



Measurement of RF Interference from a  
Model STXe60  
60W FM Broadcast Transmitter

For : Broadcast Electronics  
4100 N. 24th Street  
Quincy, IL 62305

P.O. No. : 144363  
Date Tested : May 13<sup>th</sup> to June 3<sup>rd</sup>, 2013  
Test Personnel : Ian Carnegie  
Specification : FCC "Code of Federal Regulations" Title 47  
Part 73, Subpart B

Test Report By :

A handwritten signature in black ink, appearing to read "Ian Carnegie".

Ian F Carnegie

Approved By :

A handwritten signature in black ink, appearing to read "Raymond J Klouda".

Raymond J. Klouda  
Registered Professional  
Engineer of Illinois - 44894



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Total Page Count, Including Appendices = 18**



**REVISION HISTORY**

Revision	Date	Description
—	24 June 2013	Initial release

## Measurement of RF Emissions from a Model STXe60 60W FM Broadcast Transmitter

### 1 INTRODUCTION

#### 1.1 Scope of Tests

This document represents the results of the series of radio interference measurements performed on a Model STXe60 60W FM Broadcast Transmitter, (hereinafter referred to as the Equipment Under Test (EUT)). No serial number was assigned to the EUT. The EUT was designed to transmit in the range of 87.5MHz to 108.0MHz using an external antenna. The EUT has a power output rating of 60 Watts. The EUT was manufactured and submitted for testing by Broadcast Electronics located in Quincy, IL.

#### 1.2 Purpose

The test series was performed to determine if the EUT meets the requirements of the FCC "Code of Federal Regulations" Title 47, Part 73, for Radio Broadcast Services, Subpart B for FM Broadcast Stations. Testing was performed in accordance with TIA/EIA-603.

#### 1.3 Deviations, Additions and Exclusions

There were no deviations, additions to, or exclusions from the test specification during this test series.

#### 1.4 EMC Laboratory Identification

This series of tests was performed by Elite Electronic Engineering Incorporated of Downers Grove, Illinois.

#### 1.5 Laboratory Conditions

The temperature at the time of the test was 22°C and the relative humidity was 32%.

### 2 APPLICABLE DOCUMENTS

The following documents of the exact issue designated form part of this document to the extent specified herein:

- Federal Communications Commission "Code of Federal Regulations", Title 47, Part 73, Subpart B, dated October 2012
- TIA-603-C-2004, "Land Mobile FM or PM Communications Equipment - Measurement and Performance Standards"

### 3 EUT SETUP AND OPERATION

#### 3.1 General Description

The EUT is a 60W FM Broadcast Transmitter, Part No. STXe60. It is used commonly in FM radio stations.

##### 3.1.1 Power Input

The EUT obtained 230VAC 50Hz power via a 3 wire, 1.5 meter long, unshielded power cord.

##### 3.1.2 Peripheral Equipment

There was no peripheral equipment submitted with the EUT.

##### 3.1.3 Signal Input/Output Leads

The EUTs signal input and output ports were filled as follows:



The STXe60's "EXC RF OUT" port was connected to its "PA RF IN" port via an included 8cm cable.

For emissions testing with modulation on, the "COMP" port of the STXe60 was connected to the audio out port of a laptop where a white noise simulated signal was played from a looping mp3 file (unless otherwise noted in each test appendix).

#### 3.1.4 Grounding Considerations

The EUT was grounded through third wire of its input power cord.

### 3.2 Operational Mode

For all tests the EUT was energized. The EUT was set to transmit at 97.75MHz, 60W output power. The output of the EUT was unmodulated for all tests except for occupied bandwidth tests. For occupied bandwidth tests, the EUT was modulated with a 1 kHz audio signal.

The EUT was tested while running software version 1.1.

The cables were manually maximized during the preliminary emissions sweeps. The cable arrangement which resulted in the worst case emissions was utilized.

### 3.3 EUT Modifications

No modifications were required for compliance to the FCC requirements.

## 4 TEST FACILITY AND TEST INSTRUMENTATION

### 4.1 Shielded Enclosure

The radiated emissions tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. With the exception of the floor, the reflective surfaces of the shielded chamber are lined with ferrite tiles on the walls and ceiling. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane.

### 4.2 Test Instrumentation

The test instrumentation and auxiliary equipment used during the tests are listed in Table 9-1. All equipment was calibrated per the instruction manuals supplied by the manufacturer.

### 4.3 Calibration Traceability

Test equipment is maintained and calibrated on a regular basis. All calibrations are traceable to the National Institute of Standards and Technology (NIST).

## 5 TEST PROCEDURES

### 5.1 Power Output Rating

#### 5.1.1 Requirements

The power output rating of the transmitting equipment is the carrier power at which the transmitting equipment may be operated continuously into the test load.

#### 5.1.2 Procedures

The EUT was set to transmit at 97.75MHz.

- a) The antenna port of the EUT was connected to a spectrum analyzer through a directional coupler and 10dB of attenuation.
- b) The following spectrum analyzer settings were employed:

- trace 1 = on (Max Hold)
- center frequency = transmit frequency of the EUT
- resolution bandwidth = 200kHz
- video bandwidth > resolution bandwidth
- frequency span = 2MHz
- sweep = Auto
- detector function = peak

c) Several sweeps were made with the settings listed above.

### 5.1.3 Results

The output power measurements are shown in a tabular form on page 12.

## 5.2 Occupied Bandwidth Emissions

### 5.2.1 Requirements

Per CFR 47 Section 73.317, FM broadcast stations employing transmitters authorized after January 1, 1960, must maintain the bandwidth occupied by their emissions in accordance with the specification detailed below. FM broadcast stations employing transmitters installed or type accepted before January 1, 1960, must achieve the highest degree of compliance with these specifications practicable with their existing equipment. In either case, should harmful interference to other authorized stations occur, the licensee shall correct the problem promptly or cease operation.

Any emission appearing on a frequency removed from the carrier by between 120 kHz and 240 kHz inclusive must be attenuated at least 25 dB below the level of the unmodulated carrier. Compliance with this requirement will be deemed to show the occupied bandwidth to be 240 kHz or less.

Any emission appearing on a frequency removed from the carrier by more than 240 kHz and up to and including 600 kHz must be attenuated at least 35 dB below the level of the unmodulated carrier.

Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least  $43 + 10 \text{ Log}_{10}(\text{Power, in watts})$  dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

### 5.2.2 Procedures

- a. The EUT was set to transmit at 97.75MHz.
- b. The antenna port of the EUT was connected to a spectrum analyzer through a directional coupler and 10dB of attenuation.
- c. The following spectrum analyzer settings were employed:
  - center frequency = transmit frequency of the EUT
  - resolution bandwidth = 1MHz
  - video bandwidth > resolution bandwidth
  - frequency span = 5MHz
  - sweep = Auto
  - detector function = peak
  - trace = max hold
  - Several sweeps were made with the settings listed above.
- d. The reference level on the spectrum analyzer was set to the peak of the unmodulated output of the EUT.
- e. The EUT was then modulated with a 1 kHz audio sine wave.
- f. The following spectrum analyzer settings were employed:
  - center frequency = transmit frequency of the EUT

- resolution bandwidth = 1kHz
- video bandwidth > resolution bandwidth
- frequency span = 1MHz
- sweep = Auto
- detector function = peak
- trace = max hold
- Several sweeps were made with the settings listed above.

### 5.2.3 Results

As can be seen from the data, all emissions measured from the EUT were within the specification limits. The plots of the emission mask are presented on pages 13 through 14.

## 5.3 Spurious Emissions at Antenna Terminal

### 5.3.1 Requirements

Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least  $43 + 10 \text{ Log}_{10}(\text{Power, in watts})$  dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

### 5.3.2 Procedures

The EUT was set to transmit at 97.75MHz.

- a) The antenna port of the EUT was connected to a spectrum analyzer through a directional coupler and 10dB of attenuation.
- b) The resolution bandwidth of the spectrum analyzer was set to 100kHz.
- c) A sweep was made from 30MHz to 1GHz.

### 5.3.3 Results

The plot of the antenna conducted output measurement is presented on page 15. As can be seen from the data, the EUT's spurious emissions were within the limit.

## 5.4 Field Strength of Spurious Emissions

### 5.4.1 Requirements

Any emission appearing on a frequency removed from the carrier by more than 600 kHz must be attenuated at least  $43 + 10 \text{ Log}_{10}(\text{Power, in watts})$  dB below the level of the unmodulated carrier, or 80 dB, whichever is the lesser attenuation.

### 5.4.2 Procedures

All tests were performed in a 32ft. x 20ft. x 18ft. hybrid ferrite-tile/anechoic absorber lined test chamber. The walls and ceiling of the shielded chamber are lined with ferrite tiles. Anechoic absorber material is installed over the ferrite tile. The floor of the chamber is used as the ground plane. The shielded enclosure prevents emissions from other sources, such as radio and TV stations from interfering with the measurements. All powerlines and signal lines entering the enclosure pass through filters on the enclosure wall. The powerline filters prevent extraneous signals from entering the enclosure on these leads.

- a) Preliminary radiated emissions measurements were first performed using a peak detector and automatically plotted. The broadband measuring antenna was positioned at a 3 meter distance from the EUT. The entire frequency range from 30MHz to 1GHz was investigated using a peak detector function. All preliminary tests were performed with the EUT operating in the transmit mode at 97.75MHz.
- b) All significant broadband and narrowband signals found in the preliminary sweeps were then measured using a peak detector at a test distance of 3 meters. The measurements were made with a BiLog antenna over the frequency range of 30MHz to 1GHz.



- c) To ensure that maximum emission levels were measured, the following steps were taken:
  - The EUT was rotated so that all of its sides were exposed to the receiving antenna.
  - Since the measuring antennas are linearly polarized, both horizontal and vertical field components were measured.
  - The measuring antenna was raised and lowered from 1 to 4 meters for each antenna polarization to maximize the readings.
  
- d) The equivalent power was determined from the field intensity levels measured at 3 meters using the substitution method. To determine the emission power, a tuned dipole was set in place of the EUT and connected to a calibrated signal generator. The output of the signal generator was adjusted to match the received level at the spectrum analyzer. The signal level was recorded. The reading was corrected to compensate for cable loss, as required, and when the double ridged waveguide antenna was used, increased by the difference in gain between the dipole and the waveguide antenna.

#### 5.4.3 Results

The preliminary plots with the EUT transmitting at 97.75MHz are presented on data pages 16 and 17. The plots are presented for a reference only, and are not used to determine compliance.

The final radiated levels, with the EUT transmitting at 97.75MHz, are presented on data page 18. As can be seen from the data, all emissions measured from the EUT were within the specification limits. Photographs of the test configuration which yielded the highest or worst case, radiated emission levels are shown on Figure 2.

## 6 OTHER TEST CONDITIONS

### 6.1 Test Personnel and Witnesses

All tests were performed by qualified personnel from Elite Electronic Engineering Incorporated.

### 6.2 Disposition of the EUT

The EUT and all associated equipment were returned to Broadcast Communication upon completion of the tests.

## 7 CONCLUSIONS

It was determined that the Broadcast Electronics model STXe60 60W FM Broadcast Transmitter, did fully meet the requirements of the FCC "Code of Federal Regulations" Title 47, Part 73, Subpart B, Section 73.317 FM Transmission System Requirements, when tested per TIA-603.

## 8 CERTIFICATION

Elite Electronic Engineering Incorporated certifies that the information contained in this report was obtained under conditions which meet or exceed those specified in the test specifications.

The data presented in this test report pertains to the EUT at the test date. Any electrical or mechanical modification made to the EUT subsequent to the specified test date will serve to invalidate the data and void this certification.

This report must not be used to claim product endorsement by NVLAP or any agency of the US Government.





## 9 EQUIPMENT LIST

Table 9-1 Equipment List

Eq ID	Equipment Description	Manufacturer	Model No.	Serial No.	Frequency Range	Cal Date	Due Date
CDX8	COMPUTER	ELITE	WORKSTATION			N/A	
GSD3	SIGNAL GENERATOR	ROHDE & SCHWARZ	SMB100A	104454	9KHZ-6GHZ	8/20/2012	8/20/2013
GWH9	10MHZ DDS FUNCTION GENERATOR	WAVETEK	26	65404	0.0001HZ-10MHZ	12/9/2012	12/3/2013
NTA3	BILOG ANTENNA	TESEQ	6112D	28040	25-1000MHZ	2/15/2013	2/15/2014
NWQ1	DOUBLE RIDGED WAVEGUIDE ANTENNA	ETS-LINDGREN	3117	66655	1GHZ-18GHZ	3/18/2013	3/18/2014
RBA0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESIB26	100145	20HZ-26.5GHZ	3/12/2013	3/12/2014
RBE0	EMI TEST RECEIVER	ROHDE & SCHWARZ	ESU26	100095	20Hz-26GHz	3/13/2013	3/13/2014
RYE0	MODULATION ANALYZER	HEWLETT PACKARD	8901B	3104A03410	0.15-1300MHZ	9/4/2012	9/4/2013
SAA1	AC POWER SOURCE/ANALYZER	HEWLETT PACKARD	6813A	3524A-00446	0-300VRMS, 1750VA	NOTE 1	
T1E1	10DB 25W ATTENUATOR	WEINSCHTEL	46-10-43	AU1883	DC-18GHZ	8/6/2012	8/6/2013
T1N7	10DB 20W ATTENUATOR	NARDA	766-10	---	DC-4GHZ	8/6/2012	8/6/2013
WKA1	SOFTWARE, UNIVERSAL RCV EMI	ELITE	UNIV_RCV_EMI	1	---	I/O	
XDW0	50DB, 600W BIDIR COUPLER	AMPLIFIER RESEARCH	DC6180	303349	80-1000MHZ	7/16/2012	7/16/2013
XLK6	100W 50 OHM TERMINATION	JFW INDUSTRIES	50T-032-1.0	007	DC-1GHz	4/9/2013	4/9/2014
XLQF	5W, 50 OHM TERMINATION	JFW INDUSTRIES	50T-052	50	DC-2GHZ	8/6/2012	8/6/2013

N/A: Not Applicable

Note 1: For the purpose of this test, the equipment was calibrated over the specified frequency range, pulse rate, or modulation prior to the test or monitored by a calibrated instrument.

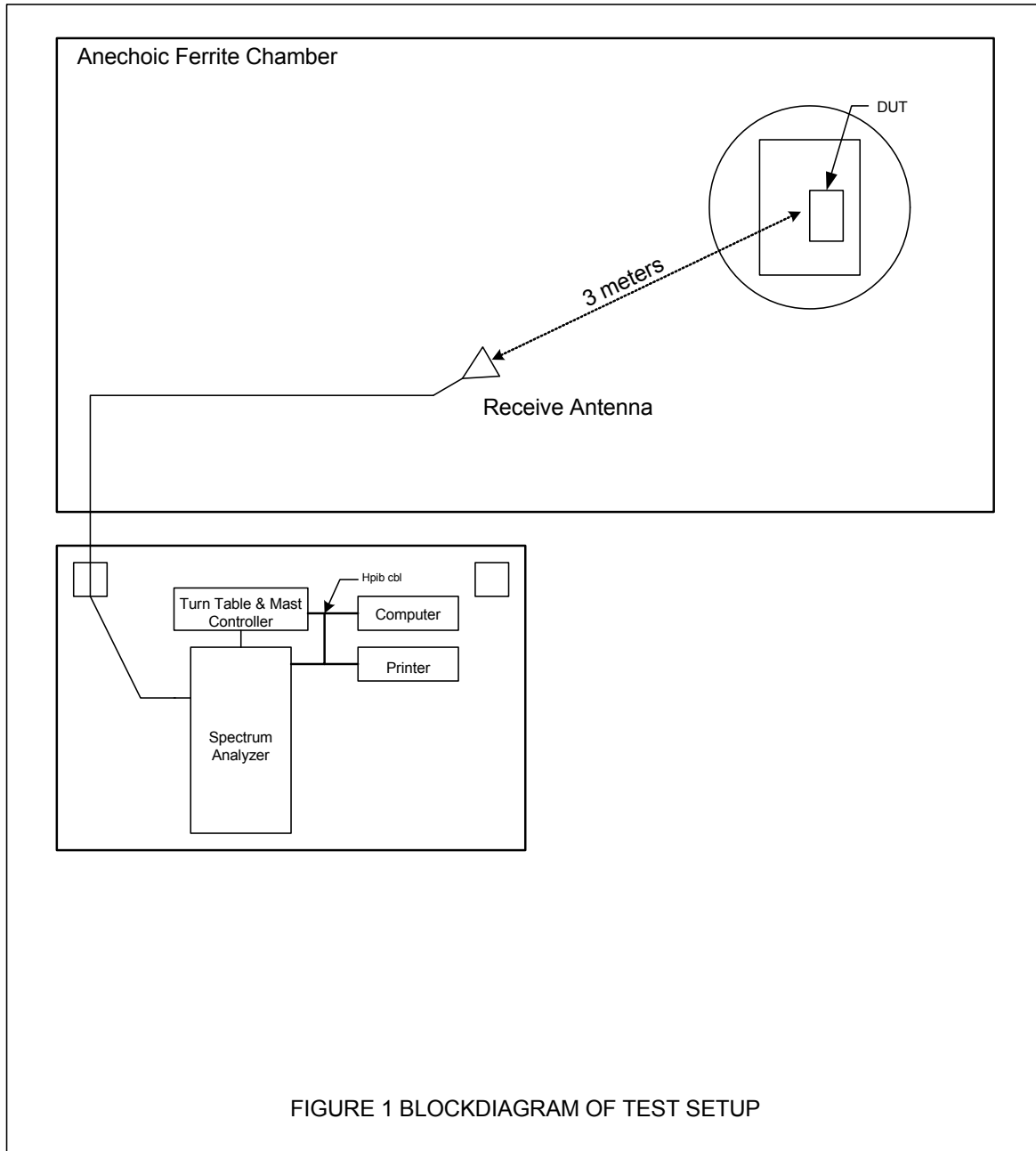
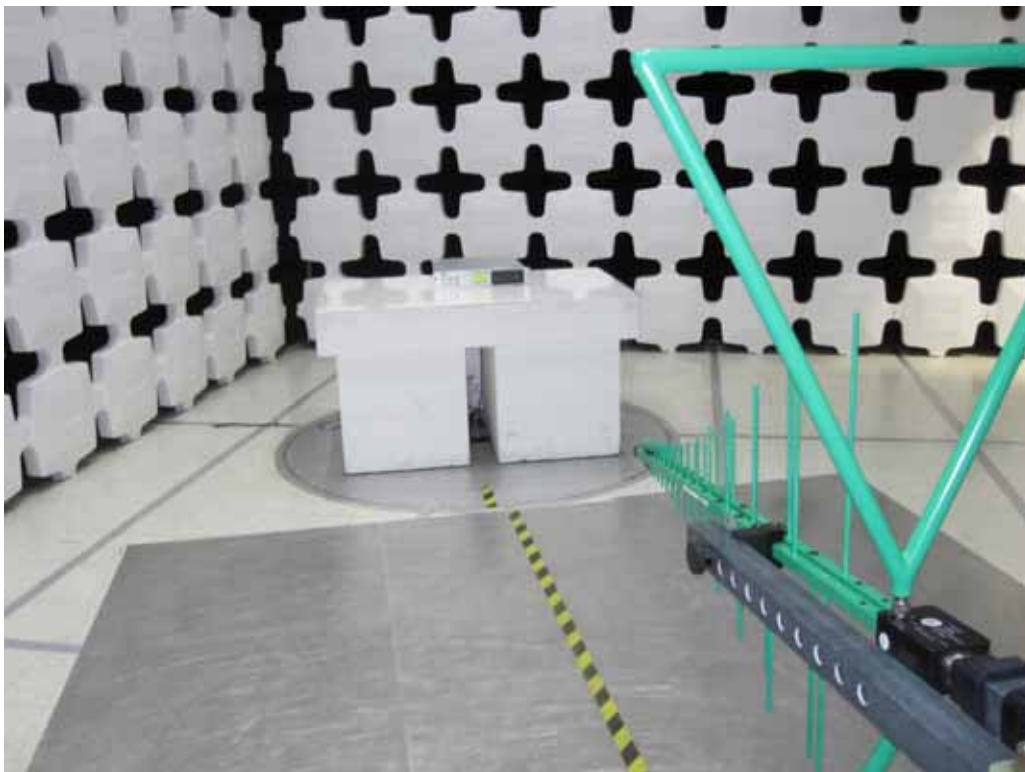


Figure 2



Test Setup for Radiated Emissions, 30MHz to 1GHz - Horizontal Polarization




Test Setup for Radiated Emissions, 30MHz to 1GHz - Vertical Polarization

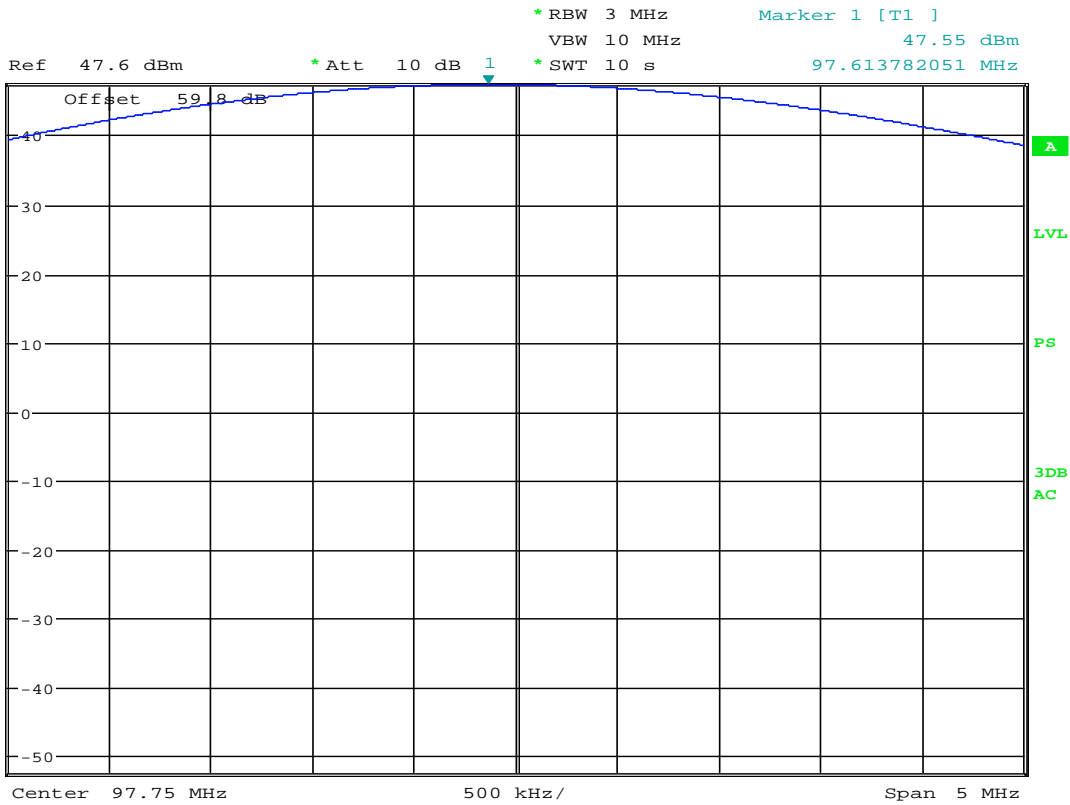


DATA PAGE

MANUFACTURER : Broadcast Electronics  
MODEL : STXe60  
SERIAL NUMBER : N/A  
TEST MODE : Transmit (@97.75MHz)  
DATE : 5/13/13  
TEST PARAMETERS : 60W ( $\approx$  48dBm)  
EQUIPMENT USED : RBB0, T1E0, XDW0, XLK6, XLQF

Frequency MHz	Measured Output Power dBm	Measured Output Power Watts	Manufacturer's Rated Power Watts
97.75	47.50	56.23	60

Checked By:   
Ian Carnegie

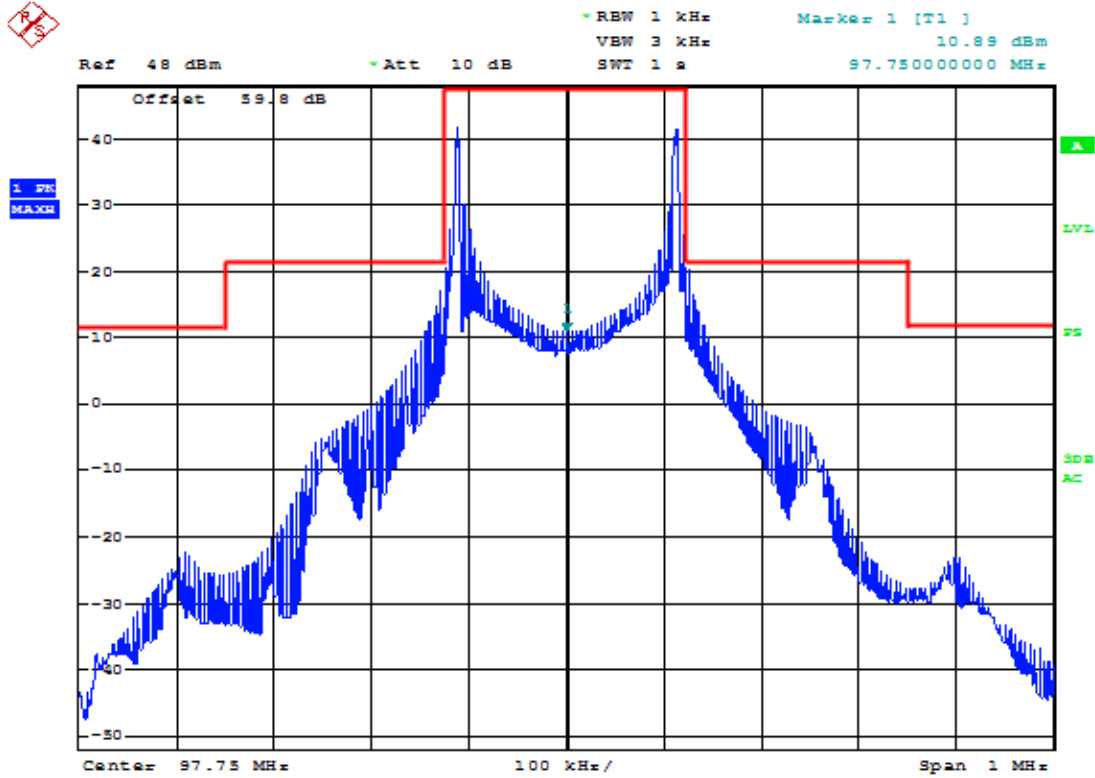


Date: 14.MAY.2013 11:46:25

**FCC: Occupied Bandwidth**

MANUFACTURER : BEI  
 MODEL NUMBER : STXe60  
 SERIAL NUMBER : N/A  
 TEST MODE : Transmit (@97.75MHz), 60W (unmodulated)  
 EQUIPMENT USED : RBB0, T1E0, XDW0, XLK6, XLQF

**NOTES**



Date: 14.MAY.2013 10:24:13

**FCC: Occupied Bandwidth**

MANUFACTURER : BEI  
 MODEL NUMBER : STXe60  
 SERIAL NUMBER : N/A  
 TEST MODE : Transmit (@97.75MHz), 60W (1 kHz modulation)  
 EQUIPMENT USED : RBB0, T1E0, XDW0, XLK6, XLQF

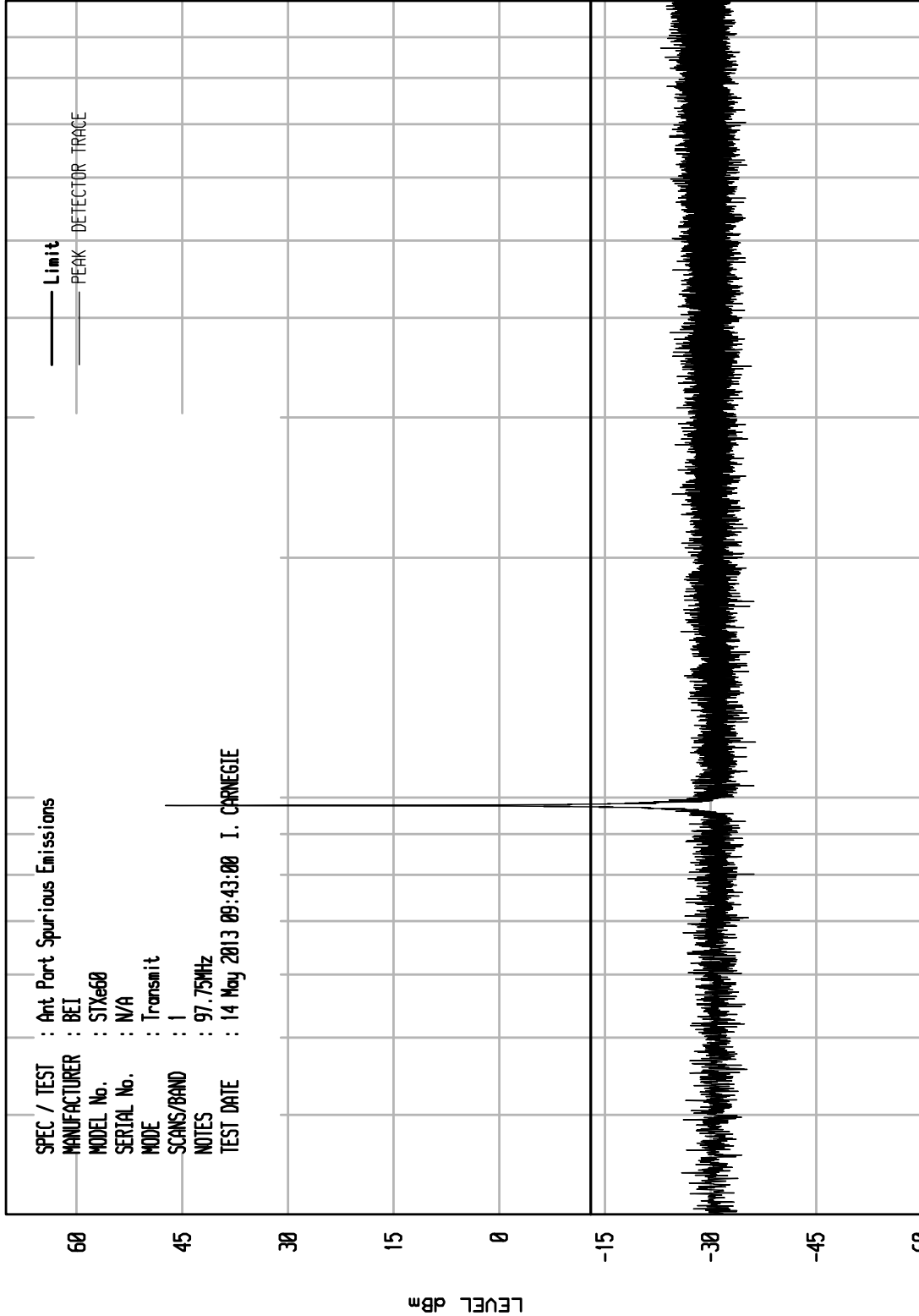
NOTES

ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

UNIV RCV EMI RUN 2

UKA1 04/26/11

SPEC / TEST : Ant Port Spurious Emissions  
 MANUFACTURER : BEI  
 MODEL No. : STXe60  
 SERIAL No. : N/A  
 MODE : Transmit  
 SCANS/BAND : 1  
 NOTES : 97.75MHz  
 TEST DATE : 14 May 2013 09:43:00 I. CARNEGIE



STOP = 999.999998

FREQUENCY MHz

100

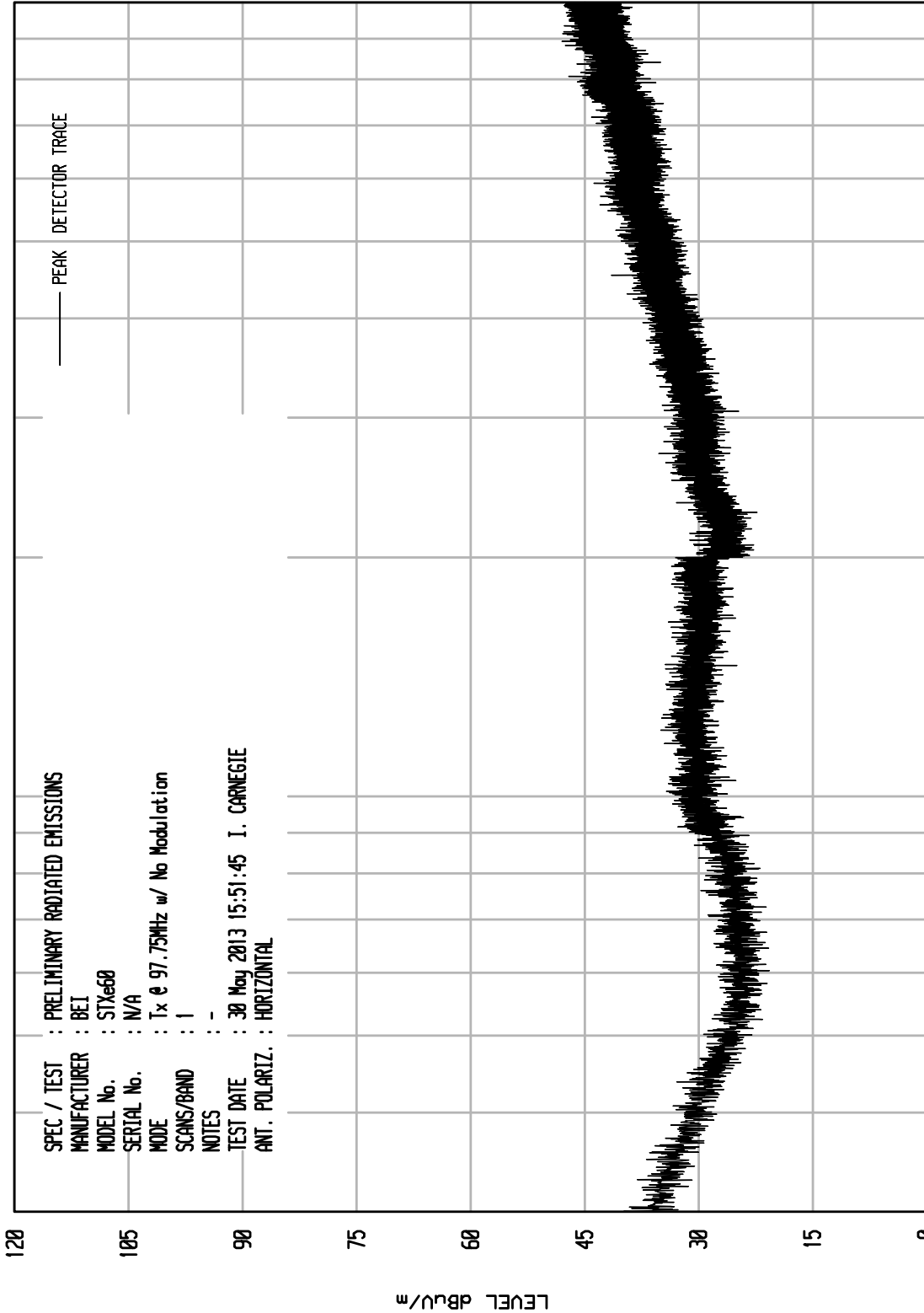
START = 30

ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

UNIV RCV EMI RUN 14

UKA1 04/24/13

SPEC / TEST : PRELIMINARY RADIATED EMISSIONS  
 MANUFACTURER : BEI  
 MODEL No. : STXe60  
 SERIAL No. : N/A  
 MODE : Tx @ 97.75MHz w/ No Modulation  
 SCANS/BAND : 1  
 NOTES : -  
 TEST DATE : 30 May 2013 15:51:45 I. CARNEGIE  
 ANT. POLARIZ. : HORIZONTAL



STOP = 1000

FREQUENCY MHz

100

START = 30

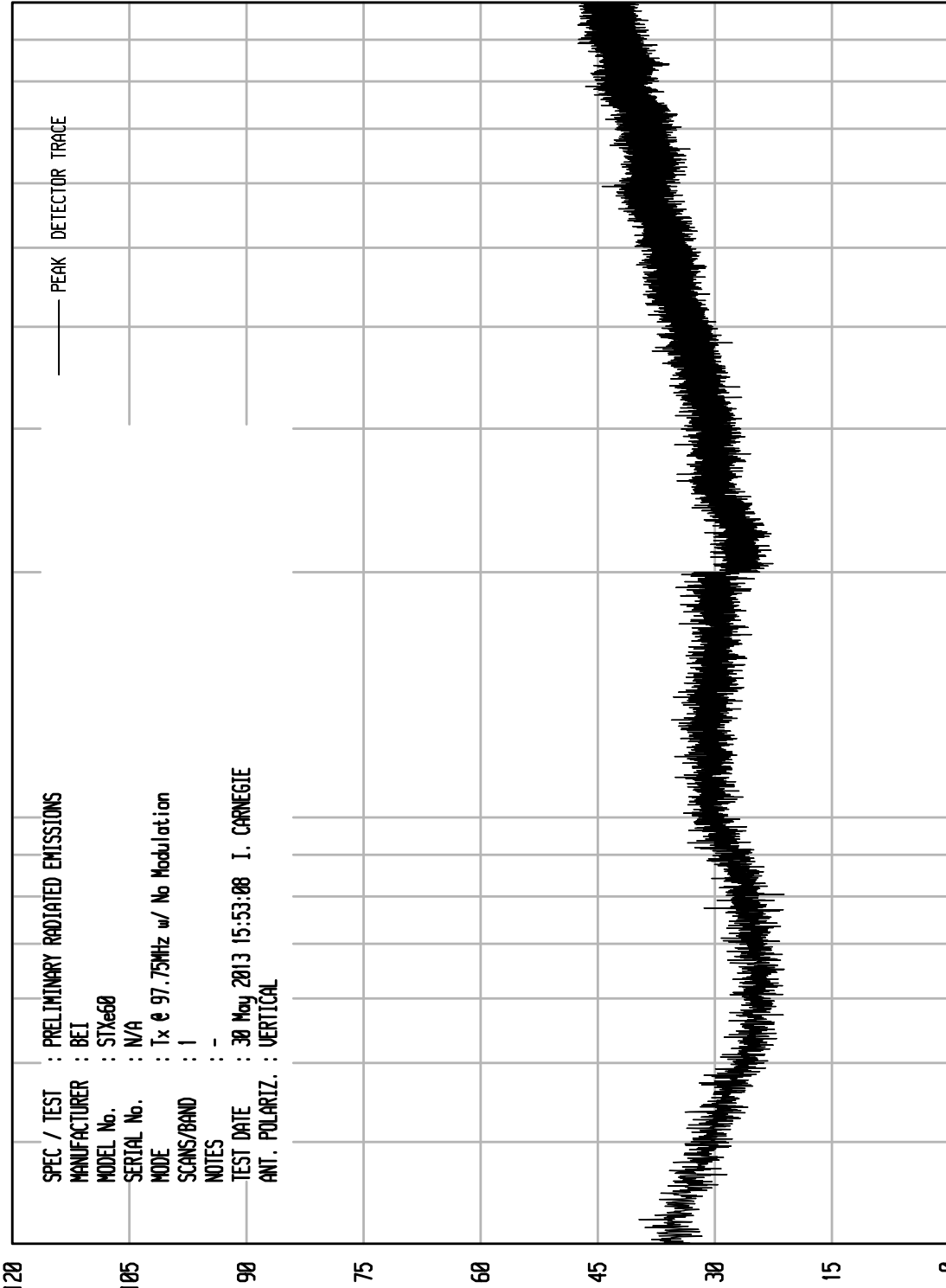


ELITE ELECTRONIC ENGINEERING Inc.  
Downers Grove, Ill. 60515

UNIV RCV EMI RUN 15

UKA1 04/24/13

SPEC / TEST : PRELIMINARY RADIATED EMISSIONS  
 MANUFACTURER : BEI  
 MODEL No. : STXe60  
 SERIAL No. : N/A  
 MODE : Tx @ 97.75MHz w/ No Modulation  
 SCANS/BAND : 1  
 NOTES : -  
 TEST DATE : 30 May 2013 15:53:08 I. CARNEGIE  
 ANT. POLARIZ. : VERTICAL



STOP = 1000

FREQUENCY MHz

100

START = 30



DATA PAGE

MANUFACTURER Broadcast Electronics  
 EUT 60W FM Broadcast Transmitter  
 MODEL NO. STXe60  
 SERIAL NO. N/A  
 SPECIFICATION FCC-73 Spurious Radiated Emissions  
 TEST Cabinet Radiated Emissions  
 TEST EQUIPMENT CDX8,RBA0,NTA3, SAA1  
 MODE Transmit (@97.75MHz), 60W, unmodulated  
 DATE TESTED May 31<sup>st</sup>, 2013  
 NOTES Peak Readings

Freq. MHz	Ant Pol	Meter Reading (dBUV)	Ambient	Matched Sig. Gen. Reading (dBm)	Equivalent Antenna Gain (dB)	Cable Loss (dB)	ERP (dBm)	Attenuation Below Output Power (dB)	Minimum Attenuation (dB)
195.50	H	27.7	Ambient	-61.0	0.0	1.0	-62.0	109.7	60.8
195.50	V	27.7	Ambient	-54.0	0.0	1.0	-55.0	102.7	60.8
293.25	H	27.1	Ambient	-57.0	0.0	1.2	-58.2	105.9	60.8
293.25	V	27.1	Ambient	-55.0	0.0	1.2	-56.2	103.9	60.8
391.00	H	27.5	Ambient	-52.0	0.0	1.3	-53.3	101.1	60.8
391.00	V	27.3	Ambient	-51.1	0.0	1.3	-52.4	100.2	60.8
488.75	H	28.4	Ambient	-50.0	0.0	1.5	-51.5	99.3	60.8
488.75	V	27.9	Ambient	-49.7	0.0	1.5	-51.2	99.0	60.8
586.50	H	27.7	Ambient	-48.6	0.0	1.6	-50.2	98.0	60.8
586.50	V	27.0	Ambient	-48.2	0.0	1.6	-49.8	97.6	60.8
684.25	H	29.6	Ambient	-45.7	0.0	1.8	-47.5	95.3	60.8
684.25	V	29.0	Ambient	-43.9	0.0	1.8	-45.7	93.5	60.8
782.00	H	29.6	Ambient	-45.7	0.0	1.9	-47.6	95.4	60.8
782.00	V	28.1	Ambient	-46.4	0.0	1.9	-48.3	96.1	60.8
879.75	H	29.2	Ambient	-45.9	0.0	2.0	-47.9	95.7	60.8
879.75	V	28.9	Ambient	-45.4	0.0	2.0	-47.4	95.2	60.8
977.50	H	29.5	Ambient	-42.5	0.0	2.1	-44.6	92.4	60.8
977.50	V	30.0	Ambient	-42.3	0.0	2.1	-44.4	92.2	60.8

Checked By:   
 Ian Carnegie