Curtis-Straus

Test Report

Report No	ED0094-3
Client	Sensormatic Electronics Corp 6600 Congress Ave Boca Raton, FL 33487
Phone	561-921-6440
Fax	561-912-6093
FRN	0005052626
Models	RF ID Reader
FCC ID	BVCIDR3000
Equipment Type	Low Power Communication Device Transmitter
Equipment Code	DSS
Results	As detailed within this report
Prepared by	Mairaj Hussain – Test Engineer
Authorized by	Michael Buchholz – EMC Manager
Issue Date	3-25-03
Conditions of issue	This Test Report is issued subject to the conditions stated in 'terms and conditions' section of this

Curtis-Straus LLC is accredited by the American Association for Laboratory Accreditation for the specific scope of accreditation under Certificate Number 1627-01. This report may contain data which is not covered by the A2LA accreditation.

Summary

This report is an application for certification of a transmitter operating under 47 CFR 15.247 of the FCC rules provided for operation of frequency hopping spread spectrum transmitters. The product covered by this report is RF ID Reader. The product was tested using the methods outlined in FCC public notice DA 00-705 (FHSS), released March 30, 2000.

The product also contains a transmitter operating under the section 47 CFR 15.225 which is covered in a separate report.

Product uses four antennas for transmissions, however only one antenna is activated at any given moment in time as described in the technical description exhibit of the report.

Test Methodology

All testing was performed according to the procedures specified in ANSI C63.4 (2000).

Frequency range investigated:	30 MHz – 10 GHz

Measurement Distance:		
Frequency (MHz)	*Distance (m)*	*Comments*
902 – 928 MHz	-	Conducted
30 –10000 MHz	3	Radiated

The EUT was maximized around three orthogonal axes. EUT antennas were maximized within their range of motion.
On February 18th, 2003 a modified version of the product was tested. The output filter on antenna ports UHF1 and UH2 was modified in order to obtain maximum power without going over the limit. Peak output power (conducted) and band edge measurements were taken for the modified version. Since some of the older models have already been manufactured, the intent is to certify and sell both versions.

All readings are peak unless otherwise noted.

The product was tested with both UHF antenna ports populated during the spurious radiated emission scans. The three UHF antennas used for EMI testing were:

Circularly polarized patch antenna

Linearly polarized patch antenna
Shelf Antenna

The product was tested with a combination of above mentioned antennas, please see table 3 and 4. Since the highest gain antenna is 8dBi, this will be used to calculate all limits.

EUT Configuration

EUT Configuration

Work Order: D0094
Company: Sensormatic Electronics Corp
Company Address: 6600 Congress Ave
Boca Raton, FL 33487
Contact: Don Umbdenstock
Person Present: Matt Reynolds

	MN	SN	FCC ID
EUT:	RF ID Reader	-	BVCIDR3000
Antenna:	S9028P (902-928 MHzMHz linear)		
	S9028PC (902-928 MHzMHz circular)		
	SA101 (902-928 MHz Shelf Antenna)		
AC Adapter	EA10603A	-	-

EUT Description: RFID Reader
EUT Max Frequency: 927.35 MHz
EUT Min Frequency: 13.56 MHz

Support Equipment:	**MN**	**SN**	**FCC ID**
Dell laptop	-	-	-

EUT Cables:	**Qty**	**Shielded?**	**Length**	**Ferrites**
DC cable from adapter	1	No	1 m	One
AC cable to adapter	1	No	> 1M	None
RJ 45 (Ethernet)	1	Yes	> 1m	None
Antenna Cables	1	Yes	> 1m	None

Unpopulated EUT Ports:	**Qty**	**Reason**
db-9	1	Not used in the configuration

Software / Operating Mode Description:

Reader was operated both in frequency hopping mode and also in single frequency mode at the lowest, mid-band, and highest frequencies in the hopping table. Modulation was on in all cases.

Statement of Conformity

The 915 MHz FHSS RF Module has been found to conform with the following parts of the 47 CFR as detailed below:

47 CFR Part #	47 CFR Part #	Comments
	15.15(b)	The product contains no user accessible controls that increase transmission power above allowable levels.
2.925	15.19	The label is shown in the label exhibit.
	15.21	Information to the user is shown in the instruction manual exhibit.
	15.27	No special accessories are required for compliance.
15.31(e)		The input power was varied from its nominal value (120V) to 102V and 138V. The respective radiated power was measured see table 1.
	15.203	The device utilizes reverse sex TNC type antenna connector.
	15.204	See attached documentation describing the antenna(s).
	15.205 15.209	The fundamental is not in a Restricted band and the spurious emissions in the Restricted bands comply with the general emission limits of 15.209.
	15.207	Conducted EMI data on AC side of DC supply is provided in this report, table 8.
15.247(a)	15.247 (a) (1)	The carrier frequencies are separated by a minimum of 20 dB bandwidth of hopping channel. See attached plot(s).
	15.247 (1) (i)	The EUT has 50 hopping frequencies. The EUT complies with the time of occupancy requirements. See attached plot. .
	15.247 (1) (ii)	The EUT does not operate in the 5725-5850 MHz band.
	15.247 (1) (iii)	The EUT does not operate in the 2400-2483.5 MHz band.
	15.247 (2)	The EUT does not use digital modulation.
15.247 (b)	15.247 (1)	The EUT does not operate in the specified bands.
	15.247 (2)	The peak output power of EUT is less than 1W. See attached plots and table 2.
	15.247 (3)	EUT does not use digital modulation.
	15.247 (4)	The antennas used with the product had gain of 6dBi and 8dBi. For 8dBi antenna the limit of peak output power was reduced by 2dB.
	15.247 (4) (i)	EUT does not operate in the specified frequency

	(ii) (iii)	band(s).
	15.247 (5)	See RF Exposure exhibit.
15.247 (c)		The EUT meets the band-edge requirements. See attached plots. No emissions from the product fall within restricted bands.
15.247 (d)		EUT does not use digital modulation.
15.247 (f)		EUT does not qualify as hybrid system.
15.247 (g)		See section 12.247(g) part of the report.
15.247 (h)		This device does not coordinate its hopping channels.

Curtis-Straus **LLC • 527 Great Road • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828**

Test Data and Plots

Section 15.31(e)

Input Voltage variation

Section 15.31(e) Voltage Variation			***Curtis-Straus LLC***
Work Order:	D0094		**Table:** 1
Date(s):	2/4/03		
Engineer:	Evan Gould		
EUT:	RFID Reader		
Carrier Frequency:	914.76MHz	**Temp:**	20°C
Voltage		**Peak Signal Level**	
Nominal (120V)		121 dBuV	
102V		121 dBuV	
139V		121 dBuV	

Conclusion:	The level of output signal at the antenna port does not change with input voltage.

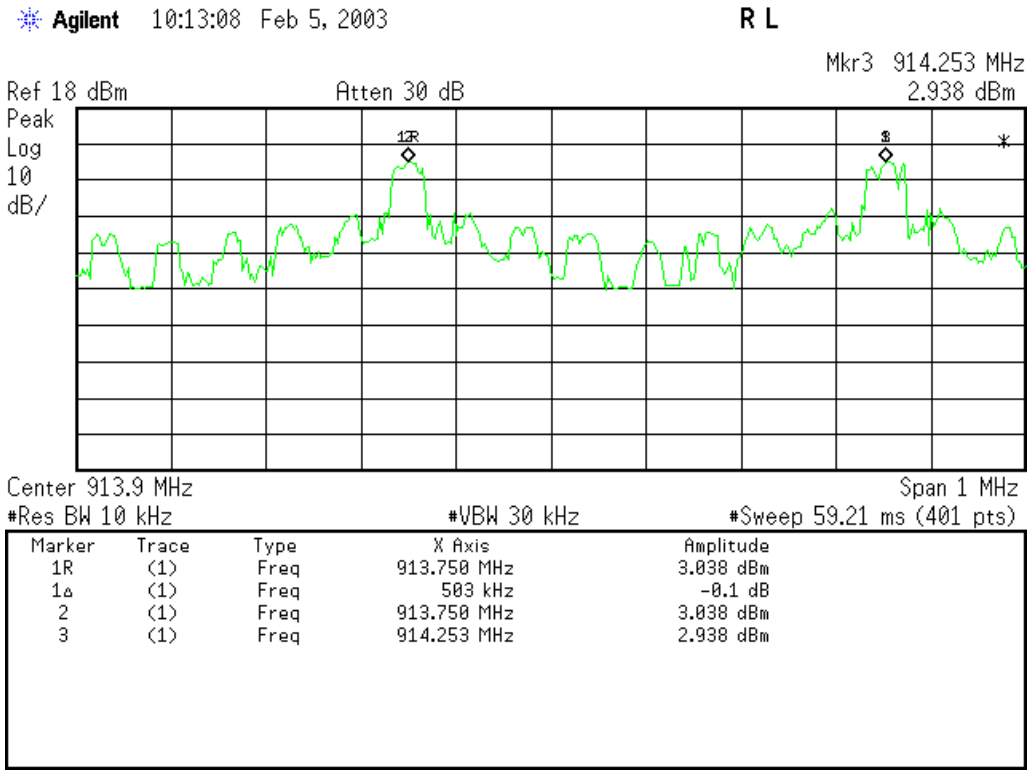
Note: Above PoP readings are off of spectrum analyzer and do not take in account for cables loss and any attenuator used.

Curtis-Straus LLC • 527 Great Road • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828

Section 15.247 (a) (1)

The receiver has an I/Q demodulator using the TX oscillator for its local oscillator. Because of this, the receiver is always tuned to the same frequency in the hopping pattern as the transmitter. Its input comes from the circulator which provides isolation from the transmitter. The outputs from the demodulator are analog signals sampled by the ADC and decoded by the DSP. The receiver's bandwidth is limited to the transmitted signal bandwidth first by means of analog antialiasing filters on the I and Q receiver channels, and further by a digital filter implemented on the DSP.

Carrier Frequency Separation



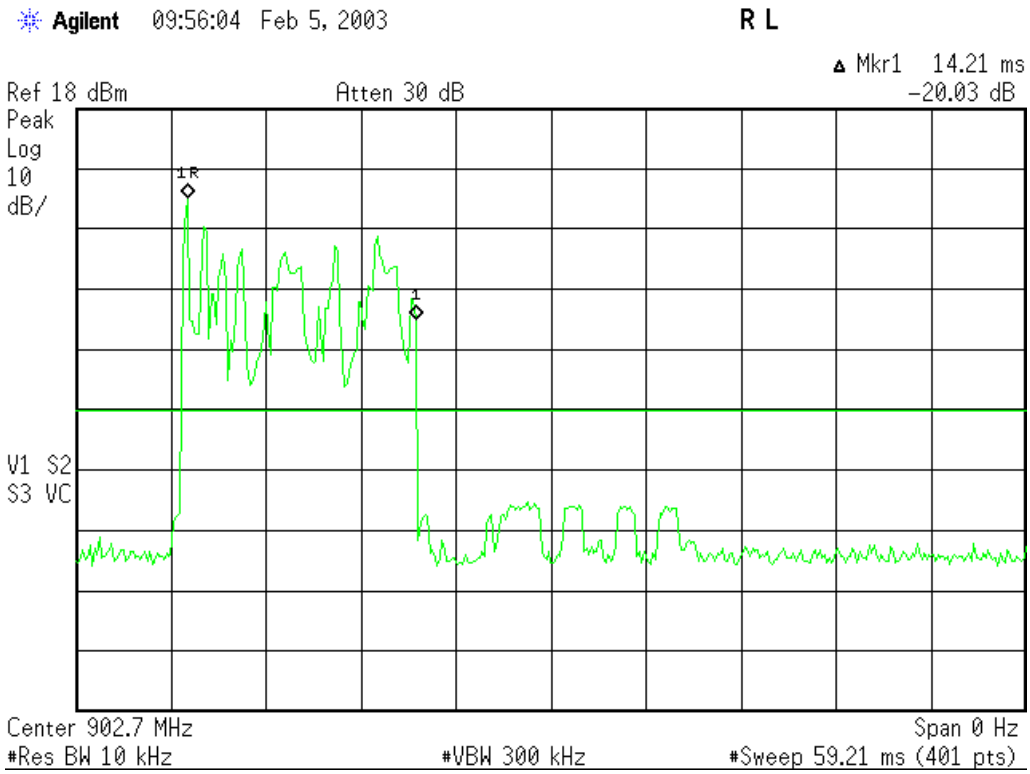
Plot # 1UHF Antenna 1 Showing carrier frequency separation

Channel separation = 503 KHz
20dB BW = 395.4 KHz (See next section)

Conclusion:	Hopping channel carrier frequencies are separated by a minimum of 20db bandwidth.

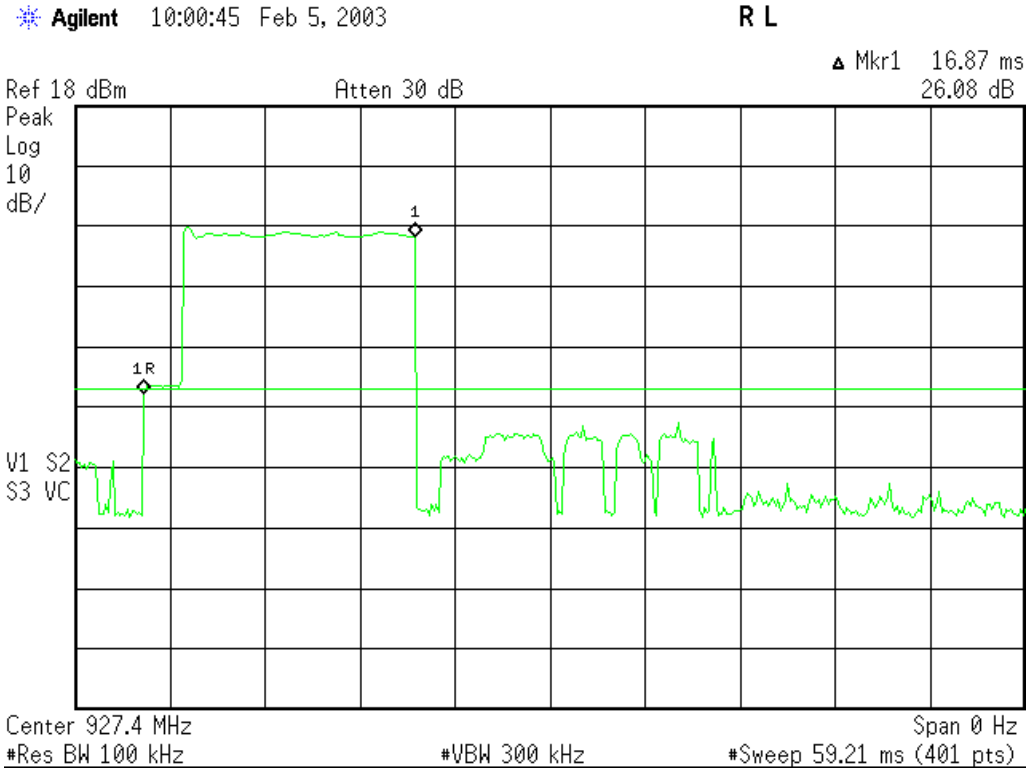
Section 15.247 (a) (1) (i)

Time of Occupancy/20 db Bandwidth Number of Hopping Frequencies



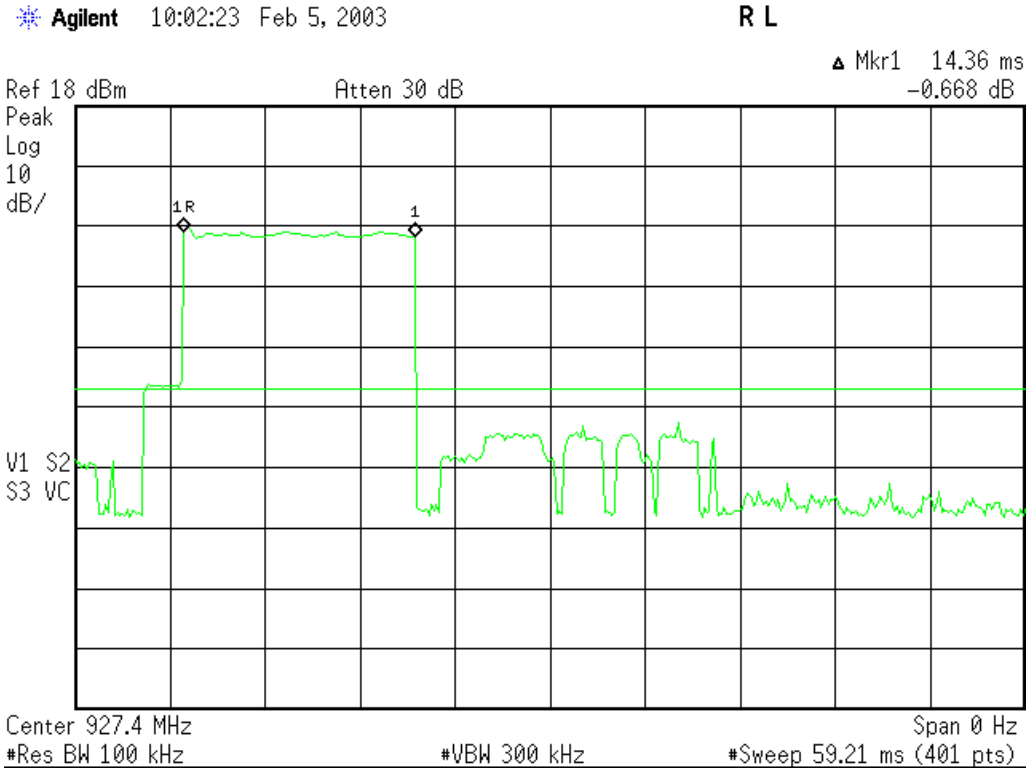
UHF Antenna Port 1, CH 0, Time of Occupancy

Conclusion:	Time of occupancy is less than 0.4sec.



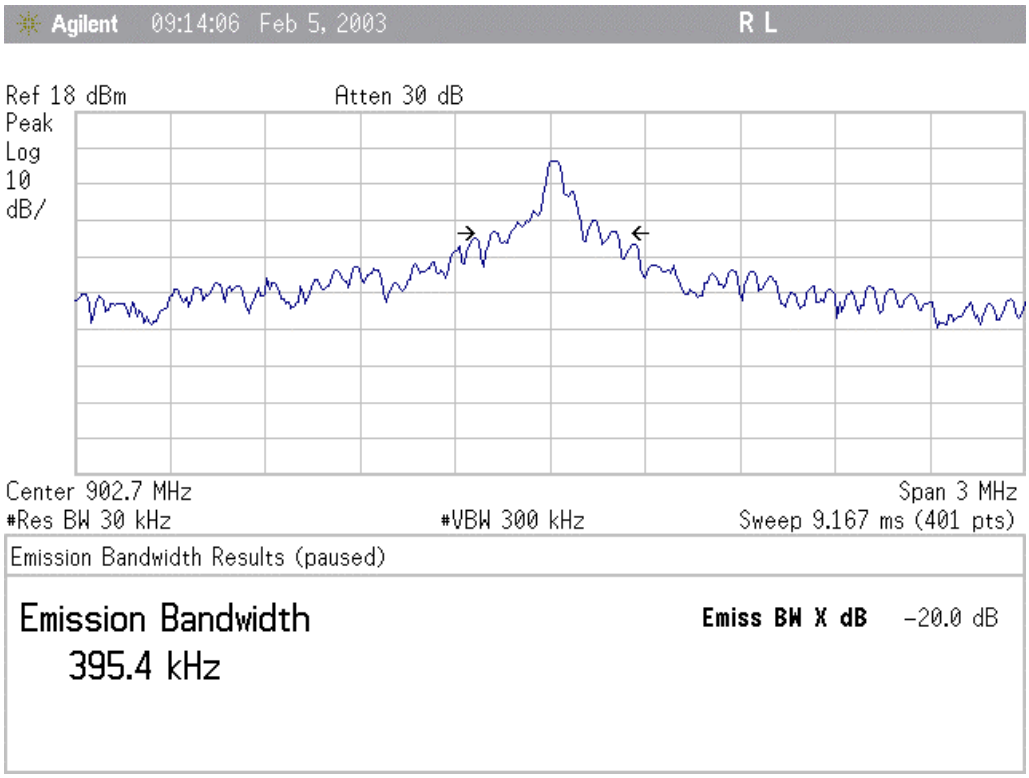
UHF Antenna Port 1, CH 49, Time of Occupancy (plot1)

Conclusion:	Time of occupancy is less than 0.4sec.

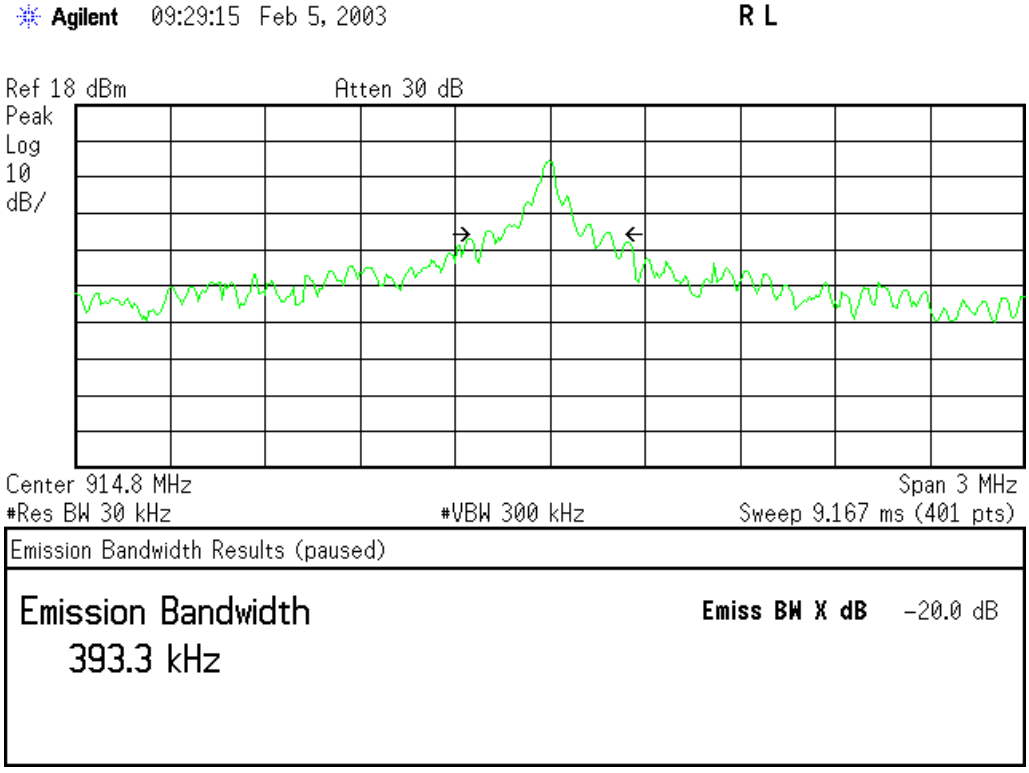


UHF Antenna Port 1, CH 49, Time of Occupancy (plot2)

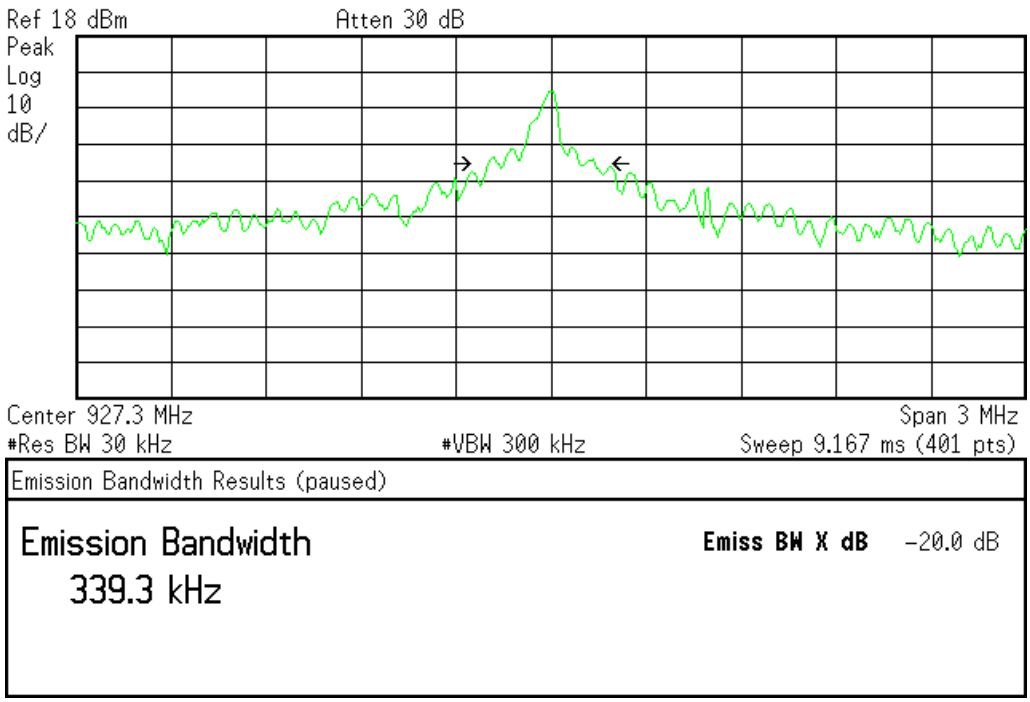
Conclusion:	Time of occupancy is less than 0.4sec.



20dB bandwidth channel 0 UHF Antenna Port 1

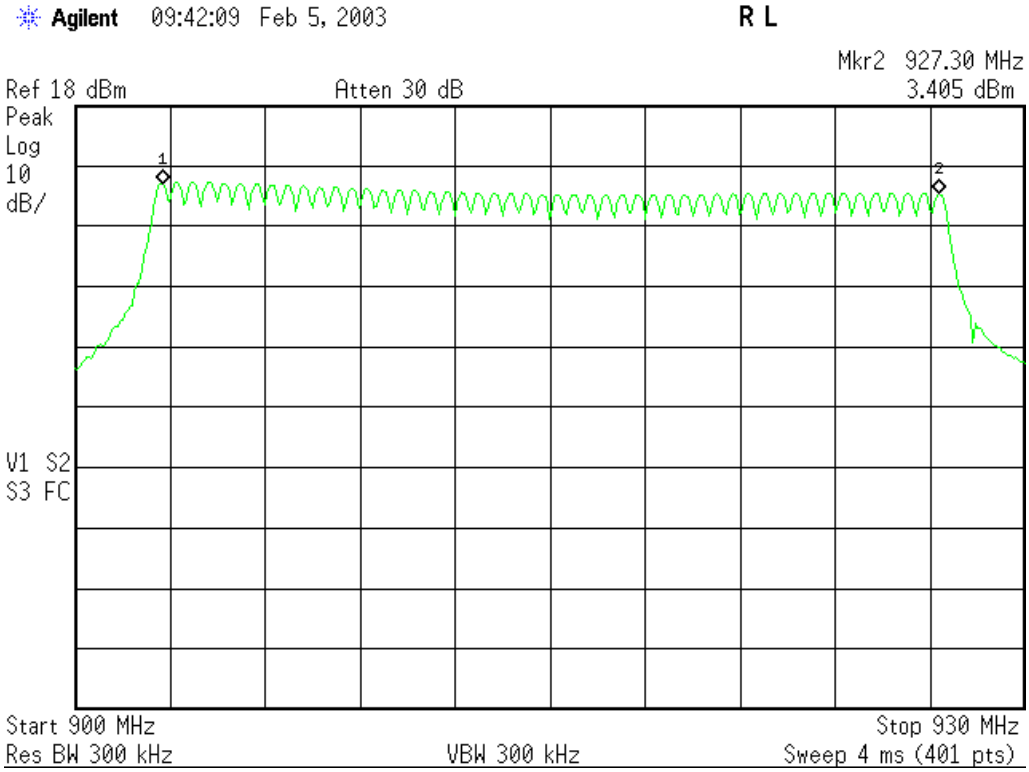


20dB bandwidth channel 24 UHF Antenna Port 1



20dB bandwidth channel 49 UHF Antenna Port 1

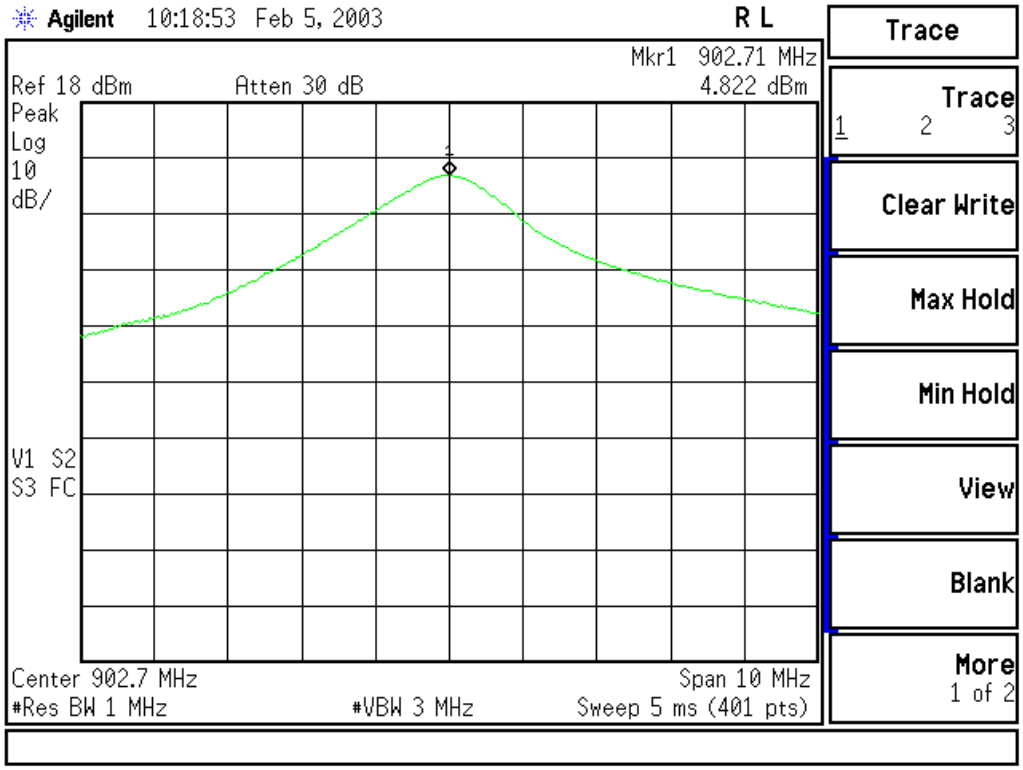
Conclusion:	The 20db bandwidth is > 250KHz and < 500 KHz



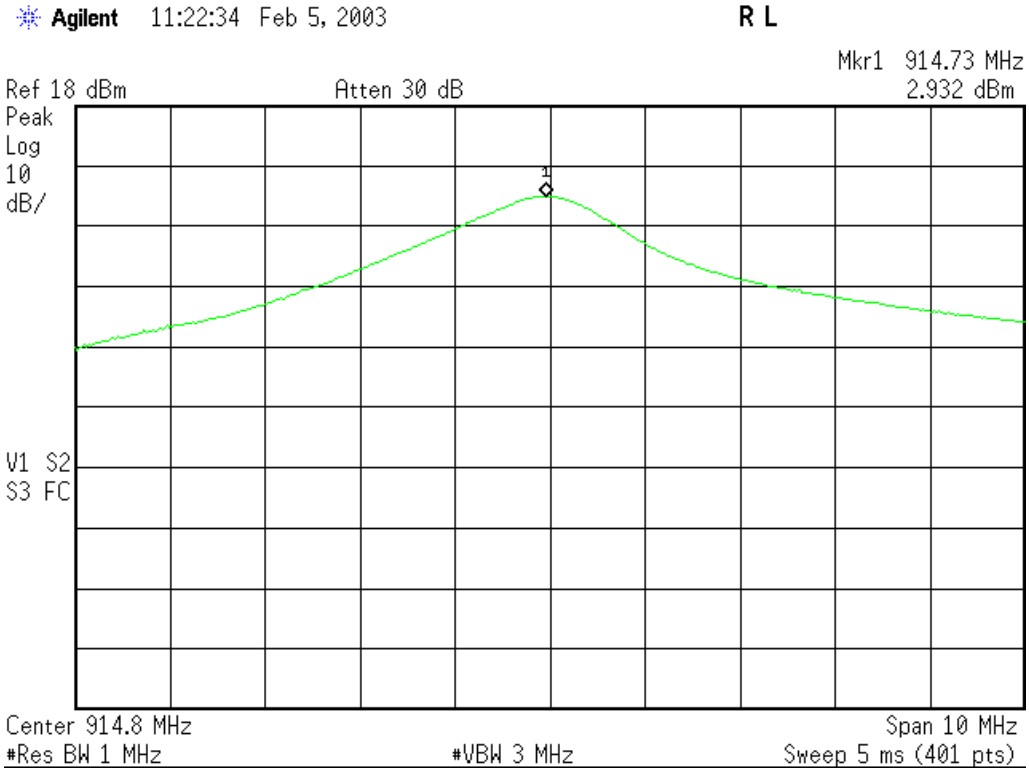
Plot showing 50 hopping channels

Section 15.247 (b)

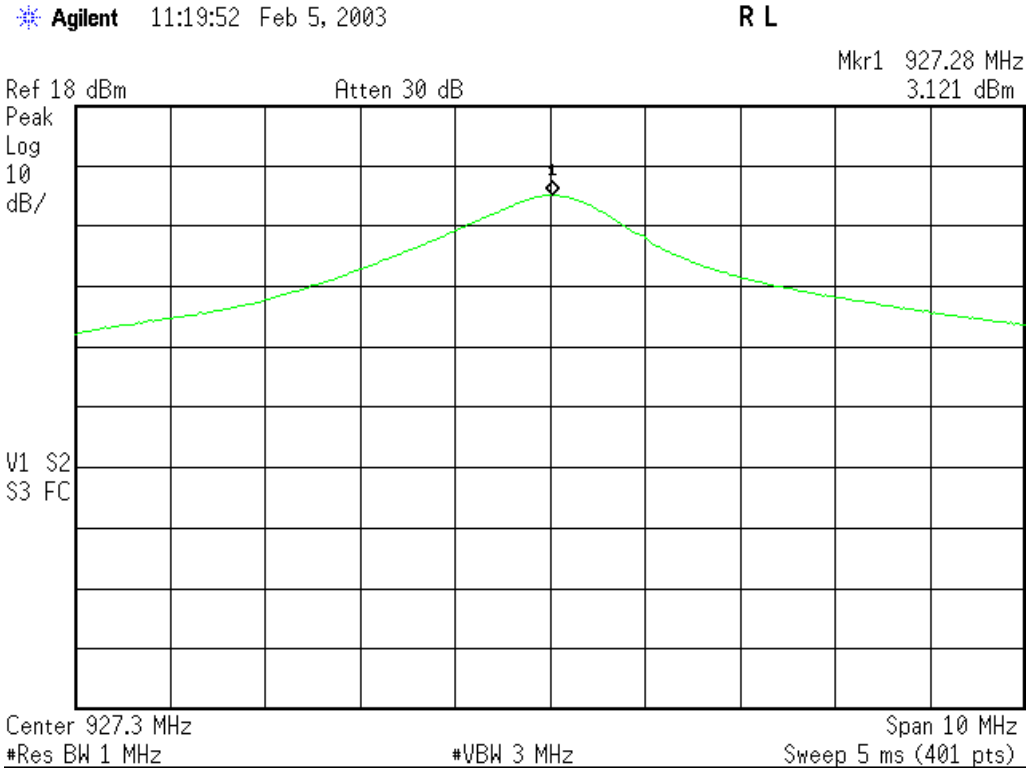
Peak OutPut Power (POP)



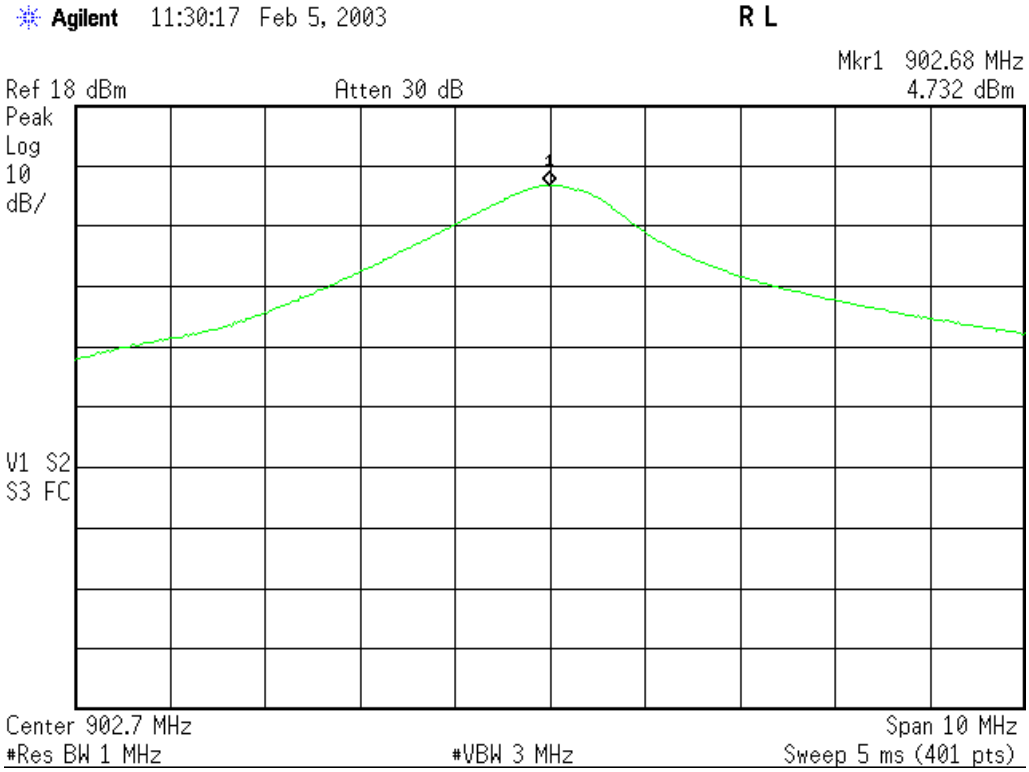
Peak output power UHF Antenna Port 1, Channel 0



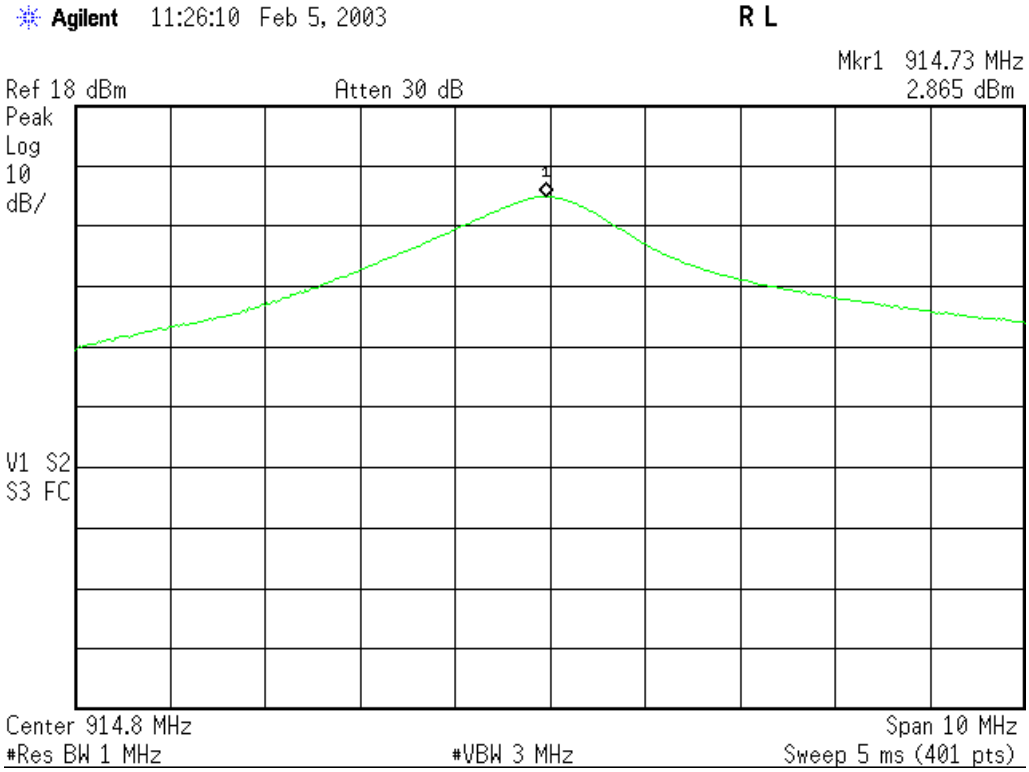
Peak output power UHF Antenna Port 1, Channel 24



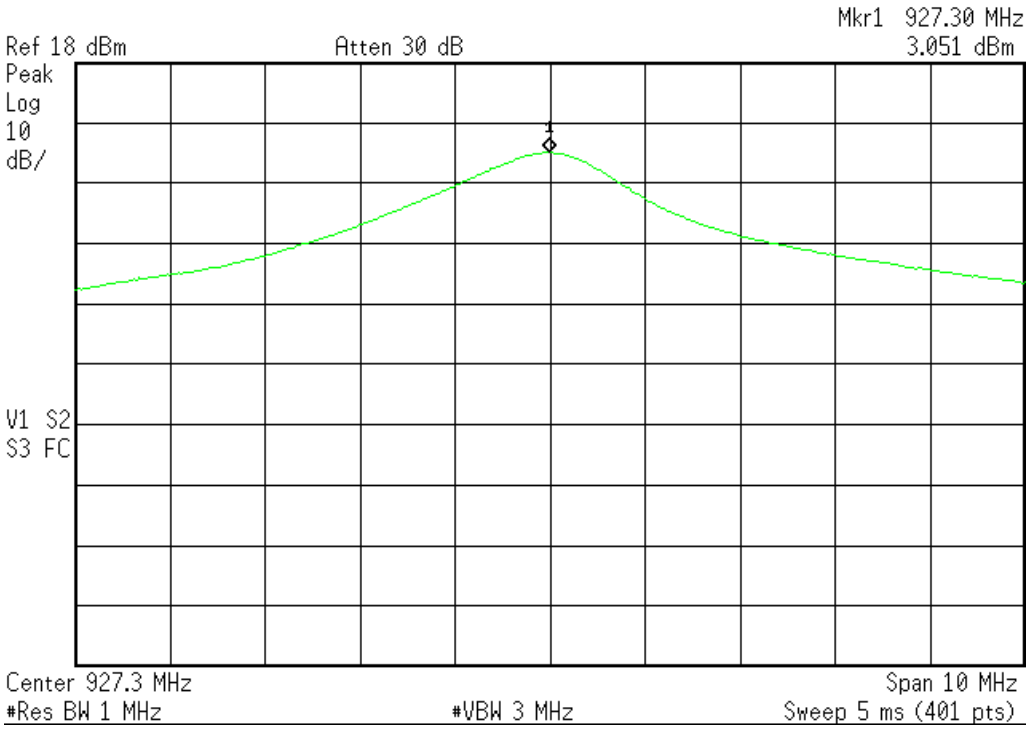
Peak output power UHF Antenna Port 1, Channel 49



Peak output power UHF Antenna Port 2, Channel 0



Peak output power UHF Antenna Port 2, Channel 24



Peak output power UHF Antenna Port 2, Channel 49

Peak Out Put Power

Work Order: D0094 **Table:** 2
Company: Sensormatic Electronics Corp
Date 2/5/03
Engineer: MH/EG/YF

Product: RFID Reader

UHF Antenna 1

Channel	Reading (dBm)	Cable(s) Factor (dB)	Attenuator (dB)	Adj Reading (dBm)	Limit (dBm)	Result
0	4.82	1.9	20.2	26.92	30[a]	Pass
24	2.93	1.9	20.2	25.03	30[a]	Pass
49	3.121	1.9	20.2	25.221	30[a]	Pass

UHF Antenna 2

Channel	Reading (dBm)	Cable(s) Factor (dB)	Attenuator (dB)	Adj Reading (dBm)	Limit (dBm)	Result
0	4.73	1.9	20.2	26.83	30[a]	Pass
24	2.865	1.9	20.2	24.965	30[a]	Pass
49	3.05	1.9	20.2	25.15	30[a]	Pass

Cable Factor: Microflex + Client's cable
Spectrum Analyzer: Orange
Pad: 20.2dB
a: Limit is 2dB less for the antenna(s) having gain of 8dBi.
Note: All readings are peak unmodulated signal

Sample Calculation:

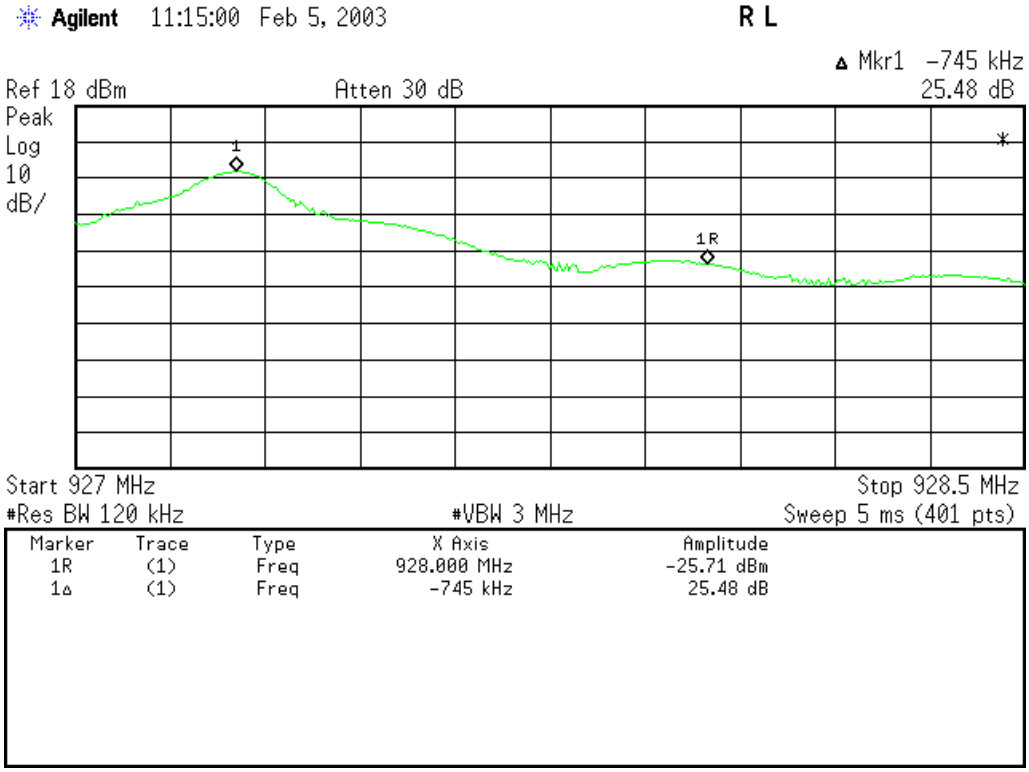
Adjusted Reading = Reading + Cable factor + Attenuator Factor

Final POP = Measured POP + Cable Factor & Pad factor

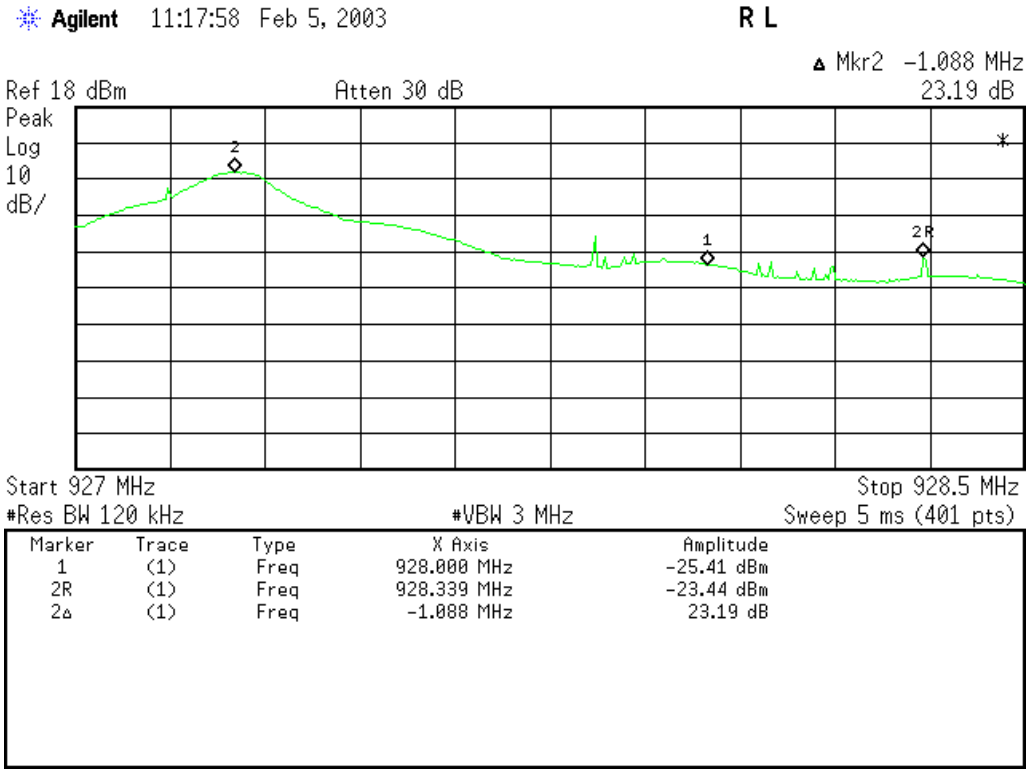
Curtis-Straus LLC • 527 Great Road • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828

Section 15.247 (c)

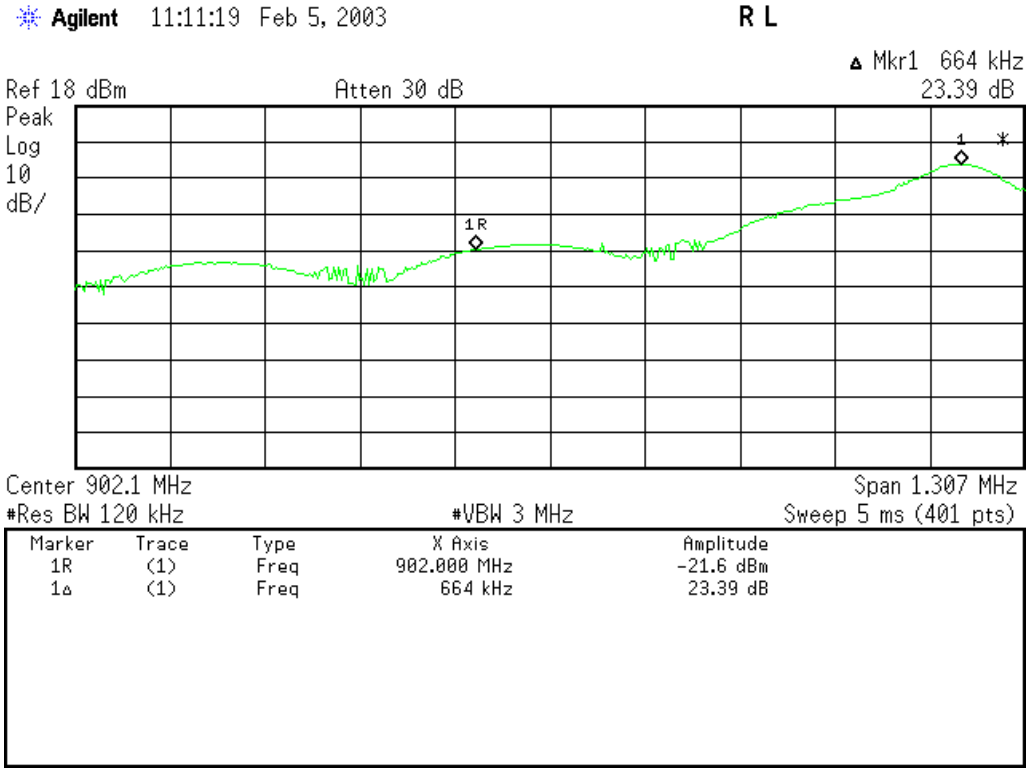
Band-Edge Plots



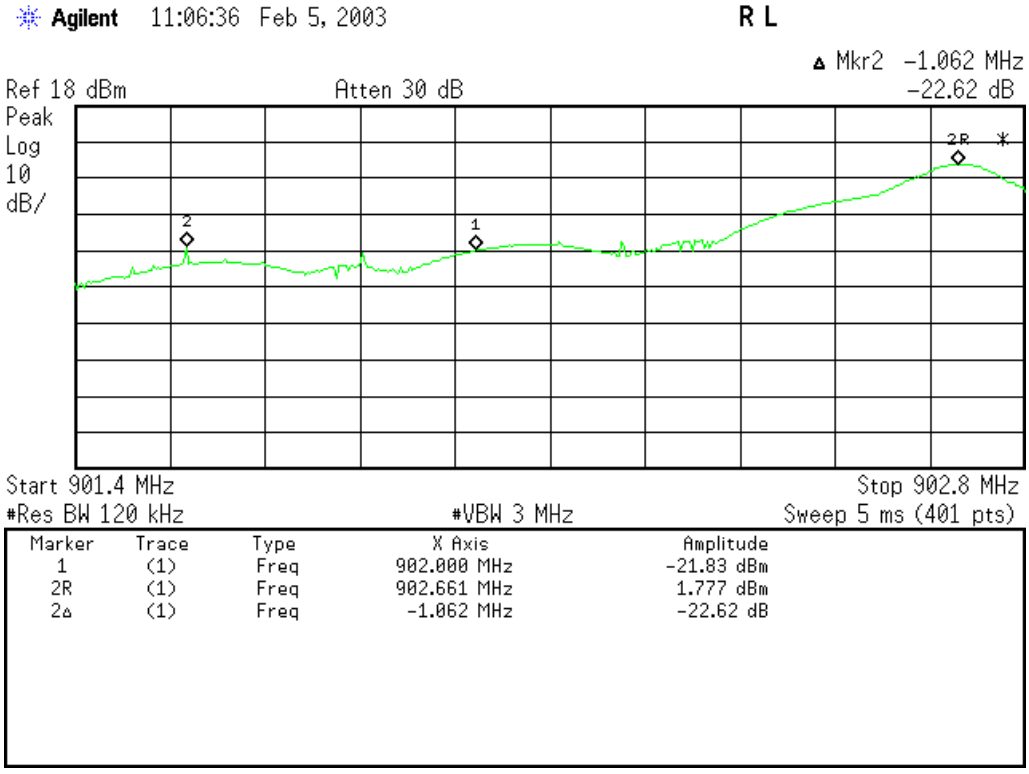
Band Edge High End (Hopping enabled)



Band Edge High End (Hopping disabled)

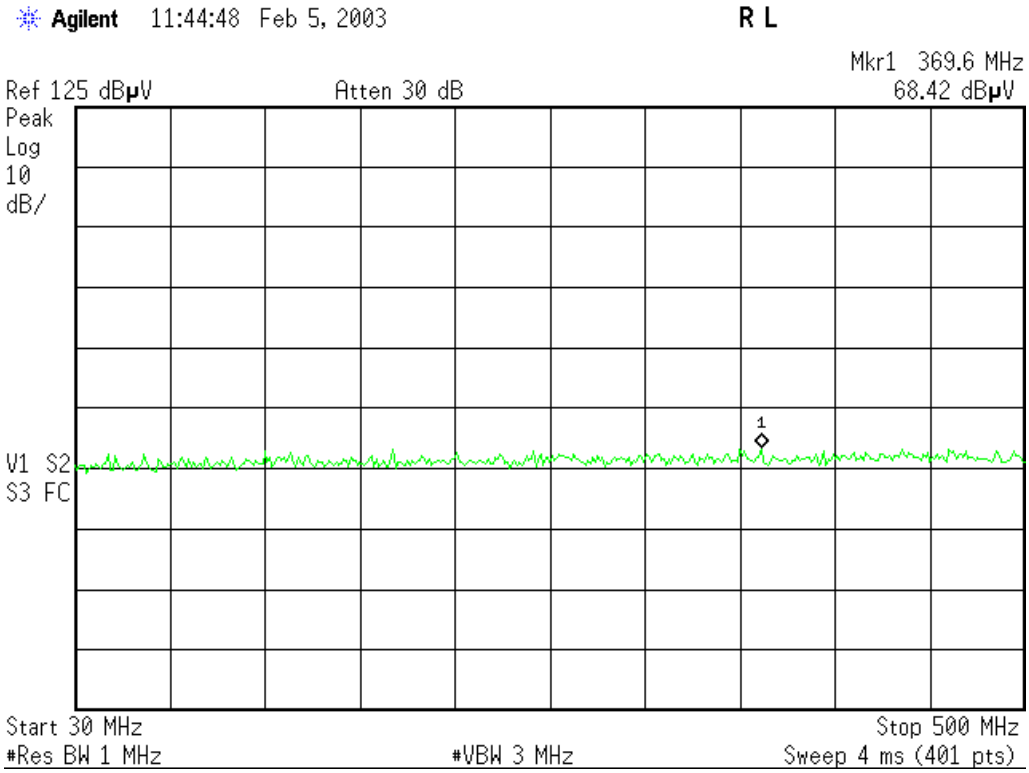


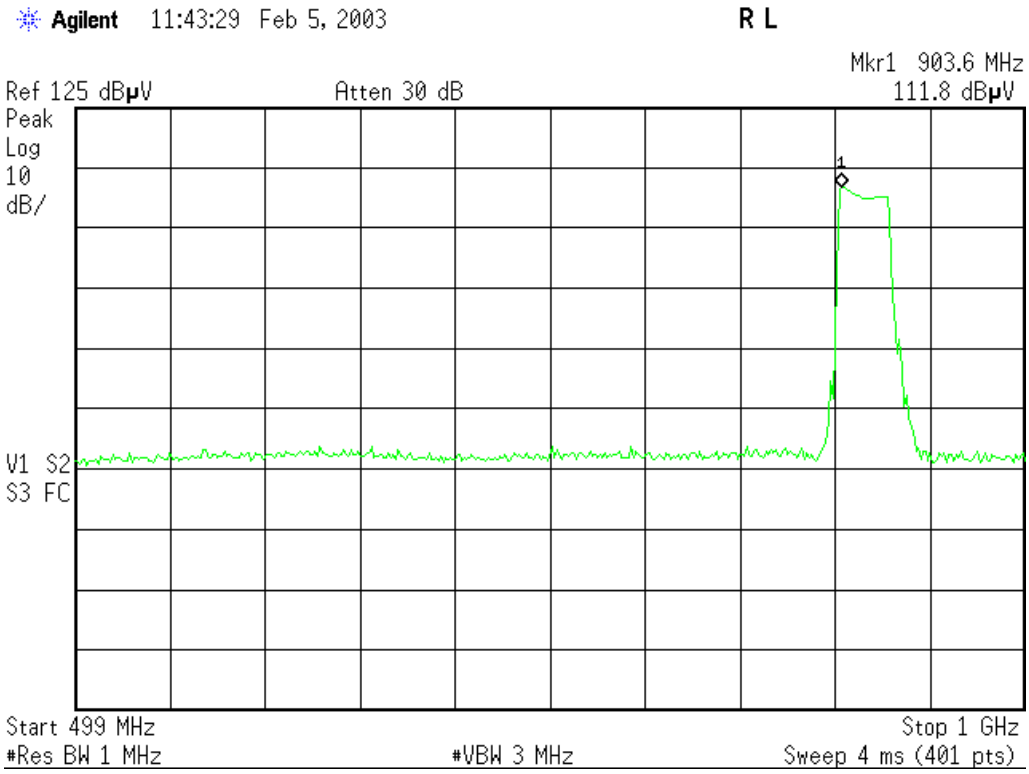
Band Edge Low End (Hopping enabled)

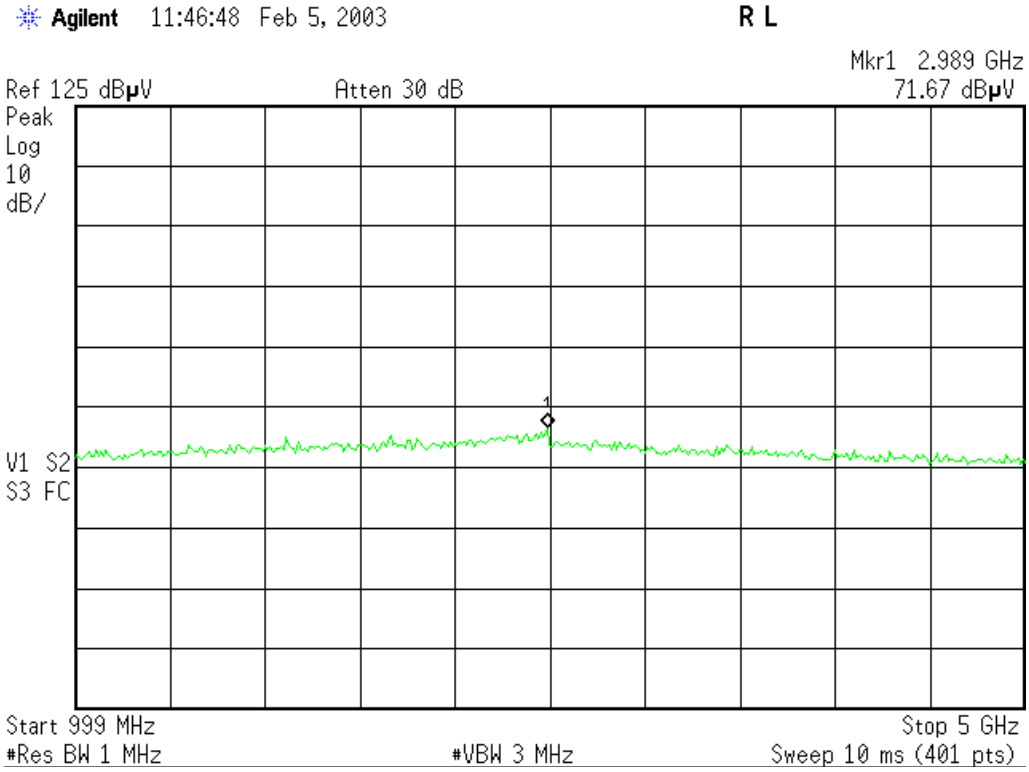


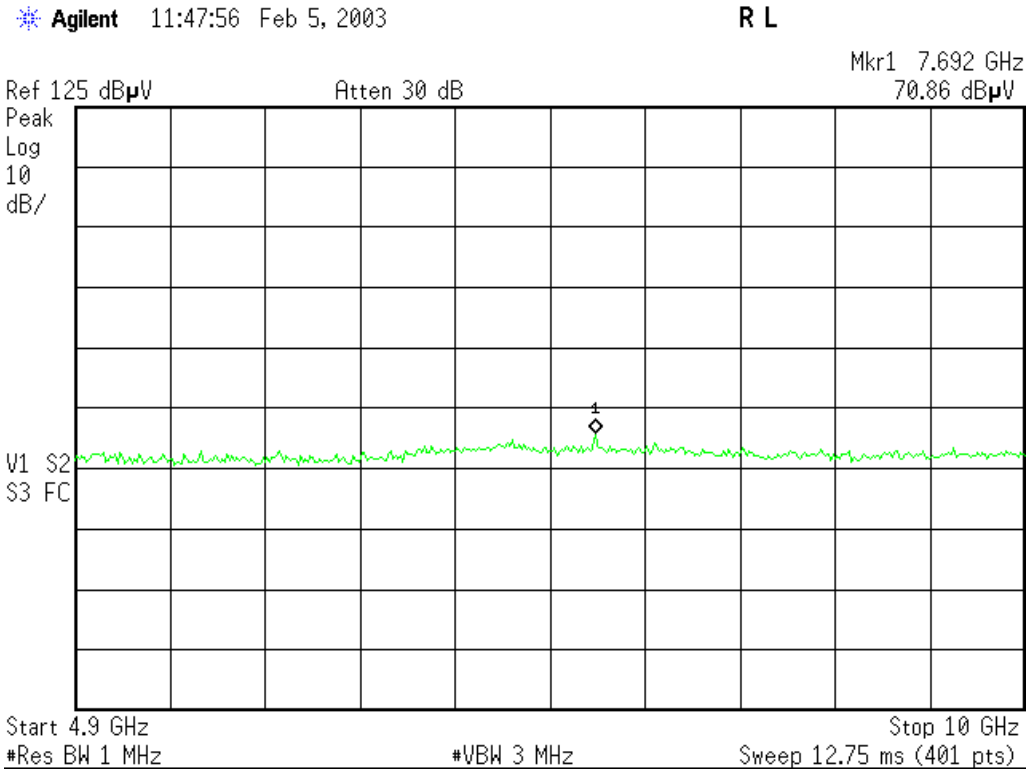
Band Edge Low End (Hopping disabled)

Section 15.247 (c) Spurious RF Conducted Emissions






Agilent 11:46:48 Feb 5, 2003
R L
Mkr1 2.989 GHz
71.67 dBµV
Ref 125 dBµV
Atten 30 dB
Peak
Log
10
dB/
V1 S2
S3 FC
Start 999 MHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 5 GHz
Sweep 10 ms (401 pts)


Agilent 11:47:56 Feb 5, 2003
R L
Mkr1 7.692 GHz
70.86 dBµV
Ref 125 dBµV
Atten 30 dB
Peak
Log
10
dB/
V1 S2
S3 FC
Start 4.9 GHz
#Res BW 1 MHz
#VBW 3 MHz
Stop 10 GHz
Sweep 12.75 ms (401 pts)

Spurious Radiated Emissions

Spurious Radiated Emissions Table

Curtis-Straus LLC

Date: 07-Feb-03 **Company:** Sensormatic Electronics Corp **Table** 3

Engineer: Mairaj Hussain **EUT Desc:** RFID Reader **Work Order:** D0094

Frequency Range: 30 - 1000 MHz **Measurement Distance:** 3 m

Notes: Four antennas on reader: 900 Cicr, 915 Shelf Antenna, 13.56 TI, 13.56 Philips **EUT Max Freq:** 927.35 MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
V	128.0	38.7	21.9	7.9	1.1	25.8				43.5	-17.7	Pass
V	160.0	36.5	21.9	9.3	1.3	25.2				43.5	-18.3	Pass
V	174.99	33.6	21.8	9.4	1.3	22.5				43.5	-21.0	Pass
H	192.0	46.7	21.6	10.1	1.5	36.7				43.5	-6.8	Pass
H	224.0	42.0	21.6	11.6	1.6	33.6				46.0	-12.4	Pass
H	256.0	49.0	21.7	13.0	1.8	42.1				46.0	-3.9	Pass
H	288.0	50.6	21.8	13.8	1.9	44.5				46.0	-1.5	Pass
H	320.0	49.0	21.8	14.6	2.1	43.9				46.0	-2.1	Pass
H	352.0	48.6	21.8	15.4	2.2	44.4				46.0	-1.6	Pass
V	384.0	45.4	21.8	16.3	2.3	42.2				46.0	-3.8	Pass
H	448.0	38.0	21.7	17.2	2.5	36.0				46.0	-10.0	Pass
H	480.0	39.0	21.6	17.5	2.7	37.6				46.0	-8.4	Pass
H	512.0	40.0	21.6	18.0	2.8	39.2				46.0	-6.8	Pass

Table Result: Pass by -1.5 dB ***Worst Freq:*** 288.0 MHz

Test Site: "T" **Pre-Amp:** Black **Cable:** 65 ft RG8A/U **Analyzer:** Black **Antenna:** Red

Thickness of DC cable's barrel increased by using the Cu tape. Recommended thickness is 5.5mm. Barrel used had thickness of 5.0mm.

Spurious Radiated Emissions Table

Curtis-Straus LLC

Date: 07-Feb-03 **Company:** Sensormatic Electronics Corp **Table** 4

Engineer: Mairaj Hussain **EUT Desc:** RFID Reader **Work Order:** D0094

Frequency Range: 30 - 1000 MHz **Measurement Distance:** 3 m

Notes: Four antennas on reader: 900 Cicr, 900 Lin, 13.56 TI, 13.56 Philips **EUT Max Freq:** 927.35 MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
H	128.0	41.0	21.9	7.9	1.1	28.1				43.5	-15.4	Pass
H	160.0	42.6	21.9	9.3	1.3	31.3				43.5	-12.2	Pass
H	192.0	50.0	21.6	10.1	1.5	40.0				43.5	-3.5	Pass
H	256.0	47.1	21.7	13.0	1.8	40.2				46.0	-5.8	Pass
H	288.0	48.4	21.8	13.8	1.9	42.3				46.0	-3.7	Pass
H	320.0	49.5	21.8	14.6	2.1	44.4				46.0	-1.6	Pass
H	352.0	48.5	21.8	15.4	2.2	44.3				46.0	-1.7	Pass
H	384.0	48.0	21.8	16.3	2.3	44.8				46.0	-1.2	Pass
H	448.0	39.0	21.7	17.2	2.5	37.0				46.0	-9.0	Pass
H	480.0	38.1	21.6	17.5	2.7	36.7				46.0	-9.3	Pass
H	512.0	35.0	21.6	18.0	2.8	34.2				46.0	-11.8	Pass
H	704.0	40.5	21.7	21.1	3.5	43.4				46.0	-2.6	Pass
H	768.0	37.6	21.7	22.5	3.7	42.1				46.0	-3.9	Pass

Table Result: Pass by -1.2 dB ***Worst Freq:*** 384.0 MHz

Test Site: "T" **Pre-Amp:** Black **Cable:** 65 ft RG8A/U **Analyzer:** Black **Antenna:** Red

Thickness of DC cable's barrel increased by using the Cu tape. Recommended thickness is 5.5mm. Barrel used had thickness of 5.0mm.

Spurious High Frequency Data

Radiated Emissions Table — *Curtis-Straus LLC*

Date: 06-Feb-03 **Company:** Sensormatic Electronics Corp **Table** 5
Engineer: Maira Hussain **EUT Desc:** RFID Reader **Work Order:** D0094

Frequency Range: 1 - 10 GHz **Measurement Distance:** 3 m
Notes: Four antennas on reader: 900 Circ, **915 Shelf Antenna**, 13.56 TI, 13.56 Philips **EUT Max Freq:** 927.35 MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
V	1823.0	31.0	24.1	28.1	1.2	36.2				54.0	-17.8	Pass
H	1843.0	31.2	24.1	28.2	1.2	36.5				54.0	-17.5	Pass
H	1393.0	29.0	23.6	26.3	1.0	32.7				54.0	-21.3	Pass
H	1962.0	32.0	24.3	28.7	1.2	37.6				54.0	-16.4	Pass
V	2435.0	36.0	24.1	30.4	1.4	43.7				54.0	-10.3	Pass

Table Result: Pass by -10.3 dB ***Worst Freq:*** 2435.0 MHz

Test Site: "T" **Pre-Amp:** Or-Blk **Cable:** 3m Microflex **Analyzer:** Blue **Antenna:** Yellow Horn

Radiated Emissions Table — *Curtis-Straus LLC*

Date: 06-Feb-03 **Company:** Sensormatic Electronics Corp **Table** 6
Engineer: Maira Hussain **EUT Desc:** RFID Reader **Work Order:** D0094

Frequency Range: 1 - 10 GHz **Measurement Distance:** 3 m
Notes: Four antennas on reader: 900 Circ, 900 Lin, 13.56 TI, 13.56 Philips **EUT Max Freq:** 927.35 MHz

Antenna Polarization (H / V)	Frequency (MHz)	Reading (dBµV)	Preamp Factor (dB)	Antenna Factor (dB/m)	Cable Factor (dB)	Adjusted Reading (dBµV/m)	--- Limit (dBµV/m)	--- Margin (dB)	--- Result (Pass/Fail)	FCC Class B Limit (dBµV/m)	FCC Class B Margin (dB)	FCC Class B Result (Pass/Fail)
H	1706.0	33.3	24.0	27.6	1.1	38.0				54.0	-16.0	Pass
H	2776.0	29.0	23.9	31.2	1.6	37.9				54.0	-16.1	Pass

Table Result: Pass by -16.0 dB ***Worst Freq:*** 1706.0 MHz

Test Site: "T" **Pre-Amp:** Or-Blk **Cable:** 3m Microflex **Analyzer:** Blue **Antenna:** Yellow Horn

Sample Calculation:

Adjusted Reading = Reading – Pre $Amp_{(factor)}$ + $Antenna_{(factor)}$ + $Cable_{(factor)}$

Section 12.247(g)

MERCURY3 Frequency-Hopping Algorithm

Channels

The system operates in the 902-928 MHz band and uses 50 hopping channels, separated by 502 kHz. The
lowest and highest channels are spaced about 700 kHz away from the edges of the band for a margin of
safety.

f(c) = 10.2400 MHz / 102 x (8992 + 5c)
where
f = frequency
c = channel, ranges from 0 to 49
f(0) = 902.726 MHz
f(1) = 903.228 MHz
f(2) = 903.730 MHz
...
f(47) = 926.318 MHz
f(48) = 926.820 MHz
f(49) = 927.322 MHz

Hopping Algorithm

The system uses a pseudorandom hop table to determine which channel to use during each hop interval. This table is listed below. The MERCURY 3's operation is characterized by periodically repeated “search cycles” during which the RF system is active separated by periods during which the RF system is inactive and processing for user commands. The user has no means of determining which channel is in use at any time nor can the user in any way coordinate commands with the particular channel in use. At the start of each search cycle, the MERCURY 3 hops to the next channel in the table and begins transmitting and receiving. The length of the search cycle depends on the number of RFID tags present. If the length of the search cycle exceeds 0.4 seconds, the RF system limits its maximum dwell time by forcing a hop to the next channel in the table before 0.4 seconds is reached. Under no circumstances will the RF system dwell more than 0.4 seconds before hopping. When the search cycle completes, the RF system shuts off until the next search cycle. The behavior of the MERCURY 3 searches is entirely independent from channel selection. Hops are made when necessary, but no decisions are made based on the particular channel in use. As a result, on average during operation all channels will be treated identically.

Hop Table

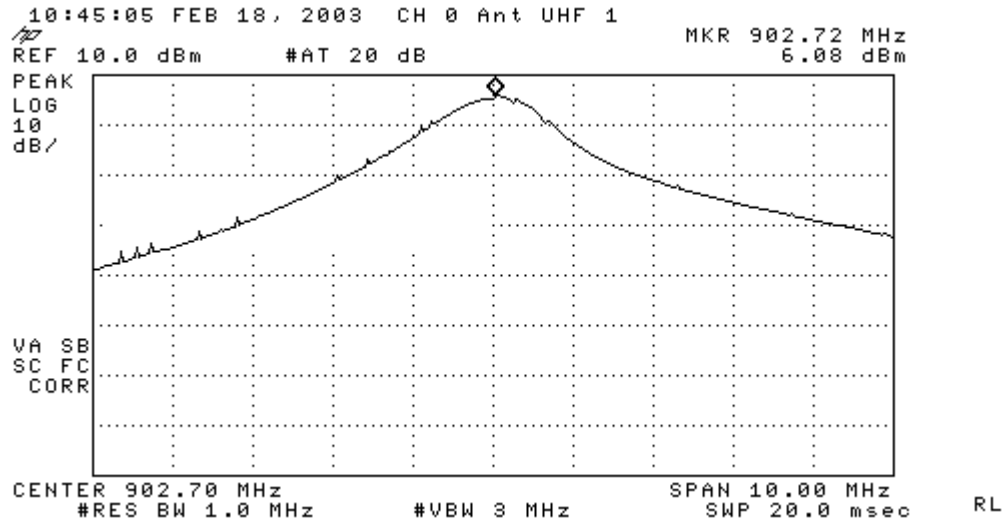
Channel numbers (0 through 49) are listed. Table is 100 entries.
12, 40, 21, 5, 42, 20, 32, 47, 37, 6, 25, 4, 17, 26, 48, 38, 22, 3, 16, 27, 41, 45, 29, 14, 2, 18, 7, 34, 49, 39, 9, 36, 13, 46, 35, 24, 31, 44, 28, 15, 1, 11, 33, 43, 23, 0, 10, 30, 8, 19, 40, 21, 5, 42, 20, 32, 47, 37, 6, 25, 4, 17, 26, 48, 38, 22, 3, 16, 27, 41, 45, 29, 14, 2, 18, 7, 34, 49, 39, 9, 36, 13, 46, 35, 24, 31, 44, 28, 15, 1, 11, 33, 43, 23, 0, 10, 30, 8, 19, 12

Curtis-Straus LLC • 527 Great Road • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828

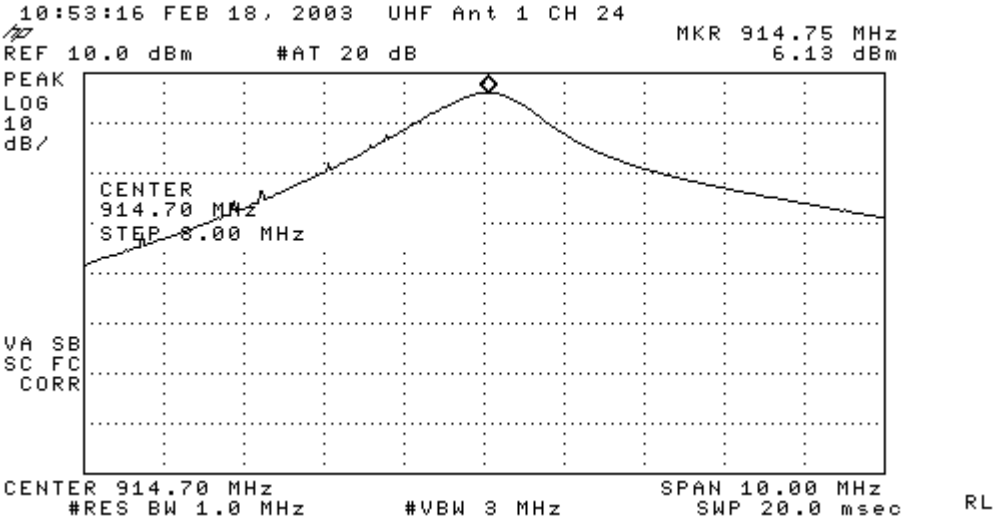
Test Data Modified Unit

Peak Output Power

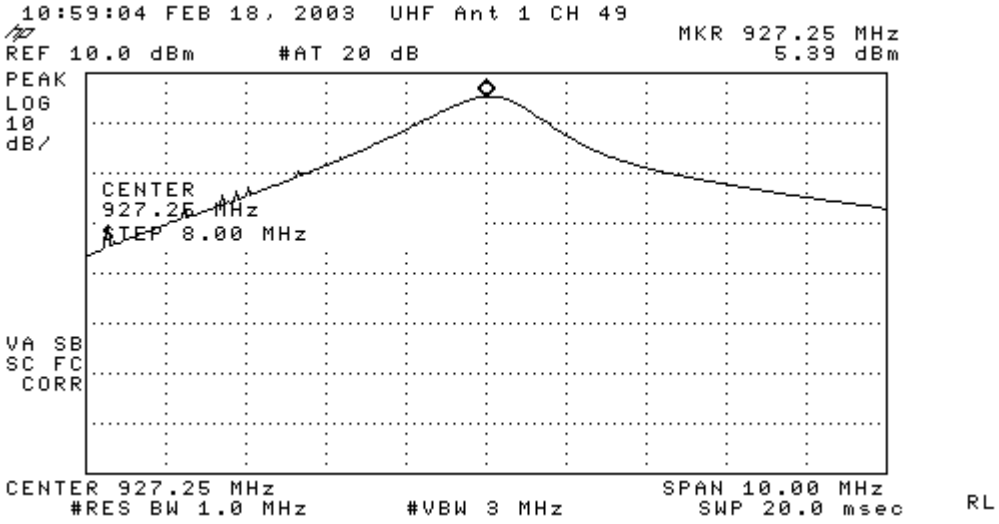
On February 18th, 2003 a modified version of the product was tested. The output filter on antenna ports UHF1 and UH2 was modified in order to obtain maximum power without going over the limit. Peak output power (conducted) and band edge measurements were taken for the modified version.



UHF Antenna Port1, Channel 0

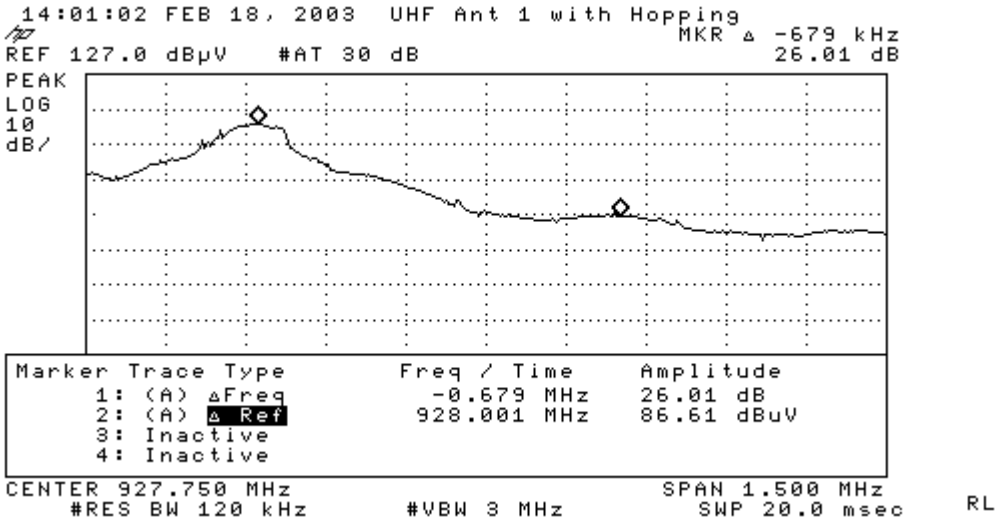


UHF Antenna Port 1, Channel 24



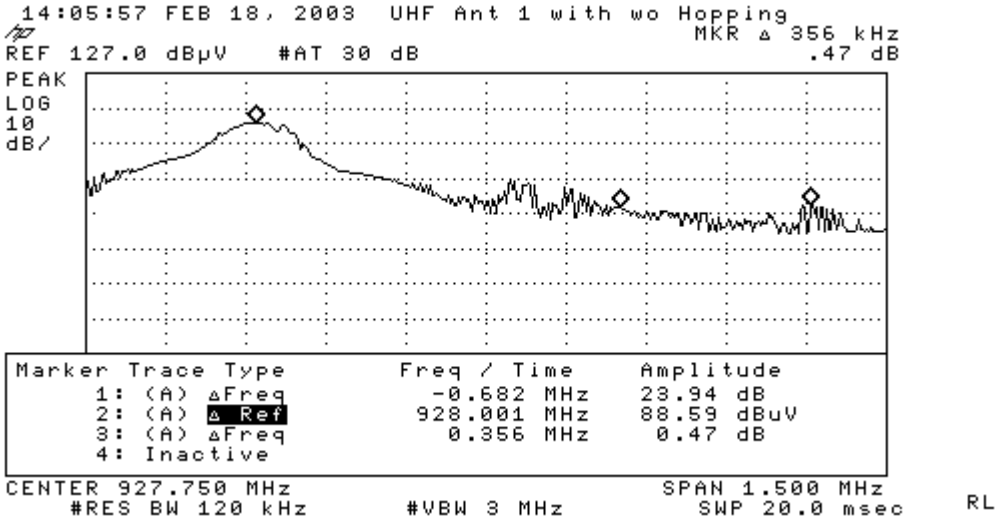
UHF Antenna Port 1, Channel 49

Band Edge Plots

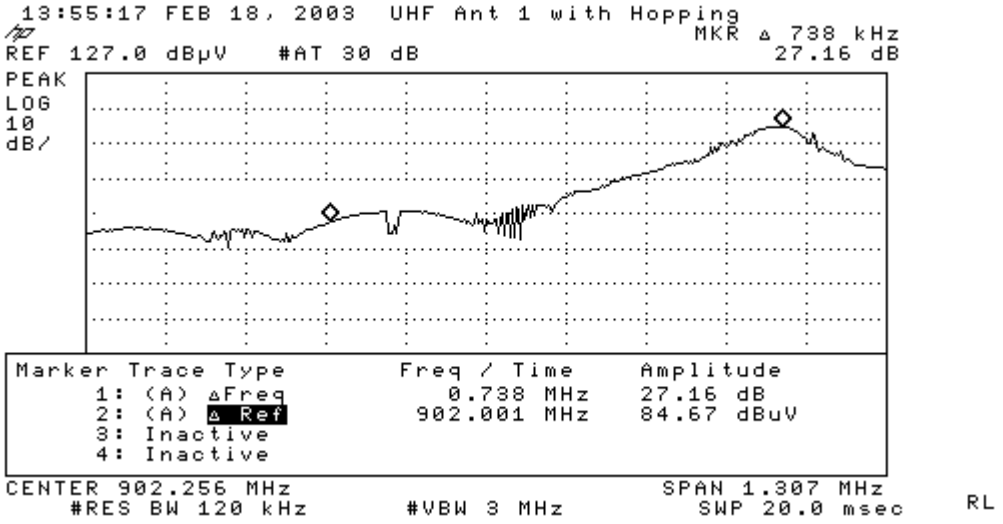


Upper Band Edge (Hopping)

Conclusion	Highest emissions outside the band is attenuated > 20dB from the carrier frequency.

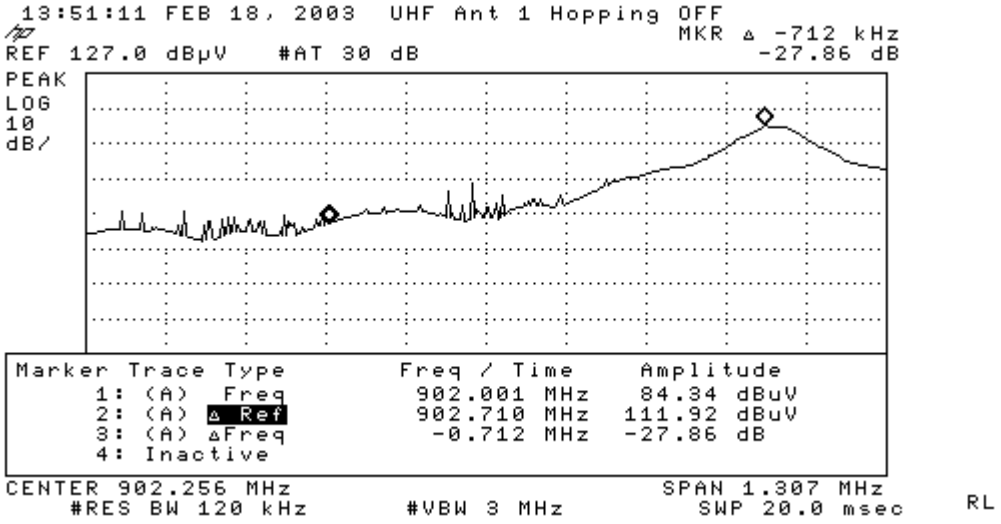


Upper Band Edge (Hopping disabled)



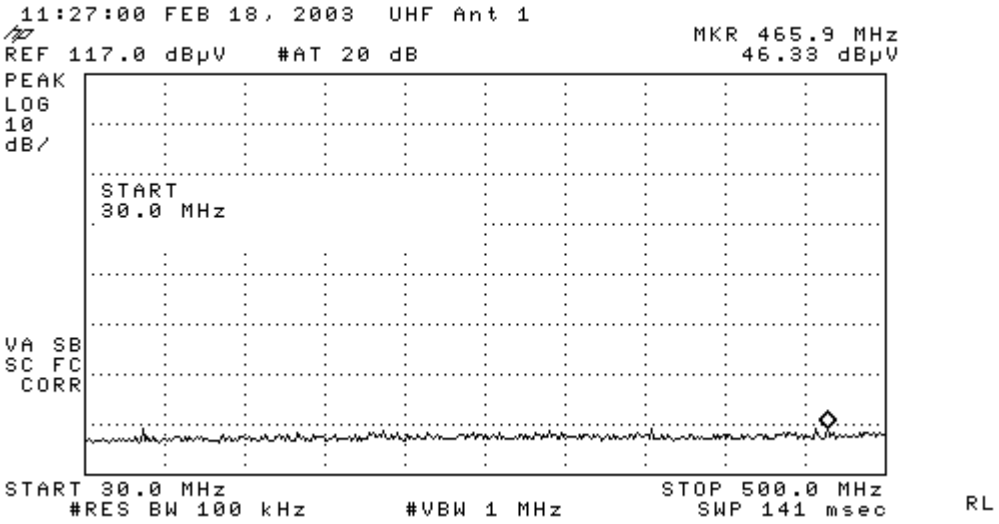
Lower Band Edge (Hopping)

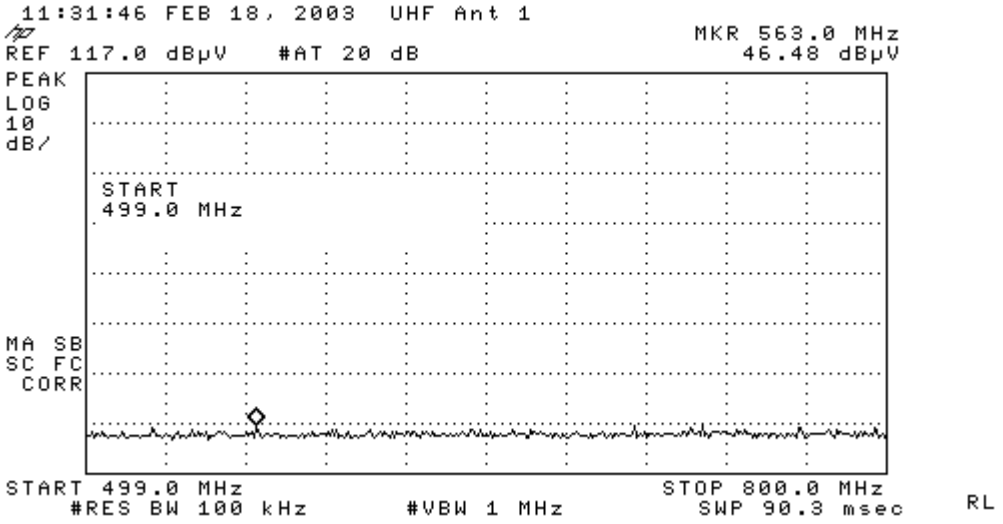
Conclusion	Highest emissions outside the band is attenuated > 20dB from the carrier frequency.

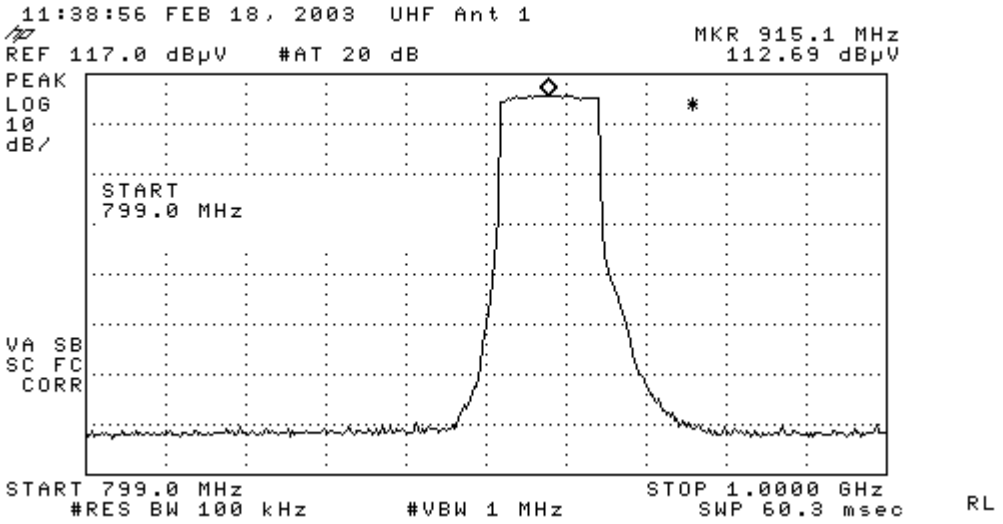


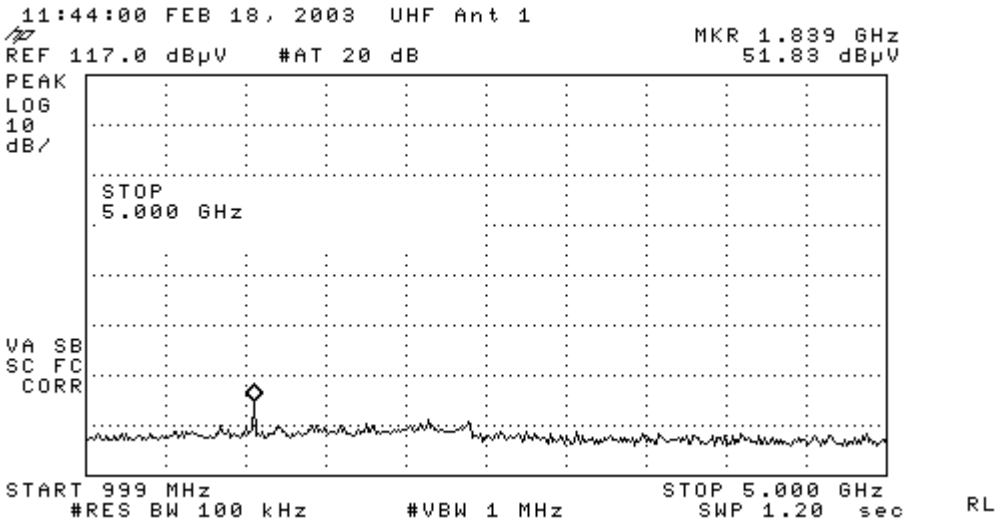
Lower Band Edge (Hopping disabled)

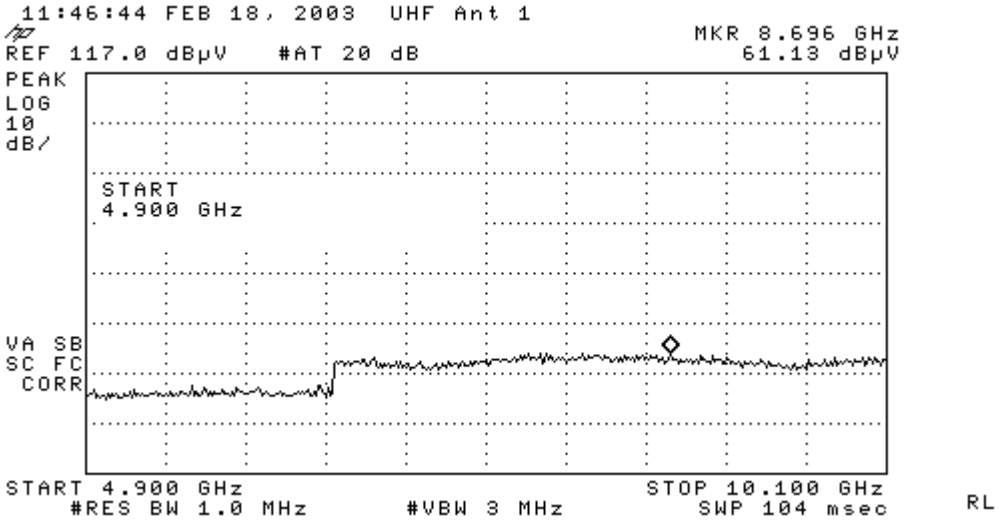
Conducted Spurious Emissions



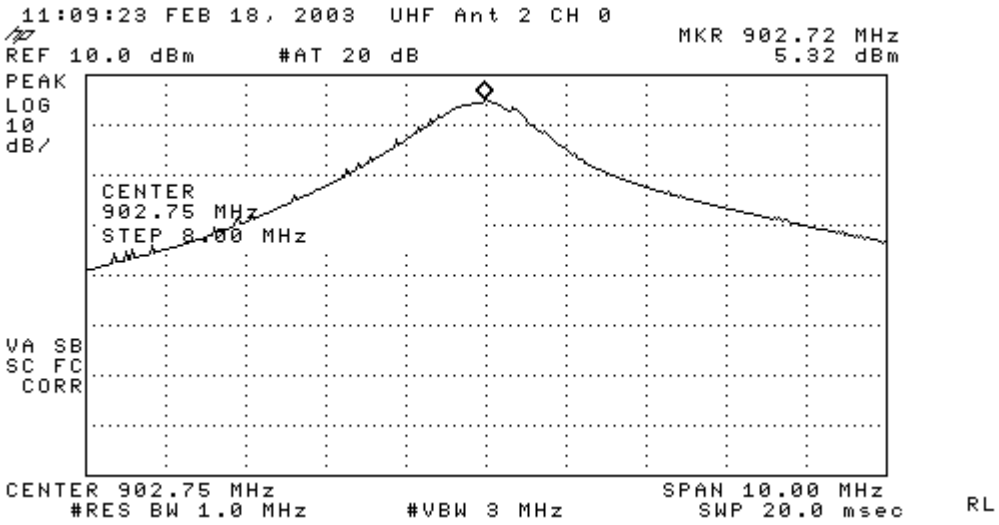

11:31:46 FEB 18, 2003 UHF Ant 1
REF 117.0 dBµV #AT 20 dB
MKR 563.0 MHz
46.48 dBµV
PEAK
LOG
10
dB/
START
499.0 MHz
MA SB
SC FC
CORR
START 499.0 MHz
#RES BW 100 kHz
#VBW 1 MHz
STOP 800.0 MHz
SWP 90.3 msec
RL


11:38:56 FEB 18, 2003 UHF Ant 1
REF 117.0 dBµV #AT 20 dB
MKR 915.1 MHz
112.69 dBµV
PEAK
LOG
10
dB/
START
799.0 MHz
VA SB
SC FC
CORR
START 799.0 MHz
#RES BW 100 kHz
#VBW 1 MHz
STOP 1.0000 GHz
SWP 60.3 msec
RL

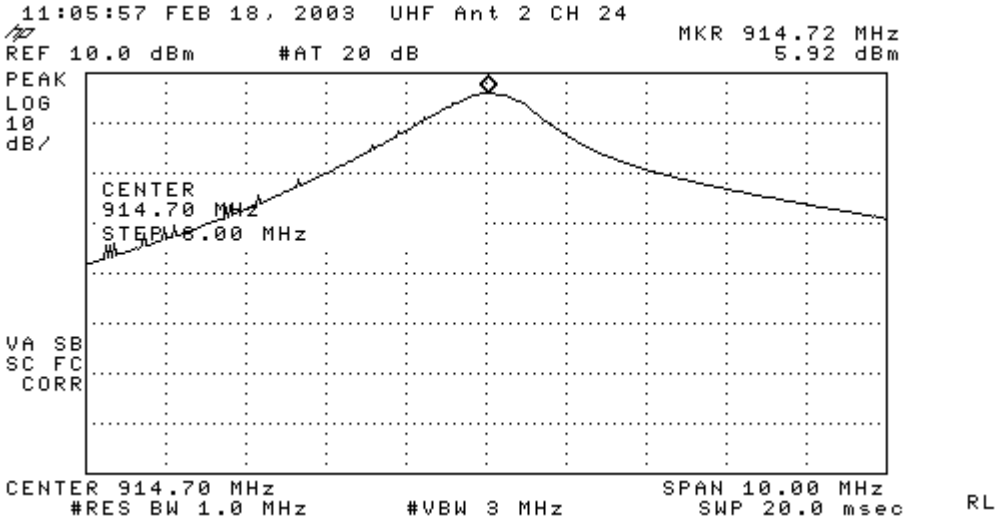

11:44:00 FEB 18, 2003 UHF Ant 1
REF 117.0 dBµV #AT 20 dB
MKR 1.839 GHz
51.83 dBµV
PEAK
LOG
10
dB/
STOP
5.000 GHz
VA SB
SC FC
CORR
START 999 MHz
#RES BW 100 kHz
#VBW 1 MHz
STOP 5.000 GHz
SWP 1.20 sec
RL


11:46:44 FEB 18, 2003 UHF Ant 1
REF 117.0 dBµV
#AT 20 dB
MKR 8.696 GHz
61.13 dBµV
PEAK
LOG
10
dB/
START
4.900 GHz
VA SB
SC FC
CORR
START 4.900 GHz
#RES BW 1.0 MHz
#VBW 3 MHz
STOP 10.100 GHz
SWP 104 msec
RL

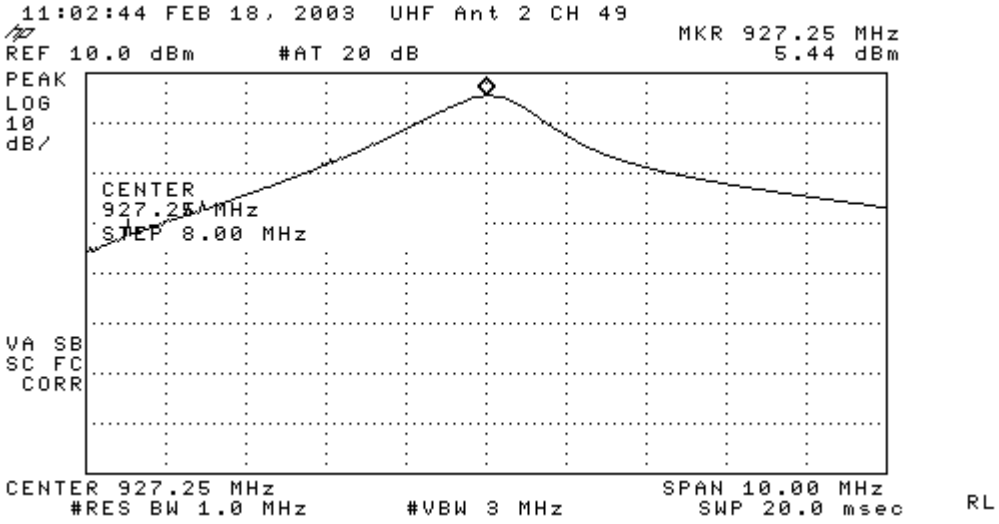
Peak Output Power (modified unit UHF Ant Port 2)



UHF Antenna Port 2 POP modified unit Channel 0



UHF Ant Port 2 POP modified unit Channel 24



UHF Antenna Port 2 POP modified unit Channel 49

Peak OutPut Power (modified unit)

Work Order: D0094 **Table:** 7
Company: Sensormatic Electronics Corp
Date: 2/18/03
Engineer: Mairaj Hussain

Product: RF ID Reader

Spectrum Analyzer: Black **Cable:** Microflex (# 6), Thing Magic's cable
Attnetuator: 20dB 50W 902

UHF Antenna 1

Channel	Reading	Cable(s) Factor	Attenuator	Adj Reading	Limit	Result
	(dBm)	(dB)	(dB)	(dBm)	(dBm)	Pass
0	6.08	1.7	19.5	27.28	28[a]	Pass
24	6.13	1.7	19.5	27.33	28[a]	Pass
49	5.39	1.7	19.5	26.59	28[a]	

UHF Antenna 2

Channel	Reading	Cable(s) Factor	Attenuator	Adj Reading	Limit	Result
	(dBm)	(dB)	(dB)	(dBm)	(dBm)	Pass
0	5.32	1.7	19.5	26.52	28[a]	Pass
24	5.92	1.7	19.5	27.12	28[a]	Pass
49	5.44	1.7	19.5	26.64	28[a]	

Cable Factor: Microflex + Client's cable
Spectrum Analyzer: Orange
Pad: 20.dB
a: 30-(Gant-6) = 30 - (8 - 6) = 28dBi Limit is adjusted for higher antenna gain
Note: All readings are peak modulated signal

AC Line Conducted Emission Measurements

LIMITS
Quasi-Peak: 250µV = 47.9dBµV in the range 450kHz to 30MHz
[47 CFR 15.207(a) Revised as of October 1, 2001]

Note: On July 12, 2004, FCC adopts the conducted emissions limits of the European CISPR 22 standard as outlined below

Frequency of emission (MHz)	Quasi-peak limit (dBµV)	Average limit (dBµV)
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.

[47 CFR 15.207(a) Revised as of October 1, 2002; amended by ET Docket 98-80; FCC 02-157, published in the Federal Register Vol. 67, No. 132, on Wednesday, July 10, 2002]

AC Mains Conducted Emissions *Curtis-Straus LLC*

Date: 07-Feb-03 **Company:** Sensormatic Electronics Corp **Table No:** 8
Engineer: Mairaj Hussain **EUT Desc:** RFID Reader **Work Order:** D0094
Notes:
Range: 0.15-30Mhz **LISN(s):** Yellow-Black Orange **Other Equipment:** --- **Spectrum Analyzer:** Black

Frequency (MHz)	Q.P. Readings QP1 (dBµV)	QP2 (dBµV)	Ave. Readings AV1 (dBµV)	AV2 (dBµV)	Impedance Factor (dB)	FCC A Applicable until July 12, 2004 Limit (dBµV)	Margin dB	FCC/CISPR A qp Limit (dBµV)	qp Margin dB	FCC/CISPR A AVE Limit (dBµV)	AVE Margin dB	Overall Result (Pass/Fail)
11.02	10.6	12.5			20.0	69.5	-37.0	73.0	-40.5	60.0	-27.5	Pass
12.77	22.0	22.1			20.0	69.5	-27.4	73.0	-30.9	60.0	-17.9	Pass
13.41	31.1	31.3			20.0	69.5	-18.2	73.0	-21.7	60.0	-8.7	Pass
13.56	73.7	68.7	38.0	38.8	20.0	69.5	**11.2**	73.0	**20.7**	60.0	-1.2	Fail
13.57	31.7	31.0			20.0	69.5	-17.8	73.0	-21.3	60.0	-8.3	Pass
13.70	28.5	30.2			20.0	69.5	-19.3	73.0	-22.8	60.0	-9.8	Pass
18.53	19.6	20.0			20.0	69.5	-29.5	73.0	-33.0	60.0	-20.0	Pass
22.30	17.6	19.1			20.0	69.5	-30.4	73.0	-33.9	60.0	-20.9	Pass
50 ohm terminator on HF 1 & 2												
13.56	12.6	13.1			20.0	69.5	-36.4	73.0	-39.9	60.0	-26.9	Pass

Table Result: Pass by 8.30 dB ***Worst Freq:*** 13.57 MHz

Test Equipment Used

REV. 3/5/03

SPECTRUM ANALYZERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	9kHz-1.8GHz	8591E	HP	3441A03559	00024	05-JUN-2003
WHITE	9kHz-22GHz	8593E	HP	3547U01252	00022	25-FEB-2004
BLUE	9kHz-1.8GHz	8591E	HP	3223A00227	00070	04-SEP-2003
YELLOW	9kHz-2.9GHz	8594E	HP	3523A01958	00100	03-JUL-2003
GREEN	9kHz-26.5GHz	8593E	HP	3829A03618	00143	02-OCT-2003
BLACK	9kHz-12.8GHz	8596E	HP	3710A00944	00337	08-JUL-2003
YELLOW-BLACK	20Hz-40.0MHz	3585A	HP	2504A05219	00030	25-DEC-2003
ORANGE	9kHz-26.5GHz	E4407B	HP	US39440975	00394	07-JUN-2003

LISN	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	956348	00753	18-APR-2003
BLUE	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	956349	00752	18-APR-2003
YELLOW-BLACK	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	984735	00248	10-MAY-2003
ORANGE	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	903707	00754	24-OCT-2003
GOLD	10kHz-30MHz	8012-50-R-24-BNC	SOLAR	984734	00247	24-OCT-2003
WHITE-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972019	00678	18-APR-2003
BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972017	00675	18-APR-2003
RED-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972016	00677	18-APR-2003
BLUE-BLACK	10kHz-30MHz	8610-50-TS-100-N	SOLAR	972018	00676	18-APR-2003

OPEN AREA TEST SITE (OATS)	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
SITE F	93448	IC 2762-F	R-468	04-FEB-2004
SITE T	93448	IC 2762-T	R-905	04-FEB-2004
SITE A	93448	IC 2762-A	R-903	04-FEB-2004
SITE M	93448	IC 2762-M	R-904	04-FEB-2004
BUBBLE (HP FACILITY)	N/A	N/A	R-1467	16-MAY-2005

LINE CONDUCTED TEST SITES	FCC CODE	IC CODE	VCCI CODE	CALIBRATION DUE
EMI 1	93448	N/A	C-480	31-MAR-2003
EMI 2	93448	N/A	C-480	31-MAR-2003
EMI 3	93448	N/A	C-480	31-MAR-2003
BUBBLE (HP FACILITY)	N/A	N/A	C-1556	16-MAY-2005

ANTENNAS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
GREEN BILOG	30MHz-2GHz	CBL6112B	CHASE	2742	00620	26-FEB-2003
GREEN-BLACK BILOG	30MHz-2GHz	CBL6112B	CHASE	2412	00127	11-JUL-2004
GREEN-WHITE BILOG	30MHz-2GHz	CBL6112B	CHASE	2574	00319	11-JUL-2004
RED BILOG	30MHz-1GHz	3143	EMCO	1270	00042	11-JUL-2004
BLUE BILOG	30MHz-1GHz	3143	EMCO	1271	00803	11-JUL-2004
GRAY BILOG	26MHz-2GHz	3141	EMCO	9703-1038	00066	18-JUL-2003
YELLOW-BLACK BILOG	20-2000MHz	CBL6140A	CHASE	1112	00126	18-JUL-2003
YELLOW HORN	1-18GHz	3115	EMCO	9608-4898	00037	08-MAY-2003
BLACK HORN	1-18GHz	3115	EMCO	9703-5148	00056	12-JUN-2003
ORANGE HORN	1-18GHz	3115	EMCO	0004-6123	00390	27-MAY-2003
WHITE HORN	18-26.5GHz	3160-09	EMCO	9610-1068	00758	26-JUN-2003
SMALL LOOP	9kHz-30MHz	PLA-130/A	ARA	1024	00755	27-JAN-2004
LARGE LOOP	20Hz-5MHz	6511	EMCO	9704-1154	00067	05-NOV-2003
ACTIVE MONOPOLE	30Hz-30MHz	3301B	EMCO	3824	00068	24-APR-2003
BLUE ACTIVE MONOPOLE	30Hz-50MHz	3301B	EMCO	4287	TELOGY RENTAL	17-AUG-2003
INDUCTION COIL	50-60Hz	1000-4-8	C-S	N/A	00778	16-SEP-2004
ADJUSTABLE DIPOLE	30-1000MHz	3121C	EMCO	1370	00757	26-JUN-2003
ADJUSTABLE DIPOLE	30-1000MHz	3121C	EMCO	1371	00756	26-JUN-2003
RE101 LOOP SENSOR	30Hz-100kHz	RE101-13.3CM	C-S	N/A	00818	07-JAN-2005
RS101 RADIATING LOOP	30Hz-100kHz	RS101-12CM	C-S	N/A	00819	07-JAN-2005
RS101 LOOP SENSOR	30Hz-100kHz	RS101-4CM	C-S	N/A	00820	07-JAN-2005

PREAMPS / ATTENUATORS / FILTERS	RANGE	MN	MFR	SN	ASSET	CALIBRATION DUE
RED	0.10-2000MHz	ZFL-1000-LN	C-S	N/A	00798	22-MAR-2003
BLUE	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00759	07-AUG-2003
BLUE-BLACK	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00800	12-SEP-2003
GREEN	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00802	22-MAR-2003
GOLD	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00044	24-MAY-2003
BLACK	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00799	22-MAR-2003
ORANGE	0.01-2000MHz	ZFL-1000-LN	C-S	N/A	00765	22-MAR-2003
WHITE	1-20GHz	SMC-12A	C-S	426643	00760	27-AUG-2003
YELLOW-BLACK	1-20GHz	SMC-12A	C-S	535055	00801	27-AUG-2003
ORANGE-BLACK	1-20GHz	SMC-12A	C-S	690639	00761	27-AUG-2003
YELLOW	18-26.5GHz	AFS4-18002650-60-8P-4	C-S	467559	00758	27-AUG-2003
HIGH PASS FILTER	1-18 GHz	SPA-F-55204	K&L	36	00817	31-DEC-2003
LOW PASS FILTER	1-9 GHz	11SL10-4100/X4400-O/O	K&L	4	00816	31-DEC-2003
20DB ATTENUATOR	0.03-20 GHz	PE 7019-20	PASTERNACK	01	00791	13-JUN-2003

Unless otherwise noted the calibration interval is one year. All equipment is calibrated using standards traceable to NIST or other nationally recognized calibration standard.

Terms And Conditions

Paragraph 1. SERVICES. LABORATORY will:

1.1 Use the degree of care and skill ordinarily exercised by and consistent with the standards of the profession.
1.2 Perform all technical services in substantial accordance with the generally accepted laboratory principles and practices.
1.3 Retain all pertinent records relating to the services performed for a period of three (3) years following submission of the report describing such services, during which period the records will be made available to CLIENT upon reasonable request.

Paragraph 2. CLIENT'S RESPONSIBILITIES. CLIENT or his authorized representative will:

2.1 Provide LABORATORY with all plans, schematics, specifications, addenda, change orders, drawings and other information for the proper performance of technical services.
2.2 Designate a person to act as CLIENT's representative with respect to LABORATORY's services to be performed on behalf of the CLIENT; such person or firm to have complete authority to transmit instructions, receive information and data, interpret and define CLIENT's policies and decisions with respect to the LABORATORY's work on behalf of the CLIENT and to order, at CLIENT's expense, such technical services as may be required.
2.3 Designate a person who is authorized to receive copies of LABORATORY's reports.
2.4 Undertake the following:
(a) Secure and deliver to LABORATORY, without cost to LABORATORY, preliminary representative samples of the equipment proposed to require technical services, together with any relevant data.
(b) Furnish such labor and equipment needed by LABORATORY to handle samples at the LABORATORY and to facilitate the specified technical services.

Paragraph 3. GENERAL CONDITIONS:

3.1 LABORATORY, by the performance of services covered hereunder, does not in any way assume any of those duties or responsibilities customarily vested in the CLIENT, its employees, or any other party, agency or authority.
3.2 LABORATORY shall not be responsible for acts of omissions of any other party or parties involved in the design, manufacture or maintenance of the equipment or the failure of any employee, contractor or subcontractor to undertake any aspect of equipment's design, manufacture or maintenance.
3.3 LABORATORY is not authorized to revoke, alter, release, enlarge or release any requirement of the equipment's design, manufacture or maintenance unless specifically authorized by CLIENT or his authorized representative.
3.4 THE ONLY WARRANTY MADE BY LABORATORY IN CONNECTION WITH ITS SERVICE PERFORMED HEREUNDER IS THAT IT WILL USE THAT DEGREE OF CARE AND SKILL AS SET FORTH IN PARAGRAPH 1 ABOVE. NO OTHER WARRANTY, EXPRESS OR IMPLIED, IS MADE OR INTENDED FOR SERVICES PROVIDED HEREUNDER.
3.5 Where the LABORATORY indicates that additional testing is advisable to obtain more valid or useful data, and where such testing has not been authorized, CLIENT agrees to view such test reports as inconclusive and preliminary.
3.6 The LABORATORY will supply technical service and prepare a report based solely on the sample submitted to the LABORATORY by the CLIENT. The CLIENT understands that application of the data to other devices is highly speculative and should be applied with extreme caution.
3.7 The LABORATORY agrees to exercise ordinary care in receiving, preserving and shipping (F.O.B. Littleton, MA) any sample to be tested, but assumes no responsibility for damages, either direct or consequential, which arise from loss, damage or destruction of the samples due to the act of examination, modification or testing, or technical services or circumstances beyond LABORATORY's control.
3.8 The LABORATORY will hold samples for thirty (30) days after tests are completed, or until the CLIENT's outstanding debts to the LABORATORY are satisfied, whichever is later.
3.9 The CLIENT recognizes that generally accepted error variances apply and agrees to consider such error variances in its use of test data.
3.10 It is agreed between LABORATORY and CLIENT that no distribution of any tests, reports or analysis other than that described below shall be made to any third party without the prior written consent of both parties unless such distribution is mandated by operation of law. It is agreed that tests, reports, or analysis results may be disclosed to third party auditors of the laboratory at the laboratory facility in the course of accreditation maintenance audits. No reference to reports or technical services of the LABORATORY shall be made in any advertising or promotional literature without the express written permission of the LABORATORY.
3.11 The CLIENT acknowledges that all employees of LABORATORY operate under employment contracts with the LABORATORY and CLIENT agrees not to solicit employment of such employees or to solicit information related to other clients from said employees.
3.12 In recognition of the relative risks and benefits of the project to both CLIENT and LABORATORY, the risks have been allocated such that the CLIENT agrees, to the fullest extent permitted by law, to limit the liability of the LABORATORY to the CLIENT for any and all claims, losses, costs, damages of any nature whatsoever or claims expenses from any cause or causes, including attorneys' fees and costs and expert witness fees and costs, so that the total aggregate liability of the LABORATORY to the CLIENT shall not exceed $100,000, or the LABORATORY'S total fee for services rendered on this project, whichever is greater. It is intended that this limitation apply to any and all liability or cause of action however alleged or arising, unless otherwise prohibited by law.

Paragraph 4. INSURANCE:

4.1 LABORATORY shall secure and maintain throughout the full period of the services provided to the CLIENT adequate insurance to protect it from claims under applicable Workmen's Compensation Acts and also shall maintain one million dollars of general liability coverage to cover claims for bodily injury, death or property damage as may arise from the performance of its services.
4.2 The CLIENT hereby warrants that it has sufficient insurance to protect its employees adequately under applicable Workmen's Compensation Acts and for bodily injury, death, or property damage.

4.3 No insurance of whatever kind or type, which may be carried by either party is to be considered as in any way limiting any other party's responsibility for damages resulting from their operations or for furnishing work and materials.

Paragraph 5. PAYMENT:

5.1 CLIENT shall pay to LABORATORY such fees for services as previously agreed, orally or in writing, within 30 days of presentment of a bill for such services performed. In the event CLIENT ordered, orally or in writing, services but such services were not assigned a rate for billing, such services shall be billed at the LABORATORY's reasonable and customary rate.
5.2 CLIENT shall be responsible for all shipping, customs and other expenses related to services provided by LABORATORY to the CLIENT, and shall fully insure any test sample or other equipment provided to LABORATORY by the CLIENT.
5.3 Amounts overdue from CLIENT to LABORATORY shall be charged interest at a rate of 1½% per month.

Paragraph 6. ISO/IEC GUIDE 17025 ADDITIONS:

6.1 CLIENT agrees that this test report will not be reproduced except in full, without written approval from the LABORATORY.
6.2 CLIENT agrees that this test report shall not be used to claim product endorsement by A2LA or ANSI or any agency of the U.S. Government.
6.3 CLIENT agrees that test results presented herein relate only to the sample tested by the LABORATORY.

Curtis-Straus LLC • 527 Great Road • Littleton, MA • TEL (978) 486-8880 • FAX (978) 486-8828