ETSI EN 303 413 V1.2.1 (2021-04)

TEST REPORT

For

Xiamen Milesight IoT Co., Ltd.

Building C09, Software Park Phase III, Xiamen 361024, Fujian, China

Tested Model: UR35-L04EU-G-P-W
Multiple Models: UR35-L04EU-G-P, UR35-L04EU-G-W, UR35-L04EU-G, UR35-L04EU-G-P-485, UR35-L04EU-G-W-485, UR35-L04EU-G-485, UR35-L04EU-G-P-W-485

Report Type:	**Product Type:**
Original Report	Industrial Cellular Router

Report Number:	XMDN220429-17582E-22A
Report Date:	2022-08-02
Reviewed By:	Rocky Xiao RF Engineer
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.12, Pulong East 1st Road, Tangxia Town, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		Industrial Cellular Router
EUT Model:		UR35-L04EU-G-P-W
Multiple Models:		UR35-L04EU-G-P, UR35-L04EU-G-W, UR35-L04EU-G, UR35-L04EU-G-P-485, UR35-L04EU-G-W-485, UR35-L04EU-G-485, UR35-L04EU-G-P-W-485
Model Difference:		Please refer to the DoS
Rated Input Voltage:		9-48Vdc from Adapter
Adapter Information:	**Model:**	2ABF060R
	Input:	100-240Vac 50/60Hz 1.7A
	Output:	48Vdc 1.25A
Serial Number:		XMDN220429-17582E-RF-S1(UR35-L04EU-G-P-W)
EUT Received Date:		2022.05.06
EUT Received Status:		Good

Technical Specification

Operation Frequency Range (MHz):	GPS L1 C/A, BDS B1I, Galileo E1: 1559-1610MHz
Modulation Type:	BPSK

Objective

This report is prepared on behalf of ***Xiamen Milesight IoT Co., Ltd.*** in accordance with ETSI EN 303 413 V1.2.1 (2021-04) 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 for access to radio spectrum.

The objective is to determine the compliance of EUT with: ETSI EN 303 413 V1.2.1 (2021-04).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 303 413 V1.2.1 (2021-04) 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 for access to radio spectrum.

Measurement Uncertainty

Parameter	F_{lab}	Maximum allow uncertainty
Radiated emission of transmitter, valid to 26,5 GHz	±3.62dB	±6dB
Radiated emission of transmitter, valid between 26,5 GHz and 66 GHz	±3.62dB	±8dB
Radiated emission of receiver, valid to 26,5 GHz	±3.62dB	±6dB
Radiated emission of receiver, valid between 26,5 GHz and 66 GHz	±3.62dB	±8dB
Humidity	±5%	±5%
Temperature	±1℃	±1℃
Voltage(DC)	±0.4%	±1%
Voltage(AC,<10kHz)	±1%	±2%

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Declarations

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 a triangle symbol "▲". Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in engineering mode, which was provided by the manufacturer.

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

Software "sscom5131▲" was used to monitor the EUT during test.

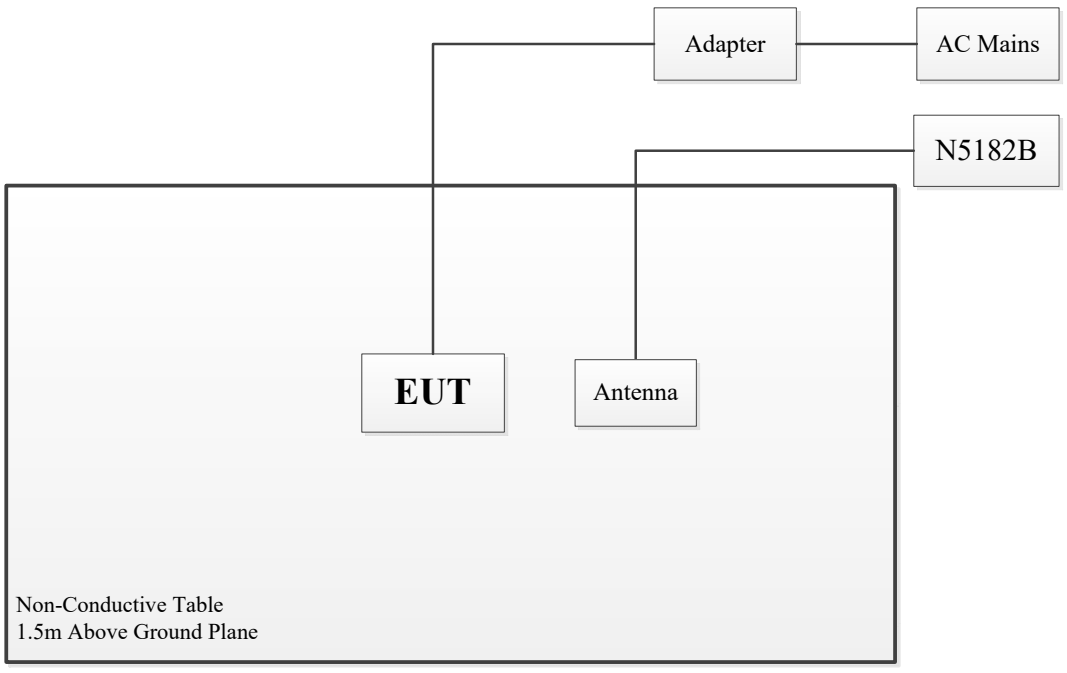
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Agilent	MXG Vector Signal Generator	N5182B	MY51350142

Support Cable List and Details

Cable Description	Shielding Cable	Ferrite Core	Length (m)	From Port	To
DC Cable	No	No	1.5	Adapter	EUT

Block Diagram of Test Setup



Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Radiated emissions below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-1	2020-11-10	2023-11-10
R&S	EMI Test Receiver	ESR3	102453	2021-10-26	2022-10-25
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2021-07-19	2022-07-18
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2021-07-19	2022-07-18
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2021-07-19	2022-07-18
Sonoma	Amplifier	310N	372193	2021-07-18	2022-07-17
EMCO	Adjustable Dipole Antenna	3121C	9109-753	N/A	N/A
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2021-09-04	2022-09-03
Agilent	Signal Generator	E8247C	MY43321350	2022-04-01	2023-03-31
Radiated emissions above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2021-10-12	2024-10-11
Agilent	Spectrum Analyzer	E4440A	SG43360054	2021-07-22	2022-07-21
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2021-09-04	2022-09-03
AH	Preamplifier	PAM-0118	469	2021-10-13	2022-10-12
TDK RF	Horn Antenna	HRN-0118	130 084	2021-10-12	2024-10-11
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-02	2021-09-04	2022-09-03
Agilent	Signal Generator	E8247C	MY43321350	2022-04-01	2023-03-31

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

Environmental Conditions

Test Item:	Radiated emissions
Temperature:	22.6~23.4℃
Relative Humidity:	49~59%
ATM Pressure:	100.9kPa
Tester:	Leo Yuan, Bill Yang
Test Date:	2022-05-17

SUMMARY OF TEST RESULTS

SN	Rule and Clause	Description of Test	Test Result
1	Clause 4.2.1	Receiver blocking	Compliant
2	Clause 4.2.2	Receiver spurious emissions	Compliant

1 - RECEIVER BLOCKING

Applicable Standard

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 in frequency bands adjacent or near-adjacent to the relevant RNSS band.

Limit

The C/N_0 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. The blocking 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

$$\Delta\ C/N_0 \leq 1\ \text{dB} \quad (4\text{-}1)$$

Test System Setup

Test setup for conducted measurements

For an EUT with an external, detachable, antenna, the EUT shall be connected to the test bed by means of the antenna port. Alternatively, the EUT may be connected in the same manner as an EUT with an integrated antenna, described below.

For an EUT with an integrated antenna, the antenna element shall be removed and a connection from the antenna to the test bed shall be made in place of the antenna element.

A conceptual block diagram for conducted measurements is shown in figure 5-1.

An equipment list and block diagram shall be provided if the test setup differs from the diagram in figure 5-1. The test bed shall be calibrated so that the blocking signal power levels of the test signals specified in table 4-2 and/or, as applicable, table 4-3 are presented to the input of the EUT.

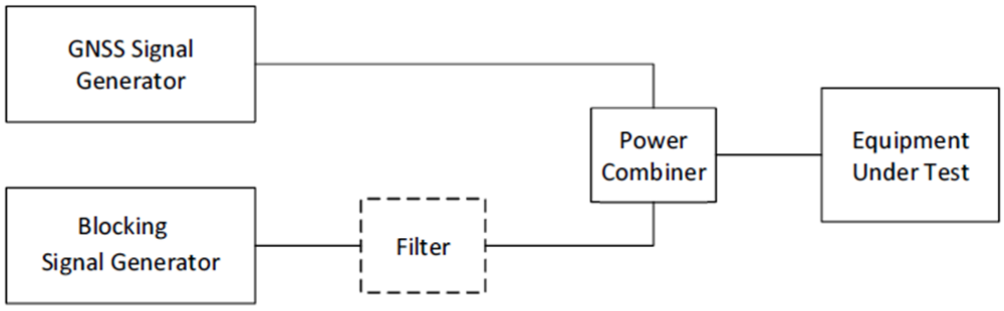


Figure 5-1: Conducted measurement setup for EUT receiver blocking

Test setup for radiated measurements

A conceptual block diagram for radiated measurements is shown in figure 5-2.

An equipment list and block diagram shall be provided, if the test setup differs from the diagram in figure 5-2.

The orientation of the EUT with respect to the transmitting antennas (normally boresight) shall be declared in the test report.

The test bed shall be calibrated so that the blocking signal power levels specified in table 4-2 and, as applicable, table 4-3 are incident upon the antenna of the EUT.

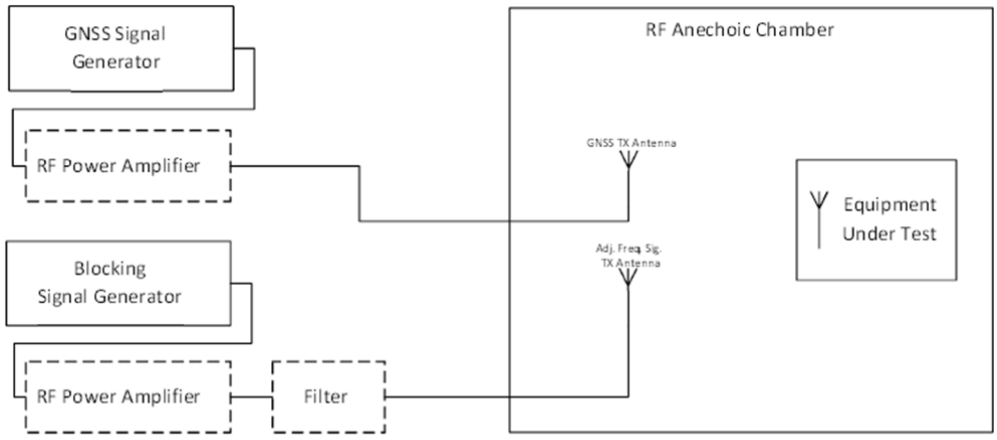


Figure 5-2: Radiated measurement setup for EUT receiver blocking

GNSS Signals

The GNSS signals are the (wanted) signals used during the conformance testing to simulate the GNSS satellites for the GNSS constellations and GNSS signals supported by the GUE. The signal details of the GNSS constellations are contained in the respective GNSS Interface Specifications.

All GNSS constellations and GNSS signals declared as supported in the test report shall be simulated during the conformance testing.

The signal power levels for each GNSS signal within each GNSS constellation are defined in table B-1.

Table B-1: Signal power levels for each GNSS signal within each GNSS constellation supported

GNSS constellation	GNSS signal	Signal power level(note)
BDS	B1I	-133 dBm
	B1C (IGSO)	-131 dBm
	B1C (MEO)	-129 dBm
Galileo	E1	-127 dBm
	E5a	-125 dBm
	E5b	-125 dBm
	E6	-125 dBm
GLONASS	G1	-131 dBm
	G2	-137 dBm
GPS	L1 C/A	-128,5 dBm
	L1C	-127 dBm
	L2C	-130 dBm
	L5	-124,9 dBm
SBAS	L1	-131 dBm
	L5	-127,5 dBm
NOTE: The signal power levels represent the total signal power of the satellite per channel, not for example pilot and data channels separately.		

Test Procedure

Test method for GUE utilizing the 1 559 MHz to 1 610 MHz RNSS band

1) Configure the GNSS signal generator to simulate the GNSS constellations 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 blocking signal switched off, the EUT shall be given sufficient time to acquire all simulated satellites from the declared GNSS constellations.

3) Record the C/N_0 value(s) reported by the EUT under the condition in step 2). Sufficient filtering shall be used to obtain stable value(s). C/N_0 may be averaged over time and across all the simulated satellites for a particular GNSS constellation and GNSS signal. However, C/N_0 shall not be averaged across different satellite signals in the same GNSS constellation or across different GNSS constellations. For a multi-GNSS constellation and/or multi-GNSS signal EUT, there shall be a separate C/N_0 value recorded for each GNSS constellation and each GNSS signal supported.

4) The blocking 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 blocking signal shall be switched on, and the EUT's C/N_0 value(s) recorded as in step 3). The difference(s) between this value(s) and the value(s) recorded in step 3) is the C/N_0 degradation caused by the blocking signal for this test point.

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 constellation and/or multi-GNSS signal EUT, there shall be a separate pass/fail determination for each GNSS constellation and for each GNSS signal supported. If the C/N_0 degradation exceeds the value in equation (4-1) for any supported GNSS constellation 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.

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".

Test method for GUE utilizing the 1 164 MHz to 1 300 MHz RNSS band

For a GUE also utilizing the RNSS bands in the 1 164 MHz to 1 300 MHz range, the test method in clause 5.4.3 (step 1) through step 7), inclusive), shall be repeated using the blocking test point centre frequencies and associated signal power levels specified in table 4-3.

If the EUT passes the C/N_0 degradation tests as defined in both clause 5.4.3 and clause 5.4.4, the EUT shall be deemed to "pass". If the C/N_0 degradation test fails tests as defined in either or both of clause 5.4.3 or clause 5.4.4, the EUT shall be deemed to "fail".

Test Data

Please refer to following table:

Mode	Frequency band	Test point centre frequency	Adjacent frequency signal power level	Messured Result C/N0			
				No interfering signal	With interfering signal	degradation in C/N0	Limit
	(MHz)	(MHz)	(dBm)				
GPS L1 C/A	1518-1525	1524	-65	37.5	37.2	0.3	Δ C/N0 ⩽ 1 dB
	1525-1549	1548	-95	37.3	36.8	0.5	
	1549-1559	1554	-105	37.1	36.9	0.2	
	1559-1610	GUE RNSS band under test					
	1610-1626	1615	-105	37.3	36.9	0.4	
	1626-1640	1627	-85	37.1	36.8	0.3	
BDS B11	1518-1525	1524	-65	37.4	37.2	0.2	Δ C/N0 ⩽ 1 dB
	1525-1549	1548	-95	37.2	36.8	0.4	
	1549-1559	1554	-105	37.2	36.9	0.3	
	1559-1610	GUE RNSS band under test					
	1610-1626	1615	-105	37.1	36.9	0.2	
	1626-1640	1627	-85	37.2	36.8	0.4	
Galileo E1	1518-1525	1524	-65	37.6	37.2	0.4	Δ C/N0 ⩽ 1 dB
	1525-1549	1548	-95	37.1	36.8	0.3	
	1549-1559	1554	-105	37.3	36.9	0.4	
	1559-1610	GUE RNSS band under test					
	1610-1626	1615	-105	37.2	36.9	0.3	
	1626-1640	1627	-85	37.1	36.8	0.3	

Note: The EUT was tested in engineering mode, "C/N_0" was monitor by software "sscom5131▲".

2 - RECEIVER SPURIOUS EMISSIONS

Applicable Standard

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

Limit

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

Test Procedure

Conducted measurement

The measurement procedure refer to ETSI EN 303 413 V1.2.1 (2021-04) §5.5.3.

Radiated measurement

According to ETSI EN 303 413 V1.2.1, the test site as described in ETSI EN 300 328, annex B and the applicable measurement procedures as described in ETSI EN 300 328, annex C shall be used.

The test procedure is further described in clause 5.5.3.1.

Test Data

Radiated Emission:

Test Result: *Compliant. The worst case please refer to following tables:*

GPS L1 C/A _ Receiver mode

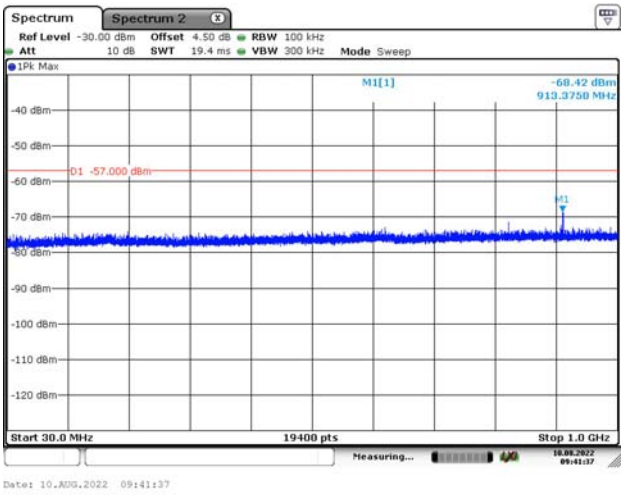
Frequency (MHz)	Polar (H/V)	Receiver Reading (dBμV)	Substituted Method			Absolute Level (dBm)	Limit (dBm)	Margin (dB)
			Substituted Level (dBm)	Antenna Gain (dBd/dBi)	Cable Loss (dB)			
1649.20	H	50.68	-67.42	10.44	0.71	-57.69	-47.00	10.69
1879.55	V	50.37	-66.76	11.66	0.95	-56.05	-47.00	9.05
214.60	H	54.68	-60.68	0.00	0.49	-61.17	-57.00	4.17
245.50	V	58.90	-60.22	0.00	0.50	-60.72	-57.00	3.72

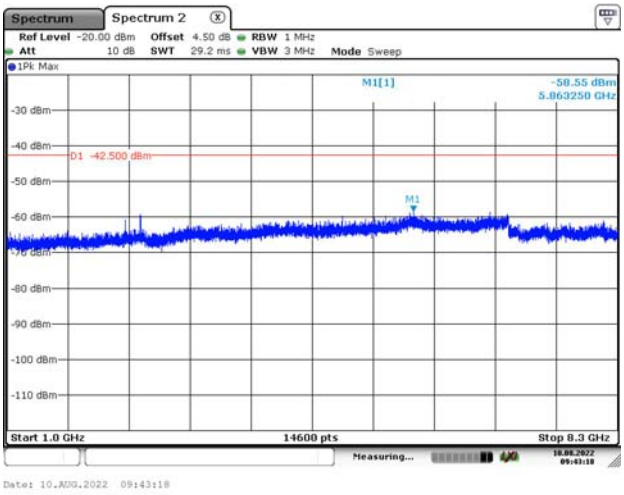
Note 1:The unit of antenna gain is dBd for frequency below 1GHz and is dBi for frequency above 1GHz.
Note 2:
Absolute Level = Substituted Level - Cable loss + Antenna Gain
Margin = Limit- Absolute Level

Conducted Emission:

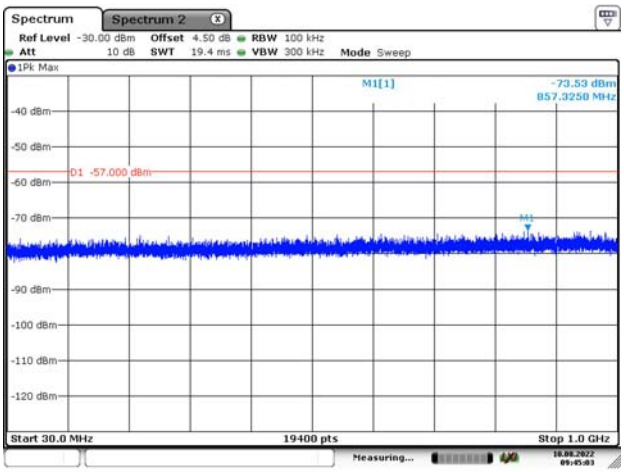
Test Result: *Compliant. The worst case please refer to following tables(plots):*

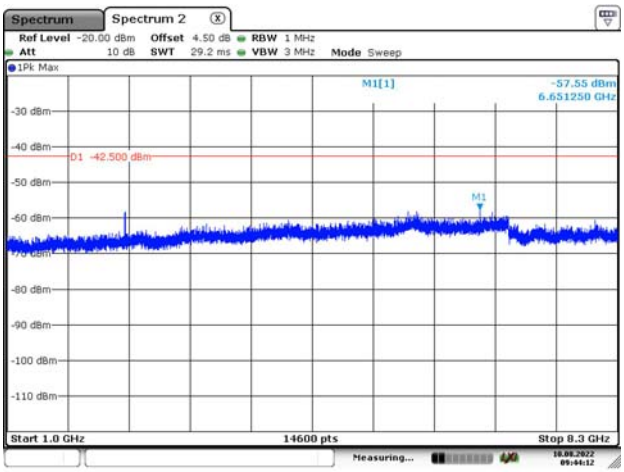
BDS B11



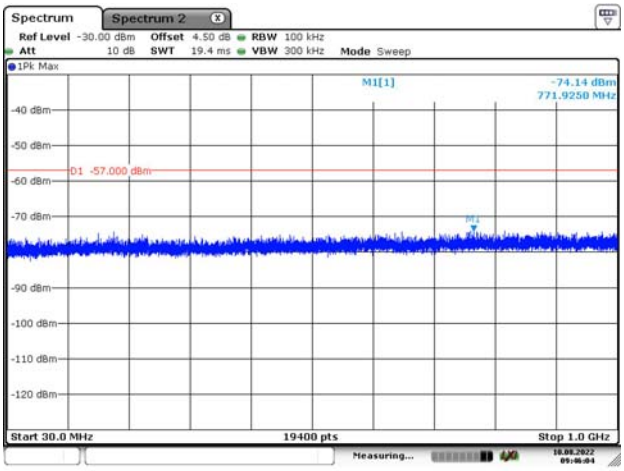


Galileo E1





GPS L1 C/A



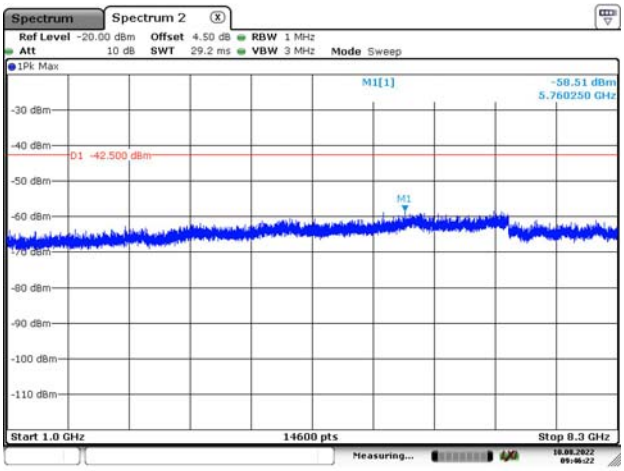


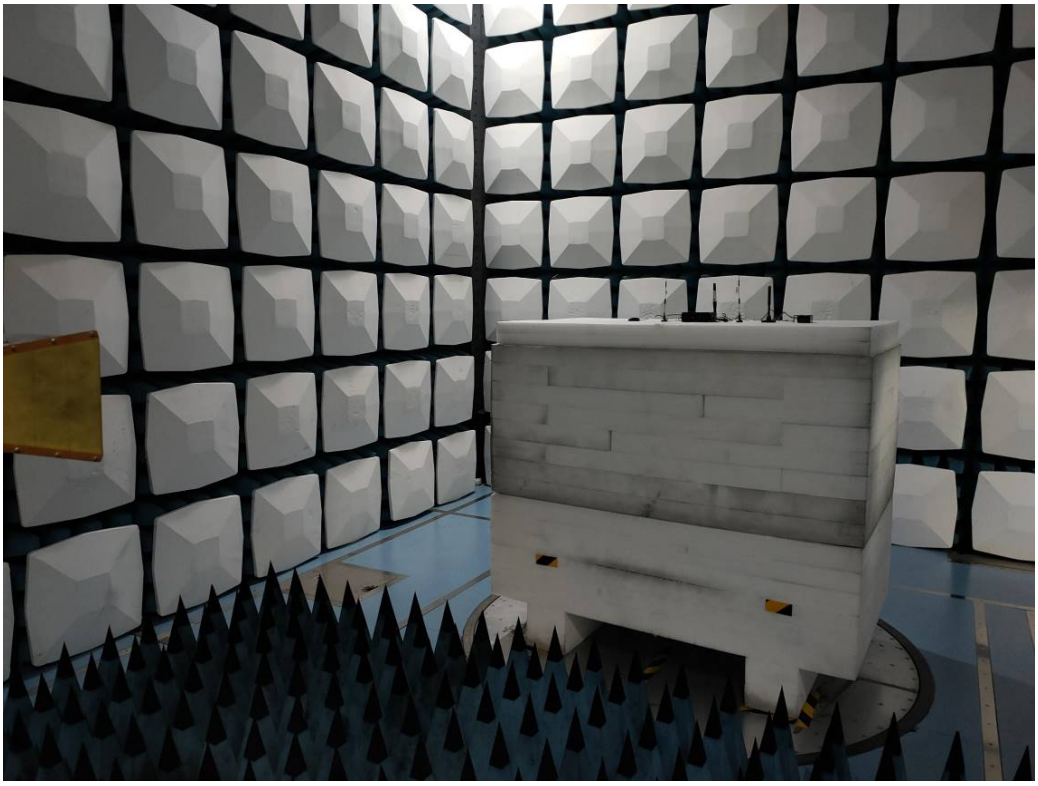
EXHIBIT A - EUT PHOTOGRAPHS

For photos in this section, please refer to report No.: XMDN220429-17582E-02 EXHIBIT A.

EXHIBIT B - TEST SETUP PHOTOGRAPHS

Radiated Emissions Below 1GHz View

Radiated Emissions Above 1GHz View



*******END OF REPORT*******