"When Jack [Ruby] told me he had killed Oswald 'for the Jews,' I believed him. On each of the three occasions we talked, he said, 'Bill, I did this so they wouldn't implicate the Jews.' ... During our last visit, he handed me a note in which he reiterated his desire to protect American Jews from a pogrom that could occur because of anger over the assassination."

--- Quote from the 1994 autobiography *My Life as a Radical Lawyer*, (p.158) by Jewish attorney William Kunstler, who was one of the few people to personally interview Jack Ruby (a Jewish mobster, born Jacob Rubenstein) after shooting Lee Harvey Oswald.

President John F. Kennedy wanted to reinstate U.S government–backed silver certificates (Executive Order 11110), bypassing the private Federal Reserve central bank and their ability to charge loan interest. Federal Reserve notes are not backed by anything other than debt, while silver certificates can be traded for hard goods. Guess who doesn't like that?

(books.google.com/books?id=jcePAAAAMAAJ)
(www.john−f−kennedy.net/executiveorder11110.htm)
NOTES:
1. FOUR WORDS PER PHYSICAL ANTENNA FACE (0-3). 0 IS A OMNI ANTENNA.
2. ONE WORD PER RADIO.
*A NTG + VG / VRGCT / MODEL

LEGEND:
AFT - ACCESS ATTEMPT FAILURE THRESHOLD
AST - ACCESS ATTEMPT SUCCESS THRESHOLD
AL - STATUS OF THE ALARM INTERFACE
ANT - ANTENNA NUMBER THE VOICE RADIO IS CONNECTED TO
ANTG - ANTENNA STATUS
BOGCT - BOG THRESHOLD FOR THE LOCATION RADIO FUNCTIONAL TEST
BOGRT - BOG THRESHOLD FOR THE ROUTINE DIAGNOSTICS
BOGST - BOG THRESHOLD FOR THE SETUP RADIO FUNCTIONAL TESTS
DTRH - DOT DETECTION THRESHOLD FOR THE SETUP RADIO TRANSMISSION
DTRVRH - DOT DETECTION THRESHOLD FOR THE VOICE RADIO TRANSMISSION
FSTG - STATUS OF THE ENTIRE FUNCTIONAL GROUP
LGR - LOCATION RADIO FUNCTIONAL TEST INTERVAL
LGR - LOCATION RADIO FUNCTIONAL TEST INTERVAL
M - STATUS OF THE MEASUREMENT INSTRUMENTS
MODEL - TYPE OF RADIO EQUIPMENT
REPL - RETURN LOSS VALUE FROM TEST GENERATOR
RF - STATUS FIELD FOR THE TEST RADIO
RFCD, RFPC1 - RADIO FREQUENCY CONTROL BITS
RDLG, RSLG - STATUS FIELDS FOR REFERENCE GENERATORS 0 AND 1, RESPECTIVELY
RRL - RETURN LOSS VALUE FOR SIGNAL FROM TEST GENERATOR AND REFLECTED FROM
ANTENNA AND ANTENNA CABLE SYSTEM
SSRD - RECEIVED SIGNAL STRENGTH INDICATOR
SRD - REVERSE VOICE DATA TIME-OUT
SRG - OVRD GROUP
STAT - STATUS OF THE RADIO
SIL - SYSTEM INTERFERENCE LEVEL THRESHOLD
SUO, SUI, SU2, SU3 - STATUS FIELDS FOR SETUP RADIOS 0 THROUGH 3, RESPECTIVELY
SUO, SUI, SU2, SU3 - SETUP CHANNEL NUMBER FOR SETUP RADIO 0 THROUGH 3, RESPECTIVELY
SUO, SUI, SU2, SU3 - SETUP RADIO FUNCTIONAL TEST INTERVAL
SUO, SUI, SU2, SU3 - SETUP RADIO TRANSMIT RETURN LOSS THRESHOLDS
TODD - TIME OF DAY INDICATOR FOR ROUTINE DIAGNOSTICS
TRHL - TRANSIT RETURN LOSS THRESHOLD
VBCHT - POWER THRESHOLD OF AN INCOMING SIGNAL
VG - VOICE GROUP
VRGCT - VOICE RADIO GROUP
VRCHN - CHANNEL NUMBER THE RADIO IS TRANSMITTING ON
VRGCT - VOICE RADIO GROUP CHANNEL TYPE
VT - VOICE RADIO LOCATION TIME INTERVAL
VUO, VU0, VU1 - VOICE RADIO OUTPUT POWER FOR RADIOS 0 AND 1
WDRN - NUMBER OF WORDS IN THE AUXILIARY BLOCK
XVSO, XVSO, XVSO - TRANSMITTER OUTPUT VALUES FOR SETUP RADIOS 0 THROUGH 3

Fig. 26—Cell Master Equipment Translator (Sheet 2 of 2)
LEGEND:

ACC - ACCESS CHANNEL THRESHOLD
ANT - ANTENNA FACE
CNST - NUMBER OF CELLS TO PUT ON CANDIDATE LIST
CPDF - CELL SITE POWER CONTROL FLAG
CTYP - TYPE OF CELL
DPIC - DYNAMIC POWER CONTROL INDICATOR
DRL - LIST OF ALTERNATE CELL SITES THE MOBILE IS DIRECTED TO
GNGH - NUMBER OF NEIGHBOR CELLS IN GROUP 1
HIGH - VOICE CHANNEL SELECTION HIGH THRESHOLD
HSCT - HIGH SIGNAL STRENGTH FOR THE CELL SITE
HSIM - HIGH SIGNAL STRENGTH FOR THE MOBILE
INTP - INTERFERENCE PROTECTION THRESHOLD
LASTR - ALTERNATE ACCESS INDICATOR
LSTC - LOW SIGNAL STRENGTH FOR THE CELL SITE
LSTM - LOW SIGNAL STRENGTH FOR THE MOBILE
MPDF - MOBILE POWER CONTROL FLAG
MPOF - MAXIMUM POWER DIFFERENTIAL
NANT - INDICATES WHICH OF THE ANTENNAS OF THE NEIGHBOR CELL SITE ARE NEIGHBOR ANTENNAS
NCAL - NUMBER OF CELL SITE ATTENUATION LEVELS
NCS - CELL SITE NUMBER OF THE NEIGHBOR
NDST - NUMBER OF TIMES A SIGNAL LEVEL TRIGGER IS IGNORED DURING A DELAYED TRIGGER STATE
NMAL - NUMBER OF MOBILE ATTENUATION LEVELS
NSGUP - SUBGROUP NUMBER FOR THE NEIGHBOR CELL
NSG - NEIGHBOR SERVER GROUP
PRIM - PRIMARY SIGNAL STRENGTH THRESHOLD
SCND - SECONDARY SIGNAL STRENGTH THRESHOLD
SGPAID - SERVER GROUP POWER AMPLIFIER IDENTIFIER
SGS - SERVER GROUP 0
SG1 - SERVER GROUP 1
STF - SPEED TRENDING FLAG
VED - INDICATES VOICE RADIO EQUIPPED FACES
VMAC - VOICE MOBILE ATTENUATION CODE
WON - NUMBER OF WORDS IN THE AUXILIARY BLOCK

Fig. 27—Cell Master Location Translator (Sheet 2 of 2)

Fig. 28—Parameter Layout for the MTSO Feature
Fig. 29—Parameter Word QM2ACST5W and Associated Call Store Option
Fig. 30—Network Routing
Fig. 31 — Mobile-Completed Call Sequence
Fig. 32 — Mobile-Originated Call Sequence
Fig. 33 — Handoff Sequence
Fig. 34—Disconnect Sequence (Mobile Initiated)
Fig. 35 — Disconnect Sequence (System Initiated)
Fig. 36—Call Sequence for Land-Originated Calls

* Applies to directional cell site antenna only
<table>
<thead>
<tr>
<th>MTSO</th>
<th>STEPS</th>
<th>CELL SITE</th>
<th>MOBILE UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Transmits setup channel data on forward setup channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Scans and locks-on forward setup channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>User initiates call</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Scans and locks-on reverse setup channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Seizes setup channel</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Acquires synch</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Sends service request</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Reformats service request</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Performs directional location*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Sends service request and priority list to MTSO</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Selects voice channel  
Sends channel designation message to cell site  
Reformats channel designation message  
Sends channel designation message to mobile unit via forward setup channel  
Tunes to voice channel  
Transmits SAT  
Detects SAT  
Sends voice channel confirmation message to MTSO  
Detects off-hook  
Completes call through network

* Applies to directional cell site antenna only

Fig. 37—Cell Sequence for Mobile-Originated Calls
Fig. 38—Procedure for Adding the MTSO Feature (Sheet 1 of 4)
Fig. 38—Procedure for Adding the MTSO Feature (Sheet 2 of 4)
Fig. 38—Procedure for Adding the MTSO Feature (Sheet 3 of 4)
NOTES:
1. In a working office, all steps to this point would normally have been completed.
2. The following translation data input procedures must be done in the sequence shown.

Fig. 38—Procedure for Adding the MTSO Feature (Sheet 4 of 4)
<table>
<thead>
<tr>
<th>PULSE SOURCE</th>
<th>OCTAL ADDRESS</th>
<th>PULSE SOURCE</th>
<th>OCTAL ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PPU030</td>
<td>00040001</td>
<td>PPU062</td>
<td>01002004</td>
</tr>
<tr>
<td>PPU031</td>
<td>00040002</td>
<td>PPU063</td>
<td>01002010</td>
</tr>
<tr>
<td>PPU032</td>
<td>00040004</td>
<td>PPU064</td>
<td>01002020</td>
</tr>
<tr>
<td>PPU033</td>
<td>00040010</td>
<td>PPU065</td>
<td>01002040</td>
</tr>
<tr>
<td>PPU034</td>
<td>00040020</td>
<td>PPU066</td>
<td>01004001</td>
</tr>
<tr>
<td>PPU035</td>
<td>00040040</td>
<td>PPU067</td>
<td>01004002</td>
</tr>
<tr>
<td>PPU036</td>
<td>01000010</td>
<td>PPU068</td>
<td>01004004</td>
</tr>
<tr>
<td>PPU037</td>
<td>01000012</td>
<td>PPU069</td>
<td>01004010</td>
</tr>
<tr>
<td>PPU038</td>
<td>01000014</td>
<td>PPU070</td>
<td>01004020</td>
</tr>
<tr>
<td>PPU039</td>
<td>01000018</td>
<td>PPU071</td>
<td>01004030</td>
</tr>
<tr>
<td>PPU040</td>
<td>01000020</td>
<td>PPU072</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU041</td>
<td>01000040</td>
<td>PPU073</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU042</td>
<td>01000050</td>
<td>PPU074</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU043</td>
<td>01000060</td>
<td>PPU075</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU044</td>
<td>01000070</td>
<td>PPU076</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU045</td>
<td>01000080</td>
<td>PPU077</td>
<td>02000010</td>
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<td>PPU046</td>
<td>01000084</td>
<td>PPU078</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU047</td>
<td>01000090</td>
<td>PPU079</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU048</td>
<td>01000100</td>
<td>PPU080</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU049</td>
<td>01000101</td>
<td>PPU081</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU050</td>
<td>01000101</td>
<td>PPU082</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU051</td>
<td>01000140</td>
<td>PPU083</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU052</td>
<td>01000140</td>
<td>PPU084</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU053</td>
<td>01000140</td>
<td>PPU085</td>
<td>02000020</td>
</tr>
<tr>
<td>PPU054</td>
<td>01000140</td>
<td>PPU086</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU055</td>
<td>01000140</td>
<td>PPU087</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU056</td>
<td>01000140</td>
<td>PPU088</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU057</td>
<td>01000140</td>
<td>PPU089</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU058</td>
<td>01000140</td>
<td>PPU090</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU059</td>
<td>01000140</td>
<td>PPU091</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU060</td>
<td>01002000</td>
<td>PPU092</td>
<td>02000010</td>
</tr>
<tr>
<td>PPU061</td>
<td>01002002</td>
<td>PPU093</td>
<td>02000010</td>
</tr>
</tbody>
</table>
### TABLE B
INDEXING SCHEME FOR THE CELL MASTER LOCATION TRANSLATOR AUXILIARY BLOCK POINTER

<table>
<thead>
<tr>
<th>LOGICAL ANTENNA FACE</th>
<th>ANTENNA FACE</th>
<th>SERVER GROUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>

### TABLE C
SET CARDS REQUIRED FOR MTSO

<table>
<thead>
<tr>
<th>SET CARD</th>
<th>DEFINITION</th>
<th>TYPICAL VALUES</th>
<th>MINIMUM VALUES</th>
<th>MAXIMUM VALUES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CELL</td>
<td>Highest cell site member number</td>
<td>5-250</td>
<td>1</td>
<td>255</td>
</tr>
<tr>
<td>GCPH</td>
<td>Number of call processing hoppers for general use</td>
<td>—</td>
<td>150</td>
<td>—</td>
</tr>
<tr>
<td>IOS(H)</td>
<td>Defines one input-output unit selector</td>
<td>—</td>
<td>1</td>
<td>63</td>
</tr>
<tr>
<td>NMCR</td>
<td>Number of mobile call registers</td>
<td>50-2500</td>
<td>0</td>
<td>5000</td>
</tr>
<tr>
<td>NMHR</td>
<td>Number of mobile handoff registers</td>
<td>—</td>
<td>10</td>
<td>NMCR</td>
</tr>
<tr>
<td>NMOR</td>
<td>Number of mobile originating registers</td>
<td>5-250</td>
<td>0</td>
<td>2500</td>
</tr>
<tr>
<td>NRMR</td>
<td>Number of roamers units allowed to access the system</td>
<td>500</td>
<td>50</td>
<td>—</td>
</tr>
</tbody>
</table>
### TABLE D

#### SUMMATION OF FEATURE GROUPS

<table>
<thead>
<tr>
<th>FEATURE GROUP</th>
<th>SET CARD</th>
<th>FEATURE PACKAGE</th>
<th>SET CARD</th>
<th>PROGRAM STORE WORDS (DECIMAL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advanced Mobile Phone Service (AMPS)</td>
<td>9S163</td>
<td>Advanced Mobile Phone Service (AMPS) Maintenance (AMPSMT)</td>
<td>9F163</td>
<td>57,824</td>
</tr>
<tr>
<td>Advanced Mobile Phone Service (AMPS)</td>
<td>9S164</td>
<td>Advanced Mobile Phone Service (AMPS) Common System (AMPSCM)</td>
<td>9F164</td>
<td>46,048</td>
</tr>
<tr>
<td>Advanced Mobile Phone Service (AMPS) Call Processing</td>
<td>9S165</td>
<td>Advanced Mobile Phone Service (AMPS) Call Processing (AMPSCP)</td>
<td>9F165</td>
<td>194,688</td>
</tr>
<tr>
<td>Advanced Mobile Phone Service (AMPS)</td>
<td>9S176</td>
<td>Advanced Mobile Phone Service (AMPS) Cell Generic (AMPSCG)</td>
<td>9F176</td>
<td>524,288</td>
</tr>
<tr>
<td>Attached Processor System</td>
<td>9SAPS</td>
<td>Attached Processor System</td>
<td>9F195</td>
<td>896</td>
</tr>
<tr>
<td>Carrier Interconnect</td>
<td>9SCARI</td>
<td>Carrier Interconnect</td>
<td>9F203</td>
<td>3140</td>
</tr>
<tr>
<td>Division of Revenue peg And usage Count</td>
<td>9SDRPC</td>
<td>Division of Revenue peg And usage Count</td>
<td>9FDRPC</td>
<td>1440</td>
</tr>
<tr>
<td>General Purpose Subroutines</td>
<td>9S157</td>
<td>General Purpose Subroutines</td>
<td>9F157</td>
<td>32</td>
</tr>
</tbody>
</table>
### TABLE E

<table>
<thead>
<tr>
<th>SPECTRUM AVAILABLE</th>
<th>NUMBER OF USERS</th>
<th>AVERAGE NUMBER OF USERS PER CELL SITE</th>
<th>AVERAGE NUMBER OF CELL SITES</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 MHz</td>
<td>625,000</td>
<td>460</td>
<td>136</td>
</tr>
<tr>
<td></td>
<td>100,000</td>
<td>460</td>
<td>239</td>
</tr>
<tr>
<td>30 MHz</td>
<td>62,500</td>
<td>830</td>
<td>95</td>
</tr>
<tr>
<td></td>
<td>200,000</td>
<td>830</td>
<td>249</td>
</tr>
</tbody>
</table>

### TABLE F

<table>
<thead>
<tr>
<th>TYPE OF FACILITY</th>
<th>BLOCKING PROBABILITY</th>
<th>NUMBER OF TRUNK GROUPS</th>
<th>NUMBER OF TRUNKS</th>
<th>SPECTRUM AVAILABLE</th>
<th>NUMBER OF SUBSCRIBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell Site Trunks</td>
<td>2%</td>
<td>140</td>
<td>2,600</td>
<td>20 MHz</td>
<td>62,500</td>
</tr>
<tr>
<td></td>
<td></td>
<td>75</td>
<td>2,300</td>
<td>30 MHz (Generic 1.0)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>220</td>
<td>4,200</td>
<td>20 MHz</td>
<td>100,000</td>
</tr>
<tr>
<td></td>
<td></td>
<td>240</td>
<td>7,000</td>
<td>30 MHz</td>
<td>200,000</td>
</tr>
<tr>
<td>Intra-MTSO Trunks</td>
<td>+1%</td>
<td>1</td>
<td>40</td>
<td>-</td>
<td>62,500</td>
</tr>
</tbody>
</table>

**Note:** The maximum quantity of these trunks is a function of traffic engineering discipline, blocking probability, number of trunk groups and spectrum available.

* Erlend B with low day-to-day variations traffic engineering
† Poisson traffic engineering.
Tracking Generator for a HP8569 Spectrum Analyzer

Overview

This is a project to construct a simple tracking generator add-on for a HP8569-series spectrum analyzer. A tracking generator is a device which can be used to turn a normal RF spectrum analyzer into a Scalar Network Analyzer (SNA). A SNA is used to measure the amplitude-vs-frequency properties of a Device Under Test (DUT). This tracking generator will allow the HP8569 to display magnitude of gain/loss only when operating in the 10–1800 MHz range. This is still very useful for testing RF cables, tuning RF filters or duplexers, aligning receiver IF stages, or even testing low-level RF amplifiers.

A tracking generator works by “tracking” the sweeping first Local Oscillator (LO) of a spectrum analyzer to generate a RF carrier at the same frequency which the spectrum analyzer is tuned to at that moment. You’re essentially transmitting and receiving at the same time in order to plot the gain/loss magnitude of the device you’re testing.

In the HP8569B, which will be used here, the first local oscillator sweeps between 2060–3850 MHz when on the 10–1800 MHz range. This LO is offset (positive) by the frequency of the first IF stage, which is 2050 MHz in the HP8569B. You can see that by mixing the sweeping 2060–3850 MHz first LO with a 2050 MHz carrier, you can generate a synchronized 10–1800 MHz sweeping output signal.

The 2050 MHz carrier will be generated by a Mini-Circuits DSN-2300A-1119+ frequency synthesizer. This is a handy all-in-one device which can generate a RF carrier between 1690–2310 MHz. The 2050 MHz RF carrier and the sweeping 2060–3850 MHz first LO will be mixed together using an Anzac MD-525-4 double-balanced mixer. The IF port of the Anzac MD-525 will have a 3 dB attenuator to help pad the output and to help provide a constant 50 ohm impedance for the other ports. A Western Microwave PMI-8984 peripheral mode RF isolator (2–7 GHz) is used on the 2060–3850 MHz first LO input to improve isolation between the tracking generator and the spectrum analyzer. This is optional, but very helpful to maintain dynamic range. A 6 dB directional coupler was also added to tap off the incoming LO signal to connect to a frequency counter. This is also optional.
The Mini−Circuits DSN−2300A−1119+ frequency synthesizer used for this tracking generator is from an oscillator board I found on eBay. It has no markings other than "P/N: 131–141987–001 IF LO CARD."

It has two MMCX female connectors labeled "TX IF LO" and "RX IF LO."

This particular unit also has a Mini−Circuits DSN−1500A synthesizer for generating a signal between 1100–1500 MHz and an on−board 10 MHz clock oscillator.

Only the Mini−Circuits DSN−2300A−1119+ frequency synthesizer and the 10 MHz reference clock oscillator (3.3V CMOS) are needed.
This oscillator board has its own 10 MHz reference clock oscillator, as shown on the lower−right.

Any standard 10 MHz 3.3 volt CMOS clock oscillator will work. Frequency stability is only required on the narrow resolution bandwidths.

It doesn't appear possible to tweak this reference oscillator frequency, but the output frequency was very stable. Slightly tweaking the 2050 MHz carrier frequency (+/− 100 kHz) is handy because the center frequency of the IF filters in the spectrum analyzer can drift over time and you may have to "peak" the response during narrow resolution filter sweeps.

The final output frequency was 2049.998253 MHz (−1747 Hz) at −4.3 dBm.

The DSN−2300A−1119+ puts out around +6 dBm and there is an on−board 10 dB attenuator.

If you are using a stand−alone DSN−2300A−1119+, you should also add this 10 dB attenuator to get the RF power down to around −4 dBm.
The oscillator board has a 12-pin header, connected via the white wires on the upper-left.

The pinout is as follows:

1. TX LO Lock Alarm
2. TX LO Load Enable
3. Synthesizer Data
4. Ground
5. Synthesizer Clock
6. Ground
7. +5 VDC
8. Ground
9. +13.4 VDC
10. Ground
11. RX LO Load Enable
12. RX LO Lock Alarm

The lock alarms are logic "high" on PLL lock, but are not used in this project.
Placing the front-panel components in the case.

The oscillator board is mounted to the inside rear-panel using little standoffs.

A N female to SMA female bulkhead adapter is used for the main RF output signal.

SMA female bulkheads are used for the first LO input and −6 dB tap.

+15 VDC power is via the banana jacks.
Adding the BASIC Stamp HomeWork Board USB.

Using a BASIC Stamp is a bit of overkill, but they are easy to program and you can now buy them at Radio Shack.

You can remove the HomeWork Board's stock breadboard with a razor blade and a little acetone.

The BASIC Stamp HomeWork Board is designed to run from a 9 volt battery, but the on−board voltage regulator will allow operation from a higher voltage power supply.

I also added 22 µF capacitors on the BASIC Stamp’s +5 VDC line.

The resistors for the LM317/LM117 should be 1% metal–film.
Overview of the completed tracking generator.

The **1st LO Input** is along the top, via the directional coupler and isolator.
The key element in this tracking generator is a quality RF mixer which provides high isolation (40+ dB) between its LO/RF/IF ports.

Used here is an Anzac MD−525 double−balanced mixer. The frequency range of its ports are LO: 5−4000 MHz, RF: 5−4000 MHz, IF: 5−1900 MHz. LO power should be around +7 dBm.

The 2050 MHz RF input signal to the mixer (left SMA) will be around −4 dBm. This level is somewhat arbitrary, but should be at least 10 dB lower than the LO signal for maximum dynamic range and to avoid generating mixer compression artifacts.

A 3 dB attenuator is on the MD−525’s IF output port (center SMA) to force the mixer and spectrum analyzer to both see a 50 ohm impedance over their entire frequency ranges.

Ideally, there should also be a 2 GHz lowpass filter on the IF output to knock down any LO leakage and the harmonics, but we can get by without it for hobby use.
On the **1st LO Input** (left) is an optional Narda Model 23696 2–4 GHz 6 dB directional coupler. This can be used to monitor the input LO frequency via a frequency counter to get a more accurate analyzer frequency readout.

The large, blue rectangle device is the Western Microwave PMI–8984 peripheral mode 20 dB isolator (HP0960–0638) which operates over the 2–7 GHz range.

This is also optional, but very useful for isolating the tracking generator from the spectrum analyzer to avoid creating spurious response artifacts.
Auxiliary RF output SMA jack is on the rear.

This is an optional 1152 or 1250 MHz output at −4 dBm from the oscillator board.
Front-panel overview of the completed HP8569 Tracking Generator project.

+15 VDC input is via the banana jacks on the lower-left. The current draw is minimal.

The upper-left red LED lights when the BASIC Stamp program finishes running.

The AUX RF A / AUX RF B SPST switch selects the optional auxiliary RF output frequency.

The N jack in the middle is the sweeping 10–1800 MHz RF Output.

The SMA jack next to the N connector is an optional −6 dB Test to measure the frequency of the first LO input.

The SMA jack on the upper-right is the 1st LO Input from the HP8569.

The switch on the lower-right is for main power.
Baseline system response test.

The RF output of the tracking generator is approximately $-13 \text{ dBm} (+/- 3 \text{ dB})$ over the $10$–$1800$ MHz frequency range.

A straight–through coaxial cable is connected from the output of the tracking generator to the RF input of a HP8569B spectrum analyzer.

The 1st LO Output SMA jack on the HP8569B is connected to the 1st LO Input SMA jack on the tracking generator. This cable should be low–loss and well shielded to minimize RF leakage. The first LO on the HP8569B provides around $+8 \text{ dBm}$ of RF power.

The HP8569B is set to $0 \text{ dBm}$ reference with $10 \text{ dB}$ attenuation. The center frequency is around $500 \text{ MHz}$ and the span is $100 \text{ MHz}$ per horizontal division and $10 \text{ dB}$ per vertical division. The "zero spur" is on the far–left.

Ideally, this response would be a perfectly straight line, but this requires the addition of a level–controlled output IF amplifier/attenuator which would increase the complexity of this project.
Close-up view of the baseline response.

This would represent an "ideal" connection with no loss.

HP spectrum analyzers with an **INP−B−>A** function can "cancel out" any anomalies in the baseline system response.

Do this by first testing the baseline response with a high-quality, straight-through coaxial connection and storing the Trace B response by pressing **STORE BLANK**.

Connect the device to test then press the **INP−B−>A** button.

This "subtracts" the baseline response anomalies from the current input to show only the response of the DUT.

You'll need to redo this "cancelling" technique everytime you change the analyzer's display functions or swap out cables.
Testing a Industrial Communication Engineers, Ltd. Model 413 bandpass filter (144–148 MHz).

The center frequency is still around 500 MHz and the span is 100 MHz per horizontal division and 10 dB per vertical division.

The 3 dB points of this filter are around 110 and 170 MHz. The "spike" on the right is around 621 MHz.
Experimental tracking generator for the 1700–4100 MHz range.

In this mode, the HP8569B's sweeping first LO signal (2021.4–4421.4 MHz) is mixed with an external 321.4 MHz signal to generate a tracking 1700–4100 MHz output.

The mixer is a Watkins–Johnson M1G double–balanced mixer. It requires +7 dBm of LO power and has around 40 dB of port isolation. The LO/RF ports can operate over the 1000–4200 MHz range.

The M1G's LO port has a Western Microwave PMI–8984 peripheral mode isolator on its input for additional isolation.

The M1G's IF port is used for the 321.4 MHz input, which is at around −4 dBm and is supplied via an external RF signal generator.

The RF port is then the sweeping 1700–4100 MHz output. There is a high–quality 3 dB attenuator on the RF port.
Alternate view.

The SMA jack is for the **1st LO Input**.

The BNC jack is for the **321.4 MHz Input**.

The N jack is for the sweeping **1700–4100 MHz Output**.
1700–4100 MHz tracking generator in operation.

Displayed is a sweep of a commercial 2.4 GHz bandpass filter.

The HP8569B's center frequency is around 2.424 GHz and the span is 50 MHz per horizontal division. Vertical span is 10 dB per division.
Tracking Generator for a HP8569B
2050 MHz RF Carrier

2050 MHz RF Carrier
-4 dBm

Mini-Circuits
DSN-2300A-119

Synthesizer

100Ω

68Ω

1 kΩ

5.6 kΩ

100Ω

10 kΩ

5.6 kΩ

5V to 3.3V

Power LED

100Ω

10 kΩ

10 kΩ

100Ω

+3V Lock
0V Unlock

Lock
Detect
Unused

BS P0
Data

BS P1
Clock

BS P2
Load Enable

BS P4

100Ω

1 kΩ

5.6 kΩ

10 kΩ

10 kΩ

5.6 kΩ

3.3Ω

10 MHz Reference Oscillator Input

Ferrite Bead

50Ω microstripline

Resistors for LM317 should be 1%

10 MHz clock should be 3.3 V CMOS

10 µF

2.2 kΩ

10 µF

22 µF

243Ω

Acj

Vout

Vin

+15 VDC

+15 VDC
'Mini-Circuits DSN-2300A-1119 PLL Frequency Synthesizer Loader Code
GEPPR HP8569B Tracking Generator / BASIC Stamp 2 / Version 1

DSN-2300A-1119 Pin      BASIC Stamp Port
−−−−−−−−−−−−−−−−−−      −−−−−−−−−−−−−−−−
DATA (9)                P1
CLK (11)                P0
LE (12)                P2

($STAMP BS2)
($PBASIC 2.5)

IVAL1 VAR Word
IVAL2 VAR Byte

FVAL1 VAR Word
FVAL2 VAR Byte

RVAL1 VAR Word
RVAL2 VAR Byte

NVAL1 VAR Word
NVAL2 VAR Byte

IVAL1 = $9F80
IVAL2 = $13

FVAL1 = $9F80  ' Prescaler = /32
FVAL2 = $12

RVAL1 = $1000  ' R = 40  10 MHz / 40 = 250 kHz
RVAL2 = $A0

NVAL1 = $2100  ' N = 8200  B = 256  A = 8 for 2050 MHz
NVAL2 = $21

LOW 0  ' CLK
LOW 1  ' DATA
LOW 2  ' LE
LOW 4  ' LED

  ' Load Initial
SHIFTOUT 1,0,1,[IVAL1\16]
SHIFTOUT 1,0,1,[IVAL2]
PULSOUT 2,1  ' Bring LE high, then low
PAUSE 5

  ' Load Function
SHIFTOUT 1,0,1,[FVAL1\16]
SHIFTOUT 1,0,1,[FVAL2]
PULSOUT 2,1  ' Bring LE high, then low
PAUSE 5

  ' Load /R
SHIFTOUT 1,0,1,[RVAL1\16]
SHIFTOUT 1,0,1,[RVAL2]
PULSOUT 2,1  ' Bring LE high, then low
PAUSE 5

  ' Load /N
SHIFTOUT 1,0,1,[NVAL1\16]
SHIFTOUT 1,0,1,[NVAL2]
PULSOUT 2,1  ' Bring LE high, then low
PAUSE 5

HIGH 4  ' Light front-panel LED
END
They're laughing at you... literally!

Change!
End of Issue #115

Any Questions?

Editorial and Rants

- If I had a son, he’d look like this murderer.
Anna Dieter−Eckerdt, 6 and Abigail Robinson, 11

Spic Killers: Cinthya Garcia−Cisneros and Mario Echeverria

Didn't hear about this one, did you?

Two beautiful White step−sisters were playing in a pile of leaves at their Hillboro, Oregon front yard last Sunday, when a speeding, careening car lost control and plowed into them. One died in the arms of a responding emergency firefighter at the scene (imagine how sad that was) and the other soon died at the hospital. At least one of the wetbacks in the car that sped away is an “undocumented immigrant,” or what we should really call them – “a criminal.”

(incogman.net/2013/10/wetbacks−kill−white−girls−in−hit−and−run/)
(www.stormfront.org/forum/t1001436/)

Guess the media doesn't want to cut into their Trayvon Martin coverage...
Didn’t hear about this one, did you?

Two young members of Golden Dawn, Kapelonis Manolis and Fountoulis Georgios, were murdered earlier tonight (Nov. 1, 2013) while safeguarding an event taking place inside the offices of the party in the northern suburbs of Athens. Alexandros Gerontas, father of a two–year–old, is fighting for his life in a hospital, and the doctors diagnose the situation as critical. Two black–clad people riding a motorcycle opened fire on the guard team of 7–8 persons that were on standing in front of the offices of Golden Dawn.

Early information suggests that after using a MP–5, they moved in close and shot both in the head with 9 mm pistols. Golden Dawn members had nothing to defend themselves with, as the police in the previous week raided most Golden Dawn offices and arrested people for merely sticks of wood. Golden Dawn had notified the police of the event taking place and asked for police protection. None was given.

It should be noted that even MPs of Golden Dawn have no police escort, after it was removed by a decision of the ministry. For the past month and a half, Golden Dawn has been the target of both a systematic terror campaign from the police, and also the extreme left.

The Greek "anti–terrorist" squad was used against Golden Dawn – while the murderers walk free.