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TEL: +82-31-645-6300 FAX: +82-31-645-6401

GNSS Receiver Test REPORT

CE Certification

Applicant Name:
WISOL CO., Ltd.

531-7, Gajang-Ro, Osan-si, Gyeonggi-do,
18103, Rep. of KOREA

Date of Issue:
Oct. 16, 2017

Location:
HCT Co., Ltd.
74, Seoicheon-ro 578beon-gil, Majang-myeon,
Icheon-si, Gyeonggi-do, 17383, Rep. of KOREA

Report No.: HCT-A-1710-E002

MODEL:	**SFM20R1**
APPLICANT:	**WISOL CO., Ltd.**

Use of Report:	Approval for CE
EUT Type:	Module
Testing Environment:	Temperature : (22.2 ± 3.0)℃ Relative Humidity : (60.9 ± 3.0) % R.H.
Date of Test:	July 15, 2017
Applicable Standard:	ETSI EN 303 413 V1.1.1 (2017-06)

All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Report prepared by : Dae Gun Kim

Report approved by : Young Kwan Kim

Report Revision

TEST REPORT NO.	DATE	DESCRIPTION
HCT-A-1710-E002	Oct.16, 2017	- First Approval Report

Result of Test

CONTENTS

1. DETAILS OF APPLICANT

Company	WISOL CO., Ltd. 531-7, Gajang-Ro, Osan-si, Gyeonggi-do, 18103, Rep. of KOREA
Contact Point	Attention: Ryu, Ho Jin E-Mail : hjryu@wisol.co.kr

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment	Module
Model	SFM20R1
Hardware version	1.0
Software version	SFM20R_V204
Additional Model	-
Serial number	-
Manufacturer	WISOL CO., Ltd
Rating	DC 3.3 V

3. DESCRIPTION OF THE EQUIPMENT UNDER TEST

3.1 Manufacturers declarations

No. of units:	Two (Conducted EUT, Radiated EUT)
Application:	Module
Model No.:	SFM20R1
Specification(s):	ETSI EN 303 413 V1.1.1 (2017-06)
Antenna type:	External Antenna
Operating frequency range:	1 559 MHz ~ 1 610 MHz (GLONASS: 1 605.375 MHz, 6CH)

Note:

All the testing were performed according to the procedures in ETSI EN 303 413 V1.1.1 (2017-06)

All possible frequencies have been observed.

3.2 Supported GNSS and GNSS signals

GNSS	GNSS Signals Designations
GLONASS	G1
GPS	L1

4. TEST SUMMARY

The list of test item called for in ETSI EN 303 413 V1.1.1 (2017-06) is given below**:**

Clause	Test item	Result
4.2.1	Adjacent frequency band selectivity performance	Passed
4.2.2	Spurious emission	Passed

5. TEST EQUIPMENT

No.	Instrument	Model No.	Due to Calibration	Manufacture	Serial No.
☒	Multi-GNSS Simulator	GSG 64	2018-04-12	SPECTRACOM	200544
☒	BI-LOG Antenna (30 MHz ~ 1 GHz)	VULB9160	2018-10-14	Schwarzbeck	3368
☒	Broadband Low Noise Amplifier (0.1 GHz ~ 18 GHz)	CBLU1183540	2018-01-25	CERNEX	24614
☒	AMPLIFIER (9 KHz ~ 1 GHz)	310N	2018-05-15	SONOMA INSTRUMENT	186169
☒	Horn Antenna (1 GHz ~ 18 GHz)	BBHA9120D	2017-12-11	Schwarzbeck	9120D-1191
☒	Vector Signal Generator	SMU200A	2017-09-30	Rohde&Schwarz	104781
☒	Semi anechoic chamber	10m×5m×5m	-	EMERSON&CUMING	-
☒	Turn Table	DE 3260	-	INNCO GmbH	-
☒	Signal Analyzer (20 Hz ~ 30.0 GHz)	FSVR	2018-04-24	Rohde&Schwarz	101040
☒	Spectrum Analyzer (3 Hz ~ 26.5 GHz)	N9020A	2017-09-22	Agilent	MY46471928
☒	Power Divider	11636B	2018-05-31	Agilent	07048
☒	32dB Step Attenuator	AF9003-69-31	2017-10-24	WEINSCHEL	11787
☒	20dB Attenuation	8493C	2018-06-22	HP	17280

All equipment is calibrated with traceable calibrations.

Each calibration is traceable to the national or international standards

6. GENERAL REQUIREMENTS

6.1 GUE adjacent frequency band selectivity performance

The C/N_0 metric reported by the GUE for all GNSS and GNSS signals and supported by the GUE shall not degrade by more than the value given in the equation 5-1 when an adjacent frequency signal is applied.

$$\Delta C/N_0 \leq 1dB \qquad \text{Equation 5-1}$$

Note:

References: ETSI EN 303 413 V1.1.1 (2017-06) Clause 4.2.1

6.2 Spurious emission

Receiver spurious emissions are emissions at any frequency when the GUE is in receive-only operating mode. In case of a GUE with an external antenna connector, these limits apply to emissions at the antenna port (conducted). For emissions radiated by the cabinet or for emissions radiated by a GUE with an integral antenna (without an antenna connector), these limits are e.r.p. for emissions up to 1 GHz and e.i.r.p. for emissions above 1 GHz.

Frequency range	Maximum power	Bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 8,3 GHz	-47 dBm	1 MHz

Note:

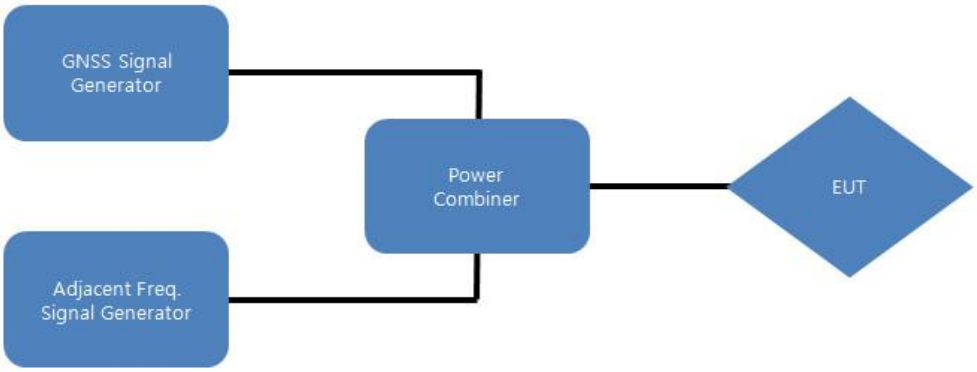
References: ETSI EN 303 413 V1.1.1 (2017-06) Clause 4.2.2

7. GUE adjacent frequency band selectivity performance-Test Results

7.1 Conducted or Radiated testing:

Conducted

7.2 Test set-up



7.3 Test Procedure

Refer to the ETSI EN 303 413 V1.1.1 (2017-06) Clause 5.4.3

7.4 Test Method

-. Record the baseline C/N0 value(s) reported by the EUT with the adjacent frequency signal switched off.

-. Record the baseline C/N0 value(s) reported by the EUT with the adjacent frequency signal generator configured to generate the signal defined in the test procedure.

-. If the C/N0 degradation from two values does not exceed the 1dB, then this test point is set to "pass". If the C/N0 degradation exceeds the 1dB, then this test point is set to "fail."

7.5 Test Results for 1599 MHz to 1610MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Measured C/N0 (dB-Hz)			
			No interfering signal	With interfering signal	Decrease of C/N0	Decrease ≤ 1 dB?
1518 to 1525	1524	-65	-	-	-	BDS N/A
			-	-	-	Galileo N/A
			37.5	37.5	0.0	GLONASS Pass
			40.0	40.0	0.0	GPS Pass
1525 to 1549	1548	-95	-	-	-	BDS N/A
			-	-	-	Galileo N/A
			37.5	37.5	0.0	GLONASS Pass
			40.0	40.0	0.0	GPS Pass
1549 to 1559	1554	-105	-	-	-	BDS N/A
			-	-	-	Galileo N/A
			37.5	37.5	0.0	GLONASS Pass
			40.0	40.0	0.0	GPS Pass
1610 to 1626	1615	-105	-	-	-	BDS N/A
			-	-	-	Galileo N/A
			37.5	37.5	0.0	GLONASS Pass
			40.0	40.0	0.0	GPS Pass
1626 to 1640	1627	-85	-	-	-	BDS N/A
			-	-	-	Galileo N/A
			37.5	37.5	0.0	GLONASS Pass
			40.0	40.0	0.0	GPS Pass

7.6 Final Test result for 1599 MHz to 1610MHz RNSS band:

■ Pass ☐ Fail

8. Spurious Emission-Test Results

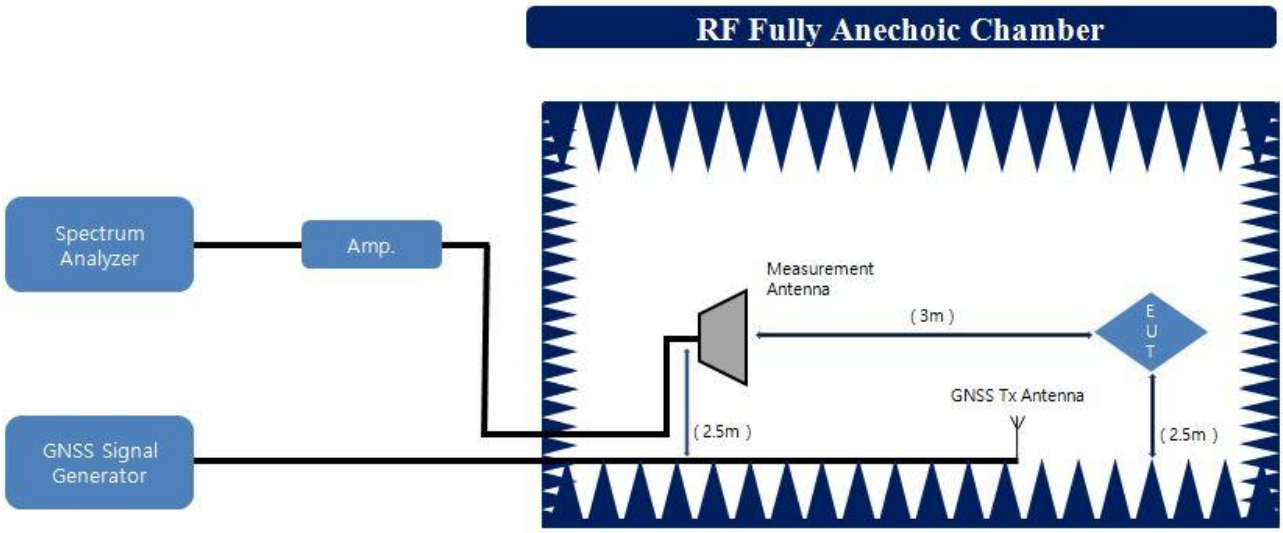
8.1 Test site

Fully Anechoic Chamber : ☐ 30MHz ~ 1GHz ☐ 1GHz ~ 8.3GHz

Semi Anechoic Chamber : ■ 30MHz ~ 1GHz ■ 1GHz ~ 8.3GHz

8.2 Test set-up

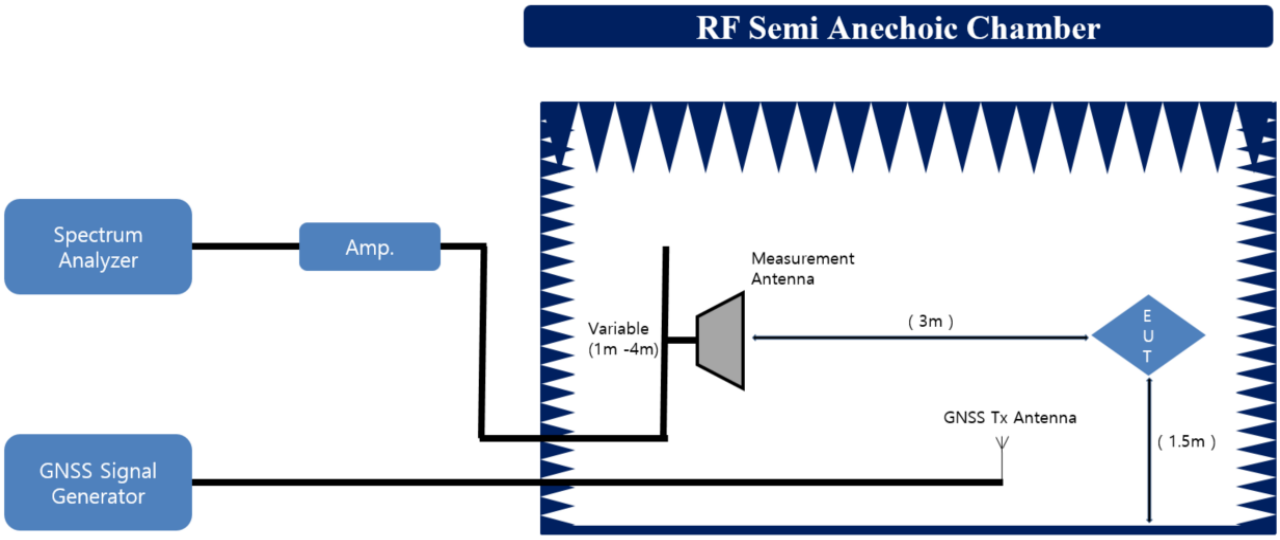
8.2.1 Fully Anechoic Chamber



8.2.1.1 Test Method

- Correction values from a verified site calibration was used.
- During the tests, the measurement antenna polarization and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.
- The test was performed by placing the EUT on 3 orthogonal axis(X, Y, Z) at antenna polarization (Horizontal, Vertical) and shown the worst case on this report.

8.2.2 Semi Anechoic Chamber



8.2.2.1 Test Method

-. The Measurement antenna mast provides a variable height facility (from 1 m to 4 m) so that the position of the measurement antenna can be optimized for maximum coupled signal between antennas or between a EUT and the measurement antenna.

-. During the tests the measurement antenna polarization and EUT azimuth were varied in order to identify the maximum level of emissions from the EUT.

-. The test was performed by placing the EUT on 3orthogonal axis (X, Y, Z) at antenna polarization (Horizontal, Vertical) and shown the worst case in this report.

8.3 Measurement Uncertainty

Semi Anechoic Chamber: 30 MHz ~ 1 GHz: 4.80 dB (about 95 %, *k* = 2)

1 GHz ~ 8.3 GHz: 5.70 dB (about 95 %, *k* = 2)

8.4 Test Procedure

Refer to the ETSI EN 303 413 V1.1.1 (2017-06) Clause 5.5.2

8.5 GNSS signal(s) present or absent:

■ Present ☐ Absent

8.6 Receiver Spurious Emissions test result:

■ Pass ☐ Fail ☐ N/A

30MHz - 1GHz

GNSS	Measurement Frequency(MHz)	Polarization	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
GLONASS / GPS	No peak found					RMS

1GHz – 8.3GHz

GNSS	Measurement Frequency(MHz)	Polarization	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
GLONASS / GPS	No peak found					RMS

Note

1. Performed at normal test condition.
2. All possible frequencies have been observed.
3. Spurious emissions were measured from 30 MHz to 8.3 GHz in the presence of all GNSS signals.

9. PHOTOGRAPHS OF THE EUT

Photographs is described in Appendix A. Please refer to Appendix A.

10. TEST SETUP PHOTOGRAPHS

Setup photo is described in Appendix C. Please refer to Appendix C.