ROHDE & SCHWARZ

SERVICE INSTRUCTIONS

Adjacent-channel Power Meter

Option CMT-B6

803.7810.02

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Contents

# 5 Service Manual for Adjacent-channel Power Meter Option CMT-B6

(See circuit diagram 803.7832 S)

## 5.1 Function Description

The internal RF synthesizer, the RF amplifier and mixer modules on the analog unit and the adjacent-channel power meter module are used for adjacent-channel power measurements.

The adjacent-channel power meter module consists of two circuits which are almost independent of one another:

→ A 800-MHz fixed oscillator of high spectral purity with a 1:2 divider.

→ A 455-kHz IF section with the weighting filter, selectable amplifiers and an rms meter.

If a transmitter with an RF <200 MHz is to be measured, the transmitter frequency is directly converted to 455 kHz using the internal RF synthesizer. The signal quality of the internal RF synthesizer is sufficient in this frequency range to enable measurements up to approx. 80 dB.

If the transmitter frequency is in the 70-cm band (approx. 450 MHz) or in the 900-MHz band, conversion to 400 MHz or 800 MHz is required.

The adjacent-channel power measurement is made as follows (see flowchart) using the filter (E160) (the filter has a 3-dB bandwidth of approx. 3.5 kHz, a 6-dB bandwidth of approx. 4 kHz and a stopband attenuation of more than 80 dB) and several conversion processes.

Start adjacent-channel measurement

Calibration: The filter characteristic is measured using the internal RF generator. Of interest are:

- The passband peak
- The right and left 3-dB points (subfilter bandwidth)
- The right and left 6-dB points

Reference measurements: Detection of the nominal wanted channel. The subfilter bandwidth is applied to the wanted channel by means of several conversion processes. The conversion frequencies are selected such that the subfilter bandwidths are combined with the 3-dB points. With the 10-kHz and 12.5-kHz channel spacing: 2 subfilter bandwiths; with the 20-kHz channel spacing depending on the individual subfilter bandwidth: 3 or 4 subfilter bandwidths; with the 25-kHz channel spacing: 4 subfilter bandwidths.

The intermediate results (true rms values) are collected by the computer and stored.

Adjacent-channel measurement: The 6-dB point of the filter is converted to the limit of the nominal adjacent channel nearest to the carrier. Subfilter bandwidths are then added to the 3-dB points until the adjacent channel is covered. The wanted channel always remains in the stopband of the filter during these measurements.

The intermediate results are collected by the computer and stored. The computer calculates the carrier-to-unwanted power ratio from the measured value for the wanted channel and the adjacent channel.

Other measurements if necessary

Upper numeric limit reached with adjacent-channel measurements ?

No

Yes

Is it time to calibrate again ?

No

Yes

### 5.1.1 800-MHz Fixed Oscillator
(See circuit diagram 803.7832 S, sheet 1)

This part of the circuit contains a broadband phase controlled 800-MHz fixed oscillator (V70). The signal is first divided by 2 (D10) and then by 4 (D30) by coupling out with R67 and then applied to the phase comparator D35. The 100-MHz reference signal is applied to the phase comparator from X911 via line receiver D36. The loop filter N60 provides the control loop with a bandwidth of approx. 100 kHz. The 800-MHz signal from the decoupler R68 and the signal from D10 divided by 2 are applied to the RF relay K100. The 800-MHz or 400-MHz signal is applied to the LO gate of mixer E110.

Transmitter signals with frequencies <200 MHz are applied from X917 to X916 without conversion. Transmitter frequencies of approx. 450 MHz (70-cm band) are converted with 400 MHz to approx. 50 MHz and applied to X916 for further conversion. Corresponding conversion for transmitter frequencies from the 900-MHz band takes place using the 800-MHz fixed frequency. The level at X916 after conversion is the same as that at X917 before conversion.

### 5.1.2 455-kHz IF Section
(See circuit diagram 803.7832 S, sheet 2)

This part of the circuit receives the IF of 455 kHz with a level of approx. 270 mV which is amplified by V155 to approx. 1 $V_{rms}$. The ceramic filter with a pass bandwidth of approx. 4 kHz and a blocking of above 80 dB separates the wanted channel and the adjacent channel using the conversion processes carried out by the internal RF synthesizer. The circuit then contains 8 amplifier stages with a gain of 0 or 10 dB in order to drive the input of the rms meter N215 in the correct dynamic range. The rms meter is an active multiplier circuit with the same signal at both inputs (pins 5 and 9). The integration required for the rms measurement is handled by C222. Square-root extraction has been omitted which means that the DC voltage at output X1.A28 corresponds to the square of the rms input voltage at P10. The useful range of the DC voltage at output X1.A28 is between 0.5 and 5 V.

## 5.2 Testing and Adjustment

### 5.2.1 Testing the Fixed Oscillator

**Test equipment:**

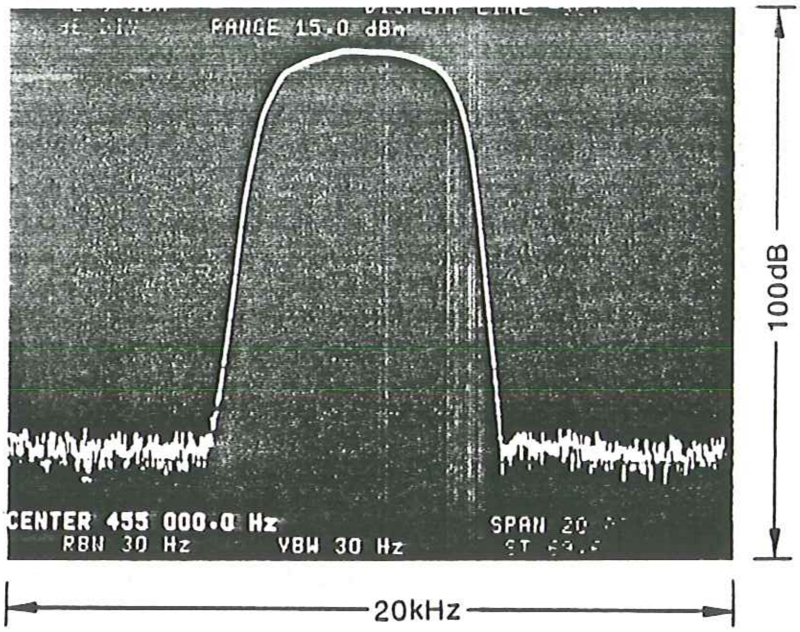
| | | |
|---|---|---|
| | RF synthesizer, e.g. SMPC | (at X917) |
| | Spectrum analyzer | (at X916) |
| | 100-MHz crystal oscillator, e.g. from the basic instrument | (at X911) |

- Apply unmodulated signal of 50 mV to X917.
- Switch relays K120 and K121 to the conversion path.
- RF analyzer setting: centre 50 MHz, span 200 kHz
- Connect K100 to the 800-MHz branch (pin 1) and set RF synthesizer to 850 MHz. A 50 MHz, 50 mV (±1 dB) signal with a high spectral purity must be measured on the RF analyzer.
- Connect K100 to the 400-MHz branch (pin 9) and adjust the RF synthesizer to 450 MHz. The RF analyzer should indicate the same signal as before.

## 5.2.2 Testing the IF Section

**Test equipment:** AF synthesizer, e.g. SPN (at X918)
DC-Voltmeter (at X1.A28)

Measure the filter characteristic over its total dynamic range using the selectable amplifiers (0 and 10 dB).




The relationship between the AC voltage and DC is logarithmic because the data are squared in the rms meter:

$$V_{DC} \text{ (logarithmic)} = \text{approx. } 10 \times \log \frac{V_{rms}}{V_{ref}} - \text{gain (dB)}$$

## 5.2.3 Adjusting the Fixed Oscillator

**Test equipment:** Spectrum analyzer
Voltmeter
100-MHz crystal oscillator
RF synthesizer

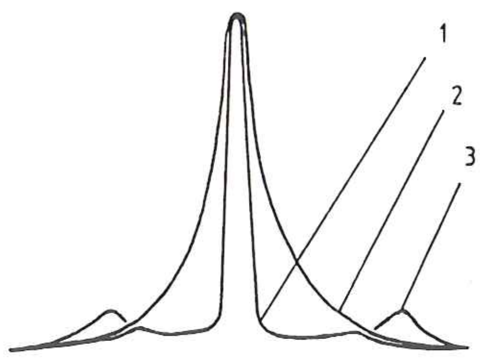
Carry out the adjustment with the cover closed, since with the cover opened other results are obtained. The test setup corresponds to that in Section 5.2.1.

### 5.2.3.1 Adjusting the Oscillator

- Apply a 100-MHz reference (ECL) to X911.
- Apply 850 MHz (50 mV) to X917.
- Connect spectrum analyzer to X916, centre 50 MHz, span 500 kHz.
- Connect voltmeter to P18.
- Set R78 and R52 to centre positions.
- Set output frequency to 800 MHz (50 MHz on analyzer) using C65 and adjust tuning voltage to 12 V ±0.5 V at P18.

### 5.2.3.2 Adjusting the Phase Control

Adjust the control bandwidth to 100 kHz using R61.




1 = correct

### 5.2.3.3 Adjusting the Level Converter

If the phase control does not lock when the power supply or the 100-MHz reference is switched on and off, the offset of the level converter must be adjusted.

→ Adjust R52 such that the PLL always locks.

### 5.2.3.4 Adjusting the Oscillator Output Power

→ Connect analyzer to K1.

→ Measure level of 400-MHz signal.

→ Set level of 800-MHz signal to the same value (approx. -7 dBm) using R78.

→ Check that both levels are the same.

### 5.2.4 Adjusting the IF Section

| | | |
|---|---|---|
| **Test equipment:** | AF synthesizer | (at X918) |
| | DC voltmeter | (at X1.A28) |
| | Oscilloscope | (at P11) |

### 5.2.4.1 Adjusting the Offset

→ Apply 0 V to X918.

→ Set all amplifiers to 10 dB.

→ Adjust to 0 V (+10 mV/-0 mV) using R222.

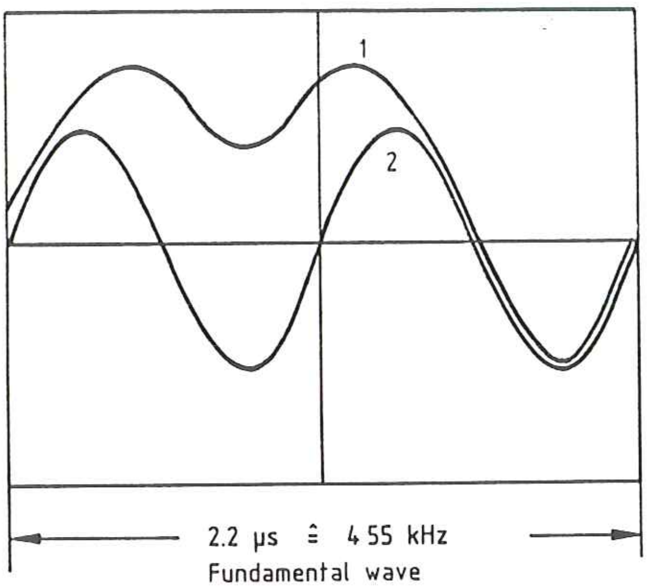
## 5.2.4.2 Adjusting the Balance

→ Apply 270 mV, 455 kHz.

→ Set all amplifiers to 0 dB.

→ Remove C222.

→ Set the following signal shape on the oscilloscope using R226.




1 = not adjusted
2 = correctly adjusted

→ Insert C222 again.

→ Check offset adjustment.

## 5.3 Interfaces

| Connectors | Input Output | De-signation | Value | Tolerance |
|---|---|---|---|---|
| X917 | I | HF | 50 mV | |
| X916 | O | HF | 50 mV | ±1 dB |
| X911 | I | 100 MHz | ECL(to +5V) | |
| X918 | I | ZF | 270 mV | |
| X1.A28 | O | DC | 0.5 to 5V*) | |
| X1.A8 | I | Data | CMOS 5 V | |
| X1.B10/A10 | I | Clock | CMOS 5 V | |
| X1.A3 | I | Strobe | CMOS 5 V | |
| X1.A1/B1 | I | +5 $V_D$ | approx. 230 mA | ±30 mA |
| X1.A13/B13 | I | +5 $V_A$ | <25 mA | |
| X1.A17/B17 | I | +15 V | approx. 60 mA | Without relay +60 mA/relay |
| X1.A19/B19 | I | -15 V | approx. 40 mA | ±10 mA |
| X1.A15/B15 | I | +24 V | approx. 4 mA | ±2 mA |

*) Useful range of input voltage