REV	Δ	Description	Sheet Effected	Date	Drawn	Checked
A				16.12.02	D.Lanuel	S.Cohen

EMC Laboratory

MMR-R

FCCID :NTAMMR2

Manufactured by Tadiran-Telematics

EMC Test Report

According FCC Part 15 Requirements

OCT 2002

	Function/Title	Name	Signature	Date
Prepared by	Test Engineer	D.Lanuel		10.12.02
Approved by	EMC Lab. Manager	S.Cohen		16.12.02

Table of Contents

Para **Page**

1. TEST DATA INFORMATION

1.1. Description of equipment Under Test.

Equipment Under Test:	**MMR-R**
FCCID	**NTAMMR2**
Serial Numbers:	**0001**
Mode of Operation:	**RX MODE – 900MHz ISM band (multi frequency)**
Year of Manufacture:	**2002**

1.2. Applicant Information:

Applicant:	**TADIRAN Telematics Ltd.**
Applicant Address:	**26 HAMELACHA St. HOLON 58117**
Telephone:	**972-3-5575773**
FAX:	**972-3-5575753**
The testing was observed by the following applicant's personnel:	**Mr. Genik Anatoly** **Mr. slava Snitkovski**

1.3. Test Performance:

Date of reception for testing:	**10/12/02**
Dates of testing:	**11/12/02**
Test Laboratory Location:	**TADIRAN EMC LAB , Hashoftim 26 Holon 58102** **ISRAEL** **Tel: 972-3-5574476 Fax: 972-3-5575320**
Applicable EMC Specification:	**Federal Communication Commission (FCC),** **Code of Federal Regulations 47,** **FCC Docket 89-103,** **Part 15: Radio Frequency Devices,** **Sections 15.107 & 15.109 & 15.111**

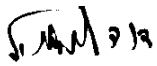
2. TEST SUMMARY AND SIGNATURES.

TADIRAN EMC Laboratory has completed testing of E.U.T in accordance with the requirements of the FCC Part 15 Regulations for Class B equipment.

The E.U.T has been found to comply with the emission requirements of the FCC Part 15 Regulations for parts 15.107,15.109 &15.111

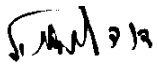
2.1. **Test performed by:**

Mr. D. Lanuel Test Engineer



2.2. **Test Report prepared by:**

Mr. D. Lanuel Test Engineer



2.3. **Test Report Approved by:**

Mr. Samuel Cohen EMC Lab. Manager

3. GENERAL INFORMATION

3.1. Specification Reference

Section 15.107:	Limits of Mains Terminal Interference Voltage (Conducted Emission) in the 0.45MHz to 30MHz frequency range. For Unintentional Radiators.
Section 15.109:	Limits of Radiated Interference Field Strength in the 30MHz to 1000MHz frequency range.
Section 15.111:	Limits of Antenna power conduction at 450KHz TO 1GHz

3.2. Applicable Documents.

3.1 Federal Communication Commission (FCC), Code of Federal Regulations 47, FCC Docket 89-103, Part 15: Radio Frequency Devices, Sections 15.107 & 15.109.

3.2 FCC/OET, Laboratory Measurement Procedures MP-4, July 1987, "FCC Procedures for Measuring RF Emissions from Computing Devices".

3.3 FCC/Office of Science and Technology OST-55, August 1982, "Characteristics of Open Field Test Sites".

3.4 FCC/OET, "FCC Procedure for Measuring Electromagnetic Emissions from Digital Devices", TP-5, March 1989.

3.5 FCC/OET, "Understanding the FCC Regulations Concerning Computing Devices", OST-62, May 1984

3.6 International Special Committee On Radio Interference (CISPR) Publication 16, First Edition 1977, "CISPR Specification for Radio Interference Measuring Apparatus and Measurement Methods".

3.7 American National Standard, "Specifications for Electromagnetic Noise and Field Strength Instrumentation, 9KHz to 1GHz", ANSI C63.2, 1987.

3.8 American National Standard, "Method of Measurement Electromagnetic Emissions from Low-Voltage Electrical and Electronic Equipment in the range of 9KHz to 40GHz", ANSI C63.4, 1992.

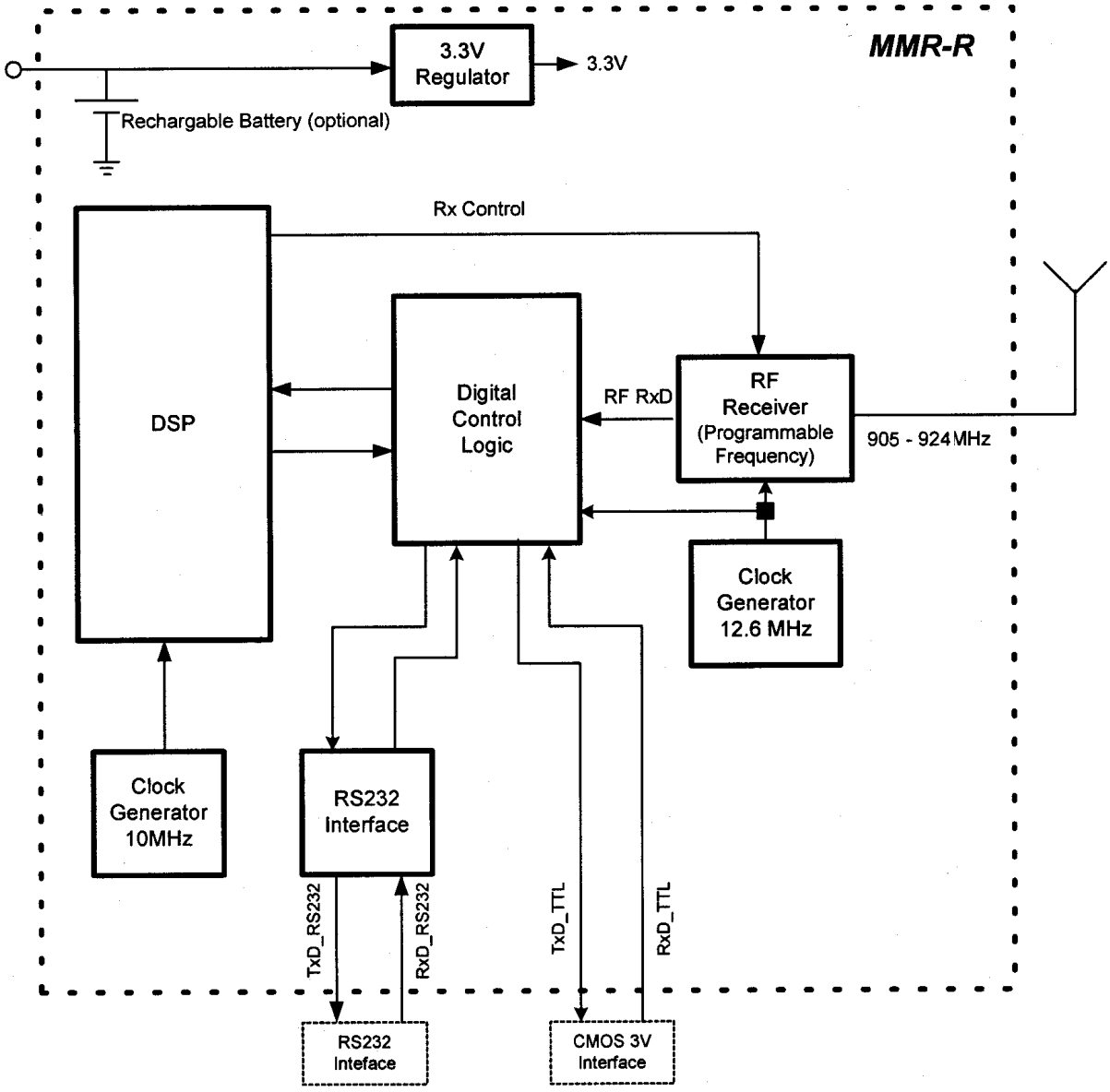
3.3. E.U.T description

3.3.1. The MMR-R is a compact RF receiver unit operates at 900MHz ISM band (multi frequency).

- **The MMR-R is used for wireless data collection (transmitted from water meters)**

3.3.2. E.U.T Block Diagram

- **A block diagram of the MMR-R is described below.**



3.3.3. Equipment Photographs

Refer to Appendix A

3.3.4. E.U.T Test Configuration

- **The E.U.T test configuration for Conducted and Radiated Emission measurements is given in tables RE-A and CE-A**
- **Auxiliary test equipment list for radiated emission test is given in table RE-A**
- **Auxiliary test equipment list for Conducted emission test is given in table CE-A**

3.4. E.U.T Mode of Operation description

3.4.1. The test was performed to measure Radiated & Conducted emission at RX Mode by four configurations:

3.4.1.1. ***Portable configuration. With Out port-Antenna***

3.4.1.2. ***Portable configuration. With Out port-50ohm***

3.4.1.3. ***Vehicular configuration. With Out port-Antenna***

3.4.1.4. ***Vehicular configuration With Out port-50ohm***

Error! No topic specified.

4. ADMINISTRATIVE DATA

4.1. Scope

This document describes the measurement procedures and tests for Radiated and conducted emission testing of the MMR-R Manufactured by TADIRAN-Telematics.

4.2. Administrative Data

The test was performed by the TADIRAN / EMC Laboratory, 26 Hashoftim St. P.O.B. 267, 58102 Holon, ISRAEL.

4.3. Certification And Qualifications

I Certify that TADIRAN / EMC Laboratory. Conducted the tests performed in order to obtain a technical data presented in this application. Also based on the results of this enclosed data I have concluded that the equipment tested meets or exceeds the requirements of the Rules and regulations governing this application.
TADIRAN / EMC Laboratory, 26 Hashoftim St. P.O.B. 267, 58102 Holon, ISRAEL was established in 1975 to provide Electromagnetic Compatibility testing, Consulting and Engineering. All facility are equipped with modern Automated test equipment and staffed with experienced EMC test engineers. Engineering support is a standard feather of our sites, we are ready to support and assist our customers in meeting the compliance requirements.
Our qualifications include:
Quality assurance MIL-I-45208A
Calibration per MIL-STD-45662A
FCC Listed
ISO 9001 Approved By The International Certification Network "IQNet"
ISO 9001 Approved By the Standards Institute of Israel.
Approved by I.D.F for Compliance with regulation.
Approved by I.A.F for Compliance with regulation

TADIRAN / EMC Laboratory has previously performed FCC testing of similar equipment. Appendix A includes an FCC approval of our application for licensing of a previous generation of a Transceiver product operating under the requirements of FCC part 15.247 for intentional radiator equipment. As well as evidence for our accreditation by ISO 9001 & listing by FCC.

4.4. Measurement Repeatability information

The test data presented in this report has been acquired using the guidelines set forth in FCC Part 15 .The test data presented in this document are valid only for the equipment identified under the test conditioned described. Repeatability of these tests results will only be achieved with identical test conditions. This conditions include: the same test distance, E.U.T height, measurement site characteristics and the same E.U.T System components, The system must have the same interconnecting cables arranged in identical placement to that in the test set-up, with the system and /or E.U.T functioning in identical mode of operation (i.e. software and so on) as on the date of the test. Any deviation from the test conditions and the environment on the date of test may result in measurement repeatability difficulties. All changes made to the E.U.T during the course of testing as identified in this test report must be incorporated into the E.U.T or identical modes to ensure compliance with the FCC regulations.

4.5. MEASURING EQUIPMENT CALIBRATION

4.5.1. Receiving System Calibration

The equipment calibration is traceable. Calibration is performed under the MIL-STD-45662A requirements

Antennas calibration

Biconical and Log-periodic antennas are calibrated by using the reference antenna method according to ANSI C63.5-1988, when the reference antenna is the Robert's antenna.

Double-ridged guide antennas (1-18 GHz) are calibrated by using two identical antenna methods according to ANSI C63.2-1987 and SAE ARP-958

Calibration of listed above antennas is performed periodically once a year

Robert antenna is calibrated every three years by using the reference antenna method according to ANSI C63.5-1988, when the reference antenna is the calibrated Robert antenna.

Antennas, which are used according to military standards tests, are calibrated every two years by using two identical antenna methods according to SAE ARP-958.

5. OUT OF BAND RADIATED FIELD STRENGTH MEASUREMENT TEST ACCORDING TO 15.109

Testing Engineer: D.Lanuel **Date** 20/10/02

5.1. General

The test was performed to measure Radiated emission at RX Mode by four configurations: 1 Portable configuration. With Out port-Antenna
2 Portable configuration. With Out port-50ohm
3 Vehicular configuration. With Out port-Antenna
4 Vehicular configuration. With Out port-50ohm

5.2. Test Results Summary & Conclusions

5.2.1. The E.U.T was found in compliance with 15.109 Requirements

5.3. Limits of Radiated Interference Field Strength according 15.109

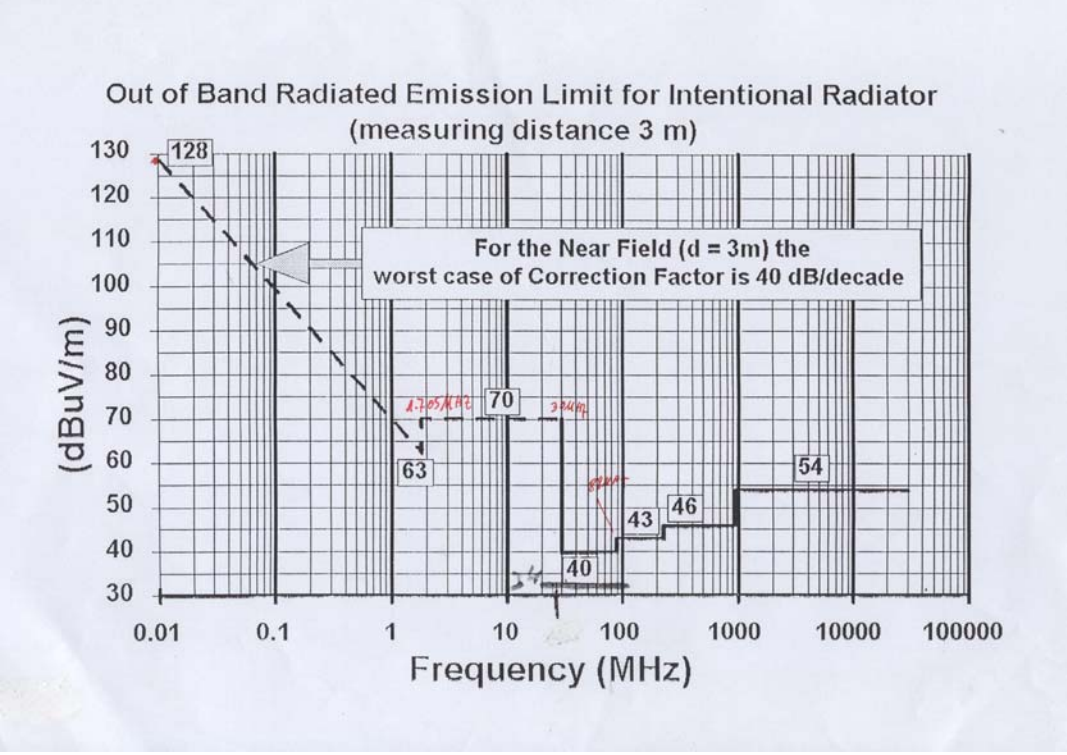
The test unit shall meet the limits of Table 1 for Class B equipment.

Table 1 Limits For Class B equipment

Frequency Range (MHz)	Quasi-peak Limits (dBµV/m)
30 - 88	40
88 - 216	43
216 - 960	46
Above 960	54

5.4. Limits of Radiated Interference Field Strength according 15.109

The test unit shall meet the limits of Table 1 for Class B equipment.



5.5. Test Instrumentation and Equipment

Table RE-A Test Instrumentation and Equipment

Item	Model	Manufacturer	Next Date Calibration
Spectrum Analyzer	8568A	HP	12/08/03
Spectrum Analyzer	8593E	HP	31/01/03
Broadband Antenna	BTA-L	FRANKONIA	10.04.03
Low Noise Amplifier (0-1GHz)	AM-1300-N	MITEQ	14.01.03
Low Noise Amplifier (1-2GHz)	SMC-09	MITEQ	14.01.03
Low Noise Amplifier (2-6GHz)	MWA-02060-4025	ELISRA	14.01.03

5.5.1. The measuring system block diagram shown in Figure RE-1.

5.5.2. E.U.T orientation and antenna position shown in Figure RE-2

5.5.3. Cables configuration shown in Figure RE-3

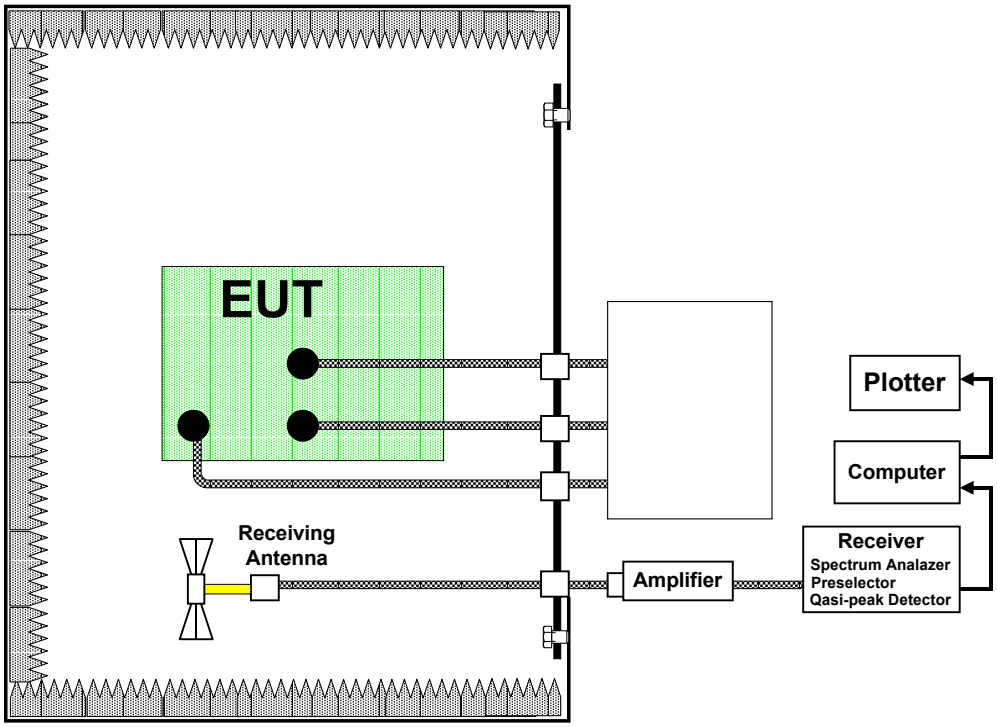


Figure RE-1

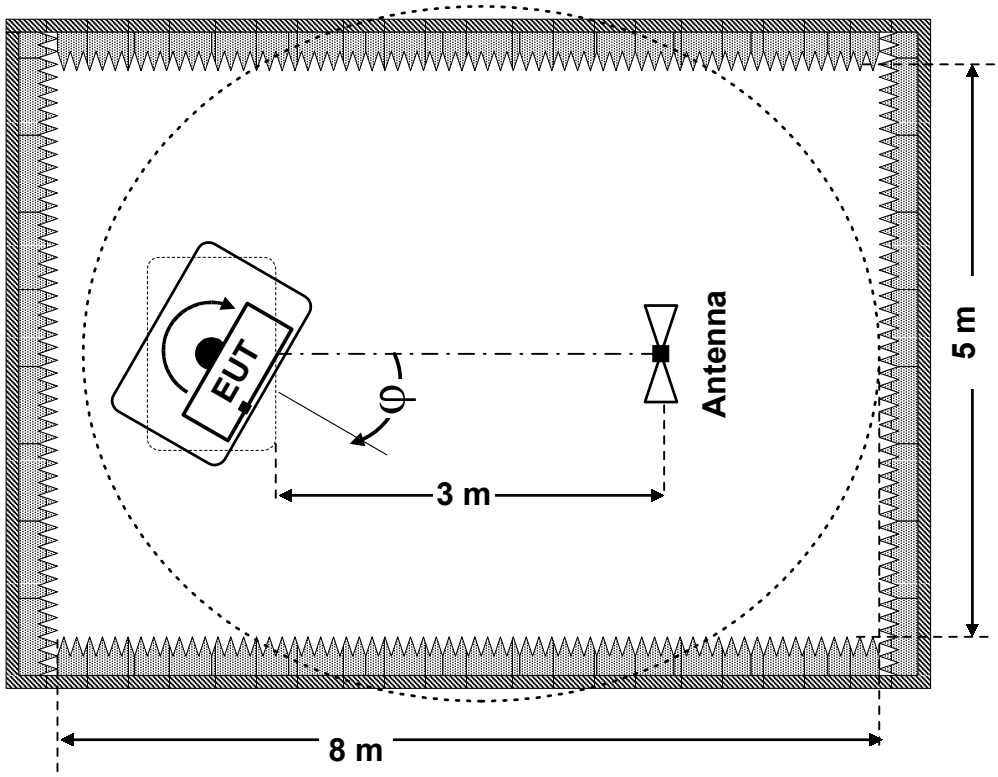


Figure RE-2

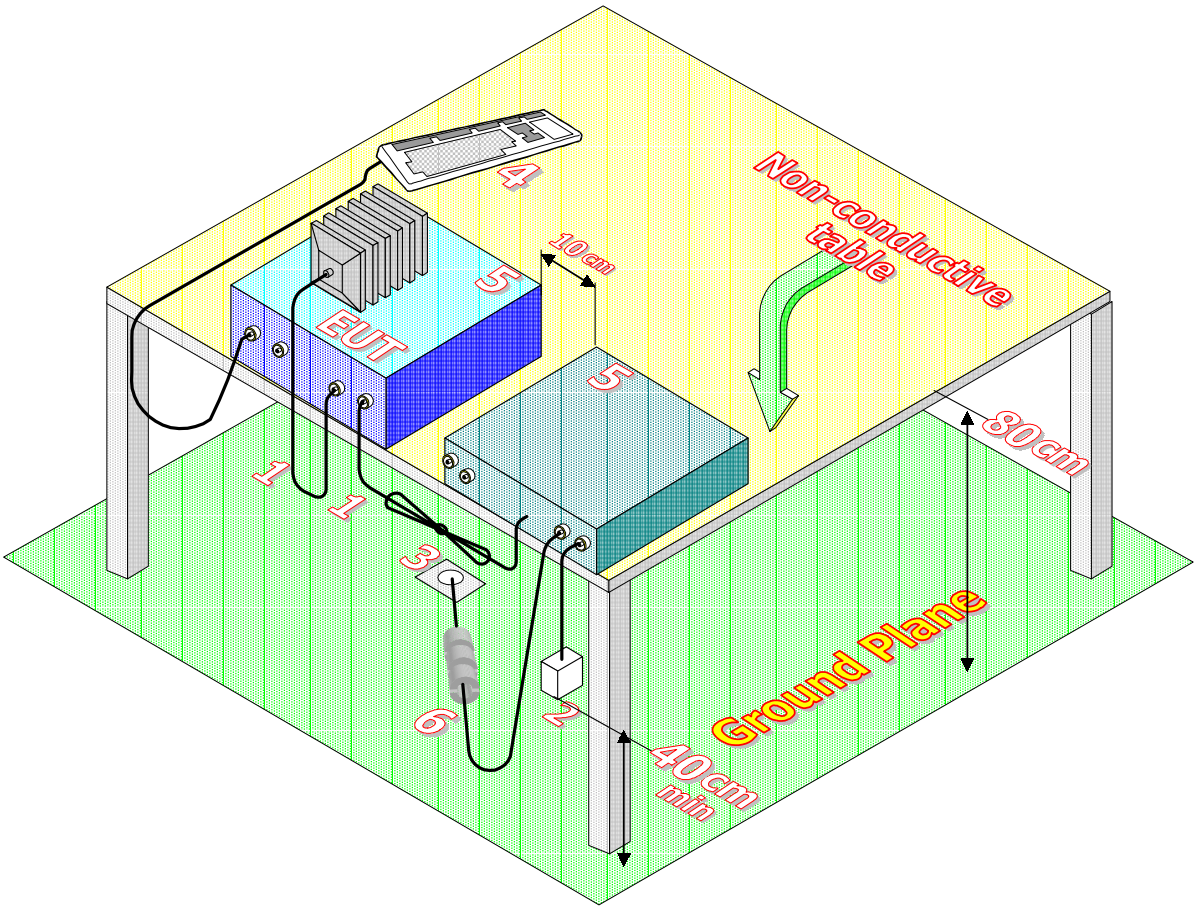


Figure RE-3

1. If cables, which hand closer than 40 cm to the horizontal ground plane cannot be shortened to the appropriate length, the excess shall be folded back and forth forming a bundle 30 cm to 40 cm long.
2. The end of I/O signal cables, which are not connected to a peripheral, may be terminated, if required to proper operation using correct terminating impedance.
3. Main junction boxes shall be flush with, and bonded directly to, metal ground plane
4. Cables of hand operated devices such as keyboards, mousses; etc. shall be placed as for normal usage.
5. Peripherals shall be placed at distance 10 cm from each other and from the controller, except for the monitor, which, if for an acceptable installation practice, shall be placed directly on top of the controller.
6. Mains cables, telephone lines or other connections to auxiliary equipment located outside the test area shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turn table. No extension cords shall be used to mains receptacle.
7 Ferrite clamps or ferrite tubes. No more than one cable per clamp.

5.6. Preliminary Test Procedure

5.6.1. Maintain setup in absorber-lined shielded room as shown in Figures RE-1, RE-2 and RE-3.

5.6.2. Turn on the E.U.T and allow sufficient time for stabilization.

5.6.3. Monitor the frequency range of interest at a fixed antenna height and E.U.T azimuth.

5.6.4. Rotate the E.U.T 360° to maximize the suspected highest amplitude signal.

5.6.5. Move the antenna over its full-allowed range of travel to maximize the suspected highest amplitude signal.

5.6.6. Change the polarity of the antenna and repeat step d and e. compare the result suspected highest amplitude signal with that found for the other polarity. Select and note the higher of the two signals. The signal is termed the highest observed signal with the respect to the limit.

5.6.7. Repeat testing for each operational mode of the E.U.T.

5.6.8. Choose six highest emissions relative to limit and record antenna heights and polarities, E.U.T configuration for each emission frequency.

5.6.9. Perform measurements for selected frequencies using quasi-peak detector.

5.7. Preliminary Results

Table RE-B Preliminary Test Results for RX Mode 15.109

Configuration	Antenna Polarization	Freq. Range MHz	Res. BW (kHz)	Plot No.	Compl. Y/N
Calibration		30	**120**	**Plot REcal/1**	**Y**
		100		**Plot REcal/2**	**Y**
		500		**Plot REcal/3**	**Y**
		1000		**Plot REcal/4**	**Y**
		1500		**Plot REcal/5**	**Y**
		4000		**Plot REcal/6**	**Y**
Portable Configuration Out Port-Antenna	Both Hor.&Ver	30-200	**120**	**Plot RE/1**	**Y**
		200-1000		**Plot RE/2**	**Y**
		1000-2000	**1000**	**Plot RE/3**	**Y**
		2000-5000	**1000**	**Plot RE/4**	**Y**
Portable Configuration Out Port-50 Ohm	Both Hor.&Ver	30-200	**120**	**Plot RE/5**	**Y**
		200-1000		**Plot RE/6**	**Y**
		1000-2000	**1000**	**Plot RE/7**	**Y**
		2000-5000	**1000**	**Plot RE/8**	**Y**
Vehicular Configuration Out Port-Antenna	Both Hor.&Ver	30-200	**120**	**Plot RE/9**	**Y**
		200-1000		**Plot RE/10**	**Y**
		1000-2000	**1000**	**Plot RE/11**	**Y**
		2000-5000	**1000**	**Plot RE/12**	**Y**
Vehicular Configuration Out Port-50 Ohm	Both Hor.&Ver	30-200	**120**	**Plot RE/13**	**Y**
		200-1000		**Plot RE/14**	**Y**
		1000-2000	**1000**	**Plot RE/15**	**Y**
		2000-5000	**1000**	**Plot RE/16**	**Y**

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

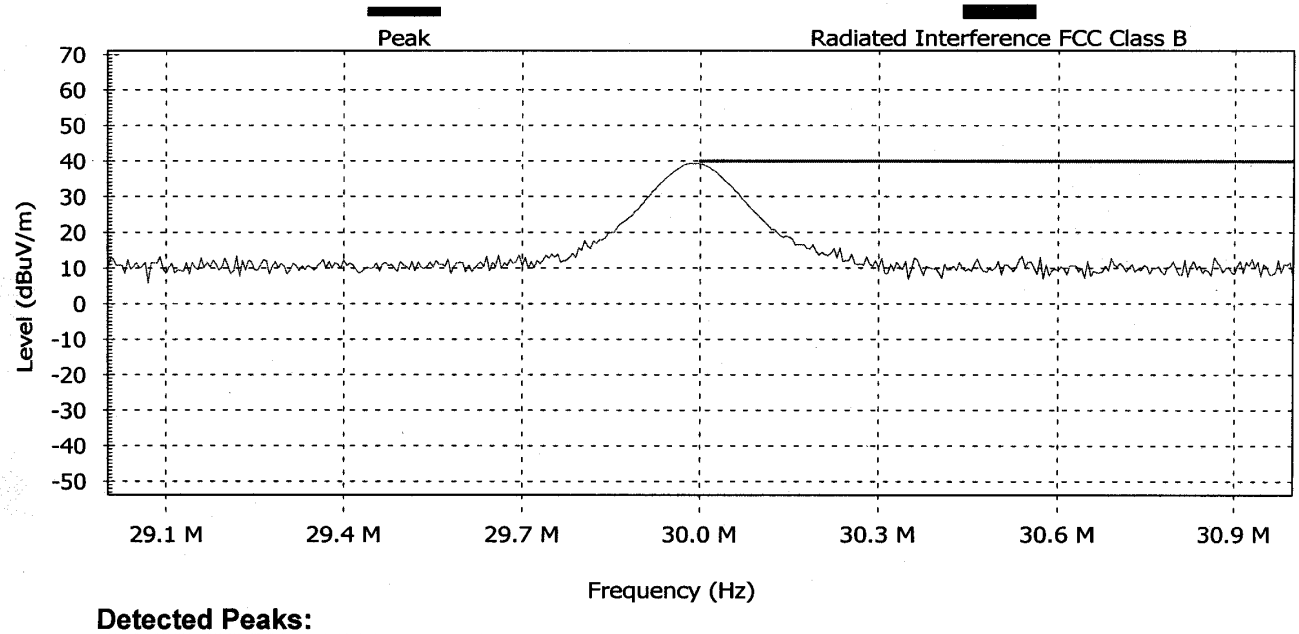
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 31) Calibratin BTA-L Ant 30MHz RE FCC CLASS B
From 29 MHz to 31 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	29.989	Cont.	39.4		Pass	Pass

Settings:

Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 1

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

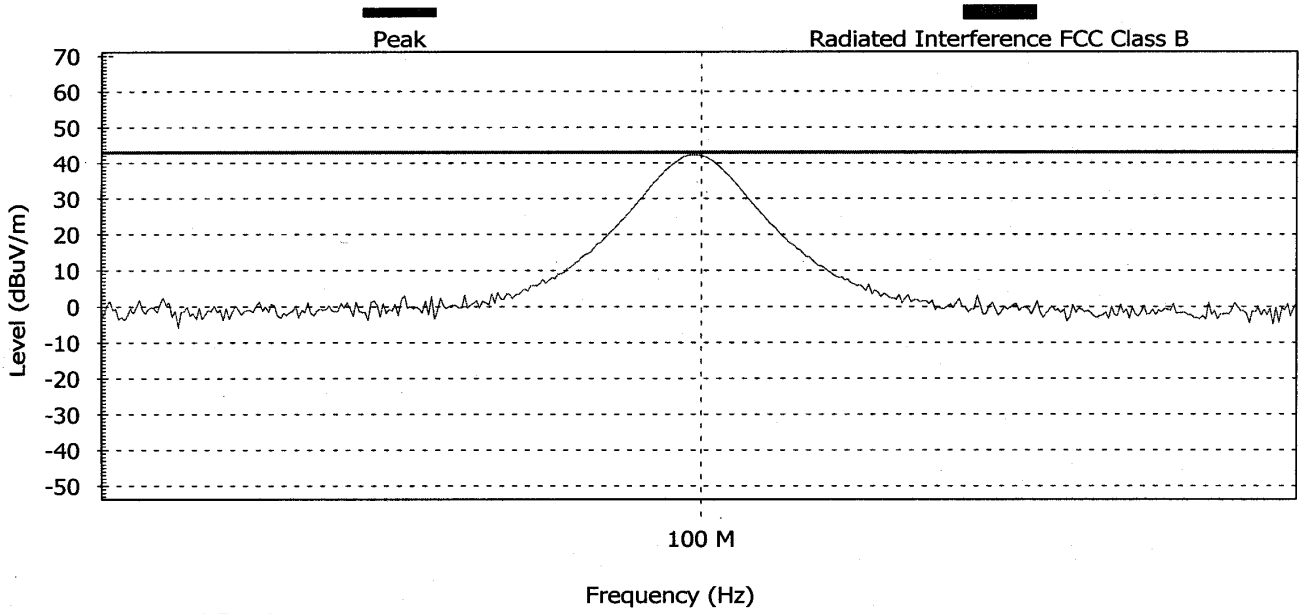
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 33) Calibratin BTA-L Ant 100MHz RE FCC CLASS B
From 99 MHz to 101 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	99.989	Cont.	42.3		Pass	Pass

Settings:

Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 2

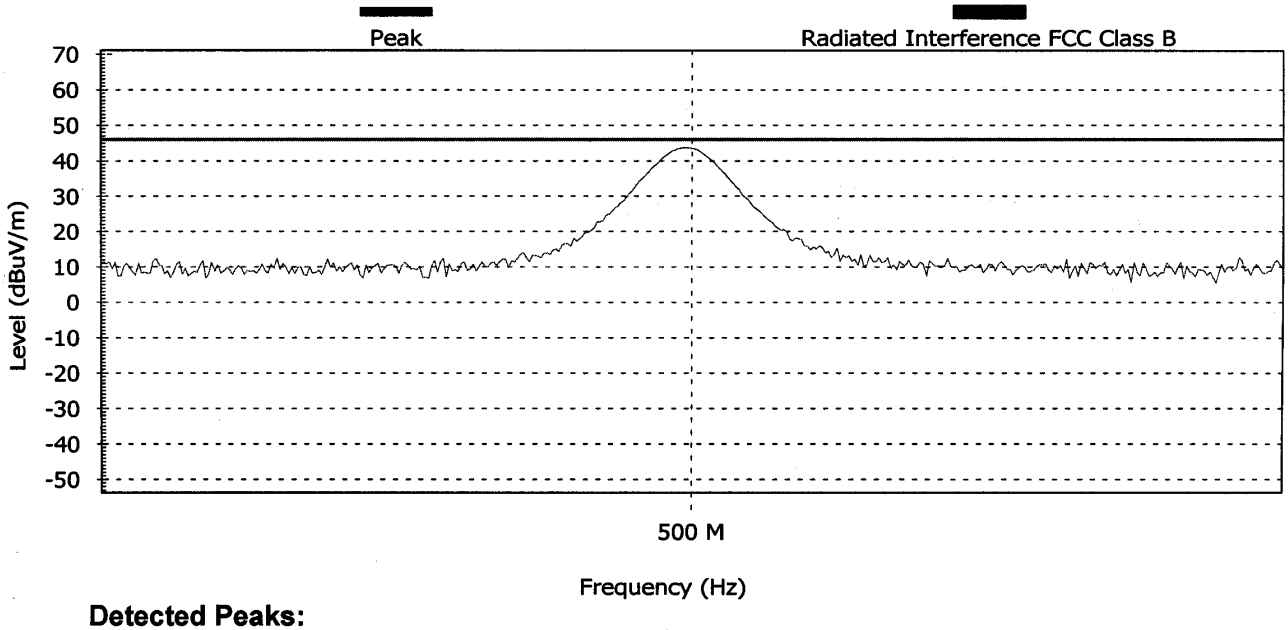
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 34) Calibratin BTA-L Ant 500MHz RE FCC CLASS B
From 499 MHz to 501 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	499.994	43.7		Pass	Pass

Settings:
Antenna: Horizontal at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 3

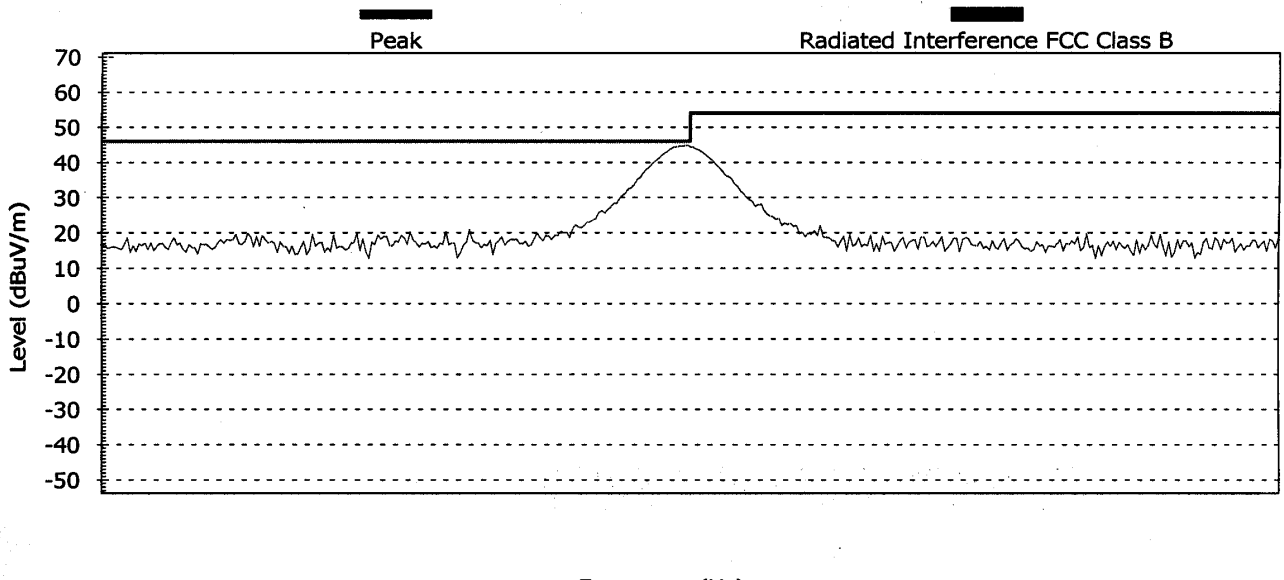
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 36) Calibratin BTA-L Ant 960MHz RE FCC CLASS B
From 959 MHz to 961 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	959.992	45.0		Pass	Pass

Settings:

Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 4

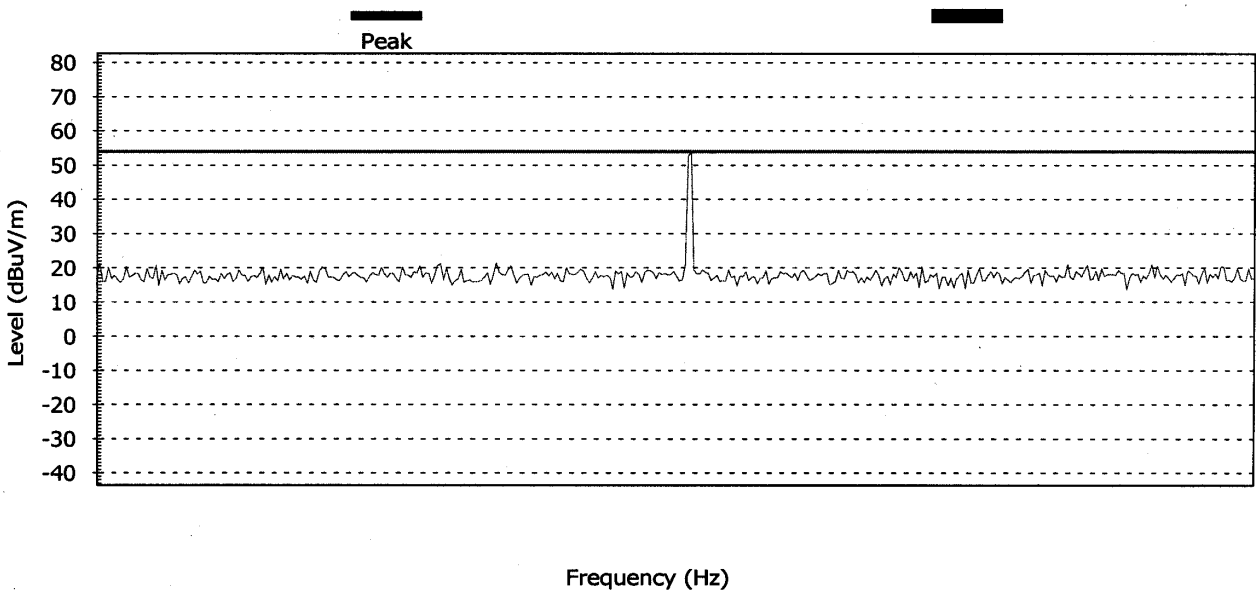
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 130) Calibratin 1.5GHz RE FCC CLASS B
From 1449 MHz to 1551 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	1499.982	54.4		Pass	Pass

Settings:

Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 21.25 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 5

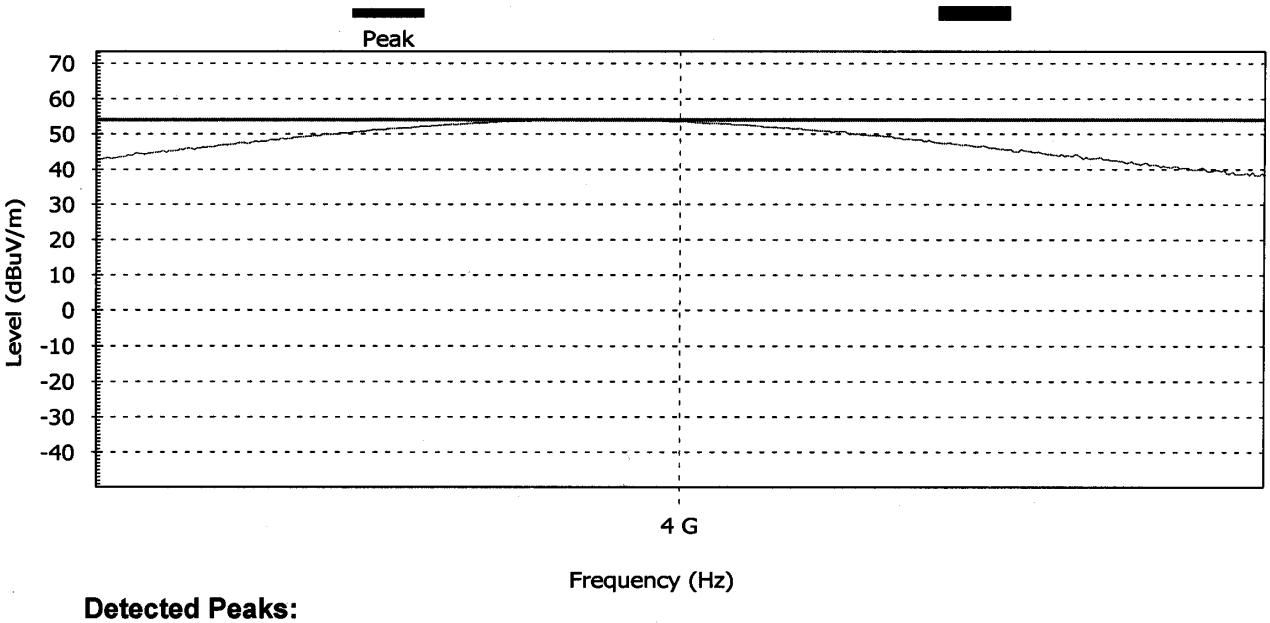
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 131) Calibratin 4GHz RE FCC CLASS B
From 3999.9 MHz to 4000.1 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass
1	3999.983	54.2		Pass	Pass

Settings:

Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines
Measure the peaks with the peak detector

Plot REcal/ 6

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

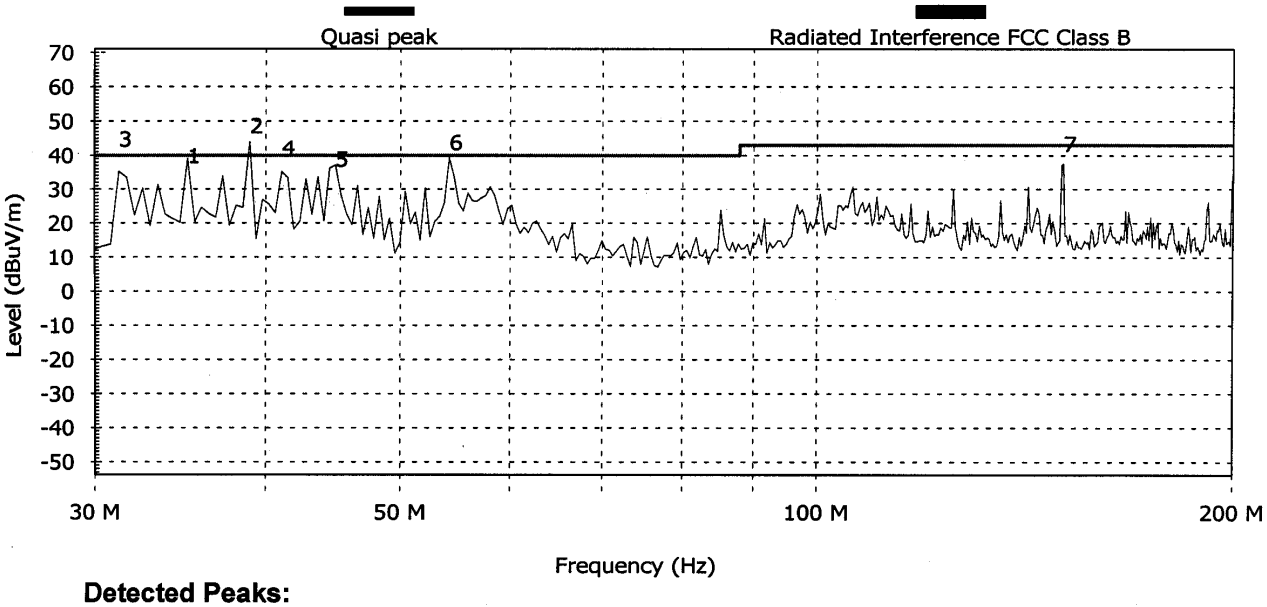
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 37) RE FCC CLASS B 30-200MHz
From 30 MHz to 200 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	36.715	Disc. NB	34.5	27.2		40.0	Pass	Pass	Pass	0	1	H
2	38.925	Disc. BB	44.0	26.4		40.0	Pass	Pass	Pass	0	1	H
3	40.472	Disc. BB	36.3	30.3		40.0	Pass	Pass	Pass	355	1.1	H
4	40.526	Disc. NB	37.7	29.5		40.0	Pass	Pass	Pass	0	1	H
5	43.257	Disc. NB	34.9	27.4		40.0	Pass	Pass	Pass	0	1	H
6	54.225	Disc. NB	39.1	25.9		40.0	Pass	Pass	Pass	0	1	H
7	149.918	Disc. BB	38.8	32.3		43.0	Pass	Pass	Pass	0	1	V

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 35.4169998168
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 1

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

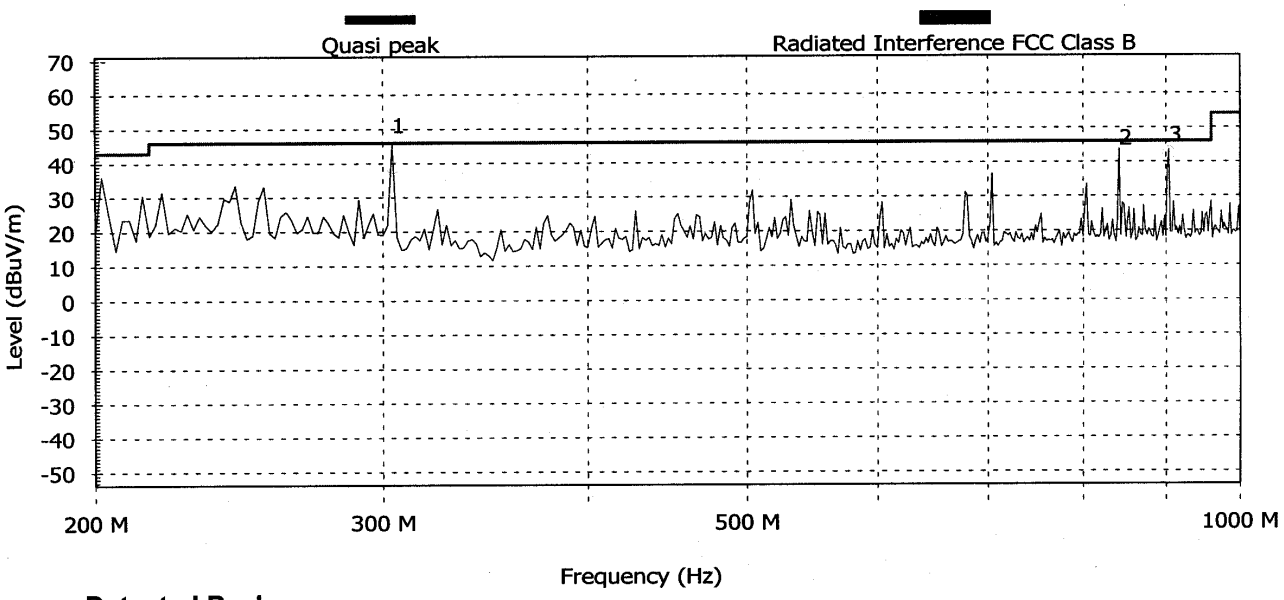
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 51) RE FCC CLASS B 200-1000MHz
From 200 MHz to 1000 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	299.966	Cont. NB	46.6	38.8		46.0	Pass	Pass	Pass	0	1	V
2	834.592	Disc. BB	42.4	-10.5		46.0	Pass	Pass	Pass	0	1	H
3	899.972	Cont. NB	43.3	42.5		46.0	Pass	Pass	Pass	5	1	H

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 166.666992187
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 2

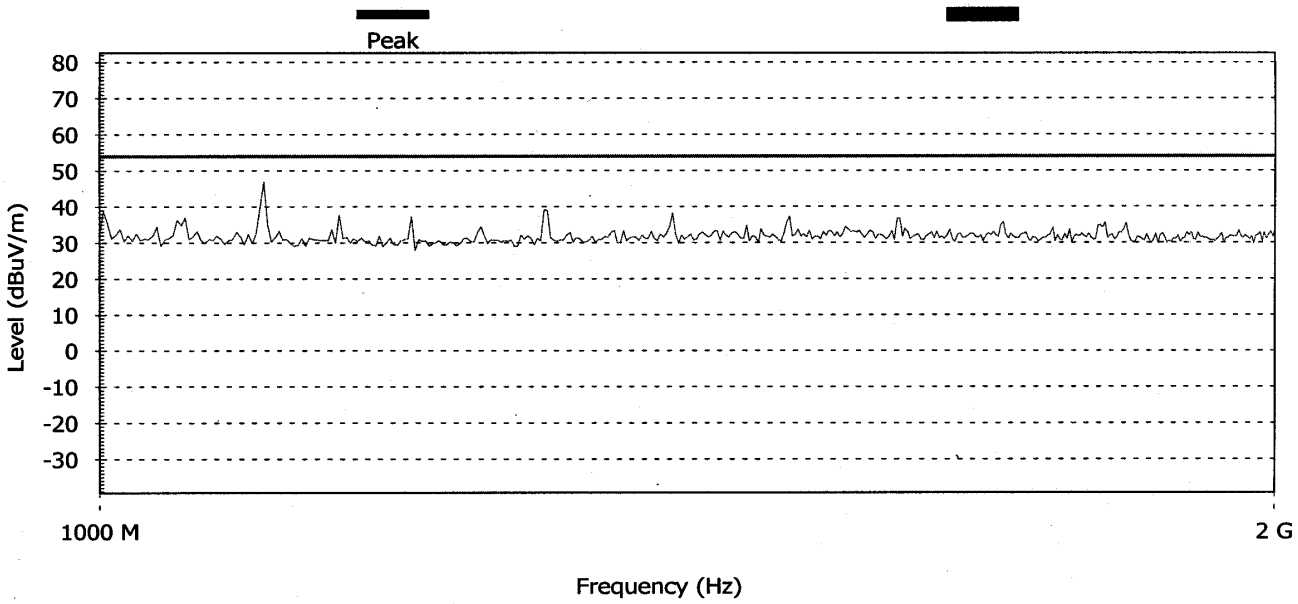
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 88) RE FCC CLASS B 1-2GHz
From 1000 MHz to 2000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 3

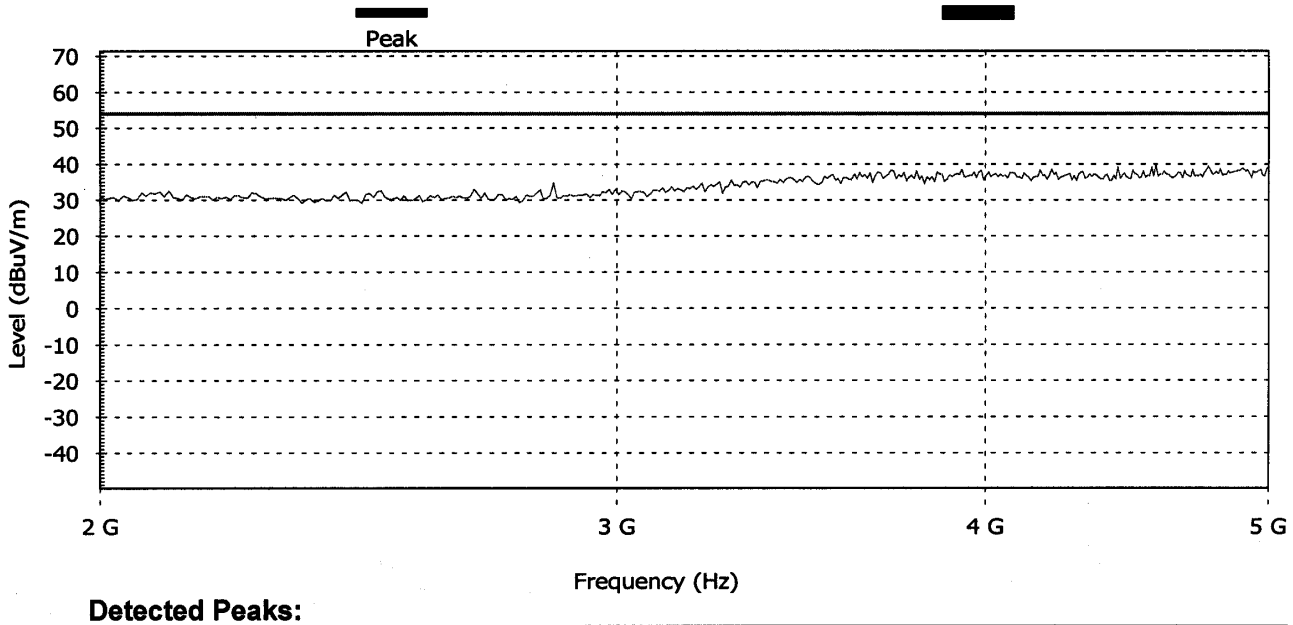
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 87) RE FCC CLASS B 2-5GHz
From 2000 MHz to 5000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 46.427997589
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Note:

Plot RE/ 4

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

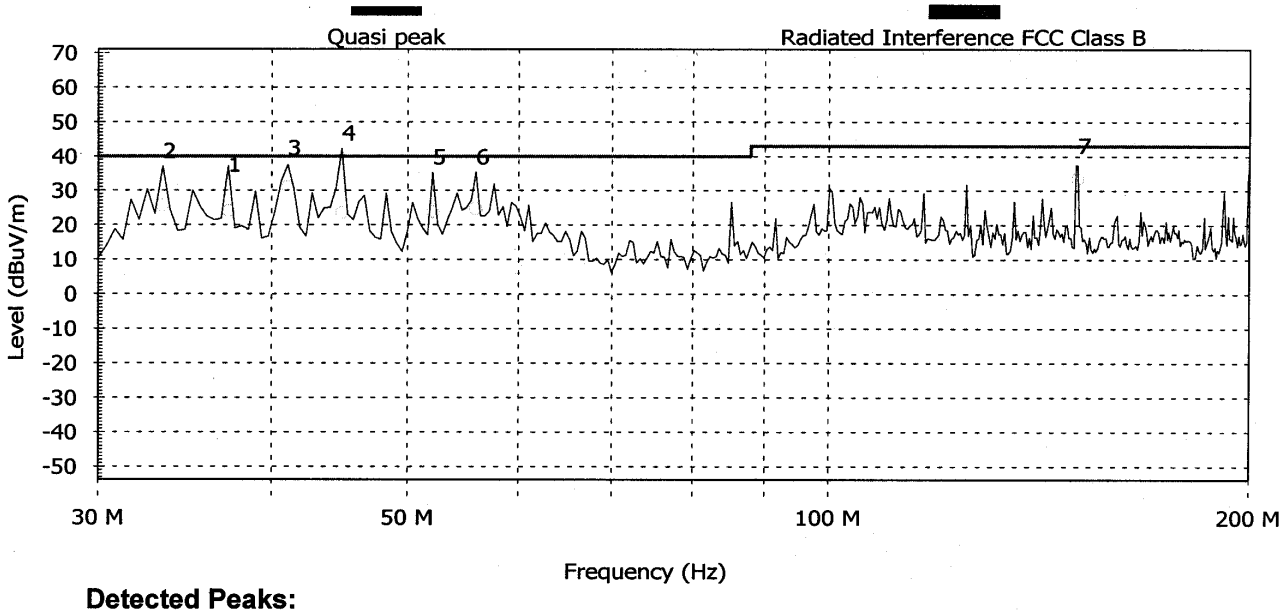
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 39) RE FCC CLASS B 30-200MHz
From 30 MHz to 200 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	32.125	Disc. NB	34.9	26.0		40.0	Pass	Pass	Pass	0	1	H
2	33.4	Disc. BB	37.0	25.6		40.0	Pass	Pass	Pass	0	1	H
3	40.919	Disc. NB	37.9	31.0		40.0	Pass	Pass	Pass	355	1	H
4	44.875	Disc. NB	42.2	23.5		40.0	Pass	Pass	Pass	0	1	H
5	52.1	Disc. NB	35.2	23.7		40.0	Pass	Pass	Pass	0	1	H
6	55.925	Disc. NB	35.3	24.7		40.0	Pass	Pass	Pass	0	1	H
7	149.844	Disc. BB	38.6	33.3		43.0	Pass	Pass	Pass	0	1	V

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB: RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 35.4169998168
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 5

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

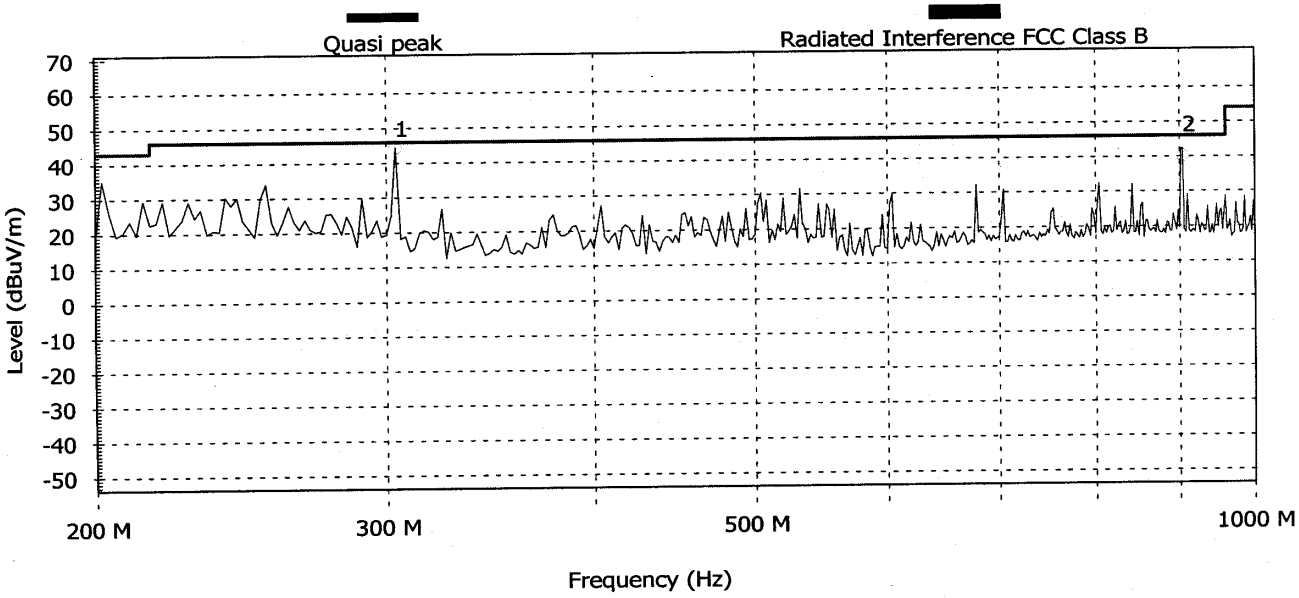
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 52) RE FCC CLASS B 200-1000MHz
From 200 MHz to 1000 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	299.99	Cont. NB	45.4	44.4		46.0	Pass	Pass	Pass	355	1	H
2	899.983	Cont. NB	44.6	40.1		46.0	Pass	Pass	Pass	0	1	H

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 166.666992187
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 6

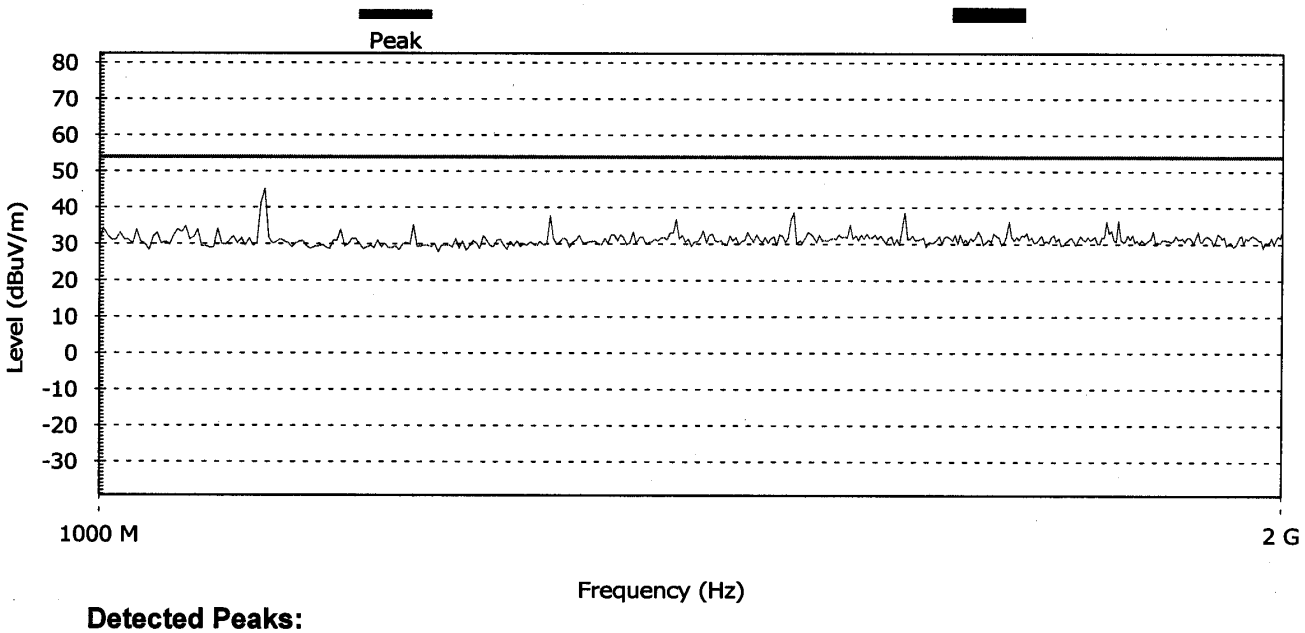
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 84) RE FCC CLASS B 1-2GHz
From 1000 MHz to 2000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 7

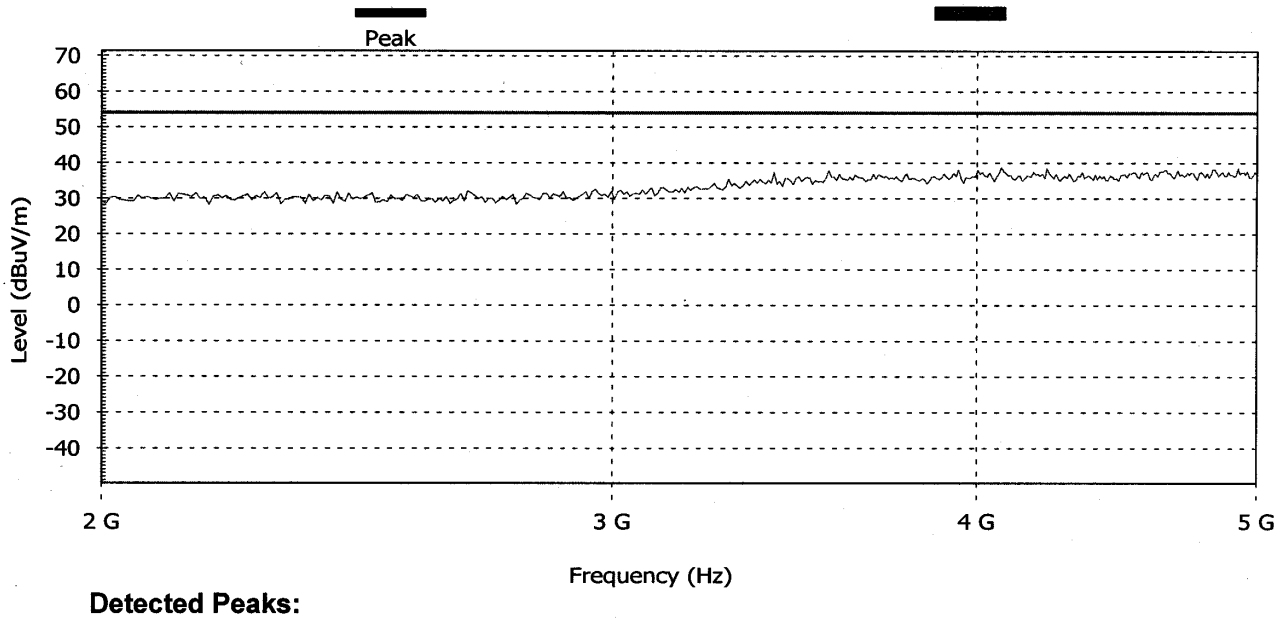
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 86) RE FCC CLASS B 2-5GHz
From 2000 MHz to 5000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 46.427997589
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 8

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

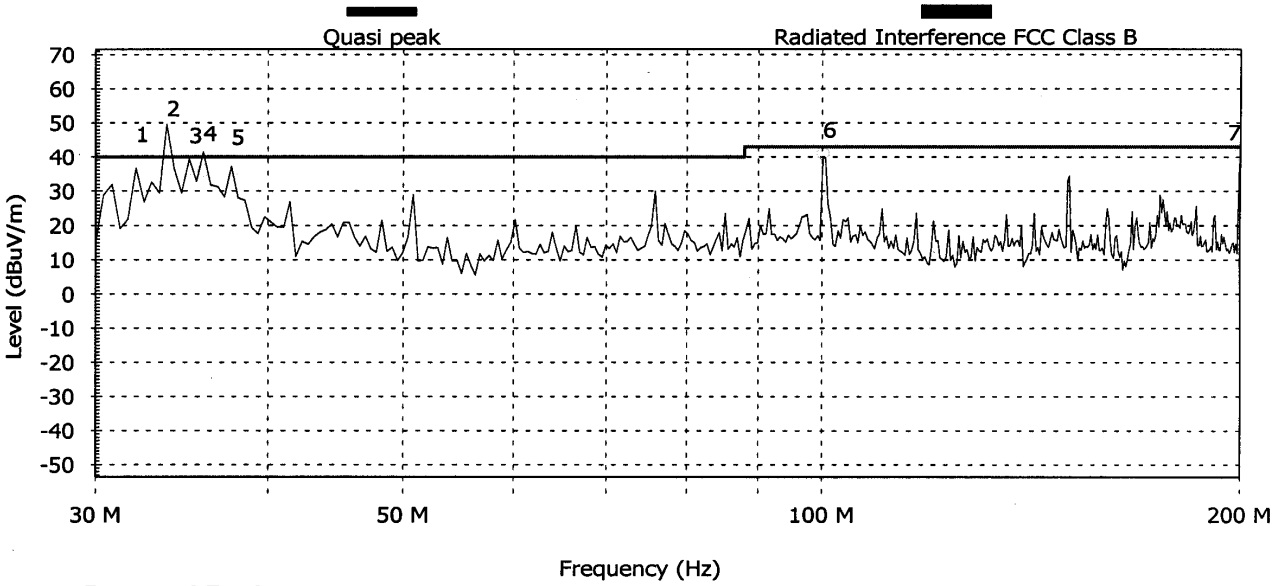
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 111) RE FCC CLASS B 30-200MHz
From 30 MHz to 200 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	33.526	Disc. NB	41.8	36.3		40.0	Pass	Pass	Pass	270	1	V
2	33.825	Disc. NB	49.6	36.0		40.0	Pass	Pass	Pass	270	1	V
3	35.179	Disc. BB	41.7	36.3		40.0	Pass	Pass	Pass	270	1	V
4	35.732	Disc. BB	42.4	36.1		40.0	Pass	Pass	Pass	275	1	V
5	36.059	Disc. BB	42.4	35.7		40.0	Pass	Pass	Pass	270	1	V
6	99.994	Cont. NB	43.4	41.0		43.0	Pass	Pass	Pass	270	1	V
7	199.988	Disc.	42.7	40.7		43.0	Pass	Pass	Pass	265	1	H

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 35.4169998168
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 9

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

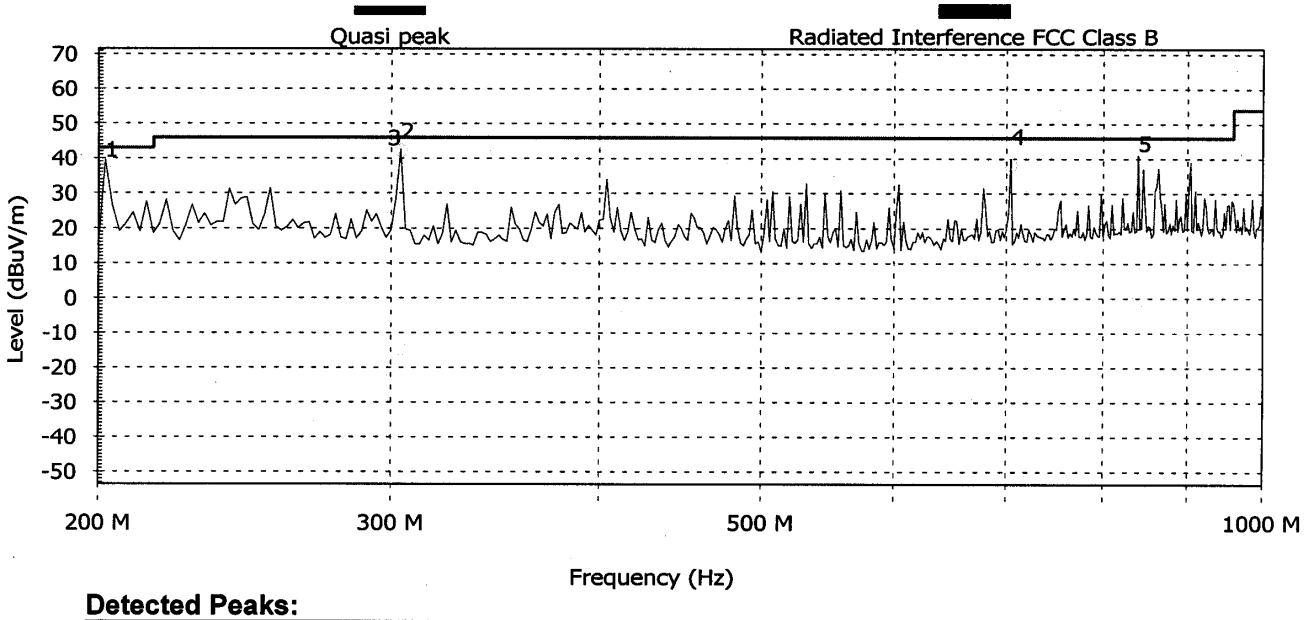
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 112) RE FCC CLASS B 200-1000MHz
From 200 MHz to 1000 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	200.008	Disc.	38.0	36.5		43.0	Pass	Pass	Pass	270	1.1	V
2	299.988	Disc. NB	43.3	42.2		46.0	Pass	Pass	Pass	270	1.1	V
3	304	Disc. NB	41.3	-14.7		46.0	Pass	Pass	Pass	270	1	H
4	699.986	Cont. NB	41.8	38.2		46.0	Pass	Pass	Pass	270	1	V
5	836.928	Disc. BB	40.0	-0.7		46.0	Pass	Pass	Pass	270	1	H

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 166.666992187
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 10

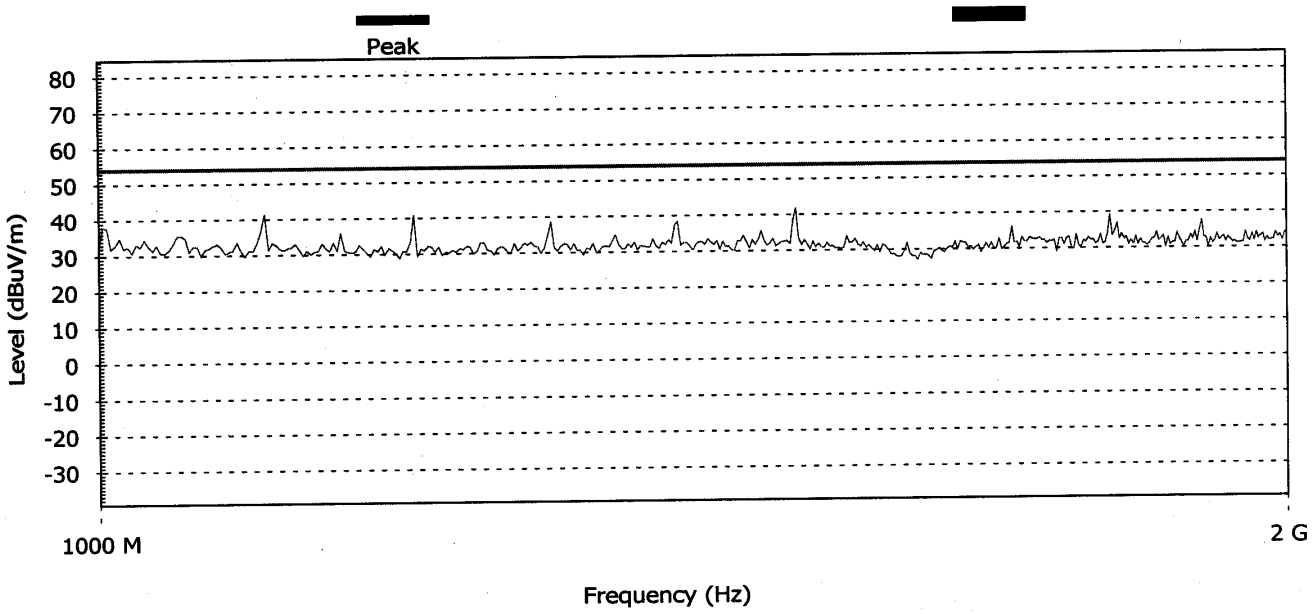
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 123) RE FCC CLASS B 1-2GHz
From 1000 MHz to 2000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 11

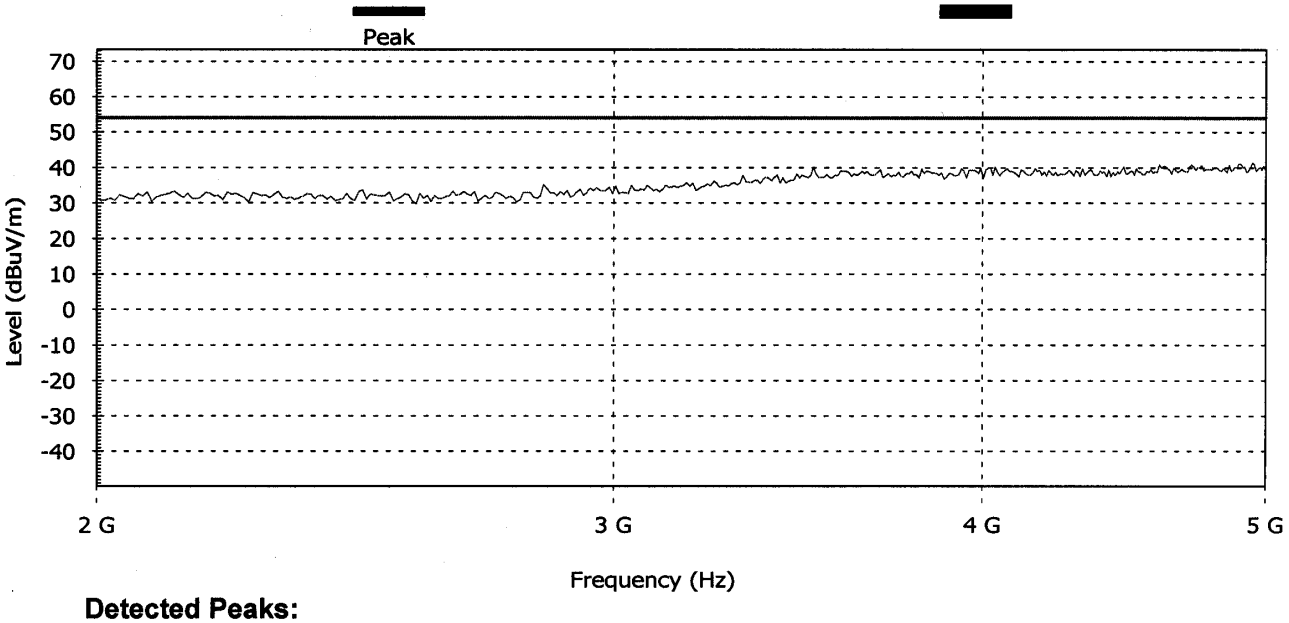
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 120) RE FCC CLASS B 2-6GHz
From 2000 MHz to 5000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 46.427997589
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 12

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

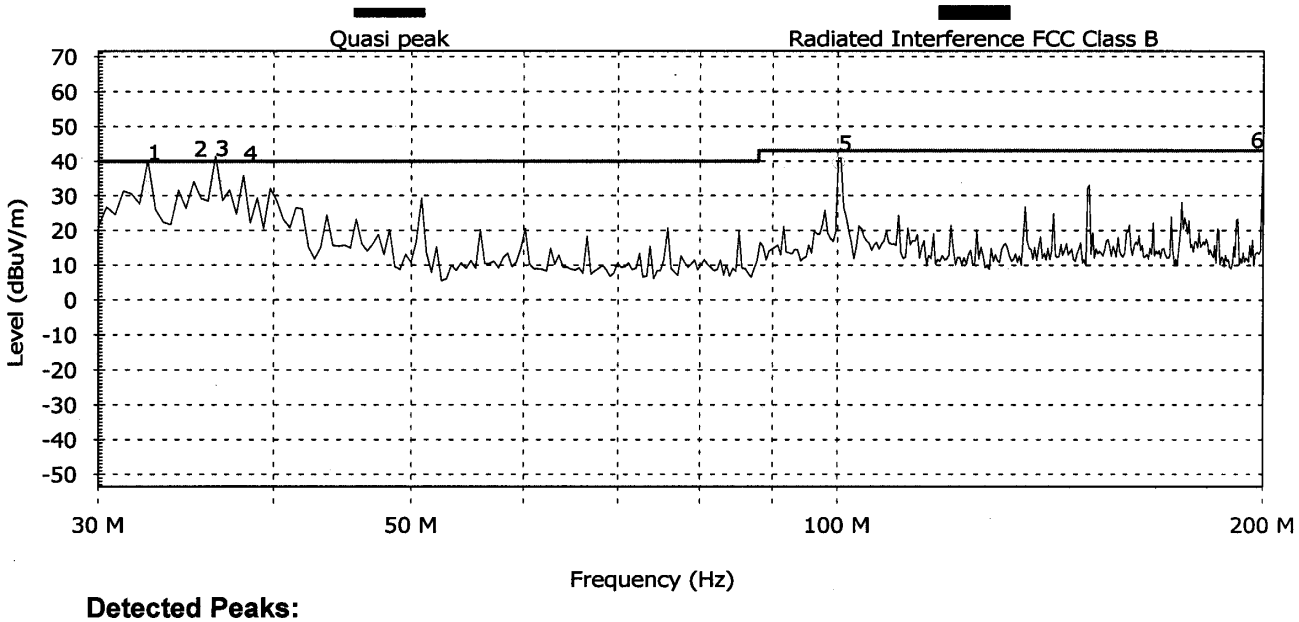
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 115) RE FCC CLASS B 30-200MHz
From 30 MHz to 200 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	31.749	Disc. NB	38.1	32.6		40.0	Pass	Pass	Pass	355	1	V
2	35.496	Disc. BB	38.9	32.3		40.0	Pass	Pass	Pass	0	1	V
3	36.045	Disc. NB	39.4	33.5		40.0	Pass	Pass	Pass	355	1	V
4	37.22	Disc. NB	38.2	31.4		40.0	Pass	Pass	Pass	355	1	V
5	99.998	Cont. NB	40.6	39.5		43.0	Pass	Pass	Pass	355	1	V
6	199.991	Disc.	41.5	38.0		43.0	Pass	Pass	Pass	0	1	V

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 35.4169998168
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 13

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

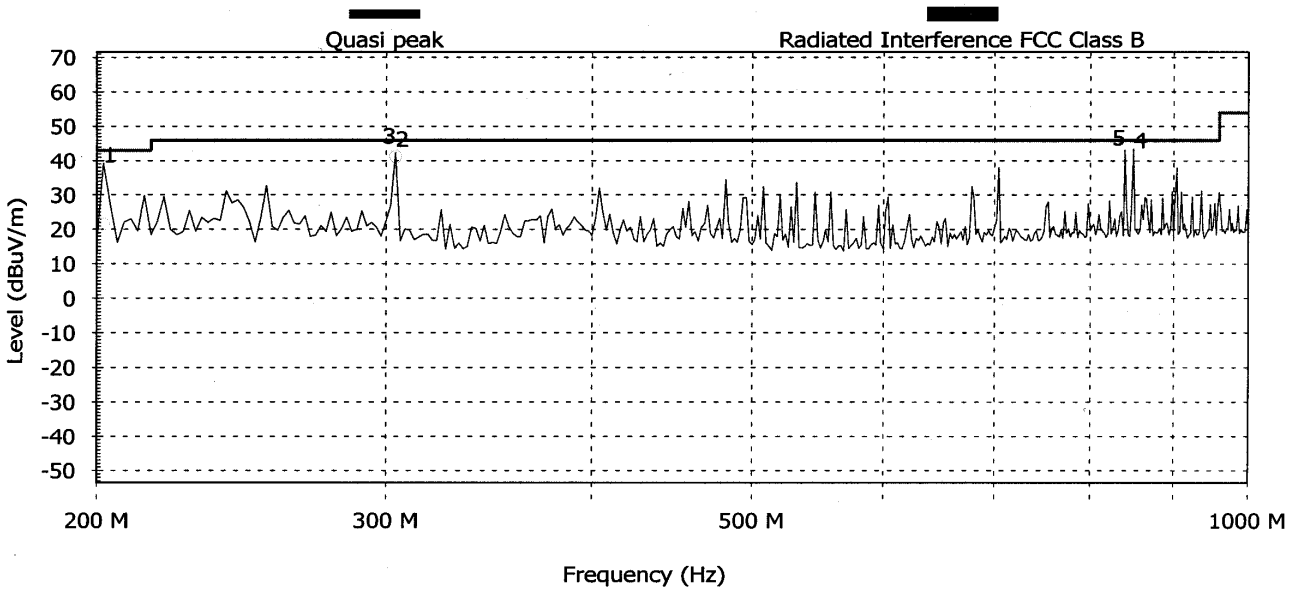
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 114) RE FCC CLASS B 200-1000MHz
From 200 MHz to 1000 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	Type	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Angle (degrees)	Height (m)	H/V
1	200.16	Disc. NB	37.2	21.5		43.0	Pass	Pass	Pass	0	1	V
2	299.991	Cont. NB	41.7	41.3		46.0	Pass	Pass	Pass	0	1	H
3	299.992	Disc. NB	42.7	41.1		46.0	Pass	Pass	Pass	0	1	V
4	835.28	Disc. NB	41.5	-4.0		46.0	Pass	Pass	Pass	0	1	V
5	839.808	Disc. BB	42.2	-3.1		46.0	Pass	Pass	Pass	0	1	H

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 120 kHz. VBW: 1000 kHz. Sweep time: 166.666992187
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot RE/ 14

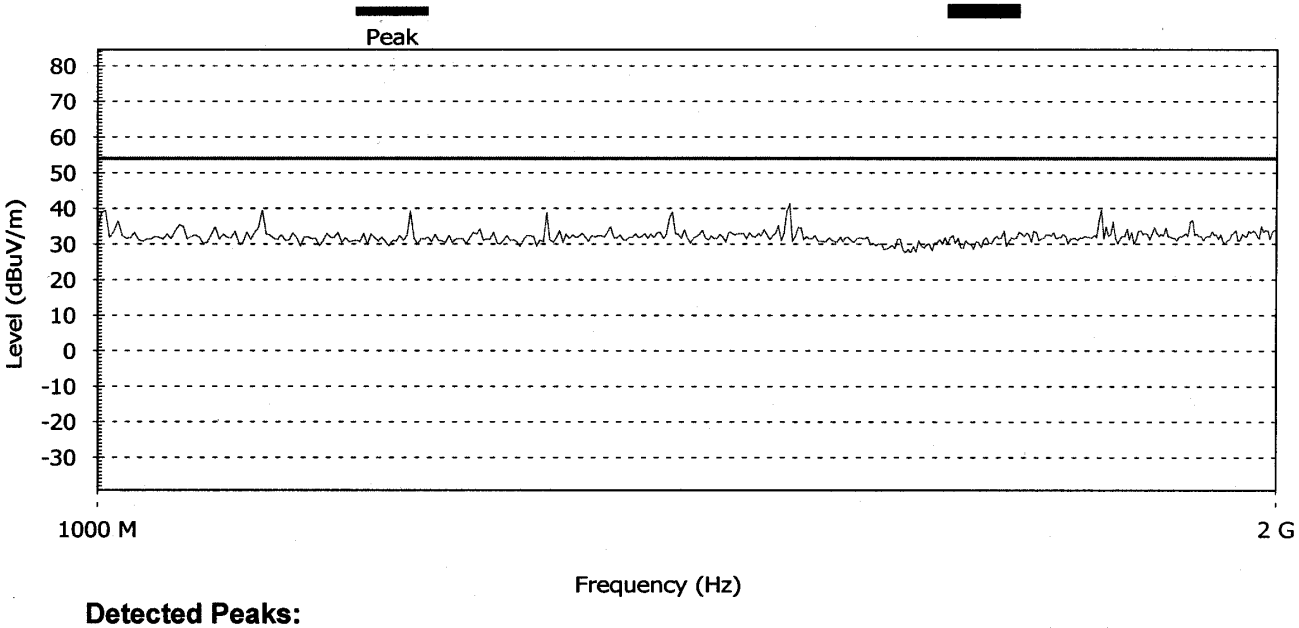
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 122) RE FCC CLASS B 1-2GHz
From 1000 MHz to 2000 MHz
Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 20 ms.
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 15

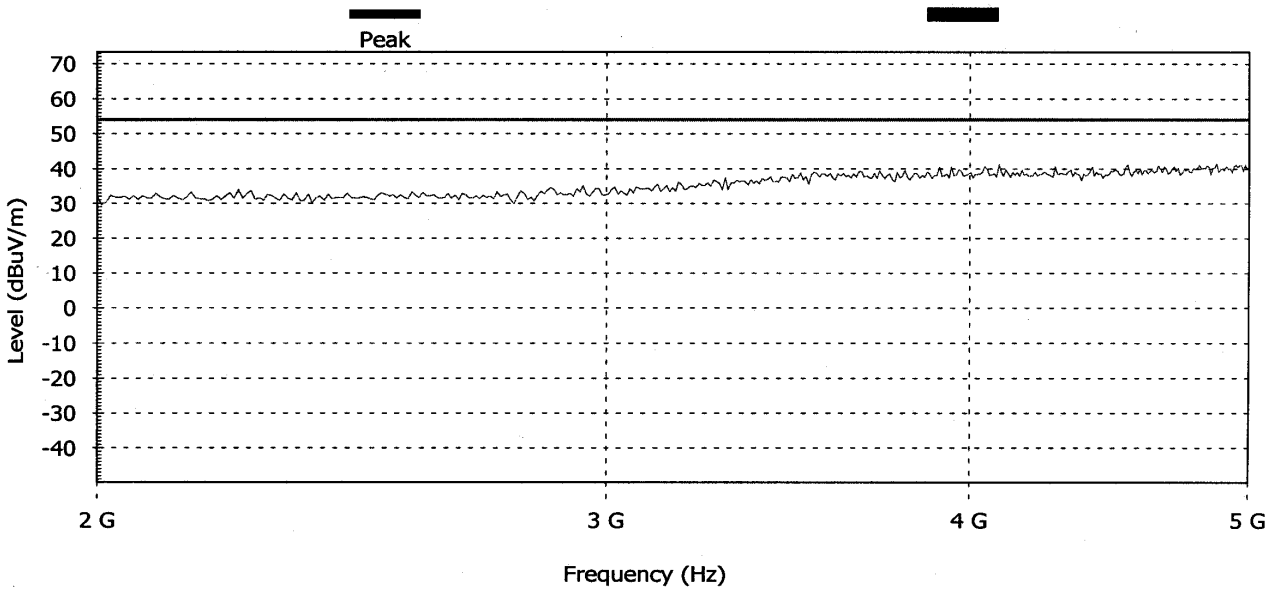
EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Radiated Emission

Description: 121) RE FCC CLASS B 2-6GHz
From 2000 MHz to 5000 MHz
Graph:

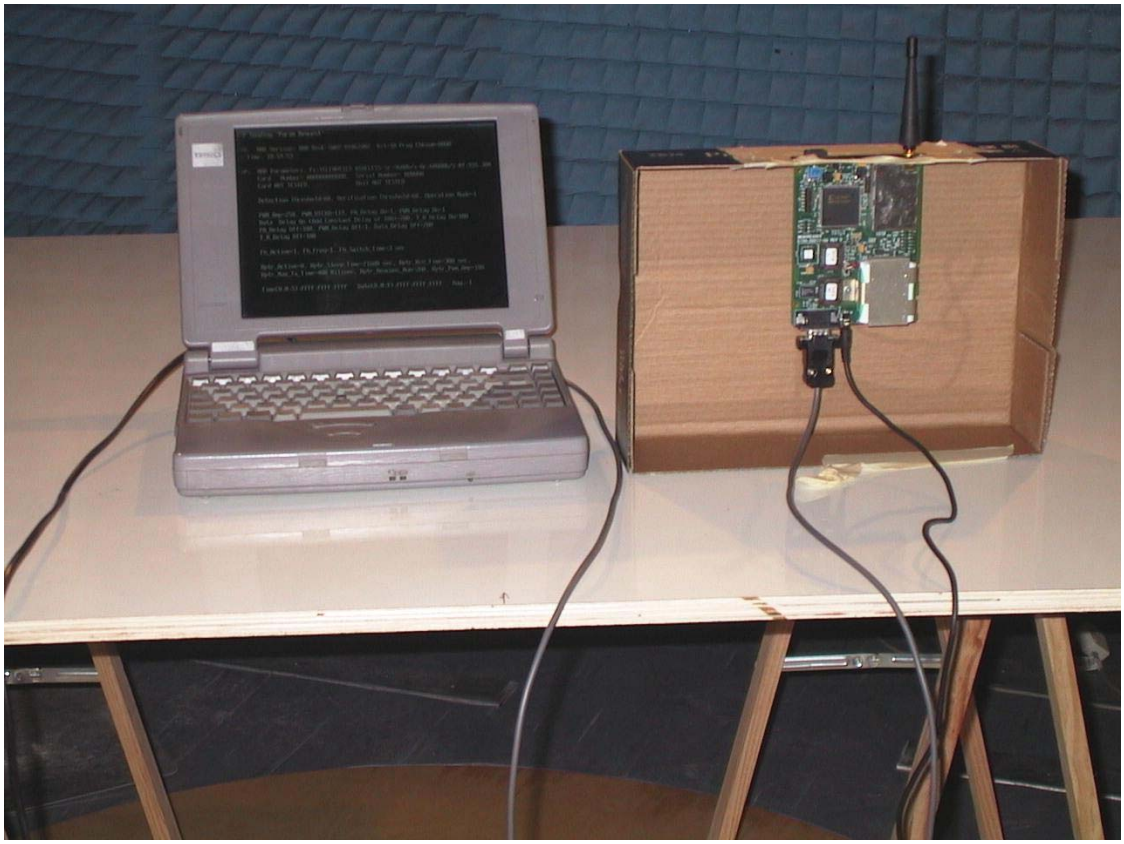


Detected Peaks:

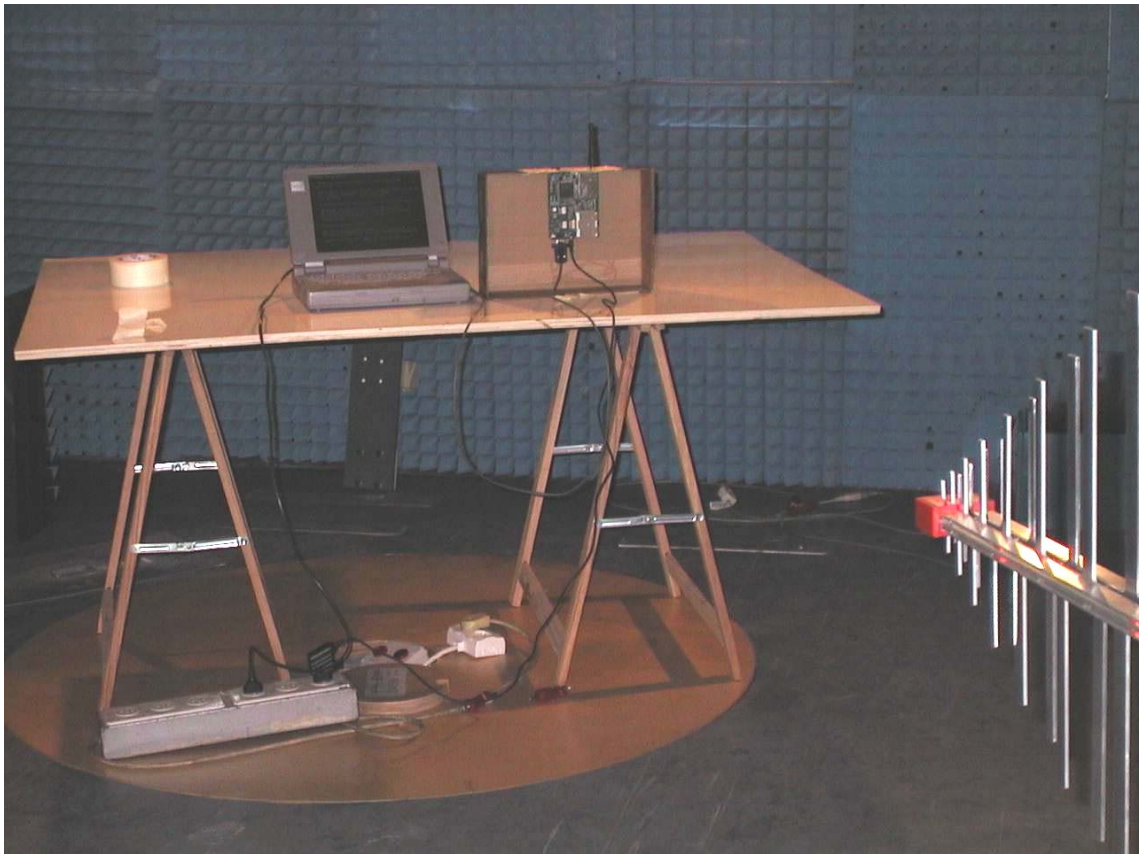
Nr	Frequency (MHz)	PK (dBuV/m)	AVG (dBuV/m)	QP (dBuV/m)	RMS (dBuV/m)	PK Limit (dBuV/m)	AVG Limit (dBuV/m)	QP Limit (dBuV/m)	RMS Limit (dBuV/m)	PK Pass	AVG Pass	QP Pass	RMS Pass	Pass	Angle (degrees)	Height (m)

Settings:
Antenna: Both Polarizations at 3 m
Ref. Level: 70.0 dBuV/m Att: 0 dB. RBW: 1000 kHz. VBW: 1000 kHz. Sweep time: 46.427997589
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the peak detector

Plot RE/ 16

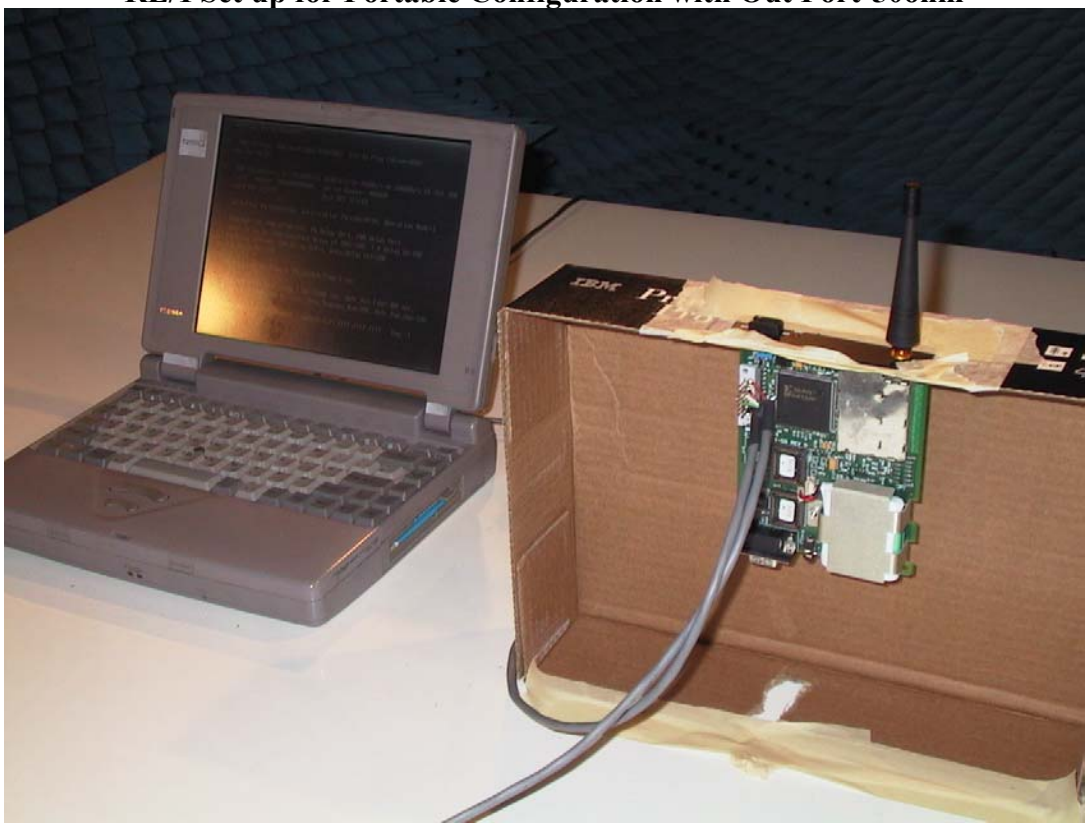


RE/1 Set up for Portable Configuration with Out Port-Antenna



RE/2 Set up for 30MHz-1GHz Portable Configuration with Out Port-Antenna

RE/1 Set up for Portable Configuration with Out Port-50ohm



RE/1 Set up for Vehicular Configuration with Out Port-Antenna

6. FINAL RADIATED INTERFERENCE FIELD STRENGTH MEASUREMENT

Testing Engineer: D.Lanuel **Date** 16/12/02

6.1. Test Instrumentation and Equipment

Table RE-A Test Instrumentation and Equipment

Item	Model	Manufacturer	Next Date Cal.
Spectrum Analyzer	8568B+opt 462	HP	12.08.03
Preselector	85685A	HP	12.08.03
Quasi-Peak Detector	85650	HP	12.08.03
Broadband Antenna	BTA-L	FRANKONIA	10.04.03
Computer	PENTIUM	IBM Compatible	N.P.C.R

6.2. Test Setup

6.2.1. The measuring system block diagram shown in Figure RE-1.

6.2.2. E.U.T orientation and antenna position shown in Figure RE-2

6.2.3. Cables configuration shown in Figure RE-3

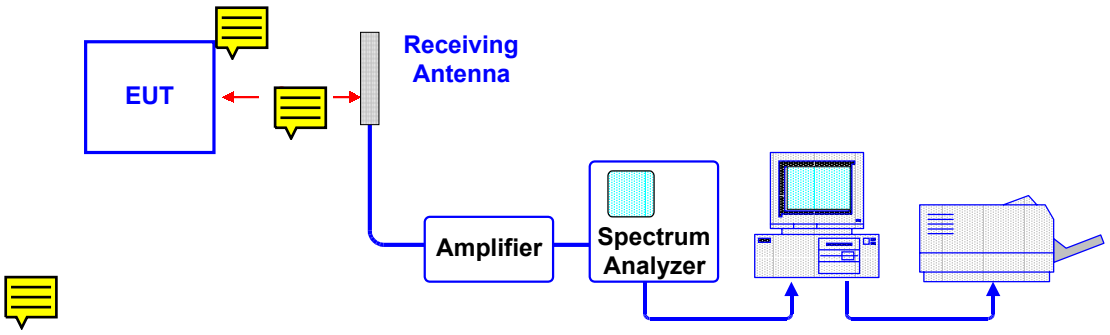


Figure RE-1

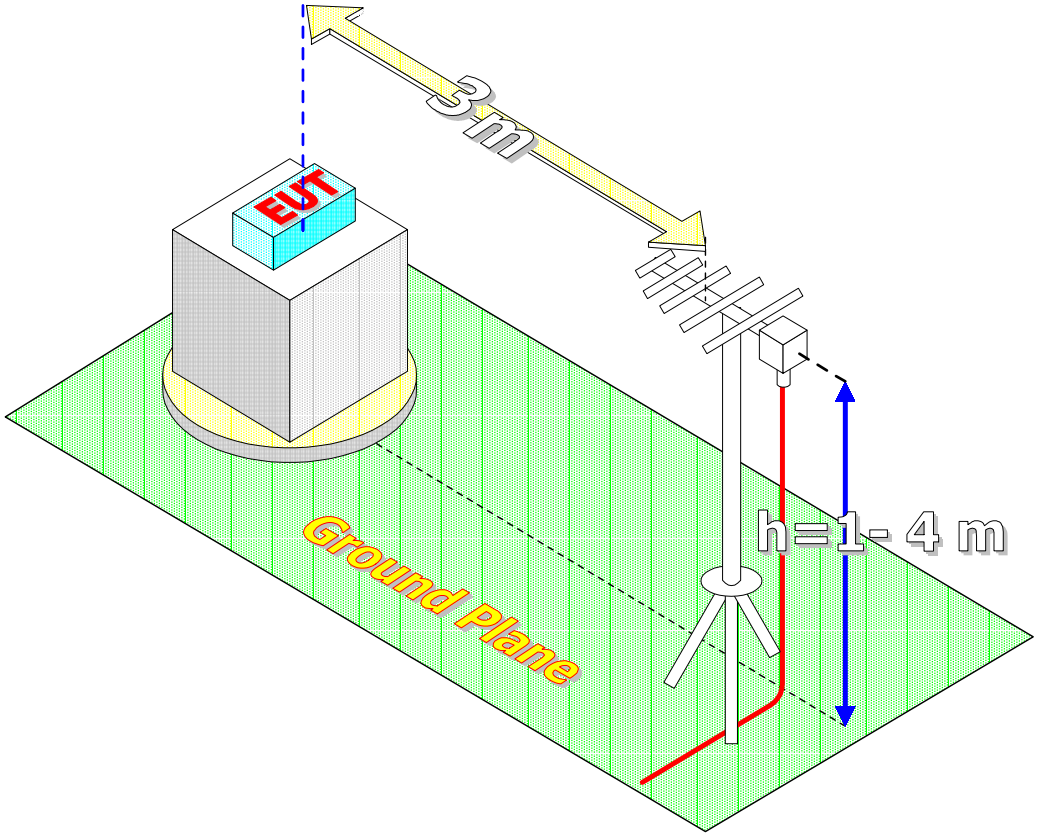
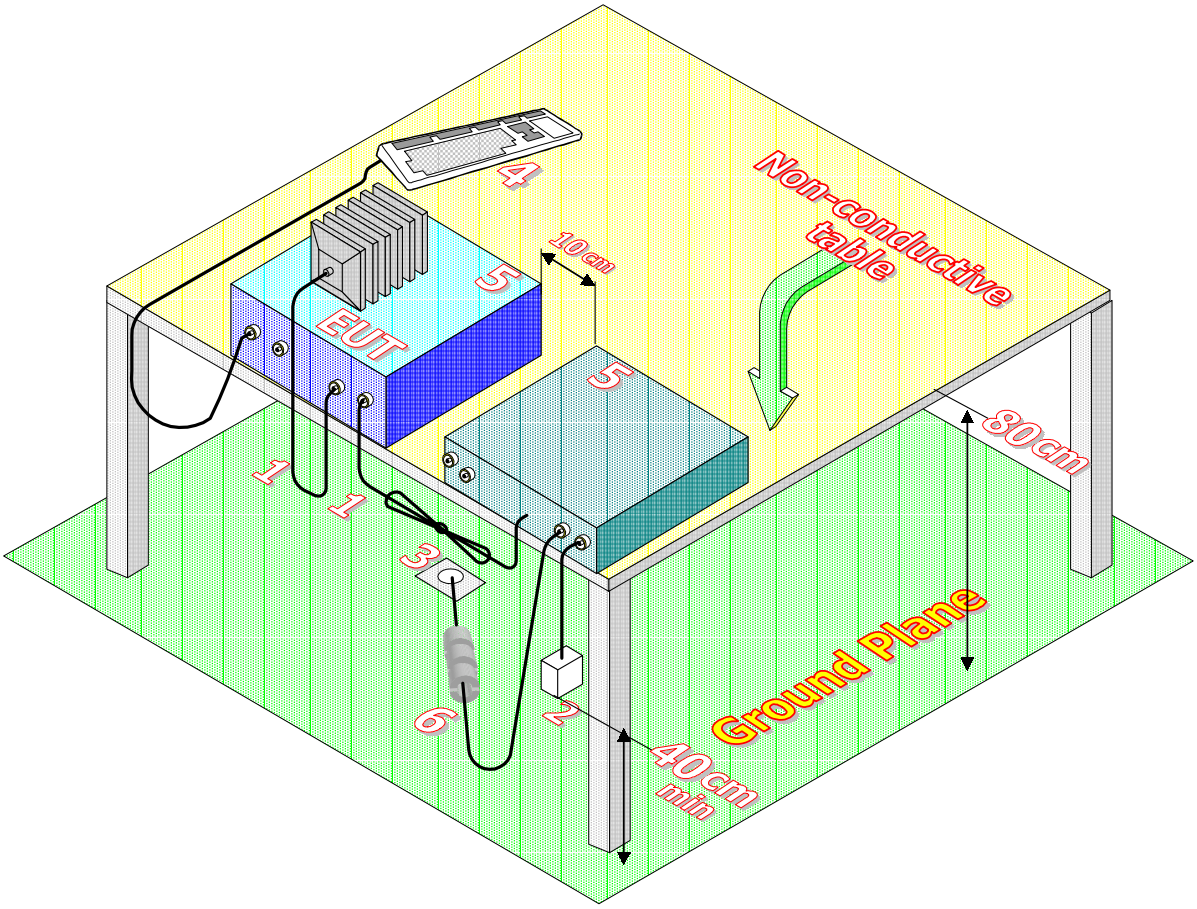

3m
EUT
Ground Plane
h=1- 4 m

Figure RE-2


4
10cm
5
EUT
5
Non-conductive table
80cm
1
1
3
6
2
40cm min
Ground Plane

1. If cables, which hand closer than 40 cm to the horizontal ground plane cannot be shortened to the appropriate length, the excess shall be folded back and forth forming a bundle 30 cm to 40 cm long.
2. The end of I/O signal cables, which are not connected to a peripheral, may be terminated, if required to proper operation using correct terminating impedance.
4. Main junction boxes shall be flush with, and bonded directly to, metal ground plane
4. Cables of hand operated devices such as keyboards, mousses; etc. shall be placed as for normal usage.
5. Peripherals shall be placed at distance 10 cm from each other and from the controller, except for the monitor, which, if for an acceptable installation practice, shall be placed directly on top of the controller.
6 Mains cables, telephone lines or other connections to auxiliary equipment located outside the test area shall drape to the floor, be fitted with ferrite clamps or ferrite tubes placed on the floor at the point where the cable reaches the floor and then routed to the place where they leave the turn table. No extension cords shall be used to mains receptacle.

7 Ferrite clamps or ferrite tubes. No more than one cable per clamp.

6.3. Final Test Results

Table RE-F Six Highest Emissions RX Mode 15.109

Mode Of Operation	Freq. (MHz)	Quasi-peak Reading (*) (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarity Ver/Hor	Height (m)	Azimuth Angle φ (deg)
RX Portable Config. Out-port-Ant.	40.472	29.1	40	10.9	H	1	0
	43.257	29.4	40	10.6	H	1	0
	54.225	29.8	40	10.2	H	1	0
	149.918	33.6	43	9.4	V	1	0
	834.592	38.7	46	7.3	H	1	0
	899.972	40.9	46	5.1	H	1	5

(*) Resolution B/W = 120 kHz

Table RE-F Six Highest Emissions RX Mode 15.109

Mode Of Operation	Freq. (MHz)	Quasi-peak Reading (*) (dBμV/m)	Limit dBμV/m	Margin (dB)	Polarity Ver/Hor	Height (m)	Azimuth Angle φ (deg)
RX Portable Config. Out port 50ohm.	32,125	33	40	7	H	1	0
	33.4	38.9	40	1.1	H	1	0
	44.875	30.7	40	9.3	H	1	0
	149.844	33.4	43	9.6	V	1	0
	299.99	37.1	46	8.9	H	1	0
	899.983	45	46	1	H	1	5

(*) Resolution B/W = 120 kHz

Table RE-F Six Highest Emissions RX Mode 15.109

Mode Of Operation	Freq. (MHz)	Quasi-peak Reading (*) (dBμV/m)	Limit dBμV/m	Margin (dB)	Polarity Ver/Hor	Height (m)	Azimuth Angle φ (deg)
RX Vehicle Config. Out-port-Ant.	33.526	37.1	40	2.9	V	1	0
	35.179	35	40	5	V	1	0
	199.998	33.7	43	9.3	H	1	0
	200.08	33.1	43	9.9	V	1	0
	699.986	38.5	46	7.5	V	1	0
	836.928	38.9	46	7.1	H	1	0

(*) Resolution B/W = 120 kHz

Table RE-F Six Highest Emissions RX Mode 15.109

Mode Of Operation	Freq. (MHz)	Quasi-peak Reading (*) (dBμV/m)	Limit dBμV/m	Margin (dB)	Polarity Ver/Hor	Height (m)	Azimuth Angle φ (deg)
RX Vehicle Config. Out-port-50ohm.	31.749	38.8	40	1.2	V	1	0
	35.496	32.5	40	7.5	V	1	0
	36.045	31.8	40	8.2	V	1	0
	199.991	35.3	43	7.7	V	1	0
	835.28	38.9	46	7.1	V	1	0
	839.808	41.7	46	4.3	H	1	0

7. CONDUCTED EMISSIONS, AC POWER LEADS ACCORDING TO FCC 15.107

Frequency Range: **450 kHz – 30 MHz**

Testing Engineer: D.Lanuel **Date : 19**/12/02

7.1. Equipment Under Test Description and Operation
MMR-R, S/N 0001 manufactured by TADIRAN-Telematics

7.1.1. Modes of Operation

The MMR-R was set to Battery Charge at RX Mode

7.1.2. Operating Voltage 110 V, AC 50Hz

7.2. Test Results Summary & Conclusions

The MMR-R complies with FCC, Part 15.107 conducted emissions requirement.

7.3. **Limits of Conducted Emission at Mains Terminals**

The test unit shall meet the limits of Table 1 for FCC Part 15 Para 15.107 equipment.

Table 1 Limits for intentional radiator according 15.107

Frequency Range MHz	Quasi-peak Limits dBµV
0.45 – 30	48

7.4. **Test Instrumentation and Equipment**

Table CE-A – Test Instrumentation and Equipment

Item	Model	Manufacturer	Next Date Calibration
Spectrum Analyzer	8593E	HP	31/01/03
Signal Generator	2017	Marconi	21/06/03
LISN	FCC-LISN-3B	FISCHER	31/08/04

7.5. **Test Setup**

7.5.1. Calibration setup shown in Figure CE-1.

7.5.2. The testing setup shown in Figure CE-2.

7.5.3. Equipment and cable configuration shown in Figure CE-3.

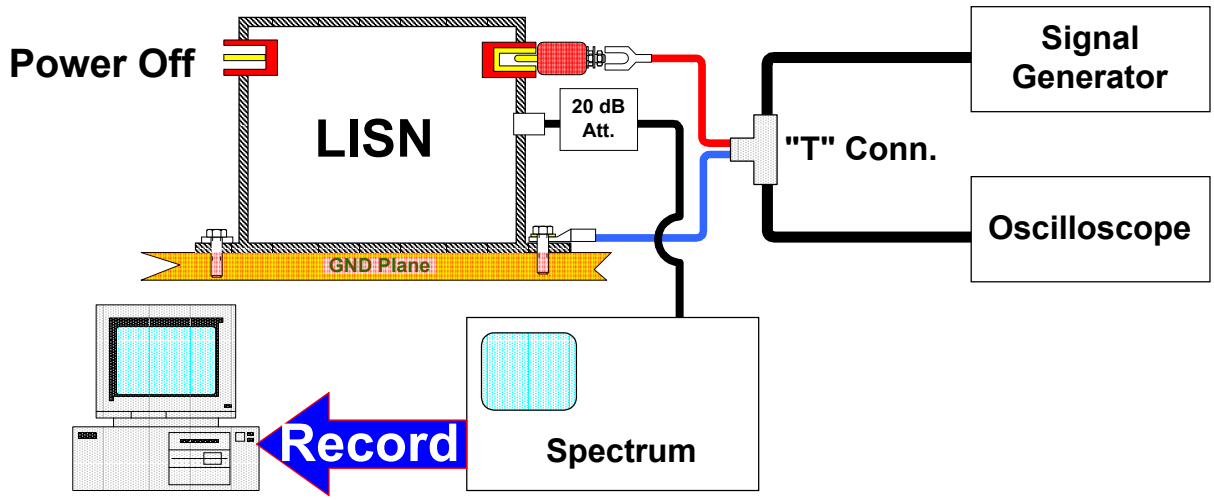


Figure CE-1

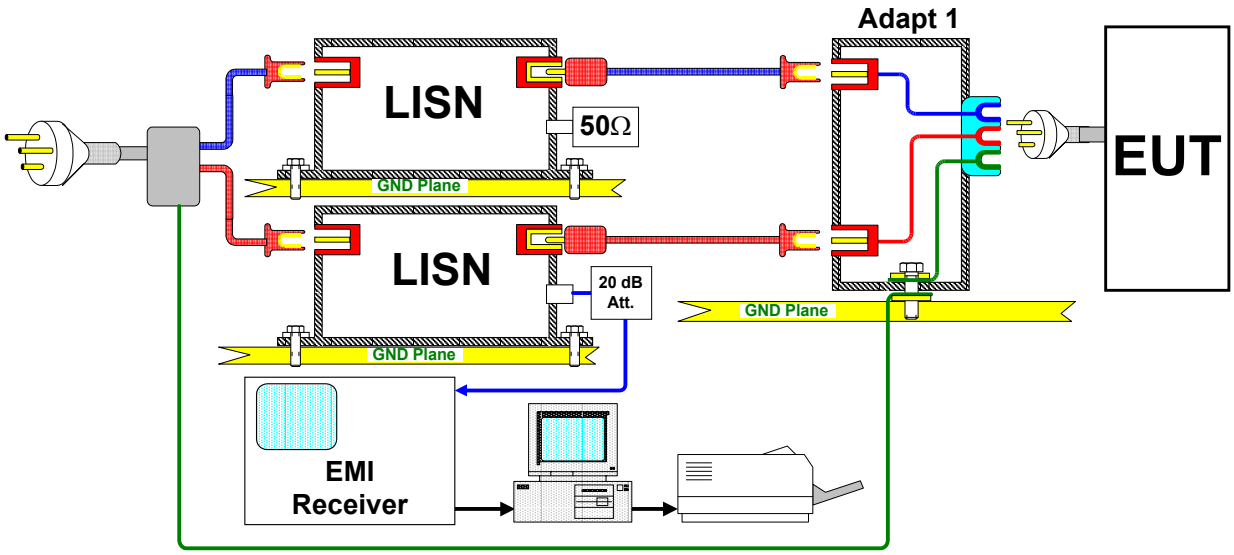


Figure CE-2

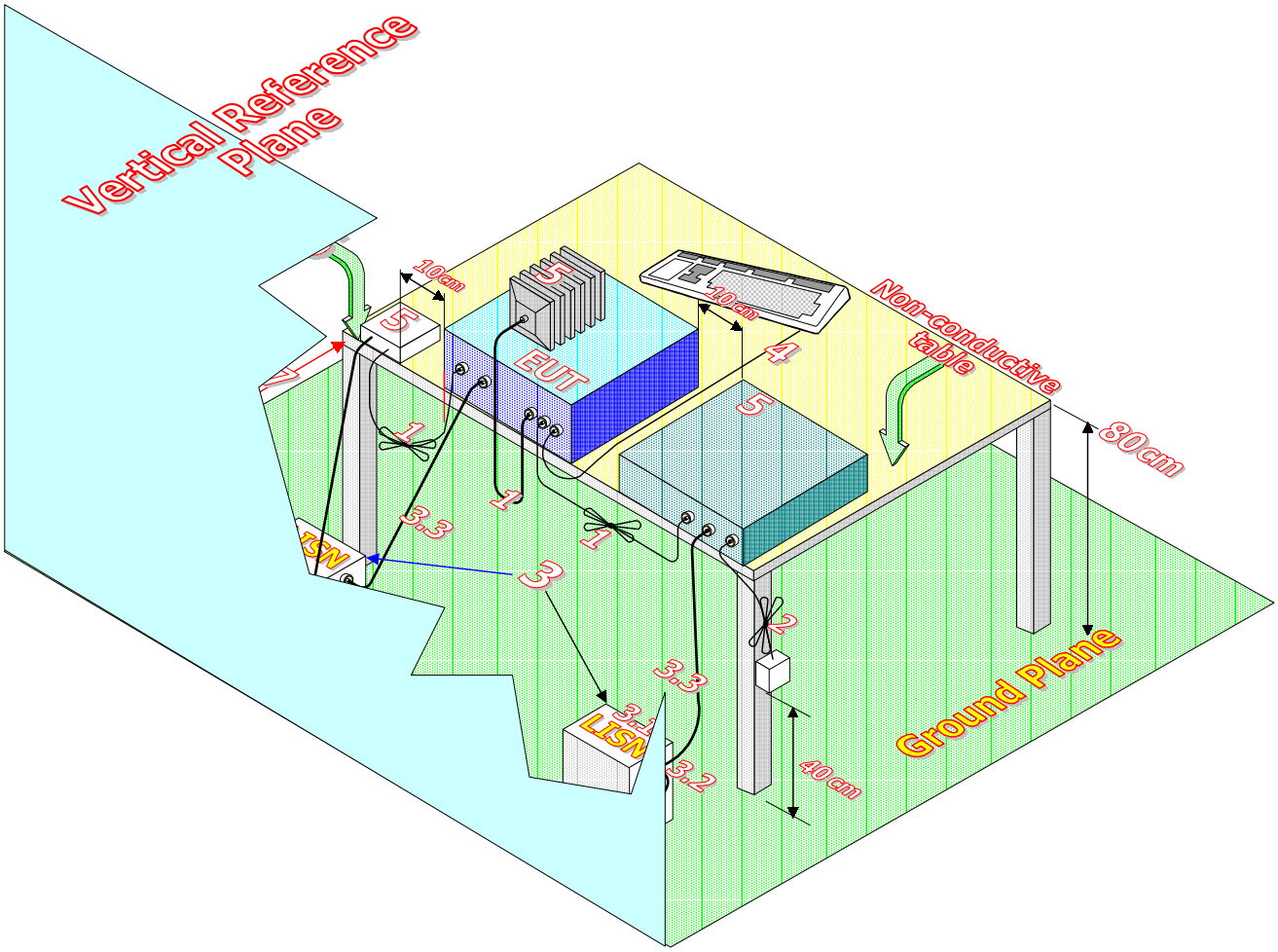


Figure CE-3

1 Interconnecting cables that hand closer than 40 cm to the horizontal ground plane shall be folded back and forth forming a bundle 30 cm to 40 cm long, hanging approximately in the middle between ground plane and table.

2 I/O cables are connected to a peripheral shall be bundled in the center. The end of the cable may be terminated if required using correct terminating impedance.

3 The total length shall not exceed 1 m.

3 E.U.T is connected to one LISN. Unused LISN connectors shall be terminated in 50 Ω.

4 All other equipment powered from second LISN

5 A multiple outer strip can be used for multiple power cords of non-E.U.T equipment.

6 LISN at least 80 cm from nearest part of E.U.T chassis.

7 Cables of hand operated devices such as keyboards, mousses; etc. have to be placed as close as possible to the host Non-E.U.T components being tested.

8 Rear of E.U.T, including peripherals shall be all aligned and flush with the rear tabletop.

9 Rear tabletop shall be 40 cm removed from a vertical conducting plane that bonded to the floor ground plane.

7.6. Test Procedure

The test procedure shall be as follows:

7.6.1. Calibration.

Perform the measured system check using the calibration setup shown in Figure CE-1.

7.6.2. Turn on the measurement equipment and allow sufficient time for stabilization.

7.6.3. Apply the calibrated signal level, which is 6 dB below the limit given in Table 1 at 500kHz and 29 MHz to the power output terminal of LISN.

7.6.4. Scan the spectrum analyzer for each frequency in the same manner as a normal data scan. Verify that the spectrum analyzer indicates a level within ± 3 dB of injected level. Correction factor shall be applied for LISN and 20 dB for attenuator.

7.6.5. E.U.T Testing. Perform emission data scan using the measurement setup shown in Figures CE-2 and CE-3.

7.6.6. Turn on the E.U.T to operational mode and allow sufficient time for stabilization.

7.6.7. Select (Phase) lead for testing.

7.6.8. Scan the spectrum analyzer over the applicable frequency range

7.6.9. Repeat (2) and (3) for (Neutral) lead.

7.6.10. Choose six highest emissions relative to limit and feel Table CE-D.

7.6.11. Perform measurements for selected frequencies using quasi-peak detector.

Table CE-B Calibration Results

Lead P/N	Frequency MHz	Plot No.	Test Signal DBuV(peak)	Result dBuV	Deviation dB
Phase(Line 1)	0.5	**CE-CAL/ 1**	**48**	**47.7**	-0.3
	29	**CE-CAL/ 3**	**48**	**46.7**	-1.3
Neutral	0.5	**CE-CAL/ 4**	**48**	**48**	0
	29	**CE-CAL/ 6**	**48**	**46.8**	1.2

Table CE-C Test Results 15.107

Lead P/N	Mode of Operation	Frequency Range (MHz)	Resolution BW (kHz)	Plot No.	Comply. Y/N
Phase	RX	0.45 – 30	**9**	**CE/ 1**	**Y**
Neutral		0.45 – 30		**CE/ 2**	**Y**

EUT File:
N:\COMMON\Radimation EUT Data\Telematix\Mmr-r.eut
Order Number:

2

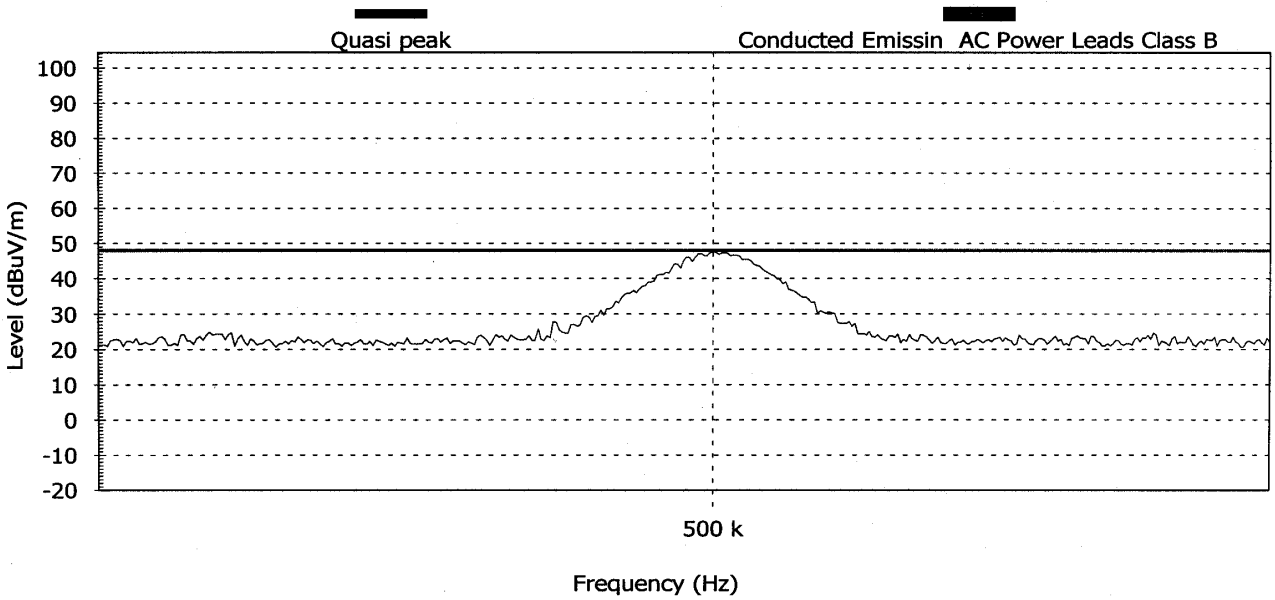
EUT
Name: MMR-R
Serial Number: 992543700061

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 98) Calibration 500KHz CE FCC CLASS B
From 0.45 MHz to 0.55 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Line
1	0.5	47.7	47.7		48.0	Pass	Pass	Pass	Line 1

Settings:
Description: 98) Calibration 500KHz CE FCC CLASS B
From 0.45 MHz to 0.55 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 33.3330001831055 r
Detect all peaks above 6 dB below the limit lines with a maximum of 1 peaks.
Measure the peaks with the quasi-peak detector

Plot CEcal/ 1

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

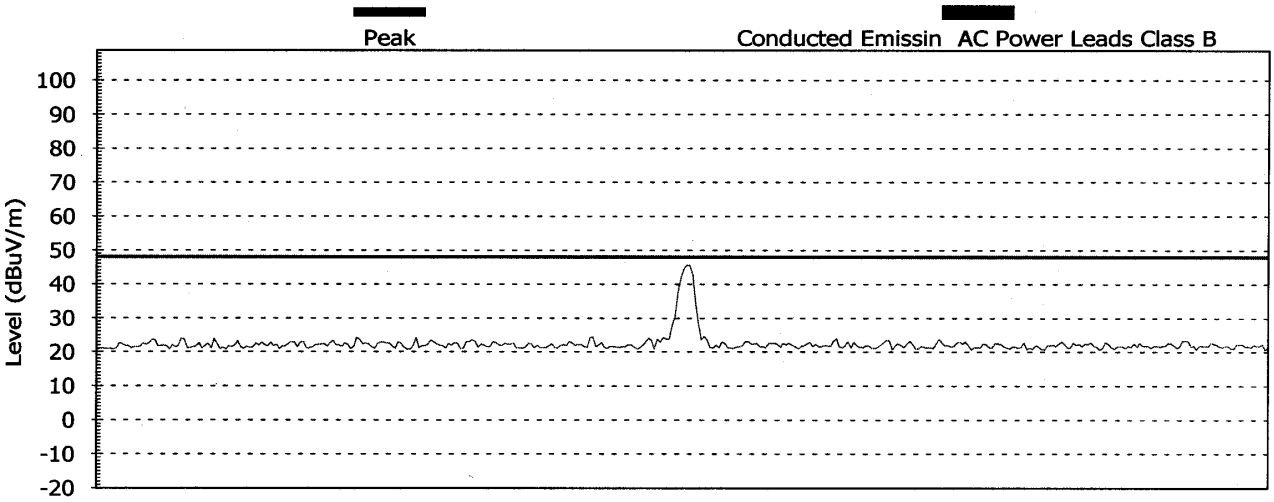
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 103) Calibration 29MHz CE FCC CLASS B
From 28.5 MHz to 29.5 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass	Line
1	29	46.7		Pass	Pass	Line 1

Settings:
Description: 103) Calibration 29MHz CE FCC CLASS B
From 28.5 MHz to 29.5 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 37.0369987487793 r
Detect all peaks above 6 dB below the limit lines with a maximum of 1 peaks.
Measure the peaks with the peak detector

Plot CEcal/ 2

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

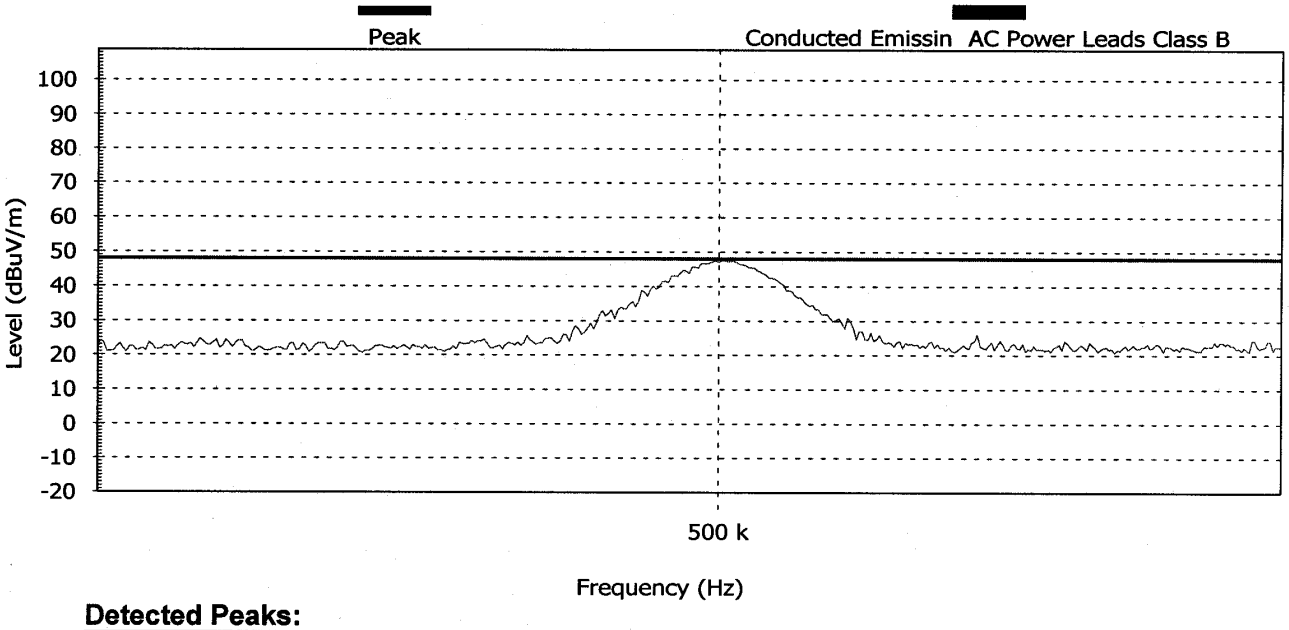
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 106) Calibration 500KHz CE FCC CLASS B
From 0.45 MHz to 0.55 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass	Line
1	0.5	48.0		Pass	Pass	Neutral

Settings:
Description: 106) Calibration 500KHz CE FCC CLASS B
From 0.45 MHz to 0.55 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 33.3330001831055 r
Detect all peaks above 6 dB below the limit lines with a maximum of 1 peaks.
Measure the peaks with the peak detector

Plot CEcal/ 3

EUT File:
N:\COMMON\Radimation EUT Data\Telematix\Mmr-r.eut
Order Number:

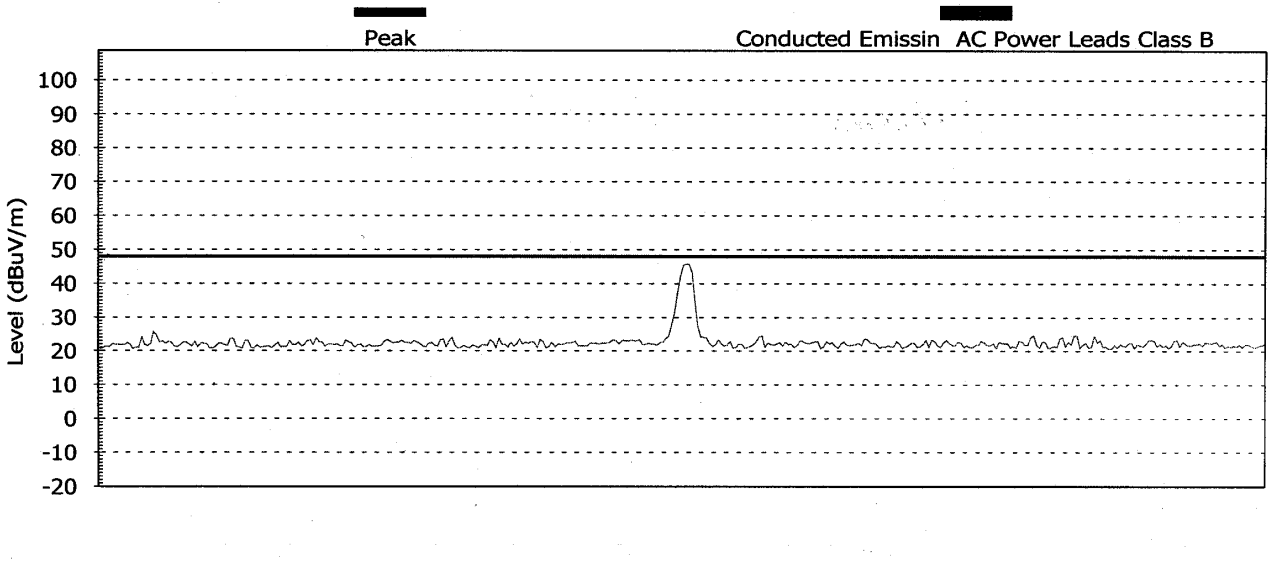
EUT
Name: MMR-R
Serial Number: 992543700061

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 107) Calibration 29MHz CE FCC CLASS B
From 28.5 MHz to 29.5 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	PK Limit (dBuV/m)	PK Pass	Pass	Line
1	29	46.8		Pass	Pass	Neutral

Settings:
Description: 107) Calibration 29MHz CE FCC CLASS B
From 28.5 MHz to 29.5 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 37.0369987487793 r
Detect all peaks above 6 dB below the limit lines with a maximum of 1 peaks.
Measure the peaks with the peak detector

Plot CEcal/ 4

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

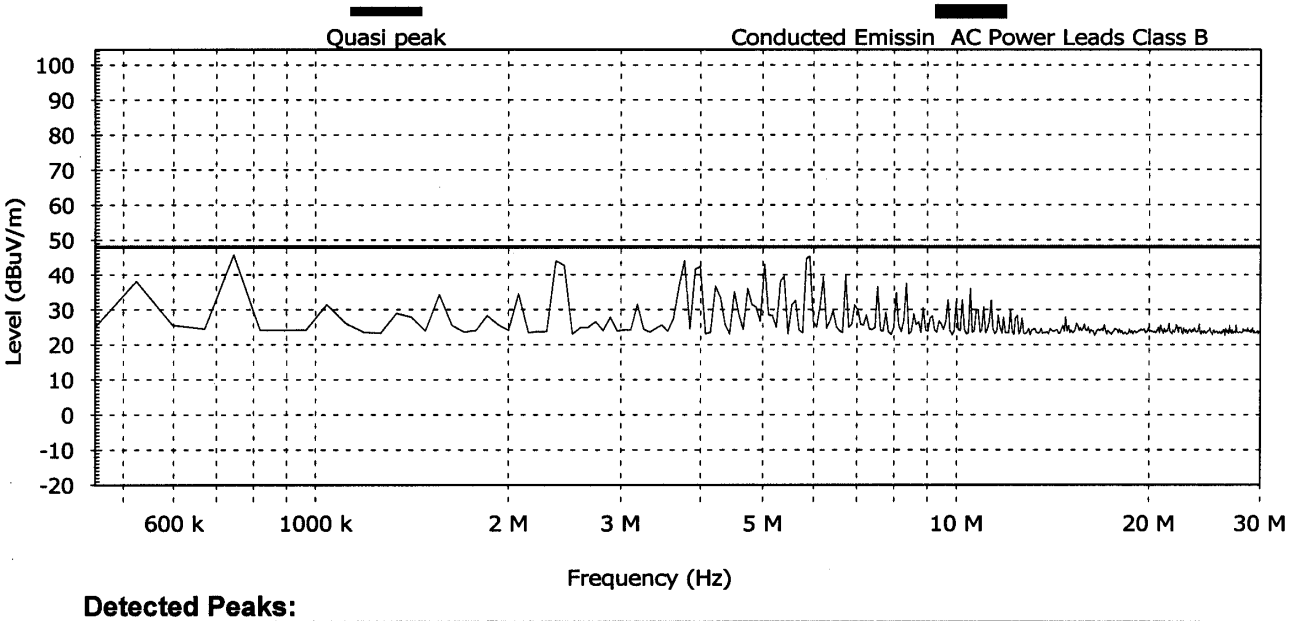
EUT
Name: MMR-R
Serial Number: 001

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 96) CE FCC CLASS B
From 0.45 MHz to 30 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Line
1	1.541	44.1	47.4		48.0	Pass	Pass	Pass	Line 1
2	2.873	43.4	45.1		48.0	Pass	Pass	Pass	Line 1
3	3.919	43.6	43.7		48.0	Pass	Pass	Pass	Line 1
4	4.827	43.5	41.4		48.0	Pass	Pass	Pass	Line 1
5	5.937	42.3	37.4		48.0	Pass	Pass	Pass	Line 1
6	5.972	49.3	46.2		48.0	Pass	Pass	Pass	Line 1

Settings:
Description: 96) CE FCC CLASS B
From 0.45 MHz to 30 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 1094.44494628906 r
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot CE/ 1

EUT File:
N:\COMMON\Telematics\MMR-R\Data\Mmr-r.eut
Order Number:

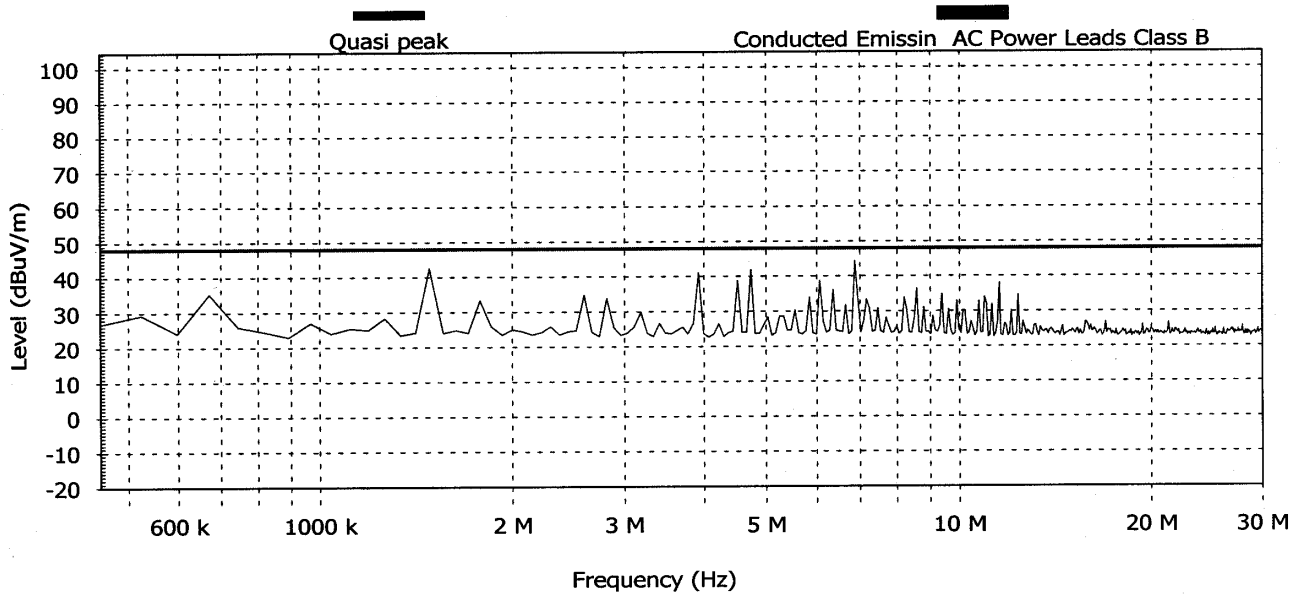
EUT
Name: MMR-R
Serial Number: 992543700061

Client
Name: Telematics
Contact Person: Zeev Inbar

Conducted Emission LISN

Description: 95) CE FCC CLASS B
From 0.45 MHz to 30 MHz

Graph:



Detected Peaks:

Nr	Frequency (MHz)	PK (dBuV/m)	QP (dBuV/m)	PK Limit (dBuV/m)	QP Limit (dBuV/m)	PK Pass	QP Pass	Pass	Line
1	1.898	42.5	45.5		48.0	Pass	Pass	Pass	Neutral
2	5.958	44.9	42.8		48.0	Pass	Pass	Pass	Neutral

Settings:
Description: 95) CE FCC CLASS B
From 0.45 MHz to 30 MHz
Ref. Level: 80.0 dBuV/m Att: 0 dB. RBW: 9 kHz. VBW: 30 kHz. Sweep time: 1094.44494628906 r
Detect all peaks above 6 dB below the limit lines with a maximum of 10 peaks.
Measure the peaks with the quasi-peak detector

Plot CE/ 2

8. ANTENNA POWER CONDUCTION FOR RECEIVER ACCORDING TO FCC 15.111

Frequency Range: **450 kHz – 5000 MHz**

Testing Engineer: D.Lanuel **Date: 26/11/02**

8.1. Equipment Under Test Description and Operation

MMR-R, S/N 0001 manufactured by TADIRAN-Telematics

8.1.1. Modes of Operation

The MMR-R was set to Battery Charge at RX Mode

8.1.2. Operating Voltage 110 V, AC 50Hz

8.2. Test Results Summary & Conclusions

The MMR-R complies with FCC, Part 15.111 Antenna power conduction requirement.

8.3. Limits of Antenna power conduction

The test unit shall meet the limits of Table 1 for FCC Part 15 Para 15.111 equipment.

Table 1 Limits for intentional radiator according 15.111

Frequency Range MHz	Quasi-peak Limits dBµV
0.45 – 5000	50(2.0 nanowatts)

8.4. Test Instrumentation and Equipment

Table CD-A – Test Instrumentation and Equipment

Item	Model	Manufacturer	Next Date Calibration
Spectrum Analyzer	8593E	HP	31/01/03
LISN	FCC-LISN-3B	FISCHER	31/08/04

8.5. Test Setup

8.5.1. The testing setup shown in Figure CEant-1.

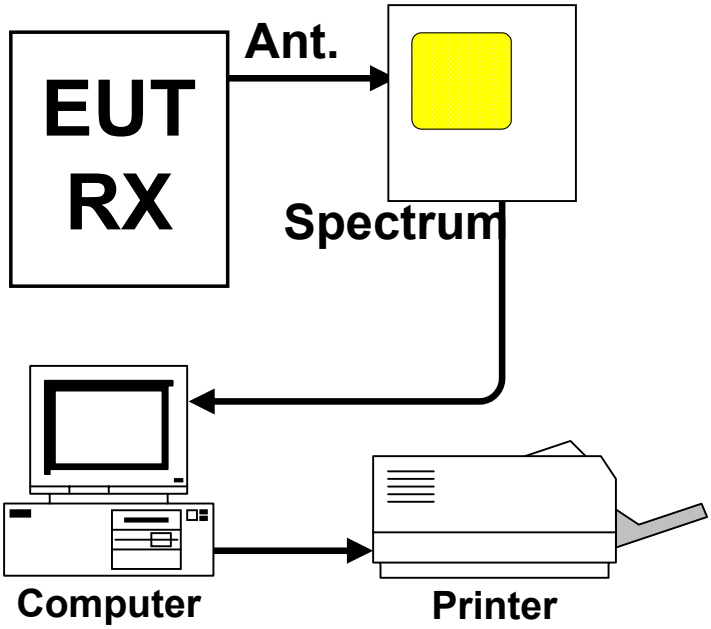


Figure Ceant/1 Test Set up

8.6. **Test Procedures** The test procedures shall be as follows:

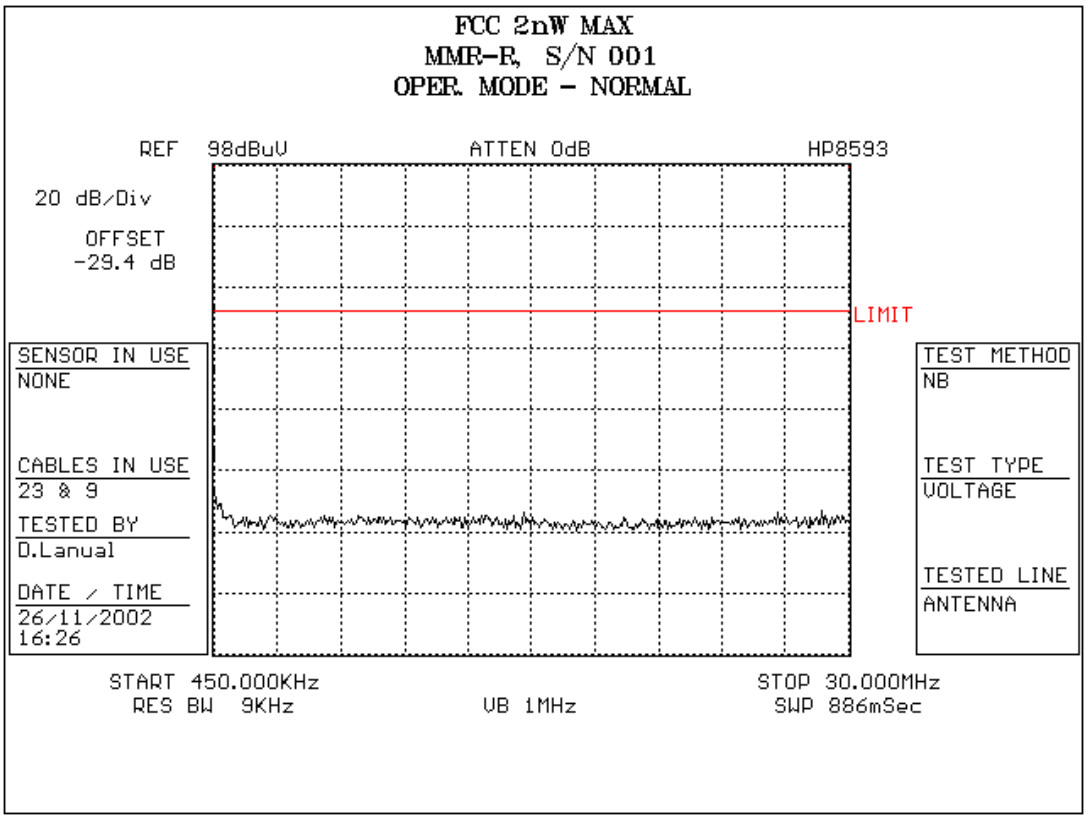
8.6.1. **E.U.T testing.** Perform emission data scan using the measurement setup of Figure CEant.

8.6.1.1. Select E.U.T to Receive Mode

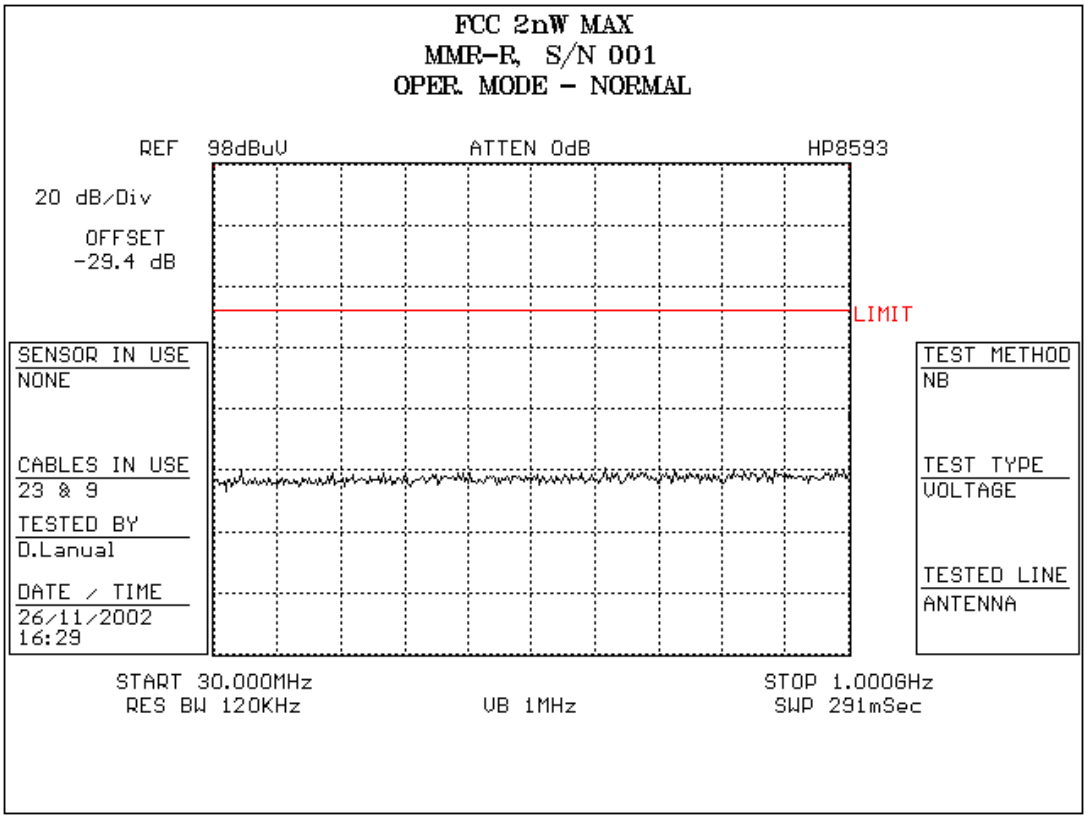
- Scan the spectrum analyzer over the applicable frequency range using the following bandwidth:

Table CE06 - B

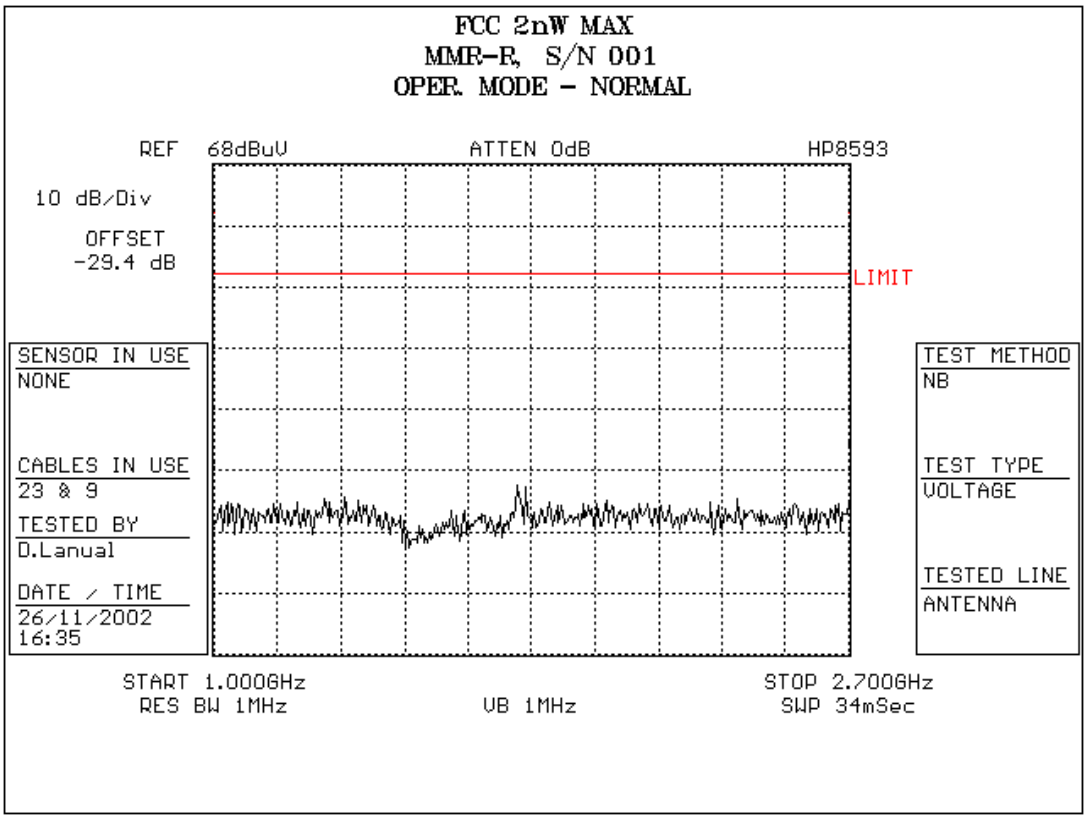
Frequency Range [MHz]	NB Res. Bw [KHz]	Video Bw [KHz]
0.45 - 30	9	1000
30 - 1000	120	1000



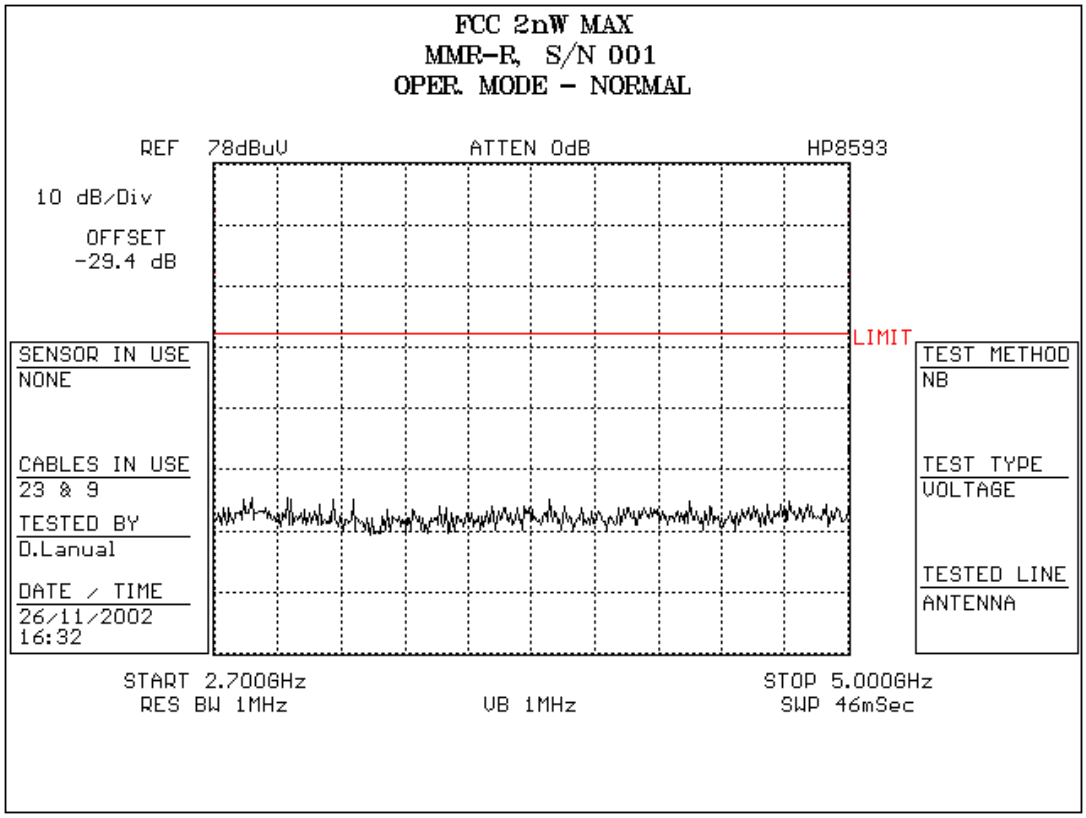
Plot CEant/ 1



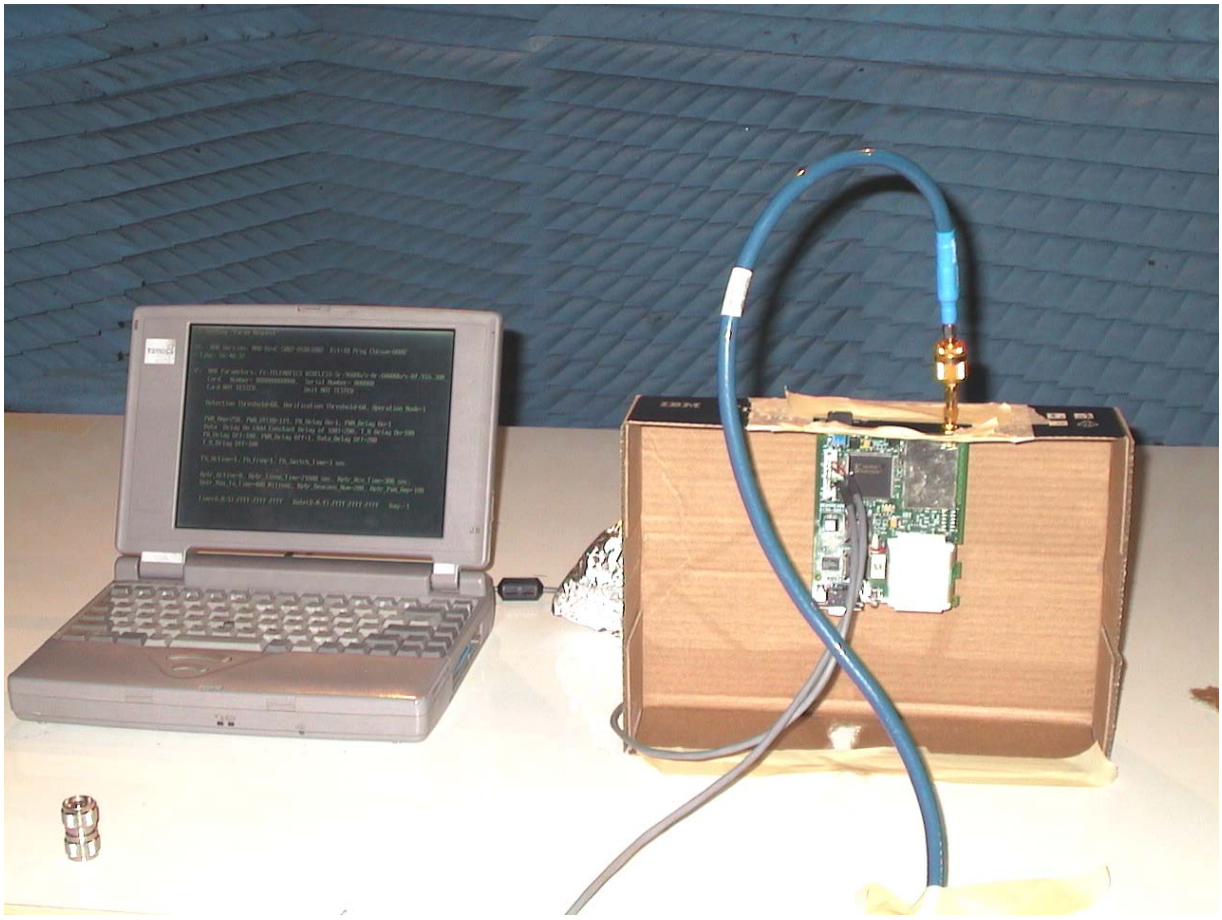
Plot CEant/ 2



Plot CEant/ 3



Plot CEant/ 4



Picture Ceant/1

APPENDIX A

EUT DESCRIPTION

9. E.U.T INTRODUCTION

9.1. **The following document describes the technical specification of the Meter & Monitoring Reader board (called MMR-R, receive only) for the USA market.**

9.2. **The MMR-R is a compact RF receiver unit operates at 900MHz ISM band (multi frequency)**

- **The MMR-R is used for wireless data collection (transmitted from water meters)**

9.3. **Definitions, Abbreviation and Acronyms**

TBD

10. MMR-R DESCRIPTION

10.1. **Operational Modes**

Mode	DSP	Digital Logic	RF Receiver
Receive	**On (fast clock)**	**On**	**On**
Power Down	**On (slow clock)**	**Partial On**	**Off**

10.2. **Board Layout and Size**

Board Size: 125x100x28

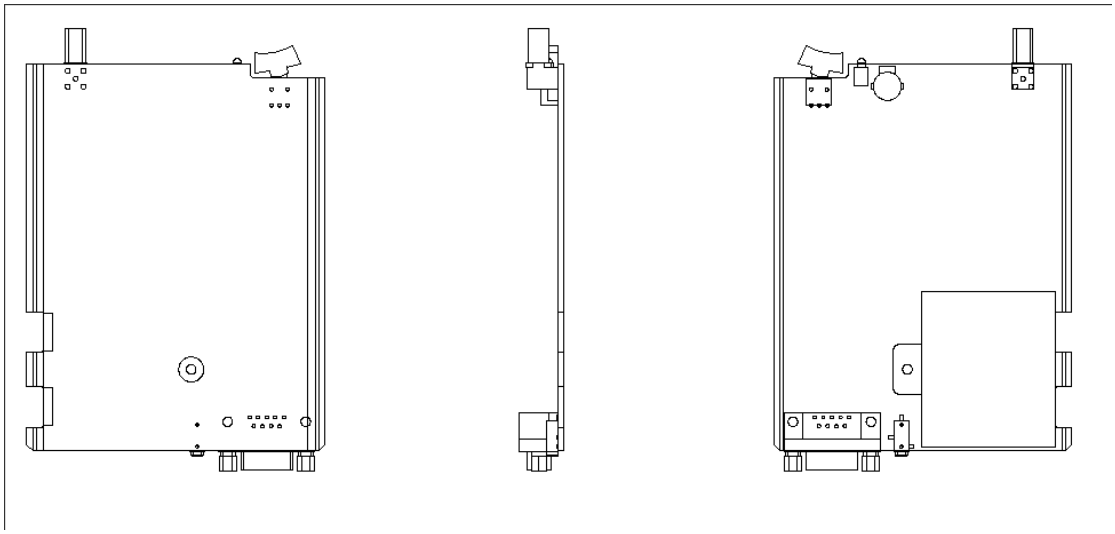


Figure 1: Board Layout

11. ELECTRICAL PERFORMANCE

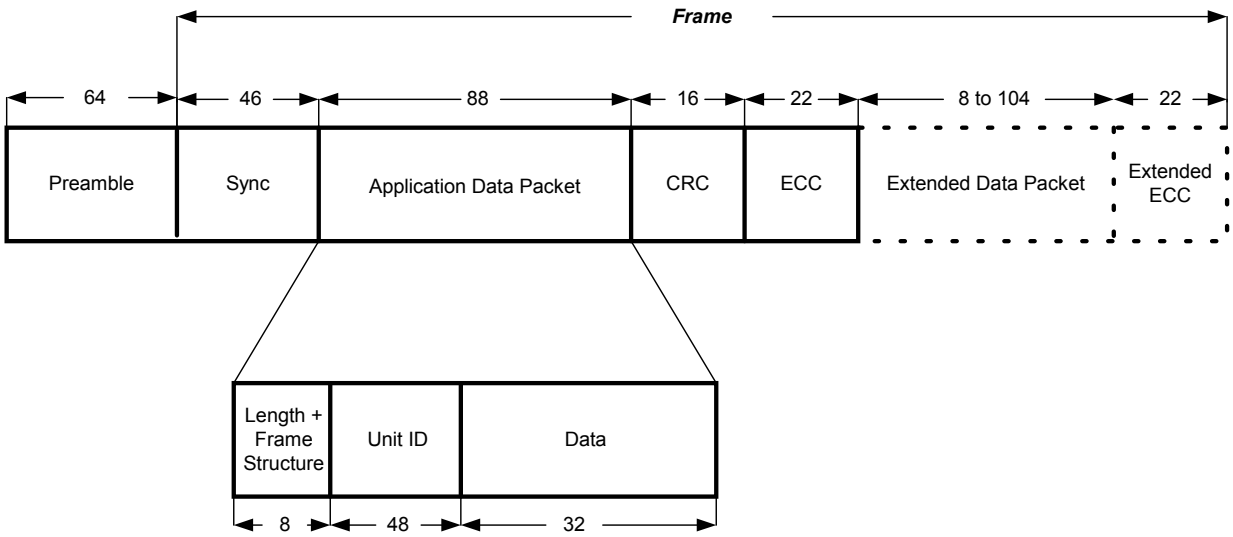
11.1. Receive Unit

11.1.1. Receive Parameters

Table 1 – Receive Parameters

Parameter	Value
Receive frequency	**Programmable in the range 905MHz – 924MHz**
Sensitivity (BER 1E-3)	**-102dBm**
Modulation	**FSK**
Frequency deviation	**100 kHz**
Bit rate	**60 Kbps**
Coding	**Manchester**

11.1.2. Receive Protocol



Notes:

1. **All numbers indicate number of bits.**
2. **The preamble is alternating ones and zeros. The Preamble length is ~64 bits (at 120kbps).**
3. **CRC is used as an error detection code. It is calculated on the entire data packet.**
4. **ECC is used as an error correction code. The BCH is calculated on the Packet data + CRC.**

Figure 2: Receive (Uplink) Frame

11.2. External Interfaces

The MMR includes 2 external interfaces:

- **Asynchronous Serial Communication port:**
- **Battery Charger/External Power Supply**
- **Antenna Port (50 Ohm input)**

11.2.1. Communication Port

The MMR-R is connected to external controller (e.g. Hand Held Compute). The units communicate via asynchronous serial communication.

- **The MMR-R transfers to the external controller the collected data (received via RF from remote meter).**
- **The MMR-R receives from the external controller operational parameters and commands.**

Following are the communication port characteristic:

- **Physical levels: either RS232 or Digital 3V CMOS**
- **Baud rate: 9600**
- **Data Format: 8 bits + 1 stop bit (no parity)**

11.3. Power Source

The MMR-R can be either operated via internal rechargeable battery (NiMH 4.8V 700mA) or external 5V.

11.4. Environmental Conditions

Operating Temperature: -10° C to + 70° C

Storage Temperature: -40° C to +85° C

Humidity: Up to 95%

12. MMR-R CIRCUIT BOARD LAYOUT PHOTOGRAPH

12.1. Print side Layout photograph

12.2. Component Side Layout Photograph