TEST REPORT

Report Number: 3080099MIN-001A
Project Number: 3080099
July 26, 2005

Evaluation of the Wireless Switch Transmitter

FCC ID: MN3100301

To
FCC 15, Subpart C, Section 247

For
Ablenet Inc.

Test Performed by:	Test Authorized by:
Intertek	Ablenet, Inc.
7250 Hudson Blvd. Suite 100	2808 Fareview Avenue North
Oakdale, MN 55128	Roseville, MN 55113

Prepared by: _____ Date: July 26, 2005
Uri Spector

Approved by: _____ Date: July 26, 2005
Simon Khazon

CONTENTS

1.0 GENERAL DESCRIPTION

1.1 Related Submittals Grants

This is single application of the *Wireless Switch Transmitter Model: 100-301-XX* for Certification under FCC Part 15, Subpart C. There are no other simultaneous applications.

1.2 Product Description

The *Wireless Switch Transmitter* is a part of the Wireless Switch System. The *Wireless Transmitter* is a Digital Modulation Transmitter operating at 2430 MHz frequency band under Section 15.247. The intended use of the *Wireless Transmitter* unit is to generate a RF signal, deliver the signal to the antenna in order to communicate with the *Wireless Switch Receiver*. During testing the *Wireless Transmitter* was powered by two AA internal batteries.

Antenna Description:

Integrated Trace Antenna
Antenna Gain: 2.14dBi

Sample Submitted: July 21, 2005
Test Work Started: July 21, 2005
Test Work Completed: July 25, 2005

1.3 Test Methodology

Emission measurements were performed according to the procedures in ANSI C63.4-2001. All field strength radiated emissions measurements were performed in the semi-anechoic chamber, and for each scan, the procedure for maximizing emissions in Appendices D and E were followed. All field strength radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The test site facility used to collect the radiated and conducted measurement data is located at 7250 Hudson Blvd., Suite 100, Oakdale, Minnesota. This test facility has been fully described in a report dated on March 2003 submitted to FCC. Please reference the site registration number: 90706, dated April 18, 2003.

2.0 SYSTEM TEST CONFIGURATION

2.1 Justification

Since the antenna is an integrated antenna, no measurements at the antenna terminal were performed.

Line Conducted Emissions testing is inappropriate and therefore unnecessary as batteries power the equipment.

2.2 EUT Setup

For simplicity of testing, the transmitter was wired to transmit continuously

2.3 EUT Exercising Software

The *Wireless Switch Transmitter* was operated in continuous transmission mode at 2430MHz in continuous single channel digital transmission mode for testing purposes.

2.4 Special Accessories

There are no special accessories necessary for compliance of these products.

Cables

External Switch cable- not shielded, 6 ft. long.
Output cable- not shielded, 7 in long, Jack plug connector

2.5 Equipment Modification

No modifications were installed on the EUT during testing.

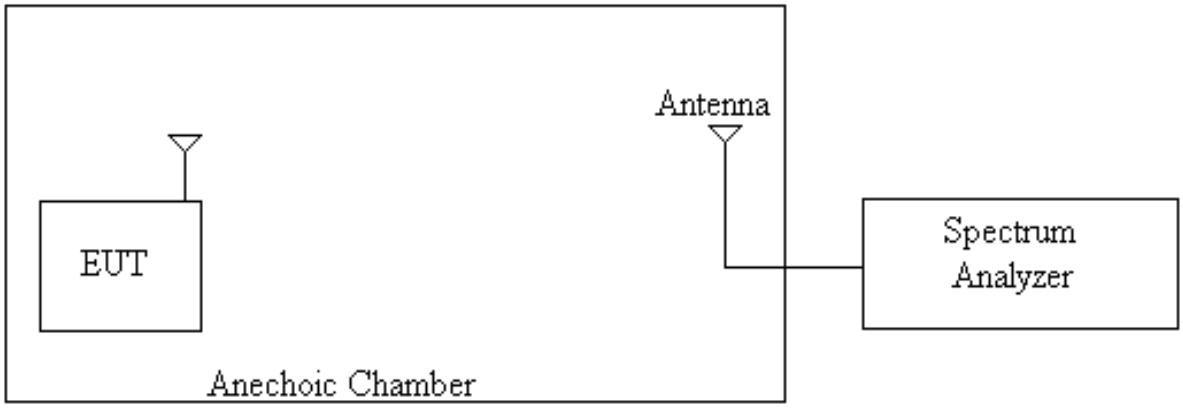
2.6 Support Equipment List and Description

N/A

2.7 Test Configuration Block Diagrams

The EUT was setup as tabletop equipment.
The EUT was powered at 3VDC from new two AA internal batteries

Field Strength Measurements



3.0 TEST RESULTS

Data is included for the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs, data tables and graphical representations of the emissions are included.

The EUT is intended for operation under the requirements of Part 15 Subpart C. Specific test requirements include the following:

47 CFR 15.247(a)(1), 15.215	Bandwidth of Emissions
47 CFR 15.247(a)(2)	6dB Bandwidth of Emission
47 CFR 15.247(a)(3)	Output Power
47 CFR 15.247(c)	Band Edge Compliance
47 CFR 15.247(c)	Radiated Spurious Emissions
47 CFR 15.247(d)	Peak Power Spectral Density

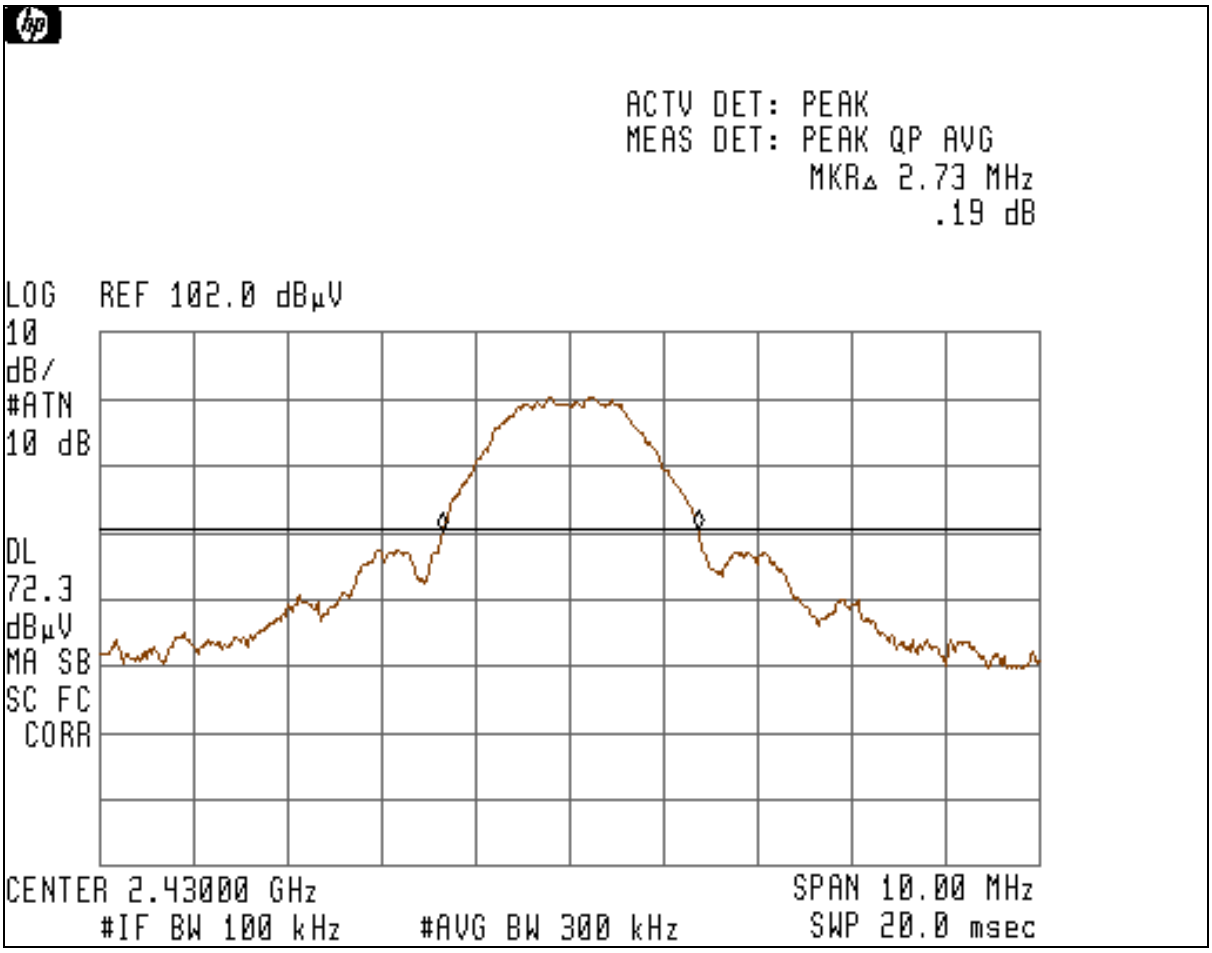
3.1 Bandwidth of Emissions, FCC 15.231(c), 15.215

Bandwidth of Emissions measurements was made at frequency of 2430MHz.

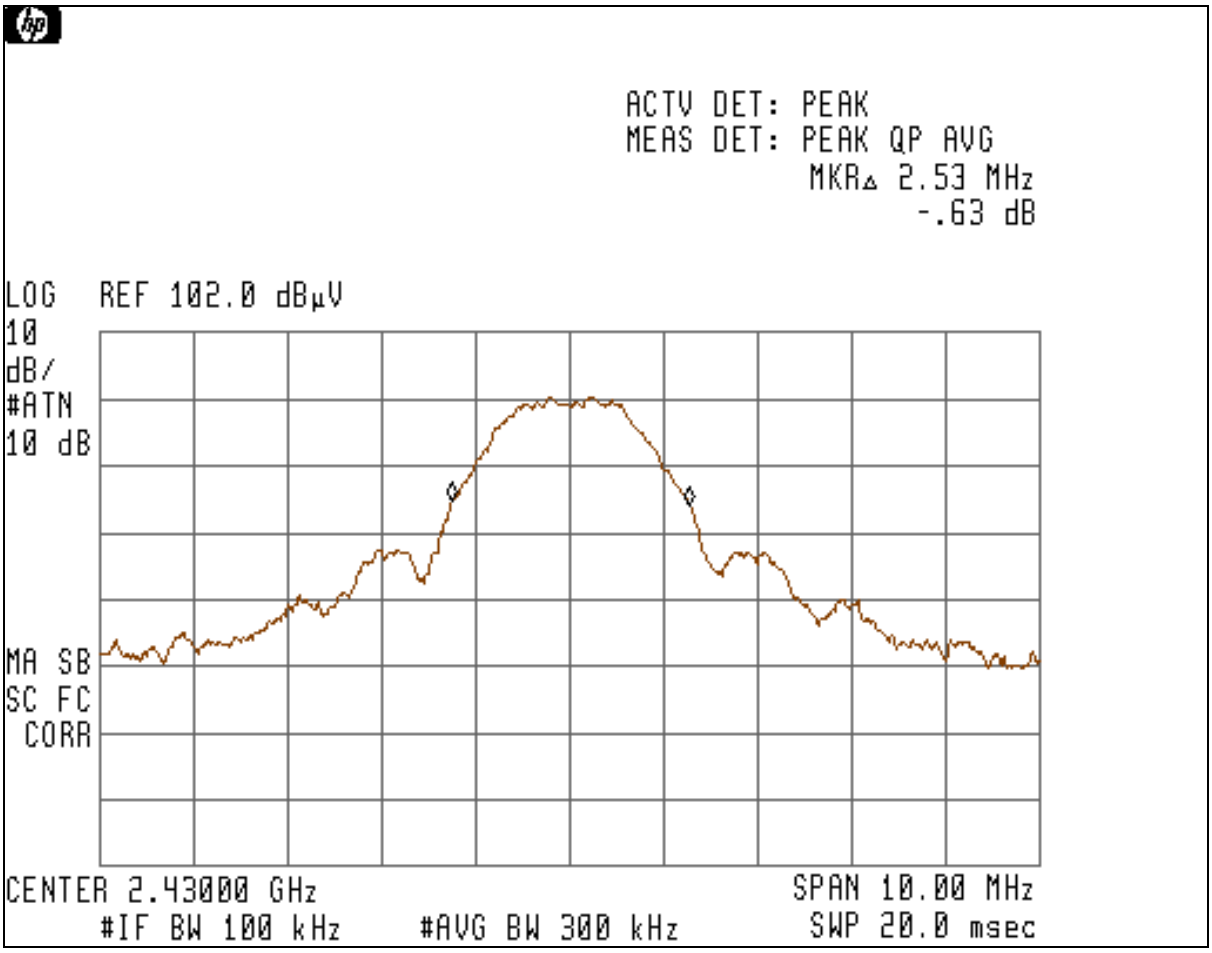
Bandwidth of Emissions at –20dB level was measured at 2.73MHz.
Bandwidth of Emissions at 99% power level was measured at 2.53MHz

The # 3-1-1 shows the Bandwidth of Emissions at –20dB level.
The # 3-1-2 shows the Bandwidth of Emissions at 99% power level (for reference).

Graph 3-1-1


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.73 MHz
.19 dB
LOG REF 102.0 dBµV
10
dB/
#ATN
10 dB
DL
72.3
dBµV
MA SB
SC FC
CORR
CENTER 2.43000 GHz
SPAN 10.00 MHz
#IF BW 100 kHz
#AVG BW 300 kHz
SWP 20.0 msec

Graph 3-1-2


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 2.53 MHz
-.63 dB
LOG REF 102.0 dBµV
10
dB/
#ATN
10 dB
MA SB
SC FC
CORR
CENTER 2.43000 GHz
SPAN 10.00 MHz
#IF BW 100 kHz
#AVG BW 300 kHz
SWP 20.0 msec

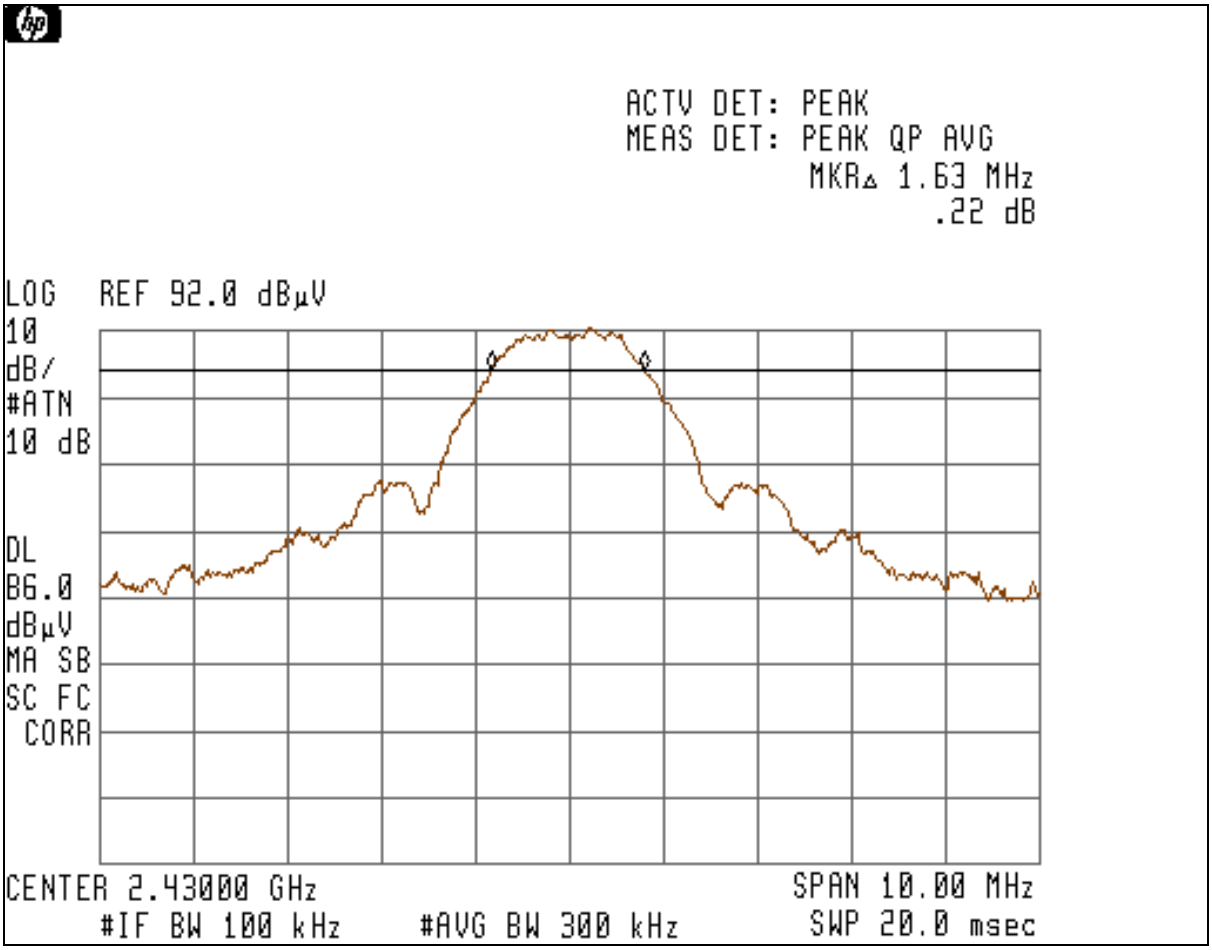
3.2 6dB Bandwidth of Emissions, FCC 15.247(a)(1)(iii)

6dB Bandwidth of Emissions measurements was made for frequency of 2430MHz.

The minimum 6dB bandwidth shall be at least 500kHz.
Bandwidth of Emissions at 6dB level was measured at 1.63MHz.

Graph 3-2-1 shows the Bandwidth of Emissions at 6dB level.

Graph 3-2-1



3.3 Output Power, FCC 15.247(a)(3)

For system in frequency range 2400-2483.5MHz using digital modulation, maximum peak output power shall not exceed 1 watt.

Peak Output Power measurements were made at the 2430MHz.

Test Procedure

The Peak Power Output for the device was derived from measuring maximum radiated field strength at 2430MHz, and then calculating by using formula: $P=(E*d)^2/(30*G)$ where:

P= Power in watts
E= Measured maximum field strength in V/m=96.1dBµV/m=63.826mV/m=0.06382V/m
G= Numeric gain=2.14dBi=1.279
d= Distance in meters from which the field strength was measured=3m

$P=(0.06382*3)^2/(30*1.279)=$**0.953mW**

For maximum radiated field strength measurement see Table 3-3-1.

Radiated Emission at Fundamental **Date:** 7/21/2005

Company: Ablenet Inc.

Model: Wireless Switch Transmitter

Test Engineer: Uri Spector

Limits: FCC Part 15.247

Test Site: 3 meters Anechoic chamber, 3 meters measurement distance

Note: All readings were taken with Peak Detector

Table # 3-3-1

Frequency	Antenna			Reading	Total Emissions
MHz	Polarity	Hts(cm)	Factor (dB1/m)	dBµV	dBµV/m
2430.00	V	100	-3.8	92.5	**88.8**
2430.00	H	165	-3.8	99.9	**96.1**

3.4 Band Edge Compliance, FCC 15.247(c)

Left and right band-edge compliance measurements were made for band-edge frequencies of 2400.0MHz and 2483.5MHz respectively.

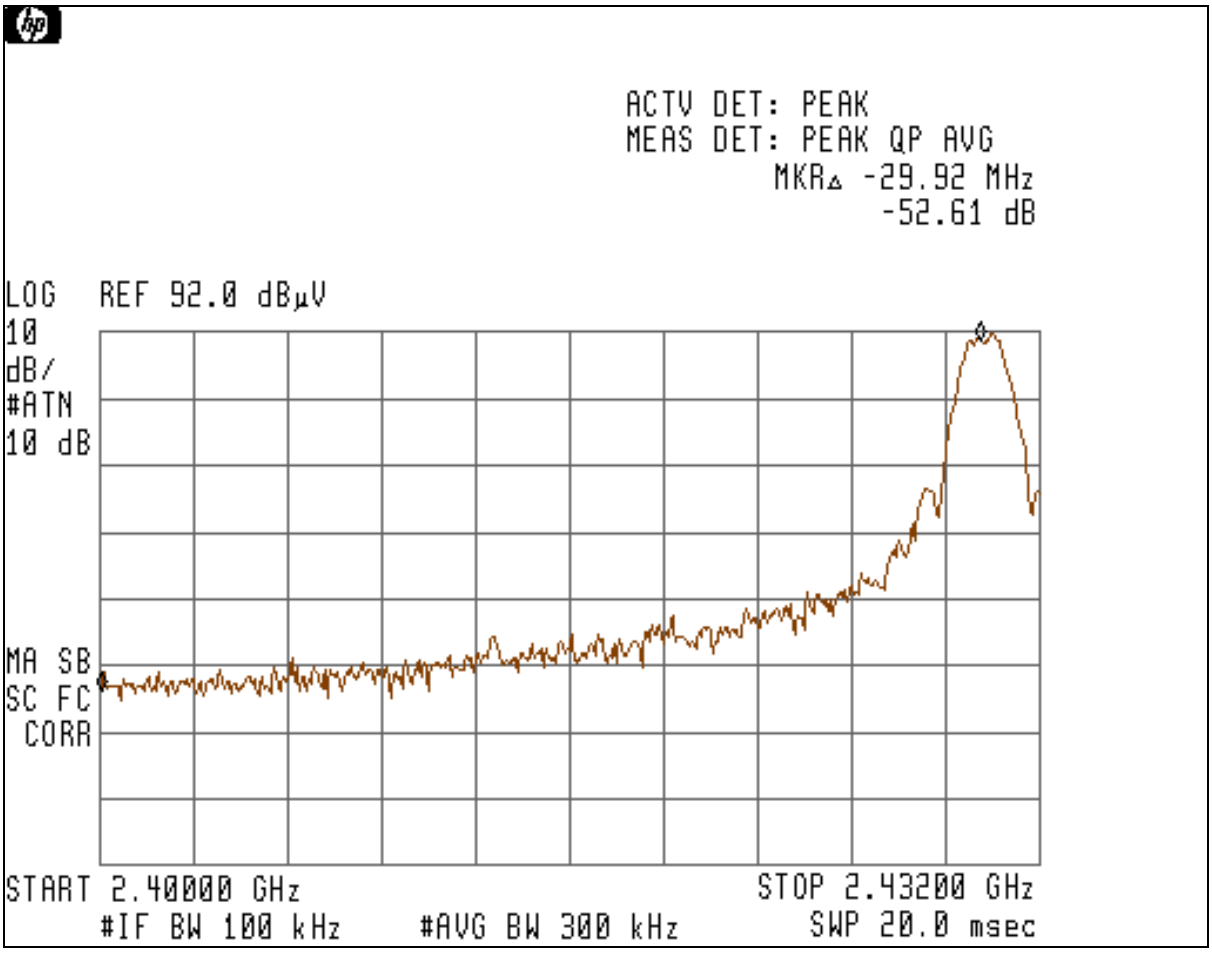
Test Procedure

The maximum Spurious Radiated Emission of the EUT was measured at the fundamental frequency of 2430MHz using IF BW of 100kHz (see Graphs 3-4-1, 3-4-2).

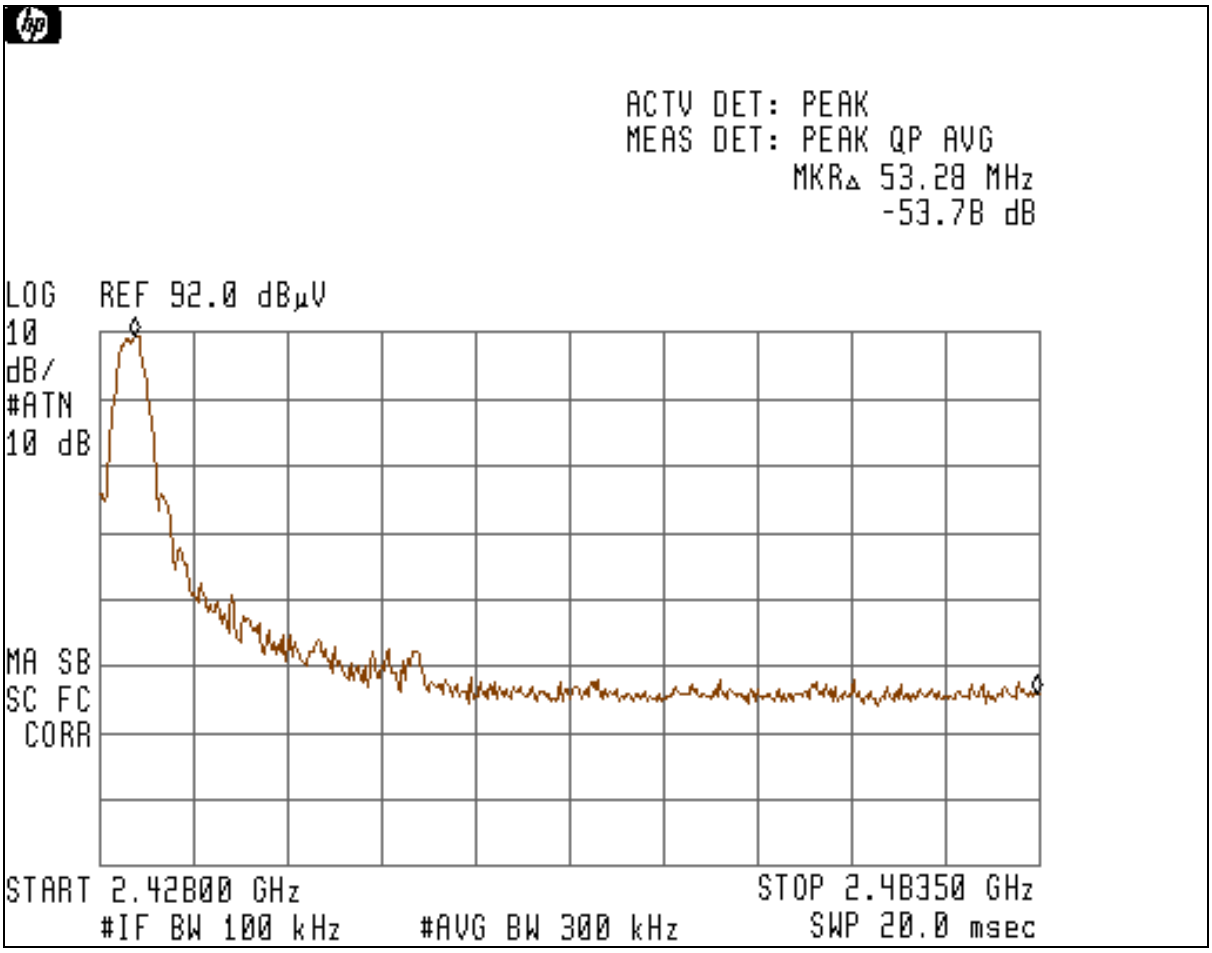
The Band-Edge Emissions Attenuation at 2400MHz is 52.61dB
The Band-Edge Emissions Attenuation at 2483.5MHz is 53.58dB

The limit in any 100kHz bandwidth outside the frequency band, the radio frequency power shall be at least 20dB below, therefore the transmitter complies with the 20dB Band Edge requirements.

Graph 3-4-1


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ -29.92 MHz
-52.61 dB
LOG REF 92.0 dBµV
10
dB/
#ATN
10 dB
MA SB
SC FC
CORR
START 2.40000 GHz
STOP 2.43200 GHz
#IF BW 100 kHz
#AVG BW 300 kHz
SWP 20.0 msec

Graph 3-4-2


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKRΔ 53.28 MHz
-53.78 dB
LOG REF 92.0 dBµV
10
dB/
#ATN
10 dB
MA SB
SC FC
CORR
START 2.42800 GHz
STOP 2.48350 GHz
#IF BW 100 kHz
#AVG BW 300 kHz
SWP 20.0 msec

3.5 Radiated Spurious Emissions, FCC 15.247(c)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or radiated measurement. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emissions limits specified in section 15.209(a).

Field Strength Measurements

The EUT was placed on a non-conductive table 0.8m above the ground plane inside the Anechoic Chamber. The table was centered on a motorized turntable, which allows 360-degree rotation. The measurement antenna was positioned at 3m distance. The Bicono-Log antenna was used in frequency range from 30MHz to 1GHz, and the Horn antenna was used in frequency range above 1GHz. The radiated emissions were maximized by configuring the EUT through its placement in three orthogonal axes, by rotating the EUT, by changing antenna polarization, and by changing antenna height from 1 to 4m. Method of the direct Field Strength Calculation is shown in Section 3.8.

Table from 3-5-1 shows Radiated Spurious Emissions in restricted band in frequency range from 1 GHz to 25 GHz. No Radiated Spurious Emissions were detected from 1GHz to 2.4GHz and above 3rd harmonic.

Graphs 3-5-1, 3-5-2 show Radiated Spurious Emissions in restricted band in frequency range from 30 MHz to 1 GHz. No Radiated Spurious Emissions in restricted band above floor noise were detected in this frequency range.

Spurious Radiated Emissions **Date:** 7-20-2005

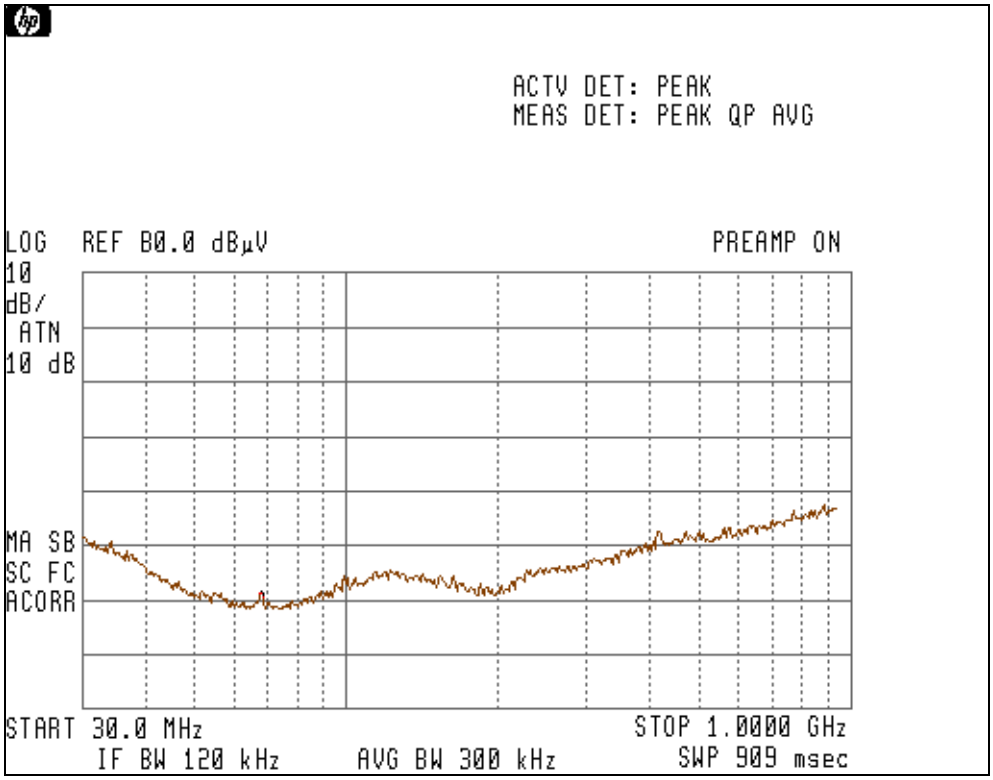
Company: Ablenet, Inc.
Model: Wireless Switch Transmitter
Test Engineer: Uri Spector
Limits: FCC Parts 15.247(c), 15.209
Test Site: 3 meters Anechoic chamber, 3 meters measurement distance
Note: All readings were taken with RBW 1MHz and VBW l0Hz
Table shows harmonics spurious emissions in the Restricted Bands of Operation per FCC 15.205

Table # 3-5-1

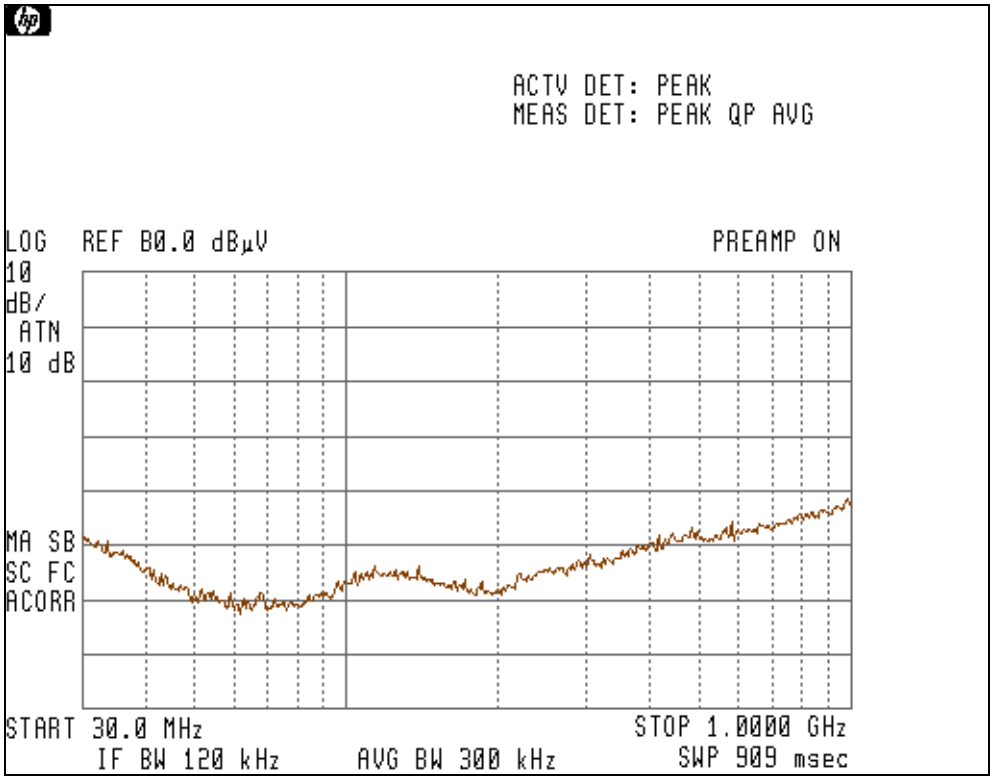
Frequency	Antenna			Reading	Duty Cycle	Total Emissions	Limit	Margin
MHz	Polarity	Hts(cm)	Factor (dB1/m)	dBµV	Factor (dB)	dBµV/m	dBµV/m	dB
4859.06	V	100	3.6	31.7	0.0	35.3	54.0	-18.7
4859.06	H	100	3.6	30.4	0.0	34.0	54.0	-20.0
7288.55	V	100	7.1	30.5	0.0	37.6	54.0	-16.4
7288.55	H	100	7.1	30.9	0.0	38.0	54.0	-16.0

Comments: No spurious emissions in restricted band were detected detected above 3th harmonic

Graph 3-5-1
Spurious Radiated Emissions from 30MHz-1000MHz
Vertical Antenna Polarity



Graph 3-5-2
Spurious Radiated Emissions from 30MHz-1000MHz
Horizontal Antenna Polarity



3.6 Peak Power Spectral Density, FCC 15.247(d)

For system in frequency range 2400-2483.5MHz using digital modulation, the Peak Power Spectral Density from intentional radiator shall not be greater than **8dBm** in any 3kHz band.

Peak Power Spectral Density measurements were made at the 2430MHz.

Test Procedure

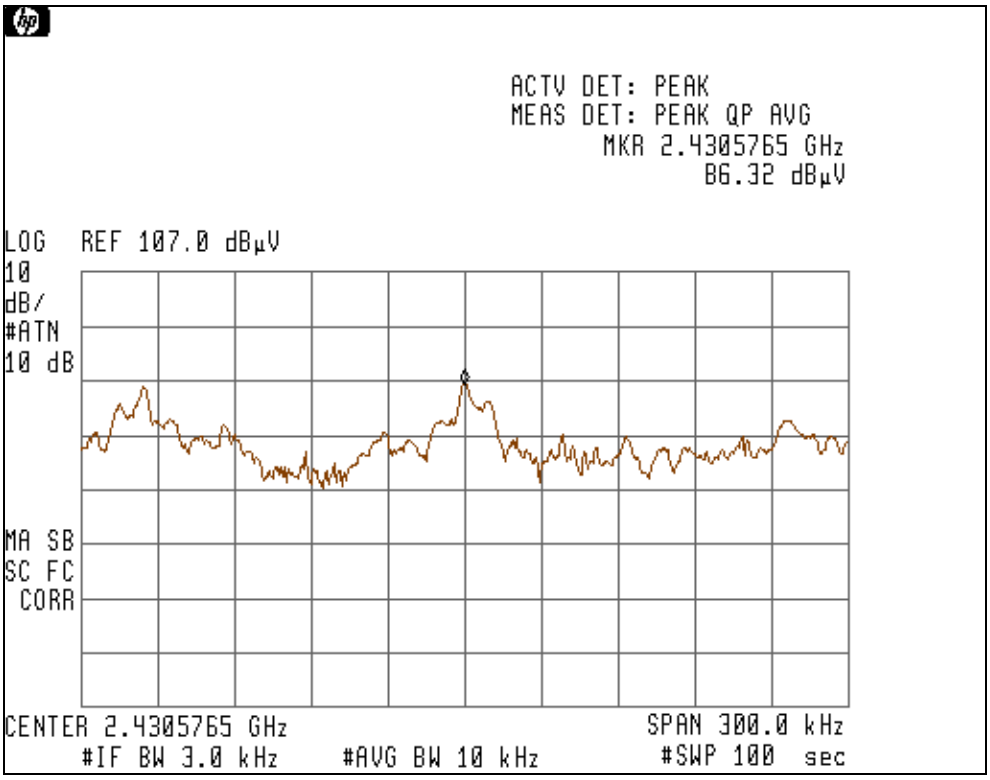
The peak power spectral density for the device was derived from measuring maximum radiated field strength at 2430MHz (see Table 3-3-1). Then analyzer setting was reset to RBW=3kHz, VBW>RBW, span=300kHz, sweep=100sec (see Graph 3-6-1). **Note:** Graph 3-6-1 shows the reading without correction factors.

Then calculating by using formula: $P=(E*d)^2/(30*G)$ @ 3kHz band where:

P= Power in watts
E= Measured maximum field strength in V/m for the setting indicated above=82.5dBµV/m=13.335mV/m=0.0133V/m
G= Numeric gain=2.14dBi=1.279
d= Distance in meters from which the field strength was measured=3m

$P=(0.0133*3)^2/(30*1.279)$=**0.0414mW= -13.829dBm**

Graph 3-6-1


ACTV DET: PEAK
MEAS DET: PEAK QP AVG
MKR 2.4305765 GHz
86.32 dBµV
LOG REF 107.0 dBµV
10
dB/
#ATN
10 dB
MA SB
SC FC
CORR
CENTER 2.4305765 GHz
#IF BW 3.0 kHz
#AVG BW 10 kHz
SPAN 300.0 kHz
#SWP 100 sec

3.7 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured emissions reading on the EMI Receiver.
The basic equation with a sample calculation is as follows:

FS = RA + AF + CF - AG

Where: FS = Field Strength in dB(µV/m)
RA = Receiver Amplitude in dB(µV)
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB(m^{-1})
AG = Amplifier Gain in dB

Assume a receiver reading of 48.1 dB(µV) is obtained. The antenna factor of 7.4 dB(m^{-1}) and cable factor of 1.6 dB is added and amplifier gain of 16.0 dB is subtracted giving field strength of 41.1 dB(µV/m).

RA = 48.1 dB(µV)
AF = 7.4 dB(m^{-1})
CF = 1.6 dB
AG = 16.0 dB
FS = RA + AF + CF - AG
FS = 48.1 + 7.4 + 1.6 – 16.0
FS = 41.1 dB(µV/m)

In the tables the Cable correction factors are included to the Antenna Factors.

Tested by:

Uri Spector
EMC Project Engineer
Intertek ETL SEMKO

Signature

Date: July 27, 2005

4.0 TEST EQUIPMENT

Receivers/Spectrum Analyzers and Test Software

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
HP85462A Receiver RF Section	3325A00106	09/04	09/05	X
HP85460A RF Filter Section	3330A00109	09/04	09/05	X
TILE! Instrument Control System	ver. 3.4.G.3	N/A	N/A	X
Advantest R3271A Spectrum Analyzer	55050084	06/05	06/06	X

Antennas

DESCRIPTION	SERIAL NO.	LAST CAL	CAL DUE	USED
Schaffner-Chase Bicono-Log Antenna	2468	01/05	01/06	X
EMCO Horn Antenna 3115	9507-4513	12/04	12/05	X
Reactel 7HS-4G-S12 Filter	0223	01/05	01/06	X
HP 83017A Pre-Amplifier	3123A00475	05/05	05/06	X