

October 8, 2001

Federal Communications Commission
Authorization and Evaluation Division
7435 Oakland Mills Road
Columbia, MD 21046

Attention: Applications Examiner

Applicant: Nokia Inc. dba Nokia Networks
6000 Connection Drive, Irving , Texas 75039

Equipment: Nokia UltraSite EDGE 800 MHz Base Station Transceiver Module
FCC ID: L7KTSTB-01

Specification: for a 47 CFR 22 Licensed Certification

Dear Examiner:

The following application for Grant of Equipment Authorization is presented on behalf of Nokia Inc. dba Nokia Networks for the Licensed Certification of their Model: UltraSite EDGE 800MHz Base Station (BTS) Transceiver Module.

Enclosed, please find a complete data and documentation package demonstrating that this device complies with the technical requirements of 47 CFR 22, for a Base Station (BTS) Transceiver Module.

If you have any questions, please contact the undersigned, who is authorized to act as Agent.

Sincerely,



Chris Harvey, Director
EMC Laboratory
MET Laboratories, Inc.

MET Laboratories, Inc. *Safety Certification - EMI - Telecom Environmental Simulation*

914 WEST PATAPSCO AVENUE ! BALTIMORE, MARYLAND 21230-3432 ! PHONE (410) 354-3300 ! FAX (410) 354-3313

ENGINEERING TEST REPORT

in support of the
Application for Grant of Equipment Authorization

EQUIPMENT: Nokia UltraSite EDGE 800 MHz Base Station

FCC ID: L7KTSTB-01

Specification: 47 CFR 22

On Behalf of the Applicant: Nokia Inc. dba Nokia Networks
6000 Connection Drive
Irving, TX 75039

Manufacturer: Nokia Inc. dba Nokia Networks
6000 Connection Drive
Irving, TX 75039

Manufacturer's Representative Mr. Steve Mitchell

Test Date(s): 14-20 Aug. 2001

ENGINEERING STATEMENT

I ATTEST: the measurements shown in this report were made in accordance with the procedures indicated, and that the emissions from this equipment were found to be within the limits applicable. I assume full responsibility for the accuracy and completeness of these measurements. On the basis of the measurements made, the equipment tested is capable of operation in accordance with the requirements of Part 22 of the FCC Rules under normal use and maintenance.



Liming Xu
EMC Engineer, MET Laboratories

Summary of Test Results

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 22 of 47 CFR. All tests were conducted using measurement procedure ANSI C63.4-1992.

Type of Submission/Rule Part:	Original Filing/Part 22
EUT:	Nokia Networks UltraSite EDGE BTS Transceiver Module
FCC ID:	L7KTSTB-01
Type of Emissions:	360KGXW (GMSK) 357KGXW (8PSK)
RF Power output:	GMSK : 40.0 Watts full power (some channels are documented as being reduced power in the Block Edge Power Section 6.5 of this report) 8PSK : 8PSK : 46.0Watts full power (some channels not documented as being reduced power in the Block Edge Power Section 6.5 of this report)
Frequency Range (MHz):	824-849 receive and 869-894 Transmit (869.2-893.8)
Frequency Stability:	+/- 20Hz

Summary of Test Data

Name of Test	FCC Rule Part/Section	Results
Radiated Spurious Emissions	2.1053 2.1057, 22.901(d) and 22.917(e).	Complies
Occupied Bandwidth	2.1049, 22.901(d) ,22.917(e).	Complies
RF Power Output	2.1046, 22.913(a).	Complies
Spurious Emissions at Antenna Terminals	2.1051,22.901(d) and 22.917(e).	Complies
Out of band emissions	2.1051, 22.901(d) ,22.917(e).	Complies
Frequency Stability over temperature variations	2.1055(a)(1)	Complies
Frequency Stability over supply Voltage variations	2.1055(d)(1)	Complies
Modulation Characteristics	2.1047(a)	Complies

1.0 INTRODUCTION

The following data is presented on behalf of the Applicant, Nokia Inc. dba Nokia Networks, as verification of the compliance of the Nokia Base Station (BTS) Transceiver Module, UltraSite EDGE 800 MHz to the requirements of 47 CFR 22.

2.0 TEST SITE

All testing was conducted at MET Laboratories, Inc., 914 West Patapsco Avenue, Baltimore, Maryland 21230-3493. Radiated emissions measurements were performed in a three-meter semi-anechoic chamber. A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

3.0 TEST EQUIPMENT USED

Manufacturer	Equipment	Calibration Due Date @ time of testing	Cal. Interval
Hewlett Packard	8563A Spectrum Analyzer	9/14/02	annual
EMCO	Biconical Antenna 3104	3/21/02	annual
EMCO	EMCO Log Periodic Antenna	11/01/01	annual
EMCO	Double Ridge Guided Horn	2/27/02	annual
Hewlett Packard	8594EM Analyzer	1/8/02	annual

4.0 EQUIPMENT UNDER TEST CONFIGURATION

The Base Station (BTS) Transceiver Module was configured with AC/DC power supply modules and an external PC to program the EUT to output a 8-PSK/GMSK Modulation type RF signal. The EUT with host external computer was configured for maximum signal gain and bandwidth. The EUT was operated in a manner representative of the typical usage of the equipment. During all testing, system components were manipulated within the confines of typical usage to maximize each emission.

5.0 TEST TYPE(S)

- 5.1 Radiated Emissions: 47 CFR 2.1053, 2.1057, 22.901(d) and 22.917(e).
- 5.2 Occupied Bandwidth: 47 CFR 2.1049, 22.901(d) and 22.917(e).
- 5.3 RF Power Output: 47 CFR 2.1046, 22.913(a).
- 5.4 Spurious Emission at Antenna Terminals: 47 CFR 2.1051, 22.901(d) and 22.917(e).
- 5.5 Out of band emissions: 22.901(d) and 22.917(e).
- 5.6 Frequency Stability over temperature variations: 47 CFR 2.1055(a)(1)
- 5.7 Frequency Stability over variations in supply voltage: 47 CFR 2.1055(d)(1)
- 5.8 Modulation Characteristics: 47 CFR 2.1047(a)

6.0 TEST RESULTS**6.1 TEST TYPE:** Radiated Emissions**6.1.1 TECHNICAL SPECIFICATION:** 2.1053, 2.1057, 22.901(d) and 22.917(e).**6.1.2 TEST DATE(S):** 17 Aug. 2001**6.1.3 MEASUREMENT PROCEDURES:**

As required by §2.1053, *field strength of spurious radiation measurements* were made in accordance with the general procedures of ANSI C63.4-1992 "Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz". Preliminary radiated emission measurements were performed inside a shielded chamber with all digital signal generators on and terminated. The frequency list from the preliminary measurements was used as a guide for making final measurements on a 3 meter semi-anechoic chamber (equivalent to Open Area Test Site). The unit was scanned over the frequency range of the lowest system oscillator value to 9 GHz. The Radiated Spurious Emissions *Limit* is obtained by the following:

Based on an output power (as measured at the output of the Amplifier) of 45 watts:

$$P_o = 45 \text{ W}$$

the radiated power level of all spurious emissions must be attenuated by at least $43 + 10\log(P_o)$ below P_o , yielding:

$$P_o \& [43 + 10\text{Log}(45)] \text{ ' } \& 13\text{dBm}$$

6.1.4 RESULTS:

All of the measurable radiated emissions are related to the digital device portion of the EUT, and thus are compared to the 47CFR 15 Class B field strength limit. Mathematical calculations indicate that these field strengths yield radiated power levels greater than 30 dB below the -13 dBm limit for spurious emissions from the transmitter portion of the EUT calculated above. There were no observable radiated emissions from the transmitter portion of the EUT.

The Spurious Radiated Emissions were measured from 1GHz to 9GHz for the Transceiver Module installed into configurations 1 through 6. There were no detectable spurious emissions in that frequency range. The following is a summary of the differences of each of the configurations:

Configuration 1: Outdoor Enclosure IBBU with AC power
 Configuration 2: Indoor Enclosure IBBU AC power
 Configuration 3: Indoor Full Enclosure, 24VDC power
 Configuration 5: Indoor Midi Enclosure, -48VDC power
 Configuration 6: Outdoor Midi Enclosure, 24VDC power

note: there was no configuration 4 tested in this test program.

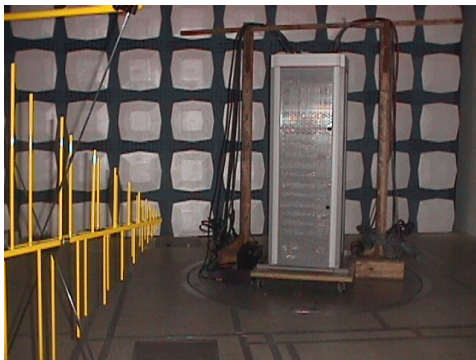
Photograph of Radiated Emissions
Test Configuration



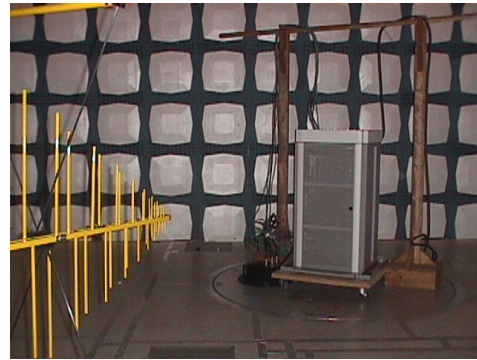
Config. 1



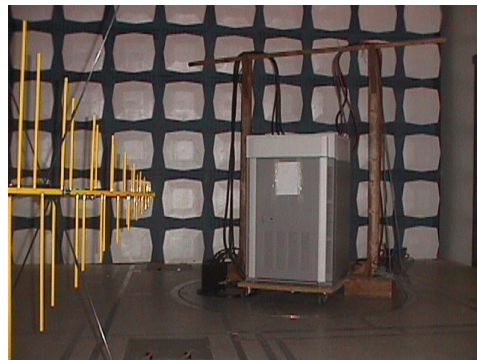
Config. 2



Config. 3



Config. 5



Config. 6

6.2 TEST TYPE: Occupied Bandwidth

6.2.1 TECHNICAL SPECIFICATION: 47CFR2.1049, 22.901(d) and 22.917(e).

6.2.2 TEST DATE(S): 14 Aug. 2001

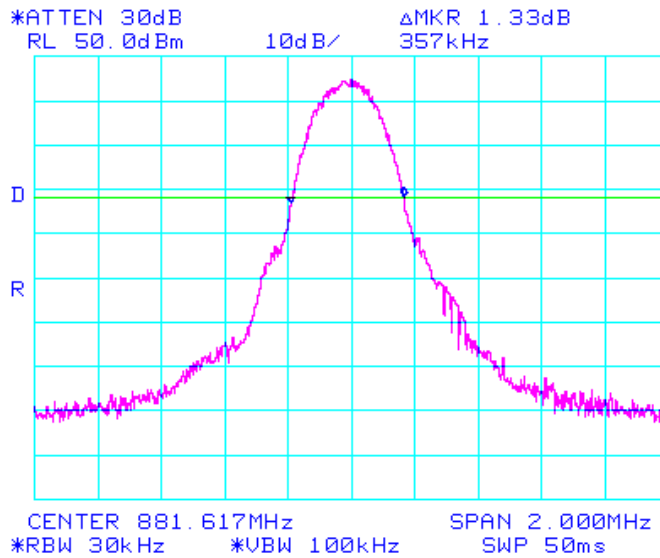
6.2.3 MEASUREMENT PROCEDURES:

As required by §2.1049 of CFR 47, *occupied bandwidth measurements* were made on the Base Transmitter Station (BTS). The EUT was configured to transmit a GMSK or 8-PSK modulated carrier signal. Using a bandwidth of 30KHz, we determined the occupied bandwidth of the emission at the center of the selectable channel range.

6.2.4 RESULTS:

Equipment complies with Section 2.1049. Plots of the occupied bandwidth, as measured at the RF output port follows:

Occupied B/W 8PSK; PL16, ARFCN 190, Met11107



6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47CFR2.1046 and 22.913(a).

6.3.2 TEST DATE(S): 14-15 Aug. 2001

6.3.3 MEASUREMENT PROCEDURES:

As required by §2.1046 of CFR 47, *RF power output measurements* were made at the RF output terminals using an attenuator and spectrum analyzer. This test was performed with carrier modulated by a GMSK or 8-PSK modulation signal.

Plots of the RF output Power level of the Digitally modulated carrier, as measured at the RF output are included on the following page .

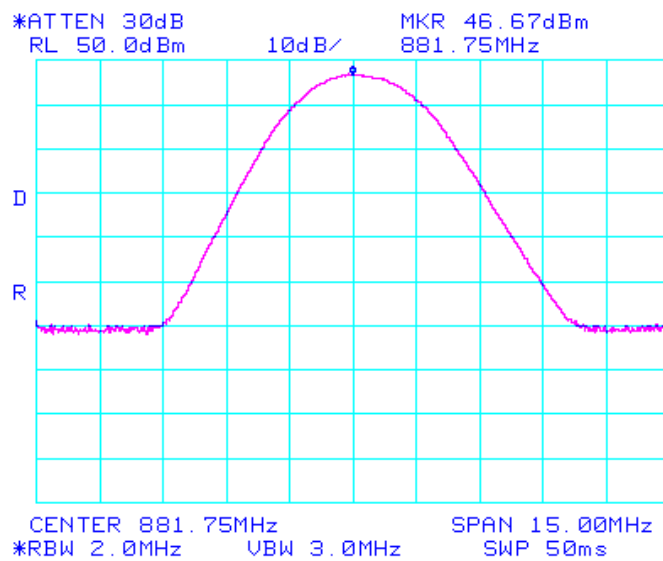
6.3.4 RESULTS:

Equipment complies with 47CFR 2.1046 and 22.913(a). The Base Transceiver Station (BTS) does not exceed 100 W (or 50 dBm) at the carrier frequency.

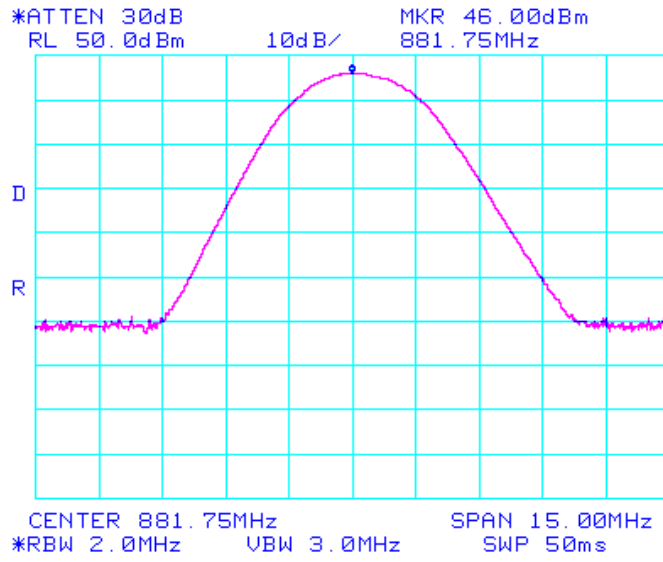
The following pages show measurements of RF Power output which is summarized below:

- GMSK : 40.0 Watts full power at all channels not documented as being reduced power in the Block Edge Power Section 6.5 of this report
- 8PSK : 46.0Watts full power at all channels not documented as being reduced power in the Block Edge Power Section 6.5 of this report

RF power output 8PSK PL-16 ARFCH 190 Met 11107



RF power output GMSK PL0 ARFCN 190 Met11107



6.4 TEST TYPE: Spurious Emissions at Antenna Terminals**6.4.1 TECHNICAL SPECIFICATION:** 2.1051, 22.901(d) and 22.917(e).**6.4.2 TEST DATE(S):** 14-15 Aug. 2001**6.4.3 MEASUREMENT PROCEDURES:**

As required by §2.1051 of CFR 47, *spurious emissions at antenna terminal measurements* were made at the RF output terminals using a 50 S attenuator and spectrum analyzer set for a 100 kHz bandwidth. This test was performed with Digitally modulated carrier signals. The EUT was adjusted for continuous transmission on frequencies across the operating band. The frequency spectrum was investigated from 9.0 KHz to 9.0 GHz.

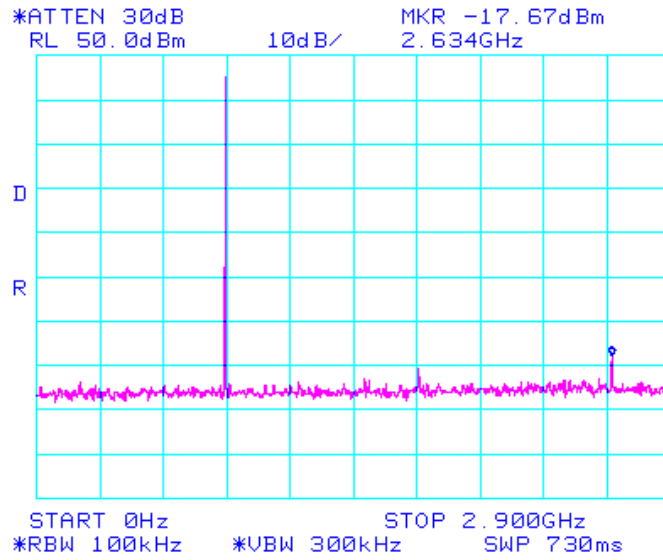
6.4.4 RESULTS:

The following plots are included to illustrate compliance with the requirements of 47 CFR Part 22.901(d) and 22.917(e).

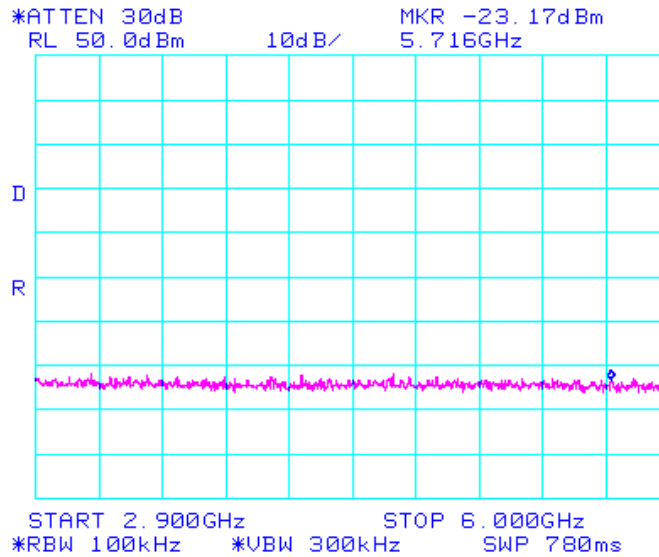
Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
9 kHz - 2.9 GHz	2.63GHz	-17.7	-13.1
2.9 GHz - 6.0 GHz	none	none	-13.1
6.0 GHz - 9.0 GHz	none	none	-13.1

Equipment complies with Section 2.1051, 22.901(d) and 22.917(e). Note, the signal at approximately 880 MHz is the carrier signal and not a spurious emission. Spurious emissions for both GMSK and 8PSK modulation types were measured. Data contained in this report represents the worst case, which was for GMSK modulation.

Conducted spur emissions at antenna port; PLO, ARFCN 190 Met11107



Conducted spur emissions at antenna port; PLO, ARFCN 190 Met11107



6.5 TEST TYPE: Out of band emissions.

6.5.1 TECHNICAL SPECIFICATION: 2.1051, 22.901(d) and 22.917(e).

6.5.2 TEST DATE(S): 15 Aug. 2001

6.5.3 MEASUREMENT PROCEDURES:

As recommended in FCC Part 22, Out of band emissions were measured using a 30 KHz RBW. The unit was exercised using signal types required by §2.1049.

6.5.4 Results:

Modulation products outside of this band are attenuated at least $43 + 10 \text{ Log (P)}$ below the level of the modulated carrier. A Plot of the spurious emissions at the transmit frequency, as measured at the antenna port, appears on the following page.

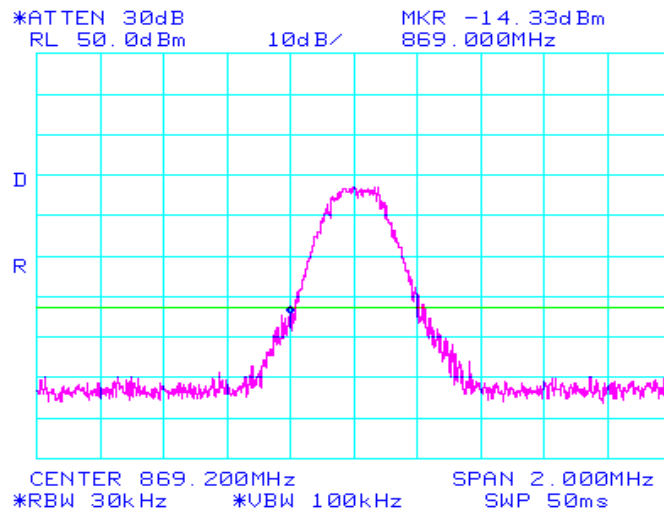
Plots of the spurious emissions as measured at the extremes of each frequency block appear on the following pages.

Channel	Channel Frequency (MHz)	Channel Block	Block Edge (MHz)	Maximum Power Level GMSK Modulation	Maximum Power Level 8PSK Modulation
128	869.2	A'' + A	869	PL-14	PL-28
181	879.8	A'' + A	880	Blocked	PL-28
182	880.0	Block Edge	880	Blocked	Blocked
183	880.2	B	880	PL-14	PL-28
231	889.8	B	890	Blocked	PL-29
232	890.0	Block Edge	890	Blocked	Blocked
233	890.2	A'	890	PL-14	PL-28
238	891.2	A'	891.5	PL-8	PL-23
239	891.4	Block Edge	891.5	Blocked	Blocked
240	891.6	Block Edge	891.5	Blocked	Blocked
241	891.8	B' + B''	891.5	PL-6	PL-20
251	893.8	B' + B''	894	Blocked	PL-30

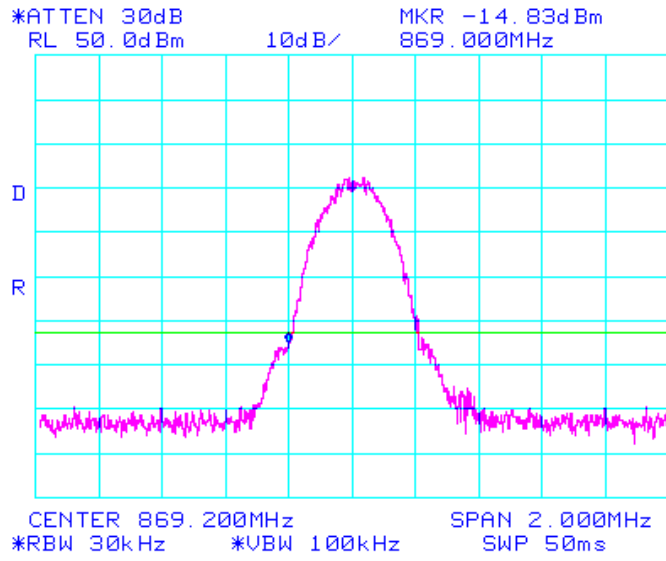
PL = Power Level

note, all channels not listed above can transmit at full power

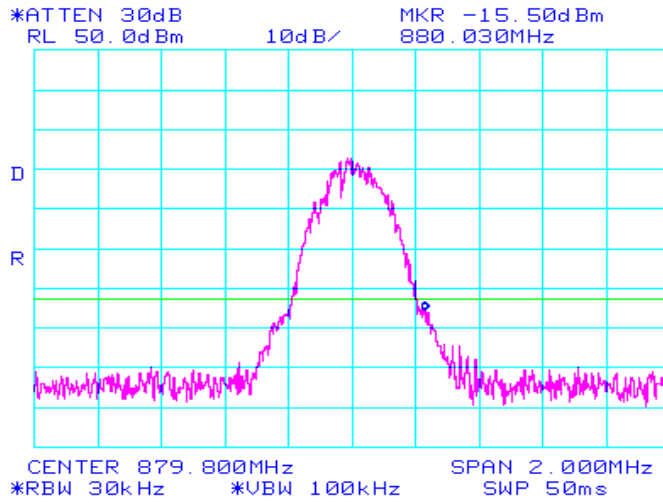
CH 128 GMSK PL-14 Met11107



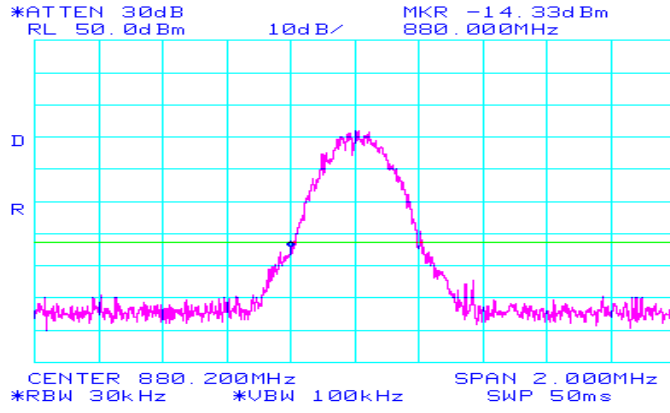
CH 128 8PSK PL-28 Met11107



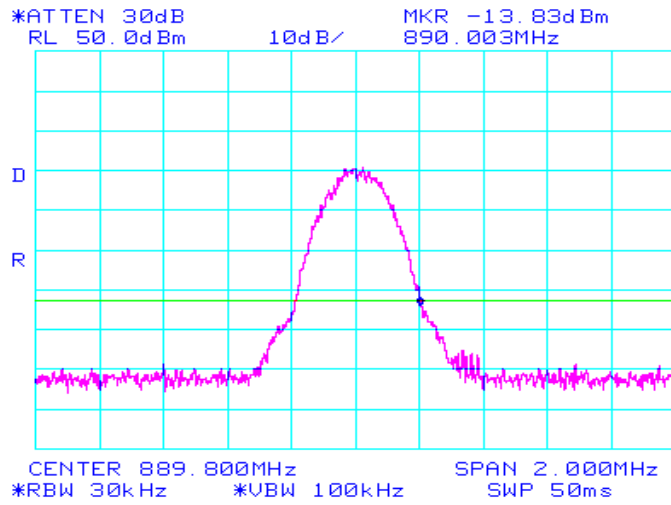
CH 181 8PSK PL-28 Met11107



CH 183 8PSK PL-28 Met11107



CH 231 8PSK PL-29 Met11107



6.6 TEST TYPE: Frequency Stability over Temperature Variations**6.6.1 TECHNICAL SPECIFICATION:** 2.1055(a)(1)**6.6.2 TEST DATE(S):** 20 Aug. 2001**6.6.3 MEASUREMENT PROCEDURES:**

As required by §2.1055(a)(1) of CFR 47, *frequency tolerance measurements* were made over the temperature range of -30EC to +50EC. The frequency measurements were made using direct input to a spectrum analyzer. Climatic control was accomplished using an environmental simulation chamber. The temperature was first lowered to -30EC and then raised hourly in 10E increments. The unit remained in the chamber during temperature transitions and during the measurement process.

6.6.5 Results:

Frequency tolerance of carrier signal: +/- 0.005% for a temperature variation from - 30EC to + 50EC at normal supply voltage.

CARRIER FREQUENCY DEVIATIONS DUE TO TEMPERATURE INSTABILITY

Temperature (EC)	Carrier Frequency (MHz)	Frequency Deviation (Hz)	Deviation Limit (Hz)
-30	881.51581	-10	± 98
-20	881.51582	0	± 98
-10	881.51583	10	± 98
0	881.51583	10	± 98
+10	881.51582	0	± 98
+20	881.51582	0	± 98
+30	881.51582	0	± 98
+40	881.51582	0	± 98
+50	881.51581	- 10	± 98

The unit meets the requirements of 2.1055 (a)(1)

6.7 TEST TYPE: Frequency Stability over Voltage Variations**6.7.1 TECHNICAL SPECIFICATION:** 2.1055(d)(1)**6.7.2 TEST DATE(S):** 20 Aug 2001**6.7.3 MEASUREMENT PROCEDURES:**

As required by §2.1055(d)(1) of CFR 47, *frequency tolerance measurements* were made over changes in the supply voltage to the EUT from 85% to 115% of the nominal supply voltage using a variac to vary the AC/DC supply. The frequency measurements were made using direct input to a spectrum analyzer.

6.7.5 Results:

Frequency tolerance of carrier signal: $\pm 0.005\%$ for a variation in primary voltage from 85% to 115% of the **rated supply**.

Percentage of Rated Supply	DC Voltage 24V	Carrier Frequency (MHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	20.4	881.51577	0	± 98
100 %	24	881.51577	0	± 98
115 %	27.6	881.51577	0	± 98

The unit meets the requirements of 2.1055 (d)(1)

Percentage of Rated Supply	DC Voltage 48V	Carrier Frequency (MHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	40.8	881.51578	0	± 98
100 %	48	881.51578	0	± 98
115 %	55.2	881.51578	0	± 98

Percentage of Rated Supply	AC Voltage (VAC @ 60 Hz)	Carrier Frequency (GHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	178.5	881.51578	0	± 98
100 %	210	881.51578	0	± 98
115 %	241.5	881.51578	0	± 98

The unit meets the requirements of 2.1055 (d)(1)

