4.2.1. Position determination

Proposed modifications

AECS 12nd. meeting

Moscow, 9-11 February 2016

Part I - General requirements

7.2.1. The GNSS receiver shall be able to output the navigation solution in a NMEA-0183 protocol format (RMC, GGA, VTG, GSA and GSV message). The AECD setup for NMEA-0183 messages output ~~to external devices~~ shall be described in the operation manual.

- *In order to avoid any misunderstanding on the connectivity between the GNSS receiver and the GNSS simulator, it is eliminated any reference to "external devices"*

(…)

7.2.10. and 17.2.10. The GNSS receiver shall be able to obtain a position fix at least every second.

- *Time between position fixes needs to be defined in order to be coherent with the current 1Hz signal output set for all the test methods.*

- *At this point, this new sentence in the performance requirements section is purely informative. It does not imply any extra burden to the testing procedure.*

Annex 8 - Test methods for the navigation solutions

3.1.5. Test results are considered successful if navigation information via NMEA-0183 protocol is received **in all the AECD/AECS samples**.

(…)

3.7.13. The test result is considered to be positive in case:

- the value of time to first fix in "cold" start mode, as measured in 3.7.7, do not exceed 3600 seconds at signal level on the antenna input of the AECD/AECS of minus 144 dBm **in all the eCall samples**;
- the GNSS navigation solution is available for at least 600 seconds at signal level on the antenna input of the AECD/AECS of minus 155 dBm as measured in 3.7.9 **in all the eCall samples**;
- and re-acquisition of GNSS signals and calculation of the navigation solution at signal level on the antenna input of the eCall of minus 150 dBm is possible and time interval measured in 3.7.12 does not exceed **60 seconds in all the AECD/AECS samples**.

- *In order to avoid misunderstandings and keep coherence in all the test descriptions, there is a need to explicitly mention to repeat the test for the 3 samples also in the "NMEA output" and the "Sensitivity" tests.*

Annex 8 - Test methods for the navigation solutions

3.1.6. The test of NMEA-0183 messages output and the assessment of the positioning accuracy in autonomous static mode can be combined.

- *In order to save 1 extra hour of GNSS testing, it is offered the chance to test the "assessment of positioning accuracy in autonomous static mode" and the "NMEA messages output" at the same time*

(…)

2.1.1. The number of the eCall test samples shall be at least 3 pieces **and can be performed in parallel.**

- *In order to reduce 3 times the total GNSS testing timing, it is permitted the use of modern simulators that permit to 'repeat' the tests with the 3 samples in parallel.*

Overview on the time needed to test the navigation solution

TIMING GNSS TESTING - BEST CASE		
	value	**unit**
pieces	3 x 1	item
connection time	1	min
setting up simulator	1	min
result extraction	2	min

1	NMEA duration	0	min
	Sub-total	**0**	**min**

2	Accuracy Static	4	GNSS
	run duration static	60	min
	Sub-total	**253**	**min**

3	Accuracy Dynamic	1	repetitions
	run duration dynamic	60	min
	Sub-total	**64**	**min**

4	Accuracy Dynamic shadow	1	repetitions
	run duration dynamic shadow	60	min
	Sub-total	**64**	**min**

5	Cold start	10	repetitions
	cold start duration part1	1	min
	cold start duration part2	5	min
	reset	1	min
	Sub-total	**92**	**min**

6	Re-acquisition wait	15	min
	re-acquisition execution (block +tes	2	min
	re-acquisition repetitions	10	
	Sub-total	**39**	**min**

7	Sensitivity extra setting/calibration	2	min
	first fix - best case	1	min
	tracking	10	min
	re-acquisition	2	min
	Sub-total	**19**	**min**

Overall time GNSS testing	**531**	**minutes**
	8.9	**hours**
	~ 1	**working day**

Annex: Minor typo remarks (1/6)

16.2. Position determination

- If the AECS is fitted, in accordance with paragraph 1.4. and not yet verified according to Part I of this Regulation, with GNSS receiver supporting at least three GNSS including GLONASS, Galileo and GPS, and is capable of reception and processing of SBAS signals, then the AECS shall comply with the requirements of paragraphs 17.2.1 to **17.2.11**.

(…)

17.2.7 Sensitivity at receiver input shall be:

- GNSS signals detection (cold start) do not exceed 3600 s at signal level on the antenna input of the **AECS** of minus 144 dBm;
- GNSS signals tracking and navigation solution calculation is available for at least 600 s at signal level on the antenna input of the **AECS** of minus 155 dBm;
- Re-acquisition of GNSS signals and calculation of the navigation solution is possible and does not exceed 20 60 s at signal level on the antenna input of the **AECS** of minus 150 dBm.

(…)

17.2.11. The testing procedures in Annex 8 can be performed either on the **AECS** unit including post processing ability or directly on the GNSS receiver being a part of the **AECS**.

Annex: Minor typo remarks (2/6)

Annex 8 Test methods for the navigation solution~~s~~ (paragraphs 7.2 and 17.2)

The purpose of the tests in this Annex is to verify the compliance of navigation characteristics of the AECD/AECS calculated by its GNSS receiver ~~navigation module~~ to the requirements defined in sections 7.2 and 17.2. of this Regulation.

2.1 – It should say: GNSS receiver *(instead of navigation receiver)*
2.1.6 – It should say: GNSS receiver *(instead of navigation receiver)*
3.5.2 – It should say: GNSS receiver *(instead of navigation receiver)*
3.7 – It should say: GNSS receiver *(instead of navigation receiver)*
3.7.4 – Figure 5 should say: AECD/AECS *(instead of The AECD)*

$$dB(м) = 2 \cdot \frac{a(1-e^2)}{(1-e^2 \sin^2 \varphi)^{3/2}} \cdot \frac{0{,}5'' \cdot \pi}{180 \cdot 3600''} \cdot dB, \quad (4)$$

$$dL(м) = 2 \cdot \frac{a \cdot \cos \varphi}{\sqrt{1-e^2 \sin^2 \varphi}} \cdot \frac{0{,}5'' \cdot \pi}{180 \cdot 3600''} \cdot dL, \quad (5)$$

Annex: Minor typo remarks (3/6)

3.2.7. (1) $\Delta B(j) = B(j) - B_{truej},$ → $\Delta B(j) = |B(j) - B_{truej}|,$

3.2.8. (3) $\sigma_B = \sqrt{\frac{\sum_{j=1}^{N}(B(j) - dB)^2}{N-1}},$ → $\sigma_B = \sqrt{\frac{\sum_{j=1}^{N}(\Delta B(j) - dB)^2}{N-1}},$

(2)

Where
- Btruej is the actual value of B coordinate in "j" time moment, in ~~angle~~ **arc-**seconds
- B(j) is the determined ~~by the GNSS receiver~~ value of B coordinate in "j" time moment **by the GNSS receiver** , ~~angle~~ **arc-**seconds;

(5) ,

Where
a is the **semi-**major ~~semi~~axis of ellipsoid, m
e – first eccentricity, [0 – 1]
φ – **determined value of**~~current~~ latitude, radians.

3.2.9 Convert calculated SD values of latitude and longitude determination from ~~angle~~ **arc-**seconds to meters according to formulas (4) – (5):

Annex: Minor typo remarks (4/6)

$$dB(м) = 2 \cdot \frac{a(1-e^2)}{(1-e^2 \sin^2\varphi)^{3/2}} \cdot \frac{0{,}5'' \cdot \pi}{180 \cdot \sout{3600''}} \cdot dB, \quad (4)$$

$$dL(м) = 2 \cdot \frac{a \cdot \cos\varphi}{\sqrt{1-e^2 \sin^2\varphi}} \cdot \frac{0{,}5'' \cdot \pi}{180 \cdot \sout{3600''}} \cdot dL, \quad (5)$$

Annex: Minor typo remarks (5/6)

Table ~~XXX~~4 – Recommended list of measurement instruments, test and auxiliary equipment

Equipment name	Required technical characteristics of test equipment	
	Scale range	Scale accuracy
Global navigation satellite system simulator of GLONASS, Galileo and GPS signals	Number of simulated signals: at least 18	Mean square deviation of random accuracy component of pseudo-range to GLONASS / Galileo / GPS satellites not more: • stadiometric code phase: 0,1 m; • communication carrier phase: 0,001 m; • pseudovelocity: 0,005 m/sec.
Digital stopwatch	Maximum count volume: 9h 59 min 59,99sec	Daily variation at (25±5)°C not more than 1 sec. Time discreteness 0,01sec.
Vector network analyser	Frequency range: 300 kHz .. 4000 kHz Dynamic range: (minus 85 .. 40) dB	Accuracy F = 1·10-6 kHz Accuracy D = (0,1 .. 0,5) dB
Low-noise amplifier	Frequency range: 1200.. 1700 MHz Noise coefficient: not more 2,0 dB Amplifier gain coefficient: 24 dB	
Attenuator 1	Dynamic range: (0 .. 11) dB	Accuracy ± 0,5 dB
Attenuator 2	Dynamic range: (0 .. 110) dB	Accuracy ± 0,5 dB
Power source	Range of direct current voltage setting: from 0,1 to 30 V Current intensity of output voltage: at least 3A	Accuracy V = ± 3% Accuracy A = ± 1%
N o t e – it is allowed to apply other similar types of equipment providing determination of characteristics with the required accuracy.		

Annex: Minor typo remarks (6/6)

Figure 4 – Diagram of path calibration

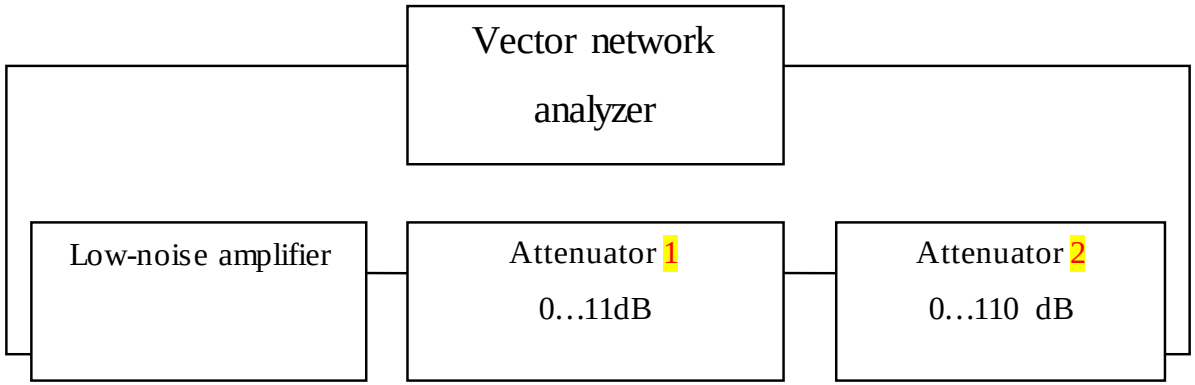

Figure 5 – Arrangement for evaluation of GNSS module sensitivity