PRODUCT RADIO FREQUENCY ENERGY EXPOSURE COMPLIANCE TEST PRFEECT CERTIFICATE

PRFEECT NO.: N/A DATE SUBMITTED: 11/17/98 REVISION DATE/NUMBER: N/A

PRODUCT MANUFACTURER: Motorola

SECTOR/GROUP/DIVISION: MIM/MSPG/APSP OTHER:

LOCATION (ADDRESS): 5401 N. Beach St., Ft. Worth, Texas 76137

PRODUCT DESCRIPTION: Boomerang Voice Pager

MODEL: A06GFS9850AA SERIAL NUMBER: 00000870BC

FREQUENCIES OF OPERATION: 896-902 Mhz TX

MAXIMUM POWER OUTPUT (WATTS): .965 (time averaged over 30 min)

TEST METHOD : SAR to general population/uncontrolled exposure units

TESTING LOCATION:

PRODUCT CUSTOMERS AND LOCATION (to confirm applicable standards, state whether the customers are consumers or other users and identify generally the geographic areas where product is intended to be sold):

Consumers; use in Continental United States

Based on the information provided and the testing results obtained for the above described product, the undersigned certifies that, when used as stated in the operating instructions supplied, said product is within the limits identified in Policy, Section III, for the region in which it is intended to be sold.

PRINT NAME: Q. Balzano

SIGNED : Quirino Balzano DATE APPROVED: 12/14/98

TITLE: Chief EME Scientist, Electromagnetic Research Lab

LOCATION : Motorola, 8000 W. Sunrise Blvd., Plantation, Florida, 33322

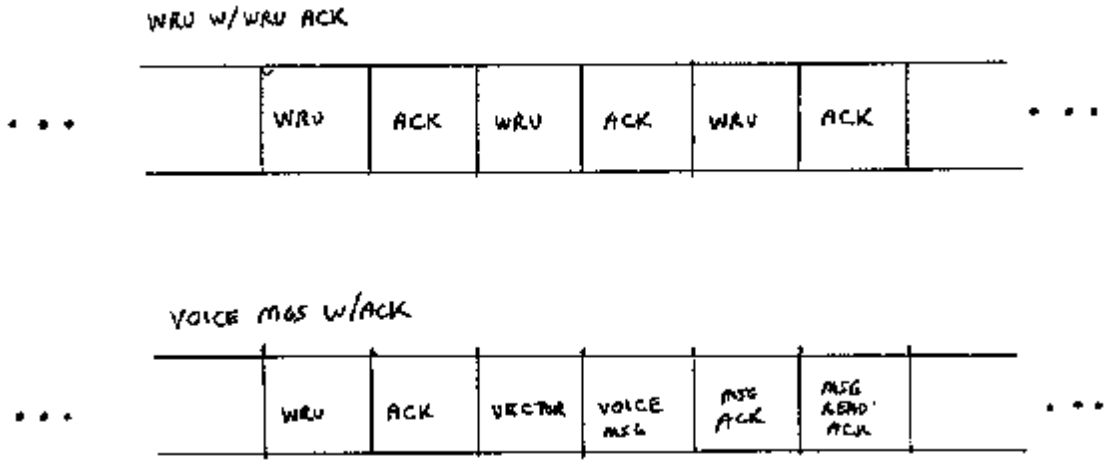
PHONE: (954) 723-6139 FAX: (954) 723-5611

Forward a signed copy of this form to: Motorola Chief EME Scientist, Motorola Inc., Florida Electromagnetic Research Laboratory, 8000 West Sunrise Boulevard, Plantation, Florida 33322, USA.

ALD 11/20/96

Here are the diagrams for typical InFlexion frames

1 frame = 1 division = 1.875 seconds



Summary of Protocol-compliant worst case scenarios for the Boomerang Pager

Pager Scenario	**#ACKs/#Frames**	**% of Frames with ACKS**
Registration attempt	15/34	44.12
WRU w/ WRU ACK	½	50.00
Voice msg w/ msg read ACK	3/6	**50.00**

This document describes the theoretical maximum inbound traffic that can be generated by a Boomerang pager. In most cases, this traffic will be less than the minimum traffic described in ReFLEX InFLEXion Protocol Specification Document Version 2.6 due to software limitations.

There are three scenarios described below:

1) Maximum Inbound Traffic Caused by Registration Failures
2) Continuous stream of WRU and WRU Responses
3) Voice Message Transmission

These scenarios do not reflect typical system/pager/user behavior although they are theoretically possible.

Boomerang has greater limits than the protocol specifies in Section 8.5.4 Minimum Personal Decoding Requirements. The maximum message activity in a Boomerang pager is:

1 address per frame
1 pending vector (vector to ACK)
1 pending message (vector to last fragment)
8 pending fragments

Boomerang is also restricted on the number of inbound responses that it can handle (see Section 8.6.6 Minimum Inbound Scheduling Requirements).

Boomerang can only support:

1 pending scheduled inbound response, and
1 pending inbound (ALOHA) command

Boomerang was designed to handle one transaction at a time pager, and is therefore only able to decode one vector per frame on its personal address. Any additional vectors sent in the same frame will be ignored by the pager (as described in Section 7.4.3 Error handling table).

Although the pager can be directed to ACK in the same frame as received address/vector, Boomerang does not have this ability. If the system specifies a rf (response frame) of 0 in a vector, Boomerang will process the vector, but will not generate a response. The ACK will be discarded.

Scenario 1: Maximum Inbound Traffic Caused by Registration Failures

---

The worst case inbound traffic scenario occurs when a pager is not registered on the system. If the system is configured so that the randomization interval is zero (ri = 0), the aloha timeout is zero (t = 0), and the number of retires is 14 (rt = 7), the pager will transmit fifteen registration requests in consecutive frames. After transmitting the 15 ACKs, the pager will move from WAIT to OUT and scan for a new channel. The time required to find the system is dependent on the pagers codeplug configuration. For a worst case scenario, the pager would be programmed with a Frame Scan Timeout of 0 (FST=0). The typical values are usually 4 or 5. A FSTO of 0 causes the pager to sleep for a minimum of 2 frames, channel activity detect for one frame, and SPID match for 1 frame. If the pager finds activity and a matching SPID on the first attempt, it will begin sending in another 15 zone registration requests. This configuration is particularly bad because the system will never be able stop the Registration Requests.

In this case, the pager will transmit in one slot in 15 out of 19 frames **(about 79% of frames will contain ACKs)**. If the FSTO of the pager is increased to a typical value, the percentage is greatly reduced.

While it is possible for the system to be configured with an aloha timeout of 0, it violates the protocol. The protocol specifies that the aloha timeout must be between 1 and 255 (Section 3.7.6.21 BIW for ALOHA Time-out Period and Randomization Interval).

If an aloha timeout of 1 is used, the pager will still ACK 15 times, but will wait one frame between each ACK. If the system doesn't respond after the 15th attempt, the pager will sleep for 2 frames, channel activity detect for 1 frame, and SPID match for one frame before restarting the registration requests. This results in ACKs in one slot in 15 out of 34 frames **(about 44.11% of frames contain inbound traffic).**

Scenario 2: Continuous Stream of WRU and WRU Responses

This case could occur if the system transmits a WRU Vector to a pager in every frame with a response scheduled for the next frame. The pager will receive the vector in the first frame, but miss the WRU vector in the second frame because it is transmitting a scheduled response. This will cause the pager to ACK in every other frame **(50% of frames contain inbound traffic).**

Boomerang is limited to one pending vector (vector to ACK), so multiple responses can not be queued up by the system.

Scenario 3: Voice Message Transmission

The third scenario is only possible if the system has zero turn around time for message scheduling. This means that the system needs to receive a response in one frame and act on it in time to transmit additional information in the very next frame. It is highly unlikely that any system will ever be this efficient. However, assuming an ideal system, the pager could generate the following traffic:

a) WRU vector from system
b) WRU response from pager (ACK)
c) WTL vector from system with 1 fragment scheduled and 1 response
d) Voice Fragment for WTL vector
e) WTL response from pager (ACK)
f) Message Read response from pager (ACK)

This results in 3 inbound responses for every 6 frames **(50% of frames contain inbound traffic).** It is also unlikely that the user would be able to generate a Message Read response that quickly, but these are all worst case assumptions.

For Reference purposes:

From ReFLEX InFLEXion Protocol Specification Document Version 2.6

Section 8.5.4 Minimum Personal Message Decoding Requirements

A subscriber unit must support a minimum amount of messaging activity on its personal address. At any time, a subscriber unit must simultaneously support on its personal address:

2 receptions of that address in the same frame,
2 pending vectors,
16 pending fragments, and
2 pending messages

A message is pending while its MSN is in the Incomplete state

A vector is pending from the moment it is decoded until the latest of:
the frame in which it appears has expired
all frames in which any fragments are scheduled by the vector have expired, and
the frame in which any response is scheduled by the vector has expired.

Section 8.6.6 Minimum Inbound Scheduling Requirements

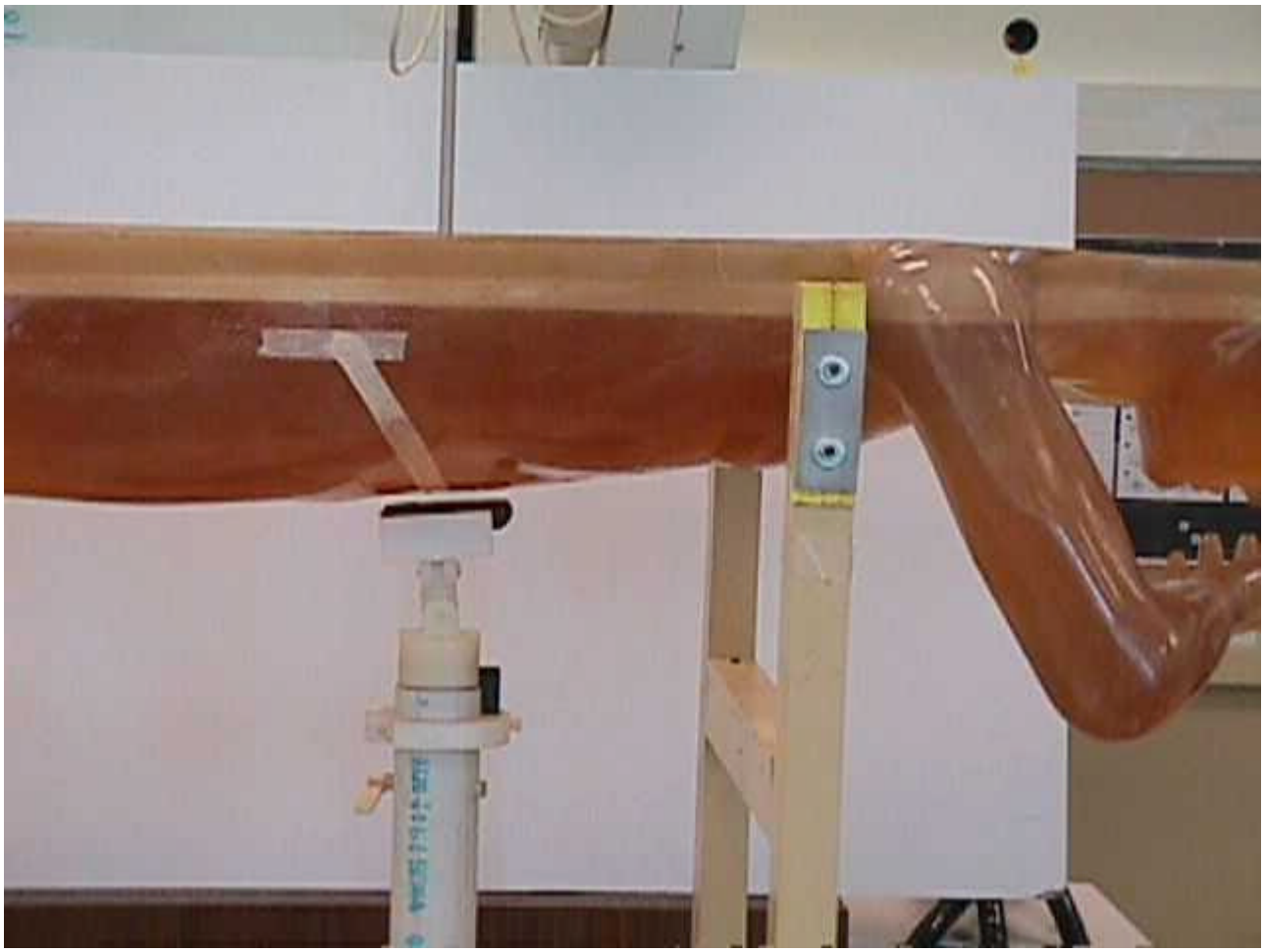
A subscriber unit must support a minimum number of scheduled inbound responses and inbound commands. At any time, a subscriber unit must simultaneously support:

2 pending scheduled inbound responses, and
8 pending inbound (ALOHA) commands

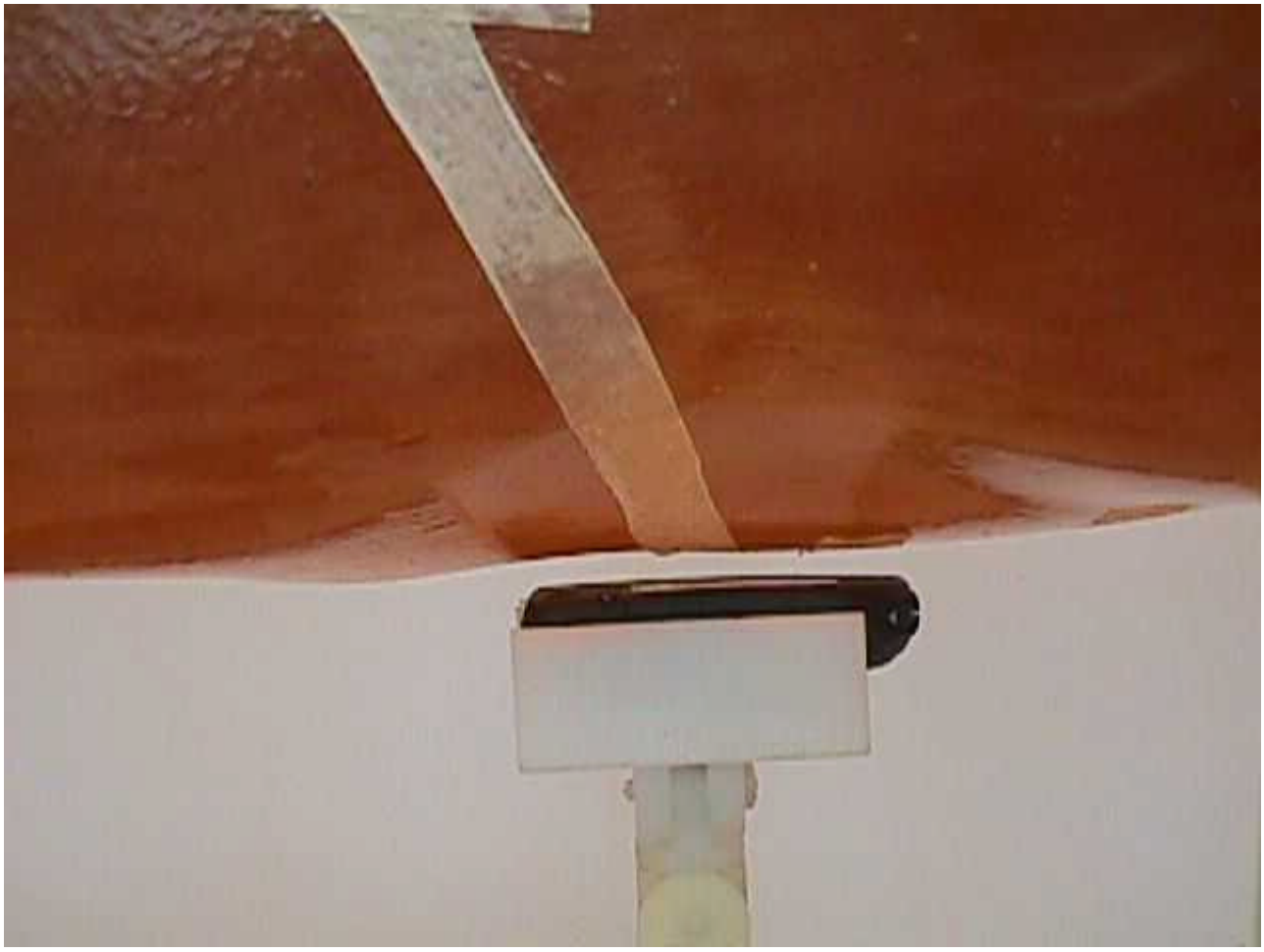
Section 7.4.3 Error handling table

7. More addresses than subscriber unit can handle - Ignore excess addresses

---

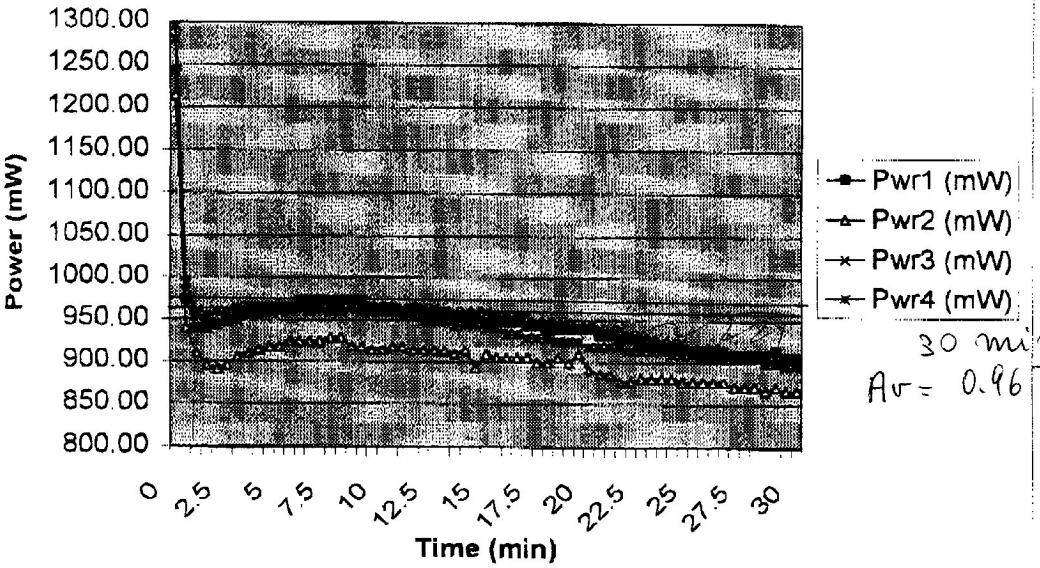


Picture 1 – Boomerang Flush with Phantom



Picture 2 – Closer View of Boomerang Tests

Boomerang conducted Tx pwr vs. time



30 minutes
Av = 0.967 mW

Boomerang Avg conducted TX power vs. time