NORTEL NETWORKS™

FCC Part 24/Part22 Test Report for S12000 Indoor and Outdoor Base stations FCC ID#AB6S12000

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Corrections (§5.5) concerning spurious in 8 PSK for configuration PCS1900 PA30W.

Alain CAILLE

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1. INTRODUCTION

1.1. OBJECT

This report presents the test data in accordance with FCC Part 24 Subpart E for the S12000 Indoor and Outdoor Basestations in PCS1900 band configured with:

- a new module introduction : HePA (GMSK 60W / Edge 45W) 1900 .
- existing configuration with PA (GMSK 30W / Edge 30W) 1900 Band only

These results can be applied for mixed BTS configuration 1900 Band PA (GMSK 30W / Edge 30W) and HePA (GMSK 60W / Edge 45W)

This report presents also the test data in accordance with FCC Part 22, Subpart H , for the S12000 Indoor and Outdoor Basestations in 850 Band configured with:

- 850 Band only - PA (GMSK 30W / Edge 30W)

These results can be applied for 1900 / 850 Dual Band BTS configuration :

- 1900/ 850 Dual Band - PA (GMSK 30W / Edge 30W)
- 1900 Band HePA (GMSK 60W / Edge 45W) mixed with 850 Band PA (GMSK 30W / Edge 30W)

This report presents test data for GMSK modulation and 8PSK modulation (EDGE functionality).

1.2. SCOPE

This document applies to the S12000 BTS GSM 1900 Outdoor and Indoor versions.

RF Tests have been performed in the worst case S12000 BTS configuration (8HePA).

S8000 BTS can integrate a maximum of 6 HePA modules. As we use same modules eDRX, HePA and duplexer in S8000/S12000 BTS , measurements available in this document can be applied to S12000 BTS and S8000 BTS.

1.3. PRODUCT CONFIGURATI0NS

Testing was conducted on the Outdoor S12000 BTS with a worst case configuration of 8 HePA modules. As the RF transmit paths are identical in both the Outdoor system and Indoor system, testing has been conducted on the Outdoor version only. Measurements were taken with all available coupling configurations including with duplexer involves the compliance with H2D (two input coupler with 3dB loss coupling associated with duplexer) and the H4D configuration (four input coupler with 7dB loss coupling associated with duplexer). The systems use both GMSK modulation and 8PSK, testing was done with both modulation types.

2. RELATED DOCUMENTS

2.1. APPLICABLE DOCUMENTS

[A1]	CFR 47 - Part 2	FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS
[A2]	CFR 47 - Part 24	PERSONAL COMMUNICATIONS SERVICES
[A3]	CFR 47 - Part 22	PUBLIC MOBILE SERVICES

2.2. REFERENCE DOCUMENTS

[R1]	PE/BTS/DJD/0222	FCC Part 24 Type Acceptance Filing for Nortel's S8000 Outdoor BTS AB6OUDS8000
[R2]	PCS/BTS/DJD/0234	AB6OUDS8000: FCC Part 24 Class II Permissive Change Application : S8000 Indoor BTS
[R3]	PCS/BTS/DJD/0730	AB6OUDS8000: FCC Part 24 Class II Permissive Change Application : S8000 Indoor BTS
[R4]	PCS/BTS/DJD/0743	S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000
[R5]	PCS/BTS/DJD/0746	S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000

[R6]	PCS/BTS/DJD/04574	S8000 Outdoor and Indoor BTS GSM 1900 : FCC Part 24 Class II Permissive Change Application AB6OUDS8000
[R7]	PE/BTS/DJD/002630	S8000 Outdoor and Indoor BTS eGSM 850 FCC Part 22 : exhibits documents
[R8]	PE/BTS/DJD/4233	S12000 Indoor BTS GSM 850 / PCS 1900: FCC Part 22 / FCC Part 24 Certification Filing for Nortel AB6INDS12000 exhibits document
[R9]	PE/BTS/DJD/4248	S12000 Outdoor BTS GSM 850 / PCS 1900: FCC Part 22 / FCC Part 24 Certification Filing for Nortel AB6OUTS12000 exhibits document

3. ABBREVIATIONS & DEFINITIONS

3.1. ABBREVIATIONS

DRX	Driver Receiver Unit
e-DRX	EDGE DRX
BCF	Base Common Function
BTS	Base Transceiving Station
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

3.2. DEFINITIONS

- PCS1900 Frequency Band and Channels

PCS 1900	C512	C661	C810
F Tx (MHz)	1930.2	1960	1989.8
F Rx (MHz)	1850.2	1880	1909.8

For 512 < n <810

$F_{Rx}(n) = 1850.2 + 0.2*(n-512)$

$F_{Tx}(n) = F_{Rx}(n) + 80$

IF frequencies on Radio Board: For Tx path 299 MHz
For Rx path 211 MHz

Clock frequency on the Radio Board 13MHz created from 4.096MHz coming from the Digital board.

- GSM850 Frequency Band and Channels

GSM 850	C128	C189	C251
Short	B	M	T
F Tx (MHz)	869.2	881.4	893.8
F Rx (MHz)	824.2	836.4	848.8

For 128 < n <251

$F_{Rx}(n) = 824.2 + 0.2*(n-128)$

$T_{Tx}(n) = F_{Rx}(n) + 45$

IF frequencies on Radio Board: For Tx path 133 MHz
For Rx path 71 MHz

Clock frequency on the Radio Board 13MHz created from 4.096MHz coming from the Digital board.

4. EXHIBIT 1 : TEST REPORT – HEPA PCS1900

4.1. INTRODUCTION

The following information is submitted for update of the type acceptance of a Broadband PCS Base Station for Northern Telecom, Inc., in accordance with FCC Part 24, Subpart E and Part 2, Subpart J of the FCC Rules and Regulations.
The measurement procedures were in accordance with the requirements of Part 2.

4.2. MEASUREMENT RESULTS

Table 1 is a summary of the measurement results for this update.

Table 1 : Measurement Results Summary

FCC Measurement Specification	IC Limit Specification	Description	Result	Note
2.1046(a), 2.1033(c)(8) 24.232	6.2	RF Power Output	Complies	
2.1049		Occupied Bandwidth	Complies	
2.1051, 2.1057 24.238	6.3 6.4	Spurious Emissions at Antenna Terminals	Complies	With power reduction at band edge channels
2.1055 24.235	7.0	Frequency Stability	Complies	

4.3. NAME OF TEST: RF POWER OUTPUT

4.3.1. 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.

4.3.2. TEST RESULTS

Table 2 shows the test results of RF Output Power for **GMSK modulation** with several coupling configurations :

Radio Channel	Frequency (MHz)	Duplexer Power (dBm)	H2D Power (dBm)	H4D Power (dBm)	HePA Output Power (dBm)	Limit (dBm)
512	1930,2	45.8	42.2	39.3	GMSK (60W) 47.8 dBm +/- 0.5 dB	50 dBm
548	1937,4	46.1	42.4	39.6		
585	1944,8	46.3	42.6	39.8		
587	1945,2	46.3	42.6	39.8		
598	1947,4	46.2	42.6	39.8		
610	1949,8	46.3	42.6	39.8		
612	1950,2	46.3	42.6	39.8		
648	1957,4	46.5	42.9	39.9		
685	1964,8	46.5	42.8	39.9		
687	1965,2	46.5	42.8	39.9		
698	1967,4	46.5	42.9	39.9		
710	1969,8	46.5	42.9	39.9		
712	1970,2	46.5	42.9	39.9		
723	1972,4	46.5	42.8	39.9		
735	1974,8	46.5	42.8	39.8		
737	1975,2	46.5	42.8	39.8		
773	1982,4	46.5	42.7	39.9		
810	1989,8	46.6	42.9	39.9		

Table 3 shows the test results of RF Output Power for **8PSK modulation** supported by eDRX/HePA 1900 with several coupling configurations :

Radio Channel	Frequency (MHz)	Duplexer Power (dBm)	H2D Power (dBm)	H4D Power (dBm)	HePA Output Power (dBm)	Limit (dBm)
512	1930,2	45	41.9	38.5	8PSK (45W) 46.5 dBm +/- 0.5 dB	50 dBm
548	1937,4	45.3	41.6	38.8		
585	1944,8	45.5	41.8	39		
587	1945,2	45.5	41.8	39		
598	1947,4	45.4	41.8	39		
610	1949,8	45.5	41.8	39		
612	1950,2	45.5	41.8	39		
648	1957,4	45.7	42	39.1		
685	1964,8	45.7	42	39.1		
687	1965,2	45.7	42	39.1		
698	1967,4	45.7	42	39.1		
710	1969,8	45.7	42	39.1		
712	1970,2	45.7	42	39.1		
723	1972,4	45.7	42	39.1		
735	1974,8	45.7	42	39		
737	1975,2	45.7	42	39.1		
773	1982,4	45.7	41.9	39.1		
810	1989,8	45.8	42.1	39.2		

Table 4 shows the HePA Output RF Power reduction available

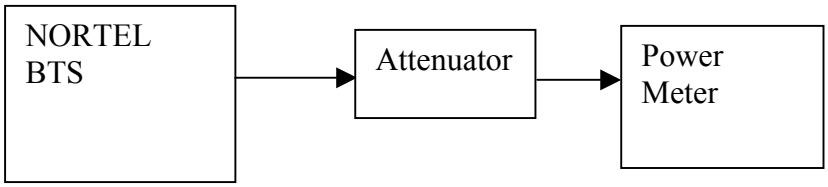
- For GMSK modulation
- For 8PSK modulation supported by eDRX/HePA 1900

Power reduction available	HePA **(60W)** output Power for GMSK modulation (dBm)	HePA **(45W)** output Power for 8PSK modulation (dBm)
Pmax *Pmax – 1dB*	**47.8**	**46.5**
Pmax – 2 dB *Pmax – 3dB*	45.8	44.5
Pmax – 4 dB *Pmax – 5dB*	43.8	42.5
Pmax – 6 dB *Pmax – 7dB*	41.8	40.5

4.3.3. TEST PROCEDURE

The equipment was configured as shown in schematic 1.

Schematic 1: Test configuration for RF Output Power



The BTS was configured to transmit at maximum power (static level 0) :

- for GMSK modulation, in mode GMSK no synchro,
- for 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

Measurements were made at frequencies which are the bottom, middle and top of each of the licensed blocks.

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

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

4.4. NAME OF TEST : OCCUPIED BANDWIDTH

4.4.1. 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.

4.4.2. TEST RESULTS

The maximum occupied bandwidth was found to be:
320.6 kHz, measured on channel 661, f=1960 MHz in GMSK modulation,
317 kHz, measured on channel 661, f=1960 MHz in 8PSK modulation.

Figure 1: Sample plot for occupied bandwidth in GMSK modulation

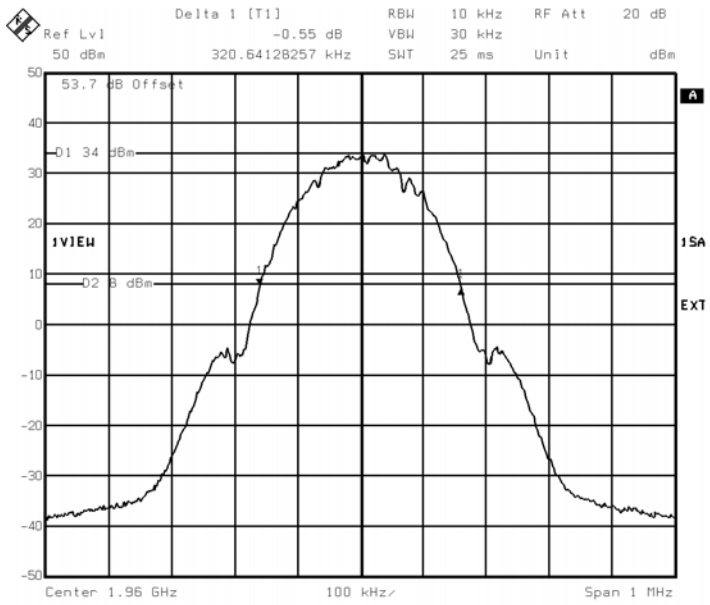
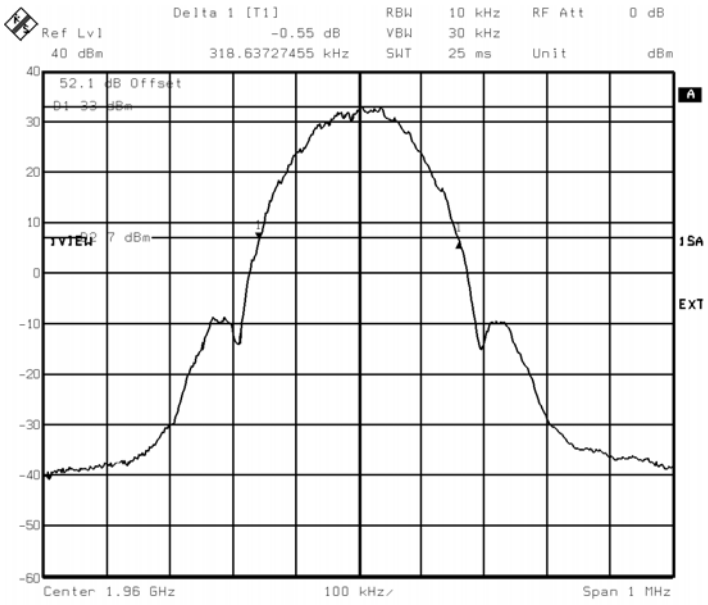


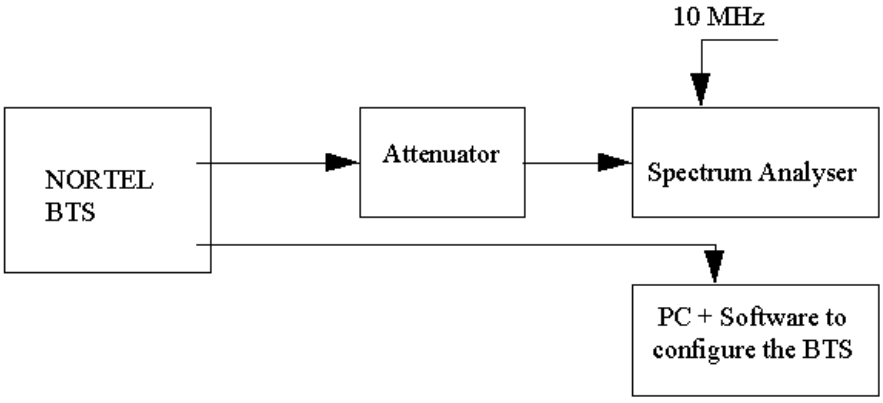
Figure 2: Sample plot for occupied bandwidth in 8PSK modulation



4.4.3. TEST PROCEDURE

The equipment was configured as shown in schematic 2.

Schematic 2 : Test configuration for Occupied bandwidth



The BTS was configured to transmit at maximum power (static level 0) :

- for GMSK modulation, in mode GMSK no synchro,
- for 8PSK modulation, in mode logical PDCH, Type GPRS, coding MCS5.

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 :

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

4.5. NAME OF TEST: SPURIOUS EMISSIONS AT ANTENNA TERMINALS

4.5.1. FCC REQUIREMENTS LIMITS – FCC PART 24.238

(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.

4.5.2. TEST RESULTS WITH DUPLEXER CONFIGURATION

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (46.3 dBm = 42.63 Watts).

Therefore the spurious emissions must be attenuated by at least 43 + 10*Log(42.63) =59.3dB
The measured output power was 46.3 dBm ; therefore the limit is 46.3 – 59.3 = -13 dBm.

Spurious measurement is performed with the worst configuration with Duplexer coupling and 60W High Power amplifier .

The Nominal power at antenna connector : PD max =46.5 dBm.

The test compliance with duplexer involves the compliance with H2D (two input coupler with 3dB loss coupling associated with duplexer) and the compliance with H4D configuration (four input coupler with 7dB loss coupling associated with duplexer).

Tables 5 and 6 show the results for Spurious Emissions at Antenna Terminals.

Table 5 : Spurious emissions with the diplexer for GMSK modulation

	Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax-4	-16.2	-13	3.2
A	585	Pmax-4	-14.7	-13	1.7
D	587	Pmax-4	-15.4	-13	2.4
D	610	Pmax-4	-14.3	-13	1.3
B	612	Pmax-4	-15.1	-13	2.1
B	685	Pmax-4	-14.1	-13	1.1
E	687	Pmax-4	-15	-13	2
E	710	Pmax-4	-14.6	-13	1.6
F	712	Pmax-4	-15.2	-13	2.2
F	735	Pmax-4	-14.5	-13	1.5
C	737	Pmax-4	-14.6	-13	1.6
C	810	Pmax-4	-13.9	-13	0.9

Tables 6: Spurious emissions with the diplexer for 8PSK modulation

	Channel	Power emission level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax-2	-16.3	-13	3.3
A	585	Pmax-2	-16.8	-13	3.8
D	587	Pmax-2	-15.8	-13	2.8
D	610	Pmax-2	-16.2	-13	3.2
B	612	Pmax-2	-15.4	-13	2.4
B	685	Pmax-2	-15.8	-13	2.8
E	687	Pmax-2	-15.2	-13	2.2
E	710	Pmax-2	-16	-13	3
F	712	Pmax-2	-14.6	-13	1.6
F	735	Pmax-2	-16.1	-13	3.1
C	737	Pmax-2	-15.3	-13	2.3
C	810	Pmax-2	-15.2	-13	2.2

Notes :

GMSK modulation measurements:
Figures from 3 to 6 show sample plots for the case when the transmitter was tuned with the power reduced by 4 dB in diplexer configuration for differents Edge Channel 512 , 585, 737, 810.

8PSK modulation measurements:
Figures from 7 to 10 show sample plots for the case when the transmitter was tuned at the power reduced by 2dB in diplexer configuration.

Out of band measurement in GMSK modulation:
Figures from 11 to 20 show sample plots for frequency spans from 0 to 20 GHz with emission on channel 810 at maximum power with diplexer configuration.

Figure 3 :
-1 MHz adjacent band (Channel 512, Pmax-4),
Diplexer only, GMSK modulation

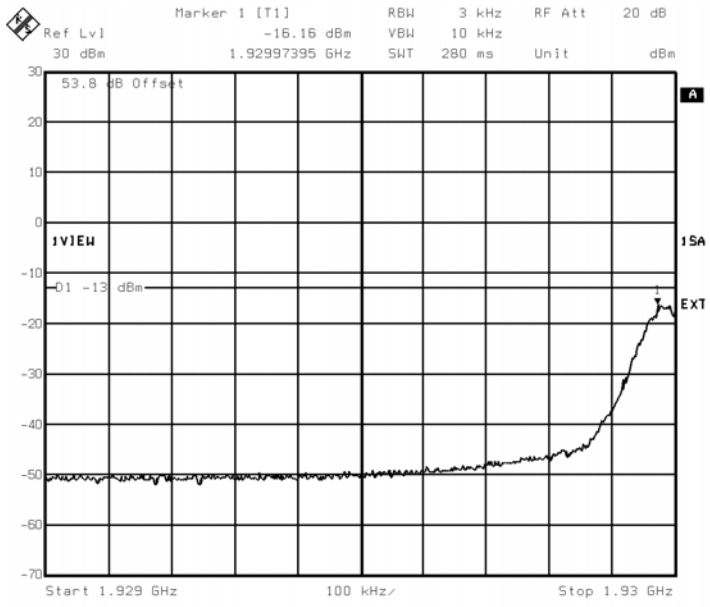


Figure 4 :
+1 MHz adjacent band (Channel 585, Pmax-4),
Diplexer only, GMSK modulation

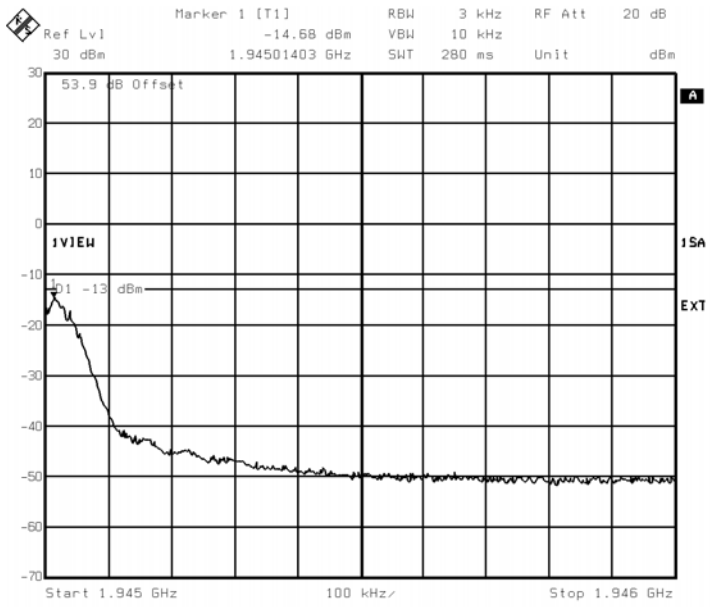


Figure 5 :
-1 MHz adjacent band (Channel 737, Pmax-4),
Diplexer only, GMSK modulation

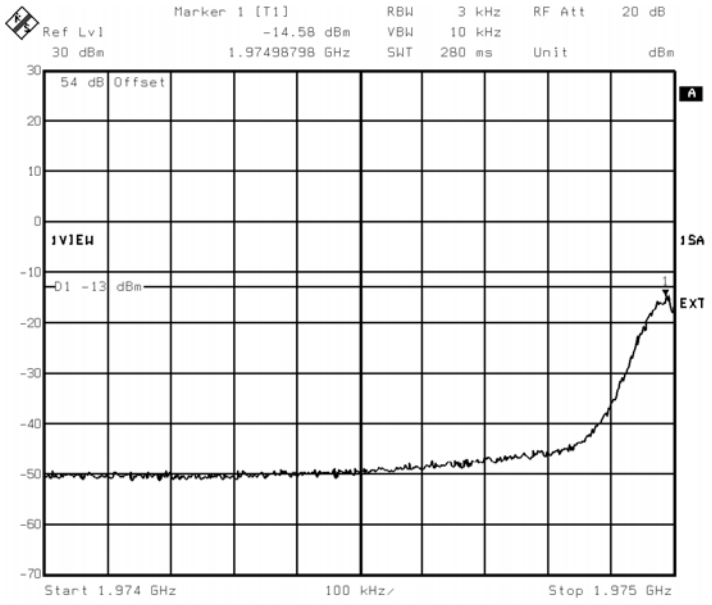


Figure 6:
+1 MHz adjacent band (Channel 810, Pmax-4),
Diplexer only, GMSK modulation

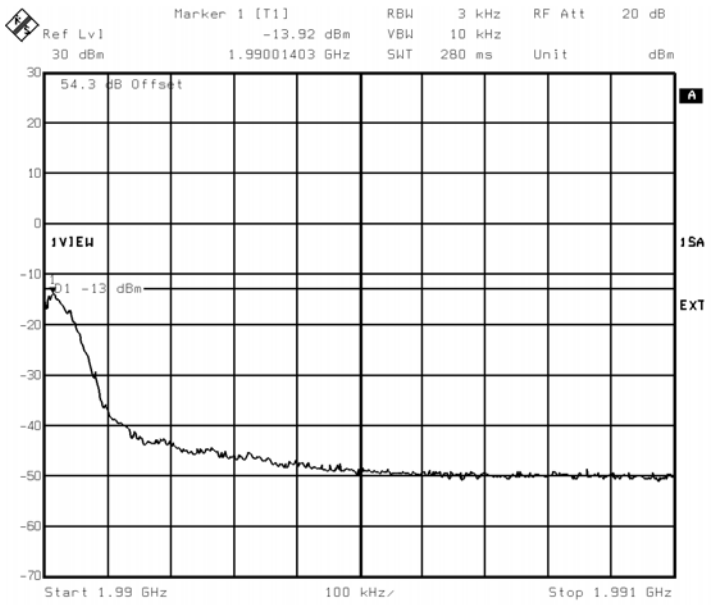


Figure 7:

-1 MHz adjacent band (Channel 512, Pmax-2),
Diplexer only, 8PSK modulation

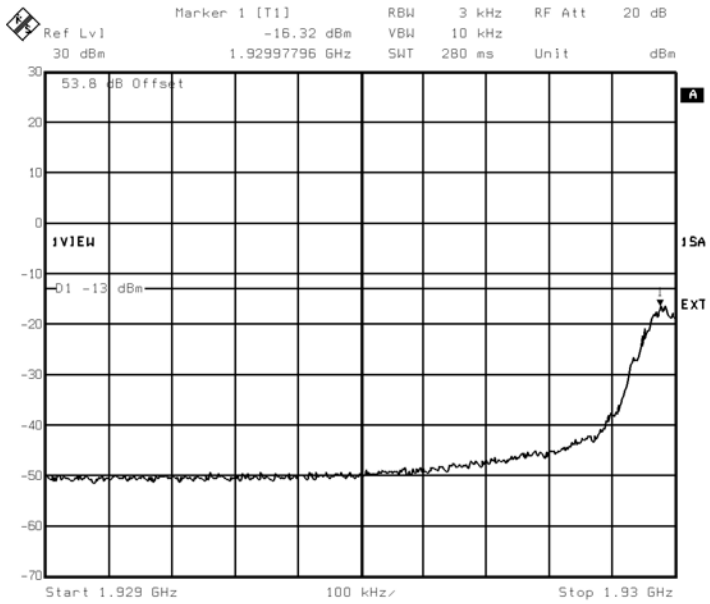


Figure 8:

+1 MHz adjacent band (Channel 585, Pmax-2),
Diplexer only, 8PSK modulation

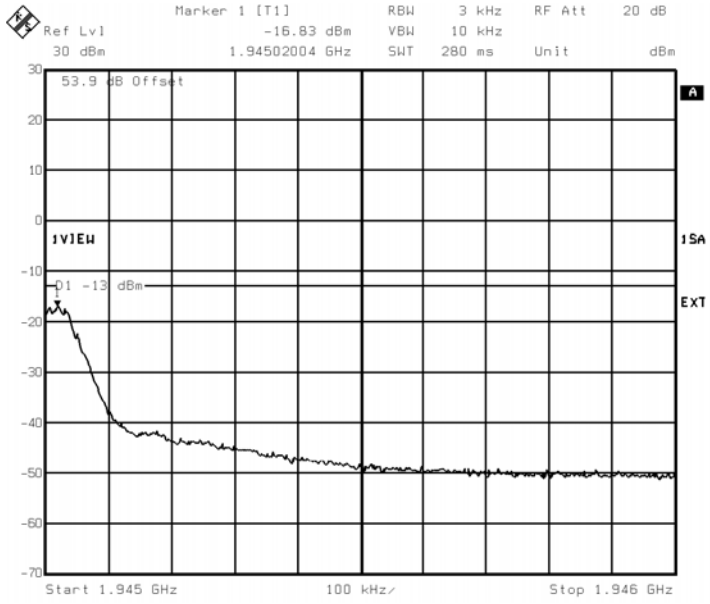


Figure 9:
-1 MHz adjacent band (Channel 737, Pmax-2),
Diplexer only, 8PSK modulation

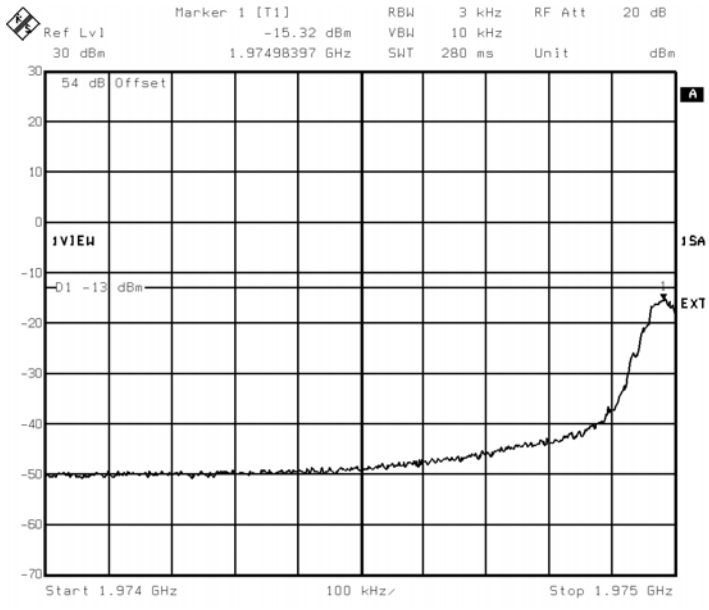
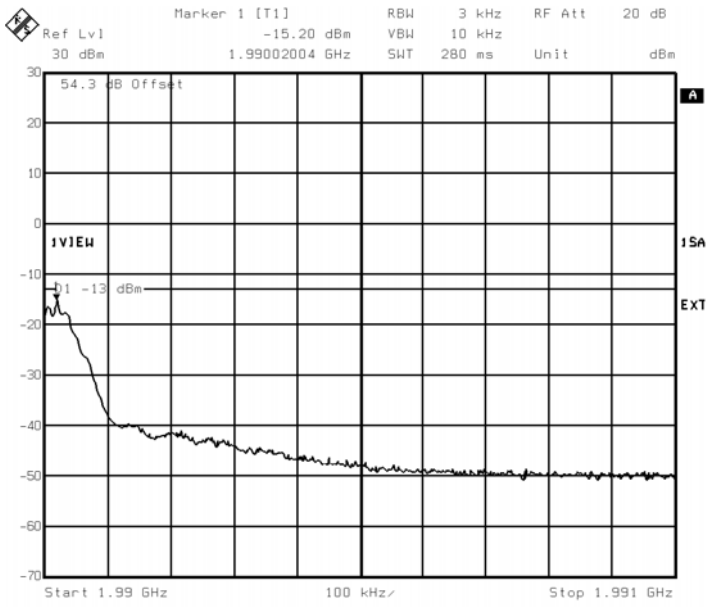


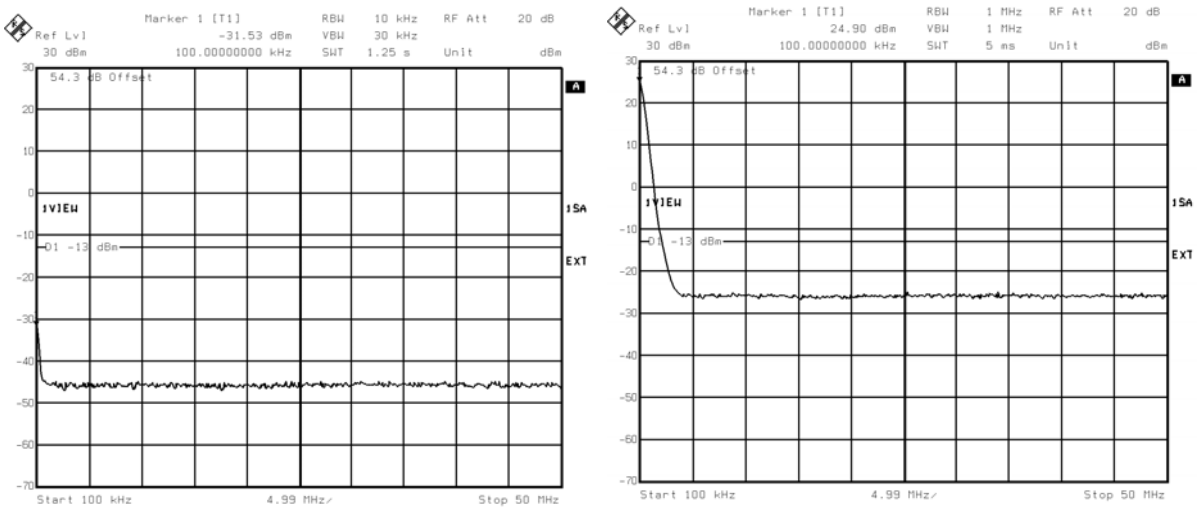
Figure 10:
+1 MHz adjacent band (Channel 810, Pmax-2),
Diplexer only, 8PSK modulation



Out-of-block emissions (Channel 810, Pmax), Diplexer, GMSK modulation

Figure 11:

100 kHz – 50 MHz

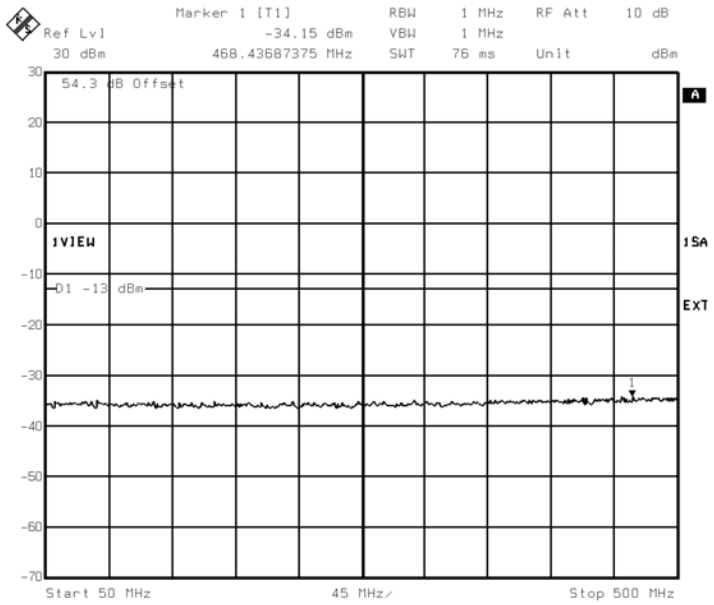


RBW=10 kHz RBW=1 MHz (*)

(*) *Note: spectrum line at 100 kHz is internal DC spectrum line of analyser*

Figure 12:

50 MHz – 500 MHz



Out-of-block emissions (Channel 810, Pmax), Diplexer, GMSK modulation

Figure 13 : 500 MHz – 1970.2 MHz

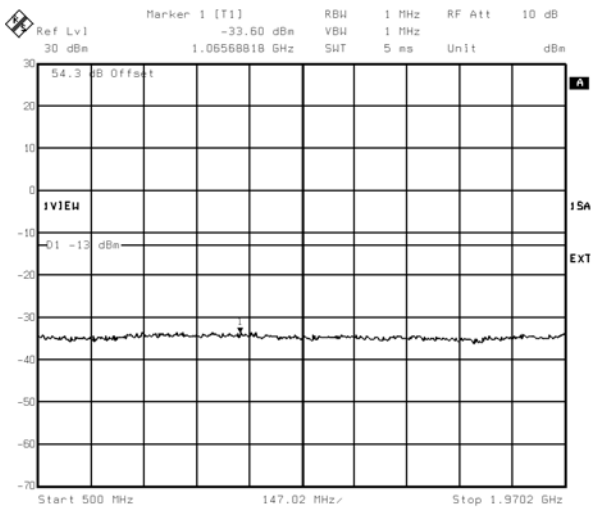


Figure 14 : 1970.2 – 1974 MHz

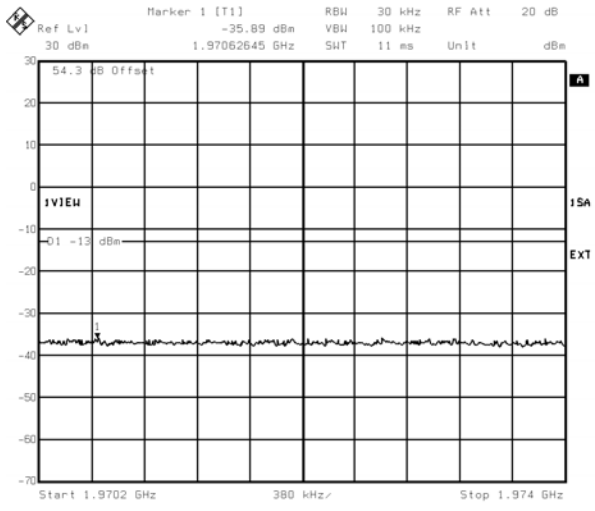
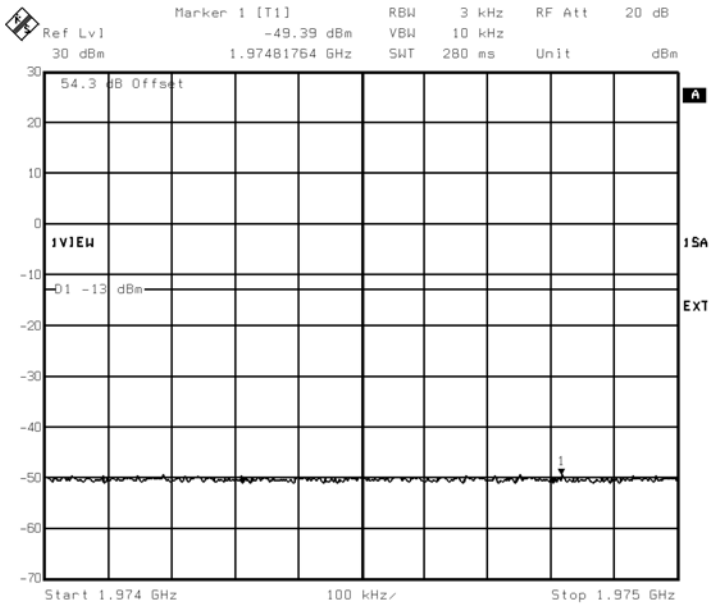


Figure 15 : 1974 – 1975 MHz



Out-of-block emissions (Channel 810, Pmax), Diplexer, GMSK modulation

Figure 16 : 1991 – 1994.8 MHz

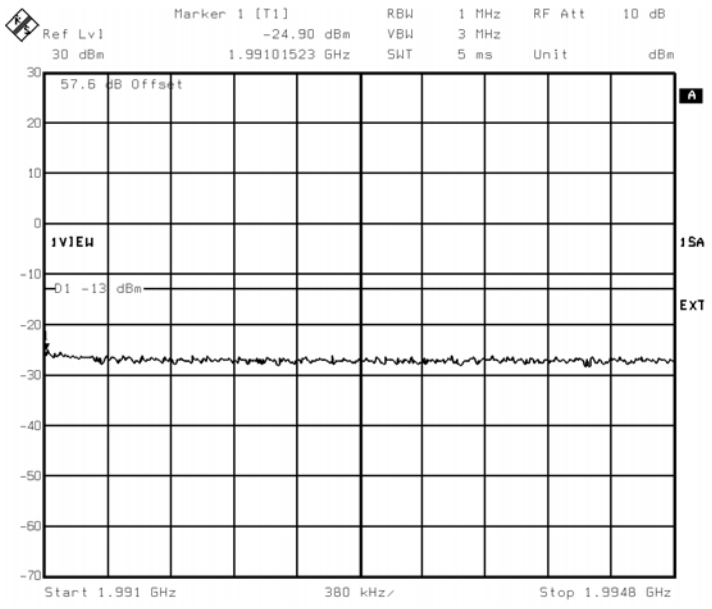
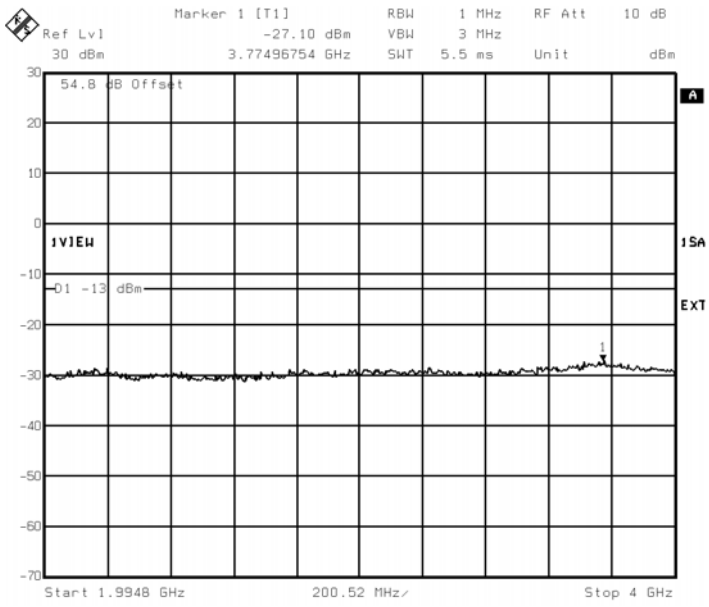


Figure 17 : 1994.8 MHz – 4 GHz



Out-of-block emissions (Channel 810, Pmax), Diplexer, GMSK modulation

Figure 18 : 4 – 8 GHz

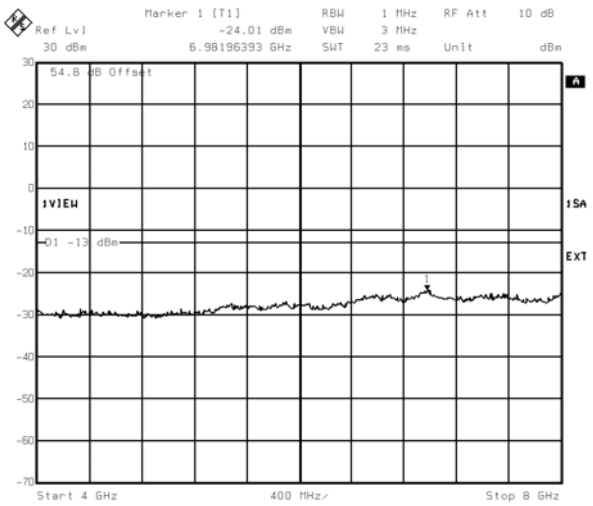


Figure 19 : 8 – 12 GHz

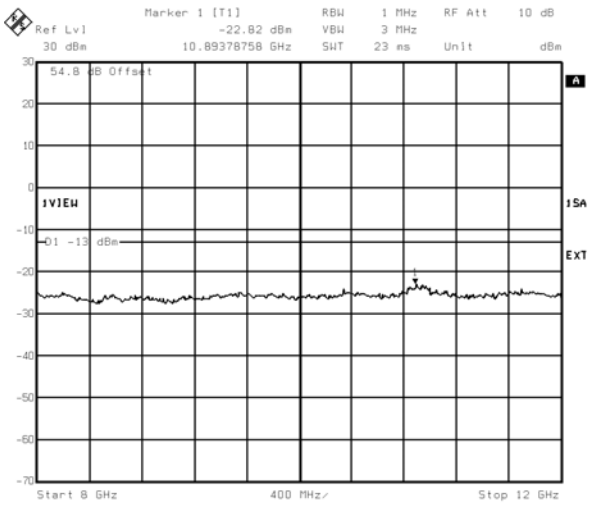
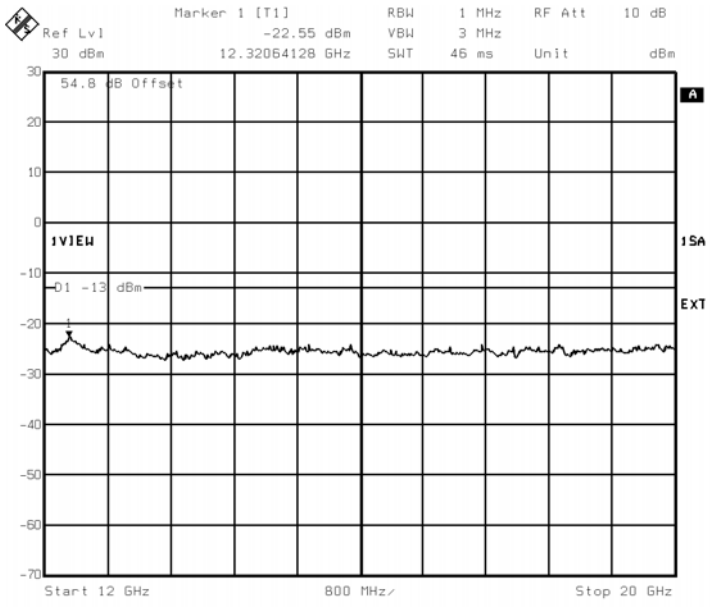


Figure 20 : 12 – 20 GHz



4.5.3. TEST RESULTS WITH H2D DUPLEXER CONFIGURATION

Table 7: Spurious emissions with the H2D for GMSK modulation

	Channel	Power level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax	-15.1	-13	2.1
A	585	Pmax	-14.1	-13	1.1
D	587	Pmax	-14.9	-13	1.9
D	610	Pmax	-14.1	-13	1.1
B	612	Pmax	-15.2	-13	2.2
B	685	Pmax	-13.7	-13	0.7
E	687	Pmax	-14.4	-13	1.4
E	710	Pmax	-14.1	-13	1.1
F	712	Pmax	-14.4	-13	1.4
F	735	Pmax	-13.9	-13	0.9
C	737	Pmax	-14.3	-13	1.3
C	810	Pmax	-13.5	-13	0.5

GMSK modulation measurements:

Figures from 21 to 24 show sample plots for the case when the transmitter was tuned with the maximum power in H2D diplexer configuration for different Edge Channel 512 , 585, 737, 810.

Table 8: Spurious emissions with the H2D for 8PSK modulation

	Channel	Power level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax	-16.9	-13	3.9
A	585	Pmax	-17.7	-13	4.7
D	587	Pmax	-16.5	-13	3.5
D	610	Pmax	-17.2	-13	4.2
B	612	Pmax	-16.8	-13	3.8
B	685	Pmax	-17	-13	4
E	687	Pmax	-16.2	-13	3.2
E	710	Pmax	-17.4	-13	4.4
F	712	Pmax	-16.2	-13	3.2
F	735	Pmax	-17.1	-13	4.1
C	737	Pmax	-16.2	-13	3.2
C	810	Pmax	-16.5	-13	3.5

8PSK modulation measurements:

Figures from 25 to 28 show sample plots for the case when the transmitter was tuned at the maximum power in H2D diplexer configuration.

Figure 21:
-1 MHz adjacent band (Channel 512, Pmax),
H2D, GMSK modulation

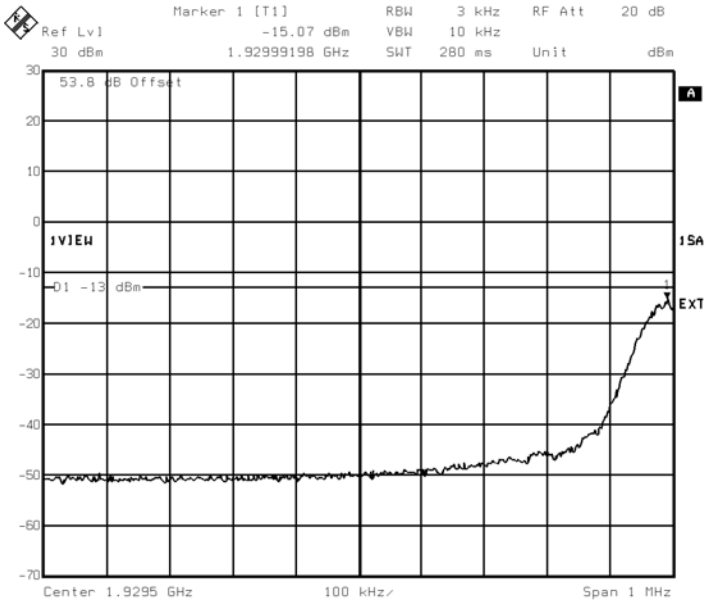


Figure 22 :
+1 MHz adjacent band (Channel 585, Pmax),
H2D, GMSK modulation

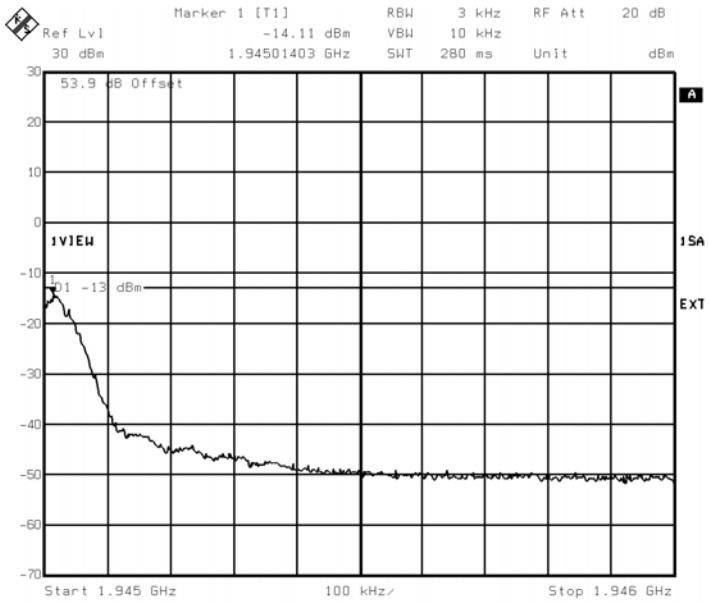


Figure 23 :
-1 MHz adjacent band (Channel 737, Pmax),
H2D, GMSK modulation

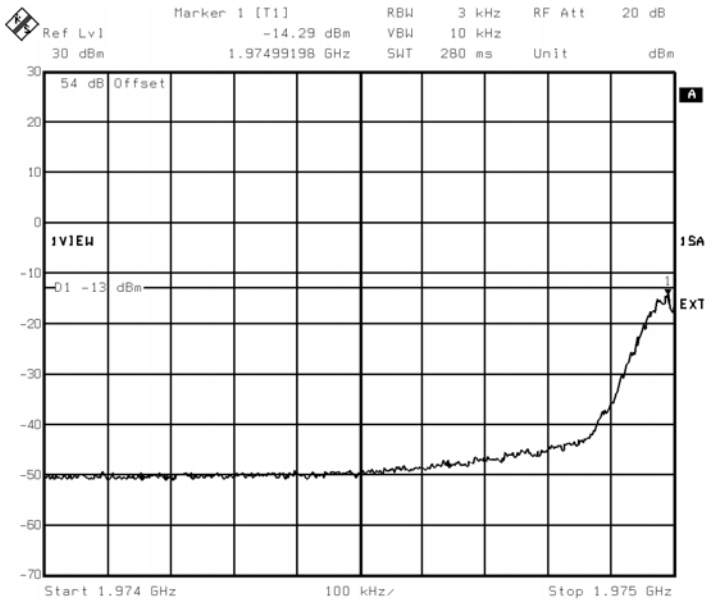


Figure 24 :
+1 MHz adjacent band (Channel 810, Pmax),
H2D, GMSK modulation

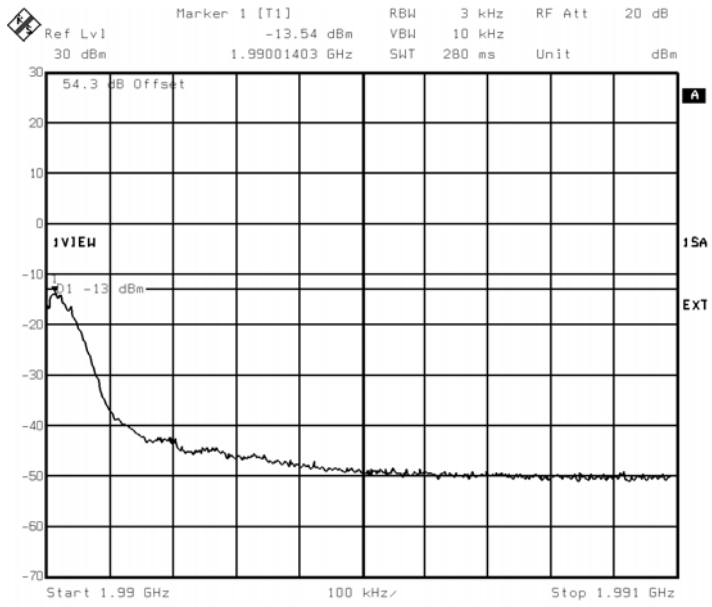


Figure 25 :
-1 MHz adjacent band (Channel 512, Pmax),
H2D, 8PSK modulation

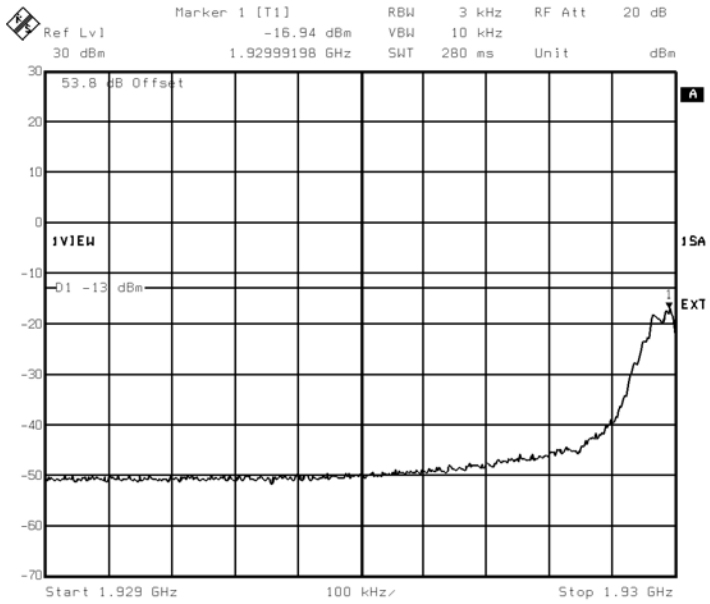


Figure 26 :
+1 MHz adjacent band (Channel 585, Pmax),
H2D, 8PSK modulation

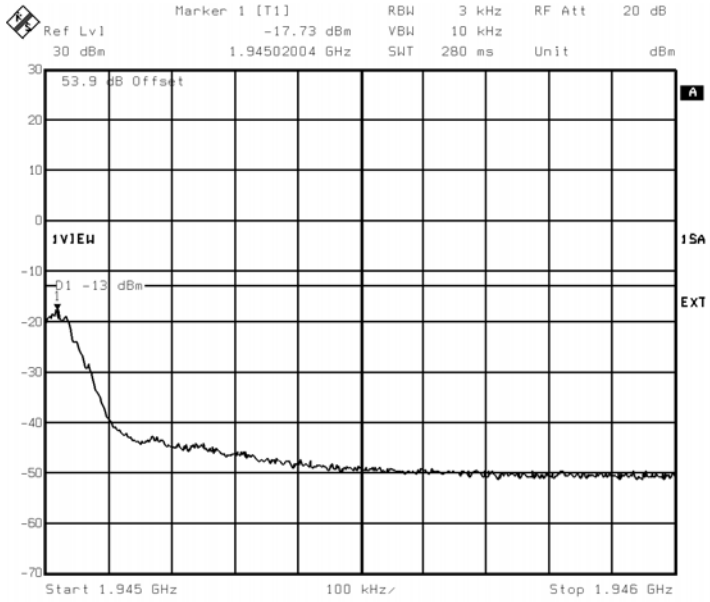


Figure 27 :
-1 MHz adjacent band (Channel 737, Pmax),
H2D, 8PSK modulation

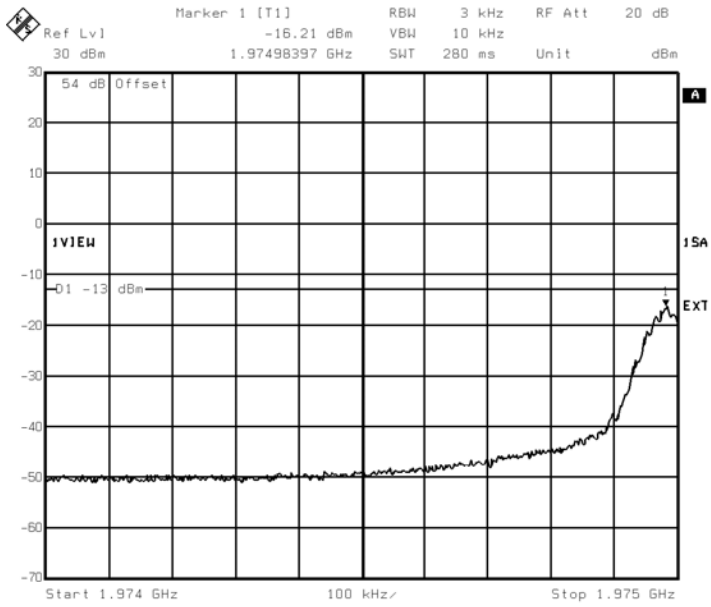
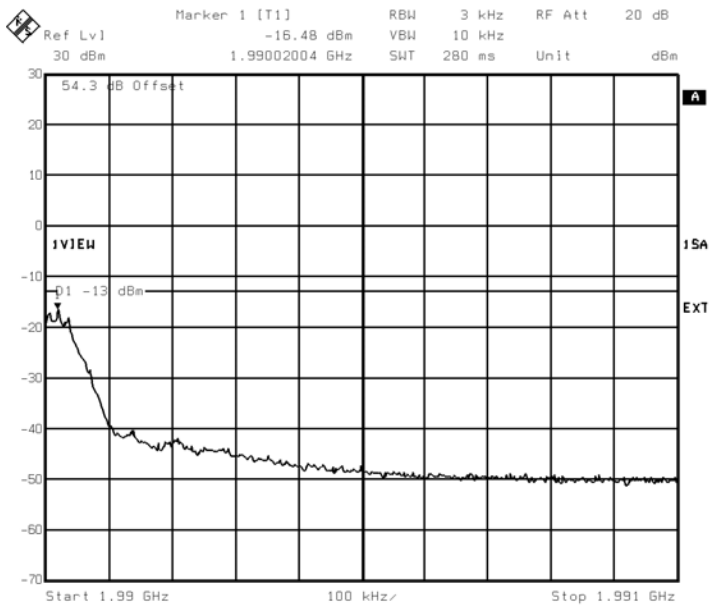


Figure 28 :
+1 MHz adjacent band (Channel 810, Pmax),
H2D, 8PSK modulation



4.5.4. TEST RESULTS WITH H4D DUPLEXER CONFIGURATION

Table 9: Spurious emissions with the H4D for GMSK modulation

	Channel	Power level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax	-17.8	-13	4.8
A	585	Pmax	-17.1	-13	4.1
D	587	Pmax	-18	-13	5
D	610	Pmax	-16.3	-13	3.3
B	612	Pmax	-18.1	-13	5.1
B	685	Pmax	-16.4	-13	3.4
E	687	Pmax	-17.6	-13	4.6
E	710	Pmax	-16.6	-13	3.6
F	712	Pmax	-17.1	-13	4.1
F	735	Pmax	-16.6	-13	3.6
C	737	Pmax	-17.7	-13	4.7
C	810	Pmax	-16.3	-13	3.3

GMSK modulation measurements:

Figures from 29 to 32 show sample plots for the case when the transmitter was tuned with the maximum power in H4D diplexer configuration for different Edge Channel 512 , 585, 737, 810.

Table 10: spurious emissions with the H4D for 8PSK modulation

	Channel	Power level	Spurious emissions level (dBm)	Limit (dB)	Margin (dB)
A	512	Pmax	-20.2	-13	7.2
A	585	Pmax	-20.3	-13	7.3
D	587	Pmax	-19.2	-13	6.2
D	610	Pmax	-20.5	-13	7.5
B	612	Pmax	-18.9	-13	5.9
B	685	Pmax	-20.1	-13	7.1
E	687	Pmax	-18.8	-13	5.8
E	710	Pmax	-20	-13	7
F	712	Pmax	-19	-13	6
F	735	Pmax	-19.9	-13	6.9
C	737	Pmax	-19.4	-13	6.4
C	810	Pmax	-19.9	-13	6.9

8PSK modulation measurements:

Figures from 33 to 36 show sample plots for the case when the transmitter was tuned at the maximum power in H4D diplexer configuration.

Figure 29:
-1 MHz adjacent band (Channel 512, Pmax),
H4D, GMSK modulation

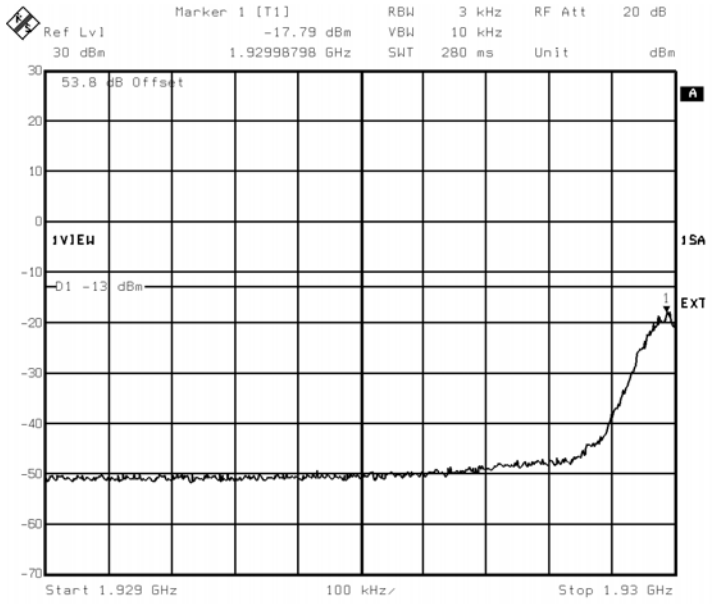


Figure 30 :
+1 MHz adjacent band (Channel 585, Pmax),
H4D, GMSK modulation

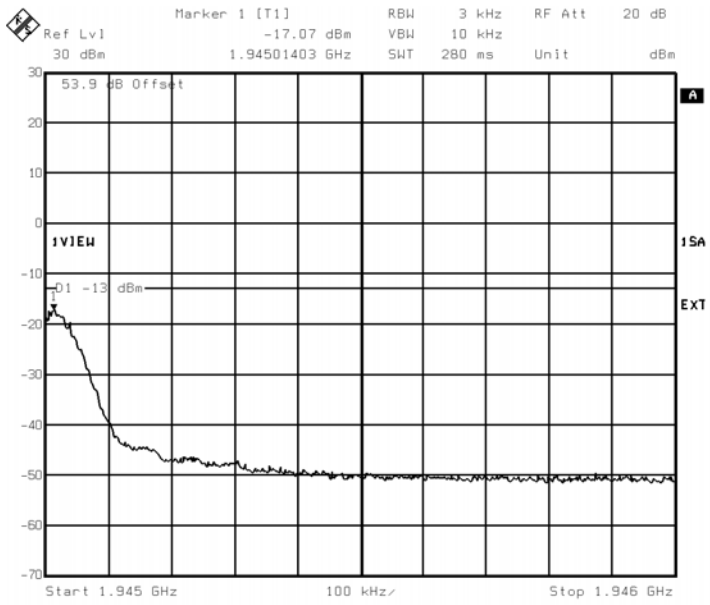


Figure 31 :
-1 MHz adjacent band (Channel 737, Pmax),
H4D, GMSK modulation

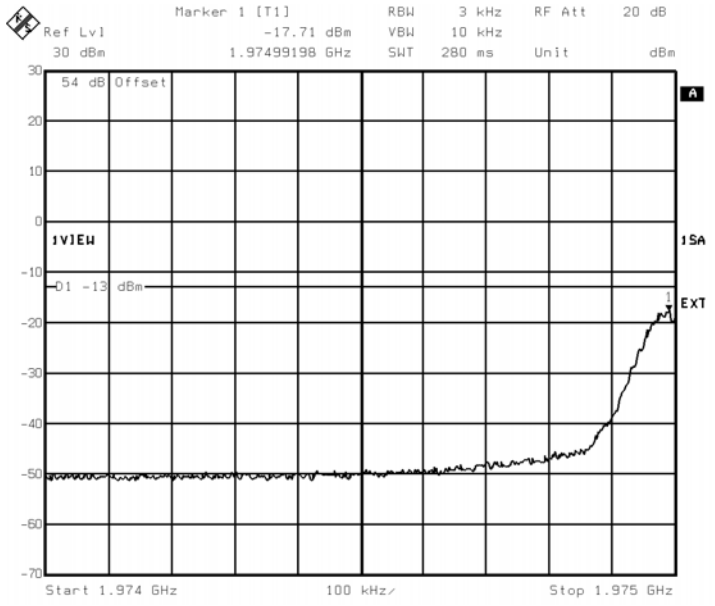


Figure 32 :
+1 MHz adjacent band (Channel 810, Pmax),
H4D, GMSK modulation

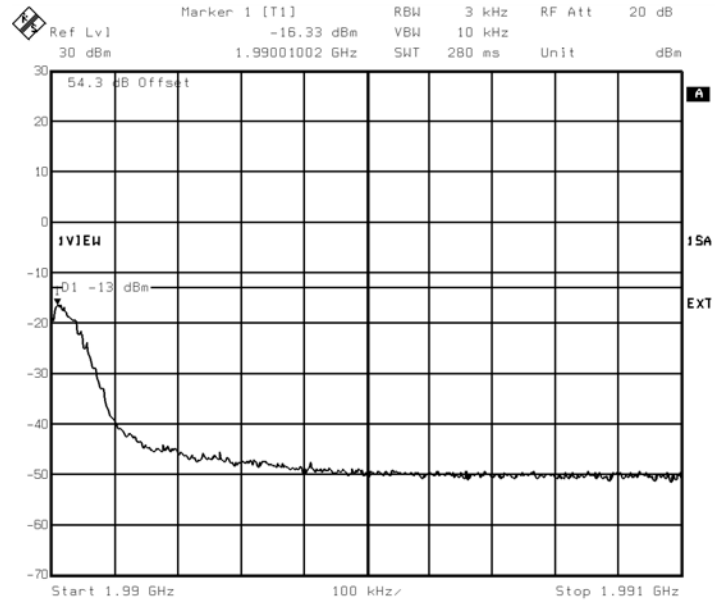


Figure 33:
-1 MHz adjacent band (Channel 512, Pmax),
H4D, 8PSK modulation

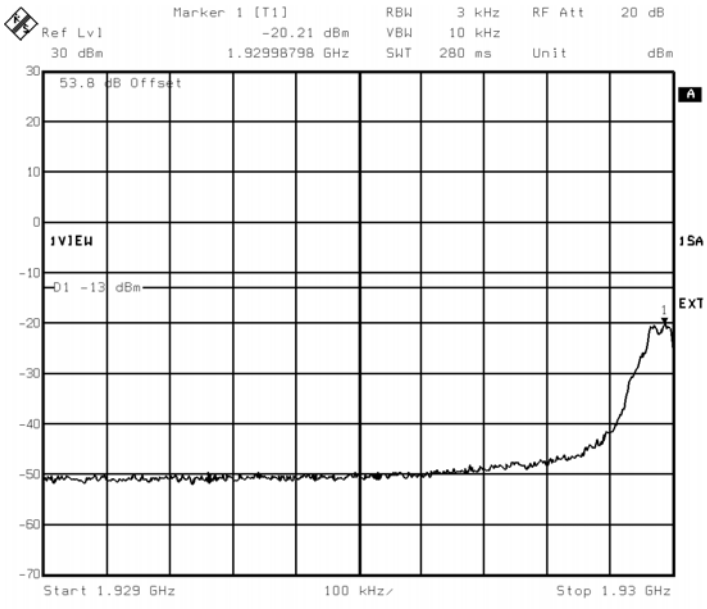


Figure 34 :
+1 MHz adjacent band (Channel 585, Pmax),
H4D, 8PSK modulation

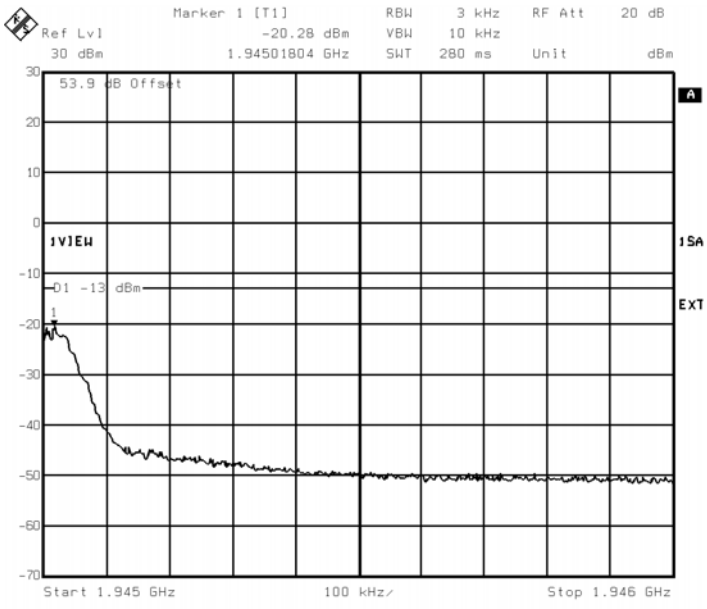


Figure 35:
-1 MHz adjacent band (Channel 737, Pmax),
H4D, 8PSK modulation

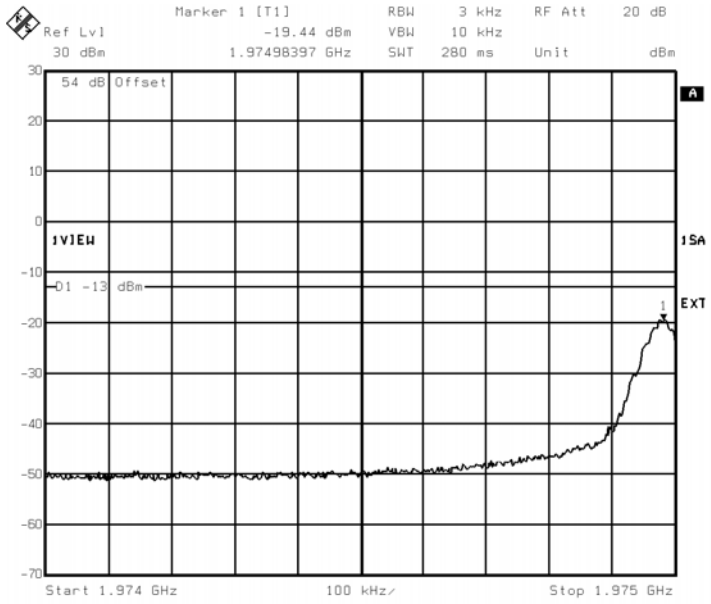
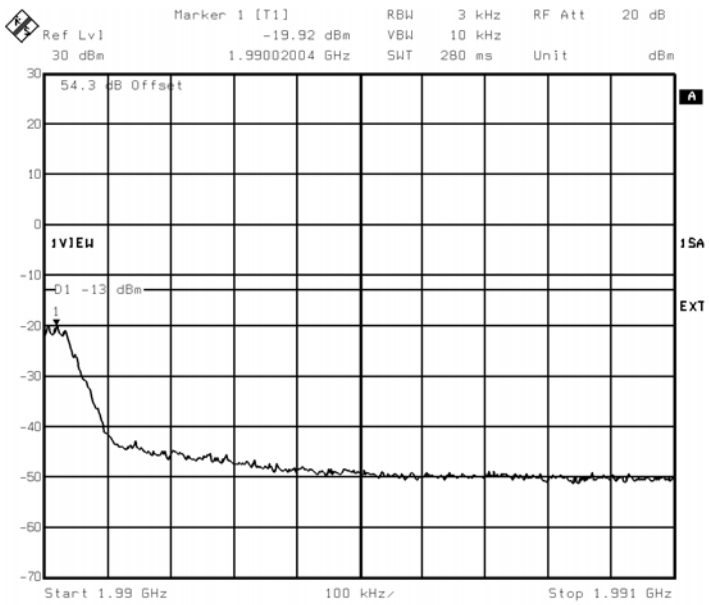


Figure 36 :
+1 MHz adjacent band (Channel 810, Pmax),
H4D, 8PSK modulation



4.5.5. CONCLUSION

- **GMSK modulation:**

Coupling Configuration	Antenna Output power (dBm)	Power reduction Measurement (qualification modules)	System Power limitation GMSK modulation
Diplexer	46.5	Pmax – 4 dB = 42.5 dBm	**Pmax – 6 dB = 40.5 dBm**
H2D	43	Pmax = 43 dBm	**Pmax – 2 dB = 41 dBm**
H4D	40	Pmax = 40 dBm	**Pmax = 40 dBm**

For system limit, 2dB power reduction margin is taken to ensure the compliance for the case of diplexer and H2D due to eDRX/HePA products tolerances.

In order to comply with the emission limits in the 1 MHz bands immediately outside and adjacent to the frequency block, the absolute transmit power level of the block edge channels has been done at **Pmax – 6 dB = 40.5 dBm** for the worst case in diplexer configuration.

- **8PSK modulation:**

eDRX and HePA 1900 support 8 PSK modulation.

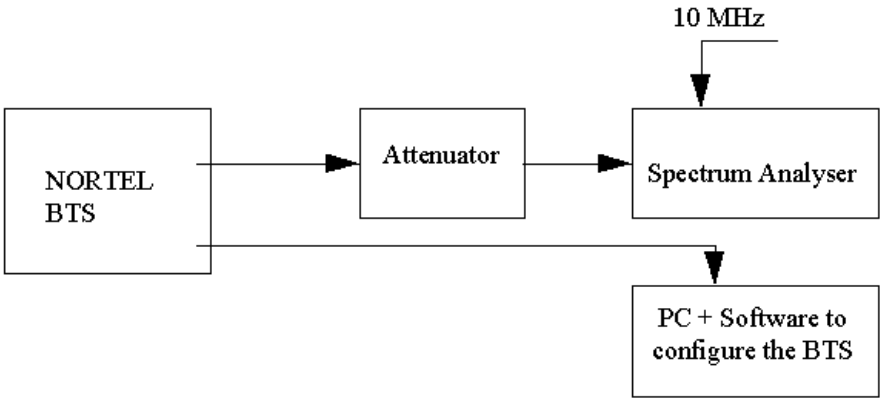
Coupling	Antenna port Output power (dBm)	Power reduction measurement	System Power limitation 8 PSK modulation
Diplexer	45.8	Pmax – 2 dB = 43.8 dBm	**Pmax – 2 dB = 43.8 dBm**
H2D	42	Pmax = 42 dBm	**Pmax = 42 dBm**
H4D	39	Pmax = 39 dBm	**Pmax = 39 dBm**

In the worst configuration (Diplexer) , the maximum power emission with 2dB reduced **(Pmax-2dB)** allows to be compliant with the spurious emission limits (-13 dBm) in the 1 MHz bands immediately outside and adjacent to the frequency block for 8PSK modulation .

4.5.6. TEST PROCEDURE

The equipment was configured as shown in schematic 3 .

Schematic 3 : Test configuration for Spurious emissions at antenna terminals



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 PCS 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 .

For these measurements, the resolution bandwidth of the spectrum analyzer was set to at least 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 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

For all other measurements the BTS carrier frequency was adjusted to Channel 810.

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 tenth harmonic of the fundamental emission (20 GHz).

The measured level of the emissions was recorded and compared to the -13 dBm limit.

4.6. NAME OF TEST: FREQUENCY STABILITY

Table 6 shows the Frequency Stability for channel 661 (F=1960 MHz) in BTS 12000 OUTDOOR configuration (8 HePA) under extreme conditions.

Table 11: Frequency Stability in BTS S12000 Outdoor configuration – Channel 661

Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	85% Nominal Supply voltage 195 V AC	Nominal Supply voltage 230V AC	115% Nominal Supply voltage 264 V AC
-30	50.3	56.8	47.4
-20	56.9	56.5	45.4
-10	57.7	56.6	43.7
0	62.3	49.2	61.5
10	49.7	54.6	48.0
20	49.2	58.7	56.3
30	56.5	49.4	53.9
40	58.7	71.0	63.0
50	60.7	61.0	56.6

The maximum frequency deviation allowed is 90 Hz.

The maximum deviation measured (71Hz) is sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The S12000 Outdoor BTS complies with the requirement.

Thermal tests have been performed with OUTDOOR BTS S12000.

The BTS S12000 must operate under the following external extreme temperatures:

- BTS S12000 Outdoor : - 30°C / + 50 °C

Frequency stability test is performed under following extreme conditions:

- Temperature from –30°C to +50°C at intervals of 10 degrees.
- With AC power supply variations: 195 VAC , 230 VAC, 264 VAC.

All Modules (eDRX and HePA) run with nominal power regulation at maximum power (60W) in GMSK modulation. The eDRX/HePA were configured to transmit at maximum power (Static level 0).

BTS S12000 is equipped with eDRX/HePA in slots 0, 1, 2, 3, 6, 7, 8, 9 with following emission configuration :

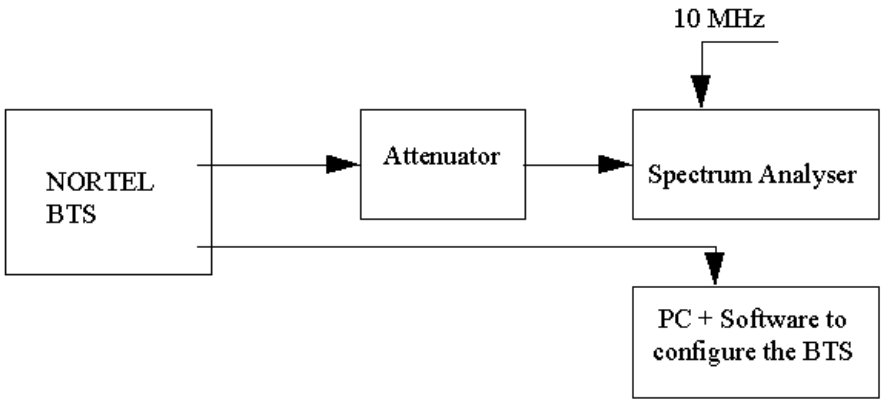
slot 0 : BCCH → C542
slot 1 : TCH → C661
slot 2 : BCCH → C572
slot 3 : BCCH → C602
slot 6 : BCCH → C632
slot 7 : BCCH → C692
slot 8 : BCCH → C722
slot 9 : BCCH → C752

Frequency deviation is measured in slot 1 on channel C661.

A period of at least one hour was allowed prior to measurement to ensure that all the components of the oscillator circuit was stabilized at each temperature.

The equipment was configured as shown in figure 16.

Figure 16: Test configuration for Frequency Stability



5. EXHIBIT 2: TEST REPORT FOR PA30W PCS1900/GSM850

5.1. INTRODUCTION

The following information is submitted to introduce a Certification of a Broadband PCS Base Station for Northern Telecom, Inc:

- According to FCC Part 24, Subpart E and Part 2,
- According to FCC Part 22, Subpart H and Part 2,

Subpart J of the FCC Rules and Regulations. The measurement procedures were in accordance with the requirements of Part 2.999.

5.2. MEASUREMENT RESULTS

Tables 1, 2 are a summary of the measurement results performed in this report.

Table 1: PCS 1900 Measurement Results Summary

FCC Measurement Specification	IC Limit Specification	Description	Results	Note
2.1046 , 24.232	6.2	RF Power Output	Compliant	Reference to [R5] [R8] [R9]
2.1047		Modulation characteristics		
2.1049		Occupied Bandwidth		
2.1051, 2.1057, 24.238	6.3 , 6.4	Spurious Emissions at Antenna Terminals		
2.1055 , 24.235	7.0	Frequency Stability		

Table 2: GSM 850 Measurement Results Summary

FCC Measurement Specification	IC Limit Specification RSS 128 Section	Description	Results	Note
2.1046	7.1	RF Power Output	Compliant	Reference to [R7] [R8] [R9]
2.1047	7.2	Modulation characteristics		
2.1049		Occupied Bandwidth		
2.1051	7.4 , 7.5	Spurious Emissions at Antenna Terminals		
2.1055	8.1 , 8.2	Frequency Stability		

Measurements in GSMK modulation for GSM 850 Band are available in document [R7].

Additional GMSK tests are performed for the Edge channel of sub-band A", A, B, A', B'. Additional Tests are also performed in 8PSK modulation.

5.3. TEST NAME: 2.1046 RF OUTPUT POWER

FCC REQUIREMENTS

FCC Limit (Part 22.913) Effective radiated power limits

The effective radiated power (ERP) of base transmitters and cellular repeaters must not exceed 500 Watts.

FCC Limit (Part 24.232) Power and antenna hight limits

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. 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.

TEST RESULTS GSM 850

Table 3: measured RF Output Power in GSM 850 band

Sub band	Radio Channel	Frequency (MHz)	RF Output Power (dBm) GMSK	RF Output Power (dBm) 8PSK	Maximum Rated Power (dBm)	Limit (dBm)
A”	128	869.2	43.5	44.0	44,8 (30 W)	50
	131	869.8	43.5	44.1		
A	133	870.2	43.6	44.1		
	181	879.8	43.7	44.3		
B	183	880.2	43.6	44.3		
	231	889.8	43.5	44.2		
A’	233	890.2	43.4	44.2		
	238	891.2	43.4	44.1		
B’	241	891.8	43.4	44.2		
	251	893.8	43.2	44.0		

TEST RESULTS PCS 1900

Table 4 : measured RF Output Power in PCS 1900 band

Band	Radio Channel	Frequency (MHz)	Measured RF Output Power (dBm)	Measured RF Output Power (dBm) 8PSK	Maximum Rated Power (dBm)	Limit (dBm)
A	512	1930,2	42.9	43	44.8	50
A	548	1937,4	43.0	43.2		
A	585	1944,8	43.2	43.5		
D	587	1945,2	43.2	43.5		
D	598	1947,4	43.2	43.5		
D	610	1949,8	43.2	43.5		
B	612	1950,2	43.2	43.5		
B	648	1957,4	43.4	43.5		
B	685	1964,8	43.4	43.6		
E	687	1965,2	43.3	43.5		
E	698	1967,4	43.3	43.5		
E	710	1969,8	43.4	43.7		
F	712	1970,2	43.4	43.7		
F	723	1972,4	43.4	43.7		
F	735	1974,8	43.5	43.8		
C	737	1975,2	43.5	43.8		
C	773	1982,4	43.5	43.8		
C	810	1989,8	43.3	43.6		

5.4. TEST NAME: 2.1049 OCCUPIED BANDWIDTH

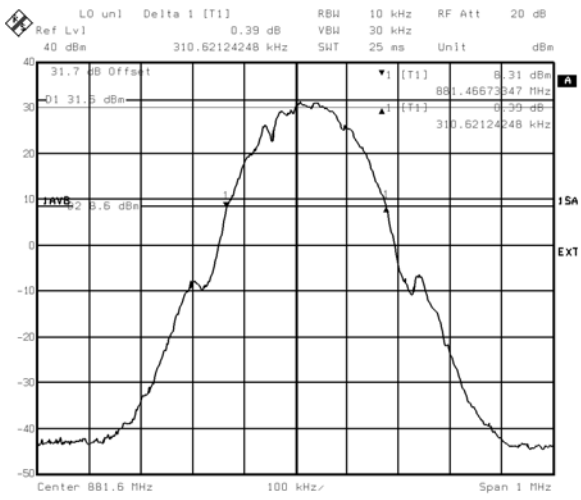
FCC REQUIREMENTS

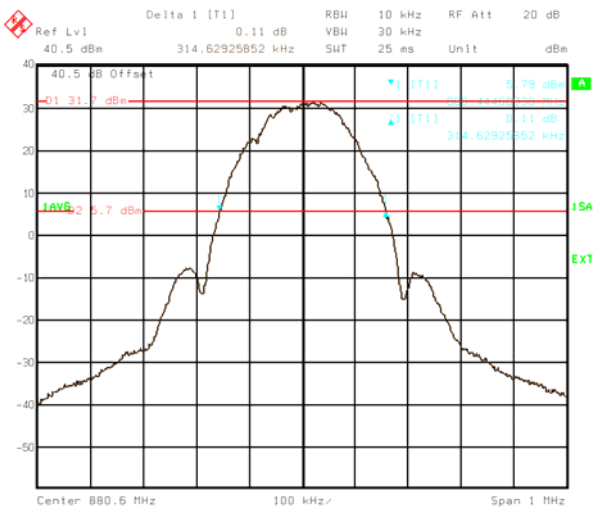
The occupied bandwidth is defined as the width of the signal between two points, one below the carrier center frequency and one above the carrier center frequency, outside of which all emissions are attenuated of at least 26 dB.

TEST RESULTS GSM 850

Figure 1: sample plot for occupied bandwidth, @ M (GSM 850 band)

GMSK modulation **8PSK Modulation**





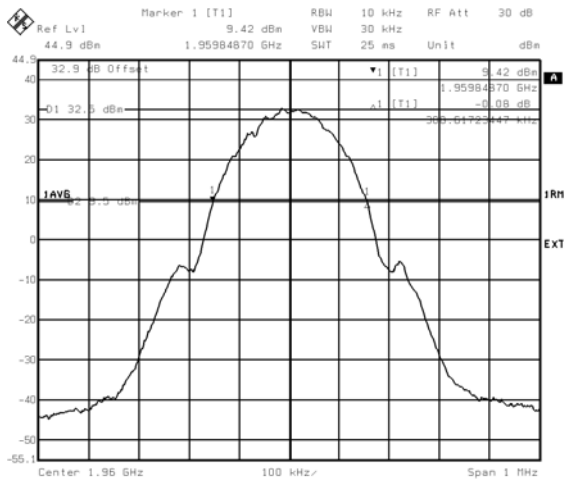
The maximum occupied bandwidth was found 320 kHz for GMSK modulation

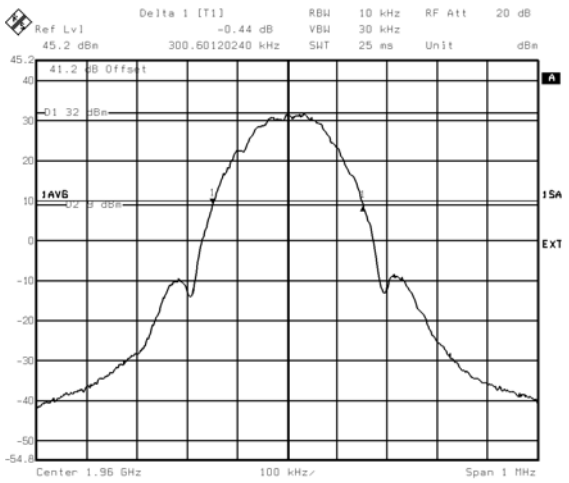
The maximum occupied bandwidth was found 314 kHz for 8PSK modulation

TEST RESULTS PCS 1900

Figure 2: sample plot for occupied bandwidth @ M (PCS 1900 band)

GMSK modulation **8PSK Modulation**





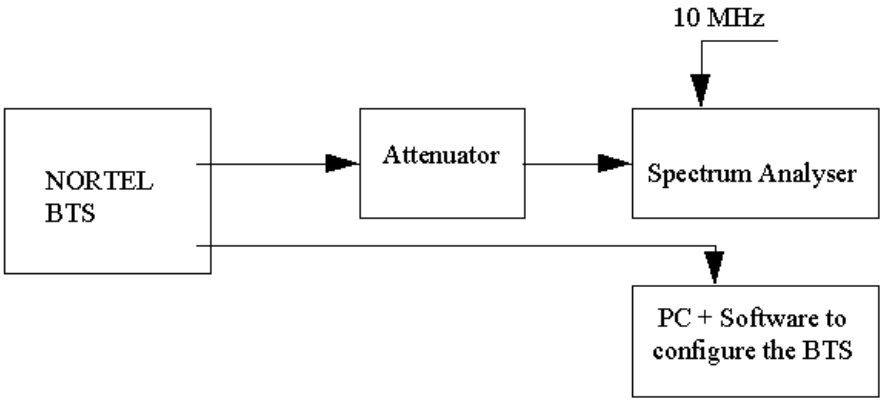
The maximum occupied bandwidth was found to be:

320 kHz , measured on channel 661, f = 1960.0 MHz GMSK modulation.
318 kHz , measured on channel 661, f = 1960.0 MHz 8PSK modulation.

TEST PROCEDURE

The equipment was configured as shown in Schematic1.

Schematic1 : Test configuration for Occupied bandwidth



The BTS was configured to transmit at maximum power (Static Level 0).
Measurements were performed at middle frequency of the transmit band.

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

The spectrum analyzer had the following settings:

Resolution bandwidth:	10 kHz
Video bandwidth:	30 kHz
Span:	1 MHz and 2.2 MHz
Sweep time:	25 ms
Reference Level Offset:	Corrected to take into account cables and attenuator losses

5.5. TEST NAME: 2.1051 SPURIOUS EMISSIONS AT ANTENNA TERMINALS

FCC REQUIREMENTS

(c) At 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.

(d) 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.

(e) 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.

(f) 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.

TEST RESULTS GSM 850

The reference level for spurious emissions at the antenna terminals is taken from the measured output power (43.9 dBm = 24.5 Watts).
Therefore the spurious emissions must be attenuated by at least 43 + 10*Log(24.5) = 56.9 dB.
The measured output power was 43.9 dBm ; therefore the limit is 43.9 - 56.9 = -13 dBm.

Spurious measurement is performed in the following coupling configuration with 30W Power amplifier and with duplexer .

The nominal power at antenna connector : Pduplexer max = 44dBm

Tables 5 and 6 show the results for Spurious Emissions at Antenna Terminals.

Table 5: Test results for Spurious Emissions in GMSK modulation

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A''	128	Pmax – 2 dB	-13.4	-13	0.4
A''	131	Pmax – 2 dB	-13.4	-13	0.4
A	133	Pmax – 2 dB	-13.6	-13	0.6
A	181	Pmax – 2 dB	-13.2	-13	0.2
B	183	Pmax – 2 dB	-13.9	-13	0.9
B	231	Pmax – 2 dB	-13.7	-13	0.7
A'	233	Pmax – 2 dB	-14.3	-13	1.3
A'	238	Pmax	-35.8	-13	22.8
B'	241	Pmax	-34	-13	21
B'	251	Pmax – 2 dB	-13.5	-13	0.5

Table 6: Test results for Spurious Emissions in 8PSK Modulation

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A''	128	Pmax – 2 dB	-14.8	-13	1.8
A''	131	Pmax – 2 dB	-14.9	-13	1.9
A	133	Pmax – 2 dB	-14.0	-13	1.0
A	181	Pmax – 2 dB	-14.9	-13	1.9
B	183	Pmax – 2 dB	-14.4	-13	1.4
B	231	Pmax – 2 dB	-14.8	-13	1.8
A'	233	Pmax – 2 dB	-14.3	-13	1.3
A'	238	Pmax	-31.5	-13	18.5
B'	241	Pmax	-33.6	-13	20.6
B'	251	Pmax – 2 dB	-14.8	-13	1.8

Table 7 : Spurious Out of Tx band – GMSK modulation

Frequency (MHz)	Spurious Emissions (dBm)	Margin (dB)	Limit (dBm)
0.1-50	-37.7	24.7	-13
50–500	-36.9	23.9	
500-880.4	-28.8	15.8	
882..8–1000	-28.2	15.2	
1000–2000	-29	16	
2000–40000	-28	15	
4000–120000	-25.5	12.5	
12000–20000	-25.7	12.7	

Notes :

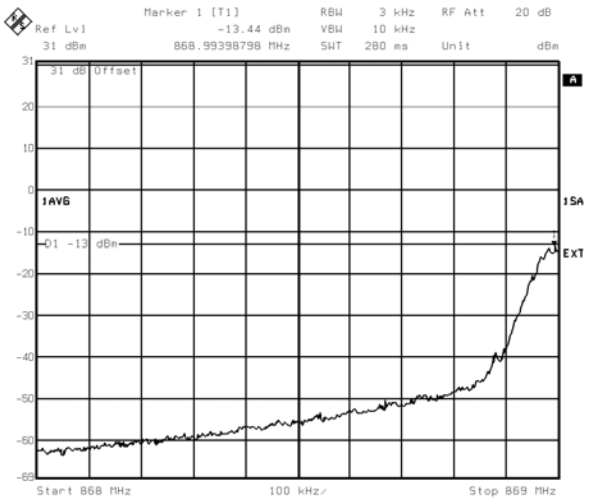
Figures 3,4,5 show sample plots for the case when the transmitter was respectively tuned to edge channels in Tx band for GMSK modulation.

Figures 6,7,8 show sample plots for the case when the transmitter was respectively tuned to edge channels in Tx band for 8PSK modulation.

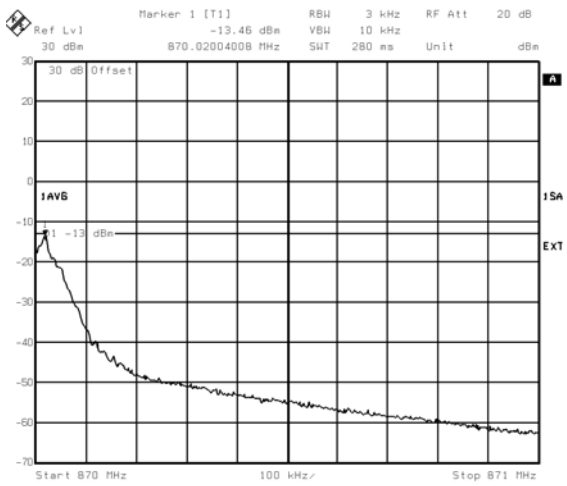
Figure 9,10,11 show sample plots for frequency spans from 0 to 20 GHz with emission on channel 190 at Pmax = 44 dBm with Duplexer module.

Figure 3 : 1 MHz adjacent band
GMSK MODULATION – Duplexer configuration
Power limitation :Pmax - 2 dB

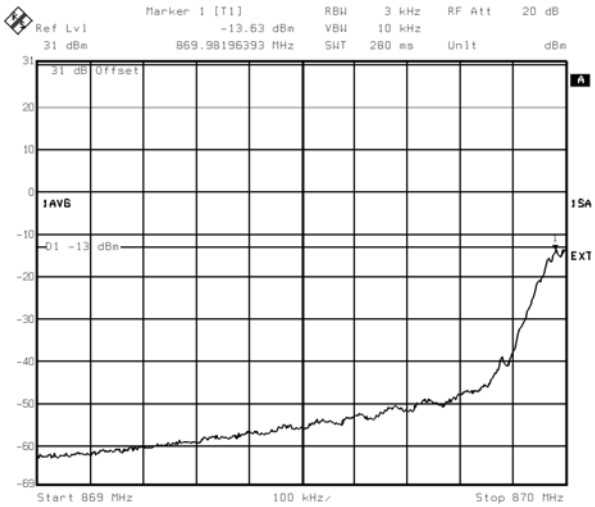
Channel 128



Channel 131



Channel 133



Channel 181

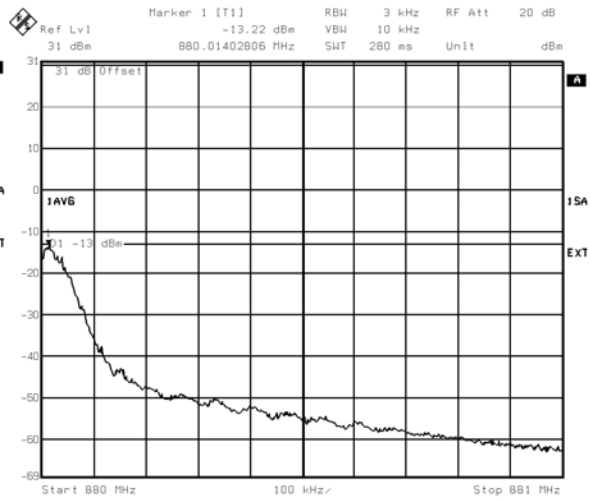
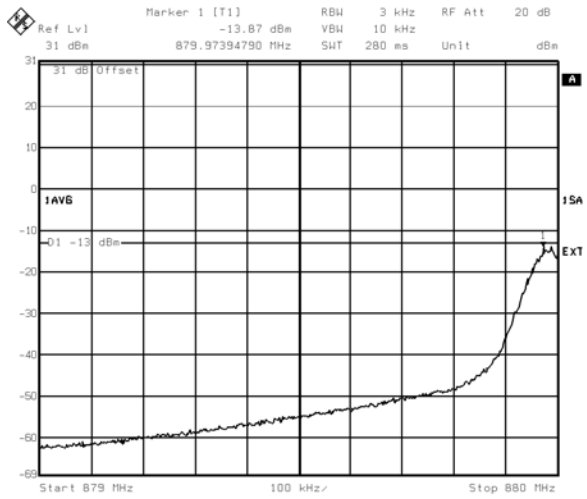


Figure 4 : 1 MHz adjacent band
GMSK MODULATION – Duplexer configuration
Power limitation :Pmax - 2 dB

Channel 183



Channel 231

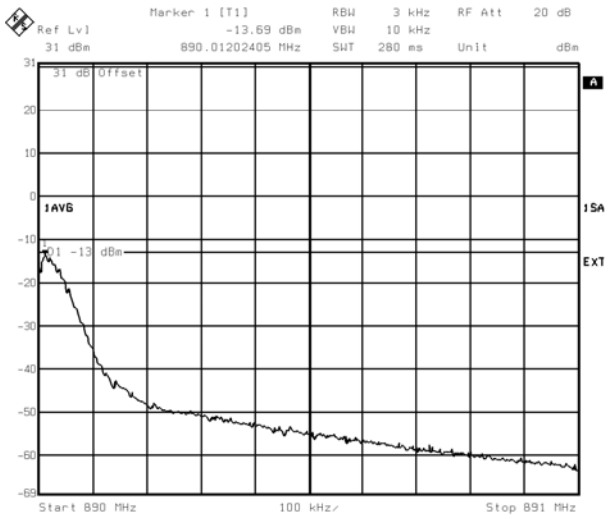
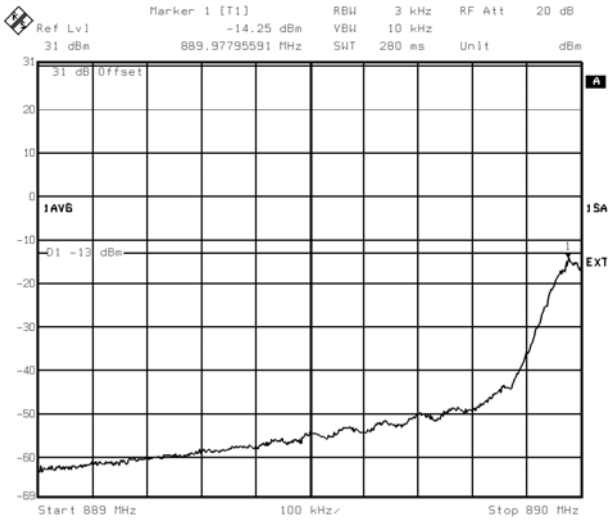


Figure 5: 1 MHz adjacent band
GMSK MODULATION – Duplexer configuration

Channel 233

-1 MHz adjacent band**,**

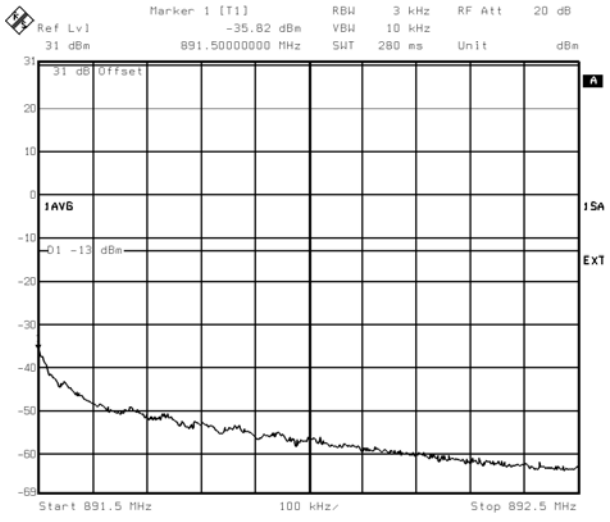
Power limitation Pmax –2dB



Channel 238

+1 MHz adjacent band

Power limitation: Pmax



-1MHz adjacent band

Channel 241

Power limitation P Max

+ 1MHz adjacent band

Channel 251

Pmax –2dB

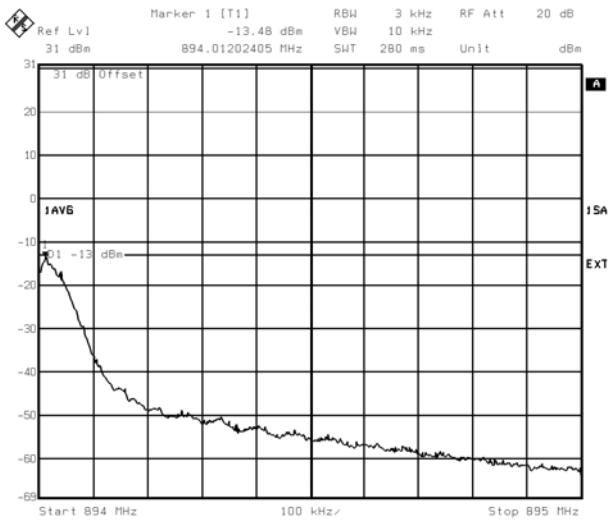
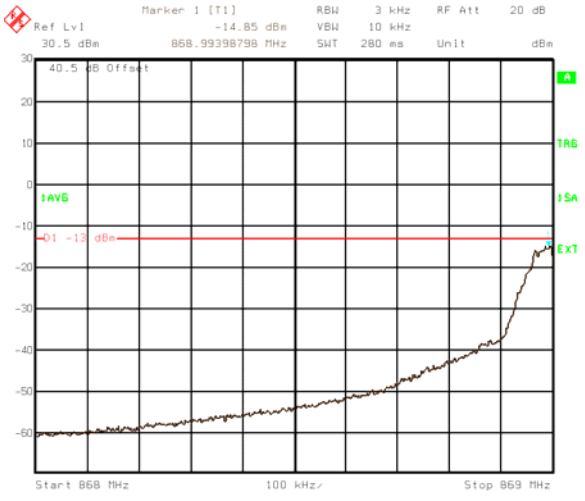
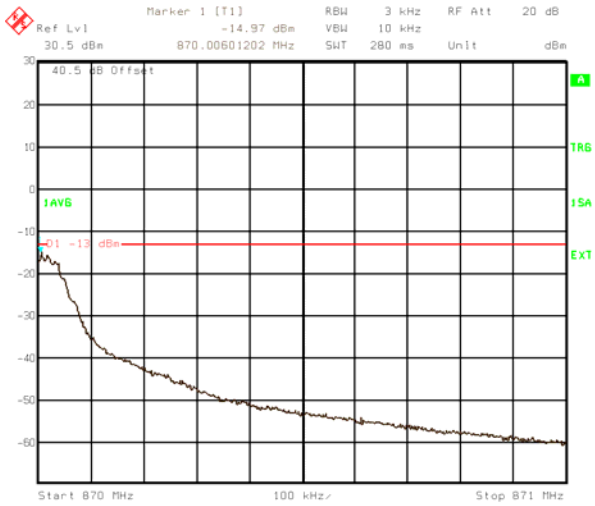


Figure 6 : 1 MHz adjacent band
8PSK MODULATION – Duplexer configuration
Power limitation :Pmax - 2 dB

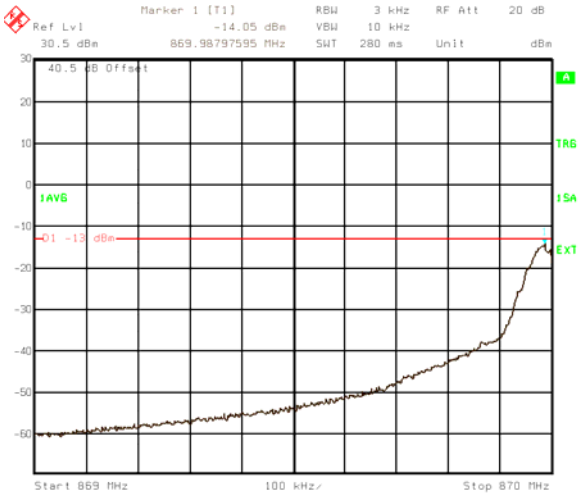
Channel 128



Channel 131



Channel 133



Channel 181

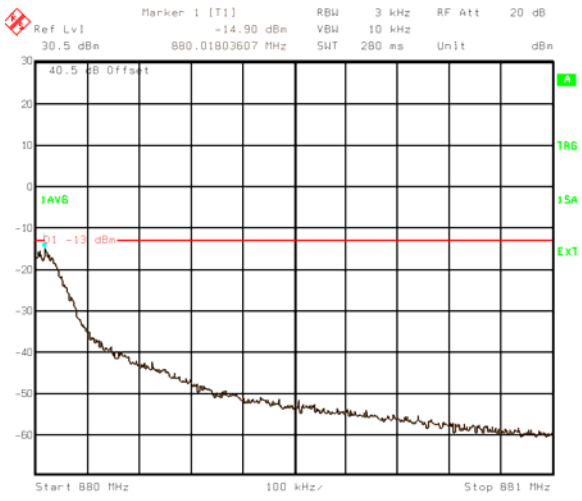
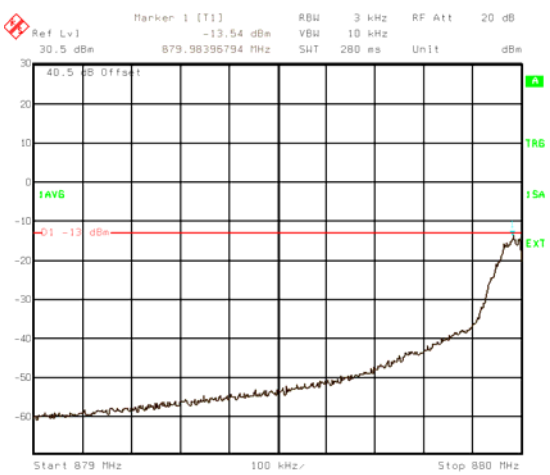


Figure 7 : 1 MHz adjacent band
8PSK MODULATION – Duplexer configuration
Power limitation :Pmax - 2 dB

Channel 183



Channel 231

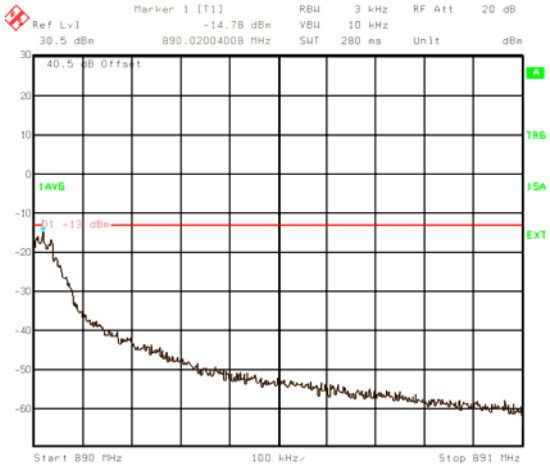
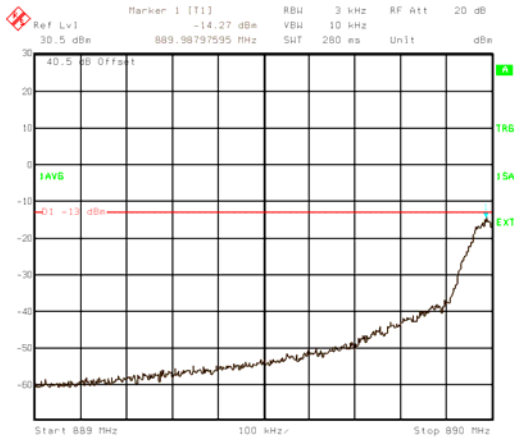


Figure 8 : 1 MHz adjacent band
8PSK MODULATION – Duplexer configuration

Channel 233

-1 MHz adjacent band,

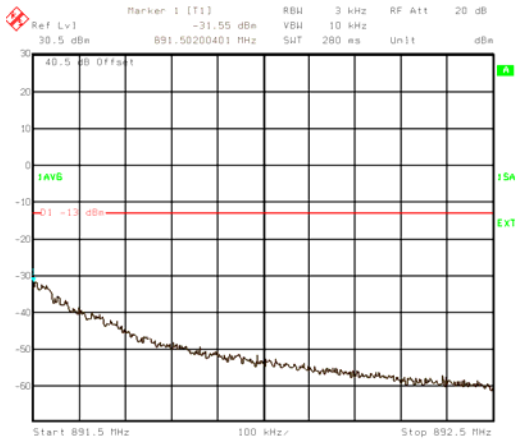
Power limitation Pmax –2dB



Channel 238

+1 MHz adjacent band

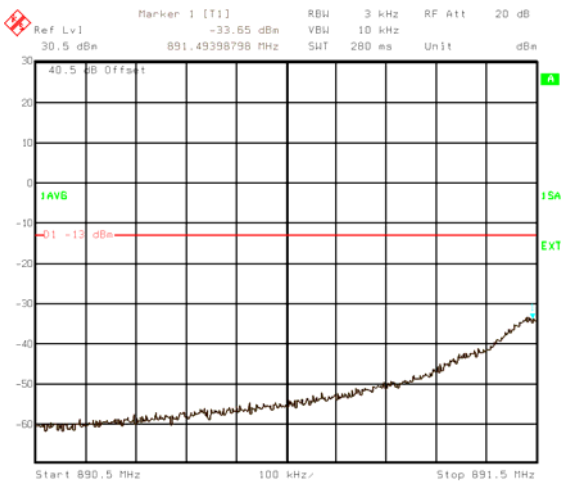
Power limitation: Pmax



-1MHz adjacent band

Channel 241

Power limitation P Max



+ 1MHz adjacent band

Channel 251

Pmax –2dB

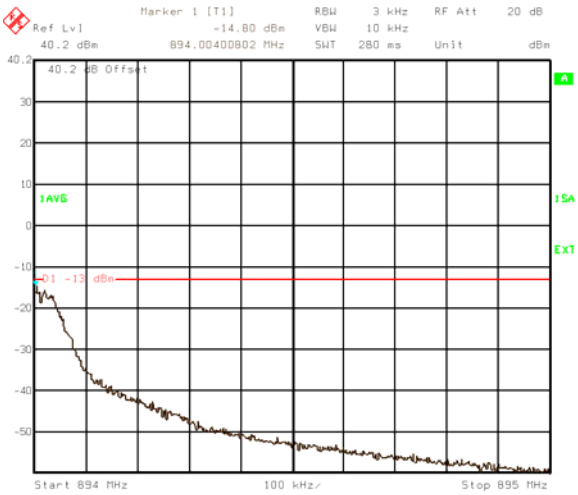
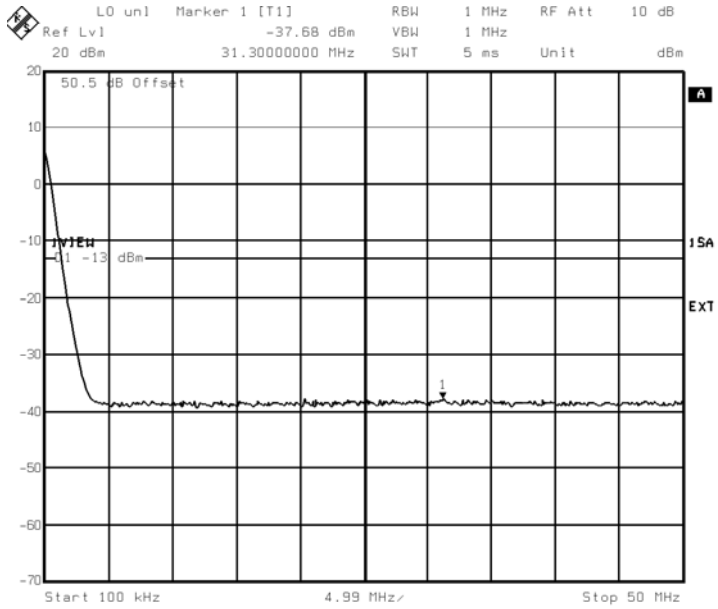


Figure 9: Out of block emissions (channel 190, Pmax)

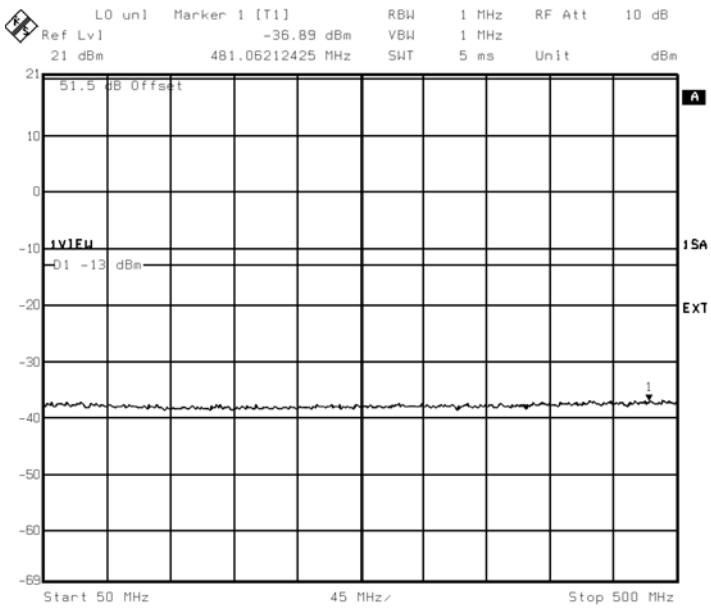
100 kHz-50 Mhz



RBW = 1 MHz

Note: spectrum line s at 100 kHz are internal DC spectrum line of Analyser

50 Mhz-500 MHz



500 MHz-880.4 MHz

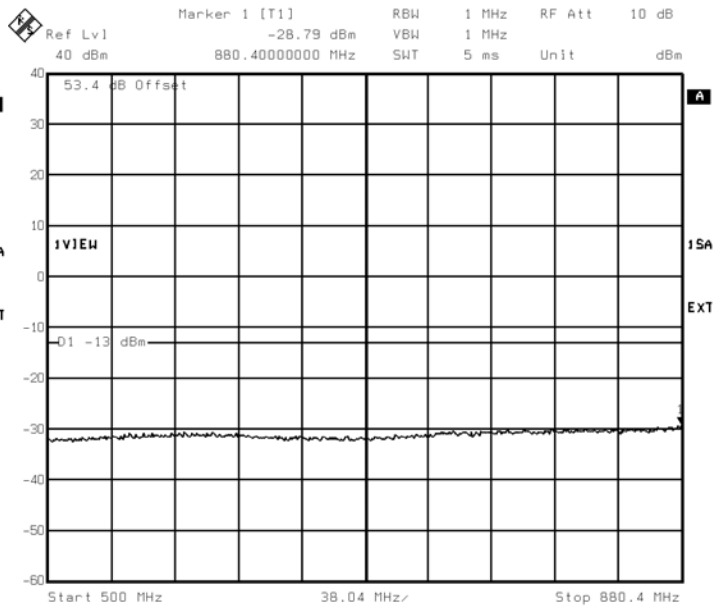
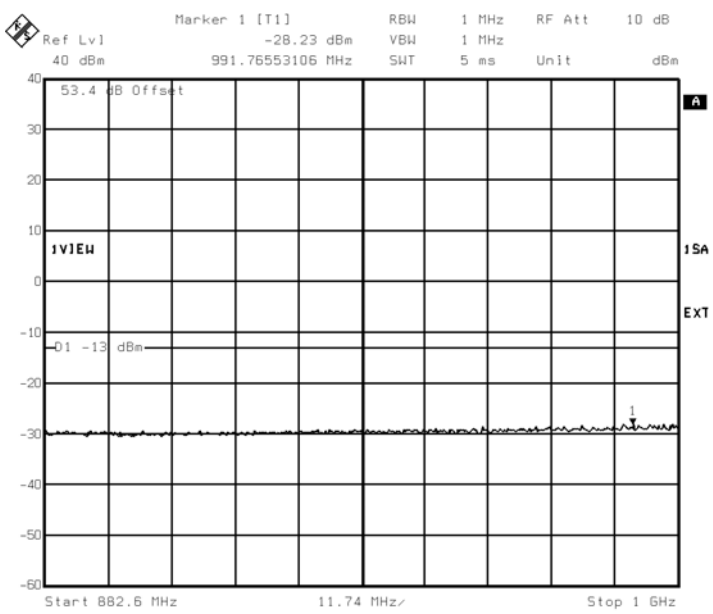
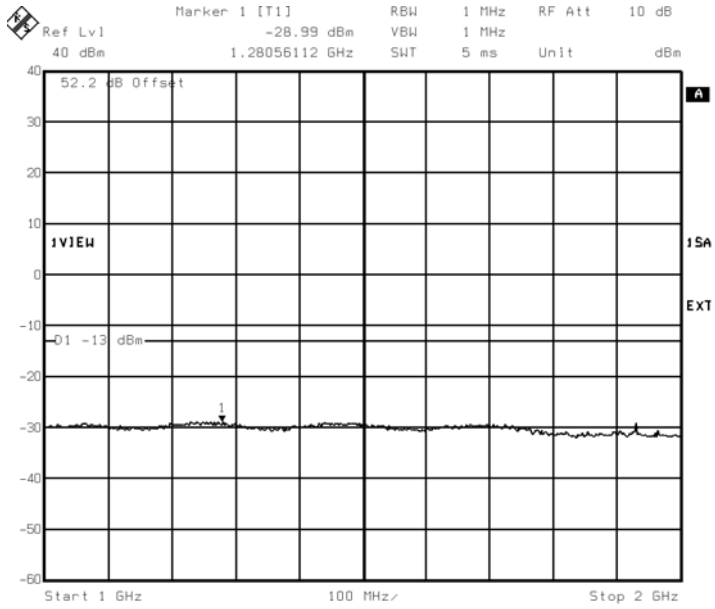


Figure 10: Out of block emissions (channel 190, Pmax)

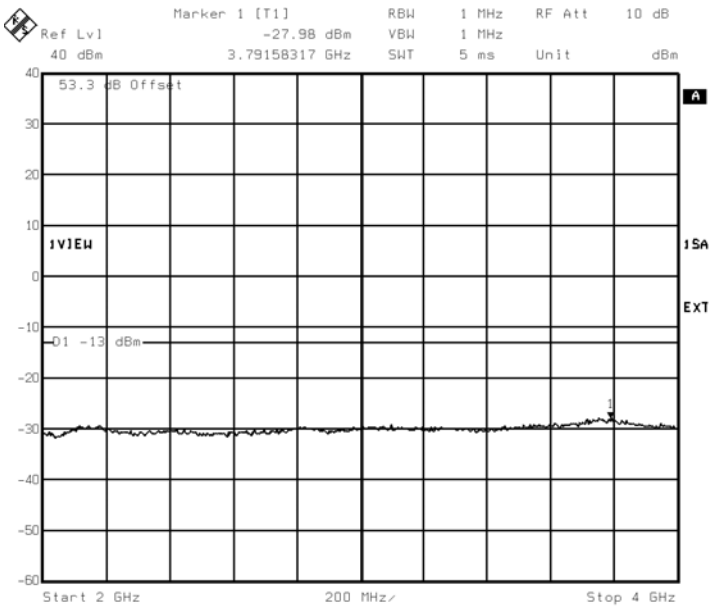
882.8 MHz-1000 MHz



1000 MHz-2000 MHz



2 GHz-4 GHz



4 GHz-12 GHz

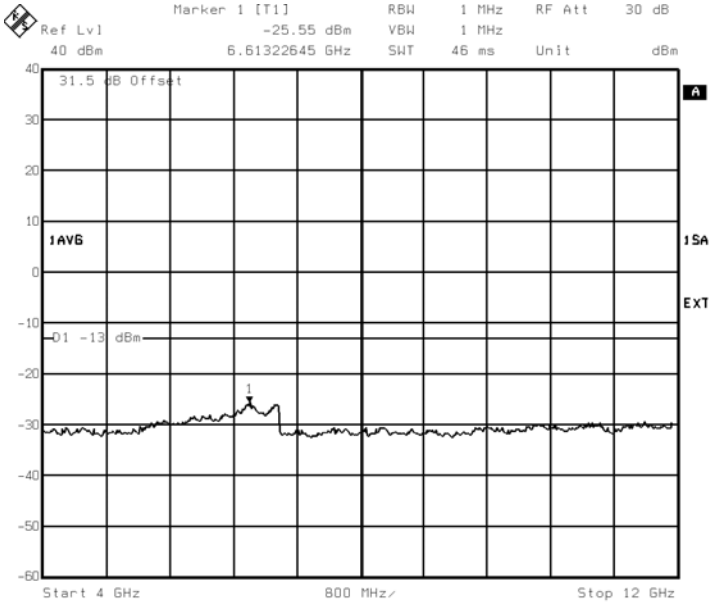
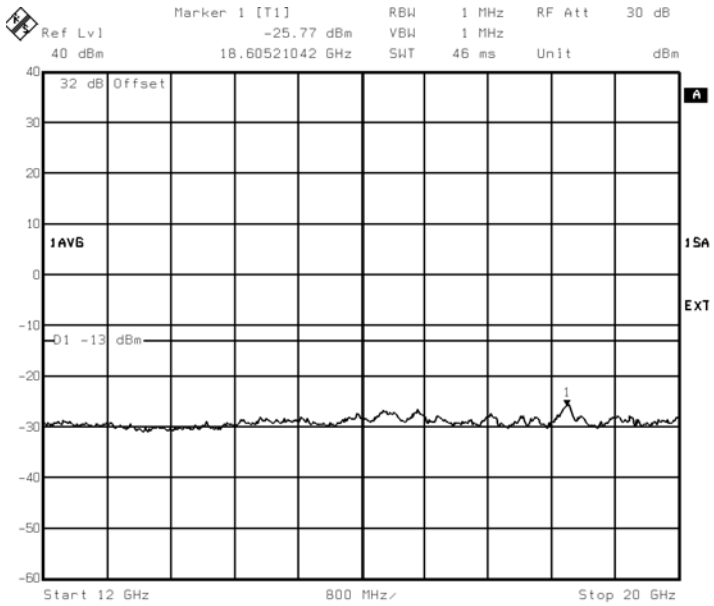


Figure 11 : Out of block emissions (channel 190, Pmax)

12 GHz-20 GHz



Conclusion : .

For both modulation GMSK and 8PSK, the worst case is the Duplexer configuration and it has been done at P_D max - 2dB = 42 dBm.

For Edge Channel ARFCN 128, 131, 133, 181, 183, 231, 233, 251, power has to be reduced by 2dB in order to meet spurious emission requirement.

For Edge Channel ARFCN 238, 241, the maximum power (44dBm) has allowed to meet spurious emission requirement.

The H2D configuration has been done at maximum power P_{H2D}max =44 dBm.

TEST RESULTS PCS 1900

Spurious measurement is performed with the worst configuration with Duplexer coupling and 30W Power amplifier . The Nominal power at antenna connector : P_D max =44dBm. The test compliance with duplexer involves the compliance with H2D (two input coupler with 3dB loss coupling associated with duplexer) and the compliance with H4D configuration (four input coupler with 7dB loss coupling associated with duplexer).

Table 8: Test results for Spurious Emissions at Antenna Terminals

- Duplexer configuration - In band – GMSK modulation

Band	Channel	Emission Level(dBm)	Spurious (dBm)	Margin (dB)	Limit (dBm)
A	512	Pmax	-13.4	0.4	-13
		Pmax-2	-15	2	
A	585	Pmax	-13	0	
		Pmax-2	-13.7	0.7	
D	587	Pmax	-12.8	-0.2	-13
		Pmax-2	-15	2	
D	610	Pmax	-11.3	-1.7	
		Pmax-2	-12.6	-0.4	
		Pmax-4	-15	2	
B	612	Pmax	-12.5	-0.5	-13
		Pmax-2	-14.5	1.5	
B	685	Pmax	-11.3	-1.7	
		Pmax-2	-12.6	-0.4	
		Pmax-4	-15	2	
E	687	Pmax	-12.4	-0.6	-13
		Pmax-2	-14.4	1.4	
		Pmax-4	-15.3	2.3	
E	710	Pmax	-10.8	-2.2	
		Pmax-2	-12.8	-0.2	
		Pmax-4	-14.5	1.5	
F	712	Pmax	-12.4	-0.6	-13
		Pmax-4	-16.3	3.3	
F	735	Pmax	-11.5	-1.5	
		Pmax-4	-14.6	1.6	
C	737	Pmax	-12.2	-0.8	-13
		Pmax-4	-16	3	
C	810	Pmax	-11.5	-1.5	
		Pmax-4	-15.5	2.5	

Tables 9: Spurious emissions with the diplexer for 8PSK modulation

	Channel	Power emission level	Spurious Emissions Level (dBm)	Limit (dBm)	Margin (dB)
A	512	P max	-14.9	-13	1.9
A	585	P max	-13.3	-13	0.3
D	587	P max	-15.1	-13	2.1
D	610	P max	-13.8	-13	0.8
B	612	P max	-14.9	-13	1.9
B	685	P max	-13.3	-13	0.3
E	687	P max	-14.6	-13	1.6
E	710	P max	-13.5	-13	0.5
F	712	P max	-14.5	-13	1.5
F	735	P max	-13.8	-13	0.8
C	737	P max	-14.6	-13	1.6
C	810	P max	-14.1	-13	1.1

Notes :

GMSK modulation measurements:
Figures from 12 to 14 show sample plots for the case when the transmitter was tuned with the power reduced by 4 dB in diplexer configuration for differents Edge Channel from 512 to 810.

8PSK modulation measurements:
Figures from 15 to 16 show sample plots for the case when the transmitter was tuned at the maximum power in diplexer configuration.

Out of band measurement in GMSK modulation:
Figures from 17 to 19 show sample plots for frequency spans from 0 to 20 GHz with emission on channel 810 at maximum power with diplexer configuration.

Table 10: **Spurious emissions Out of Tx band – GMSK modulation**

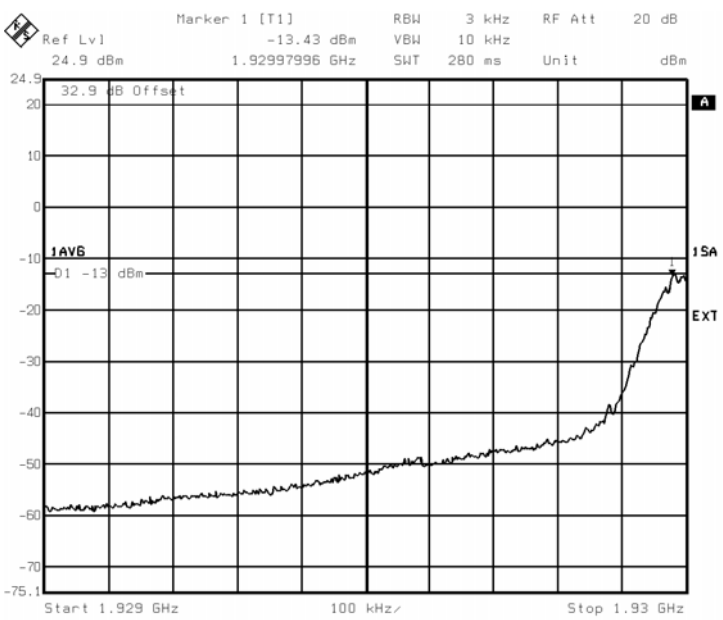
Frequency (MHz)	Spurious Emissions Level (dBm)	Margin (dB)	Limit (dBm)
0.1-50	-34.2	21.2	-13
50-500	-33	20	
500-1970.2	-33.7	20.7	
1970.2-1974	-40	27	
1974-1975	-55	42	
1991-1994.8	-34	21	
1994.8-4000	-35	22	
4000-8000	-35	22	
8-12 GHz	-35.2	22.2	
12-20 GHz	-34	21	

Figure 12 :

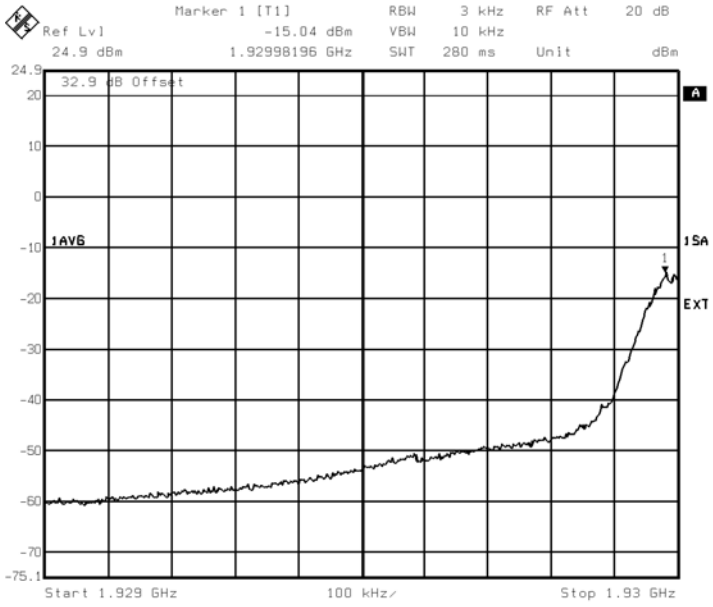
GMSK modulation

-1 MHz adjacent band (Channel 512)

Pmax

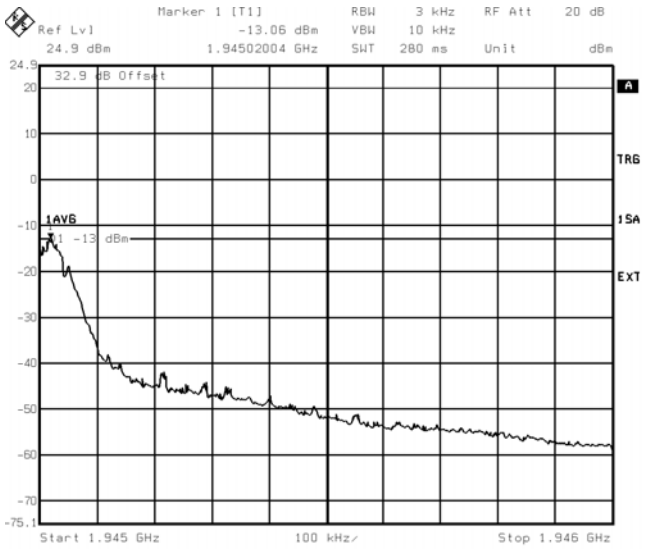


Pmax-2dB



+1 MHz adjacent band (Channel 585)

Pmax



Pmax-2dB

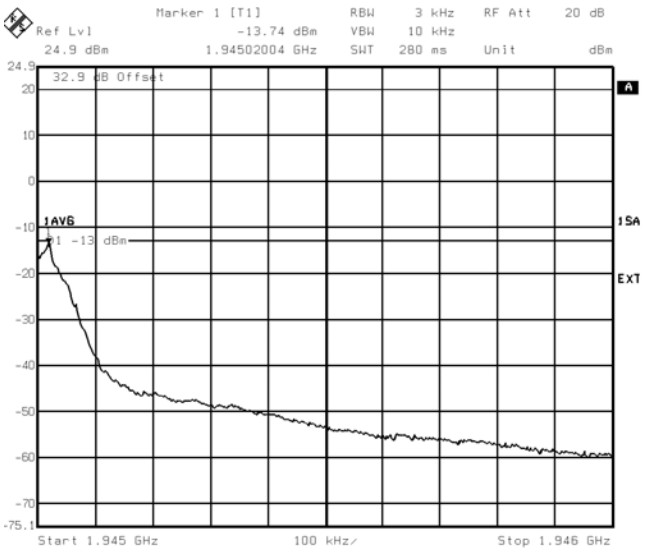
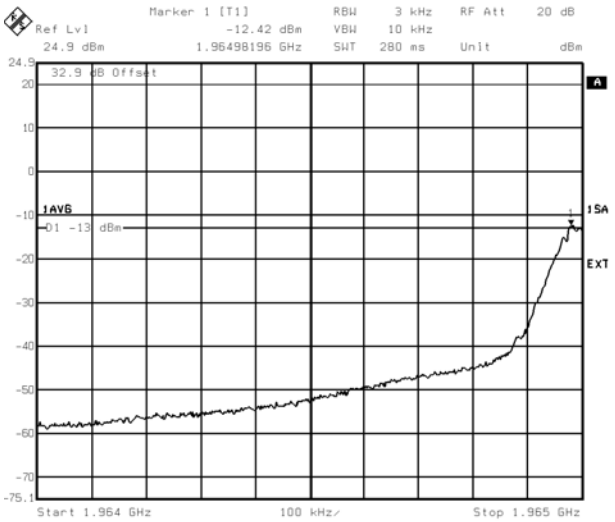


Figure 13 :

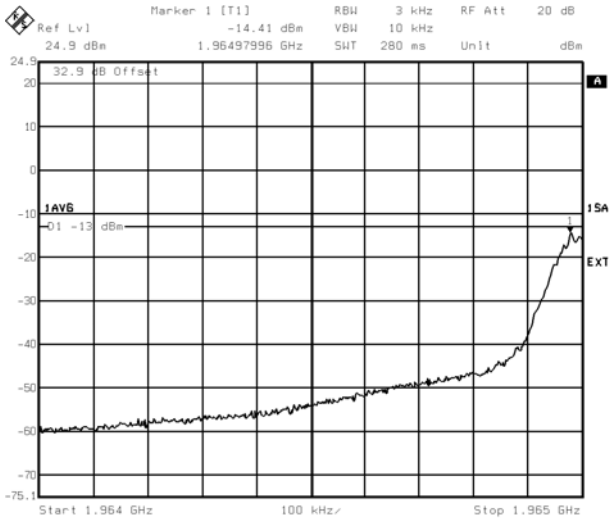
GMSK modulation

-1 MHz adjacent band (Channel 687)

Pmax

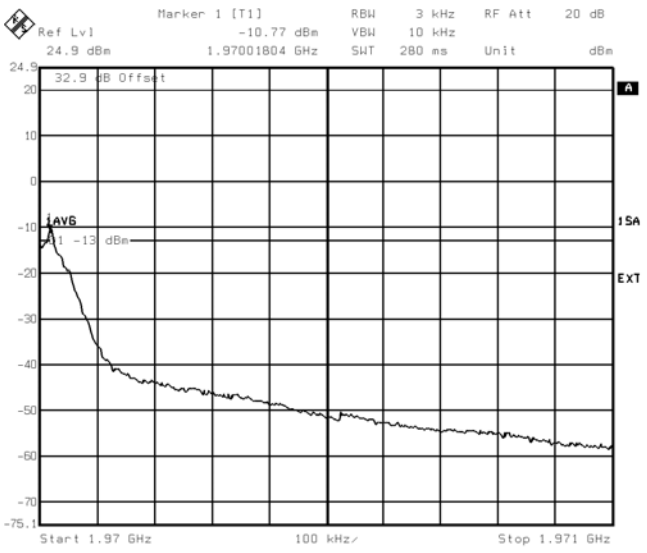


Pmax-2dB



+1 MHz adjacent band (Channel 710)

Pmax



Pmax-4dB

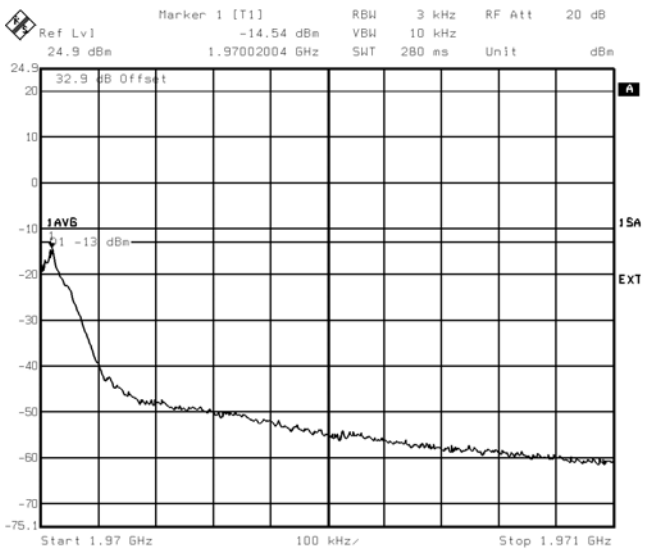
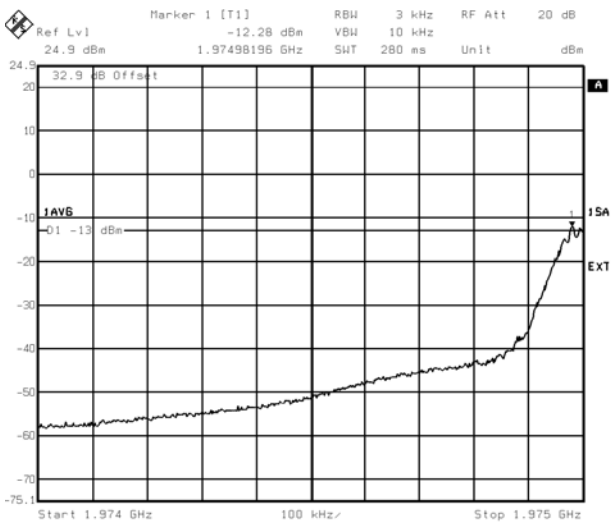


Figure 14:

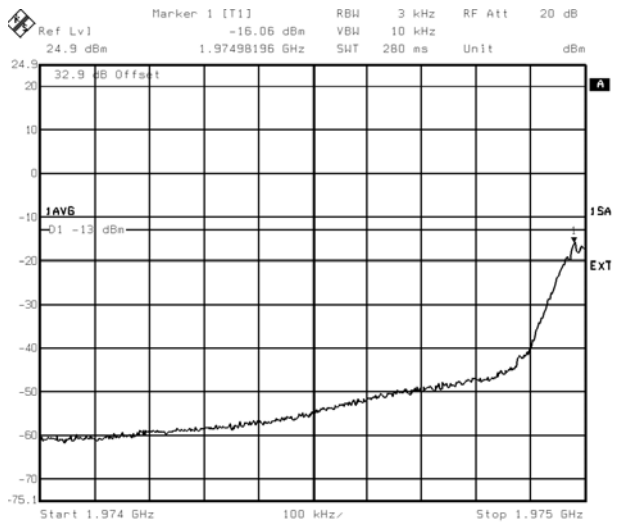
GMSK modulation

-1 MHz adjacent band (Channel 737)

Pmax

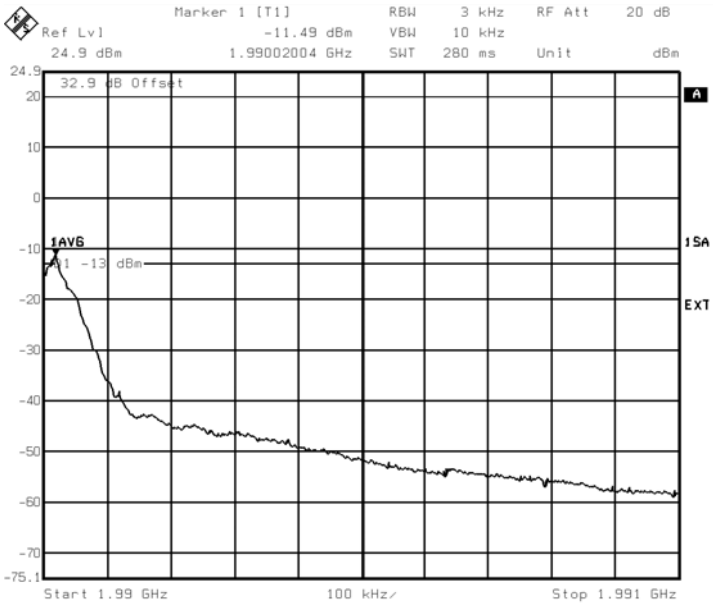


Pmax-4dB



+1 MHz adjacent band (Channel 810)

Pmax



Pmax-4dB

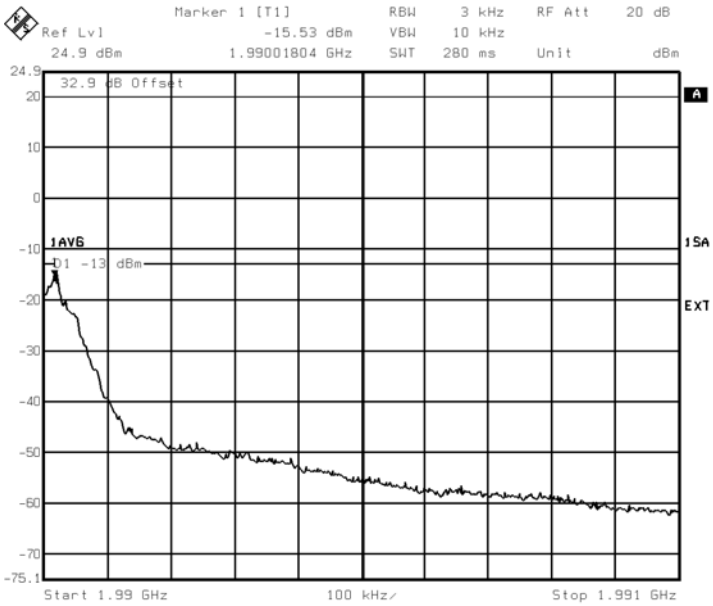
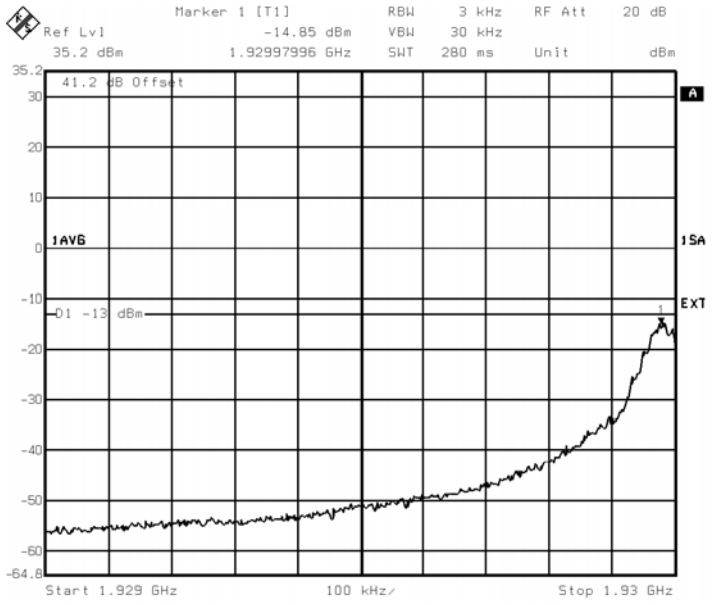


Figure 15:

-1 MHz adjacent band (Channel 512, Pmax)
Diplexer only, 8PSK modulation



+1 MHz adjacent band (Channel 585, Pmax),

Diplexer only, 8PSK modulation

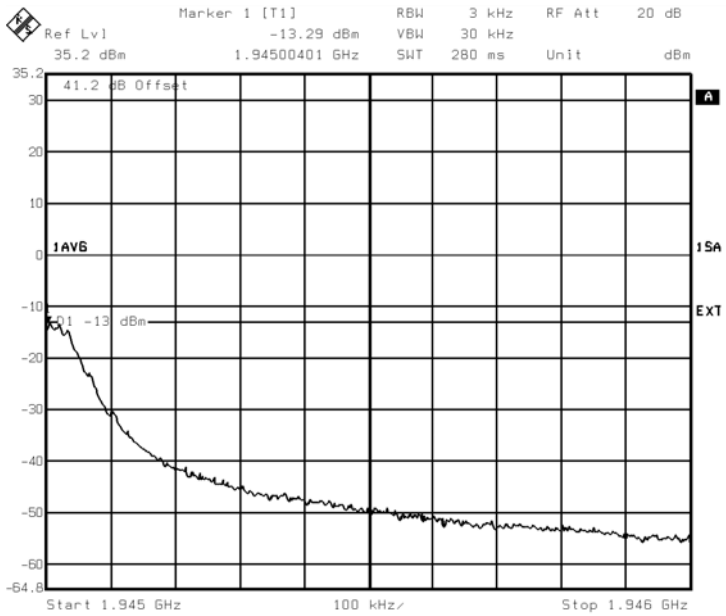
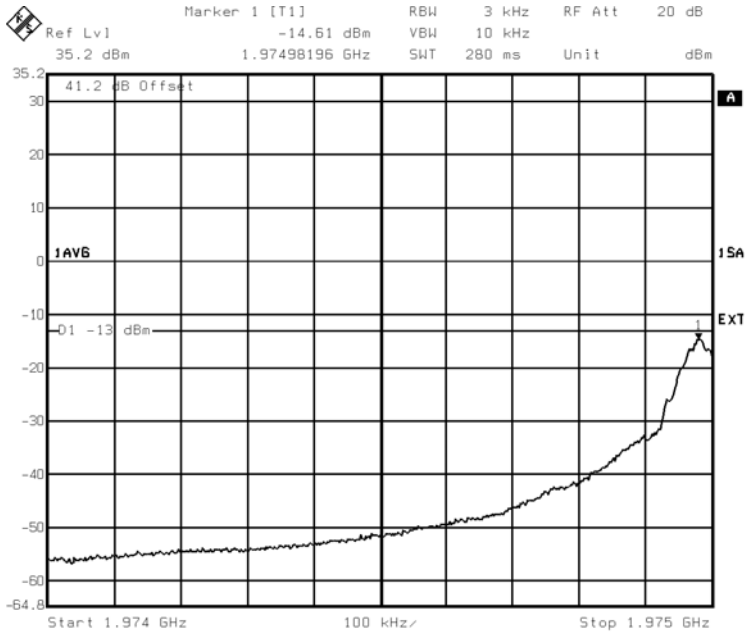


Figure 16

-1 MHz adjacent band (Channel 737, Pmax)
Diplexer only, 8PSK modulation



+1 MHz adjacent band (Channel 810, Pmax),

Diplexer only, 8PSK modulation

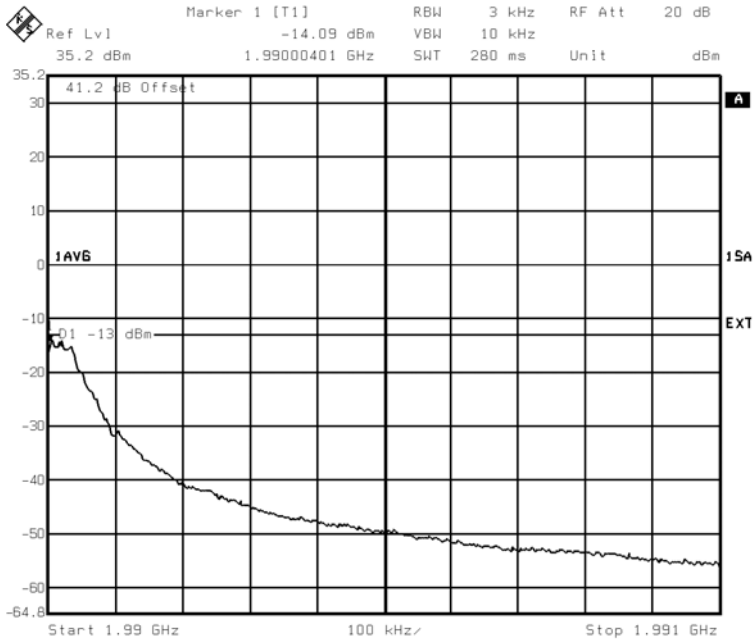
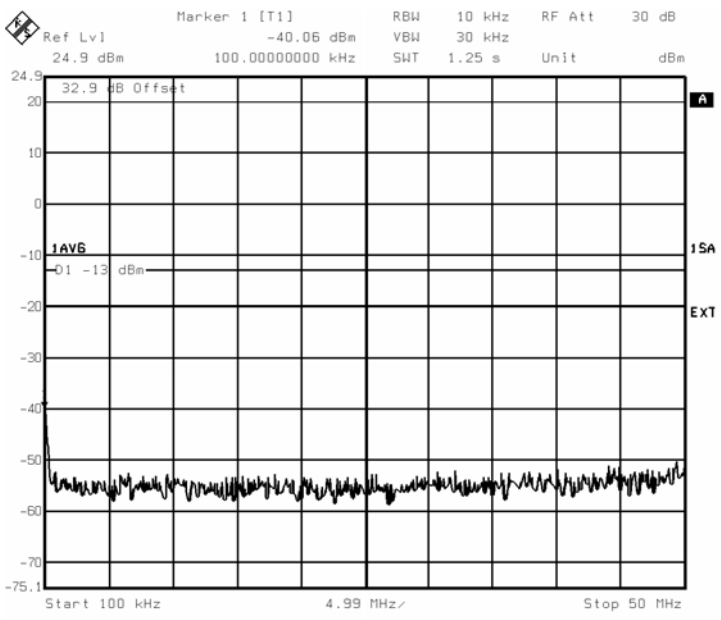
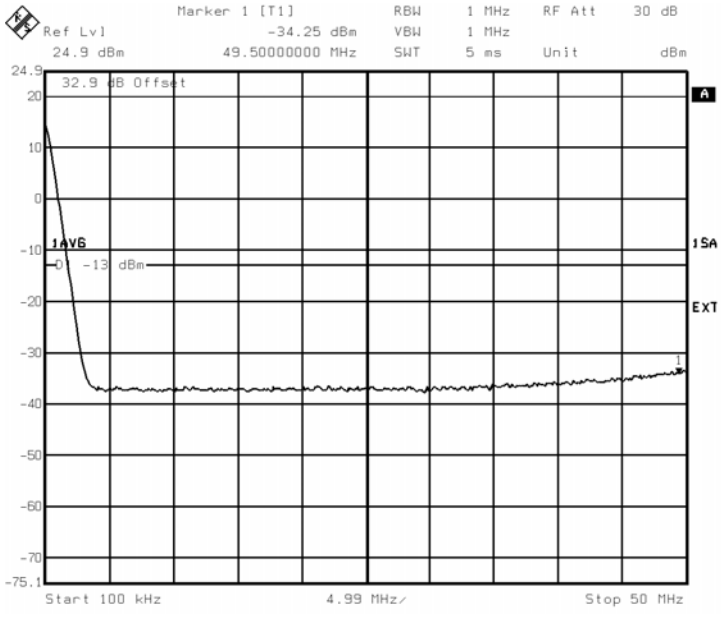


Figure 17: Out of block emissions (Channel 810, Pmax) for GMSK modulation

100kHz–50 MHz

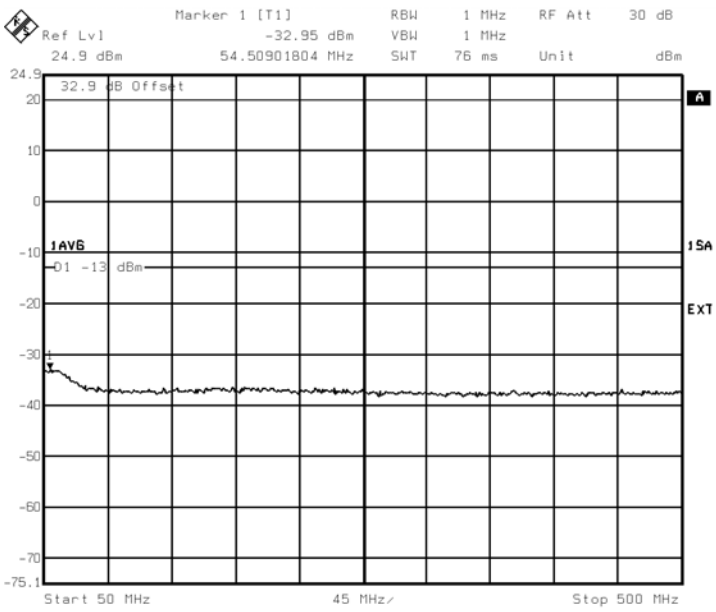




RBW = 10 kHz RBW = 1 MHz

Note : spectrum lines at 100 kHz is internal DC spectrum line of Analyzer.

50 MHz–500MHz



500 MHz-1970.2 MHz

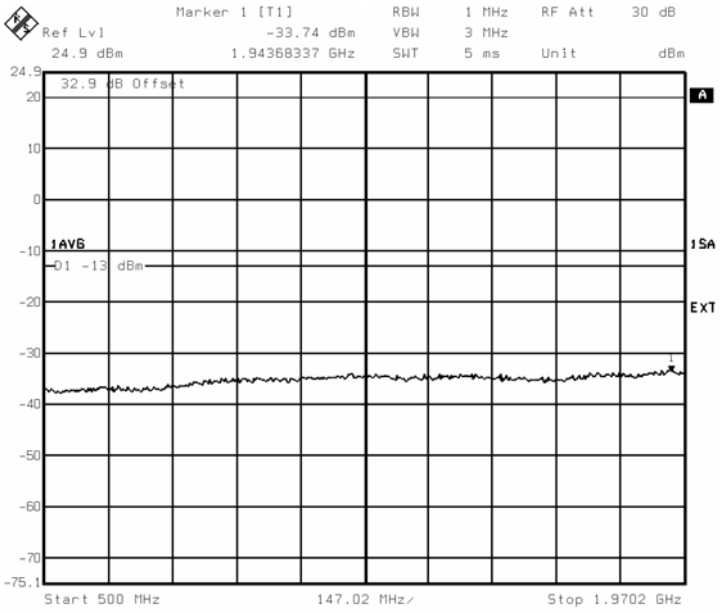
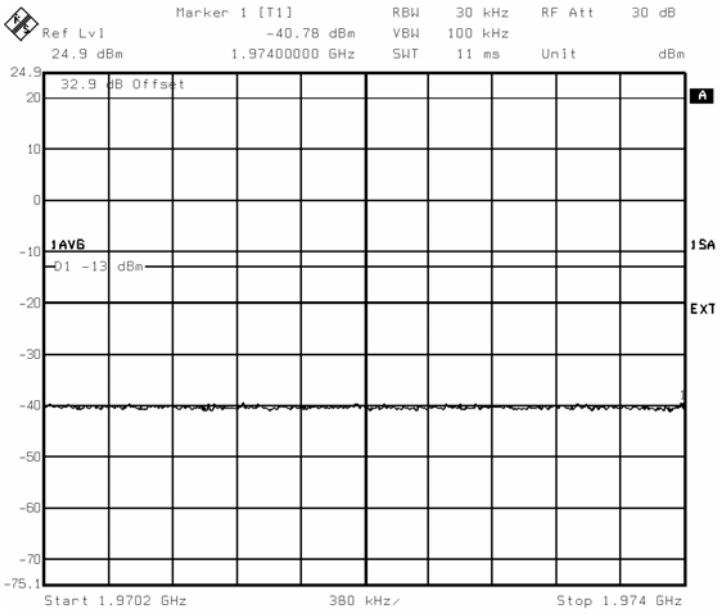
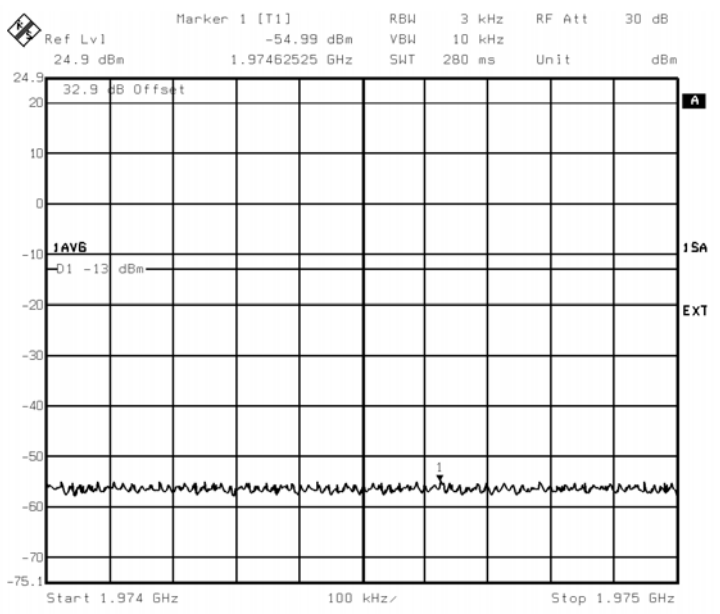


Figure 18: Out of block emissions (Channel 810, Pmax)

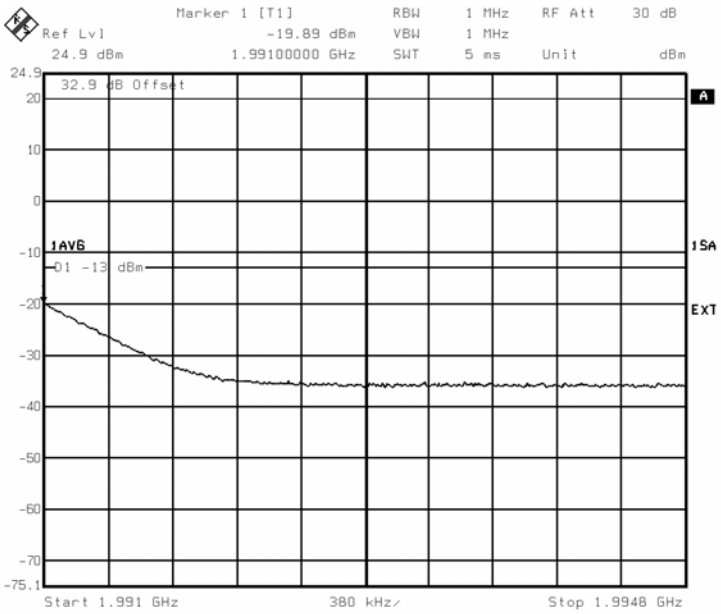
1970.2–1974 MHz



1974 MHz-1975 MHz



1991 MHz-1994.8 MHz



1994.8 MHz-4 GHz

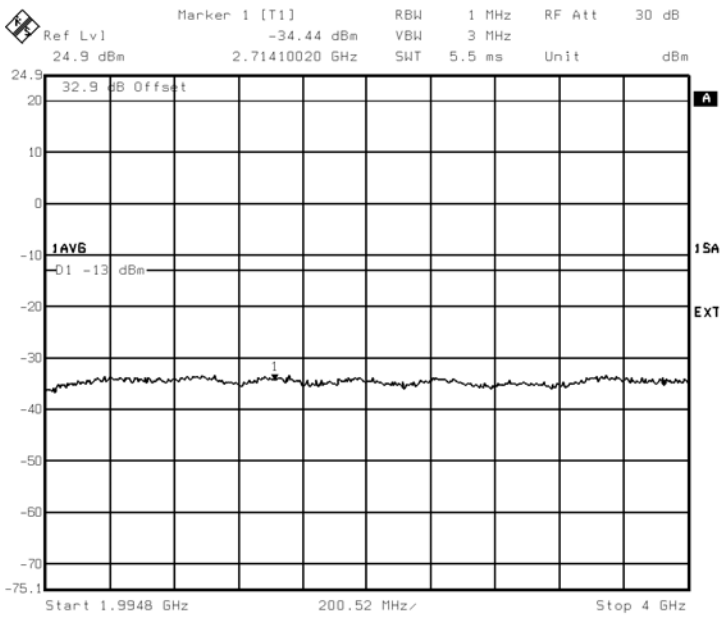
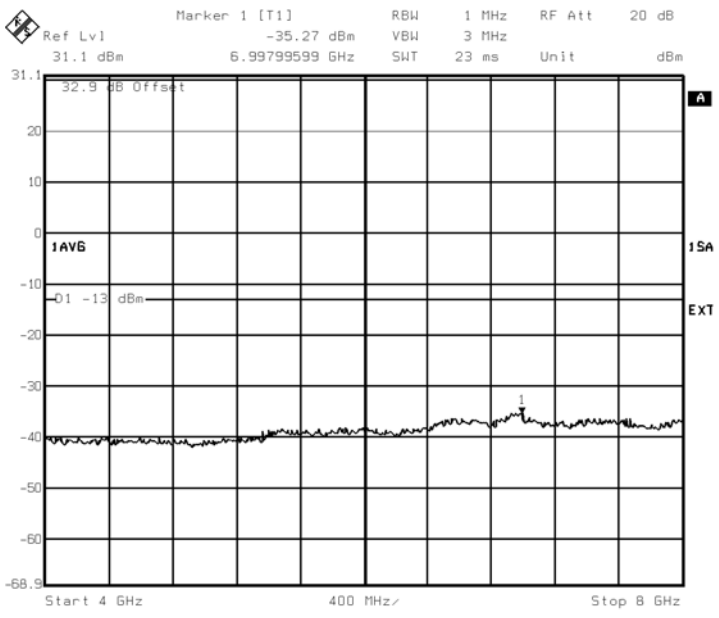
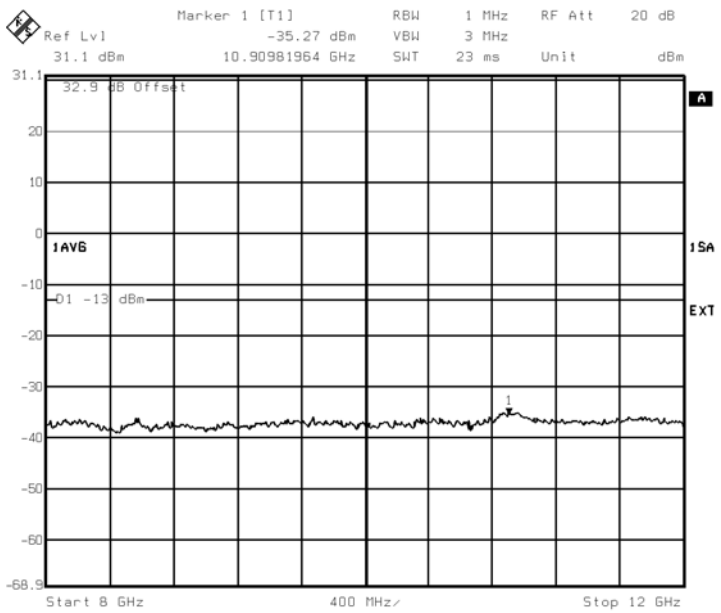


Figure 19: Out of block emissions (Channel 810, Pmax)

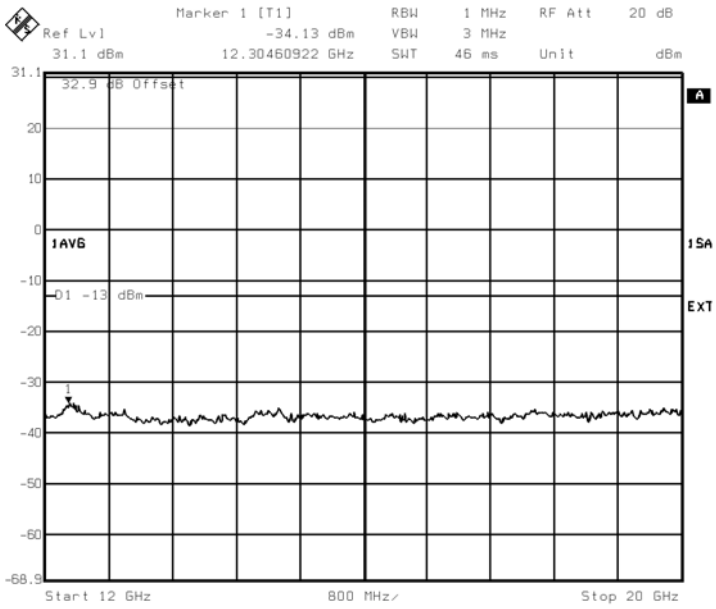
4–8 GHz



8-12 GHz



12-20 GHz



Conclusion : .

- **GMSK modulation:**

The worst case is the Duplexer configuration and emission power has been done at PD max - 4dB = 40 dBm

In order to comply with the emission limits in the 1 MHz bands immediately outside and adjacent to the frequency block, the absolute transmit power level of the block edge channels is set to **40 dBm** for GMSK modulation.

- **8PSK modulation:**

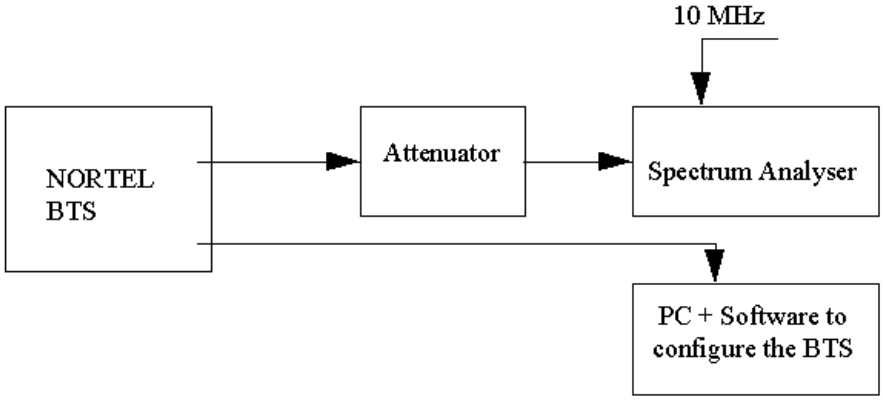
eDRX and eSCPA 1900 support 8 PSK modulation.

In the worst configuration (Diplexer) , **maximum emission power P=44 dBm** allows to be compliant with the spurious emission limits (-13 dBm) in the 1 MHz bands immediately outside and adjacent to the frequency block for 8PSK modulation.

TEST PROCEDURE

The equipment was configured as shown in schematic2.

Schematic2 : Test configuration for Spurious emissions at antenna terminals



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

The transmitter was set to operate to maximum power in Tx activation mode GMSK no synchro.

Initially the transmitter was set to operate to maximum power. Then in case of out of limits, the power has been decreased by 2 or 4dB.

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 .

For these measurements, the resolution bandwidth was of the spectrum analyzer was set to at least 1% of the emission bandwidth. In this case the emission bandwidth measured was near 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 Offset:	Corrected to take into account cables and attenuator losses
Sweep time:	Coupled
Detector:	Sample
Trace:	Average
Sweep count:	200

For all other measurements the BTS carrier frequency was adjusted to Channel 190 in GSM850 and Channel 810 in PCS 1900.

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 -13dBm limit.

5.6. TEST NAME: 2.1055 FREQUENCY STABILITY

FCC REQUIREMENTS

The frequency stability shall be sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST RESULTS GSM 850

Table 11 shows the Frequency Stability for channel 190 (F=881.6 MHz) in BTS 12000 OUTDOOR configuration under extreme conditions.

Table 11: Frequency Stability in BTS S12000 Outdoor configuration – Channel 190

Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	85% Nominal Supply voltage 195 V AC	Nominal Supply voltage 230V AC	115% Nominal Supply voltage 264 V AC
-30	7.75	7.43	-7.43
-20	11.69	-11.56	10.46
-10	10.85	9.81	-11.24
0	15.56	13.11	12.53
10	-10.65	13.3	-11.75
20	8.33	13.04	8.85
30	11.69	10.65	-12.91
40	14.98	11.69	-8.78
50	10.2	-10.53	10.98

The maximum frequency deviation allowed is 45 Hz. The maximum deviation measured (15.56 Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

Table 12 shows the Frequency Stability for channel 190 (F=881.6 MHz) in BTS 12000 Indoor configuration under extreme conditions.

Table 12: Frequency Stability in BTS S12000 Indoor configuration – Channel 190

Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	Channel 190 @ DC supply voltage		
	40V	48V	57V
-5	7.81	6.59	8.78
5	12.46	10.98	-12.20
15	9.56	8.91	-8.98
25	8.98	10.65	10.01
35	10.20	9.04	10.33
45	10.07	8.01	9.17

The maximum frequency deviation allowed is 40 Hz.The maximum deviation measured (12.5Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

TEST RESULTS PCS 1900

Table 13 shows the Frequency Stability for channel 661 (F=1960 MHz) in BTS 12000 OUTDOOR configuration under extreme conditions.

Table 13: Frequency Stability in BTS S12000 Outdoor configuration – Channel 661

Temperature (°C)	Maximum Carrier Frequency Deviation (Hz)		
	85% Nominal Supply voltage 195 V AC	Nominal Supply voltage 230V AC	115% Nominal Supply voltage 264 V AC
-30	17.95	16.14	18.02
-20	14.72	-21.50	19.24
-10	17.56	-23.31	-23.70
0	-18.08	23.44	-19.24
10	22.79	20.86	-19.63
20	18.92	-22.34	16.14
30	17.37	19.31	-25.18
40	27.51	20.99	23.34
50	22.02	-19.05	22.86

The maximum frequency deviation allowed is 90 Hz.

The maximum deviation measured (-25.2 Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The S12000 Outdoor BTS complies with the requirement.

Table 14 shows the Frequency Stability for channel 512 (F=1930.2 MHz) in BTS 12000 Indoor configuration under extreme conditions.

Table 14: Frequency Stability in BTS S12000 Indoor configuration – Channel 512

Temperature (°C)	**Maximum Carrier Frequency Deviation (Hz)**		
	Channel 512 @ DC supply voltage		
	-40V	-48V	-57V
-5	13.2	11.2	17.7
5	22	22.6	21.4
15	12.6	16.2	15.2
25	15.3	12.7	15.1
35	13	12.6	13.9
45	13.9	15.6	16.5

The maximum frequency deviation allowed is 90 Hz.

The maximum deviation measured (22,6 Hz) is more than sufficient to ensure that the fundamental emission stays within the authorized frequency block.

The S12000 Indoor BTS complies with the requirement.

TEST PROCEDURE

Thermal tests have been performed with S12000 BTS .

The BTS S12000 must operate under the following external extreme temperatures:

- BTS S12000 Outdoor : - 30°C / + 50 °C
- BTS S12000 Indoor: - 5°C / + 45 °C

Frequency stability test is performed under following extreme conditions:

- for outdoor S12000 BTS
- Temperature from –30°C to +50°C at intervals of 10 degrees.
- With AC power supply variations: 195 VAC , 230 VAC, 264 VAC

- for Indoor S12000 BTS
- Temperature from –5°C to +45°C at intervals of 10 degrees.
- With DC power supply variations: -40V, -48V, -57V.

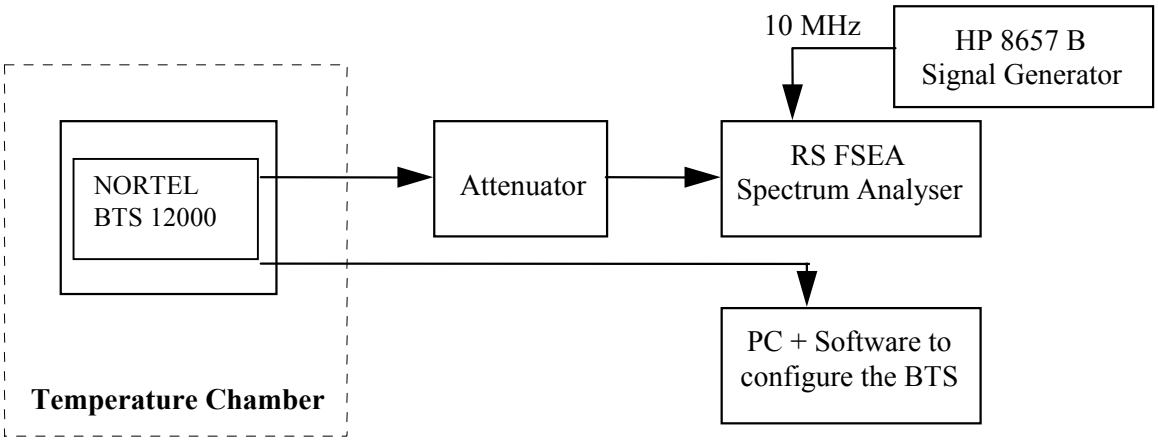
The BTS S12000 must operate under the following external extreme temperatures:

Frequency stability test is performed under following extreme conditions:

Modules (eDRX and eSCPA) run with nominal power regulation at maximum power (30W) in GMSK modulation. The eDRX/eSCPA were configured to transmit at maximum power (Static level 0).
A period of at least one hour was allowed prior to measurement to ensure that all the components of the oscillator circuit was stabilized at each temperature.

The equipment was configured as shown in Schematic3.

Schematic3: Test configuration for Frequency Stability



6. MEASUREMENT EQUIPMENT LIST

Equipment description	Manufacturer	Model	Serial No.	V/A date
Power Meter	Giga-tronics	8542C	515956	04/2003
Programmable AC source	Chroma	Model 6590	57220073	04/2004
Spectrum Analyser	R&S	FSEA	509455	12/2003
Spectrum Analyser	R&S	FSEM	525495	07/2003
Signal Generator	R&S	SMT 03	509922	03/2003
30 dB attenuator 100 W	Spinner		25483	
20 dB attenuator 80 W	Radiall		R417720118	

7. EXHIBIT 2 : UPDATED EQUIPMENT LIST

Description	Hardware code	Comment
Base Cabinet		
CPCMI T1	NTQA66AA	
CMCF	NTQA66CB	
CBCF	NTQA66GA	

- **PCS1900 Radio Modules used with the 60W High Power Amplifier configuration**

Radio Modules GSM 1900		
GSM 1900 eDRX	NTQA88PA	EDRX PCS1900 (GMSK / 8PSK)
GSM 1900 High Power Amplifier	NTQA50RA	HePA (60 W GMSK / 45W 8PSK)
GSM 1900 Duplexer	NTQA51DA NTQA51FA	Without TOS meter With TOS meter
GSM1900 Tx Filter	NTQA52CA NTQA52CB	Without TOS meter With TOS meter
GSM 1900 Two Ways Hybrid Duplexer (60W Power handling)	NTQA38KA NTQA38LA	Without TOS meter With TOS meter
GSM 1900 Four Ways Hybrid Duplexer	NTQA52BA NTQA52BB	Without TOS meter With TOS meter
GSM 1900 Splitter	NTQA10AA	Rx Splitter for Rx way only

Power limitation to comply to 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** = 40.5 dBm	**Power Limitation :** **Pmax – 2 dB** = 43.8 dBm
H2D	**Power Limitation :** **Pmax – 2 dB** = 41 dBm	Pmax = 42 dBm
H4D	Pmax = 40 dBm	Pmax = 39 dBm

- **PCS1900 Radio Modules used with 30W Power Amplifier configuration**

Description	Hardware code	Comment
Radio Modules GSM 1900		
GSM 1900 DRX	NTQA01DA	DRX ND PCS1900 (GMSK only)
GSM 1900 Power Amplifier	NTQA50DB	PA GMSK 30W
GSM 1900 eDRX	NTQA88PA	EDRX PCS1900 (GMSK / 8PSK)
GSM 1900 Power Amplifier	NTQA50GA	eSCPA (GMSK / 8PSK) 30W
GSM 1900 Diplexer	NTQA51DA NTQA51FA	Without TOS meter With TOS meter
GSM1900 Tx Filter	NTQA52CA NTQA52CB	Without TOS meter With TOS meter
GSM 1900 Two Ways Hybrid Duplexer	NTQA51AA NTQA51BA	Without TOS meter With TOS meter
GSM 1900 Four Ways Hybrid Duplexer	NTQA52BA NTQA52BB	Without TOS meter With TOS meter
GSM 1900 Splitter	NTQA10AA	Rx Splitter for Rx way only

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

Coupling configuration	System Power limitation GMSK modulation	System Power limitation 8 PSK modulation (If 8PSK is supported by modules)
Diplexer Tx Filter	**Power Limitation : Pmax – 4 dB = 40 dBm**	Pmax= 44 dBm
H2D	Pmax = 41 dBm	Pmax= 41 dBm
H4D	Pmax = 37 dBm	Pmax = 37 dBm

- **GSM850 Radio Modules used with 30W Power Amplifier configuration**

Description	Hardware code	Comment
Radio Modules GSM 850		
GSM 850 DRX	NTQA88HA	eDRX
GSM 850 Splitter	NTQA88XA	
GSM 850 Power Amplifier	NTQA37AA	eSCPA
Full Band coupling (*Tx Band 869-894 MHz)*		
GSM 850 Duplexer	NTQA38GA NTQA38FA	Without TOS meter With TOS meter
GSM 850 Tx Filter	NTQA39CA NTQA39DA	Without TOS meter With TOS meter
GSM 850 Two Ways Hybrid Duplexer	NTQA38JA NTQA38HA	Without TOS meter With TOS meter
Part Band coupling (*Tx Band 869- 891.5 MHz)*		
GSM 850 Duplexer	NTQA38CA NTQA38DA	Without TOS meter With TOS meter
GSM 850 Tx Filter	NTQA39AA NTQA39BA	Without TOS meter With TOS meter
GSM 850 Two Ways Hybrid Duplexer	NTQA38BA NTQA38AA	Without TOS meter With TOS meter

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

Coupling configuration	System Power limitation GMSK modulation	System Power limitation 8 PSK modulation (If 8PSK is supported by modules)
Diplexer Tx Filter	**Power Limitation : Pmax – 2 dB = 42 dBm Except ARFCN 238 , 241 : Pmax**	**Power Limitation : Pmax – 2 dB = 42 dBm Except ARFCN 238 , 241 : Pmax**
H2D	Pmax = 41 dBm	Pmax= 41 dBm

For Edge Channel ARFCN 128, 131, 133, 181, 183, 231, 233, 251, power has to be reduced by 2dB in order to meet spurious emission requirement.

For Edge Channel ARFCN 238, 241, maximum power (44dBm) has allowed to meet spurious emission requirement.

End of DOCUMENT