



**Satellite Earth Stations and Systems (SES);
Very Small Aperture Terminals (VSAT);
Transmit-only, transmit-and-receive, receive-only satellite
earth stations operating in the 4 GHz and 6 GHz
frequency bands;
Harmonised Standard for access to radio spectrum**

ReferenceREN/SES-00432

Keywordsregulation, satellite, VSAT

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Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° w061004871

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Contents

Intellectual Property Rights	7
Foreword.....	7
Modal verbs terminology	8
Introduction	8
1 Scope	9
2 References	10
2.1 Normative references	10
2.2 Informative references	10
3 Definitions of terms, symbols and abbreviations	11
3.1 Terms	11
3.2 Symbols	13
3.3 Abbreviations.....	13
4 Technical requirements specifications	14
4.1 General.....	14
4.1.1 Environmental profile	14
4.1.2 Centralized Control and Monitoring Functions (CCMF)	14
4.1.3 Transmit operational configurations	14
4.1.4 Transmit VSAT states and radio states	14
4.1.4.1 Definitions	14
4.1.4.2 Class A CMF	15
4.1.4.3 Class B CMF	15
4.1.4.4 Radio states.....	15
4.2 Conformance requirements	16
4.2.1 Off-axis spurious radiation.....	16
4.2.1.1 Justification.....	16
4.2.1.2 Specification	16
4.2.1.2.1 Transmit VSAT.....	16
4.2.1.2.2 Receive-only VSAT.....	17
4.2.1.3 Conformance tests	18
4.2.2 On-axis spurious radiation for transmit VSAT	18
4.2.2.1 Justification.....	18
4.2.2.2 Specifications	18
4.2.2.2.1 Specification 1: "Carrier-on" radio state	18
4.2.2.2.2 Specification 2: "Carrier-off" and "Emissions disabled radio states"	18
4.2.2.3 Conformance tests	18
4.2.3 Off-axis e.i.r.p emission density.....	18
4.2.3.0 General	18
4.2.3.1 Justification.....	18
4.2.3.2 Specification	19
4.2.3.3 Conformance tests	20
4.2.4 Carrier suppression.....	20
4.2.4.1 Justification.....	20
4.2.4.2 Specification	20
4.2.4.3 Conformance tests	20
4.2.5 Mechanical (antenna pointing) for transmit VSAT	20
4.2.5.1 Justification.....	20
4.2.5.2 Specification	20
4.2.5.3 Conformance tests	21
4.2.6 Class A Centralized Control and Monitoring Functions	21
4.2.6.1 Centralized Control and Monitoring Functions (CMF)	21
4.2.6.1.1 General.....	21
4.2.6.1.2 VSAT state transition diagram.....	21
4.2.6.1.3 Specification of states	22
4.2.6.2 Control Channels (CC)	23

4.2.6.2.1	Justification	23
4.2.6.2.2	Specification	23
4.2.6.2.3	Conformance tests.....	23
4.2.6.3	Self-monitoring functions.....	24
4.2.6.3.1	General.....	24
4.2.6.3.2	Processor monitoring	24
4.2.6.3.3	Transmit subsystem monitoring.....	24
4.2.6.3.4	VSAT transmission validation	25
4.2.6.4	Reception of commands from the CCMF	26
4.2.6.4.1	General.....	26
4.2.6.4.2	Disable message.....	26
4.2.6.4.3	Enable Message	26
4.2.6.5	Power-on/Reset.....	27
4.2.6.5.1	Justification	27
4.2.6.5.2	Specification	27
4.2.6.5.3	Conformance tests.....	27
4.2.7	Class B Centralized Control and Monitoring Functions.....	27
4.2.7.0	General	27
4.2.7.1	Processor monitoring.....	28
4.2.7.1.1	Justification	28
4.2.7.1.2	Specification	28
4.2.7.1.3	Conformance tests.....	28
4.2.7.2	Transmit subsystem monitoring	29
4.2.7.2.1	Justification	29
4.2.7.2.2	Specification	29
4.2.7.2.3	Conformance tests.....	29
4.2.7.3	Power-on/Reset.....	29
4.2.7.3.1	Justification	29
4.2.7.3.2	Specification	29
4.2.7.3.3	Conformance tests.....	29
4.2.7.4	Control Channel (CC) reception	29
4.2.7.4.1	Justification	29
4.2.7.4.2	Specification	29
4.2.7.4.3	Conformance tests.....	30
4.2.7.5	Network control commands.....	30
4.2.7.5.1	Justification	30
4.2.7.5.2	Specification	30
4.2.7.5.3	Conformance test	30
4.2.7.6	Initial burst transmission	30
4.2.7.6.1	Justification	30
4.2.7.6.2	Specification	30
4.2.7.6.3	Conformance tests.....	30
4.2.8	Receive antenna off-axis gain pattern	30
4.2.8.1	Justification.....	30
4.2.8.2	Specification	31
4.2.8.3	Conformance tests	31
4.2.9	Blocking performance	31
4.2.9.1	Justification.....	31
4.2.9.2	Specification	31
4.2.9.3	Conformance tests	31
4.2.10	Adjacent Signal Selectivity	32
4.2.10.1	Justification.....	32
4.2.10.2	Specification	32
4.2.10.3	Conformance tests	32
5	Testing for compliance with technical requirements.....	32
5.1	Environmental conditions for testing.....	32
6	Test methods for the complete VSAT	32
6.1	General.....	32
6.2	Off-axis spurious radiation	33
6.2.1	Test method.....	33

6.2.1.a	General	33
6.2.1.0	Multi-carrier operation	34
6.2.1.1	Up to 1 000 MHz	34
6.2.1.1.1	Test site	34
6.2.1.1.2	Measuring receivers	34
6.2.1.1.3	Procedure	35
6.2.1.2	Above 1 000 MHz	35
6.2.1.2.0	General	35
6.2.1.2.1	Identification of the significant frequencies of spurious radiation	35
6.2.1.2.2	Measurement of radiated power levels of identified spurious radiation	36
6.2.1.2.3	Measurement of conducted spurious radiation at the antenna flange	37
6.3	On-axis spurious radiation for transmit VSAT	38
6.3.1	Test method	38
6.3.1.1	Test site	38
6.3.1.2	Method of measurement	38
6.3.1.2.1	General	38
6.3.1.2.2	Method of measurement at the antenna flange	38
6.3.1.2.3	Method of measurement with a test antenna	39
6.4	Off-axis e.i.r.p emission density within the band	40
6.4.0	General	40
6.4.1	Test method	40
6.4.1.1	General	40
6.4.1.2	Transmit output power density	41
6.4.1.2.1	General	41
6.4.1.2.2	Test site	41
6.4.1.2.3	Method of measurement	41
6.4.1.3	Antenna transmit gain	42
6.4.1.3.1	General	42
6.4.1.3.2	Test site	42
6.4.1.3.3	Method of measurement	42
6.4.1.4	Antenna transmit radiation patterns	43
6.4.1.4.1	General	43
6.4.1.4.2	Test site	43
6.4.1.4.3	Method of measurement	43
6.4.1.4.4	Co-polar radiation pattern - azimuth	44
6.4.1.4.5	Co-polar radiation pattern - elevation	44
6.4.1.4.6	Cross-polar radiation pattern - azimuth	45
6.4.1.4.7	Cross-polar radiation pattern - elevation	45
6.4.2	Computation of results	46
6.5	Carrier suppression	46
6.5.1	Test method	46
6.6	Antenna pointing for transmit VSAT	46
6.6.1	Test method	46
6.7	Class A Centralized Control and Monitoring Functions	47
6.7.1	General	47
6.7.2	Test arrangement	47
6.7.3	Control Channels (CC)	48
6.7.3.1	Test method	48
6.7.3.1.0	General	48
6.7.3.1.1	Test method for internal CC	48
6.7.3.1.2	Test method for external CC	49
6.7.4	Processor monitoring	49
6.7.4.1	Test method	49
6.7.5	Transmit subsystem monitoring	49
6.7.5.1	Test method	49
6.7.6	VSAT transmission validation	50
6.7.6.1	Test method for VSAT validation by the CCMF for VSAT using internal CC	50
6.7.6.2	Test method for VSAT validation by receiving station(s) for VSAT using internal CC	50
6.7.6.3	Test method for transmission validation for VSAT using external CC	50
6.7.7	Reception of commands from the CCMF	50
6.7.7.1	Test method	50
6.7.8	Power-on/Reset	50

6.7.8.1	Test method	50
6.8	Class B Centralized Control and Monitoring Functions	51
6.8.0	General	51
6.8.1	Test arrangement	51
6.8.2	Processor monitoring - Test method	52
6.8.3	Transmit subsystem monitoring - Test method	52
6.8.4	Power-on/Reset - Test method	53
6.8.5	Control Channel (CC) reception - Test method	53
6.8.6	Network Control commands - Test method	54
6.8.7	Initial burst transmission - Test method	55
6.9	Receive antenna off-axis gain pattern	56
6.9.1	Test method	56
6.9.1.1	Test site	56
6.9.1.2	Method of measurement	56
6.9.1.3	Computation	57
6.10	Blocking performance	57
6.10.1	Test method	57
6.11	Adjacent Signal Selectivity	57
6.11.1	Test method	57
7	Void	58
Annex A (informative):	Relationship between the present document and the essential requirements of Directive 2014/53/EU	59
Annex B (normative):	Pointing stability methodology	62
Annex C (informative):	Maximum measurement uncertainty	63
Annex D (informative):	Bibliography	64
Annex E (informative):	Change history	65
History		66

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Foreword

This draft Harmonised European Standard (EN) has been produced by ETSI Technical Committee Satellite Earth Stations and Systems (SES), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI Standardisation Request deliverable Approval Procedure (SRdAP).

The present document has been prepared under the Commission's standardisation request C(2015) 5376 final [i.2] to provide one voluntary means of conforming to the essential requirements of Directive 2014/53/EU [i.5] on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC.

Once the present document is cited in the Official Journal of the European Union under that Directive, compliance with the normative clauses of the present document given in table A.1 confers, within the limits of the scope of the present document, a presumption of conformity with the corresponding essential requirements of that Directive, and associated EFTA regulations.

Proposed national transposition dates	
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Modal verbs terminology

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Introduction

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Figure 1: Void

Sample Document

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1 Scope

The present document specifies technical characteristic and methods of measurements for Very Small Aperture Terminal (VSAT) equipment which has the following characteristics:

- the VSAT is operating in one or more frequency ranges within the following bands allocated to the Fixed Satellite Service (FSS), shared with other services, e.g. the Fixed Service (FS) and the Mobile Service (MS):
 - 5,850 GHz to 7,075 GHz (Earth-to-space);
 - 3,400 GHz to 4,200 GHz (space-to-Earth);
 - 4,500 GHz to 4,800 GHz (space-to-Earth);
- the VSAT uses linear or circular polarization;
- the VSAT operates through a geostationary satellite at least 2° away from any other geostationary satellite operating in the same frequency band and covering the same area;
- the VSAT antenna diameter does not exceed 7,3 m, or equivalent effective area;
- the VSAT is either:
 - a transmit-only VSAT: designed for transmission-only of radio-communications signals in the frequency band (earth-to-space) specified in the present clause; or
 - a transmit-and-receive VSAT: designed for transmission-and-reception of radio-communications signals in the frequency bands specified in the present clause; or
 - a receive-only VSAT: designed for reception-only of radio-communications signals in the frequency band (space-to-Earth) specified in the present clause;
- the VSAT is designed for unattended operation;
- the VSAT is operating as part of a satellite network (e.g. star, mesh or point-to-point) used for the distribution and/or exchange of information between users; the VSAT is controlled, and monitored for the transmit functionality, by a Centralized Control and Monitoring Facility (CCMF). The VSAT has to implement Control and Monitoring Functions with either Class A or Class B (structures of the radio states). The specifications associated to the CCMF facility are outside the scope of the present document.

The present document applies to the VSAT with its ancillary equipment and its various terrestrial ports, and when operated within the boundary limits of the operational environmental profile defined for the intended use of the VSAT including all equipment as brought to the market.

The present document does not contain any requirement, recommendation or information about the installation of the VSAT.

All parts of the indoor unit related to reception, processing and presentation of the received information except the control channel are not within the scope of the present document. The syntax of the control channel messages is outside the scope of the present document. The present document is intended to cover the provisions of Directive 2014/53/EU (Radio Equipment Directive) [i.5] article 3.2.

NOTE: The relationship between the present document and essential requirements of article 3.2 of Directive 2014/53/EU [i.5] is given in annex A.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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- [1] Void.
- [2] Void.
- [3] [CISPR 16-1-5:2014](#): "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-5: Radio disturbance and immunity measuring apparatus - Antenna calibration test sites for 5 MHz to 18 GHz".
- [4] Void.
- [5] Void.
- [6] [ERC/REC 74-01 \(2021\)](#): "Unwanted emissions in the spurious domain".

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- [i.1] Void.
- [i.2] [Commission Implementing Decision C\(2015\) 5376](#) of 4.8.2015 on a standardisation request to the European Committee for Electrotechnical Standardisation and to the European Telecommunications Standards Institute as regards radio equipment in support of Directive 2014/53/EU of the European Parliament and of the Council.
- [i.3] Void.
- [i.4] ETSI TR 102 375 (V1.2.1): "Satellite Earth Stations and Systems (SES); Guidelines for determining the parts of satellite earth station antenna radiation patterns concerned by the geostationary satellite orbit protection".
- [i.5] [Directive 2014/53/EU](#) of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC (Radio Equipment Directive).
- [i.6] Void.

- [i.7] ETSI TR 102 215 (V1.3.1): "Electromagnetic compatibility and Radio spectrum Matters (ERM); Recommended approach, and possible limits for measurement uncertainty for the measurement of radiated electromagnetic fields above 1 GHz".
- [i.8] ETSI EG 203 336: "Guide for the selection of technical parameters for the production of Harmonised Standards covering article 3.1(b) and article 3.2 of Directive 2014/53/EU".

3 Definitions of terms, symbols and abbreviations

3.1 Terms

For the purposes of the present document, the following terms apply:

ancillary equipment: equipment used in connection with a VSAT where the three following conditions are met:

- a) the equipment is intended for use in conjunction with the VSAT to provide additional operational and/or control features (e.g. to extend control to another position or location); and
- b) the equipment cannot be used on a standalone basis, to provide user functions independently of the VSAT; and
- c) the absence of the equipment does not inhibit the operation of the VSAT

carrier-off radio state: radio state in which the VSAT may transmit but does not transmit any carrier

NOTE 1: The phrase "the VSAT may transmit" means that all the conditions for transmission are satisfied (e.g. where transmissions are permitted and no failure is detected).

NOTE 2: The existence of a "carrier-off" radio state depends on the system of transmission used. For VSATs designed for continuous transmission mode there may be no "carrier-off" radio state.

carrier-on radio state: radio state in which the VSAT may transmit and actually transmits a carrier

Centralized Control and Monitoring Functions (CCMF): set of functional entities that, at system level, monitor and control the correct operation of all transmit VSAT in a network

Control Channel (CC): channel or channels by which VSAT receive control information from the CCMF

EIRP_{max}: maximum e.i.r.p capability of the VSAT as defined for the intended use of the VSAT

NOTE: Different values of EIRP_{max} for each combination of occupied bandwidth and transmission parameters can be applied as per the intended use of the VSAT (see clause 4.1.3).

emissions disabled radio state: radio state in which the VSAT does not transmit a carrier

NOTE: This radio state only applies in certain CMF states as defined in clause 4.1.4. (e.g. before system monitoring pass, before the control channel is received, when a failure is detected, when the VSAT is commanded to disable). The "emissions disabled" radio state requires lower unwanted emissions than the "carrier-off" radio state.

environmental profile: range of environmental conditions under which equipment within the scope of the present document is required to comply with the provisions of the present document

external control channel: control channel which is either:

- i) carried by the VSAT network via the same or another satellite, but not within the internal protocol of the VSAT system; or
- ii) carried by the PSTN or some other means

external response channel: response channel which is either:

- i) carried by the VSAT network via the same or another satellite, but not within the internal protocol of the VSAT system; or

- ii) carried by the PSTN or some other means

$f_{\min}$: lower bound of the VSAT transmit frequency range defined for the intended use of the VSAT

$f_{\max}$: upper bound of the VSAT transmit frequency range defined for the intended use of the VSAT

NOTE: In the case of equipment designed to operate over more than one contiguous frequency range a separate $f_{\min}$ and $f_{\max}$ may be defined to each range.

indoor unit: part of the VSAT which is not part of the outdoor unit

NOTE: It is generally installed inside a building and is connected to the outdoor unit. The connection cable between the outdoor and indoor unit is considered part of the indoor unit.

integral antenna: antenna which may not be removed during the tests according to the intended use of the VSAT

internal control channel: control channel which is carried by the VSAT network via the same satellite as used for transmission of user data and within the internal protocol structure of the VSAT system

internal response channel: response channel which is carried by the VSAT network via the same satellite as used for transmission of user data and within the internal protocol structure of the VSAT system

Internally Mounted Equipment (IME): modules of the internal equipment which are not defined for the intended use of the VSAT as externally mounted equipment are defined as IMEC

network: collection of interconnected earth stations and satellite allowing the transfer of information between earth stations and satellite including star, mesh and point-to-point configurations

nominal antenna diameter: diameter of the antenna defined for the intended use of the VSAT

NOTE 1: An antenna with a nominal antenna diameter D has the same technical characteristics as a circular aperture antenna of diameter D . For non circular aperture antenna, the nominal antenna diameter is defined for the intended use of the VSAT.

NOTE 2: Network operators might request antennas of a certain diameter. Then an antenna that is compliant with the requirement for nominal antenna diameter equal to the requested antenna diameter can be used and its diameter noted in the test report.

nominated bandwidth: bandwidth of the VSAT radio frequency transmission which is wide enough to encompass all spectral elements of the transmission and meet the conditions of notes 1 and 2

NOTE 1: The nominated bandwidth is centred on the transmit frequency and does not exceed five times the occupied bandwidth.

NOTE 2: The nominated bandwidth is wide enough to encompass all spectral elements of the transmission which have a level greater than the specified spurious radiation limits. The nominated bandwidth is wide enough to take account of the transmit carrier frequency stability. This definition is chosen to allow flexibility regarding adjacent channel interference levels which will be taken into account by operational procedures depending on the exact transponder carrier assignment situation.

occupied Bandwidth (B_o): for a digital modulation scheme - the width of the signal spectrum 10 dB below the maximum inband density

outdoor unit: part of the VSAT intended to be installed outdoor, as defined for the intended use of the VSAT, or as indicated in the user documentation

NOTE 1: The outdoor unit usually comprises three main parts:

- a) the antenna sub-system which converts the incident radiation field into a guided wave and vice versa;
- b) the Low Noise Block (LNB) down converter, which is a device that amplifies, with very low internal noise, the received signals in the Radio Frequency (RF) band and converts them to intermediate frequencies;

- c) the upconverter and the power amplifier which convert from the intermediate frequency to RF and amplify the low level RF signals for transmission through the antenna subsystem.

NOTE 2: The installation equipment (means of attachment) is outside the scope of the present document. However, the antenna structures and other components directly mounted on the antenna and forming an integral part of it, are subject to the specifications of the present document.

removable antenna: antenna which may be removed during the tests according to the intended use of the VSAT

Response Channel (RC): channel by which VSAT transmit monitoring information to the CCMF

spurious radiation: any radiation outside the nominated bandwidth

NOTE: For a receive-only VSAT there is no nominated bandwidth therefore any radiation is a spurious radiation.

transmission disabled state: radio state in which the VSAT is not authorized by the CCMF to transmit

transmit VSAT: VSAT capable of being used either for transmission only, or for transmission and reception

Very Small Aperture Terminal (VSAT): complete VSAT equipment, comprising the outdoor unit and the indoor unit including the connection cable(s) between the units, as brought to the market

3.2 Symbols

For the purposes of the present document, the following symbols apply:

dBsd Ratio expressed in decibels relative to the spectral density

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

BDU	Below Deck Unit
BW	Wanted signal occupied Bandwidth
CC	Control Channel
CCF	Control Channel reception Failure
CCMF	Centralized Control and Monitoring Function
CCR	Control Channel correctly Received
CISPR	(Comité International Spécial des Perturbations Radioélectriques) International Special Committee on Radio Interference
CV	Control Variable
CW	Continuous Wave
EIRP, e.i.r.p	Equivalent Isotropically Radiated Power
EMC	ElectroMagnetic Compatibility
EN	European Standard
EUT	Equipment Under Test
FEC	Forward Error Correction
FS	Fixed Service
FSS	Fixed Satellite Service
G _{EUT}	Antenna Gain of EUT
GSO	Geostationary Satellite Orbit
HPA	High Power Amplifier
IME	Internally Mounted Equipment
ITU	International Telecommunication Union
LNB	Low Noise Block (low noise amplifier and down-converter)
LO	Local Oscillator
MS	Mobile Service
OATS	Open Area Test Site
PSTN	Public Switched Telephone Network
RC	Response Channel
RE	Reset Event
RED	Radio Equipment Directive

RF	Radio Frequency
SMF	System Monitoring Fail
SMP	System Monitoring Pass
SMV	Self-Monitoring Variable
STE	Special Test Equipment
TDMA	Time Division Multiple Access
TxD	Transmission Disable command
TxE	Transmission Enable command
VSAT	Very Small Aperture Terminal

4 Technical requirements specifications

4.1 General

4.1.1 Environmental profile

The technical requirements of the present document apply under the environmental profile for operation of the equipment, which shall be in accordance with its intended use. The equipment shall comply with all the technical requirements of the present document at all times when operating within the boundary limits of the operational environmental profile defined by its intended use.

The environmental profile for operation of the equipment shall include the ranges of humidity, temperature and supply voltage.

4.1.2 Centralized Control and Monitoring Functions (CCMF)

The transmit VSAT shall comply with all the technical requirements of the CCMF either class A or class B or both as specified in clauses 4.2.6 and 4.2.7 respectively. It shall be noted in the test report to which class, A or B or both, the transmit VSAT belongs according to its intended use.

4.1.3 Transmit operational configurations

VSAT can dynamically change the occupied bandwidth and/or other transmission parameters (e.g. FEC, modulation, symbol rate) of the transmitted signal. For each combination of occupied bandwidth and other transmission parameters, an $EIRP_{max}$ and a nominated bandwidth shall be defined for the intended use of the VSAT. The following specifications apply to the VSAT for each combination of occupied bandwidth and other transmission parameters.

The nominated bandwidth shall be centred on the transmit frequency and shall not exceed five times the occupied bandwidth.

The lower bound (f_{min}) and the upper bound (f_{max}) of each contiguous transmit frequency range of the VSAT shall be defined for the intended use of the VSAT. In each case f_{min} and f_{max} shall be within the frequency range from 5,850 GHz to 7,075 GHz.

4.1.4 Transmit VSAT states and radio states

4.1.4.1 Definitions

For transmit VSATs, VSAT states and radio states are defined.

The present document allows the use of either class A Control and Monitoring Functions (CMF) or class B CMF, which implementation and requirements are defined in clauses 4.1.4.2 to 4.1.4.4. For the purpose of the present document four states of the VSAT are defined for each class of CMF. In both cases the present document does not assume a particular implementation of the VSAT state machine.

The present document defines the permitted levels of emissions in terms of radio states: these radio states are equally applicable to both classes of VSAT states as described in clause 4.1.4.4.

4.1.4.2 Class A CMF

For VSATs implementing class A CMF, the four states are the following:

- "Out-of-service";
- "Checking";
- "Stand-by"; and
- "In-service".

The four states of the VSAT are represented in figure 2 and are used in clause 4.2.6 for the specification of the class A CMF.

In the "Out-of-service", "Checking" and "Stand-by" states the VSAT is not allowed to transmit. In the "In-service" state the VSAT is allowed to transmit.

4.1.4.3 Class B CMF

For VSATs implementing class B CMF, the four states are the following:

- "Non valid";
- "Initial phase";
- "Transmission disabled"; and
- "Transmission enabled".

The four states of the VSAT are represented in figure 3 and are used in clause 4.2.7 for the specification of the class B CMF.

4.1.4.4 Radio states

The VSAT "may transmit" when all the conditions for transmission are satisfied (e.g. in a state where transmissions are permitted, no failure detected).

The following radio states of the VSAT are defined:

- "Emissions disabled" when the VSAT does not transmit any carrier;
- "Carrier-off" when the VSAT may transmit but does not transmit any carrier;
- "Carrier-on" when the VSAT may transmit and transmits a carrier.

Table 1a gives the only possible combinations of the VSAT states and radio states which shall apply, with some examples of associated events.

When the VSAT transmits several carriers having different frequencies, a VSAT state machine is associated with each carrier or each set of carriers.