Universal Interference Emulator
TAS5600

Dramatically simplifies the test setup required for comprehensive receiver performance analysis.

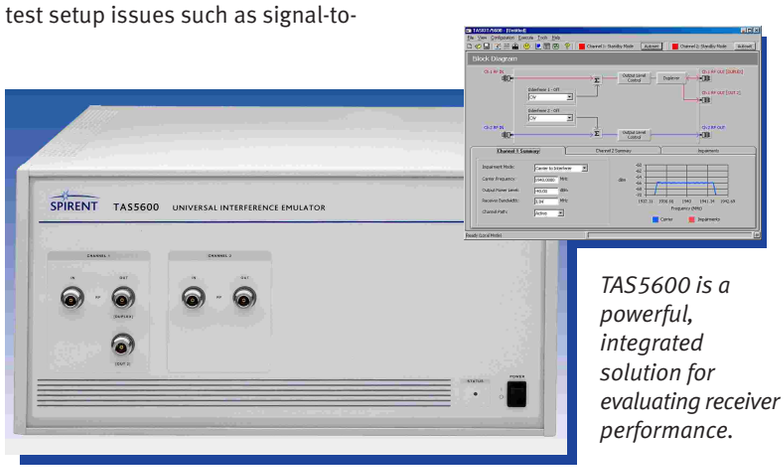
Wireless equipment's mitigation of the effects of co-channel and adjacent channel interference directly affects key performance metrics such as capacity, quality, and coverage. A receiver's performance must be characterized over a variety of channel conditions that reflect real world operating conditions. This characterization must be done precisely, as small differences in receiver performance can have a dramatic impact on performance metrics. Uncertainty in test conditions leads to an even greater uncertainty in test results.

Creating a test setup for today's wireless receivers can be a challenging task given all of the elements required. Covering all types of real-world interference requires combining signal generators, noise generators, cables, and RF combiners. The challenges inherent in constructing a test rack for receiver characterization include:

- Interferer Phase Noise
- Modulated Interferer ACLR
- Test set VSWR interactions contributing to amplitude uncertainty
- Signal-to-noise ratio accuracy
- Receiver sensitivity testing accuracy
- Test set self-intermodulation
- Test set repeatability and reproducibility
- Minimization of technical resource involvement necessary to perform the test

Spirent's TAS5600 Universal Interference Emulator addresses these issues by combining all of the necessary hardware to facilitate receiver testing. The TAS5600 addresses critical receiver test setup issues such as signal-to-noise ratio accuracy, output power accuracy, phase noise, ACLR, test set VSWR interaction, and repeatability over time and across multiple test setups.

Specifically, the TAS5600 combines the functionality of two high-performance, low phase noise signal generators, two arbitrary waveform generators, two real-time signal generators, a precision instrument grade power meter, and high accuracy RF attenuators, across multiple RF channels to support diversity testing. This powerful combination of hardware is housed within a single rack-mountable chassis.



TAS5600 is a powerful, integrated solution for evaluating receiver performance.

Major Features:

- Precise, repeatable C/N and C/I emulation in one integrated instrument
- Application-specific UMTS and CDMA2000 interferers
- Integrates functionality of multiple signal generators, attenuators and measurement devices
- Signal generation engine with long data sequences for maximum confidence in test results
- GSM modulated inteferer, with optional fading, is ideal for dual mode test applications
- Combines with Spirent's SR5500 to provide fading conditions necessary for complete receiver testing
- Two independent RF channels for receiver diversity testing
- Maintains signal path during calibration cycle to speed up test execution
- TASKIT® software provides easy setup and control

Benefits:

- Increases confidence in test results
- Reduces test time
- Assures repeatable results over time and across multiple test setups
- Integrates of all receiver testing components eliminating unweildy test setups

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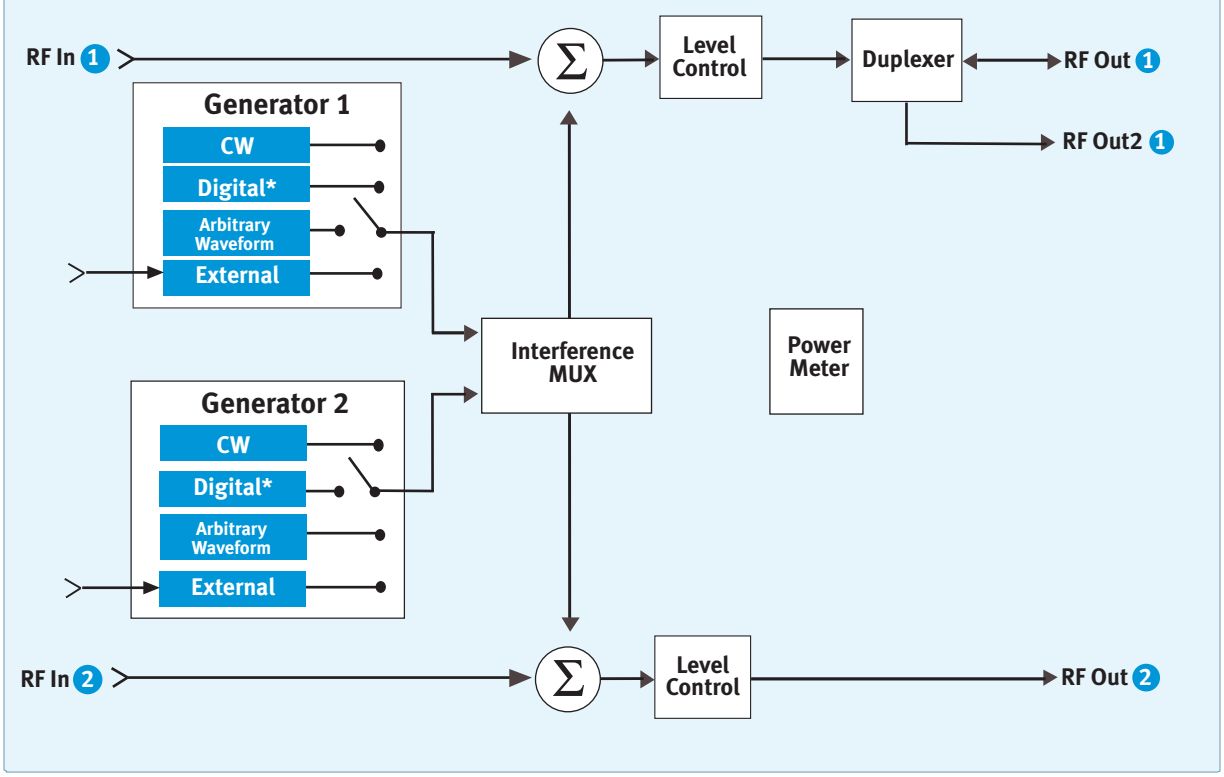
TAS5600 Architecture



TAS5600 combines precision interference generators, a power meter, attenuators, signal combiners and a duplexer in one compact, easy-to-control instrument.

** The TAS5600's digitally-modulated interferers include AWGN, WCDMA, GSM and CDMA2000.*

Receiver performance test setups require multiple signal generators, RF attenuators and signal combiners. To increase level accuracies a measurement device is typically included into the test setup. A calibration methodology, control software, and maintenance are required.

The TAS5600 addresses these complex requirements inherent to receiver testing. The TAS5600 is a two channel instrument that combines multiple signal generators with the required RF components and an instrument grade power meter to satisfy receiver testing requirements. The internal signal generators can be configured to provide low phase noise CW, popular modulated interferer types, or AWGN. The two signal generators can be combined and sent to one or both channels, or used individually on a per channel basis. The instrument grade power meter within the TAS5600 automatically samples RF power levels at multiple locations within the instrument to assure accurate level settings.

The TAS5600 has been optimized to be repeatable over time to give consistent results across multiple test setups.

Operation of the TAS5600 is via TASKIT/5600 control software. Alternately, user-generated control code can be employed via the TAS5600's comprehensive remote command set over GPIB, Ethernet, or RS 232.

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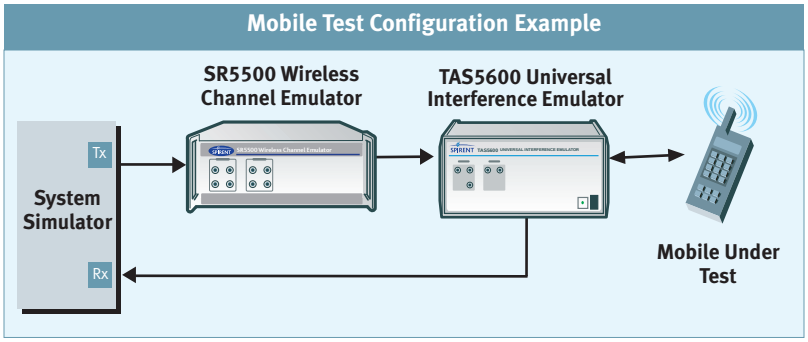
TAS5600 Application Examples

C2K-LAB and UMTS-LAB Test Systems

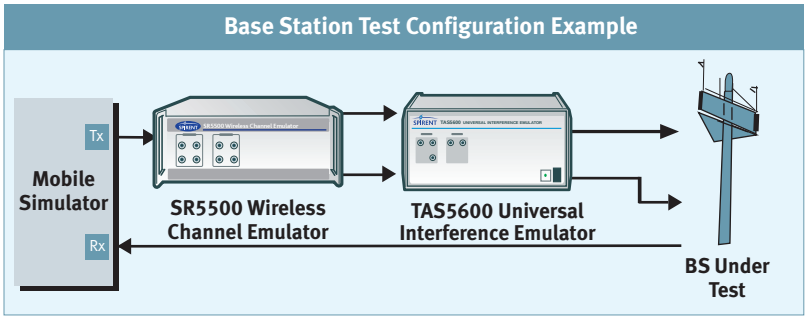
The TAS5600 combines with Spirent's SR5500 RF Channel Emulator to provide complete transmission media emulation for testing handset and base station receiver performance. The combination of the TAS5600 and SR5500 meets or exceeds all the critical additive interference and multipath fading requirements in both the UMTS and CDMA2000 specifications.

The SR5500 channel simulator provides all of the channel propagation models required to test modern receivers. Channel propagation models such as Rayleigh and Rician multipath fading, multipath delay spread, moving propagation, and birth-death propagation conditions are all simulated in the SR5500. Combining the SR5500 with the TAS5600 creates a compact test setup for complete physical layer receiver testing. With the TAS5600 internal duplexer, external hardware, such as combiners, splitters, and circulators, is eliminated.

The TAS5600 combines with the SR5500 to reduce test deployment and execution time. It is no longer necessary to interpret cryptic test specifications and then calibrate an unwieldy test setup. For UMTS testing, Spirent offers UMTS-LAB – a combination of the SR5500 along with the TAS5600, including interferers specific to testing UMTS UEs and Node Bs. Spirent offers C2K-LAB for testing to CDMA2000 standards. This combination includes an SR5500 and a TAS5600 including interferers specific to CDMA2000 testing. For these systems, Spirent provides UMTS and CDMA2000 test configuration files with our instruments and on our website for use with the TAS5600 and SR5500.



TAS5600 and SR5500 combine to form a physical layer test system for handsets.



TAS5600 and SR5500 combine to form a physical layer test system for base stations.

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Unprecendented Performance

Measurement Performance Challenge

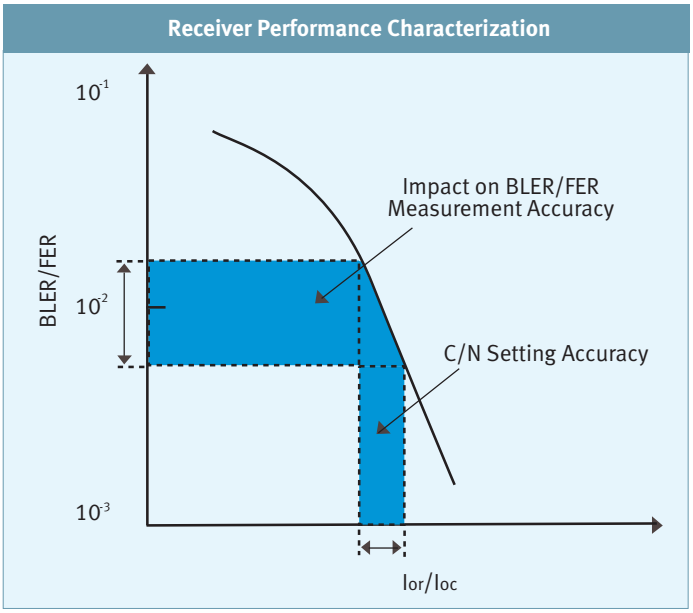
In order to have confidence in receiver performance test results, the level of uncertainty of the test system must be minimized. Further, parasitic signals not associated with the test should not be present.

Accuracy

When constructing a test setup for receiver testing one of the most important performance criteria is the accuracy of signal-to-noise (SNR) ratios. Unlike analog modulation schemes, modern receivers use spread spectrum in conjunction with convolutional or turbo coding and have error rate performance that degrades rapidly as certain breakpoints are crossed. For this reason, signal-to-noise ratio accuracy is extremely important. Small errors in SNR will show up as large differences in error rate. In order to have confidence in the error rate results, there must be a high degree of confidence in the SNR setting.

By combining an instrument grade power meter along with factory calibrated signal paths, the 5600 provides:

- Accurate ratio generation and level setting
- Excellent repeatability
- Increased confidence in test results



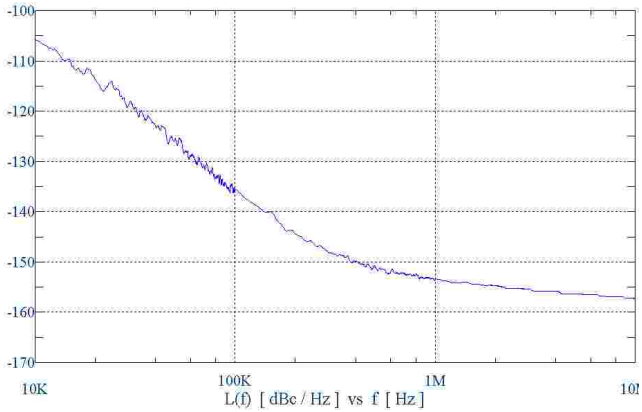
TAS5600's high C/N (and C/I) ratio setting accuracy make it ideal for receiver performance breakpoint characterization.

Purity

When testing the interference performance of a receiver, undesired spurious signals can reduce the confidence in test results. In interference tests, a signal with an amplitude much higher than the desired signal is placed adjacent to the receiver's channel. The purpose of the test is to determine whether the receiver's adjacent channel selectivity is sufficient. The value of this test can be degraded if the phase noise of the CW signal or the ACLR of the modulated signal is too high. The TAS5600 has been specifically designed to offer:

- Ultra-Low Phase Noise
- Excellent ACLR Performance

The TAS5600 exceeds the phase noise and ACLR requirements of popular receiver test standards. Using the TAS5600 for receiver testing assures that the adjacent channel performance of the receiver is being tested with equipment that will deliver ultra clean, accurate channel conditions thus giving confidence in the test results.

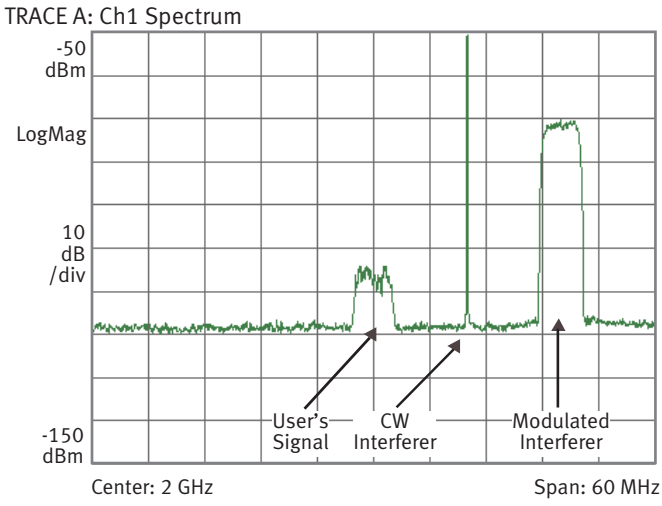


TAS5600 with the Low Phase Noise Option demonstrates extremely low phase noise, eliminating co-channel noise during adjacent channel testing scenarios.

Realism

Both narrow and wideband interference are present in the radio environment and must be simulated as interference during receiver testing.

The TAS5600 delivers signals for co-channel and adjacent channel testing that are realistic. Simultaneous generation of different interferer types reflects real-world scenarios. Further, the data that is used to generate the user channels that are modulated onto the interfering carrier has a long repetition interval. This combination of long data repetition interval along with ultra-low phase noise and low ACLR combine to make the TAS5600 the highest performing, most realistic test set for receiver co-channel and adjacent channel testing.



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UMTS Receiver Testing

The Answer to 3GPP Testing

In order to verify that UMTS User Equipment and Node-Bs conform to 3GPP standards, various co-channel and adjacent channel interference tests are required. These conformance tests verify a minimum level of receiver or transmitter performance in the presence of co-channel and adjacent channel interfering signals. The types of signals required can include uplink and downlink WCDMA signals, GSM signals with propagation effects, single and dual tones, or AWGN. The level accuracy required for these interfering signals is demanding.

Accurate Interferer Generation

The TAS5600 exceeds the 3GPP accuracy requirements by combining precision signal generation techniques with extremely accurate hardware calibration to provide unprecedented interference performance. The low phase noise CW generators combined with the precision baseband signal generators within the instrument create modulated RF signals with extremely low Adjacent Channel Leakage Ratio (ACLR). These low phase noise CW and low ACLR modulated interferers assure that during adjacent channel selectivity, blocking, or spurious response tests, the receiver under test will not have its receive channel falsely polluted with phase noise, spectral re-growth, or spectrum "spill-over" which would greatly devalue the test results.

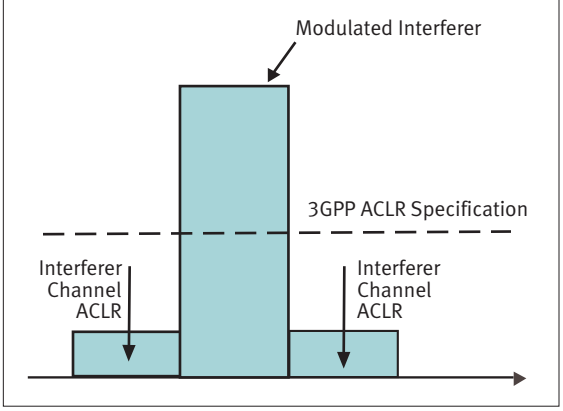
An important characteristic of the WCDMA or GSM modulated interferers is their data sequence repetition rate. To produce accurate BLER/BER test case results, the data contained in the Dedicated Physical Channels should not repeat for the duration of the test. However, sequences from digital signal generation engines in signal generators used for WCDMA and GSM performance testing can repeat as frequently as every frame. Uniquely, the TAS5600 uses a real-time approach to achieve a data sequence length of greater than one hour, while generating a 3GPP-specified Downlink Modulated Interferers that contains common channels and 16 Dedicated Physical Channels. Similarly, the TAS5600 generates Uplink Modulated Interferers that contain one control channel and one data channel with a data sequence length of over one hour.

The TAS5600 includes the following UMTS interferer types:

- WCDMA Uplink
- WCDMA Downlink
- Faded GSM
- Single and Dual CW
- AWGN

The interferers in the TAS5600 are designed to exceed the ACLR requirements of all adjacent interference tests currently specified by 3GPP for WCDMA receiver performance.

Low Adjacent Channel Leakage Ratio (ACLR)



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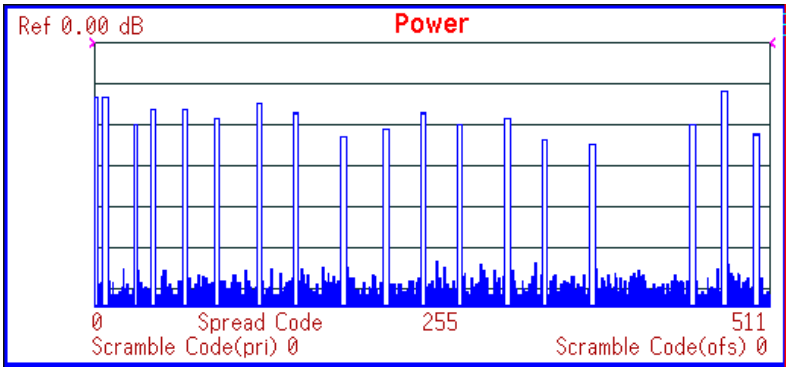
Wide Range of UMTS Interferers

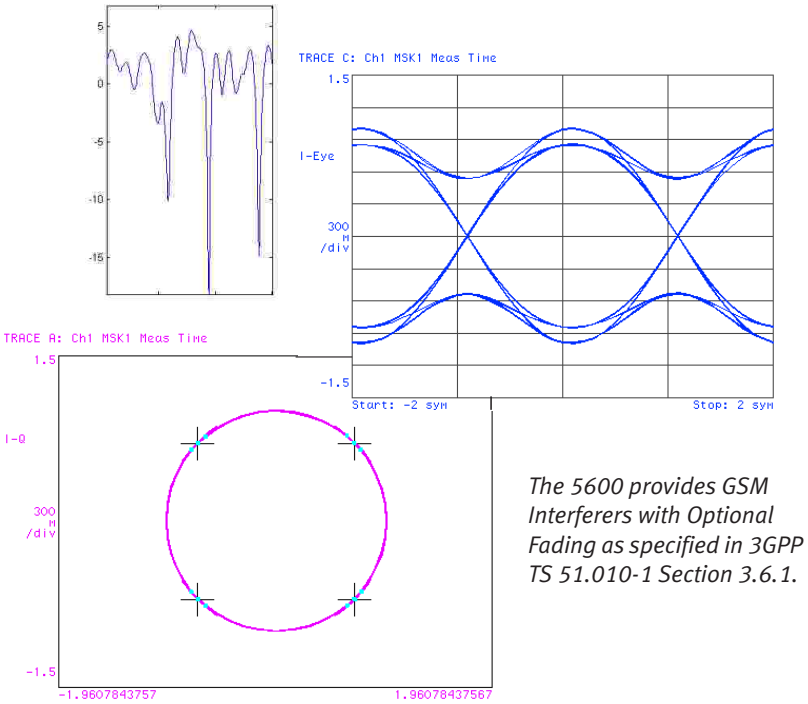
To effectively address the testing requirement of UMTS UEs and Node-Bs, the TAS5600 provides extremely accurate and realistic interference generation. All required interferer types, such as uplink and downlink WCDMA, GSM, AWGN, and CW are included. The format of the WCDMA modulated interferer is defined in the appropriate 3GPP downlink (TS 34.121 and TS 34.122) and uplink (TS 25.141 and TS 25.142) specifications. Each WCDMA interference signal within the TAS5600 is comprised of multiple downlink or uplink channels. These channels are then modulated on to an RF carrier at the desired interference frequency using a scrambling code provided by the user.

TAS5600 provides all the applicable WCDMA Uplink and Downlink channels. This is a Code Domain plot for a WCDMA Downlink Channel.



GSM Modulated Interferers

The GSM modulated interferer allows verification of adjacent channel receiver performance in the presence of a second GSM channel. This is an ideal tool for manufacturers who want to test dual-mode UMTS UEs. The GSM modulated interferer provides a GMSK modulated carrier with optional fading. The interferer meets UMTS testing standards as defined in 3GPP TS 51.010-1 Section 3.6.1 and Annex A5.2 for uplink and downlink testing.



The 5600 provides GSM Interferers with Optional Fading as specified in 3GPP TS 51.010-1 Section 3.6.1.

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CDMA2000 Receiver Testing

Addressing IS-97 and IS-98 Test Requirements

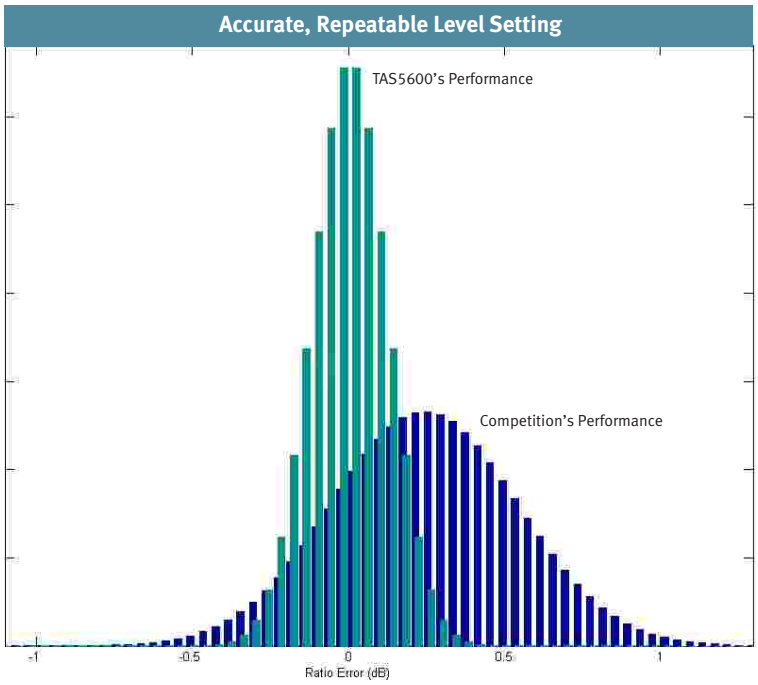
In order to verify that CDMA2000 handsets and base stations conform to the requirements of IS-97 or IS-98 standards, various co-channel and adjacent channel interference tests are performed. These tests verify a minimum level of receiver or transmitter performance in the presence of co-channel and adjacent channel interfering signals. The types of interfering signals required can include forward and reverse link CDMA2000 signals, single and dual tones, or AWGN. The level accuracy and purity required for these interfering signals is demanding.

Accuracy and Purity

In order to accurately assess the Frame Error Rate (FER) performance of a CDMA2000 receiver it is critical to set the Ior/Ioc ratio accurately. Highly accurate level settings can be difficult to achieve in custom built setups given the implications of VSWR interaction, power level requirements, and fading conditions. A custom built setup will also require calibration with each use and consistency across different test stations will be difficult to achieve. Inaccurate ratio settings can invalidate days of testing and cause inconsistencies in performance evaluations. Because of the nature of CDMA, small errors in Ior/Ioc cause large changes in FER. The TAS5600 has been designed specifically to address this ratio accuracy challenge. Using an internal instrument grade power meter, factory calibration, and proprietary techniques, the TAS5600 demonstrates a level of performance that ensures accurate and consistent results over time and across different test setups.

The TAS5600 exceeds IS-97 and IS-98 test specifications with:

- Accurate Ratio and Level Settings
- Ultra-Low Phase Noise
- Excellent ACLR Performance



TAS5600 provides accurate, repeatable interference ratios.

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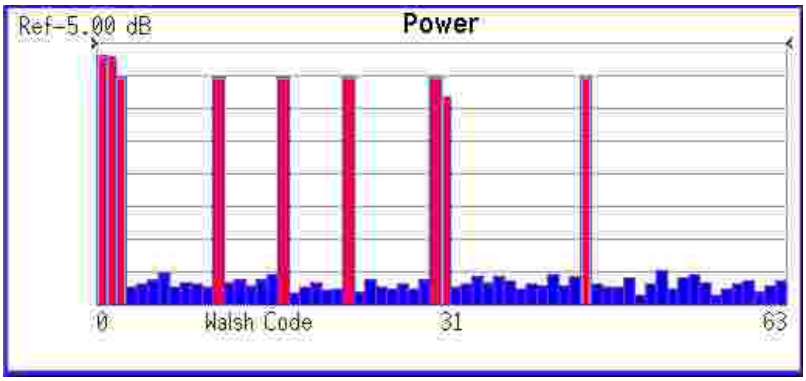
CDMA2000 Interference Types

The TAS5600 contains the necessary modulated interferers for both forward and reverse link receiver adjacent channel interference testing. Low Adjacent Channel Leakage Ratio (ACLR) performance and long data sequence length ensure the highest level of confidence for Adjacent Channel Selectivity tests.

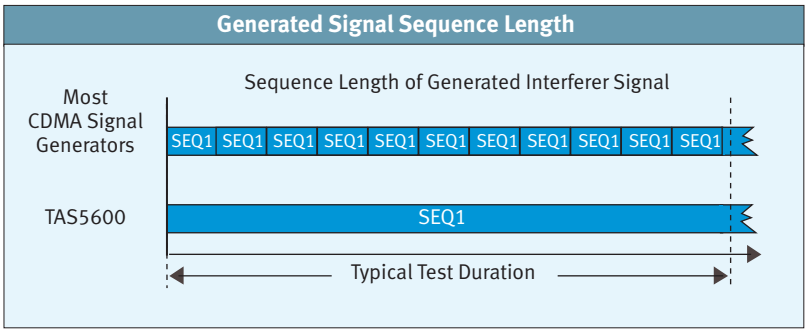
For handset testing, the TAS5600 generates an interfering forward link base station signal that includes the pilot, paging, sync, and six traffic channels. The reverse link modulated interferer, used for base station testing, contains a reverse link pilot only, as required by CDMA2000 standards. An important characteristic of the CDMA2000 modulated interferer is its data sequence repetition rate. To produce accurate FER test case results, the data contained in the paging, sync, and traffic channels should not repeat for the duration of the test. Unlike many commercial signal generators that have data sequences which repeat as often as every frame, the TAS5600 uses real-time signal generation techniques to generate data sequences with very low repetition rates. To maximize confidence in FER test case results, the data on each of the channels in the forward link interferer is random and has a minimum sequence length of one hour. This significantly exceeds industry test requirements.

The TAS5600 includes the following CDMA2000 interference types:

- Forward Link CDMA2000
- Reverse Link CDMA2000
- Single and Dual CW
- AWGN



TAS5600 provides all the applicable CDMA2000 Uplink and Downlink channels. This Code Domain plot shows a CDMA2000 channel.



Unlike most CDMA signal generators, the sequence length of the generators in the TAS5600 results in a test duration long enough to give a high degree of confidence in the test results.

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TAS5600 Specifications

- The following specifications describe warranteed performance over the temperature range 0-40° C and include a 30-minute warm-up time from ambient conditions.
- All specifications are measured at 880 and 1940 MHz unless stated otherwise.
- Supplemental italicized parameters are also provided for information and indicate typical, non-warranted performance.
- The achievable output level, C/N and C/I power ratios are a function of the carrier input signal, the desired output power level of the carrier signal, and the maximum available noise and interference power.
- Technical specifications are subject to change without notice.

Carrier Path

Number of Independent RF Carrier Channels	2
Integrated High Power Channel Duplexers	1
RF Carrier Frequency	400 - 2700 MHz
Carrier Input Range	*-50 to 0 dBm*
Amplitude Resolution	0.1 dB
Output Level Range	*-121 to -10 dBm*
Accuracy of Carrier Output Level	+/- 1.0 dB
Channel Amplitude Variation Relative to Nominal Insertion Loss	
3.84 MHz Bandwidth	*+/- 0.05 dB*
40 MHz Bandwidth	*+/- 0.25 dB*
Channel-to-Channel Isolation in C/N Mode	*›70 dB*
Input & Output VSWR	*‹1.5:1*
Maximum Duplex Port Input Power	+30 dBm
Input & Output Connector	50 ohm N-type

Interference

Independent Interference Generators	2
Interference Generator Modes	CW, Bandlimited AWGN, WCDMA, CDMA2000, GSM, External User Supplied
C/N Accuracy	*+/- 0.2 dB*
C/I Accuracy	*+/- 0.5 dB*
Interference Frequency Range	400 - 2700 MHz
Frequency Resolution	10 kHz

CW Interference

C/I Ratio Range	+20 to -100 dB
C/I Ratio Resolution	0.1 dB
Maximum Interference Output Power	*-10 dBm*

Typical Phase Noise (SSB Phase Noise in units of dBc/Hz):

	Offsets		
CW Frequency	**285 kHz**	**635 kHz**	**10 MHz**
400 to 675 MHz	-142	-149	-156
675 to 1350 MHz	-136	-143	-156
1350 to 2200 MHz	-130	-137	-156
2200 to 2700 MHz	-128	-135	-156

Typical Phase Noise with Option TAS5600-F02 (SSB Phase Noise in units of dBc/Hz):

	Offsets		
CW Frequency	**285 kHz**	**635 kHz**	**10 MHz**
400 to 550 MHz	-151	-153	-156
700 to 1000 MHz	-149	-151	-156
1700 to 2200 MHz	-143	-149	-156

IS-98 Requirement: -144 dBc/Hz @ 285 kHz offset for Fc=1 GHz; -144 dBc/Hz @ 635 kHz offset for Fc=2 GHz

IS-97 Requirement: -144 dBc/Hz @ 285 kHz offset for Fc=1 GHz; -149 dBc/Hz @ 655 kHz offset for Fc=2 GHz

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TAS5600 Specifications cont.

Bandlimited AWGN

AWGN Bandwidth	
‹0.5 dB Ripple	›5.76 MHz
6 dB Rolloff	*7.4 MHz*
C/N Ratio Range	+30 to -30 dB
C/N Ratio Resolution	0.1 dB
Maximum Interference Output Power	*-25 dBm @ 5.76 MHz BW*
B/W Pseudo-Random Sequence Duration	*3 Hours Minimum*

WCDMA Interferer

Modulation Types	WCDMA Downlink, WCDMA Uplink
Channel Configuration WCDMA Downlink	P-SCH, S-SCH, P-CPICH, P-CCPCH, PICH, DPCH x 16
WCDMA Uplink	DPCCH, DPDCH
C/I Ratio Range	+20 to -80 dB
C/I Ratio Resolution	0.1 dB
Maximum Interference Output Power	*-25 dBm*
ACLR (5 MHz offset)	*68 dB*
Data Channel Sequence Duration	*1 Hour Minimum*

GSM Interferer

Data Source	GMSK modulated carrier
Data Source Rate	270.833 kbits/sec
Filter Shape	Gaussian BT = 0.3
Fading Types	Classic Doppler
Fading Doppler	0.1 Hz to 1.5 kHz
Fading Profiles	TU Type1, TU Type2, RA Type1, RA Type2, HT Type1, HT Type2, EQ, TI
C/I Ratio Range	+20 to -80 dB
C/I Ratio Resolution	0.1 dB
Maximum Interference Output Power	*-25 dBm*
Data Sequence Length	*1 Hour Minimum*

CDMA2000 Interferer

Modulation Types	CDMA2000 Forward Link CDMA2000 Reverse Link
Channel Configuration CDMA2000 Forward Link	F_PILOT, F_SYNC, F_PAGING, F_FCHx6
CDMA2000 Reverse Link	R_PILOT
C/I Ratio Range	+20 to -80 dB
C/I Ratio Resolution	0.1 dB
Maximum Interference Output Power	*-25 dBm*
ACLR (2.5 MHz offset)	*74 dB*
Data Channel Sequence Duration	*1 Hour Minimum*

Power Measurement

Measurement Type	RMS power
Frequency Range	400 - 2700 MHz
Averaging Range	1 to 128
Measurement span per average	400 msec
Relative Measurement Accuracy	*0.1 dB*

Safety and Environmental

Power Requirements	
Voltage	88-265 VAC (auto-sensing)
Frequency	47-63 Hz
Dimensions and Weight	
Height	8.75 in, 222 mm
Width	16.88 in, 429 mm
Depth	21 in, 533 mm
Weight	*65 lbs, 28.9 kg*
Remote Interfaces	RS-232(DCE), GPIB (IEEE488.2), 10BaseT
Program Storage	PC Card

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TAS5600 Ordering Information

TAS5600 Universal Interference Emulator - Base

- Includes two RF channels, one built-in duplexer and two interference generators, including CW and AWGN

TAS5600W Universal Interference Emulator - WCDMA

- WCDMA-configured instrument, including options F06 and F07

TAS5600C2K Universal Interference Emulator - CDMA2000

- CDMA2000-configured instrument, including options F02 and F05

TAS5600U Universal Interference Emulator

- Universal instrument, including options F02, F03, FO4, and F05

TAS5600-F02 Low Phase Noise Option

- Improved phase noise performance of internal CW generators

TAS5600-F05 CDMA2000 Interferer Option

- CDMA2000 Forward and Reverse link modulated interferers with long repetition interval

TAS5600-F06 WCDMA Interferer Option

- WCDMA Uplink and Downlink modulated interferers with long repetition interval

TAS5600-F07 GSM Interferer Option

- GMSK modulated interferer with multipath fading and long repetition interval

UMTS-LAB Test System for WCDMA Wireless Applications

- Complete emulation of fading plus co-channel and adjacent channel interference conditions required by 3GPP WCDMA test specifications.
- Includes SR5500 Wireless Channel Emulator, TAS5600W Universal Interference Emulator and TASKIT software for Windows PC control.

C2K-LAB Test System for CDMA2000 Wireless Applications

- Complete emulation of fading plus co-channel and adjacent channel interference conditions required by CDMA2000 test specifications.
- Includes SR5500 Wireless Channel Emulator, TAS5600C2K Universal Interference Emulator and TASKIT software for Windows PC control.

A complete Annual Service Agreement is available for the instrument.

Please contact your sales representative for pricing information.

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