

Test Report

Test report no.: 25051441-46099-0

Date of issue: 2025-11-21

Test result: The test item - **passed** - and **complies** with below listed standards.

Applicant

Aptiv Services Deutschland GmbH

Manufacturer

Aptiv Services Deutschland GmbH

Test Item

SRR6PH

RF-Spectrum Testing according to:

特定無線設備の技術基準適合証明等に関する規則

Ordinance concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment

Article 2, Clause 1, Item 8

無線設備規則

Ordinance Regulating Radio Equipment

Article 49.14.14 and dedicated articles (76.5 GHz band)

Tested by
(name, function, signature)

Sebastian Janoschka
Head of Department RF


signature

Approved by
(name, function, signature)

Piotr Sardyko
Deputy Head of Department RF


signature

Applicant and Test item details

Applicant	Aptiv Services Deutschland GmbH Am Technologiepark 1 42119, Wuppertal, Germany Fon: +49 2261 971 415
Manufacturer	Aptiv Services Deutschland GmbH Am Technologiepark 1 42119, Wuppertal, Germany
Test item description	Short Range Radar (SRR6+)
Model/Type reference	SRR6PH

Standard specific information

Frequency	76.0 GHz to 77.0 GHz
Antenna	integrated patch antenna
Power supply	7.0 to 16.0 V DC
Temperature range	-40 °C to +85 °C

Disclaimer and Notes

The content of this report relates to the mentioned test sample(s) only.

IBL-Lab GmbH does not take samples. The samples used for testing are provided by the applicant.

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Signatures are done electronically, if signer does not match stated signer, it is signed per order.

Information supplied by the applicant can affect the validity of results. The data is marked accordingly.

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Within this test report, a ☒ point / ☐ comma is used as a decimal separator.

If otherwise, a detailed note is added adjoined to its use.

Decision rule:

Decision rule based on simple acceptance without guard bands, binary statement, based on mutually agreed uncertainty tolerances with expansion factor k=2 according to ILAC-G8:09/2019

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2 GENERAL INFORMATION

2.1 Administrative details

Testing laboratory	IBL-Lab GmbH Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany Fon: +49 6894 38938-0 Fax: +49 6894 38938-99 URL: https://ib-lenhardt.com/ E-Mail: info@ib-lenhardt.com
Accreditation / Designation	The testing laboratory is accredited by Deutsche Akkreditierungsstelle GmbH (DAkkS) in compliance with DIN EN ISO/IEC 17025:2018. Scope of testing and registration number: • Attachment to the accreditation certificate D-PL-21375-01-00 ○ Electronics ○ Electromagnetic Compatibility ○ Radio ○ Electromagnetic Compatibility and Telecommunication (FCC requirements) ○ Telecommunication (TC) and Electromagnetic Compatibility (EMC) for Canadian Standards ○ Automotive EMC Website DAkkS: https://www.dakks.de/ The Deutsche Akkreditierungsstelle GmbH (DAkkS) is also a signatory to the ILAC Mutual Recognition Arrangement. • Designations ○ FCC Testing Laboratory Designation Number DE0024 ○ ISED ISED Company Number 27156 Testing Laboratory CAB Identifier DE0020 ○ Kraftfahrt-Bundesamt KBA-P 00120-23
Testing location	IBL-Lab GmbH Heinrich-Hertz-Allee 7 66386 St. Ingbert / Germany
Date of receipt of test samples	2025-09-01
Start – End of tests	2025-09-02 – 2025-09-17

2.2 Possible test case verdicts

Test sample meets the requirements	P (PASS) – the measured value is below the acceptance limit, AL = TL
Test sample does not meet the requirements	F (FAIL) – the measured value is above the acceptance limit, AL = TL
Test case does not apply to the test sample	N/A (Not applicable)
Test case not performed	N/P (Not performed)

2.3 Observations

No additional observations other than the reported observations within this test report have been made.

2.4 Opinions and Interpretations

No appropriate opinions or interpretations according ISO/IEC 17025:2017 clause 7.8.7 are within this test report.

2.5 Document history

-0 Initial Version

2.6 Further documents

List of further applicable documents belonging to the present test report:
– no additional documents –

3 ENVIRONMENTAL & TEST CONDITIONS

3.1 Environmental conditions of test laboratory

Temperature	20°C ± 5°C
Relative humidity	25-75% r.H.
Barometric Pressure	860-1060 mbar
Power supply	230 V AC ± 5%

3.2 Normal and extreme test conditions

	minimum	normal	maximum
Temperature	-40 °C	20 °C	+85 °C
Relative humidity	-/-	45 % r.h.	-/-
Power supply	6.5 V DC	13.2 V DC	16.0 V DC

4 TEST STANDARDS AND REFERENCES

Test standard (not accredited)

Ordinance Regulating Radio Equipment

Standard: 無線設備規則

Ordinance Regulating Radio Equipment

Chapter I General Provision

Chapter II Transmitting Equipment

Chapter III Receiving Equipment

Chapter IV Equipment Classification, Article 49.14.12 (76.5 GHz band)

With test method as described in OCTR (特定無線設備の技術基準適合証明等に関する規則),

Annex 1, Appendix 22-14 (according Notification 88) or alternative test method considered as equivalent.

Reference	Description
– none –	– none –

5 EQUIPMENT UNDER TEST (EUT)

5.1 Product description

Short Range Radar (SRR6+)

5.2 Description of test item

Model name*	SRR6PH		
Serial number*	EUT #1 (w ETH):	28843769A	25176 00184
	EUT #2 (non ETH):	28832197A	24354 00225
Hardware status*	EUT #1: B6 EUT #2: B5		
Software status*	12.71.01.F7		

*: as declared by applicant

5.3 Technical data of test item

Technology*	automotive radar
Operational frequency band*	76.0 GHz to 77.0 GHz
Type of radio transmission*	modulated carrier
Modulation type*	FMCW
Number of channels*	1
Channel bandwidth*	< 1 GHz
Channel spacing*	N/A
Receiver category*	N/A
Receiver bandwidth*	N/A
Duty cycle*	54%
Antenna Gain*	17.5 dBi
Antenna*	integrated patch antenna
Power supply*	7.0 to 16.0 V DC
Temperature range*	-40 °C to +85 °C

*: as declared by applicant

5.4 Operational modes

OP 1	Normal operating mode
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5.5 Additional information

Model differences	2 different EUT's were tested. According to customer declaration, they differ in the possibility to additionally connect an ethernet cable. One EUT has an ethernet connector, the other doesn't have an ethernet connector.
Ancillaries tested with	none
Additional equipment used for testing	none

5.6 Operating conditions

Information is under NDA and to be found in document “*Technical Data Homologation–29_10_25*”, provided by applicant.

5.7 Antenna characteristics

Information is under NDA and to be found in document “*Technical Data Homologation–29_10_25*”, provided by applicant.

6 SUMMARY OF TEST RESULTS

Test specification

Ordinance regulating radio equipment Article 2, Item 8

Clause	Requirement / Test Case	Test Conditions	Result / Remark	Verdict
7.1	Frequency allocation / Frequency tolerance / 99 % Occupied bandwidth	Nominal Extreme	938.063 MHz	- PASS -
7.2	Antenna power (radiated) / Antenna power tolerance	Nominal	26.15 dBm	- PASS -
7.3	Transmitter antenna gain (Antenna characteristics)	Nominal	17.5 dBi	- PASS -
7.4	Antenna power (conducted) / Antenna power tolerance (+1.76 dB; -3.01 dB)	Nominal	EUT#1: 9.78 dBm EUT#2: 11.33 dBm	- PASS -
7.5	Spurious emissions and Unwanted emissions Secondary radiated emissions	Nominal	see note 1	- PASS -
7.6	Automatic stop function radio waves	Nominal		- N/P -

Notes

Note 1:

Secondary emissions are emissions at any frequency when the equipment is in receive mode. Consequently, secondary emission testing applies only when the equipment can work in a receive-only mode or is a receive only device. In cases where receivers are used in combination with permanently co-located transmitters the receivers will be tested together with the transmitter in operating mode as part of the transmitter spurious.

Comments and observations

none

7 TEST RESULTS

7.1 Frequency allocations / Frequency tolerance / 99 % Occupied bandwidth

Description

The operating frequency range is the frequency range over which the equipment is transmitting. The occupied frequency range of the equipment is determined by the lowest (f_L) and the highest frequency (f_H) as occupied by the power envelope.

Limits

The upper and lower limits of the operating frequency range shall meet the following conditions:
 $f_L \geq 76 \text{ GHz}$ // $f_H \leq 77 \text{ GHz}$

Test procedure

A spectrum analyser with the following settings is used as measuring receiver in the test set-up:

- Start frequency: lower than the lower edge of the permitted frequency range.
- Stop frequency: higher than the upper edge of the permitted frequency range.
- Resolution Bandwidth: 1 MHz.
- Video Bandwidth: $\geq 3 \text{ MHz}$.
- Detector mode: Positive peak (OTCR, Annex 1, Appendix 22-14)
- Display mode: Maxhold.

The 99 % OBW function is then used to determine the operating frequency range.

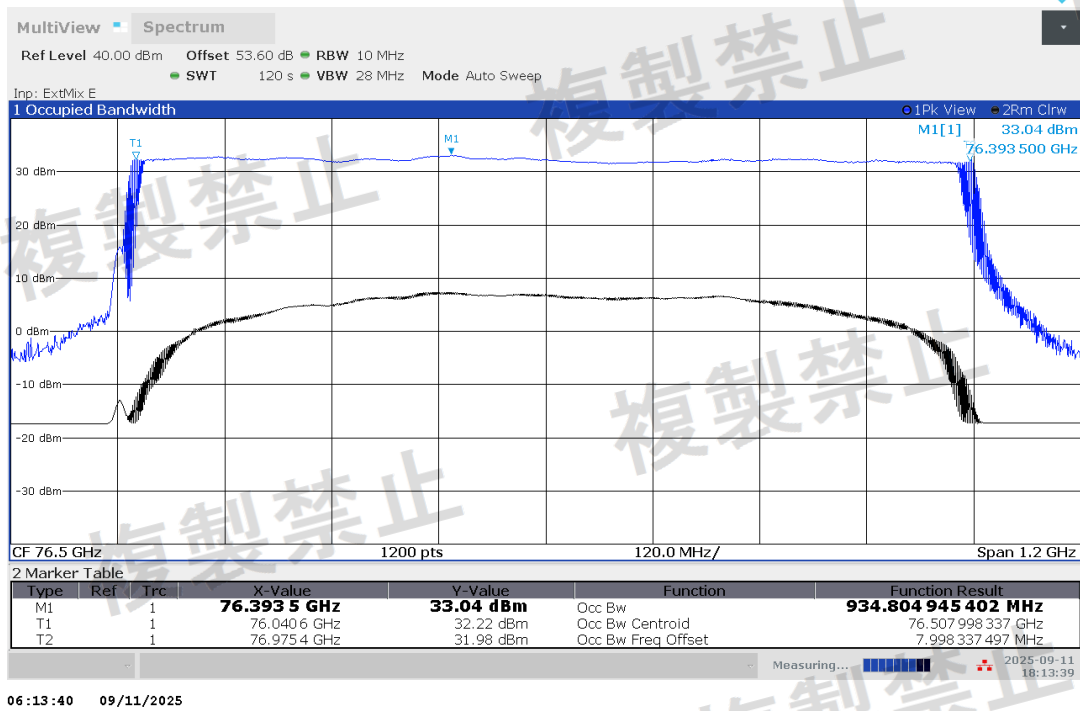
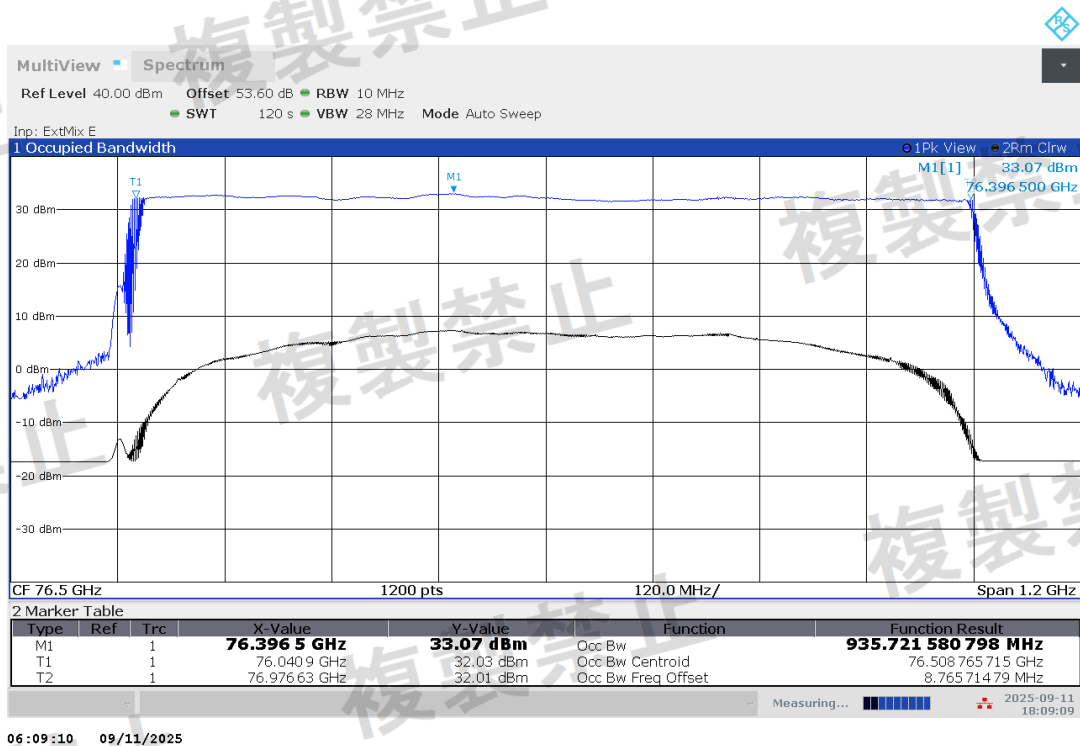
- f_H is determined. f_H is the frequency of the upper marker resulting from the OBW.
- f_L is determined. f_L is the frequency of the lower marker resulting from the OBW.
- f_C is the centre frequency.

Test setup: 8.3, 8.4

Test results:

Test environment	EUT Mode	Test distance	f_L [GHz]	f_H [GHz]	99% OBW [MHz]
T_{nom}/V_{min}	EUT #1, OP1	1.5 m	76.041	76.975	935
T_{nom}/V_{nom}	EUT #1, OP1	1.5 m	76.041	76.977	936
T_{nom}/V_{max}	EUT #1, OP1	1.5 m	76.040	76.977	937
T_{min}/V_{nom}	EUT #1, OP1	1.5 m	76.043	76.979	935
T_{max}/V_{nom}	EUT #1, OP1	1.5 m	76.047	76.973	925
T_{nom}/V_{min}	EUT #2, OP1	1.5 m	76.040	76.978	938
T_{nom}/V_{nom}	EUT #2, OP1	1.5 m	76.040	76.977	937
T_{nom}/V_{max}	EUT #2, OP1	1.5 m	76.040	76.977	937
T_{min}/V_{nom}	EUT #2, OP1	1.5 m	76.043	76.980	937
T_{max}/V_{nom}	EUT #2, OP1	1.5 m	76.042	76.979	936

Measurements were done after DUT being exposed to vibration and to 35 °C with 95 % humidity, RBW set to 10 MHz due to pulse desensitisation

Plot no. 1: OBW, Peak detector, EUT#1, OP 1, T_{nom} / V_{min} Plot no. 2: OBW, Peak detector, EUT#1, OP 1, T_{nom} / V_{nom} 

複製禁止

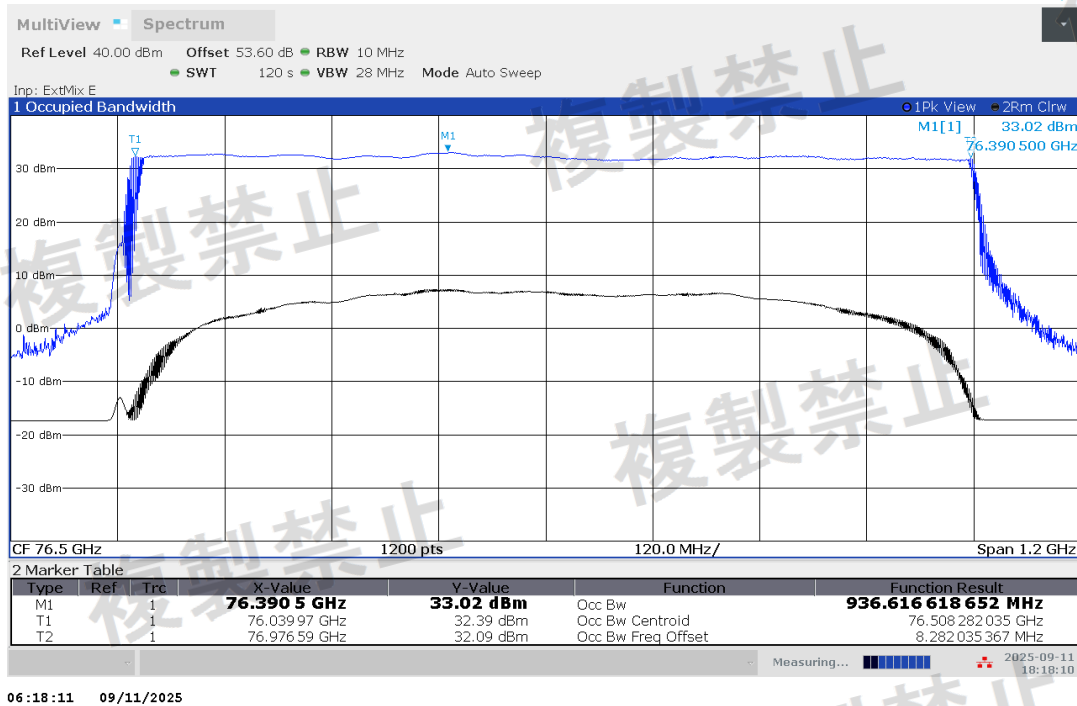
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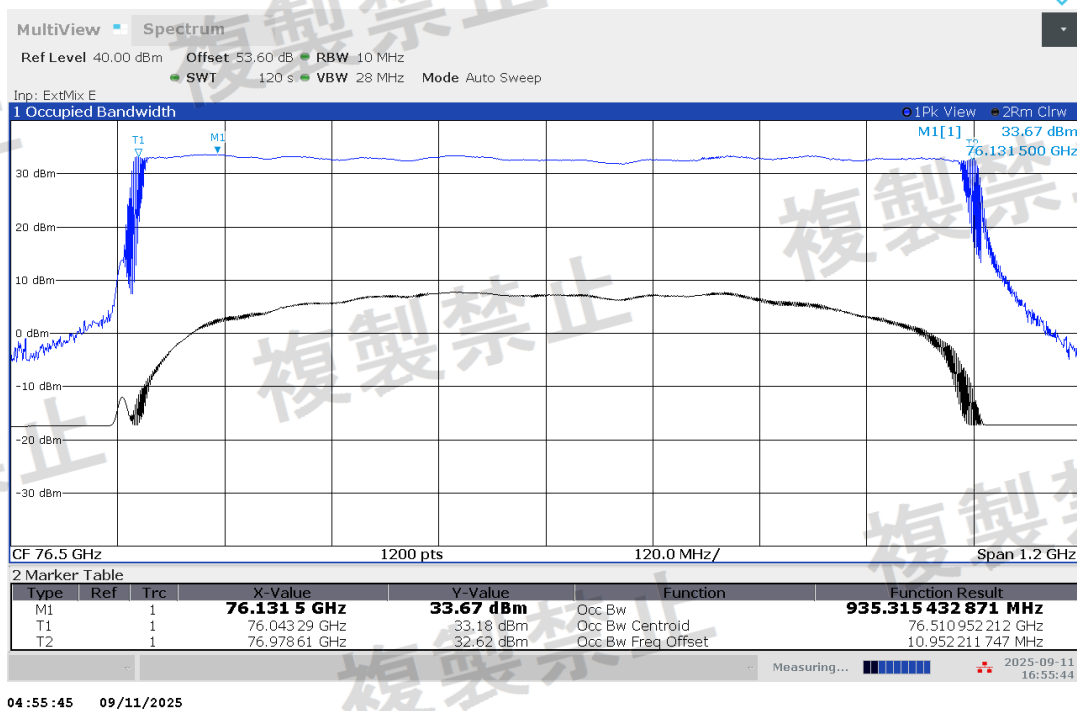
Plot no. 3: OBW, Peak detector, EUT#1, OP 1, T_{nom} / V_{max}



複製禁止

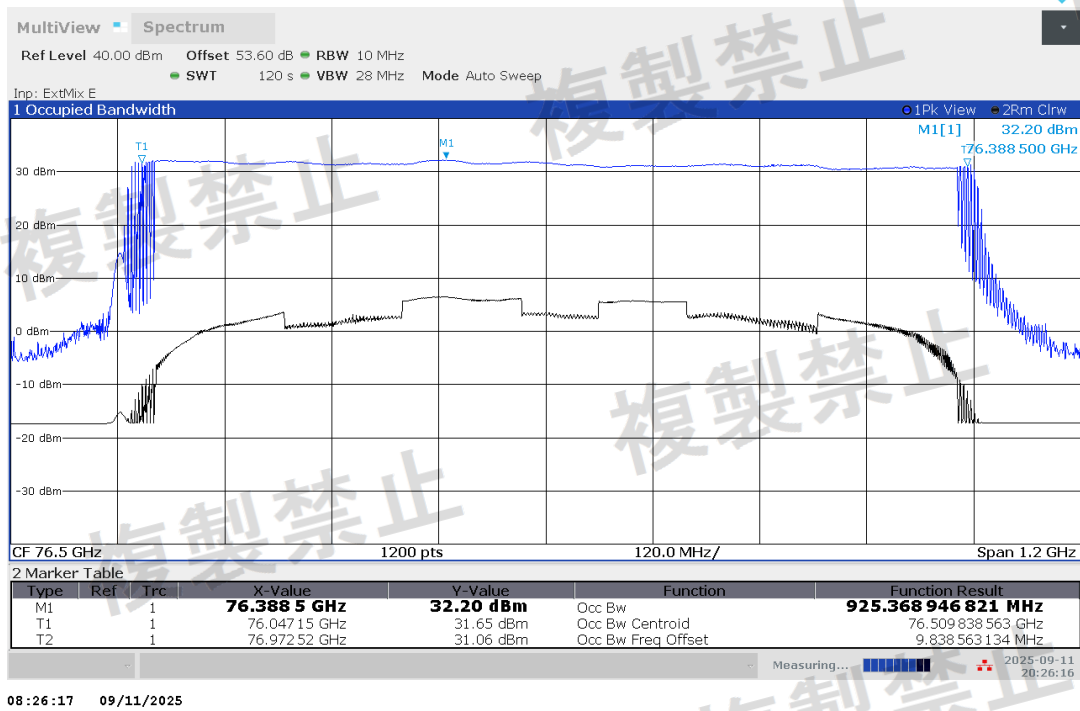


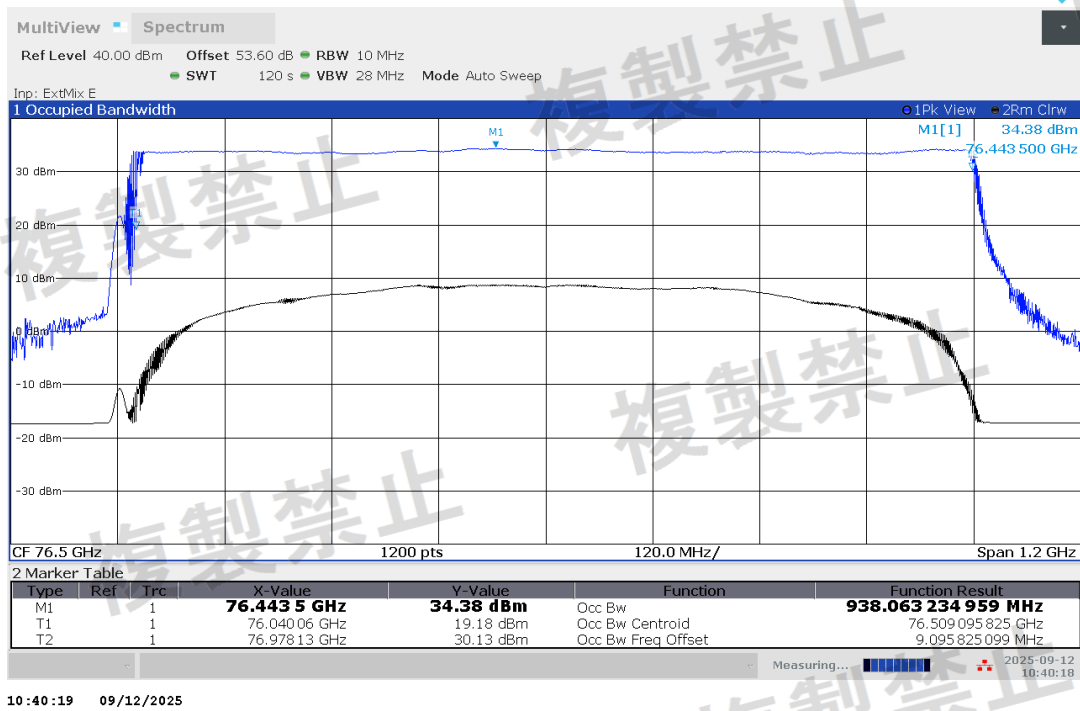
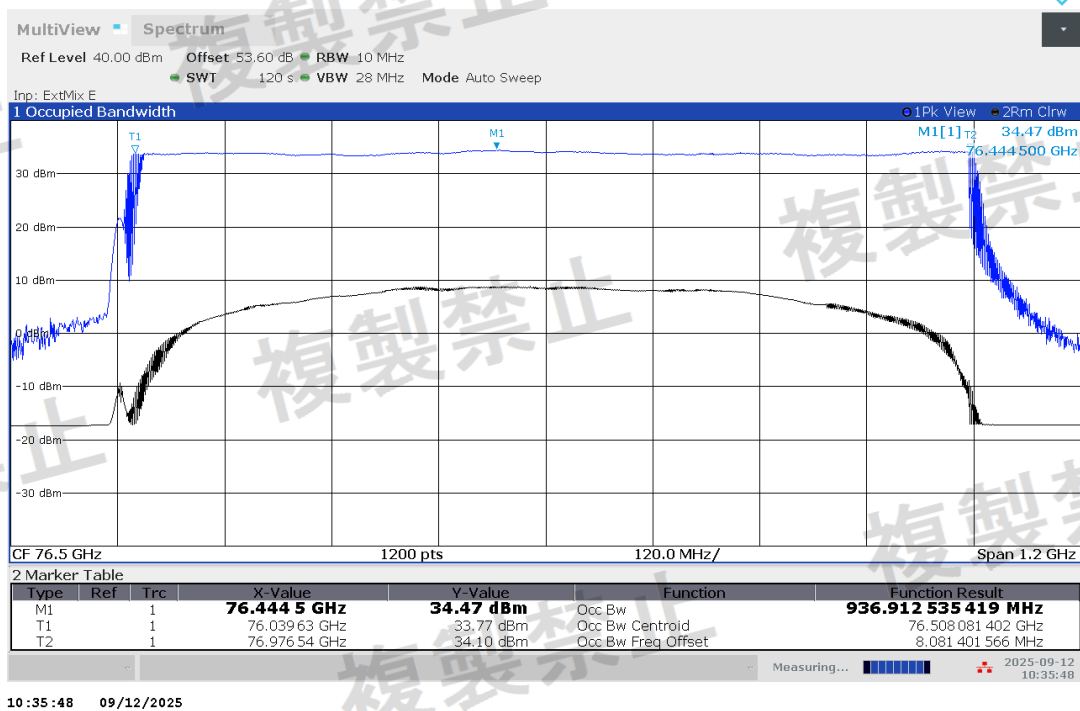
Plot no. 4: OBW, Peak detector, EUT#1, OP 1, T_{min} / V_{nom}

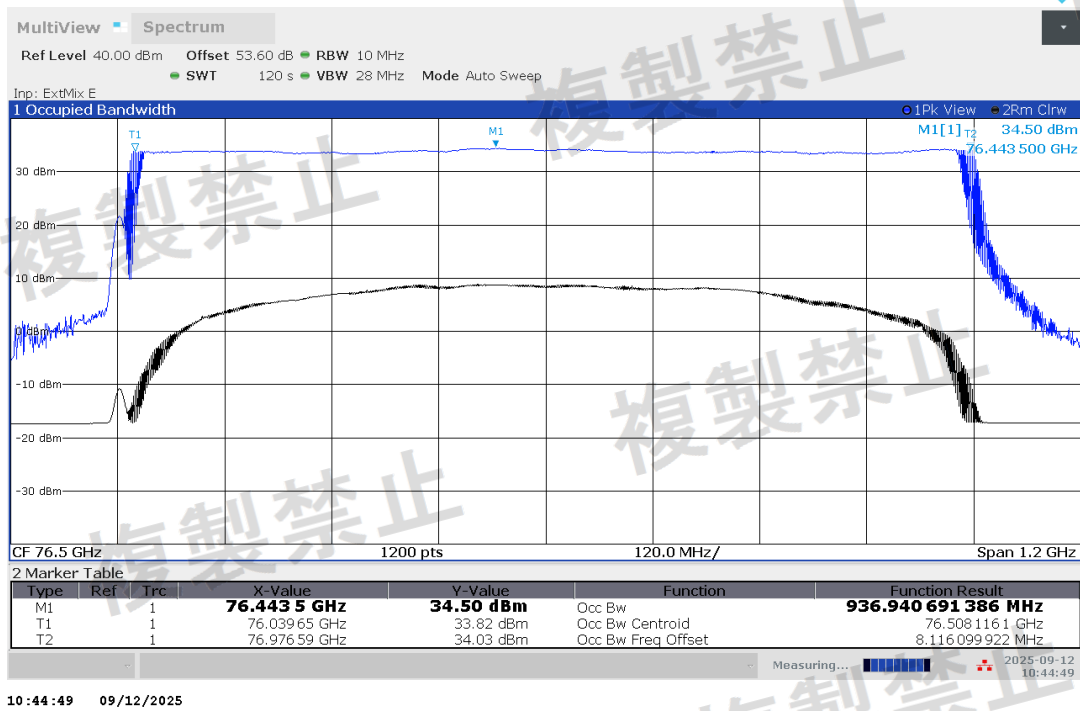
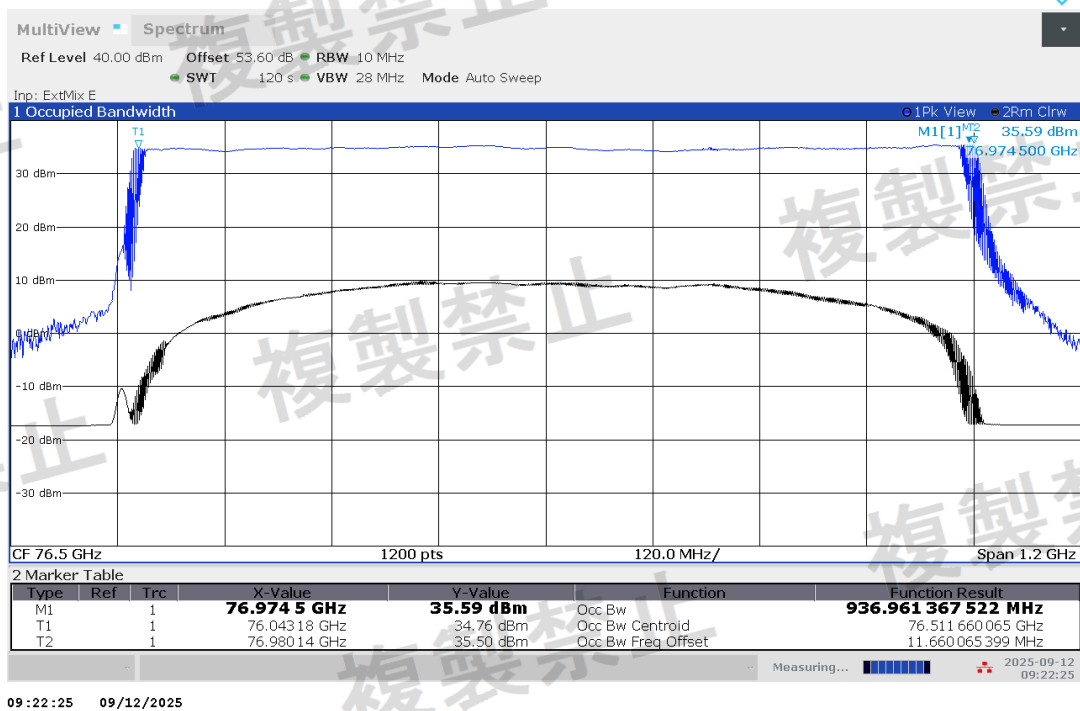


複製禁止

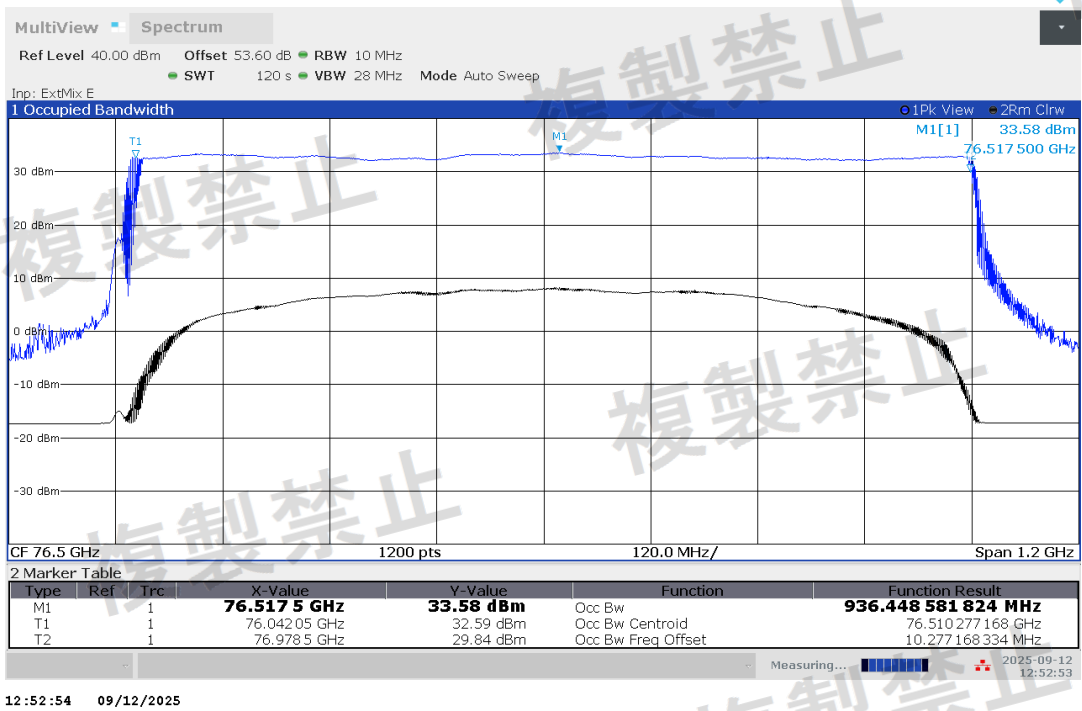
複製禁止

Plot no. 5: OBW, Peak detector, EUT#1, OP 1, $T_{\max}$ / V_{nom} 

Plot no. 6: OBW, Peak detector, EUT#2, OP 1, T_{nom} / V_{min} Plot no. 7: OBW, Peak detector, EUT#2, OP 1, T_{nom} / V_{nom} 

Plot no. 8: OBW, Peak detector, EUT#2, OP 1, T_{nom} / V_{max} Plot no. 9: OBW, Peak detector, EUT#2, OP 1, T_{min} / V_{nom} 

Plot no. 10: OBW, Peak detector, EUT#2, OP 1, T_{max} / V_{nom}



7.2 Antenna power (radiated) / Antenna power tolerance

Description

The radiated mean (average) power (e.i.r.p.) of the EUT, at a particular frequency is the product of the mean power supplied to the antenna times the antenna gain in a given direction relative to an isotropic antenna under the specified conditions of measurement. The maximum mean power (e.i.r.p.) is the mean power radiated in the direction of the maximum level (usually the boresight of the antenna) under the specified conditions of measurement. This radiated power is to be measured in the operating frequencies ranges.

The value is given in dBm.

Limits

The radar device's conducted mean power shall not exceed 10 mW / 10 dBm within the occupied bandwidth.

The antenna power tolerance is limited to nominal antenna power +50% and -70%.

Test procedure

Method with spectrum analyser

A spectrum analyser with the following settings is used as measuring receiver in the test set-up described in clause 5:

- Start frequency: lower than the lower edge of the operating frequency range.
- Stop frequency: higher than the upper edge of the operating frequency range.
- Resolution bandwidth: 1 MHz.
- Detector mode: RMS.
- Averaging time: larger than one EUT cycle time.
- Video bandwidth: $VBW \geq RBW$.
- Display mode: clear write.
- Sweep time: averaging time $\times$ number of sweep points.

Channel Power function needs to be used to calculate the average power. Boundaries for the calculation needs to be defined. This is typically the operating frequency range.

Method with power meter

The power meter shall be connected to the measurement antenna. The frequency correction factor shall be taken into account. The power meter shall be a true RMS power meter. The measurement time shall be equal or longer than the EUT cycle time.

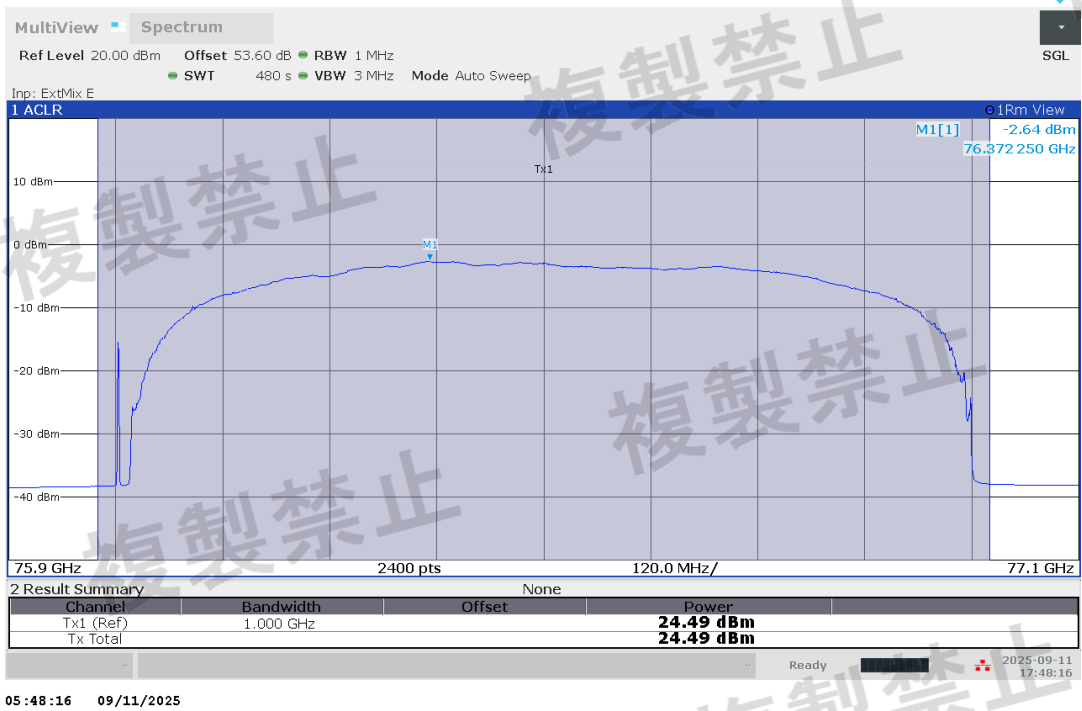
Test procedure used: Method with Spectrum Analyzer

Test setup: 8.3

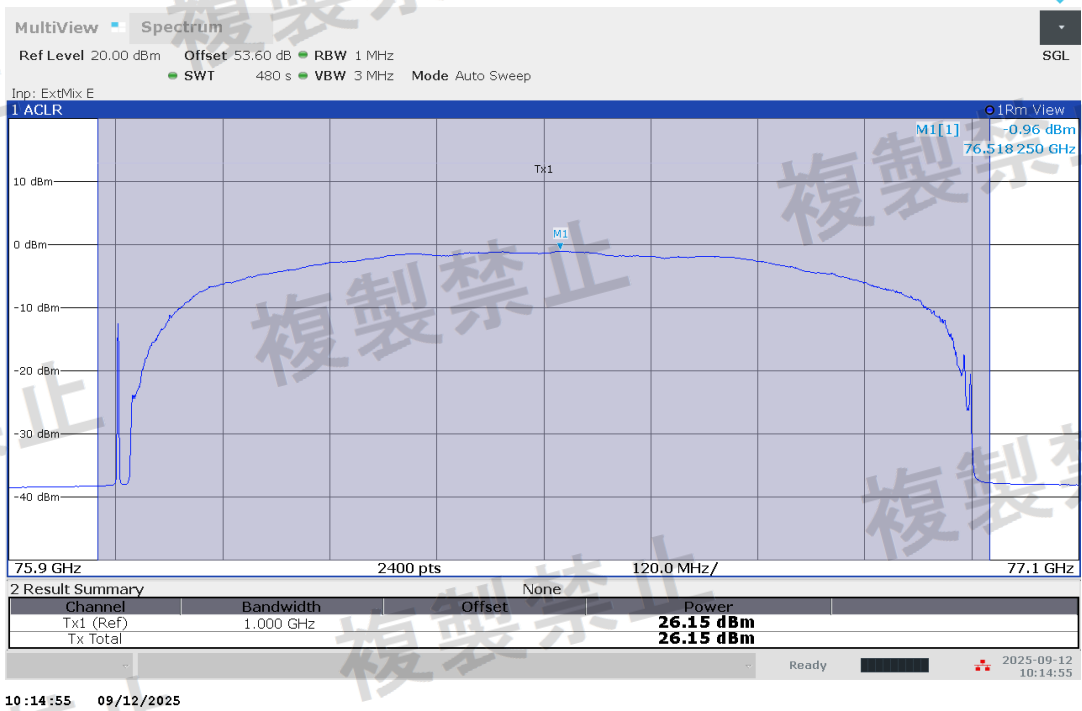
Test results:

EUT mode	Test distance	Mean power (EIRP) [dBm]
EUT #1, OP 1	1.5 m	24.49
EUT #2, OP 1	1.5 m	26.15

Plot no. 11: Mean Power EIRP, RMS detector / Channel Power, EUT #1, OP 1



Plot no. 12: Mean Power EIRP, RMS detector / Channel Power, EUT #2, OP 1



7.3 Transmitter antenna gain (Antenna characteristics)

Description

The transmit antenna gain is limited to value shown below.

Limits

The transmit antenna gain is limited to max. 40 dBi.

Test results:

See chapter 5.2!

7.4 Antenna power (conducted) / Antenna power tolerance

Description

The conducted antenna power is defined as the mean power during the active transmission burst. It is calculated, based on radiated antenna power (mean equivalent isotropically radiated power (EIRP)), EUT's duty cycle and antenna gain as declared by applicant / manufacturer.

Limits

The radar device's conducted mean power shall not exceed 10 mW / 10 dBm within the occupied bandwidth. The antenna power tolerance is limited to nominal antenna power +50% and -70%. The Antenna gain is limited to max. 40 dBi.

Calculation of conducted antenna power

Conducted antenna power [dBm] = radiated mean power [dBm]
(mean power during active transmission) + duty cycle correction (DCCF = $-10 \times \log(\text{Duty cycle [\%]}/100)$ [dB]
- antenna gain [dBi]

Antenna gain as declared by the customer: 14.3 dBi

Test results:

EUT Mode	Radiated mean EIRP [dBm]	Duty cycle [%] *)	DCCF [dB]	Antenna gain [dBi] *)	Conducted antenna power [dBm]
EUT #1, OP 1	24.49	54	2.68	17.5	9.78
EUT #2, OP 1	26.15	54	2.68	17.5	11.33

*) as declared by applicant

7.5 Spurious emissions and Unwanted emissions

Description

OOB emissions are emissions on a frequency or frequencies immediately outside the necessary bandwidth which results from the modulation process, but excluding spurious emissions.

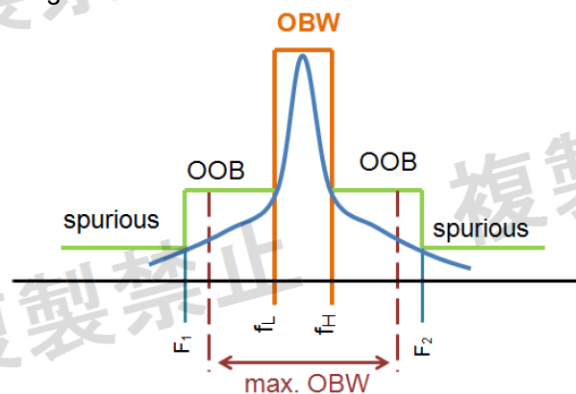
The measurement results of f_H and f_L of the occupied bandwidth measurement will be used to determine the operating BW of the device.

The operating bandwidth ($f_H - f_L$) will be used to calculate the ranges of OOB and spurious domain.

Spurious emissions are emission on a frequency or frequencies which are outside the necessary bandwidth and the level of which may be reduced without affecting the corresponding transmission of information. Spurious emissions include harmonic emissions, parasitic emissions, intermodulation products and frequency conversion products, but exclude out-of-band emissions.

According to CEPT/ERC/Recommendation 74-01, and Recommendation ITU-R SM.329-12, the boundary between the out-of-band and spurious domains is $\pm 250\%$ of the operating bandwidth (OBW) from the centre frequency of the emission. Out-of-band and spurious emissions are measured as spectral power density under normal operating conditions.

Overview OOB/spurious, depending on OBW:



The borders are calculated as follows:

$$f_c = (f_L + f_H) / 2$$

$$F_1 = f_c - (2.5 \times (f_H - f_L))$$

$$F_2 = f_c + (2.5 \times (f_H - f_L))$$

This calculation takes into account that the border between OOB and spurious may be larger or smaller than the maximum permitted range of operation.

NOTE: The out-of-band domain may be larger or smaller than the maximum permitted range of operation.

Limits

The effective radiated power of any radiated spurious emission shall be not greater than the values given in table below:

Frequency range	Limit
Unwanted emissions in spurious domain	50 μ W (-13 dBm)
Unwanted emissions in out-of-band domain	100 μ W (-10 dBm)

Calculation of the far field distance (Rayleigh distance):

The aperture dimensions of these horn antennas shall be small enough so that the measurement distance in meters is equal to or greater than the Rayleigh distance (i.e. $R_m = 2D^2 / \lambda$), where D is the largest linear dimension (i.e. width or height) of the antenna aperture in m and λ is the free-space wavelength in meters at the frequency of measurement.

Antenna type	Frequency range [GHz]	D [m]	Highest frequency in use [GHz]	Far field distance R_m [m]
20240-20	18.0 – 26.5	0.0520	26.5	0.478
22240-20	26.5 – 40.0	0.0342	40	0.312
23240-20	33.0 – 50.0	0.0280	50	0.261
24240-20	40.0 – 60.0	0.0230	60	0.212
25240-20	50.0 – 75.0	0.0185	75	0.171
26240-20	60.0 – 90.0	0.0150	90	0.135
27240-20	75.0 – 110	0.0124	110	0.113
28240-20	90.0 – 140	0.0100	140	0.093
29240-20	110 – 170	0.0085	170	0.082
30240-20	140 – 220	0.0068	220	0.068
32240-20	220 – 325	0.00446	243	0.032

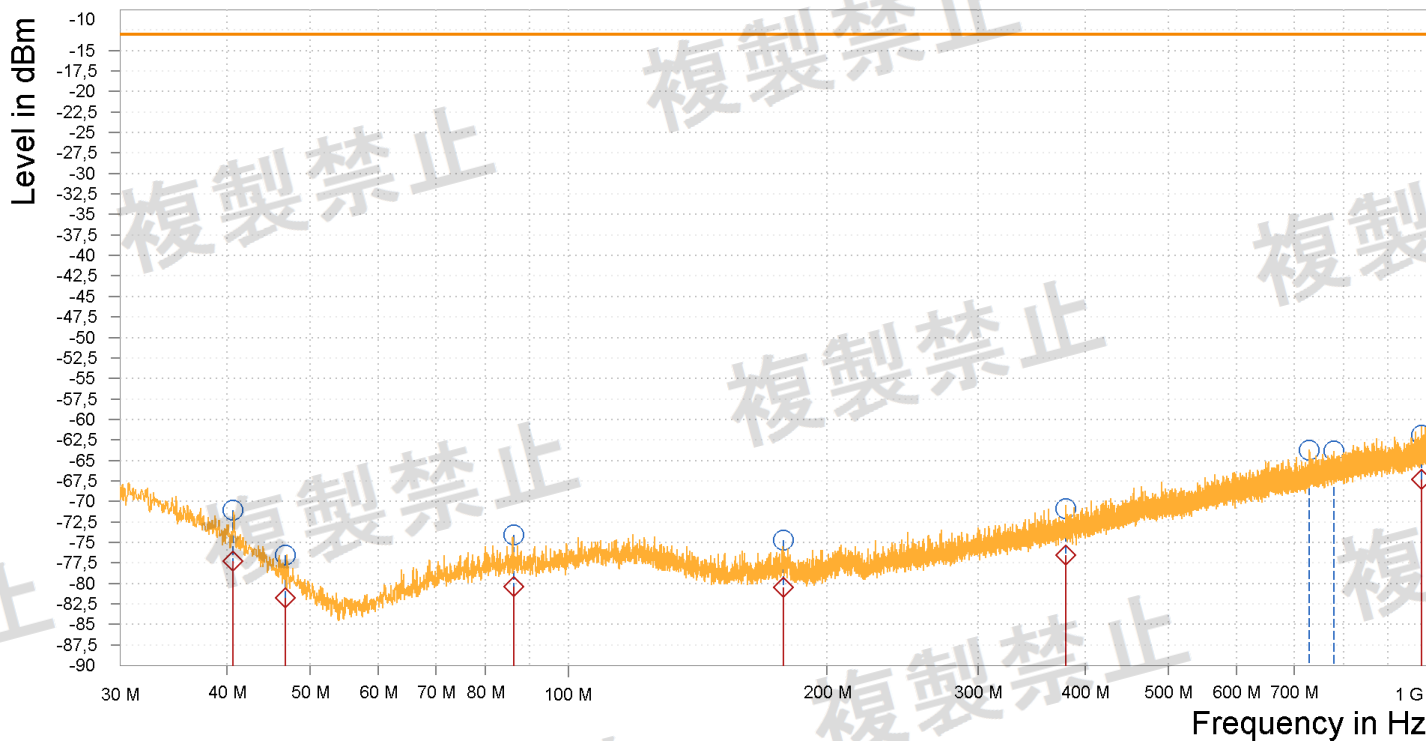
Used test distances

Up to 18 GHz: 3.00 m
18 – 60 GHz: 1.00 m
60 – 90 GHz: 1.50 m
90 – 110 GHz: 0.50 m
110 – 170 GHz: 0.25 m
In-band / OOB: 1.50 m

Test setup: 8.1 – 8.3
Test results:

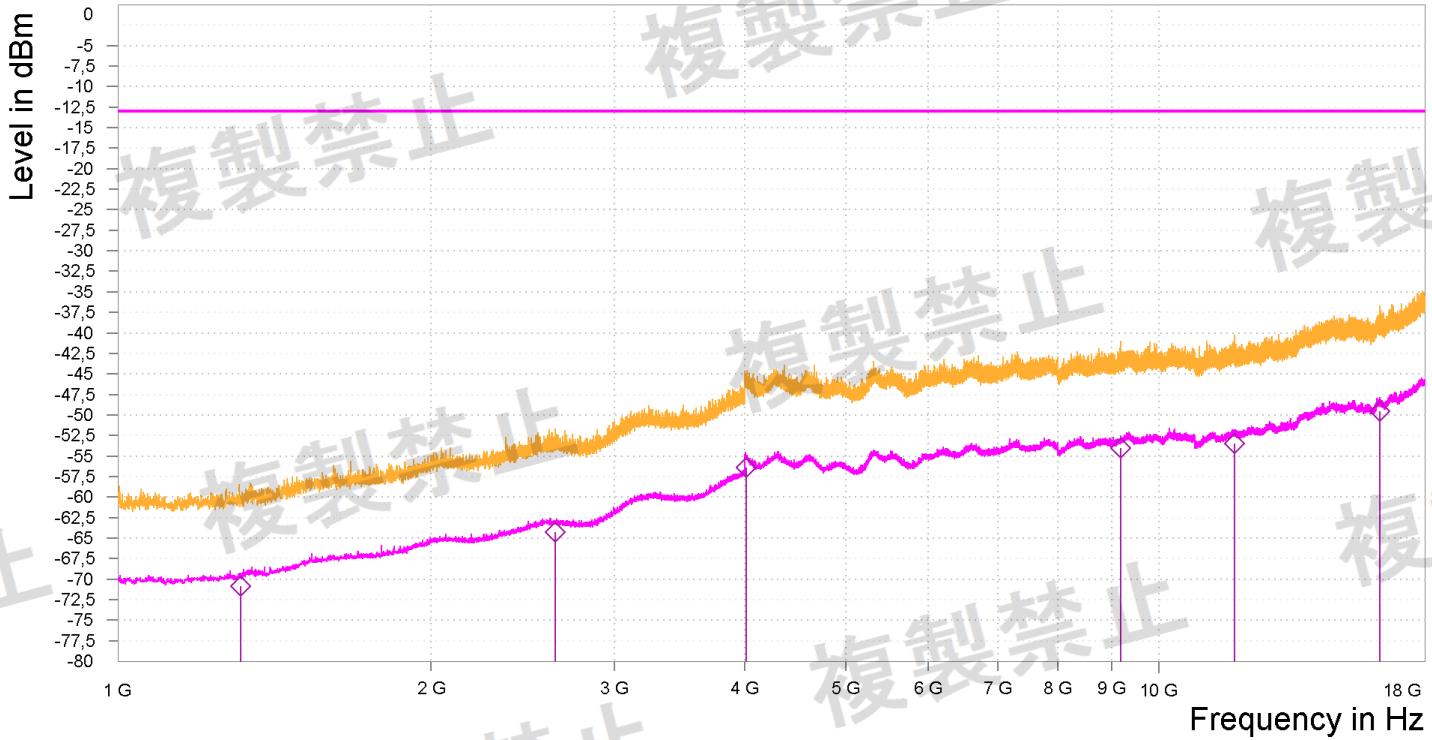
Channel / EUT Mode	Frequency [GHz]	Detector	Test distance [m]	Level [dBm]	Limit [dBm]	Margin [dB]
No critical peaks found. Please refer to plots.						
N/A	N/A	N/A	N/A	N/A	N/A	N/A

Plot no. 13: radiated emissions 30 MHz – 1 GHz, hor./vert. polarization, EUT #1



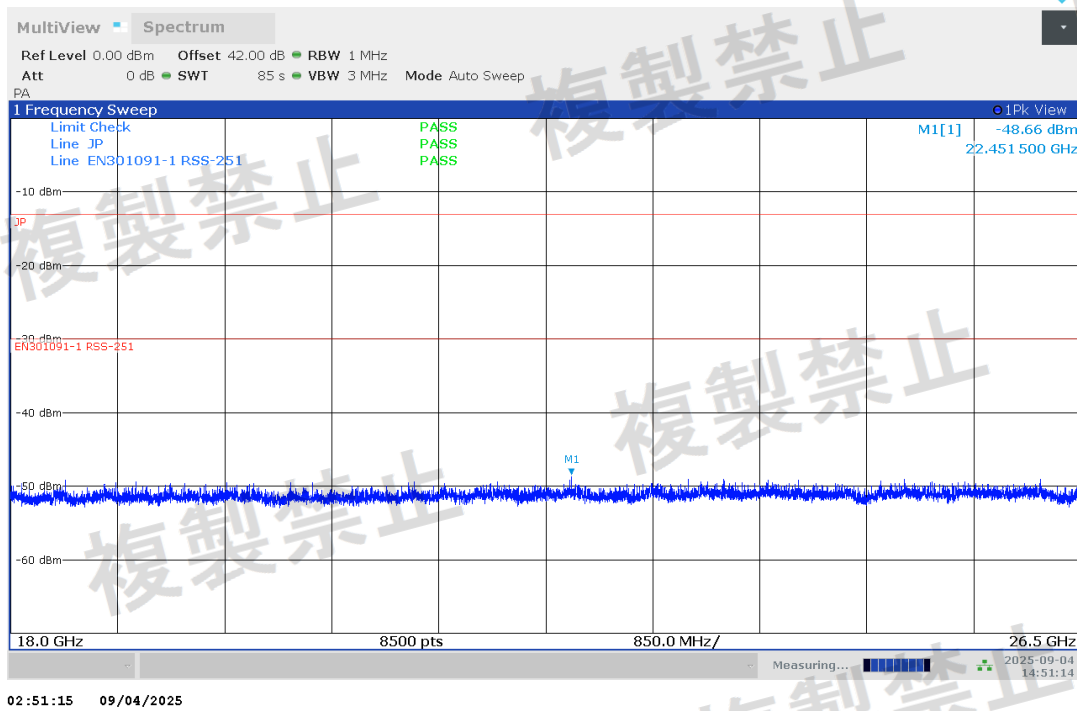
Rg	Frequency [MHz]	QPK Level [dBm]	Correction [dB]	Elevation [deg]	Azimuth [deg]	Antenna Height [m]	Time of Meas.
1	40,624	-77,29	26,35	1,1	347,2	1,50	09:06:30
1	46,805	-81,79	22,06	48,7	25	1,50	09:03:28
1	86,318	-80,42	23,16	3,4	212,3	1,50	09:00:35
1	178,006	-80,48	22,68	1,9	156,1	1,50	08:59:24
1	379,524	-76,51	26,60	14,3	354,8	1,50	09:01:51
1	985,618	-67,37	35,03	10,9	106,8	1,50	09:05:02

Plot no. 14: radiated emissions 1 GHz – 18 GHz, hor./vert. polarization, EUT #1

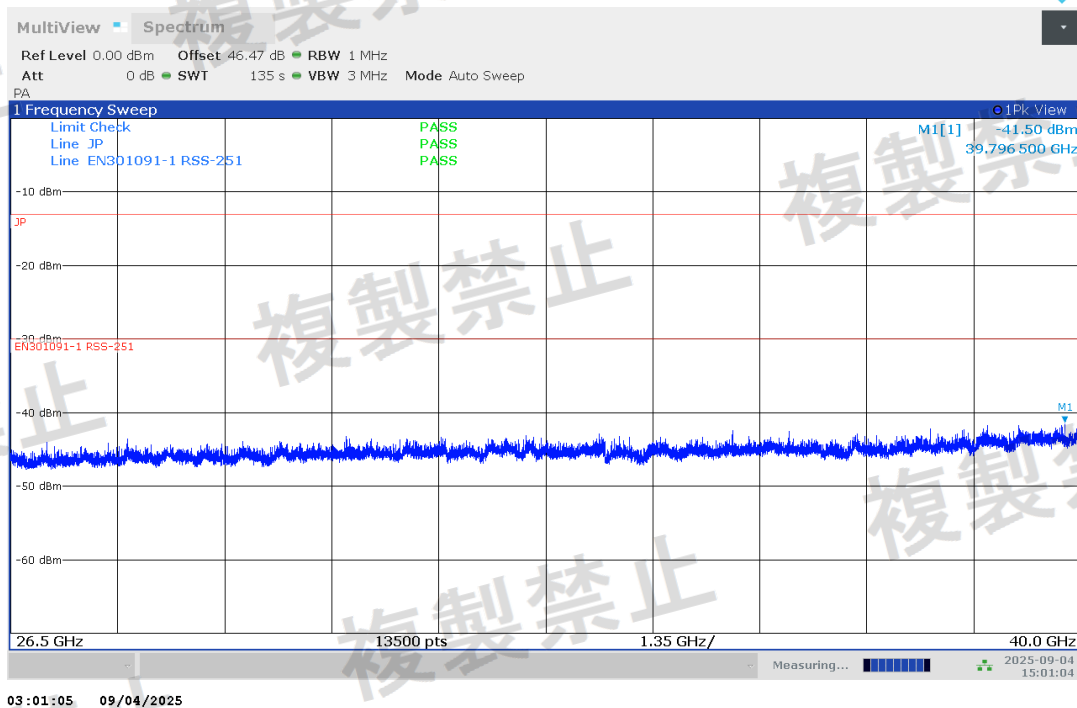


Rg	Frequency [MHz]	RMS Level [dBm]	RMS Limit [dBm]	RMS Margin [dB]	Correction [dB]	Elevation [deg]	Azimuth [deg]	Antenna Height [m]	Time of Meas.
1	1.311,900	-70,85	-13,00	57,85	36,71	5,1	317,3	1,50	10:30:54
1	2.629,100	-64,29	-13,00	51,29	41,82	10	364,7	1,50	10:33:21
1	4.015,200	-56,41	-13,00	43,41	45,07	10	79	1,50	10:32:08
1	9.194,400	-54,04	-13,00	41,04	49,12	100	239,2	1,50	10:35:53
1	11.813,800	-53,46	-13,00	40,46	49,61	98	2,9	1,50	10:34:49
1	16.309,700	-49,52	-13,00	36,52	53,65	10,1	311,2	1,50	10:29:57

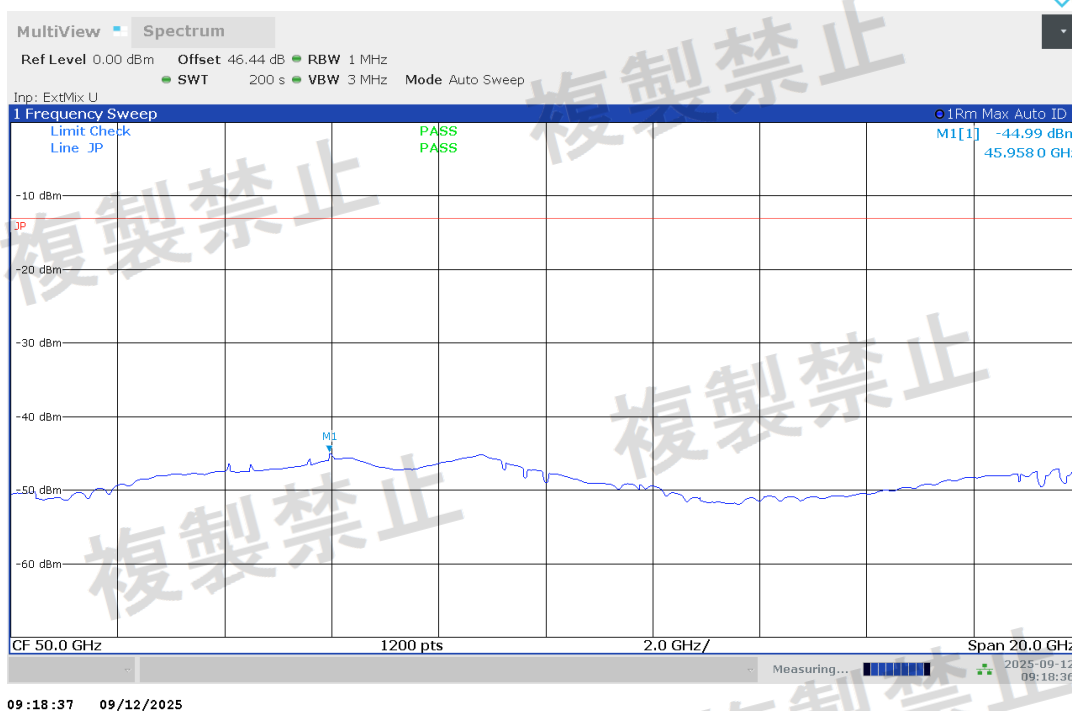
Plot no. 15: radiated emissions 18 GHz – 26.5 GHz, hor./vert. polarization, EUT #1



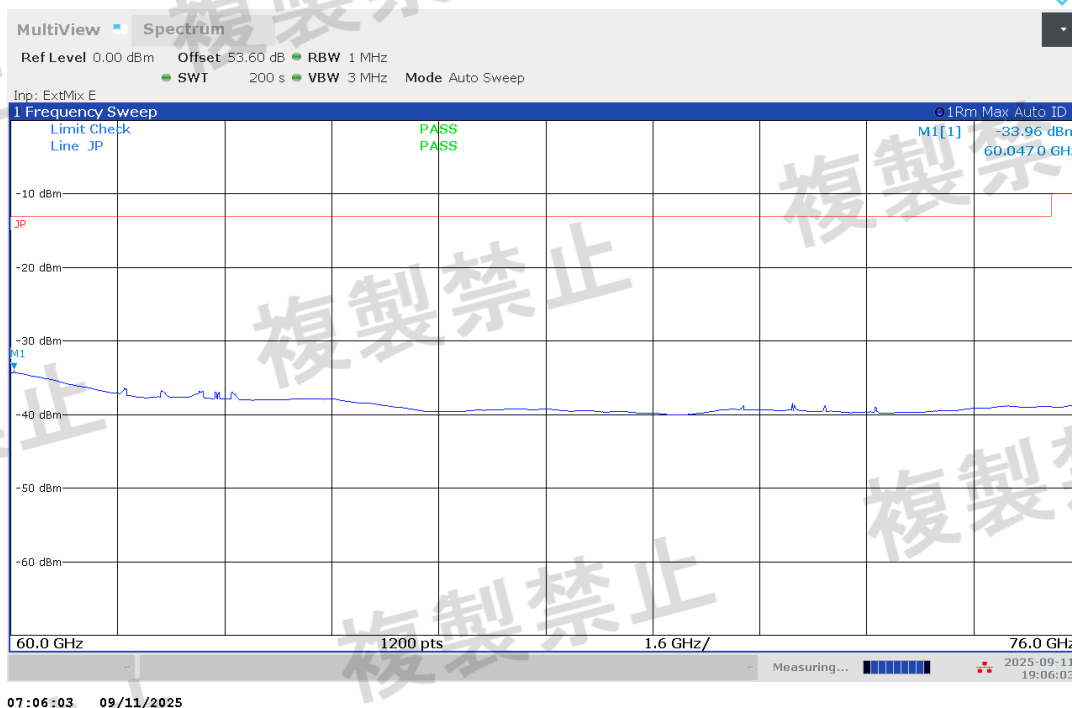
Plot no. 16: radiated emissions 26.5 GHz – 40 GHz, hor./vert. polarization, EUT #1



Plot no. 17: radiated emissions 40 GHz – 60 GHz, hor./vert. polarization, EUT #1



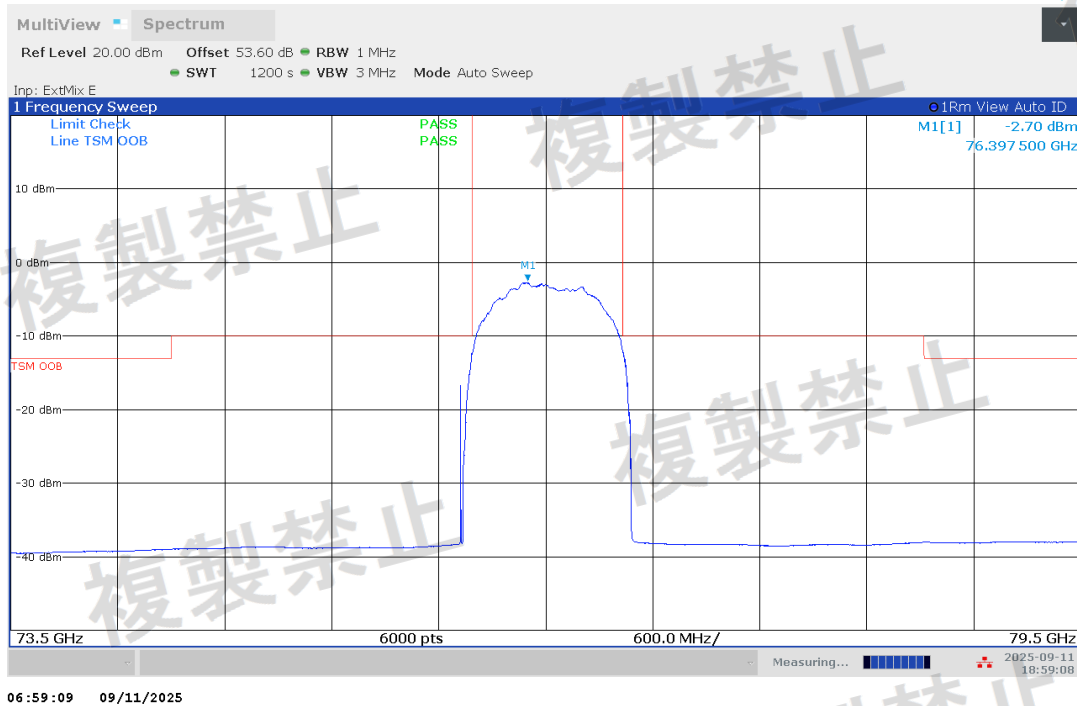
Plot no. 18: radiated emissions 60 GHz – 76 GHz, hor./vert. polarization, EUT #1



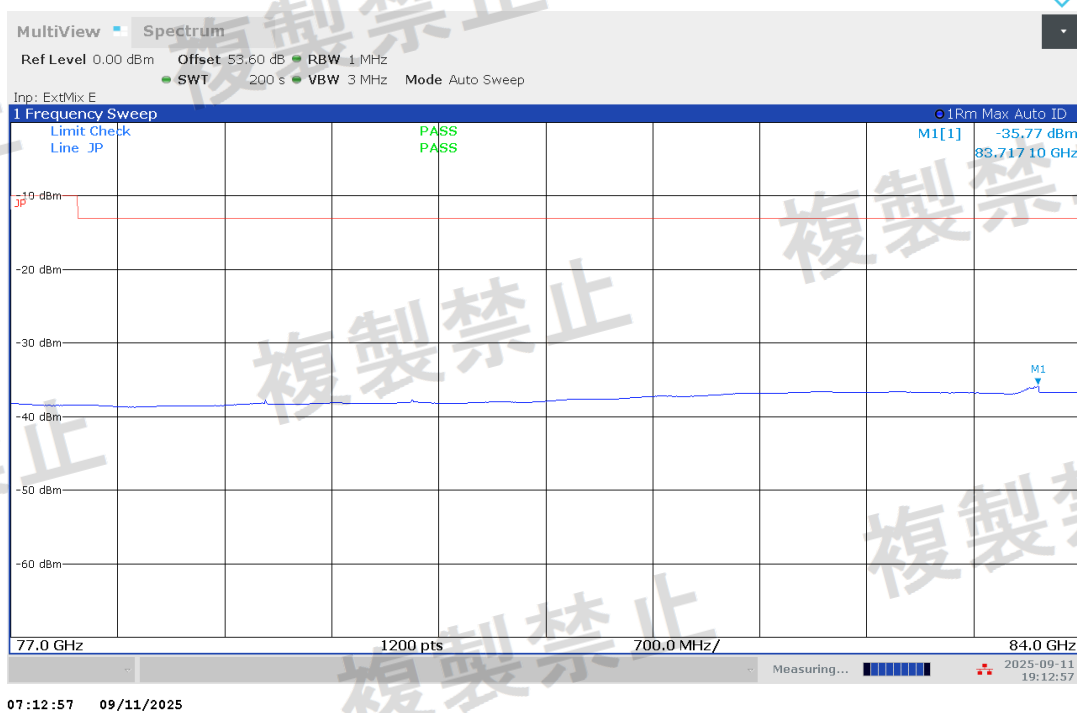
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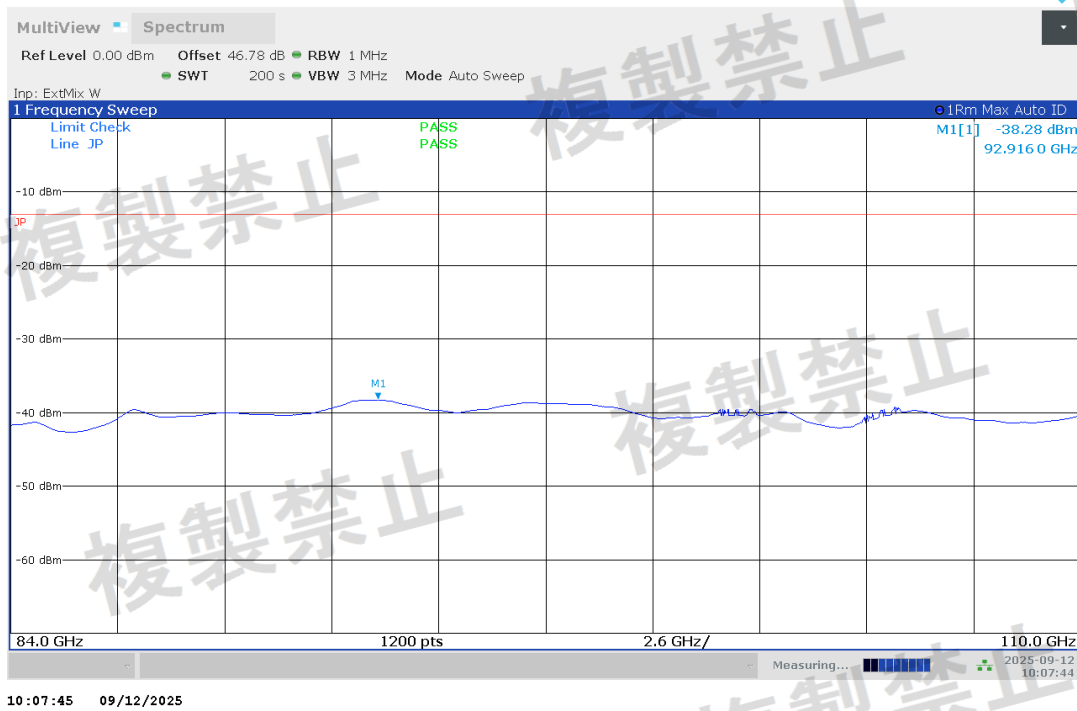
Plot no. 19: radiated emissions OOB, hor./vert. polarization, EUT #1



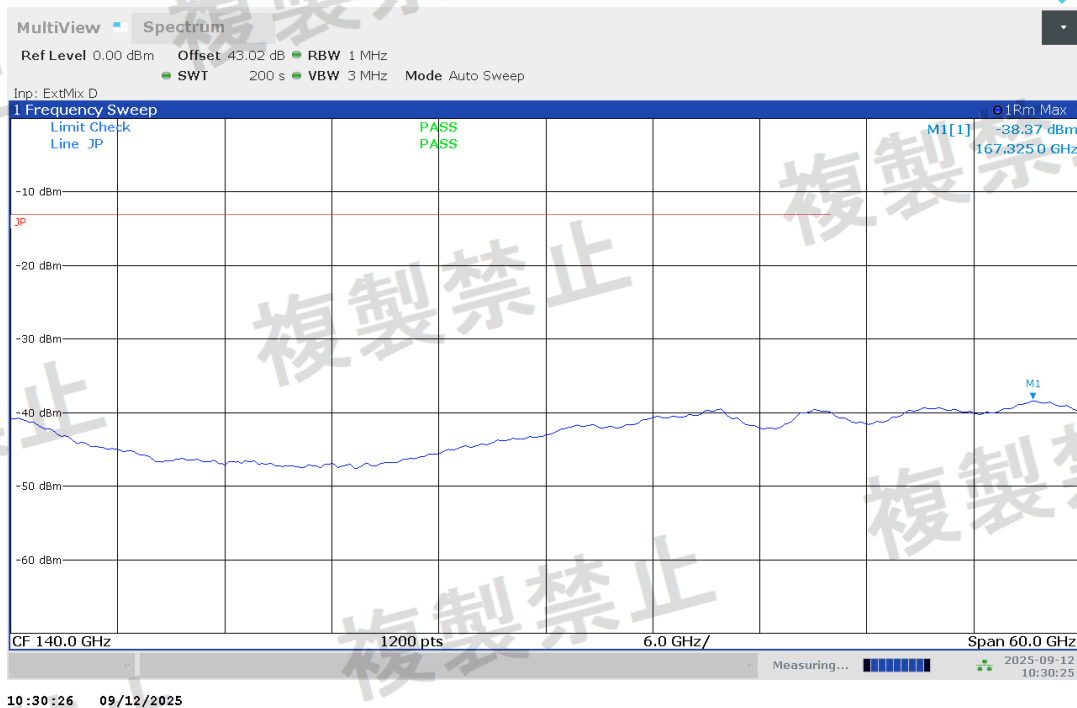
Plot no. 20: radiated emissions 77 GHz – 84 GHz, hor./vert. polarization, EUT #1



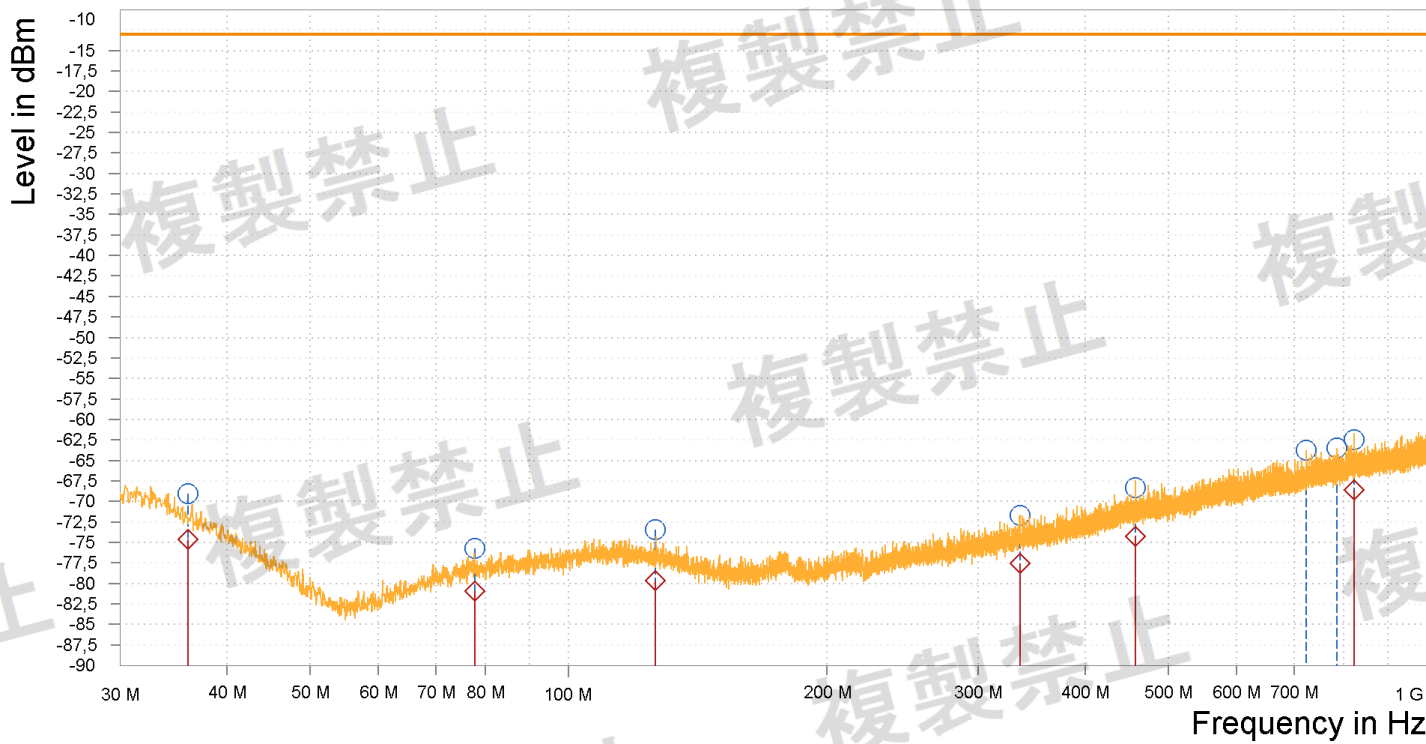
Plot no. 21: radiated emissions 84 GHz – 110 GHz, hor./vert. polarization, EUT #1



Plot no. 22: radiated emissions 110 GHz – 170 GHz, hor./vert. polarization, EUT #1

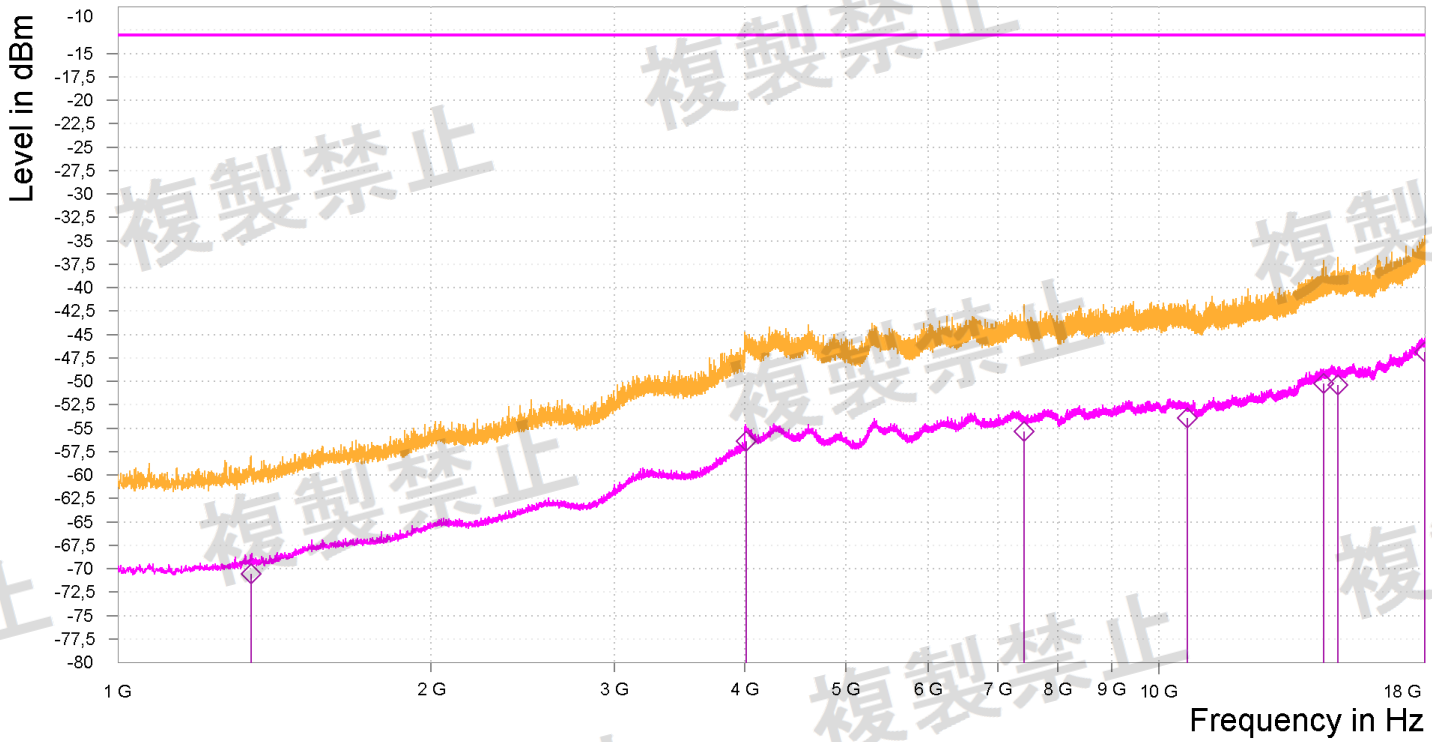


Plot no. 23: radiated emissions 30 MHz – 1 GHz, hor./vert. polarization, EUT #2



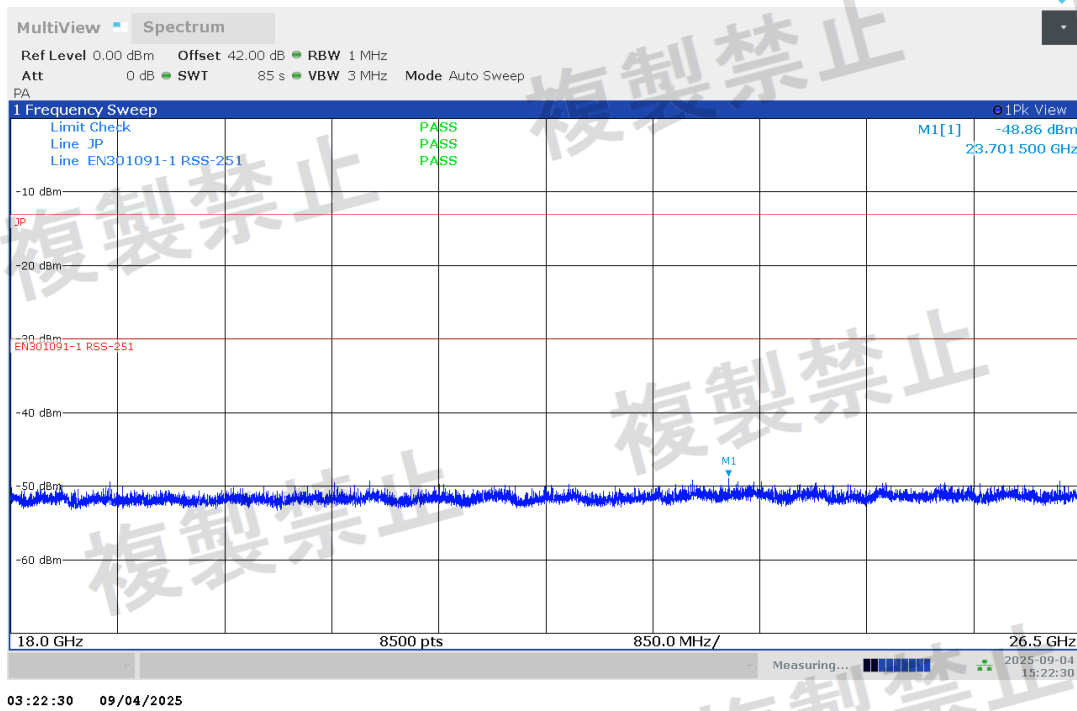
Rg	Frequency [MHz]	QPK Level [dBm]	Correction [dB]	Elevation [deg]	Azimuth [deg]	Antenna Height [m]	Time of Meas.
1	36,033	-74,61	29,12	105	27,2	1,50	09:17:03
1	77,718	-80,94	22,61	-15	-23	1,50	09:18:27
1	126,217	-79,67	23,71	57,3	-7	1,50	09:19:39
1	335,846	-77,53	25,58	92,3	47,3	1,50	09:22:25
1	457,538	-74,24	28,52	59,2	251,2	1,50	09:21:05
1	822,387	-68,62	33,64	60	74,3	1,50	09:16:00

Plot no. 24: radiated emissions 1 GHz – 18 GHz, hor./vert. polarization, EUT #2

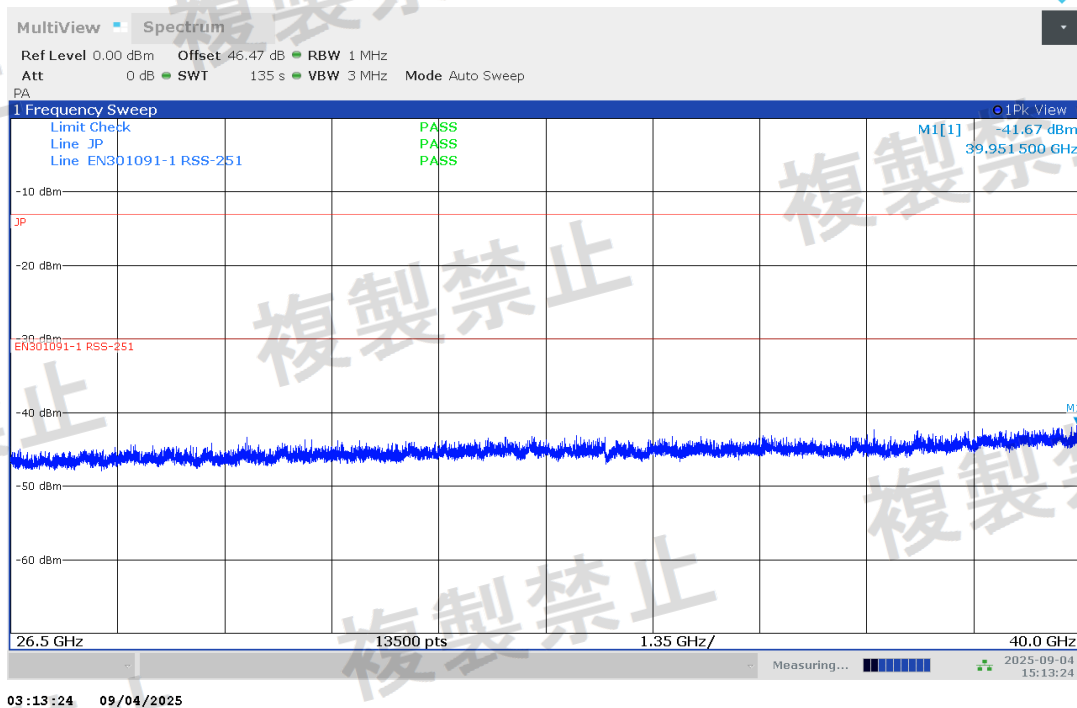


Rg	Frequency [MHz]	RMS Level [dBm]	RMS Limit [dBm]	RMS Margin [dB]	Correction [dB]	Elevation [deg]	Azimuth [deg]	Antenna Height [m]	Time of Meas.
1	1.343,100	-70,59	-13,00	57,59	36,83	55	18,1	1,50	09:42:47
1	4.013,400	-56,40	-13,00	43,40	45,07	80	106,5	1,50	09:43:58
1	7.423,600	-55,35	-13,00	42,35	47,89	90,1	66,4	1,50	09:45:06
1	10.641,400	-53,90	-13,00	40,90	49,46	54,8	13,8	1,50	09:41:42
1	14.397,900	-50,22	-13,00	37,22	52,77	10	146	1,50	09:38:07
1	14.843,600	-50,41	-13,00	37,41	52,97	-3,6	374,4	1,50	09:40:11
1	17.990,100	-46,87	-13,00	33,87	56,30	9,9	189,9	1,50	09:39:06

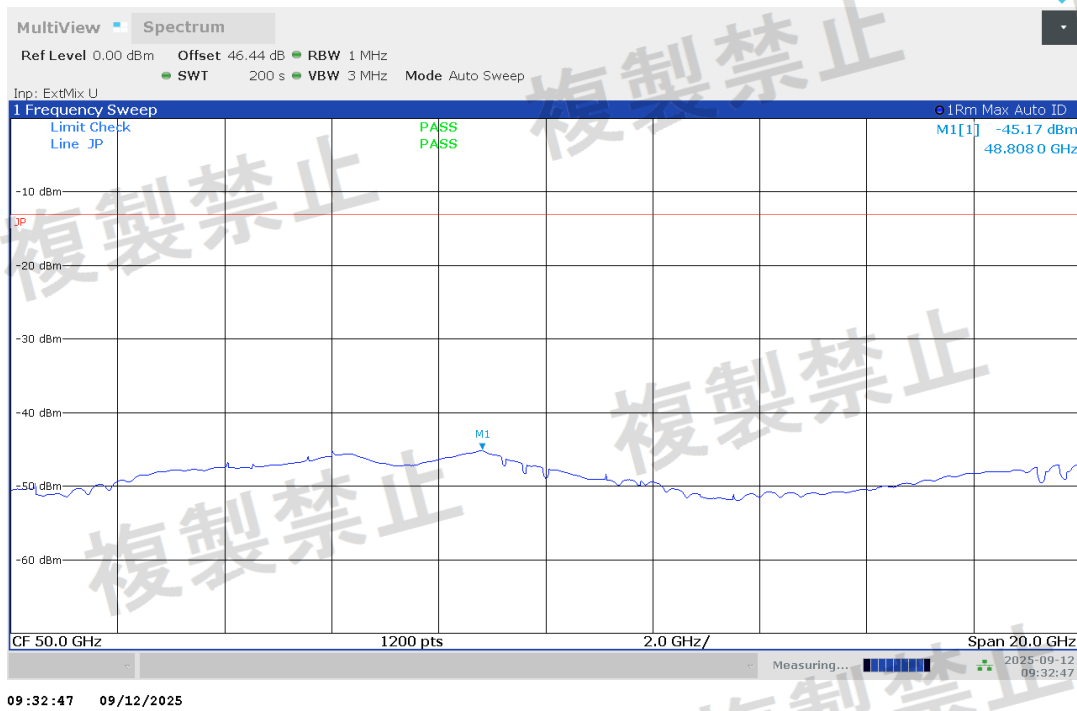
Plot no. 25: radiated emissions 18 GHz – 26.5 GHz, hor./vert. polarization, EUT #2



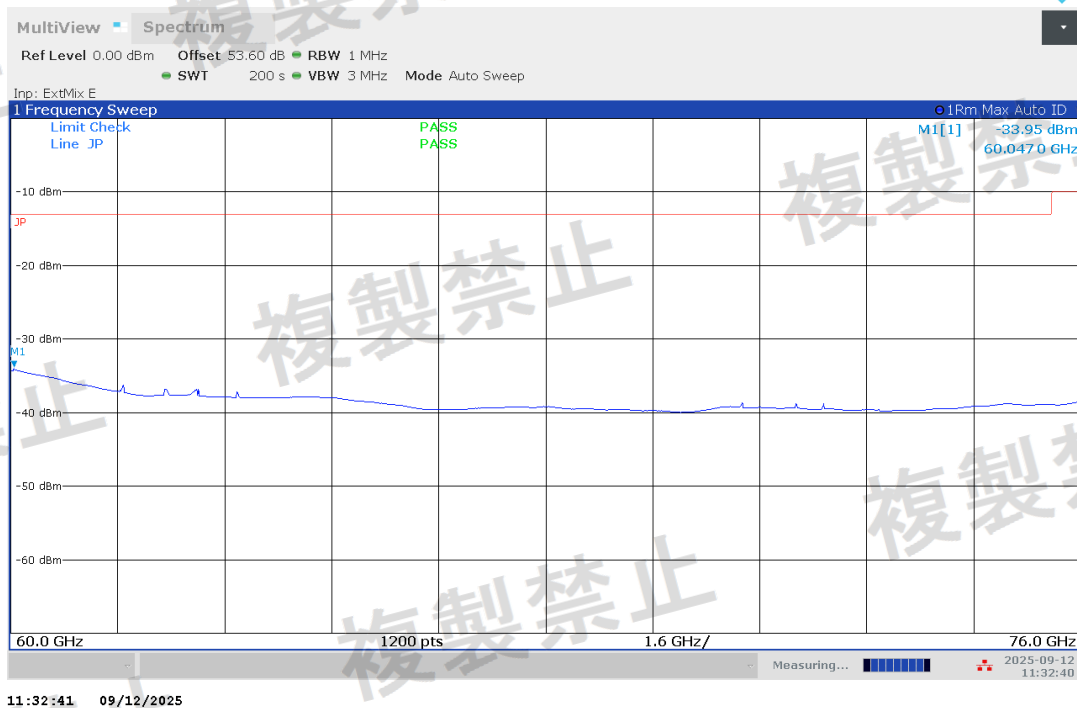
Plot no. 26: radiated emissions 26.5 GHz – 40 GHz, hor./vert. polarization, EUT #2



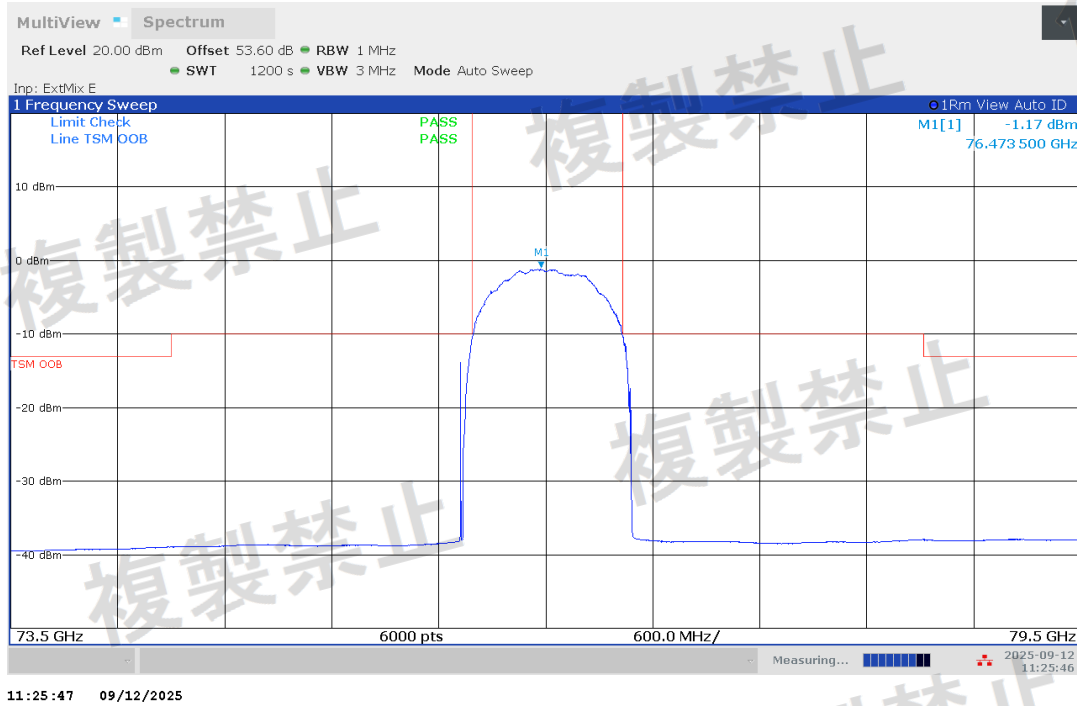
Plot no. 27: radiated emissions 40 GHz – 60 GHz, hor./vert. polarization, EUT #2



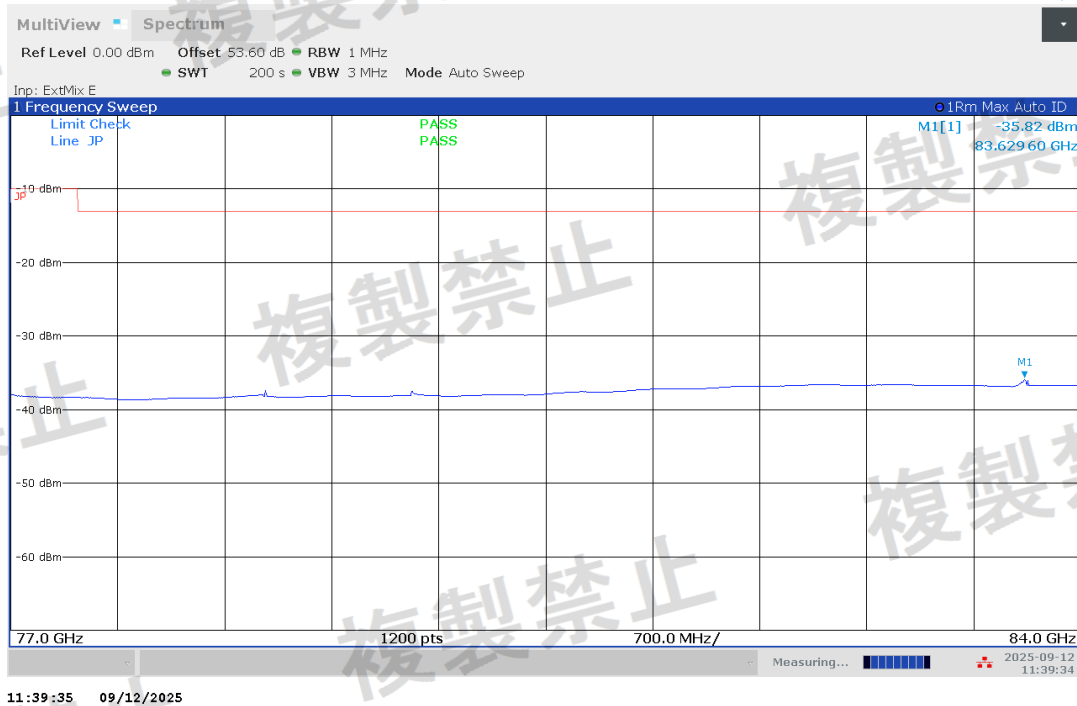
Plot no. 28: radiated emissions 60 GHz – 76 GHz, hor./vert. polarization, EUT #2



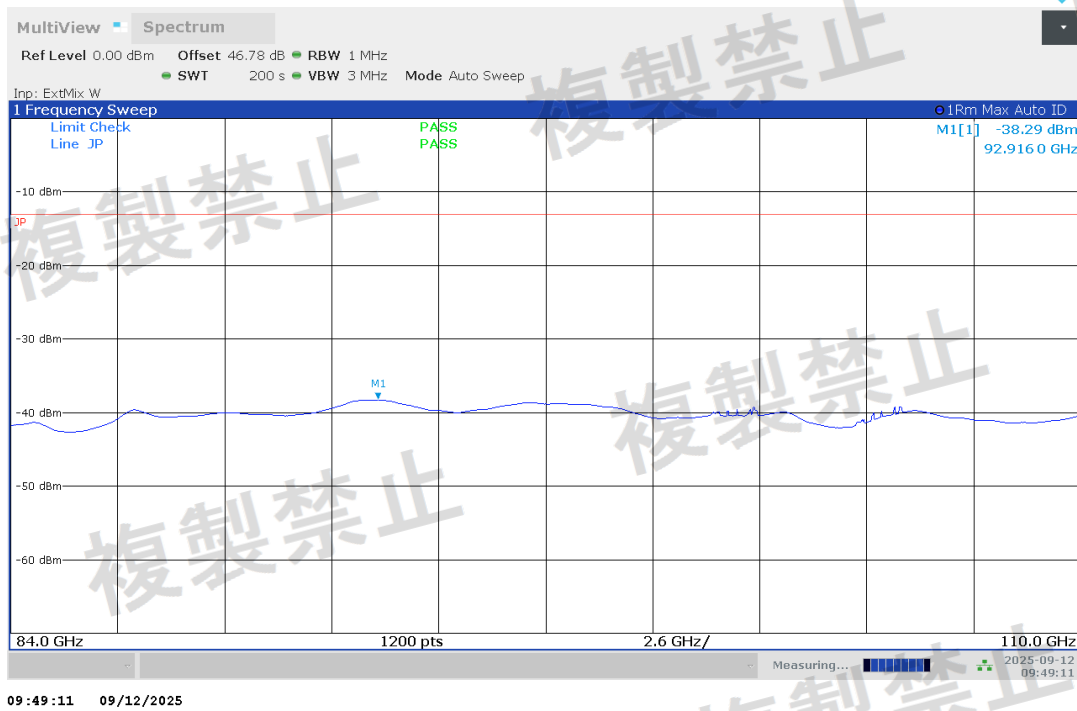
Plot no. 29: radiated emissions OOB, hor./vert. polarization, EUT #2



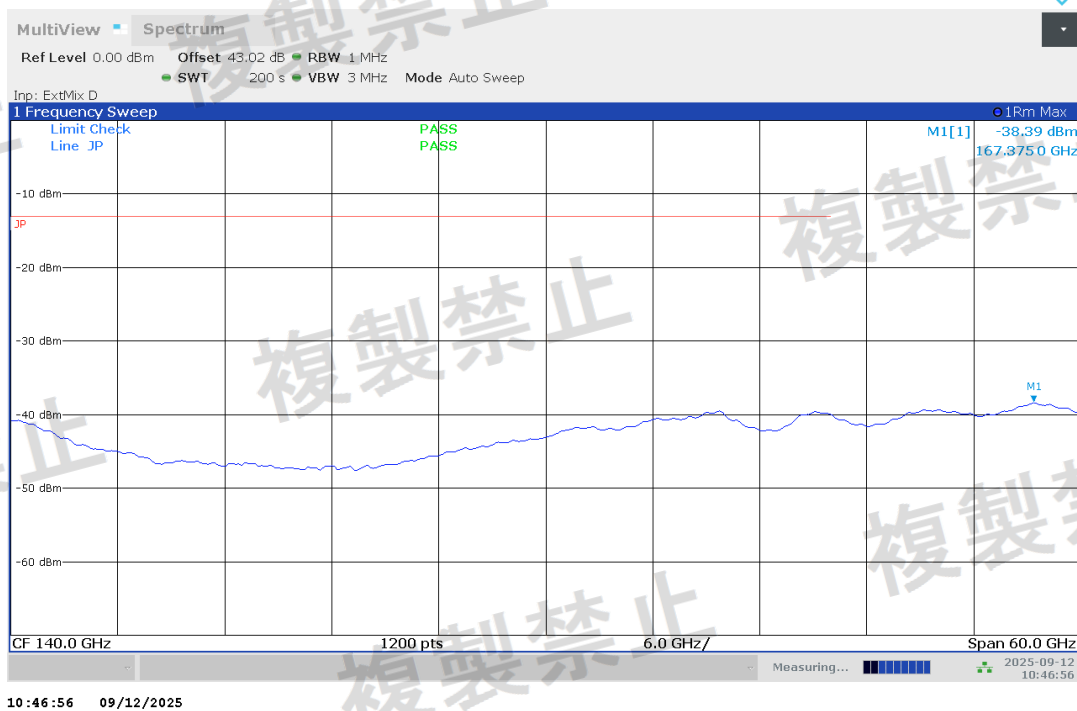
Plot no. 30: radiated emissions 77 GHz – 84 GHz, hor./vert. polarization, EUT #2



Plot no. 31: radiated emissions 84 GHz – 110 GHz, hor./vert. polarization, EUT #2



Plot no. 32: radiated emissions 110 GHz – 170 GHz, hor./vert. polarization, EUT #2



7.6 Automatic stop function radio waves (non-motion mode)**Description**

EUT may cease transmissions (if supported by EUT) or reduce the transmitter power when the car is moving less than e.g. 5 km/h or stops moving.

Note

Please refer to applicant's / manufacturer's documentation.

8 TEST SETUP DESCRIPTION

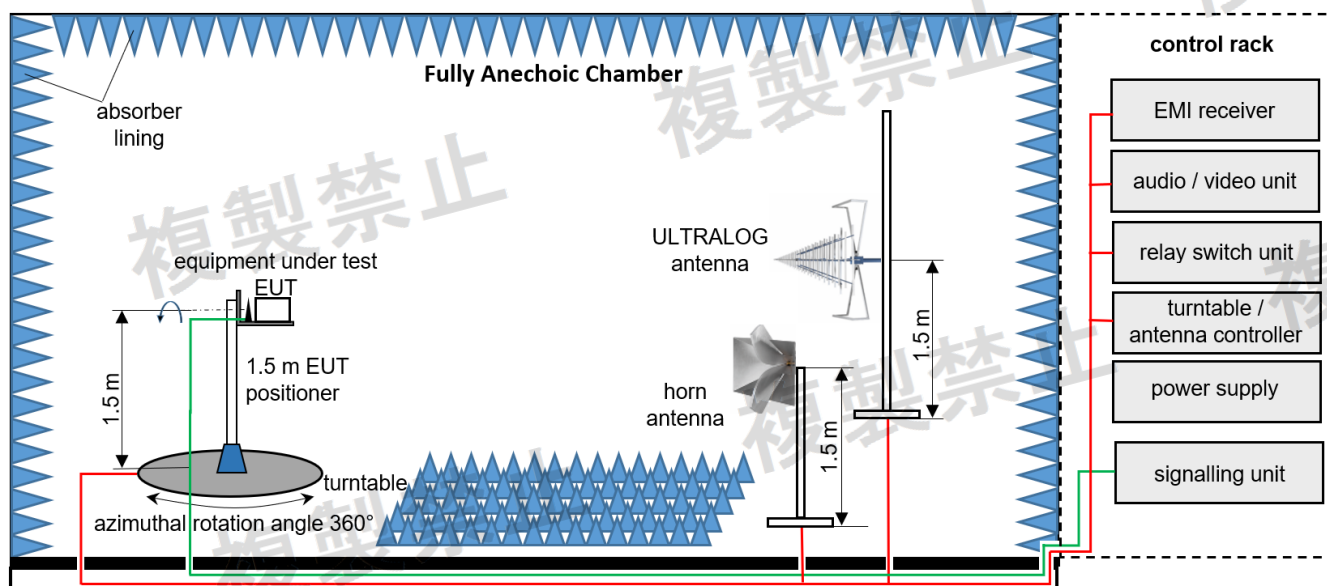
Typically, the calibrations of the test apparatus are commissioned to and performed by an accredited calibration laboratory. The calibration intervals are determined in accordance with the DIN EN ISO/IEC 17025. In addition to the external calibrations, the laboratory executes comparison measurements with other calibrated test systems or effective verifications. Cyclic chamber inspections and range calibrations are performed. Where possible, RF generating and signalling equipment as well as measuring receivers and analysers are connected to an external high-precision 10 MHz reference (GPS-based or rubidium frequency standard).

In order to simplify the identification of the equipment used at some special tests, some items of test equipment and ancillaries can be provided with an identifier or number in the equipment list below (Lab/Item).

Kind of calibration (abbreviations):

- C = calibrated
- CM = cyclic maintenance
- NR = not required
- L = locked

8.1 Fully Anechoic Chamber



Measurement distance: Ultralog antenna and horn antenna at 3 meters

EMC32 software version: 11.20.00

$$\text{ROP} = \text{AV} + \text{D} - \text{G} + \text{CA}$$

(ROP - radiated output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain+amplifier gain; CA-cable-loss signal path)

Example calculation:

$$\text{ROP} [\text{dBm}] = -65.0 [\text{dBm}] + 50 [\text{dB}] - 20 [\text{dBi}] + 5 [\text{dB}] = -30 [\text{dBm}] (1 \mu\text{W})$$

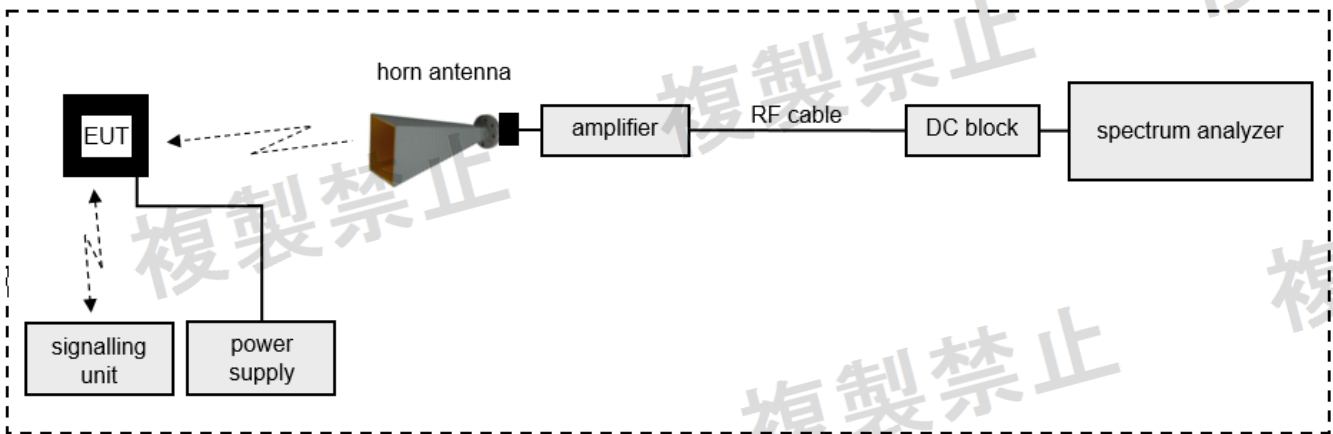
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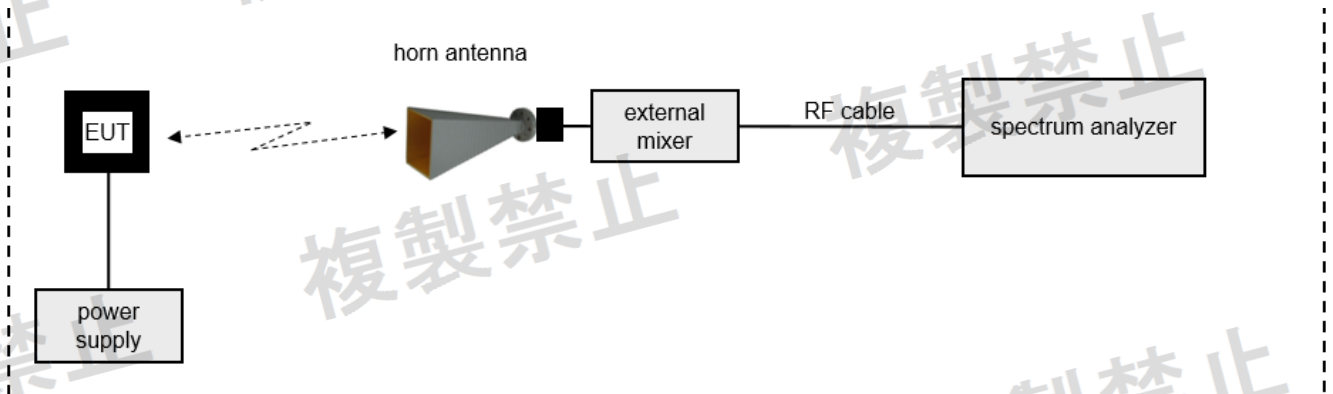
List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	Power Supply	Rohde & Schwarz	IN 600	101554	LAB000824	NR	–
2	Antenna	Rohde & Schwarz	HL562E	102173	LAB000673	C	2022-10-17 → 36M → 2025-10-17
3	Power Supply	Chroma	61602		LAB000507	NR	–
4	EMI Test Receiver	Rohde & Schwarz	ESW26	101517	LAB000363	C	2025-01-10 → 12M → 2026-01-10
5	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PSI 9080-40 T	2000230001	LAB000313	NR	–
6	Test table	innco systems GmbH	PT1208-080-RH	-	LAB000306	NR	–
7	Antenna Mast	Berlebach	Tripod HFH2-Z8 & -Z9	101762	LAB000292	NR	–
8	Positioner	matur GmbH	TD 1.5-10KG		LAB000258	NR	–
9	Compressed Air	Implotex	1-850-30	-	LAB000256	NR	–
10	Semi/Fully Anechoic Chamber	Albatross Projects GmbH	Babylon 5 (SAC 5)	20168.PRB	LAB000235	CM	2025-03-18 → 36M → 2028-03-18
11	Measurement Software	Rohde & Schwarz	EMC32 V11.20		LAB000226	NR	–
12	Turntable	matur GmbH	TT2.0-2t	TT2.0-2t/921	LAB000225	NR	–
13	Antenna Mast	matur GmbH	CAM4.0-P	CAM4.0-P/316	LAB000224	NR	–
14	Antenna Mast	matur GmbH	BAM4.5-P	BAM4.5-P/272	LAB000223	NR	–
15	Controller	matur GmbH	FCU 3.0	10082	LAB000222	NR	–
16	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350292	LAB000191	NR	–
17	Pre-Amplifier	Schwarzbeck Mess-Elektronik OHG	BBV 9718 C	84	LAB000169	CM	0000-00-00 → 12M →
18	Antenna	Rohde & Schwarz	HF907	102899	LAB000151	C	2023-05-15 → 36M → 2026-05-15
19	Antenna	Rohde & Schwarz	HL562E	102005	LAB000150	C	2022-12-22 → 36M → 2025-12-22
20	Open Switch and Control Platform	Rohde & Schwarz	OSP220 Base Unit 2HU	101748	LAB000149	NR	–
21	Antenna	Rohde & Schwarz	HFH2-Z2E	100954	LAB000108	C	2025-06-24 → 24M → 2027-06-24

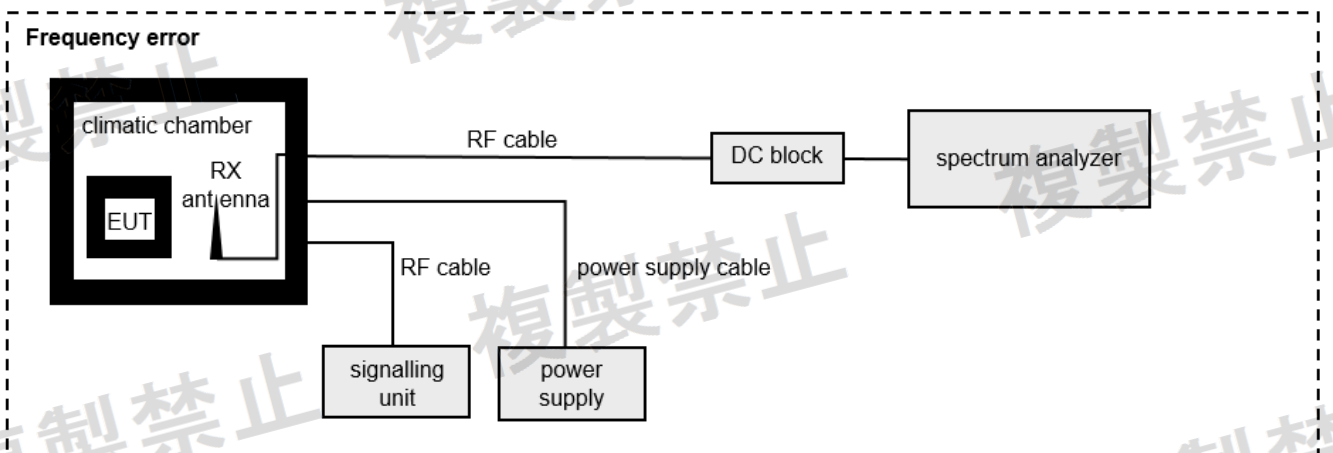
8.2 Radiated measurements > 18 GHz



8.3 Radiated measurements > 50 GHz



8.4 Radiated measurements under extreme conditions



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 $ROP = AV + D - G$

(ROP -rad. output power; AV-analyzer value; D-free field attenuation of measurement distance; G-antenna gain)

Example calculation:
 $ROP \text{ [dBm]} = -54.0 \text{ [dBm]} + 64.0 \text{ [dB]} - 20.0 \text{ [dBi]} = -10 \text{ [dBm]} \text{ (100 } \mu\text{W)}$

Note: conversion loss of mixer is already included in analyzer value.

List of test equipment used:

No.	Equipment	Manufacturer	Type	Serial No.	IBL No.	Kind of Calibration	Last / Next Calibration
1	Antenna	Flann Microwave Ltd	24240-20 (40.0-60.0 GHz)	275176	LAB000376	CM	2026-05-21 → 12M → 2027-05-21
2	Harmonic Mixer	Rohde & Schwarz	FS-Z060	101350	LAB000375	C	2025-04-15 → 12M → 2026-04-15
3	Absorber	Telemeter Electronic	EPP 12	-	LAB000327	NR	-
4	Test table	innco systems GmbH	PT0707-RH light	-	LAB000303	NR	-
5	Filter (Coax/WG, LPF, HPF, Band)	TTE	10-WHPF-84.5-UG387	-	LAB000299	NR	-
6	Antenna	Flann Microwave Ltd	570240-20 (325-500 GHz)	226025	LAB000228	CM	2025-05-21 → 12M → 2026-05-21
7	Power Supply	Elektro-Automatik GmbH & Co. KG	EA-PS 2042-10 B	2878350255	LAB000189	NR	-
8	WG-Coax-Adapter	Flann Microwave Ltd	23373-TF30 UG383/U	273384	LAB000184	CM	2025-06-24 → 12M → 2026-06-24
9	WG-Coax-Adapter	Flann Microwave Ltd	22093-TF30 UG599/U	273263	LAB000183	CM	2025-06-24 → 12M → 2026-06-24
10	WG-Coax-Adapter	Flann Microwave Ltd	20093-TF30 UBR220	273373	LAB000180	CM	2025-06-24 → 12M → 2026-06-24
11	Antenna	Flann Microwave Ltd	30240-20 (140-220 GHz)	273390	LAB000178	CM	2025-05-21 → 12M → 2026-05-21
12	Antenna	Flann Microwave Ltd	28240-20 (90.0-140 GHz)	273371	LAB000176	CM	2025-05-21 → 12M → 2026-05-21
13	Coaxial Cable	Huber & Suhner	SF101/1.0m	503989/1	LAB000163	CM	2025-04-25 → 12M → 2026-04-25
14	Coaxial Cable	Rosenberger	LU7-022-1000	34	LAB000154	CM	2025-04-25 → 12M → 2026-04-25
15	Coaxial Cable	Rosenberger	LU7-022-1000	33	LAB000153	CM	2025-04-25 → 12M → 2026-04-25
16	Antenna	Flann Microwave Ltd	32240-20 (220-325 GHz)	273469	LAB000152	CM	2025-05-21 → 12M → 2026-05-21
17	Antenna	Flann Microwave Ltd	29240-20 (110-170 GHz)	273382	LAB000139	CM	2025-05-21 → 12M → 2026-05-21
18	Antenna	Flann Microwave Ltd	27240-20 (75.0-110 GHz)	273367	LAB000137	CM	2025-05-21 → 12M → 2026-05-21
19	Antenna	Flann Microwave Ltd	26240-20 (60.0-90.0 GHz)	273417	LAB000135	CM	2025-05-21 → 12M → 2026-05-21
20	Antenna	Flann Microwave Ltd	25240-20 (50.0-75.0 GHz)	272860	LAB000133	CM	2025-05-21 → 12M → 2026-05-21
21	Antenna	Flann Microwave Ltd	23240-20 (33.0-50.0 GHz)	273431	LAB000131	CM	2025-05-21 → 12M → 2026-05-21
22	Antenna	Flann Microwave Ltd	22240-20 (26.5-40.0 GHz)	270448	LAB000130	CM	2025-05-21 → 12M → 2026-05-21
23	Antenna	Flann Microwave Ltd	20240-20 (18.0-26.5 GHz)	266402	LAB000127	CM	2025-05-21 → 12M → 2026-05-21
24	Harmonic Mixer	Rohde & Schwarz	FS-Z170	100996	LAB000126	C	2025-05-26 → 12M → 2026-05-26
25	Harmonic Mixer	Rohde & Schwarz	FS-Z325	101015	LAB000117	C	2025-04-09 → 12M → 2026-04-09
26	Harmonic Mixer	Rohde & Schwarz	FS-Z220	101039	LAB000116	C	2025-04-25 → 12M → 2026-04-25
27	Harmonic Mixer	Rohde & Schwarz	FS-Z140	101144	LAB000115	C	2025-04-09 → 12M → 2026-04-09
28	Harmonic Mixer	Rohde & Schwarz	FS-Z110	102000	LAB000114	C	2025-05-21 → 12M → 2026-05-21
29	Harmonic Mixer	Rohde & Schwarz	FS-Z090	102020	LAB000113	C	2025-05-07 → 12M → 2026-05-07
30	Harmonic Mixer	Rohde & Schwarz	FS-Z075	102015	LAB000112	C	2025-05-16 → 12M → 2026-05-16
31	Spectrum Analyser	Rohde & Schwarz	FSW50	101450	LAB000111	C	2025-06-12 → 12M → 2026-06-12
32	Antenna Mast	Schwarzbeck Mess-Elektronik OHG	AM 9104	99	LAB000109	NR	-
33	Multimeter	Keysight	U1242B	MY59110034	LAB000009	C	2025-09-05 → 12M → 2026-09-05

9 MEASUREMENT UNCERTAINTIES

Radio frequency	$\leq \pm 10$ ppm
Radiated emission	$\leq \pm 6$ dB
Temperature	$\leq \pm 1$ °C
Humidity	$\leq \pm 5$ %
DC and low frequency voltages	$\leq \pm 3$ %

The indicated expanded measurement uncertainty corresponds to the standard measurement uncertainty for the measurement results multiplied by the coverage factor $k = 2$. It was determined in accordance with EA-4/01 m:2013. The true value is located in the corresponding interval with a probability of 95 %.

Annex 1 EUT Photographs, external

Photo No. 1:

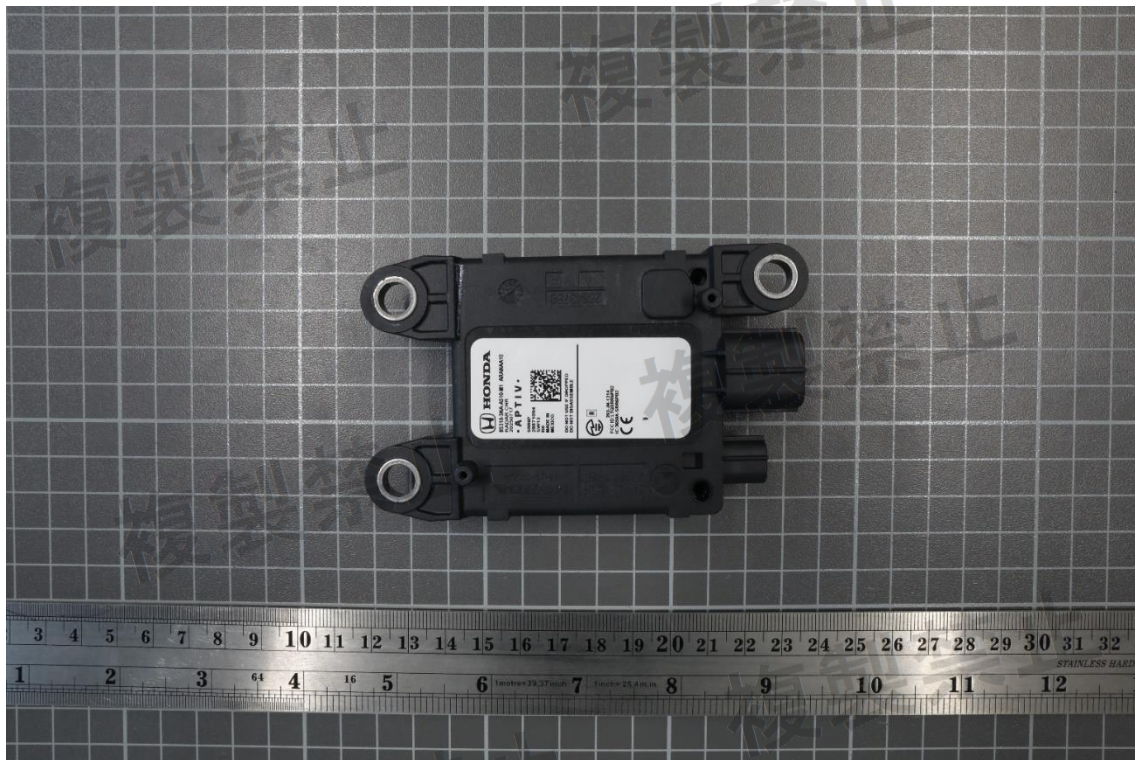


Photo No. 2:

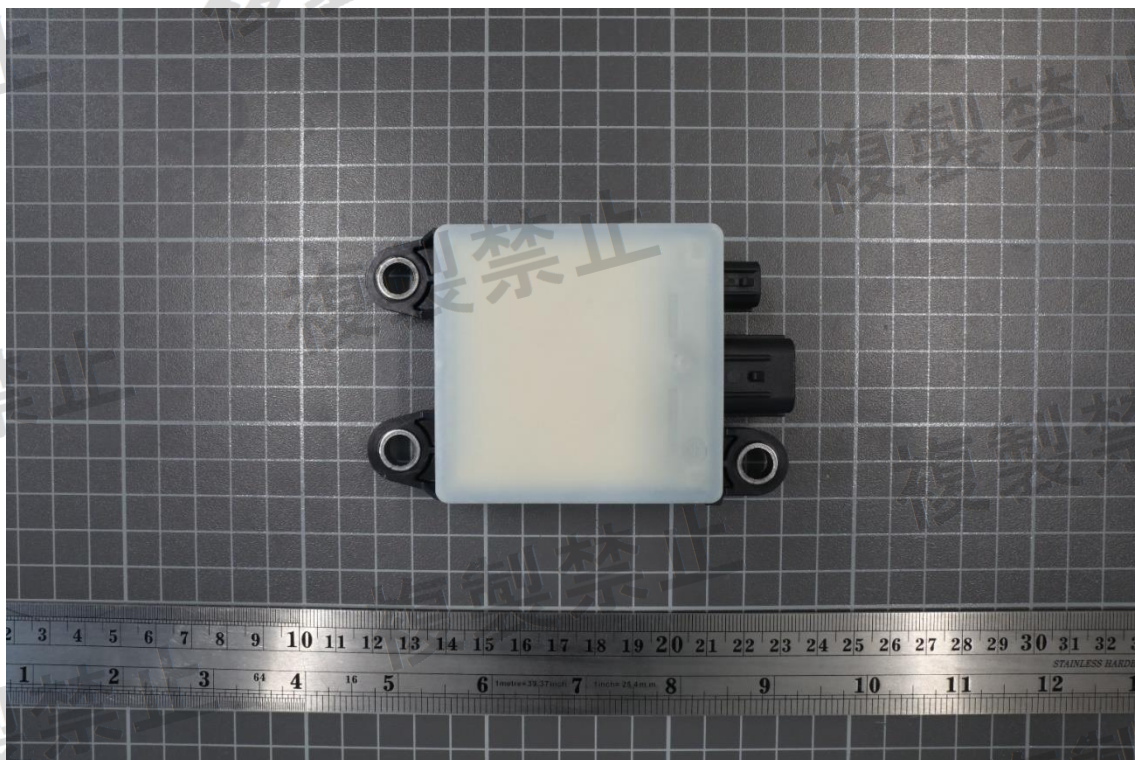


Photo No. 3:

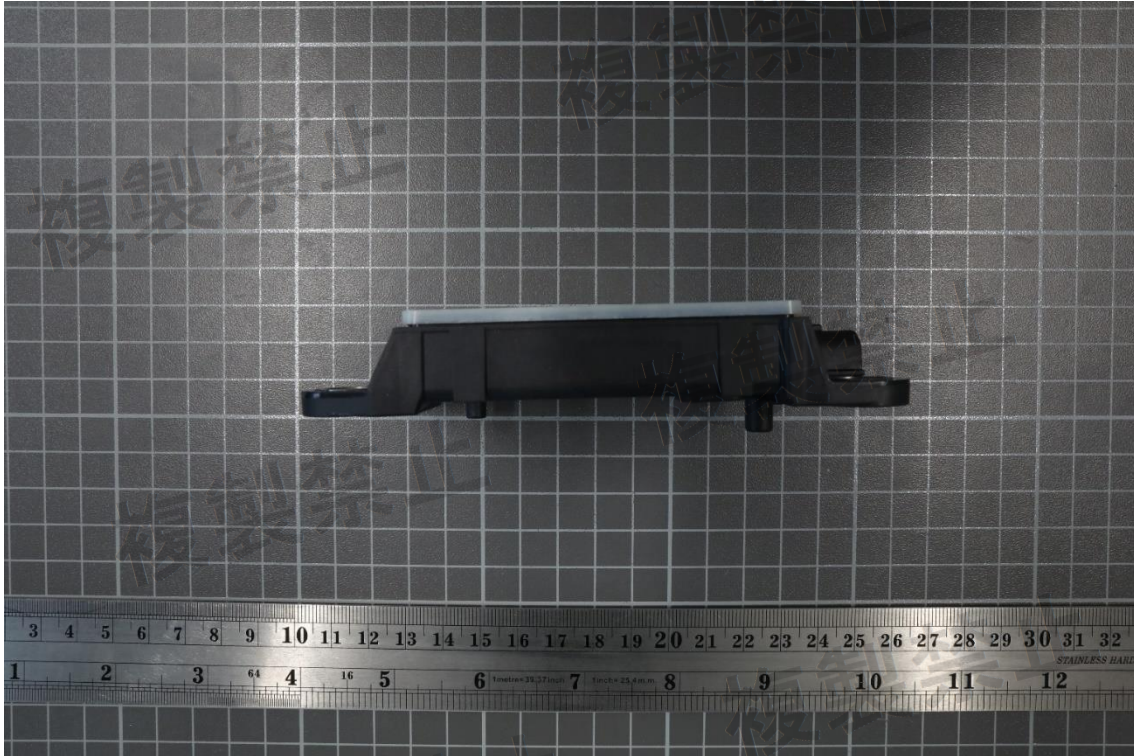


Photo No. 4:



Photo No. 5:



Photo No. 6:



Photo No. 7:

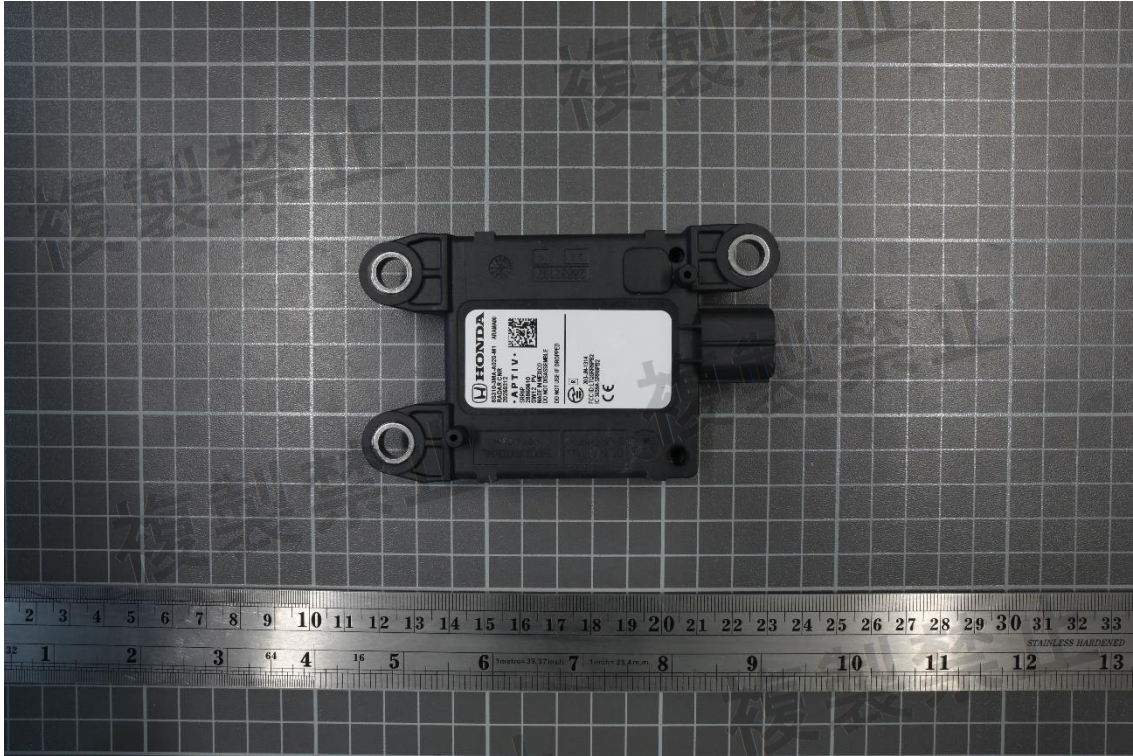


Photo No. 8:

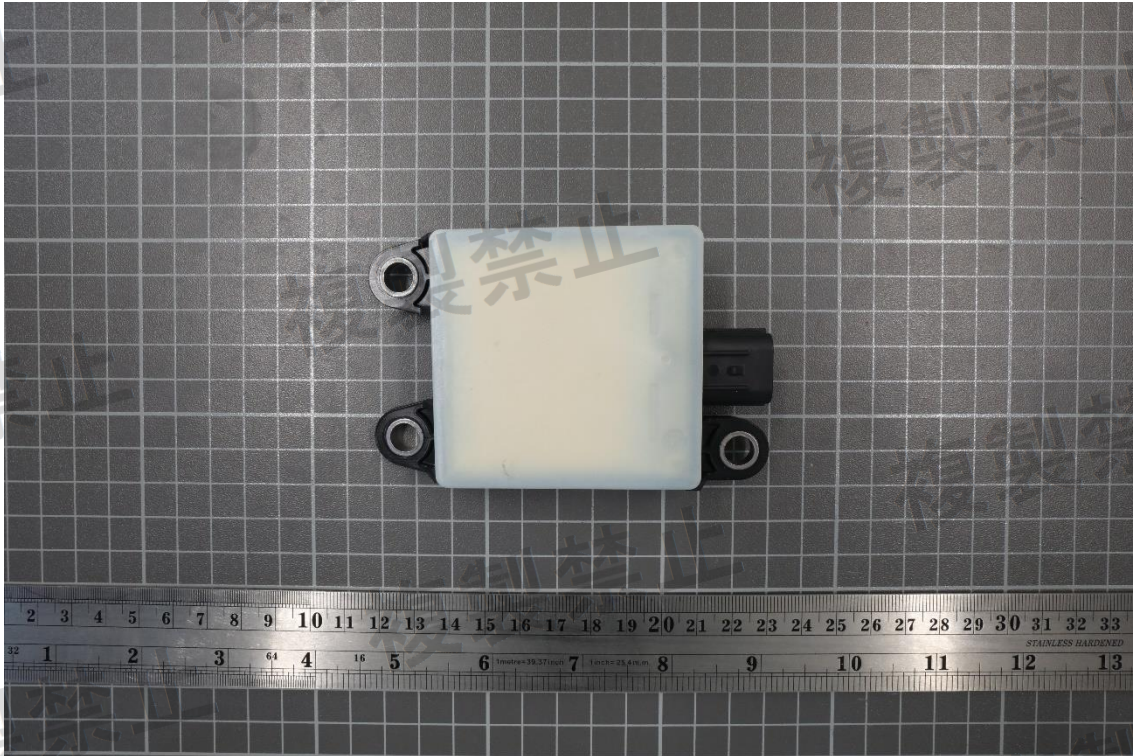


Photo No. 9:



Photo No. 10:

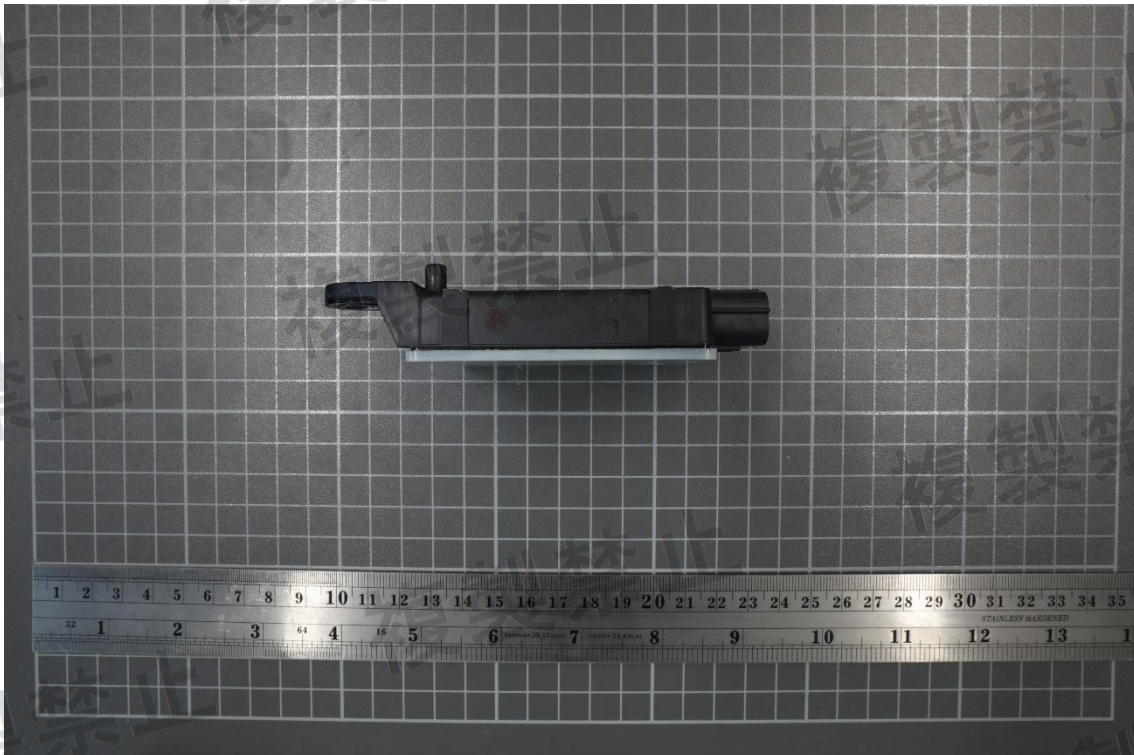


Photo No. 11:

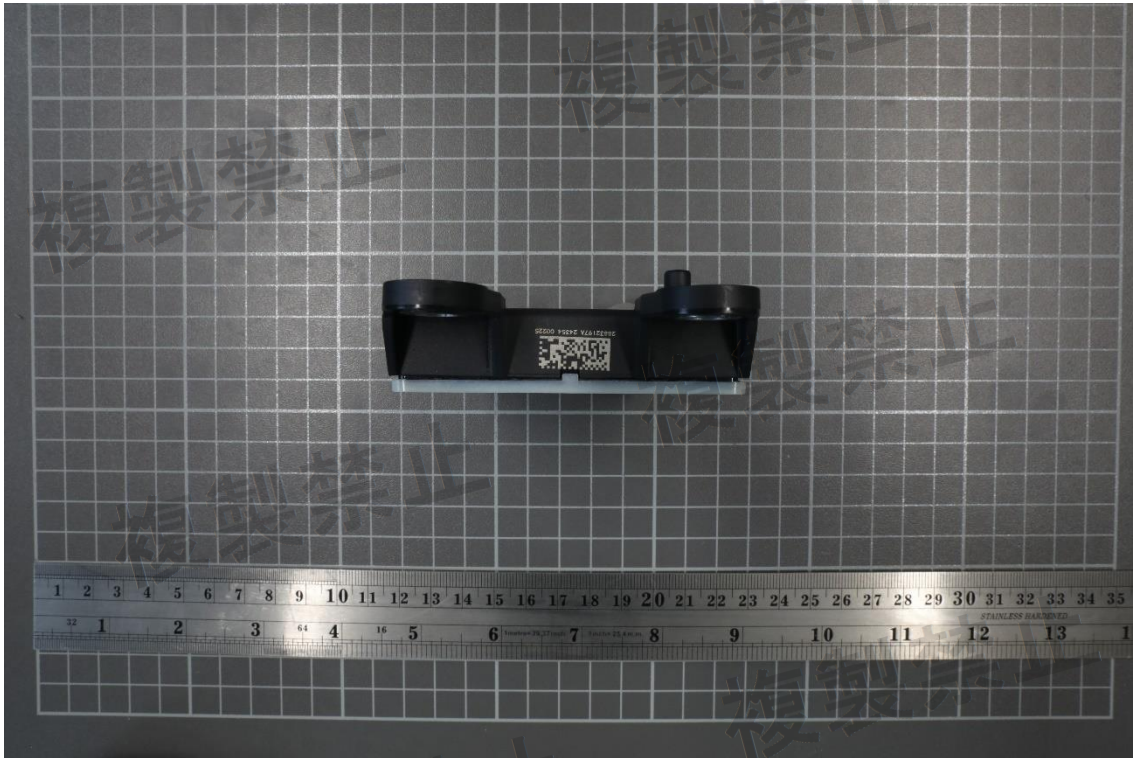
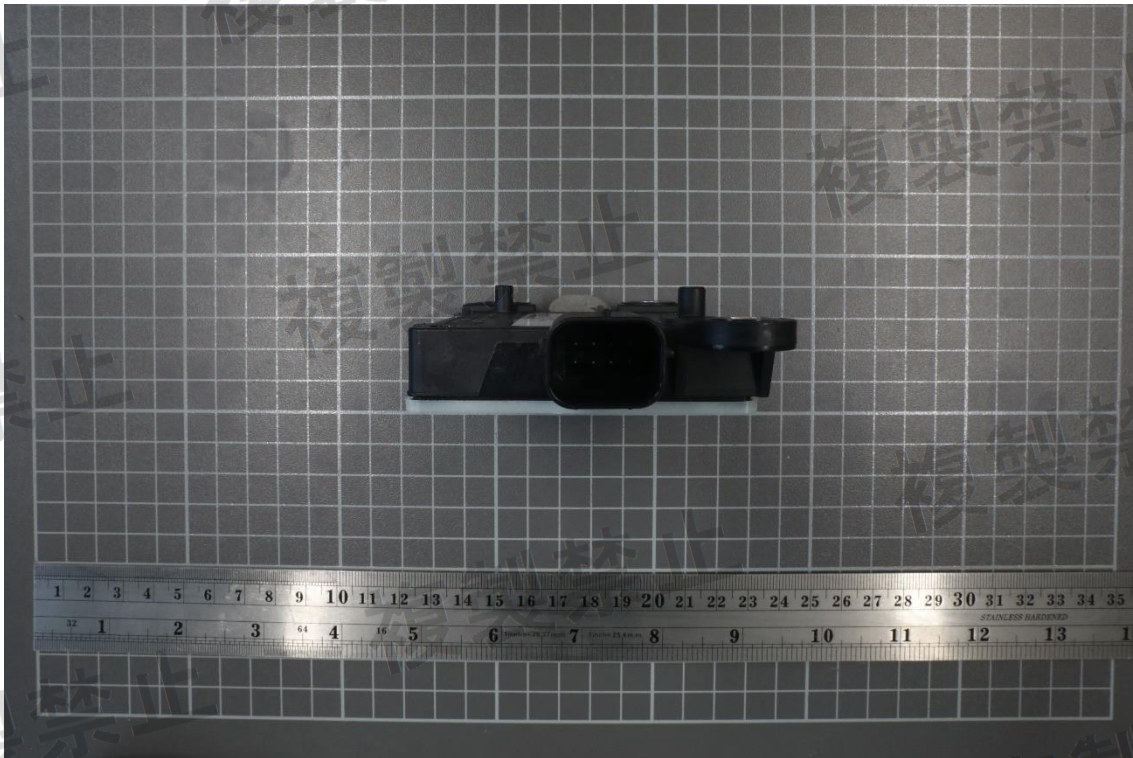


Photo No. 12:



Annex 2 EUT Photographs, internal

Photo No. 13:

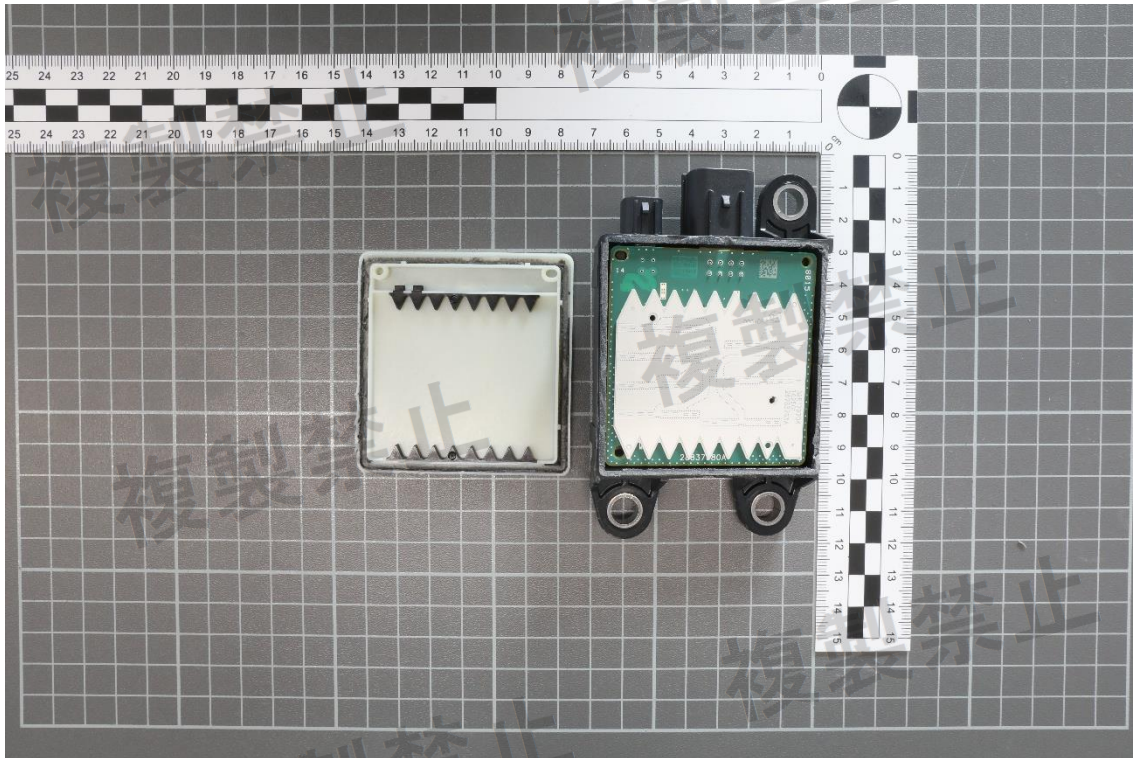


Photo No. 14:

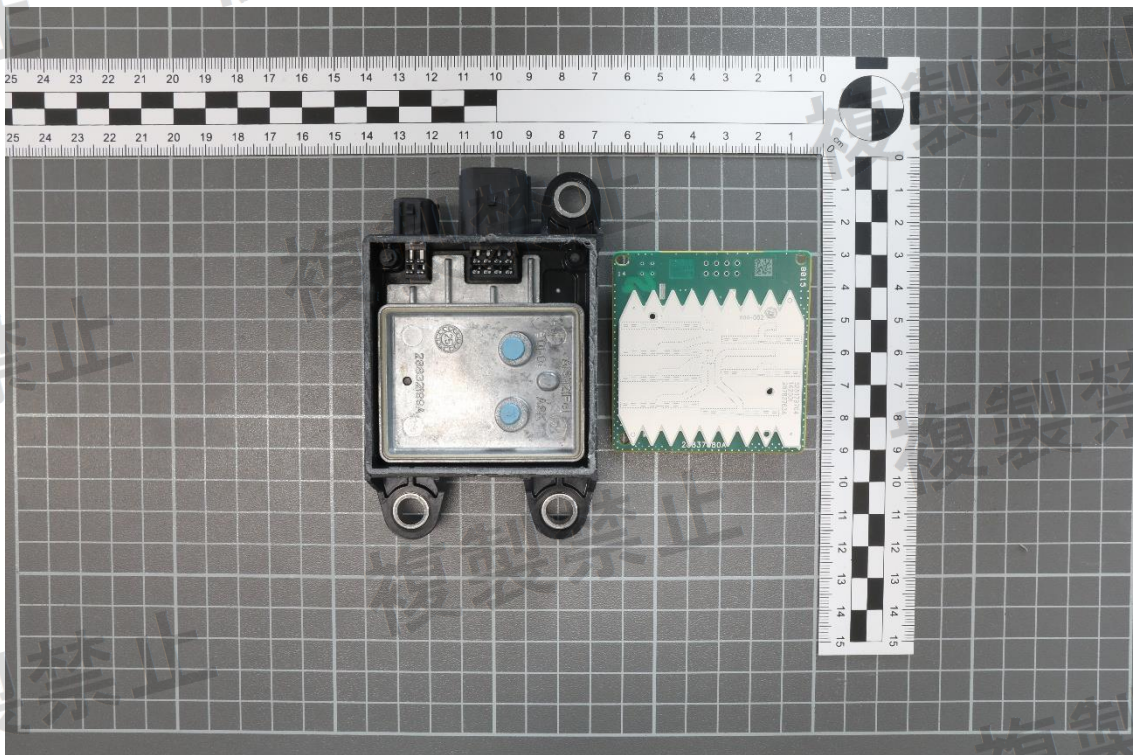


Photo No. 15:

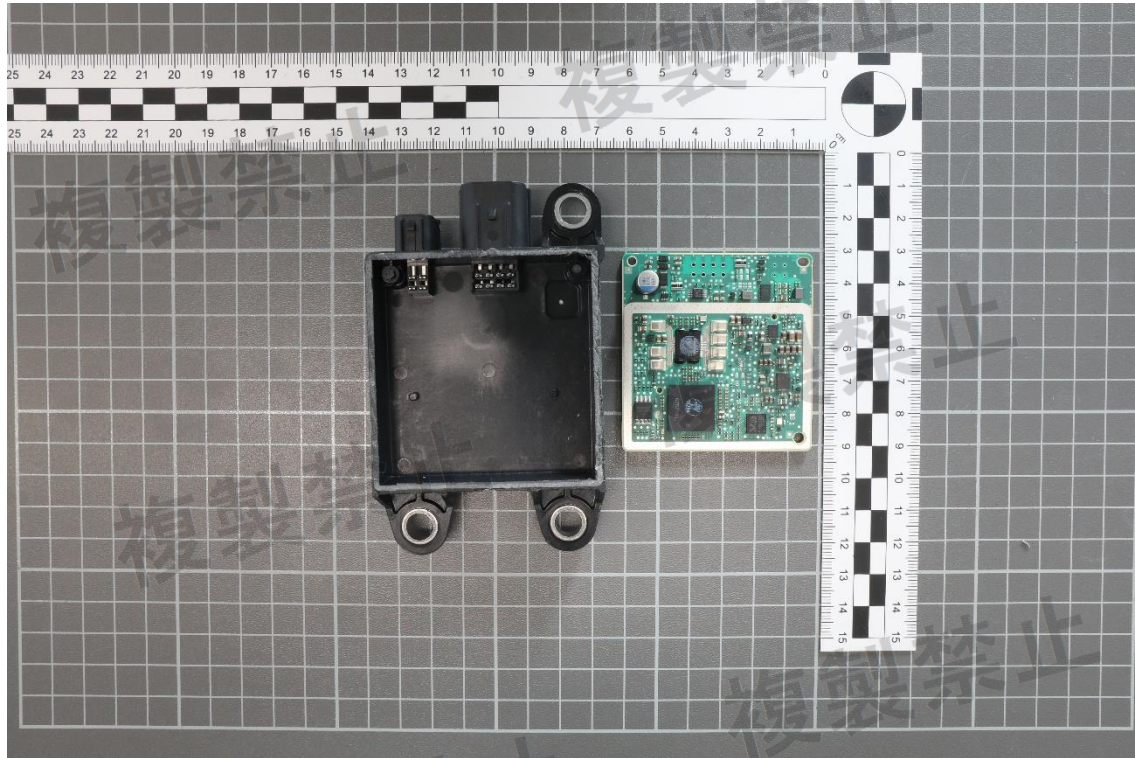


Photo No. 16:

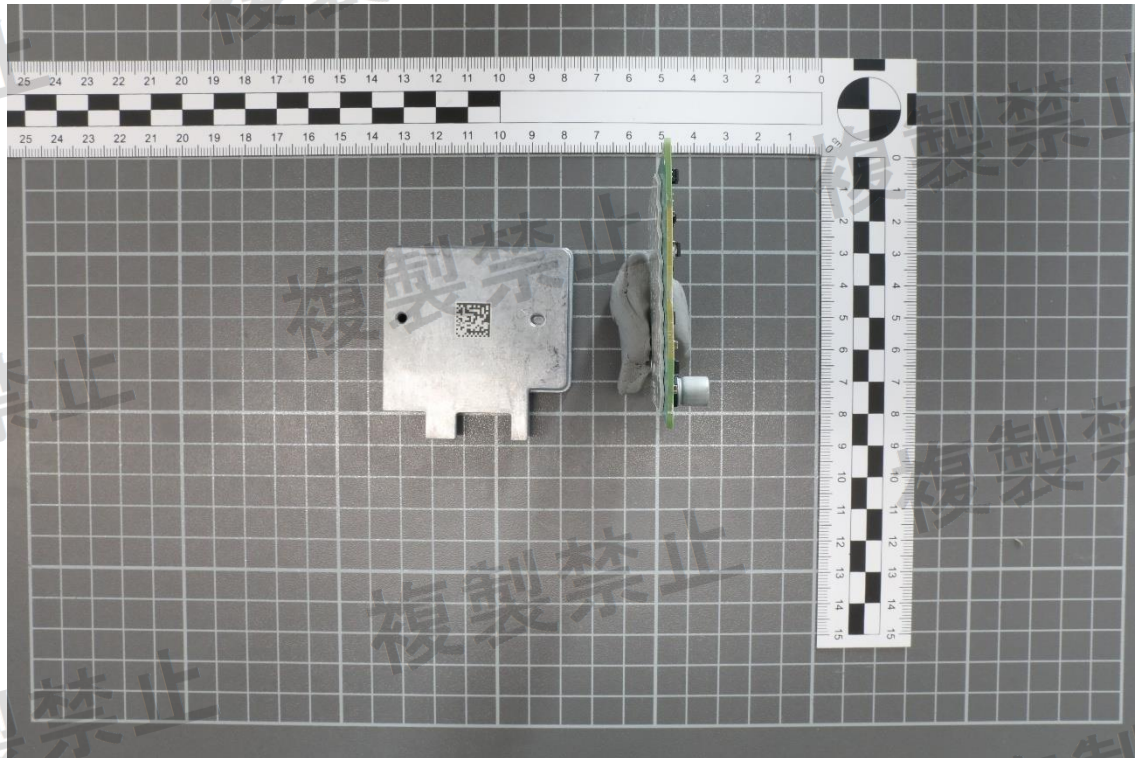


Photo No. 17:

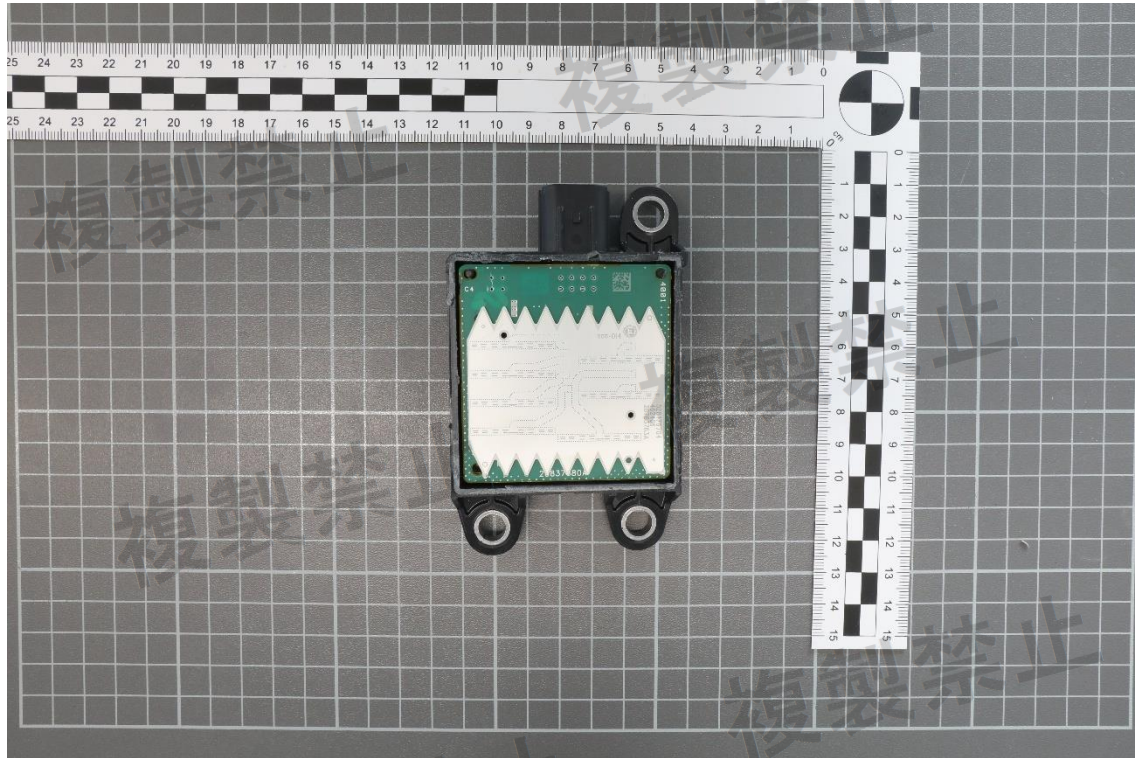


Photo No. 18:

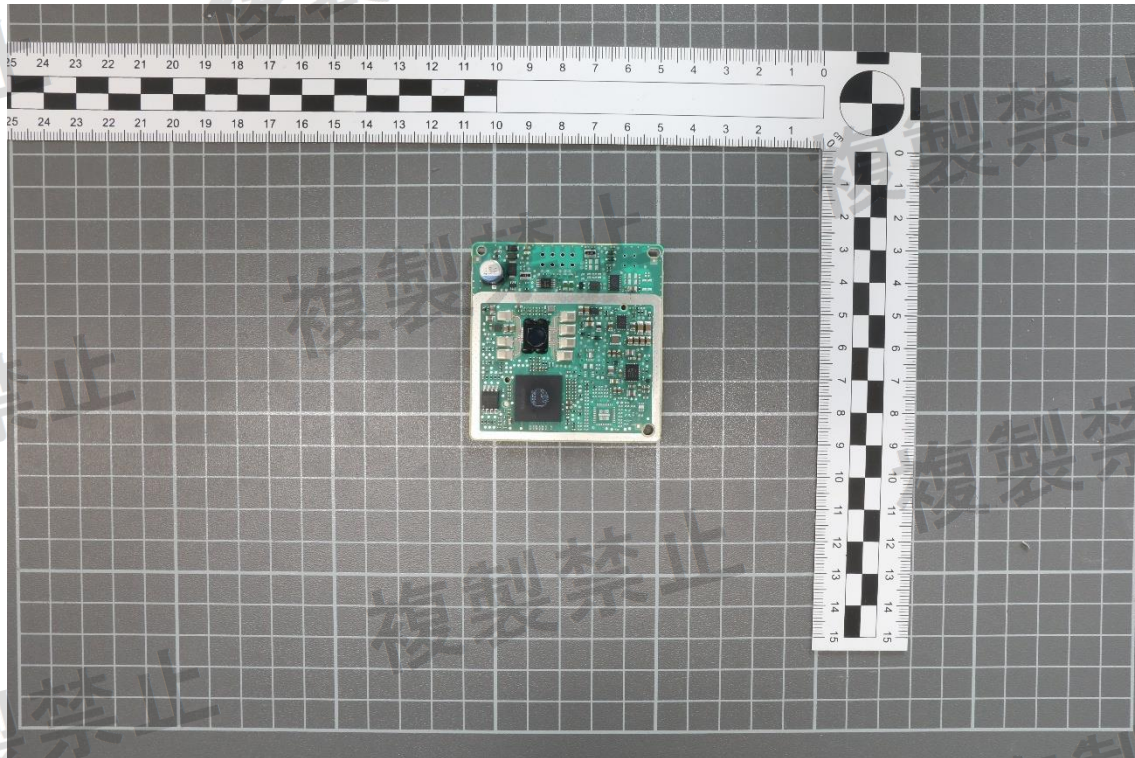
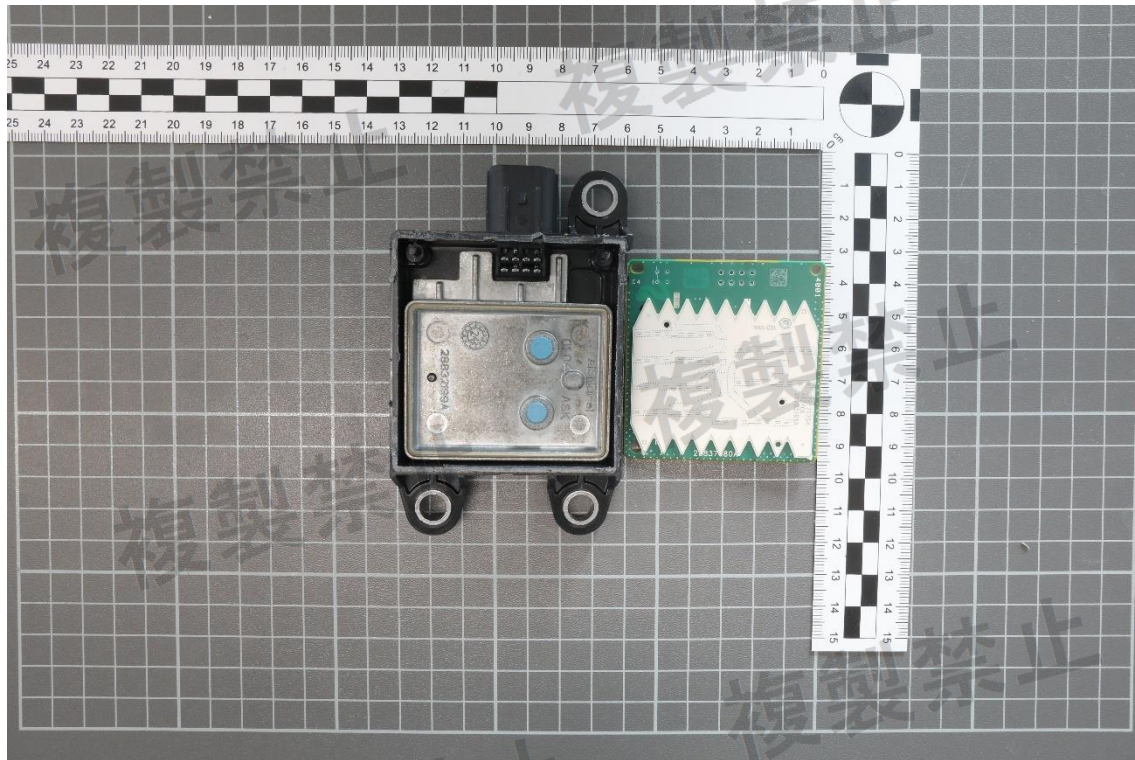


Photo No. 19:



Annex 3 Test Setup Photographs

Photo No. 20:

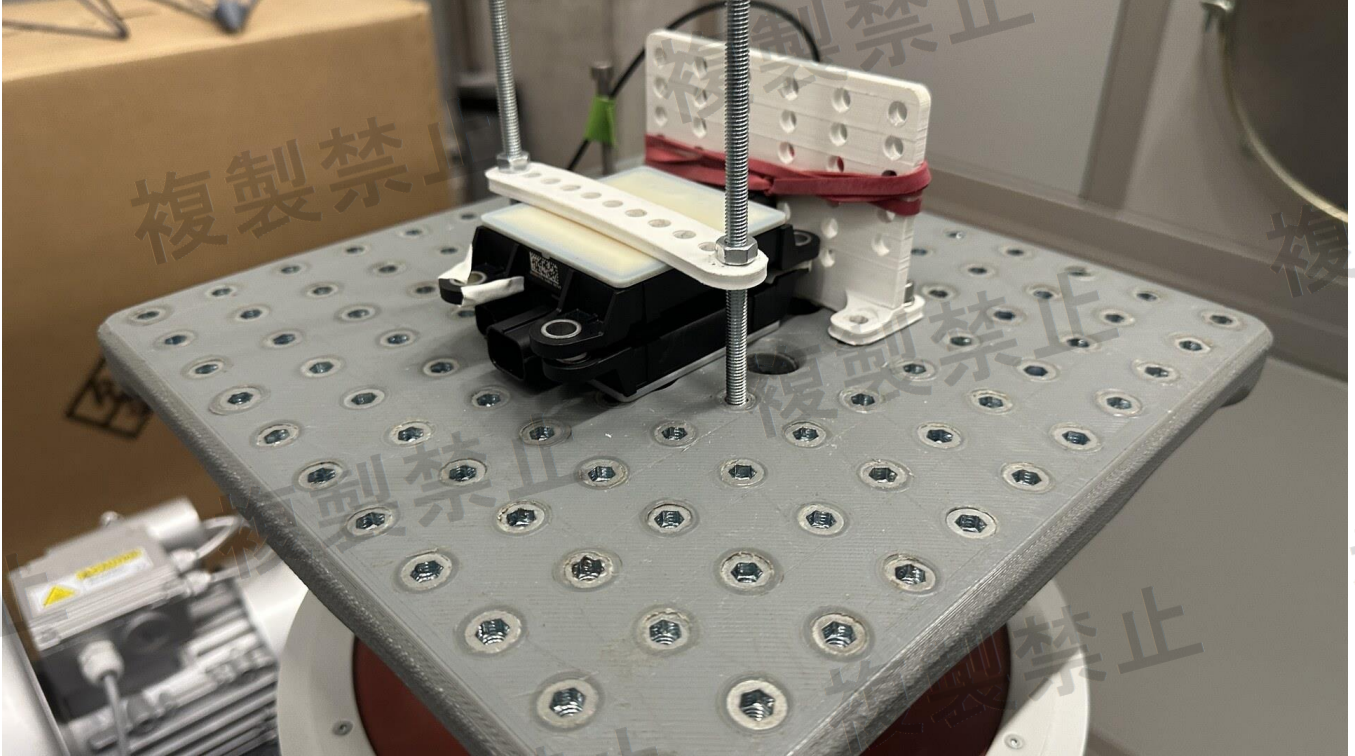


Photo No. 21:



Photo No. 22:



Photo No. 23:

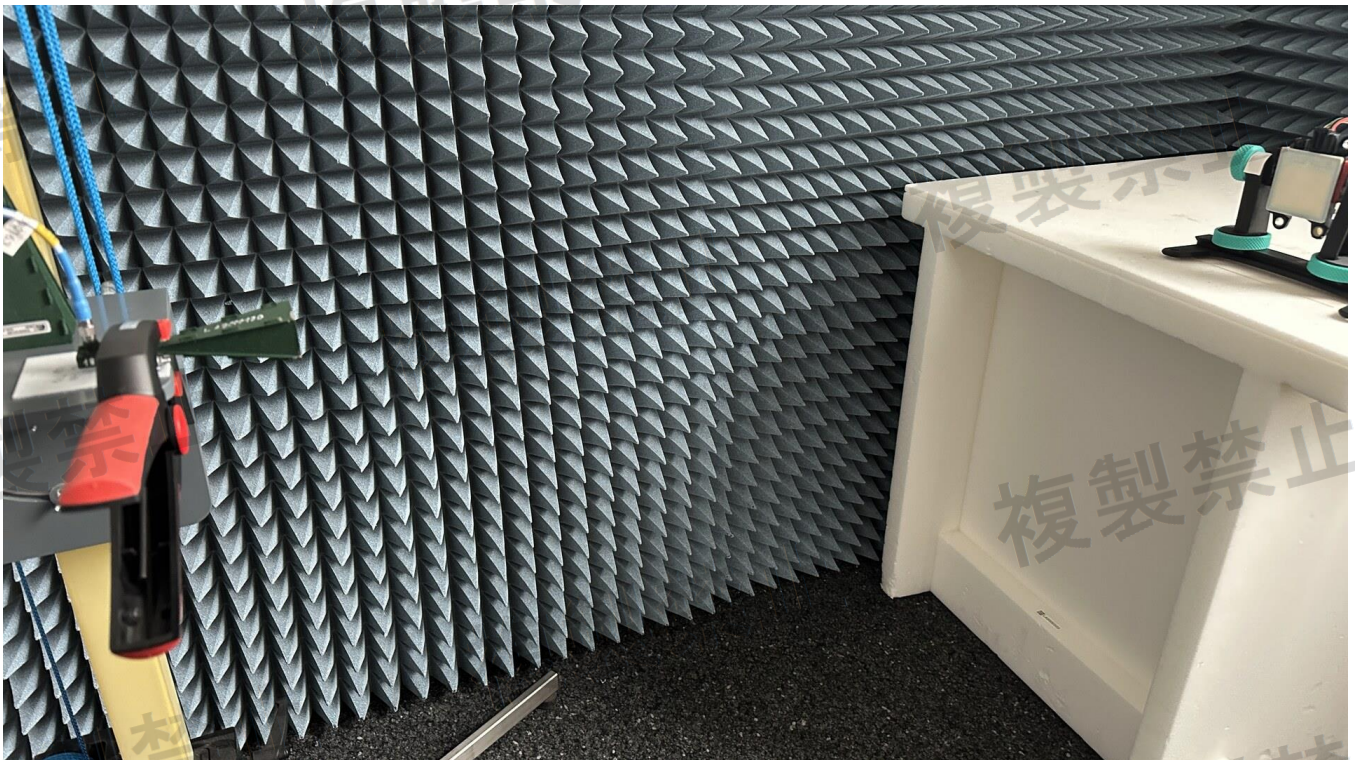


Photo No. 24:

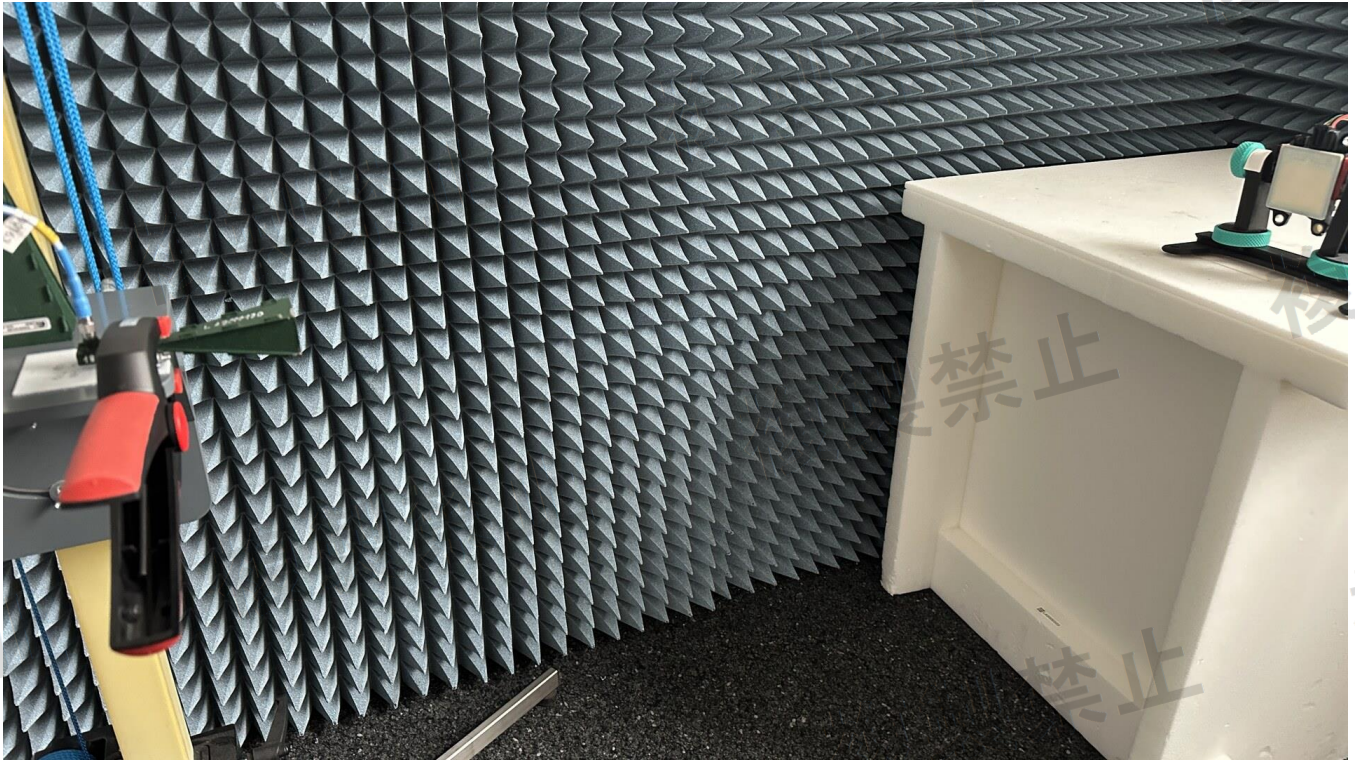


Photo No. 25:

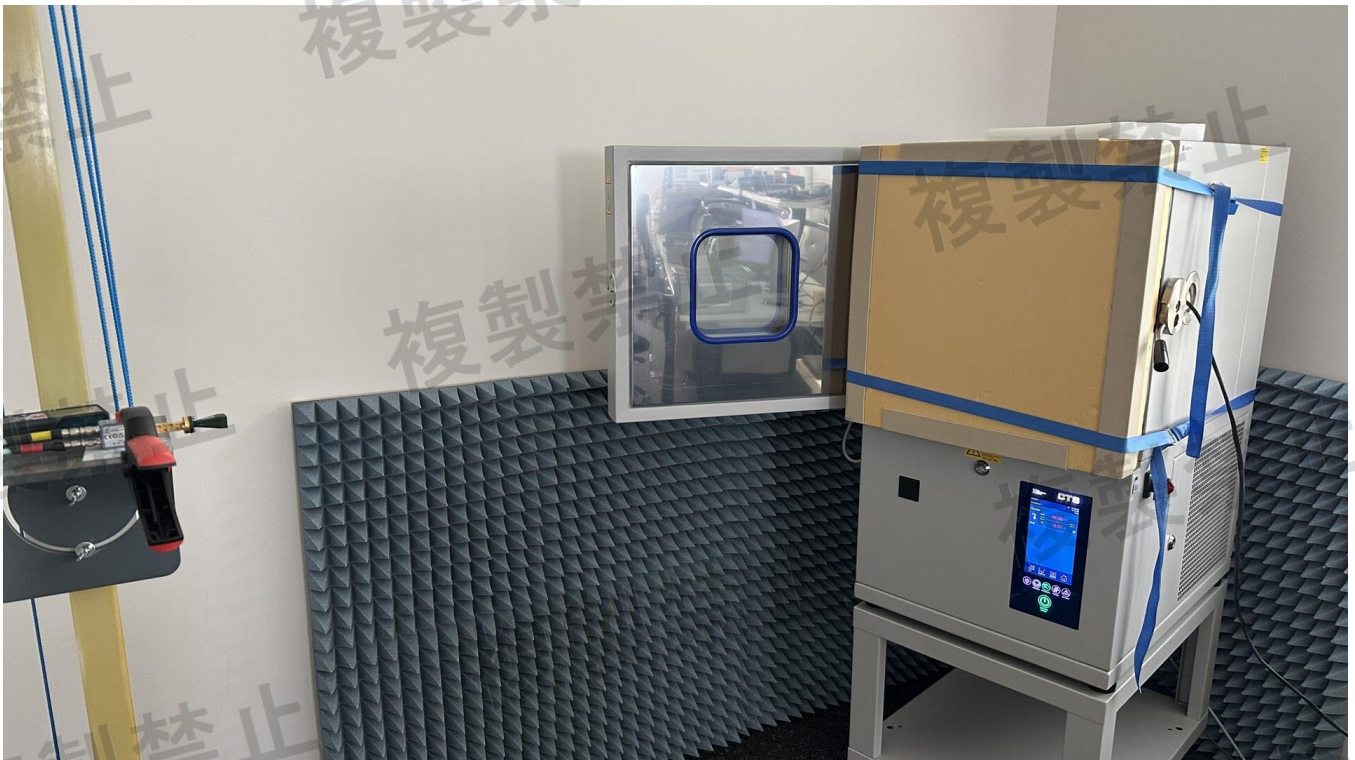


Photo No. 26:

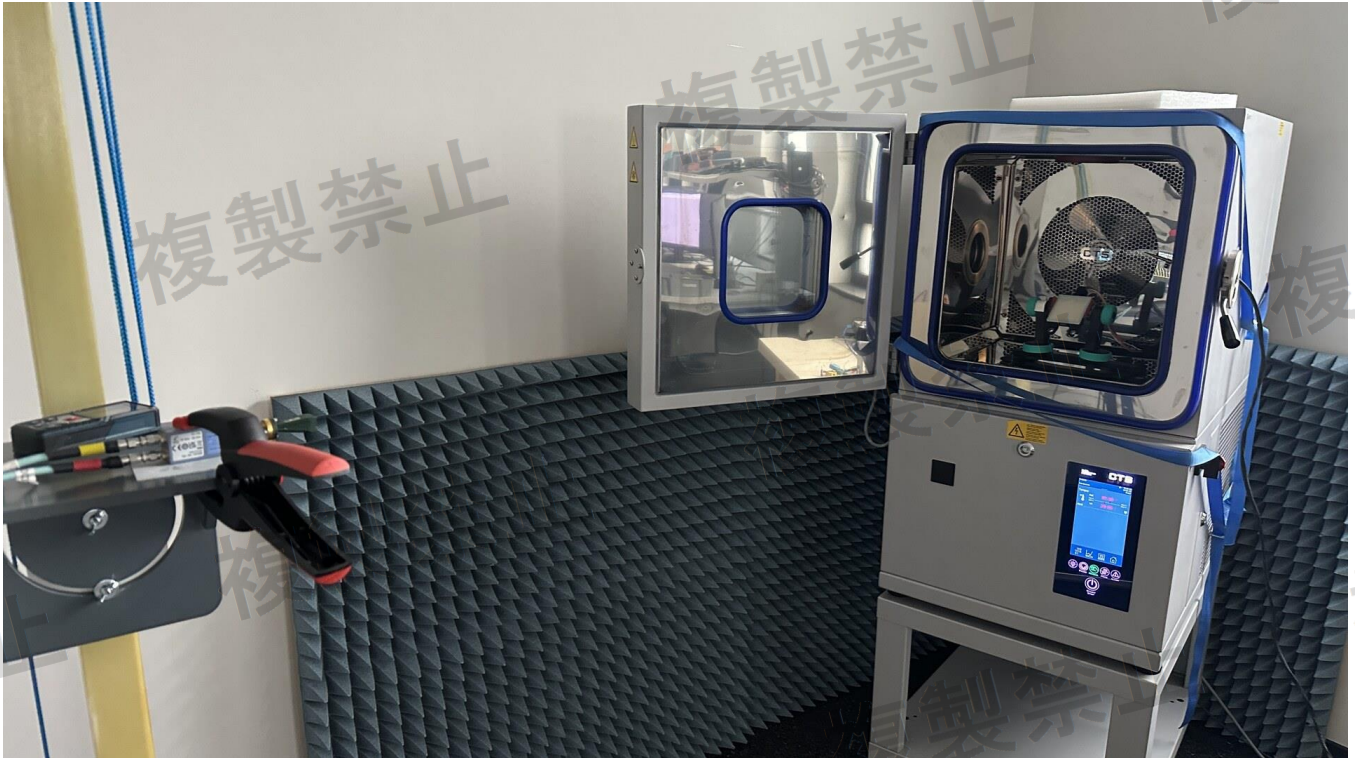


Photo No. 27:



Photo No. 28:



Photo No. 29:

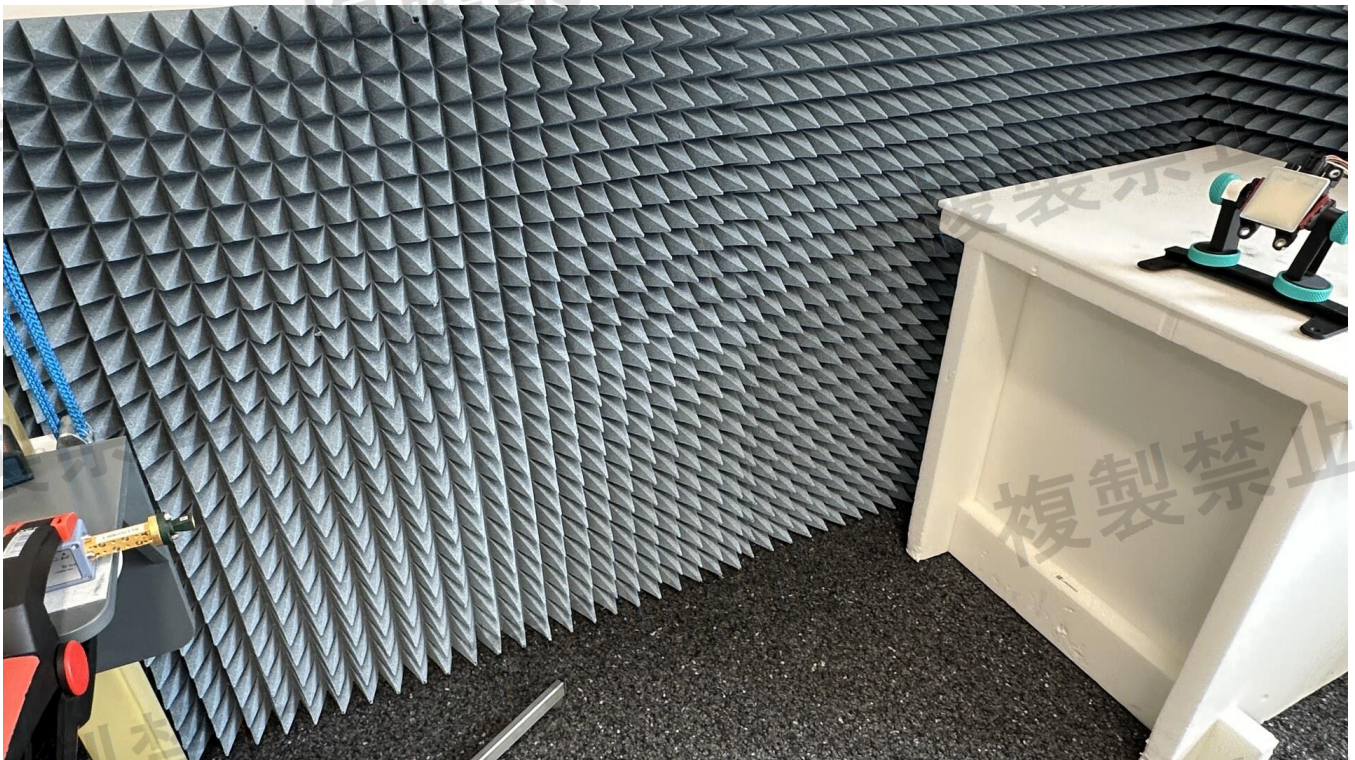


Photo No. 30:



End of Test Report
