



**EM RESEARCH TEST REPORT
FOR THE
INTERROGATION TRANSMITTER, 870-00004
FCC PERMISSIVE CHANGE II FOR PART 87
COMPLIANCE**

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Date of test: August 15, 2000

Report No: FC00-089

DOCUMENTATION CONTROL:

A handwritten signature in black ink, appearing to read 'Tracy Phillips'.

Tracy Phillips
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APPROVED BY:

A handwritten signature in black ink, appearing to read 'Dennis Ward'.

Dennis Ward
Director of Laboratories
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PART 87 CERTIFICATION TEST REPORT**

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ADMINISTRATIVE INFORMATION

DATE OF TEST:

August 15, 2000

PURPOSE OF TEST:

To demonstrate the compliance of the Interrogation Transmitter, 870-00004, with the requirements for FCC Permissive Change II to Part 87 devices. This report represents testing of the transmitter with the addition of an output spectrum control filter, which was added to meet output pulse rise and fall times. This modification was initiated as a result of FAA system tests, and spectrum management inputs.

MANUFACTURER:

EM Research, Inc.
2465 Highway 40
Verdi, NV 89439

REPRESENTATIVE:

Matt Eiting

TEST LOCATION:

CKC Laboratories, Inc.
5473A Clouds Rest, Mariposa, CA 95338

TEST PERSONNEL:

Skip Doyle

TEST METHOD:

FCC Parts 2 and 87

FREQUENCY RANGE TESTED:

450 kHz – 10.3 GHz

EQUIPMENT UNDER TEST:**Interrogation Transmitter**

Manuf: EM Research, Inc.
Model: 870-00004
Serial: 1845
FCC ID: NYKEMPA101

SUMMARY OF RESULTS

The EM Research, Inc. Interrogation Transmitter, 870-00004, was tested in accordance with FCC Part 87 devices and Permissive Change II guidelines. As received, the above equipment was found to be fully compliant with the limits of Part 87 devices. The results in this report apply only to the items tested, as identified herein.

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The system Interrogation Transmitter (ANPC P/N: 870-00004) is used to transmit all of the pulse modulation Interrogation signals used within the landing system. These signals and their purposes are summarized as follows:

- 1030 MHz interrogation pulse pair is transmitted to the tracked aircraft and initiates transponder 1090 MHz response.
- 1030 MHz suppression pulse is transmitted a fixed time after the first 1030 interrogation pulse is received by the airborne transponder and suppresses the 1090 MHz response if receive strength criteria are met.

Both of the above pulses are very low duty cycle as the system interrogation rate is typically set to 10 Hz. The transmitter contains all components required to generate these signals, receiving timing control via a digital control from the Interrogator Control PCBA (ANPC P/N: 690-00100) within the system Base CPU.

MEASUREMENT UNCERTAINTY

Associated with data in this report is a ± 4 dB measurement uncertainty.

EUT OPERATING FREQUENCY

The EUT was operating at 1029.970 MHz.

TEMPERATURE AND HUMIDITY DURING TESTING

The temperature during testing was within +15°C and + 35°C.
The relative humidity was between 20% and 75%.

PERIPHERAL DEVICES

The EUT was tested with the following peripheral devices:

PC

Manuf: MEGA
Model:
Serial:
FCC ID: DoC

Monitor

Manuf: Hyundai
Model:
Serial:
FCC ID: DoC

Keyboard

Manuf: Sierra Computers
Model:
Serial:
FCC ID: DoC

2.1033(c)(5) – Frequency Range

1029.970 MHz.

2.1033(c)(7) – Maximum Power Rating

Maximum power rating as defined in the operating part(s) of the rules.

400 watts

2.1033(c)(14)/2.1046/87.131 - RF POWER OUTPUT

Test Location: CKC Laboratories, Inc. • 5473A Clouds Rest Rd, Barn • Mariposa, CA 95338 • (800)-500-4EMC
 Customer: **EM Research**
 Specification: **FCC Part 87.131**
 Work Order #: **73741** Date: 08/15/2000
 Test Type: **FCC Part 2.1046, Power Output** Time: 12:51:16
 Equipment: **Interrogation Transmitter** Sequence#: 1
 Manufacturer: EM Research Tested By: Skip Doyle
 Model: P/N: EMPA-870-00004 S/N: 1845

Test Equipment Used:

Equipment	Mfg.	Model	S/N	Date Cal.	Cal Due
Coax cable # 3 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Coax cable # 2 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Directional Coupler	Werlatone	C2630	3805	04/21/2000	04/21/2001
QP Adapter	HP	85650A	2811A01267	07/07/2000	07/07/2001
Spectrum Analyzer-Display	HP	8566B	2209A01404	07/07/2000	07/07/2001
Spectrum Analyzer-RF Sect.	HP	8566B	2209A01404	07/07/2000	07/07/2001

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Interrogation Transmitter*	EM Research	P/N: EMPA-870-00004	1845

Support Devices:

Function	Manufacturer	Model #	S/N
PC	MEGA		
Monitor	Hyundai		
Keyboard	Sierra Computers		

Test Conditions / Notes:

Spec Limit for EUT is 400W, which = 56dBm = 163dB_uV. EUT operation in accordance with customers setup procedure. Computer timing is producing a pulse @ 10Hz, 0.8uS width pulse pair, and amplitude of 1.5V. Interrogation RF output is connected to Spectrum analyzer via 1 40dB directional coupler with 50 ohm load and 2 6dB Pads. Tested in accordance with FCC Parts 87.131/2.1046.

Measurement Data:		Reading listed by margin.		Test Distance: Direct Connection					
#	Freq MHz	Cable		Dist Table	Corr dB _u V	Spec dB _u V	Margin dB	Polar Ant	
		Rdng dB _u V	dB						
1	1029.970M	155.9	+0.3	+0.2	+0.0	156.4	163.0	-6.6	None

Calculation for Mean Power in watts:

Total pulse on time = 0.0016ms
 1) 0.0016ms/100ms=0.000016
 2) 0.000016 x 400watts = 0.0064Watts
 3) 0.0064W/1mW = 6.4mW
 4) 10log (6.4) = 8.06dBm mean power
 5) Half wave dipole = 2.15dBm
 8.06dBm + 2.15dBm = 10.21dBm total mean power

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal AnalyzerVBW & RBW Setting
1029.970MHz	1MHz

PHOTOGRAPH OF TEST SETUP



2.1033(c)(14)/2.1049(i)/87.135 - OCCUPIED BANDWIDTH

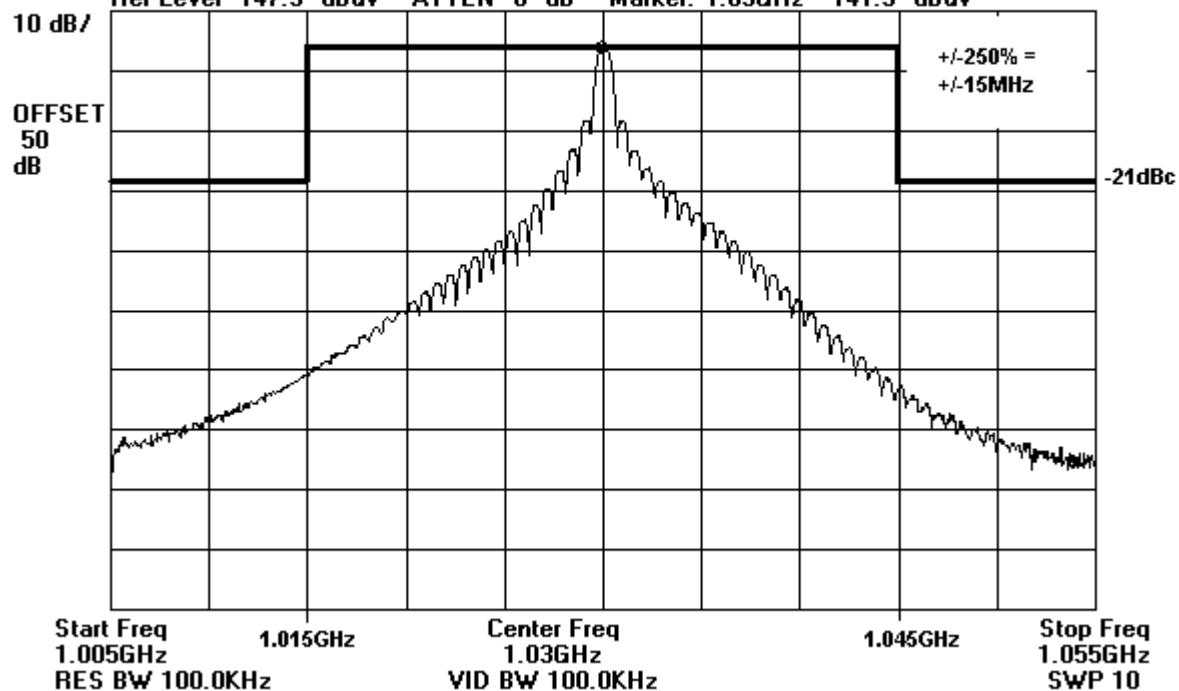
Test Conditions: The EUT was connected directly to the signal analyzer. Computer timing is producing a pulse @ 10Hz, 0.8uS width pulse pair, and amplitude of 1.5V. Interrogation RF output is connected to Spectrum analyzer via 1 40dB directional coupler with 50 ohm load and 2 6dB Pads.

The emission designator is 6M00M1D.

TEST EQUIPMENT USED:

Equipment	Mfg.	Model	S/N	Date Cal.	Cal Due
Coax cable # 3 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Coax cable # 2 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Directional Coupler	Werlatone	C2630	3805	04/21/2000	04/21/2001
QP Adapter	HP	85650A	2811A01267	07/07/2000	07/07/2001
Spectrum Analyzer-Display	HP	8566B	2209A01404	07/07/2000	07/07/2001
Spectrum Analyzer-RF Sect.	HP	8566B	2209A01404	07/07/2000	07/07/2001

Title: Occupied Bandwidth Plot, 1.6 μ s pulse 10 Hz with 50MHz Span - FCC Pt 87
Ref Level 147.5 dBuV ATTEN 0 dB Marker: 1.03GHz 141.3 dBuV



PHOTOGRAPH OF TEST SETUP



2.1033(c)(14)/2.1051/87.131 - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

Test Location: CKC Laboratories • 5473A Clouds Rest • Mariposa Ca, 95338 • 209-966-5240
Customer: **EM Research**
Specification: **FCC Part 87.131**
Work Order #: **73741** Date: 08/15/2000
Test Type: **FCC Part 2.1051, Spurious Emissions** Time: 14:03:57
@ Antenna Terminal
Equipment: **Interrogation Transmitter** Sequence#: 2
Manufacturer: EM Research Tested By: Skip Doyle
Model: P/N: EMPA-870-00004 S/N: 1845

Test Equipment Used:

Equipment	Mfg.	Model	S/N	Date Cal.	Cal Due
Coax cable # 3 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Coax cable # 2 (2')	Andrew	FSL1-50A	N/A	05/10/2000	05/10/2001
Directional Coupler	Werlatone	C2630	3805	04/21/2000	04/21/2001
QP Adapter	HP	85650A	2811A01267	07/07/2000	07/07/2001
Spectrum Analyzer-Display	HP	8566B	2209A01404	07/07/2000	07/07/2001
Spectrum Analyzer-RF Sect.	HP	8566B	2209A01404	07/07/2000	07/07/2001

Equipment Under Test (* = EUT):

Function	Manufacturer	Model #	S/N
Interrogation Transmitter*	EM Research	P/N: EMPA-870-00004	1845

Support Devices:

Function	Manufacturer	Model #	S/N
PC	MEGA		
Monitor	Hyundai		
Keyboard	Sierra Computers		

Test Conditions / Notes:

Spec Limit for EUT is 8.06dBm – 21.06dB = -13.00dBm = 94.00dBuV. EUT operation in accordance with customers setup procedure. Computer timing is producing a pulse @ 10Hz, 0.8uS width pulse pair, and amplitude of 1.5V. Interrogation RF output is connected to Spectrum analyzer via 1 40dB and 2 6dB Pads. Tested in accordance with FCC Parts 87.139/2.1051.

#	Freq MHz	Rdng dB μ V	Cable			Dist Table	Corr dB μ V	Spec dB μ V	Margin dB	Polar Ant
			Cable dB	Cable dB	Cable dB					
1	2060.076M	88.6	+0.7	+0.7		+0.0	90.0	94.0	-4.0	None
2	6179.723M	77.4	+3.2	+2.7		+0.0	83.3	94.0	-10.7	None

3	764.100M	79.6	+0.0	+0.0	+0.0	79.6	94.0	-14.4	None
4	3090.080M	72.1	+3.3	+3.1	+0.0	78.5	94.0	-15.5	None
5	5150.142M	73.7	+2.3	+1.2	+0.0	77.2	94.0	-16.8	None
6	5150.094M	72.9	+2.3	+1.2	+0.0	76.4	94.0	-17.6	None
7	4120.112M	73.4	+1.5	+1.3	+0.0	76.2	94.0	-17.8	None
8	861.066M	72.3	+0.0	+0.0	+0.0	72.3	94.0	-21.7	None
9	933.676M	70.2	+0.0	+0.0	+0.0	70.2	94.0	-23.8	None
10	2059.966M	52.3	+0.7	+0.7	+0.0	53.7	94.0	-40.3	None
		Ave							

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal Analyzer VBW & RBW Setting
10MHz - 30MHz	9kHz
30MHz - 1MHz	120kHz
1GHz - 10.3GHz	1MHz

PHOTOGRAPH OF TEST SETUP



2.1033(c)(14)/2.1053/87.139 - FIELD STRENGTH OF SPURIOUS RADIATION

FCC Part 2.1053 Measurements required: Field strength of spurious radiation											
Polarity	Freq(MHz)	Reading in dBuV/m	PreAmp Factor	Cable Factor	Horn Antenna	High Pass Filter	Corrected E (dBuV/M)	V/M	ERP (Watts)	Spec Limit Watts	Pass or Fail
Vertical	4119.70	76.00	-33.40	8.50	33.00	0.0	84.1	0.016032454	0.000047019	0.082224W	Pass
Vertical	3089.55	71.50	-32.10	10.20	31.90	0.0	81.5	0.011885022	0.000025839	0.082224W	Pass
Vertical	2059.85	81.60	-35.00	5.40	27.10	0.0	79.1	0.009015711	0.000014869	0.082224W	Pass
Notes: Frequency range investigated was from 10MHz to 10.3GHz. All spurious and harmonic emissions were investigated. All emissions detected that were less than 20dB below the permissible value were reported. Rated Power output of transmitter at 400 Watts.											
CALCULATIONS											
Note: The data taken is relative to the radiated power of each spurious emission with reference to the rated mean power output of the transmitter.											
10 log (10.21mW/10) = 1mW											
10.21dBm - 21.06dBc = - 10.85dBm											
Inv Log (-10.85dBm/10) = 0.082224W											
Spec Limit = 0.082224 Watts											
ERP = (Ed)²/30(G)											
E = V/m											
d= distance											
G = Gain of Antenna (numerical gain of half wave dipole antenna 1.64) per Part 2.1053(a)											
Conversion of dBuV/m to V/m											
[invlog(Reading in dBuV/m/20)]*.000001 = V/m											

VIDEO BANDWIDTH AND RESOLUTION BANDWIDTH SETTINGS:

Frequency Range	Signal AnalyzerVBW & RBW Setting
10MHz - 30MHz	9kHz
30MHz - 1MHz	120kHz
1GHz - 10.3GHz	1MHz

PHOTOGRAPH OF TEST SETUP

Front View



Back View