



TESTING LABORATORY
CERTIFICATE #4820.01



FCC PART 15.249

TEST REPORT

For

Badge Messenger, INC

11 Industrial Blvd, Sauk Rapids, Minnesota 56379 USA

FCC ID:2AUET-202018SRX

Report Type: Original Report	Product Type: CAREL
Report Number:	<u>RDG190903003-00A</u>
Report Date:	<u>2020-05-25</u>
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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		CAREL
EUT Model:		SRX
Operation Frequency:		923.5-927.7MHz
Modulation Type:		Lora
Adapter Information	Model:	HNBM050200WU
	Input:	100-240Vac 50/60Hz 0.35A MAX
	Output:	5Vdc 2.0A
Rated Input Voltage:		DC 3.7V from battery or DC 5V from adapter
Serial Number:		RDG190903003-RF-S2
EUT Received Date:		2019.09.03
EUT Received Status:		Good

Note: the device contains a certified tablet, FCC ID: 2AUET-191813SRM

Objective

This type approval report is prepared on behalf of **Badge Messenger, INC** in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Rules Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 rules.

Related Submittal(s)/Grant(s)

Part of system submittal with FCC ID: 2AUET-202018SRM.

Test Methodology

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

All emissions measurement was performed and Bay Area Compliance Laboratories Corp. (Dongguan).

Measurement Uncertainty

Parameter	Measurement Uncertainty
Occupied Channel Bandwidth	±5 %
Unwanted Emissions, radiated	30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical 1G~6GHz: 4.45 dB, 6G~26.5GHz: 5.23 dB
Temperature	±1°C
Humidity	±5%
DC and low frequency voltages	±0.4%
Duty Cycle	1%
AC Power Lines Conducted Emission	3.12 dB (150 kHz to 30 MHz)

Note: Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Dongguan) to collect test data is located on the No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 897218, the FCC Designation No. : CN1220.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0022.

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “ Δ ”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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This report may contain data that are not covered by the accreditation scope and shall be marked with an asterisk “★”.

SYSTEM TEST CONFIGURATION

Justification

The EUT was configured in operating mode for testing which was provided by the manufacturer.

The device employs total 8 channels as below for test:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	923.5	4	925.9
1	924.1	5	926.5
2	924.7	6	927.1
3	925.3	7	927.7

EUT Exercise Software

The software: 'Badge Messenger.app' was used during test, which was provided by manufacturer. The maximum power level was configured by the software as below table:

Test Software Version	Badge Messenger.app		
Test Frequency	923.5	925.3	927.7
Power Level Setting	6	5	5

Equipment Modifications

No modifications were made to the EUT.

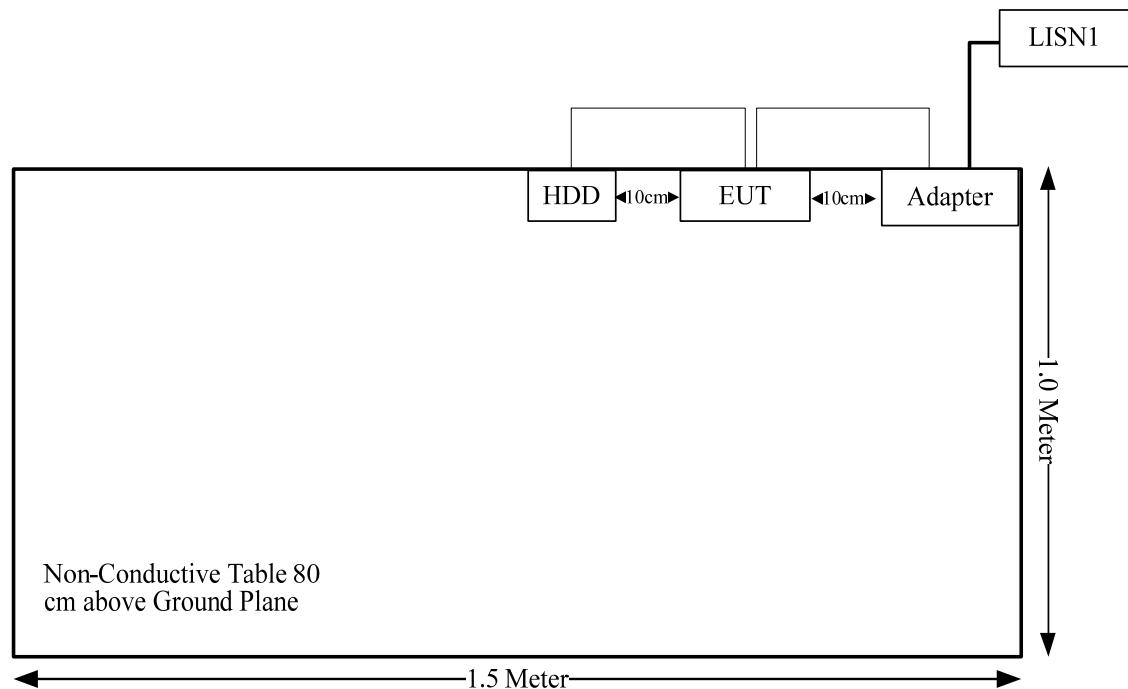
Local Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Dell	HDD	512GHD	fssDS-fdds17

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
DC Cable	Yes	No	1.0	EUT	Adapter
USB Cable	Yes	No	1.0	EUT	HDD

Block Diagram of Test Setup



SUMMARY OF TEST RESULTS

FCC Rules	Description of Test	Result
§15.203	Antenna Requirement	Compliance
§15.207(a)	Conduction Emissions	Compliance
15.205, §15.209, §15.249	Radiated Emissions	Compliance
§15.215 (c)	20 dB Bandwidth	Compliance

FCC§15.203 - ANTENNA REQUIREMENT

Applicable Standard

According to § 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

Antenna Connector Construction

The EUT has two internal Antenna attach to the EUT, the user can't replace it, fulfill the requirement of this section. Please refer to the EUT photos.

Antenna Chain	Antenna Type	input impedance (Ohm)	Antenna Gain
0	Dipole	50	3 dBi
1	Dipole	50	3 dBi

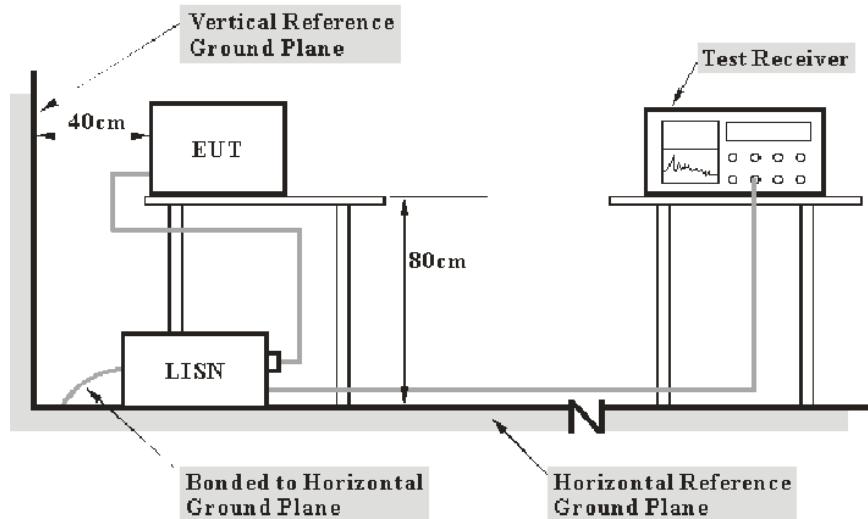
Result: Compliant.

FCC §15.207 (a)– AC LINE CONDUCTED EMISSIONS

Applicable Standard

FCC§15.207(a)

EUT Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207.

The spacing between the peripherals was 10 cm.

The adapter was connected to the main LISN with a 120 V/60 Hz AC power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emission test, the adapter was connected to the first LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$V_C = V_R + A_C + VDF$$

$$C_f = A_C + VDF$$

Herein,

V_C (cord. Reading): corrected voltage amplitude

V_R : reading voltage amplitude

A_C : attenuation caused by cable loss

VDF: voltage division factor of AMN

C_f : Correction Factor

The “Margin” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2019-09-05	2020-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2019-09-12	2020-09-12
R&S	EMI Test Receiver	ESCI	101121	2019-05-09	2020-05-09

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

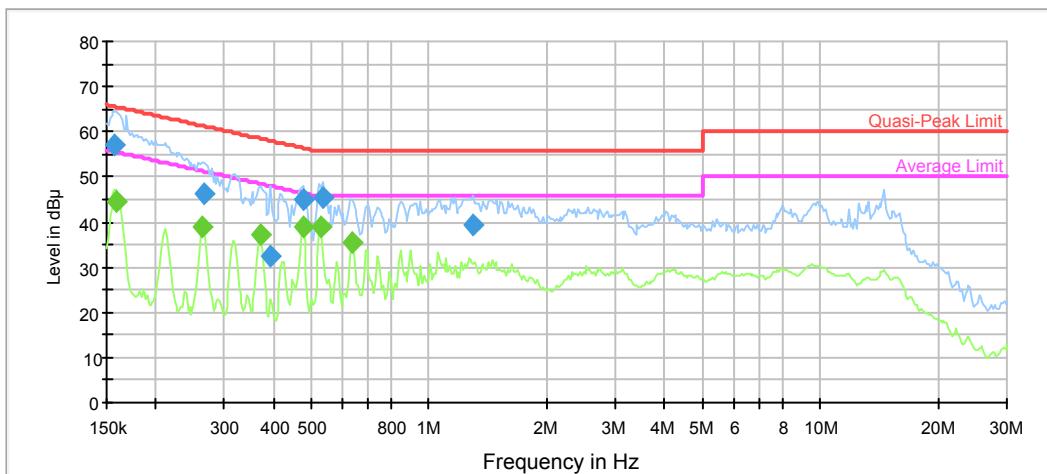
Test Data

Environmental Conditions

Temperature:	27.2°C
Relative Humidity:	64%
ATM Pressure:	100.1kPa
Tester:	Sem Xiang
Test Date:	2019-09-30

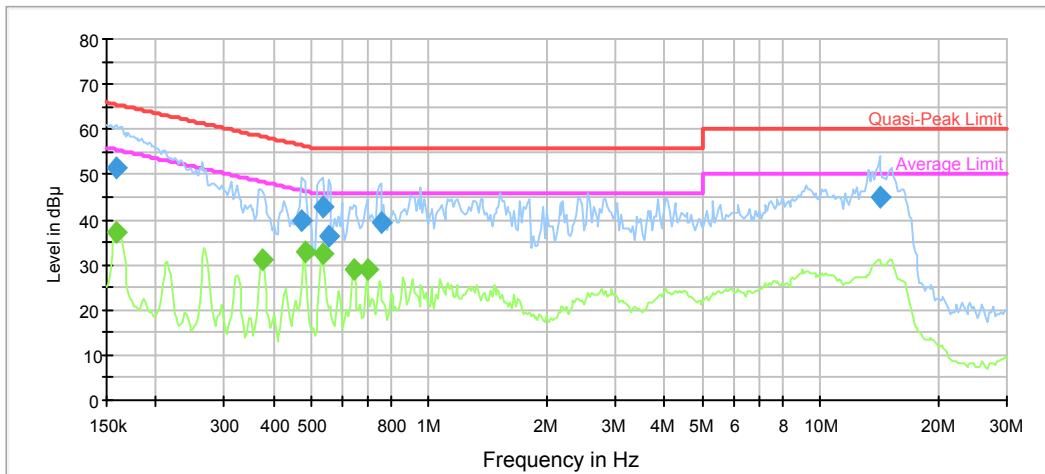
Test Mode: Transmitting

AC120V, 60 Hz, Line:



Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.157652	57.3	9.000	L1	11.1	8.3	65.6	Compliance
0.267135	46.4	9.000	L1	10.3	14.8	61.2	Compliance
0.393790	32.5	9.000	L1	10.0	25.5	58.0	Compliance
0.475741	45.0	9.000	L1	9.9	11.4	56.4	Compliance
0.536077	45.4	9.000	L1	9.9	10.6	56.0	Compliance
1.299660	39.3	9.000	L1	9.8	16.7	56.0	Compliance

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.159228	44.5	9.000	L1	11.1	11.0	55.5	Compliance
0.264490	38.8	9.000	L1	10.3	12.5	51.3	Compliance
0.370968	37.0	9.000	L1	10.0	11.5	48.5	Compliance
0.475741	39.0	9.000	L1	9.9	7.4	46.4	Compliance
0.530770	38.8	9.000	L1	9.9	7.2	46.0	Compliance
0.634879	35.6	9.000	L1	9.8	10.4	46.0	Compliance

AC120V, 60 Hz, Neutral:

Frequency (MHz)	QuasiPeak (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.159228	51.3	9.000	N	11.0	14.2	65.5	Compliance
0.471031	39.7	9.000	N	9.9	16.8	56.5	Compliance
0.536077	42.8	9.000	N	9.9	13.2	56.0	Compliance
0.552321	36.2	9.000	N	9.8	19.8	56.0	Compliance
0.751890	39.2	9.000	N	9.8	16.8	56.0	Compliance
14.156613	44.8	9.000	N	9.9	15.2	60.0	Compliance

Frequency (MHz)	Average (dB μ V)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dB μ V)	Comment
0.159228	37.0	9.000	N	11.0	18.5	55.5	Compliance
0.374678	31.1	9.000	N	10.0	17.3	48.4	Compliance
0.480499	32.7	9.000	N	9.9	13.6	46.3	Compliance
0.536077	32.4	9.000	N	9.9	13.6	46.0	Compliance
0.641227	28.9	9.000	N	9.8	17.1	46.0	Compliance
0.694357	28.9	9.000	N	9.8	17.1	46.0	Compliance

FCC§15.205, §15.209&§15.249- RADIATED EMISSIONS

Applicable Standard

As per FCC§15.249 (a), 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:

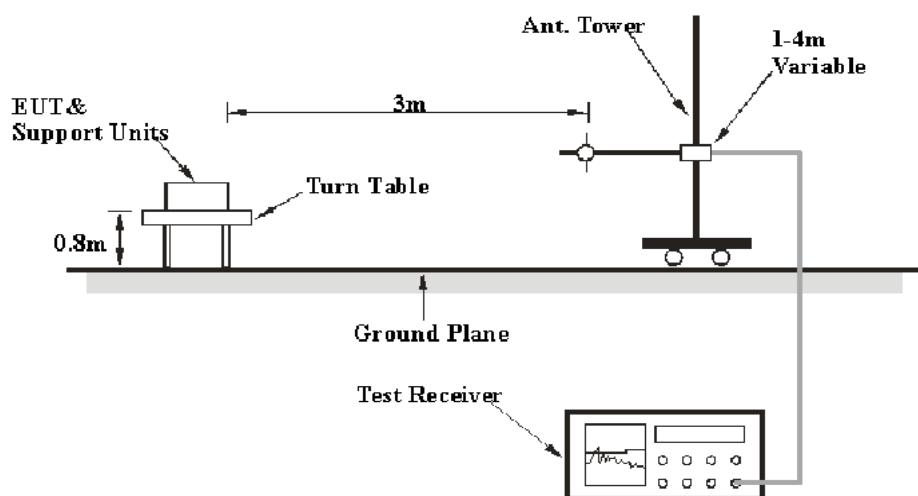
Fundamental frequency	Field strength of fundamental (millivolts/meter)	Field strength of harmonics (microvolts/meter)
902–928 MHz	50	500
2400–2483.5 MHz	50	500
5725–5875 MHz	50	500
24.0–24.25 GHz	250	2500

As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

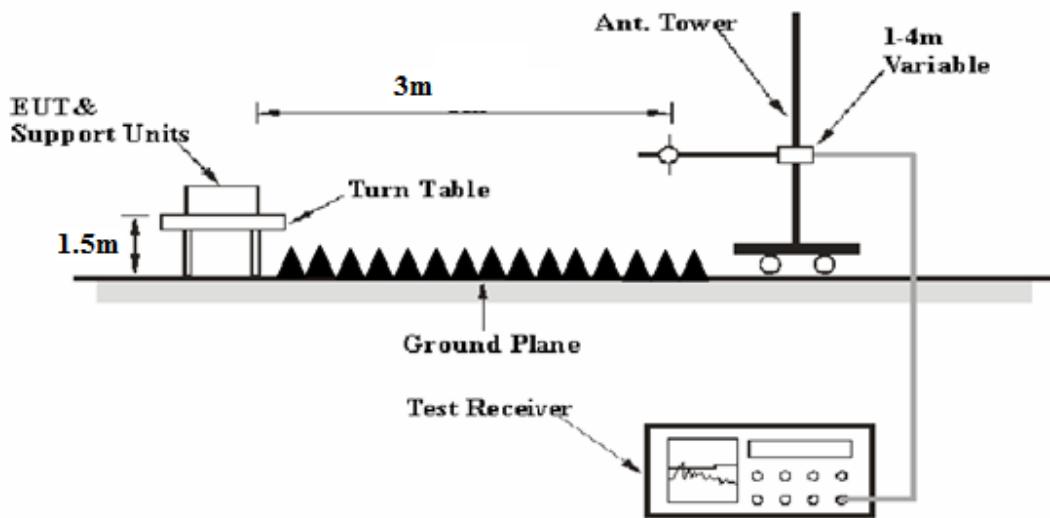
(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

EUT Setup

Below 1 GHz:



Above 1 GHz:



The radiated emission below 1GHz tests were performed in the 3 meters chamber test site A, above 1GHz tests were performed in the 3 meters chamber test site B, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, and FCC 15.249 limits.

Test Equipment Setup

The system was investigated from 30 MHz to 9.5 GHz.

During the radiated emission test, the EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Measurement
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	PK
	1MHz	10 Hz	/	AV

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

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

All data was recorded in the Quasi-peak detection mode from 30 MHz to 1GHz, peak and average detection mode above 1 GHz.

Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain from the Meter Reading. The basic equation is as follows:

$$\text{Corrected Amplitude} = \text{Meter Reading} + \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “Margin” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Corrected Amplitude}$$

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESR3	102453	2019-09-12	2020-09-12
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-1	2017-11-10	2020-11-10
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2019-09-05	2020-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2019-05-06	2020-05-06
HP	Amplifier	8447D	2727A05902	2019-09-05	2020-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2019-05-09	2020-05-09
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2019-09-05	2020-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2019-09-05	2020-09-05

*** Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

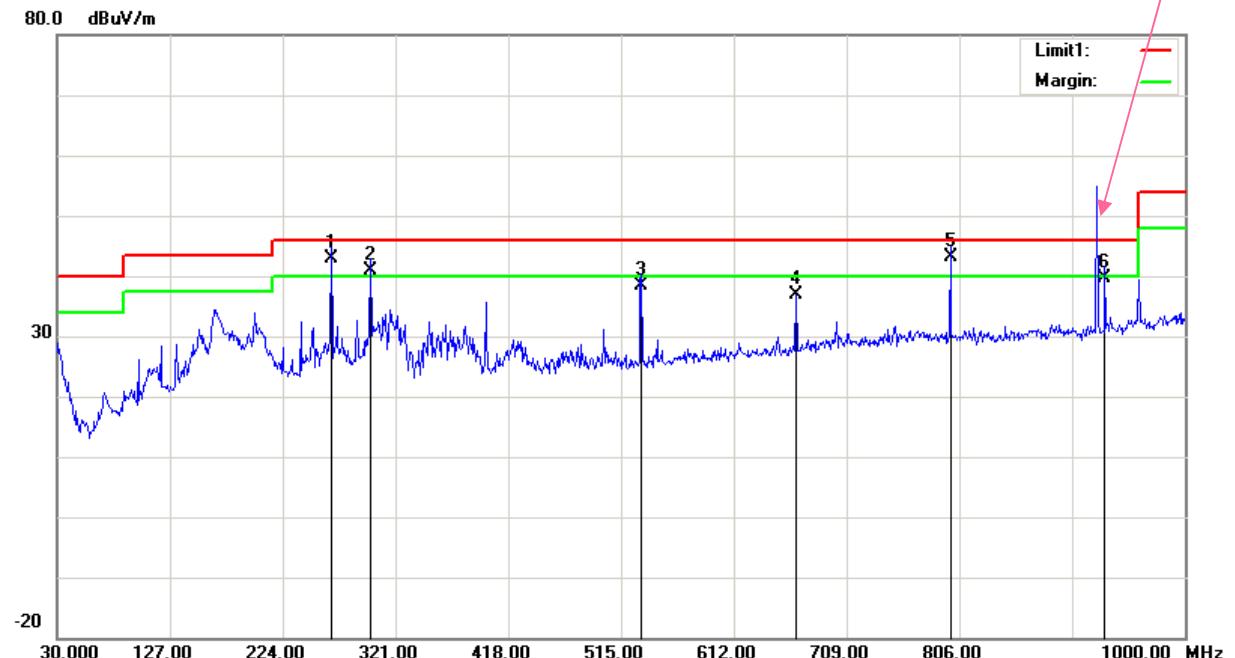
Environmental Conditions

Test Items	Radiation Below 1GHz	Radiation Above 1GHz
Temperature:	27.2 °C	27.3°C
Relative Humidity:	52%	56 %
ATM Pressure:	100.3 kPa	100.4 kPa
Tester:	Tyler Pan	Tyler Pan
Test Date:	2019-09-17	2019-09-17

Test Mode: Transmitting

1) 30MHz-1GHz(Middle channel is the worst):

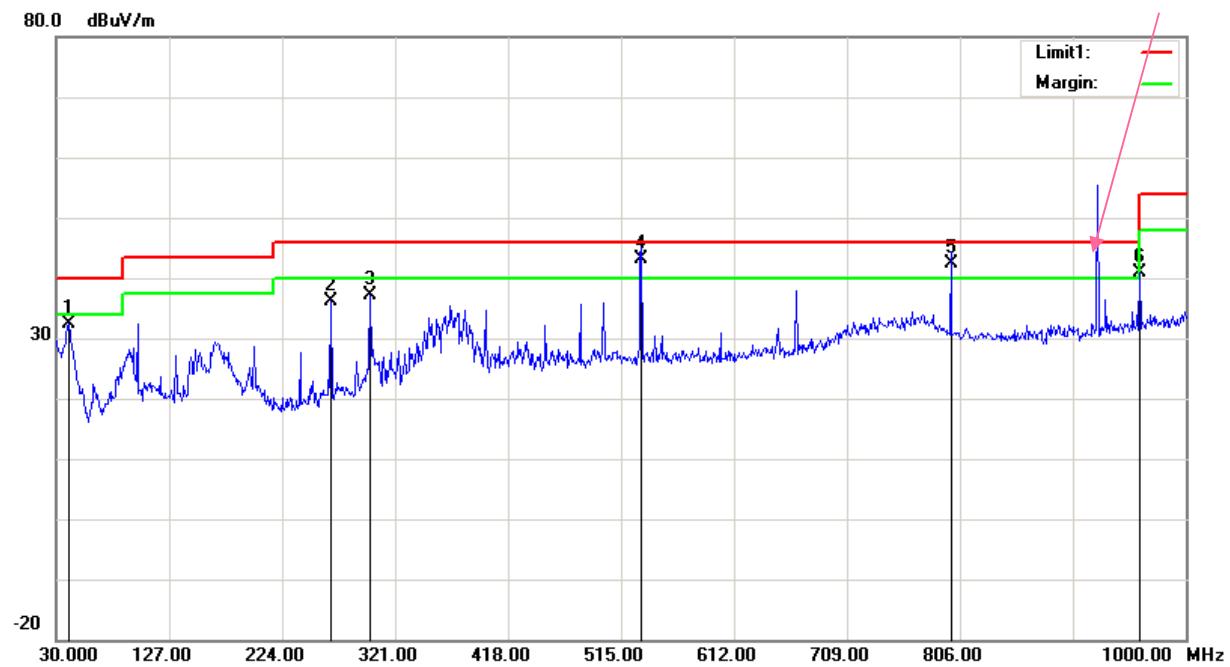
Horizontal:



Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
265.7100	47.44	QP	-4.49	42.95	46.00	3.05
299.6600	44.81	QP	-3.83	40.98	46.00	5.02
532.4600	38.04	QP	0.37	38.41	46.00	7.59
665.3500	34.62	peak	2.25	36.87	46.00	9.13
798.2400	38.66	QP	4.37	43.03	46.00	2.97
931.1300	38.99	QP	0.62	39.61	46.00	6.39

Vertical:

Fundamental

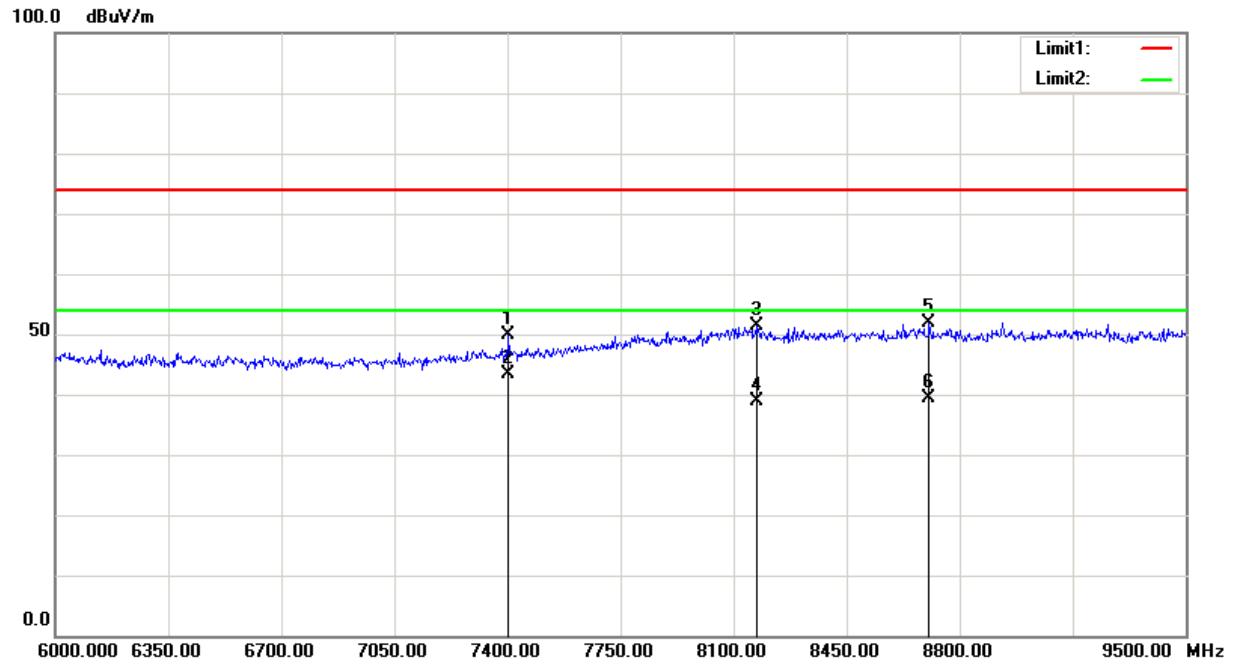
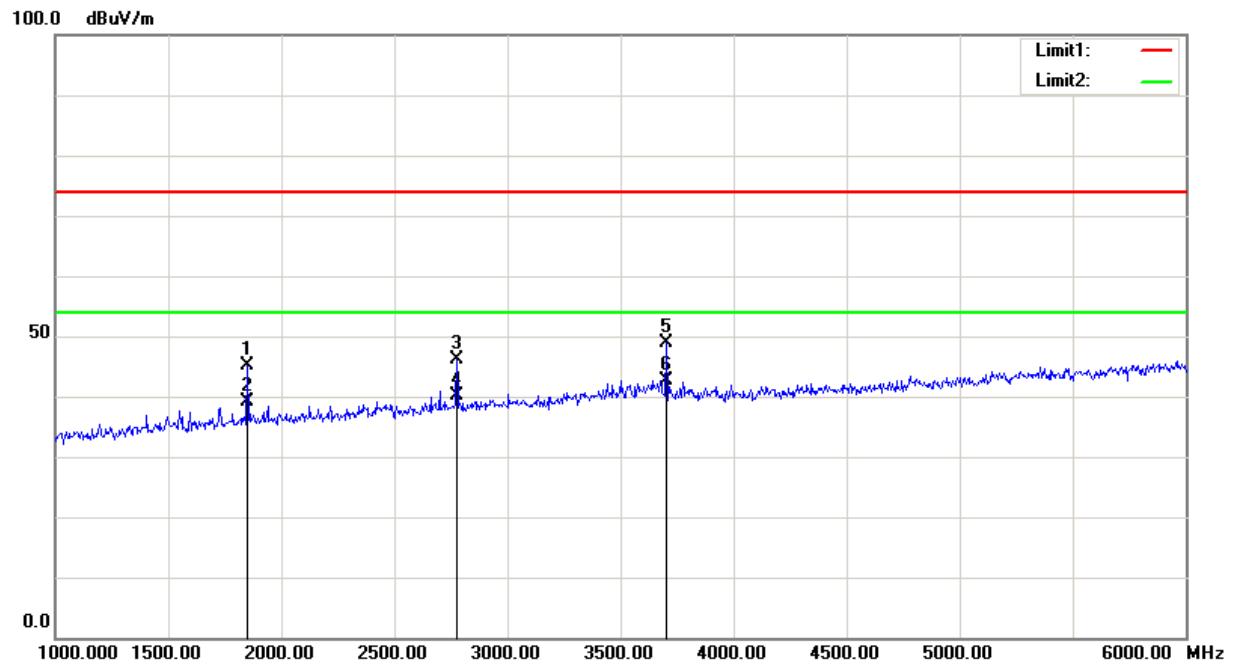


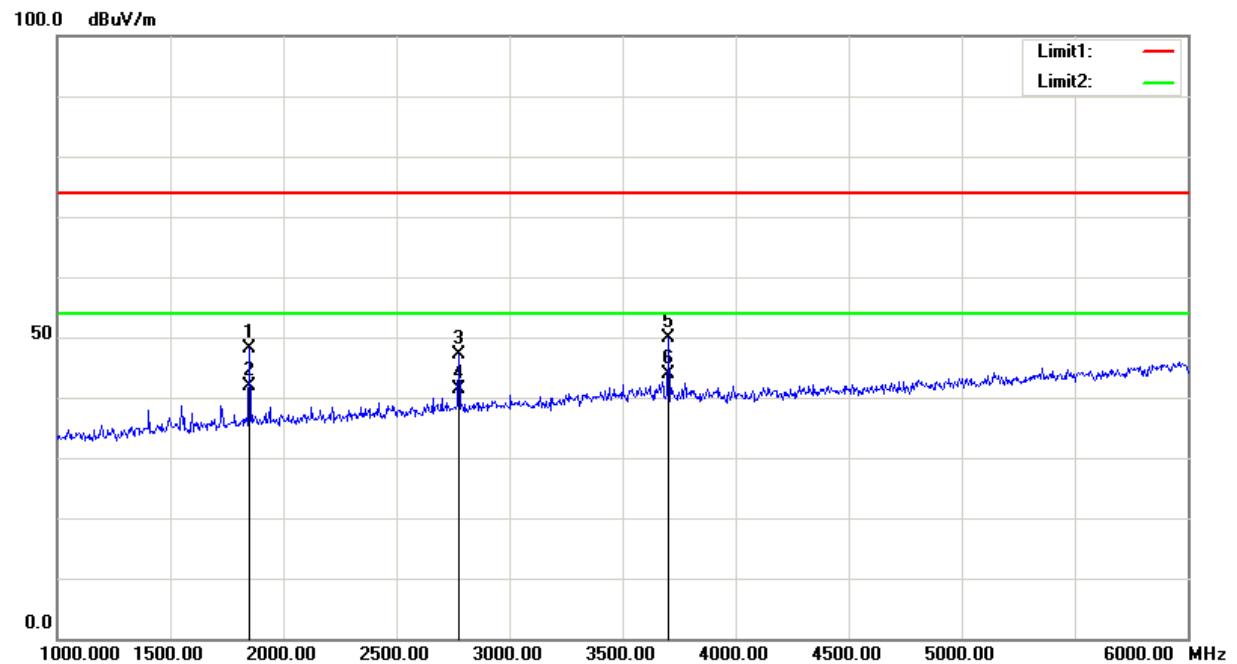
Frequency (MHz)	Receiver Reading (dBuV)	Detector	Correction Factor (dB/m)	Cord. Amp. (dBuV/m)	Limit (dBuV/m)	Margin (dB)
40.6700	38.61	peak	-6.32	32.29	40.00	7.71
265.7100	40.58	peak	-4.49	36.09	46.00	9.91
299.6600	40.85	peak	-3.83	37.02	46.00	8.98
532.4600	42.75	QP	0.37	43.12	46.00	2.88
798.2400	38.12	QP	4.37	42.49	46.00	3.51
960.2300	39.68	peak	1.09	40.77	54.00	13.23

2) Fundamental, Bandedge and 1GHz-10GHz:

Frequency (MHz)	Receiver		Rx Antenna		Cable loss (dB)	Amplifier Gain (dB)	Corrected Amplitude (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
	Reading (dB μ V)	Detector	Polar (H/V)	Factor (dB/m)					
Low Channel: 923.50 MHz									
923.50	65.76	QP	H	22.47	4.34	0.00	92.57	93.98	1.41
923.50	66.13	QP	V	22.47	4.34	0.00	92.94	93.98	1.04
902.00	10.30	QP	V	22.34	4.29	0.00	36.93	46.00	9.07
1847.00	54.54	PK	V	26.66	1.66	35.98	46.88	74.00	27.12
1847.00	48.32	AV	V	26.66	1.66	35.98	40.66	54.00	13.34
2770.50	52.04	PK	V	29.27	1.93	36.54	46.70	74.00	27.30
2770.50	45.97	AV	V	29.27	1.93	36.54	40.63	54.00	13.37
3694.00	52.11	PK	V	31.73	2.57	37.03	49.38	74.00	24.62
3694.00	46.21	AV	V	31.73	2.57	37.03	43.48	54.00	10.52
7388.00	47.65	PK	V	36.21	4.50	37.46	50.90	74.00	23.10
7388.00	41.74	AV	V	36.21	4.50	37.46	44.99	54.00	9.01
Middle Channel: 925.30 MHz									
925.30	66.85	QP	H	22.51	4.36	0.00	93.72	93.98	0.26
925.30	66.31	QP	V	22.51	4.36	0.00	93.18	93.98	0.80
1850.60	55.50	PK	V	26.67	1.66	35.99	47.84	74.00	26.16
1850.60	49.24	AV	V	26.67	1.66	35.99	41.58	54.00	12.42
2775.90	51.77	PK	V	29.29	1.93	36.54	46.45	74.00	27.55
2775.90	45.87	AV	V	29.29	1.93	36.54	40.55	54.00	13.45
3701.20	52.45	PK	V	31.74	2.58	37.02	49.75	74.00	24.25
3701.20	46.37	AV	V	31.74	2.58	37.02	43.67	54.00	10.33
7402.40	48.14	PK	V	36.25	4.48	37.48	51.39	74.00	22.61
7402.40	42.11	AV	V	36.25	4.48	37.48	45.36	54.00	8.64
High Channel: 927.70 MHz									
927.70	65.84	QP	H	22.55	4.34	0.00	92.73	93.98	1.25
927.70	66.17	QP	V	22.55	4.34	0.00	93.06	93.98	0.92
928.00	14.40	QP	V	22.56	4.34	0.00	41.30	46.00	4.70
1855.40	55.43	PK	V	26.69	1.66	36.00	47.78	74.00	26.22
1855.40	49.13	AV	V	26.69	1.66	36.00	41.48	54.00	12.52
2783.10	51.53	PK	V	29.32	1.94	36.55	46.24	74.00	27.76
2783.10	45.60	AV	V	29.32	1.94	36.55	40.31	54.00	13.69
3710.80	52.12	PK	V	31.76	2.57	37.02	49.43	74.00	24.57
3710.80	46.33	AV	V	31.76	2.57	37.02	43.64	54.00	10.36
7421.60	48.32	PK	V	36.30	4.45	37.50	51.57	74.00	22.43
7421.60	41.97	AV	V	36.30	4.45	37.50	45.22	54.00	8.78

Test plots(Middle Channel was the worst)
Horizontal



Vertical:

FCC §15.215(c) – 20 dB BANDWIDTH TESTING

Applicable Standard

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.

Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
3. Repeat above procedures until all frequencies measured were complete.

Test Equipment List and Details

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	Spectrum Analyzer	FSV40	101474	2020-01-09	2021-01-09
Unknown	Coaxial Cable	C-SJ00-0010	C0010/04	Each Time	/

* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Test Data

Environmental Conditions

Temperature:	28.1 °C
Relative Humidity:	60%
ATM Pressure:	99.4 kPa
Tester:	Tyler Pan
Test Date:	2020-05-22

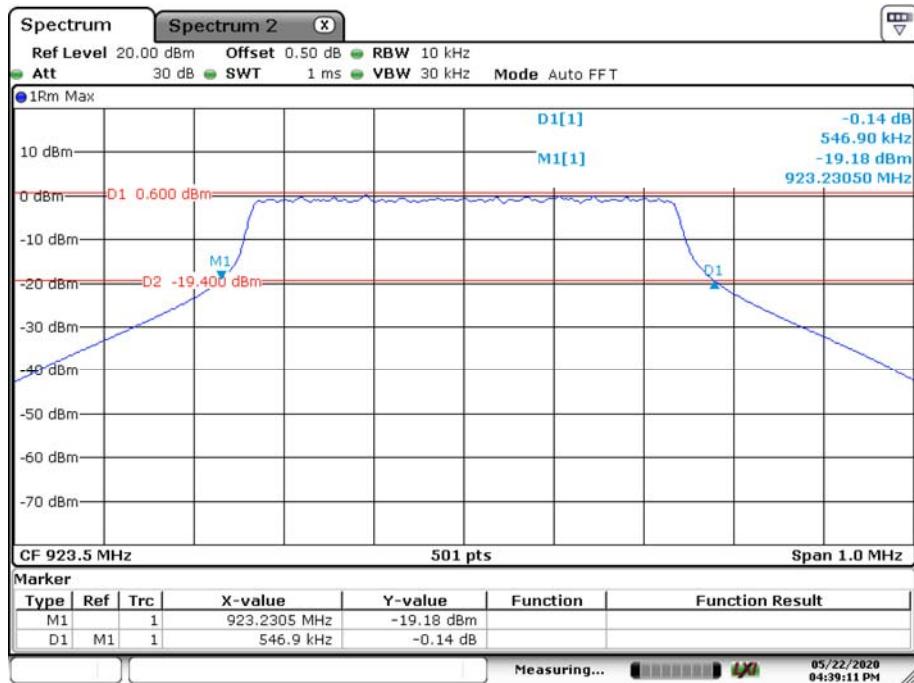
Test Result: Compliant.

Please refer to following tables and plots

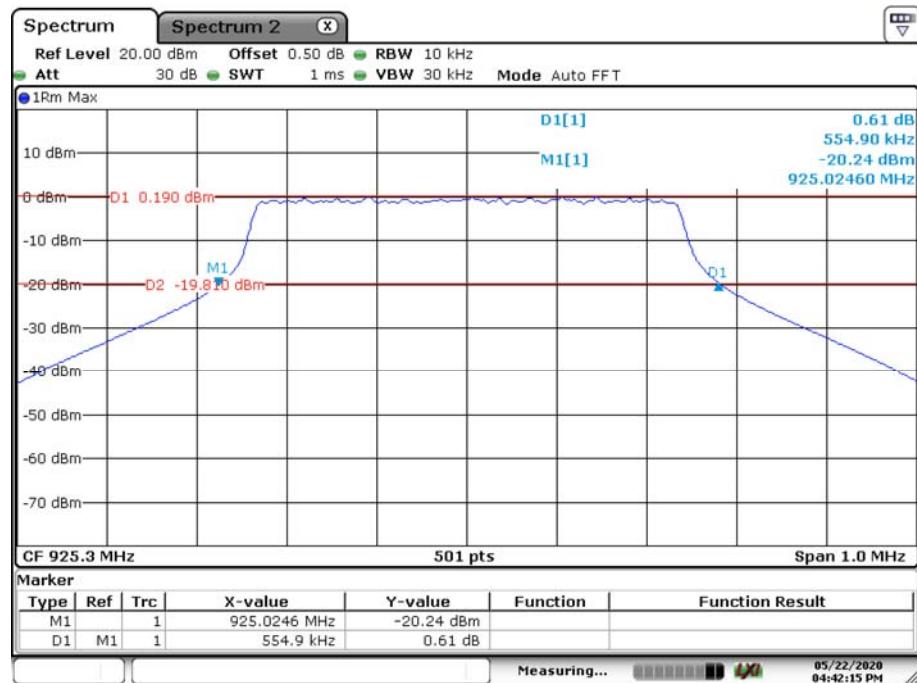
Test Mode: Transmitting

Channel	Frequency (MHz)	20 dB Bandwidth (kHz)
Low	923.5	546.9
Middle	925.3	554.9
High	927.7	550.9

Low Channel

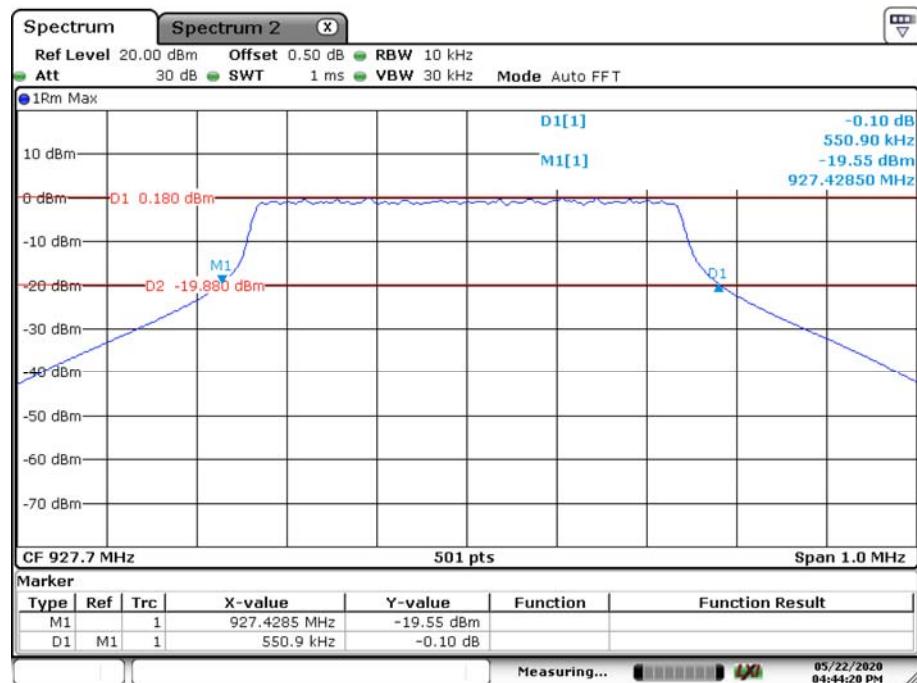


Middle Channel



Date: 22.MAY.2020 16:42:16

High Channel



Date: 22.MAY.2020 16:44:21

***** END OF REPORT *****