GSM BTS RADIO QUALIFICATION (FCC) TEST REPORT FOR RM2 1900 INTRODUCTION

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All the tests base on D2 release

APPROVALS

Approved By: 

Daniel Tan / GSM Product Approvals Manager

CONTENTS

1. INTRODUCTION

This document presents the measurement results of tests performed on this report presents the test data in accordance with FCC Part 24, for the Nortel Networks GSM 9000 Indoor BTS in Dual Band GSM850 / PCS1900 band.
This report presents test data for GMSK and 8PSK modulation (EDGE functionality).

1.1 SCOPE OF THIS DOCUMENT

This document presents the radio qualification plan of following modules introduction:

- Introduction of RM2 PCS1900 (GMSK 50W / 8PSK 30W) Radio module.
- Introduction of RM2 PCS1900 (GMSK 30W / 8PSK 30W) Radio module

The main tests of Qualification will be performed on RM2 1900 (50W /30W) because the RM2 50W is the worst critical module concerning consumption, thermal, RF power features.

Only some tests will be performed on RM2 30W (listed in the document), for the others tests RM2 50W compliance will ensure the RM2 30W compliance.

Following RF performances tests will be performed to check FCC compliance:

- At ambient temperature, Radio tests will be performed in Indoor 18000 BTS.

Radio Tests will be performed in GMSK & 8PSK modulation

1.2 AUDIENCE FOR THIS DOCUMENT

This document is to be used by any person needing a view on Nortel Networks GSM 18000 Indoor BTS.

2. RELATED DOCUMENTS

2.1 APPLICABLES DOCUMENTS

[A1]	47 CFR Part 24	PERSONAL COMMUNICATION SERVICES , January2003
[A2]	47 CFR Part22	PUBLIC MOBILE SERVICES
[A3]	47 CFR Part2	FREQUENCY ALLOCATION AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS , October 2003
[A4]	IC RSS-133	Spectrum Management and Telecommunication Policy – Radio Standard Specifications, Issue 3- June 2005

2.2 REFERENCE DOCUMENTS

[R1]	PCS/BTS/DPL/02350	Radio Test Plan for the introduction of RM2 1900 MHz(FCC &3GPP)
[R2]	PE/BTS/DJD/021878	GSM 18000 Indoor BTS Radio Test Report according to FCC Part 24 & FCC Part 22 (FCC ID AB6BTS18IND)
[R3]	PE/BTS/DJD/021883	GSM 18000 Outdoor BTS Radio Test Report according to FCC Part 24 & FCC Part 22 (FCC ID AB6BTS18OUT)

3. ABBREVIATIONS AND DEFINITIONS

3.1 ABBREVIATIONS

RM	Radio Module
BCF	Base Common Function
BTS	Base Transceiving Station
DDM	Dual Diplexer Module
GSM	Global System for Mobile Communications
GPRS	General Packet Radio Service
EDGE	Enhanced Data for GSM Evolution
PDTCH	Packet Data Logical Channel
PA	Power Amplifier
e-SCPA	EDGE Single Carrier PA
HePA	Edge High Power Amplifier
LNA	Low Noise Amplifier
OMC	Operation and Maintenance Center
TCU	Trans-Coding Unit
MSC	Mobile Switching Center
RF	Radio Frequency
Tx	Transmitter
TxF	Emission Filter

3.2 DEFINITIONS

BTS9000: Nortel product line
BTS18000: Nortel product line

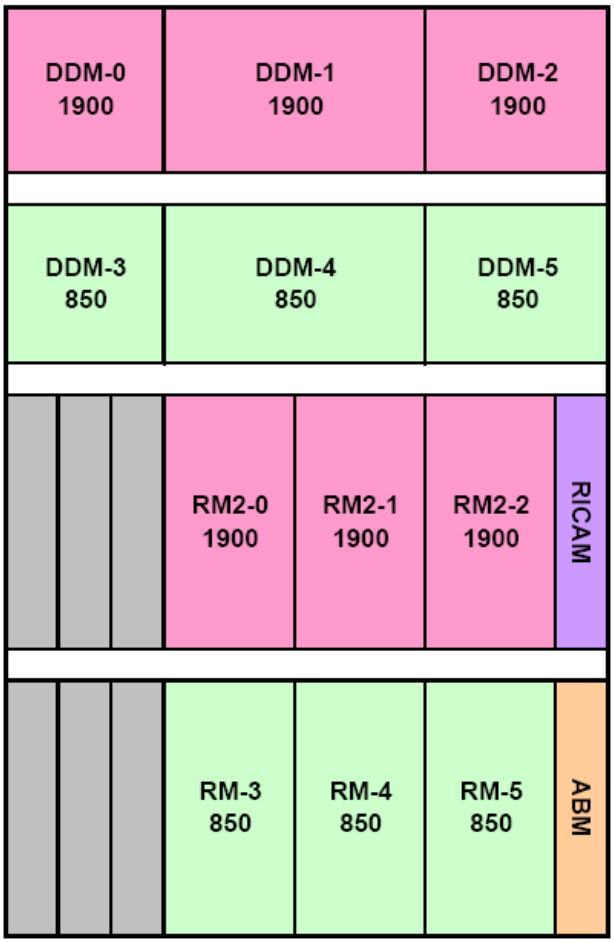
B Bottom ARFCN. Downlink (BTS Tx) and Uplink (BTS Rx) frequencies are given as follow:
GSM 850: $F_{B\ downlink}$ = 869.2 MHz; $F_{B\ uplink}$ = 824.2 MHz
PCS1900: $F_{B\ downlink}$ =1930.2 MHz; $F_{B\ uplink}$ =1850.2 MHz

M Middle ARFCN. Downlink (BTS Tx) and Uplink (BTS Rx) frequencies are given as follow:
GSM 850: $F_{M\ downlink}$ = 881.4 MHz; $F_{M\ uplink}$ = 836.4 MHz
PCS1900: $F_{M\ downlink}$ = 1960.0 MHz; $F_{M\ uplink}$ = 1880.0 MHz

T Top ARFCN. Downlink (BTS Tx) and Uplink (BTS Rx) frequencies are given as follow:
GSM 850: $F_{T\ downlink}$ = 893.8 MHz; $F_{T\ uplink}$ = 848.8 MHz
PCS1900: $F_{T\ downlink}$ = 1989.8 MHz; $F_{T\ uplink}$ =1909.8 MHz

4. TEST CONFIGURATION

4.1 BTS CONFIGURATION UNDER TESTS



Radio Modules are equipped with three identical RF ways:

- Tx0 for Channel B
- Tx1 for Channel M
- Tx2 for Channel T

For the RM of GSM1900, MPRM2 and RM2 were configured in BTS.
For the RM of GSM850, HPRM and MPRM were configured in BTS.

Two types of coupling device are tested:

- Diplexer is the worst case for spurious level.
- H2 combiner introduces additional 3dB losses

4.2 MODULE CONFIGURATION UNDER TEST

Designation	Hardware code PEC Code	Release	Serial number	comments
CABINET	NTN016AF	03	NNTM7880Y829	
DDM	NTN063AM	04	FICT06000HTG	PCS1900
DDM	NTN063AM	04	FICT06000HTK	PCS1900
DDM	NTN063AM	04	FICT06000HTL	PCS1900
DDM	NTN063HM	02	FICT03002MJG	GSM850
DDM	NTN063HM	02	FICT03002MJH	GSM850
DDM	NTN063HM	02	FICT03002MH6	GSM850
RICAM	NTN024AA	05	NNTMGWF301DF	
ABM	NTN029AF	05	NNTMJR001HPR	
RM	NTN050JA	01	NNTM7880WJC1	GSM850
RM	NTN050JA	01	NNTM7880WT5G	GSM850
RM	NTN050JA	01	NNTM78801HPR	GSM850
SICS	NTN071GM	02	NNTMLA08H5GA	
ALARM ALPRO	NTQ811CA	01	NNTM7880YB2G	
RM	NTN050PP	D2	NNTM7880Y9R3	PCS1900@50/30W
RM	NTN050PP	D2	NNTM7880Y9Q6	PCS1900@50/30W
RM	NTN050PP	D2	NNTM7880Y9QT	PCS1900@50/30W
RM	NTN050CP	D2	NNTM7880Y9RQ	PCS1900@30/30W

4.3 TEST EQUIPMENT

Equipment	Model	S/N	Last Cal.	Cal. due
PSA series spectrum analyzer	E4440A	MY46187898	2008-04-22	2009-04-22

4.4 BTS SOFTWARE

BTS Load software version : V16_B1

Test bench software version : Integration Test v4.08

RM2 Load software version : V16_A4

4.5 TEST SOFTWARE

TIL_alarm: V01f 205

TIL_COAM: V16e403

WINTOOL: V05A2_E19.0

WIN TMI: V03D306

5. TEST REPORT: RM2 PCS1900

5.1 INTRODUCTION

The following information is to introduce new modules RM2 PCS1900 (50W GMSK/30W 8PSK) and RM2 PCS1900 (30W GMSK/30W 8PSK) in GSM BTS for Nortel Network, in accordance with FCC Part 24 of the FCC Rules and Regulations.

5.2 MEASUREMENT CASE

Tests performed on RM2 PCS1900 (50W GMSK/30W 8PSK) (NTN050PP) and RM2 PCS1900 (30W GMSK/30W 8PSK) (NTN050CP) as follow:

Test Case	Modulation	RESULT
RF Power Output	GMSK / 8PSK	Complies
Occupied Bandwidth	GMSK / 8PSK	Complies
Spurious Emissions at Antenna Terminals	GMSK / 8PSK	Complies

5.3 NAME OF TEST: RF POWER OUTPUT

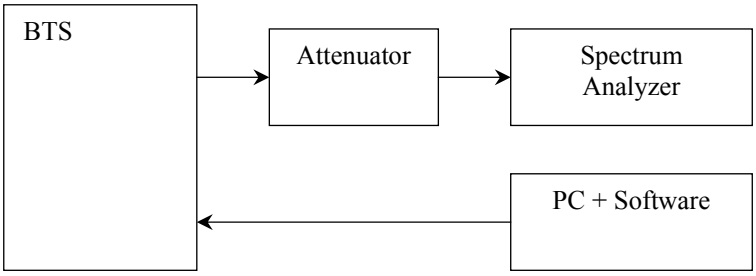
5.3.1 FCC REQUIREMENTS – FCC PART 24.232

Base stations are limited to 1640 watts peak equivalent isotropically radiated power (e.i.r.p.) with an antenna height up to 300 meters HAAT. See 24.53 for HAAT calculation method. Base station antenna heights may exceed 300 meters with a corresponding reduction in power. In no case may the peak output power of a base station transmitter exceed 100 watts.

Specification for Radio Modulation Test:

Band	Modulation	Power	DDM Diplexer		DDM H2	
			Low Limit	Up Limit	Low Limit	Up Limit
PCS1900	GMSK	30w	42.5	45.1	38.5	42.4
	8PSK	30w	42.5	45.1	38.5	42.4
PCS1900	GMSK	50w	44.7	47.2	40.7	44.0
	8PSK	30w	42.5	45.1	38.5	42.4

5.3.2 TEST PRINCIPLE



The BTS was configured to transmit at maximum power (static level 0 & Dynamic level 0):
- For GMSK modulation, in mode GMSK no synchro,
- For 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

Measurements were carried on frequencies which are C512 (B), C587, C661 (M), C687, C735, and C810 (T).

The output power was measured using the PSA which has the following settings:

Mode: Average
Reference Level Offset: Corrected to account for cable(s) and attenuator losses

5.3.3 TEST RESULTS

The Table shows the test results of RF Output Power for **GMSK & 8PSK** modulation with several coupling configurations:

5.3.3.1 OUTPUT POWER AT ANTENNA WITH MPRM2 50/30W

- **H2D configuration:**

ARFCN	Modulation	Mean Power	Sanction
C512	GMSK	42.17	Pass
	8PSK	40.36	Pass
C587	GMSK	42.49	Pass
	8PSK	40.75	Pass
C661	GMSK	42.60	Pass
	8PSK	40.78	Pass
C687	GMSK	42.61	Pass
	8PSK	40.74	Pass
C735	GMSK	42.61	Pass
	8PSK	40.82	Pass
C810	GMSK	42.62	Pass
	8PSK	40.78	Pass

- **Diplexer configuration:**

ARFCN	Modulation	Mean Power	Sanction
C512	GMSK	45.61	Pass
	8PSK	43.84	Pass
C587	GMSK	45.89	Pass
	8PSK	44.12	Pass
C661	GMSK	45.87	Pass
	8PSK	44.16	Pass
C687	GMSK	45.85	Pass
	8PSK	44.13	Pass
C735	GMSK	45.80	Pass
	8PSK	44.22	Pass
C810	GMSK	45.86	Pass
	8PSK	44.21	Pass

5.3.3.2 OUTPUT POWER AT ANTENNA WITH RM2 30/30W

- **H2D configuration:**

ARFCN	Modulation	Mean Power	Sanction
C512	GMSK	39.91	Pass
	8PSK	40.03	Pass
C587	GMSK	40.20	Pass
	8PSK	40.32	Pass
C661	GMSK	40.41	Pass
	8PSK	40.45	Pass
C687	GMSK	40.45	Pass
	8PSK	40.46	Pass
C735	GMSK	40.35	Pass
	8PSK	40.57	Pass
C810	GMSK	40.30	Pass
	8PSK	40.49	Pass

- **Diplexer configuration:**

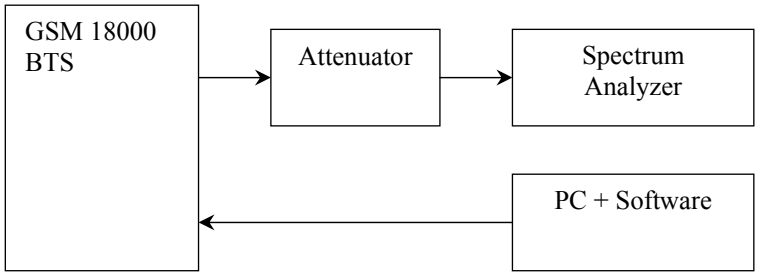
ARFCN	Modulation	Mean Power	Sanction
C512	GMSK	43.30	Pass
	8PSK	43.47	Pass
C587	GMSK	43.69	Pass
	8PSK	43.80	Pass
C661	GMSK	43.81	Pass
	8PSK	43.82	Pass
C687	GMSK	43.77	Pass
	8PSK	43.79	Pass
C735	GMSK	43.72	Pass
	8PSK	43.90	Pass
C810	GMSK	43.71	Pass
	8PSK	43.83	Pass

5.4 NAME OF TEST: OCCUPIED BANDWITH

5.4.1 FCC REQUIREMENTS

The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

5.4.2 TEST PRINCIPLE



The BTS was configured to transmit at maximum power (Static Level 0). Measurements were made at frequencies which were at the bottom and top of the transmit band.

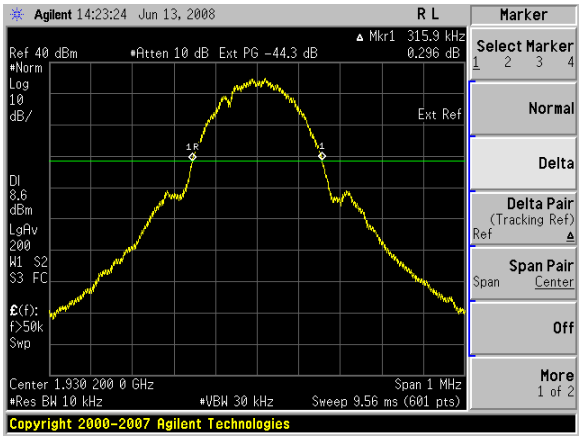
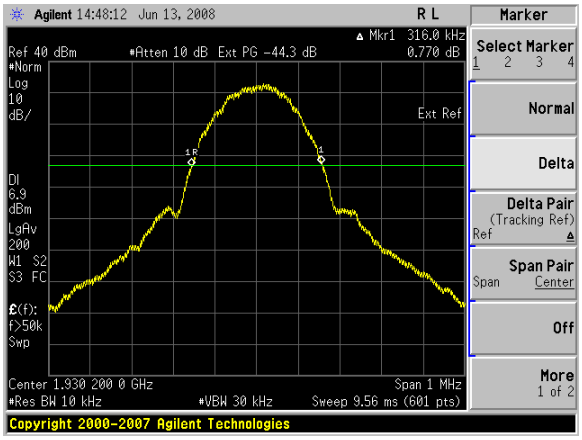
The occupied bandwidth was measured by determining the bandwidth out of which all emissions are attenuated at least 26 dB below the transmitter power.

The spectrum analyzer had the following settings:

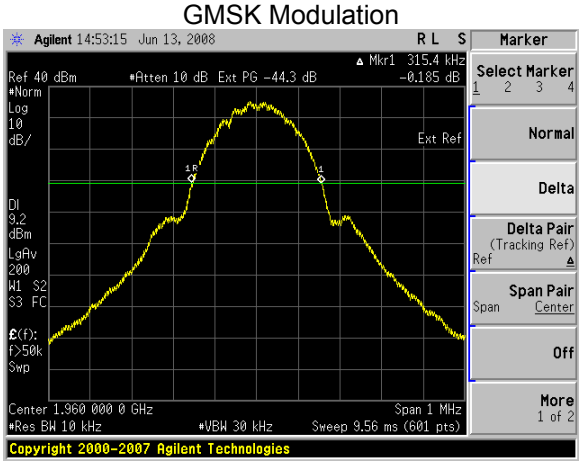
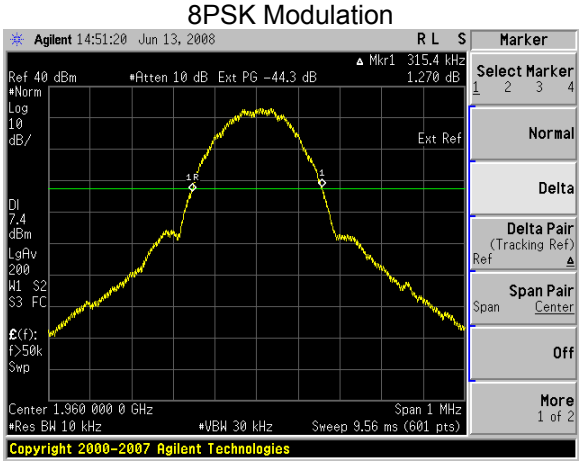
Resolution bandwidth:	10 kHz
Video bandwidth:	30 kHz
Span:	1 MHz
Reference level:	40 dBm
Reference Level Offset:	Corrected to account for cable(s) and attenuator losses
Level range:	100 dB
Sweep time:	25 ms

5.4.3 TEST RESULTS

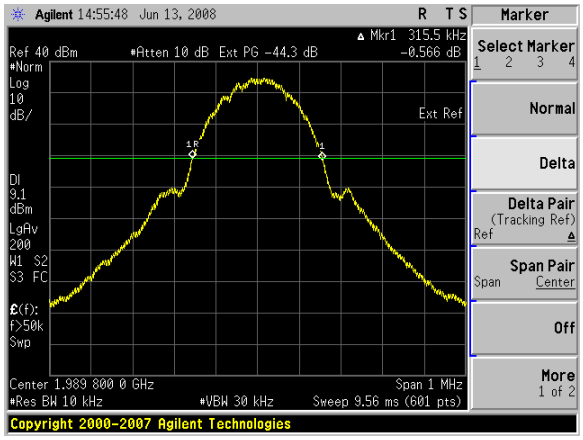
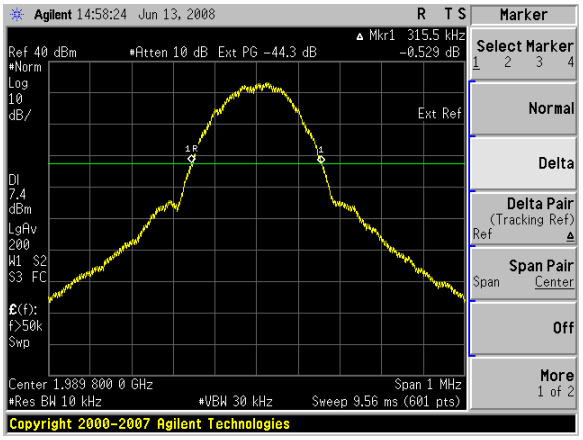
- **Channel B**

MPRM2 1900 Diplexer Configuration	
GMSK Modulation	8PSK Modulation
	
The maximum occupied bandwidth is 316KHz for GMSK at Dp Configuration. The maximum occupied bandwidth is 316KHz for 8PSK at Dp Configuration.	

- **Channel M**

MPRM2 1900 Diplexer Configuration	
GMSK Modulation	8PSK Modulation
	
The maximum occupied bandwidth is 315KHz for GMSK at Dp Configuration. The maximum occupied bandwidth is 315KHz for 8PSK at Dp Configuration.	

➢ **Channel T**

<table>
<tr><td colspan="2">MPRM2 1900 Diplexer Configuration</td></tr>
<tr><td>GMSK Modulation</td><td>8PSK Modulation</td></tr>
<tr><td> 
</td><td> 
</td></tr>
<tr><td colspan="2">The maximum occupied bandwidth is 315KHz for GMSK at Dp Configuration.
The maximum occupied bandwidth is 315KHz for 8PSK at Dp Configuration.</td></tr>
</table>

5.5 NAME OF TEST: SPURIOUS EMISSION AT TERMINALS

5.5.1 FCC REQUIREMENTS LIMITS

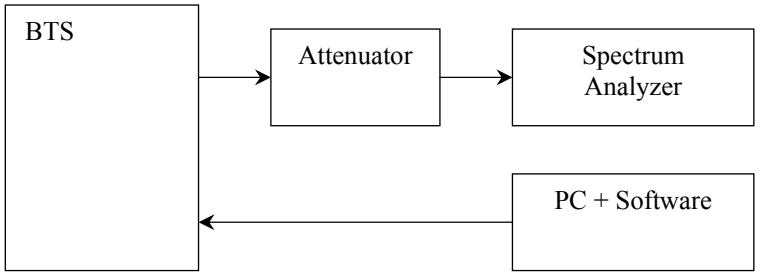
(a) On any frequency outside a licensee's frequency block, the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB.

(b) Compliance with these provisions is based on the use of measurement instrumentation employing a resolution bandwidth of 1 MHz or greater. However, in the 1 MHz bands immediately outside and adjacent to the frequency block a resolution bandwidth of at least one percent of the emission bandwidth of the fundamental emission of the transmitter may be employed. The emission bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated at least 26 dB below the transmitter power.

(c) When measuring the emission limits, the nominal carrier frequency shall be adjusted as close to the licensee's frequency block edges, both upper and lower, as the design permits.

(d) The measurements of emission power can be expressed in peak or average values, provided they are expressed in the same parameters as the transmitter power.

5.5.2 TEST PRINCIPLE



For adjacent channels emissions, the BTS nominal carrier frequency was adjusted to each block edge channel.

Channels 512 and 810 are those channels which are at the lower and upper edges of the PCS1900 band respectively.

The BTS was configured to transmit at maximum power (static level 0) or a reduced power:
- For GMSK modulation, in mode GMSK no synchro.
- For 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

Initially the transmitter was set to operate to maximum power. Then in case of out of limits, the power has been decreased by 2 dB.

For these measurements, the resolution bandwidth was of the spectrum analyzer was set to at le ast 1% of the emission bandwidth. In this case the emission bandwidth measured was closed to 300 kHz. Therefore, the resolution bandwidth was set to 3 kHz. The spectrum analyzer had the following settings for adjacent band:

Resolution bandwidth:	3 kHz
Video bandwidth:	10 kHz
Span:	1 MHz

Reference level:	30 dBm
Reference Level Offset:	Corrected to account for cable(s), filter and attenuator losses
Level range:	100 dB
Sweep time:	Coupled
Detector:	Sample
Trace:	Average
Sweep count:	200

The spectrum analyzer had the following settings for out of block emissions.

Resolution bandwidth:	1 MHz
Video bandwidth:	1 MHz

The emissions were investigated up to the twentieth harmonic of the fundamental emission (20 GHz).
The measured level of the emissions was recorded and compared to the -13 dBm limit.

5.5.3 TEST RESULTS

5.5.3.1 MPRM2 50/30W WITH DDM H2 CONFIGURATION

- **GMSK MODULATION**

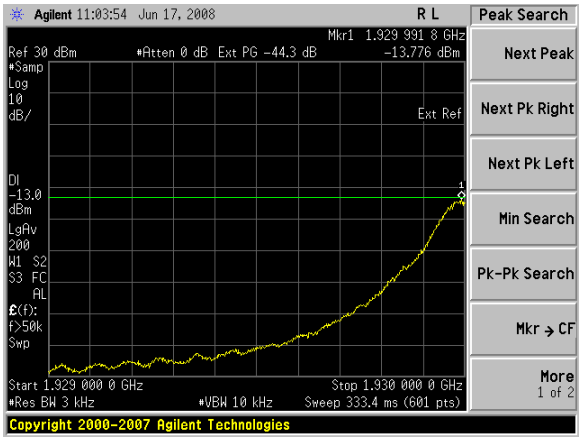
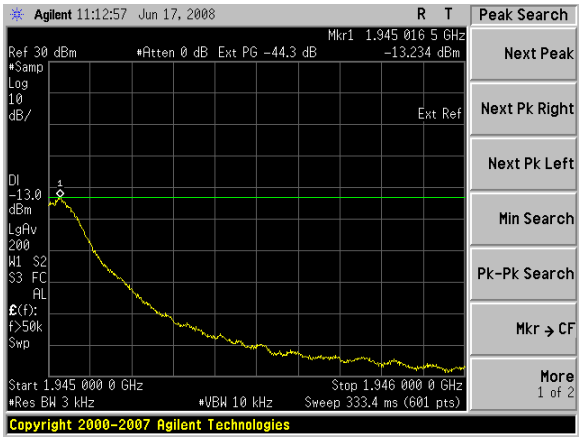
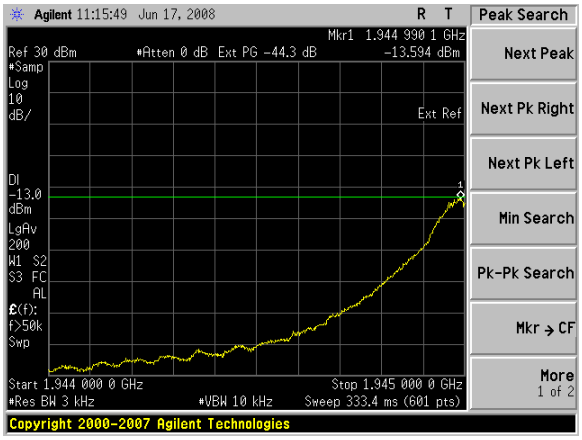
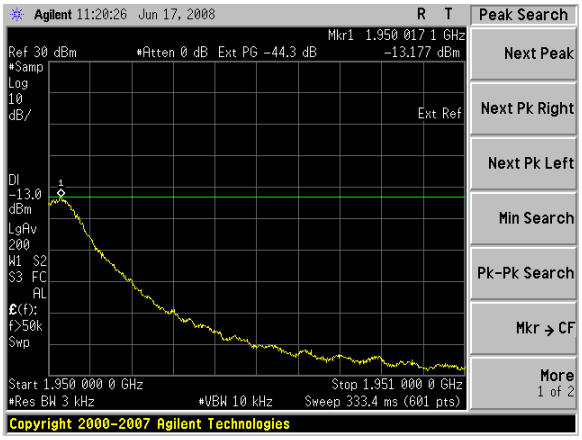
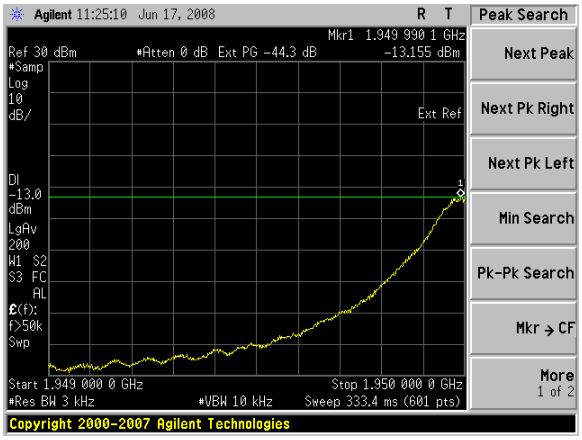
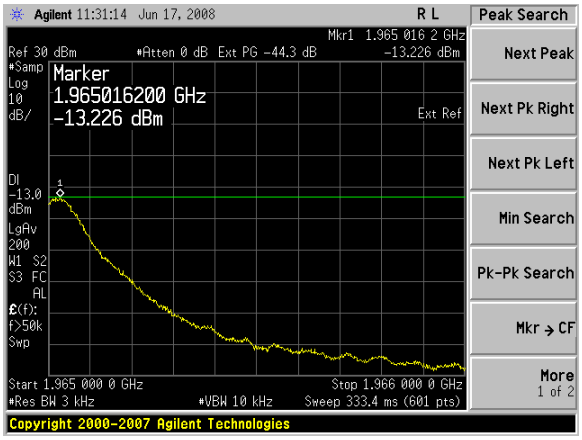
The reference level for spurious emissions at the antenna terminals is taken from the measured output power is 42.5dBm=17.8W.
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (17.8) = 55.5 dB
The measured output power was 42.5 dBm therefore the limit is 42.5 – 55.5 = -13 dBm.
Spurious measurement is performed with the DDM H2 configuration.
The Nominal power at antenna connector: P max =42.5 dBm

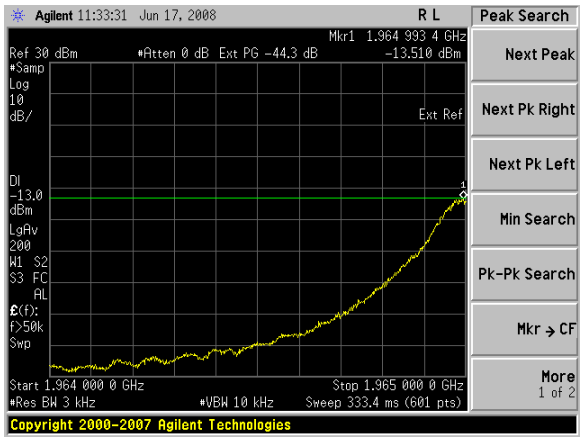
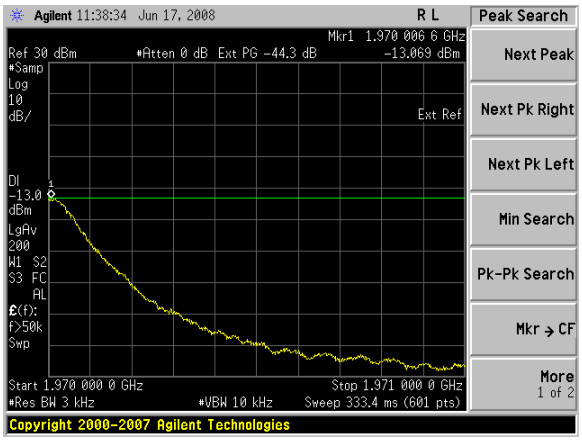
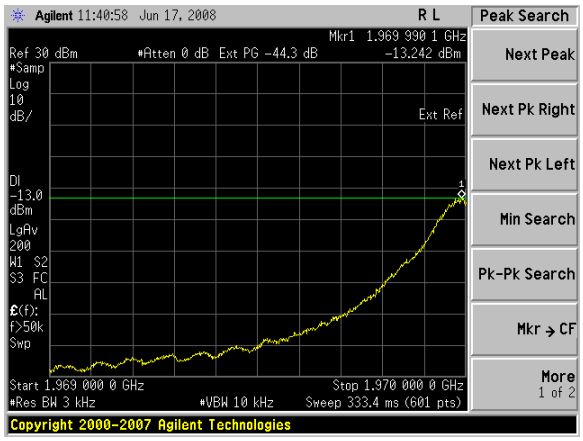
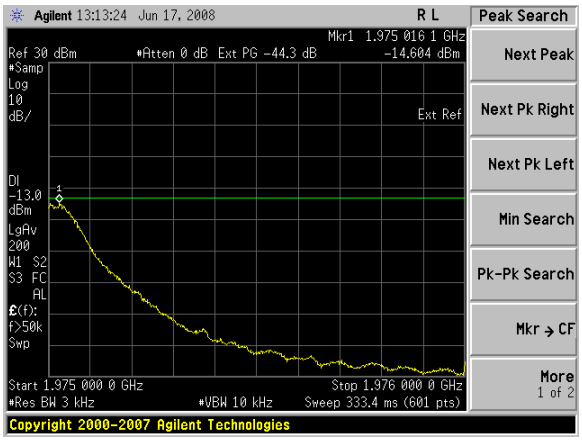
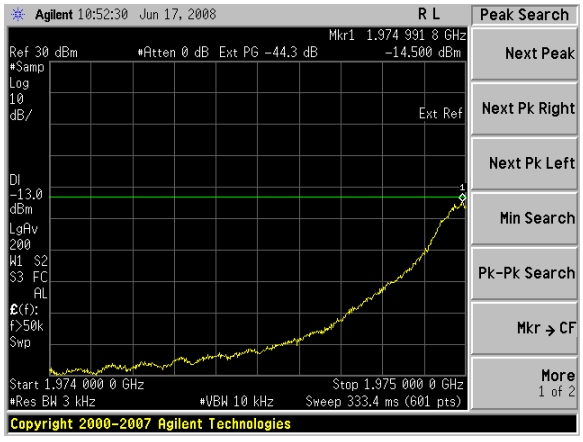
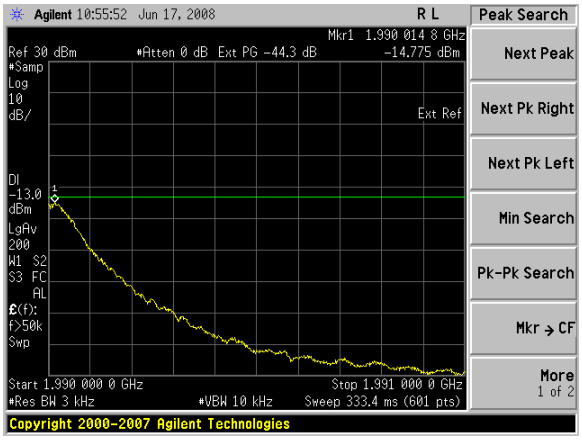
Table show the result for Spurious Emission at Antenna Terminal

Test result for GMSK Modulation H2 Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512		-13.8			-0.8
585		-13.2			-0.2
587		-13.6			-0.6
610		-13.2			-0.2
612		-13.2			-0.2
685		-13.2			-0.2
687		-13.5			-0.5
710		-13.1			-0.1
712		-13.2			-0.2
735			-14.6		-1.6
737			-14.5		-1.5
810			-14.8		-1.8

Figure: In Band – Edge block channel – 1MHz adjacent band
GMSK Modulation – H2 configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax-2dB	C585 Pmax-2dB
	
C587 Pmax-2dB	C610 Pmax-2dB
	
C612 Pmax-2dB	C685 Pmax-2dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax-2dB	C710 Pmax-2dB
	
C712 Pmax-2dB	C735 Pmax-4dB
	
C737 Pmax-4dB	C810 Pmax-4dB
	

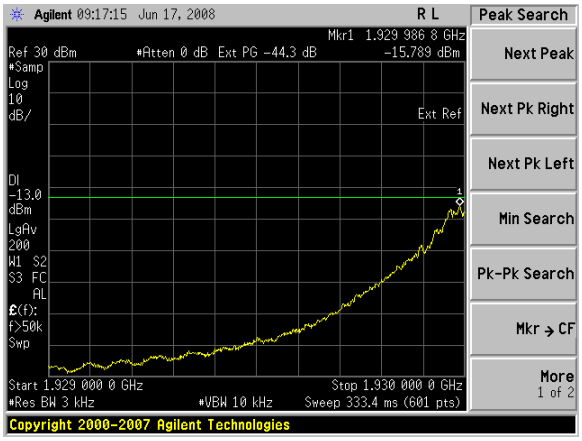
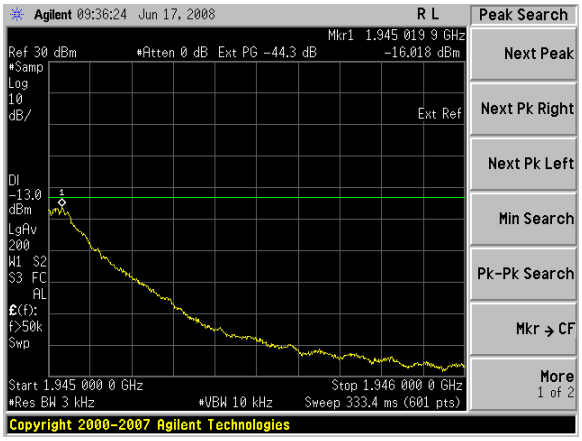
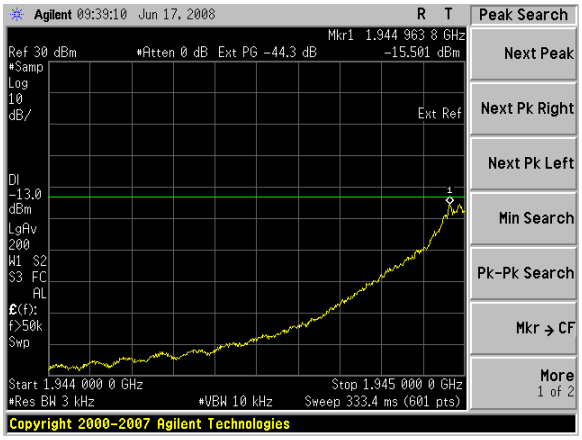
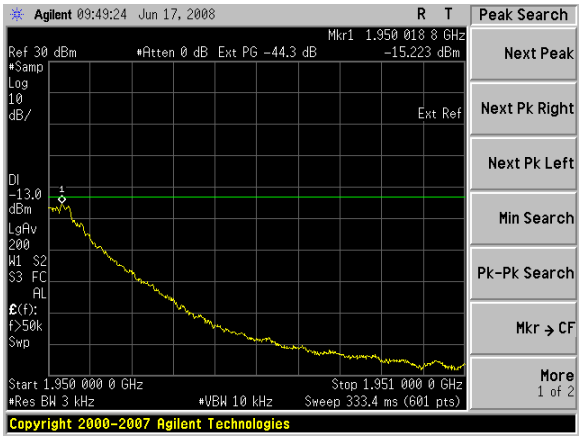
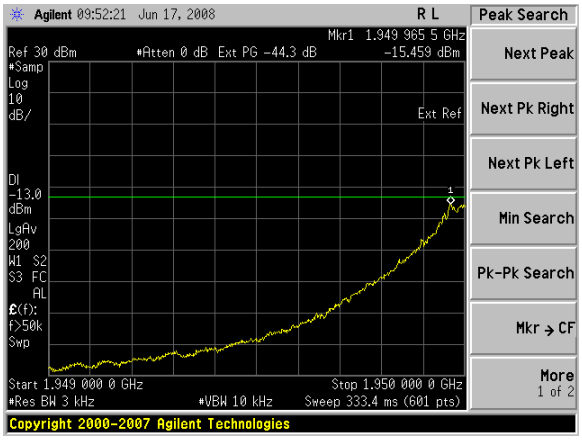
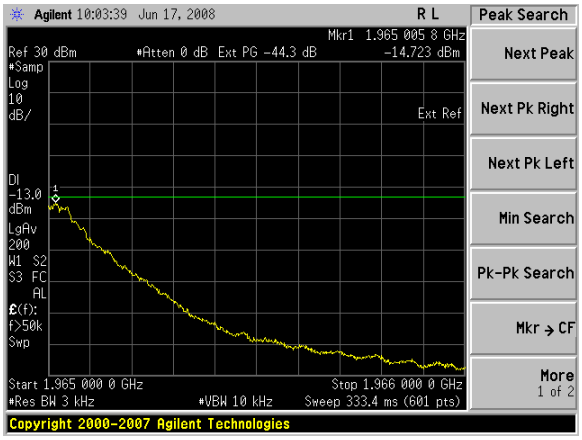
- **8PSK MODULATION**

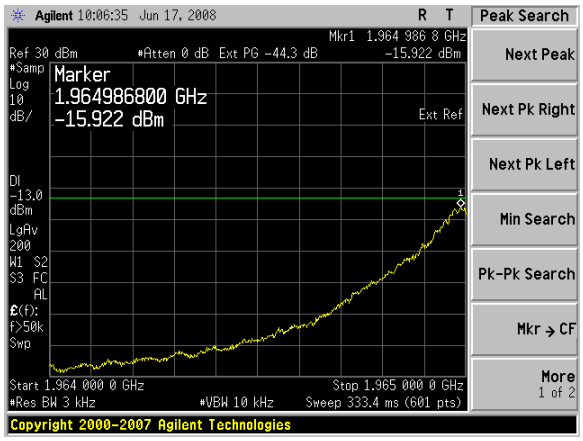
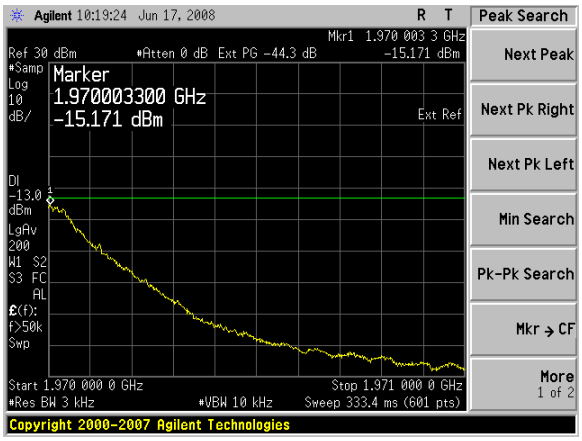
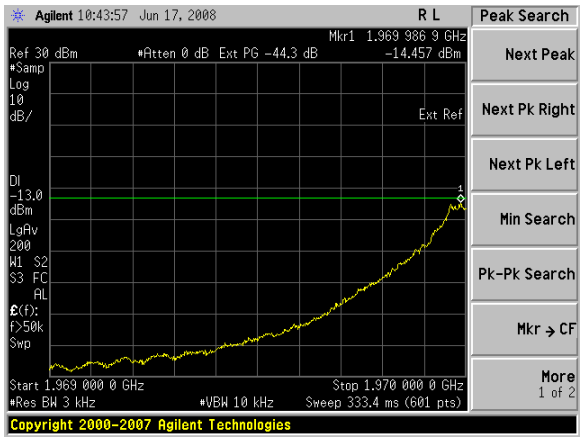
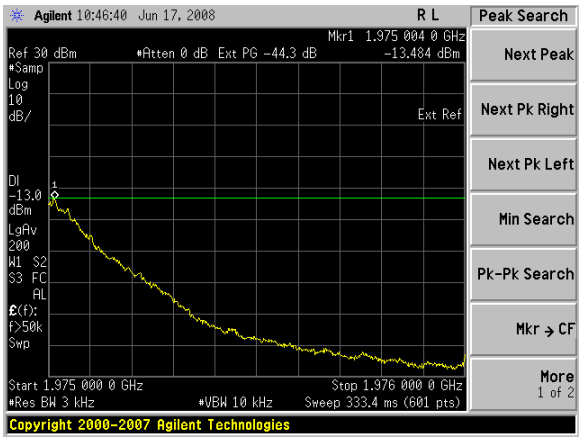
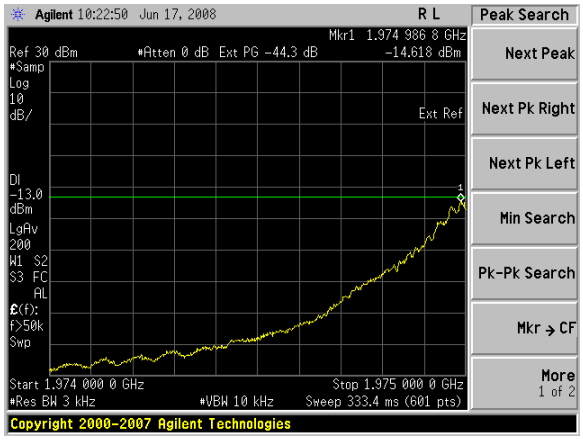
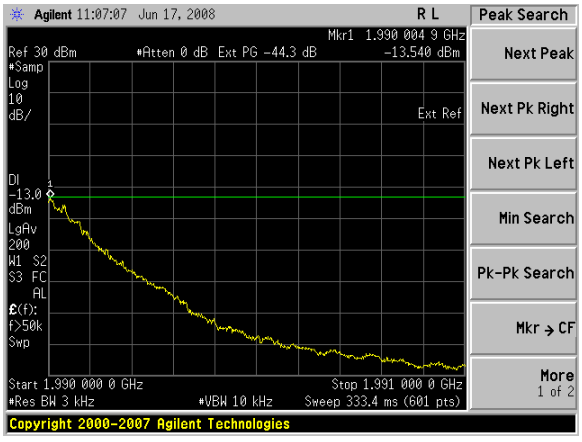
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (40.5 dBm = 11.2 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (12.6) = 53.5 dB
The measured output power was 40.5 dBm therefore the limit is 40.5 – 53.5 = -13 dBm.
Spurious measurement is performed with the DDM H2 configuration.
The Nominal power at antenna connector: Pmax =40.5 dBm

Test result for 8PSK Modulation H2D Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512	-15.8				-2.8
585	-16.1				-3.1
587	-15.5				-2.5
610	-15.2				-2.2
612	-15.5				-2.5
685	-14.7				-1.7
687	-15.9				-2.9
710	-15.2				-2.2
712	-14.5				-1.5
735	-13.5				-0.5
737	-14.7				-1.7
810	-13.5				-0.5

Figure: In Band – Edge block channel – 1MHz adjacent band
8PSK Modulation – H2 configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax	C585 Pmax
	
C587 Pmax	C610 Pmax
	
C612 Pmax	C685 Pmax
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax	C710 Pmax
	
C712 Pmax	C735 Pmax
	
C737 Pmax	C810 Pmax
	

5.5.3.2 MPRM2 50/30W WITH DDM DIPLEXER CONFIGURATION

- **GMSK MODULATION**

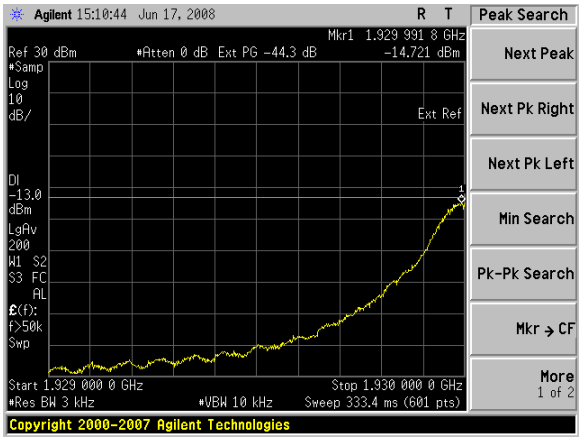
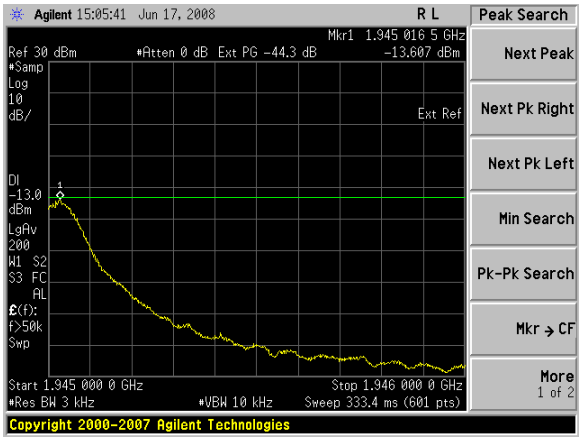
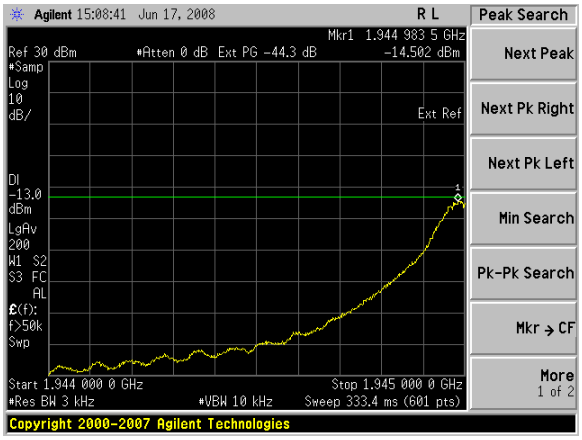
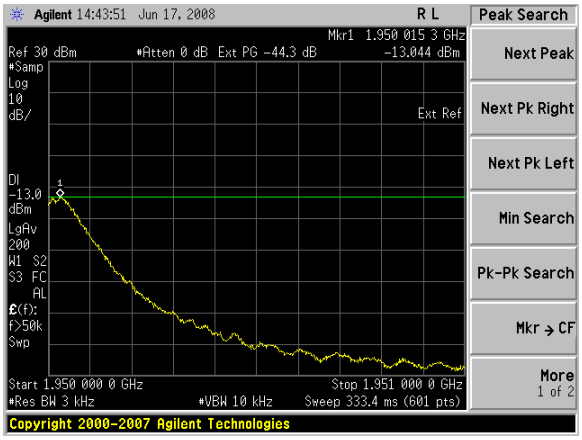
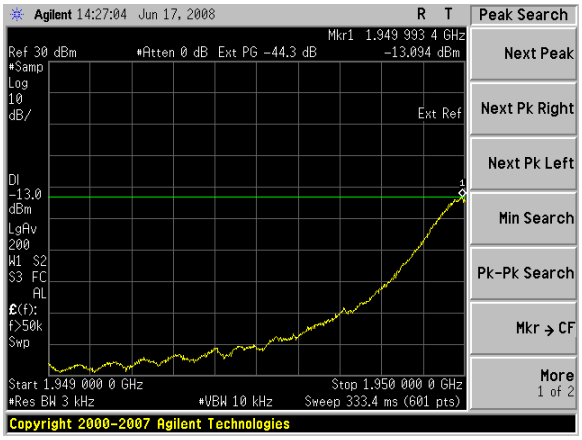
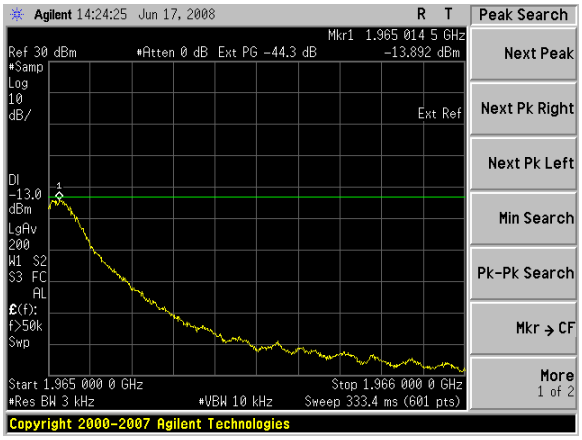
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (46 dBm = 39.8 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (39.8) = 59 dB
The measured output power was 46 dBm therefore the limit is 46 – 59 = -13 dBm.
Spurious measurement is performed with the DDM H2 configuration.
The Nominal power at antenna connector: P max =46 dBm

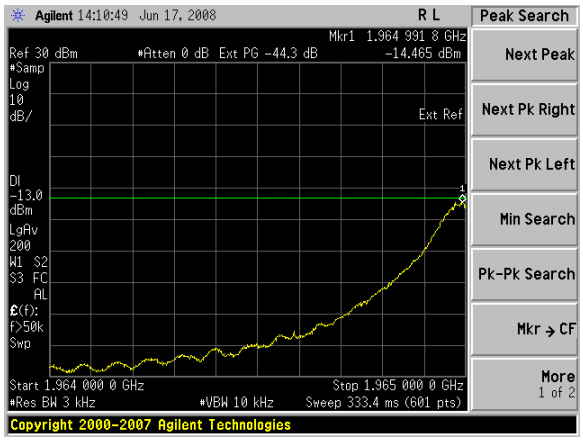
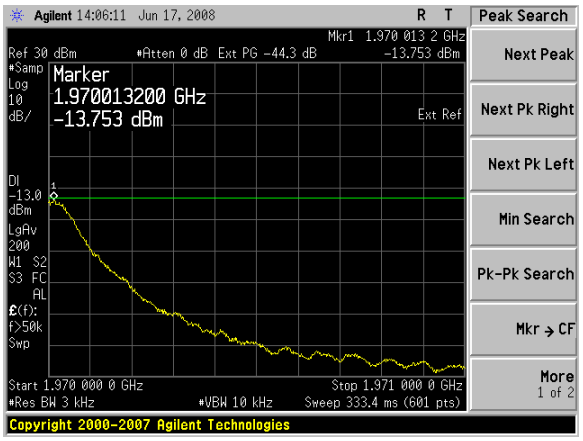
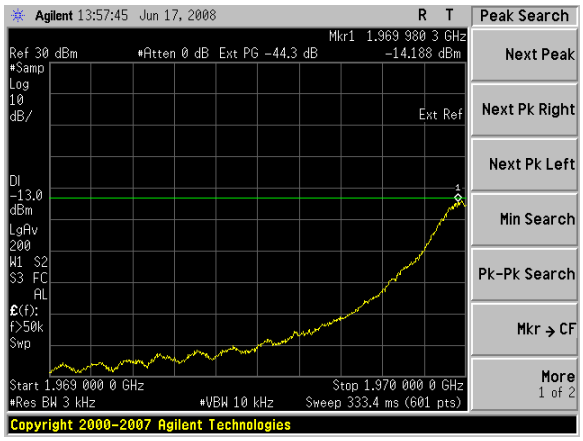
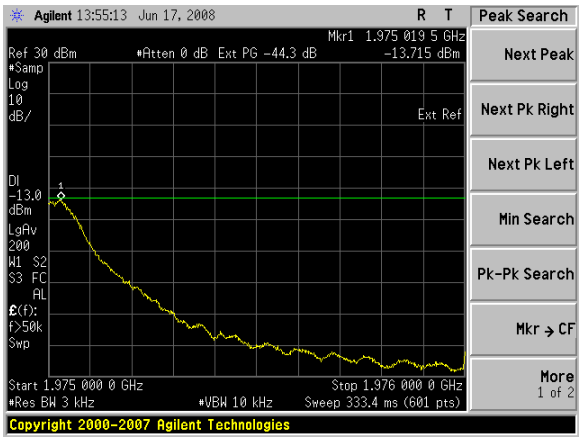
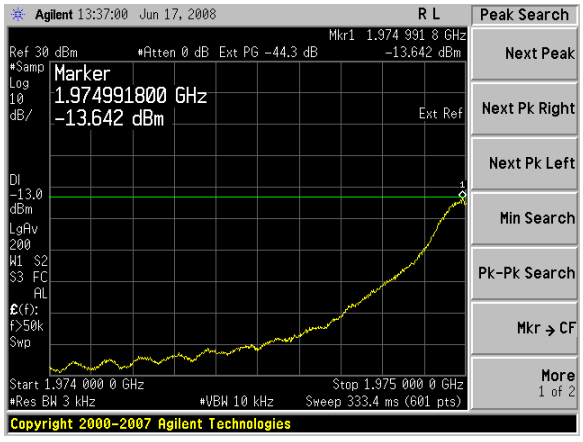
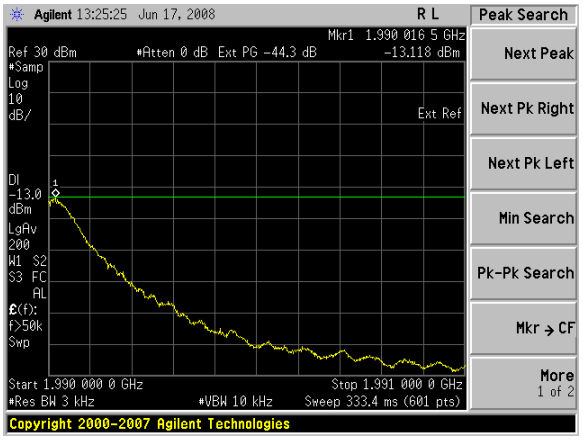
Table show the result for Spurious Emission at Antenna Terminal

Test result for GMSK Modulation Dp Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512				-14.7	-1.7
585				-13.6	-0.6
587				-14.5	-1.5
610				-13.0	0.0
612				-13.1	-0.1
685				-13.9	-0.9
687				-14.5	-1.5
710				-13.8	-0.8
712				-14.2	-1.2
735				-13.7	-0.7
737				-13.6	-0.6
810				-13.1	-0.1

Figure: In Band – Edge block channel – 1MHz adjacent band
GMSK Modulation – Dp configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax-6dB	C585 Pmax-6dB
	
C587 Pmax-6dB	C610 Pmax-6dB
	
C612 Pmax-6dB	C685 Pmax-6dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax-6dB	C710 Pmax-6dB
	
C712 Pmax-6dB	C735 Pmax-6dB
	
C737 Pmax-6dB	C810 Pmax-6dB
	

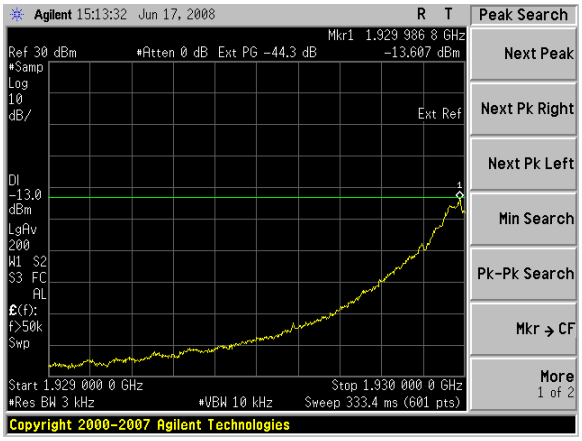
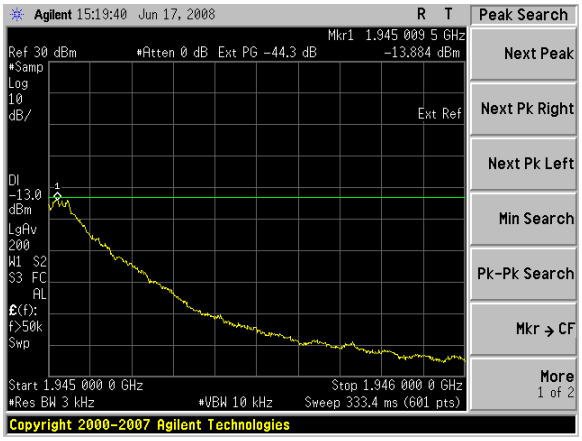
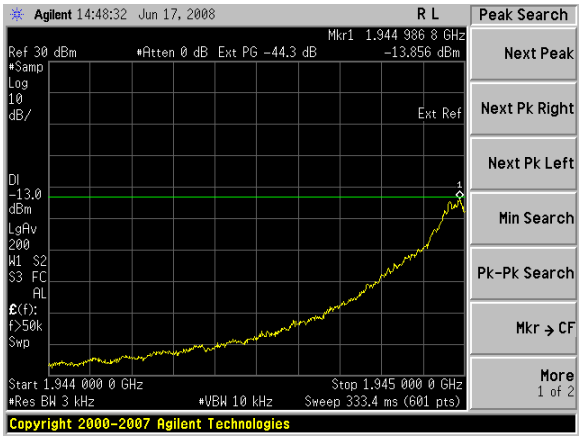
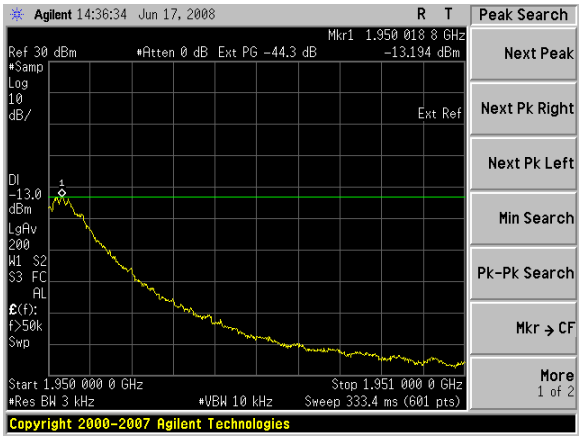
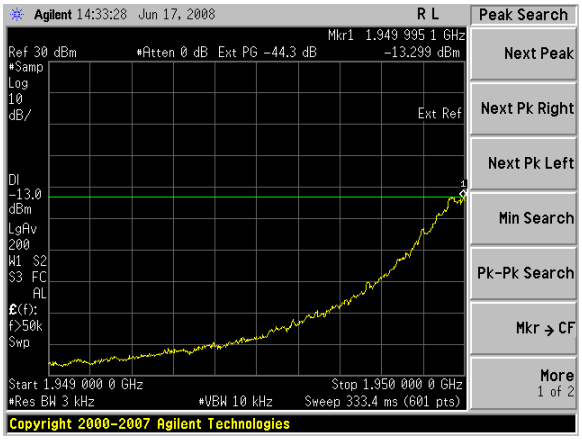
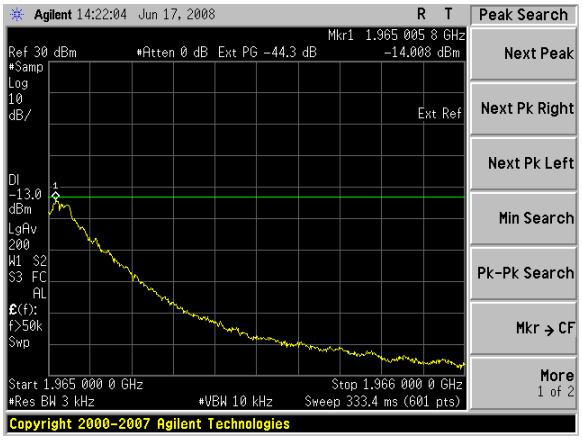
- **8PSK MODULATION**

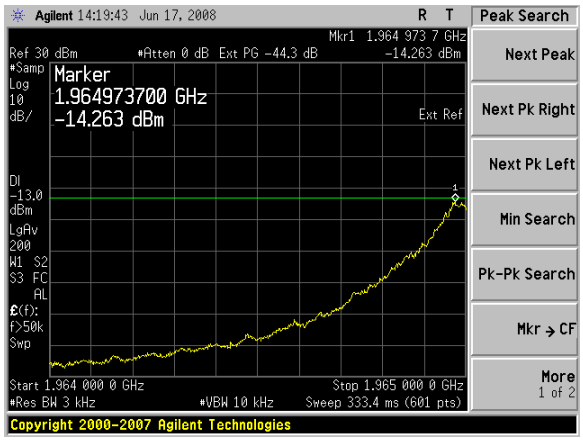
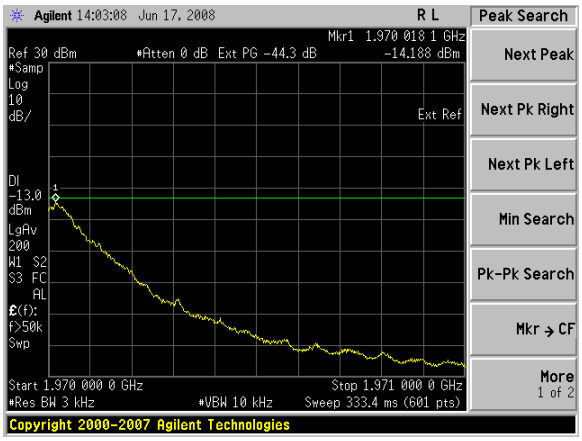
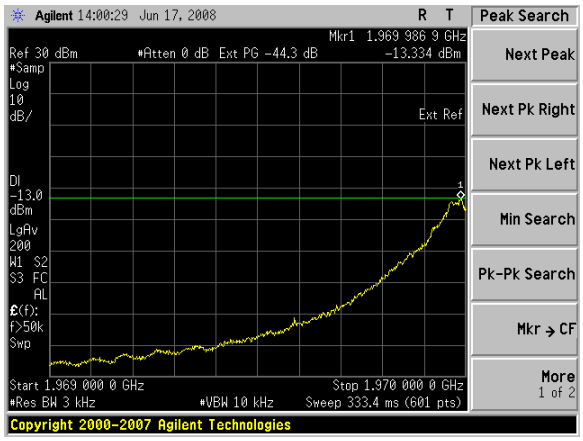
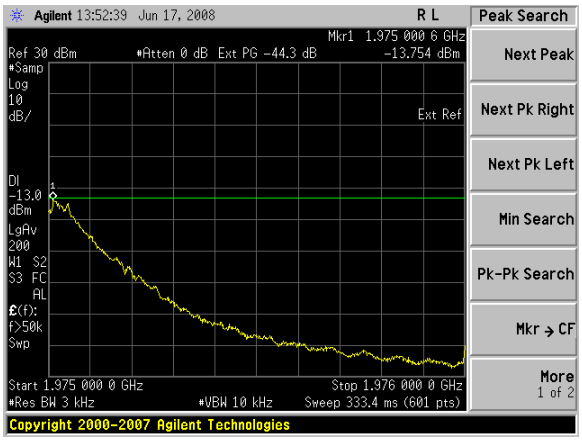
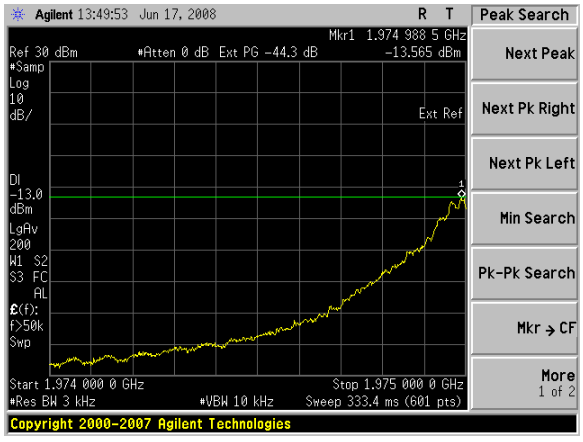
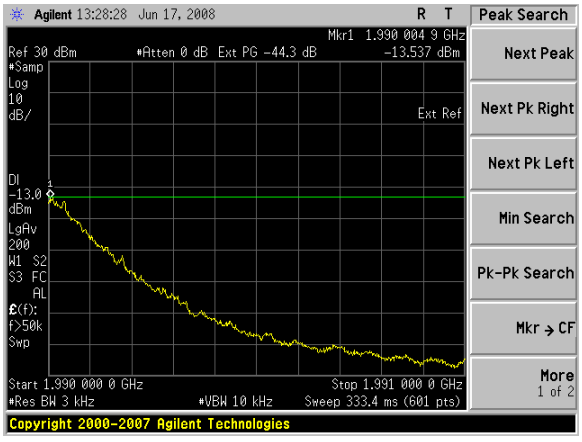
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (44 dBm = 25.1 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (25.1) = 57 dB
The measured output power was 44 dBm therefore the limit is 44 – 57 = -13 dBm.
Spurious measurement is performed with the DDM H2 configuration.
The Nominal power at antenna connector: Pmax =44 dBm

Test result for 8PSK Modulation Dp Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512			-13.6		-0.6
585		-13.9			-0.9
587			-13.9		-0.9
610			-13.2		-0.2
612			-13.3		-0.3
685			-14.0		-1.0
687			-14.3		-1.3
710			-14.2		-1.2
712			-13.3		-0.3
735			-13.8		-0.8
737			-13.6		-0.6
810			-13.5		-0.5

Figure: In Band – Edge block channel – 1MHz adjacent band
8PSK Modulation – Dp configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax-4dB	C585 Pmax-2dB
	
C587 Pmax-4dB	C610 Pmax-4dB
	
C612 Pmax-4dB	C685 Pmax-4dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax-4dB	C710 Pmax-4dB
	
C712 Pmax-4dB	C735 Pmax-4dB
	
C737 Pmax-4dB	C810 Pmax-4dB
	

5.5.3.3 RM2 30/30W WITH DDM H2 CONFIGURATION

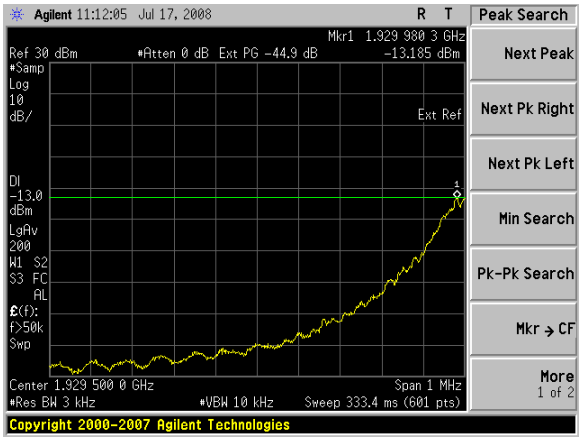
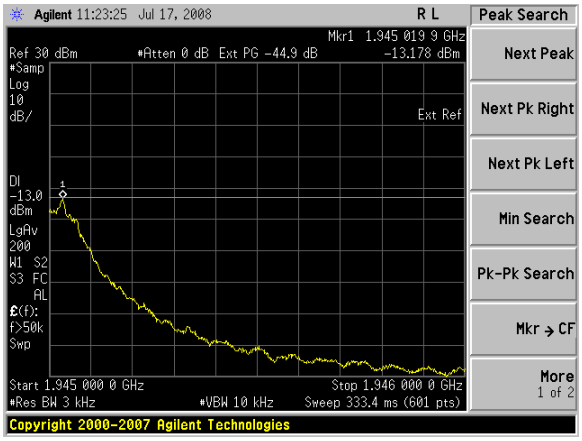
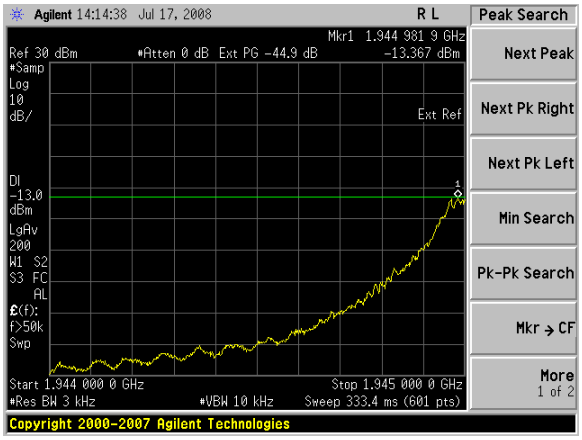
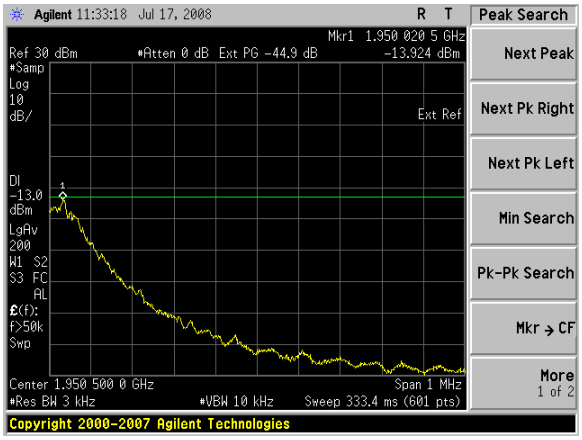
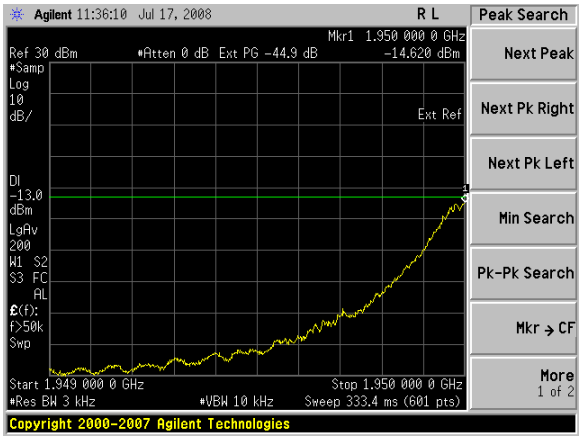
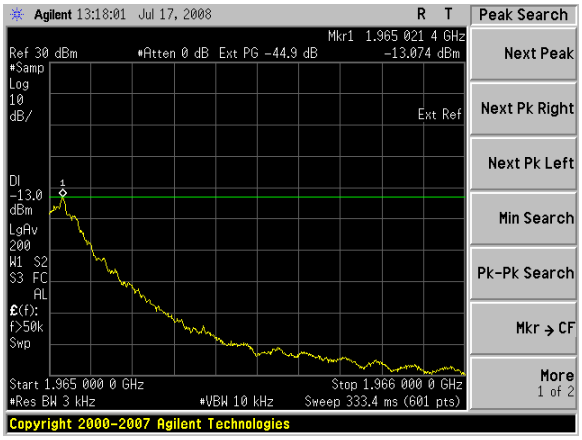
- **GMSK MODULATION**

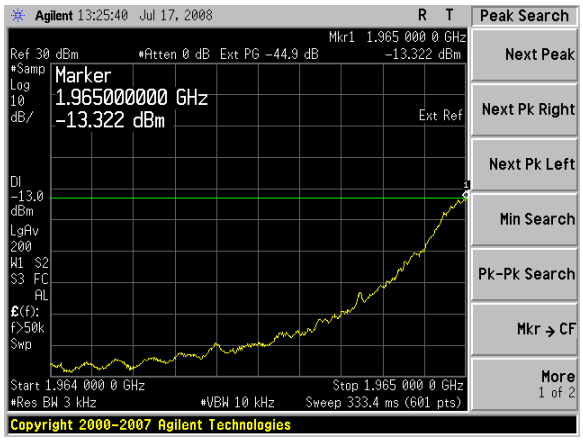
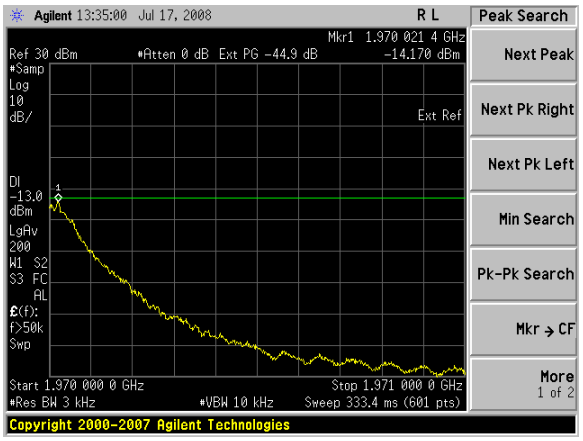
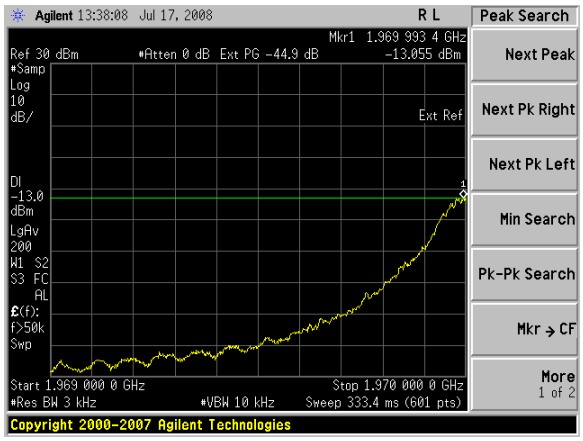
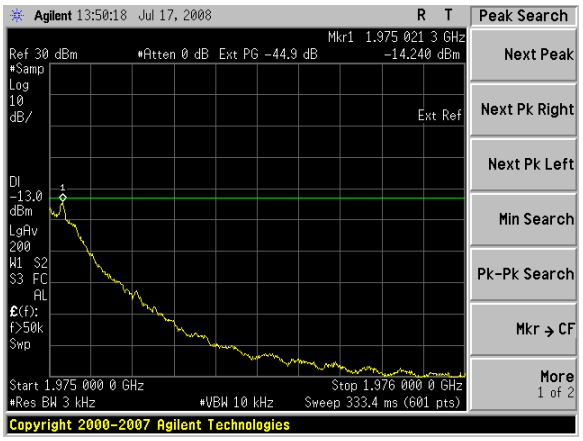
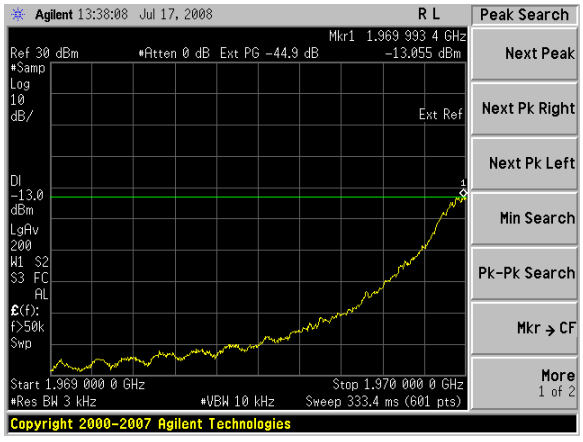
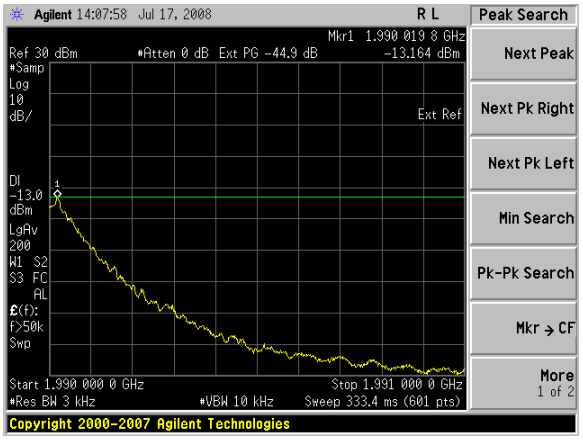
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (40.5 dBm = 11.2 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (17.8) = 53.5 dB
The measured output power was 44 dBm therefore the limit is 40.5 – 53.5= -13 dBm.
Spurious measurement is performed with the DDM diplexer configuration.
The Nominal power at antenna connector: P max =40.5 dBm

Test result for GMSK Modulation H2 Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512	-13.2				-0.2
585		-13.2			-0.2
587	-13.4				-0.4
610		-13.9			-0.9
612		-14.6			-1.6
685		-13.1			-0.1
687	-13.3				-0.3
710		-14.2			-1.2
712	-13.1				-0.1
735		-14.2			-1.2
737	-13.1				-0.1
810		-13.2			-0.2

Figure: In Band – Edge block channel – 1MHz adjacent band
GMSK Modulation – H2 configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax	C585 Pmax-2dB
	
C587 Pmax	C610 Pmax-2dB
	
C612 Pmax-2dB	C685 Pmax-2dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax	C710 Pmax-2dB
	
C712 Pmax	C735 Pmax-2dB
	
C737 Pmax	C810 Pmax-2dB
	

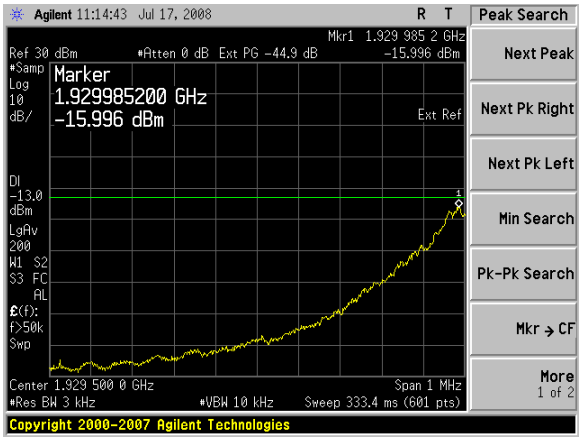
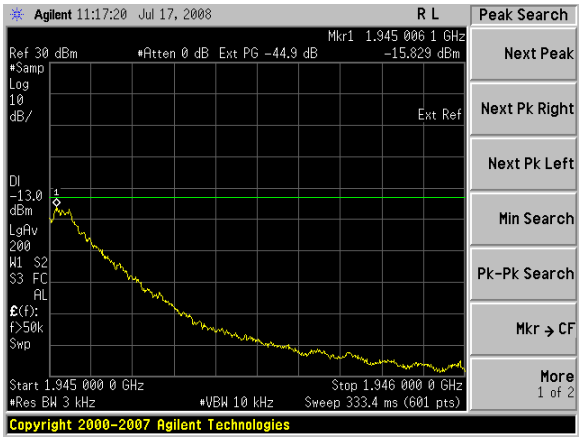
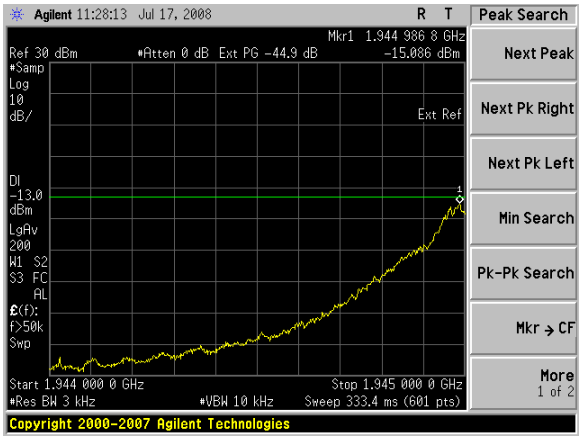
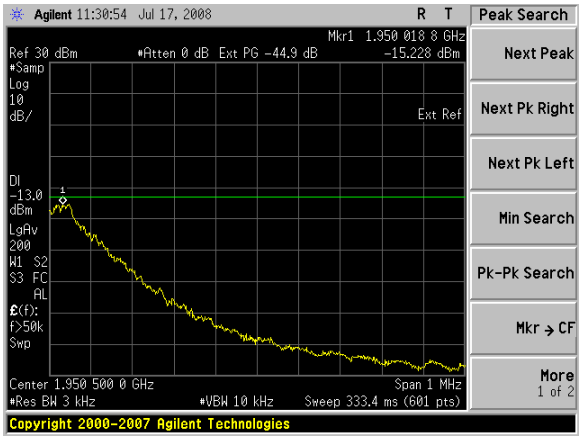
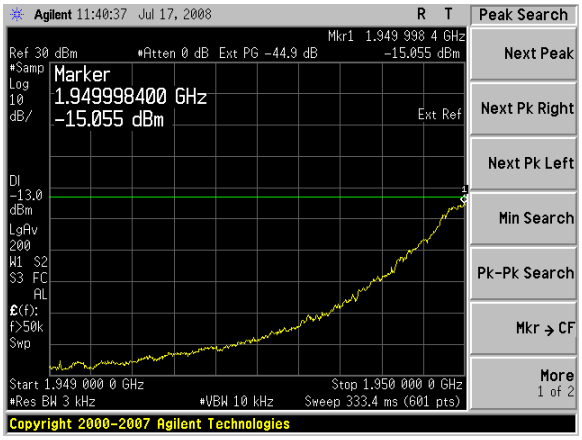
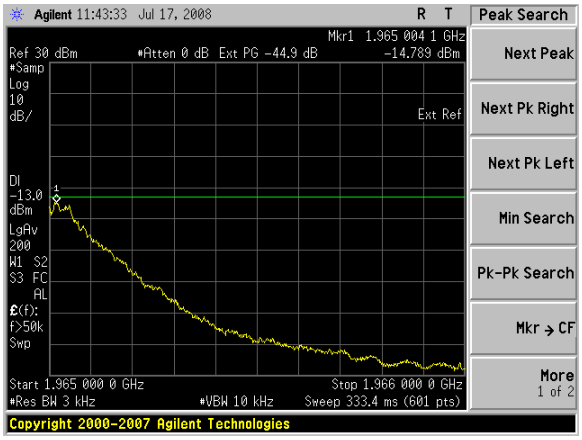
- **8PSK MODULATION**

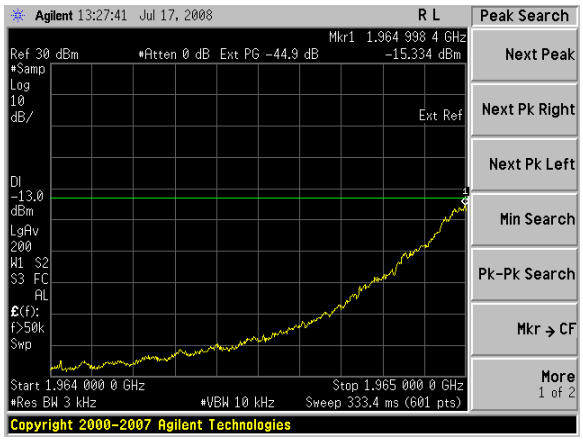
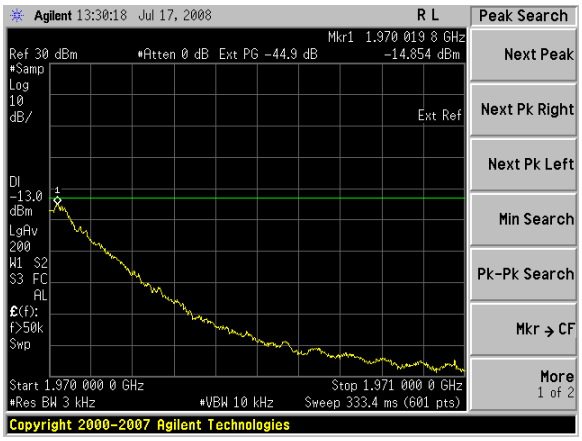
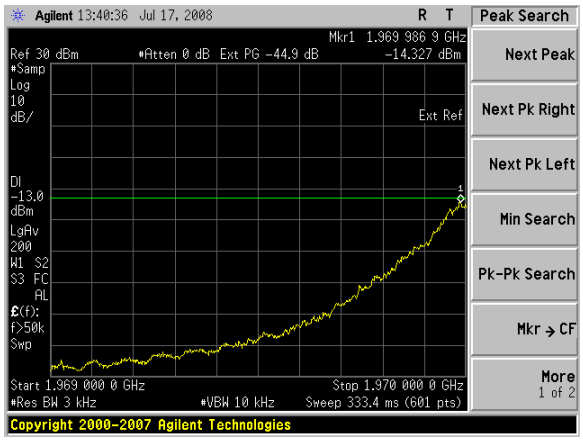
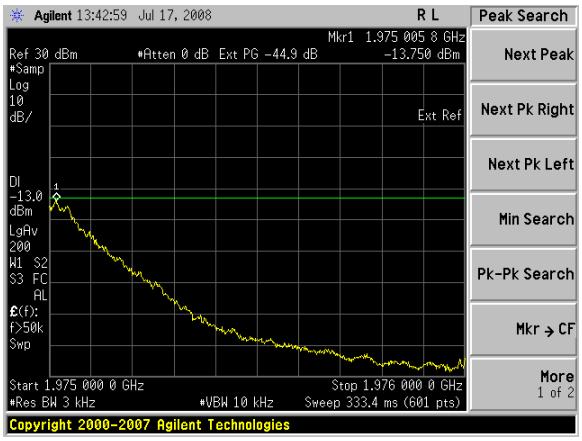
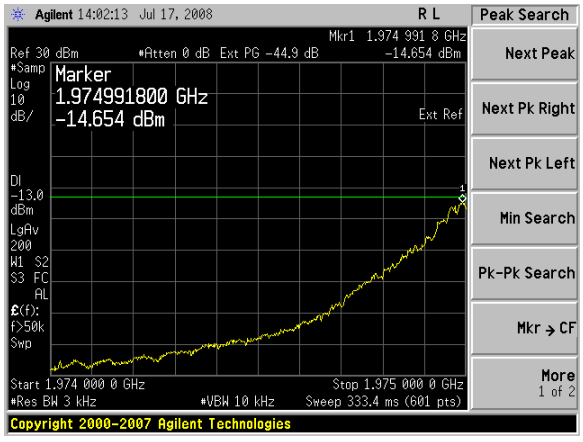
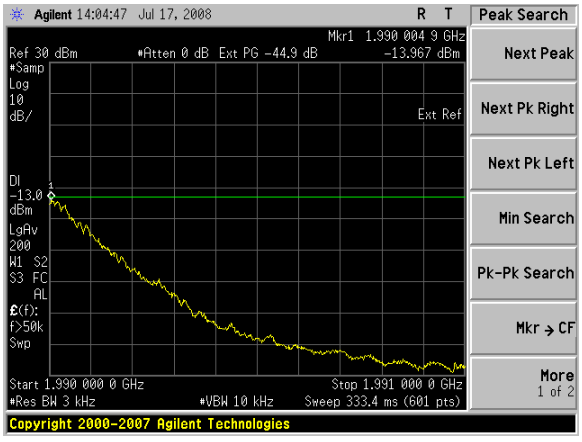
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (40.5 dBm = 11.2 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (17.8) = 53.5 dB
The measured output power was 44 dBm therefore the limit is 40.5 – 53.5= -13 dBm.
Spurious measurement is performed with the DDM diplexer configuration.
The Nominal power at antenna connector: P max =40.5 dBm

Test result for 8PSK Modulation H2 Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512	-16.0				-3.0
585	-15.8				-2.8
587	-15.1				-2.1
610	-15.2				-2.2
612	-15.1				-2.1
685	-14.8				-1.8
687	-15.3				-2.3
710	-14.9				-1.9
712	-14.3				-1.3
735	-13.8				-0.8
737	-14.7				-1.7
810	-14.0				-1.0

Figure: In Band – Edge block channel – 1MHz adjacent band
8PSK Modulation – H2 configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax	C585 Pmax
	
C587 Pmax	C610 Pmax
	
C612 Pmax	C685 Pmax
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax	C710 Pmax
	
C712 Pmax	C735 Pmax
	
C737 Pmax	C810 Pmax
	

5.5.3.4 RM2 30/30W WITH DDM DIPLEXER CONFIGURATION

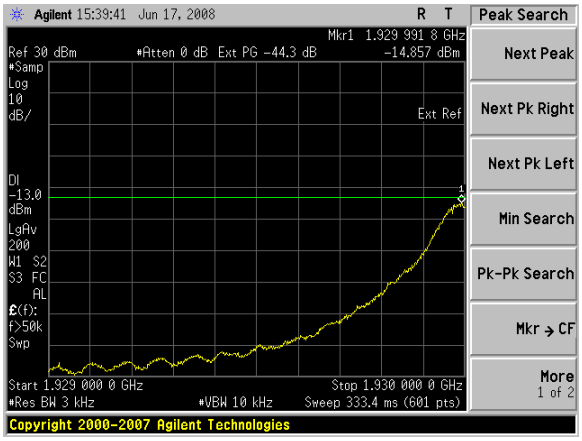
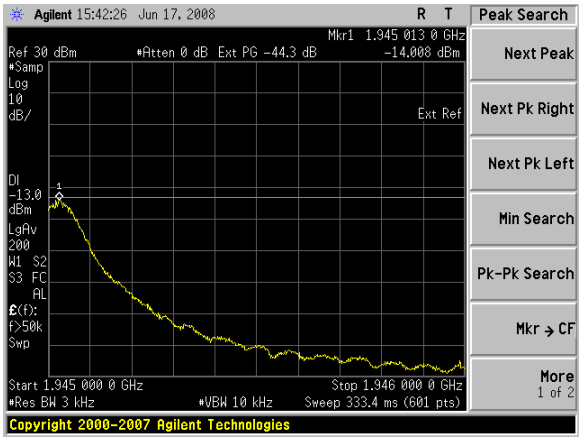
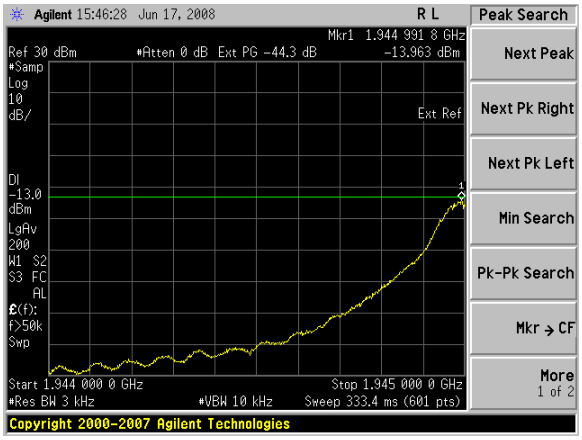
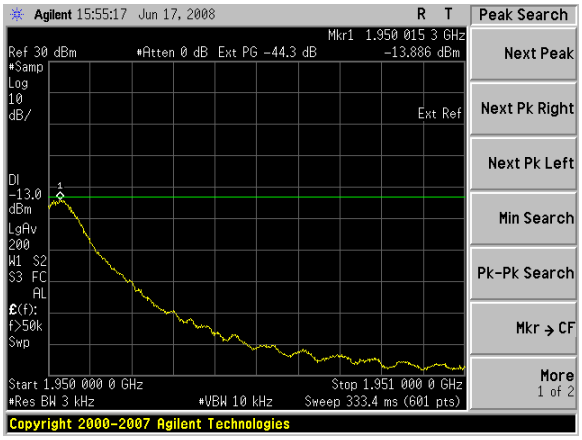
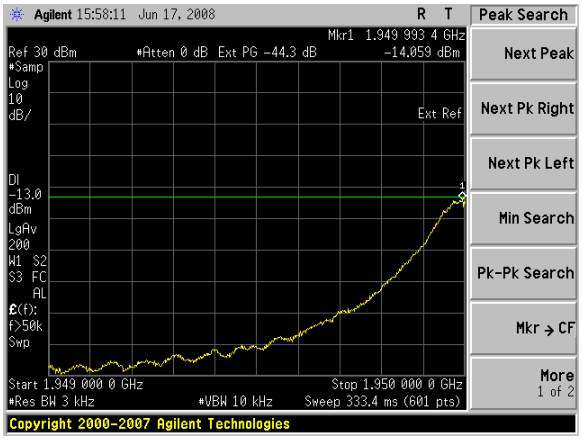
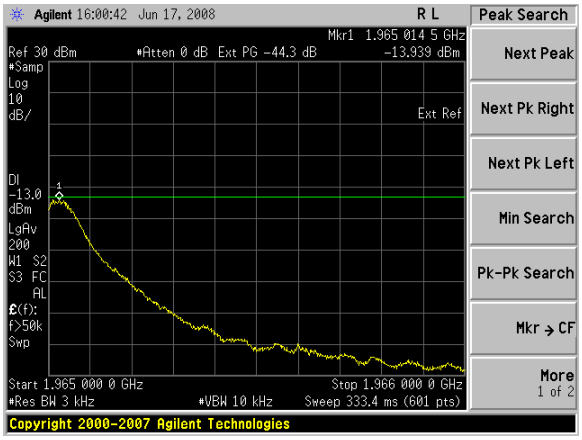
- **GMSK MODULATION**

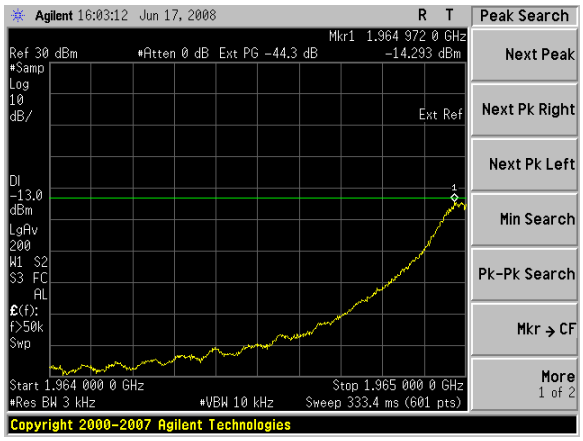
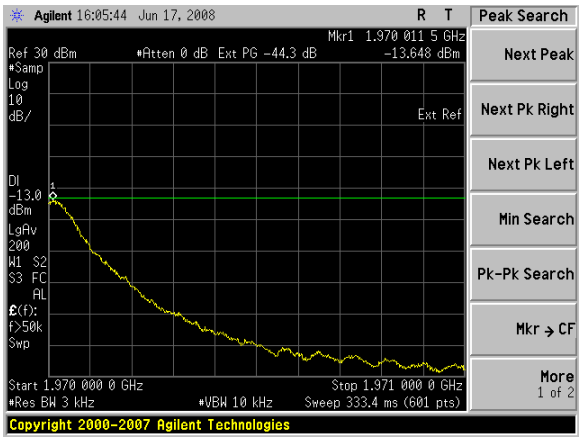
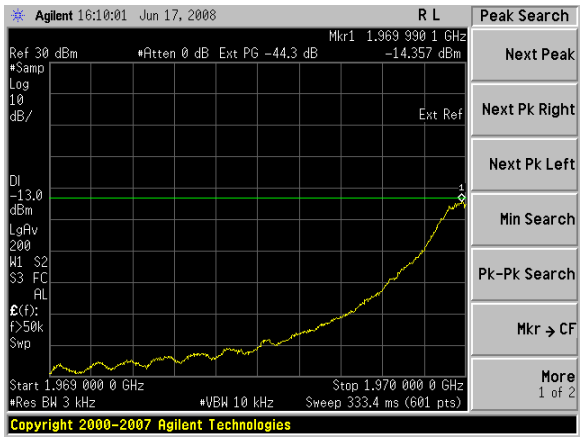
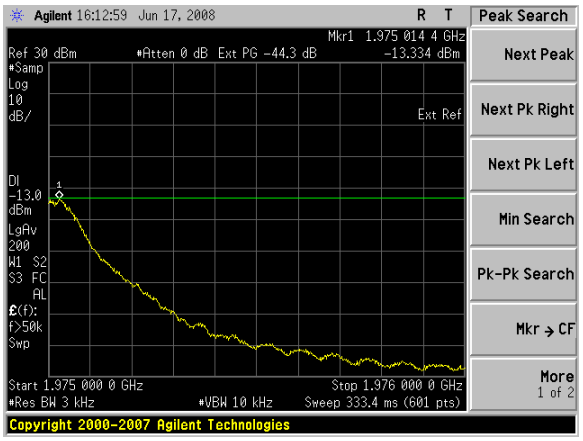
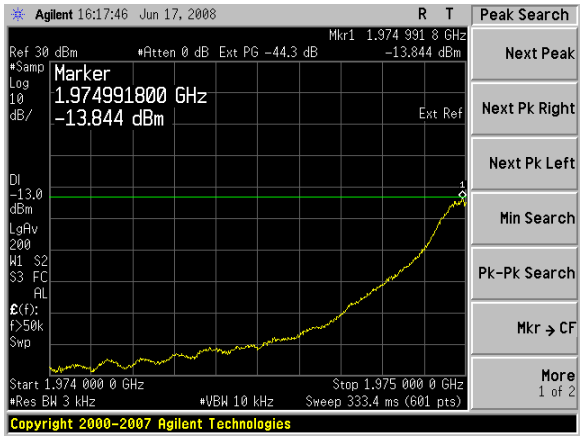
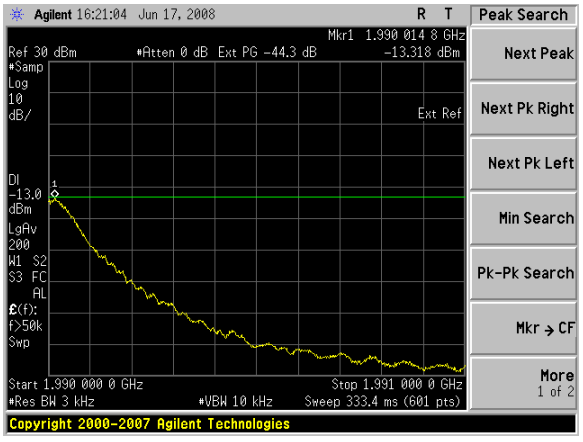
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (44 dBm = 25.1 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (25.1) = 57 dB
The measured output power was 44 dBm therefore the limit is 44 – 57= -13 dBm.
Spurious measurement is performed with the DDM diplexer configuration.
The Nominal power at antenna connector: P max =44 dBm

Test result for GMSK Modulation Dp Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512			-14.9		-1.9
585			-14.0		-1.0
587			-14.0		-1.0
610			-13.9		-0.9
612			-14.1		-1.1
685			-13.9		-0.9
687			-14.3		-1.3
710			-13.6		-0.6
712			-14.4		-1.4
735			-13.3		-0.3
737			-13.8		-0.8
810			-13.3		-0.3

Figure: In Band – Edge block channel – 1MHz adjacent band
GMSK Modulation – Dp configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax-4dB	C585 Pmax-4dB
	
C587 Pmax-4dB	C610 Pmax-4dB
	
C612 Pmax-4dB	C685 Pmax-4dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax-4dB	C710 Pmax-4dB
	
C712 Pmax-4dB	C735 Pmax-4dB
	
C737 Pmax-4dB	C810 Pmax-4dB
	

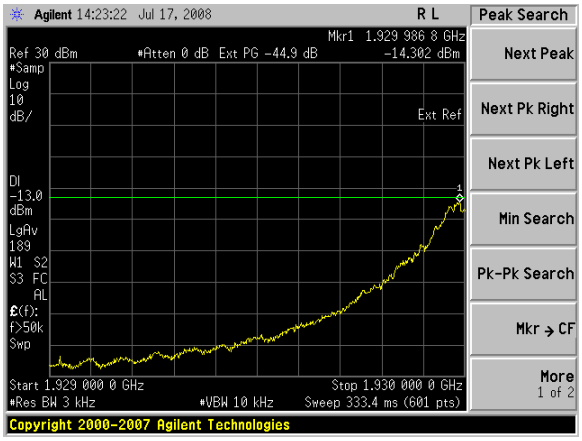
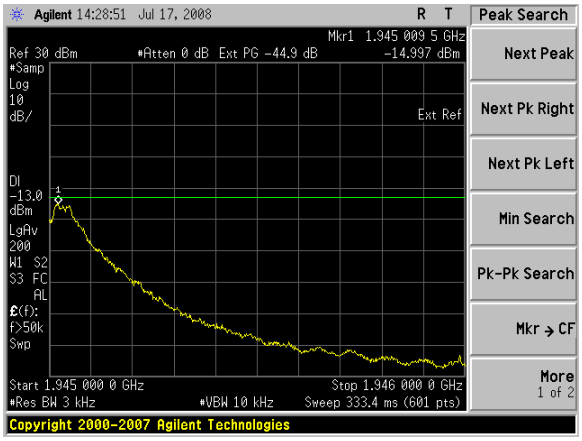
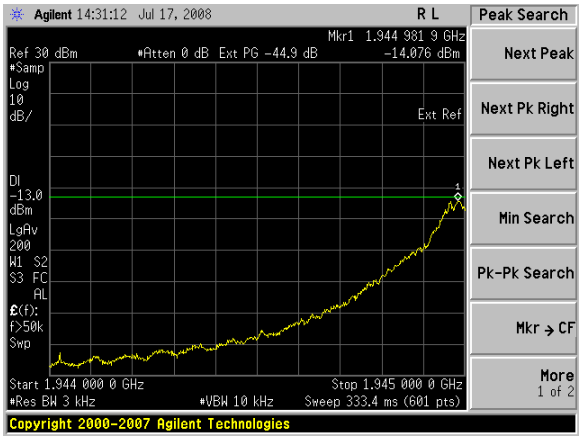
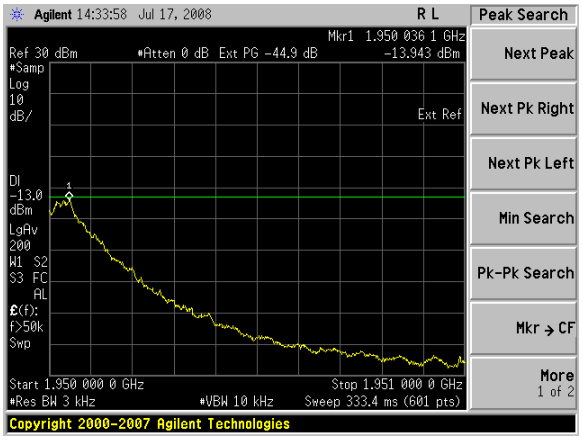
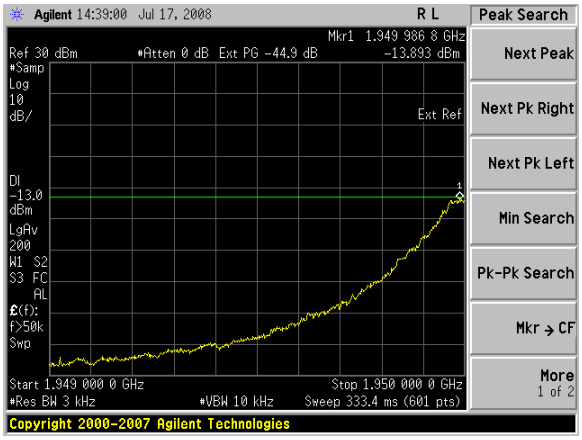
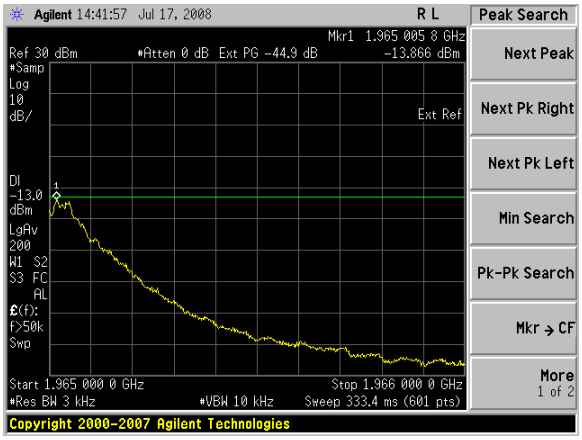
- **8PSK MODULATION**

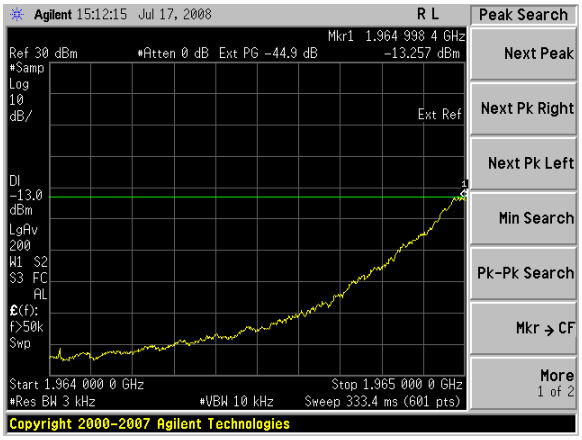
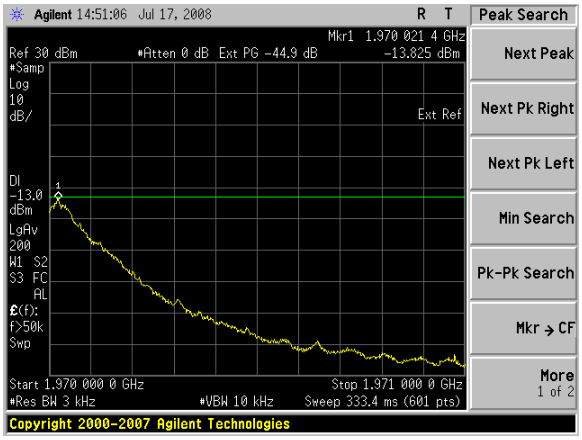
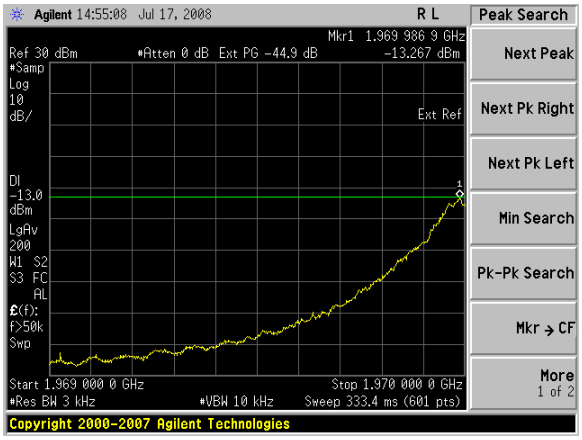
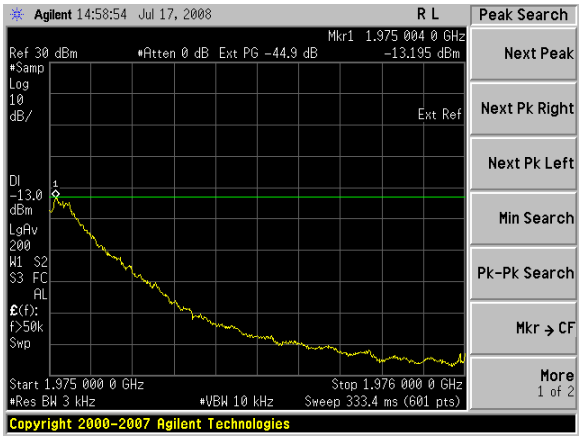
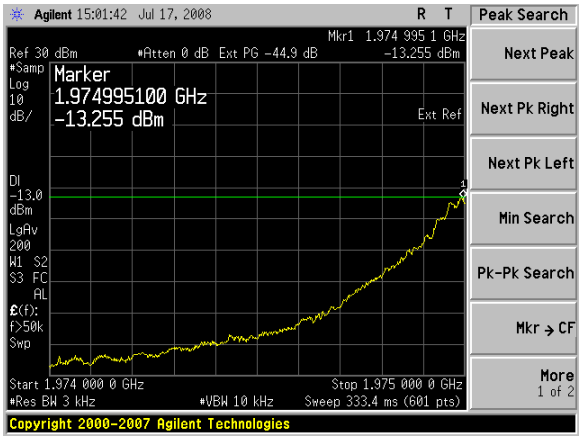
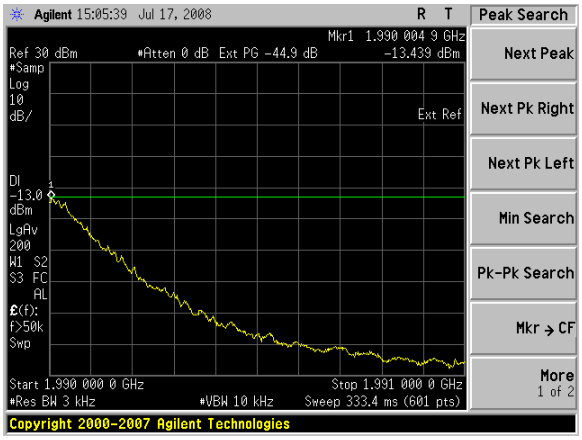
The reference level for spurious emissions at the antenna terminals is taken from the measured output power (44 dBm = 25.1 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log (25.1) = 57 dB
The measured output power was 44 dBm therefore the limit is 44 – 57= -13 dBm.
Spurious measurement is performed with the DDM diplexer configuration.
The Nominal power at antenna connector: P max =44 dBm

Test result for 8PSK Modulation Dp Configuration

Channel	Spurious Emission Level (dBm)				Margin (dB)
	Power Level (Pmax)	Power Level (Pmax-2)	Power Level (Pmax-4)	Power Level (Pmax-6)	
512		-14.3			-1.3
585		-15.0			-2.0
587		-14.1			-1.1
610		-13.9			-0.9
612		-13.9			-0.9
685		-13.9			-0.9
687	-13.3				-0.3
710		-13.8			-0.8
712		-13.3			-0.3
735		-13.2			-0.2
737		-13.3			-0.3
810		-13.4			-0.4

Figure: In Band – Edge block channel – 1MHz adjacent band
8PSK Modulation – Dp configuration

-1 MHz adjacent band	+1MHz adjacent band
C512 Pmax-4dB	C585 Pmax-4dB
	
C587 Pmax-4dB	C610 Pmax-4dB
	
C612 Pmax-4dB	C685 Pmax-4dB
	

-1 MHz adjacent band	+1MHz adjacent band
C687 Pmax-2dB	C710 Pmax-4dB
	
C712 Pmax-4dB	C735 Pmax-4dB
	
C737 Pmax-4dB	C810 Pmax-4dB
	

Result Summary:

Module	Coupling configuration	Power limitation	
		GMSK	8PSK
RM2 PCS1900 50W/30W	DDM Dp	Pmax-6	Pmax-4
	DDM H2	Pmax-4	Pmax
RM2 PCS1900 30W/30W	DDM Dp	Pmax-4	Pmax-2
	DDM H2	Pmax-2	Pmax

5.5.3.5 OUT OF BLOCK SPURIOUS EMISSION

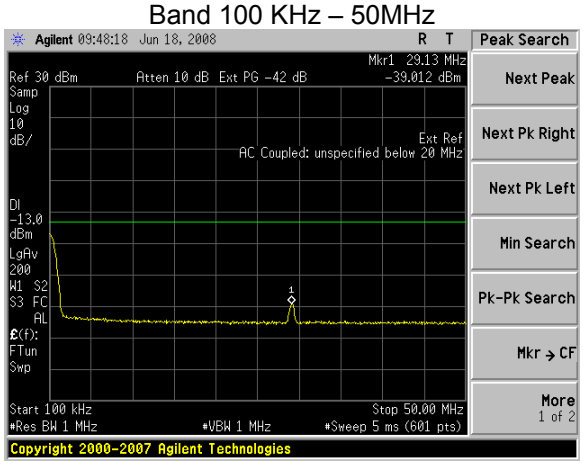
- **Test result for MPRM 50W/30W Diplexer configuration – Pmax @ C810**

Power	Frequuency MHz	Spurious Level GMSK (dBm)	Spec. (dBm)	Margin (dB)
Pmax	100 kHz - 50 MHz	-39.0	-13	-26.0
	50 MHz - 500 MHz	-42.7	-13	-29.7
	500 MHz - 1970.2 MHz	-40.9	-13	-27.9
	1970.2 MHz - 1974 MHz	-56.0	-13	-43.0
	1974 MHz - 1975 MHz	-65.1	-13	-52.1
	1991 MHz - 1994.8 MHz	-51.5	-13	-38.5
	1994.8 MHz - 4 GHz	-36.5	-13	-23.5
	4 GHz - 8 GHz	-35.1	-13	-22.1
	8 GHz - 12 GHz	-34.4	-13	-21.4
	12 GHz - 20 GHz	-30.4	-13	-17.4
Margin				<-17

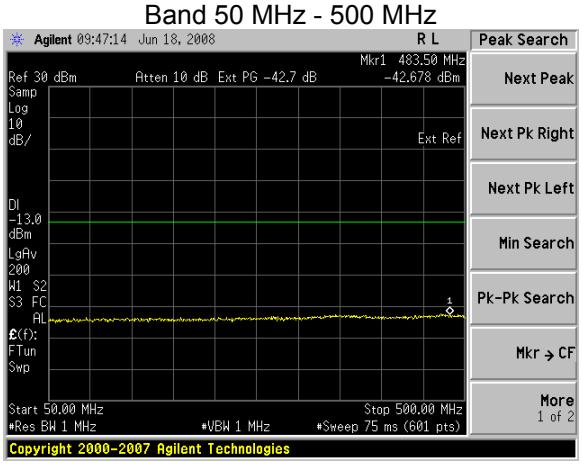
Spurious out of block is performed only on RM2 PCS1900 50W Dp configuration in GMSK modulation which is the worst emission case.
As the margin is greater than 17dB, the RM2 1900 30W spurious compliance is ensured with the compliance of RM2 PCS1900 (50W).

Figure: Out of block emission
GMSK Modulation – HD Configuration

Band 100 KHz – 50MHz

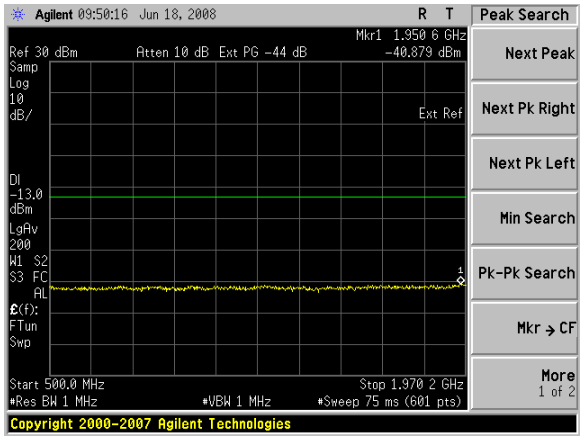


Band 50 MHz - 500 MHz

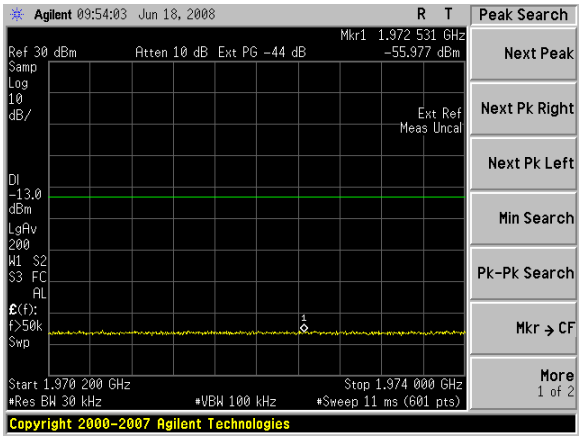


Note: spectrum line at 100KHz are internal DC spectrum line of Analyzer

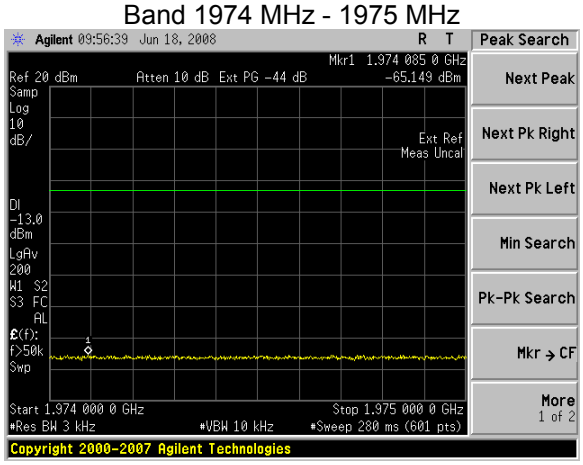
Band 500 MHz - 1970.2 MHz



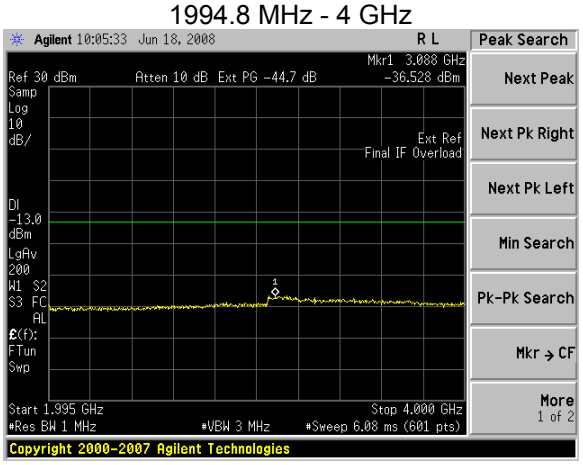
Band 1970.2 MHz - 1974 MHz



Band 1974 MHz - 1975 MHz

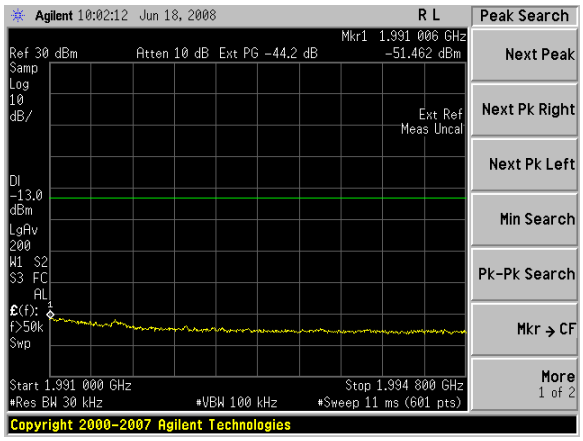


1994.8 MHz - 4 GHz

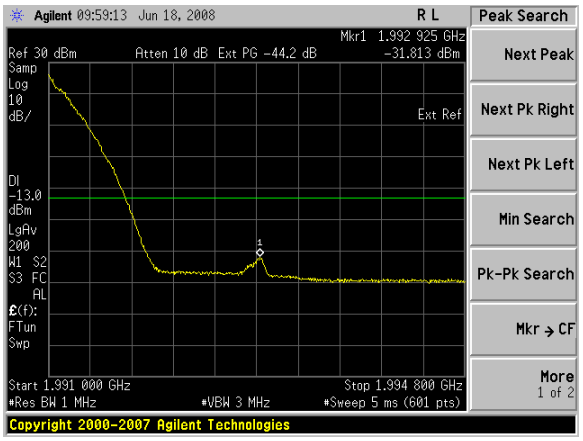


Band 1991 MHz - 1994.8 MHz

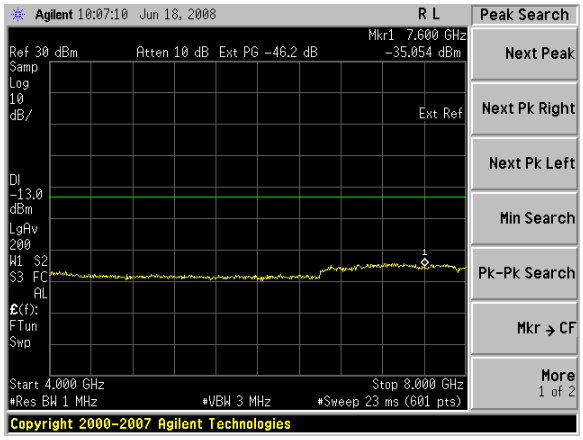
RBW = 30KHz



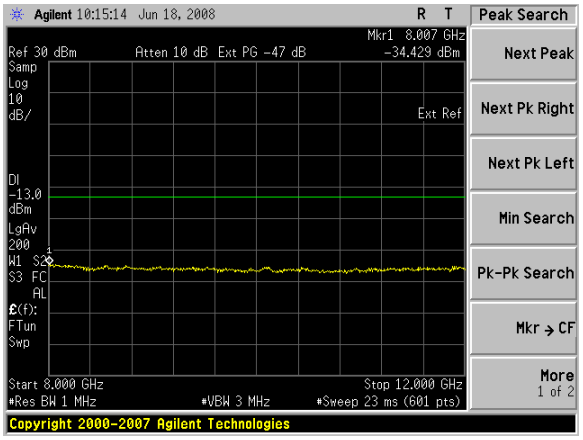
RBW = 1MHz



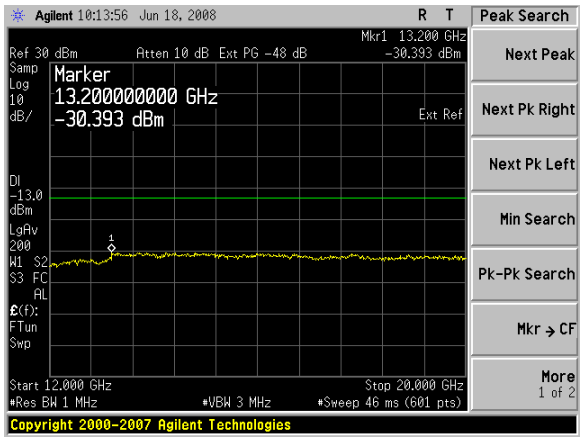
Band 4 GHz - 8 GHz



Band 8 GHz - 12 GHz



Band 12 GHz - 20 GHz



6. GLOBAL CONCLUSION

- **Interconnect Digital board**

HARDWARE EQUIPEMENT UNDER TEST		
Description	**Hardware code**	**Comment**
Interconnect board		
Logical board		
IFM 0 - IFM 1	NTN025AA NTN025AF	
ICM 0 - ICM 1	NTN023AA NTN023AF	
ABM 0 – ABM 1	NTN029AA NTN029AA	
RICAM	NTN024AA	

- **GSM1900 Radio Modules used with 30W Power Amplifier configuration**

Radio modules PCS1900		
RM 30W PCS1900	NTN050PM	
PCS1900 Coupling module		
PCS1900 DDM H2	NTN063AA NTN063AM	DDM 1900 W/VSWR W/HYBRIDS DDM 1900 W/O VSWR W/HYBRIDS
PCS1900 DDM	NTN063BA NTN063BM	DDM 1900 W/VSWR W/O HYBRIDS DDM 1900 W/O VSWR W/O HYBRIDS
TXF H2	NTN064AA NTN064AM	TX FILTER 1900 W/VSWR W/HYB TX FILTER 1900 W/O VSWR W/HYB
TXF H2	NTN064BA NTN064BM	TX FILTER 1900 W/VSWR W/O HYB TX FILTER 1900 W/O VSWR W/OHYB

Power limitation to comply to Adjacent Band spurious at antenna connector

Coupling configuration	**System Power limitation** **GMSK modulation**	**System Power limitation** **8 PSK modulation**
DDM Duplexer Tx Filter (without H2)	**Power Limitation : Pmax – 2 dB = 42.5 dBm**	**Power Limitation : Pmax – 2 dB = 42 dBm**
DDM H2 Tx Filter H2	**Pmax = 41 dBm**	**Pmax = 40.5 dBm**

- **GSM1900 RM2 Radio Modules 30W Power Amplifier configuration**

Radio modules PCS1900		
RM 30W PCS1900	NTN050CP	
PCS1900 Coupling module		
PCS1900 DDM H2	NTN063AA NTN063AM	DDM 1900 W/VSWR W/HYBRIDS DDM 1900 W/O VSWR W/HYBRIDS
PCS1900 DDM	NTN063BA NTN063BM	DDM 1900 W/VSWR W/O HYBRIDS DDM 1900 W/O VSWR W/O HYBRIDS
TXF H2	NTN064AA NTN064AM	TX FILTER 1900 W/VSWR W/HYB TX FILTER 1900 W/O VSWR W/HYB
TXF H2	NTN064BA NTN064BM	TX FILTER 1900 W/VSWR W/O HYB TX FILTER 1900 W/O VSWR W/OHYB

Power limitation to comply to Adjacent Band spurious at antenna connector

Coupling configuration	**System Power limitation** **GMSK modulation**	**System Power limitation** **8 PSK modulation**
DDM Duplexer Tx Filter (without H2)	**Power Limitation : Pmax – 4 dB =40 dBm**	**Power Limitation : Pmax – 2dB =42 dBm**
DDM H2 Tx Filter H2	**Pmax – 2 dB= 38.5 dBm**	**Pmax = 40.5 dBm**

- **GSM1900 RM2 Radio Modules 50W Power Amplifier configuration**

Radio modules PCS1900		
RM 50W PCS1900	NTN050PP	
PCS1900 Coupling module		
PCS1900 DDM H2	NTN063AA NTN063AM	DDM 1900 W/VSWR W/HYBRIDS DDM 1900 W/O VSWR W/HYBRIDS
PCS1900 DDM	NTN063BA NTN063BM	DDM 1900 W/VSWR W/O HYBRIDS DDM 1900 W/O VSWR W/O HYBRIDS
TXF H2	NTN064AA NTN064AM	TX FILTER 1900 W/VSWR W/HYB TX FILTER 1900 W/O VSWR W/HYB
TXF H2	NTN064BA NTN064BM	TX FILTER 1900 W/VSWR W/O HYB TX FILTER 1900 W/O VSWR W/OHYB

Power limitation to comply to Adjacent Band spurious at antenna connector

Coupling configuration	**System Power limitation** **GMSK modulation**	**System Power limitation** **8 PSK modulation**
DDM Duplexer Tx Filter (without H2)	**Power Limitation : Pmax –6 dB = 40 dBm**	**Power Limitation : Pmax – 4dB** = 40 dBm
DDM H2 Tx Filter H2	**Pmax –4 = 38.5 dBm**	Pmax = 40.5 dBm

- **GSM850 Radio Modules used with 60W Power Amplifier configuration**

Description	Hardware code	Serial Number	Comment
Radio Modules GSM 850			
HPRM 3T 60W GSM850	NTN050JA	CDN200651002	Radio Module 850Mhz (GMSK 60W / 8PSK 45W)
Full Band coupling (*Tx Band 869-894 MHz)*			
DDM 850 H2	NTN063HA	FICT02002064	With TOS meter
	NTN063HM	FICT02002064	With out TOS meter
DDM 850	NTN063JA	FICT02002064	With TOS meter
	NTN063JM	FICT02002064	With out TOS meter
Tx Filter 850 H2	NTN064HA	FICT02001XL4	With TOS meter
	NTN064HM	FICT02001XL4	Without TOS meter
Tx Filter 850	NTN064JA	FICT02001XL4	With TOS meter
	NTN064JM	FICT02001XL4	Without TOS meter

Power limitation to comply with Adjacent Band spurious at antenna connector:

Coupling configuration	System Power limitation GMSK modulation	System Power limitation 8 PSK modulation
Diplexer Tx Filter	Power Limitation : Pmax – 6 dB = 41.3 dBm Except ARFCN 238 , 241 : Pmax	Power Limitation : Pmax – 4 dB = 42.4 dBm Except ARFCN 238 , 241 : Pmax
DDM 850	Power Limitation : Pmax – 2 dB = 42 dBm Except ARFCN 238, 241 : Pmax	Pmax= 43 dBm

For Edge Channel ARFCN 128, 131, 133, 181, 183, 231, 233, 251, power has to be reduced by 6dB (GMSK) or 4dB (8PSK) in order to meet spurious emission requirement.

For Edge Channel ARFCN 238, 241, maximum power has allowed to meet spurious emission requirement.