# EXHIBITS

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# EXHIBIT 1: Letter Requesting Confidentiality under Sec. 0.457(d)

***Thomas N. Cokenias*** *EMC &Radio Approvals*
*Test & Consulting Services for Commercial, Military, International Compliance*
*P.O. Box 1086*
*El Granada, CA 94018*

20 January 2000

FCC Laboratory
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Application Examiner
Reviewing Engineer

Re: Request for confidentiality per Section 0.459 of FCC Rules

Applicant: Watkins Johnson.

FCC ID: NTTSX1121

To whom it may concern,

Request is hereby submitted, on behalf of my client Watkins Johnson, to withhold from public review certain portions of the application for equipment certification for the referenced FCC identifier. In particular, the following sections of the application and report are requested to be kept confidential:

Schematics
Block diagrams
Theory of operation (P2P Architecture)

Rationale for request for confidentiality:

Watkins Johnson has invested considerable time and materials in research and development to produce the referenced product. Disclosure of the confidential portions of this application to competitors would give them competitive advantage in developing similar products.

The $135 fee for confidentiality has been submitted along with the fee for certification. If you have questions or need further information, please contact the undersigned.

Sincerely,

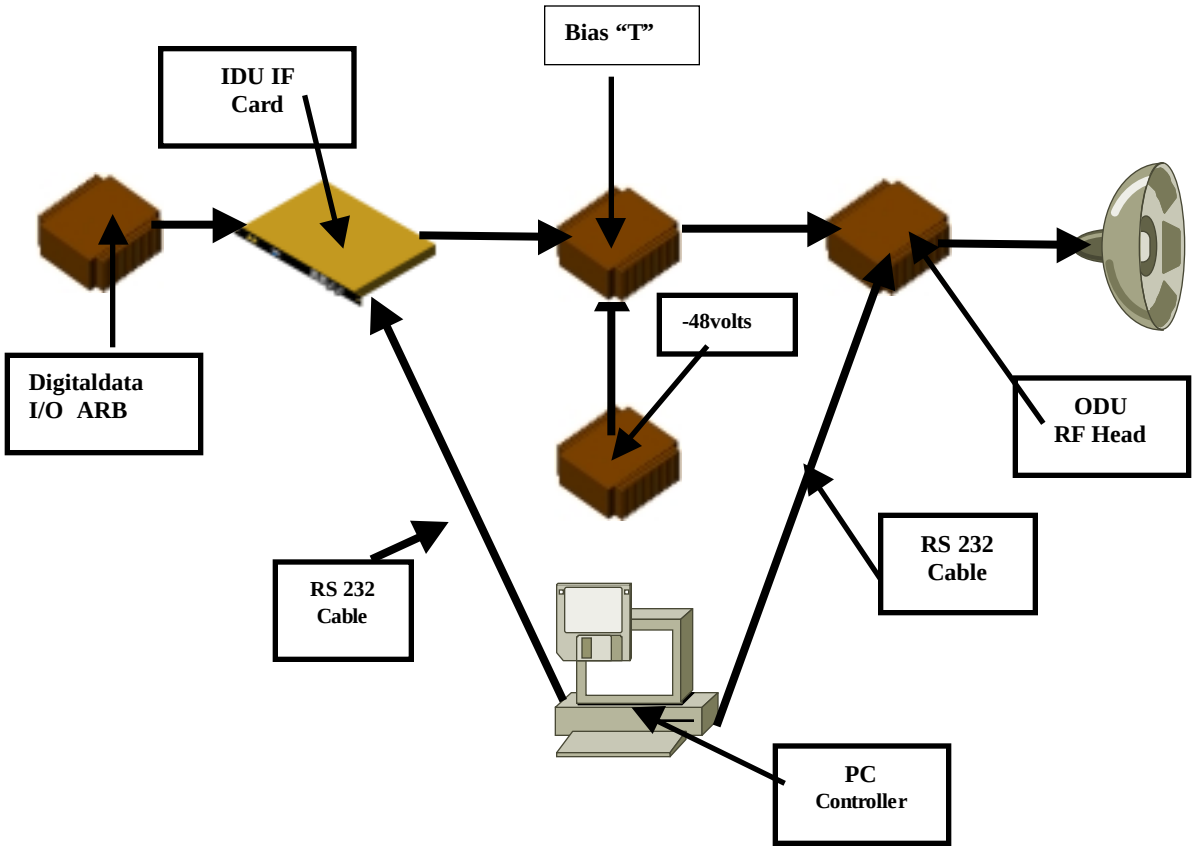
THOMAS N. COKENIAS
EMC Consultant/Agent for Watkins Johnson.

*Tel 650 726 1263* *fax 650 726 1252* *trephonc@macconnect.com*

# EXHIBIT 2: Product Description and Operation Overview

The Watkins Johnson FCC ID: NTTSX1121 is a MMDS transceiver operating under the provisions of Part 21 of the Rules. Model SX1121 is subscriber or customer premises equipment (CPE).

Refer to the system module diagram below:




Product development strategy is to follow a modular approach.

**Digital data I/O** for the initial version of the system will be a line card that will fit into a standard Cisco router chassis. For test purposes, a Tektronix arbitrary waveform generator will simulate the signal output of the router/line card combination.

The **IDU IF card** up-link performs the modulation functions of the system. A 330 MHz signal is modulated with the digital data stream using Orthogonal Frequency Division Multiplexing (OFDM) techniques. The system is capable of producing channel bandwidths in 1.5 MHz multiples. The system will be configurable for use with 1.5, 3, and 6 MHz channel bandwidths.

For the down-link signal, the IF card demodulates the receiver IF signal from the RF head and routes the demodulated digital information to the digital I/O card.

It is anticipated that the IDU IF card will be used with a number of different RF heads, but will provide the same kind of OFDM modulation, the same IF signals, and at the same channel spacing as will be provided for the present application. The IDU output RF spectrum is shown for 6 MHz channels in Exhibit 11.

The **bias "T"** provides DC and the 330 MHz IF signal on a single coaxial cable for routing to the RF head.

The **ODU RF head** produces the RF transmit link at 2.5 – 2.7 GHz , and houses the receiver LNAs, receiver local oscillator, and the receiver IF bandpass filters and IF amplifiers. The RF head also houses the TX-RF diplexer.

The **PC controller** and **RS 232 cables** are for system control and set-up for testing purposes.

The antenna shown in the diagram is specified but not supplied by WJ. The –48 VDC supply shown in the diagram is telephone central office (CO) power or a customer provided supply.

## SPECIFICATIONS

**RF Head**

| | |
|---|---|
| Frequency range: | 2.5 – 2.7 GHz |
| Power output: | 39dBm, 36 dBm, and 33 dBm |
| Channel Bandwidth: | 1.5 MHz, 3 MHz, and 6 MHz configurable |

**IF Head**

| | |
|---|---|
| Frequency range: | 24 MHz clock, 48 MHz blanking, 330 MHz modulated carriers |
| Power output: | -13 dBm nominal (programmable) |

A detailed description of the theory of operation and product configuration is found in the attached document, *rf hea~1.doc*.

# EXHIBIT 3: Information for which Confidentiality is Requested

**Schematics**

**Block Diagrams**

**Theory of Operations**

## Schematics

***- see separate attachment***

# Block Diagram

***- see separate attachment***

## Theory of Operation

***- see separate attachment: rf hea~1.doc***

# EXHIBIT 4: Product Photographs

***- see separate attachments***

## EXHIBIT 5: User Manual and FCC ID Label

***- see separate attachments***

# EXHIBIT 6: RF Hazard Information Per Sec. 1.1307

For transmitters operating in the 2.5-2.7 GHz frequency range, paragraph 1.1310 limits maximum permissible exposure (MPE) to 1 mW/cm2 for uncontrolled environments, and 5 mW/cm2 for controlled environments.

The maximum distance from the antenna at which MPE is met or exceeded is calculated from the equation relating field strength in V/m, transmit power in watts, transmit antenna gain, and separation distance in meters:

E,V/m = $(\sqrt{(30*P*G)})/d$ Power density, mW/m2 = $E^2/3770$

E for MPE 1mW/m2 = 61.4 V/m d, meters = $(\sqrt{(30*P*G)})/61.4$

Watkins Johnson does not provide an antenna with their MMDS radio system. The licensee is responsible for placing a label on the antenna providing adequate information regarding hazardous RF exposure ( such as the maximum distance at which MPE is achieved) and including reference to the applicable FCC regulations. MPE are calculated for a typical 24 dBi antenna:

**Watkins Johnson**

**FCC ID: NTTSX1121**

**RF Hazard Distance Calculation**

**Exposure, mW/cm2:** 1.00

| Max RF Power P, dBm | TX Antenna G, dBi | MPE Safe Distance, cm |
|---|---|---|
| 23.0 | 24.0 | 63.2 |
| 26.0 | 24.0 | 89.2 |
| 29.0 | 24.0 | 126.0 |

**Basis of Calculations:**

E^2/3770 = S, mW/cm2
E, V/m = (Pwatts*Ggain*30)^.5/d, meters
d = ((Pwatts*G*30)/3770*S))^0.5
Pwatts*Ggain = 10^(PdBm-30+GdBi)/10)

Refer to user manual RF Hazard information page for information to user and installer re FCC requirements concerning MPE, exposure from multiple sources, and other similar topics.

Draft version of the warning label is found in separate attachment *CPEwarning.doc*

# EXHIBIT 7: Report of Measurements

## FCC CERTIFICATION INFORMATION

The following information is in accordance with FCC Rules, 47CFR Part 2.

**2.1033(c)1** Applicant: Watkins Johnson
3333 Hillview Avenue
Palo Alto, CA 94304-1233

**2.1033(c)2** FCC ID: NTTSX1121

**2.1033(c)3** Installation instructions are found in attached document.

**2.1033(c)4** Emission type is OFDM in 1.5 MHz, 3 MHz, or 6 MHz channels

1M50D1D , 3M00D1D, and 6M00D1D

**2.1033(c)5** Frequency range: 2500-2700 MHz

**2.1033(c)6 Range of Operating Power**

0 – 29 dBm, TX attenuation settings via software

**2.1033(c)7 Maximum Power Rating**

Maximum allowed per 21.904: 33 dBw

Maximum rated output power of EUT:

29 dBm for 1.5 MHz channel
26 dBm for 3 MHz channel
23 dBm for 6 MHz channel

**2.1033(c)8 Applied voltages and currents into the final transistor elements**

Refer to electronic format schematics accompanying this application

**2.1033(c)9 Tune-up procedure**

Refer to electronic format file installation. for hardware configuration instructions. RF channel selection and RF power output of the ODU outdoor unit are selected via control and set-up PC software via GUI.

**2.1033(c)10 Circuit and Functional Block Diagram, Description of Circuitry**

Complete product schematics are attached as electronic files.
Circuit description and theory of operation are found in the attached electronic file *rf hea~1.doc*.

**2.1033(c)11 FCC ID Label**

Attached as electronic file *FCC label*

**2.1033(c)12 Product Photographs**

Attached as JPEG electronic files

**2.1033(c)13 Description of Modulation System**

Refer to appropriate chapters in attached electronic file P2P-Architecture.doc

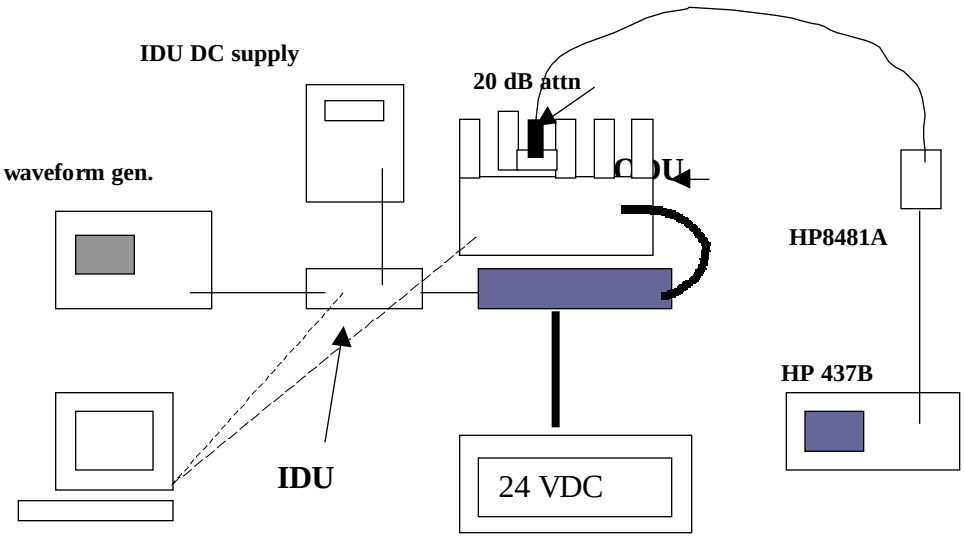
**2.1033(c)14 Test Data per 2.1046 – 2.1057**

**2.1055 RF Output Power Measurements**

**Measurement equipment used:**

HP EpM-441A Power meter
HP 8481A power sensor

**Test set-up:**



## Test Procedures

1. Set the IDU channel bandwidth parameters and output level to desired values. Output level is chosen to maximize RF output level from ODU while keeping spectral re-growth and spurious emissions from ODU at acceptably low levels.
2. Set ODU output power and channel bandwidth parameters as required.
3. Zero HP 437/HP8481A and enter HP8481A cal factors.
4. Connect HP8481A to 20 dB attenuator and record value.

## Test Results

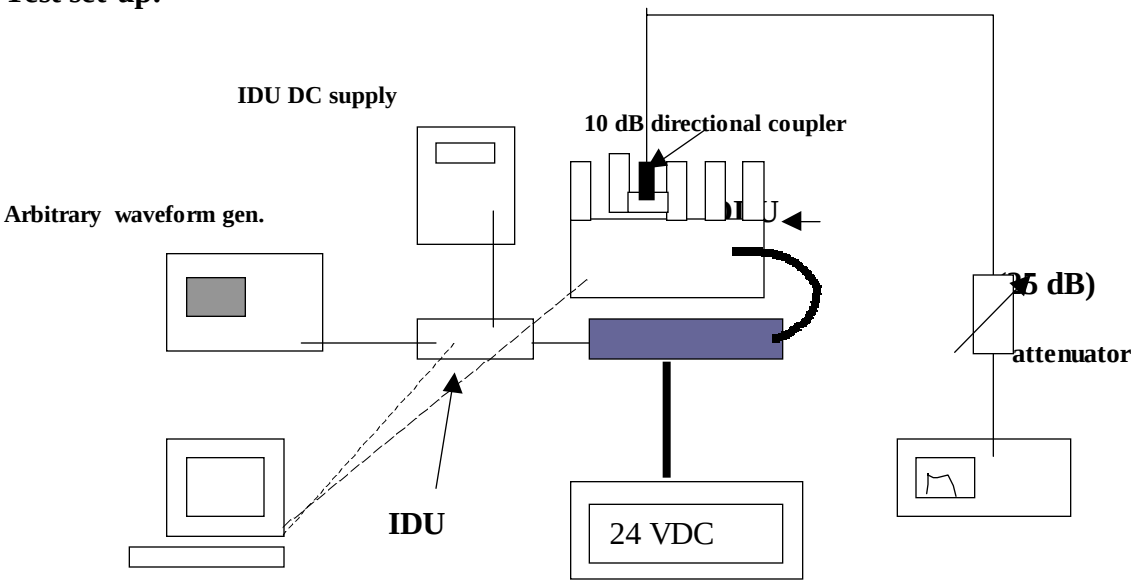
***- refer to attached electronic file***

## Section 2.1047 Modulation Characteristics

### Measurement equipment used:

Rohde&Schwarz FSIQ3 spectrum analyzer
Directional coupler
Variable attenuator, 0-90 dB

### Test set-up:




### Test Procedures

1. Set transmitter output power and channel bandwidth parameters.
2. Set RES BW=100 kHz, VID BW = 10 Hz. Adjust the variable attenuator to optimize analyzer dynamic range while minimizing analyzer spectral regrowth.
3. Plot/photograph resultant spectrum analyzer trace.

### Test Results

**PASS.** Best dynamic range, minimum re-growth with attenuator set to 25 dB.

***- refer to attached electronic files***

## Section 2.1049 Occupied Bandwidth

### Measurement Equipment Used:

Rohde&Schwarz FSIQ3 spectrum analyzer
Directional coupler
Variable attenuator, 0-90 dB

### Test Set-up

- Same as for 2.1047 above, but without the Special Test Fixture

### Test Procedures and Results:

Using MKR DELTA function of the analyzer:

-26 dB Occupied Bandwidth: 1.5MHz, 3.0 MHz, and 6 MHz

## Section 2.1051 Spurious and Harmonic Emissions at Antenna Terminals

### Measurement Equipment Used:

Rohde&Schwarz FSIQ3 spectrum analyzer

### Test Set-up

- Same as for 2.1049 above

### Test Procedures

Section 21.908(e) requires that for a 100 kHz measurement bandwidth, all emissions removed from the band edge by more than 3 MHz must be attenuated at least 60 dB below the channel emission flat top.

1. Set spectrum analyzer to TX output center frequency, RES BW = 100 kHz, VID BW = 100 Hz.
2. Use analyzer PEAK SEARCH to find flat top peak.
3. Set DISPLAY LINE to a level 60 dB below flat top peak
4. Record transmitter output spectrum from 1 MHz to $10^{th}$ harmonic of TX output frequency
5. Plot/photograph spectrum analyzer data

### Test Results

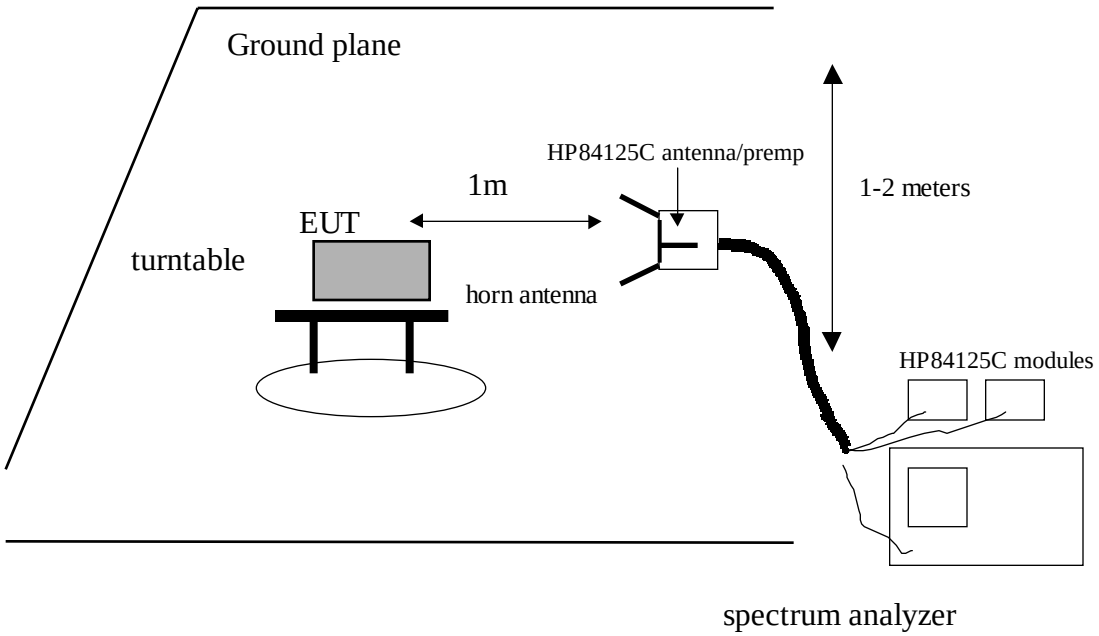
**PASS.** Refer to attached spectrum analyzer charts in Exhibit 10. Output emissions data is presented from 1 MHz to the 10th harmonic of the carrier frequency.

## Section 2.1053 Field Strength of Spurious and Harmonic Radiation

### Measurement Equipment Used:

HP 8565E Spectrum Analyzer
HP 84125C Microwave EMI Measurement System

### Test Set-Up




### Minimum Requirement

The magnitude of each spurious and harmonic emission detected as being radiated from the EUT must be at a level more than 60 dB below the emission flat top.

Resultant radiated field at 3 m from an RF source feeding an isotropic antenna:

**E@1m, dBuV/m = (95.2 + $P_{-60dBm}$ ) dBuV/m,** where $P_{-60dBm}$ is 60 dB below flat top.

### Test Method

The antenna output port of the EUT was terminated with a 50 ohm load. A CW signal was input to the ODU to produce full operating power. CW was chosen to overcome system losses and dynamic range limitations at 3 meters.

The EUT was rotated 360° and the search antenna was raised and lowered in both polarities, all in an attempt to maximize the levels of the received emission for each harmonic and spurious emission up to 10 fo.

**Test Results**

Maximum output, 2503 MHz: 28 dBm
38 - 60 = -32dBm, generating field strength of 63.2 dBuV/m at 3 m = 73.7 dBuV/m@ 1m
Refer to attached spectrum analyzer graphs.

## 2.1056 Frequency Stability

**NOT APPLICABLE.** Frequency stability tests are not meaningful for OFDM modulation systems.

## Part 15 Digital Device Emissions

Tests were performed to measure radiated emissions per 15.109 of the Rules. A separate verification report is being held on file at Watkins JohnsonSystems.

**Test Site**

All testing was performed at Watkins Johnsonby me or under my supervision. Conducted and radiated emissions were performed using test equipment with calibration traceable to NIST, and following test procedures accepted by the industry.

THOMAS N. COKENIAS
Consultant, EMC&Radio Type Approvals

# EXHIBIT 8: Data Graphs: Emissions Masks

***- see attached electronic files***

# EXHIBIT 9: Data Graphs: Antenna Conducted Emissions

# Case Radiated Emissions

## Antenna Conducted Emissions, 6 MHz Channel Bandwidth

***- see attached electronic files***

## Case Radiated Emissions, 1 meter Separation

***- see attached electronic files***

# EXHIBIT 10 IDU Signals to RF Module

***- see attached electronic files***