

Test Report



INTENTIONAL RADIATOR TESTS ACCORDING TO FCC PART 15 C REQUIREMENTS

Equipment Under Test: Handheld PTT communication device

Type: Aina Kepler

Customer: AINA Wireless Finland Oy
Joensuunkatu 7 G
FI-24100 Salo
FINLAND

Manufacturer: AINA Wireless Finland Oy
Joensuunkatu 7 G
FI-24100 Salo
FINLAND

FCC Rule Part: 15.209: 2019

Date: 3 April 2023

Issued by:

A blue ink signature of Pekka Kälviäinen.

Pekka Kälviäinen
Testing Engineer

Date: 3 April 2023

Checked by:

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Rauno Repo
Senior EMC/RF Specialist

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Equipment Under Test (EUT)

Handheld PTT communication device

Type:	Aina Kepler
Serial no:	-
FCC ID:	2AH78-AKEPLER
IC:	21419-AKEPLER
Cellular module:	Quectel EC25-AF
FCC ID:	2AH78201808EC25AF
IC:	21419-2018EC25AF
Battery:	Rechargeable Li-Polymer Battery
Type:	VARTA Storage GmbH, EZPack XL

Description of the EUT

The equipment under test (EUT) is hand held PTT communication device with 2.4GHz ISM, 13.56 MHz NFC, GNSS and cellular capabilities.

Classification of the device

Fixed device	☐
Mobile Device (Human body distance > 20cm)	☐
Portable Device (Human body distance < 20cm)	☒

Modifications Incorporated in the EUT

No modifications.

Power Supply

EUT:	Rechargeable Li-Polymer Battery
Nominal Voltage:	3.7 VDC
Battery type:	VARTA Storage GmbH, EZPack XL
Rated capacity:	3.7V 2400mAh 8.9Wh

Peripherals

none

Disclaimer

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Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 30 days only.

Summary of Testing

SUMMARY OF TESTING

Test Specification	Description of Test	Result
§15.209(a)	Radiated Spurious Emissions	PASS

EUT Test Conditions during Testing

All radio modules were set to operate.

- ISM, txf = 2440 MHz
- 4G LTE, txf= 1880 MHz, BW 10MHz, (system simulator 1960 MHz)
- NFC, txf = 13.56 MHz, no tag
- GNSS receiver on

Test Facility

Testing Laboratory / address: FCC designation number: FI0002 ISED CAB identifier: T004	SGS Fimko Ltd Takomotie 3 FI-00380, HELSINKI FINLAND
Test Site:	☐ K10LAB, ISED Canada registration number: 8708A-1 ☒ K5LAB, ISED Canada registration number: 8708A-2 ☐ T10LAB

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

TEST RESULTS**Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz**

Standard:	ANSI C63.10	(2013)
Tested by:	PKA	
Date:	1 April 2022	
Temperature:	23 ± 3 °C	
Humidity:	20 - 60 % RH	
Measurement uncertainty:	± 4.51 dB	Level of confidence 95 % (k = 2)

FCC Rule: §15.31(h), §15.209(a)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power. In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

The correction factor in the final result tables contains the sum of the transducers (antenna + amplifier + cables). Spurious emissions were measured while the radios of the EUT were set to continuous transmission.

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

TEST RESULTS, all radios transmit

Full Spectrum

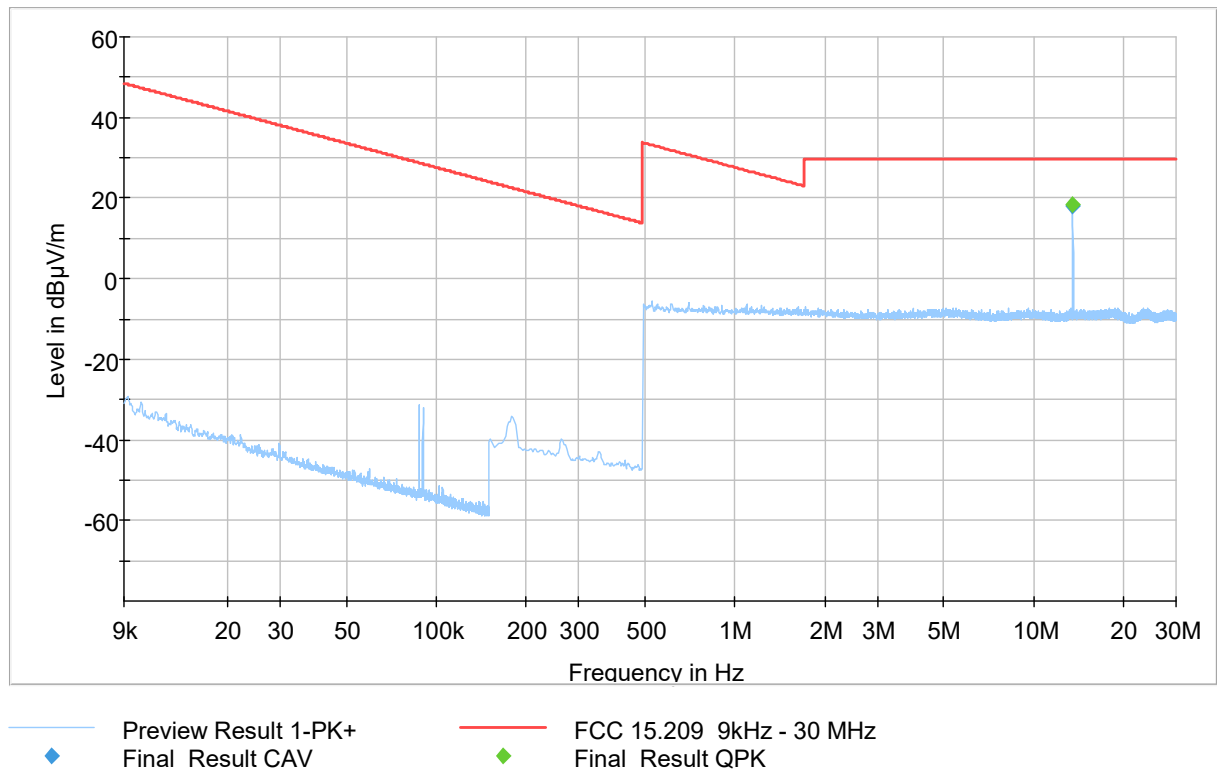


Table 1. Final QP results

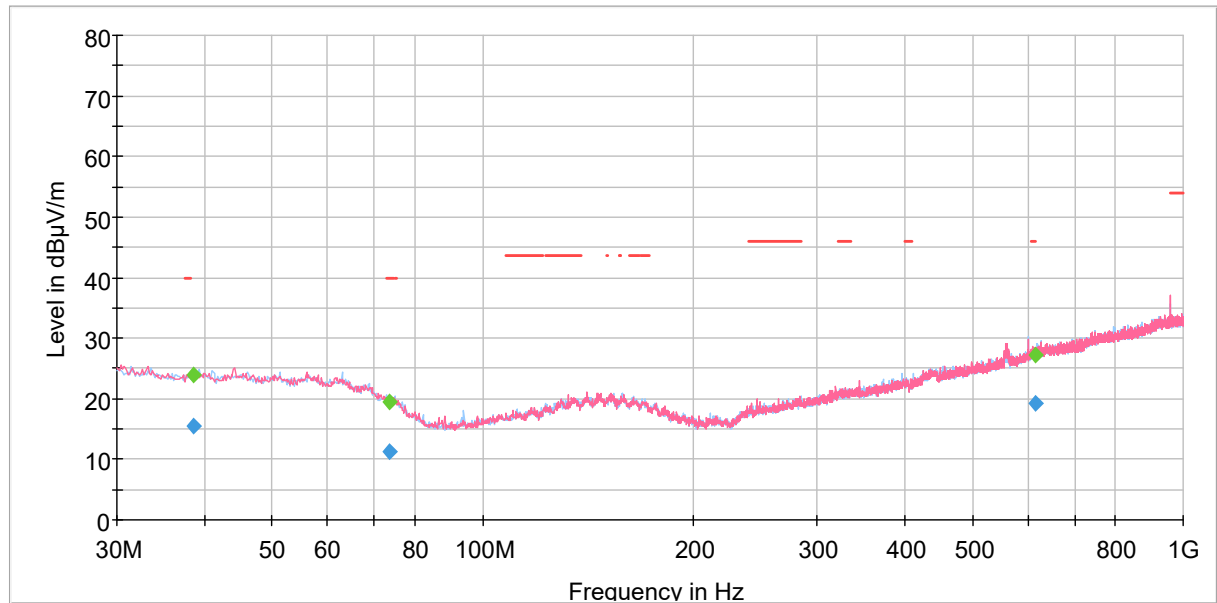
Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
13.559000	18.33	*)	*)	1000.0	9.000	190.0	V	53.0	-20.0

*) Fundamental of the NFC (15.225 limit 80.0 dBμV/m)

According to ANSI C63.10 (clause 5.3.2) and RSS-Gen (Clause 4.11) the measurements below 30 MHz can be performed at a closer distance than the EUT limit distance, the results shall be extrapolated to limit distance by using the square of an inverse linear distance extrapolation factor (40 dB/ decade). This method was used when performing measurements at a distance of 3 m instead of limit distances 300 m or 30 m.

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

Full Spectrum



- Preview Result 1H-PK+
- Preview Result 1V-PK+
- FCC Part 15.205 Restricted bands Electric Field Strength QP (9 kHz - 1 GHz)
- Final_Result QPK
- Final_Result PK+

Figure 1. Spurious emissions 30 MHz to 1 GHz

Table 2. Final QP results

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
38.545000	15.45	40.00	24.55	1000.0	120.000	330.0	H	56.0	16.8
73.585000	11.27	40.00	28.73	1000.0	120.000	126.0	H	145.0	15.2
614.175000	19.17	46.00	26.83	1000.0	120.000	100.0	H	138.0	27.2

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

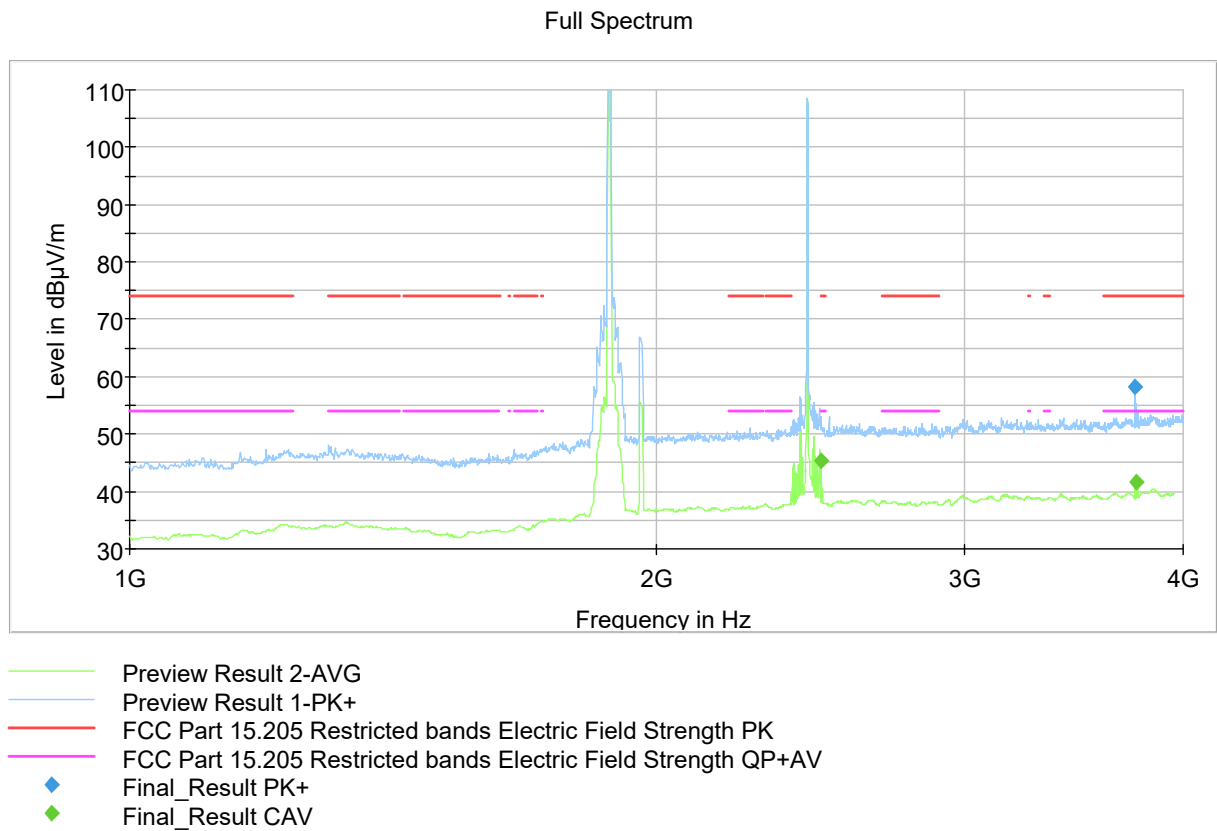


Figure 2. Spurious emissions 1 GHz to 4 GHz

Table 3. Final Peak results

Frequency (MHz)	MaxPeak (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
3752.075000	58.13	74.00	15.87	1000.0	1000.000	207.0	H	210.0	16.7

Table 4. Final Average results

Frequency (MHz)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
2484.575000	45.44	54.00	8.56	1000.0	1000.000	105.0	H	251.0	15.2
3760.025000	41.57	54.00	12.43	1000.0	1000.000	173.0	H	219.0	16.6

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

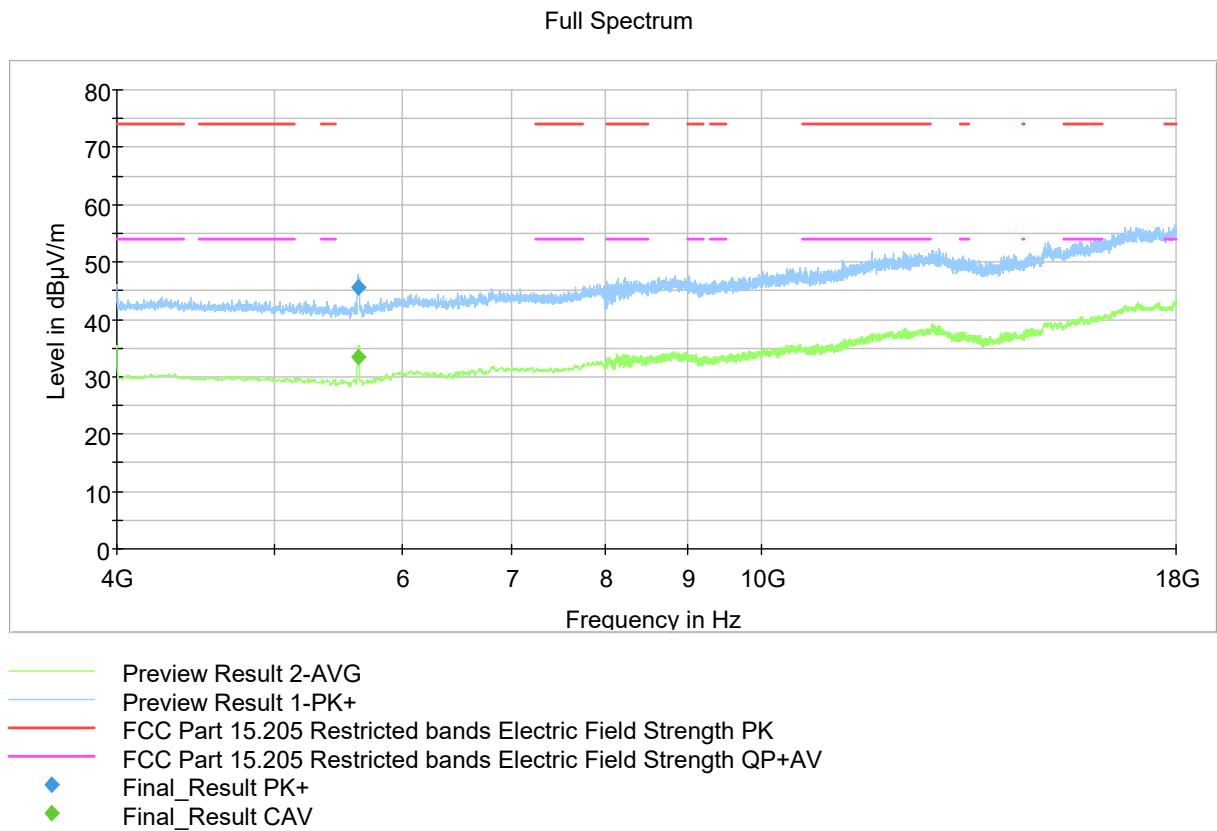


Figure 4. Spurious emissions 4 GHz to 18 GHz

Table 5. Final Peak results

Frequency (MHz)	MaxPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
5640.5250	-64.36dBc	-20dBc	44.36	1000.0	1000.000	178.0	H	242.0	8.0

Transmitter Radiated Spurious Emissions 0.009 MHz – 26.5 GHz

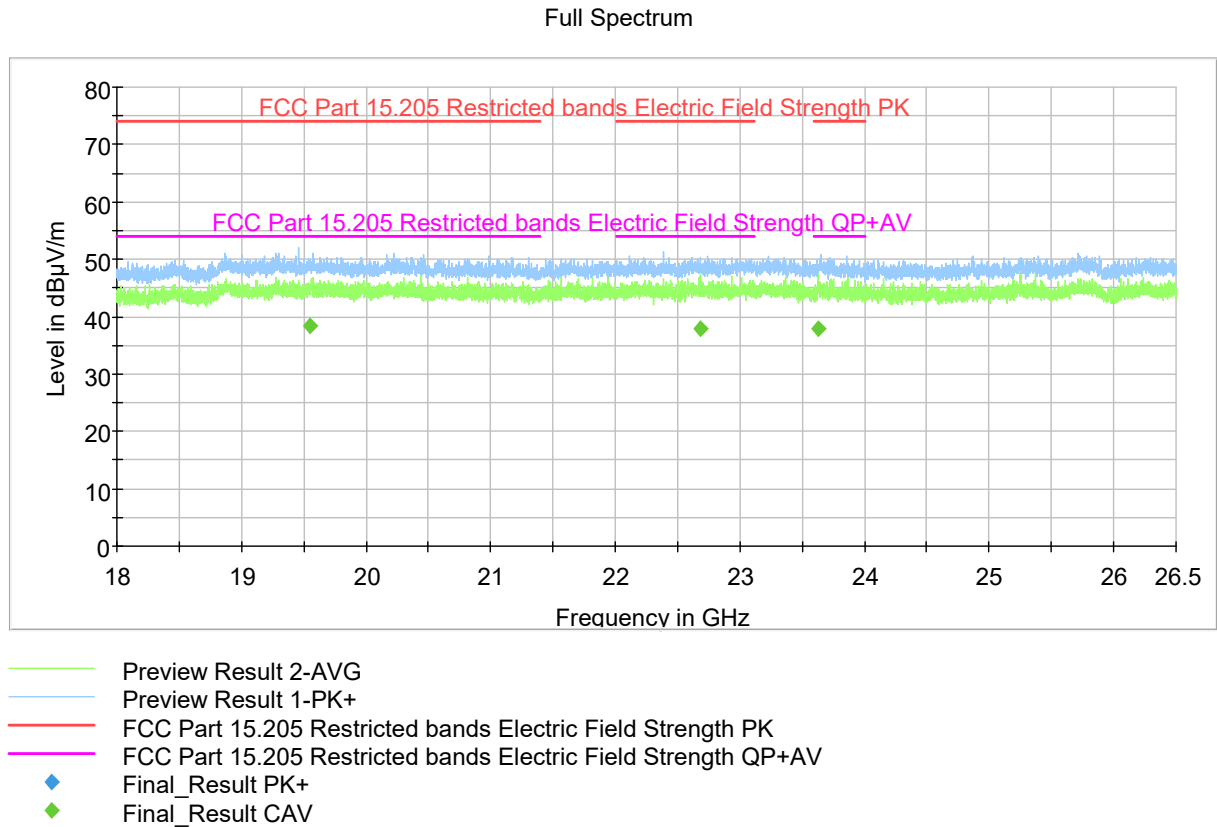


Figure 5. Spurious emissions 18 GHz to 26.5 GHz

Table 6. Final Average results

Frequency (MHz)	CAverage (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
19552.200000	38.40	53.90	15.50	1000.0	1000.000	107.0	V	127.0	7.0
22685.800000	38.02	53.90	15.88	1000.0	1000.000	100.0	H	326.0	8.0
23631.800000	37.87	53.90	16.03	1000.0	1000.000	107.0	H	134.0	5.3

TEST EQUIPMENT

RF-Test Equipment

Equipment	Manufacturer	Type	Inv or serial	Prev Calib	Next Calib
RF PREAMPLIFIER	CIAO	CA118-3123	inv:10278	2021-10-05	2022-10-05
RF PREAMPLIFIER	CIAO	CA1840-5019	inv:10593	2021-10-05	2022-10-05
ANTENNA	EMCO	3117, emi 1-18GHz	inv:9569	2021-04-09	2023-04-09
ANTENNA	EMCO	3160-09, emi 18-26.5GHz	inv:7294	2022-02-22	2023-02-22
ANTENNA	ROHDE & SCHWARZ	HFH2-Z2 , 335.4711.52	inv:8013	2020-10-28	2022-10-28
ANTENNA	SCHWARZBECK	VULB 9168	inv:8911	2020-11-04	2022-11-04
ATTENUATOR	PASTERNAK	PE 7004-4 (4dB)	inv:10126	2022-02-23	2024-02-23
ATTENUATOR	HUBER&SUHNER	6606.19.AA (A4)	inv:10393	2021-04-01	2023-04-01
TURNTABLE	MATURO	DS430 UPGRADED	inv:10182	NCR	-
MAST & TURNTABLE CONTROLLER	MATURO	NCD	inv:10183	NCR	-
ANTENNA MAST	MATURO	TAM 4.0E	inv:10181	NCR	-
TEST SOFTWARE	ROHDE & SCHWARZ	EMC-32	-	NCR	-
EMI TEST RECEIVER	ROHDE & SCHWARZ	ESW26	inv:10679	2021-06-21	2022-06-21
HIGH PASS FILTER	WAINWRIGHT	WHKX4.0/18G-10SS	inv:10403	2021-01-29	2023-01-29
BAND REJECT FILTER	WAINWRIGHT	WRCD1877.5/182.5-1875/1885-40/10SS	inv:10613	2021-01-29	2023-01-29
TEMPERATURE/ HUMIDITY SENSOR	EDS	OW-ENV-TH, K5 SAC	inv:10517	2021-10-22	2022-10-22

NCR = No calibration required

END OF TEST REPORT