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TECHNICAL REPORT
FOR THE
TWO WAY PAGER, e80, MODEL 1100
FCC PART 24 SUBPART D AND
FCC PART 15 SUBPART B SECTION 15.107 AND 15.109 CLASS B
COMPLIANCE

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This report contains a total of 6 pages.

DESCRIPTION OF THE EQUIPMENT UNDER TEST

PerComm e80 two-way pager is a handheld unit designed for two-way wireless communication over a ReFLEX network. A Lithium Ion rechargeable battery powers the device. The device antenna is integral to the unit.

Technical characteristics

- | | |
|------------------------|---|
| 1. Output Power | 1 Watt (conducted) |
| 2. Frequency Range | |
| • Transmitter | 896-902 MHz |
| • Receiver | 929-941 MHz |
| 3. Channel Spacing | |
| • Transmitter | 12.5 kHz in 6.25Khz steps |
| • Receiver | 6.25, 10 and 12.5 kHz |
| 4. Data rates | |
| • Transmitter | 800, 1600, 6400 and 9600 bits per second |
| • Receiver | 1600, 3200 and 6400 bits per second |
| 5. Modulation | |
| • Transmitter | 4-level continuous phase frequency shift keying |
| • Receiver | 2-level and 4-level CPFSK |
| 6. Frequency deviation | +/- 800 and +/-2400 Hz |
| 7. Frequency stability | 1 ppm |

EQUIPMENT UNDER TEST

ReFLEX Telemetry Device

Manufacturer:	PerComm, Inc
Model Name:	e80
Model Number:	1100
FCC ID	NNT1100 (pending)

PERIPHERAL DEVICES

The EUT was tested in three configurations: the unit by itself, the unit with an AC/DC power adaptor charging the battery and the unit with a serial cable attached to its serial connector.

2.1033(c)(3) USER'S MANUAL

There are two user manuals. One is the e80 Quick Guide and the other is the e80 Reference Manual.

2.1033(c)(4) TYPE OF EMISSIONS

The emission designator is 10K0F1D.

Bandwidth calculation

Type of modulation: CPFSK continuous phase 4-level frequency shift keying.

Deviation: $D = 2400$ Hz maximum.

Maximum symbol rate = $9600 \text{ bits per second} / 2 \text{ bits per symbol} = 4800 \text{ symbol per second}$.

Maximum modulation frequency: $M = 4800 \text{ symbols} / 2 \text{ symbols per cycle} = 2400 \text{ Hz}$.

Necessary bandwidth: B_n is given by:

$$B_n = 2 \cdot M + 2 \cdot D = 2 \cdot 2400 + 2 \cdot 2400 = 9600 \text{ Hz}$$

Hence the bandwidth designator is 10K0.

The last three symbols are F for frequency modulation, 1 for a single channel containing digital information without the use of a modulating sub-carrier and D for data transmission.

2.1033(c)(5) FREQUENCY RANGE

The device operates in the frequency range of 901-902 MHz.

2.1033(c)(6) OPERATING POWER

The Pout is 1 watt. The output power is measured in conducted conditions in the lab or in manufacturing conditions prior to the unit assembly and prior to mounting the antenna.

2.1033(c)(7) MAXIMUM POWER RATING

Per FCC Part 24.132(a) stations transmitting in the 901-902 MHz band are limited to 7 watts E.R.P.

2.1033(c)(8) DC VOLTAGES

The e80 two-way pager operates from a Lithium Ion battery. The battery voltage in normal mode of operation ranges from 4.2V to 3.4V. The PA is powered straight from the battery. The DC current consumption in the PA's stage is typical 600 mA.

2.1033(c)(9) TUNE-UP PROCEDURE

There is no tune-up procedure for the output power as it is fixed to the maximum output power supplied by the final RF power amplifier stage. The voltage on the power amplifier can be lowered and as a consequence the output power diminishes.

2.1033(c)(10) SCHEMATICS AND CIRCUITRY DESCRIPTION

The necessary information is contained in separate confidential documents.

2.1033(c)(11) LABEL AND PLACEMENT

The necessary information is contained in the document FCC Label.

2.1033(c)(12) SUBMITTAL PHOTOS

The necessary information is contained in two files one containing the External Photos and one with the Internal Photos.

2.1033(c)(13) MODULATION INFORMATION

The necessary information is contained in the PerComm Report.

2.1033(c)(14)/2.1046/24.132(a) RF POWER OUTPUT

The necessary information is contained in the Protocol Labs Report.

2.1033(c)(14)/2.1047(d)/24.131 MODULATION CHARACTERISTIC

Part 2.1047(a) is Not Applicable to the e80 device.

Part 2.1047(b) is Not Applicable to the device. The e80 does not employ modulation limiting. The samples of the complex envelope of the signal are generated by the DSP via software. Two D-to-As convert these samples in analog I/Q signals. These analog signals modulates an IF carrier that later on is up-converted to the transmit frequency. The over-modulation is prevented because the DSP is controlling the frequency deviation. The TIA/EIA-603-A method of measuring the modulation limiting is Not Applicable.

Part 2.1047(d) the necessary information is contained in the PerComm Report.

2.1033(c)(14)/2.1049(i)/24.131 OCCUPIED BANDWIDTH

The necessary information is contained in the PerComm Report.

2.1033(c)(14)/2.1051 SPURIOUS EMISSIONS AT THE ANTENNA TERMINAL

The internal antenna does not allow this type of measurement.

2.1033(c)(14)/2.1053/24.133 FIELD STRENGTH OF SPURIOUS RADIATION

The necessary information is contained in the Protocol Labs Report.

2.1033(c)(14)/2.1055/24.135 FREQUENCY STABILITY

The necessary information is contained in the PerComm Report.

2.1093 RADIOFREQUENCY RADIATION EXPOSURE EVALUATION

The necessary information is contained in the document SAR Report.

The SAR measurements were performed with a duty cycle of 25%, higher than the maximum duty cycle allowed in the ReFLEX protocol. A calculation of the worst duty cycle is presented below.

The worst-case duty cycle for the e80 device transmitter occurs on a collapse rate of 1 when the device is sending messages to the infrastructure. For this calculation, we assume infinite messages are queued in the device; each message is the maximum length allowed (700 bytes) and the back channel is running at its slowest speed (800 bps).

The ReFLEX protocol is timed on frames, each being 1.875 seconds long. The sequence for transmitting a message from the device is shown in the following table. Also shown is transmitter on time and elapsed time in seconds.

Frame	Event	Transmitter on-time	Elapsed time
1	Device sends Request to Transmit to system	0.162	1.875
2	Request goes to system controller and is scheduled	0	1.875
3	Unusable Frame	0	1.875
4	Grant for data unit is sent to Device	0	1.875
5	Device sends first data unit (100 Bytes) to system	1.875	1.875
6	Data unit goes to system controller and next data	0	1.875

	unit is scheduled		
7	Unused frame	0	1.875
8	Grant for next data unit is sent to Device	0	1.875
9	Device sends data unit to system	1.875	1.875
10 – 29	Repeat steps 6-9 until entire message is transmitted (5 more data units for a total of 7)	5 x 1.875	20 x 1.875
30	Last data unit goes to system controller, and End of Transmission is scheduled	0	1.875
31	Unusable frame	0	1.875
32	End of Transmission is send to Device	0	1.875
33	Device sends ACK to End of Transmission to system	0.162	1.875
	Totals	13.449s	61.875s

Thus, the maximum duty cycle for the Location Tag device transmitter is:

$$D = \frac{13.449}{61.875} = 21.74\%$$

Note: This is the theoretical maximum based on the protocol, but is not achievable in a real system due to computing delays and traffic delays.

15.107 CONDUCTED LIMITS

e80 connected to the AC/DC adapter was tested for conducted limits. The necessary information is contained in the Protocol Labs Report.

15.109 RADIATED EMISSIONS

The necessary information is contained in the Protocol Labs Report.