FCC PART 15, SUBPART C
ISED RSS-210, ISSUE 10, DECEMBER 2019

TEST AND MEASUREMENT REPORT

For

Aiut sp. z o.o.

ul. Wyczółkowskiego 113,
44-109 Gliwice, Poland

FCC ID: 2AKQSOKO5MS5
IC: 22378-OKO5MS5

Report Type: Original Report		**Product Type:** A metering device, IoT Network Gateway
Prepared By	Zhao Zhao Test Engineer	
Report Number	R2006297-249	
Report Date	2020-08-28	
Reviewed By	Simon Ma RF Supervisor	
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A2LA ACCREDITED
CERTIFICATE #3297.02

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
0	R2006297-249	Original Report	2020-08-28

1 General Description

1.1 Product Description for Equipment Under Test (EUT)

This test and measurement report was prepared on behalf of *Aiut sp. z o.o.* and their product model: *OKO 5MS5,* FCC ID: 2AKQSOKO5MS5, IC: 22378-OKO5MS5, or the "EUT" as referred to in this report. It is a metering device, IoT Network Gateway that has wireless function operating in the 902-928 MHz band. In addition to the model number tested, family model number: OKO 58S5 and ALEVEL 03S5 are declared electrically identical by the applicant. Please refer to the difference below, and manufacturer Declaration of Similarity Letter in Annex D of this report.

Model Number	Contains WWAN Module		
OKO 5MS5	Yes	FCC ID: RI7ME910G1WW	IC: 5131A-ME910G1WW
OKO 58S5	Yes	FCC ID: RI7LE910NAV2	IC: 5131A-LE910NAV2
ALEVEL 03S5	No	-	-

The WWAN radio cannot transmit simultaneously with the 900 MHz radio.

1.2 Mechanical Description of EUT

The EUT measures approximately 100 mm (L) x 61 mm (Ø) and weighs approximately 0.32 kg.

The test data gathered are from typical production sample, serial number: R2006297-01 and R2006297-02 assigned by BACL.

1.3 Objective

This report is prepared on behalf of *Aiut sp. z o.o.* in accordance with Part 2, Subpart J, and Part 15, Subparts C of the Federal Communication Commission's rules and ISED RSS-210 Issue 10, DEC 2019.

The objective is to determine compliance with FCC Part 15.249 and ISED RSS-210 rules for Antenna Requirements, Occupied Bandwidth, and Radiated Spurious Emissions.

1.4 Related Submittal(s)/Grant(s)

N/A

1.5 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

1.6 Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

Parameter	Measurement uncertainty
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±0.57 dB
Power Spectral Density, conducted	±1.48dB
Unwanted Emissions, conducted	±1.57dB
All emissions, radiated	±4.0 dB
AC power line Conducted Emission	±2.0 dB
Temperature	±2 º C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

1.7 Test Facility Registrations

BACLs test facilities that are used to perform Radiated and Conducted Emissions tests are currently recognized by the Federal Communications Commission as Accredited with NIST Designation Number US1129.

BACL's test facilities that are used to perform Radiated and Conducted Emissions tests are currently registered with Industry Canada under Registration Numbers: 3062A-1, 3062A-2, and 3062A-3.

BACL is a Chinese Taipei Bureau of Standards Metrology and Inspection (BSMI) validated Conformity Assessment Body (CAB), under Appendix B, Phase I Procedures of the APEC Mutual Recognition Arrangement (MRA). BACL's BSMI Lab Code Number is: SL2-IN-E-1002R

BACL's test facilities that are used to perform AC Line Conducted Emissions, Telecommunications Line Conducted Emissions, Radiated Emissions from 30 MHz to 1 GHz, and Radiated Emissions from 1 GHz to 6 GHz are currently recognized as Accredited in accordance with the Voluntary Control Council for Interference [VCCI] Article 15 procedures under Registration Number A-0027.

1.8 Test Facility Accreditations

Bay Area Compliance Laboratories Corp. (BACL) is:

A- ***An independent, 3rd-Party, Commercial Test Laboratory accredited to ISO/IEC 17025:2005 by A2LA (Test Laboratory Accreditation Certificate Number 3297.02),*** in the fields of: Electromagnetic Compatibility and Telecommunications. Unless noted by an Asterisk (*) in the Compliance Matrix (See Section 3 of this Test Report), BACL's ISO/IEC 17025:2005 Scope of Accreditation includes all of the Test Method Standards and/or the Product Family Standards detailed in this Test Report..

BACL's ISO/IEC 17025:2005 Scope of Accreditation includes a comprehensive suite of EMC Emissions, EMC Immunity, Radio, RF Exposure, Safety and wireline Telecommunications test methods applicable to a wide

range of product categories. These product categories include Central Office Telecommunications Equipment [including NEBS - Network Equipment Building Systems], Unlicensed and Licensed Wireless and RF devices, Information Technology Equipment (ITE); Telecommunications Terminal Equipment (TTE); Medical Electrical Equipment; Industrial, Scientific and Medical Test Equipment; Professional Audio and Video Equipment; Industrial and Scientific Instruments and Laboratory Apparatus; Cable Distribution Systems, and Energy Efficient Lighting.

B- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.03)*** to certify

- For the USA (Federal Communications Commission):
  - 1- All Unlicensed radio frequency devices within FCC Scopes A1, A2, A3, and A4;
  - 2- All Licensed radio frequency devices within FCC Scopes B1, B2, B3, and B4;
  - 3- All Telephone Terminal Equipment within FCC Scope C.
- For the Canada (Industry Canada):
  - 1 All Scope 1-Licence-Exempt Radio Frequency Devices;
  - 2 All Scope 2-Licensed Personal Mobile Radio Services;
  - 3 All Scope 3-Licensed General Mobile and Fixed Radio Services;
  - 4 All Scope 4-Licensed Maritime and Aviation Radio Services;
  - 5 All Scope 5-Licensed Fixed Microwave Radio Services
  - 6 All Broadcasting Technical Standards (BETS) in the Category I Equipment Standards List.
- For Singapore (Info-Communications Development Authority (IDA)):
  - 1 All Line Terminal Equipment: All Technical Specifications for Line Terminal Equipment – Table 1 of IDA MRA Recognition Scheme: 2011, Annex 2
  - 2. All Radio-Communication Equipment: All Technical Specifications for Radio-Communication Equipment – Table 2 of IDA MRA Recognition Scheme: 2011, Annex 2
- For the Hong Kong Special Administrative Region:
  - 1 All Radio Equipment, per KHCA 10XX-series Specifications;
  - 2 All GMDSS Marine Radio Equipment, per HKCA 12XX-series Specifications;
  - 3 All Fixed Network Equipment, per HKCA 20XX-series Specifications.
- For Japan:
  - 1 MIC Telecommunication Business Law (Terminal Equipment):
    - All Scope A1 - Terminal Equipment for the Purpose of Calls;
    - All Scope A2 - Other Terminal Equipment
  - 2 Radio Law (Radio Equipment):
    - All Scope B1 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 1 of the Radio Law
    - All Scope B2 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 2 of the Radio Law
    - All Scope B3 - Specified Radio Equipment specified in Article 38-2-2, paragraph 1, item 3 of the Radio Law

C- ***A Product Certification Body accredited to ISO/IEC 17065:2012 by A2LA (Product Certification Body Accreditation Certificate Number 3297.01)*** to certify Products to USA's Environmental Protection Agency (EPA) ENERGY STAR Product Specifications for:

1 Electronics and Office Equipment:
- for Telephony (ver. 3.0)
- for Audio/Video (ver. 3.0)
- for Battery Charging Systems (ver. 1.1)
- for Set-top Boxes and Cable Boxes (ver. 4.1)
- for Televisions (ver. 6.1)
- for Computers (ver. 6.0)
- for Displays (ver. 6.0)

- for Imaging Equipment (ver. 2.0)
- for Computer Servers (ver. 2.0)

2 Commercial Food Service Equipment
- for Commercial Dishwashers (ver. 2.0)
- for Commercial Ice Machines (ver. 2.0)
- for Commercial Ovens (ver. 2.1)
- for Commercial Refrigerators and Freezers

3 Lighting Products
- For Decorative Light Strings (ver. 1.5)
- For Luminaires (including sub-components) and Lamps (ver. 1.2)
- For Compact Fluorescent Lamps (CFLs) (ver. 4.3)
- For Integral LED Lamps (ver. 1.4)

4 Heating, Ventilation, and AC Products
- for Residential Ceiling Fans (ver. 3.0)
- for Residential Ventilating Fans (ver. 3.2)

5 Other
- For Water Coolers (ver. 3.0)

D- ***A NIST Designated Phase-I and Phase-II Conformity Assessment Body (CAB) for the following economies and regulatory authorities under the terms of the stated MRAs/Treaties:***

- Australia: ACMA (Australian Communication and Media Authority) – APEC Tel MRA -Phase I;
- Canada: (Industry Canada - IC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China – Taiwan):
  - BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
  - NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
  - Radio & Teleterminal Equipment (R&TTE) Directive 1995/5/EC
    US -EU EMC & Telecom MRA CAB
- Hong Kong Special Administrative Region: (Office of the Telecommunications Authority – OFTA) APEC Tel MRA -Phase I & Phase II
- Israel – US-Israel MRA Phase I
- Republic of Korea (Ministry of Communications - Radio Research Laboratory) APEC Tel MRA -Phase I
- Singapore: (Infocomm Development Authority - IDA) APEC Tel MRA -Phase I & Phase II;
- Japan: VCCI - Voluntary Control Council for Interference US-Japan Telecom Treaty VCCI Side Letter-
- USA:
  - ENERGY STAR Recognized Test Laboratory – US EPA
  - Telecommunications Certification Body (TCB) – US FCC;
- Vietnam: APEC Tel MRA -Phase I;

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to ANSI C63.10-2013.

The EUT was tested in a testing mode to represent worst-case results during the final qualification test.

2.2 EUT Exercise Software

The EUT was transmit using Terminal V1.93b provided by *AIUT Sp. z.o.o*. The test software is compliant with the standard requirements being against.

Modulation	Frequency (MHz)	Power Setting
FSK	902.025	default
	915.025	default
	926.880	default

2.3 Duty Cycle Correction Factor

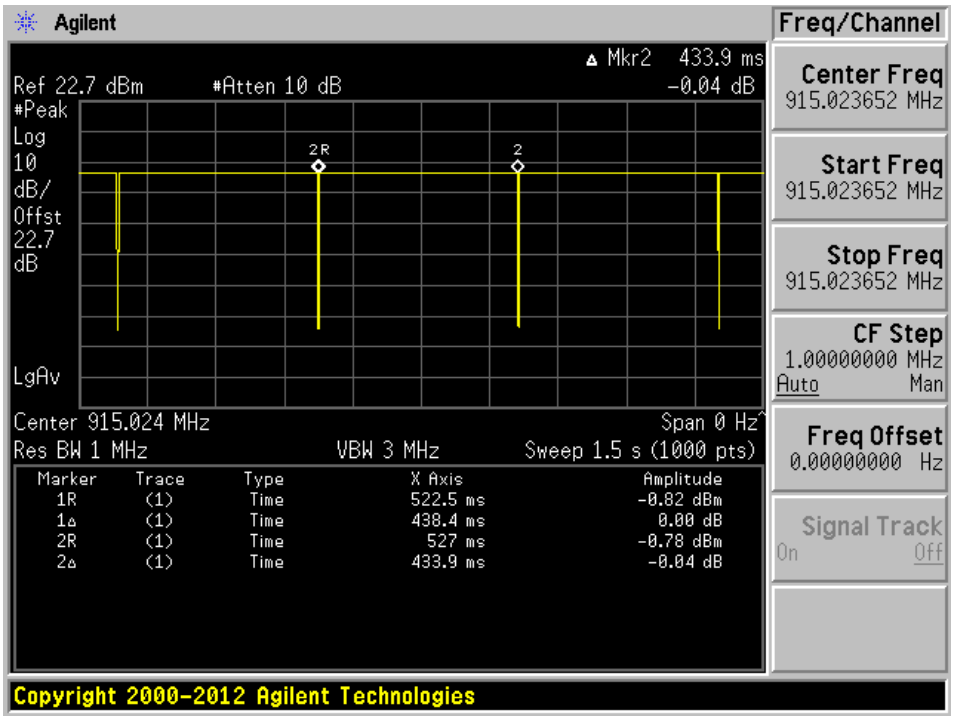
According to ANSI C63.10-2013 section 11.6:

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be utilized to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data is being acquired (i.e., no transmitter off-time is to be considered).

On Time (ms)	Period (ms)	Duty Cycle (%)	Duty Cycle Correction Factor (dB)
433.9	438.4	98.97	-

Duty Cycle = On Time (ms)/ Period (ms); Duty Cycle Correction Factor (dB) = 10*log (1/Duty Cycle)

Please refer to the following plots.


Agilent
Freq/Channel
Mkr2 433.9 ms
Ref 22.7 dBm
#Atten 10 dB
-0.04 dB
#Peak
Log
10
dB/
Offst
22.7
dB
2R
2
LgAv
Center 915.024 MHz
Span 0 Hz
Res BW 1 MHz
VBW 3 MHz
Sweep 1.5 s (1000 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 522.5 ms -0.82 dBm
1Δ (1) Time 438.4 ms 0.00 dB
2R (1) Time 527 ms -0.78 dBm
2Δ (1) Time 433.9 ms -0.04 dB
Center Freq
915.023652 MHz
Start Freq
915.023652 MHz
Stop Freq
915.023652 MHz
CF Step
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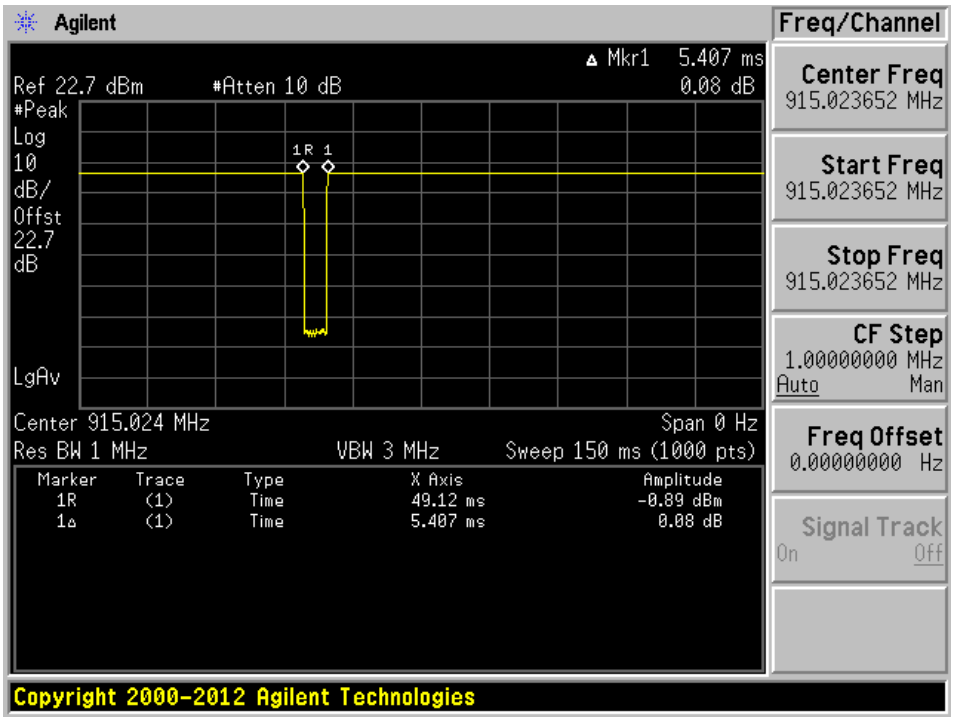
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Copyright 2000-2012 Agilent Technologies


Agilent
Freq/Channel
Mkr1 5.407 ms
Ref 22.7 dBm
#Atten 10 dB
0.08 dB
#Peak
Log
10
dB/
Offst
22.7
dB
1R 1
LgAv
Center 915.024 MHz
Span 0 Hz
Res BW 1 MHz
VBW 3 MHz
Sweep 150 ms (1000 pts)
Marker Trace Type X Axis Amplitude
1R (1) Time 49.12 ms -0.89 dBm
1Δ (1) Time 5.407 ms 0.08 dB
Center Freq
915.023652 MHz
Start Freq
915.023652 MHz
Stop Freq
915.023652 MHz
CF Step
1.00000000 MHz
Auto Man
Freq Offset
0.00000000 Hz
Signal Track
On Off
Copyright 2000-2012 Agilent Technologies

2.4 Equipment Modifications

None

2.5 Local Support Equipment

Manufacturer	Description	Model
ASUS	Laptop	-

2.6 Support Equipment

N/A

2.7 Interface Ports and Cabling

Cable Description	Length (m)	To	From
Micro USB to USB	< 1 m	Laptop	EUT
RF Cable	< 1 m	EUT	PSA

3 Summary of Test Results

Results reported relate only to the product tested.

FCC & ISED Rules	Description of Test	Results
FCC §2.1091 ISED RSS-102	RF Exposure	Compliant
FCC §15.203 ISED RSS-Gen §8.3	Antenna Requirement	Compliant
FCC §15.207 ISED RSS-Gen §8.8	AC Line Conducted Emissions	N/A
FCC §2.1053, §15.205, §15.209, §15.249 (a) ISED RSS-210	Radiated Spurious Emissions	Compliant
FCC §15.215 ISED RSS-Gen §6.6	Emission Bandwidth	Compliant

N/A: The EUT is powered by battery, therefore, AC Line Conducted Emission test is not applicable.

4 FCC §2.1091 & ISED RSS-102 - RF Exposure

4.1 Applicable Standards

According to FCC §2.1091 (Mobile Devices) RF exposure is calculated.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3-1.34	614	1.63	*(100)	30
1.34-30	824/f	2.19/f	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500	/	/	f/1500	30
1500-100,000	/	/	1.0	30

Note: f = frequency in MHz
* = Plane-wave equivalent power density

According to ISED RSS-102 Issue 5:

2.5.2 Exemption Limits for Routine Evaluation – RF Exposure Evaluation

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz[6] and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $4.49/f^{0.5}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than $1.31 \times 10^{-2} f^{0.6834}$ W (adjusted for tune-up tolerance), where f is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance).

In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

4.2 MPE Prediction

Predication of MPE limit at a given distance, Equation from OET Bulletin 65, Edition 97-01

$$S = PG/4\pi R^2$$

Where: S = power density
P = power input to antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

The MPE calculation was based on the power of cellular networks since the cellular networks has higher power.

4.3 Test Results for FCC

Model: OKO 5MS5 with Module FCC ID: RI7ME910G1WW

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
NB-IoT							
2	23.86	25	20	0	0.063	1.0	Pass
4	23.62	25	20	0	0.063	1.0	Pass
5	23.24	25	20	0	0.063	0.549	Pass
12	23.56	25	20	0	0.063	0.466	Pass
13	23.68	25	20	0	0.063	0.518	Pass
25	23.7	25	20	0	0.063	1.0	Pass
26	23.86	25	20	0	0.063	0.543	Pass
66	23.81	25	20	0	0.063	1.0	Pass
71	21.89	22	20	0	0.032	0.442	Pass
85	23.63	25	20	0	0.063	0.465	Pass

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm²)	Limit (mW/cm²)	Result
eMTC							
2	23.86	25	20	0	0.063	1.0	Pass
4	23.62	25	20	0	0.063	1.0	Pass
5	23.24	25	20	0	0.063	0.549	Pass
12	23.56	25	20	0	0.063	0.466	Pass
13	23.68	25	20	0	0.063	0.518	Pass
25	23.7	25	20	0	0.063	1.0	Pass
26	23.86	25	20	0	0.063	0.543	Pass
66	23.81	25	20	0	0.063	1.0	Pass
85	23.63	25	20	0	0.063	0.465	Pass

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Division Factors (dB)	Antenna Gain (dBi)	Max E.R.P/E.I.R.P (dBm)	Evaluated Distance (cm)	Power Density (mW/cm²)	Limit (mW/cm²)	Result
GPRS									
850(1slot)	33.23	33.5	-9.03	0	24.47	20	0.056	0.549	Pass
850(2slots)	31.87	33.5	-6.02	0	27.48	20	0.111	0.549	Pass
850(3slots)	29.91	30	-4.26	0	25.74	20	0.075	0.549	Pass
850(4slots)	27.67	28	-3.01	0	24.99	20	0.063	0.549	Pass
1900(1slot)	30.26	30.5	-9.03	0	21.47	20	0.028	1.0	Pass
1900(2slots)	30.41	30.5	-6.02	0	24.48	20	0.056	1.0	Pass
1900(3slots)	29.56	30	-4.26	0	25.74	20	0.075	1.0	Pass
1900(4slots)	28.98	29	-3.01	0	25.99	20	0.079	1.0	Pass
EDGE									
850(1slot)	27.31	28	-9.03	0	18.97	20	0.016	0.549	Pass
850(2slots)	27.52	28	-6.02	0	21.98	20	0.031	0.549	Pass
850(3slots)	27.84	28	-4.26	0	23.74	20	0.047	0.549	Pass
850(4slots)	26.84	27	-3.01	0	23.99	20	0.050	0.549	Pass
1900(1slot)	26.72	27	-9.03	0	17.97	20	0.012	1.0	Pass
1900(2slots)	26.53	27	-6.02	0	20.98	20	0.025	1.0	Pass
1900(3slots)	26.44	27	-4.26	0	22.74	20	0.037	1.0	Pass
1900(4slots)	26.30	27	-3.01	0	23.99	20	0.050	1.0	Pass

Model: OKO 58S5 with Module FCC ID: RI7LE910NAV2

Frequency Band	Reference Frequency (MHz)	Tune-up Power (dBm)	Evaluated Distance (cm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Result
LTE FDD							
FDD 12	699.0	24.00	20	0	0.050	0.466	Pass
FDD 17	704.0	24.00	20	0	0.050	0.469	Pass
FDD 13	777.0	24.00	20	0	0.050	0.518	Pass
FDD 5	824.7	24.00	20	0	0.050	0.55	Pass
FDD 4	1710.7	24.00	20	0	0.050	1.000	Pass
FDD 2	1850.7	24.00	20	0	0.050	1.000	Pass
WCDMA/HSPA							
FDD V	826.4	24.50	20	0	0.056	0.551	Pass
FDD II	1852.4	24.50	20	0	0.056	1.000	Pass

4.4 RF Exposure Exemption Evaluation for ISED

Model: OKO 5MS5 with Module IC: 5131A-ME910G1WW

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
NB-IoT						
2	23.86	25	0	0.316	2.239	Exempt
4	23.62	25	0	0.316	2.122	Exempt
5	23.24	25	0	0.316	1.288	Exempt
12	23.56	25	0	0.316	1.151	Exempt
13	23.68	25	0	0.316	1.238	Exempt
25	23.7	25	0	0.316	2.239	Exempt
26	23.86	25	0	0.316	1.278	Exempt
66	23.81	25	0	0.316	2.122	Exempt
71	21.89	22	0	0.158	1.110	Exempt
85	23.63	25	0	0.316	1.150	Exempt

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
eMTC						
2	23.86	25	0	0.316	2.239	Exempt
4	23.62	25	0	0.316	2.122	Exempt
5	23.24	25	0	0.316	1.288	Exempt
12	23.56	25	0	0.316	1.151	Exempt
13	23.68	25	0	0.316	1.238	Exempt
25	23.7	25	0	0.316	2.239	Exempt
26	23.86	25	0	0.316	1.278	Exempt
66	23.81	25	0	0.316	2.122	Exempt
85	23.63	25	0	0.316	1.150	Exempt

Frequency Band	Max Conducted Power (dBm)	Tune-up Power (dBm)	Division Factors (dB)	Antenna Gain (dBi)	Max E.R.P/E.I.R.P (dBm)	Max E.R.P/E.I.R.P (W)	Limit (W)	Result
GPRS								
850(1slot)	33.23	33.5	-9.03	0	24.47	0.280	1.288	Exempt
850(2slots)	31.87	33.5	-6.02	0	27.48	0.560	1.288	Exempt
850(3slots)	29.91	30	-4.26	0	25.74	0.375	1.288	Exempt
850(4slots)	27.67	28	-3.01	0	24.99	0.316	1.288	Exempt
1900(1slot)	30.26	30.5	-9.03	0	21.47	0.140	2.239	Exempt
1900(2slots)	30.41	30.5	-6.02	0	24.48	0.281	2.239	Exempt
1900(3slots)	29.56	30	-4.26	0	25.74	0.375	2.239	Exempt
1900(4slots)	28.98	29	-3.01	0	25.99	0.397	2.239	Exempt
EDGE								
850(1slot)	27.31	28	-9.03	0	18.97	0.079	1.288	Exempt
850(2slots)	27.52	28	-6.02	0	21.98	0.158	1.288	Exempt
850(3slots)	27.84	28	-4.26	0	23.74	0.237	1.288	Exempt
850(4slots)	26.84	27	-3.01	0	23.99	0.251	1.288	Exempt
1900(1slot)	26.72	27	-9.03	0	17.97	0.063	2.239	Exempt
1900(2slots)	26.53	27	-6.02	0	20.98	0.125	2.239	Exempt
1900(3slots)	26.44	27	-4.26	0	22.74	0.188	2.239	Exempt
1900(4slots)	26.30	27	-3.01	0	23.99	0.251	2.239	Exempt

Model: OKO 58S5 with Module IC: 5131A-LE910NAV2

Frequency Band	Reference Frequency (MHz)	Tune-up Power (dBm)	Antenna Gain (dBi)	Tune-up EIRP (W)	Limit (W)	Result
LTE FDD						
FDD 12	699.0	24.00	0	0.251	1.151	Pass
FDD 17	704.0	24.00	0	0.251	1.157	Pass
FDD 13	777.0	24.00	0	0.251	1.238	Pass
FDD 5	824.7	24.00	0	0.251	1.289	Pass
FDD 4	1710.7	24.00	0	0.251	2.122	Pass
FDD 2	1850.7	24.00	0	0.251	2.240	Pass
WCDMA/HSPA						
FDD V	826.4	24.50	0	0.282	1.291	Pass
FDD II	1852.4	24.50	0	0.282	2.241	Pass

5 FCC §15.203 & ISED RSS-Gen §8.3 - Antenna Requirements

5.1 Applicable Standards

According to FCC §15.203:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this Section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

According to ISED RSS-Gen §8.3: Transmitter Antenna

The applicant for equipment certification, as per RSP-100, must provide a list of all antenna types that may be used with the license-exempt transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna.

License-exempt transmitters that have received equipment certification may operate with different types of antennas. However, it is not permissible to exceed the maximum equivalent isotropically radiated power (e.i.r.p.) limits specified in the applicable standard (RSS) for the license-exempt apparatus.

Testing shall be performed using the highest gain antenna of each combination of license-exempt transmitter and antenna type, with the transmitter output power set at the maximum level. 9 When a measurement at the antenna connector is used to determine RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna manufacturer.

User manuals for transmitters equipped with detachable antennas shall also contain the following notice in a conspicuous location:

This radio transmitter (identify the device by certification number) has been approved by Industry Canada to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Immediately following the above notice, the manufacturer shall provide a list of all antenna types approved for use with the transmitter, indicating the maximum permissible antenna gain (in dBi).

5.2 Antenna Description

The antenna used by the EUT is an integral 1/4 whip antenna.

Modulation	Frequency Range (MHz)	Antenna Type	Maximum Antenna Gain (dBi)
FSK	902-928	Dipole	0

6 FCC §15.209, §15.249(a) & ISED RSS-210 - Spurious Radiated Emissions

6.1 Applicable Standards

As per FCC §15.35(d): Unless otherwise specified, on any frequency or frequencies above 1000 MHz, the radiated emission limits are based on the use of measurement instrumentation employing an average detector function. Unless otherwise specified, measurements above 1000 MHz shall be performed using a minimum resolution bandwidth of 1 MHz.

As Per FCC §15.205(a) and RSS-Gen except as show in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

MHz	MHz	MHz	GHz
0.090 – 0.110 0.495 – 0.505 2.1735 – 2.1905 4.125 – 4.128 4.17725 – 4.17775 4.20725 – 4.20775 6.215 – 6.218 6.26775 – 6.26825 6.31175 – 6.31225 8.291 – 8.294 8.362 – 8.366 8.37625 – 8.38675 8.41425 – 8.41475 12.29 – 12.293 12.51975 – 12.52025 12.57675 – 12.57725 13.36 – 13.41	16.42 – 16.423 16.69475 – 16.69525 25.5 – 25.67 37.5 – 38.25 73 – 74.6 74.8 – 75.2 108 – 121.94 123 – 138 149.9 – 150.05 156.52475 – 156.52525 156.7 – 156.9 162.0125 –167.17 167.72 – 173.2 240 – 285 322 – 335.4 399.9 – 410 608 – 614	960 – 1240 1300 – 1427 1435 – 1626.5 1645.5 – 1646.5 1660 – 1710 1718.8 – 1722.2 2200 – 2300 2310 – 2390 2483.5 – 2500 2690 – 2900 3260 – 3267 3.332 – 3.339 3 3458 – 3 358 3.600 – 4.400	4. 5 – 5. 15 5. 35 – 5. 46 7.25 – 7.75 8.025 – 8.5 9.0 – 9.2 9.3 – 9.5 10.6 – 12.7 13.25 – 13.4 14.47 – 14.5 15.35 – 16.2 17.7 – 21.4 22.01 – 23.12 23.6 – 24.0 31.2 – 31.8 36.43 – 36.5 Above 38.6

As per FCC §15.209(a): Except as provided elsewhere in this Subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table

Frequency (MHz)	Field Strength (micro volts/meter)	Measurement Distance (meters)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100**	3
88 - 216	150**	3
216 - 960	200**	3
Above 960	500	3

** Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this Section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this Part, e.g., Sections 15.231 and 15.241.

As per FCC §15.249(a) and RSS-210 Annex 2 section A2.9: Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Frequency (MHz)	Field Strength of Fundamental (millivolts/meter)	Field Strength of Harmonics (microvolts/meter)
902-928	50	500
2400-2483.5	50	500
5725-5875	50	500
24000-24250	250	2500

As per FCC §15.249(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

As per RSS-210 Annex B.10 Devices shall comply with the following requirements:
The field strength of fundamental and harmonic emissions measured at 3 m shall not exceed the limits in table B2.

Table B2 — Field strength limits at various frequencies

	Field strength (mV/m)	
Frequency bands (MHz)	Fundamental emissions	Harmonic emissions
902-928	50	0.5
2400-2483.5	50	0.5
5725-5875	50	0.5
24000-24250	250	2.5

The field strength shall be measured using an average detector, except for the fundamental emission in the frequency band 902-928 MHz, which is based on measurements using an International Special Committee on Radio Interference (CISPR) quasi-peak detector.

Emissions radiated outside of the specified frequency bands, except for harmonic emissions, shall be attenuated by at least 50 dB below the level of the fundamental emissions or to the general field strength limits listed in RSS-Gen, whichever is less stringent.

6.2 Test Setup

The radiated emissions tests were performed in the 5-meter Chamber, using the setup in accordance with ANSI C63.10-2013. The specification used was FCC 15 Subpart C limits.

The spacing between the peripherals was 10 centimeters.

External I/O cables were draped along the edge of the test table and bundle when necessary.

6.3 Test Procedure

For the radiated emissions test, the EUT host, and all support equipment power cords were connected to the AC floor outlet.

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

The EUT was set 3 meter away from the testing antenna, which was varied from 1-4 meter, and the EUT was placed on a turntable, which was 0.8 meter and 1.5 meter above the ground plane for below and above 1000 MHz measurements, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna's polarity should be changed between horizontal and vertical.

The spectrum analyzer or receiver was set as:

Below 1000 MHz:

RBW = 100 kHz / VBW = 300 kHz / Sweep = Auto

Above 1000 MHz:

(1) Peak: RBW = 1MHz / VBW = 1MHz / Sweep = Auto
(2) Average: RBW = 1MHz / VBW = 10Hz / Sweep = Auto

6.4 Corrected Amplitude & Margin Calculation

The Corrected Amplitude (CA) is calculated by adding the Antenna Factor (AF), the Cable Loss (CL), the Attenuator Factor (Atten) and subtracting the Amplifier Gain (Ga) to indicated Amplitude (Ai) reading. The basic equation is as follows:

CA = Ai + AF + CL + Atten – Ga

For example, a corrected amplitude of 40.3 dBuV/m = Indicated Reading (32.5 dBuV) + Antenna Factor (+23.5dB) + Cable Loss (3.7 dB) + Attenuator (10 dB) - Amplifier Gain (29.4 dB)
The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of -7 dB means the emission is 7 dB below the maximum limit. The equation for margin calculation is as follows:

Margin = Corrected Amplitude – Limit

6.5 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde and Schwarz	Signal Analyzer	FSV40	1321.3008K39-101203-UW	2019-08-06	1.5 years
Rohde & Schwarz	Receiver, EMI Test	ESCI 1166.5950.03	100338	2018-07-05	2.5 years
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB3	A020106-2	2018-11-20	2 years
ETS Lindgren	Antenna, Horn	3117	00218973	2019-02-13	2 years
Agilent	Amplifier, Pre	8449B	3147A00400	2020-02-27	1 year
IW Microwave	150 Series 2.92mm Cable	KPS1501AN-3780-KPS	DC 1925	2019-09-11	1 year
IW Microwave	157 Series 2.92mm Cable	KPS-1571AN-2400	DC 1922	2020-06-06	1 year
HP	Pre-Amplifier	8447D	2443A04374	2019-08-13	1 year
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) "A2LA Policy on Metrological Traceability".*

6.6 Test Environmental Conditions

Temperature:	20-22 ºC
Relative Humidity:	32-44 %
ATM Pressure:	101.5 kPa

The testing was performed by Zhao Zhao on 2020-07-27 and on 2020-08-10 in 5m chamber 3.

6.7 Summary of Test Results

According to the data hereinafter, the EUT complied with FCC Title 47, Part 15C and ISED RSS-210 standard's radiated emissions limits, and had the worst spurious emission margin of:

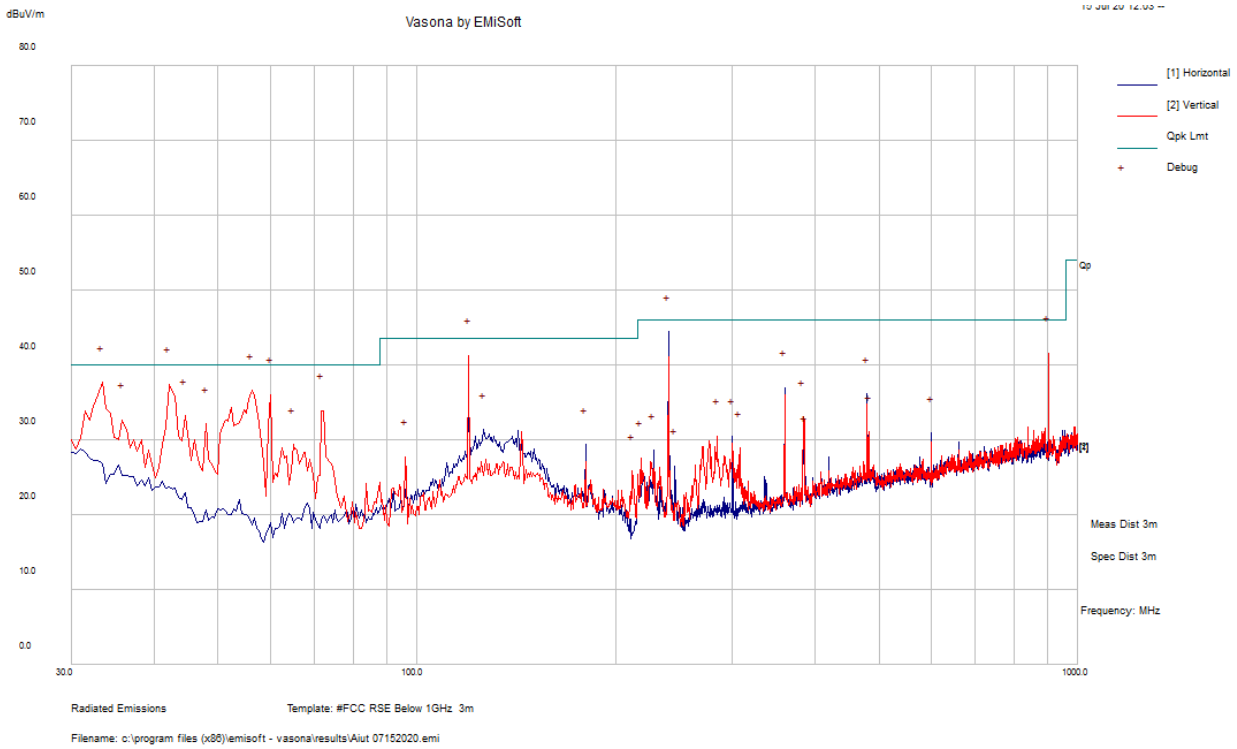
Mode: Transmitting			
Margin (dB)	**Frequency (MHz)**	**Polarization (Horizontal/Vertical)**	**Channel**
-1.80	902	Vertical	Low channel

Please refer to the following table and plots for specific test result details

6.8 Radiated Emissions Test Results

Except fundamental field strength and band-edge emissions, testing was performed with band-reject filter.

1) 30 MHz – 1 GHz Worst Case (Low Channel), Measured at 3 meters



Frequency (MHz)	Corrected Amplitude (dBµV/m)	Antenna Height (cm)	Antenna Polarity (H/V)	Turntable Azimuth (degrees)	Limit (dBµV/m)	Margin (dB)	Comment
240.041	44.13	126	H	102	46	-1.87	QP
120.01	41	102	V	184	43.5	-2.5	QP
33.383	31.72	118	V	90	40	-8.28	QP
42.1495	29.08	126	V	315	40	-10.92	QP
56.425	31.51	138	V	30	40	-8.49	QP
60.07	36.07	100	V	0	40	-3.93	QP

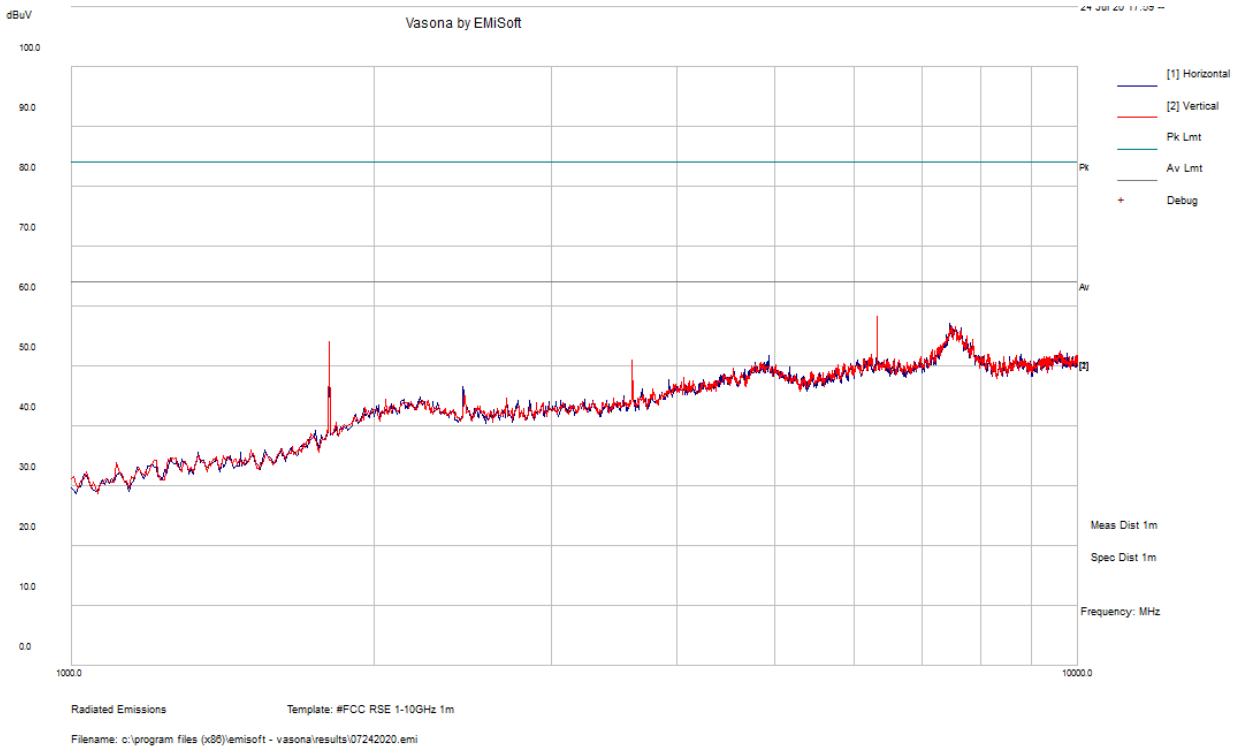
2) 1–10 GHz Measured at 3 meters

Frequency (MHz)	S.A. Reading (dBµV)	Turntable Azimuth (degrees)	Test Antenna			Cable Loss (dB)	Pre-Amp. (dB)	Cord. Reading (dBµV/m)	FCC/IC		Comments
			Height (cm)	Polarity (H/V)	Factor (dB/m)				Limit (dBµV/m)	Margin (dB)	
Low Channel											
902.025	91.53	257	100	V	28.0	1.78	28.00	93.31	94	-0.69	Peak
902	42.42*	257	100	V	28.0	1.78	28.00	44.20	46	-1.80	Peak
1804	50.59	60	178	H	30.9	4.635	36.96	49.165	74	-24.835	Peak
1804	45.07	60	178	H	30.9	4.635	36.96	43.645	54	-10.355	Ave
1804	54.35	69	176	V	30.9	4.635	36.96	52.925	74	-21.075	Peak
1804	50.89	69	176	V	30.9	4.635	36.96	49.465	54	-4.535	Ave
2706	45.71	68	160	H	32.6	6.293	36.24	48.363	74	-25.637	Peak
2706	35.64	68	160	H	32.6	6.293	36.24	38.293	54	-15.707	Ave
2706	46.70	301	177	V	32.6	6.293	36.24	49.353	74	-24.647	Peak
2706	36.59	301	177	V	32.6	6.293	36.24	39.243	54	-14.757	Ave
Mid Channel											
915.025	90.89	257	100	V	28.4	1.78	27.96	93.11	94	-0.89	Peak
1830.05	45.08	56	166	H	30.9	4.635	36.96	43.655	74	-30.345	Peak
1830.05	35.33	56	166	H	30.9	4.635	36.96	33.905	54	-20.095	Ave
1830.05	53.13	55	190	V	30.9	4.635	36.96	51.705	74	-22.295	Peak
1830.05	49.25	55	190	V	30.9	4.635	36.96	47.825	54	-6.175	Ave
2745.075	45.62	52	168	H	32.6	6.293	36.24	48.273	74	-25.727	Peak
2745.075	35.91	52	168	H	32.6	6.293	36.24	38.563	54	-15.437	Ave
2745.075	46.33	292	182	V	32.6	6.293	36.24	48.983	74	-25.017	Peak
2745.075	36.33	292	182	V	32.6	6.293	36.24	38.983	54	-15.017	Ave
High Channel											
926.880	90.87	257	100	V	28.3	1.78	27.92	93.03	94	-0.97	Peak
928	28.72	257	100	V	28.3	1.78	27.92	30.88	46	-15.12	Peak
1853.76	52.05	45	199	H	30.9	4.635	36.96	50.625	74	-23.375	Peak
1853.76	46.88	45	199	H	30.9	4.635	36.96	45.455	54	-8.545	Ave
1853.76	53.88	83	197	V	30.9	4.635	36.96	52.455	74	-21.545	Peak
1853.76	49.57	83	197	V	30.9	4.635	36.96	48.145	54	-5.855	Ave
2780.64	46.34	30	177	H	32.6	6.293	36.24	48.993	74	-25.007	Peak
2780.64	36.07	30	177	H	32.6	6.293	36.24	38.723	54	-15.277	Ave
2780.64	45.22	296	180	V	32.6	6.293	36.24	47.873	74	-26.127	Peak
2780.64	36.30	296	180	V	32.6	6.293	36.24	38.953	54	-15.047	Ave

Note: fundamental and band-edge field strength were measured with peak detector. The peak field strength level has demonstrated compliance with the average limit and quasi peak limit at the fundamental and band-edge frequencies respectively. Therefore, average field strength at fundamental frequency and quasi peak field strength at band-edge were not measured.

Note*: this value was measured with 3 kHz RBW, and corrected with 100 kHz to 3 kHz correction factor.

1GHz-10GHz Graph (Measured at 1 meter)



7 FCC §15.215 (c) & ISED RSS-Gen §6.6 - Emission Bandwidth

7.1 Applicable Standards

As per FCC §15.215 (c),

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. In the case of intentional radiators operating under the provisions of subpart E, the emission bandwidth may span across multiple contiguous frequency bands identified in that subpart. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

As per ISED RSS-Gen §6.6,

The emission bandwidth (×dB) is defined as the frequency range between two points, one above and one below the carrier frequency, at which the spectral density of the emission is attenuated × dB below the maximum in-band spectral density of the modulated signal. Spectral density (power per unit bandwidth) is to be measured with a detector of resolution bandwidth in the range of 1% to 5% of the anticipated emission bandwidth, and a video bandwidth at least 3× the resolution bandwidth.
When the occupied bandwidth limit is not stated in the applicable RSS or reference measurement method, the transmitted signal bandwidth shall be reported as the 99% emission bandwidth, as calculated or measured.

7.2 Measurement Procedure

The transmitter shall be operated at its maximum carrier power measured under normal test conditions.

The span of the analyzer shall be set to capture all products of the modulation process, including the emission skirts.

The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the occupied bandwidth (OBW) and video bandwidth (VBW) shall be approximately 3×RBW.

Note: Video averaging is not permitted.

A peak, or peak hold, may be used in place of the sampling detector as this may produce a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold may be necessary to determine the occupied bandwidth if the device is not transmitting continuously.

The trace data points are recovered and are directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded.

The difference between the two recorded frequencies is the 99% occupied bandwidth.

7.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rohde & Schwarz	Signal Analyzer	FSQ26	200749	2019-11-07	2 years
-	RF Cable	-	-	Each Time	-

Note[1]: cable and attenuator included in the test set-up will be checked each time before testing.
Statement of Traceability: BACL Corp. *attests that all of the calibrations on the equipment items listed above were traceable to NIST or to another internationally recognized National Metrology Institute (NMI), and were compliant with A2LA Policy P102 (dated 02 October 2018) "A2LA Policy on Metrological Traceability".*

7.4 Test Environmental Conditions

Temperature:	23º C
Relative Humidity:	32 %
ATM Pressure:	101.3 KPa

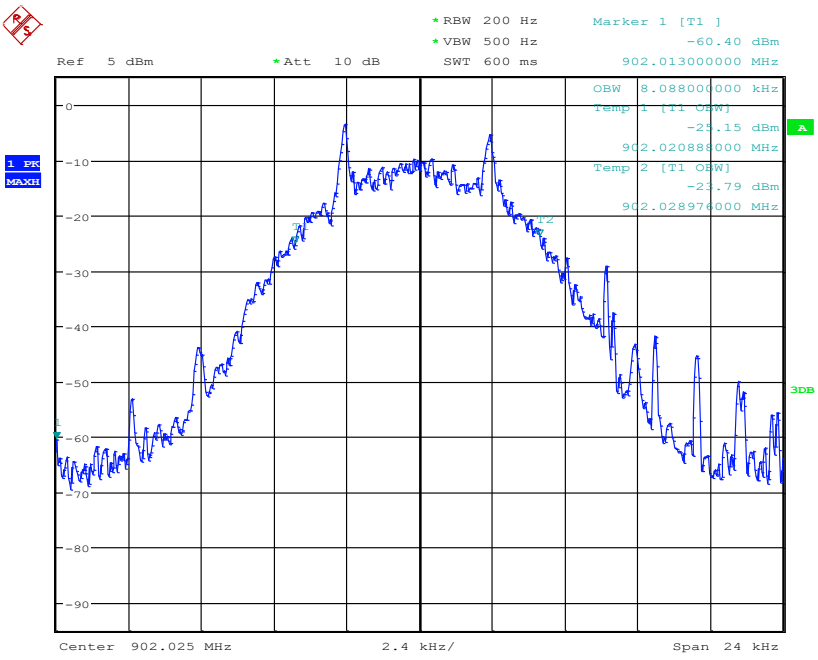
The testing was performed by Zhao Zhao on 2020-08-13 in RF site.

7.5 Test Results

Frequency (MHz)	99% OBW (kHz)	20 dB Bandwidth (kHz)
902.025	8.088	7.808
915.025	8.200	8.136
926.880	8.192	8.128

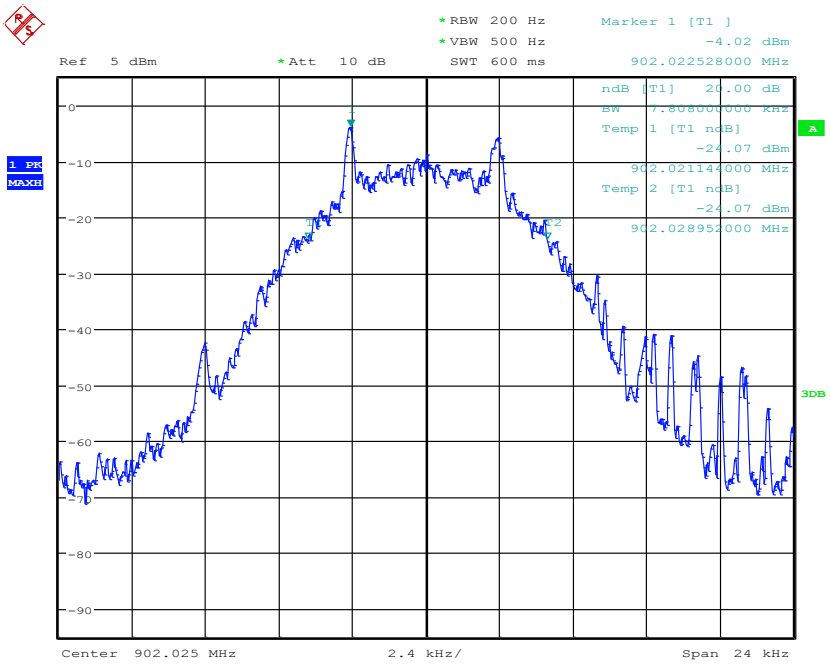
Please refer to the following plots for detailed test results.

Low Channel
99% Occupied Bandwidth



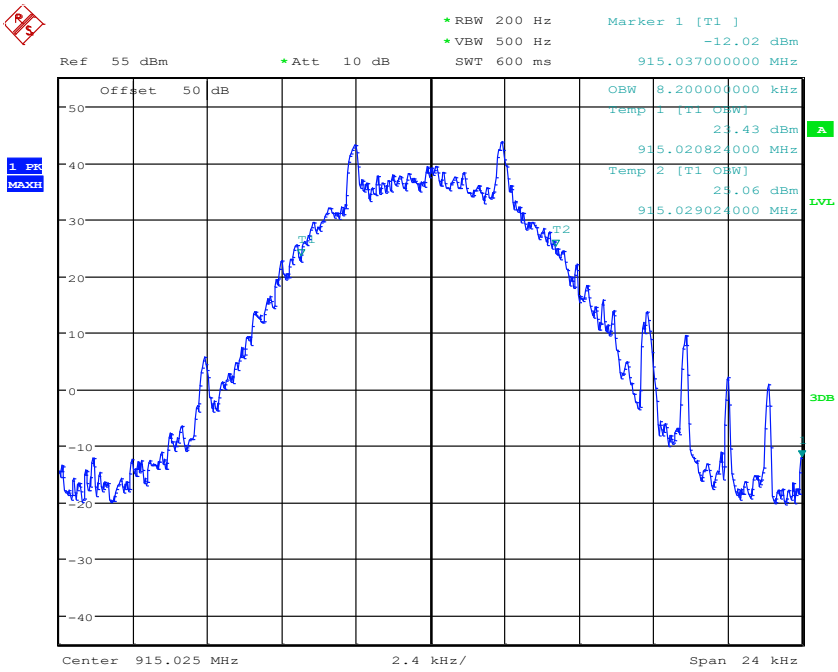
Date: 9.JAN.2003 23:13:30

20 dB bandwidth



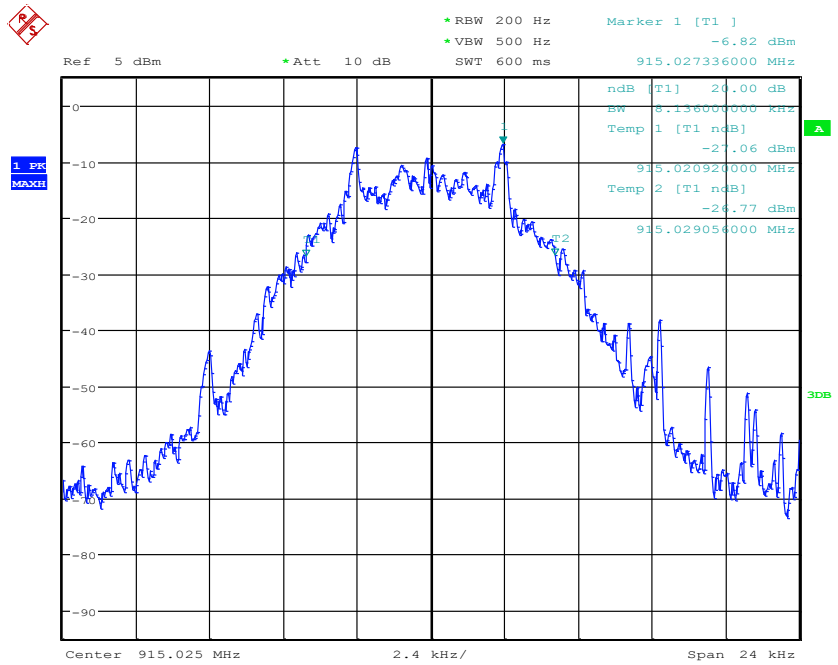
Date: 9.JAN.2003 23:13:02

Mid Channel
99% Occupied Bandwidth



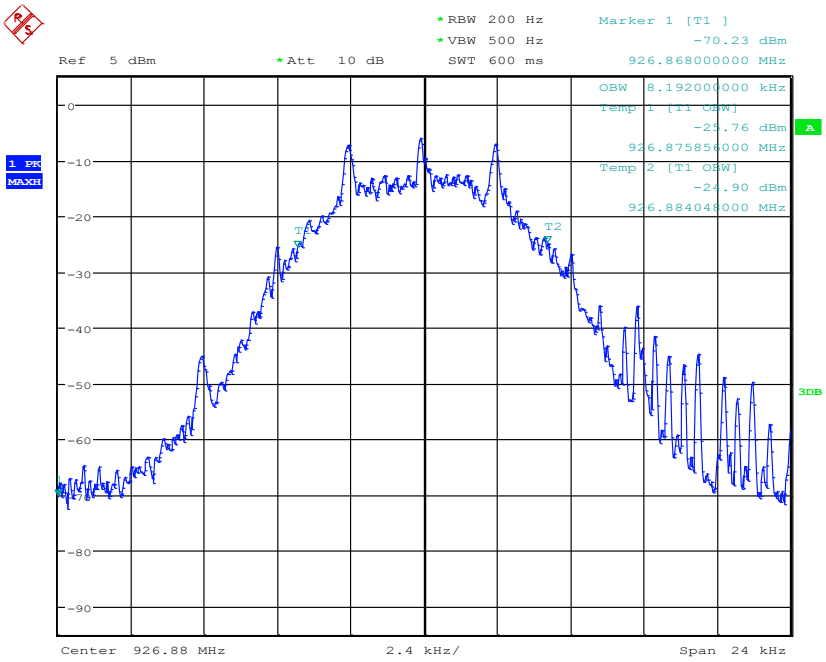
Date: 9.JAN.2003 23:10:35

20 dB bandwidth



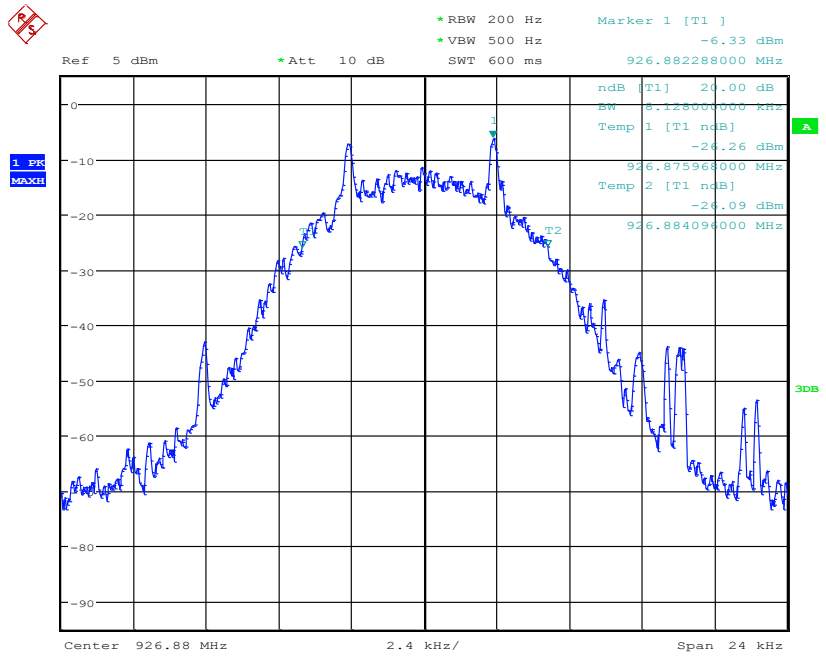
Date: 9.JAN.2003 23:12:14

High Channel
99% Occupied Bandwidth



Date: 9.JAN.2003 23:14:14

20 dB bandwidth



Date: 9.JAN.2003 23:14:41

8 Annex A (Normative) – EUT Test Setup Photographs

Please refer to the attachment.

9 Annex B (Normative) – EUT External Photographs

Please refer to the attachment.

10 Annex C (Normative) – EUT Internal Photographs

Please refer to the attachment.

11 Annex D (Normative) – A2LA Electrical Testing Certificate

Accredited Laboratory

A2LA has accredited

BAY AREA COMPLIANCE LABORATORIES CORP.

Sunnyvale, CA

for technical competence in the field of

Electrical Testing

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2005 *General requirements for the competence of testing and calibration laboratories*. This laboratory also meets A2LA *R222 - Specific Requirements EPA ENERGY STAR Accreditation Program*. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system *(refer to joint ISO-ILAC-IAF Communiqué dated April 2017)*.

Presented this 2nd day of October 2018.

Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 3297.02
Valid to September 30, 2020
Revised June 5, 2019

For the tests to which this accreditation applies, please refer to the laboratory's Electrical Scope of Accreditation.

Please follow the web link below for a full ISO 17025 scope

https://www.a2la.org/scopepdf/3297-02.pdf

--- END OF REPORT ---