APPLICATION		
DASH NO.	NEXT ASSY	USED ON
-001		940-0530

TITLE SHEET

REVISIONS - ALL SHEETS ARE SAME REVISION STATUS

SH	REV	DESCRIPTION	DATE	APPROVED
55	A	Added Appendix A to include spurious emissions test data. Reason Code: 05 Severity Code: 09	05 DEC 06	K. Peavler J. Spence L. King W. Lambert

Typed signatures constitute approval. Actual signatures on file at Honeywell in Redmond WA.

CAD Prepared Drawing Using MSWord Software.
Not to be manually altered.

CONTRACT NO.

PRECIOUS METAL INDICATOR CODE: NA

Honeywell International Inc.
Redmond, WA 98073-9701

Honeywell

DRAWN	E, Kline	06/4/28
CHECK		
ENGR	B.D. Brown	06/4/28
MFG		
QA	W. Lambert	06/4/28
APVD	L. King	06/4/28
APVD		

SPECIFICATION, FEDERAL COMMUNICATIONS COMMISSION (FCC) ACCEPTANCE REPORT
FOR
TPL-100A MILACAS-FR

SIZE	CAGE CODE	DWG NO.	REV.
A	**97896**	070-4764-001	A

SCALE: NONE

SHEET 1 OF 78

REVISION STATUS OF SHEETS INDEX											
		ADDED SHEETS						ADDED SHEETS			
SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR	SHEET NUMBER	REV LTR
ALL	-										

REVISIONS				
SH	REV	DESCRIPTION	DATE	APPROVED
ALL	A			

Table of Contents

INTRODUCTION

Product Description

TPL-100A series is the latest addition to Honeywell's Traffic Alert and Collision Avoidance (TCAS) product line. The unit is designed to meet the Minimum Operational Performance Standards (MOPS) for TCAS Airborne Equipment, RTCA/DO-185A, MOPS for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/MODE S) Airborne Equipment, RTCA/DO-181A, MOPS for 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services-Broadcast (TIS-B), RTCA/DO-260A and the Environmental Conditions and Test Procedures for Airborne Equipment, RTCA DO-160D requirements. Each unit described below will be certified to TCAS Airborne Equipment, TCAS II, Technical Standard Order (TSO), C119b.

The processor design has an Aeronautical Radio, Incorporated (ARINC) 600 form factor, 6 Modular Concept Unit (MCU), and is commonly known as the TPL-100A MILACAS-FR. This Line Replacement Unit (LRU) is designed for use on military airlift/tanker aircraft.

TPL-100A MILACAS-FR contains both standard TCAS and Formation Flight System (FFS) capability. The TPL-100A MILACAS-FR is sometimes referred to as a Processor or the Processor.

This processor also performs formation flight position keeping functions. It uses a standard TCAS antenna system and combines the functions of TCAS and FFS into one unit and shares the same hardware. The software is partitioned into two systems. The two systems are capable of separate control and function.

MILACAS-FR provides the TCAS function, which performs collision avoidance, and provides situational awareness, when it actively interrogates nearby aircraft with Mode S and ATCRBS Mode C altitude interrogations.

The MILACAS-FR Processor uses Mode S extended squitter to support passive surveillance. The TCAS aircraft receives the global positioning system (GPS) location information of the intruder target. This concept is called Automatic Dependent Surveillance Broadcast (ADS-B).

Mechanical design of the TPL-100A is based on revolutionary, yet fundamental concepts, which takes advantage of today's technology. A Liquid Crystal Display (LCD) is located on the front cover of the processor. It displays configuration, system and LRU health status and reports fault isolation data. A Personal Computer Memory Card International Association (PCMCIA) card slot also located on the front cover, enables software uploads of Operational Flight Programs (OFP) and downloading of history and flight files. The TPL-100A can record up to 60 Traffic Advisory (TA) and 10 Resolution Advisories (RA) incursions. The unit operates on 115 VAC, 400 Hz power and does not require external cooling.

DEFINITIONS/ACRONYMS

ADS-B	Automatic Dependent Surveillance – Broadcast
AGC	Automatic Gain Control
AM	Amplitude Modulation
ARINC	Aeronautical Radio, Incorporated
ATCRBS	Air Traffic Control Radar Beacon System
ATCRBS/Mode Select	Air Traffic Control Radar Beacon System/Mode Select
ATE	Automatic Test Equipment
BITE	Built In Test Equipment
BPF	Band Pass Filter
BW	Band Width
Cal	Calibration
Ch	Channel
CPU	Central Processing Unit
CW	Continuous Wave
DAC	Digital to Analog Converter
dBc	dB below carrier
dBm	Decibel (referenced to milliwatts)
DMM	Digital Multi Meter
DPSK	Differential Phase Shift Keying
DRVR	Driver
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FFS	Formation Flight System
FIFO	First In First Out
GHz	Giga Hertz
GPS	Global Positioning System
HBF	High Bandpass Filter
Hz	Hertz
I	In-phase
IC	Integrated Circuit
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
IQ	In-phase quadrature
KHz	Kilo Hertz
LCD	Liquid Crystal Display
LDMOS	Laterally Diffused Metal Oxide Semiconductor
LNA	Low Noise Amplifier
LO	Local Oscillator
LPF	Low Pass Filter
LRU	Line Replacement Unit
MB	Mega bit
MCU	Modular Concept Unit
MHz	Mega Hertz
MMIC	Monolithic Microwave Integrated Circuit
MOPS	Minimum Operational Performance Standards
MOSFET	Metal-Oxide Semiconductor Field-Effect Transistor
mV	Millivolt
ns	Nanosecond
NTIA	National Telecommuncations and Information Administration
OFP	Operational Flight Program

DEFINITIONS/ACRONYMS (cont'd)

OCXO	Oven controlled crystal oscillator
PAM	Pulse Amplitude Modulation
PCMCIA	Personal Computer Memory Card International Association
PFN	Pulse Forming Network
PIN	Positive Intrinsic Negative
PLD	Programmable Logic Device
PLL	Phase Lock Loop
PPM	Parts per million
Q	Quadrature
RA	Resolution Advisory
RF	Radio Frequency
RTCA	Radio Technical Commission for Aeronautics
RX	Receiver
SPDT	Single Pole Double Throw
TA	Traffic Advisory
TCAS	Traffic Collision Avoidance System
TIS-B	Traffic Information Service-Broadcast
TSO	Technical Standard Order
TTL	Transistor-Transistor Logic
TX	Transmitter
µs	Micro second
UUT	Unit Under Test
VAC	Volts Alternating Current
VNA	Vector Network Analyzer
V_{RMS}	Volts root means squared
W	Watts
WS	Whisper Shout
XPDR	Transponder

GENERAL INFORMATION

Applicable documents

Industry Standards

RTCA DO-160D	Environmental Conditions and Test Procedures for Airborne Equipment
RTCA/DO-178B	Software Considerations In Airborne Systems and Equipment Certification
RTCA/DO-181A	Minimum Operational Performance for Air Traffic Control Radar Beacon System/Mode Select (ATCRBS/MODE S) Airborne Equipment
RTCA/DO-185A	Minimum Operational Performance Standards (MOPS) for TCAS Airborne Equipment
RTCA/DO-260A	Minimum Operational Performance Standards for 1090 MHz Automatic Dependent Surveillance – Broadcast (ADS-B) and Traffic Information Services (TIS-B)

FEDERAL AVIATION ADMINISTRATION (FAA)

TSO C119b	TCAS Airborne Equipment, TCAS II

FEDERAL COMMUNICATIONS COMMISSION (FCC)

CFR Title 47	Telecommunications
Part 2	Frequency Allocation and Radio Treaty Matters; General Rules and Regulations
2.925	Identification of Equipment
2.1033	Application for certification
(b) 1, 2,3,4,5	
(c) 1,2,3,4,5,6,7,8,9,10,11,12,13	
Part 87	Aviation Services
87.139	Emission Limitations

National Telecommunications and Information Administration (NTIA)

Manual of Regulations and Procedures for
Federal Radio Frequency Management (Redbook)

Annex J	Guidelines for Determining of Necessary Bandwidth

Applicable documents (cont'd)

Honeywell Int'l Inc.

722-4442-310	Schematic, IHAS IOM PROC BOARD
722-4477-305	Schematic,, Front Interconnect
722-4489-310	Schematic, SYNTH IF Module
722-4490-305	Schematic, Front End
722-4506-312	Schematic, Transmitter
722-4621-305	Schematic, Mezzanine Processor
722-4622-302	Schematic, Rear Interconnect
722-4710-306	Schematic, Power Supply

UUT Description

Unit Part Number	940-0530-001
Serial Numbers	TPL00207 and TPL00210
Mod Status	1 through 6
Flight Software Load	66
ATP Software Load	503

Technical Description

Emission Designator

20M0V1D (1030 MHz Mixed Pulse Amplitude Modulation (PAM) and Differential Phase Shift Keying (DPSK) from Mode S Transponder)
20M0K1D (1030 MHz Mode C Transponders)
7M60M1D (1090 MHz Mode S Transponder/Data Link)

Frequency Range

Transmitter:	1030 ± 0.01 MHz / 1090 ± 0.10 MHz
Receiver:	1090 ± 3.0 MHz / 1030 ± 0.2 MHz

Range of Operating Power

Each of 4 ports:	46.5 ± 2.0 dBm
	28.2 to 70.8 W
Total Power:	52.5 ± 2.0 dBm
	178 to 282 W

Maximum Power Rating

Total:	+54.5 dBm
Per Port:	+48.5 dBm

The maximum output power required is that specified for satisfactory operation per RTCA/DO-185A MOPS.

Maximum RF Output Power: 400 W

Transmitter DC Voltages and Currents

The following voltages and currents exist on the TCAS Transmitter Module:

Applicable Stage	Supply Voltage	Supply Current
Output Stage	+32VDC	15.0A
Driver Stage #2	+26VDC	0.400A
Driver Stage #1	+5V Pulse	0.030A

Please refer to the description of the TCAS Transmitter Modules and related circuits in TPL-100A Theory of Operation section of this report.

Function of Active Devices

The following devices are used in the TPL-100A Transmitter:

Reference Symbol	Function	MFG P/N	Honeywell P/N
U5,U9,U11,U15	Amplifier	MSA-2643	322-1398-001
U253-256	Pre-driver	MHVIC910HR2	322-1373-001
Q3,Q4,Q9,Q10	Final Amp	BLA1011-200	341-0984-001

Circuit Diagrams

See separate Attachment, “Schematics”, to this report.

Instruction Books

See separate Attachment, “Maintenance Manual”, to this report.

Transmitter Alignment Procedure

There are no alignment manual adjustments for the TPL-100A transmitter. Shown below is the test procedure.

TPL-100A Transmitter Test

1. Introduction

2. Test Panel Setup

2.1 Select board number or type in TX BOARD window.
2.2 Left mouse click in BITE TX3 window, select Current Monitor.
2.3 Drop down menu in DMM SELECT, select 36V supply.
2.4 Enable "TRIGGER", "TX_MOD", "TX_MD2", "TX_ON" signals by selecting buttons to left of each.

3. Continuity Test

Connect transmitter module 722-4506-012 to test fixture and attach all power and RF connections.

3.1 Turn on +7V supply only.
3.2 Check the +7V supply for current limiting.
3.3 Check the Digital Attenuator bits for shorts:
Set attenuators for all channels to maximum attenuation, using the "gang" setting, -31dB.

3.3.1 Load programmable logic device (PLD)
3.3.2 Monitor +7V supply for current limiting

3.4 Check the in-phase quadrature (IQ) digital to analog converter (DAC) bits for shorts:

3.4.1 Set all bits to DACs by loading "128" in the in-phase (I) and quadrature (Q) fields and "gang" all DACs.
3.4.2 Load PLD
3.4.3 Monitor +7V supply for current limiting

4. Set Timing, Set Driver and Output Bias Levels:

4.1 Enable "TRIGGER", "TX_MOD", "TX_MD2", "TX_ON" signals by selecting buttons to left of each.
4.2 Go to OPERATE drop down menu, select SETUP, disable remaining two columns, go back to OPERATE.
4.3 Set timing column1 to 2µs, column2 to 500nS, column3 to 800nS, column4 to 750nS, column5 to 2 µs
4.4 Adjust bias control for each driver and output stage, using slider or rocker switch to set proper bias.
4.5 Record bias current and bit setting for driver and output of each channel

Bias Control Procedure

1. Turn on external +7V and +36V power supplies
2. Enable TX_ON and TX_MOD by selecting buttons to left of each.
3. Disable all timing columns except column 6 (AM mod). Go to OPERATE drop down menu, select SETUP, disable remaining two columns, go back to OPERATE.
4. Set column 6 timing to 4 µs
5. OFF µs window: set period off time to 320 µs
6. N FILTER window: reset filters to 4 samples.
7. Zero and null pulses: select RESET, NULL & SET DELTAS filters buttons.
8. In BIAS CONTROL REGISTER: Set each driver (DRVR) and each output (OUTP) stage one at a time.
9. Enable AUTO located in BIAS CONFG area.
10. Select LOAD FIFO then CONFIG/START

5. Timing Requirements

Use Crystal Detector with 20dB pad,
Oscilloscope settings: BW @ 20 MHz, 500nS/ Div, 200mV/Div, Avg @ 16 samples
Measurement of risetime, falltime and pulse width:
Rise and fall time measured between 1dB and 20dB below peak power level.
Pulse width measured at 6dB below peak power level.

Spec: Risetime 50 – 100nsec, Fall time, 50 – 200nsec, Pulse Width, 750 – 850nsec

5.1 Set Automatic Gain Control (AGC)-3dB, W/S att. -6dB Ch.1,3 &4
5.2 Set W/S -9dB Ch.2
5.3 Set pulse width to 800nS ("TX_MD2")
5.4 Check rise, fall and pulse width
5.5 Set AGC-3dB, W/S att. -26dB Ch.1,3 &4
5.6 Set W/S -29dB Ch.2.
5.7 Set pulse width to 800nS.
5.8 Check rise, fall and pulse width

6. Power Out:

Spectrum analyzer settings: Freq. 1030 MHz, Span 200 MHz, Res. BW 3 MHz, Swp 3.5s, + offset. Use spectrum analyzer to measure 2nd harmonic.
Assure input to PPM/spectrum analyzer is padded, protected from high power. Use PPM to measure power out and Cal port power.
Cal Port measurements: From CAL CHANNEL window select CHANNEL (1,2,3 or 4) FORWARD

6.1 Set timing 6mS rep, 1µs width
6.2 Set phase to 0
6.3 Set AGC to 6dB Ch. 1,3 & 4
6.4 Set W/S attenuator to 0
6.5 Record data

TX Cal Reverse Path

6.6 Make sure RF is off and that all stages of the amplifier are biased off. Test can be done using either a signal generator and spectrum analyzer or a vector network analyzer (VNA).

6.7 Using external generator, inject 0dBm Continuous Wave (CW) power into the output of each channel and measure the output power at the TX_CAL output connector, J6. Use the tx control software to set the output to each channel return path.

Pulse Droop

Spec: -.5dB max

6.8 Set pulse width to 30µs
6.9 . Set AGC-3dB, W/S att. -6dB Ch.1,3 &4
6.10 Set W/S -9dB Ch.2
6.11 Check pulse droop, in dB, between 1µs and 29µs for each channel

7. Spectrum (ATCRBS)

Measure each channel alone, with all other channels off.

7.1 Set AGC to 3 dB channels 1,3 &4.
7.2 W/S att. to 3 dB channels 1,3 &4.
7.3 W/S att. to 3 dB channel 2.
7.4 Set up spectrum analyzer as follows: Freq: 1030 MHz, Span 200 MHz, Res BW 3 MHz
7.5 Take peak marker reading, set delta marker.
7.6 Set spectrum analyzer lower freq to 970 MHz, upper freq to 990 MHz and Res BW to 100 KHz.
7.7 Take reading at 970 MHz delta marker and 990 MHz delta marker.
7.8 Set spectrum analyzer lower freq to 1070 MHz, upper freq to 1090 MHz and Res BW to 100 KHz.
7.9 Take reading at 1070 MHz delta marker and 1090 delta marker.

8. Relative Phase, Each Ch

Each channel measured alone.
Use AD 8302 phase detector.

8.1 Set AGC to -3dB Ch. 1, 3 & 4
8.2 Set W/S att. to -6 Ch. 1,3 & 4 .
8.3 Ch.2 set to -9dB
8.4 Record voltage setting of phase detector output from scope.

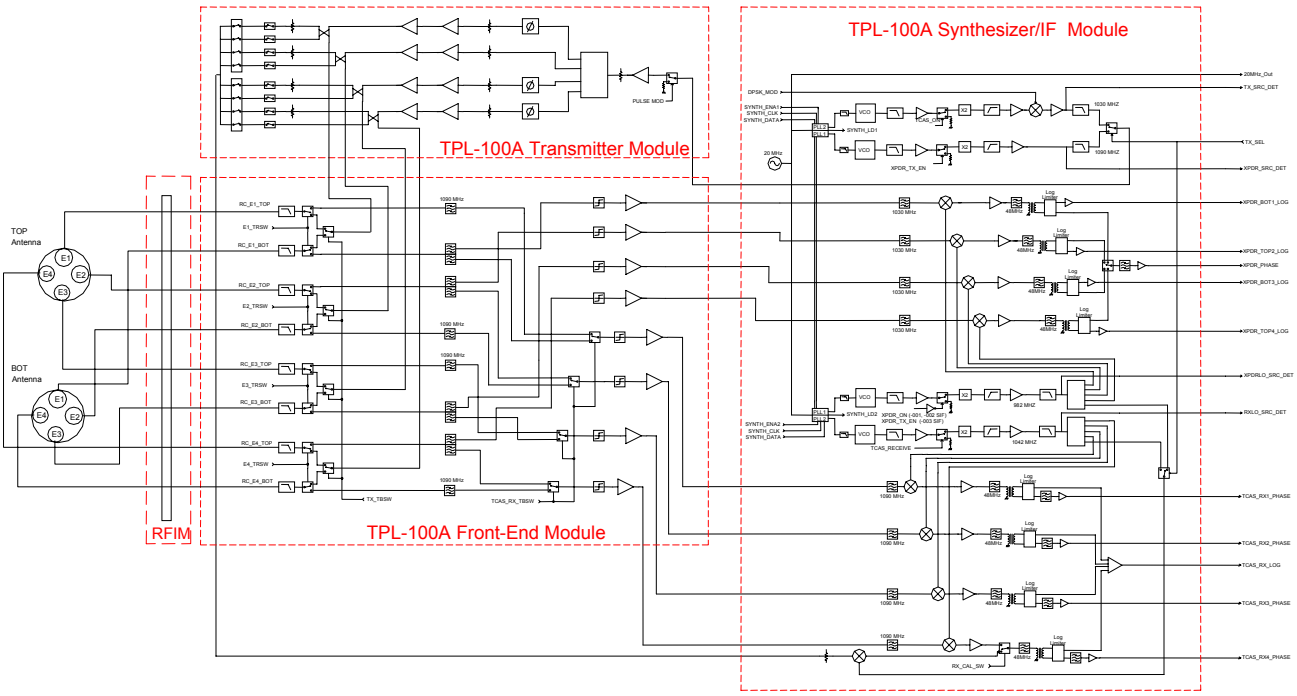
9. Relative Phase, All Chs Coupling to Ch 2

Gang IQ so channels 1,3 &4 change together.

9.1 Set AGC to -3dB Ch. 1, 3 & 4
9.2 Set W/S att. to -6 Ch. 1,3 & 4
9.3 Ch.2 set to -9dB.
9.4 Measure Pout for Ch.2 for phase shift of Ch. 1,3 & 4

TPL-100A RF Theory of Operation

TPL-100A RF Block Diagram

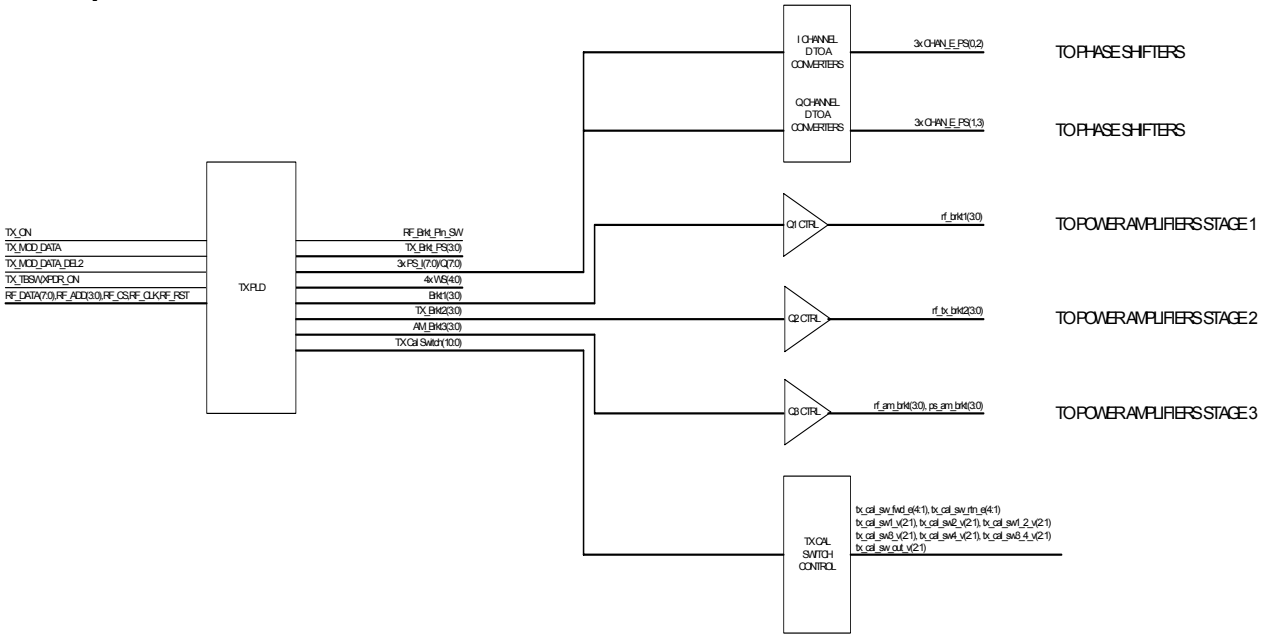


Transmitter Assembly

The transmitter consists of the following primary sub circuits:

- Digital interface control
- RF modulator / pulse forming network
- Four power amplifier channels
- RF amplifier bias control
- Integrated phase shifters
- Integrated Whisper/Shout attenuators
- Transmitter calibration

Digital Interface Control



The digital interface control consists of a PLD, three sets of 8-bit digital to analog converter(s) (DAC), three sets of bias drivers and four quad analog switches.

The PLD contains one-time programmable logic gates configured to drive the phase shifters, digital attenuators, RF power amplifier gates, RF modulation signals and transmitter calibration switches. The PLD inputs are the timing brackets which drive the RF power amplifier gates, 4 address lines, 8 data lines and chip select, clock and reset lines. The output levels of the PLD are 3.3V Transistor-Transistor Logic (TTL).

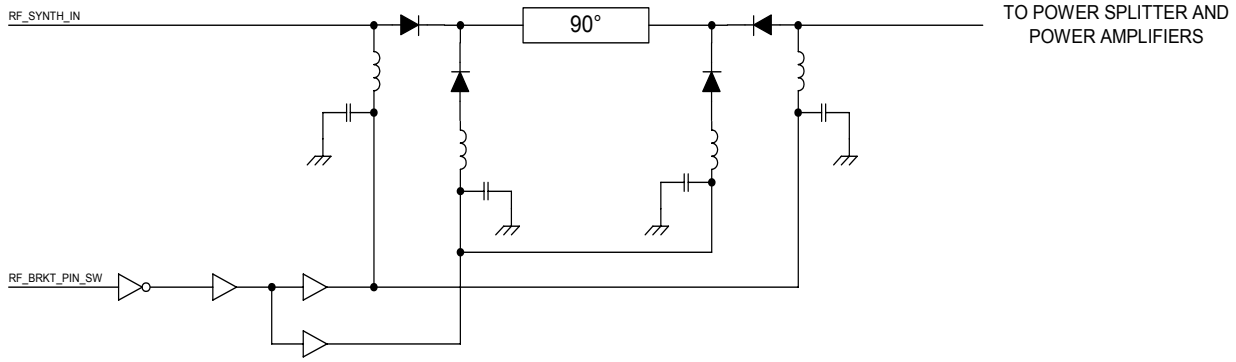
RF channels 1, 3 and 4 contain phase shifters. Channel 2 is the reference channel and does not use a phase shifter. Three pairs of 8-bit DACs control the three RF phase shifters. Each 8-bit DAC controls an I channel or a Q channel of the associated phase shifter.

Each DAC takes a TTL input from the PLD and outputs an analog level to the associated phase shifter in the RF channel.

Bias drivers which take TTL signals from the PLD control the timing of each of the three stages of the power amplifier channels. A current source controls stage 1. A bias control circuit controls the voltage levels at the gates of stages 2 and 3.

The transmitter calibration circuit consists of a network of Monolithic Microwave Integrated Circuit (MMIC) switches controlled using four quad analog switches. The PLD controls the analog switches using a logic map to switch the selected RF path to the calibration output connector.

RF Modulator / PFN

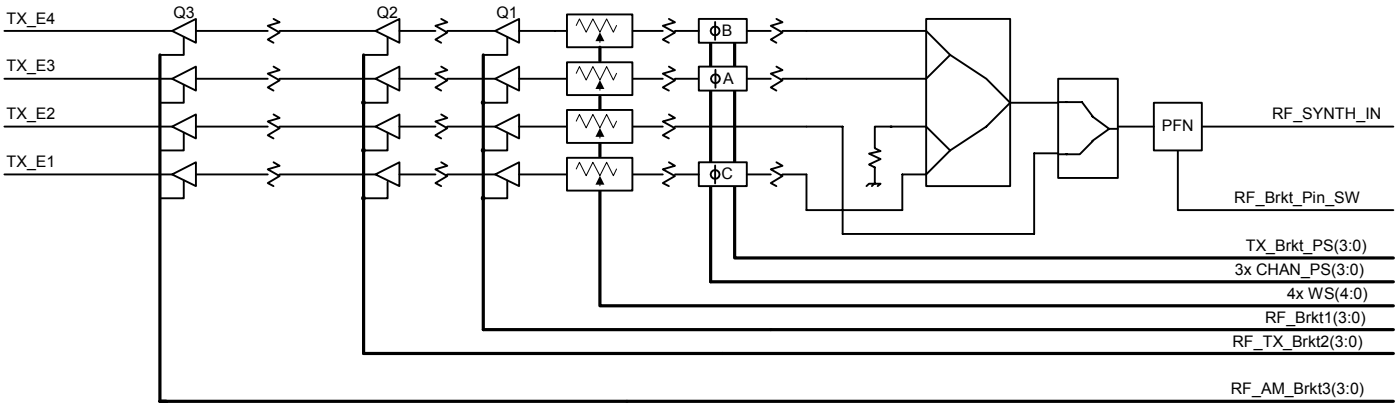


The PFN directly modulates the RF signal generated from the receiver assembly.

The PLD drives a TTL signal to an inverter gate at RF_BRKT_PIN_SW. The inverter gate shifts the voltage level into the PFN and drives the control amplifiers. The control amplifiers drive the PIN diodes of the RF circuit and modulate the RF signal received at RF_SYNTH_IN. The positive-intrinsic-negative (PIN) diodes in the RF circuit attenuate or pass the RF signal as they are activated by the control amplifiers.

The 90 degree phase shift, comprised of lumped components, increases the attenuating capability of the RF circuit.

Four power amplifier channels



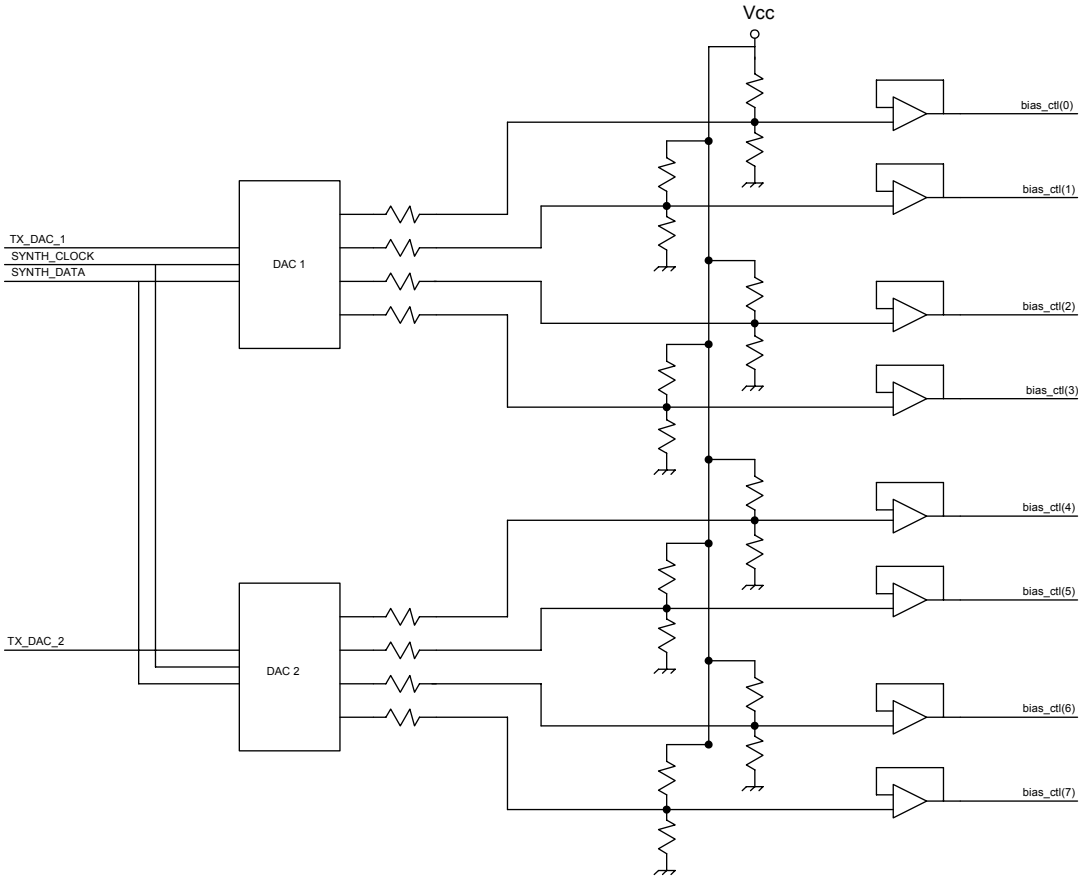
The four power amplifiers comprise 3 stages. Each stage is gated on during the transmit cycle.

The first stage uses a MMIC gain block capable of delivering +9 dbm.

The second stage is a commercial IC which is made up of 3 stages. It is capable of delivering 10 watts of power. The gain is controlled by adjusting the level of each gate voltage driven separately by rf_tx_brkt2(0), rf_tx_brkt2(1), rf_tx_brkt2(2), and rf_tx_brkt2(3) . The gain is adjusted to compensate for temperature variation of the chain. The drain voltage is set to 26 volts.

The output stage is a laterally diffused metal oxide semiconductor (LDMOS) device capable of delivering 200 watts. The gate voltage is adjusted for a drain current of 1.8 amp when no RF signal is present. The gate voltages are independently controlled with rf_am_brkt3(0), rf_am_brkt3(1) , rf_am_brkt3(2), and rf_am_brkt3(3). The drain voltage is set to 32 volts using 4 linear voltage regulators.

RF amplifier bias control



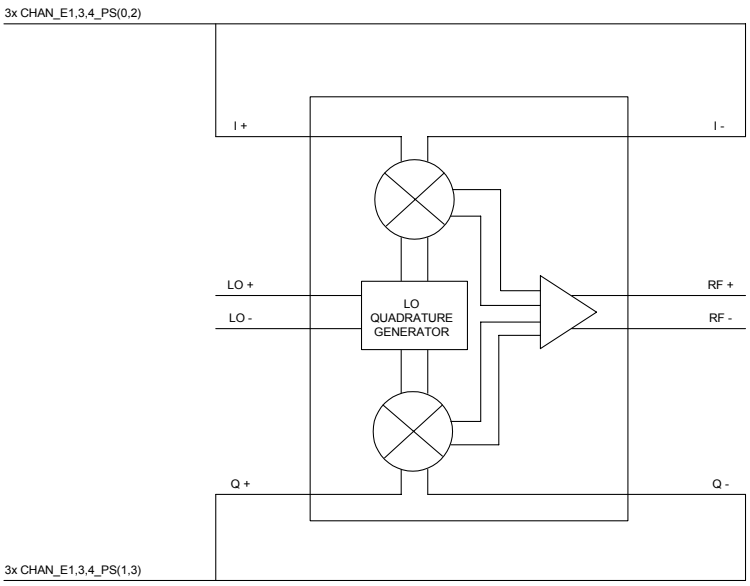
The peak current of the stage 1 IC is set to 27ma using feedback amplifiers Q13, Q14, Q15, and Q16.

The gate signal timing pulses tx_brkt2(0), tx_brkt2(1), tx_brkt2(2), tx_brkt2(3) going to the 2nd stage amplifier MHVIC910HR2 are ac coupled to prevent excessive duration of the transmitted pulse. The level of each gate signal bias_ctl(0), bias_ctl(2), bias_ctl(4), bias_ctl(6) is adjusted by measuring the drain current in each IC. The current is measured by measuring the voltage across R468 (1 ohm). This voltage is proportional to the 26 volt power supply going to the power amplifier.

The gate bias to the output stage is adjusted to control the drain current. The power supply voltage to the metal-oxide semiconductor field-effect transistor (MOSFET) driver is adjusted to control the 4 gate bias lines (bias_ctl(1), bias_ctl(3), bias_ctl(5), bias_ctl(7)) . The gate bias is ac coupled to prevent CW transmission in the case of a digital fault. The drain current is measured by measuring the voltage across 1 ohm resistor, R468.

Software turns on each stage individually to make current measurements.

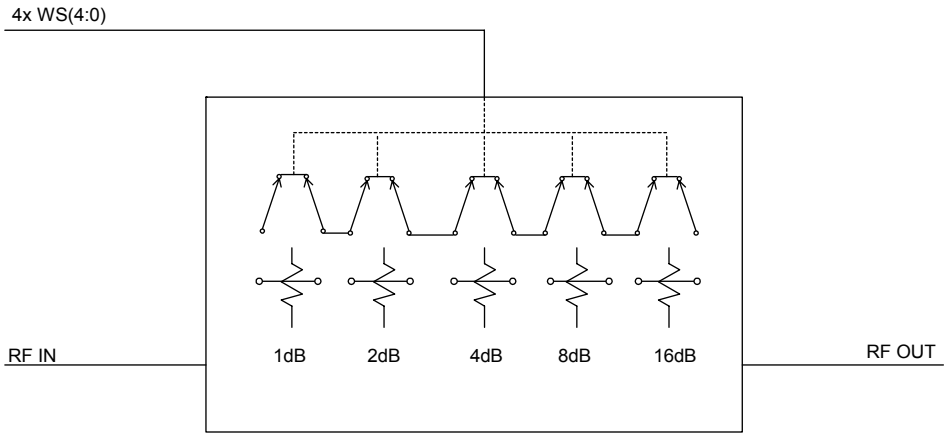
Integrated phase shifters



The 3 phase shifters use I/Q modulators to adjust the phase. The Q and I input levels are differential signals coming from 8 bit DACs.

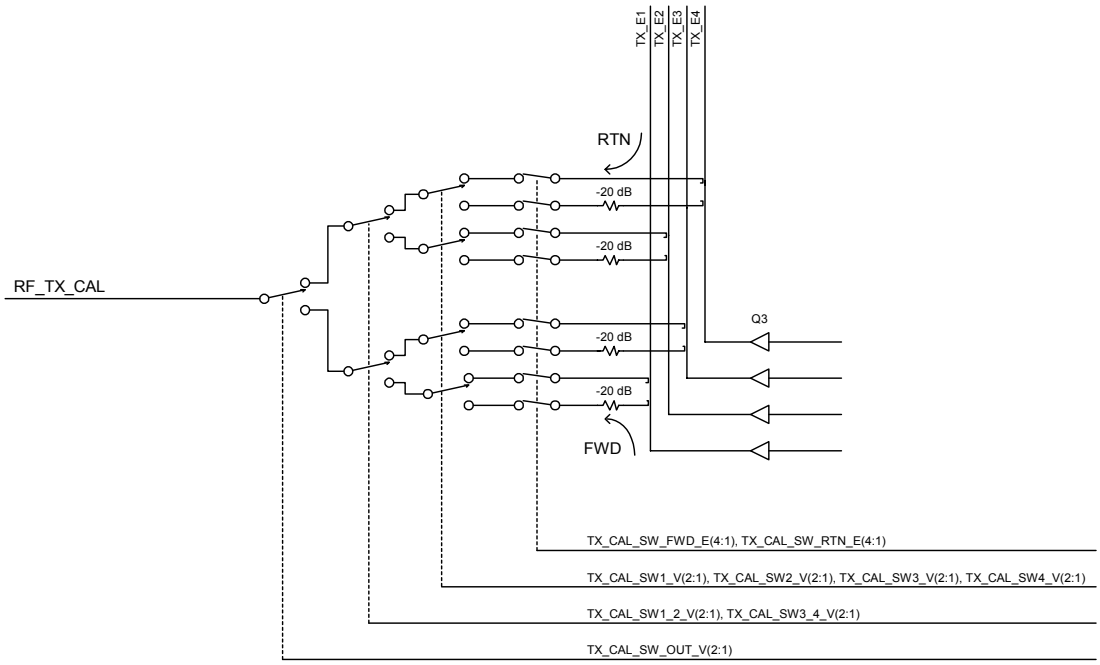
The I and Q input signals also adjust the gain by up to 6 db. They are labeled chan_e1_ps(3:0) ,chan_e3_ps(3:0), chan_e4_ps(3:0). The phase shifters are turned on only during the transmit cycle by TTL signals rf_tx_brkt_ps(0), rf_tx_brkt_ps(2), and rf_tx_brkt_ps(3).

Integrated WS attenuators



Each of the four power amplifier channels uses a WS attenuator. The WS attenuators use a commercial MMIC which is a 5-bit digital attenuator with integral TTL driver. The PLD directly controls the WS attenuator for each channel independently through signals WS_E1(4:0), WS_E2(4:0), WS_E3(4:0) and WS_E4(4:0). The attenuation step size is 1dB and provides 31dB of total attenuation range.

Transmitter calibration



The transmitter calibration network consists of four printed couplers and three sets of MMIC switches.

At the output of each of the four power amplifier channels there is a printed coupler used to sample the RF power level at the output of the transmitter. The forward arm of each coupler contains a 20dB attenuator to protect the MMIC switches in the calibration network.

The first set of MMIC switches are single pole – single throw and switch either the forward or return arm of the printed coupler into the calibration network. These are controlled using the TX_CAL_SW_FWD_E(4:1) and TX_CAL_SW_RTN_E(4:1) signals.

The second set of MMIC switches selects the channel which is to be calibrated. These are controlled using the TX_CAL_SW1_V(2:1), TX_CAL_SW2_V(2:1), TX_CAL_SW3_V(2:1) and TX_CAL_SW4_V(2:1) signals.

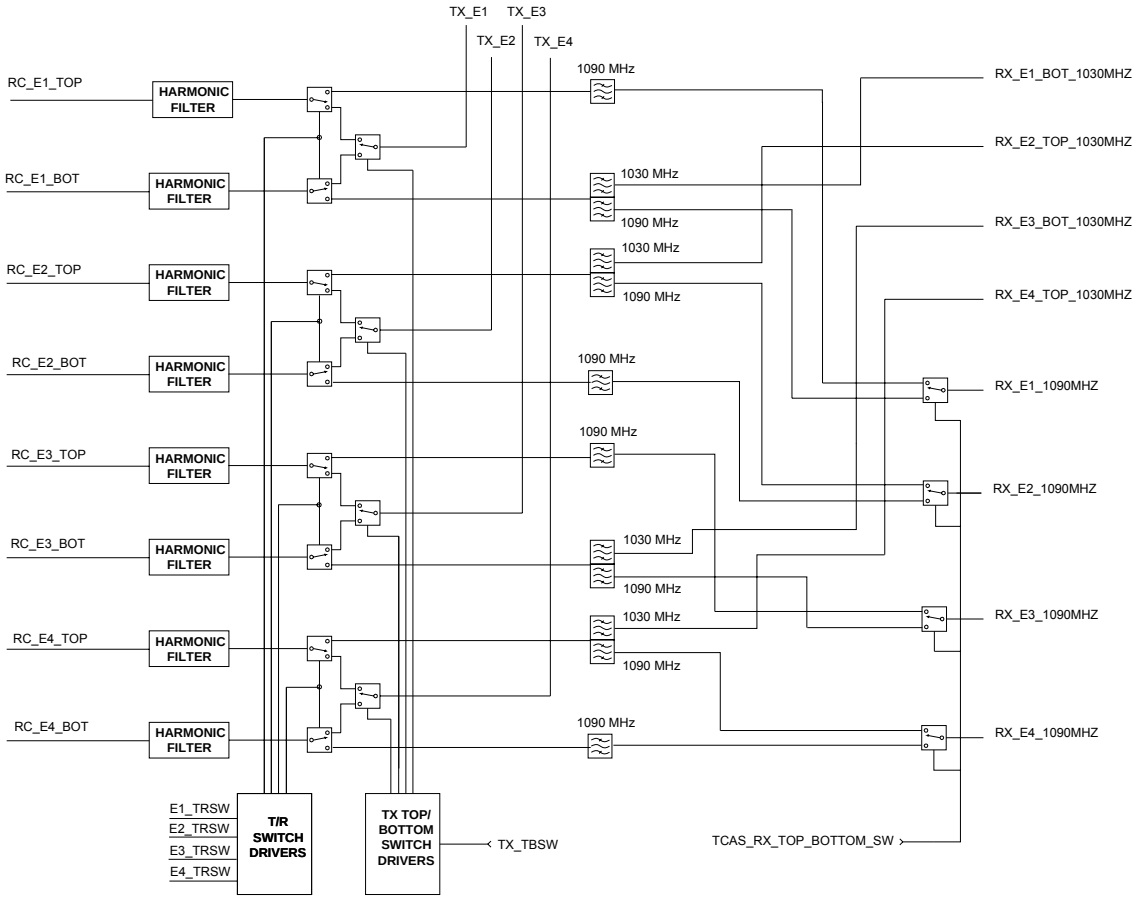
The third set of MMIC switches connects the selected channel to the output connector. These are controlled using the TX_CAL_SW1_2_V(2:1) and TX_CAL_SW3_4_V(2:1) and TX_CAL_SW_OUT_V(2:1) signals.

Receiver Assembly

The receiver consists of the following primary sub circuits.

- RF Switch
- LNA
- IF
- Synthesizer

RF Switch



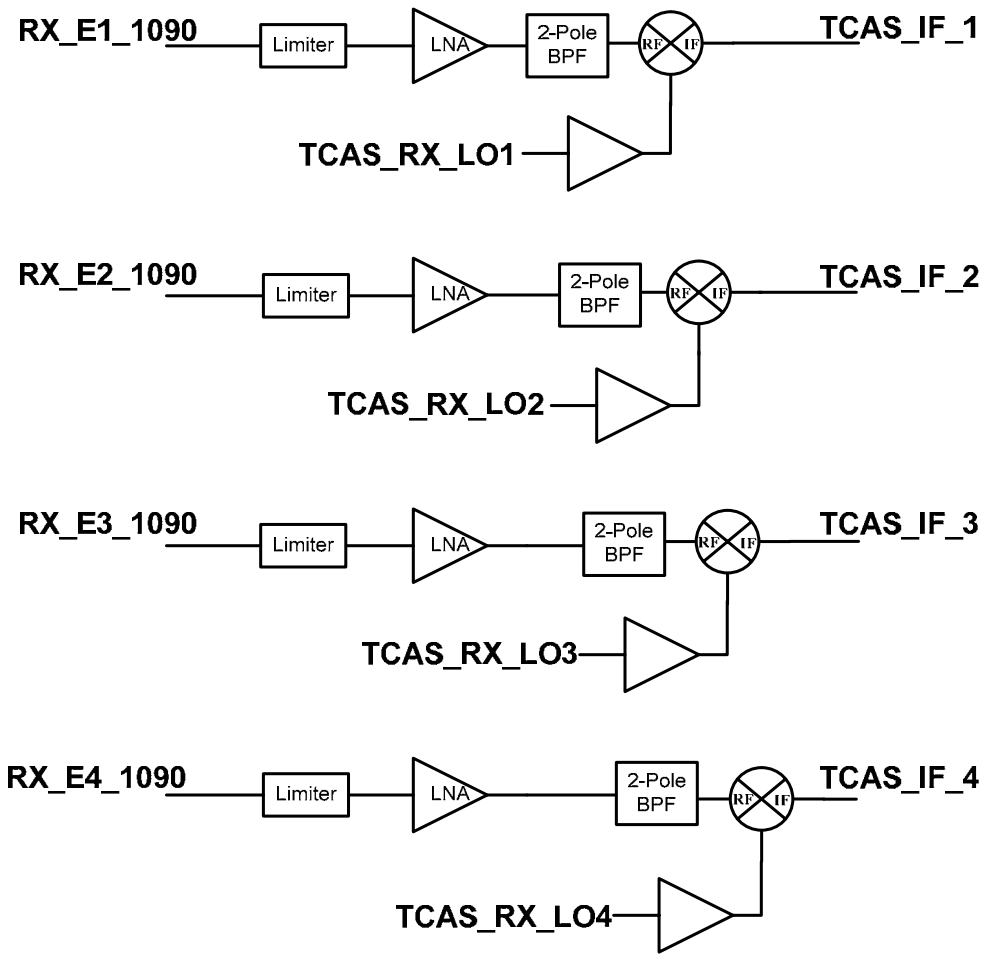
The RF switch section contains the transmit top/bottom antenna switch, transmit/receive switch, TCAS receive top/bottom switch, transmit top/bottom switch drivers, and transmit/receive switch drivers. The RF switches consists of an arrangement of one-quarter wavelength microstrips with pin diodes that provide multiple RF signal pathways. The transmit top/bottom switch has common control for the four channels and the transmit/receive switch has individual control for each channel. Each of the eight antenna inputs has a harmonic filter before the RF switches.

The transmit/receive switching elements are controlled individually by four power MOSFET drivers and are controlled by the logic signals E1_TRSW, E2_TRSW, E3_TRSW, and E4_TRSW. The transmit TOP/BOTTOM switching elements are controlled by logic signal TX_TBSW. Switching time is 400 nanoseconds (ns), or less. The transmit top/bottom switch provides 20 dB minimum isolation between elements. The transmit/receive switch provides 20 dB minimum isolation between paths.

The RF Switch section also contains the first stage of filtering for the receive signals. High-Q ceramic 2-pole bandpass filters are used in each receive signal path to attenuate out of band signals.

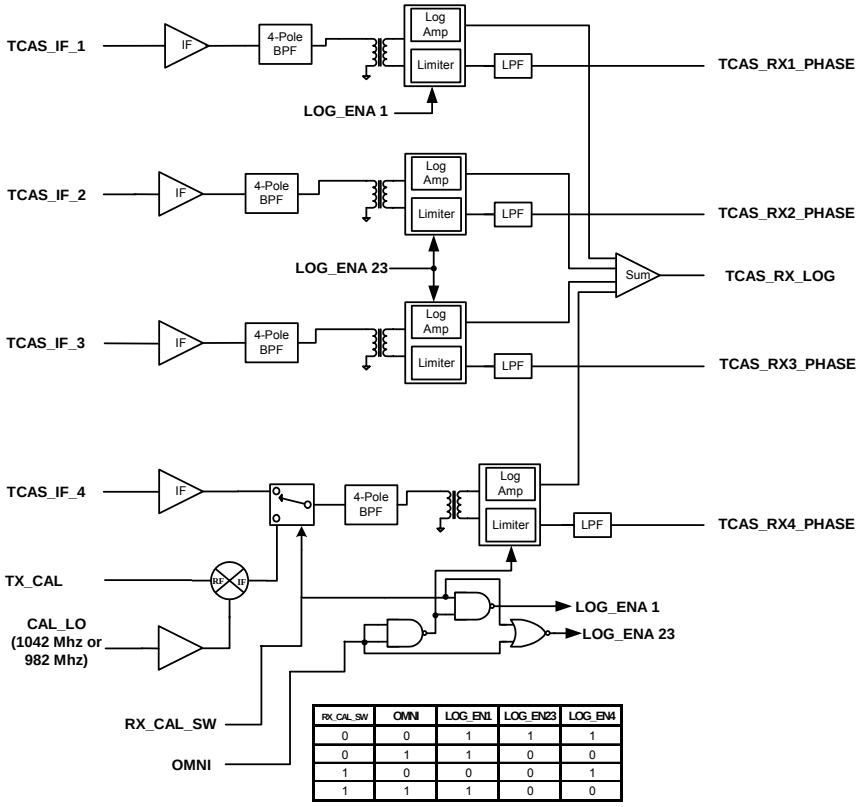
RX_ Ex_1030MHz and RX_Ex_1090MHz signals are then routed to the Limiter/LNA sections of the receiver. TX_E1 through TX_E4 are each routed to a connector that brings in the transmit signal from the transmitter module.

Rx 1090 MHz - LNA



The LNA section is shown. This section includes a limiter, LNA and 1090 MHz bandpass filtering for the input RF signals for the four receiver channels. This section rejects image frequencies and any other noise outside the selected band. The low-level received signals in each receiver channel are boosted to a higher level by the LNA, and then filtered by filtered by high-Q ceramic 2-pole bandpass filters,. A diode limiter circuit is used for protection from high input power. The 1090 MHz received signal is mixed with the 1042 MHz RX_LO (1-4) to produce the 48 MHz IF output for each channel that is sent to the IF section. Each 1042 MHz RX_LO signal is applied to a RF gain block amplifier to apply proper signal strength for the mixers.

Rx 1090 MHz – IF

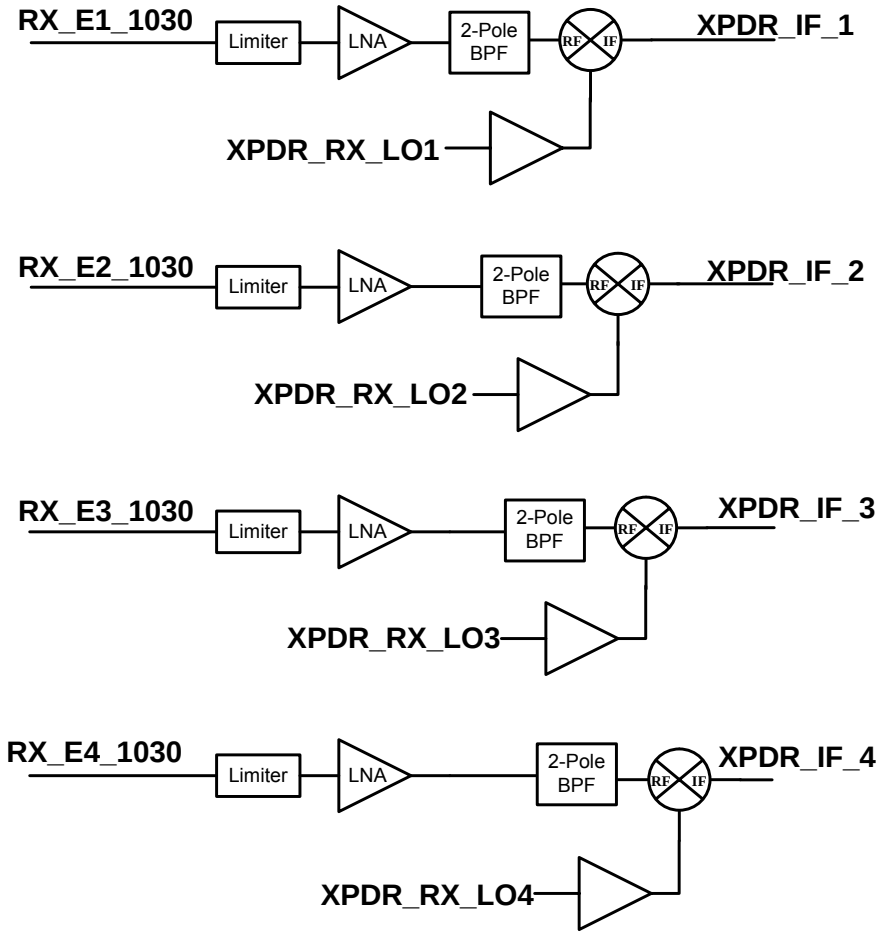


RX_CAL_SW	OMNI	LOG_EN1	LOG_EN23	LOG_EN4
0	0	1	1	1
0	1	1	0	0
1	0	0	0	1
1	1	1	0	0

The IF section, shown in block diagram, provides an additional stage of amplification for each of the four receiver channels provides additional filtering for the 48MHz IF signals, and divides each channel into limited video to the digital module, and a summed log signal to the digital module.

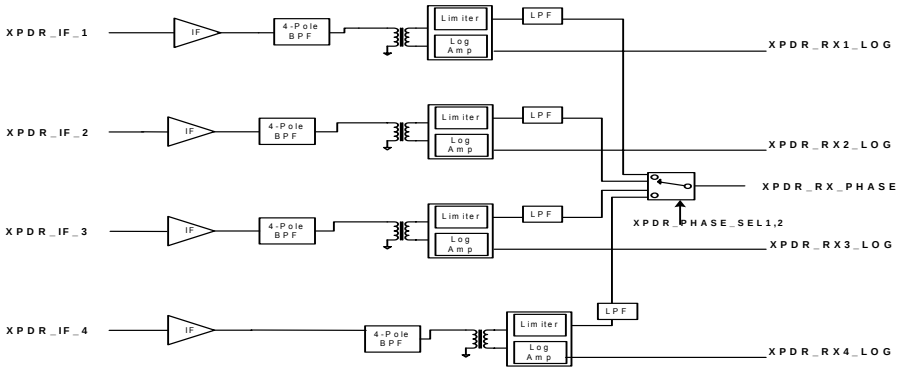
The IF inputs from the LNA section (TCAS_IF_1, IF_2, IF_3, and IF_4), that are received replies from the antenna are each amplified and filtered through a 4-pole band pass filter (BPF). The IF_4 signal differs from the other channels in there is a single pole double throw (SPDT) which can route in the TX_CAL signal for transmitter calibration of 1090 MHz and 1030 MHz transmissions. These signals are then applied to a limiting-logarithmic amplifier. A lumped element low pass filter (LPF) further filters the limiting signal. Each log amplifier produces an output that is a logarithmic function of its input. The outputs from the four log amplifiers are applied to a log summer and buffer circuit, which produces a negative pulse output scaled to 20 millivolts (mV) per dB. The TCAS_RX_LOG output is routed to the digital module where it is decoded to determine range and altitude.

Rx 1030 MHz - LNA



The LNA is shown. This section includes LNA and 1030 MHz bandpass filtering for the input RF signals for the four receiver channels. This section rejects image frequencies and any other noise outside the selected band. The low-level received signals in each receiver channel are boosted to a higher level by the LNA, and then filtered by high-Q ceramic 2-pole bandpass filters. A diode limiter circuit is used for protection from high input power. The 1030 MHz received signal is mixed with the 982 MHz RX_LO (1-4) to produce the 48 MHz IF output for each channel that is sent to the IF section. Each 982 MHz RX_LO signal is applied to a RF gain block amplifier to apply proper signal strength for the mixers.

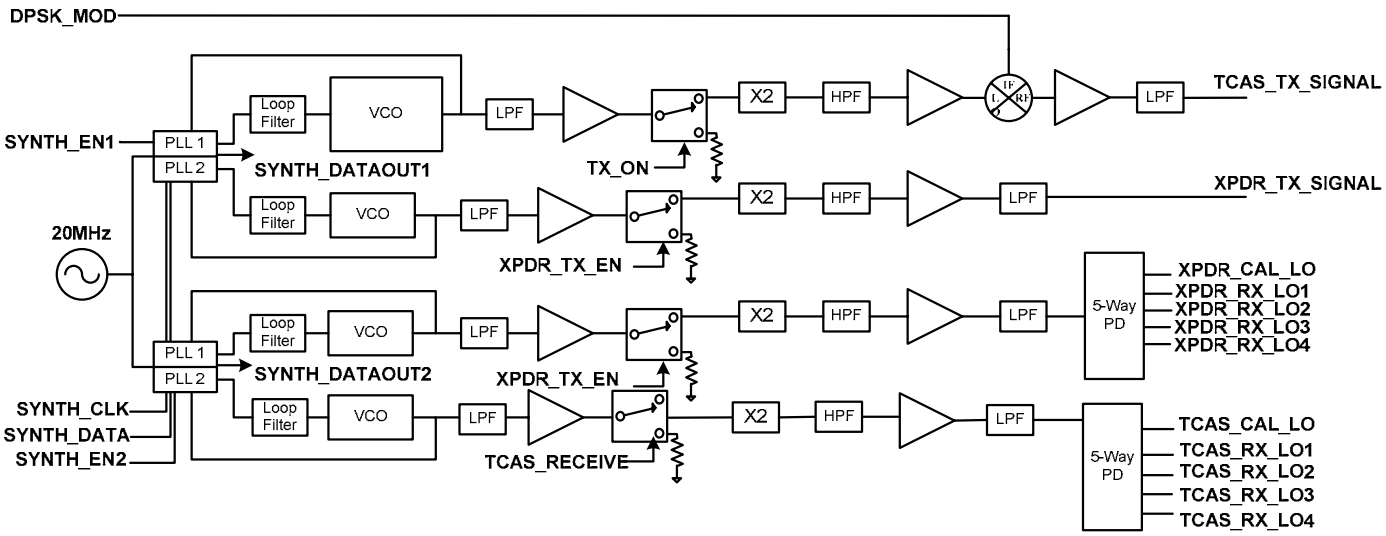
Rx 1030 MHz - IF



The IF section, shown in block diagram, provides an additional stage of amplification for each of the four Transponder receiver channels provides additional filtering for the 48MHz IF signals and divides each channel into limited video to the digital module, and a summed log signal to the digital module.

The IF inputs from the LNA section (XPDR_IF_1, IF_2, IF_3, and IF_4) that are received replies from the antenna are each amplified and filtered through a 4-pole BPF. These signals are then applied to a limiting-logarithmic amplifier. A lumped element LPF further filters the limiting signal. Each log amplifier produces an output that is a logarithmic function of its input. The outputs from the four limiter amplifiers are selected by a switch and the XPDR_RX_PHASE signal is routed to the digital module where it is decoded along with the four XPDR_RX_LOG outputs.

Tx and Rx Synthesizers



The synthesizer, shown in block diagram, produces the TX_SIGNALs, CAL_LOs, TCAS_RX_LO (1-4), XPDR_RX_LO (1-4) and 20 MHz. The TCAS_TX_SIGNAL generates the following frequencies, 1030MHz (TCAS_TX_SIGNAL), 1087MHz, 1090MHz, and 1093MHz (XPDR_TX_SIGNAL) as selected by TX_SEL to the transmitter. The calibration LO (CAL_LO) frequency is 982 MHz (XPDR_CAL_LO) or 1042 MHz (TCAS_CAL_LO) as selected by TX_SEL. The transponder receiver LO (XPDR_RX_LOx) frequency is 982MHz. The TCAS receiver LO (TCAS_RX_LOx) frequency is 1042MHz.

Each signal is generated from a single 20 MHz crystal oscillator, which is installed in an oven for precise performance over a wide range of operation temperatures. The 20 MHz signal is applied to two separate dual Phase Lock Loop (PLL) IC. Each PLL circuit operates a voltage controlled oscillator with a loop filter to generate the synthesized frequency. The synthesized frequencies are 521MHz for the TCAS_RX_LO, 545 MHz for the XPDR_TX_SIGNAL, and 491 MHz for the XPDR_RX_LO. The TCAS_TX_SIGNAL can generate four different synthesized frequencies, 515, 543.5, 545, and 546.5 MHz, depending on transmitter operation.

The following synthesized signals TCAS_TX_SIGNAL, XPDR_TX_SIGNAL, XPDR_RX_LO, and TCAS_RX_LO are applied to hybrid LPF and RF gain block. A single pole double throw (SPDT) RF switch is used as an on-off switch. The switch's second output is an RF termination. This is controlled by a TTL signal for each synthesized frequency. The synthesized frequency is then doubled to obtain the output frequency. It is filtered with a hybrid band pass filter (HBF) and isolated with RF gain block.

The TCAS_TX_SIGNAL is routed to the DPSK mixer, where it can be mixed with a modulated DPSK signal that is generated by 250ns pulse square wave with a 50% duty cycle from the digital module. An additional RF gain stage is used for isolation and then the signal is further filtered by hybrid LPF and then sent directly to the transmitter module.

The XPDR_RX_LO and TCAS_RX_LO frequencies are filtered by a hybrid LPF. Each signal is routed to the calibration mixer and the RX_LO is split into five signals by an RF power divider. Four of these signals become Local Oscillator(s) (LO)s for the main receive channels. The fifth signal from each divider is routed to the cal mixer.

The 20MHz signal from the oven controlled crystal oscillator (OCXO) is buffered and then routed through the Front Interconnect to the digital module.

TPL Modulation Scheme

1090Mhz Mode S Transmissions

Pulse Position Modulation

4 Pulse Preamble

Pulse width	0.5 usecs
Pulse position	0, 1, 3.5, and 4.5 usecs
Rise/Fall time	50-100/50-200 nsecs.

56 or 112 Data Bits (Manchester encoding)

Pulse width	0.5 usecs
Data rate	1Mhz
Pulse position	"1" – first 0.5 usec data chip "0" – second 0.5 usec data chip
Rise/Fall time	50-100/50-200 nsecs.

1090Mhz Mode A/C Transmissions

Pulse Position Modulation

2 Framing Pulses positioned at 0 and 20.3 usecs

Up to 13 data pulses positioned every 1.45usecs between framing pulses.

1 SPI pulse positioned at 24.65 usecs

Pulse width	0.45 usecs
Rise/Fall time	50-100/50-200 nsecs.

1030Mhz Mode A/C Transmissions

Pulse Position Modulation

5 Pulse spacing	@ 0, 2, 4, 21, 23 usecs for Mode C @ 0, 2, 4, 8, 10 usecs for Mode A.
Pulse width	0.8 usecs.
Rise/Fall time	50-100/50-200 nsecs.

1030Mhz Mode S Transmissions

Pulse Position/DPSK Modulation

Pulse Position Modulation

P1, P2, and P6 pulses positioned at 0, 2, and 3.5 usecs

P1/P2 Pulse width	0.8 usecs for P1 and P2
P6 Pulse width	16.25 usecs for 56 Bit message 30.25 usecs for 112 Bit message.
Rise/Fall time	50-100/50-200 nsecs.

DPSK Modulation

Modulation rate and type	4Mhz DPSK during P6
Preamble	7 bits "0000010" at start of P6
Data rise time	<80 nsecs while maintaining spectral limits.

Identification Plate

LRU Photographs

6 MCU

Test Procedures and Data

Interrogation Test Modes

The TPL-100A uses the following test modes for making transmitter measurements.

1. Mode S Test Mode 1 - A Mode S interrogation format with a short P6 pulse, but containing a data block whose bit values are all ONE. The interrogation rate is 50 per second, nominal.

2. Mode S Test Mode 2 - A Mode S interrogation format with a long P6 pulse, but containing a data block whose bit values are all ONE. The interrogation rate is 50 per second, nominal.

3. Mode S Test Mode 3 - A Mode S interrogation format with a long P6 pulse containing no internal modulation (i.e., no sync or data phase reversals). The interrogation rate is 50 per second, nominal.

4. Mode C Test Mode 1 - A standard Mode C only all-call interrogation at a rate of 50 per second, nominal.

5. Whisper-Shout Test Mode 2 - A standard high resolution whisper-shout sequence for the minimum TCAS as defined in DO-185A subparagraph 2.2.4.5.4.1.2 at 10 per second, nominal.

6. No-Interrogation Test Mode - A mode in which the TCAS and Transponder transmitter is programmed to transmit no interrogations but otherwise is active.

7. Transponder, DF19, Mode S Test Mode 1 - A Transponder Mode S long reply format of Downlink Format 19, DF19.

RF Power Output – Transmitter @ 1030 MHz

Test Procedure:

The TPL-100A peak pulse power was measured at each of the four antenna ports while in interrogation test mode 2. The data is shown below.

Test Limits:

Each of four ports:	+46.0dBm ± 2.0dB
Total power output:	+52.0dBm ± 2.0dB

Test Results:

Antenna Port E1:	47.9 dBm	61.7 watts
Antenna Port E2:	46.7 dBm	46.8 watts
Antenna Port E3:	47.5 dBm	56.2 watts
Antenna Port E4:	46.0 dBm	39.8 watts
Total Power output:	53.1 dBm	204.5 watts

Pulse Characteristics – Transmitter @ 1030 MHz

Test Procedure:

The TPL-100A pulse characteristics were measured while operating in interrogation test modes 1, 2, and 4. The data is shown below.

Test Limits:

Mode C Only "All-Call" (P1, P2, P3, P4)

Pulse Duration:		0.800 ± 0.050 µs
Rise Time:		0.050 to 0.100 µs
Decay Time:		0.050 to 0.200 µs
Pulse Spacing:	P1 to P2	2.000 ± 0.100 µs
	P1 to P3	21.000 ± 0.100 µs
	P3 to P4	2.000 ± 0.040 µs

Mode S

Pulse Duration:	P1, P2	0.800 ± 0.050 µs
	P6 (short)	16.250 ± 0.050 µs
	P6 (long)	30.250 ±0.125 µs
Rise Time:		0.050 to 0.100 µs
Decay Time:		0.050 to 0.200 µs
Pulse Spacing:	P1 to P2	2.000 ± 0.040 µs
	P2 to Sync Phase Reversal	2.750 ± 0.040 µs
	P6 Leading Edge to Sync Phase Reversal	1.250 ± 0.040 µs

Test Results:

Mode C Only "All-Call" (P1, P2, P3, P4)

		P1	P2	P3	P4	
Pulse Duration:		0.818	0.811	0.815	0.820	µs
Rise Time:		0.088	0.090	0.093	0.085	µs
Decay Time:		0.101	0.079	0.102	0.103	µs
Pulse Spacing:	P1 to P2	2.01 µs				
	P1 to P3	21.0 µs				
	P3 to P4	1.98 µs				

Mode S

		P1	P2	P6	
Pulse Duration:	P1, P2	0.794	0.800		µs
	P6 (short)			16.30	µs
	P6 (long)			30.30	µs
Rise Time:		0.097	0.090	0.090	µs
Decay Time:		0.105	0.102	0.104	µs
Pulse Spacing:	P1 to P2	1.99 µs			
	P2 to Sync Phase Reversal	2.73 µs			
	P6 Leading Edge to Sync Phase Reversal	1.24 µs			

RF Power Output - Transmitter @ 1090 MHz

Test Procedure:

The TPL-100A peak pulse power was measured at each of the four antenna ports at the LRU; Transponder, DF19, Mode S Test Mode 1. The data is shown below:

Test Limits:

Total power output: +57.0dBm ± 3.0dB

Test Results:

XPDR Mode S Pulse Chars	Unit	Lower	Result	Upper	Status	Watts
Top 1 Max Pulse Power	dBm	N/A	49.10	N/A	PASS	81.283
Top 2 Max Pulse Power	dBm	N/A	47.65	N/A	PASS	58.210
Top 3 Max Pulse Power	dBm	N/A	48.5	N/A	PASS	70.794
Top 4 Max Pulse Power	dBm	N/A	48.95	N/A	PASS	78.523
Total Power	Watts					288.81
Total Power	dBm					54.61

Pulse Characteristics – Transmitter @ 1090 MHz

Test Procedure:

The TPL100A pulse characteristics were measured; Transponder, DF19, Mode S Test Mode 1. The data is shown below:

Test Limits:

DF-19 all pulses

Pulse Duration: 0.500 ± 0.050 μs

Rise Time: 0.050 to 0.100 μs

Decay Time: 0.050 to 0.200 μs

DF-19 Preamble Pulse Spacing:

P1 to P2 1.000 ± 0.050 μs

P1 to P3 3.500 ± 0.050 μs

P1 to P4 4.500 ± 0.050 μs

DF-19 Data Pulse Spacing:

P1 to S1 8.000 ± 0.050 μs

Test Results:

Bot 1 P1-P2 Pulse Spacing	µs	0.967
Bot 1 P1-P3 Pulse Spacing	µs	3.499
Bot 1 P1-P4 Pulse Spacing	µs	4.471
Bot 1 P1-S1 Pulse Spacing	µs	8
Bot 1 P1 Pulse Width	µs	0.46717
Bot 1 P1 Rise Time	ns	64.514
Bot 1 P1 Fall Time	ns	157.14
Bot 1 P2 Pulse Width	µs	0.49007
Bot 1 P2 Rise Time	ns	79.128
Bot 1 P2 Fall Time	ns	155.05
Bot 1 P3 Pulse Width	µs	0.46711
Bot 1 P3 Rise Time	ns	67.543
Bot 1 P3 Fall Time	ns	161.66
Bot 1 P4 Pulse Width	µs	0.49123
Bot 1 P4 Rise Time	ns	79.502
Bot 1 P4 Fall Time	ns	161.4
Bot 1 S1 Pulse Width	µs	0.4671
Bot 1 S1 Rise Time	ns	66.52
Bot 1 S1 Fall Time	ns	160.74
Top 2 P1-P2 Pulse Spacing	µs	0.969
Top 2 P1-P3 Pulse Spacing	µs	3.497
Top 2 P1-P4 Pulse Spacing	µs	4.469
Top 2 P1-S1 Pulse Spacing	µs	8
Top 2 P1 Pulse Width	µs	0.45816
Top 2 P1 Rise Time	ns	73.454
Top 2 P1 Fall Time	ns	163.86
Top 2 P2 Pulse Width	µs	0.48059
Top 2 P2 Rise Time	ns	85.623
Top 2 P2 Fall Time	ns	163.12
Top 2 P3 Pulse Width	µs	0.45802
Top 2 P3 Rise Time	ns	74.967
Top 2 P3 Fall Time	ns	167.21
Top 2 P4 Pulse Width	µs	0.48096
Top 2 P4 Rise Time	ns	85.932
Top 2 P4 Fall Time	ns	170.69
Top 2 S1 Pulse Width	µs	0.45816
Top 2 S1 Rise Time	ns	75.043
Top 2 S1 Fall Time	ns	169.06
Bot 3 P1-P2 Pulse Spacing	µs	0.969
Bot 3 P1-P3 Pulse Spacing	µs	3.5
Bot 3 P1-P4 Pulse Spacing	µs	4.471
Bot 3 P1-S1 Pulse Spacing	µs	8
Bot 3 P1 Pulse Width	µs	0.46752
Bot 3 P1 Rise Time	ns	72.667
Bot 3 P1 Fall Time	ns	158.87
Bot 3 P2 Pulse Width	µs	0.49006
Bot 3 P2 Rise Time	ns	84.518
Bot 3 P2 Fall Time	ns	158.59
Bot 3 P3 Pulse Width	µs	0.46801
Bot 3 P3 Rise Time	ns	72.796

Test Results (cont'd):

Bot 3 P3 Fall Time	ns	161.11
Bot 3 P4 Pulse Width	µs	0.49145
Bot 3 P4 Rise Time	ns	83.714
Bot 3 P4 Fall Time	ns	163.06
Bot 3 S1 Pulse Width	µs	0.46771
Bot 3 S1 Rise Time	ns	73.377
Bot 3 S1 Fall Time	ns	165
Top 4 P1-P2 Pulse Spacing	µs	0.974
Top 4 P1-P3 Pulse Spacing	µs	3.499
Top 4 P1-P4 Pulse Spacing	µs	4.474
Top 4 P1-S1 Pulse Spacing	µs	8
Top 4 P1 Pulse Width	µs	0.47107
Top 4 P1 Rise Time	ns	60.40
Top 4 P1 Fall Time	ns	155.73
Top 4 P2 Pulse Width	µs	0.49589
Top 4 P2 Rise Time	ns	72.504
Top 4 P2 Fall Time	ns	156.67
Top 4 P3 Pulse Width	µs	0.47183
Top 4 P3 Rise Time	ns	60.998
Top 4 P3 Fall Time	ns	161.64
Top 4 P4 Pulse Width	µs	0.49578
Top 4 P4 Rise Time	ns	71.93
Top 4 P4 Fall Time	ns	159.93
Top 4 S1 Pulse Width	µs	0.47205
Top 4 S1 Rise Time	ns	58.00
Top 4 S1 Fall Time	ns	124.90

Occupied Bandwidth – Transmitter @ 1030 MHz

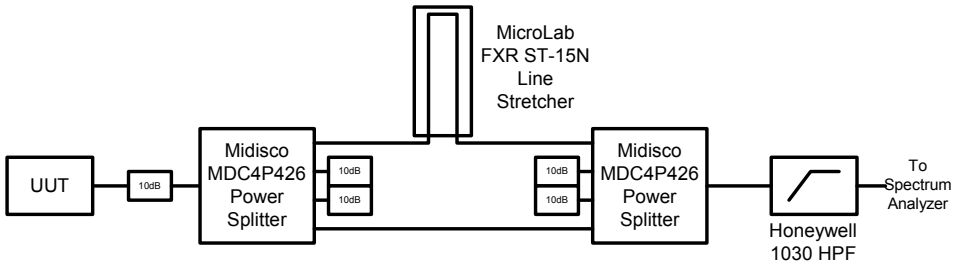
Test Procedure:

Connect each antenna port to a spectrum analyzer through a 60 dB attenuator. Set the spectrum analyzer as follows:

Scan Width : 20 MHz/div
Resolution Bandwidth : 100 KHz for spectrum, 3 MHz for occupied BW
Center Frequency : 1030 MHz
Reference Level : +50 dBm

Program TCAS for Mode S test mode 3 and top antenna. Measure peak power at 1030 MHz. Program TCAS for Mode S test mode 2 and verify proper signal spectrum bounds.

A notch filter was used to prevent the power at 1030 MHz from causing spurious responses in the spectrum analyzer when measuring the 2nd and 3rd harmonics. The filter is shown below as well as its response.



Notch Filter Response	1030 MHz	2060MHz	3090MHz
	-51 dB	-28 dB	-25 dB

Test Limits:

Occupied Bandwidth: < 20 MHz for 99% of transmitted power.

In addition to the Federal Communications Commission (FCC) requirement of Occupied Bandwidth, the MOPS limits the output spectrum per RTCA/DO-185A, Paragraph 2.2.3.3 as shown below:

Frequency Difference (MHz From Carrier)	Maximum Relative Power (dB Down From Peak)
.GE. 4 and .LT. 6	6
.GE. 6 and .LT. 8	11
.GE. 8 and .LT. 10	15
.GE.10 and .LT. 20	19
.GE.20 and .LT. 30	31
.GE.30 and .LT. 40	38
.GE.40 and .LT. 50	43
.GE.50 and .LT. 60	47
.GE.60 and .LT. 90	50
.GE.90	60

Test Results:

The output spectrums were recorded for each antenna port and analyzed for conformance with the above definition of occupied bandwidth. It was established that 99% of the total transmitted power was contained in a 23.8 MHz bandwidth and that the remaining energy was equally distributed on both sides of the occupied band, centered on the assigned frequency.

Requested Bandwidth: 20 MHz

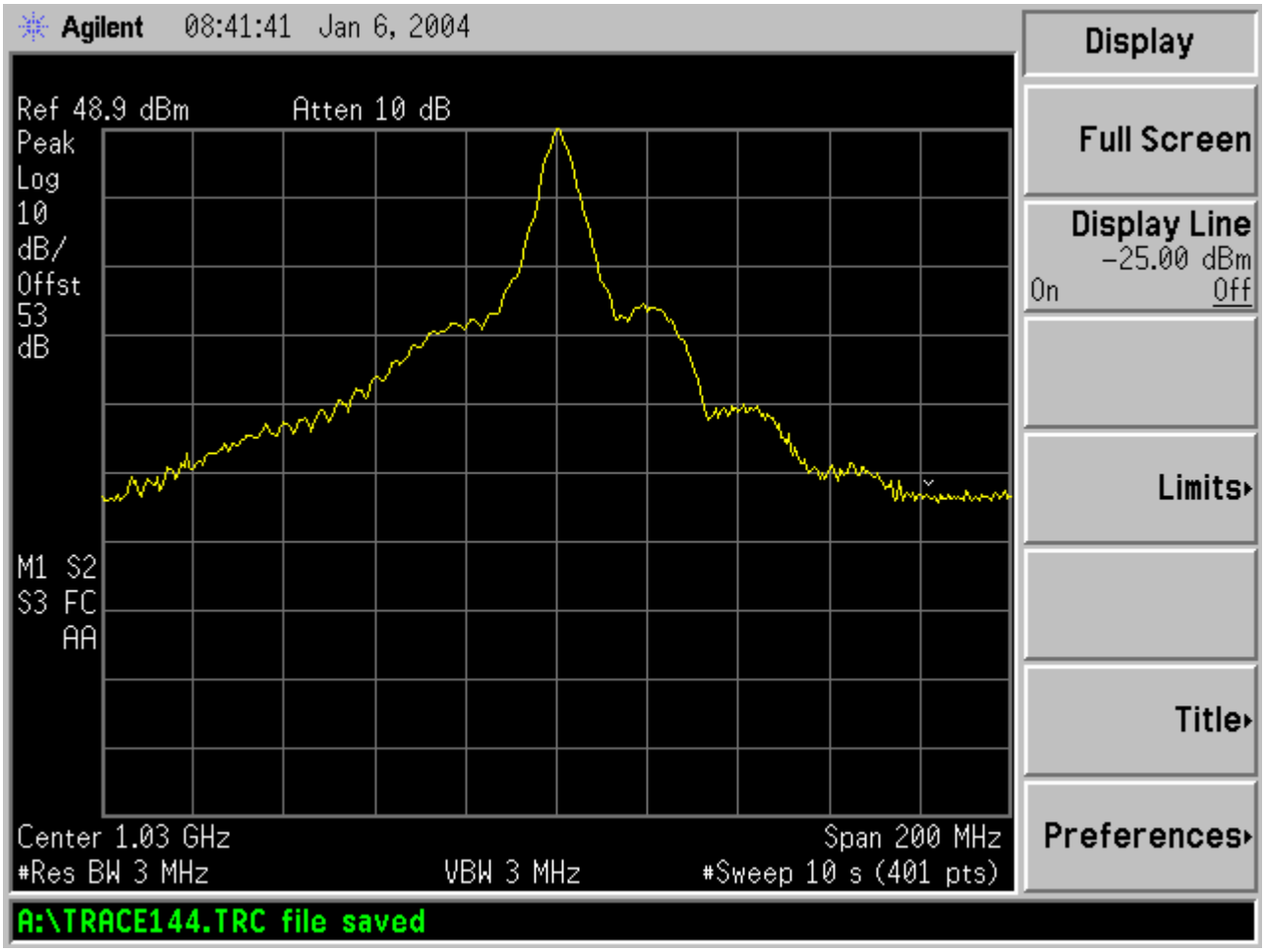
Measured Occupied Bandwidth: 23.8 MHz

The requested BW is based on unmodulated pulse. However, the mode S pulse has 4 MHz DPSK data embedded in it causing spectral spreading. The requirements of RTCA/DO-185A MOPS allows for 40 MHz occupied BW.

It was further shown that the transmitted energy was in conformance with the above referenced MOPS requirements as shown by the following data and figure.

Test Results:

Mode S Test Mode 3			47.9dBm	46.7dBm	47.5dBm	46.0dBm
Ref Amplitude @ 1030MHz						
Mode S Test Mode 2						
Amplitude @ 1030MHz						
Frequency offset from 1030MHz	Start – Stop Frequency	Limit (-dB)	E1 Data (dB)	E2 Data (dB)	E3 Data (dB)	E4 Data (dB)
GE 4 and LT 6						
	1024.1-1026	6	25.7	26.2	24.1	25.4
	1034-1035.9	6	24.3	27	17.4	24.5
GE 6 and LT 8						
	1022.1-1024	11	17.8	18.9	16.5	18.2
	1036-1037.9	11	17.1	20.0	17.4	17.1
GE 8 and LT 10						
	1020.1-1022	15	34.5	35.6	32.6	35.2
	1038-1039.9	15	34.7	38.4	35.2	34.2
GE 10 and LT 20						
	1010.1-1020	19	27.5	29.5	25.6	29.1
	1040-1049.9	19	29.2	33.0	29.5	27.8
GE 20 and LT 30						
	1000.1-1010	31	36.4	42.1	35.0	39.2
	1050-1059.9	31	34.0	41.3	33.8	36.4
GE 30 and LT 40						
	990.1-1000	38	46.4	53.0	46.2	50.6
	1060-1069.9	38	50.9	50.3	46.0	53.7
GE 40 and LT 50						
	980.1-990	43	51.2	62.0	52.0	57.3
	1070-1079.9	43	55.5	57.7	50.0	56.2
GE 50 and LT 60						
	970.1-980	47	54.1	63.2	53.1	60.1
	1080-1089.9	47	59.7	68.4	56.2	66.1
GE 60 and LT 90						
	940.1-970	50	58.2	66.8	57.2	63.8
	1090-1119.9	50	65.8	69.6	67.7	68.3


Agilent 08:41:41 Jan 6, 2004
Ref 48.9 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
53
dB
M1 S2
S3 FC
AA
Center 1.03 GHz
Span 200 MHz
#Res BW 3 MHz
VBW 3 MHz
#Sweep 10 s (401 pts)
Display
Full Screen
Display Line
-25.00 dBm
On
Off
Limits
Title
Preferences
A:\TRACE144.TRC file saved

Spurious Emissions at Antenna Terminals – Transmitter @ 1030 MHz

Test Procedure:

The TPL-100A spurious emissions at each of the four antenna ports were investigated from 150 KHz to 12 GHz, with specific measurements at local oscillator and transmitter harmonic frequencies. Set the spectrum analyzer to 100 KHz resolution BW.

The results and worst case spurious outputs are recorded below.

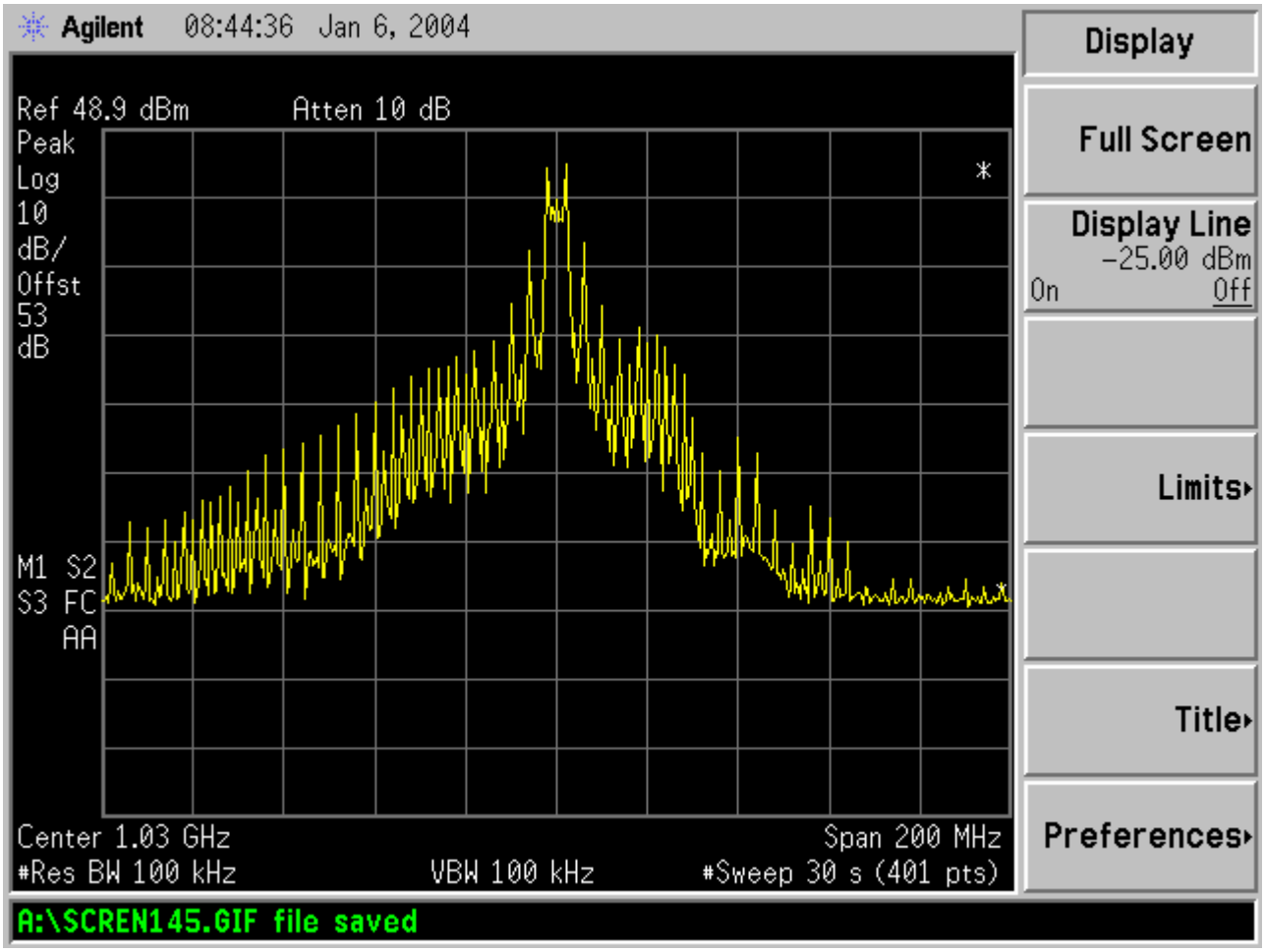
Test Limits:

Frequency Difference (MHz From Carrier)	Maximum Emission Level (dB Below Peak Power)
GE. 20 and .LT. 40	25
.GE. 40 and .LT. 100	35
.GT. 100	60

Test Results:

Frequency Difference (MHz From Carrier)	Maximum Emission Level (dBc) E1	E2	E3	E4
1030 MHz (carrier)	0 (+47.9dBm)	0 (+46.7dBm)	0 (+47.5dBm)	0 (+46.0dBm)
1090 MHz (LO)	65.8 (-17.9 dBm)	68.4 (-21.7 dBm)	67.7 (-20.2 dBm)	68.3 (-22.3dBm)
2060 MHz (2^{nd} harm.)	87.1 (-39.2 dBm)	84.6 (-37.9 dBm)	86.2 (-38.7 dBm)	85.3 (-39.3 dBm)
3090 MHz (3^{rd} harm.)	88.2 (-40.3 dBm)	80.0 (-33.3 dBm)	83.7 (-36.2 dBm)	88.0 (-42.0 dBm)

These emissions were all greater than 18.8 dB below the limits per FCC Rules and Regulations Part 87.139.Emissions Limitations. All other emissions were greater than 19.8 dB below the FCC limits.


Agilent 08:44:36 Jan 6, 2004
Ref 48.9 dBm
Atten 10 dB
Peak
Log
10
dB/
Offst
53
dB
M1 S2
S3 FC
AA
Center 1.03 GHz
Span 200 MHz
#Res BW 100 kHz
VBW 100 kHz
#Sweep 30 s (401 pts)
Display
Full Screen
Display Line
-25.00 dBm
On
Off
Limits
Title
Preferences
A:\SCREN145.GIF file saved

Occupied Bandwidth – Transmitter @ 1090 MHz

Test Procedure:

Connect chamber antenna outputs 1-4 to a spectrum analyzer through a 30 dB attenuator. Set the spectrum analyzer as follows:

Scan Width : 20 MHz/div
Resolution Bandwidth : 3 MHz for occupied BW
Center Frequency : 1090 MHz
Reference Level : +50 dBm

Program TPL for DF-19 and top antenna; Transponder, DF19, Mode S Test Mode 1. Measure peak power at 1090 MHz and verify proper signal spectrum bounds.

Test Limits:

Occupied Bandwidth: < 20 MHz for 99% of transmitted power.

Test Results:

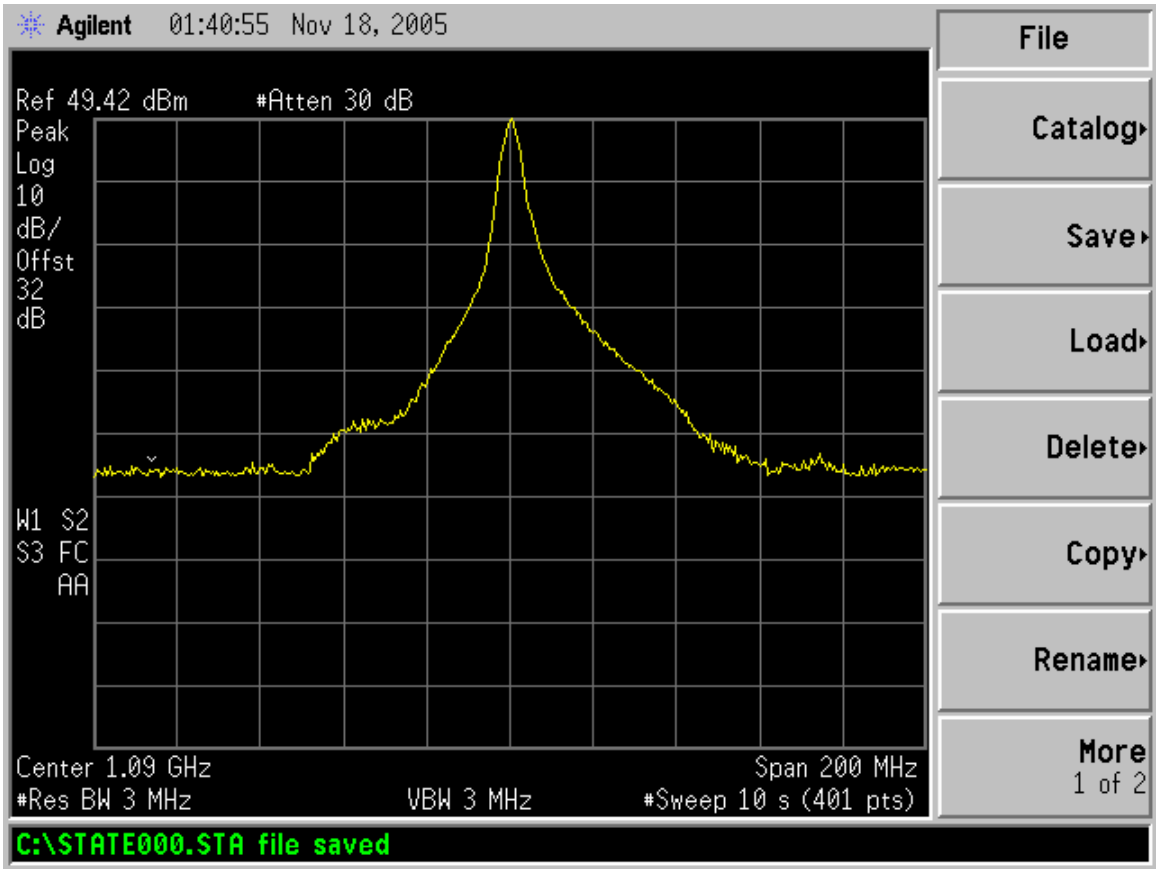
The output spectrums were recorded and analyzed for conformance with the definition of occupied bandwidth. It was established that 99% of the total transmitted power was contained in an 12 MHz bandwidth and that the remaining energy was equally distributed on both sides of the occupied band, centered on the assigned frequency. The occupied bandwidth was found to be close to the necessary bandwidth as defined in “Manual of Regulations and Procedures for Federal Radio Frequency Management” Annex J.

	-freq	+freq	-freq	+freq	-freq	+freq	-freq	+freq
-20db frequencies (MHz)	-5.15	6.7	-5.5	6.875	-5.75	6.75	-4.875	6.375

Requested Bandwidth: 20 MHz

Necessary Bandwidth: 11.93MHz
(=1.79/√(PW*RT), where PW = pulse width of 450 ns and RT=rise time of 50nsec)

Measured Occupied Bandwidth: 11.99 MHz


Agilent 01:40:55 Nov 18, 2005
Ref 49.42 dBm
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Peak
Log
10
dB/
Offst
32
dB
W1 S2
S3 FC
AA
Center 1.09 GHz
Span 200 MHz
#Res BW 3 MHz
VBW 3 MHz
#Sweep 10 s (401 pts)
File
Catalog
Save
Load
Delete
Copy
Rename
More
1 of 2
C:\STATE000.STA file saved

Emission Bandwidth - Transmitter @ 1090 MHz

Test Procedure:

Connect antenna output 1-4 to a spectrum analyzer through a 30dB attenuator. Set the spectrum analyzer as follows:

Scan Width : 20 MHz/div
Resolution Bandwidth : 100 KHz for spectrum
Center Frequency : 1090 MHz
Reference Level : +50 dBm

Program TPL for DF-19 and top antenna; Transponder, DF19, Mode S Test Mode 1. Measure peak power at 1090 MHz and verify proper signal spectrum bounds.

Test Limits:

The FAA limits for the output spectrum per RTCA/DO-181B MOPS, Paragraph 2.2.4.2.3 is shown below:

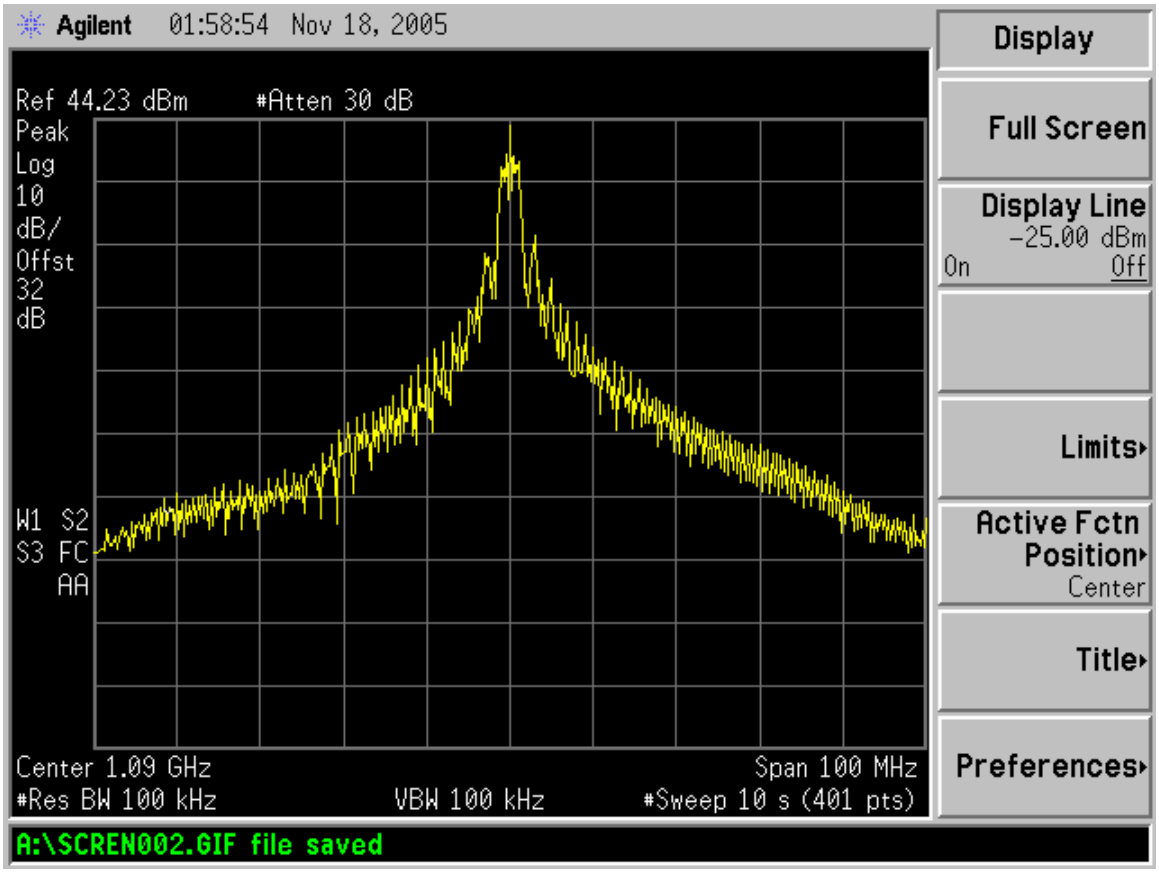
Frequency Difference Maximum Relative Power

(MHz From Carrier)	(dB Down From Peak)
.GE. 1.3 and .LT. 7	3
.GE. 7 and .LT. 23	20
.GE. 23 and .LT. 78	40
.GE.78	60

Test Results:

The transmitted energy was in conformance with the above referenced MOPS requirements as shown by the following data and figure.

			e1		e2		e3		e4	
Start freq (MHz)	Stop freq (MHz)	limit	Amp (dBm)	dBc	Amp (dBm)	dBc	Amp (dBm)	dBc	Amp (dBm)	dBc
100	1012	60	-22.02	65.94	-24.44	67.14	-23.66	65.27	-19.39	62.82
1012	1067	40	-9.904	53.824	-12.51	55.21	-9.438	51.048	-9.582	53.012
1067	1083	20	12.09	31.83	11.03	31.67	8.923	32.687	10.15	33.28
1083	1088.7	3	29.28	14.64	28.17	14.53	26.67	14.94	28.16	15.27
1088.7	1091.3	0	43.92	0	42.7	0	41.61	0	43.43	0
1091.3	1097	3	28.68	15.24	27.47	15.23	26.56	15.05	28.21	15.22
1097	1113	20	14.61	29.31	13.11	29.59	11.54	30.07	13.05	30.38
1113	1168	40	-0.509	44.429	-0.557	43.257	-4.777	46.387	-6.521	49.951
1168	2100	60	-21.5	65.42	-22.44	65.14	-25.36	66.97	-23.35	66.78



The frequencies where the spectrum was down by 3, 20, 40, and 60 dB were also recorded:

		-freq	+freq		-freq	+freq		-freq	+freq		-freq	+freq
-3db frequencies (MHz)		-0.05	0.055		-0.0525	0.05		-0.055	-0.0525		-0.05	0.05375
-20db frequencies (MHz)		-1.575	1.575		-1.577	1.5725		-1.5775	1.5725		-1.575	1.575
-40db frequencies (MHz)		-12	13.5		-11.003	14.372		-11.003	13.497		-11	13.5
-60db frequencies (MHz)		-39	45.5		-27.752	40		-25.75	45.5		-29.5	27.5

Spurious Emissions at Antenna Terminals – Transmitter @ 1090 MHz

Test Procedure:

The TPL-100A spurious emissions at the antenna were investigated from 150 KHz to 12 GHz, with specific measurements at local oscillator and transmitter harmonic frequencies. Set the spectrum analyzer to 100 KHz resolution BW.
The results and worst case spurious outputs are recorded below.

Test Limits:

Frequency Difference Maximum Emission Level

(MHz From Carrier)	(dB Below Peak Power)
.	
GE. 20 and .LT. 40	25
.GE. 40 and .LT. 100	35
.GT. 100	60

Test Results:

Frequency Difference Maximum Emission Level (dBc)

Start freq (MHz)	Stop freq (MHz)	limit	e1 Amp (dBm)	dBc	e2 Amp (dBm)	dBc	e3 Amp (dBm)	dBc	e4 Amp (dBm)	dBc
2170	2190	60	-20.03	63.95	-21.87	64.57	-23.71	65.32	-20.62	64.05
3260	3280	60	-23.93	67.85	-23.27	65.97	-24.29	65.9	-23.02	66.45
4350	4370	60	-24.94	68.86	-25.01	67.71	-26.74	68.35	-24.47	67.9
5440	5460	60	-24.08	68	-24.37	67.07	-26.21	67.82	-25.13	68.56

These emissions were at least 3.95 dB below the limits per FCC Rules and Regulations Part 87.139 Emission Limitations. All other emissions were greater than 8 dB below the FCC limits.

Receiver Bandwidth – 1030 MHz

Test Procedure:

The TPL-100A receiver response was measured to determine the -3db and -60db frequencies.
The results are recorded below.

Test Limits:

Frequency Difference

(MHz From Carrier)	(dB Below Peak Power)
> 0.2	3
> 25	60

Test Results:

-3db frequencies(MHz)		1026.3	1033.8		1025.8	1034.1		1025.6	1033.8		1026.1	1033.9
-20db frequencies(MHz)		1022.6	1038.7		1022.2	1038.2		1022	1037.7		1022.8	1038.4
-40db frequencies(MHz)		1018.3	1042.6		1018.3	1041.8		1017.1	1041.5		1019.4	1042.1
-60db frequencies(MHz)		1013.4	1047		1014.2	1045.8		1012.8	1045.5		1015.4	1045.9

Field Strength of Spurious Radiation

Test Procedure:

Spurious radiation from the case and cables of the TPL-100A was measured in accordance with RTCA/DO-160D, Environmental Conditions and Test Procedures for Airborne Equipment, and with respect to FCC requirements, from 150 KHz to 6 GHz for narrow band energy. The test was conducted using a test site meeting the requirements of both the FCC and that specified in RTCA/DO-160D. To ensure maximum emissions measurements, the antennas were oriented both vertically and horizontally. The EMI receiver narrowband settings are indicated in the Test Results.

Test Limits:

Frequency Difference (MHz From Carrier)	Maximum Emission Level (dB Below Peak Power)
.GE. 20 and .LT. 40	25
.GE. 40 and .LT. 100	35
.GT. 100	60

Test Results:

The spurious levels outside of exclusion zones were within limits with one exception. There was a radiated emissions failure at 1584 MHz/5.8dB over the limit.

Emissions between 1023.415MHz to 1035.460MHz and 1087.000 MHz to 1091.010 MHz are due to normal TCAS and transponder transmissions of the TPL-100A UUT. These exclusion zones include transmitter frequency and harmonics.

Charts below are:

Radiated Narrow Band Horizontal 25 MHz – 6 GHz

Radiated Narrow Band Vertical 150 KHz – 6 GHz

Horizontal Polarity

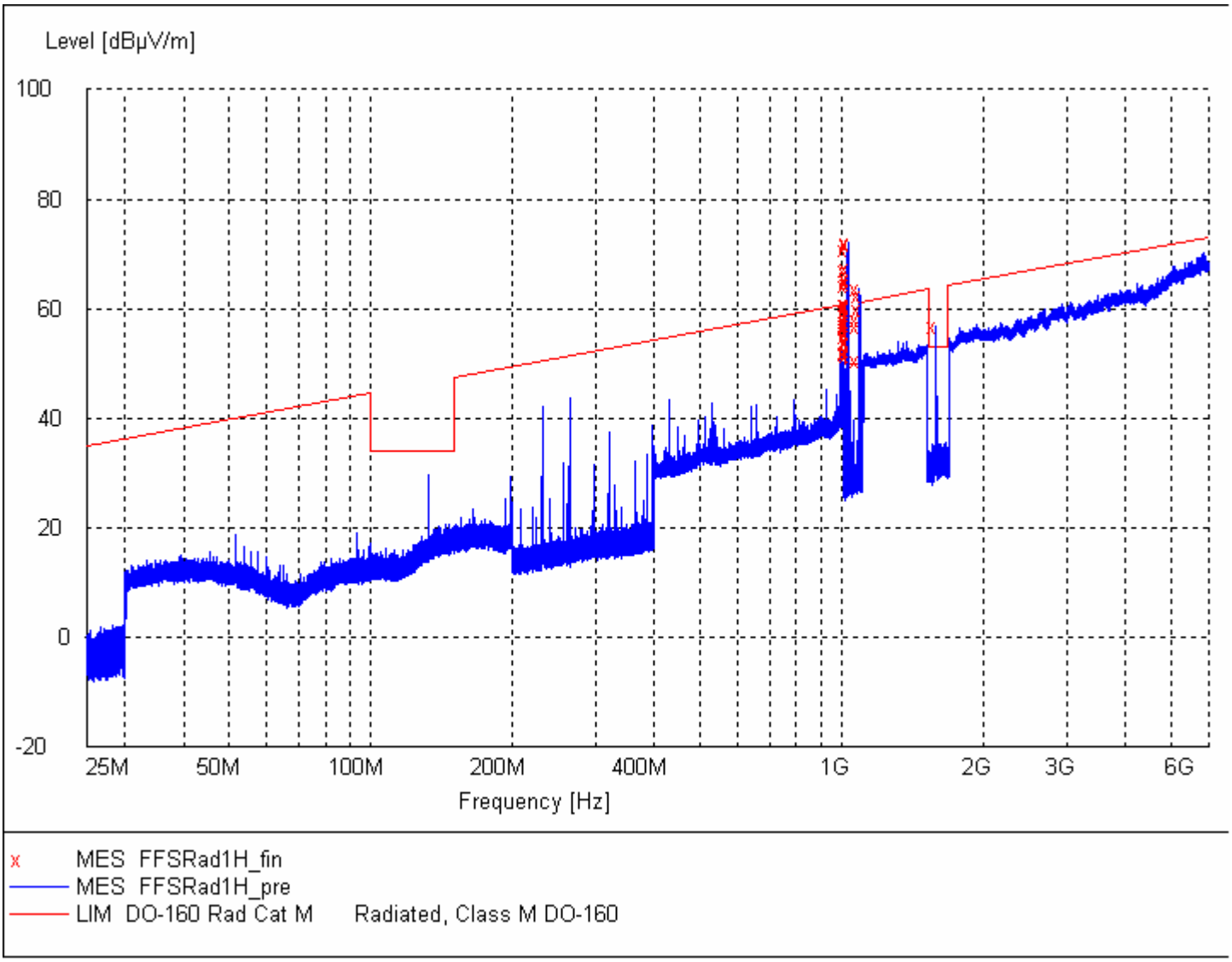
Honeywell International Inc.
Redmond, Washington 98073

```
Unit Under Test:  FFS, TPL-100A
Part Number:      940-0530-001
Serial Number:    00210
Procedure Number: 940-0530-101, Rev. D
Operator:         Reza Nahcheri
Test Details:     Radiated Emissions Narrow Band
Comment:          UUT Mode 1 NB Horizontal
Start of Test:    2/17/2006
```

SCAN TABLE: "160D Cat M Rad NB H"

Short Description: DO160B/C Radiated Emissions

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
25.0 MHz	30.0 MHz	500.0 Hz	MaxPeak	20.0 ms	1 KHz	94455-1 Horz.
30.0 MHz	200.0 MHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	94455-1 Horz.
200.0 MHz	400.0 MHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96005 Horz.s/n 1032
400.0 MHz	1.0 GHz	50.0 KHz	MaxPeak	20.0 ms	100 KHz	96005 Horz.s/n 1032
1.0 GHz	1.0 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Horz. s/n 2041
1.0 GHz	1.1 GHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96001 Horz. s/n 2041
1.1 GHz	1.5 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Horz. s/n 2041
1.5 GHz	1.7 GHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96001 Horz. s/n 2041
1.7 GHz	6.0 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Horz. s/n 2041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60
40
20
0
-20
25M
50M
100M
200M
400M
1G
2G
3G
6G
Frequency [Hz]
x MES FFSRad1H_fin
MES FFSRad1H_pre
LIM DO-160 Rad Cat M
Radiated, Class M DO-160

MEASUREMENT RESULT: "FFSRad1H_fin"

2/17/2006 9:07AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB
1023.415000	52.20	26.4	50.0	2.2
1026.865000	60.89	26.4	50.0	10.9
1027.355000	59.66	26.4	50.0	9.7
1027.605000	51.65	26.4	50.0	1.6
1027.850000	56.42	26.4	50.0	6.4
1028.095000	66.91	26.4	50.0	16.9
1028.340000	57.79	26.4	50.0	7.8
1028.365000	51.79	26.4	50.0	1.8
1028.585000	59.52	26.4	50.0	9.5
1028.835000	67.01	26.4	50.0	17.0
1028.860000	54.96	26.4	50.0	5.0
1029.085000	56.97	26.4	50.0	7.0
1029.325000	64.21	26.4	50.0	14.2
1029.350000	60.64	26.4	50.0	10.6
1029.570000	70.71	26.4	50.0	20.7
1029.600000	58.87	26.4	50.0	8.9
1029.820000	71.99	26.4	50.0	22.0
1029.845000	71.99	26.4	50.0	22.0
1030.070000	51.51	26.4	50.0	1.5
1030.285000	67.43	26.4	50.0	17.4
1030.310000	65.40	26.4	50.0	15.4
1030.530000	65.26	26.4	50.0	15.3
1030.555000	57.80	26.4	50.0	7.8
1030.775000	60.90	26.4	50.0	10.9
1030.805000	53.55	26.4	50.0	3.5
1031.025000	57.11	26.4	50.0	7.1
1031.050000	52.51	26.4	50.0	2.5
1031.270000	64.35	26.4	50.0	14.3
1031.515000	71.88	26.4	50.0	21.9
1031.760000	60.39	26.4	50.0	10.4
1032.010000	60.11	26.4	50.0	10.1
1032.255000	57.53	26.4	50.0	7.5
1032.750000	55.78	26.4	50.0	5.8
1033.240000	53.94	26.4	50.0	3.9
1035.460000	52.52	26.4	50.0	2.5
1087.000000	50.49	26.6	50.0	0.5
1089.000000	63.54	26.6	50.0	13.5
1089.985000	58.02	26.6	50.0	8.0
1090.015000	56.79	26.6	50.0	6.8
1091.000000	62.44	26.6	50.0	12.4
1091.010000	59.90	26.6	50.0	9.9
1584.005000	56.66	28.4	53.0	3.7

Vertical Polarity

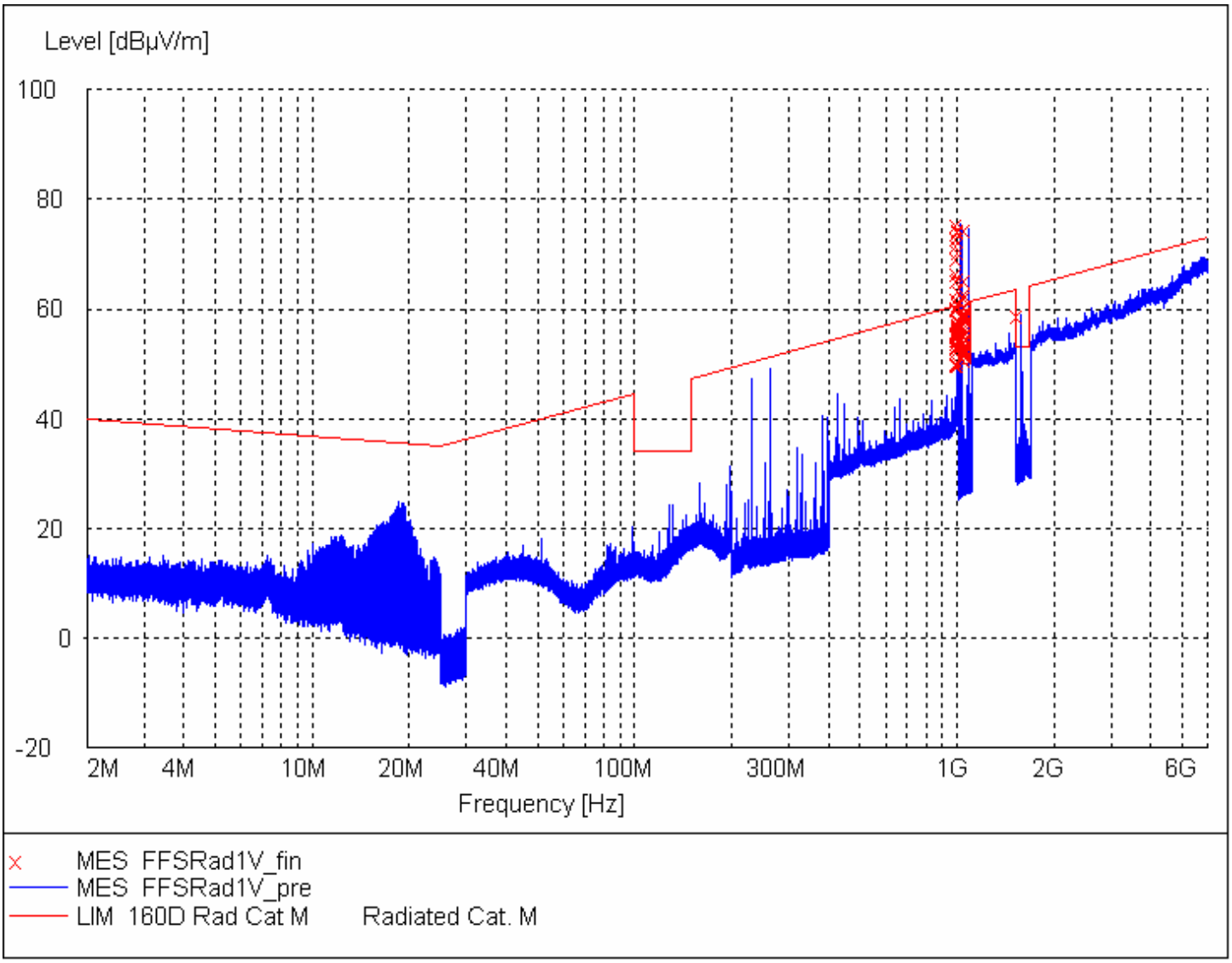
Honeywell International Inc.
Redmond, Washington 98073

```
Unit Under Test:  FFS, TPL-100A
Part Number:      940-0530-001
Serial Number:    00210
Procedure Number: 940-0530-101, Rev. D
Operator:         Reza Nahcheri
Test Details:     Radiated Emissions Narrow Band
Comment:          UUT Mode 1 NB Vertical
Start of Test:    2/16/2006
```

SCAN TABLE: "160D Cat M Rad NB V"

Short Description: DO160B/C Radiated Emissions

Start Frequency	Stop Frequency	Step Width	Detector	Meas. Time	IF Bandw.	Transducer
150.0 KHz	25.0 MHz	500.0 Hz	MaxPeak	20.0 ms	1 KHz	3301B s/n 00047829
25.0 MHz	30.0 MHz	500.0 Hz	MaxPeak	20.0 ms	1 KHz	94455-1 Vert
30.0 MHz	200.0 MHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	94455-1 Vert
200.0 MHz	400.0 MHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96005 Vert.s/n 1032
400.0 MHz	1.0 GHz	50.0 KHz	MaxPeak	20.0 ms	100 KHz	96005 Vert.s/n 1032
1.0 GHz	1.0 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Vert. s/n 2041
1.0 GHz	1.1 GHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96001 Vert. s/n 2041
1.1 GHz	1.5 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Vert. s/n 2041
1.5 GHz	1.7 GHz	5.0 KHz	MaxPeak	20.0 ms	10 KHz	96001 Vert. s/n 2041
1.7 GHz	6.0 GHz	500.0 KHz	MaxPeak	20.0 ms	1 MHz	96001 Vert. s/n 2041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80
60
40
20
0
-20
2M
4M
10M
20M
40M
100M
300M
1G
2G
6G
Frequency [Hz]
MES FFSRad1V_fin
MES FFSRad1V_pre
LIM 160D Rad Cat M
Radiated Cat. M

MEASUREMENT RESULT: "FFSRad1V_fin"

2/17/2006 9:41AM

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB
1024.080000	54.06	26.3	50.0	4.1
1024.575000	52.39	26.3	50.0	2.4
1024.820000	53.04	26.3	50.0	3.0
1026.050000	53.18	26.3	50.0	3.2
1027.285000	53.82	26.3	50.0	3.8
1027.530000	62.10	26.3	50.0	12.1
1027.775000	55.80	26.3	50.0	5.8
1028.025000	72.97	26.3	50.0	23.0
1028.270000	55.40	26.3	50.0	5.4
1028.295000	50.03	26.3	50.0	0.0
1028.515000	65.43	26.3	50.0	15.4
1028.765000	60.00	26.3	50.0	10.0
1028.790000	50.45	26.3	50.0	0.5
1029.010000	55.54	26.3	50.0	5.5
1029.035000	53.32	26.3	50.0	3.3
1029.245000	75.44	26.3	50.0	25.4
1029.270000	60.29	26.3	50.0	10.3
1029.500000	71.63	26.3	50.0	21.6
1029.745000	69.17	26.3	50.0	19.2
1029.760000	66.58	26.3	50.0	16.6
1030.000000	55.28	26.3	50.0	5.3
1030.430000	65.70	26.3	50.0	15.7
1030.680000	58.12	26.3	50.0	8.1
1030.705000	56.47	26.3	50.0	6.5
1030.925000	56.61	26.3	50.0	6.6
1030.950000	54.48	26.3	50.0	4.5
1031.170000	74.51	26.3	50.0	24.5
1031.200000	56.08	26.3	50.0	6.1
1031.410000	74.40	26.3	50.0	24.4
1031.665000	57.02	26.3	50.0	7.0
1031.910000	70.51	26.3	50.0	20.5
1032.155000	61.07	26.3	50.0	11.1
1032.185000	50.04	26.3	50.0	0.0
1032.650000	57.99	26.3	50.0	8.0
1033.140000	63.51	26.3	50.0	13.5
1033.390000	57.44	26.3	50.0	7.4
1033.635000	50.75	26.3	50.0	0.7
1034.620000	53.47	26.3	50.0	3.5
1034.865000	54.23	26.3	50.0	4.2
1035.360000	55.03	26.3	50.0	5.0
1035.850000	56.77	26.3	50.0	6.8
1036.100000	53.48	26.4	50.0	3.5
1036.590000	54.37	26.4	50.0	4.4
1087.005000	50.96	26.6	50.0	1.0
1087.015000	51.79	26.6	50.0	1.8
1088.005000	53.94	26.6	50.0	3.9
1088.700000	53.30	26.6	50.0	3.3
1088.725000	52.91	26.6	50.0	2.9
1088.740000	52.08	26.6	50.0	2.1
1088.975000	57.66	26.6	50.0	7.7
1088.990000	65.29	26.6	50.0	15.3
1089.200000	54.32	26.6	50.0	4.3
1089.240000	56.71	26.6	50.0	6.7
1089.445000	59.01	26.6	50.0	9.0
1089.695000	58.63	26.6	50.0	8.6
1089.705000	60.79	26.6	50.0	10.8
1089.735000	55.65	26.6	50.0	5.6
1089.860000	56.18	26.6	50.0	6.2
1089.960000	58.89	26.6	50.0	8.9
1089.990000	74.63	26.6	50.0	24.6
1090.100000	62.93	26.6	50.0	12.9
1090.185000	52.65	26.6	50.0	2.7
1090.210000	55.25	26.6	50.0	5.3
1090.235000	54.07	26.6	50.0	4.1
1090.345000	52.52	26.6	50.0	2.5

MEASUREMENT RESULT: "FFSRad1V_fin"

(continued)

Frequency MHz	Level dBµV/m	Transd dB	Limit dBµV/m	Margin dB
1090.440000	58.22	26.6	50.0	8.2
1090.470000	56.85	26.6	50.0	6.9
1090.555000	51.81	26.6	50.0	1.8
1090.655000	60.39	26.6	50.0	10.4
1090.680000	55.12	26.6	50.0	5.1
1090.700000	59.41	26.6	50.0	9.4
1090.915000	62.36	26.6	50.0	12.4
1090.945000	55.52	26.6	50.0	5.5
1091.145000	55.52	26.6	50.0	5.5
1091.165000	55.52	26.6	50.0	5.5
1091.205000	52.66	26.6	50.0	2.7
1584.005000	58.84	28.4	53.0	5.8

Frequency Stability

Transmitter Frequency Stability

Test Procedure:

The TPL-100A was placed into a controlled temperature chamber and stabilized at the temperature indicated. The UUT was then operated for fifteen minutes after which time the transmitter frequency was measured.

Test Limits:

± 20 PPM or ± 20.6 KHz from the +25°C frequency over a temperature range from –55°C to +70°C.

Test Results:

Temperature (°C)	Frequency (MHz)	Deviation from +25°C (KHz)
-55	1029.998	-1.0
-40	1029.998	-1.0
-20	1029.998	-1.0
0	1029.998	-1.0
+25	1029.999	0.0
+30	1029.999	0.0
+50	1030.000	+1.0
+70	1029.999	0.0

Crystal Oven Thermal Time Constant

Test Procedure:

The response of the oven-stabilized oscillator was measured. The UUT was stabilized at the test temperature with power off. Immediately after the UUT was turned on, and each successive minute thereafter, the frequency was measured until no further change was recorded.

Test Limits:

Per RTCA/DO-160D and RTCA/DO-185A MOPS: Less than 30 minutes.

Test Results:

	Frequency (MHz)		
Elapsed time (min)	-55°C	25°C	+70°C
0	1029.998	1029.999	1029.999
1	1029.998	1029.999	1029.999
2	1029.998	1029.999	1029.999
3	1029.997	1029.999	1029.999
4	1029.998	1029.999	1029.999
5	1029.998	1029.999	1029.999

Frequency Stability with Supply Voltage Variations

Test Procedure:

The transmitter frequency variation due to a ± 15% primary power variation was measured at +25°C.

Test Limits:

± 20 PPM or ± 20.6 KHz from nominal primary input power for a ± 15% variation of primary input power.

Test Results:

Input Voltage (V_{RMS})	Frequency (MHz)	Deviation (KHz)
115% 132 V_{RMS}	1029.999	1.0
100% 115 V_{RMS}	1029.999	1.0
85% 97 V_{RMS}	1029.999	1.0

Equipment List

1. 400 Hz Power Supply, Elgar 1001SL with 400SP plug in
2. Tektronix TDS 640A Digital Oscilloscope
3. RGS 2000 TCAS Reply Generator
4. SDX 2000 Transponder Reply Generator
5. Miscellaneous Power Attenuators
6. Agilent E4404B Spectrum Analyzer
7. QualMark Model OVS-2.5 HALT/HASS System
8. Hewlett Packard, Model 8596E, Spectrum Analyzer

Note: All test equipment was in calibration.

Appendix A – CKC Laboratories Tests Report; FCC Part 87 Radiated Emissions

Report No.: FC06-073

HONEYWELL INTERNATIONAL INC. TEST REPORT

FOR THE

TPL-100A, PN: 940-0530-001

FCC PART 87 RADIATED SPURIOUS EMISSIONS

COMPLIANCE

DATE OF ISSUE: NOVEMBER 30, 2006

PREPARED FOR:

Honeywell International Inc.
15001 NE 36th Street
Redmond, WA 98052

P.O. No.: 3966918
W.O. No.: 85922

PREPARED BY:

Mary Ellen Clayton
CKC Laboratories, Inc.
5046 Sierra Pines Drive
Mariposa, CA 95338

Date of test: November 16, 2006

Report No.: FC06-073

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ADMINISTRATIVE INFORMATION

DATE OF TEST:	November 16, 2006
DATE OF RECEIPT:	November 16, 2006
FREQUENCY RANGE TESTED:	10 kHz-11 GHz
MANUFACTURER:	Honeywell International Inc. 15001 NE 36th Street Redmond, WA 98052
REPRESENTATIVE:	Keith Peavler
TEST LOCATION:	CKC Laboratories, Inc. 22116 23rd Drive S.E., Suite A Bothell, WA 98021-4413
TEST METHOD:	FCC Part 87 Radiated Spurious Emissions
PURPOSE OF TEST:	To demonstrate the compliance of the TPL-100A, PN: 940-0530-001 with the requirements for FCC Part 87 Radiated Spurious Emissions devices.

FCC TO CANADA STANDARD CORRELATION MATRIX

CONDITIONS FOR COMPLIANCE
No modifications to the EUT were necessary to comply.

APPROVALS

Steve Behm, Director of Engineering Services

QUALITY ASSURANCE:	**TEST PERSONNEL:**
Joyce Walker, Quality Assurance Administrative Manager	Ryan Rutledge, Test Technologist
Katie Molina, Senior EMC Engineer/Lab Manager	

EQUIPMENT UNDER TEST (EUT) DESCRIPTION

The customer declares the EUT tested by CKC Laboratories was representative of a production unit.

At the time of testing, the following model was tested by CKC Laboratories: **TCAS, PN: 940-0530-001**

Since the time of testing the manufacturer has chosen to use the following model name in its place. Any differences between the names does not affect their EMC characteristics and therefore complies to the level of testing equivalent to the tested model name shown on the data sheets: **TPL-100A**

EQUIPMENT UNDER TEST

TPL-100A

Manuf:	Honeywell International Inc.
Model:	TPL-100A
Part No:	940-0530-001
Serial:	TPL00210

PERIPHERAL DEVICES

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

Antenna Simulator

Manuf:	Honeywell
Model:	PN: 727-0016-001
Serial:	0025

Antenna Simulator

Manuf:	Honeywell
Model:	PN: 727-0016-001
Serial:	0074

TEMPERATURE AND HUMIDITY DURING TESTING

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

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

Test Location: CKC Laboratories •22116 23rd Dr SE • Bothell, WA 98021-4413 • 425-402-1717

Customer: **Honeywell International Inc.**
Specification: **2.1053/87.139 Spurious**
Work Order #: **85922** Date: 11/16/2006
Test Type: **Radiated Scan** Time: 11:25:29
Equipment: **TCAS** Sequence#: 3
Manufacturer: Honeywell Tested By: Ryan Rutledge
Model: PN: 940-0530-001
S/N: TPL00210

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
Agilent E4446A	S/N: US44300437	05/27/2006	05/27/2008	AN02673
Bothell 5m Cable Set	S/N: P05444	11/28/2005	11/28/2007	ANP05444
EMCO 6502 Active Loop	S/N: 2156	02/20/2006	02/20/2008	AN00052

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

Function	Manufacturer	Model #	S/N
TCAS*	Honeywell	PN: 940-0530-001	TPL00210

Support Devices:

Function	Manufacturer	Model #	S/N
Antenna Simulator	Honeywell	PN: 727-0016-001	0025
Antenna Simulator	Honeywell	PN: 727-0016-001	0074

Test Conditions / Notes:

Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied when maximizing emissions. RF output is terminated with antenna simulators that are placed under the table, on the conductive surface of the turntable. Transmitter operating under normal conditions, terminated with antenna simulators Customer states that lowest operating frequency in device is 20 MHz, and highest frequency is 1090 MHz. We will measure radiated spurious emissions from 10 MHz to 11 GHz Frequency ranges tested: 10 - 30 MHz @ 9 kHz RBW, 9 kHz VBW. Measurement distance: 3 meters.

Transducer Legend:

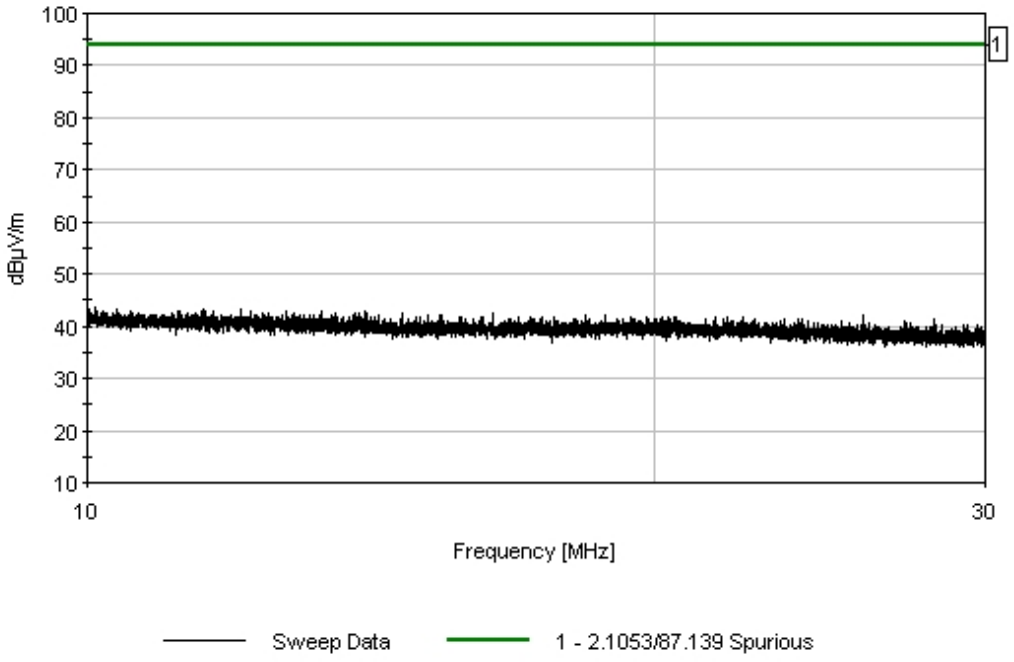
T1=ANT- AN00052-022006	T2=Bothell 5 meter cable set

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	10.000M	15.3	+9.3	+0.4			+19.0 360	44.0	94.0	-50.0	Vert 100
2	10.097M	14.9	+9.3	+0.4			+19.0 360	43.6	94.0	-50.4	Vert 100
3	11.526M	14.9	+9.0	+0.4			+19.0 360	43.3	94.0	-50.7	Vert 100
4	10.374M	14.6	+9.2	+0.4			+19.0 360	43.2	94.0	-50.8	Vert 100

5	12.068M	14.7	+8.9	+0.5		+19.0 360	43.1	94.0	-50.9	Vert 100
6	10.192M	14.3	+9.3	+0.4		+19.0 360	43.0	94.0	-51.0	Vert 100
7	11.563M	14.6	+9.0	+0.4		+19.0 360	43.0	94.0	-51.0	Vert 100
8	10.113M	14.2	+9.3	+0.4		+19.0 360	42.9	94.0	-51.1	Vert 100
9	10.533M	14.3	+9.2	+0.4		+19.0 360	42.9	94.0	-51.1	Vert 100
10	11.212M	14.5	+9.0	+0.4		+19.0 360	42.9	94.0	-51.1	Vert 100
11	12.200M	14.5	+8.9	+0.5		+19.0 360	42.9	94.0	-51.1	Vert 100
12	11.165M	14.3	+9.1	+0.4		+19.0 360	42.8	94.0	-51.2	Vert 100
13	11.510M	14.4	+9.0	+0.4		+19.0 360	42.8	94.0	-51.2	Vert 100
14	11.654M	14.4	+9.0	+0.4		+19.0 360	42.8	94.0	-51.2	Vert 100
15	12.755M	14.5	+8.8	+0.5		+19.0 360	42.8	94.0	-51.2	Vert 100
16	13.335M	14.6	+8.7	+0.5		+19.0 360	42.8	94.0	-51.2	Vert 100
17	14.038M	14.8	+8.5	+0.5		+19.0 360	42.8	94.0	-51.2	Vert 100
18	13.562M	14.6	+8.6	+0.5		+19.0 360	42.7	94.0	-51.3	Vert 100
19	13.887M	14.6	+8.6	+0.5		+19.0 360	42.7	94.0	-51.3	Vert 100
20	16.425M	14.7	+8.5	+0.5		+19.0 360	42.7	94.0	-51.3	Vert 100

CKC Laboratories Date: 11/16/2006 Time: 11:25:29 Honeywell International Inc. WO#: 85922
2.1053/87.139 Spurious Test Distance: 3 Meters Sequence#: 3 Polarity: Vert
Notes: Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied wh



Test Location: CKC Laboratories •22116 23rd Dr SE • Bothell, WA 98021-4413 • 425-402-1717

Customer: **Honeywell International Inc.**
Specification: **2.1053/87.139 Spurious**
Work Order #: **85922** Date: 11/16/2006
Test Type: **Radiated Scan** Time: 11:29:57
Equipment: **TCAS** Sequence#: 4
Manufacturer: Honeywell Tested By: Ryan Rutledge
Model: PN: 940-0530-001
S/N: TPL00210

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
Agilent E4446A	S/N: US44300437	05/27/2006	05/27/2008	AN02673
Bothell 5m Cable Set	S/N: P05444	11/28/2005	11/28/2007	ANP05444
EMCO 6502 Active Loop	S/N: 2156	02/20/2006	02/20/2008	AN00052

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

Function	Manufacturer	Model #	S/N
TCAS*	Honeywell	PN: 940-0530-001	TPL00210

Support Devices:

Function	Manufacturer	Model #	S/N
Antenna Simulator	Honeywell	PN: 727-0016-001	0025
Antenna Simulator	Honeywell	PN: 727-0016-001	0074

Test Conditions / Notes:

Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied when maximizing emissions. RF output is terminated with antenna simulators that are placed under the table, on the conductive surface of the turntable. Transmitter operating under normal conditions, terminated with antenna simulators Customer states that lowest operating frequency in device is 20 MHz, and highest frequency is 1090 MHz. We will measure radiated spurious emissions from 10 MHz to 11 GHz Frequency ranges tested: 10 - 30 MHz @ 9 kHz RBW, 9 kHz VBW. Measurement distance: 3 meters.

Transducer Legend:

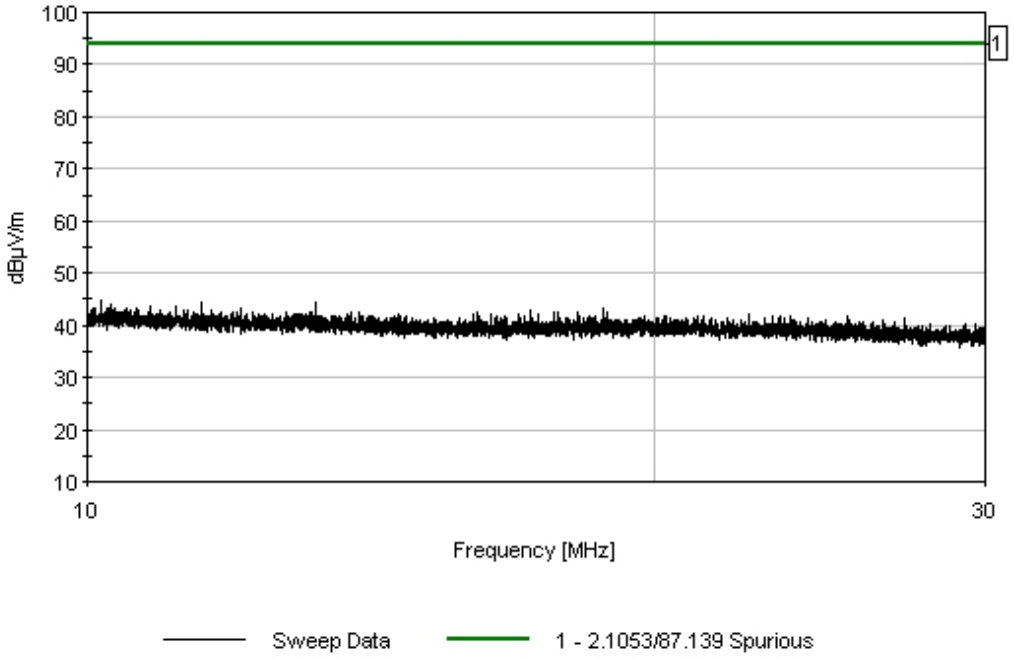
T1=ANT- AN00052-022006	T2=Bothell 5 meter cable set

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	10.161M	16.2	+9.3	+0.4			+19.0	44.9	94.0	-49.1	Horiz 100
2	13.233M	16.2	+8.7	+0.5			+19.0	44.4	94.0	-49.6	Horiz 100
3	11.497M	15.9	+9.0	+0.4			+19.0	44.3	94.0	-49.7	Horiz 100
4	10.283M	15.5	+9.2	+0.4			+19.0	44.1	94.0	-49.9	Horiz 100
5	10.805M	15.2	+9.1	+0.4			+19.0	43.7	94.0	-50.3	Horiz 100

6	11.134M	15.1	+9.1	+0.4		+19.0	43.6	94.0	-50.4	Horiz 100
7	10.000M	14.7	+9.3	+0.4		+19.0	43.4	94.0	-50.6	Horiz 100
8	10.272M	14.8	+9.2	+0.4		+19.0	43.4	94.0	-50.6	Horiz 100
9	10.624M	14.8	+9.2	+0.4		+19.0	43.4	94.0	-50.6	Horiz 100
10	10.069M	14.6	+9.3	+0.4		+19.0	43.3	94.0	-50.7	Horiz 100
11	10.088M	14.5	+9.3	+0.4		+19.0	43.2	94.0	-50.8	Horiz 100
12	10.495M	14.6	+9.2	+0.4		+19.0	43.2	94.0	-50.8	Horiz 100
13	12.065M	14.8	+8.9	+0.5		+19.0	43.2	94.0	-50.8	Horiz 100
14	18.782M	15.0	+8.6	+0.6		+19.0	43.2	94.0	-50.8	Horiz 100
15	10.248M	14.5	+9.2	+0.4		+19.0	43.1	94.0	-50.9	Horiz 100
16	10.175M	14.2	+9.3	+0.4		+19.0	42.9	94.0	-51.1	Horiz 100
17	10.650M	14.3	+9.2	+0.4		+19.0	42.9	94.0	-51.1	Horiz 100
18	11.641M	14.5	+9.0	+0.4		+19.0	42.9	94.0	-51.1	Horiz 100
19	17.216M	14.8	+8.5	+0.6		+19.0	42.9	94.0	-51.1	Horiz 100
20	10.935M	14.3	+9.1	+0.4		+19.0	42.8	94.0	-51.2	Horiz 100

CKC Laboratories Date: 11/16/2006 Time: 11:29:57 Honeywell International Inc. WO#: 85922
2.1053/87.139 Spurious Test Distance: 3 Meters Sequence#: 4 Polarity: Horiz
Notes: Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied wh



Test Location: CKC Laboratories •22116 23rd Dr SE • Bothell, WA 98021-4413 • 425-402-1717

Customer: **Honeywell International Inc.**
Specification: **2.1053/87.139 Spurious**
Work Order #: **85922** Date: 11/16/2006
Test Type: **Radiated Scan** Time: 10:10:17
Equipment: **TCAS** Sequence#: 1
Manufacturer: Honeywell Tested By: Ryan Rutledge
Model: PN: 940-0530-001
S/N: TPL00210

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
Agilent E4446A	S/N: US44300437	05/27/2006	05/27/2008	AN02673
Bothell 5m Cable Set	S/N: P05444	11/28/2005	11/28/2007	ANP05444
HP 8447D PreAmp	S/N: 2944A08601	07/10/2006	07/10/2008	AN01517
Chase BILOG	S/N: 2458	02/02/2005	02/02/2007	AN01993

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

Function	Manufacturer	Model #	S/N
TCAS*	Honeywell	PN: 940-0530-001	TPL00210

Support Devices:

Function	Manufacturer	Model #	S/N
Antenna Simulator	Honeywell	PN: 727-0016-001	0025
Antenna Simulator	Honeywell	PN: 727-0016-001	0074

Test Conditions / Notes:

Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied to find maximum emissions. RF output is terminated with antenna simulators that are placed under the table, on the conductive surface of the turntable. Transmitter operating under normal conditions, terminated with antenna simulators Frequency range tested: 30 - 1000 MHz @ 120 kHz RBW, 120 kHz VBW. Measurement distance: 3 meters.

Transducer Legend:

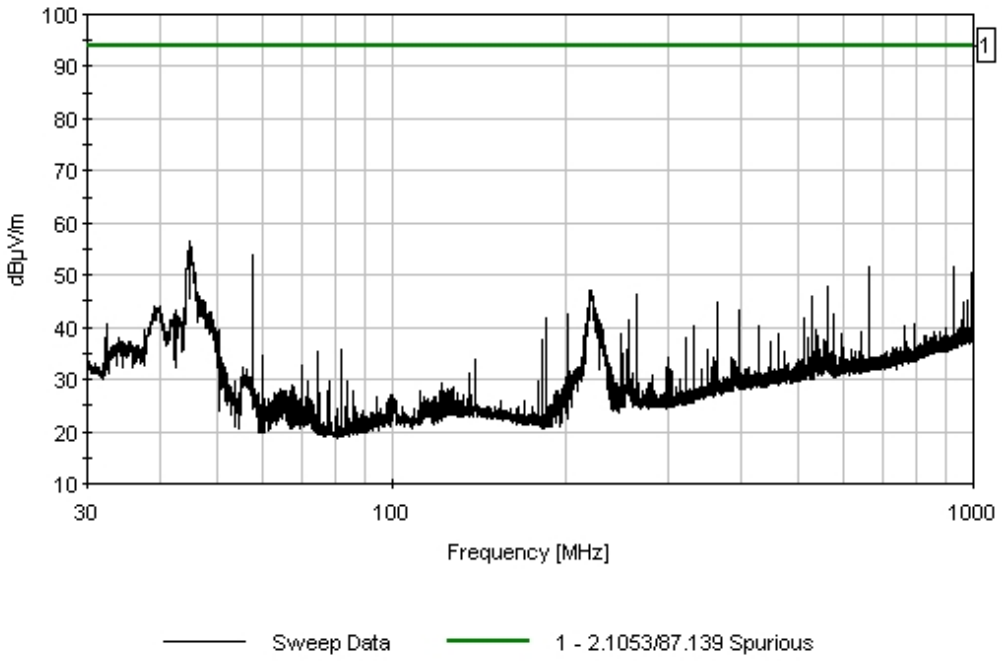
T1=Chase AN 1993 SN 2458 2/2/05-2/2/07 T2=Bothell 5 meter cable set
T3=AMP-AN01517-071006

Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	45.140M	58.7	+14.3	+1.0	-27.6		+10.0	56.4	94.0	-37.6	Vert 100
2	44.874M	57.6	+14.5	+1.0	-27.6		+10.0	55.5	94.0	-38.5	Vert 100
3	57.817M Ambient	60.7	+9.8	+1.1	-27.6		+10.0	54.0	94.0	-40.0	Vert 100
4	659.978M	45.9	+20.3	+3.9	-28.6		+10.0	51.5	94.0	-42.5	Vert 100
5	924.015M	41.1	+23.5	+4.7	-27.8		+10.0	51.5	94.0	-42.5	Vert 100

6	44.341M	53.1	+14.7	+0.9	-27.6	+10.0	51.1	94.0	-42.9	Vert 100
7	994.147M	38.6	+24.4	+5.1	-27.8	+10.0	50.3	94.0	-43.7	Vert 100
8	560.928M	43.5	+19.3	+3.5	-28.5	+10.0	47.8	94.0	-46.2	Vert 100
9	219.271M	51.1	+10.9	+2.1	-27.1	+10.0	47.0	94.0	-47.0	Vert 100
10	994.879M	35.1	+24.4	+5.1	-27.8	+10.0	46.8	94.0	-47.2	Vert 100
11	264.033M	47.9	+13.0	+2.4	-27.0	+10.0	46.3	94.0	-47.7	Vert 100
12	46.671M	49.0	+13.5	+1.0	-27.6	+10.0	45.9	94.0	-48.1	Vert 100
13	528.032M	41.9	+18.9	+3.4	-28.4	+10.0	45.8	94.0	-48.2	Vert 100
14	976.797M	33.7	+24.2	+5.0	-27.7	+10.0	45.2	94.0	-48.8	Vert 100
15	47.336M	48.6	+13.1	+1.0	-27.6	+10.0	45.1	94.0	-48.9	Vert 100
16	362.949M	43.3	+16.0	+2.9	-27.4	+10.0	44.8	94.0	-49.2	Vert 100
17	960.074M	33.5	+24.0	+4.9	-27.6	+10.0	44.8	94.0	-49.2	Vert 100
18	39.217M	43.8	+17.0	+0.9	-27.7	+10.0	44.0	94.0	-50.0	Vert 100
19	223.447M	47.4	+11.1	+2.1	-27.0	+10.0	43.6	94.0	-50.4	Vert 100
20	42.744M	44.6	+15.4	+0.9	-27.6	+10.0	43.3	94.0	-50.7	Vert 100
21	395.966M	40.8	+17.2	+3.0	-27.7	+10.0	43.3	94.0	-50.7	Vert 100
22	217.236M	47.2	+10.7	+2.1	-27.1	+10.0	42.9	94.0	-51.1	Vert 100
23	42.445M	44.0	+15.5	+0.9	-27.6	+10.0	42.8	94.0	-51.2	Vert 100
24	200.316M	48.4	+9.6	+2.1	-27.4	+10.0	42.7	94.0	-51.3	Vert 100
25	575.936M	38.0	+19.5	+3.6	-28.4	+10.0	42.7	94.0	-51.3	Vert 100
26	44.009M	44.5	+14.8	+0.9	-27.6	+10.0	42.6	94.0	-51.4	Vert 100
27	42.278M	43.6	+15.6	+0.9	-27.7	+10.0	42.4	94.0	-51.6	Vert 100
28	43.077M	43.6	+15.2	+0.9	-27.6	+10.0	42.1	94.0	-51.9	Vert 100
29	184.789M	47.5	+9.7	+2.0	-27.3	+10.0	41.9	94.0	-52.1	Vert 100
30	511.944M	38.0	+18.7	+3.3	-28.3	+10.0	41.7	94.0	-52.3	Vert 100

CKC Laboratories Date: 11/16/2006 Time: 10:10:17 Honeywell International Inc. WO#: 85922
2.1053/87.139 Spurious Test Distance: 3 Meters Sequence#: 1 Polarity: Vert
Notes: Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied to



Test Location: CKC Laboratories •22116 23rd Dr SE • Bothell, WA 98021-4413 • 425-402-1717

Customer: **Honeywell International Inc.**
Specification: **2.1053/87.139 Spurious**
Work Order #: **85922** Date: 11/16/2006
Test Type: **Radiated Scan** Time: 10:33:02
Equipment: **TCAS** Sequence#: 2
Manufacturer: Honeywell Tested By: Ryan Rutledge
Model: PN: 940-0530-001
S/N: TPL00210

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
Agilent E4446A	S/N: US44300437	05/27/2006	05/27/2008	AN02673
Bothell 5m Cable Set	S/N: P05444	11/28/2005	11/28/2007	ANP05444
HP 8447D PreAmp	S/N: 2944A08601	07/10/2006	07/10/2008	AN01517
Chase BILOG	S/N: 2458	02/02/2005	02/02/2007	AN01993

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

Function	Manufacturer	Model #	S/N
TCAS*	Honeywell	PN: 940-0530-001	TPL00210

Support Devices:

Function	Manufacturer	Model #	S/N
Antenna Simulator	Honeywell	PN: 727-0016-001	0025
Antenna Simulator	Honeywell	PN: 727-0016-001	0074

Test Conditions / Notes:

Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied to find maximum emissions. RF output is terminated with antenna simulators that are placed under the table, on the conductive surface of the turntable. Transmitter operating under normal conditions, terminated with antenna simulators Frequency range tested: 30 - 1000 MHz @ 120 kHz RBW, 120 kHz VBW. Measurement distance: 3 meters.

Transducer Legend:

T1=Chase AN 1993 SN 2458 2/2/05-2/2/07 T2=Bothell 5 meter cable set
T3=AMP-AN01517-071006

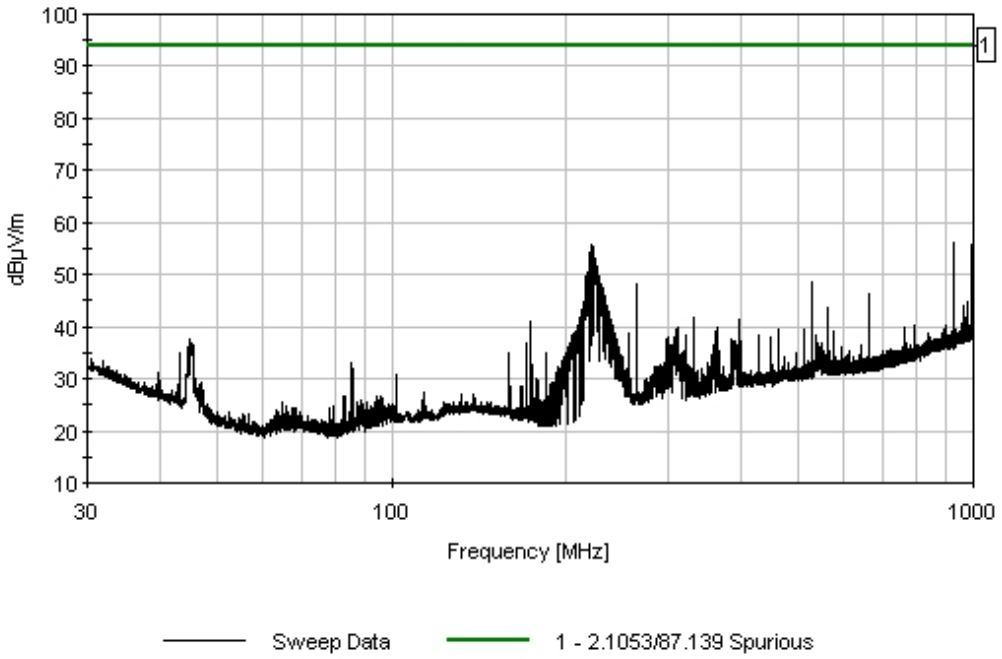
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq MHz	Rdng dBµV	T1 dB	T2 dB	T3 dB	dB	Dist Table	Corr dBµV/m	Spec dBµV/m	Margin dB	Polar Ant
1	924.015M	45.6	+23.5	+4.7	-27.8		+10.0 360	56.0	94.0	-38.0	Horiz 180
2	995.192M	44.0	+24.4	+5.1	-27.8		+10.0 360	55.7	94.0	-38.3	Horiz 180
3	221.413M	59.2	+11.0	+2.1	-27.1		+10.0 360	55.2	94.0	-38.8	Horiz 180
4	221.627M	59.2	+11.0	+2.1	-27.1		+10.0 360	55.2	94.0	-38.8	Horiz 180
5	220.877M	59.0	+11.0	+2.1	-27.1		+10.0 360	55.0	94.0	-39.0	Horiz 180

6	222.376M	58.5	+11.1	+2.1	-27.0	+10.0 360	54.7	94.0	-39.3	Horiz 180
7	223.019M	58.4	+11.1	+2.1	-27.0	+10.0 360	54.6	94.0	-39.4	Horiz 180
8	218.735M	57.5	+10.8	+2.1	-27.1	+10.0 360	53.3	94.0	-40.7	Horiz 180
9	218.307M	56.8	+10.8	+2.1	-27.1	+10.0 360	52.6	94.0	-41.4	Horiz 180
10	218.950M	55.7	+10.9	+2.1	-27.1	+10.0 360	51.6	94.0	-42.4	Horiz 180
11	226.124M	55.1	+11.3	+2.1	-27.0	+10.0 360	51.5	94.0	-42.5	Horiz 180
12	989.548M	39.0	+24.4	+5.1	-27.8	+10.0 360	50.7	94.0	-43.3	Horiz 180
13	217.022M	54.8	+10.7	+2.1	-27.1	+10.0 360	50.5	94.0	-43.5	Horiz 180
14	217.665M	54.5	+10.8	+2.1	-27.1	+10.0 360	50.3	94.0	-43.7	Horiz 180
15	216.165M	54.0	+10.7	+2.1	-27.1	+10.0 360	49.7	94.0	-44.3	Horiz 180
16	217.343M	53.8	+10.8	+2.1	-27.1	+10.0 360	49.6	94.0	-44.4	Horiz 180
17	225.696M	53.2	+11.3	+2.1	-27.0	+10.0 360	49.6	94.0	-44.4	Horiz 180
18	226.874M	53.1	+11.4	+2.1	-27.0	+10.0 360	49.6	94.0	-44.4	Horiz 180
19	227.731M	52.7	+11.4	+2.1	-27.0	+10.0 360	49.2	94.0	-44.8	Horiz 180
20	528.032M	44.5	+18.9	+3.4	-28.4	+10.0 360	48.4	94.0	-45.6	Horiz 180
21	228.587M	51.7	+11.5	+2.1	-27.0	+10.0 360	48.3	94.0	-45.7	Horiz 180
22	264.033M	49.9	+13.0	+2.4	-27.0	+10.0 360	48.3	94.0	-45.7	Horiz 180
23	230.194M	50.6	+11.6	+2.1	-27.0	+10.0 360	47.3	94.0	-46.7	Horiz 180
24	231.372M	50.5	+11.6	+2.2	-27.0	+10.0 360	47.3	94.0	-46.7	Horiz 180
25	229.658M	50.6	+11.5	+2.1	-27.0	+10.0 360	47.2	94.0	-46.8	Horiz 180
26 QP	220.475M	50.9	+11.0	+2.1	-27.1	+10.0 95	46.9	94.0	-47.1	Horiz 200
^	220.492M	62.5	+11.0	+2.1	-27.1	+10.0 95	58.5	94.0	-35.5	Horiz 200
28	214.987M	50.7	+10.6	+2.1	-27.2	+10.0 360	46.2	94.0	-47.8	Horiz 180

29	659.978M	40.6	+20.3	+3.9	-28.6	+10.0 360	46.2	94.0	-47.8	Horiz 180
30	232.550M	49.0	+11.7	+2.2	-27.0	+10.0 360	45.9	94.0	-48.1	Horiz 180
31	233.513M	47.9	+11.8	+2.2	-27.0	+10.0 360	44.9	94.0	-49.1	Horiz 180

CKC Laboratories Date: 11/16/2006 Time: 10:33:02 Honeywell International Inc. WO#: 85922
2.1053/87.139 Spurious Test Distance: 3 Meters Sequence#: 2 Polarity: Horiz
Notes: Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied to



Test Location: CKC Laboratories •22116 23rd Dr SE • Bothell, WA 98021-4413 • 425-402-1717

Customer: **Honeywell International Inc.**
Specification: **2.1053/87.139 Spurious**
Work Order #: **85922** Date: 11/16/2006
Test Type: **Radiated Scan** Time: 12:43:17
Equipment: **TCAS** Sequence#: 5
Manufacturer: Honeywell Tested By: Ryan Rutledge
Model: PN: 940-0530-001
S/N: TPL00210

***Test Equipment*:**

Function	S/N	Calibration Date	Cal Due Date	Asset #
Agilent E4446A	S/N: US44300437	06/13/2005	06/13/2007	AN02673
60" Pasternack 40 GHz Coax	S/N: N/A	05/11/2006	05/11/2008	AN05422
20' Heliax Cable	S/N: 36	03/16/2006	03/16/2008	ANP05419
HP 83017A .5 - 26.5 GHz Pre-amp	S/N: 3123A00464	10/03/2005	10/03/2007	AN01271
36" Pasternack 40 GHz Coax	S/N: N/A	02/08/2005	02/08/2007	AN05206
EMCO 3115 Horn Ant	S/N: 9606-4854	12/13/2005	12/13/2007	AN01412

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

Function	Manufacturer	Model #	S/N
TCAS*	Honeywell	PN: 940-0530-001	TPL00210

Support Devices:

Function	Manufacturer	Model #	S/N
Antenna Simulator	Honeywell	PN: 727-0016-001	0025
Antenna Simulator	Honeywell	PN: 727-0016-001	0074

Test Conditions / Notes:

Device is placed on wooden table 80 cm above a ground plane. Table will be rotated and antenna height varied when maximizing emissions. RF output is terminated with antenna simulators that are placed under the table, on the conductive surface of the turntable. Transmitter operating under normal conditions, terminated with antenna simulators Customer states that lowest operating frequency in device is 20 MHz, and highest frequency is 1090 MHz. We will measure radiated spurious emissions from 10 MHz to 11 GHz. Frequency ranges tested: 1 - 11 GHz @ 1 MHz RBW, 1 MHz VBW. Measurement distance: 3 meters.

Transducer Legend:

T1=ANT-AN01412-121305	T2=P05206 40GHz
T3=AMP-AN01271-100305 - .5-26.5 GHz	T4=CAB-P05419-031506
T5=Cable ANP05422 - 60"	

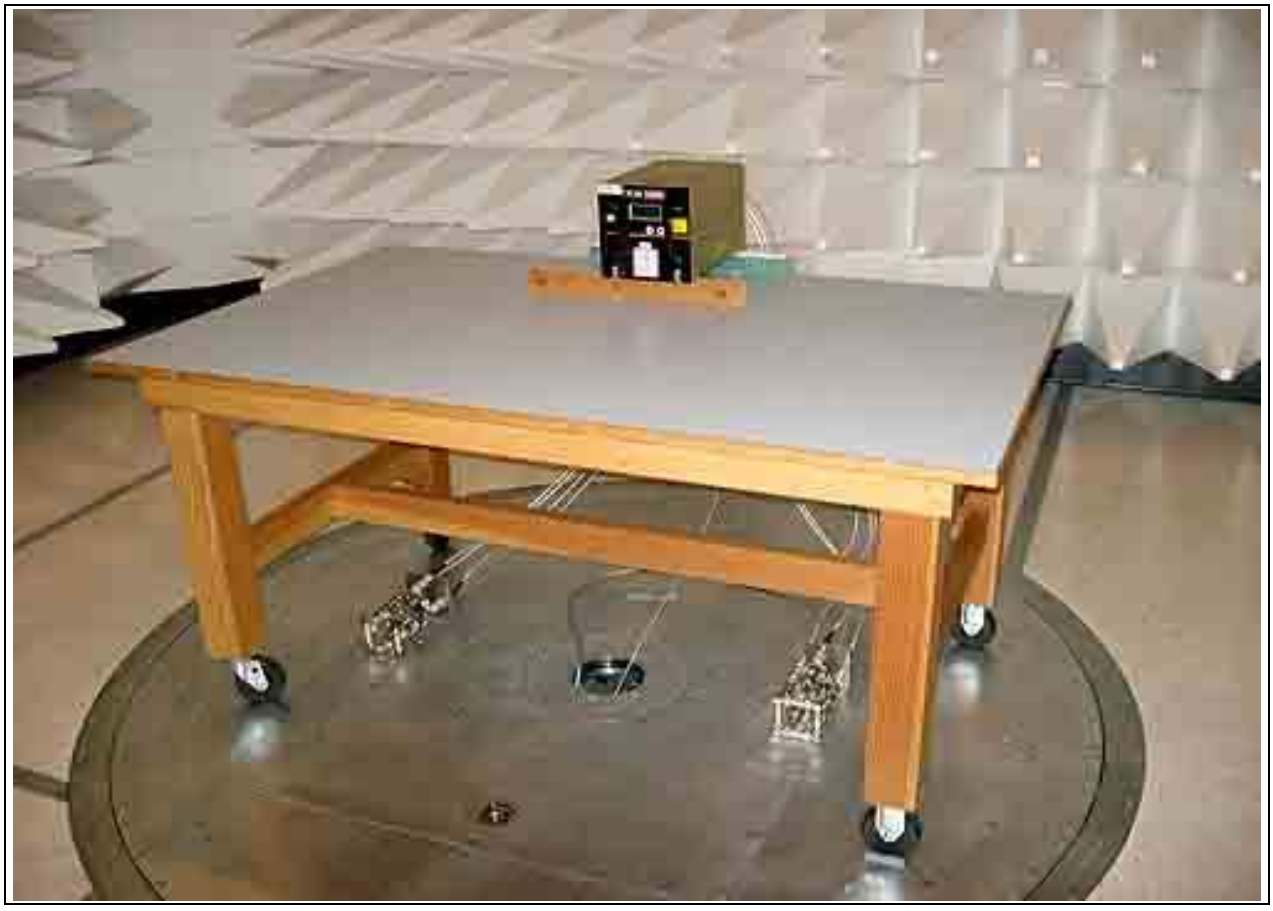
Measurement Data: Reading listed by margin. Test Distance: 3 Meters

#	Freq	Rdng	T1 T5	T2	T3	T4	Dist	Corr	Spec	Margin	Polar
	MHz	dBµV	dB	dB	dB	dB	Table	dBµV/m	dBµV/m	dB	Ant
1	1030.300M	102.7	+23.7	+0.7	-37.1	+1.2	+10.0	102.7	94.0	+8.7	Vert
	Ambient		+1.5						Fundamentals		100
2	1090.100M	92.9	+24.1	+0.7	-36.8	+1.2	+10.0	93.6	94.0	-0.4	Horiz
	Ambient		+1.5				20		Fundamentals		200

3	1030.400M Ambient	93.0	+23.7 +1.5	+0.7	-37.1	+1.2	+10.0 20	93.0	94.0 Fundamentals	-1.0	Horiz 200
4	1088.900M Ambient	78.7	+24.1 +1.5	+0.7	-36.8	+1.2	+10.0	79.4	94.0 Fundamentals	-14.6	Vert 100
5	1583.940M	67.8	+26.2 +1.9	+0.8	-35.0	+1.5	+10.0 20	73.2	94.0	-20.8	Horiz 200
6	1584.064M	65.0	+26.2 +1.9	+0.8	-35.0	+1.5	+10.0 342	70.4	94.0	-23.6	Vert 150
7	1583.919M	60.5	+26.2 +1.9	+0.8	-35.0	+1.5	+10.0 10	65.9	94.0	-28.1	Vert 211
8	2376.016M	52.1	+28.5 +2.3	+1.1	-34.0	+1.9	+10.0 43	61.9	94.0	-32.1	Horiz 190
9	1715.972M	55.4	+26.2 +1.9	+0.9	-34.8	+1.6	+10.0 25	61.2	94.0	-32.8	Horiz 190
10	1451.892M	51.3	+26.0 +1.8	+0.8	-35.4	+1.6	+10.0 10	56.1	94.0	-37.9	Vert 211
11	1452.100M	50.7	+26.0 +1.8	+0.8	-35.4	+1.6	+10.0 20	55.5	94.0	-38.5	Horiz 200
12	1848.100M	49.0	+26.2 +2.0	+0.9	-34.6	+1.7	+10.0 342	55.2	94.0	-38.8	Vert 150
13	1188.200M	46.9	+24.6 +1.6	+0.7	-36.3	+1.1	+10.0 360	48.6	94.0	-45.4	Vert 210

PHOTOGRAPHS

PHOTOGRAPH SHOWING RADIATED EMISSIONS



Radiated Emissions - Front View

PHOTOGRAPH SHOWING RADIATED EMISSIONS

Radiated Emissions - Back View