



## Electromagnetic Compatibility Test Report

Tests Performed on a MacMillan Publishing, Inc.

900 MHz Transciever, i>clickr Model TMX14

Radiometrics Document RP-6895



*Product Detail:*

FCC ID: T24-TMX14

IC: 6495A-TMX14

Equipment type: 900 MHz Digital transmission system.

*Test Standards:*

US CFR Title 47, Chapter I, FCC Part 15 Subpart C

FCC Part 15 CFR Title 47: 2008

Industry Canada RSS-210, Issue 7: 2007 as required for Category I Equipment

This report concerns: Original Grant for Certification

FCC Part 15.247

*Tests Performed For:*

**MacMillan Publishing, Inc., Division of Holtzbrinck**

41 Madison Av. 38<sup>th</sup> Floor

New York City, NY 10010

*Test Facility:*

**Radiometrics Midwest Corporation**

12 East Devonwood

Romeoville, IL 60446

(815) 293-0772

*Test Date(s): (Month-Day-Year)*

October 3 thru November 9, 2010

Document RP-6895 Revisions:

Rev.	Issue Date	Affected Pages	Revised By
0	December 1, 2010		
1	January 10, 2011	1, 4, 8, 9 & 20-22	Joseph Strzelecki

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Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

**1 ADMINISTRATIVE DATA***Equipment Under Test:*

A MacMillan Publishing, Inc., 900 MHz transceiver i&gt;clickr

Model: TMX14, Serial Number: none

This will be referred to as the EUT in this Report

*Date EUT Received at Radiometrics: (Month-Day-Year)*

October 1, 2010

*Test Date(s): (Month-Day-Year)*

October 3 thru November 9, 2010

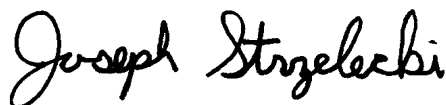
*Test Report Written By:*

Joseph Strzelecki

Radiometrics

*Test Witnessed By:*

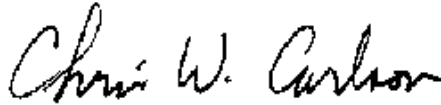
The tests were not witnessed by MacMillan Publishing, Inc.

*Radiometrics' Personnel Responsible for Test:*

Joseph Strzelecki

Senior EMC Engineer

NARTE EMC-000877-NE

*Test Report Approved By*

Chris W. Carlson

Director of Engineering

NARTE EMC-000921-NE

**2 TEST SUMMARY AND RESULTS**

The EUT (Equipment Under Test) is a 900 MHz transceiver, Model i>clickr TMX14, manufactured by MacMillan Publishing, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

**900 MHz Test Results**

Environmental Phenomena	Frequency Range	FCC Section	RSS-210 Section#	Test Result
6 dB Bandwidth Test;	902-928 MHz	15.247 a	A8.1 (4)	Pass
20 dB Bandwidth Test;	902-928 MHz	15.247 a	A8.1 (4)	Pass
Peak Output Power	902-928 MHz	15.247 b	A8.1 (1)	Pass
Band-edge Compliance of RF Conducted Emissions	902-928 MHz	15.247 d	A8.4 (2)	Pass
Spurious RF Conducted Emissions	30 MHz to 25 GHz	15.247 d	A8.5	Pass
Spurious Radiated Emissions	30 MHz to 25 GHz	15.247 d	A8.5	Pass
Power Spectral Density	2400 to 2483 MHz	15.247 e	A8.2 (1)	Pass
Conducted Emissions, AC Mains	0.15 - 30 MHz	15.207	7.2.2 of RSS-Gen	Pass
Radiated Emissions (Unintentional Radiation Receive mode)	30 MHz to 5 GHz	15.109	Table 2	Pass

## 2.1 RF Exposure Compliance Requirements

Since the power output is 20.9 mW, The EUT meets the FCC requirement for RF exposure. Since the EUT is less than 200 mW, it is exempt from RSS-102. There are no power level adjustments and the antenna is permanently attached. The detailed calculations for RF Exposure are presented in a separate document.

## 3 EQUIPMENT UNDER TEST (EUT) DETAILS

### 3.1 EUT Description

The EUT is a 900 MHz transceiver, Model i>clickr TMX14, manufactured by MacMillan Publishing, Inc. The EUT was in good working condition during the tests, with no known defects.

#### 3.1.1 FCC Section 15.203 & RSS-GEN Antenna Requirements

The antenna is a half wave monopole. The antenna does not have a standard connector. The antenna's coax is soldered to the PCB. It cannot be readily modified by the end user. Therefore, it meets the 15.203 Requirements.

### 3.2 Related Submittals

MacMillan Publishing, Inc. is not submitting any other products simultaneously for equipment authorization related to the EUT.

## 4 TESTED SYSTEM DETAILS

### 4.1 Tested System Configuration

The system was configured for testing in a typical fashion. The EUT was placed on an 80-cm high, nonconductive test stand. The testing was performed in conditions as close as possible to installed conditions. Wiring was consistent with manufacturer's recommendations.

Power was supplied at 115 VAC, 60 Hz single-phase to its external power supply. The identification for all equipment, plus descriptions of all cables used in the tested system, are:

**Tested System Configuration List**

Item	Description	Type*	Manufacturer	Model Number	Serial Number
1	i>clickr 900 MHz Transceiver	E	MacMillan Publishing, Inc.	TMX14	none
2	EUT power Supply	E	V-Infinity	EPS050100	None
3	Notebook	H	Dell	D620 (PP18L)	25886676421
4	Notebook Power Supply	H	Dell	LA90PS0-00	CN-0DF266-71615-694-2C8C
5	Modem	P	US Robotics	0701	22SBBAC9FPMN

\* Type: E = EUT, P = Peripheral, S = Support Equipment; H = Host Computer

Testing of the MacMillan Publishing, Inc., i>clickr Model TMX14, Transceiver,

#### List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.8	AC Cord	Power supply to i>clicker	No
1	1.8	USB cable	i>clicker and Computer	Yes
1	1.8	Serial cable	Modem and Computer	Yes
1	1.8	USB Cable	i>clicker and flash drive	Yes

## 4.2 Special Accessories

No special accessories were used during the tests in order to achieve compliance.

## 4.3 Equipment Modifications

No modifications were made to the EUT at Radiometrics' test facility in order to comply with the standards listed in this report.

## 5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2008	Code of Federal Regulations Title 47, Chapter 1, Federal Communications Commission, Part 15 - Radio Frequency Devices
ANSI C63.4-2003	2003	Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
IC RSS-210 Issue 7	2007	Low Power Licence-Exempt Radiocommunication Devices (All Frequency Bands) Category I Equipment
IC RSS-Gen Issue 2	2007	General Requirements and Information for the Certification of Radiocommunication Equipment (RSS-Gen)
FCC DA 00-705	2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
FCC 558074	2005	Measurement of Digital Transmission Systems Operating under Section 15.247

The test procedures used are in accordance with the FCC 558074, Industry Canada RSS-212 and ANSI document C63.4-2003, "Methods of Measurement of Radio Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". The specific procedures are described herein. Radiated testing was performed at an antenna to EUT distance of 3 meters. The antenna was raised and lowered from 1 to 4 meters.

## 6 RADIOMETRICS' TEST FACILITIES

The results of these tests were obtained at Radiometrics Midwest Corp. in Romeoville, Illinois, USA. Radiometrics is accredited by A2LA (American Association for Laboratory Accreditation) to conform to ISO/IEC 17025: 2005 "General Requirements for the Competence of Calibration and Testing Laboratories". Radiometrics' Lab Code is 121191 and Certification Number is 1495.01. Radiometrics' scope of accreditation includes all of the test methods listed herein. A copy of the accreditation can be accessed on our web site ([www.radiomet.com](http://www.radiomet.com)). Radiometrics accreditation status can be verified at A2LA's web site ([www.a2la2.org](http://www.a2la2.org)).

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

The following is a list of shielded enclosures located in Romeoville, Illinois used during the tests:

Chamber A: Is an anechoic chamber that measures 24' L X 12' W X 12' H. The walls and ceiling are fully lined with ferrite absorber tiles. The floor has a 10' x 10' section of ferrite absorber tiles located in the center. Panashield of Rowayton, Connecticut manufactured the chamber. The enclosure is NAMAS certified.

Chamber E: Is a custom made anechoic chamber that measures 52' L X 30' W X 18' H. The walls and ceiling are fully lined with RF absorber. Pro-shield of Collinsville, Oklahoma manufactured the chamber.

Test Station F: Is an area that measures 10' D X 12' W X 10' H. The floor and back wall are metal shielded. This area is used for conducted emissions measurements.

A separate ten-foot long, brass plated, steel ground rod attached via a 6 inch copper braid grounds each of the above chambers. Each enclosure is also equipped with low-pass power line filters.

The FCC has accepted these sites as test site number US1065. The FCC test site Registration Number is 732175. Details of the site characteristics are on file with the Industry Canada as site number IC3124A-1.

A complete list of the test equipment is provided herein. The calibration due dates are indicated on the equipment list. The equipment is calibrated in accordance to ANSI/NCSL Z540-1 with traceability to the National Institute of Standards and Technology (NIST).

## 7 DEVIATIONS AND EXCLUSIONS FROM THE TEST SPECIFICATIONS

There were no deviations or exclusions from the test specifications.

## 8 CERTIFICATION

Radiometrics Midwest Corporation certifies that the data contained herein was taken under conditions that meet or exceed the requirements of the test specification. The results relate only to the EUT listed herein. Any modifications made to the EUT subsequent to the indicated test date will invalidate the data and void this certification.

## 9 TEST EQUIPMENT TABLE

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
AMP-05	RMC/Celeritek	Pre-amplifier	MW110G	1001	1.0-12GHz	12 Mo.	02/11/10
AMP-20	Avantek	Pre-amplifier	SF8-0652	15221	8-18GHz	12 Mo.	02/11/10
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	02/11/10
ANT-13	EMCO	Horn Antenna	3115	2502	1.0-18GHz	24 Mo.	10/22/08
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	11/25/09
ANT-53	EMCO	Loop Antenna	6507	1453	1 kHz-30 MHz	12 Mo.	11/04/09
HPF-01	Solar	High Pass Filter	7930-100	HPF-1	0.15-30MHz	24 Mo.	10/27/09
LSN-03	Farnell	50 uH LISN	1EXLSN30B	000314	0.01-30MHz	24 Mo.	06/01/09

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

RMC ID	Manufacturer	Description	Model No.	Serial No.	Frequency Range	Cal Period	Cal Date
PRE-01	Hewlett Packard	Preselector	85685A	2510A00143	20 Hz-2GHz	12 Mo.	01/11/10
REC-01	Hewlett Packard	Spectrum Analyzer	8566A	2106A02115, 2209A01349	30Hz-22GHz	12 Mo.	10/29/10
REC-03	Anritsu	Spectrum Analyzer	MS2601B	MT94589	0.01-2200MHz	12 Mo.	03/15/10
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	04/06/10
REC-08	Hewlett Packard	Spectrum Analyzer	8566B	2648A13481 2209A01436	30Hz-22GHz	24 Mo.	08/21/09
THM-02	Fluke	Temp/Humid Meter	971	93490471	N/A	12 Mo.	04/01/10

Note: All calibrated equipment is subject to periodic checks.

## 10 TEST SECTIONS

### 10.1 AC Conducted Emissions

The tests and limits are in accordance with FCC section 15.207 and RSS Gen section 7.2.2.

A computer-controlled analyzer was used to perform the conducted emissions measurements. The frequency range was divided into 500 subranges equally spaced on a logarithmic scale. The computer recorded the peak of each subrange. This data was then plotted on semi-log graph paper generated by the computer and plotter. Adjusting the positions of the cables and orientation of the test system then maximizes the highest emissions.

Mains Conducted emission measurements were performed using a 50 Ohm/50 uH Line Impedance Stabilization Network (LISN) as the pick-up device. Measurements were repeated on both leads within the power cord. If the EUT power cord exceeded 80 cm in length, the excess length of the power cord was made into a 30 to 40 cm bundle near the center of the cord. The LISN was placed on the floor at the base of the test platform and electrically bonded to the ground plane.

#### FCC Limits of Conducted Emissions at the AC Mains Ports

Frequency Range (MHz)	Class B Limits (dBuV)	
	Quasi-Peak	Average
0.150 - 0.50*	66 - 56	56 - 46
0.5 - 5.0	56	46
5.0 - 30	60	50
* The limit decreases linearly with the logarithm of the frequency in this range.		

The initial step in collecting conducted data is a peak detector scan and the plotting of the measurement range. Significant peaks are then marked as shown on the following table, and these signals are then measured with the quasi-peak detector. The following represents the worst case emissions from the host computer, (with the EUT connected) power cord, after testing all modes of operation.



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Test Date : November 9, 2010

The Amplitude is the final corrected value with cable and LISN Loss.

Test Mode; Transmitting at 903.5, 914 and 923 MHz. Each transmit freq was tested separately. The highest emissions are shown below.

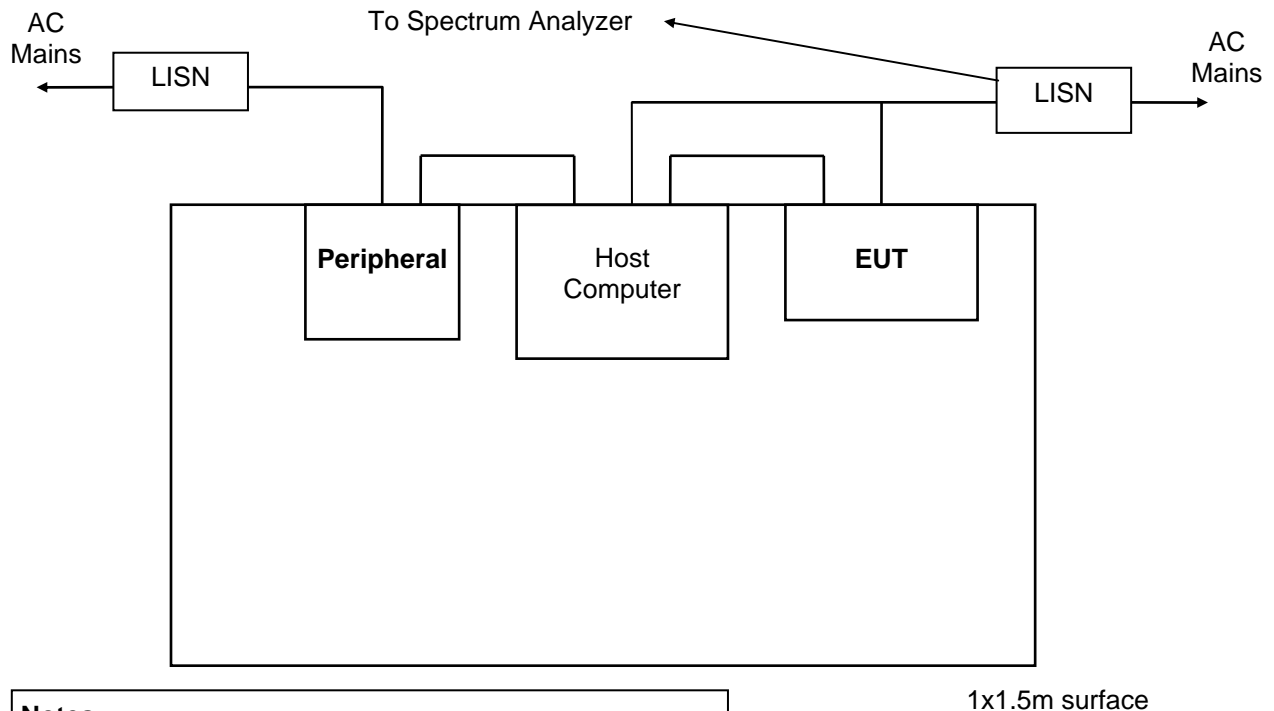
Lead Tested	Frequency MHz	QP Amplitude	QP Limit	Average Amplitude	Average Limit
AC Hot	0.159	52.0	65.5	39.9	55.5
AC Hot	0.231	56.4	62.4	41.4	52.4
AC Hot	0.304	52.1	60.1	41.4	50.1
AC Hot	0.421	45.1	57.4	32.9	47.4
AC Hot	0.571	49.8	56.0	37.1	46.0
AC Hot	0.686	50.0	56.0	36.3	46.0
AC Hot	0.907	50.0	56.0	38.7	46.0
AC Hot	1.066	52.1	56.0	37.8	46.0
AC Hot	1.136	54.0	56.0	43.0	46.0
AC Hot	1.172	51.7	56.0	36.8	46.0
AC Hot	1.234	52.1	56.0	41.0	46.0
AC Hot	1.445	48.6	56.0	33.7	46.0
AC Hot	2.617	44.1	56.0	26.5	46.0
AC Hot	6.987	44.2	60.0	29.5	50.0
AC Neutral	0.168	47.8	65.1	34.1	55.1
AC Neutral	0.1798	50.1	64.5	32.2	54.5
AC Neutral	0.3041	45.2	60.1	36.4	50.1
AC Neutral	0.3702	43.1	58.5	26.6	48.5
AC Neutral	0.5718	43.8	56.0	31.8	46.0
AC Neutral	0.7953	46.4	56.0	31.3	46.0
AC Neutral	0.9145	43.5	56.0	32.6	46.0
AC Neutral	0.9645	49.2	56.0	27.4	46.0
AC Neutral	1.136	53.5	56.0	37.1	46.0
AC Neutral	1.202	51.2	56.0	29.3	46.0
AC Neutral	1.368	47.2	56.0	30.8	46.0
AC Neutral	1.475	46.3	56.0	28.1	46.0
AC Neutral	3.648	44.5	56.0	27.4	46.0
AC Neutral	7.829	41.8	60.0	30.5	50.0

The above are the worst case results with three frequencies.

\* QP readings are quasi-peak with a 9 kHz bandwidth and no video filter.

Judgment: Passed by 2.0 dB



**Figure 1. Conducted Emissions Test Setup****Notes:**

- LISN's at least 80 cm from EUT chassis
- Vertical conductive plane 40 cm from rear of table top
- EUT power cord bundled

**10.2 Occupied Bandwidth**

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation. The EUT was transmitting at its maximum data rate. The trace was allowed to stabilize.

The marker-to-peak function was set to the peak of the emission. Then the marker-delta function was used to measure 20 dB down one side of the emission. The marker-delta function was reset and then moved to the other side of the emission, until it is (as close as possible to) even with the reference marker level. The marker-delta reading at this point is the 20 dB bandwidth of the emission.

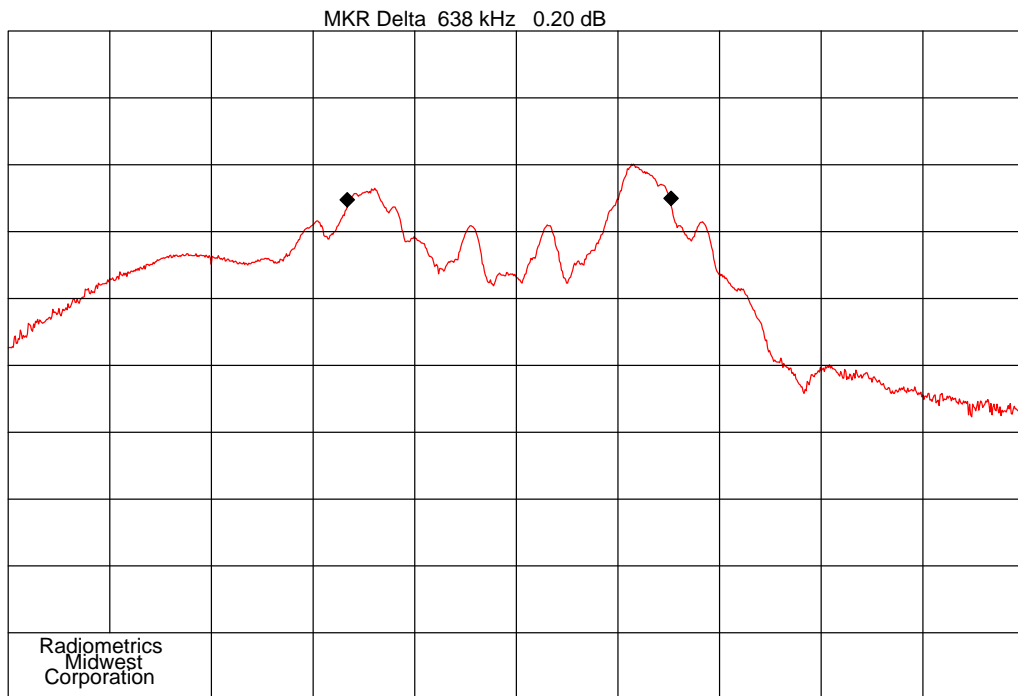
Channel MHz	6 dB EBW kHz	20 dB (99%) EBW kHz (Canada)
903.5	638	1316
914.0	642	1290
923.0	657	995

Judgement: Pass

The Bandwidth must be at least 500 kHz

6 dB Bandwidth

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

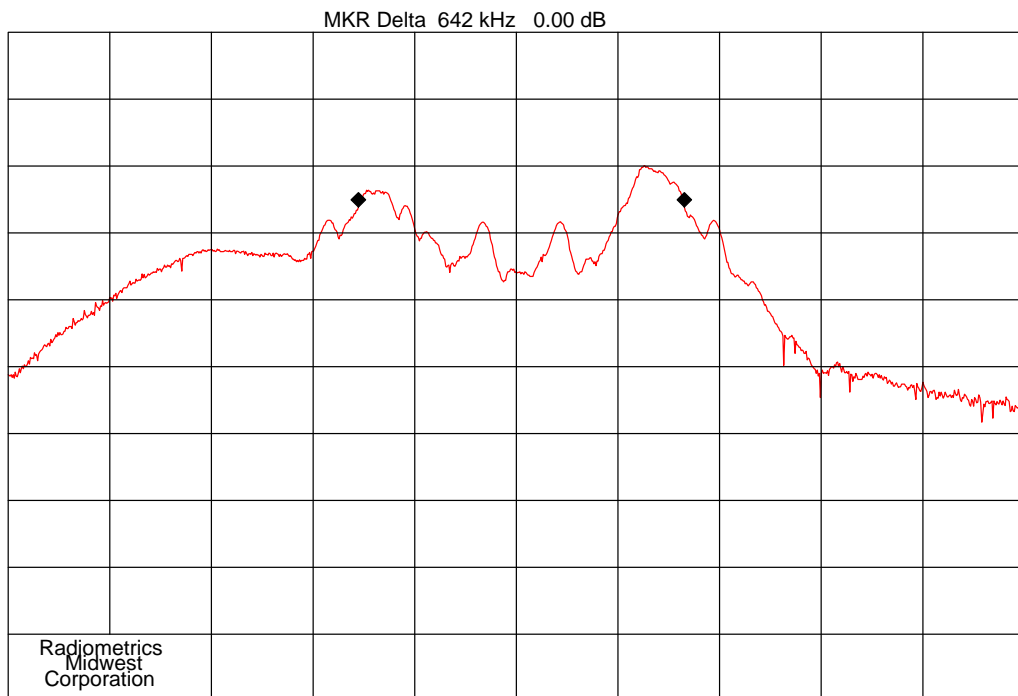


Company: Indesign  
CENTER 903.50 MHz  
RES BW 30 kHz  
10 dB/

Notes: 6 dB Bandwidth, Low Channel

ITEM : iClicker Base  
REF 30.0 dBm  
VBW 100 kHz  
Time: 14:02

Date : 11-08-2010  
SPAN 2.00 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BW1-6



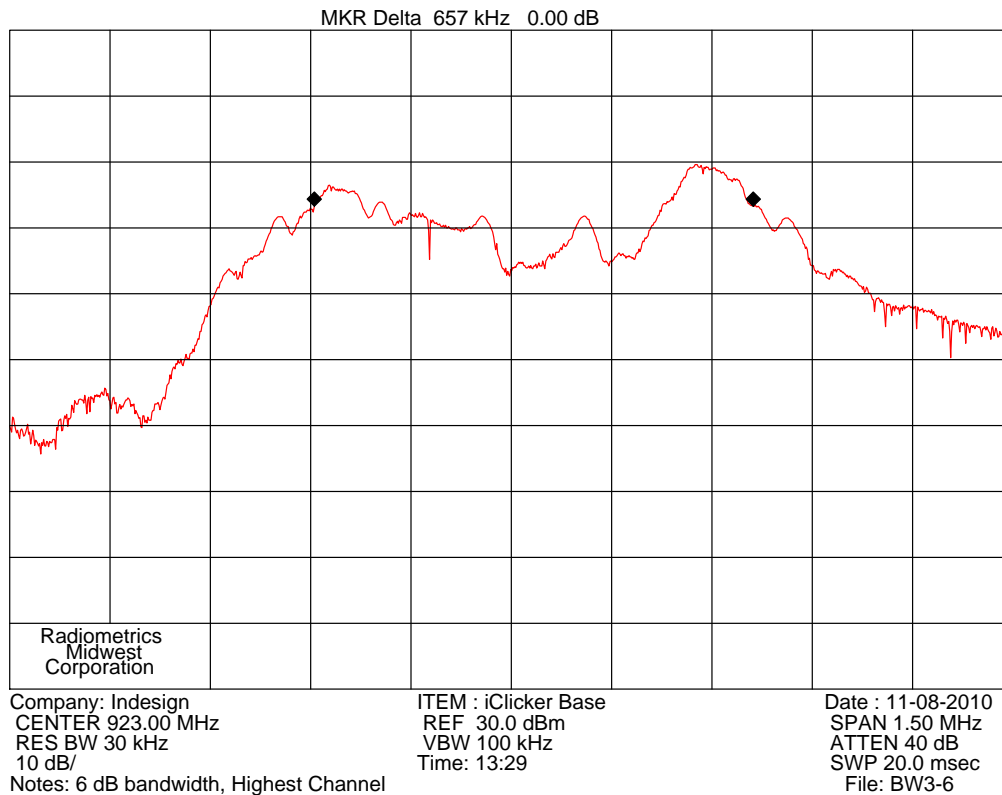
Company: Indesign  
CENTER 914.00 MHz  
RES BW 30 kHz  
10 dB/

Notes: 6 dB Bandwidth, Mid Channel

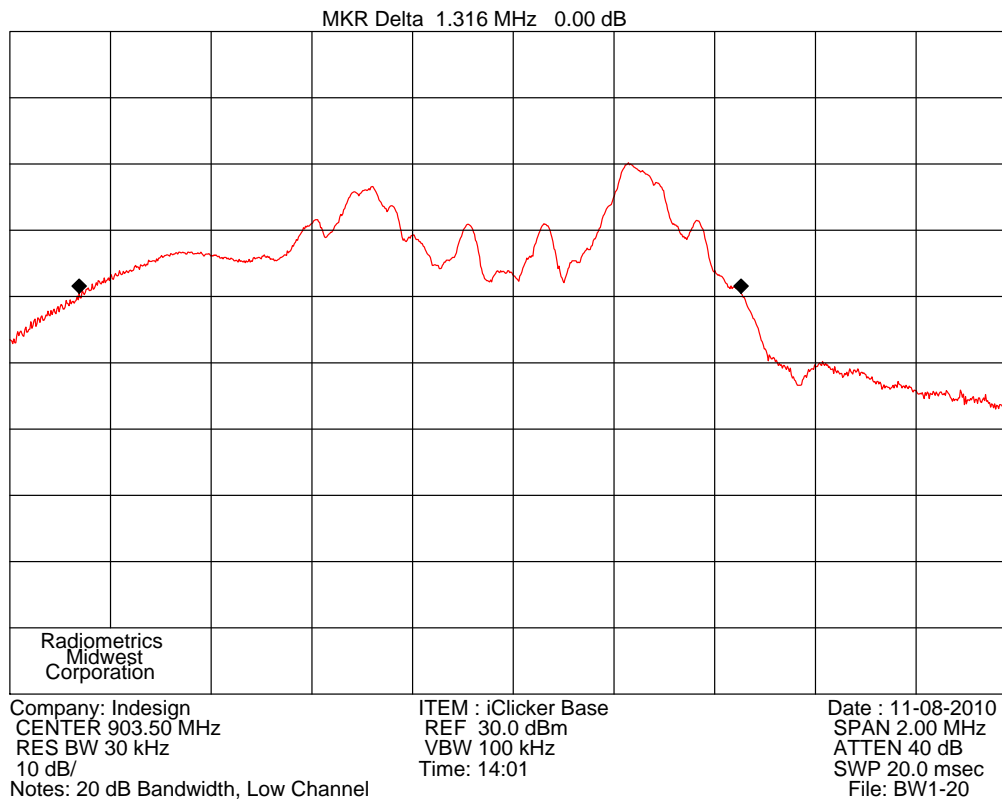
ITEM : iClicker Base  
REF 30.0 dBm  
VBW 100 kHz  
Time: 13:51

Date : 11-08-2010  
SPAN 2.00 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BW2-6

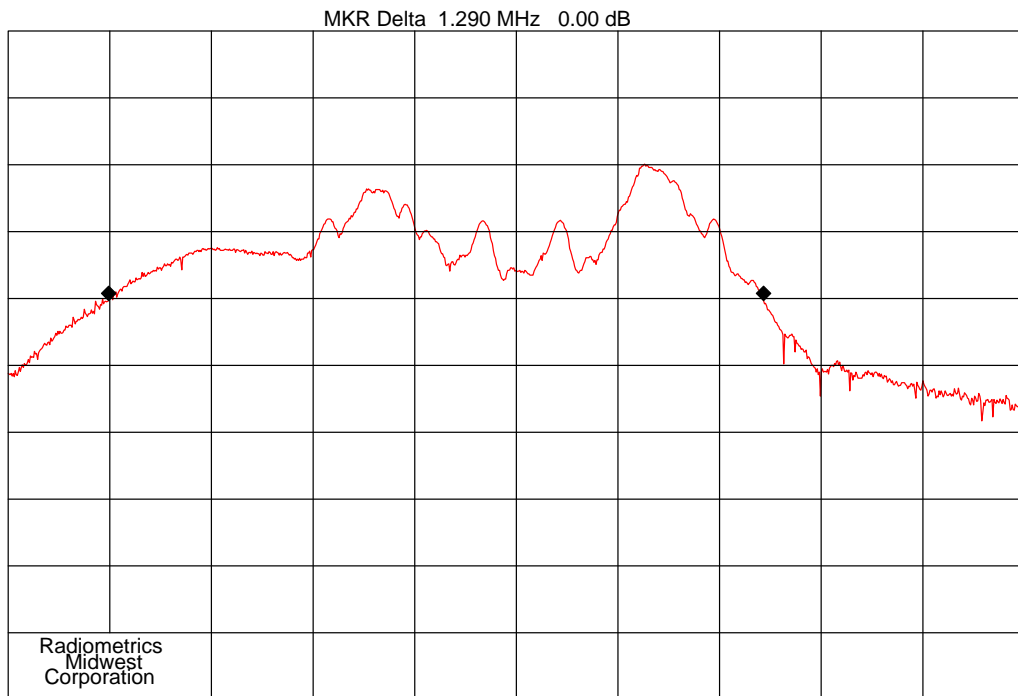
## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,



## 20 dB Bandwidth (99%)



## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

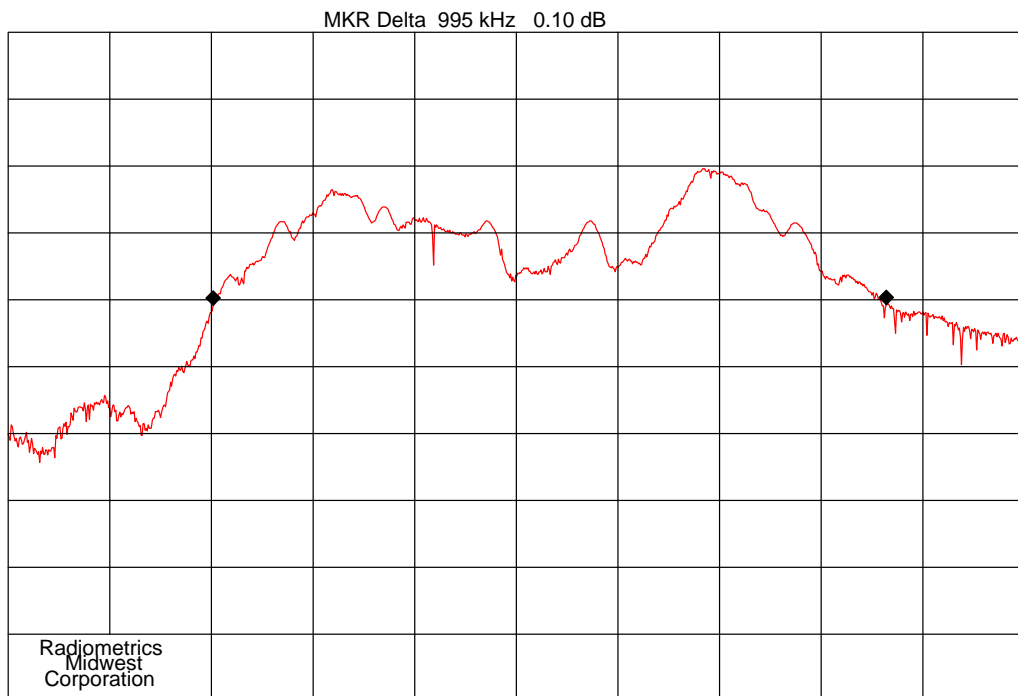


Company: Indesign  
CENTER 914.00 MHz  
RES BW 30 kHz  
10 dB/

Notes: 20 dB Bandwidth, Mid Channel

ITEM : iClicker Base  
REF 30.0 dBm  
VBW 100 kHz  
Time: 13:59

Date : 11-08-2010  
SPAN 2.00 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BW2-20



Company: Indesign  
CENTER 923.00 MHz  
RES BW 30 kHz  
10 dB/

Notes: 20 dB bandwidth, Highest Channel

ITEM : iClicker Base  
REF 30.0 dBm  
VBW 100 kHz  
Time: 13:31

Date : 11-08-2010  
SPAN 1.50 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BW3-20

Testing of the MacMillan Publishing, Inc., i>clickr Model TMX14, Transceiver,

### 10.3 Peak Output Power

The EUT antenna port on the was connected to the spectrum analyzer via a low loss coaxial cable. The power output option 2; Method #3 from FCC rules 558074 was used for this test. The spectrum analyzer was set to the following settings:

Span = 2 MHz; RBW = 3 MHz; VBW = 3 MHz; Sweep = auto  
Detector function = peak; Trace = max hold

The trace was allowed to stabilize. The marker-to-peak function was used to measure the peak of the emission. The indicated level is the peak output power. Note 30 dBm = 1 watt. Since the gain of the antenna is always less than 6 dB, the limit is not reduced.

Frequency (MHz)	Reading (dBm)	Cable Loss (dB)	Total Power (dBm)		Limit (dBm)
			dBm	Watts	
903.5	12.7	0.2	12.9	0.0195	30
914.0	13	0.2	13.2	0.02089	30
923.0	12.8	0.2	13	0.01995	30

Judgment: Pass by 16.8 dB

### 10.4 Power Spectral Density

PSD option 1 was used for this test on the 900 MHz Radio. No external attenuator was used. The spectrum analyzer was set to the following settings:

Span = 500 kHz RBW = 3 kHz; VBW = 10 kHz  
Sweep = 167 seconds; Detector Function = Peak

Frequency (MHz)	Reading dBm	Cable Loss (dB)	3 kHz Spectral Density (dBm)	Limit (dBm)
903.5	1.8	0.2	2.0	8.0
914.0	1.9	0.2	2.1	8.0
923.0	1.8	0.2	2.0	8.0

Judgment: Pass by 5.9 dB

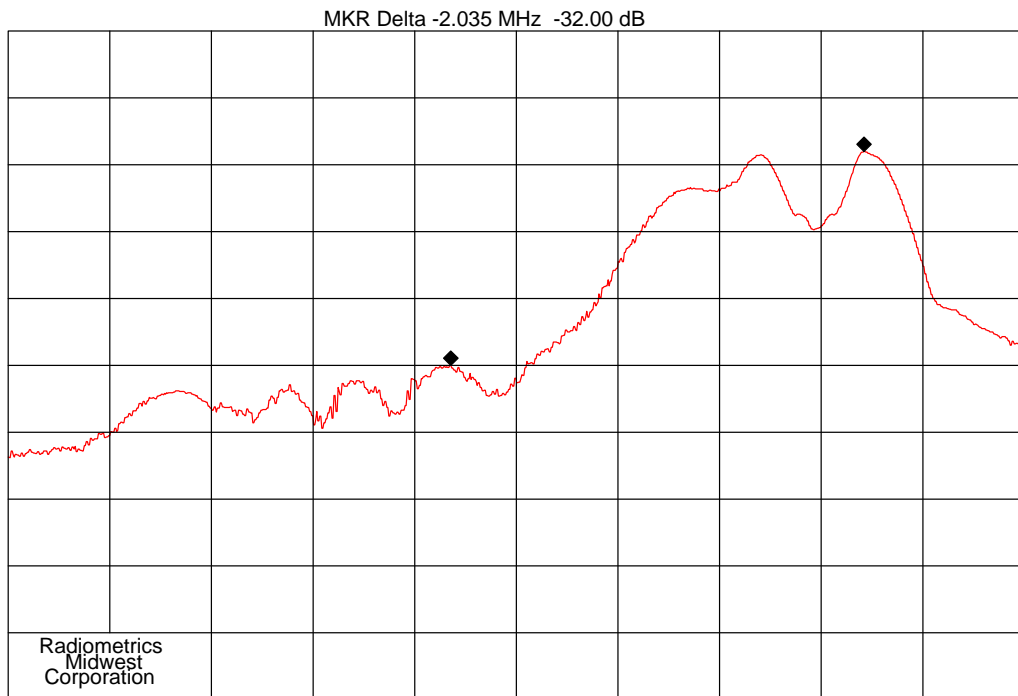
### 10.5 Band-edge Compliance of RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record the worst case of the modulation at the band-edge, with the EUT set to the lowest frequency. The trace was allowed to stabilize.

Channel	Band Edge in dB	Minimum Allowed dB
Lower Band edge	32	20
Upper Band edge	45.4	20

Judgment: Pass by 12.0 dB

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

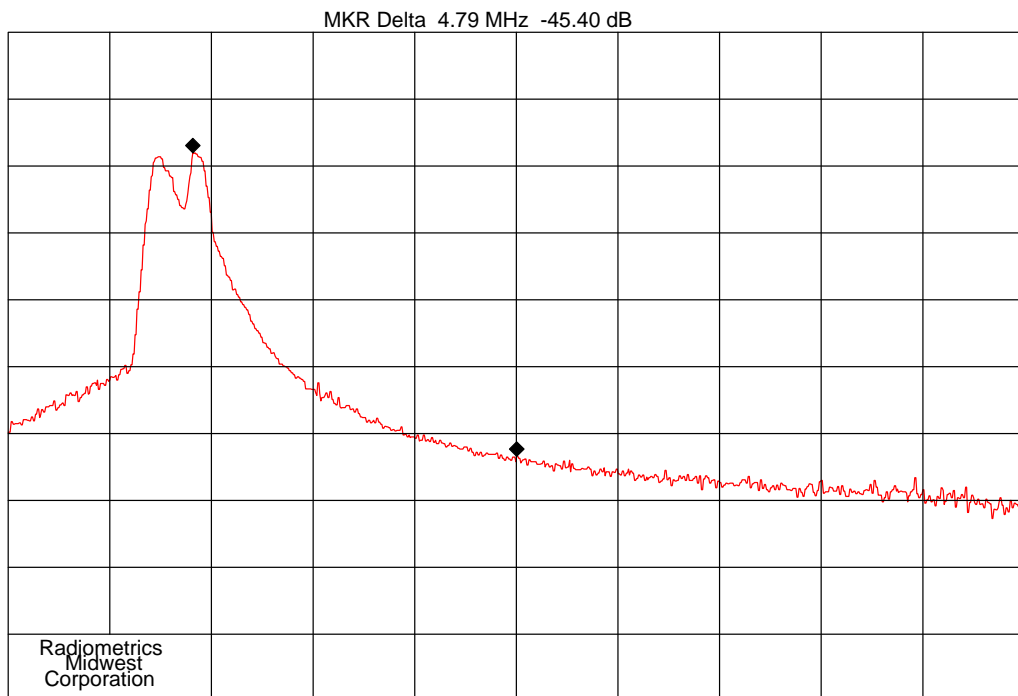


Company: Indesign  
CENTER 902.00 MHz  
RES BW 100 kHz  
10 dB/

Notes: Band Edge, Low Channel

ITEM : iClicker Base  
REF 30.0 dBm  
VBW 300 kHz  
Time: 14:06

Date : 11-08-2010  
SPAN 5.00 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BE-L



Company: Indesign  
CENTER 928.0 MHz  
RES BW 100 kHz  
10 dB/

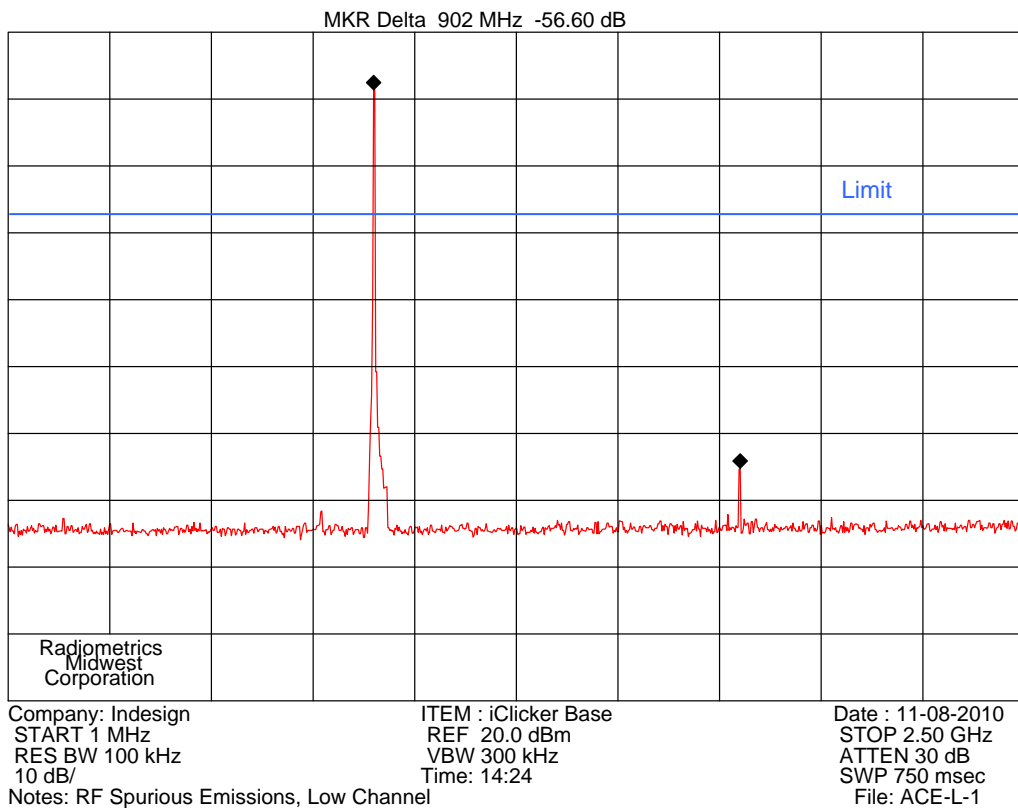
Notes: Band Edge, Highest Channel

ITEM : iClicker Base  
REF 30.0 dBm  
VBW 300 kHz  
Time: 14:19

Date : 11-08-2010  
SPAN 15.0 MHz  
ATTEN 40 dB  
SWP 20.0 msec  
File: BE-H

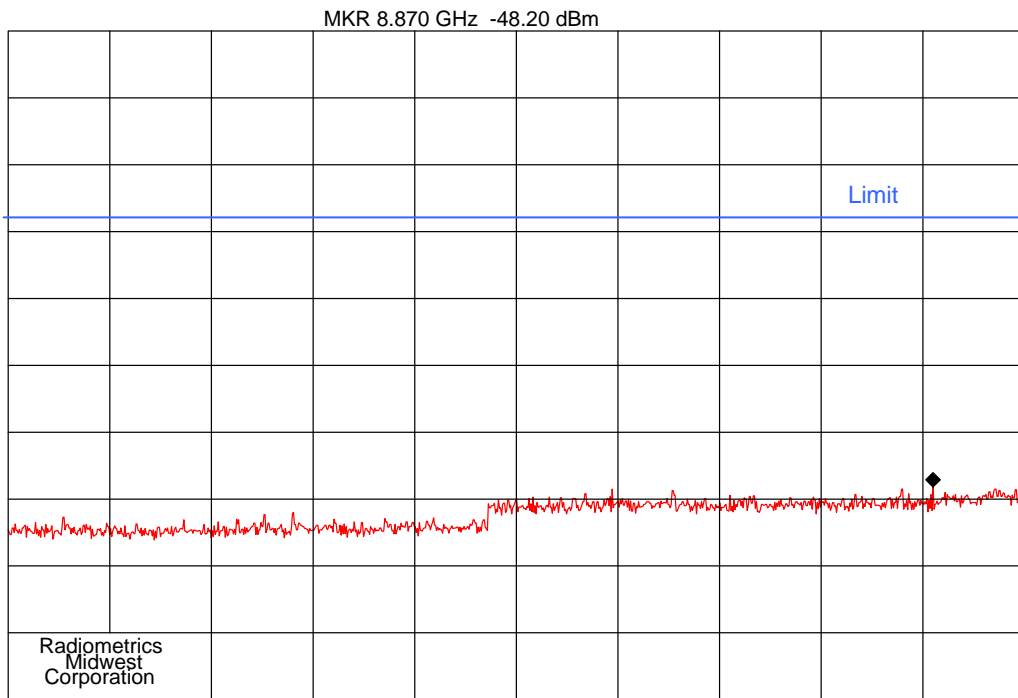
## 10.6 Spurious RF Conducted Emissions

The spectrum analyzer was set to the MAX HOLD mode to record all spurious emissions from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. The trace was allowed to stabilize. The first two plots were made while stepping through three frequencies (Low middle and high). Each frequency was on for 30 seconds.





## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

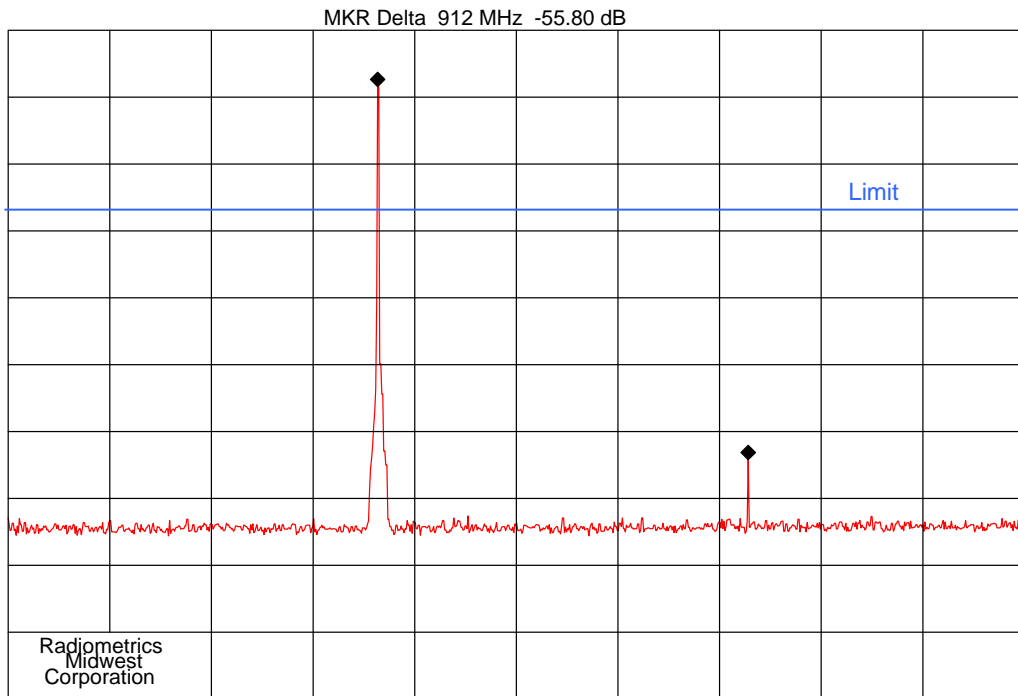


Company: Indesign  
START 2.50 GHz  
RES BW 100 kHz  
10 dB/

ITEM : iClicker Base  
REF 20.0 dBm  
VBW 300 kHz  
Time: 14:26

Date : 11-08-2010  
STOP 9.50 GHz  
ATTEN 30 dB  
SWP 2.10 sec  
File: ACE-L-2

Notes: RF Spurious Emissions, Low Channel



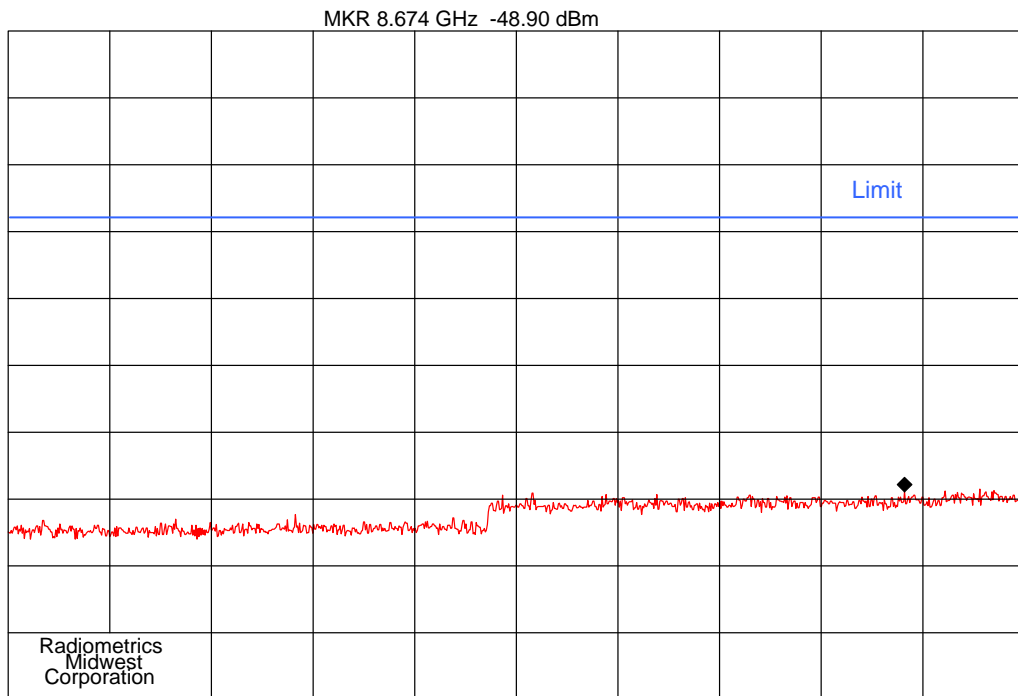
Company: Indesign  
START 1 MHz  
RES BW 100 kHz  
10 dB/

ITEM : iClicker Base  
REF 20.0 dBm  
VBW 300 kHz  
Time: 14:29

Date : 11-08-2010  
STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec  
File: ACE-M-1

Notes: RF Spurious Emissions, Mid Channel

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

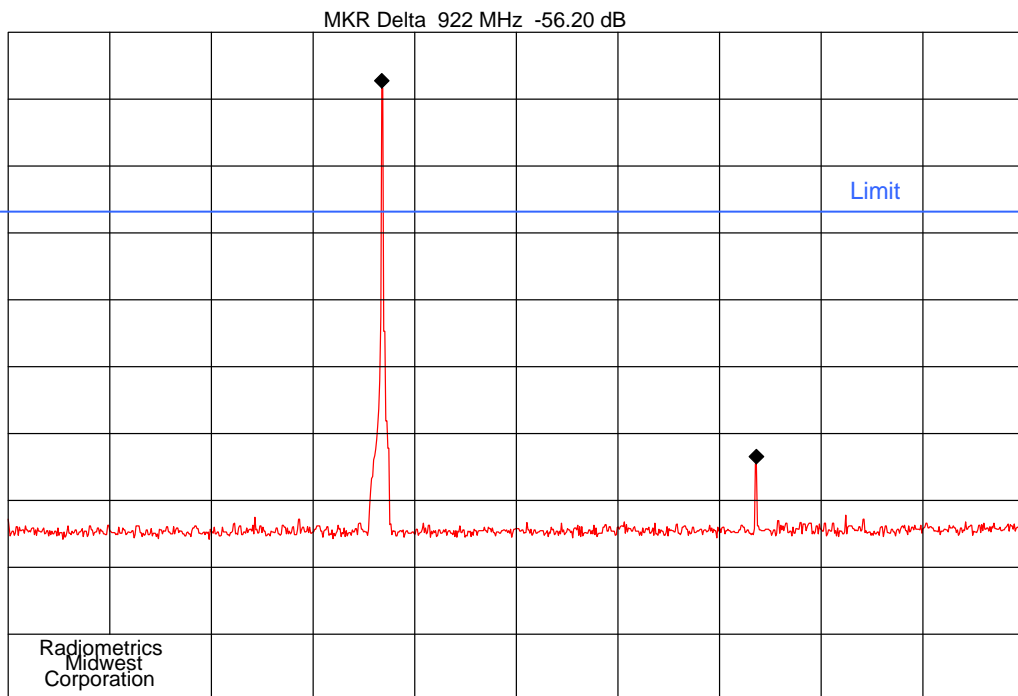


Company: Indesign  
START 2.50 GHz  
RES BW 100 kHz  
10 dB/

ITEM : iClicker Base  
REF 20.0 dBm  
VBW 300 kHz  
Time: 14:26

Date : 11-08-2010  
STOP 9.50 GHz  
ATTEN 30 dB  
SWP 2.10 sec  
File: ACE-M-2

Notes: RF Spurious Emissions, Mid Channel



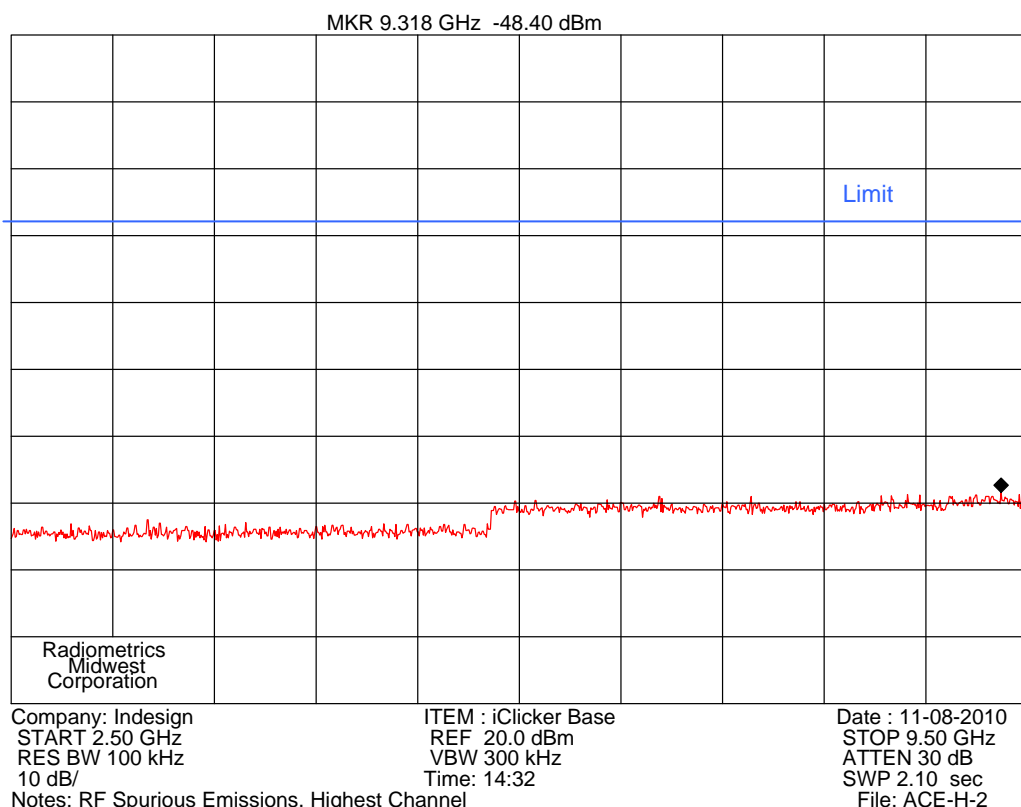
Company: Indesign  
START 1 MHz  
RES BW 100 kHz  
10 dB/

ITEM : iClicker Base  
REF 20.0 dBm  
VBW 300 kHz  
Time: 14:31

Date : 11-08-2010  
STOP 2.50 GHz  
ATTEN 30 dB  
SWP 750 msec  
File: ACE-H-1

Notes: RF Spurious Emissions, Highest Channel

Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,



Judgement: Pass by at least 30 dB

## 10.7 Spurious Radiated Emissions

Radiated emission measurements were performed with linearly polarized broadband antennas. The results obtained with these antennas can be correlated with results obtained with a tuned dipole antenna. The radiated emission measurements were performed with a spectrum analyzer. The bandwidth used from 150 kHz to 30 MHz is 9 or 10 kHz and the bandwidth from 30 MHz to 1000 MHz is 100 or 120 kHz. Above 1 GHz, a 1 MHz bandwidth is used. A 10 dB linearity check is performed prior to start of testing in order to determine if an overload condition exists.

From 30 to 1000 MHz, an Anritsu spectrum analyzer was used. For tests from 1 to 25 GHz, an HP 8566 spectrum analyzer was used. For tests from 1 to 10 GHz, a high pass filter was used to reduce the fundamental emission. Figure 4 herein lists the details of the test equipment used during radiated emissions tests. In addition, a high pass filter was used to reduce the fundamental emission.

Final radiated emissions measurements were performed inside of an anechoic chamber at a test distance of 3 meters. The anechoic chamber is designated as Chamber E. This Chamber meets the Site Attenuation requirements of ANSI C63.4 and CISPR 16-1. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 30 to 9300 MHz was slowly scanned. Measurements were performed using two antenna polarizations, (vertical and horizontal). The worst case emissions were recorded. All measurements may be performed using either the peak, average or quasi-peak detector functions. If the peak detector data exceeds or is marginally close to the limits, the measurements are repeated using a quasi-peak detector or average function as required by the specification for final determination of compliance.

## Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

The detected emission levels were maximized by rotating the EUT, adjusting the positions of all cables, and by scanning the measurement antenna from 1 to 4 meters above the ground.

### 10.7.1 Radiated Emissions Field Strength Sample Calculation

The field strength is calculated by adding the Antenna Factor and Cable Loss, and by subtracting the Amplifier Gain from the measured reading. The basic equation is as follows:

$$FS = RA + AF + CF - AG$$

Where: FS = Field Strength

RA = Receiver Amplitude

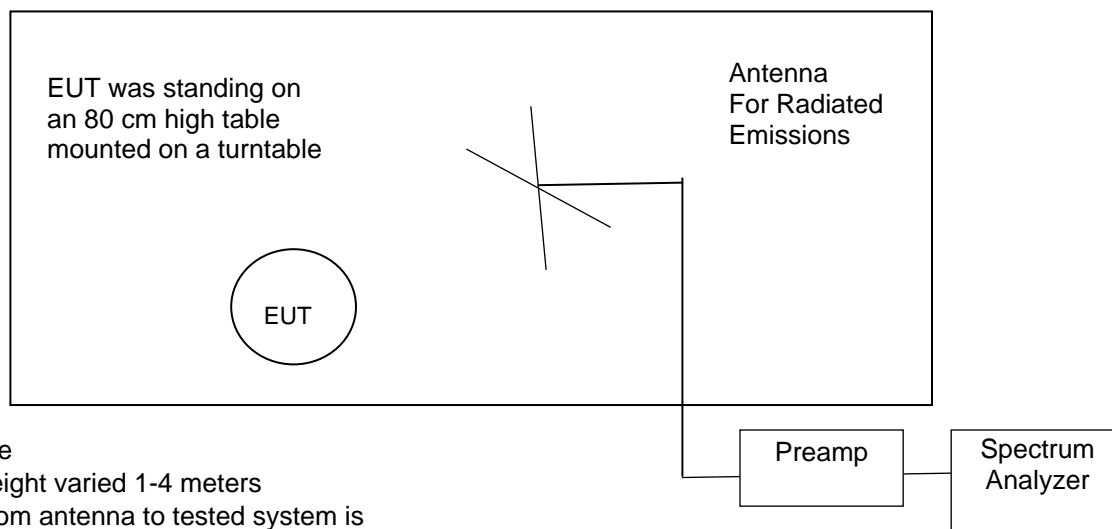
AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

**Figure 2. Drawing of Radiated Emissions Setup**

Chamber E, anechoic



**Notes:**

- Not to Scale
- Antenna height varied 1-4 meters
- Distance from antenna to tested system is 3 meters
- AC cords not shown. They are connected to AC outlet with low-pass filter on turntable

Frequency Range	Receive Antenna	Pre-Amplifier	Spectrum Analyzer
30 to 1000 MHz	ANT-44	AMP-22	REC-03
1 to 10 GHz	ANT-13	AMP-05	REC-01

### 10.7.2 Spurious Radiated Emissions Test Results

The following spectrum analyzer settings were used.

Span = wide enough to fully capture the emission being measured

RBW = 1 MHz for  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  RBW; Sweep = auto; Detector function = peak

Trace = max hold

A Video Bandwidth of 10 Hz was used for Average measurements above 1 GHz.

Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

**10.7.3 Spurious Emissions (All Except Harmonics)**

Manufacturer	MacMillan Publishing, Inc.	Specification	FCC Part 15 Subpart C & RSS-210
Model	i>clickr TMX14	Test Date	11/8/2010
Serial Number	none	Test Distance	3 Meters
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; BC = Biconical (ANT-3); LP = Log-Periodic (ANT-6); HN = Horn (ANT-13) P = peak; Q = QP		
Notes	Corr. Factors = Cable Loss – Preamp Gain Full System with Laptop; Worst case of Transmit and Receive mode These results do not include the transmitter harmonics		

Freq. MHz	Meter Reading dBuV	Dect. Type	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
			Factor dB	Pol/ ID#		EUT	Limit	
32.4	35.5	P	16.1	H/44	-25.5	26.1	40.0	13.9
54.4	36.9	P	12.7	H/44	-25.1	24.5	40.0	15.5
63.6	35.4	P	9.5	H/44	-24.9	20.0	40.0	20.0
92.0	37.9	P	8.1	H/44	-24.6	21.4	43.5	22.1
104.4	38.6	P	11.8	H/44	-24.6	25.8	43.5	17.7
119.6	42.0	P	14.3	H/44	-24.7	31.6	43.5	11.9
143.6	39.1	P	10.5	H/44	-24.7	24.9	43.5	18.6
159.2	38.5	P	10.4	H/44	-24.8	24.1	43.5	19.4
191.2	50.8	P	9.5	H/44	-25.0	35.3	43.5	8.2
206.8	43.4	P	10.1	H/44	-25.0	28.5	43.5	15.0
229.2	47.8	P	11.6	H/44	-25.0	34.4	46.0	11.6
230.6	48.2	P	11.6	H/44	-25.0	34.8	46.0	11.2
240.2	44.2	P	12.2	H/44	-25.0	31.5	46.0	14.5
247.4	39.4	P	12.5	H/44	-25.0	26.9	46.0	19.1
276.6	48.3	P	13.1	H/44	-24.9	36.5	46.0	9.5
299.0	41.5	P	13.0	H/44	-24.7	29.8	46.0	16.2
323.6	46.6	P	13.5	H/44	-24.4	35.7	46.0	10.3
360.0	45.5	P	14.8	H/44	-24.1	36.1	46.0	9.9
368.4	47.5	P	15.0	H/44	-24.1	38.4	46.0	7.6
386.9	40.5	P	15.0	H/44	-23.9	31.6	46.0	14.4
415.4	42.2	P	16.7	H/44	-23.7	35.2	46.0	10.8
423.8	40.8	P	17.1	H/44	-23.6	34.3	46.0	11.7
431.7	39.1	P	16.9	H/44	-23.6	32.5	46.0	13.5
459.7	47.3	P	16.8	H/44	-23.5	40.7	46.0	5.3
497.2	38.1	P	17.1	H/44	-23.5	31.7	46.0	14.3
553.0	40.4	P	18.0	H/44	-23.3	35.1	46.0	10.9
600.0	41.6	P	18.8	H/44	-23.1	37.3	46.0	8.7
645.0	44.9	P	18.8	H/44	-22.6	41.1	46.0	4.9
875.0	41.2	P	21.3	H/44	-22.5	40.0	46.0	6.0
967.0	37.4	P	22.1	H/44	-22.2	37.3	54.0	16.7
1060.0	37.1	P	23.6	H/44	-21.6	39.2	54.0	14.8
1152.0	40.1	P	24.3	H/44	-21.4	43.0	54.0	11.0
1242.0	38.3	P	24.9	H/44	-21.1	42.1	54.0	11.9
1331.0	32.0	P	25.4	H/44	-20.9	36.5	54.0	17.5
1425.0	30.2	P	25.7	H/44	-20.6	35.2	54.0	18.8

Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

Freq. MHz	Meter Reading dBuV	Dect. Type	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
			Factor dB	Pol/ ID#		EUT	Limit	
34.0	43.6	P	16.0	V/44	-25.5	34.1	40.0	5.9
35.2	41.8	P	16.0	V/44	-25.5	32.3	40.0	7.7
64.4	45.2	P	9.2	V/44	-24.9	29.4	40.0	10.6
74.0	41.9	P	6.9	V/44	-24.8	24.0	40.0	16.0
82.8	41.3	P	7.1	V/44	-24.7	23.7	40.0	16.3
92.0	49.0	P	8.1	V/44	-24.6	32.6	43.5	10.9
100.8	50.2	P	9.9	V/44	-24.6	35.5	43.5	8.0
106.8	45.7	P	12.1	V/44	-24.6	33.2	43.5	10.3
119.6	49.8	P	14.3	V/44	-24.7	39.4	43.5	4.1
159.2	45.1	P	10.4	V/44	-24.8	30.7	43.5	12.8
183.6	45.9	P	9.3	V/44	-24.9	30.3	43.5	13.2
191.2	51.2	P	9.5	V/44	-25.0	35.7	43.5	7.8
212.4	51.1	P	10.8	V/44	-25.0	36.9	43.5	6.6
226.7	45.9	P	11.6	V/44	-25.0	32.5	46.0	13.5
229.2	41.5	P	11.6	V/44	-25.0	28.1	46.0	17.9
240.2	45.1	P	12.2	V/44	-25.0	32.3	46.0	13.7
276.6	47.3	P	13.1	V/44	-24.9	35.5	46.0	10.5
287.2	48.7	P	12.7	V/44	-24.8	36.6	46.0	9.4
323.0	45.4	P	13.5	V/44	-24.4	34.6	46.0	11.4
351.6	43.7	P	14.9	V/44	-24.2	34.5	46.0	11.5
368.4	46.2	P	15.0	V/44	-24.1	37.1	46.0	8.9
431.1	45.5	P	16.9	V/44	-23.6	38.8	46.0	7.2
459.7	48.4	P	16.8	V/44	-23.5	41.8	46.0	4.2
465.3	43.7	P	17.2	V/44	-23.5	37.4	46.0	8.6
482.1	42.1	P	17.1	V/44	-23.6	35.6	46.0	10.4
507.0	41.9	P	17.2	V/44	-23.5	35.6	46.0	10.4
553.0	41.6	P	18.0	V/44	-23.3	36.3	46.0	9.7
599.0	42.4	P	18.8	V/44	-23.1	38.0	46.0	8.0
645.0	42.4	P	18.8	V/44	-22.6	38.6	46.0	7.4
691.0	41.9	P	19.8	V/44	-22.3	39.4	46.0	6.6
737.0	36.4	P	19.8	V/44	-22.2	34.0	46.0	12.0
783.0	39.0	P	20.5	V/44	-22.2	37.3	46.0	8.7
797.2	43.3	Q	20.2	V/44	-22.2	41.4	46.0	4.6
799.8	40.7	Q	20.3	V/44	-22.2	38.8	46.0	7.2
875.0	38.6	P	21.3	V/44	-22.5	37.4	46.0	8.6
952.0	35.7	P	22.5	V/44	-22.3	35.9	46.0	10.1
967.0	34.8	P	22.1	V/44	-22.2	34.7	54.0	19.3
1056.0	37.1	P	23.6	V/44	-21.6	39.1	54.0	14.9
1242.0	33.3	P	24.9	V/44	-21.1	37.1	54.0	16.9
1328.0	31.8	P	25.4	V/44	-20.9	36.3	54.0	17.7
1426.0	29.3	P	25.7	V/44	-20.6	34.4	54.0	19.6

Judgment: Passed by 4.1 dB

For emissions above 1 GHz, the average limit of 54 was used while measuring with a peak detector. This made the average measurements unnecessary since the average limit is lower than the peak limit.

Testing of the MacMillan Publishing, Inc., i&gt;clickr Model TMX14, Transceiver,

**10.7.4 Spurious Radiated Emissions Test Results above 1 GHz and Fundamental**

hrm #	Tx Freq MHz	Spectrum Analyzer Reading in dBuV				Corr. Fact dB	Emission Freq MHz	Field Strength				Margin Under Limit
		Vertical Polarization		Horizontal Polarization				EUT Peak - Average		Limit Peak - Ave		
		Peak	Ave	Peak	Ave			dBuV/m				
1	903.5	80.1	N/A	71.6	N/A	23.3	903.5	109.4	N/A	125.2	N/A	15.8
2	903.5	35.6	31.6	35.9	31.9	35.9	1807	71.8	67.8	N/A	N/A	N/A
3	903.5	48.8	44.8	48.3	44.3	6.7	2710.5	55.5	51.5	74	54	2.5
4	903.5	41.4	37.4	40.2	36.2	9.7	3614	51.1	47.1	74	54	6.9
5	903.5	41.2	37.2	41.2	37.2	12.4	4517.5	53.6	49.6	74	54	4.4
6	903.5	39.1	35.1	34.5	30.5	7.6	5421	46.7	42.7	74	54	11.3
7	903.5	40.2	36.2	39.7	35.7	8.5	6324.5	48.7	44.7	N/A	N/A	N/A
8	903.5	38.9	34.9	37.8	33.8	10.8	7228	49.7	45.7	74	54	8.3
9	903.5	37.8	33.8	36.5	32.5	14.6	8131.5	52.4	48.4	74	54	5.6
10	903.5	35.2	31.2	34.8	30.8	19.4	9035	54.6	50.6	74	54	3.4
1	914	80.8	N/A	74.0	N/A	24.4	914.0	111.2	N/A	125.2	N/A	14.0
2	914.0	36.2	32.2	37.8	33.8	34.8	1828	72.6	68.6	N/A	N/A	N/A
3	914.0	46.3	42.3	45.1	41.1	6.4	2742	52.7	48.7	74	54	5.3
4	914.0	41.8	37.8	41.2	37.2	9.9	3656	51.7	47.7	74	54	6.3
5	914.0	39.8	35.8	38.5	34.5	12.6	4570	52.4	48.4	74	54	5.6
6	914.0	41.4	37.4	37.7	33.7	7.8	5484	49.2	45.2	74	54	8.8
7	914.0	38.2	34.2	38.1	34.1	8.4	6398	46.6	42.6	N/A	N/A	N/A
8	914.0	37.5	33.5	37.2	33.2	11.6	7312	49.1	45.1	74	54	8.9
9	914.0	36.1	32.1	36.7	32.7	14.9	8226	51.6	47.6	74	54	6.4
10	914.0	34.7	30.7	34.8	30.8	19.5	9140	54.3	50.3	74	54	3.7
1	923.0	80.3	N/A	73.2	N/A	23.8	923.0	110.1	N/A	125.2	N/A	15.1
2	923.0	36.9	32.9	38.5	34.5	33.6	1846	72.1	68.1	N/A	N/A	N/A
3	923.0	46.2	42.2	43.2	39.2	6.4	2769	52.6	48.6	74	54	5.4
4	923.0	43.6	39.6	43.0	39.0	10.1	3692	53.7	49.7	74	54	4.3
5	923.0	41.2	37.2	40.3	36.3	12.6	4615	53.8	49.8	74	54	4.2
6	923.0	44.3	40.3	40.5	36.5	7.9	5538	52.2	48.2	N/A	N/A	N/A
7	923.0	37.8	33.8	37.6	33.6	8.3	6461	46.1	42.1	N/A	N/A	N/A
8	923.0	37.4	33.4	36.1	32.1	12.2	7384	49.6	45.6	74	54	8.4
9	923.0	36.2	32.2	37.9	33.9	15.4	8307	53.3	49.3	74	54	4.7
10	923.0	34.2	30.2	34.3	30.3	20	9230	54.3	50.3	N/A	N/A	N/A
Column numbers (see below for explanations)												
1	2	3	4	5	6	7	8	9	10	11	12	13

Column #1. hrm = Harmonic; BE = Band Edge emissions

Column #2. Frequency of Transmitter.

Column #3. Uncorrected readings from the spectrum analyzer in dBuV

Column #4. Average Reading based on peak reading reduced by the Duty cycle correction.

Column #5. Same as Column #3 except Horizontal Receive antenna

Column #6. Same as Column #4 except Horizontal Receive antenna

Column #7. Corr. Factors = Cable Loss – Preamp Gain + Antenna Factor

Column #8. Frequency of Tested Emission

Column #9. Highest peak field strength at listed frequency.

Column #10. Highest Average field strength at listed frequency.

Column #11. Peak Limit. (Non-Restricted Band limits are Not Applicable; Fund Pk limit = 1W or 125.2 dBuV/m)

Column #12. Average Limit. (Non-Restricted Band limits are Not Applicable)

Column #13. The margin is the worst case margin in dB under the peak or average limits for that row.

Judgment: Passed by 2.5 dB