European
Automobile
Manufacturers
Association

Brussels, 4 April 2000

**Meetings - WG-EMC No.8** **WG.EMC/3/00**

**Subject** : **Minutes of the ACEA/ETSI Meeting 28.03.2000**

Ladies and Gentlemen,

Please find attached the minutes of the ACEA/ETSI meeting which was held on 28 March 2000.
Please note that within 2 weeks, Mr. FORM is expecting to receive your editorial comments on **Annex 1**.
The next meeting has been provisionally scheduled for 6 July 2000.

Best regards,
A. LAMERIGTS

Encl. : 16

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A C E A

**ACEA/ETSI MEETING**
**TUESDAY, 28 MARCH 2000**
**MINUTES**

## 0. ATTENDANCE

See attendance list enclosed as **Annex 2**

## 1. APPROVAL OF THE AGENDA

***Noted :***
WG.EMC/2/00 of 20.03.2000

***Agreed :***
That the agenda be adopted.

## 2. APPROVAL OF THE MINUTES OF THE MEETING OF 24.11.99

***Noted :***
WG.EMC/6/99 of 6.12.99

***Agreed :***
The minutes be adopted.

## 3. PREPARATION OF THE EMC MEETING AND OF THE INSTALLATION GUIDELINES FOR RADIO COMMUNICATION EQUIPMENT IN VEHICLES AS A BASIS FOR AN ISO TECHNICAL REPORT

***Noted :***
Annex I to WG.EMC/2/00 (ISO/5C22/SC3/WG3N 843Rev. of 03/2000)

***Discussion :***
In Annex I enclosed to the agenda of this meeting, further comments by Mr. BEADMAN and Mr. AUST were listed. These comments were discussed extensively and resulted in a "final" paper attached to these minutes. Comments to this "final" paper of editorial nature have to be communicated directly to Mr. FORM within 2 weeks after which deadline, he will transmit the final paper to ISO. The purpose is to agree on ISO/TC2/SC3/WG3 and to vote it at the next ISO meeting in June.

A C E A

No full agreement could be reached on Item 4.2 'Antenna' concerning the following sentence : *"For transmitting systems with an RF-output power level above 100 mW (< 1MHz) or 20 mW (> 1MHz), an external antenna is required"*. The ETSI representative cannot accept the limits.

An alternative wording proposed by ACEA i.e. *"Unless otherwise authorised by the vehicle manufacturers, an external antenna is required for transmitting systems with an RF output power level above 100 mW (<1 MHz) or 20 mW (> 1 MHz)"* was considered as more appropriate but still not acceptable by ETSI representatives. The ETSI representatives requested the Pilot to make the ISO Group aware of their objection.

During the discussion of the tables (item 3.2 of the document), the ETSI representatives suggested to improve the link between ETSI and ISO.
This could be done by establishing an exchange of papers between the two bodies i.e. Mr. MARTIN will provide the ETSI Secretariat with discussion papers on vehicle standards ; the ETSI Secretariat will provide Mr. MARTIN with papers dealing with proposals for ETSI standards related to vehicles.

***Agreed :***

- Members of the WG.EMC requested to inform Mr. FORM of further editorial comments to **Annex 1** to these minutes
- Mr. FORM to transmit **Annex 1** as an ACEA/ETSI input to ISO with the remark that ETSI cannot fully support Item 4.1
- To improve communication between ETSI and ISO by exchanging work papers.

## 4. DISCUSSION OF THE YORK EMC STUDY ON 95/54/EC AND ORAL REPORT OF THE FIRST MEETING OF 15.03 2000 IN BRUSSELS

***Discussion :***
The ACEA Secretariat orally reported on the meeting and informed the attendees that by 3 April 2000, the York Institute will distribute a questionnaire on a large scale. A next meeting is scheduled for 5 July 2000 in which the York Institute will report on the first results of the analysis of the answers to the questionnaire.
ETSI requested some clarification on whether Dir. 95/54/EC will be amended. In fact, ACEA is expecting as an outcome of the study, a clarification of the interpretation of Dir. 95/54/EC. The clarification does not necessarily result in amendments to Dir. 95/54/EC.

## 5. DATE AND PLACE OF NEXT MEETING

The next meeting is provisionally scheduled for 6 July 2000.

Annex 1

**ISO/TC22/SC3/WG3N 843rev**

0~~43~~/2000

# EMC guidelines for installation of after market radio frequency transmitting equipment in road vehicles

**This draft is for publication as an ISO technical report.**

**Involved parties:** **ISO/TC22/SC3/WG3**
**ETSI ERM TG4**
**Joint WG EMC ACEA/ETSI**

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# EMC guidelines for installation of after market radio frequency transmitting equipment in road vehicles

## 1. SCOPE

This technical report provides guidance for the installation in vehicles of :

- radio frequency transmitting equipment
- "in-road-vehicles" mounting kits for transportable and handheld RF equipment;
- ancillary equipment associated with the above.

This technical report :

- details the recommended methods for installation of the RF equipment in the vehicle;
- recommends the installation methods to minimise the possibility of Electromagnetic interference (EMI) between the installed equipment and the vehicle electrical and electronic systems.

## 2. DEFINITIONS AND ABREVIATIONS

### 2.1. Definitions

For the purposes of this technical report, the following definitions apply :

| | |
|---|---|
| Mobile equipment : | receiver, transmitter or transmitter/receiver (tranceiver) that is intended for installation and use in a vehicle, and powered by the mains battery of the vehicle |
| Ancillary equipment : | any equipment required as part of the installation in addition to the radio (e.g. voltage converter |
| Equipment supplier : | the supplier of the equipment to the installer, which may be a dealer, distributor or manufacturer |
| Floating system: | isolated earth return |
| Ground plane : | a conducting plane of a minimum dimension proportional to the wavelength on which a panel mount antenna is fitted |
| Installer : | radio equipment installation technician |
| Radiating element : | the part of an antenna which radiates the signal |
| Radio system : | the complete radio system installation in a vehicle |

~~*Comment (Mr. Aust). Replace by: 'A radio frequency system using RF for two way communication'*~~

| | |
|---|---|
| Vehicle supplier : | the supplier of the vehicle, which may be a dealer or the manufacturer/importer of the vehicle |

### ~~1.2.~~2.2. Abreviations

For the purposes of this technical report, the following abreviations apply :

| | |
|---|---|
| ECU | Electronic Control Unit |
| EMC | Electromagnetic Compatibility |
| HT | High Tension i.e. the high voltage circuits of the ignition system |
| ICE | In Car Entertainment |
| PC | Personal Computer |
| PMR | Private Mobile Radio |
| RA | Radiocommunications Agency |

| | |
|---|---|
| RF | Radio Frequency |
| RQAS | Radiocommunications Quality Assurance Scheme |
| VSWR | Voltage Standing Wave Ratio |

# 3. GENERAL

Installation of RF transmitting equipment shall be performed by competent personnel. The vehicle and RF transmitting equipment manufacturers' instruction manuals and installation notes shall be followed.

*Note :* Vehicle manufacturer's instructions take priority in case of conflict.

~~***Comment (Mr. Aust): Replace "vehicle manufacturers instruction take priority in case of conflict" by "'Installation of RF transmitting equipment shall be performed by competent personnel, who shall be responsible for the conformity of the installation except in cases, where vehicle manufacturers instruction have been deemed to take priority in a case of conflict.'.***~~

~~***Comments (Mr. Beadmann):***~~ The installation must comply with national legal requirements for the installation and use of RF-equipment in ve~~-~~hicles.

Installation must be checked for possible interference between the RF transmitting equipment and the vehicle electric systems~~.~~

~~***Comment (Mr. Aust): "***~~as described in 5.3.

## ~~1.1.~~3.1. Customer Liaison and installation requirements

The customer should :

- be advised to use a suitable antenna for the particular application and optimum position;
- be made aware of the various fixing locations and mounts available for the items to be fitted;
- be asked whether an ignition switched supply to the equipment is required.

## ~~1.2.~~3.2. EMC Requirements

After market RF-transmitting equipment for installation in road vehicles shall fulfill the requirements of RF-product relevant EMC-standards and road vehicle standards~~ as well~~. (Contact the road vehicle manufacturer and/or equipment supplier if necessary~~)~~ to ensure that the lates version is used).

The purpose of road vehicle EMC-standards (see. table 1) is to ensure:

- the protection for broadcast receivers in a residential environment from radio disturbances from~~of~~ vehicles~~ in more than 10m distance. *Replace by ..*~~at distances greater than 10m~~*, (Mr. Aust)*~~
- that vehicle RF-receivers shall have~~be~~ sufficiently protection~~ed *Replace by ...shall have sufficiently protection...(Mr. Aust)*~~ from unwanted emissions of other electric systems (RF-systems included) installed in the same vehicle;
- that no vehicle functions are affected due to the susceptibility of RF-systems to radiated or conducted disturbances.~~ *Replace by ...due to the lack of susceptibility of any electrical or electtronical system in vehicle to....(Mr. Aust)*~~

| | |
|---|---|
| **ISO 11451** | Road vehicles - Vehicle test methods for electric disturbances by narrowband radiated electromagnetic energy. |
| **ISO 11452** | Road vehicles – Component test methods for electric disturbances by narrowband radiated electromagnetic energy. |
| **ISO 7637** | Road vehicles -Electric disturbances by conduction and coupling |

| | |
|---|---|
| **ISO 10605** | Electrostatic discharge |
| **CISPR 12** | Limits and methods of measurement of radio disturbance characteristics of vehicles, motorboats, and spark-ignited engine driven devices |
| **CISPR 25** | Limits and methods of measurements of radio disturbance characteristics for the protection of receivers used on board vehicles |
| **ISO 14982** | Land- und forstwirtschaftliche Maschinen - Electromagnetic compatibility – Prüfverfahren und Bewertungskriterien ~~(provided by Mr. Beadmann)~~ |
| **ISO 13766** | Earth moving machinery – Electromagnetic compatibility ~~(provided by Mr. Beadmann)~~ |

**Table 1**: ISO/IEC EMC standards for road vehicles.

| | |
|---|---|
| **95/54/EC~~G~~** | Radio interference (Electromagnetic Compatibility) of vehicles |
| **ECE-R 10** | Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility |
| **1999/5/EC~~G~~** | R&TTE |
| **ECE-R 97** | |

**Table 2**: Selection of EMC regulations for~~on~~ vehicles and~~/or~~ RF equipment ~~*Replace by ...some type of vehicular RF equipment.(Mr. Aust)*~~

In addition ~~comparison~~ to vehicle standards RF-product specific EMC standards (see. table 3) are designed to ensure that:

- the RF-system operates in environments specified in the applicable Radio EMC standard~~as intended in a specified environment~~,
- unwanted emissions are controlled to a specific level.

~~*Replace by*~~
~~*□: the protection of broadcast receivers in a residential environment from radio disturbances of vehicles at distances greater than 10m.*~~
~~*□: That the RF-system operates as intended in base station, mobile and portable environments.'*~~
~~*(Mr. Aust)*~~

| | |
|---|---|
| **EN 300-279** | EMC standard for PMR radio equipment |
| **EN 300-342-1** | EMC standard for GSM &DCS1800 MHz terminal radio equipment |
| **EN 300-683** | EMC standard for SHORT RANGE DEVICES |
| **EN 300-827** | EMC standard for TETRA radio equipment |
| **ETS 300-680-1** | EMC standard for Citizens Band (CB ) radio equipment, Part 1 Angle modulated |
| **ETS 300-682-2** | EMC standard for Citizens Band (CB ) radio equipment, Part 2 Doubleside band and Single Side Band |
| **ETS 300-684** | EMC standard for commercially available amateur radio equipment |

**Table 3**: Selection of EMC product standards for RF-equipment.

### ~~1.1.1~~3.2.1 ~~Equipment or v~~Vehicle supplier's warranty

Installation of mobile radio equipment to any part of the vehicle, other than an authorised connection or mounting location may invalidate the vehicle warranty. If in doubt the vehicle or equipment suppliers should be consulted.

~~The sentence 'Installation of mobile radio equipment to any part of the vehicle, other than an authorised connection or mounting location invalidate the vehicle warranty' will not comply with the law in some European countries. We thus propose that the warranty should only be invalidated, when a fault has been caused by the installation or mounting of the equipment **(Mr. Aust)**~~

### ~~1.1.2~~3.2.2 Electromagnetic and radio frequency interference

Full consideration should be given to the positioning of mobile RF transmitting equipment to minimise electromagnetic interference (EMI) and radio frequency interference (RFI) between the RF transmitting equipment being installed and the vehicle electrical and electronic systems.
Mobile equipment may include radio equipment, ~~all~~ ancillary equipment, ~~and particularly~~ antenna and feeder cable.

## ~~1.3.~~3.3. Radio Equipment and Ancillary Items

Before installing the radio equipment or any other ancillary items, ensure that all vehicle manufacturers and equipment supplier's instructions shall~~are~~ followed so that the safe operation of the vehicle ~~users safety~~ is not impaired.

Care must be taken when planning the installation that any additional fitments used do not constitute a safety hazard and not contravene safety regulations.

Care should be taken to ensure that the microphone/handset lead is not installed such that the lead can interfere with the vehicle controls or driver.

Where a handportable or transportable unit is ~~to be~~ installed in road vehicles, the correct car adapter kit specified for the product shall~~must~~ be used. ~~*replace by a car adapter kit which has been specified by the radio equipment manufacturer must be used.* **Mr. Aust.**~~

# 4. INSTALLATION

## 4.1. The Installation Process

For the antenna care must be exercised in:

- choosing the antenna;
- siting it in a recommended location;
- installing it correctly;
- ensuring all connections in the antenna feeder are sealed to prevent dirt and water from entering the feeder and affecting its performance;
- ensuring all connections are electrically tested;
- ensuring a satisfactory VSWR reading is obtained.

## ~~1.2.~~4.2. Antenna

Unless otherwise authorised by the vehicle manufacturer an external antenna is required f~~F~~or transmitting systems with an RF-output power level above 100mW (<1MHz) or 20mW (>1MHz) ~~an external antenna is required~~.
~~to be replaced by: '*For transmitting systems with an RF-output power that may compromise the RF immunity of vehicle internal electronic equipment an external antenna is required.*'~~
~~We are conducting a research to determine appropriate power levels, Mr. Aust.~~

The external antenna and feeder cable must be impedance matched with a VSWR < 1.5. The best position for an antenna is on the metallic roof, preferabl~~e~~y towards the centre but where possible with minimum distance of a ¼ wavelength from any opening, such as a sunroof or windows. Care should be taken when siting an other antenna next to an existing antenna or when mounting antennas with magnetic bases as these could affect the accuracy or operation of the compass on vehicles so equipped.

## ~~1.1.1~~4.2.1 Radiation patterns and ground planes

To create a symmetrical, non-directional radiation pattern an antenna needs to be mounted vertically on a horizontal ground plane with ideally a radius of at least a ¼ wavelength at the lowest frequency band being used as said as in table 4~~.~~

**Table 4 - Approximate Frequency to wavelength conversion**.

| Frequency (MHz) | Wavelength (cm) | 1/4 Wavelength (cm) |
|---|---|---|
| 50 | 600 | 150 |
| 80 | 375 | 94 |
| 150 | 200 | 50 |
| 450 | 66 | 17 |
| 900 | 33 | 8 |
| 1800 | 16.5 | 4 |

The antenna should not be located close to any ~~vertical~~ structure~~, windscreen pillar, or any structure on the roof, etc,~~ which could act as a resonant structure.
~~*Change to: 'Any vertical polarised antenna should not be located close to any vertical structure, windscreen pillar, or any structure on the roof, etc, which could act as a resonant structure.', **Mr. Aust***~~

Care should be taken when siting the antenna close to an existing antenna, ensure that there is a separation of at least ¼ wavelength for transmit frequencies below 600 MHz and one wavelength for transmit frequencies above 600MHz (see table 4).

The antenna should be located as high as possible, the ideal location is on the roof of the vehicle. Any other location may have a marked affect on the radiation pattern of the antenna.

## ~~1.1.2~~4.2.2 Ground plane provision

When the antenna installation is to be carried out on a non-metallic surface:

- a ground plane independent antenna can be fitted directly to any surface (Glassfibre etc.) or onto a mounting bracket which may be supplied by the manufacturer;
- standard antenna can be used with a ground plane fitted to the underside of the panel for example an metallic plate complying with dimensions in Table 4 (see in 4.2.1).

## ~~1.1.3~~4.2.3 Fitting the antenna

### 4.2.3.1 "On-glass" antennas

Care should be taken to ensure the antenna is mounted clear of the window heater elements, decorative coating, washer/wiper and integral screen receiver antenna where fitted. Before fitting an on-glass antenna, refer to manufacturer's instructions and recommendations. In some cases this may constitute a safety hazard and may invalidate the vehicle manufacturer's warranty. On-glass antennas may not be suitable for vehicles with double-glazed screens, reflective coatings or other special glass.

> *NOTE*: If interference occurs to the "in the road vehicle" entertainment equipment or other vehicle electrical equipment, repositioning or use of a different type of antenna should be considered.

Scrupulous cleanliness must be observed and care should be taken not to touch the adhesive surfaces or the glass after cleaning prior to fixing. Care should be taken to ensure that the glass is within the specified temperature range when fixing the antenna mount in order to obtain a good bond.

#### ~~1.1.1.2~~4.2.3.2 Special and temporary antennas

These can include combined (dual or multi-frequency), ground plane independent, low profile, boot lip, magnetic and window clip types. Where applicable, the antenna manufacturer's instructions should be followed with due regard to the vehicle manufacturers instructions and limitations.
On temporary mount types care should be taken with routing the coaxial cable through door/boot openings to minimise risk of damage to the cable.
Combined antennas may be supplied with a separate diplexer unit which should be securely fixed in a ~~dry~~ location, where it is protected against ingress of water and other particles.

## ~~1.3.~~4.3. Antenna cable

Coaxial cable connectors must be used. Shielded and low loss~~impedance matched~~ antenna cable which is impedance matched for the equipment~~low loss cable~~ (VSWR<1.5) should be used to provide a continuos run between antenna and radio equipment. Excess coaxial cable should not be coiled up as this may have affect the tuning of the antenna as well producing electrical interference. If possible the antenna cable should be cut to the correct length.

~~The cable should to be routed in a way to avoid sharp bends and where possible existing vehicle wiring and electronic modules. Safety sensitive electronic control units (e.g. Airbag and ABS systems), circuits and harnesses must not be used for parallel wiring. If it is necessary to cross over wiring, cross at right angles~~

~~If an extension feeder cable is required then suitable co-axial cable should be used and correctly terminated with good quality, low loss connectors. If the antenna cable provided is to short, where possible the cable should be replaced by a suitable feeder cable of correct length. Extending the length of the feeder cable may result in additional losses particularly at frequencies above 800 MHz.~~

### ~~1.1.1~~4.3.1 Routing of the feeder cable

The cable should to be routed in a way to avoid sharp bends and where possible existing vehicle wiring and electronic modules. Safety sensitive electronic control units (e.g. Airbag and ABS systems), circuits and harnesses must not be used for parallel wiring. If it is necessary to cross over wiring, cross at right angles

If an extension feeder cable is required then suitable co-axial cable should be used and correctly terminated with good quality, low loss connectors. If the antenna cable provided is to short, where possible the cable should be replaced by a suitable feeder cable of correct length. Extending the length of the feeder cable may result in additional losses particularly at frequencies above 800 MHz.

~~Ensure that the feeder cable is properly secured, and routed in a way to avoid sharp bends and where possible existing vehicle wiring and electronic modules.~~ Ensure that the feeder cable is not strained or distorted e.g. by excessive tightening of cable ties. When vehicle trim is replaced, make sure that the panels do not trap the feeder cable. Additional care should be taken when installing a glass mount antenna to the rear screen of a hatch-back type vehicle to allow opening and to prevent damage to the feeder cable over a period of time.

### ~~1.1.2~~4.3.2 Fitting of the co-axial connectors

Fit the correct antenna connectors at each end of the feeder cable to match the equipment using either crimp or soldered connectors as appropriate. In the case of crimp connectors, use only the correct crimping tool. Ensure that the joints are electrically and mechanically sound.

> *NOTE*: Before and after replacing any vehicle trim, which may have been removed to install the antenna, it is advisable to carry out the antenna checks specified in paragraph 4.5.1.

# ~~1.4.~~4.4. Installation of Radio ~~mobile~~ equipment

## 4.4.1 Mounting of equipment in the vehicle.

Equipment should be installed such ~~mounted in such a manner~~ that: ~~change to: should be installed such that:~~

- it conforms with equipment and vehicle manufacturer's instructions;
- it cannot be damaged or it's ventilation restricted. Special care should be taken to ensure that equipment cannot be damaged by ingress of water;

~~replace by: neither the equipment nor the connector shall be liable to damage nor shall the ventilation be restricted. Special care should be taken to ensure that equipment cannot be damaged by ingress of water. Mr. Aust~~

- access is not barred to vehicle equipment in the load storage area e.g. wheeljack, fire extinguishers, spare wheel;
- the connections to the equipment should be easily accessible in order that the equipment may be removed for operation in transportable mode, or for repairs and servicing;
- it does not hinder the operation of airbags or other safety equipment.

## ~~1.1.2~~4.4.2 Routing of cables

### 4.4.2.1 General

Where possible, all cables should pass under carpets and through mouldings in such a way as to afford maximum protection. If necessary, use sleeving, a proprietary protector and/or cable ties where required.

### ~~1.1.1.2~~4.4.2.2 Routing

Select a route for the cables, ideally on the opposite side of the vehicle to the fuel pipe, clear of brake pipes, cables, controls, vehicle wiring and any hot components. Under no circumstances should any cables be attached to the foregoing.
Cables should be routed so that they avoid :

- sharp edges;
- continual bending;
- stress or strain;
- abrasion;
- extreme temperature;
- not cause a hazard to the occupants of the car.

## ~~1.1.3~~4.4.3 Power supply

### 4.4.3.1 General

When available, the manufacturer's instructions for the vehicle and/or the mobile radio equipment should be used as the primary guide for the connection to a power source. If information is not provided, then the following guidelines should be used.

### ~~1.1.1.2~~4.4.3.2 Provision of a dedicated/permanent supply

A dedicated supply cable should be used for the radio equipment installation, which should be as short as possible to the battery positive and negative connections. Do not connect directly to the battery pillars but use the battery terminals provided.

It is also recommended, that unless a moulded twin supply cable is used, then the two supply lines are twisted together along their length in order to reduce induced noise.

The supply cable from the radio equipment should approach the battery in such a way that when terminated the two wires cannot be inadvertently reversed e.g. one wire is shorter than the other.

CONNECTIONS SHOULD NOT BE MADE TO ANY ECU FEEDS UNDER ANY CIRCUMSTANCES.

#### ~~1.1.1.3~~4.4.3.3 Supply cable and routing

In addition to Clause 4.4.3.2 the following should be taken into account.

When fitting a supply cable, the following should be considered:

- heavy duty cable of a low resistance should be used on long cable runs to minimise voltage drop;
- the cable should be of a higher current capacity than the protection fuse and the correct fuse fitted;

~~Addition of statement: '*It is recommended that both the feed and return cables from the power supply to the radio are fused*' (Note: Survey damage the car, when the earth traps gets loose). **Mr. Aust.**~~

- the cable should be as short as possible;
- the cable should be secured well clear of moving parts, e.g. shock absorbers, steering, drive shaft, control pedals etc.;
- the cable should be secured well clear of the engine, exhaust or other hot items;
- the supply cable run should, where possible, be separate from that of the ICE equipment control cables, although they may pass through the same holes in the chassis and body for ease of fitting. Suitable grommets should be fitted if additional holes are drilled;
- the cables should be supported, avoiding sharp bends and not be subjected to strain;
- the cable should be sited away from ignition coil, HT circuits and ECUs and, where possible, other vehicle wiring.

#### 4.4.3.4 24 volt or higher vehicle supply

Most mobile radio equipment operates from a 12 volt supply. If the vehicle has a 24 volt or higher supply then it is essential that a suitable regulator or converter is used which will provide the nominal supply voltage and current for which the radio equipment is designed. ~~It should also comply with vehicle EMC requirements~~ ~~*Replace by:*~~ 'The converter together with the radio equipment should also comply with vehicle EMC requirements and the radio product EMC requirements.'

A 12 VOLT TAP MUST NOT BE TAKEN FROM THE VEHICLE BATTERIES

A means of switching off the regulator or converter must also be provided; this can be via the ignition switch, direct switching from the mobile radio, a master switch or some other means agreed with the customer.

The supply cable to the regulator or converter must be as short as practicable and suitable fuses should be fitted as close as possible to the supply. The unit should be mounted in accordance with the manufacturer's instructions. Unless environmentally protected it should be located in a dry and well ventilated position.

The installation of the mobile radio equipment should be carried out in such a manner that the integrity of the vehicle isolated power supply is not impaired. Continuity checks between the positive and negative supplies and the vehicle chassis must be carried out before and after installation to ensure isolation of the power supply is maintained. The checks should be carried out with the isolation switch in the 'on' position.

# 5. TEST & FINAL INSPECTION

## 5.1. Antenna Basic Checks

Ensure that the antenna radiating element is specified for the intended use.

Before connection to the equipment, wherever possible the antenna should be DC tested as follows:

- low resistance between the centre pin of the co-axial connector and the antenna radiating element ~~where accessible.~~ (less than 0.1 ohm);
- no unintended connection between the centre pin of the co-axial connector and vehicle earth; ~~*change to: no unintended connection between*...~~
- some antennas are DC grounded e.g. glass mount, centre tapped, base loaded, etc. Where this occurs consult the manufacturer's installation instructions.
- low resistance between the body of the co-axial connector and vehicle earth.(less than 0.1 ohm);

## ~~1.2.~~5.2. Test Calls

Tests of the radio installations should be made in all operational modes of the radio equipment, to check all functions of the mobile radio equipment wherever possible. These checks should be made with the vehicle systems in use after the equipment has been fully installed.

~~Replace by: '*Tests of the radio installations should be made in the representative operational modes of the radio equipment.*~~

*UNDER NO CIRCUMSTANCES SHOULD ANY INSTALLATION TECHNICIAN ATTEMPT TO MODIFY ANY RADIO EQUIPMENT*~~'~~

~~Note: Certain RF-systems (e.g. GSM-phones) transmit with different RF-power levels and that in this case the test may not necessarily be performed at the max. RF-power level.~~

## ~~1.3.~~5.3. Interference Checks

Checks should be made for interference from and to all electrical and electronic equipment in the vehicle, both in standby and transmit modes. This should be carried out to show that no vehicle functions are affected and vehicle manufacturer specifications are still meet, initially with the ignition switch on but the engine not running, all tests should be repeated with the engine running, followed by road tests at various speeds. ~~*Change to: 'This should be carried out according to the vehicle manufacturer instruction, initially with the ignition switch on but the engine not running, all tests should be repeated with the engine running, followed by road tests at various speeds.'*~~ ~~**Mr. Aust**~~

If any interference occurs then every effort should be made to locate and rectify any installation problem.

> *Note: Certain RF-systems (e.g. GSM-phones) transmit with different RF-power levels and that in this case the test may not necessarily be performed at the max. RF-power level.*

If a problem is found and cannot be rectified, and it is suspected that the equipment or vehicle is out of specification, then the appropriate manufacturer, agent or supplier should be consulted. If, after following the manufacturer's, agent's or supplier's advice, the problem with the vehicle still exists, it should be noted and the customer must be advised.

*UNDER NO CIRCUMSTANCES SHOULD ANY INSTALLATION TECHNICIAN ATTEMPT TO MODIFY ANY VEHICLE DEVICE OR VEHICLE SYSTEM WHICH IS BEING AFFECTED.*

ACEA

**MEETING WG.EMC-ETSI**
**28 MARCH 2000**
**10 A.M.**

| | | |
|---|---|---|
| ETSI | Mr. N. LIGHTFOOT | |
| ETSI | Mr. B. OLIVER | absent |
| MIRA | Mr. T. BEADMAN | TBG |
| MOTOROLA | Mr. P. MALMBAK | |
| NOKIA | Mr. D. AUST | |
| VISTEON | Mr. C. WRIGHT | |
| VW | Mr. T. FORM | ok |
| BNA | Mr MARTIN Francis | ok |
| SIEMENS | Mr ~~Gerd~~ Ortkiass | |

ACEA : Mr. A. LAMERIGTS

Apologies
Mr. B. Duriez, PSA
Mr. J-L Lecocq, PSA
Mr. H. Fückel, Adam Opel
Mr. B. Oliver, Etsi
Mr. K-E. Olsson, Scania