



FCC CFR47 PART 90 TYPE ACCEPTANCE

TEST REPORT

FOR

RTU WIRELESS LOCAL LOOP

MODEL:ST-880RSU

FCC ID: NZSST-880RSU

REPORT NUMBER: 98E7323

ISSUE DATE:JUNE23,1998

Prepared for
SMARTRUNK SYSTEMS
23278 BERNHARDT ST
HAYWARD CA, 94545
USA

Prepared by
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EXHIBITS

1.	FCC 731 FORM
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10.	PRODUCT SPECIFICATION, DOCUMENT#502-4907
11.	BLOCK DIAGRAM

1. VERIFICATION OF COMPLIANCE

COMPANY NAME: SMARTRUNK SYSTEMS
23278 BERNHARDT ST
HAYWARD CA, 94545

CONTACT PERSON: GEORGE Z H ZHANG / PROJECT ENGINEER

TELEPHONE NO: 510-887-1950

MODEL NO/NAME: ST-880RSU

SERIAL NO: N/A

DATE TESTED: MAY 4, 1998

TYPE OF EQUIPMENT:	SKYLINK RTU LOCAL LOOP
MEASUREMENT DISTANCE:	3 METER
TECHNICAL LIMIT:	FCC 90.210
FCC RULES:	PART 15, PART 90
EQUIPMENT AUTHORIZATION PROCEDURE	TYPE ACCEPTANCE

The above equipment was tested by Compliance Consulting Services for compliance with the requirements set forth in the FCC CFR 47, PART 15 AND 90. The results of testing in this report apply to the product/system which was tested only. Other similar equipment will not necessarily produce the same results due to production tolerance and measurement uncertainties.

Approved By

Compliance Consulting Services, Inc.



Mike C. I. Kuo / Vice President

2. **PRODUCT DESCRIPTION**

ST-880RSU SkyLink Remote Subscriber Unit (RSU) is designed to operate in the SkyLink Wireless Local Loop System. The RSU is working in the 800MHz frequency band. The RSU contains two PCBs. One is a full duplex UHF transceiver unit. Another is a logic control unit with the telephone interface. For detailed description of the unit, please refer to **Exhibit 8 - Theory of Operation.**

3. **TEST FACILITY**

The open area test sites and conducted measurement facilities used to collect the radiated data are located at 561F Monterey Road, Morgan Hill, California, USA. The sites are constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22.

4. **ACCREDITATION AND LISTING**

The test facilities used to perform radiated and conducted emissions tests are accredited by National Voluntary Laboratory Accreditation Program for the specific scope of accreditation under Lab Code:200065-0 to perform Electromagnetic Interference tests according to FCC PART 15 AND CISPR 22 requirements. No part of this report may be used to claim or imply product endorsement by NVLAP or any agency of the US Government. In addition, the test facilities are listed with Federal Communications Commission (reference no: 31040/SIT (1300B3) and 31040/SIT(1300F2))

5. **MEASUREMENT INSTRUMENTATION**

Radiated emissions were measured with one or more of the following types of linearly polarized antennas: tuned dipole, biconical, log periodic, bi-log, ridged waveguide, liner horn. EMI receivers were used for line conducted readings, spectrum analyzers with pre-selectors and quasi-peak detectors were used to perform radiated measurements. Receiving equipment (i.e., receiver, analyzer, quasi-peak adapter, pre-selector) and LISNs conform to CISPR specification for "Radio Interference Measuring Apparatus and Measurement Methods," Publication 16.

Calibrated wideband preamplifiers, coaxial cables, and coaxial attenuators are also used for making measurements.

6. MEASURING INSTRUMENT CALIBRATION

The measuring equipment which was utilized in performing the tests documented herein has been calibrated in accordance with the manufacturer's recommendations for utilizing calibration equipment which is traceable to recognized national standards.

7. UNITS OF MEASUREMENT

Measurements of radiated interference are reported in terms of dB(uV/m) at a specified distance. The indicated readings on the spectrum analyzer were converted to dB(uV/m) by use of appropriate conversion factors. Measurements of conducted interference are reported in terms of dB(uV).

The field strength is calculated by adding the Antenna Factor and Cable Factors, then by subtracting the Amplifier Gain from the measured reading. The basic equation with a sample calculation 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

Assume a receiver reading of 52.5 dBuV is obtained. The Antenna Factor of 7.4dB/m and a Cable Factor of 1.1dB is added. The Amplifier Gain of 29 dB is subtracted, giving a field strength of 32 dBuV/m. The 32 dBuV/m value was mathematically converted to its corresponding level in uV/m.

$$FS = 52.5 + 7.4 + 1.1 - 29 = 32 \text{ dBuV/m}$$

$$\text{Level in uV/m} = \text{Common Antilogarithm} [(32 \text{ dBuV/m})/20] = 39.8 \text{ uV/m}$$

8. CLASSIFICATION OF DIGITAL DEVICE

Class A includes digital devices that are marketed for use in commercial, industrial or business environments, excluding devices which are marketed for use by the general public or are intended to be used in the home.

Class B includes digital devices that are marketed for use in residential environments, notwithstanding use in commercial, business and industrial environments.

Note: The responsible party may also qualify a device intended to be marketed in a commercial, business or industrial environment as Class B device, and in fact is encouraged

to do so provided the device complies with the technical specifications for a Class B digital device. In the event that a particular type of device has been found to repeatedly cause harmful interference to radio communications, the Commission may classify such a digital device as a Class B digital device, regardless of its intended use.

9. RADIATED EMISSION LIMITS

FCC PART 15 CLASS A

MEASURING DISTANCE OF 10 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	90	39.1
88-216	150	43.5
216-960	210	46.4
Above 960	300	49.5

FCC PART 15 CLASS B

MEASURING DISTANCE OF 3 METER		
FREQUENCY RANGE (MHz)	FIELD STRENGTH (Microvolts/m)	FIELD STRENGTH (dBuV/m)
30-88	100	40
88-216	150	43.5
216-960	200	46
Above 960	500	54

10. RADIATED EMISSION TEST PROCEDURE

The EUT and all other support equipment are placed on a wooden table 80 cm above the ground screen. Antenna to EUT distance is 3 meters . During the test, the table is rotated 360 degrees to maximize emissions and the antenna is positioned from 1 to 4 meters above the ground screen to further maximize emissions. The antenna is polarized in both vertical and horizontal positions.

EUT test configuration is according to Section 8 of ANSI C63.4/1992.

Monitor the frequency range of interest at a fixed antenna height and EUT azimuth. Frequency span should be small enough to easily differentiate between broadcast stations and intermittent ambients. Rotate EUT 360 degrees to maximize emissions received from EUT. If emission increases by more than 1 dB, or if another emission appears that is greater by 1 dB, return to azimuth where maximum occurred and perform additional cable manipulation to further maximize received emission.

Move antenna up and down to further maximize suspected highest amplitude signal. If emission increased by 1 dB or more, or if another emission appears that is greater by 1dB or more, return to antenna height where maximum signal was observed and manipulate cables to produce highest emissions, noting frequency and amplitude.

11. AMBIENT CONDITIONS

The ambient conditions at the time of final tests were as follows:

	Radiated Emission	Conducted Emission
Temperature	20° C	21° C
Humidity	60%	62%

12. TEST EQUIPMENT LIST

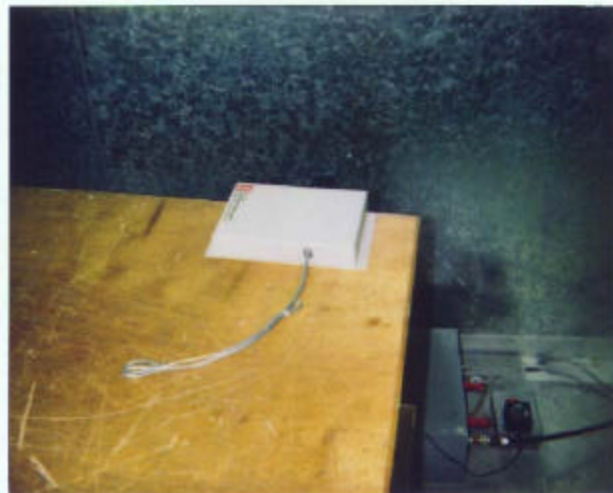
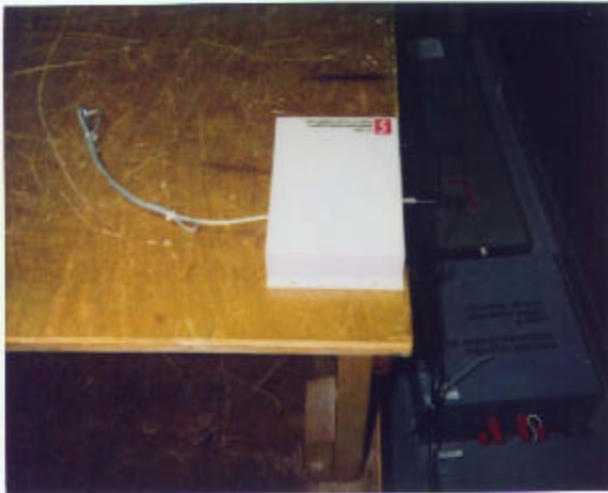
Equipment	Manufacturer	Model No.	Serial No.	Site	Cal Date	Due Date
Spectrum Analyzer	H.P.	8593EM	3710A00205	A	05/97	05/98
Antenna	EMCO	3146	NSN=X100	A/F	10/97	10/98
Antenna	ARA	DRG-118/A	104	A/F	12/96	12/97
Pre-Amp	H.P.(P2)	8447D	2944A06265	A/F	09/97	09/98
Pre-Amp	H.P.	8449B	3008A00369	A/F	03/97	03/98
Watt Meter	BIRD	4410A	10828	N/A	N/A	12/23/98
Communications Test Set	HP	8920A RF	3614A08287	N/A	N/A	7/17/98
Environmental Chamber	THERMOTRON	S1.2 MINI - MAX	25-3428-21	N/A	N/A	N/A
Thermal Coupler	TEKTRONICS	DTM20	113217	N/A	N/A	4/147/99
Signal Generator	AIE	2TSG-1	2972813	N/A	N/A	4/22/99
Oscilloscope	PHILLIPS	PM3335	DM650003	N/A	N/A	4/22/99
Transmission Line Tester	AMREL	185T	952559	N/A	N/A	11/19/98
Multi-meter	FLUKE	77	64791154	N/A	N/A	4/21/99

13. EUT SETUP PHOTOS

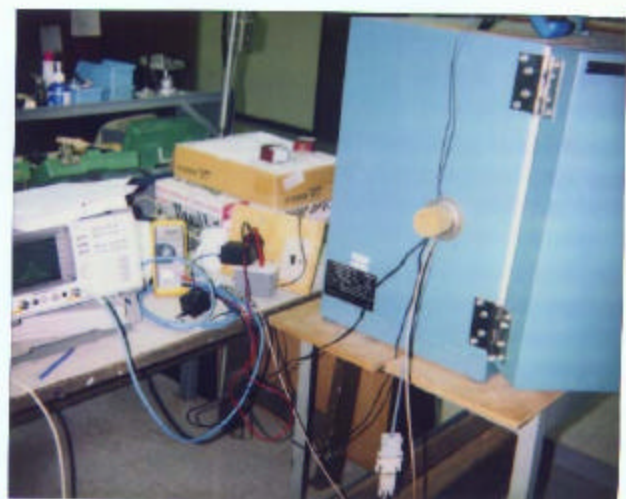
RADIATED EMISSIONS



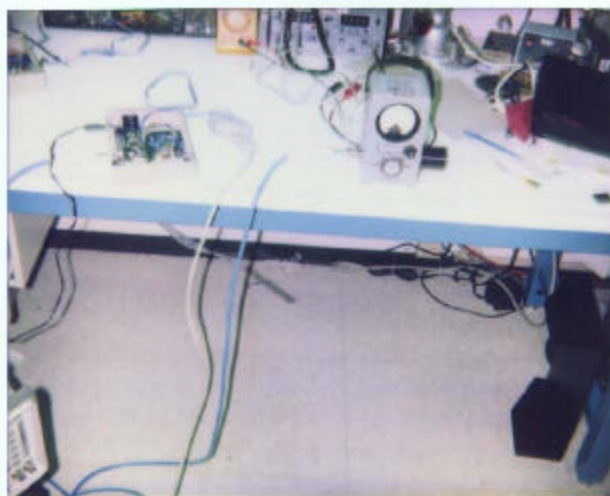
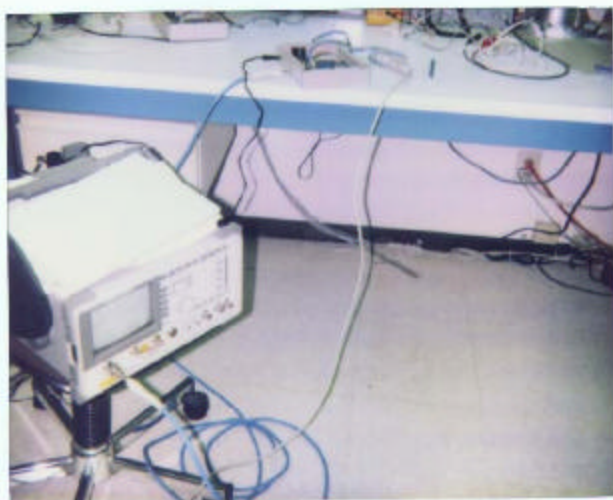
CONDUCTED EMISSIONS



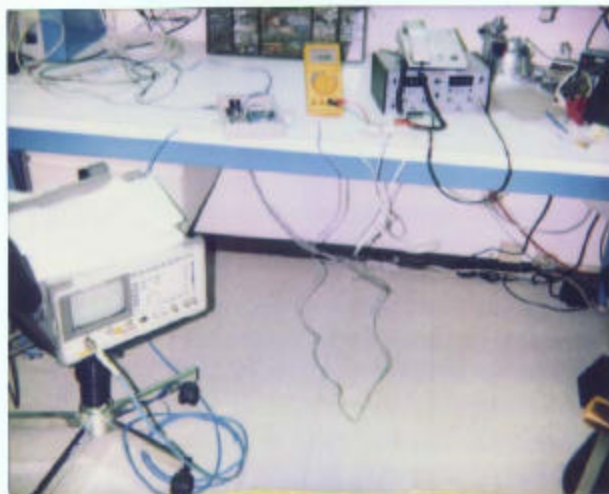
FREQUENCY STABILITY



RF POWER



MODULATION CHARACTERISTICS



14. TEST RESULT SUMMARY

FCC PART 15 Radiated Emission Test was conducted by operating the configuration as indicated below.

REFER TO SHEET #20 IN TEST RESULTS SECTION							
OATS No: B / 3 meter		Data Report No. 980505B1		Date 05/05/98		Tested By: PETE KREBILL	
Six Highest Radiated Emission Readings							
Frequency Range Investigated				30 MHz TO 1000MHz			
Freq (MHz)	Meter Reading (dBuV)	C.F. (dB/m)	Corrected Reading (dBuV/m)	Limits (dBuV/m)	Margin (dB)	Reading Type (P/Q/A)	Polar (H/V)
529.00	38.00	-5.39	32.61	46.00	-13.39	P	H
227.70	40.10	-11.68	28.42	46.00	-17.58	P	H
349.10	38.00	-7.79	30.21	46.00	-15.79	P	H
392.00	32.10	-7.54	24.56	46.00	-21.44	P	H
520.00	30.20	-5.71	24.49	46.00	-21.51	P	V
313.00	27.60	-7.87	19.73	46.00	-26.27	P	V

C.F.(Correction Factor)=Antenna Factor+Cable Loss-Amplifier Gain

Corrected Reading = Metering Reading + C.F. Margin=Corrected Reading - Limits

P=Peak Reading

H=Horizontal Polarization/Antenna

Q=Quasi-peak

V=Vertical Polarization/Antenna

A=Average Reading

Comments:N/A

Conducted Room		Plot No. SMART1		Date 5/5/98		Tested By: PETE KREBILL	
Six Highest Conducted Emission Readings							
Frequency Range Investigated				450 kHz TO 30 MHz			
Freq (MHz)	Meter Reading (dBUV)	C.F. (dB)	Corrected Reading (dBUV/m)	Limits (dBUV/m)	Margin (dB)	Reading Type (P/Q/A)	Line (L1/L2)
28.63	25.2	0	25.2	48.0	-22.8	P	1
25.05	21.7	0	21.7	48.0	-26.3	P	1
21.47	18.9	0	18.9	48.0	-29.1	P	1
17.89	18.7	0	18.7	48.0	-29.3	P	1
17.89	18.5	0	18.5	48.0	-29.5	P	2
0.45	20.2	0	20.2	48.0	-27.8	P	2

C.F.(Correction Factor)=Insertion Loss + Cable Loss

Corrected Reading = Metering Reading + C.F.

Margin=Corrected Reading - Limits

P=Peak Reading

L1=Hot

Q=Quasi-peak

L2=Neutral

A=Average Reading

FCC PART 2 TYPE ACCEPTANCE TEST REQUIREMENT:

SECTION 2.985 RF POWER OUTPUT

Unmodulated peak power, measured with power meter.

28.195dBm=656mWATTS

SECTION 2.987 MODULATION CHARACTERISTICS

SEE PLOT #19 FOR SECTION (a)

SEE RESULTS BELOW FOR SECTION (b)

LIMIT OF +,-5KHZ DEVIATION, WHICH IS SYSTEMS RATED DEVIATION.

POSITIVE DEVIATION:

-9.8dBm INPUT AT 3KHZ RESULTS IN 3.03KHZ INSTANTANEOUS
DEVIATION,3.33KHZ STEADY STATE DEVIATION.

-9.8dBm INPUT VARYING BETWEEN 300HZ AND 3000HZ RESULTS
IN 4.702KHZ STEADY STATE DEVIATION.

NEGATIVE DEVIATION:

-8.8dBm INPUT AT 3KHZ RESULTS IN 3.2KHZ INSTANTANEOUS
DEVIATION, 3.156KHZ STEADY STATE DEVIATION.

-8.8dBm INPUT VARYING BETWEEN 300HZ AND 3000HZ RESULTS
IN 4.65KHZ STEADY STATE DEVIATION.

SECTION 2.989 OCCUPIED BANDWIDTH

Measured at antenna jack with a 3.2dBm input of 2.5KHz at phone jack.

SEE PLOTS #18, 13 & 12

SECTION 2.991 SPURIOUS EMISSION AT ANTENNA TERMINALS

Measured with same input as 2.989

SEE PLOTS 1, 2, 3, 16 & 17 FOR 806.0125MHZ

SEE PLOTS 4, 5, 6, 15 & 14 FOR 815.5125MHZ

SEE PLOTS 7, 8, 9, 10 & 11 FOR 824.9875MHZ

SECTION 2.995 FREQUENCT STABILITY

LIMIT OF 1.5ppm OR 1209HZ AS STATED IN 90.213.

OVER TEMPERATURE -30C TO +50C:

806.0125MHZ 550HZ DRIFT

815.5125MHZ 500HZ DRIFT

824.9875MHZ 600HZ DRIFT

OVER VOLTAGE 93.5VAC TO 138VAC:

806.0125MHZ 490HZ DRIFT

815.5125MHZ 320HZ DRIFT

824.9875MHZ 560HZ DRIFT

SECTION 2.993 FIELD STRENGTH OF SPURIOUS RADIATION

Technical Limits applied :Section 90.210 emission masks.

BELOW SIX WORST READINGS, SEE 21 & 22 IN TEST RESULTS FOR COMPLETE RESULTS.

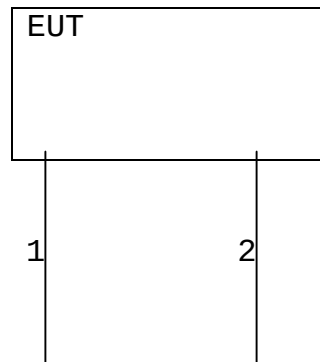
FREQ (MHz)	LEVEL (dBuV)	AF (dB)	CL (dB)	AMP (dB)	FL (dB)	DIST (dB)	TOTAL (dBuV/m)	LIMIT (dBuV/m)	MARGIN (dB)
3224.05	84.5	31.8	3.96	-35.5	1	-10.5	75.26	82	-6.74
1631.025	76.78	25.2	2.34	-35.5	10	-10.5	68.24	82	-13.76
3262.06	77	31.8	3.96	-35.5	1	-10.5	67.76	82	-14.24
5708.5875	73.9	35	5.68	-35.5	1	-10.5	69.58	82	-12.42
1649.735	76.1	25.2	2.34	-35.5	10	-10.5	67.64	82	-14.36
3299.47	83.3	31.8	3.96	-35.5	1	-10.5	74.06	82	-7.94

15. EXTERNAL I/O CABLE CONSTRUCTION DESCRIPTION

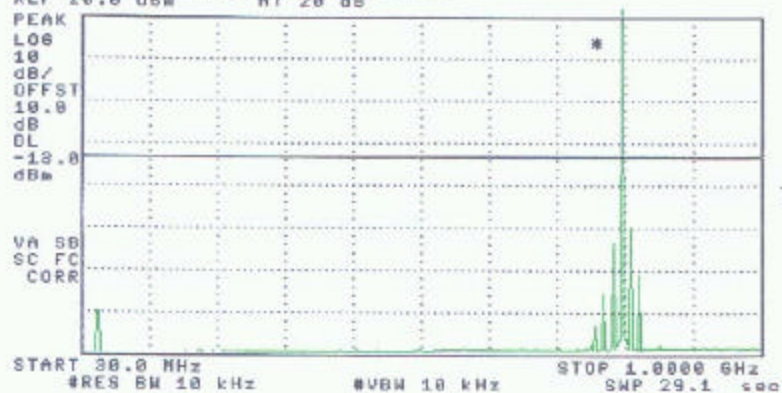
CABLE NO:1	
I/O Port: :power	Number of I/O ports of this type:1
Number of Conductors:3	Connector Type:110VAC USA type
Capture Type:push-in	Type of Cable used:UN-SHIELDED
Cable Connector Type: MOLD	Cable Length:1.5 M
Bundled During Tests: NO	Data Traffic Generated: no
Remark: N/A	

CABLE NO:2	
I/O Port:: phone jack	Number of I/O ports of this type:1
Number of Conductors: 4	Connector Type:RJ11
Capture Type: SNAP-IN	Type of Cable used: UN-SHIELDED
Cable Connector Type: MOLD	Cable Length:1.0
Bundled During Tests: NO	Data Traffic Generated: YES
Remark: terminated with 600 ohm load	

16. CONFIGURATION BLOCK DIAGRAM

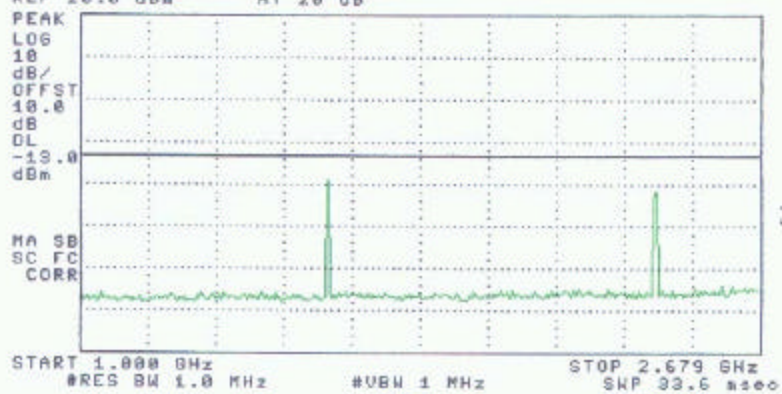


11:09:36 MAY 04, 1998
 /27 SMARTRUNK SKYLINK 886.0125MHZ
 REF 20.0 dBm AT 20 dB



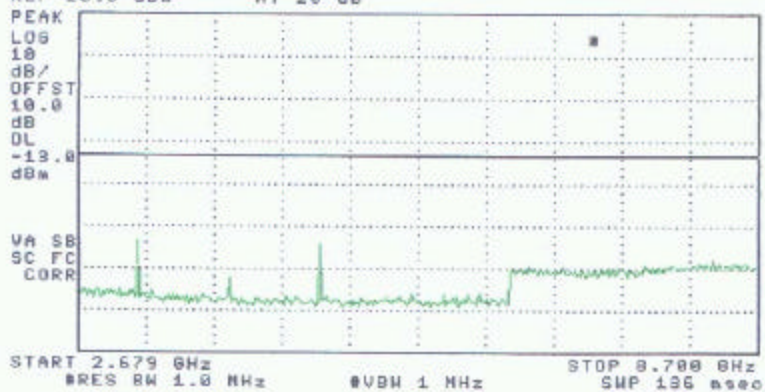
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 REF 20.0 dBm AT 20 dB



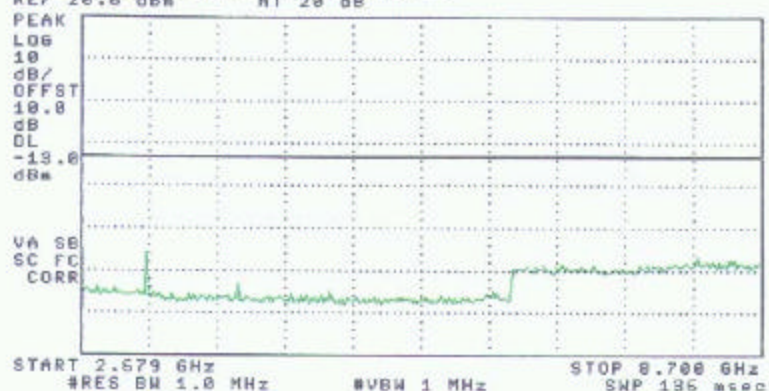
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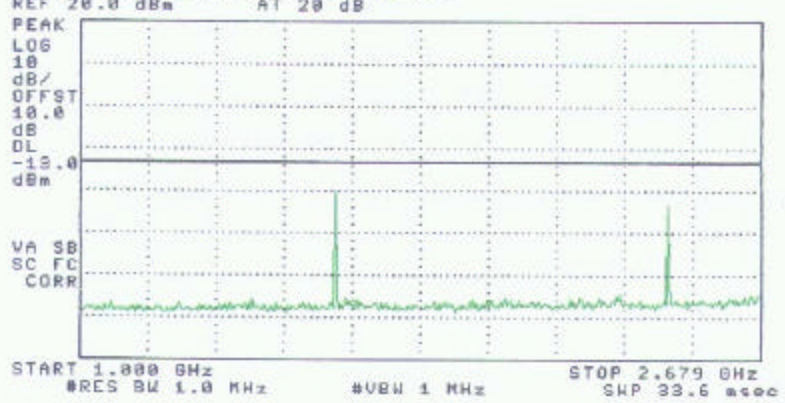
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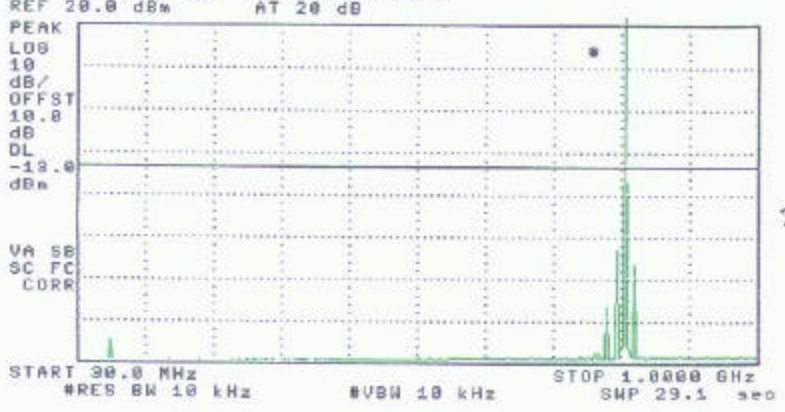
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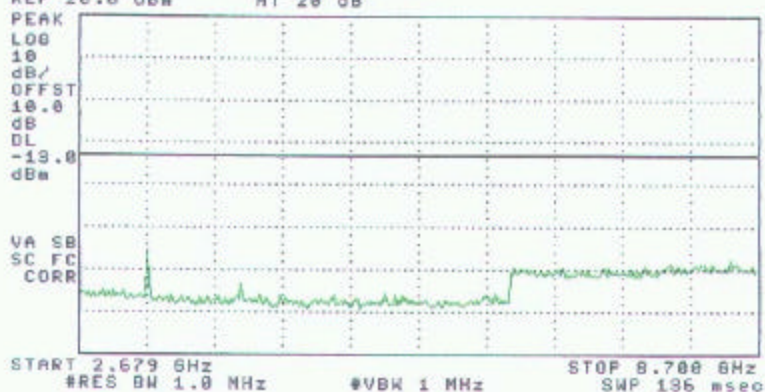
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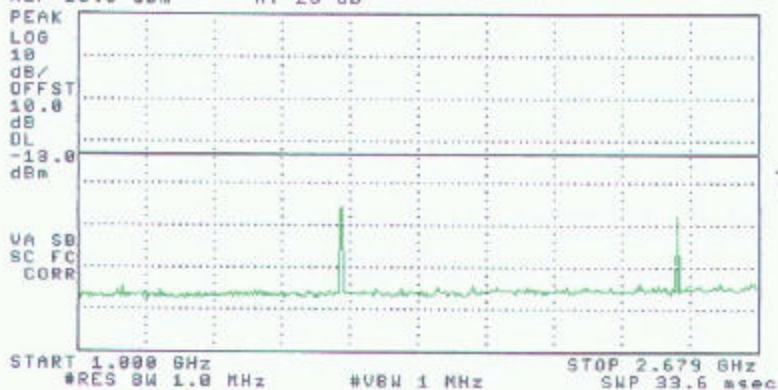
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 REF 20.0 dBm AT 20 dB



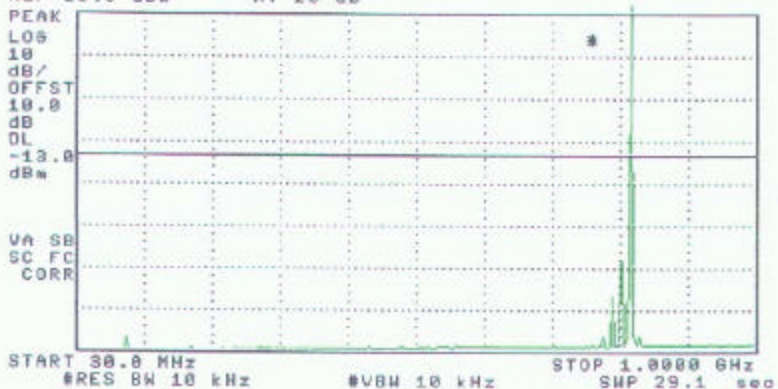
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 SMARTTRUNK SKYLINK 824.9875MHZ
 REF 20.0 dBm AT 20 dB

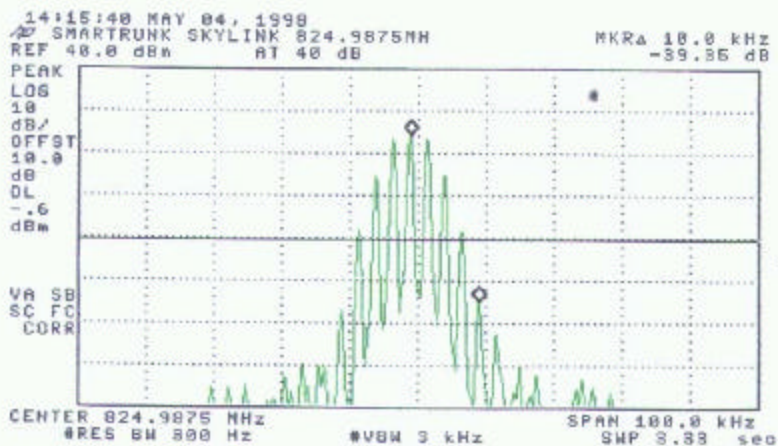


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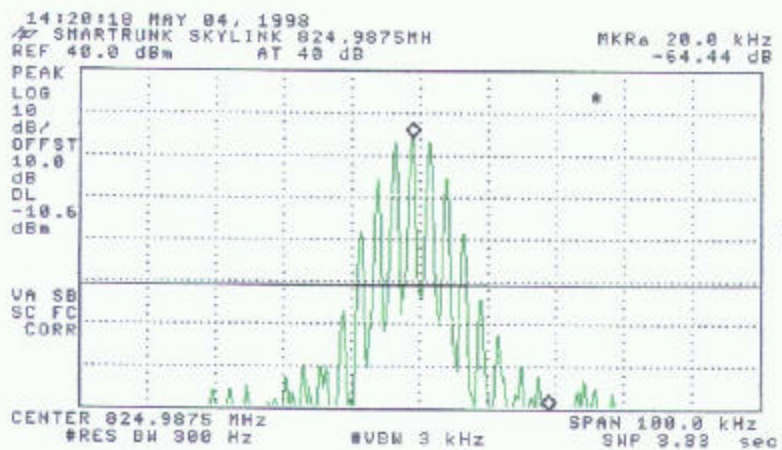
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 REF 20.0 dBm AT 20 dB



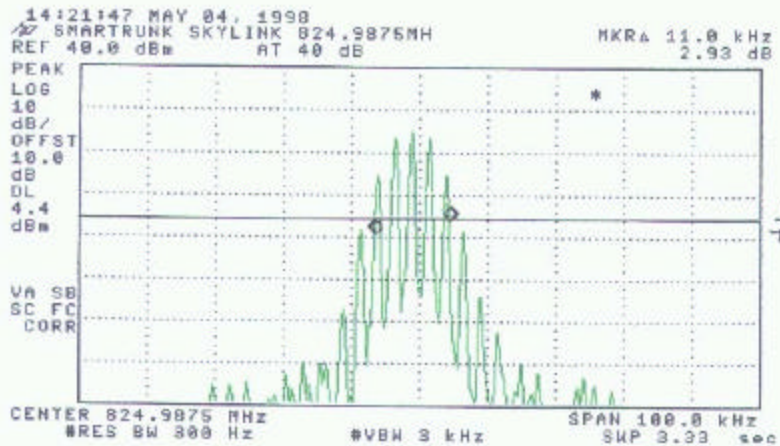
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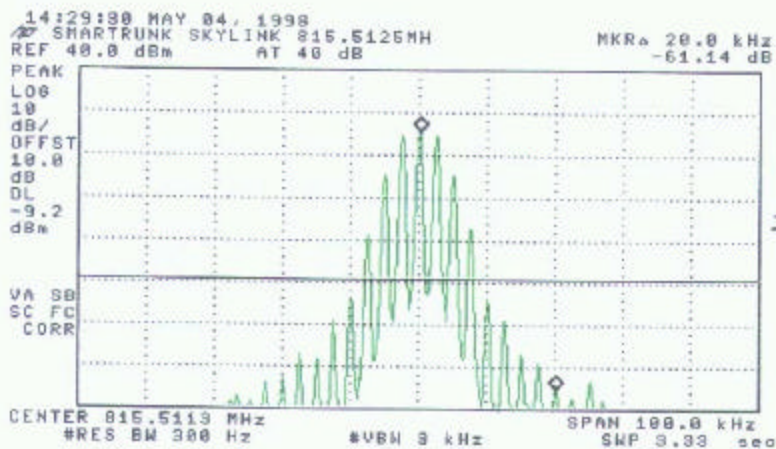
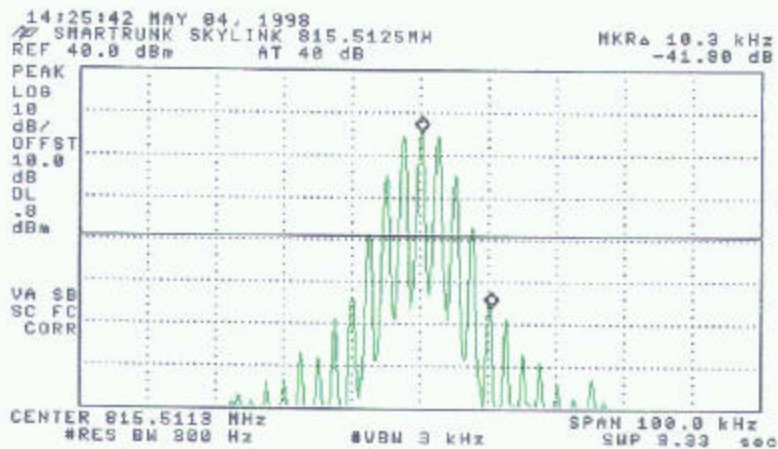
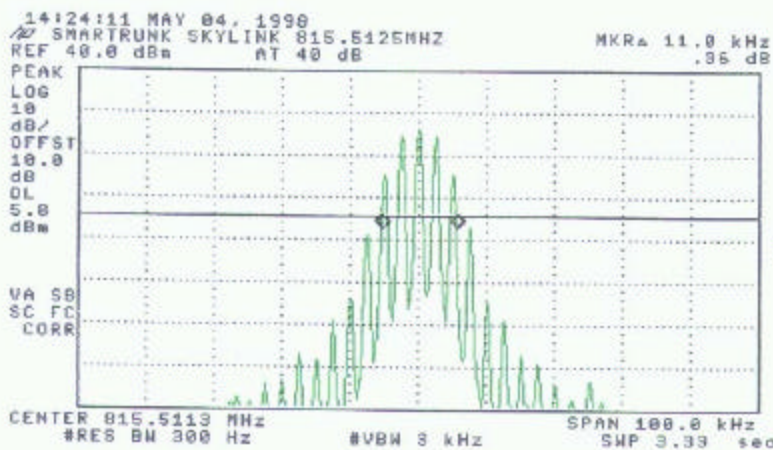
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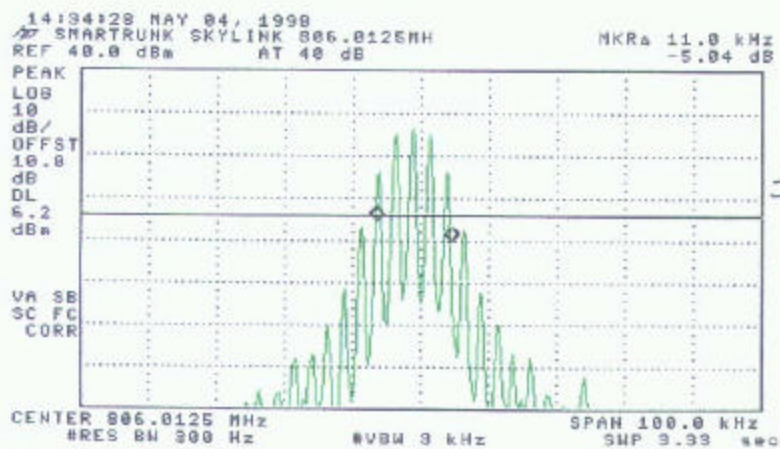
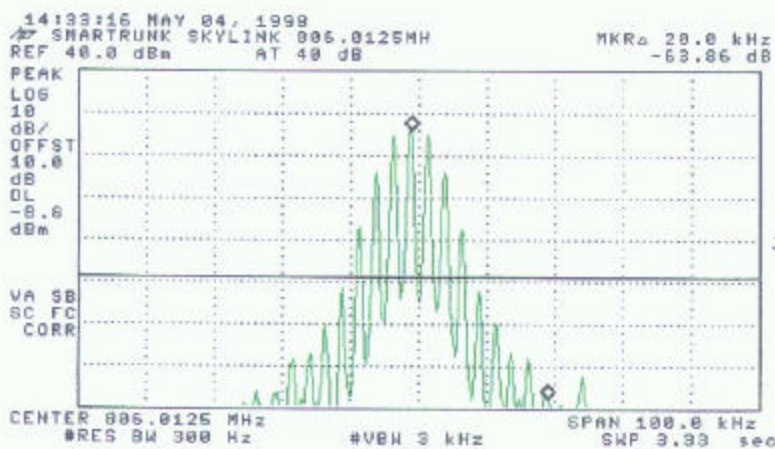
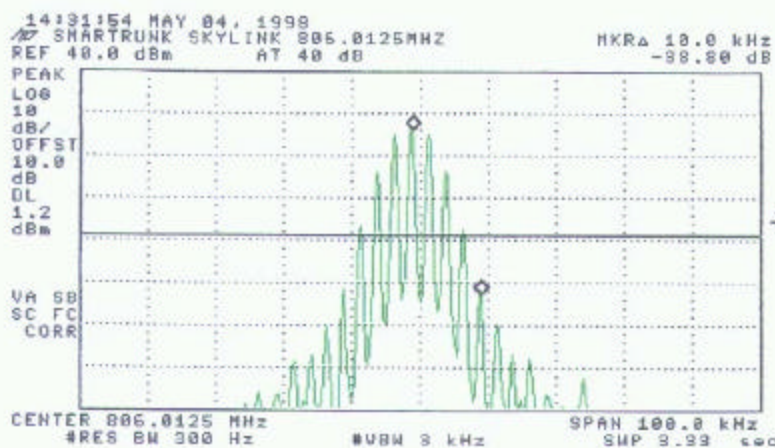


#11



#12





PLOT #19

Curtis Autin
16/03/98

Characterize Test of RF Level to Frequencies

SETUP was as follows:

1. All the measurement were with the 880 in the alignment mode.
2. Used a service monitor to generate the RF carrier at -80DBm.
3. Modulated 1Khz carrier at 3.0 KHz deviation.

To set up the service monitor for all the following see the application handbook.

I perform two test one without R4 change the 880 RSU and the other with the R4 change.

Without the R4 change ST-880 RSU

Frequencies HZs	Signal level DB
300	-4.77
500	0
1000	-3.19
1500	-6.02
2000	-7.60
2500	-10.99
3000	-14.03

With the R4 change ST-880 RSU

Frequencies HZs	Signal level DB
300	-5.20
500	0
1000	-3.35
1500	-6.66
2000	-9.71
2500	-11.65
3000	-13.59

PLOT #19

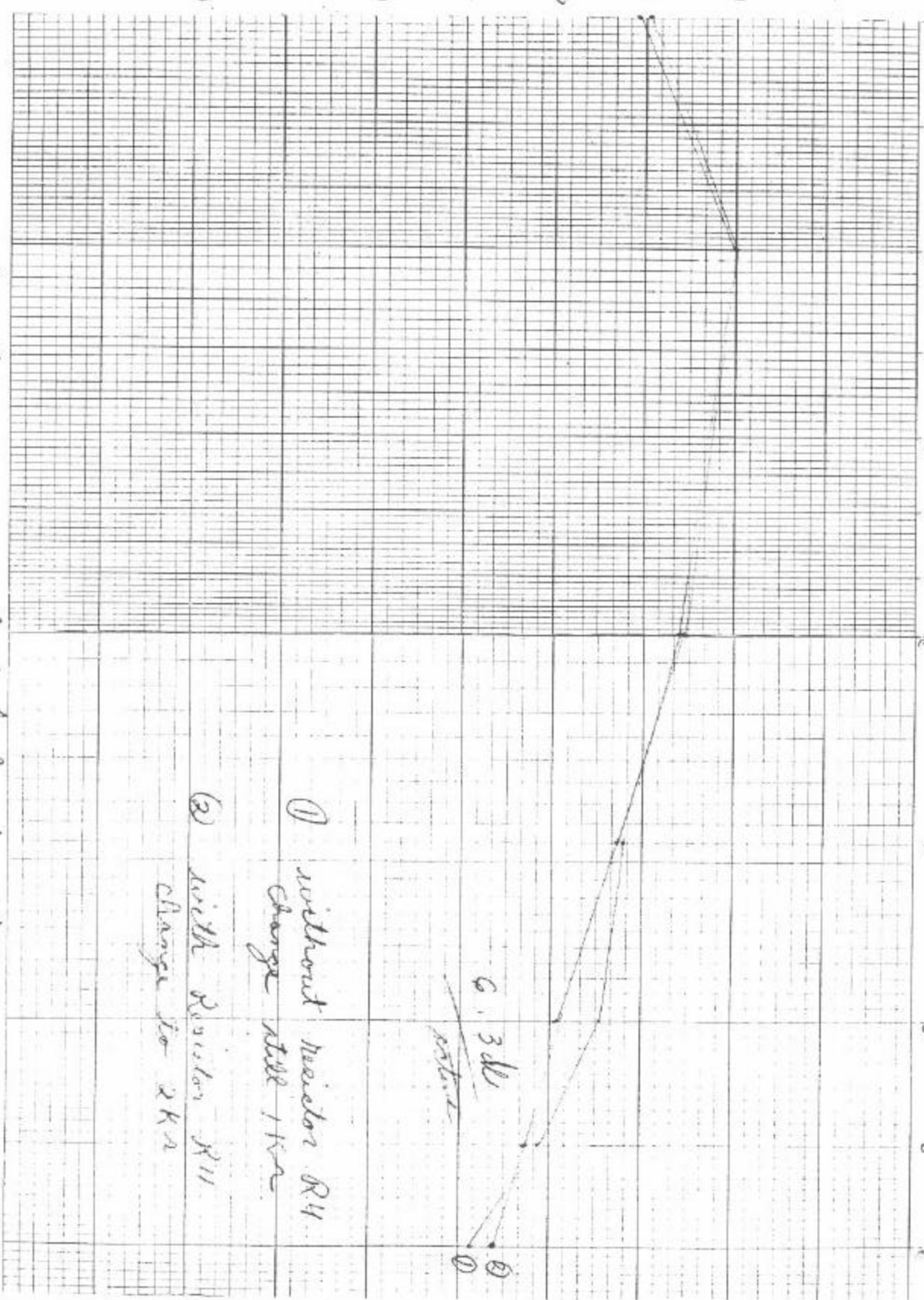
HZ

300
200
100
0
-5
-10
-20
-30

300 400 500 600 700 800 900 1000 1500 2000 2500 3000

signal at 3.0K

original level - 80 dB



① without resistor R4
change still 1K Ω

② with Resistor R11
change to 2K Ω

FREQ to signal level test

#20

Compliance Engineering Services Inc.

Project No. : 98E7323

Report No. : 980505B1

Date : 05/05/1998

Time : 09:14

Test Engr : PETE K

>> 3 M RADIATED EMISSION DATA <<

Company : SMARTRUNK
 Equipment Under Test : SKYLINK SU
 Test Configuration : EUT ONLY
 Type of Test : FCC CLASS B
 Mode of Operation : RX

Freq.	dBuV	PreAmp	Ant	Cable	dBuV/m	Limit	Margin	Pol	Hgt(m)	Az
LP 2120 ; Pre-pamp = 8447D-P8 2944A06589:										
BROADBAND SIGNALS BELOW:										
529.00	38.00	-27.93	18.00	4.54	32.61	46.00	-13.39	H	1.0	0
227.70	40.10	-26.95	12.30	2.96	28.42	46.00	-17.58	H	1.0	0
349.10	38.00	-26.99	15.55	3.64	30.21	46.00	-15.79	H	1.0	0
392.00	32.10	-27.21	15.81	3.86	24.56	46.00	-21.44	H	1.0	0
BELOW GROUND FLOOR READINGS										
520.00	30.20	-27.91	17.71	4.50	24.49	46.00	-21.51	V	1.0	0
313.00	27.60	-26.80	15.47	3.46	19.73	46.00	-26.27	V	1.0	0

Total # of data 6

V. b2.2

Sheet

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SMARTRUNK
RTU WIRELESS LOCAL LOOP
SKYLINK ST-880

PETE KREBILL
1/14/98
SITE A

ALL READINGS ARE PEAK

F(MHz)	Level (dBuV)	AF (dB)	CL (dB)	AMP (dB)	FILTER (dB)	DIST (dB)	Total (dBuV/m)	Limit (dBuV/m)	Margin (dB)
FO:806.0125									
1612.025H	72.9	25.2	2.34	-35.5	10	-10.5	64.44	82	-17.56
2418.0375H	74.2	29.2	2.88	-35.5	1	-10.5	61.28	82	-20.72
3224.05H	84.5	31.8	3.96	-35.5	1	-10.5	75.26	82	-6.74
4030H	72.6	32.2	5.04	-35.5	1	-10.5	64.84	82	-17.16
4836.075H	71.6	34.3	5.4	-35.5	1	-10.5	66.3	82	-15.7
5642.0875H	64.4	35	5.68	-35.5	1	-10.5	60.08	82	-21.92
6448.1H	68.7	35.4	5.94	-35.5	1	-10.5	65.04	82	-16.96
7254.1125H	58.3	36.4	6.12	-35.5	1	-10.5	55.82	82	-26.18
8060.125H	60.6	37.1	6.84	-35.5	1	-10.5	59.54	82	-22.46
FO:815.5125									
1631.025V	76.7	25.2	2.34	-35.5	10	-10.5	68.24	82	-13.76
2446.5375H	78.9	29.2	2.88	-35.5	1	-10.5	65.98	82	-16.02
3262.06V	77	31.8	3.96	-35.5	1	-10.5	67.76	82	-14.24
4077.5625V	65.3	32.2	5.04	-35.5	1	-10.5	57.54	82	-24.46
4893.075H	71.1	34.3	5.4	-35.5	1	-10.5	65.8	82	-16.2
5708.5875H	73.9	35	5.68	-35.5	1	-10.5	69.58	82	-12.42
6524.1H	63.3	35.4	5.94	-35.5	1	-10.5	59.64	82	-22.36
7339.6125H	66.2	36.4	6.12	-35.5	1	-10.5	63.72	82	-18.28
8155.125H	61.4	37.1	6.84	-35.5	1	-10.5	60.34	82	-21.66
FO:824.8675									
1649.735V	76.1	25.2	2.34	-35.5	10	-10.5	67.64	82	-14.36
2474.6025H	78.6	29.2	2.88	-35.5	1	-10.5	65.68	82	-16.32
3299.47H	83.3	31.8	3.96	-35.5	1	-10.5	74.06	82	-7.94
4124.3375H	73.6	32.2	5.04	-35.5	1	-10.5	65.84	82	-16.16
4949.205H	72.2	34.3	5.4	-35.5	1	-10.5	66.9	82	-15.1
5774.0725H	60.6	35	5.68	-35.5	1	-10.5	56.28	82	-25.72

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Sheet1

6598.94H	71.3	35.4	5.94	-35.5	1	-10.5	67.64	82	-14.36
7423.8075H	63.8	36.4	6.12	-35.5	1	-10.5	61.32	82	-20.68
8248.675H	61.1	37.1	6.84	-35.5	1	-10.5	60.04	82	-21.96

AF= ANTENNA FACTOR
 CL=CABLE LOSS
 AMP= AMPLIFIER GAIN
 H=HORIZONTAL
 V=VERTICAL

FILTER=HP FILTER INSERTION LOSS
 DIST=DISTANCE CORRECTION TO 3 METERS

READINGS WERE TAKEN FOR HORIZONTAL AND VERTICAL, ONLY MAXIMUM EMISSION IS REPORTED.