



**ADDENDUM TO FC02-087**

**FOR THE**

**MODE S TRANSPONDER, KT 73**

**FCC PART 87**

**COMPLIANCE**

**DATE OF ISSUE: OCTOBER 24, 2002**

**PREPARED FOR:**

Honeywell International Inc.  
23500 West 105th St., MS 56  
Olathe, KS 66061-6615

P.O. No.: A00008370  
W.O. No.: 79530

**PREPARED BY:**

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

Date of test: September 30 - October 3, 2002

**Report No.: FC02-087A**

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**CKC Laboratories, Inc. has received test site Registration Acceptance from the following agencies:**

FCC (USA); VCCI (Japan); and Industry Canada.

**CKC Laboratories, Inc. has received Letters of Acceptance through an MRA for the following agencies:**

ACA/NATA (Australia); SABS (South Africa); SWEDAC (Sweden); Radio Communications Agency (RA); HOKLAS (Hong Kong); Bakom (Swiss); BIPT (Belgium); Denmark Telestyrelsen; RvA (Netherlands); SEE (Luxembourg) SITTEL (Bolivia); and UKAS (UK).

## ADMINISTRATIVE INFORMATION

<b>DATE OF TEST:</b>	September 30 - October 3, 2002
<b>DATE OF RECEIPT:</b>	September 30, 2002
<b>PURPOSE OF TEST:</b>	To demonstrate the compliance of the Mode S Transponder, KT 73 with the requirements for FCC Part 87 devices. The purpose of Addendum A is to revise the MPE calculations and revise the plots on pages 19-21 to show the emissions masks.
<b>TEST METHOD:</b>	FCC Part 87
<b>FREQUENCY RANGE TESTED:</b>	9 kHz - 12 GHz
<b>MANUFACTURER:</b>	Honeywell International Inc. 23500 West 105th St., MS 56 Olathe, KS 66061-6615
<b>REPRESENTATIVE:</b>	Larry Haddix
<b>TEST LOCATION:</b>	CKC Laboratories, Inc. 5473A Clouds Rest Mariposa, CA 95338

## SUMMARY OF RESULTS

As received, the Honeywell International Inc. Mode S Transponder, KT 73 was found to be fully compliant with the following standards and specifications:

### United States

➤ FCC Part 87

### CONDITIONS FOR COMPLIANCE

No modifications to the EUT were necessary to comply. Conducted emissions not required for this device.

## APPROVALS

### QUALITY ASSURANCE:

A handwritten signature in black ink that reads "Steve Behm".

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Steve Behm, Director of Engineering Services

A handwritten signature in black ink that reads "Joyce Walker".

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Joyce Walker, Quality Assurance Administrative Manager

A handwritten signature in black ink that reads "Chuck Kendall".

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Chuck Kendall, EMC/Lab Manager

### TEST PERSONNEL:

A handwritten signature in black ink that reads "Randy Clark".

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Randy Clark, EMC Engineer

A handwritten signature in black ink that reads "Monika Brandle".

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Monika Brandle, EMC Engineer/  
Evaluation Engineer

## **EQUIPMENT UNDER TEST (EUT) DESCRIPTION**

The EUT tested by CKC Laboratories was a production unit.

The KT 73 General Aviation Mode S Transponder is designed to meet TSO C-112 for a Level 2 ATCRBS/Mode Select Airborne Transponder System. It is a panel mount transponder that replies to ATCRBS Mode A and C, Intermode, and Mode S interrogations.

Since the KT 73 is a Level 2 transponder it can handle Standard Length Message (SLM) Comm A & Comm B Mode S data link protocols.

The KT 73 is compliant with TSO-C112 Class 2A requirements. It will pass Surveillance (UF 4 and UF 5) and Comm-A (UF 20 and UF 21) (minus the 24 bit Aircraft Address) to the ADLP (Airborne Data Link Processor).

The KT 73 is capable of receiving messages from the ADLP and sending the messages to the ground in Comm-B (DF 20 and DF 21) replies. The transponder/ADLP communicate using an RS-232 hardware interface and the RS-232 protocol developed by Lincoln Labs.

The KT 73 has the ability to enter and display an 8-digit alphanumeric Flight ID code. The Flight ID information can be entered by the pilot via front panel controls or received from an ADLP. Flight ID can be selected for display from the front panel.

The KT 73 is capable of accepting altitude information via Gillham (Mode C Gray Code), ARINC 429 or serial RS-232 and will work with conventional ATCRBS blade or quarter-wave monopole type antennas.

The KT 73 contains BITE (Built In Test Equipment) so the operational health of the unit is constantly monitored. When an error is detected the unit will flash an amber FAIL light on the front of the unit. In test mode, it will display an error code on the front panel display to diagnose problems.

The KT 73 has an Air/Ground discrete that, when connected to a strut switch on the aircraft, can disable ATCRBS and Mode S All-Call replies when the aircraft is on the ground. A front panel switch position is available to be used by the pilot instead of the strut switch.

The KT 73 is capable of interfacing to the Traffic Information Service (TIS). This data link is intended to improve the safety and efficiency of "see and avoid" flight by providing automatic display to the pilot of nearby traffic and warnings of any potentially threatening conditions.

The KT 73 is capable of Automatic Dependent Surveillance – Broadcast (ADS-B) operation. This is a function of an aircraft or surface vehicle that transmits position, altitude, vector, and other information for use by other aircraft, surface vehicles, or ground facilities. The KT 73 will have the capability to transmit extended squitters. The KT 73 will also have the capability to operate in the Extended Squitter/Non Transponder mode.

## EQUIPMENT UNDER TEST

### Mode S Transponder

Manuf: Honeywell  
Model: KT 73  
Serial: Y503  
FCC ID: ASYKT73 (pending)

## PERIPHERAL DEVICES

The EUT was tested with the following peripheral device(s):

### Coaxial Coupler

Manuf: Narda  
Model: 3202B-20  
Serial: 61893  
FCC ID: DoC

### IFR Test Set

Manuf: IFR  
Model: S-1403DL w/MLD  
Serial: 28500633  
FCC ID: DoC

### KT 73 Test Box

Manuf: Honeywell  
Model: 71-09893-0010  
Serial: 190-3162-04  
FCC ID: DoC

### IFR Test Set

Manuf: IFR  
Model: ATC-1400A  
Serial: 204006889  
FCC ID: DoC

## **TEMPERATURE AND HUMIDITY DURING TESTING**

The temperature during testing was within +15°C and + 35°C.

The relative humidity was between 20% and 75%.

## **2.1033(c)(3) USER'S MANUAL**

The necessary information is contained in a separate document.

## **2.1033 (c)(4) TYPE OF EMISSIONS**

12M6V1D

## **2.1033(c)(5) FREQUENCY RANGE**

1090-1092 MHz

## **2.1033(c)(6) OPERATING POWER**

251 Watts typical

## **2.1033(c)(7) MAXIMUM POWER RATING**

For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

## **2.1033(c)(8) DC VOLTAGES**

The voltage applied to the Power Oscillator, Q1, and the Power Amp, Q2, is 50 VDC from a regulated supply included in the unit. The pulse current during an RF power pulse is 16 amps.

## **2.1033(c)(9) TUNE-UP PROCEDURE**

The necessary information is contained in a separate document.

## **2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION**

The necessary information is contained in a separate document.

## **2.1033(c)(11) LABEL AND PLACEMENT**

The necessary information is contained in a separate document.

## **2.1033(c)(12) SUBMITTAL PHOTOS**

The necessary information is contained in a separate document.

### **2.1033(c)(13) MODULATION INFORMATION**

The unit employs pulse modulation prescribed by FAA TSO-C112. This requires pulses of  $0.450 \pm 0.100$  microseconds for ATCRBS and  $500 \pm 0.050$  microseconds for Mode S with rise times of 0.100 microsecond maximum and falltimes of 0.200 microseconds maximum for both. The KT73 transmitter includes a 1090 MHz frequency source, a 70 W class C power oscillator then provides the drive power needed for the 450 W class C final power amplifier. A low pass filter between the transmitter and the RF I/O port with a 3 dB corner frequency of 1.3 GHz attenuates the transmitter's carrier harmonics. The maximum rated condition, Mode S reply, has a 120 microsecond length with four pulses in the first eight microseconds, which is called the preamble, and pulses of 0.5 or 1.0 microsecond length filling in the next 112 microseconds, which is called the data block. Binary data is coded by the pulse position in the one microsecond frames.



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

Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**

Specification: **2.1046/87.131**

Work Order #: **79530**

Date: 10/01/2002

Test Type: **2.1046 - RF Power Output**

Time: 15:14:51

Equipment: **Mode S Transponder**

Sequence#: 1

Manufacturer: Honeywell

Tested By: Monika Brandle

Model: KT 73

S/N: Y503

### ***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

### ***Support Devices:***

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

### ***Test Conditions / Notes:***

The EUT is a panel mount transponder operating in ATCRBS Mode A IDENT 0000. An IFR Test Set is used to continuously interrogate the transponder. RBW/VBW = 3 MHz. The output power was measured using different bandwidth resolutions. It was determined that the full power was integrated using a 3 MHz resolution bandwidth. Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

### ***Transducer Legend:***

T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=Cust Cable 311601

### ***Measurement Data:***

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1091.320M	109.9	+19.5	+30.0	+0.4	+0.9	+0.0	160.7	162.0	-1.3	None

Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**

Specification: **2.1046/87.131**

Work Order #: **79530**

Date: 10/01/2002

Test Type: **2.1046 - RF Power Output**

Time: 15:20:32

Equipment: **Mode S Transponder**

Sequence#: 2

Manufacturer: Honeywell

Tested By: Monika Brandle

Model: KT 73

S/N: Y503

***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

***Support Devices:***

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

***Test Conditions / Notes:***

The EUT is a panel mount transponder operating in ATCRBS Mode A IDENT 7777. An IFR Test Set is used to continuously interrogate the transponder. RBW/VBW = 3 MHz. The output power was measured using different bandwidth resolutions. It was determined that the full power was integrated using a 3 MHz resolution bandwidth. Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

***Transducer Legend:***

T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=Cust Cable 311601

***Measurement Data:*** Reading listed by margin. Test Distance: None

#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1091.800M	110.0	+19.5	+30.0	+0.4	+0.9	+0.0	160.8	162.0	-1.2	None

Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**  
 Specification: **2.1046/87.131**  
 Work Order #: **79530** Date: 10/01/2002  
 Test Type: **2.1046 - RF Power Output** Time: 16:50:56  
 Equipment: **Mode S Transponder** Sequence#: 3  
 Manufacturer: Honeywell Tested By: Monika Brandle  
 Model: KT 73  
 S/N: Y503

**Equipment Under Test (\* = EUT):**

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

**Support Devices:**

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

**Test Conditions / Notes:**

The EUT is a panel mount transponder operating in Mode S. An IFR Test Set is used to continuously interrogate the transponder. RBW/VBW = 3 MHz. The output power was measured using different bandwidth resolutions. It was determined that the full power was integrated using a 3 MHz resolution bandwidth. Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

**Transducer Legend:**

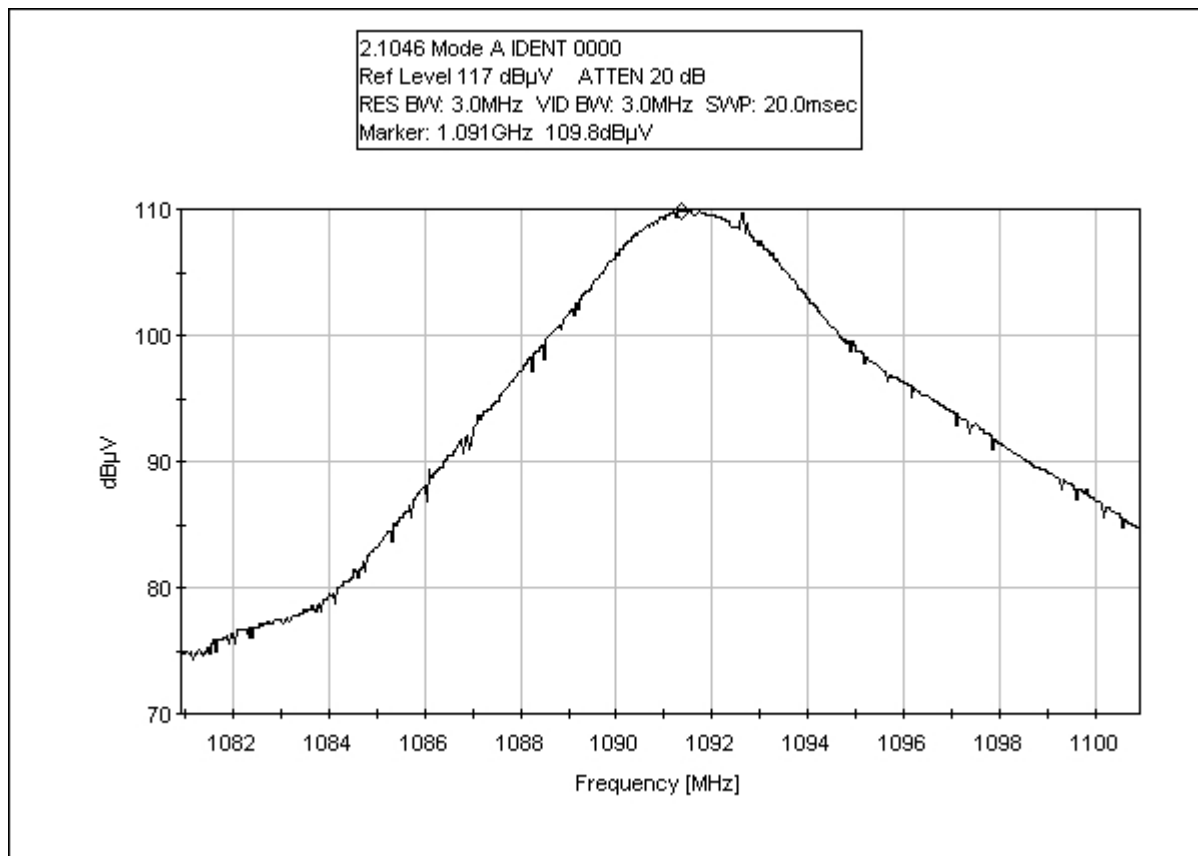
T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=BW Corr Factor

**Measurement Data:** Reading listed by margin. Test Distance: None

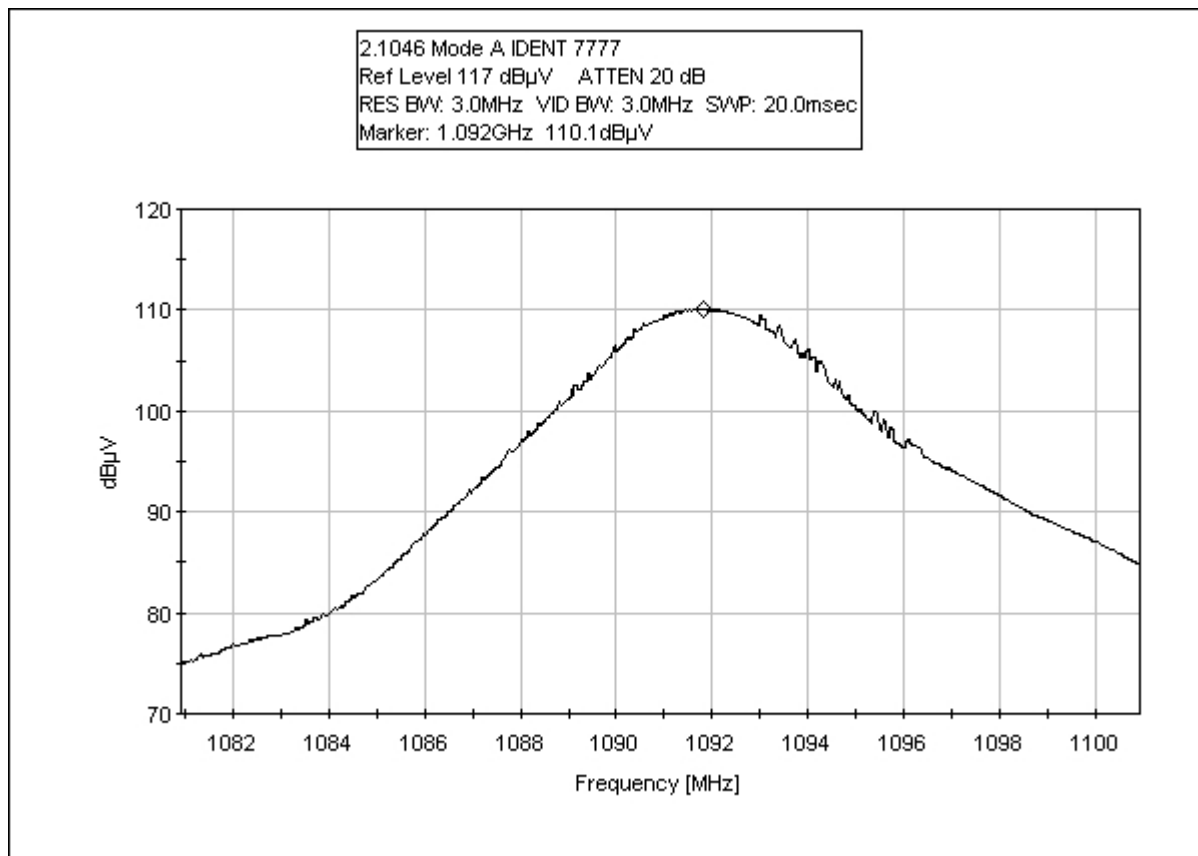
#	Freq MHz	Rdng dBμV	T1 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	1092.120M	110.2	+19.5	+30.0	+0.4	+0.9	+0.0	161.0	162.0	-1.0	None

This reading shows the worst case RF power output at 161 dBμV = 251 Watts.

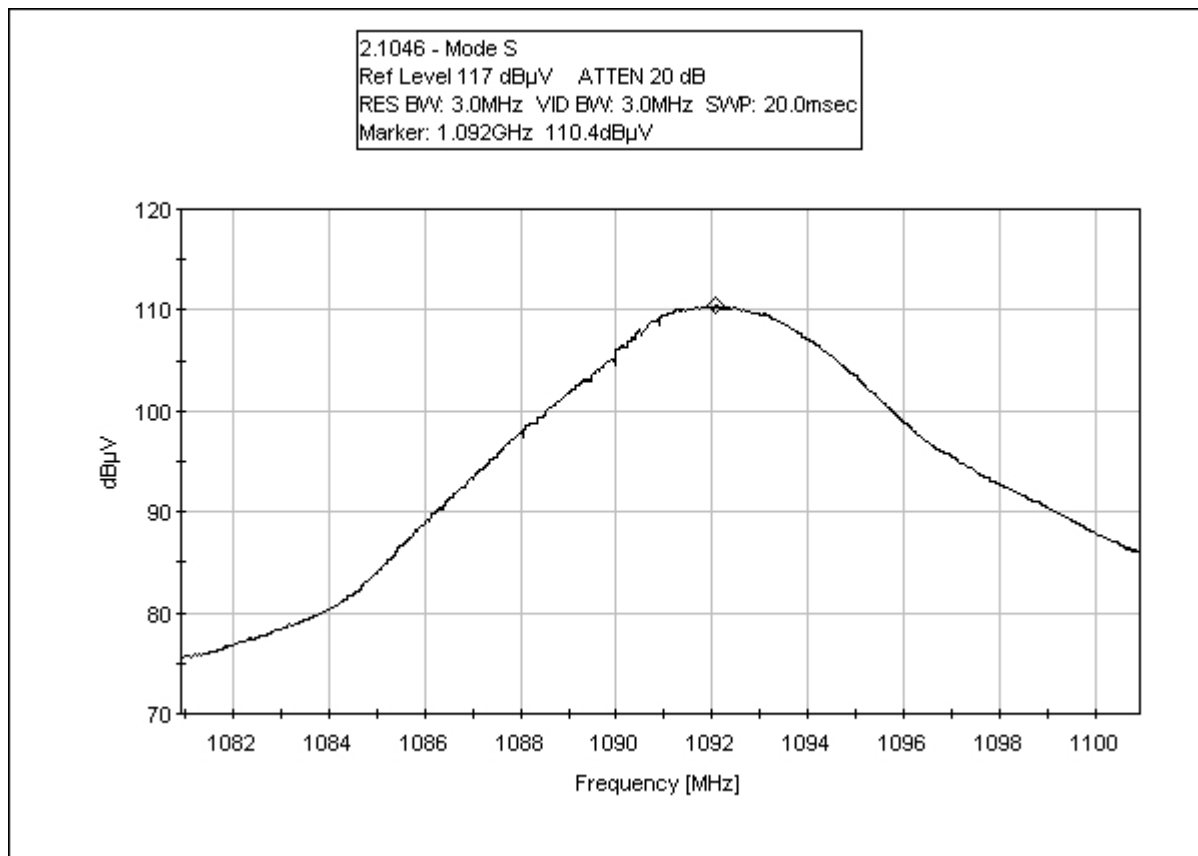
## MODE A IDENT 0000 PLOT



## MODE A IDENT 7777 PLOT



## MODE S PLOT



## TEST EQUIPMENT

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
QP Adapter	HP	85650A	2811A01267	00478	1/30/02	1/30/03
S/A Display	HP	8566B	2403A08241	00489	1/30/02	1/30/03
Spectrum Analyzer	HP	8566B	2209A01404	00490	1/30/02	1/30/03
Power Supply	Sorenson	DCR-60-30B	0176	00765	7/17/02	7/17/03



RF Power



Close-up of IFR Connections



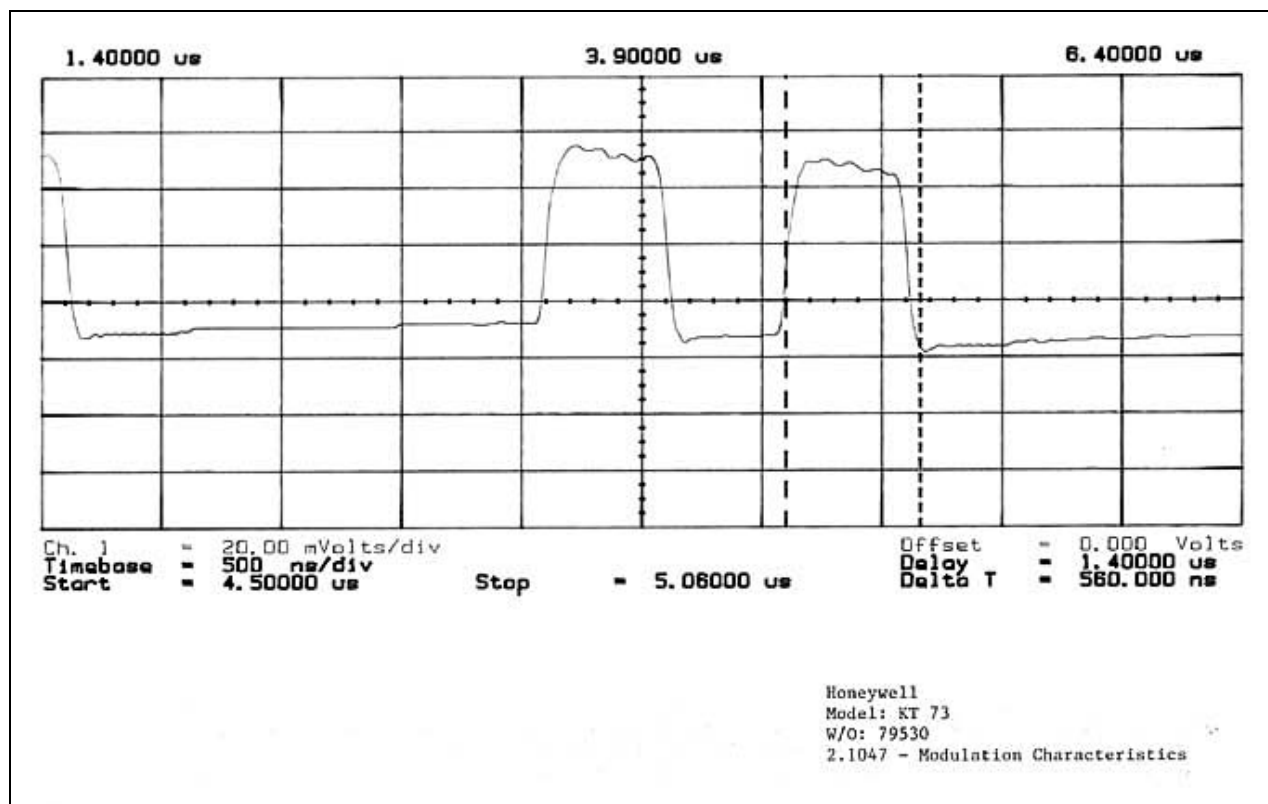
**2.1033(c)(14)/2.1047(a) - MODULATION CHARACTERISTICS - AUDIO FREQUENCY RESPONSE**

Not applicable to this unit.

**2.1033(c)(14)/2.1047(b)/87.141 MODULATION CHARACTERISTICS – Modulation Limiting Response**

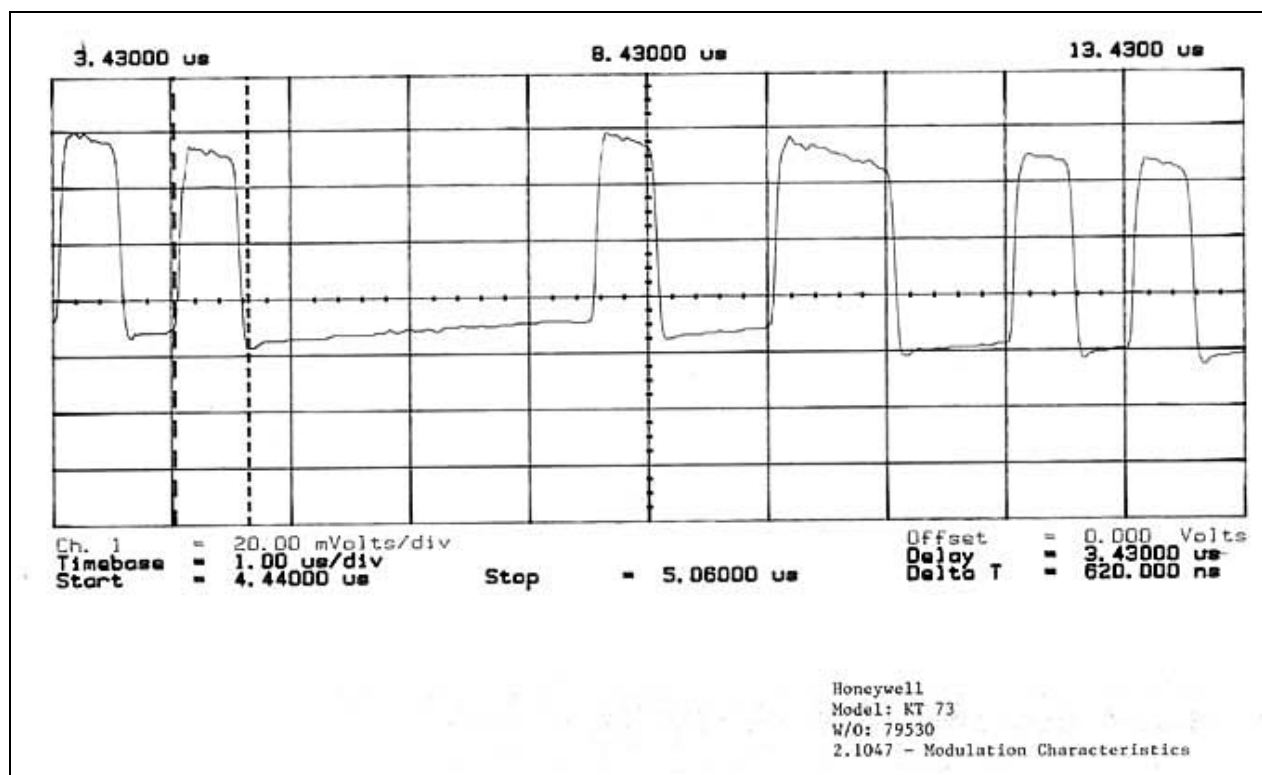
**Test Conditions:** The EUT is a panel mount transponder operating at 1090 MHz with an input voltage of 28VDC. The transponder is operating in its worst case modulation, Mode S, which was determined during antenna conducted measurements. An IFR Test Set is used to continuously interrogate the transponder.

**MODULATION PLOT**

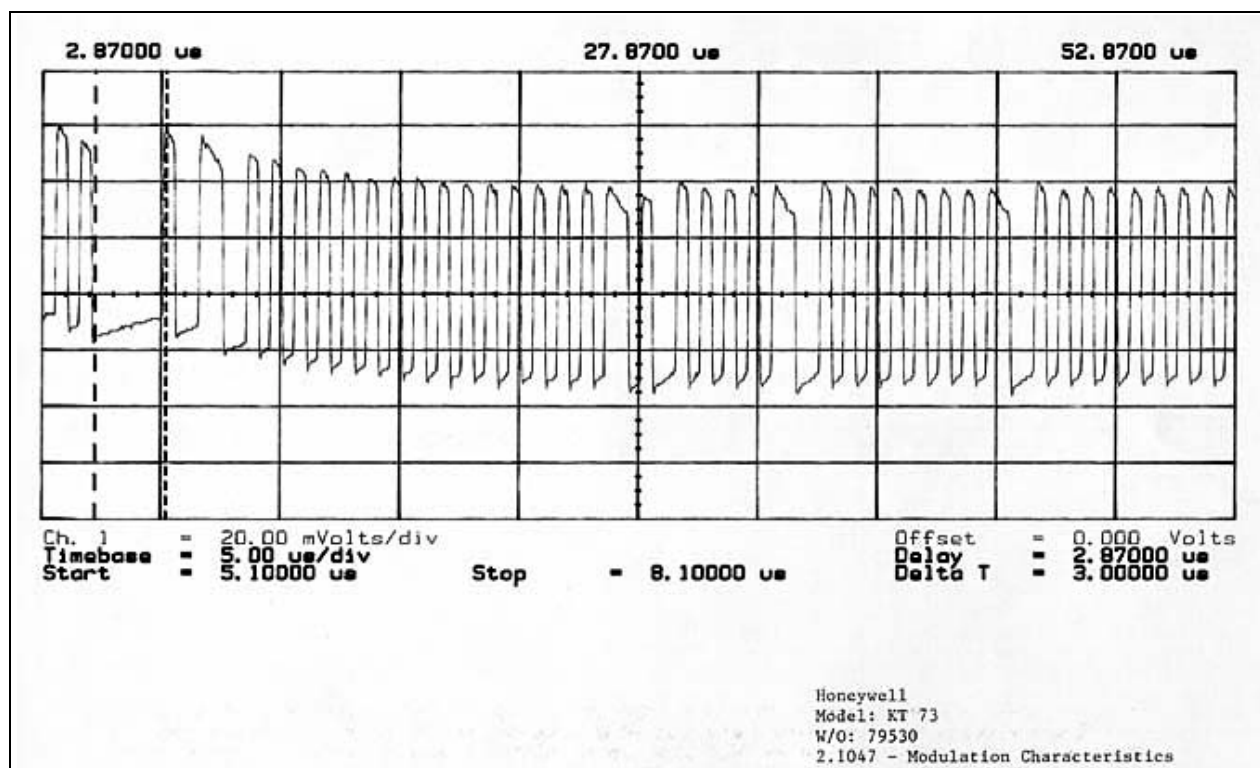




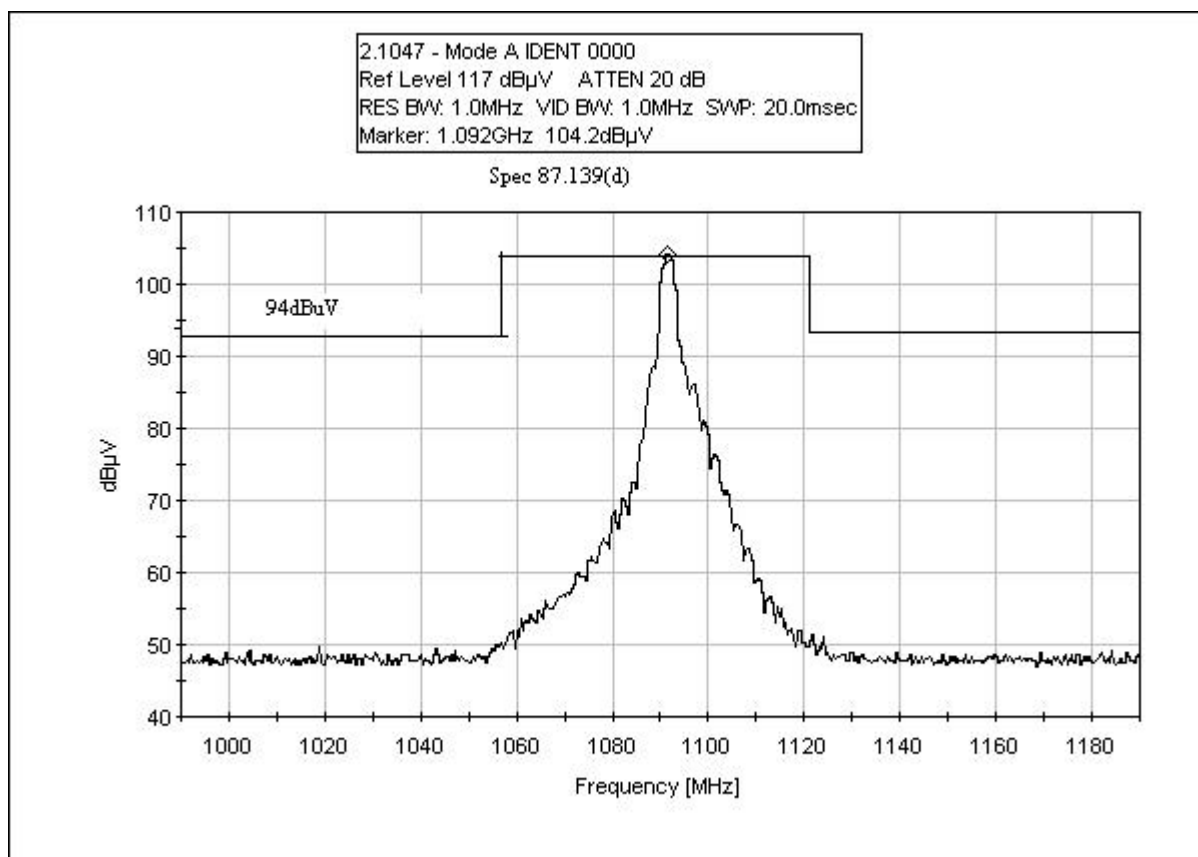
## MODULATION PLOT



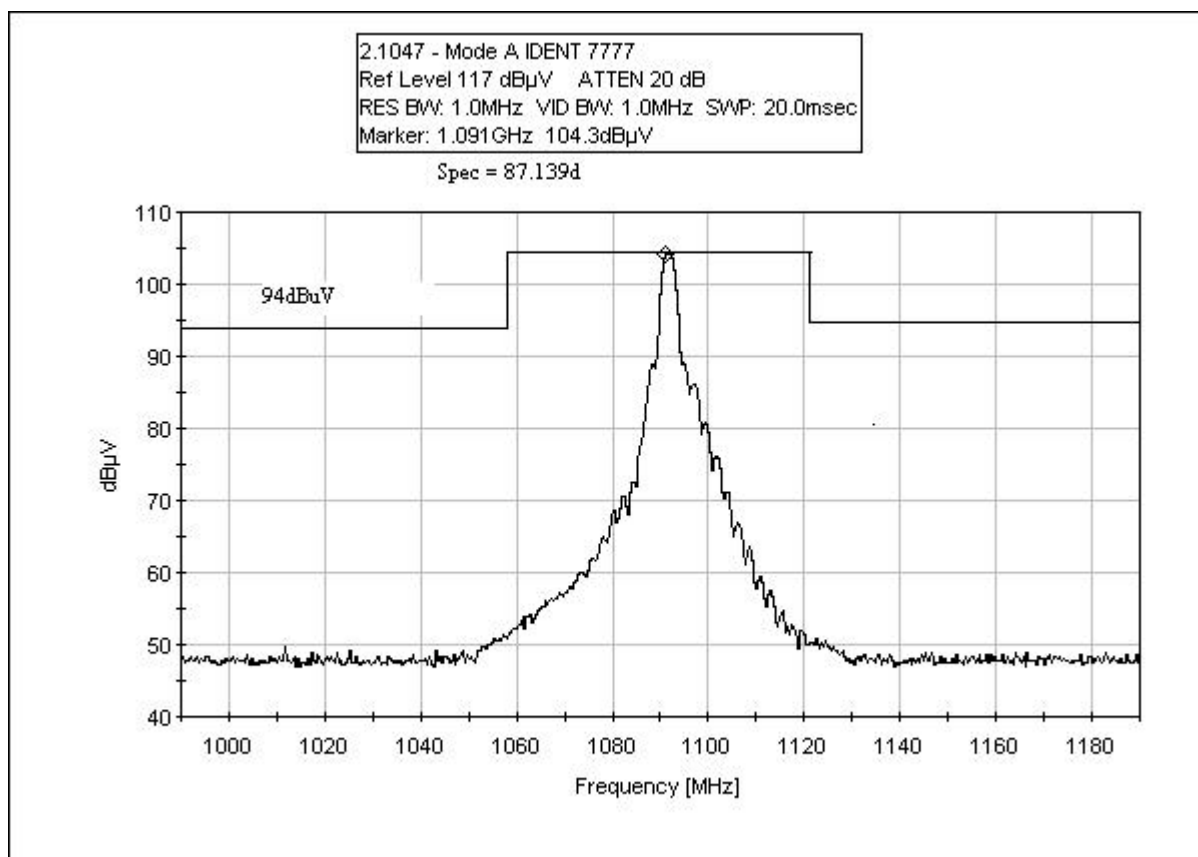
## MODULATION PLOT



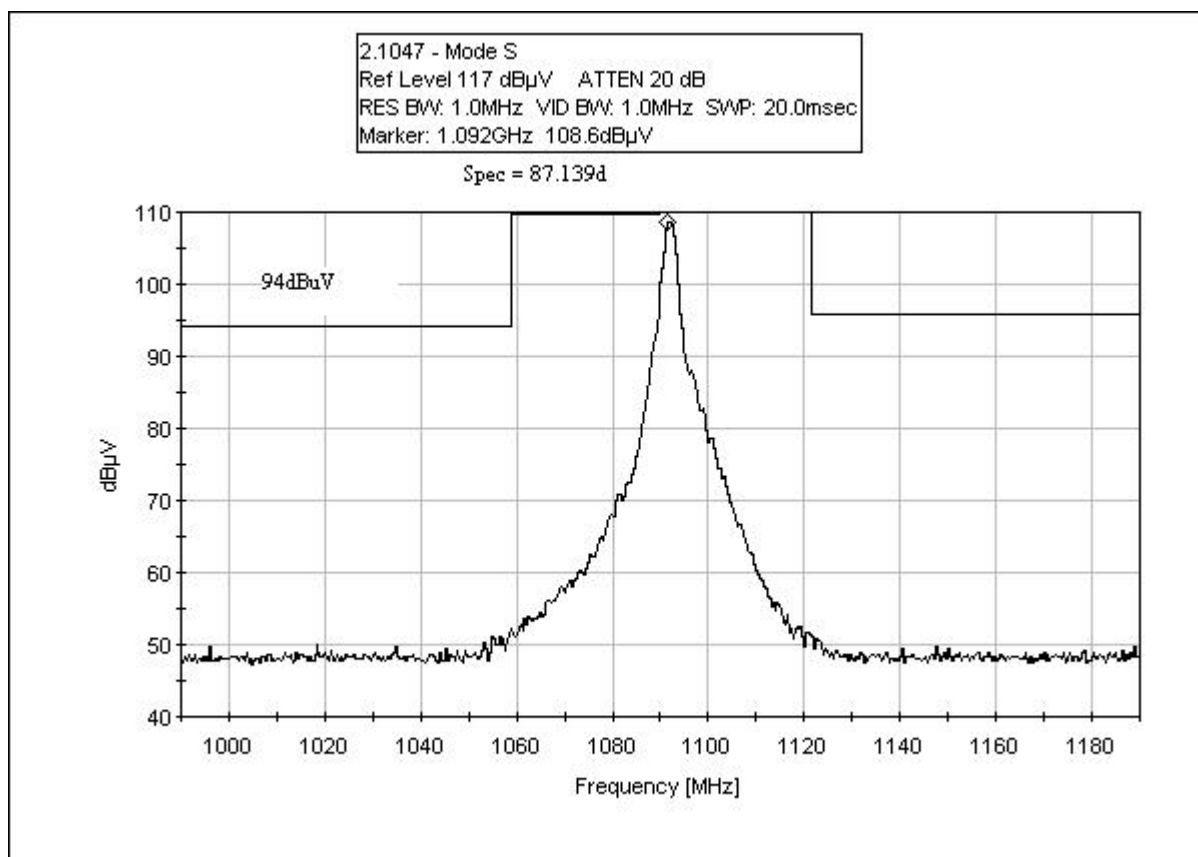
## MODULATION MODE A IDENT PLOT

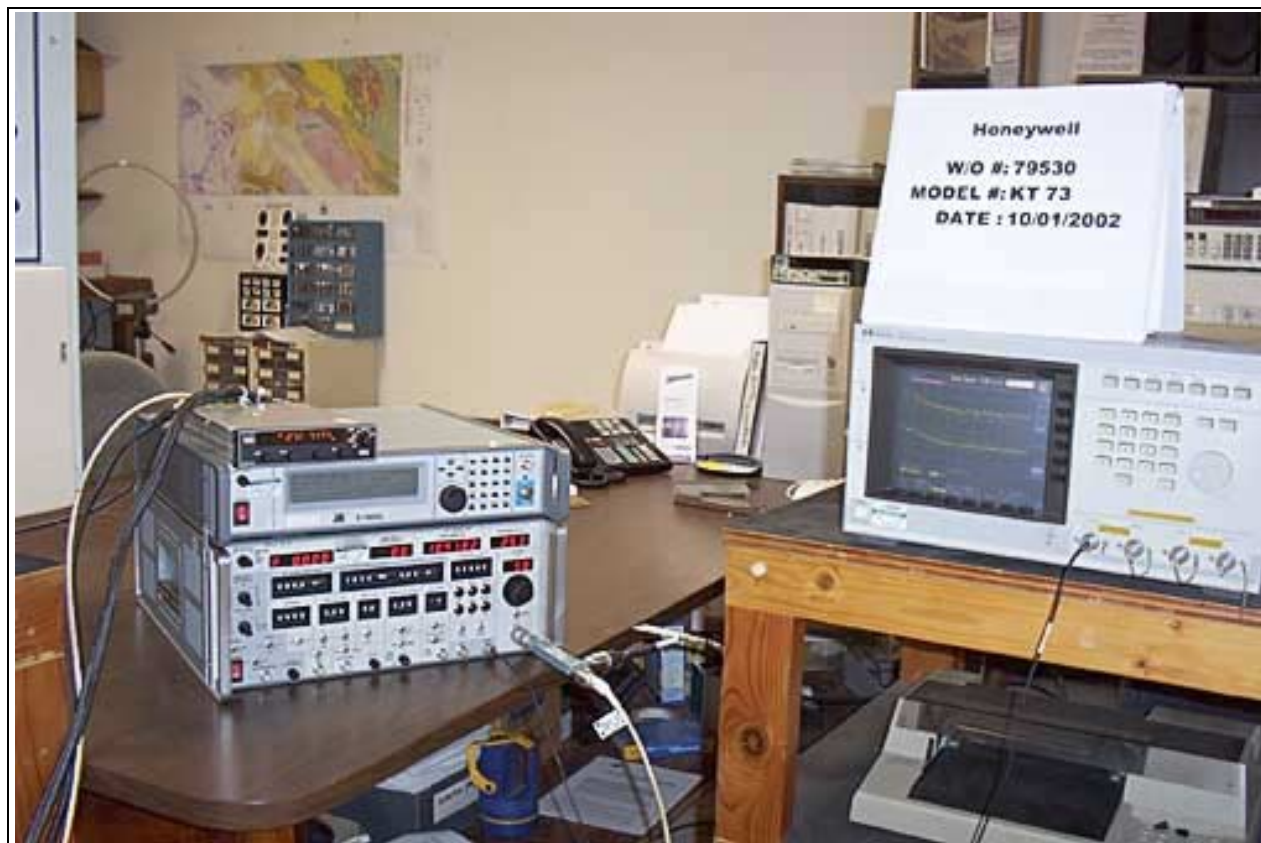


## MODULATION MODE A IDENT 7777 PLOT



## MODULATION MODE S PLOT





## Modulation

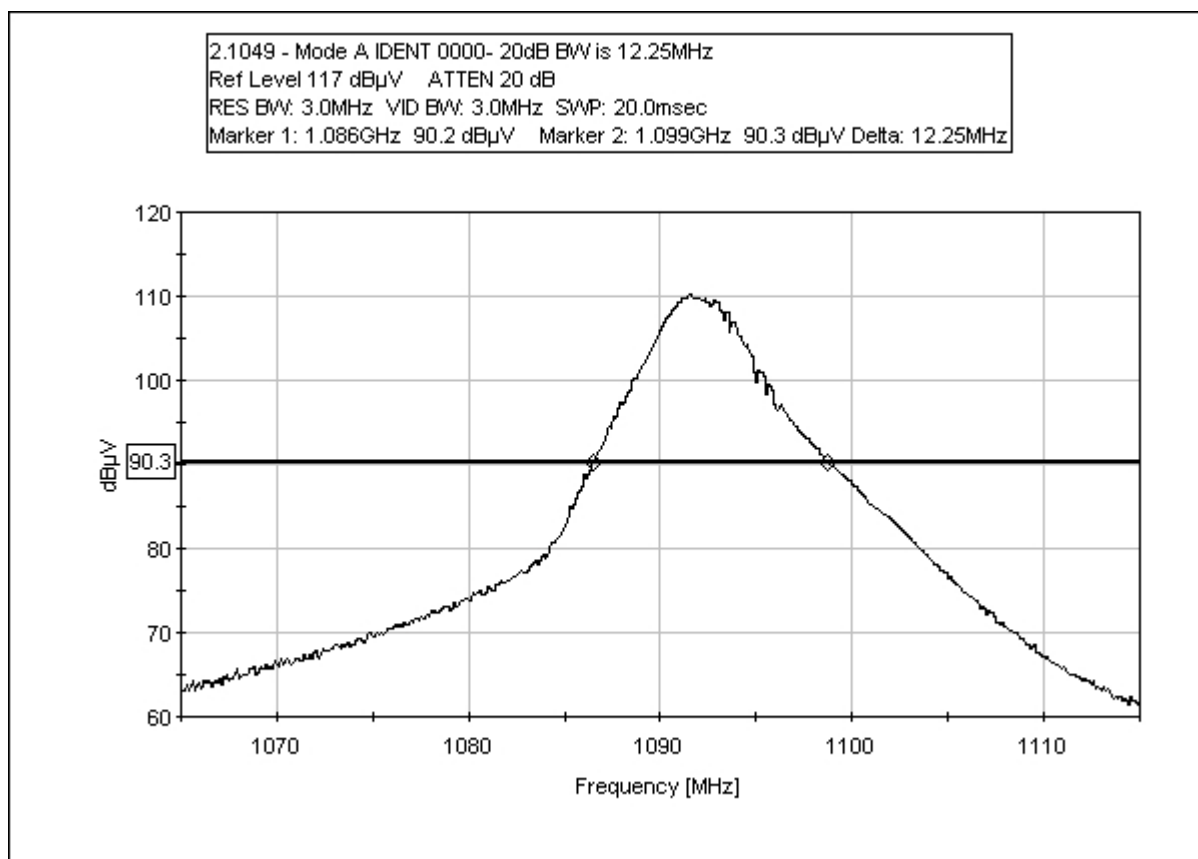
### TEST EQUIPMENT

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
Digital O-Scope	HP	54111D	3051A03191	02008	9/28/02	9/28/03

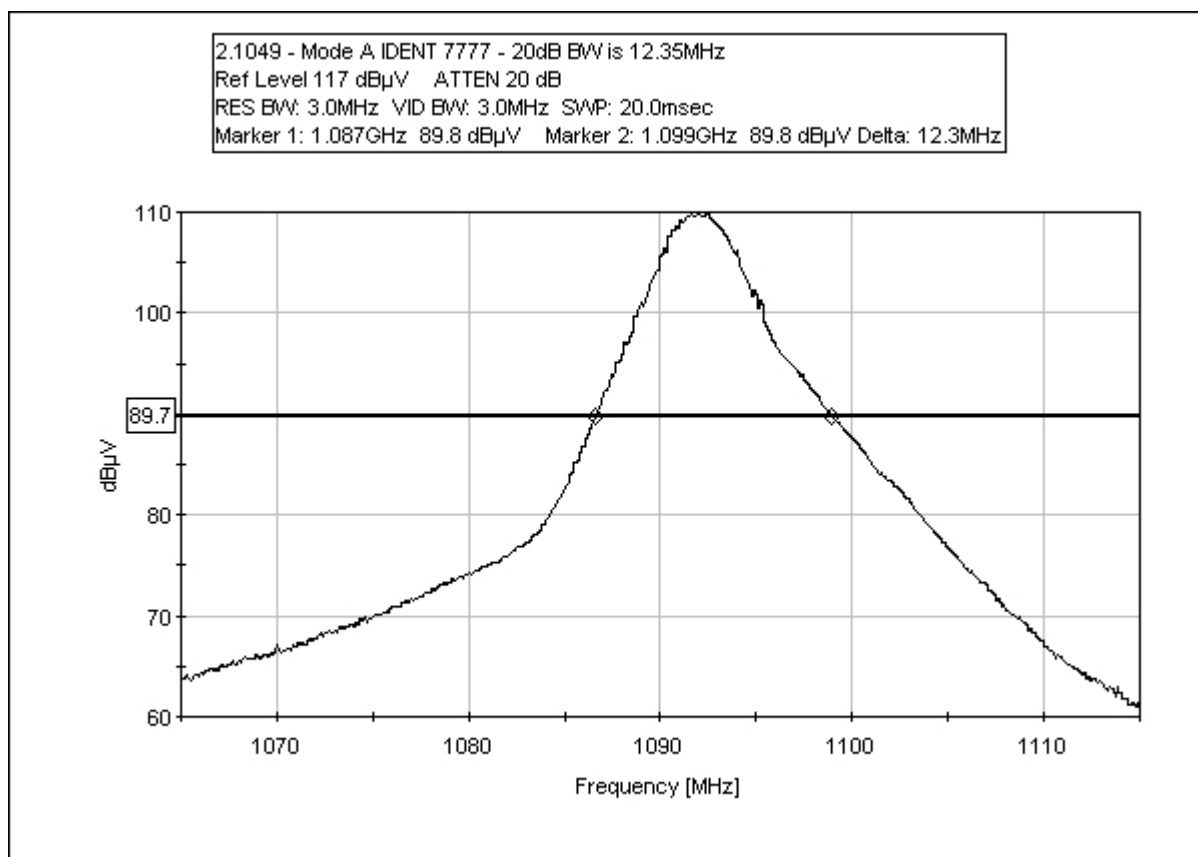
## 2.1033(c)(14)/2.1049(i)/87.135/87.139 - OCCUPIED BANDWIDTH

**Test Conditions:** The EUT is a panel mount transponder operating in Mode A IDENT 0000, Mode A IDENT 7777, or Mode S. An IFR Test Set is used to continuously interrogate the transponder. The maximum measured BW was 12.55 MHz.

### **OCCUPIED BANDWIDTH MODE A IDENT 0000 PLOT**

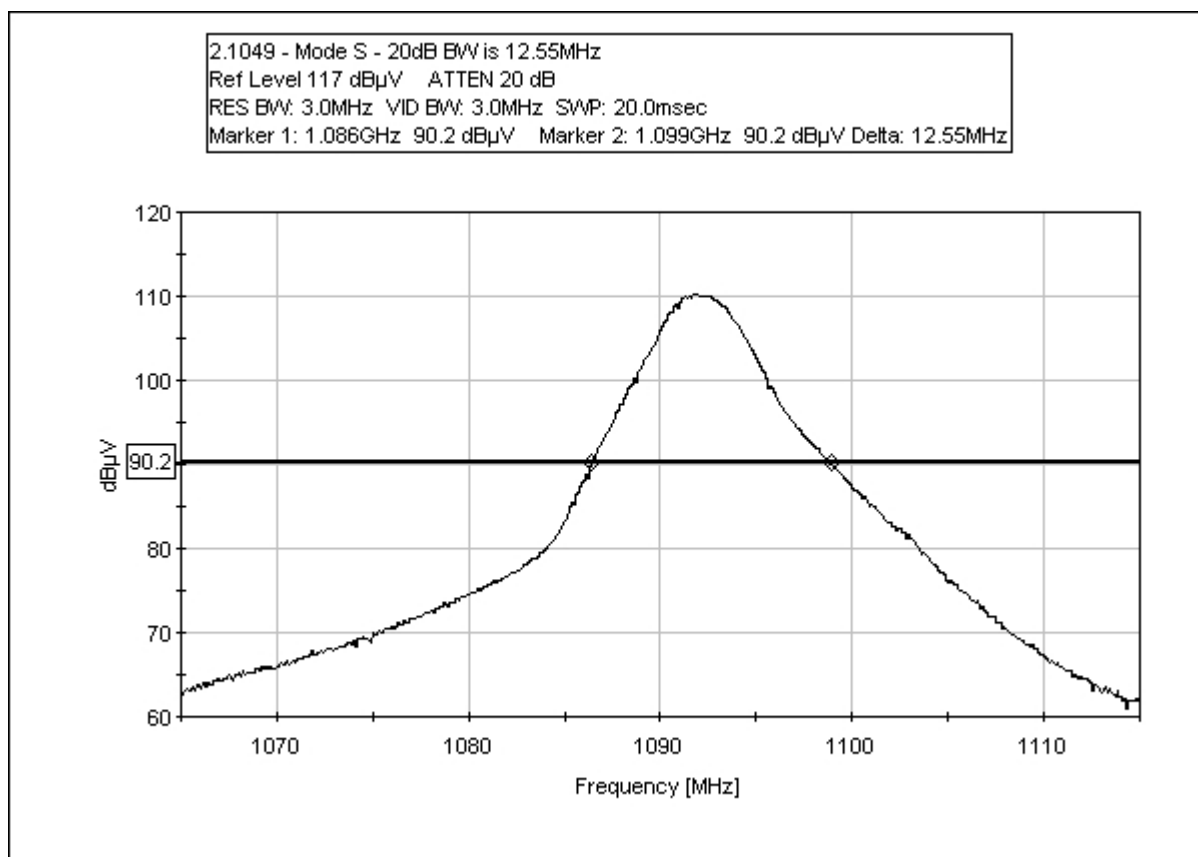


## OCCUPIED BANDWIDTH MODE A IDENT 7777 PLOT





## OCCUPIED BANDWIDTH MODE S PLOT



### TEST EQUIPMENT

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
QP Adapter	HP	85650A	2811A01267	00478	1/30/02	1/30/03
S/A Display	HP	8566B	2403A08241	00489	1/30/02	1/30/03
Spectrum Analyzer	HP	8566B	2209A01404	00490	1/30/02	1/30/03
Power Supply	Sorenson	DCR-60-30B	0176	00765	7/17/02	7/17/03



Occupied Bandwidth



Close-up of IFR Connections

## 2.1033(c)(14)/2.1051/87.139 - SPURIOUS EMISSIONS AT ANTENNA TERMINAL

ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	12 GHz	1 MHz

Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**

Specification: **2.1051/87.139d**

Work Order #: **79530**

Date: 10/02/2002

Test Type: **2.1051 -Spurious Emissions At Antenna Terminal**

Time: 13:18:34

Equipment: **Mode S Transponder**

Sequence#: 4

Manufacturer: Honeywell

Tested By: Monika Brandle

Model: KT 73

S/N: Y503

### ***Equipment Under Test (\* = EUT):***

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

### ***Support Devices:***

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

### ***Test Conditions / Notes:***

The EUT is a panel mount transponder operating in ATCRBS Mode A IDENT 0000. An IFR Test Set is used to continuously interrogate the transponder. Frequency Range Scanned: 9 kHz-12 GHz. CISPR Bandwidths were used for the conducted measurements at the antenna terminal.  $P_o=251\text{Watts}$   $P_y=(251)(450\text{ns})(14)(1200) = 1.9\text{Watts}$  where  $P_y=(P_o)(T_w)(N)(R)$   $P_y$  = Mean Transmitter Power  $P_o$ = Peak Output Power  $T_w$ = Pulse width (Seconds)  $R$  = Reply Rate (Hz). Therefore Limit =  $43 + 10\log(P_y) = 43 + 10\log(1.9\text{W}) = 43 + 2.7819 = 45.78\text{dBc}$ ; Therefore  $1.9\text{Watts} = 32.78\text{dBm}$  Spurious limit =  $32.78-45.78\text{dB} = -13\text{dBm}$ . Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

### ***Transducer Legend:***

T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=Cust Cable 311601
T5=HPF 1.5GHz	

**Measurement Data:**

Reading listed by margin.

Test Distance: None

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dB $\mu$ V	dB	dB	dB	dB	Table	dB $\mu$ V	dB $\mu$ V	dB	Ant
1	2180.000M	23.0	+17.4 +0.4	+31.1	+0.5	+1.2	+0.0	73.6	94.0	-20.4	None
2	5341.500M	24.8	+16.5 +0.9	+26.7	+1.2	+1.8	+0.0	71.9	94.0	-22.1	None
3	3270.000M	22.1	+17.4 +0.2	+29.5	+0.9	+1.4	+0.0	71.5	94.0	-22.5	None
4	4360.000M	22.4	+17.4 +0.5	+28.4	+0.6	+1.5	+0.0	70.8	94.0	-23.2	None
5	6670.700M	29.7	+13.6 +0.4	+22.7	+1.0	+2.5	+0.0	69.9	94.0	-24.1	None
6	9686.899M	28.5	+15.5 +0.9	+20.3	+1.0	+3.0	+0.0	69.2	94.0	-24.8	None
7	8662.200M	28.3	+14.6 +0.3	+20.8	+1.2	+2.9	+0.0	68.1	94.0	-25.9	None
8	7700.700M	27.7	+13.7 +0.5	+21.4	+1.3	+2.8	+0.0	67.4	94.0	-26.6	None
9	919.000M	27.4	+0.0 +20.1	+0.0	+0.0	+0.0	+0.0	47.5	94.0	-46.5	None
10	134.800M	44.5	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	44.5	94.0	-49.5	None
11	2.594M	40.7	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	40.7	94.0	-53.3	None
12	2.852M	40.5	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	40.5	94.0	-53.5	None
13	3.275M	38.0	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	38.0	94.0	-56.0	None
14	4.598M	32.9	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	32.9	94.0	-61.1	None
15	132.800M	32.3	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	32.3	94.0	-61.7	None
16	12052.600 M	27.8	+0.0 -0.1	+0.0	+2.0	+0.0	+0.0	29.7	94.0	-64.3	None
17	5.820M	29.2	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	29.2	94.0	-64.8	None

Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**

Specification: **2.1051/87.139d**

Work Order #: **79530**

Date: 10/02/2002

Test Type: **2.1051 -Spurious Emissions At Antenna Terminal**

Time: 13:21:03

Equipment: **Mode S Transponder**

Sequence#: 5

Manufacturer: Honeywell

Tested By: Monika Brandle

Model: KT 73

S/N: Y503

**Equipment Under Test (\* = EUT):**

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

**Support Devices:**

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

**Test Conditions / Notes:**

The EUT is a panel mount transponder operating in ATCRBS Mode A IDENT 7777. An IFR Test Set is used to continuously interrogate the transponder. Frequency Range Scanned: 9 kHz-12 GHz. CISPR Bandwidths were used for the conducted measurements at the antenna terminal.  $P_o = 251 \text{ Watts}$   $P_y = (251)(450\text{ns})(14)(1200) = 1.9 \text{ Watts}$  where  $P_y = (P_o)(T_w)(N)(R)$   $P_y$  = Mean Transmitter Power  $P_o$  = Peak Output Power  $T_w$  = Pulse width (Seconds)  $R$  = Reply Rate (Hz) Therefore  $\text{Limit} = 43 + 10\log(P_y) = 43 + 10\log(1.9\text{W}) = 43 + 2.7819 = 45.78\text{dBc}$ . Therefore  $1.9 \text{ Watts} = 32.78\text{dBm}$  Spurious limit =  $32.78 - 45.78\text{dB} = -13\text{dBm}$ . Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

**Transducer Legend:**

T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=Cust Cable 311601
T5=HPF 1.5GHz	

**Measurement Data:**

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	2180.000M	23.0	+17.4 +0.4	+31.1	+0.5	+1.2	+0.0	73.6	94.0	-20.4	None
2	5341.500M	24.8	+16.5 +0.9	+26.7	+1.2	+1.8	+0.0	71.9	94.0	-22.1	None
3	3270.000M	22.1	+17.4 +0.2	+29.5	+0.9	+1.4	+0.0	71.5	94.0	-22.5	None
4	4360.000M	22.4	+17.4 +0.5	+28.4	+0.6	+1.5	+0.0	70.8	94.0	-23.2	None
5	6670.700M	29.7	+13.6 +0.4	+22.7	+1.0	+2.5	+0.0	69.9	94.0	-24.1	None

6	9686.899M	28.5	+15.5 +0.9	+20.3	+1.0	+3.0	+0.0	69.2	94.0	-24.8	None
7	8662.200M	28.3	+14.6 +0.3	+20.8	+1.2	+2.9	+0.0	68.1	94.0	-25.9	None
8	7700.700M	27.7	+13.7 +0.5	+21.4	+1.3	+2.8	+0.0	67.4	94.0	-26.6	None
9	920.000M	32.7	+0.0 +19.5	+0.0	+0.0	+0.0	+0.0	52.2	94.0	-41.8	None
10	3.496M	41.6	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	41.6	94.0	-52.4	None
11	2.139M	40.6	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	40.6	94.0	-53.4	None
12	133.600M	39.6	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	39.6	94.0	-54.4	None
13	4.187M	39.1	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	39.1	94.0	-54.9	None
14	2.824M	35.4	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	35.4	94.0	-58.6	None
15	6.230M	35.0	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	35.0	94.0	-59.0	None
16	8.350M	32.1	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	32.1	94.0	-61.9	None
17	12052.600 M	27.8	+0.0 -0.1	+0.0	+2.0	+0.0	+0.0	29.7	94.0	-64.3	None
18	16.530M	27.1	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	27.1	94.0	-66.9	None



Test Location: CKC Laboratories Inc. • 5473A Clouds Rest • Mariposa CA 95338 • 1 800 500 4EMC (4362)

Customer: **Honeywell**

Specification: **2.1051/87.139d**

Work Order #: **79530**

Date: 10/02/2002

Test Type: **2.1051 -Spurious Emissions At Antenna Terminal**

Time: 13:27:37

Equipment: **Mode S Transponder**

Sequence#: 6

Manufacturer: Honeywell

Tested By: Monika Brandle

Model: KT 73

S/N: Y503

**Equipment Under Test (\* = EUT):**

Function	Manufacturer	Model #	S/N
Mode S Transponder*	Honeywell	KT 73	Y503

**Support Devices:**

Function	Manufacturer	Model #	S/N
Coaxial Coupler	Narda	3202B-20	61893
KT 73 Test Box	Honeywell	71-09893-0010	190-3162-04
IFR Test Set	IFR	S-1403DL w/MLD	28500633
IFR Test Set	IFR	ATC-1400A	204006889

**Test Conditions / Notes:**

The EUT is a panel mount transponder operating in Mode S. An IFR Test Set is used to continuously interrogate the transponder. Frequency Range Scanned: 9 kHz-12 GHz. CISPR Bandwidths were used for the conducted measurements at the antenna terminal.  $P_o = 251 \text{ Watts}$   $P_y = (251)(450\text{ns})(14)(1200) = 1.9 \text{ Watts}$  where  $P_y = (P_o)(T_w)(N)(R)$   $P_y$  = Mean Transmitter Power  $P_o$  = Peak Output Power  $T_w$  = Pulse width (Seconds)  $R$  = Reply Rate (Hz) Therefore Limit =  $43 + 10\log(P_y) = 43 + 10\log(1.9\text{W}) = 43 + 2.7819 = 45.78\text{dBc}$ . Therefore  $1.9 \text{ Watts} = 32.78\text{dBm}$  Spurious limit =  $32.78 - 45.78\text{dB} = -13\text{dBm}$ . Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

**Transducer Legend:**

T1=20dB DC 61893	T2=30dBpd
T3=Cable GHz #9	T4=Cust Cable 311601
T5=HPF 1.5GHz	

**Measurement Data:**

Reading listed by margin.

Test Distance: None

#	Freq MHz	Rdng dBμV	T1 T5 dB	T2 dB	T3 dB	T4 dB	Dist Table	Corr dBμV	Spec dBμV	Margin dB	Polar Ant
1	2028.200M	24.2	+17.4 +0.5	+31.3	+0.5	+1.2	+0.0	75.1	94.0	-18.9	None
2	3191.100M	24.3	+17.4 +0.2	+29.6	+0.9	+1.4	+0.0	73.8	94.0	-20.2	None
3	4538.600M	25.2	+17.4 +0.4	+28.3	+0.5	+1.6	+0.0	73.4	94.0	-20.6	None
4	5484.200M	24.8	+16.2 +0.9	+26.2	+1.2	+1.9	+0.0	71.2	94.0	-22.8	None
5	6707.400M	30.5	+13.6 +0.4	+22.6	+0.9	+2.6	+0.0	70.6	94.0	-23.4	None

6	9909.000M	28.9	+15.6 +0.8	+20.2	+1.1	+3.0	+0.0	69.6	94.0	-24.4	None
7	8725.200M	27.6	+14.7 +0.3	+20.8	+1.3	+2.9	+0.0	67.6	94.0	-26.4	None
8	7554.100M	27.8	+13.6 +0.4	+21.5	+1.1	+2.8	+0.0	67.2	94.0	-26.8	None
9	1050.200M	35.5	+0.0 +23.6	+0.0	+0.4	+0.0	+0.0	59.5	94.0	-34.5	None
10	919.700M	35.0	+0.0 +19.7	+0.0	+0.0	+0.0	+0.0	54.7	94.0	-39.3	None
11	1038.800M	27.6	+0.0 +21.2	+0.0	+0.4	+0.0	+0.0	49.2	94.0	-44.8	None
12	3.062M	45.9	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	45.9	94.0	-48.1	None
13	134.300M	45.7	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	45.7	94.0	-48.3	None
14	2.078M	41.3	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	41.3	94.0	-52.7	None
15	4.061M	40.1	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	40.1	94.0	-53.9	None
16	5.080M	37.4	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	37.4	94.0	-56.6	None
17	6.020M	35.9	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	35.9	94.0	-58.1	None
18	8.050M	34.6	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	34.6	94.0	-59.4	None
19	4.985M	33.5	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	33.5	94.0	-60.5	None
20	10.060M	32.6	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	32.6	94.0	-61.4	None
21	10879.200 M	28.2	+0.0 +0.7	+0.0	+2.6	+0.0	+0.0	31.5	94.0	-62.5	None
22	11977.400 M	28.1	+0.0 -0.1	+0.0	+2.0	+0.0	+0.0	30.0	94.0	-64.0	None
23	12.070M	29.7	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	29.7	94.0	-64.3	None
24	15.280M	27.7	+0.0 +0.0	+0.0	+0.0	+0.0	+0.0	27.7	94.0	-66.3	None

#### TEST EQUIPMENT

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
QP Adapter	HP	85650A	2811A01267	00478	1/30/02	1/30/03
S/A Display	HP	8566B	2403A08241	00489	1/30/02	1/30/03
Spectrum Analyzer	HP	8566B	2209A01404	00490	1/30/02	1/30/03
Power Supply	Sorenson	DCR-60-30B	0176	00765	7/17/02	7/17/03





Spurious Emissions



Close-up of IFR Connections

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

<b>ANALYZER BANDWIDTH SETTINGS PER FREQUENCY RANGE</b>			
TEST	BEGINNING FREQUENCY	ENDING FREQUENCY	BANDWIDTH SETTING
RADIATED EMISSIONS	9 kHz	150 kHz	200 Hz
RADIATED EMISSIONS	150 kHz	30 MHz	9 kHz
RADIATED EMISSIONS	30 MHz	1000 MHz	120 kHz
RADIATED EMISSIONS	1000 MHz	12 GHz	1 MHz

**Test Conditions:** The EUT is a panel mount transponder operating at 1090MHz with an input voltage of 28VDC. The transponder is operating in its worst case modulation, Mode S, which was determined during antenna conducted measurements. An IFR Test Set is remotely located and used to continuously interrogate the transponder. Frequency Range investigated: 9 kHz-12 GHz.

Derivation of 87.139 limit: Ant Gain = -.85dBi, Output power at the antenna terminal was measured as 161dBuV = 251Watts = 24dBW

ERP in Watts = 251Watts

EIRP = Ant Terminal Measurement + Ant Gain (dBi)-2dB Cable Loss (per manufacturer)  
 = 24dBW+- .85dBi-2dB  
 = 21.15dBW

Note: The limits for output power vary. In accordance with Part 87.131, the class of station is "Radionavigation". For this particular class, frequency, emission and maximum power will be determined by the appropriate standards during the certification process.

Operating Frequency: 851 – 869 MHz  
 Channels: Low, middle, high  
 Highest Measured Output Power: 54.00 ERP(dBm)= 251 ERP(Watts)  
 Distance: 3 meters  
 Limit:  $43+10\log(P)$  67.00 dBc

Freq. (MHz)	Reference Level (dBm)	Antenna Polarity (H/V)	dBc
4,357.96	-30.6	Vert	84.60
2,183.10	-35.10	Vert	89.10
4,360.08	-28.50	Horiz	82.50
3,261.64	-32.70	Horiz	86.70
2,183.44	-26.20	Horiz	80.20
32.25	-71.00	Vert	125.00
35.30	-58.30	Vert	112.30

#### TEST EQUIPMENT

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
Antenna, Bicon	A&H	SAS-200/542	156	00225	12/06/01	12/6/02
Antenna, Log	A&H	SAS-200/510	154	01330	6/19/02	6/19/03
Preamp	HP	8447D	1937A02604	00099	3/21/02	3/21/03
Preamp	HP	8449B	3008A00301	02010	10/19/01	10/19/02
QP Adapter	HP	85650A	2811A01267	00478	1/30/02	1/30/03
S/A Display	HP	8566B	2403A08241	00489	1/30/02	1/30/03
Spectrum Analyzer	HP	8566B	2209A01404	00490	1/30/02	1/30/03
Antenna, Horn	EMCO	3115	4085	00656	03/19/02	03/19/03



Radiated Emissions - Front View



Radiated Emissions - Back View

## 2.1033(c)(14)/2.1055/87.133/87.147 - FREQUENCY STABILITY

**Test Conditions:** The EUT is a panel mount transponder operating at 1090MHz with an input voltage of 28VDC. The transponder is operating in its worst case modulation, Mode S, which was determined during antenna conducted measurements. An IFR Test Set is used to continuously interrogate the transponder.

**Customer:** Honeywell  
**WO#:** 79530  
**Date:** 04-Nov-02  
**Test Engineer:** Monika Brandle

**Device Model #:** KT 73  
**Operating Voltage:** 28 VDC  
**Frequency Limit:** 2.9 %  
**Frequency Limit:** 2.7 MHz T=550us, BW = 12.55MHz

87.133(d) For radar transmitters, except non-pulse signal radio altimeters, the frequency at which maximum emission occurs must be within the authorized frequency band and must not be closer than 1.5/T MHz to the upper and lower limits of the authorized bandwidth where T is the pulse duration in microseconds. TSO Frequency Deviation = 1MHz

### Temperature Variations

Channel Frequency:	Channel 1 (MHz)	Dev. (MHz)
	1091.92	
Temp (C) Voltage		
-20 28	1091.42000	0.50000
-10 28	1091.00000	0.92000
0 28	1090.96000	0.96000
10 28	1091.28000	0.64000
20 28	1091.92000	0.00000
30 28	1092.16000	0.24000
40 28	1092.11000	0.19000
50 28	1092.38000	0.46000

### Voltage Variations (±15%)

Channel Frequency:	Channel 1 (MHz)	Dev. (MHz)
	1091.92	
20 23.8	1091.77000	0.15000
20 28	1091.80000	0.12000
20 32.2	1092.04000	0.12000

<b>Max Deviation (MHz)</b>	<b>0.96000</b>
<b>Max Deviation (%)</b>	<b>0.08792</b>
	<b>PASS</b>





## Temperature Testing

### TEST EQUIPMENT USED FOR FCC TESTS 2.1055

<i>Equipment</i>	<i>Manufacturer</i>	<i>Model #</i>	<i>Serial #</i>	<i>Asset #</i>	<i>Cal Date</i>	<i>Cal Due</i>
QP Adapter	HP	85650A	2811A01267	00478	1/30/02	1/30/03
S/A Display	HP	8566B	2403A08241	00489	1/30/02	1/30/03
Spectrum Analyzer	HP	8566B	2209A01404	00490	1/30/02	1/30/03
Power Supply	Sorenson	DCR-60-30B	0176	00765	7/17/02	7/17/03
Thermometer	Omega	HH-26K	T-202884	02242	8/30/02	8/30/03
Temp Chamber	Thermotron	S-1.2 MiniMax	11899	01879	2/7/02	2/7/03

## 2.1091- MPE CALCULATIONS

Calculations prepared for:

*Honeywell*  
23500 West 105th Street  
Olathe KS 66061-6615

Calculations prepared by:

*Monika Brandle*  
CKC Laboratories, Inc.  
5473A Clouds Rest Road  
Mariposa, CA 95338

Model Number: KT 73

FCC Identification:

Fundamental Operating Frequency: 1090MHz

Maximum Rated Output Power: 251 Watts

Measured Output Power: 251 Watts

Mean Output Power 2.3 Watts

$$\text{EIRP} = \text{ANT Cond (dB)} + \text{Cust ANT Gain (dBi)}$$

$$\text{EIRP} = 33.6\text{dBm} + .85\text{dBi} = -32.75\text{dBm or } 1.88\text{Watts}$$

Power Output and Operating Frequency Information used for these calculations were from:

CKC Laboratories, Inc. Mean Output Power was calculated as follows:

$$P_o = 251\text{ Watts}$$

$$P_y = (251)(550\text{ns})(14)(1200) = \mathbf{2.3\text{Watts}}$$

Where

$$P_y = (P_o)(T_w)(N)(R)$$

$P_y$  = Mean Transmitter Power

$P_o$  = Peak Output Power

$T_w$  = Pulse width (Seconds) Manufacturer declares a pulse width of 450ns-550ns

$N$  = number of pulses

$R$  = Reply Rate (Hz)

MPE Limit in accordance with 1.1310(b): Limits for general population/uncontrolled exposure

$$\text{MPE Limit} = f/1500, \text{ where } f = \text{Frequency in MHz}$$

$$\text{MPE Limit for 1090 MHz} = 1090/1500 = \mathbf{0.726667\text{mW/cm}^2}$$

Power Output (Watts)	Power Output (EIRP)	Power Density Limit (mW/cm <sup>2</sup> )	Minimum Distance (cm)
2.3 (Mean)	1.88W	0.726667	14.35213087

$$\text{Power Density (mW/cm}^2\text{)} = (\text{EIRP}) / (d^2 * 4 * \pi)$$

EIRP = Measured or Calculated EIRP, in mWatts

$d$  = Distance in centimeters

Under normal operating conditions, the antenna is designed to maintain a separation distance of 14.3 centimeters from all persons. As can be seen from the MPE results, this device passes the limits specified in 1.1310 at a distance of 14.3cm at a rated average output power of 1.88 Watts.