



Application

For

Unlicensed Transmitter Operating Under:

**Title 47 USC Part 2, Subpart J, Paragraph 2.907, 2.1043 Equipment Authorization
of Certification for an Intentional Radiator per Part 15, Subpart C,
Paragraphs 15.207, 15.209 and 15.249**

For

FAAFTECH TECNOLOGIA LTDA

Model: SP(NN)+

FCC ID: 2AXLF-SHIFTP

UST Project: 20-0242

Issue Date: December 4, 2020

Total Pages in This Report: 31

3505 Francis Circle Alpharetta, GA 30004

PH: 770-740-0717 Fax: 770-740-1508

www.ustech-lab.com



I certify that I am authorized to sign for the Test Agency and that all of the statements in this report and in the Exhibits attached hereto are true and correct to the best of my knowledge and belief:

US TECH (Agent Responsible For Test):

By: Alan Ghasiani

Name: 

Title: Consulting Engineer – President

Date: December 4, 2020



This report shall not be reproduced except in full. This report may be copied in part only with the prior written approval of US Tech. The results contained in this report are subject to the adequacy and representative character of the sample provided. This report must not be used to claim product certification, approval, or endorsement by NVLAP, NIST or any agency of the Federal Government.

3505 Francis Circle Alpharetta, GA 30004
PH: 770-740-0717 Fax: 770-740-1508
www.ustech-lab.com

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

MEASUREMENT TECHNICAL REPORT

COMPANY NAME: FAAFTECH TECNOLOGIA LTDA
MODEL: SP(NN)+
FCC ID: 2AXLF-SHIFTP
DATE: December 4, 2020

This report concerns (check one): Original ☒ Class II Change ☐

Equipment type: Low Power 2.4 GHz Radio transceiver

Transmitter details:

Frequency of operation: 2402-2480 MHz

Number of channels: 40

Type of modulation: GFSK

Data/Bit Rate: 1M bps

Antenna Gain: 2.0 dBi

Maximum Output Power: 77.07 dBuV/m @ 3 m

Software used to program EUT: SmartRF Studio v7

EUT firmware number: proprietary software.

Power setting: +0 dBm

Report prepared by:
US Tech
3505 Francis Circle
Alpharetta, GA30004

Table of Contents

<u>Paragraph</u>	<u>Title</u>	<u>Page</u>
1	General Information.....	7
1.1	Purpose of this Report	7
1.2	Characterization of Test Sample.....	7
1.3	Product Description	7
1.4	Configuration of Tested System.....	7
1.5	Test Facility.....	8
2	Tests and Measurements	10
2.1	Test Equipment.....	10
2.2	Modifications to EUT Hardware	10
2.3	Number of Measurements for Intentional Radiators (15.31(m)).....	11
2.4	Frequency Range of Radiated Measurements (Part 15.33).....	11
2.4.1	Intentional Radiator.....	11
2.4.2	Unintentional Radiator	11
2.5	Measurement Detector Function and Bandwidth (CFR 15.35)	12
2.5.1	Detector Function and Associated Bandwidth	12
2.5.2	Corresponding Peak and Average Requirements.....	12
2.5.3	Pulsed Transmitter Averaging.....	12
2.6	Transmitter Duty Cycle (CFR 15.35 (c)).....	12
2.7	EUT Antenna Requirements (CFR 15.203)	13
2.8	Restricted Bands of Operation (CFR 15.205)	13
2.9	Intentional Radiator, Power Line Conducted Emissions (CFR 15.207).....	13
2.10	Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c)) (IC RSS 210, A2.9 (a))	14
2.11	Band Edge Measurements – (CFR 15.249 (d)).....	18
2.12	Unintentional Radiator, Powerline Emissions (CFR 15.107)	23
2.13	Unintentional Radiator, Radiated Emissions (CFR 15.109).....	24
2.14	Measurement Uncertainty	27
2.14.1	Conducted Emissions Measurement Uncertainty	27
2.14.2	Radiated Emissions Measurement Uncertainty	27

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

List of Figures

<u>Figures</u>	<u>Title</u>	<u>Page</u>
Figure 1.	Block Diagram of Test Configuration	9
Figure 2.	Band Edge Compliance, Low Channel Delta – Peak	19
Figure 3.	Radiated Restricted Band 2310 MHz to 2390 MHz, Peak	20
Figure 4.	Band Edge Compliance, High Channel Delta, Peak	21
Figure 5.	Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak	22

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

List of Tables

<u>Table</u>	<u>Title</u>	<u>Page</u>
Table 1.	EUT and Peripherals.....	9
Table 2.	Test Instruments	10
Table 3.	Number of Test Frequencies for Intentional Radiators.....	11
Table 4.	Allowed Antenna(s)	13
Table 5.	Spurious Radiated Emissions below 30 MHz.....	15
Table 6.	Intentional Radiator, Radiated Emissions (CFR 15.209),.....	15
Table 7.	Peak Radiated Fundamental & Harmonic Emissions.....	16
Table 8.	Average Radiated Fundamental & Harmonic Emissions	17
Table 9.	Radiated Restricted Band 2310 MHz to 2390 MHz, Peak	20
Table 10.	Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak.....	22
Table 11.	Transmitter Power Line Conducted Emissions Test Data, Part 15.107 ...	23
Table 12.	Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),	25
Table 13.	Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),	26

List of Attachments

FCC Agency Agreement
Application Forms
Letter of Confidentiality
Test Configuration Photographs
External Photographs
Internal Photographs
Permissive Change Letter
Confidential Schematics
Copy of Original FCC Certificate

1 General Information

1.1 Purpose of this Report

This report is prepared as a means of conveying test results and information concerning the suitability of this exact product for public distribution according to the FCC Rules and Regulations Part 15, Section 249.

1.2 Characterization of Test Sample

The sample used for testing was received by US Tech on November 16, 2020 in good operating condition.

1.3 Product Description

The Equipment Under Test (EUT) is the FAAFTECH TECNOLOGIA LTDA Model SP(NN)+. The SP(NN)+ is an aftermarket car throttle response controller with Bluetooth feature. The Bluetooth feature allows the user to interface with the module using a proprietary application that can be found any major application store such as Google Play or Apple App Store.

The model name SP(NN)+ has place holder characters. The “NN” can be any two numeric characters signifying the type of car harness the EUT is being sold with for example SP02+, SP08+, SP33+...etc... means the EUT is paired with different harness depending on the car connection.

1.4 Configuration of Tested System

The sample was tested per *ANSI C63.4:2014, Methods of Measurement of Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz* for FCC subpart A Digital equipment Verification requirements and per *ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices* for FCC subpart C Intentional Radiators.

A list of EUT and Peripherals is found in Table 1. A block diagram of the tested system is shown in Figure 1. Test configuration photographs are provided in separate Appendices.

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

1.5 Test Facility

Testing was performed at US Tech's measurement facility at 3505 Francis Circle, Alpharetta, GA 30004. This site has been fully described and registered with the FCC. Its designation number is US5301. Additionally this site has also been fully described and submitted to Industry Canada (ISED), and has been approved under file number 9900A-1.

1.6 Related Submittals

The EUT is subject to the following FCC authorizations:

- a) Certification under section 15.207 and 15.209 as a transmitter.
- b) SDoC under 15.101 as a digital device.

The SDoC requirement shares many common report elements with the Certification report. Therefore, though this report is mostly intended to provide data for the Certification process, the SDoC authorization report (Parts 15.107 and 15.109) for the EUT is included herein.

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

Table 1. EUT and Peripherals

PERIPHERAL MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	FCC ID	CABLES P/D
Control Module FAAFTECH TECNOLOGIA LTDA	SP(NN)+	Engineering Sample	2AXLF-SHIFTP	N/A
Car harness FAAFTECH TECNOLOGIA LTDA	Various	Engineering Sample	None	P/D
Antenna See antenna details	--	--	--	--

U= Unshielded S= Shielded P= Power D= Data

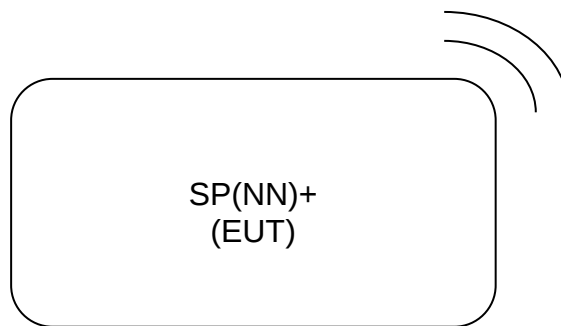


Figure 1. Block Diagram of Test Configuration

2 Tests and Measurements

2.1 Test Equipment

The table below lists test equipment used to evaluate this product. Model numbers, serial numbers and their calibration status are indicated.

Table 2. Test Instruments

TEST INSTRUMENT	MODEL NUMBER	MANUFACTURER	SERIAL NUMBER	CALIBRATION DUE DATE
SPECTRUM ANALYZER	4407B	AGILENT	US41442935	9/02/2022 2 yr Cal
SPECTRUM ANALYZER	8593E	HEWLETT-PACKARD	3205A00124	1/29/2022 2 yr Cal
RF PREAMP 100 kHz to 1.3 GHz	8447D	HEWLETT-PACKARD	1937A02980	5/13/2021
PREAMP 1.0 GHz to 26.0 GHz	8449B	HEWLETT-PACKARD	3008A00480	5/13/2021
LOOP ANTENNA	6502	ETS Lindgren	9810-3246	4/06/2022 2yr cal
BICONICAL ANTENNA	3110B	EMCO	9307-1431	11/11/2022 2 yr cal.
LOG PERIODIC ANTENNA	3146	EMCO	9110-3236	8/22/2021 2 yr. cal.
HORN ANTENNA	3115	EMCO	9107-3723	11/28/2020 2 yr cal.
HIGH PASS FILTER	H3R020G2	MICROWAVE CIRCUITS	001DC9528	5/11/2021

Note: The calibration interval of the above test instruments are 12 months unless stated otherwise and all calibrations are traceable to NIST/USA.

2.2 Modifications to EUT Hardware

No physical modifications were made by US Tech in order to bring the EUT into compliance with FCC Part 15, Subpart C Intentional Radiator Limits for the transmitter portion of the EUT or the Subpart B Unintentional Radiator Limits (Receiver and Digital Device) Requirements.

2.3 Number of Measurements for Intentional Radiators (15.31(m))

Measurements of intentional radiators or receivers shall be performed and reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in Table 3 below.

Table 3. Number of Test Frequencies for Intentional Radiators

Frequency Range over which the device operates	Number of Frequencies	Location in the Range of operation
1 MHz or less	1	Middle
1 to 10 MHz	2	1 near the top 1 near the bottom
Greater than 10 MHz	3	1 near top 1 near middle 1 near bottom

Because the EUT operates at 2402 MHz to 2480 MHz, 3 test frequencies were used.

2.4 Frequency Range of Radiated Measurements (Part 15.33)

2.4.1 Intentional Radiator

The spectrum shall be investigated for the intentional radiator from the lowest RF signal generated in the EUT, without going below 9 kHz to the 10th harmonic of the highest fundamental frequency generated or 40 GHz, whichever is the lowest.

2.4.2 Unintentional Radiator

For the digital device, an unintentional radiator, the frequency range shall be 30 MHz to 1000 MHz, or to 5 times the highest internal clock frequency.

2.5 Measurement Detector Function and Bandwidth (CFR 15.35)

The radiated and conducted emissions limits shown herein are based on the parameters outlined following.

2.5.1 Detector Function and Associated Bandwidth

On frequencies below 1000 MHz, the limits herein are based upon measurement equipment employing a CISPR Quasi-peak detector function and related measurement bandwidths (i.e. 9 kHz from 150 kHz to 30 MHz and 120 kHz from 30 MHz to 1000 MHz). Alternatively, measurements may be made with equipment employing a peak detector function as long as the same bandwidths specified for the quasi-peak device are used.

2.5.2 Corresponding Peak and Average Requirements

Above 1000 MHz, radiated limits are based on measuring instrumentation employing an average detector function. When average radiated emissions are specified there is also a corresponding Peak requirement, as measured using a peak detector, of 20 dB greater than the average limit. For all measurements above 1000 MHz the Resolution Bandwidth shall be at least 1 MHz.

2.5.3 Pulsed Transmitter Averaging

When the radiated emissions limit is expressed as an average value, and the transmitter is pulsed, the measured field strength shall be determined by applying a Duty Cycle Correction Factor based upon dividing the total ON time during the first 100 ms period by 100 ms (or by the period if less than 100 ms). The duty cycle may be expressed logarithmically in dB.

NOTE: If the transmitter was programmed to transmit at >98% duty cycle, then, wherever applicable (where the detection mode was AVG), the duty cycle factor calculated will be applied.

2.6 Transmitter Duty Cycle (CFR 15.35 (c))

The operating duty cycle of the transmitter under normal operation did not change from the originally certified radio.

Pulse transmitter averaging as detailed in clause 2.5.3 above is considered whenever the EUT operation involves pulse transmission signals.

2.7 EUT Antenna Requirements (CFR 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. Only the antenna(s) listed in Table 4 will be used with this module.

Table 4. Allowed Antenna(s)

REPORT REFERENCE	MANUFACTURER	TYPE OF ANTENNA	MODEL	GAIN dBi	TYPE OF CONNECTOR
Antenna 1	FAAFTECH TECNOLOGIA LTDA	Trace	Engineering Sample	+2.0	PCB Trace

2.8 Restricted Bands of Operation (CFR 15.205)

Only spurious emissions can fall in the frequency bands of CFR 15.205. The field strength of these spurious emissions cannot exceed the limits of 15.209. Radiated Harmonics and other Spurious Emissions are examined for this requirement; see paragraph 2.1.

2.9 Intentional Radiator, Power Line Conducted Emissions (CFR 15.207)

Measurements to demonstrate compliance with the conducted limits are not required for devices which only employ battery power for operation and which do not operate from the AC power lines or contain provisions for operation while connected to the AC power lines. Devices that include, or make provisions for, the use of battery chargers which permit operating while charging, AC adapters or battery eliminators or that connect to the AC power lines indirectly, obtaining their power through another device which is connected to the AC power lines, shall be tested to demonstrate compliance with the conducted limits.

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

2.10 Intentional Radiator, Radiated Emissions (CFR 15.209, 15.249(a),(c)) (IC RSS 210, A2.9 (a))

Radiated Radio measurements: the EUT was placed into a continuous transmit mode of operation and a preliminary scan was performed on the EUT to find signal frequencies that were caused by the transmitter part of the product. To obtain the worst case results, the EUT was placed on a table top of a non-conductive table, 80 cm above the ground floor. The EUT was positioned 3 meters away from the receiving antenna during testing (1 meter at frequencies above 6 GHz and if the emissions were less than 6 dB from the noise floor). The EUT was tested in X, Y and Z axes or the position of normal operation to determine the worst case orientation. Radiated measurements below 30 MHz were tested with a RBW = 9 kHz; emissions below 1 GHz were tested with a RBW = 120 kHz and radiated measurements above 1 GHz were measured using a RBW = 1 MHz. VBW was set to three times the RBW value.

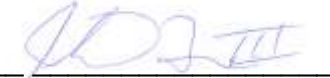
US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFT
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

Table 5. Spurious Radiated Emissions below 30 MHz

9 kHz to 30 MHz, 15.209 limits							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	AVG Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG
All emissions found were more than 20 dB below the limit.							

Test Date: November 24, 2020

Tested By
Signature: 

Name: John Freeman

Table 6. Intentional Radiator, Radiated Emissions (CFR 15.209), 30 MHz to 25 GHz

30 MHz to 1000 MHz with Class B Limits							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK or QP
All emissions found were more than 20 dB below the limit except for fundamental and harmonics. Fundamental and harmonic emissions are presented in a separate table, following.							

Test Date: November 24, 2020

Tested By
Signature: 

Name: John Freeman

US Tech Test Report
 FCC ID:
 Test Report Number:
 Issue date:
 Customer:
 Model:

FCC Part 15.209/249
 2AXLF-SHIFTP
 20-0242
 December 4, 2020
 FAAFTECH TECNOLOGIA LTDA
 SP(NN)+

Table 7. Peak Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.249(a)					Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242					Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
2402.00	84.19	--	-7.12	77.07	114.0	3.0m./HORZ	36.9	PK
4804.00*	51.18	--	2.63	53.81	74.0	3.0m./HORZ	20.2	PK
7206.00	51.55	-9.50	8.16	50.21	74.0	1.0m./HORZ	23.9	PK
No other harmonics seen.								
Mid - Channel								
2440.00	81.20	--	-6.06	75.14	114.0	3.0m./HORZ	38.9	PK
4880.00*	51.07	--	3.62	54.69	74.0	3.0m./HORZ	19.3	PK
No other harmonics seen.								
High - Channel								
2480.00	77.83	--	-5.73	72.10	114.0	3.0m./HORZ	41.9	PK
4960.00*	51.63	--	4.26	55.89	74.0	3.0m./HORZ	18.1	PK
No other harmonics seen.								

Notes:

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB).
4. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.

Sample Calculation at 2402.00 MHz:

Magnitude of Measured Frequency	84.19	dBuV
+Antenna Factor + Cable Loss - Amplifier Gain	-7.12	dB/m
Corrected Result	77.07	dBuV/m

Test Date: November 30, 2020

Tested By
 Signature: _____

Name: Mark Afroozi

US Tech Test Report
 FCC ID:
 Test Report Number:
 Issue date:
 Customer:
 Model:

FCC Part 15.209/249
 2AXLF-SHIFTP
 20-0242
 December 4, 2020
 FAAFTECH TECNOLOGIA LTDA
 SP(NN)+

Table 8. Average Radiated Fundamental & Harmonic Emissions

Test: FCC Part 15, Para 15.209, 15.249(a)					Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242					Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	Factor (dB)	AF+CA -AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector Mode
Low - Channel								
2402.00	83.95	--	-7.12	76.83	94.0	3.0m./HORZ	17.2	AVG
4804.00*	33.25	--	2.63	35.88	54.0	3.0m./HORZ	18.1	AVG
7206.00	31.41	-9.50	8.16	30.07	54.0	1.0m./HORZ	23.9	AVG
No other harmonics seen.								
Mid - Channel								
2440.00	80.76	--	-6.06	74.70	94.0	3.0m./HORZ	38.9	AVG
4880.00*	31.30	--	3.62	34.92	54.0	3.0m./HORZ	19.1	AVG
No other harmonics seen.								
High - Channel								
2480.00	77.42	--	-5.73	71.69	94.0	3.0m./HORZ	22.3	AVG
4960.00*	37.94	--	4.26	42.20	54.0	3.0m./HORZ	11.8	AVG
No other harmonics seen.								

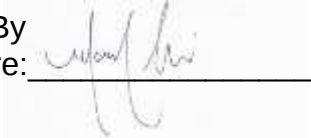
Notes:

1. (*) Falls within the restricted bands of CFR 15.205. Limits based on CFR15.209 & 20 dB relaxation for peak measurements of CFR 15.35.
2. No other signals detected within 20 dB of specification limit. Harmonics investigated up to the 10th harmonic
3. Measurements taken at 1 meter were extrapolated to 3 meters using a factor of (-9.5 dB).
4. The EUT was placed in three orthogonal positions and the transmitter was in constant broadcast mode, with a duty cycle of greater than 98%. The emissions were measured with the receive antenna in vertical and horizontal polarizations. The data listed in the above table was worst case.
5. Duty Cycle factor of -20 dB is added to the additional factor column.

Sample Calculation at 2402.0 MHz:

Magnitude of Measured Frequency	83.95	dBuV
+Antenna Factor + Cable Loss+ Amplifier Gain	-7.12	dB/m
Corrected Result	76.83	dBuV/m

Test Date: November 30, 2020

Tested By
 Signature: 

Name: Mark Afroozi

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

2.11 Band Edge Measurements – (CFR 15.249 (d))

Band Edge measurements are made following the guidelines in FCC KDB Publication No. 558074 with the EUT initially operating on the Lowest Channel and then operating on the Highest Channel within its band of operation. Radiated measurements are performed to demonstrate compliance with the requirement of 15.249(d) that all emissions outside of the band edges be attenuated by at least 50 dB or 15.209 limits, when compared to its highest in-band value (contained in a 100 kHz band).

To capture the band edge, set the Spectrum Analyzer frequency span set to 2 MHz to capture the peak level of the emission operating on the channel closest to the band edge as well as any modulation products falling outside of the authorized band of operation. See figure and calculations below for more detail.

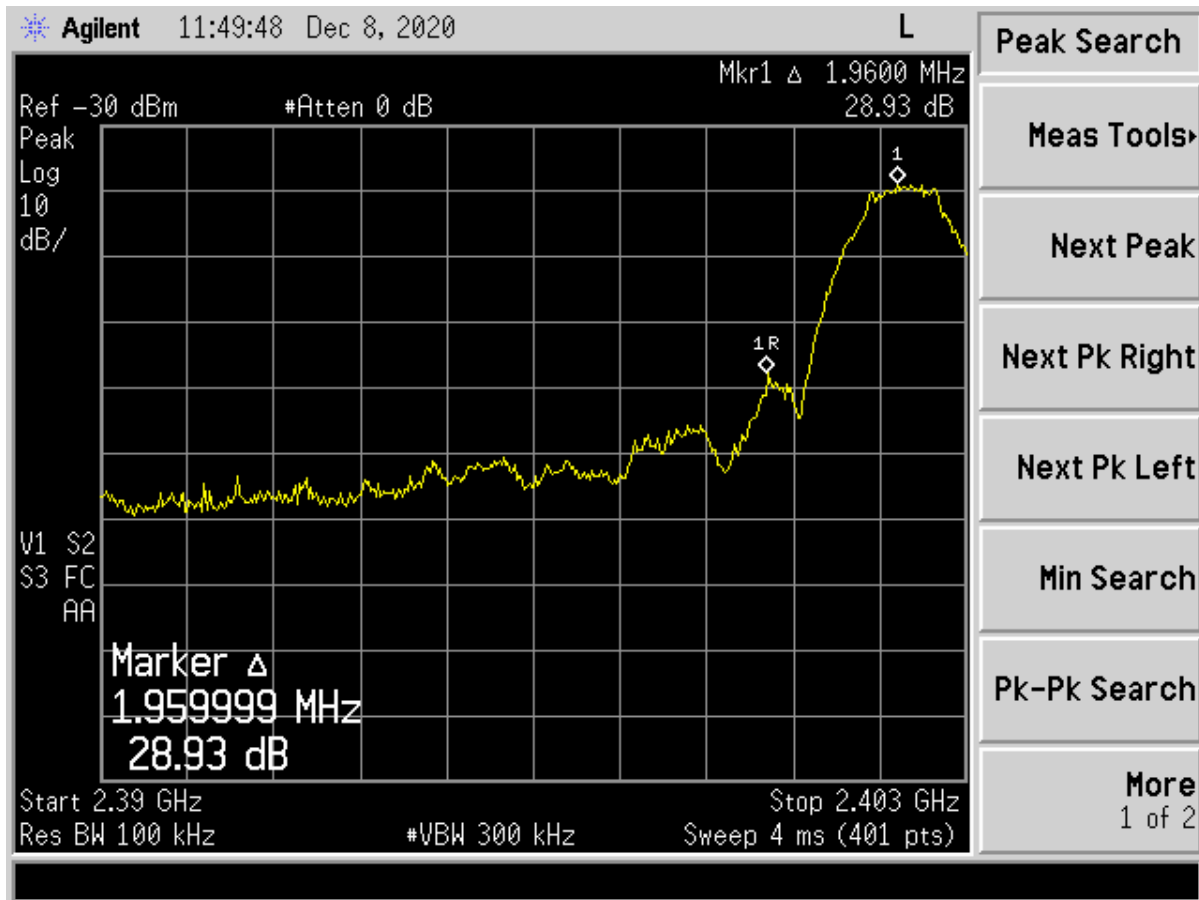


Figure 2. Band Edge Compliance, Low Channel Delta – Peak

Low Channel Corrected Measured Value from Table 7	77.07	dBuV
Low Channel Band Edge Delta from figure above	-28.93	dB
Calculated Result (PEAK)	48.14	dBuV/m
Band Edge Limit (AVG)	54.00	dBuV/m
Calculated Result (PEAK)	-48.14	dBuV/m
Band Edge Margin	5.86	dBuV/m

Note: Peak meets AVG limits.

US Tech Test Report
 FCC ID:
 Test Report Number:
 Issue date:
 Customer:
 Model:

FCC Part 15.209/249
 2AXLF-SHIFTP
 20-0242
 December 4, 2020
 FAAFTECH TECNOLOGIA LTDA
 SP(NN)+

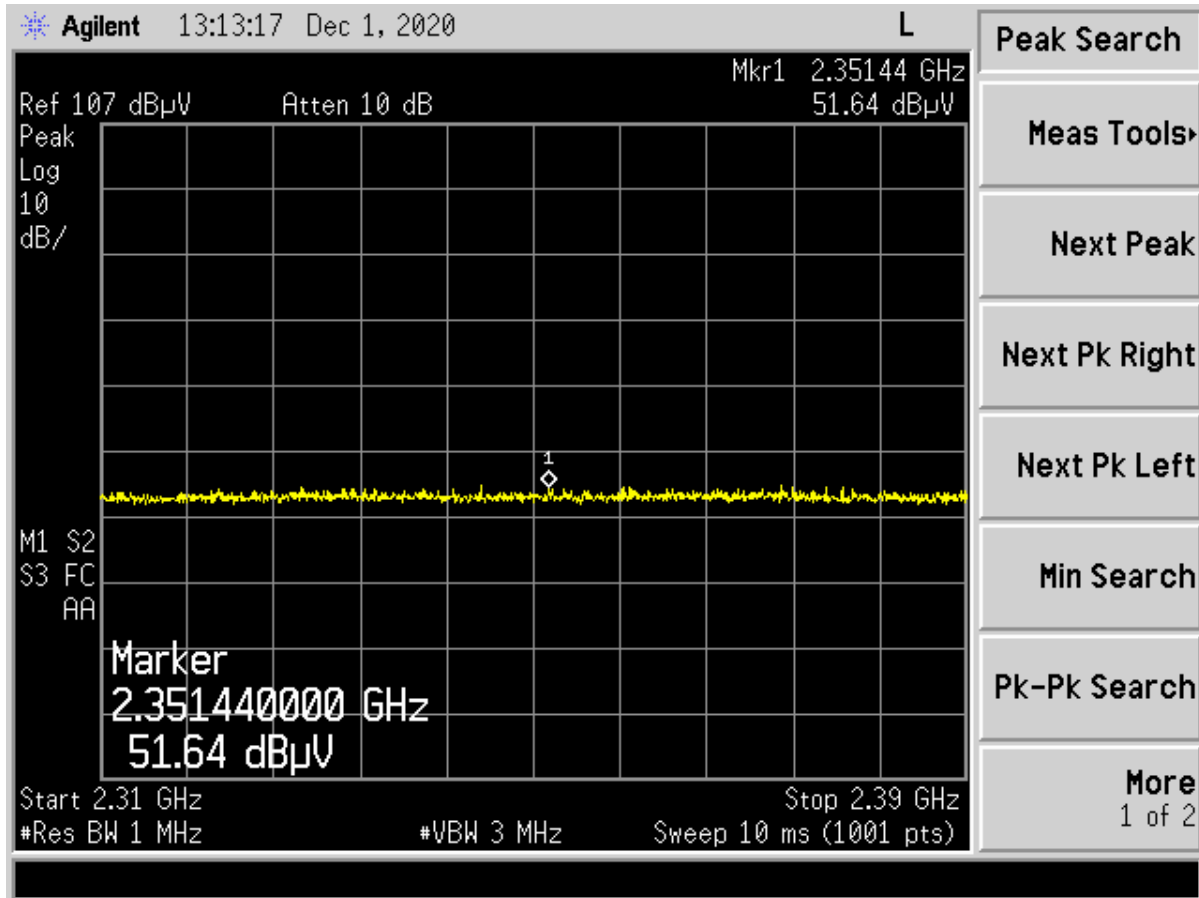


Figure 3. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

Table 9. Radiated Restricted Band 2310 MHz to 2390 MHz, Peak

2310 MHz to 2390 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG
2351.44	51.64	-7.49	44.15	54.0	3.0m./HORZ	9.9	PK
Note: PK meets AVG limit							

Test Date: December 1 & 8, 2020
 Tested By
 Signature: _____

Name: Mark Afroozi

US Tech Test Report
 FCC ID:
 Test Report Number:
 Issue date:
 Customer:
 Model:

FCC Part 15.209/249
 2AXLF-SHIFTP
 20-0242
 December 4, 2020
 FAAFTECH TECNOLOGIA LTDA
 SP(NN)+

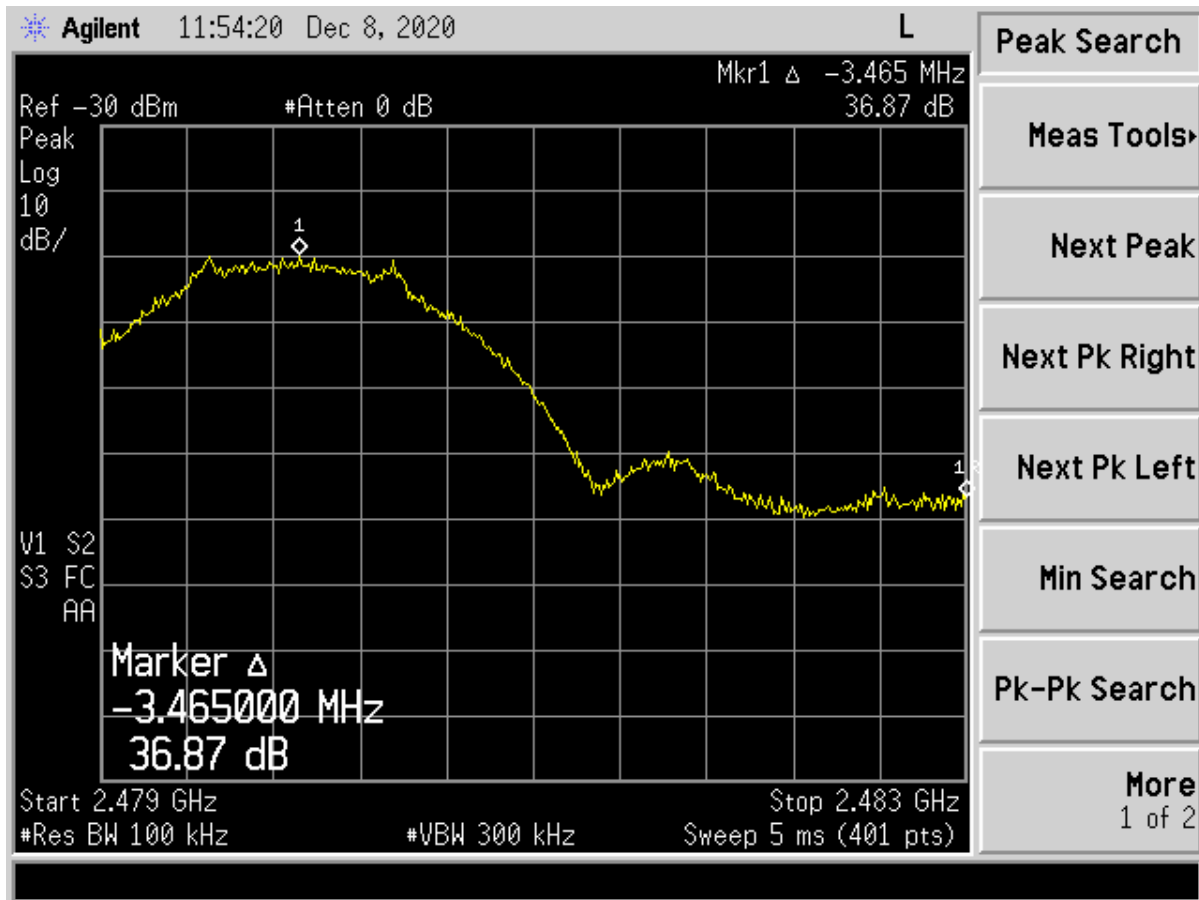


Figure 4. Band Edge Compliance, High Channel Delta, Peak

High Channel Corrected Measured Value from Table 7	72.10	dBuV
High Channel Band Edge Delta from figure above	-36.87	dB
Calculated Result (PEAK)	35.23	dBuV/m
Band Edge Limit (AVG)	54.00	dBuV/m
Calculated Result (PEAK)	-35.23	dBuV/m
Band Edge Margin	18.77	dBuV/m

Note: Peak meets AVG limits

US Tech Test Report
 FCC ID:
 Test Report Number:
 Issue date:
 Customer:
 Model:

FCC Part 15.209/249
 2AXLF-SHIFTP
 20-0242
 December 4, 2020
 FAAFTECH TECNOLOGIA LTDA
 SP(NN)+

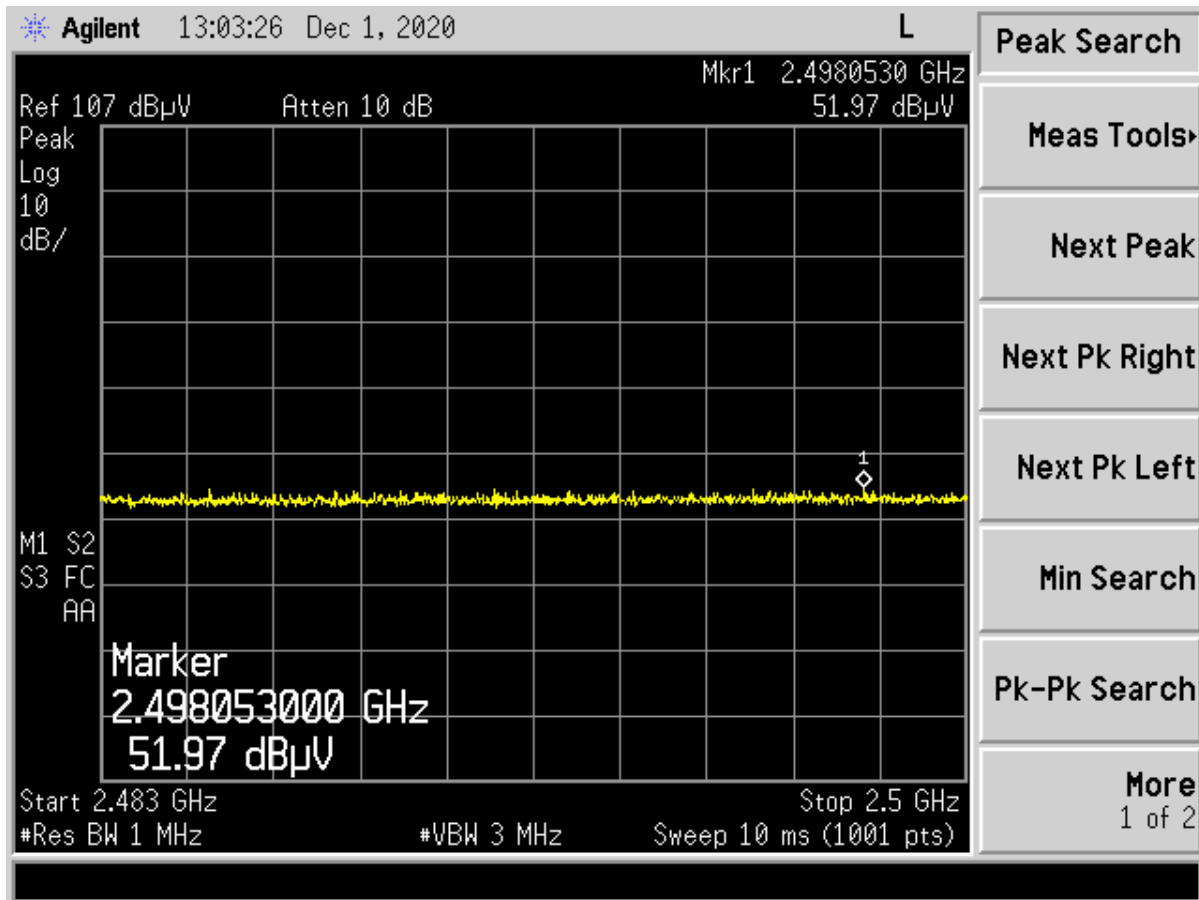


Figure 5. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

Table 10. Radiated Restricted Band 2483.5 MHz to 2500 MHz, Peak

2483.5 MHz to 2500 MHz Restricted Band Peak Measurements							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	PK Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK, or AVG
2498.05	51.97	-5.73	46.24	54.0	3.0m./HORZ	7.8	PK
Note: PK meets AVG limit							

Test Date: December 1 & 8, 2020
 Tested By
 Signature: _____

Name: Mark Afroozi

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

2.12 Unintentional Radiator, Powerline Emissions (CFR 15.107)

The power line conducted voltage emission measurements have been carried out in accordance with CFR 15.107, per ANSI C63.4:2014, Paragraph 7, with a spectrum analyzer connected to a LISN and the EUT placed into a continuous mode of transmission.

Since the EUT is battery powered, this test was not applied.

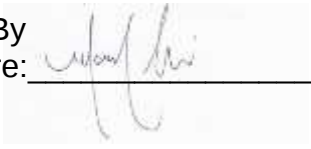
NOTE: The test data provided in this section is to support the requirement for the digital apparatus.

Table 11. Transmitter Power Line Conducted Emissions Test Data, Part 15.107

9kHz to 30 MHz with Class B Limits						
Test: Power Line Conducted Emissions				Client: FAAFTECH TECNOLOGIA LTDA		
Project: 20-0242				Model: SP(NN)+		
Frequency (MHz)	Test Data (dBuV)	LISN+CL-PA (dB)	Results (dBuV)	AVG Limits (dBuV)	Margin (dB)	Detector PK, QP, or AVG
The EUT is battery powered: therefore this test is not applicable.						

SAMPLE CALCULATION: N/A

Test Date: November 30, 2020

Tested By
Signature: 

Name: Mark Afroozi

2.13 Unintentional Radiator, Radiated Emissions (CFR 15.109)

Radiated emissions disturbance Measurements were performed with an instrument having both peak and quasi-peak detectors over the frequency range of 30 MHz to 12.5 GHz. Measurements of the radiated emissions were made with the receiver antenna at a distance of 3 m from the boundary of the test unit.

The test antenna was varied from 1 m to 4 m in height while watching the analyzers' display for the maximum magnitude of the signal at the test frequency. The antenna polarization (horizontal or vertical) and test sample azimuth were varied during the measurements to find the maximum field strength readings to record.

The worst-case radiated emissions in the range of 30 MHz to 12.5 GHz are more than 20 dB below the limit.

NOTE: The test data provided in this section is to support the requirement for the digital apparatus.

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

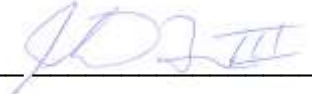
FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

**Table 12. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),
30 MHz to 1000 MHz**

30 MHz to 1000 MHz with Class B Limits							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK or QP
All emissions found are more than 20 dB below the limit except for fundamental and harmonics. Fundamental and harmonic emissions are presented in a separate table above.							

SAMPLE CALCULATION: N/A

Test Date: November 24, 2020

Tested By
Signature: 

Name: John Freeman

US Tech Test Report
FCC ID:
Test Report Number:
Issue date:
Customer:
Model:

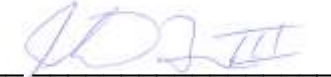
FCC Part 15.209/249
2AXLF-SHIFTP
20-0242
December 4, 2020
FAAFTECH TECNOLOGIA LTDA
SP(NN)+

**Table 13. Unintentional Radiator, Peak Radiated Emissions (CFR 15.109),
1 GHz to 12.5 GHz**

1 GHz to 12.5 GHz with Class B Limits							
Test: Radiated Emissions				Client: FAAFTECH TECNOLOGIA LTDA			
Project: 20-0242				Model: SP(NN)+			
Frequency (MHz)	Test Data (dBuV)	AF+CA-AMP (dB/m)	Results (dBuV/m)	Limits (dBuV/m)	Antenna Distance/ Polarization	Margin (dB)	Detector PK or AVG
All emissions found are more than 20 dB below the limit except for fundamental and harmonics. Fundamental and harmonic emissions are presented in a separate table above.							

SAMPLE CALCULATION: N/A

Test Date: November 24, 2020

Tested By
Signature: 

Name: John Freeman

2.14 Measurement Uncertainty

The measurement uncertainties given were calculated using the method detailed in CISPR 16-4-2: 2011. A coverage factor of $k=2$ was used to give a level of confidence of approximately 95%.

2.14.1 Conducted Emissions Measurement Uncertainty

Measurement Uncertainty (within a 95% confidence level) for this test is ± 2.85 dB.

This EUT is battery powered; therefore this tested was deemed not applicable.

2.14.2 Radiated Emissions Measurement Uncertainty

For a measurement distance of 3 m the measurement uncertainty (with a 95% confidence level) for this test using a Biconical Antenna (30 MHz to 200 MHz) is ± 5.40 dB. This value includes all elements of measurement.

The measurement uncertainty (with a 95% confidence level) for this test using a Log Periodic Antenna (200 MHz to 1000 MHz) is ± 5.19 dB.

The measurement uncertainty (with a 95% confidence level) for this test using a Horn Antenna is ± 5.08 dB.