



DMR Rx Test Solution

Signal Analyzer
MS2830A

Reference Specifications

ETSI EN 300 113 Version 2.1.1 (2016-08) / Technical characteristics of the receiver

ETSI TS 102 361-1 Version 2.4.1 (2016-02) / Air Interface

[Anritsu] DMR Rx Test Solution

Rx Evaluation

Unit, Module



*Output in Test Mode

MS2830A
Signal Analyzer

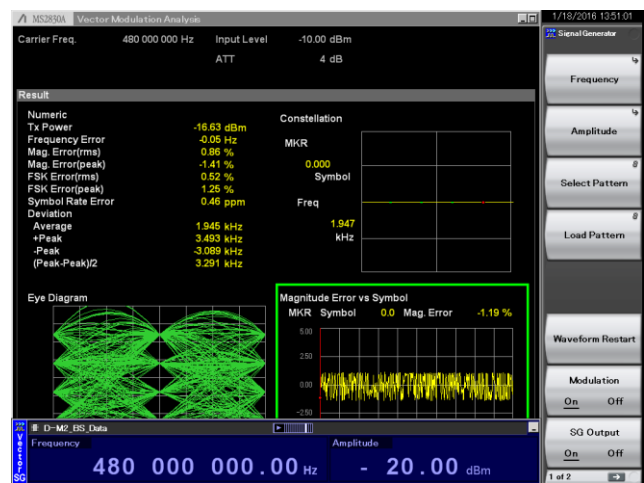


Signal Generator

BER Measurement Function

MS2830A-020
3.6 GHz Vector Signal Generator

MS2830A-026
BER Measurement Function



Note: For details, refer to the DMR standard.

EN 300 113	Receiver Test Items	Number of Required Signals	BER Measurement Function
8.1	Maximum usable sensitivity (conducted)	1	✓
8.4	Error behavior at high input levels	1	✓
8.5	Co-channel rejection	2	✓
8.6	Adjacent channel selectivity	2	✓
8.7	Spurious response rejection	2	✓
8.8	Intermodulation response rejection	3	✓
8.9	Blocking or desensitization	2	✓
8.10	Spurious radiations	0	-
9.1	Receiver desensitization (with simultaneous transmission and reception)	1	✓
9.2	Receiver spurious response rejection (with simultaneous transmission and reception)	1	✓

Test Signals

Measures transmitter and receiver

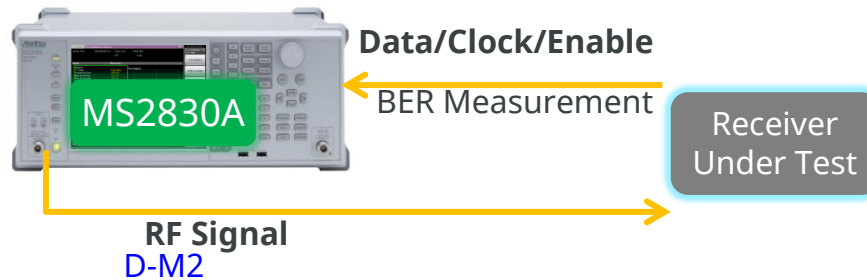
(Specified by EN 300 113 6.3 Normal test signals (wanted and unwanted signals))

Test Signals	Contents
D-M2	consisting of a pseudo-random bit sequence of at least 511 bits according to ITU-T Recommendation O.153 [4]; → Random Modulation for 4FSK
D-M2'	this is the same type as D-M2, but the pseudo-random bit sequence is independent of D-M2 (perhaps identical with D-M2 but started at another point of time); → Add Start Offset base D-M2
A-M3	consisting of an RF signal, modulated by an audio frequency signal of 400 Hz with a deviation of 12 % of the channel separation. This signal is used as an unwanted signal. → FM Modulation = 1500Hz (12.5kHz * 12%) , FM Rate=400 Hz For co-channel rejection and adjacent channel selectivity.

Maximum usable sensitivity

Measures receiver **Maximum usable sensitivity**, which is the minimum level of signal at the receiver input

Limits: (Specified by EN 300 113 8.1.3 Limits)



The screenshot shows the BER Test interface with the following data and annotations:

- Data Type:** PN9
- Count Mode:** Data
- Data:** 10000 Bit
- Error:** 97 Bit
- Measure Mode:** Single
- Status:** Measuring
- Error Rate:** 1.008E-002 (1.008%)
- Error Count:** 97 / 9620
- BER Test Start or Stop:** Measure Start, Measure Stop
- Clears measurement result:** Count Clear
- Data Type:** PN9
- Measure Mode:** Single
- Count Mode:** Data

BER Measurement Example Measured Bit

Maximum usable sensitivity

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

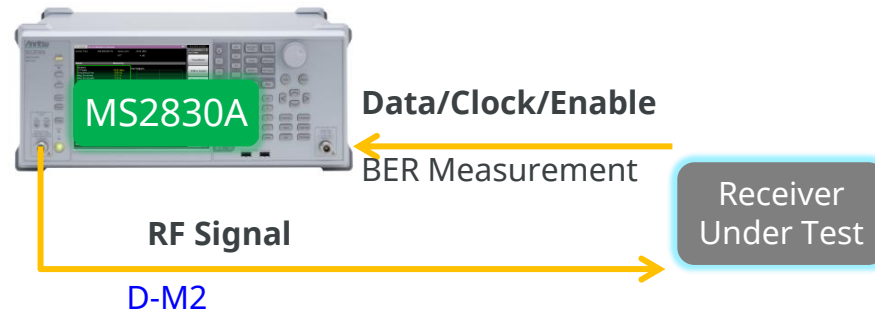
Limits

Table 9: Sensitivity levels (mean power) for different channel bandwidths and gross (on-air) bit rates

Channel BW	Data Rate	Sensitivity
12,5 kHz	9,6 kbit/s or less	-110 dBm
	more than 9,6 kbits to 16 kbit/s	-105 dBm
	more than 16 kbits to 38,4 kbit/s	-98 dBm
	greater than 38,4 kbit/s	-93 dBm
20 kHz and 25 kHz	9,6 kbit/s or less	-110 dBm
	more than 9,6 kbit/s to 38,4 kbit/s	-105 dBm
	more than 38,4 kbits to 76,8 kbit/s	-98 dBm
	greater than 76,8 kbit/s	-93 dBm

Error behavior at high input levels

Measures Receiver error behaviour (performance) **at high input levels** (noise free operation) is defined by the bit error ratio (continuous bit stream) or by the number of messages lost or corrupted when the level of the wanted signal is significantly above the maximum usable sensitivity.



Equipment under test

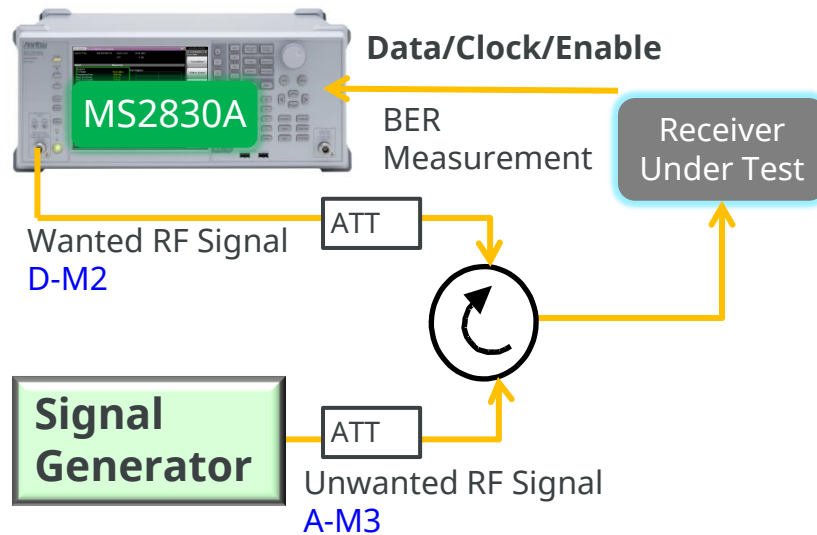
The same as Measurement of Maximum usable sensitivity.

Limits

The bit error ratio (continuous bit streams) shall not exceed 10^{-4} .
The number of messages or packets not correctly received (lost or corrupted) shall not exceed 1.

Co-channel rejection

Measures the capability of the receiver to receive a **wanted** modulated signal without exceeding a given degradation due the presence of an **unwanted** modulated signal, both signals being at the nominal frequency of the receiver.



Co-channel rejection

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

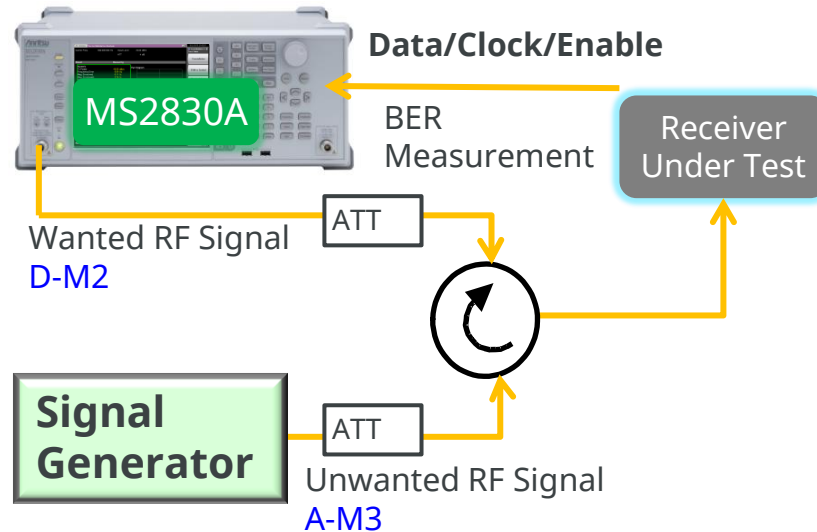
Limits: ([Specified by EN 300 113 8.5.3 Limits](#))

Table 11: Co-channel limits (mean power) for different channel bandwidths and gross (on-air) bit rates

Channel BW	Data Rate	Sensitivity
12,5 kHz	9,6 kbit/s or less	between 12,0 dB and 0 dB
	more than 9,6 kbit/s to 16 kbit/s	between 17,0 dB and 0 dB
	more than 16 kbit/s to 38,4 kbit/s	between 24,0 dB and 0 dB
	greater than 38,4 kbit/s	between 29,0 dB and 0 dB
20 kHz and 25 kHz	9,6 kbit/s or less	between 8,0 dB and 0 dB
	more than 9,6 kbit/s to 38,4 kbit/s	between 12,0 dB and 0 dB
	more than 38,4 kbit/s to 76,8 kbit/s	between 19,0 dB and 0 dB
	greater than 76,8 kbit/s	between 24,0 dB and 0 dB

Adjacent channel selectivity

Measures the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.



Adjacent channel selectivity

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

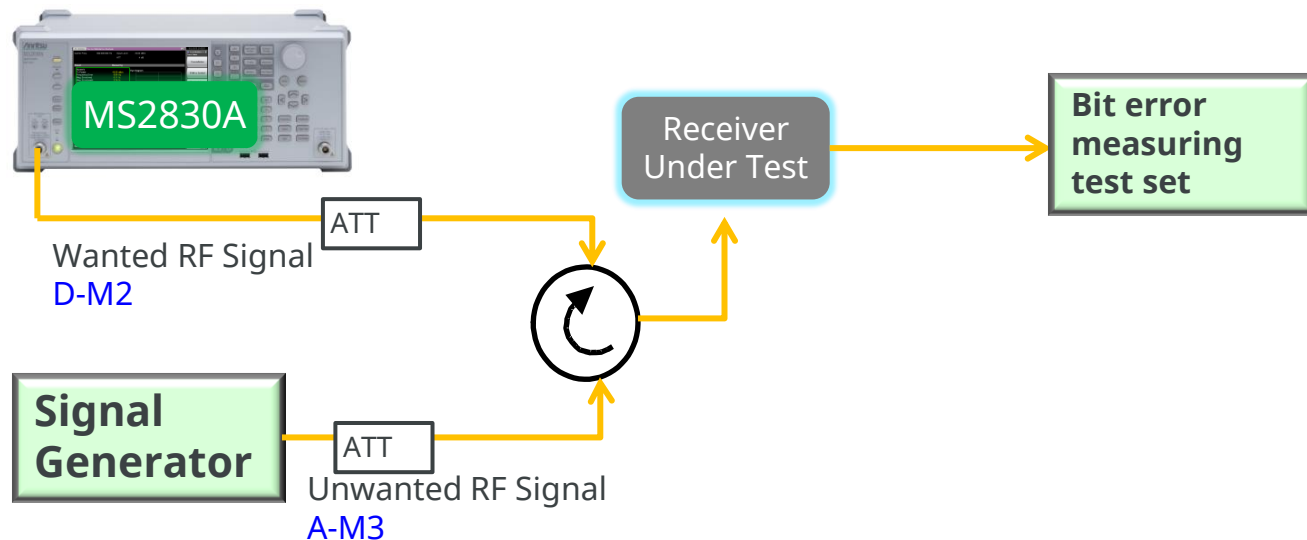
Limits: ([Specified by EN 300 113 8.5.3 Limits](#))

Table 12: Adjacent channel selectivity

	Channel separation	
	12,5 kHz	20/25 kHz
normal test conditions	60,0 dB	70,0 dB
extreme test conditions	50,0 dB	60,0 dB

Spurious response rejection

Measures of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal at any other frequency, at which a response is obtained.



Spurious response rejection

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

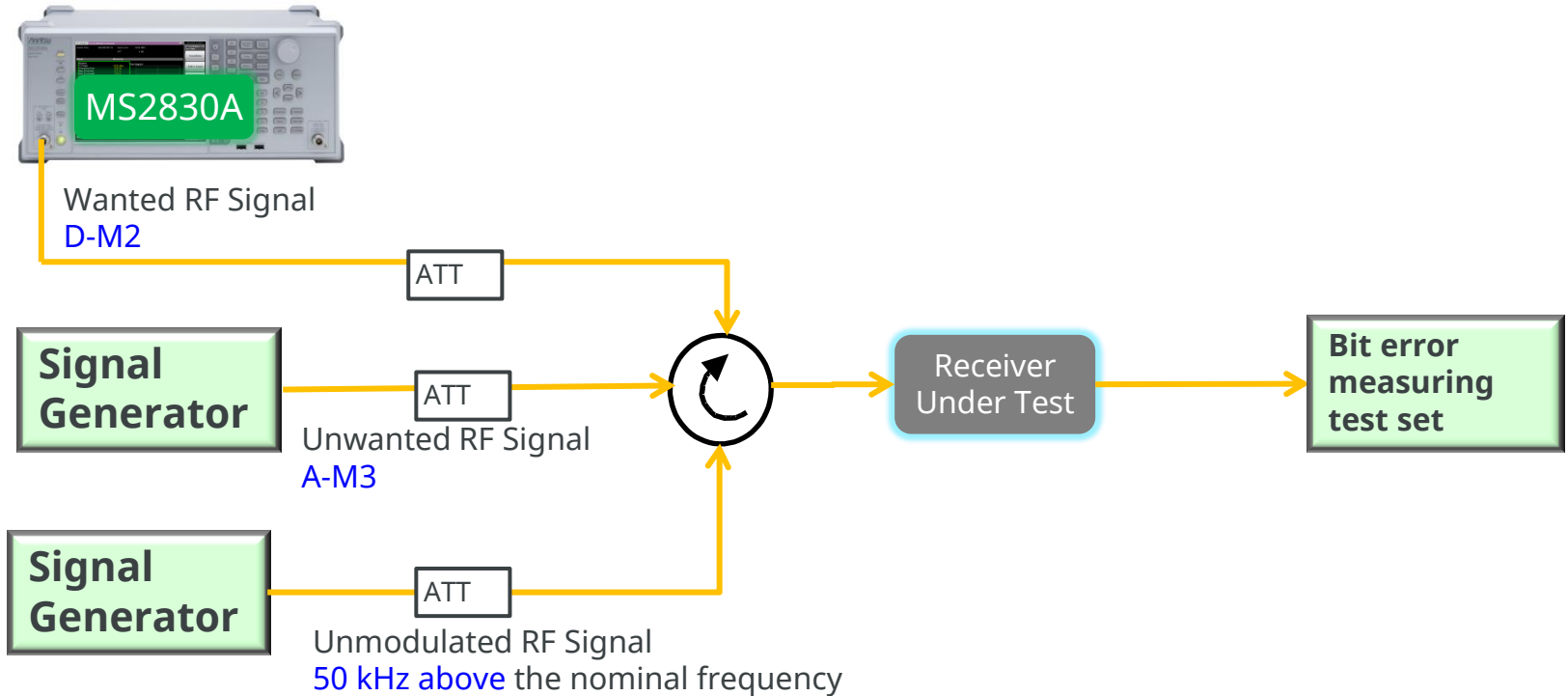
Limits: (Specified by EN 300 113 8.7.7 Limits)

8.7.7 Limits

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection shall be such that under the specified test conditions, the given degradation shall not be exceeded for levels of the unwanted signal up to -37 dBm.

Intermodulation response rejection

Measures the capability of the receiver to receive a wanted modulate signal, without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.



Intermodulation response rejection

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

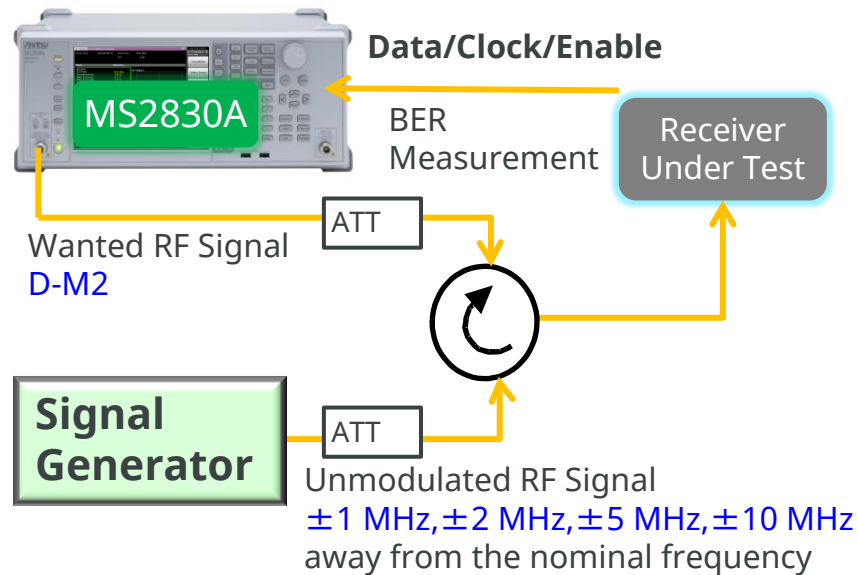
Limits: (Specified by EN 300 113 8.8.3 Limits)

8.8.3 Limits

The intermodulation response rejection of the equipment shall be such that under the specified test conditions, the given degradation shall not be exceeded for levels of the unwanted signal up to -37 dBm for base stations and -42 dBm for mobile and handportable stations.

Blocking or desensitization

Measures the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted input signal at any frequencies other than those of the spurious responses or the adjacent channels.



Blocking or desensitization

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

Limits: (Specified by [EN 300 113 8.9.3](#))

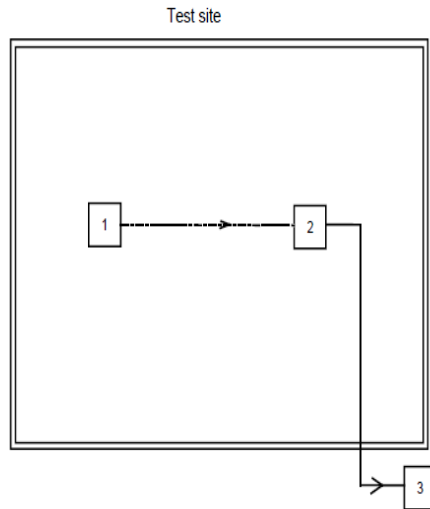
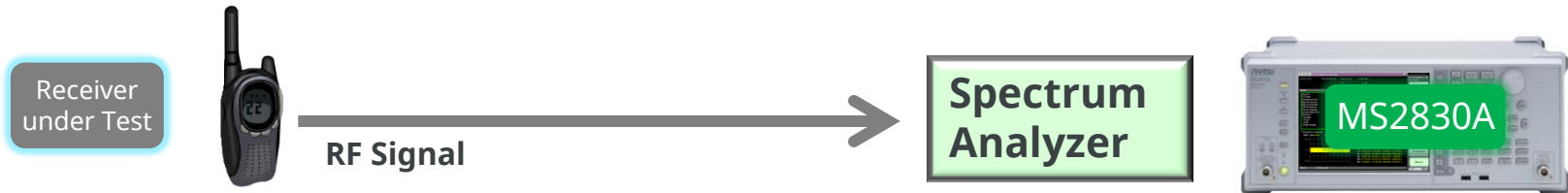
8.9.3 Limits

The blocking level, for any frequency within the specified ranges, shall not be less than -23 dBm except at frequencies on which spurious responses are found, clause 8.6.

Spurious radiations

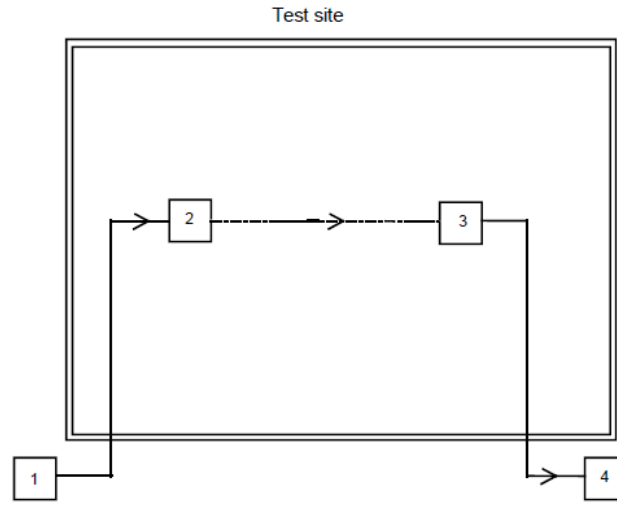
Measures the Spurious radiations from the receiver are emissions at any frequency

Conducted emissions



- 1) Receiver under test
- 2) Test antenna
- 3) Spectrum analyser or selective Voltmeter (test receiver)

Figure 31: Measurement arrangement



- 1) Signal generator
- 2) Substitution antenna
- 3) Test antenna
- 4) Spectrum analyser or selective Voltmeter (test receiver)

Figure 32: Measurement arrangement

Spurious radiations

Limits: (Specified by EN 300 113 7.9.4 Limits)

8.10.4 Limits

The power of any spurious radiation shall not exceed the values given in tables 13 and 14.

Table 13: Conducted components

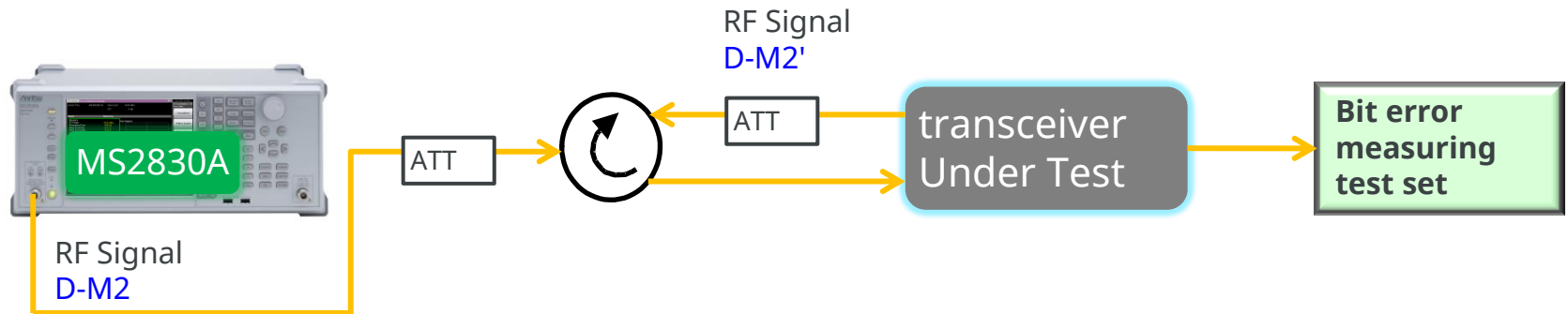
Frequency range	Limit
9 kHz to 1 GHz	2,0 nW (-57 dBm)
above 1 GHz to 4 GHz or above 1 GHz to 12,75 GHz	20,0 nW (-47 dBm)

Table 14: Radiated components

Frequency range	Limit
30 MHz to 1 GHz	2,0 nW (-57 dBm)
above 1 GHz to 4 GHz	20,0 nW (-47 dBm)

Receiver desensitization (with simultaneous transmission and reception)

The desensitization is the degradation of the sensitivity of the receiver resulting from the transfer of power from the transmitter to the receiver due to coupling effects. It is expressed as the difference in dB between the maximum usable sensitivity levels (data or messages, conducted), with and without simultaneous transmissions.



Receiver desensitization (with simultaneous transmission and reception)

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

Limits: (Specified by EN 300 113 9.1.3 Limits)

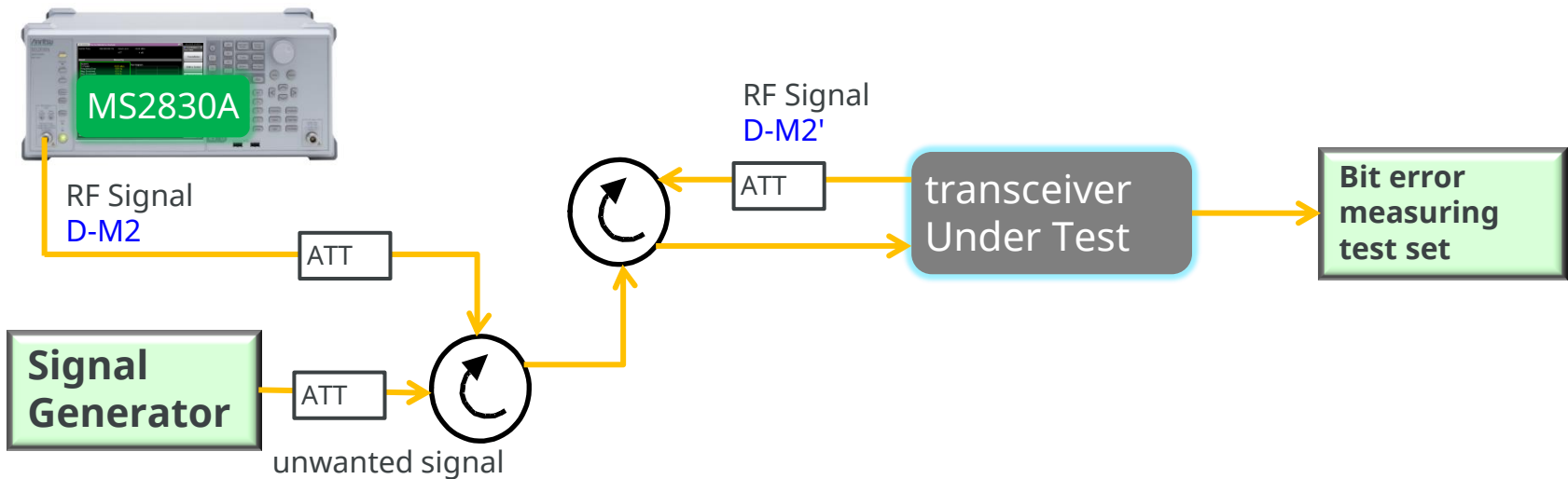
9.1.3 Limits

The desensitization shall not exceed 3,0 dB and the limit of maximum usable sensitivity under normal test conditions shall be met.

Receiver spurious response rejection (with simultaneous transmission and reception)

Measures the capability of the receiver to achieve a specific spurious response rejection ratio when receiving a wanted modulated signal in the presence of:

- an unwanted signal at any other frequency, at which a response may be obtained;
- the unmodulated signal of the transmitter operating at duplex frequency distance, at the rated output power and attenuated by the duplex filter or by the distance between the antennas.



Receiver spurious response rejection (with simultaneous transmission and reception)

Equipment signal under test

For continuous mode

BS data, BS voice, MS data, MS voice

For discontinuous mode

MS data single slot, MS voice single slot, TDMA direct slot1 data,
TDMA direct slot1 voice, TDMA direct slot2 data, TDMA direct slot2 voice

Limits: (Specified by [EN 300 113 9.2.3 Limits](#))

9.2.3 Limits

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious response rejection ratio shall be greater than 67,0 dB.

