

DNB ENGINEERING, INC.

**APPLICATION FOR CERTIFICATION
OF A CLASS B DIGITAL DEVICE**

per
FCC Part 15 Subpart B

EUT: AR16 SCANNER RECEIVER

PREPARED FOR APPLICANT:
AOR Ltd.
2375 W. 230th Pl.
Torrance, CA 90501

REPORT #96035-1

Prepared By:
DNB ENGINEERING, INC.
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TRANSMITTAL SUMMARY

Unit tested: AR16 SCANNER RECEIVER

Specifications: ANSI C63.4 (1992)
CFR 47 FCC part 15 Subpart B

Purpose of Report: This report was prepared to document the status of the
AR16 SCANNER RECEIVER with requirements of the
regulations listed above.

Test Summary The EUT's compliance status according to the tests
performed is as follows.

REQUIREMENTS		STATUS
CFR 47 Part 15	30-1000 MHz	
Radiated Emissions		COMPLIANT Class B

The report shall not be reproduced, except in full, without the written approval of DNB
ENGINEERING, INC. Results contained in this report relate only to the item tested.

CERTIFICATION OF TEST DATA - per 2.911(d)

This report, containing emissions test data and evaluations, has been prepared by an independent electromagnetic compatibility laboratory, DNB ENGINEERING, in accordance with the applicable specifications and instructions required per the Introduction. DNB Engineering has been evaluated and approved to do these tests as proof of compliance.

The data evaluation and equipment configuration presented herein are a true and accurate representation of the measurements of the test emissions characteristics as of the dates and at the times of the test under the conditions herein specified.

Equipment Tested: AR16 SCANNER RECEIVER
FCC ID: NVJ AR16B
Dates of Test: 11-23-98

Test Performed: _____
Norm Hansen
Test Technician
Date

Test Report Reviewed: _____
Rick Linford
Facility Manager
Regulatory Engineer
Date

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1. INTRODUCTION

1.1 Administrative Data Per 2.1033(a) and 2.911(c)

1.1.1 REQUEST FOR CERTIFICATION Per 2.1033(b)1:

Applicant: AOR Ltd.
2375 W. 230th Pl.
Torrance, CA 90501

Contact: Takashi "Taka" Nakayama
Phone: (310) 530-8145

Manufacturer: Same as above

Dates of Test: 11-23-98

Equipment Under Test (EUT): AR16 SCANNER RECEIVER
FCC ID: NVJ AR16B

1.2 Related Submittals/Grants

All Peripherals possess grants.

1.3 Purpose of Tests

The purpose of this series of tests was to demonstrate the Electromagnetic Compatibility (EMC) characteristics of the EUT. The following tests were performed:

REQUIREMENTS	STATUS
CFR 47 Part 15 30-1000 MHz	
Radiated Emissions	COMPLIANT Class B

2. TEST DESCRIPTION

2.1 System Configuration Table

Config-uration	Unit Name - Processor, Monitor, Printer, Cable, etc. (indent for features of a unit)	Style/Model/Part No.	Serial Number	Obj. of test	VAC	Comments/ FCC ID#
A	AR16 Scanner Receiver	AR16	010220	■	BAT(3VDC)	
B	AR16 Scanner Receiver	AR16	010220	■	BAT(3VDC)	
	Headset and cable w/3.5mm phone jack	ANDREA NC-80				
	2 Conductor cable w/3.5mm phone jack					

■ - Specific device(s) for which this test is being conducted.

2.2 Equipment Description

The AR16 is a battery operated receiver that can be tuned to or scan frequencies from 0.5MHz to 1300 MHz.

2.3 Circuit Description - per 2.1033(b)4

See electronic exhibits attached

2.3.1 Mode of Operation

The receiver was tuned to receive 30MHz, 450MHZ, and 950MHz. The EUT was oriented both horizontal and vertical on the table. Both configuration A (without cables) and B (with cables) were used to determine worst case. The configuration without cables (Config. A) was found to allow the highest emissions and was used for taking final measurements.

2.3.2 Modifications to EUT

No documented changes were provided for this EUT.

2.4 Photograph of EUT - per 2.1033(b)(7)

AR16 SCANNER RECEIVER

See attached electronic exhibits.

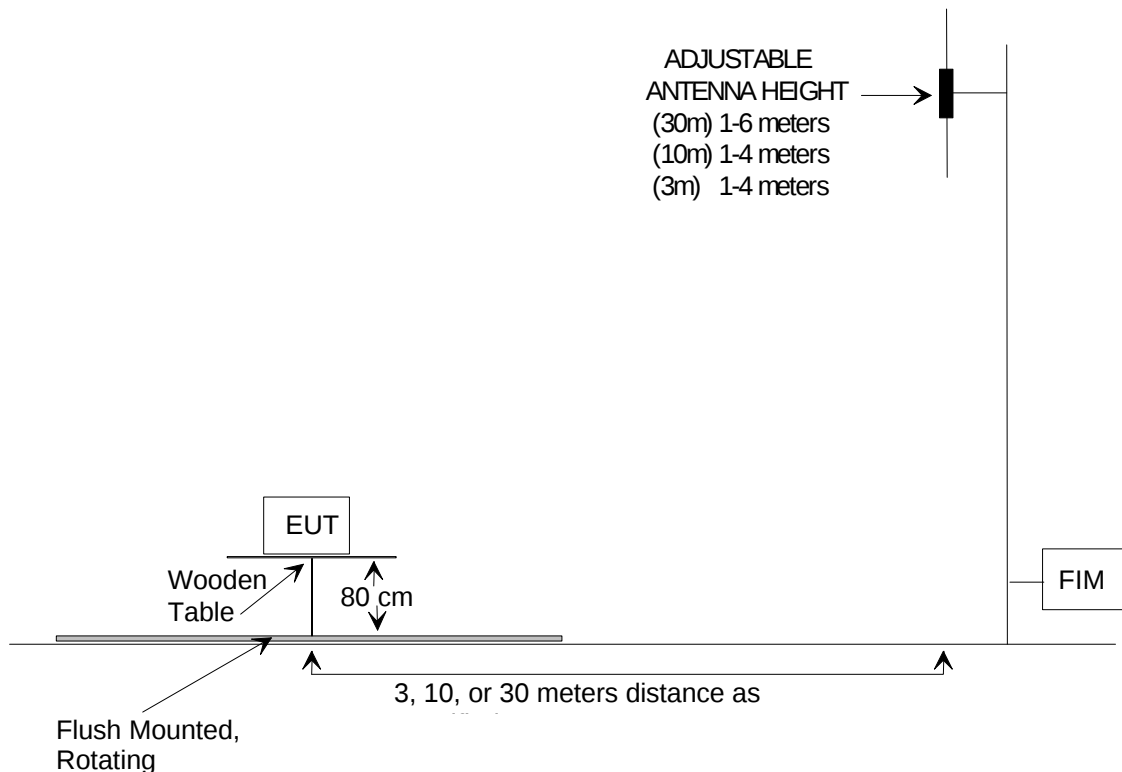
3. EMISSIONS FCC PART 15

per EN 55022 class B

3.1 Radiated Emissions Test Setup and Procedure - Per 2.1033(b)(6) Per 2.947(a)

The EUT was placed on a wooden table 1 meter wide and 1.5 meters long which rests on a flush mounted, steel-top turntable on the open area test site as shown in Section 3.1.1. The top of the table is 80 cm above the ground plane. The turn-table can be rotated 360 degrees. Measuring antenna is set at the prescribed distance. Measurements are made with broad band antennas that have been correlated with tuned dipole antennas. The mast is 4.5 meters high and is self-supporting. The height of the antenna can be varied from 1 to 4 meters. Positioning of the antenna is controlled remotely.

3.1.1 Spurious Radiation Test Site Per 2.1033(b)6



Radiated Test Setup and Procedure - cont'd

The EUT is put into the operational test mode as stated in Section 2.3.1 is then started.

The spectrum analyzer is setup to store the peak emission over the band of the antenna. Peak EUT and ambient emissions are stored while the turntable is rotated 360°. Peak spectrum analyzer trace is then plotted with the addition of antenna and cable correction factors. The limit is plotted on the same graph. A receiver with CISPR Quasi Peak capabilities is then used on the frequencies identified as the highest with respect to the plotted limit. Ambients are noted on the graph along with EUT emissions. The highest EUT frequencies, with respect to the limit, are maximized.

To maximize emissions levels, the turntable is rotated and the antenna is raised and lowered to determine the point of maximum emanations. The cables are then manipulated at that point to maximize emissions. Measurements are made with the antennas in each horizontal and vertical polarization separately. The data obtained from these tests is corrected with the proper cable, preamplifier and antenna factors. The results are then transcribed onto tables that show the maximum emission levels. The highest emissions are listed in a Radiated Emissions Summary table.

If no emissions can be found, the lowest harmonics of the EUT clocks within the bands of the standard are tuned into with the receiver. If no emissions are found, the noise floor will be entered into the table and noted. A minimum of six frequencies will be logged. Summary results will reflect only actual emissions from the EUT.

Radiated Test Setup and Procedure - cont'd

The field intensity measurements are made using standard techniques with a spectrum analyzer or EMI receiver as the calibrated Field Intensity Meter (FIM). Preamplifiers and filters are used when required.

When using the Hewlett Packard Model 8568B Spectrum Analyzer as the FIM, the Analyzer is calibrated to read signal level in dBm. Where:

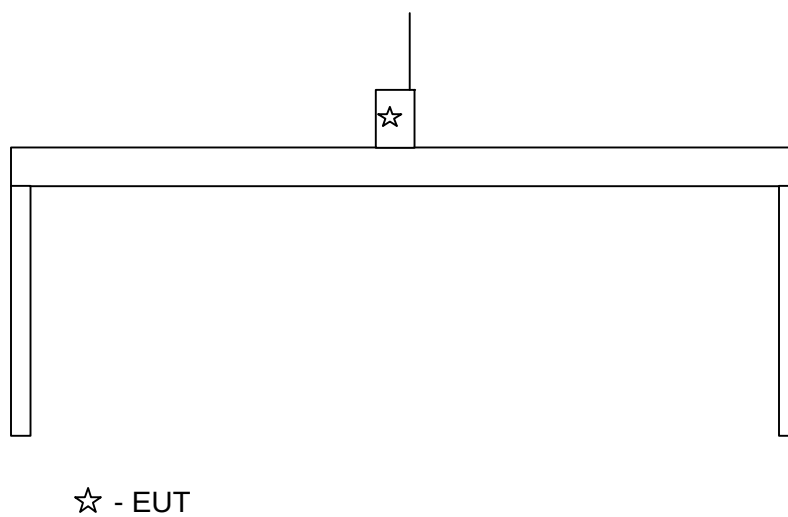
$$0 \text{ dBm (50 ohms)} = 107 \text{ dBuV (50 ohms)}$$

The signal level (dBuV) = indicated signal level (dBm) + 107 dB. To obtain the signal level in dBuV/m it is necessary to add the antenna factor in dB.

3.1.2 Example Of Typical Calculation Per 2.1033(b)6

Measurement Distance = 3 Meter		
Rohde and Schwarz reading @ 60 MHz	_____→	49.0 dBuV
Antenna Factor	+7.5 dBuV	
Cable Loss	+2.0 dBuV	
Preamplifier	-25.5 dBuV	
	_____→	-16.0 dBuV
Field Strength dBuV/m at 3 Meter =	_____→	33.0 dBuV

3.1.3 *Diagram of Test Setup - per 2.1033(b)5*



3.1.4 Radiated Emissions Compliance Data - table #1

The EUT was compliant with FCC part 15 class B radiated emissions requirements.

Radiated Emissions Summary Test Data

per FCC, class B at 3 meters
(30 to 1000 MHz)

AOR LTD				EUT: AR16 Scanner Receiver				
Freq. (MHz)	Meas'd (dBuV)	Amp Factors (dB)	Cable Factors (dB)	Antenna Factors (dB)	Total Factors (dB)	Corrected signal (dBuV/m)	Limit (dBuV/m)	Delta (dB)
990.00	44.2	26.0	10.3	23.6	7.9	52.1	54.0	-1.9
990.00	43.3	26.0	10.3	23.6	7.9	51.2	54.0	-2.8
509.90	42.1	26.5	7.0	19.0	-0.6	41.5	46.0	-4.5
395.10	42.7	25.9	6.4	16.9	-2.7	40.0	46.0	-6.0
470.10	39.5	26.3	6.8	18.2	-1.4	38.1	46.0	-7.9
470.10	39.1	26.3	6.8	18.2	-1.4	37.7	46.0	-8.3

- Six highest frequencies relative to the Limit.
- Reference Appendix A for all data taken.

3.1.5 Photograph of Radiated Test Setup - per 2.1033(b)(7)

AR16 SCANNER RECEIVER

See attached electronic exhibits.

4. LABELING REQUIREMENTS - PER 2.1033(B)(7)

Label will be constructed of 0.02 inch plastic attached as shown on the equipment with permanent adhesive.

All information on the label will be etched or screened. All methods will exceed the expected lifetime of the equipment.

The label will be large enough to allow all information to be readily legible.

4.1 Additional Label Required

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) This device must accept any interference received, including interference that may cause undesired operation.

Shown above is a copy of the label with the Part 15.19 Compliance Statement, Location of required information is checked "below".

- ☐ The label will be placed in a conspicuous location on the device.
- ☒ The device is too small for a compliance label. Therefore the label will be placed in a prominent location in the Instruction Manual or other information supplied to the user.
- ☐ The device is too small for a compliance label. The label will be placed on the container in which the device will be marketed.

CONTENTS OF LABEL

See attached electronic exhibits.

LABEL PLACEMENT

See attached electronic exhibits.

5. BLOCK DIAGRAM & SCHEMATIC DIAGRAMS

See attached electronic exhibits.

6. OWNERS MANUAL

See attached electronic exhibits.

7. APPENDIX SECTION

7.1 APPENDIX A: TEST DATA

7.2 APPENDIX B: UNCERTAINTY TOLERANCE

UNCERTAINTY TOLERANCE

DNB Engineering's Utah Facility is within acceptable uncertainty tolerances per ANSI C63.4 (1992) sections 5.4.6.1 and 5.4.6.2 as well as CISPR 16-1(1993) Annex M, section M.2.

ANSI C63.4 (1992)

5.4.6.1 Site Attenuation. A measurement site shall be considered acceptable for radiated electromagnetic field measurements if the horizontal and vertical NSA derived from measurements, i.e., the "measured NSA," are within ± 4 dB of the theoretical NSA (5.4.6.3) for an ideal site.

5.4.6.1 NSA Tolerance. The ± 4 dB tolerance in 5.4.6.1 includes instrumentation calibration errors, measurement technique errors, and errors due to site anomalies. These errors are analyzed in ANSI C63.6-1988 [3], wherein it is shown that the performance of a well-built site contributes only 1 dB of the total allowable tolerance.

CISPR 16-1 (1993)

M.2 Error analysis

. . . The total estimated errors are the basis for the ± 4 dB site acceptability criterion consisting of approximately 3 dB measurement uncertainty and an additional allowable 1 dB for site imperfections.

***7.3 APPENDIX C: TEST SITE CERTIFICATION, CHALK CREEK
EMI SITE - per 2.948(a)***

SITE CHARACTERISTICS, CHALK CREEK EMI TEST SITE

General:

The DNB Engineering test facility is located in Chalk Creek Canyon near Coalville, Utah. Site characteristics were measured according to the procedures outlined in ANSI C63.4 (1992) "Characteristics of Open Field Test Site". The results of these characterizations indicate that the Chalk Creek site is an outstanding facility to perform accurate and repeatable EMI tests.

This facility has been FCC approved to perform class B certification testing since January, 1986. In October of 1996, according to the FCC requirement to re-apply every three years, the facility was recertified. Certification was granted for the 3, 10, and 30 meter positions for both ranges. Facility approval was granted by the FCC Oct. 15, 1996 under file number 31040/PRV 1300F2.

In July of 1997, **The American Association for Laboratory Accreditation, A2LA**, granted accreditation to this facility. Standards for which accreditation was granted: RF Emissions: ANSI C63.4 - 1992, FCC Part 15 subpart B and C, FCC Part 18 CISPR 11, CISPR 13, CISPR 14, CISPR 22, EN 55011, EN 55013, EN 55014, EN 55022, EN 60601-1-2, EN 50081-1, EN 50081-2, IEC 601-1-2; RF Immunity: EN 50082-1, EN 50082-2, Radiated Susceptibility: EN 61000-4-3, ENV 50140, ENV 50204, IEC 1000-4-3, IEC 801-3, ESD: EN 61000-4-2, IEC 1000-4-2, IEC 801-2, EFT: EN 61000-4-4, IEC 1000-4-4, IEC 801-4, Surge: EN 61000-4-5, ENV 50142, IEC 1000-4-5, IEC 801-5, Injected RF Immunity: EN 61000-4-6, ENV 50141, IEC 1000-4-6, IEC 801-6

In September, 1994 the National Certified Testing/Competent/ Notified Body for Norway and Scandinavian Countries (NEMKO) approved this test facility. DNB now offers the testing required for the CE Mark. **NEMKO EMC Laboratory Authorization No.: ELA 131** Standards for which accreditation was granted: RF Emission: EN 55011, EN 55022, EN 50081-1, EN 50081-2; RF Immunity: EN 50082-1, EN 50082-2

In September, 1994, the New Zealand Ministry of Commerce certified that DNB ENGINEERING, INC. EMC facilities meet their laboratory approval criteria for EMC testing and placed DNB ENGINEERING on their list of Ministry-Approved laboratories.

In August, 1995, VCCI certified that the Chalk Creek facility was acceptable to perform EMI test according to VCCI requirements. The certificate number is 715.

Ambient Emissions

Ambient emission measurements were made to determine the level of the ambient emanations at the DNB test facility. The results indicate that all ambient signals are below the FCC, and VCCI radiated emission limits or that each can easily be identified as an ambient signal.

7.4 APPENDIX D: EMC INSTRUMENTATION AND MEASUREMENT EQUIPMENT

All test equipment are calibrated by a certified metrology facility using standards traceable to NIST.

Each instrument is calibrated annually or more frequently if required.

Test Equipment for Emissions

Description	Manufacturer	Model	Serial	Cal. Due
Antenna Mast, site 2 (30m)	AH Systems	AMSC-6	2159-4C	
Plotter	HP	7475A	2517A20261	
Printer	HP	2671G	2520A31080	
PRE Amp (30m)	HP	8447D	2727A06182	3/4/99
PRE Amp (3,10m)	HP	8447D	2727A06180	6/17/99
CISPR Adapter site 2	HP	85650A	2043A00277	9/25/99
Computer desk top site 1	HP	9826A	2439A09175	
Spectrum Analyzer site 2	HP	8568B	1721A00113	9/23/99
Receiver site 2	R&S	ESH3	872842/045	5/13/99
Receiver site 2	R&S	ESVP	882402/005	1/27/99
Spectrum Monitor site 2	R&S site 1	EZM(3)	880 087/038	
Log Periodic Antenna site 2	SCH	UHAL09107	91071004(L10)	7/24/99
Biconical Antenna site 2	SCH	BBA9106	11	7/20/99
LISN	SCH	NSLK 8126	142	11/6/99
LISN	SCH	NNLA 8120	301	11/6/99
Bicon Antenna	AH SYS	SAS-200/543	183	7/20/99
Log Periodic Antenna	AH SYS	SAS-200/512	322	7/24/99
Horn Antenna, Double Rdg Gd	AH SYS	SAS-200/571	222	4/3/99
Horn Antenna	AR	AT4000	10801	
Antenna Mast, site 1(30m outside)	DNB	2159-2	AMS6	
Antenna Mast, site 1(10m inside)	EMCO 1	1050*	1236a	
Antenna Mast, site 1(3m inside)	EMCO1	1050*	1236b	
Printer	HP	2671G	2520A31883	
Computer desk top	HP	9826A	231A05633	
PRE Amp (3m)	HP	8447D	2727A06191	6/18/99
PRE Amp (30m) site 1	HP	8447D	2727A06181	6/17/99
CISPR Adapter site 1 (ref. only)	HP	85650A	2043A00124	10/27/99
Plotter	HP	7475A	2325A64445	
Spectrum Analyzer site 1	HP	8566B	2421A00516	10/27/99
RF/Preselector site 1 (ref. only)	HP	85685A	2724A00659	10/27/99
PRE Amp. (10m)	HP	8447D	2727A06184	6/17/99
Amplifier	Mini-Circuits	ZHL-1042J	N111496-6	
Amplifier (2-20 GHz, 22dB gain)	MITEQ	AFS6-02002000-18O-MP	428738	6/17/99
Receiver site 1	R&S	ESH3	882399/025	6/19/99
Spectrum Monitor site 1	R&S	EZM(3)	880 487/037	
Receiver site 1	R&S	ESVP	879807/048	6/19/99
LISN	SCH	NNLK 8121	218	11/6/99
Log Periodic Antenna	SCH	UJALP9107	2C	7/24/99
LISN	SCH	NNLK 8121	156	11/6/99
Antenna Mast site 1 port. (10m outside)	Unisys	U-258	CC-300-5023	

7.5 APPENDIX E: INFORMATION SUPPLIED TO APPLICANT

INFORMATION PERTAINING TO EQUIPMENT MANUFACTURED AFTER COMPLIANCE TESTING

It is prudent that manufacturers have an established Quality Assurance program to spot check their products on a periodic basis, either based upon time or quantities produced. Obviously, a change in the engineering design should be sufficient justification for a re-test.

The Quality assurance test need not be formal Verification or Certification such as required during the initial production of the product. However, it should be sufficient in scope to assure that the EMI characteristics of the product have not changed to the degree that the product exceeds the FCC limits. If a new model of a product is produced, it must undergo full Verification or Certification testing and, in case of Certification, be filed with the FCC.

It is expected that the FCC will place greater emphasis and resources in spot checking commercially available products. If a product is found not to be compliant with the Limits specified in Part 15, Subpart B, the manufacturer will be subject to the appropriate penalties imposed by the Commission. The initial Certification or Verification is sufficient to justify initial production. The additional quality assurance testing performed is the manufacturer's responsibility to assure continued compliance.