

TEST REPORT

Report number : KST-JPR-220001

Issue date : 2022-04-25

Applicant : HL Klemove Corp.
10-74, 224, Harmony -ro, Yeonsu-gu, Incheon,
Republic of Korea

Equipment under test (EUT) : Vehicle Radar

Model name : SRR30SA

Date of test : 2022.04.20~2022.04.21

Test place : Kostec Co., Ltd.
28(175-20,Annyeong-dong)406-gil sejaro,
Hwaseong-si Gyeonggi-do, Korea

Test results : PASS

The results in this report are applicable only to the equipment tested.

This report shall not be re-produced except in full without the written approval of Kostec Co., Ltd..

Tested by;

Kwang-Yeol, Choo

Approved by;

Gyeong-Hyeon, Park

1. Summary of Test

1. Purpose of test

Specified low power radio station For millimeter wave radar (76GHz band)

2. Standards

Certification Ordinance Article 2 Clause 1 Item8

1) Test Methods

Test methods to be determined on a temporary basis by TÜV SÜD Japan. JPD_W_07.049J

"Ministry of Internal Affairs and Communications Notification Article 88 Appendix 22-14"

2) Deviation from standards

None

3. List of applied test to the EUT

	Classification of EUT	Condition	Result
1	Voltage fluctuation	-	PASS
2	Frequency Tolerance	Radiated	PASS
3	Occupied Bandwidth	Radiated	PASS
4	RF Output Power Tolerance	Radiated	PASS
5	Unwanted (Spurious) Emission Strength	Radiated	PASS

1) Test set up

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2) Modification to the EUT by laboratory

None

2. Test Information

1. Applicant

HL Klemove Corp.
10-74, 224, Harmony -ro, Yeonsu-gu, Incheon, Republic of Korea
Phone: +82-2-6188-3278 / Fax: +82-2-6188-3989

2. Equipment under test Vehicle Radar

3. Model number SRR30SA

4. Serial number Proto type

5. Size (W) 120 × (D) 21 × (H) 83 mm

6. Terminal limitation -20°C to 60°C

7. RF Specification Frequency range 76 - 77GHz

8. Number of RF Channels 1 Channel

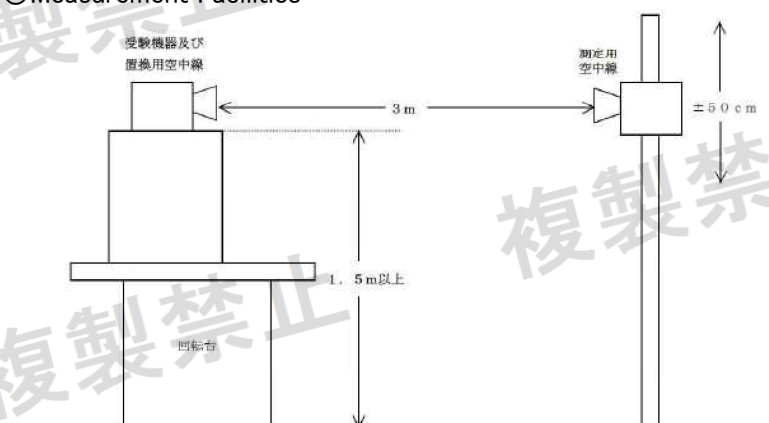
9. Modulation method FMCW

10. Data rate 900 Mbps

11. Variation of the family model(s) None

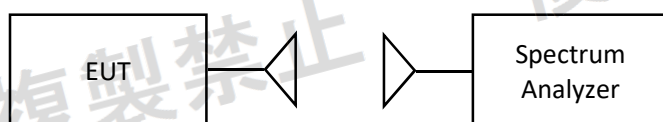
3. Configuration of equipment

◎Measurement Facilities

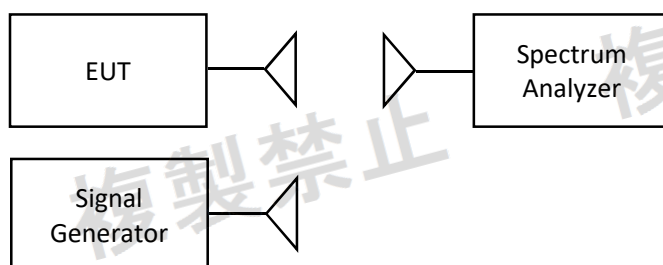


◎Test setup

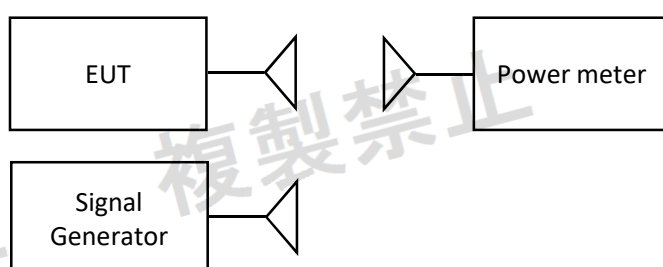
1. Frequency tolerance, Occupied bandwidth



2. Unwanted(Spurious) emission strength



2. RF output power tolerance



4. Test results

Environment of test room	Date of test	2022-04-20	2022-04-21		
	Temperature	21.0 °C	22.0 °C	°C	°C
	Humidity	46.0 %	46.0 %	%	%

Peak Antenna Gain	13.7	dBi
Declaration Output Power	10.0	mW
	10.0000	dBm
E.I.R.P.	23.7000	dBm
Input Power Voltage	12.0	VDC

Tested Circuit Insertion Loss			dB
Transmission Time	ON TIME	0.0265	ms
	OFF TIME	0.0337	ms
	Ratio	0.4402	-

Test category ;	Specified low power radio station For millimeter wave radar (76GHz band)
The reason why the tests are performed only at rated voltage :	When the input voltage to receiver RF circuit varies below $\pm 1\%$ as the input voltage from the external power supply to the receiver varies $\pm 10\%$ (excluding power supply).

Measurement Channel		Ch.	F _L	Middle	F _H	Result	Limit	Note
Measurement Frequency		GHz		76.5				76-77GHz
Frequency Tolerance	Normal condition	GHz	76.04428	76.49163	76.93898	PASS	76-77GHz	
	After the vibration test	GHz	76.04430	76.49172	76.93913	PASS	76-77GHz	
	Low temperature test	GHz	76.05413	76.49158	76.94902	PASS	76-77GHz	-20°C
	High temperature test	GHz	76.04891	76.49148	76.94406	PASS	76-77GHz	60°C
	After the humidity test	GHz	76.04401	76.49156	76.93912	PASS	76-77GHz	35°C,95%
Occupied Bandwidth		MHz		894.7016		PASS	1000MHz	
RF Output Power		mW		7.953		PASS	10mW	
RF Output Power Tolerance		%		-57.470000			+50 to -70%	
Unwanted (Spurious) Emission Strength	30 to 1000MHz	μW		0.002830		PASS	50uW or below	
		MHz		958.200		----	----	
	1 to 72GHz	μW		0.132740		PASS	50uW or below	
		MHz		41923.000		----	----	
	72 to 74.5GHz	μW		0.005140		PASS	50uW or below	
		MHz		73580.700		----	----	
	74.5 to 76.0GHz	μW		-			100uW or below	Out-Band
		MHz		-		----	----	N/A
	77.0 to 78.5GHz	μW		-			100uW or below	Out-Band
		MHz		-		----	----	N/A
	78.5 to 81GHz	μW		0.005680		PASS	50uW or below	
		MHz		79095.700		----	----	
	81 to 120GHz	μW		0.007550		PASS	50uW or below	
		MHz		103901.000		----	----	
	120 to 160GHz	μW		0.008000		PASS	50uW or below	
		MHz		125864.000		----	----	

5. Measurement equipment list

USE	Equipment	Company	Model No.	Serial No.	Calibrated by	Cal. Method	Cal. Due	Cal. Date
X	Temp. & Humi. Chamber	ESPEC	SH-641	92006831	HCT	c	2023-01-19	2022-01-19
X	Pulse Power Meter	ANRITSU	ML2495A	1608009	HCT	c	2022-07-28	2021-07-28
X	Pulse Power Sensor	ANRITSU	MA2411B	1726174	HCT	c	2022-07-28	2021-07-28
X	Spectrum Analyzer	Rohde & Schwarz	FSV40	101727	HCT	c	2022-07-19	2021-07-19
X	Spectrum Analyzer	Rohde & Schwarz	FSW85	101602	HCT	c	2022-06-30	2021-06-30
X	Signal Generator	Rohde & Schwarz	SMB100A	179628	HCT	c	2023-01-17	2022-01-17
X	Signal Generator	KEYSIGHT	N5173B	MY57280148	HCT	c	2022-06-11	2021-06-11
X	DC Power supply	Agilent Technology	6632B	MY43004005	HCT	c	2023-01-18	2022-01-18
X	Trilog-Broadband Antenna	EMCO	3142B	1745	HCT	c	2023-04-08	2022-04-08
X	Horn Antenna	EMCO	3115	2996	HCT	c	2023-02-10	2022-02-10
X	Horn Antenna	SCHWARZBECK	BBHA 9170	9170-722	HCT	c	2023-01-20	2022-01-20
X	Low Noise Amplifier	TESTEK	TK-PA01S	200141-L	HCT	c	2022-08-31	2021-08-31
X	AMPLIFIER	Agilent Technology	8449B	3008A02577	HCT	c	2023-01-17	2022-01-17
X	AMPLIFIER	TESTEK	TK-PA1840H	160010-L	HCT	c	2023-01-18	2022-01-18
X	Horn Antenna	OML, Inc.	M19RH	T01	OML, Inc.	c	2023-04-19	2022-04-19
X	Horn Antenna	OML, Inc.	M12RH	T02	OML, Inc.	c	2023-04-18	2022-04-18
X	Horn Antenna	OML, Inc.	M08RH	T03	OML, Inc.	c	2023-04-19	2022-04-19
X	Harmonic Mixer	OML, Inc.	M12HWD	200529-1	HCT	c	2022-07-12	2021-07-12
X	Harmonic Mixer	OML, Inc.	M08HWD	200529-1	HCT	c	2022-07-12	2021-07-12
X	Source Module	OML, Inc.	S19MS-A	200529-1	HCT	c	2023-04-18	2022-04-18
X	Source Module	OML, Inc.	S12MS-A	200529-1	HCT	c	2023-04-18	2022-04-18
X	Source Module	OML, Inc.	S08MS-A	200529-1	HCT	c	2023-04-18	2022-04-18

Note1: "X" は使用した測定機器です。
"X" used equipment.

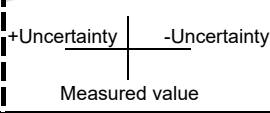
Note2: 較正期限は、較正を行った日の翌月から起算して1年以内です。
The validity of measurement equipment is one year from the first day of the following month of the calibration date.

Note3: 較正方法 ...
Cal.Method ...

- イ) : 国立研究開発法人情報通信研究機構（NICT）（以下「機構」という。）又は第百二条の十八第一項の指定較正機関
（TELEC, インターテックジャパン、キーサイト）が行う較正
- ア) : Calibration conducted by the National Institute of Information and Communications Technology ~ NICT ~ or a designated calibration agency under Article 102-18 paragraph (1) ~ TELECOM Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- ロ) : 計量法（平成四年法律第五十一号）第百三十五条又は第百四十四条の規定に基づく校正（JCSS校正）
- バ) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) ~ Japan Calibration Service System ~
- ハ) : 外国において行う較正であつて、機構又は第百二条の十八第一項の指定較正機関（TELEC, インターテックジャパン、キーサイト）が行う較正に相当するもの
- シ) : Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1) ~ TELECOM Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
- ニ) : イからハまでのいずれかに掲げる較正等を受けたものを用いて行う較正等
- ド) : Calibration conducted by using other equipment that listed above from a) to c)

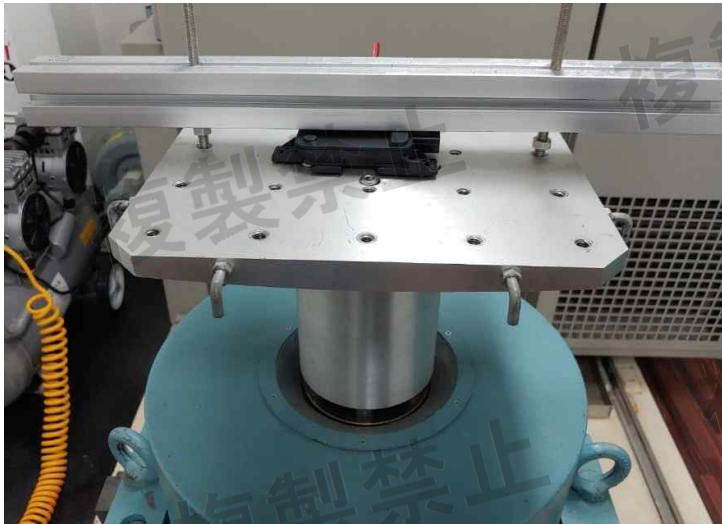
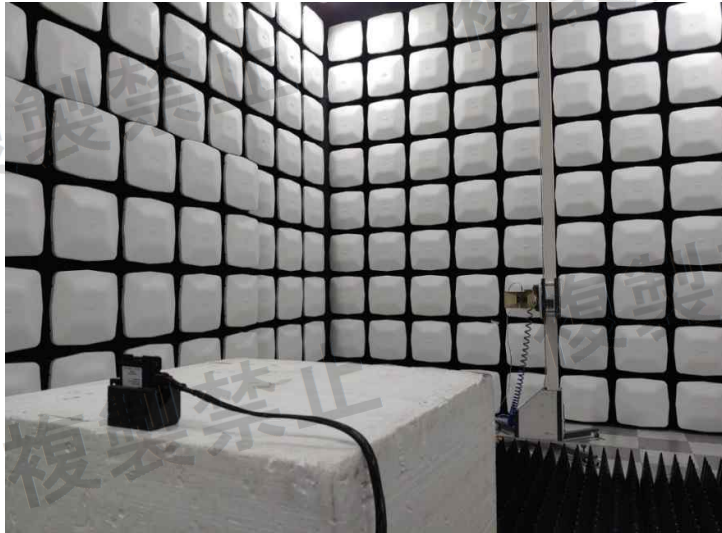
6. Uncertainty

Parameter	Uncertainty
Total RF power radiated	$\pm 3.62\text{dB}$
Spurious emissions radiated	$\pm 4.18\text{dB}$
Temperature	$\pm 2^\circ\text{C}$
Humidity	$\pm 5\%$

Judge	Measured value and standard limit value	
PASS	Case1  Even if it takes uncertainty into consideration, a standard limit value is fulfilled.	
	Case2  Although measured value is in a standard limit value, a limit value won't be fulfilled if uncertainty is taken into consideration.	
FAIL	Case3  Although measured value exceeds a standard limit value, a limit value will be fulfilled if uncertainty is taken into consideration.	
	Case4  Even if it takes uncertainty into consideration, a standard limit value isn't fulfilled.	

7. Photographs

Setup Photo





8. Test chart

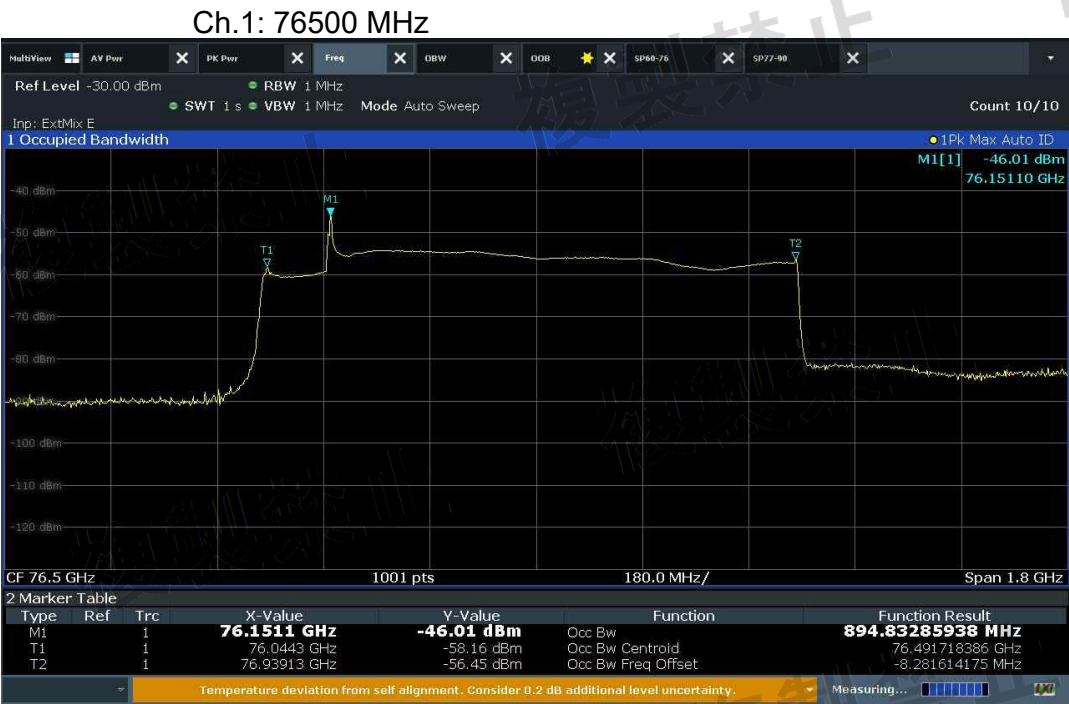
8.1 Frequency tolerance. Occupied bandwidth

8.1.1 Normal condition test

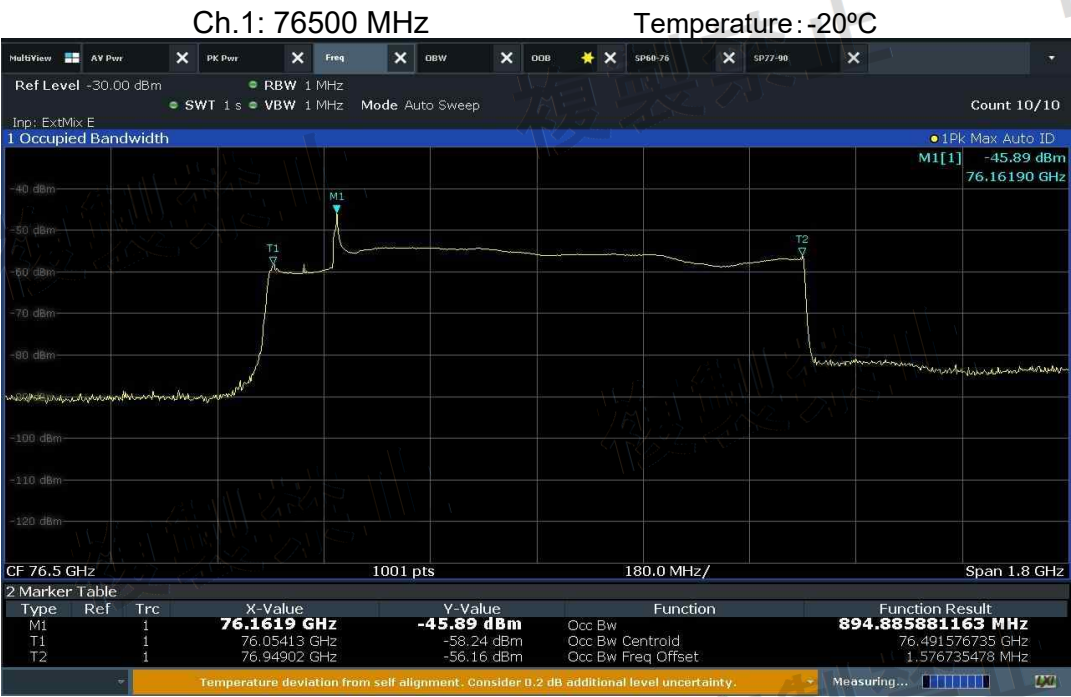
Ch.1: 76500 MHz



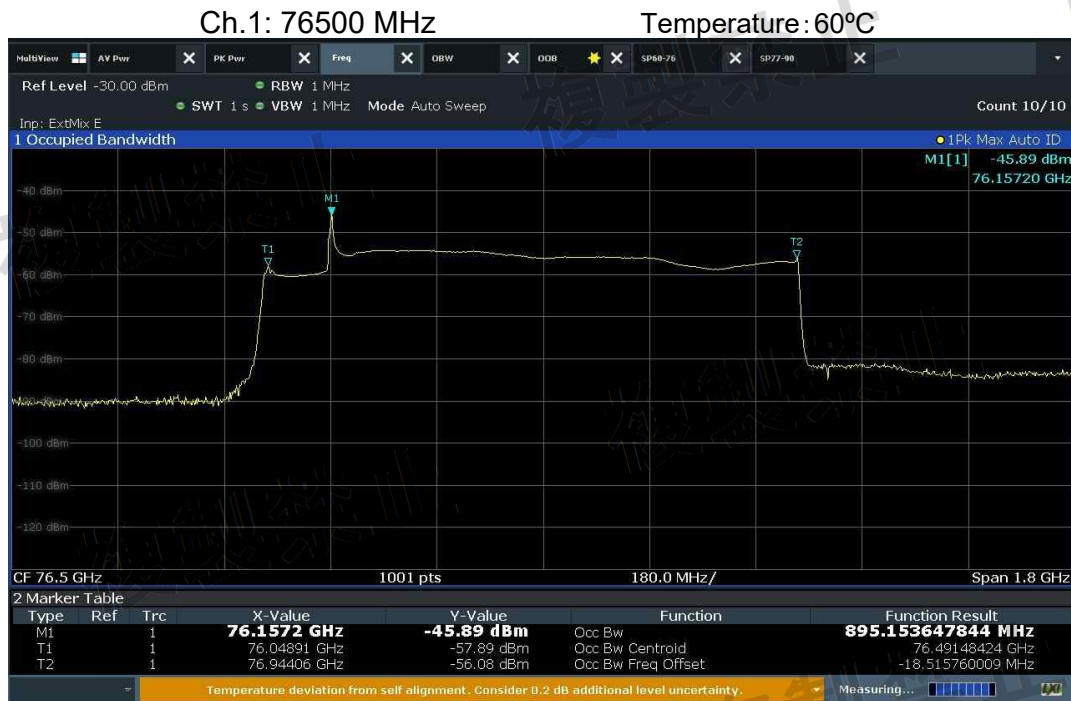
8.1.2 After the vibration test



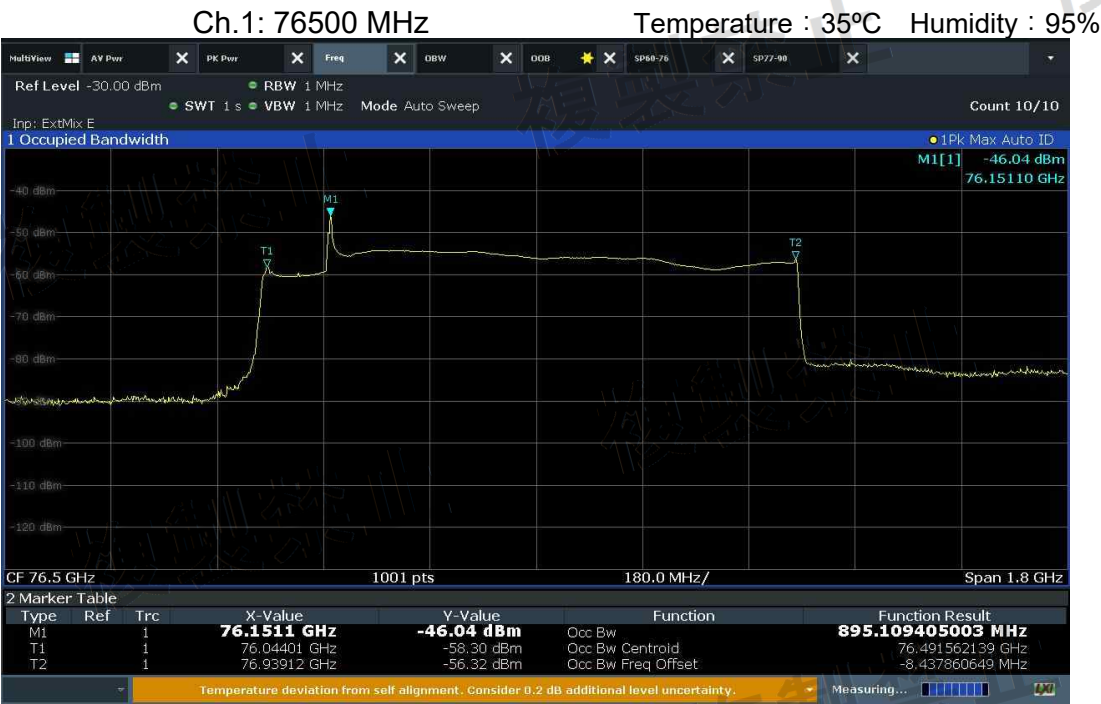
8.1.3 Low temperature test



8.1.4 High temperature test

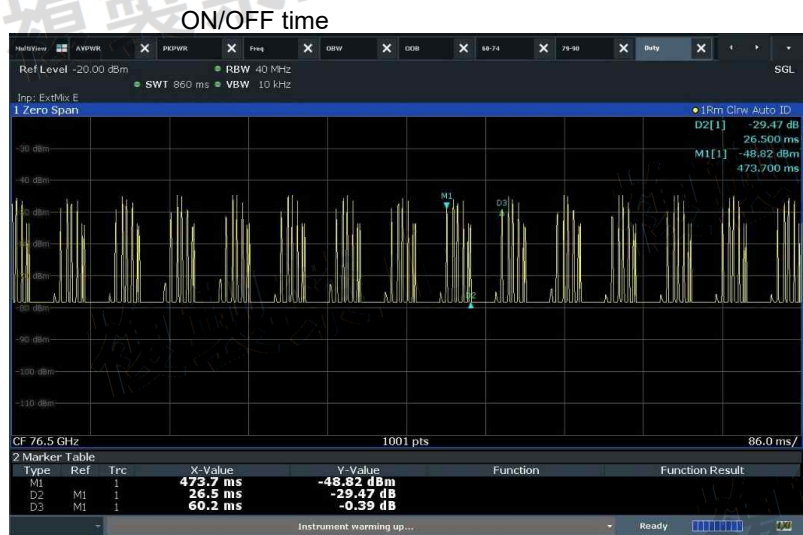


8.1.5 After the humidity test



8.2 RF output power

H/V	Frequency [GHz]	SA Reading [dBm]	SG Reading [dBm]	Cable loss [dB]	Subs Ant. Gain [dBi]	EUT Ant. Gain [dBi]	Transmission Time (Ratio)	Result [mW]
V	76.5	-27.12	-3	1.1	23.24	13.7	0.44	7.95329925



8.3 Unwanted(Spurious) emission strength

H/V	Frequency [GHz]	SA Reading [dBm]	SG Reading [dBm]	Cable loss [dB]	Subs Ant. Gain [dBi]	Result [μW]	Limit [μW]	Margin [dB]
V	0.9582	-14.12	3.58	4.56	5.5	0.00283	50	49.99717
V	41.923	-30.61	-0.36	1.1	22.69	0.13274	50	49.86726
V	73.5807	-39.15	-14.93	1.1	23.14	0.00514	50	49.99486
74.5 to 76.0GHz & 77.0 to 78.5GHz No measurement is made if no unmodulated continuous wave condition is encountered during operation.							100	N/A
							100	N/A
V	79.0957	-38.92	-14.83	1.1	23.47	0.00568	50	49.99432
V	103.901	-36.99	-13.04	1.1	22.92	0.00755	50	49.99245
V	125.864	-34.36	-13.26	1.1	23.39	0.00800	50	49.992

9. Laboratory description

1. Location

Name: KOSTEC Co., Ltd.

Address: 28(175-20,Annyeong-dong)406-gil sejaro, Hwaseong-si Gyeonggi-do, Korea

Phone: +82-31-222-4251

Fax: +82-31-222-4252

2. Accreditation and Registration

1) KOLAS(ILAC-MRA)

Accreditation No.: KT232

2) CBTL

LAB CODE: TL604

3) RRA (MRA)

RRA(National Radio Research Agency): KR0041

FCC Designation No.: KR0041

IC Designation No.: KR0041

4) VCCI Membership No.: 2005

Registration number	Expiration date
C-14685	2023-12-14
G-10834	2023-12-14
R-14202	2024-05-17
T-12225	2023-12-14