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9 September 1999

FCC Laboratory
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Frank Coperich

Re: Cisco FCC ID LDK-OFDM-MMDS2 Correspondence No: 9181
Your email: 11 August 1999 Confirmation No.: EA94329

Dear Frank,

The answers to your questions follow.

In addition, a new issue. There was a change to the transmitter RF power amplifier circuit - in the time that elapsed after the application was filed, Cisco found it necessary to change vendors for the GaAsFET RF amplifiers. The transistors are now being supplied by Fujitsu. In addition to this change, minor board layout errors and omissions were corrected since the filing in May for FCC certification. New schematics, PDF files named "Blaze2", have been uploaded to the FCC electronic filing site already.

As a result of these changes, output power has been increased: 6 MHz channel…..33 dBm
12 MHz channel…..31.5 dBm

Out of band spurious and harmonic emission suppression is equal to or better than that already reported. New spectrum analyzer charts are attached below, showing compliance with -60 dB suppression requirement. Note that measurements for broadband signals are referenced to emission flat top, but the CW spurs are referenced to the 31.5 dBm or 33 dBm total average channel power, as amplitude of CW is independent of resolution bandwidth.

Please modify the 731 form to reflect this change.

Answers to your questions:

1. The radio employs an OFDM modulation scheme.

   For 6 MHz channels: 512 tones, each with 64 QAM modulation
   For 12 MHz channels: 1024 tones, each with 64 QAM modulation

   I believe either W1D or D1D are appropriate. Please let me know your take on this and modify the 731 form accordingly.

2. The Block Diagram, Test Report 1 of 3 and 2 of 3 were sent again, hopefully you received them OK. The website sent a confirmation message indicating all was received.

3. The "System Interconnect Drawing" should be included as a confidential document, it is a kind of block diagram. Please add it to the list of documents for which Cisco requests confidentiality.
4. The spectrum analyzer plots do not show the -60 dB attenuation because the spectrum analyzer dynamic range is incapable of making this measurement, due to the spectral regrowth in the analyzer itself. Many months before the certification application was submitted, as product was being developed, attempts were made to find an off-the-shelf measurement system with sufficient dynamic range to show the required attenuation.

   Engineers used HP, Rohde and Schwarz, and other analyzers, along with dynamic range enhancement kits (for HP), and spent many hours experimenting with external attenuator settings, internal attenuation settings, reference levels, and resolution bandwidths, in an attempt to find the combination that would yield the required dynamic range, without placing the analyzer in a mode where power input to the front end mixer would create internally produced spectral regrowth.

   Most analyzer mixers begin to enter gain compression or start to exhibit non-linear responses at aggregate power input levels of around -15 dBm. The transmitter output is on the order of 30 - 33 dBm. After numerous attempts, the best dynamic range that could be achieved was between 59 and 61 dB. This number was very difficult to repeat, and seemed to vary from day to day, even on the same instrument. Reliable and repeatable performance was only at 55 dB dynamic range.

   After weeks of experimentation it became evident that an off the shelf solution was not available for measuring > 60 dB flat-top to noise floor without creating spectral re-growth in the analyzer itself. In response, Cisco developed a special test fixture to be used with the spectrum analyzer. The system is described in the Word attachment titled, "Special Test Fixture", which I am submitting again today. Basically, the test fixture uses narrow band SAW filters ahead of the analyzer that allow only a small portion of the 6/12 MHz channel power through, thereby keeping the power level at the mixer to an acceptably low level. Using swept frequency sources and mixers (to translate the MDS frequency down to the operating frequencies of commercially available SAW filters), the actual relative amplitude of flat top to band edge ratios remain the same, and the analyzer spectral regrowth levels are much lower because total power to the mixer is lower, due to the SAW filter having a BW<<6MHz.

   Test results on new transmiiter, using Special Test Fixture:

   6 MHz channel: -3 MHz @ -62.1 dBc; +3 MHz @ -62.3 dBc
   12 MHz channel: -3 MHz @ -61.9 dBc; +3 MHz @ - 62.1 dBc

5. Refer to page 27 of the test report, with spectrum analyzer chart titled, "Antenna Conducted Emissions, 6 MHz Channel Bandwidth (1 of 7)". The -60 dBc level is -44.4 dBm, shown by the display line. The relationship of field strength and power input to a dummy load

(1) EV/m = (˚(30*PW*G))/d meters (E volts/m, P watts, G numeric gain over isotropic)

Taking 20 log of each side, assume G=1 for dummy load, asusme 1 meter test distance, simplify terms,

(2) E@1m, dBuV/m = (104.8 + PdBm) dBuV/m. For a -44 dBm level

(3) E@1m, dBuV/m = (60.4 + PdBm) dBuV/m

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The HP84125C, when used with the memory card supplied with it, applies all corrections such as cable loss, antenna factor, and amplifier gains to the received signal and displays a corrected field strength level on the spectrum analyzer screen. System operation is verified per user manual by connecting a signal generator to where the antenna port would normally connect, and comparing the displayed emission level with the theoretical level calculated for the system loss/gain parameters.

When checked in this manner, the HP84125C system readings were within+/- 2 dB of calculated values.

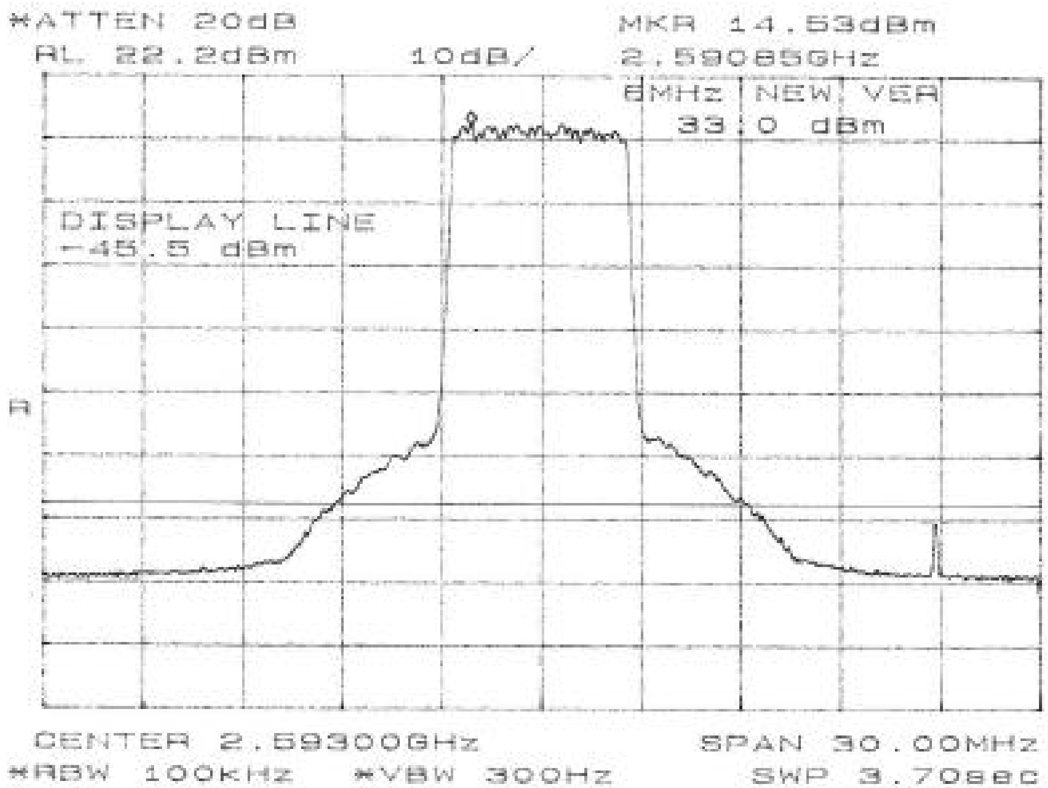
The display line of the HP84125C was set to 60.4 dBuV/m, the level calculated as being the field produced by a -44 dBm signal into a dummy load/transmitter case located 1 meter away. The corrected data on the spectrum analyzer plot is below the 60.4 dBuV/m limit line for emissions up to 10fo.

Hopefully the above explanations and the data graphs below are sufficient for you to issue a grant of certification for this product. If you still have questions, please don't hesistate to contact me by email, telephone, or fax.

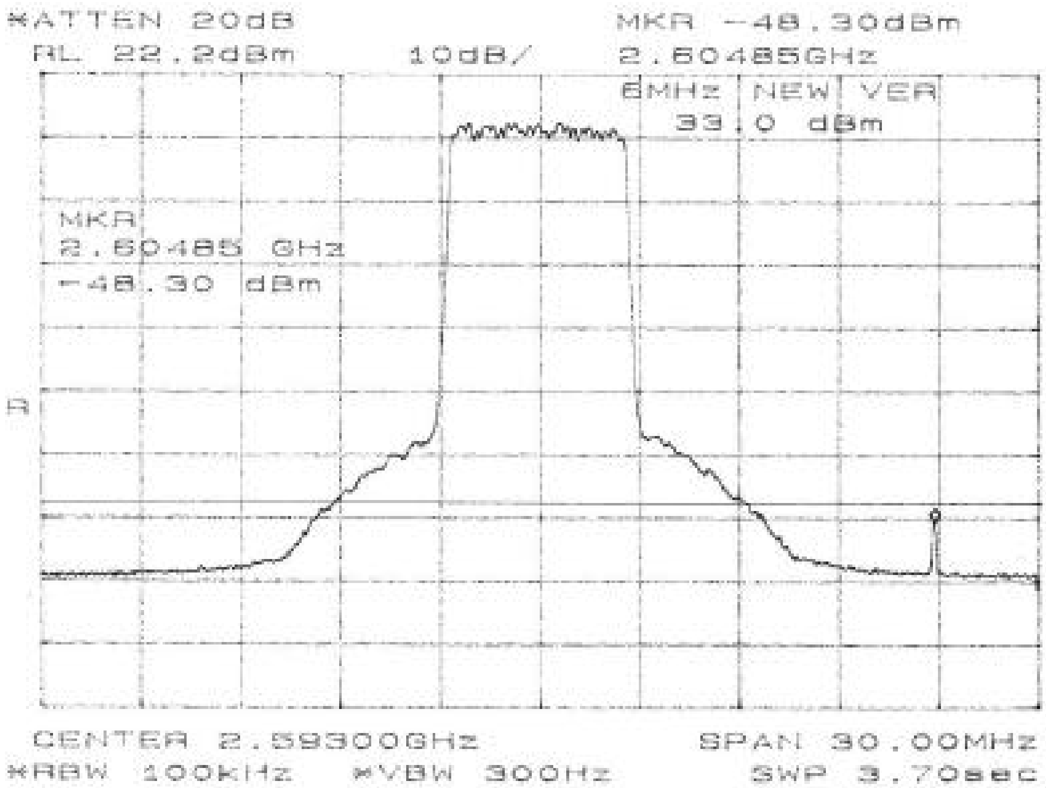
Sincerely,

Tom Cokenias
EMC Consultant/Agent for Cisco Systems Inc.

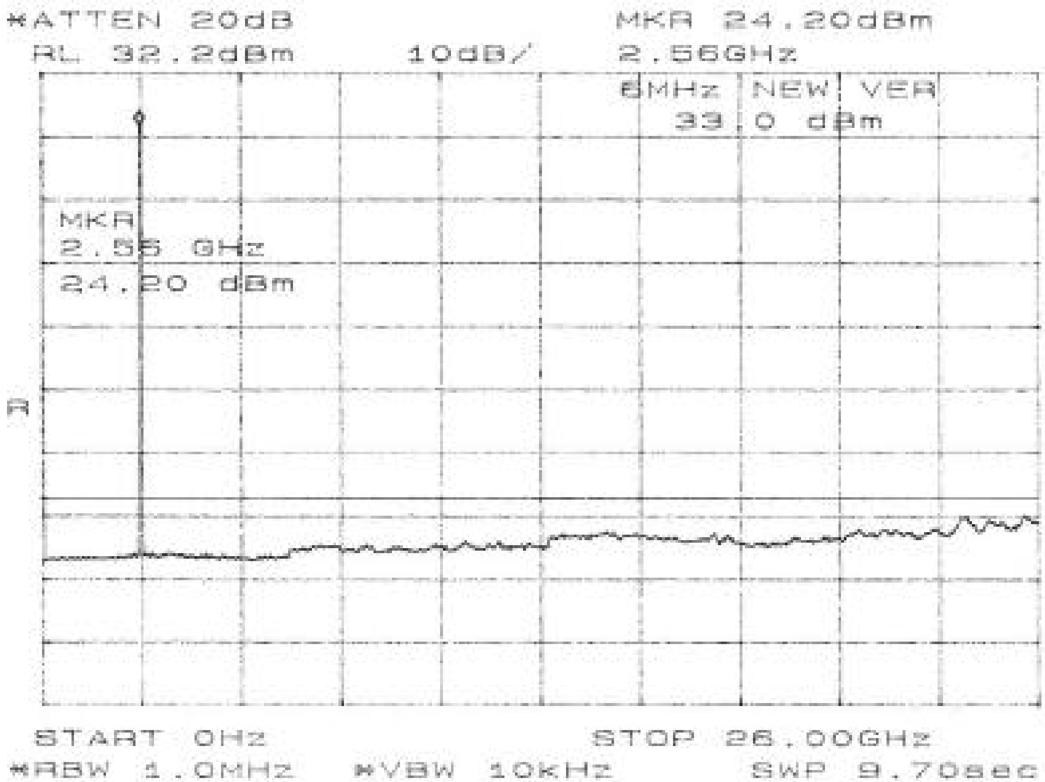
TX Output, 6 MHz channel, w/ Fujitsu RF Power Transistors



6 MHz TX output, out of band spurious: -48 dBm - 33 dBm output = -81 dBc



Spurious and Harmonic output, 6 MHz channel (worst case)



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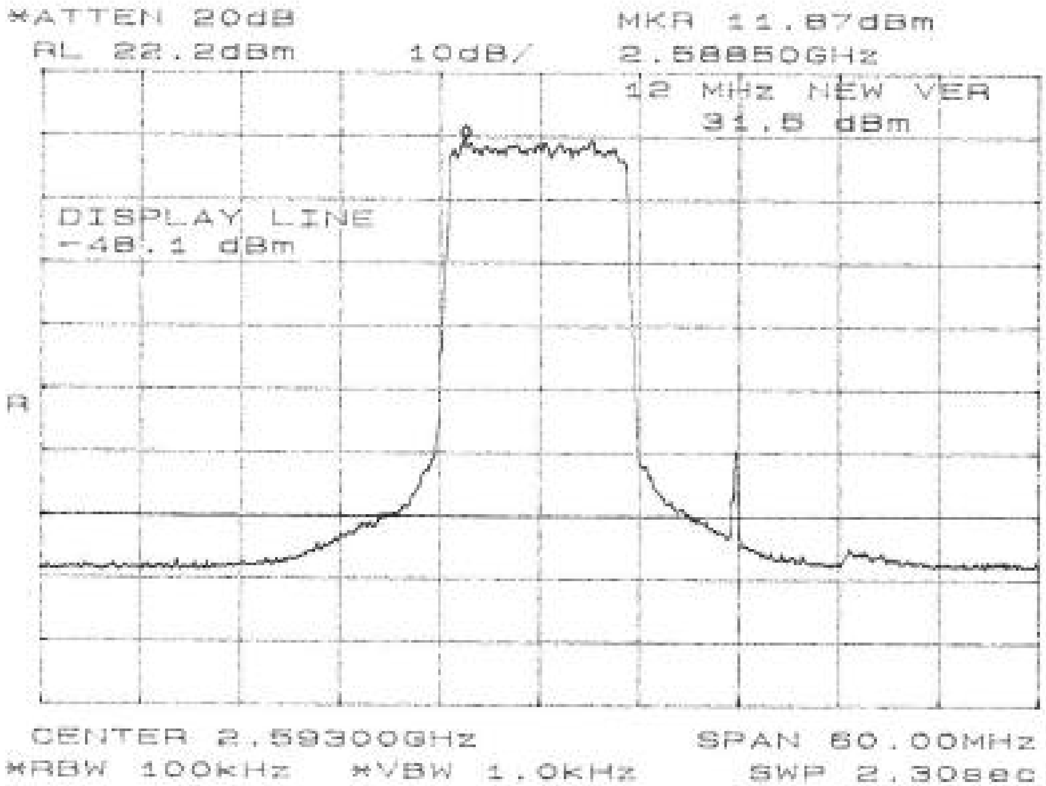
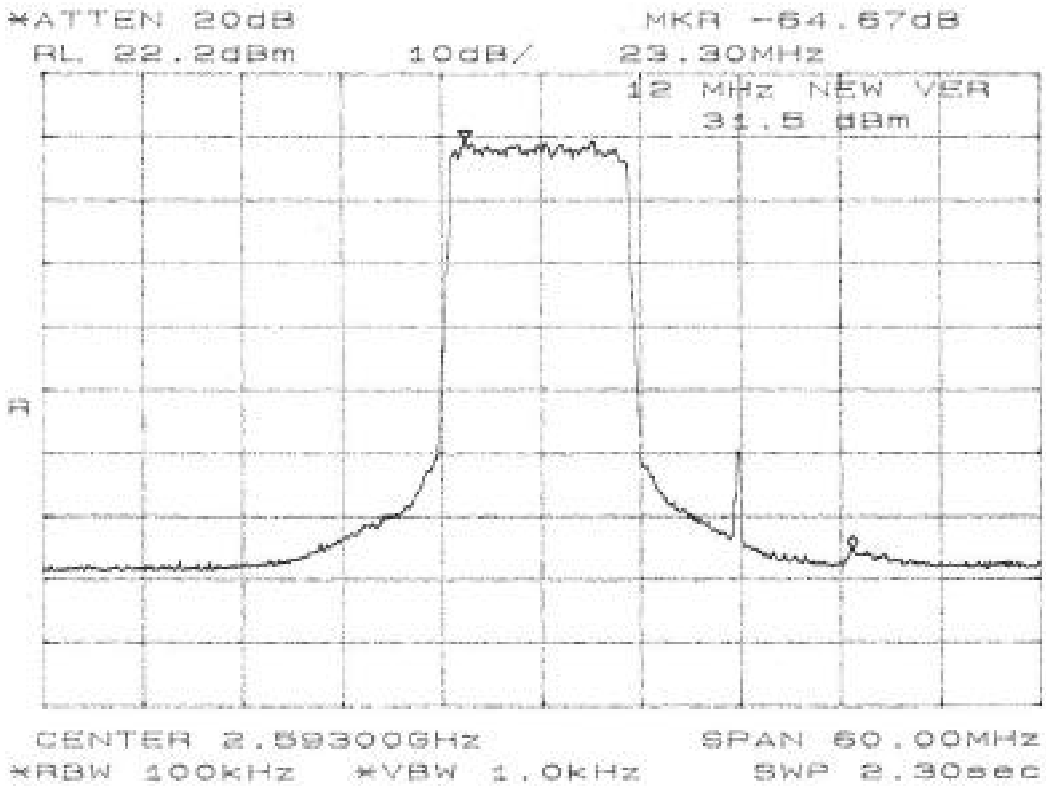
12 MHz Channel Output



12 MHz channel output, LO image



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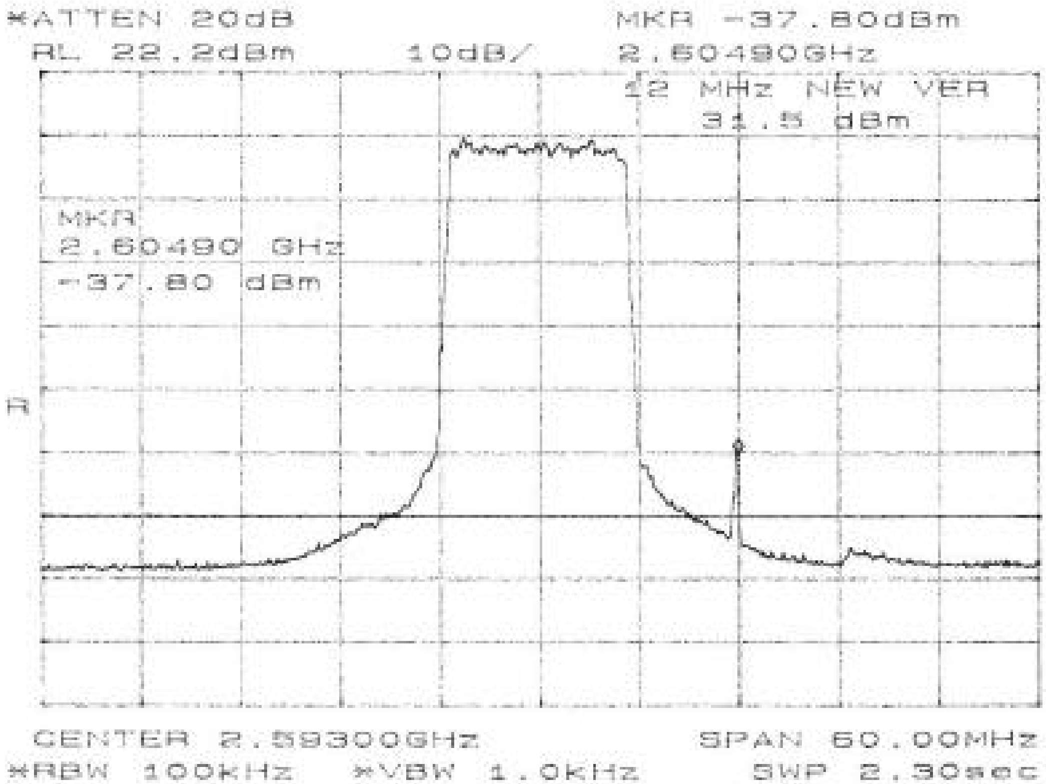
12 MHz TX channel, spurious output: -37.8 dBm - 31.5 dBm = -69.3 dBc



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