Conducted Testing of Terrestrial Broadcast Sound Receivers according to ETSI EN 303 345

Application Note

Products:

- R&S®BTC
- R&S®BTC-B1
- R&S®BTC-B11
- R&S®BTC-B3103
- R&S®BTC-B2
- R&S®BTC-B3203
- R&S®VT-K2150
- R&S®NRP6A

Since June 2017 almost all radio transmitters and receivers sold or put into operation in the European Union have to be tested for immunity against interferers in adjacent frequency bands. ETSI standard EN 303 345 defines the tests to be performed on broadcast sound receivers, and the requirements to be passed.

This application note describes the test procedures and provides script files and interferer signals for the Broadcast Test Center R&S®BTC.

Note:

Please find the most up-to-date document on our homepage
http://www.rohde-schwarz.com/appnote/1GP117.

Application Note
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ROHDE&SCHWARZ

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1 Background

1.1 Radio Equipment Directive (RED) 2014/35/EU

Directive 2014/53/EU (THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, 2014) “establishes a regulatory framework for the making available on the market and putting into service” “of radio equipment” ”in the [European] Union”.

All radio equipment (transmitters and receivers), sold or put into operation in the European Union must comply with the requirements set forth in this directive. Exempted is certain radio amateur equipment, certain marine equipment and airborne products, and evaluation kits for research and development facilities.

Requirement 2 of article 3 mandates the efficient use of radio spectrum and the avoidance of harmful interference.

1.2 ETSI EN 303 345

The standard ETSI EN 303 345 has been prepared under standardization request C(2015) 5376 to provide means of conforming to the essential requirements of Directive 2014/53/EU (THE EUROPEAN PARLIAMENT AND THE COUNCIL OF THE EUROPEAN UNION, 2014).

The standard was first drafted in one part. Version 1.1.7 was the final draft for voting.

Meanwhile the standard has been split up into five parts:

Part 1: Generic requirements and measuring methods (ETSI, 2020-02) [1]
Part 2: Limits for the AM broadcast sound service (ETSI, 2020-02) [2]
Part 3: Limits for the FM broadcast sound service (ETSI, 2019-11) [3]
Part 4: Limits for the DAB broadcast sound service (ETSI, 2019-11) [4]
Part 5: Limits for the DRM broadcast sound service (ETSI, 2020-02) [5]

This version of the application note reflects the published version of the standards as of February 2020.

1.3 Purpose of this document

This application note describes the tests defined in ETSI EN 303 345 and provides guidance for manual tests according to this standard, using the broadcast test center R&S® BTC.

This document concentrates on conducted testing. It does not include measurements of unwanted emissions in the spurious domain.

1.4 Signal parameters

1.4.1 Remark on “quasi-peak” measurements

Quasi-peak measurement is defined in ITU-R BS.468-4 (ITU-R, 1986-07/1) as a level measurement with a certain dynamic characteristic in response to tone bursts. In section 2.6 of this document it is stipulated that “*The instrument shall be calibrated such that a steady input signal of 1 kHz sine-wave at 0.775 V r.m.s., having less than 1% total harmonic distortion, shall give a reading of 0.775 V, 0 dB.*”

In contradiction to this definition, ITU-R BS.641 (ITU-R, 1986-07/2) [11] suggests in section 5 that the quasi-peak reading for a sinusoidal signal should be equal to its peak value: “*The unwanted transmitter L is then modulated with a 500 Hz sinusoidal tone obtained from audio frequency generator A. Attenuator B is then adjusted to obtain a deviation of ± 32 kHz (see Note). The audio-frequency level at the input of the unwanted transmitter before the pre-emphasis is now measured by means of the noise voltmeter U. The noise-weighting network is switched off. Next, a noise signal C + D replaces the sinusoidal tone, and attenuator E is adjusted to obtain the same peak-reading as before at the noise voltmeter. The (quasi) peak-deviation is thus equal to ± 32 kHz.*”

The definition of the interferer signals in EN 303 345-2 (ETSI, 2020-02) [2] and EN 303 345-3 (ETSI, 2019-11) [3] gives RMS values of the modulation depth or frequency deviation, respectively. The reference to quasi-peak values in Note 2 of Table 1 is based on the definition in ITU-R BS.641 (ITU-R, 1986-07/2) [10].

1.4.2 AM signals

AM Signals			
	Wanted Signal	**Unwanted Signal**	**Blocking Signal**
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2, clause 1 Band-limited to 4.5 kHz	1 kHz tone
Modulation depth	40 %	22.8 % RMS	80 %

Table 1-1: AM signal parameters

The AM blocking signal is also used for blocking tests on FM, DAB and DRM receivers.

1.4.3 FM signals

FM Signals		
	Wanted Signal	**Unwanted Signal**
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2, clause 1 Band-limited to 15 kHz
Deviation	± 60.8 kHz peak	15.9 kHz RMS with pre-emphasis
Pilot tone	Off	Off

Table 1-2: FM signal parameters

1.4.4 DAB signal

DAB Signals		
	Wanted Signal	**Unwanted Signal**
Audio Modulation	Service label: “Sine+” 1 kHz tone at a level of -3 dBFS Coding: mono, 128 kbit/s AAC[1]	Any DAB ensemble without the "Sine+" service
Other modulation parameters	DAB signal with EEP-3A according to ETSI EN 300 401 (ETSI/EBU, 2006-06)	DAB signal with EEP-3A according to ETSI EN 300 401 (ETSI/EBU, 2006-06)

Table 1-3: DAB signal parameters

1.4.5 DRM signal

DRM Signals				
	Wanted Signal	**Unwanted Signal**		
Audio coding	Sevice label: “Sine 1kHz” 1 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate	Service label: "Sine 2kHz" 2 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate		
Frequency band		LF / MF	HF	VHF
Channel coding parameters	RM flag	0	0	1
	Protection level	1	1	2
	MSC mode	0	0	0
	Interleaver depth	1	1	0
	Robustness mode	B	B	E
	Spectrum occupancy	2	3	0
Other modulation parameters	DRM signal to ETSI ES 201 980, clause B (ETSI/EBU, 2017-04)			

Table 1-4: DRM signal parameters

[1] The use of HE-AACv2 coding is specified in the DAB+ standard (ETSI TS 102 563) (ETSI/EBU, 2017-01)

1.5 Test configurations

All tests (sensitivity, adjacent channel selectivity and blocking) are specified for the combinations of wanted signal frequencies and modulation types listed in table Table 1-5.

Test configurations			
Test	**Modulation Type**	**Frequency Band**	**Wanted Center Frequency (MHz)**
1	AM	LF	0.216
2		MF	0.999
3		HF	9.9
4	FM	VHF band II	98
5	DAB	VHF band III	202.928
6	DRM	LF	0.216
7		MF	0.999
8		HF1	4
9		HF2	19
10		VHF band I	65
11		VHF band II	100
12		VHF band III	200

Table 1-5: Test configurations

1.6 BTC Configuration

ACS (adjacent channel selectivity) and blocking tests require two signals to be generated and provided simultaneously, the wanted or useful signal and the interferer.

Various different configurations of the test setup can be imagined to generate the required signals. This application note provides instructions and files for two of them.

1.6.1 One signal path with arbitrary generation of the interferer signal

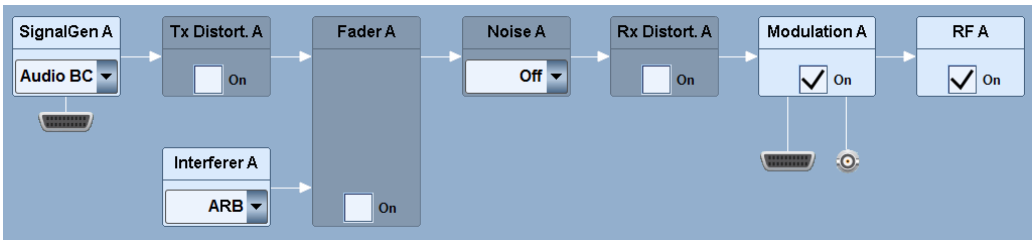

Fig. 1-1: BTC Configuration with one signal path

In this configuration the interferer is played from an arbitrary vector signal file and added with the required frequency shift and gain or attenuation to the wanted signal at the modulator input. To avoid degradation of the wanted signal by carrier leakage, the carrier frequency is set to the RF frequency of the interferer, and the wanted signal is offset in frequency by the required spacing.

1.6.2 Two signal paths with two real-time modulators

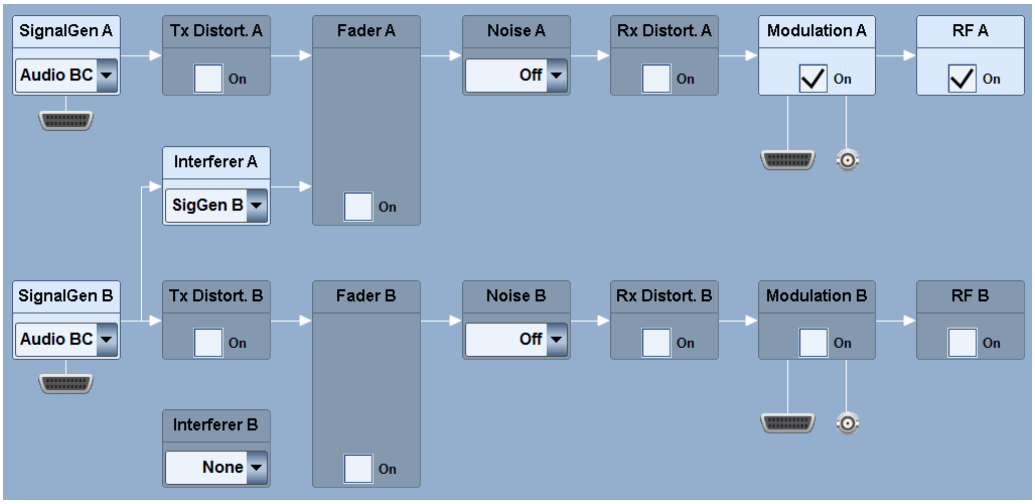

Fig. 1-2: BTC configuration with two signal paths

In this configuration the modulating interferer signal is modulated in real-time. For analog modulation schemes the audio signal is either generated in the internal audio generator or played from a wav file in the internal audio player. For DAB and DAB+ a traffic stream is played from a file in the player of the internal multimedia generator. For DRM appropriate DCP files are played in the modulator.

The signals may be added as RF signals from both generator outputs, but in the files provided they are added with appropriate frequency shift and gain or attenuation at the modulator input. To avoid degradation of the wanted signal by carrier leakage, also here the carrier frequency is set to the RF frequency of the interferer, and the wanted signal is offset in frequency by the required spacing.

1.7 Scripts versus Save-Recall-Files

1.7.1 Save-Recall-Files

Save-recall files contain information about the complete instrument settings in a proprietary format. This includes parameters for functions which are not active in the stored instrument setup, and for options which are not used and may not be present in other instruments. Due to the amount of information contained, save-recall files are several MB large.

Save-recall files are easy to generate from the current instrument state without requiring further knowledge. They are recommended only for storing instrument states and loading them again on the same instrument. They should not be used for transferring instrument states to another instrument with different configuration.

1.7.2 Script files

Script files are text files containing SCPI commands for selected instrument settings. By their nature they do not store a complete instrument state, and the outcome may

depend on the state of the instrument before the script had been started. On the other hand script files allow to specify the order of execution of the commands, and SCPI commands for specific actions like adjustment may be included.

Furthermore script files allow “partial” instrument setups, for example for configuring the audio analyzer function without altering the state of the signal generator.

The size of script files varies largely, depending on the complexity of the instrument state to be achieved. They are considerably smaller than save-recall files, usually a few KB large.

Script files cannot be loaded by remote command. In remote control the script file should be opened on the host PC, and the SCPI commands contained in the script file should be sent one by one as remote commands.

1.7.3 Files provided with this application note

This application note provides more than 200 files for performing the tests according to EN 303 345 on different configurations of the R&S® Broadcast Test Center BTC. Therefore script files are chosen as means for distributing the instrument setups.

Audio wave files for the unwanted signal in AM and FM ACS tests are provided for download with archive file “EN303345_WaveFiles.zip”.

For testing ACS of DAB and DAB+ receivers with the single-path configuration of the R&S®BTC, the waveform file “T DMB_DAB_M1_V1_351.wv” is also provided for download. Playing this waveform in the multi arb waveform generator requires option R&S®WV-K801 (T-DMB/DAB waveforms).

2 Preparations

2.1 Script files

Unzip the archive file “EN303345_ScriptFiles.zip” and copy the 223 script files contained therein to folder "D:\Scripts\EN303345" on the R&S® BTC.

Script files for sensitivity testing are named “EN303345_Sens_xx_yy.scpi” where *xx* denotes the modulation scheme and *yy* denotes the frequency band.

Script files for adjacent channel selectivity testing are named “EN303345_ACS_xx_yy_+Nm_nPath.scpi” where *xx* denotes the modulation scheme, *yy* denotes the frequency band, *m* = 1 …3 or *m* = 2 …4 (FM) denotes the frequency separation between wanted and unwanted signal as number of channels. The sign “+” or “-“ indicates whether the unwanted signal is higher or lower in frequency than the wanted signal. *n* = 1 | 2 is the number of signal paths used in the R&S® BTC.

Script files for blocking tests are named “EN303345_Blocking_xx_yy_-_nPath.scpi” where *xx* denotes the modulation scheme and *yy* denotes the frequency band. The sign “+” or “-“ indicates whether the unwanted signal is higher or lower in frequency than the wanted signal. *n* = 1 | 2 is the number of signal paths used in the R&S® BTC.

2.2 Signal files

Unzip the archive file “EN303345_WaveFiles.zip” and copy the 2 wav files contained therein to folder "D:\AUDIOPLAYER\EN_303345" on the R&S® BTC. The files are based on the single-channel files “AM_Unwanted.wav” and “FM_Unwanted.wav” from archive “en_30334501v010101p0.zip” (ETSI, 2018) [6] which is part of the standard.

“RED_Sine+_120s_eti_ni_file.DAB_C” is a DAB stream and requires R&S® Lib-K51. “eti1_file.DABP_C” is a DAB+ stream and requires R&S® Lib-K53. Both files must be present in folder “D:\TSGEN\DABPLUS” on the R&S® BTC for DAB(+) testing.

Files “LFMF_wanted.DCP_C”, “LFMF_unwanted.DCP_C”, “HF_wanted.DCP_C”, “HF_unwanted.DCP_C”, “VHF_wanted.DCP_C” and “VHF_unwanted.DCP_C” must be present in folder “D:\TSGEN\DRM\EN 303 345 DRM Testing” on the R&S® BTC for DRM testing.

For AM and FM testing in the single-path configuration, vector signal files “AM_Unwanted.wv”, “FM_Unwanted.wv” and “Blocking.wv” must be present in “D:\ARB\EN303345”. These files can be found in archive “en_30334501v010101p0.zip” (ETSI, 2018) which is part of the standard.

For DAB testing in the single-path configuration, vector signal file “T-DMB_DAB_M1_V1_351.wv” (part of T-DMB/DAB waveforms R&S®WV-K801) must be present in “D:\ARB\TDMB_DAB” and “Blocking.wv” must be present in ““D:\ARB\EN303345”.

For DRM and DRM+ testing in the single-path configuration, vector signal files “LFMF_unwanted.wv”, “HF_unwanted.wv” and “VHF_unwanted.wv” must be present in

"D:\ARB\DRM_WAVEFORMS\EN 303 345 DRM Testing", and "Blocking.wv" must be present in ""D:\ARB\EN303345".

2.3 Test setup

This application note provides script files for single-path and two-path configuration of the R&S® BTC. In the single-path configuration the interferers are loaded from arbitrary vector signal files and added to the wanted signal with the specified frequency offset and level ratio at the modulator input. In the two-path configuration, the unwanted signals are generated in the second path and added to the wanted signal with the specified frequency offset and level ratio before they are fed into the modulator. In both cases RF output A outputs the complete RF signal for all tests. No external combiner is required.

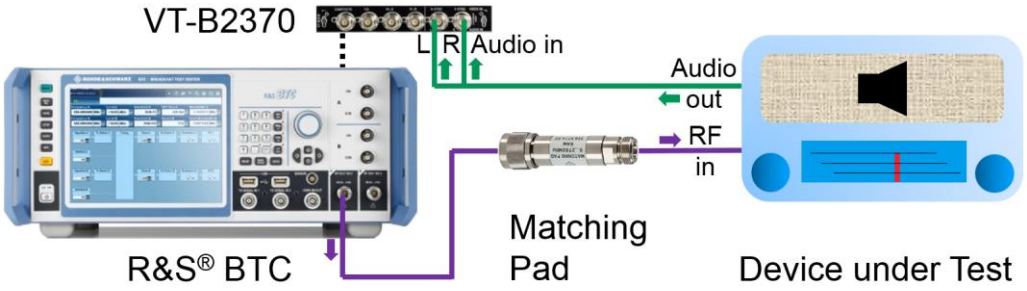

Fig. 2-1: Generic test setup

The matching pad is only required if the impedance of the RF input of the device under test differs from 50 Ohm. It should be placed as close as possible to the RF input of the device under test.

The audio content of all test signals is mono only. Therefore it is in principle sufficient to measure one audio output signal of the device under test. If the device under test has stereo outputs, it is possible to connect them to both audio inputs of the R&S® BTC Analog AV RX module VT-B2370 and perform a two-channel measurement.

2.4 Impairment criteria

The requirements regarding the signal quality depend on the modulation system, but are the same, respectively, for sensitivity, adjacent channel selectivity and blocking tests. They are shown in the following table, taken from (ETSI, 2020-02) [1].

Impairment Criteria for Sensitivity Tests	
AM	SNR ≥ 28 dBQ ref 40% AM
FM	SNR ≥ 40 dBQ ref. 60.8 kHz deviation; clean audio (see note 1)
DAB	Clean audio (see note 2)
DRM	Clean audio (see note 2)
Note 1: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. clicks resulting from FM threshold effects) Note 2: Clean audio is defined as 10 seconds of audio with no subjective impairments (e.g. muting, clicks, warbles or squeaks)	

Table 2-1: Impairment criteria for sensitivity tests

“dBQ“ means ratio determined with quasi-peak detector and noise weighting according to ITU-R BS.468-4 (ITU-R, 1986-07/1). The weighting filter is defined in figure 1b and table 1. The required dynamic response of the quasi-peak detector is defined in table 2 and 3 of the same recommendation.

3 Measurements

3.1 Audio measurement

The following audio measurements have to be performed for checking the impairment criteria during each of the following tests. If the audio output of the device under tests features a volume control, it is recommended to use a high volume setting in order to achieve a good signal-to-noise ratio.

3.1.1 Quasi-peak signal-to-noise ratio

Signal-to-noise ratio is measurement is performed by measuring the signal level and the noise level (with signal switched off) separately and calculating the voltage ratio or level difference.

During sensitivity tests the modulation can be switched off at the R&S® BTC for the noise level measurement. During adjacent channel selectivity tests and blocking tests the modulation must not be switched off altogether because this would disable the interferer as well. Instead, switch “Audio” in the modulator sub-tab of TX SignalGen A to “Off”.

3.1.2 Clean audio

In manual measurement the condition “clean audio” can be judged subjectively. There should be no impairment audible. With digital audio (DAB, DRM) the quality usually decreases dramatically within 1 dB of signal level or I/C ratio change, respectively. With FM, good listening conditions (quiet listening room or headphones) are recommended.

An instrumental judgement can be achieved with FFT analysis applying a lower level limit in the spectrum at the signal frequency and an upper level limit at all other frequencies.

Alternatively a selective rms measurement with a narrow bandstop at the signal frequency can be applied with an appropriate upper limit, together with a wideband rms measurement with lower limit for detecting dropouts.

Another alternative is perceptive quality evaluation using the “PEAQ” method.

All three alternatives require an external audio analyzer, for example R&S® UPV.

3.2 Sensitivity

According to (ETSI, 2020-02) [2], “the receiver sensitivity is the minimum wanted signal level required to provide a given level of audio quality.” The requirements for the audio quality depending on the modulation type are specified in Table 2-1.

3.2.1 Signals

The modulation parameters of the wanted signals for sensitivity test are listed in Table 1-1, Table 1-2, Table 1-3 and Table 1-4.

AM and FM signals are generated in the audio generator of the AM or FM modulator of the R&S® BTC.

The DAB signal is loaded from play file “RED_Sine+_120s_eti_ni_file.DAB_C” into the player of the Multimedia generator.

The DRM signals are loaded from file “LFMF.DCP_C”, “HF.DCP_C” or “VHF.DCP_C”, respectively, depending on the frequency band. The files contain multiplex distribution interface (MDI) streams encapsulated in distribution and communications protocol (DCP) packets.

3.2.2 Script files

Run script file “EN303345_Sens_xx_yy.scpi” from folder “D:\Scripts\EN303345” for the desired modulation type and wanted signal frequency according to Table 1-5.

3.2.3 Test procedure

There are two alternative test procedures, a fast pass-fail test against the requirements set forth in the respective part of EN 303 345, and a RF level adjustment to determine the actual receiver sensitivity.

- Determine the attenuation from the R&S® BTC RF output to the input of the DUT (if no matching pad is used) or the input of the matching pad, respectively. This can be done by measuring the signal level at this point with a power meter or with the power measurement function of a signal analyzer.
- If a matching pad is used, add the attenuation of the matching pad and potential attenuation of cables and connectors between the matching pad and the DUT RF input.
- Set the wanted signal level to the required receiver sensitivity plus attenuation between R&S® BTC RF output and the RF input of the device under test plus 30 dB.
- Tune the receiver of the device under test to the wanted signal frequency. Adjust the volume control of the device under test to obtain a sufficient output level without clipping.

For pass-fail testing:

- Reduce the wanted signal level by 30 dB.
- Check the signal quality requirement for the modulation type in use according to Table 2-1.

For determining the receiver sensitivity:

- Reduce the wanted signal level in 1 dB steps until the signal quality falls below the requirement.

- The sensitivity is the lowest signal level at the RF input of the device under test with which the signal quality requirement is fulfilled.

3.3 Adjacent channel selectivity

According to (ETSI, 2020-02) [1], “the adjacent channel selectivity at a given frequency separation is the ratio” (I/C) “of the maximum unwanted signal level to the wanted signal level” permitted “to provide a given level of audio quality. The wanted and unwanted signals are of the same modulation type.”

3.3.1 Signals

The wanted signals are the same as for the sensitivity test (see 3.2.1).

For DAB and DRM the modulation of the unwanted signal is the same as the modulation of the wanted signal.

For AM and FM the unwanted signal is modulated (AM for amplitude-modulated wanted signal, FM for frequency-modulated wanted signal) with spectrally shaped noise. The modulation signal for the unwanted signal has to fulfil spectrum and rms level requirements. At the same time the peak value has to be below the value producing clipping or over-modulation in the modulator.

The noise files provided with this application note are derived from the wav files provided in (ETSI, 2018) [6], but adapted in format to the requirements of the audio player in the AM and FM modulators. The wav files have been extended to two channels with identical contents. The level of the AM interferer in the file “AM_UNWANTED_2CH.WAV” had been increased to be able to achieve the specified AM modulation depth.

3.3.2 Script files

Run script file “EN303345_ACS_xx_yy_+Nm_nPath.scpi” from folder “D:\Scripts\EN303345”. For each of the twelve wanted signals according to Table 1-5 and each of the two signal path configurations there are six save-recall files with different frequency offsets according to the following table, and interferer-to-wanted signal level ratios corresponding to the requirements of EN 303 345-1 (ETSI, 2020-02) [1].

Channel spacing for adjacent channel selectivity tests			
Test	**Modulation Type**	**Frequency Band**	**Frequency difference interferer vs. wanted signal (N = 1, 2, 3)**
1	AM	LF	±N * 9 kHz
2		MF	±N * 9 kHz
3		HF	±N * 10 kHz
4	FM	VHF band II	±(N+1) * 100 kHz
5	DAB	VHF band III	±N * 1712 kHz
6	DRM	LF	±N * 9 kHz
7		MF	±N * 9 kHz
8		HF1	±N * 10 kHz
9		HF2	±N * 10 kHz
10		VHF band I	±N * 100 kHz
11		VHF band II	±N * 100 kHz
12		VHF band III	±N * 100 kHz

Table 3-1: Channel spacing for adjacent channel selectivity tests

3.3.3 Test procedure

There are two alternative test procedures, a fast pass-fail test against the requirements set forth in the respective part of EN 303 345, and an adjustment of the interferer attenuation to determine the actual adjacent channel selectivity.

- Disable the interferer signal and adjust the wanted signal level at the input of the device under test to the required value, or at the input of the matching pad to the required value plus the attenuation of matching pad and subsequent cables and connectors, respectively. The level at this point can be measured using a power meter or the power measurement function of a signal analyzer.

For pass-fail testing:

- Enable the interferer signal with the required I/C ratio.
- Check the signal quality requirement for the modulation type in use according to Table 2-1.

For determining the adjacent channel selectivity of the receiver:

- Start from a lower I/C ratio and increase the I/C ratio (decrease the interferer attenuation) in 1 dB steps until the signal quality falls below the requirement.
- The adjacent channel selectivity is the highest I/C ratio with which the signal quality requirement is fulfilled.

3.4 Blocking

According to EN 303 345-1 (ETSI, 2020-02) [1], “the blocking ratio at a given frequency separation is the ratio” (I/C) “of the maximum AM unwanted signal level to the wanted signal level” permitted “to provide a given level of audio quality”.

3.4.1 Signals

The wanted signals are the same as for the sensitivity test (see 3.2.1) and adjacent channel selectivity test.

The unwanted signal for blocking tests is an AM signal modulated with a 1 kHz tone at 80% modulation depth, independent of the modulation type of the wanted signal.

3.4.2 Script files

Run script file “EN303345_Blocking_xx_yy_-_nPath.scpi” from folder “D:\Scripts\EN303345”. For each of the twelve wanted signals according to Table 1-5 and each of the two signal path configurations there are two script files with positive and negative frequency difference according to the following table, and interferer-to-wanted signal level ratios corresponding to the requirements of EN 303 345-1 (ETSI, 2020-02) [1].

Channel spacing for blocking tests			
Test	**Modulation Type**	**Frequency Band**	**Frequency difference interferer vs. wanted signal**
1	AM	LF	±90 kHz
2		MF	±90 kHz
3		HF	±100 kHz
4	FM	VHF band II	±800 kHz
5	DAB	VHF band III	±12 MHz
6	DRM	LF	±90 kHz
7		MF	±90 kHz
8		HF1	±100 kHz
9		HF2	±100 kHz
10		VHF band I	±800 kHz
11		VHF band II	±800 kHz
12		VHF band III	±800 kHz

Table 3-2: Channel spacing for blocking tests

3.4.3 Test procedure

There are two alternative test procedures, a fast pass-fail test against the requirements set forth in the respective part of EN 303 345, and an adjustment of the interferer attenuation to determine the actual blocking ratio.

- Disable the interferer signal and adjust the wanted signal level at the input of the device under test to the required value, or at the input of the matching pad to the required value plus the attenuation of matching pad and subsequent cables and connectors, respectively. The level at this point can be measured using a power meter or the power measurement function of a signal analyzer.

For pass-fail testing:

- Enable the interferer signal with the required I/C ratio.
- Check the signal quality requirement for the modulation type in use according to Table 2-1.

For determining the adjacent blocking ratio of the receiver:

- Start from a lower I/C ratio and increase the I/C ratio (decrease the interferer attenuation) in 1 dB steps until the signal quality falls below the requirement.
- The adjacent channel selectivity is the highest I/C ratio with which the signal quality requirement is fulfilled.

4 Literature

[1] **ETSI** Broadcast Sound Receivers; Part 1: Generic requirements and measuring methods // ETSI EN 303 345-1 V1.1.1. - Sophia Antipolis : ETSI, 2020-02.

[2] **ETSI** Broadcast Sound Receivers; Part 2: Limits for the AM broadcast sound service; Harmonised Standard for access to radio spectrum // ETSI EN 303 345-2 V1.1.1. - Sophia Antipolis : ETSI, 2020-02.

[3] **ETSI** Broadcast Sound Receivers; Part 3: Limits for the FM broadcast sound service; Harmonised Standard for access to radio spectrum // ETSI EN 303 345-3 V1.1.0. - Sophia Antipolis : ETSI, 2019-11.

[4] **ETSI** Broadcast Sound Receivers; Part 4: Limits for the DAB broadcast sound service; Harmonised Standard for access to radio spectrum // ETSI EN 303 345-4 V1.1.0. - Sophia Antipolis : ETSI, 2019-11.

[5] **ETSI** Broadcast Sound Receivers; Part 5: Limits for the DRM broadcast sound service; Harmonised Standard for access to radio spectrum // ETSI EN 303 345-5 V1.1.1. - Sophia Antipolis : ETSI, 2020-02.

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5 Ordering Information

The following table contains order information for required instruments, options and accessories. The last two columns specify which products are required for a one-path configuration of the R&S®BTC and which are required for a two-path configuration. Coders, stream libraries and waveform libraries have to be selected according to the transmission standards desired for testing.

Please contact your local sales office for detailed clarification.

Designation	Type	Order No.	1-Path Config.	2-Path Config.
Broadcast Test Center	R&S®BTC	2114.3000.02	●	●
Baseband Generator, 1st channel	R&S®BTC-B1	2114.3500.02	●	●
Baseband Generator, 2nd channel	R&S®BTC-B2	2114.3600.02	-	●
Baseband Main Module, two I/Q paths to RF	R&S®BTC-B12	2114.6600.02	●	●
Frequency range 100 kHz up to 3 GHz	R&S®BTC-B3103	2114.3100.02	●	●
Frequency range 100 kHz up to 3 GHz	R&S®BTC-B3203	2114.3300.02	-	●
EXT. Baseband Routing	R&S®BTC-K8	2114.6968.02	-	●
Multimedia Generation Suite	R&S®BTC-K20	included in base unit	●	●
Multi ARB Waveform Generator, (SL)	R&S®BTC-K35	2114.6974.02	●	●
DAB/DAB+/T-DMB Coder	R&S®BTC-K511	2114.7106.02	●	-
T-DMB/DAB Coder Package	R&S®BTC-PK511	2114.7687.02	-	●
AM/FM RDS RDBS Coder	R&S®BTC-K570	2114.7141.02	●	-
AM / FM / RDS Coder Package	R&S®BTC-PK570	2114.7806.02	-	●
T-DMB/DAB Streams	R&S®LIB-K51	2116.9364.02	●	●
DAB+ Streams	R&S®LIB-K53	2116.9387.02	●	●
T-DMB/DAB Waveforms	R&S®WV-K801	2116.9787.02	●	-
DRM Waveforms	R&S®WV-K803	2116.9806.02	●	-
DRM+ Waveforms	R&S®WV-K811	2116.9887.02	●	-
DRM/DRM+ Coder	R&S®BTC-K519	2114.7058.02	●	-
DRM+ Coder Package	R&S®BTC-PK519	2114.7635.02	-	●
DRM/DRM+ MDI Stream Library	R&S®LIB-K60	2116.9458.02	●	●
Analog AV RX	R&S®VT-B2370	2115.7600.06	●	●

Designation	Type	Order No.	1-Path Config.	2-Path Config.
Audio Analysis	R&S®VT-K2150	2115.8235.02	●	●
Power measurements	R&S®BTC-K2055	2114.7258.02	●	●
Average Power Sensor	R&S®NRP6A	1424.6796.02	●	●
Six-Pole Interface Cable, length: 1.50 m (Accessory to R&S®NRP6A)	R&S®NRP-ZK6	1419.0664.02	●	●
Alternatively: Average Power Sensor	R&S®NRP-Z91 (discontinued)	1168.8004.02	●	●
Signal and Spectrum Analyzer	R&S®FSV4	1321.3008.04	●	●
Preamplifier, 9 kHz to 4 GHz	R&S®FSV4-B22	1310.9600.02	●	●
Matching Pad 0 … 2700 MHz	R&S®RAM	358.5414.02	●	●
Power Splitter	R&S®RVZ	0800.6612.52	●	●

Rohde & Schwarz

The Rohde & Schwarz electronics group offers innovative solutions in the following business fields: test and measurement, broadcast and media, secure communications, cybersecurity, radiomonitoring and radiolocation. Founded more than 80 years ago, this independent company has an extensive sales and service network and is present in more than 70 countries.

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