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TEST REPORT

CE GNSS Test for SFM20R1

APPLICANT
SJI Co.,Ltd

REPORT NO.
HCT-RO-2209-CE001

DATE OF ISSUE
September 1, 2022

Tested by
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Additional Model
-

Applicant	**SJI Co.,Ltd** 54-33, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, Republic of Korea
Product Name	Sigfox Quad-mode module
Model Name	SFM20R1
Date of Test	July 15, 2017
Test Standard Used	ETSI EN 303 413 V1.2.1 (2021-04)
Test Result	Refer to the attachment
Test Environment	Temperature: (22.2 ± 3.0)°C, Relative Humidity : (60.9 ± 3.0) %
Manufacturer	**SJI Co.,Ltd**
Frequency range and etc.	1 559 MHz ~ 1 610 MHz

This result shown in this test report refer only to the sample(s) tested unless otherwise stated.
This test results were applied only to the test methods required by the standard.

REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	September 01, 2022	Initial Release

The above Test Report is not related to the accredited test result by (KS Q) ISO/IEC 17025 and KOLAS(Korea Laboratory Accreditation Scheme) / A2LA(American Association for Laboratory Accreditation), which signed the ILAC-MRA.

If this report is required to confirmation of authenticity, please contact to www.hct.co.kr

CONTENTS

1. APPLICANT INFORMATION

The EUT has been tested by request of

Company	**SJI Co.,Ltd** 54-33, Dongtanhana 1-gil, Hwaseong-si, Gyeonggi-do, Republic of Korea

2. EQUIPMENT UNDER TEST (EUT)

2.1 Identification of the EUT

Equipment	Sigfox Quad-mode module
Model	SFM20R1
Hardware version	1.0
Software version	SFM20R_V204
Additional Model	-
Serial number	-
Manufacturer	SJI 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:	Sigfox Quad-mode module
Model:	SFM20R1
Specification(s):	ETSI EN 303 413 V1.2.1 (2021-04)
Antenna type:	External Antenna
Operating frequency range:	1 559 MHz ~ 1 610 MHz

Note:

1. All the testing were performed according to the procedures in ETSI EN 303 413 V1.2.1 (2021-04).
2. All possible frequencies have been observed.
3. In the case of GLONASS, at a minimum Channel 6 (1 605.375 MHz) was included.
4. In the case of BDS at least one MEO satellite shall be used for measurements.

3.2 Supported GNSS and GNSS signals

GNSS	GNSS Signals Designations
GLONASS	G1
GPS	L1 C/A

4. TEST SUMMARY

The list of test item called for in ETSI EN 303 413 V1.2.1 (2021-04) is given below:

Clause	Test item	Result
4.2.1	Receiver blocking	Passed (See note 2, 3)
4.2.2	Receiver spurious emission	Passed (See note 3)

Note:

1. Standard update: ETSI EN 303 413 V1.1.1 → ETSI EN 303 413 V1.2.1
2. With editorial change of v1.2.1, test name of 'Adjacent frequency band selectivity' was changed to 'Receiver Blocking test' and there is no difference in terms of test method.
3. The test data was reused from previous report. (previous report no.: HCT-RF-1907-CE028)

5. TEST EQUIPMENT

No.	Instrument	Model	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 Receiver blocking

Receiver blocking is a measure of the capability of the GUE to receive a wanted signal without exceeding a given degradation due to the presence of an unwanted input signal operating in accordance with the allocation table of the ITU Radio Regulations [i.13] in frequency bands adjacent or near-adjacent to the relevant RNSS band.

The C/N0 metric reported by the GUE for all GNSS constellations and GNSS signals given in table 4-1 and supported by the GUE shall not degrade by more than the value given in equation (4-1) when a blocking signal is applied.

Equation (4-1): Maximum degradation in C/N0

$$\Delta C/N0 \leq 1\ dB$$

Note:

References: ETSI EN 303 413 V1.2.1 (2021-04) Clause 4.2.1

6.2 Receiver spurious emission

Receiver spurious emissions are emissions at any frequency when the GUE is active.

The receiver spurious emissions of the GUE shall not exceed the values given in table 4-5. 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.

Table 4-5: Receiver spurious emission limits

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:

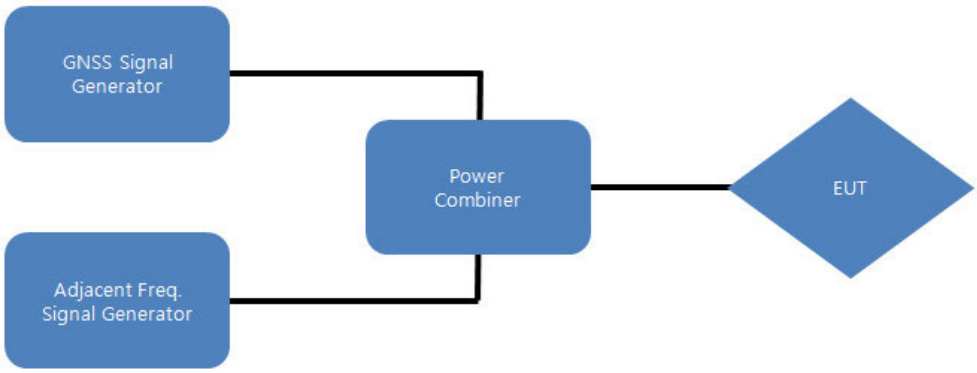
References: ETSI EN 303 413 V1.2.1 (2021-04) Clause 4.2.2

7. Receiver blocking - Test Results

7.1 Conducted or Radiated testing

■ Conducted ☐ Radiated

7.2 Test set-up



7.3 Test Procedure

Refer to the ETSI EN 303 413 V1.2.1 (2021-04) Clause 5.4.3, 5.4.4

7.4 Test Method

- Record the baseline C/N0 value(s) reported by the EUT with the blocking signal switched off.
- Record the baseline C/N0 value(s) reported by the EUT with the blocking 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 Receiver blocking test results for 1 559 MHz to 1 610 MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Blocking signal power level (dBm)	Measured C/N0 (dB-Hz)				
			No blocking signal	With blocking signal	Decrease of C/N0	Decrease ≤ 1 dB?	
1 518 to 1 525	1 524	-65	-	-	-	BDS	N/A
			-	-	-	Galileo	N/A
			37.5	37.5	0.0	GLONASS	Pass
			40.0	40.0	0.0	GPS	Pass
1 525 to 1 549	1 548	-95	-	-	-	BDS	N/A
			-	-	-	Galileo	N/A
			37.5	37.5	0.0	GLONASS	Pass
			40.0	40.0	0.0	GPS	Pass
1 549 to 1 559	1 554	-105	-	-	-	BDS	N/A
			-	-	-	Galileo	N/A
			37.5	37.5	0.0	GLONASS	Pass
			40.0	40.0	0.0	GPS	Pass
1 610 to 1 626	1 615	-105	-	-	-	BDS	N/A
			-	-	-	Galileo	N/A
			37.5	37.5	0.0	GLONASS	Pass
			40.0	40.0	0.0	GPS	Pass
1 626 to 1 640	1 627	-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 receiver blocking test result for 1 559 MHz to 1 610 MHz RNSS band:

■ Pass ☐ Fail

8. Receiver spurious emission - Test Results

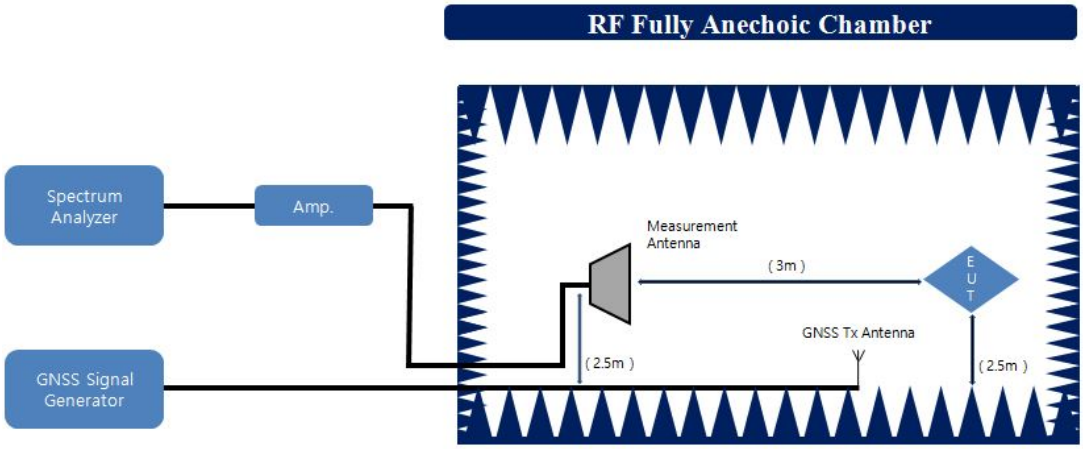
8.1 Test site

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

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

8.2 Test set-up

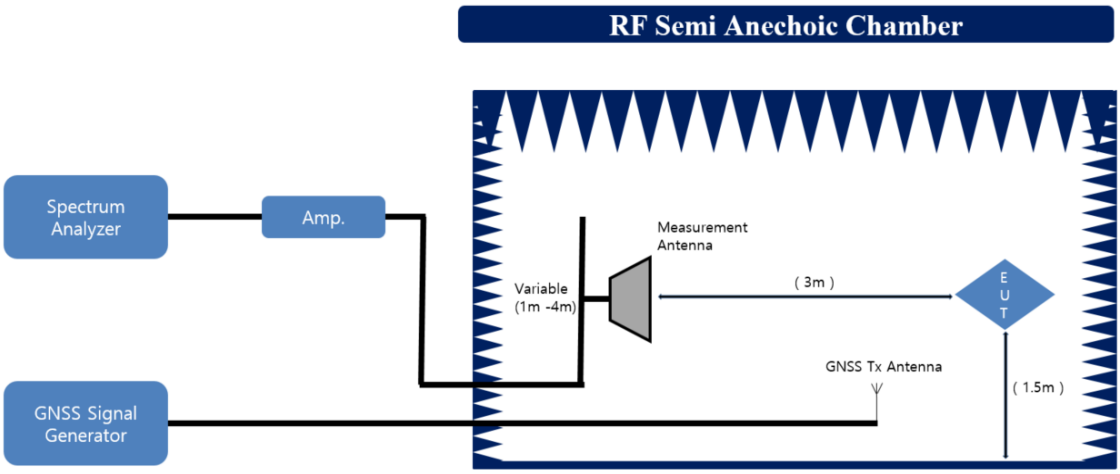
8.2.1 Fully Anechoic Chamber



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

- Radiated Disturbance (30 MHz ~ 1 GHz) : 4.80 dB (about 95 %, k= 2)
- Radiated Disturbance (1 GHz ~ 8.3 GHz) : 5.70 dB (about 95 %, k= 2)

8.4 Test Procedure

Refer to the ETSI EN 303 413 V1.2.1 (2021-04) Clause 5.5.3

8.5 GNSS signal(s) present or absent:

■ Present ☐ Absent

8.6 Receiver Spurious Emissions test result:

■ Pass ☐ Fail ☐ N/A

30 MHz – 1 GHz

GNSS	Measurement Frequency(MHz)	Polarization	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
GLONASS G1 GPS L1 C/A	No peak found					RMS

1 GHz – 8.3 GHz

GNSS	Measurement Frequency(MHz)	Polarization	Level (dBm)	Limit (dBm)	Margin (dB)	Detector
GLONASS G1 GPS L1 C/A	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

■ Photographs is described in Appendix C. Please refer to Appendix C.