



## Electromagnetic Compatibility Test Report

Tests Performed on an RF IDEas, Inc.

**13.56 MHz Card Reader, Model RDR-7581AKU & RDR-7581AK2**

**Radiometrics Document RP-5926A**



*Product Detail:*

FCC ID: M9MRDR7581

Equipment type: Low Power Intentional Radiator

*Test Standards:*

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

FCC Part 15 CFR Title 47: 2006

This report concerns: Original Grant for Certification

FCC Part 15.209

*Tests Performed For:*

**RF IDEas, Inc.**

1250 South Grove Av.

Barrington, IL 60010

*Test Facility:*

**Radiometrics Midwest Corporation**

12 East Devonwood

Romeoville, IL 60446

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

November 22, to December 13, 2006

**Document RP-5926A Revisions:**

Rev.	Issue Date	Affected Pages	Revised By
0	December 13, 2006		

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1 ADMINISTRATIVE DATA

Table with administrative data including equipment details, dates, personnel signatures, and roles.

2 TEST SUMMARY AND RESULTS

The EUT (Equipment Under Test) is a 13.56 MHz Card Reader, Model RDR-7581AKU & RDR-7581AK2, manufactured by RF IDEas, Inc. The detailed test results are presented in a separate section. The following is a summary of the test results.

Emissions Tests Results

Table with 4 columns: Environmental Phenomena, Frequency Range, Test Standard, Test Result.

2.1 RF Exposure Compliance Requirements

The equivalent radiated power output is less than 1 mW, The EUT meets the FCC requirement for RF exposure. There are no power level adjustments and the antenna is permanently attached.

3 EQUIPMENT UNDER TEST (EUT) DETAILS

3.1 EUT Description

The EUT is a 13.56 MHz Card Reader, Model RDR-7581AKU & RDR-7581AK2, manufactured by RF IDEas, Inc. The EUT was in good working condition during the tests, with no known defects.

The 13.56 MHz RF Section is the same on both the serial and USB versions of the EUT.

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### 3.1.1 FCC Section 15.203 Antenna Requirements

The antenna is permanently attached to the PCB. The antenna is internal to the EUT and it is not readily available to be modified by the end user. Therefore it meets the 15.203 Requirement.

### 3.2 Related Submittals

RF Ideas, 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.

The serial EUT was connected to the host computer's serial port and keyboard connector with a pass-through connector.

The USB EUT was connected to the host computer's USB port.

Power was supplied at 115 VAC, 60 Hz single-phase to the host computer. 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	USB Card Reader	E	RF Ideas, Inc.	RDR-7581AKU	none
2	Serial Card Reader	E	RF Ideas, Inc.	RDR-7581AK2	none
3	Notebook PC	H	Dell	Latitude PPX	H9WVC01
4	Mouse	P	Hewlett Packard	M-S34	LZB91090529
5	Notebook PC Power Supply	P	Dell	AA20031	CN-09364U-16291-275-01WZ

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

#### List of System Cables

QTY	Length (m)	Cable Description	Connected to (Item #)	Shielded?
1	1.7	DB9 Serial Cable	#1 and #3	Yes
1	0.3	Keyboard Jumper Cable	#2 and #3	Yes
1	1.8	USB Cable	#1 and #3	Yes
1	1.9	AC Power Cord	#5	No
1	2.0	Mouse Cable	#3 and #4	Yes

### 4.2 Special Accessories

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

### 4.3 Equipment Modifications

A Fair-Rite Products Corp ferrite part Number 0443164251 was added to the data cable of the reader.

## 5 TEST SPECIFICATIONS AND RELATED DOCUMENTS

Document	Date	Title
FCC CFR Title 47	2006	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

The test procedures used are in accordance with the 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)).

The following is a list of shielded enclosures located in Romeoville, Illinois that were for the tests herein:

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.

Open Area Test Site (OATS): Is located on 8625 Helmar Road in Newark, Illinois, USA and measures 56' L X 24' W X 17' H. The entire open field test site has a metal ground screen. 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 file number IC3124.

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).

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### 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-12	MITEQ	Pre-amplifier	AM-1431	530935	0.01-1000MHz	12 Mo.	02/06/06
AMP-22	Anritsu	Pre-amplifier	MH648A	M23969	0.1-1200MHz	12 Mo.	12/21/05
ANT-06	EMCO	Log-Periodic Ant.	3146	1248	200-1000MHz	24 mo	01/31/06
ANT-28	Empire	Loop Antenna	LG-105	102	10-150kHz	24 Mo.	12/12/05
ANT-29	Empire	Loop Antenna	LP-105	656	0.15-30MHz	24 Mo.	12/12/05
ANT-42	EMCO	Bicon Antenna	3104C	9512-4713	25-300MHz	24 Mo.	01/26/06
ANT-44	Impossible Machine	Super Log Antenna	SL-20M2G	1002	20-2000MHz	24 Mo.	12/12/05
REC-07	Anritsu	Spectrum Analyzer	MS2601A	MT53067	0.01-2200MHz	12 Mo.	02/07/06

Note: All calibrated equipment is subject to periodic checks.

### 10 TEST SECTIONS

#### 10.1 Radiated RF 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 450 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 and an amplifier with a 10 dB attenuator connected to the input was used for the measurement. The out of band emissions and the ambient emissions were below the level of input overload (80 dBuV).

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 CISPR 16-1 and ANSI C63.4. Chamber E is located at 12 East Devonwood Ave. Romeoville, Illinois EMI test lab.

The entire frequency range from 0.1 to 1000 MHz was slowly scanned with particular attention paid to those frequency ranges which appeared high. 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 or the 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 function as required by the specification for final determination of compliance.

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

The field strength is calculated by adding the antenna factor, distance correction factor, cable loss, and subtracting the amplifier gain from the measured reading. Each antenna, cable and amplifier has individual factors across its usable frequency range. The antenna factor converts the voltage reading in dBuV to field strength in dBuV/meter.

### 10.1.1 Field Strength 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:

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

Where: FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

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**10.1.2 E-field Radiated Emissions Test Results (30 to 1000 MHz)**

Test Date	November 22, 2006
Test Distance	3 Meters
Specification	FCC Part 15 Subpart C & RSS-210
Notes	Operating at 13.56 MHz
Abbreviations	Pol = Antenna Polarization; V = Vertical; H = Horizontal; ANT-44 = BiLog Antenna; P = peak; Q = QP

**EUT RDR-7581AKU**

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/Type		EUT	Limit	
54.6	32.7 P	13.6	H/44	-17.3	29.1	40.0	10.9
81.6	34.5 P	6.8	H/44	-16.9	24.4	40.0	15.6
221.0	38.5 P	11.3	H/44	-15.6	34.3	46.0	11.7
230.0	39.7 P	11.7	H/44	-15.5	36.0	46.0	10.0
243.6	40.4 P	12.2	H/44	-15.4	37.3	46.0	8.7
246.0	39.8 P	12.3	H/44	-15.4	36.8	46.0	9.2
248.4	44.2 P	12.3	H/44	-15.4	41.2	46.0	4.8
270.8	41.8 P	13.0	H/44	-15.3	39.6	46.0	6.4
297.6	45.4 P	13.6	H/44	-15.1	44.0	46.0	2.0
324.8	42.7 P	14.4	H/44	-14.9	42.2	46.0	3.8
325.2	41.0 P	14.5	H/44	-14.9	40.6	46.0	5.4
366.2	37.3 P	16.7	H/44	-14.7	39.4	46.0	6.6
420.2	39.3 P	16.2	H/44	-14.5	41.2	46.0	4.8
433.4	39.1 P	16.3	H/44	-14.4	41.1	46.0	4.9
40.8	39.1 P	14.9	V/44	-17.6	36.5	40.0	3.5
54.6	42.2	13.2	V/44	-17.3	38.1	40.0	1.9
135.6	38.2 P	13.2	V/44	-16.3	35.1	43.5	8.4
175.8	39.5 P	10.0	V/44	-16.0	33.6	43.5	9.9
189.6	42.3 P	10.2	V/44	-15.9	36.7	43.5	6.8
202.8	40.7 P	10.5	V/44	-15.7	35.6	43.5	7.9
230.6	37.3 P	12.2	V/44	-15.5	34.1	46.0	11.9
243.6	42.5 P	12.9	V/44	-15.4	40.1	46.0	5.9
244.4	42.3 P	12.9	V/44	-15.4	39.9	46.0	6.1
270.6	42.3 P	13.3	V/44	-15.3	40.5	46.0	5.5
298.4	41.6 P	13.7	V/44	-15.1	40.3	46.0	5.7
373.4	39.4 P	16.6	V/44	-14.7	41.4	46.0	4.6
433.4	36.9 P	16.4	V/44	-14.4	39.0	46.0	7.0



**RADIOMETRICS MIDWEST CORPORATION - EMC Test Report**

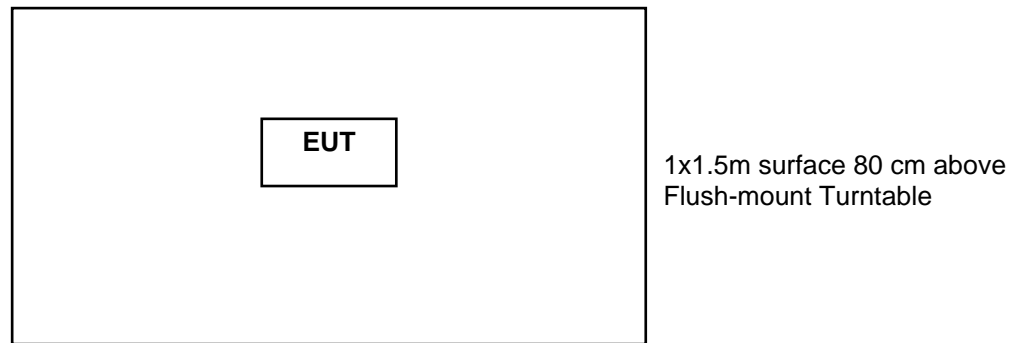
Testing of the RF IDEas, Inc., Model RDR-7581AKU & RDR-7581AK2, 13.56 MHz Card Reader

**EUT RDR-7581AK2**

Freq. MHz	Meter Reading dBuV	Antenna		Corr. Factors dB	Field Strength dBuV/m		Margin Under Limit dB
		Factor dB	Pol/ Type		EUT	Limit	
54.6	32.1 P	13.6	H/44	-17.3	28.5	40.0	11.5
81.6	32.5 P	6.8	H/44	-16.9	22.5	40.0	17.5
122.4	37.0 P	15.0	H/44	-16.5	35.6	43.5	7.9
135.6	39.3 P	12.7	H/44	-16.3	35.8	43.5	7.7
149.4	35.9 P	10.0	H/44	-16.2	29.8	43.5	13.7
175.8	38.7 P	9.3	H/44	-16.0	32.1	43.5	11.4
176.4	38.2 P	9.3	H/44	-16.0	31.6	43.5	11.9
202.8	40.6 P	10.2	H/44	-15.7	35.1	43.5	8.4
203.4	34.2 Q	10.2	H/44	-15.7	28.8	43.5	14.7
269.4	33.8 P	13.1	H/44	-15.3	31.7	46.0	14.3
270.0	35.2 P	13.1	H/44	-15.3	33.1	46.0	12.9
284.4	36.0 P	12.8	H/44	-15.2	33.7	46.0	12.3
297.0	37.4 P	13.5	H/44	-15.1	35.9	46.0	10.1
325.2	39.8 P	14.5	H/44	-14.9	39.4	46.0	6.6
325.8	38.7 P	14.5	H/44	-14.9	38.4	46.0	7.6
339.0	38.2 P	15.4	H/44	-14.8	38.8	46.0	7.2
352.8	42.2 P	16.0	H/44	-14.8	43.5	46.0	2.5
379.8	37.3 P	16.3	H/44	-14.7	39.1	46.0	6.9
40.8	41.0 P	14.9	V/44	-17.6	38.3	40.0	1.7
54.6	32.7 P	13.2	V/44	-17.3	28.7	40.0	11.3
67.2	35.0 P	9.1	V/44	-17.2	27.0	40.0	13.0
122.0	40.0 Q	15.1	V/44	-16.5	38.7	43.5	4.8
135.6	38.7 P	13.2	V/44	-16.3	35.7	43.5	7.8
176.4	36.9 P	10.0	V/44	-16.0	31.0	43.5	12.5
202.8	40.7 P	10.5	V/44	-15.7	35.6	43.5	7.9
284.4	35.4 P	13.2	V/44	-15.2	33.5	46.0	12.5
325.2	34.5 P	15.1	V/44	-14.9	34.8	46.0	11.2

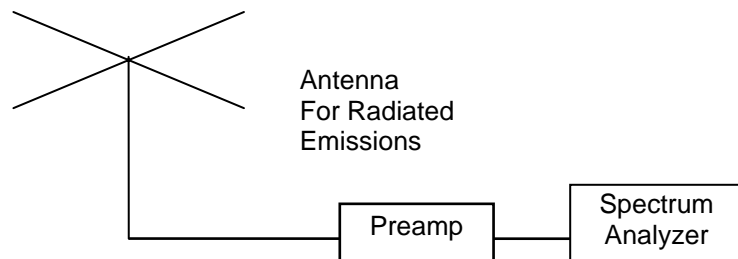
Judgment: Passed by 1.7 dB

**Figure 1. Drawing of Radiated Emissions Setup**



**Notes:**

- AC outlet with low-pass filter at the base of the turntable
- Antenna height varied from 1 to 4 meters
- Distance from antenna to tested system is 3 meters
- Not to Scale



**10.2 Magnetic Field Measurements and Decay Factor Calculations**

Radiated emission measurements are performed with shielded loop antennas. An Empire LG-105 and an Empire LP-105 antenna were used. The antennas were rotated in order to find the maximize readings. The measurements were performed at two distances.

The decay exponent used is 2. The distance correction factor is calculated as follows:

$$\text{Distance factor (dB)} = 40 \cdot \text{Log}(\text{TD}/\text{SD})$$

TD is the actual test distance in meters. SD meters is the specification distance.

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**10.2.1 Magnetic Field Radiated Emissions Results (0.009 to 30 MHz)**

Test Date	December 12, 2006
Test Distance	3 Meters
Specification	FCC 15 & RSS-210
Notes	Corr. Factors = cable loss - preamp gain - distance factor. Decay Exponent = 2 Shielded Loop Antennas were used for this test.
Abbreviations	P = peak; Q = QP

**EUT RDR-7581AK2**

Freq MHz	Peak meter reading dBuV	Loop Ant Factor	Dist (m)	Decay exp	Cable Loss dB	Distance factor dB	Amp Gain Db	Field Strength dBuV/m	15.209 Limit dBuV/m	Margin under limit
13.561	51.6	41.0	3.0	2.0	0.4	-40.0	29.0	24.0	29.5	5.5
27.122	27.1	39.6	3.0	2.0	0.5	-40.0	27.0	-0.3	29.5	29.8
13.561	36.2	41.0	6.4	2.0	0.4	-26.8	29.0	21.8	29.5	7.7
27.122	16.0	39.6	6.4	2.0	0.5	-26.8	27.0	1.8	29.5	27.7

**EUT RDR-7581AKU**

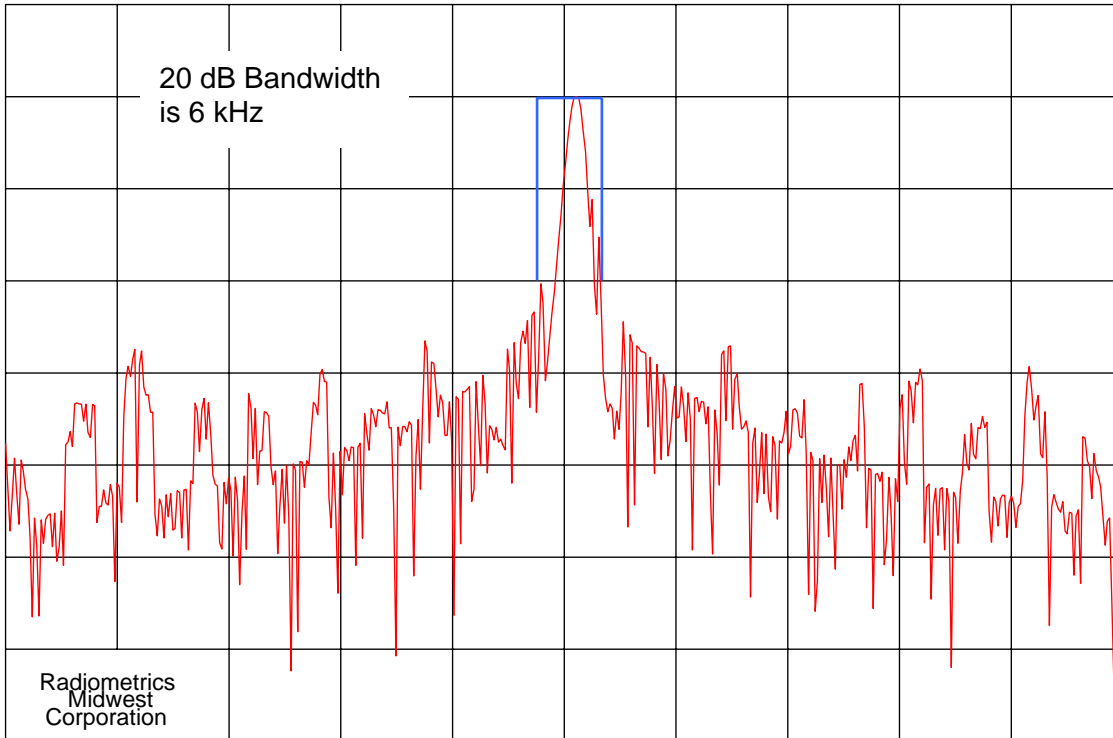
Freq MHz	Peak meter reading dBuV	Loop Ant Factor	Dist (m)	Decay exp	Cable Loss dB	Distance factor dB	Amp Gain Db	Field Strength dBuV/m	15.209 Limit dBuV/m	Margin under limit
13.561	50.9	41.0	3.0	2.0	0.4	-40.0	29.0	23.3	29.5	6.2
27.122	26.3	39.6	3.0	2.0	0.5	-40.0	27.0	-1.1	29.5	30.6
13.561	37.3	41.0	6.4	2.0	0.4	-26.8	29.0	22.9	29.5	6.6
27.122	16.0	39.6	6.4	2.0	0.5	-26.8	27.0	1.8	29.5	27.7

Judgement: Passed by 5.5 dB.

### 10.3 Occupied Bandwidth (20 dB)

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.



COMPANY : RF Ideas

START FREQ. = 13.51 MHz

RBW = 1.0 kHz

10 dB/div

NOTES : Occupied Bandwidth,

Maximum Signal Amplitude = 70 dBuV at 13.56058 MHz.

ITEM : RDR-7581AKU

REF. LEVEL = 080.0 dBuV

VBW = 100 kHz

TIME = 11:17

DATE : 12-13-2006

SPAN = .1 MHz

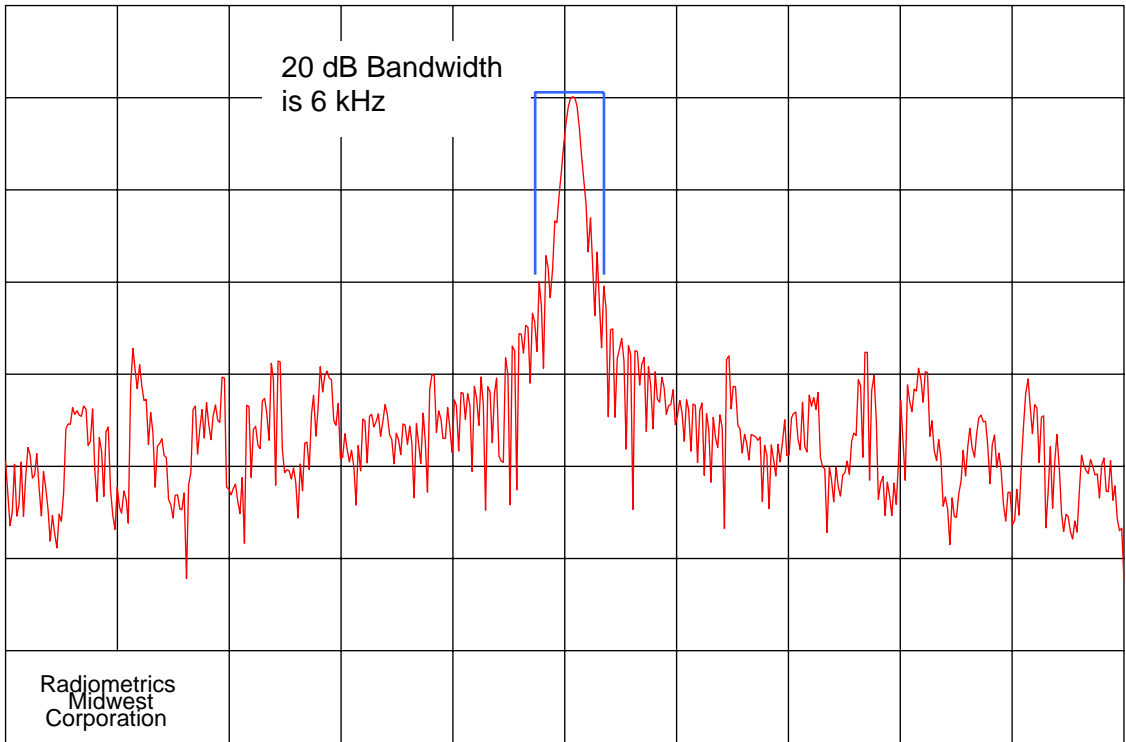
ATTEN = 0 dB

SWP TIME = 300 mSec

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COMPANY : RF Ideas  
START FREQ. = 13.51016 MHz  
RBW = 1.0 kHz  
10 dB/div  
NOTES : Occupied Bandwidth,  
Maximum Signal Amplitude = 70.11 dBuV at 13.56059 MHz.

ITEM : RDR-7581AK2  
REF. LEVEL = 080.0 dBuV  
VBW = 100 kHz  
TIME = 11:53

DATE : 12-13-2006  
SPAN = .1 MHz  
ATTEN = 0 dB  
SWP TIME = 300 mSec  
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