

# TEST REPORT



**CTK Co., Ltd.**  
(Ho-dong), 113, Yejik-ro, Cheoin-gu,  
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Report No.:  
CTK-2022-01798  
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## 1. Applicant

- Name : MOBASE ELECTRONICS CO., LTD.
- Address : 100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Republic of Korea
- Date of Receipt : 2020-05-31

## 2. Manufacturer

- Name : MOBASE ELECTRONICS CO., LTD.
- Address : 100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Republic of Korea

**3. Use of Report :** For FCC Certification, For ISED Certification

**4. Test Sample / Model :** Immobilizer FOB Key / MBECFOB2402

**5. Date of Test :** 2022-06-07 to 2022-06-08

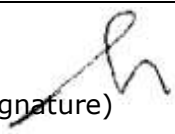

**6. Test Standard(method) used :** FCC 47 CFR part 15 subpart C 15.225  
RSS-Gen Issue 5, RSS-210 Issue 10

**7. Testing Environment:** Temp.: (24.8 ± 1) °C, Humidity: (47 ± 3) % R.H.

**8. Test Results :** Compliance

**9. Location of Test :**  Permanent Testing Lab     On Site Testing

The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This report cannot be reproduced or copied without the written consent of CTK.

Approval	Tested by	Technical Manager
	Bong-seok Kim: (Signature) 	Young-taek Lee: (Signature) 

Remark. This report is not related to KOLAS accreditation and relevant regulation.

2022-07-13

**CTK Co., Ltd.**



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## REPORT REVISION HISTORY

Date	Revision	Page No
2022-07-13	Issued (CTK-2022-01798)	all

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# 1. General Product Description

## 1.1 Client Information

<b>Company</b>	MOBASE ELECTRONICS CO., LTD.
<b>Contact Point</b>	100, Saneop-ro 156beon-gil, Gwonseon-gu, Suwon-si, Gyeonggi-do, Republic of Korea
<b>Contact Person</b>	Name : Hee tack Ryu E-mail : shadow@mobaseelec.com Tel : +82-31-8090-2611

## 1.2 Product Information

<b>FCC ID</b>	NYOMBECFOB2402
<b>IC</b>	3109A-MBECFOB2402
<b>Product Description</b>	Immobilizer FOB Key
<b>Hardware Version Identification Number(HVIN) or Model name</b>	MBECFOB2402
<b>Variant Model name</b>	-
<b>Firmware Version Identification Number (FVIN)</b>	-
<b>Operating Frequency Range</b>	433.92 MHz
<b>RF Output Power</b>	65.7 dBuV/m @ 3 m
<b>Antenna Type</b>	Integral antenna
<b>Power Source</b>	DC 3 V (Battery)

## 1.3 Antenna Information

<input checked="" type="checkbox"/>	Integral antenna (antenna permanently attached)
<input type="checkbox"/>	Temporary RF connector provided
<input type="checkbox"/>	No temporary RF connector provided Transmit chains bypass antenna and soldered temporary RF connector provided for connected measurement. In case of conducted measurements the transmitter shall be connected to the measuring equipment via a suitable attenuator and correct for all losses in the RF path.
<input type="checkbox"/>	External antenna (dedicated antennas)



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## 2. Facility and Accreditations

### 2.1 Test Facility

The measurement facility is located at 5, Dongbu-ro 221beon-gil, Cheoin-gu, Yongin-si, Gyeonggi-do, Republic of Korea.

### 2.2 Laboratory Accreditations and Listings

Country	Agency	Registration Number
USA	FCC	805871
CANADA	ISED	8737A
KOREA	NRRA	KR0025

### 2.3 Calibration Details of Equipment Used for Measurement

Test equipment and test accessories are calibrated on regular basis. The maximum time between calibrations is one year or what is recommended by the manufacturer, whichever is less. All test equipment calibrations are traceable to the Korea Research Institute of Standards and Science (KRISS), therefore, all test data recorded in this report is traceable to KRISS.



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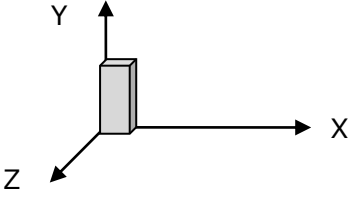
### 3. Test Specifications

#### 3.1 Standards

FCC Part Section(s)	RSS Section(s)	Requirement(s)	Status (Note 1)	Report Clause
15.203	RSS-Gen 6.8	Antenna Requirement	C	1.3
15.231(a)	RSS-210 Annex A.1.1	Technical requirements	C	4.1
15.231(c)	RSS-210 Annex A.1.3	Emission Bandwidth	C	4.2
15.231(b)	RSS-210 Annex A.1.2 (a)	Field strength emission	C	4.3
15.231(b)	RSS-210 Annex A.1.2 (b)	Unwanted emissions	C	4.3
15.207	RSS-Gen 8.8	AC Power line Conducted Emissions	NA(Note 2)	-
<i>Note 1:</i> C=Complies NC=Not Complies NT=Not Tested NA=Not Applicable				
<i>Note 2:</i> The equipment is operated on battery power only.				
<i>Note 3:</i> The sample was tested according to the following specification: ANSI C63.10-2013.				

### 3.2 Mode of operation during the test

#### The Worst Case Measurement Configuration

<b>Tests Item</b>	Radiated Emissions
<b>Condition</b>	Radiated measurement
<b>User Position</b>	<input type="checkbox"/> EUT will be placed in fixed position.
	<input type="checkbox"/> EUT will be placed in mobile position and operating multiple positions.
	<input checked="" type="checkbox"/> EUT will be a hand-held or body-worn battery-powered devices and operating multiple positions.
<b>EUT faces identified relative to view from receiving antenna</b>	



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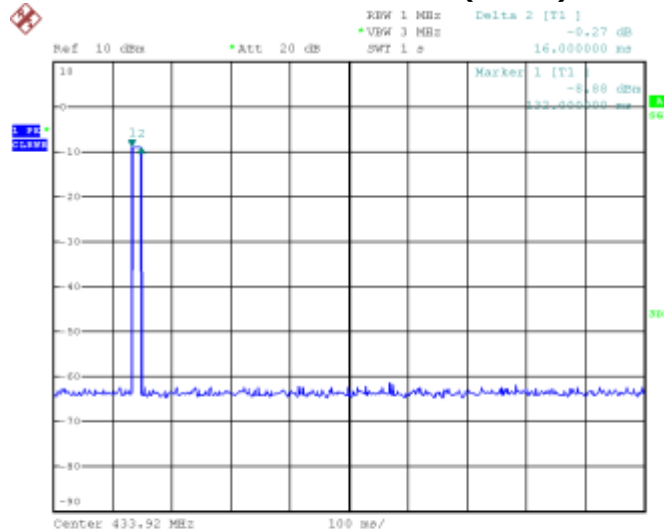
### Test signal Duty Cycle

Duty cycle(On time/Period)	1 (100 %)
Duty cycle factor [20log(duty cycle)]	0 dB

### Nominal Signal Duty Cycle

Duty cycle(On time/Period)	0.16 (16 ms / 100 ms) ※ Unless otherwise specified, when the radiated emission limits are expressed in terms of the average value of the emission, and pulsed operation is employed, the measurement field strength shall be determined by averaging over one complete pulse train, including blanking intervals, as long as the pulse train does not exceed 0.1 s(ANSI C63.10 Clause 7.5)
Duty cycle factor [20log(duty cycle)]	-15.9 dB

### Transmission time (16 ms)



CAC-5500  
 Date: 8.JUN.2022 17:54:43





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### 3.3 Peripheral Devices

No.	Device	Manufacturer	Model No.	Serial No.
1	-	-	-	-

### 3.4 Maximum Measurement Uncertainty

The value of the measurement uncertainty for the measurement of each parameter.  
Coverage factor  $k = 2$ , Confidence levels of 95 %

Test Item	Uncertainty
Radiated emissions (below 1 GHz)	3.88 dB (C.L.: Approx. 95 %, $k=2$ )
Radiated emissions (above 1 GHz)	4.62 dB (C.L.: Approx. 95 %, $k=2$ )



## 4. Technical Characteristic Test

### 4.1 Technical requirements

#### Requirement

Requirements	
<input checked="" type="checkbox"/>	A manually operated transmitter shall be equipped with a push-to-operate switch and be under manual control at all times during transmission. When released, the transmitter shall cease transmission within no more than 5 seconds of being released.
<input type="checkbox"/>	A transmitter that has been activated automatically shall cease transmission within 5 seconds of activation.
<input type="checkbox"/>	Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.
<input type="checkbox"/>	Intentional radiators used for radio control during emergencies involving fire, security of goods (e.g. burglar alarms) and safety-of-life, when activated to signal an alarm, may operate during the interval of the alarm condition.

#### Test Procedures

Refer ANSI C63.10-2013, clause 7.4(Procedure for determining compliance of unlicensed wireless devices having periodic operation).



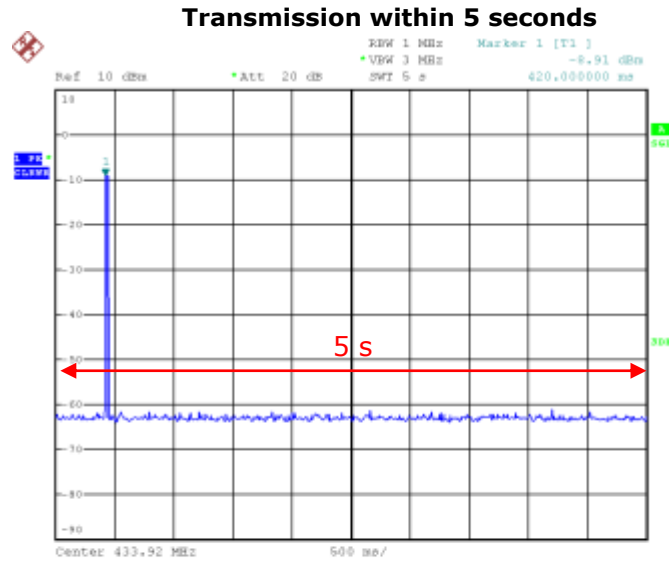
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## Test results

The requirements are:

Complies



CAC-5500

Date: 8.JUN.2022 17:54:13

## 4.2 Emission Bandwidth

### Requirement

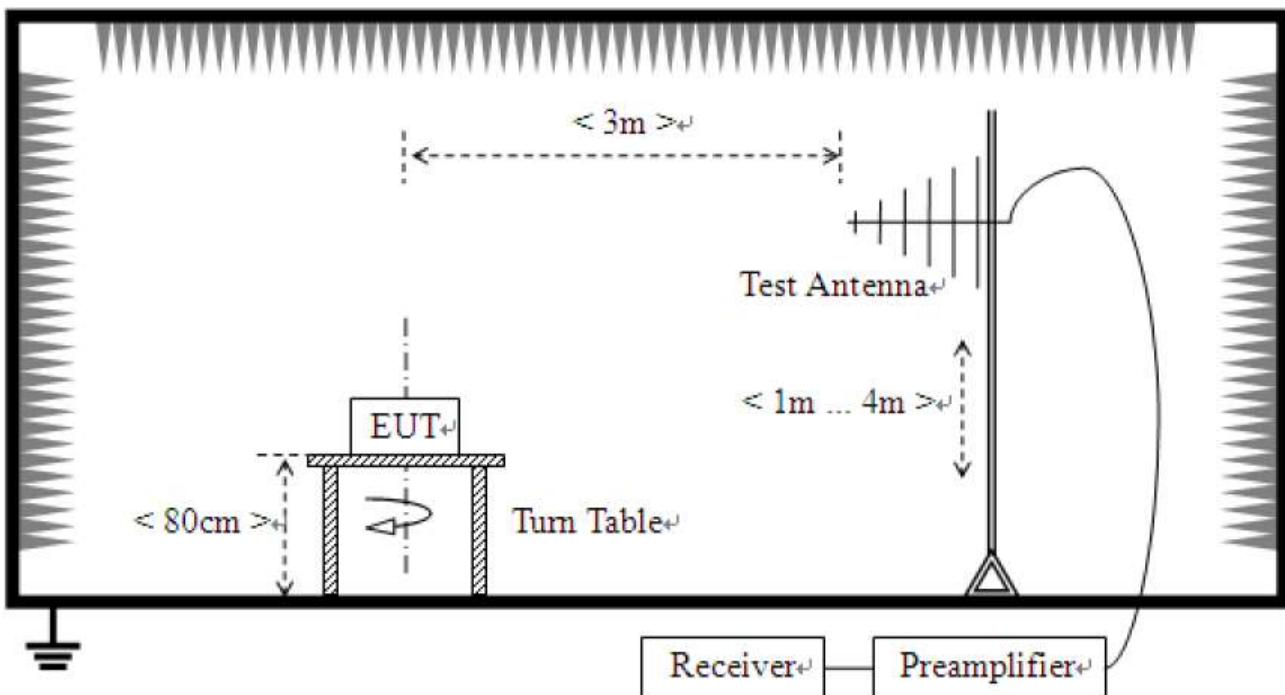
The occupied bandwidth of momentarily operated devices shall be less than or equal to 0.25% of the centre frequency for devices operating between 70 MHz and 900 MHz. For devices operating above 900 MHz, the occupied bandwidth shall be less than or equal to 0.5% of the centre frequency.

Bandwidth is determined at the points 20 dB down from the modulated carrier.

### Test Procedures

For the emission bandwidth refer ANSI C63.10-2013, clause 6.9(Occupied bandwidth).

### Test Setup





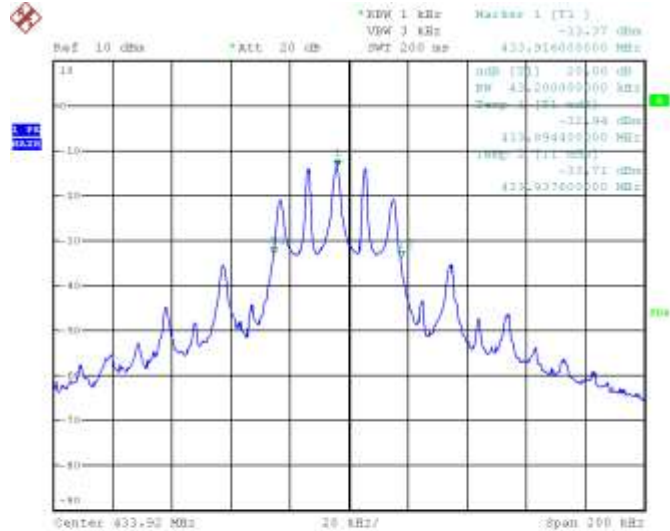
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### Test results

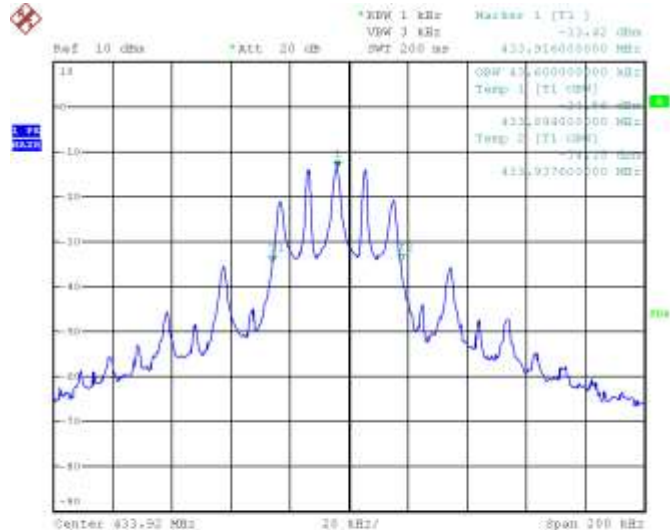
Emission Bandwidth	Result	Limit
20dB Bandwidth	42.8 kHz	1.0848 MHz
99% Bandwidth	42.8 kHz	N/A

**Emission Bandwidth Plot 20dB Bandwidth**



CAD-5500  
 Date: 8.JUN.2022 17:52:10

**Emission Bandwidth Plot 99% Bandwidth**



CAD-5500  
 Date: 8.JUN.2022 17:47:00

### 4.3 Field strength emissions

#### Requirement

- (a) The field strength of emissions from momentarily operated intentional radiators shall not exceed the limits in table A1, based on the average value of the measured emissions. The requirements of the "Pulsed operation" section of RSS-Gen apply for averaging pulsed emissions and limiting peak emissions.

If an average limit is specified for the EUT, then the peak emission shall also be measured with instrumentation properly adjusted for factors such as pulse desensitization to ensure that the peak emission is less than 20 dB above the average limit.

**Table A1 : Permissible field strength limits for momentarily operated devices**

Fundamental frequency(MHz), excluding restricted frequency bands specified in RSS-Gen	Field strength of fundamental emissions (uV/m at 3 m)	Field strength of fundamental emissions (dBuV/m at 3 m)
70 - 130	1 250	61.9
130 - 174	1 250 to 3 750*	61.9 - 71.5
174 - 260**	3 750	71.5
260 - 470**	3 750 to 12 500*	71.5 - 81.9
Above 470	12 500	81.9
<b>433.92</b>	<b>10 998</b>	<b>80.8</b>

\* Linear interpolation with frequency, f, in MHz:

- For 130 - 174 MHz : Field Strength (uV/m) = (56.82 x f) - 6136

- For 260 - 470 MHz : Field Strength (uV/m) = (41.67 x f) - 7083

\*\* Frequency bands 225-328.6 MHz and 335.4-399.9 MHz are designated for the exclusive use of the Government of Canada. Manufacturers should be aware of possible harmful interference and degradation of their licence-exempt radio equipment in these frequency bands.

- (b) Unwanted emissions shall be 10 times below the fundamental emissions field strength limits in table A1 or comply with the limits specified in RSS-Gen, whichever is less stringent.

<input checked="" type="checkbox"/>	10 times below fundamental emissions field strength limits : 60.8 dBuV/m
<input type="checkbox"/>	Limits specified in RSS-Gen

※ RSS-Gen limit

Frequency(MHz)	Field Strength	Field Strength dBuV/m	Measurement Distance (meters)
0.009-0.490	6.37/F (F in kHz) uA/m	48.5 - 13.8	300
0.490-1.705	63.7/F (F in kHz) uA/m	33.8 - 23	30
1.705-30	0.08 uA/m	29.5	30
30-88	100 uV/m	40	3
88-216	150 uV/m	43.5	3
216-960	200 uV/m	46	3
Above 960	500 uV/m	54	3



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## Test Location

10 m SAC (test distance :  10 m,  3 m)

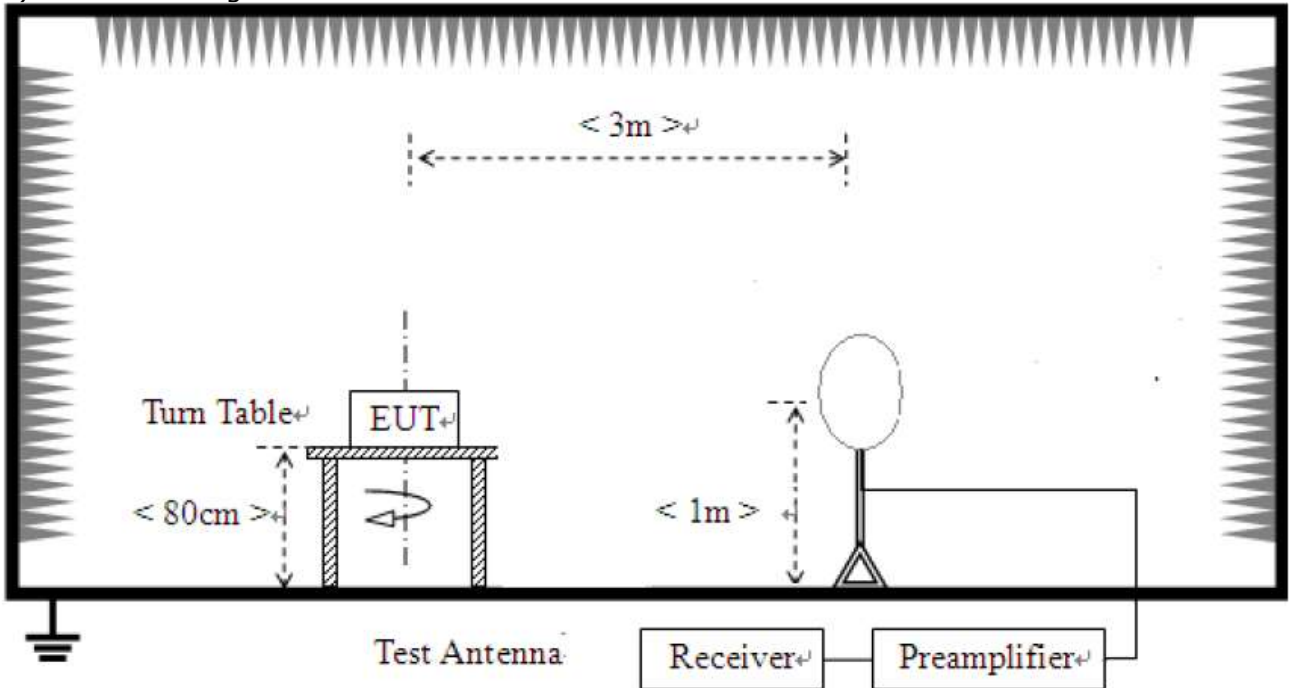
## Test Procedures

Test Method	
<input checked="" type="checkbox"/>	Refer as ANSI C63.10-2013, clause 6.4(Radiated emissions from unlicensed wireless devices below 30 MHz).
<input checked="" type="checkbox"/>	Radiated emission tests shall be performed in the frequency range of 9 kHz to 30 MHz, using a calibrated loop antenna. When perpendicular to the ground plane, the lowest height of the magnetic antenna shall be 1 m above the ground and shall be positioned at the specified distance from the EUT. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
<input checked="" type="checkbox"/>	The results shall be by using the square of an inverse linear distance extrapolation factor(40 dB/decade).
<input checked="" type="checkbox"/>	Refer as ANSI C63.10-2013, clause 6.5(Radiated emissions from unlicensed wireless devices in the frequency range of 30 MHz to 1000 MHz).
<input checked="" type="checkbox"/>	Refer as ANSI C63.10-2013, clause 6.6(Radiated emissions from unlicensed wireless devices above 1 GHz).
<input checked="" type="checkbox"/>	Test Antenna height is carried from 1m to 4m above the ground to determine the maximum value of the field strength. The emissions levels at both horizontal and vertical polarizations should be tested.
<input checked="" type="checkbox"/>	Emissions more than 20 dB below the limit do not need to be reported.

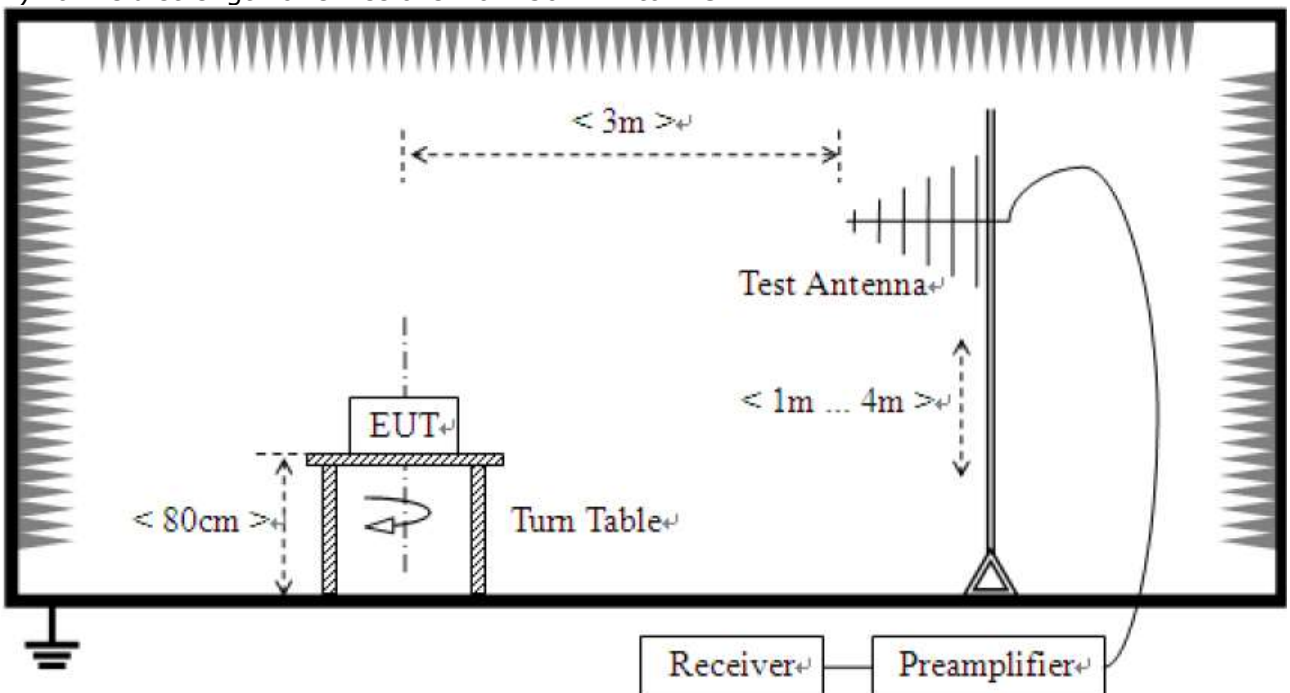
Measuring instrument Settings	
Frequency Range	9 kHz - 5 GHz
RBW	200 Hz (9 kHz - 150 kHz) 9 kHz (150 kHz - 30 MHz) 120 kHz (30 MHz - 1 000 MHz) 1 MHz (above 1 GHz)
VBW	≥ RBW
Sweep time	auto couple

## Test Setup

- 1) For field strength of emissions from 9 kHz to 30 MHz

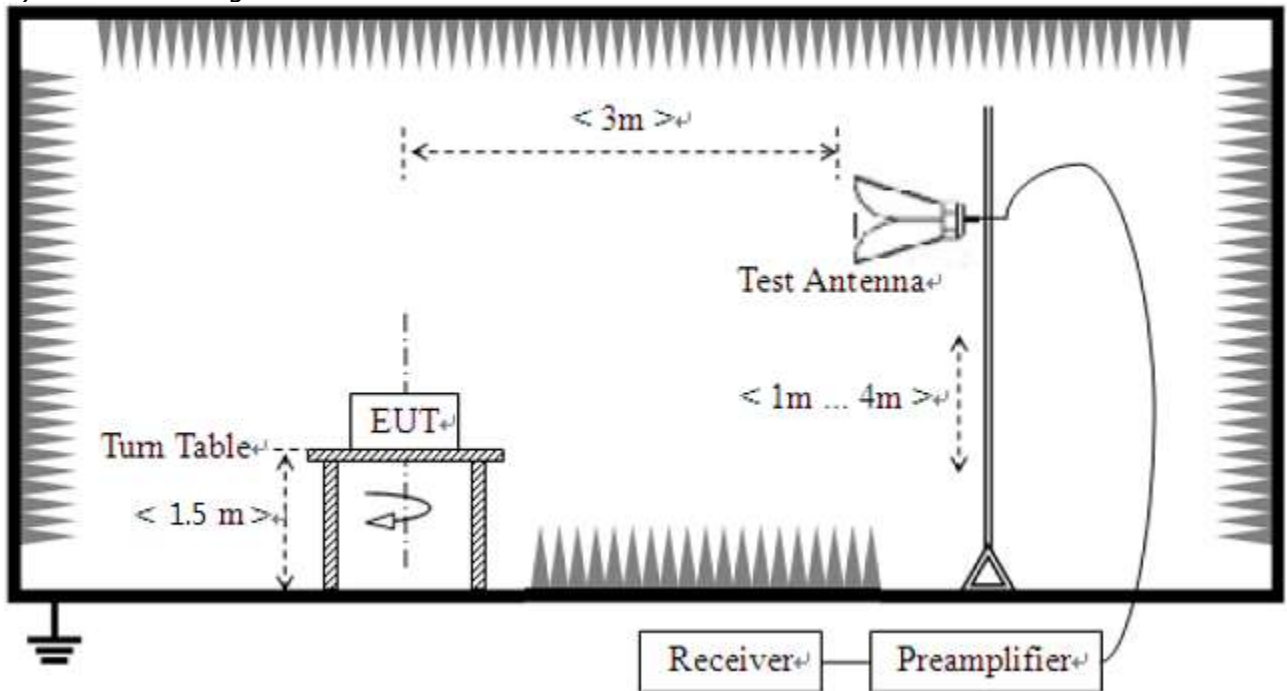


- 2) For field strength of emissions from 30 MHz to 1 GHz





3) For field strength of emissions above 1 GHz



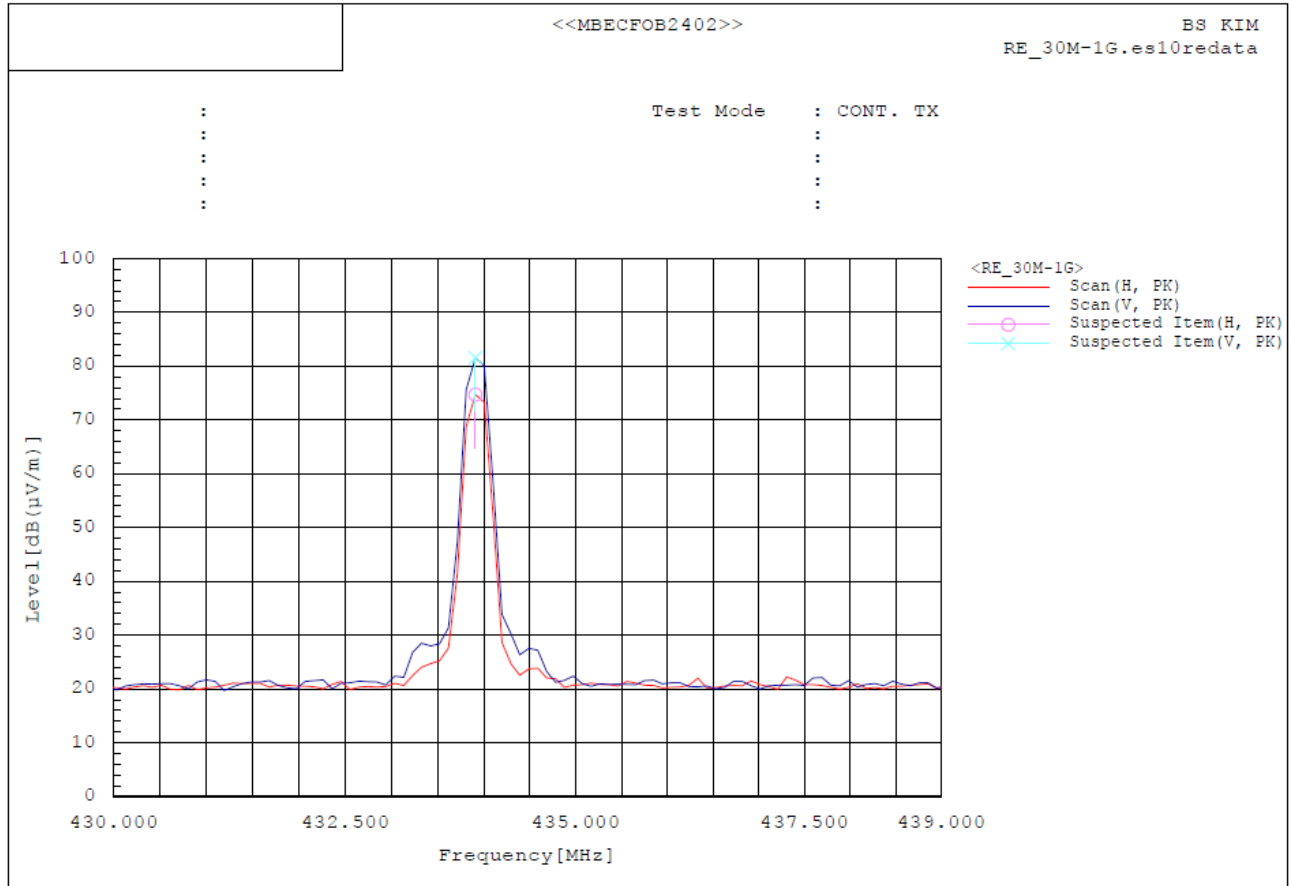


## Test results

### 1) Fundamental frequency emissions

The requirements are:

Complies



Frequency [MHz]	Polarization	Reading [dBuV]	c.f [dB/m]	Duty cycle factor [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Magin[dB]	Remark
433.92	Ver.	85.6	-4.0	-	81.6	100.8	19.2	Peak
		85.6	-4.0	-15.9	65.7	80.8	15.1	Average
	Hor.	78.7	-4.0	-	74.7	100.8	26.1	Peak
		78.7	-4.0	-15.9	58.8	80.8	22.0	Average

#### Remark :

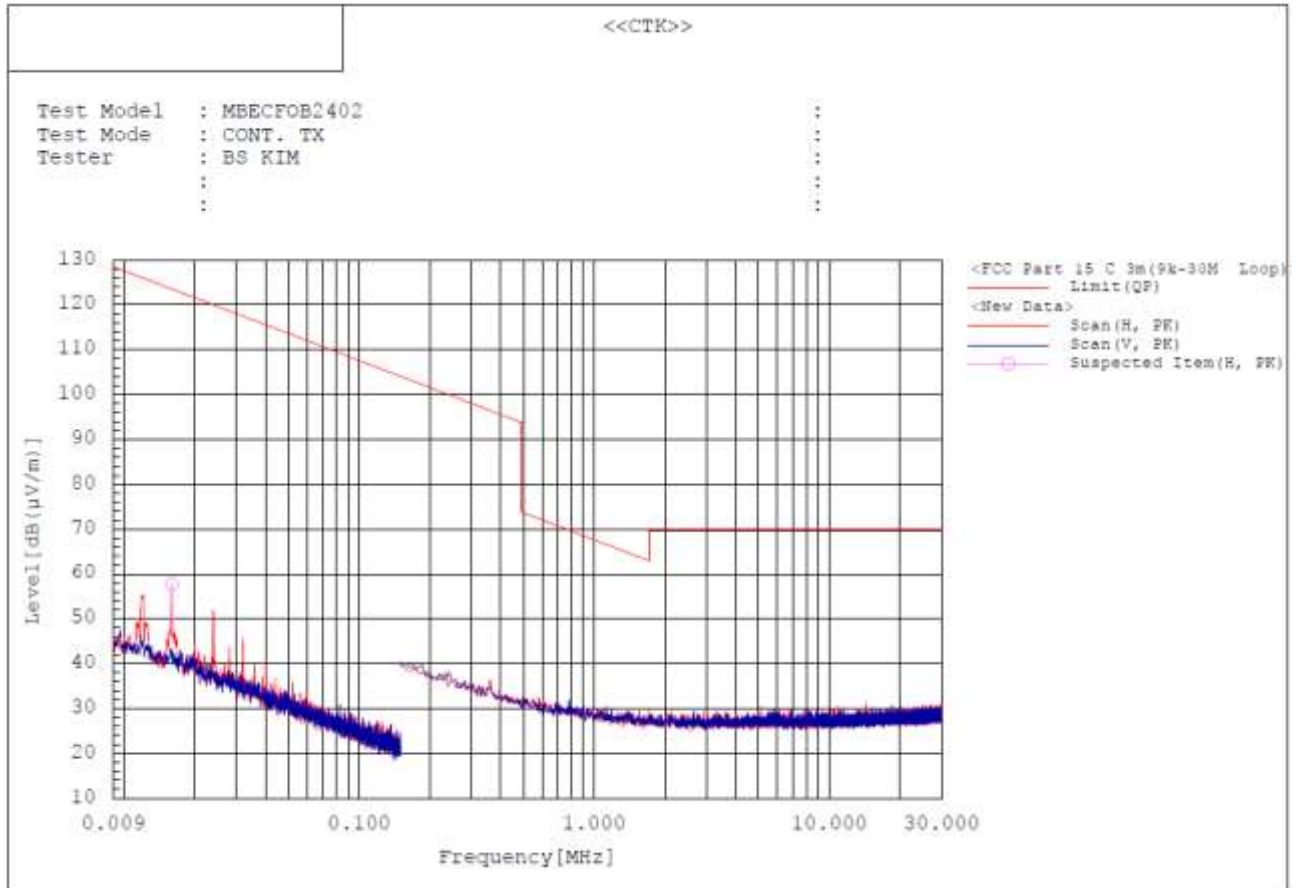
1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp. Gain
3. Average Result = Peak Result + 20log(duty cycle)

## 2) Unwanted emissions

Frequency range : 9 kHz - 30 MHz

The requirements are:

Complies



**Result** : Emissions more than 20 dB below the limit don't need to be reported.

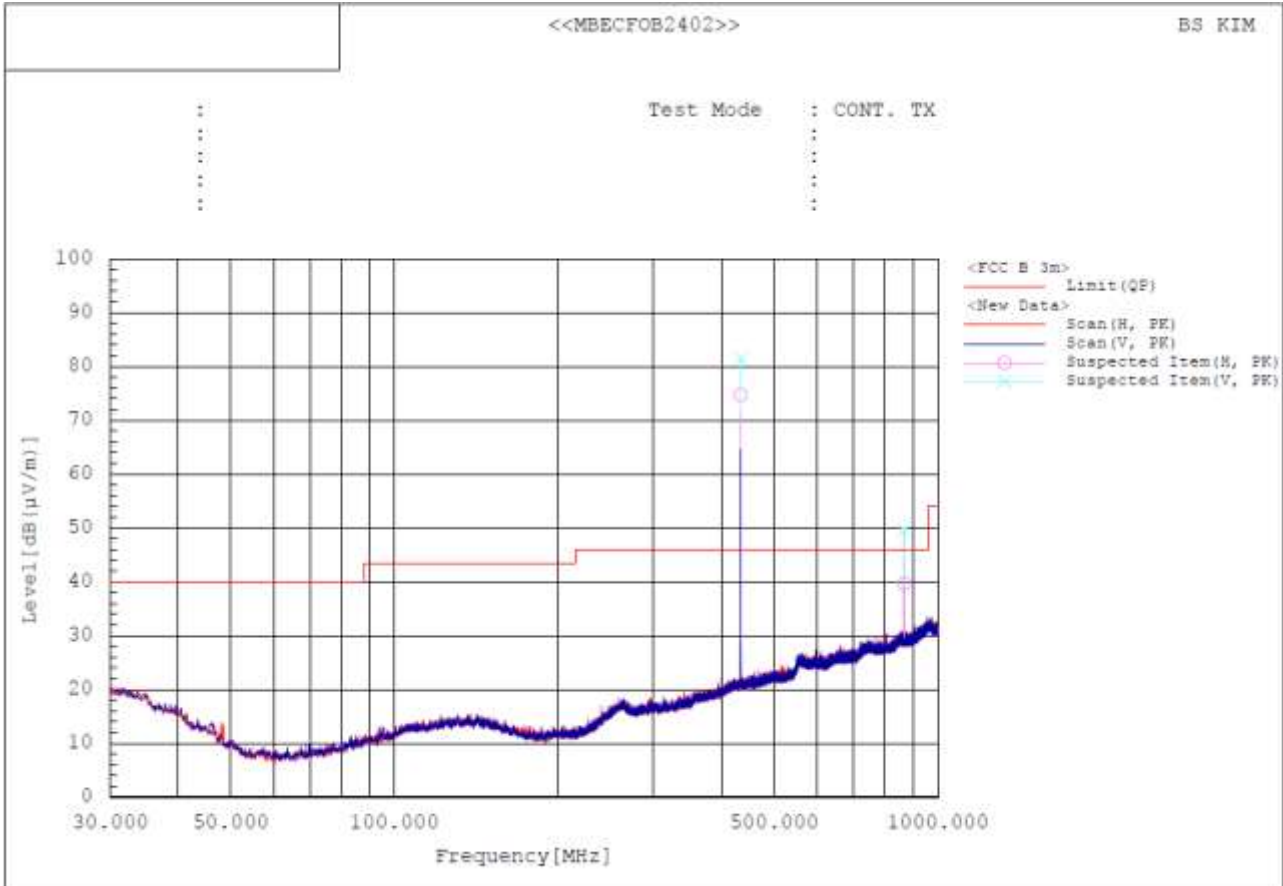
### Remark :

1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator

**Frequency range : 30 MHz - 1 GHz**

The requirements are:

Complies



Frequency [MHz]	Polarization	Reading [dBuV]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Magin[dB]	Remark
433.908	Hor.	78.7	-4.0	74.7	-	-	Fundamental
433.908	Ver.	85.6	-4.0	81.6	-	-	Fundamental
867.886	Hor.	33.8	5.9	39.7	60.8	21.1	Peak
867.886	Ver.	43.7	5.9	49.6	60.8	11.2	Peak

**Remark :**

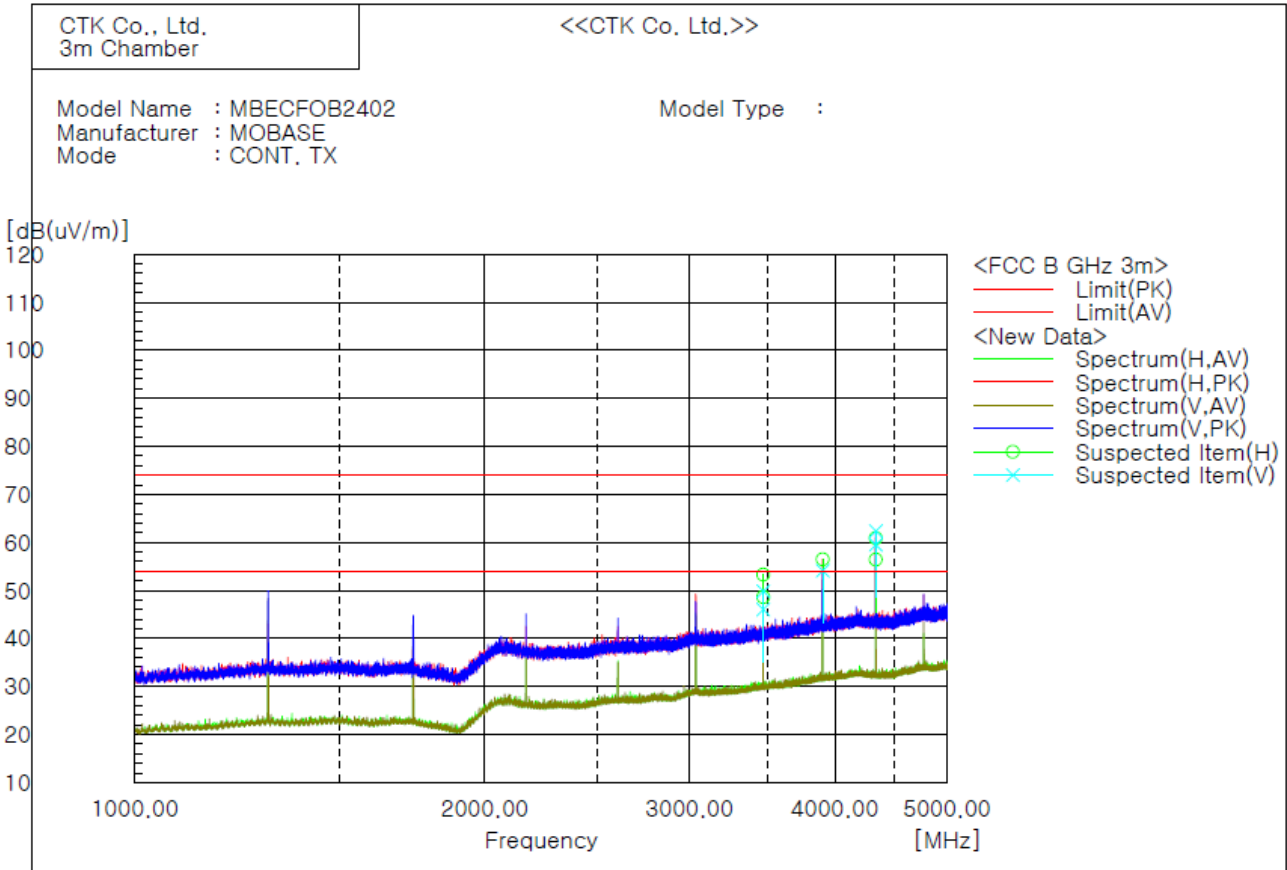
1. Result = Reading + c.f(correction factor)
2. Correction factor = Antenna factor + Cable loss + 6 dB attenuator - Amp. Gain
3. Test result in peak detector is less than Quasi-peak limit.



**Frequency range : 1 GHz - 5 GHz**

The requirements are:

Complies



No.	Frequency [MHz]	Polarization	Reading [dBuV]	c.f [dB/m]	Result [dBuV/m]	Limit [dBuV/m]	Magin[dB]	Remark
1	3 471.699	H	55.1	-1.8	53.3	80.8	27.5	Peak
2	3 471.499	H	50.4	-1.8	48.6	60.8	12.2	Average
3	3 471.499	V	51.6	-1.8	49.8	80.8	31.0	Peak
4	3 471.499	V	47.8	-1.8	46.0	60.8	14.8	Average
5	3 905.316	V	53.8	0.3	54.1	80.8	26.7	Peak
6	3 905.516	H	56.2	0.3	56.5	80.8	24.3	Peak
7	4 339.333	V	61.5	0.8	62.3	80.8	18.5	Peak
8	4 339.333	H	60.1	0.8	60.9	80.8	19.9	Peak
9	4 339.333	V	58.7	0.8	59.5	60.8	1.3	Average
10	4 339.333	H	55.6	0.8	56.4	60.8	4.4	Average

**Remark :**

1. Result = Reading + c.f(Correction factor)
2. Correction factor = Antenna factor + Cable loss - Amp. Gain



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## APPENDIX A – Test Equipment Used For Tests

### Instrument for Radiated emission

No.	Name of Equipment	Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date
1	EMI Test Receiver	Rohde & Schwarz	ESW44	102039	2022-05-04	2023-05-04
2	Active Loop Antenna	SCHWARZBECK	FMZB 1513	1513-125	2022-04-15	2024-04-15
3	Bilog Antenna	TESEQ	CBL6111D	60654	2021-09-03	2023-09-03
4	AMPLIFIER	SONOMA	310N	411011	2021-08-25	2022-08-25
5	6dB Attenuator	PASTERNAK	PE7AP006-06	L20210504000023	2021-08-25	2022-08-25
6	Double Ridged Guide Antenna	ETS-Lindgren	3115	00078895	2022-04-14	2023-04-14
7	Low Noise Amplifier	TESTEK	TK-PA1840H	210124-L	2021-11-15	2022-11-15
8	EMI Test Receiver	R&S	ESU40	100336	2022-01-11	2023-01-11
9	Spectrum Analyzer	R&S	FSP	100401	2022-01-05	2023-01-05

### Cable

No.	Cable	Manufacturer	Model No.	Serial No.	Check Date
1	RF Cable (below 1 GHz/Radiation)	HUBER+SUHNER	SUCOFLEX 104	MY27558/4	2022-04-12
2	RF Cable (below 1 GHz/Radiation)	CANARE	L-5D2W	N/A	2022-04-12
3	RF Cable (above 1GHz/Radiation)	Junkosha Inc.	MWX221	2008S246	2022-04-14
4	RF Cable (above 1GHz/Radiation)	Rosenberger	NONE	1520.9927.00	2022-04-14
5	RF Cable (above 1GHz/Radiation)	Sensorview	9S18	TPC2204060007	2022-04-14
6	Cable (Conduction)	JUNFLON	J12J102248-00-1	SEP-10-14-007	2022-06-08

-END-