#### FCC PART 15, SUBPART B and C; FCC 15.247; RSS-247 and RSS-GEN TEST REPORT

For

#### 900 MHz SENSOR

#### **Model: ESSENTIALS**

Part Number: DS-VP-ESS-900-S

Prepared for

MESA LABORATORIES, INC. 12100 WEST 6<sup>TH</sup> AVENUE LAKEWOOD, COLORADO 80228

Prepared by:

JAMES ROSS

Approved by:

#### **KYLE FUJIMOTO**

COMPATIBLE ELECTRONICS INC. 114 OLINDA DRIVE BREA, CALIFORNIA 92823 (714) 579-0500

DATE: SEPTEMBER 16, 2022

	REPORT		APPENDICES			TOTAL	
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Report Number: **B20822D1** FCC Part 15 Subpart B and C; FCC 15.247; RSS-247; and RSS-GEN Test Report COMPATIBLE ELECTRONICS Model: Essentials; Part Number: DS-VP-ESS-900-S

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### **GENERAL REPORT SUMMARY**

This electromagnetic emission test report is generated by Compatible Electronics Inc., which is an independent testing and consulting firm. The test report is based on testing performed by Compatible Electronics personnel according to the measurement procedures described in the test specifications given below and in the "Test Procedures" section of this report.

The measurement data and conclusions appearing herein relate only to the sample tested and this report may not be reproduced without the written permission of Compatible Electronics, unless done so in full.

The client must not use this report to claim product certification, approval or endorsement by NVLAP, NIST or any agency of the U.S. government.

Device Tested:	900 MHz Sensor Models: Essentials P/N: DS-VP-ESS-900-S S/N: N/A
Product Description:	The EUT a battery powered general purpose 902-928 MHz logging sensor measuring temperature, humidity, and discrete inputs. The integrated MCU/radio clocks are: $32.768$ kHz and $48$ MHz. The dimensions of the EUT is $4.4$ " (H) x $2.15$ " (W) x $1.2$ " (L).
Modifications:	The EUT was not modified to meet the specifications.
Customer:	Mesa Laboratories, Inc. 12100 West 6th Avenue Lakewood, Colorado 80228
Test Dates:	August 17, 18 and 20, 2022
Test Specifications cov	vered by accreditation:

Test Specifications: Emissions requirements CFR Title 47, Part 15, Subpart B; and Subpart C, Sections 15.205, 15.209, and 15.247; RSS-247 and RSS-GEN



Test Procedures:

ANSI C63.4 and ANSI C63.10

Test Deviations:

s: The test procedure was not deviated from during the testing.

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### **SUMMARY OF TEST RESULTS**

TEST	DESCRIPTION	RESULTS
1	Conducted RF Emissions, 150 kHz – 30 MHz	This test was not performed because the EUT is an internal battery power device only and does not connect to the public AC mains.
2	Radiated RF Emissions, 9 kHz –9300 MHz	Complies with the <b>Class B</b> limits of CFR Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15 Subpart C; RSS-247 and RSS-GEN Highest reading in relation to spec limit: 41.08 dBuV/m @ 951.00 MHz (*U = 3.30 dB)
3	20 dB Bandwidth	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247
4	Peak Power Output	Complies with the relevant requirements of FCC Title 47, Part 15, Subpart C, section 15.247 (b) (2); RSS-247
5	RF Conducted Antenna Test	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (d); RSS-247
6	Carrier Frequency Separation	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1); RSS-247
7	Average Time of Occupancy	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247
8	Peak Power Spectral Density from the International Radiator to the Antenna	This test was not performed because the EUT is a frequency hopper.
9	99% Bandwidth	This test was performed to obtain the emission designator required by Innovation, Science and Economic Development Canada.
10	Number of Hopping Frequencies	Complies with the relevant requirements of CFR Title 47, Part 15, Subpart C, section 15.247 (a) (1) (i); RSS-247

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#### 1. PURPOSE

This document is a qualification test report based on the emissions tests performed on the 900 MHz Sensor, Model: Essentials, Part Number: DS-VP-ESS-900-S. The emissions measurements were performed according to the measurement procedures described in ANSI C63.4 and ANSI C63.10. The tests were performed in order to determine whether the electromagnetic emissions from the equipment under test referred to as EUT hereafter, are within the <u>Class B specification limits defined</u> by CFR Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247; <u>RSS-247 and RSS-GEN</u>.

Note: This test report is for the G4 Compatibility Mode. For the G5 Compatibility Mode, please see Compatible Electronics, Inc. test report B20822D2.



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1.1

If a measured value exceeds a specification limit it implies non-compliance. If the value is below a specification limit it implies compliance. Measurement uncertainty of the laboratory is reported with all measurement results but generally not taken into consideration unless a standard, rule or law requires it to be considered.

Qualification test reports are only produced for products that are in compliance with the test requirements, therefore results are always in conformity. Otherwise, an engineering report or just the data is provided to the customer.

When performing a measurement and making a statement of conformity, in or out-of-specification to manufacturer's specifications or Pass/Fail against a requirement, there are two possible outcomes:

- The result is reported as conforming with the specification
- The result is reported as not conforming with the specification

The decision rule is defined below.

When the test result is found to be below the limit but within our measurement uncertainty of the limit, it is our policy that the final acceptance decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be exactly on the specification, it is our policy, in the case of unwanted emissions measurements to consider the result non-compliant, however, the final decision is left to the customer, after discussing the implications and potential risks of the decision.

When the test result is found to be over the specification limit under any condition, it is our policy to consider the result non-compliant.

In terms of uncertainty of measurement, the laboratory is a calibrated and tightly controlled environment and generally exceptionally stable, the measurement uncertainties are evaluated without the considering of the test sample. When it comes to the test sample however, as most testing is performed on a single sample rather than a sample population, and that sample is often a pre-production representation of the final product that test sample represents a significantly higher source of measurement uncertainty. We advise our customers of this and that when in doubt (small test to limit margins), they may wish to perform statistical sampling on a population to gain a higher confidence in the results. All lab reported results are that of a single sample in any event.

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#### 2.1 Location of Testing

The emissions tests described herein were performed at the test facility of Compatible Electronics, 114 Olinda Drive, Brea, California 92823.

#### 2.2 Traceability Statement

The calibration certificates of all test equipment used during the test are on file at the location of the test. The calibration is traceable to the National Institute of Standards and Technology (NIST).

#### 2.3 Cognizant Personnel

Mesa Laboratories, Inc.

Joel CunninghamEngineering LeadPaul HillSenior Engineer

Compatible Electronics Inc.

James RossSenior Test EngineerKyle FujimotoSenior Test Engineer

#### 2.4 Date Test Sample was Received

The test sample was received prior to the initial date of testing.

#### 2.5 Disposition of the Test Sample

The test sample has not been returned to Mesa Laboratories, Inc. as of the date of this test report.

#### 2.6 Abbreviations and Acronyms

The following abbreviations and acronyms may be used in this document.

EMI	Electromagnetic Interference
EUT	Equipment Under Test
P/N	Model
S/N	Serial Number
ITE	Information Technology Equipment
N/A	Not Applicable
RF	Radio Frequency
HP	Hewlett Packard
LISN	Line Impedance Stabilization Network
LO	Local Oscillator
TX	Transmit
RX	Receive

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#### **3. APPLICABLE DOCUMENTS**

The following documents are referenced or used in the preparation of this emission Test Report.

SPEC	TITLE
FCC Title 47, Part 15 Subpart C	FCC Rules – Radio frequency devices (including digital devices) – Intentional Radiators
FCC Title 47, Part 15 Subpart B	FCC Rules – Radio frequency devices (including digital devices) – Unintentional Radiators
KDB 558074 D01 v05r02	Guidance for Performing Compliance Measurements on Digital Transmission System, Frequency Hopping Spread Spectrum System, and Hybrid System Devices Operating Under Section 15.247 of the FCC Rules
ANSI C63.4: 2014	American National Standard for Methods of Measurement of Radio- Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz
ANSI C63.10: 2013	American National Standard of procedure for compliance testing of unlicensed wireless devices
RSS-GEN Issue 5: April 2018 + Amendment 1: March 2019 + Amendment 2: February 2021	General Requirements for Compliance of Radio Apparatus
RSS-247 Issue 2: February 2017	Digital Transmissions Systems (DTSs), Frequency Hopping Systems (FHSS) and License-Exempt Local Area Network (LE-LAN) Devices

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#### 4. DESCRIPTION OF TEST CONFIGURATION

#### 4.1 Description of Test Configuration – Emissions

The 900 MHz Sensor, Model: Essentials, Part Number: DS-VP-ESS-900-S (EUT) was tested connected to a 10K Thermistor Temperature probe and I2C temperature/humidity probe via its probe input ports. The EUT was also connected to a Door Switch / Motion / Alarm Contact via its discrete switch/contact input port.

The EUT was powered by two "AA" batteries.

The EUT was tested for emissions while in the X, Y, and Z axis. The X orientation is when the EUT is parallel to the ground mounted horizontally. The Y orientation is when the EUT is perpendicular to the ground mounted vertically. The Z orientation is when the EUT is perpendicular to the ground mounted horizontally.

The firmware inside the EUT allowed the EUT to continuously transmit or receive at the low, middle, and high channels for both the G4 and G5 configurations on a continuous basis.

The firmware is stored on the company's servers.

Note: The EUT was tested in the G4 Compatibility Mode configuration.

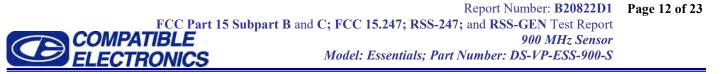
The radiated data was taken in the continuously exercising mode of operation. All initial investigations were performed with the EMI Receiver in manual mode scanning the frequency range continuously. The cables were bundled and routed as shown in the photographs in Appendix D.

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#### 4.1.1 Cable Construction and Termination

- Cable 1This is a 40-centimeter braid shielded cable connecting the 10K Thermistor Temperature probe to the<br/>EUT. The cable has a 6-pin round Hirose connector at the EUT end and is hard wired into the probe.<br/>The shield of the cable was grounded to the chassis via the connector.
- **<u>Cable 2</u>** This is a 40-centimeter braid shielded cable connecting the I2C Humidity Temperature probe to the EUT. The cable has a 6-pin round Hirose connector at the EUT end and is hard wired into the probe. The shield of the cable was grounded to the chassis via the connector.
- <u>Cable 3</u> This is a 1-meter braid shielded cable connecting the Door Switch / Motion / Alarm Contact to the EUT. The cable has a 1/8 inch connector at the EUT end and is hard wired into the Door Switch / Motion / Alarm Contact. The shield of the cable was grounded to the chassis via the connector.

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#### 5. LISTS OF EUT, ACCESSORIES AND TEST EQUIPMENT

#### 5.1 EUT and Accessory List

EQUIPMENT	MANUFACTURER	MODEL NUMBER	SERIAL NUMBER	WIRELESS ID
900 MHZ SENSOR (EUT)	MESA	ESSENTIALS	N/A	FCC ID: UUYESS900
	LABORATORIES, INC.	P/N: DS-VP-ESS-900-S		IC ID: 6891A-ESS900
10K THERMISTOR	MESA	P/N: 71205-12	23578	N/A
TEMPERATURE PROBE	LABORATORIES, INC.			
I2C HUMIDITY/	MESA	P/N: 72112	227164	N/A
TEMPERATURE PROBE	LABORATORIES, INC.			
DOOR SWITCH /	MESA	P/N: 166552	N/A	N/A
MOTION / ALARM	LABORATORIES, INC.			
CONTACT				
FIRMWARE*	MESA	VPX CONFIGURATION	Version 1.3.10.0	N/A
	LABORATORIES, INC.	UTILITY		
LAPTOP*	VOSTRO	P89G	DQNH703	DoC

\*Only used to program the EUT and then was removed during the testing.

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#### 5.2 Emissions Test Equipment

EQUIPMENT TYPE	MANU- FACTURER	MODEL NUMBER	SERIAL NUMBER	CAL. DATE	CAL. DUE DATE		
	RF RADIATED EMISSIONS TEST EQUIPMENT						
TDK TestLab	TDK RF Solutions, Inc.	9.22	700145	N/A	N/A		
EMI Receiver, 20 Hz – 26.5 GHz	Keysight Technologies, Inc.	N9038A	MY51210510	September 17, 2021	September 17, 2022		
System Controller	Sunol Sciences Corporation	SC110V	112213-1	N/A	N/A		
Turntable	Sunol Sciences Corporation	2011VS	N/A	N/A	N/A		
Antenna-Mast	Sunol Sciences Corporation	TWR95-4	112213-3	N/A	N/A		
Loop Antenna	Com-Power	AL-130R	121090	February 10, 2022	February 10, 2025		
CombiLog Antenna	Com-Power	AC-220	61093	December 14, 2021	December 14, 2023		
Horn Antenna	Com-Power	AH-118	10050113	December 16, 2021	December 16, 2023		
Preamplifier	Com-Power	PA-118	181653	March 7, 2022	March 7, 2023		
Computer	Hewlett Packard	p6716f	MXX1030PX0	N/A	N/A		
LCD Monitor	Hewlett Packard	52031a	3CQ046N3MG	N/A	N/A		

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#### 6. TEST SITE DESCRIPTION

#### 6.1 Test Facility Description

Please refer to section 2.1 of this report for emissions test location.

#### 6.2 EUT Mounting, Bonding and Grounding

For frequencies 1 GHz and below: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 0.8 meters above the ground plane.

For frequencies above 1 GHz: The EUT was mounted on a 1.0 by 1.5 meter non-conductive table 1.5 meters above the ground plane.

The EUT was not grounded during testing.

#### 6.3 Measurement Uncertainty

Compatible Electronics'  $U_{lab}$  value is less than  $U_{cispr}$ , thus based on this – compliance is deemed to occur if no measured disturbance exceeds the disturbance limit

V I						
Measu	Ucispr	$U_{\text{lab}} = 2 \ uc \ (y)$				
Conducted disturbance (mains port)	(150 kHz – 30 MHz)	3.4 dB	2.72 dB			
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(30 MHz – 1 000 MHz)	6.3 dB	3.32 dB (Vertical) 3.30 dB (Horizontal)			
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(1 GHz - 6 GHz)	5.2 dB	4.06 dB			
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(6 GHz – 18 GHz)	5.5 dB	4.06 dB			
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(18 GHz – 26.5 GHz)	N/A	4.43 dB			
Radiated disturbance (electric field strength on an open area test site or alternative test site)	(26.5 GHz – 40 GHz)	N/A	4.57 dB			

$$u_{\rm c}(y) = \sqrt{\sum_i c_i^2 \ u^2(x_i)}$$

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#### 7. CHARACTERISTICS OF THE TRANSMITTER

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

#### 7.1 Channel Description and Frequencies

The FHSS uses at least a minimum of 50 channels minimum using a pseudo random technique. It uses GFSK modulation. Please see the channel separation data sheet in Appendix E for the separation between channels for each sub-band.

The four sub-bands (Hop Sets) that the EUT can operate on are:

1. 906.00 to 924.00 MHz, which contains 60 channels

2. 903.00 to 926.00 MHz, which contains 60 channels

3. 903.00 to 913.34 MHz, which contains 60 channels

4. 914.770 to 926.00 MHz, which contains 60 channels

See Appendix E for the each plot showing the total number of channels in each sub-band.

#### 7.2 Antenna Gain

The antenna has a gain of 5.42 dBi.

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#### 8. TEST PROCEDURES

The following sections describe the test methods and the specifications for the tests. Test results are also included in this section.

#### 8.1 **RF Emissions**

#### 8.1.1 Conducted Emissions Test

The EMI Receiver was used as a measuring meter. A quasi-peak and/or average reading was taken only where indicated in the data sheets. A 10 dB attenuator was used for the protection of the EMI Receiver input stage, and the offset was adjusted accordingly to read the actual data measured. The LISN output was measured using the EMI Receiver. The output of the second LISN was terminated by a 50-ohm termination. The effective measurement bandwidth used for this test was 9 kHz.

Please see section 6.2 of this report for mounting, bonding, and grounding of the EUT. The EUT was powered through the LISN, which was bonded to the ground plane. The LISN power was filtered and the filter was bonded to the ground plane. The EUT was set up with the minimum distances from any conductive surfaces as specified in ANSI 63:4. The excess power cord was wrapped in a figure eight pattern to form a bundle not exceeding 0.4 meters in length.

The conducted emissions from the EUT were maximized for operating mode as well as cable placement. The final data was collected under program control by computer software. The final qualification data is located in Appendix E.

#### **Test Results:**

This test was not performed because the EUT is an internal battery powered device and does not connect to the public AC mains.

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#### 8.1.2 Radiated Emissions Test

The EMI Receiver was used as the measuring meter. A built-in, internal preamplifier was used to increase the sensitivity of the instrument. The EMI Receiver was initially used with the Analyzer mode feature activated. In this mode, the EMI receiver can then record the actual frequency to be measured. This final reading is then taken accurately in the EMI Receiver mode, which takes into account the cable loss, amplifier gain and antenna factors, so that a true reading is compared to the true limit. A quasi-peak reading was taken only for those readings, which are marked accordingly on the data sheets. The effective measurement bandwidth used for the radiated emissions test was according to the frequency measured (200 Hz for 10 kHz to 150 kHz, 9 kHz for 150 kHz to 30 MHz, 120 kHz for 30 MHz to 1 GHz and 1 MHz for 1 GHz to 9.3 GHz).

The frequencies above 1 GHz were averaged by using duty cycle correction factor.

The EMI test chamber of Compatible Electronics, Inc. was used for radiated emissions testing. This test site is in full compliance with ANSI C63.4. Please see section 6.2 of this report for mounting, bonding and grounding of the EUT. The turntable supporting the EUT is remote controlled using a motor. The turntable permits EUT rotation of 360 degrees in order to maximize emissions. Also, the antenna mast allows height variation of the antenna from 1 meter to 4 meters. Data was collected in the worst case (highest emission) configuration of the EUT. At each reading, the EUT was rotated 360 degrees and the antenna height was varied from 1 to 4 meters (for E field radiated field strength). The gunsight method was used when measuring with the horn antenna in order to ensure accurate results.

The EUT was tested at a 3-meter test distance. The six highest emissions are listed in Table 1.

The measurement bandwidths and transducers used for the radiated emissions test were:

FREQUENCY RANGE	EFFECTIVE MEASUREMENT BANDWIDTH	TRANSDUCER
9 kHz to 150 kHz	200 Hz	Loop Antenna
150 kHz to 30 MHz	9 kHz	Loop Antenna
30 MHz to 1 GHz	120 kHz	CombiLog Antenna
1 GHz to 9.3 GHz	1 MHz	Horn Antenna

#### **Test Results:**

The EUT complies with the **Class B** limits of **CFR** Title 47, Part 15, Subpart B; and the limits of CFR Title 47, Part 15, Subpart C sections 15.205, 15.209 and 15.247 (d); and the limits of RSS-247 and RSS-GEN for radiated emissions.

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#### 8.1.3 RF Emissions Test Results

# Table 1.0 RADIATED EMISSION RESULTS 900 MHz Sensor Model: Essentials; Part Number: DS-VP-ESS-900-S

Frequency MHz	Quasi-Peak EMI Reading* (dBuV)	Specification Limit (dBuV)	Delta (Cor. Reading – Spec. Limit) dB)
951.00 (H) (Tx)	41.08	46.00	-4.92
855.00 (H) (Tx)	41.01	46.00	-4.99
895.10 (H) (Tx)	38.23	46.00	-7.77
911.90 (H) (Rx)	34.06	46.00	-11.94
905.00 (H) (Rx)	33.95	46.00	-12.05
833.40 (H) (Rx)	33.86	46.00	-12.14

Notes:

- \* The complete emissions data is given in Appendix E of this report.
- (Tx) Transmit
- (Rx) Receive
- (V) Vertical
- (H) Horizontal

#### 8.1.4 Sample Calculations

A correction factor for the antenna, cable, and a distance factor (if any) must be applied to the meter reading before a true field strength reading can be obtained. This Corrected Meter Reading is then compared to the specification limit in order to determine compliance with the limits.

Conversion to logarithmic terms: Specification limit ( $\mu$ V/m) log x 20 = Specification Limit in dBuV/m To correct for distance when measuring at a distance other than the specification

For measurements below 30 MHz: (Specification distance / test distance) log x 40 = distance factor For measurements above 30 MHz: (Specification distance / test distance) log x 20 = distance factor Note: When using an Active Antenna, the Antenna factor shall be subtracted due to the combination of the internal amplification and antenna loss.

Corrected Meter Reading = meter reading + F - A + C

Where:

F = antenna factor A= amplifier gain C = cable loss

The correction factors for the antenna and the amplifier gain are attached in Appendix D of this report. The data sheets are attached in Appendix E.

The distance factor D is 0 when the test is performed at the required specification distance. When the limit is in terms of magnetic field, the following equation applies:

H [dB (
$$\mu$$
A/m)] = V [dB ( $\mu$ V)] + L<sub>c</sub> [dB] - G<sub>PA</sub> [dB] + AF<sup>H</sup> [dB(S/m)]  
where: *H* is the magnetic field strength (to be compared with the limit),  
*V* is the voltage level measured by the receiver or spectrum analyzer,  
*L<sub>c</sub>* is the cable loss,  
*G<sub>PA</sub>* is the gain of the preamplifier (if used), and  
*AF<sup>H</sup>* is the magnetic antenna factor.

The  $G_{PA}$  term is only included in the equation when an external preamplifier is used in the measurement chain, in front of the receiver or spectrum analyzer. An external preamplifier is not usually necessary (or even advisable, due to risk of saturating the input mixer of the receiver) when an active loop antenna is used. In that case, the antenna factor of the loop already includes the gain of its built-in preamplifier

If the "electrical" antenna factor is used instead, the above equation becomes:

H [dB (μA/m)] =V [dB (μV)] + L<sub>C</sub> [dB] - G<sub>PA</sub> [dB] + AF<sup>E</sup> [dB (m<sup>-1</sup>)] - 51.5 [dBΩ] Where:  $AF^E$  is the "electric" antenna factor, as provided by the antenna calibration laboratory.

When the limit is in terms of electric field, the following equation applies:

 $E \left[ dB \left( \mu V/m \right) \right] = V \left[ dB \left( \mu V \right) \right] + L_{C} \left[ dB \right] - G_{PA} \left[ dB \right] + AF^{E} \left[ dB \left( m^{-1} \right) \right]$ 

or, if the magnetic antenna factor is used:

 $E [dB (\mu V/m)] = V [dB (\mu V)] + L_C [dB] - G_{PA} [dB] + AF^H [dB(S/m)] + 51.5[dB\Omega]$ The display of the receiver (or spectrum analyzer) **shall not** be configured in units of current, e.g.  $\mu A$  or dB ( $\mu A$ ). That conversion is calculated inside the receiver (or spectrum analyzer) using its input impedance, which is 50  $\Omega$ , while the magnetic field calculation is based on the free-space impedance of 377  $\Omega$ .

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#### 8.2 20 dB Bandwidth

The 20 dB Bandwidth was measured using the EMI Receiver. The bandwidth was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was between 1% and 5% of the bandwidth and the video bandwidth was  $\geq$  3 X RBW.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. The 20 dB bandwidth is less than the separation between channels. Please see the data sheets located in Appendix E.

#### 8.3 Peak Output Power

The Peak Output Power was measured using the EMI Receiver. The peak output power was measured using a direct connection from the RF output of the EUT. The resolution bandwidth was greater than the 20 dB bandwidth and the video bandwidth was  $\geq$  3 X RBW. The cable loss was also added back into the reading using the reference level offset.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (b) (2); and RSS-247. The maximum peak output power is less than 1 Watt. Please see the data sheets located in Appendix E.

#### 8.4 RF Antenna Conducted Test

The RF antenna conducted test was performed using the EMI Receiver. The RF antenna conducted test measured using a direct connection from the RF out on the EUT into the input of the EMI Receiver. The resolution bandwidth was 100 kHz, and the video bandwidth was 300 kHz. The spans were wide enough to include all the harmonics and emissions that were produced by the intentional radiator.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d); and RSS-247. The RF power that is produced by the intentional radiator is at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power. Please see the radiated emission data sheets located in Appendix E.

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#### 8.5 RF Band Edges

The RF band edges were taken at the edges of the ISM spectrum (902 MHz when the EUT was on the low channel and 928 MHz when the EUT was on the high channel) using the EMI Receiver. The RBW was set to 100 kHz and the VBW was set to 300 kHz. Plots of the fundamental were taken to ensure the amplitude at the band edges were at least 20 dB down from the peak of the fundamental emission. The plots were taken in both frequency hopping mode and single channel mode.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d). The RF power at the band edges at 902 MHz and 928 MHz meet the requirements of FCC Title 47, Part 15, Subpart C section 15.247 (d); and RSS-247. Please see the data sheets located in Appendix E.

#### 8.6 Carrier Frequency Separation

The Channel Hopping Separation Test was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was approximately 30% of the channel spacing, and the video bandwidth  $\geq$  RBW. The frequency span was wide enough to include the peaks of two adjacent channels.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1); and RSS-247. The Channel Hopping Separation is greater than the 20 dB bandwidth. Please see the data sheets located in Appendix E.

#### 8.7 Number of Hopping Frequencies

The Number of Hopping Frequencies was measured using the EMI Receiver. The EUT was operating in its normal operating mode. The resolution bandwidth was set to approximately 30% of the channel spacing, and the video bandwidth was  $\geq$  RBW. The frequency span was wide enough to include all of the peaks in the frequency band of operation.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. Please see the data sheets located in Appendix E.

#### 8.8 Average Time of Occupancy Test

The Average Time of Occupancy Test was measured using the EMI Receiver. The EUT was operating in normal operating mode. The frequency span was taken to 0 Hz to determine the time for each transmission and the number of transmissions over a 20 second period. The RBW was set to be less than the channel spacing. The low hop band table was determined to be the worst case because this mode results in the pulses appearing more frequently.

#### **Test Results:**

The EUT complies with the relevant requirements of FCC Title 47, Part 15, Subpart C section 15.247 (a) (1) (i); and RSS-247. Please see the data sheets located in Appendix E.

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#### 8.9 Fundamental Field Strength (Duty Cycle Calculations)

The Peak Transmit Radiated Field Strength was measured at a 3-meter test distance. The EMI Receiver was used to obtain the duty cycle. The data sheets are located in Appendix E.

Where

 $\delta(dB) = 20 \log \left[ \sum_{i=1}^{\infty} (nt_i + mt_2 + ... + \xi t_x) / T \right]$ *n* is the number of pulses of duration *t*1 *m* is the number of pulses of duration *t*2  $\xi$  is the number of pulses of duration *tx T* is the period of the pulse train or 100 ms if the pulse train length is greater than 100 ms

Duty Cycle Correction Factor = -20.00dB

Pulse = 1 \* 18.2 mS

Total On Time = 18.2 mS

Duty Cycle Train was longer than 100mS; therefore 100mS span was used.

18.2 mS / 100 mS = 18.2 %

 $20 \log (0.182) = -14.79 \text{ dB correction factor}$ 

#### 8.10 Variation of the Input Power

The variation of the input power test was performed using the EMI Receiver. The EUT input power was varied between 85% and 115% of the nominal rated supply voltage. The carrier frequency was monitored for any change in amplitude.

#### **Test Results:**

This test was not performed because the EUT is an internal battery powered only device.

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#### 8.11 99% Bandwidth

The 99 % bandwidth was measured using an EMI Receiver.

The following steps were performed for measuring the 99% bandwidth per RSS-GEN, Issue 5, clause 6.7:

- 1. Set RBW to 1 % to 5 % of the actual occupied bandwidth.
- 2. Set VBW to greater than 3 times the RBW.
- 3. Set the EMI Receiver to the occupied bandwidth Function set at 99%
- 4. Set the peak detector to max hold
- 5. Set the sweep time to auto
- 6. Allow the trace to stabilize.

Please note that this was only used to determine the emission bandwidth and that there are no limits or pass/fail criteria for this test. Please see the data sheets located in Appendix E.

#### 9. CONCLUSIONS

The 900 MHz Sensor, Model: Essentials, Part Number: DS-VP-ESS-900-S (EUT), as tested, meets all of the specification limits defined in FCC Title 47, Part 15, Subpart B; and Subpart C, sections 15.205, 15.207, 15.209, and 15.247; and RSS-GEN and RSS-247.

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APPENDIX A

# LABORATORY ACCREDITATIONS AND RECOGNITIONS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

Page A2

## LABORATORY ACCREDITATIONS AND RECOGNITIONS



For US, Canada, Australia/New Zealand, Japan, Taiwan, Korea, and the European Union, Compatible Electronics is currently accredited by NVLAP to ISO/IEC 17025. For the most up-to-date version of our scopes and certificates please visit http://celectronics.com/quality/scope/

Quote from ISO-ILAC-IAF Communiqué on the Management Systems Requirements of ISO/IEC 17025, General Requirements for the competence of testing and calibration laboratories:

"A laboratory's fulfilment of the requirements of ISO/IEC 17025 means the laboratory meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid test results and calibrations. The management system requirements in ISO/IEC 17025 are written in language relevant to laboratory operations and operate generally in accordance with the principles of ISO 9001"

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**APPENDIX B** 

# **MODIFICATIONS TO THE EUT**

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044



### **MODIFICATIONS TO THE EUT**

The modifications listed below were made to the EUT to pass FCC Subpart B and C, FCC 15.247, RSS-GEN, and RSS-247 specifications.

All the rework described below was implemented during the test in a method that could be reproduced in all the units by the manufacturer.

No modifications were made to the EUT during the testing.



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**APPENDIX C** 

# *MODELS COVERED UNDER THIS REPORT*

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044



### **MODELS COVERED UNDER THIS REPORT**

USED FOR THE PRIMARY TEST

900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Serial Number: N/A Note: G4 Compatibility Mode

There are no additional models covered under this report.



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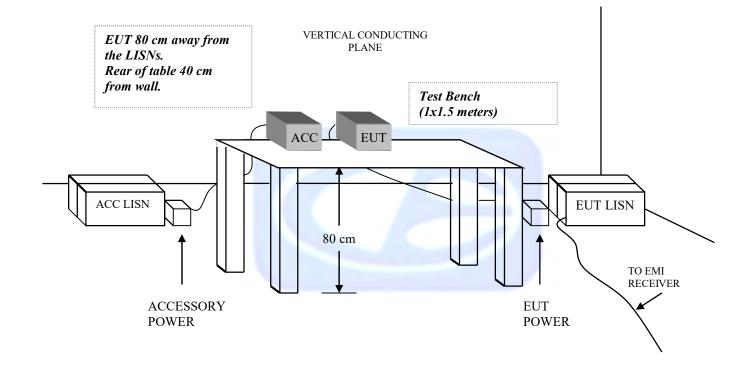
**APPENDIX D** 

# DIAGRAMS AND CHARTS

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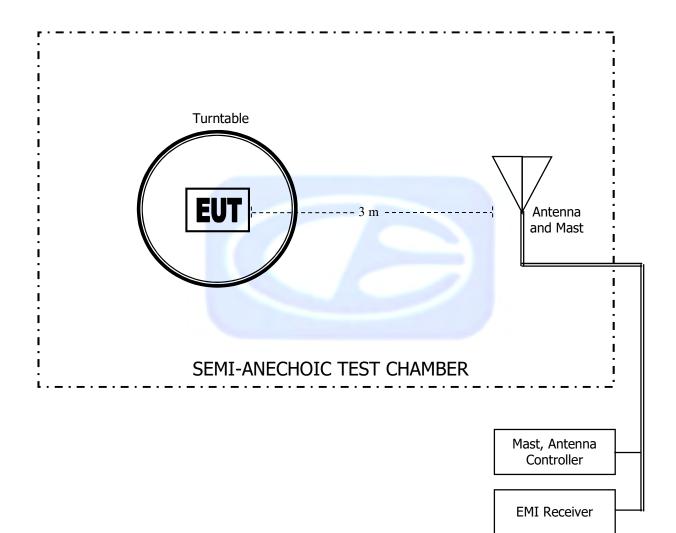


### FIGURE 1: CONDUCTED EMISSIONS TEST SETUP



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### FIGURE 2: LAYOUT OF THE SEMI -ANECHOIC TEST CHAMBER



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### COM-POWER AL-130R

### LOOP ANTENNA

### S/N: 121090

### CALIBRATION DATE: FEBRUARY 10, 2022

FREQUENCY (MHz)	MAGNETIC (dB/m)	ELECTRIC (dB/m)
0.009		
	15.6	-35.8
0.01	15.8	-35.6
0.02	14.8	-36.6
0.03	15.6	-35.9
0.04	15.0	-36.5
0.05	14.4	-37.1
0.06	14.6	-36.9
0.07	14.3	-37.2
0.08	14.3	-37.2
0.09	14.4	-37.0
0.10	14.1	-37.4
0.20	14.1	-37.4
0.30	14.0	-37.5
0.40	13.9	-37.6
0.50	14.1	-37.3
0.60	14.1	-37.3
0.70	14.2	-37.3
0.80	14.2	-37.3
0.90	14.2	-37.2
1.00	14.4	-37.0
2.00	14.6	-36.9
3.00	14.6	-36.8
4.00	14.9	-36.6
5.00	14.9	-36.7
6.00	14.8	-36.7
7.00	14.6	-36.8
8.00	14.5	-37.0
9.00	14.3	-37.2
10.00	14.5	-37.0
11.00	14.6	-36.9
12.00	14.7	-36.7
13.00	14.9	-36.6
14.00	15.0	-36.5
15.00	14.9	-36.6
16.00	14.9	-36.6
17.00	14.6	-36.8
18.00	14.4	-37.1
19.00	14.5	-37.0
20.00	14.5	-37.0
21.00	14.2	-37.3
22.00	13.9	-37.5
23.00	13.9	-37.5
24.00	13.8	-37.7
25.00	13.4	-38.0
26.00	13.2	-38.2
27.00	13.2	-38.3
28.00	12.7	-38.7
29.00	12.7	-38.8
30.00	12.4	-39.0

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### COM-POWER AC-220

### COMBILOG ANTENNA

### S/N: 061093

### CALIBRATION DATE: DECEMBER 14, 2021

FREQUENCY (MHz)	FACTOR (dB)	FREQUENCY (MHz)	FACTOR (dB)
30	22.5	200	16.0
35	21.4	250	17.4
40	21.0	300	19.7
45	20.6	350	20.0
50	19.7	400	22.2
60	16.1	450	22.4
70	12.8	500	23.1
80	12.5	550	23.4
90	14.2	600	24.9
100	15.4	650	25.3
120	16.5	700	25.4
125	16.8	750	26.4
140	15.9	800	26.7
150	16.6	850	27.1
160	18.5	900	27.9
175	15.9	950	28.0
180	15.5	1000	28.0

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### COM POWER AH-118

### HORN ANTENNA

### S/N: 10050113

### CALIBRATION DATE: DECEMBER 16, 2021

FREQUENCY	FACTOR	FREQUENCY	FACTOR
(GHz)	(dB)	(GHz)	(dB)
1.0	23.86	10.0	38.91
1.5	25.67	10.5	39.94
2.0	28.25	11.0	39.10
2.5	29.17	11.5	39.70
3.0	29.78	12.0	40.29
3.5	30.88	12.5	41.93
4.0	31.21	13.0	41.34
4.5	32.96	13.5	40.57
5.0	33.30	14.0	40.23
5.5	34.24	14.5	42.25
6.0	34.57	15.0	43.63
6.5	35.61	15.5	39.96
7.0	36.60	16.0	40.38
7.5	37.49	16.5	40.56
8.0	37.44	17.0	40.93
8.5	37.98	17.5	42.27
9.0	38.01	18.0	43.77
9.5	38.53		

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### **COM-POWER PAM-118**

### PREAMPLIFIER

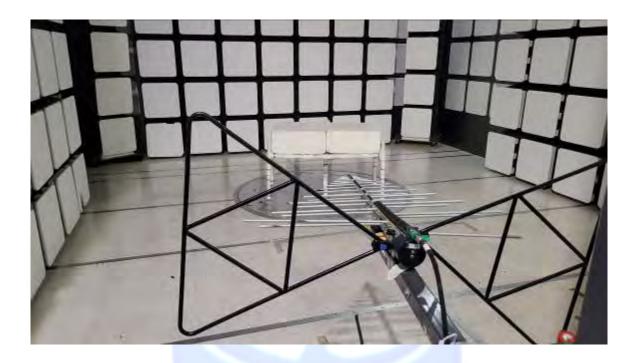
### S/N: 181653

### CALIBRATION DATE: MARCH 7, 2022

FREQUENCY (GHz)	FACTOR (dB)	FREQUENCY (GHz)	FACTOR (dB)
1.0	40.02	6.0	38.84
1.1	39.72	6.5	39.20
1.2	39.93	7.0	39.46
1.3	39.98	7.5	39.67
1.4	39.99	8.0	39.28
1.5	40.20	8.5	38.63
1.6	40.05	9.0	38.96
1.7	40.15	9.5	39.33
1.8	40.20	10.0	39.58
1.9	40.33	11.0	38.25
2.0	40.33	12.0	40.03
2.5	40.60	13.0	40.55
3.0	40.76	14.0	40.36
3.5	40.87	15.0	39.34
4.0	40.39	16.0	37.34
4.5	39.55	17.0	42.14
5.0	40.34	18.0	42.54
5.5	39.45		

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**Newbury Park Division 1050 Lawrence Drive** Newbury Park, CA 91320 (805) 480-4044



### FRONT VIEW

#### MESA LABORATORIES, INC. 900 MHz SENSOR – G4 COMPATIBILITY MODE MODEL: ESSENTIALS; PART NUMBER: DS-VP-ESS-900-S FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – BELOW 1 GHz

## PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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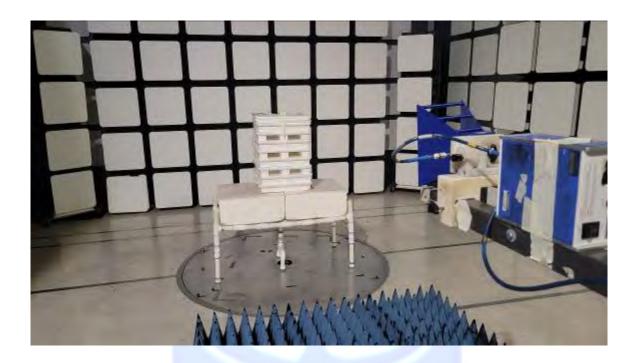


## **REAR VIEW**

#### MESA LABORATORIES, INC. 900 MHz SENSOR – G4 C COMPATIBILITY MODE MODEL: ESSENTIALS; PART NUMBER: DS-VP-ESS-900-S FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – BELOW 1 GHz

## PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044



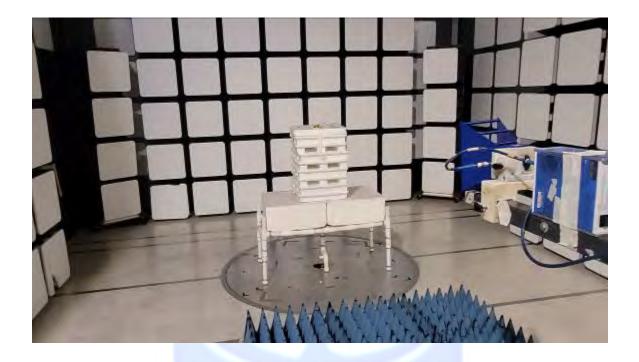
### FRONT VIEW

#### MESA LABORATORIES, INC. 900 MHz SENSOR – G4 COMPATIBILITY MODE MODEL: ESSENTIALS; PART NUMBER: DS-VP-ESS-900-S FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – ABOVE 1 GHz

## PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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#### **REAR VIEW**

#### MESA LABORATORIES, INC. 900 MHz SENSOR – G4 COMPATIBILITY MODE MODEL: ESSENTIALS; PART NUMBER: DS-VP-ESS-900-S FCC SUBPART B AND C; RSS-GEN and RSS-247 – RADIATED EMISSIONS – ABOVE 1 GHz

## PHOTOGRAPH SHOWING THE EUT CONFIGURATION FOR MAXIMUM EMISSIONS

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**APPENDIX E** 

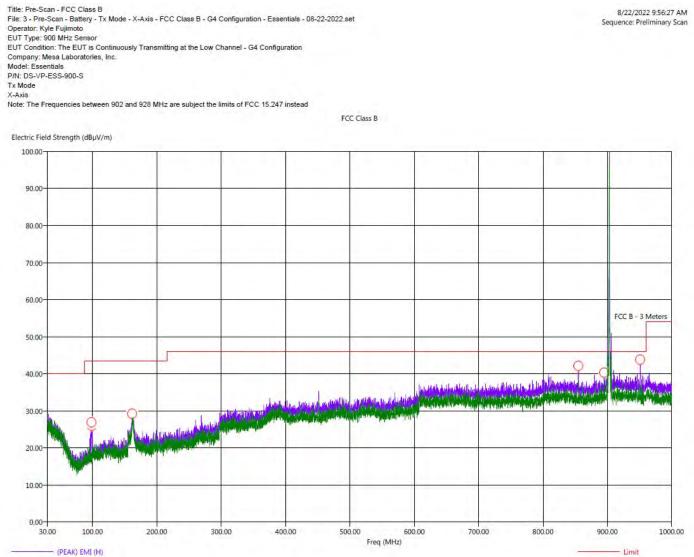
# DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

## **RADIATED EMISSIONS**

## DATA SHEETS

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(PEAK) EMI (V)

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

Title: Radiated Final - FCC Class B File: 3 - Final Scan - Battery - Tx Mode - X-Axis - FCC Class B - G4 Configuration - Essentials - 08-22-2022.set Operator: Kyle Fujimoto EUT Type: 900 MHz Sensor EUT Condition: The EUT is Continuously Transmitting at the Low Channel - G4 Configuration Company: Mesa Laboratories, Inc. Model: Essentials P/N: DS-VP-ESS-900-S Tx Mode X-Axis

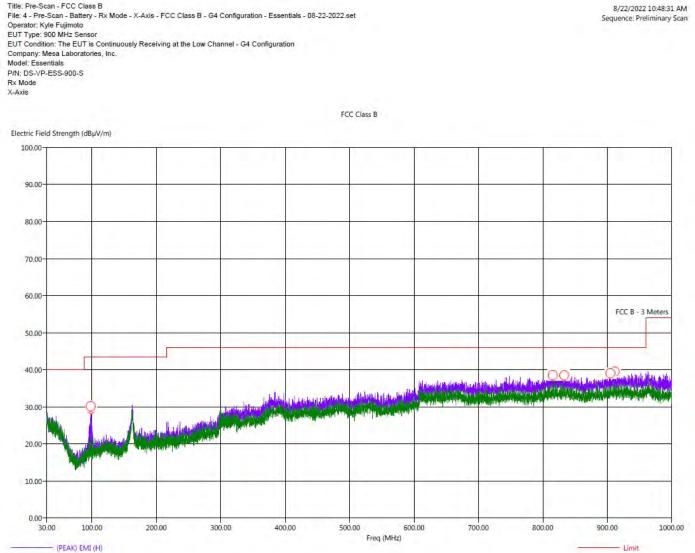
Ttbl Agl Freq (MHz) Pol (PEAK) EMI (QP) EMI (PEAK) Margin (QP) Margin Transducer Cable Twr Ht Limit (dBµV/m) (dB)  $(dB\mu V/m)$ (dB) (dB) (dBµV/m) (dB) (deg) (cm) 98.40 99.00 -20.16 -26.42 43.50 43.50 196.23 334.62 н 23.34 17.08 15.24 0.78 198.50 н 21.55 16.41 15.31 0.79 86.75 30.98 25.37 -12.52 -18.13 43.50 21.90 1.07 233.75 287.28 161.50 н 855.00 895.10 -4.99 2.57 283.75 258.00 192.05 159.28 н 44.00 41.01 -2.00 46.00 27.00 42.73 38.23 -3.27 46.00 27.70 H 951.00 44.05 41.08 -1.95 -4.92 46.00 28.10 2.77 254.75 159.10



FCC Class B

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

8/22/2022 10:27:22 AM Sequence: Final Measurements



(PEAK) EMI (V)

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

Title: Radiated Final - FCC Class B File: 4 - Final Scan - Battery - Tx Mode - X-Axis - FCC Class B - G4 Configuration - Essentials - 08-22-2022.set Operator: Kyle Fujimoto EUT Type: 900 MHz Sensor EUT Condition: The EUT is Continuously Receiving at the Low Channel - G4 Configuration Company: Mesa Laboratories, Inc. Model: Essentials PN: DS-VP-ESS-900-S Rx Mode X-Axis

(PEAK) Margin Freq (MHz) Pol (PEAK) EMI (QP) EMI (QP) Margin Transducer Cable Ttbl Agl Twr Ht Limit (dBµV/m) (dB) (dB)(dBµV/m) (dB) (deg) (dBµV/m) (dB) (cm) 98.20 HH 28.33 21.03 -15.17 -22.47 43.50 15.23 0.78 181.50 175.10 98.60 -23.37 43.50 0.78 164.75 159.28 26.44 20.13 -17.06 15.24 H -12.30 27.40 2.54 360.25 385.25 815.70 39.51 33.70 -6.49 46.00 240.35 369.07 833.40 H 40.37 33.86 -5.63 -12.14 46.00 27.76 2.56 66.50 905.00 HH 33 95 -12.05 46.00 168 50 39.04 -6.96 28.08 2.63 911.90 39.41 34.06 -6.59 -11.94 46.00 28.20 2.65 314.25 172.89



FCC Class B

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8/22/2022 11:25:39 AM Sequence: Final Measurements FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1806.00					12.10	1.2.2.2.1		Not in Restricted Band
1806.00		_						Tested via Conducted
2709.00	45.06	V	73.97	-28.91	Peak	319.50	222.20	
2709.00	30.27	٧	53.97	-23.70	Avg	319.50	222.20	
3612.00	35.95	V	73.97	-38.02	Peak	170.25	109.79	
3612.00	21.16	٧	53.97	-32.81	Avg	170.25	109.79	
4515.00	45.48	V	73.97	-28.49	Peak	53.50	174.92	
4515.00	30.69	V	53.97	-23.28	Avg	53.50	174.92	
5418.00	43.21	V	73.97	-30.76	Peak	15.25	127.34	
5418.00	28.42	V	53.97	-25.55	Avg	15.25	127.34	
6321.00			-			1		Not in Restricted Band
6321.00			_			-		Tested via Conducted
7224.00						1		Not in Restricted Band
7224.00			-			-	-	Tested via Conducted
8127.00	44.73	V	73.97	-29.24	Peak	301.75	206.98	
8127.00	29.94	V	53.97	-24.03	Avg	301.75	206.98	
9030.00	43.94	V	73.97	-30.03	Peak	105.75	191.04	
9030.00	29.15	V	53.97	-24.82	Avg	105.75	191.04	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1806.00	10.00	1		1.1.1.1.1			1	Not in Restricted Band
1806.00	1			-		-	-	Tested via Conducted
2709.00	48.11	V	73.97	-25.86	Peak	346.75	111.40	
2709.00	33.32	V	53.97	-20.65	Avg	346.75	111.40	
3612.00	36.86	V	73.97	-37.11	Peak	186.75	127.22	
3612.00	22.07	V	53.97	-31.90	Avg	186.75	127.22	
4515.00	42.61	V	73.97	-31.36	Peak	190.50	127.34	
4515.00	27.82	V	53.97	-26.15	Avg	190.50	127.34	
5418.00	42.55	V	73.97	-31.42	Peak	110.75	111.40	
5418.00	27.76	V	53.97	-26.21	Avg	110.75	111.40	
6321.00								Not in Restricted Band
6321.00			1				1.0	Tested via Conducted
7224.00			1					Not in Restricted Band
7224.00			)					Tested via Conducted
8127.00	44.18	٧	73.97	-29.79	Peak	214.25	127.34	
8127.00	29.39	V	53.97	-24.58	Avg	214.25	127.34	
9030.00	44.96	V	73.97	-29.01	Peak	134.25	142.98	
9030.00	30.17	V	53.97	-23.80	Avg	134.25	142.98	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1806.00				0.000	0.000			Not in Restricted Band
1806.00		_			1			Tested via Conducted
2709.00	47.01	V	73.97	-26.96	Peak	328.25	159.04	
2709.00	32.22	V	53.97	-21.75	Avg	328.25	159.04	
3612.00	39.20	V	73.97	-34.77	Peak	126.25	159.10	
3612.00	24.41	V	53.97	-29.56	Avg	126.25	159.10	
4515.00	45.73	V	73.97	-28.24	Peak	144.50	143.16	
4515.00	30.94	V	53.97	-23.03	Avg	144.50	143.16	
5418.00	46.36	V	73.97	-27.61	Peak	175.00	159.04	
5418.00	31.57	V	53.97	-22.40	Avg	175.00	159.04	
6321.00		_			-			Not in Restricted Band
6321.00		_		1				Tested via Conducted
7224.00	7							Not in Restricted Band
7224.00					-	-		Tested via Conducted
8127.00	43.52	V	73.97	-30.45	Peak	108.50	190.86	
8127.00	28.73	V	53.97	-25.24	Avg	108.50	190.86	
9030.00	44.47	V	73.97	-29.50	Peak	111.25	127.22	
9030.00	29.68	V	53.97	-24.29	Avg	111.25	127.22	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1806.00				1 1	-			Not in Restricted Band
1806.00					1			Tested via Conducted
2709.00	49.97	Н	73.97	-24.00	Peak	98.00	142.62	
2709.00	35.18	н	53.97	-18.79	Avg	98.00	142.62	
3612.00	38.34	н	73.97	-35.63	Peak	23.00	111.46	
3612.00	23.55	Н	53.97	-30.42	Avg	23.00	111.46	
4515.00	44.67	н	73.97	-29.30	Peak	135.00	222.62	
4515.00	29.88	Н	53.97	-24.09	Avg	135.00	222.62	
5418.00	47.84	н	73.97	-26.13	Peak	154.50	111.40	
5418.00	33.05	Н	53.97	-20.92	Avg	154.50	111.40	
6321.00					1.2		-	Not in Restricted Band
6321.00			-			1		Tested via Conducted
7224.00	-							Not in Restricted Band
7224.00								Tested via Conducted
8127.00	44.91	н	73.97	-29.06	Peak	115.25	111.40	
8127.00	30.12	Н	53.97	-23.85	Avg	115.25	111.40	
9030.00	43.74	н	73.97	-30.23	Peak	19.00	249.08	
9030.00	28.95	Н	53.97	-25.02	Avg	19.00	249.08	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto Page E11

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1806.00			1	CC 0				Not in Restricted Band
1806.00		-	12-33	1			-	Tested via Conducted
2709.00	48.22	н	73.97	-25.75	Peak	241.25	142.92	
2709.00	33.43	н	53.97	-20.54	Avg	241.25	142.92	
3612.00	37.64	н	73.97	-36.33	Peak	228.75	205.85	
3612.00	22.85	н	53.97	-31.12	Avg	228.75	205.85	
4515.00	47.25	н	73.97	-26.72	Peak	236.25	142.86	
4515.00	32.46	н	53.97	-21.51	Avg	236.25	142.86	
5418.00	51.05	н	73.97	-22.92	Peak	62.75	107.76	
5418.00	36.26	Н	53.97	-17.71	Avg	62.75	107.76	
6321.00				1				Not in Restricted Band
6321.00				1				Tested via Conducted
7224.00	-		-	-				Not in Restricted Band
7224.00				-				Tested via Conducted
8127.00	44.72	н	73.97	-29.25	Peak	289.25	158.20	
8127.00	29.93	н	53.97	-24.04	Avg	289.25	158.20	
9030.00	43.13	н	73.97	-30.84	Peak	155.25	249.97	
9030.00	28.34	н	53.97	-25.63	Avg	155.25	249.97	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S Low Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1806.00				1000	-			Not in Restricted Band
1806.00			_					Tested via Conducted
2709.00	52.45	Н	73.97	-21.52	Peak	113.00	159.10	
2709.00	37.66	н	53.97	-16.31	Avg	113.00	159.10	
3612.00	39.75	н	73.97	-34.22	Peak	135.75	127.28	
3612.00	24.96	Н	53.97	-29.01	Avg	135.75	127.28	
4515.00	46.61	н	73.97	-27.36	Peak	237.50	143.34	
4515.00	31.82	Н	53.97	-22.15	Avg	237.50	143.34	
5418.00	48.74	н	73.97	-25.23	Peak	49.00	111.28	
5418.00	33.95	Н	53.97	-20.02	Avg	49.00	111.28	
6321.00					1.2	-		Not in Restricted Band
6321.00		-			-			Tested via Conducted
7224.00								Not in Restricted Band
7224.00	-		-				-	Tested via Conducted
8127.00	47.63	н	73.97	-26.34	Peak	89.25	159.04	
8127.00	32.84	н	53.97	-21.13	Avg	89.25	159.04	
9030.00	42.81	н	73.97	-31.16	Peak	142.75	142.86	
9030.00	28.02	н	53.97	-25.95	Avg	142.75	142.86	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1827.00	1 T 1	1		1	1210	12.00		Not in Restricted Band
1827.00	4							Tested via Conducted
2740.50	46.95	V	73.97	-27.02	Peak	314.00	223.04	
2740.50	32.16	۷	53.97	-21.81	Avg	314.00	223.04	
3654.00	40.55	v	73.97	-33.42	Peak	104.25	111.40	
3654.00	25.76	۷	53.97	-28.21	Avg	104.25	111.40	
4567.50	47.56	V	73.97	-26.41	Peak	52.00	143.28	
4567.50	32.77	V	53.97	-21.20	Avg	52.00	143.28	
5481.00			-		-	1		Not in Restricted Band
5481.00						(C		Tested via Conducted
6394.50						1		Not in Restricted Band
6394.50								Tested via Conducted
7308.00	45.53	V	73.97	-28.44	Peak	344.50	127.34	
7308.00	30.74	۷	53.97	-23.23	Avg	344.50	127.34	
8221.50	45.47	V	73.97	-28.50	Peak	309.75	143.10	
8221.50	30.68	V	53.97	-23.29	Avg	309.75	143.10	
9135.00	43.85	V	73.97	-30.12	Peak	339.50	111.40	
9135.00	29.06	V	53.97	-24.91	Avg	339.50	111.40	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1827.00	1			1	1210	12.00		Not in Restricted Band
1827.00							_	Tested via Conducted
2740.50	46.71	V	73.97	-27.26	Peak	158.25	111.25	
2740.50	31.92	٧	53.97	-22.05	Avg	158.25	111.25	
3654.00	39.82	V	73.97	-34.15	Peak	355.75	191.22	
3654.00	25.03	٧	53.97	-28.94	Avg	355.75	191.22	
4567.50	45.32	V	73.97	-28.65	Peak	13.75	143.04	
4567.50	30.53	V	53.97	-23.44	Avg	13.75	143.04	
5481.00						1		Not in Restricted Band
5481.00						(		Tested via Conducted
6394.50						1		Not in Restricted Band
6394.50		-				1		Tested via Conducted
7308.00	46.90	V	73.97	-27.07	Peak	0.00	111.22	
7308.00	32.11	V	53.97	-21.86	Avg	0.00	111.22	
8221.50	44.67	V	73.97	-29.30	Peak	331.00	111.46	
8221.50	29.88	V	53.97	-24.09	Avg	331.00	111.46	
9135.00	44.29	V	73.97	-29.68	Peak	259.25	143.34	
9135.00	29.50	V	53.97	-24.47	Avg	259.25	143.34	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1827.00				1	1210	1.2.2.2.20		Not in Restricted Band
1827.00								Tested via Conducted
2740.50	45.66	V	73.97	-28.31	Peak	208.00	111.40	
2740.50	30.87	۷	53.97	-23.10	Avg	208.00	111.40	
3654.00	40.35	V	73.97	-33.62	Peak	166.75	127.28	
3654.00	25.56	۷	53.97	-28.41	Avg	166.75	127.28	
4567.50	46.78	V	73.97	-27.19	Peak	162.75	127.40	
4567.50	31.99	V	53.97	-21.98	Avg	162.76	127.40	
5481.00			-					Not in Restricted Band
5481.00								Tested via Conducted
6394.50						10000		Not in Restricted Band
6394.50		-						Tested via Conducted
7308.00	43.90	V	73.97	-30.07	Peak	135.50	111.40	
7308.00	29.11	۷	53.97	-24.86	Avg	135.50	111.40	
8221.50	43.95	V	73.97	-30.02	Peak	168.50	190.92	
8221.50	29.16	V	53.97	-24.81	Avg	168.50	190.92	
9135.00	44.56	V	73.97	-29.41	Peak	112.00	238.74	
9135.00	29.77	V	53.97	-24.20	Avg	112.00	238.74	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1827.00				1	1210	22.55		Not in Restricted Band
1827.00	4					1		Tested via Conducted
2740.50	46.50	н	73.97	-27.47	Peak	193.50	111.10	
2740.50	31.71	н	53.97	-22.26	Avg	193.50	111.10	
3654.00	38.98	н	73.97	-34.99	Peak	343.75	222.86	
3654.00	24.19	Н	53.97	-29.78	Avg	343.75	222.86	
4567.50	44.37	н	73.97	-29.60	Peak	291.75	143.28	
4567.50	29.58	Н	53.97	-24.39	Avg	291.75	143.28	
5481.00			-			-	-	Not in Restricted Band
5481.00								Tested via Conducted
6394.50						1		Not in Restricted Band
6394.50						-		Tested via Conducted
7308.00	46.21	н	73.97	-27.76	Peak	244.75	238.68	
7308.00	31.42	Н	53.97	-22.55	Avg	244.75	238.68	
8221.50	44.71	н	73.97	-29.26	Peak	168.00	143.04	
8221.50	29.92	Н	53.97	-24.05	Avg	168.00	143.04	
9135.00	44.38	н	73.97	-29.59	Peak	177.75	111.40	
9135.00	29.59	н	53.97	-24.38	Avg	177.75	111.40	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1827.00					1210	12.00		Not in Restricted Band
1827.00								Tested via Conducted
2740.50	48.21	н	73.97	-25.76	Peak	228.75	166.38	
2740.50	33.42	Н	53.97	-20.55	Avg	228.75	166.38	
3654.00	41.68	н	73.97	-32.29	Peak	197.50	111.40	
3654.00	26.89	Н	53.97	-27.08	Avg	197.50	111.40	
4567.50	49.55	н	73.97	-24.42	Peak	186.50	111.46	
4567.50	34.76	Н	53.97	-19.21	Avg	186.50	111.46	
5481.00						1		Not in Restricted Band
5481.00						1		Tested via Conducted
6394.50			-			1		Not in Restricted Band
6394.50					-	-		Tested via Conducted
7308.00	45.81	н	73.97	-28.16	Peak	152.75	143.34	
7308.00	31.02	Н	53.97	-22.95	Avg	152.75	143.34	
8221.50	45.37	н	73.97	-28.60	Peak	297.25	159.72	
8221.50	30.58	Н	53.97	-23.39	Avg	297.25	159.72	
9135.00	46.54	н	73.97	-27.43	Peak	175.25	111.64	
9135.00	31.75	н	53.97	-22.22	Avg	175.25	111.64	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S MIddle Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1827.00				1	12.20	12.00		Not in Restricted Band
1827.00								Tested via Conducted
2740.50	50.19	н	73.97	-23.78	Peak	114.25	127.28	
2740.50	35.40	н	53.97	-18.57	Avg	114.25	127.28	
3654.00	39.49	н	73.97	-34.48	Peak	200.25	111.52	
3654.00	24.70	Н	53.97	-29.27	Avg	200.23	111.52	
4567.50	45.85	н	73.97	-28.12	Peak	131.00	111.46	
4567.50	31.06	Н	53.97	-22.91	Avg	131.00	111.46	
5481.00	() ()		-			-		Not in Restricted Band
5481.00								Tested via Conducted
6394.50						1		Not in Restricted Band
6394.50						-		Tested via Conducted
7308.00	45.19	н	73.97	-28.78	Peak	285.00	111.46	
7308.00	30.40	н	53.97	-23.57	Avg	285.00	111.46	
8221.50	45.32	н	73.97	-28.65	Peak	96.75	175.28	
8221.50	30.53	Н	53.97	-23.44	Avg	96.75	175.28	
9135.00	43.90	н	73.97	-30.07	Peak	20.50	191.10	
9135.00	29.11	н	53.97	-24.86	Avg	20.50	191.10	

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1852.00					12.12	12.00		Not in Restricted Band
1852.00		_						Tested via Conducted
2778.00	48.68	V	73.97	-25.29	Peak	321.75	159.28	
2778.00	33.89	٧	53.97	-20.08	Avg	321.75	159.28	
3704.00	41.55	V	73.97	-32.42	Peak	297.00	127.28	
3704.00	26.76	V	53.97	-27.21	Avg	297.00	127.28	
4630.00	50.28	V	73.97	-23.69	Peak	53.75	158.98	
4630.00	35.49	V	53.97	-18.48	Avg	53.75	158.98	
5556.00					-	1		Not in Restricted Band
5556.00								Tested via Conducted
6482.00						1		Not in Restricted Band
6482.00						1		Tested via Conducted
7408.00	45.46	V	73.97	-28.51	Peak	306.75	238.86	
7408.00	30.67	V	53.97	-23.30	Avg	306.75	238.86	
8334.00	45.50	V	73.97	-28.47	Peak	7.75	190.86	
8334.00	30.71	V	53.97	-23.26	Avg	7.75	190.86	
9260.00	1		-			1		Not in Restricted Band
9260.00								Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1852.00				1	1210	12.55		Not in Restricted Band
1852.00					_			Tested via Conducted
2778.00	47.71	V	73.97	-26.26	Peak	167.50	111.34	
2778.00	32.92	۷	53.97	-21.05	Avg	167.50	111.34	
3704.00	41.15	V	73.97	-32.82	Peak	0.00	175.22	
3704.00	26.36	V	53.97	-27.61	Avg	0.00	175.22	
4630.00	47.14	V	73.97	-26.83	Peak	0.50	127.22	
4630.00	32.35	V	53.97	-21.62	Avg	0.50	127.22	
5556.00					-	-		Not in Restricted Band
5556.00						(C. 11)		Tested via Conducted
6482.00			-			1		Not in Restricted Band
6482.00		-				1		Tested via Conducted
7408.00	45.99	V	73.97	-27.98	Peak	357.75	111.40	
7408.00	31.20	V	53.97	-22.77	Avg	357.75	111.40	
8334.00	45.62	V	73.97	-28.35	Peak	333.75	143.46	
8334.00	30.83	V	53.97	-23.14	Avg	333.76	143.46	
9260.00						1		Not in Restricted Band
9260.00								Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto Page E21

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1852.00				1	1210	12.55		Not in Restricted Band
1852.00		_	-	12-11		1		Tested via Conducted
2778.00	44.94	V	73.97	-29.03	Peak	1.00	111.64	
2778.00	30.15	٧	53.97	-23.82	Avg	1.00	111.64	
3704.00	43.81	V	73.97	-30.16	Peak	353.50	127.34	
3704.00	29.02	٧	53.97	-24.95	Avg	353.50	127.34	
4630.00	48.60	V	73.97	-25.37	Peak	309.25	127.28	
4630.00	33.81	V	53.97	-20.16	Avg	309.25	127.28	
5556.00						-		Not in Restricted Band
5556.00						(C		Tested via Conducted
6482.00								Not in Restricted Band
6482.00				1		1		Tested via Conducted
7408.00	45.75	V	73.97	-28.22	Peak	73.00	238.98	
7408.00	30.96	V	53.97	-23.01	Avg	73.00	238.98	
8334.00	45.71	V	73.97	-28.26	Peak	200.50	159.28	
8334.00	30.92	V	53.97	-23.05	Avg	200.50	159.28	
9260.00						1		Not in Restricted Band
9260.00								Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - X-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1852.00				1	1210	12.00		Not in Restricted Band
1852.00				- 1				Tested via Conducted
2778.00	48.26	н	73.97	-25.71	Peak	300.75	159.40	
2778.00	33.47	Н	53.97	-20.50	Avg	300.75	159.40	
3704.00	40.25	н	73.97	-33.72	Peak	63.75	143.10	
3704.00	25.46	Н	53.97	-28.51	Avg	63.75	143.10	
4630.00	47.89	н	73.97	-26.08	Peak	313.75	190.92	
4630.00	33.10	Н	53.97	-20.87	Avg	313.75	190.92	
5556.00			-		-	-		Not in Restricted Band
5556.00	-							Tested via Conducted
6482.00						1		Not in Restricted Band
6482.00						-		Tested via Conducted
7408.00	45.79	н	73.97	-28.18	Peak	248.50	222.92	
7408.00	31.00	н	53.97	-22.97	Avg	248.50	222.92	
8334.00		-						No Emission Discovered
8334.00						1		At This Frequency
9260.00	1					1		Not in Restricted Band
9260.00								Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - Y-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant, Height (cm)	Comments
1852.00				1	12.20	12.00		Not in Restricted Band
1852.00					-			Tested via Conducted
2778.00	47.48	н	73.97	-26.49	Peak	26.00	175.10	
2778.00	32.69	н	53.97	-21.28	Avg	26.00	175.10	
3704.00	42.48	н	73.97	-31.49	Peak	359.75	159.16	
3704.00	27.69	Н	53.97	-26.28	Avg	359.75	159.16	
4630.00	52.31	н	73.97	-21.66	Peak	18.25	127.34	
4630.00	37.52	н	53.97	-16.45	Avg	18.25	127.34	
5556.00						-		Not in Restricted Band
5556.00						<u></u>		Tested via Conducted
6482.00								Not in Restricted Band
6482.00				1		1		Tested via Conducted
7408.00	44.30	н	73.97	-29.67	Peak	209.55	238.98	
7408.00	29.51	Н	53.97	-24.46	Avg	208.50	238.98	
8334.00	44.94	н	73.97	-29.03	Peak	146.00	111.22	
8334.00	30.15	Н	53.97	-23.82	Avg	146.00	111.22	
9260.00	1					1		Not in Restricted Band
9260.00								Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

	Report Number: B20822D1
FCC Part 15 Subpart	B and C; FCC 15.247; RSS-247; and RSS-GEN Test Report
OMPATIBLE	900 MHz Sensor
LECTRONICS	Model: Essentials; Part Number: DS-VP-ESS-900-S

FCC 15.247 Mesa Laboratories, Inc. 900 MHz Sensor Model: Essentials Part Number: DS-VP-ESS-900-S High Channel - Z-Axis Transmit Mode G4 Configuration

Date: 08/17/2022 Lab: D Tested By: Kyle Fujimoto

Freq. (MHz)	Level (dBuV/m)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Table Angle (deg)	Ant. Height (cm)	Comments
1852.00	1		· · · · · ·	1.1.1.1		1		Not in Restricted Band
1852.00		1.1.1						Tested via Conducted
2778.00	51.51	н	73.97	-22.46	Peak	297.00	127.22	
2778.00	36.72	н	53.97	-17.25	Avg	297.00	127.22	
3704.00	41.89	н	73.97	-32.08	Peak	18.00	143.34	
3704.00	27.10	Н	53.97	-26.87	Avg	18.00	143.34	
4630.00	48.70	н	73.97	-25.27	Peak	0.00	111.22	
4630.00	33.91	Н	53.97	-20.06	Avg	0.00	111.22	
5556.00			-		-			Not in Restricted Band
5556.00	1		1		C			Tested via Conducted
6482.00								Not in Restricted Band
6482.00					_			Tested via Conducted
7408.00	46.55	н	73.97	-27.42	Peak	39.25	111.40	
7408.00	31.76	Н	53.97	-22.21	Avg	39.25	111.40	
8334.00	45.81	н	73.97	-28.16	Peak	211.75	127.22	
8334.00	31.02	Н	53.97	-22.95	Avg	211.75	127.22	
9260.00	-		-		-	-		Not in Restricted Band
9260.00					-			Tested via Conducted

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

AConf		m me Eu	J1 - 9 KH7	z to 30 MF	Iz and 1	GHz to 9.3	3 GHz	
Freq.	iguraiton Level	Pol			Peak / QP /	Ant. Height	Table Angle	
(MHz)	(dBuV)	(v/h)	Limit	Margin	Avg	(m)	(deg)	Comments
			-		1			No Emissions Detected
			-	1				from the Non Harmonic Emissions
	· · · · · · · · · · · · · · · · · · ·		· · · · · · · · ·		2			from the Tx
_	-	]	-					9 kHz to 30 MHz
_			1					No Emissions Detected
			· · · · · · ·					from the Non Harmonic Emissions
			· · · · · · · · · ·					from the Tx
								1 GHz to 9.3 GHz
								No Emissions Detected
			-					from the Digilal Portion
			-					of the EUT
			-					9 kHz to 30 MHz
-								No Emissions Detected
								from the Digital Portion
	1		-					of the EUT
						G (		1 GHz to 9.3 GHz
_			-		<u> </u>			Tested in both Horizontal and
					-			Vertical Polaizations
_								Tested in the X-Axis, Y-Axis,
_								and Z-Axis
		2	1	1 1				

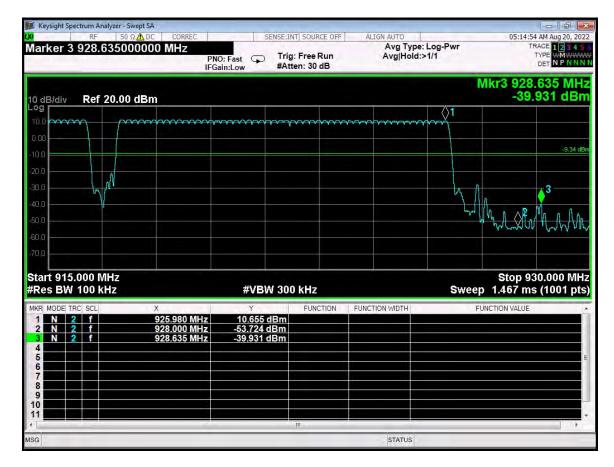
Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

00 MHz Nodel: E Part Nun Receiver	boratories, Sensor ssentials hber: DS-V r Portion - iguration	P-ESS-9		and 1 GH	iz to 9.3 (	SHz	Date: 08/1 Lab: D Tested By:	7/2022 Kyle Fujimoto
Freq. (MHz)	Level (dBuV)	Pol (v/h)	Limit	Margin	Peak / QP / Avg	Ant. Height (m)	Table Angle (deg)	Comments
					-			No Emissions Detected
	-	-		( +	1 1			in Receiver Mode
1		7 3		S	1	1 1		9 kHz to 30 MHz
1.1		0 0	10.000	2.11	9 de 18	1		
1.0		0.000	1.000	2.2		1 1		No Emissions Detected
		) 0	10.000	2.52.54	300 m (c)	1	1	in Receiver Mode
1.1		c = c	1.00	2.2.30		100.00		1 GHz to 9.3 GHz
		4	1	2	-	1		Tested in both Horizontal and
-	111	-	-		1	-	0.00	Vertical Polaizations
-							-	vertical Polaizations
-		-	-		-			Tested in the X-Axis, Y-Axis,
		7		2.00	0	1 1		and Z-Axis
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Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

BAND EDGES DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Band Edge - High Channel - G4 Compatibility Mode - Frequency Hopping - Hop Set 3 Worst Case

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

	RF	50 Ω 🚹 [	OC CORREC	SENSE(1	NT SOURCE OFF	ALIGN AUTO		04:55:56 AM Aug 20, 20
splay	Line	-9.21 dBr	PNC		g: Free Run tten: 30 dB	Avg Ty	pe: Log-Pwr	TRACE 1234 TYPE WMWW DET NPNN
dB/div	Ref	20.00 dB	m				N	1kr1 925.980 MH 10.79 dBi
00								-9.21 c
.0							ph h	
.0						mm	N N	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
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	5.000 W 100			#VBW 30	0 kHz		Sweep	Stop 930.000 M 1.467 ms (1001 p
R MODE	TRC SCL		X	Y	FUNCTION	FUNCTION WIDTH	FU	NCTION VALUE
N	2 f		925.980 MHz 928.000 MHz	10.794 dBm -54.416 dBm				
					in.			

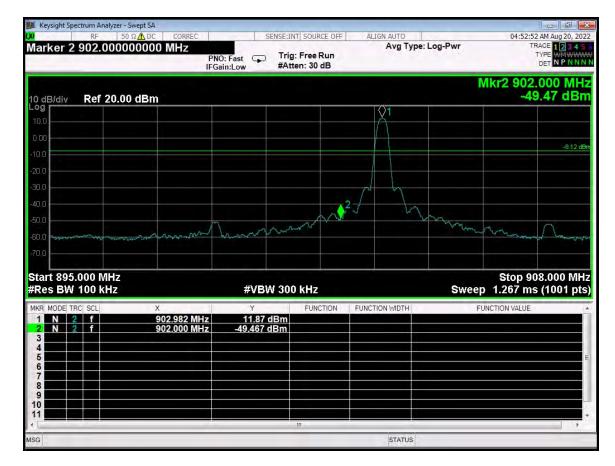
High Channel - G4 Compatibility Mode - Single Channel

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

splay Line -8.12 c	PNO	East 🕞 Trig	nt source off : Free Run ten: 30 dB	ALIGN AUTO Avg Typ	e: Log-Pwr	TRA TY	M Aug 20, 20 CE 1 2 3 4 PE WWWW DET N P N N
dB/div Ref 20.00	dBm				М	kr1 902.9 11.	95 MH 88 dBi
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).0	The second second	man					
J,D	allowing and a free and a second						
tart 895.000 MHz Res BW 100 kHz		#VBW 30	) kHz		Sweep	Stop 908 1.267 ms	.000 Mi (1001 pt
KR MODE TRC SCL	× 902.995 MHz	۲ 11.878 dBm	FUNCTION	FUNCTION WIDTH	FUN	ICTION VALUE	_
2 N 2 f	902.000 MHz	-49.561 dBm					
4 <b></b>							
6 7 8							
° 9							
			in .				,

Band Edge - Low Channel - G4 Compatibility Mode - Frequency Hopping - Hop Set 2 Worst Case

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

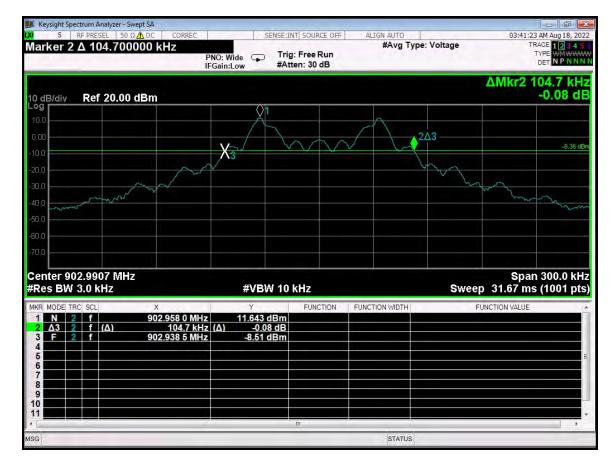


Band Edge - Low Channel - G4 Compatibility Mode - Single Channel

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

-20 dB BANDWIDTH DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



-20 dB Bandwidth - 903.00 MHz - G4 Compatibility Mode - 104.7 kHz

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



-20 dB Bandwidth - 913.50 MHz - G4 Compatibility Mode - 105.0 kHz

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



-20 dB Bandwidth - 926.00 MHz - G4 Compatibility Mode - 105.9 kHz

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

# *RF ANTENNA CONDUCTED DATA SHEETS*

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

Keysight Spectrum Analyzer - Swept SA			
RF 50 Ω 🗘 DC CORREC	SENSE:INT SOURCE OFF	ALIGN AUTO Avg Type: Log-Pwr	07:22:57 AM Aug 20, 202 TRACE 1 2 3 4 5
)isplay Line -8.49 dBm	PNO: Wide 😱 Trig: Free Run IFGain:Low Atten: 30 dB	Avg Type. Log-Fwi	
0 dB/div Ref 20.00 dBm		Mk	r1 902.955 5 MH 11.509 dBn
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2.00			-8.49 dE
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enter 903.0000 MHz Res BW 100 kHz	#VBW 300 kHz		Span 500.0 kH 1.000 ms (1001 pt
G		STATUS	

RF Antenna Conducted Low Channel - G4 Compatibility Mode - Reference Level

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

	REC SENSE;INT SOURCE OFF A	ALIGN AUTO	07:23:27 AM Aug 20, 202
pan 870.000000 MHz	PNO: Fast 😱 Trig: Free Run IFGain:Low Atten: 30 dB	Avg Type: Log-Pwr	TRACE 12345 TYPE WMWWW DET N P N N N
dB/div Ref 20.00 dBm			Mkr1 451.08 MH -47.524 dBr
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0'0 date a coloration fillen ich Ause auf ich ad au			
tart 30.0 MHz Res BW 100 kHz	#VBW 300 kHz	Sweep	Stop 900.0 MH 83.20 ms (1001 pt
G		STATUS	

RF Antenna Conducted - Low Channel - G4 Compatibility Mode - 30 MHz to 900 MHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

RF 50 Ω ADC CORRI 1arker 1 901.834000000 MHz	PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	07:23:48 AM Aug 20, 202 TRACE 1 2 3 4 5 TYPE WMWWW DET N P.N N
0 dB/div Ref 20.00 dBm		Mł	r1 901.834 MH -45.487 dBr
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70.0			
tart 900.000 MHz Res BW 100 kHz	#VBW 300 kHz	Sweep	Stop 902.000 MH 1.000 ms (1001 pt

RF Antenna Conducted - Low Channel - G4 Compatibility Mode - 900 MHz to 902 MHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

RF 50 Ω/ Iarker 1 1.80505200		SENSE:INT SOURCE OFF	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	07:24:09 AM Aug 20, 202 TRACE 1 2 3 4 5 TYPE WMWWW DET N P N N N
0 dB/div Ref 20.00 d	Bm			Mkr1 1.805 1 GH -42.140 dBn
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0,0				-8.49 df
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50.0 Nother property for the providence	had mouth a function and the second	aliyoun washingtool and the dis	wight to work the second state of the second s	and the property in the second
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tart 0.928 GHz Res BW 100 kHz	#VE	300 kHz	Sweer	Stop 3.500 GH 245.9 ms (1001 pts
SG			STATUS	

RF Antenna Conducted - Low Channel - G4 Compatibility Mode - 928 MHz to 3.5 GHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

10 dB/div Ref 20.00 dBm			Mkr1 6.318 8 GH
			-48.646 dBn
10.0			
0.00			
10,0			-8.49 dB
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itart 3.500 GHz Res BW 100 kHz	#VBW 300 kHz		Stop 9.300 GH Sweep 554.3 ms (1001 pts

RF Antenna Conducted - Low Channel - G4 Compatibility Mode - 3.5 GHz to 9.3 GHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

「Keysight Spectrum Analyzer - Swept SA ア RF 50 Ω 介 DC CORR	EC SENSE:INT SOURCE OFF	ALIGN AUTO	07:33:38 AM Aug 20, 202
Display Line -8.99 dBm	PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE WMWWW DET N P N N N
odB/div Ref 20.00 dBm		Mkr	1 913.457 0 MH: 11.009 dBn
-og	♦1		
0.00			
10.0			-8.99 dE
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70.0			
Center 913.5000 MHz			Span 500.0 kH
Res BW 100 kHz	#VBW 300 kHz	Sweep	1.000 ms (1001 pts

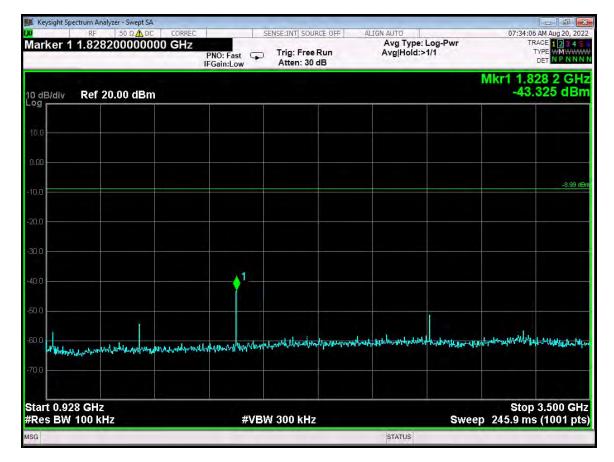
RF Antenna Conducted - Mid Channel - G4 Compatibility Mode - Reference Level

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

	M	kr1 456.408 MH -47.883 dBn -8.99 dE
		-8,99 dE
		-8,99 dE
		-8,99 d
<p<sup>1</p<sup>		
with more hand when when the	han manager have been and have a second	something and the second states of the second state
≠VBW 300 kHz	Sweep	Stop 902.0 MH 83.40 ms (1001 pts
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RF Antenna Conducted - Mid Channel - G4 Compatibility Mode - 30 MHz to 902 MHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



RF Antenna Conducted - Mid Channel - G4 Compatibility Mode - 928 MHz to 3.5 GHz

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

RF Narker 1 6.3942	50 Ω 🛕 DC CORREC 2000000000 GHz	PNO: Fast	se:INT  SOURCE OFF   Trig: Free Run Atten: 30 dB	ALIGN AUTO Avg Type: Lo Avg Hold:>1/		07:34:23 AM Aug 20, 202 TRACE 1234 S TYPE WMWWW DET N P N N N
0 dB/div Ref 20	0.00 dBm				Mkr	1 6.394 2 GH -51.239 dBn
10.0						
0.00						
10.0						-8.99 df
20.0						
30.0						
40.0						
50.0						
0.0 mpromentication	where the king to make we want	mhatayhahan	uport of the pople of the second	กปนุของประเทศเหตุ	and the second second	uturturturturtut
0.0						
tart 3.500 GHz Res BW 100 kH	7	#VBIA	300 kHz		Sween 55	Stop 9.300 GH 4.3 ms (1001 pts
sg				STATUS		

RF Antenna Conducted - Mid Channel - G4 Compatibility Mode - 3.5 GHz to 9.3 GHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

📕 Keysight Spectrum Analyzer - Swept SA			
/ RF 50.0 <u>A</u> DC CORREC Narker 1 925.958000000 MHz	PNO: Wide Figure Anter Source OFF	ALIGN AUTO Avg Type: Log-Pwr	07:42:12 AM Aug 20, 202 TRACE 12345 TYPE WMWWW DET N P N N N
0 dB/div Ref 20.00 dBm		Mkr	1 925.958 0 MH 10.375 dBr
10.0	∮ <sup>1</sup>		
3.00			
			-9.63 df
20.0			North March 199
30.0 month and a second s			Jun Marine
0.0		_	- van el A
0.0			
0.0			
0.0			
enter 926.0000 MHz Res BW 100 kHz	#VBW 300 kHz	Sween	Span 500.0 kH 1.000 ms (1001 pt
IG I		STATUS	

RF Antenna Conducted - High Channel - G4 Compatibility Mode - Reference Level

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

4 Aarker 1	RF 50 Ω DC CC 1 463.384000000 MH	7	E(INT SOURCE OFF	ALIGN AUTO Avg Type: Log-Pwr	07:42:33 AM Aug 20, 202 TRACE 1 2 3 4 5
		PNO: East	rig: Free Run Atten: 30 dB	Avg Hold:>1/1	
0 dB/div	Ref 20.00 dBm			N	lkr1 463.384 MH -48.463 dBr
10.0					
					-9.63 d
0.0					
0.0					
0.0					
0.0			<b>∳</b> <sup>1</sup>		
0.0					1
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0.0					
tart 30. Res BW	0 MHz / 100 kHz	#VBW 3	00 kHz	Sweep	Stop 902.0 MH 83.40 ms (1001 pt
Res BW	/ 100 kHz	#VBW 3	i00 kHz	Sweep	83.40 ms (1001 pt

RF Antenna Conducted - High Channel - G4 Compatibility Mode - 30 MHz to 902 MHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

RF 50.Ω <u>A</u> DC larker 1 929.940000000	CORREC SENSE.INT SOURCE OFF MHZ PNO: Wide Trig: Free Run IFGain:Low Atten: 30 dB	ALIGN AUTO Avg Type: Log-Pwr Avg Hold:>1/1	07:42:50 AM Aug 20, 202 TRACE 1 2 3 4 5 TYPE WMWWW DET N P N N N
0 dB/div Ref 20.00 dBm		Μ	kr1 929.940 MH -52.840 dBn
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3.00			
0.0			-9.63 dE
0.0			
0.0			
0.0		_	
0.0			
10.0 Manana markanalar	an warman and and the second	mmmmmmm	human
0.0			
tart 928.000 MHz Res BW 100 kHz	#VBW 300 kHz	Swaan	Stop 930.000 MH 1.000 ms (1001 pt
	#VBW 500 KH2	SWEED	1000 ms (1001 pt

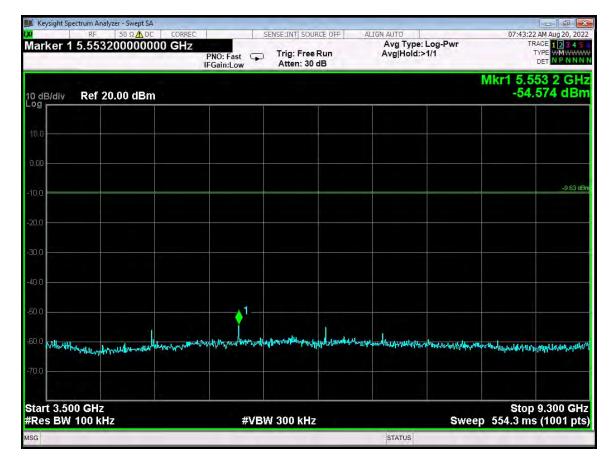
RF Antenna Conducted - High Channel - G4 Compatibility Mode - 928 MHz to 930 MHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

<sup>RF</sup> larker 1 1.85	50 Ω ▲ DC COR 2630000000 GH	Z	SE:INT SOURCE OFF	ALIGN AUTO Avg Type: I Avg Hold:>*		TRA	M Aug 20, 20: CE 1234 PE M M M M ET N P N N N
)dB/div Ref	20.00 dBm				M	kr1 1.852 -44.0	63 GH 99 dBr
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0.0							-9.63 d
o.o							
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0.0		• <sup>1</sup>					
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0,0							
tart 0.930 GH: Res BW 100 k		#VBW	300 kHz		Sweep	Stop 3 245.7 ms	3.500 GF (1001 pt
				STATUS	oncep	2-1011 1113	(Toor pe

RF Antenna Conducted - High Channel - G4 Compatibility Mode - 930 MHz to 3.5 GHz

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044

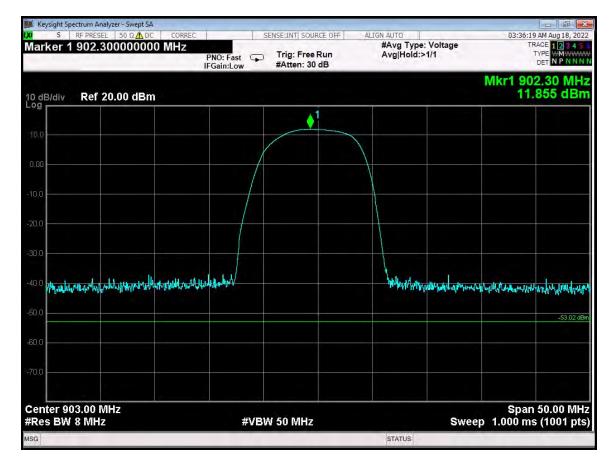


RF Antenna Conducted - High Channel - G4 Compatibility Mode - 3.5 GHz to 9.3 GHz

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

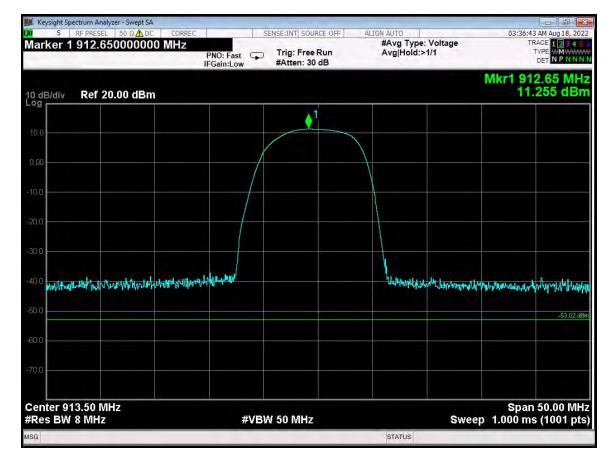
### PEAK POWER OUTPUT DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Peak Power Output - 903.00 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Peak Power Output - 913.50 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

III Keysight Spectrum Analyzer - Swept SA III S RF PRESEL 50 Ω Δ DC CORREC Marker 1 925.2500000000 MHz	PNO: Fast IFGain:Low	SENSE:INT SOURCE OFF	ALIGN AUTO #Avg Typ Avg Hold	pe: Voltage :>1/1	03:37:04 AM Aug 18, 202: TRACE 1 2 4 5 TYPE WWWWW DET N P N N N
10 dB/div Ref 20.00 dBm	in Gam. Eon				Mkr1 925.25 MH: 10.528 dBn
10.0		<b>1</b>			
0.00	/				
10,0					
30.0					
40.0 perturbatively refrequences and with the standard back the	holomateville		andrituulu	rillin to many the second	Helpolydawwateretuiletwalke
60.0					-53.02 dB
60,0					
-70.0					
Center 926.00 MHz ¢Res BW 8 MHz Isg	#VB	N 50 MHz	STATUS	Sweep	Span 50.00 MH: 1.000 ms (1001 pts

Peak Power Output - 926.00 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

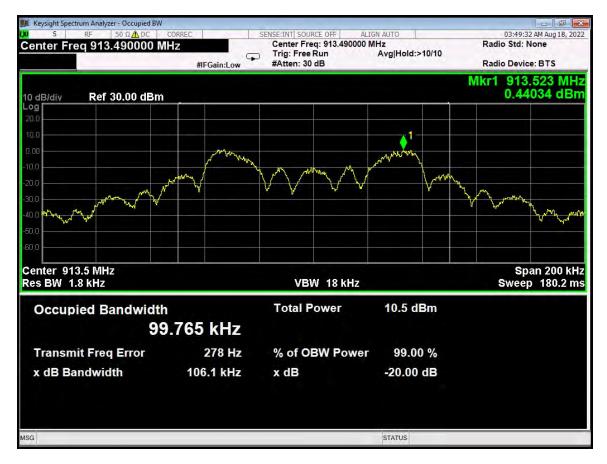
99% BANDWIDTH DATA SHEET

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



99 % Bandwidth - 903.00 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



99 % Bandwidth - 913.50 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

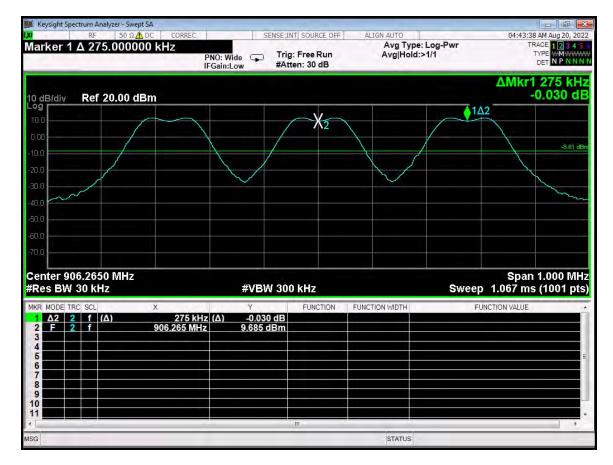


99 % Bandwidth - 926.00 MHz - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

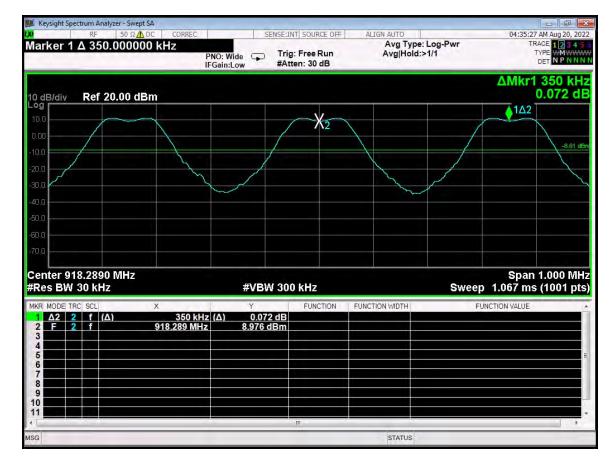
## CHANNEL FREQUENCY SEPARATION DATA SHEET

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



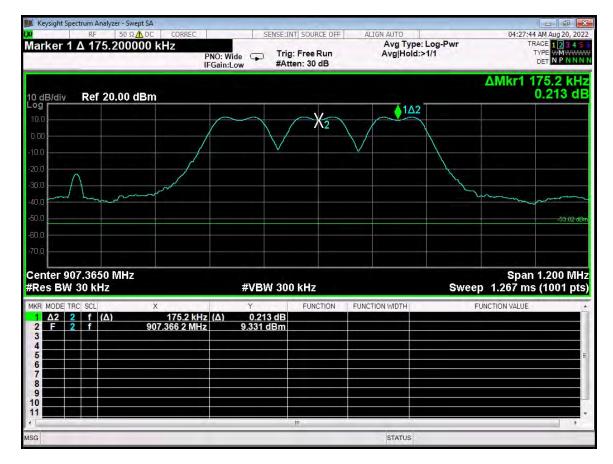
Channel Frequency Separation - Hop Set 0 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Channel Frequency Separation - Hop Set 1 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Channel Frequency Separation - Hop Set 2 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

Keysight Spect	rum Analyzer - Sw RF 50 Ω	ept SA	CENCE-TH	IT SOURCE OFF	ALIGN AUTO	Т	04:22:48 AM Aug 20, 3
arker 1 Δ	175.2000	000 kHz	Wide 😱 Trig	: Free Run ten: 30 dB		be: Log-Pwr d:>1/1	TRACE 1234 TYPE WMWA DET N P N
dB/div	Ref 20.00 (	dBm					ΔMkr1 175.2 k 0.036 (
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00 1.0					$\vee$		
.0 .0							-53,82
.ā							
enter 920 tes BW 3	.0400 MHz 0 kHz		#VBW 300	) kHz		Sweep	Span 1.200 N 1.267 ms (1001 p
R MODE TRC	SCL	х 175.2 kHz (Δ)	Ƴ 0.036 dB	FUNCTION	FUNCTION WIDTH	FUI	NCTION VALUE
F 2	f	920.040 0 MHz	8.953 dBm				
				III			
					1		

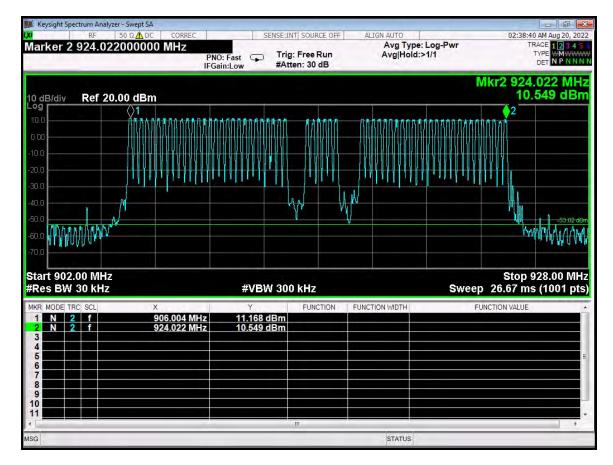
Channel Frequency Separation - Hop Set 3 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

#### NUMBER OF FREQUENCIES

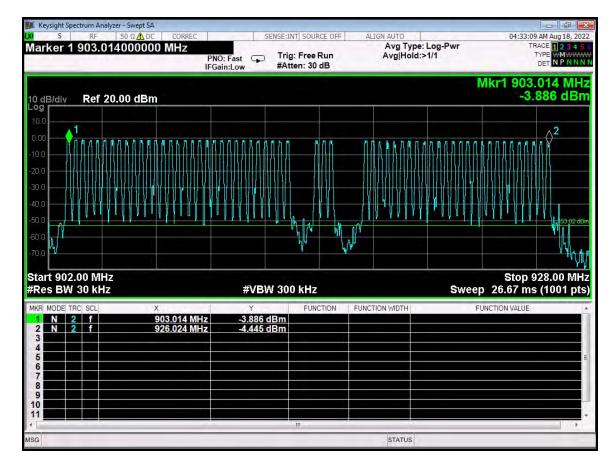
#### DATA SHEET

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



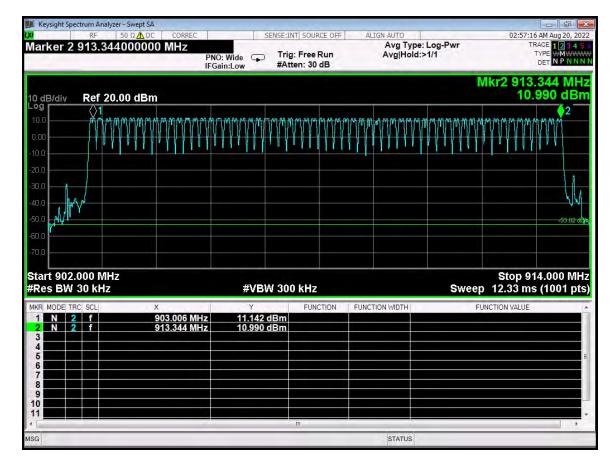
Number of Maximum Channels is 60 - Hop Set 0 - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



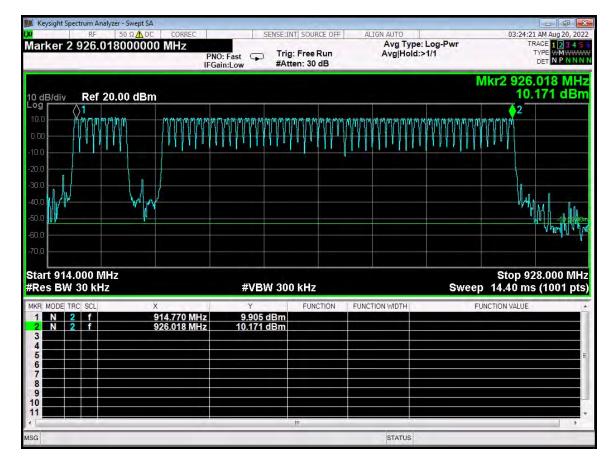
Number of Maximum Channels is 60 - Hop Set 1 - G4 Compatibility Mode

Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Number of Maximum Channels is 60 - Hop Set 2 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Number of Maximum Channels is 60 - Hop Set 3 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

## TIME OF OCCUPANCY

## DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

	ALIGN AUTO	08:16:44 AM Aug 20, 202
PNO: Wide 🕞 Trig: Free Run IFGain:Low #Atten: 70 dB	Avg Type: Log-Pwr	TRACE 1 2 3 4 5 TYPE WMWWW DET N P N N N
		ΔMkr1 60.00 -1.189 dl
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		-9.63 d
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Introdecestations separation of the second second second	neryhter französissen földer som frankrigen for som for som for som for som for som for som som som som som som	องกัจกระประเทศการสุดไปแระเวลาระการ 
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In Providence Andrew Merskeinen Andrew Merskeinen Andrew Mersennen Andrew Mersen auf der Sternen Andrew Mersen	ing the free water fill matter in the free water	on the heats when the ten or and
Introducedularity Hyrodisamili Alaani Kisanaani	unghthe theory and an eld an and the or any	องกำังกรุ่มรูปข้างให้มารัฐสได้แรงมากการการ 
#VBW 300 kHz		

Time Between Pulses - 60 Seconds - Hop Set 0 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

larker 1 ∆	RF 50 Ω 18.0500	ms		PNO: Wide 🕞	SENSE:INT SO Trig: Fre #Atten: 7	e Run	ALIGN AUTO Avg Type:	Log-Pwr	TRAI TY	M Aug 20, 202 DE 12345 PE WM WWW ET NPNNN
0 dB/div	Ref 20.00	dBm							ΔMkr1 1	8.05 m 1.14 dl
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).00										
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Muhaumana 80.0	wherenex 2						Alland provident provident	unander and an and an and an	ndenslandsendah	nigen (hyper)
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0.0										
0,0										
	000000 M	Hz			W 300 kH				s	ipan 0 H
enter 906. es BW 68 I										1001 pt

One Pulse is 18.05 ms - Hop Set 0 - G4 Compatibility Mode Time of Occupancy: 18.05 ms per 20 seconds Limit: 400 ms per 20 seconds

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

α RF 50 ΩΔ DC COM Marker 1 Δ 60.0000 s	PNO: Wide 🕞 Tri	NT SOURCE OFF A g: Free Run tten: 70 dB	LIGN AUTO Avg Type: Log-Pwr	08:26:48 AM Aug 20, 202 TRACE 1 2 3 4 5 TYPE WMWAAAA DET N P N N N
0 dB/div Ref 20.00 dBm				∆Mkr1 60.00 0.04 dl
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	JARA-Jan, Jayla, Shi Araya Shi	annailtean an Andrean an Annailtean an Annailtean an Annailtean an Annailtean an Annailtean an Annailtean an An	Alekkonsking i saiden at synder	Autoriales as all the first hard so the first hard and
40.0	NAAN-dala garada ya kuma ya kum	annahrinn an Annair a	Akahannahap wasang mangapaka	Alerandera and Alerandi apartication of
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Time Between Pulses - 60 Seconds - Hop Set 1 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

s RF PRESEL 50 Ω Δ DC CORREC larker 1 Δ 18.2000 ms	PNO: Wide 🖵	Trig: Free Run #Atten: 70 dB	ALIGN AUTO #Avg Type:	Voltage	04:49:51 AM Aug 18, 202: TRACE 1 2 3 4 5 TYPE WMWWWAA DET N P N N N
0 dB/div Ref 20.00 dBm					ΔMkr1 18.20 m -0.76 dl
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1.00					
0,0					
20.0 กลุงหม่มหลงมากกรรมปูกระบาทสายสายกระบาทสายสาย 20.0	warmandultudesseX2		122 hundlytreensembles	ารรุโซสารประโยชาติเราสาร	deiteren hannelanderen men
10.0					
0.0					-53.02 df
50.0					
0.0					
					Span 0 H

One Pulse is 18.20 ms - Hop Set 1 - G4 Compatibility Mode Time of Occupancy: 18.05 ms per 20 seconds Limit: 400 ms per 20 seconds

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

RF 50 QADC COR	REC SENSE(INT SOURCE OFF	ALIGN AUTO	09:03:01 AM Aug 20, 202
larker 1 ∆ 60.0000 s	PNO: Wide Trig: Free Run IFGain:Low #Atten: 70 dB	Avg Type: Log-Pwr	TRACE 1234 TYPE MMWWW DET N P N N N
o dB/div Ref 20.00 dBm			ΔMkr1 60.00 -0.561 dl
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0.0	unande valnivina i Uniter turarina anti-provinari, ag		hypoliselelerteistischerklisstressingshriss
	unande valnivina i Uniter turarina anti-provinari, ay		hypolodeletestsscherklastinnen och för
0.0	#VBW 300 kHz		Span 0 H 120.0 s (1001 pt

Time Between Pulses - 60 Seconds - Hop Set 2 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

larker 1	ஈ   50 ஓ <u>∧</u> ந I ∆ 18.0500 ms	S P	NO: Wide 🖵 Gain:Low	ENSE:INT  SOURCE OF Trig: Free Run #Atten: 70 dB		NUTO	Log-Pwr	TR/ T	AM Aug 20, 202 ACE 12345 APE MANNA DET NPNNN
0 dB/div	Ref 20.00 dBr							ΔMkr1 ′	18.05 m -0.11 dl
10.0						r	Man <mark>ik (</mark> inte	. W. M W	
10.0									-9.63 d
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0.0									
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60.0									
0,0	13.325000 MHz								Span 0 H

One Pulse is 18.05 ms - Hop Set 2 - G4 Compatibility Mode Time of Occupancy: 18.05 ms per 20 seconds Limit: 400 ms per 20 seconds

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

	CORREC SEN	SE;INT SOURCE OFF	ALIGN AUTO	09:10:34 AM Aug 20, 202
larker 1 Δ 60.2400 s		Trig: Free Run #Atten: 70 dB	Avg Type: Log-Pwr	TRACE 1234 TYPE WMWWW DET NPNN
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		300 KHz	and the second	собъеми и и и и и и и и и и и и и и и и и и

Time Between Pulses - 60.24 Seconds - Hop Set 3 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

RF 50 ΩΔ CC COR 1arker 1 Δ 18.1000 ms	PNO: Wide	Trig: Free Run #Atten: 70 dB	ALIGN AUTO Avg Type: Log-F		107:54 AM Aug 20, 202 TRACE 1 2 3 4 5 TYPE WM WWWA DET N P N N N
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enter 914.773000 MHz es BW 68 kHz	#VB	N 300 kHz		Sweep 50.00	Span 0 H ) ms (1001 pt

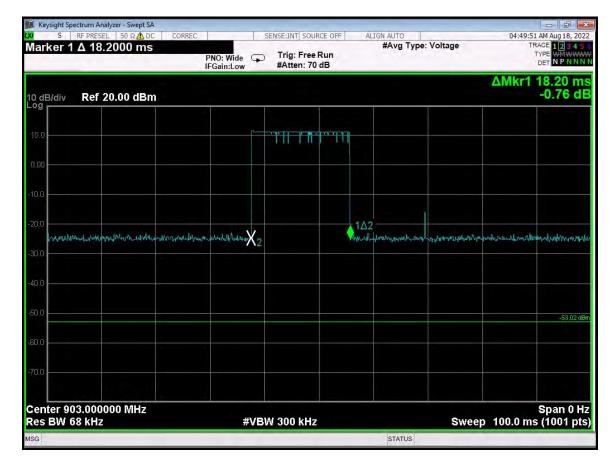
One Pulse is 18.10 ms - Hop Set 3 - G4 Compatibility Mode Time of Occupancy: 18.05 ms per 20 seconds Limit: 400 ms per 20 seconds

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## **DUTY CYCLE**

## DATA SHEETS

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400



Time of One Pulse - 18.2 ms - Worst Case Mode of Hop Set 1 - G4 Compatibility Mode

Brea Division 114 Olinda Drive Brea, CA 92823 (714) 579-0500 Newbury Park Division 1050 Lawrence Drive Newbury Park, CA 91320 (805) 480-4044 Lake Forest Division 20621 Pascal Way Lake Forest, CA 92630 (949) 587-0400

Ø RF 50ΩALDC Marker 1 Δ 60.0000 s	CORREC SENSE:INT SOUR PNO: Wide Trig: Free IFGain:Low #Atten: 70	Avg Type: Log-Pwr Run	08:26:48 AM Aug 20, 202: TRACE 1 2 3 4 5 TYPE WMWMMA DET N P NNN
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40.0			
50.0			
50.0			
0.0			
enter 903.000000 MHz tes BW 68 kHz	#VBW 300 kHz		Span 0 H Sweep 120.0 s (1001 pts
sg		STATUS	

One pulse per 60 seconds - G4 Compatibility Mode

Note: Worst Case Mode of Hop Set 1 table used, which results in the pulses appearing more frequently

Duty Cycle = 18.2 %

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