別表１

情報通信審議会情報通信技術分科会
海上無線通信委員会　構成員

（五十音順・敬称略）

区分	氏名	所属
主査	鈴木（すずき）　務（つとむ）	電気通信大学名誉教授、日本工業大学名誉教授
主査代理	三木（みき）　哲也（てつや）	電気通信大学　理事
専門委員	市野（いちの）　芳明（よしあき）	（財）テレコムエンジニアリングセンター理事
	伊藤（いとう）　好（このむ）	（社）日本船主協会　通信問題サブW／Ｇグループ長
	今井（いまい）　忠義（ただよし）	海上保安庁交通部整備課長
	新城（しんじょう）　達郎（たつろう）	海上保安庁総務部情報通信課長 （※　平成 20 年５月から）
	資宗（すけむね）　克行（よしゆき）	情報通信ネットワーク産業協会専務理事
	中島（なかじま）　敏（さとし）	海上保安庁総務部情報通信企画課長 （※　平成 20 年５月まで）
	中村（なかむら）　勝英（かつひで）	水洋会事務局長
	山﨑（やまさき）　保昭（やすはる）	全国遠洋鮪漁撈通信協議会　技術顧問

別表 2

情報通信審議会情報通信技術分科会
海上無線通信委員会作業班　構成員

（五十音順・敬称略）

区分	氏名	所属
主任	中村（なかむら）　勝英（かつひで）	水洋会　事務局長
構成員	安藤（あんどう）　勝美（かつみ）	日本無線株式会社　海上機器事業部　海上機器技術部　担当部長
	内海（うつみ）　邦夫（くにお）	水産庁　資源管理部管理課　漁船管理班　課長補佐 （※　平成 20 年 3 月まで）
	大井（おおい）　清（きよし）	社団法人　全国漁業無線協会　専務理事
	大西（おおにし）　泰史（やすふみ）	国土交通省　海事局安全基準課　専門官
	菊池（きくち）　剛（たけし）	海上保安庁　総務部 情報通信課　課長補佐 （※　平成 20 年 4 月から）
	齋藤（さいとう）　春夫（はるお）	水産庁　資源管理部管理課　漁船管理班　課長補佐 （※　平成 20 年 4 月から）
	斎藤（さいとう）　光明（みつあき）	社団法人　日本船主協会　海務部 （※　平成 20 年 2 月から）
	阪井（さかい）　英太（えいた）	株式会社トキメック　第 1 制御事業部　船舶港湾事業 技術部　第２技術課
	坂口（さかぐち）　忠男（ただお）	古野電気株式会社 舶用機器事業部　国内営業部　営業開発課 （※　小型船舶救急連絡装置担当）
	谷道（たにみち）　幸雄（ゆきお）	社団法人全国船舶無線工事協会　業務部長
	田原（たはら）　孝義（たかよし）	古野電気株式会社　舶用機器事業部　営業企画部 企画担当部長　（※　簡易型ＡＩＳ担当）
	遠山（とおやま）　修（おさむ）	株式会社ゼニライトブイ　技術開発部　技術開発グループ グループ長
	中川（なかがわ）　永伸（えいしん）	財団法人　テレコムエンジニアリングセンター
	畠山（はたけやま）　仁（ひとし）	海上保安庁　交通部 整備課 信号施設室 主任信号施設技術官
	平林（ひらばやし）　光雄（みつお）	太洋無線株式会社　技術部 海洋システム課長
	細野（ほその）　雄二（ゆうじ）	海上保安庁　総務部 情報通信業務課　課長補佐 （※　平成 20 年 3 月まで）
	山本（やまもと）　泰三（たいぞう）	社団法人　日本船主協会　海務部　課長代理 （※　平成 20 年 1 月まで）
	矢内（やうち）　崇雅（たかまさ）	株式会社沖コンサルティングソリューションズ

別紙１

簡易型 AIS で交換されるメッセージ一覧表

No.	メッセージ名	受信と処理※1	自局による送信	注釈
0	未定義			
1	位置通報（定期）	Yes ※2	No	
2	位置通報（割当）	Yes	No	
3	位置通報（呼掛けを受けた場合）	Yes	No	
4	基地局通報	Yes	No	
5	静的及び航海関係情報	Yes	No	
6	宛先指定バイナリメッセージ	No	No	
7	バイナリ認知	No	No	
8	バイナリ放送メッセージ	Yes	No	
9	標準 SAR 航空機位置通報	Opt	No	
10	UTC と日付要求	No	No	
11	UTC／日付応答	Opt	No	
12	安全関係宛先指定メッセージ	Yes	No	
13	安全関係認知	No	Yes	msg12 を処理するオプションが実行される場合、送信されること
14	安全関係放送メッセージ	Yes	Opt	予め決められた定型文のみでの送信
15	呼掛け	Yes	No	CSAIS は、msg18 と msg24 を求めた呼掛けに応答すること。また、msg19 を求めた基地局の呼掛けにも応答すること。
16	割当モード指令	No	No	
17	DGNSS 放送バイナリメッセージ	Opt	No	

No.	メッセージ名	受信と処理[a]	自局による送信	注釈
18	標準 Class B 装置位置通報	Yes	Yes	CSAIS はフラグビット 143 を“1”として“CS”であることを示す
19	拡張 Class B 装置位置通報	Opt	Yes	海岸局呼掛け応答としてのみ送信
20	データリンク管理メッセージ	Yes	No	
21	航路標識通報	Yes	No	
22	チャンネル管理メッセージ	Yes	No	当該機能の使用は特定地域では異なる場合がある
23	グループ割当	Yes	No	
24	CSAIS 静的情報	Yes	Yes	A と B の 2 タイプ
25-63	未定義	No	No	拡張用

※1　本表で“受信と処理”とは、例えばインタフェースや表示への出力等、ユーザにとって明白な機能を意味する。同期の場合、IEC62287-1 7.3.1.1 に従ってメッセージを受信し処理することが必要；これはメッセージ 1、2、3、4、18、19 に適用される。

※2　“Yes”のうち下線を引いた項目は、IEC62287-1 において”Opt”とされているもの。

１．外観及び構造試験

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
1. 外観及び構造	外観、構造、寸法、重量等を取扱説明書と照合して確認する。	1. 取扱説明書の記述を満足していること。 2. 次の構造のものであること。 (1) 装置は、次の機能を有すること。 ｱ. TDMA 送信 ｲ. TDMA2 チャネル同時受信 ｳ. CH70 での DSC 受信 ｴ. GNSS 受信部 ｵ. インターフェイス (2) 迅速かつ確実な作動ができ、不必要な作動は最小限とすること。 (3) 制御部は通常の調整が容易に行え、容易に識別できる構造であること。また、通常必要のない操作は容易に行えない構造であること。 (4) 制御器の識別及び表示器の読み取りのために照明を備える場合には、照度調節器を備え航行に支障が無いように調整できること。 (5) 誤操作により故障を生じたり、人を傷つける構造でないこと。 (6) 他の装置と接続する場合には、相互に性能を維持すること。 (7) “0”から“9”までの数字入力キーが備え付けられている場合には､その配置は ITU-T 勧告 E.161 又は ISO3791 によること。 (8) 装置は、過電流、過電圧及び過度的又は偶発的な逆電圧から保護されていること。	 IEC80/426/FDIS IEC62287-1 6.1 IMO A.694(17) Annex 3.1 Annex 3.2 Annex 3.3 Annex 3.4 Annex 3.5 Annex 3.6 Annex 4.2	

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
1. 外観及び構造 つづき		(9)　装置の 55V を超えるピーク電圧が印加される帯電部は、容易に露出しないように、次のいずれかの構造の保護カバーを有すること。 ｱ. カバーを開けることにより自動的に電流が遮断されること。 ｲ. 工具等を用いてカバーを開ける構造であり、高電圧を示す注意銘板が装置内及び保護カバー双方に備え付けられていること。 (10) 露出金属部は、接地できる構造であること。 (11) 装置の主構成品は、煩雑な補正又は調整をすることなく、容易に交換できること。 (12) 装置は検査、保守が容易に行えるような設計、構造であること。	IMO A.694(17) Annex 7.1 Annex 7.2 Annex 8.1 Annex 8.2	
2. 表示確認	1. 機器に備えられている資料を確認する。 2. 装置の外部に表示されている事項等を確認する。	1. 操作説明書に加え、保守の為に以下の資料が備えられていること。 (1)　故障の診断、修理が構成部品レベルで可能なように設計されている場合 ｱ. 完全な回路図 ｲ. 部品配置図 ｳ. 部品表 (2)　故障の診断、修理が構成部品レベルで可能なように設計されていない場合 ｱ. 故障したユニットの識別、交換を可能にする資料 2. 次の事項について装置の外部に表示されるか、又は表示し得るようになっていること。 (1)　装置の名称、型式、製造年月、製造番号及び製造者名 (2)　操舵室に装備する機器にあっては磁気コンパス安全距離	IMO A.694(17) Annex 8.3 Annex 9 IEC60945(Ed4) 11.2.2	

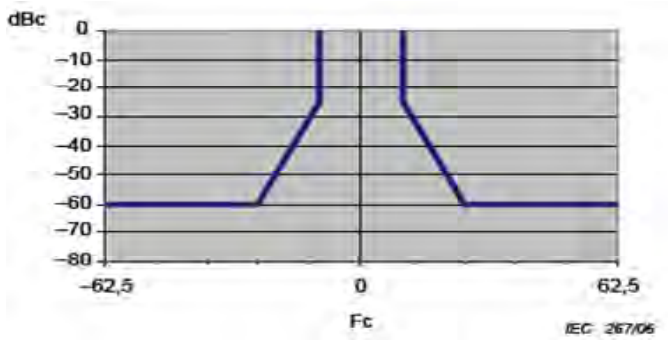
２．機器の機械的及び電気的条件

(1) 機能条件　（以下の各項目は次号に規定する通常試験の温度で行う。）

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
1. 制御部	制御部の機能について確認する。	機器の動作と並行して適当な周期で機器の自己診断が行われる。 (1) 電源オン及び正常送信表示機能 (2) 送信タイムアウト表示 (3) エラー表示機能	IEC 62287-1 6.6.1 6.7.1	
2. 電　源	電源供給について確認する。	この装置の電源は、船舶の主電源及び代替電源から供給されること。	IEC 62287-1 9.1	
3. 情報の送信	静的及び動的情報を入力し、msg18 による位置情報及び msg24 による静的情報の送信を確認する。	静的及び動的情報が正常に送信されること。	ITU-R M.1371-3 Annex7 IEC 62287-1 6.5.1 10.2.1.1	
4. 情報の更新	1. msg18 による位置情報送信間隔を確認する。 2. msg24 による静的情報送信間隔を確認する。 3. 静的情報の内容を変更し、送信するまでの時間を確認する。	1. msg18 の送信間隔は規定時間の±10%以内であること。 2. msg24 による静的情報が 6 分毎に送信されること。 3. データの内容変更後 1 分以内に、変更された MSG24 のデータを送信し、その後再び6分毎にデータを送信すること。	ITU-R M.1371 3.3.4.4 IEC 62287-1 6.5.2 10.2.1.1	
5. 情報の受信	msg1, 2, 3, 4, 5, 8, 12, 14, 15, 18, 20, 21, 22, 23, 24 が正常に受信され、処理できることを確認する。	受信したメッセージに基づいて、正常に処理すること。	IEC 61993-2 6.11 10.2	

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
6. 運用周波数の切替え	DSC 又は msg22 で運用周波数の切替えコマンドを受信し、運用周波数の切替えを確認する。	正常に運用周波数の切替えができること。	ITU-R M.1371 Annex2 4.1 IEC62287-1 4.1.5 10.4 Annex C.3.2	

(2) TDMA 送信部

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
1. 周波数許容偏差	スイッチ投入 2 分後の機器を無変調状態で搬送波のみを出力したときの周波数偏差を測定する。	周波数偏差は、通常試験環境において±0.5kHz 以下、限界試験環境において±1.0kHz 以下となること。	ITU-R M.1371-2 IMO MSC74(69) Annex3/7 IEC 62287-1 11.1.1	
2. 送信電力	スイッチ投入 2 分後、希望周波数においてテストメッセージで変調された信号を出力したときの平均電力を測定する。	搬送波電力は、通常試験環境において 33dB±1.5dB、限界試験環境において 33dB±3dB となること。	ITU-R M.1371-2 Annex2 2.13.2 IMO MSC74(69) Annex3/7 IEC 62287-1 11.1.2	
3. 占有周波数帯幅	希望周波数において占有周波数帯幅が最大となる変調状態、もしくは通常運用されている信号のうち、占有周波数帯幅が最大となる信号による変調状態において、スペクトル分布の全電力をスペクトルアナライザ等により測定する。そして、スペクトル分布の上限及び下限部分の電力和が、それぞれ全電力の 0.5%となる周波数幅を測定する。	スペクトル分布が、下図の範囲内のレベルとなること。 占有帯域幅は、16kHz 以内であること。 	IU-R M.1371 Annex2 2.4.2 IEC 62287-1 11.1.3.3	

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
4. スプリアス発射及び不要発射の強度	1. 帯域外領域(搬送波から±12.5kHz から±62.5kHz までの周波数領域)のスプリアス発射の強度を、無変調送信状態において測定する。 2. スプリアス領域(基本周波数から±62.5kHz 以上離れた周波数領域)の不要発射強度を、テストメッセージで変調又は必要に応じ無変調送信状態において、9kHz から第 10 次高調波までの周波数範囲にて測定する。	1. スプリアス発射の強度は、2.5μW 以下であること。 2. 不要発射の強度は、2.5μW 以下であること。	ITU-R M.329-8 Category D	
5. 送信タイミング特性	1. 希望周波数においてテストメッセージで変調した試験信号の送信出力が、送信開始後安定状態の-3dB に達するまでの時間を測定する。 2. 希望周波数においてテストメッセージで変調した試験信号の送信出力が、送信を終了後 50dB 低下するまでの時間を測定する。	1. 送信開始後 0.3ms(3bits)以内であること。 2. 送信終了後 0.3ms(3bits)以内であること。	ITU-R M.1371 Annex2 2.12.1 IEC 62287-1 11.1.5	
6. 安全対策	送信動作中にアンテナ端を開放し、その後アンテナ端を短絡する。	装置に異常がないこと。	ITU-R M.1371 Annex2 2.15	

(3) TDMA 受信部

項　　目	試　験　方　法	判　　定　　基　　準	対応する国際基準	備　考
1. 受信感度	-107dBm の RF 入力で、テストメッセージにより変調された必要信号を加えたときのパケット誤り率を測定する。	パケット誤り率（PER）が 20%以下であること。	IEC 62287-1 11.2.1	
2. 高レベル入力時の誤り特性	-77dBm 及び-7dBm の RF 入力で、テストメッセージにより変調された必要信号を加えたときのパケット誤り率を測定する。	-77dBm の場合はパケット誤り率（PER）が 2%以下、 -7dBm の場合はパケット誤り率(PER)が 10%以下であること。	IEC 62287-1 11.2.2	
3. 同一チャネル除去比	希望周波数においてテストメッセージで変調された受信感度より 6dB 高い必要信号と、同一周波数において規定信号で変調され信号レベルが必要信号より 10dB 低い妨害波を加えたときのパケット誤り率を測定する。	パケット誤り率（PER）が 20%以下であること。	IEC 62287-1 11.2.3	
4. 隣接チャネル選択度	希望周波数においてテストメッセージで変調され、RF 入力が-101dBm の必要信号と、隣接チャネル周波数において 400Hz 正弦波(周波数偏移：±3kHz)で変調され、RF 入力が-31dBm の妨害信号を同時に加えたときのパケット誤り率を測定する。	パケット誤り率（PER）が 20%以下であること。	IEC 62287-1 11.2.4	
5. スプリアスレスポンス除去比	希望周波数においてテストメッセージで変調され、RF 入力が-101dBm の必要信号と、特定周波数において 400Hz 正弦波(周波数偏移：±3kHz)で変調され、RF 入力が-31dBm の妨害信号を同時に加えたときのパケット誤り率を測定する。	パケット誤り率（PER）が 20%以下であること。	IEC 62287-1 11.2.5	

<table>
<tr><th>項　　目</th><th>試　験　方　法</th><th>判　　定　　基　　準</th><th>対応する国際基準</th><th>備　考</th></tr>
<tr><td>6. 相互変調除去比</td><td>希望周波数においてテストメッセージで変調され、RF 入力が-101dBm の必要信号と、次表の妨害信号を同時に加えたときのパケット誤り率を測定する。
<table>
<tr><th>妨害波</th><th>周波数</th><th>変調</th><th>レベル</th></tr>
<tr><td>1</td><td>希望波
±50kHz</td><td>無変調</td><td>-36dBm</td></tr>
<tr><td>2</td><td>希望波
±100kHz</td><td>400Hz 正弦波
偏移±3kHz</td><td>-36dBm</td></tr>
</table></td><td>パケット誤り率（PER）が 20%以下であること。</td><td>IEC 62287-1
11.2.6</td><td></td></tr>
<tr><td>7. 感度抑圧</td><td>希望周波数においてテストメッセージで変調され、RF 入力が-101dBm の必要信号と、次表の妨害信号を同時に加えたときのパケット誤り率を測定する。
<table>
<tr><th>妨害波</th><th>周波数</th><th>変調</th><th>レベル</th></tr>
<tr><td rowspan="5">1</td><td>希望波±500kHz</td><td rowspan="5">無変調</td><td>-23dBm</td></tr>
<tr><td>±1MHz</td><td>-23dBm</td></tr>
<tr><td>±2MHz</td><td>-23dBm</td></tr>
<tr><td>±5MHz</td><td>-15dBm</td></tr>
<tr><td>±10MHz</td><td>-15dBm</td></tr>
</table></td><td>パケット誤り率（PER）が 20%以下であること。</td><td>IEC 62287-1
11.2.7</td><td></td></tr>
<tr><td>8. 副次輻射</td><td>受信時にアンテナから輻射される電波の強度を測定する。</td><td>9kHz から 1GHz の場合は 2nW(-57dBm)以下、
1GHz から 4GHz の場合は 20nW(-47dBm)以下であること。</td><td>IEC 62287-1
11.3.1</td><td></td></tr>
</table>

(4) 環境条件

環境条件	試　験　方　法	条　　件	対応する国際基準	備　考
1. 通常試験	通常試験は、右記の条件において行う。	・温度範囲：　＋15℃ ～ ＋35℃ ・湿度範囲：　20% ～ 75% ・電　　源：　電圧変動 ±3%	IEC62287-1 8.2.1 IEC60945 (Ed3)	
2. 限界電源	電源電圧を定格電圧の±10%の範囲で変動させる。	左記の状態において、支障なく動作していること。		
3. 高温試験	電源を入れた状態で 55±3℃の温度に 10 時間以上保持した後、通常電源及び限界電源において、下記の性能試験を行う。 (1)周波数偏差、(2)送信電力、(3)感度	左記の状態において、支障なく動作していること。		
4. 低温試験	電源を入れた状態で－15±3℃の温度に10時間以上保持した後、通常電源及び限界電源において、下記の性能試験を行う。 (1)周波数偏差、(2)送信電力、(3)感度	左記の状態において、支障なく動作していること。		
5. 湿度試験	温度 40±3℃、相対湿度 93±3%の状態で 10 時間以上保持した後電源を入れ、通常電源において性能試験を行う。	左記の状態において、支障なく動作していること。		
6. 動試験	30Hz 振動で耐久試験を行い、耐久試験中及び耐久試験終了前に下記の性能試験を行なう。 (1)周波数偏差、(2)送信電力、(3)感度 更に、水平面内の互いに直交する2方向に対しても、上記手順により振動試験を行なう。	左記の状態において、支障なく動作していること。		

小型船舶データ伝送システムの船舶識別番号

１．識別番号は 10 桁で構成する。

県別番号（2 桁）	登録番号（7 桁）	種別番号（1 桁）
12	1234567	0

① 県別番号

漁船の場合の県別番号は、漁船登録番号の所属都道府県の符号を表１－１に記載されている県番号に置き換えて使用する。

② 登録番号

登録番号は、漁船登録番号の船級を含めた番号を使用する。

漁船登録番号が 7 桁に満たない場合“0”を挿入し 7 桁とする。

③ 種別番号

種別番号は表 1-2 から指定する。

２．識別番号の詳細

漁船登録番号　　HK 2-123456

県別番号（2 桁）	登録番号（7 桁）	種別番号(1 桁)
80	2123456	0

３．都道府県別番号表及び種別番号表

表 1-1　都道府県別番号表

都道府県名	県符号	県番号	都道府県名	県符号	県番号	都道府県名	県符号	県番号
新潟県	NG	10	福井県	FK	30	福岡県	FO	60
長野県	NN	11	滋賀県	SG	31	大分県	OT	61
栃木県	TG	12	京都府	KT	32	熊本県	KM	62
群馬県	GM	13	兵庫県	HG	33	宮崎県	MZ	63
茨城県	IG	14	大阪府	OS	34	鹿児島県	KG	64
千葉県	CB	15	奈良県	NR	35	佐賀県	SA	65
埼玉県	ST	16	和歌山県	WK	36	長崎県	NS	66
東京都	TK	17	島根県	SN	40	青森県	AM	70
山梨県	YN	18	鳥取県	TT	41	秋田県	AT	71
神奈川県	KN	19	岡山県	OY	42	岩手県	IT	72
石川県	IK	20	広島県	HS	43	山形県	YM	73
富山県	TY	21	山口県	YG	44	宮城県	MG	74
岐阜県	GF	22	愛媛県	EH	50	福島県	FS	75
愛知県	AC	23	香川県	KA	51	北海道	HK	80

静岡県	SO	24	徳島県	TO	52	沖縄県	ON	90
三重県	ME	25	高知県	KO	53			

表 1-2　種別番号表

局種別	種別番号
漁船局	**0**
レジャー船局	**1**
その他船舶局	2
未定義	3
未定義	4
グループ局	**5**
未定義	6
海岸局	**7**
未定義	8
未定義	9

４．識別番号の例

船舶識別番号は県別に連番とする。

① 船舶識別番号（漁船の場合）

県別番号（2 桁）	登録番号（7 桁）	種別番号
19	2123456	**0**

使用例　　KN2－123456（KN:神奈川県）

識別番号は　**19 2123456　0**　となる。

② 船舶識別番号（漁船以外）

県別番号（2 桁）	登録番号（7 桁）	種別番号
60	0123456	**2**

使用例　　123456（主たる停泊港：福岡）

識別番号は　**60 0123456　2** となる。

③ 海岸局識別番号（位置情報伝送システムに限る。）

県別番号（2 桁）	登録番号（7 桁）	種別番号
01	0000001	**7**

海岸局の登録番号は登録順で行うことする。

別紙 4

小型船舶データ伝送システムのデータフォーマット

1　伝送データの構成

伝送するデータのデータフォーマットの構成は、以下のとおりであること。

⑴　伝送するデータの構成は、以下のとおりであること。

ドットパターン部	データパケット部

⑵　データパケット部は、同期キャラクタ、実パケット、誤り訂正符号、EOS から構成されるものであること。

⑶　ドットパターン部は、200 ビット以上の信号から成ること。

⑷　救急信号のデータパケット部は、下記の構成から成ること。

データパケット部								
同期ｷｬﾗｸﾀ	通報種別	自局識別番号	緯度経度情報	船速情報	船針路情報	予備	EOS	ECC

⑸　救急信号出力で 27524kHz を使用する場合は、なるべく前置信号 2100Hz を 5 秒間付加するものであること。

⑹　位置情報等のデータ伝送のデータパケット部は、下記の構成から成ること。

データパケット部						
同期ｷｬﾗｸﾀ	通報種別	自局識別番号	相手局識別番号	データ任意長	EOS	ECC

⑺　位置情報等のデータ伝送のデータ部は、任意とする。

2　伝送データの詳細

2.1　ドットパターン部

「1」と「0」の繰り返しで、200 ビット以上で構成すること。

2.2　データパケット部

データパケット部の構成については、以下のとおりであること。

⑴　データパケット部の構成

データパケット部は、DX、RX の 2 相で構成するタイムダイバシティ方式とし、構成は以下のとおりであること。

DX相	同期ｷｬﾗｸﾀ部	実パケット部	EOS	ECC	EOS	EOS
RX相	同期ｷｬﾗｸﾀ部	実パケット部			EOS	ECC

送信時にはキャラクタ単位で相を切り替えるものとし、タイムダイバシティ伝送時間間隔は 4 キャラクタ遅延とする。（キャラクタについては表 1 参照）

⑵ 同期キャラクタ：DX 相は６キャラクタ、RX 相は８キャラクタとし、キャラクタの値は DX 相はすべて 125 とし、RX 相は送信順に RX7 から RX0（111 から 104 まで）までとする。

⑶ DX 相、RX 相とも実パケットは同内容であること。

⑷ EOS 部は固定値(127）キャラクタであること。DX 相は EOS ECC EOS EOS の 4 キャラクタで、RX 相は EOS ECC の２キャラクタで構成する。

EOS は固定キャラクタで 127 とする。ECC は初期値 0 で実パケット部先頭からのキャラクタ単位の XOR 値とする。

⑸ キャラクタデータのビット構成

データパケット部の１キャラクタは 10 ビットで構成し、下位 7 ビットを実データとし、上位 3 ビットをエラーチェックビットとすること（1 実データ（b0～b6）で表現できる値は 0～127 となる。エラーチェックビット（b7～b9）は実データの 0 のビットの数 b7 を上位、b9 を下位として表す。）。

１データのビット構成例

値	MSB LSB	エラーチェックビット b9～b7 の解説
0	1110000000	b0～b7 に 0 は 7 つあるので値は 111
4	0110000100	b0～b7 に 0 は 6 つあるので値は 110、それを逆順に表記して 011
7	0010000111	b0～b7 に 0 は 6 つあるので値は 100、それを逆順に表記して 001

ア　実際の送信データ

データパケット部の実際の送信データと送信キャラクタ順序図

送信データと送信キャラクタ順序図

DX 相	DX		DX		DX		DX		DX		DX		A1		A2	
RX 相		RX 7		RX 6		RX 5		RX 4		RX 3		RX 2		RX 1		RX 0

P1		P2		P3		P4		P5		L1		L2		L3		L4	
	A1		A2		P1		P2		P3 1		P4		P5		L1		L2

L5		L6		L7		L8		L9		V1		V2		D1		D2	
	L3		L4		L5		L6		L7		L8		L9		V1		V2

S		EOS		ECC		EOS		EOS	
	D1		D2		S		EOS		ECC

DX:DX 同期キャラクタ（125）
RX0～RX7:RX 同期キャラクタ
（RX0=104 ～ RX7=111）
A1,A2:通報種別
V1,V2:船速
D1,D2:針路
S：予備
ECC:ECC 計算値

P1～P5:自局識別番号　　EOS:固定値（127）
L1～L9:緯度経度

信号フォーマットのついては別図１を参照

３　救急情報の詳細

3.1 通報種別

⑴　値の範囲：0～9999

⑵　データパケットへの展開

A1	通報種別の上位２桁
A2	通報種別の下位２桁

例：0199 → A1=01 A2=99

４　救急情報での指定。（救急情報については図 2 参照）

⑴　発信器等による通報の場合：0199

⑵　救急スイッチによる通報の場合：0299

⑶　テストスイッチによる通報の場合　：0399

５　自局識別番号（相手局識別番号も同じ構成とする）

⑴　値の範囲：0～9999999999

⑵　データパケットへの展開

P1	自局識別番号の上位２桁
P2	2 桁毎に振当てる
P3	
P4	
P5	自局識別番号の最下位 2 桁

例：8002123456 → P1=80 P2=02 P3=12 P4=34 P5=56

６　緯度、経度

緯度経度値の度と分および分の小数部を 1/10000 分の桁まで表示する。N/S EW はその組み合わせで象限番号として 0～3 で表す。象限番号=9 は測位無効状態とする。

⑴　値の範囲：緯度 90 度 00 分 0000S～90 度 00 分 0000N
　　経度 180 度 00 分 0000W～180 度 00 分 0000E

⑵　データパケットへの展開

L1:10 の桁	NE=0 NW=1 SE=2 SW=3 緯度経度無効=9
L1: 1 の桁	緯度の度 10 の桁の値
L2:10 の桁	緯度の度 1 の桁の値
L2: 1 の桁	緯度の分 10 の桁の値
L3:10 の桁	緯度の分 1 の桁の値
L3: 1 の桁	緯度の分小数部 0.1 の桁の値
L4:10 の桁	緯度の分小数部 0.01 の桁の値
L4: 1 の桁	緯度の分小数部 0.001 の桁の値
L5:10 の桁	緯度の分小数部 0.0001 の桁の値
L5: 1 の桁	経度の度 100 の桁の値

L6:10 の桁	経度の度 10 の桁の値
L6: 1 の桁	経度の度 1 の桁の値
L7:10 の桁	経度の分 10 の桁の値
L7:1 の桁	経度の分 1 の桁の値
L8:10 の桁	経度の分小数部 0.1 の桁の値
L8:1 の桁	経度の分小数部 0.01 の桁の値
L9:10 の桁	経度の分小数部 0.001 の桁の値
L9:1 の桁	経度の分小数部 0.0001 の桁の値

例：35'12.4567N　135'34.5678E

NE なので象限番号=0

L1=03 L2=51 L3=24 L4=56 L5=71 L6=35 L7=34 L8=56 L9=78

7　船速（0.1kt 単位の船速値）

⑴ 値の範囲：0～1024 無効は 9999

⑵ データパケットへの展開

V1	船速の上位２桁
V2	船速の下位２桁

例：12.3kt → 船速値=123 → V1=01 V2=23

8　船針路（ 0.1 度単位の針路値）

⑴ 値の範囲：0～3600 無効は 9999

⑵ データパケットへの展開

D1	船針路の上位２桁
D2	船針路の下位２桁

例：12.3 度 → 針路値=123 → D1=01 D2=23

例：123.4 度 → 針路値=1234 → D1=12 D2=34

9　予備

⑴ 値の範囲：00～99

⑵ データパケットへの展開

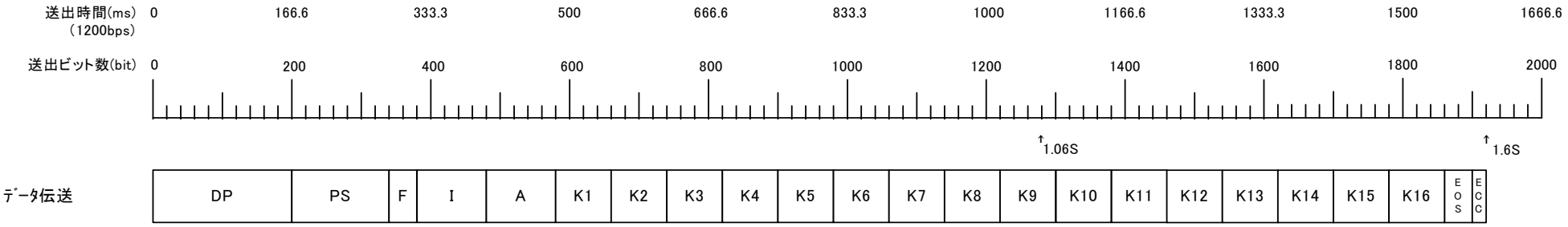
S	情報の２桁

例：2 人　→　予備値=2　→　S=02

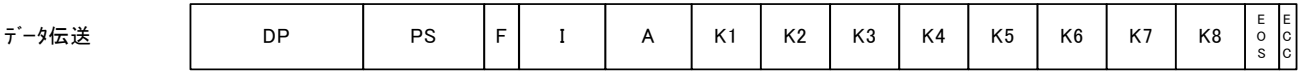
表１　10 単位キャラクタ表

シンボル番号	送信信号とビットの位置 12345678910
0	BBBBBBBYYY
1	YBBBBBBYYB
2	BYBBBBBYYB
3	YYBBBBBYBY
4	BBYBBBBYYB
5	YBYBBBBYBY
6	BYYBBBBYBY
7	YYYBBBBYBB
8	BBBYBBBYYB
9	YBBYBBBYBY
10	BYBYBBBYBY
11	YYBYBBBYBB
12	BBYYBBBYBY
13	YBYYBBBYBB
14	BYYYBBBYBB
15	YYYYBBBBYY
16	BBBBYBBYYB
17	YBBBYBBYBY
18	BYBBYBBYBY
19	YYBBYBBYBB
20	BBYBYBBYBY
21	YBYBYBBYBB
22	BYYBYBBYBB
23	YYYBYBBBYY
24	BBBYYBBYBY
25	YBBYYBBYBB
26	BYBYYBBYBB
27	YYBYYBBBYY
28	BBYYYBBYBB
29	YBYYYBBBYY
30	BYYYYBBBYY
31	YYYYYBBBYB
32	BBBBBYBYYB
33	YBBBBYBYBY
34	BYBBBYBYBY
35	YYBBBYBYBB
36	BBYBBYBYBY
37	YBYBBYBYBB
38	BYYBBYBYBB
39	YYYBBYBBYY
40	BBBYBYBYBY
41	YBBYBYBYBB
42	BYBYBYBYBB
43	YYBYBYBBYY
44	BBYYBYBYBB
45	YBYYBYBBYY
46	BYYYBYBBYY
47	YYYYBYBBYB
48	BBBBYYBYBY
49	YBBBYYBYBB
50	BYBBYYBYBB
51	YYBBYYBBYY
52	BBYBYYBYBB
53	YBYBYYBBYY
54	BYYBYYBBYY
55	YYYBYYBBYB
56	BBBYYYBYBB
57	YBBYYYBBYY
58	BYBYYYBBYY
59	YYBYYYBBYB
60	BBYYYYBBYY
61	YBYYYYBBYB
62	BYYYYYBBYB
63	YYYYYYBBBY
64	BBBBBBYYYB
65	YBBBBBYYBY
66	BYBBBBYYBY
67	YYBBBBYYBB
68	BBYBBBYYBY
69	YBYBBBYYBB
70	BYYBBBYYBB
71	YYYBBBYBYY
72	BBBYBBYYBY
73	YBBYBBYYBB
74	BYBYBBYYBB
75	YYBYBBYBYY
76	BBYYBBYYBB
77	YBYYBBYBYY
78	BYYYBBYBYY
79	YYYYBBYBYB
80	BBBBYBYYBY
81	YBBBYBYYBB
82	BYBBYBYYBB
83	YYBBYBYBYY
84	BBYBYBYYBB
85	YBYBYBYBYY
86	BYYBYBYBYY
87	YYYBYBYBYB
88	BBBYYBYYBB
89	YBBYYBYBYY
90	BYBYYBYBYY
91	YYBYYBYBYB
92	BBYYYBYBYY
93	YBYYYBYBYB
94	BYYYYBYBYB
95	YYYYYBYBBY
96	BBBBBYYYBY
97	YBBBBYYYBB
98	BYBBBYYYBB
99	YYBBBYYBYY
100	BBYBBYYYBB
101	YBYBBYYBYY
102	BYYBBYYBYY
103	YYYBBYYBYB
104	BBBYBYYYBB
105	YBBYBYYBYY
106	BYBYBYYBYY
107	YYBYBYYBYB
108	BBYYBYYBYY
109	YBYYBYYBYB
110	BYYYBYYBYB
111	YYYYBYYBBY
112	BBBBYYYYBB
113	YBBBYYYBYY
114	BYBBYYYBYY
115	YYBBYYYBYB
116	BBYBYYYBYY
117	YBYBYYYBYB
118	BYYBYYYBYB
119	YYYBYYYBBY
120	BBBYYYYBYY
121	YBBYYYYBYB
122	BYBYYYYBYB
123	YYBYYYYBBY
124	BBYYYYYBYB
125	YBYYYYYBBY
126	BYYYYYYBBY
127	YYYYYYYBBB

図１　信号フォーマット　シーケンスタイム(ﾃﾞｰﾀ伝送)　例



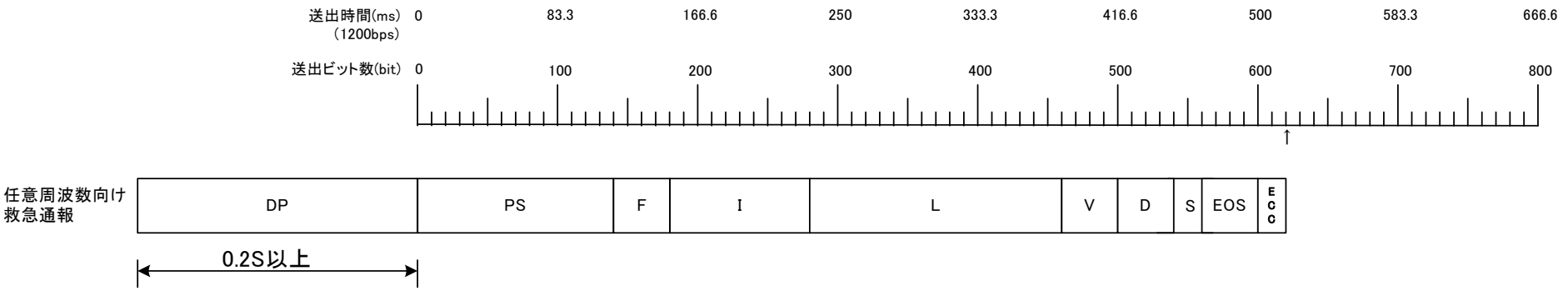
記号	ビット数	名　　称	記号	ビット数	名　　称
DP	200bit	ドットパターン	A	50*2bit	相手局識別番号
PS	60+80bit	同期キャラクタ	K	640*2bit	データ
F	20*2bit	通報種別(漢字)	EOS	10*4bit	シーケンス終了
I	50*2bit	自局識別番号	ECC	10*2bit	誤り訂正キャラクタ



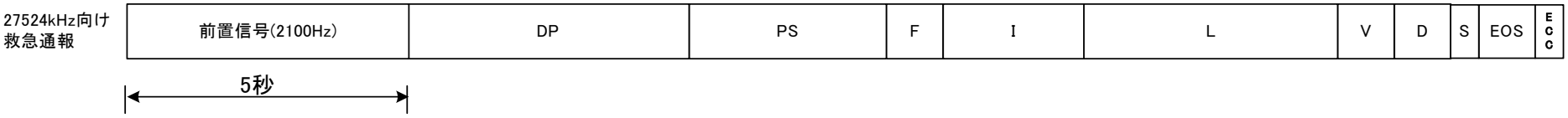
記号	ビット数	名　　称	記号	ビット数	名　　称
DP	200bit	ドットパターン	A	50*2bit	相手局識別番号
PS	60+80bit	同期キャラクタ	K	320*2bit	データ
F	20*2bit	通報種別(漢字)	EOS	10*4bit	シーケンス終了
I	50*2bit	自局識別番号	ECC	10*2bit	誤り訂正キャラクタ

データ伝送の場合のフォーマット　データ部は可変長、通報種別/自局/相手局識別番号と EOS/ECC は固定

図２ 救急通報の場合のフォーマット



記号	ビット数	名　　称	記号	ビット数	名　　称	記号	ビット数	名　　称
DP	600bit	ドットパターン	L	90*2bit	緯度経度情報	EOS	10*4bit	シーケンス終了
PS	60+80bit	同期キャラクタ	V	20*2bit	船速情報	ECC	10*2bit	誤り訂正キャラクタ
F	20*2bit	通報種別	D	20*2bit	針路情報			
I	50*2bit	自局識別番号	S	10*2bit	予備			



記号	ビット数	名　　称	記号	ビット数	名　　称	記号	ビット数	名　　称
DP	200bit	ドットパターン	L	90*2bit	緯度経度情報	EOS	10*4bit	シーケンス終了
PS	60+80bit	同期キャラクタ	V	20*2bit	船速情報	ECC	10*2bit	誤り訂正キャラクタ
F	20*2bit	通報種別	D	20*2bit	針路情報			
I	50*2bit	自局識別番号	S	10*2bit	予備			

【参考資料 1】

用語集

海上人命安全条約（SOLAS 条約）

船舶の航行安全、特に人命の安全を確保するため、船舶の構造・設備の基準を始め、無線設備の備付け義務、その機能要件、遭難周波数の聴取義務等について定めたものである。1914 年に最初の SOLAS 条約が採択され、以降の技術革新や社会情勢の変化等を加味し、幾度の改正を受け、現行の 1974 年 SOLAS 条約に至ったもの。

感度抑圧

受信装置において、高いレベルの妨害波により低いレベルの希望波が抑圧される現象。

タイムダイバシティ方式

一定の時間ごとに電波の送信と受信を行う方式。

バイナリメッセージ

数字、文字等の情報を 2 進数で表現したもの。

BIIT

BIIT は、Built In Integrity Test の略。機器の動作と並行して適当な周期で機器の完全性をテストする自己診断機能。

CDV

CDV は、Committee Draft for Vote の略。投票用委員会原案を意味し、CDV 文書に各国が投票した結果賛成が 2/3 以上、かつ、反対 1/4 以下で可決される。

COMSAR

COMSAR は、Sub-Committee on Radiocommunications and Search and Rescue の略。MSC の下部機関の一つであり、海上における通信及び捜索救助に関する事項の検討を行う役割を担っている。

DGNSS

DGNSS は、Differential Global Navigation Satellite System の略。GNSS を陸上の施設が送信する信号により精度を高くしたもの。

FDIS

FDIS は、Final Draft International Standard の略。最終国際規格案を意味し、規格案として最終的に作成されるもの。この段階で、すべての国の代表が 2 ヶ月間かけて投票を行う。

GNSS

GNSS は、Global Navigation Satellite System の略。世界各国の衛星ナビゲーションシステム全体の総称で、GPS や GLONASS 等がある。

IALA

IALA は、International Association of Marine Aids to Navigation and Lighthouse Authorities の略。1957 年に発足した非政府機関で、航路標識システムの設置・維持又はその関連事業に関する機関等によって構成され、IMO、ITU 等の海上関係の国際機関と連携し、航路標識システムの標準化等を行う役割を担っている。

IEC

IEC は、International Electrotechnical Commission の略。1908 年に設立されまた機関。世界各国の電気及び電子技術規格の調整と統一を促進することを目的としている。会員は、各国の代表的標準化機関（1 国 1 機関）から成り、日本は 1953 年に日本工業標準調査会（JISC）が加盟。

船舶関係では、船舶技術分野に関わる技術専門委員会（TC：Technical Committee）の国内審議団体として TC18（船舶並びに移動式及び固定式海洋構造物専門委員会)、TC18/SC18A（同/ケーブル及びケーブル敷設分科委員会）などを中心に活動。レーダーは TC80(航行計器部門)に属する。

国際海事機関（IMO）

IMO は、International Maritime Organization の略。国際連合の専門機関の一つで、海上の安全、海洋環境の保護等の分野で国際協力を図ることを目的に 1958 年（昭和 33 年）に設立された政府間海事協議機関（IMCO：Inter-Governmental Maritime Consultative Organization）が、1982 年（昭和 57 年）に改称されたもの。海事問題に関して審議し基準を採択する。本部はロンドン。加盟国は 165 ヵ国。

IPR 問題

GP&C System International 社が AIS に採用された SOTDMA 方式に関する特許を保有していることを主張し、同方式を用いた非 SOLAS 船に搭載される AIS には、特許使用料

の負担を求めている問題。

ITU-R

ITU-R は、International Telecommunication Union Radiocommunications Sector の略。国際電気通信連合の無線通信部門で、無線通信に関する標準化や勧告を行う役割を担っている。

MMSI

MMSI は、Maritime Mobile Service Identity の略。海上移動業務識別番号をいい、遭難時等に個々の船舶を識別するためのものであり、3 桁の国別番号と 6 桁の船舶を識別する番号で構成される。

海上安全委員会（MSC）

MSC は、Maritime Safety Committee の略。IMO において、船舶の安全全般について担当する委員会。各国の主管庁が参加しており、下部機関である COMSAR、NAV 等の各小委員会で検討された決議案、勧告案等を審議し総会へ提出するほか、SOLAS 条約附属書の改正案、同委員会決議を採択する役割を担っている。

msg

msg は、message の略。

NAV

NAV は、Sub-Committee on Safety of Navigation の略。MSC の下部機関の一つであり、船舶の航路、通報等の航行安全に関する制度及び航行機器の搭載要件に関する検討を行う役割を担っている。

NP

NP は、New work item proposal の略。新たな業務の項目について提案することをいう。

TC80

TC80 は、Technical Committee80 の略。IEC の下部機関の一つであり、航海機器、無線機器の試験方法等について検討を行う役割を担っている。

【参考資料 2】

導入あたっての制度的整理事項

簡易型 AIS 及び小型船舶データ伝送システムの円滑な導入を図るためには、技術的条件の策定のほか、制度的課題についても整理を行う必要があることから、海上無線通信委員会において意見として出された意見について次ぎのとおり取りまとめた。

１　無線操作の簡易化

簡易型 AIS 及び小型船舶データ伝装システムは小型の船舶を対象とするシステムであり、基本的に無線設備がデータ通信を自動的に行うものであることから、無線設備の操作については電源 ON/OFF が主体であり、簡易な操作の部類として整理することが考えられる。

２　無線局の免許手続の簡略化

簡易型 AIS 及び小型船舶データ伝送システムは、比較的小規模な無線設備であり、今後多数の導入が期待されることから、利用者の負担の軽減を図るため、技術基準適合証明の適用による簡易な免許手続の適用が考えられる。

３　小型船舶データ伝送システムの普及

小型船舶データ伝送システムは、対象となる船舶が経営規模の小さい漁船であることから、普及促進を図るためには、関係行政機関等による行政的支援が望まれる。

４　船員用小型発信器

小型船舶救急連絡装置に使用する船員用小型発信器については、導入促進を図るため、低コストである現用の小電力システムを用いること、当該システムは、免許手続が不要な設備であるものが望ましい。また、転落等の非常時における通信を確保するため、キャリアセンス機能を具備しないことが考えられる。

【参考資料 3】

非船舶搭載用 AIS の国際標準化検討状況補足

１　AIS　基地局装置（IEC62320-1　Ed.1）

IEC62320-1 Ed.1 は、2007 年 2 月に国際規格化された。基地局装置では、これまで AIS Class A、CSAIS にて開発された PI センテンス以外に、18 種類のセンテンスが開発されており、これらに対して、ドイツの検定機関 BSH(Bundesamt fur Seeschifffart und Hydrographie)での試験結果の記述等に指摘があったことを受けて、AISWG は、IEC62320-100 PAS としての改訂版規格策定への取組を行っている。

２　AIS AtoN(Aids to Navigation) Station（IEC62320-2 Ed.2）

2007 年 8 月の AISWG1 会議（オーストラリア：キャンベラ）において、AIS AtoN に関する各国からのコメントに対する決議会議が開催され、FDIS（ Final Document for International Standard)案が作成され、TC80 事務局へ送付された。

３　AIS Repeater Station（IEC62320-3　Ed.1）

IEC 規格の開発案件における Non-ship AIS として、Repeater Station が挙げられていた。IALA Recommendation A-124 の規定によると、Repeater Station は Simplex タイプと Duplex タイプの２タイプが記述されているが、Duplex タイプは送信時 2 周波数を使用することから、送信時 1 周波数の AIS 運用規定に反するため、IEC では Simplex タイプの規格開発を行うこととした。その後、AISWG では、2008 年 8 月の Scotland Edinburgh 会議における CDV 案の取りまとめを目標に開発作業を行っている。

Repeater Station はドイツ、米国等の河川利用が発達している国における Inland AIS システムへの適用が挙げられている。

４　Limited　Base　Station（IEC62320-4　Ed.1）

IALA Recommendation A-124 において、「限定された機能を有する基地局装置」として規定されている装置の IEC 規格を開発することとしているが、現時点では Repeater Station の開発段階であり、Limited Base Station の開発には至っていない。

Annex 7

Class B AIS using CSTDMA technology

1 Definition

This Annex describes a Class B AIS using carrier-sense TDMA (CSTDMA) technology, subsequently referred to as Class B “CS”. The CSTDMA technology requires that the Class B “CS” unit listens to the AIS network to determine if the network is free of activity and transmits only when the network is free. The Class B “CS” unit is also required to listen for reservation messages and comply with these reservations. This polite operation ensures that a Class B “CS” will be interoperable and will not interfere with equipment that complies with Annex 2.

2 General requirements

2.1 General

2.1.1 Capabilities of the Class B “CS” AIS

The Class B “CS” AIS station should be inter-operable and compatible with Class A or other Class B shipborne mobile AIS stations or any other AIS station operating on the AIS VHF data link. In particular, Class B “CS” AIS stations should receive other stations, should be received by other stations and should not degrade the integrity of the AIS VHF data link.

Transmissions from Class B “CS” AIS stations should be organized in “time periods” that are synchronized to VDL activity.

The Class B “CS” AIS should only transmit if it has verified that the time period intended for transmission does not interfere with transmissions made by equipment complying with Annex 2. Transmissions of the Class B “CS” AIS should not exceed one nominal time period (except when responding to a base station with Message 19).

An AIS station intended to operate in receive-only mode should not be considered a Class B shipborne mobile AIS station.

2.1.2 Modes of operation

The system should be capable of operating in a number of modes as described below subject to the transmission of messages by a competent authority. It should not retransmit received messages.

2.1.2.1 Autonomous and continuous mode

An “autonomous and continuous” mode for operation in all areas transmitting Message 18 for scheduled position reporting and Message 24 for static data.

The Class B “CS” AIS should be able to receive and process messages at any time except during time periods of own transmission.

2.1.2.2 Assigned mode

An “assigned” mode for operation in an area subject to a competent authority responsible for traffic monitoring such that:

– the reporting interval, silent mode and/or transceiver behaviour may be set remotely by that authority using group assignment by Message 23; or

– time periods are reserved by Message 20 (see § 3.18, Annex 8).

2.1.2.3 Interrogation mode

A “polling” or controlled mode where the Class B “CS” AIS responds to interrogations for Messages 18 and 24 from a Class A AIS or a base station. A base station interrogation for Message 19 specifying transmission offset should also be answered[2]. An interrogation overrides a silent period defined by Message 23 (see § 3.21, Annex 8).

A Class B “CS” AIS should not interrogate other stations.

3 Performance requirements

3.1 Composition

The B “CS” AIS should comprise:

– A communication processor, capable of operating in a part of the VHF maritime mobile service band, in support of short-range, VHF, applications.

– At least one transmitter and three receiving processes, two for TDMA and one for DSC on channel 70. The DSC process may use the receiving resources on a time-share basis as described in § 4.2.1.6. Outside the DSC receiving periods the two TDMA receiving processes should work independently and simultaneously on AIS channels A and B[3].

– A means for automatic channel switching in the maritime mobile band (by Message 22 and DSC; Message 22 should have precedence). Manual channel switching should not be provided.

– An internal GNSS position sensor, which provides a resolution of one ten thousandth of a minute of arc and uses the WGS-84 datum (see § 3.3).

3.2 Operating frequency channels

The Class B “CS” AIS should operate at least on the frequency channels with 25 kHz bandwidth in the range from 161.500 MHz to 162.025 MHz of the RR Appendix 18 and in accordance with Recommendation ITU-R M.1084, Annex 4. The DSC receiving process should be tuned to channel 70.

The Class B “CS” AIS should automatically revert to receive-only mode on the channels AIS1 and AIS2 when commanded to operate at frequency channels outside its operating range and/or bandwidth.

3.3 Internal GNSS receiver for position reporting

The Class B “CS” AIS should have an internal GNSS receiver as source for position, COG, SOG.

The internal GNSS receiver may be capable of being differentially corrected, e.g. by evaluation of Message 17.

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[2] Note that because Message 19 is a message occupying two time periods, this requires the reservation of the respective time periods by Message 20 prior to interrogation.

[3] In some regions, the competent authority may not require DSC functionality.

If the internal GNSS sensor is inoperative, the unit should not transmit Messages 18 and 24 unless interrogated by a base station[4].

3.4 Identification

For the purpose of ship and message identification, the appropriate MMSI number should be used. The unit should only transmit if an MMSI is programmed.

3.5 AIS Information

3.5.1 Information content

The information provided by the Class B "CS" AIS should include (see Message 18, Table 67):

3.5.1.1 Static

– Identification (MMSI)
– Name of ship
– Type of ship
– Vendor ID (optional)
– Call sign
– Dimensions of ship and reference for position.

The default value for type of ship should be 37 (pleasure craft).

3.5.1.2 Dynamic

– Ship's position with accuracy indication and integrity status
– Time (UTC seconds)
– Course over ground (COG)
– Speed over ground (SOG)
– True heading (optional).

3.5.1.3 Configuration information

The following information about configuration and options active in the specific unit should be provided:

– AIS Class B "CS" unit
– Availability of minimum keyboard/display facility
– Availability of DSC channel 70 receiver
– Ability to operate in the whole marine band or 525 kHz band
– Ability to process channel management Message 22.

3.5.1.4 Short safety-related messages

– Short safety-related messages, if transmitted, should be in compliance with, § 3.12, Annex 8 and should use pre-configured contents.

It should not be possible for the user to alter the pre-configured contents.

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[4] Note that in this case the synchronization process will not take into account distance delays.

3.5.2 Information reporting intervals

The Class B "CS" AIS should transmit position reports (Message 18) in reporting intervals of:

– 30 s if SOG > 2 knots

– 3 min if SOG ≤ 2 knots

provided that transmission time periods are available. A command received by Message 23 should override the reporting interval; a reporting interval of less than 5 s is not required.

Static data sub-messages 24A and 24B should be transmitted every 6 min in addition to and independent of the position report (see § 4.4.1). Message 24B should be transmitted within 1 min following Message 24A.

3.5.3 Transmitter shutdown procedure

An automatic transmitter shutdown should be provided in the case that a transmitter does not discontinue its transmission within 1 s of the end of its nominal transmission. This procedure should be independent of the operating software.

3.5.4 Static data input

Means should be provided to input and verify the MMSI prior to use. It should not be possible for the user to alter the MMSI once programmed.

4 Technical requirements

4.1 General

This section covers layers 1 to 4 (physical layer, link layer, network layer, transport layer) of the OSI model (see Annex 2, § 1).

4.2 Physical layer

The physical layer is responsible for the transfer of a bit stream from an originator to the data link.

4.2.1 Transceiver characteristics

General transceiver characteristics should be as specified in Table 31.

4.2.1.1 Dual channel operation

The AIS should be capable of operating on two parallel channels in accordance with § 4.41. Two separate TDMA receive channels or processes should be used to simultaneously receive information on two independent frequency channels. One TDMA transmitter should be used to alternate TDMA transmissions on two independent frequency channels.

Data transmissions should default to AIS 1 and AIS 2 unless otherwise specified by a competent authority, as described in § 4.4.1 and § 4.6.

4.2.1.2 Bandwidth

The Class B AIS should operate on 25 kHz channels according to Recommendation ITU-R M.1084-4 and RR Appendix 18.

TABLE 31

Transceiver characteristics

Symbol	Parameter name	Value	Tolerance
PH.RFR	Regional frequencies (range of frequencies within RR Appendix 18)[1] (MHz). Full range 156.025 to 162.025 MHz is also allowed. This capability will be reflected in Message 18	161.500 to 162.025	–
PH.CHS	Channel spacing (encoded according to RR Appendix 18 with footnotes)[2] (kHz) Channel bandwidth	25	–
PH.AIS1	AIS 1 (default channel 1) (2 087)[2] (MHz)	161.975	±3 ppm
PH.AIS2	AIS 2 (default channel 2) (2 088)[2] (MHz)	162.025	±3 ppm
PH.BR	Bit rate (bit/s)	9 600	±50 ppm
PH.TS	Training sequence (bits)	24	–
	GMSK transmitter BT-product	0.4	
	GMSK receiver BT-product	0.5	
	GMSK modulation index	0.5	

(1) See Recommendation ITU-R M.1084, Annex 4.

(2) In some Regions, the competent authority may not require DSC functionality.

4.2.1.2 Bandwidth

The Class B AIS should operate on 25 kHz channels according to Recommendation ITU-R M.1084-4 and RR Appendix 18.

4.2.1.3 Modulation scheme

The modulation scheme is bandwidth adapted frequency modulated Gaussian filtered minimum shift keying (GMSK/FM). The NRZI encoded data should be GMSK coded before frequency modulating the transmitter.

4.2.1.4 Training sequence

Data transmission should begin with a 24-bit demodulator training sequence (preamble) consisting of one segment synchronization. This segment should consist of alternating zeros and ones (0101....). This sequence always starts with a 0.

4.2.1.5 Data encoding

The NRZI waveform is used for data encoding. The waveform is specified as giving a change in the level when a zero (0) is encountered in the bit stream.

Forward-error correction, interleaving or bit scrambling is not used.

4.2.1.6 DSC operation

The Class B “CS” AIS should be capable of receiving DSC channel management commands. It should either have a dedicated receive process, or it should be capable of retuning its TDMA

receivers to channel 70 on a time-sharing basis, with each TDMA receiver taking alternate turns to monitor channel 70 (for details see § 4.6).[5]

4.2.2 Transmitter requirements

4.2.2.1 Transmitter parameters

Transmitter parameters should be as given in Table 32.

TABLE 32

Transmitter parameters

Transmitter parameters	Value	Condition
Frequency error	±500 Hz	
Carrier power	33 dBm ±1.5 dB	Conducted
Modulation spectrum	–25 dBW –60 dBW	Δfc < ±10 kHz ±25 kHz < Δfc < ±62.5 kHz
Modulation accuracy	< 3 400 Hz 2 400 ±480 Hz 2 400 ±240 Hz 1 740 ±175 Hz 2 400 ±240 Hz	Bit 0, 1 Bit 2, 3 Bit 4 ... 31 Bit 32 ... 199: For a bit pattern of 0101... For a bit pattern of 00001111...
Power versus time characteristics	Transmission delay: 2 083 µs Ramp up: ≤ 313 µs Ramp down: ≤ 313 µs Transmission duration: ≤ 23 333 µs	Nominal 1-time period transmission
Spurious emissions	–36 dBm –30 dBm	9 kHz ... 1 GHz 1 GHz ... 4 GHz

4.2.3 Receiver parameters

Receiver parameters should be as given in Table 33.

4.3 Link layer

The link layer specifies how data should be packaged in order to apply error detection to the data transfer. The link layer is divided into three sub-layers.

4.3.1 Link sub-layer 1: medium access control (MAC)

The MAC sub-layer provides a method for granting access to the data transfer medium, i.e. the VHF data link. The method used should be TDMA.

4.3.1.1 Synchronization

Synchronization should be used to determine the nominal start of the CS time period (T_0).

[5] In some regions, the competent authority may not require DSC functionality.

TABLE 33

Receiver parameters

Receiver parameters	Values		
	Results	Wanted signal	Unwanted signal(s)
Sensitivity	20% per	–107 dBm –104 dBm at ±500 Hz offset	
Error at high input levels	2% per	–77 dBm	–
	10% per	–7 dBm	–
Co-channel rejection	20% per	–101 dBm	–111 dBm –111 dBm at ±1 kHz offset
Adjacent channel selectivity	20% per	–101 dBm	–31 dBm
Spurious response rejection	20% per	–101 dBm	–31 dBm 50 MHz ... 520 MHz
Intermodulation response rejection	20% per	–101 dBm	–36 dBm
Blocking and desensitization	20% per	–101 dBm	–23 dBm (<5 MHz) –15 dBm (>5 MHz)
Spurious emissions	–57 dBm –47 dBm	9 kHz ... 1 GHz 1 GHz ... 4 GHz	

4.3.1.1.1 Sync mode 1: AIS stations other than Class B “CS” are received

If signals from other AIS stations complying with Annex 2 are received, the Class B “CS” should synchronize its time periods to their scheduled position reports (suitable account should be taken of the propagation delays from the individual stations). This applies to message types 1, 2, 3, 4, 18 and 19 as far as they are providing position data and have not been repeated (repeat indicator = 0).

Synchronization jitter should not exceed ±3 bits (±312 μs) from the average of the received position reports. That average should be calculated over a rolling 60 s period.

If these AIS stations are no longer received, the unit should maintain synchronization for a minimum of 30 s and switch back to sync mode 2 after that.

Other synchronization sources fulfilling the same requirements are allowed (optionally) instead of the above.

4.3.1.1.2 Sync mode 2: no station other than Class B “CS” is received

In the case of a population of Class B “CS” stations alone (in the absence of any other class of station that can be used as a synchronization source) the Class B “CS” station should determine the start of time periods (T_0) according to its internal timing.

If the Class B “CS” unit receives an AIS station that can be used as a synchronization source (being in sync mode 2) it should evaluate timing and synchronize its next transmission to this station.

Time periods reserved by a base station should still be respected.

4.3.1.2 CS detection method

Within a time window of 1 146 µs starting at 833 µs and ending at 1 979 µs after the start of the time period intended for transmission (T_0) the AIS Class B "CS" should detect if that time period is used (CS detection window).

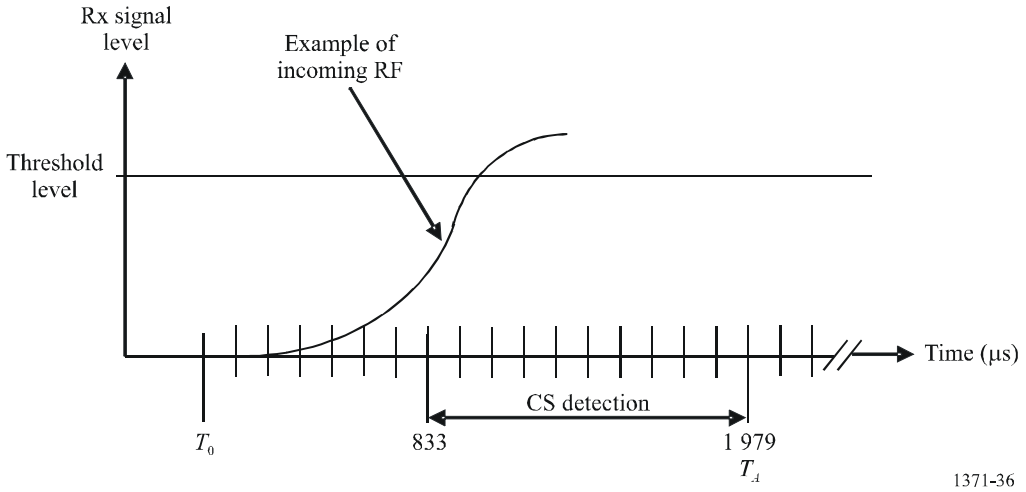
NOTE 1 – Signals within the first 8 bits (833 µs) of the time period are excluded from the decision (to allow for propagation delays and ramp down periods of other units).

The Class B "CS" AIS should not transmit on any time period in which, during the CS detection window, a signal level greater than the "CS detection threshold" (§ 4.3.1.3) is detected.

The transmission of a CSTDMA packet should commence 20 bits (T_A = 2 083 µs + T_0) after the nominal start of the time period (see Fig. 36).

FIGURE 36

Carrier sense timing



4.3.1.3 CS detection threshold

The CS detection threshold should be determined over a rolling 60 s interval on each Rx channel separately. The threshold should be determined by measuring the minimum energy level (representing the background noise) plus an offset of 10 dB. The minimum CS detection threshold should be –107 dBm and background noise should be tracked for a range of at least 30 dB (which results in a maximum threshold level of –7 dBm).[6]

4.3.1.4 VDL access

The transmitter should begin transmission by turning on the RF power immediately after the duration of the carrier sense window (T_A).

The transmitter should be turned off after the last bit of the transmission packet has left the transmitting unit (nominal transmission end T_E assuming no bit stuffing).

The access to the medium is performed as shown in Fig. 37 and Table 34:

---

[6] The following example is compliant with the requirement:

Sample the RF signal strength at a rate >1 kHz, average the samples over a sliding 20 ms period and over a 4 s interval determine the minimum period value. Maintain a history of 15 such intervals. The minimum of all 15 intervals is the background level. Add a fixed 10 dB offset to give the CS detection threshold.

FIGURE 37

Power versus time mask

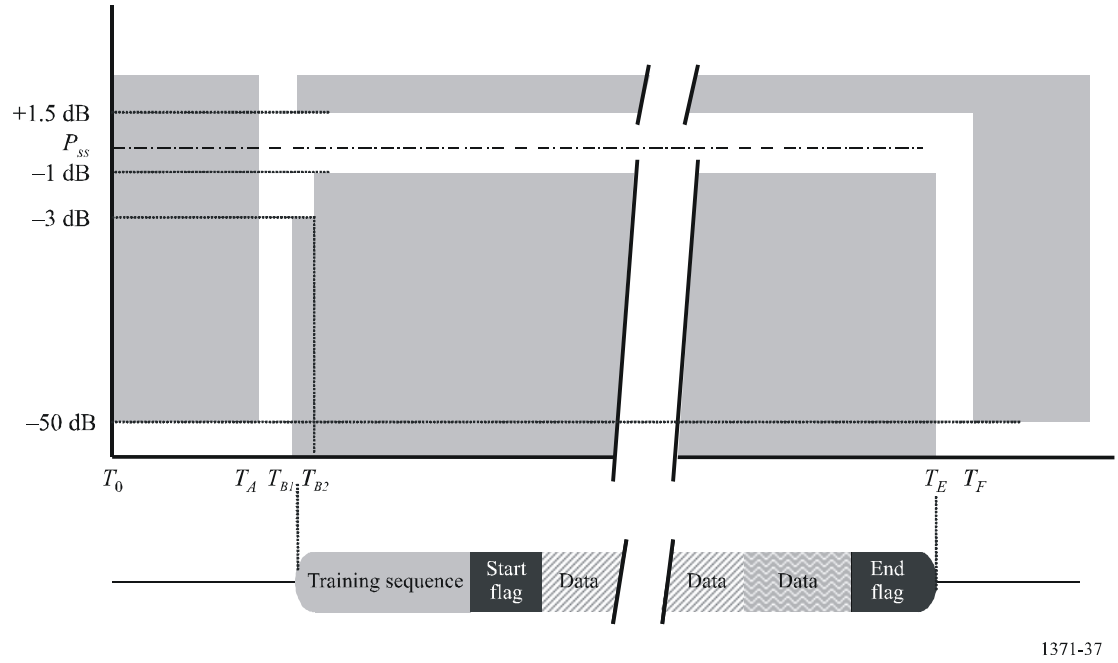


TABLE 34

Definition of timings for Fig. 37

Reference		bits	Time (ms)	Definition
T_0 to T_A		0	0	Start of candidate transmission time period Power should not exceed –50 dB of P_{ss}
T_A to T_B		20	2 083	Begin of upramping
T_B	T_{B1}	23	2 396	Power should reach within +1.5 or –3 dB of P_{ss}
	T_{B2}	25	2 604	Power should reach within +1.5 or –1 dB of P_{ss}
T_E (plus 1 stuffing bit)		248	25 833	Power should still remain within +1.5 or –1 dB of P_{ss}
T_F (plus 1 stuffing bit)		251	26 146	Power should reach –50 dB of steady state RF output power (P_{ss}) and stay below this

There should be no modulation of the RF after the termination of transmission (T_E) until the power has reached zero and next time period begins (T_G).

4.3.1.5 VDL state

The VDL state is based on the result of the carrier sense detection (see § 4.3.1.2) for a time period. A VDL time period can be in one of the following states:

– FREE: time period is available and has not been identified as used in reference to § 4.3.1.2.

– USED: VDL has been identified as used in reference to § 4.3.1.2.

– UNAVAILABLE: time periods should be indicated as “UNAVAILABLE” if they are reserved by base stations using Message 20 regardless of their range.

Time periods indicated as “UNAVAILABLE” should not be considered as a candidate time period for use by own station and may be used again after a time-out. The time-out should be 3 min if not specified or as specified in Message 20.

4.3.2 Link sub-layer 2: data link service (DLS)

The DLS sub-layer provides methods for:

– data link activation and release;

– data transfer; or

– error detection and control.

4.3.2.1 Data link activation and release

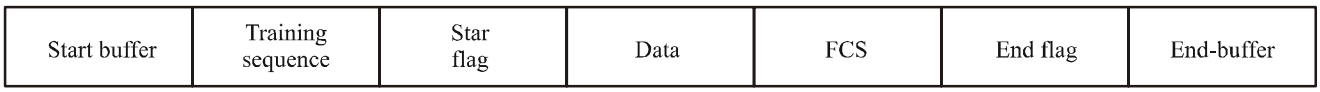
Based on the MAC sub-layer the DLS will listen, activate or release the data link. Activation and release should be in accordance with § 4.3.1.4.

4.3.2.2 Data transfer

Data transfer should use a bit-oriented protocol which is based on the high-level data link control (HDLC) as specified by ISO/IEC 3309: 1993 – Definition of packet structure. Information packets (I-Packets) should be used with the exception that the control field is omitted (see Fig. 38).

FIGURE 38

Transmission packet



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4.3.2.2.1 Bit stuffing

The bit stream should be subject to bit stuffing. This means that if five consecutive ones (1’s) are found in the output bit stream, a zero should be inserted. This applies to all bits except the data bits of HDLC flags (start flag and end flag, see Fig. 38).

4.3.2.2.2 Packet format

Data is transferred using a transmission packet as shown in Fig. 38.

The packet should be sent from left to right. This structure is identical to the general HDLC structure, except for the training sequence. The training sequence should be used in order to synchronize the VHF receiver as described in § 4.2.1.4. The total length of the default packet is 256 bits. This is equivalent to 26.7 ms.

4.3.2.2.3 Start-buffer

The start-buffer (refer to Table 35) is 23 bits long and consists of:

– CS-delay 20 bits

  – Reception delay (sync jitter + distance delay)

  – Own synchronization jitter (relative to synchronization source)

  – Ramp-up (received Message)

  - CS detection window
  - Internal processing delay
- Ramp-up (own transmitter) 3 bits

TABLE 35

Start buffer

Sequence	Description	Bits	Note
1	Reception delay (synchronization jitter + distance delay)	5	Class A: 3 bits of jitter + 2 bits (30 NM) distance delay; base station: 1 bit of jitter + 4 bits (60 NM) distance delay
2	Own synchronization jitter (relative to synchronization source)	3	3 bits according to § 4.3.1.1
3	Ramp-up (received Message)	8	Refer to Annex 2, start of detection window
4	Detection window	3	
5	Internal processing delay	1	
6	Ramp-up (own transmitter)	3	
	Total	**23**	

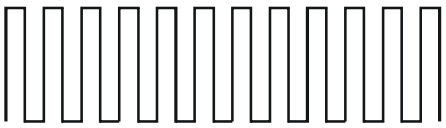
4.3.2.2.4 Training sequence

The training sequence should be a bit pattern consisting of alternating 0's and 1's (010101010...).

Twenty-four bits of preamble are transmitted prior to sending the flag. This bit pattern is modified due to the NRZI mode used by the communication circuit. See Fig. 39.

FIGURE 39

Training sequence



a) Unmodified bit pattern

b) Modified bit pattern by NRZI

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4.3.2.2.5 Start flag

The start flag should be 8 bits long and consists of a standard HDLC flag. It is used to detect the start of a transmission packet. The start flag consists of a bit pattern, 8 bits long: 01111110 (7Eh). The flag should not be subject to bit stuffing, although it consists of 6 bits of consecutive ones (1's).

4.3.2.2.6 Data

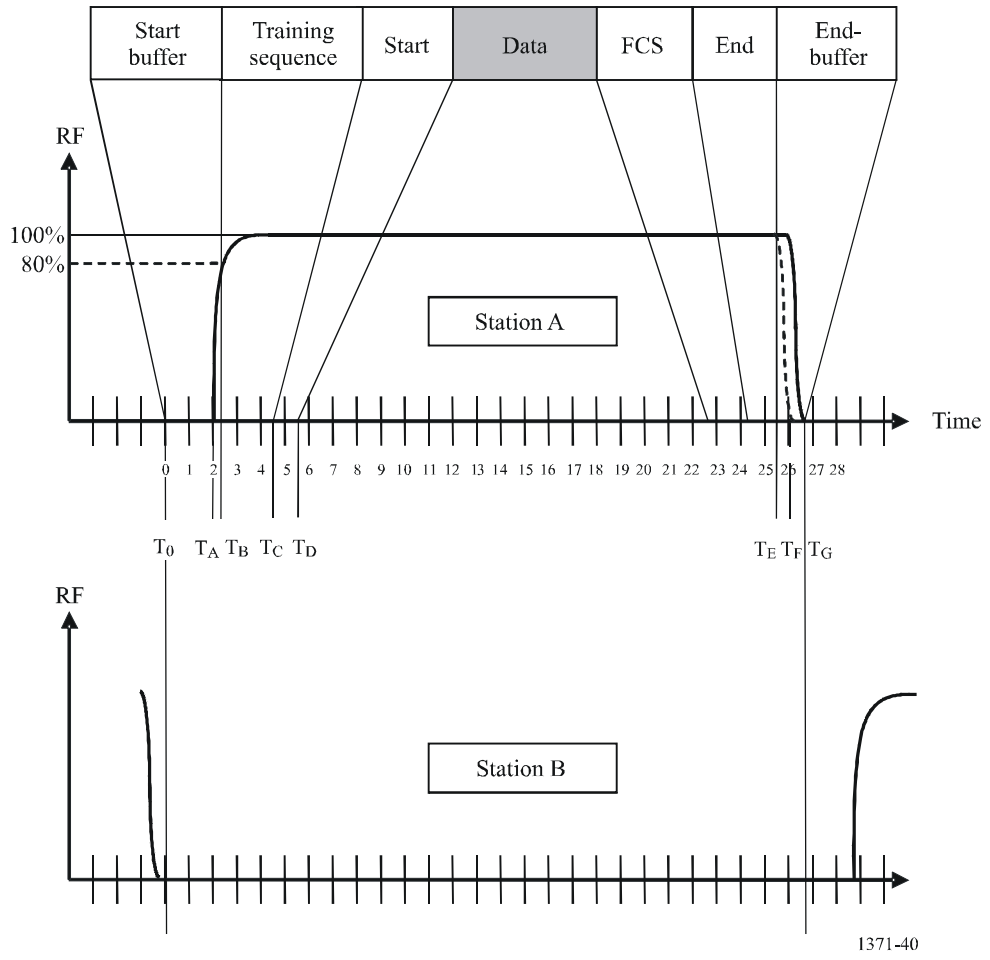
The data portion in the default transmission packet transmitted in one-time period is a maximum of 168 bits.

4.3.2.2.7 Frame check sequence

The frame check sequence (FCS) uses the cyclic redundancy check (CRC) 16-bit polynomial to calculate the checksum as defined in ISO/IEC 3309: 1993. All the CRC bits should be pre-set to one (1) at the beginning of a CRC calculation. Only the data portion should be included in the CRC calculation (see Fig. 40).

FIGURE 40

Transmission timing



4.3.2.2.8 End flag

The end flag is identical to the start flag as described in § 4.3.2.2.5.

4.3.2.2.9 End-buffer

– bit stuffing: 4 bits.

(The probability of 4 bits of bit stuffing is only 5% greater than that of 3 bits; refer to Annex 2 § 3.2.2.8.1.)

– ramp down: 3 bits

– distance delay: 2 bits.

(A buffer value of 2 bits is reserved for a distance delay equivalent to 30 NM for own transmission.)

A repeater delay is not applicable (duplex repeater environment is not supported).

4.3.2.3 Summary of the transmission packet

The data packet is summarized as shown in Table 36:

TABLE 36

Summary of the transmission packet

Action	Bits	Explanation
Start-buffer:		
CS-delay	20	*T*0 to *TA* in Fig. 41
Ramp up	3	*TA* to *TB* in Fig. 41
Training sequence	24	Necessary for synchronization
Start flag	8	In accordance with HDLC (7Eh)
Data	168	Default
CRC	16	In accordance with HDLC
End flag	8	In accordance with HDLC (7Eh)
End-buffer:		
Bit stuffing	4	
Ramp down	3	
Distance delay	2	
Total	**256**	

4.3.2.4 Transmission timing

Table 37 and Fig. 40 show the timing of the default transmission packet (one-time division).

TABLE 37

Transmission timing

***T*(*n*)**	**Time (µs)**	**bit**	**Description**
T_0	0	0	Start of time division; beginning of start buffer
T_A	2 083	20	Start of transmission (RF power is applied)
T_B	2 396	23	End of start buffer; RF power and frequency stabilization time, beginning of training sequence
T_C	4 896	47	Beginning of start flag
T_D	5 729	55	Beginning of data
T_E	25 729	247	Beginning of end buffer; nominal end of transmission (assuming 0 bit stuffing)
T_F	26 042	250	Nominal end of ramp down (power reaches –50 dBc)
T_G	26 667	256	End of time period, start of next time period

4.3.2.5 Long transmission packets

Autonomous transmissions are limited to one-time period. When responding to an interrogation by a base station for Message 19, the response may occupy two-time periods.

4.3.2.6 Error detection and control

Error detection and control should be handled using the CRC polynomial as described in § 4.3.2.2.7.

CRC errors should result in no further action by the Class B "CS".

4.3.3 Link sub-layer 3 – link management entity (LME)

The LME controls the operation of the DLS, MAC and the physical layer.

4.3.3.1 Access algorithm for scheduled transmissions

The Class B "CS" should use a CSTDMA access using transmission periods, which are synchronized to periods of RF activity on the VDL.

The access algorithm is defined by the following parameters in Table 38:

TABLE 38

Access parameters

Term	Description	Value
Reporting interval (RI)	Reporting interval as specified in § 3.5.2	5 s ... 10 min
Nominal transmission time (NTT)	Nominal time period for transmission defined by RI	
Transmission interval (TI)	Time interval of possible transmission periods, centred around NTT	TI = $^{RI}/_{3}$ or 10 s, whichever is less
Candidate period (CP)	Time period where a transmission attempt is made (excluding time periods indicated unavailable)	
Number of CP in TI		10

The CSTDMA algorithm should follow the rules given below (see Fig. 41):

1 Randomly define 10 CP in the TI.

2 Starting with the first CP in TI, test for CS, § 4.3.1.2, and transmit if the status of CP is "unused", otherwise wait for the next CP.

3 Transmission should be abandoned if all 10 CPs are "used".

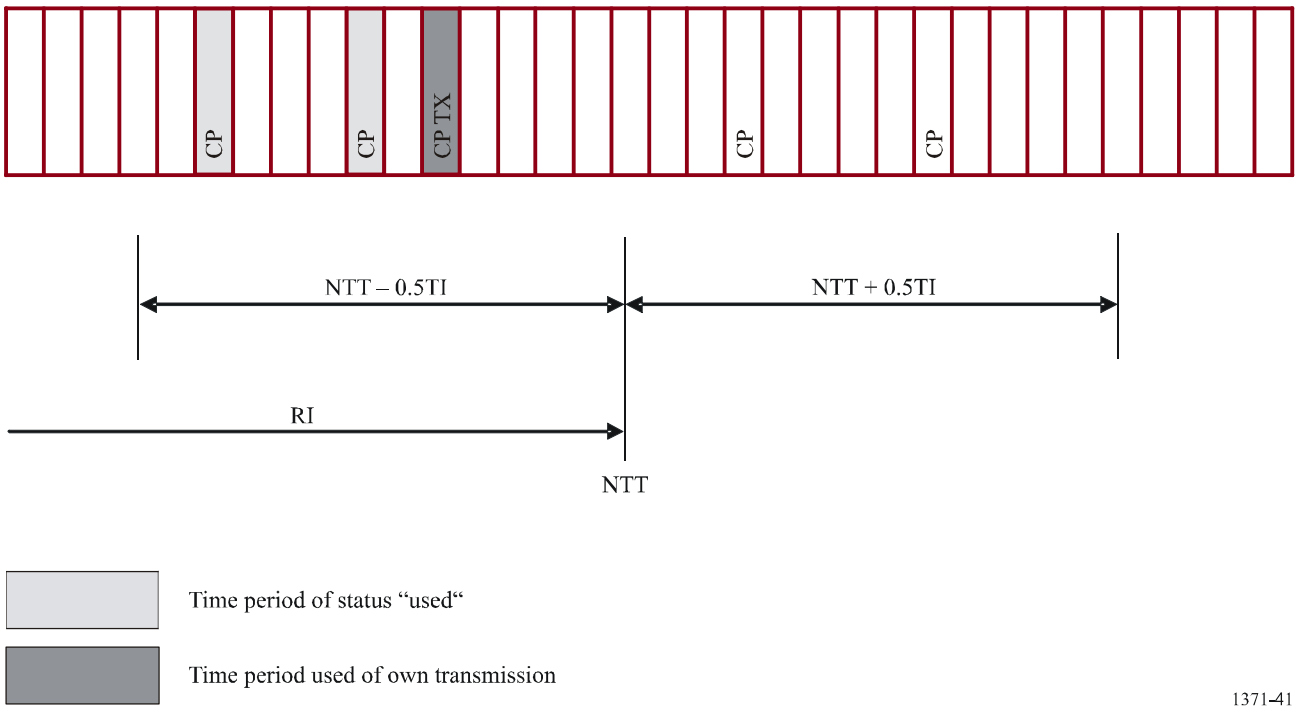
4.3.3.2 Access algorithm for unscheduled transmissions

Unscheduled transmissions, except responses to interrogations by a base station, should be performed by assigning a nominal transmission time within 25 s of the request and should use the access algorithm described in § 4.3.2.1.

If the option to process Message 12 is implemented, an acknowledgement Message 13 should be transmitted in response to Message 12 on the same channel with up to 3 repetitions of the access algorithm if needed.

FIGURE 41

Example of CSTDMA access



4.3.3.3 Modes of operation

There should be three modes of operation.

– Autonomous (default mode)
– Assigned
– Interrogation

4.3.3.3.1 Autonomous

A station operating autonomously should determine its own schedule for the transmission of its position reports.

4.3.3.3.2 Assigned

A station operating in the assigned mode should use a transmission schedule assigned by a competent authority's base station. This mode is initiated by a group assignment command (Message 23).

The assigned mode should affect the transmission of scheduled position reports, except the Tx/Rx mode and the quiet time command, which also affect static reports.

If a station receives this group assignment command and belongs to the group addressed by region and selection parameters it should enter into assigned mode which should be indicated by setting the "Assigned Mode Flag" to "1".

To determine whether this group assignment command applies to the recipient station it should evaluate all selector fields concurrently.

When commanded to a specific transmission behaviour (Tx/Rx mode or reporting interval), the mobile station should tag it with a time-out, randomly selected between 4 and 8 min after the first transmission[7]. After the time-out has elapsed the station should return to autonomous mode.

When commanded to a specific reporting rate, the AIS should transmit the first position report with assigned rate after a time randomly selected between the time the Message 23 has been received and the assigned interval to avoid clustering.

Any individual assignment command received should take precedence over any group assignment command received; i.e. the following cases should be applied:

– if Message 22 is individually addressed, the Tx/Rx mode field setting of Message 22 should take precedence over the Tx/Rx mode field setting of Message 23;

– if Message 22 with regional settings is received, the Tx/Rx mode field setting of Message 23 should take precedence over the Tx/Rx mode field setting of Message 22. In the case of Tx/Rx mode field, the receiving station reverts to its previous Tx/Rx mode regional operating setting after the Message 23 assignment has expired.

When a Class B "CS" station receives a quiet time command, it should continue to schedule NTT periods but should not transmit Messages 18 and 24 on either channel for the time commanded. Interrogations should be answered during the quiet period. Transmissions of safety related messages may still be possible. After the quiet time has elapsed, transmissions should be resumed using the transmission schedule as maintained during the quiet period.

Subsequent quiet time commands received during the first commanded quiet time should be ignored.

The quiet time command should override a reporting rate command.

4.3.3.3.3 Interrogation mode

A station should automatically respond to interrogation messages (Message 15) from an AIS station (see Table 62, Annex 8). Operation in the interrogation mode should not conflict with operation in the other two modes. The response should be transmitted on the channel where the Interrogation message was received.

If interrogated for Message 18 or 24 with no offset specified in Message 15, the response should be transmitted within 30 s using the access algorithm as described in § 4.3.3.2. If no free candidate period has been found, one transmission retry should be performed after 30 s.

If interrogated by a base station with an offset given in Message 15, the response should be transmitted in the specified time period without applying the access algorithm as described in § 4.3.3.2.

An interrogation for Message 19 should only be responded to if the interrogation Message 15 contains an offset to the time period in which the response should be transmitted[8].

Interrogations for the same message received before own response has been transmitted may be ignored.

---

[7] Because of the time-out, assignments may be reissued by the competent authority as needed. If a Message 23 commanding a reporting interval of 6 or 10 min is not refreshed by the base station, the assigned station will resume normal operation after time-out and thus not establish the assigned rate.

[8] This can only be done by a base station. The base station will reserve time periods by Message 20 prior to interrogation.

4.3.3.4 Initialization

At power on, a station should monitor the TDMA channels for one (1) minute to synchronize on received VDL-transmissions (§ 4.3.1.1) and to determine the CS detection threshold level (§ 4.3.1.3). The first autonomous transmission should always be the scheduled position report (Message 18) see § 3.16, Annex 8.

4.3.3.5 Communication state for CS access

Because Class B "CS" does not use any Communication state information, the communication state field in Message 18 should be filled with the default value[9] "1100000000000000110" and the communication state selector flag field filled with "1".

4.3.3.6 VDL message use

Table 39 shows how the messages defined in Annex 8 should be used by a Class B "CS" shipborne mobile AIS device.

TABLE 39

Use of VDL messages by a Class B "CS" AIS

Message No.	Name of message	Annex 8 reference	Receive and process (1)	Transmit by own station	Remark
0	Undefined				
1	Position report (Scheduled)	§ 3.1	Optional	No	
2	Position report (Assigned)	§ 3.1	Optional	No	
3	Position report (When interrogated)	§ 3.1	Optional	No	
4	Base station report	§ 3.2	Optional	No	
5	Static and voyage related data	§ 3.3	Optional	No	
6	Addressed binary message	§ 3.4	No	No	
7	Binary acknowledge	§ 3.5	No	No	
8	Binary broadcast message	§ 3.6	Optional	No	
9	Standard SAR aircraft position report	§ 3.7	Optional	No	
10	UTC and date inquiry	§ 3.8	No	No	
11	UTC/Date response	§ 3.2	Optional	No	
12	Safety related addressed message	§ 3.10	Optional	No	NOTE – Information can also be transferred via Message 14

[9] A Class B" CS" station by default reports sync state 3 and does not report "number of received stations" . Therefore it will not be used as sync source for other stations.

TABLE 39 (*end*)

Message No.	Name of message	Annex 8 reference	Receive and process (1)	Transmit by own station	Remark
13	Safety related acknowledge	§ 3.5	No	Optional	Should be transmitted if the option to process Message 12 is implemented
14	Safety related broadcast message	§ 3.12	Optional	Optional	Transmit with predefined text only, see § 4.3.3.7
15	Interrogation	§ 3.13	Yes	No	Class B "CS" should respond to interrogations for Message 18 and Message 24. It should also respond to interrogations for Message 19 by a base station
	Assigned mode command	§ 3.21	No	No	Message 23 is applicable to the "CS"
17	DGNSS broadcast binary message	§ 3.15	Optional	No	
18	Standard Class B equipment position report	§ 3. 16	Optional	Yes	A Class B "CS" AIS should indicate "1" for "CS" in flag bit 143
19	Extended Class B equipment position report	§ 3.17	Optional	Yes	Transmit ONLY as response on base station interrogation
20	Data link management message	§ 3.18	Yes	No	
21	Aids-to-navigation report	§ 3.19	Optional	No	
22	Channel management message	§ 3. 20	Yes	No	Use of that function may be different in certain regions
23	Group assignment	§ 3.21	Yes	No	
24	Class B "CS" static data	§ 3.22	Optional	Yes	Part A and Part B
25	Single slot binary message	§ 3.23	Optional	No	
26	Mult. slot binary message with Communications State	§ 3.24	No	No	
27-63	Undefined	None	No	No	Reserved for future use

(1) "Receive and process" in this table means functionality visible for the user, e.g. output to an interface or display. For synchronization it is necessary to receive and internally process messages according to § 4.3.1.1; this applies to Messages 1, 2, 3, 4, 18, 19.

4.3.3.7 Use of safety related message, Message 14 (optional)

The data contents of Message 14 if implemented should be predefined and the transmission should not exceed one-time period. Table 40 specifies the maximum number of data bits used for Message 14 and is based on the assumption that the theoretical maximum of stuffing bits will be needed.

TABLE 40

Number of data bits for use with Message 14

Number of time periods	Maximum data bits	Stuffing bits	Total buffer bits
1	136	36	56

The Class B "CS" AIS should only accept the initiation of a Message 14 once a minute by a user manual input. Automatic repetition is not allowed.

The Message 14 may have precedence over Message 18.

4.4 Network layer

The network layer should be used for:

– establishing and maintaining channel connections;

– management of priority assignments of messages;

– distribution of transmission packets between channels;

– data link congestion resolution.

4.4.1 Dual channel operation

The normal default mode of operation should be a two-channel operating mode, where the AIS simultaneously receives on both channels A and B in parallel.

The DSC process may use the receiving resources on a time-share basis as described in § 4.6. Outside the DSC receiving periods the two TDMA receiving processes should work independently and simultaneously on channels A and B.

For periodic repeated messages, the transmissions should alternate between channels A and B. The alternating process should be independent for Message 18 and Message 24.

Transmission of complete Message 24 should alternate between channels (all sub-messages to be transmitted on the same channel before alternating to the other channel).

Channel access is performed independently on each of the two parallel channels.

Responses to interrogations should be transmitted on the same channel as the initial message.

For non-periodic messages other than those referenced above, the transmissions of each message, regardless of message type, should alternate between channels A and B.

4.4.2 Channel management

Channel management should be done according to Annex 2, § 4.1 except:

– Channel management should be by Message 22 or DSC command. No other means should be used.

– The Class B “CS” AIS is only required to operate in the band specified in § 3.2 with a channel spacing of 25 kHz. It should stop transmitting if commanded to a frequency outside its operating capability.

TABLE 41

Channel management transitional behaviour

		Step	Region 1 Channel A (frequency 1)	Region 1 Channel B (frequency 2)	Region 2 Channel A (frequency 3)	Region 2 Channel B (frequency 4)
Region 1		A	1	1		
	Transitional zone	B	2		2	
Region 2	Transitional zone	C	2		2	
		D			1	1

1 Transmit with nominal reporting interval.

2 Transmit with half the reporting interval.

When entering (Step A to B) or leaving (Step C to D) a transitional zone the Class B “CS” AIS should continue to evaluate the CS threshold taking into account the noise level of the old channel initially and the new channel as time progresses. It should continuously transmit (on frequency 1 and frequency 3 in Step B) with the required rate maintaining its schedule.

4.4.3 Distribution of transmission packets

4.4.3.1 Assigned reporting intervals

A competent authority may assign reporting intervals to any mobile station by transmitting group assignment Message 23. An assigned reporting interval should have precedence over the nominal reporting rate; a reporting interval of less than 5 s is not required.

The Class B “CS” should react on next shorter/next longer commands only once until time-out.

4.4.4 Data link congestion resolution

The Class B “CS” AIS access algorithm as described in § 4.3.3.1 guarantees that the time period intended for transmission does not interfere with transmissions made by stations complying with Annex 2. Additional congestion resolution methods are not required and should not be used.

4.5 Transport layer

The transport layer should be responsible for:

– converting data into transmission packets of correct size;

– sequencing of data packets;

– interfacing protocol to upper layers.

4.5.1 Transmission packets

A transmission packet is an internal representation of some information, which can ultimately be communicated to external systems. The transmission packet is dimensioned so that it conforms to the rules of data transfer.

The transport layer should convert data intended for transmission, into transmission packets.

The Class B “CS” AIS should only transmit Messages 18, 19 and 24 and may optionally transmit Message 14.

4.5.2 Sequencing of data packets

The Class B “CS” AIS is periodically transmitting the standard position report Message 18.

This periodic transmission should use the access scheme described in § 4.3.3.1. If a transmission attempt fails because of, e.g. high channel load, this transmission should not be repeated. Additional sequencing is not necessary.

4.6 DSC channel management

4.6.1 DSC functionality

The AIS should be capable of performing regional channel designation and regional area designation as defined in Annex 3; DSC transmissions (acknowledgements or responses) should not be broadcast.

The DSC functionality should be accomplished by using a dedicated DSC receiver or by time-sharing the TDMA channels. The primary use of this feature is to receive channel management messages when AIS 1 and/or AIS 2 are not available.

4.6.2 DSC time-sharing

In the case of equipment, which implements the DSC receive function by time-sharing the TDMA receive channels, the following should be observed.

One of the receive processes should monitor DSC channel 70 for the 30 s time periods in Table 42. This selection should be swapped between the two receive processes.

TABLE 42

DSC monitoring times

Minutes past UTC hour
05:30-05:59
06:30-06:59
20:30-20:59
21:30-21:59
35:30-35:59
36:30-36:59
50:30-50:59
51:30-51:59

If the AIS is utilizing this time-sharing method to receive DSC, AIS transmissions should still be performed during this period. In order to accomplish the CS algorithm, the AIS receivers’ channel

10.9.4.1.2 Required results

The interface shall be compliant with IEC 61162 series protocol and the manufacturer's documentation of interface hardware.

11 Physical tests

11.1 TDMA transmitter

(see 7.2.2)

11.1.1 Frequency error

11.1.1.1 Definition

The frequency error of the transmitter is the difference between the measured carrier frequency in the absence of modulation of the transmitter and its required frequency.

11.1.1.2 Method of measurement

a) The carrier frequency shall be measured in the absence of modulation.

b) Tests shall be performed on the lowest operating frequency on which the EUT can transmit according to the manufacturer's specification and AIS 2 (162,025 MHz).

c) The measurement shall be made under normal and extreme test conditions.

11.1.1.3 Required results

The frequency error shall not exceed ±0,5 kHz under normal and ±1 kHz under extreme test conditions.

11.1.2 Carrier power

11.1.2.1 Definition

The power of a radio frequency signal (conducted) is defined as the mean power delivered to a 50 Ω load during a radio frequency cycle. The Carrier Power is defined as the average radio frequency power measured over the transmitter duration. The transmitter duration is defined in 7.3.1.4.

11.1.2.2 Method of measurement

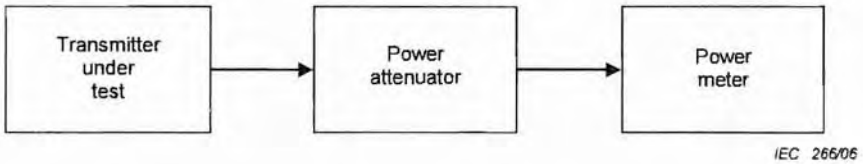


Figure 9 – Measurement arrangement for carrier power

a) The transmitter shall generate test signal number 4.

b) The average power shall be measured over the transmitter duration. This power shall be further averaged over measurements from 200 transmissions. This value shall be corrected according to the transmitter duty cycle to indicate the carrier power.

c) Tests shall be performed on the lowest operating frequency on which the EUT can transmit according to the manufacturer's specification and AIS 2 (162,025 MHz).

d) The measurement shall be carried out under normal and extreme test conditions.

11.1.2.3 Required results

At all test frequencies, the carrier power shall be 33 dBm ±1,5 dBm under normal test conditions.

At all test frequencies the carrier power shall be 33 dBm ±3 dBm under extreme test conditions.

11.1.3 Transmission spectrum

11.1.3.1 Definition

This test is to ensure that the modulation and transient sidebands produced by the transmitter under normal operating conditions fall within the allowable mask.

11.1.3.2 Method of measurement

a) The test shall use test signal number 4.

b) The EUT shall be connected to a spectrum analyser. A resolution bandwidth of 1 kHz, video bandwidth of 3 kHz or greater and positive peak detection (maximum hold) shall be used for this measurement. A sufficient number of sweeps shall be used and sufficient transmission packets measured to ensure that the emission profile is developed.

c) Tests shall be performed on the lowest operating frequency on which the EUT can transmit according to the manufacturer's specification and AIS 2 (162,025 MHz).

11.1.3.3 Required result

The spectrum for slotted transmission shall be within the emission mask as follows:

- in the region between the carrier and ±10 kHz removed from the carrier, the modulation and transient sidebands shall be below 0 dBc;
- at ±10 kHz removed from the carrier, the modulation and transient sidebands shall be below –25 dBc;
- at ±25 kHz to ±62,5 kHz removed from the carrier, the modulation and transient sidebands shall be below the lower value of –60 dBc or –30 dBm;
- in the region between ±10 kHz and ±25 kHz removed from the carrier, the modulation and transient sidebands shall be below a line specified between these two points.

The reference level for the measurement shall be the carrier power (conducted) recorded for the appropriate test frequency in 11.1.2.

For information the emission mask specified above is shown in Figure 10.

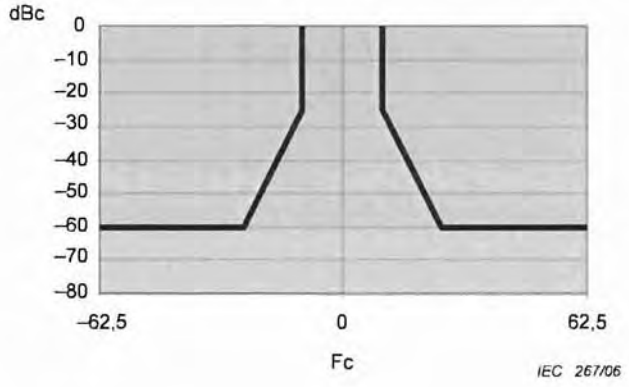


Figure 10 – Emission mask

11.1.4 Modulation accuracy

11.1.4.1 Definition

The modulation accuracy is the measurement of the peak frequency deviation of the transmitter modulation and the correct implementation of the GMSK BT filtering.

11.1.4.2 Method of measurement

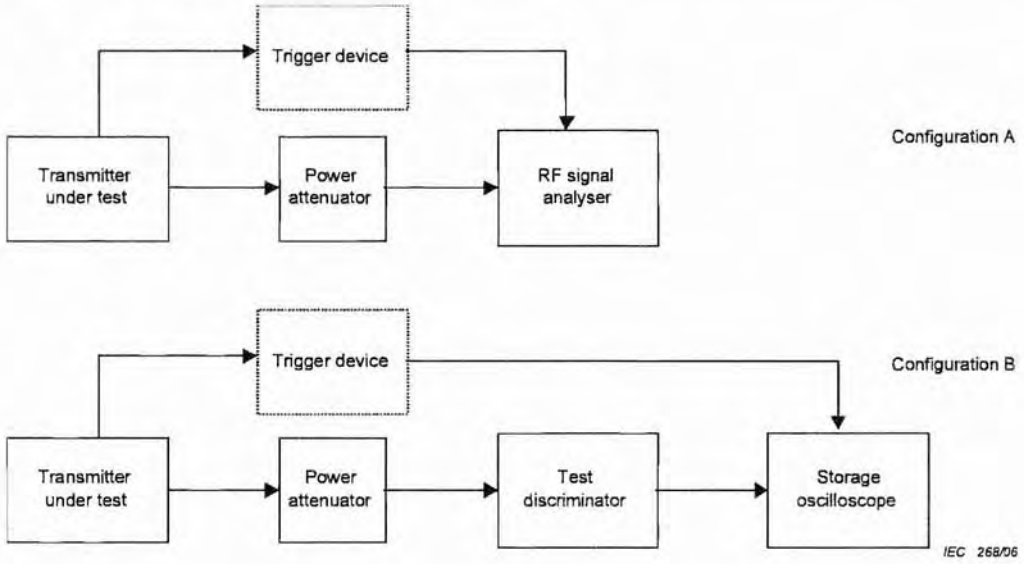


Figure 11 – Measurement arrangement for modulation accuracy

The measurement procedure shall be as follows:

a) the equipment shall be connected in either configuration A or configuration B as shown. The trigger device is optional if the equipment is capable of synchronising to the transmitted bursts;

b) the transmitter shall be tuned to AIS 2 (162,025 MHz);

c) the transmitter shall be modulated with test signal number 2;

d) the deviation from the carrier frequency shall be measured as a function of time;

e) the transmitter shall be modulated with test signal number 3;

f) the deviation from the carrier frequency shall be measured as a function of time;

g) measurements shall be repeated at the lowest frequency on which the EUT can transmit, according to the manufacturer's specification;

h) testing shall be repeated under extreme test conditions.

11.1.4.3 Required results

Peak frequency deviation at various points within the data frame shall comply with Table 22. These limits apply to both the positive and negative modulation peaks. Bit 0 is defined as the first bit of the training sequence.

Table 22 – Peak frequency deviation versus time

Measurement period from centre to centre of each bit	Test signal 2		Test signal 3	
	Normal	Extreme	Normal	Extreme
Bit 0 to bit 1	<3 400 Hz			
Bit 2 to bit 3	2 400 ±480 Hz			
Bit 4 to bit 31	2 400 ±240 Hz	2 400 ±480 Hz	2 400 ±240 Hz	2 400 ±480 Hz
Bit 32 to bit 199	1 740 ±175 Hz	1 740 ±350 Hz	2 400 ±240 Hz	2 400 ±480 Hz

11.1.5 Transmitter output power versus time function

11.1.5.1 Definition

Transmitter output power versus time function is a combination of the transmitter delay, attack time, release time and transmission duration (referring to Figure 3), where:

a) transmitter delay (T_A) is the time between the start of the candidate transmission time period and the time when the transmission power exceeds –50 dBc;

b) transmitter attack time ($T_B - T_A$) is the time between the transmit power exceeding –50 dBc and the moment when the transmit power has reached a level 1 dB below the measured steady-state power (Pss) and maintains a level within +1,5/–1 dB from P_{ss} thereafter;

c) transmitter release time ($T_F - T_E$) is the time between the end flag being transmitted and the moment when the transmitter output power has reduced to a level 50 dB below P_{ss} and remains below this level thereafter;

d) transmission duration ($T_F - T_A$) is the time from when power exceeds –50 dBc to when the power returns to and stays below –50 dBc.

11.1.5.2 Method of measurement

a) The measurement shall be carried out by transmitting test signal number 2 (note that this test signal generates one additional stuffing bit within its CRC portion).

b) The EUT shall be connected to a spectrum analyser. A resolution bandwidth of 1 MHz, video bandwidth of 1 MHz and a sample detector shall be used for this measurement. The analyser shall be in zero-span mode for this measurement.

c) For the purposes of this test, the EUT shall be equipped with a test signal (SYNC) indicating the start of each time period that it intends to transmit into. This will be used as a trigger source for the spectrum analyser. The SYNC signal shall be aligned to the nominal start time (T_0) of the transmission time period.

d) Tests shall be performed on the lowest operating frequency on which the EUT can transmit according to the manufacturer's specification and AIS 2 (162,025 MHz).

11.1.5.3 Required result

The transmitter power shall remain within the mask shown in Figure 3 and associated timings given in Table 6.

11.2 TDMA receivers

(see 7.2.3)

11.2.1 Sensitivity

11.2.1.1 Definition

The maximum usable sensitivity is the minimum level of signal (dBm) at the receiver input, produced by a carrier at the nominal frequency of the receiver, modulated with the typical test signal (test signal 5), which will, without interference, produce after demodulation a data signal with a specified packet error rate (*PER*).

11.2.1.2 Method of measurement

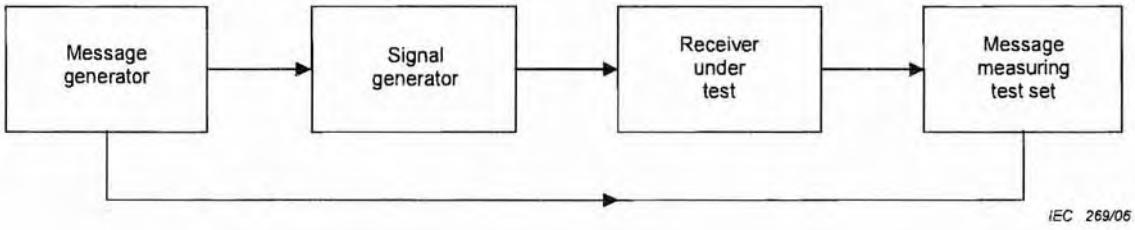


Figure 12 – Measurement arrangement

The measurement procedure shall be as follows:

a) the signal generator shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5;

b) the signal level at the input of the receiver shall be set to –107 dBm;

c) the message measuring test set shall be monitored and the packet error rate observed; The *PER* shall be derived by the following formula:

$$PER = (P_{TX} - P_{RX})/P_{TX} \times 100 \ (\%)$$

where

P_{RX} is the number of packets received without errors;

P_{TX} is the number of transmitted packets.

d) the test shall be repeated at the nominal carrier frequency ±500 Hz and the level at the input to the receiver adjusted to –104 dBm under normal conditions;

e) the test shall be carried out on the lowest TDMA frequency declared by the manufacturer and AIS 2 (162,025 MHz);

f) repeat under extreme conditions, at the nominal carrier frequency only. The signal generator shall be adjusted so the level at the input to the receiver is –101 dBm.

11.2.1.3 Required results

The *PER* shall not exceed 20 %.

11.2.2 Error behaviour at high input levels

11.2.2.1 Definition

The error behaviour (performance) at high input levels (noise free operation) is defined in the same manner as for the measurement of the maximum usable sensitivity when the level of the wanted signal is significantly above the maximum wanted sensitivity.

11.2.2.2 Method of measurement

The measurement configuration for receiver sensitivity (11.2.1) shall be used.

The signal generator shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5. The test shall be carried out on the lowest TDMA frequency declared by the manufacturer and AIS 2 (162,025 MHz). The message measuring test set shall be monitored and the packet error rate observed.

a) The level of the input signal shall be adjusted to a level of –77 dBm;

b) The level of the input signal shall be adjusted to a level of –7 dBm.

11.2.2.3 Required results

The *PER* shall not exceed 2 % under a) and 10 % under b).

11.2.3 Co-channel rejection

11.2.3.1 Definition

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

11.2.3.2 Method of measurement

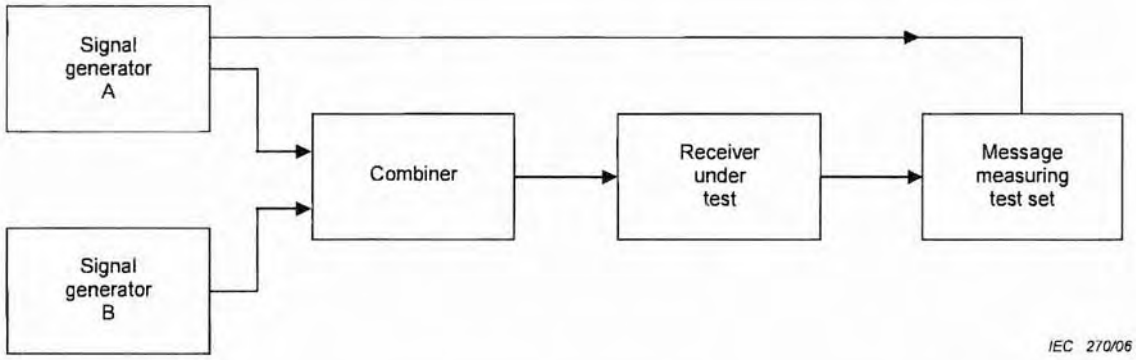


Figure 13 – Measurement arrangement with two generators

The measurement procedure shall be as follows:

a) two generators A and B, shall be connected to the receiver via a combining network;

b) the wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5;

c) the unwanted signal, provided by generator B, shall also be at the nominal frequency of the receiver. Generator B shall be modulated to generate test signal number 4, either continuously or in the same time period as that used by generator A for test signal number 5. The content of the wanted and unwanted signals shall not be synchronised;

d) the level of the wanted signal from generator A shall be adjusted to –101 dBm;

e) the level of the unwanted signal from generator B shall be adjusted to –111 dBm;

f) the message measuring test set shall be monitored and the packet error rate (*PER*) observed;

g) the measurement shall be repeated for displacements of the unwanted signal of ±1 kHz[11] from the nominal frequency of the receiver and the *PER* again observed;

h) the test shall be carried out on the lowest TDMA frequency declared by the manufacturer and AIS 2 (162,025 MHz).

11.2.3.3 Required result

The *PER* shall not exceed 20 %.

11.2.4 Adjacent channel selectivity

11.2.4.1 Definition

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

11.2.4.2 Method of measurement

The measurement procedure shall be as follows:

a) the measurement configuration for co-channel rejection (11.2.3) shall be used;

b) the wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5;

c) the unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ±3 kHz. Generator B shall be at a frequency 25 kHz above that of the wanted signal;

d) the level of the wanted signal from generator A shall be adjusted to a level of –101 dBm;

e) the level of the unwanted signal from generator B shall be adjusted to –31 dBm;

f) the message measuring test set shall be monitored and the packet error rate observed;

g) repeat the above measurement with the unwanted signal 25 kHz below the wanted signal;

h) the test shall be carried out on the lowest TDMA frequency declared by the manufacturer and AIS 2 (162,025 MHz).

11.2.4.3 Required results

The *PER* shall not exceed 20 %.

11.2.5 Spurious response rejection

11.2.5.1 Definition

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

11.2.5.2 Manufacturers' declarations

The manufacturer shall declare the following in order to calculate the "Limited Frequency Range" over which the initial part of the test will be performed:

- list of intermediate frequencies: (IF_1, IF_2, ...IF_N) in Hz;

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[11] – which is twice the allowable transmit frequency tolerance.

- switching range of the receiver[12];
- frequency of the local oscillator[13] at AIS 2 and at the lowest TDMA channel: (f_{LOH}, f_{LOL}).

11.2.5.3 Introduction to the method of measurement

The initial evaluation of the unit shall be performed over the "Limited Frequency Range" and shall then be performed at the frequencies identified from this test and at "Specific Frequencies of Interest" (as defined below).

To determine the frequencies at which spurious responses can occur the following calculations shall be made:

a) calculation of the "Limited Frequency Range":

the limits of the limited frequency range (LFR_{HI} LFR_{LO}) are determined from the following calculations:

$$LFR_{HI} = f_{LOH} + (IF_1 + IF_2 + \ldots + IF_N + sr/2)$$

$$LFR_{LO} = f_{LOL} - (IF_1 + IF_2 + \ldots + IF_N + sr/2)$$

b) calculation of Specific Frequencies of Interest (SFI) outside the limited frequency range:

these are determined by the following calculations:

$$SFI_1 = (K \times f_{LOH}) + IF_1$$

$$SFI_2 = (K \times f_{LOL}) - IF_1$$

where K is an integer from 2 to 4.

11.2.5.4 Method of measurement over the Limited Frequency Range

Two methods are available for the measurements over the Limited Frequency Range, one based on SINAD measurements (A) and the other based on PER measurements (B). Either method may be used, but in each case shall be followed by the method of measurement at identified frequencies.

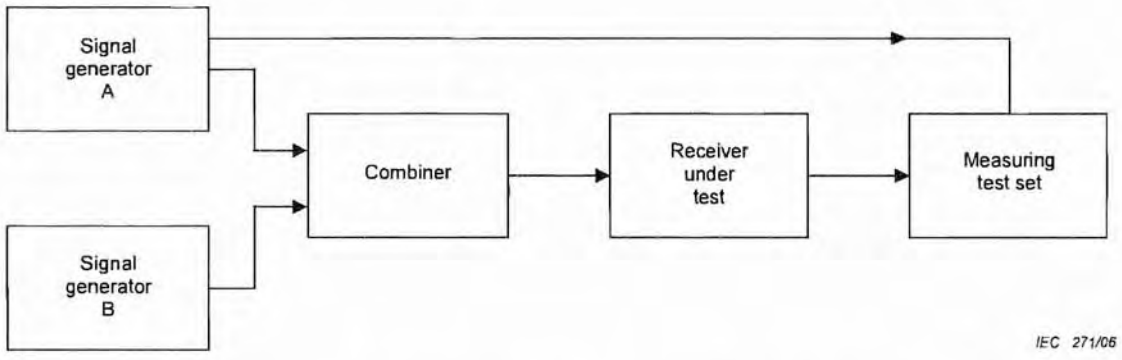

Figure 14 – SINAD or PER/BER measuring equipment

12 Switching range corresponds to the frequency range over which the receiver can be tuned.

13 This may be a VCO, crystal, sampling clock, BFO, Numerically Controlled Oscillator depending on the design of the equipment.

11.2.5.4.1 A) Method of search over the "Limited Frequency Range" using SINAD measurement

a) Two generators A and B shall be connected to the receiver via a combining network.

The wanted signal, provided by generator A, shall be at the nominal frequency of the receiver and shall be modulated with 1 kHz sine wave at ±2,4 kHz deviation.

The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz.

b) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

The signal level from generator A (wanted) shall be adjusted to –101 dBm at the receiver.

The SINAD value shall be noted (and should be greater than 14 dB)

c) Signal generator B shall be switched on and adjusted to –27 dBm at the receiver.

d) The frequency of the unwanted signal shall be varied in steps of 5 kHz over the Limited Frequency Range (from LFR_{LO} to LFR_{HI}).

e) The frequency of any spurious response detected (by an decrease in SINAD of 3 dB or more) during the search shall be recorded for use in the next measurements.

11.2.5.4.2 B) Method of search over the "Limited Frequency Range" using PER or BER measurement

a) Two generators A and B, shall be connected to the receiver via a combining network.

The wanted signal, provided by generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5.

The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ±3 kHz.

b) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

The signal level from generator A (wanted) shall be adjusted to –101 dBm at the receiver.

The PER or BER shall be noted.

c) Signal generator B shall be switched on and adjusted to –27 dBm at the receiver.

d) The frequency of the unwanted signal shall be varied in steps of 5 kHz over the Limited Frequency Range (from LFR_{LO} to LFR_{HI})

e) The frequency of any spurious response detected (by an increase in either PER or BER) during the search shall be recorded for use in the next measurements.

f) In the case where operation using a continuous packet stream is not possible a similar method may be used.

11.2.5.5 Method of measurement (at identified frequencies)

a) Two generators A and B, shall be connected to the receiver via a combining network.

The wanted signal, provided by generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5.

The unwanted signal, provided by generator B, shall be frequency modulated with a 400 Hz sine wave giving a deviation of ± 3 kHz. Generator B shall be at the frequency of that spurious response being considered.

b) Initially, generator B (unwanted) shall be switched off (maintaining the output impedance).

The signal level from generator A (wanted) shall be adjusted –101 dBm at the receiver.

c) Generator B shall be switched on, and the level of the unwanted signal set to –31 dBm.

d) For each frequency noted during the tests over the Limited Frequency Range and the Specific Frequencies of Interest (SFI_1 and SFI_2), transmit 200 packets to the EUT and note the PER.

11.2.5.6 Required results

At any frequency separated from the nominal frequency of the receiver by two channels or more, the spurious responses shall not result in a *PER* of greater than 20 %.

11.2.6 Intermodulation response rejection

11.2.6.1 Definition

The intermodulation response rejection is the capability of the receiver to receive a wanted modulated signal, without exceeding a given degradation due to the presence of two close-spaced unwanted signals with a specific frequency relationship to the wanted signal frequency.

11.2.6.2 Method of test

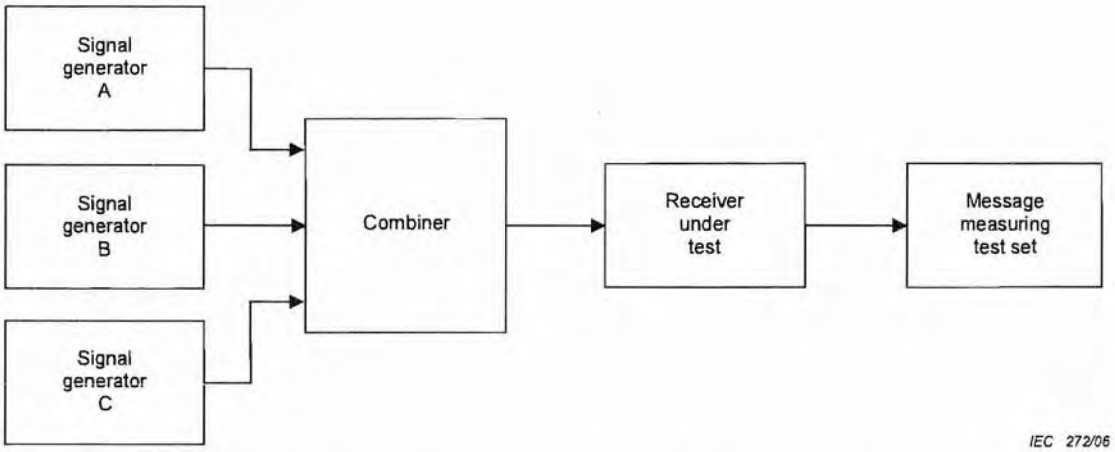

Figure 15 – Measurement arrangement for intermodulation

The measurement procedure shall be as follows:

a) three signal generators shall be connected to the receiver via a combining network;

b) the wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5;

c) the unwanted signal from generator B shall be unmodulated;

d) the unwanted signal from generator C shall be frequency modulated with a 400 Hz sine wave giving a deviation of ±3 kHz;

e) the signal level from generator A (wanted) shall be set for –101 dBm at the receiver input;

f) the signal level from generators B and C shall be set for –36 dBm at the receiver input;

g) the frequencies of generators A, B, C shall be set as per test #1 of Table 23;

h) the message measuring test set shall be monitored and the packet error rate observed;

i) repeat the measurement with frequencies set as per tests #2, #3 and #4 of Table 23.

Table 23 – Frequencies for inter-modulation test

	Generator A Wanted AIS signal	Generator B Unmodulated (+/-50 kHz)	Generator C Modulated (+/-100 kHz)
Test #1	162,025 MHz	162,075 MHz	162,125 MHz
Test #2	162,025 MHz	161,975 MHz	161,925 MHz
Test #3	F_{TDMAlo}	F_{TDMAlo} +50 kHz	F_{TDMAlo} +100 kHz
Test #4	F_{TDMAlo}	F_{TDMAlo} –50 kHz	F_{TDMAlo} –100 kHz

NOTE F_{TDMAlo} is the lowest frequency on which the EUT can operate according to the manufacturer's specification.

11.2.6.3 Required results

The PER shall not exceed 20 %.

11.2.7 Blocking or desensitisation

11.2.7.1 Definition

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

11.2.7.2 Method of measurement

The measurement procedure shall be as follows:

a) two generators A and B, shall be connected to the receiver via a combining network;

b) the wanted signal, provided by signal generator A, shall be at the nominal frequency of the receiver and shall be modulated to generate test signal number 5;

c) the unwanted signal from generator B shall be unmodulated and shall be at a frequency 0,5 MHz to 10 MHz away from the nominal frequency of the receiver. Measurements shall be carried out at frequencies of the unwanted signal at approximately ±500 kHz, ±1 MHz, ±2 MHz, ±5 MHz and ±10 MHz, avoiding those frequencies at which spurious responses could occur (see C.4.5);

d) initially, signal generator B (unwanted signal) shall be switched off (maintaining the output impedance). The level of the wanted signal from generator A shall be adjusted to –101 dBm at the receiver input;

e) the RF signal level for signal generator B (unwanted signal) shall be adjusted to –23 dBm when the frequency setting is less than ±5 MHz. For frequency settings of ±5 MHz or higher the RF level shall be adjusted to –15 dBm;

f) the test shall be repeated for all the frequencies defined in step c);

g) the test shall be carried out on the lowest frequency on which the EUT can operate according to the manufacturer's specification and AIS 2 (162,025 MHz).

11.2.7.3 Required results

The maximum packet error rate shall not exceed 20 %.

11.3 Conducted spurious emissions

11.3.1 Spurious emissions from the receiver

11.3.1.1 Definition

Spurious emissions from the receiver are components at any frequency, conducted to the antenna. The level of spurious emissions shall be measured as their power level in a specified load.

11.3.1.2 Method of measurement

The receiver shall be connected to a 50 Ω attenuator. The output of the attenuator shall be connected to a spectrum analyser or selective voltmeter having an input impedance of 50 Ω. If the detecting device is not calibrated in terms of power input, the level of any detected components shall be determined by a substitution method using a signal generator. The measurement shall extend over the frequency range 9 kHz to 4 GHz.

The receiver shall be switched on, and the measuring receiver shall be tuned over the frequency range 9 kHz to 4 GHz.

At each frequency at which a spurious component is detected, the power level shall be recorded as the spurious level delivered into the specified load.

11.3.1.3 Required results

The power of any spurious emission in the specified range at the antenna terminal shall not exceed –57 dBm (2 nW) in the frequency range 9 kHz to 1 GHz and –47 dBm (20 nW) in the frequency range 1 GHz to 4 GHz.

11.3.2 Spurious emissions from the transmitter

11.3.2.1 Definition

Conducted spurious emissions are emissions on a frequency or frequencies, which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

11.3.2.2 Method of measurement

The transmitter shall be connected to a 50 Ω power attenuator. The output of the power attenuator shall be connected to a measuring receiver.

If possible, the measurement shall be made with the transmitter unmodulated. If this is not possible, the transmitter shall be modulated by test signal number 4. If possible the modulation should be continuous for the duration of the measurement.

The measurement shall be made over a frequency range from 9 kHz to 4 GHz, excluding the channel on which the transmitter is operating and its adjacent channels.

The resolution bandwidth of the measuring instrument shall be the smallest bandwidth available which is greater than the spectral width of the spurious component being measured. This shall be considered to be achieved when the next highest bandwidth causes less than 1 dB increase in amplitude. Positive peak detection (maximum hold) shall be selected on the spectrum analyser used for this measurement.