

ETSI EN 303 413 V1.1.1 (2017-06)

TEST REPORT

For

Tersus GNSS Inc.

Room 203, Building 2, Lane 666, Zhangheng Road, Pudong District, Shanghai, P.R.China.

Tested Model: David30

Report Type: Original Report	Product Type: GNSS Receiver
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

Applicant:	Tersus GNSS Inc.
Tested Model:	David30
Product Type:	GNSS Receiver
Power Supply:	DC 5-36 V
RF Function:	GPS
Operation Frequency:	1575.42MHz
Modulation Type:	GPS: BPSK
Antenna Type:	circularly polarized antenna
*Maximum Antenna Gain:	5.5dBi

Note: The maximum antenna gain was provided by the applicant.

**All measurement and test data in this report was gathered from production sample serial number: RSHA201204001-1. (Assigned by BACL, Kunshan). The EUT was received on 2020-12-04.*

Objective

The following report of is prepared on behalf of *Tersus GNSS Inc.* in accordance with ETSI EN 303 413 V1.1.1 (2017-06), Satellite Earth Stations and Systems (SES); Global Navigation Satellite System (GNSS) receivers; Radio equipment operating in the 1 164 MHz to 1 300 MHz and 1 559 MHz to 1 610 MHz frequency bands; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.

The object is to determine the compliance of the EUT with ETSI EN 303 413 V1.1.1 (2017-06).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 303 413 V1.1.1 (2017-06).

Measurement Uncertainty

Item		Uncertainty
Radiated emission	30MHz~1GHz	5.91dB
	1GHz~6GHz	4.68dB
	6 GHz ~18 GHz	4.92dB
Occupied Bandwidth		0.5kHz
Temperature		1.0°C
Humidity		6%
Time		5 %
Supply voltages		0.4%

Test Facility

The test site used by Bay Area Compliance Laboratories Corp. (Kunshan) to collect test data is located on the No.248 Chenghu Road,Kunshan,Jiangsu province,China.

Bay Area Compliance Laboratories Corp. (Kunshan) Lab is accredited to ISO/IEC 17025 by A2LA (Lab code: 4323.01) and the FCC designation No. CN1185 under the FCC KDB 974614 D01 and CAB identifier CN0004 under the ISED requirement. The facility also complies with the radiated and AC line conducted test site criteria set forth in ANSI C63.4-2014.

SYSTEM TEST CONFIGURATION

Justification

The system was configured for testing in Engineering Mode, which was provided by the manufacturer.

EUT Exercise Software

No software was used to test.

Equipment Modifications

No modifications were made to the unit tested.

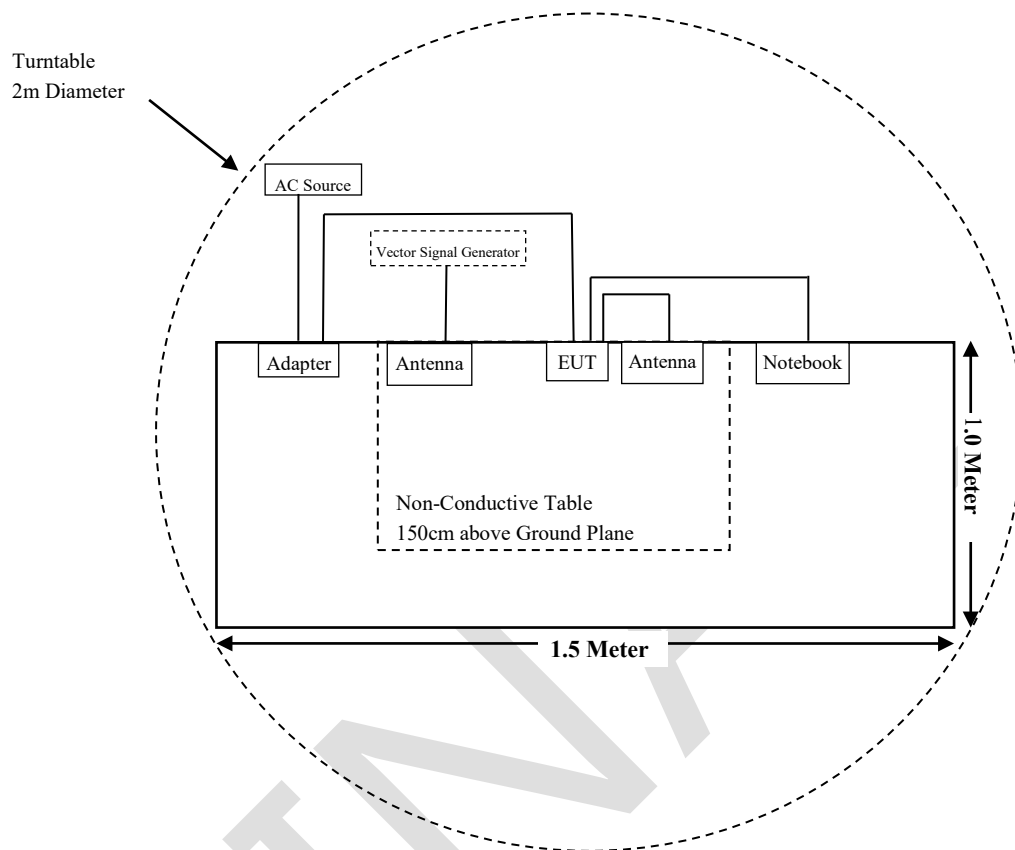
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
/	Antenna	AX4E02	/
/	Adapter	/	/

External I/O Cable

Cable Description	Length (m)	From	To
Power Cable1	1.5	EUT	Adapter
Power Cable2	1.2	Adapter	AC Source
Power Cable3	1.5	EUT	Notebook
Power Cable4	1.2	EUT	Antenna

For Radiated Emissions(Below 1GHz&Above 1GHz)



SUMMARY OF TEST RESULTS

ETSI EN 303 413 V1.1.1 (2017-06)

ETSI EN 303 413 V1.1.1 (2017-06)	Description of test	Result
Clause 4.2.1	Adjacent signal selectivity	Compliant
Clause 4.2.2	Spurious emission	Compliant

TEST EQUIPMENT LIST

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated Emission Test (Chamber 1#)					
Rohde & Schwarz	EMI Test Receiver	ESCI	100195	2020-11-27	2021-11-26
Sunol Sciences	Broadband Antenna	JB3	A090314-1	2020-08-05	2023-08-04
Sunol Sciences	Bilog antenna	JB3	A060217	2020-08-04	2023-08-03
Sonoma Instrunent	Pre-amplifier	310N	171205	2020-08-14	2021-08-13
Rohde & Schwarz	CE Test software	EMC32	100357	/	/
MICRO-COAX	Coaxial Cable	Cable-8	008	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-9	009	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-10	010	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-7	007	2020-08-15	2021-08-14
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2020-08-05	2021-08-04
Radiated Emission Test (Chamber 2#)					
Rohde & Schwarz	EMI Test Receiver	ESU40	100207	2020-04-01	2021-03-31
ETS-LINDGREN	Horn Antenna	3115	9207-3900	2020-07-15	2023-07-14
ETS-LINDGREN	Horn Antenna	3115	6229	2020-01-10	2023-01-09
A.H.Systems,inc	Amplifier	PAM-0118P	512	2020-02-20	2021-02-19
Rohde & Schwarz	Auto test Software	EMC32	100361	/	/
MICRO-COAX	Coaxial Cable	Cable-6	006	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-11	011	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-12	012	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-13	013	2020-08-15	2021-08-14
MICRO-COAX	Coaxial Cable	Cable-16	016	2020-08-15	2021-08-14
Rohde & Schwarz	SMBV100A Vector Signal Generator	SMBV100A	261558	2020-08-05	2021-08-04
Keysight	MXG Vector Signal Generator	N5182B	MY53051592	2020-11-27	2021-11-26

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Kunshan) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

ETSI EN 303 413 V1.1.1 (2017-06) CLAUSE 4.2.1 – ADJACENT SIGNAL SELECTIVITY

Definition

GUE adjacent frequency band selectivity is the ability of the GUE to achieve the specified performance in the presence of noise produced by signals operating in accordance with the allocation table of the ITU Radio Regulations [i.16] in frequency bands adjacent or near-adjacent to the relevant RNSS band.

Specifications

The C/N_0 metric reported by the GUE for all GNSS 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 an adjacent frequency signal is applied. The adjacent frequency signal is defined in table 4-4, with the frequencies and power levels defined in table 4-2 and/or in table 4-3 depending on the RNSS bands supported by the GUE.

Equation 4-1: Maximum degradation in C/N_0

Table 4-1: GNSS, GNSS signals and RNSS frequency bands

GNSS	GNSS Signal Designations	RNSS Frequency Band (MHz)
BDS	B1I	1 559 to 1 610
Galileo	E1	1 559 to 1 610
	E5a	1 164 to 1 215
	E5b	1 164 to 1 215
	E6	1 215 to 1 300
GLONASS	G1	1 559 to 1 610
	G2	1 215 to 1 300
GPS	L1	1 559 to 1 610
	L2	1 215 to 1 300
	L5	1 164 to 1 215
SBAS	L1	1 559 to 1 610
	L5	1 164 to 1 215

Table 4-2: Frequency bands, adjacent frequency signal test point centre frequencies and power levels for the 1 559 MHz to 1 610 MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
1 518 to 1 525	1 524	-65	MSS (space-to-Earth) band
1 525 to 1 549	1 548	-95	MSS (space-to-Earth) band
1 549 to 1 559	1 554	-105	MSS (space-to-Earth) band
1 559 to 1 610	GUE RNSS band under test		
1 610 to 1 626	1 615	-105	MSS (Earth-to-space) band
1 626 to 1 640	1 627	-85	MSS (Earth-to-space) band

Table 4-3: Frequency bands, adjacent frequency signal test point centre frequencies and power levels for the 1 164 MHz to 1 300 MHz RNSS band

Frequency band (MHz)	Test point centre frequency (MHz)	Adjacent frequency signal power level (dBm)	Comments
960 to 1 164	1 154	-75	AM(R)S, ARNS band
1 164 to 1 215		GUE RNSS band under test	
1 215 to 1 260		GUE RNSS band under test	
1 260 to 1 300		GUE RNSS band under test	
1 300 to 1 350	1 310	-85	Radiolocation, ARNS, RNSS (Earth-to-space) band

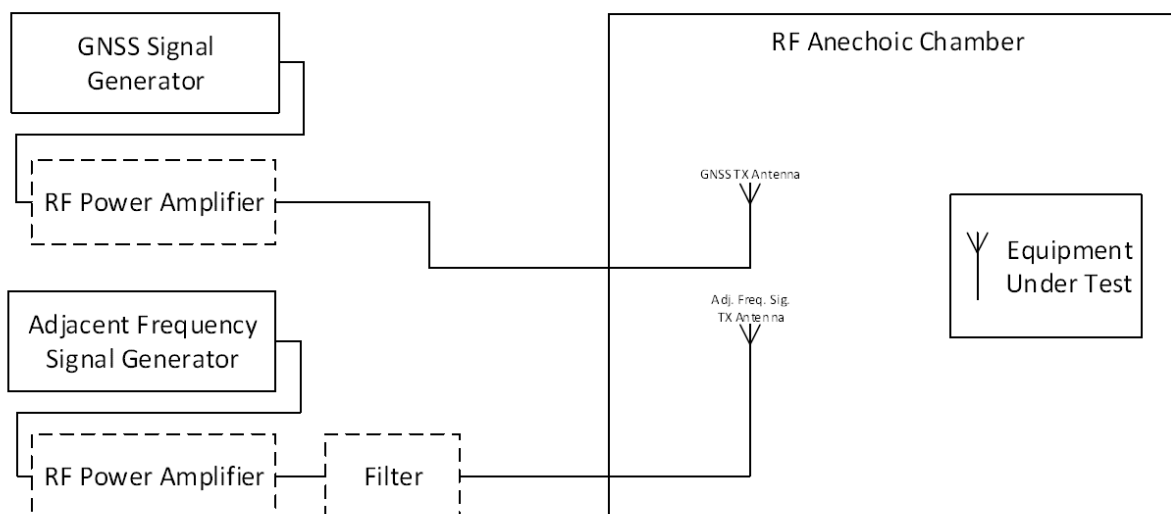
Table 4-4: Adjacent frequency signal

Parameter	Value	Comments
Frequency	See table 4-2 and table 4-3	
Power level	See table 4-2 and table 4-3	
Bandwidth	1 MHz	See clause B.1 for details
Format	AWGN	

Annex B contains details of the adjacent frequency signal and the GNSS signals that shall be used in performing the conformance tests. Annex C contains a detailed explanation of the C/N_0 metric. Clause C.3 describes the calculation of the nominal bounding value for the adjacent frequency signal power level at the points closest to the operating band given in table 4-2.

Test Procedure

The test equipment and EUT shall be configured according to figure 5-2 for Radiated measurements.

**Figure 5-2: Radiated measurement setup for EUT adjacent frequency band selectivity performance**

- 1) Configure the GNSS signal generator to simulate those GNSS and GNSS signals from table 4-1 declared as supported by the GUE, with power levels and other details as specified in clause B.2.
- 2) With the adjacent frequency signal switched off, the EUT shall be given sufficient time to acquire all simulated satellites from the declared GNSS system(s).
- 3) Record the baseline C/N_0 value(s) reported by the EUT. Sufficient filtering shall be used to obtain a stable value. C/N_0 may be averaged across all the satellites in view for each GNSS constellation. However, C/N_0 shall not be averaged across satellite signals in different GNSS constellations. For a multi-GNSS EUT, there shall be a separate C/N_0 value recorded for each GNSS constellation and each GNSS signal supported.
- 4) The adjacent frequency signal generator shall be configured to generate the signal defined in table 4-4, at the first test point centre frequency and signal power level as specified in table 4-2.
- 5) The adjacent frequency signal shall be switched on, and the EUT's C/N_0 value(s) recorded as in step 3) to measure the degradation with respect to the baseline value(s) recorded in step 3).
- 6) Test point Pass/Fail Criteria: If the C/N_0 degradation from step 5) does not exceed the value in equation 4-1, then this test point is set to "pass". If the C/N_0 degradation exceeds the value in equation 4-1, then this test point is set to "fail." For a multi-GNSS and multi-signal EUT, there shall be a separate pass/fail determination for each GNSS and for each GNSS signal supported. If the C/N_0 degradation exceeds the value in equation 4-1 for any supported GNSS or supported GNSS signal, then this test point is set to "fail".
- 7) Step 1) through step 6) shall be repeated for all test point centre frequencies (and associated signal power level) specified in table 4-2.

Test Data

Environmental Conditions

Temperature:	23.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Gao Chao on 2021-01-14.

If the EUT passes the C/N_0 degradation test for all test points for all GNSS constellations and all GNSS signals declared as supported from table 4-1, the EUT shall be deemed to "pass". If the C/N_0 degradation test fails for any GNSS constellation or GNSS signal at any of the test points, the EUT shall be deemed to "fail".

Signal Type	Signal Designations	Test point centre frequency	Adjacent frequency signal power level (dBm)	Without interfering signal (dB-Hz)	With interfering signal (dB-Hz)	Decrease of C/N_0 (dB)	Limit (dB)	Result
GPS	L1	1524	-65	44.22	43.61	0.61	1	Pass
		1548	-95	44.29	43.75	0.54	1	Pass
		1554	-105	44.3	43.86	0.44	1	Pass
		1615	-105	44.25	43.51	0.74	1	Pass
		1627	-85	44.18	43.64	0.54	1	Pass

Note: The adjacent frequency signal and the GNSS signals that shall be used in performing the conformance tests. The adjacent frequency signal is 1 MHz filtered AWGN signal used for interferer simulation and the GNSS signal is designation L1 of GPS. A test receiver outside chamber was used to record the test result.

ETSI EN 303 413 V1.1.1 (2017-06) CLAUSE 4.2.2 – RECEIVER SPURIOUS RADIATIONS

Definition

Receiver spurious emissions are emissions at any frequency when the GUE is in receive-only operating mode.

Limit

The 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: 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

Test Procedure

The test site as described in ETSI EN 300 328 [1], annex B and the applicable measurement procedures as described in ETSI EN 300 328 [1], annex C shall be used.

The test procedure is further described in 303413 clause 5.5.2.1.

Test Data

Environmental Conditions

Temperature:	23.7 °C
Relative Humidity:	52 %
ATM Pressure:	101.0 kPa

The testing was performed by Chao Gao on 2021-01-14.

Test Mode: Receiving

Frequency (MHz)	Receiver Reading (dBμV)	Turntable Angle Degree	Rx Antenna		Substituted			Absolute Level (dBm)	EN 303 413	
			Height (cm)	Polar (H/V)	Submitted Level (dBm)	Cable Loss (dB)	Antenna Gain (dBi/dBd)		Limit (dBm)	Margin (dB)
693.97	37.84	270	150	H	-61.89	0.62	-1.68	-64.71	-57	7.71
693.97	38.33	21	150	V	-61.32	0.62	-1.68	-63.22	-57	6.22
3142.22	40.40	56	228	H	-68.30	0.52	9.41	-59.24	-47	12.24
3142.22	41.54	181	115	V	-67.98	0.52	9.41	-59.07	-47	12.07

Note : The unit of antenna gain is dBd for frequency below 1GHz and dBi for frequency above 1GHz.

Absolute Level = Submitted Level - Cable loss + Antenna Gain

Margin = Limit- Absolute Level

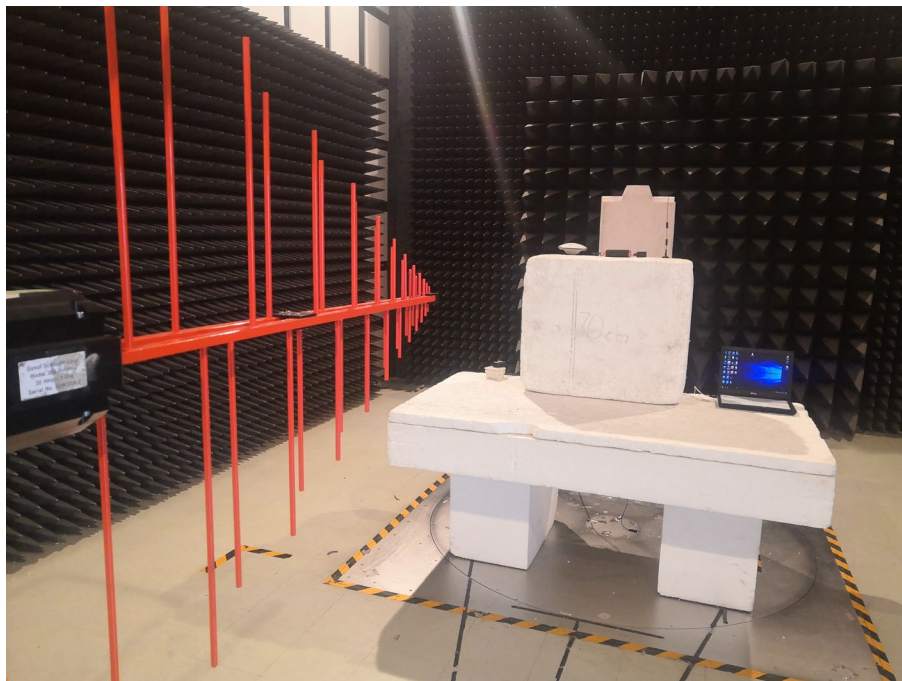
EXHIBIT A - EUT PHOTOGRAPHS

Please refer to report No.: RSHA201204001-01A which was issued by BACL (Kunshan).

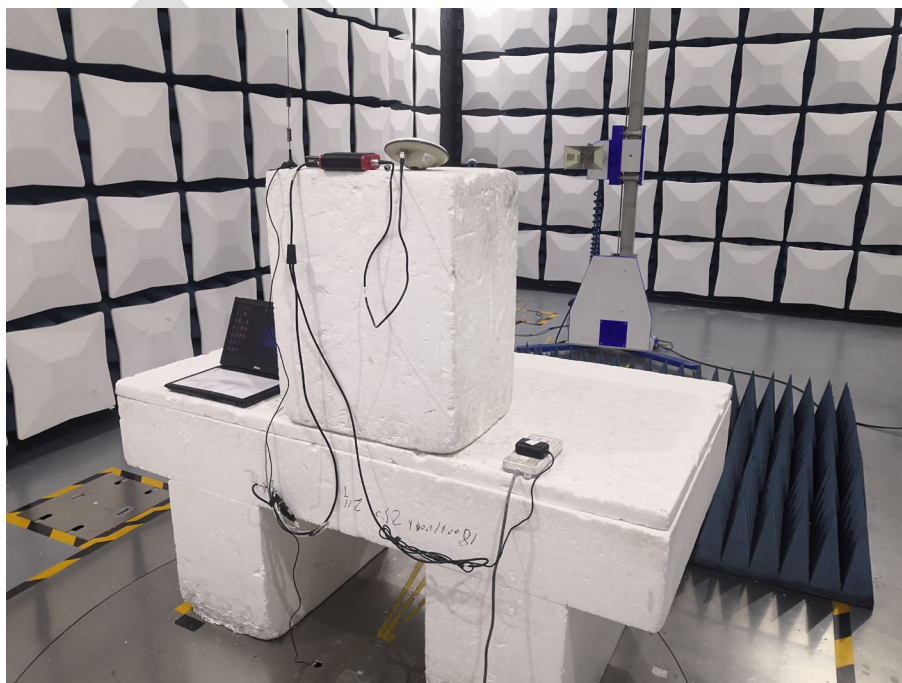
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EXHIBIT B - TEST SETUP PHOTOGRAPHS

Radiated Spurious Emissions Test View (Below 1GHz)



Radiated Spurious Emissions Test View (Above 1GHz)



Declarations

- 1: BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.
- 2: Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.
- 3: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.
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