



**DECLARATION OF COMPLIANCE MPE ASSESSMENT OF PCII Report**

<p><b>Motorola Solutions Inc. EME Test Laboratory</b> Motorola Solutions Malaysia Sdn Bhd Plot 2A, Medan Bayan Lepas, Mukim 12 SWD 11900 Bayan Lepas Penang, Malaysia.</p>	<p><b>Date of Report:</b> 02/27/2025 <b>Report Revision:</b> A</p>
--	--

<p><b>Responsible Engineer:</b> <b>Report Author:</b> <b>Date/s Tested:</b> <b>Test Location:</b> <b>Manufacturer:</b> <b>Manufacturer Location:</b>  <b>DUT Description:</b> <b>Test TX mode(s):</b> <b>Max. Power output:</b> <b>Tx Frequency Bands:</b> <b>Signaling type:</b> <b>Model(s) Tested:</b> <b>Model(s) Certified:</b> <b>(HVIN/PMN)</b> <b>Serial Number(s):</b> <b>Classification:</b> <b>Applicant Name:</b> <b>Applicant Address:</b>  <b>Firmware Version (FVIN):</b> <b>FCC ID:</b>  <b>FCC Test Firm Registration Number:</b></p>	<p>Hoe Kean Loon (EME Engineer) Hamidi Bin Ismail (EME Senior Technician) 01/6/2025-01/09/2025 Penang EME Laboratory Motorola Solutions Malaysia Sdn Bhd. Plot 2A, Medan Bayan Lepas Mukim, 12 SWD, 11900 Bayan Lepas, Penang, Malaysia APX8500 mobile All Bands (VHF, UHF, 7/800) CW Refer table 6 Refer table 6 Refer table 6 M37TXS9PW1AN Refer 1.0 Introduction 681IAN3371, 681IL4223 Occupational/Controlled Environment Motorola Solutions Inc. Plot 2A, Medan Bayan Lepas Mukim, 12 SWD, 11900 Bayan Lepas, Penang, Malaysia R33.04.00 AZ492FT7118  823256</p>
--	---

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. The results and statements contained in this report pertain only to the device(s) evaluated.

**Saw Sun Hock (Approval Signatory)**  
**Approved Date: 02/28/2025**

**Document Revision History**

<b>Date</b>	<b>Revision</b>	<b>Comments</b>
02/27/2025	A	Initial release

**Table of Contents**

1.0 Introduction ..... 4

2.0 FCC MPE Summary..... 4

3.0 Abbreviations / Definitions ..... 5

4.0 Referenced Standards and Guidelines..... 5

5.0 Power Density Limits ..... 6

6.0 N<sub>c</sub> Test Channels ..... 7

7.0 Measurement Equipment ..... 8

8.0 Measurement System Uncertainty Levels..... 8

9.0 Product and System Description ..... 8

10.0 Additional Options and Accessories..... 10

11.0 Test Set-Up Description ..... 10

12.0 Method of Measurement with trunk mounted antenna(s)..... 10

    12.1 External/Bystander vehicle MPE measurements ..... 10

    12.2 Internal/Passenger vehicle MPE measurements ..... 11

13.0 Method of Measurement with roof mounted antenna(s) ..... 12

    13.1 External/Bystander vehicle MPE measurements ..... 12

    13.2 Internal/Passenger vehicle MPE measurements ..... 12

14.0 MPE Variability Requirement for External/Bystander vehicle MPE measurement..... 13

15.0 MPE Calculations..... 13

16.0 Antenna Summary ..... 14

17.0 Test Results Summary ..... 15

    17.1 MPE Test Results Summary for LMR..... 15

    17.2 MPE Test Results for WLAN ..... 15

    17.3 Simultaneous Transmission..... 17

18.0 Conclusion ..... 18

19.0 User Instructions Considerations ..... 19

Appendix A - Antenna Locations, Test Distances, and Cable Losses ..... 20

Appendix B - Probe Calibration Certificates ..... 26

Appendix C - Photos of Assessed Antennas..... 38

### 1.0 Introduction

This report details the test setup, test equipment and test results of Maximum Permissible Exposure (MPE) performed at Motorola Solutions test site for product model M37TXS9PW1AN. The information herein is to show evidences of Class II Permissive Change compliance based on the MPE evaluation on the change of the inductor used in the harmonic filter/output network of the APX8500 transmitter board. This device intended only use by workers when at work with Motorola Solutions approved antennas.

Model	Hardware Version ID Number (HVIN)	Product Marketing Name (PMN)	Description
M37TXS9PW1AN	N/A	APX8500	APX8500 mobile All Bands (VHF,UHF, 7/800)
M37TXS9PW1CN	N/A	APX8500	APX8500 mobile All Bands (VHF,UHF, 7/800)

### 2.0 FCC MPE Summary

**Table 1**

Equipment Class	Frequency band (MHz)	Trunk Mounted Antennas				Roof Mounted Antennas			
		Passenger		Bystander		Passenger		Bystander	
		Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)
TNB	150.8 – 173.4 (LMR VHF)	NA	NA	NA	NA	0.42	*212.1	0.41	*202.8
	406.1 – 470 (LMR UHF1)	NA	NA	NA	NA	0.12	45.4	0.27	89.9
	450 – 512 (LMR UHF2)	NA	NA	NA	NA	0.11	37.1	0.27	89.9
	769-775; 799-824; 851-869 (LMR 7/800)	0.142 <sup>(1)</sup>	26.4 <sup>(2)</sup>	0.149 <sup>(3)</sup>	26.2 <sup>(4)</sup>	0.04	8.4	0.06	12.1
DTS	2412 – 2462 (WLAN 2.4 GHz)	0.0301	3.01	0.0301	3.01	0.0301	3.01	0.0301	3.01
NII	5180 - 5825 (WLAN 5 GHz)	0.0120	1.20	0.0120	1.20	0.0120	1.20	0.0120	1.20
Simultaneous (Highest Combined Percentage of Limit)			29.41 <sup>(5)</sup>		29.21 <sup>(6)</sup>		215.11		205.81

Notes:

- 1) NA – VHF, UHF1 and UHF2 antennas restricted for trunk mount installation.
- 2) \* Requires SAR simulation (in Original filing report).
- 3) <sup>(1)</sup> New highest reported power density for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 0.142 mW/cm<sup>2</sup> compared with previous on filed result is 0.130 mW/cm<sup>2</sup>.
- 4) <sup>(2)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 26.4% compared with previous on filed result is 23.6%.
- 5) <sup>(3)</sup> New highest reported power density for LMR 7/800MHz band Trunk Mounted Antennas with Bystander is 0.149 mW/cm<sup>2</sup> compared with previous on filed result is 0.130 mW/cm<sup>2</sup>.
- 6) <sup>(4)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Bystander is 26.2% compared with previous on filed result is 22.9%.
- 7) <sup>(5)</sup> New highest Combined Percentage of limit between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Passenger is 29.41% compared with previous on field result is 26.61%.
- 8) <sup>(6)</sup> New highest Combined Percentage of limit between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Bystander is 29.21% compared with previous on field result is 25.91%.
- 9) Previous on file highest percentage for VHF and UHF1/2 bands are remain unchanged.

### 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  
NA: Not Applicable  
BS: Bystander  
PB: Passenger Back seat  
PTT: Push to Talk  
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.
- American National Standards Institute (ANSI) / Institute of Electrical and Electronics Engineers (IEEE) C95. 1-1999
- 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
- 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 6) – 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 mW/cm <sup>2</sup>	IEEE C95.1 mW/cm <sup>2</sup>	IEEE C95.1 W/m <sup>2</sup>	RSS-102 Issue 6 W/m <sup>2</sup>
10 – 20				10.0
20 – 48				$44.72 / f^{0.5}$
30 – 300	1.0			
48 – 100				6.455
10 – 400				
100 – 300		1.0	10.0	
100 – 6,000				$0.6455 f^{0.5}$
300 – 1,500	$f/300$			
300 – 3,000		$f/300$	$f/30$	
400 – 2,000				
1,500 – 15,000				
1,500 – 100,000	5.0			
2,000 – 300,000				
3,000 – 300,000		10.0	100.0	
6,000 – 15,000				50.0
15000 – 150,000				50.0
150000 – 300,000				$3.33 \times 10^{-4} f$

**Table 3 – General Population / Uncontrolled Exposure Limits**

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

**6.0 N<sub>c</sub> 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**

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

where  $N_c$  is the number of test channels,  $f_{\text{high}}$  and  $f_{\text{low}}$  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	ETS Model HI-2200	00084225	02/13/2024	02/13/2025
Probe – E-Field	ETS Model E100	00237361		
Probe – H-Field	ETS Model H200	00084225		

E-field measurements are in mW/cm<sup>2</sup>.

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	<i>u<sub>i</sub></i> (±%)		<i>v<sub>i</sub></i>
<b>Measurement System</b>						
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	∞
<b>Test sample Related</b>					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	∞
<b>Combined Standard Uncertainty</b>		RSS		15.6	15.6	∞
<b>Expanded Uncertainty</b> (95% CONFIDENCE LEVEL)		<i>k</i> =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 contains WLAN technology for data capabilities over 2.4 GHz 802.11 b/g/n and 5 GHz 802.11 a/n/ac 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**

Technologies	Bands (MHz)	Duty Cycle (%)	Max power (W)	
LMR	136-174 (VHF band)	50% (PTT)	120	
	380- 470 (UHF1) 450- 520 (UHF2)	380–484	50% (PTT)	120
		485-512	50% (PTT)	48
		512-520	50% (PTT)	30
	764-805 ; 806-870 (7/800 band)	764-805	50% (PTT)	36
		806-870	50% (PTT)	42
WLAN	2400 – 2483.5 (802.11b/g/n)	100%	0.0631 (802.11 b) 0.025 (802.11 g) 0.025 (802.11 n)	
	5180-5825 (802.11 a/n/ac)	100%	0.0316	

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 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 mobile radio installed in the test vehicle, at the specified distances and test locations indicated in sections 12.0, 13.0 and Appendix A.

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 with trunk mounted antenna(s)

### 12.1 External/Bystander vehicle MPE measurements

Initially the 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 (3) bystander test locations 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 90 cm (for VHF band). 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.

Each of the offered antennas mounted at the center of the trunk were assessed at the rear of the vehicle while maintaining a minimum of twenty (20) centimeter separation distance between the probe sensor and vehicle body. The worst case antenna was then tested at a 45° radial at the corner of the trunk, and 90° radial at the side of the trunk.

Tests for the 90° radial direction were conducted with the antenna displaced towards the "bystander on the side of the trunk" test location in order to attain 90 cm (12 cm antenna displacement) distances from that test location. In this way, the antenna is closer to the test location, and the MPE is higher, than it would be if the antenna was left at the center of the trunk

## 12.2 Internal/Passenger vehicle MPE measurements

Antenna is located toward the center of the trunk at a minimum 85 cm from backseat passenger. Users are instructed, per installation manual, to mount antennas on the roof only if a minimum 85cm cannot be achieved. Refer to Appendix A for antenna location and distance.

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

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.

## **13.0 Method of Measurement with roof mounted antenna(s)**

### **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 the 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 90 cm (for VHF band). 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 backseat (PB) conditions are determined by taking the average of the (3) measurements (Head, Chest, and Lower Trunk) inside the vehicle for 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.

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 this mobile radio are presented in section 17.0. 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.

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.*)

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

*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<sup>2</sup>) 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<sup>2</sup>) using the equation 3. H-field measurements are only applicable to frequencies below 300MHz.*

### Equation 3 – Converting A/m to mW/cm<sup>2</sup>

$$mW/cm^2 = (A/m)^2 * 37.699$$

### 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<sub>c</sub>) and actual number of tested channels (Actual N<sub>c</sub>). This information was used to determine the test configurations presented in this report.

Table 7 below shows the antennas used for PCII report only.

**Table 7**

Antenna No.	Antenna Model	Frequency Range (MHz)	Physical Length (cm)	Gain (dBi)	Remarks	Mount Location (Roof/Trunk)	Overlap FCC Bands (MHz)	FCC N <sub>c</sub>	Actual N <sub>c</sub>
<b>VHF (136- 174 MHz)</b>									
1	HAD4017A	146-174	46.2	2.15	1/4 wave	Roof	150.8-173.4	4	5
2	HAD4007A	144-150.8	49.0	2.15	1/4 wave	Roof	150.8	1	2
<b>UHF1 (380-470 MHz)</b>									
3	HAE6010A	380-433	63.5	5.65	1/2 wave	Roof	406.1-433	3	5
4	HAE6015A	450-520	26.2	4.15	1/2 wave	Roof	450-470	3	3
<b>UHF2 (450-520 MHz)</b>									
5	HAE6013A	380-470	29	4.15	1/2 wave	Roof	450-470	3	3
6	HAE6015A	450-520	26.2	4.15	1/2 wave	Roof	450-512	6	7
<b>7/800 (764-870 MHz)</b>									
7	HAF4014A	764-870	57.7	5.15	1/4 wave	Roof/ Trunk	769-775; 799-824; 851-869	8	9
8	HAF4017A	764-870	34.5	5.15	1/4 wave	Roof/ Trunk	769-775; 799-824; 851-869	8	9

### 17.0 Test Results Summary

#### 17.1 MPE Test Results Summary for LMR

Refer to the following Table 8 for current PCII MPE results summary for each test configuration: antenna location, test positions (BS-Bystander, PB-Passenger Backseat), E/H field measurements, angle, 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.

**Table 8**

Trunk / Roof	Test Post.	E/H Field	Antenna No.	Antenna Model	Max Pwr (W)	Initial Pwr (W)	Tx Freq (MHz)	Max Calc. P.D. (mW/cm <sup>2</sup> )	FCC Limit	% To FCC Spec Limit
<b>VHF</b>										
Roof	BS	H	1	HAD4007A, 1/4 Wave (144-150.8MHz)	120	117	150.8000	0.244	0.20	122.2
Roof	PB	H	2	HAD4017A, 1/4 Wave (146-174MHz)	120	116	165.01250	0.162	0.20	81.2
<b>UHF 1</b>										
Roof	BS	E	3	HAE6015A, 1/2 Wave (450-520MHz)	120	117	450.01250	0.203	0.30	67.7
Roof	PB	E	4	HAE6010A, 1/2 Wave (380-433MHz)	120	117	406.5000	0.072	0.27	26.8
<b>UHF 2</b>										
Roof	BS	E	5	HAE6015A, 1/2 Wave (450-520MHz)	120	117	450.01250	0.203	0.30	67.7
Roof	PB	E	6	HAE6013A, 1/2 Wave (380-470MHz)	120	117	450.01250	0.068	0.30	22.5
<b>7/800</b>										
Trunk	BS	E	7	HAF4014A, 1/4 Wave (764-870MHz)	42	41.1	851.01250	0.149	0.57	26.2
Trunk	PB	E	8	HAF4017A, 1/4 Wave (764-870MHz)	42	41.6	806.0125	0.142	0.54	26.4

#### 17.2 MPE Test Results for WLAN

Antenna PMAN5100A support WLAN 2.4 GHz only, was intended for mounting on the windshield of the vehicle. This antenna 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 used 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<sub>t</sub> = 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 9 summarized the MPE calculation for WLAN.

**Table 9**

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 <sup>2</sup> )	FCC Limit (mW/cm <sup>2</sup> )	% To FCC Spec Limit
<b>WLAN 2.4 GHz</b>										
PMAN5100A	0.0631	100.00%	2412.0	6.00	2.20	20	1.00	0.0301	1.00	3.01
PMAN5100A	0.0631	100.00%	2437.0	6.00	2.20	20	1.00	0.0301	1.00	3.01
PMAN5100A	0.0631	100.00%	2462.0	6.00	2.20	20	1.00	0.0301	1.00	3.01
PMAN5101A	0.0631	100.00%	2412.0	6.00	3.00	20	1.00	0.0250	1.00	2.50
PMAN5101A	0.0631	100.00%	2437.0	6.00	3.00	20	1.00	0.0250	1.00	2.50
PMAN5101A	0.0631	100.00%	2462.0	6.00	3.00	20	1.00	0.0250	1.00	2.50
AN000163A01 / AN000163A05	0.0631	100.00%	2412.0	5.15	2.20	20	1.00	0.0248	1.00	2.48
AN000163A01 / AN000163A06	0.0631	100.00%	2437.0	5.15	2.20	20	1.00	0.0248	1.00	2.48
AN000163A01 / AN000163A07	0.0631	100.00%	2462.0	5.15	2.20	20	1.00	0.0248	1.00	2.48
<b>WLAN 5 GHz</b>										
AN000163A01 / AN000163A05	0.0316	100.00%	5180.0	5.15	3.47	20	1.00	0.009	1.00	0.93
AN000163A01 / AN000163A06	0.0316	100.00%	5502.5	5.15	3.47	20	1.00	0.009	1.00	0.93
AN000163A01 / AN000163A07	0.0316	100.00%	5825.0	5.15	3.47	20	1.00	0.009	1.00	0.93
PMAN5101A	0.0316	100.00%	5180.0	3.20	4.00	20	1.00	0.0052	1.00	0.52
PMAN5101A	0.0316	100.00%	5502.5	3.20	4.00	20	1.00	0.0052	1.00	0.52
PMAN5101A	0.0316	100.00%	5825.0	3.20	4.00	20	1.00	0.0052	1.00	0.52

Notes:

- 1) Distance from antenna (d), 20cm for more conservative estimation.
- 2) Cable loss (L),
  - 2.20 dB with 17’ PFP240 cable for 2.4 GHz WLAN (Antenna PMAN5100A, AN000163A0, AN000163A05)
  - 3.00 dB with 1’ RG316 and 16’ PFP195 cable for 2.4 GHz WLAN (Antenna PMAN5101A)
  - 3.47 dB with 17’ PFP240 cable for 5.0 GHz WLAN (Antenna AN000163A0, AN000163A05)
  - 4.00 dB with 1’ RG316 and 16’ PFP195 cable for 5.0 GHz WLAN (Antenna PMAN5101A)
- 3) Numeric gain (G), factor in the cable loss with conversion 10<sup>^((dBi-L)/10)</sup>
- 4) Enhancement Factor (F), 1 (Ground reflection already factor in during antenna characterization)

### 17.3 Simultaneous Transmission

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

The highest percentage of limit for each standalone transmitters indicated in Table 10.

**Table 10**

Transmitters	Frequency Band (MHz)	Highest Percentage of Limit (%)	
		Passenger, Back Seat (PB)	By-Stander (BS)
LMR VHF	150.8 - 173.4	*212.1	*202.8
LMR UHF1	406.1 - 470	45.4	89.9
LMR UHF2	450 - 512	37.1	89.9
LMR 7/800	769-775; 799-824; 851-869	26.4 <sup>(1)</sup>	26.2 <sup>(2)</sup>
WLAN 2.4 GHz	2412 - 2462	3.01	3.01
WLAN 5 GHz	5180 - 5825	0.93	0.93

Notes:

1)\*Requires SAR Simulation (In Original filing report)

2) <sup>(1)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 26.4% compared with previous on filed result is 23.6%.

3) <sup>(2)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 26.2% compared with previous on filed result is 22.9%.

4) Previous on file highest percentage for VHF and UHF1/2 bands are remain unchanged.

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  $\leq 1.0$ , according to calculated/estimated, numerically modeled, or measured field strengths or power density.

Calculated Maximum Power density for WLAN 2.4 GHz greater than WLAN 5 GHz and both 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 11.

**Table 11**

Simultaneous Transmission Scenario	Highest Combined Percentage of Limit (%)	
	Passenger, Back Seat (PB)	Bystander (BS)
LMR VHF and WLAN	*215.11	*205.81
LMR UHF1 and WLAN	48.41	92.91
LMR UHF2 and WLAN	40.11	92.91
LMR 7/800 and WLAN	29.41 <sup>(1)</sup>	29.21 <sup>(2)</sup>

Notes:

1)\*Requires SAR Simulations. (In Original filing report).

2) <sup>(1)</sup> New highest Simultaneous Transmission Scenario between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Passenger is 29.41% compared with previous on field result is 26.61%.

3) <sup>(2)</sup> New highest Transmission Scenario limit between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Bystander is 29.21% compared with previous on field result is 25.91%.

4) Previous on file highest percentage for VHF and UHF1/2 bands are remain unchanged.

### 18.0 Conclusion

The assessments for this device were performed with an output power range as indicated in section 17.1 (for LMR). 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 transmitter scaled to maximum allowable power output are indicated in Table 12 for internal/passenger to the vehicle, and external/bystander to the vehicle.

**Table 12: Maximum MPE RF Exposure Summary (LMR)**

Equipment Class	Frequency band (MHz)	Trunk Mounted Antennas				Roof Mounted Antennas			
		Passenger		Bystander		Passenger		Bystander	
		Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)	Power Density (mW/cm <sup>2</sup> )	Percentage of Limit (%)
TNB	150.8 – 173.4 (LMR VHF)	NA	NA	NA	NA	0.42	*212.1	0.41	*202.8
	406.1 – 470 (LMR UHF1)	NA	NA	NA	NA	0.12	45.4	0.27	89.9
	450 – 512 (LMR UHF2)	NA	NA	NA	NA	0.11	37.1	0.27	89.9
	769-775; 799-824; 851-869 (LMR 7/800)	0.142 <sup>(1)</sup>	26.4 <sup>(2)</sup>	0.149 <sup>(3)</sup>	26.2 <sup>(4)</sup>	0.04	8.4	0.06	12.1
DTS	2412 – 2462 (WLAN 2.4 GHz)	0.0301	3.01	0.0301	3.01	0.0301	3.01	0.0301	3.01
NII	5180 - 5825 (WLAN 5 GHz)	0.009	0.93	0.009	0.93	0.009	0.93	0.009	0.93
Simultaneous (Highest Combined Percentage of Limit)			29.41 <sup>(5)</sup>		29.21 <sup>(6)</sup>		215.11		205.81

Notes:

- 1) NA – VHF, UHF1 and UHF2 antennas restricted for trunk mount installation.
- 2) \* Requires SAR simulation (in Original filing report).
- 3) <sup>(1)</sup> New highest reported power density for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 0.142 mW/cm<sup>2</sup> compared with previous on filed result is 0.130 mW/cm<sup>2</sup>.
- 4) <sup>(2)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Passenger is 26.4% compared with previous on filed result is 23.6%.
- 5) <sup>(3)</sup> New highest reported power density for LMR 7/800MHz band Trunk Mounted Antennas with Bystander is 0.149 mW/cm<sup>2</sup> compared with previous on filed result is 0.130 mW/cm<sup>2</sup>.
- 6) <sup>(4)</sup> New highest reported percentage of limit for LMR 7/800MHz band Trunk Mounted Antennas with Bystander is 26.2% compared with previous on filed result is 22.9%.
- 7) <sup>(5)</sup> New highest Combined Percentage of limit between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Passenger is 29.41% compared with previous on field result is 26.61%.
- 8) <sup>(6)</sup> New highest Combined Percentage of limit between 7/800MHz band and WLAN 2.4GHz Trunk Mounted Antennas with Bystander is 29.21% compared with previous on field result is 25.91%.
- 9) Previous on file highest percentage for VHF and UHF1/2 bands are remain unchanged

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

Although MPE is a convenient method of demonstrating RF Exposure requirements, SAR is recognized as the “basic restriction”. For those configurations are compliance to the General Population / Uncontrolled SAR 1g limit of 1.6 W/kg is demonstrated through SAR computational analysis.

The computational results show that this device, when used with the offered antennas in accordance with the user manual instructions, exhibits the maximum peak average SAR values indicated in the Table below for the configurations requiring SAR analysis.

**Table 13**

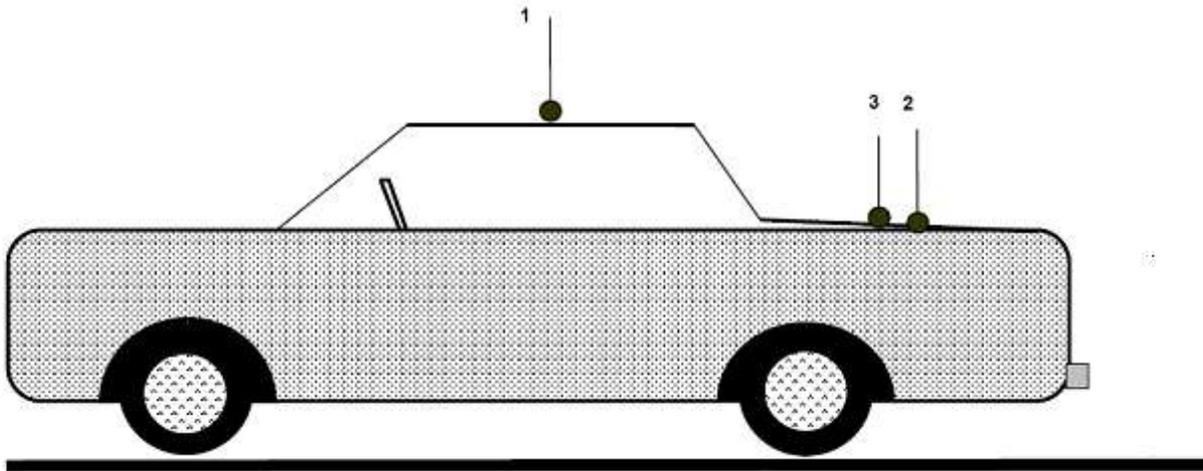
<b>Exposure Conditions</b>	<b>Maximum peak average SAR (1g)</b>
Passenger	0.57 W/kg
Bystander	1.03 W/kg

**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.

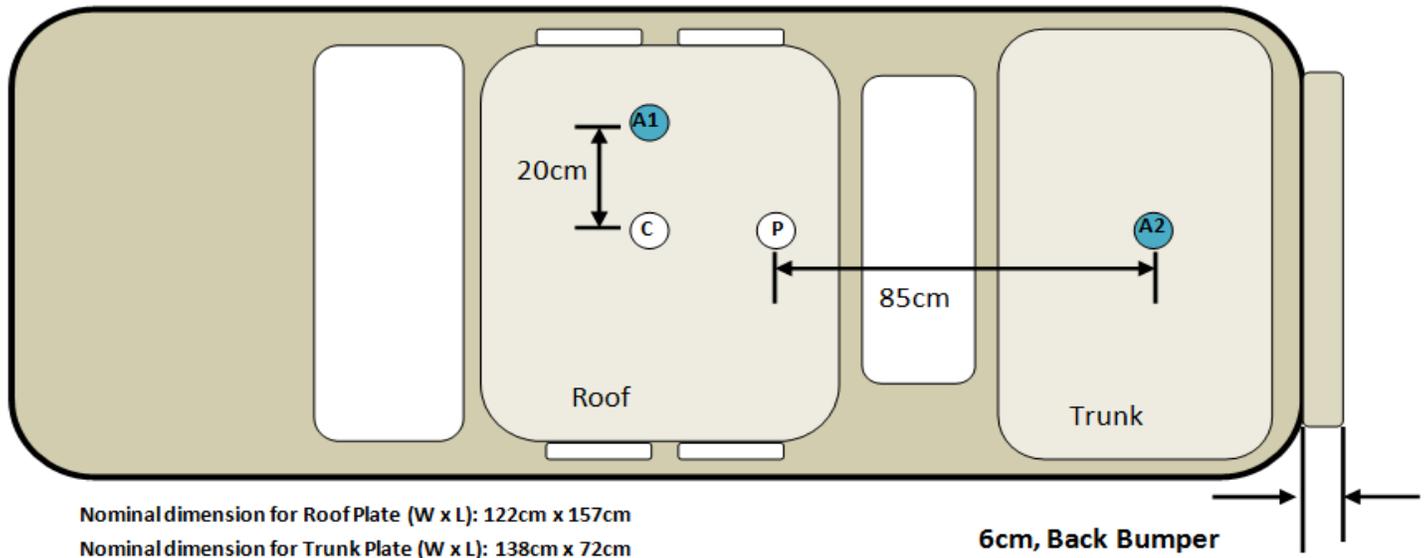
## Appendix A - Antenna Locations, Test Distances, and Cable Losses

### Antenna locations



1. Roof (20cm from center)
2. Trunk (85cm from back of the back seat)
3. Trunk (center)

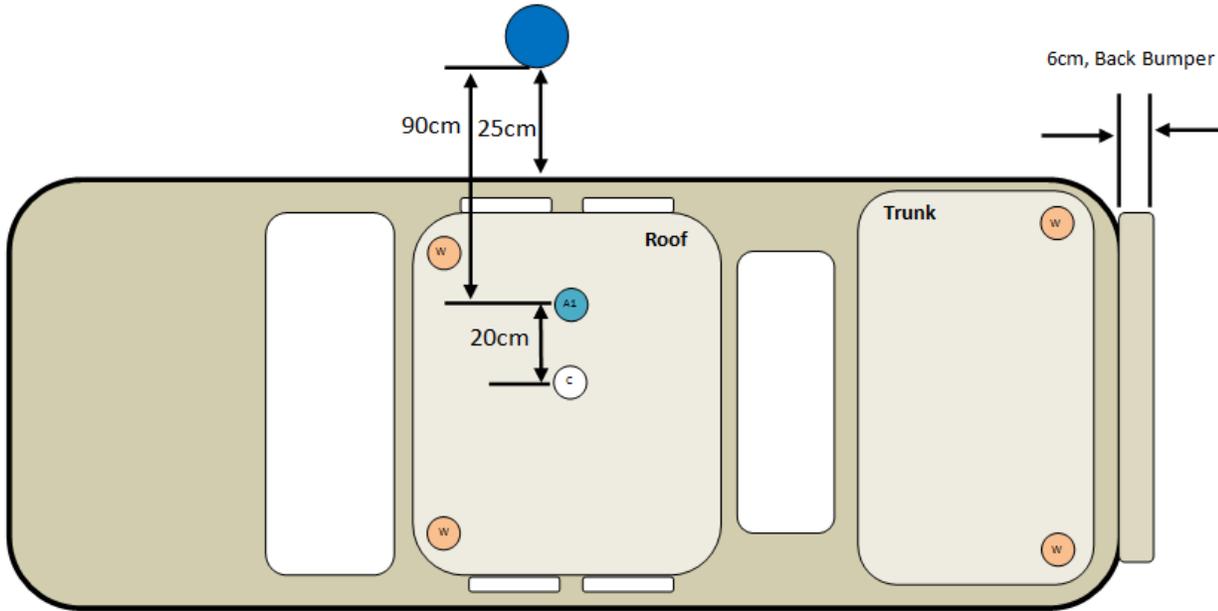
Passenger Antenna mounting  
(LMR VHF, UHF R1, UHF R2 and 7/800 band)



Notes:

- 1.) Antenna location A1: APX mobile radio roof antenna mounting locations for passenger back and front testing (for LMR VHF, UHF R1, UHF R2 and 7/800 bands)
- 2.) Antenna location A2: APX mobile trunk antenna mounting locations for passenger back and front testing (for LMR 7/800 band only).
- 3.) Total distance between trunk mount antenna and rear passenger is 85cm

### Bystander Antenna mounting and test locations for distance 90cm (LMR VHF, UHF R1 and UHF R2 bands)



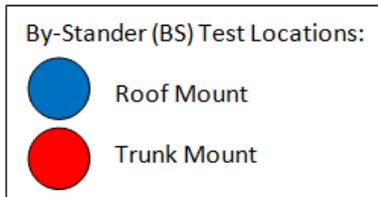
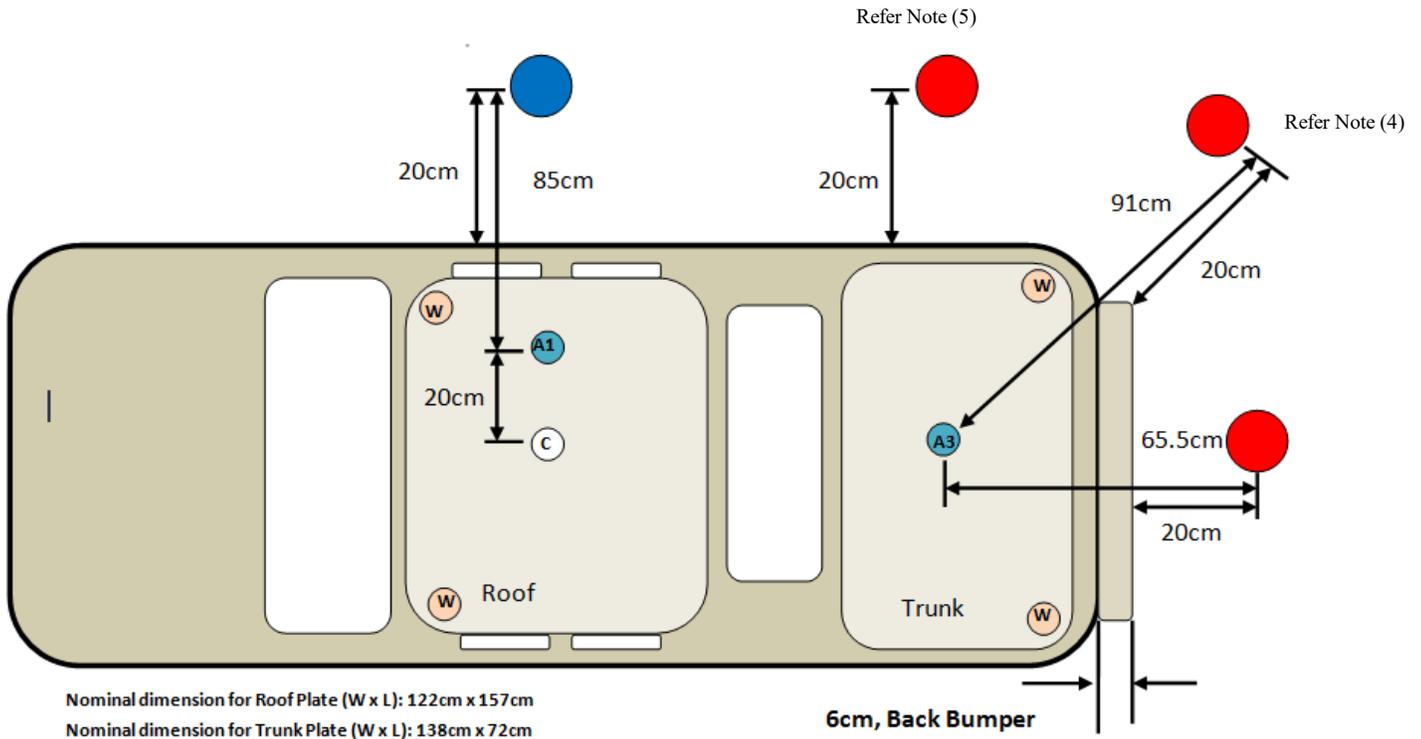
**Bystander (BS) Test Locations:**

 Roof Mount

**Notes:**

- 1.) Antenna location A1: LMR antennas roof mount for bystander testing (20cm offset from center)
- 2.) Antenna location W: Total 4 locations identified for WLAN antenna mounting. (If LMR antennas installed at trunk, WLAN antenna should installed at roof and vice versa)

### Bystander Antenna mounting and test locations for distance 60cm (LMR 7/800 band)



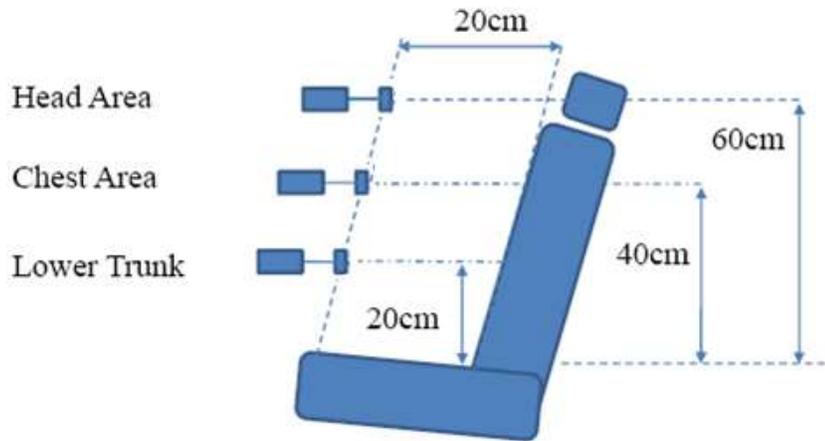
Notes:

- 1.) Antenna location A1: LMR antennas roof mount for bystander testing (20cm offset from center)
- 2.) Antenna location A3: LMR antennas trunk mount for bystander testing
- 3.) Antenna location W: Total 4 locations identified for WLAN antenna mounting. (If LMR antennas installed at trunk, WLAN antenna should installed at roof and vice versa)
- 4.) Total distance between Bystanders from the centered-trunk mount antenna is 60cm and 65.5cm at bumper to maintain a minimum 20cm separation between probe sensor to the vehicle body.
- 5.) Total distance between Bystander 45 degree angle from the centered-trunk mount antenna is 91cm to maintain a minimum 20cm separation between probe sensor to the vehicle body.
- 6.) Total distance between Bystander 90 degree angle from the centered-trunk mount antenna is 60cm (by moving antenna location A3 42cm from center of the trunk)

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

Meter - Probe

 Probe diameter is 5.5cm



## 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

5800 MHz - 20.4 dB

Appendix B - Probe Calibration Certificates



Certificate of Calibration
ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994
Certificate Number 240209-131305-3fldf5



Model Number E100; HI-2200
Manufacturer ETS - Lindgren
Description Field Probe
Serial Number 00237361; 00206805
Customer Asset No. N/A

Customer
Motorola Solutions Malaysia Sdn Bhd
Plot 2A Medan Bayan Lepas Technoplex
Industrial Park Mukim 12 SWD
Bayan Lepas, Penang 11900
MALAYSIA

Date of Calibration 02/13/2024
Temperature 23°C
Humidity 39% RH

Location of Calibration
Keysight Technologies Inc.
1346 Yellowwood Road
Kimballton, IA 51543
United States

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

Table with 3 columns: Calibration Standard(s), Calibration Method(s), Calibration Procedure(s). Includes IEEE Std 1309-2013 Section 4.1, 5, 8.2, Annex A, A.3, 7.3, 8.3.3.3 and methods like Calculated, Substitution.

Calibration Software
Probe Calculated Method 3.14
Probe Comparison 1.5.2

As Received Conditions
The measured values of the equipment were observed in specification at the points tested.

Action Taken
No action was taken.

As Completed Conditions
The measured values of the equipment were observed in specification at the points tested.

Calibration Due
Based on the customer's request, the next calibration is due on 13 Feb 2025

Remarks or Special Requirements
A probe position document is included with this certificate. This calibration is valid only for the alignment/mounting position specified in this report.

Keysight Technologies, Inc.
1346 Yellowwood Road
Kimballton, IA 51543
United States

Brandt Langer Iowa Service Center Manager

Issue Date 13 Feb 2024

Page 1 of 7



# Certificate of Calibration

ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994  
Certificate Number 240209-131305-3f1df5



This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

### Traceability Information

Technician Name      Dennis Bissen

Measurements are traceable to the International System of Units (SI) via national metrology institutes ([www.keysight.com/find/NMI](http://www.keysight.com/find/NMI)) that are signatories to the CIPM Mutual Recognition Arrangement.

### Calibration Equipment Used

Manufacturer	Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
AR	100W1000B	Amp	11546	NA	
AR	15T4G18	Amp	10888	NA	NA
EMCO	5101	TEM Cell	10420	NA	2003121920
EMCO	5302	G/TEM	10223	NA	2003121915
AR	600A400	Amplifier, 10KHz-400 MHz, 600W	624658	NA	
AR	75A250	Amp	10560	NA	N/A
AR	80S1G4	Amp	11728	NA	
Agilent Technologies, Inc.	83650B	Synthesized Swept Signal Generator	1354	11/30/2024	231026-132122-02ee89
Hewlett-Packard	8481A	Power Sensor	10449	06/30/2024	230629-130030-5f3da1
Hewlett-Packard	8487A	Power Sensor	10577	02/28/2025	240130-103045-c70ff0
Agilent Technologies, Inc.	8648D	Signal Generator	10307	12/31/2024	231026-134816-25ae97
Agilent Technologies, Inc.	8648D	Signal Generator	11028	02/29/2024	230113-115008-67a419
Schwarzbeck Mess-Elektronik	BBHA 9120D	Horn	10194	10/31/2024	231026-132817-d3dc83
Agilent Technologies, Inc.	E4419B	EPM Series Power Meter	10458	10/31/2024	231026-130607-a4620d
AR	FI7000	Interface	11015	NA	700516
AR	FL7006	Isotropic Probe	10946	03/08/2024	2023010355-1
Holaday	HI-4422	Isotropic Probe	10022	01/21/2025	2022100146-1
dbwave	PADD200050180 0B	Dual Directional Coupler	20522	03/31/2024	230301-141152-7ab616

### Compliance with Specification

Unless otherwise noted, the calibration results are reported without factoring in the effect of uncertainty on the assessment of compliance/specification.



**Certificate of Calibration**  
 ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994  
 Certificate Number 240209-131305-3f1df5



**In Specification/Out of Specification Explanation**

The standard criteria to determine the "In Specification/Out of Specification" status is based on one or more of the following conditions, as requested by the client:

1. If the manufacturer has a specified specification for the item being calibrated, then the calibration values are compared to this specification, and the values must fall within the manufacturer's specification. The specification may be obtained from the manufacturer's web site, data sheets, equipment manuals, etc.
2. Where specifications are called out in a published standard, the calibration results are compared to this specification, and the measured values must fall within the standard's specification.
3. In cases where the manufacturer, standard, or client does not identify any relevant specifications, applicable calibration results are compared to historical data with a +/- 3 dB specification.

**Uncertainty of Measurement**

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008(GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Parameter	Range	MU (+/-)
RF Isotropic E-Field Probes - GTEM Cell - Isotropic	10 kHz to 1000 MHz	0.97 dB
RF Isotropic E-Field Probes - TEM Cell - Linearity	5 kHz to 800 MHz	0.91 dB
RF Isotropic E-Field Probes - Anechoic Chamber - Frequency Response	(450 to 18,000) MHz	1.1 dB
RF Isotropic E-Field Probes - GTEM Cell - Frequency Response	10 kHz to 1000 MHz	0.79 dB

2024\_Frequency Response.txt

Customer Name: Motorola Solutions Malaysia Sdn Bhd  
 Probe Manufacturer: ETS - Lindgren  
 Probe Model: E100; HI-2200  
 Probe Serial No.: 00237361; 00206805  
 Notes:  
 CAL CERT #: 240209-131305-3f1df5

Frequency in MHz	Correction Factors	
	Multiplier	20V/m dB
0.1	1.17	1.37
0.5	1.23	1.79
1	1.10	0.79
3	1.05	0.41
15	1.00	0.01
27.12	1.00	0.02
30	1.00	-0.03
75	1.06	0.50
100	1.07	0.57
150	1.08	0.67
200	1.08	0.71
250	1.10	0.87
300	1.17	1.37
400	0.91	-0.81
500	1.07	0.60
600	1.09	0.77
700	1.18	1.46
800	0.95	-0.46
900	1.03	0.25
1000	0.97	-0.26
2000	1.04	0.35
2450	0.92	-0.71
3000	0.90	-0.94
3500	0.84	-1.47
4000	0.91	-0.78
5000	1.04	0.37
5500	1.07	0.62
6000	1.21	1.63

## 2024\_Isotropic Response.txt

Customer Name: Motorola Solutions Malaysia Sdn Bhd

Probe Manufacturer: ETS - Lindgren

Probe Model: E100; HI-2200

Probe Serial No.: 00237361; 00206805

Notes:

CAL CERT #: 240209-131305-3f1df5

Isotropic Response at 400 MHz at 20V/m

Deg	Response dB
0	0.00
45	-0.03
90	-0.04
135	-0.10
180	-0.16
225	-0.10
270	0.00
315	-0.01
360	-0.01

Max Dev. 0.16

2024\_Linearity.txt

Customer Name: Motorola Solutions Malaysia Sdn Bhd  
 Probe Manufacturer: ETS - Lindgren  
 Probe Model: E100; HI-2200  
 Probe Serial No.: 00237361; 00206805  
 Notes:  
 CAL CERT #: 240209-131305-3f1df5

Linearity

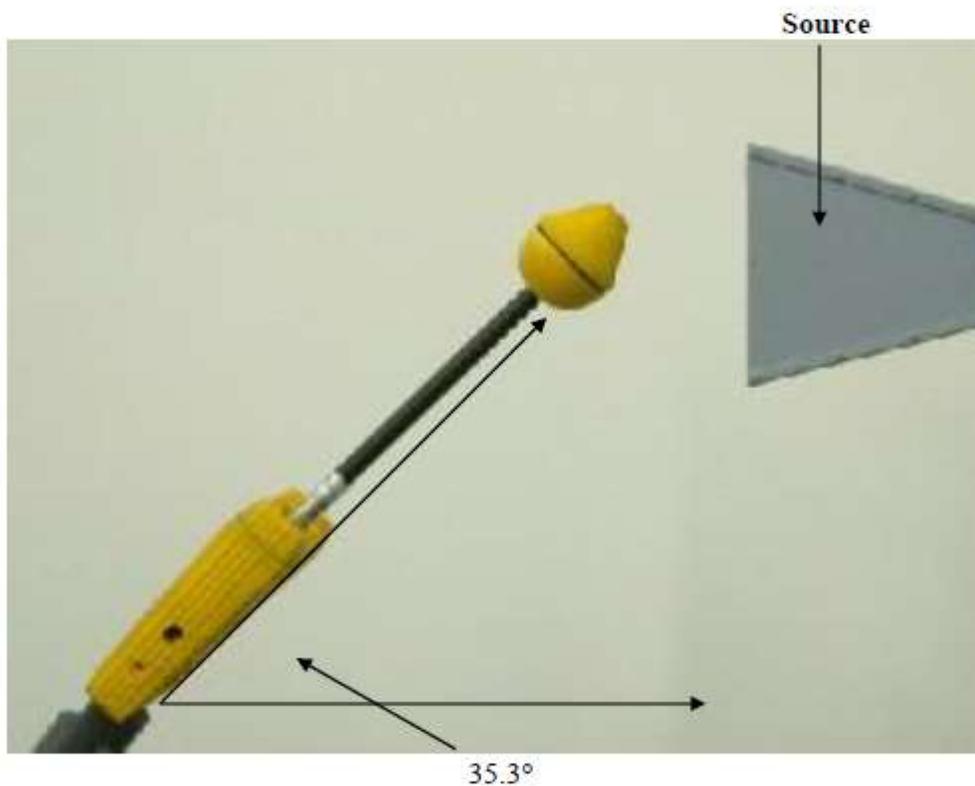
Freq MHz	Applied Field V/m	Indicated Field V/m	Max Dev dB
27.12	0.51	0.70	-2.75
27.12	1.02	1.11	-0.73
27.12	2.08	1.96	0.52
27.12	4.07	3.84	0.51
27.12	8.05	7.46	0.66
27.12	15.15	13.83	0.79
27.12	20.12	18.34	0.80
27.12	30.15	27.30	0.86
27.12	50.27	45.50	0.87
27.12	65.60	59.66	0.82
27.12	100.40	91.95	0.76
27.12	125.00	114.40	0.77
27.12	200.70	184.60	0.73
27.12	252.90	233.60	0.69
27.12	300.10	277.90	0.67
27.12	350.40	324.90	0.66
27.12	403.30	373.90	0.66
27.12	454.00	421.20	0.65
27.12	501.40	466.00	0.64
27.12	551.60	518.80	0.53
27.12	603.90	568.80	0.52

## Probe Alignment/Mounting Position

The alignment/mounting position of the probe is critical. The correction factors given with calibration are valid only for the indicated alignment/mounting position. Deviation from indicated alignment/mounting position of calibration can produce errors in excess of 6 dB.

The probe was positioned with the probe wand at a  $35.3^\circ$  angle position with the probe head centered in front of the field source. The picture below is for probe positioning reference only. The equipment shown does not necessarily indicate the equipment used for calibration.

Side View





**Certificate of Calibration**  
ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994  
Certificate Number 240209-131101-f21e01



**Model Number** H200; HI-2200  
**Manufacturer** ETS - Lindgren  
**Description** Field Probe  
**Serial Number** 00084225; 00206805  
**Customer Asset No.** N/A

**Customer**  
Motorola Solutions Malaysia Sdn Bhd  
Plot 2A Medan Bayan Lepas Technoplex  
Industrial Park Mukim 12 SWD  
Bayan Lepas, Penang 11900  
MALAYSIA

**Date of Calibration** 02/13/2024  
**Temperature** 23°C  
**Humidity** 39% RH

**Location of Calibration**  
Keysight Technologies Inc.  
1346 Yellowwood Road  
Kimballton, IA 51543  
United States

This certifies that the equipment has been calibrated using applicable Keysight Technologies procedures and in compliance with ISO/IEC 17025:2017 and ANSI/NC SL Z540.1-1994 (R2002). The quality management system is registered to ISO 9001:2015.

Calibration Standard(s)	Calibration Method(s)	Calibration Procedure(s)
IEEE Std 1309-2013 Section 4.1 IEEE Std 1309-2013 Section 5 IEEE Std 1309-2013 Section 8.2 IEEE Std 1309-2013 Section Annex A IEEE Std 1309-2013 Section A.3	Substitution	287330

**Calibration Software**  
Probe Comparison 1.5.2

**As Received Conditions**  
The measured values of the equipment were observed in specification at the points tested.

**Action Taken**  
No action was taken.

**As Completed Conditions**  
The measured values of the equipment were observed in specification at the points tested.

**Calibration Due**  
Based on the customer's request, the next calibration is due on 13 Feb 2025.

**Remarks or Special Requirements**  
A probe position document is included with this certificate. This calibration is valid only for the alignment/mounting position specified in this report.

This calibration report shall not be reproduced, except in full. The documented results relate to the equipment calibrated only.

The test limits stated in the report correspond to the published specifications of the equipment, at the points tested.

Keysight Technologies, Inc.  
1346 Yellowwood Road  
Kimballton, IA 51543  
United States

  
Brandt Langer Iowa Service Center Manager

Issue Date 13 Feb 2024

Page 1 of 5



**Certificate of Calibration**  
 ISO/IEC 17025:2017 and ANSI/NCSL Z540.1-1994  
 Certificate Number 240209-131101-f21e01



**Traceability Information**

Technician Name      Dennis Bissen

Measurements are traceable to the International System of Units (SI) via national metrology institutes ([www.keysight.com/find/NMI](http://www.keysight.com/find/NMI)) that are signatories to the CIPM Mutual Recognition Arrangement.

**Calibration Equipment Used**

Manufacturer	Model Number	Model Description	Equipment ID	Cal Due Date	Certificate Number
AR	100W1000B	Amp	11546	NA	
EMCO	5101	TEM Cell	10420	NA	2003121920
EMCO	5302	G/TEM	10223	NA	2003121915
AR	600A400	Amplifier, 10KHz-400 MHz, 600W	624658	NA	
Agilent Technologies, Inc.	8648D	Signal Generator	10307	12/31/2024	231026-134816-25ae97
AR	FI7000	Interface	11015	NA	700516
AR	FL7006	Isotropic Probe	10946	03/08/2024	2023010355-1
Holaday	HI-4422	Isotropic Probe	10022	01/21/2025	2022100146-1

**Compliance with Specification**

Unless otherwise noted, the calibration results are reported without factoring in the effect of uncertainty on the assessment of compliance/specification.

**In Specification/Out of Specification Explanation**

The standard criteria to determine the "In Specification/Out of Specification" status is based on one or more of the following conditions, as requested by the client:

1. If the manufacturer has a specified specification for the item being calibrated, then the calibration values are compared to this specification, and the values must fall within the manufacturer's specification. The specification may be obtained from the manufacturer's web site, data sheets, equipment manuals, etc.
2. Where specifications are called out in a published standard, the calibration results are compared to this specification, and the measured values must fall within the standard's specification.
3. In cases where the manufacturer, standard, or client does not identify any relevant specifications, applicable calibration results are compared to historical data with a +/- 3 dB specification.

**Uncertainty of Measurement**

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008(GUM). The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k such that the coverage probability corresponds to approximately 95%. This probability corresponds to a coverage factor of k=2 for a normal distribution.

Parameter	Range	MU (+/-)
RF Isotropic E-Field Probes - TEM Cell - Linearity	5 kHz to 800 MHz	0.91 dB
RF Isotropic E-Field Probes - GTEM Cell - Frequency Response	10 kHz to 1000 MHz	0.79 dB

## 2024\_Frequency Response.txt

Customer Name: Motorola Solutions Malaysia Sdn Bhd

Probe Manufacturer: ETS - Lindgren

Probe Model: H200; HI-2200

Probe Serial No.: 00084225; 00206805

Notes:

CAL CERT #: 240209-131101-f21e01

Freq in MHz	Correction Factors	
	Mult	dB
5	1.85	5.36
6	1.78	5.01
7	1.76	4.90
8	1.74	4.79
9	1.73	4.76
10	1.72	4.74
13.6	1.73	4.76
15	1.73	4.77
20	1.72	4.71
27.1	1.67	4.43
30	1.63	4.26
40	1.52	3.63
50	1.38	2.83
60	1.26	2.01
70	1.16	1.26
75	1.10	0.81
80	1.05	0.45
90	0.96	-0.32
100	0.89	-0.97
150	0.72	-2.85
175	0.72	-2.89
200	0.75	-2.46
250	0.76	-2.42
300	0.67	-3.48

2024\_Linearity.txt

Customer Name: Motorola Solutions Malaysia Sdn Bhd

Probe Manufacturer: ETS - Lindgren

Probe Model: H200; HI-2200

Probe Serial No.: 00084225; 00206805

Notes:

CAL CERT #: 240209-131101-f21e01

## Linearity

Freq MHz	Applied Field A/m	Indicated Field A/m	Max Dev dB
27.12	0.04	0.035	1.11
27.12	0.05	0.050	0.52
27.12	0.08	0.070	1.13
27.12	0.13	0.130	0.24
27.12	0.17	0.170	0.15
27.12	0.27	0.260	0.20
27.12	0.33	0.330	0.07
27.12	0.54	0.530	0.08
27.12	0.67	0.670	0.00
27.12	0.80	0.800	0.03
27.12	0.94	0.940	-0.04
27.12	1.06	1.070	-0.04
27.12	1.21	1.210	-0.01
27.12	1.33	1.350	-0.11
27.12	1.47	1.490	-0.14
27.12	1.60	1.670	-0.36

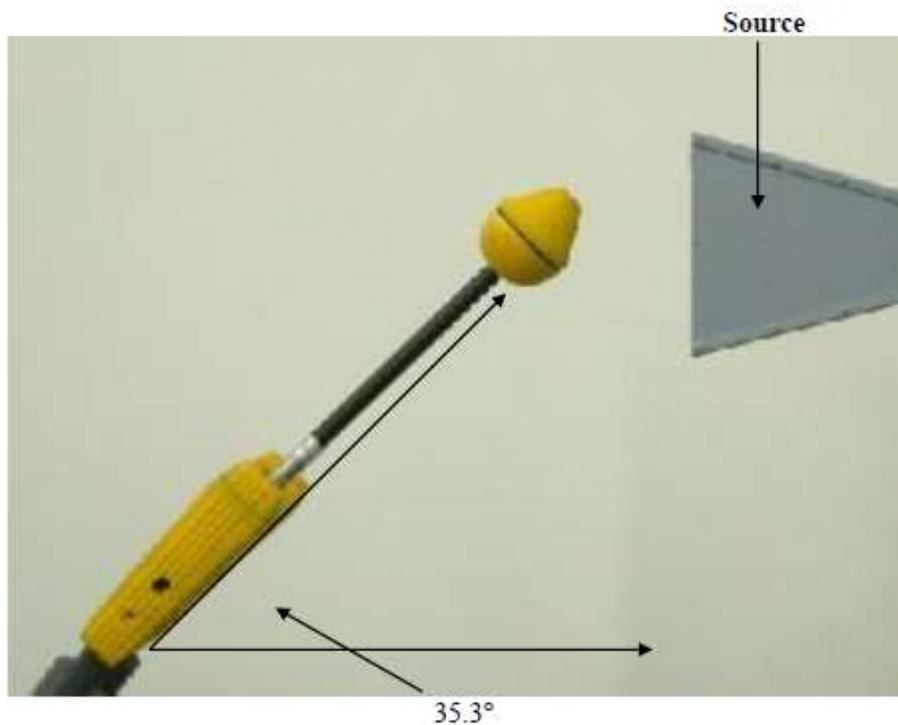
W&amp;G\_critical\_angle.doc

## Probe Alignment/Mounting Position

The alignment/mounting position of the probe is critical. The correction factors given with calibration are valid only for the indicated alignment/mounting position. Deviation from indicated alignment/mounting position of calibration can produce errors in excess of 6 dB.

The probe was positioned with the probe wand at a  $35.3^\circ$  angle position with the probe head centered in front of the field source. The picture below is for probe positioning reference only. The equipment shown does not necessarily indicate the equipment used for calibration.

Side View



**Appendix C - Photos of Assessed Antennas**  
(Refer to Ex 7B)