TELEMATICS
MOBILE INFORMATION EXCHANGE

GPS and GSM Jamming Application Note

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1 Overview

The purpose of this document is to provide detailed instructions on how to configure GPS and GSM Jamming detection. The document provide guidance in setting up the events and what hardware platforms and firmware versions is compatible (required) with these features.

There is a profusion of cheap plug-in MP3 players that are being used by truck drivers. These devices typically plug into the cigarette lighter socket in the vehicle cab and can be tuned to play music via the vehicle's radio sound system. Most vehicle tracking systems are susceptible to the GPS jamming caused by these devices which also block the positioning signals of Smart phone devices.

The FM36XX (2G) and FM37XX (3G) Fleet management systems are designed to use two different space-based satellite positioning systems. Both the USA maintained "Global Positioning System" (GPS) and also the Russian "Global Navigation Satellite System" (GLONASS) systems are supported and each can provide global coverage.

Since GLONASS operates at a broad bandwidth, unintentional jamming from MP3 players and other noisy, uncertified products will not affect the GLONASS positioning service. The FM37xx and FM36xx products are able to sense jamming and automatically switch from GPS to GLONASS, providing uninterrupted positioning data when subjected to this kind of jamming.

Notes:

1. Intentional, malicious jamming equipment will usually transmit at a broad bandwidth and target all forms of satellite positioning systems, thereby blocking positioning data in both GPS and GLONASS.

2. For GSM jamming there is no counter action possible. If the GSM channel is jammed the FM3xxx cannot send any GPRS or SMS messages and therefore will not be able to deliver any events to warn the user. The Jamming events will be buffered in memory and only will be uploaded the next time that the FM3xxx can communicate with the back-end system.

2 Hardware and Software Compatibility

1. GSM Jamming is only available on units with the BGS2 Modem:
   a. The FM35xx and FM36xx can report GSM jamming
   b. The FM37xx and FM38xx can NOT report GSM jamming
2. GLONASS is only supported on units with UBlox-7 modules:
   a. FM36xx, FM37xx and FM38xx supports GLONASS
   b. FM35xx does NOT support GLONASS.
3. GPS Jamming is only supported on modules with the UBlox-6 modules:
   a. The FM35xx, FM36xx, FM37xx and FM38xx supports GPS Jamming
   b. The FM36xx, FM37xx and FM38xx can switch to GLONASS if jamming is detected.
   c. The FM35xx can report jamming but cannot switch the GLONASS when jamming is detected (since it does not support GLONASS)
4. Firmware version BAS 1.51b (E14.09.06.xx) and later supports GPS and GSM jamming events
5. MiX Fleet Manager (DynaMiX) V15.5 or later supports GPS and GSM jamming events.

3 GPS Jamming

The table below shows the main differences between these GPS and GLONASS positioning systems. It must be noted that both systems have to rely on very sensitive receivers since the signals are transmitted > 25,000 km from the surface of the earth. This means that any signal originating on the surface of the earth and transmitted on one of the carrier frequencies (1575.42 to 1602 MHz) will be much stronger than the signals from the satellites and therefore jam the true GPS or GLONASS signals.

Specifications	GPS	GLONASS
Orbital radius	26,560 Km	25,510 km
Orbital period	About 11 hours and 58 minutes	11 hours and 16 minutes
Carrier signals	L1 band: 1575.42 MHz L2 band: 1227.60 MHz	L1 band: 1602 MHz + k x (9/16) MHz L2 band: 1246 MHz + k x (7/16) MHz where k is the channel number

The FM3xxx expose a parameter called "**GPS Jamming Status**" that can be selected in events. The meaning of the various numbers that this parameter can return is defined as follows:

- 0 = Unknown status
- 1 = OK - no significant GPS jamming
- 2 = Warning - interference visible but fix GPS OK
- **3 = Critical - interference visible and no GPS fix**

The FM3xxx firmware will also automatically switch between GPS and GLONASS if jamming is detected on a specific positioning system. This will allow the FM3xxx to recover from "unintentional jamming" since the frequency spectrum is quite broad and the changes are very slim that any device (other than a purpose build jammer) will transmit at both 1575 MHz as well as 1602 MHz at the same time.

If the firmware set BAS 1.60d E15.02.11.xx (or later) is installed on the FM3xxx it will automatically switch to GLONASS if GPS is jammed or switched to GPS if GLONASS is jammed, without the need for configuration changes.

The default switching thresholds are:

1. Time Unlocked Threshold = 60 seconds - The time that the GPS must be unlocked (no GPS Fix) before it will automatically switch to the other mode.
2. Jamming Ratio Threshold = 50 % - The percentage of time that the GPS has to be jammed (while unlocked) before it automatically switch to the other mode.

In Figure 1 an example is shown of how the ***GPS Jamming Detected*** event can be set up in MiX Fleet Manager.

Figure 1: GPS Jamming Detected Event

4 GSM Jamming

When the GSM is jammed, it means that the FM3xxx will lose all communication ability to the back-end system and unless it is fitted with a Satellite Modem (Inmarsat or Iridium) it will not be able to deliver the "GSM Jamming Detected" event even if you configure it as a critical event.

The FM3xxx expose a parameter called "GSM Jamming Status" that can be selected in events. The meaning of the various numbers that this parameter can return is defined as follows:

- 0 = Not initialized
- 1 = OK
- 2 = Possible jamming
- 3 = Bad signal
- 4 = Industrial interference
- **5 = Jamming detected**

Note that if the FM3xxx is fitted with a Satellite Modem, it will automatically switch to Satellite if the GPRS and SMS communication channels becomes unavailable. This is default backup communication strategy and settings for any FM3xxx unit. If the FM3xxx is not fitted with a backup communication mechanism, it will simply buffer all the events in memory and only deliver them at the first opportunity that the GSM modem can establish communication with the back-end again.

In Figure 2 an example is shown of how the ***GSM Jamming Detected*** event can be set up in MiX Fleet Manager.

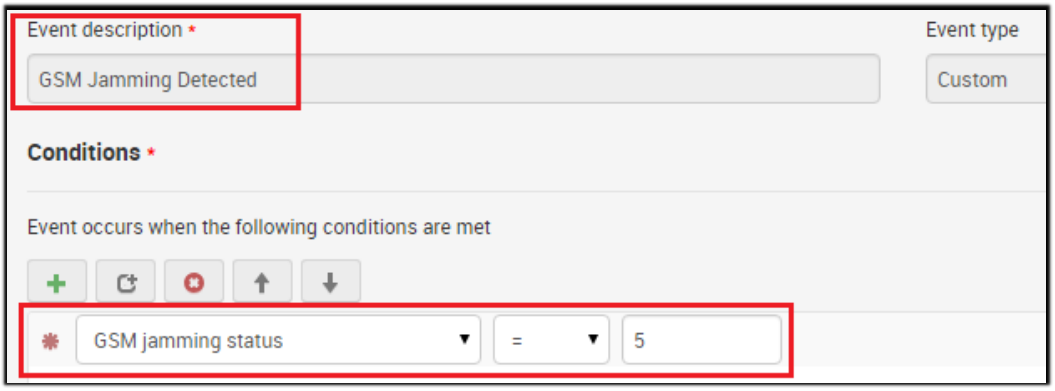

Figure 2: GSM Jamming Detected Event