MOTOROLA SOLUTIONS

MS ISO/IEC 17025
TESTING
SAMM No. 0826

ACCREDITED
CERTIFICATE 2518.05

DECLARATION OF COMPLIANCE: MPE ASSESSMENT Part 1 of 2

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Date of Report: 2/18/2020
Report Revision: A

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Report author:	Goh Jue Yie (EME Engineer)
Date(s) Tested:	3/8/2017-3/20/2017; 12/25/2019- 12/27/2019; 2/09/2020 - 2/12/2020
Manufacturer:	Futurecom Systems Group (DVR), Motorola Solutions. Inc (Mobile)
Date submitted for test:	01/13/2017; 12/23/2019
DUT Description:	**APX6500 UHF R1**: Multiple HW Encryption WiFi Interoperability Data Modem Tethering via WiFi or Cable **Companion Device**: DVR 800 (806-824 MHz; 851-869MHz), Digital Vehicular Repeater
Test TX mode(s):	CW
Max. Power output:	**APX6500 UHF R1**: 48W (380-470 MHz); 11.22 mW (Bluetooth); 6.3 mW (Bluetooth LE); 39.8 mW (WLAN 2.4GHz 802.11b), 15.8 mW (WLAN 2.4GHz 802.11g), 12.6mW (WLAN 2.4GHz 802.11n); 15.8mW (WLAN 5GHz 802.11a/n/ac) **Companion Device:** 10W (DVR 800)
TX Frequency Bands:	**APX6500 UHF R1:** 380-470 MHz; WLAN 2412-2462 MHz; WLAN 5180-5825 MHz; BT 2402-2480 MHz **Companion Device:** 806-824 MHz; 851-869 MHz
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:	**APX6500 UHF R1:** M25QSS9PW1BN (PMUE5620A) **Companion Device**: MOBEXCOM DVRS 800 (DQPMDVR8000P)
Model(s) Certified:	M22QSS9PW1BN (PMUE5620A), M24QSS9PW1BN (PMUE5620A), M25QSS9PW1BN (PMUE5620A), M36QSS9PW1BN (PMUE5620A), M25QSS9PW1BNI (PMUE5620A)
Serial Number(s):	471TVZ0903 (APX6500 UHF R1) , 17010530 (DVR 800)
Classification:	Occupational/Controlled Environment
FCC ID:	**APX6500 UHF R1**: AZ492FT7129 (406.1-470 MHz, 2402-2480 MHz, 2412-2462 MHz; 5180-5825 MHz) **Companion Device**: LO6-DVRS800 (806-824 MHz; 851-869MHz) This report contains results that are immaterial for FCC equipment approval, which are clearly identified.
IC:	**APX6500 UHF R1**: 109U-92FT7129 **Companion Device**: 2098B-DVRS800 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.

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.

Tiong Nguk Ing
Digitally signed by Tiong Nguk Ing
Date: 2020.04.02 14:20:53 +08'00'

Tiong Nguk Ing
Deputy Technical Manager (Approved Signatory)
Approval Date: 4/2/2020

Document Revision History

Date	Revision	Comments
2/18/2020	A	Initial release

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Appendices

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 APX6500 UHF R1 M25QSS9PW1BN (PMUE5620A) (FCC ID: AZ492FT7129) and Companion Device DVR 800 (FCC ID: LO6-DVRS800).

2.0 FCC MPE Summary

Table 1

APX6500 UHF R1 band (FCC ID: AZ492FT7129) Roof Mounted Antenna					
Equipment Class	Frequency Band (MHz)	Passenger		Bystander	
		Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
TNB	406.1-470 MHz	0.060	21.2%	0.030	12.2%
DTS	WLAN (2412-2462)	0.018	1.77%	0.018	1.77%
NII	WLAN (5180 - 5825)	0.007	0.67%	0.007	0.67%
DSS	BT (2402-2480)	0.005	0.50%	0.005	0.50%
Companion Device DVR 800 (FCC ID: LO6-DVRS800) Trunk Mounted Antenna					
Equipment Class	Frequency Band (MHz)	Passenger		Bystander	
		Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
TNB	806-824; 851-869	0.060	11.1%	0.028	4.9%
Simultaneous Transmissions					
Simultaneous Transmissions conditions		Passenger		Bystander	
		Highest Combine % of limit		Highest Combine % of limit	
APX6500 (UHF R1 band) + WLAN + DVR 800		30.0%		15.3%	

3.0 Abbreviations / Definitions

CNR: Calibration Not Required
CW: Continuous Wave
DUT: Device Under Test
EME: Electromagnetic Energy
FM: Frequency Modulation
MPE: Maximum Permissible Exposure
GPS: Global Positioning System
LMR: Land Mobile Radio
SAR: Specific Absorption Rate
NA: Not Applicable
BS: Bystander
PB: Passenger Back seat
PF: Passenger Front seat
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

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			

Table 2 – Occupational / Controlled Exposure Limits (Con't.)

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
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				$3.33\times10^{-4} f$

Table 3 – General Population / Uncontrolled 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				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
Automobile	Volvo 240-1988	NA	NA	NA
Survey Meter Probe – E-Field Probe – H-Field	ETS Model HI-2200 ETS Model E100 ETS Model H200	00206805 00126277 00084225	04/01/2019	04/01/2020

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

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

APX6500 UHF R1 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.

MOBEXCOM DVR 800 is Digital Vehicular Repeater (DVR) manufactured by Futurecom System Group. At standalone the DVR operates at a maximum power up to 20W, but when the DVR is interfaced to the APX6500 Mobile radio, the maximum power is 10W as listed in Table 6. For more detailed information refer to the Product Safety and RF Energy Exposure Booklet for DVR.

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 (W)
APX6500 (UHF R1)	380-470 (UHF1 band)	50 (PTT)	48
	BT 2402-2480	100	0.0112
	BT LE 2402-2480	100	0.0063
	WLAN 2400 – 2462 (802.11b/g/n)	100	0.0398 (802.11b)
			0.0158 (802.11g)
			0.0126 (802.11n)
	WLAN 5180-5825 (802.11 a/n/ac)	100	0.0158
DVR 800	806-824; 851-869	100	10

This test report covers the RF exposure performance of the APX6500 UHF R1 FCC ID: AZ492FT7129 interfaced with, and transmitting simultaneously with Companion device (DVR 800) FCC ID: LO6-DVRS800. DVR operate in repeater; transmit with duty cycle up to 100%. A duty factor of 50% applies for APX6500 UHF R1 with PTT operating mode.

Table 7 lists the simultaneous transmission conditions.

Table 7 – Simultaneous transmission conditions

Simultaneous transmission conditions	APX6500 UHF R1	DVR 800
APX6500 UHF R1 + DVR 800	x	x

Note:
x: Simultaneous transmitting antennas

This device will be marketed to and used by employees solely for work-related operations. User training is the responsibility of these organizations. The Product Safety and RF Energy Exposure Booklet for Digital Vehicular Repeater Systems (DVRS) contains all the information necessary to inform the organization and its employees in safe usage and for creating training materials or conducting instructional sessions for those employees.

Accordingly this product is classified as Occupational/Controlled Exposure. However, in accordance with FCC requirements, the passengers inside the vehicle and the bystanders external to the vehicle 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 APX6500 UHF R1 Mobile radio and Companion device (DVR 800) installed in the test vehicle, at the specified distances and test locations indicated in sections 12.0, 13.0 and Appendix A.

All antennas described in Table 8 were considered in order to develop the test plan for this product. Antennas were installed and tested per their appropriate mount locations (Roof / Trunk) and defined test channels. The DVR antenna mounted at center of the trunk (for external/bystander measurement) or toward the center of the trunk at a minimum 85 cm from backseat passenger (for Internal/passenger measurement), and the APX6500 UHF R1 Mobile radio antennas are mounted at the center of the roof.

The system was tested using a low-loss 16’ Teflon RG58A/U cable attaching the radio to the transmit antenna. This cable is shorter and lower attenuation than the 17’ RG58A/U cables supplied in the customer kits for connecting the radio to the transmit antenna. The cable used in the test setup also has lower attenuation over the test frequency range than the cable provided in the customer kits. The use of a shorter cable with lower attenuation in the test setup ensures that the test data is more conservative with regards to the actual installation. Cable losses are reported in Appendix A.

12.0 Method of Measurement for DVR with trunk mounted antenna(s)

12.1 External/Bystander vehicle MPE measurements

Initially the DVR antenna is located at the center of the trunk. Refer to Appendix A for antenna location and distance.

MPE measurements for bystander (BS) conditions are determined by taking the average of (10) measurements in a 2 m vertical line for each of the (5) bystander test locations indicated in Appendix A with 20 cm height increments, with the distance of 90cm from the test vehicle's body, as stated in the user manual. 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 vehicle.

12.2 Internal/Passenger vehicle MPE measurements

The DVR antenna is located toward the center of the trunk at a minimum 85 cm from backseat passenger. Refer to Appendix A for antenna location and distance.

MPE measurements for passenger front seat (PF) and backseat (PB) conditions are determined by taking the average of the (3) measurements (Head, Chest, and Lower Trunk) inside the vehicle for both the front and back seats.

The backseat is a bench seat and therefore each position (Head, Chest & Lower Trunk) were scanned across (horizontally) the seat starting from the middle of the seat to the edge of the seat stopping 20 cm from the vehicle door. Similar process was used in the front bucket seat.

The probe handle is oriented parallel (horizontal) to the ground and pointed towards the back of the vehicle. The probe handle is not oriented normal to the seat surface. The probe head (incorporating the field sensors) is scanned continuously (using the max-hold function available in the meter) along three test axes which are parallel to the seat angle (intended as the line determined by the intersection of the plane of the seat and the plane of the backrest) and are 20 cm from the seat surface. One test axis is at the Head height, another is at the Chest height, and another is at the Lower Trunk height. The maximum field level value recorded for each test axis is logged. The MPE is determined by averaging these three maximum values regardless of the geometrical location where they were observed. For instance, the locations of the three maxima may lie on different vertical (relative to ground) lines.

This approach leads to results that are representative of the exposure of vehicle occupants since it is based on an average across the body portions closest to the antenna for trunk mount positions, and is conservatively biased because the highest results for each test axis are combined, e.g. the highest head exposure could be in the middle of the seat while the highest lower trunk exposure could be closer to the door.

13.0 Method of Measurement APX6500 UHF R1 Mobile radio with roof mounted antenna(s)

The installation requirements for this radio indicate that in multiple single-band antenna configurations and the antennas should be installed at the center of the roof.

13.1 External/Bystander vehicle MPE measurements

Antenna is located at the center of the roof. (Refer to Appendix A for antenna location and distance)

MPE measurements for bystander (BS) conditions are determined by taking the average of (10) measurements in a 2m vertical line for each of the (5) bystander test locations indicated in Appendix A with 20 cm height increments at the test distance of 90cm from the test vehicle body.
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 vehicle.

13.2 Internal/Passenger vehicle MPE measurements

Antenna is located at the center of the roof. (Refer to Appendix A for antenna location and distance)

MPE measurements for passenger front seat (PF) and backseat (PB) conditions are determined by taking the average of the (3) measurements (Head, Chest, and Lower Trunk) inside the vehicle for both the front and back seats.

The backseat is a bench seat and therefore each position (Head, Chest & Lower Trunk) were scanned across (horizontally) the seat starting from the middle of the seat to the edge of the seat stopping 20 cm from the vehicle door. Similar process was used in the front bucket seat.

The probe handle is oriented parallel (horizontal) to the ground and pointed towards the back of the vehicle. The probe handle is not oriented normal to the seat surface. The probe head (incorporating the field sensors) is scanned continuously (using the max-hold function available in the meter) along three test axes which are parallel to the seat angle (intended as the line determined by the intersection of the plane of the seat and the plane of the backrest) and are 20 cm from the seat surface. One test axis is at the Head height, another is at the Chest height, and another is at the Lower Trunk height. The maximum field level value recorded for each test axis is logged. The MPE is determined by averaging these three maximum values regardless of the geometrical location where they were observed. For instance, the locations of the three maxima may lie on different vertical (relative to ground) lines.

This approach leads to results that are representative of the exposure of vehicle occupants since it is based on an average across the body portions closest to the antenna for both trunk and roof mount positions, and is conservatively biased because the highest results for each test axis are combined, e.g. the highest head exposure could be in the middle of the seat while the highest lower trunk exposure could be closer to the door.

14.0 MPE Variability Requirement for External/Bystander vehicle MPE measurement

If all the MPE bystander measurements for a particular antenna are below 50% of the FCC MPE limit, no variability testing for that antenna is required.

If one or more MPE bystander measurements for a particular is between 50-80% of the FCC MPE limit, with no results > 80%, variability testing shall be done on the single worst case for that antenna.

For any MPE bystander measurement above 80% of the MPE limit, variability testing shall be done for all of such configuration. When SAR simulation is performed for a particular antenna configuration to determine compliance, variability measurements are not required for that antenna configuration.

15.0 MPE Calculations

The final MPE results for APX6500 UHF R1 Mobile radio and Companion device (DVR 800) are presented in section 17.0. These results are based on 50% duty cycle for APX6500 UHF R1 (PTT operation) and 100% duty cycle for DVR 800 (repeater operation).

Below is an explanation of how the MPE results are calculated. Refer to Appendix F for APX6500 UHF R1; Appendix G for Companion device (DVR 800).

External to vehicle (Bystander) - 10 measurements are averaged over the body (*Avg_over_body*).
Internal to vehicle (Passengers) - 3 measurements are averaged over the body (*Avg_over_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.)*

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

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

16.0 Antenna Summary

Table below summarizes the tested or evaluated antennas and their descriptions, mount location (roof/trunk), overlap of FCC bands, number of test channels per FCC KDB 447498 (FCC N_c). This information was used to determine the test configurations presented in this report.

Table 8

Antenna No.	Antenna Model	Frequency Range (MHz)	Physical Length (cm)	Gain (dBi)	Remarks	Mount Location (Roof/ Trunk)	Overlap FCC Bands (MHz)	FCC N_c
APX6500 UHF R1								
1	HAE4003A	450-470	16	2.15	1/4 wave	Roof	450-470	3
2	HAE4011A	450-470	73.2	5.65	1/2 wave	Roof	450-470	3
3	HAE6010A	380-433	63.5	5.65	1/2 wave	Roof	406.1-433	3
4	HAE6011A	380-433	91.0	7.15	5/8 Wave	Roof	406.1-433	3
5	HAE6012A	380-433	18.2	2.15	1/4 wave	Roof	406.1-433	3
6	HAE6013A	380-470	29	4.15	1/2 wave	Roof	406.1-470	5
7	HAE6015A	450-520	26.2	4.15	1/2 wave	Roof	450-470	3
8	HAE6016A	450-512	8.3	2.15	1/4 wave	Roof	450-470	3
9	HAE6031A	380-520	28	4.15	1/2 wave	Roof	406.1-470	5
10	*RAE4014ARB	445-470	92.7 (450.0125 MHz) 90.5 (460 MHz) 89.0 (469.9875 MHz)	7.15	5/8 Wave	Roof	445-470	3
11	PMAN5100A	2400-2500	5.7 (L) x 1.9 (W)	3.0		Glass mount	2412-2462	3
12	PMAN5101A	2400-2500 / 4900-5900	5.4 (L) x 1.32 (W)	2.7 / 0.2		Glass mount	2412-2462 ; 5180-5825	3
13	AN000163A01	2400-2500 / 4900-5900	7	3.5 / 3.3	Monopole	Roof/ Trunk	2412-2462 ; 5180-5825	3
14	AN000163A05	2400-2500 / 4900-5900	7	2.5 / 1.6	Monopole	Roof/ Trunk	2412-2462 ; 5180-5825	3
DVR 800								
15	HAF4016A	764-870	9	2.15	1/4 wave	Trunk	769-775; 799-806	4

17.0 Test Results Summary

17.1 MPE Test Results Summary for APX6500 UHF R1 Mobile radio and DVR 800

Refer to the following appendices for MPE test results for each test configuration: antenna location, test positions (BS1-Bystander test location #1, BS2-Bystander test location #2, BS3-Bystander test location #3, BS4-Bystander test location #4, BS5-Bystander test location #5, PB-Passenger Backseat, PF-Passenger Front seat), E/H field measurements, antenna model & freq. range, maximum output power, initial power, TX frequency, max calculated power density results, applicable FCC specification limits and % of the applicable specification limits.

- Appendix D for APX6500 UHF R1
- Appendix E for Companion Device (DVR 800)

Table 9 summarized the highest maximum calculated power density and highest % of the applicable specification limit for each standalone transmitters (APX6500 UHF R1 Mobile radio and DVR 800).

Table 9

Test Positions	APX6500 (FCC ID: AZ492FT7129)		DVR 800 (FCC ID: LO6-DVRS800)	
	Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
FCC US				
Passenger, Front Seat (PF)	0.06	21.2%	0.03	5.8%
Passenger, Back Seat (PB)	0.05	17.1%	0.06	11.1%
Bystander #1 (BS-1)	0.03	12.2%	0.01	1.0%
Bystander #2 (BS-2)	0.03	9.5%	0.02	2.9%
Bystander #3 (BS-3)	0.03	10.5%	0.02	3.0%
Bystander #4 (BS-4)	0.02	5.6%	0.03	4.9%
Bystander #5 (BS-5)	0.01	4.2%	0.02	3.0%
ISED Canada				
Passenger, Front Seat (PF)	0.06	36.2%	0.03	12.7%
Passenger, Back Seat (PB)	0.05	30.2%	0.06	23.5%
Bystander #1 (BS-1)	0.03	20.9%	0.01	2.2%
Bystander #2 (BS-2)	0.03	15.7%	0.02	6.1%
Bystander #3 (BS-3)	0.03	18.0%	0.02	6.4%
Bystander #4 (BS-4)	0.02	9.7%	0.03	10.5%
Bystander #5 (BS-5)	0.01	7.3%	0.02	6.4%

17.2 MPE Test Results for Bluetooth and WLAN

Antenna PMAN5100A and PMAN5101A was intended for mounting on the windshield of the vehicle. These antennas should be installed close to the top, and on the front windshield only. Antennas AN000163A01 and AN000163A05 support WLAN 2.4 GHz / 5 GHz should be installed at roof or trunk of the vehicle. 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

$$S = \frac{P_t G}{4\Pi d^2} F$$

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

Table 10

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/cm²)	MPE Spec Limit (mW/cm²) FCC	% To FCC Spec Limit	ICNIRP	% To ICNIRP Spec Limit	ISED limit	% To ISED Spec Limit
WLAN 2.4 GHz														
AN000163A01	0.040	100%	2412.0	3.50	0.00	20	1.00	0.018	1.00	1.77	1.00	1.77	0.54	3.30
AN000163A01	0.040	100%	2437.0	3.50	0.00	20	1.00	0.018	1.00	1.77	1.00	1.77	0.54	3.28
AN000163A01	0.040	100%	2462.0	3.50	0.00	20	1.00	0.018	1.00	1.77	1.00	1.77	0.54	3.26
AN000163A05	0.040	100%	2412.0	2.50	0.00	20	1.00	0.014	1.00	1.41	1.00	1.41	0.54	2.62
AN000163A05	0.040	100%	2437.0	2.50	0.00	20	1.00	0.014	1.00	1.41	1.00	1.41	0.54	2.61
AN000163A05	0.040	100%	2462.0	2.50	0.00	20	1.00	0.014	1.00	1.41	1.00	1.41	0.54	2.59
PMAN5100A	0.040	100%	2412.0	3.00	0.00	20	1.00	0.016	1.00	1.58	1.00	1.58	0.54	2.94
PMAN5100A	0.040	100%	2437.0	3.00	0.00	20	1.00	0.016	1.00	1.58	1.00	1.58	0.54	2.92
PMAN5100A	0.040	100%	2462.0	3.00	0.00	20	1.00	0.016	1.00	1.58	1.00	1.58	0.54	2.90
PMAN5101A	0.040	100%	2412.0	2.70	0.00	20	1.00	0.015	1.00	1.47	1.00	1.47	0.54	2.75
PMAN5101A	0.040	100%	2437.0	2.70	0.00	20	1.00	0.015	1.00	1.47	1.00	1.47	0.54	2.73
PMAN5101A	0.040	100%	2462.0	2.70	0.00	20	1.00	0.015	1.00	1.47	1.00	1.47	0.54	2.71
WLAN 5 GHz														
AN000163A01	0.016	100%	5180.0	3.30	0.00	20	1.00	0.007	1.00	0.67	1.00	0.67	0.90	0.75
AN000163A01	0.016	100%	5502.5	3.30	0.00	20	1.00	0.007	1.00	0.67	1.00	0.67	0.94	0.71
AN000163A01	0.016	100%	5825.0	3.30	0.00	20	1.00	0.007	1.00	0.67	1.00	0.67	0.98	0.69
AN000163A05	0.016	100%	5180.0	1.60	0.00	20	1.00	0.005	1.00	0.46	1.00	0.46	0.90	0.50
AN000163A05	0.016	100%	5502.5	1.60	0.00	20	1.00	0.005	1.00	0.46	1.00	0.46	0.94	0.48
AN000163A05	0.016	100%	5825.0	1.60	0.00	20	1.00	0.005	1.00	0.46	1.00	0.46	0.98	0.46
PMAN5101A	0.016	100%	5180.0	0.20	0.00	20	1.00	0.003	1.00	0.33	1.00	0.33	0.90	0.36
PMAN5101A	0.016	100%	5502.5	0.20	0.00	20	1.00	0.003	1.00	0.33	1.00	0.33	0.94	0.35
PMAN5101A	0.016	100%	5825.0	0.20	0.00	20	1.00	0.003	1.00	0.33	1.00	0.33	0.98	0.34
Bluetooth 2.4 GHz														
AN000163A01	0.011	100%	2402.0	3.50	0.00	20	1.00	0.005	1.00	0.50	1.00	0.50	0.54	0.93
AN000163A01	0.011	100%	2441.0	3.50	0.00	20	1.00	0.005	1.00	0.50	1.00	0.50	0.54	0.92
AN000163A01	0.011	100%	2480.0	3.50	0.00	20	1.00	0.005	1.00	0.50	1.00	0.50	0.55	0.91
AN000163A05	0.011	100%	2402.0	2.50	0.00	20	1.00	0.004	1.00	0.40	1.00	0.40	0.54	0.74
AN000163A05	0.011	100%	2441.0	2.50	0.00	20	1.00	0.004	1.00	0.40	1.00	0.40	0.54	0.73
AN000163A05	0.011	100%	2480.0	2.50	0.00	20	1.00	0.004	1.00	0.40	1.00	0.40	0.55	0.73
PMAN5100A	0.011	100%	2402.0	3.00	0.00	20	1.00	0.004	1.00	0.45	1.00	0.45	0.54	0.83
PMAN5100A	0.011	100%	2441.0	3.00	0.00	20	1.00	0.004	1.00	0.45	1.00	0.45	0.54	0.82
PMAN5100A	0.011	100%	2480.0	3.00	0.00	20	1.00	0.004	1.00	0.45	1.00	0.45	0.55	0.81
PMAN5101A	0.011	100%	2402.0	2.70	0.00	20	1.00	0.004	1.00	0.42	1.00	0.42	0.54	0.78
PMAN5101A	0.011	100%	2441.0	2.70	0.00	20	1.00	0.004	1.00	0.42	1.00	0.42	0.54	0.77
PMAN5101A	0.011	100%	2480.0	2.70	0.00	20	1.00	0.004	1.00	0.42	1.00	0.42	0.55	0.76

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)

17.3 Simultaneous Transmission

APX6500 mobile will transmit simultaneously with Companion device (DVR 800); refer to Table 7 for all simultaneous transmission conditions.

The combine MPE results for APX6500 7/800MHz and Companion device (DVR 800) were calculated base on the percent of MPE limit for each applicable test channels according to the formula below. This is due to the signals emitted by each individual transmitter are statistically uncorrelated; the collective compliance of the transmitters is determined by summing the individual ratios between actual measured power density (S) and maximum allowed MPE exposure. Compliance is achieved if the total exposure (T) is less than one.

Formula:

$$T = \frac{S_1}{MPE_1} + \frac{S_2}{MPE_2} + \ldots < 1$$

The highest combined power density percentage of the applicable specification limits are indicating in table 11.

Table 11- Highest Combine MPE % of limits

Test Positions	APX6500 (FCC ID: AZ492FT7129)		DVR 800 (FCC ID: LO6-DVRS800)	APX6500 + WLAN + DVR 800	
	UHF R1	WLAN	800 MHz band		
	[1] Highest % of Limit	[2] Highest % of Limit	[3] Highest % of Limit	[1]+[2]+[3] Combine % of Limit	Table No.
FCC US					
Passenger, Front Seat (PF)	21.2%	1.77%	5.8%	28.8%	
Passenger, Back Seat (PB)	17.1%	1.77%	11.1%	30.0%	
Bystander #1 (BS-1)	12.2%	1.77%	1.0%	15.0%	
Bystander #2 (BS-2)	9.5%	1.77%	2.9%	14.2%	
Bystander #3 (BS-3)	10.5%	1.77%	3.0%	15.3%	
Bystander #4 (BS-4)	5.6%	1.77%	4.9%	12.3%	
Bystander #5 (BS-5)	4.2%	1.77%	3.0%	9.0%	
ISED Canada					
Passenger, Front Seat (PF)	36.2%	3.30%	12.7%	52.2%	
Passenger, Back Seat (PB)	30.2%	3.30%	23.5%	57.0%	
Bystander #1 (BS-1)	20.9%	3.30%	2.2%	26.4%	
Bystander #2 (BS-2)	15.7%	3.30%	6.1%	25.1%	
Bystander #3 (BS-3)	18.0%	3.30%	6.4%	27.7%	
Bystander #4 (BS-4)	9.7%	3.30%	10.5%	23.5%	
Bystander #5 (BS-5)	7.3%	3.30%	6.4%	17.0%	

18.0 Conclusion

The assessment for APX6500 UHF R1 and Companion device (DVR 800) were performed as indicates in section 17.1 with an output power range listed in Table 6. 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 APX6500 UHF R1 and Companion device (DVR 800) scaled to maximum allowable power output are indicated in Table 12 (FCC US) and Table 13 (ISED Canada) for internal/passenger of to the vehicle, and external/bystander to the vehicle.

These MPE results herein demonstrate compliance to FCC Occupation/Controlled Exposure limit. However, FCC rules required compliance for Passengers and Bystanders to FCC General Population / Uncontrolled limits. Maximum Combined MPE percentage in bold exceed General Population / Uncontrolled limit.

Table 12 – Maximum MPE RF Exposure Summary (FCC US)

APX6500 UHF R1 band (FCC ID: AZ492FT7129) Roof Mounted Antenna					
Equipment Class	Frequency Band (MHz)	Passenger		Bystander	
		Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
TNB	406.1-470 MHz	0.060	21.2%	0.030	12.2%
DTS	WLAN (2412-2462)	0.018	1.77%	0.018	1.77%
NII	WLAN (5180 - 5825)	0.007	0.67%	0.007	0.67%
DSS	BT (2402-2480)	0.005	0.50%	0.005	0.50%
Companion Device DVR 800 (FCC ID: LO6-DVRS800) Trunk Mounted Antenna					
Equipment Class	Frequency Band (MHz)	Passenger		Bystander	
		Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
TNB	806-824; 851-869	0.060	11.1%	0.028	4.9%
Simultaneous Transmissions					
Simultaneous Transmissions conditions		Passenger		Bystander	
		Highest Combine % of limit		Highest Combine % of limit	
APX6500 (UHF R1 band) + WLAN + DVR 800		30.0%		15.3%	

Table 13 – Maximum MPE RF Exposure Summary (ISED Canada)

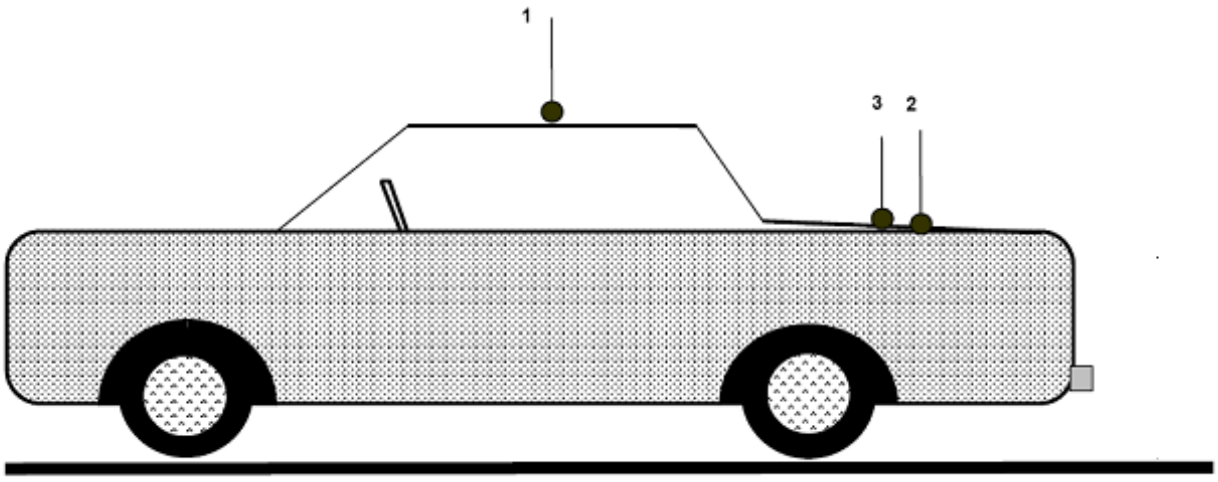
APX6500 UHF R1 band (IC: 109U-92FT7129) Roof Mounted Antenna				
Frequency Band (MHz)	Passenger		Bystander	
	Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
406.1-430, 450-470	0.060	36.2%	0.030	20.9%
2.4GHz WLAN (2412-2462)	0.018	3.3%	0.018	3.3%
5GHz WLAN (5180 - 5825)	0.007	0.8%	0.007	0.8%
BT (2402-2480)	0.005	0.9%	0.005	0.9%
Companion Device DVR 800 (IC: 2098B-DVRS800) Trunk Mounted Antenna				
Frequency Band (MHz)	Passenger		Bystander	
	Power Density (mw/cm^2)	Highest % of Limit	Power Density (mw/cm^2)	Highest % of Limit
806-824; 851-869	0.060	23.5%	0.028	10.5%
Simultaneous Transmissions				
Simultaneous Transmissions conditions	Passenger		Bystander	
	Highest Combine % of limit		Highest Combine % of limit	
APX6500 (UHF R1 band) + WLAN + DVR 800	57.0%		27.7%	

19.0 User Instructions Considerations

In order to facilitate the requirements for occupational exposure limits, the Safety Manual for this radio requires the radio operator to maintain 90 cm in all directions between the vehicle and external persons while transmitting.

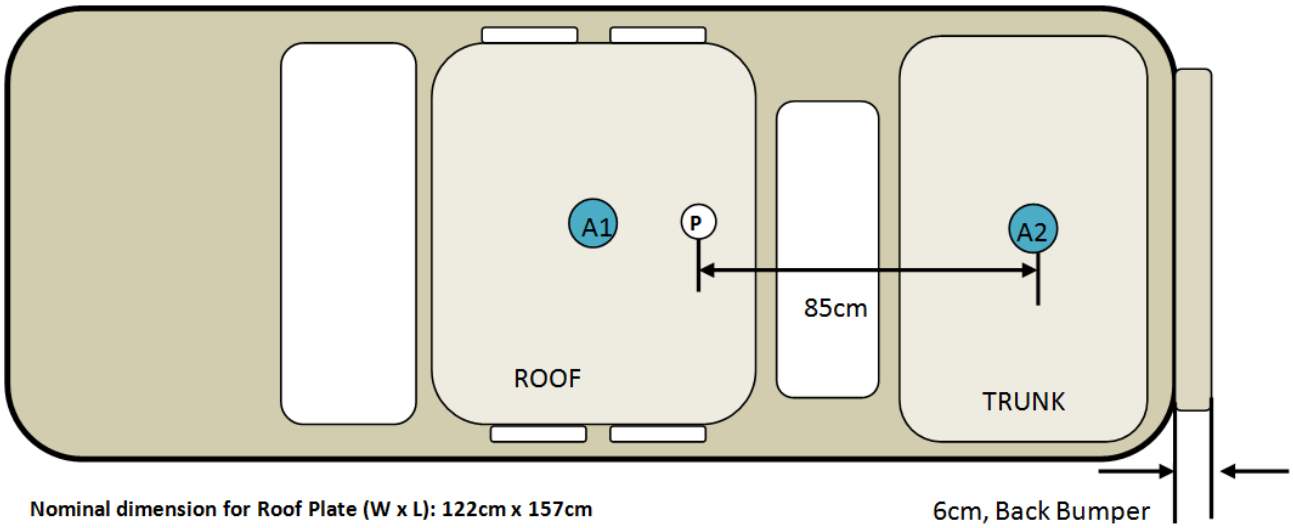
Appendix A - Antenna Locations, Test Distances, and Cable Losses

Antenna locations



1. Roof (center)
2. Trunk (85cm from back of the back seat)
3. Trunk (center)

Passenger Antenna mounting



Nominal dimension for Roof Plate (W x L): 122cm x 157cm

Nominal dimension for Trunk Plate (W x L): 138cm x 72cm

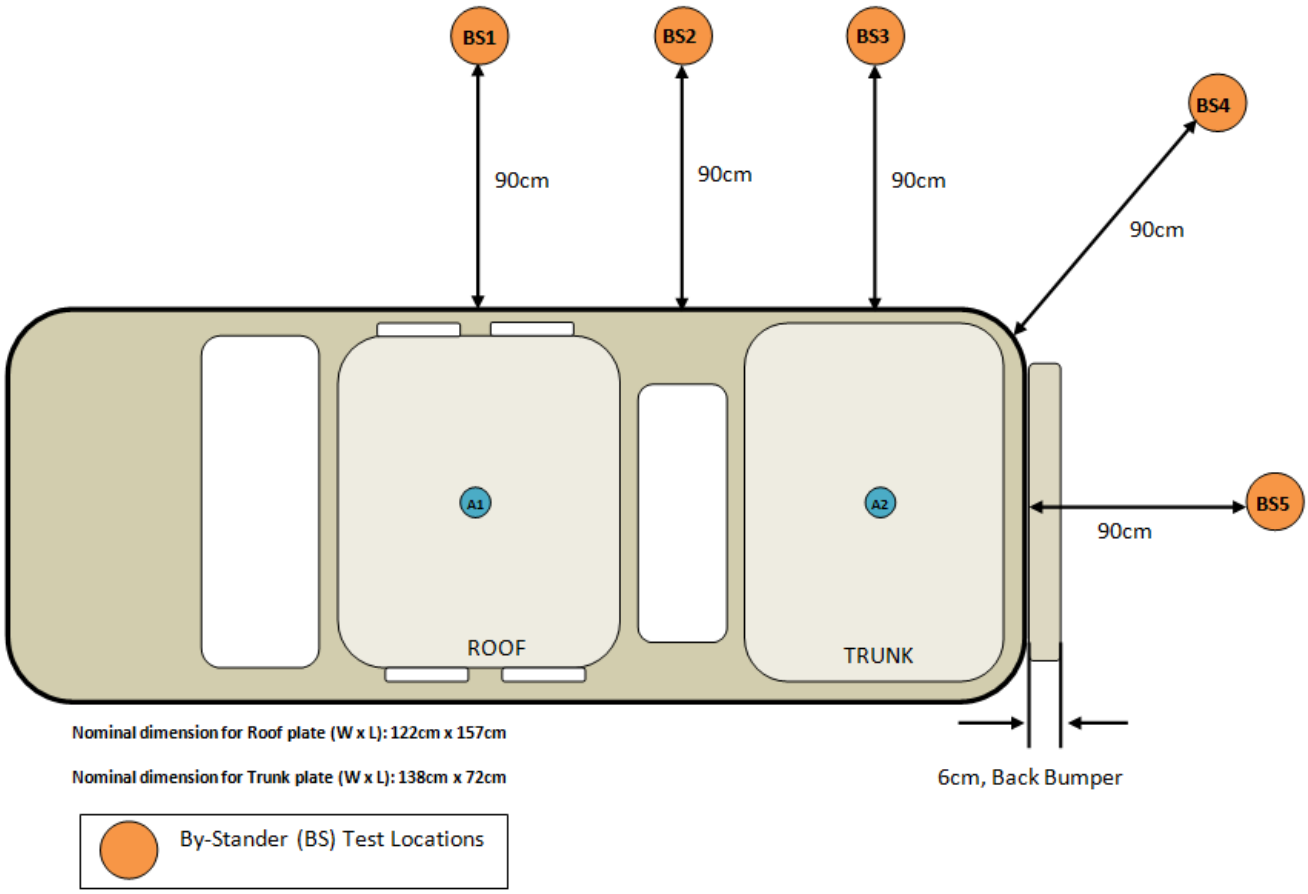
Notes:

1.) Antenna location A1: APX mobile radio roof antenna mounting locations for passenger back and front testing.

2.) Antenna location A2: DVR trunk antenna mounting locations for passenger back and front testing

3.) Total distance between trunk mount antenna and rear passenger is 85cm

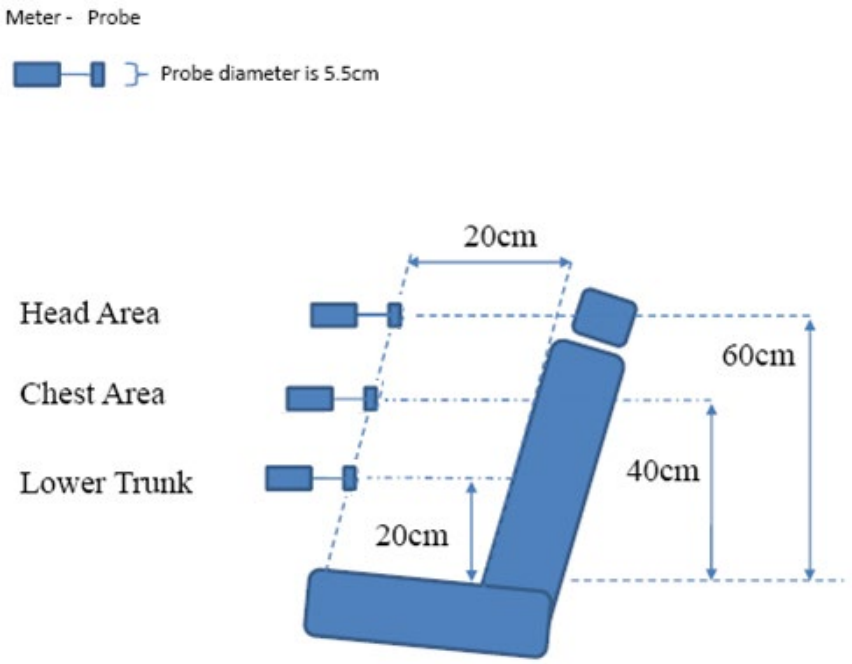
Bystander Antenna mounting



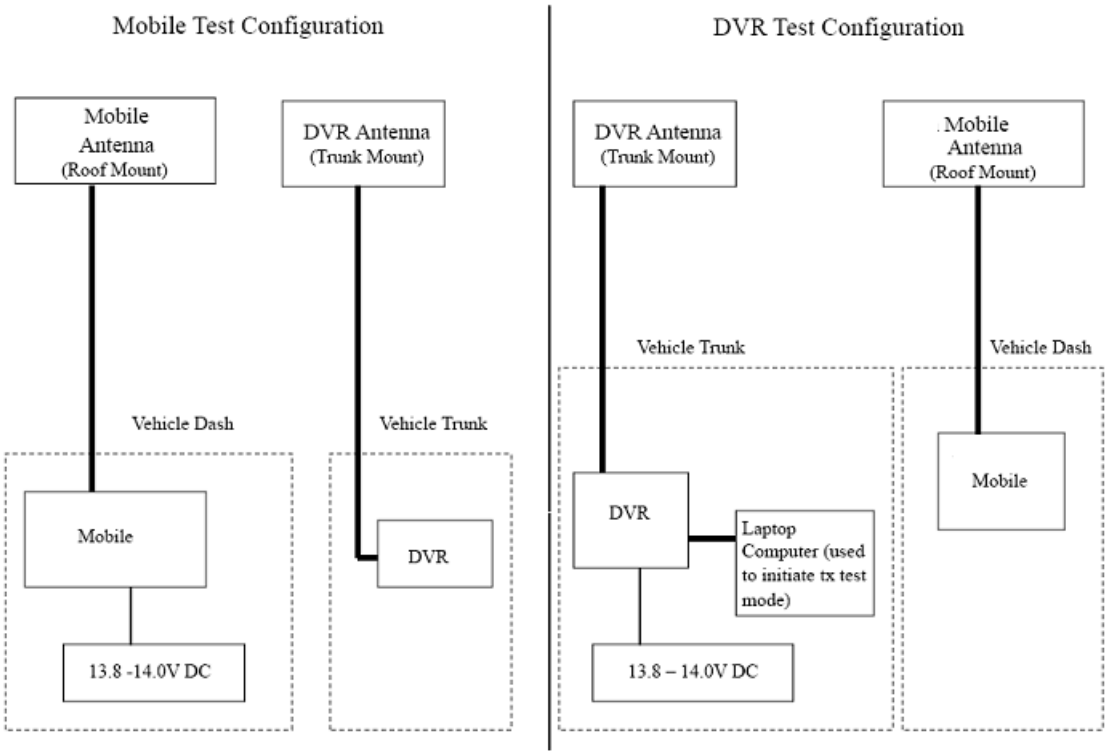
Note:

1.) Antenna location A1: APX mobile radio roof antenna mounting locations for passenger and bystander testing
2.) Antenna location A2: DVR trunk antenna mounting locations for bystander testing
3.) Bystander location BS2: Center point of the bystander test location BS1 and test location BS3
4.) Bystander location BS (1-5): 90cm away from the vehicle body. Apply for both roof and trunk testing

Seat scan areas
(Applicable to both front and back seats)



MPE Test Configuration



Cable Losses

Test Cable

Teflon RG58A/U Loss Per 100 Feet

160 MHz - 5 dB

450 MHz - 9 dB

1 GHz - 13.8 dB

Customer Cable

RG-58A/U Loss Per 100 Feet (For LMR)

136 MHz – 5.5 dB

450 MHz – 9.6 dB

900 MHz – 13.9 dB

PFP 240 Loss Per 100 Feet (For BT/WLAN)

2500 MHz - 12.9 dB

Appendix B - Probe Calibration Certificates

Service Test Report
QAF 1126, 03/11
Report ID: 129185

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

ETS-LINDGREN
An ESCO Technologies Company
Tracking # S000045944
Equipment Check
Attested by GC Date: 01-Apr-19
www.ets-lindgren.com

Certificate of Test Conformance

Page 1 of 1

Reference: S 000045944

Customer: Motorola Solutions Malaysia Sdn Bhd (Innoplex) - Plot 2A, Medan Bayan Lepas, Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia. Bayan Lepas Penang 11900 Malaysia

The instrument listed below has been tested and verified to Internal Quality Standards. Test data is Attached. Equipment used during instrument testing is controlled by laboratory compliance with ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994 using ETS-Lindgren Quality Management System internal procedures.

Manufacturer	ETS-Lindgren
Instrument Type	RF Survey Meter
Model	HI-2200
Serial Number/ID	00206805

Status In
In Tolerance
Date Completed
01-Apr-19
Status Out
Compliant with Internal Quality Standards

Remarks
Functional test performed with customer's E100 S/N: 00126277 and H200 S/N: 00084225. Firmware Updated.

I would like to take this opportunity to express our appreciation for using ETS-Lindgren for your EMI test equipment services and I am looking forward to continued business with your organization. Please feel free to contact our offices at (512) 531-6400, if you have any questions regarding this report.

Sincerely,

George Cisneros
Calibration Supervisor

Date Attested: 01-Apr-19

ACCREDITED Calibration Laboratory Certificate 1207.01

Cert I.D.: 129186

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

ETS-LINDGREN An ESCO Technologies Company
Track# S000045944 Ltd Cal ☐
By JAA Date 01-Apr-19
Next Cal Due
www.ets-lindgren.com

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:	*00126277*	**Date Code:**	
Tracking Number:	**S 000045944**	**Alternate ID:**	
Date Completed:	01-Apr-19	**Customer:**	Motorola Solutions Malaysia Sdn Bhd (Innoplex) - Plot 2A, Medan Bayan Lepas, Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia. Bayan Lepas Penang 11900 Malaysia
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: Probe received in tolerance thus before and after data are the same. Probe calibrated with customer's HI-2200 S/N: 00206805.

Calibration Traceability: All Measuring and Test Equipment (M/TE) identified below are traceable to the SI units through the National Institute for Standards and Technology (NIST) or other recognized National Metrology Institute. Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994.

Standards and Equipment Used:

Make / Model / Name / S/N / Recall Date				
HP	8648C	Signal Generator	3836U02236	18-Apr-19
Keysight	E9304A	Power Sensor	MY56100039	18-Apr-19
Hewlett Packard	E4422B	Signal Generator	US40050591	09-Aug-19
Agilent	E4419B	Power Meter	MY45104171	20-May-19
Rohde & Schwarz	SMB 100A	Signal Generator	101558	17-Sep-19
Agilent	E9304A	Power Sensor	MY41499013	18-Apr-19
Agilent	E9304A	Power Sensor	MY41499012	18-Apr-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100734	18-Apr-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100246	29-Jan-20
Agilent	N1913A	Power Meter	MY50000415	19-Feb-20
Marconi	2024	Signal Generator	112343/043	06-Apr-19
Rohde & Schwarz	NRVD	Power Meter	100451	01-Oct-19
Hewlett Packard	E4419B	Power Meter	US39250717	14-Aug-20
Keysight	E9304A	Power Sensor	MY56100005	18-Apr-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100352	27-Jul-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100037	28-Sep-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100362	13-Dec-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100732	19-Apr-19
Keysight	N5183B	MXG Analog Signal Gener	MY53270789	10-Jan-20

Condition of Instrument
Upon Receipt:
In Tolerance to Internal Quality Standards

On Release:
In Tolerance to Internal Quality Standards

Calibration Completed By
Julio A. Aquino, Calibration Technician

Attested and Issued on 01-Apr-19
George Cisneros, Calibration Supervisor

This document provides traceability of measurements to recognized national standards using controlled processes at the ETS-Lindgren Calibration Laboratory. Uncertainties listed are derived from the methods described by NIST Tech Note 1297. This certificate and report may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-2005 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 population unless otherwise noted. QAF 1127 (03/11)

CALIBRATION REPORT

Electric Field Sensor

Model	*S/N*
E100	00126277
HI-2200	00206805

Date: 01 Apr 2019

New Instrument
_ Other
_ Out of Tolerance
X Within Tolerance

Frequency Response

Frequency Response		*Nominal Field*	*Cal Factor**	*Deviation*
	MHz	*V/m*	(Eapplied/Eindicated)	*dB*
1	1	20	1.05	-0.44
2	15	20	1.01	-0.04
3	30	20	1.01	-0.06
4	75	20	1.01	-0.09
5	100	20	1.02	-0.13
6	150	20	1.01	-0.12
7	200	20	1.01	-0.06
8	250	20	1.01	-0.06
9	300	20	0.99	0.04
10	400	20	1.06	-0.47
11	500	20	0.94	0.54
12	600	20	0.93	0.63
13	700	20	1.00	0.04
14	800	20	1.01	-0.06
15	900	20	1.04	-0.32
16	1000	20	1.06	-0.52
17	2000	20	1.06	-0.48
18	2450	20	1.10	-0.84
19	3000	20	1.07	-0.62
20	3500	20	0.98	0.13
21	4000	20	1.07	-0.60
22	5000	20	1.41	-2.98
23	5500	20	1.40	-2.89
24	6000	20	1.56	-3.84

* 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 0.49 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

ETS·LINDGREN™
An ESCO Technologies Company

PROBE ROTATIONAL RESPONSE

Model	E100
S/N	00126277
Report	S000045944
Date	Date of Calibration 01 April 2019
Time	12:14:50 PM
Isotropy *	+ 0.292 dB/ -0.292 dB

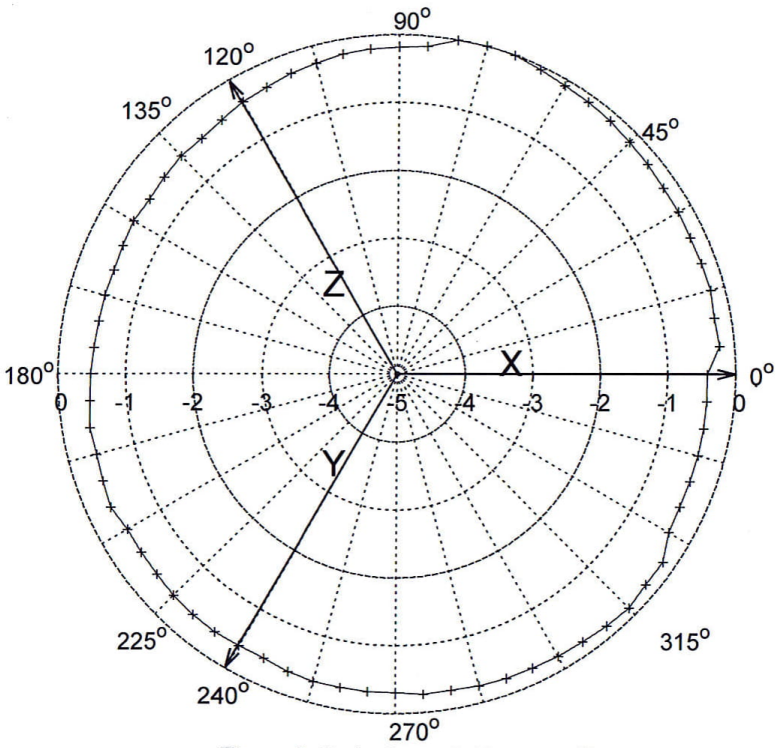


Figure 1: Probe Isotropic Response Chart.

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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ilac-MRA A2LA ACCREDITED Calibration Laboratory Certificate 1207.01

Cert I.D.: 129187

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

ETS·LINDGREN An ESCO Technologies Company
Track# S000045944 Ltd Cal ☐
By JAA Date 01-Apr-19
Next Cal Due _____
www.ets-lindgren.com

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:**	5-300MHz / 30mA/m-10A/m
Model Number:	H200	**Instrument Type:**	Isotropic Magnetic Field Probe (2)
Serial Number/ ID:	*00084225*	**Date Code:**	
Tracking Number:	**S 000045944**	**Alternate ID:**	
Date Completed:	01-Apr-19	**Customer:**	Motorola Solutions Malaysia Sdn Bhd (Innoplex) - Plot 2A, Medan Bayan Lepas, Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia. Bayan Lepas Penang 11900 Malaysia
Test Type:	Standard Field, Field Strength		

Calibration Uncertainty: Direct Field Method 1.15dB

k=2, (95% Confidence Level)

Test Remarks: Probe received in tolerance thus before and after data are the same. Probe calibrated with customer's HI-2200 S/N: 00206805.

Calibration Traceability: All Measuring and Test Equipment (M/TE) identified below are traceable to the SI units through the National Institute for Standards and Technology (NIST) or other recognized National Metrology Institute. Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-2005 and ANSI/NCSL Z540-1-1994.

Standards and Equipment Used:

Make / Model / Name / S/N / Recall Date				
HP	8648C	Signal Generator	3836U02236	18-Apr-19
Keysight	E9304A	Power Sensor	MY56100039	18-Apr-19
Hewlett Packard	E4422B	Signal Generator	US40050591	09-Aug-19
Agilent	E4419B	Power Meter	MY45104171	20-May-19
Rohde & Schwarz	SMB 100A	Signal Generator	101558	17-Sep-19
Agilent	E9304A	Power Sensor	MY41499013	18-Apr-19
Agilent	E9304A	Power Sensor	MY41499012	18-Apr-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100734	18-Apr-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100246	29-Jan-20
Agilent	N1913A	Power Meter	MY50000415	19-Feb-20
Marconi	2024	Signal Generator	112343/043	06-Apr-19
Rohde & Schwarz	NRVD	Power Meter	100451	01-Oct-19
Hewlett Packard	E4419B	Power Meter	US39250717	14-Aug-20
Keysight	E9304A	Power Sensor	MY56100005	18-Apr-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100352	27-Jul-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100037	28-Sep-19
Rohde & Schwarz	NRV-Z55	Thermal Power Sensor	100362	13-Dec-19
Rohde & Schwarz	NRP-Z91	Power Sensor	100732	19-Apr-19
Keysight	N5183B	MXG Analog Signal Gener	MY53270789	10-Jan-20

Condition of Instrument
Upon Receipt:
In Tolerance to Internal Quality Standards

On Release:
In Tolerance to Internal Quality Standards

Calibration Completed By
Julio A. Aquino, Calibration Technician

Attested and Issued on 01-Apr-19
George Cisneros, Calibration Supervisor

This document provides traceability of measurements to recognized national standards using controlled processes at the ETS-Lindgren Calibration Laboratory. Uncertainties listed are derived from the methods described by NIST Tech Note 1297. This certificate and report may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-2005 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 population unless otherwise noted. QAF 1127 (03/11)

CALIBRATION REPORT

Magnetic Field Sensor

Model	*S/N*
H200	00084225
HI-2200	00206805

Date: 01 Apr 2019

New Instrument
_ Other
_ Out of Tolerance
X Within Tolerance

Frequency Response

Frequency Response		*Nominal Field*	*Cal Factor**	*Deviation*
	MHz	*A/m*	(Eapplied/Eindicated)	*dB*
1	10	30	1.02	-0.16
2	15	30	0.99	0.12
3	30	30	0.96	0.34
4	50	30	0.95	0.43
5	75	30	0.93	0.62
6	100	30	0.90	0.89
7	150	30	0.84	1.51
8	175	30	0.80	1.89
9	200	30	0.76	2.38
10	250	30	0.65	3.77
11	300	30	0.53	5.50

* Corrected magnetic field values (A/m) can be obtained by multiplying the Cal Factor with the indicated H field readings.

Linearity

maximum linearity deviation is 0.37 dB

(measurements taken from 30 mA/m to 9 A/m at 27.12 MHz)

Test Conditions

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

The above sensor was calibrated to factory specifications. This calibration is performed per IEEE 1309 standard. All equipment used are traceable to US National Institute of Standards and Technology (NIST).

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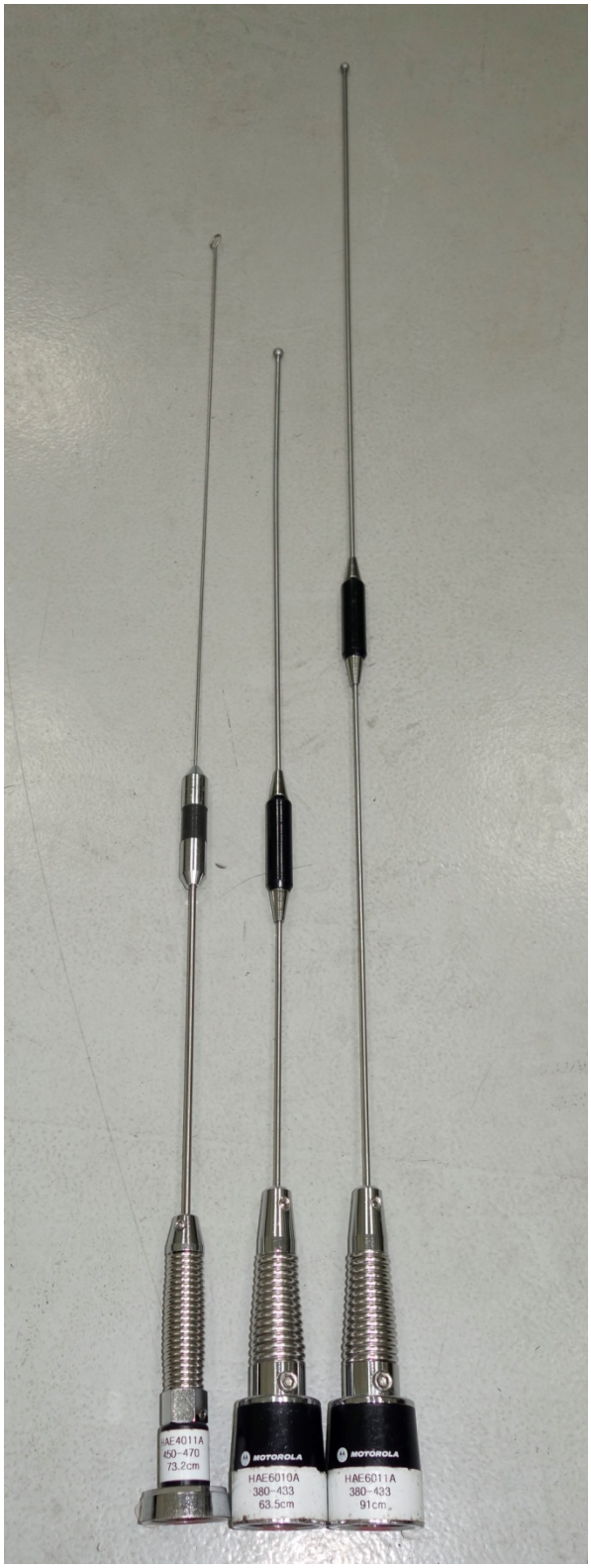
Appendix C - Photos of Assessed Antennas
(All antennas mounted to the vehicle with magnetic mount base)

APX 6500 UHF R1

Antenna kit numbers: (From Left to Right)
HAF4013A, HAF4014A, HAF4016A and HAF4017A



Antenna kit numbers: (From Left to Right)
HAE4011A, HAE6010A, HAE6011A

Antenna kit numbers: (From Left to Right)
HAE6013A, HAE6015A, HAE6031A

Antenna kit numbers:
RAE4014ARB (3pcs)

Companion Device (DVR 800)

Antenna kit number
HAF4016A