March 27, 2002

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 1900 MHz Base Station Transceiver Module
FCC ID: L7KTSPR-01

Specification: for a 47 CFR 24 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 1900MHz 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 24, 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 1900 MHz Base Station
FCC ID:	L7KTSPR-01
Specification:	47 CFR 24
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):	March 25, 26, 2002

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 24 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 24, of 47 CFR. All tests were conducted using measurement procedure ANSI C63.4-1992.

Type of Submission/Rule Part:	Original Filing/Part 24
EUT:	Nokia Networks Ultrasite EDGE BTS Transceiver Module
FCC ID:	L7KTSPR-01
Type of Emissions:	327KGXW (GMSK) 323KGXW (8PSK)
RF Power output:	GMSK :2.0 Watts at lowest channel of PCS band 1.3 Watts at highest channel of PCS band 76.4 Watts at all other chanels 8PSK 5.8 Watts at lowest channel of PCS band 3.7 Watts at highest channel of PCS band 80.0 Watts at all other chanels
Frequency Range (MHz):	1850-1910 receive and 1930-1990 Transmit (1930.2-1989.8)
Frequency Stability:	+/- 20 Hz

Summary of Test Data

Name of Test	FCC Rule Part/Section	Results
Radiated Spurious Emissions	2.1053; 24.238(a)	Complies
Occupied Bandwidth	2.1049	Complies
RF Power Output	2.1046; 24.232(a),(c)	Complies
Spurious Emissions at Antenna Terminals	2.1051; 24.238(a)	Complies
Spurious Emissions at Antenna Terminals Frequency Block Edges	2.1051; 24.238(b)	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 1900 MHz to the requirements of 47 CFR 24.

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 on a three-meter semi-anechoic chamber (Equivalent to an Open Area Test Site, OATS). A complete site description is on file with the FCC Laboratory Division as 31040/SIT/MET.

3.0 TEST EQUIPMENT USED

Test Equipment	Manufacturer	Model #	Met Asset #	Cal Date	Cal Due
Receiver	HP	8546A	1T4302	08/11/01	08/11/02
Antenna	EMCO	BIC	1T4303	3/27/02	3/27/03
Antenna	EMCO	LP	1T2342	11/27/01	11/27/02
Test Room	Met	CH#1	1T4300	08/17/01	08/17/02

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 PCS 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 CFR2.1053, , 24.238(a)
5.2 Occupied Bandwidth: 47 CFR2.1049
5.3 RF Power Output: 47 CFR 2.1046, 24.232(a), ©
5.4 Spurious Emission at Antenna Terminals: 47 CFR 2.1051, 24.238(a)
5.5 Spurious Emission at Antenna Terminals at Frequency Block edges +/- 1 MHz, 47 CFR 2.1051, 24.238(b)
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; 24.238(a)

6.1.2 TEST DATE(S): 25 March 2002

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 in a 3 meter semi-anechoic chamber (equivalent to an Open Area Test Site). The unit was scanned over the frequency range of the lowest system oscillator value to 20 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 80 watts:

$$P_o = 80 \text{ W}$$

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

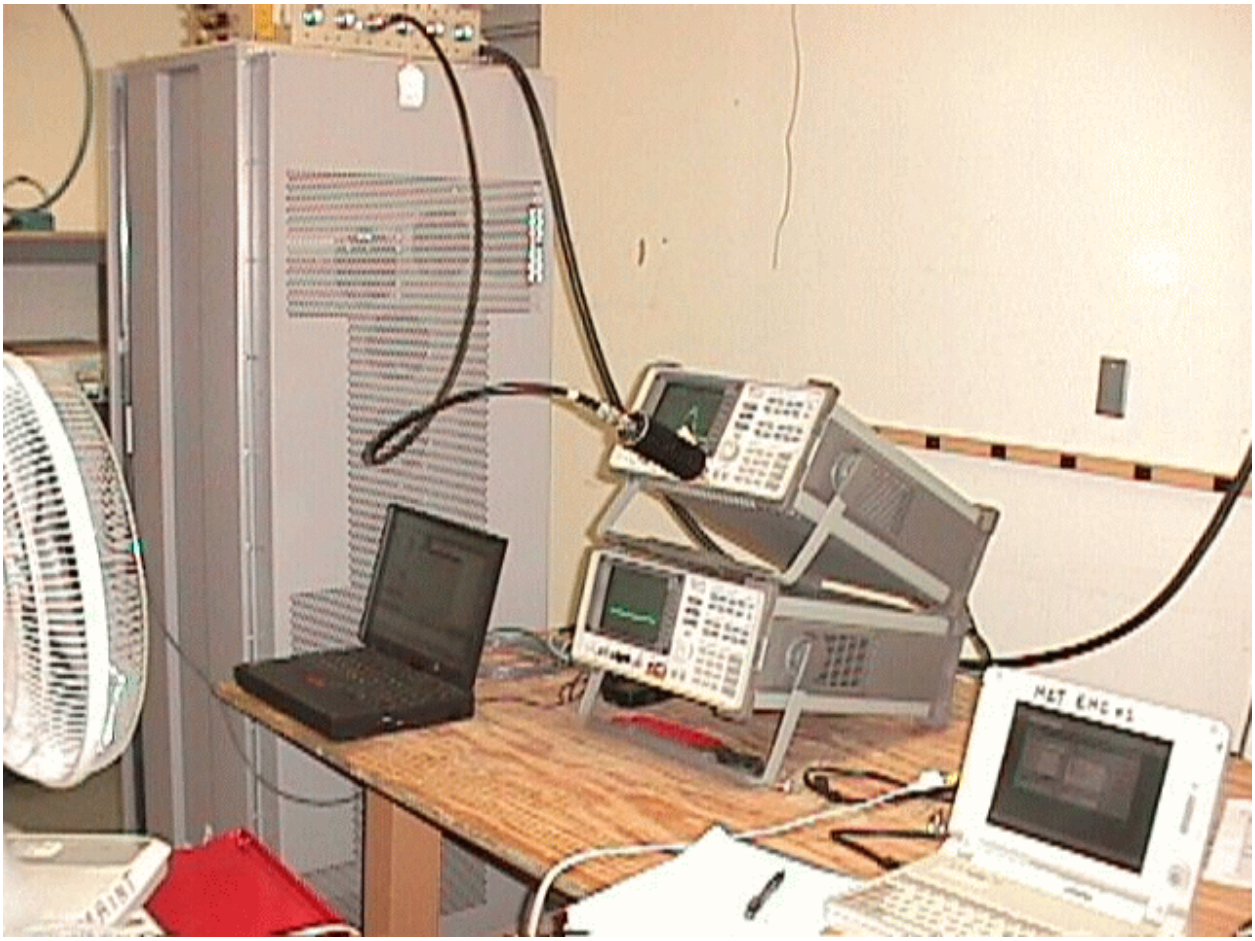
$$Po\&[43\ \%\ 10Log(80)]\ '\&13dBm$$

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 20GHz for the Transceiver Module. There were no detectable spurious emissions in that frequency range.

Photograph of Part.24
Test Configuration



6.2 TEST TYPE: Occupied Bandwidth

6.2.1 TECHNICAL SPECIFICATION: 47CFR2.1049

6.2.2 TEST DATE(S): 26 March, 2002

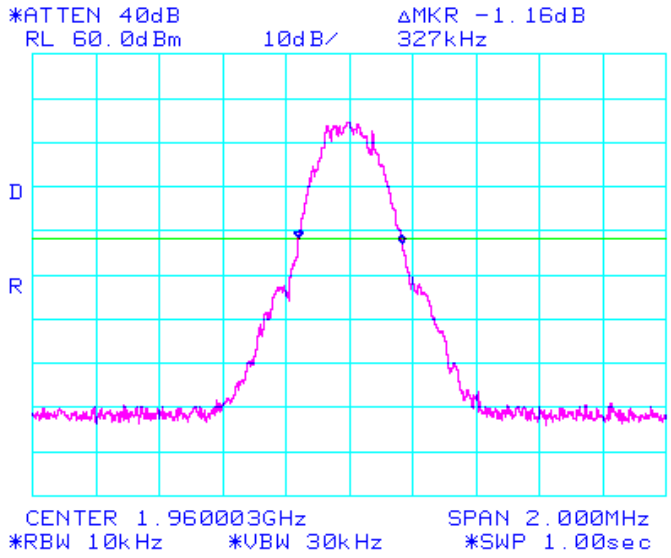
6.2.3 MEASUREMENT PROCEDURES:

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 PCS GMSK or 8-PSK modulated carrier signal. Using a bandwidth of 10KHz, we determined the occupied bandwidth of the emission at the center of the selectable channel range.

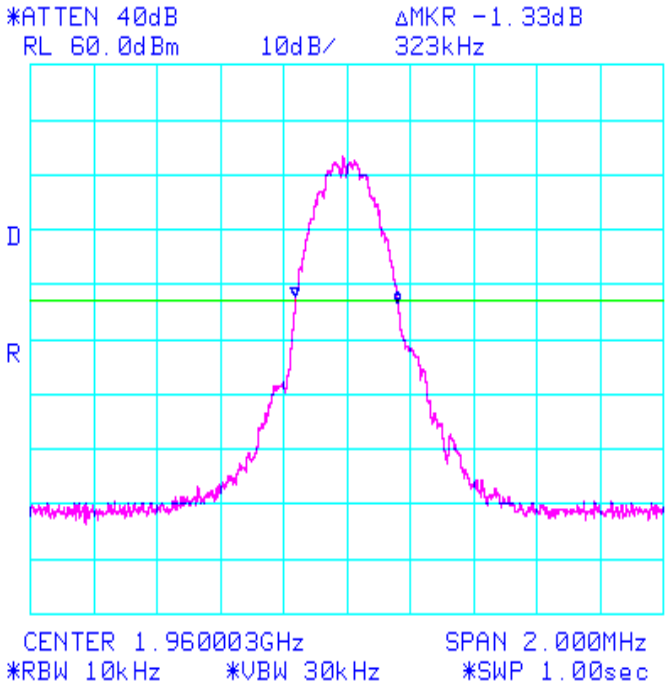
6.2.4 RESULTS:

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

Occupied B/W GMSK; PL-0 ARFCN 661 Met12084



Occupied B/W 8-PSK; PL 0 ARFCN 661 Met 12084



6.3 TEST TYPE: RF Power Output

6.3.1 TECHNICAL SPECIFICATION: 47CFR2.1046 and 24.232(a), (c)

6.3.2 TEST DATE(S): 25-26 March 2002

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 .

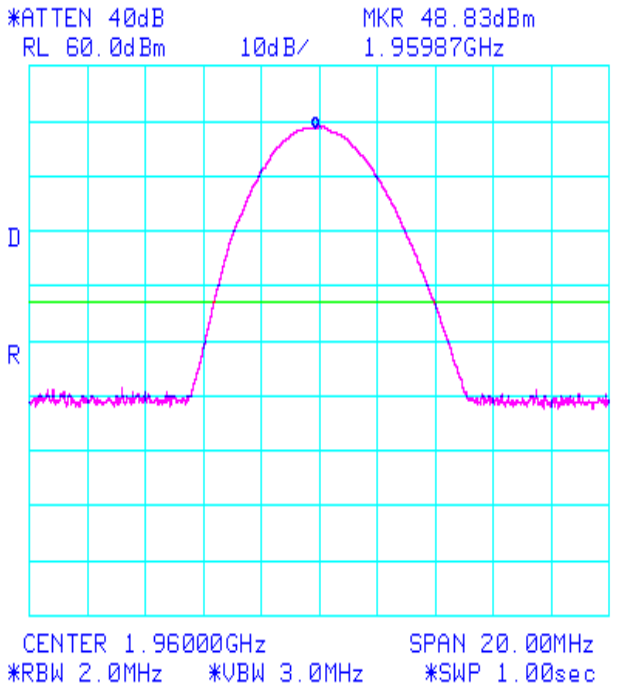
6.3.4 RESULTS:

Equipment complies with 47CFR 2.1046 and 24.232(a). The Base Transceiver Station (BTS) does not exceed 100 W (or 50 dBm) at the carrier frequency.

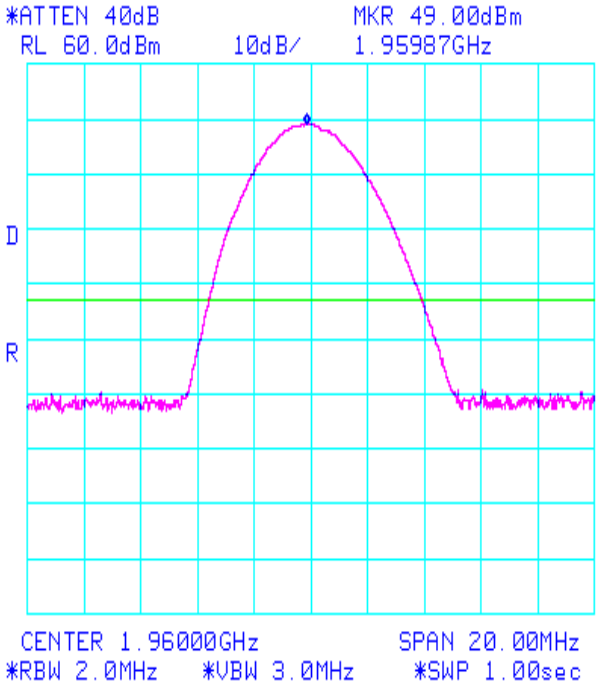
The following pages show measurements of RF Power output which is summarized below:

GMSK :	2.0 Watts at lowest channel of PCS band
	1.3 Watts at highest channel of PCS band
	76.4 Watts at all other channels
8PSK:	5.8 Watts at lowest channel of PCS band
	3.7 Watts at highest channel of PCS band
	80.0Watts at all other channels

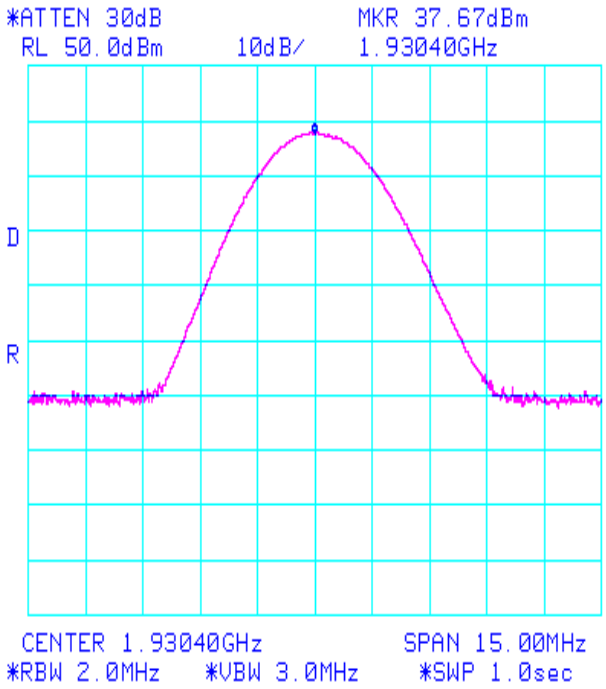
RF power output at antenna port GMSK; PL-0 ARFCN 661 Met12084



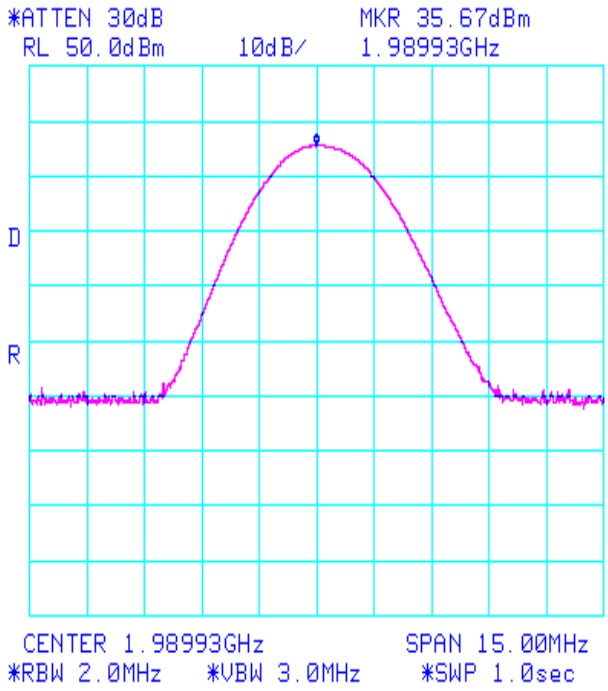
RF power output at antenna port 8-PSK; PL-0 ARFCN 661 Met12084



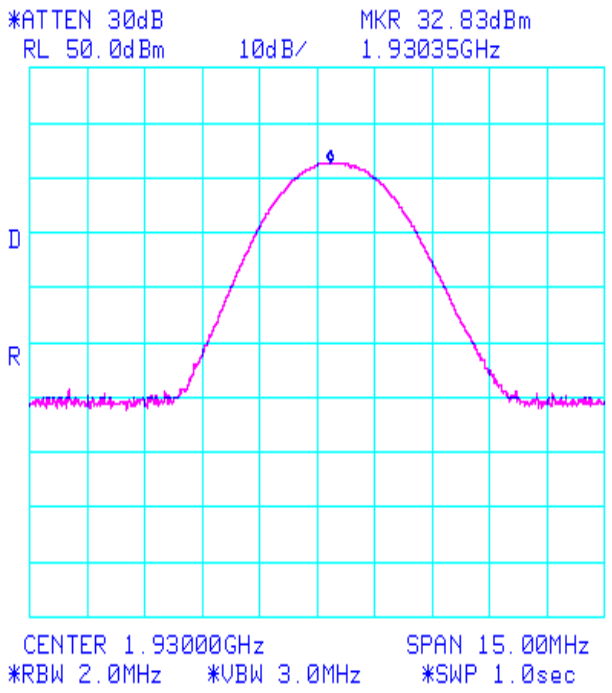
RF power at low side of block A 8-PSK PL-5 Met12084



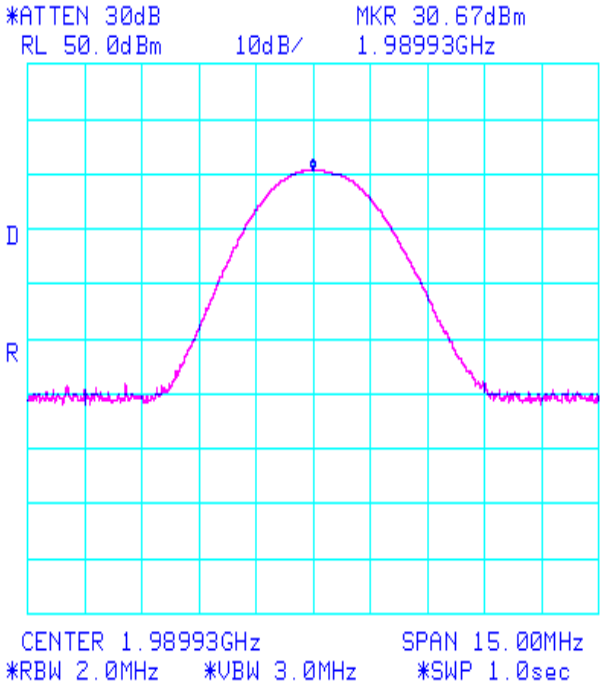
RF power at high side of block C 8-PSK PL-6 Met12084



RF power at low side of block A GMSK PL-7 Met12084



RF power output at high side of block C GMSK PL-8 Met12084



6.4 TEST TYPE: Spurious Emissions at Antenna Terminals

6.4.1 TECHNICAL SPECIFICATION: 2.1051; 24.238(a)

6.4.2 TEST DATE(S): March 26, 2002

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. The RBW of 100 kHz was used to investigate and search for spurious emissions; any spurs found with this technique are to be re-measured with the appropriate 1MHz RBW. There were no detectable spurious emissions for this EUT. This test was performed with Digitally modulated carrier signals, and the EUT was adjusted for continuous transmission on frequencies across the operating band. The frequency spectrum was investigated from 9.0 KHz to 20.0 GHz.

6.4.4 RESULTS:

The following plots are included to illustrate compliance with the requirements of 47 CFR Part 24.238(a):

Spurious emissions (GMSK)

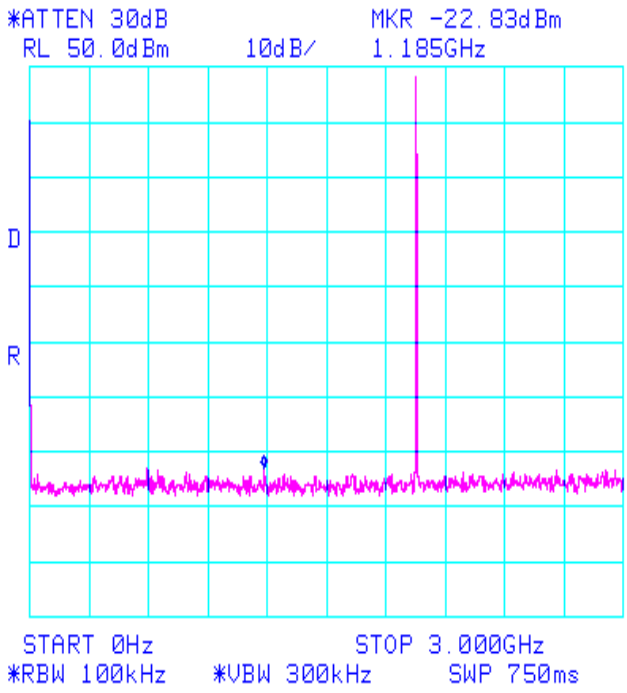
Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
9 kHz - 2.9 GHz	none	none	-13.1
2.9 GHz - 8.0 GHz	3.917GHz	-17.67	-13.1
8.0 GHz - 14.0 GHz	none	none	-13.1
14.0 GHz - 20.0 GHz	none	none	-13.1

Spurious emissions (8-PSK)

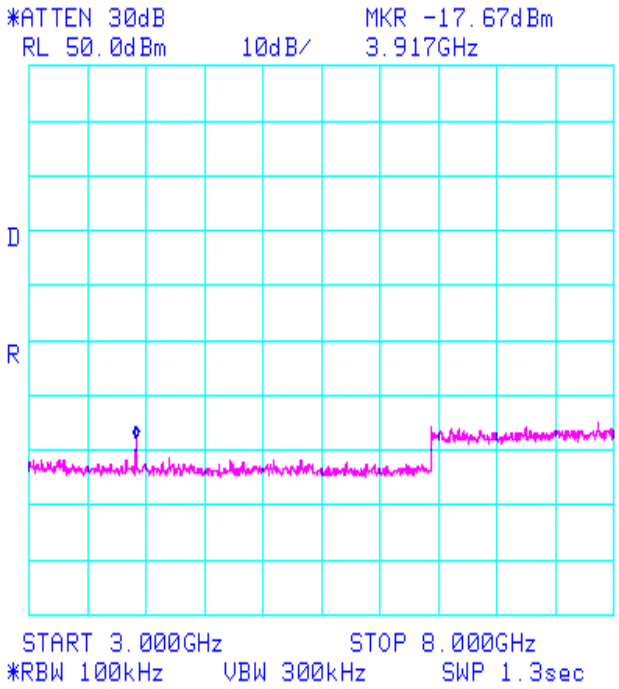
Frequency Range	Emission Frequency	Emission Level (dBm)	Limit (dBm)
9 kHz - 2.9 GHz	213MHz	-22.33	-13.1
2.9 GHz - 8.0 GHz	none	none	-13.1
8.0 GHz - 14.0 GHz	none	none	-13.1
14.0 GHz - 20.0 GHz	none	none	-13.1

Equipment complies with Section 2.1051and 24.238(a). Note, the signal at approximately 1960 MHz is the carrier signal and not a spurious emission. Spurious emissions for both GMSK and 8PSK modulation types were measured.

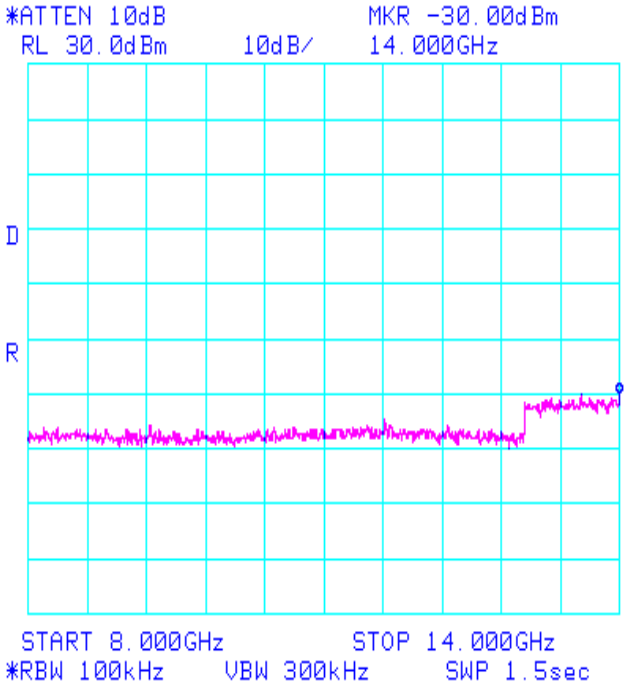
Conducted spur emissions at antenna port GMSK PL-0, ARFCN 661 Met 12084



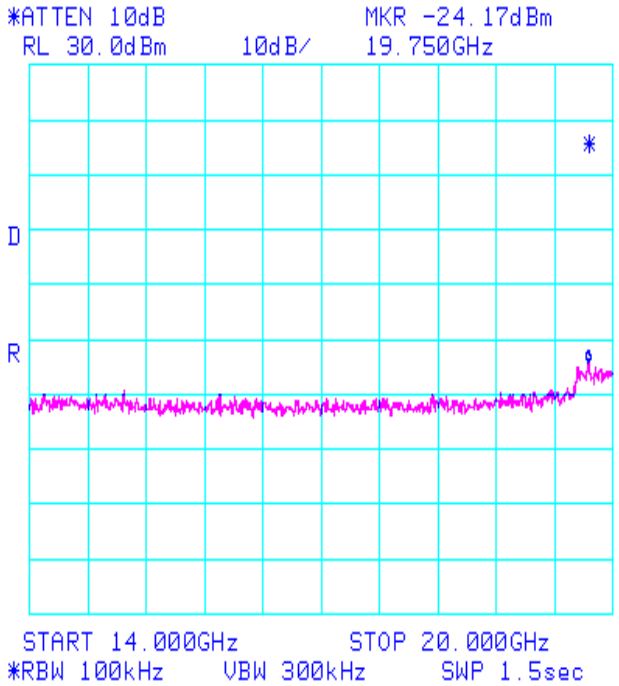
Conducted spur emissions at antenna port GMSK; PL-0, ARFCN 661 Met12084



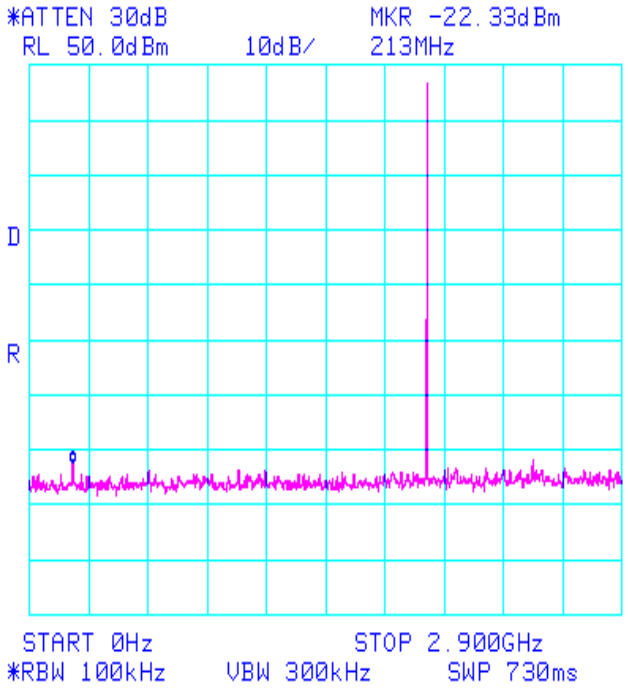
Conducted spur emissions at antenna port GMSK; PL-0, ARFCN 661 Met12084



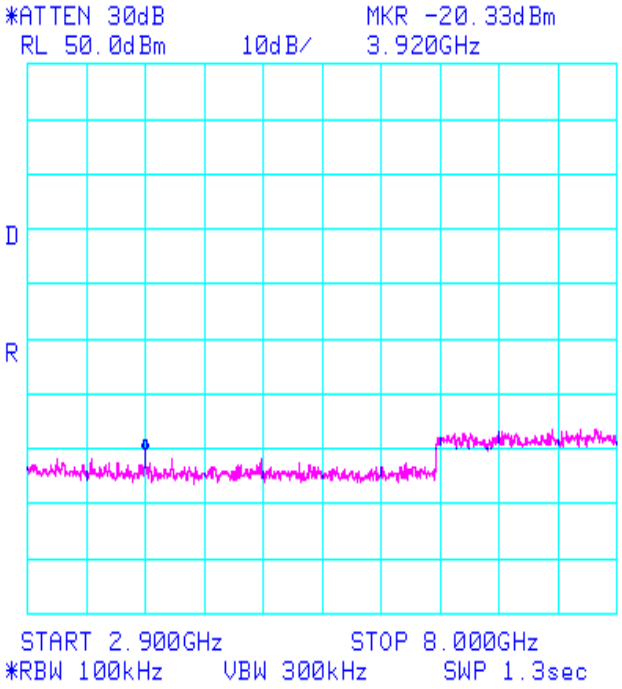
Conducted spur emissions at antenna port GMSK; PL-0, ARFCN 661 Met12084



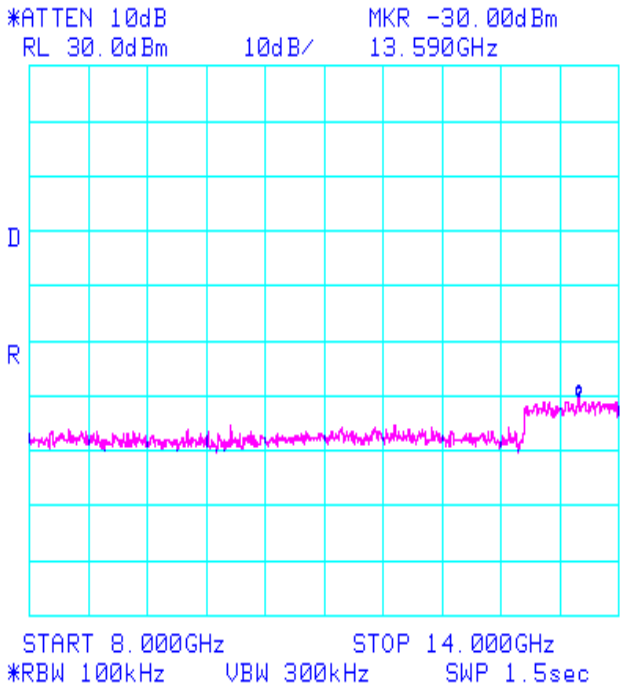
Conducted spur emissions at antenna port 8-PSK; PL-0, ARFCN 661 Met12084



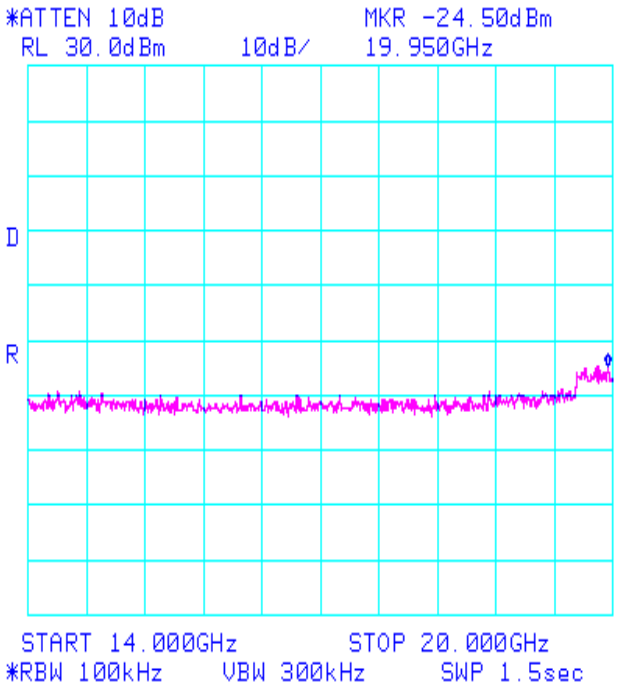
Conducted spur emissions at antenna port 8-PSK; PL-0, ARFCN 661 Met12084



Conducted spur emissions at antenna port 8-PSK; PL-0, ARFCN 661 Met12084



Conducted spur emissions at antenna port 8-PSK; PL-0, ARFCN 661 Met12084



6.5 TEST TYPE: Spurious Emissions at Antenna Terminals at Block Edges +/- 1 MHz

6.5.1 TECHNICAL SPECIFICATION: 2.1051; 24.238(b)

6.5.2 TEST DATE(S): 25 March, 2002

6.5.3 MEASUREMENT PROCEDURES:

As recommended in FCC Part 24, 1% of the Occupied bandwidth was chosen to measure the peak of any emission inside the 1.0 MHz frequency band adjacent to each frequency block edge. All other frequencies were measured using a 3 KHz RBW. The unit was exercised using signal types required by §2.1049.

6.5.4 Results:

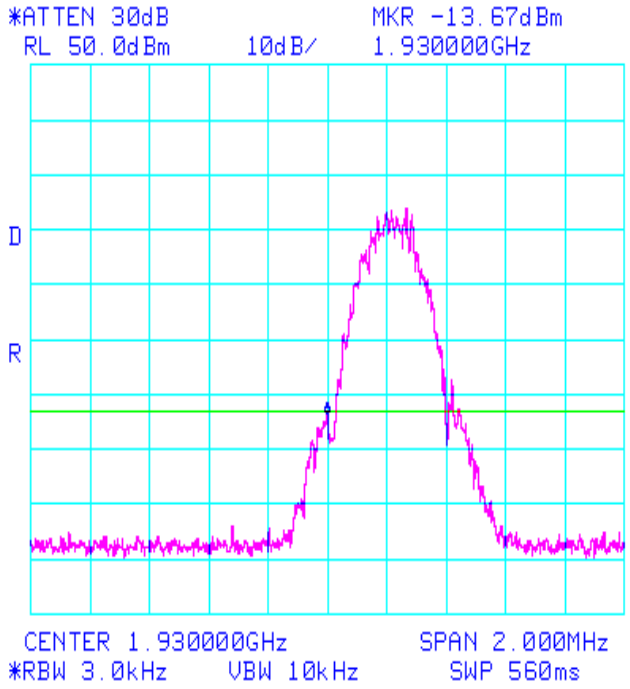
Modulation products outside of this band are attenuated at least 43 + 10 Log (P) below the level of the modulated carrier. A Plot of the spurious emissions at +/- 1 MHz around the transmit frequency, as measured at the antenna port, appears on the following page.

SPURIOUS EMISSION FREQUENCY BLOCKS

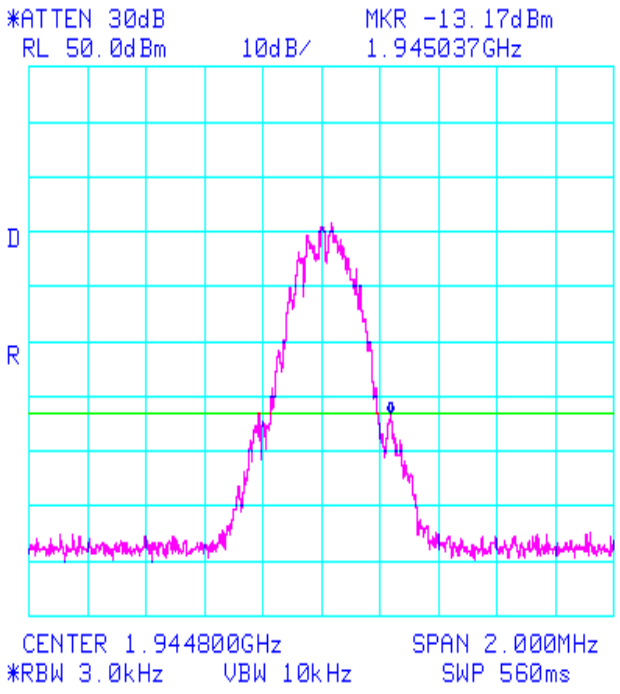
Frequency Block (MHz)	Low Frequency (CH #)	Hi Frequency (CH #)
A (1930 - 1945)	512 (1930.2)	585 (1944.8)
B (1950 - 1965)	612 (1950.2)	685 (1964.8)
C (1975 - 1990)	737 (1975.2)	810 (1989.8)
D (1945 - 1950)	587 (1945.2)	610 (1949.8)
E (1965 - 1970)	687 (1965.2)	710 (1969.8)
F (1970 - 1975)	712 (1970.2)	735 (1974.8)

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

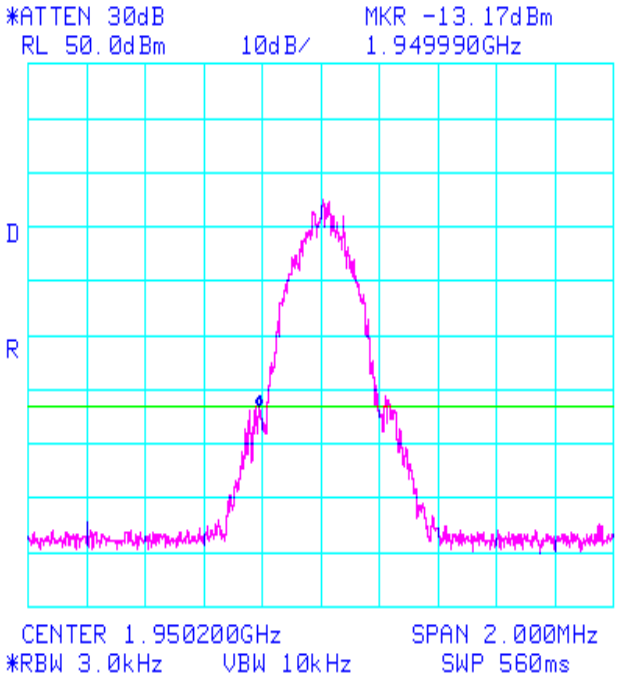
Spur emissions at frequency block edges low side of Block A GMSK PL-7 Met1208



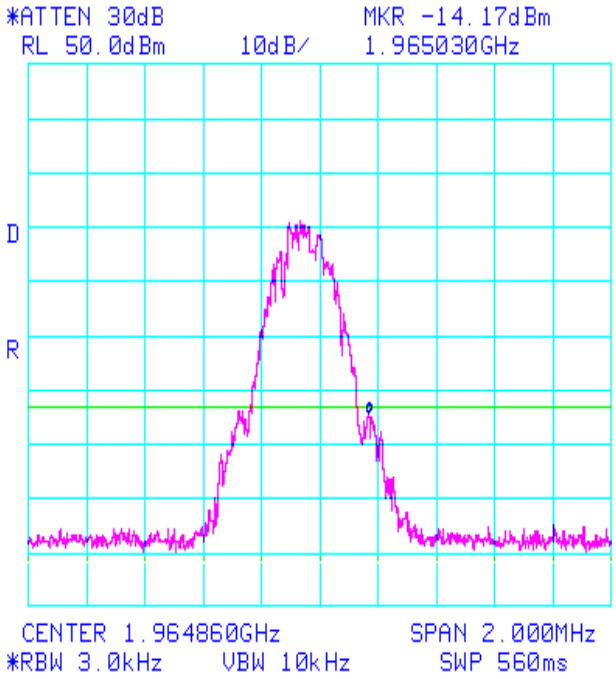
Spur emissions at frequency block edges High side of Block A GMSK PL-8 Met12084



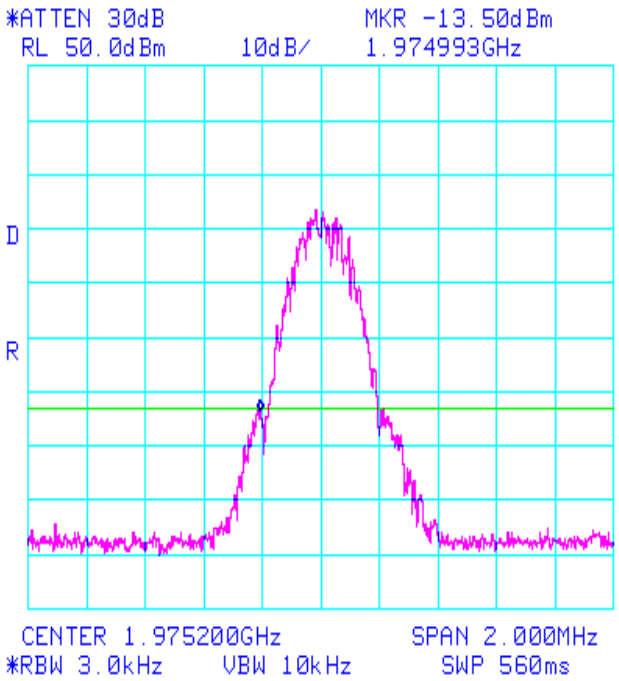
Spur emissions at frequency block edges low side of of block B PL-7 GMSK Met12084



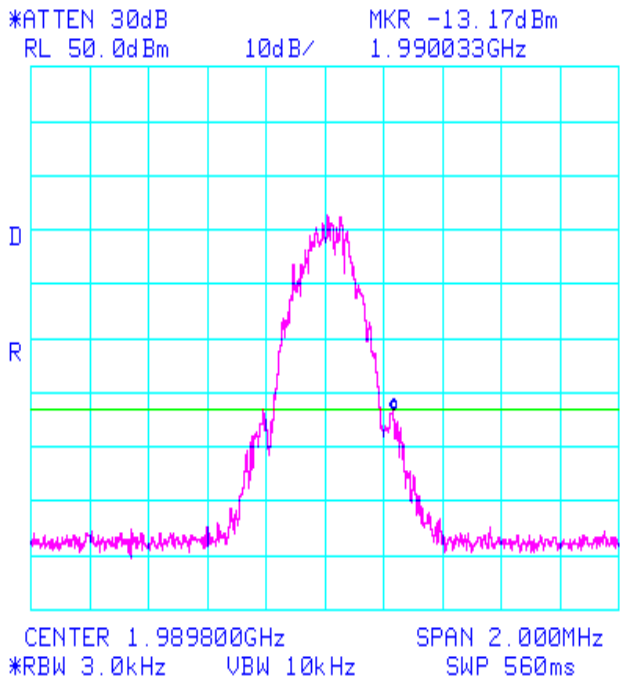
Spur emissions at frequency block edges high side of block B PL-8 GMSK Met12084



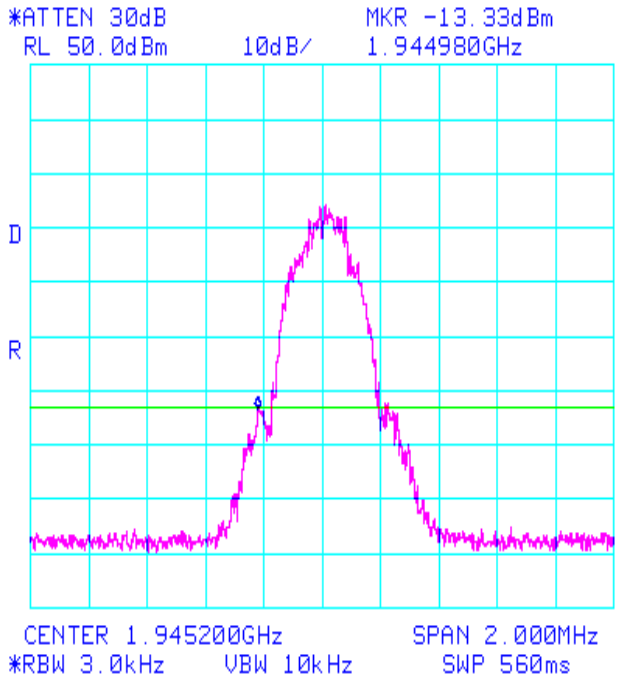
Spur emissions at frequency block edges low side of block C PL-7 GMSK Met12084



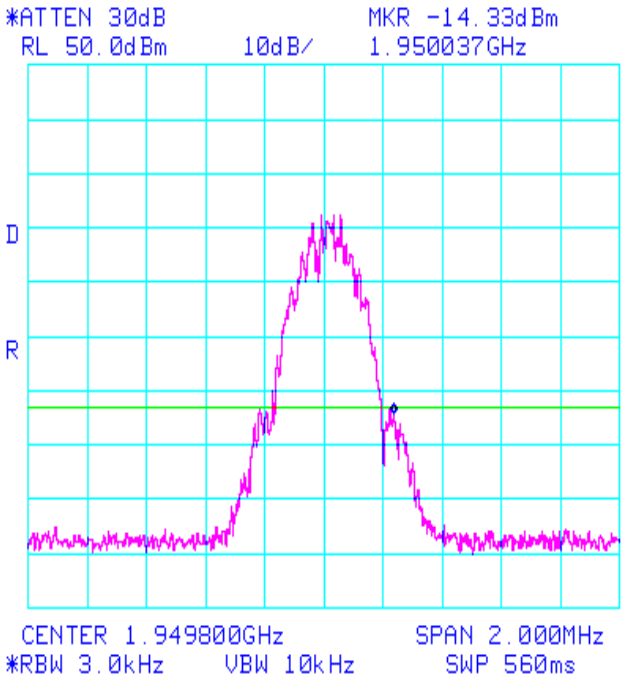
Spur emissions at frequency block edges high side of block C PL-8 GMSK Met12084



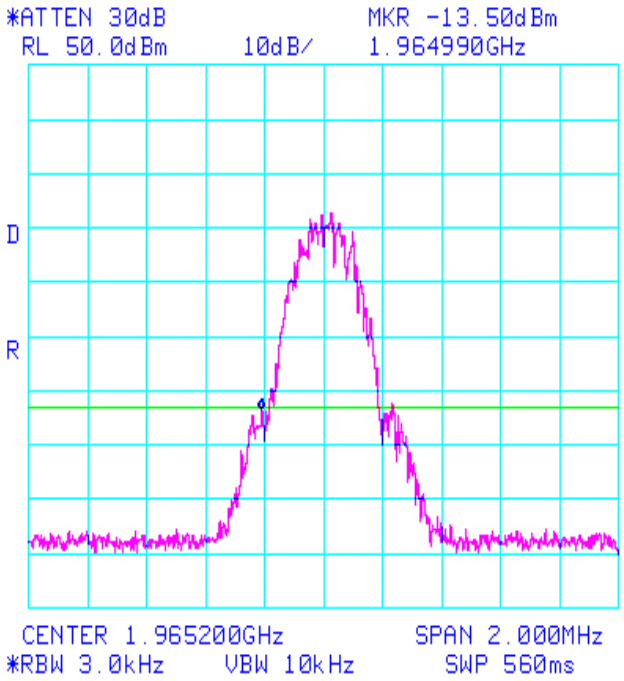
Spur emissions at frequency block edges low side of block D PL-7 GMSK Met12084



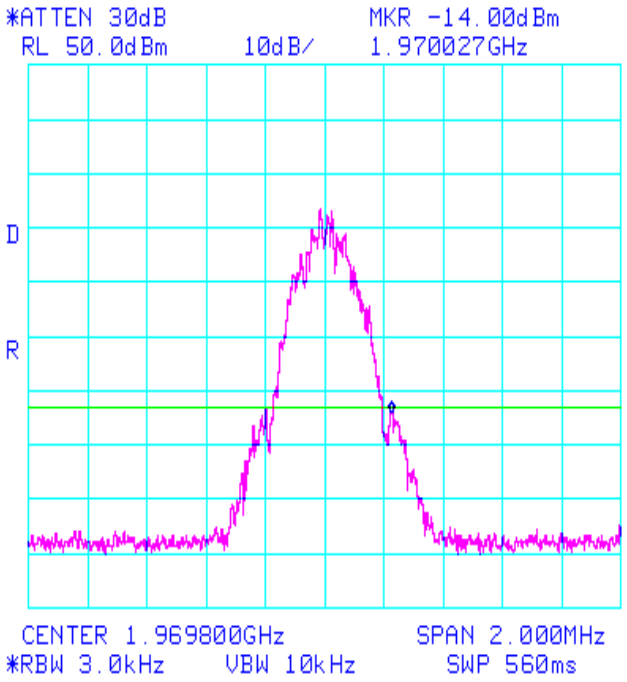
Spur emissions at frequency block edges high side of block D PL-8 GMSK Met12084



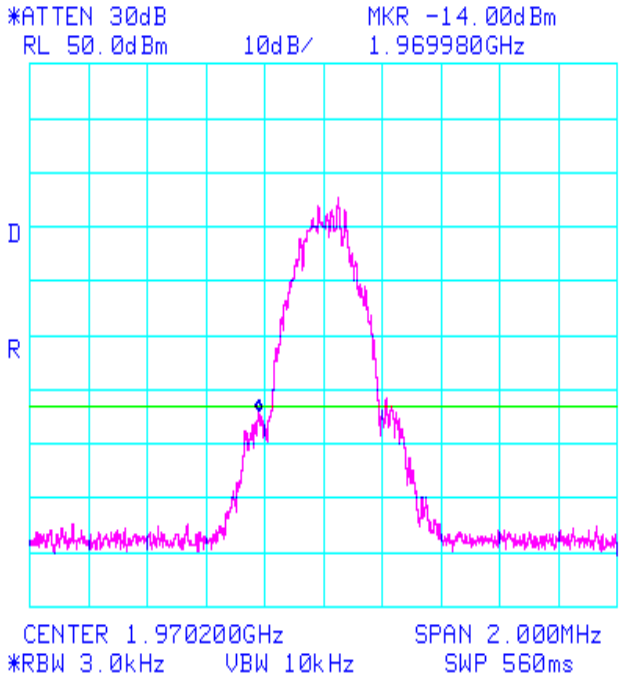
Spur emissions at frequency block edges low side of block E PL-7 GMSK Met12084



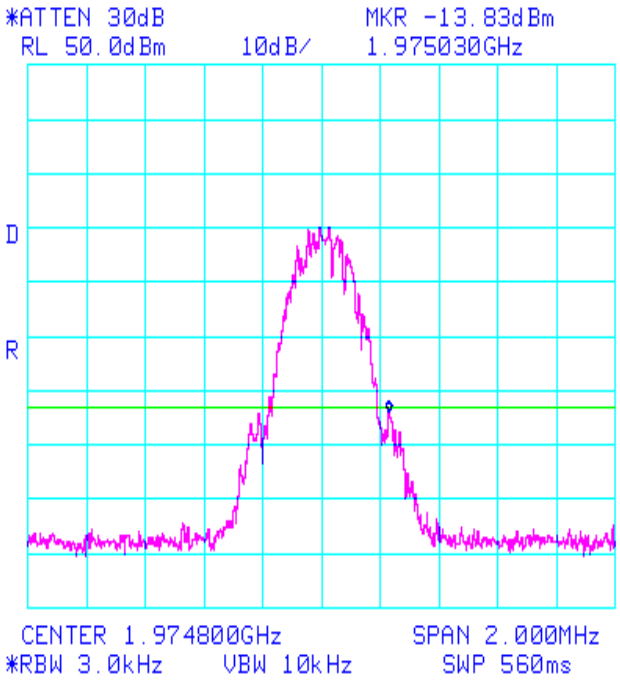
Spur emissions at frequency block edges high side of block E PL-8 GMSK Met12084



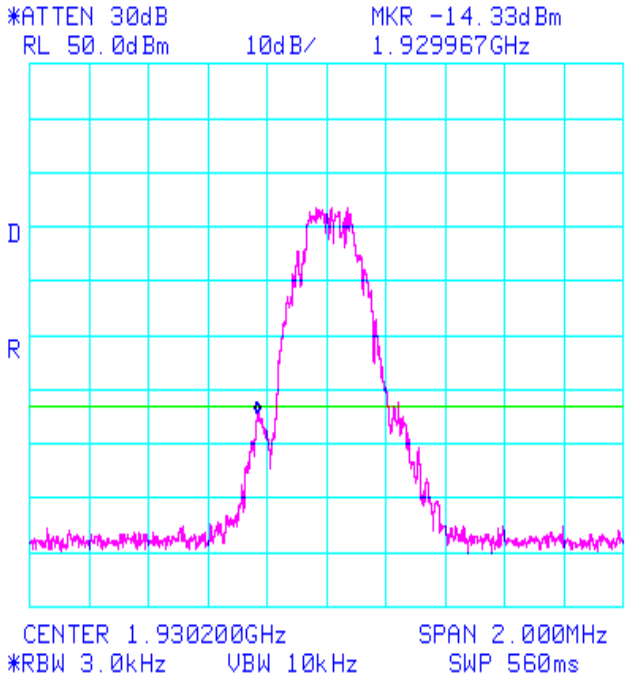
Spur emissions at frequency block edges low side of block F PL-7 GMSK Met12084



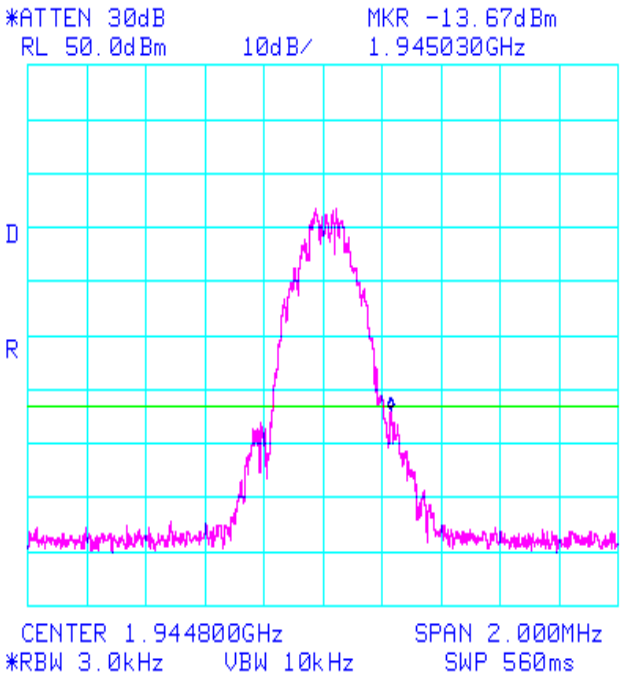
Spur emissions at frequency block edges high side of block F PL-8 GMSK Met12084



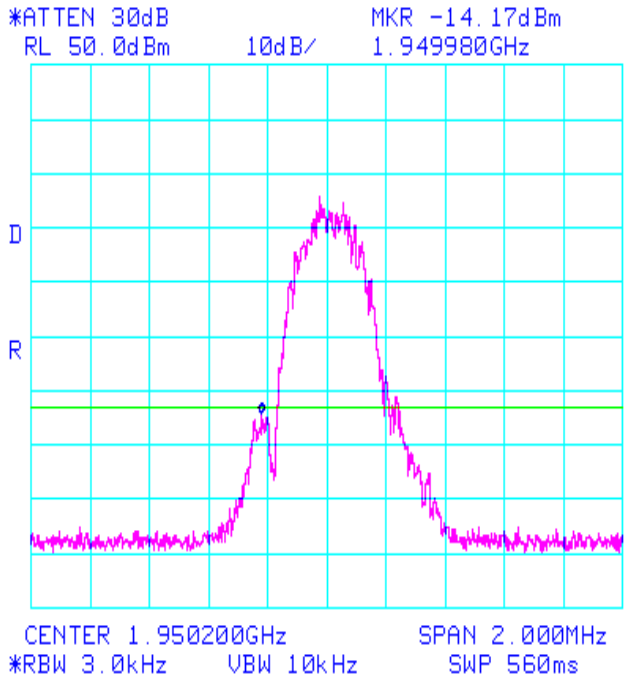
Spur emissions at frequency block edges low side of block A PL-5 8-PSK Met12084



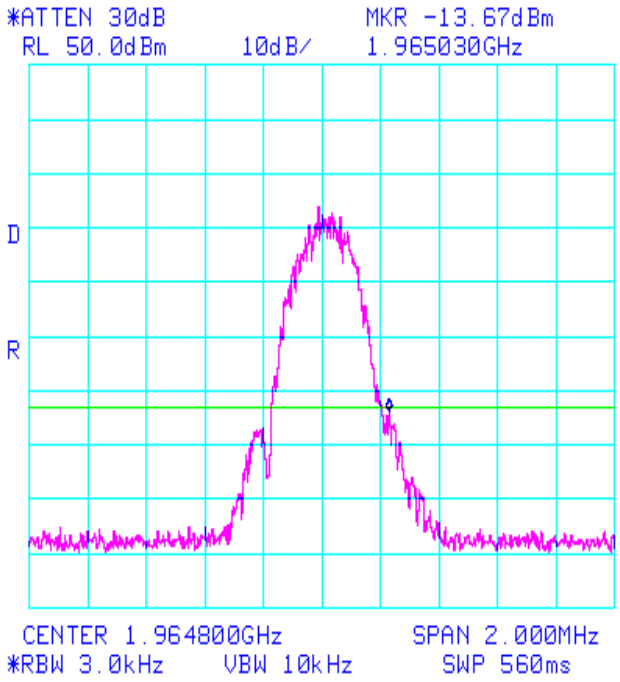
Spur emissions at frequency block edges high side of block A PL-6 8-PSK Met12084



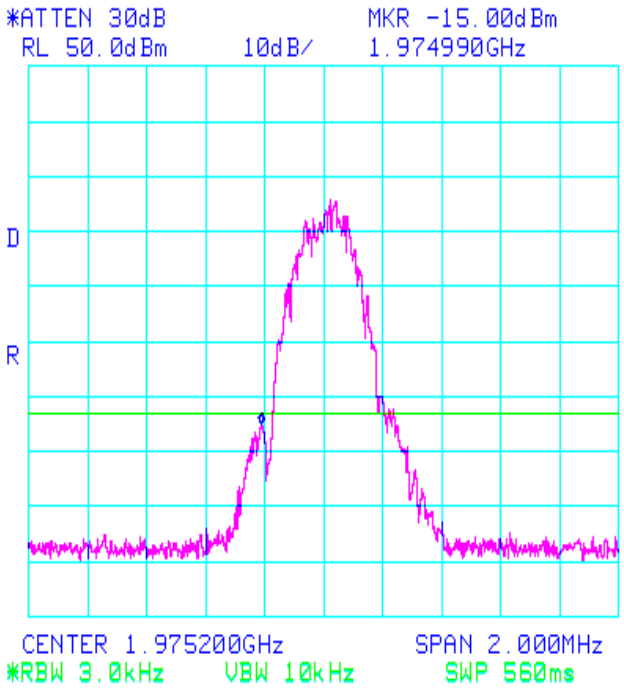
Spur emissions at frequency block edges low side of block B PL-5 8-PSK Met12084



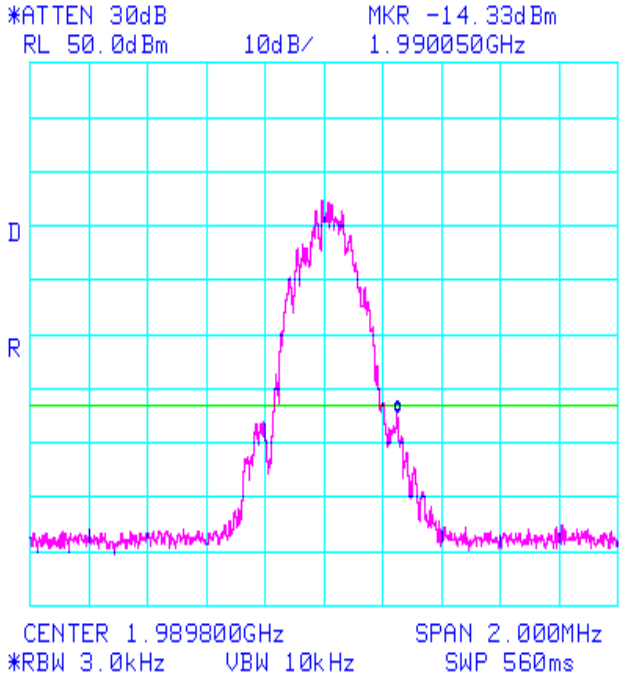
Spur emissions at frequency block edges high side of block B PL-6 8-PSK Met12084



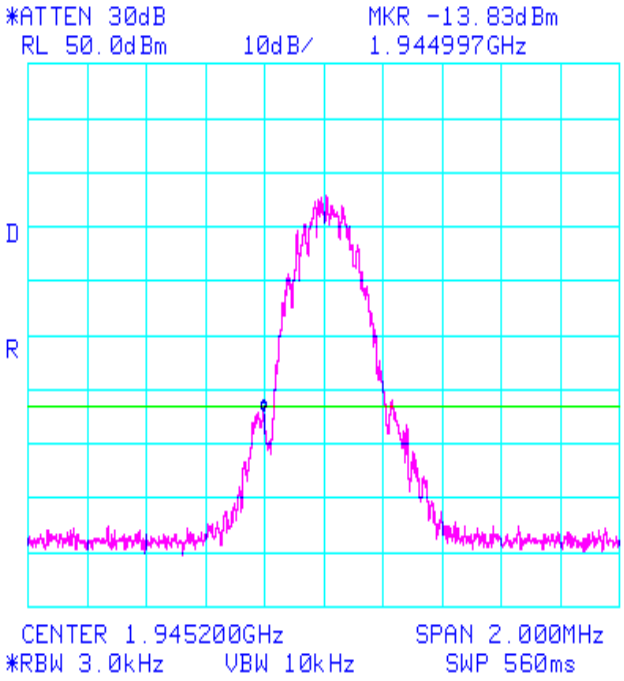
Spur emissions at frequency block edges low side of block C 8-PSK PL 5 Met12084



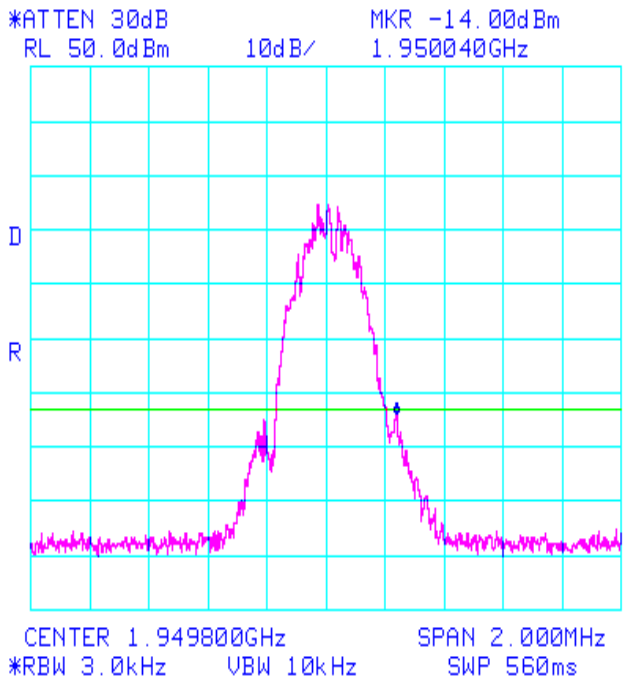
Spur emissions at frequency block edges high side of block C 8-PSK PL-6 Met12084



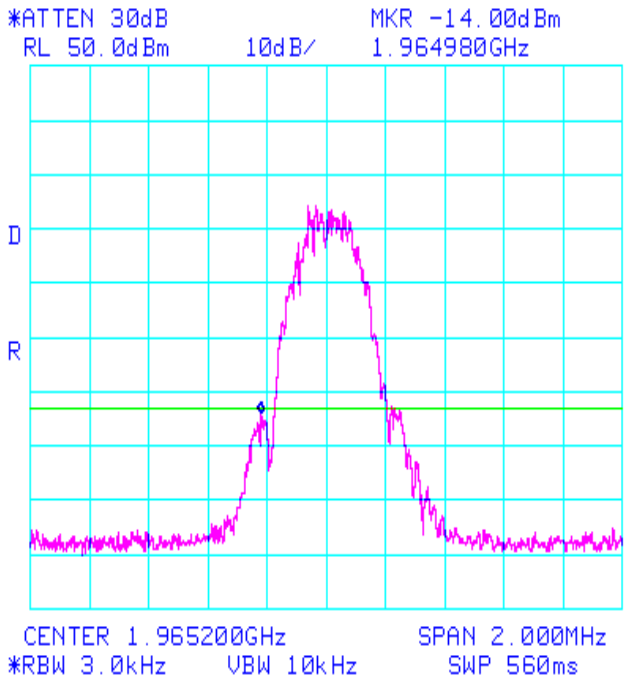
Spur emissions at frequency block edges low side of block D 8-PSK PL-5 Met12084



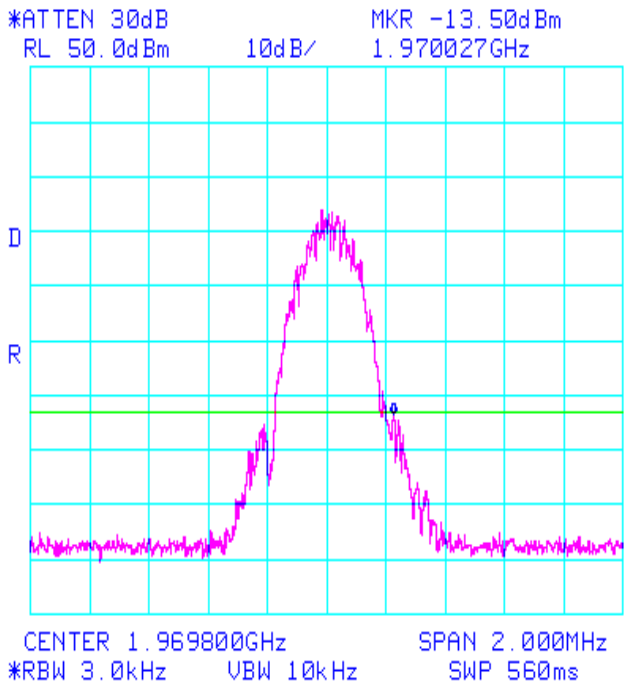
Spur emissions at frequency block edges high side of block D 8-PSK PL-6 Met12084



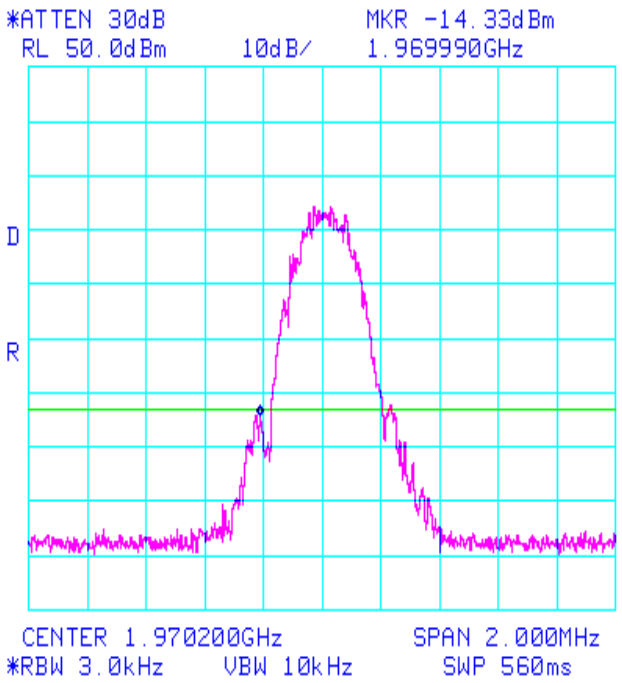
Spur emissions at frequency block edges low side of block E 8-PSK PL-5 Met12084



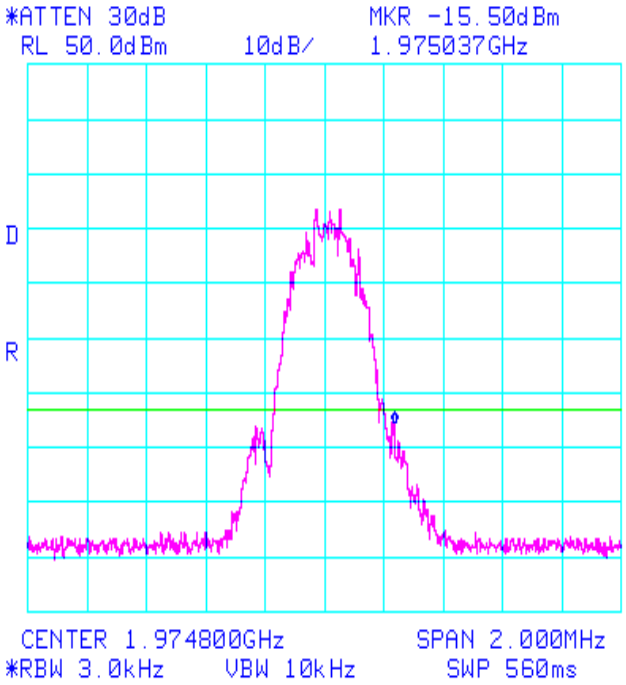
Spur emissions at frequency block edges high side of block E 8-PSK PL-6 Met12084



Spur emissions at frequency block edges low side of block F 8-PSK PL-5 Met12084



Spur emissions at frequency block edges high side of block F 8-PSK PL-6 Met12084



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 (CH 661) (GHz)	Frequency Deviation (Hz)	Deviation Limit (Hz)
-30	1.95993235	40	± 98
-20	1.95993237	20	± 98
-10	1.95993237	20	± 98
0	1.95993239	0	± 98
+10	1.95993239	0	± 98
+20	1.95993239	0	± 98
+30	1.95993239	0	± 98
+40	1.95993239	0	± 98
+50	1.95993237	- 20	± 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: ± 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 (GHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	20.4	1.95993227	10	± 98
100 %	24	1.95993228	0	± 98
115 %	27.6	1.95993228	0	± 98

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

Percentage of Rated Supply	DC Voltage 48V	Carrier Frequency (GHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	40.8	1.95993230	0	± 98
100 %	48	1.95993230	0	± 98
115 %	55.2	1.95993230	0	± 98

Percentage of Rated Supply	AC Voltage (VAC @ 60 Hz)	Carrier Frequency (GHz)	Deviation (Hz)	Deviation Limit (Hz)
85 %	178.5	1.95993230	0	± 98
100 %	210	1.95993230	0	± 98
115 %	241.5	1.95993230	0	± 98

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

6.9 TEST TYPE: Modulation Characteristics

6.9.1 TECHNICAL SPECIFICATION: 2.1047(a)

6.9.2 TEST DATE(S): 25 March, 2002

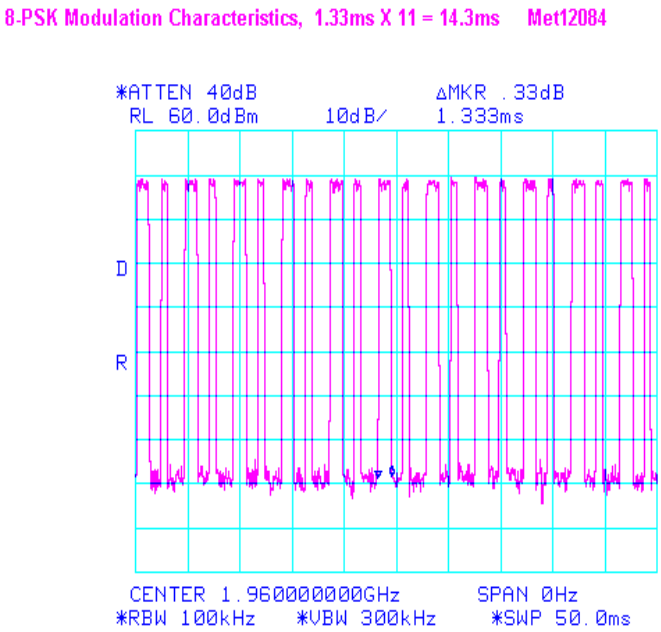
6.9.3 MEASUREMENTS REQUIRED:

The UltraSite 1900 PCS BTS uses GMSK or 8-PSK modulation. In GMSK/8-PSK modulation, voice or data information is digitized and coded into a bit stream. The bits are conveyed through precise phase changes in the carrier.

6.9.4 RESULTS:

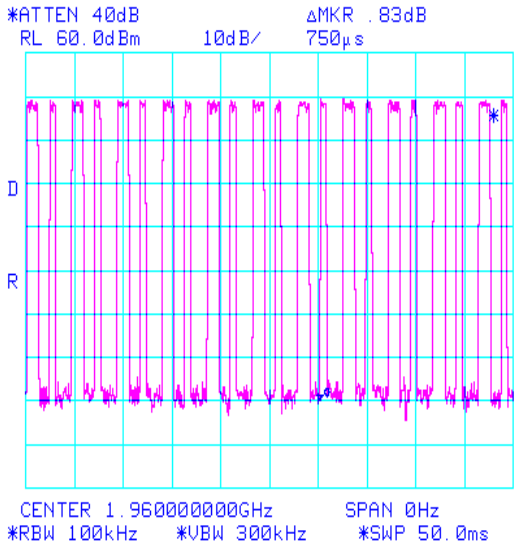
The following plots give a detailed explanation of the modulation scheme used in the BTS of the PCS system.

Modulation Characteristics 8-PSK; PL-0, ARFCN661
Frequency hopping w/3 time slots

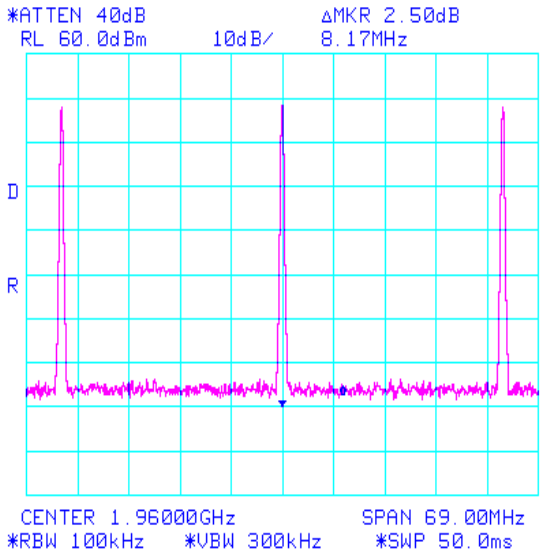


Modulation Characteristics 8-PSK; PL-0, ARFCN661
Frequency hopping w/3 time slots

8-PSK Modulation Characteristics, 0.75ms X 11 = 8.25ms Met12084

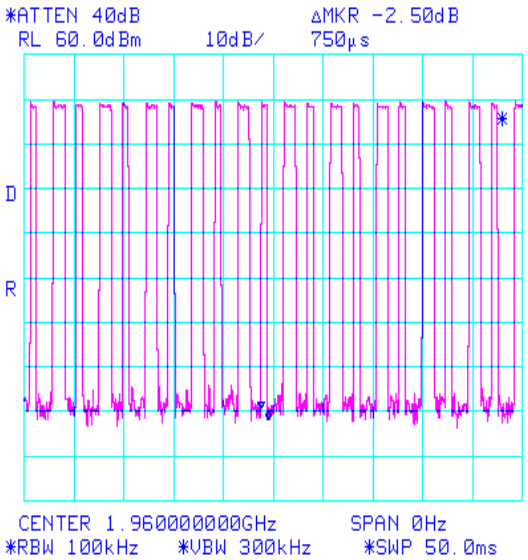


Modulation Characteristics 8-PSK PL-0, ARFCN 512, 661 and 810 Met12084

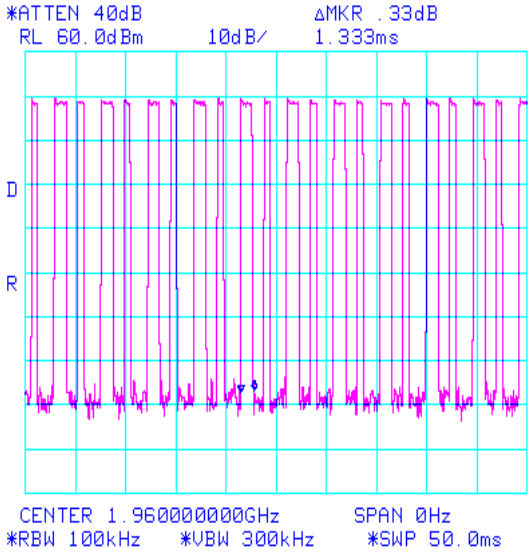
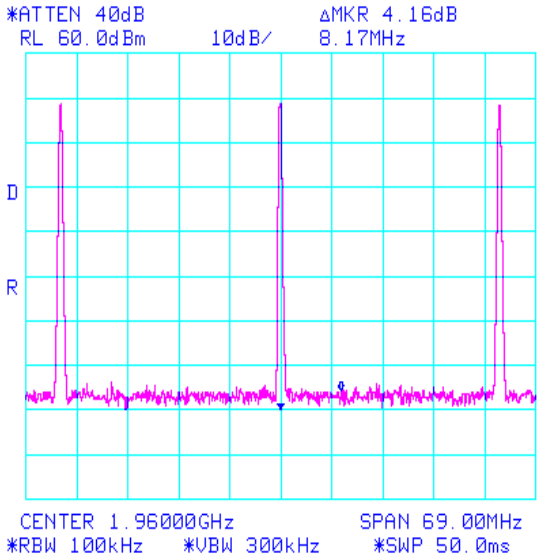


Modulation Characteristics GMSK; PL-0, ARFCN661
Frequency hopping w/3 time slots

GMSK Modulation Characteristics, 0.75ms X 11 = 8.25ms Met12084



GMSK Modulation Characteristics, 1.333ms X 11 = 14.3ms Met12084



Modulation Characteristics GMSK PL-0; ARFCN 512, 661 and 810 Met 12084