

INTERTEK TESTING SERVICES

MEASUREMENT/TECHNICAL REPORT

Manutec Industrial Limited - MODEL: Sentinel PS-08 Receiver
FCC ID: NQB8L102-PS08RX

This report concerns (check one:) Original Grant X Class II Change

Equipment Type: Superregenerative Receiver (example: computer, printer, modem, etc.)

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes No X

If yes, defer until:
date

Company Name agrees to notify the Commission by:
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes No X

If no, assumed Part 15, Subpart B for unintentional radiator - the new 47 CFR [10-1-96 Edition] provision.

Report prepared by:

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EXHIBIT 1

GENERAL DESCRIPTION

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1.3 Test Methodology

Both AC mains line-conducted and radiated emission measurements were performed according to the procedures in ANSI C63.4 (1992). All radiated measurements were performed in an Open Area Test Site. Preliminary scans were performed in the Open Area Test Site only to determine worst case modes. For each scan, the procedure for maximizing emissions in Appendices D and E were followed. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

1.4 Test Facility

The open area test site and conducted measurement facility used to collect the radiated data is located at Garment Centre, 576 Castle Peak Road, Kowloon, Hong Kong. This test facility and site measurement data have been placed on file with the FCC.

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EXHIBIT 2

SYSTEM TEST CONFIGURATION

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2.0 System Test Configuration

2.1 Justification

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a cardboard box, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

For maximizing emissions, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data reported in Exhibit 3.0.

The device was powered from an AC/DC adaptor.

2.2 EUT Exercising Software

There was no special software to exercise the device. Once the unit is powered up, it received continuously.

2.3 Support Equipment List and Description

This product was tested with a relay which is extended by 1 m cable. The cable is wired by a ferrite near the terminal of the receiver.

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2.4 Equipment Modification

Any modifications installed previous to testing by Manutec Industrial Limited will be incorporated in each production model sold/leased in the United States.

No modifications were installed by Intertek Testing Services.

2.5 Special Accessories

There are no special accessories necessary for compliance of this product.

Confirmed by:

*C. K. Lam
Assistant Manager - EMC
Intertek Testing Services
Hong Kong Ltd.
Agent for Manutec Industrial Limited*



Signature

June 23, 1998

Date

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EXHIBIT 3

EMISSION RESULTS

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3.0 Emission Results

Data is included of the worst case configuration (the configuration which resulted in the highest emission levels). A sample calculation, configuration photographs and data tables of the emissions are included.

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3.1 Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CF - AG$$

where FS = Field Strength in dB μ V/m

RA = Receiver Amplitude (including preamplifier) in dB μ V

CF = Cable Attenuation Factor in dB

AF = Antenna Factor in dB

AG = Amplifier Gain in dB

In the following table(s), the reading shown on the data table reflects the preamplifier gain. An example for the calculations in the following table is as follows:

$$FS = RR + LF$$

where FS = Field Strength in dB μ V/m

RR = RA - AG in dB μ V

LF = CF + AF in dB

Assume a receiver reading of 52.0 dB μ V is obtained. The antenna factor of 7.4 dB and cable factor of 1.6 dB are added. The amplifier gain of 29 dB is subtracted, giving a field strength of 32 dB μ V/m. This value in dB μ V/m was converted to its corresponding level in μ V/m.

$$RA = 52.0 \text{ dB}\mu\text{V/m}$$

$$AF = 7.4 \text{ dB}$$

$$CF = 1.6 \text{ dB}$$

$$AG = 29.0 \text{ dB}$$

$$FS = RR + LF$$

$$FS = 23 + 9 = 32 \text{ dB}\mu\text{V/m}$$

$$RR = 23.0 \text{ dB}\mu\text{V}$$

$$LF = 9.0 \text{ dB}$$

$$\text{Level in mV/m} = \text{Common Antilogarithm} [(32 \text{ dB}\mu\text{V/m})/20] = 39.8 \mu\text{V/m}$$

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3.2 Radiated Emission Configuration Photograph

Worst Case Radiated Emission

Front View

at 312.518 MHz



FCC ID:

NQB8L102-PS08RX



RADIATED

Model No. PS 08

File: 9802962

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3.3 Radiated Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 3.9 dB

*All readings are peak unless stated otherwise

TEST PERSONNEL:



Signature

Ken C. C. Lam, Compliance Engineer
Typed/Printed Name

June 26, 1998
Date

INTERTEK TESTING SERVICES

Company: Manutec Industrial Limited
Model: Sentinel PS-08 Receiver

Date of Test: June 3, 1998

Table 1

FCC Class B Radiated Emissions

Polarity	Frequency (MHz)	Reading (dB μ V)	Antenna Factor (dB)	Pre-Amp Gain (dB)	Net at 3m (dB μ V/m)	Limit at 3m (dB μ V/m)	Margin (dB)
H	298.723	29.7	22	16	35.7	46	-10.3
H	300.919	30.3	22	16	36.3	46	-9.7
H	303.156	31.6	22	16	37.6	46	-8.4
H	305.493	31.5	23	16	38.5	46	-7.5
H	307.807	33.2	23	16	40.2	46	-5.8
H	310.180	33.1	23	16	40.1	46	-5.9
H	312.518	35.1	23	16	42.1	46	-3.9
H	317.194	33.5	23	16	40.5	46	-5.5
H	319.535	32.8	23	16	39.8	46	-6.2
H	321.889	30.1	23	16	37.1	46	-8.9

- NOTES: 1. Negative sign in the column shows value below limit.
2. Peak Detector Data.
3. All measurements were made at 3 meters. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.

Test Engineer: Ken C. C. Lam

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3.5 Conducted Emission Data

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Judgement: Passed by 16.5 dB

*All readings are peak unless stated otherwise

TEST PERSONNEL:



Signature

Ken C. C. Lam, Compliance Engineer
Typed/Printed Name

June 26, 1998

Date

INTERTEK TESTING SERVICES

Company: Manutec Industrial Limited
Model: Sentinel PS-08 Receiver

Date of Test: June 3, 1998

Graph 1

Conducted Emissions
Section 15.107 Requirements

Report No.: 9805275

Mode: Alarm

1. Test of the alarm system at the
alarm location. Results:

Test results: ☐ Pass ☒ Fail
Tested by: [blank] Date: [blank]
Reviewed by: [blank] Date: [blank]

2. Test of the alarm system at the
alarm location. Results: ☐ Pass ☒ Fail
Tested by: [blank] Date: [blank]
Reviewed by: [blank] Date: [blank]

dBm

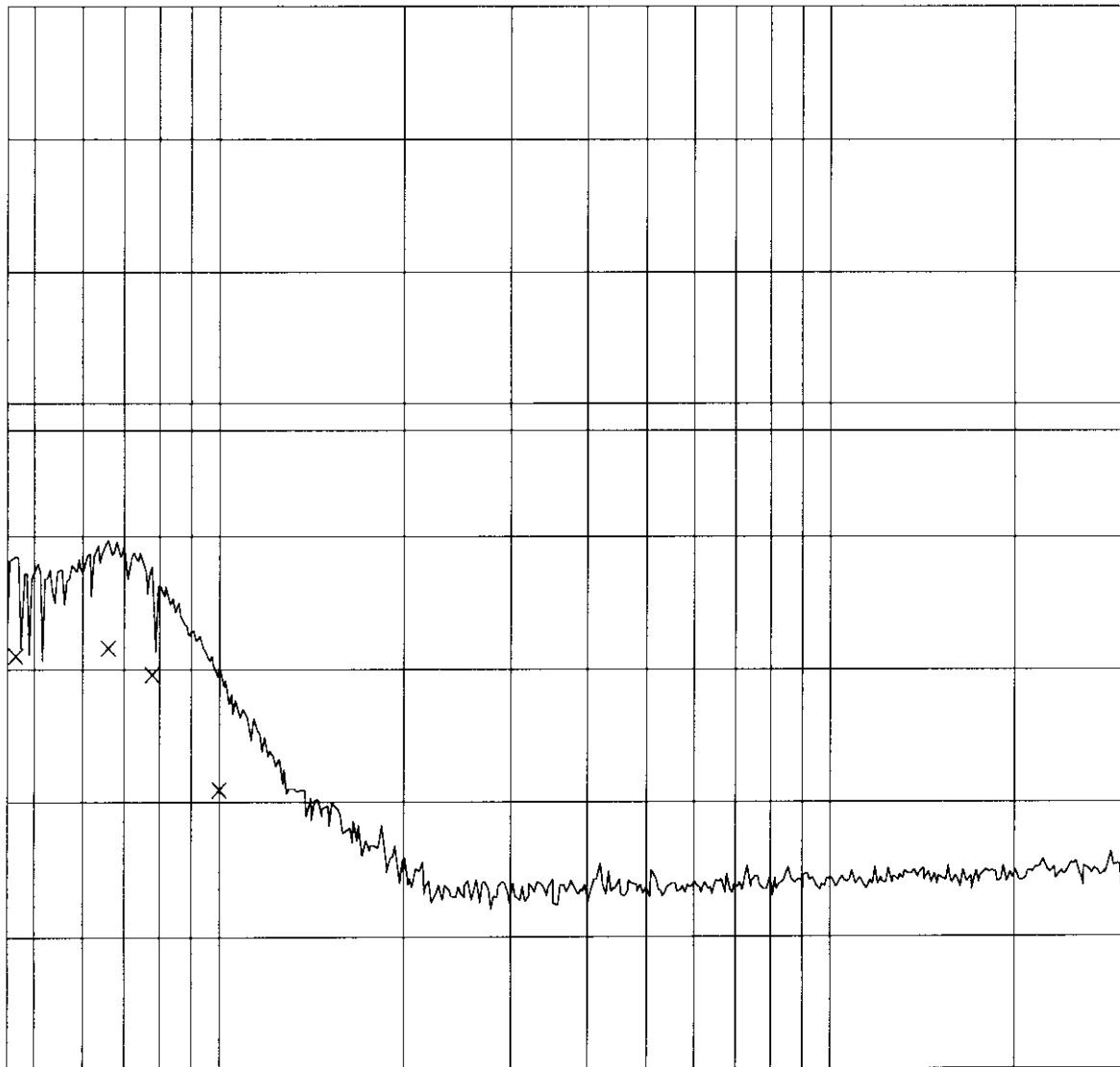


FIGURE 1

Ctrl. No.: N/A

FCCID: NQB8L102-PS08RX

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Company: Manutec Industrial Limited
Model: Sentinel PS-08 Receiver

Date of Test: June 3, 1998

Table 2

Conducted Emissions Section 15.107 Requirements



Intertek Testing Services

ETL Testing Laboratories

Mode: Alarm

Report No.: 9805275

Tested By: Hong, Report No.: 9805275

Scan Settings: 11 Range,

```
----- Frequencies -----|----- Receiver Settings -----|
Start      Stop      Step      IF BW  Detector  M-Time  Atten  Preamp  OpRge
450k       30M       5k       10k    PK        20ms   AUTO  LN OFF  60dB
Final Measurement Results:
```

Frequency MHz	QP Level dBuV	QP Limit dBuV
0.46500	31.0	48.0
0.66000	31.5	48.0
0.78000	29.6	48.0
1.00000	26.9	48.0

* limit exceeded

Ctrl. No.: N/A

FCCID: NQB 8L102-PS08RX

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EXHIBIT 4

EQUIPMENT PHOTOGRAPHS

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4.0 Equipment Photographs

Photographs of the tested EUT are attached.

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EXHIBIT 8

MISCELLANEOUS INFORMATION

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8.0 Miscellaneous Information

This miscellaneous information includes details of the stabilizing process (including a plot of the stabilized waveform), the test procedure and calculation of factors such as pulse desensitization and averaging factor.

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8.1 Stabilization Waveform

Previous to the testing, the superregenerative receiver was stabilized as outlined in the test procedure. The plot on the following page shows the fundamental emission when a signal generator was used to stabilize the receiver. Please note that the antenna was placed as close as possible to the EUT for clear demonstration of the waveform and that accurate readings are not possible from this plot.

hp

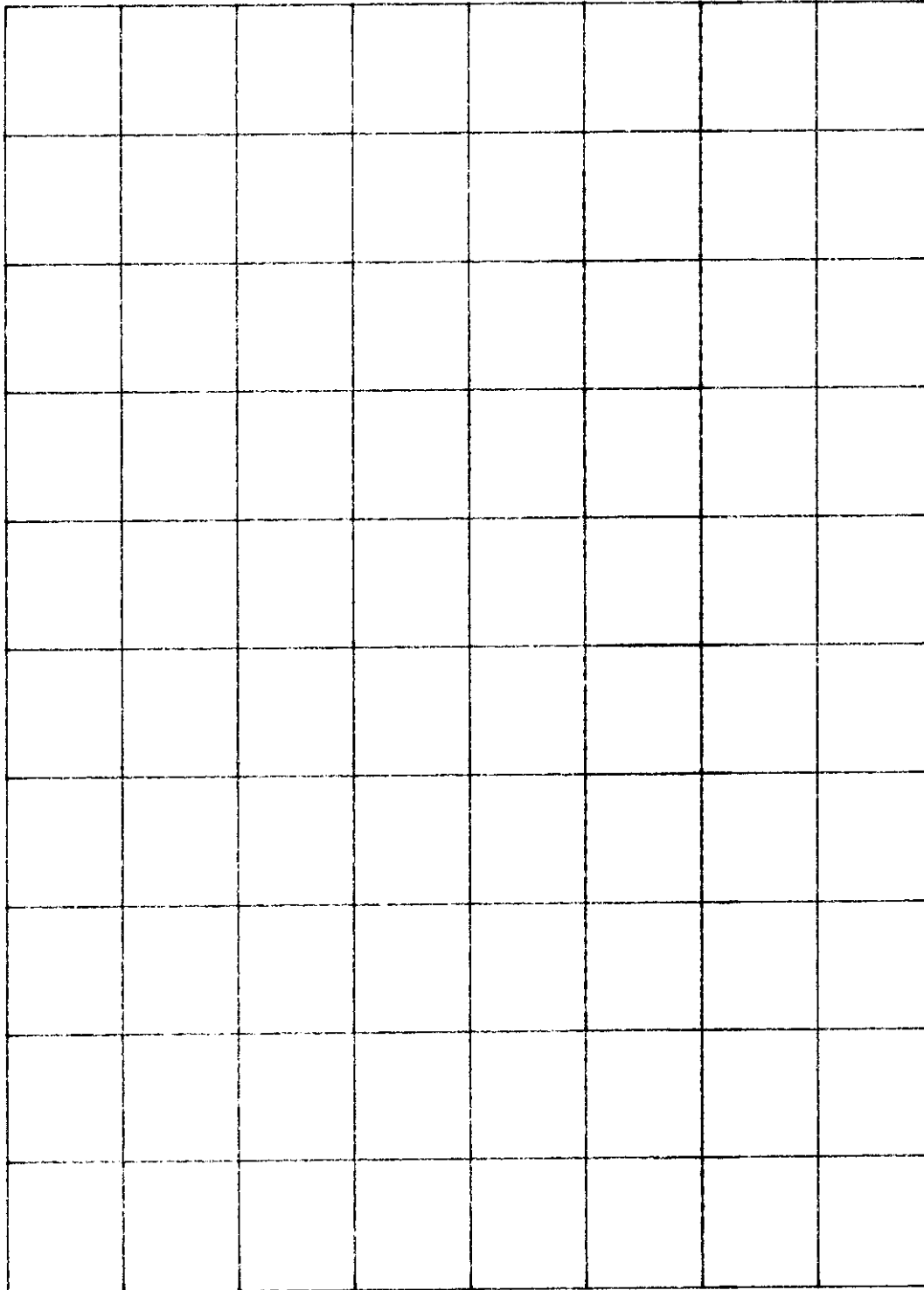
REF 87.0 dBμV AT 10 dB

PEAK

LOG

10

dB/



VA SB
SC FC
CORR

CENTER 322.13 MHz

#RES BW 30 kHz

SPAN 75.00 MHz

SWP 250 msec

#VBW 3 MHz

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8.2 Discussion of Pulse Desensitization

The determination of pulse desensitivity was made in accordance with Hewlett Packard Application Note 150-2, *Spectrum Analysis ... Pulsed RF*.

This device is a superregenerative receiver. The stabilized signals are continuous, and no desensitization of the measurement equipment occurs.

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8.3 Calculation of Average Factor

The emission limits are specified using spectrum analyzers or receivers which incorporate quasi-peak detectors. Typical measurements are made using peak detectors, however, emissions which approach the respective emission limit are measured using a quasi-peak detector.

For measurements above 1 GHz, spectrum analyzers or receivers using average detectors are employed, or the appropriate average factor can be applied.

Measurements using spectrum analyzers with filters other than peak detectors are recorded in the data table section of this report.

This device is a superregenerative receiver.

It is not necessary to apply average factor to the measurement results.

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8.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services Hong Kong Ltd. in the measurements of superregenerative receivers operating under the Part 15, Subpart B rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.4 - 1992. Superregenerative receivers are stabilized prior to measurement by generating a signal well above the receiver threshold whose frequency is tuned until the emissions stabilize into a line spectrum. The signal is usually generated as CW with a Marconi 2022D signal generator and a short whip antenna and is at a level of several hundred to several thousand mV/m. Plots of the stabilized signal will be shown. If a modulated signal is used, it will be noted.

The equipment under test (EUT) is attached to a cardboard box and placed on a wooden turntable which is four feet in diameter and approximately one meter in height above the groundplane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The cardboard box is adjusted through all three orthogonal axis to obtain maximum emission levels. The antenna height and polarization are also varied during the testing to search for maximum signal levels. The height of the antenna is varied from one to four meters.

Detector function for radiated emissions is in peak mode. Average readings, when required, are taken by measuring the duty cycle of the equipment under test and subtracting the corresponding amount in dB from the measured peak readings. A detailed description for the calculation of the average factor can be found in Exhibit 8.3.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower. For line conducted emissions, the range scanned is 450 kHz to 30 MHz.

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8.4 Emissions Test Procedures (cont)

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

Conducted measurements were made as described in ANSI C63.4 - 1992.

The IF bandwidth used for measurement of radiated signal strength was 100 kHz or greater below 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. A discussion of whether pulse desensitivity is applicable to this unit is included in this report (See Exhibit 8.2). Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Measurements are normally conducted at a measurement distance of three meters. All measurements are extrapolated to three meters using inverse scaling, unless otherwise reported. Measurements taken at a closer distance are so marked.