

# 20GHz High Performance RF Analog Signal Generator

CASE STUDY: TCS004  
Keysight - RF Analog  
SIGNAL GENERATOR

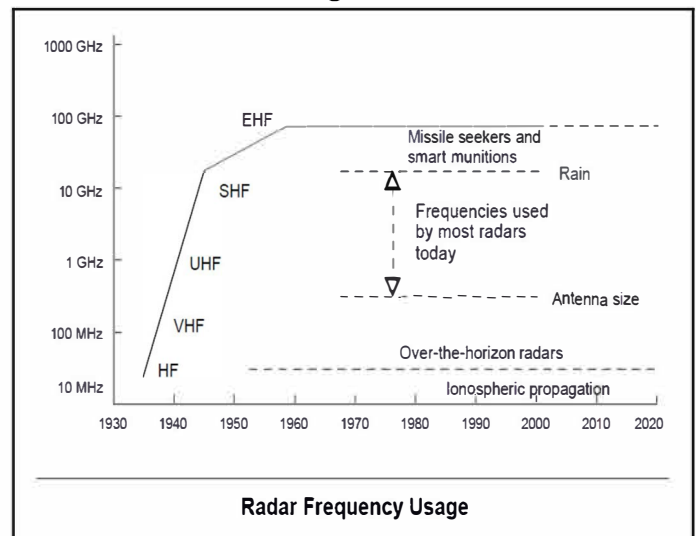
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**CUSTOMER:** DoT FAA  
**SOW:** DTFAAC-15-P-05558

The FAA put out an Open Market Survey to identify a 20GHz High-Performance RF Analog Signal Generator under their modernization efforts, as reported to Congress for funding in US General Accounting Office (GAO) RCED-99-25. The FAA's modernization program is focused on replacing and upgrading the National Airspace System's (NAS) equipment and facilities to meet the increase in traffic volume, enhance the margin of air safety, and increase the efficiency of their air traffic control system. One key area of this modernization program addresses the need for the FAA to have the ability to perform research, development, and test at high radio frequencies (RF). Much of the RF spectrum allocated to the FAA over the past 60 years has become saturated, and the FAA must deal with interference from other RF spectrum users. As this graph indicates, radar frequencies have rapidly increased since the introduction of radar in the mid-1930s. Today, the majority of radars operate between the Ultra High Frequency (UHF) and Super High Frequency (SHF) bands.

- UHF 300 to 3000MHz / 1m to 100mm Wavelength
- SHF 3000MHz to 30GHz / 100mm to 10mm Wavelength

The FAA has the need to move into the higher RF spectrum to make use of advancements in radars that operate in these higher frequencies. In addition, these higher frequencies are used in FAA satellite communications.



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## MINIMUM REQUIREMENTS

The FAA required a 20GHz High-Performance RF Analog Signal Generator that provided a high RF Output ( $> +25\text{dBm}$ ) with a Single Sideband (SSB) Phase Noise of better than  $-140\text{ dBc/Hz}$  and Switching Speed of  $<10\text{msec}$ . In addition, the signal generator is required to provide Narrow Pulse Modulated Signals (variable pulse width of  $20\text{nsec}$  minimum, variable repetition rate up to  $10\text{MHz}$ , with a rise and fall time of  $10\text{nsec}$ ). These specifications were required to enable the FAA to test both (1) the complex radar and communication systems and (2) for the response to real-world RF spectrum interference environments.

## MINIMUM TECHNICAL REQUIREMENTS

- 10MHz to 20GHz Analog RF Signal
- $> +25\text{dBm}$  RF Output
- Built-in Step Attenuator down to  $-130\text{dBm}$  minimum
- Type N (f) RF Output Connector
- Ultra-low SSB Phase Noise better than  $-140\text{ dBc/Hz}$
- AM, FM,  $\emptyset\text{M}$ , Pulse Modulation
- Narrow Pulse Modulation variable pulse width
- Switching Speed of  $<10\text{msec}$  minimum
- Analog Ramp Sweep
- LAN and GPIB interfaces
- Minimum 3 year warranty

## TEVET SOLUTION

TEVET engaged directly with the engineering team at the FAA to gain a full understanding of the application and the test challenges they were faced with. TEVET conducted a full gap analysis to gain further insight to what was required for not only today's need but also future capabilities the customer may have. Determining factors of the gap analysis for identifying the best COTS solution included: not only selecting a High-Performance RF Analog Signal Generator that met all the current required specification, but also selecting an instrument provider that offered instrument platforms for additional modernization plans. After evaluating several technologies from different instrumentation providers, TEVET settled on Keysight and their E8257D-521. In addition to meeting today's need, we found that only Keysight offered an extensive product line of "single-box", "modular" and "software" platforms for future modernization.



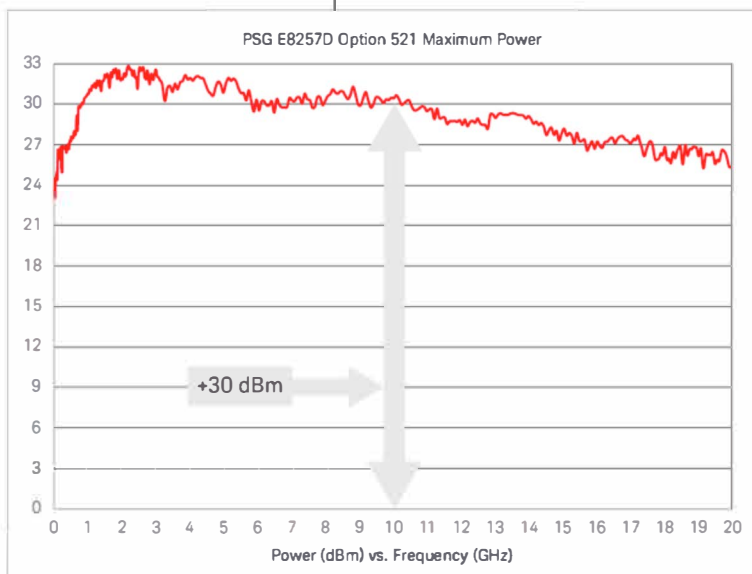
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## KEY TECHNICAL ADVANTAGES

### HIGH-PERFORMANCE RF ANALOG SIGNAL GENERATOR

- E8257D-521 10MHz to 20GHz PSG
  - o World's first Microwave Analog RF Signal Generator to break the 1 watt output power barrier:  $>+30\text{dBm}$  typical
  - o Minimizes the need for additional hardware such as amplifiers, couplers and detectors in most test applications
  - o Addresses the demanding needs of Doppler radar, ADC, and receiver-blocking tests with extremely low phase noise:  $-91\text{ dBc/Hz}$  at 100 Hz offset, and  $-126\text{ dBc/Hz}$  at 10 kHz offset (10 GHz)
  - o Backwards compatible with legacy Keysight (Agilent/HP) signal sources for full system coding: 8340 Series, 8360x Series, and 8370x Series
  - o 3 year warranty standard



### DRIVE HIGH-POWER SIGNALS IN TEST ENVIRONMENTS PRONE TO SIGNAL LOSS

Option 521 is capable of generating more than 1 W ( $+30\text{dBm}$ ) of output power to drive high-power signals and overcome test system losses. Eliminate external amplifiers and improve calibration accuracy and repeatability with automatic level control and step attenuation at high power levels.

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