July 16, 1998

Chief, Equipment Authorization Branch,
Authorization and Evaluation Division,
Office of Engineering and Technology
FEDERAL COMMUNICATIONS COMMISSION
P.O. Box 358315
Pittsburgh, PA 15251-5315

Gentlemen:

The enclosed documents constitute a formal submittal and request for a Class II Permissive Change pursuant to Subpart C of Part 15 of FCC Rules (CFR 47) regarding changes to intentional radiators. A change is being proposed to the Advanced Fibre Communications model mSSR-XCVR 2.4 GHz, which would result in changes to the performance characteristics originally reported to the Commission. Since the mSSR-XCVR 2.4 GHz is presently certified, an emissions test has been performed to demonstrate that it continues to comply with FCC Part 15 limits for intentional radiators.

This submittal was prepared by Elliott Laboratories, as duly authorized agent. A copy of the letter of our appointment as agent is enclosed. Please also find enclosed a check in the amount of $45.00 for the application fee.

If there are any questions or if further information is needed, please contact Elliott Laboratories for assistance.

Sincerely,

Mark Briggs
Manager, EMC Consulting Services

MB/crm
Enclosures: Application Fee
FCC Form 731
Agent Authorization Letter
Anti-Drug Abuse Statement
Request For Confidentiality
Emissions Test Report with Exhibits

File: R27473

Electromagnetic Emissions Test Report and Request for Class II Permissive Change pursuant to FCC Part 15, Subpart C Specifications for a Intentional Radiator on the Advanced Fibre Communications Model: mSSR-XCVR 2.4 GHz

PRESENT FCC ID:	NJV0310-0951
GRANT DATE:	May 6, 1998
GRANTEE:	Advanced Fibre Communications, Inc. 1 Willowbrook Court Petaluma, CA 94954
TEST SITE:	Elliott Laboratories, Inc. 684 W. Maude Avenue Sunnyvale, CA 94086
REPORT DATE:	July 16, 1998
FINAL TEST DATE:	July 13, 1998
TEST ENGINEER:	Pamela Galvan and Herb Smith

AUTHORIZED SIGNATORY: _____

Mark Briggs
Manager, EMC Consulting Services

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SCOPE

An electromagnetic emissions test has been performed on the Advanced Fibre Communications Transceiver model mSSR-XCVR 2.4 GHz pursuant to Subpart C of Part 15 of FCC Rules for intentional radiators. Conducted and radiated emissions data has been collected, reduced, and analyzed within this report in accordance with measurement guidelines set forth in FCC Rules This test has been performed to confirm continued compliance of a new version of the mSSR-XCVR 2.4 GHz in accordance with Part 2, Section 2.1043 of the FCC Rules for permissive changes to Certified devices.

The intentional radiator above has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

Final system data was gathered in a mode that tended to maximize emissions by varying orientation of EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

Every practical effort was made to perform an impartial test using appropriate test equipment of known calibration. All pertinent factors have been applied to reach the determination of compliance.

The test results recorded herein are based on a single type test of the Advanced Fibre Communications model mSSR-XCVR 2.4 GHz and therefore apply only to the tested sample. The sample was selected and prepared by Scott Pradels of Advanced Fibre Communications, Inc..

OBJECTIVE

The primary objective of the manufacturer is compliance with Subpart C of Part 15 of FCC Rules for the radiated and conducted emissions of intentional radiators. In this case, minor modifications to the design of the subject device require that additional testing be performed to demonstrate that the device continues to comply with the Rules. The original Grant of Equipment Authorization issued by the FCC for the Certification of the subject device will be valid for the new version once acceptance is received from the FCC.

Certification is a procedure where the manufacturer or a contracted laboratory makes measurements and submits the test data and technical information to the FCC. The FCC issues a Grant of Equipment Authorization upon successful completion of their review of the submitted documents. Once the equipment authorization has been obtained, the label indicating compliance must be attached to all identical units which are subsequently manufactured.

Maintenance of FCC compliance is the responsibility of the manufacturer. Any modification of the product which may result in increased emissions should be checked to ensure compliance has been maintained (i.e., printed circuit board layout changes, different line filter, different power supply, harnessing or I/O cable changes, etc.).

TEST SITE

GENERAL INFORMATION

Final test measurements were taken on July 13, 1998 at the Elliott Laboratories Open Area Test Site located at 684 West Maude Avenue, Sunnyvale, California. Pursuant to section 2.948 of the Rules, construction, calibration, and equipment data has been filed with the Commission.

The FCC recommends that ambient noise at the test site be at least 6 dB below the allowable limits. Ambient levels are below this requirement with the exception of predictable local TV, radio, and mobile communications traffic. The test site contains separate areas for radiated and conducted emissions testing. Considerable engineering effort has been expended to ensure that the facilities conform to all pertinent FCC requirements.

CONDUCTED EMISSIONS CONSIDERATIONS

Conducted emissions testing is performed in conformance with ANSI C63.4. Measurements are made with the EUT connected to the public power network through a nominal, standardized RF impedance, which is provided by a line impedance stabilization network, known as a LISN. A LISN is inserted in series with each current-carrying conductor in the EUT power cord.

RADIATED EMISSIONS CONSIDERATIONS

The FCC has determined that radiation measurements made in a shielded enclosure are not suitable for determining levels of radiated emissions. Radiated measurements are performed in an open field environment. The test site is maintained free of conductive objects within the CISPR defined elliptical area incorporated in ANSI C63.4 guidelines.

MEASUREMENT INSTRUMENTATION

RECEIVER SYSTEM

AN EMI receiver as specified in CISPER 16 is used for emissions measurements. The ESH3 receiver can measure over the frequency range of 9 kHz up to 2000 MHz. These receivers, allow both ease of measurement and high accuracy to be achieved. The receivers have Peak, Average, and CISPR (Quasi-peak) detectors built into their design so no external adapters are necessary. The receiver automatically sets the required bandwidth for the particular detector used during measurements.

For measurements above the frequency range of the receivers, a spectrum analyzer is utilized because it provides visibility of the entire spectrum along with the precision and versatility required to support engineering analysis. Average measurements above 1000MHz are performed on the spectrum analyzer using the linear-average method with a resolution bandwidth of 1 MHz and a video bandwidth of 10 Hz.

INSTRUMENT CONTROL COMPUTER

A Rohde and Schwarz EZM Spectrum Monitor/Controller is utilized to convert the receiver measurements to the field strength at the antenna, which is then compared directly with the appropriate specification limit. This provides faster, more accurate readings by performing the conversions described under Sample Calculations within the Test Procedures section of this report. Results are printed in a graphic and/or tabular format, as appropriate.

The EZM provides a visual display of the signal being measured. In addition, the EZM Spectrum Monitor runs the automated data collection programs which control both receivers. This provides added accuracy since all site correction factors, such as cable loss and antenna factors, are added automatically.

LINE IMPEDANCE STABILIZATION NETWORK (LISN)

Line conducted measurements utilize a fifty microhenry Line Impedance Stabilization Network as the monitoring point. The 50 uH LISNs used were manufactured by Fischer Custom Communications, model LISN-3 in combination with a 250 uH Fischer Custom Communications LISN-3 CISPR adapter. This network provides for calibrated radio frequency noise measurements by the design of the internal low pass and high pass filters on the EUT and measurement ports, respectively.

POWER METER

A power meter and thermister mount are used for all output power measurements from transmitters as they provides a broadband indication of the power output. The power meter used was the Hewlett Packard model 432A, S/N 992-05509 and the thermister mount was the Hewlett Packard model 478A, S/N 46397.

FILTERS/ATTENUATORS

External filters and precision attenuators are often connected between the receiving antenna or LISN and the receiver. This eliminates saturation effects and non-linear operation due to high amplitude transient events.

ANTENNAS

A biconical antenna is used to cover the range from 30 MHz to 300 MHz and a log periodic antenna is utilized from 300 MHz to 1000 MHz. Narrowband tuned dipole antennas are used over the 30 to 1000 MHz range for precision measurements of field strength. Above 1000 MHz, a horn antenna is used.

The antenna calibration factors are included in site factors which are programmed into the test receivers

ANTENNA MAST AND EQUIPMENT TURNTABLE

The antennas used to measure the radiated electric field strength are mounted on a non-conductive antenna mast equipped with a motor-drive to vary the antenna height.

ANSI C63.4 specifies that the test height above ground for table mounted devices shall be 80 centimeters. Floor mounted equipment shall be placed on the ground plane if the device is normally used on a conductive floor or separated from the ground plane by insulating material from 3 to 12 mm if the device is normally used on a non-conductive floor. During radiated measurements, the EUT is positioned on a motorized turntable in conformance with this requirement.

INSTRUMENT CALIBRATION

All test equipment is regularly checked to ensure that performance is maintained in accordance with the manufacturer's specifications. All antennas are calibrated at regular intervals with respect to tuned half-wave dipoles. An appendix of this report contains the list of test equipment used and calibration information.

TEST PROCEDURES

EUT AND CABLE PLACEMENT

The FCC requires that interconnecting cables be connected to the available ports of the unit and that the placement of the unit and the attached cables simulate the worst case orientation that can be expected from a typical installation, so far as practicable. To this end, the position of the unit and associated cabling is varied within the guidelines of ANSI C63.4, and the worst case orientation is used for final measurements.

CONDUCTED EMISSIONS

Conducted emissions are measured at the plug end of the power cord supplied with the EUT. Excess power cord length is wrapped in a bundle between 30 and 40 centimeters in length near the center of the cord. Preliminary measurements are made to determine the highest amplitude emission relative to the specification limit for all the modes of operation. Placement of system components and varying of cable positions are performed in each mode. A final peak mode scan is then performed in the position and mode for which the highest emission was noted on all current carrying conductors of the power cord.

RADIATED EMISSIONS

Radiated emissions measurements are performed in two phases as well. A preliminary scan of emissions is conducted in which all significant EUT frequencies are identified with the system in a nominal configuration. At least two scans are performed from 30 to 1000 MHz. One or more of these is with the antenna polarized vertically while the one or more of these is with the antenna polarized horizontally. During the preliminary scans, the EUT is rotated through 360˚, the antenna height is varied and cable positions are varied to determine the highest emission relative to the limit.

A speaker is provided in the receiver to aid in discriminating between EUT and ambient emissions. Other methods used during the preliminary scan for EUT emissions involve scanning with near field magnetic loops, monitoring I/O cables with RF current clamps, and cycling power to the EUT.

Final maximization is a phase in which the highest amplitude emissions identified in the spectral search are viewed while the EUT azimuth angle is varied from 0 to 360 degrees relative to the receiving antenna. The azimuth which results in the highest emission is then maintained while varying the antenna height from one to four meters. The result is the identification of the highest amplitude for each of the highest peaks. Each recorded level is corrected in the receiver using appropriate factors for cables, connectors, antennas, and preamplifier gain. Emissions which have values close to the specification limit may also be measured with a tuned dipole antenna to determine compliance.

DIRECT MEASUREMENTS OF EMISSIONS FROM THE ANTENNA PORT

Direct measurements are performed with the antenna port of the EUT connected to either the power meter or spectrum analyzer via a suitable attenuator and/or filter. These are used to ensure that the front end of the measurement instrument is not overloaded by the fundamental transmission.

SPECIFICATION LIMITS AND SAMPLE CALCULATIONS

The limits for conducted emissions are given in units of microvolts, and the limits for radiated emissions are given in units of microvolts per meter at a specified test distance. Data is measured in the logarithmic form of decibels relative to one microvolt, or dB microvolts (dBuV). For radiated emissions, the measured data is converted to the field strength at the antenna in dB microvolts per meter (dBuV/m). The results are then converted to the linear forms of uV and uV/m for comparison to published specifications.

For reference, converting the specification limits from linear to decibel form is accomplished by taking the base ten logarithm, then multiplying by 20. These limits in both linear and logarithmic form are as follows:

CONDUCTED EMISSIONS SPECIFICATION LIMITS

Frequency Range (MHz)	Limit (uV)	Limit (dBuV)
0.450 to 30.000	250	48

RADIATED EMISSIONS SPECIFICATION LIMITS

The limits below were used for all spurious emissions that fell in restricted bands.

Frequency Range (MHz)	Limit (uV/m @ 3m)	Limit (dBuV/m @ 3m)
0.009-0.490	$2400/F_{KHz}$ @ 300m	$67.6-20*\log_{10}(F_{KHz})$ @ 300m
0.490-1.705	$24000/F_{KHz}$ @ 30m	$87.6-20*\log_{10}(F_{KHz})$ @ 30m
1.705 to 30	30 @ 30m	29.5 @ 30m
30 to 88	100	40
88 to 216	150	43.5
216 to 960	200	46.0
Above 960	500	54.0

SAMPLE CALCULATIONS - CONDUCTED EMISSIONS

Receiver readings are compared directly to the conducted emissions specification limit (decibel form) as follows:

$$R_r - B = C$$

and

$$C - S = M$$

where:

R_r = Receiver Reading in dBuV

B = Broadband Correction Factor*

C = Corrected Reading in dBuV

S = Specification Limit in dBuV

M = Margin to Specification in +/- dB

* Broadband Level - Per ANSI C63.4, 13 dB may be subtracted from the quasi-peak level if it is determined that the emission is broadband in nature. If the signal level in the average mode is six dB or more below the signal level in the peak mode, the emission is classified as broadband.

SAMPLE CALCULATIONS - RADIATED EMISSIONS

Receiver readings are compared directly to the specification limit (decibel form). The receiver internally corrects for cable loss, preamplifier gain, and antenna factor. The calculations are in the reverse direction of the actual signal flow, thus cable loss is added and the amplifier gain is subtracted. The Antenna Factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements. A distance factor, when used for electric field measurements, is calculated by using the following formula:

$$F_d = 20*LOG_{10} (D_m/D_s)$$

where:

F_d = Distance Factor in dB

D_m = Measurement Distance in meters

D_s = Specification Distance in meters

Measurement Distance is the distance at which the measurements were taken and Specification Distance is the distance at which the specification limits are based. The antenna factor converts the voltage at the antenna coaxial connector to the field strength at the antenna elements.

The margin of a given emission peak relative to the limit is calculated as follows:

$$R_c = R_r + F_d$$

and

$$M = R_c - L_s$$

where:

R_r = Receiver Reading in dBuV/m

F_d = Distance Factor in dB

R_c = Corrected Reading in dBuV/m

L_s = Specification Limit in dBuV/m

M = Margin in dB Relative to Spec

EQUIPMENT UNDER TEST (EUT) DETAILS

GENERAL

The Advanced Fibre Communications model mSSR-XCVR 2.4 GHz is a Spread-Spectrum Transceiver which is designed to operate using Direct Sequence techniques. The sample was received on July 13, 1998 and tested on July 13, 1998. The EUT consisted of the following component(s):

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC mSSR-XCVR-A RFl Board	8100-0281	NJV0310-0951
AFC AIM Antenna Interface Module	8100-0951	NJV0310-0951

ENCLOSURE

The mSSR-XCVR enclosure is primarily constructed of fabricated sheet steel. It measures approximately 8 cm wide by 8 cm deep by 14 cm high.

The AIM enclosure is primarily constructed of fabricated sheet steel. It measures approximately 6 cm wide by 4 cm deep by 10 cm high.

INPUT POWER

The EUT uses the following 48 V power supply contained within the enclosure:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
AFC mR-PSU	8100-0346	1C	AFC01361313

EMI SUPPRESSION DEVICES

The EUT contained the following EMI suppression devices during emissions testing:

Description	Manufacturer	Part Number
None	-	-

PRINTED WIRING BOARDS

The Advanced Fibre Communications model mSSR-XCVR 2.4 GHz contained the following printed wiring boards during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial #	Crystals (MHz)
AFC mSSR-XCVR-A RFl Board	81000281	0D	AFC01361169	400, 280, Xr, and Xt *

Note: * Xt is a VCO which varies from 2210 - 2265 MHz, depending upon the actual operating channel. Xr is a VCO which varies from 22250 - 2305 MHz, depending upon the operating channel.

SUBASSEMBLIES

The Advanced Fibre Communications model mSSR-XCVR 2.4 GHz contained the following subassembly modules during emissions testing:

Manufacturer/Description	Assembly #	Rev.	Serial Number
AFC Antenna Interface Module (AIM)*	8100-0951	1B	AFC013620
AFC RSC/24 Enclosure	0310-1001	2A	Nor Serialized

Note: The AIM is unmodified from the original submittal.

SUPPORT EQUIPMENT

The following equipment was used as local support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC mR-PSU 48V input Power supply*	8100-0346	N/A
AFC mSSR-XCVR-B Digital Board*	8100-0282	N/A
AFC mCPU Main CPU Board*	8100-0078	N/A
Mean Well S320-48 230V ac to 48Vdc Power supply	None	N/A
Tecom 1m parabolic dish antenna	None	N/A

The following equipment was used as remote support equipment for emissions testing:

Manufacturer/Model/Description	Serial Number	FCC ID Number
None	-	-

EXTERNAL I/O CABLING

The I/O cabling configuration during emissions testing was as follows:

Cable Description	Length (m)	From Unit/Port	To Unit/Port
50 Coaxial	1.1	SSR-XCVR Input	AIM Output
50 Coaxial	1.1	SSR-XCVR Output	AIM Input
50 Coaxial	1.1	Antenna	AIM Antenna
Unshielded	1.5	SSRXCVR Power supply	External power supply

TEST MODES

The EUT was configured to constantly transmit on either the low (2410 MHz), center (2430 MHz) or high (2460 MHz) channel.

ANTENNA SYSTEM

The antenna system used with the Advanced Fibre Communications Transceiver, model mSSR-XCVR 2.4 GHz, is designed to be professionally installed and so utilizes a standard rf connector (N-type). The EUT can be used with a variety of high gain parabolic dish antennas for point-to-point operation. A 1m dish (Tecom 1m Dish Antenna) was used during testing as this was the highest gain antenna that could be physically located on the test table.

PROPOSED MODIFICATION DETAILS

GENERAL

This section details the modifications to the Advanced Fibre Communications model mSSR-XCVR 2.4 GHz being proposed. All performance and construction deviations from the characteristics originally reported to the FCC are addressed

PRINTED WIRING BOARDS

The device originally submitted comprised of a single board (containing digital and rf circuits) and an Antenna Interface Module (AIM). This version effectively splits the original design into two separate circuit boards, one with the rf circuits and the other with the digital circuits. this allows the device to be installed in a smaller chassis which can then be mounted in a pedestal.

The modifications were explained to the FCC prior to testing. Richard Fabina of the FCC detailed in his Fax (dated June 18, 1998) that only radiated spurious emissions would be affected by this change and only these emissions would have to be reported to the FCC.

TEST RESULTS

TEST DATA ANALYSIS - CONDUCTED

Testing was performed for radiated emissions only. The power, bandwidth, processing gain and spectral density have not been affected by the modifications as the circuitry is identical to the original device. This test plan was agreed upon by the FCC through Richard Fabina.

TEST DATA ANALYSIS - RADIATED

The following measurements were extracted from the data recorded during the radiated electric field emissions scan and represent the highest amplitude peaks relative to the specification limit. The actual test data and correction factors are contained in the appendices of this report.

Maximized Radiated Emissions, Peak/Average Readings,
Restricted Bands, Sorted by Margin - **High Channel**
(Worst Case Operating Channel)

Frequency MHz	Level dBuV/m	Pol v/h	FCC Limit	FCC Margin	Detector Pk/Avg	Azimuth degrees	Height meters	Comments
2483.500	51.1	v	54.0	-2.9	Avg	0	1.5	Band Edge measurement - noise floor
2483.500	50.3	h	54.0	-3.7	Avg	0	2.0	Band Edge measurement - noise floor
4530.000	47.0	h	54.0	-7.0	Pk	150	1.0	Peak Reading, Average Limit
4530.000	46.7	v	54.0	-7.3	Pk	0	1.0	Peak Reading, Average Limit
2265.000	42.0	v	54.0	-12.0	Avg	180	1.1	
2483.500	61.8	h	74.0	-12.2	Pk	0	2.0	Band Edge measurement - noise floor
2483.500	61.6	v	74.0	-12.4	Pk	0	1.5	Band Edge measurement - noise floor
4930.000	41.4	v	54.0	-12.6	Avg	10	1.0	
4930.000	37.7	h	54.0	-16.3	Avg	190	1.0	
4930.000	50.3	v	74.0	-23.7	Pk	10	1.0	
4930.000	49.3	h	74.0	-24.7	Pk	190	1.0	
2265.000	47.3	v	74.0	-26.7	Pk	180	1.1	

Note: Peak reading RBW=1MHz, VBW=1MHz, Average Reading RBW=1MHz, VBW=10Hz

TEST DATA ANALYSIS - ANTENNA CONDUCTED

Not Required. The proposed changes will not affect the results already submitted to the FCC for the original device.

TEST DATA ANALYSIS - PROCESSING GAIN, POWER AND BANDWIDTH

Not Required. The proposed changes will not affect the results already submitted to the FCC for the original device.

EXHIBIT A

Test Equipment Calibration

Test Equipment List - SVOATS#1

	Manufacturer/Description		Model	Asset #	Interval	Last Cal	Cal Due
☐	Elliott Laboratories	FCC / CISPR LISN	LISN-3, OATS	304	12	6/24/98	6/24/99
☑	EMCO	Double Ridge Horn Antenna, 1-18	3115	487	12	6/18/98	6/18/99
☐	EMCO	Biconical Antenna, 30-300 MHz	3110B	363	12	4/8/98	4/8/99
☐	EMCO	Log Periodic Antenna, 0.3-1 GHz	3146A	364	12	4/8/98	4/8/99
☐	EMCO	Double Ridge Horn Antenna, 1-18	3115	786	12	11/13/97	5/13/99
☐	Hewlett Packard	Power Meter	432A	259, (F304)	12	3/10/98	3/10/99
☐	Hewlett Packard	Spectrum Analyzer, RF Section	85680B	BN1724	12	5/11/98	5/11/99
☐	Hewlett Packard	Spectrum Analyzer, Display Section	85662A	BN110605	12	5/11/98	5/11/99
☐	Hewlett Packard	RF Preselector	85685A	BN1725	12	5/11/98	5/11/99
☐	Hewlett Packard	Quasi Peak Adapter	85650A	BN281	12	5/11/98	5/11/99
☑	Hewlett Packard	Spectrum Analyzer	8563E	284, (F194)	24	1/14/98	1/14/2000
☑	Hewlett Packard	Microwave Preamplifier, 1-26.5	8449B	263, (F303)	12	6/8/98	6/8/99
☐	Hewlett Packard	Thermistor Mount	478A	652	12	3/10/98	3/10/99
☐	Hewlett Packard	EMC Receiver/Analyzer	8595EM	780	24	10/24/97	10/24/99
☐	Hewlett Packard	Microwave Preamplifier, 1-26.5GHz	8449B	785	12	11/10/97	11/10/98
☐	Hewlett Packard	EMC Receiver/Analyzer	8595EM	787	12	10/27/97	10/27/98
☐	Narda West	High Pass Filter	HPF 180	821	12	2/20/98	2/20/99
☑	Narda-West	EMI Filter 5.6 GHz, High Pass	60583 HXP370	247	12	4/27/98	4/27/99
☑	Narda-West	EMI Filter 2.4 GHz, High Pass	60583 HPF-161	248	12	4/27/98	4/27/99
☐	Rohde & Schwarz	10 dB Pad / Pulse Limiter	ESH3 Z2	372	12	6/22/98	6/22/99
☐	Rohde & Schwarz	Test Receiver	ESN	775	12	6/22/98	6/22/99
☐	Solar Electronics	High Pass Filter, (c = 8 kHz	7930-8.0	277	12	7/1/98	7/18/99

File Number: T27415

Date: 7/13/98
Engr: P.G./H.S.

EXHIBIT B

Test Measurement Data

The following data includes conducted emission measurements of the Advanced Fibre Communications model mSSR-XCVR 2.4 GHz and maximized radiated emissions measurements of the complete system.

Elliott

EMC Test Log

Client:	Advanced Fibre Communications	Date:	7/13/98	Test Engr:	Pam/Herb
Product:	mSSR-XCVR (2.46 GHz)	File:	T27415	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #1	Contact:	Scott Pradels
Spec:	FCC Part 15.247	Page:	1 of 4	Approved:	

Test Objective

The objective of this test session is to perform final qualification testing the EUT defined below relative to Part 15.247 of the FCC rules governing non-licensed intentional radiators. The results from this test are to be submitted to the FCC in order to obtain approvals for a Class II Permissive change to the device which has been approved under FCC ID: NJV 0310-0951 on 5/6/98.

The changes made to the device are:
The device originally submitted comprised of a single board (containing digital and rf circuits) and an Antenna Interface Module (AIM). This version uses two circuit boards, one with the rf circuits and the other with the digital circuits in place of the single board.

Testing was performed for radiated emissions only. The power, bandwidth, processing gain and spectral density have not been affected by the modifications as the circuitry is identical to the original device. This test plan was agreed upon by the FCC through Richard Fabina.

Test Summary

Run #1 - Maximized Radiated Emissions Scan, Spurious Emissions In Restricted Bands.

PASS* Results: §15.207 -2.9 dB Avg @ 2483.5 MHz Vertical

Note: * indicates that the difference between the highest amplitude emission with respect to the specification limit is within the measurement uncertainty. This signal was a noise floor measurement - moving the antenna closer to the device under test gave no increase in the measured field strength.

Equipment Under Test (EUT) General Description

The EUT is a spread spectrum transceiver which is designed to operate in the 2.4 GHz band. Normally, the EUT would be placed on a mast or inside a pedestal during operation. The EUT was treated as table-top equipment during emissions testing to simulate the end user environment.

Equipment Under Test (EUT)

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC mSSR-XCVR-A RFl Board	8100-0281	NJV0310-0951
AFC AIM Antenna Interface Module	8100-0951	NJV0310-0951

Power Supply and Line Filters

The EUT uses the following 48 V power supply contained within the enclosure:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
AFC mR-PSU	8100-0346	1C	AFC01361313

Printed Wiring Boards in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly #	Rev.	Serial Number	Crystals (MHz)
AFC mSSR-XCVR-A RFl Board	81000281	0D	AFC01361169	400, 280, Xr and Xt *

* Xt is a VCO which varies from 2210 - 2265 MHz, depending upon the actual operating channel. Xr is a VCO which varies from 22250 - 2305 MHz, depending upon the operating channel.

Subassemblies in EUT

The following information was provided by the manufacturer:

Manufacturer/Description	Assembly Number	Rev.	Serial Number
AFC Antenna Interface Module (AIM)*	8100-0951	1B	AFC013620
AFC RSC/24 Enclosure	0310-1001	2A	Nor Serialized

The AIM is unmodified from the original submittal.

Antenna

The EUT is designed to be professionally installed and so utilizes a standard rf connector (N-type). The EUT can be used with a variety of high gain parabolic dish antennas for point-to-point operation. A 1m dish (Tecom 1m Dish Antenna) was used during testing as this was the highest gain antenna that could be physically located on the test table.

EUT Enclosure(s)

The mSSR-XCVR enclosure is primarily constructed of fabricated sheet steel. It measures approximately 8 cm wide by 8 cm deep by 14 cm high.

The AIM enclosure is primarily constructed of fabricated sheet steel. It measures approximately 6 cm wide by 4 cm deep by 10 cm high.

Client:	Advanced Fibre Communications	Date:	7/13/98	Test Engr:	Pam/Herb
Product:	mSSR-XCVR (2.46 GHz)	File:	T27415	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #1	Contact:	Scott Pradels
Spec:	FCC Part 15.247	Page:	3 of 4	Approved:	

EMI Suppression Devices (filters, gaskets, etc.)

Description	Manufacturer	Model
None	-	-

Local Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
AFC mR-PSU 48V input Power supply*	8100-0346	N/A
AFC mSSR-XCVR-B Digital Board*	8100-0282	N/A
AFC mCPU Main CPU Board*	8100-0078	N/A
Mean Well S320-48 230V ac to 48Vdc Power supply	None	N/A
Tecom 1m parabolic dish antenna	None	N/A

Items marked * were installed inside the same enclosure as mSSR-XCVR-A circuit board

Remote Support Equipment

Manufacturer/Model/Description	Serial Number	FCC ID Number
None	-	-

Interface Cabling

Cable Description	Length (m)	From Unit/Port	To Unit/Port
50 Coaxial	1.1	SSR-XCVR Input	AIM Output
50 Coaxial	1.1	SSR-XCVR Output	AIM Input
50 Coaxial	1.1	Antenna	AIM Antenna
Unshielded	1.5	SSRXCVR Power supply	External power supply

Test Software

The EUT was configured to constantly transmit on either the low (2410 MHz), center (2430 MHz) or high (2460 MHz) channel.

Client:	Advanced Fibre Communications	Date:	7/13/98	Test Engr:	Pam/Herb
Product:	mSSR-XCVR (2.46 GHz)	File:	T27415	Proj. Eng:	Mark Briggs
Objective:	Final Qualification	Site:	SVOATS #1	Contact:	Scott Pradels
Spec:	FCC Part 15.247	Page:	4 of 4	Approved:	

General Test Conditions

During radiated testing, the EUT was connected to 48V dc via an external AC-DC power supply. The EUT and all local support equipment were located on the turntable for radiated testing and conducted testing. All remote support equipment was located approximately 30 meters from the EUT with all I/O connections running on top of the groundplane.

Test Data Tables

See attached data

Elliott

Emissions Test Data

Client:	Advanced Fibre Communications	Date:	7/13/98	Test Engr:	Pam/Herb
Product:	mSSR-XCVR	File:	T27415	Proj. Engr:	Mark Briggs
Objective	Final Qualification	Site:	SVOATS #1	Contact:	Scott Pradels
Spec:	FCC Part 15.247	Distance:	3 m	Approved:	

Run #1a: Radiated Emissions - Spurious Emissions In Restricted Bands (High Channel)

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2483.500	51.1	v	54.0	-2.9	Avg	0	1.5	Band Edge measurement - noise floor
2483.500	50.3	h	54.0	-3.7	Avg	0	2.0	Band Edge measurement - noise floor
4530.000	47.0	h	54.0	-7.0	Pk	150	1.0	Peak Reading, Average Limit
4530.000	46.7	v	54.0	-7.3	Pk	0	1.0	Peak Reading, Average Limit
2265.000	42.0	v	54.0	-12.0	Avg	180	1.1	
2483.500	61.8	h	74.0	-12.2	Pk	0	2.0	Band Edge measurement - noise floor
2483.500	61.6	v	74.0	-12.4	Pk	0	1.5	Band Edge measurement - noise floor
4930.000	41.4	v	54.0	-12.6	Avg	10	1.0	
4930.000	37.7	h	54.0	-16.3	Avg	190	1.0	
4930.000	50.3	v	74.0	-23.7	Pk	10	1.0	
4930.000	49.3	h	74.0	-24.7	Pk	190	1.0	
2265.000	47.3	v	74.0	-26.7	Pk	180	1.1	

Note 1: Peak reading RBW=1MHz, VBW=1MHz, Average Reading RBW=1MHz, VBW=10Hz.

Run #1b: Radiated Emissions - Spurious Emissions In Restricted Bands (Center Channel)

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
4860.000	48.2	v	54.0	-5.8	Pk	0	1.0	Peak Reading, Average Limit
2325.000	47.8	v	54.0	-6.2	Pk	180	1.1	Peak Reading, Average Limit
2325.000	47.4	h	54.0	-6.6	Pk	200	1.3	Peak Reading, Average Limit
4860.000	47.3	h	54.0	-6.8	Pk	160	1.2	Peak Reading, Average Limit
2230.000	45.8	h	54.0	-8.2	Pk	190	1.3	Peak Reading, Average Limit
2230.000	42.2	v	54.0	-11.8	Pk	180	1.0	Peak Reading, Average Limit

Run #1c: Radiated Emissions - Spurious Emissions In Restricted Bands (Low Channel)

Frequency	Level	Pol	FCC	FCC	Detector	Azimuth	Height	Comments
MHz	dBuV/m	v/h	Limit	Margin	Pk/QP/Avg	degrees	meters	
2311.000	47.8	h	54.0	-6.2	Avg	155	1.5	
4622.000	46.8	v	54.0	-7.2	Pk	200	1.0	Peak Reading, Average Limit
4420.000	45.4	v	54.0	-8.6	Pk	155	1.5	Noise Floor, Peak Reading, Average Limit
2210.000	44.8	v	54.0	-9.3	Pk	150	1.0	Peak Reading, Average Limit
2311.000	43.9	v	54.0	-10.1	Avg	180	1.4	
4622.000	42.5	h	54.0	-11.5	Avg	200	1.0	
2210.000	38.4	h	54.0	-15.6	Avg	150	1.5	
4820.000	37.8	v	54.0	-16.2	Pk	180	1.0	Peak Reading, Average Limit
2311.000	50.9	h	74.0	-23.1	Pk	155	1.5	
2311.000	48.8	v	74.0	-25.3	Pk	180	1.4	
4622.000	46.4	h	74.0	-27.6	Pk	200	1.0	
2210.000	44.7	h	74.0	-29.3	Pk	150	1.5	

Note 1: Peak reading RBW=1MHz, VBW=1MHz, Average Reading RBW=1MHz, VBW=10Hz.