



OML Model # 40200WGS Harmonic Generator

OML recently introduced a radiated harmonic and spurious emissions testing kit designed to **fulfill the spirit of the FCC required testing** for radiating devices (transmitters) operating between 20 and 78 GHz. The kit consists of the appropriate waveguide mixers and horn antennas for frequency coverage from 40 GHz to 220+ GHz.

In 1998 the FCC adopted the terminology of “certification” in its Part 15 rules with regard to “licensed” and “unlicensed” transmitters. As part of that action and with subsequent actions the FCC has redefined the spurious emissions suppression requirements for certification (type acceptance). Currently, the manufacturer must test for and certify that the output spectrum of his transmitter product meets the relevant FCC criteria as to radiated levels for all spurious emissions, including harmonics. It appears that it is concern over the potential interference that could be caused by these harmonic emissions that is the root cause for these requirements. In general, these are the current spurious emissions testing requirements:

Operating frequency, equipment under test	Frequency range to be investigated
below 10 GHz	to the lower of the 10th harmonic or 40 GHz
10 to 30 GHz	to the lower of the 5th harmonic or 100 GHz
above 30 GHz	to the lower of the 5th harmonic or 200 GHz
76 to 77 GHz	to 231 GHz

In addition to the FCC requirements, the ISO certification of calibration and certification laboratories contains a requirement that the proper operation of any test equipment to be used in the certification/calibration process must be established prior to any certification/calibration testing. Both of the above are great rules, however several problems face the engineer who needs to qualify his test setup. First, above 110 GHz the entire process is impacted by the fact that no recognized standards are available (in the world) for the measurement of power above 95 GHz. Accurate measurement of an emitter's harmonic and spurious output levels is not possible without a reference on which to base the measurement. Second, reliable and affordable signal sources, capable of generating useful signals above 110 GHz, are very scarce. The engineer does not have at his disposal a reliable signal source with which he can confirm that his spectrum analyzer/harmonic mixer is even functioning. In all likelihood, the transmitter he needs to test does not emit spurious signals above 110 GHz strong enough to be easily measured with even the best test equipment available today.

In response to the many customer questions and requests regarding how to confirm the validity of their test programs, OML has developed a "Harmonic Generator" signal source. The OML # 40200WGS Harmonic Generator utilizes an even harmonic multiplier to produce usable signals from 40 to 200+ GHz which vary in amplitude from typically 10 dB above the spectrum noise floor to greater than 60 dB above noise. The Harmonic Generator does not require any adjustment and can be driven by any signal generator (synthesizer recommended) covering 8.2 to 16.6 GHz capable of producing an output level of +7 to +11 dBm. The Harmonic Generator is equipped with a 40 GHz high pass filter to suppress strong lower frequency feedthrough. This filtering is necessary to avoid the generation of RF harmonics in the harmonic mixers used for testing for harmonics. The design of the Harmonic Generator also takes advantage of the high pass filter characteristic of the harmonic mixers input waveguide. The cutoff frequency of the mixer's input waveguide rejects all lower frequency harmonics. For example, the second harmonic of a 38 GHz transmitter is to be measured. The frequency of the synthesizer used for driving the Harmonic Generator is set 9.5 GHz to produce a 76 GHz signal. The horn antenna is removed from the M12HWA mixer and its waveguide is connected to the output waveguide of the Harmonic Generator. The output signal will be precise in frequency. The waveguide input of mixer will reject all signals below 48.3 GHz allowing the user to easily find the desired signal and confirm proper operation. The horn antenna is then replaced onto the mixer and testing of the subject transmitter can proceed.

The Harmonic Generator has been designed to provide a stable and repeatable output level. The Harmonic Generator is not an absolute calibration source and its output level will vary with frequency. OML suggests that when the Harmonic Generator is received, the user perform a set of verification tests with the mixers to be used, at frequencies of expected interest, and that the spectrum analyzer response be plotted and held for future reference. The data will be especially helpful when setting up future tests above 110 GHz where no conversion loss data for harmonic mixers are available.