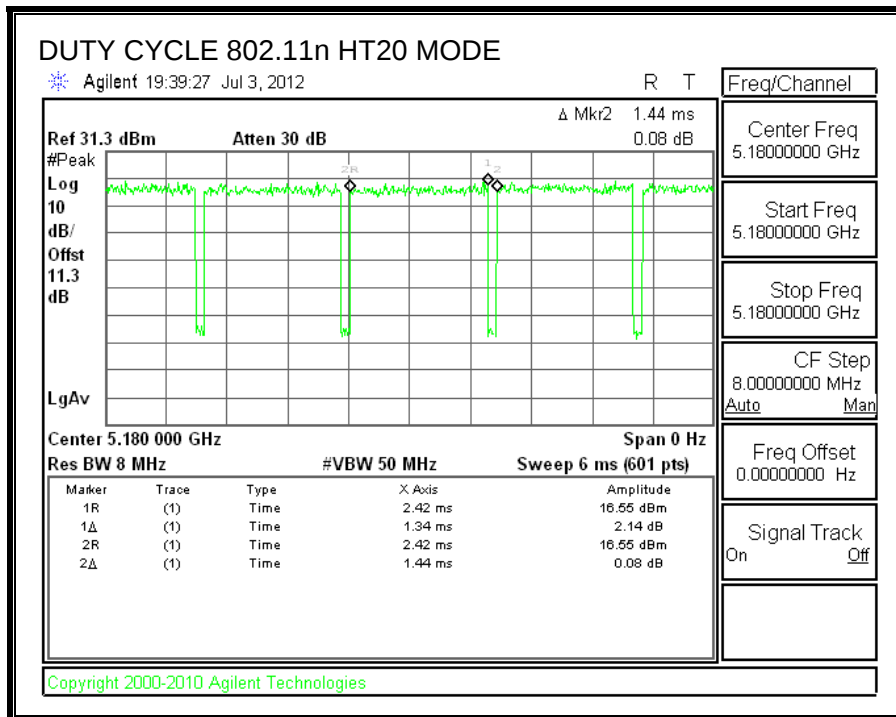
7.1.2. MEASUREMENT METHOD FOR POWER AND PPSD

The Duty Cycle is less than 98% and consistent therefore KDB 789033 Method SA-2 is used.

7.1.3. MEASUREMENT METHOD FOR AVERAGE SPURIOUS EMISSIONS ABOVE 1 GHz

The Duty Cycle is less than 98% and consistent, KDB 789033 Method AD with Power RMS Averaging and duty cycle correction is used.

7.1.4. DUTY CYCLE PLOTS



8. ANTENNA PORT TEST RESULTS

8.1. 802.11n HT20 MODE IN THE 5.2 GHz BAND

8.1.1. 26 dB BANDWIDTH

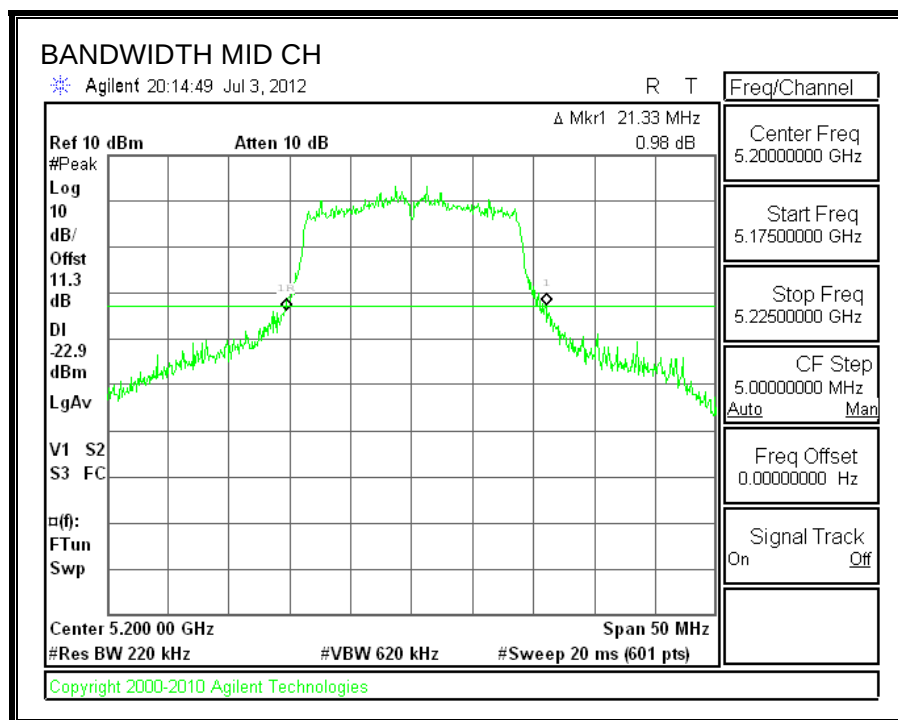
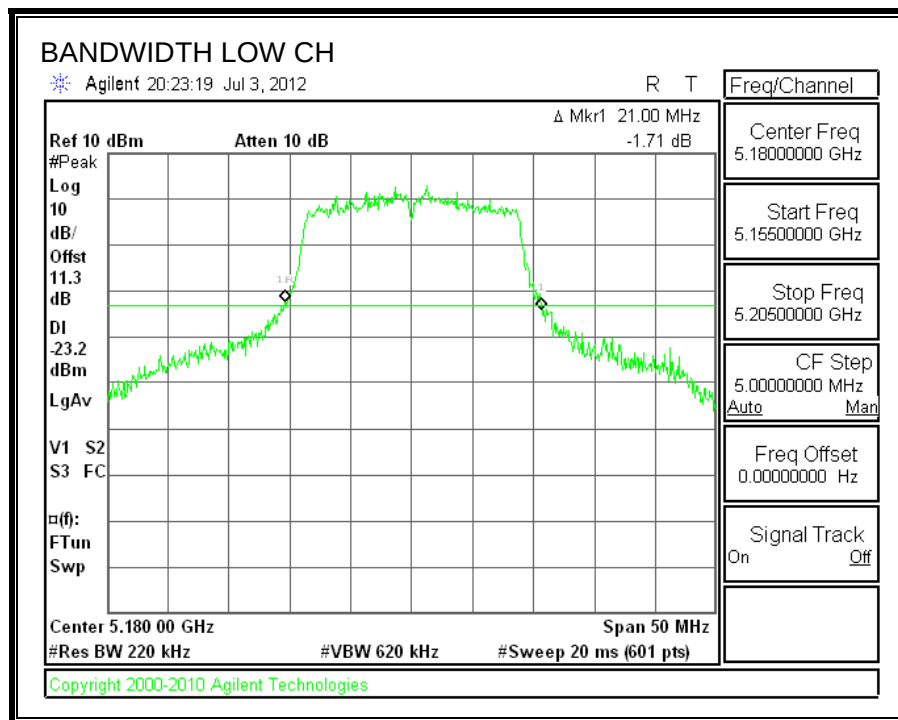
LIMITS

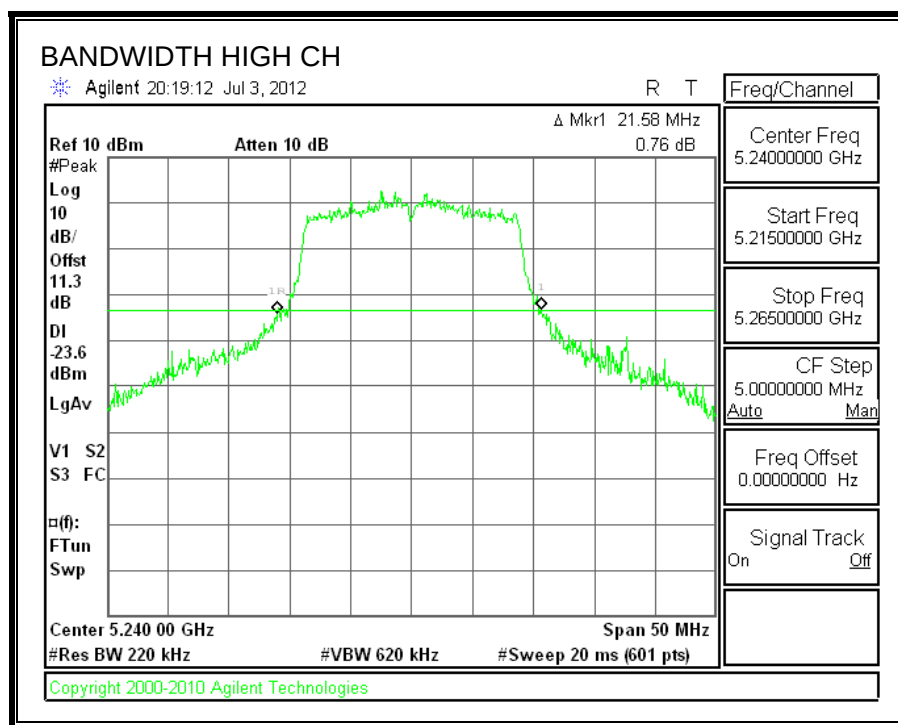
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	26 dB Bandwidth (MHz)
Low	5180	21.00
Mid	5200	21.33
High	5240	21.58

26 dB BANDWIDTH





8.1.2. 99% BANDWIDTH

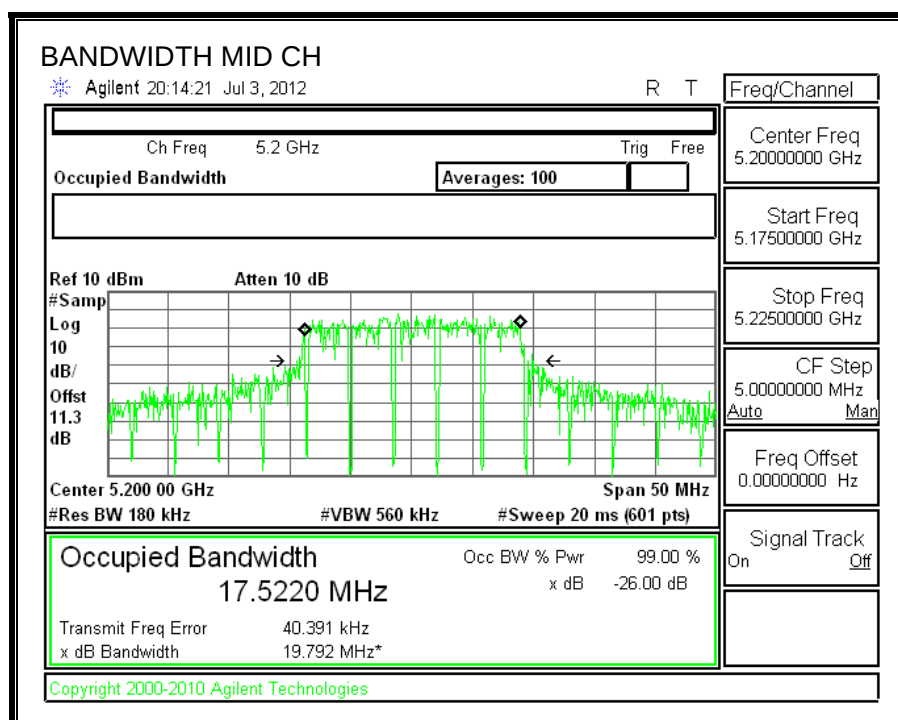
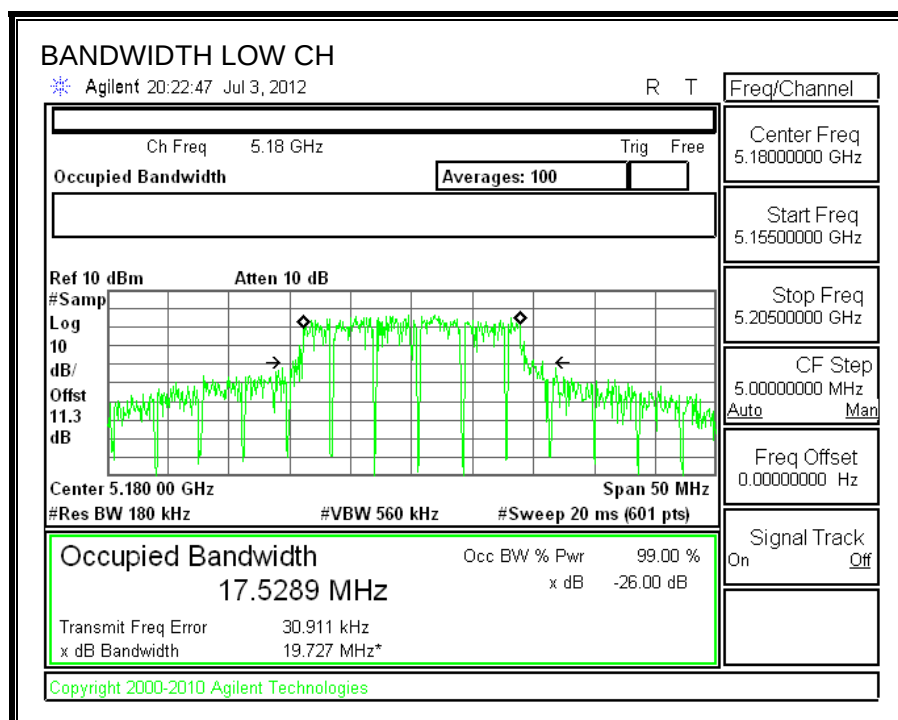
LIMITS

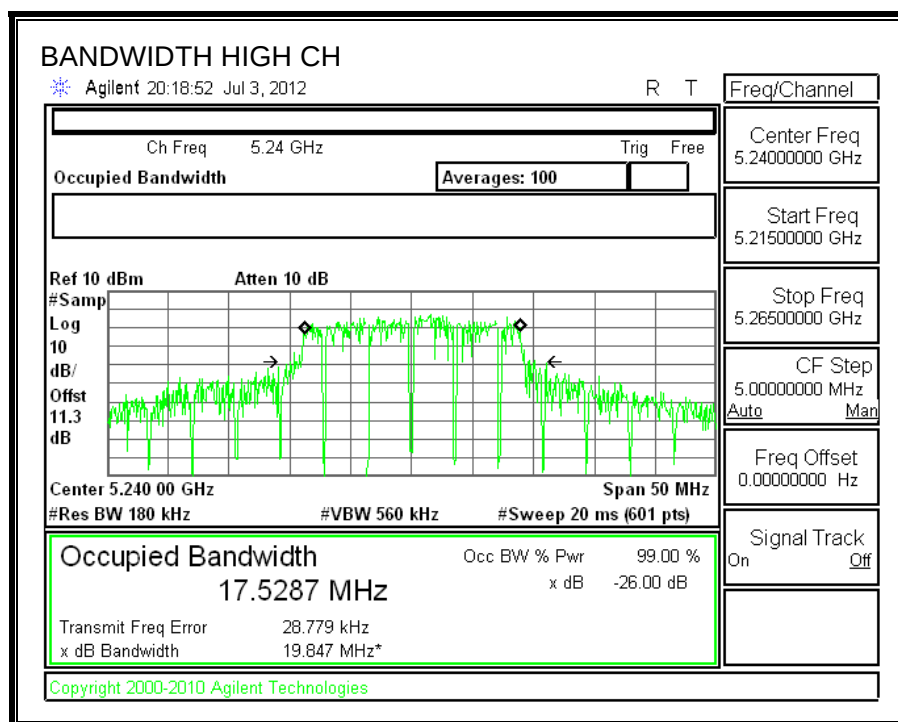
None; for reporting purposes only.

RESULTS

Channel	Frequency (MHz)	99% Bandwidth (MHz)
Low	5180	17.5289
Mid	5200	17.5220
High	5240	17.5287

99% BANDWIDTH





8.1.3. AVERAGE POWER

LIMITS

None; for reporting purposes only.

TEST PROCEDURE

The transmitter output is connected to a power meter.

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.

RESULTS

Channel	Frequency (MHz)	Power (dBm)
Low	5180	10.85
Mid	5200	10.43
High	5240	10.38

8.1.4. OUTPUT POWER AND PPSD

LIMITS

FCC §15.407 (a) (1)

IC RSS-210 A9.2 (1)

For the band 5.15–5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed the lesser of 50 mW or $4 \text{ dBm} + 10 \log B$, where B is the 99% emission bandwidth for IC (26dB emission bandwidth for FCC) in MHz. In addition, the peak power spectral density shall not exceed 4 dBm in any 1-MHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the peak power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

DIRECTIONAL ANTENNA GAIN

There is only one transmitter output therefore the directional gain is equal to the antenna gain.

RESULTS

Limits

Channel	Frequency (MHz)	Fixed Limit (dBm)	B (MHz)	4 + 10 Log B Limit (dBm)	Directional Gain (dBi)	Power Limit (dBm)	PPSD Limit (dBm)
Low	5180	17	17.53	16.44	2.55	16.44	4.00
Mid	5200	17	17.52	16.44	2.55	16.44	4.00
High	5240	17	17.53	16.44	2.55	16.44	4.00

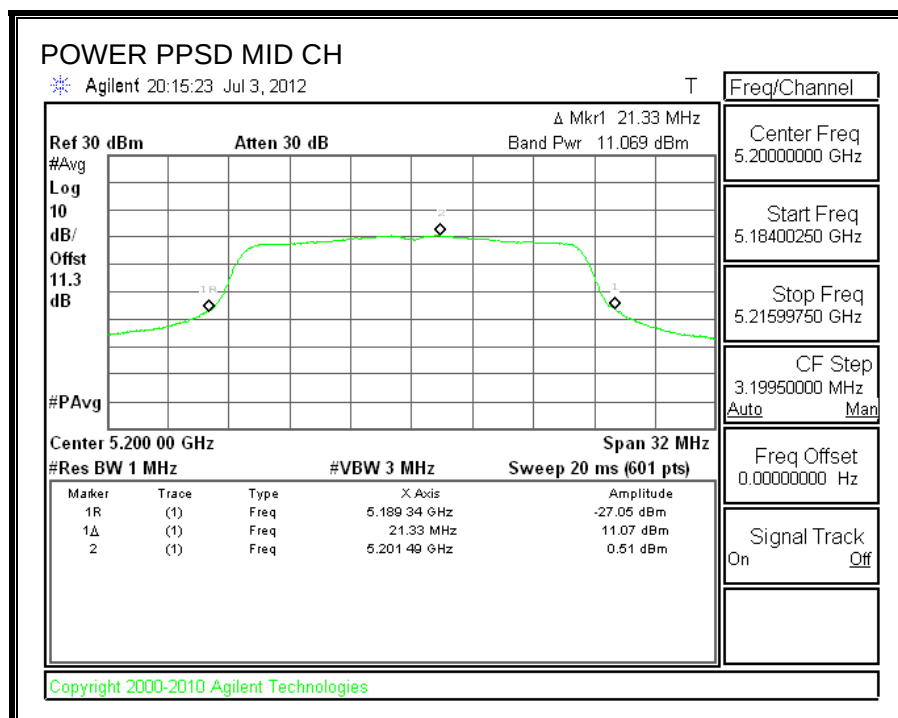
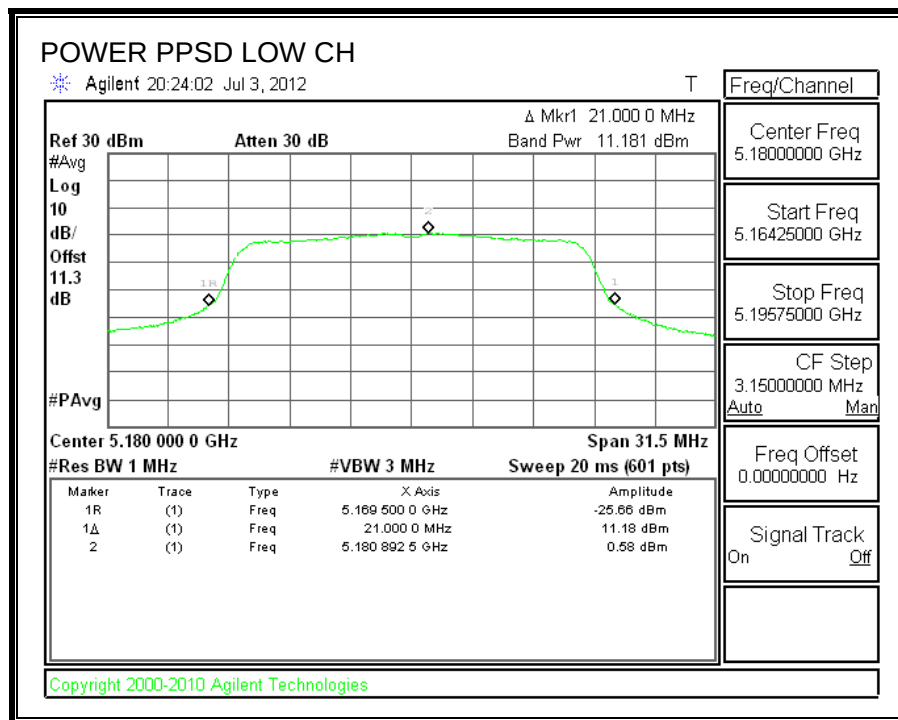
Duty Cycle CF (dB)	0.31	Included in Calculations of Corr'd Power &PPSD
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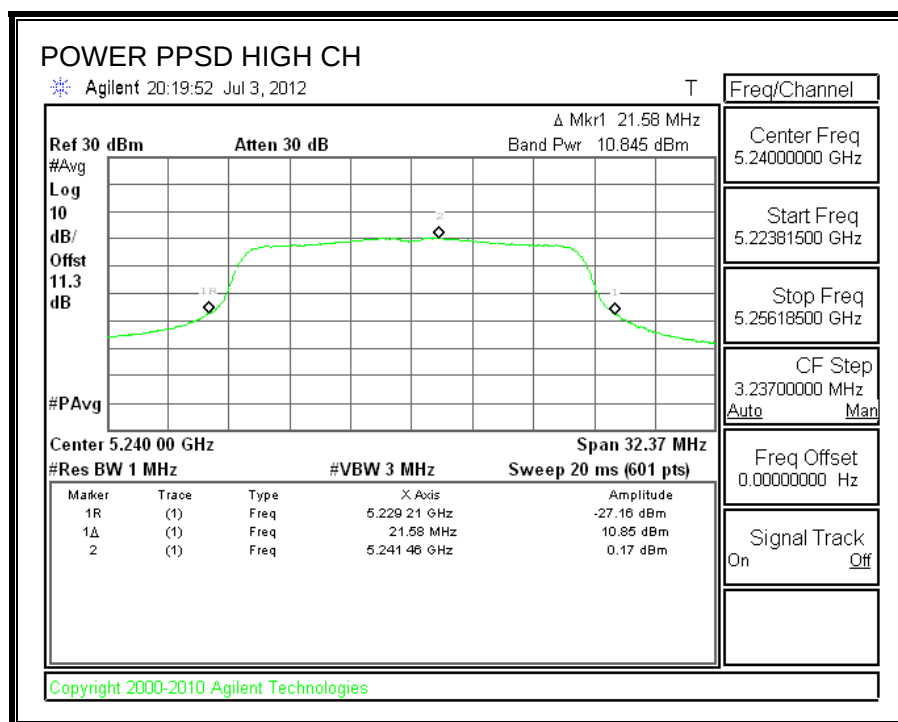
Output Power Results

Channel	Frequency (MHz)	Meas Power (dBm)	Corr'd Power (dBm)	Power Limit (dBm)	Power Margin (dB)
Low	5180	11.181	11.49	16.44	-4.95
Mid	5200	11.069	11.38	16.44	-5.06
High	5240	10.845	11.16	16.44	-5.28

PPSD Results

Channel	Frequency (MHz)	Meas PPSD (dBm)	Corr'd PPSD (dBm)	PPSD Limit (dBm)	PPSD Margin (dB)
Low	5180	0.58	0.89	4.00	-3.11
Mid	5200	0.51	0.82	4.00	-3.18
High	5240	0.17	0.48	4.00	-3.52





8.1.5. PEAK EXCURSION

LIMITS

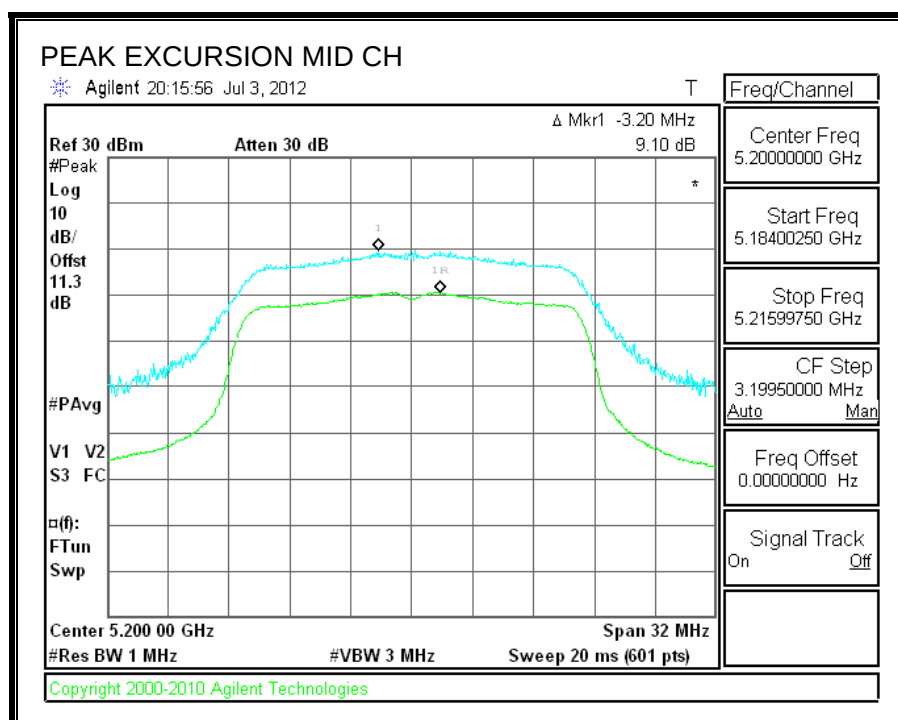
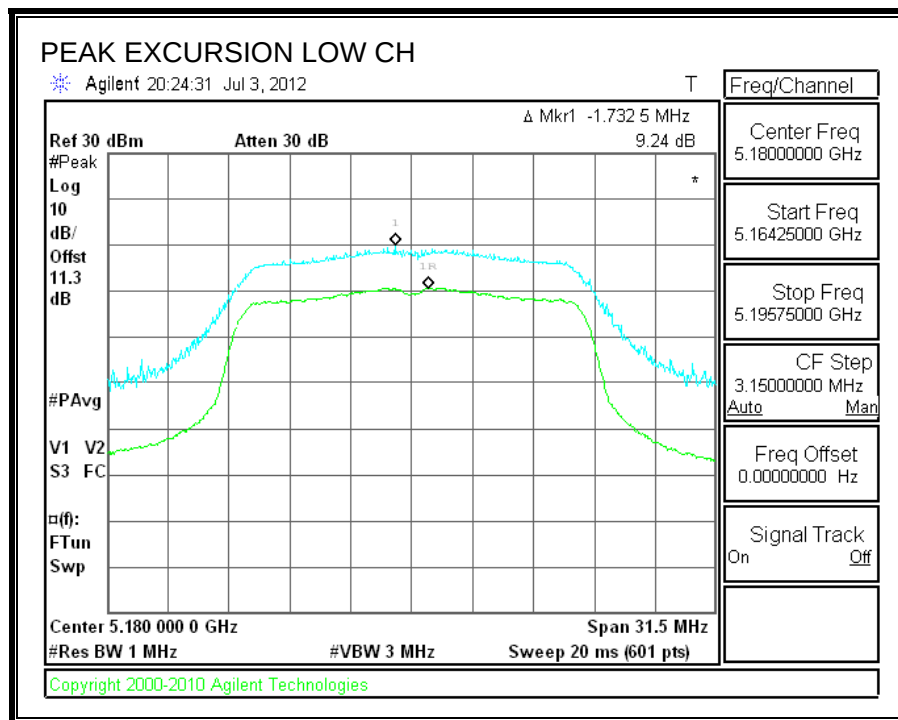
FCC §15.407 (a) (6)

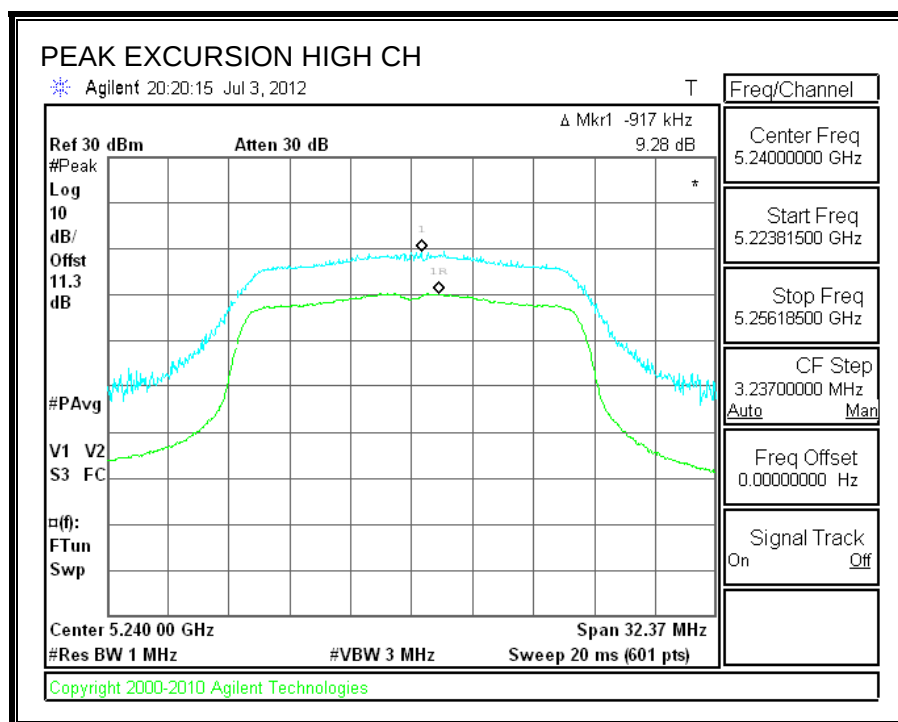
The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the peak transmit power (measured as specified above) shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

RESULTS

Channel	Frequency (MHz)	PK Level (dBm)	Limit (dB)	Margin (dB)
Low	5180	9.24	13	-3.76
Mid	5200	9.10	13	-3.90
High	5240	9.28	13	-3.72

PEAK EXCURSION





9. RADIATED TEST RESULTS

9.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-GEN 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.

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.

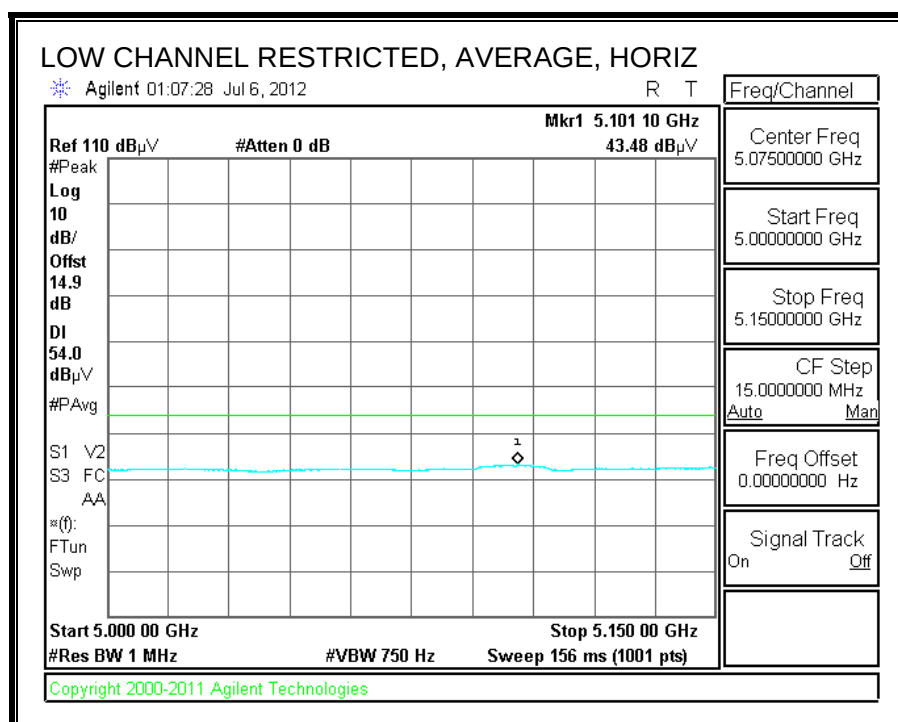
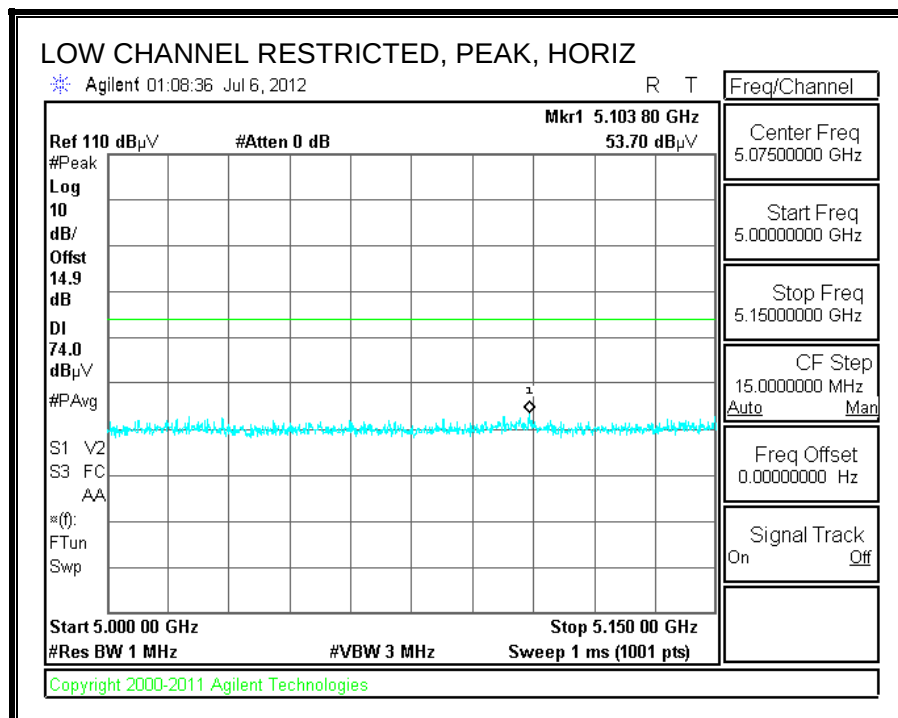
For measurements above 1 GHz the resolution bandwidth is set to 1 MHz; the video bandwidth is set to 1 MHz for peak measurements and as applicable for average measurements.

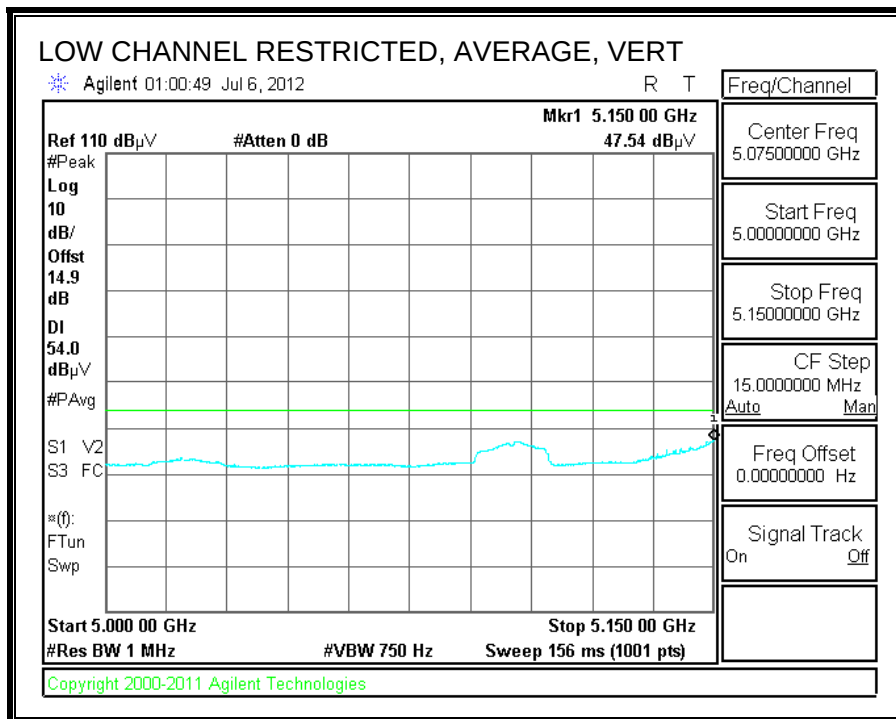
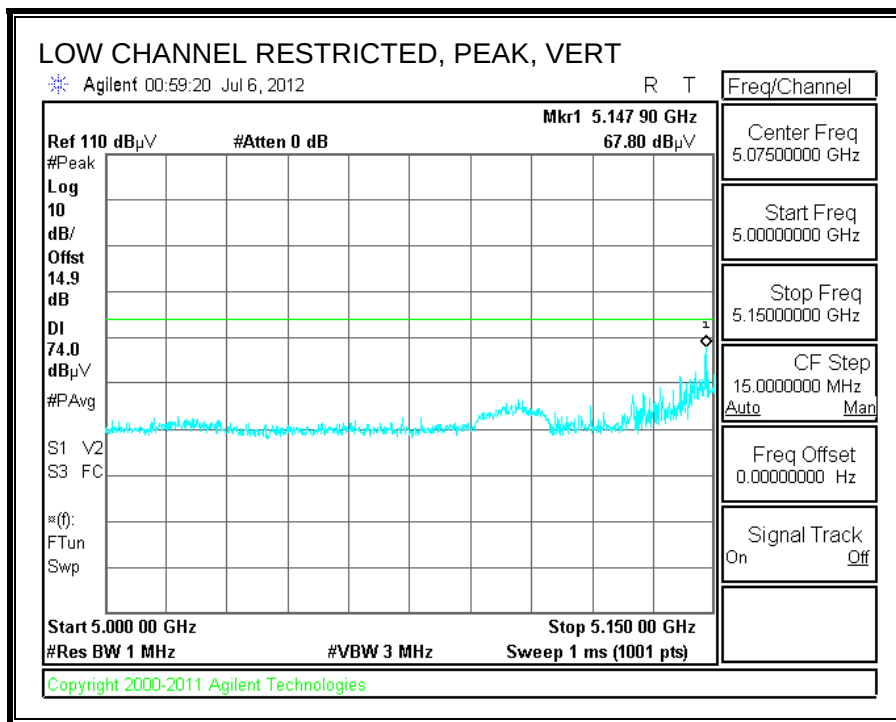
The spectrum from 30 MHz to 40 GHz is investigated with the transmitter set to the lowest, middle, and highest channels in each applicable band.

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.

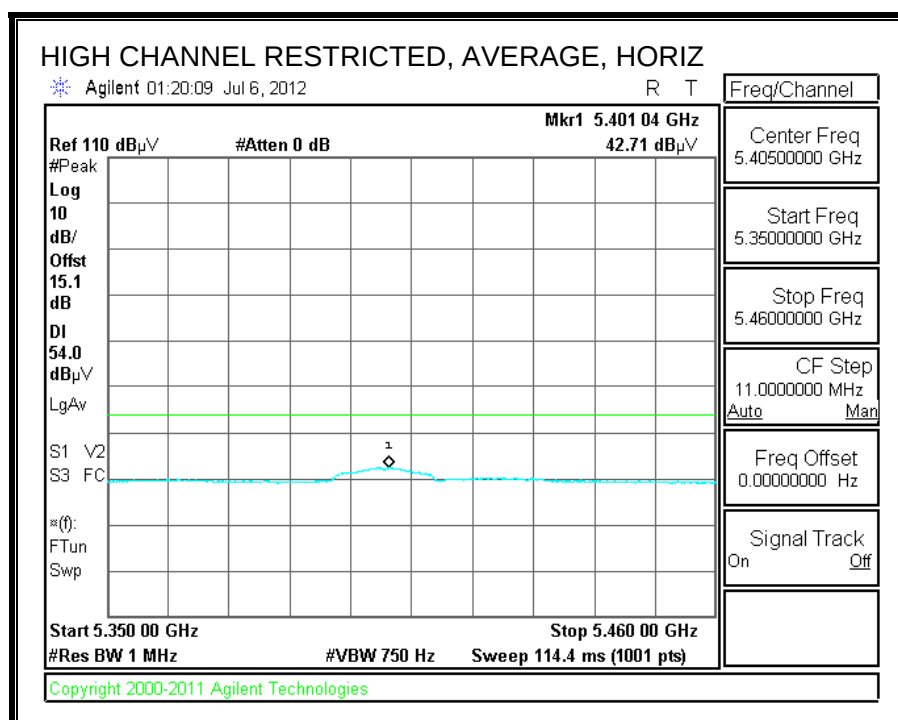
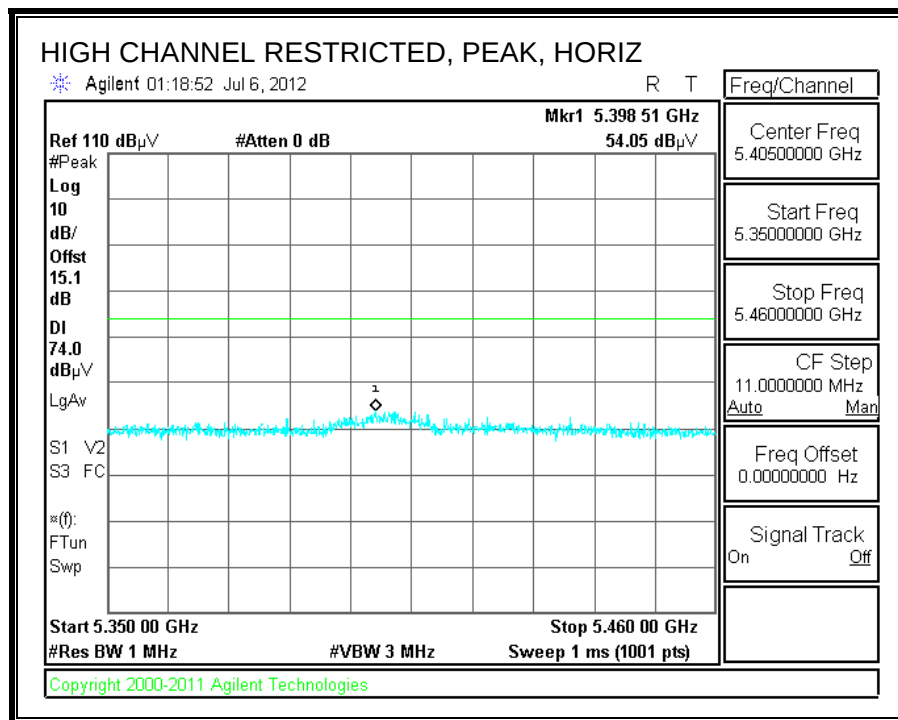
9.2. TX ABOVE 1 GHz 802.11n HT20 MODE IN THE 5.2 GHz BAND

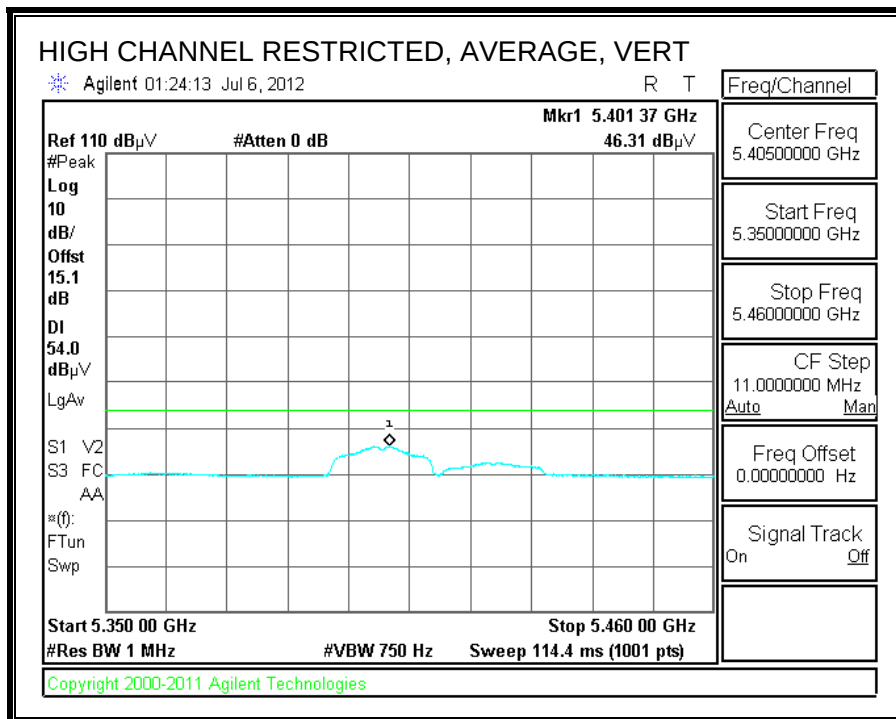
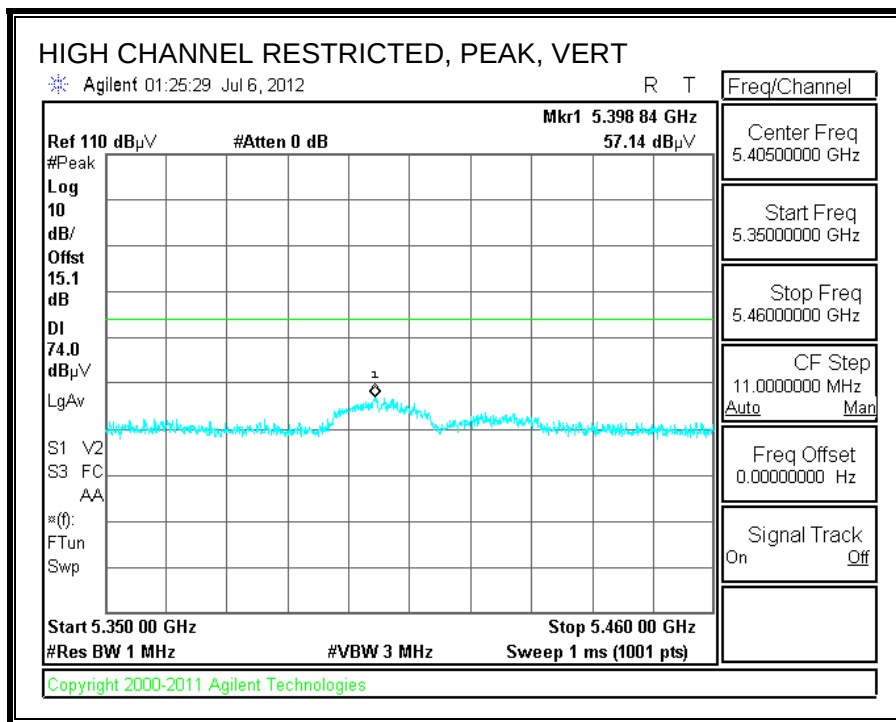
RESTRICTED BANDEDGE (LOW CHANNEL)





RESTRICTED BANDEDGE (HIGH CHANNEL)





HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement																	
Compliance Certification Services, Fremont 5m Chamber-A																	
Company:		MITSUMI ELECTRONIC 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	
3' cable 22807700				12' cable 22807600				20' cable 22807500								R_001	
Peak Measurements RBW=VBW=1MHz Average Measurements RBW=1MHz ; VBW=10Hz																	
f GHz	Dist (m)	Read Pk dBuV	Read Avg. dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filtr 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 (5180 MHz)																	
15.540	3.0	36.1	23.8	39.0	12.2	-34.0	0.0	0.0	53.3	41.0	74	54	-20.7	-13.0	H		
15.540	3.0	36.4	23.7	39.0	12.2	-34.0	0.0	0.0	53.5	40.8	74	54	-20.5	-13.2	V		
Mid Channel (5200 MHz)																	
15.600	3.0	36.4	23.6	38.8	12.2	-34.0	0.0	0.0	53.5	40.6	74	54	-20.5	-13.4	H		
15.600	3.0	36.1	23.6	38.8	12.2	-34.0	0.0	0.0	53.1	40.7	74	54	-20.9	-13.3	V		
High Channel (5240 MHz)																	
15.720	3.0	35.8	22.9	38.4	12.3	-34.0	0.0	0.0	52.5	39.7	74	54	-21.5	-14.3	H		
15.720	3.0	35.1	23.0	38.4	12.3	-34.0	0.0	0.0	51.8	39.8	74	54	-22.2	-14.2	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										

9.3. 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 ChmbrA 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 ChmbrA 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

10. 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 [*]	56 to 46 [*]
0.5-5	56	46
5-30	60	50

^{*} 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.

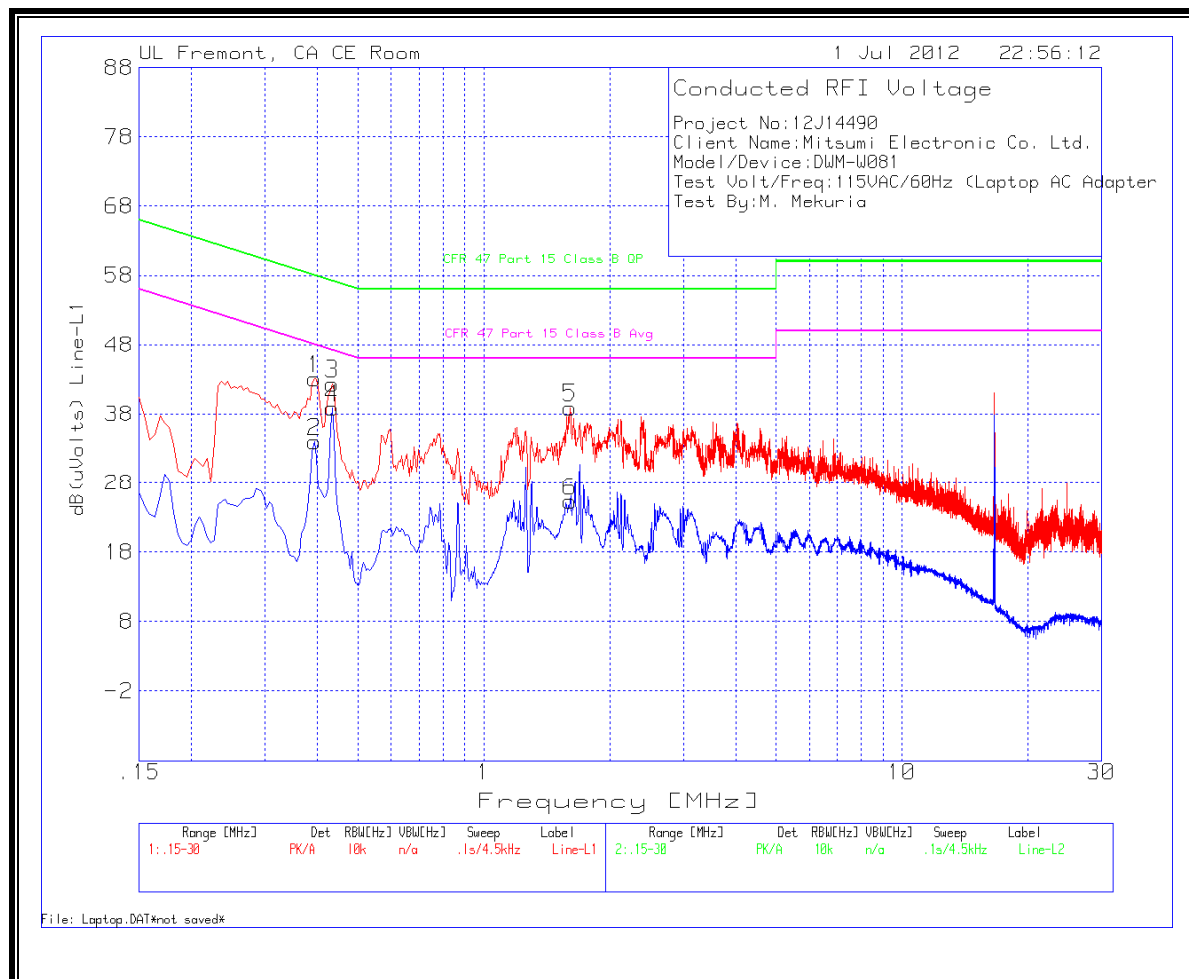
Line conducted data is recorded for both NEUTRAL and HOT lines.

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

