



FCC PART 90Y ISEDC RSS-111, ISSUE 5, Sept 2014 TEST AND MEASUREMENT REPORT

For

Mimosa Networks, Inc.

469 El Camino Real, Suite 100,

Santa Clara, CA 95050, USA

FCC ID: 2ABZJ-100-00085 IC: 11823A-10000085

Report Type: Original l	Report	Product type: Point to Point Wireless Device
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DOCUMENT REVISION HISTORY

Revision Number Report Number		Description of Revision	Date of Revision
0 R18062717-90		Original Report	2018-10-09

1. General Information

1.1 Product Description for Equipment under Test (EUT)

This test and measurement report was prepared on behalf of *Mimosa NetworksInc.*, and their product model: *C5x*, FCC ID: 2ABZJ-100-00085, IC: 11823A-10000085 or the "EUT" as referred to in this report. The product is a point to point/point to multipoint wireless device.

1.2 Objective

This type approval report is prepared on behalf of *Mimosa Networks Inc.* in accordance Part 90 of the Federal Communication Commissions.

The objective was to determine the RF output power, Power Spectral Density, Peak Excursion, Occupied Bandwidth, Emission Mask, Conducted and Radiated Spurious Emissions and Frequency Stability Behavior are in compliance with the FCC rules.

1.3 Related Submittal(s)/Grant(s)

R18062717-407 Report with FCC ID: 2ABZJ-100-00085, IC: 11823A-10000085

1.4 Test Methodology

All measurements contained in this report were conducted in accordance with ANSI/TIA-603-E-2016 and ANSI C63.26-2015

All tests were performed at Bay Area Compliance Laboratories Corp.

1.5 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 repeatabil

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 ° C
Humidity	±5 %
DC and low frequency voltages	±1.0 %
Time	±2 %
Duty Cycle	±3 %

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1.6 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.

1.7 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 3279.02), 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 3279.03) 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 (Innovation, Science and Economic development Canada - ISEDC):

- 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 & Fixed Radio Services;
- 4 All Scope 4-Licensed Maritime & 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.

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- For Singapore (Infocomm Media Development Authority - IMDA):

- 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 3279.01) 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 & 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: (Innovation, Science and Economic development Canada ISEDC) Foreign Certification Body – FCB – APEC Tel MRA -Phase I & Phase II;
- Chinese Taipei (Republic of China Taiwan):

- o BSMI (Bureau of Standards, Metrology and Inspection) APEC Tel MRA -Phase I;
- o NCC (National Communications Commission) APEC Tel MRA -Phase I;
- European Union:
 - EMC Directive 2014/30/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Radio Equipment (RE) Directive 2014/53/EU US-EU EMC & Telecom MRA CAB (NB)
 - o Low Voltage Directive (LVD) 2014/35/EU
- 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 Media Development Authority IMDA) 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;
 - o Nationally Recognized Test Laboratory (NRTL) US OSHA
- Vietnam: APEC Tel MRA -Phase I;
- -

2 System Test Configuration

2.1 Justification

The EUT was configured for testing according to TIA/EIA-603-E and ANSI C63.26.

The EUT was tested in the normal (native) operating mode to represent *worst*-case results during the final qualification test.

2.2 EUT Exercise Software

The test software used was Putty provided by *Mimosa Networks*. The software is compliant with the standard requirements being tested against.

Please refer to the following power setting table.

25 dBi Dish Antenna:

Modulation Channel		Frequency (MHz)	Power Setting
VHT20	Low	4950	0
	Middle	4965	0
	High	4980	0

8 dBi Internal Antenna:

Modulation	Channel Frequency (MHz)		Power Setting
VHT20	Low	4950	18
	Middle	4965	18
	High	4980	18

2.3 Equipment Modifications

There are two RF cables, one for each antenna port, coming out of the EUT to connect the antenna ports to the power spectrum analyzer.

2.4 Local Support Equipment

Manufacturer	Description	Model	
Dell	Laptop	Latitude E6410	

2.5 Support Equipment

Manufacturer	Description	Model	
Lenovo	Laptop	P50s	
Mimosa Networks	POE injector	G0566-500-120	

2.6 Interface Ports and Cabling

Cable Description Length (m)		То	From
Cat5e	~1	EUT	POE Injector
Cat5e	~1	POE Injector	Laptop

3 Summary of Test Results

FCC/ISEDC Rules	Description of Tests	Results
FCC §1.1310, §2.1091, ISEDC RSS-102 Issue 5	RF Exposure	Compliant
FCC §90.1215(a) ISEDC RSS-111 Issue 5 §5.3	RF Output Power	Compliant
FCC §90.1215(b) ISEDC RSS-111 Issue 5 §4.2	Power Spectral Density	Compliant
FCC §2.1049, §90.210 ISEDC RSS-111 Issue 5 §5.5	Occupied Bandwidth and Emission Mask	Compliant
FCC §90.1215(e), ISEDC RSS-111 Issue 5 §5.4	Peak Excursion	Compliant
FCC §90.210, §2.1051, ISEDC RSS-111 Issue 5 §5.5	Spurious Emissions at Antenna Terminals	Compliant
FCC §90.210, §2.1051, ISEDC RSS-111 Issue 5 §5.5	Radiated TX Spurious Emissions	Compliant
FCC §2.1055, §90.213 ISEDC RSS-119 Issue 5 §5.3	Frequency Stability	Compliant

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

4.1 Applicable Standards

FCC §2.1091, (a) Requirements of this section are a consequence of Commission responsibilities under the National Environmental Policy Act to evaluate the environmental significance of its actions. See subpart I of part 1 of this chapter, in particular §1.1307(b).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Averaging Time (minutes)	
	(A) Limits for O	ccupational/Control	led Exposures		
0.3-3.0	614	1.63	*(100)	6	
3.0-30	1842/f	4.89/f	*(900/f ²)	6	
30-300	61.4	0.163	1.0	6	
300-1500	/	/	f/300	6	
1500-100,000	/	/	5	6	
(B) Limits for General Population/Uncontrolled Exposure					
0.3-1.34	614	1.63	*(100)	30	
1.34-30	842/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	30	

Limits for Exposure

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 MHz⁶ 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 x 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

25 dBi Dish Antenna

4.9 GHz Radio

Maximum output power at antenna input terminal (dBm):	<u>2.94</u>
Maximum output power at antenna input terminal (mW):	<u>1.97</u>
Prediction distance (cm):	<u>20</u>
Prediction frequency (MHz):	<u>4980</u>
Maximum Antenna Gain, typical (dBi):	<u>25</u>
Maximum Antenna Gain (numeric):	316.23
Power density of prediction frequency at 20 cm (mW/cm ²):	0.124
FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²):	<u>1.0</u>

8 dBi Internal Antenna

4.9 GHz Radio

<u>19.45</u>	Maximum peak output power at antenna input terminal (dBm):
<u>88.10</u>	Maximum peak output power at antenna input terminal (mW):
<u>20</u>	Prediction distance (cm):
<u>4950</u>	Prediction frequency (MHz):
<u>8</u>	Maximum Antenna Gain, typical (dBi):
<u>6.310</u>	Maximum Antenna Gain (numeric):
<u>0.111</u>	Power density of prediction frequency at 20 cm (mW/cm ²):
<u>1.0</u>	FCC MPE limit for uncontrolled exposure at prediction frequency (mW/cm ²):

Conclusion

The device is compliant with the requirement MPE limit for uncontrolled exposure. All transceiver modules must be installed with a separation distance of no less than **20** cm from all persons.

4.3 **RF exposure evaluation exemption for IC**

25 dBi Dish Antenna:

 $2.94 + 25 \text{ dBi} = 27.94 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 4.405 \text{ W} = 36.44 \text{ dBm}$

8 dBi Internal Antenna:

 $19.45 + 8 \text{ dBi} = 27.45 \text{ dBm} < 1.31 \times 10^{-2} f^{0.6834} = 4.387 \text{ W} = 36.42 \text{ dBm}$

Conclusion

Therefore the RF exposure is not required. All transceiver modules must be installed with a separation distance of no less than **20** cm from all persons.

5 FCC §90.1215(a) & ISEDC RSS-111 §5.3 - RF Output Power

5.1 Applicable Standard

According to FCC §90.1215, the transmitting power of stations operating in the 4940-4990 MHz band must not exceed the maximum limits in this section.

(a)(1) The maximum conducted output power should not exceed:

Channel bandwidth (MHz)	Low power maximum conducted output power (dBm)	High power maximum conducted output power (dBm)
1	7	20
5	14	27
10	17	30
15	18.8	31.8
20	20	33

According to ISEDC RSS-111 Section 5.3,

Equipment is classified as either a low-power or high-power device according to its maximum transmitted power and its channel bandwidth as described in the section below. The equipment's occupied bandwidth shall not exceed its channel bandwidth. The transmitted power of low- power and high-power devices shall not exceed the maximum limits corresponding to the equipment type given in Table 1.

Table 1 — Channel Bandwidth and Power Limits				
	Transmitter Power, P (<u>dBm</u>)			
Channel Bandwidth (MHz)	Low-power Device	High-power Device		
1	P ≤ 7	7 < P ≤ 20		
5	P ≤ 14	14 < P ≤ 27		
10	P ≤ 17	17 < P ≤ 30		
15	P ≤ 18.8	18.8 < P ≤ 31.8		
20	P ≤ 20	20 < P ≤ 33		

5.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

5.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	1 year
-	RF cable	-	-	Each time ¹	N/A
-	20dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 09 June 2016) "A2LA Policy on Metrological Traceability".

5.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Harry Zhao on 2018-10-09 in the RF Site.

5.5 Test Results

Dish Antenna – Antenna Gain 25 dBi

	Output Power			
Frequency (MHz)	Ant 1 (dBm)	Ant 2 (dBm)	Total (dBm)	Limit (dBm)
4950	0.22	-1.19	2.58	4
4965	0.34	-0.99	2.74	4
4980	0.54	-0.78	2.94	4

Note: Reduced Power Limit = Original Power Limit – (Antennta Gain - 9 dBi)

Internal Antenna – Antenna Gain 8 dBi

	Output Power			
Frequency (MHz)	Ant 1 (dBm)	Ant 2 (dBm)	Total (dBm)	Limit (dBm)
4950	17.12	15.63	19.45	20
4965	16.98	15.76	19.42	20
4980	16.81	15.95	19.41	20

Please refer to the following plots for conducted output power.

Mimosa Networks, Inc.

4965 MHz

Dish Antenna

Antennna Port 1



4950 MHz



Antennna Port 2



4980 MHz



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Internal Antenna

Antennna Port 1





Antennna Port 2



4950 MHz

4980 MHz



6 FCC §90.1215(b) & ISEDC RSS-111 §4.2 - Power Spectral Density

6.1 Applicable Standard

According to FCC §90.1215,

(b) Low power devices are also limited to a peak power spectral density of 8 dBm per one MHz. Low power devices using channel bandwidths other than those listed above are permitted; however, they are limited to a peak power spectral density of 8 dBm/MHz. If transmitting antennas of directional gain greater than 9 dBi are used, both the maximum conducted output power and the peak power spectral density should be reduced by the amount in decibels that the directional gain of the antenna exceeds 9 dBi.

According to ISEDC RSS-111 Section 4.2,

The transmitter power spectral density shall be measured over a bandwidth of 1 MHz or 99% of the emission bandwidth, whichever is less, with the power measured as per Section 4.1. A resolution bandwidth less than the measurement bandwidth can be used provided that the measured power is integrated to show total power over the measurement bandwidth.

6.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	1 year
-	RF cable	-	-	Each time ¹	N/A
-	20dB attenuator	-	-	Each time ¹	N/A

6.3 Test Equipment List and Details

Note¹: 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 09 June 2016) "A2LA Policy on Metrological Traceability".

6.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Harry Zhao on 2018-10-09 in the RF Site.

6.5 Test Results

Dish Antenna – Antenna Gain 25 dBi

Frequency (MHz)	Ant 1 (dBm/MHz)	Ant 2 (dBm/MHz)	Total (dBm/MHz)	Limit (dBm/MHz)
4950	-11.347	-13.040	-9.10	-8
4965	-11.400	-12.778	-9.02	-8
4980	-11.303	-12.500	-8.85	-8

Note: Reduced Power Limit = Original Power Limit – (Antennta Gain - 9 dBi)

Internal Antenna – Antenna Gain 8 dBi

Frequency (MHz)	Ant 1 (dBm/MHz)	Ant 2 (dBm/MHz)	Total (dBm/MHz)	Limit (dBm/MHz)
4950	5.597	3.955	7.86	8
4965	5.184	4.080	7.68	8
4980	5.070	4.480	7.80	8

Please refer to the following plots.

Dish Antenna



Antennna Port 1



Antennna Port 2



4950 MHz

4965 MHz



Internal Antenna



Antennna Port 1



Antennna Port 2



4950 MHz



7 FCC §2.1049, §90.210 & ISEDC RSS-111 §5.5 - Occupied Bandwidth & Emission Mask

7.1 Applicable Standard

FCC §90.210

(1) Emission Mask L. For low power transmitters (20 dBm or less) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: $10 + 242 \log (\% \text{ of } (BW)/50) \text{ dB}.$

(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: $20 + 31 \log (\% \text{ of (BW)/55}) \text{ dB}$ attenuation.

(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: $28 + 68 \log (\% \text{ of (BW)}/100) \text{ dB}$ attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

ISEDC RSS-111,

5.5 Transmitter Unwanted Emissions

Transmitter unwanted emissions shall be measured according to the method described in Section 4.3.

On any frequency f, offset from the channel centre frequency fc by a separation fd (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified below in Table 2. Figure 1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

Dffset Frequency f _d	Mini	mum Attenuation (dB)
% of the Equipment's Channel Bandwidth)	Low-power Transmitter	High-power Transmitter
$0 < f_{d} \le 45$	0	0
$45 < f_{d} \le 50$	219 log (f _d /45)	568 log (f _d /45)
$50 < f_{d} \le 55$	10 + 242 log (f _d /50)	26 + 145 log (f _d /50)
$55 < f_d \le 100$	20 + 31 log (f _d /55)	32 + 31 log (f _d /55)
$100 < f_d \le 150$	28 + 68 log (f _d /100)	40 + 57 log (f _d /100)
f _d > 150	40	whichever is less stringent 50 or 55 + 10 log p

7.2 Test Procedure

The RF output of the transmitter was connected to the input of the spectrum analyzer through sufficient attenuation.

The resolution bandwidth of the spectrum analyzer was set at 200 kHz.

7.3 Test Equipment List and Details

Manufacturer Description		Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	MY48250238	2018-05-08	1 year
Rhode & Schwarz	Spectrum Analyzer	FSV40	1321.3008K3 9-101203-UW	2018-07-23	1 Year
-	RF cable	-	-	Each time ¹	N/A
-	20dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 09 June 2016) "A2LA Policy on Metrological Traceability".

7.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Harry Zhao on 2018-10-06 in the RF Site.

Test Results 7.5

Dish Antenna – Antenna Gain 25 dBi

Frequency	Occupied Bandwidth			
(MHz)	Ant 1 (MHz)	Ant 2 (MHz)		
4950	17.9711	17.8349		
4965	17.9701	17.9876		
4980	17.9635	17.8357		

Internal Antenna – Antenna Gain 8 dBi

Frequency	Occupied Bandwidth			
(MHz)	Ant 1 (MHz)	Ant 2 (MHz)		
4950	18.0294	17.8272		
4965	18.0031	17.8199		
4980	17.9984	17.8236		

Please refer to the following plots.

Occupied Bandwidth

Dish Antenna

🔆 Agilent

Ref 31 dBm #Peak

.og 10

B

Offst

Antennna Port 1

4950 MHz



4965 MHz



Antennna Port 2



4950 MHz

4965 MHz



4965 MHz

Internal Antenna

Antennna Port 1

$4950 \; \text{MHz}$





Antennna Port 2



🔆 Agilent				Freq/Chan	nel
Ch Freq 4 Occupied Bandwidth	.98 GHz		Trig Free	Center F 4.98000000	req GHz
				Start F 4.96500000	req GHz
Ref 21 dBm #Att #Peak Log	en 20 dB	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		Stop F 4.99500000	req GHz
dB/ 0ffst			- t	CF S 3.00000000 <u>Auto</u>	tep MHz Mar
dB Center 4.980 00 GHz			Span 30 MHz	Freq Off 0.00000000	set Ha
#Res BW 200 kHz	VBW 620 kHz	#Sweep 1	. s (601 pts)	Signal Tra	ack
Uccupied Bandwi	dth 236 MH 7	Occ BW % Pwr x dB	99.00 % -26.00 dB	0n	<u>0f</u>
Transmit Freq Error x dB Bandwidth	-6.555 kHz 23.802 MHz				
Copyright 2000-2012	Agilent Technologies	;			

Emission Mask L

Dish Antenna

Antennna Port 1

4950 MHz

Spectrum)					
Ref Level 10.00 STOP Count 100,	dBm Offset 2 /100	2.00 dB	Mode Sweep			
1Av AvgPwr	and a state of the	11				
Limit Check		PASS	Ň	11[1]		-20.64 dBn
0 dBm<200	-				4	1.957520 GH
10 dBm						
-10 ubin			M1			
-20 dBm			Imperie			
20 dBm		/				
-30 ubm						
-40 dBm-						
E0 d0m						
-50 dBm						
-60 dBm						
70 d0m					N	1
-/U UBIN						
-80 dBm						
CF 4.95 GHz			691 pts		Spa	n 200.0 MHz
Spectrum Emissi	ion Mask		Standard: None			
Tx Power	-1.70 dBm	Tx Ba	ndwidth 20.000 M	1Hz	RBW 200.	.000 kHz
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	∆Limit
-100.000 MHz	-30.000 MHz	200.000 kHz	4.91985 GHz	-65.93 dBm	-64.23 dB	-24.23 dB
-30.000 MHz	-20.000 MHz	200.000 kHz	4.92015 GHz	-65.90 dBm	-64.20 dB	-24.38 dB
-20.000 MHz	-11.000 MHz	200.000 kHz	4.93885 GHz	-47.44 dBm	-45.74 dB	-25.61 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.93917 GHz	-46.29 dBm	-44.58 dB	-26.25 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.94083 GHz	-34.82 dBm	-33.12 dB	-31.45 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.95917 GHz	-34.57 dBm	-32.87 dB	-31.20 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.96083 GHz	-46.09 dBm	-44.38 dB	-26.05 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.96115 GHz	-47.23 dBm	-45.53 dB	-25.40 dB
20.000 MHz	30.000 MHz	200.000 kHz	4.97985 GHz	-69.31 dBm	-67.61 dB	-27.79 dB
30.000 MHz	100.000 MHz	200.000 kHz	5.03998 GHz	-65.56 dBm	-63.86 dB	-23.86 dB
			Me	asuring E RRA	N IN 11 11 11 1444	06.10.2018 10:51:27

Date: 6.OCT.2018 10:51:27

4965 MHz

Spectrum							1
Ref Level 10.00 STOP Count 100	0 dBm Offset 2 1/100	2.00 dB	Mode Sweep				
1Av AvgPwr							
Limit Check		PASS		M1[1]			-20.65 dB
0 dBps<200				-			1.970640 GH
-10 dBm				_	-	_	_
-20 dBm		· · · · · · · · · · · · · · · · · · ·	M1				
-30 dBm							_
-40 dBm			+	-	-	_	_
-50 dBm			$ \rightarrow $	_			
60 d0m		· · · · · · · · · · · · · · · · · · ·		6			
-00 UBIII							
-70 dBm				-			L
-80 dBm						_	
CF 4.965 GHz			691 pts			Spa	n 200.0 MH;
pectrum Emiss	ion Mask		Standard: Non	e			
Tx Power	-1.76 dBm	Tx Ba	ndwidth 20.000) MHz		RBW 200	.000 kHz
Range Low	Range Up	RBW	Frequency	Power A	bs P	ower Rel	∆Limit
-100.000 MHz	-30.000 MHz	200.000 kHz	4.92004 GH	z -64.05	dBm	-62.30 dB	-22.30 dB
-30.000 MHz	-20.000 MHz	200.000 kHz	4.93515 GH	z -69.82	dBm	-68.06 dB	-28.23 dB
-20.000 MHz	-11.000 MHz	200.000 kHz	4.95385 GH	z -47.54	dBm	-45.78 dB	-25.65 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.95417 GH	z -46.46	dBm	-44.70 dB	-26.37 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.95583 GH	z -34.97	dBm	-33.21 dB	-31.55 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.97417 GH	z -34.56	dBm	-32.80 dB	-31.13 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.97583 GH	z -46.05	dBm	-44.29 dB	-25.96 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.97615 GH	z -47.12	dBm	-45.37 dB	-25.24 dt
20.000 MHz	30.000 MHz	200.000 kHz	4.99485 GH	z -69.32	dBm	-67.56 dB	-27.73 dt
30.000 MHz	100.000 MHz	200.000 kHz	5.00008 GH	z -66.20	dBm	-64.45 dB	-24.45 df
T			, (leasuring	Constant of the		06.10.2018

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Date: 6.OCT.2018 11:43:38

Antennna Port 2

4950 MHz

		00000000					
Ref Level 10.00	dBm Offset 2	2.00 dB	Mode Sweep				
1 Av AvgPwr	/100						
Limit Check		PARS		M1[1]			-21 88 dB
D dBm							4.957250 GH
200				1	1	1	1
-10 dBm			1		_		-
20 dBm			MI				
-30 dBm				-	_		
40 dBm				1			
io dom				~	_		
-50 dBm	-		/		-	-	-
-60 dBm							
						-	
70 dBm				-		*	
-80 dBm							
CF 4.95 GHz			691 pts			Spa	n 200.0 MH
pectrum Emissi	on Mask		Standard: No	ne			
Tx Power	-3.01 dBm	Tx Ba	ndwidth 20.0	00 MHz		RBW 200	.000 kHz
Range Low	Range Up	RBW	Frequency	Powe	er Abs	Power Rel	ALimit
-100.000 MHz	-30.000 MHz	200.000 kHz	4.91985 0	Hz -6	9.88 dBm	-66.88 dB	-26.88 dB
-30.000 MHz	-20.000 MHz	200.000 kHz	4.92015 0	Hz -6	9.80 dBm	-66.79 dB	-26.97 dB
-20.000 MHz	-11.000 MHz	200.000 kHz	4.93885 0	Hz -4	3.18 dBm	-45.18 dB	-25.05 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.93917 0	Hz -4	7.12 dBm	-44.11 dB	-25.78 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.94083 0	Hz -3	5.65 dBm	-32.64 dB	-30.98 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.95917 0	Hz -3	5.64 dBm	-32.63 dB	-30.97 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.96083 0	Hz -4	5.86 dBm	-43.85 dB	-25.52 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.96115 0	Hz -41	3.06 dBm	-45.06 dB	-24.93 dB
20.000 MHz	30.000 MHz	200.000 kHz	4.97985 0	Hz -71	0.61 dBm	-67.61 dB	-27.78 dB
30.000 MHz	100.000 MHz	200.000 kHz	5.03998 0	Hz -6	9.57 dBm	-66.56 dB	-26.56 dB
30.000 MHz	100.000 MHz	200.000 kHz	5.03998 0	Hz -6	9.57 dBm	-66.56 dB	-2

Date: 6.OCT.2018 11:58:36

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Date: 6.OCT.2018 11:57:10

4980 MHz



Date: 6.OCT.2018 11:55:51

Internal Antenna

Antennna Port 1

4950 MHz

Spectrum)					
Ref Level 20.00 STOP Count 100/	dBm Offset 2 /100	2.00 dB	Mode Sweep			
1Av AvgPwr						
Limit Check		PASS	N	11[1]		-4.47 dBn
10 dBm 200					4	.958060 GH
0 dBm			MI			
-10 dBm						
-20 dBm						
-30 dBm						_
-40 dBm		,				
-50 dBm						
-60 dBm						
-70 dBm						
CF 4.95 GHz			691 pts		Spa	n 200.0 MHz
Spectrum Emissi	on Mask	T	Standard: None	41 I-	000	000 ku -
TX POWER	14.30 dBm	IX Bd		nHZ Dowon the	RBW 200.	UUU KHZ
100.000 MHz	20.000 MHz	200,000 kHz	A 01005 CH2	F6 55 dBm	71 05 dB	21.05 dp
-30.000 MHz	-20.000 MHz	200.000 kHz	4 02015 GHz	-56.25 dBm	-70.75 dB	-30.02 dB
-20.000 MHz	-11.000 MHz	200.000 kHz	4.93885 GHz	-30.88 dBm	-45.38 dB	-25.25 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.93917 GHz	-29.61 dBm	-44.11 dB	-25.77 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.94083 GHz	-18.62 dBm	-33.12 dB	-31.45 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.95917 GHz	-18.31 dBm	-32.81 dB	-31.14 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.96083 GHz	-29.44 dBm	-43.94 dB	-25.61 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.96115 GHz	-30.70 dBm	-45.20 dB	-25.07 dB
20.000 MHz	30.000 MHz	200.000 kHz	4.97985 GHz	-56.91 dBm	-71.41 dB	-31.59 dB
30.000 MHz	100.000 MHz	200.000 kHz	4.98015 GHz	-57.05 dBm	-71.55 dB	-31.55 dB
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Ref Level 20.00	dBm Offset 2	2.00 dB	Mode Sweep			
STOP Count 100	/100					
1AV AVGPWr						
Limit Check		PABS	M	1[1]		-4.33 dB
10 000200				1 1	1	-972230 GF
0 dBm			M1			
-10 dBm		1				
-20 dBm						
-30 dBm						
-40 dBm						
-50 dBm						
-60 dBm						_
-70 dBm	and the second					
CF 4.965 GHz	d ⁰	191 No.	691 pts		Spa	n 200.0 MHz
spectrum Emiss	ion Mask		Standard: None			
Tx Power	14.52 dBm	Tx Ba	ndwidth 20.000 M	IHz	RBW 200.	000 kHz
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	∆Limit
-100.000 MHz	-30.000 MHz	200.000 kHz	4.93427 GHz	-57.10 dBm	-71.61 dB	-31.61 dE
-30.000 MHz	-20.000 MHz	200.000 kHz	4.93515 GHz	-56.77 dBm	-71.29 dB	-31.47 dE
-20.000 MHz	-11.000 MHz	200.000 kHz	4.95385 GHz	-30.97 dBm	-45.49 dB	-25.36 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.95417 GHz	-29.76 dBm	-44.27 dB	-25.94 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.95583 GHz	-18.69 dBm	-33.21 dB	-31.54 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.97417 GHz	-18.21 dBm	-32.73 dB	-31.06 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.97583 GHz	-29.42 dBm	-43.94 dB	-25.61 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.97615 GHz	-30.63 dBm	-45.15 dB	-25.02 dE
20.000 MHz	30.000 MHz	200.000 kHz	4.99485 GHz	-56.87 dBm	-71.39 dB	-31.57 dE
30,000 MHz	100.000 MHz	200.000 kHz	4.99515 GHz	-57.22 dBm	-71.74 dB	-31.74 dF

4965 MHz

Date: 6.OCT.2018 11:48:01

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			4980 MHz			
Spectrum						
Ref Level 20.00 STOP Count 100	dBm Offset 2 /100	2.00 dB	Mode Sweep			
1Av AvgPwr						
Limit Check		PASS		M1[1]		-4.08 dBr
10 dBm 200		0.00000		A CONTRACTOR OF	4	1.986450 GH
			MI	1 1	1	and the second second
D dBm		1				
-10 dBm						
-20 dBm				1		
-30 dBm						
-40 dBm						_
-50 dBm						
-60 dBm						
-70 dBm						
CF 4.98 GHz			691 pts		Spa	n 200.0 MHz
spectrum Emiss Tx Power	ion Mask 14.84 dBm	Тх Ва	Standard: None ndwidth 20.000	e) MHz	RBW 200	.000 kHz
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	ALimit
-100.000 MHz	-30.000 MHz	200.000 kHz	4.94985 GH	-57.11 dBm	-71.95 dB	-31.95 dB
-30.000 MHz	-20.000 MHz	200.000 kHz	4.95015 GH;	-56.73 dBm	-71.57 dB	-31.75 dB
-20.000 MHz	-11.000 MHz	200.000 kHz	4.96885 GH	-30.71 dBm	-45.55 dB	-25.42 dB
-11.000 MHz	-10.000 MHz	200.000 kHz	4.96917 GH	2 -29.52 dBm	-44.36 dB	-26.03 dB
-10.000 MHz	-9.000 MHz	200.000 kHz	4.97083 GH	-18.41 dBm	-33.25 dB	-31.58 dB
9.000 MHz	10.000 MHz	200.000 kHz	4.98917 GH	-17.92 dBm	-32.76 dB	-31.09 dB
10.000 MHz	11.000 MHz	200.000 kHz	4.99083 GH	-29.15 dBm	-43.99 dB	-25.66 dB
11.000 MHz	20.000 MHz	200.000 kHz	4.99115 GH	-30.42 dBm	-45.26 dB	-25.13 dB
20.000 MHz	30.000 MHz	200.000 kHz	5.00985 GH;	-57.25 dBm	-72.09 dB	-32.27 dB
30.000 MHz	100.000 MHz	200.000 kHz	5.01131 GH:	z -57.28 dBm	-72.12 dB	-32.12 dB
)[٩ (feasuring		06.10.2018 11:45:57

Date: 6.OCT.2018 11:45:57

Antennna Port 2

4950 MHz

Spectrum	ſ					H
Ref Level 20.00 STOP Count 100	0 dBm Offset 2 0/100	2.00 dB	Mode Sweep			
1Av AvgPwr						
Limit Check 10 dpm 200	¢	PASS	M	11[1]		-5.32 dB 4.957520 GF
0 dBm			MI			_
-10 dBm						-
-20 dBm						
-30 dBm						
-40 dBm			$ \rightarrow $			
-50 dBm						
-60 dBm				2		_
-70 dBm						_
CF 4.95 GHz			691 pts		Spa	n 200.0 MH
Spectrum Emiss	sion Mask		Standard: None	1991.2		
Tx Power	13.49 dBm	Tx Ba	ndwidth 20.000 M	1Hz	RBW 200	.000 KHz
Range Low	Range Up	RBW	Frequency	Power Abs	Power Rel	<u>ALimit</u>
-100.000 MH2	-30.000 MH2	200.000 kHZ	4.91985 GHZ	-59.83 dBm	-/3.32 dB	-33.32 dB
-30.000 MH2	-20.000 MH2	200.000 KH2	4.92015 GHZ	-39.04 dBm	-/ 3.13 GB	-33.30 dB
-11 000 MH2	-10.000 MH2	200.000 kH2	4.93003 0H2	-30.34 dem	-43.00 dB	-24.93 UB
-10.000 MHz	-10.000 MHz	200.000 kHz	4 94083 6Hz	-19 25 dBm	-32 73 dB	-31 07 dP
9.000 MHz	10.000 MHz	200.000 kHz	4.95917 GHz	-19.08 dBm	-32.57 dB	-30.90 dF
10.000 MHz	11.000 MHz	200.000 kHz	4.96083 GHz	-30.29 dBm	-43.78 dB	-25.45 dF
11.000 MHz	20.000 MHz	200.000 kHz	4.96115 GHz	-31.23 dBm	-44.72 dB	-24.59 de
20.000 MHz	30.000 MHz	200.000 kHz	4.97985 GHz	-60.34 dBm	-73.82 dB	-34.00 dt
30.000 MHz	100.000 MHz	200.000 kHz	4.98073 GHz	-60.25 dBm	-73.74 dB	-33.74 dB
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Date: 6.OCT.2018 11:51:24





Date: 6.OCT.2018 11:52:50

4980 MHz



Date: 6.OCT.2018 11:54:08

8 FCC §90.1215 (e) & ISEDC RSS-111 §5.4 - Peak Excursion

8.1 Applicable Standard

According to FCC §90.1215, (e) The ratio of the peak excursion of the modulation envelope (measured using a peak hold function) to the maximum conducted output power shall not exceed 13 dB across any 1 MHz bandwidth or the emission bandwidth whichever is less.

According to ISEDC RSS-111 Section 5.4 Transmitter Peak to Average Power Ratio (PAPR)

The PAPR of the equipment shall not exceed 13 dB for more than 0.1% of the time, using a signal that corresponds to the highest PAPR during periods of continuous transmission.

8.2 Test Procedure

Please refer to ANSI C63.26-2015 Section 5.2.6.

8.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Signal Analyzer	FSV40	1321.3008K39 -101203-UW	2018-07-23	1 year
-	RF cable	-	-	Each time ¹	N/A
-	20dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 09 June 2016) "A2LA Policy on Metrological Traceability".

8.4 Test Environmental Conditions

Temperature:	20-25 °C		
Relative Humidity:	44-55 %		
ATM Pressure:	101-102 kPa		

The testing was performed by Harry Zhao on 2018-10-11 in the RF Site.

8.5 Test Results

Dish Antenna – Antenna Gain 25 dBi

Frequency (MHz)	Ant 1 (dB)	Ant 2 (dB)	Limit (dB)
4950	-8.63	-9.76	13
4965	-8.03	-9.87	13
4980	-8.49	-9.79	13

Internal Antenna – Antenna Gain 8 dBi

Frequency (MHz)	Ant 1 (dB)	Ant 2 (dB)	Limit (dB)
4950	-8.16	-9.68	13
4965	-8.43	-9.76	13
4980	-7.61	-9.40	13

Please refer to the following plots.

Dish Antenna

Antennna Port 1





Date: 11.OCT.2018 06:48:55

4965 MHz



Date: 11.OCT.2018 06:50:34





Date: 11.OCT.2018 06:51:39

Antennna Port 2

4950 MHz



Date: 11.OCT.2018 06:56:15

4965 MHz



Date: 11.OCT.2018 06:54:55





Date: 11.OCT.2018 06:53:28

Internal Antenna

Antennna Port 1

$4950 \; \text{MHz}$



Date: 11.OCT.2018 06:37:53

4965 MHz



Date: 11.OCT.2018 06:45:56

Report Number: R18062717-90



4980 MHz

Date: 11.OCT.2018 06:47:41

Antennna Port 2



Date: 11.OCT.2018 06:58:01

4965 MHz



Date: 11.OCT.2018 06:59:21





Date: 11.OCT.2018 07:00:10

9 FCC §2.1051, §90.210 & ISEDC RSS-111 §5.5 - Spurious Emissions at Antenna Terminals

9.1 Applicable Standard

FCC §90.210

(1) Emission Mask L. For low power transmitters (20 dBm or less) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: $10 + 242 \log (\% \text{ of } (BW)/50) \text{ dB}.$

(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: $20 + 31 \log (\% \text{ of (BW)/55}) \text{ dB}$ attenuation.

(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: $28 + 68 \log (\% \text{ of (BW)}/100) \text{ dB}$ attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

ISEDC RSS-111,

5.5 Transmitter Unwanted Emissions

Transmitter unwanted emissions shall be measured according to the method described in Section 4.3.

On any frequency f, offset from the channel centre frequency fc by a separation fd (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified below in Table 2. Figure 1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

et Frequency f _d	Mini	Minimum Attenuation (dB)			
dwidth)	Low-power Transmitter	High-power Transmitter			
$0 < f_{d} \le 45$	0	0			
$45 < f_d \le 50$	219 log (f _d /45)	568 log (f _d /45)			
$50 < f_{d} \le 55$	10 + 242 log (f _d /50)	26 + 145 log (f _d /50)			
$55 < f_{d} \le 100$	20 + 31 log (f _d /55)	32 + 31 log (f _d /55)			
$100 < f_d \le 150$	28 + 68 log (f _d /100)	40 + 57 log (f _d /100)			
f _d > 150	40	whichever is less stringent 50 or 55 + 10 log p			

9.2 Test Procedure

The RF output of the transceiver was connected to a spectrum analyzer through appropriate attenuation. The resolution bandwidth of the spectrum analyzer was set at 200 kHz for emissions below 1 GHz and 200 kHz for emissions above 1 GHz. Sufficient scans were taken to show any out of band emissions up to 10th harmonic.

9.3 Test Equipment List and Details

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Rhode & Schwarz	Spectrum Analyzer	FSV40	1321.3008K39- 101203-UW	2018-07-23	1 Year
-	RF cable	-	-	Each time ¹	N/A
-	20dB attenuator	-	-	Each time ¹	N/A

Note¹: 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 09 June 2016) "A2LA Policy on Metrological Traceability".

9.4 Test Environmental Conditions

Temperature:	20-25 °C		
Relative Humidity:	44-55 %		
ATM Pressure:	101-102 kPa		

The testing was performed by Harry Zhao on 2018-10-06 in the RF Site.

9.5 Test Results

Dish Antenna

Antennna Port 1

		4950	MHz		_
Spectrum					1
Ref Level 10.00 dE	m Offset 22.00	dB Mode S	Sween		
Count 10/10					
1 AvaPwr					
Limit Check		PASS	M1[1]		-18,90 dBn
Line SPURIOU	S LINE ABS	PASS	Access research		4.9581000 GH
dBm	and a second second second	1000 C C C C C C C C C C C C C C C C C C		1 1	ing a second second
10 dBm					
M1					
20 dBm					
30 dBm	_				
SPURIOUS_LINE_ABS	8				_
200 Mar					
50 dBm					
(D 10					
60 dBm	2	and the second second	100	1 maketa atter	and the second second
and the second second	and when the share and	Party and a strength	Le Alexandrander	a harden a harden and	
an Constantial M	the heat we have	5455 AL			Contraction Name
CF 20.015 GHz		2600	0 pts	St	an 39.97 GHz
purious Emissions					
Range Low	Range Up	RBW	Frequency	Power Abs	∆Limit
30.000 MHz	1.000 GHz	200.000 kHz	968.47500 MHz	-68.40 dBm	-26.90 dB
1.000 GHz	4.920 GHz	200.000 kHz	4.84013 GHz	-61.84 dBm	-20.34 dB
4.920 GHz	5.000 GHz	200.000 kHz	4.95628 GHz	-17.45 dBm	-17.45 dB
5.000 GHz	12.000 GHz	200.000 kHz	6.59985 GHz	-44.07 dBm	-2.57 dB
12.000 GHz	40.000 GHz	200.000 kHz	39.45540 GHz	-58.59 dBm	-17.09 dB
Y			Measuring		05.10.2018

Date: 6.OCT.2018 13:02:01

Spectrum					
Ref Level 10.00 dE Count 10/10	3m Offset 22.00	dB Mode S	Sweep		
1 AvgPwr			20		
Limit Check	IS LINE ABS	PASS	M1[1]		-18.28 dBn +.9612000 GH:
U dBm		67.08 A.C.C.		1 1	
-10 dBm				+ + -	
20 dBm				+	
30 dBm				+	
SPURIOUS_LINE_ABS	5				_
50 dBm					
60 dBm		Constant and the		1 Contraction of the American	
Dudacan	and and the second	A second second second	The other states and the sea	A Production of the State of th	
here an					
AND A DESCRIPTION	d a particular and the back				
CF 20.015 GHz		2600	U pts	Sp	an 39.97 GHz
purious Emissions					
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	200.000 kHz	592.11500 MHz	-68.44 dBm	-26.94 dB
1.000 GHz	4.920 GHz	200.000 kHz	4.91951 GHz	-61.31 dBm	-19.81 dB
4.920 GHz	5.000 GHz	200.000 kHz	4.95828 GHz	-18.00 dBm	-18.00 dB
5.000 GHz	12.000 GHz	200.000 kHz	6.62015 GHz	-44.73 dBm	-3.23 dB
12.000 GHz	40.000 GHz	200.000 kHz	39.41060 GHz	-58.91 dBm	-17.41 dB
T I			Measuring		06.10.2018

4965 MHz

Date: 6.OCT.2018 12:59:58

		1900	101112		G
Spectrum					[H
Ref Level 10.00 de Count 10/10	Bm Offset 22.00	dB Mode S	Sweep		
1 AvgPwr			27		
Limit Check D dBm	IS_LINE_ABS_	PASS PASS	M1[1]	т т ^с	-17.32 dB 4.9873000 GF
10 dBm					
20 dBm					
30 dBm				+	
SPURIOUS_LINE_ABS	S				_
50 dBm					
60 dBm				and the second	
ED, dBase	Laborer and and and	And the state of the	A standard and a second	a dealer and the state of the s	
Acres 10					
I. J. J. Banklins	and the second second	0.00	0.		a wante
start 30.0 MHZ		2000	o prs		atup 40.0 GH
Range Low	Pange IIn	PBW	Frequency	Power Abs	ALimit
30,000 MHz	1,000 GHz	200,000 kHz	874.38500 MHz	-68.66 dBm	-27.16 d
1.000 GHz	4.920 GHz	200.000 kHz	4.88031 GHz	-61.75 dBm	-20.25 d
4.920 GHz	5.000 GHz	200.000 kHz	4.98548 GHz	-16.98 dBm	-16.98 d
5.000 GHz	12.000 GHz	200.000 kHz	6.64045 GHz	-44.89 dBm	-3.39 d
12.000 GHz	40.000 GHz	200.000 kHz	39.45540 GHz	-58.88 dBm	-17.38 d
			Measuring	C	06.10.2018 12:58:21

4980 MHz

Date: 6.OCT.2018 12:58:21

Antennna Port 2

4950 MHz

Spectrum					
Ref Level 10.00 dE Count 10/10	Offset 22.00	dB Mode S	Sweep		
1 AvgPwr	der th	20	27		
Limit Check 0 dBhine_SPURIOU	IS_LINE_ABS_	PABS PABS	M1[1]	1 1	-19.90 dBr 4.9548000 GH
-10 dBm				-	
-20 dBm	_			+	
-30 dBm					1.00
SPURIOUS_LINE_ABS	5				
50 dBm					
-60 dBm					
Th days	Lanna and a star	A	a strategic and a strategic and	and a second a leaves	and be determined
ten konst					
uter mersteated	shiph and break the state				an state
Start 30.0 MHz		2600	0 pts		Stop 40.0 GHz
purious Emissions					0.02
Range Low	Range Up	RBW	Frequency	Power Abs	۵Limit
30.000 MHz	1.000 GHz	200.000 kHz	879.23500 MHz	-68.55 dBm	-25.55 dB
1.000 GHz	4.920 GHz	200.000 kHz	4.90873 GHz	-64.37 dBm	-21.37 dB
4.920 GHz	5.000 GHz	200.000 kHz	4.95676 GHz	-18.70 dBm	-18.70 dB
5.000 GHz	12.000 GHz	200.000 kHz	6.59985 GHz	-46.70 dBm	-3.70 dB
12.000 GHz	40.000 GHz	200.000 kHz	39.39100 GHz	-59.11 dBm	-16.11 dB
			Measuring	CRAMMER MA	05.10.2018

Date: 6.OCT.2018 12:51:57





Date: 6.OCT.2018 12:50:45

4980 MHz

Spectrum						
Ref Level 10.00 de Count 10/10	3m Offset 22.00	dB Mode S	Sweep			
1 AvgPwr	da an		27			
Limit Check 0 dBmine_SPURIOL	IS_LINE_ABS_	PASS PASS	M1[1]	-17.95 4.9869000		
-10 dBm						
-20 dBm						
-30 dBm	_					
SPURIOUS_LINE_AB	s_+					
-50 dBm						
-60 dBm						
COL AD THE REAL PROVIDENCE	La marganet	A DATE OF THE ASSAULT	" Marine Company	والمرجعة والمرجع والم	al Brand and a state of the	
Linesoid States	Augure Label &					
Start 30.0 MHz		2600	0 pts	5	Stop 40.0 GHz	
purious Emissions						
Range Low	Range Up	RBW	Frequency	Power Abs	∆Limit	
30.000 MHz	1.000 GHz	200.000 kHz	875.35500 MHz	-68.58 dBm	-25.58 dB	
1.000 GHz	4.920 GHz	200.000 kHz	4.90285 GHz	-64.75 dBm	-21.75 dB	
4.920 GHz	5.000 GHz	200.000 kHz	4.98692 GHz	-17.91 dBm	-17.91 dB	
5.000 GHz	12.000 GHz	200.000 kHz	6.64045 GHz	-47.34 dBm	-4.34 dB	
12.000 GHz	40.000 GHz	200.000 kHz	39.48620 GHz	-58.51 dBm	-15.51 dB	
) (Measuring	CONSERVATION CONSERVATION CONSERVATION CONSERVATION CONSERVATION CONSTRAINTS CONSERVATION CONSERVATICON CONSERVATICON CONSERVATICON CONSERVATICON CONSERVATICON CONSERVATICON CONSERVATICON CONSERVATICA	06.10.2018	

Date: 6.OCT.2018 12:53:57

Internal Antenna

Antennna Port 1



Date: 6.OCT.2018 13:08:33



4965 MHz

Date: 6.OCT.2018 13:10:03

		.,			G
Spectrum					
Ref Level 10.00 de Count 10/10	Bm Offset 22.00	dB Mode S	Sweep		
1 AvgPwr	9a - 10	20	27		
Limit Check		PABS	M1[1]		-1.69 dB
D dBm	JS_LINE_ABS_	PASS	1	1 1	1.9863000 GI
-10 dBm					
-20 dBm					
SPURIOUS_LINE_AB	S_				
40 dBm	_				
50 dBm					
	In the local second	a second the second second	Russian and	and a state of the same	1 Andrews
- the second					
Start 30.0 MHz	a present of a state of	2600	0 nts		ston 40.0 GH
nurious Emissions	5				
Range Low	Range Up	RBW	Frequency	Power Abs	ALimit
30.000 MHz	1.000 GHz	200.000 kHz	774.47500 MHz	-56.94 dBm	-31.94 d
1.000 GHz	4.920 GHz	200.000 kHz	4.91657 GHz	-56.34 dBm	-31.34 d
4,920 GHz	5.000 GHz	200.000 kHz	4,98596 GHz	-1.42 dBm	-21.42 d
5.000 GHz	12,000 GHz	200.000 kHz	6.64045 GHz	-41.49 dBm	-16.49 d
12.000 GHz	40.000 GHz	200.000 kHz	39.40780 GHz	-59.03 dBm	-34.03 d
			Measuring		06.10.2018 13:11:26

4980 MHz

Date: 6.OCT.2018 13:11:26

Antennna Port 2

Spectrum					E
Ref Level 10.00 dE STOP Count 10/10	Bm Offset 22.00	dB Mode S	Sweep		('
1 AvgPwr	1		57		
Limit Check 0 dBhine_SMIRIOU	JS_LINE_ABS_	PASS PASS	M1[1]	т т I	-2.75 dBm 4.9566000 GHz
-10 dBm					
-20 dBm					
SPURIOUS_LINE_ABS	s				
-40 dBm					
50 dBm					
-60 dBm			• 100 I.N		- A - March
Standa and a standard	معقاهم فعارضه الم		and the site Konnells has	A de la addition d'a sincered	
1. August 1. Aug					
an in an and	d. A topole all a finite that				a
Start 30.0 MHz		2600	0 pts		Stop 40.0 GHz
purious Emissions	5				
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	200.000 kHz	745.37500 MHz	-59.04 dBm	-33.04 dB
1.000 GHz	4.920 GHz	200.000 kHz	4.91755 GHz	-53.64 dBm	-27.64 dB
4.920 GHz	5.000 GHz	200.000 kHz	4.95660 GHz	-2.75 dBm	-22.75 dB
5.000 GHz	12.000 GHz	200.000 kHz	9.90245 GHz	-46.83 dBm	-20.83 dB
12.000 GHz	40.000 GHz	200.000 kHz	39.37980 GHz	-58.65 dBm	-32.65 dB
			Measuring		05.10.2018

4950 MHz

Date: 6.OCT.2018 13:17:59



4965 MHz

Date: 6.OCT.2018 13:17:06

4980 MHz



Date: 6.OCT.2018 13:15:33

10 FCC §2.1051, §90.210 & ISEDC RSS-111 §5.5 - Radiated TX Spurious Emissions

10.1 Applicable Standard

FCC §90.210

(1) Emission Mask L. For low power transmitters (20 dBm or less) operating in the 4940-4990 MHz frequency band, the power spectral density of the emissions must be attenuated below the output power of the transmitter as follows:

(1) On any frequency removed from the assigned frequency between 0-45% of the authorized bandwidth (BW): 0 dB.

(2) On any frequency removed from the assigned frequency between 45-50% of the authorized bandwidth: 219 log (% of (BW)/45) dB.

(3) On any frequency removed from the assigned frequency between 50-55% of the authorized bandwidth: $10 + 242 \log (\% \text{ of } (BW)/50) \text{ dB}.$

(4) On any frequency removed from the assigned frequency between 55-100% of the authorized bandwidth: $20 + 31 \log (\% \text{ of (BW)/55}) \text{ dB}$ attenuation.

(5) On any frequency removed from the assigned frequency between 100-150% of the authorized bandwidth: $28 + 68 \log (\% \text{ of (BW)}/100) \text{ dB}$ attenuation.

(6) On any frequency removed from the assigned frequency above 150% of the authorized bandwidth: 40 dB.

(7) The zero dB reference is measured relative to the highest average power of the fundamental emission measured across the designated channel bandwidth using a resolution bandwidth of at least one percent of the occupied bandwidth of the fundamental emission and a video bandwidth of 30 kHz. The power spectral density is the power measured within the resolution bandwidth of the measurement device divided by the resolution bandwidth of the measurement device. Emission levels are also based on the use of measurement instrumentation employing a resolution bandwidth of at least one percent of the occupied bandwidth.

ISEDC RSS-111,

5.5 Transmitter Unwanted Emissions

Transmitter unwanted emissions shall be measured according to the method described in Section 4.3.

On any frequency f, offset from the channel centre frequency fc by a separation fd (expressed as a percentage of the channel bandwidth), the power spectral density of the unwanted emissions for low- and high-power transmitters shall comply with the limits specified below in Table 2. Figure 1 shows the emission mask for low- and high-power transmitters. For equipment with multiple transmitters, the unwanted emissions of each transmitter shall comply with the emission limits based on the output power of the transmitter regardless of the total output power of the equipment (i.e. total output power from all the transmitters).

Offset Frequency fd	Min	Minimum Attenuation (dB)				
ndwidth)	Low-power Transmitter	High-power Transmitter				
$0 < f_{d} \le 45$	0	0				
$45 < f_d \le 50$	219 log (f _d /45)	568 log (f _d /45)				
$50 < f_d \le 55$	10 + 242 log (f _d /50)	26 + 145 log (f _d /50)				
$55 < f_{d} \le 100$	20 + 31 log (f _d /55)	32 + 31 log (f _d /55)				
$100 < f_d \le 150$	28 + 68 log (f _d /100)	40 + 57 log (f _d /100)				
f _d > 150	40	whichever is less stringent 50 or 55 + 10 log p				

p: transmitter's output power (in watts), measured as per Section 4.1

10.2 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 is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter or 1.5 meter above ground plane, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

The frequency range up to 40GHz was investigated.

Manufacturer	Description	Model No.	Serial No.	Calibration Date	Calibration Interval
Agilent	Analyzer, Spectrum	E4446A	US44300386	2018-06-01	1 year
Sunol Sciences	System Controller	SC99V	011003-1	N/R	N/A
Sunol Sciences	Antenna, Biconi-Log	JB1	A013105-3	2018-02-26	2 years
Agilent	Amplifier, Pre	8447D	2944A10187	2018-04-02	1 year
IW	AOBOR Hi frequency CoAX Cable	DC 1531	KPS- 1501A3960K PS	2018-01-04	1 year
-	Hi frequency CoAX Cable	-	-	Each time ¹	N/A
-	SMA cable	-	C00011	Each time ¹	N/A
Agilent	Pre-Amplifier	8449B	3147A00400	2018-02-02	1 year
A.H. Systems	Pre-Amplifer	PAM 1840V	170	2018-09-10	1 Year
Sunol Sciences	Antenna, Horn	DRH-118	A052704	2017-03-27	2 years
Wisewave	Antenna, Horn	ARH-4223-02	10555-01	2018-02-14	2 years
Wisewave	Antenna, Horn	ARH-2823-02	10555-02	2017-12-15	2 years
Vasona	Test software	V6.0 build 11	10400213	N/R	N/R

10.3 Test Equipment List and Details

Note¹: cables and attenuators 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 09 June 2016) "A2LA Policy on Metrological Traceability".

10.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	35-40 %
ATM Pressure:	101-102 kPa

The testing was performed by Harry Zhao on 2018-10-09 in the 5 meter chamber 3.

10.5 Test Results

Worst Margin: -1.32 dB at 6600 MHz in the Vertical polarization for the Dish Antenna.

Б	S.A.	Turntable	Т	'est Anten	na	Cable	Pre-	Cord.	Cord.	FCC/I	SEDC
Frequency (MHz)	Reading	Azimuth	Height	Polarity	Factor	Loss	Amp.	Reading	Reading	Limit	Margin
(101112)	(dBµV)	(degrees)	(cm)	(H/V)	(dB / m)	(dB)	(dB)	$(dB\mu V/m)$	(dBm)	(dBm)	(dB)
				Lo	w Channel	4950 MH	Z				
89.8	28.24	0	213	Н	13.90	0.84	21.17	21.81	-73.39	-20.70	-52.69
89.8	32.15	0	243	V	13.90	0.84	21.17	25.72	-69.48	-21.3	-48.18
120.5	25.63	0	213	Н	20.40	0.93	28.13	18.82	-76.38	-20.70	-55.68
99.5	32.08	0	243	V	16.70	0.93	28.13	21.57	-73.63	-21.3	-52.33
60.7	27.59	0	213	Н	13.50	0.78	18.85	23.02	-72.18	-20.70	-51.48
6600	24.93	0	265	Н	34.43	9.39	0.00	68.75	-26.45	-20.70	-5.75
6600	28.76	0	265	V	34.43	9.39	0.00	72.58	-22.62	-21.30	-1.32
9900	42.42	0	265	Н	38.14	12.06	35.79	56.83	-38.37	-20.70	-17.67
9900	39.25	0	265	V	38.14	12.06	35.79	53.66	-41.54	-21.30	-20.24
14850	25.23	0	265	Н	41.80	14.42	33.32	48.13	-47.07	-20.70	-26.37
14850	24.42	0	265	V	41.80	14.42	33.32	47.32	-47.88	-21.30	-26.58
				Mide	dle Channe	1 4965 MI	Hz				
89.8	28.35	0	213	Н	13.90	0.84	21.17	21.92	-73.28	-21.30	-51.98
89.8	32.32	0	243	V	13.90	0.84	21.17	25.89	-69.31	-21.80	-47.51
120.5	26.90	0	213	Н	20.40	0.93	28.13	20.09	-75.11	-21.30	-53.81
99.5	32.04	0	243	V	16.70	0.93	28.13	21.53	-73.67	-21.80	-51.87
60.7	27.59	0	213	Н	13.50	0.78	18.85	23.02	-72.18	-21.30	-50.88
60.7	31.21	0	243	V	13.50	0.78	18.85	26.64	-68.56	-21.80	-46.76
6620	23.65	0	265	Н	34.43	9.39	0.00	67.47	-27.73	-21.30	-6.43
6620	27.79	0	265	V	34.43	9.39	0.00	71.61	-23.59	-21.80	-1.79
9930	40.89	0	265	Н	38.38	12.06	35.79	55.54	-39.66	-21.30	-18.36
9930	40.54	0	265	V	38.38	12.06	35.79	55.19	-40.01	-21.80	-18.21
14895	24.81	0	265	Н	41.56	14.42	33.32	47.47	-47.74	-21.30	-26.44
14895	24.37	0	265	Н	41.56	14.42	33.32	47.03	-48.18	-21.80	-26.38
				Hig	sh Channel	4980 MH	z				
89.8	28.12	0	213	Н	13.90	0.84	21.17	21.69	-73.51	-21.20	-52.31
89.8	32.34	0	243	V	13.90	0.84	21.17	25.91	-69.29	-21.60	-47.69
120.5	24.69	0	213	Н	20.40	0.93	28.13	17.88	-77.32	-21.20	-56.12
99.5	31.74	0	243	V	16.70	0.93	28.13	21.23	-73.97	-21.60	-52.37
60.7	24.65	0	213	Н	13.50	0.78	18.85	20.08	-75.12	-21.20	-53.92
60.7	30.54	0	243	V	13.50	0.78	18.85	25.97	-69.23	-21.60	-47.63
6640	23.86	0	265	Н	34.65	9.39	0.00	67.90	-27.30	-21.20	-6.10
6640	27.12	0	265	V	34.65	9.39	0.00	71.16	-24.04	-21.60	-2.44
9960	39.98	0	265	Н	38.38	12.06	35.72	54.70	-40.50	-21.20	-19.30
9960	41.46	0	265	V	38.38	12.06	35.72	56.18	-39.02	-21.60	-17.42
14940	21.62	0	265	V	41.22	14.42	33.32	43.93	-51.27	-21.20	-30.07
14940	21.83	0	265	V	41.22	14.42	33.32	44.14	-51.06	-21.60	-29.46

25 dBi Dish Antenna

Engguanar	S.A.	Turntable	Т	est Anter	nna	Cable	Pre-	Cord.	Cord.	FCC/I	SEDC
r requency (MH ₇)	Reading	Azimuth	Height	Polarity	Factor	Loss	Amp.	Reading	Reading	Limit	Margin
	(dBµV)	(degrees)	(cm)	(H/V)	(dB/m)	(dB)	(dB)	$(dB\mu V/m)$	(dBm)	(dBm)	(dB)
				L	ow Chann	el 4950 M	ſHz				
89.8	27.82	0	213	Н	13.90	0.84	21.17	21.39	-73.81	-17.00	-56.81
89.8	30.13	0	243	V	13.90	0.84	21.17	23.70	-71.50	-18.50	-53.00
120.5	27.41	0	213	Н	20.40	0.93	28.13	20.60	-74.60	-17.00	-57.60
101.1	29.12	0	243	V	16.70	0.93	28.13	18.61	-76.59	-18.50	-58.09
60.7	27.65	0	213	Н	13.50	0.78	18.85	23.08	-72.12	-17.00	-55.12
60.7	30.47	0	243	V	13.50	0.78	18.85	25.90	-69.30	-18.50	-50.80
6600	14.78	0	213	Н	34.43	9.39	0.00	58.60	-36.60	-17.00	-19.60
6600	15.00	0	243	V	34.43	9.39	0.00	58.82	-36.38	-18.50	-17.88
9900	48.98	0	213	Н	38.14	12.06	35.79	63.39	-31.81	-17.00	-14.81
9900	45.44	0	243	V	38.14	12.06	35.79	59.85	-35.35	-18.50	-16.85
14850	35.11	0	213	Н	41.80	14.42	33.32	58.01	-37.19	-17.00	-20.19
14850	34.98	0	243	V	41.80	14.42	33.32	57.88	-37.32	-18.50	-18.82
Middle Channel 4965 MHz											
89.8	28.06	0	213	Н	13.90	0.84	21.17	21.63	-73.57	-17.00	-56.57
89.8	30.26	0	243	V	13.90	0.84	21.17	23.83	-71.37	-18.40	-52.97
120.5	25.50	0	213	Н	20.40	0.93	28.13	18.69	-76.51	-17.00	-59.51
101.1	29.72	0	243	V	16.70	0.93	28.13	19.21	-75.99	-18.40	-57.59
60.7	27.48	0	213	Н	13.50	0.78	18.85	22.91	-72.29	-17.00	-55.29
60.7	31.81	0	243	V	13.50	0.78	18.85	27.24	-67.96	-18.40	-49.56
6620	14.28	0	213	Н	34.43	9.39	0.00	58.10	-37.10	-17.00	-20.10
6620	14.06	0	243	V	34.43	9.39	0.00	57.88	-37.32	-18.40	-18.92
9930	49.95	0	213	Н	38.38	12.06	35.79	64.60	-30.60	-17.00	-13.60
9930	46.82	0	243	V	38.38	12.06	35.79	61.47	-33.73	-18.40	-15.33
14895	33.36	0	213	Н	41.56	14.42	33.32	56.02	-39.19	-17.00	-22.19
14895	29.92	0	243	V	41.56	14.42	33.32	52.58	-42.63	-18.40	-24.23
				Н	igh Chann	el 4980 N	4Hz				
89.8	29.67	0	213	Н	13.90	0.84	21.17	23.24	-71.96	-17.10	-54.86
89.8	30.51	0	243	V	13.90	0.84	21.17	24.08	-71.12	-18.40	-52.72
120.5	27.62	0	213	Н	20.40	0.93	28.13	20.81	-74.39	-17.10	-57.29
101.1	29.85	0	243	V	16.70	0.93	28.13	19.34	-75.86	-18.40	-57.46
60.7	28.11	0	213	Н	13.50	0.78	18.85	23.54	-71.66	-17.10	-54.56
60.7	31.76	0	243	V	13.50	0.78	18.85	27.19	-68.01	-18.40	-49.61
6640	13.41	0	213	Н	34.65	9.39	0.00	57.45	-37.75	-17.10	-20.65
6640	13.16	0	243	V	34.65	9.39	0.00	57.20	-38.00	-18.40	-19.60
9960	50.62	0	213	Н	38.38	12.06	35.72	65.34	-29.86	-17.10	-12.76
9960	46.46	0	243	V	38.38	12.06	35.72	61.18	-34.02	-18.40	-15.62
14940	32.62	0	213	Н	41.22	14.42	33.32	54.93	-40.27	-17.10	-23.17
14940	29.18	0	243	V	41.22	14.42	33.32	51.49	-43.71	-18.40	-25.31

8 dBi Internal Antenna

Note¹: Cord.Reading (dBm) = Cord.Reading (dB μ V/m) - 95.2 Note²: Limit = Fundamental Channel Power (e.i.r.p) measured in chamber- 40 dB

25 dBi Dish Antenna

Frequency	Fundamental Channel Power (e.i.r.p) measured in chamber					
(MHz)	Horizontal Polaization	Vertical Polaization				
4950	19.3 dBm	18.7 dBm				
4965	18.7 dBm	18.2 dBm				
4980	18.8 dBm	18.4 dBm				

8 dBi Internal Antenna

Frequency	Fundamental Channel Power (e.i.r.p) measured in chamber					
(MHz)	Horizontal Polaization	Vertical Polaization				
4950	23 dBm	21.5 dBm				
4965	23 dBm	21.6 dBm				
4980	22.9 dBm	21.6 dBm				

11 FCC §90.1213, §2.1055 &ISEDC RSS-111 §5.2 - Frequency Stability

11.1 Applicable Standard

FCC §2.1055,

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30° to $+50^{\circ}$ centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

ISEDC RSS-111 §5.2

5.2 Transmitter Frequency Stability

The applicant shall ensure frequency stability by showing that the occupied bandwidth is maintained within the band of operation when tested at the temperature and supply voltage variations specified for the frequency stability measurement in RSS-Gen.

11.2 Test Procedure

Frequency Stability vs. Temperature: The equipment under test was connected to an external AC power supply and the RF output was connected to the Spectrum Analyzer via feed-through attenuators. The EUT was placed inside the temperature chamber. The AC leads and RF output cable exited the chamber through an opening made for the purpose.

After the temperature stabilized for approximately 20 minutes, the frequency output was recorded from the Spectrum Analyzer.

Frequency Stability vs. Voltage: An external variable AC power supply Source. The voltage was set to 115% and 85% of the nominal value. The output frequency was recorded for each voltage.

11.3 Test Equipment List and Details

Manufacturers	Descriptions	Models	Serial Numbers	Calibration Dates	Calibration Interval
Rhode & Schwarz	Spectrum Analyzer	FSV40	1321.3008K39- 101203-UW	2018-07-23	1 year
Espec	Chamber, Environmental	ESL-4CA	18010	2018-02-23	1 year
-	SMA cable	-	-	Each time ¹	N/A

Note¹: cable and attenuator included in the test set-up will be checked each time before testing. **Statement of Traceability: BACL Corp.** attests that all calibrations have been performed per the A2LA requirements, traceable to the NIST.

11.4 Test Environmental Conditions

Temperature:	20-25 °C
Relative Humidity:	44-55 %
ATM Pressure:	101-102 kPa

The testing was performed by Harry Zhao on 2018-10-09 in the RF Site.

11.5 Test Results

Antenna Port 1

4950 MHz

Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperat	ure		
120	50	4950	4950.0282	5.69	
120	40	4950	4950.0375	7.58	
120	30	4950	4950.0313	6.31	
120	20	4950	4950.0375	7.58	
120	10	4950	4950.0406	8.20	
120	0	4950	4950.0313	6.31	
120	-10	4950	4950.0281	5.68	
120	-20	4950	4950.0282	5.69	
120	-30	4950	4950.0188	3.79	
Frequency vs. Voltage					
102	20	4950	4950.0406	8.20	
138	20	4950	4950.0400	8.08	

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Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperat	ure		
120	50	4965	4965.0344	6.92	
120	40	4965	4965.0375	7.55	
120	30	4965	4965.0313	6.29	
120	20	4965	4965.0375	7.55	
120	10	4965	4965.0344	6.93	
120	0	4965	4965.0407	8.19	
120	-10	4965	4965.0375	7.55	
120	-20	4965	4965.0282	5.67	
120	-30	4965	4965.0407	8.19	
Frequency vs. Voltage					
102	20	4965	4965.0344	6.93	
138	20	4965	4965.0406	8.18	

4965 MHz

Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperat	ure		
120	50	4980	4980.0344	6.90	
120	40	4980	4980.0375	7.53	
120	30	4980	4980.0375	7.53	
120	20	4980	4980.0406	8.15	
120	10	4980	4980.0469	9.42	
120	0	4980	4980.0438	8.79	
120	-10	4980	4980.0281	5.64	
120	-20	4980	4980.0282	5.65	
120	-30	4980	4980.0226	4.53	
Frequency vs. Voltage					
102	20	4980	4980.0375	7.53	
138	20	4980	4980.0313	6.28	

Antenna Port 2

Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperati	ure		
120	50	4950	4950.0000	0.00	
120	40	4950	4950.0032	0.64	
120	30	4950	4950.0063	1.26	
120	20	4950	4950.0032	0.64	
120	10	4950	4950.0032	0.64	
120	0	4950	4950.0031	0.63	
120	-10	4950	4950.0031	0.63	
120	-20	4950	4950.0063	1.26	
120	-30	4950	4950.0032	0.64	
Frequency vs. Voltage					
102	20	4950	4949.9938	-1.26	
138	20	4950	4950.0063	1.26	

4950 MHz

Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperat	ure		
120	50	4965	4964.9969	-0.63	
120	40	4965	4964.9969	-0.63	
120	30	4965	4965.0032	0.63	
120	20	4965	4965.0032	0.63	
120	10	4965	4965.0063	1.26	
120	0	4965	4965.0063	1.26	
120	-10	4965	4965.0031	0.62	
120	-20	4965	4965.0032	0.63	
120	-30	4965	4965.0031	0.62	
Frequency vs. Voltage					
102	20	4965	4965.0032	0.63	
138	20	4965	4965.0000	0.00	

Test Condition		Reference	Measured	Frequency	
Voltage (Vac)	Temperature (°C)	Frequency (MHz)	Frequency (MHz)	Error (ppm)	
	Fre	equency vs. Temperatu	ure		
120	50	4980	4980.0000	0.00	
120	40	4980	4980.0031	0.62	
120	30	4980	4979.9969	-0.63	
120	20	4980	4980.0031	0.62	
120	10	4980	4980.0031	0.62	
120	0	4980	4980.0063	1.26	
120	-10	4980	4980.0094	1.88	
120	-20	4980	4980.0032	0.63	
120	-30	4980	4980.0032	0.63	
Frequency vs. Voltage					
102	20	4980	4980.0063	1.26	
138	20	4980	4980.0000	0.00	

12 Appendix A (Normative) FCC & ISEDC Labeling Requirements

12.1 FCC ID Label Requirement

Per FCC Part 2.925, (a) Each equipment covered in an application for equipment authorization shall bear a nameplate or label listing the following:

(1) FCC Identifier consisting of the two elements in the exact order specified in §2.926. The FCC Identifier shall be preceded by the term FCC ID in capital letters on a single line, and shall be of a type size large enough to be legible without the aid of magnification.

Example: FCC ID: XXX123

Where: XXX—Grantee Code, 123—Equipment Product Code

(b) The grantee code assigned pursuant to paragraph (c) of this section is assigned permanently to applicants/grantees and is valid only for the party specified as the applicant/grantee in the code assignment(s).

(c) A grantee code will have three characters consisting of Arabic numerals, capital letters, or combination thereof

(d) The equipment product code assigned by the grantee shall consist of a series of Arabic numerals, capital letters or a combination thereof, and may include the dash or hyphen (-). The total of Arabic numerals, capital letters and dashes or hyphens shall not exceed 14 and shall be one which has not been previously used in conjunction with:

12.2 IC Label Requirements

Per IC RSP-100, Issue 10 §3.1

Every unit of Category I radio apparatus certified for marketing and use in Canada shall bear a label identified by a unique combination of a model number and a certification number, which are assigned as described below in this section. This label shall be permanently affixed to the device or displayed electronically and its text must be clearly legible. If the dimensions of the device are too small or if it is not practical to place the label on the device and electronic labelling has not been implemented, the label shall be, upon agreement with Industry Canada, placed in a prominent location in the user manual supplied with the device. The user manual may be in an electronic format and must be readily available. The model number is assigned by the applicant and shall be unique to each model of radio apparatus. The model number shall be clearly indicated by a prefix such as "Model:". The word "Model" may be abbreviated; for example, the model number displayed on the label and preceded by the text "M / N:", or equivalent, is acceptable.

The certification number is made up of a Company Number (CN), assigned by Industry Canada's Certification and Engineering Bureau, followed by the Unique Product Number (UPN) assigned by the applicant. The certification number shall appear as follows:

IC: XXXXXX-YYYYYYYYYYY

Where:

• XXXXXX is the Company Number (CN) assigned by Industry Canada, made up of 6 alphanumeric characters (A-Z, 0-9) at most, including a letter at the end of the CN to distinguish between different addresses for the same company;

• YYYYYYYYYY is the Unique Product Number (UPN) assigned by the applicant, made up of 11 alphanumeric characters (A-Z, 0-9) at most; and

12.3 FCC ID & IC Label Contents and Location



13 Appendix B - EUT Photographs

Please see attachments:

Exhibit – EUT Test Setup Photographs Exhibit – EUT External Photographs Exhibit – EUT Internal Photographs

14 Appendix C (Normative) - A2LA Electrical Testing Certificate



--- END OF REPORT ---