Report On

FCC CFR 47 Part 24 and Industry Canada RSS 133 Testing of the
Ericsson (China) Communications Company Ltd
RRUN19-22 / KRC 161 170/5

COMMERCIAL-IN-CONFIDENCE

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REPORT ON

FCC CFR 47 Part 24 and Industry Canada RSS 133 Testing of the Ericsson (China) Communications Company Ltd
RRUN19-22 / KRC 161 170/5

Document 75905184 Report 01 Issue 1

December 2008

PREPARED FOR

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DATED 04 December 2008

ENGINEERING STATEMENT

The measurements shown in this report were made in accordance with the procedures described on test pages. All reported testing was carried out on a sample equipment to demonstrate limited compliance with FCC CFR 47: Part 24 and Industry Canada RSS 133. The sample tested was found to comply with the requirements defined in the applied rules.

Test Engineer(s);

C Zhang

Q Li

UKAS TESTING 0141

CONTENTS

SECTION 1

REPORT SUMMARY

FCC CFR 47 Part 24 and Industry Canada RSS 133 Testing of the
Ericsson (China) Communications Company Ltd
RRUN19-22 / KRC 161 170/5

1.1 INTRODUCTION

The information contained in this report is intended to show verification of the Ericsson (China) Communications Company Ltd RRUN19-22 / KRC 161 170/5 to the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

Testing was carried out in support of an application for Grant of Equipment Authorisation in the name of Ericsson (China) Communications Company Ltd RRUN19-22 / KRC 161 170/5.

Objective	To perform FCC and Industry Canada Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out.
Manufacturer	Ericsson (China) Communications Company Ltd
Model Number(s)	RRUN19-22
Serial Number(s)	CB 47968839
Software Version	-
Hardware Version	R1B
Number of Samples Tested	1
Test Specification/Issue/Date	FCC CFR 47 Part 24: 2007 Industry Canada RSS 133: 2008
Incoming Release Date	Declaration of Build Status 07 October 2008
Order Number Date	4502682309 26 November 2008
Start of Test	24 November 2008
Finish of Test	02 December 2008
Name of Engineer(s)	C Zhang Q Li
Related Document(s)	FCC CFR 47 Part 2:2007 RSS-Gen Issue 2:2007 ANSI C63.4:2003

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of results in accordance with FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008, is shown below.

Configuration 1 - Base Station							
Section	Spec Clause		Test Description	Mode	Mod State	Result	Comments
	FCC Part 24	Industry Canada RSS 133					
	24.232(a)	6.4	Effective Isotropically Radiated Power	1930.2 MHz	0	N/A	No integral antenna.
				1960 MHz	0	N/A	
				1989.8 MHz	0	N/A	
2.1	24.232 (a)	6.4	Maximum Peak Output Power - Conducted	1930.2 MHz	0	Pass	-
				1960 MHz	0	Pass	
				1989.8 MHz	0	Pass	
2.2	24.232(d)	-	Peak – Average Ratio	1960 MHz	0	Pass	
2.3	2.1047 (d)		Modulation Characteristics	1960 MHz	0	Pass	-
2.4	2.1049, 24.238(b)	2.3	Occupied Bandwidth	1930.2 MHz	0	Pass	-
				1960 MHz	0	Pass	
				1989.8 MHz	0	Pass	
2.5	2.1051, 24.238(b)	6.5	Spurious Emissions at Antenna Terminals (±1MHz)	1930.2 MHz	0	Pass	-
				1960 MHz		N/A	
				1989.8 MHz	0	Pass	
2.6	2.1053, 24.238(a)	6.5	Radiated Spurious Emissions	1930.2 MHz	0	Pass	-
				1960 MHz	0	Pass	
				1989.8 MHz	0	Pass	
2.7	2.1051, 24.238(a)	6.5	Conducted Spurious Emissions	1930.2 MHz	0	Pass	-
				1960 MHz	0	Pass	
				1989.8 MHz	0	Pass	
2.8	-	6.6	Receiver Spurious Emissions	1930.2 MHz	0	Pass	
				1960 MHz	0	Pass	
				1989.8 MHz	0	Pass	
2.9	2.1055, 24.235	6.3	Frequency Stability Under Temperature Variations	1930.2 MHz		N/A	-
				1960 MHz	0	Pass	
				1989.8 MHz		N/A	
2.10	2.1055, 24.235	6.3	Frequency Stability Under Voltage Variations	1930.2 MHz		N/A	-
				1960 MHz	0	Pass	
				1989.8 MHz		N/A	

N/A – Not Applicable

1.3 DECLARATION OF BUILD STATUS

MAIN EUT	
MANUFACTURING DESCRIPTION	Radio Equipment
MANUFACTURER	Ericsson
TYPE	RRUN19-22
PART NUMBER	KRC 161 170/5
SERIAL NUMBER	CB 47968839
HARDWARE VERSION	R1B
SOFTWARE VERSION	--
TRANSMITTER OPERATING RANGE	1930.2MHz - 1989.8MHz
RECEIVER OPERATING RANGE	1850.2MHz – 1909.8MHz
COUNTRY OF ORIGIN	P. R. China
INTERMEDIATE FREQUENCIES	--
ITU DESIGNATION OF EMISSION	250KGXW 250KG7W
HIGHEST INTERNALLY GENERATED FREQUENCY	1989.8MHz
OUTPUT POWER (W or dBm)	43dBm(GMSK), 39.7dBm(8PSK)
FCC ID	WODFKRC161170-5
IC ID	287AH-FG1611705
TECHNICAL DESCRIPTION (a brief description of the intended use and operation)	RRUN19-22 is the radio part of a GSM Radio Base Station

Signature

Jiang Xiaoying

Date 07 November 2008

D of B S Serial No 75905184/01

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.

1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was an Ericsson (China) Communications Company Ltd RRUN19-22 / KRC 161 170/5 working in the public mobile service 1900MHz band which provides communication connections to GSM1900 network. The RRUN19-22 / KRC 161 170/5 operates from a -48V DC volt supply.

The Equipment Under Test (EUT) is shown in the photograph below. A full technical description can be found in the Manufacturers documentation.

Equipment Under Test

1.4.2 Test Configuration

Configuration 1: Radio Equipment

The EUT was configured in accordance with FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

The RRUN19-22 / KRC 161 170/5 supports both GMSK and 8PSK modulation at 1900MHz, the cabinet can house two TRX's. Testing was performed on one TRX RF output connector. The complete testing was performed with both modulation schemes at maximum RF power unless otherwise stated. The EUT was powered by a -48V DC Power supply.

1.4.3 Modes of Operation

Modes of operation of each EUT during testing were as follows:

Mode 1 - 1930.2 MHz (Bottom Channel)

Mode 2 - 1960 MHz (Middle Channel)

Mode 3 - 1989.8 MHz (Top Channel)

Information on the specific test modes utilised are detailed in the test procedure for each individual test.

1.5 TEST CONDITIONS

For all tests the EUT was set up in accordance with the relevant test standard and to represent typical operating conditions. Tests were applied with the EUT situated in a shielded enclosure, test laboratories or an open test area as appropriate.

The EUT was powered from a -48 V DC supply.

1.6 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.7 MODIFICATION RECORD

Modification State	Description of Modification fitted to EUT	Sample S/N
0	Initial sample supplied by customer	CB47968839

No modifications were made to the EUT during testing.

1.8 ALTERNATIVE TEST SITE

Under our UKAS Accreditation, TÜV Product Service Ltd conducted the testing at:

Ericsson Tower, No.5 Lize East Street Chaoyang District, Beijing 100102 China

Except the testing for section 2.5 Radiated Spurious Emission was conducted at following site registrations:

FCC Accreditation
612767 The State Radio Monitoring Center, No.80 Beilishi Road Xicheng District Beijing, China.

Industry Canada Accreditation
7308A The State Radio Monitoring Center, No.80 Beilishi Road Xicheng District Beijing, China.

SECTION 2

TEST DETAILS

FCC CFR 47 Part 24 and Industry Canada RSS 133 Testing of the
Ericsson (China) Communications Company Ltd
RRUN19-22 / KRC 161 170/5

2.1 MAXIMUM PEAK OUTPUT POWER - CONDUCTED

2.1.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 24.232(a)
Industry Canada RSS 133:2008 Clause 6.4

2.1.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.1.3 Date of Test and Modification State

24 November 2008 – Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

Using a spectrum analyzer and attenuator(s), the output power of the EUT was measured at the antenna terminals. The EUT supports GMSK and 8PSK modulation schemes. The carrier power was measured with both modulations and all of the timeslots working.

The spectrum analyzer RBW and VBW were set to 1MHz and the path loss measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.1.6 Environmental Conditions

	24 November 2008
Ambient Temperature	21.4°C
Relative Humidity	28.3%

2.1.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Maximum Peak Output Power - Conducted.

The test results are shown below.

Configuration 1 - Mode 1

	Frequency (MHz)	Path Loss (dB)	Result (dBm)	Result (W)
GMSK	1930.2	41.65	43.44	22.080
8PSK	1930.2	41.65	43.39	21.827

Configuration 1 - Mode 2

	Frequency (MHz)	Path Loss (dB)	Result (dBm)	Result (W)
GMSK	1960	41.65	43.29	21.330
8PSK	1960	41.65	43.28	21.281

Configuration 1 - Mode 3

	Frequency (MHz)	Path Loss (dB)	Result (dBm)	Result (W)
GMSK	1989.8	41.65	43.02	20.045
8PSK	1989.8	41.65	43.03	20.091

Limit	≤100W or <+50dBm

Remarks

The EUT does not exceed 100W or +50dBm at the measured frequencies.

2.2 PEAK – AVERAGE RATIO

2.2.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 24.232(d)

2.2.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.2.3 Date of Test and Modification State

02 December 2008 – Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007.

A peak to average ratio measurment is performed at the conducted port of the EUT. The spectrum analyzers Complementary Cumulative Distribution Function (CCDF) measurement profile is used to determined the largest deviation between the average and the peak power of the EUT in given bandwidth. The CCDF curve shows how much time the peak waveform spends at or above a given average power level. The percent of time the signal spends at or above the level defines the probability for that particular power level.

The spectrum analyzer measurment bandwidth was set to 1MHz and the path loss measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.2.6 Environmental Conditions

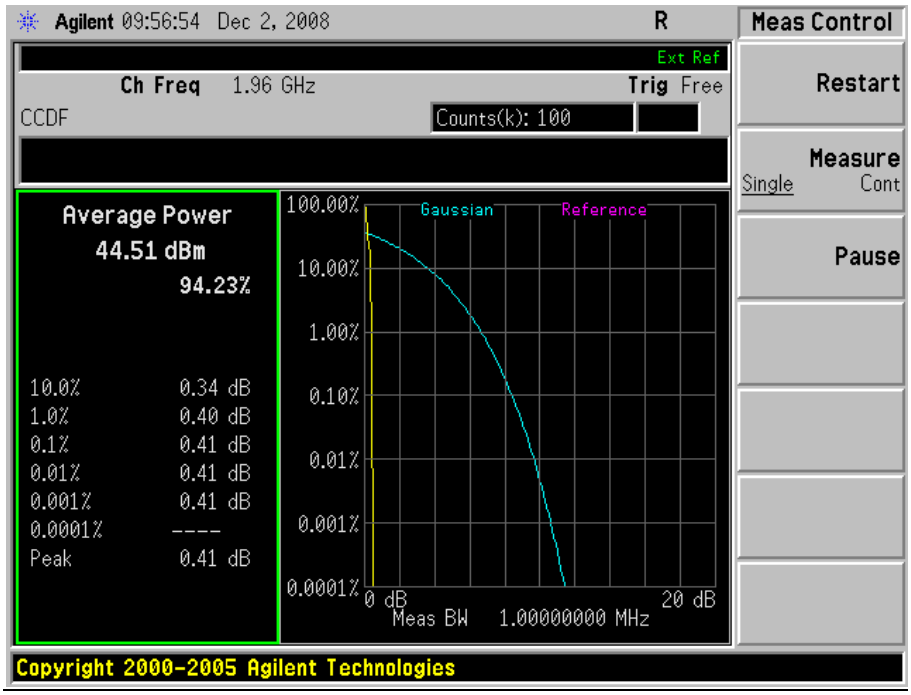
	02 December 2008
Ambient Temperature	24.2°C
Relative Humidity	22.4%

2.2.7 Test Results

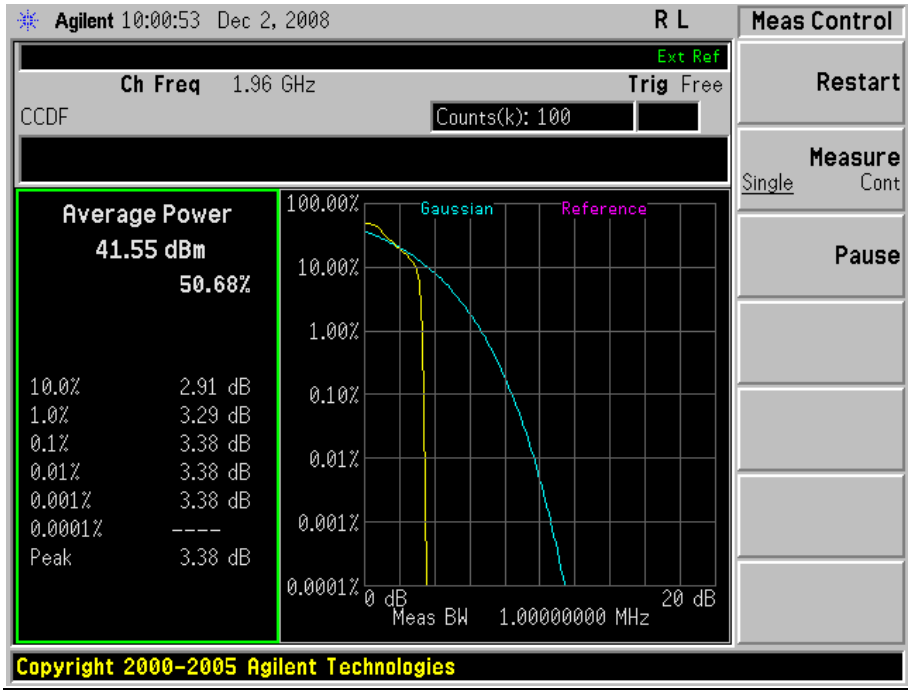
For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 Peak – Average Ratio.

The test results are shown below.

GMSK – Transmitting under maximum Power



8PSK – Transmitting under maximum Power



Limit	13dB

Remarks

The Peak – Average ratio does not exceed 13dB at the measured frequencies.

2.3 MODULATION CHARACTERISTICS

2.3.1 Specification Reference

FCC CFR 47 Part 2: 2007, Clause 2.1047(d)

2.3.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.3.3 Date of Test and Modification State

26 November 2008 – Modification State 0

2.3.4 Modulation Description

The modulation scheme used in GSM is called Gaussian Minimum Shift Keying (GMSK). GMSK facilitates the use of narrow bandwidth and allows for both coherent and non coherent detection capabilities. It is a scheme in which the transitions from One to Zero or Zero to One do not occur quickly, but over a period of time. If pulses are transmitted quickly harmonics are transmitted. The power spectrum for a square wave is rich in harmonics, and the power within the side lobes is wasted, and can be a cause of potential interference.

A method to reduce the harmonics is to round off the edges of the pulses thus lowering the spectral components of the signal. In GSM this is done by using a Gaussian pre-filter which typically has a bandwidth of 81.25kHz. The output from the Gaussian filter then phase modulates the carrier. As there are no dramatic phase transitions of the carrier this gives a constant envelope and low spectral component output from the transmitter.

The spectral efficiency is calculated by

bit rate / Channel bandwidth = 270.83333 kbit/s / 200 kHz = 1.354 bit/s/Hz.

The bandwidth product BT = Bandwidth x bit duration = 81.25 kHz x 3.6923 micros = 0.3

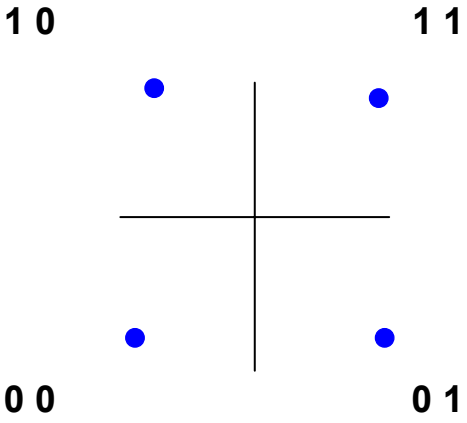
GMSK and 8PSK overview.

The modulation schemes used for the EUT are GMSK and 8PSK. The 8PSK modulation scheme is EDGE (Enhanced Date Rates for GSM Evolution).

A brief overview of how GMSK and 8PSK works is shown below.

GMSK (Gaussian Minimum Shift Keying)

The fundamental principal behind GMSK is Phase shift keying. This splits a data stream into a series of 2-digit phase shifts, using the following phase shifts to represent data pairs.



Therefore for the BIT sequence 0 0 1 1 1 0 0 1 The corresponding phase shift will be used

BIT SEQUENCE	0 0	1 1	1 0	01
PHASE	225º	45º	135º	315º

This is called QPSK (Quadratic Phase Shift Keying)

However

There is a problem with QPSK: transition from e.g. 00 to 11 gives phase shift of 180° (π radians). This has the effect of inverting the carrier waveform and this can lead to detection errors at the receiver.

Solution: restrict phase changes to ± 90°

1. Split bitstream into 2 streams e.g.

	0 0		1 1		0 1		1 0	
I Stream	0		1		0		1	
Q stream		0		1		1		0

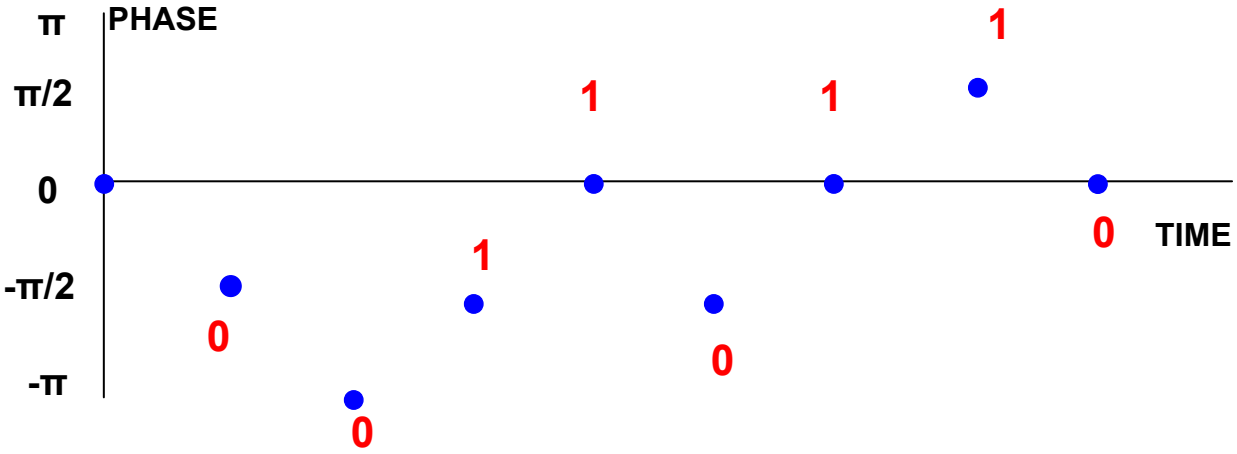
2. Modulate each stream with PSK (1 = 90° or π/2, 0 = -90° or - π/2 phase shift)

I Stream	0		1		0		1	
	-π/2		-π/2		-π/2		π/2	
Q stream		0		1		1		0
		-π/2		π/2		π/2		-π/2

3. Combine (add) the two PSK signals:

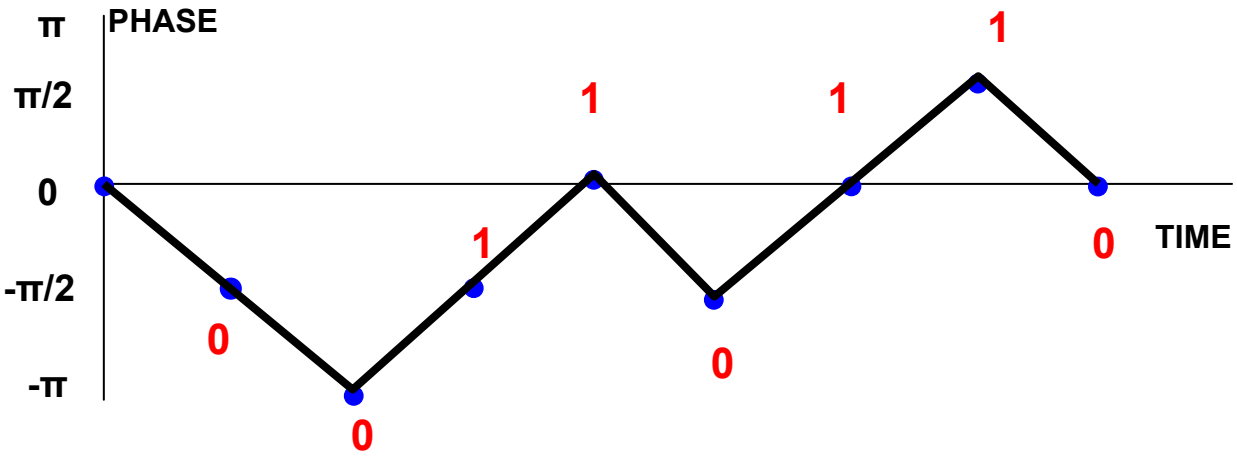
Combined Phase	-π/2	-π	-π/2	0	-π/2	0	π/2	0

Result: offset - QPSK, phase change is restricted to ± π/2 radians:



It would be preferable to have "gradual" changes in place between each pair of bits (Continuous-phase modulation). Replacing each “rectangular” shaped pulse (for 1 or 0) with a sinusoidal pulse can do this:

Result: Minimum Shift Keying (MSK):



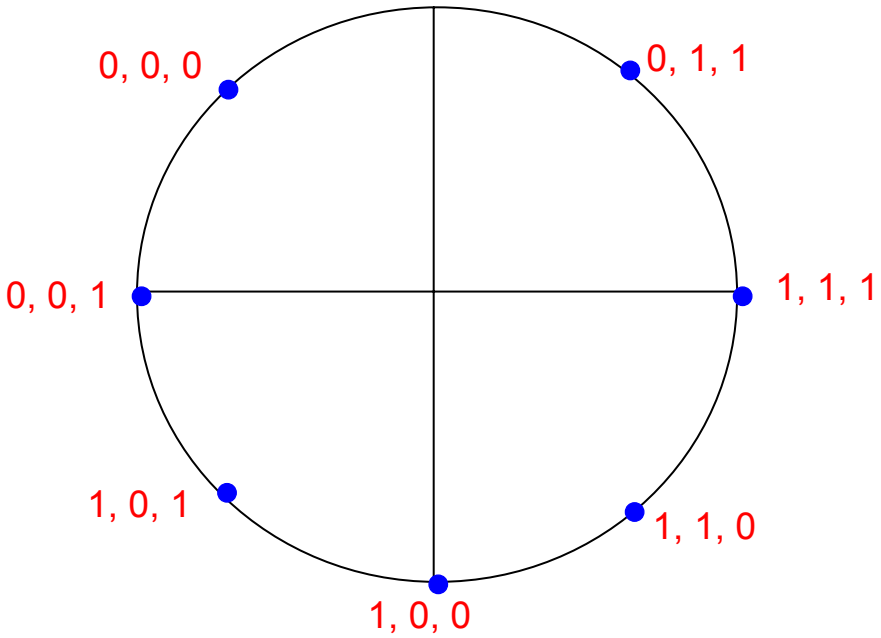
Gaussian Minimum Shift Keying

MSK has high sidebands relative to the main lobes in the frequency domain - this can lead to interference with adjacent signals.

If the rectangular pulses corresponding to the bitstream are filtering using a Gaussian-shaped impulse response filter, we get Gaussian MSK (GMSK) - this has low sidelobes compared to MSK.

8-SK (8-Phase Shift Keying)

8PSK uses the same basic principle of phase shift modulation. The only difference being the increased number of vectors.



2.3.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 2: 2007.

Using a spectrum analyzer and attenuator(s). The EUT supports GMSK and 8PSK modulation schemes. The EUT was transmitting with both modulations with the timeslots active as shown, the plots were captured in the time domain.

The spectrum analyzer RBW and VBW were set to 100/300kHz and the path loss measured and entered as a reference level offset.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

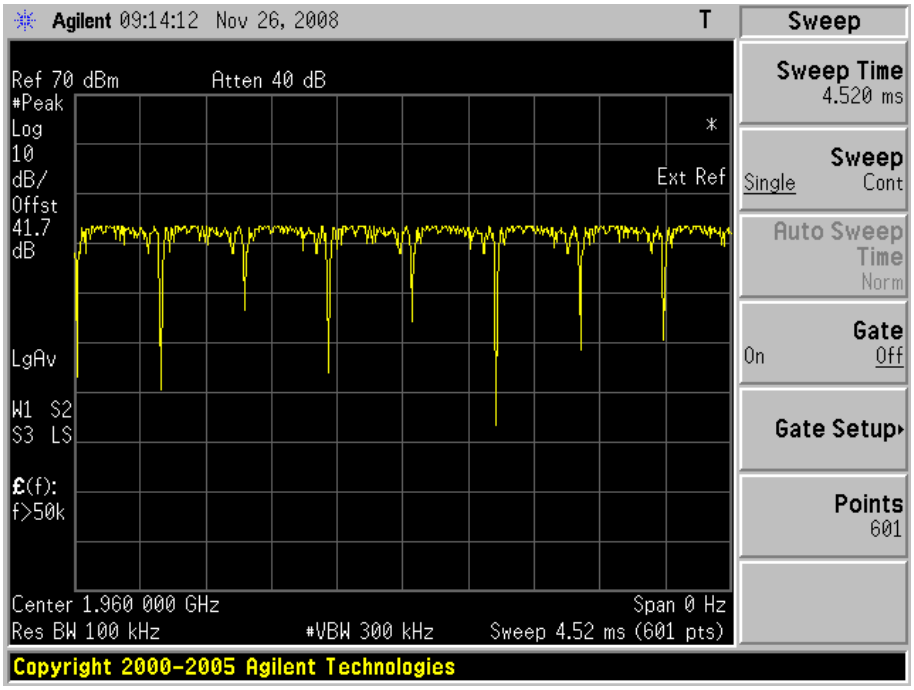
2.3.6 Environmental Conditions

	26 November 2008
Ambient Temperature	21.4°C
Relative Humidity	28.3%

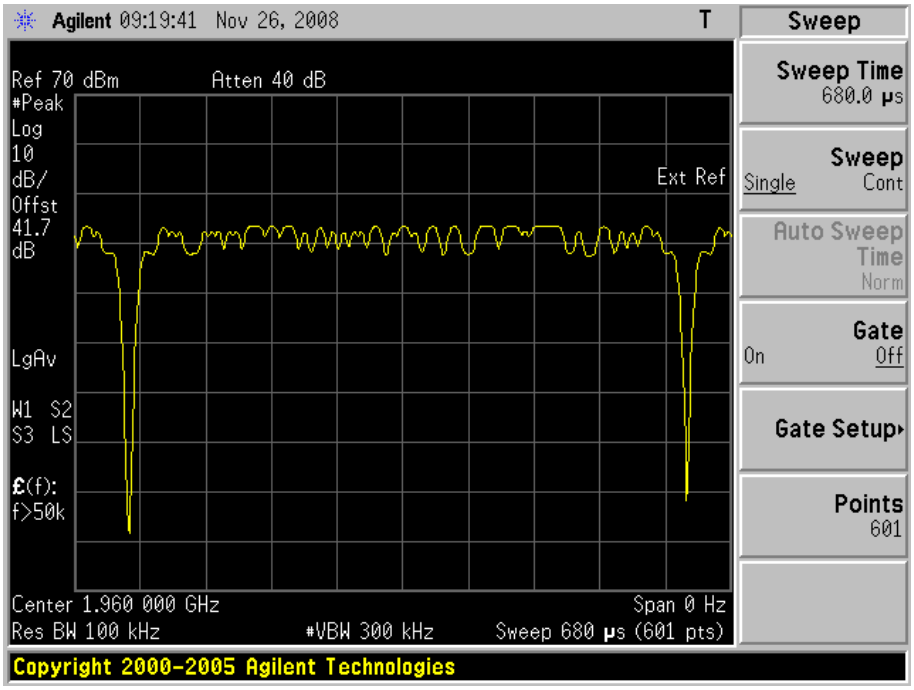
2.3.7 Test Result

Four plots are shown on the following pages showing the EUT transmitting with the display in the time domain:

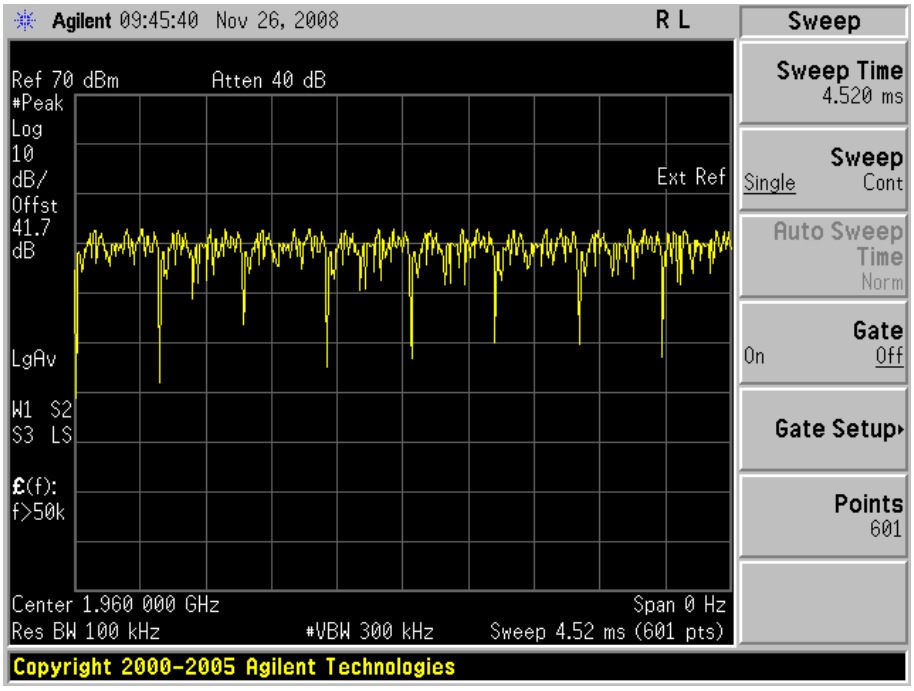
EUT transmitting with GMSK modulation showing all timeslots:



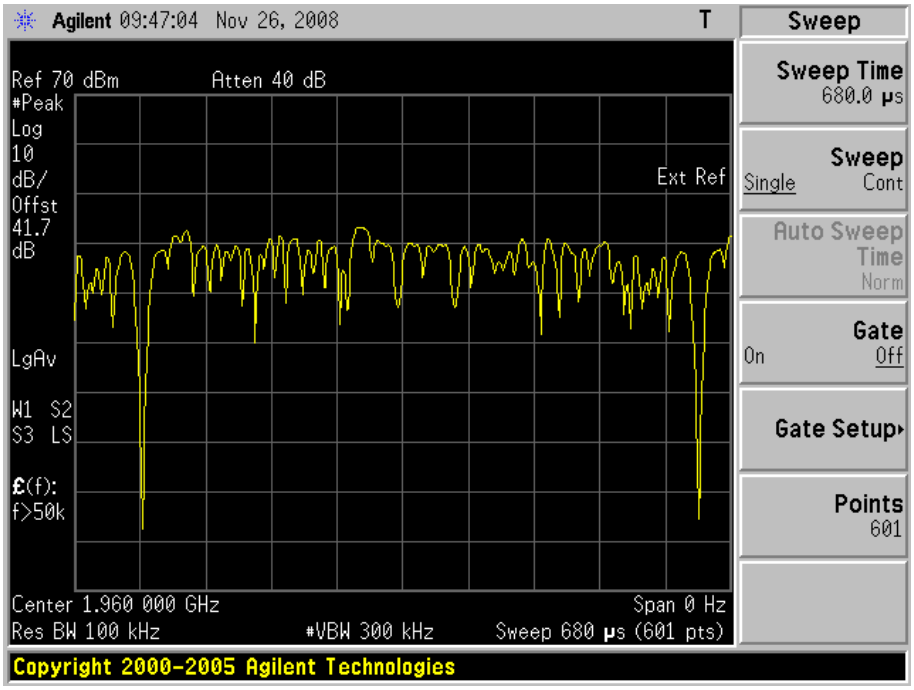
EUT transmitting with GMSK modulation showing one timeslot:



EUT transmitting with 8PSK modulation showing all timeslots:



EUT transmitting with 8PSK modulation showing one timeslot:



2.4 OCCUPIED BANDWIDTH

2.4.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1049(h), 24.238(b)
Industry Canada RSS 133:2008 Clause 2.3

2.4.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.4.3 Date of Test and Modification State

24 November 2008 – Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

The EUT was transmitting at maximum power, modulated with all timeslots active. Using a resolution bandwidth of 10 kHz and a video bandwidth of 100 kHz.The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission.The –26dBc points were also established and the emission bandwidth determined.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.4.6 Environmental Conditions

	24 November 2008
Ambient Temperature	21.4°C
Relative Humidity	28.3%

2.4.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Occupied Bandwidth.

Configuration 1 - Mode 1

	Frequency (MHz)	99% Power bandwidth (kHz)
GMSK	1930.2	224.0820
8PSK	1930.2	221.3486

Configuration 1 - Mode 2

	Frequency (MHz)	99% Power bandwidth (kHz)
GMSK	1960	231.2873
8PSK	1960	214.8757

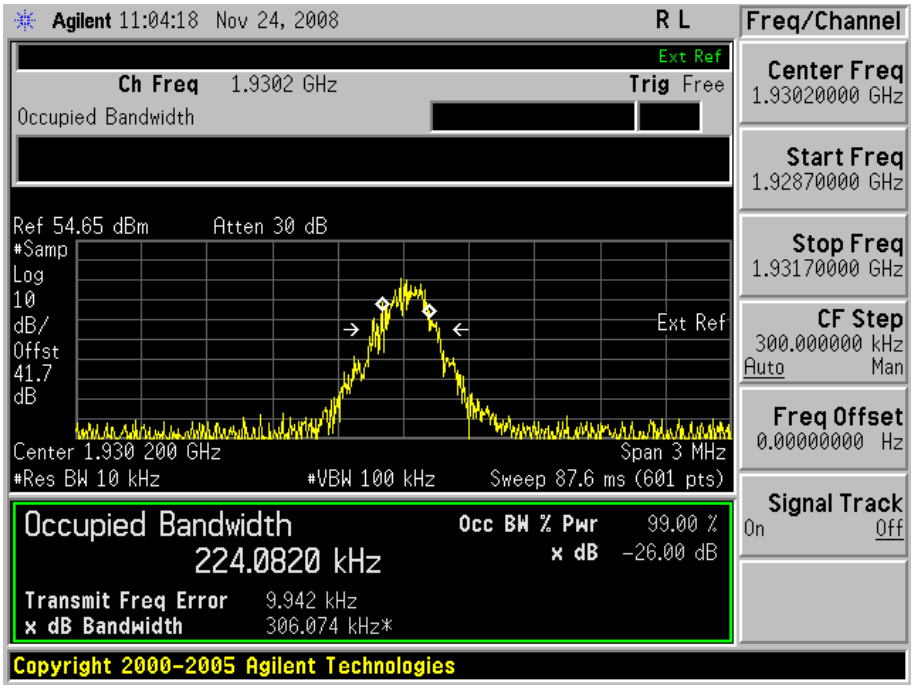
Configuration 1 - Mode 3

	Frequency (MHz)	99% Power bandwidth (kHz)
GMSK	1989.8	231.4503
8PSK	1989.8	234.8098

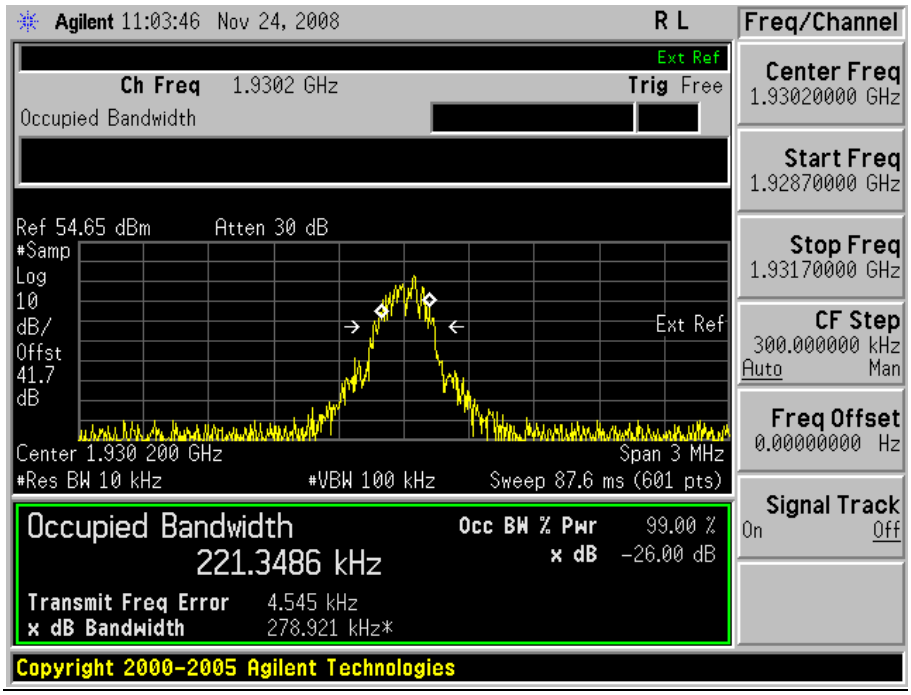
The plots of test results are shown below.

Configuration 1 - Mode 1

GMSK - Maximum Power

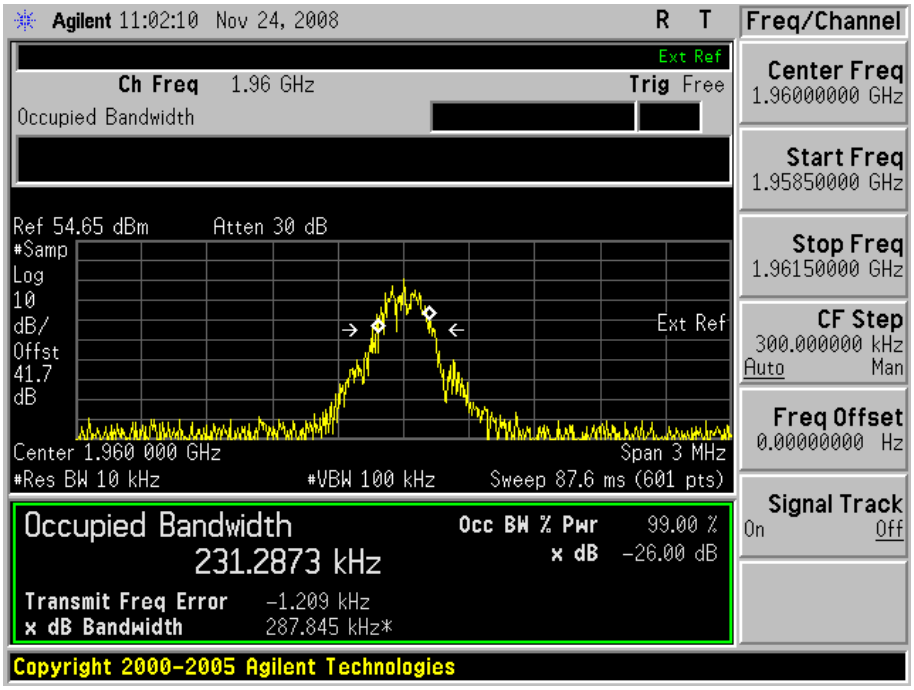


8PSK - Maximum Power

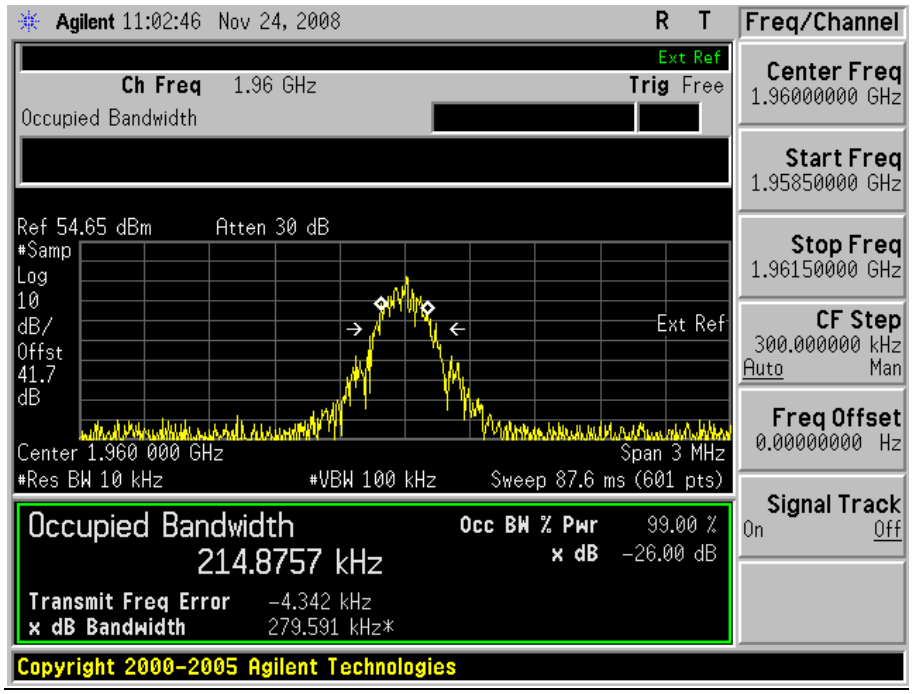


Configuration 1 - Mode 2

GMSK - Maximum Power

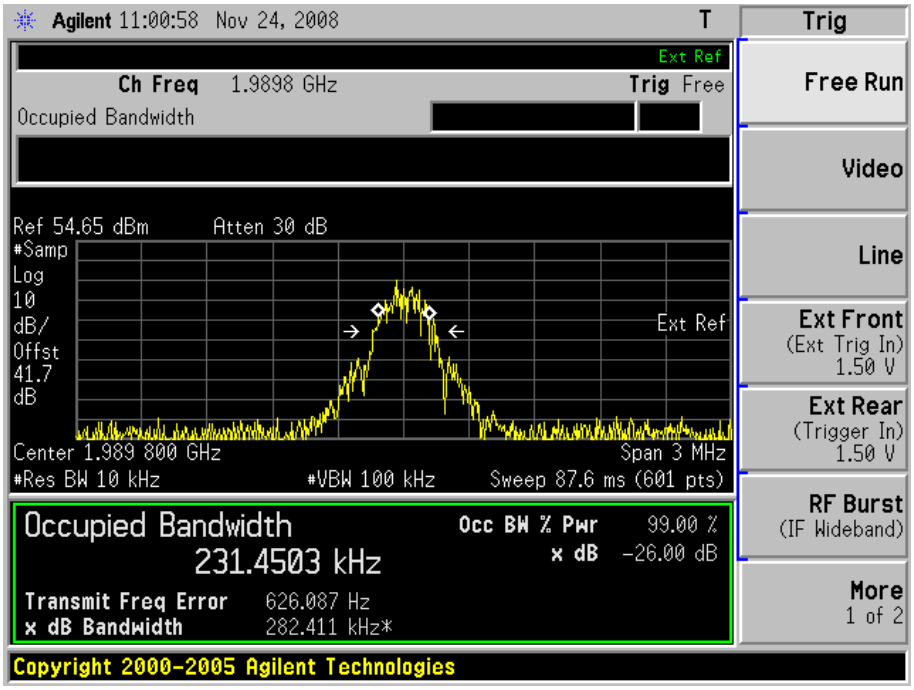


8PSK - Maximum Power

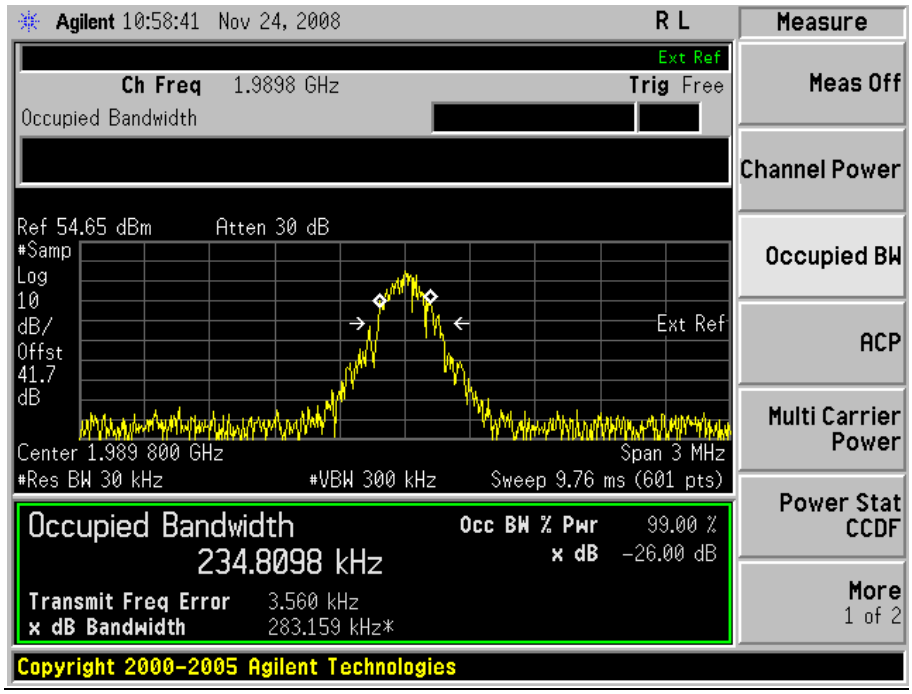


Configuration 1 - Mode 3

GMSK - Maximum Power



8PSK - Maximum Power



2.5 SPURIOUS EMISSIONS AT TERMINALS (±1MHz)

2.5.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1051, 24.238(b)
Industry Canada RSS 133:2008 Clause 6.5

2.5.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.5.3 Date of Test and Modification State

24 November 2008 – Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

In accordance with 24.238(b), at least 1% of the 26dB bandwith was used for the resolution and video bandwidths up to 1 MHz away from the block edge. At greater than 1MHz the resolution and video bandwidths were increased to 1 MHz.

The reference power and path losses of all channels used for testing in each frequency block were measured. It was found that there was <0.5dB variation in all channels, thus the worst case reference level offset was used throughout. Having entered the reference level offset, the limit line was displayed, showing the –13dBm, (43+10log (P)), limit.

The EUT was tested at it's maximum power level with all timeslots active.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 3

2.5.6 Environmental Conditions

	24 November 2008
Ambient Temperature	21.4°C
Relative Humidity	28.3%

2.5.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Spurious Emissions Antenna Terminals (±1MHz)

The test results are shown below.

Below are the Frequencies the EUT was tested against along with the tested channels.

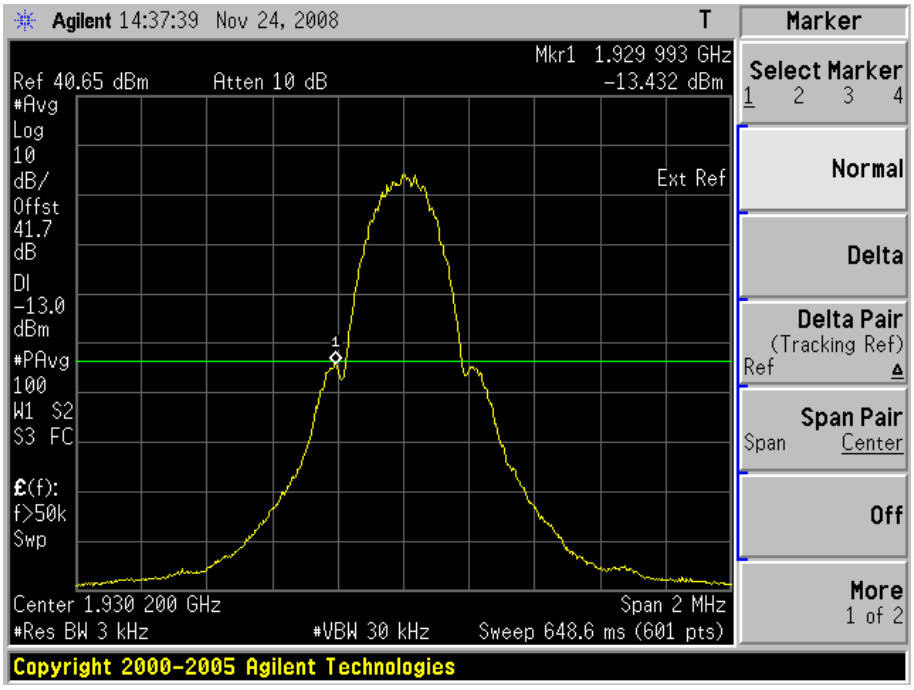
Channel (MHz)	Edge Test with GMSK modulation Channel No./Frequencies	Edge Test with 8PSK modulation Channel No./Frequencies
Bottom 1930.2	Channel: 512 Frequency: 1930MHz P1 Power level	Channel: 512 Frequency : 1930MHz P0 Power level
Top 1989.8	Channel: 810 Frequency : 1990MHz P2 Power level	Channel : 810 Frequency : 1990MHz P0 Power level

The channels shown in the table above are the minimum and maximum channels that can be used in the authorised frequency ranges to maintain compliance. Channels used outside of those stated and power levels used beyond those stated in the table exceed the specification limits, thus they cannot be used.

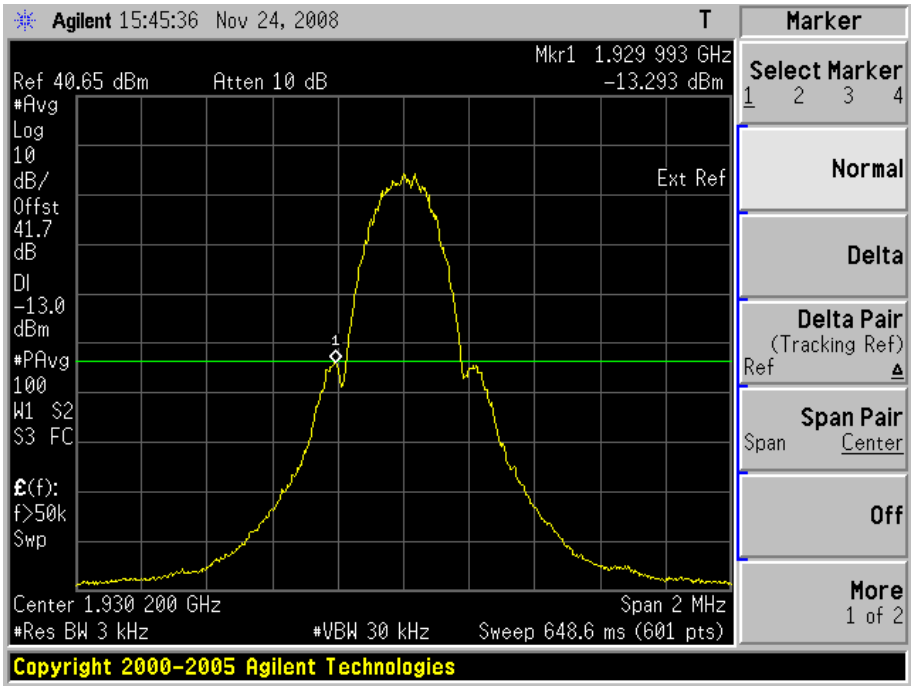
The channels outside of those shown in the table above were not tested at lower power levels to determine a level at which compliance would be achieved. Therefore, to maintain compliance, only the channels shown in the table above shall be used.

Configuration 1 - Mode 1

GMSK - Edge Measurement with EUT Transmitting on P1 Power Level

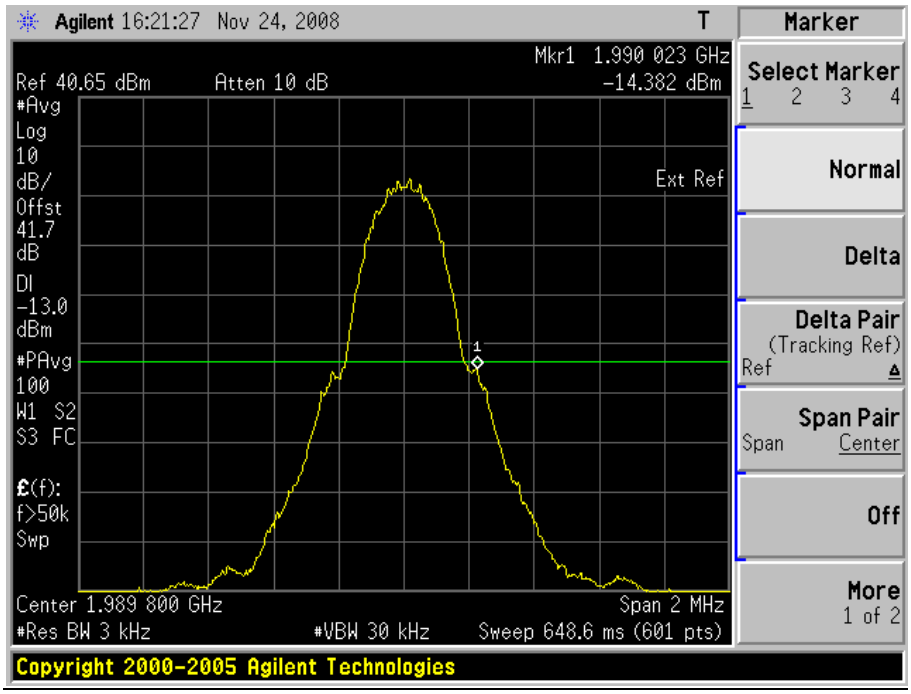


8PSK - Edge Measurement with EUT Transmitting on P0 Power Level

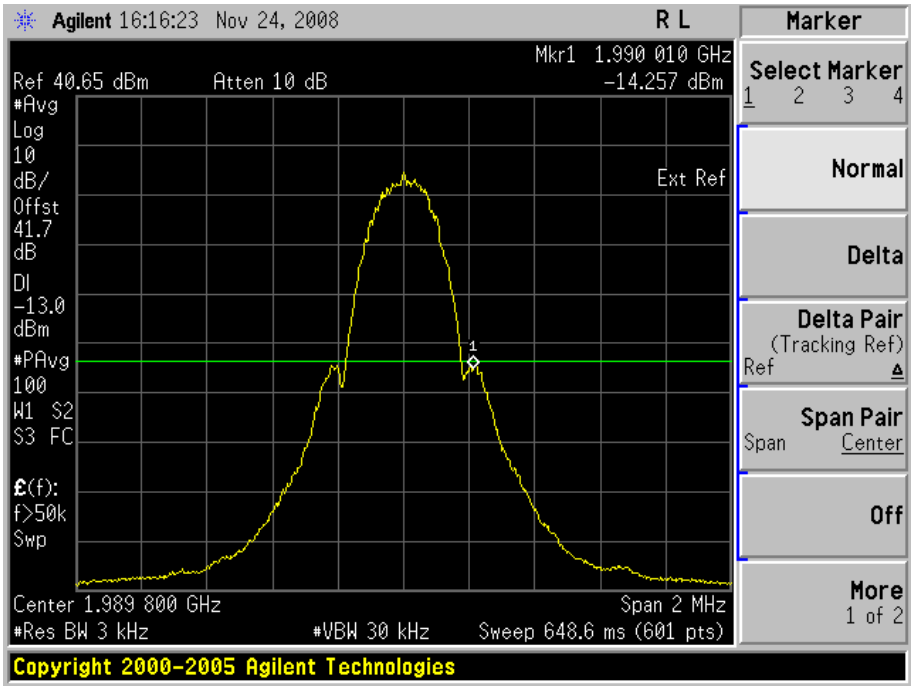


Configuration 1 - Mode 3

GMSK - Edge Measurement with EUT Transmitting on P2 Power Level



8PSK - Edge Measurement with EUT Transmitting on P0 Power Level



2.6 RADIATED SPURIOUS EMISSIONS

2.6.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1053, 24.238(a)
Industry Canada RSS 133:2008 Clause 6.5

2.6.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.6.3 Date of Test and Modification State

27 November 2008 – Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

A preliminary profile of the Spurious Radiated Emissions was obtained by operating the EUT on a remotely controlled turntable within a semi-anechoic chamber. Measurements of emissions from the EUT were obtained with the Measurement Antenna in both Horizontal and Vertical Polarisations. The profiling produced a list of the worst-case emissions together with the EUT azimuth and antenna polarisation.

Using the information from the preliminary profiling of the EUT, the list of emissions was then confirmed or updated under Anechoic Chamber (3 metres) conditions. Emission levels were maximised by adjusting the antenna height, antenna polarisation and turntable azimuth.

Emissions identified within the range 30MHz – 1GHz were then formally measured using a CISPR Quasi-Peak detector.

Emissions identified within the range 1GHz – 20GHz were then formally measured using Peak and Average Detectors, as appropriate.

The measurements were performed at a 3m distance unless otherwise stated.

The limits for Spurious Emissions have been calculated, as shown below using the following formula:

Field Strength of Carrier - (43 + 10Log (P)) dB

Where:
Field Strength is measured in dBµV/m
P is measured Transmitter Power in Watts

Determination of Spurious Emission Limit

As the EUT does not have an integral antenna, the field strength of the carrier has been calculated assuming that the power is to be fed to a half-wave tuned dipoles as per 2.1053(a).

$E_{(v/m)}=(30 \times G_i \times P_o)^{0.5} / d$

Where G_i is the antenna gain of ideal half-wave dipoles,
P_o is the power out of the transceiver in W,
d is the measurement distance in meter.

Therefore at 3m measurement distance the field strength using the lowest transceiver output power would be:

$E_{(v/m)}=(30 \times 1.64 \times 20.045)^{0.5} / 3 = 10.468V/m = 140.4dB\mu V/m$

As per 22.917(a) the spurious emission must be attenuated by 43 + 10log (P_o) dB this gives:

43 + 10log(20.045) = 56.0dB

Therefore the limit at 3m measurement distance is:

140.4 – 56.0 = 84.4 dBµV/m

This limit has been used to determine Pass or Fail for the harmonics measured and detailed in the following results.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.6.6 Environmental Conditions

	27 November 2008
Ambient Temperature	18.2°C
Relative Humidity	23.3%

2.6.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 Clause 6.5 for Radiated Spurious Emissions.

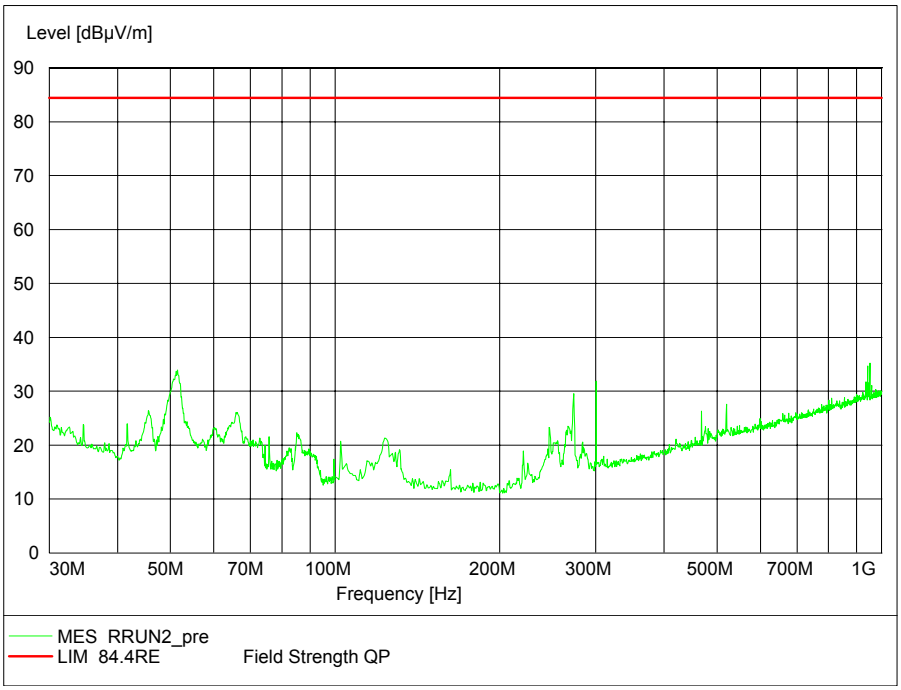
The test results are shown below.

Configuration 1 - Mode 1

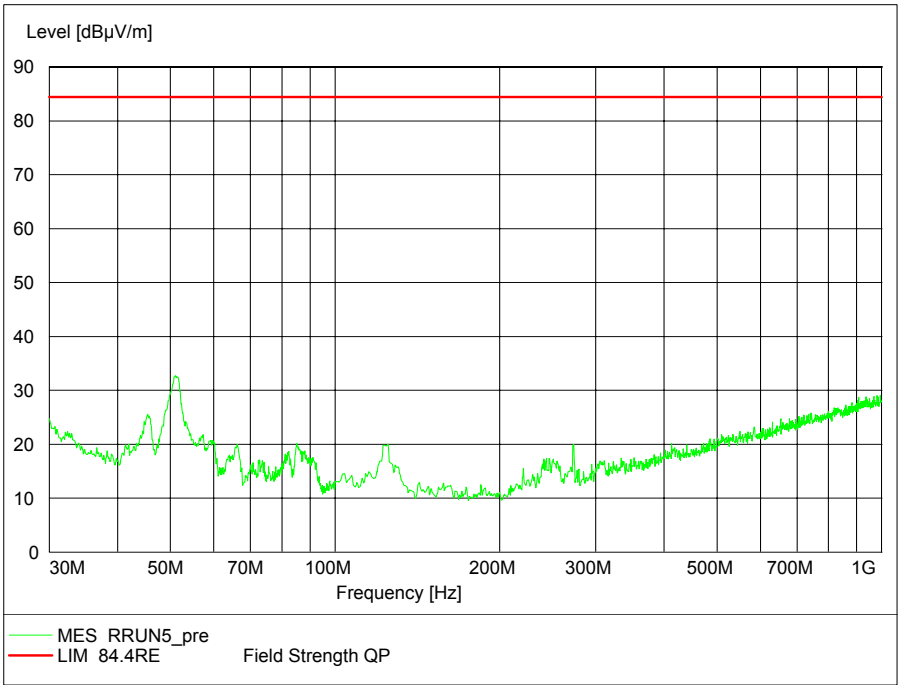
No emissions were detected within 10dB of the limit.

30MHz to 1GHz

GMSK

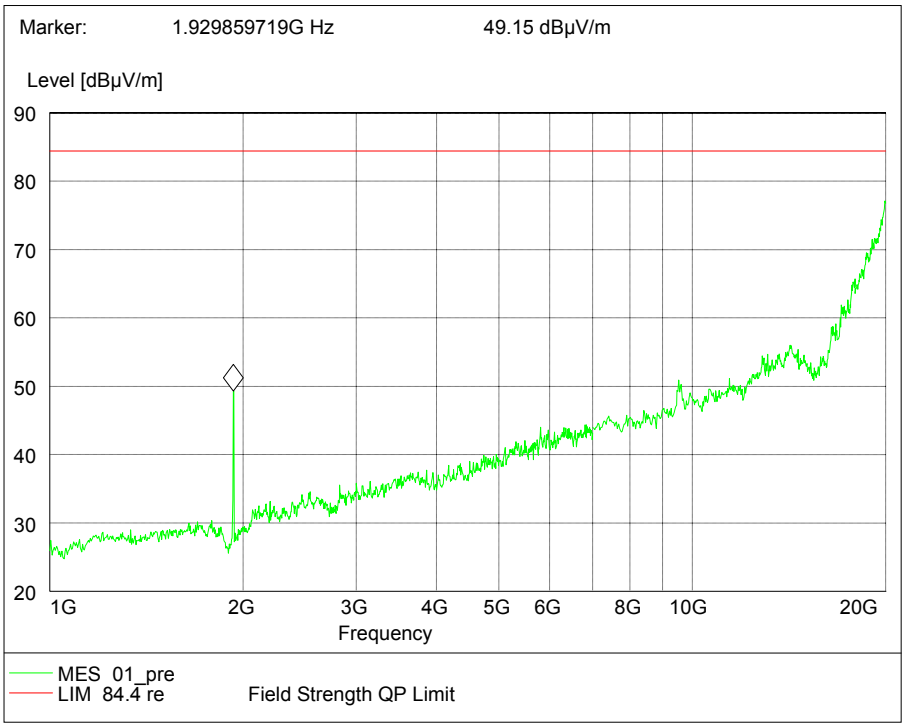


8PSK

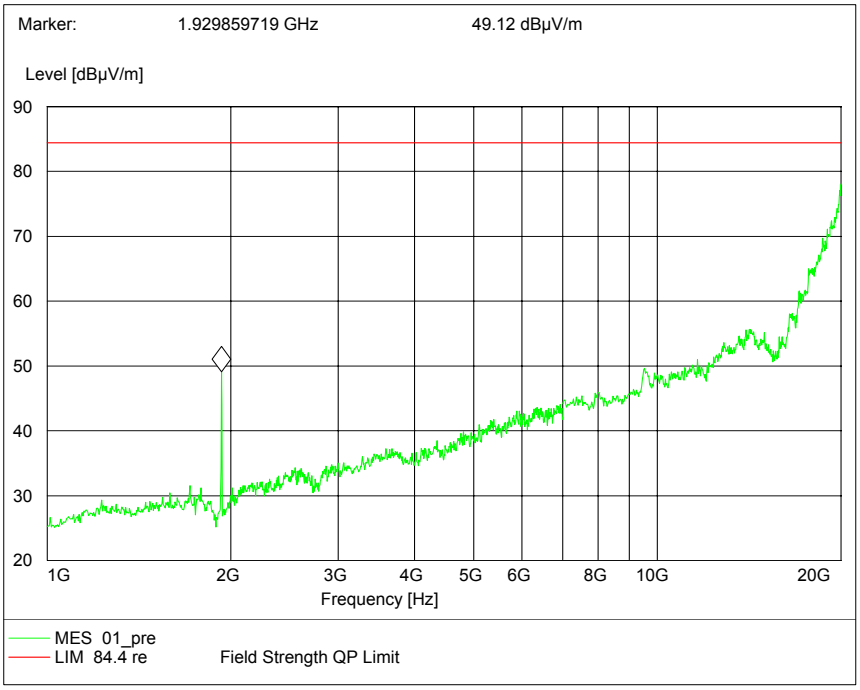


1GHz to 20GHz

GMSK



8PSK

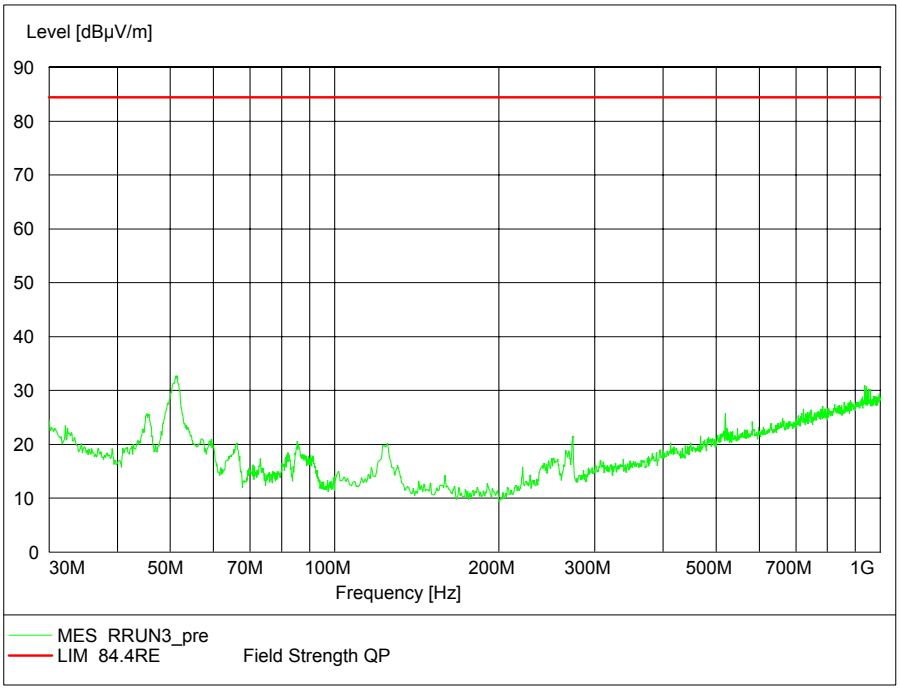


Configuration 1 - Mode 2

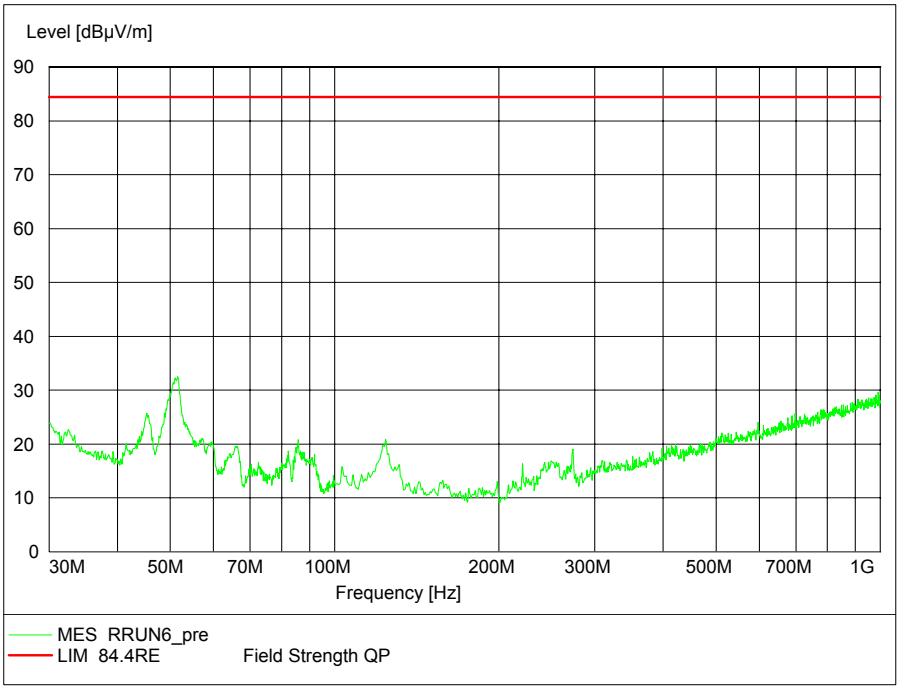
No emissions were detected within 10dB of the limit.

30MHz to 1GHz

GMSK

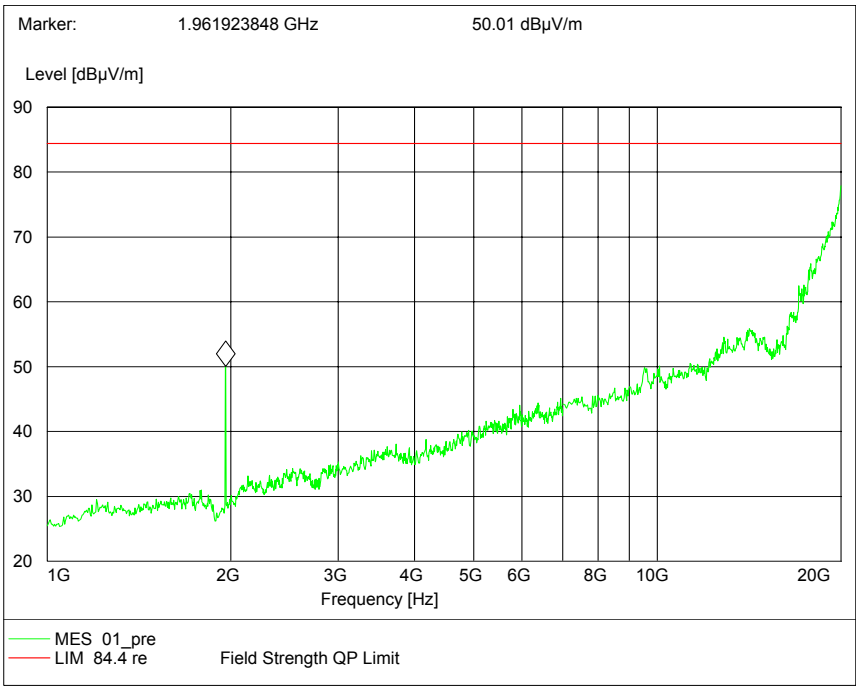


8PSK

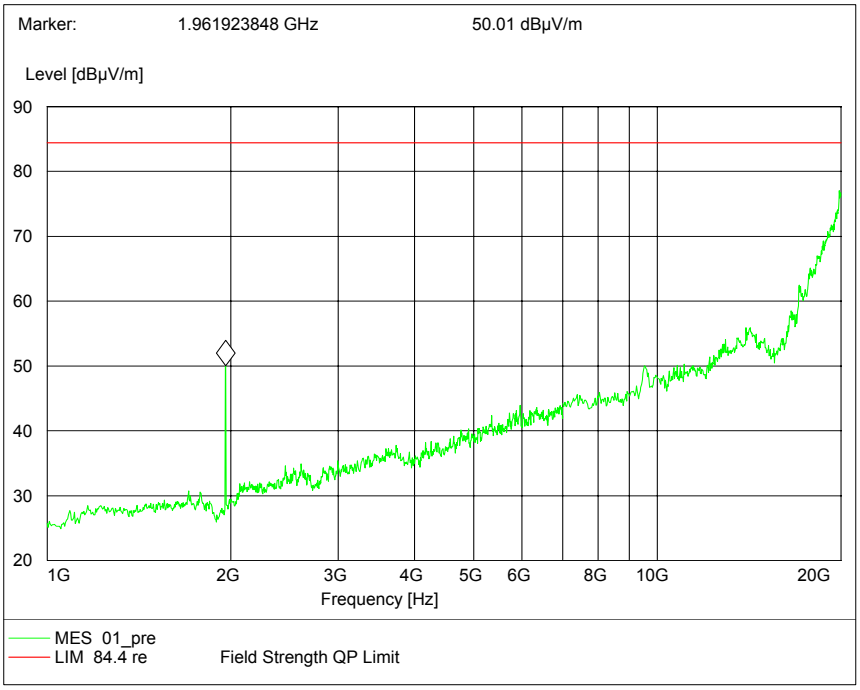


1GHz to 20GHz

GMSK



8PSK

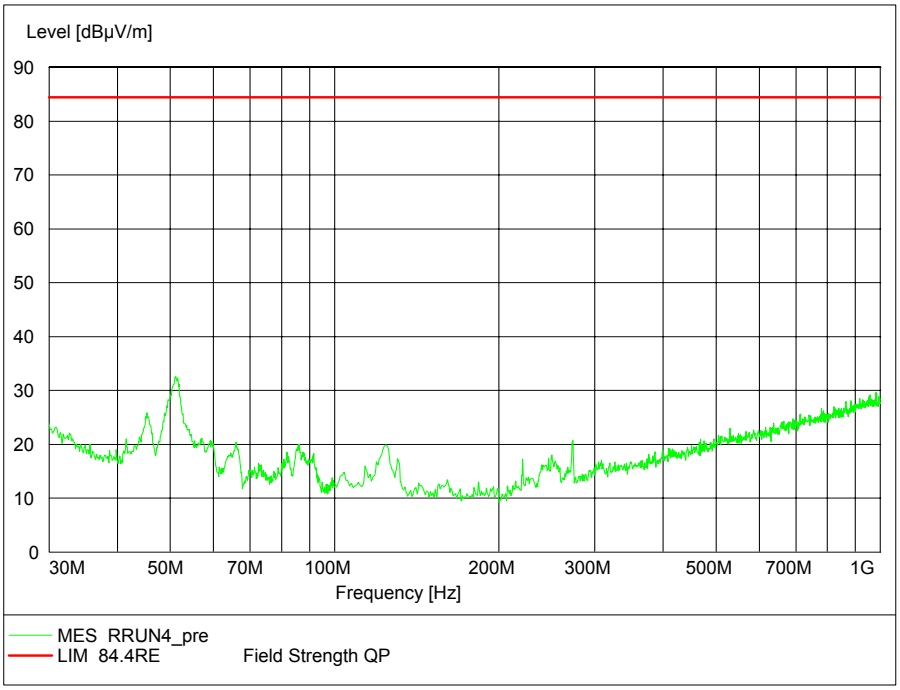


Configuration 1 - Mode 3

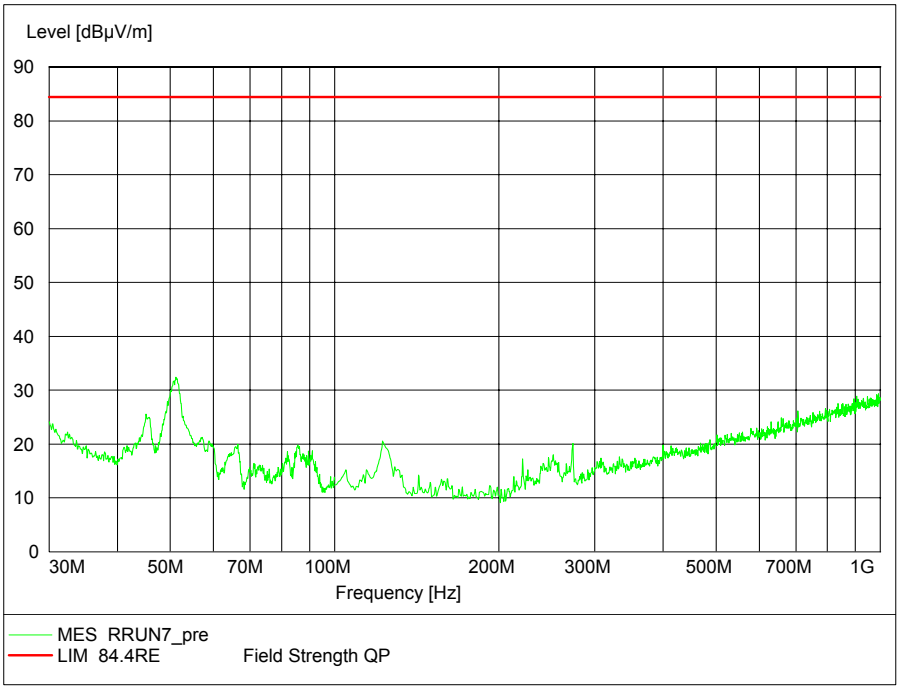
No emissions were detected within 10dB of the limit.

30MHz to 1GHz

GMSK

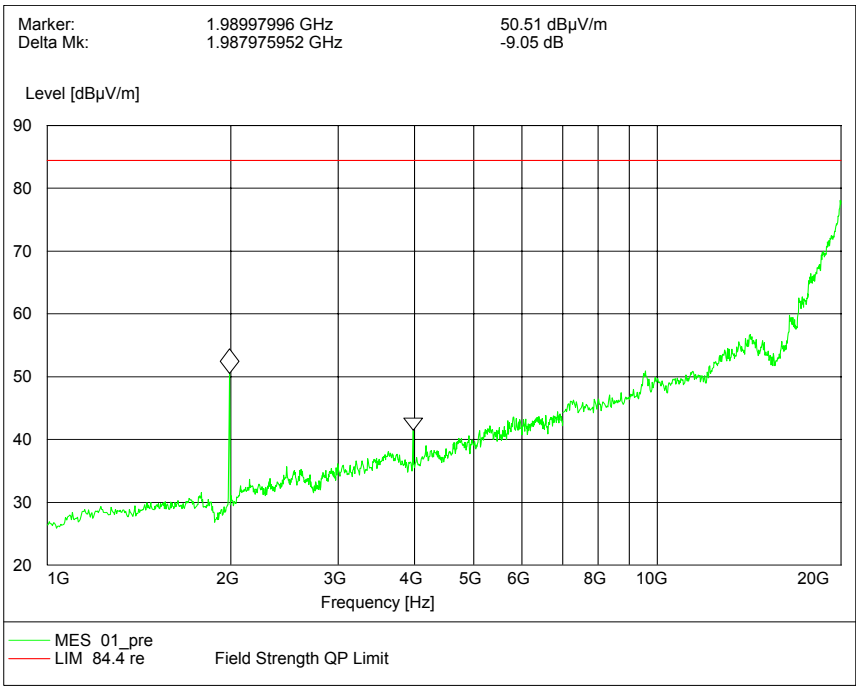


8PSK

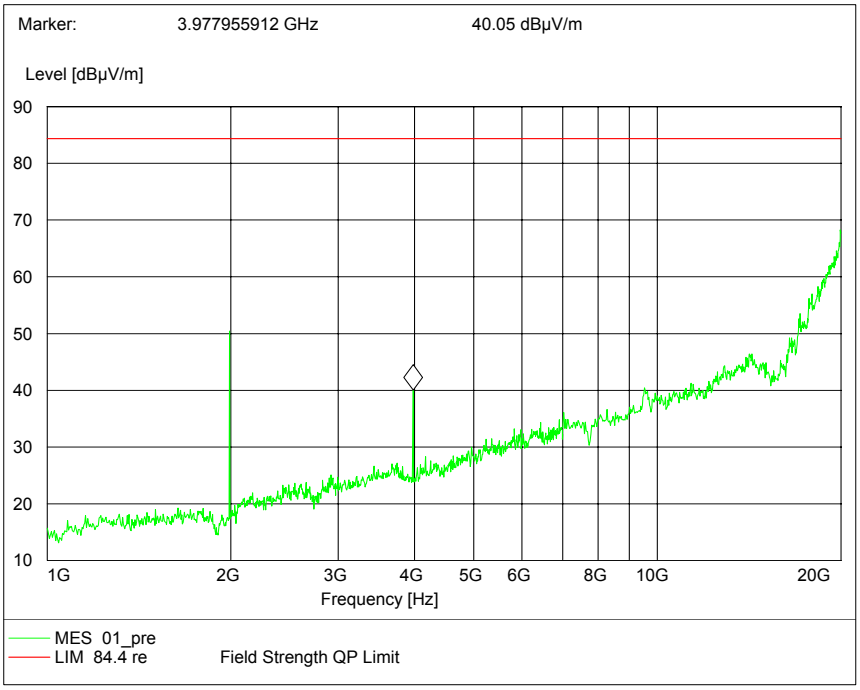


1GHz to 20GHz

GMSK



8PSK



Limit	84.4dBµV/m.

2.7 CONDUCTED SPURIOUS EMISSIONS

2.7.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1051, 24.238 (a)
Industry Canada RSS 133:2008 Clause 6.5

2.7.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.7.3 Date of Test and Modification State

25 November 2008 – Modification State 0

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

In accordance with Part 2.1051, the spurious emissions from the antenna terminal were measured. The transmitter output power was attenuated using a attenuator and the frequency spectrum investigated from 9kHz to 20GHz. The EUT was set to transmit on full power. The EUT was tested on Bottom, Middle and Top channels for both power levels. The resolution was set to 1MHz and video bandwidths were set to 1MHz thus meeting the requirements of Part 24.238(b). The spectrum analyser detector was set to Max Hold. The limit line was displayed, showing the –13dBm, (43+10log (P)), limit.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case.

In addition, measurements were made up to the 10^{th} harmonic of the fundamental.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 1
- Mode 2
- Mode 3

2.7.6 Environmental Conditions

	25 November 2008
Ambient Temperature	21.4°C
Relative Humidity	23.8%

2.7.7 Test Results

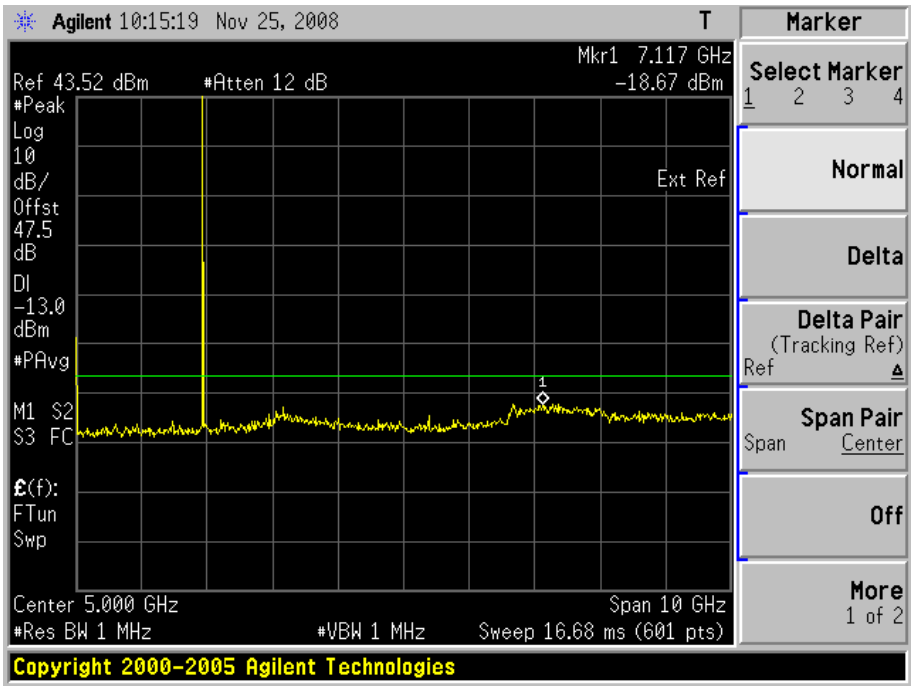
For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Spurious Emissions.

The test results are shown below.

Configuration 1 - Mode 1

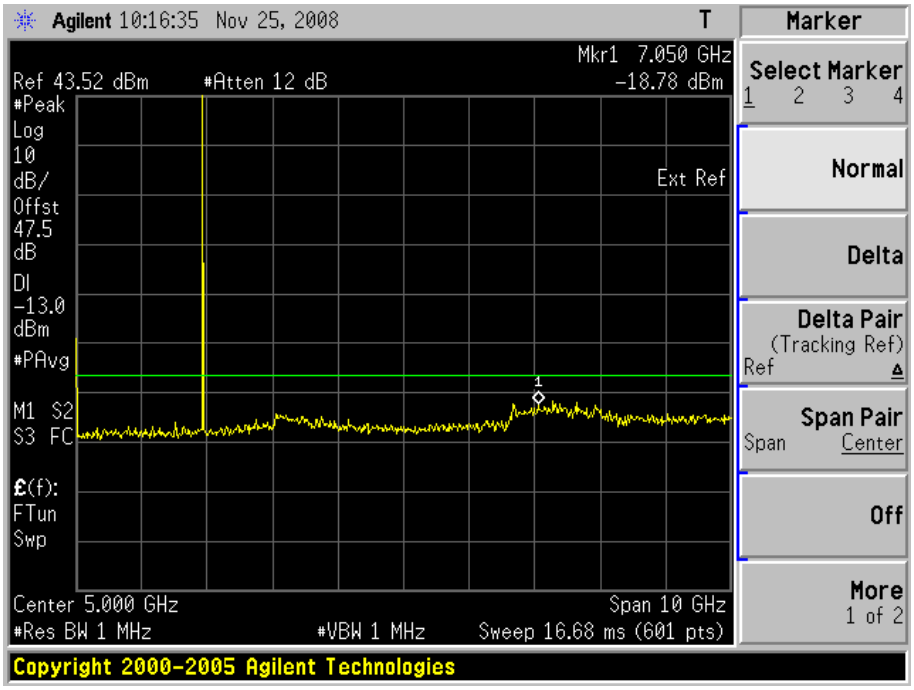
9kHz to 10GHz

GMSK - Maximum Power



Note: The emission beyond the limit is the operating frequency.

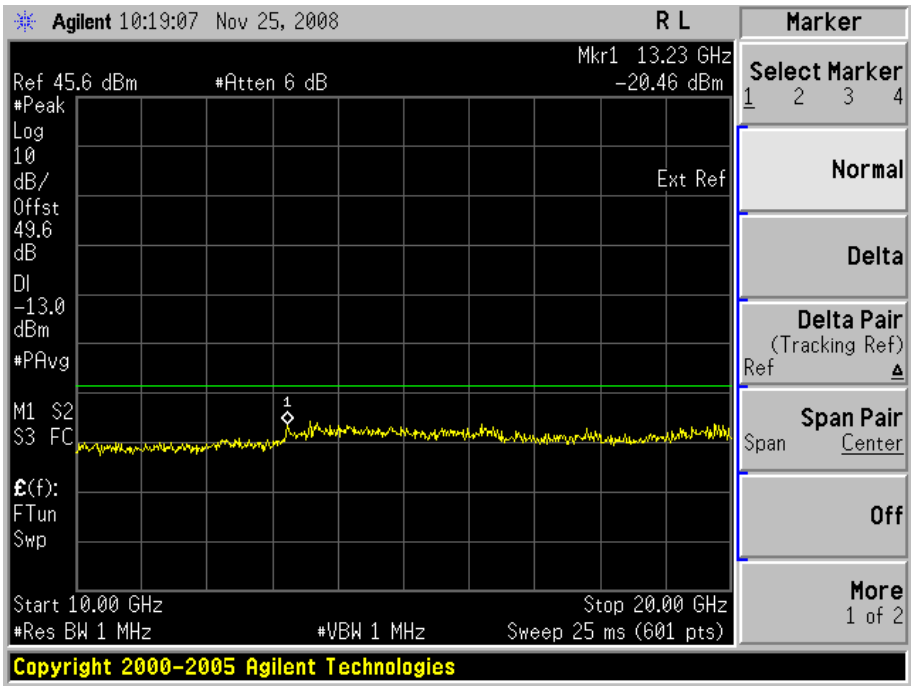
8PSK - Maximum Power



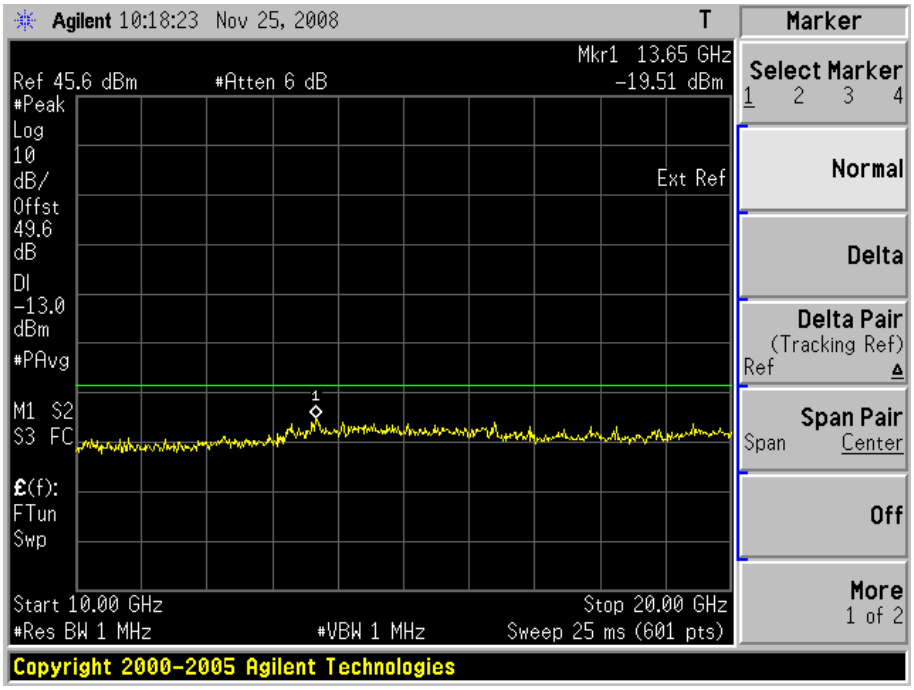
Note: The emission beyond the limit is the operating frequency.

10GHz to 20GHz

GMSK - Maximum Power



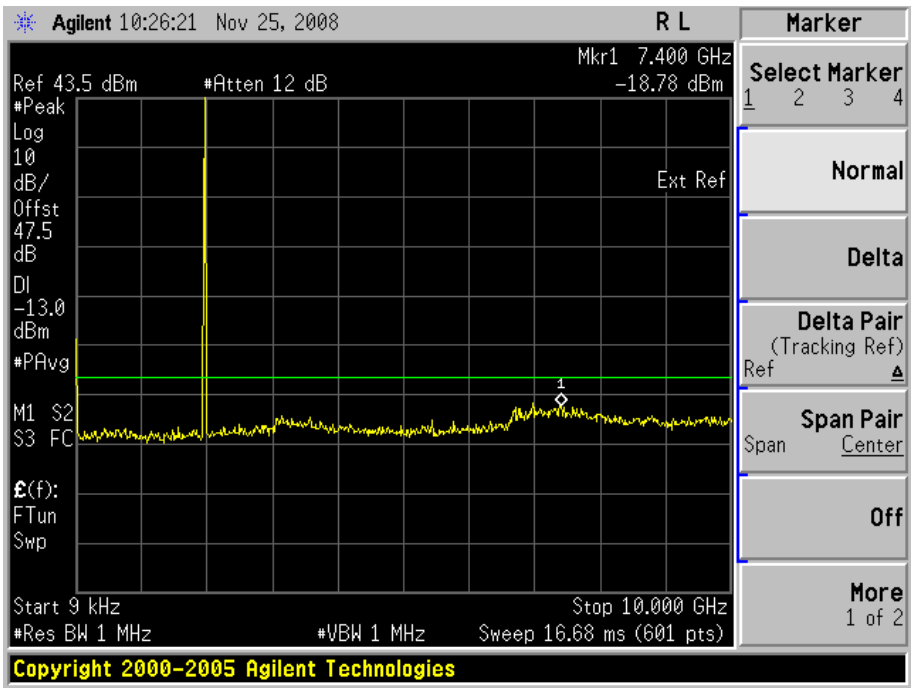
8PSK - Maximum Power



Configuration 1 - Mode 2

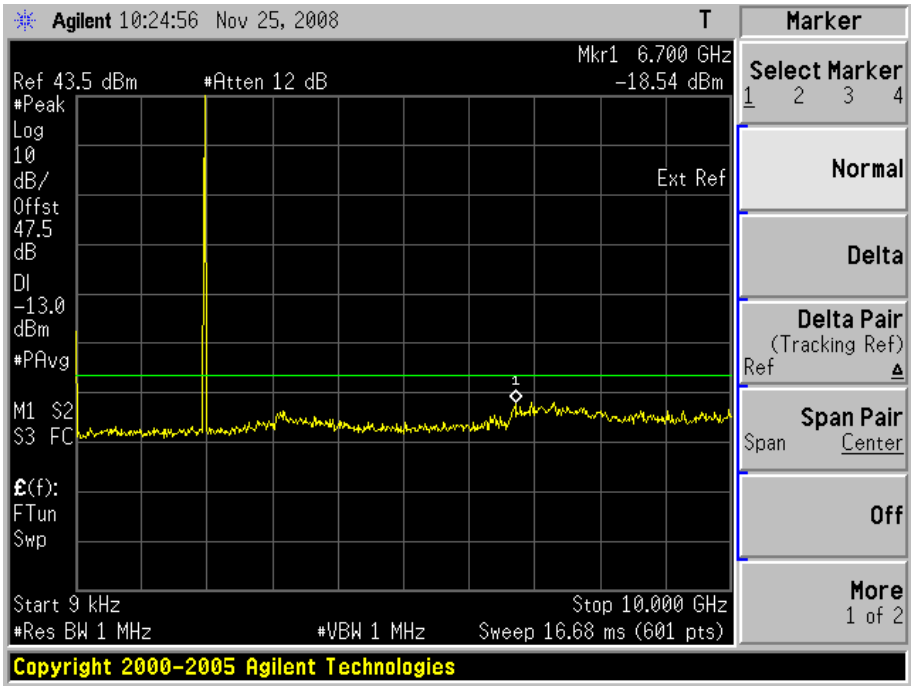
9kHz to 10GHz

GMSK - Maximum Power



Note: The emission beyond the limit is the operating frequency.

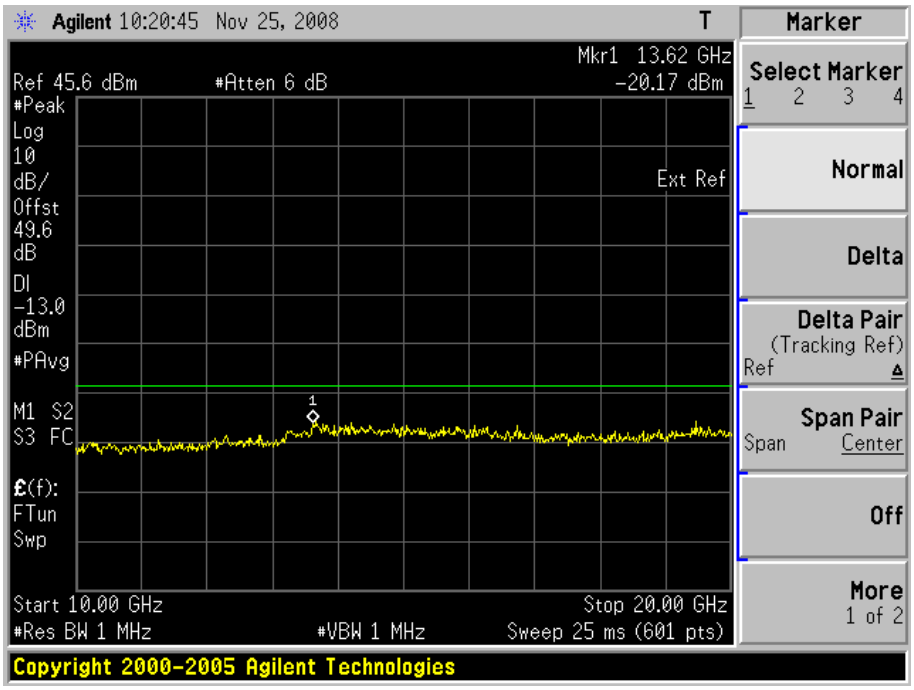
8PSK - Maximum Power



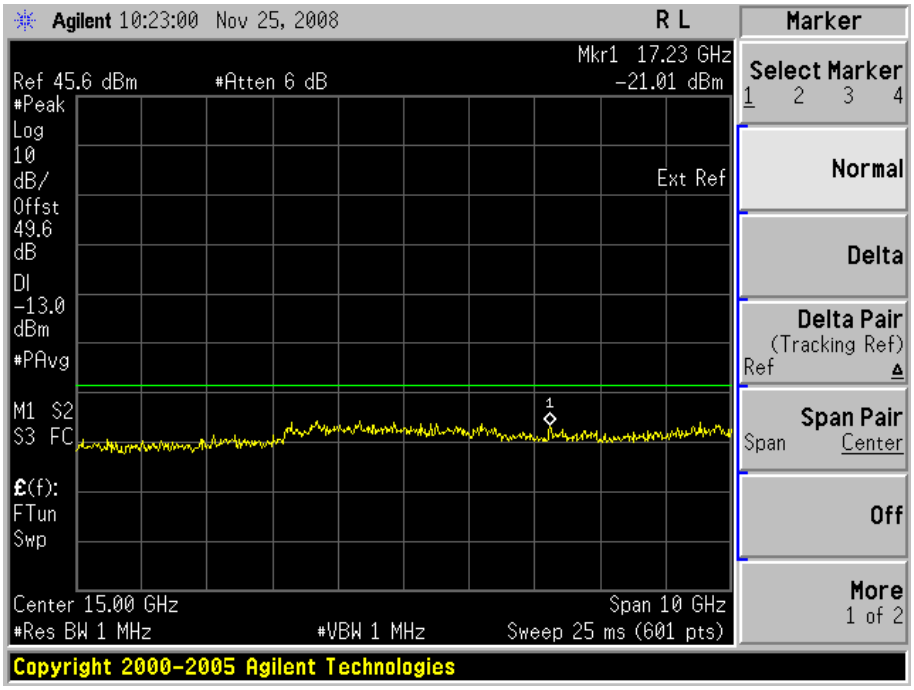
Note: The emission beyond the limit is the operating frequency.

10GHz to 20GHz

GMSK - Maximum Power



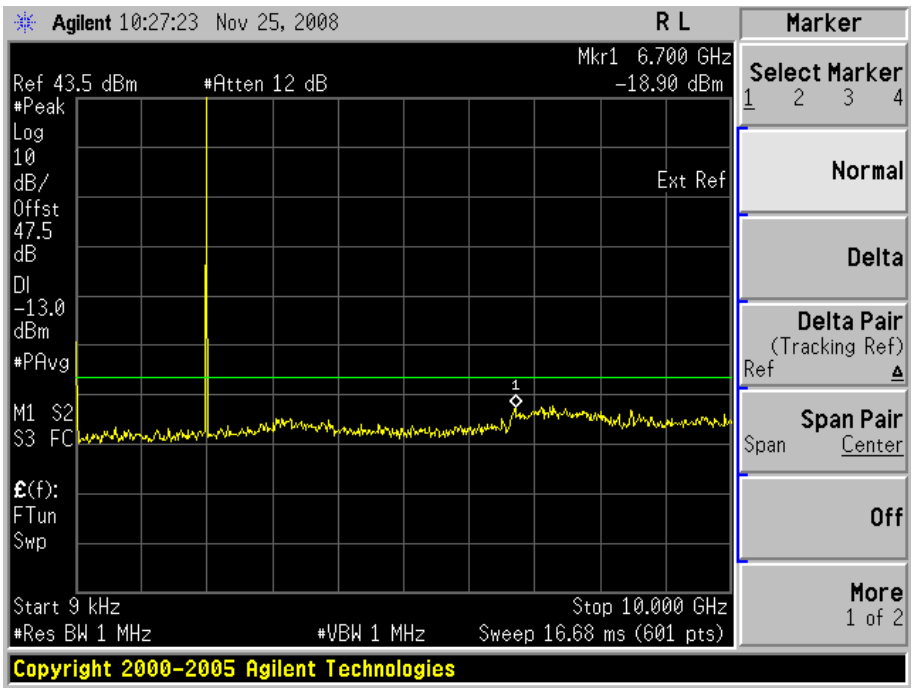
8PSK - Maximum Power



Configuration 1 - Mode 3

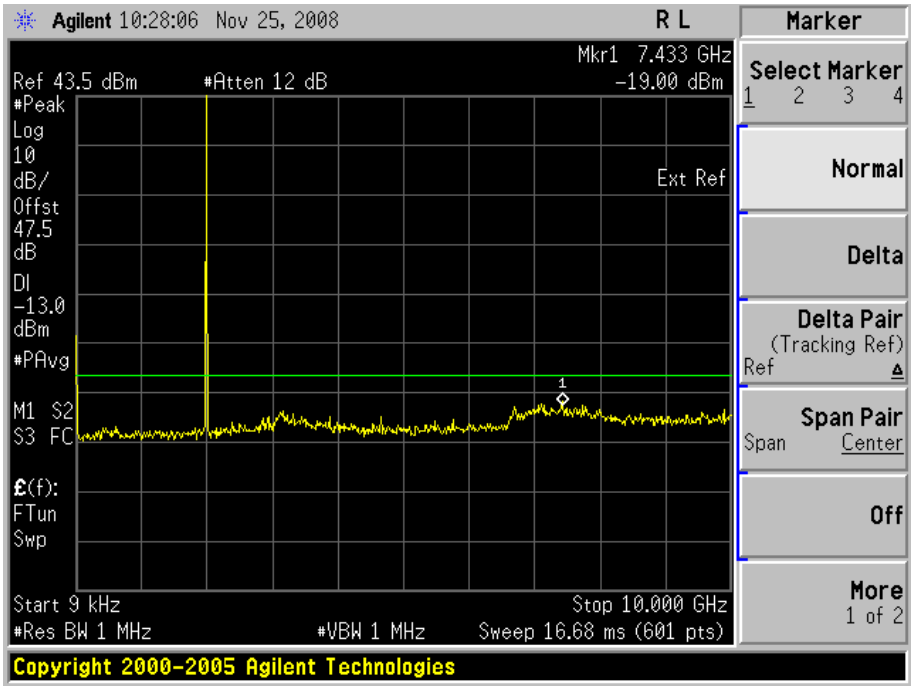
9kHz to 10GHz

GMSK - Maximum Power



Note: The emission beyond the limit is the operating frequency.

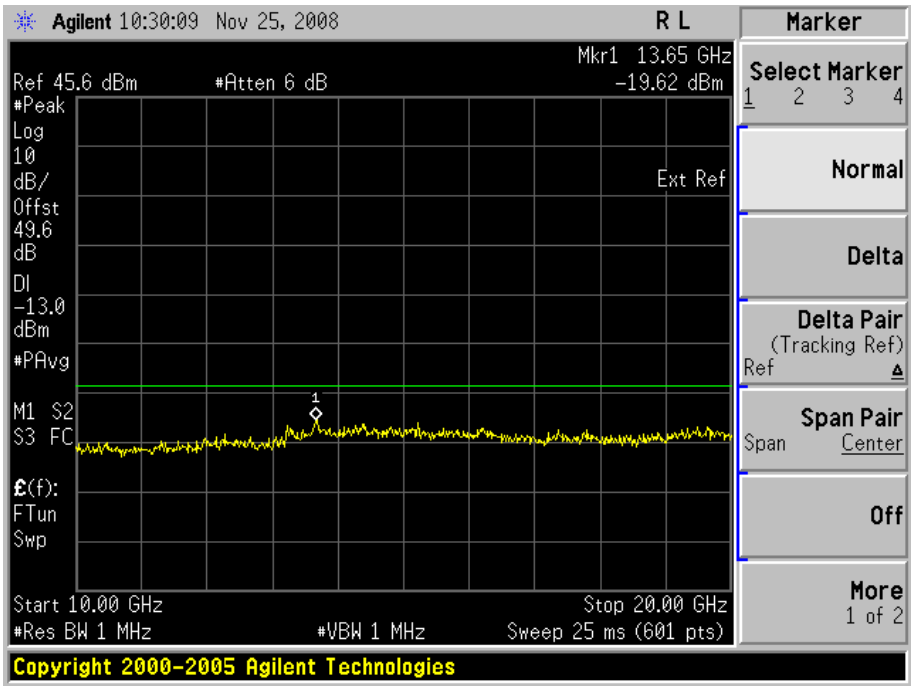
8PSK - Maximum Power



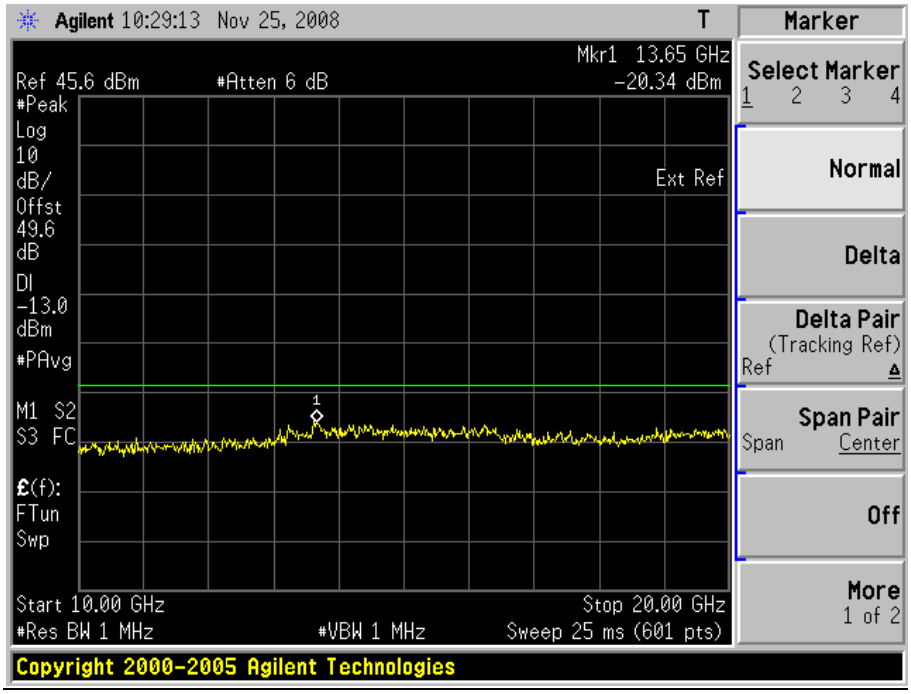
Note: The emission beyond the limit is the operating frequency.

10GHz to 20GHz

GMSK - Maximum Power



8PSK - Maximum Power



Limit	-13dBm

2.8 RECEIVER SPURIOUS EMISSIONS

2.8.1 Specification Reference

Industry Canada RSS 133:2008 Clause 6.6

2.8.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.8.3 Date of Test and Modification State

02 December 2008 – Modification State 0

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of Industry Canada RSS 133:2008.

In accordance with RSS-Gen Clause 6(b), the receiver spurious emissions from the antenna terminal were measured. The transmitter output power and the frequency spectrum investigated from 9kHz to 10GHz. The EUT was set to receiver mode. The EUT was tested on Middle channel for both modulations. The resolution was set to 1MHz and video bandwidths were set to 1MHz thus meeting the requirements of RSS-Gen Clause 6(b). The spectrum analyser detector was set to Max Hold. The limit line was displayed, showing the –57dBm, 2 nanowatts, limit.

The maximum path loss across the measurement band was used as the reference level offset to ensure worst case.

In addition, measurements were made up to the 10^{th} harmonic of the fundamental.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration – Mode 1
Mode 2
Mode 3

2.8.6 Environmental Conditions

	02 December 2008
Ambient Temperature	24.2°C
Relative Humidity	22.4%

2.8.7 Test Results

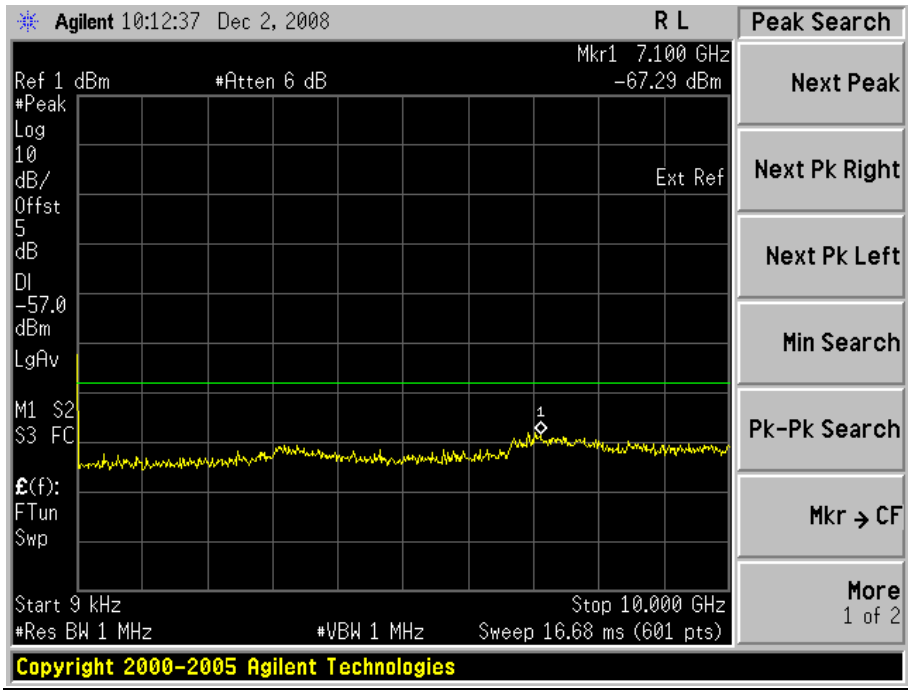
For the period of test the EUT met the requirements of Industry Canada RSS 133:2008 for Spurious Emissions.

The test results are shown below.

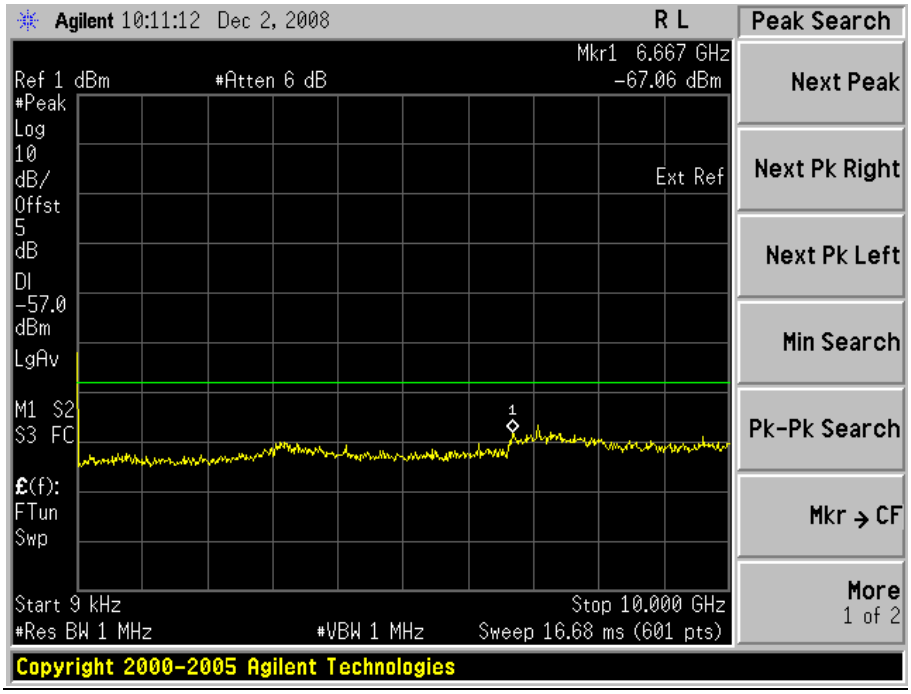
Configuration 1 - Mode 1

9kHz to 10GHz

GMSK



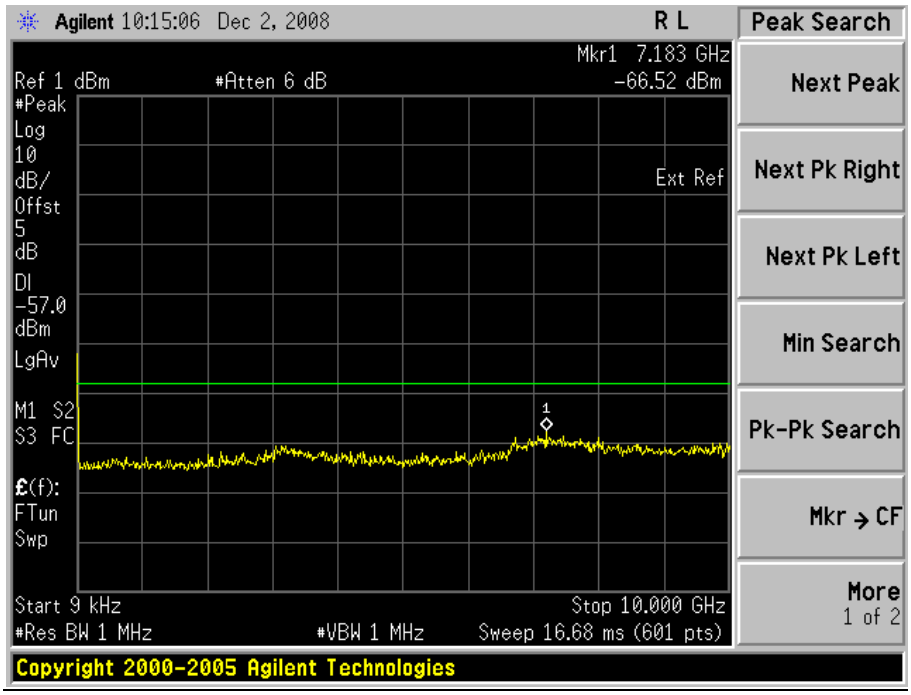
8PSK



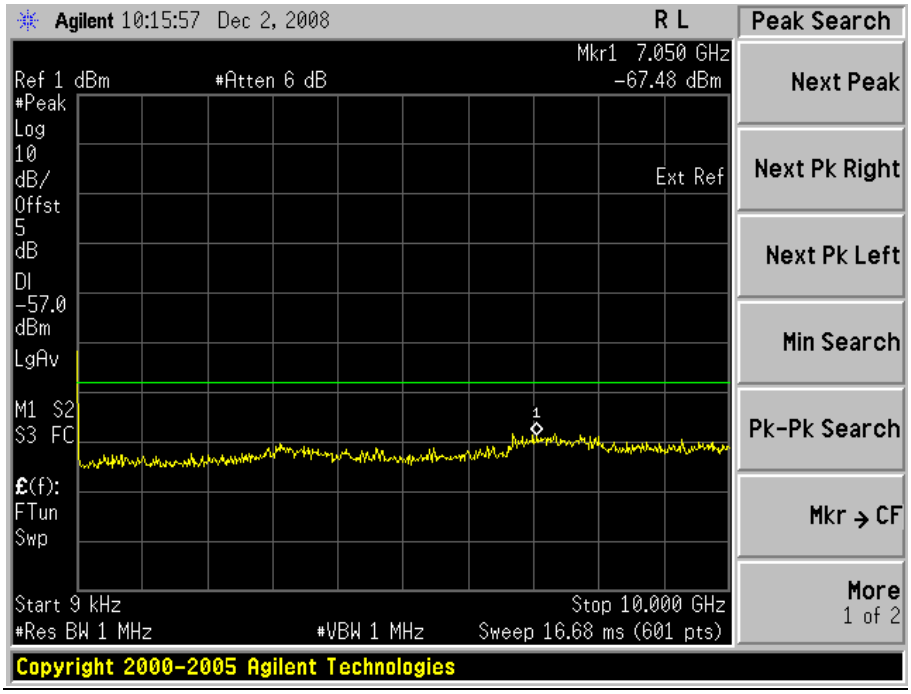
Configuration 1 - Mode 2

9kHz to 10GHz

GMSK



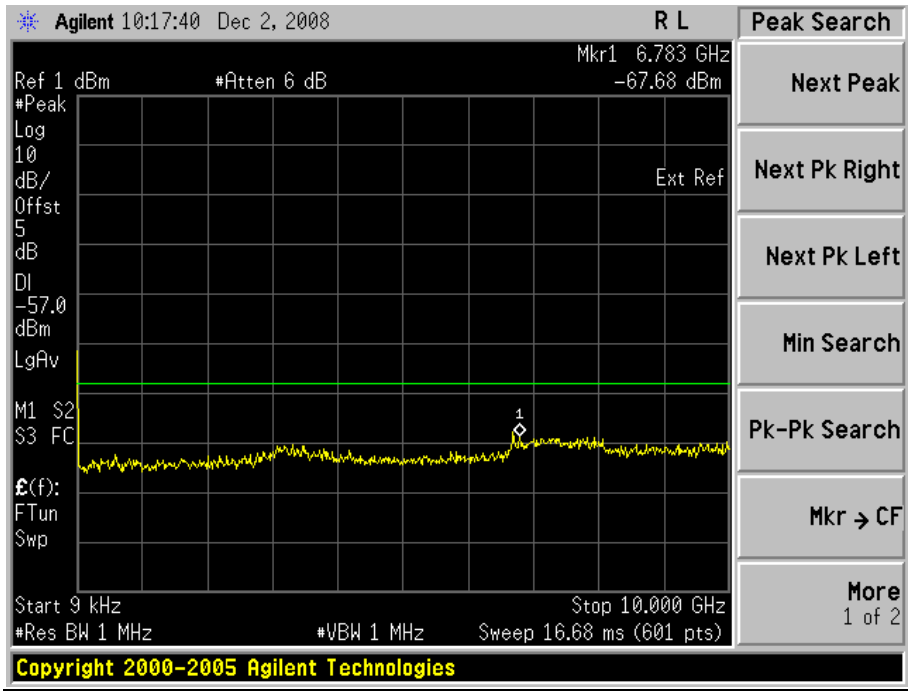
8PSK



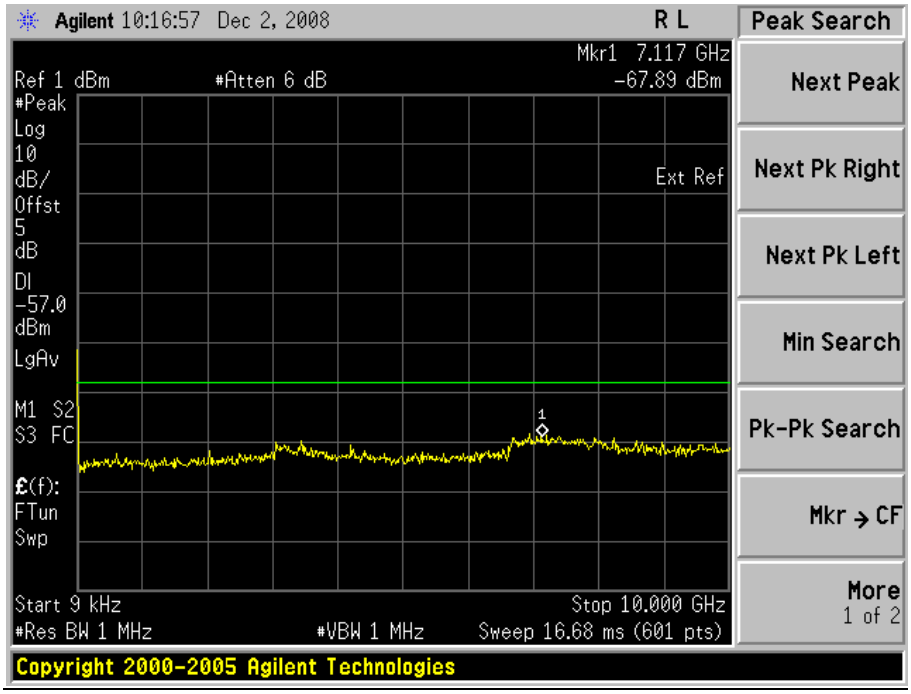
Configuration 1 - Mode 3

9kHz to 10GHz

GMSK



8PSK



Limit	-57dBm

2.9 FREQUENCY STABILITY UNDER TEMPERATURE VARIATIONS

2.9.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1055, 24.235
Industry Canada RSS 133:2008 Clause 6.3

2.9.2 Equipment Under Test

RRUN19-22 / KRC 161 170/5

2.9.3 Date of Test and Modification State

25 to 26 November 2008 – Modification State 0

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

The EUT was set to transmit on maximum power with all timeslots active. A Spectrum Analyser was used to measure the frequency error. The average result was taken over 200 bursts. The temperature was adjusted between –30ºC and +50ºC in 10º steps as per 2.1055.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.9.6 Environmental Conditions

	25 November 2008	26 November 2008
Ambient Temperature	21.4°C	22.0°C
Relative Humidity	23.8%	23.2%

2.9.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Frequency Stability Under Temperature Variations.

The test results are shown below.

Configuration 1 - Mode 2

GMSK

Temperature Interval (ºC)	Deviation (Hz)
-30	1.99
-20	-1.31
-10	-2.04
0	-6.27
+10	0.06
+20	-4.97
+30	-8.67
+40	-1.40
+50	1.62

8PSK

Temperature Interval (ºC)	Deviation (Hz)
-30	0.97
-20	2.75
-10	0.83
0	-3.67
+10	1.06
+20	-2.97
+30	-3.04
+40	-3.02
+50	-0.99

Limit	±1.0 ppm or ±1.96 kHz

Remarks

The frequency stability of the EUT is sufficient to keep it within the authorised frequency ranges at any temperature interval across the measured range.

2.10 FREQUENCY STABILITY UNDER VOLTAGE VARIATIONS

2.10.1 Specification Reference

FCC CFR 47 Part 24: 2007, Clause 2.1055, 24.235
Industry Canada RSS 133:2008 Clause 6.3

2.10.2 Equipment Under Test

RRUN19-22, S/N: CB 47968839

2.10.3 Date of Test and Modification State

25 November 2008 – Modification State 0

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.5 Test Method and Operating Modes

The test was applied in accordance with the test method requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008.

The EUT was set to transmit on maximum power with all timeslot active. A Spectrum Analyser was used to measure the frequency error. The average result was taken over 200 bursts. The supplied voltage was varied from 85 to 115 percent of the nominal value.

The test was performed with the EUT in the following configurations and modes of operation:

Configuration 1 - Mode 2

2.10.6 Environmental Conditions

	25 November 2008
Ambient Temperature	21.4°C
Relative Humidity	23.8%

2.10.7 Test Results

For the period of test the EUT met the requirements of FCC CFR 47 Part 24: 2007 and Industry Canada RSS 133:2008 for Frequency Stability Under Voltage Variations.

The test results are shown below.

Configuration 1 - Mode 2

20°C

GMSK

DC Voltage (V)	Deviation (Hz)
40.8	-2.73
48.0	-4.97
55.2	-1.78

8PSK

DC Voltage (V)	Deviation (Hz)
40.8	-7.76
48.0	-2.97
55.2	-0.81

Limit	±1.0 ppm or ±1.96 kHz

SECTION 3

TEST EQUIPMENT USED

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

Instrument	Manufacturer	Type No.	Serial No.	Calibration Due
Section 2.1, 2.2, 2.3, 2.4 2.5, 2.7 and 2.8 – Maximum Conducted Output Power , Emission Limitations for Cellular Equipment/Occupied Bandwidth , Spurious Emissions at Antenna Terminals (±1MHz) and Spurious Emissions				
Spectrum Analyser	Agilent	E4440A	MY46186610	2009/07/04
40dB Attenuator	Aeroflex Weinschel	48-40-43-LIM	BR5025	O/P MON
Network Analyzer	Agilent	8720D	US38431317	2009/05/04
Power Supply	Da Hua	DH1716-10	-	O/P MON
Digital Multimeter	FLUKE	179	91820401	2009/01/04
Thermo-hygrometer	AZ Instruments	8705	9151655	2008/12/20
Section 2.6 – Radiated Spurious Emissions				
EMI Receiver	Rohde & Schwarz	ESI 40	100015	2009/08/20
Ultra log test antenna	Rohde & Schwarz	HL562	100167	2009/08/20
Double-Ridged Waveguide Horn Antenna	Rohde & Schwarz	HF 906	100029	2009/08/20
Antenna master	Frankonia	MA 260	-	TU
Relay Switch Unit	Rohde & Schwarz	331.1601.31	338965002	TU
Signal generator	Rohde & Schwarz	SMR 20	100086	2009/08/20
Semi- Anechoic Chamber	Frankonia	23.18m×16.88m×9.60m	-	2010/07/19
Digital Multimeter	FLUKE	179	91820401	2009/01/04
Thermo-hygrometer	AZ Instruments	8705	9151655	2008/12/20
Section 2.9 and 2.10 – Frequency Stability Under Temperature and Voltage Variations				
Spectrum Analyser	Agilent	E4440A	MY46186610	2009/07/04
40dB Attenuator	Aeroflex Weinschel	48-40-43-LIM	BR5025	O/P MON
Network Analyzer	Agilent	8720D	US38431317	2009/05/04
Temperature Chamber	Zengda	GDW/SJ 6-16	200510203	O/P MON
Power Supply	Da Hua	DH1716-10	-	O/P MON
Digital Multimeter	FLUKE	179	91820401	2009/01/04
Thermo-hygrometer	AZ Instruments	8705	9151655	2008/12/20

TU Traceability Unscheduled
O/P MON Output monitored with calibrated equipment

3.2 MEASUREMENT UNCERTAINTY

For a 95% confidence level, the measurement uncertainties for defined systems are:-

Test Discipline	Frequency / Parameter	MU
Radiated Emissions, Bilog Antenna, AOATS	30MHz to 1GHz Amplitude	5.1dB*
Radiated Emissions, Horn Antenna, AOATS	1GHz to 40GHz Amplitude	6.3dB*
Substitution Antenna, Radiated Field	30MHz to 20GHz Amplitude	2.6dB
Worst case error for both Time and Frequency measurement 12 parts in 106.		

* In accordance with CISPR 16-4

SECTION 4

ACCREDITATION, DISCLAIMERS AND COPYRIGHT

4.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT

This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA (Not UKAS Accredited).