FCC CFR47 PART 15 SUBPART C
INDUSTRY CANADA RSS-210 ISSUE 7

CERTIFICATION TEST REPORT

FOR

ALTIERRE TETHERED DEVICE

MODEL NUMBER: ATD100

FCC ID: W22- ATD100
IC: 9005A- ATD100

REPORT NUMBER: 10U13260-1, Revision A

ISSUE DATE: AUGUST 05, 2010

Prepared for
ALTIERRE CORPORATION
1980 CONDOURSE DRIVE
SAN JOSE, CA 95131, U.S.A.

Prepared by
COMPLIANCE CERTIFICATION SERVICES
47173 BENICIA STREET
FREMONT, CA 94538, U.S.A.
TEL: (510) 771-1000
FAX: (510) 661-0888

NVLAP LAB CODE 200065-0

Revision History

Rev.	Issue Date	Revisions	Revised By
--	07/26/2010	Initial Issue	T. Chan
A	08/05/2010	Revised The Sign Of Preamp Test Data On Page 26	T. Chan

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME: ALTIERRE CORPORATION
1980 CONDOURSE DRIVE
SAN JOSE, CA 95131, USA

EUT DESCRIPTION: ALTIERRE TETHERED DEVICE TO REGISTER 2.4GHZ ELECTRONIC SHELF LABEL TAGS

MODEL: ADT100

SERIAL NUMBER: 101

DATE TESTED: JULY 19 – 22, 2010

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
CFR 47 Part 15 Subpart C	Pass
INDUSTRY CANADA RSS-210 Issue 7 Annex 8	Pass
INDUSTRY CANADA RSS-GEN Issue 2	Pass

Compliance Certification Services, Inc. (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 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 CCS and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by 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 CCS By:

THU CHAN
ENGINEERING MANAGER
COMPLIANCE CERTIFICATION SERVICES

Tested By:

WILLIAM ZHUANG
EMC ENGINEER
COMPLIANCE CERTIFICATION SERVICES

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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 2, and RSS-210 Issue 7.

3. FACILITIES AND ACCREDITATION

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

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:

Field Strength (dBuV/m) = Measured Voltage (dBuV) + Antenna Factor (dB/m) + Cable Loss (dB) – Preamp Gain (dB)

36.5 dBuV + 18.7 dB/m + 0.6 dB – 26.9 dB = 28.9 dBuV/m

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%.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

Altierre Tethered Device (ATD) is a short range radio to provision Altierre Electronic Shelf Labels such as the ATAG400. The ATD makes use of a short range 100MHz loop to identify an Altierre electronic shelf label. Then the ATD uses a 2.4GHz RF link to provision and load data into the Altierre electronic shelf labels.

The radio module is manufactured by Altierre Corp.

5.2. MAXIMUM OUTPUT POWER

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

Frequency (MHz)	Mode	Output Power (dBm)	Output Power (mW)
2434.5	DSSS	15.27	33.65

5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes an external antenna, with a maximum gain of -1 dBi.

5.4. SOFTWARE AND FIRMWARE

The software and firmware installed in the EUT during testing was Test Software 2.4.1.

5.5. WORST-CASE CONFIGURATION AND MODE

The worst-case channel is determined as the channel with the highest output power.

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5.6. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

PERIPHERAL SUPPORT EQUIPMENT LIST				
Description	Manufacturer	Model	Serial Number	FCC ID
Laptop	Lenovo	0673BHU	L3-AT761 0709	Doc
AC Adapter	Lenovo	92P1156	11S92P1156Z1DX	Doc

I/O CABLES

I/O CABLE LIST						
Cable No.	Port	# of Identica Ports	Connector Type	Cable Type	Cable Length	Remarks
1	AC	1	US115V	Unshielded	1.0m	
2	DC	1	JACK	Unshielded	1.80m	
3	USB	1	USB	Unshielded	1.2m	

TEST SETUP

The EUT is a stand alone device and all support equipments should be in the shielded box during the test

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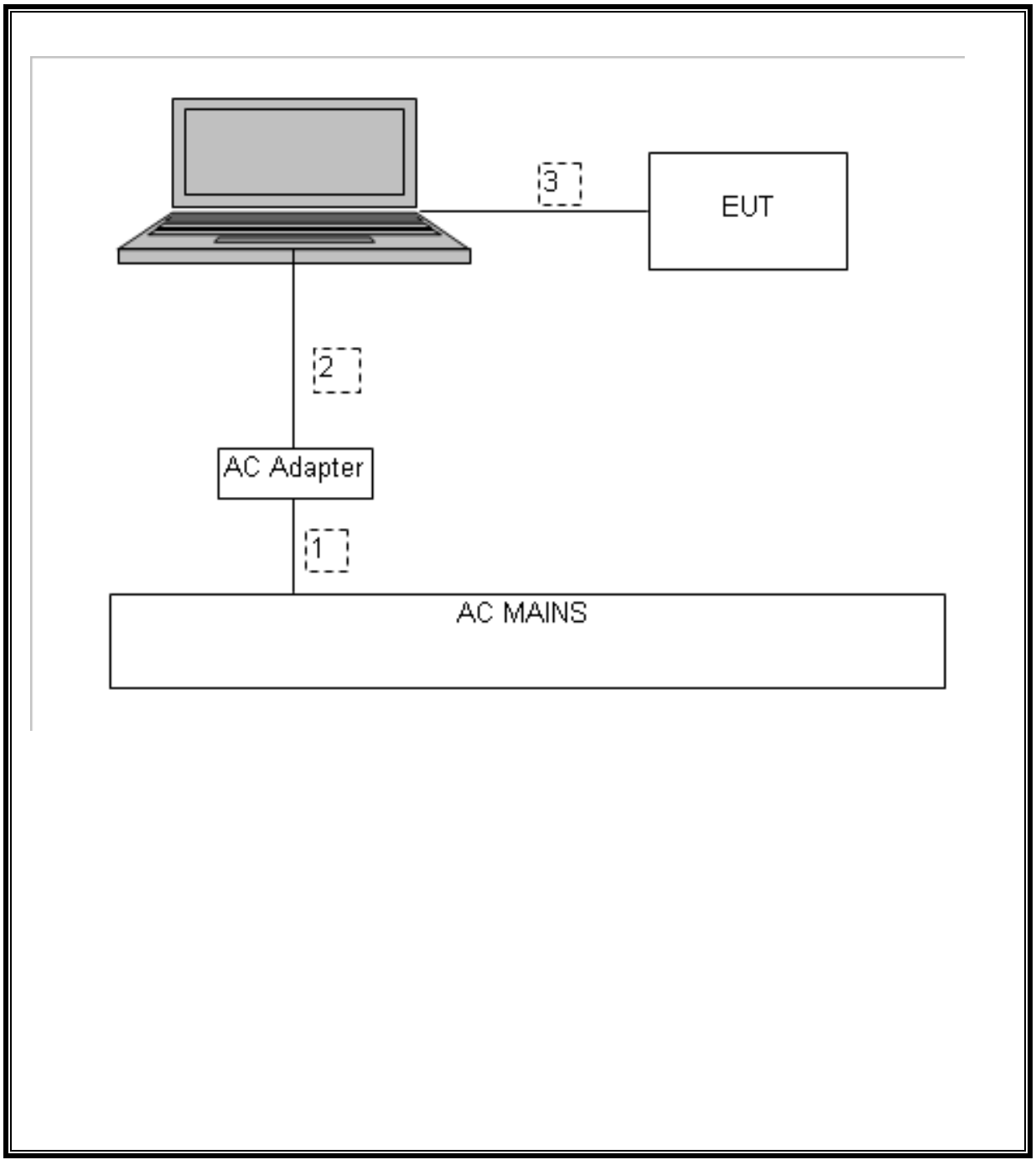
SETUP DIAGRAM FOR TESTS



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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, 44 GHz	Agilent / HP	E4446A	C01159	05/08/11
Spectrum Analyzer, 26.5 GHz	Agilent / HP	E4440A	C01178	08/31/10
Antenna, Horn, 18 GHz	EMCO	3115	C00783	07/29/10
Preamplifier, 26.5 GHz	Agilent / HP	8449B	C01063	08/04/10
Antenna, Bilog, 2 GHz	Sunol Sciences	JB1	C01016	07/14/11
Preamplifier, 1300 MHz	Agilent / HP	8447D	C00580	07/06/11
Peak Power Meter	Agilent / HP	E4416A	C00963	12/04/11
Peak / Average Power Sensor	Agilent / HP	E9327A	C00964	12/04/11
EMI Test Receiver, 30 MHz	R & S	ESHS 20	N02396	05/06/11
LISN, 30 MHz	FCC	LISN-50/250-25-2	N02625	11/06/10
LISN, 10 kHz ~ 30 MHz	Solar	8012-50-R-24-BNC	N02481	11/05/10

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7. ANTENNA PORT TEST RESULTS

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

The transmitter output is connected to a spectrum analyzer. The RBW is set to 100 kHz and the VBW is set to 300 kHz. The sweep time is coupled.

RESULTS

Frequency (MHz)	6 dB Bandwidth (MHz)	Minimum Limit (MHz)
2434.5	3.567	0.5

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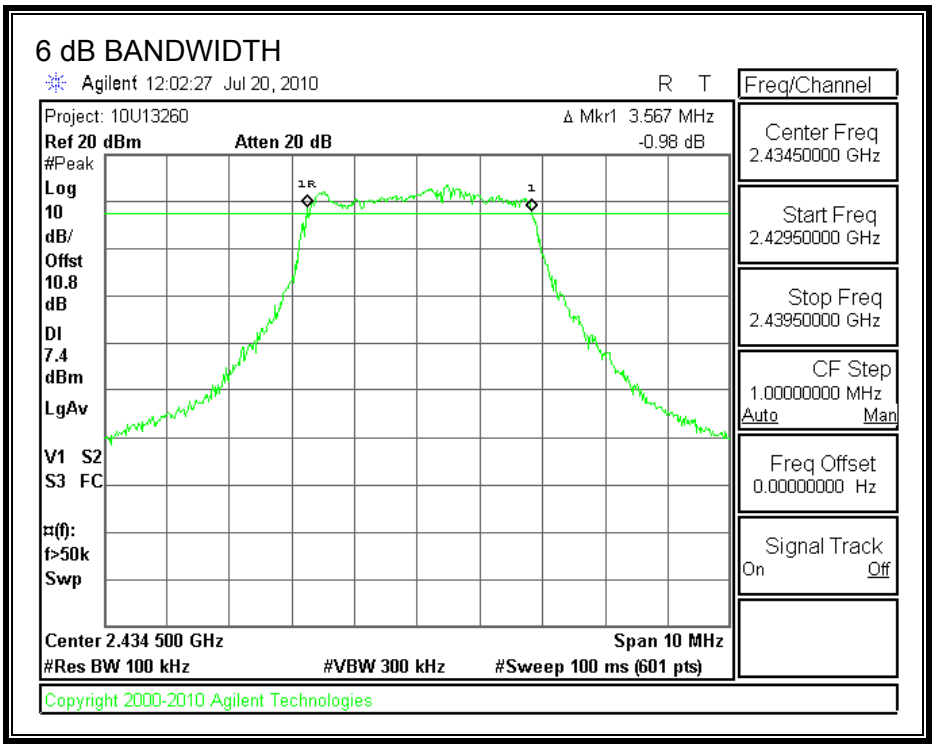
6 dB BANDWIDTH



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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

Frequency (MHz)	99% Bandwidth (MHz)
2434.5	3.5688

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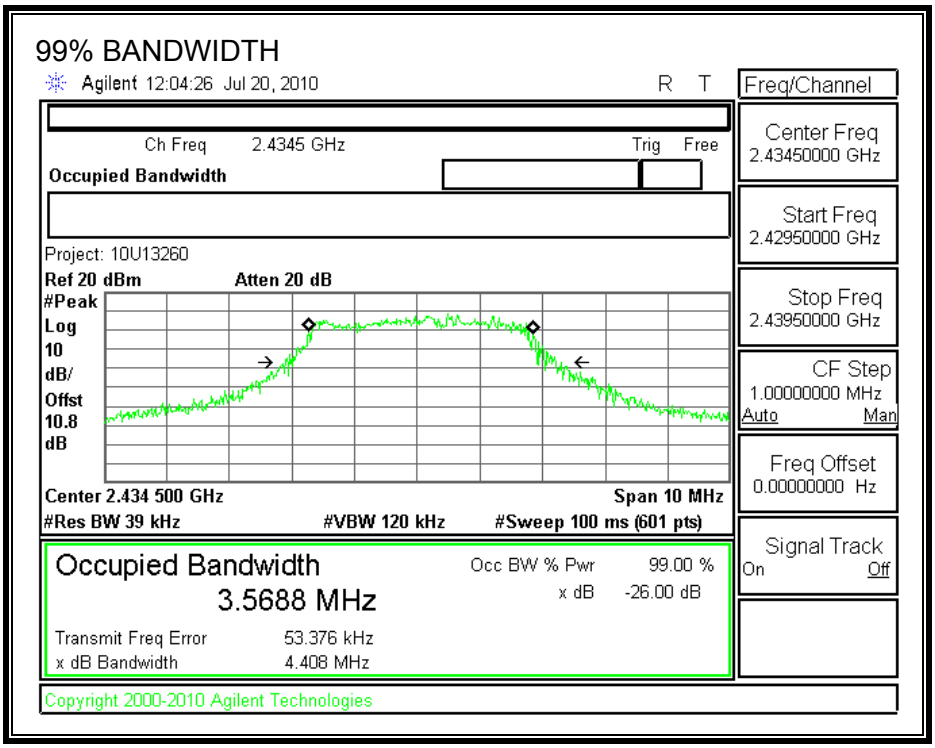
99% BANDWIDTH



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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

The transmitter output is connected to a power meter.

RESULTS

The cable assembly insertion loss of 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Frequency (MHz)	Power (dBm)
2434.5	15.37

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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 10.8 dB (including 10 dB pad and 0.8 dB cable) was entered as an offset in the power meter to allow for direct reading of power.

Frequency (MHz)	Power (dBm)
2434.5	8.69

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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

Output power was measured based on the use of a peak measurement, therefore the power spectral density was measured using PSD Option 1 in accordance with FCC document "Measurement of Digital Transmission Systems Operating under Section 15.247", March 23, 2005.

RESULTS

Frequency (MHz)	PPSD (dBm)	Limit (dBm)	Margin (dB)
2434.5	-5.43	8	-13.43

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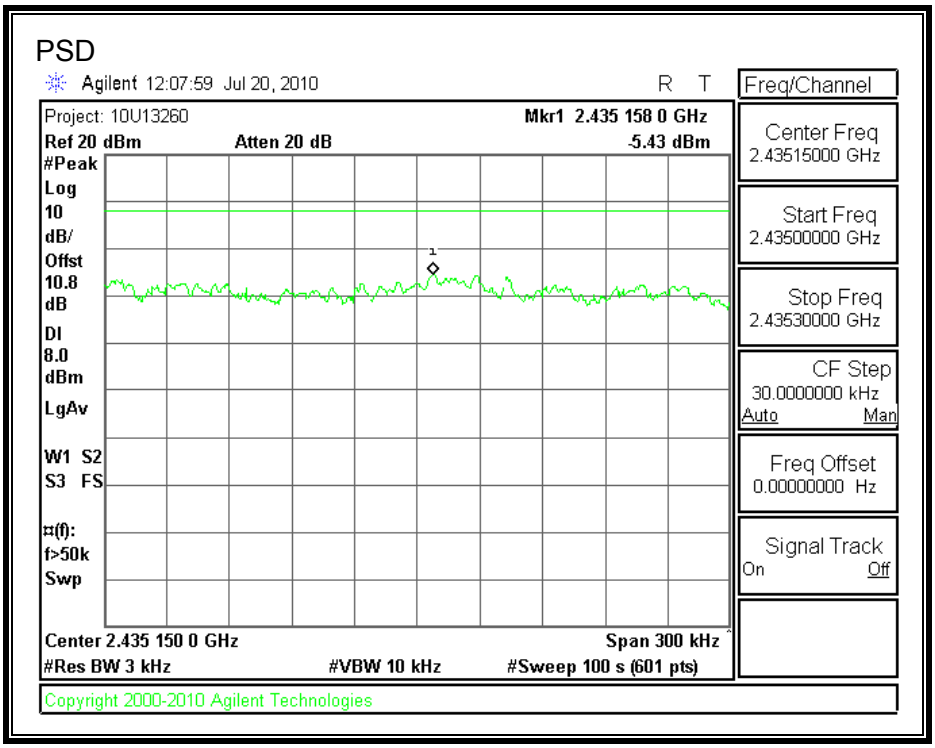
POWER SPECTRAL DENSITY



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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 26 GHz is investigated with the transmitter set to the lowest, middle, and highest channels.

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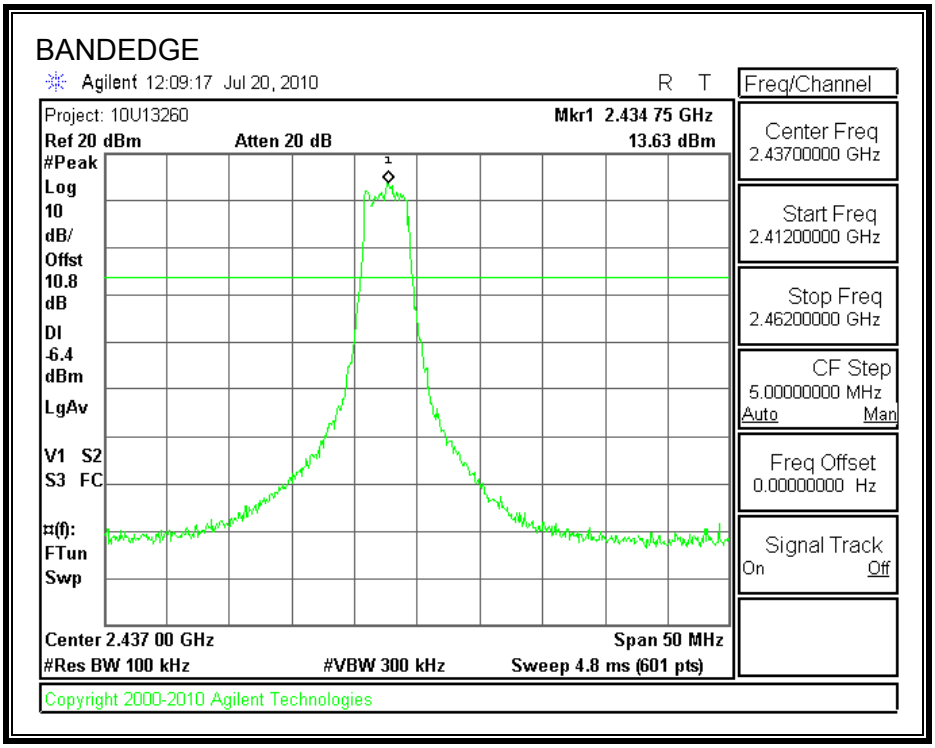
RESULTS

SPURIOUS EMISSIONS



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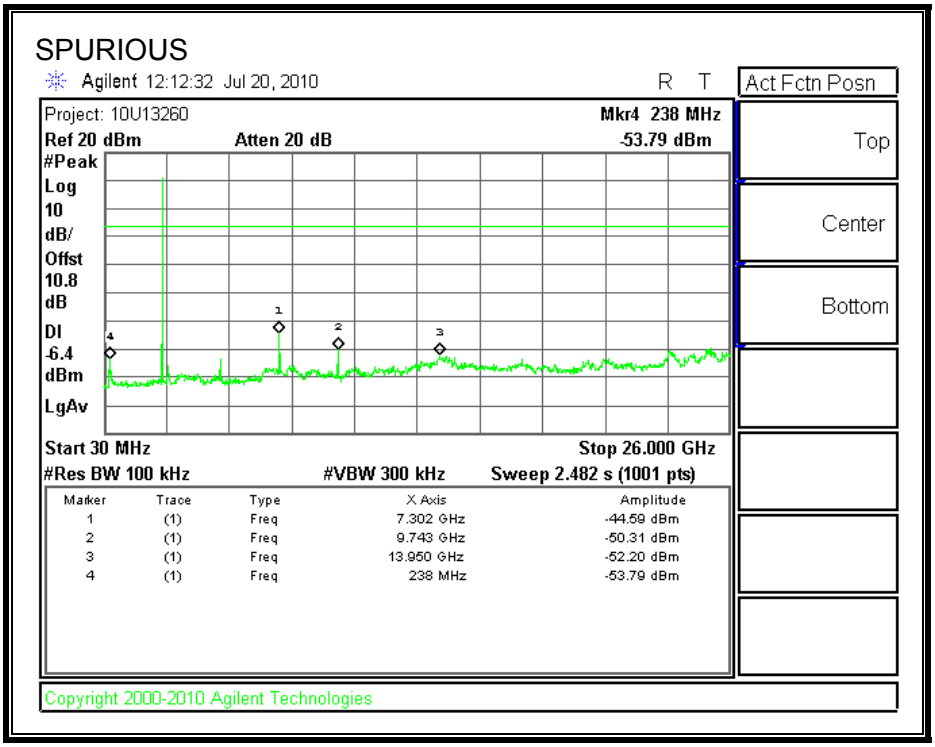

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8. RADIATED TEST RESULTS

8.1. LIMITS AND PROCEDURE

LIMITS

FCC §15.205 and §15.209

IC RSS-210 Clause 2.6 (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, and 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 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.

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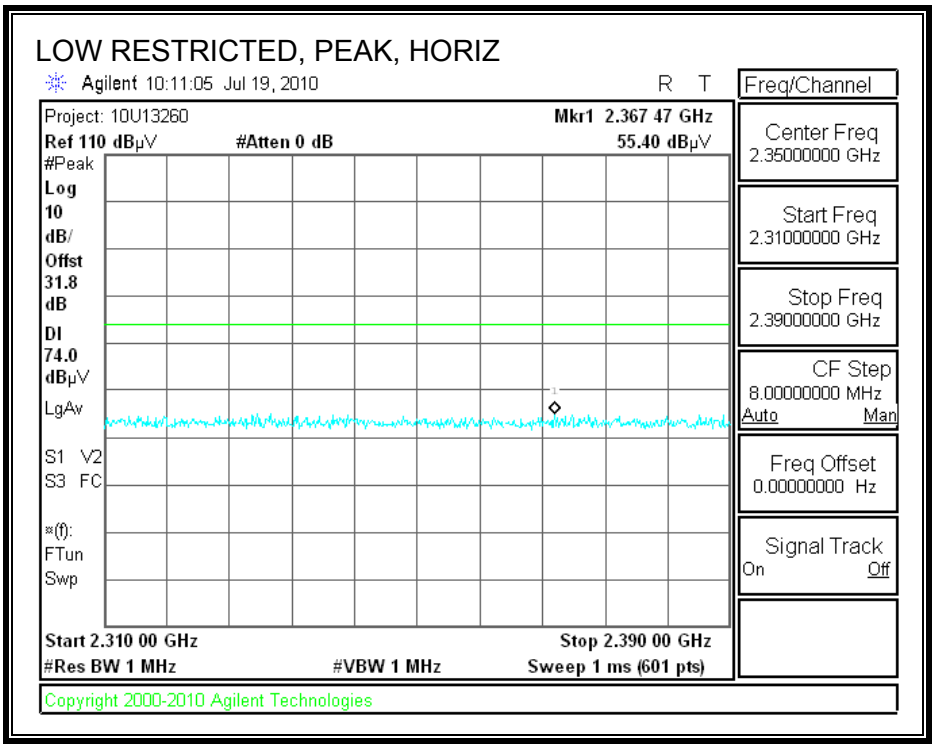
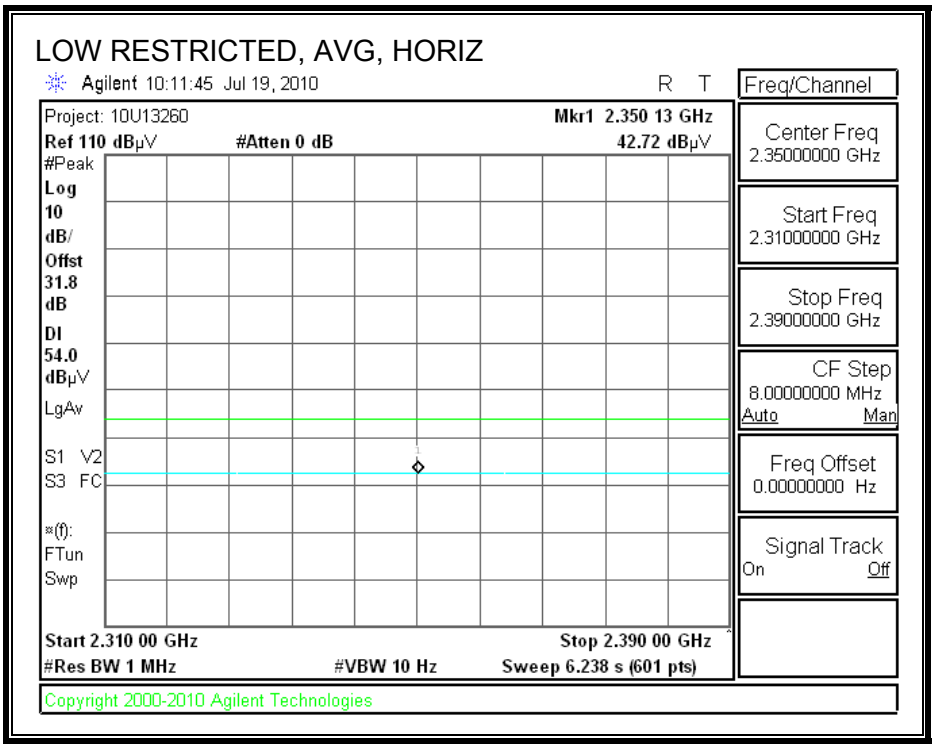
8.2. TRANSMITTER ABOVE 1 GHz

LOW RESTRICTED BANDEDGE (HORIZONTAL)





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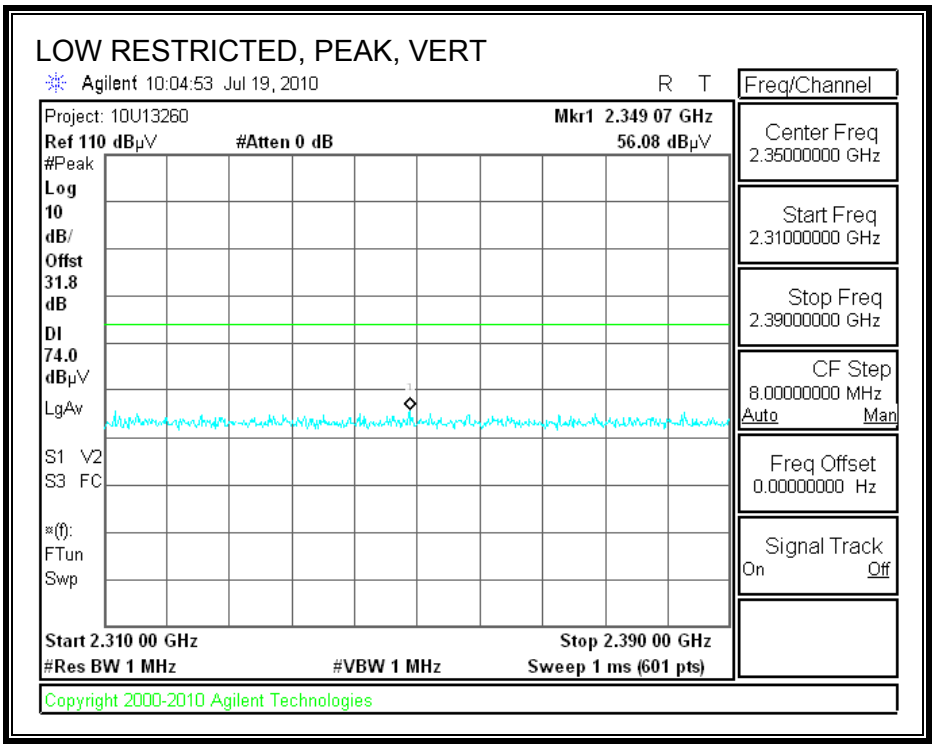
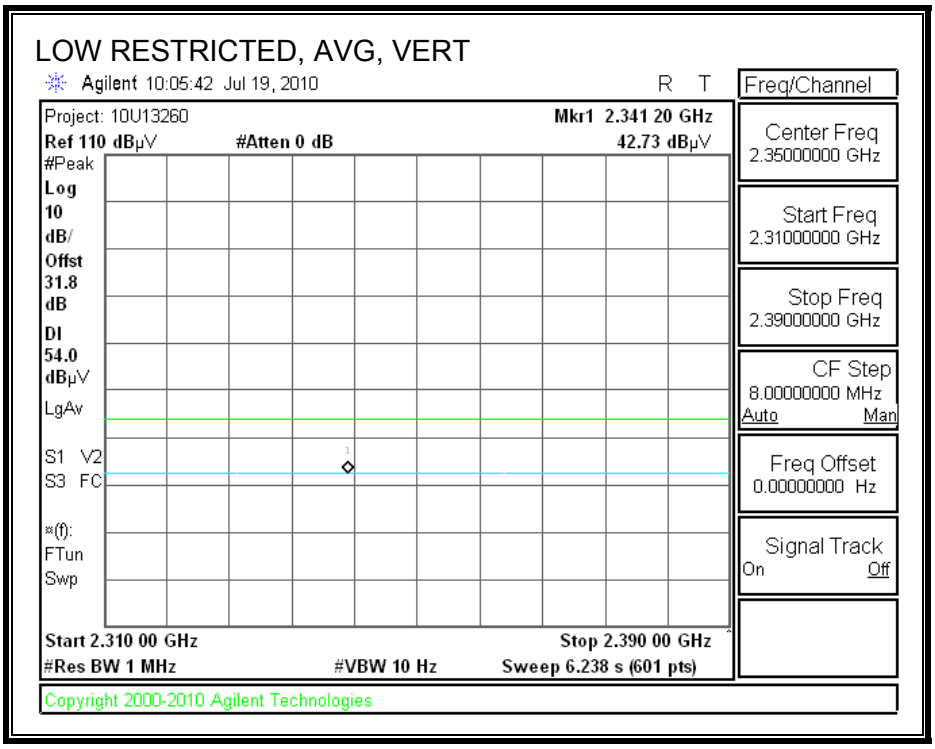
LOW RESTRICTED BANDEDGE (VERTICAL)





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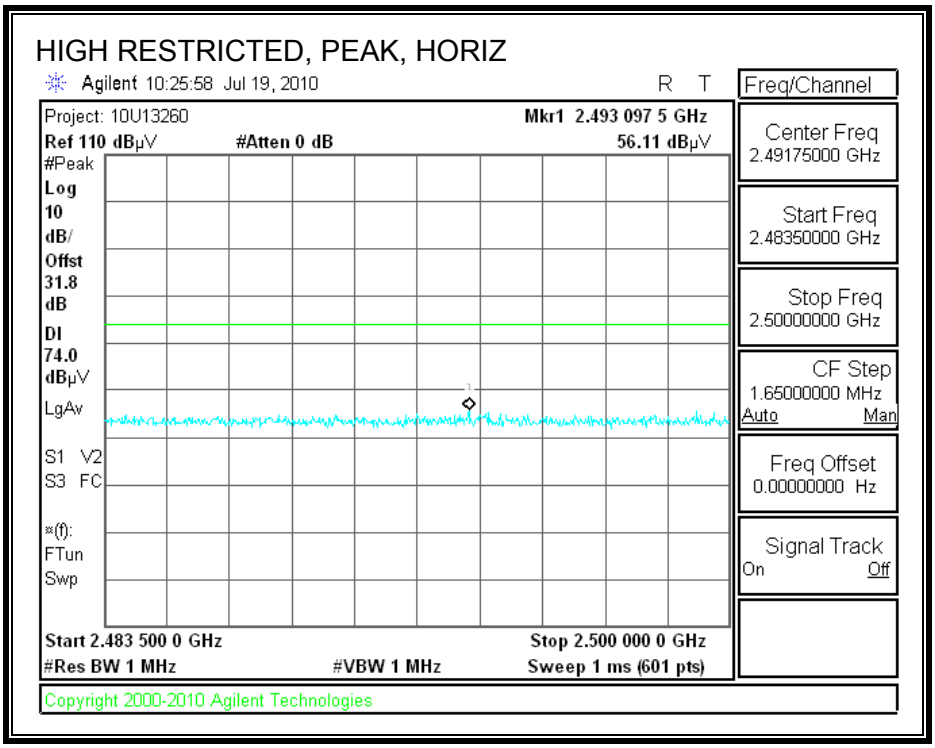
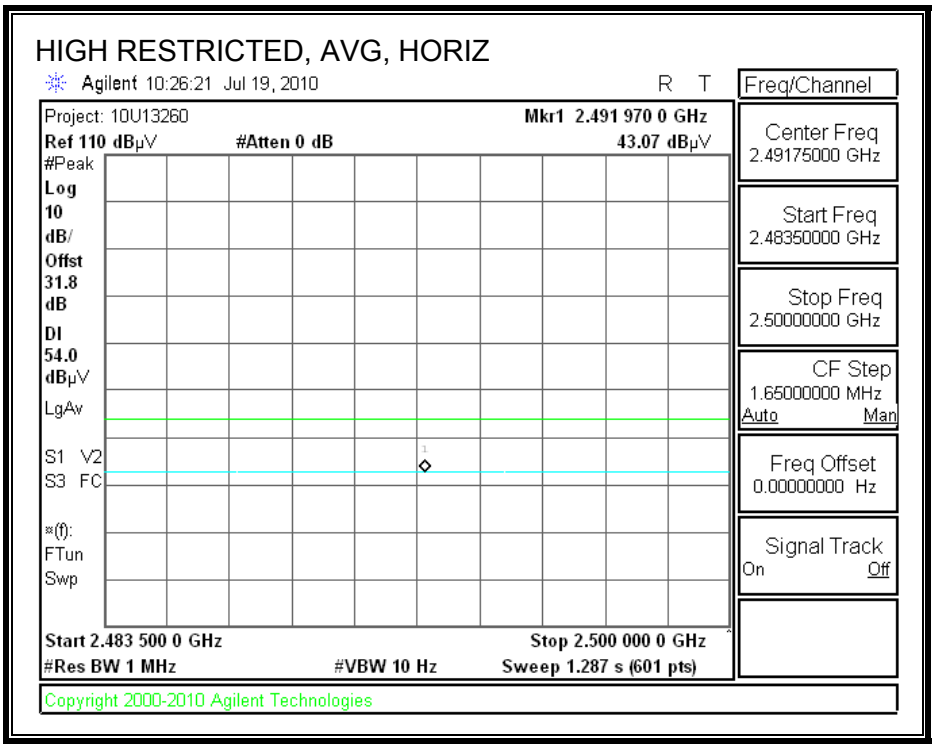
HIGH RESTRICTED BANDEDGE (HORIZONTAL)





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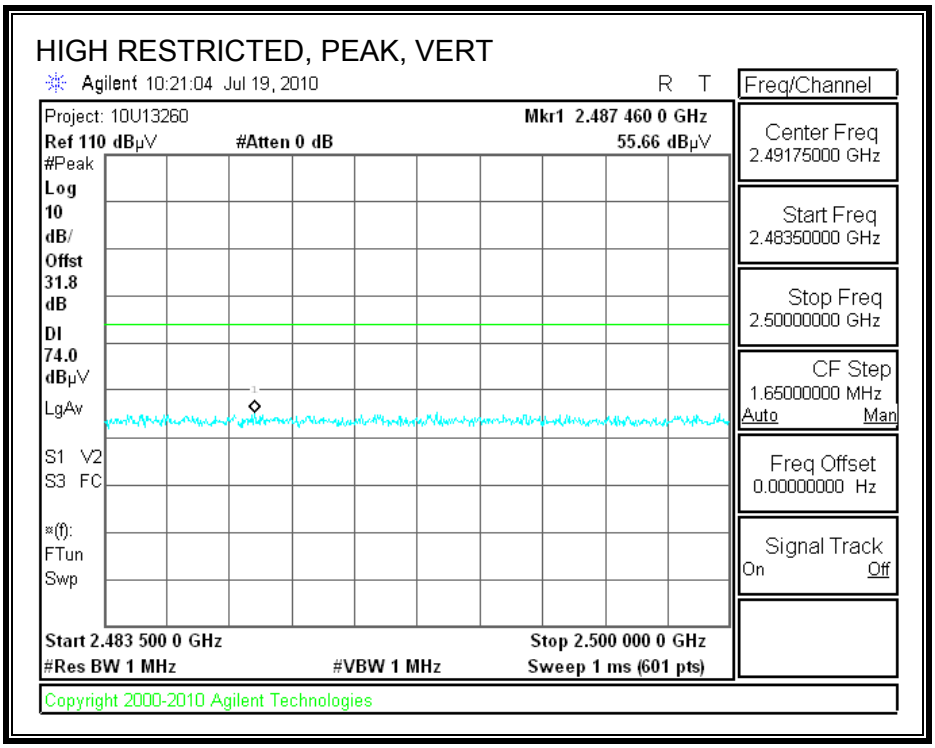
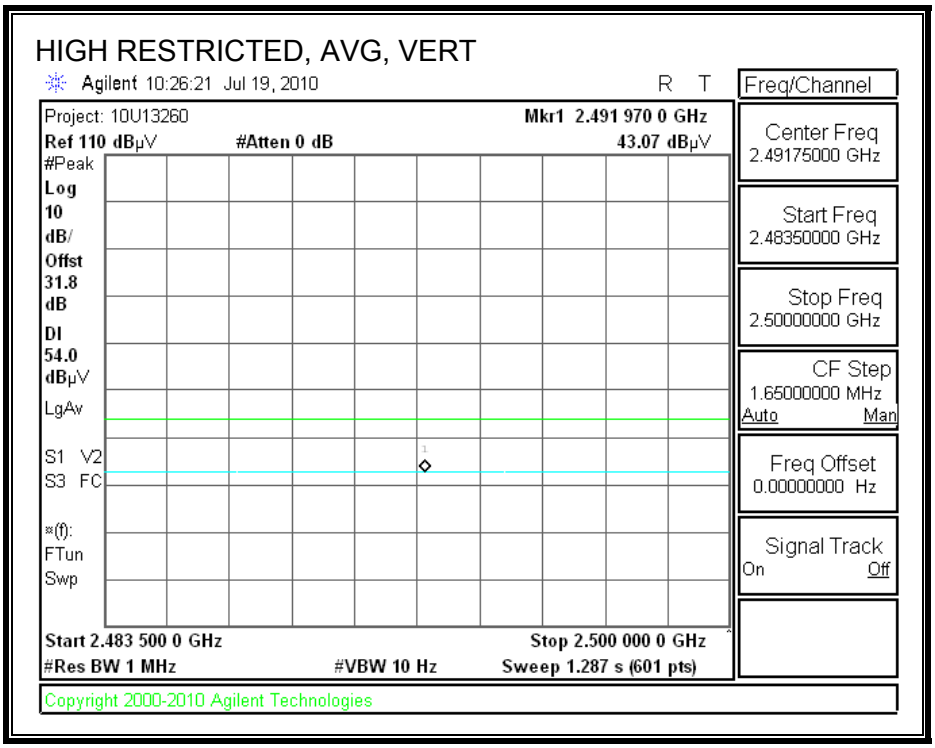
HIGH RESTRICTED BANDEDGE (VERTICAL)





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HARMONICS AND SPURIOUS EMISSIONS

High Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date: 07/19/10
Project #: 10U13260
Company: Altierre
EUT Description: Altierre Tethered Device to Register 2.4GHz
EUT M/N: ATD
Test Target: FCC B
Mode Oper: Tx 2.4GHz

f	Measurement Frequency	Amp	Preamp Gain		Average Field Strength Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		Peak Field Strength Limit
Read	Analyzer Reading	Avg	Average Field Strength @ 3 m		Margin vs. Average Limit
AF	Antenna Factor	Peak	Calculated Peak Field Strength		Margin vs. Peak Limit
CL	Cable Loss	HPF	High Pass Filter		

f GHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Fltr dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant.High cm	Table Angle Degree	Notes
4.864	3.0	66.3	33.1	5.8	36.5	0.0	0.0	68.7	74.0	-5.3	V	P	101.5	284.4	
4.864	3.0	46.6	33.1	5.8	36.5	0.0	0.0	49.0	54.0	-5.0	V	A	101.5	284.4	
4.864	3.0	63.4	33.1	5.8	36.5	0.0	0.0	65.8	74.0	-8.2	H	P	100.0	183.6	
4.864	3.0	45.4	33.1	5.8	36.5	0.0	0.0	47.9	54.0	-6.1	H	A	100.0	183.6	
7.296	3.0	62.9	35.3	7.3	36.2	0.0	0.0	69.2	74.0	-4.8	H	P	158.0	101.4	
7.296	3.0	39.6	35.3	7.3	36.2	0.0	0.0	45.9	54.0	-8.1	H	A	158.0	101.4	
7.296	3.0	64.0	35.3	7.3	36.2	0.0	0.0	70.4	74.0	-3.6	V	P	156.4	138.9	
7.296	3.0	40.3	35.3	7.3	36.2	0.0	0.0	46.6	54.0	-7.4	V	A	156.4	138.9	
12.160	3.0	44.3	39.0	9.8	35.4	0.0	0.0	57.7	74.0	-16.3	V	P	175.0	228.2	
12.160	3.0	24.3	39.0	9.8	35.4	0.0	0.0	37.7	54.0	-16.3	V	A	175.0	228.2	
12.160	3.0	41.3	39.0	9.8	35.4	0.0	0.0	54.7	74.0	-19.3	H	P	152.2	188.8	
12.160	3.0	24.1	39.0	9.8	35.4	0.0	0.0	37.5	54.0	-16.5	H	A	152.2	188.8	
19.456	3.0	34.4	43.5	13.1	34.6	0.0	0.0	56.4	74.0	-17.6	H	P	184.7	115.3	
19.456	3.0	21.5	43.5	13.1	34.6	0.0	0.0	43.5	54.0	-10.5	H	A	184.7	115.3	
19.456	3.0	34.0	43.5	13.1	34.6	0.0	0.0	56.0	74.0	-18.0	V	P	199.7	8.0	
19.456	3.0	21.5	43.5	13.1	34.6	0.0	0.0	43.5	54.0	-10.5	V	A	199.7	8.0	

Rev. 4.1.2.7
Note: No other emissions were detected above the system noise floor.

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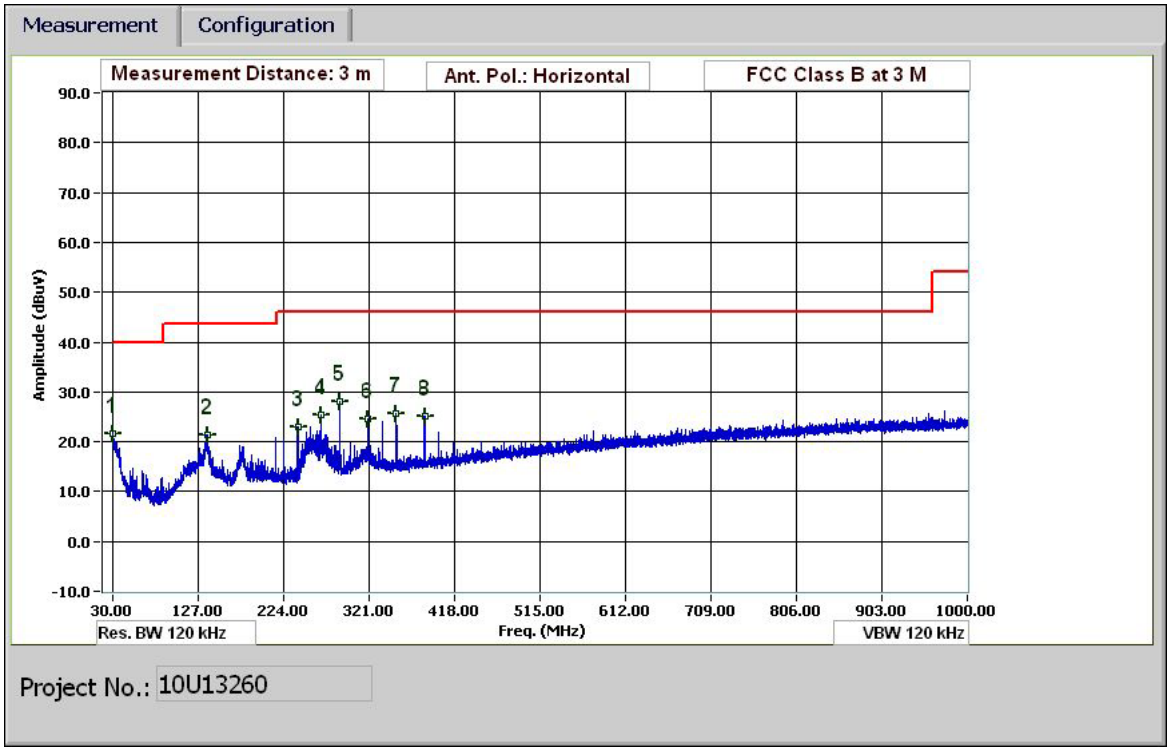
8.3. RECEIVER ABOVE 1 GHz

Not applicable, the EUT is transceiver device.

8.4. WORST-CASE BELOW 1 GHz

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

HORIZONTAL PLOT



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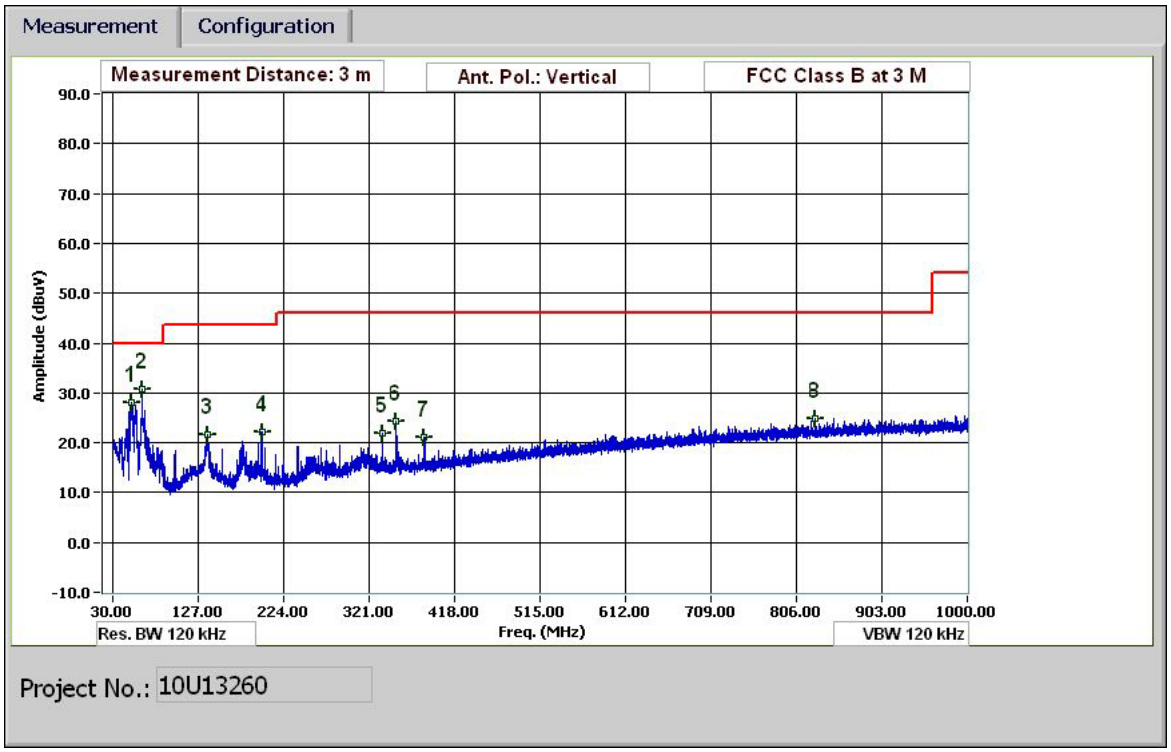
SPURIOUS EMISSIONS 30 TO 1000 MHz (WORST-CASE CONFIGURATION, VERTICAL)

VERTICAL PLOT



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HORIZONTAL & VERTICAL DATA

30-1000MHz Frequency Measurement
Compliance Certification Services, Fremont 5m Chamber

Test Engr: William Zhuang
Date: 07/19/10
Project #: 10U13260
Company: Altierre
EUT Description: Altierre Tethered Device to Register 2.4GHz
EUT M/N: ATD
Test Target: FCC B
Mode Oper: Tx 2.4GHz

f	Measurement Frequency	Amp	Preamp Gain	Margin	Margin vs. Limit
Dist	Distance to Antenna	D Corr	Distance Correct to 3 meters		
Read	Analyzer Reading	Filter	Filter Insert Loss		
AF	Antenna Factor	Corr.	Calculated Field Strength		
CL	Cable Loss	Limit	Field Strength Limit		

f MHz	Dist (m)	Read dBuV	AF dB/m	CL dB	Amp dB	D Corr dB	Filter dB	Corr. dBuV/m	Limit dBuV/m	Margin dB	Ant. Pol. V/H	Det. P/A/QP	Ant. High cm	Table Angle Degree	Notes
2432 MHz, Vertical															
51.241	3.0	47.5	8.3	0.6	28.4	0.0	0.0	28.0	40.0	-12.0	V	P			
63.961	3.0	50.4	8.0	0.7	28.4	0.0	0.0	30.7	40.0	-9.3	V	P			
137.644	3.0	35.6	13.3	1.1	28.3	0.0	0.0	21.7	43.5	-21.8	V	P			
199.087	3.0	37.1	11.9	1.2	28.2	0.0	0.0	22.1	43.5	-21.4	V	P			
336.013	3.0	34.3	14.0	1.6	28.1	0.0	0.0	21.8	46.0	-24.2	V	P			
351.973	3.0	36.5	14.2	1.7	28.1	0.0	0.0	24.2	46.0	-21.8	V	P			
383.895	3.0	32.7	14.7	1.8	28.1	0.0	0.0	21.1	46.0	-24.9	V	P			
827.913	3.0	28.5	21.2	2.7	27.5	0.0	0.0	24.9	46.0	-21.1	V	P			
2432 MHz, Horizontal															
30.480	3.0	29.7	19.9	0.5	28.4	0.0	0.0	21.7	40.0	-18.3	H	P			
136.924	3.0	35.1	13.3	1.1	28.3	0.0	0.0	21.3	43.5	-22.2	H	P			
240.009	3.0	38.0	11.8	1.3	28.2	0.0	0.0	22.9	46.0	-23.1	H	P			
266.650	3.0	39.7	12.3	1.4	28.2	0.0	0.0	25.3	46.0	-20.7	H	P			
288.011	3.0	41.7	13.0	1.5	28.1	0.0	0.0	28.0	46.0	-18.0	H	P			
320.052	3.0	37.3	13.7	1.6	28.1	0.0	0.0	24.5	46.0	-21.5	H	P			
351.973	3.0	38.0	14.2	1.7	28.1	0.0	0.0	25.8	46.0	-20.2	H	P			
384.015	3.0	36.8	14.7	1.8	28.1	0.0	0.0	25.2	46.0	-20.8	H	P			

Rev. 1.27.09
Note: No other emissions were detected above the system noise floor.

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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 *	56 to 46 *
0.5-5	56	46
5-30	60	50

* Decreases with the logarithm of the frequency.

TEST PROCEDURE

ANSI C63.4

RESULTS

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6 WORST EMISSIONS

CONDUCTED EMISSIONS DATA (115VAC 60Hz)									
Freq.	Reading			Closs	Limit	EN_B	Margin		Remark
(MHz)	PK (dBuV)	QP (dBuV)	AV (dBuV)	(dB)	QP	AV	QP (dB)	AV (dB)	L1 / L2
0.20	53.78	--	36.62	0.00	63.82	53.82	-10.04	-17.20	L1
0.27	47.45	--	31.77	0.00	61.24	51.24	-13.79	-19.47	L1
5.08	43.33	--	29.03	0.00	60.00	50.00	-16.67	-20.97	L1
0.20	50.66	--	35.21	0.00	63.69	53.69	-13.03	-18.48	L2
0.26	44.26	--	30.30	0.00	61.34	51.34	-17.08	-21.04	L2
5.28	40.49	--	26.33	0.00	60.00	50.00	-19.51	-23.67	L2
6 Worst Data									

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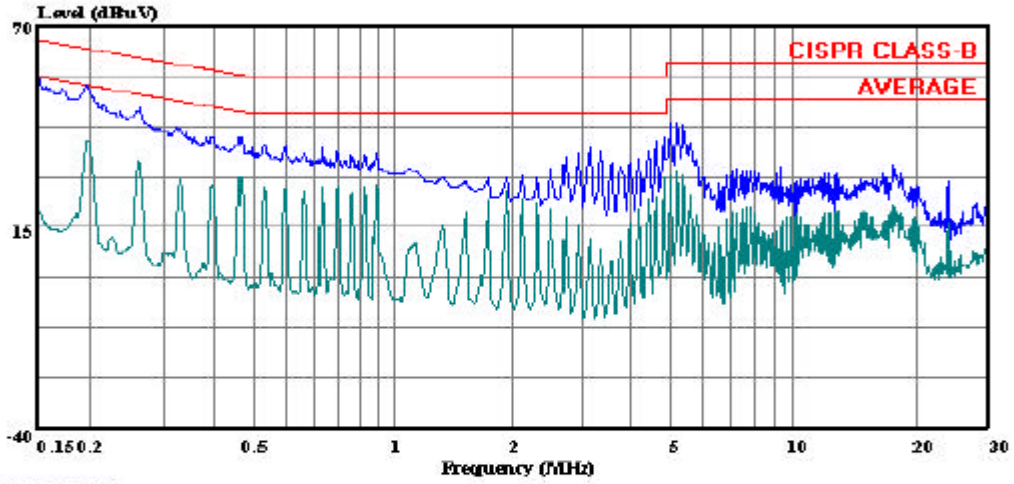
LINE 1 RESULTS

7F #8 Ln120 Neihu Rd Sec1,
Taipei, Taiwan R.O.C.
Tel:02-26594900
Fax:02-26594833

Data#: 29 File#: 10U13260-2.4GHz-LC.EMI
Date: 07-22-2010 Time: 16:13:02



Trace: 27 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Tom Chen
Project #: : 10U13260
Company: : Altierre Corporation
EUT Description:: Altierre Tethered Devic
Model: : ATD100
Configuration: : EUT, Laptop and minimum configuration
Mode: : Tx, 2.4GHz
Target: : FCC Class B
Voltage: : 115V / 60Hz
: L1: Peak (Blue); Average (Green)

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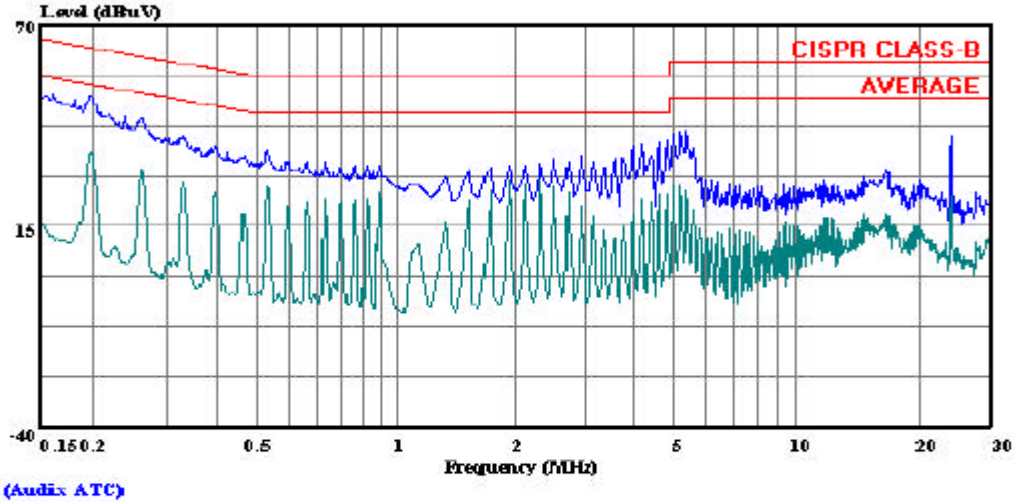
LINE 2 RESULTS

7F #8 Ln120 Neihu Rd Sec1,
Taipei, Taiwan R.O.C.
Tel:02-26594900
Fax:02-26594833

Data#: 38 File#: 10U13260-2.4GHz-LC.EMI
Date: 07-22-2010 Time: 16:44:44



Trace: 36 Ref Trace:

Condition: CISPR CLASS-B
Test Operator: : Tom Chen
Project #: : 10U13260
Company: : Altierre Corporation
EUT Description:: Altierre Tethered Devic
Model: : ATD100
Configuration: : EUT, Laptop and minimum configuration
Mode: : Tx, 2.4GHz
Target: : FCC Class B
Voltage: : 115V / 60Hz
: L2: Peak (Blue); Average (Green)

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10. MAXIMUM PERMISSIBLE EXPOSURE

FCC RULES

§1.1310 The criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*($900/f^2$)	6
30–300	61.4	0.163	1.0	6
300–1500			f/300	6
1500–100,000			5	6
(B) Limits for General Population/Uncontrolled Exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*($180/f^2$)	30

TABLE 1—LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)—Continued

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	Averaging time (minutes)
30–300	27.5	0.073	0.2	30
300–1500			f/1500	30
1500–100,000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

NOTE 1 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

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IC RULES

IC Safety Code 6, Section 2.2.1 (a) A person other than an RF and microwave exposed worker shall not be exposed to electromagnetic radiation in a frequency band listed in Column 1 of Table 5, if the field strength exceeds the value given in Column 2 or 3 of Table 5, when averaged spatially and over time, or if the power density exceeds the value given in Column 4 of Table 5, when averaged spatially and over time.

Table 5
Exposure Limits for Persons Not Classed As RF and Microwave Exposed Workers (Including the General Public)

1 Frequency (MHz)	2 Electric Field Strength; rms (V/m)	3 Magnetic Field Strength; rms (A/m)	4 Power Density (W/m^2)	5 Averaging Time (min)
0.003–1	280	2.19		6
1–10	$280/f$	$2.19/f$		6
10–30	28	$2.19/f$		6
30–300	28	0.073	2*	6
300–1 500	$1.585f^{0.5}$	$0.0042f^{0.5}$	$f/150$	6
1 500–15 000	61.4	0.163	10	6
15 000–150 000	61.4	0.163	10	$616\,000/f^{1.2}$
150 000–300 000	$0.158f^{0.5}$	$4.21 \times 10^{-4}f^{0.5}$	$6.67 \times 10^{-5}f$	$616\,000/f^{1.2}$

* Power density limit is applicable at frequencies greater than 100 MHz.

Notes: 1. Frequency, f, is in MHz.
2. A power density of 10 W/m^2 is equivalent to 1 mW/cm^2.
3. A magnetic field strength of 1 A/m corresponds to 1.257 microtesla (μT) or 12.57 milligauss (mG).

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EQUATIONS

Power density is given by:

S = EIRP / (4 * Pi * D^2)

where

S = Power density in W/m^2
EIRP = Equivalent Isotropic Radiated Power in W
D = Separation distance in m

Power density in units of W/m^2 is converted to units of mWc/m^2 by dividing by 10.

Distance is given by:

D = SQRT (EIRP / (4 * Pi * S))

where

D = Separation distance in m
EIRP = Equivalent Isotropic Radiated Power in W
S = Power density in W/m^2

In the table(s) below, Power and Gain are entered in units of dBm and dBi respectively and conversions to linear forms are used for the calculations.

LIMITS

From FCC §1.1310 Table 1 (B), the maximum value of S = 1.0 mW/cm^2
From IC Safety Code 6, Section 2.2 Table 5 Column 4, S = 10 W/m^2

RESULTS

Band	Mode	Separation Distance (m)	Output Power (dBm)	Antenna Gain (dBi)	IC Power Density (W/m^2)	FCC Power Density (mW/cm^2)
2.4 GHz	DSSS	0.20	15.37	-1.00	0.05	0.005

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