

# Testing FLO Transmitters

## Using FLO Test tools and a Signal Analyzer/Digitizer for Signal Quality Testing.

### Introduction

This paper introduces tools for testing Forward Link Only (FLO) transmitter signals by measuring the quality metrics of Modulation Error Ratio (MER) and Group Delay. Engineers who test the RF section of FLO transmitters will be particularly interested in the process and procedures described. Table 1 lists Reference documents.



Figure 1 MS269xA

A test suite called FLO Test Tools is available from the FLO Forum ([www.floforum.org](http://www.floforum.org)). FLO Test Tools contains a Test Receiver software component that runs on a Windows PC and interfaces with commercial off-the-shelf hardware that receives the RF FLO signal and digitizes it into I/Q time domain samples.

Anritsu offers a Vector Signal Analyzer, the MS269xA, with digitizing capability that works seamlessly with the Test Receiver software. The MS269xA is a one-box tester that includes, as standard, a swept mode Spectrum Analyzer, a FFT mode Vector Signal Analyzer, and a high-performance Digitizer. With the addition of the optional Vector Signal Generator a one-box tester is created that can be used a general-purpose RF measurement instrument or, when equipped with analysis software, for modulation analysis of all 3GPP standards including LTE.

Reference Document	Title
floforum2008.095.00	FLO Air Interface Specification Revision 2.0
floforum2008.040.03	FLO Transmitter Minimum Performance Specification
floforum2008.128.00	MediaFLO Test Tools Set
---	FLO MER GUI System Integration and User's Guide (80-T2506-1)

Table 1 Reference Documents

## MER and Group Delay Measurements

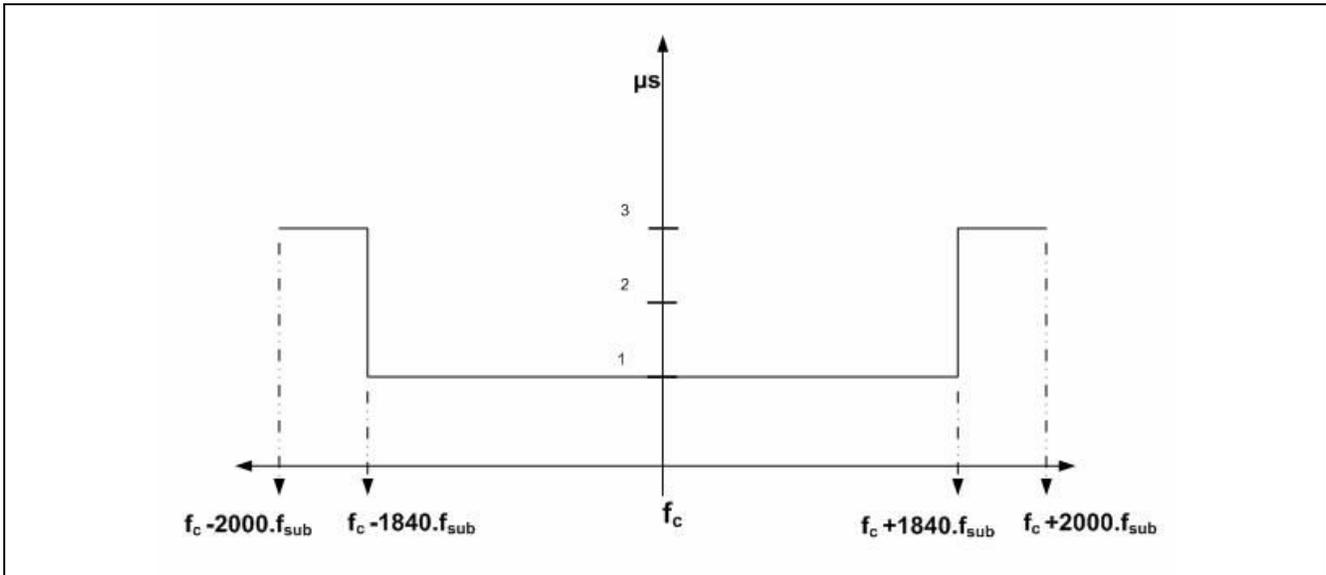
Table 2 shows the Minimum Performance Specification (MPS) for both MER and Group Delay.

MPS Test Item	Requirement
Modulation Error Ratio	Average MER < 33dB
Group Delay	Maximum 1 $\mu$ s for $ f-f_c  < 1840f_{sub}$ Maximum 3 $\mu$ s for $1840f_{sub} <  f-f_c  < 2000f_{sub}$

*Table 2 MPS Tests*

MER measures the signal-to-noise ratio of each subcarrier at the transmitter output. It is expressed as a single, composite figure of merit that indicates the quality of the transmit waveform. The MPS places an upper bound of 33 dB on the average measured MER.

Group Delay measures degradation of the FLO signal by transmitter filtering. The MPS dictates that group delay variation of up to 1 microsecond across the center 3680 subcarriers, and up to 3 microseconds across the band edges (first and last 160 subcarriers) is acceptable for the transmit filter.



*Figure 2 Group Delay Specification*

Figure 3 illustrates the interconnections used when testing a FLO transmitter using the MS269xA and the Test Receiver Software. The FLO Transmitter output connects to the Signal Analyzer input using an RF cable. A common 10 MHz frequency reference signal and 1 PPS GPS reference for Superframe timing is distributed to the FLO Transmitter and the Signal Analyzer.

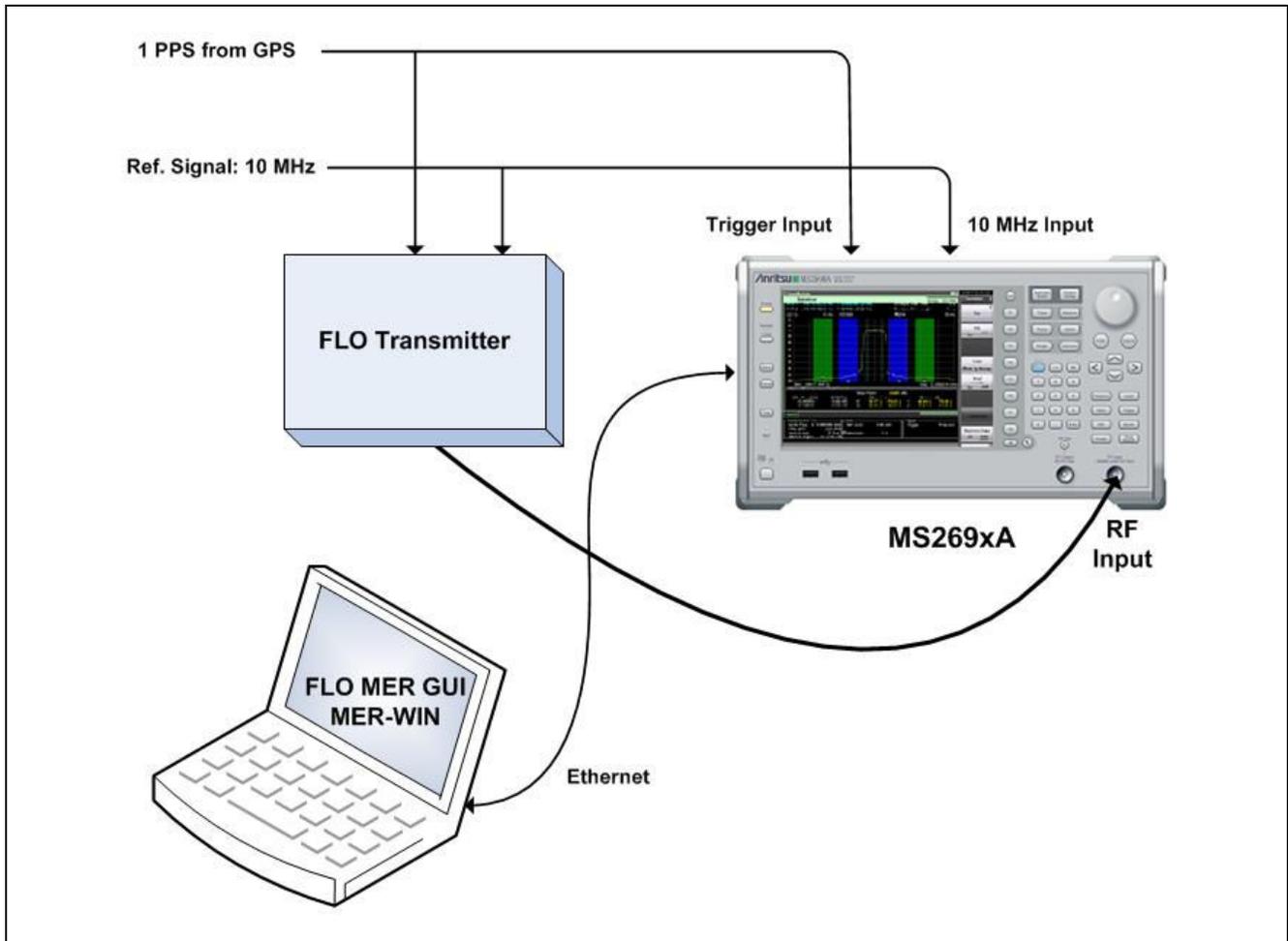


Figure 3 Test Setup

The FLO MER GUI commands the MS269xA to capture a one-second Superframe. The FLO waveform is digitized into IQ samples at the appropriate sample rate according to the bandwidth, shown in Table 3. After saving the IQ samples to a file and moving them to the PC running the FLO MER GUI, the FLO MER GUI processes the digitized file and reports the MER. Statistical analysis is included if multiple measurements and processing iterations are performed. Figure 4 and Figure 5 show screen shots of the digitizing process and the MER analysis window.

FLO Signal Bandwidth	Sampling Rate
5 MHz	9.25 MHz
6 MHz	11.1 MHz
7 MHz	12.95 MHz
8 MHz	14.8 MHz

Table 3 Sampling rate for FLO Bandwidths



## **Transmitter Measurements using the MS269xA Signal Analyzer**

In addition to acting as the digitizer for MER and Group Delay measurements, the MS269xA performs all traditional RF transmitter measurements, most with the press of a single button.

- Spectrum Analysis
- Channel Power
- Occupied Bandwidth
- Adjacent Channel Leakage Ratio (ACLR)
- Spurious Emissions
- Spectrogram
- Power vs. Time
- CCDF
- Phase Noise

### **Conclusion**

The MS269xA is a versatile one-box tester that includes Spectrum Analyzer and Signal Analyzer functions useful for RF transmitter characterization. The standard digitizer capability functions seamlessly with the FLO Test Tools to perform measurements of MER and group delay making it an ideal choice for measuring the quality metrics for FLO transmitter signals.

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