FCC Certification Change Request

Date: Nov. 15, 2000

Subject: Permit of Change Request for devices under FCC ID: ABZMCAD200

Motorola Card Acceptance Devices, models T6479A, T6480A, T6481A, T6499A, T6500A, T6501A, T6548A have been certified under FCC ID number: ABZMCAD200.

The firmware used in these devices, will be updated to comply with ISO 14443 standard. The current models (listed above comply with a previous version of this standard, but not with the final version. The change does not imply any hardware modifications and does in no way affect the RF functionality of the devices. The only difference consist in software communication protocol modifications.

Since the new firmware is not backwards compatible with the previous version, new model numbers must be assigned to these devices, in addition to the existing ones. The new model numbers are: L3201A, L3202A, L3203A, L3204A, L3205A, L3206A, L3207A. All of these models (the current ones and the newly assigned ones) will be shipping, so we request that the new model numbers be added to the list of certified models under FCC ID: ABZMCAD200.

The cross-reference between the current models and the new models (with upgraded software) is as follows:

T6479A – L3206A
T6480A – L3204A
T6481A – L3205A
T6499A – L3202A
T6500A – L3203A
T6501A – L3201A
T6548A – L3207A

Best Regards,

Victor Toma
Lead Engineer
Worldwide Smartcard Solutions Division
Motorola
5201 Tollview Dr., Rolling Meadows, IL 60008

MOTOROLA

Integrated Information Systems Group
8201 E. McDowell Road
Scottsdale, AZ 85252-1417

Report No. WSSD141200

Class II Permissive Change Report

Card Acceptance Device (CAD+)

Low Power Transceiver Module

FCC ID: ABZMCAD200

Model Nos. T6480A *(and variants)*

Equipment Manufacturer:	**Motorola, Inc.** **1301 East Algonquin Rd.** **Room 1726** **Schaumburg, Illinois 60196**
Tests Conducted By:	**Motorola IISG** **EMC Test Facility** **8201 E. McDowell Rd.** **Scottsdale, Arizona 85252**
Tests Period:	**December 5th to December 12th , 2000**
Test Summary:	**Complies with FCC Part 15, Subpart C, Unlicensed Low Power Transmitters**

The Motorola IISG EMC/TEMPEST Laboratory is accredited through the

NVLAP®

NVLAP Lab Code 100405-0

6.0 Introduction

6.0.1 Objective

This report is submitted as part of a Class II Permissive Change request for the Motorola CAD+ transceiver module authorized under the FCC ID: ABZMCAD200. The original filing included modifications required to improve the radiated emissions testing on the CAD+ module. These changes were implemented into this most recent revision of the module tested. The data, which was affected by these changes, is presented in this report.

Specifically, the changes included implementation of ground traces between Shield 1 and 2 on the control board thereby providing a more effective reference between the RF Transmitter and Receiver sections of the module. A 47pf capacitor was added inside Shield 1 of the RF Transmitter, which connects the AM_MOD side of R156 to ground and effectively reduces the emissions radiating from the collector of the drive transistor.

Additionally, the firmware has been updated from Revision V1.1 to V1.2 to comply with ISO 14443 standard. The current models comply with a previous version of this standard, but not with the final version. This firmware change does not include any associated hardware modifications and in no way affects the RF functionality of these devices. The only difference consists in software communication protocol modifications. This change is noted here for information only and for completeness of the current changes. New model numbers are being assigned to these modules incorporating the most recent version of the firmware.

6.0.1 Product Description

The Motorola CAD+ module is a low power radio frequency transceiver designed for applications such as identification systems, security systems, Access Control, and data collection. The subassembly consists of two printed circuit boards and referred to as the Card Acceptance Device (CAD+). The control board contains the microprocessor, non-volatile memory, and radio frequency transmitting and receiving circuitry. The board communicates with the smart cards via an RF link.

The antenna board is a pcb with copper traces forming the transmit and receive antennas. There are four different antenna configurations. The 104 x 67mm antenna board is attached to a ferrite plate and a metal back plate which serves as a ground plane. The 50 x 25mm antenna board also utilizes a ferrite but has no back plate. The other two antenna boards are different sizes with no ferrite or back plate and include a 65 x 45mm PCB and a 100 x 110mm PCB.

When the transceiver module is powered, a low-power radio frequency (RF) field is continuously transmitted by the CAD+ at 13.56 MHz. When a Smartcard is presented within the CAD+ RF field, the microchip embedded in the card, is activated and transmits a unique Identification (ID) number back to the reader at a frequency of 847.5 kHz. The reader validates the identification number, and, if it is valid, converts it to a predefined data format and sends it to the control panel through a data cable. The control panel determines the action to be taken (e.g. open a door, update database, etc.).

Product Specifications:

Operating Frequency	-	13.56 MHz $\pm$ 0.01%
Modulation Type	-	8-14% ASK
Effective Radiated Power	-	< 7.2 mW (+8.57 dBm)

The reader outputs data in RS-485, RS-232, CMOS, and Byte-Wide Parallel Transfer data formats making it easy to upgrade an existing site to proximity using the wiring already in place. The CAD+ tested was configured for a serial, RS-485, data interface.

6.0.2 Facility Description

EMI testing of the CAD+ was performed at the Motorola Integrated Information Systems Group's (IISG) EMI/TEMPEST Test Laboratory. This test laboratory is located in the southeast wing of the Hayden building at 8201 E. McDowell Road, Scottsdale, AZ.

Motorola IISG Test Facility Address:

Motorola, Inc.
Integrated Information Systems Group
Hayden EMC Facility
8201 E. McDowell Rd. M/D H2550
Scottsdale, AZ 85252

The facility has been found to be in compliance with the requirements of Section 2.948 of the FCC rules, per FCC letter 31040/SIT, 1300F2, dated October 6, 1998. The facility has also been issued a Certificate of Accreditation through the National Voluntary Laboratory Accreditation Program (NVLAP) by NIST. This is under NVLAP Code: 100405-0 and is effective through September 30, 2001.

6.0.3 Quality System

The EMI/TEMPEST Test Laboratory maintains a Quality Manual that describes the quality assurance program of the EMC/TEMPEST Facility to set forth procedures covering all quality assurance functions. This manual has been constructed to reflect a quality program in compliance with the requirements of the following:

- National Institute of Standards & Technology (NIST) National Voluntary Laboratory Accreditation Program (NVLAP)
- NIST/NVLAP EMC MIL-STD 462 Program Handbook (Apr. 1994)
- NVLAP EMC and Telecommunications FCC Methods Handbook 150-11 (Apr. 1995)
- MIL-Q-9858A, MIL-STD 461, 462, 463, 461D, 462D
- National Security Agency Technical and Security Requirements Document for the Endorsed TEMPEST Test Services Program, NSA TSRD No. 88-8B, 5 Oct. 1993
- System Solution Group of Motorola Quality Six Sigma Program.

6.0.4 Standard References

47 CFR 2	Code of Federal Regulations, Title 47, Part 2, "Frequency Allocations and Radio Treaty Matters; General Rules and Regulations"
47 CFR 15	Code of Federal Regulations, Title 47, Part 15, "Radio Frequency Devices" Subpart C, "Intentional Radiators"

C63.4-1992 American National Standards Institute (ANSI), "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz"

6.1 Test Procedures

6.1.1 Operational Configuration

The CAD+ was tested as a subassembly with the CAD+ connected to an interface control unit and with the external host interface cable connected. The module was set up and operated in a continuous transmit mode at the frequency of 13.56 MHz and at its maximum rated output power for each of these tests. There is no specification limit on modulation characteristics except that the modulation source shall be representative of that used in an actual installation. The unit utilizes 8-14% ASK modulation and was generated internal to the module.

6.1.2 Measurement Equipment

Test Equipment Nomenclature	Motorola Item Number	Manufacturer	Model Number	Cal. Date	Cal. Due
Biconilog Antenna	T47085	EMCO	3142B	10/31/00	10/31/01
Biconilog Antenna	T47086	EMCO	3142B	10/31/00	10/31/01
H-Field Loop Antenna	T36610	Electro Metrics	ALP-70	NCR	NCR
Antenna Mast	0003-2246	EMCO	2070-2	NCR	NCR
Antenna Controller	G72315	EMCO	2090	NCR	NCR
Spectrum Analyzer/ EMI Receiver	G68094	Rhode & Schwarz	ESI40	5/01/00	5/31/01
Spectrum Analyzer/ EMI Receiver	G71791	Rhode & Schwarz	ESI7	8/29/00	8/31/01

6.1.3 Radiated Spurious Emissions Procedure

Radiated spurious emission were measured over the frequency range of 9 kHz to 1 GHz in an anecohic chamber (20ft x 24ft x 16ft) and an open area test site (OATS). Refer to Figure 6.1-2 and 6.1-3 for test setups.

The radiated emissions between 9 kHz and 30 MHz, including the carrier level, were measured in an anechoic chamber using a shielded magnetic loop antenna at a 3 meter distance. The levels were extrapolated to the required test distance defined in 47 CFR Part 15 using the square of an inverse linear distance formula. These emissions were maximized by rotating the equipment on the turntable. When the using the magnetic loop antenna it was also rotated along its vertical axis.

The radiated emissions above 30 MHz were initially measured in a semi-anechoic shield room in order to identify the emissions before proceeding to the open area test site (OATS). This provides the capability of taking accurate measurements in a higher ambient environment such as at the rooftop OATS. The Rohde & Schwarz EMI Receiver System was used for the pre-scans. Typically, signals within approximately 10 dB of the limit are noted for measurements on the OATS.

Final measurements on the OATS were taken with an Rohde & Schwarz ESI-7 EMI receiver system with preselector at a 3 meter test distance from the receiving antenna. The CAD+ module was placed on a .8 meter high non-conductive table on a rotating turntable which is flush with the site ground plane.

The receiving antenna was scanned over a height range from 1 to 4 meters in both antenna polarities, and the turntable was rotated 360 degrees. The highest emissions were recorded and the final field strength level determined using the following formula:

Field Strength (dBuV/m) = Measured Level (dBuV) + Cable Loss (dB) + Antenna Factor (dB)

6.1.4 AC Conducted Emissions Procedure

The test methods of ANSI 63.4 were used for performing the AC Conducted Emissions tests. A Universal Power Source (UPS) manufactured by Power Designs, Inc., Model 6050A, was used as the AC power mains interface and DC source for the CAD+. This generic commercial off the shelf (COTS) power supply was used since no specific source has been identified for AC power applications. The AC supply was connected to the Line Impedance Stabilization Network (LISN). As specified in Paragraph 13.1.3.1, the tests were performed with a dummy load connected to the antenna output terminals since it has a detachable antenna board. The dummy load simulates the impedance of the PCB loop antenna at 2 Ω in series with a 1.3uH inductance.

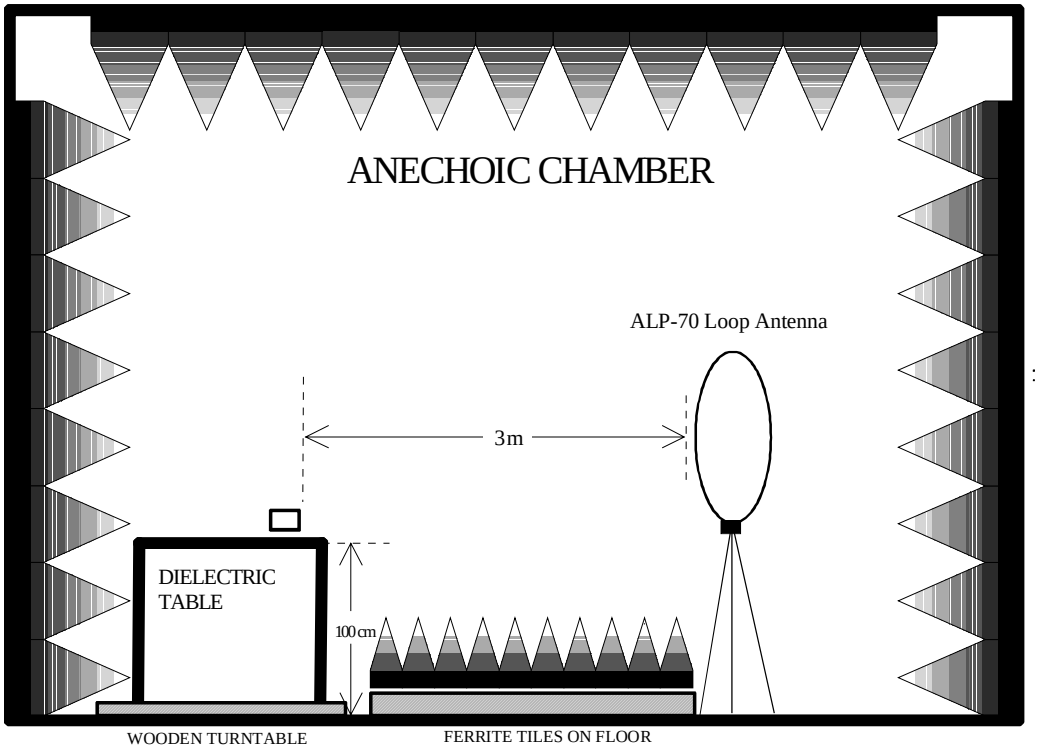


Figure 6.1-2 Radiated Spurious Emissions Test Setup - Chamber

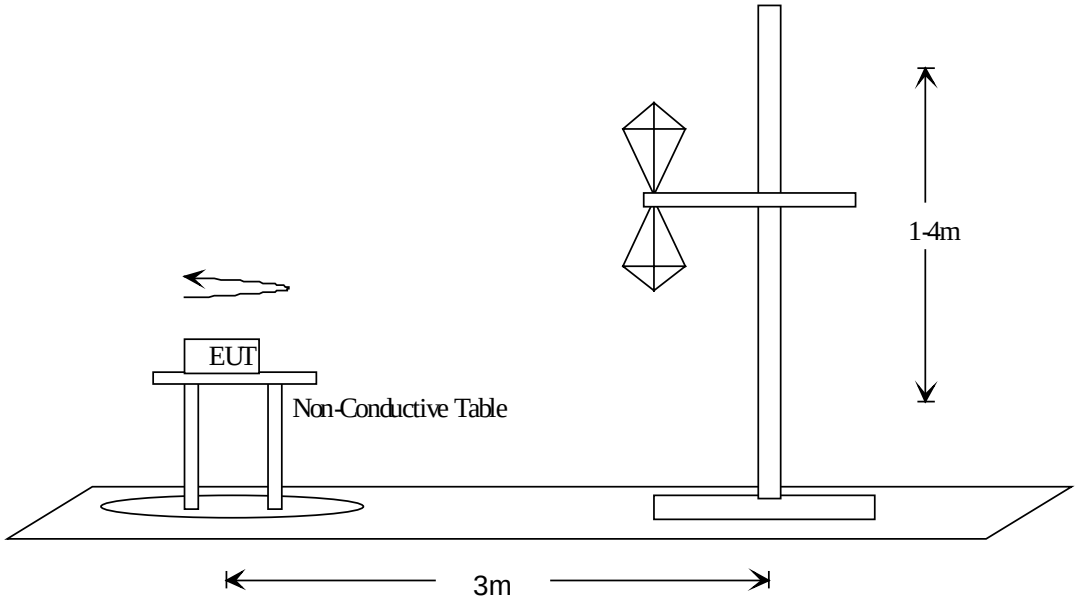


Figure 6.1-3 Radiated Spurious Emissions Test Setup -OATS

6.2 Test Results

6.2.1 Radiated Spurious Emissions Measurement Test Results

All measurements were made with the CAD+ module transmitting at its maximum rated output power. The antenna is an integral part of the unit and the unit is continuously transmitting at 13.56 MHz. The emissions were measured using a peak detector for a worse case reading of each signal. This was done since a narrower bandwidth was used to measure the levels due to the presence of broadband ambient signals. The measured signals were verified to be narrowband, as expected for clock harmonics, and that the affect of using a narrower bandwidth was insignificant to the measured levels.

The radiated emissions for the frequency range of 9 kHz to 30 MHz were all similar or below the original filing data and, therefore, not included in this report. Measurements for 30 MHz to 1 GHz were taken first in the semi-anechoic chamber in order to identify the critical frequencies. Signals, which were within 10 dB of the limit, were recorded and their final measurement was taken on the OATS. The measurements were taken at a test distance of 3 meters per the specification.

All emissions were below the specification limits of 47 CFR Section 15.209. The levels of these signals were actually lower than the worst case emissions originally filed. However, the reportable frequencies have changed specifically those related to the digital harmonics of the 18.432 MHz clock and are, therefore, presented here for this Class II permissive change. The signal at 184.32 MHz was the worst case emission measuring –4.3 dB below the specification limits. The data sheet provides frequencies that were measured with all four of the antenna types but only the worst case levels are shown in most cases.

Additionally, this equipment complies with the requirements of 47 CFR Section 15.205 on operating outside of the specified restricted bands. The CAD+ operating frequency of 13.56 MHz is outside of any of the restricted bands specified in 15.205. Spurious emissions are permitted in these bands with the condition that they comply with the same requirements of 15.209 as tested.

The photo representative of the test setup is shown as Figures C-1.

6.2.2 AC Conducted Emissions Measurement Test Results

The CAD+ complies with the AC Conducted Emission requirements. The conducted emissions scans are shown in Appendix B. The data illustrates that additional noise is now present on the AC power lines including the 18.432 MHz clock fundamental. The AC Conducted Emissions compliance was verified as part of transmitter modular approval per requirement no. 5 of Public Notice DA 00-1407. A setup photo is shown as Figure C-2 of Appendix C.

Appendix A

Radiated Spurious Emission Measurements

30 MHz to 1000 MHz

MOTOROLA IISG TEST DATA SHEET

FCC Radiated Test Results

Equip.	CAD+ Transceiver Module	Test Date:	12/5/00
Mode:	Transmit	Test Technician:	J. Dykema
Model#:	V1.2 Firmware	Measurement Distance (m)	3
Serial #:	CLN7510A	Equipment Class	B

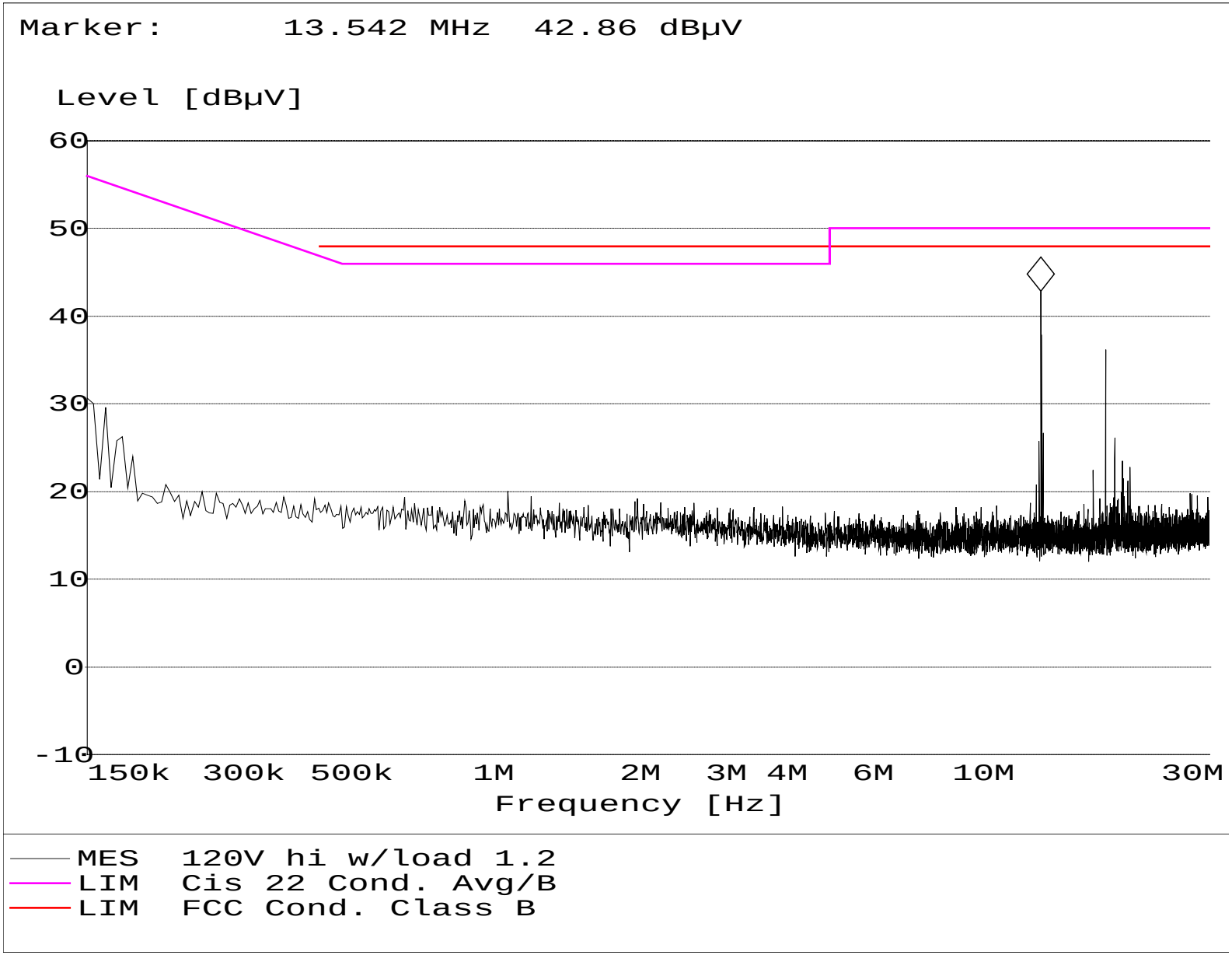
Bold Reading are Quasi Peak — 68° Hum 35.% BP 29.98

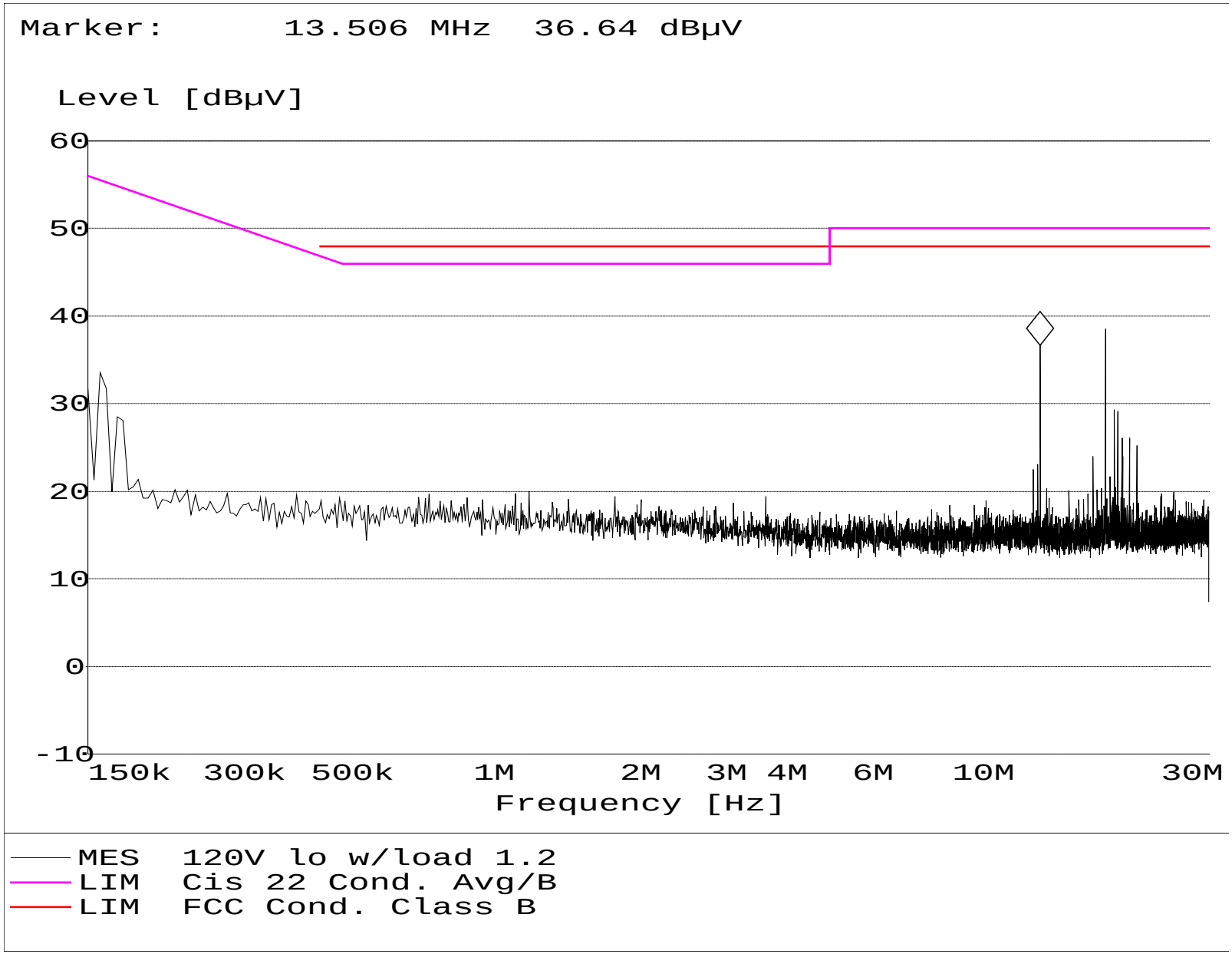
Frequency MHz	SA Reading (dBuV)	Az	Ht cm	Pol	Antenna Factor	Cable/Attn. Loss	Pre Amp dB	Emission (dBuV/m)	Spec Limit (dBuV/m)	Deviation from Spec. Limit (dB)	Comments:
184.320	18.4	CE	100	V	10.1	9.5	0.0	38.0	43.5	-5.5	100x110mm
221.180	14.7	CE	100	V	11.7	10.0	0.0	36.3	46.0	-9.7	100x110mm
184.320	18.2	CE	100	V	10.1	9.5	0.0	37.8	43.5	-5.7	104x67mm
221.180	16.5	CE	100	V	11.7	10.0	0.0	38.2	46.0	-7.8	104x67mm
184.320	19.6	CE	100	V	10.1	9.5	0.0	39.2	43.5	-4.3	65x40mm
221.180	13.6	CE	100	V	11.7	10.0	0.0	35.3	46.0	-10.7	65x40mm
55.290	9.0	CE	100	V	7.9	8.6	0.0	25.6	40.0	-14.4	50x25mm
73.740	8.4	CE	100	V	7.4	8.4	0.0	24.2	40.0	-15.8	50x25mm
110.590	12.3	CE	100	V	7.8	9.0	0.0	29.1	43.5	-14.4	50x25mm
147.480	1.3	CE	100	V	7.8	9.3	0.0	18.4	43.5	-25.1	50x25mm
184.320	18.1	CE	100	V	10.1	9.5	0.0	37.7	43.5	-5.8	50x25mm
221.180	13.0	CE	100	V	11.7	10.0	0.0	34.7	46.0	-11.3	50x25mm
331.770	5.3	CE	100	V	14.3	10.9	0.0	30.4	46.0	-15.6	50x25mm

CE = Cable Edge

Appendix B

AC Conducted Emissions Measurements


Marker: 13.542 MHz 42.86 dBµV
Level [dBµV]
60
50
40
30
20
10
0
-10
150k 300k 500k 1M 2M 3M 4M 6M 10M 30M
Frequency [Hz]
MES 120V hi w/load 1.2
LIM Cis 22 Cond. Avg/B
LIM FCC Cond. Class B


Marker: 13.506 MHz 36.64 dBµV
Level [dBµV]
60
50
40
30
20
10
0
-10
150k 300k 500k 1M 2M 3M 4M 6M 10M 30M
Frequency [Hz]
MES 120V lo w/load 1.2
LIM Cis 22 Cond. Avg/B
LIM FCC Cond. Class B

MOTOROLA
Integrated Information Systems Group

18 December, 2000

Communications Certification Lab
1940 West Alexander Street
Salt Lake City, Utah 84119

Attention: Mr. William S. Hurst

Re: Application for Permissive Changes, Class II, for FCC ID: ABZMCAD200

Motorola, Inc., Integrated Information Systems Group, 8201 E. McDowell Rd, Scottsdale, Arizona 85252 herein submits this application for Class II Permissive Changes to the Card Acceptance Device (CAD+) module. The Card Acceptance Device (CAD+) is manufactured by Motorola WSSD located at 1301 East Algonquin Road, Schaumburg, IL 60196.

The following changes were incorporated into the CAD+, FCC ID: ABZMCAD200. These changes were made as a result of the original testing on the CAD+ and which have been implemented into this most recent revision of the product.

a) Ground traces were implemented between Shield 1 and 2 on the control board thereby providing a more effective reference between the RF Transmitter and Receiver sections of the module.
b) A 47pf capacitor was added inside Shield 1 of the RF Transmitter, which connects the AM_MOD side of R156 to ground and effectively reduces the emissions radiating from the collector of the drive transistor.

A change to the conducted and radiated emissions signature was noticed during the compliance verification of the most recent revision of this equipment. Although this data was still in compliance with Part 15 requirements, it was perceived as degradation to the performance characteristics of the original filing. The final emissions data is included in the attached test report for your review.

Additionally, the firmware has been updated from a version of V1.1 to V1.2. This change is explained in the attached memo and does not include any associated hardware modifications nor does it affect the RF functionality of these devices. The only difference consists in software communication protocol modifications. This change is noted here for information only and for completeness of the current changes.

Sincerely,

Gil Estrella
EMC Engineer
Motorola IISG