Update of GNSS IDM in China

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1. Existing limits on unintentional interference in China
Taking the CISPR (international special commission on radio interference) as reference, a National standard of the People’s Republic of China has been made - 《Industrial, scientific and medical (ISM) radio-frequency equipment - Disturbance characteristics - Limits and methods of measurement》
The relationship between power and field strength can be defined as:

\[
\frac{PG}{4\pi D^2} = \frac{E^2}{120\pi}
\]

- **P**: transmitting power in Watts
- **D**: measuring distance in meters
- **E**: field strength in Volts/meter
- **G**: the numerical gain of transmitting antenna

**Note:**
- The relationship is derived from the formula for the power density of an electromagnetic field. It shows how the power (P) spreads out with distance (D) and results in a field strength (E) that depends on the frequency (G) of the transmission.
Emission limits of ISM equipment in each band

**41.3 dBm/MHz (FCC)**

- **-41.3 dBm/MHz (FCC)**
- **-55.9 dBm/MHz (China)**

<table>
<thead>
<tr>
<th>Center Frequency/MHz</th>
<th>Range/MHz</th>
<th>Max Allowable Level (dBm)</th>
<th>ITU Frequency Limit (dBm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.780</td>
<td>6.765~6.795</td>
<td>Considered</td>
<td>5.138</td>
</tr>
<tr>
<td>13.560</td>
<td>13.553~13.567</td>
<td>Not Limited</td>
<td>5.150</td>
</tr>
<tr>
<td>27.120</td>
<td>26.957~27.283</td>
<td>Not Limited</td>
<td>5.150</td>
</tr>
<tr>
<td>40.680</td>
<td>40.66~40.70</td>
<td>Not Limited</td>
<td>5.150</td>
</tr>
</tbody>
</table>

**BDS band**

**Limit in China**

**Part 15 Limit**

**Frequency in GHz**
Conclusions:

- Unlicensed equipment are not allowed to operate in RNSS band.
- The transmitting limits of ISM equipment was -55.9dBm/MHz up to 2.3 GHz which is much more strict than FCC part 15.
- There is no transmitting limits in the band of 2.4~2.5 GHz.
2. Discussion on GNSS as critical infrastructure
Question 1:

Do you consider Global Navigation Satellite System or their services to be National Critical Infrastructure? How does your answer impact the protection of GNSS and its service in your nation?

➢ BDS is national essential space infrastructure at present.
➢ As the application increasing, the protection of BDS and its services in China is becoming vital.
Question 2:

What do you consider to be the definition of “International Critical Infrastructure”?

➢ There’s still no definition for international critical infrastructure, it needs more discussion and investigation.
3. Discussion on GNSS jammers
Question:

Whether it is legal within each country to manufacture, sell domestically, export, purchase, own, or use GNSS jammers?

➢ It is illegal within China to manufacture, sell domestically, export, purchase, own, or use GNSS jammers.

➢ The government has promulgated series laws and regulations to prevent the harmful interference to legal services.
4. IDM system development and IDM techniques in China
**IDM system development**

The IDM system have not been built up, but it has been programmed in China, including IDM data center and system of monitoring stations. It will be gradually completed in recent years.

**IDM system structure in China**
We have also installed some experimental grid monitoring systems and have studied the IDM techniques:

a) Interference monitoring and localization techniques based on spectrum sensors

b) Interference monitoring and localization techniques based on GNSS navigation receiver

c) Spoofing detection techniques
Techniques of GNSS interference monitoring and localization based on grid (multiple spectrum sensors) have been studied.

System structure diagram

The grid of monitoring system for Qingdao Olympic center
Localization algorithms such as AOA/TOA/TDOA et al. have been used.
b) *Interference monitoring by navigation receiver*

The source of interference can be monitored and localized by utilizing the information of navigation receivers.
The carrier to noise ratio, AGC, received power of receiver will vary significantly when interference occurs. Interference can be monitored and distinguished by the combination of these information.
c) **Spoofing detection techniques**

Meanwhile, we have also studied the spoofing detection techniques based on phase measurements:

- Spoofing is a kind of interference signal with evil intention, of which aim is to force the GNSS receivers to make false localization results.
It is implemented by phase measurements of received signals which has unique advantage since the phase measurements with high precision can be achieved by most common receivers.
4. Summary
The existing limitation of unintentional interference levels has been reviewed.

GNSS as critical infrastructure and GNSS jammers have been discussed.

IDM system development and IDM techniques in China have been introduced.
Thank you!

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