Giga-tronics

Technical Publication Change Instructions

Updated replacement pages and/or drawings are attached to these Change Instructions. Please remove and discard the corresponding pages and/or drawings, and replace them with the attached pages and/or drawings. Failure to make these replacements may result in loss of product efficiency and possible failure.

Page numbers no longer have an alpha suffix, the revision level will now have a numerical suffix denoting its difference. Specific changes are identified by change bars in corresponding margins. A replacement page with no suffix has not been changed but is included only because it is part of the changed page.

Replacement pages will become standard pages without a suffix in the next printing of this manual and the Front Matter, Table of Contents, Preface and Index will be updated at that point. For record purposes, you are encouraged to retain these change instructions as a permanent part of the manual. Record new changes in your manual section entitled "Record of Changes".

Product:	8650A	**Manual:**	SERIES 8650A UNIVERSAL POWER METERS OPERATION MANUAL	
Errata Issued:	October 11, 2001	**Errata #:**	31470-E1	
Manual P/N:	**Manual Revision:**	**Print Date:**	**New Manual Revision:**	**Errata Print Date:**
31470	E	April 2001	E1	October 2001

Update your product technical manual. Replace the page(s) indicated below with their new revision level:

ECO(s):	**Replace/Add Page(s):**	**Remark(s):**
N/A	Replace 2-35 thru 2-38	Update to sections 2.3.15 and 2.3.16 because of changes that are related to section 3.19 through ECO 8014 (Requested under QIR 010705).
8014	Replace 3-101 thru 3-102	Update to section 3.19, specifically sections 3.19.1, 3.19.2 and 3.19.3 per QIR 010705. Changes officially implemented by ECO 8014.

2.3.14 Burst Signal Measurements

In a burst signal, the RF is pulsed on and off (i.e., pulse modulated). Often, the RF is modulated during the pulse on time. Typical examples are TDMA digital cellular telephone formats such as NADC, PDC, and GSM. These formats and many others produce amplitude modulation of the RF during bursts.

Two types of power measurement can be made on these types of signals. If the total average power is desired, MAP mode should be used. Total average power includes both the off and on time of the pulses in the averaging. Often it is desired to know the average power just during the bursts. BAP mode makes this type of measurement very easy. The procedure is as follows:

1. Calibrate the sensor according to the procedure outlined earlier in this section.

2. From the Main Menu press [*Sensor Setup*]. From the Sensor Setup menu, press [*Modulated Sensor*] and then select the BAP mode by pressing [*BAP*].

3. Press **[FREQ]** and enter the operating carrier frequency.

4. Connect the sensor to the burst signal source and record the power level.

The 8650A will automatically find the portions of the signal which are in the burst and include only those portions in the average.

Burst signals can have a high peak power-to-average power ratio depending on duty cycle. This ratio is proportional to the duty cycle and is given by:

$$10 \cdot \log\left(\frac{Duty\ Cycle\ [\%]}{100}\right)$$

This assumes no modulation during the burst. Modulation during the burst will increase this ratio by its own peak-to-average ratio. Due to this characteristic of burst signals, care must be taken to keep the peak power below the maximum rated input power of the sensor.

☛ ***NOTE:*** *If the burst average power is too low or if the bursts on time or off time between the bursts are too narrow, the 8650A may lose sync with the bursts and fail to display the burst average power. When this happens,* ***NoSync*** *will flash on the screen to the right of the sensor power units, and the meter will display total average power as in MAP mode. The conditions under which the 8650A may lose sync are listed in the following Sections 2.3.15 and 2.3.16 and also in the minimum pulse width specifications in Section B.2.2 for the modulated sensor used.*

2.3.15 Burst Start Exclude, Burst End Exclude

When measuring burst signals, it is sometimes desirable to mask the beginning or the end of a burst so that overshoot and other distortions do not affect the reading.

The Burst Start Exclude and Burst End Exclude features make it possible for BAP mode measurements to exclude the beginning or the end of a burst in this way. Both features can be used simultaneously, but this requires caution: if the excluded periods overlap, there is nothing left of the burst to be measured. If the entire burst is excluded, **NoSync** will flash on the screen to the right of the sensor power units, and the meter will revert to average measurement in the style of the MAP mode.

The start exclude time is selected from a series of discrete values from 0.000 ms to 45.548 ms in increments of 0.027 ms. The end exclude time has the same discrete values available except the maximum time value is limited to 31.960 ms when burst dropout time is 0.000 ms. For non-zero values of burst dropout time, the maximum value of end exclude time is limited to 3.423 ms minus the burst dropout time setting.

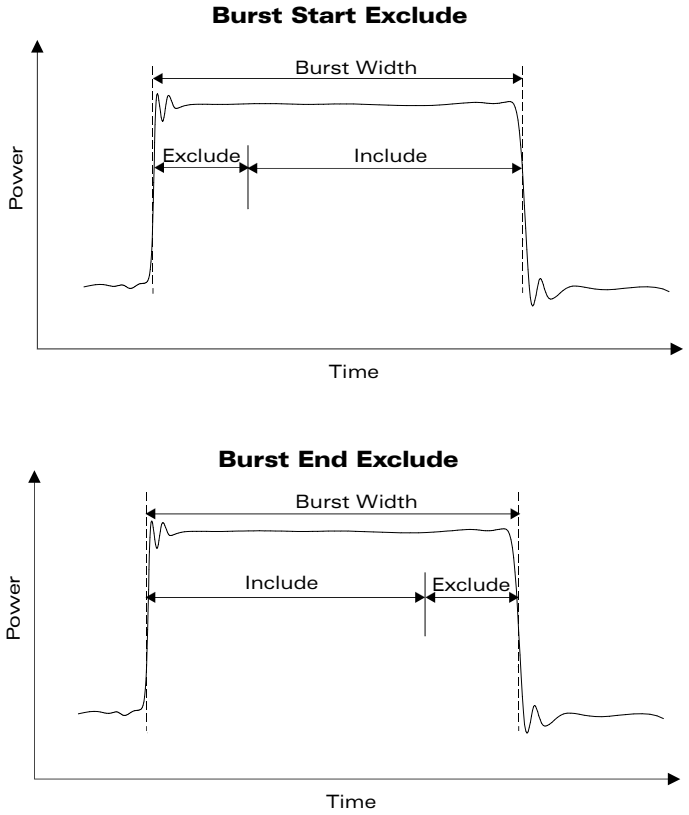

Figure 2-20: Burst Start Exclude & Burst End Exclude

2.3.16 Burst Dropout

In the BAP mode, average power is measured only during bursts. Because, in this mode, the bursts are automatically detected by the power meter, the user need not be aware of the burst repetition rate in order to make the measurement.

However, the BAP measurement algorithm defines bursts in a way which may be considered undesirable in some applications. In the example illustrated below, a 3.5 ms burst is followed by an OFF period of the same duration. During the burst, two brief dropouts occur. Normally, in BAP mode, each dropout would be interpreted as the end of a burst; the BAP algorithm would interpret the burst as three separate bursts, and the dropouts would be excluded from the average power measurement. As a result, the average power reading would be artificially raised.

When the Burst Dropout feature is enabled, the BAP algorithm is modified so that a dropout of sufficiently brief duration is not interpreted as the end of a burst. In the example below, dropout time is specified at 350 µs. The two dropouts, which occur during the burst have a duration of less than 350 µs; therefore the entire burst is interpreted as a single burst, and the dropouts are included in the average power measurement. The 3.5 ms OFF period following the burst is interpreted as the end of the burst, because it exceeds 350 µs in duration.

This feature must be configured and interpreted with care. The dropout time is selected from a series of discrete values from 0.000 ms to 3.746 ms in increments of 0.027 ms when end exclude time is 0.000 ms. For non-zero values of end exclude time, the maximum value of burst dropout time is limited to 3.423 ms minus the end exclude setting. These are only the guaranteed minimum values. In practice, the BAP algorithm may tolerate dropouts up to 2.15 times as long as the minimum value. Therefore, the time between bursts must be at least 2.2 times as long as the selected dropout time (because, if the time between bursts is less than the tolerated dropout time, the BAP algorithm never recognizes the end of a burst, and the signal is simply averaged, as if the MAP mode had been selected). Also, dropouts occurring at the end of a burst are a problem, because the BAP algorithm cannot distinguish them from the end of the burst itself; there should be at least 250 µs of burst remaining after the last dropout within that burst.

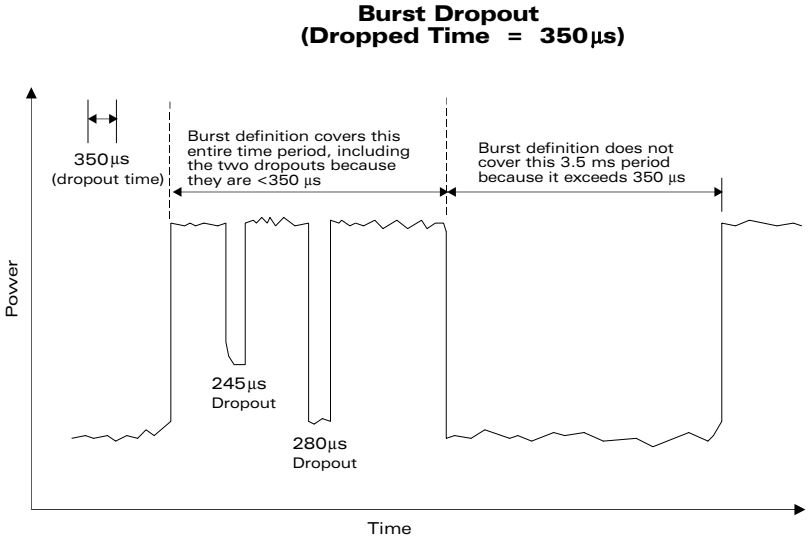

Figure 2-21: Burst Dropout

2.3.17 Optimizing Measurement Speed

In many power measurement situations, measurement speed is defined in terms of settling time following a step change in average power. In other words, it is desired to know the average power level within some specified tolerance as quickly as possible following a power level change. This is often accomplished by setting up the power meter in free-run mode over the GPIB and monitoring the collected measurement data with the host computer until it falls within the predetermined tolerance window.

The Auto average feature of the 8650A eliminates the need for the host computer to do any data monitoring and can be set up to automatically output measurement data when it has settled to within the specified tolerance. This is done by triggering each measurement with a TR2 command and waiting for the meter to signal the host with an SRQ. The SRQ is asserted and the data is put on the bus as soon as the power measurement has averaged long enough to be within the specified tolerance.

The tolerance is specified by including the measurement settling tolerance parameter with an FA command (Auto average on). This parameter is specified in terms of percentage. For example, if a measurement settling tolerance of 1% is specified, the 8650A Auto average algorithm will specify an averaging time just long enough so that the result put on the bus is within ±0.5% (that is, ±0.02 dB) of the average power. Thus, the settled measurement data is available on the bus in the minimum time necessary to be within the specified tolerance.

The tolerance specified in the FA command is a *target* tolerance. For example, it is possible that the peak-to-peak power variation of the signal being measured is so great that the maximum averaging time of 20 seconds is not long enough to reduce the variation to within the specified tolerance. It is also possible that the rate of power variation is so slow that more than 20 seconds of averaging is required. In these cases, further averaging would have to be done by the host computer.

The following example program shows how to set up a triggered measurement, optimized for speed using the auto averaging feature:

```
Tr2:                                ! Read using TR2 command
ON INTR 7 GOSUB Srq_interrupt       ! Set up SRQ interrupt
ENABLE INTR 7                       ! Enable SRQ interrupt
OUTPUT 713;*SRE41                   ! Set service request mask
OUTPUT 713;CS                       ! Clear status byte
OUTPUT 713;TR2                      ! Trigger measurement
Data_ready=0                        ! Clear flag
WHILE Data_ready=0                  ! Wait for data ready
END WHILE
RETURN
Srq_interrupt:                      ! SRQ jumps here
State=SPOLL(713)                    ! Get status byte
IF BIT(State,0) THEN                ! If the Data Ready bit is set...
        Data_ready=1                ! Set the flag
        ENTER 713;Tr2_reading       ! Read the measurement
        OUTPUT 713;CS               ! Clear the status byte
        OUTPUT 713;*SRE0            ! Clear the service request mask
        END IF
RETURN
```

3.19 Advanced Features

3.19.1 Burst Start Exclude

Commands which cause the beginning of a burst to be excluded from measurement are based on the BSTE function code (this feature is available only in the BAP mode):

Syntax: [AE or BE] BSTE [a] EN

[AE or BE] prefix specifies Sensor A or Sensor B.
[a] specifies the number of 0.027 ms samples to be excluded; it has an integer value in the range of 0 to 1686 with 1686 samples corresponding to 45.519 ms. The command is ignored for [a] values that are out of acceptable range.

Examples: OUTPUT 713;AE BSTE 1 EN

! exclude one sample = 0.027 ms from start of burst, for BAP
! measurements on sensor A

OUTPUT 713;BE BSTE 3 EN

! exclude three samples = 0.081 ms from start of burst, for BAP
! measurements on sensor B

3.19.2 Burst End Exclude

Commands which cause the end of a burst to be excluded from measurement are based on the BSPE function code (this feature is available only in BAP mode):

Syntax: [AE or BE] BSPE [a] EN

[AE or BE] prefix specifies Sensor A or Sensor B.
[a] specifies the number of 0.027 ms samples to be excluded; it has an integer value in the range of 0 to 1183 (1183 samples correspond to 31.936 ms) when burst dropout time is 0.000 ms. For non-zero values of burst dropout time, the maximum value of end exclude time is limited to 3.396 ms minus the burst dropout time setting. The command is ignored for [a] values that are out of acceptable range.

Examples: OUTPUT 713;AE BSPE 1 EN

! exclude one sample = 0.027 ms from end of burst, for BAP
! measurements on sensor A

OUTPUT 713;BE BSPE 3 EN

! exclude three samples = 0.081 ms from end of burst, for BAP
! measurements on sensor B

3.19.3 Burst Dropout Tolerance

Commands which define a tolerated burst dropout time are based on the BTDP function code (this feature is available only in BAP mode):

Syntax: [AE or BE] BTDP [a] EN

[AE or BE] prefix specifies Sensor A or Sensor B.
[a] specifies the dropout time in milliseconds with a range of 0 to 3.346 when the burst end exclude time is 0.000 ms. The value entered will be rounded to the nearest multiple of 0.027 ms. For non-zero values of end exclude time, the maximum value of burst dropout time is limited to 3.396 ms minus the end exclude time. The command is ignored for [a] values that are ouf acceptable range. The actual value can be checked by means of a MEAS query. The dropout time represents a guaranteed minimum time; the time actually tolerated will usually be greater, and can be up to 2.125 times greater. (Note: selecting a value of zero effectively disables this function).

Examples: OUTPUT 713;AE BTDP .02 EN

```
! set dropout  time to 0.02 ms or nearest (=0.027 ms) discrete
! value, for BAP measurements on sensor A
```

```
OUTPUT 713;BE BTDP .06 EN

! set dropout  time to 0.06 ms or nearest (=0.054 ms) discrete
! discrete value, for BAP measurements on sensor B
```

3.19.4 Min/Max Power Value

The Min/Max feature monitors the measurements being taken, and maintains a continuously updated record of the highest and lowest values measured so far.

☛ ***NOTE:*** *The Min/Max feature can only be used in the standard measurement collections modes (not in the fast modes).*

Enabling the Min/Max Feature

☛ ***NOTE:*** *These commands must be preceded by CH [n] EN command.*

The Min/Max feature is enabled or disabled by simple commands consisting of one of two function codes:

Syntax: [MN0 or MN1]

Examples:

```
OUTPUT 713;MN          ! Enable the Min/Max feature
OUTPUT 713;MN0         ! Disable the Min/Max feature
```

The MN1 command, like the LG command, has the effect of specifying logarithmic measurement units (dB or dBm). Like the PH0 and CR0 commands, this command will disable crest factor and peak hold measurements.