GE Security, Inc.
Base Station Transceiver
B4Z-846-TCVR
Class II Permissive Change
8/5/2004

GE Security, Inc.
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1. Introduction

This device is a radio transceiver. It receives signals from other transceivers. It transmits signals to other transceivers. A hardwired bus provides a data link to a security panel. Both the receiver and the transmitter operate as frequency hopping spread spectrum (FHSS) links using the 902-928MHz ISM band.

This device was originally certified under Part 15, Subpart C, Paragraph 15.247, in a grant dated 04/23/04. We have made several minor changes to the design in order to use it in a different application. These changes have not required a board change, nor has there been any change in frequency determining elements or clock sources. A complete list of the changes is given in this report. We are requesting a Class II Permissive Change.

A full set of measurements has been taken on the modified design. The results of these measurements are included in this report, and show compliance with the requirements.

Please send comments/suggestions on the report to paul.saldin@ge.com.

Grantee Code: B4Z

2. Statement of Compliance

§2.911 Application

a) This is a permissive change application and has been filed electronically with form 731.
b) All information required has been supplied.
c) The applicant has signed the application (electronically).
d) The technical data has been signed.
e) Applicant signature block on electronic form 731 completed by officer of the company or authorized company personnel.
f) The appropriate fee has been paid electronically by credit card on 08/05/2004.

§2.925 Label

Each piece of equipment for which authorization is granted will be uniquely identified with "FCC ID: B4Z-846-TCVR." The required statement will appear with the FCC ID on the product. See Exhibit A, "*id label.pdf*".

§2.947 Measurement Procedure

a) The scan of the restricted bands was made in a radiated manner, with the unit powered by Class 2 transformer. The radiated measurement procedure follows ANSI C63.4 procedure.

b) All other RF measurements were made in a conducted manner.

c) Procedural notes are contained in the laboratory report.

d) A list of test equipment used is contained in the laboratory report.

§2.948 Description of Measurement Facilities

Measurements were performed at TUV Testing Services Open Test Site. The FCC keeps a full description of the measurement facilities on file. TUV's acceptance and approval is dated as December 5, 1993 in a letter received from the FCC.

The address of the test facility is:
TUV Product Service
19035 Wild Mountain Road
Taylors Falls, MN 55084-1758

Phone: 651-638-0297
Contact: Joel Schneider
Test Engineer in Charge

See Exhibit B, *"test_pho.pdf"*, for sketch of radiated measurement setup.

§2.1043 Application for Permissive Change

a) There have been no changes in frequency determining circuitry, frequency multiplication circuitry, modulation circuitry, or field strength ratings due to this change. Variations in characteristics of the device have been tested and comply with the FCC requirements.

b) This is a filing for a Class II Permissive Change.

2) This technical report contains the results of the testing performed to determine compliance with the FCC requirements.

4) As holder of the grant of certification, we are authorized to make this Permissive Change.

3. Description of Change

The purpose of the change is to allow the transceiver to operate with a small alarm panel. These changes have not required a board change, nor has there been a change in frequency determining elements or clock sources. Please refer to Exhibit H, "*extern.pdf*" and Exhibit I, "*intern.pdf*" for photographs of the panel and connection to the transceiver.

The majority of the changes involve the connection of the transceiver to the panel and have no bearing on the RF portion of the board. The one change that does involve the RF portion is a change in transmitter supply voltage from 5V to 3.3V. In order to compensate for this change, the bias of the RF power amplifier was changed by modifying the value of a resistor.

The following is a list of the changes. Please refer to Exhibit E, "*schematic.pdf*", Exhibit F, "*ppd.pdf*", and Exhibit G, "*block.pdf*".

- J8, J3, R22, R25, R26, Q5, and R2 were removed, as they are no longer needed to communicate to the panel.
- Wiring harness J4 soldered in place of J3. This harness provides communication to the panel.
- C2 and U2 removed. 5V is no longer needed on the board for communication to the panel.
- R17, R18, CR1, and CR2 removed. These are the LEDs, no longer needed.
- Processor model changed from PIC18LF242 to PIC18LF2420.
- Regulator U11 changed from 5V to 3.3V output. This is the regulator that supplies power to the RF transmitter. R41 changed from 15kohm to 18kohm to increase the bias on the RF power amlifier to compensate for the change in supply voltage.

4. Lab Measurements Discussion / Test Notes

All required measurements have been taken on a unit modified with the changes in order to show continued compliance with the requirements.

*4.1 Frequencies to be Examined [**§15.31(m)**]*

In accordance with the guidelines of §15.31(m), all conducted and radiated measurements were performed at the lower, middle, and upper frequencies of the 902-928MHz band.

*4.2 Antenna Requirement [**§15.203**]*

The transmitter antenna is permanently soldered to the circuit board, and therefore complies with the requirement that no other antenna shall be used with the device.

4.3 Antenna Characteristics [§15.204]

There is only one antenna proposed for use with this device, and it has not changed from the original grant. This antenna has the following characteristics:

4.3.1 Antenna Type

The antenna is approximately a ¼ wave monopole at 900MHz.

4.3.2 Antenna Manufacturer

None; the antenna is a simple wire soldered to the circuit board.

4.3.3 Antenna Gain

The ¼ wave monopole is a well known antenna type. The theoretical gain of an ideal ¼ wave monopole is 5.15dBi. The antenna on this transmitter has some non-ideal characteristics, finite ground plane being the most significant. Therefore, the antenna gain will be somewhat lower than the ideal number of 5.15dBi.

4.4 Public Utility Power Line Measurements [§15.207]

The voltage conducted back onto the AC power line was measured and found to be in compliance with the Class B limits. Please see Exhibit M, "*ac line conducted emissions.pdf*".

4.5 Frequency Hopping System Description[§15.247(a)]

This system meets the definition of a frequency hopping spread spectrum system as follows:

4.5.1 Carrier Frequency Separation

Carrier frequency separation is 524kHz. This meets the requirement that it be greater than the 20dB bandwidth, which is 160kHz. See Exhibit P, "*channel separation.pdf*" and Exhibit Q, "*20dB bandwidth.pdf*".

4.5.2 Randomization of Hopping Frequencies

A pseudorandomly ordered list of 50 hopping frequencies is used for carrier frequency selection. On each new hop, the software selects the next frequency in the list, resulting in a pseudorandom distribution and an equal use of each frequency on average. See Exhibit J, "*random freq list.pdf*".

4.5.3 Number of Hopping Frequencies

The system uses 50 hopping frequencies as required. See Exhibit J, "*random freq list.pdf*" for the list of the frequencies. See Exhibit R, "*number of hops.pdf*" for a plot showing usage of 50 frequencies. This plot was made by setting the spectrum analyzer to peak hold and presenting the transmitter with a continuous data stream.

4.5.4 Time of Occupancy

The dwell time on each frequency is 55.5msec. See Exhibit S, "*dwell time.pdf*" for a plot of the packet length. The software enforces a minimum interpacket delay of 46msec. This minimum delay between hops, in conjunction with the provision that all 50 hopping frequencies are used equally on average, guarantees that the transmitter shall not occupy any frequency for more than 0.4 seconds in a 20 second period.

4.5.5 20dB Bandwidth

The 20dB bandwidth of the modulated transmission is 160kHz. This complies with the requirement that the bandwidth be less than 500kHz. See Exhibit Q, "*20dB Bandwidth.pdf*".

4.6 Output Power [§15.247(b)]

4.6.1 Peak Output Power

The peak output power of the transmitter is in compliance with the 1W limit for the low, middle and high channels. This data was taken with the unit operating in a continuous (non-modulated) manner. See Exhibit T, "*conducted output power.pdf*" for the conducted test data.

4.6.2 De Facto EIRP Limit

The gain of the transmit antenna is given earlier in this report. Because the gain of the antenna is less than 6dBi, the peak output power need not be reduced to comply with this requirement.

4.7 Spurious Emissions [§15.247(c)]

4.7.1 Band-Edge Compliance

The transmitter was found to comply with the 20dB-down band-edge requirements with the hopping function both disabled and enabled.

In order to test with the hopping function disabled, the transmitter was put in a special mode in which it was locked on the low channel. Repeated data packets were then transmitted with the spectrum analyzer on peak hold at the low channel. The same test was then repeated for the high channel. The results of these tests are shown in Exhibit V, "*lower band edge no hop.pdf*" and Exhibit W, "*upper band edge no hop.pdf*".

The hopping function was then enabled, and packets were transmitted until many had occurred at the low channel. The spectrum analyzer was once again on peak hold at the low channel. The same test was then repeated for the high channel. The results of these tests are shown in Exhibit X, "*lower band edge hop.pdf*" and Exhibit Y, "*upper band edge hop.pdf*".

4.7.2 Spurious RF Conducted Emissions

Spurious emissions not lying in restricted bands were tested in a conducted manner. These emissions were tested with the transmitter tuned to low, mid, and high channels and transmitting in a continuous manner.

The 2nd and 7th are the only harmonics that lie in non-restricted bands. The power conducted at these harmonics was found to comply with the requirement that it be 20dB down from the fundamental. See Exhibit U, "*conducted spurious emissions.pdf*" for the conducted test data, showing a spectrum analyzer plot of the low, mid, and high frequency for each of the non-restricted harmonics.

4.7.3 Spurious RF Radiated Emissions

A complete scan was performed to determine the radiated field strength of spurious emissions falling within the restricted bands defined in §15.205. These emissions were tested with the transmitter tuned to low, mid, and high channels and transmitting in a continuous manner. See Exhibit H, "*extern.pdf*" for pictures of the test setup.

4.7.3.1 Calculation of allowed limit

For spurs above 1000MHz, §15.205(b) allows duty cycle averaging per §15.35. The following is the derivation of the allowed duty cycle correction factor for this transmitter.

The transmitter employs amplitude modulation and transmits 208 bits. Each bit has an "ON" time of 122 µS. The total on time of a single packet is:

208 * 122 µS = 25.376 msec.

The interpacket delay time of 45mS, enforced by the software, ensures that only one packet is sent in any given 100mS window. The duty cycle correction factor is therefore:

20*LOG(25.376/100) = -11.91 dB

The raw limit for spurs falling above 960MHz is given in §15.209 as 500 microvolts per meter, or 54 dBuV/m. After applying the duty cycle correction factor, the limit for this transmitter for spurs above 1000MHz in the restricted bands is:

54 – (-11.91) = 65.91 dBuV/m

4.7.3.2 Radiated Emissions Results

Results of the radiated scan are shown in Exhibit Z, "*radiated spurious emissions.pdf*". These results show that all spurs lying in restricted bands above 1000MHz fall below the 65.91 dBuV/m limit. The highest spur was 4.59dB below the limit at 2.746GHz.