STABILOCK 4031 4032

Spectrum Analyzer

Hardware Option 248 290 / 248 291

Operating Instructions

Doc. Version: 9811-330-A

Acterna Muenchen GmbH, Gutenbergstr. 2 – 4, D-85737 Ismaning

☎ +49 (89) 9 96 41-0 Fax: +49 (89) 9 96 41-160

Supplement to operating instructions; file under Chapter 9

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Contents

☞ **For differences from former versions:** see the Lifeline at the end of this supplement.

Differences from Standard Analyzer

Incorporation of the "Spectrum Analyzer" hardware option in your Communication Test Set has given it exceptionally powerful test functions that are far superior to those of the standard analyzer. In the design of the new analyzer, special attention was paid to an intuitive style of operation so that you will be able to perform tests after just brief familiarization.

☞ Please note, now that the optional analyzer has been installed, that the standard analyzer described in Chapter 6 is no longer available. So harmonics are no longer displayed in the form of a bar chart for instance, because the new analyzer, with its large sweep width, can show harmonics direct as spectral lines.

Major differences between analyzers		
Feature	**Standard analyzer**	**Optional analyzer***
Smallest sweep width	200 kHz	10 kHz
Largest sweep width	10 MHz	875 MHz
Sweep time (for 200 kHz sweep width)	c. 2 s	c. 0.3 s (FFT)
Maximum display range	80 dB	100 dB
Harmonics measurement	bar chart	spectral lines
Level/frequency difference measurement	no	yes
Automatic tuning to peak levels	no	yes
Superimposed grid	no	yes
Superimposed stored curve	no	yes
Max Hold, Min&Max, Average functions	no	yes
Level zoom	no	yes
GSM trigger mode	no	yes

*) Please refer to the data sheet for the option for full technical details and operating instructions for combination with other options.

Signal Input

Apply the RF test signal as usual to socket RF or RF DIRECT (low-power signals to RF DIRECT, signals of P > 0.5 W to RF).

Overload risk: Watch for the critical limits when applying the test signal (see Chapter 1, "Permissible RF input power").

Calling up Analyzer

The analyzer can only be called up in TX mode:

1.	[TX]	Call up basic TX mask.
2.	[ANALYZER]	Call up main analyzer mask.

[ANALYZER] produces full-format display of the main analyzer mask. [HELP] and [PRINT] keep their usual functions (see Chapter 3).

Calling up the main mask means that the analyzer is also started. The brief reference guide at the end of these operating instructions tells you what the fields and softkeys are for.

☞ **Disabling background signaling:** The analyzer will not be started properly if, when you call it up, the background signaling of a software option is active (noticable by illumination of the green "B/SAT" LED). Remedy: before calling up the analyzer, hit [B/SAT] (LED extinguishes) to disable background signaling.

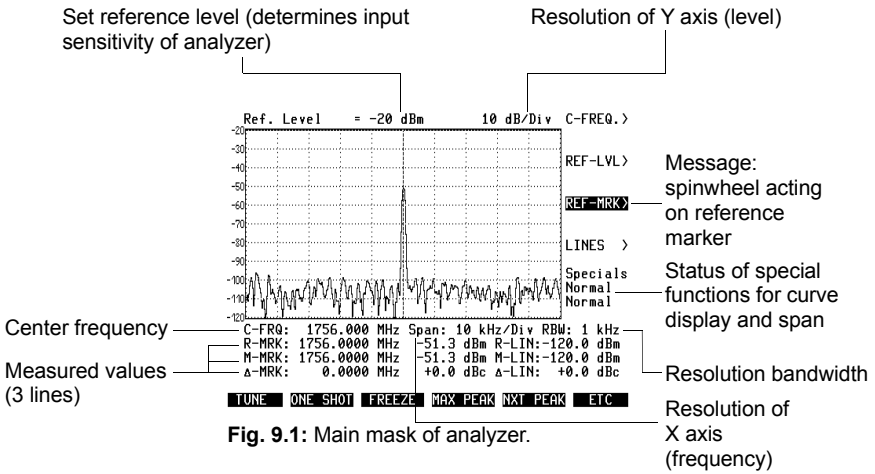

Fig. 9.1: Main mask of analyzer.

☞ The resolution bandwidth (RBW) is displayed in all analyzer masks, provided STABILOCK 4032 (4031) is supplied with a host firmware version of 6.20 (4.20) or greater.

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Meaning of Markers and Lines

In contrast to the standard analyzer, this new analyzer has two frequency markers and two level lines (lines for onscreen assistance):

Frequency markers

Vertical lines for assistance. Depending on the position of the markers, the analyzer shows the frequency and level of the marked spectral line. The two markers can be moved separately or together.

Reference marker

This is the one you need most. Use the reference marker when you want to measure the frequency and level of a spectral line.

R-MRK: 1756.0000 MHz -51.3 dBm

Measurement display: R-MRK field (frequency and level)

Measurement marker

Identical in function to the reference marker. You will need this in addition to the reference marker when you want to measure the frequency and level difference of two spectral lines.

Measurement display: M-MRK field (frequency and level)

M-MRK: 1756.0000 MHz -51.3 dBm
Δ-MRK: 0.0000 MHz +0.0 dBc

Difference display: Δ-MRK field (frequency and level difference)

Level lines

Horizontal lines for assistance. Depending on the position of the lines, the analyzer shows the associated level. The two lines can be moved separately or together.

Reference line

Use the reference line when you want to measure the level of spectral lines but do not wish to move the reference marker.

Measurement display: R-LIN field (level)

Measurement line

Identical in function to the reference line. You will need this in addition to the reference line when you want to measure level differences.

R-LIN:-120.0 dBm
M-LIN:-120.0 dBm
Δ-LIN: +0.0 dBc

Measurement display: M-LIN field (level)

Difference display: Δ-LIN field (level difference M-LIN – R-LIN)

Activating markers and lines

Frequency markers and level lines are moved with the spinwheel. So you must decide beforehand which marker or line you want to move.

First decide whether you need a frequency marker or a level line:

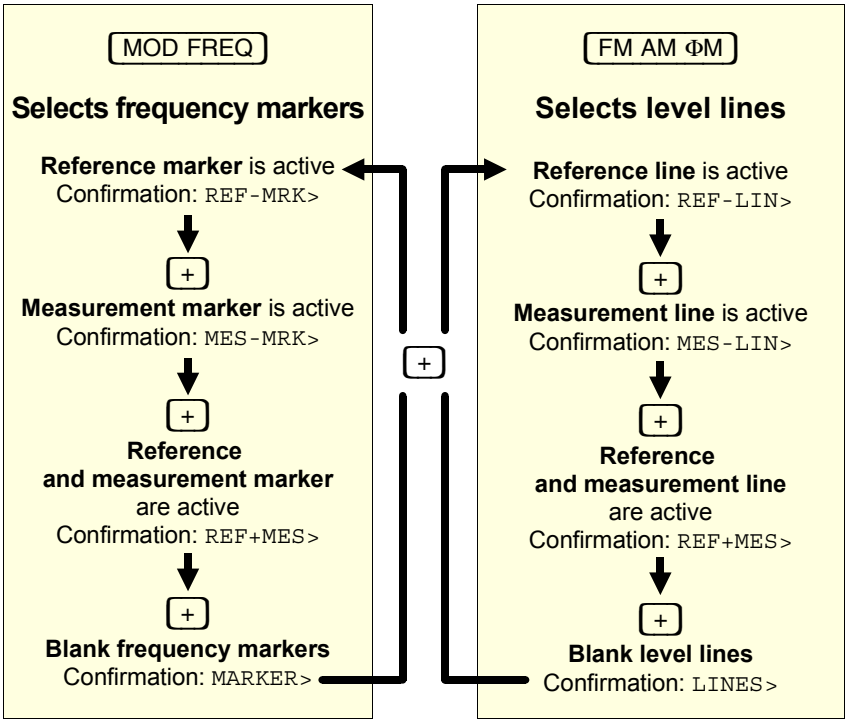
MOD FREQ

Activates frequency markers: The MARKER> scroll field becomes the active field and shows the scroll variable REF-MRK>. This indicates that the spinwheel is now acting on the reference marker.

By choosing different scroll variables (eg with +) you can activate the measurement marker or both markers at the same time. You can see the selected mode from the name of the scroll variable (see also illustration).

FM AM ΦM

Activates level lines: The LINES> scroll field becomes the active field and shows the scroll variable REF-LIN>. This indicates that the spinwheel is now acting on the reference line. The remaining procedure is identical to that for frequency markers.



Examples

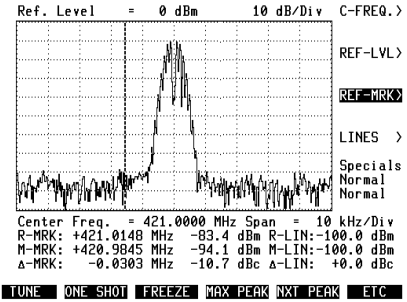


Fig. 9.2: Here only the reference marker is active (recognizable by REF-MRK> scroll variable). M-MRK field still shows measured values of last measurement-marker position.

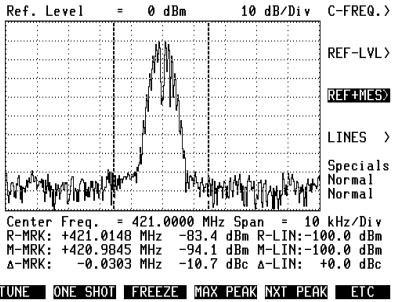


Fig. 9.3: Reference and measurement marker are active (recognizable by REF+MES> scroll variable). Turning spinwheel moves both markers synchronously.

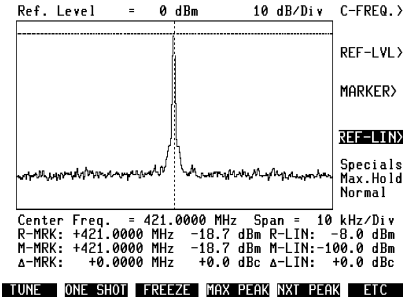


Fig. 9.4: Here only the reference line is active (recognizable by REF-LIN> scroll variable). M-LIN field still shows measured values of last measurement-line position.

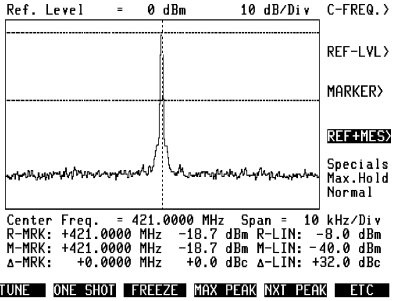


Fig. 9.5: Reference and measurement line are active (recognizable by REF+MES scroll variable). Δ-LIN field shows difference between values M-LIN and R-LIN.

Extra notes on operation

- Frequency markers and level lines are blanked: turning the spinwheel always causes the reference marker to appear.
- When you bring them back onscreen, frequency markers and level lines appear at the position last set.
- When you blank frequency markers or level lines, the numeric display of the measured value stays. Measured values apply to the position last set. They are not updated until you reposition markers or lines.

Basic Settings

Basic settings are normally made just once when you start to test and then hardly need to be altered any more.

Selecting input

Unlike with the standard analyzer, selection of the RF input socket is not made in the main mask but in a newly added mask.

1.	ANALYZER	Call up SETTINGS mask. Here you can make special settings. But, to begin with, only the softkeys in this mask are of importance.
2.	RF or RF DIR	Couple required RF socket.
3.	RETURN	Return to main mask.

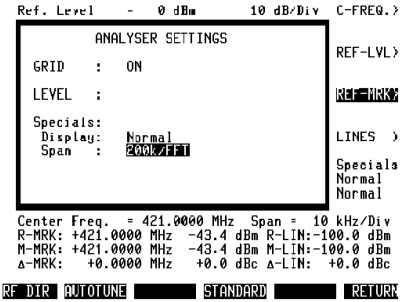


Fig. 9.6: SETTINGS mask. Calling up this mask gives softkeys different functions to those of main mask.

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Setting center frequency

Entering the center frequency tunes the analyzer to the required frequency band. The center of the analyzer window is placed precisely on the center frequency. Instead of frequencies, you can also work with channel numbers if you make the appropriate declarations in the GENERAL PARAMETERS mask.

☞ The sweep width can affect the setting of the center frequency (see "Selecting sweep width").

There are the following possibilities when tuning the analyzer to the center frequency:

Direct tuning to entry	
Allround method. Gets you where you want to go no matter what the current operating mode is.	
1. FREQUENCY	`Center Freq.` field becomes entry field.
2. <value>	Enter required frequency on numeric keypad or set it with spinwheel.
3. ENTER	Confirm entry with ENTER. If current sweep width will not allow entered center frequency, value is corrected automatically to nearest permissible center frequency (see "Selecting sweep width").
Tuning to position of reference marker	
Useful when you want to tune to the value of the reference frequency.	
1. Preparation	Set reference marker to required position with spinwheel.
2. TUNE	Tune analyzer to reference frequency. **Note:** When working with channel numbers, do not tune automatically. Channel number/frequency assignment requires a frequency spacing that cannot always be maintained in automatic tuning.
Tuning to peak level	
Useful when the input signal is unknown (see "Selecting reference level").	
1. ANALYZER	Call up SETTINGS mask.
2. AUTOTUNE	Searches entire frequency spectrum, outside of momentarily visible band too, for highest level and tunes analyzer to this signal. **Note:** AUTOTUNE is only possible if the RF socket is coupled.
3. RETURN	Return to main mask.

Selecting reference level

When you select the reference level, you determine the input sensitivity of the analyzer. The lower the figure, the higher is the sensitivity.

1. (LEVEL)	`Ref. Level` scroll field becomes entry field.
2. Select scroll variable	Choose required reference level, eg with (UNIT/SCROLL). Level values (scroll variables) presented will depend on coupled RF socket: RF: `+50` to `-20 dBm` RF DIRECT: `+20` to `-40 dBm` Increment: 10 dBm

How to make the right choice

Select the reference level so that the most powerful signal component just falls short of overdriving the analyzer. This will be the case when the highest spectral line is just below the top edge of the analyzer window. Choosing the reference level like this makes optimum use of the display range of the analyzer.

If the analyzer is overdriven, it may not display the frequency spectrum correctly. Spectral components can appear, for instance, that are not really present.

☞ **Concealed level peaks:** The input stage of the analyzer is broadband. This means that signal components outside of the visible band may go unnoticed in causing overdriving. Remedy: search the frequency band with (AUTOTUNE) for the most powerful signal component and select the reference level accordingly (see "Setting center frequency").

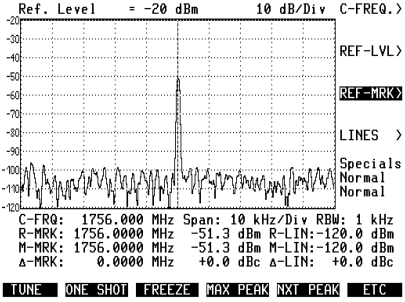


Fig. 9.7: Here the reference level is chosen correctly. The most powerful signal component remains just below the top edge of the analyzer window.

Selecting sweep width

The sweep width (span) determines frequency resolution in the spectrum displayed. The lower the figure, the higher is the resolution and the smaller the displayed frequency segment.

1. Preparation	Position cursor on `Span` scroll field.
2. Select scroll variable	Choose required sweep width (span per scale division), eg with [UNIT/SCROLL]. Refer to table (column 1) for available scroll variables. Depending on the span, there will be different limits for the permissible center frequency (see table).

☞ **Automatic post-tuning:** If the center frequency and reference frequency do not agree and the span is reduced, the analyzer adopts the reference frequency as the new center frequency. Normally this is an advantage, because the marked signal component is automatically displayed with higher resolution. In unfavorable cases, however, this post-tuning may shift the observed frequency band outside of the window, which will make retuning necessary.

Relationship between span, permissible center frequency and resolution
Valid for STABILOCK 4031/4032 **without** the "2.3-GHz-Frequency Extension" hardware option

Span per div	Span total	Perm. center frequency [MHz]		1 pixel is
		Minimum	Maximum	
1 kHz/Div	10 kHz*)	0.4050	998.9950	25 Hz
2 kHz/Div	20 kHz*)	0.4100	998.9900	50 Hz
5 kHz/Div	50 kHz*)	0.4250	998.9750	125 Hz
10 kHz/Div	100 kHz*)	0.4500	998.9500	0.25 kHz
20 kHz/Div	200 kHz*)	0.5000	998.9000	0.50 kHz
20 kHz/Div	200 kHz	0.5000	998.9000	0.50 kHz
50 kHz/Div	500 kHz	0.6500	998.7500	1.25 kHz
100 kHz/Div	1 MHz	0.9000	998.5000	2.50 kHz
200 kHz/Div	2 MHz	1.0400	998.0000	5.00 kHz
500 kHz/Div	5 MHz	2.5400	996.5000	12.50 kHz
1 MHz/Div	10 MHz	5.0400	994.0000	25.00 kHz
2 MHz/Div	20 MHz	10.0400	989.0000	50.00 kHz
5 MHz/Div	50 MHz	150.0000	974.0000	125.00 kHz
10 MHz/Div	100 MHz	175.0000	950.0000	250.00 kHz
20 MHz/Div	200 MHz	225.0000	900.0000	500.00 kHz
50 MHz/Div	500 MHz	375.0000	750.0000	1.25 MHz
100 MHz/Div	875 MHz	500.0000	500.0000	2.50 MHz

*) FFT span

Relationship between span, permissible center frequency and resolution
Valid for STABILOCK 4031/4032 (serial number ≤ 1588999)
with the "2.3-GHz-Frequency Extension" hardware option

Span per div	Span total	Perm. center frequency [MHz]		1 pixel is
		Minimum	Maximum	
1 kHz/Div	10 kHz*)	0.4050	2299.995	25 Hz
2 kHz/Div	20 kHz*)	0.4100	2299.990	50 Hz
5 kHz/Div	50 kHz*)	0.4250	2299.975	125 Hz
10 kHz/Div	100 kHz*)	0.4500	2299.950	0.25 kHz
20 kHz/Div	200 kHz*)	0.5000	2299.900	0.50 kHz
20 kHz/Div	200 kHz	0.5000	998.9000	0.50 kHz
50 kHz/Div	500 kHz	0.6500	998.7500	1.25 kHz
100 kHz/Div	1 MHz	0.9000	998.5000	2.50 kHz
200 kHz/Div	2 MHz	1.0400	998.0000	5.00 kHz
500 kHz/Div	5 MHz	2.5400	996.5000	12.50 kHz
1 MHz/Div	10 MHz	5.0400	994.0000	25.00 kHz
2 MHz/Div	20 MHz	10.0400	989.0000	50.00 kHz
5 MHz/Div	50 MHz	150.0000	974.0000	125.00 kHz
10 MHz/Div	100 MHz	175.0000	950.0000	250.00 kHz
20 MHz/Div	200 MHz	225.0000	900.0000	500.00 kHz
50 MHz/Div	500 MHz	375.0000	750.0000	1.25 MHz
100 MHz/Div	875 MHz	500.0000	500.0000	2.50 MHz

*) FFT span

Relationship between span, permissible center frequency and resolution
Valid for STABILOCK 4031/4032 (serial number ≥ 1688000)
with the "2.3-GHz-Frequency Extension" hardware option

Span per div	Span total	Center frequency [MHz]		Center frequency [MHz] PCS range		1 pixel is
		Minimum	Maximum	Minimum	Maximum	
1 kHz/Div	10 kHz*)	0.4050			2299.995	25 Hz
2 kHz/Div	20 kHz*)	0.4100			2299.990	50 Hz
5 kHz/Div	50 kHz*)	0.4250			2299.975	125 Hz
10 kHz/Div	100 kHz*)	0.4500			2299.950	0.25 kHz
20 kHz/Div	200 kHz*)	0.5000			2299.900	0.50 kHz
20 kHz/Div	200 kHz	0.5000	998.9000	1790.000	2020.000	0.50 kHz
50 kHz/Div	500 kHz	0.6500	998.7500	1790.000	2020.000	1.25 kHz
100 kHz/Div	1 MHz	0.9000	998.5000	1790.000	2020.000	2.50 kHz
200 kHz/Div	2 MHz	1.0400	998.0000	1790.000	2020.000	5.00 kHz
500 kHz/Div	5 MHz	2.5400	996.5000	1790.000	2020.000	12.50 kHz
1 MHz/Div	10 MHz	5.0400	994.0000	1790.000	2020.000	25.00 kHz
2 MHz/Div	20 MHz	10.0400	989.0000	1790.000	2020.000	50.00 kHz
5 MHz/Div	50 MHz	150.0000	974.0000	1790.000	2020.000	125.00 kHz
10 MHz/Div	100 MHz	175.0000	950.0000	1790.000	2020.000	250.00 kHz
20 MHz/Div	200 MHz	225.0000	900.0000	1790.000	2020.000	500.00 kHz
50 MHz/Div	500 MHz	375.0000	750.0000	–	–	1.25 MHz
100 MHz/Div	875 MHz	500.0000	500.0000	–	–	2.50 MHz

*) FFT span

Important notes on sweep width

Depending on the selected span, the analyzer uses different techniques for the best possible display of the spectrum:

- The spectrum is detected with a fixed synthesized frequency (IF: 120 kHz) and calculated by a fast Fourier transform (FFT).
- The spectrum is detected with a swept synthesized frequency and evaluated by zero down-conversion.

☞ The different techniques result in a number of peculiarities that you should be familiar with when working with the analyzer. These peculiarities are relevant when you do not want to examine the (normally) well filtered transmit signals of radios with your Communication Test Set but random signals with a large share of harmonics.

Span/div	Technique*)		Peculiarities				
	FFT	Zero down-conversion	Display range 100 dB (otherwise 80 dB)	Image reception 240 kHz below test signal	f_{center} < 125 MHz: mixture products ≤ –10 dBc	f_{center} ≥ 125 MHz: mixture products ≤ –50 dBc	Smallest start frequency 125 MHz
1 kHz	✘		✘	✘	✘	✘	
2 kHz	✘		✘	✘	✘	✘	
5 kHz	✘		✘	✘	✘	✘	
10 kHz	✘		✘	✘	✘	✘	
20 kHz	(✘)	✘		(✘)	✘	✘	
50 kHz		✘			✘	✘	
100 kHz		✘			✘	✘	
200 kHz		✘			✘	✘	
500 kHz		✘			✘	✘	
1 MHz		✘			✘	✘	
2 MHz		✘			✘	✘	
5 MHz		✘				✘	✘
10 MHz		✘				✘	✘
20 MHz		✘				✘	✘
50 MHz		✘				✘	✘
100 MHz		✘				✘	✘
(✘) = at 20 kHz/div it is possible to switch to FFT (see "Testing Aids")							

*) If the Communications Test Set is fitted with the "2.3-GHz-Frequency Extension" hardware option, please see the tables on page 9-15.

Explanations to table

Display range Use the large display range with a small span when the signal spectrum contains very large and very small spectral components (eg when measuring the harmonics of a fundamental).

Image reception If, when the signal spectrum is unknown, you suspect that you are seeing an image frequency, check by using a larger span (≥ 20 kHz/div).

Mixture products At center frequencies f_{center} < 125 MHz there is only relatively weak damping (10 dBc) of harmonic mixture products. The span is only important in as much as a center frequency of < 125 MHz is not permissible from 5 MHz/div onwards.

Example: center frequency = 50 MHz

There is a 150-MHz signal on the input. The analyzer shows an harmonic mixture product at 50 MHz that is 10 dBc weaker than the level of the 150-MHz signal.

At center frequencies $f_{center} \geq 125$ MHz the attenuation of harmonic mixture products increases to 50 dBc.

Example: center frequency = 200 MHz

There is a 600-MHz signal on the input. The analyzer shows an harmonic mixture product at 200 MHz that is 50 dBc weaker than the level of the 600-MHz signal.

Start frequency Up to a span of 2 MHz/div the analyzer will allow 0.4 MHz as the smallest start frequency (start frequency = frequency at left edge of window). From 5 MHz span the start frequency increases to 125 MHz.

Note: Testing is possible in the frequency band 0.4 to 2 MHz, but the specifications of the analyzer only apply from 2 MHz onwards (see "Technical Data").

Activating grid

A grid can be superimposed on the main mask of the analyzer for easier orientation.

☞ **Grid conceals level lines:** It is better to disable the grid if you are working with level lines.

1.	[ANALYZER]	Call up SETTINGS mask.
2.	Preparation	Position cursor on GRID scroll field.
3.	Select scroll variable	Choose required function, eg with [UNIT/SCROLL]. ON: grid superimposed OFF: grid disabled
4.	[RETURN]	Return to main mask.

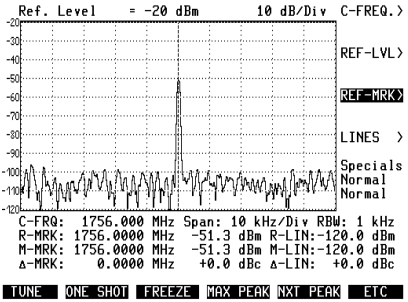


Fig. 9.8: Grid ON.

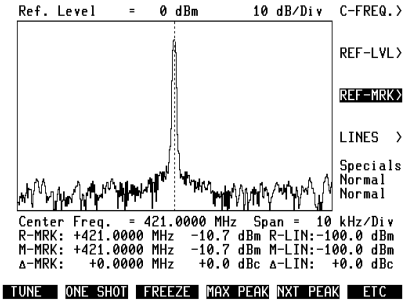


Fig. 9.9: Grid OFF.

Applications

This section looks at typical analyzer applications. The instructions detail all the steps in operation immediately after calling up the analyzer. So, depending on where you are, some steps may be omitted, or additional ones may be necessary.

Measuring frequency and level with reference marker

1.	Basic settings	See section "Basic Settings".
2.	MOD FREQ	Activate reference marker.
3.	Position marker	Position reference marker on required spectral line with spinwheel.

Read measured values from `R-MRK` field (frequency and level)

Measuring frequency and level with measurement marker

Sometimes it may be better not to alter the position of the reference marker (see section "Selecting sweep width"). Use the measurement marker instead.

1.	Basic settings	See section "Basic Settings".
2.	MOD FREQ + (+)	Activate measurement marker.
3.	Position marker	Position measurement marker on required spectral line with spinwheel.

Read measured values from `M-MRK` field (frequency and level)

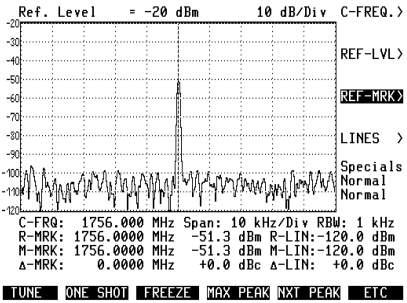


Fig. 9.10: Frequency/level measurement with reference marker.

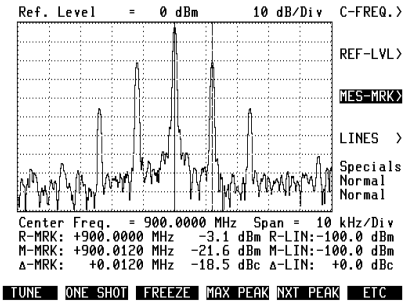


Fig. 9.11: Frequency/level measurement with measurement marker.

Measuring frequency/level difference

1.	Basic settings	See section "Basic Settings".
2.	MOD FREQ	Activate reference marker.
3.	Position marker	Position reference marker with spinwheel as required, eg on one of two spectral lines whose frequency and level difference is to be measured.
4.	+	Activate measurement marker.
5.	Position marker	Position measurement marker with spinwheel as required, eg on second spectral line.

Read measured values from Δ-MRK field (frequency and level difference)

Measuring level with reference line

Use the reference line to measure the level of different components in the displayed spectrum. Compared to measuring with a marker, this method is very much faster if the spectral components of interest are similar in level but far apart.

1.	Basic settings	See section "Basic Settings".
2.	FM AM ΦM	Activate reference line.
3.	Position line	Position reference line with spinwheel as required.

Read measured value from R-LIN field

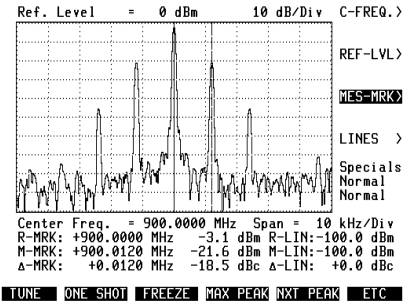


Fig. 9.12: Measuring frequency/level difference (Δ-MRK = M-MRK – R-MRK).

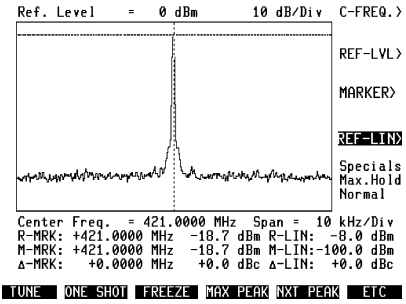


Fig. 9.13: Measuring level with reference line (R-LIN field).

Measuring harmonics

The analyzer can measure harmonics in different ways. A fast method is that of detection and measurement with the Next Peak function (see "Testing Aids"). For precise measurement with 100 dB display range the following method is better however.

1.	Basic settings	See section "Basic Settings". For large display range, select span ≤10 kHz/div. Center frequency = fundamental.
2.	FM AM ΦM	Activate reference line.
3.	Position line	Position reference line with spinwheel on peak of fundamental.
4.	+	Activate measurement line.
5.	Position line	Position measurement line with spinwheel on spectral line of 1st harmonic. Tune analyzer to harmonic beforehand as necessary.
6.	Measure 1st harmonic	Read measured levels from fields M-LIN (absolute) and Δ-LIN (relative).
7.	Repeat steps 5 + 6 for 2nd and following harmonics	Read measured levels from fields M-LIN (absolute) and Δ-LIN (relative).

Displaying tolerance window

Frequency markers and level lines are highly suitable for displaying an onscreen window. If such a window is defined as a tolerance window, you can see at a glance whether a spectrum is in the permissible range.

1.	Basic settings	See section "Basic Settings".
2.	MOD FREQ	Activate reference marker.
3.	Position marker	Position reference marker with spinwheel.
4.	+	Activate measurement marker.
5.	Position marker	Position measurement marker with spinwheel.
6.	FM AM ΦM	Activate reference line.
7.	Position line	Position reference line with spinwheel.
8.	+	Activate measurement line.
9.	Position line	Position measurement line with spinwheel.

Testing Aids

The analyzer offers you various testing aids so that you can work faster and with greater ease.

Call up testing aids with the softkeys of the main mask (ETC shows the second softkey level, RETURN takes you back to the first level), or select the required scroll variable in the SETTINGS mask.

Testing aid	Meaning
ZOOM	Resolution ten times higher (Y axis).
MAX PEAK and NXT PEAK	Reference and measurement marker are positioned on highest level peak in *displayed* range. They can then be positioned on the next highest level peaks.
ONE SHOT	Spectrum is recorded one time (necessary for AUTORUN and controller mode).
FREEZE	Analysis of signals that are not constantly present.
STORE and RECALL	Comparison of two spectra by superimposed display onscreen.
Max. Hold display	Measurement of briefly appearing peak levels.
Min&Max display	Display of extreme figures when spectral display fluctuates.
Average display	Settling of spectral display (blanking of brief interfering signals).
Special sweep modes	Short sweep time with span = 20 kHz/div. Trigger mode for GSM bursts.

High level resolution

1. (FM AM ΦM)	Activate reference line.
2. Position line	Position reference line just above tip of spectral line to be measured. **Note on very small spectral lines:** Do not position the reference line in the *bottom* part of the scale, otherwise the zoom display will not be correct (remedy: if permissible, reduce reference level).
3. (ETC) + (ZOOM)	Call up second softkey level of main mask and hit (ZOOM). Peak of spectral line is now displayed with tenfold level resolution (1 dB/div). If necessary, adjust reference line and read measured figure from R-LIN field. **Note on Ref. Level:** In zoom mode the relationship "Ref. Level ≙ upper edge of window" *does not* apply (no visual estimation of level). In zoom mode the display range of the analyzer is fully maintained, ie the reference line may be shifted to any position (no matching of reference level necessary).
4. (ZOOM OFF)	Return to standard resolution.

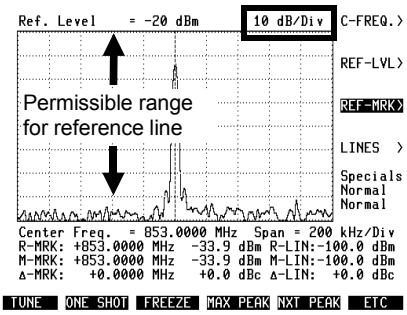


Fig. 9.14: Curve with 10 dB/div standard resolution.

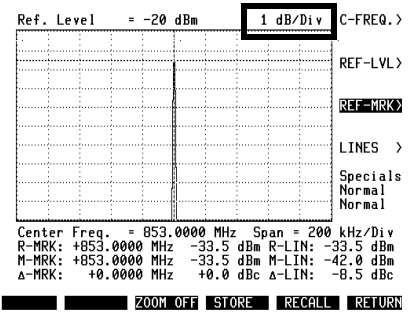


Fig. 9.15: Same curve displayed with high level resolution.

9

Tuning to level peaks

With the automatic tuning to level peaks you can very quickly position the measurement marker on the harmonics of a fundamental for example.

1. (MAX PEAK)	Reference and measurement marker are activated automatically and positioned on spectral component with highest level. Level peaks outside of displayed range are *ignored*!
2. (NXT PEAK)	Measurement marker is positioned on spectral component with next highest level. Level peaks outside of displayed range are *ignored*! Reference marker remains on spectral component with highest level.

Performing one-shot measurements

If the analyzer is not operated manually but remotely controlled, it is necessary to be able to record a specific spectrum.

1. (ONE SHOT)	Starts recording of spectrum and freezes display onscreen.
2. (CONTIN)	Triggers continuous measurement again.

Freezing spectrum

This function is useful, for instance, if a signal spectrum or single spectral lines only appear briefly. (FREEZE) automatically couples the AF signal analysis so that aural monitoring of the modulation signal is possible at the same time as visual transmitter tuning.

1. (FREEZE)	Freezes momentarily displayed spectrum onscreen. AF signal analysis is coupled automatically to DEMOD signal path (aural monitoring of modulated signals). Tune reference marker (transmitter search) with spinwheel.
2. (CONTIN)	Triggers continuous measurement again.

Storing spectrum

1. (STORE)	Stores momentarily displayed signal spectrum in main memory of Communication Test Set. Only contents of window are stored, ie without any markers and lines that are present.

Recalling stored spectrum

1. (RECALL)	Recalls signal spectrum, previously stored with (STORE), to window of analyzer. If window shows another spectrum before recall, this will stay onscreen (both spectra are displayed superimposed on one another). But all settings and numeric measured figures only apply to test signal that is being fed in. **Note:** If you want to compare two spectra correctly, no changes may be made to reference level, span and center frequency after storing one of the spectra.
2. (CLEAR)	Clears recalled signal spectrum from screen.

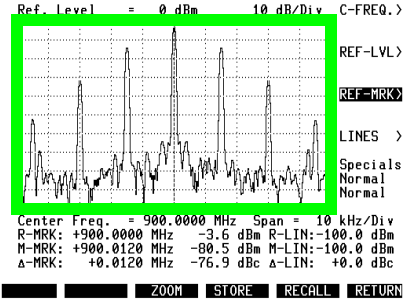


Fig. 9.16: (STORE) stores marked area of main mask (window).

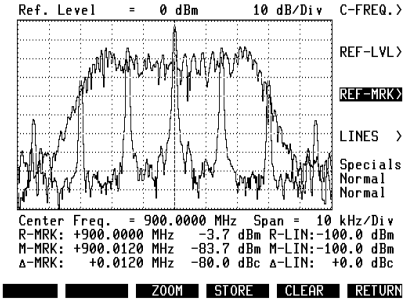


Fig. 9.17: Superimposed display of two signal spectra.

Max. Hold function

When the Max. Hold function is called up, the analyzer does not show the momentary signal spectrum but instead, in every pixel column, the maximum figures appearing in the period of observation. In this way you can document interference peaks, for instance, without having to watch the screen continuously.

1. (ANALYZER)	Call up SETTINGS mask.
2. `Display` field	Position cursor on `Display` scroll field.
3. Select `Max.Hold` variable	Choose scroll variable, eg with (+).
4. (RETURN)	Return to main mask. `Specials` display field confirms that Max. Hold function is now effective. **Disabling function:** select `Normal` scroll variable or hit (STANDARD).

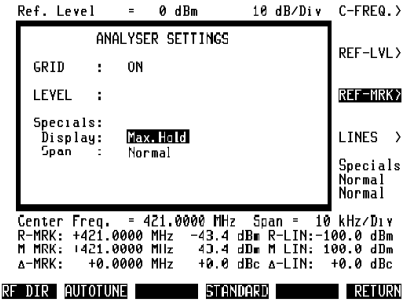


Fig. 9.18: Select `Max.Hold` scroll variable in `Display` field.

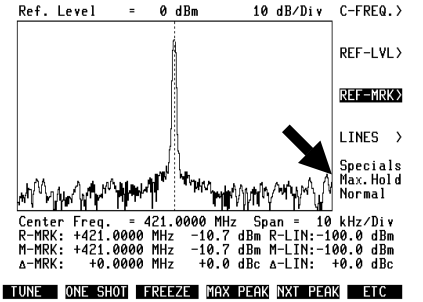


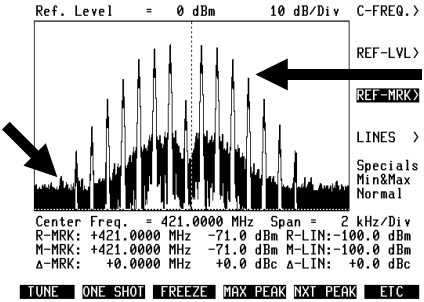
Fig. 9.19: Main mask indicates selected special setting.

Min&Max function

When the Min&Max function is called up, the analyzer does not show the momentary signal spectrum but instead the minimum and maximum figures appearing in the period of observation. In each pixel column the two extremes are joined by a line so that vertical fluctuations of the spectrum show clearly as a band.

1. (ANALYZER)	Call up SETTINGS mask.
2. `Display` field	Position cursor on `Display` scroll field.
3. Select `Min&Max` variable	Choose scroll variable, eg with (+).
4. (RETURN)	Return to main mask. `Specials` display field confirms that Min&Max function is now effective. **Disabling function:** select `Normal` scroll variable or hit (STANDARD).

Dark band indicates heavy fluctuation in lower range of signal spectrum.



These strong spectral lines are not subject to any fluctuation with time.

Fig. 9.20: Min&Max display of signal spectrum.

AVG (averaging) function

When the AVG function is called up, the analyzer does not show the momentary signal spectrum but instead, in every pixel column, the average figure of the particular spectral line. The average is formed from an adjustable number of previous one-shot measurements. In this way, for instance, you can blank briefly appearing interference peaks when displaying a static spectrum.

The AVG function may not be used for dynamic signal spectra because the averaging would corrupt the display.

1. (ANALYZER)	Call up SETTINGS mask.
2. `Display` field	Position cursor on `Display` scroll field.
3. Select `AVG xxx` variable	Choose scroll variable, eg with (+). `xxx = Slow` (50 measurements) `Med` (20 measurements) `Fast` (5 measurements)
4. (RETURN)	Return to main mask. `Specials` display field confirms that AVG function is now effective. **Disabling function:** select `Normal` scroll variable or hit (STANDARD).

☞ With the `Slow` setting you should remember that 50 measurements can take a relatively long time. On a sweep width of 100 MHz/div the analyzer requires about 1.5 s for one measurement. This means that it will take the analyzer about 75 s to show correctly a spontaneously performed change in the level of the input signal (after this time there is no more averaging with the "old" level values). Remedy: restart the analyzer (eg (FREEZE) + (CONTIN)); this always produces averaging with "fresh" measured values.

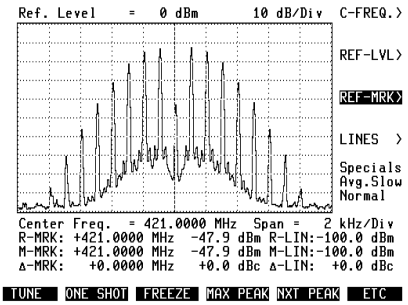


Fig. 9.21: Same spectrum as for Min&Max function but averaged over 50 measurements.

200-kHz FFT

Normally the analyzer works with a sweep width of 20 kHz/div with zero down-conversion (total sweep width: 200 kHz). A one-shot measurement then takes about 0.6 s. The analyzer is faster (about 0.3 s) if you choose FFT (fast Fourier transform). Because of the risk of image frequencies however, be sure to refer to the section "Important notes on sweep width".

1. (ANALYZER)	Call up SETTINGS mask.
2. `Span` field	Position cursor on `Span` scroll field.
3. Select `200k/FFT` variable	Choose scroll variable, eg with (+).
4. (RETURN)	Return to main mask. `Specials` display field confirms that 200k/FFT function is now effective (20 kHz/div). **Disabling function:** select `Normal` scroll variable or hit (STANDARD).

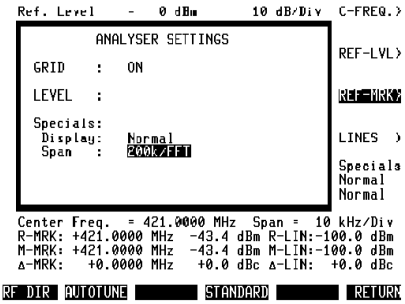


Fig. 9.22: Select `200k/FFT` scroll variable in `Span` field.

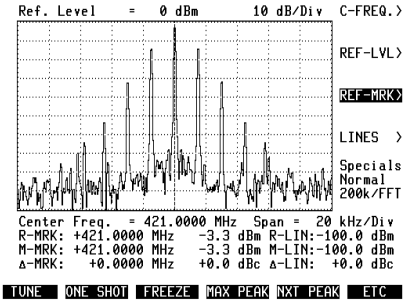


Fig. 9.23: Main mask indicates selected special setting.

GSM trigger mode

This mode is intended for adjustment of the I/Q modulators of GSM mobiles. For this purpose the mobile must first be made to emit RF carrier bursts (GMSK modulation: continuous sequence of 1s or 0s). The analyzer will then show the spectrum of the carrier bursts (**Fig. 9.24**)

☞ **Trigger condition:** The analyzer triggers at 25% of P_{max} and awaits the typical GSM burst.

In GSM trigger mode the sweep width is automatically 20 kHz/div (FFT) (see section "200-kHz FFT").

1. (ANALYZER)	Call up SETTINGS mask.
2. `Span` field	Position cursor on `Span` scroll field.
3. Select `GSM Trig` variable	Choose scroll variable, eg with (+).
4. (RETURN)	Return to main mask. `Specials` display field confirms that GSM trigger function is now effective. Span is 20 kHz/div.
5. Set center frequency	Set center frequency to 902 MHz.
6. Apply GSM carrier bursts	Analyzer shows two sidebands at 902 MHz ± 67.71 kHz. Residual carrier and lower sideband can now be adjusted to minimum. **Disabling function:** select `Normal` scroll variable in SETTINGS mask or hit (STANDARD).

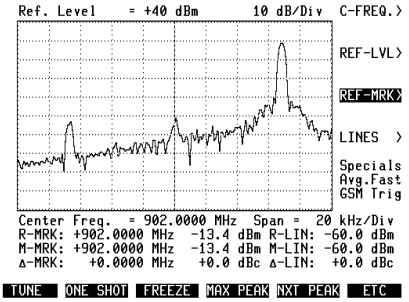


Fig. 9.24: Spectral display of RF carrier bursts of GSM mobiles.

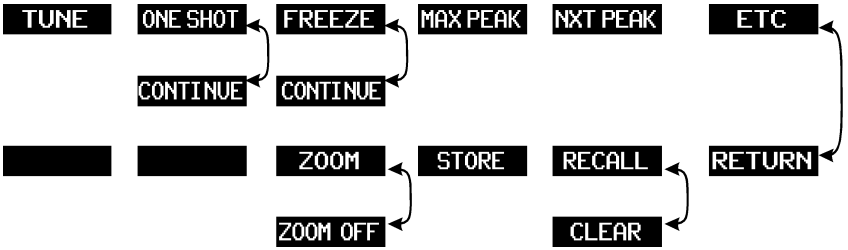
Brief Reference

Entry fields		
Field	**Meaning**	
Numeric entry fields		
Center Freq.	Positions analyzer window on frequency axis.	
Scroll fields (main mask)		
Ref. Level	Determines input sensitivity. The smaller the figure, the higher the sensitivity (risk of overdriving!).	
Span	Determines frequency resolution of displayed spectrum.	
Scroll fields (setting mask)	**Variables**	**Meaning**
GRID	ON/OFF	Inserts or removes grid in window.
LEVEL	—	No function at present
Display	MAX.HOLD	Spectrum shows maximum values appearing in period of observation.
	MIN&MAX	Spectrum shows maximum and minimum values appearing in period of observation.
	AVG Slow	Analyzer shows average of last 50 spectral displays.
	AVG Med	Analyzer shows average of last 20 spectral displays.
	AVG Fast	Analyzer shows average of last 5 spectral displays.
Span	200k/FFT	Sweep width is 200 kHz (FFT).
	GSM Trig	GSM trigger mode with sweep width 200 kHz (FFT)

Softkeys	
Softkey	**Meaning**
Main mask	
(TUNE)	Tunes analyzer center frequency to position of reference marker.
(ONE SHOT)	Executes one-shot measurement and freezes display. (CONTINUE) enables continuous measurements again.
(FREEZE)	Momentary display is frozen and DEMOD signal path is cut in (aural monitoring). (CONTINUE) enables continuous measurements again.
(MAX.PEAK)	Positions reference and measurement marker on maximum level in visible spectrum.

Softkeys	
Softkey	**Meaning**
NXT.PEAK	Positions measurement marker on next highest component in visible spectrum.
ETC ↔ RETURN	Switches between first and second softkey level.
ZOOM ↔ ZOOM OFF	Spectrum (below reference line) is displayed with 1 dB level resolution.
STORE	Stores curve of spectrum (internally).
RECALL ↔ CLEAR	Recalls previously stored curve to window (alternative function: clear).
SETTINGS mask	
RF ↔ RF DIR	Couples RF input socket.
AUTOTUNE	Searches entire frequency range for strongest spectral component and tunes analyzer center frequency to this component.
STANDARD	Sets all scroll variables to defaults.
RETURN	Returns to main mask and restarts with current settings.

Softkeys of main mask



Softkeys of SETTINGS mask

Function of keys	
Key	**Meaning**
ANALYZER	Dual function: calls up analyzer. If this is already called up, calls up SETTINGS mask.
FREQUENCY	`Center Freq.` becomes current entry field.
LEVEL	`Ref. Level` becomes current entry field.
MOD FREQ	Activates reference marker.
FM AM ΦM	Activates reference line.

IEEE Commands

Command	Meaning
ANALZ	Calls up analyzer, proceeding from TX mode. If analyzer is already called up, calls up SETTINGS mask.
Main mask	
WRTVA01,+/-n dBm	Sets reference level to n dBm (n = one of permissible scroll variables).
WRTVA02,n MHz	Sets center frequency to n MHz.
WRTVA03,n kHz/div	Sets span (n = one of permissible scroll variables).
SOFT_name	Hits softkey by program.
MARKP x	Positions reference marker. Entry in pixels (x = 0 – 400, 0 = left).
MARKF x	Positions reference marker (x = frequency).
LINEP x	Positions reference line. Entry in pixels (x = 16 – 160, 160 = top).
PEAKxs	Search for peak: x = type of peak (M = max, N = next) s = search direction from present position (L = left, R = right, B = both)
Setting mask	
WRTVA01,oN/oFf	Grid on/off
WRTVA03,n	Setting in `Display` scroll field (n = one of permissible scroll variables)
WRTVA04,n	Setting in `Span` scroll field (n = one of permissible scroll variables)
SOFT_name	Hits softkey by program.

RESULT query

Result	Meaning
RESULT5	Reference-marker frequency (R-MRK, frequency field) in MHz
RESULT6	Reference-marker level (R-MRK, level field) in dBm
RESULT7	Measurement-marker frequency (M-MRK, frequency field) in MHz
RESULT8	Measurement-marker level (M-MRK, level field) in dBm
RESULT9	Offset frequency (Δ-MRK, frequency field) in MHz
RESULTA	Offset level (Δ-MRK, level field) in dBc

Lifeline

The chronological lifeline tells you what modifications have been made to the hardware (HW) and the operating instructions. After a hardware update the lifeline helps you to find out quickly about all major changes (see code) in the updated operating instructions that are supplied.

Code: C = Correction, IN = Important Note, NF = New Feature

Doc. Version	Δ pages	Code	Changes
9701-100-A	9-15	IN	Refer to "2.3-GHz-Frequency Extension".
9706-100-A	9-15	NF	Additional informations about FEX.
	9-14	C	Corrected values in the table.
9809-320-A	9-6	NF	RBW displayed in all analyzer masks.
9811-330-A	no	NF	Supports ACPM for TETRAPOL via command [7000B0].
	no	NF	CRT version response [079000] returns software version 3.30 instead of 3a20.