Frequency Conversion Measurements with Vector Network Analyzer ZVR

Application Note 1EZ27_0L

Subject to change

23 October 1996, Peter Kraus

Products:

ZVR incl. Option ZVR-B4

ZVRE incl. Option ZVR-B4

ZVRL incl. Option ZVR-B4

ROHDE&SCHWARZ

Measurements on a double-converting front-end

1 Front-end block diagram

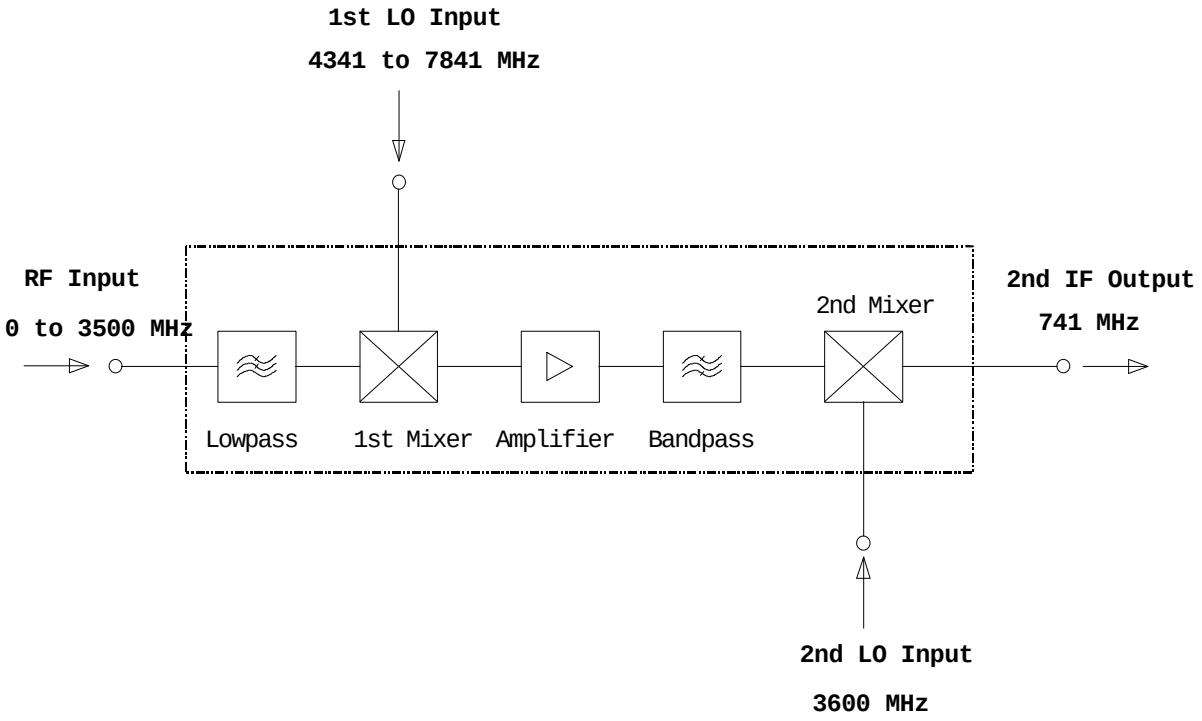

Fig. 1: Block diagram of DUT

Vector Network Analyzer ZVR is able to control two external generators via the IEC/IEEE bus in the frequency conversion mode. This feature allows to make automatic measurements on DUTs with up to two frequency converters. For the measurement of the conversion response over the whole frequency range, one of the two generators must be swept. Since this frequency variation is controlled via the IEC/IEEE bus, the sweep time must be increased (automatically) depending on the used generator. Very short sweep time is possible by the use of a generator SME or SMP and the IEC+TTL remote mode. In this case the generator operates in the frequency list mode triggered by ZVR.

In order to obtain a high accuracy of frequency conversion measurements, the option *Power Calibration* ZVR-B7 is necessary. With this option the frequency response of the internal source and front-end of the ZVR will be corrected. Therefore errors at different input and output frequencies are avoided. S11, $|S21|$ and S22 measurements can be done.

Another method to increase accuracy is to use a reference converter (Option *Reference Mixer Ports* ZVR-B6) which serves to generate a reference signal. The advantage of this kind of measurement is that no power calibration is necessary and the phase and group delay difference to the reference converter can be measured. The disadvantage is that no absolute values of conversion gain and conversion delay are available.

2 Test setup with external reference converter (front-end)

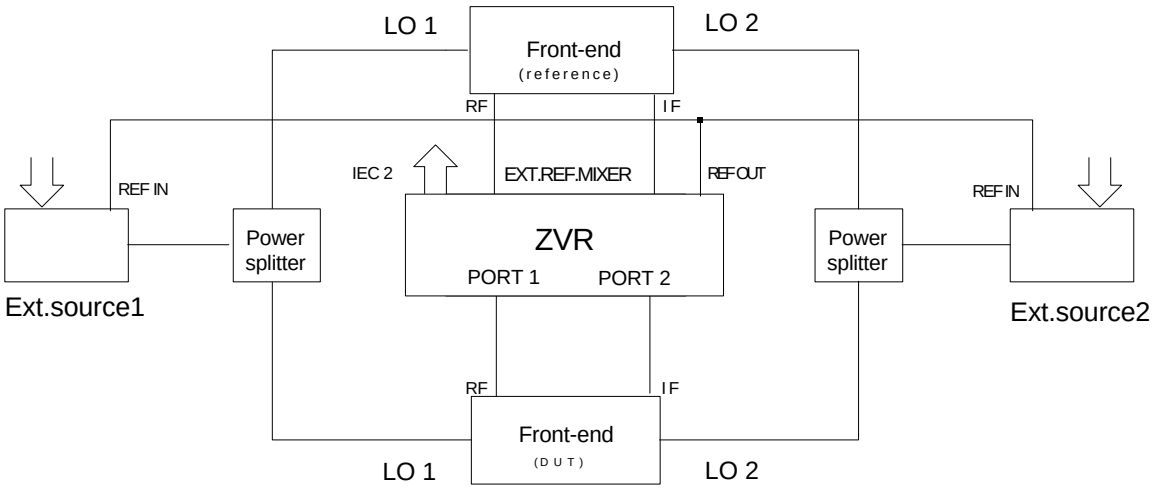

Fig. 2: Test setup

3 Measurement results

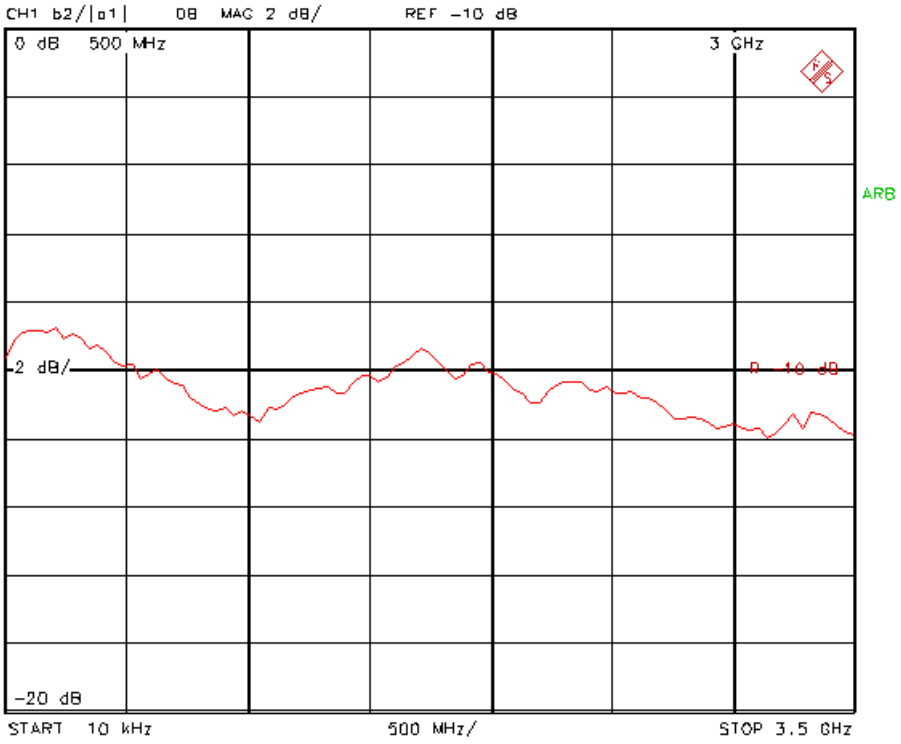

Fig. 3: Frequency response of front-end

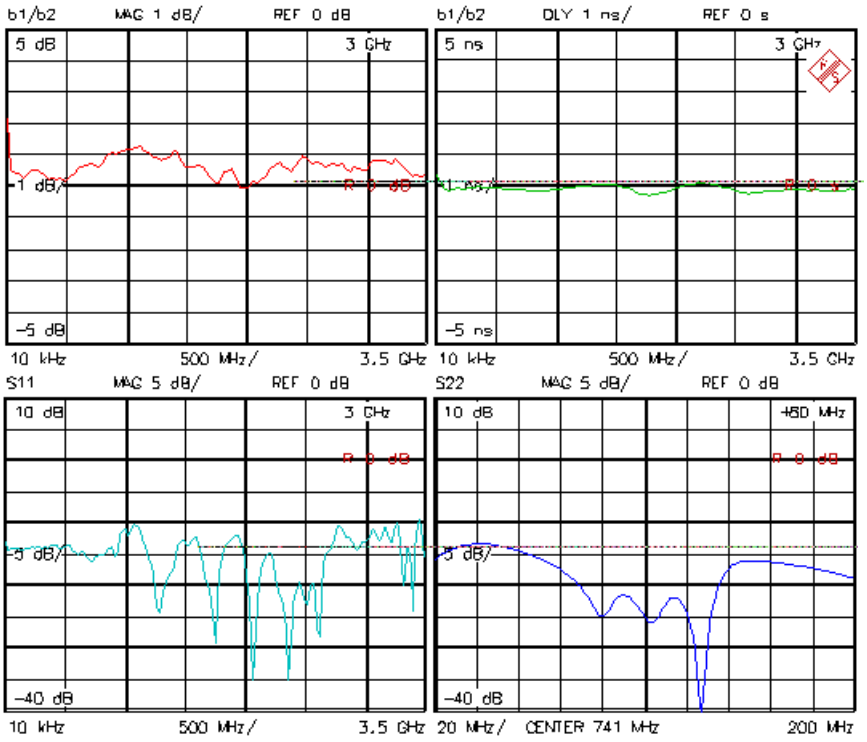

Fig. 4: Frequency response and delay difference to a reference front-end and input and output reflection

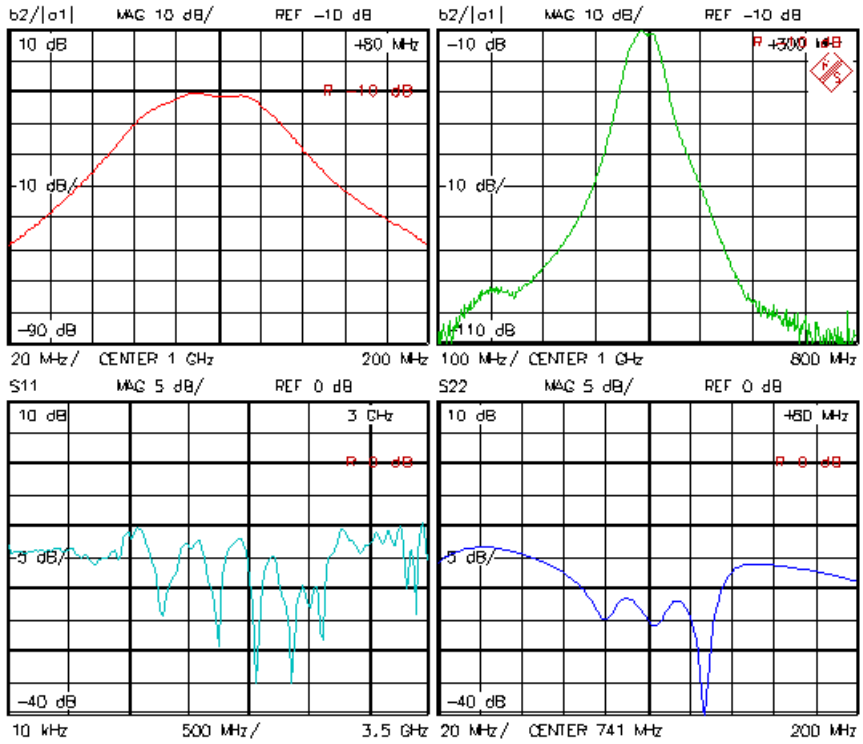

Fig. 5: Frequency response in the narrowband and wideband range

4 Measurement settings

ARBITRARY SYSTEM FREQUENCIES

FUNDAMENTAL FREQUENCY: 10 kHz ... 3.5 GHz

FREQ	ON	POWER		NUM		DEN	xF	OFFSET		RESULT
INT SRC		-10 dBm	(	1	/	1	)xF		=	10kHz..3.5GHz
EXT SRC1	√	0 dBm	(	1	/	1	)xF	+4.341 GHz	=	4.34GHz..7.84GHz
EXT SRC2	√	0 dBm						3.6 GHz	=	3.6GHz
RECEIVE			(	0	/	1	)xF	+741 MHz	=	741 MHz

EXT SOURCES CONFIG

SRC	REMOTE	IEC ADDR	TYPE
1	IEC	28	SMP02
2	IEC	19	SMT06

Fig. 6: Frequency response

ARBITRARY SYSTEM FREQUENCIES

FUNDAMENTAL FREQUENCY: 900 MHz ... 1.1 GHz

FREQ	ON	POWER		NUM		DEN	xF	OFFSET		RESULT
INT SRC		-10 dBm	(	1	/	1	)xF		=	900 MHz..1.1GHz
EXT SRC1	√	0 dBm	(	0	/	1	)xF	+5.341 GHz	=	5.34GHz
EXT SRC2	√	10 dBm						3.6 GHz	=	3.6GHz
RECEIVE			(	1	/	1	)xF	-1.741 GHz	=	841 MHz..641 MHz

EXT SOURCES CONFIG

SRC	REMOTE	IEC ADDR	TYPE
1	IEC	28	SMP02
2	IEC	19	SMT06

Fig. 7: Selectivity at 1 GHz (narrowband)

ARBITRARY SYSTEM FREQUENCIES

FUNDAMENTAL FREQUENCY: 600 MHz ... 1.4 GHz

FREQ	ON	POWER		NUM		DEN	xF	OFFSET		RESULT
INT SRC		-10 dBm	(	1	/	1	)xF		=	600 MHz..1.4GHz
EXT SRC1	√	0 dBm	(	0	/	1	)xF	+5.341 GHz	=	5.34GHz
EXT SRC2	√	10 dBm						3.6 GHz	=	3.6GHz
RECEIVE			(	1	/	1	)xF	-1.741 GHz	=	1.14GHz..341 MHz

EXT SOURCES CONFIG

SRC	REMOTE	IEC ADDR	TYPE
1	IEC	28	SMP02
2	IEC	19	SMT06

Fig. 8: Selectivity at 1 GHz (wideband)

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