MOTOROLA SOLUTIONS

MS ISO/IEC 17025 TESTING SAMM No. 0826

ACCREDITED CERTIFICATE 2518.05

DECLARATION OF COMPLIANCE: MPE ASSESSMENT

Motorola Solutions Inc.
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Date of Report: 08/18/2022
Report Revision: B

Responsible Engineer:	Saw Sun Hock (EME Engineer)
Report author:	Sin Keng LEE (EME Engineer)
Date(s) Tested:	6/28/2021
Manufacturer:	Motorola Solutions. Inc
Date submitted for test:	6/8/2021
DUT Description:	APX 6500 800/900MHz: Multiple HW Encryption WiFi Interoperability Data Modem Tethering via WiFi or Cable (Motorcycle configuration- G138)
Test TX mode(s):	CW
Max. Power output:	Refer to Table 6
TX Frequency Bands:	Refer to Table 6
Signaling type:	FM, TDMA, FHSS (Bluetooth), 802.11b/g/n (WLAN 2.4 GHz), 802.11 a/n/ac (WLAN 5 GHz)
Model(s) Tested:	M25VRS9PW1CN (PMUF1980A) with G138 option
Model(s) Certified:	M25VRS9PW1CN (PMUF1980A) with G138 option
Serial Number(s):	471TXB1933
Classification:	Occupational/Controlled Environment
Applicant Name:	Motorola Solutions Inc.
Applicant Address:	8000 West Sunrise Boulevard, Fort Lauderdale, Florida 33322
FCC ID:	AZ492FT7141 LMR 806-824 MHz, 851-869 MHz, 896-901 MHz, 935-940 MHz, Bluetooth 2402-2480 MHz, WLAN 2412-2462 MHz; WLAN 5180-5825 MHz This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
ISED:	109U-92FT7141 This report contains results that are immaterial for ISED Canada equipment approval, which are clearly identified.

The MPE results clearly demonstrate compliance with FCC Occupational/Controlled RF Exposure limits. FCC rules require compliance for Passengers and Bystanders to the FCC General Population/Uncontrolled limits. The test results clearly demonstrate compliance with ICNIRP Guidelines for limiting exposure in time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz) and Health Canada Safety Code 6 (2015). Limits of Human Exposure to Radio frequency Electromagnetic Energy in the Frequency Range from 3 kHz to 300 GHz.

Based on the information and the testing results provided herein, the undersigned certifies that when used as stated in the operating instructions supplied, said product complies with the national and international reference standards and guidelines listed in section 4.0 of this report (no deviation from standard methods). This report shall not be reproduced without written approval from an officially designated representative of the Motorola Solutions Inc. EME Laboratory.
I attest to the accuracy of the data and assume full responsibility for the completeness of these measurements.
This reporting format is consistent with the suggested guidelines of the TIA TSB-159 April 2006
The results and statements contained in this report pertain only to the device(s) evaluated herein.

Saw Sun Hock (Approved Signatory)
Approval Date: 8/19/2022

Document Revision History

Date	Revision	Comments
02/18/2022	A	Initial release
08/18/2022	B	Update the Model Name

Table of Contents

1.0 Introduction

This report details the test setup, test equipment and test results of Maximum Permissible Exposure (MPE) performed at Motorola Solutions' outside test site for product model APX 6500 800-900MHz M25VRS9PW1CN (PMUF1980A) with G138 Motorcycle Option.

2.0 FCC MPE Summary

Table 1

Equipment Class	Frequency Band (MHz)	Bystander		Operator	
		Power Density (mW/cm^2)	Percentage of Limit (%)	Power Density (mW/cm^2)	Percentage of Limit (%)
TNB	LMR 800-900MHz (806-824, 851-869, 896-901, 935-940)	0.086	15.1	0.215	6.9
DTS	WLAN (2412-2462)	0.025	2.5	0.025	2.5
NII	WLAN (5180 - 5825)	0.011	1.06	0.011	1.06
DSS	BT (2402-2480)	0.007	0.71	0.007	0.71
Simultaneous (Highest Combined Percentage of Limit)			17.6		9.4

3.0 Abbreviations / Definitions

CNR: Calibration Not Required
CW: Continuous Wave
DUT: Device Under Test
EME: Electromagnetic Energy
FHSS: Frequency Hopping Spread Spectrum
FM: Frequency Modulation
MPE: Maximum Permissible Exposure
GPS: Global Positioning System
LMR: Land Mobile Radio
SAR: Specific Absorption Rate
NA: Not Applicable
BS: Bystander
PTT: Push to Talk
WLAN: Wireless Local Area Network
TDMA: Time Division Multiple Access

4.0 Referenced Standards and Guidelines

This product is designed to comply with the following applicable national and international standards and guidelines.

- United States Federal Communications Commission, Code of Federal Regulations; Rule Part 47CFR § 1.1310, § 2.1091 (d) and § 2.1093 for RF Exposure, where applicable.
- Federal Communications Commission, "Evaluating Compliance with FCC Guidelines for Human Exposure to Radio frequency Electromagnetic Fields", OET Bulletin 65 (Edition 97-01), FCC, Washington, D.C.: August 1997.
- Institute of Electrical and Electronics Engineers (IEEE) C95.1-2019

- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1992. Specific to FCC rules and regulations.
- Institute of Electrical and Electronics Engineers (IEEE) C95.3-2002
- International Commission on Non-Ionizing Radiation Protection (ICNIRP) 1998
- Ministry of Health (Canada) Safety Code 6 (2015), Limits of Human Exposure to Radio frequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
- RSS-102 (Issue 5) – Radio Frequency (RF) Exposure Compliance of Radio communication Apparatus (All Frequency Bands)
- FCC KDB – 447498 D01 General RF Exposure Guidance v06
- FCC KDB – 865664 D02 RF Exposure Reporting v01r02
- EN 62311:2008 Assessment of electronic and electrical equipment related to human exposure restrictions for electromagnetic fields (0 Hz – 300 GHz).

5.0 Power Density Limits

Table 2 – Occupational / Controlled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65/ 47CFR § 1.1310	ICNIRP	IEEE C95.1 2019	RSS-102 Issue 5 2015
	mW/cm^2	W/m^2	W/m^2	W/m^2
10 – 20				10.0
20 – 48				$44.72 / f^{0.5}$
30 – 300	1.0			
48 – 100				6.455
10 – 400		10.0		
100 – 400			10.0	
100 – 6,000				$0.6455 f^{0.5}$
300 – 1,500	f/300			
400 – 2,000		f/40	f/40	
1,500 – 100,000	5.0			
2,000 – 300,000		50.0	50.0	
6,000 – 15,000				50.0
15000 – 150,000				50.0
150000 –300,000				3.33×10-4 f

Table 3 – General Population / Uncontrolled Exposure Limits

Frequency Range (MHz)	FCC OET Bulletin 65/ 47CFR § 1.1310 mW/cm^2	ICNIRP W/m^2	IEEE C95.1 2019 W/m^2	RSS-102 Issue 5 2015 W/m^2
10 – 20				2.0
20 – 48				$8.944 / f^{0.5}$
30 – 300	0.2			
48 – 300				1.291
10 – 400		2.0		
100 – 300				
100 – 400			2.0	
300 – 1,500	f/1,500			
300 – 6000				$0.02619 f^{0.6834}$
400 – 2,000		f/200	f/200	
1,500 – 100,000	1.0			
2,000 – 300,000		10.0	10.0	
6,000 – 15,000				10.0
15,000 – 150,000				10.0
150,000 – 300,000				$6.67\times10^{-5} f$

6.0 N_c Test Channels

The number of test channels is determined by using Equation 1 below. This equation is available in FCC's KDB 447498. The test channels are appropriately spaced across the antenna's frequency range.

Equation 1 – Number of test channels

$N_c = \text{Round } \{[100(f_{high} - f_{low})/f_c]^{0.5} \times (f_c / 100)^{0.2}\}$

where N_c is the number of test channels, f_{high} and f_{low} are the highest and lowest frequencies within the transmission band, f_c is the mid-band frequency, and frequencies are in MHz.

7.0 Measurement Equipment

Table 4 – Equipment

Equipment Type	Model #	SN	Calibration Date	Calibration Due Date
Motorcycle	Honda CBX750-2003	NA	NA	NA
Survey Meter Probe – E-Field	ETS Model HI-2200 ETS Model E100	00206805 00237361	11/25/2020	11/25/2021

E-field measurements are in mW/cm^2.

8.0 Measurement System Uncertainty Levels

Table 5 – Uncertainty Budget for Near Field Probe Measurements

	Tol. (± %)	Prob. Dist.	Divisor	u_i (±%)		v_i
Measurement System						
Probe Calibration	7.1	N	1.00	7.1	50.4	∞
Survey Meter Calibration	0.0	N	1.00	0.0	0.0	¥
Hemispherical Isotropy	8.0	R	1.73	4.6	21.33	∞
Linearity	5.0	R	1.73	2.9	8.33	∞
Pulse Response	1.0	R	1.73	0.6	0.33	∞
RF Ambient Noise	3.0	R	1.73	1.7	3.00	∞
RF Reflections	8.0	R	1.73	4.6	21.33	∞
Probe Positioning	10.0	R	1.73	5.8	33.333	∞
Test sample Related					0.00	
Antenna Positioning	3.0	N	1.00	3.0	9.0	∞
Power drift	5.0	R	1.73	2.9	8.33	∞
Bystander measurement uncertainty	4.8	N	1.00	4.8	23.04	∞
Passenger measurement uncertainty	8.1	N	1.00	8.1	65.61	∞
Combined Standard Uncertainty		RSS		15.6	15.6	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)		*k*=2		31	31	

9.0 Product and System Description

This mobile device operates in the LMR bands using either frequency modulation (FM) with 100% transmit duty cycle or TDMA signals with maximum of 50% transmit duty cycle. For conservative assessment, FM signal was tested. A duty factor of 50% applies for PTT operation mode.

This device also incorporates a Class 1 Bluetooth device which is a Frequency Hopping Spread Spectrum (FHSS) technology. The Bluetooth radio modem is used to wireless link audio accessories. The maximum actual transmission duty cycle is imposed by the Bluetooth standard. The maximum duty cycle for BT is 100%. Bluetooth Low Energy (BT LE) intended to reduce power consumption.

This device also contains WLAN technology for data capabilities over 802.11b/g/n 2.4 GHz and 802.11 a/n/ac 5 GHz wireless networks.

Table 6 below summarizes the technologies, bands, maximum duty cycles and maximum output powers. Maximum output powers are defined as upper limit of the production line final test station.

Table 6 – Bands, Duty Cycle and Maximum power

Technologies	Bands (MHz)	Duty Cycle (%)	Max Power
LMR (8/900MHz)	806-825, 851-870	50 (PTT)	18W
	896-901; 935-940		18W
	901-902; 940-941		4W
BT	2402-2480	100	11.2mW
BT LE	2402-2480	100	6.3mW
WLAN	2412 – 2462 (802.11b/g/n)	100	39.8mW (802.11b)
			7.079mW (802.11g – Channel 1 and 11), 15.8mW (802.11g – Channel 2-10)
			7.079mW (802.11n – Channel 1 and 11), 12.58mW (802.11n – Channel 2-10)
	5180-5825 (802.11 a/n/ac)	100	15.84mW

This device will be marketed to and used by employees solely for work-related operations, such as public safety agencies, e.g. police, fire and emergency medical. User training is the responsibility of these agencies which can be expected to employ the usage instructions, safety information and operational cautions set forth in the user's manual, instructional sessions or other means.

Accordingly this product is classified as Occupational/Controlled Exposure. However, in accordance with FCC requirements, the bystanders external to the test motorcycle are evaluated to the General Population/Uncontrolled Exposure Limits.

(Note that “Bystanders” as used herein are people other than operator)

10.0 Additional Options and Accessories

Not available.

11.0 Test Set-Up Description

Assessments were performed with mobile radio installed on the test motorcycle, at the specified distances and test locations indicated in section 12.0, 13.0 and Appendix A.

All antennas described in Table 7 were considered in order to develop the test plan for this product. Antennas were installed and tested per their defined test channels reported in Appendix D.

12.0 Method of Measurement for motorcycle mounted antenna(s)

12.1 Bystander vehicle MPE measurements

Antenna is located at the rear of the test motorcycle. Refer to Appendix A for antenna location with respect to the bystander.

MPE measurements for bystander (BS) conditions are determined by taking the average of (10) measurements in a 2m vertical line for the bystander test location indicated in Appendix A with 20 cm height increments, with the distance between the antenna and the geometric center of the probe sensor equal to 60 cm, directly behind the motorcycle. Unlike a car, the motorcycle does not feature a large rectangular trunk and other features (e.g. windows) that may produce significantly distinct exposures depending on the location of a bystander relative to the trunk. For a motorcycle equipped with a wire antenna mounted on a small ground plane, the separation distance between the antenna and bystander is the main factor determining the exposure levels and for this reason the rear test location is employed.

The separation distance used for testing is defined from the antenna where as the RF safety booklet defines the same distance from the motorcycle body to ensure that the assessment is applicable to other motorcycles. The measurement probe is positioned orthogonal to antenna (typically parallel to ground with a vertically mounted antenna) and aimed directly at the antenna's axis. These measurements are representative of persons other than the operator standing next to the motorcycle.

12.2 Operator MPE measurements

Antenna is located at the rear of the test motorcycle. Refer to Appendix A for antenna location with respect to the operator.

MPE measurements for operator (OP) conditions are determined by taking the average of the (3) measurements (Head, Chest) at the test distance of 37.5cm from the operators' seat area to antennas. (Lower Trunk) at test distance of 48.5 cm to maintain 20 cm separation distance between probe sensor and reradiating objects (motorcycle's enclosure).

The measurement probe is oriented parallel (horizontal) to the ground and positioned above the motorcycle operator's seat. The probe head is pointed towards the back of the motorcycle and aimed directly at the antenna's axis while maintaining a twenty (20) centimeter separation distance between the probe sensor and reradiating structures. These (3) measurements are representative of the operator.

13.0 MPE Calculations

The final MPE results for this mobile radio are presented in section 15.0. These results are based on 50% duty cycle for PTT for LMR bands.
Below is an explanation of how the MPE results are calculated. Refer to Appendix D for MPE measurement results and calculations for LMR band.

Bystander - 10 measurements are averaged over the body (*Avg_over_body*).
Operator - 3 measurements are averaged over the top portion of body (*Avg_TopPortion_body*).

The Average over Body test methodology is consistent with IEEE/ANSI C95.3-2002 guidelines. Therefore;

Equation 2 – Power Density Calculation *(Calc._P.D.)*

$$Calc.\_P.D. = (Avg\_over\_body) * (probe\_frequency\_cal\_factor) * (duty\_cycle)$$

$$Calc.\_P.D. = (Avg\_TopPortion\_body) * \frac{2}{3} * (probe\_frequency\_cal\_factor) * (duty\_cycle)$$

Note 1: The highest "average" cal factors from the calibration certificates were selected for the applicable frequency range. Linear interpretation was used to determine "probe_frequency_cal_factor" for the specific test frequencies.

Note 2: The E-field probe calibration certificate's frequency cal factors were determined by measuring V/m. The survey meter's results were measured in power density (mW/cm^2) and therefore the "probe_frequency_cal_factor" was squared in equation 2 to account for these results.

Note 3: The H-field probe calibration certificate's frequency cal factors were determined by measuring A/m. The survey meter's results were measured in A/m and therefore the "Avg_over_body" A/m results were converted to power density (mW/cm^2) using the equation 3. H-field measurements are only applicable to frequencies below 300MHz.

Equation 3 – Converting A/m to mW/cm^2

$$mW/cm\text{^}2 = (A/m)\text{^}2 * 37.699$$

Equation 4 – Power Density Maximum Calculation

$$Max\_Calc.\_P.D. = P.D.\_calc * \frac{\max\_output\_power}{initial\_output\_power}$$

Note 4: For initial output power> max_output_power; max_output_power / initial output power = 1

14.0 Antenna Summary

Table below summarizes the tested antennas and their descriptions, overlap of FCC bands, number of test channels per FCC KDB 447498 (FCC N_c) and actual number of tested channels (Actual N_c). This information was used to determine the test configurations presented in this report.

Table 7

Antenna No.	Antenna Model	Frequency Range (MHz)	Physical Length (cm)	Gain (dBi)	Remarks	Overlap FCC Bands (MHz)	FCC N_c	Actual N_c
1	HAF4038A	806-941	6.1	2.15	1/4 wave	806-824 / 851-869 / 896-901 / 935-940	12	12
BT/WLAN								
2	AN000163A02	2400-2500 / 4900-5900	7	5.0 / 5.25	Monopole	2412-2462 ; 5180-5825	3	3

15.0 Test Results Summary

15.1 MPE Test Results Summary for LMR

The following tables below summarize the MPE results for each test configuration: test positions (BS-Bystander, OP-Operator), E field measurements, antenna model & freq. range, maximum output power, initial power, TX frequency, max calculated power density results, applicable FCC/ISED Canada specification limits and % of the applicable specification limits.

Table 8
LMR 8/900 Bystander MPE assessment to General Population / Uncontrolled Exposure Limits

Test Pos.	E/H field	Antenna No.	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To FCC Spec Limit	ICNIRP Limit	% To ICNIRP Spec Limit	ISED Limit	% To ISED Spec Limit
BS	E	1	HAF4038A, 806-941MHz	18.0	17.8	806.0000	0.067	0.54	12.4	0.40	16.6	0.25	26.4
				18.0	17.7	815.0000	0.065	0.54	12.0	0.41	16.1	0.26	25.6
				18.0	17.9	824.0000	0.077	0.55	13.9	0.41	18.6	0.26	29.7
				18.0	18.0	851.0000	0.086	0.57	**15.1**	0.43	**20.2**	0.26	**32.6**
				18.0	18.0	860.0000	0.083	0.57	14.5	0.43	19.3	0.27	31.3
				18.0	17.9	869.0000	0.079	0.58	13.6	0.43	18.1	0.27	29.4
				18.0	17.9	896.0000	0.077	0.60	12.8	0.45	17.1	0.27	28.1
				18.0	17.9	898.5000	0.079	0.60	13.2	0.45	17.6	0.27	28.9
				18.0	18.0	900.0000	0.078	0.60	12.9	0.45	17.2	0.27	28.3
				18.0	17.9	935.0125	0.091	0.62	14.6	0.47	19.5	0.28	32.4
				18.0	17.9	937.5000	0.091	0.63	14.5	0.47	19.3	0.28	32.2
				18.0	17.8	939.0000	0.092	0.63	14.7	0.47	19.6	0.28	32.6
				4.0	4.0	901.5000	0.023	0.60	3.8	0.45	5.1	0.27	8.3
				4.0	4.0	940.5000	0.026	0.63	4.2	0.47	5.6	0.28	9.4

Notes:
Results highlight in **Bold** are configurations with highest percentage of limits for operator.

Table 9
LMR 8/900 Operator MPE assessment to Occupational /Controlled Exposure Limits

Test Pos.	E/H field	Antenna No.	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/ cm^2)	FCC Limit	% To FCC Spec Limit	ICNIRP Limit	% To ICNIRP Spec Limit	ISED Limit	% To ISED Spec Limit
OP	E	1	HAF4038A, 806-941MHz	18.0	17.8	806.0000	0.148	2.69	5.5	2.02	7.3	1.83	8.1
				18.0	17.7	815.0000	0.142	2.72	5.2	2.04	7.0	1.84	7.7
				18.0	17.9	824.0000	0.145	2.75	5.3	2.06	7.0	1.85	7.8
				18.0	18.0	851.0000	0.147	2.84	5.2	2.13	6.9	1.88	7.8
				18.0	18.0	860.0000	0.129	2.87	4.5	2.15	6.0	1.89	6.8
				18.0	17.9	869.0000	0.120	2.90	4.2	2.17	5.5	1.90	6.3
				18.0	17.9	896.0000	0.173	2.99	5.8	2.24	7.7	1.93	8.9
				18.0	17.9	898.5000	0.180	3.00	6.0	2.25	8.0	1.93	9.3
				18.0	18.0	900.0000	0.180	3.00	6.0	2.25	8.0	1.94	9.3
				18.0	17.9	935.0125	0.212	3.12	6.8	2.34	9.1	1.97	10.7
				18.0	17.9	937.5000	0.214	3.13	6.9	2.34	9.1	1.98	10.8
				18.0	17.8	939.0000	0.215	3.13	**6.9**	2.35	**9.2**	1.98	**10.9**
				4.0	4.0	901.5000	0.041	3.01	1.4	2.25	1.8	1.94	2.1
				4.0	4.0	940.5000	0.049	3.14	1.6	2.35	2.1	1.98	2.5

Notes:
Results highlight in **Bold** are configurations with highest percentage of limits for operator.

15.2 MPE Test Results for Bluetooth and WLAN

Antenna AN000163A02 supports BT and WLAN 2.4 GHz / 5 GHz should be installed on motorcycle's enclosure. BT, WLAN 2.4 GHz and 5 GHz will not transmit simultaneously.

MPE calculation was use to determine power density for these transmitters due to lower power. According to FCC's OET Bulletin 65 Edition 97-01 Section 2, calculations can be made to predict RF field strength and power density levels around typical RF sources. Equation (5) is generally accurate in far-field of an antenna.

Equation 5 – Power Density Calculation

$$S = \frac{P_t\, G}{4\pi d^2 L}\mathrm{F}$$

Equation (5) accounts for the maximum duty cycle of the signal, and the factor, F, to provide a worst-case prediction of power density per FCC OET Bulletin 65, Edition 97-01 1997.

Where: S = power density
P_t = maximum output power scaled by the maximum duty cycle of the signal
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
d = distance from antenna
F = Enhancement factor [1 or 2.56 for predicting ground-level field strength]

Table below summarized the MPE calculation for each standalone transmitter bands, Bluetooth and WLAN.

Table 10

BT/WLAN Bystander MPE assessment to General Population / Uncontrolled Exposure Limits

Antenna #	Max Power (W)	Duty Cycle (%)	Tx Frequency (MHz)	Antenna Gain (dBi)	Cable Loss, L (dB)	Dist., d (cm)	Enhance Factor, F	Max Calc. MPE (mW/cm^2)	MPE Spec Limit (mW/cm^2)					
									FCC	% To FCC Spec Limit	ICNIRP	% To ICNIRP Spec Limit	ISED limit	% To ISED Spec Limit
WLAN 2.4 GHz														
AN000163A02	0.040	100%	2412.0	5.00	0.00	20	1.00	0.025	1.00	2.50	1.00	2.50	0.54	4.67
AN000163A02	0.040	100%	2437.0	5.00	0.00	20	1.00	0.025	1.00	2.50	1.00	2.50	0.54	4.63
AN000163A02	0.040	100%	2462.0	5.00	0.00	20	1.00	0.025	1.00	2.50	1.00	2.50	0.54	4.60
WLAN 5 GHz														
AN000163A02	0.016	100%	5180.0	5.25	0.00	20	1.00	0.011	1.00	1.06	1.00	1.06	0.90	1.17
AN000163A02	0.016	100%	5502.5	5.25	0.00	20	1.00	0.011	1.00	1.06	1.00	1.06	0.94	1.12
AN000163A02	0.016	100%	5825.0	5.25	0.00	20	1.00	0.011	1.00	1.06	1.00	1.06	0.98	1.08
Bluetooth 2.4 GHz														
AN000163A02	0.011	100%	2402.0	5.00	0.00	20	1.00	0.007	1.00	0.71	1.00	0.71	0.54	1.32
AN000163A02	0.011	100%	2441.0	5.00	0.00	20	1.00	0.007	1.00	0.71	1.00	0.71	0.54	1.30
AN000163A02	0.011	100%	2480.0	5.00	0.00	20	1.00	0.007	1.00	0.71	1.00	0.71	0.55	1.29

Notes:
1) Distance from antenna (d), 20cm for more conservative estimation.
2) Cable loss (L), all cable loss include in antenna gain, so should be 0 dB.
3) Enhancement Factor (F), 1 (Ground reflection already factor in during antenna characterization)

15.3 Simultaneous Transmission

LMR bands can transmit simultaneously with Bluetooth or WLAN 2.4 GHz or WLAN 5 GHz. Bluetooth and WLAN 2.4 GHz or WLAN 5 GHz transmitters cannot transmit at the same time.

The highest power density results for each standalone transmitters are indicated in Table below.

Table 11

Transmitters	Frequency Band (MHz)	Bystander (BS)		Operator (OP)	
		Power Density (mW/cm^2)	Percentage of Limit (%)	Power Density (mW/cm^2)	Percentage of Limit (%)
FCC US					
LMR 8/900	806-824, 851-869, 896-901, 935-940	0.086	15.1	0.215	6.9
Bluetooth	2402 - 2480	0.007	0.71	0.007	0.71
WLAN 2.4 GHz	2412 - 2462	0.025	2.50	0.025	2.50
WLAN 5 GHz	5180 - 5825	0.011	1.06	0.011	1.06
ISED Canada					
LMR 8/900	806-824, 851-869, 896-901, 935-940	0.086	32.6	0.215	10.9
Bluetooth	2402 - 2480	0.007	1.32	0.007	1.32
WLAN 2.4 GHz	2412 - 2462	0.025	4.67	0.025	4.67
WLAN 5 GHz	5180 - 5825	0.011	1.17	0.011	1.17
ICNIRP					
LMR 8/900	806-825, 851-870, 896-901, 935-940	0.086	20.2	0.215	9.2
Bluetooth	2402 - 2480	0.007	0.71	0.007	0.71
WLAN 2.4 GHz	2412 - 2462	0.025	2.50	0.025	2.50
WLAN 5 GHz	5180 - 5825	0.011	1.06	0.011	1.06

Per KDB 447498 D01, simultaneous transmission MPE test exclusion applies when the sum of MPE ratios for all simultaneous transmitting antennas incorporated in a host device is ≤ 1.0, according to calculated/estimated, numerically modeled, or measured field strengths or power density.
Calculated Maximum Power density for WLAN 2.4 GHz is greater than WLAN 5 GHz and Bluetooth. WLAN 2.4 GHz, WLAN 5 GHz and Bluetooth transmitters cannot transmit at the same time. Thus, WLAN 2.4 GHz will be used to evaluate simultaneous transmission test exclusion. The highest combined power density percentage for simultaneous transmission indicated in Table below.

Table 12

Designator	Simultaneous Transmission Scenario	Highest Combined Percentage of Limit (%)	
		Bystander (BS)	Operator (OP)
FCC	LMR 8/900 and WLAN	17.6%	9.4%
ISED Canada	LMR 8/900 and WLAN	37.3%	15.6%
ICNIRP	LMR 8/900 and WLAN	22.7%	11.7%

16.0 Conclusion

The assessments for this device were performed with an output power range as indicated in section 15.1 (for LMR) and 15.2 (for BT/WLAN). The maximum allowable output power is equal to the upper limit of the final test factory transmit power specification listed in Table 6. The highest power density results for LMR and BT/WLAN transmitters scaled to maximum allowable power output are indicated in Table below for bystander and operator.

Table 13: Maximum MPE RF Exposure Summary (LMR)

Designator	Transmitters	Frequency Band (MHz)	Bystander (mW/cm^2)	Operator (mW/cm^2)
FCC	LMR 8/900	806-824, 851-869, 896-901, 935-940	0.086	0.215
ISED Canada	LMR 8/900	806-824, 851-869, 896-901, 935-940	0.086	0.215
ICNIRP	LMR 8/900	806-825, 851-870, 896-901, 935-940	0.086	0.215

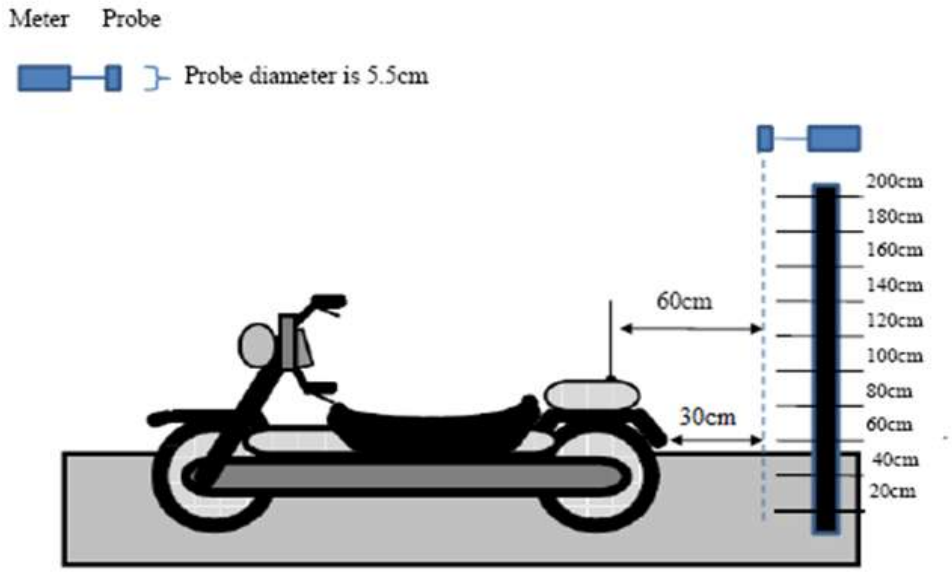
Table 14: Maximum MPE RF Exposure Summary (BT/WLAN)

Designator	Transmitters	Frequency Band (MHz)	Bystander (mW/cm^2)	Operator (mW/cm^2)
FCC / ISED Canada / ICNIRP	Bluetooth	2402-2480	0.007	0.007
	WLAN	2412-2462	0.025	0.025
	WLAN	5180-5825	0.011	0.011

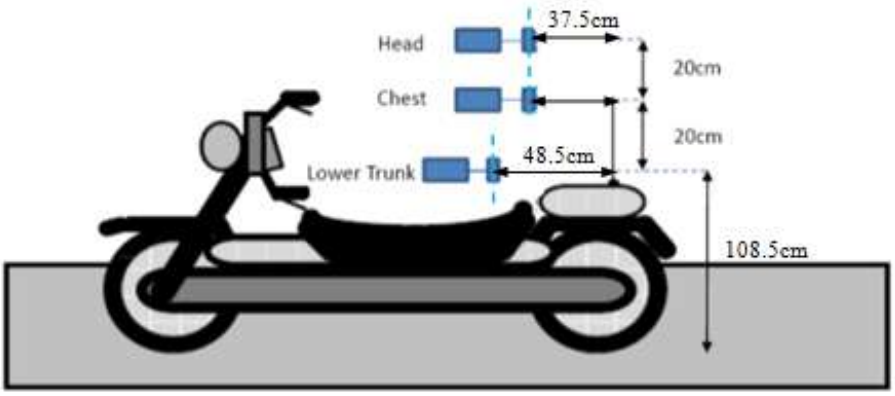
These MPE results herein demonstrate compliance to the FCC/ICNIRP/ISED Canada Occupational/Controlled Exposure limit. FCC rules require compliance for Bystanders to the FCC General Population/Uncontrolled limits.

Appendix A - Illustration of Antenna Location and Test Distances

Bystander Illustration



Operator Illustration



Note: Lower Trunk measurement distance 48.5cm from the antenna is to maintain minimum 20cm separation distance between the probe sensor and reradiating objects (motorcycle's enclosure)

Appendix B - Probe Calibration Certificates

ETS-LINDGREN
An ESCO Technologies Company
1301 Arrow Point Drive
Cedar Park, Texas 78613
(512) 531-6400

ETS-LINDGREN
An ESCO Technologies Company
Ltd Cal ☐
By JT Date 25-Nov-20
Next Cal Due
www.ets-lindgren.com

Cert I.D.: 137574

Certificate of Calibration Conformance

The instrument identified below has been individually calibrated in compliance with the following standard(s):
IEEE 1309 - 2013, Institute of Electrical and Electronics Engineers, Standard for Calibration of Electromagnetic Field Sensors and Probes, Excluding Antennas from 9 kHz to 40 GHz

Environment: Laboratory MTE is maintained in a temperature controlled environment with ambient conditions from 18 to 28 C, relative humidity less than 90%. The instrument under test has been calibrated in a suitable environment using an EMCO TEM Cell 5101C, GTEM 5305/5402 and an RF Shielded EMC Chamber which is conducive to maintaining accurate and reliable measurement quality.

Manufacturer:	ETS-Lindgren	**Operating Range:**	100kHz - 5GHz
Model Number:	E100	**Instrument Type:**	Isotropic Probe > 1 GHz
Serial Number / ID:	**00237361**		
Date Completed:	25-Nov-20		
Test Type:	Standard Field, Field Strength		
Calibration Uncertainty:	Std Field Method	100kHz - 6 GHz, +/-0.64 dB, Linearity +/- 0.95 dB, Isotropicity +/- 0.86	

k=2, (95% Confidence Level)

Test Remarks: Unit has been added to SRO: S000049991 to replace E100 S/N:00126277. Functional test performed with customer's HI-2200 S/N: 00206805. Additional frequency and field level data provided per customer.

Calibration Traceability: This document provides traceability of measurements to recognized national standards to using controlled processes. Any uncertainties listed are derived from the methods described in NIST Tech Note 1297 and other guides to the uncertainty of measurement. This certificate and any reported data may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-2017 and ANSI/NCSL Z540-1-1994. The results in this document relate only to the item(s) listed and should not be considered representative of a populations unless otherwise noted.

Standards and Equipment Used: Make / Model / Name / S/N / Calibration Date

HP	8648C	Signal Generator	3836U02236	04-May-21
Keysight	E9304A	Power Sensor	MY56100039	06-Apr-21
Hewlett Packard	E4422B	Signal Generator	US40050591	04-Sep-21
Agilent	E4419B	Power Meter	MY45104171	16-Sep-21
Agilent	E9304A	Power Sensor	MY41499013	16-Apr-21
Agilent	E9304A	Power Sensor	MY41499012	16-Apr-21
Rohde & Schwarz	NRP-Z91	Power Sensor	100734	12-Aug-21
Rohde & Schwarz	NRP-Z91	Power Sensor	100246	02-Jul-21
Agilent	E4419B	Power Meter	MY40510693	09-Jul-21
Agilent	E4419B	Power Meter	GB40202754	25-Feb-21
Agilent	N1913A	Power Meter	MY50000415	16-Mar-21
Marconi	2024	Signal Generator	112343/043	04-May-21
Rohde & Schwarz	NRVD	Power Meter	828110/019	09-Jan-21
Keysight	E9304A	Power Sensor	MY56100005	16-Apr-21
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100352	15-Oct-21
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100362	28-Jul-21
Rohde & Schwarz	NRP-Z91	Power Sensor	100732	24-Jul-21
Keysight	N5183B	MXG Analog Signal Gener	MY53270789	08-Feb-21

Condition of Instrument On Release:
In Tolerance to Internal Quality Standards

Calibration Completed By
Jeremy Toney, Calibration Technician

Attested and Issued on 25-Nov-20
George Cisneros, Calibration Supervisor

CALIBRATION REPORT

Electric Field Sensor

Model	*S/N*
E100	00237361
HI-2200	00206805

Date: 25 Nov 2020

X New Instrument
_ Other
_ Out of Tolerance
_ Within Tolerance

Frequency Response

Frequency Response		*Nominal Field*	*Cal Factor**	*Deviation*
	MHz	*V/m*	(Eapplied/Eindicated)	*dB*
1	1	20	1.05	-0.39
2	15	20	1.01	-0.09
3	30	20	1.02	-0.13
4	75	20	1.02	-0.17
5	100	20	1.03	-0.22
6	150	20	1.02	-0.18
7	200	20	1.01	-0.13
8	250	20	1.01	-0.06
9	300	20	1.01	-0.10
10	400	20	1.01	-0.08
11	500	20	1.07	-0.61
12	600	20	1.08	-0.66
13	700	20	1.07	-0.58
14	800	20	1.06	-0.53
15	900	20	1.10	-0.84
16	1000	20	1.01	-0.09
17	2000	20	1.04	-0.32
18	2450	20	1.06	-0.54
19	3000	20	0.97	0.30
20	3500	20	0.92	0.70
21	4000	20	0.99	0.09
22	5000	20	1.00	0.03
23	5500	20	1.24	-1.88
24	6000	20	1.35	-2.59

* Corrected electric field values (V/m) can be obtained by multiplying the Cal Factor with the indicated E field readings.

Linearity

maximum linearity deviation is 0.42 dB

(measurements taken from 0.3 V/m to 800 V/m at 27.12 MHz)

Test Conditions

Calibration performed at ambient room temperature: 23 ±3°C

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ETS·LINDGREN
An ESCO Technologies Company

PROBE ROTATIONAL RESPONSE

Model	E100
S/N	00237361
Date	Date of Calibration 25 November 2020
Time	01:04:34 PM
Isotropy *	+ 0.138 dB/ -0.138 dB

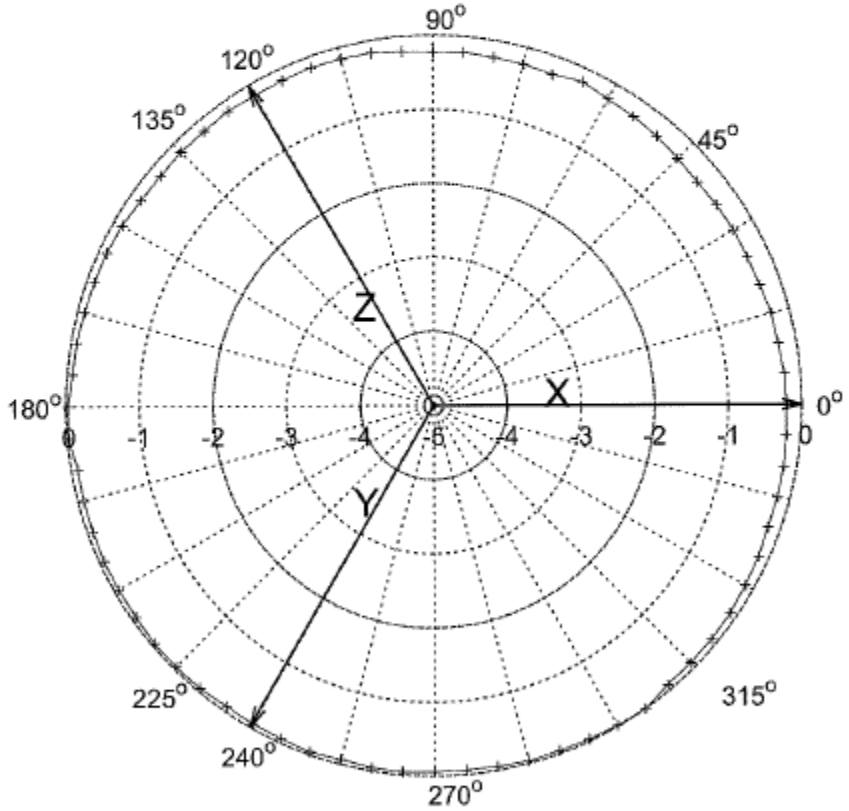

Figure 1: Probe Isotropic Response Chart.

Isotropic response is measured in a 20 V/m field at 400 MHz
*Isotropy is the maximum deviation from the geometric mean as defined by IEEE 1309-2013.

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Appendix C - Photos of Assessed Antennas

(Refer to Exhibit 7B)

Appendix D - MPE Measurement Results

Table D.1

MPE measurement data for Bystander

D.U.T. Info.							Probe Info.		Test Pos.	MPE Measurement										DUT Max. TX Factor	Avg. over Body (mW/ cm2)	Calc. P.D. (mW/ cm2)	Max Calc. P.D. (mW/ cm2)
										Bystander (BS) Positions													
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		20 cm	40 cm	60 cm	80 cm	100 cm	120 cm	140 cm	160 cm	180 cm	200 cm				
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	806.0000	18.0	17.8	CW	E	1.13	BS	0.019	0.028	0.079	0.164	0.254	0.226	0.17	0.132	0.066	0.034	0.5	0.132	0.066	0.067
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	815.0000	18.0	17.7	CW	E	1.14	BS	0.018	0.036	0.092	0.155	0.223	0.218	0.165	0.128	0.074	0.024	0.5	0.129	0.064	0.065
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	824.0000	18.0	17.9	CW	E	1.14	BS	0.016	0.05	0.077	0.195	0.294	0.277	0.2	0.135	0.059	0.028	0.5	0.152	0.076	0.077
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	851.0000	18.0	18.0	CW	E	1.17	BS	0.027	0.059	0.138	0.296	0.266	0.209	0.165	0.141	0.11	0.06	0.5	0.172	0.086	0.086
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	860.0000	18.0	18.0	CW	E	1.18	BS	0.027	0.068	0.127	0.271	0.285	0.196	0.151	0.127	0.102	0.059	0.5	0.166	0.083	0.083
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	869.0000	18.0	17.9	CW	E	1.18	BS	0.028	0.071	0.139	0.273	0.232	0.186	0.145	0.098	0.095	0.055	0.5	0.156	0.078	0.079
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	896.0000	18.0	17.9	CW	E	1.21	BS	0.048	0.091	0.144	0.299	0.252	0.202	0.128	0.05	0.03	0.018	0.5	0.152	0.076	0.077
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	898.5000	18.0	17.9	CW	E	1.21	BS	0.052	0.093	0.134	0.323	0.265	0.195	0.142	0.053	0.029	0.015	0.5	0.157	0.079	0.079
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	900.0000	18.0	18.0	CW	E	1.21	BS	0.05	0.089	0.167	0.302	0.243	0.193	0.126	0.059	0.033	0.019	0.5	0.155	0.078	0.078
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	935.0125	18.0	17.9	CW	E	1.14	BS	0.1	0.131	0.237	0.397	0.215	0.202	0.136	0.089	0.051	0.029	0.5	0.181	0.091	0.091
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	937.5000	18.0	17.9	CW	E	1.14	BS	0.106	0.153	0.231	0.355	0.198	0.238	0.143	0.08	0.051	0.031	0.5	0.180	0.090	0.091
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	939.0000	18.0	17.8	CW	E	1.13	BS	0.115	0.139	0.223	0.362	0.208	0.245	0.147	0.078	0.052	0.033	0.5	0.182	0.091	0.092
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	901.5000	4.0	4.0	CW	E	1.21	BS	0.01	0.02	0.042	0.086	0.089	0.072	0.032	0.012	0.009	0.005	0.5	0.046	0.023	0.023
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	940.5000	4.0	4.0	CW	E	1.13	BS	0.021	0.04	0.059	0.113	0.084	0.07	0.037	0.024	0.011	0.008	0.5	0.053	0.026	0.026

MPE calculations are defined in Section 13.0 .

Table D.2

MPE measurement data for Operator

D.U.T. Info.							Probe Info.		Test Pos.	MPE Measurement Operator (OP) Positions			DUT Max. TX Factor	Avg. over Body (mW/ cm2)	Calc. P.D. (mW/ cm2)	Max Calc. P.D. (mW/ cm2)
Ant Loc.	Ant. Model/ Desc.	Ant. Gain (dBi)	Tx Freq (MHz)	Max Pwr (W)	Initial Pwr (W)	Test Mode	E/H Field	Probe Cal. Factor		Head/ Top	Chest/ Middle	Lower Trunk/ Bottom				
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	806.0000	18.0	17.8	CW	E	1.13	OP	0.117	0.529	0.518	0.5	0.292	0.146	0.148
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	815.0000	18.0	17.7	CW	E	1.14	OP	0.124	0.485	0.496	0.5	0.279	0.140	0.142
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	824.0000	18.0	17.9	CW	E	1.14	OP	0.1	0.47	0.562	0.5	0.288	0.144	0.145
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	851.0000	18.0	18.0	CW	E	1.17	OP	0.132	0.436	0.563	0.5	0.293	0.147	0.147
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	860.0000	18.0	18.0	CW	E	1.18	OP	0.122	0.37	0.498	0.5	0.259	0.129	0.129
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	869.0000	18.0	17.9	CW	E	1.18	OP	0.102	0.321	0.487	0.5	0.239	0.120	0.120
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	896.0000	18.0	17.9	CW	E	1.21	OP	0.131	0.48	0.671	0.5	0.344	0.172	0.173
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	898.5000	18.0	17.9	CW	E	1.21	OP	0.141	0.523	0.669	0.5	0.358	0.179	0.180
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	900.0000	18.0	18.0	CW	E	1.21	OP	0.14	0.518	0.679	0.5	0.360	0.180	0.180
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	935.0125	18.0	17.9	CW	E	1.14	OP	0.31	0.622	0.729	0.5	0.421	0.211	0.212
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	937.5000	18.0	17.9	CW	E	1.14	OP	0.345	0.586	0.756	0.5	0.426	0.213	0.214
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	939.0000	18.0	17.8	CW	E	1.13	OP	0.349	0.575	0.764	0.5	0.425	0.213	0.215
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	901.5000	4.0	4.0	CW	E	1.21	OP	0.033	0.115	0.16	0.5	0.083	0.041	0.041
MC	HAF4038A, (806 MHz - 941 MHz)	5.15	940.5000	4.0	4.0	CW	E	1.13	OP	0.082	0.132	0.176	0.5	0.098	0.049	0.049

MPE calculations are defined in Section 13.0 .