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Saudi Standards, Metrology and Quality Org (SASO)

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**Technical specifications of the radio, digital and analog
broadcasting receiver for (AM/FM/T- DAB+)**

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**Technical specifications of the radio, digital and analog broadcasting receiver for
(AM/FM/T- DAB+)**

FOREWORD

The Saudi Standards, Metrology and Quality Organization (SASO) and Saudi Broadcasting Authority have prepared this draft Standard " Technical specifications of the radio, digital and analog broadcasting receiver for (AM/FM/T- DAB+)" This document will apply as mandatory Saudi Standard. Starting from 2020/01/01 And vehicles receivers, portable receivers and home receivers shall not be accepted unless after confirmation of the existence of the DAB +.

Technical specifications of the radio, digital and analog broadcasting receiver for (AM/FM/T- DAB+)

1- Scope

This specification shall apply to all producers, manufacturers, importers and retailers who wish to sell radio receivers and all other products which have built-in radio receivers in Saudi Arabia. It shall be used to assess the eligibility of a product for use in Saudi Arabia. This specification details the requirements for an automotive radio receiver and for other receiver types like domestic and portable. This specification covers devices which can receive terrestrially transmitted AM, FM and T-DAB+ radio services. Some of these devices may also receive other digital radio services via alternative delivery platforms, such as the internet. This specification does not cover details of a receiver intended to receive digital services via these alternative delivery platforms. This specification covers many types of receiver, including home receivers, portable receivers, devices integrated into the vehicle dashboard and aftermarket devices mounted in the dashboard, behind the dashboard, to the vehicle windscreen or elsewhere. This specification covers devices whose sole function is to receive radio services, and also devices which have one or more other functions in addition to receiving radio services. This specification details the requirements for low cost radio receivers, which represents the low- end receiver market. However, the receiver requirements were compared to the parameters used for network planning in order to meet the required field strength and protection ratios.

2- Technical Requirements:

2.1- Automotive radio receivers:

All Automotive radio receivers shall be able to receive terrestrial transmitted AM, FM and T-DAB+ sound broadcasting services and shall comply with the technical requirements mentioned at Annex (A) and (B). The AM receivers shall comply with AM Type A specification.

2.2- Domestic and Portable radio receivers:

All Domestic and Portable radio receivers shall comply with the applicable technical requirements for AM, FM or T-DAB+ mentioned at Annex (A) and (B).

3- Terms and definition

For the purposes of this document unless stated otherwise the word Receiver refers to an Automotive, Domestic and Portable AM, FM and DAB+ Radio Receiver

for the purposes of this document an automotive receiver is defined as any radio receiver that is designed specifically for use within a vehicle. For the purposes of this document the word Adaptor refers to a DAB+ Digital Radio Adaptor. An Adaptor is defined as a device that provides a DAB+ capability to another device, for example an analogue radio (AM or FM) that does not have that capability.

For T-DAB+, the receiver must be able to play out “**adequate audio reception**”. The required “adequate audio reception” is based on the reception of a 128 kbit/s DAB MPEG 2 audio component which has been transmitted with error protection level of UEP-3. “Adequate audio reception” is achieved when the receiver is capable of reconstructing a data stream at the output of the Viterbi decoder with an error rate equal to or better than 1×10^{-4} when encoded with an error protection level of EEP-3A with a 128 kbit/s DAB MPEG 2 audio component.

For T-DAB+ test purposes, an objective audio test and a performance audio test are specified. For the objective test, the audio component shall consist of a 1 KHz mono tone, encoded at 3 dB below full scale (-3dBFS) when transmitted with error protection level of EEP-3A and the receiver will be required to have no more than a permitted number of audio impairments occurring in a given period of listening. An audible impairment is defined as any disturbance to the signal detectable by a listener and includes mutes or dropouts (when the signal disappears) and audible noise at the output. The definitive method, known as the onset of impairment (OOI) test is detailed in IEC 62104:2015. For the performance tests an aural evaluation shall be made using a stereo music source with a 128 kbit/s DAB MPEG 2 audio component which has been transmitted with error protection level of UEP-3.

Requirements for AM receivers operating in MF and HF bands are referring to low cost sound broadcasting receivers.

Requirements for FM receivers operating in VHF bands are referring to low cost mono and stereo sound broadcasting receivers.

Req: means that the specification is “Required” and therefore mandatory

Opt: means that the specification is “Optional” and therefore voluntary but highly recommended

4- Normative References:

Documents contain provisions which, through reference in this text, constitute provisions of the present document.

- ETSI EN 300 401 Radio Broadcasting Systems;
- Digital Audio Broadcasting (DAB) to Mobile, Portable and Fixed receivers. ETSI TS 101 756 Digital Audio Broadcasting (DAB); Registered Tables.
- ETSI TS 102 563 Digital Audio Broadcasting (DAB); Transport of Advanced Audio Coding (AAC) audio.
- ETSI TR 101 496 Digital Audio Broadcasting (DAB); Guidelines and rules for implementation and operation; (Parts 1 and 2).
- ETSI 300 384 Radio broadcasting systems; Very High Frequency (VHF), frequency modulated, sound broadcasting transmitters
- IEC 62104:2015 Characteristics of DAB Receivers.
- ETSI TS 103 176 Digital Audio Broadcasting (DAB); Rules of implementation; Service information features
- UK DRAP: MINIMUM SPECIFICATIONS FOR DAB AND DAB+ IN-VEHICLE DIGITAL RADIO RECEIVERS AND ADAPTORS DRAP-TEG-03,
- UK DRAP: MINIMUM SPECIFICATIONS FOR DAB AND DAB+ PERSONAL AND DOMESTIC DIGITAL RADIO RECEIVERS DRAP-TEG-02.
- RECOMMENDATION ITU-R BS.415-2 - Minimum performance specifications for low-cost sound-broadcasting receivers
- ITU-R BS.703 Characteristics of AM sound broadcasting reference receivers for planning purposes
- ITU-R BS.560-4 Radio-frequency protection ratios in LF, MF and HF broadcasting
- IEC 60315-3:1989/AMD1:1999; Amendment 1 - Methods of measurement on radio receivers for various classes of emission. Part 3: Receivers for amplitude-modulated sound-broadcasting emissions
- ITU-R BS.450-3 - Transmission standards for FM sound broadcasting at VHF
- ETS 300 384 - Radio broadcasting systems; Very High Frequency (VHF), frequency modulated, sound broadcasting transmitters
- ITU-R BS.641 - Determination of radio-frequency protection ratios for frequency-modulated sound broadcasting
- ITU-R BS.412-9 - Planning standards for terrestrial FM sound broadcasting at VHF
- IEC 62106:2015 RDS (Radio Data System)

Reference to other documents or sources may be existing and is noted in the document where applicable.

Annex (A): Requirement table for T-DAB+ Radio Receiver

No.	Resource	Reference/ Details	Req.	Notes
1	GENERAL REQUIREMENTS			
1.1	Services reception	An automotive receiver must in addition to DAB+ services receive also FM and AM analogue radio services currently on air in Saudi Arabia and based on AM and FM specifications.	Req.	A DAB+ digital radio receiver with a primary purpose of adapting an analogue receiver to digital (also called Adapter) is not required to receive analogue radio services.
1.2	Output for audio	The receiver shall output the audio signal to loudspeakers and/or provide outputs to one of the interfaces specified in Clause 5 of IEC 62104:2015	Req.	
1.3	Output for audio	The receiver may optionally provide an output of the selected audio service component according to IEC 60958-3.	Opt.	
1.4	DMB (Digital Multimedia Broadcasting)	The receiver should support Hybrid Digital Radio services as specified in ETSI TS 102 428.	Opt.	DMB is a video and multimedia technology based on DAB/DAB+
1.5	Hybrid Digital Radio	The receiver should support Hybrid Digital Radio services as specified in ETSI TS 101 499 and ETSI TS 102 818	Opt.	
2	RF REQUIREMENTS			
2.1	Frequency range	174 to 230 MHz (VHF Band III)	Req.	Frequency allocation table is available in Annex A of the IEC62104:2015
2.2	RF performance	The receiver must comply with the Band III provisions of IEC 62104:2015 with the exceptions that the thresholds for Gaussian Sensitivity, Rayleigh Sensitivity and Adjacent Channel Interference should be taken from this document.	Req.	

2.3	RF Input - domestic and portable receivers	UHF FEMALE 75 Ohm as defined in IEC 61169-2:2007 or- Type F FEMALE 75 Ohm as defined in IEC 61169-24	Opt.	Domestic and portable receivers.
2.4	RF Input - automotive receivers	Shall be fitted with an antenna connection as follows: - RF standard core: Type SMB MALE 50Ohm as defined in IEC 60169-10 or - Headshell, latch: Type Fakra (SMBA) with latch as defined in ISO 20860-1	Req.	Automotive receivers: Not relevant for receivers integrated to the car (OEM).

No.	Resource	Reference/ Details	Req.	Notes
2.5	RF - Gaussian sensitivity receivers	Receivers supplied without an antenna shall be capable of providing Adequate Audio Reception with an input power level of -97,7 dBm when fed by a DAB+ signal with Gaussian transmission channel characteristics. Automotive external antenna will require a gain of -2,9 dBi or greater to produce this power at the required minimum field strength. Automotive receivers should have an input impedance of 50 Ohms.	Req.	A DAB+ Digital radio Automotive Receiver that is sold packaged or installed with an antenna must provide Adequate Audio Reception when receiving a DAB+ signal with a field strength signal greater than FSG_{min} in a Gaussian transmission channel. The value of FSG_{min} is frequency of 220 MHz, and its value at other frequencies can be calculated from the following formula: $FSG_{min} = [29,2 + 20\log(F/220)]$ dB μ V/m, where F is the frequency in MHz

2.6	RF - Gaussian sensitivity – Domestic and portable receivers	Receivers supplied without an antenna shall be capable of providing Adequate Audio Reception with an input power level of -97,7dBm when fed by a DAB+ signal with Gaussian transmission channel characteristics. This external antenna will require a gain of -8.1dBi or greater to produce this power at the required minimum field strength. Domestic receivers should have an input impedance of 75 Ohms.	Req.	A domestic receiver that is sold with an antenna must provide Adequate Audio Reception when receiving a DAB+ signal with a field strength signal greater than FSG_{min} in a Gaussian transmission channel. The value FSG_{min} is frequency dependent. It is 34,4 dBμV/m for a signal with a centre frequency of 220 MHz, and its value at other frequencies can be calculated from the following formula: $FSG_{min} = [34,4 + 20\log(F/220)]$ dB μ V/m, where F is the frequency in MHz.
2.7	RF - Maximum input power for a Gaussian Channel	For the maximum input power test, the minimum requirements in VHF band III for different types of DAB+ receivers defined in IEC 62104:2015 are: - Domestic receivers & Automotive accessory : - 10dBm - Portable receivers: - 5dBm - OEM Automotive receivers: +10dBm	Req.	The maximum input power is the maximum input level at which the DAB+ receiver will perform just before synchronisation is lost.
2.8	RF - Rayleigh sensitivity - Automotive receivers	Receivers supplied without an antenna shall be capable of providing Adequate Audio Reception (as defined above) with an input power level of -92,2dBm when fed by a DAB+ signal with Rayleigh transmission channel	Req.	A DAB+ Digital radio In-Vehicle Receiver that is sold with an antenna must provide Adequate Audio Reception (as defined above) when receiving a DAB+ signal with a field strength signal greater

		<p>characteristics. This external antenna will require a gain of -2,9 dB or greater to produce this power at the required minimum field strength. The Rayleigh fading channel characteristics will be as specified in IEC 62104:2015.</p>		<p>than FSR_{min} in a Rayleigh transmission channel.</p> <p>The value of FSR_{min} is frequency dependant. It is 34,7 dBμV/m for a signal with a centre frequency of 220 MHz</p>
2.9	<p>RF - Rayleigh sensitivity – Domestic and portable receivers</p>	<p>Receivers supplied without an antenna shall be capable of providing Adequate Audio Reception (as defined above) with an input power level of -92,2dBm when fed by a DAB+ signal with Rayleigh transmission channel characteristics. This external antenna will require a gain of -8,1dBi or greater to produce this power at the required minimum field strength. The Rayleigh fading channel characteristics will be as specified in IEC 62104:2015.</p>	Req.	<p>The receiver must provide Adequate Audio Reception of a DAB+ signal with Rayleigh transmission channel characteristics with field strengths at or above the frequency dependent value of FSR_{min.} of 39,9 dBμV/m for a signal with a centre frequency of 220 MHz</p>

2.10	RF – Receiver selectivity (Adjacent channel interference)	A receiver must be able to provide adequate reception of a DAB+ audio sub-channel with error protection level UEP3 when the wanted signal has a level of - 70dBm for domestic and - 77,7dBm for automotive receiver and it is in the presence of any one of the interfering signals with a frequency offset and amplitude as described in the table below.	Req.	The figure for adjacent channel interference (N+/- 1) from the table below is applicable for the majority of DAB+ frequency blocks where the spacing between centre frequencies is 1,712MHz.	
				Frequency block of Interferin g DAB signal relative to wanted signal	Level of interfering signal, relative to wanted signal (Gaussian wanted signal at threshold level of -70 dBm/t- 77,7dBm at the input to the receiver)
				N±1	+35dB
				N±2	+40dB
			N±3 and to extent of band	+45dB	

No.	Resource	Reference/ Details	Req.	Notes
3	DAB+ channel decoding requirements			
3.1	Decoding – general	Receivers must be capable of decoding at least one audio sub- channel.	Req.	
3.2	Decoding – DAB+	A receiver shall be able to decode a DAB+ audio service contained in a sub-	Req.	DAB+ audio services are defined in ETSI TS 102 563

		channel of a size up to and including 144 Capacity Units (e.g.96 kbps@EEP1A).		
3.3	Decoding - DAB	A receiver should be able to decode a DAB audio service contained in a sub-channel of a size up to and including 280 Capacity Units (e.g. 256 kbps@UEP1).	Opt.	DAB audio services are defined in ETSI EN 300 401.
3.4	Decoding – Audio Service	Stereo, parametric stereo and spectral band replication shall be supported	Req.	
4	Audio decoding requirements			
4.1	Audio decoding	According to ETSI EN300 401 Section 7 – Audio Coding; All clauses except 7.4.1.1 (Dynamic Range Control), 7.4.5.1 (MSC Data Groups in X-PAD), 7.4.5.2 (Dynamic Label Segment)	Req.	

No.	Resource	Reference/ Details	Req.	Notes
4.2	Audio decoding for DAB+	According to ETSI TR 102 563 - all sections are relevant	Req.	
4.3	Audio decoding – general	According to ETSI TR 101 496 part 2 Section 3 – Implementation and Operation of System Features; Clauses 3.1 (Introduction), 3.2 (Data Transport Mechanisms), 3.2.2 (Stream Mode), 3.4 (Audio Coding).	Req.	
5 Functionality and user interface				
5.1	Retuning – scan	A receiver which has a stored list of service labels from many ensembles should automatically update its stored service list or provide the user with the option of manually scanning the whole Band III band to update its stored service list when required.	Req.	
5.2	Retuning - updates	Receivers which only display the services on the current ensemble should update the displayed list of audio services if the selected ensemble reconfigures to add, remove or rename services automatically or manually. This rescan / retune feature must be able to cope with the following changes: 1. Service moves to a different multiplex 2. New multiplex launches 3. Multiplex changes its frequency	Req.	DAB+ Ensembles in Saudi Arabia will change their configuration from time to time. It is preferred that the receiver should update its stored database of available programmes by constantly checking the FIC of the ensemble to which it is currently tuned.

		<p>4. New Service appears 5. Service changes name 6. Service disappears 7. Multiple Instances of the same programme content with the same Service ID on different frequencies and with varying signal levels</p>		
5.3	Text display	<p>Automotive receiver shall have a means of displaying text to the user and this is also highly recommendable for other receiver types; alternative options for user interaction could exist for special receiver types.</p>	Req.	
5.4	Text display - basic presentation	<p>The text display shall display the audio service name (the Component Label). The text display must be able to display the following graphic symbols, correctly mapped, visually well-formed and clear: ABCDEFGHIJKLMNOPQR STUVWXYZabcdefghijklmnopqrstuvwxyz opqrstuvwxyz0123456789 Lower case characters may be mapped to upper case equivalents and therefore show only: ABCDEFGHIJKLMNOPQRST UVWXYZ0123456789</p>	Req.	

No.	Resource	Reference/ Details	Req.	Notes
5.5	Text display – full range presentation	For displays wishing to display the full range of Dynamic Label text, including these symbols as specified in ETSI EN 300 401, and if the receiver cannot display these graphic symbols correctly, then the graphical symbol shown shall be a “space” or “□” or, in any case, a similar distinctly non alpha / numeric character.	Req.	It is likely that Broadcasters will also use the following characters: @ ? + - \$ € % & ! ."() , ” and Arabic characters.
5.6	Arabic character set	In addition to the complete EBU Latin based Repertoire (code 0000), the Receivers shall support characters for ARABIC language (HEX code 7E) from ISO/IEC 10646 using UTF-8 transformations (codes 0110 and 1111).	Req.	
5.7	Text display - labels	Receivers shall receive labels from ensembles and audio services, and display long form labels in preference to short form labels.	Req.	
5.8	Text display – labels preference	The receiver shall display the Component Label, in preference to the Service Label, as it is possible to have two audio channels sharing the same Service Label. If a Component Label is not broadcast, the Service Label shall be used.	Req.	

5.9	Text display – Component label	The text display shall display the Component label in either its short form (8 characters long) or its long form (16 characters long). It is not permissible for the receiver to truncate the label to any other length.	Req.	
5.10	Text display – Dynamic Label Service	<p>Receivers shall receive the Dynamic Label Service from up to 48 bytes of the X-PAD of the currently received service and display it to the user legibly.</p> <p>Receivers should treat the special characters 0x0A and 0x0B as specified and apply such formatting as is possible on the display. The Receiver shall act upon the Command to remove the label from the display by immediately removing the label, even if it has only been partially displayed.</p>	Req.	<p>ETSI EN300 401 provides relevant information in the following section:</p> <ul style="list-style-type: none"> • Section 7 – Audio Coding <ul style="list-style-type: none"> ◦ Clause 7.4.5.2 (Dynamic Label Segment) <p>ETSI TR 101 496 part 2 provides information in the following section:</p> <ul style="list-style-type: none"> • Section 3 – Implementation and Operation of System Features <ul style="list-style-type: none"> ◦ Clauses 3.2.4 (Programme Associated Data (PAD)), 3.5.6 (Dynamic Label) <p>ETSI TR102 563 provides relevant information in the following section:</p> <ul style="list-style-type: none"> • Section 5 – Audio <ul style="list-style-type: none"> ◦ Clause 5.4(Programme Associated Data)

No.	Resource	Reference/ Details	Req.	Notes
5.11	Text display – Automotive receivers	To avoid taking unnecessary attention from the driver Automotive receivers shall not animate or scroll the dynamic label by default.	Req.	
6 Announcement signaling and switching, service labels				
6.1	Announcement switching	Automotive receiver shall support announcement switching as defined in ETSI 300 401 sub-section 8.1.6. This feature instructs the receiver to select an alternative audio source only for the duration of an audio announcement, before returning to the original source.	Req.	Manufacturers may provide the user with an option to disable this feature.
6.2	Traffic Announcement	Automotive receiver shall vector from the selected service to an audio service carrying a Traffic Announcement if all the following conditions are met: <ul style="list-style-type: none"> • The selected service is signalled as supporting announcements by means of a Fig 0/18 in the Service Information with ASu flag bit 1 set to indicated “Traffic” and is provided with a Cluster Id. • An announcement is raised by another service on the same ensemble with the same Cluster Id. • The user has not selected a menu option to disable the announcement feature 	Req.	The receiver does not have to respond to announcements that are signalled as being present on other Ensembles. Whether it does so or not is a design choice for the manufacturer.

6.3	Traffic Announcement on same Programme Identifier (PI)	Automotive receivers shall not switch to Traffic Announcements received on an FM service if that FM service has the same Programme Identifier (PI) Code as the Service ID (SID) of the original signal.	Req.	Services whose SID and PI codes match will be carrying identical content. There is no need to disrupt the DAB audio by switching to the FM version of the same audio – which may not be co-timed.
6.4	Service following	Automotive receiver shall support all aspects of service following as specified in the ETSI document ETSI TS 103 176 Digital Audio Broadcasting (DAB); Rules of implementation; Service information features.	Req.	ETSI EN300 401 provides relevant information in the following Section 8 – Data Features; Clauses 8.1.1 (Introduction), 8.1.8 (Frequency Information), 8.1.10.1 (OE Frequencies), 8.1.10.2 (OE Services), 8.1.15 (Service Linking Information)
7	User information			
7.1	Easy to Use and Simple Documentation	Receivers shall be simple to set up and operate and be provided with clear easy to understand user documentation in both Arabic and English in line with that requirement.	Req.	
7.2	Support Package	The following peripheral items shall be included within a baseline package: <ul style="list-style-type: none"> • Batteries for Remote control (if included) • An easy to understand user manual in both Arabic and English • Reception antenna(s) for supported band(s) (if antenna is not integrated). Note: not mandatory for automotive receivers. 	Req.	

Annex (B): Requirement table for AM/FM Radio Receivers

No.	Resource	Reference/ Details	Req.	Notes
1	AM radio Type A: a low sensitivity receiver for operation in MF			
1.1	Frequency range	526.5kHz - 1606.5kHz	Req.	
1.2	Type of modulation	A3 (Double sideband amplitude modulation with full carrier)	Req.	
1.3	Channel spacing	9 kHz	Req.	In the case of a tuner using PLL (Phase Locked Loop), the radio shall be able to change the receiving frequency in 9kHz steps.
1.4	RF - Sensitivity	Not worse than 5mV/m (with a built-in antenna with facilities for using an external antenna)	Req.	Sensitivity of receivers is understood as "noise limited sensitivity" in terms of field strength, required to achieve a signal to noise ratio of 26dB at the audio output at 30% modulation of 400Hz tone. The AF signal-to-noise ratio shall be according to the IEC Publication 60315-3 and the field strength values for MF band are measured according to the IEC Publication 60315-3
1.5	RF - Selectivity	Overall selectivity for a low sensitivity receiver shall be: at -6dB points: passband not less than ±3kHz , at -20dB points: passband not greater than ±10kHz	Req.	Selectivity of a receiver is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals entering through the antenna circuit. The selectivity measurement is based on the Recommendation ITU-R SM.332-4.

<p>1.6</p>	<p>RF - Image, intermediate freq. and spurious response ratio</p>	<p>Image rejection ratio shall not be less than 30dB</p>	<p>Req. The value of image and intermediate frequency rejection ratio and the production of harmonics of the intermediate frequency and/or of the oscillator frequency are factors influencing the choice of intermediate frequency. If both the carrier frequencies and the intermediate frequency are an integral multiple of the carrier spacing, then all interfering products will also be integral multiples of the carrier spacing. Theoretically, a maximum protection could then be obtained because the frequency difference between any interfering signal of this kind and the wanted carrier frequency, would be zero or a multiple of the channel spacing. No specific intermediate frequency are recommended, but the use of frequencies in the range 450-470 kHz is common. An image rejection ratio is measured according to the IEC Publication 60315-3.</p>
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No.	Resource	Reference/ Details	Req.	Notes
1.7	Audio performance	If Audio output is available, then the Audio power output shall not be less than 0.1W for less than 10% distortion.	Req.	
2	AM radio Type B: a combined receiver for operation in MF and HF			
2.1	Frequency range	MF: 526,5kHz - 1606,5kHz	Req.	HF band 2.3 MHz - 21.85MHz is divided to SW1, SW2 and SW3. Some receivers may not be able to receive all bands recommended by ITU-R BS.415- 2 but shall be able to receive SW2 band.
		SW1: 2,3-2,5MHz, 3,2-3,4MHz, 3,9-4,0MHz, 4,75-5,06MHz, 5,95-6,2MHz, 7,1-7,6MHz	Opt.	
		SW2: 9,2-9,9MHz, 11,6- 12,2MHz, 13,57-13,87MHz, 15,10-15,8MHz	Req.	
		SW3: 17,48-17,9MHz, 21,45- 21,85MHz, 25,6-26,1MHz, 26,965-27,41MHz	Opt.	
2.2	Type of modulation	A3 (Double sideband amplitude modulation with full carrier)	Req.	
2.3	Channel spacing	MF: 9kHz HF:5kHz	Req.	In the case of a tuner using PLL (Phase Locked Loop), the MF radio shall be able to change the receiving frequency in 9 kHz steps. In the case of a tuner using PLL (Phase Locked Loop) a HF receiver shall be able to change the receiving frequency in 5 kHz steps.

2.4	RF - Sensitivity	Not worse than 150μV	Req.	Sensitivity of receivers is understood as "noise limited sensitivity" in terms of field strength, required to achieve a signal to noise ratio of 26dB at the audio output of 30% modulation of 400Hz tone. The AF signal-to-noise ratio shall be according to the IEC Publication 60315-3 and the field strength values for MF band are measured according to the IEC Publication 60315-3
2.5	RF - Selectivity	At -6dB points: passband not less than \pm3kHz At -20dB points: passband not greater than \pm10kHz At -40dB points: passband not greater than \pm20kHz	Req.	Selectivity of a receiver is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals entering through the antenna circuit.

No.	Resource	Reference/ Details	Req	Notes
2.6	RF - Image, intermediate freq. and spurious response ratio	<p>Image rejection ratio shall not be less than 30dB for MF</p> <p>Image response ratio for HF shall not be less than 5dB</p> <p>Intermediate frequency and spurious response ratio for HF shall not be less than 12dB</p> <p>This does not apply to Software Defined Radios (SDR).</p>	Req.	<p>No specific intermediate frequency are recommended, but the use of frequencies in the range 450-470 kHz is common. However, it should be noted that when such frequencies are used it is then not possible to achieve a sufficient image rejection ratio in HF bands. For this case the use of higher intermediate frequency in conjunction with double-conversion should be considered for HF. An image rejection ratio is measured according to the IEC Publication 60315-3</p>
2.7	RF - Automatic gain control (A.g.c.) performance	<p>The output level shall not change by more than 6dB for a reduction in signal level of 10dB. Similarly, the output level shall not change by more than 3 dB for an increase in signal level of 20dB.</p>	Req.	<p>Automatic gain control is responding to changes of a signal level at the antenna input of the receiver. The ITU-R BS.415-2 specifies that the output level should not change for more than 10 dB for a reduction in a signal level of 30dB from 0,1V. The value of 0,1V is rather high so it is better to use the definition from ITU-R BS.703 using the sensitivity values (MF 60 dBμV/m, HF 40 dBμV/m)</p>
2.8	RF - Frequency stability	<p>Shall be such that the receiver does not require frequent retuning</p>	Req.	

2.9	Audio performance - Power output	Power output, for less than 10% distortion shall not be less than 0.1W	Req.	
2.10	Audio performance – Overall fidelity	Overall fidelity including acoustic response of loudspeaker shall be at least 250-3150Hz within 18dB limits or, alternatively it may be more convenient for some manufacturers to consider only the electrical characteristics which shall be at least 100-4000Hz within 12dB limits (audio frequency of 400 Hz should be taken as the reference 0 dB level)	Req.	

No.	Resource	Reference/ Details	Req.	Notes
3	FM radio with RDS			
3.1	Frequency range	87.5MHz - 108.00MHz	Req.	
3.2	Type of modulation	Receiver shall be designed to demodulate: F3/F8	Req.	Character "F" stands for Frequency modulation, and the numbers "3" and "8" designates the "One Channel or two channels containing analogue information"

No.	Resource	Reference/ Details	Req.	Notes
3.3	Channel spacing	Channels spacing shall be 100 kHz	Req.	In the case of a tuner using PLL (Phase Locked Loop) a FM receiver shall be able to tune the receiving frequency in 100 kHz steps.
3.4	RF - Sensitivity	Not worse than -75dB rel. 1mW (32^1 dB(μ V/m))	Req.	Sensitivity of receivers is understood as "noise limited sensitivity" in terms of field strength, required to achieve a signal to noise ratio of 30dB at the 50mW audio output.
3.5	RF - Signal to noise ratio	Better than 30dB	Req.	
3.6	RF – Intermediate frequency	Shall be 10.7MHz This does not apply to Software Defined Radios (SDR).	Req.	The local oscillator position can be 10,7MHz higher or lower from the receiving frequency.
3.7	RF - Selectivity	At least - 30dB at ± 300kHz This does not apply to Software Defined Radios (SDR).	Req.	Selectivity of a FM receiver is a measure of its ability to discriminate between a wanted signal to which the receiver is tuned and unwanted signals entering through the antenna circuit. Channel separation is 100kHz.
3.8	RF – Receiver bandwidth	Shall be ± 75 kHz This does not apply to Software Defined Radios (SDR).	Req.	
3.9	RF – Radiation of the local oscillator	The local oscillator radiation should be less than the limits specified by CISPR 22 or EN 55022.	Req.	TRA Technical specification on EMC and Safety Requirements to be considered.

3.10	Audio performance – power output	If the Audio Output is available, then the Audio power output shall be not less than 0.1W	Req.	
3.11	Audio performance – Distortion	The distortion shall be less than 5% for a frequency deviation varying between ± 15 kHz and ± 75 kHz with a modulation frequency of 400 Hz and an output power of 50mW.	Req.	
3.12	Audio performance – De-emphasis	De-emphasis of the sound signal shall be 50μs	Req.	
3.13	Radio Data System (RDS)	Automotive receivers have to comply with the RDS (Radio Data System) standard IEC 62106:2015	Req.	Chapter 3.13 mandatory for automotive receivers! Optional for other receivers.
3.13.1	Basic RDS features	Programme Identification (PI)	Req.	For automotive receivers!
3.13.2	Basic RDS features	Programme Service (PS) name	Req.	For automotive receivers!
3.13.3	Basic RDS features	Alternative Frequency (AF) lists	Req.	For automotive receivers!
3.13.4	Basic RDS features	Traffic Programme (TP) code	Req.	For automotive receivers!
3.13.5	Basic RDS features	Traffic Announcement (TA) signal	Req.	For automotive receivers!
3.13.6	Additional RDS features	Decoder Information (DI)	Opt.	For automotive receivers!
3.13.7	Additional RDS features	Music Speech (MS)	Opt.	For automotive receivers!
3.13.8	Additional RDS features	Programme Type (PTY)	Req.	For automotive receivers!
3.13.9	Additional RDS features	Programme Item Number (PIN)	Opt.	For automotive receivers!
3.13.10	Optional RDS Additional	Enhanced Other Networks information (EON)	Req.	For automotive receivers!
3.13.11	Additional RDS features	Clock Time and date (CT)	Opt.	For automotive receivers!

No.	Resource	Reference/ Details	Req.	Notes
4	User information			
4.1	Easy to Use and Simple Documentation	Receivers shall be simple to set up and operate and be provided with clear easy to understand user documentation in both Arabic and English in line with that requirement.	Req.	
4.2	Support Package	The following peripheral items should be included within a baseline package: <ul style="list-style-type: none"> • Batteries for Remote control (if included) • An easy to understand user manual in both Arabic and English • Reception antenna(s) for supported band(s) (if antenna is not integrated). Note: not mandatory for automotive receivers. 	Req.	

¹ To convert dBm to dBuV add 107 dB (for 50 ohm systems)

Req: means Requirement, mandatory

Opt: means optional, voluntary