

5X80 Series

5080, 5180 and 5380 Image Engines

Integration Manual

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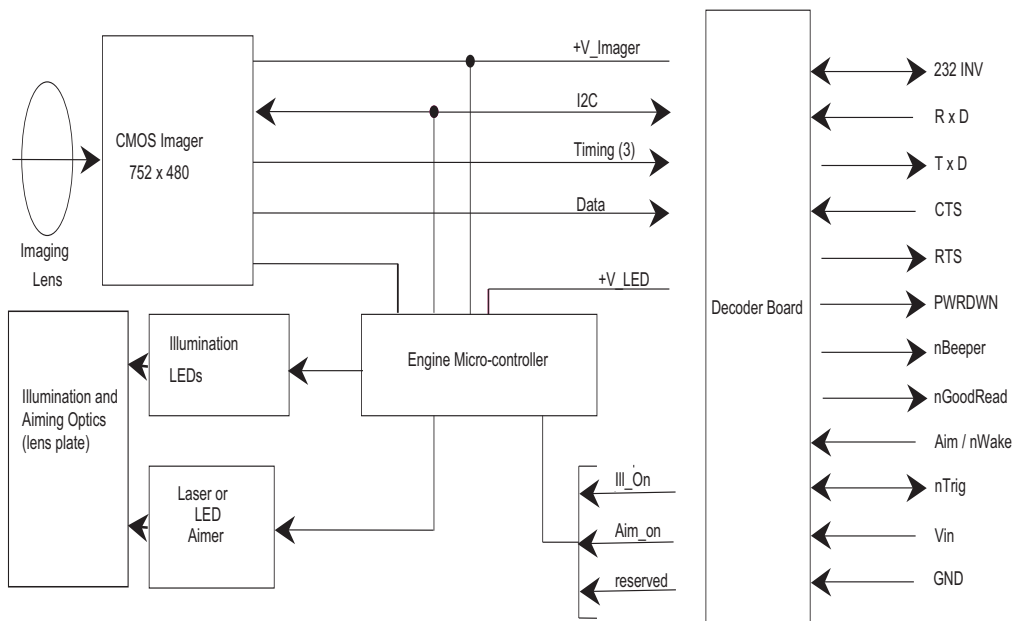


Introduction and Installation

About the 5X80 Decoded Out Image Engines

The 5X80 Series Image Engines are small decoded output engines that can read all popular 1D and 2D bar codes. The devices are comprised of two main parts: an optics module and a decoder board. The optics module contains a 752x480 pixel CMOS area imager, illumination LEDs, an internal microcontroller, and an aimer. The aimer can use either green LEDs or a laser diode to form a bright, intuitive aiming aid. The second part of the module is a decoder board that contains all the firmware to capture, decode, and output bar code data, as well as provide advanced image processing functions for image capture applications. The 5X80 2D Image Engine functions like a digital camera and adds functionality and value to an OEM product by adding capabilities such as digital image capture, document lift, signature capture, and reading OCR A and B characters.

The 5X80 Image Engine is specifically designed for easy integration into most existing portable data terminals. The size and current draw of the device allow the engine to drop in with few mechanical modifications. The decoder module supports a TTL level 232 interface that, in most cases, does not require any hardware modifications to existing platforms. This module also supports USB 1.1. To ease integration efforts, a Software Developers Kit provides a simple software interface (API).



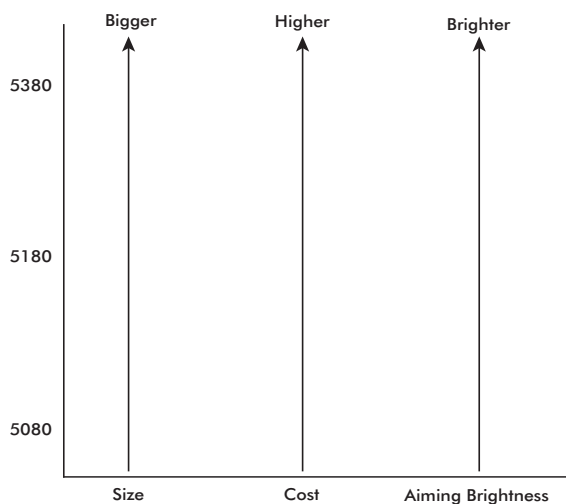
The systems may be ordered assembled with a mounting bracket or as separate components for custom mounting. The following information is presented to assist you in integrating the 5X80 module into an OEM application.

The following parts allow you to assemble your own unbracketed configuration:

Description	Part Number
2" flex from the engine to the decoder PCB	100002430
USB Decoder Board	5X80 USB DB
232 Decoder Board	5X80 232 DB

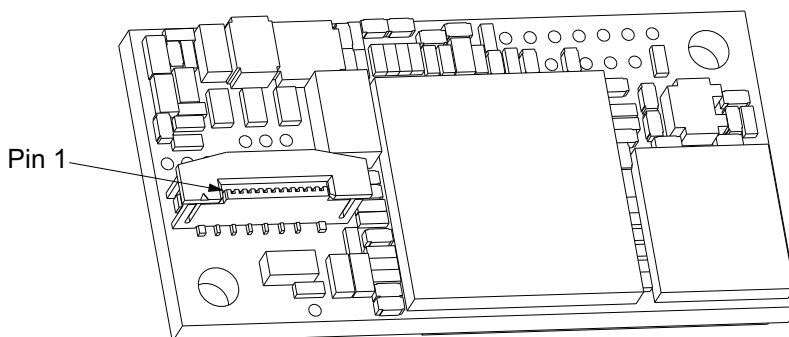
Model Comparison

The 5X80 Series has three models to choose from. A general comparison of these models is shown below.



Decoder Board to Host Interface Connector

The interface connector is a Molex .5mm vertical surface mount FFC/FPC connector (part number 52559-1252). See [Chapter 7](#) for details.



Host Interface Connection Pin Out

The decoder board to host interface signals have different definitions depending upon whether the 5X80 is operating in TTL Level 232 or USB mode. The following table defines those signals:

Pin	TTL level 232	I/O	USB	I/O
1	232 INV ^a	I, WP	NC	-
2	Vin	-	Vin	-
3	GND	-	GND	-
4	(n)RxD ^b	I	D-	I/O

Pin	TTL level 232	I/O	USB	I/O
5	(n)TxD ^(see Signal polarity is selectable using pin 1 or via software configuration on page 1-3) ^c	O	<reserved>	O
6	(n)CTS ^(see Signal polarity is selectable using pin 1 or via software configuration on page 1-3)	I	D+	I/O
7	(n)RTS ^(see Signal polarity is selectable using pin 1 or via software configuration on page 1-3) ^(see Pull up resistors may be applied to these signals. The resistor values should be greater than 10k ohms. on page 1-3)	O	<reserved>	O
8	PWRDWN	O, od, P	PWRDWN	O, od, P
9	nBEEPER	O, od	nBEEPER	O, od
10	nGoodRead	O, od	nGoodRead	O, od
11	AIM/nWAKE ^d	I, P	AIM/nWAKE	I, P
12	nTrig	I/O, od, WP	nTrig	I/O, od, WP

- a. Signal can be driven internally to a logic low level by software configuration
- b. Signal polarity is selectable using pin 1 or via software configuration
- c. Pull up resistors may be applied to these signals. The resistor values should be greater than 10k ohms.
- d. AIM function reserved for future use. Not supported at this time.

Host Interface Signal Descriptions



Warning! Do not connect a flex strip to or disconnect a flex strip from the host interface connector when power is present on the flex strip. This could damage the image engine.

TTL Level 232

Signal	Description
232INV	Input - TTL level 232 polarity control with 68k ohm pull-up. Connect to ground for UART to UART serial signal polarity and override internal polarity control. This signal can also be driven to a logic low level internally and tying or pulling this input to Vcc is not recommended.
Vin	Power – Supply voltage input. Refer to specified input values on page 3-1.
GND	Power – Supply and signal ground.
(n)RxD	Input – TTL level 232 receive data (default) and not receive data. (Polarity is menu selectable.)
(n)TxD	Output – TTL level 232 transmit data (default) and not transmit data. (Polarity is menu selectable.)
(n)CTS	Input – TTL level 232 Clear to Send signal (default) and not Clear to Send. (Polarity is menu selectable.)

TTL Level 232

Signal	Description
(n)RTS	Output – TTL level 232 Request to Send (default) and not Request to Send. (Polarity is menu selectable.)
PWRDWN	Output – Open drain, 100K pull up on engine; active high indicator that 5X80 is in power off mode.
nBEEPER	Output – Open drain, 100K pull up on engine; idle high signal that can be an active low DC or PWM controlled AC signal used to drive an external beeper.
nGoodRead	Output – Open drain, 100K pull up on engine; active low signal for driving a low current Good Read LED circuit.
AIM/nWAKE	Input – 100K pull up on engine; when in power off mode active low wake up signal to the 5X80.
nTrig	Input/Output, Open drain, weak pull up on engine; Trigger line is an active low signal to trigger the unit. Leave the signal floating and connect to ground for the active state.

USB 1.1 Compliant Signals

Signal	Description
D-	Input/Output with 33.2 Ohm series termination resistor; USB D- differential data signal.
D+	Input/Output with 33.2 Ohm series termination resistor; USB D+ differential data signal.

TTL Level 232 Interface

Interface Signal Polarity Control

This control allows the user to configure the output for TTL level 232 or inverted TTL level 232 signal polarities. This can be done internally through a menu command or externally through the 232INV signal. The default menu setting for the polarity setting is TTL level 232 logic. This means that the signals are driven at logic levels that would normally be presented to the inputs of an RS-232 (EIA-232) serial port. Setting the signals for inverted TTL level 232 will cause the 5X80 to invert the signals' polarity but maintain the TTL compatible signal levels. The signals are then driven at logic levels that can interface directly to another UART. The 232INV signal allows external control. Pulling this input to V_{cc} is not recommended. **Tying this input to GND is recommended to invert the signal polarity and allow direct interface to another UART.**

USB Interface

The 5X80 supports the following USB 1.1 compliant client interfaces:

Note: USB-capable 5X80 engines also support TTL 232 for development purposes.

Keyboard

The bar code data is sent as it would be typed. The scanner can be configured to send certain keystrokes before and after the bar code. Typical speed is 10-15ms per character. This interface cannot be used to transfer images to the host.

COM Port Emulation

The COM port emulation performs as if the scanner was connected to a typical COM port. A custom driver is provided by Honeywell.

HIDPOS

The 5X80 conforms to the USB Bar Code Reader Interface definition.

IBM SurePOS

This interface is used if you want to connect via USB with IBM SurePOS capabilities. (This is the best choice when connecting to the USB port of an IBM POS terminal).

Note: For additional USB programming and technical information, refer to Honeywell's "USB Application Note," available at www.honeywellaidc.com.

Trigger Modes

The 5X80 supports four basic trigger modes: Manual/Serial, Low Power Manual Trigger, Presentation Mode, and Scan Stand Mode. See the User's Guide for additional trigger mode information.

Manual/Serial Trigger

Manual and serial trigger modes are used to initiate a scanning session. The 5X80 waits in a reduced power state for a trigger indication in the form of a command from the TTL Serial or USB interface, or an active low signal from the nTRIG pin of the host interface connector.

The serial command strings that activate and deactivate the trigger function are:

TTL Serial

Activate: [SYN]T[CR] or [SYN]t[CR]
Deactivate: [SYN]U[CR] [SYN]u[CR]
where [SYN] = 0x16 and [CR] = 0x0d

USB

Activate: &h4
Deactivate: &h0

The scanner may be set to automatically deactivate the trigger after a specified time period.

Low Power Manual Trigger (Power Off Mode)

Note: This selection is only valid in TTL-232.

Lower power trigger mode causes the 5X80 to power off between scans. A manual trigger activation causes the power to be turned on. The trigger line is controlled on the 5X80 with a pullup so the line must be left floating to successfully enter the low power modes. The Aim/nWake line must be idle high at the time of power down, otherwise the unit will not go into stop mode. The scanner scans until a timeout or a decode, indicating the appropriate status (beeper and good read LED), outputs the data, and, if the trigger has been released, turns off the power. See [Thermal Considerations](#) on page 2-1.

Presentation Mode

Presentation Mode uses ambient light to detect bar codes. The LEDs are off for ambient conditions until a change occurs in the imager's field of view. Then the LEDs turn on automatically to read the code. If the light level in the room is not high enough, Presentation Mode may not work properly. See [Thermal Considerations](#) on page 2-1.

Scan Stand Mode

When a unit is in Scan Stand mode, the imager remains idle as long as there is a special Scan Stand symbol in its field of view. When a different code is presented, or the image is covered, the imager turns on the illumination LEDs and tries to decode the new code.

Status Indicators

Good Read LED

The 5X80 provides a pin on the host interface connector (nGoodRead) that can be used to drive an LED to indicate a Good Read status. The driver for the Good Read LED signal is driven by an Open Drain 74LVC device with a $V_{Omax} = 5.5V$ through the 100K pull up resistor on the engine. It is capable of sinking 32 mA at $V_{in} = 4.5V$ (5X80 supply voltage) or 20mA at $V_{in} = 3.3V$.

Beeper

The 5X80 provides a pin on the host interface connector (nBEEPER) that provides a PWM output for generating audible feedback to the user. This signal is used to indicate the status of the device using a variety of patterns and frequencies.

The driver for the beeper signal is driven by an Open Drain 74LVC device with a $V_{Omax} = 5.5V$ through the 100K pull up resistor on the engine. It is capable of sinking 32 mA at $V_{in} = 4.5V$ (5X80 supply voltage) or 20mA at $V_{in} = 3.3V$.



Illumination/Aimer Power Control

LED Power Control Using the PWRLDC Command

The LED Power Control using the PWRLDC command controls the current drawn by the LEDs.

PWRLDC Setting	Approximate LED Current (mA)
100	35
90	32
80	28
70	24
60	21
50	17
40	14
30	10
0	LEDs Off

The current values specified above are measured at the LEDs. The current value as it translates to the host system depends on the voltage the host is providing to the 5X80 V_{in} pin. The equation below can be used to estimate the host current at each setting when operating in interlaced mode.

$$I_{host} = \frac{9.0 I_{LED}}{0.70 V_{hos}}$$

Aimer Modes

Interlaced In interlaced mode, the illumination and aiming timing is automatically synchronized to the imager exposure period by the Image Engine. The optics module turns illumination on only during the imager exposure time, and it turns the aiming on at all other times. The interlaced mode provides the lowest overall current draw and is recommended for most applications. It also provides the brightest aimer in most applications. The Image Engine software automatically maintains an approximate 25% aimer duty cycle, even when the imager exposure time is at its maximum in dark operating environments.

Concurrent Concurrent mode is not recommended for most applications. In concurrent mode, the illumination LEDs are on continuously, while the aimer LEDs turn off during the imager exposure period, and on while the imager is not exposing. Concurrent mode is used to eliminate any flicker of the illumination LEDs that may be objectionable to the user, especially when running the engine at 12MHz. (The 5X80 Series Image Engine runs at either 12 MHz or 24 MHz.) The illumination LED current is reduced compared to interlaced mode to limit engine peak current. The image engine software automatically maintains an approximate 25% aimer duty cycle, even when the imager exposure time is at its maximum in dark operating environments.

Concurrent mode provides the brightest appearance of the illumination LEDs of any of the imager operating modes. This mode may be useful for applications when an operator is using the illumination LEDs for aiming, such as in fixed mount, kiosk, or auto-trigger applications.

Thermal Considerations



Warning! When selecting any continuous trigger mode, the ambient temperature should not exceed the maximum operating temperature of the device. If the temperature exceeds the maximum operating temperature, the performance of the device may be reduced, the life of the product may be shortened, and permanent damage may occur to the device.

Care must be taken when designing the image engines into high ambient temperature applications where high duty cycle or auto-trigger scanning is required. Such conditions can induce self heating of the image engine that can increase image noise. This can result in degraded bar code reading performance and a reduction in image quality. The following precautions should be taken when integrating the image engine.

-
- Turn off the aiming and illumination LEDs whenever possible.
 - Use menu command SCNAIM0 to turn off the aimer for applications where it is not needed.
 - When an application requires use of the aimer, use interlaced aiming mode to reduce the illumination LED duty cycle.
 - When auto-trigger operation is required, use presentation mode or scan stand mode as these modes have “built-in” thermal management features.
 - Set the SDRTIM menu command to allow the processor to enter its power saving mode quickly after a bar code decode. (See the SDRTIM description below.)
 - Provide air flow to the image engine, when possible.
 - Allow ambient light to assist the image engine in bar code decoding, thereby reducing the on-time of the illumination LEDs.

Honeywell engineers have successfully designed the image engine into many applications as described above. Please contact your Honeywell sales manager or solutions architect for detailed design assistance.

SDRTIMxxx Menu Settings

The menu setting SDRTIMxxx can be used to improve the trigger to decode time of the 5X80 image engine in certain use cases. However, in other use cases, the performance of the imager can be degraded substantially if this parameter is incorrectly set. This section defines the SDRTIMxxx setting and discusses when it should be changed from its default configuration

Definition of SDRTIMxxx

SDRTIM is an abbreviation for "Scan Driver Timeout". The setting is used to configure the length of time that the imager is allowed to keep running after it is untriggered (either by a removal of the trigger signal, or by the successful decoding of a bar code). The parameter xxx is the time, in milliseconds, that the imager continues to run. For example, if the parameter SDRTIM200 is sent to the image engine, the imager continues to gather images with the illumination LEDs off, and the decoder board will continue to store those images into memory for 200 ms after the imager is untriggered. When the SDRTIM setting expires, the image engine transitions to standby mode to conserve power until it is triggered once again. When SDRTIM = 0, the imager is not turned off after an untrigger. The setting of 0 applies an infinite timeout to the SDRTIM command.

Negative Ramifications of Long SDRTIM Settings

Caution must be used when setting SDRTIM to 0 or to a very long time period. Since the image engine never enters the power saving standby mode, significant internal heating of the image engine can occur. In high ambient temperature situations, this can result in elevated 5X80 internal temperatures that can cause signal to noise degradation of the images. Consequently, the images from the image engine can be unacceptable for human viewing, and bar code reading may no longer be possible. Additionally, since the imager never enters standby mode, the battery life of battery operated systems will be reduced.

Recommendations

It is not advisable to change the SDRTIM command from its default configuration, which is 1 ms (SDRTIM1). Please do not change this setting from its default conditions without consulting a Honeywell Solutions Architect.

DC Characteristics

Operating Voltage

	Min	Max
V _{in}	3.0	5.5
V _{Noise} (mV peak to peak)		100

Note: At least 3.0V must be maintained at the 5X80 input connector during scanning.



Warning! Do not connect a flex strip to or disconnect a flex strip from the host interface connector when power is present on the flex strip. This could damage the image engine.

Absolute Maximum Ratings (T=23°C)

Parameter	Signals	Min	Max
V _{Input}	Voltage applied to any Input	-0.5V	5.5V
V _{Output}	Voltage applied to any Output, Power Off	-0.5V	V _{cc} +0.5V

DC Operating

Parameter	Signals	(V _{cc} +3.3V, T= 23°C)		(V _{cc} +4.5V, T= 23°C)	
		Min	Max	Min	Max
V _{IL}	nRXD, nCTS, nWAKE		0.8V		0.8V
V _{IH}		2.0V		2.0V	
V _{IL}	Wake on receive activity via nRXD signal		0.8V		1.0V
V _{IH}		2.0V		2.5V	
V _{OL}	nTXD, nRTS (I _o =16mA)		0.4V		0.56V
V _{OH}		2.4V		3.8V	

Current Draw

The Idle, Standby and Power Off power modes are controlled by the SDRTIM, 232LPT, TRGLPT and TRGMOD settings.

The Idle mode is entered when the SDRTIM time-out expires.

The Standby mode is entered when the SRDTIM and 232LPT time-outs expire.

Configure the scanner to TRGMOD2 to enable the Power Off mode. The Power Off mode is entered when the SDRTIM, 232LPT and TRGLPT time-outs expire.

Current Draw for 5080 and 5180¹

(Vin = 3.3V, T= 23° C) (Vin = 5V, T= 23° C)

Power Mode	Definition	Max	Max
I _{Inrush} ²	Maximum current spike seen when power is applied to the 5X80	600mA	550mA
I _{Peak} ³	Peak current draw when the engine is operating in interlaced aiming mode	600mA	350mA
I _{PeakCAMode} ^{3,4}	Peak current draw when the engine is operating in concurrent aiming mode	820mA	480mA
I _{OpAvg} ³	Average current draw when the engine is operating in interlaced aiming mode	510mA	310mA
I _{OpCAModeAvg} ^{3,4}	Average current draw when the engine is operating in concurrent aiming mode	715mA	470mA
I _{Idle}	Maximum current draw while not scanning or decoding. Controlled by the menu command SDRTIM.	120mA	75mA
I _{Standby}	Maximum current draw while in standby mode. Mode is entered when the menu command 232LPT expires while in Idle mode. (This mode is only available in a 232 configuration).	10mA	10mA
I _{Power Off}	Current draw while in Power Off mode (PWRDWN signal is high). Mode is entered when the menu command TRGLPT expires while in both Standby and Manual Low Power (TRGMOD2) modes. (This mode is only available in a 232 configuration).	500µA	500µA

Note: The 5X80 is compliant with USB power specifications. Concurrent aiming mode is not recommended for USB applications. Interlaced aiming mode, due to its lower peak current draw, is recommended.

1. External beeper or good read LED current not included.
2. In-rush peak limit for switched power-on condition with on board power supplies starting from 0V. Plug-in or rapid power cycle (off/ on in <1 minute) in-rush current limit is 700mA at 5.0V for a duration of 100 µSec. Multiple peaks may be observed.
3. LED current set to 35mA (100% LED Current)
4. Concurrent Aimer Mode. (This may also be referred to as CA Mode.)

Current Draw for 5380¹

(Vin = 3.3V, T= 23° C) (Vin = 5V, T= 23° C)

	Max	Max
I _{Inrush} ²	600mA	550mA
I _{Peak} ³	600mA	350mA
I _{PeakCAMode} ^{3,4}	795mA	455mA
I _{OpAvg} ³	510mA	310mA
I _{OpCAModeAvg} ^{3,4}	690mA	445mA
I _{Idle}	120mA	75mA
I _{Standby}	10mA	10mA
I _{Power Off}	500µA	500µA

1. External beeper or good read LED current not included.
2. In-rush peak limit for switched power-on condition with on board power supplies starting from 0V. Plug-in or rapid power cycle (off/ on in <1 minute) in-rush current limit is 700mA at 5.0V for a duration of 100 µSec. Multiple peaks may be observed.
3. LED current set to 35mA (100% LED current)
4. Concurrent Aimer Mode. (This may also be referred to as CA Mode.)

Power Conditioning and Interruptions

Always apply power to the imager *after* connecting to the interface device.



Warning! Connecting the imager to live power (“hot plugging”) may damage the electronic components of the imager.

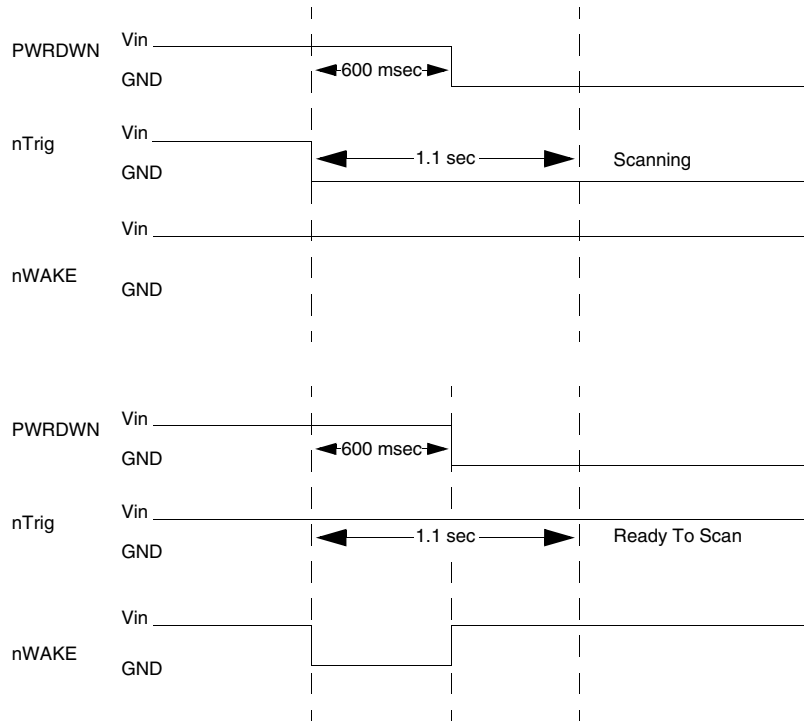
A clean and stable power source is recommended for the imager. Momentary power interruptions or fluctuations within the first 2 seconds of power up puts the imager into Power Off mode. An active low signal on the nTRIGGER or the nWAKE input powers the imager back up. A serial command will also power the imager back up. It is therefore recommended that the host device activate the nWAKE signal directly to power up the scanner.

In applications where the imager does not need to use the Power Off mode, it is recommended that a 10k pull down resistor be added to the nWAKE input.

AC Characteristics

The following diagrams indicate the typical timing for the Power-up, Power-off, and Scan and Decode sequence.

5X80 Series Power Up Timing Sequence



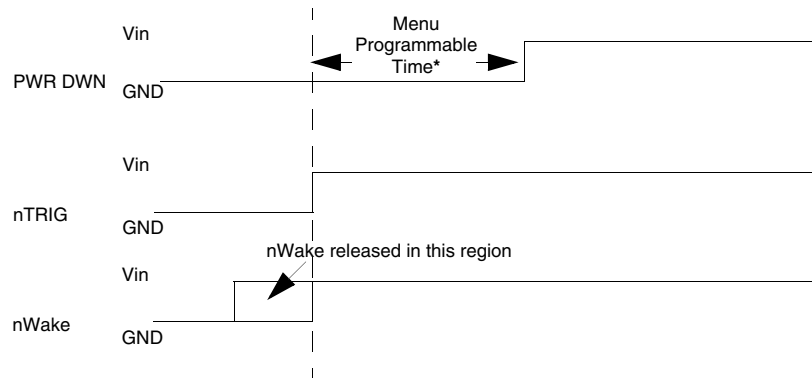
Time to come out of power modes:

300usec to exit Idle mode.

300usec to exit Standby mode.

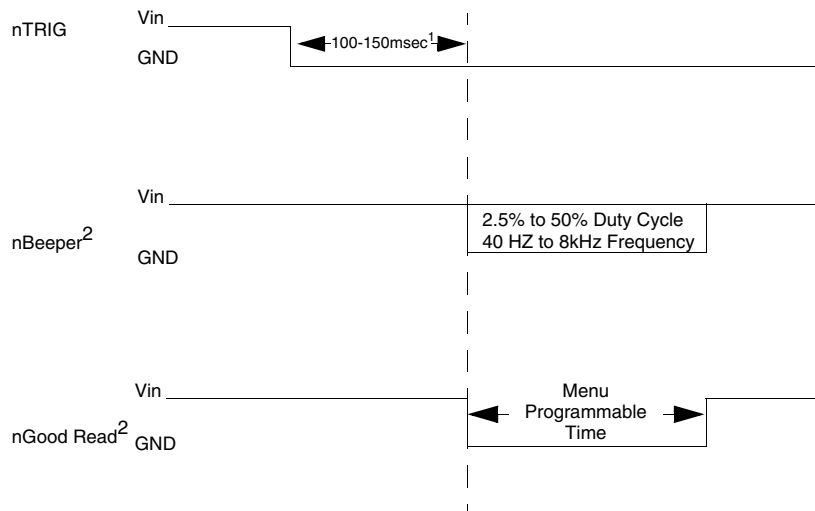
1.1 sec to exit Power Off mode.

5X80 Series Power Off Timing Sequence



* Includes SDRTIM, 232LPT and TRGLPT menu commands

5X80 Series Scan and Decode Timing Sequence



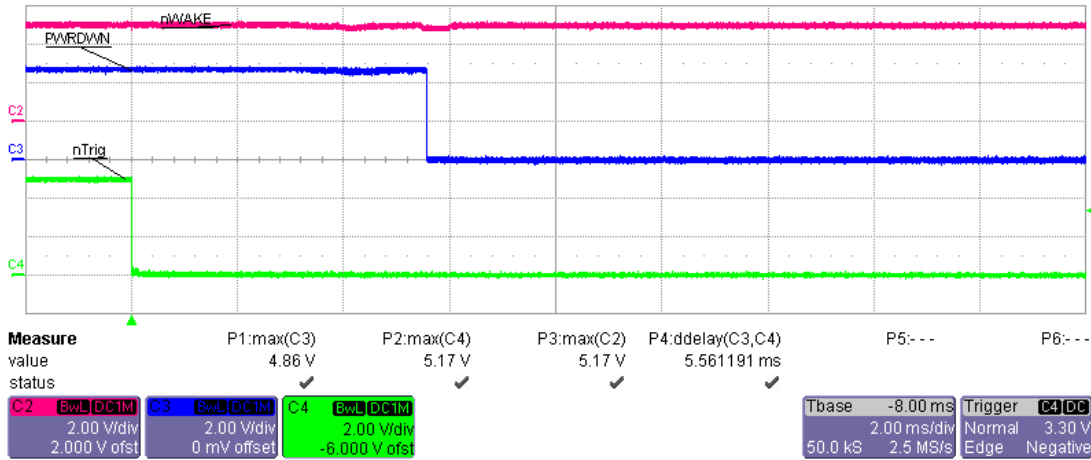
¹ Assumes good quality bar code placed at optimum focus point.

² Assumes 10k pull-up to Vin.

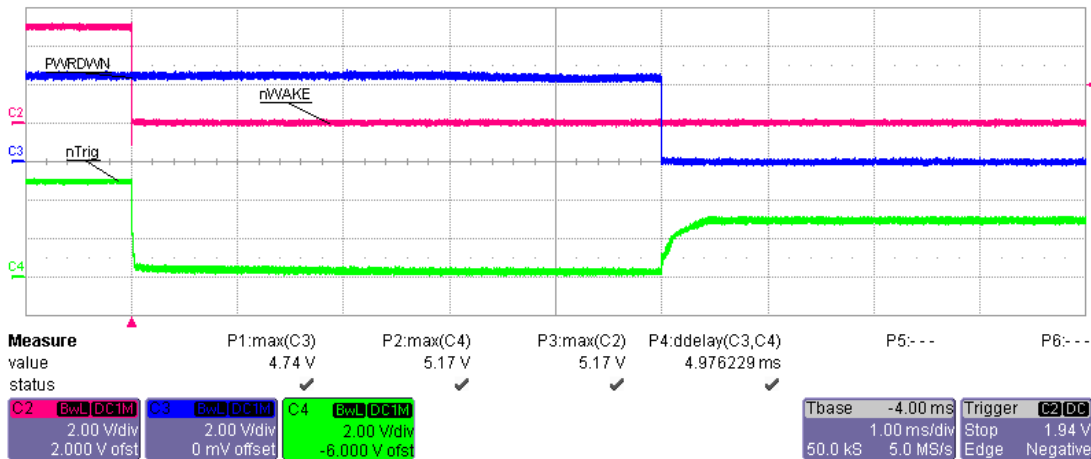
The following imager interface timing diagrams may be used for reference when designing a custom image engine to decoder flex circuit for a non-bracketed system. The diagrams indicate the timing signals as they originate from the imager, and timing relationship that is required at the decoder board connector.

Power Up From Power Off State

PWRDWN signal goes low 5.6mS after trigger is pulled low. The time to be ready to scan is ~1.1 seconds.

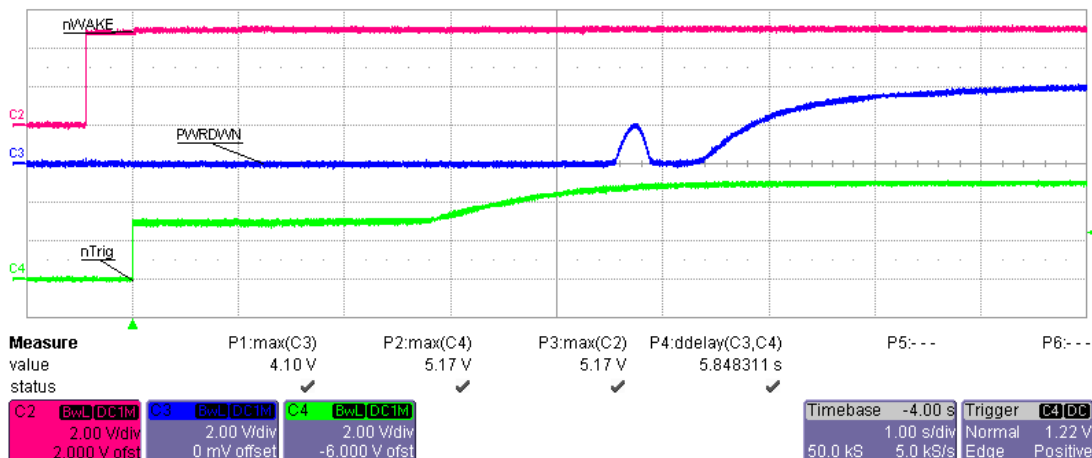


PWRDWN signal goes low 5mS after nWAKE is pulled low.



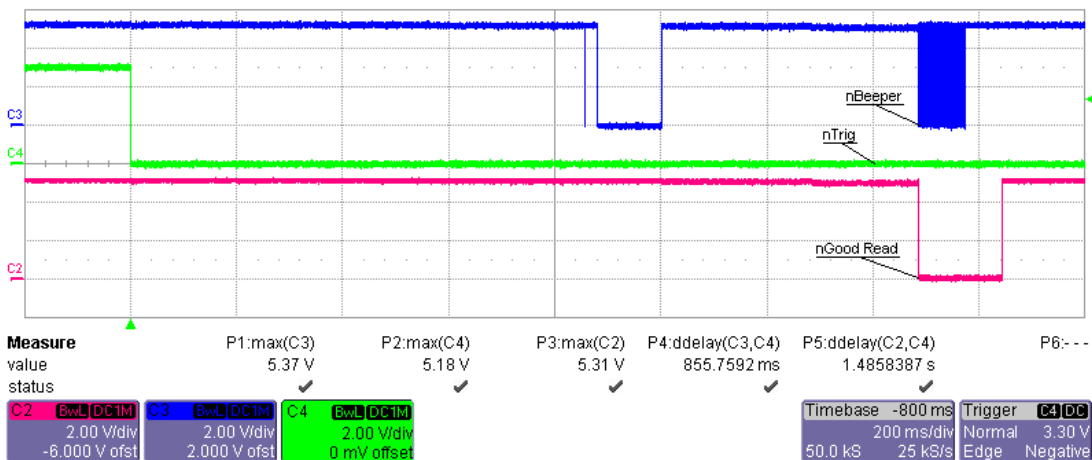
Power Off Timing

After nWAKE and nTRIG are released it takes ~7 sec for PWRDWN signal to go high. The PWRDWN signal is showing analog behavior as voltage is discharging. It is important to use a Schmitt Trigger input or transistor input.

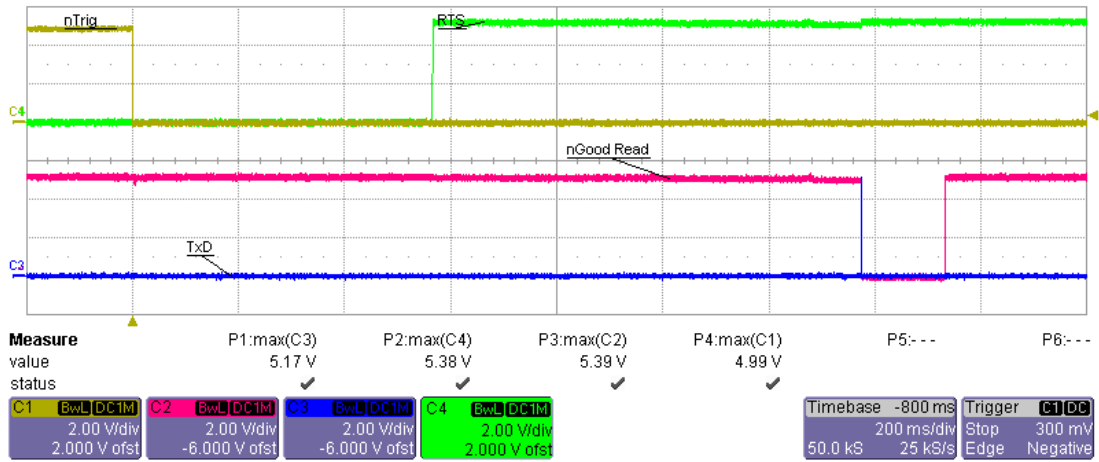


Power Up, Scan, and Beep Timing

Showing nTRIG, nBEEPER, nGOODREAD.

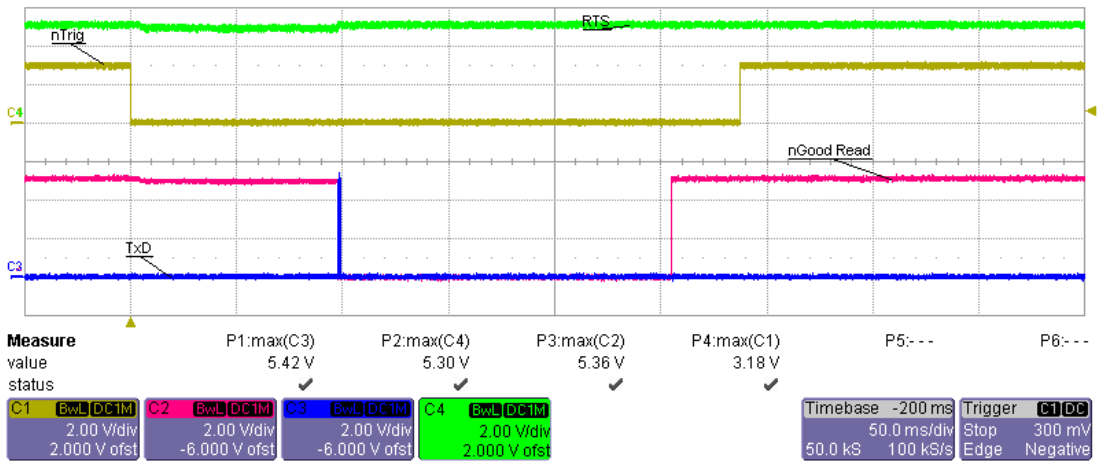


Showing nTRIG, nGOODREAD, TXD, RTS.



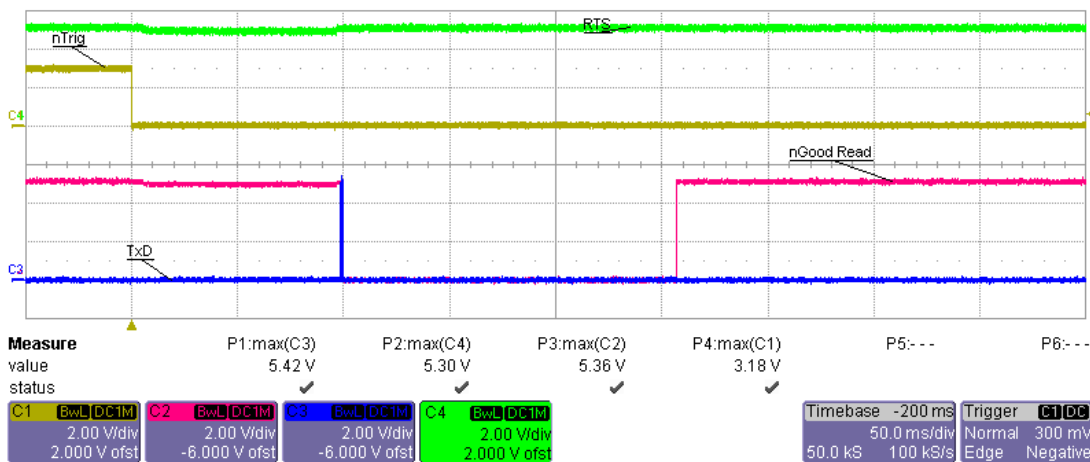
Idle to Scan and Beep Timing

Showing nTRIG, nGOODREAD, TXD, RTS.



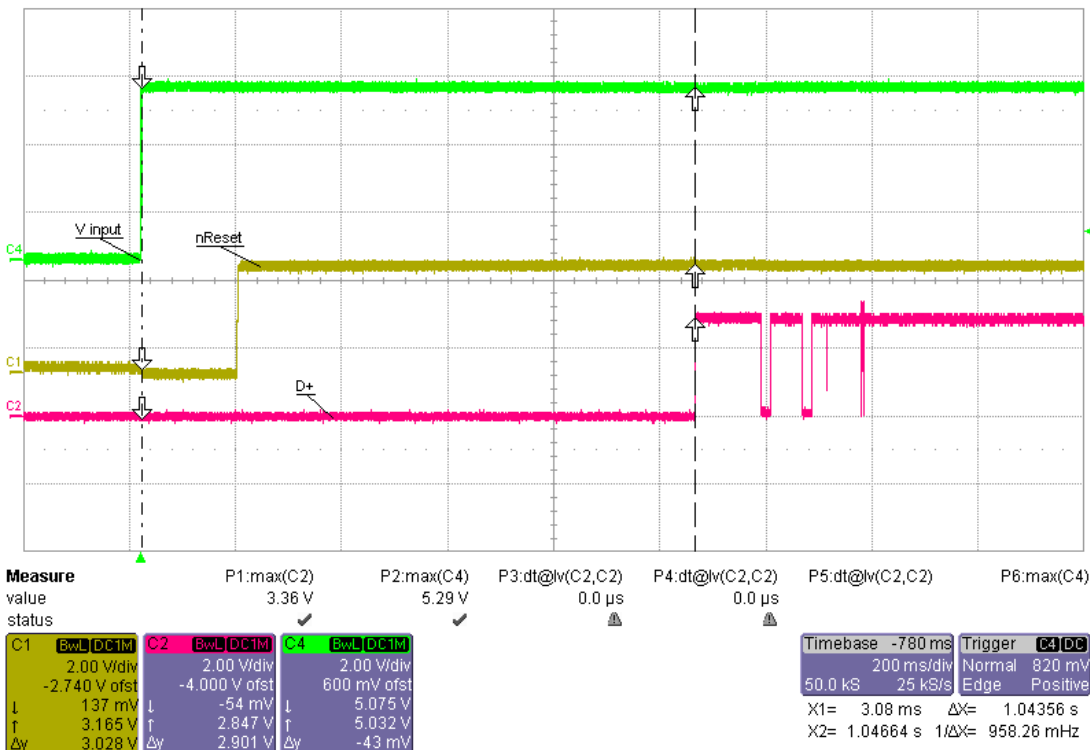
Sleep Mode to Scan and Beep Timing

Showing nTRIG, nGOODREAD, TXD, RTS.



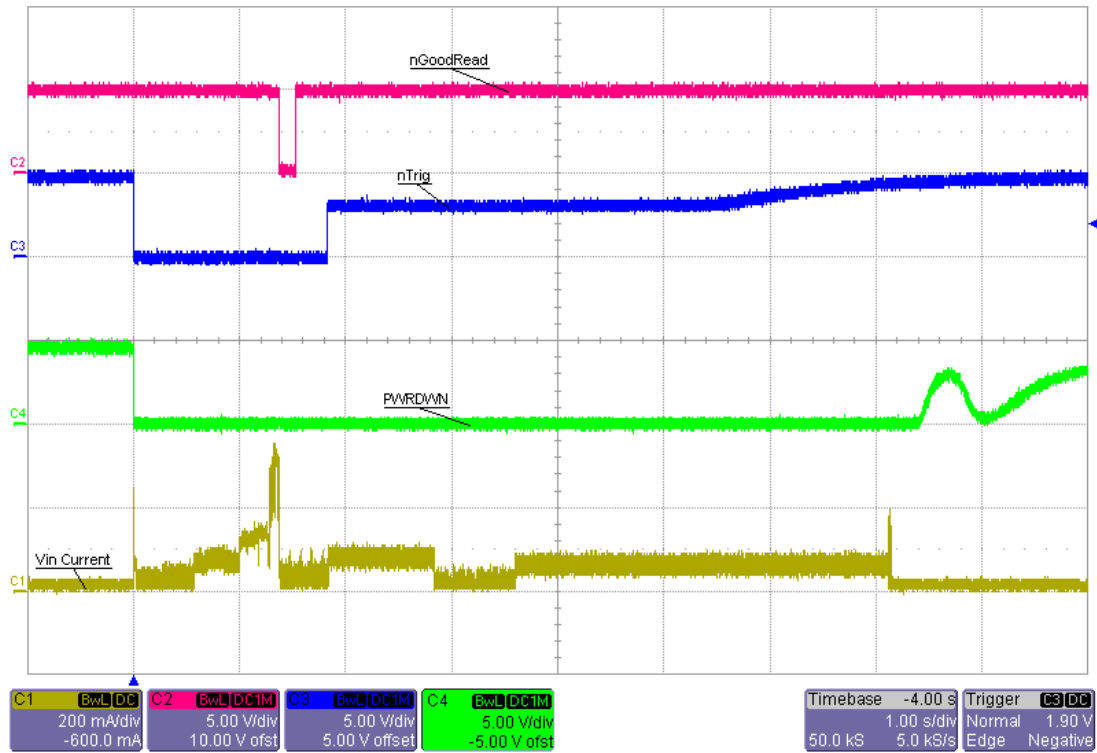
USB Enumeration Timing

Showing Vin, nRESET and D+.

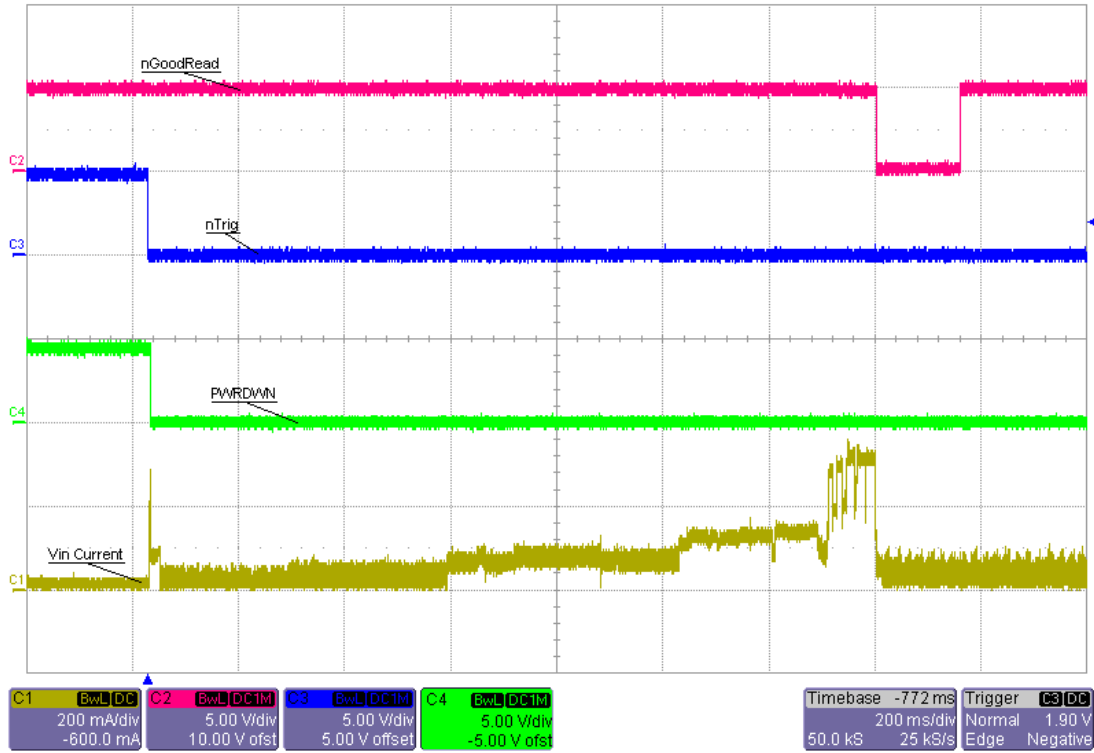


Concurrent Mode

Typical current profile from power up to power off - showing Vin current, nTRIG, nGOODREAD, PWRDWN,

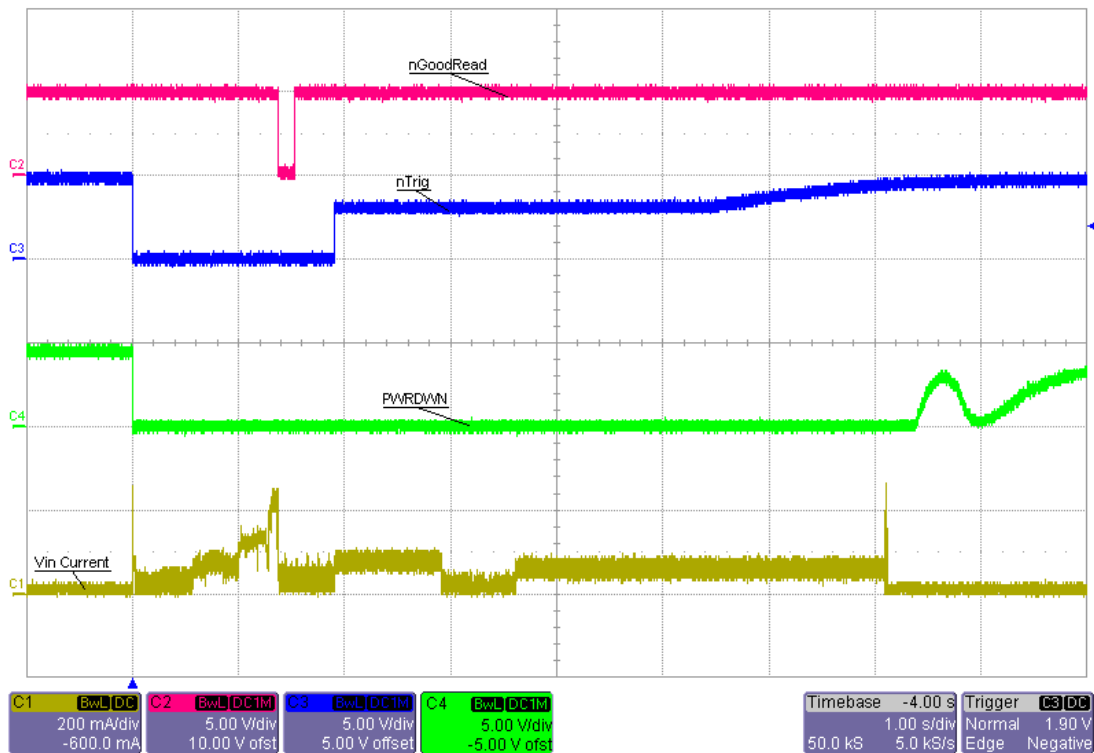


Typical current profile from power up - showing Vin current, nTRIG, nGOODREAD, PWRDWN - ZOOMED in

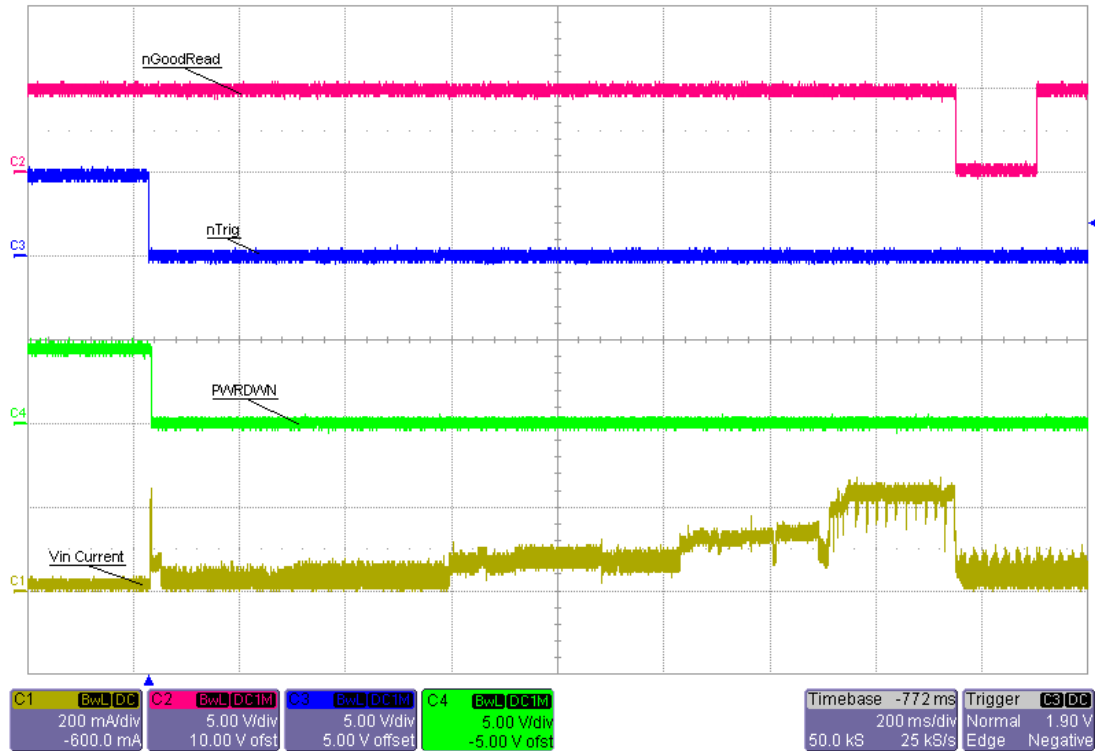


Interleaved Mode

Typical current profile from power up to power off - showing Vin current, nTRIG, nGOODREAD, PWRDWN



Typical current profile from power up - showing Vin current, nTRIG, nGOODREAD, PWRDWN - ZOOMED in



Environmental Specifications

Parameter	Specification
Temperature Ranges: Operating Storage	-22° F (non-condensing) to +122° F (-30° C (non-condensing) to +50° C) -40° F to +158° F (-40° C to +70° C)
Humidity (Operating and Storage)	Up to 95% non-condensing at 122° F (50° C)
Shock	The Image Scan Engine functions properly after being subjected to 18 shocks of 2,000 G's. for 0.7 msec and 18 shocks of 2,500 Gs for 0.7 msec at 73.4° F (23° C) applied via the mounting surface.
Vibration	The Image Scan Engine withstands a sinusity vibration of 0.20" (5.1mm) p-p displacement from 5Hz to 20Hz and 5G acceleration from 22Hz to 300Hz along each of 3 mutually perpendicular axes for a period of 2 hours per axis.
MTBF	Image Scan Engines have a calculated MTBF greater than 70,000 hours based upon MIL-HDBK-217F (02-DEC-1991). The calculation is based on the part count method for the Ground Benign (GB) environmental conditions.



Window Placement

Distance from Window

The window should be mounted close to the front of the Image Engine (parallel, no tilt). The maximum distance is measured from the front of the imager housing to the farthest surface of the window. Since unwanted reflections can occur at either surface and the window thickness can vary, the further side is the worst case.

Uncoated Window (or inside only coated): .089 inches (2.25 mm)

Coated Window (2-sided or outside only): .118 inches (3 mm)

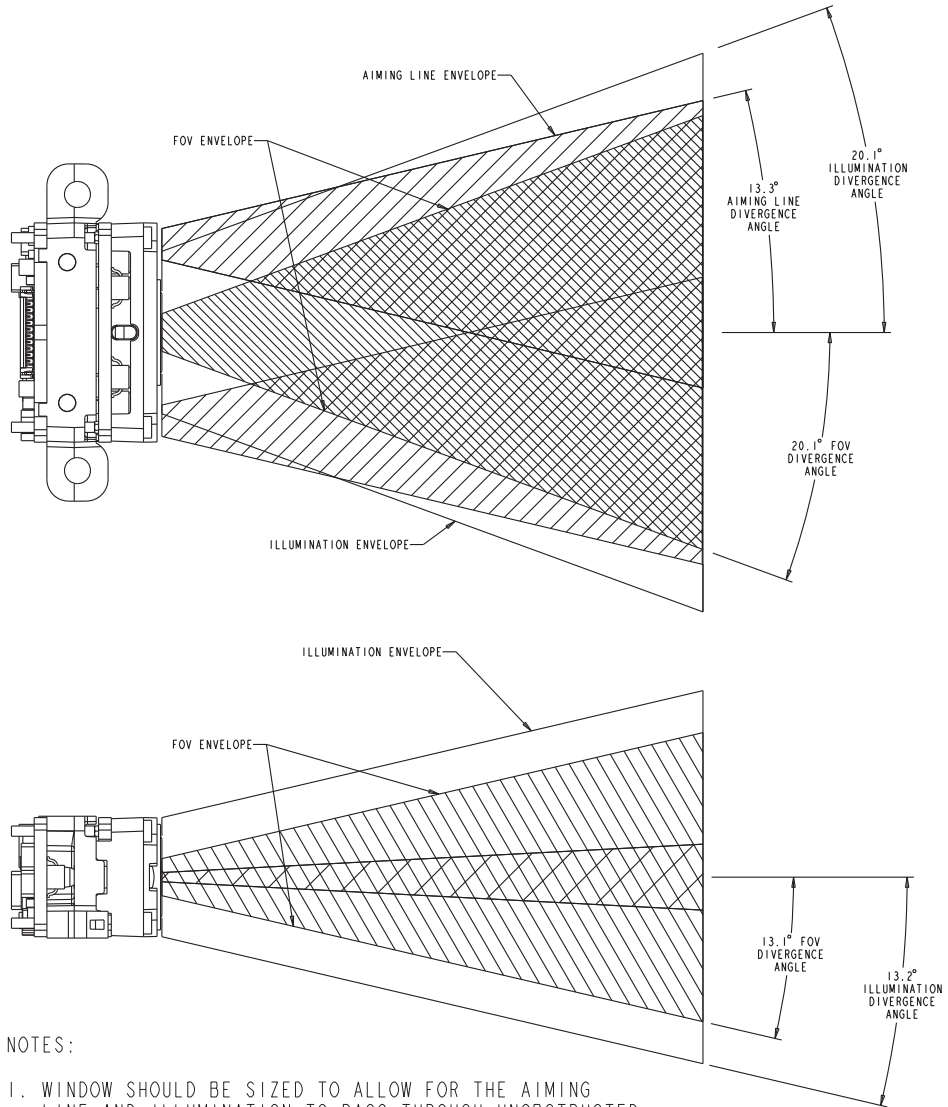
Reflective Materials in the Imager's Field of View

Highly reflective objects in the imager's field of view can cause bright spots to appear in the image and can increase the amount of time needed to read the image. These bright spots are analagous to the reflections seen when taking a snapshot of a mirror with a flash camera. When designing the imager into fixed mount applications, keep highly reflective machine components out of the imager's field of view. If such components must be within the imager's field of view, blacken or shield them to prevent this problem from occurring.

Window Size and Material Requirements

1. Window material must be clear. Clarex (cast acrylic) is preferred. Polycarbonate and CR39 are also acceptable.
2. A minimum thickness of .03 inches (.076 mm) is recommended for this window, with a maximum allowable thickness of .062 inches (1.57mm). These dimensions prevent reflections from the window that can be seen by the camera.
3. Window clear aperture shown in the following Window Size Diagram is for the location shown. The window size must increase as it is moved away from the optics module to accommodate the aiming and illumination envelopes shown.

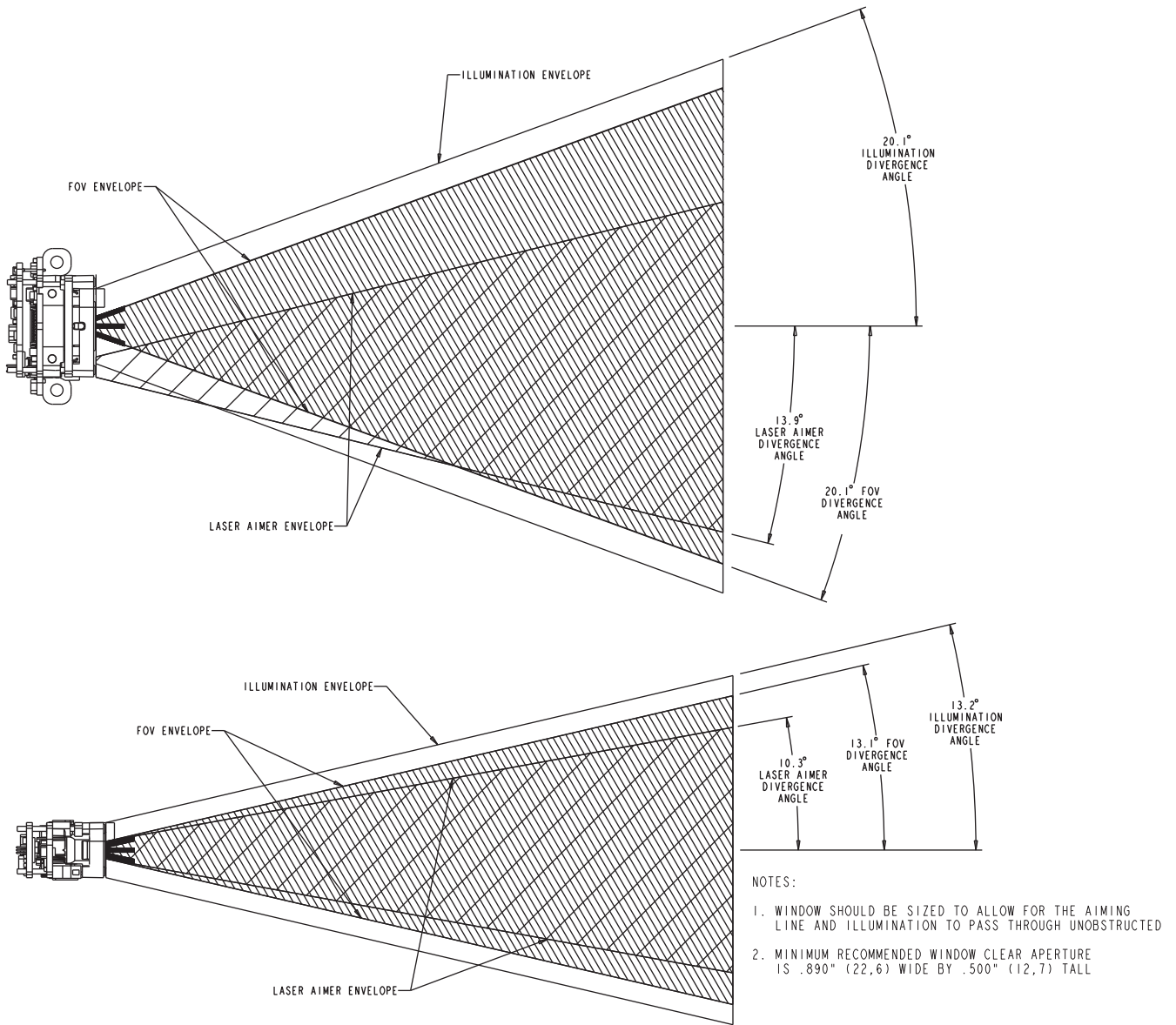
5080/5180 Window Size Diagram (LED Aimer)



NOTES:

1. WINDOW SHOULD BE SIZED TO ALLOW FOR THE AIMING LINE AND ILLUMINATION TO PASS THROUGH UNOBSTRUCTED
2. MINIMUM RECOMMENDED WINDOW CLEAR APERTURE IS .840" (21,3) WIDE BY .490" (12,4) TALL

5380 Window Size Diagram (Laser Aimer)



Depth of Field

For depth of field measurements, please refer to [Depth of Field](#), page 7-1.

Viewing Area

Field of View/Resolution for Standard Range (SR) and Smart Focus (SF) Viewing Area

Position ^a	Vertical, avg	Horizontal, avg	Tolerance	Resolution
5 inches (12.7 cm)	2.42 inches (6.15 cm)	3.8 inches (9.65 cm)	.1 inch (.25 cm)	195 DPI
7 inches (17.78 cm)	3.4 inches (8.64 cm)	5.3 inches (13.46 cm)	.17 inch (.43 cm)	140 DPI
9 inches (22.86 cm)	4.31 inches (10.95 cm)	6.7 inches (17.02 cm)	.23 inch (.584 cm)	105 DPI

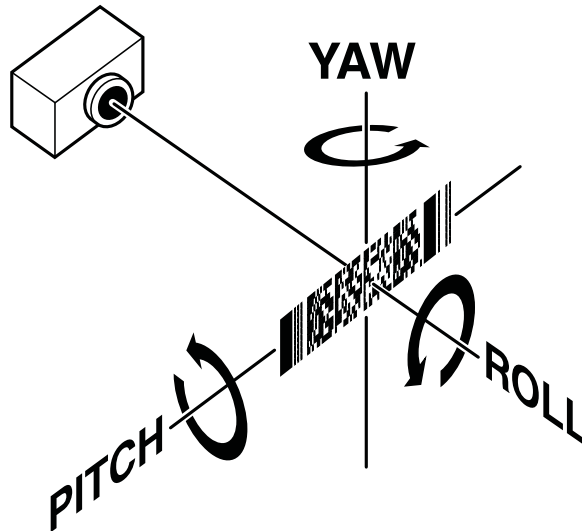
a. Z distance relative to front of engine

Note: The Field of View is specified for the full 5X80 Series resolution of 752x480 pixels. Field of view is linear with distance. See the Field of View drawings beginning on [page 4-2](#). The decoding field of view at specified distances will vary based on code density, quality, symbology, ambient conditions and power mode.

Barcode Reading Angles

The scanner may not operate under conditions of specular reflection: +/- 5° (assuming Pitch & Skew @ 0° tilt only)

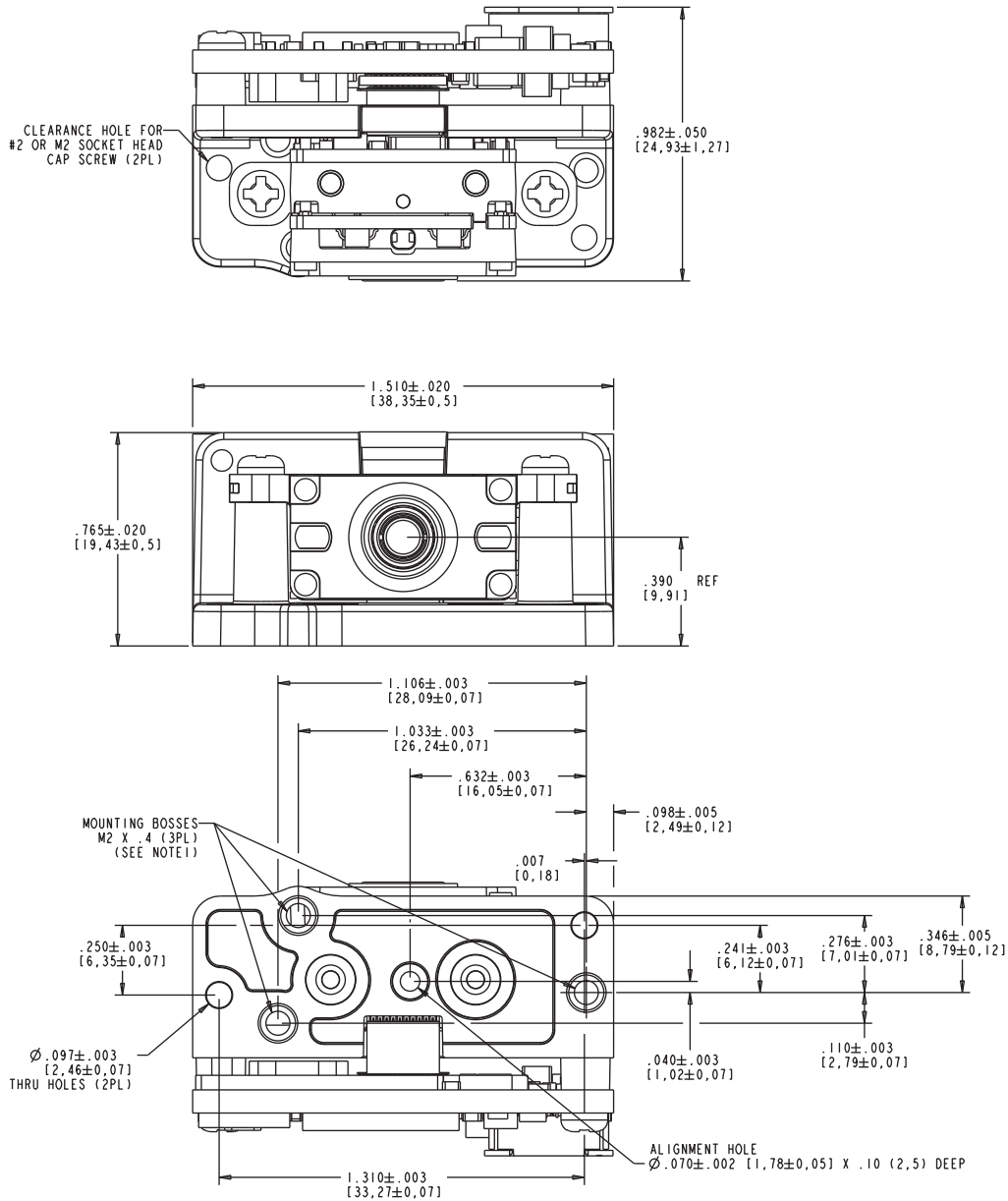
- Pitch: 40° @ 0° tilt and 0° skew
- Tilt: 360° @ 0° pitch and 10° skew
- Skew: 40° @ 0° tilt and 0° pitch



Mechanical Specifications

5080 Engine Bracketed Mounting

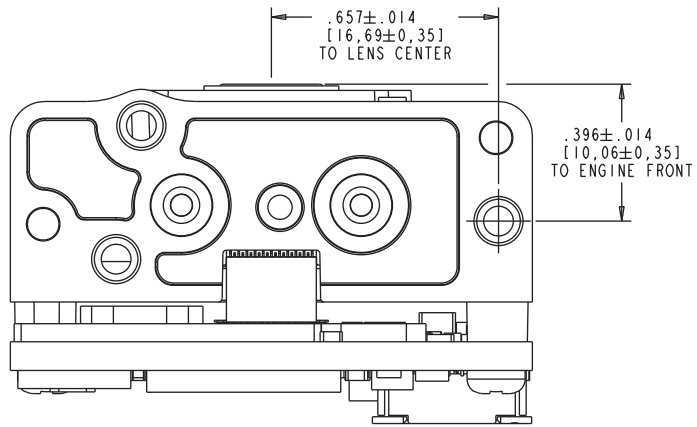
The illustrations below show the mechanical mounting dimensions for the 5080:



Units = Inches [mm]

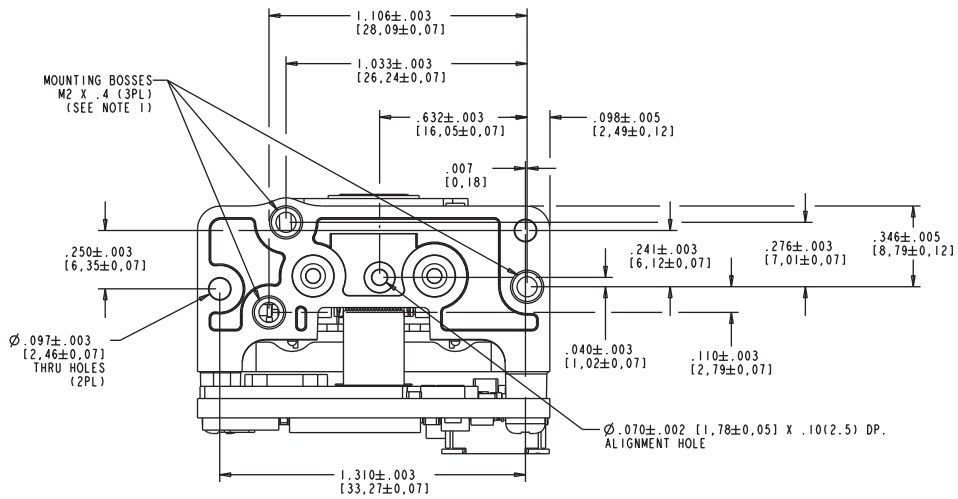
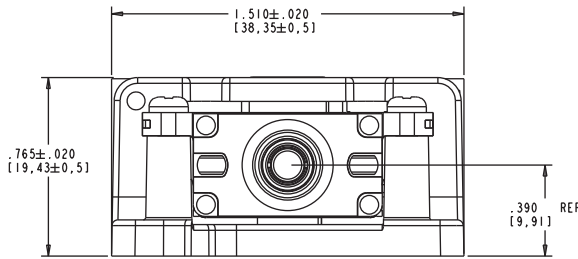
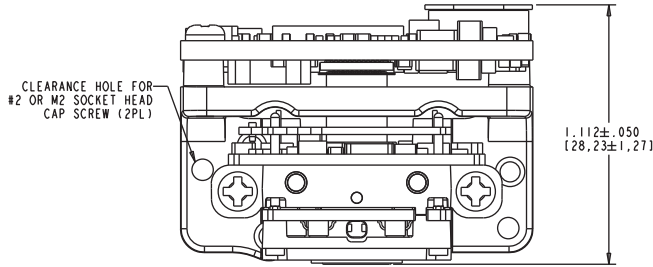
Note: M2 mounting screws should be sized so that they do not protrude above the mounting surface.

The illustration below shows the lens center dimensions for the 5080:



5180 Engine Bracketed Mounting

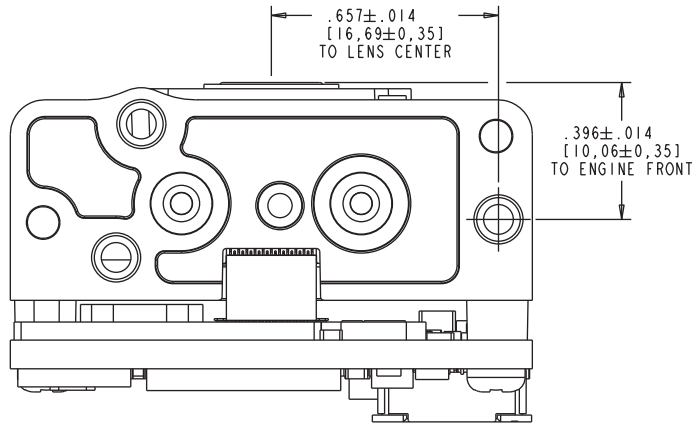
The illustrations below show the mechanical mounting dimensions for the 5180:



Units = Inches [mm]

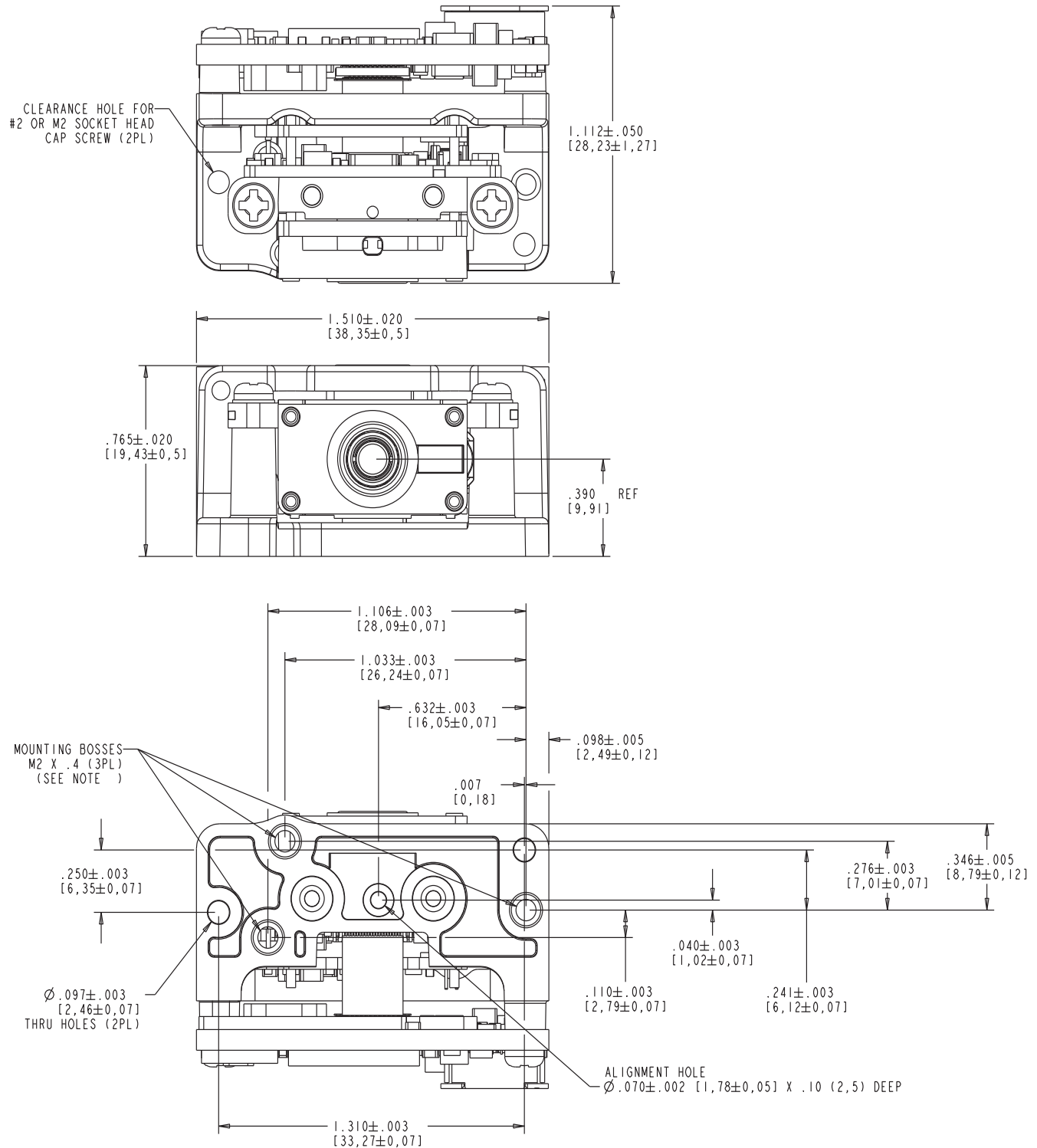
Note: M2 mounting screws should be sized so that they do not protrude above the mounting surface.

The illustration below shows the lens center dimensions for the 5180:



5380 Engine Bracketed Mounting

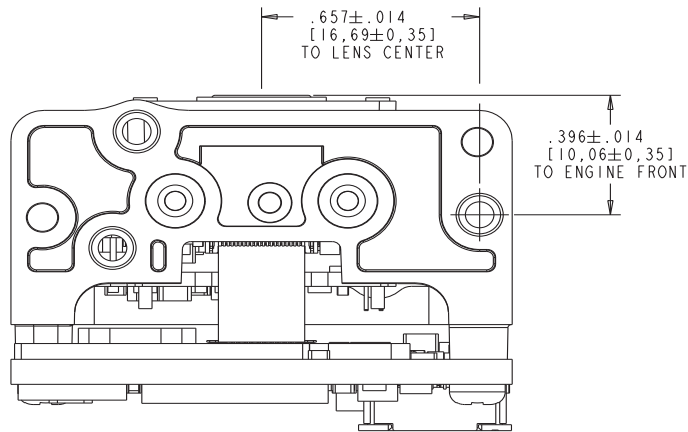
The illustrations below show the mechanical mounting dimensions for the 5380:



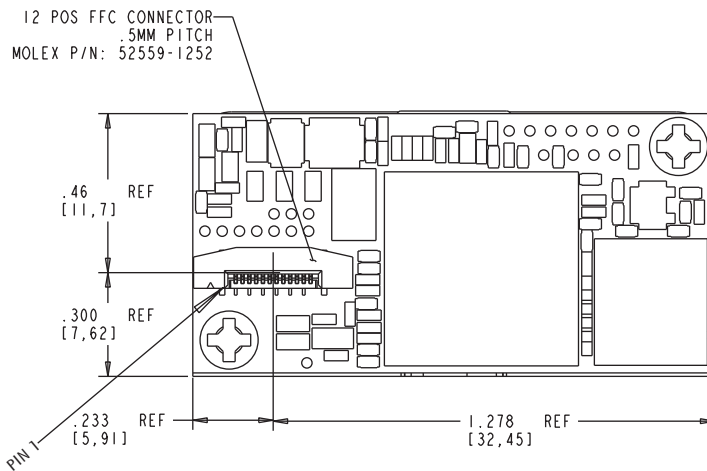
Units = Inches [mm]

Note: M2 mounting screws should be sized so that they do not protrude above the mounting surface.

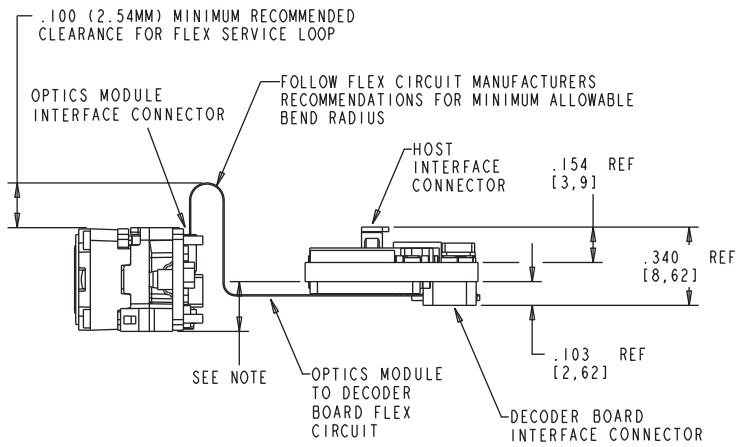
The illustration below shows the lens center dimensions for the 5380:



5X80 Connector Position



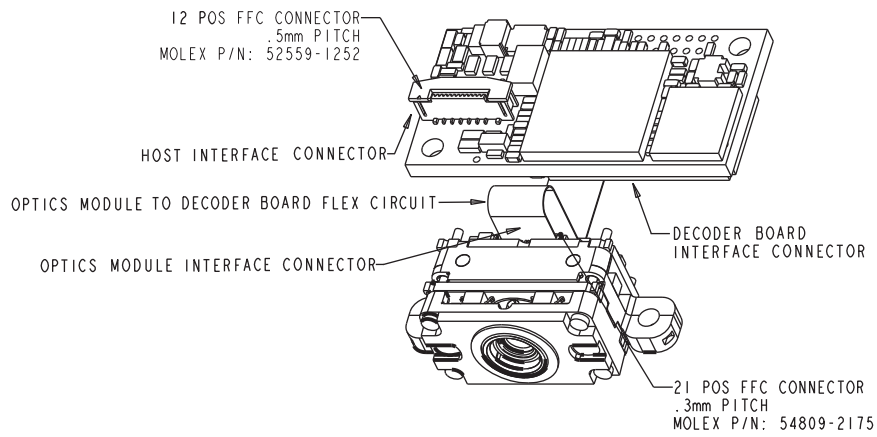
SEE PAGE 5-20 FOR BOARD ASSEMBLY DRAWINGS AND PIN OUTS.



Units = Inches [mm]

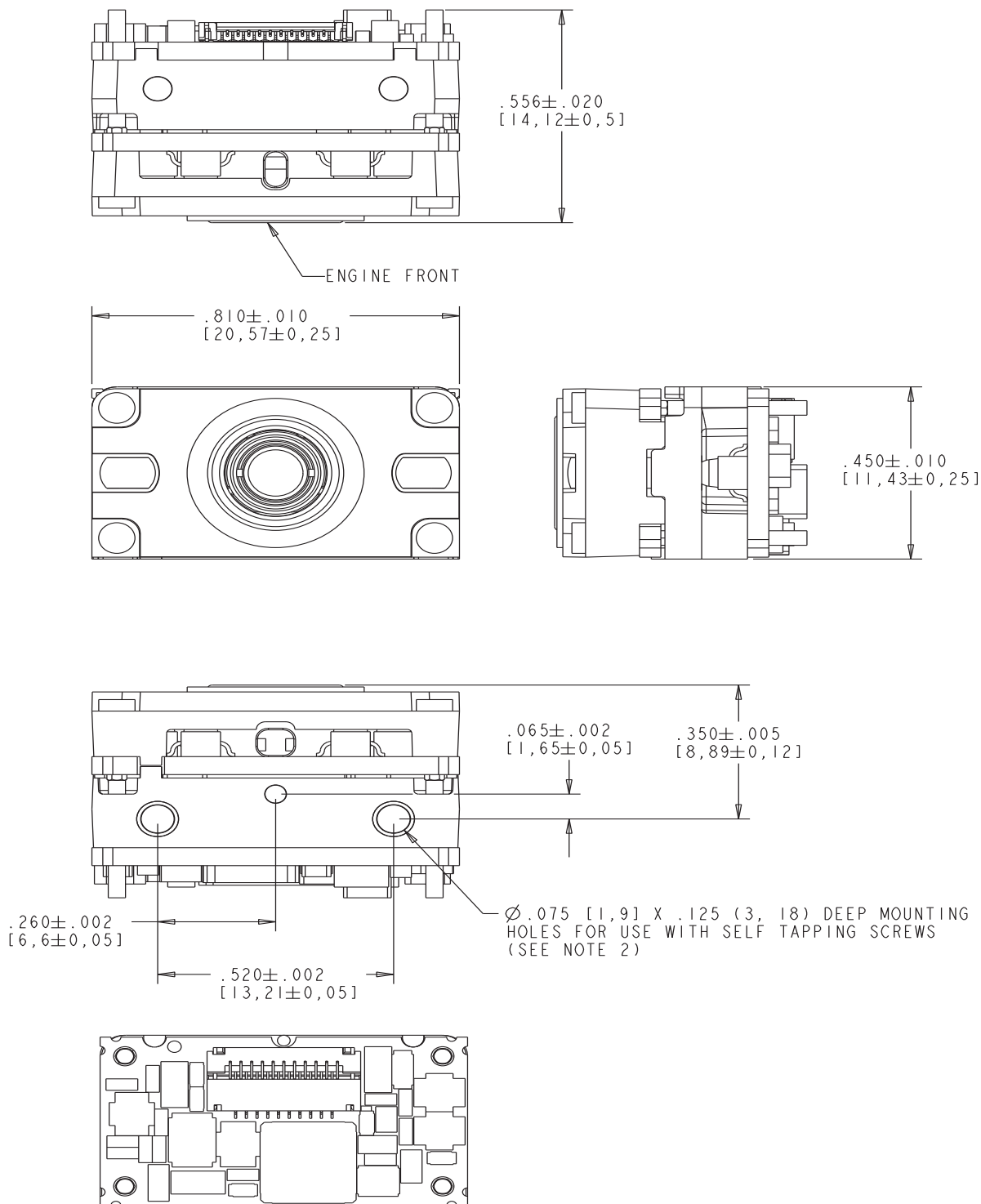
Note: Vertical location of PCB subassembly relative to the optics module is dependent on the integrator's requirements.

The illustration below shows the 5080 optics module, flex connector, and decoder board in a non-bracketed orientation:



Mounting Configuration for 5000-11 Optics Module without Ears

The illustration below shows a 5080 bottom flush mount with self tapping screws:

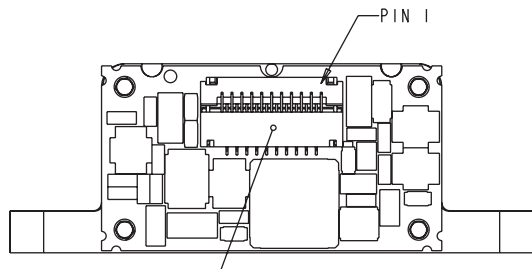
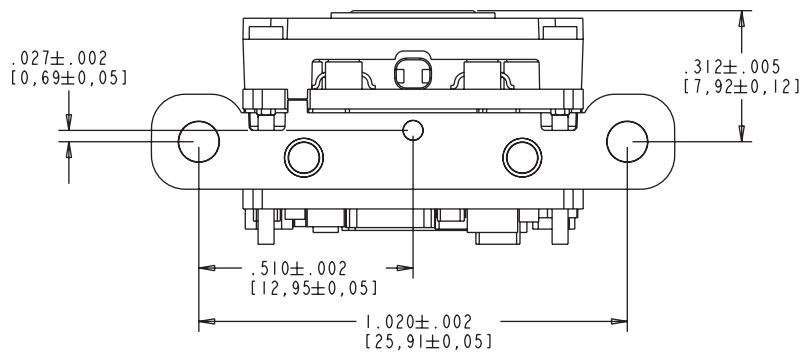
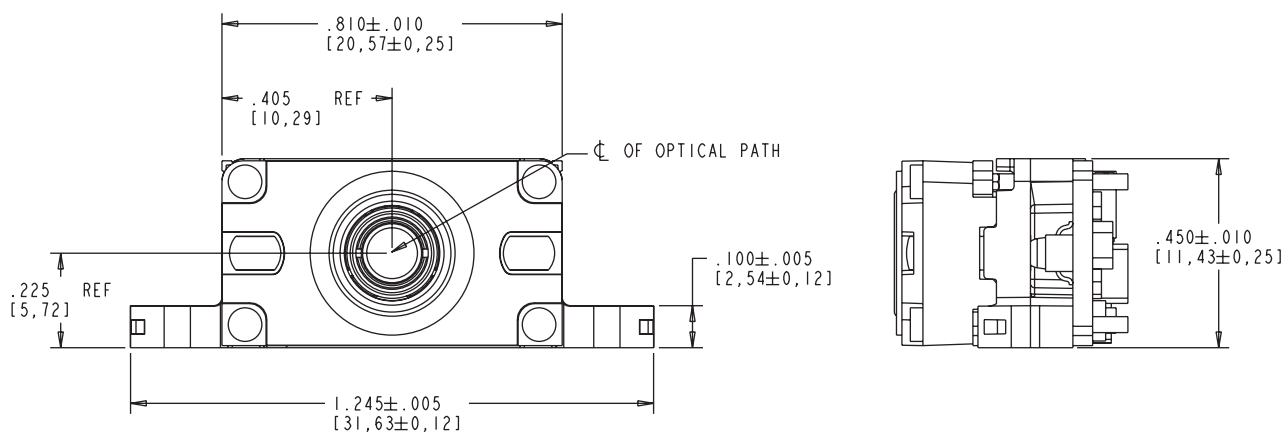
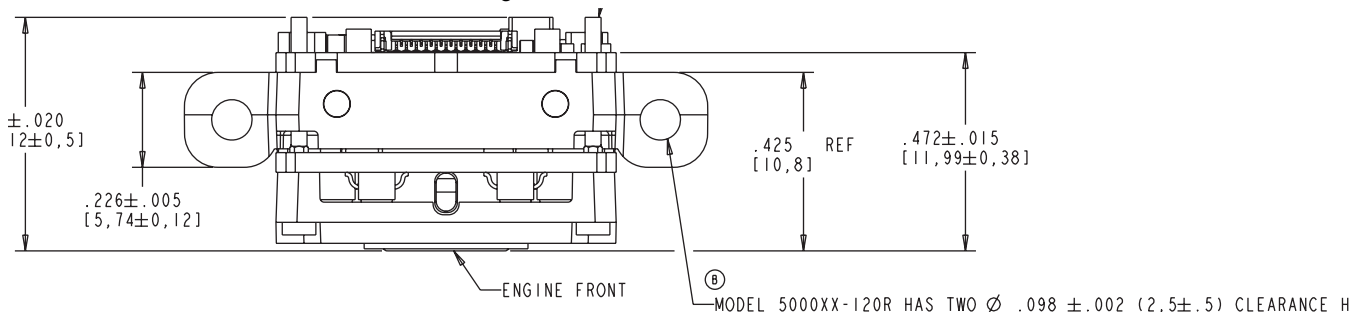


Note 2: Recommended self-tapping screws are: Textron Plastite 48-2, #2-28 screw or Textron Delta pt 22, M2.2 screw. Any screw used should be tested to verify proper fit and performance with the module.

Units = Inches [mm]

Mounting Configuration for 5000-12 Optics Module with Ears

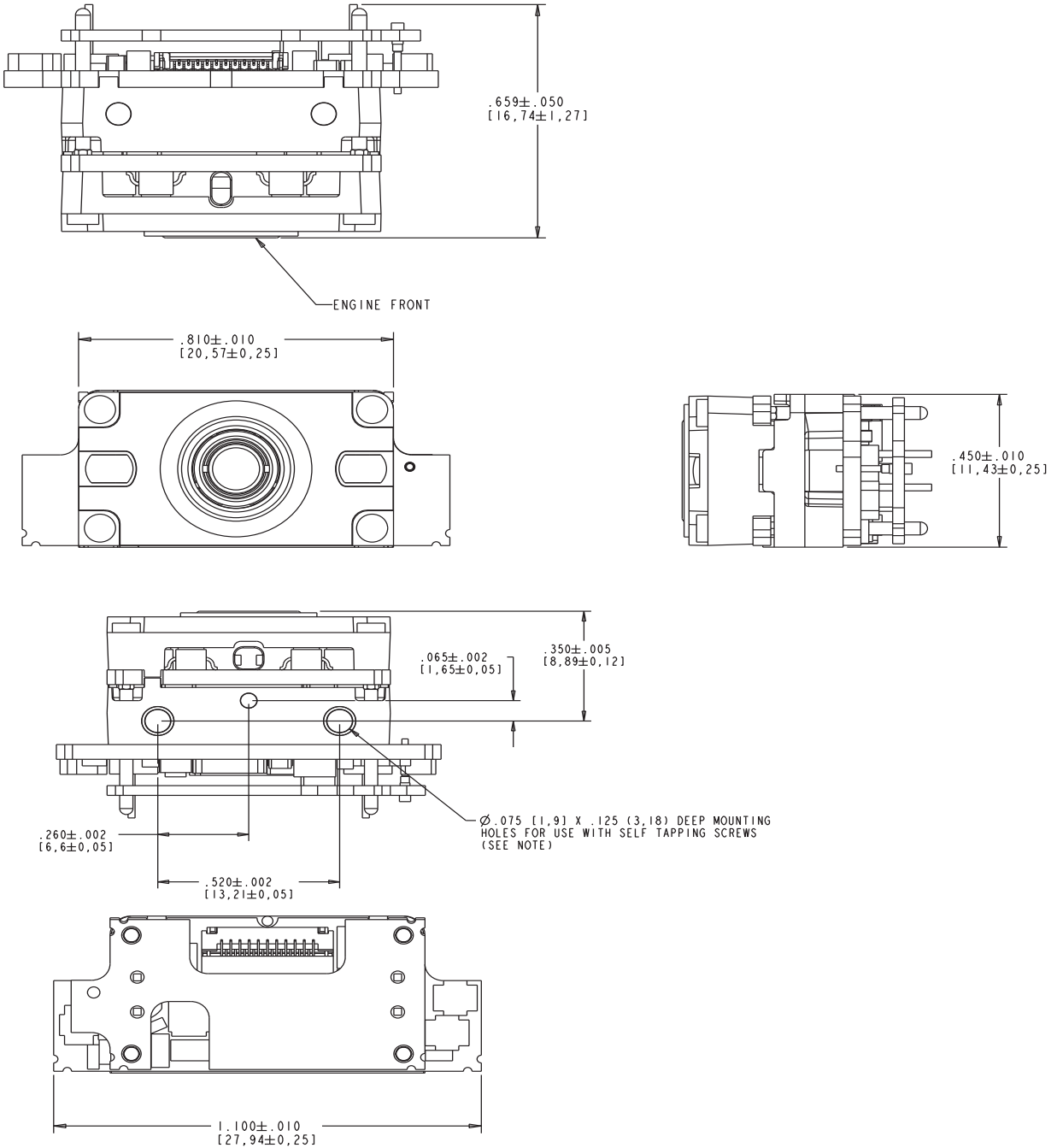
The illustration below shows the 5080 mounting tabs:



Units = Inches [mm]

Mounting Configuration for 5100-11 Optics Module without Ears

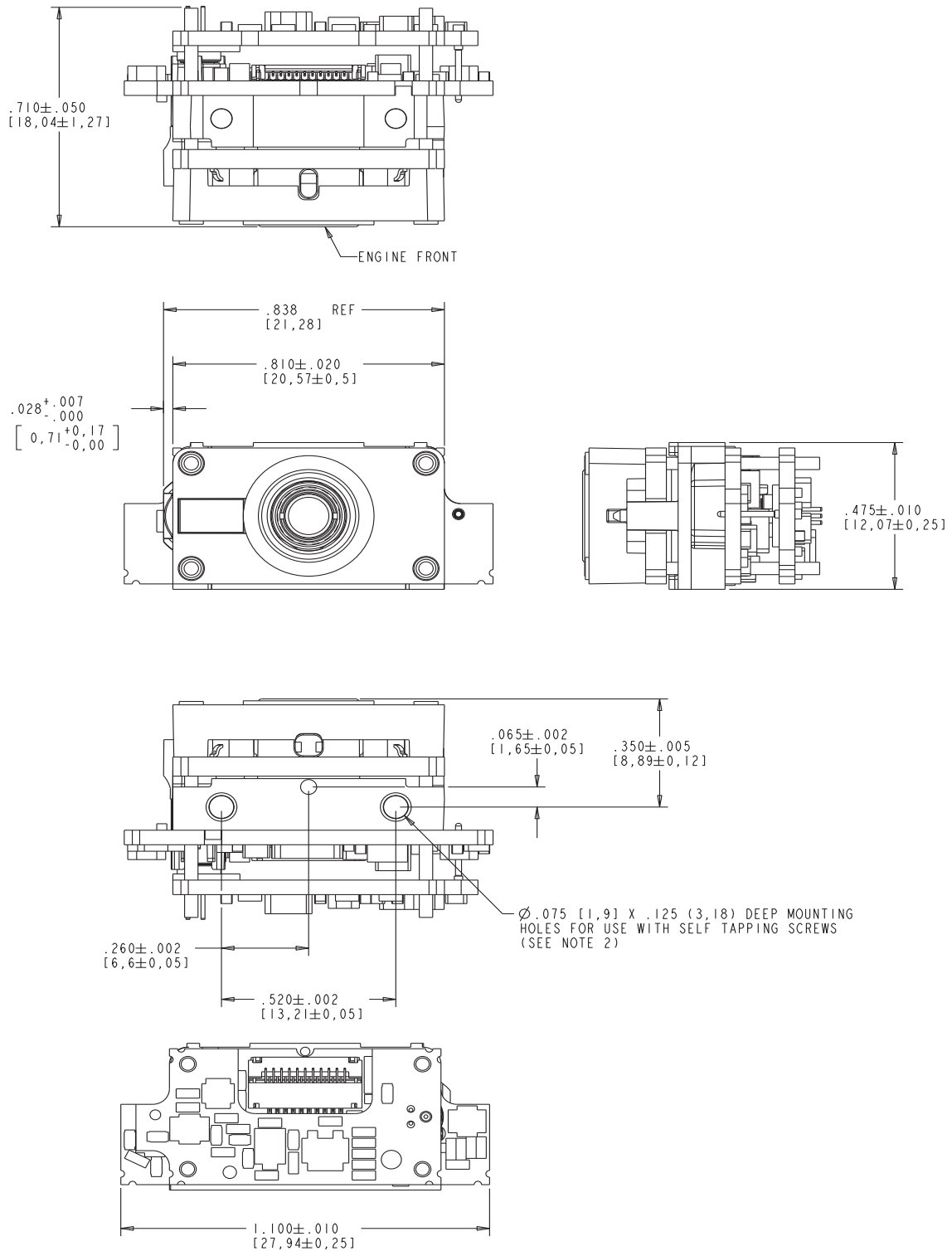
The illustration below shows a 5100-11 optics module bottom flush mount with self tapping screws:



Units = Inches [mm]

Mounting Configuration for 5300-11 Optics Module without Ears

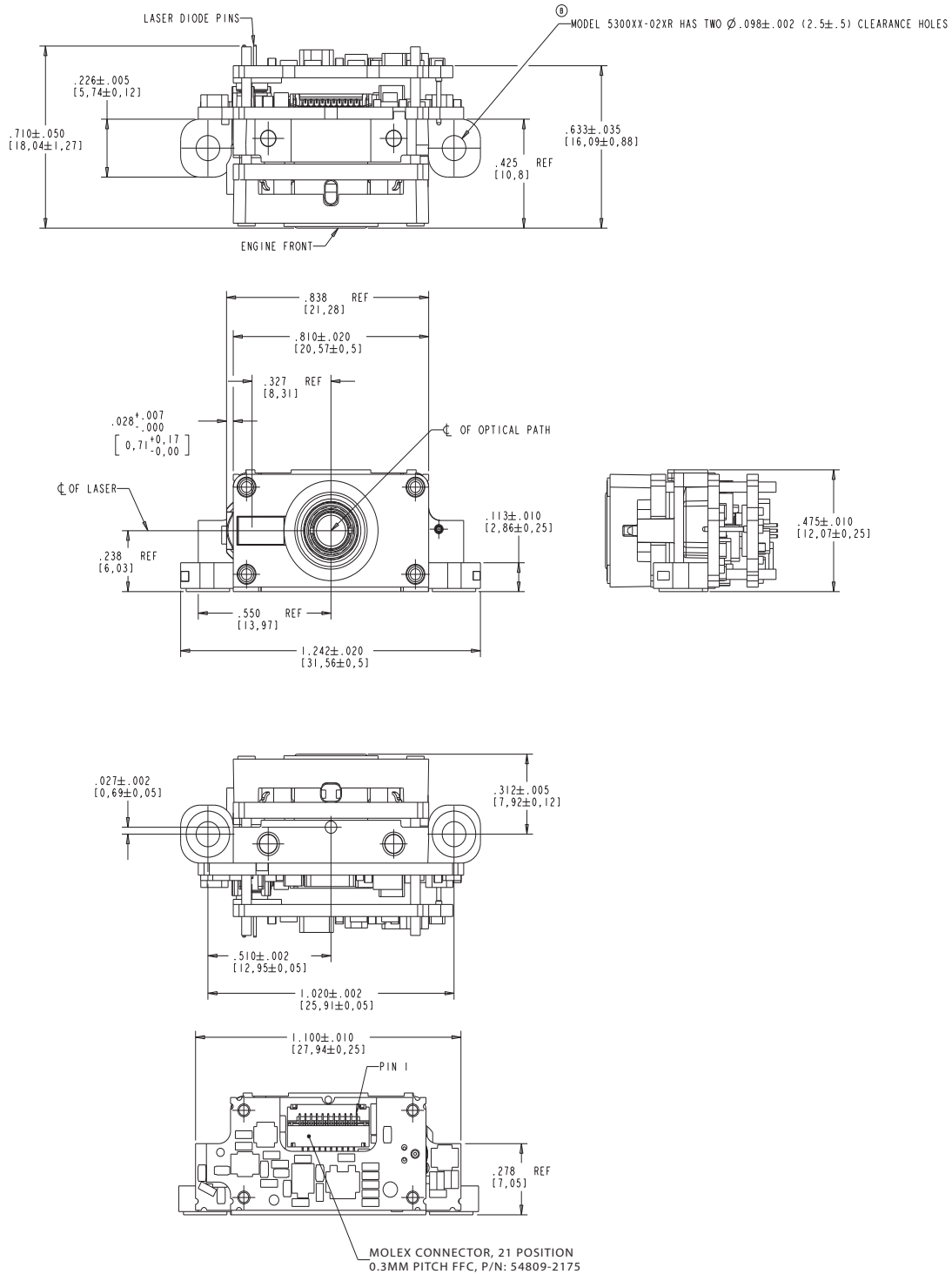
The illustration below shows a 5300-11 optics module bottom flush mount with self tapping screws:



Units = Inches [mm]

Mounting Configuration for 5300-12 Optics Module with Ears

The illustration below shows mounting tabs:



Units = Inches [mm]

Protecting the Engine from Movement

Care should be taken to mount the Image Engine in a configuration that does not allow relative movements between the flex connector and the flex strip within the connector. Such movements could cause fretting corrosion and lead to intermittent connections. The Image Engine should be protected so that no external forces are placed on the optics module during shock and vibration events that might cause the relative movement mentioned above. The flex strip should have a sufficient service loop that prevents this relative movement. In addition, the flex strip design should be consistent with the connector manufacturer's recommendations including the manufacturer's recommendations for flex strip thickness, contact material, and geometry.

Optics Module Interface Connector

Molex FFC/FPC Connector 54809-2175, .012 in. (.3 mm) pitch, right angle, SMT, ZIF, bottom contact. See Molex catalog for details.

Host Interface Connector

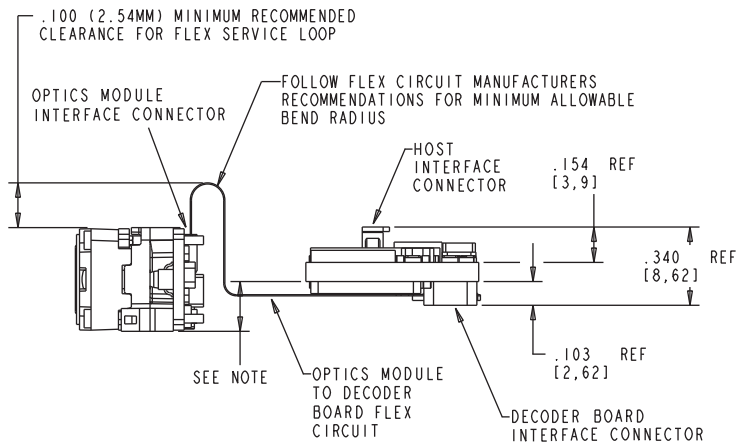
The host interface connector is a Molex 52559-1252, 12 pin, .02 in. (.5mm) pitch vertical surface mount FFC/FPC connector. See Molex catalog for details.

Decoder Board Interface Connector

The connector used to mate the imager flex circuit to the decoder board is a Molex 54722-0228. This is the receptacle side of a board-to-board connector pair. The 54722-0228 is mounted on the flex circuit. See Molex catalog for details.

Optics Module to Decoder Board Flex Circuit

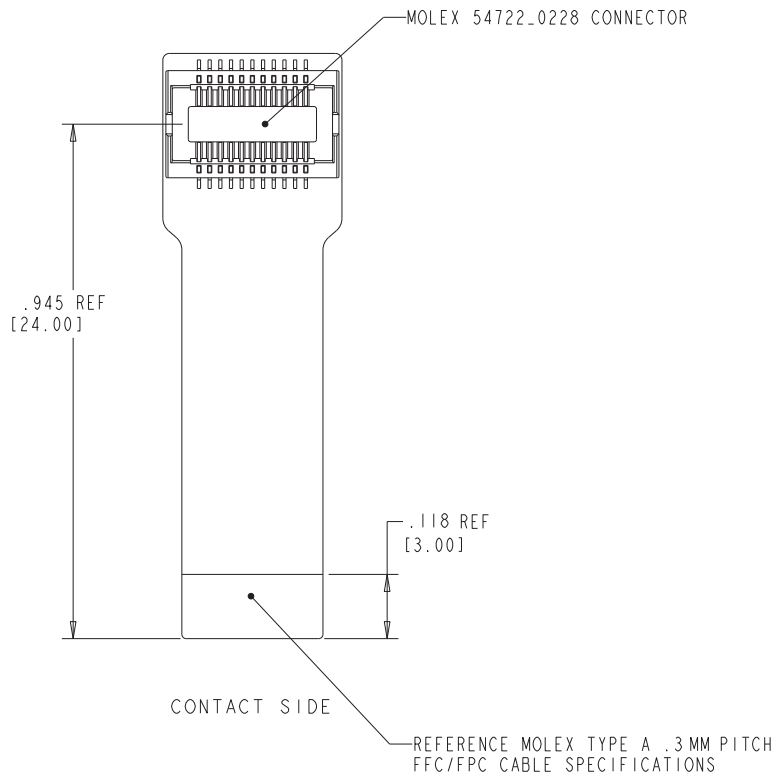
The imager flex circuit is a custom component. There are two flex circuit options available; one for bracketed and non-bracketed applications and a longer one for non-bracketed applications only.





Warning! Do not connect a flex strip to or disconnect a flex strip from the host interface connector when power is present on the flex strip. This could damage the image engine.

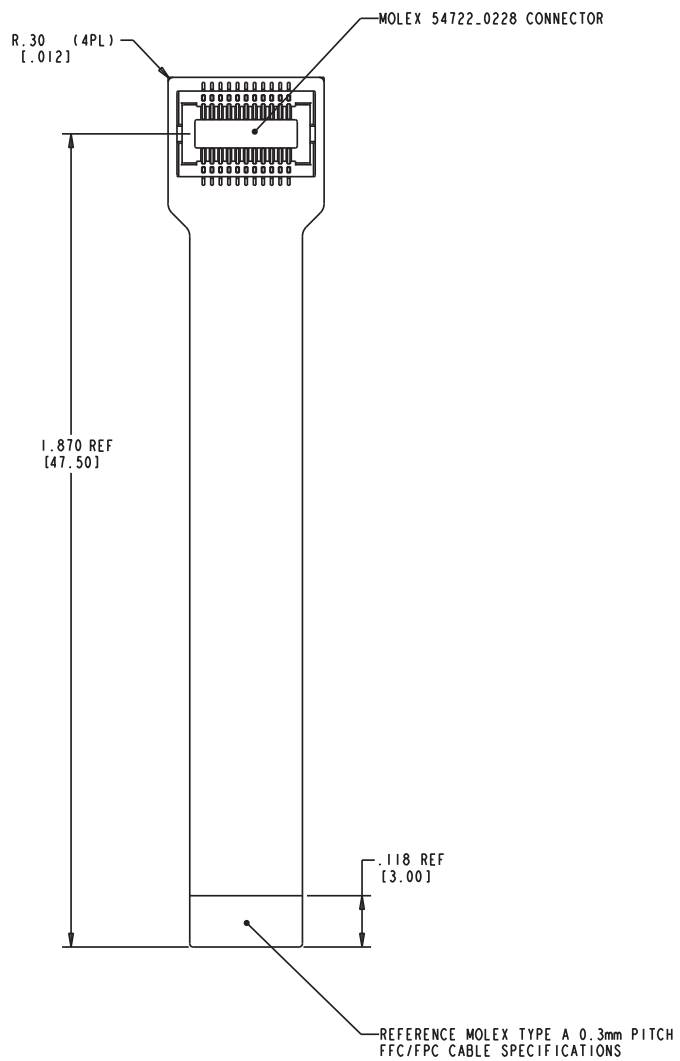
The standard flex circuit/connector assembly, which is approximately .95 inches (24.00 mm) in length is illustrated below. This option is available in bracketed configurations only.



Units = Inches [mm]

2" Flex Circuit

The 2 inch (50.8 mm) flex strip, for non-bracketed applications only, is illustrated below.

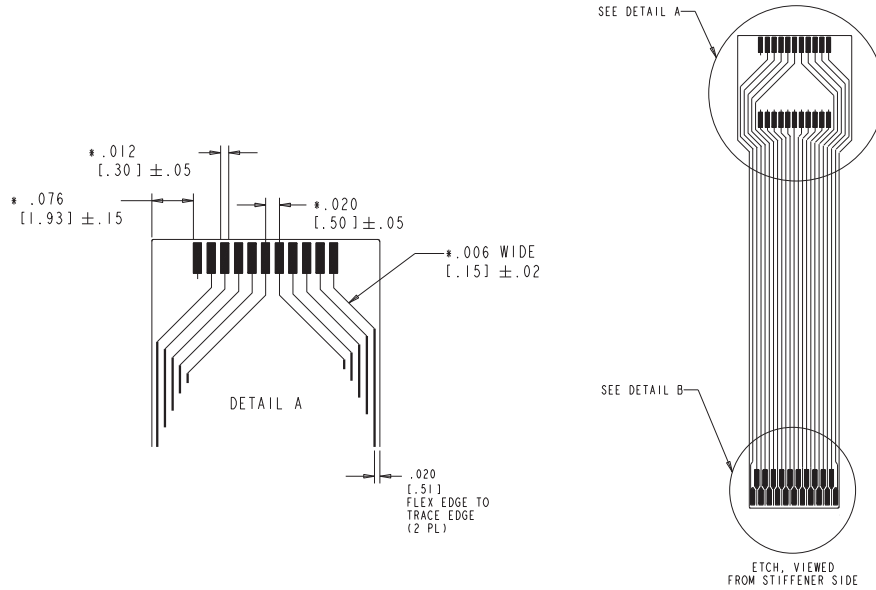


Units = Inches [mm]

Note: The flex strip should be routed and secured so that the connector does not lose connection during a drop event.

Optics Module to Decoder Flex Circuit Etch Dimensions

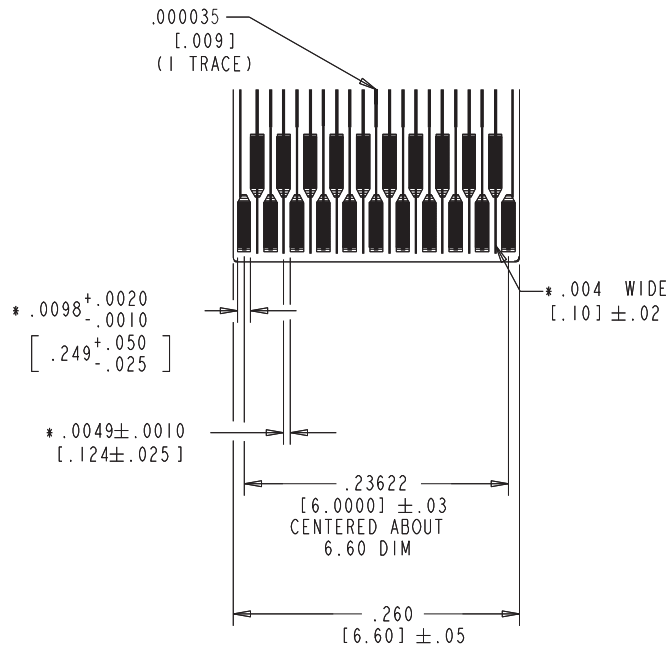
The optics module to decoder flex circuit etch dimensions are shown below.



Units = Inches [mm]

Optics Module to Decoder Flex Circuit Details

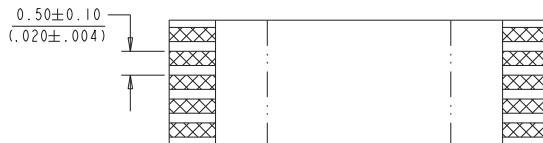
An illustration of the optics module .3mm connector etch detail (B) for the optics module to decoder flex circuit is shown below.



Units = Inches [mm]

Host Flex Circuit/Strip

The host interface flex should be compatible with a Molex 52559 (gold plated, lead free) style connector. The following is an example of a flex circuit:



Recommended characteristics:

Trace Width .01 in. (.25 mm)

Copper Weight 1 oz. (28.4 g)

Consult the connector manufacturer for the required thickness of the flex.

Also see [Design Considerations / Test Results](#) on page A-1.

Dissimilar Metals

All Honeywell 5X80 Series Image Engines are fully compliant with the European Union RoHS/WEE initiative. In order to meet this requirement, the tin/lead plated connector has been replaced with a connector that does not contain lead. Lead is one of the RoHS banned substances.

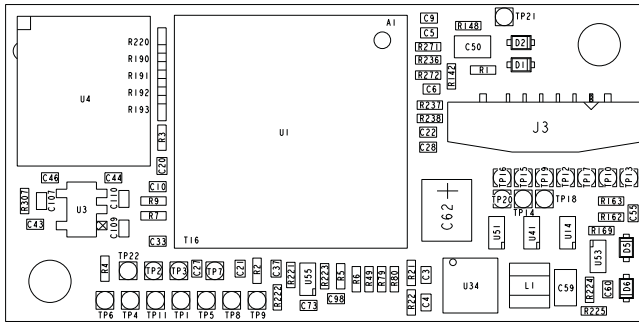
Honeywell chooses a gold plated connector for the 5X80 Series Image Engines for the following reasons:

- Flex strip suppliers recommended that all RoHS flex strips with pitch contacts of less than .039 in. (1mm) require gold plating to eliminate the risk of tin whiskers and a potential failure mode of electrical shorting that can result. The 5X80 Series I/O connector requires a flex strip with .02 in. (.5mm) spacing.
- Even though a tin plated engine I/O connector would have been RoHS compliant, a gold plated connector was used to prevent corrosion of the connector-flex strip interface that can occur when dissimilar metals are placed in contact. This corrosion can occur if a gold plated flex strip is placed in a tin plated connector. Corrosion due to dissimilar metals can ultimately result in a failure of the flex strip to engine connector interface, and a cessation of engine function.

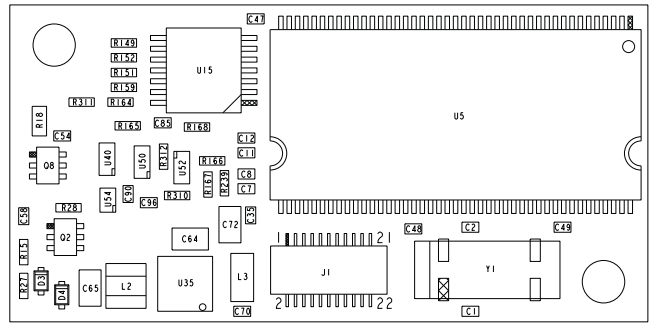


Warning! Honeywell strongly recommends using flex strips with gold plated contacts and connectors with gold plated contacts on the host board to interface to the 5X80 Series Image Engines.

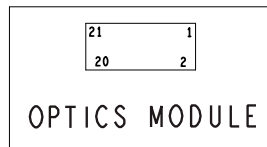
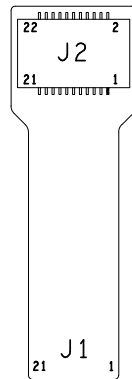
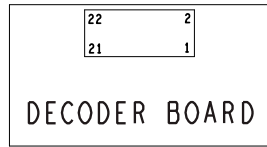
5X80 Decoder Board Sub Assembly



TOP



BOTTOM





Customer Validation

Temperature Test

To insure that the image engine stays within the operating limits of the specification, the following test must be done with the engine integrated into the designated enclosure.

1. Attach the thermocouple for each engine model as shown below.
2. Set the engine to trigger for one second on 50% duty cycle.
3. Place the integrated engine into the chamber at the maximum operating temperature.
4. Record the temperature after the temperature has stabilized.
5. Compare the results with the operating limits (see [Environmental Specifications](#) on page 3-11).

Note: Testing needs to be performed for each enclosure in which an engine will be used.

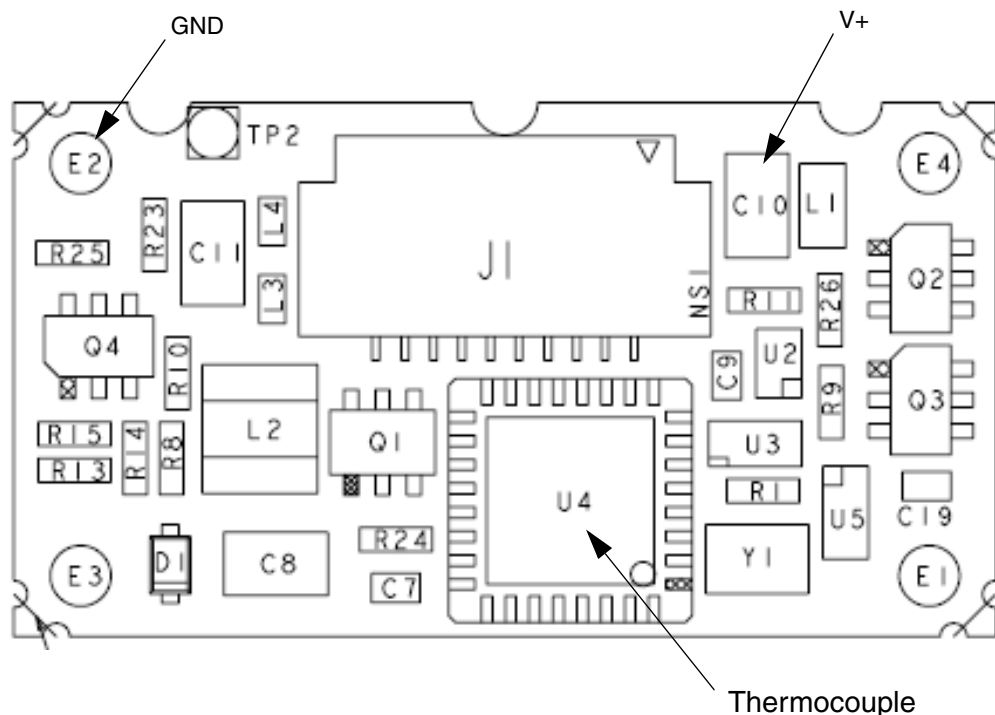
Operating Voltage

The operating voltage must be maintained within the engine's specified limits (see [Operating Voltage](#) on page 3-1).

The operating voltage needs to be measured at the engine's printed circuit board. This should be performed at room temperature. Consult the illustrations below for the points on the board at which to measure the operating voltage. The drawings below also indicate the locations of V+ and Ground.

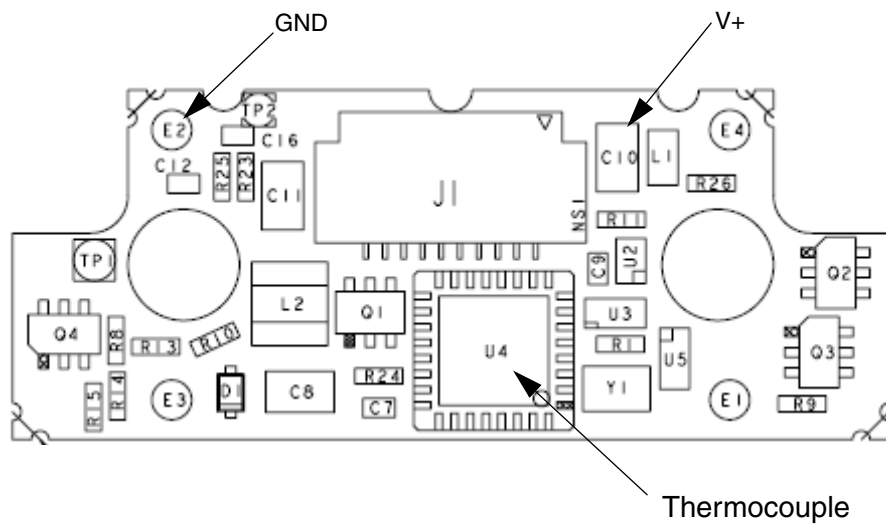
Laser Aimer PCB Assembly

5000 Engine



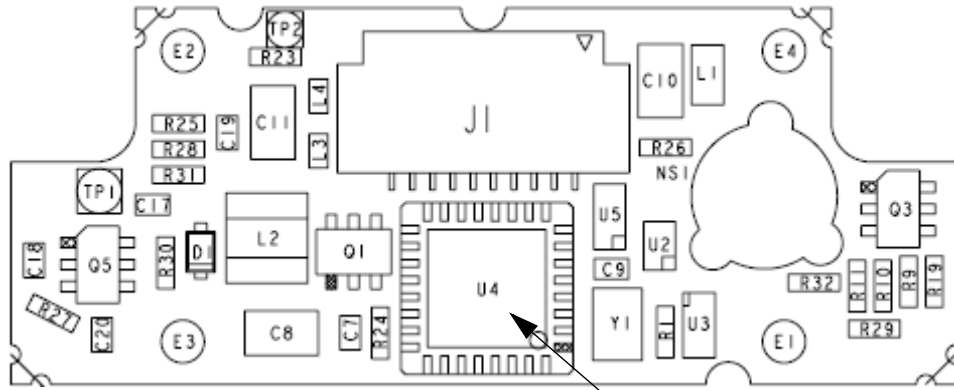
5100 Engine

Note: The following printed circuit board is under the back circuit board on the engine.

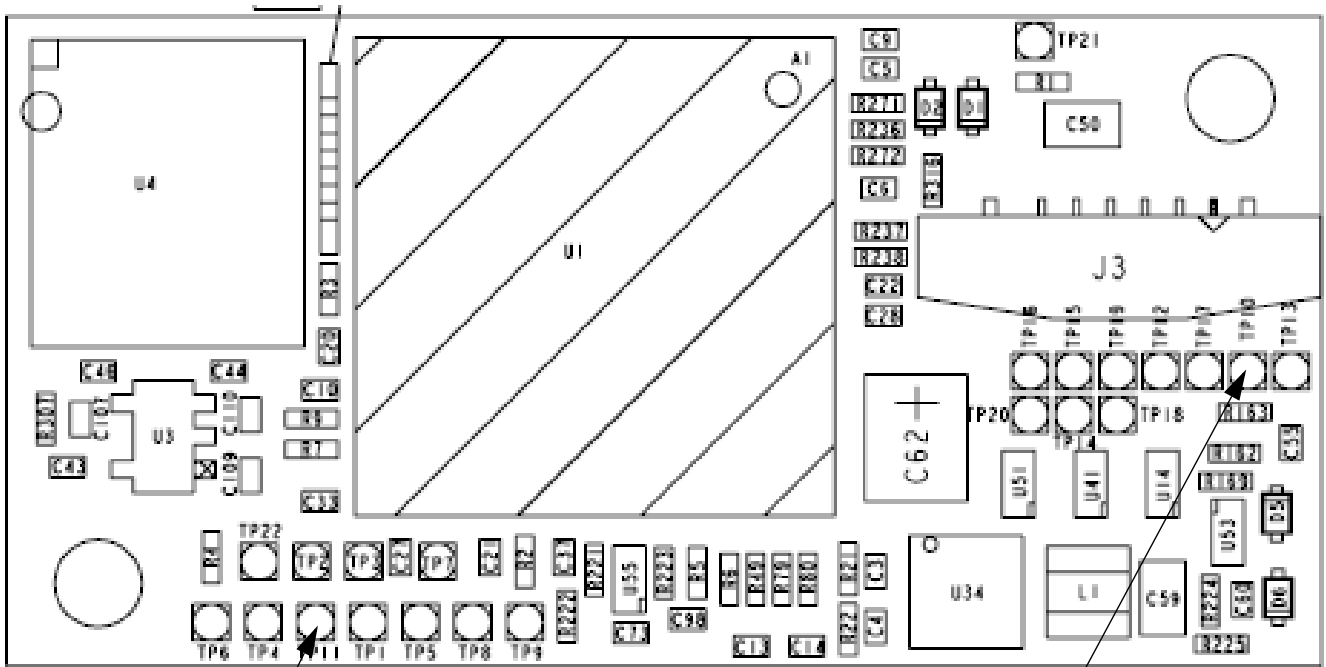


5300 Engine

Note: This printed circuit board is under the circuit board below.



Thermocouple



TP11 GND

TP10 VIN



Depth of Field

Depth of Field

The depth of field measurements used the following parameters:

- Measured using Honeywell decoder hardware platform and firmware version 31205480-002 or later. The front of engine is zero reference.
- Standard Model ISO/IEC15423 Pass = 80%
- Pixel clock frequency set at 24MHz
- +73°F (+23°C), 0 lux

Depth of Field for Standard Range (SR)

Code Size	Near Distance	Far Distance
MaxiCode 35 mil	2 inches (5.1 cm)	13 inches (33 cm)
Data Matrix 15 mil (ECC200)	2.3 inches (5.8 cm)	10.2 inches (25.9 cm)
PDF417 10 mil (ECL4)	3.1 inches (7.9 cm)	9 inches (22.9 cm)
PDF417 8.3 mil (ECL4)	3.3 inches (8.4 cm)	8 inches (20.3 cm)
PDF417 6.6 mil (ECL4)	4.5 inches (11.4 cm)	6.25 inches (15.9 cm)
Code 39 15 mil	2.1 inches (5.3 cm)	12.8 inches (32.5 cm)
Code 39 10 mil	3.2 inches (8.1 cm)	9.2 inches (23.4 cm)
Code 39 8 mil	3.5 inches (8.9 cm)	7.6 inches (19.3 cm)
UPC 13 mil, 100%	2.1 inches (5.3 cm)	13.2 inches (33.5 cm)
Postnet	4 inches (10.2 cm)	5.9 inches (15 cm)
QR Code 15 mil	3.1 inches (7.9 cm)	8.8 inches (22.3 cm)
OCR A, 12 pt	2.3 inches (5.8 cm)	9.4 inches (23.9 cm)
OCR B, 12 pt	2.5 inches (6.4 cm)	10 inches (25.4 cm)

Depth of Field for Smart Focus (SF)

Code Size	Near Distance	Far Distance
MaxiCode 35 mil	2 inches (5.1 cm)	10 inches (25.4 cm)
Data Matrix 8.3 mil	3.4 inches (8.6 cm)	5.7 inches (14.5 cm)
Data Matrix 15 mil (ECC200)	1.8 inches (4.6 cm)	7.5 inches (19 cm)
PDF417 10 mil (ECL4)	2.2 inches (5.6 cm)	7.6 inches (19.3 cm)
PDF417 8.3 mil (ECL4)	2.4 inches (6.1 cm)	6.8 inches (17.3 cm)
PDF417 6.6 mil (ECL4)	2.8 inches (7.1 cm)	6.0 inches (15.2 cm)
Code 39 15 mil	1.5 inches (3.8 cm)	9.2 inches (23.4 cm)
Code 39 10 mil	2.2 inches (5.6 cm)	7.6 inches (19.3 cm)
Code 39 8 mil	2.3 inches (5.8 cm)	6.8 inches (17.3 cm)
Code 39 7.5 mil	2.5 inches (6.4 cm)	6.5 inches (16.5 cm)
Code 39 5 mil	3.6 inches (9.1 cm)	4.2 inches (10.7 cm)
UPC 13 mil, 100%	2 inches (5.1 cm)	8.9 inches (22.6 cm)

Code Size	Near Distance	Far Distance
QR Code 8.3 mil	3.3 inches (8.4 cm)	5.4 inches (13.7 cm)
QR Code 15 mil	2.2 inches (5.6 cm)	7.2 inches (18.3 cm)
OCR A, 12 pt	2.1 inches (5.3 cm)	7.8 inches (19.8 cm)
OCR B, 12 pt	2.3 inches (5.8 cm)	7.6 inches (19.3 cm)
OCR A, 16 pt	2.9 inches (7.4 cm)	9.2 inches (23.4 cm)
OCR B, 16 pt	2.9 inches (7.4 cm)	8.2 inches (20.8 cm)

Product Service and Repair

Honeywell International Inc. provides service for all its products through service centers throughout the world. To obtain warranty or non-warranty service, contact the appropriate location below to obtain a Return Material Authorization number (RMA #) before returning the product.

North America

Telephone: (800) 782-4263
E-mail: hsmnaservice@honeywell.com

Latin America

Telephone: (803) 835-8000
Telephone: (800) 782-4263
Fax: (239) 263-9689
E-mail: laservice@honeywell.com

Brazil

Telephone: +55 (11) 5185-8222
Fax: +55 (11) 5185-8225
E-mail: brservice@honeywell.com

Mexico

Telephone: 01-800-HONEYWELL (01-800-466-3993)
Fax: +52 (55) 5531-3672
E-mail: mxservice@honeywell.com

Europe, Middle East, and Africa

Telephone: +31 (0) 40 2901 633
Fax: +31 (0) 40 2901 631
E-mail: euroservice@honeywell.com

Hong Kong

Telephone: +852-29536436
Fax: +852-2511-3557
E-mail: apservice@honeywell.com

Singapore

Telephone: +65-6842-7155
Fax: +65-6842-7166
E-mail: apservice@honeywell.com

China

Telephone: +86 800 828 2803
Fax: +86-512-6762-2560
E-mail: apservice@honeywell.com

Japan

Telephone: +81-3-6730-7344
Fax: +81-3-6730-7222
E-mail: apservice@honeywell.com

Online Product Service and Repair Assistance

You can also access product service and repair assistance online at www.honeywellaidc.com.

Technical Assistance

If you need assistance installing or troubleshooting your device, please call your distributor or the nearest technical support office:

North America/Canada

Telephone: (800) 782-4263
E-mail: hsmnasupport@honeywell.com

Latin America

Telephone: (803) 835-8000
Telephone: (800) 782-4263
E-mail: hsmlasupport@honeywell.com

Brazil

Telephone: +55 (11) 5185-8222
Fax: +55 (11) 5185-8225
E-mail: brsuporte@honeywell.com

Mexico

Telephone: 01-800-HONEYWELL (01-800-466-3993)
E-mail: soporte.hsm@honeywell.com

Europe, Middle East, and Africa

Telephone: +31 (0) 40 7999 393
Fax: +31 (0) 40 2425 672
E-mail: hsmeurosupport@honeywell.com

Hong Kong

Telephone: +852-29536436
Fax: +852-2511-3557
E-mail: aptechsupport@honeywell.com

Singapore

Telephone: +65-6842-7155
Fax: +65-6842-7166
E-mail: aptechsupport@honeywell.com

China

Telephone: +86 800 828 2803
Fax: +86-512-6762-2560
E-mail: aptechsupport@honeywell.com

Japan

Telephone: +81-3-6730-7344
Fax: +81-3-6730-7222
E-mail: aptechsupport@honeywell.com

Online Technical Assistance

You can also access technical assistance online at www.honeywellaidc.com.

Limited Warranty

Honeywell International Inc. ("HII") warrants its products and optional accessories to be free from defects in materials and workmanship and to conform to HII's published specifications applicable to the products purchased at the time of shipment. This warranty does not cover any HII product which is (i) improperly installed or used; (ii) damaged by accident or negligence, including failure to follow the proper maintenance, service, and cleaning schedule; or (iii) damaged as a result of (A) modification or alteration by the purchaser or other party, (B) excessive voltage or current supplied to or drawn from the interface connections, (C) static electricity or electro-static discharge, (D) operation under conditions beyond the specified operating parameters, or (E) repair or service of the product by anyone other than HII or its authorized representatives.

This warranty shall extend from the time of shipment for the duration published by HII for the product at the time of purchase ("Warranty Period"). Any defective product must be returned (at purchaser's expense) during the Warranty Period to HII factory or authorized service center for inspection. No product will be accepted by HII without a Return Materials Authorization, which may be obtained by contacting HII. In the event that the product is returned to HII or its authorized service center within the Warranty Period and HII determines to its satisfaction that the product is defective due to defects in materials or workmanship, HII, at its sole option, will either repair or replace the product without charge, except for return shipping to HII.

EXCEPT AS MAY BE OTHERWISE PROVIDED BY APPLICABLE LAW, THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER COVENANTS OR WARRANTIES, EITHER EXPRESSED OR IMPLIED, ORAL OR WRITTEN, INCLUDING, WITHOUT LIMITATION, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, OR NON-INFRINGEMENT.

HII'S RESPONSIBILITY AND PURCHASER'S EXCLUSIVE REMEDY UNDER THIS WARRANTY IS LIMITED TO THE REPAIR OR REPLACEMENT OF THE DEFECTIVE PRODUCT WITH NEW OR REFURBISHED PARTS. IN NO EVENT SHALL HII BE LIABLE FOR INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, AND, IN NO EVENT, SHALL ANY LIABILITY OF HII ARISING IN CONNECTION WITH ANY PRODUCT SOLD HEREUNDER (WHETHER SUCH LIABILITY ARISES FROM A CLAIM BASED ON CONTRACT, WARRANTY, TORT, OR OTHERWISE) EXCEED THE ACTUAL AMOUNT PAID TO HII FOR THE PRODUCT. THESE LIMITATIONS ON LIABILITY SHALL REMAIN IN FULL FORCE AND EFFECT EVEN WHEN HII MAY HAVE BEEN ADVISED OF THE POSSIBILITY OF SUCH INJURIES, LOSSES, OR DAMAGES. SOME STATES, PROVINCES, OR COUNTRIES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

All provisions of this Limited Warranty are separate and severable, which means that if any provision is held invalid and unenforceable, such determination shall not affect the validity of enforceability of the other provisions hereof. Use of any peripherals not provided by the manufacturer may result in damage not covered by this warranty. This includes but is not limited to: cables, power supplies, cradles, and docking stations. HII extends these warranties only to the first end-users of the products. These warranties are non-transferable.

The duration of the limited warranty for the 5X80 Series is 15 months.

Regulatory Compliance Statements

It is the OEM manufacturer's responsibility to comply with applicable regulation(s) in regard to standards for specific equipment combinations.

Honeywell shall not be liable for use of our product with equipment (i.e., power supplies, personal computers, etc.) that is not CE marked and does not comply with the Low Voltage Directive.

FCC/IC/CE

The 5X80 Series Image Engine, integrated into an OEM device, requires testing by the OEM to ensure compliance with the following federal regulations:

47 CFR Part 15

ICES-003

EC's Electromagnetic Compatibility Directive (2004/108/EC) and Low Voltage Directive (2006/95/EC)



For CE-related inquiries, please contact:

Honeywell Imaging & Mobility - Europe BV
Nijverheidsweg 9
5627 BT Eindhoven
The Netherlands

CB Scheme

IEC 60950-1 Second Edition

UL/c-UL

UL 60950-1 Second Edition

CSA C22.2 No. 60950-1-07, 2nd Edition

LED Safety Statement

LEDs have been tested and classified as "EXEMPT RISK GROUP" to the standard IEC 62471:2006.

Laser Safety Standard

LASER has been tested and classified as a "Class 1 LASER Product" to the standard IEC 60825-1 (2007) Second Edition.



The Standard also states that the following be included in all user documentation, spec sheets, and brochures, which describe this product:

Caution: Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

Note: This warning states that altering the inner parts of the laser engine in a way not specified in the user guide may cause light levels to exceed Class 1 limits. It is not an issue when using under normal conditions.

ESD Precautions

The 5X80 Series is shipped in ESD safe packaging. Use care when handling the scan engine outside its packaging. Be sure grounding wrist straps and properly grounded work areas are used.

Dust and Dirt

The 5X80 Series must be sufficiently enclosed to prevent dust particles from gathering on the imager and lens. When stocking the unit, keep it in its protective packaging. Dust and other external contaminants will eventually degrade unit performance.

RoHS

The 5X80 Series is in compliance with Directive 2002/95/EC, Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS), dated January, 2003.



Design Considerations / Test Results

EMI Considerations

Electro-magnetic interference is a concern in all electronic designs. The effects of EMI are enhanced as designs become more digital and the digital circuits' speed increases. The 5X80 is no exception.

The 5X80 product is comprised of two major components, each with its own base frequencies.

The Decoder Board

The decoder board is based on a 32KHz crystal that is used to generate a 150MHz clock for the core and a 96MHz clock for the memory interface. There are a number of other frequencies that may be generated at any given time depending on what interface the decoder board is set up to use or various intermittent signatures that occur in a typical image capture and decode process.

There are two switching power supplies on the decoder board that operate between 1MHz and 1.5MHz.

The Image Engine

The imager runs based on a 24MHz crystal that is used to drive the imager timing. The 24MHz crystal can be divided down to 12MHz for systems that cannot sustain a higher data rate. The imager pixel clock will be either 12 or 24MHz accordingly, and is the most prevalent EMI signature seen in the imaging system. The aiming and illumination LEDs are powered by a boost switching regulator running nominally at 1.2MHz. The following table shows common settings and frame rates:

Pixel Clock Frequency	Image Size	Frame Rate
12	752x480	~27 fps
24	752x480	~54 fps
12	640x480	~30 fps
24	640x480	~60 fps

Design Considerations

There are several considerations that must be made when designing a system to utilize the 5X80. When integrating the 5X80 to other components in the system, ensure that a clean power supply is being used and that there is good signal ground integrity (the quieter the better). The other major consideration in any system is interconnects. The 5X80 uses flex strips/flex circuits for its interconnect to the host system and between the decoder board and image engine. Proper flex strip design is critical to achieving adequate EMI results. The length, impedance, shape, and routing path of the flex can play big roles in the EMI signature of a product. A short list of considerations when designing with flexes follows:

- Impedance - flexes have specifications for impedance and resistance per unit length. Try to make sure your impedance is matched to the typical 50 ohms of a CMOS circuit and keep the resistance as low as possible.
- Grounding - Keep the ground traces on the flex strip as low resistance as possible.
- Length - shorter is better. Flexes tend to act like antennas; the longer they are, the more EMI transmission and reception can occur.
- Routing - keep the flex from passing over other high frequency components or input/output paths. This helps to reduce coupling in or out of the flex. Also, as a rule, avoid loops in the flex. Loops can add to the antenna effect.

Test Results

The 5X80 is designed to meet EN55022 B emission levels. The 5X80 has been tested for compliance using representative models.

Model 1 ([page A-2](#)) is based on a Portable Data Terminal platform. The Portable Data Terminal is battery powered and the 5080 is connected to the host via a TTL level serial interface using a 12 pin flex strip.

Model 2 ([page A-7](#)) is based on a cabled platform:

- The 5X80 is mounted on the Honeywell demo board
- The demo board is connected to the host via an 8 foot long, coiled, TTL level 232 cable.
- The 5X80 is operating in TTL serial-232 mode.

Model 3 ([page A-10](#)) is an alternate cabled platform:

- The 5X80 is mounted on the Honeywell demo board.
- The demo board is connected to the host via an 8 foot long, straight USB cable.
- The 5X80 is operating in USB mode.

The following pages document the test results.

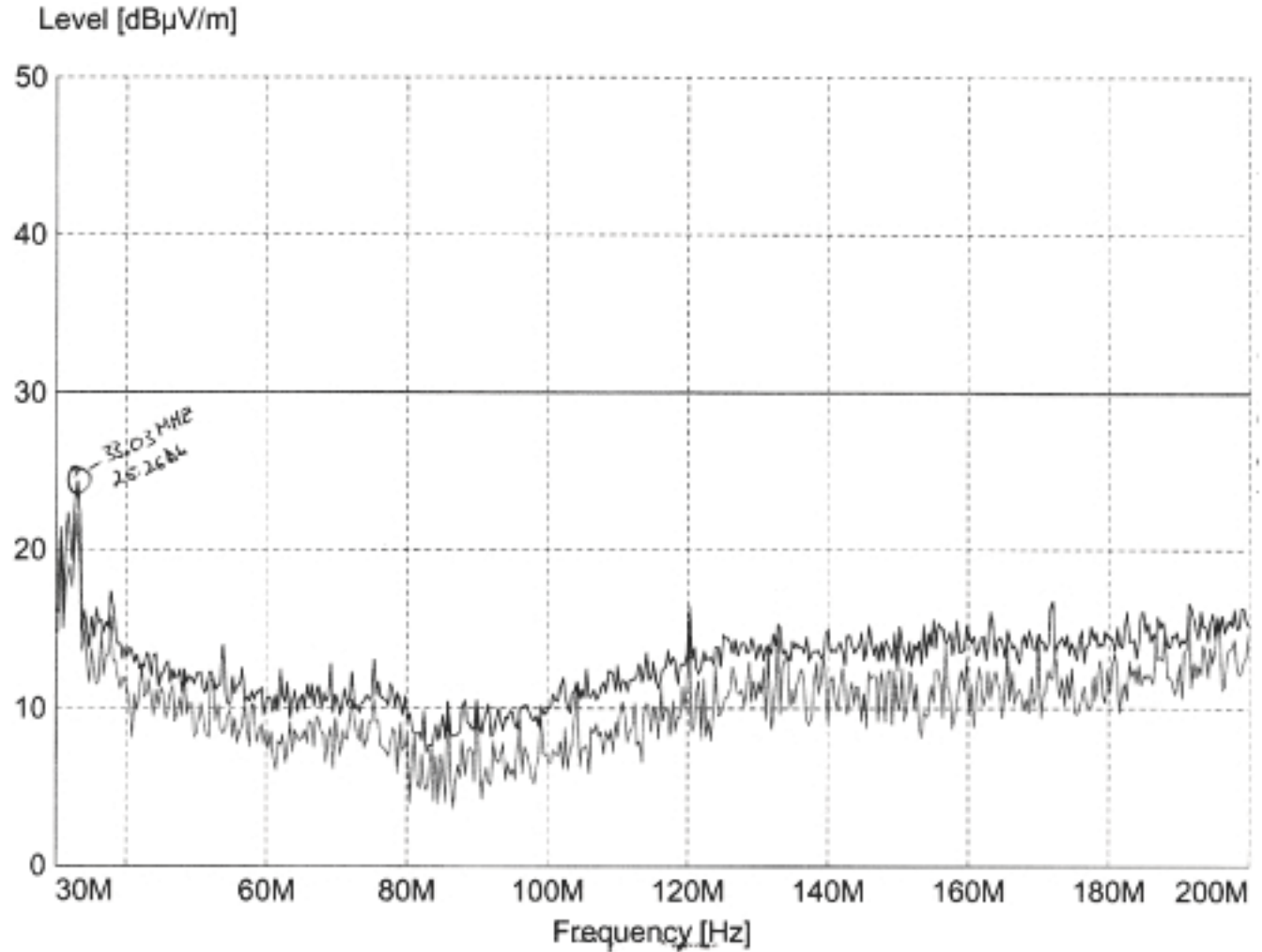
Model 1: Portable Data Terminal Test Results

The following picture shows a Portable Data Terminal that is similar to the unit tested:



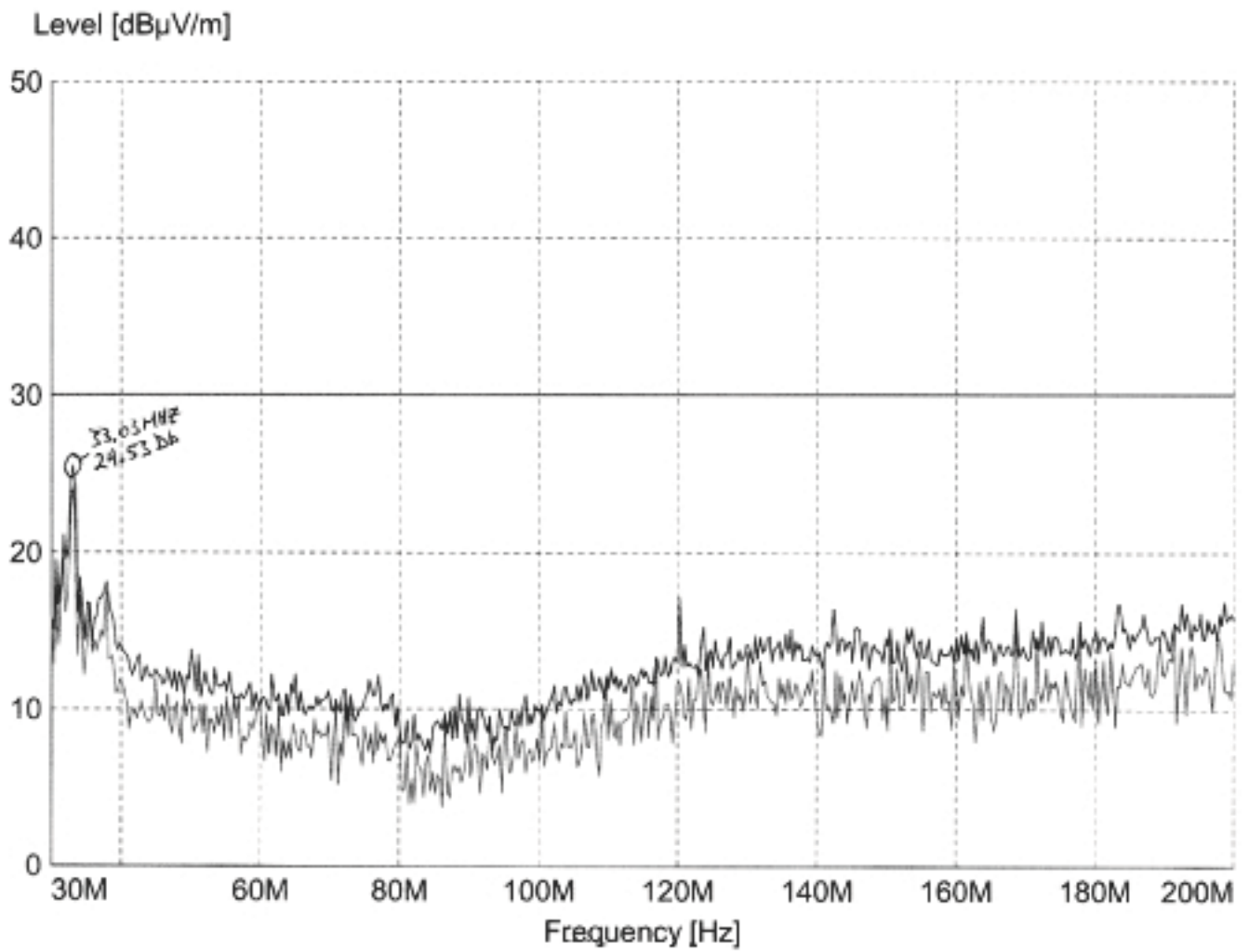
The portable data terminal passed FCC class B limits at all frequencies with a margin of 3 db or more. The test results are shown in the following charts.

Portable Data Terminal



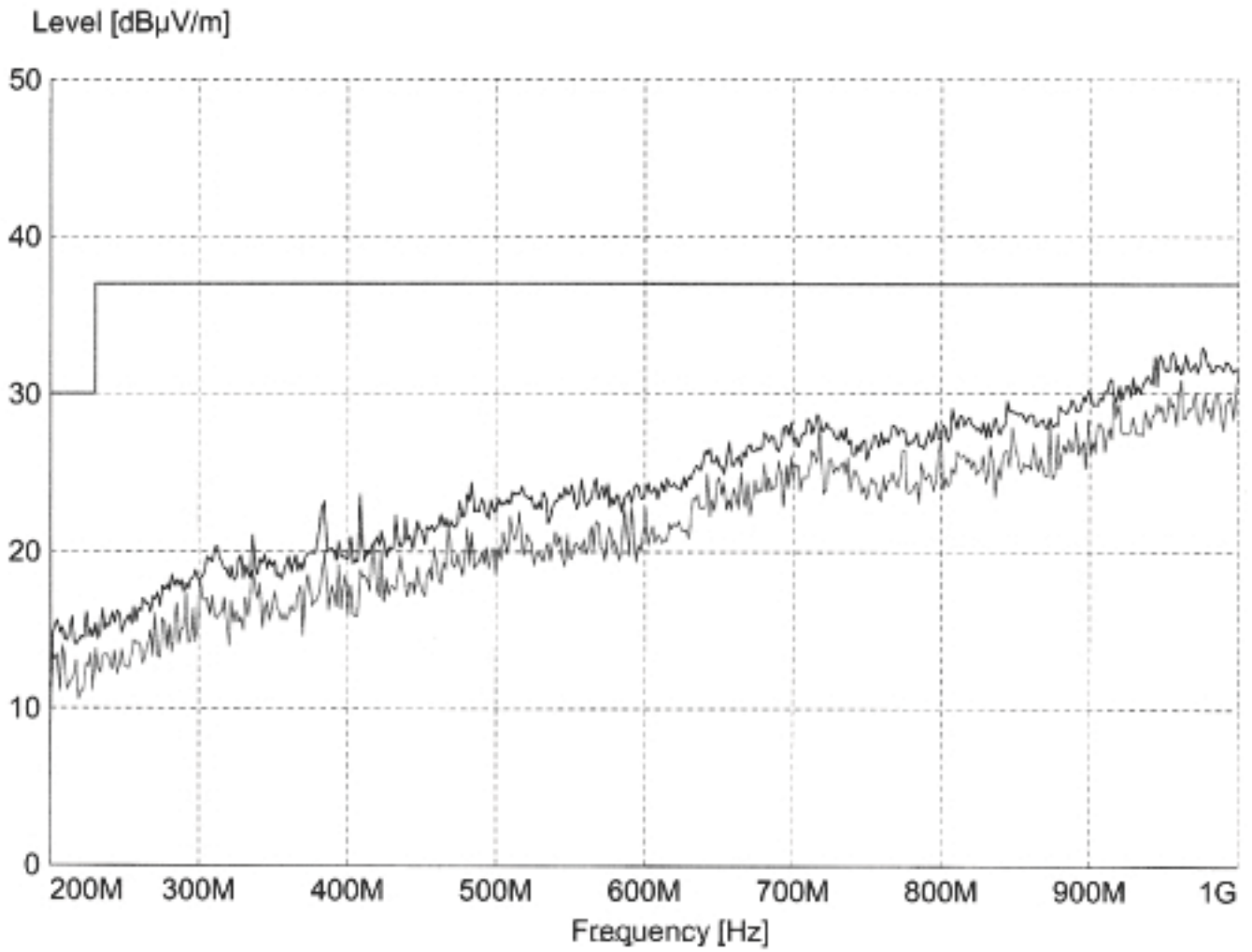
Antenna Polarity: Vertical
30MHz-200MHz Range

Portable Data Terminal



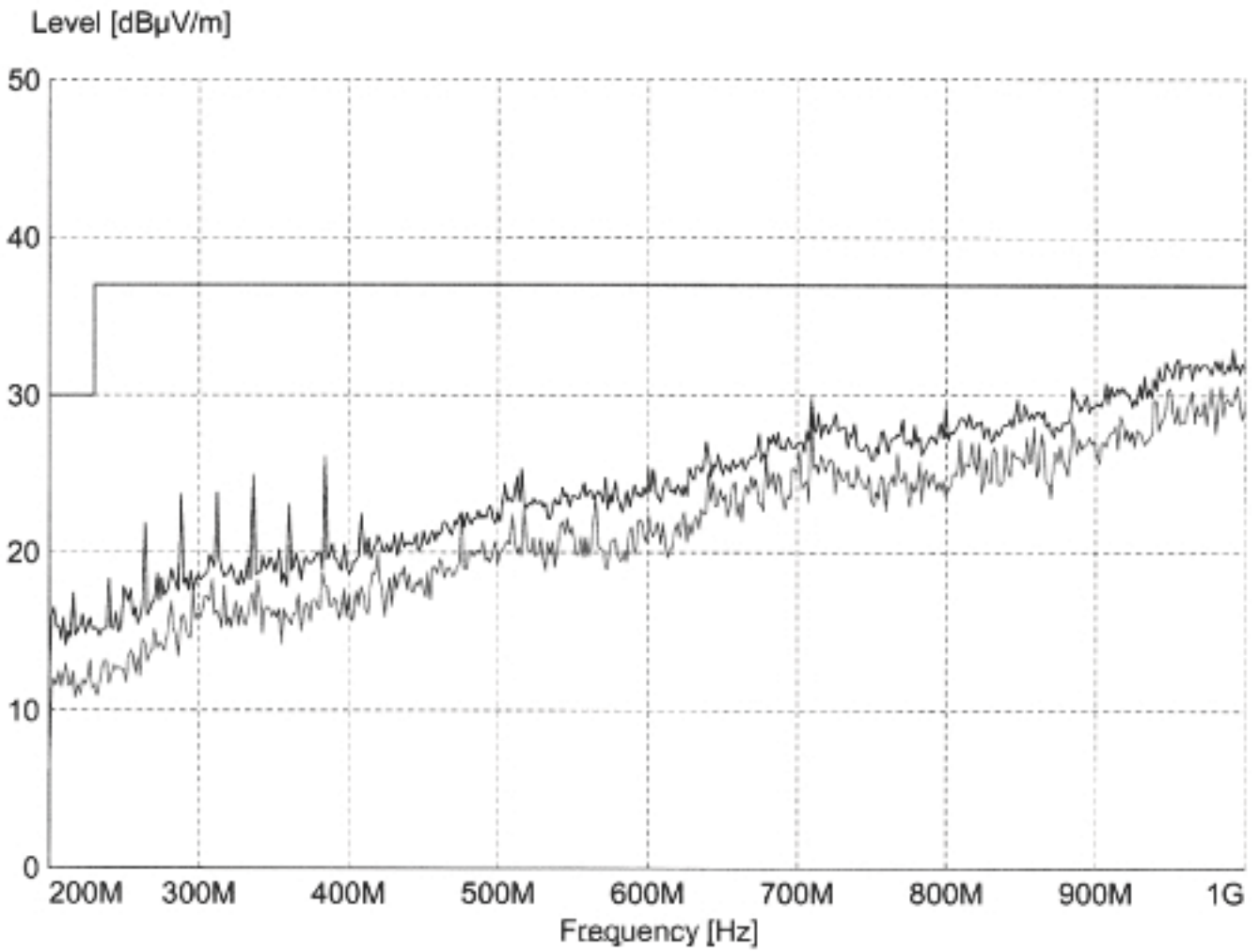
Antenna Polarity: Horizontal
30MHz-200MHz Range

Portable Data Terminal



Antenna Polarity: Vertical
200MHz-1GHz Range

Portable Data Terminal



Antenna Polarity: Horizontal
200MHz-1GHz Range

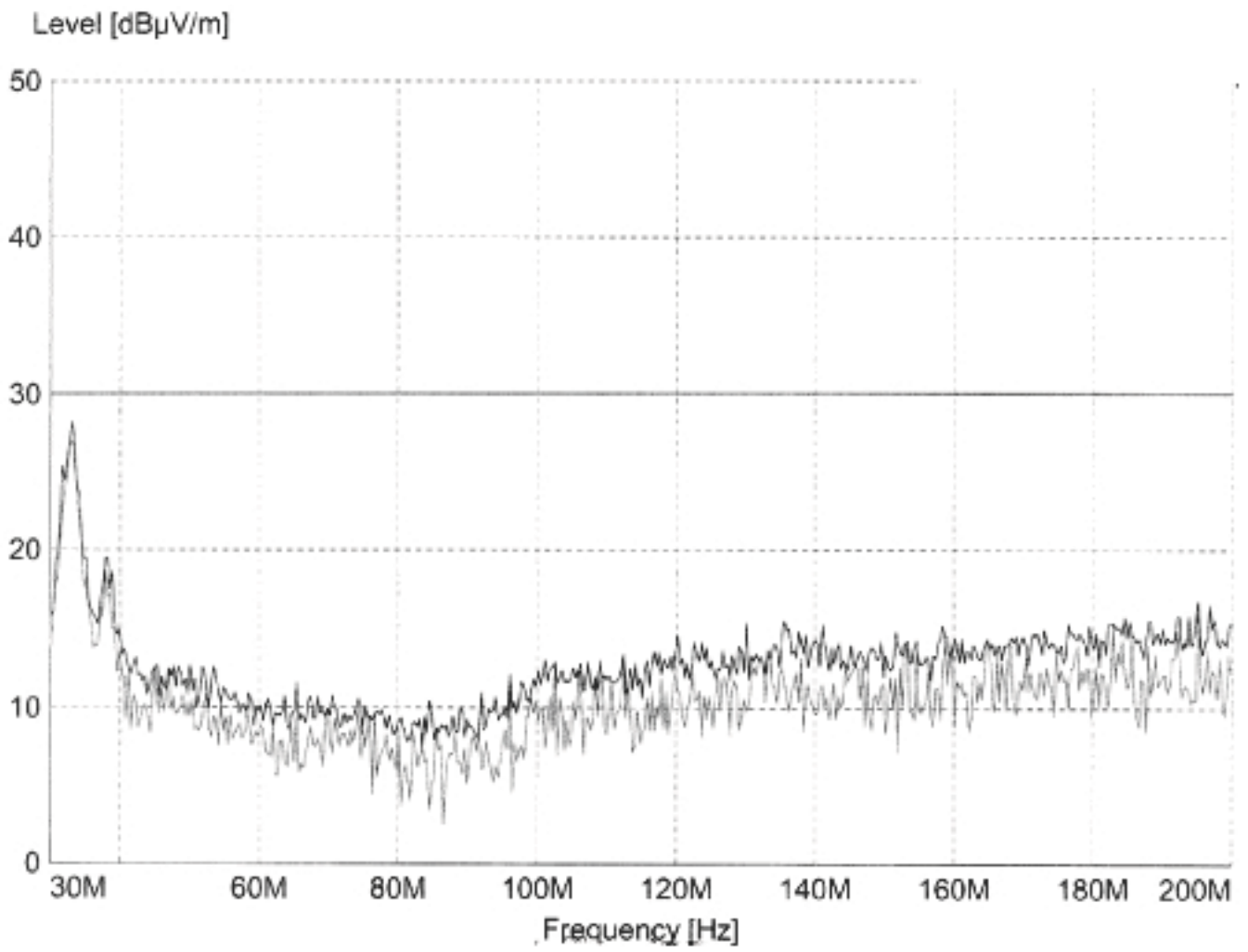
Model 2: Corded Unit in TTL-232 Mode

The illustration below shows a unit similar to the one tested.



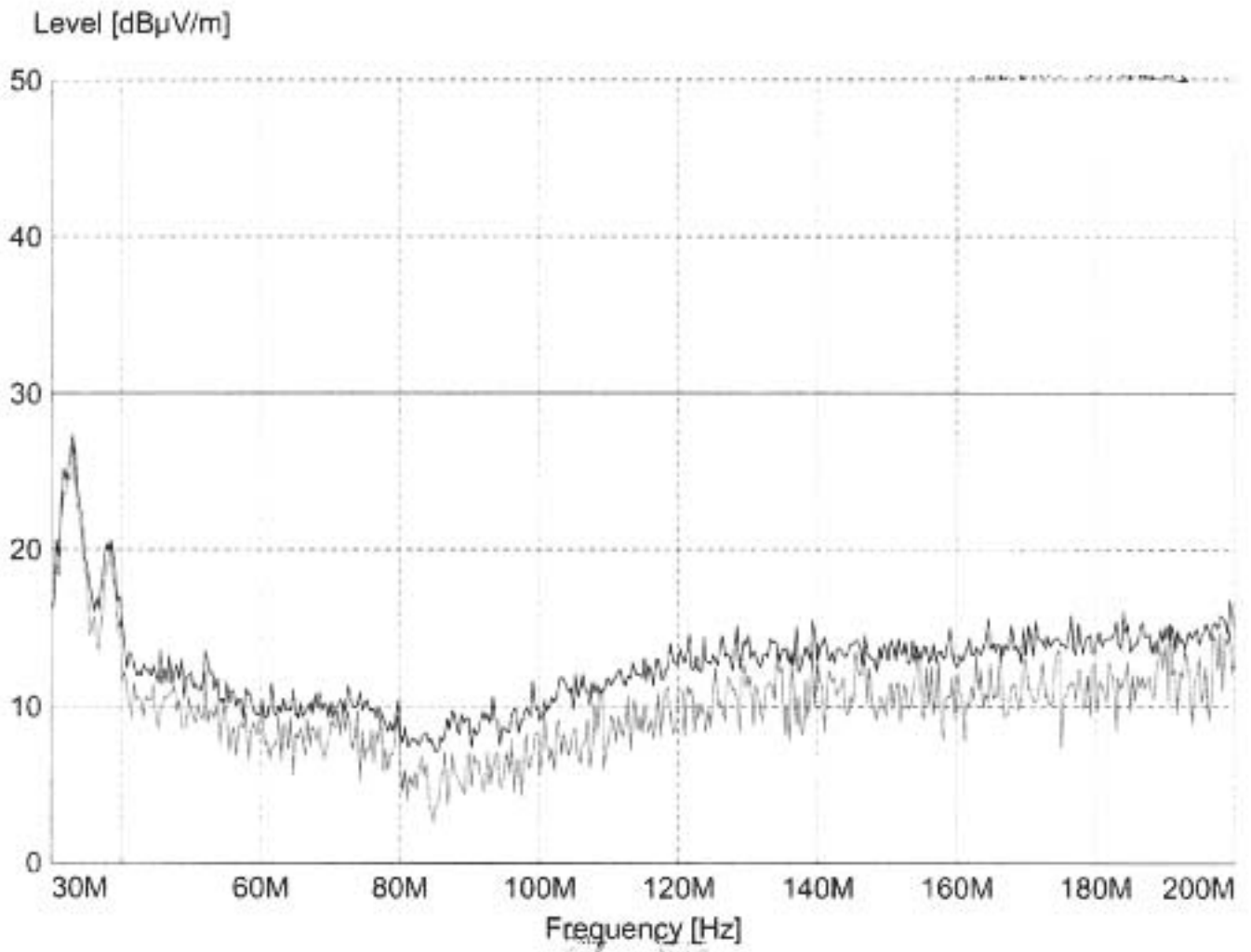
This system passed FCC class B limits at all frequencies with a margin of 3 db or more. The test results are shown in the following charts. The results are shown for 30MHz-200MHz range only, since no peaks were observed in the 200MHz-1GHz range.

Notebook and Serial/USB Converter Only



Antenna polarity: Vertical
30MHz-200MHz Range

Notebook and Serial/USB Converter Only



Antenna Polarity: Horizontal
30MHz-200MHz Range

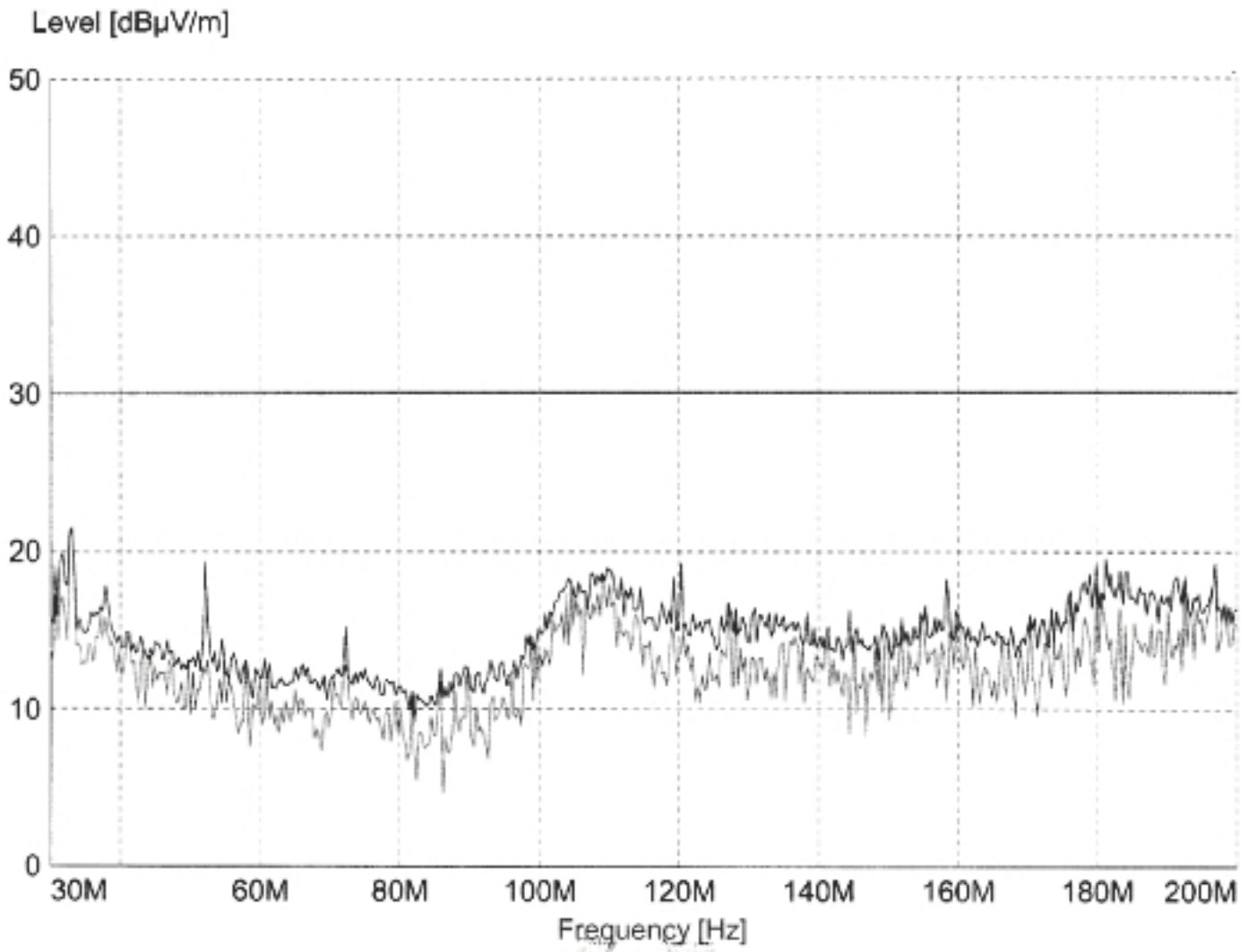
Model 3: Corded Unit in USB Mode

The illustration below shows a unit similar to the unit tested:



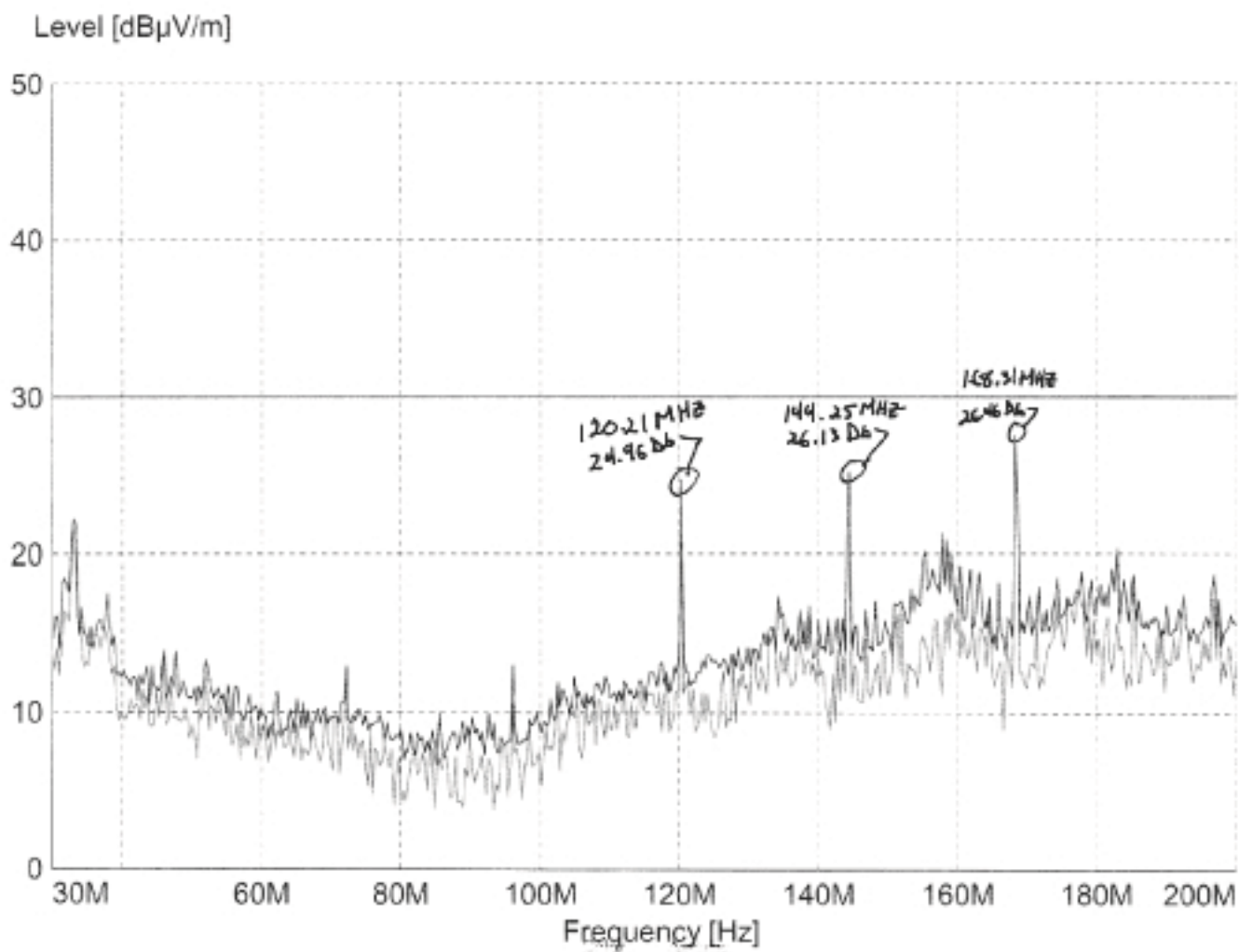
This system passed FCC Class B limits at all frequencies with a margin of 3db or more. The test results are shown in the next four charts. The results are shown for the 30MHz-200MHz range only, since there were no peaks observed in the 200MHz-1GHz range.

USB Unit with Straight Cable



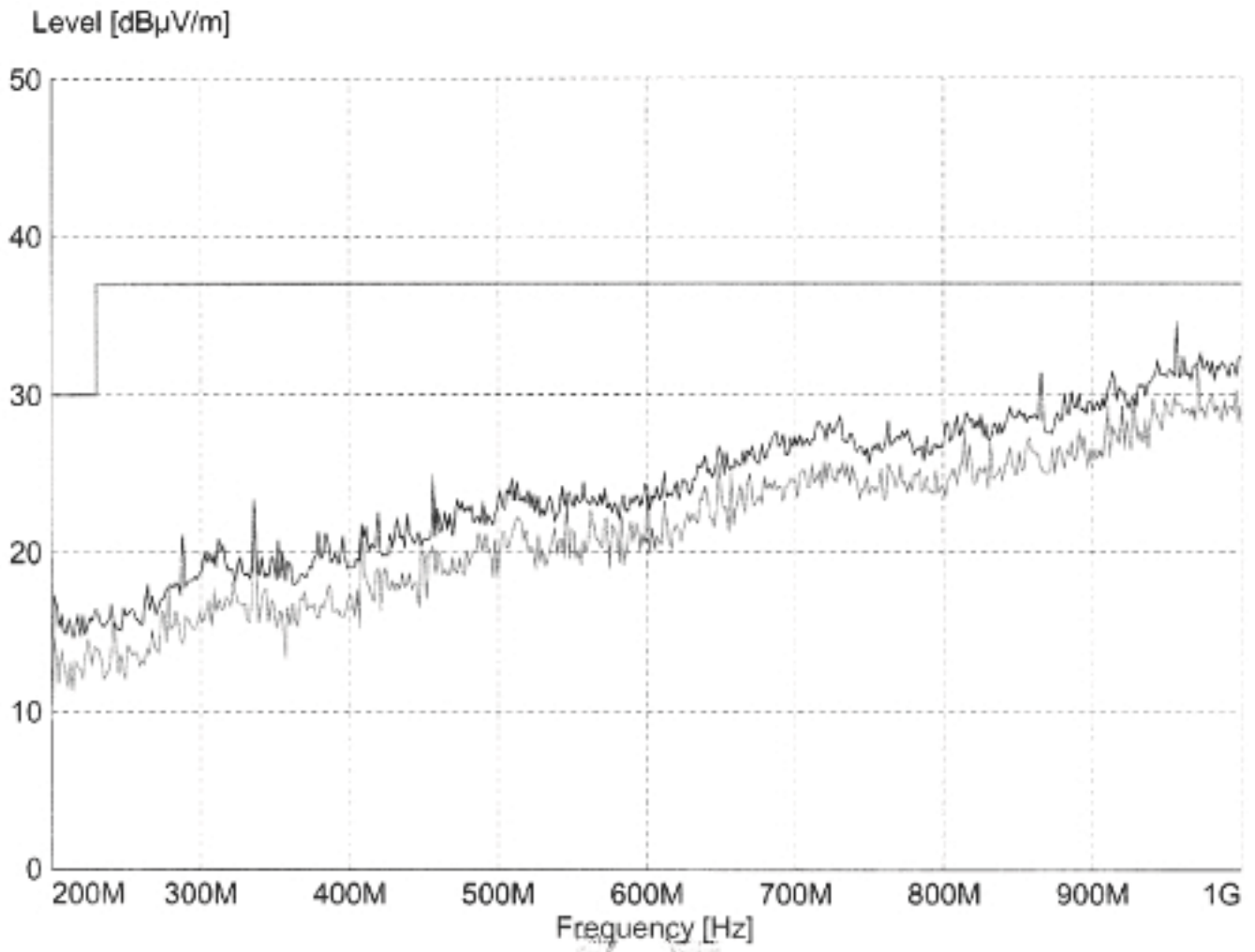
Antenna Polarity: Vertical
30MHz-200MHz Range

USB Unit with Straight Cable



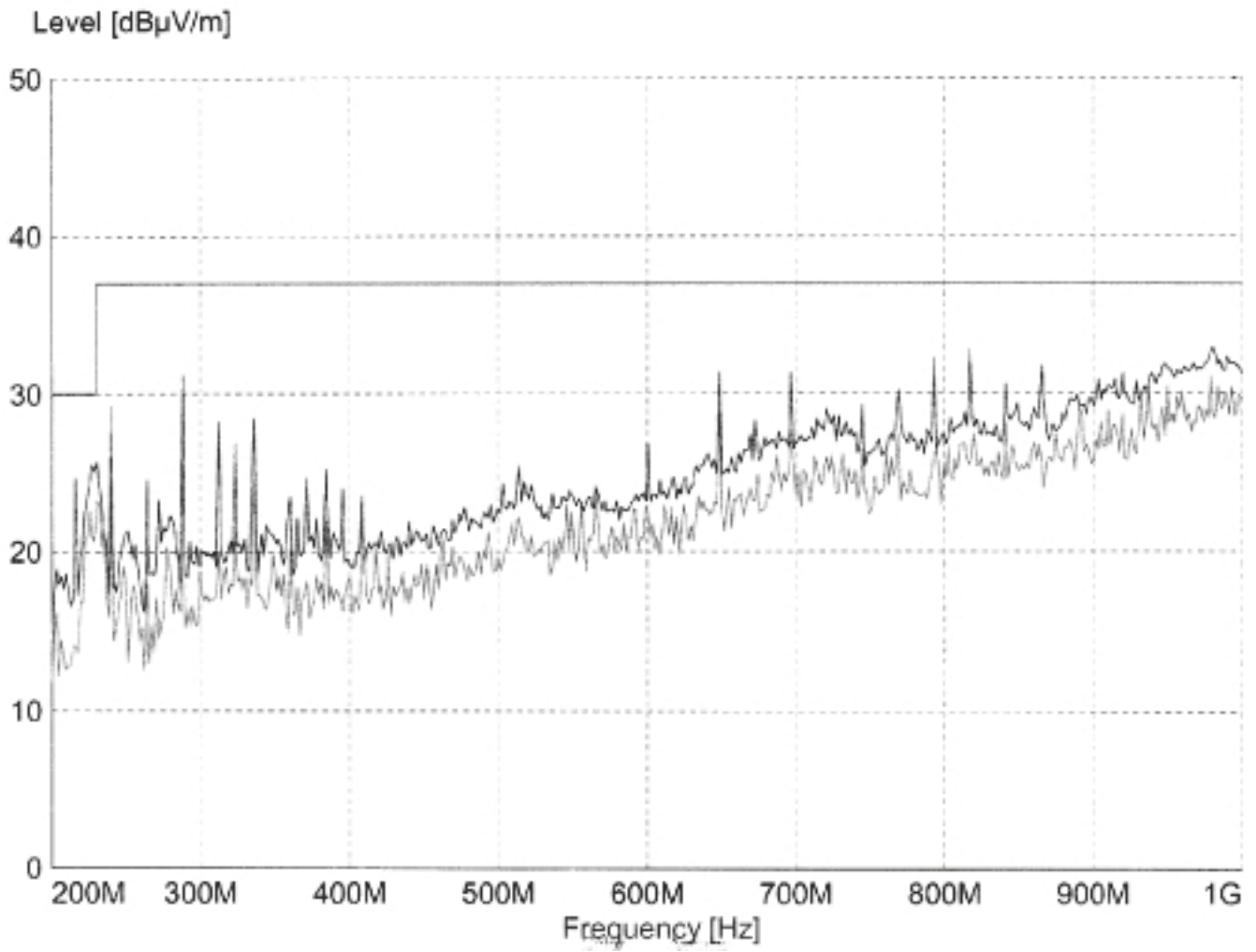
Antenna Polarity: Horizontal
30MHz-200MHz Range

USB Unit with Straight Cable



Antenna Polarity: Vertical
200MHz-1GHz Range

USB Unit with Straight Cable



Antenna Polarity: Horizontal
200MHz-1GHz Range



Honeywell Scanning & Mobility
9680 Old Bailes Road
Fort Mill, SC 29707

www.honeywellaidc.com