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MINISTRY OF NATIONAL DEFENCE
HELLENIC NATIONAL DEFENCE GENERAL STAFF
C' Branch
Communications Directorate

GRC Frequency Clearance Agreement

for Link 16 Operations within
ATHINAI FIR / HELLAS UIR

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1. General

1.1 Introduction

According to the ITU Radio Regulations, Defence applications like Link 16 cannot operate under a primary or a secondary frequency allocation. The only way to accommodate these applications is the regulatory provision of Article 4.4 of that Regulation: "Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations". Furthermore Article 48 of the International Telecommunication Convention, Administrations can "retain their entire freedom with regard to military radio installations of their army, naval and air forces". Therefore a National Frequency Clearance Agreement for the usage of Link 16 is needed.

In the early 1970's when the Joint Tactical Information Distribution System (JTIDS) systems was being developed a decision was made to operate Link 16 in the 960-1215 MHz frequency band (also known as the L-band), allocated for the use of Aeronautical Radio Navigation Systems (ARNS). Whilst best effort was made to develop the new Link 16 waveform so that it caused the minimum level of interference with existing equipment, the interference potential could not be eliminated, Since Link 16 was introduced the use of the L-band has changed considerably, and is set to change even further over the next decade as new systems are introduced. As an unauthorized user in the L-band it is the responsibility of the military community to ensure that Link 16 does not cause more than tolerable interference with the approved Air Traffic Control Systems in the band.

It is a fact that pulses generated from Link 16 terminals can affect the performance of both Civil and Military Communication, Navigation and Surveillance (CNS) systems. To date the Distance Measuring Equipment/Tactical Air Navigation (DME/TACAN) ground beacons have provided to be the most susceptible piece of ATC equipment to Link 16 interference. Extensive amounts of test data have been collected to verify that when certain operational restrictions are placed in Link 16 operations that the DME/TACAN will not experience any harmful performance degradation. Based on the robust technical evidence the operational restrictions are covered by this Agreement.

The use of Link 16 operations with the Multi-functional Information Distribution System (MIDS) and/or JTIDS within ATHINA FIR/ HELLAS UIR is subject to restrictions/conditions imposed by the Hellenic National Defence General Staff (HNDGS)/Hellenic National Radio Frequency Agency (GRC NARFA) and the Hellenic Civil Aviation Authority (HCAA). They have agreed that the use of

Link 16 within ATHINAI FIR / HELLAS UIR is allowed in peacetime on a non-interference basis and as described in the following sections.

1.2 Objective

The objective of this document is to describe the terms and conditions under which the Frequency Clearance Agreement (FCA) for Link 16 operations during peacetime within ATHINAI FIR / HELLAS UIR has been granted by the Hellenic Civil Aviation Authority.

1.3 Operating Authority

The GRC National Joint Data Link Management and Interoperability Cell (NJDLMIC), is the joint organization within GRC for designing, planning, coordinating, monitoring, managing and directing Link 16 operations within ATHINAI FIR/ HELLAS UIR. All Link 16 users operating within ATHINAI FIR / HELLAS UIR shall fully comply with this FCA and all NJDLMIC instructions. Failure to adhere to the conditions set out in this Agreement can result in the withdrawal of approval for continued use of Link 16 within ATHINAI FIR/ HELLAS UIR.

1.4 Applicability

This Agreement applies to any use of Link 16 operating within ATHINAI FIR / HELLAS UIR, during peacetime operations.

HCAA reserves the right either to impose further supplementary conditions regarding the Link 16 operations or ask the immediate cease of Link 16 transmissions, whenever required necessary for the safety of air navigation.

1.5 Precedence

This Agreement is the principal document governing the use of Link 16 within ATHINAI FIR/ HELLAS UIR and has precedence over all other documents and instructions.

1.6 Link 16 Definition

The use of the term "Link 16" in this document refers to the physical layer of the Time Division Multiple Access (TDMA) communications RF waveform architecture that uses the Link 16 message standard.

1.7 Compliance

The acceptance by the GRC NARFA and the HCAA of any use of Link 16 within the frequency band 960 to 1215 MHz is conditional on the strict observance of the specified conditions of operations mandated in this FCA

document. No condition contained in this Agreement implies any status for the Link 16 MIDS/JTIDS other than that stated, nor does any condition imply an obligation for the acceptance of the use of Link 16 MIDS/JTIDS beyond that specified in this Agreement.

1.8 Review and Amendment

This document is jointly sponsored by the HNDGS and the HCAA, and is managed by the GRC NARFA. This Agreement will continually be reviewed and will be subject to change. Amendments will be considered at any time when deemed necessary by the HNDGS and/or the HCAA.

1.9 Operating Clearance

Only those Link 16 terminals and associated platforms authorized by the GRC NARFA are cleared for operations within ATHINAI FIR / HELLAS UIR.

Permission can be requested by the Link 16 user from GRC NARFA by filing a Clearance To Radiate Request (CTR).

Each time, before activating a Link 16 Terminal, permission has to be obtained from the GRC NJDLMIC. Reporting has to be executed in accordance with paragraph 2.13.

A MIDS/JTIDS platform shall only operate with a network (initialization data) load authorized by the NJDLMIC.

1.10 Reference Documentation

The Common Frequency Clearance Criteria (CFCC)¹ Issue 3, dated 30 October 2012, is used as reference documentation for the GRC Frequency Criteria Agreement.¹

¹ The Common Frequency Clearance Criteria are produced by The Frequency Clearance Expert Group and is authorized by the Multi National Working Group. The CFCC is a composite document based on the testing and technical evidence that has been used in the generation of a wide variety of National Frequency Clearance Agreements for allowing the use of Link 16 within National borders.

2. Conditions of Use

2.1 Introduction

This chapter defines the restrictions/conditions under which Link 16 operations are allowed. The measures as laid down are designed to safeguard the availability of CNS systems within ATHINAI FIR / HELLAS UIR. To ensure that Link 16 does not cause more than tolerable interference the follow mechanisms are in place:

- The first mechanism is to actively monitor, based on best effort, ATHINAI FIR / HELLAS UIR for all Link 16 activities.
- The second mechanism is the procedural monitoring of Link 16 activities within ATHINAI FIR/ HELLAS UIR.

Execution of both mechanisms is tasked to the GRC NJDLMIC. The GRC NJDLMIC is the (sole) authority to authorize or to decline operational usage of Link 16 within ATHINAI FIR / HELLAS UIR. Link 16 operations shall be in accordance with the restrictions/conditions contained in this FCA.

2.2 Time Slot Duty Factor (TSDF)

100% TSDF is defined as 396288 Link 16 pulses in a 12 second interval. A single Link 16 user shall not transmit more than 198144 pulses in a 12 second interval, more commonly referred to as 50% TSDF.

The maximum TSDF within a Geographical Area is limited as identified in paragraph 2.7.

2.3 Message Types

Link 16 data is transmitted using either 258 or 444 pulses in a time slot. Both 258 and 444 pulse time slots are allowed on the condition the maximum pulse count limit (expressed as a Geographical Area TSDF) is maintained. The permitted message types are standard (258 pulses), packed 2 single pulse (258 pulses), packed 2 double pulse (444 pulses), and packed 4 (444 pulses).

2.4 Use of Round Trip Timing

Round Trip Timing (RTT) messages consist of 72 pulses in a timeslot and are used to request a system time update from other platforms having a greater time quality in the area. The time update is provided when the terminal with the accurate timing transmits a 72 pulse reply within the same time slot. There are two types of RTT messages RTT-A (Round Trip Timing Address Mode) and RTT-B (Round Trip Timing Broadcast Mode). Both RTT-A and RTT-B messages are permitted. RTT-B messages can result in a slightly higher TSDF.

2.5 Use of Access Modes and Functions that can Result in Contention Access

Contention transmissions occur when two or more platforms transmit in the same time slot using the identical net number and cryptographic key. This configuration has the potential to cause a slight increase in the number of Link 16 produced decodes in the TACAN/DME interrogator receiver.

The access modes and functions that could result in contention can be used without restriction. Link 16 terminal timeslot assignments with access modes that result in contention transmissions include but are not limited to:

- Initial Net Entry (INE);
- Round Trip Timing - Broadcast (RTT-B);
- Precise Participant Location and Identification (PPLI-A&B);
- Fighter to Fighter contention access;
- Time Slot Reallocation (TSR) in the non-centralized mode;
- TSR Initial Entry;
- Re-promulgation Relay;
- Conditional Paired Slot Relay (CPSR).

2.6 Multinet and Multiple Network Operations

Multinet and multiple network usage occur when two or more platforms transmit in the same time slot using a different net number and/or a different cryptographic key and/or a different time offset. This configuration has the potential to cause a slight increase in the number of Link 16 produced decodes in the TACAN/DME interrogator receiver. Multinet operations (time slot reuse on different nets) are allowed. Multiple network operations (time slot reuse in different networks whether synchronized or unsynchronized) are allowed.

2.7 Geographical TSDF (GEO TSDF)

The Geographical Area controls the pulse density (identified by TSDF) that can be transmitted by the aggregate of all platforms within a cylinder of radius equal to the defined geographic area radius. The Geographic Area of Link 16 within ATHINAI FIR operations is defined by Any Point in Space (APIS) and is set to 70NM. The total TSDF is defined as 100% in a 70 NM radius. Geographical Area is generally identified by type, radius, maximum total pulse count and maximum single platform pulse count, more commonly referred to as APIS 70: 100/50).

2.8 Output Power

The maximum output power of a terminal is assumed to be a nominal 200 Watt measured at the terminal output; however the Effective Isotropic Radiated Power (EIRP) will vary dependent on the individual platforms antenna gains and cable losses.

2.9 Separation Distances Restrictions

The minimum separation between any fixed site, marine mobile or ground mobile Link 16 terminal and any ground based DME/TACAN operating in the 960 to 1215 MHz band shall be based on a received signal level of -33 dBm (decibels relative to a milliwatt). The minimum separation shall be 0.5NM.

The minimum separation between any fixed site, marine mobile or ground mobile Link 16 terminal and any Air Traffic Control Radar Beacon System/Secondary Surveillance Radar (ATCRBS/SSR) ground equipment operating in the 960 to 1215 MHz band shall be based on a received signal level of -20 dBm. The minimum separation shall be 275 meters (900ft).

The minimum separation between any airborne Link 16 terminal and a civil aircraft operating ATC equipment in the 960 to 1215 MHz band shall be 1000ft or 305 meters in altitude and 5NM horizontal.

On military airbases, aircraft, while taxiing, recovering or departing, are allowed to infringe the 0.5NM (-33dBm receive signal level) separation of the DME/TACAN and/or the 900ft (-20dBm receive signal level) separation of the ATCRBS/SSR ground equipment when operating in a maximum power setting of 1 Watt. Aircraft not able to select the 1 Watt power setting shall maintain the minimum separation.

2.10 Interference Protection Features (IPF)

Interference Protection Features (IPF), also known as EMC Protection Features (EPF) were developed to ensure that if the Link 16 RF waveform is altered due to malfunction within the Link 16 terminal, the Link 16 terminal will cease transmitting. IPF shall be implemented in all Link 16 terminals or systems and be fully operational. After coordination with the GRC NJDLMIC an exception to the IPF controls can be granted by the NJDLMIC.

2.11 Operating Modes

There are two basic operating modes that have been implemented in a number of Link 16 terminals. The first is to always transmit the Link 16 pulses using a uniform selection of 51 carrier frequencies (corresponds to mode 1). The second is to always transmit all Link 16 pulses on a fixed frequency of 969 MHz (corresponds to mode 2, 3 and 4).

All Link 16 operations within ATHINAI FIR / HELLAS UIR shall be in Mode 1 only, which uses a pseudo random sequence amongst 51 carrier frequencies.

2.12 Cross Border Coordination

With the proliferation of Link 16 activity across Europe and around the world, it is necessary to communicate the levels of Link 16 activity each nation has planned to enable a process of cross border coordination to take place. The

methods of achieving cross border coordination are defined in the EJCC Cross Border Coordination SOP.

The GRC NJDLMIC shall employ Cross Border Coordination.

2.13 Reporting

Platforms/units operating MIDS/JTIDS within ATHINAI FIR / HELLAS UIR being in LOS with terminals of the GRC NJDLMIC are not required to forward a JTIDS Activity Report (JAR). However, the GRC NJDLMIC retains the right to order any unit to forward a JAR. Platforms/units operating MIDS/JTIDS within ATHINAI FIR / HELLAS UIR being BLOS with terminals of the GRC NJDLMIC are required to forward a JAR. The JAR has to be in compliance with the Joint GRC Link 16 SOP (JGRCL16SOP).

3. Compliance Monitoring of Link 16 Activity

3.1 Introduction

To safeguard the permission for Link 16 equipment to operate within ATHINAI FIR / HELLAS UIR Link 16 transmissions should not cause harmful interference. Link 16 equipment that operates within ATHINAI FIR / HELLAS UIR in accordance with the restrictions and conditions of this Agreement, meets this requirement.

Within ATHINAI FIR/ HELLAS UIR, all Link 16 MIDS/JTIDS activity is monitored to ensure/guarantee compliance with the restrictions and conditions of this Agreement and to optimize the data link operation. This compliance monitoring is performed by the NJDLMIC.

3.2 Purpose

The purpose of compliance monitoring of Link 16 activity is as follows:

- To detect potential violations of the terms and conditions of this Agreement before they occur. This allows authorities involved to take preventative actions in order to ensure that ARNS is not affected by harmful interference;
- To detect actual violations of the terms and conditions of this Agreement as early as possible. This allows authorities involved to take immediate actions in order to minimize any potential interference to ARNS;
- To record and/or log all Link 16 activity to permit subsequent analysis and reporting of Link 16 operations.

3.3 Responsibility

The GRC NJDLMIC has executive responsibility for Link 16 operations within ATHINAI FIR / HELLAS UIR.

The GRC NJDLMIC is responsible for compliance monitoring, recording and logging of any Link 16 activity within ATHINAI FIR / HELLAS UIR. Consequently, the Network Managers at the GRC NJDLMIC are to be consulted by all users prior to any Link 16 operations to ensure that activities are coordinated properly.

Personnel employed on compliance monitoring duties are to be qualified accordingly. Their responsibilities for compliance monitoring are to be defined clearly and they must have access to sufficient equipment to ensure that Link 16 activity complies with the terms and conditions of this Agreement.

3.4 Methodology

The compliance monitoring task is to be performed either or both by active or procedural methods. The procedural methods should incorporate detailed

record keeping. The active methods must comprise observation by qualified personnel, together with manual and electronic recording of Link 16 activity.

The GRC NJDLMIC will adhere to following principles, in relation to Link 16 activity, in order to maintain compliance with the terms and conditions of this Agreement:

- This Agreement shall be promulgated widely;
- Only qualified personnel is to be employed in Link 16 activities that have a bearing on compliance with the terms and conditions of this Agreement;
- Checks and validations of the compliance of Link 16 network designs are to be made. All Link 16 users are to operate in accordance with JGRCL16SOP to ensure that they are fully familiar with the terms and conditions contained within this Agreement. All records of Link 16 activities are to be held for a period of at least 60 days. This will permit retrospective investigation into reports of interference where Link 16 may have been a contributory factor. Furthermore, these records will permit the undertaking of investigations into violations of the terms and conditions of this Agreement. Records of the following aspects of Link 16 activity must be maintained:

- MIDS/JTIDS network designs utilized;
- MIDS/JTIDS User (JU) call signs;
- JU network entry and exit times;
- JU positions and areas of operation, including the locations of ground terminals;
- JU Initialization Data Load allocations, including any subsequent amendments;
- JU Network Function and Role allocations, including any subsequent amendments;
- Full details of all violations of the terms and conditions of this Agreement.

These details should be sufficient to permit potential future analysis.

3.5 Violation Procedures

All violations of the terms and conditions of this Agreement are to be recorded by the GRC NJDLMIC and reported to the HCAA.

The severity and effect of any violation will be dependent upon the type of occurrence and the prevailing operational situation. Different processes will exist for different occurrences and violations will be categorized as either 'Major' or 'Minor'.

Cases categorized as 'Major':

- Failure to comply immediately with a NJDLMIC instruction
- Persistent use of an unauthorized network (initialization data) load by a JU whereby the conditions of use of this Agreement are breached.

- Persistent infringement of the aeronautical CNS system(s) or ground-based Cooperative Surveillance System separation minima.
- Persistent infringement of Protected Airspace.
- Persistent operation by a JU as Relay whereby the conditions of use of this Agreement are breached.
- Persistent selection of NTR by an unauthorized JU.
- Any unauthorized use of a High Power mode.
- Operation from unauthorized location.
- Operation of an unauthorized JTIDS/MIDS terminal/platform.
- Any unauthorized use of the Contention Access Mode.

Cases categorized as 'Minor':

- Temporary use of an unauthorized network (initialization data) load by a JTIDS/MIDS User (JU).
- Temporary infringement of aeronautical CNS system(s) or ground-based Cooperative Surveillance System separation distance minima.
- Temporary infringement of Protected Airspace.
- Temporary erroneous selection of Relay.
- Temporary erroneous selection of Network Time Reference (NTR) by an unauthorized JU.
- Infringement of air-to-air separation criteria.

'Major' violations are to be investigated and notified to GRC NJDLMIC as soon as practicable, noting any immediate Network Manager corrective actions. GRC NJDLMIC will instruct the Network Manager whether any further action is required. The GRC NJDLMIC will forward a copy of the violation report to the unit of the violating platform and to the HCAA. The report will include a recommendation of how this type of violation can be prevented from reoccurring.

'Minor' violations don't need to be reported immediately, but must be recorded. The GRC NJDLMIC is to forward a copy of the violation report to the unit of the violating platform and to the HCAA. The unit is to take necessary action(s) to minimize the risk of a violation occurring again.

The GRC NJDLMIC is to maintain a database of all violations for further action and analysis. If an incident is deemed a 'Major' violation, any hand-written logs and automatic recording tapes or files are to be held for further evaluation until the investigation is closed by the HCAA. Although the processes for analyzing data from platforms may differ, the GRC NJDLMIC will be responsible for undertaking any data extraction and analyses required to fully document and report the violation. GRC NJDLMIC is to produce a periodic summary of all incidents to be presented to the HCAA.

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4. Points of Contact

4.1 PoC for further coordination:

Dept/Office	Branch	Tel	Fax
GRC JDLMIC	HNDGS/A' Branch	+30 210 657 1151 +30 210 657 1157	+30 210 657 1154
GRC NARFA	HNDGS/C' Branch	+30 210 657 6284 +30 210 657 6029	+30 210 657 6125
COMMUNICATIONS DIRECTORATE (C4)	HAFGS/C' Branch	+30 210 659 3418 +30 210 659 3464	+30 210 659 3430
DLMC/NDF	HTAF/NAOC	+30 241 051 4520 +30 241 051 4833	+30 241 053 8753