TA-TRS manual testing for new EN 303 345 version release

General Guide

This document provides information on how to perform manual testing based on current R&S TA-TRS QuickStep V4.05 platform in order to adapt to the new released EN 303 345 for broadcast sound receivers. It serves as a bridged document before new standard software package released by R&S for upgrade.

This Guide provide an example of DAB test, step by step operation on how to modify parameters and test files on both QuickStrep plateform and BTC testing interface in order to fulfill new DAB test standard changes. AM, FM and DRM test can follow the DAB test as a reference guide to make the necessay change. The Appendix provides information of comparision between the old and new EN 303 345 standard change. Users can refer it to see if the changes are needed when doing new standard test.

In the case of performing DAB new test standard test, user can follow below steps:

1. Launch the old EN303345 test template as per normal. Before start runing the test case. Plese check and make the necessary changes on plateform parameters accordingly.

2. You can change the DAB Frequency and the limit like below screenshot.

3. Check and change the DAB signal configuration manually in BTC

4. Manually change BTC test stream to DAB new draft test .wav file, like below screenshot as an example.
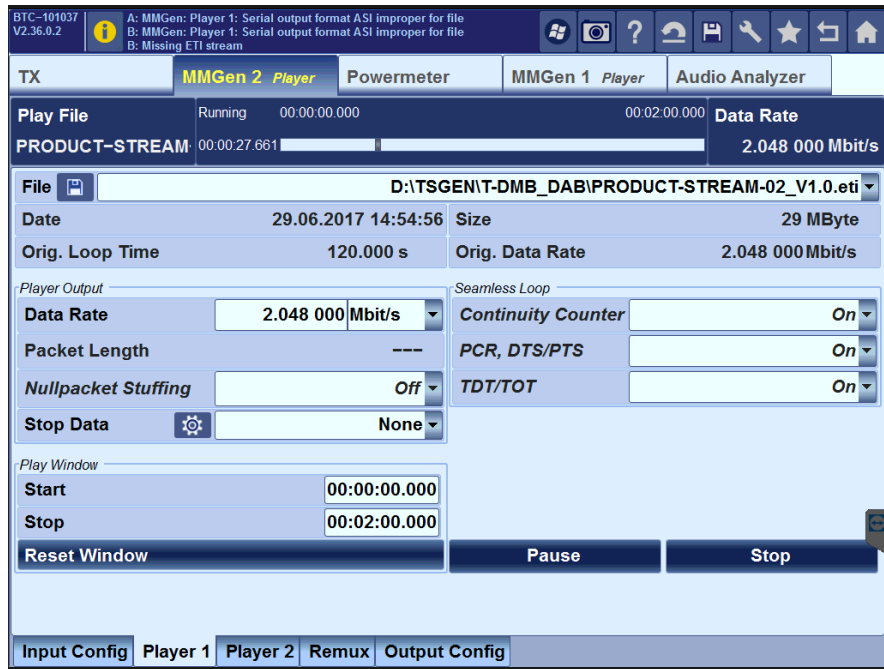
5. Double check if the test parameter setting is according to new test standard requirement.

6. Click Start to continue running the test case after all parameters are set according to the new draft standard.

Appendix

The following contents provides information on the existing TA-TRS EN 303 345 version, and the new released Version comparison. This provides as a reference if the changes on current parameters and testing files on BTC are needed in order to adapt to the new EN 303 345 Radio test standard release.

1. Content of NEW EN 303 345 standard

Broadcast Sound Receivers;
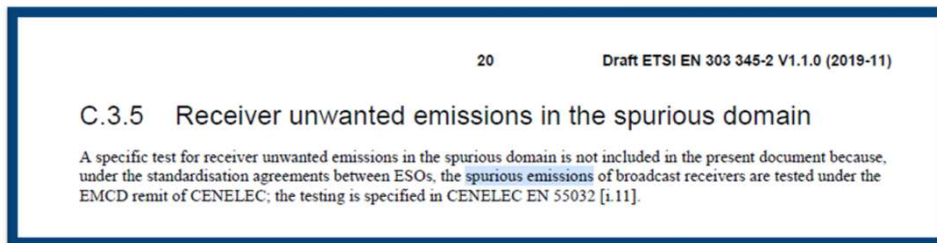**Part 1: Generic requirements and measuring methods**.
Part 2: AM broadcast sound service;
Part 3: FM broadcast sound service;
Part 4: DAB broadcast sound service;
Part 5: DRM broadcast sound service;

2. Spurious emissions

> 20   Draft ETSI EN 303 345-2 V1.1.0 (2019-11)
>
> ### C.3.5 Receiver unwanted emissions in the spurious domain
>
> A specific test for receiver unwanted emissions in the spurious domain is not included in the present document because, under the standardisation agreements between ESOs, the spurious emissions of broadcast receivers are tested under the EMCD remit of CENELEC; the testing is specified in CENELEC EN 55032 [i.11].

Spurious domain is not included in the present document because the spurious emissions of broadcast receivers are tested under the EMCD remit of CENELEC;
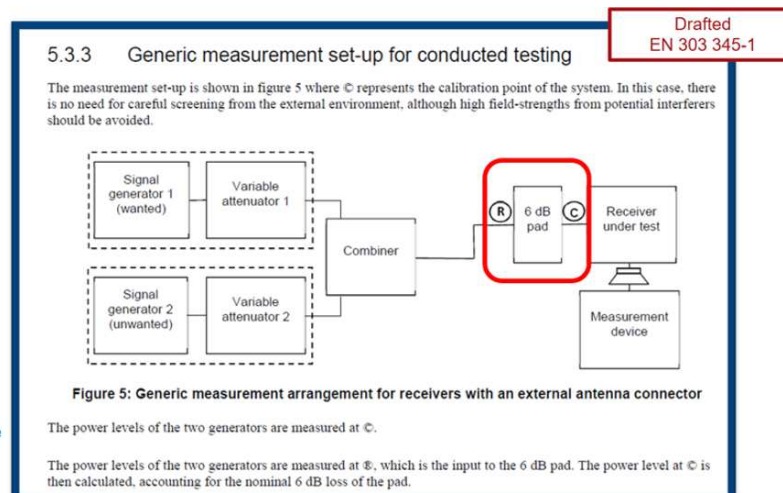
Comments:
Spurious emissions is covered in the EMC test software like ELEKTRA and EMC32.
Does not need to support in TA-TRS.

3. 6 DB PAD

Comments: The "6 dB pad" in the draft standard is shown as " 50-70Ω transistion" in the current EN 303 345 V1.1.7 standard and it can be fulfilled with the current setup sold to customers.

*Information of current standard is shown in the next page.

> Drafted EN 303 345-1
>
> ### 5.3.3 Generic measurement set-up for conducted testing
>
> The measurement set-up is shown in figure 5 where © represents the calibration point of the system. In this case, there is no need for careful screening from the external environment, although high field-strengths from potential interferers should be avoided.
>
> Signal generator 1 (wanted) — Variable attenuator 1
> Signal generator 2 (unwanted) — Variable attenuator 2
> Combiner
> ® 6 dB pad © Receiver under test
> Measurement device
>
> **Figure 5: Generic measurement arrangement for receivers with an external antenna connector**
>
> The power levels of the two generators are measured at ©.
>
> The power levels of the two generators are measured at ®, which is the input to the 6 dB pad. The power level at © is then calculated, accounting for the nominal 6 dB loss of the pad.

5.3.3 Generic measurement set-up for equipment for conducted testing

The measurement set-up is shown in figure 5. In this case, there is no need for careful screening from the external environment, although high field-strengths from potential interferers should be avoided.
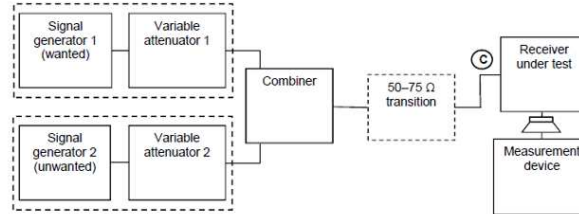
Figure 5: Generic measurement arrangement for receivers with an external antenna connector

© represents the calibration point of the system. The power levels of the two generators are measured here. Most test equipment is designed for 50 Ω systems, whereas domestic equipment is usually 75 Ω. Where the absolute level needs to be known, allowance shall be made for the loss in the transition, typically 6 dB for a minimum loss pad and 0 dB for a transformer. Care should be taken not to mix 50 Ω connectors and 75 Ω connectors, or damage could result.

For receivers which use an internal passive splitter to provide signals to multiple tuners and an active antenna which provides level matching, the power level at the calibration point shall be increased by the same factor as that provided by the active antenna (i.e. for the example of a receiver with an internal two-way 3 dB splitter and an active antenna providing a 3 dB gain, the power level at © shall be increased by 3 dB).

4. Sensitivity

5.3.4 Sensitivity measurement methods

5.3.4.1 Analogue (AM and FM) sensitivity measurements

1) The 'unwanted' signal generator remains switched off for the duration of the test.

2) The 'wanted' signal generator is set to the required modulation method, test signal configuration and centre frequency. The signal level is adjusted with the modulation disabled to the required sensitivity level plus 6 dB as measured at ©. The modulation is enabled.

3) The receiver is tuned to the frequency of the 'wanted' signal generator. For a receiver without a digital frequency display, the receiver shall be tuned for optimum THD+N (i.e. as it would be tuned by a user for best quality). The receiver's audio level shall be set so as to provide clean 1 kHz audio tone at the audio output (minimum distortion, that is typically less than 3 % total harmonic distortion, but no more than 10 % total harmonic distortion) but of sufficient level to drive the measurement device.

4) The level of the 'wanted' signal generator is reduced by 6 dB.

5) The audio output, measured using the measurement device, is recorded as the signal level, S.

6) The modulating audio signal for the 'wanted' signal generator is removed. The audio output, measured using the measurement device, is recorded as the noise level, N.

NOTE: Modulation is disabled when setting the power level to prevent sideband power from influencing the measurement. Sideband power is not considered when measuring the power of analogue signals.

Comments: Level setting can be done manually on the generator. New TA-TRS software version to control the generator and produce the required signal level.

2) The 'wanted' signal generator is set to the required modulation method and test configuration as specified in clause 4.2.3, and to the frequency specified in clause 4.2.4. The signal level is adjusted to provide the level, as measured at ©, specified in clause 4.2.4 plus 30 dB.

5.1 Two new SiGnal generation method (New standard)

Annex B (informative):
Test signal generation

The test signals required for the FM radio selectivity tests can be generated using analogue or digital techniques.

The analogue method is shown in figure B.1. An FM test signal generator is first modulated with a 500 Hz sinusoidal tone obtained from an audio signal generator. The level of the modulating signal at the input of the FM modulator is adjusted to obtain a deviation of ±32 kHz. The audio level at the FM modulator input is measured by means of a noise voltmeter. The noise voltmeter consists of a quasi-peak voltmeter with defined dynamic characteristics (see Recommendation ITU-R BS.468-4 [2]). Any noise-weighting network is switched off. Next, the band-limited noise replaces the sinusoidal tone at the FM modulator input. The level of the noise signal at the FM modulator input is adjusted to give the same quasi-peak reading at the noise voltmeter as with the sinusoidal tone with the pre-emphasis disabled. Pre-emphasis is re-enabled for the receiver tests, which increases the level into the FM modulator by 0,7 dB.

NOTE: The low pass filter has a cut-off frequency of 15 kHz and a minimum roll-off of 60 dB/octave.

Figure B.1: Block diagram for hardware generated test signal

The digital methods may use a baseband audio file, as shown in figure B.2(a), or by using a vector signal generator, as shown in figure B.2(b).

NOTE: The low pass filter has a cut-off frequency of 20 kHz and a minimum roll-off of 40 dB/octave.

Figure B.2: Block diagrams for digitally generated test signals

Waveform files are contained in archive en_30334501v010101p0.zip which accompanies ETSI EN 303 345-1 [1] and are detailed in table B.1.

Annex B (informative):
Test signal generation

The test signals required for the AM radio selectivity tests can be generated using analogue or digital techniques.

The analogue method is shown in figure B.1. An AM test signal generator is first modulated with a 500 Hz sinusoidal tone obtained from an audio signal generator. The level of the modulating signal at the input of the AM modulator is adjusted to obtain a modulation depth of 50 %. The audio level at the AM modulator input is measured by means of a noise voltmeter. The noise voltmeter consists of a quasi-peak voltmeter with defined dynamic characteristics (see Recommendation ITU-R BS.468-4 [2]). Any noise-weighting network is switched off. Next, the band-limited noise replaces the sinusoidal tone at the AM modulator input. The level of the noise signal at the AM modulator input is adjusted to give the same quasi-peak reading at the noise voltmeter as with the sinusoidal tone.

NOTE: The low pass filter has a cut-off frequency of 4,5 kHz and a minimum roll-off of 60 dB/octave.

Figure B.1: Block diagram for hardware generated test signal

The digital methods may use a baseband audio file, as shown in figure B.2(a), or by using a vector signal generator, as shown in figure B.2(b).

NOTE: The low pass filter has a cut-off frequency of 20 kHz and a minimum roll-off of 40 dB/octave.

Figure B.2: Block diagrams for digitally generated test signals

Waveform files are contained in archive en_30334501v010101p0.zip which accompanies ETSI EN 303 345-1 [1] and are detailed in table B.1.

Comments:
These are alternative digital techniques to generate the test signal. Current analogue method of using BTC &/ SFE provided to customers is working. No need for any changes in hardware.

*Information of current standard is shown in the next page.

5.2 Two new SiGnal generation for AM, FM method (Current Standard)

5.3.5 Adjacent channel selectivity and blocking measurement methods

5.3.5.1 AM and FM adjacent channel selectivity and blocking measurements

The means of generating the noise modulation for AM and FM 'unwanted' signals is shown in figure 6. It is feasible to use a PC to generate these signals, but care is needed to ensure freedom from out-of-band artifacts.

Figure 6: Arrangement for generating AM and FM interferers

ETSI

Care needs to be exercised in setting up the modulation level. Normally a quasi-peak detector is appropriate. A useful technique for FM is to switch off the pre-emphasis and then apply a 1 kHz audio tone to the modulation input of the generator. The tone is adjusted in level to achieve 19 kHz peak deviation. The tone is measured with an RMS voltmeter and replaced with noise of the same RMS voltage. With the pre-emphasis restored, the deviation should now be 34,9 kHz quasi-peak or 14,6 kHz RMS:

6. AM SiGnal generation

4 Technical requirements specifications

4.1 Test signal configurations

The generated AM signals (wanted, unwanted and blocking) shall be in accordance with table 1. The configuration is based on Recommendation ITU-R BS.1615-1 [i.5].

Table 1: AM configuration

Parameter	AM signals		
	Wanted	Unwanted	Blocking
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2 [3], clause 1, band-limited to 4,5 kHz (see note 1)	1 kHz tone
Other modulation parameters	40 % depth	22,8 % RMS depth (see note 2)	80 % depth

NOTE 1: The filter shall have a cut-off frequency of 4,5 kHz and a minimum roll-off of 60 dB/octave.
NOTE 2: This is equivalent to a quasi-peak modulation depth of 50 %. The demodulated audio level will have the same quasi-peak value as that of a carrier with 50 % AM modulation depth modulated with a 1 kHz sinusoid.

The means of generating the noise modulation for the "unwanted" signal is shown in figure 1.

Comments:
The 4,5kHz filter with minimum roll-off of 60dB/octave is readily available in BTC.

7. AM changes Sensitivity test

4.2 Sensitivity

4.2.1 Definition

The receiver sensitivity is the minimum wanted signal level required to provide a given level of audio quality.

4.2.2 Limits

The limits for sensitivity specified in table 2 shall apply. Each figure quoted is the required level of wanted signal which provides a given level of audio quality. The audio impairment criterion relevant for these tests is that the audio SNR $\geq$ 22 dBQ ref 40 % AM.

Table 2: AM sensitivity requirements

De-modulation	Tuned frequency band	Wanted signal centre frequency (MHz) (see note)	Required sensitivity limit	
			Conducted (dBm)	Radiated (dBµV/m)
AM	LF	0,216	-65	74
	MF	0,999	-65	66
	HF	9,650	-65	60

NOTE: If the receiver cannot be tuned to 9,650 MHz, the wanted signal centre frequency shall be set to the closest alternate from the following list: 3,980 MHz, 6,050 MHz, 7,330 MHz, 11,850 MHz, 13,720 MHz, 15,450 MHz, 17,690 MHz, 18,960 MHz, 21,650 MHz, 25,890 MHz.

Comments:
Current BTC is able to fulfill the change in centre frequency from 9,9MHz to 9,650MHz. TA-TRS software needs to be changed to allow for the selection of new centre frequency or the list of alternate frequencies.

11   Final draft ETSI EN 303 345 V1.1.7 (2017-03)

Table 5: Sensitivity requirements

Test	De-modulation	Tuned frequency band	Wanted signal centre frequency (MHz)	Required sensitivity limit	
				Conducted (dBm)	Radiated (dBµV/m)
1	AM	LF	0.216	-65	74
2		MF	0.999	-65	66
3		HF	9.9	-65	60

8. AM changes Adjacent channel selectivity and blocking

12   Drafted EN 303 345-2   (2019-11)

Table 4: Adjacent channel selectivity and blocking requirements

De-modulation (see note 1)	Tuned frequency band	C Wanted signal centre frequency (MHz) (see note 4)	C Wanted signal level		Required I/C ratio (see notes 2 and 3)			
			Conducted (dBm)	Radiated (dBµV/m)	N = 1 (dB)	N = 2 (dB)	N = 3 (dB)	Blocking (dB)
AM (built-in or integral antenna)	LF	0,216	n/a	80	-20	10	20	20
	MF	0,999	n/a	72	-20	10	20	20
	HF	9,650	n/a	66	-20	10	20	20
AM (external antenna)	LF	0,216	-59	n/a	-5	25	35	40
	MF	0,999	-59	n/a	-5	25	35	40
	HF	9,650	-59	n/a	-5	25	35	40

NOTE 1: The ACS and blocking requirements are currently separated into different limits for radiated and conducted testing methods. These limits are likely to be unified in a future revision of the present document. Users of the present document should consult frequently the latest list published in the Official Journal of the European Union.

NOTE 2: The frequency of the interferer shall be calculated using the channel spacing data in table 3 for each of the 6 defined adjacent channels N = {-3, -2, -1, +1, +2, +3} and the two blocking offsets. Each row of table 4 thus defines 8 individual tests.

NOTE 3: The minimum level of I for the relevant level of impairment is calculated by adding the I/C ratio to the wanted C level.

NOTE 4: If the receiver cannot be tuned to 9,650 MHz, the wanted signal centre frequency shall be set to the closest alternate from the following list: 3,980 MHz, 6,050 MHz, 7,330 MHz, 11,850 MHz, 13,720 MHz, 15,450 MHz, 17,690 MHz, 18,960 MHz, 21,650 MHz, 25,890 MHz.

Comments:
Current BTC is able to fulfill the change in centre frequency from 9,9MHz to 9,650MHz.
The change in I/C ratio for adjacent channel, N = 1, from -30dB to -20dB will require change in TA-TRS software to fulfil.
TA-TRS software needs to be changed to allow for the selection of new centre frequency or the list of alternate frequencies.

9. FM changes SG generation

Drafted EN 303 345-3

4   Technical requirements specifications

4.1   Test signal configurations

The generated FM signals (wanted and unwanted) and the blocking signal shall be in accordance with table 1. The configuration is based on Recommendation ITU-R BS.641 [i.5].

Table 1: FM configuration

Parameter	FM signals		AM signal
	Wanted	Unwanted	Blocking
Audio modulation	1 kHz tone	Weighted noise Recommendation ITU-R BS.559-2 [3], clause 1, band-limited to 15 kHz (see note 1)	1 kHz tone
Other modulation parameters	±60,8 kHz peak deviation	15,9 kHz RMS deviation (see note 2)	80 % depth
Pilot tone	None	None	

NOTE 1: The filter shall have a cut-off frequency of 15 kHz and a minimum roll-off of 60 dB/octave.

NOTE 2: This is equivalent to a quasi-peak deviation of 34,8 kHz and has pre-emphasis enabled. The quasi-peak level measurement is defined by Recommendation ITU-R BS.641 [i.5], clause 5; with pre-emphasis disabled the quasi-peak deviation is 32 kHz (14,5 kHz RMS).

The means of generating the noise modulation for the "unwanted" signal is shown in figure 1.

Comments:
Weighted noise is available within the BTC as an audio file. This audio file was generated according to the BS559.
The 15kHz filter with minimum roll-off of 60dB/octave is readily available in BTC.

10. FM changes No Clean audio anymore

Drafted
EN 303 345-3

4.3.2 Limits

The limits for selectivity and blocking specified in table 4 shall apply with the channel spacings given in table 3. Each figure quoted is the minimum acceptable level of unwanted signal, relative to that of the wanted signal, which provides a given level of audio quality. The audio impairment criteria relevant for these tests is that the audio SNR ≥ 40 dBQ ref ±60,8 kHz deviation, and that there shall be 10 seconds of audio with no subjective impairments (e.g. clicks resulting from FM threshold effects).

Comments:
Current TA-TRS software is still able to fulfil the impairment criteria without need for clean audio.

Current Standard

13   Final draft ETSI EN 303 345 V1.1.7 (2017-03)

Table 9: Impairment criteria for adjacent channel selectivity and blocking tests

Demodulation	Impairment criteria
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).

11. DAB SG changes

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EN 303 345-4

Table 1: DAB configuration

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Parameter	DAB signals		AM signal
	Wanted	Unwanted	Blocking
Audio modulation	Service label: "Sine+" 1 kHz tone at a level of -3 dBFS mono, 128 kbit/s AAC, EEP-3A	Any DAB ensemble without the "Sine+" service	1 kHz tone
Other modulation parameters	DAB signal to ETSI EN 300 401 [2], clause 15	DAB signal to ETSI EN 300 401 [2], clause 15	80 % depth
NOTE:	Level is defined in accordance with AES17 [i.5].		

Comments:
A new file for the unwanted DAB signal needed here.
The new signal file is provided in the drafted standard and can be added into TA-TRS for usage.
Only change is needed in TA-TRS to call out the new signal file.

Current Standard

4.2.3.3 DAB testing

The generated DAB signals (wanted and unwanted) and the blocking signal shall be in accordance in table 3.

Table 3: DAB configuration

Parameter	DAB signal	AM signal
	Wanted and Unwanted	Blocking
Audio modulation	Service label: "Sine+" 1 kHz tone at a level of -3 dBFS Coding: mono, 128 kbit/s AAC.	1 kHz tone
Other modulation parameters	DAB signal with EEP-3A to ETSI EN 300 401 [1], clause 15	80 % depth

12. DRM SG changes

Drafted EN 303 345-5

Table 1: DRM configuration

Parameter		DRM signals						AM signal Blocking
		Wanted			Unwanted			
Audio coding		Service label: "Sine 1 kHz" 1 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate			Service label: "Sine 2 kHz" 2 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate			1 kHz tone
Frequency band		LF/MF	HF	VHF	LF/MF	HF	VHF	
Channel coding parameters	RM flag	0	0	1	0	0	1	
	protection level	1	1	2	1	1	2	
	MSC mode	0	0	0	0	0	0	
	interleaver depth	1	1	0	1	1	0	
	robustness mode	B	B	E	B	B	E	
	spectrum occupancy	2	3	0	2	3	0	
Other modulation Parameters		DRM signal to ETSI ES 201 980 [2], clause 8			DRM signal to ETSI ES 201 980 [2], clause 8			80 % depth

NOTE: Level is defined in accordance with AES17 [i.5].

An arbitrary waveform file producing the blocking signal is available in archive en_30334501v010101p0.zip which accompanies ETSI EN 303 345-1 [1].

Comments:
A new file for the unwanted DRM signal needed here. The new signal file is provided in the drafted standard and can be added into TA-TRS for usage. Changes needed in TA-TRS to call out the new signal file.

Current Standard

4.2.3.4 DRM testing
The generated DRM signals (wanted and unwanted) and the blocking signal shall be in accordance with table 4.

Table 4: DRM configuration

Parameter		DRM signal			AM signal Blocking
		Wanted and Unwanted			
Audio coding		Service label: "Sine +" 1 kHz tone at a level of -3 dBFS Coding: mono AAC at maximum permitted rate			1 kHz tone
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 [2], clause 8			80 % depth

Drafted EN 303 345-5

Table 2: DRM sensitivity limits

De-modulation	Tuned frequency band	Wanted signal centre frequency (MHz)	Required sensitivity limit	
			Conducted (dBm)	Radiated (dBµV/m)
DRM	LF	0,216	-99	58
	MF	0,999	-99	52
	HF1	4	-99	44
	HF2	19	-99	40
	VHF band I	65	-100	45
	VHF band II	100	-100	46
	VHF band III	200	-100	51

Comments:
TA-TRS needs to be modified for the change in conducted sensitivity level.

Current Standard

Table 5: Sensitivity requirements

Test	De-modulation	Tuned frequency band	Wanted signal centre frequency (MHz)	Required sensitivity limit	
				Conducted (dBm)	Radiated (dBµV/m)
1	AM	LF	0,216	-65	74
2		MF	0,999	-65	66
3		HF	9,9	-65	60
4	FM	VHF band II	98	-90	50 (see note 1)
5	DAB	VHF band III	202,928	-94	37 (see note 2)
6	DRM	LF	0,216	-101	58
7		MF	0,999	-101	52
8		HF1	4	-101	44
9		HF2	19	-101	40
10		VHF band I	65	-102	45
11		VHF band II	100	-102	46
12		VHF band III	200	-102	51

NOTE 1: For products with an integral antenna, the requirement is relaxed to 67 dBµV/m.
NOTE 2: For products with an integral antenna, the requirement is relaxed to 50 dBµV/m.

Summary:

1. No hardware changes needed for setup provided.
2. Software changes is needed on TA-TRS.