



EXHIBIT 2A

**Test Report Provided by
Nortel**

Applicant: Nortel Networks

**For Original Equipment
Certification on:**

AB6NT1900MFRM2-FP



Test Report for FCC Equipment Authorization

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Publication History

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List of Consultants

The following people have reviewed this document prior to its release and are expected to provide recommendation for its approval:

Printed Name	Function	Department
Harold Gill	RF Systems Designer	2M67
Thomas Wong	Regulatory Prime	2U40

Decision Maker

Decision Maker's Name	Signature	Date
Thomas Wong		

Decision Ratifier

The release of this document will be reviewed and approved for distribution and use by the following:

Ratifier's Name	Signature	Date
Rick Kerlake		

Revision History

Stream/ issue	Revision Date	Reason for Change	Author
00/01	July 11, 2005	Initial Test Report	Tuan Tran
00/02	July 25, 2005	Draft Test Report for Review	Tuan Tran
00/03	August 2, 2005	Approved	Tuan Tran

Change bars are not used in this document.

Acronyms and Abbreviations

ASIC	Application Specific Integrated Circuit
BBW	Breathing, Blossoming and Wilting
BPF	Bandpass Filter
BTS	Base Station Transceiver Subsystem
BW	Bandwidth
CDMA	Code Division Multiple Access
CR	Cost Reduced
dBFS	dB relative to Full Scale
DDS	Direct Digital Synthesizer
DPM	Duplexer Preselector Module
EEPROM	Electrically Erasable and Programmable ROM
EC	Engineering Change
ERLCE	Excess Reverse Link Capacity Estimate
HSSPC	High-Speed Serial Protocol Controller
HW	Hardware
IF	Intermediate Frequency
IIC	Inter-Integrated Circuit Bus
IS	Interim Standard
LO	Local Oscillator
LPF	Lowpass Filter
MCPA	Multi-Carrier Power Amplifier
MFRM	Multi-carrier Flexible Radio Module
MFRM2	Multi-carrier Flexible Radio Module 2
NF	Noise Figure
OCNS	Orthogonal Channel Noise Source
OH	OverHead
PA	Power Amplifier
PC	Personal Computer
PPR	Peak Power Reduction
PSA	Product Specification Agreement

RBW	Resolution BandWidth
RF	Radio Frequency
Rx	Receive
SA	Spectrum Analyzer
SFRM	Single Carrier Flexible Radio Module
SW	Software
TBD	To Be Determined
TM	Triplexer Module
TPTL	Transmit Power Tracking Loop
TRM	Transmitter Receiver Module
Tx	Transmit
uP	Microprocessor
VSA	Vector Signal Analyzer
XCVR	Transceiver

1 Introduction

This test report is submitted in accordance with the FCC Rules and Regulations, Part 2, Subpart J, Sections 2.1046 through 2.1057 for equipment authorization of Nortel Networks's CDMA 1900 MHz Multiple carrier Flexible Radio Module 2 (MFRM2).

The 1900 MHz MFRM2 is intended for use in the Domestic Public Personal Communications Service area and is designed in accordance with the following standards:

- *CFR 47, Part 24, Subpart E, Broadband Personal Communications Service [1]*
- *CFR 47, Part 2, Subpart J, Equipment Authorization Procedures - Equipment Authorization [2]*
- *IC RSS-133, Issue 2, 2 GHz Personal Communication Services [3]*
- *ANSI-97-E, Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations [4]*

1.1 Required Tests

Table 1 summarizes the required tests¹ for the CDMA 1900 MHz MFRM2.

Table 1 : Required Tests

FCC Measurement Specification	FCC Limit Specification	Description	Test to be Performed?
2.1046	24.232	RF Power Output	Yes
2.1033	N/A	Application for certification	Yes
2.1049		Occupied Bandwidth	Yes
2.1051, 2.1057	24.238	Spurious Emissions at Antenna Terminals	Yes
2.1055	24.235	Frequency Stability	Yes


1. This test report presents FCC part 24 results tested in Nortel Labs. Field Strength of Spurious Emissions test measurements along with requirements specified in 2.1033 are covered in a separate Product Integrity test plan from C-MAC Engineering Canada.

2 Engineering Declaration

The CDMA 1900MHz Multiple Carrier Flexible Radio Module 2 has been tested in accordance with the requirements contained in the Federal Communications Commission Rules and Regulations Part 2 and 24.

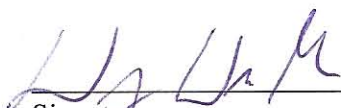
To the best of my knowledge, these tests were performed in accordance with good engineering practices using measurement procedures consistent with industry or commission standards or previous Commission correspondence or guidance and demonstrate that this equipment complies with the appropriate standards. All tests were conducted on a representative sample of the equipment for which equipment authorization is sought.

Tested by:
Tuan Tran
RF Systems Test Prime
Nortel Networks
Calgary Canada


Signature

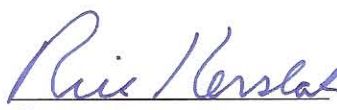
July 29, 2005
Date

Reviewed by:
Thomas Wong
CDMA/TDMA Regulatory
Emissions Prime
Nortel Networks
Calgary Canada


Signature

July 29, 2005
Date

Approved by:
Rick Kerslake
RF System Manager
Nortel Networks
Calgary Canada


Signature

Aug. 4, 2005
Date

3 Equipment Authorization Application Requirements

3.1 Standard Test Conditions and Test Equipment

The MFRM2 will be tested under the following standard test conditions unless otherwise noted:

- Ambient Temperature: 20 to 35 degrees C
- Ambient Humidity: 20 to 40%
- DC Supply Voltage: -48 Vdc and +24 Vdc (nominal)
- Supported Modulations: IS-95 (dual BPSK) IS-2000 (true QPSK) and IS-856 (QPSK, 8-PSK, 16-QAM)

3.2 EUT Identification List

Table 2 shows the identification of the components required for testing.

Table 2 : EUT Identification List

Equipment Description	Model / Part Number	Release Number	Serial Number
1900 MHz Multiple Carrier Flexible Radio Module 2 System (comprised of the modules below)	N/A	N/A	N/A
a) 1900 MFRM2 Radio Module	NTGY30BA	P3	NNTM536G36LN
c) A/D Band DPM	NTGS53JA	11	CLWVWWW101BM
d) B/E Band DPM	NTGS53KA	11	CLWVWWW101KG
e) C/F Band DPM	NTGS53LA	09	ALLG74000P0F

3.3 Test Equipment List

Table 3 shows the identification of the test equipment required for testing.

Table 3 : Test Equipment List

Description	Manufacturer	Model	Serial/Batch Number	Cal. Due Date
20 Hz to 40 GHz Spectrum Analyzer	Rohde&Schwarz	FSEK-30	849243/003	Mar 4/2006
RF Power Meter	AGILENT	E4419A	US38260706	Jan 1/ 2006
RF Power Sensor Head	AGILENT	E9300A	MY41496938	Jan 1/ 2006
VSA	AGILENT	E4406A	US40061527	Oct 19/ 2005
30dB Attenuator	Weinschel	48-30-43	BJ6055	Verified
RF Cable	N/A	N/A	N/A	Verified

4 Transmitter Tests

4.1 RF Power Output

4.1.1 RF Power Output Requirements

FCC Part 2.1046

(a) For transmitters other than single sideband, independent sideband and controlled carrier radiotelephone, power output shall be measured at the RF output terminals when the transmitter is adjusted in accordance with the tune-up procedure to give the values of current and voltage on the circuit elements specified in Sec. 2.1033(c)(8). The electrical characteristics of the radio frequency load attached to the output terminals when this test is made shall be stated.

FCC Limit (Subpart E--Broadband PCS, Sec. 24.232 Power and antenna height limits.)

In no case may the peak output power of a base station transmitter exceed 100 watts.

4.1.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. Measurements are made on channels at the bottom and top of the licensed subbands in one, two and three carrier configurations and for each of the supported modulation formats. The RF power output is measured using the Channel Power feature of the SA.

4.1.3 Test Setup

The set-up used for the MFRM2 RF power output test is illustrated in Figure 1. RF power output measurements are referenced to the antenna port of the DPM.

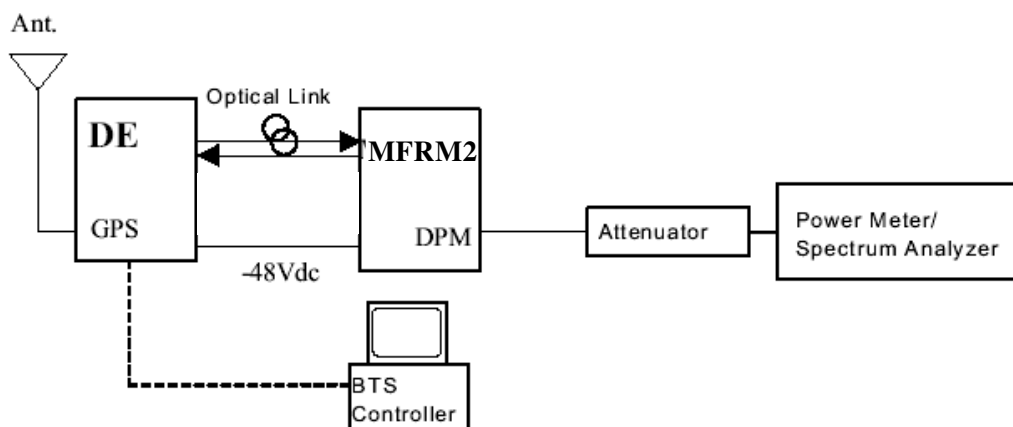


Figure 1 : Test Setup for RF Power Output Measurement

4.1.4 DOM

The RF Power Output requirements of the MFRM-2, with IS-856 (1xEV DO) waveforms were tested at full power. .

4.1.5 Test Results

The 1900 MHz MFRM2 complies with the requirement. The RF power output measured in one, two and three carrier configurations for each of the licensed subbands and supported modulation formats is shown in Table 4 through Table 11.

Table 4 : RF Output Power of 1900 MHz MFRM2, 1 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25 (A)	1931.25	46.04	46.0	50
1175 (C)	1988.75	46.09	46.0	50

Table 5 : RF Output Power of 1900 MHz MFRM2, 1 Carrier, IS-856, 16-QAM Mode

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
425 (B)	1951.25	45.97	46.0	50
775(F)	1968.75	45.93	46.0	50

Table 6 : RF Output Power of 1900 MHz MFRM2, 2 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25, 50 (A)	1931.25, 1932.5	46.18	46.0	50
1150, 1175 (C)	1987.5, 1988.75	46.18	46.0	50

Table 7 : RF Output Power of 1900 MHz MFRM2, 3 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25, 50, 75 (A)	1932.5	46.21	46.0	50
325, 350, 375 (D)	1947.5	46.0	46.0	50
425, 450, 475 (B)	1952.5	46.08	46.0	50
725, 750, 775 (E)	1967.5	46.33	46.0	50
825, 850, 875 (F)	1972.5	46.23	46.0	50
1125, 1150, 1175 (C)	1987.5	46.07	46.0	50

Table 8 : RF Output Power of 1900 MHz MFRM2, 3 Carrier, IS-856 16-QAM Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
25, 50, 75 (A)	1932.5	46.12	46.0	50
325, 350, 375 (D)	1947.5	46.11	46.0	50

Table 9 : RF Output Power of 1900 MHz MFRM2, 3 Carrier, IS-856 QPSK Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
425, 450, 475 (B)	1952.5	46.0	46.0	50
725, 750, 775 (E)	1967.5	46.05	46.0	50

Table 10 : RF Output Power of 1900 MHz MFRM2, 3 Carrier, IS-856 8-PSK Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
825, 850, 875 (F)	1972.5	46.01	46.0	50
1125, 1150, 1175 (C)	1987.5	45.96	46.0	50

Table 11 : RF Output Power of 1900 MHz MFRM2, 2 Carrier IS-95 & 1 Carrier IS-856, 16-QAM Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured RF Output Power (dBm)	Average Maximum Rated Power (dBm)	FCC Limit (dBm)
425, 450, 475 (B)	1952.5	46.01	46	50
725, 750, 775 (E)	1967.5	45.97	46	50
825, 850, 875 (F)	1972.5	46.04	46	50
1125, 1150, 1175 (C)	1987.5	46.1	46	50

4.2 Certification Requirement

4.2.1 Application for certification

FCC Part 2.1033 Application for certification.

(c) Applications for equipment other than that operating under parts 15 and 18 of the rules shall be accompanied by a technical report containing the following information:

(8) The dc voltages applied to and dc currents into the several elements of the final radio frequency amplifying device for normal operation over the power range.

4.2.2 Test Results

The final amplifying dc voltage is 27.0 Vdc. The final dc current is shown in Table 122:

Table 12 : Average Current Values Pout = 47 dBm @ the output of PA

Average Current Values @ Pout = 47 dBm				
	25°C			
	Q4 [A]	Q5 [A]	Q6 [A]	Q7 [A]
	2.8	3.4	3.1	3.0

4.3 Occupied Bandwidth

4.3.1 Occupied Bandwidth Requirements

FCC Part 2.1049

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 shall be measured under the following conditions as applicable:

(g) Transmitters in which the modulating baseband comprises not more than three independent channels--when modulated by the full complement of signals for which the transmitter is rated. The level of modulation for each channel should be set to that prescribed in rule parts applicable to the services for which the transmitter is intended. If specific modulation levels are not set forth in the rules, the tests should provide the manufacturer's maximum rated condition.

(h) Transmitters employing digital modulation techniques--when modulated by an input signal such that its amplitude and symbol rate represent the maximum rated conditions under which the equipment will be operated. The signal shall be applied through any filter networks, pseudo-random generators or other devices required in normal service. Additionally, the occupied bandwidth shall be shown for operation with any devices used for modifying the spectrum when such devices are optional at the discretion of the user.

4.3.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. Measurements are made on channels at the bottom and top of the licensed sub-bands in one, two and three carrier configurations and for each of the supported modulation formats. The occupied bandwidth is measured using the 99% Channel Power feature of the SA.

4.3.3 Test Setup

The set-up used for the MFRM2 Occupied bandwidth test is illustrated in Figure 2.

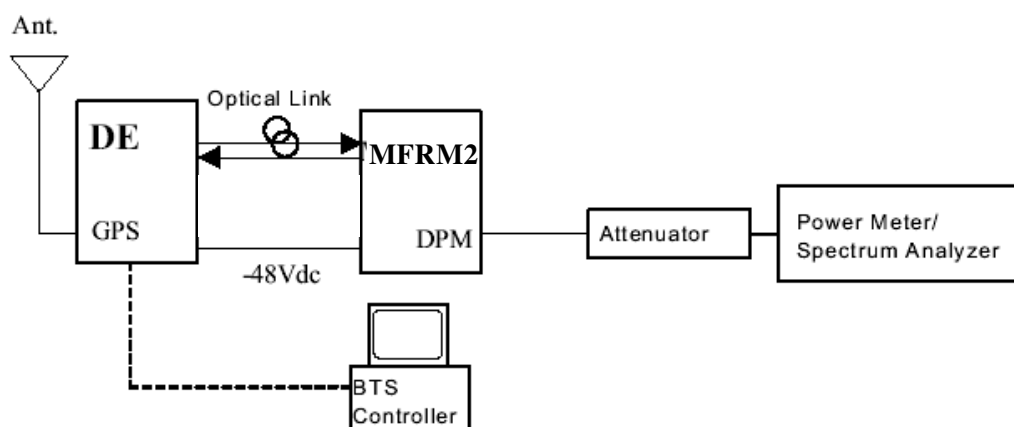


Figure 2 : Test Setup for Occupied Bandwidth Measurement

4.3.4 Test Results

The 1900 MHz MFRM2 complies with the requirement. The occupied bandwidth measured in one, two and three carrier configurations for each of the licensed subbands and supported modulation formats is shown in Table 13 through Table 20. The plots that follow show the occupied bandwidth in one, two and three carrier configurations. Although plots were recorded for all channels tested, only one sample plot per carrier configuration is provided to reduce the number of figures.

Table 13 : Occupied Bandwidth, 1900 MHz MFRM2, 1 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (kHz)
25 (A)	1931.25	1258.51
1175 (C)	1988.75	1266.53

Table 14 : Occupied Bandwidth, 1900 MHz MFRM2, 1 Carrier, IS-856, 16-QAM Mode

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (kHz)
425 (B)	1951.25	1258.51
775 (F)	1968.75	1254.51

Table 15 : Occupied Bandwidth, 1900 MHz MFRM2, 2 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz)	Measured Occupied Bandwidth (kHz)
25, 50 (A)	1931.25, 1932.5	2484.96
1150, 1175 (C)	1987.5, 1988.75	2484.97

Table 16 : Occupied Bandwidth, 1900 MHz MFRM2, 3 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
25, 50, 75 (A)	1932.5	3715.43
325, 350, 375 (D)	1947.5	3715.43
425, 450, 475 (B)	1952.5	3727.45
725, 750, 775 (E)	1967.5	3725.43
825, 850, 875 (F)	1972.5	3727.45
1125, 1150, 1175 (C)	1987.5	3727.45

Table 17 : Occupied Bandwidth, 1900 MHz MFRM2, 3 Carrier, IS-856 16-QAM Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
25, 50, 75 (A)	1932.5	3703.41
325, 350, 375 (D)	1947.5	3715.43

Table 18 : Occupied Bandwidth, 1900 MHz MFRM2, 3 Carrier, IS-856 QPSK Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
425, 450, 475 (B)	1952.5	3703.41
725, 750, 775 (E)	1967.5	3703.41

Table 19 : Occupied Bandwidth, 1900 MHz MFRM2, 3 Carrier, IS-856 8-PSK Mode

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
825, 850, 875 (F)	1972.5	3715.43
1125, 1150, 1175 (C)	1987.5	3714.43

**Table 20 : Occupied Bandwidth, 1900 MHz MFRM2, 2 Carrier IS-95 & 1 Carrier IS-856,
 16-QAM Mode**

Channel Number (Band)	Frequency (MHz) (centre channel)	Measured Occupied Bandwidth (kHz)
425, 450, 475 (B)	1952.5	3727.45
725, 750, 775 (E)	1967.5	3715.43
825, 850, 875 (F)	1972.5	3727.45
1125, 1150, 1175 (C)	1987.5	3715.43

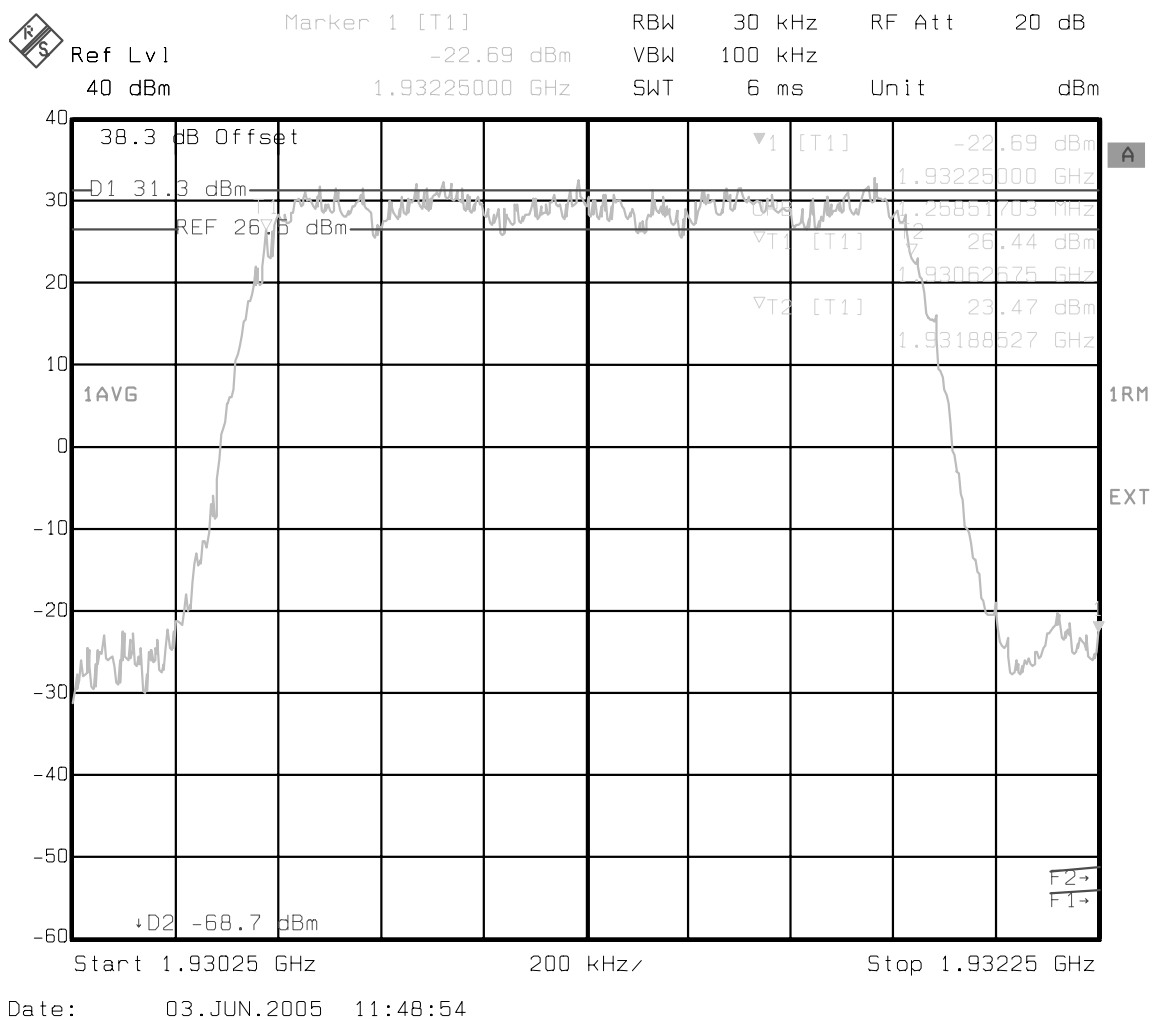
Figure 3 : Occupied Bandwidth - Single Carrier, Channel 25, IS-95 Mode


Figure 4 : Occupied Bandwidth - Single Carrier, Channel 425, IS-856, 16-QAM Mode

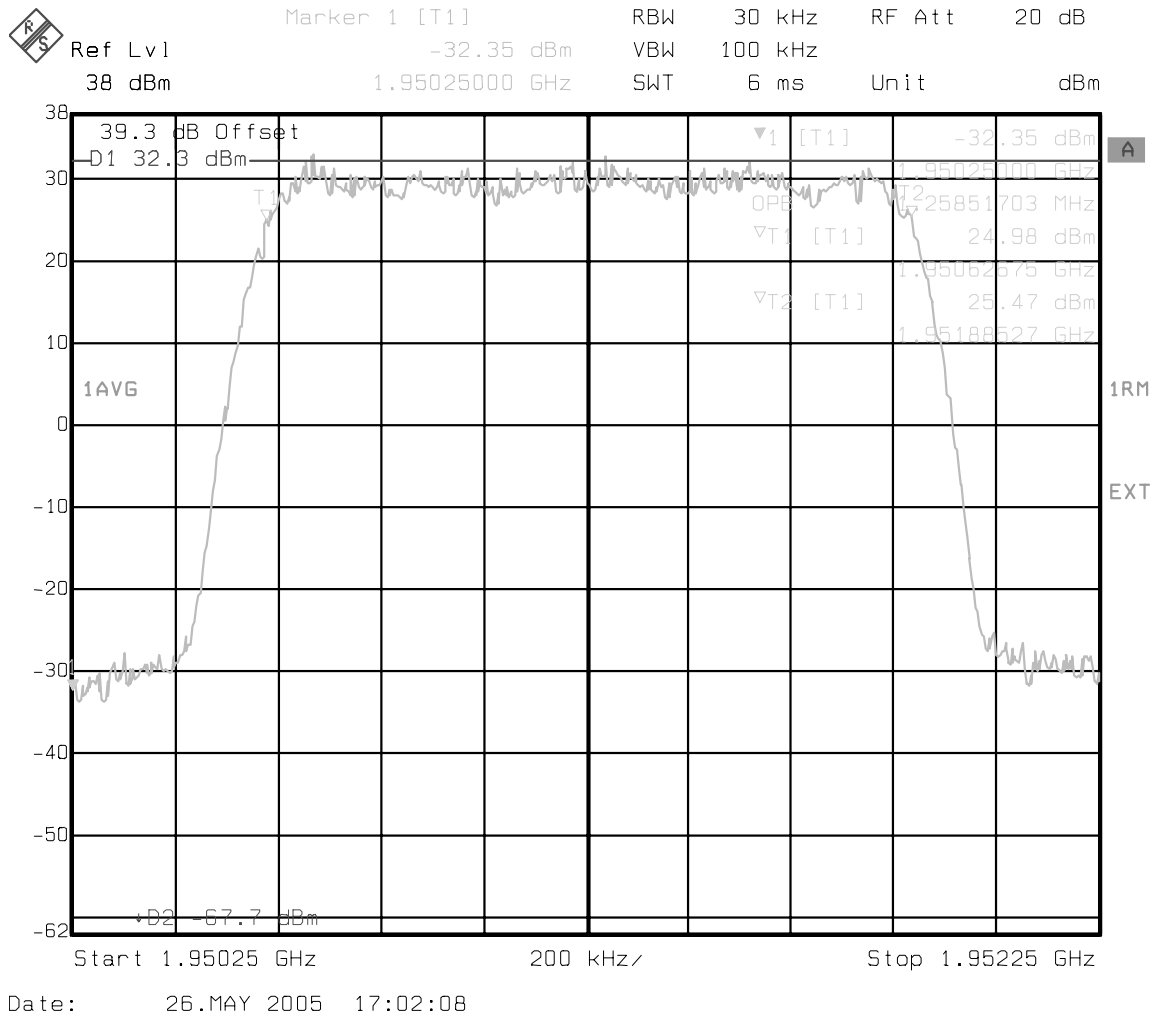


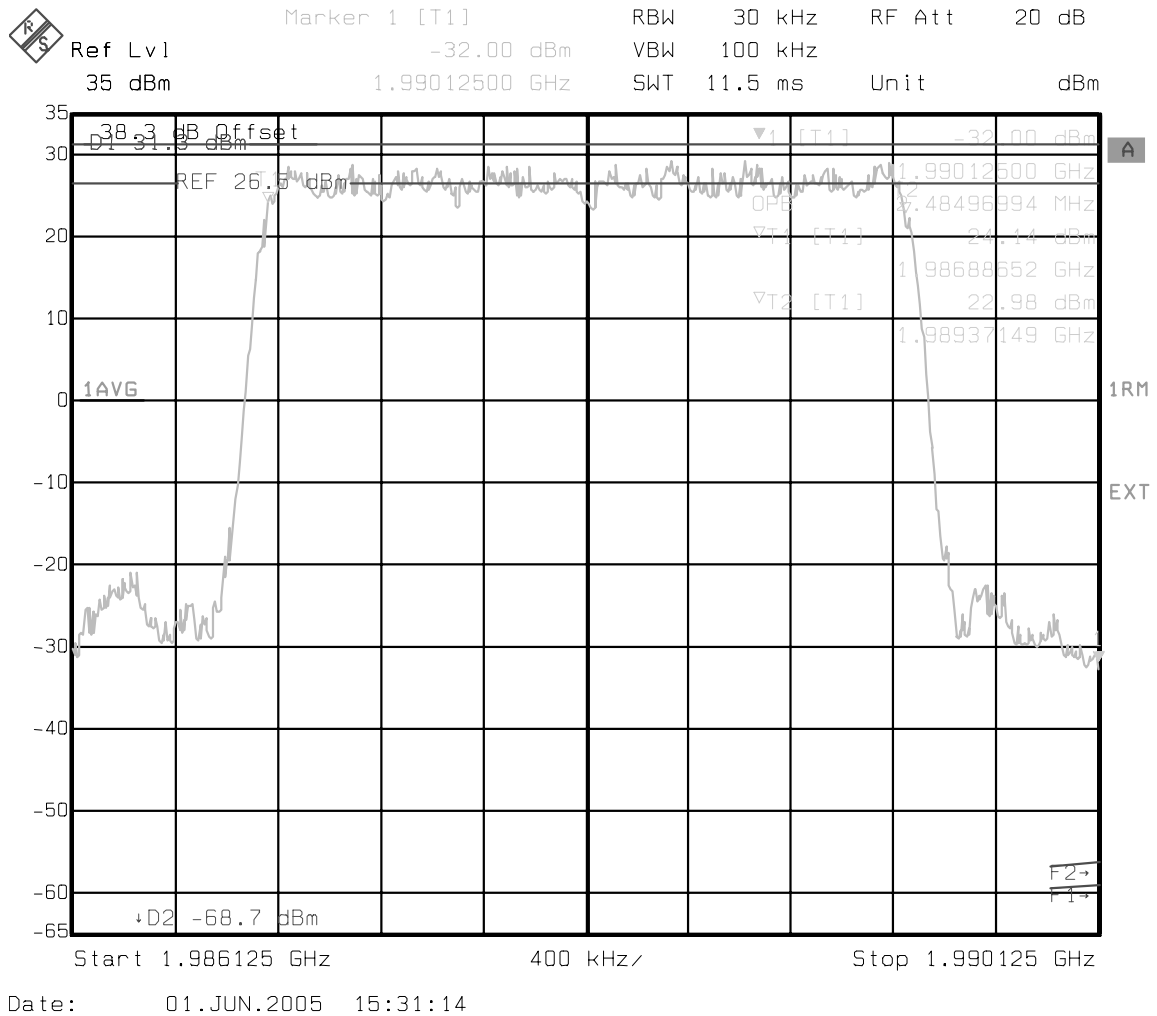
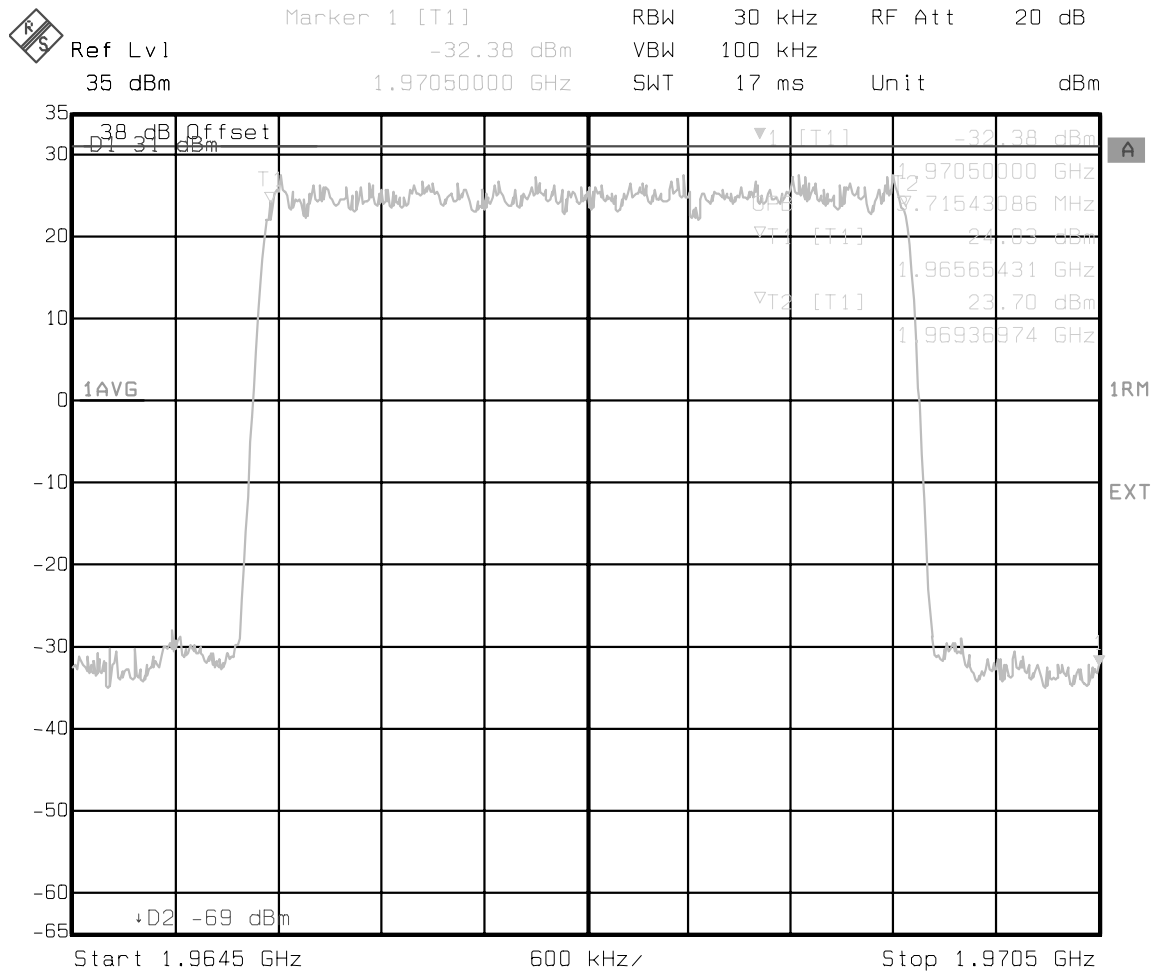
Figure 5 : Occupied Bandwidth - 2 Carrier IS-95 Mode, Channels 1150 & 1175


Figure 6 : Occupied Bandwidth - 3 Carriers IS-95 Mode, Channels 725, 750 & 775



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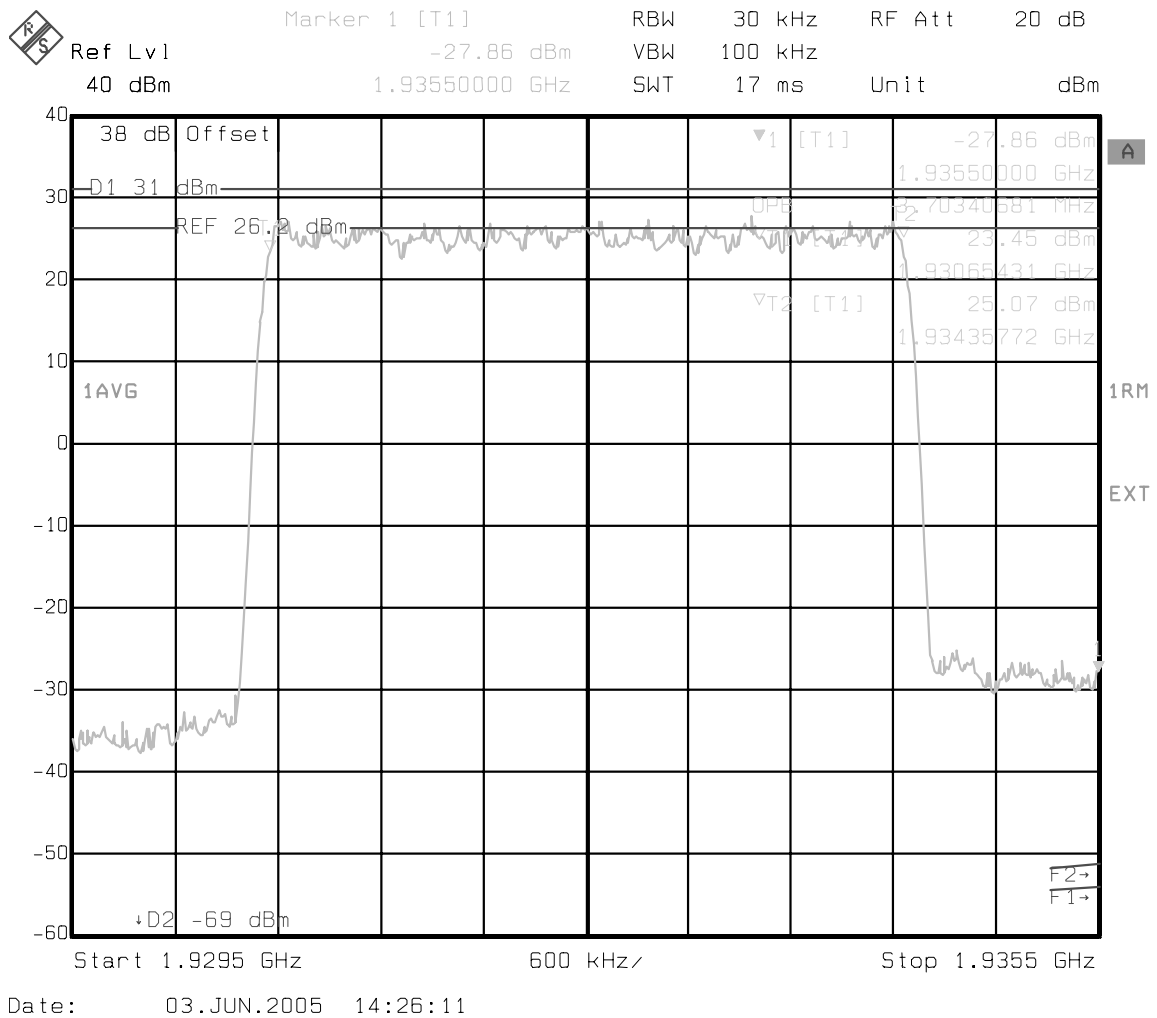
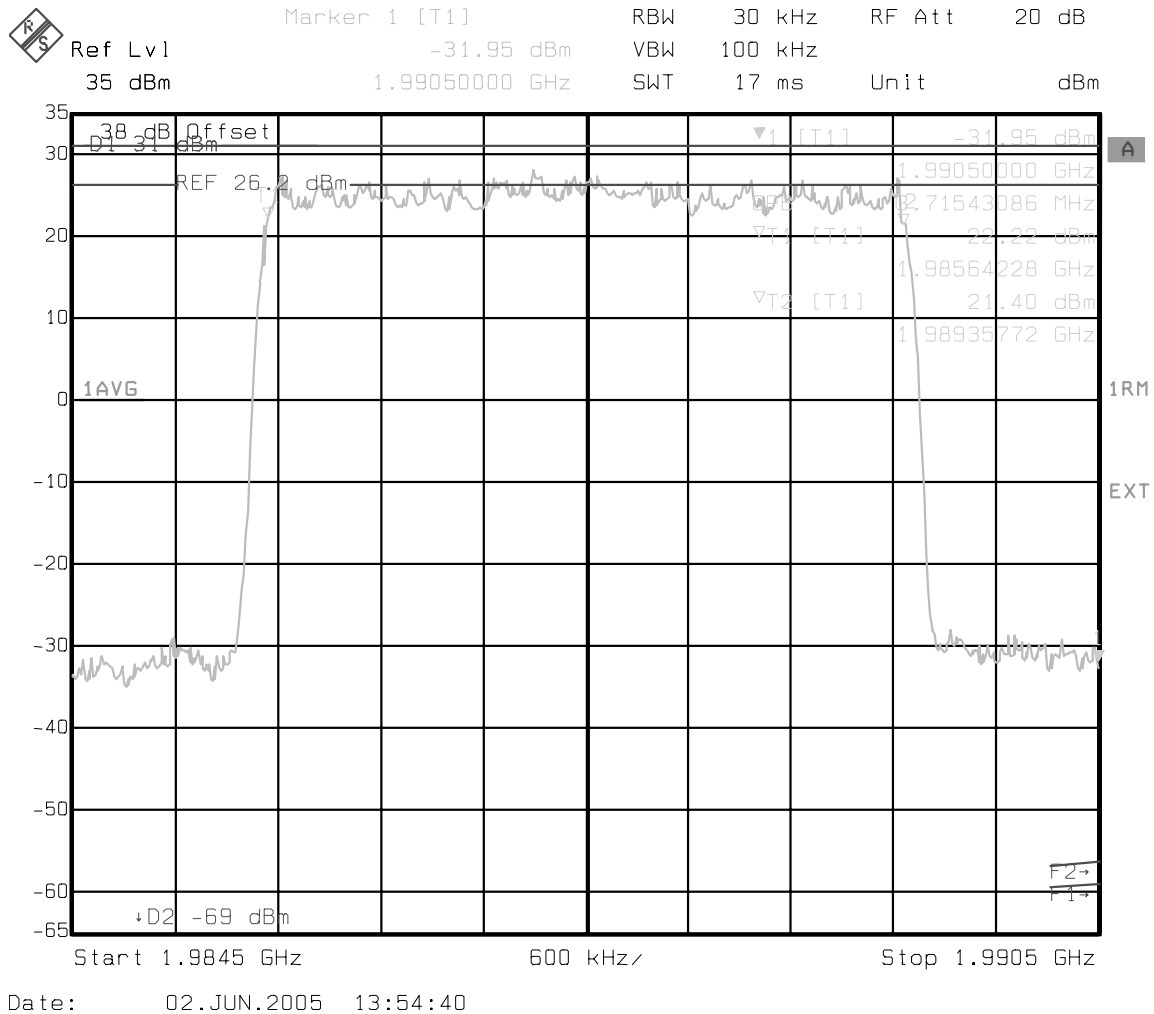
Figure 7 : Occupied Bandwidth - 3 Carrier, Channels 25, 50 & 75, IS-856, 16-QAM Mode


Figure 8 : Occupied Bandwidth - 3 Carrier, Channels 1125, 1150 & 1175, 2 Carrier IS-95 & 1 Carrier IS-856, 16-QAM Mode



4.4 Spurious Emissions at Antenna Terminals

4.4.1 Spurious Emissions Requirements

FCC Part 2.1051

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in Sec. 2.1049 as appropriate. The magnitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be specified.

FCC Part 2.1057 - Frequency Spectrum to be investigated

(a) In all of the measurements set forth in Sec. 2.1051, the spectrum shall be investigated from the lowest radio frequency signal generated in the equipment, without going below 9 kHz, up to at least the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.

(b) Particular attention should be paid to harmonics and subharmonics of the carrier frequency as well as to those frequencies removed from the carrier by multiples of the oscillator frequency. Radiation at the frequencies of multiplier stages should also be checked.

(c) The amplitude of spurious emissions which are attenuated more than 20 dB below the permissible value need not be reported.

FCC Part 24.238 Limit

(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.

4.4.2 Test Method

The DE is setup via the BTS controller to enable the MFRM2 to transmit at maximum rated output power level. Measurements are made on channels at the bottom and top of the licensed subbands in one, two and three carrier configurations and for each of the supported modulation formats. The following spectrum analyzer settings are used for the measurement of the antenna port spurious emissions:

Adjacent 1MHz to indicated subband (Upper and Lower)

Table 21 : Adjacent 1 MHz Spectrum Analyzer Settings

Setting	1 Carrier	2 Carrier	3 Carrier
Resolution Bandwidth ^a	12.5 kHz	25 kHz	37.5 kHz
Video Bandwidth ^b	125 kHz	250 kHz	375 kHz
Video Average	10 Averages	10 Averages	10 Averages
Span	1 MHz	1 MHz	1 MHz
Attenuation	20 dB	20 dB	20 dB
Ref. Level	set accordingly dBm	set accordingly dBm	set accordingly dBm
Ref. Level Offset	set accordingly dB	set accordingly dB	set accordingly dB

- a. If the spectrum analyzer can not be set to the specified RBW, the next highest RBW should be used and all measurements corrected to the specified RBW
 b. If the spectrum analyzer can not be set to the specified VBW, the next highest VBW should be used

All spectrum analyzer settings are coupled as per the manufacturers recommendations to improve measurement time, without compromising data.

All other Spurious Emissions up to 20 GHz

Table 22 : All other Emissions Spectrum Analyzer Settings

Setting	1 Carrier	2 Carrier	3 Carrier
Resolution Bandwidth	1 MHz	1 MHz	1 MHz
Video Bandwidth	10 MHz	10 MHz	10 MHz
Video Average	10 Averages	10 Averages	10 Averages
Span	set accordingly	set accordingly	set accordingly
Attenuation	20 dB	20 dB	20 dB
Ref. Level	set accordingly dBm	set accordingly dBm	set accordingly dBm

Setting	1 Carrier	2 Carrier	3 Carrier
Ref. Level Offset	set accordingly dB	set accordingly dB	set accordingly dB

4.4.3 Test Setup

The set-up used for the MFRM2 Antenna Port Spurious Emission test is illustrated in Figure 9 and consist of:

- Metro Cell Digital Enclosure shelf
- MFRM2 system --> MFRM2 Radio Module, DPM module, FAM module and cabling
- High power (100W), high frequency range (DC to 18 GHz) attenuator as per Table 3
- High frequency range (20 Hz to 40 GHz) Spectrum Analyzer as per Table 3
- High frequency range, low loss RF cabling
- Control PC

Spurious Emissions are measured on the SA, which for the purpose of filing the test report for FCC compliance, needs to be calibrated and meet to or exceed the FCC Part 2.1057 - Frequency Spectrum to be investigated requirements.

The high power, high frequency range attenuator will be verified for flatness across the frequency range specified in FCC Part 2.1057 - Frequency Spectrum to be investigated. Namely, for the 1900MHz MFRM2 the range is DC to 20 GHz.

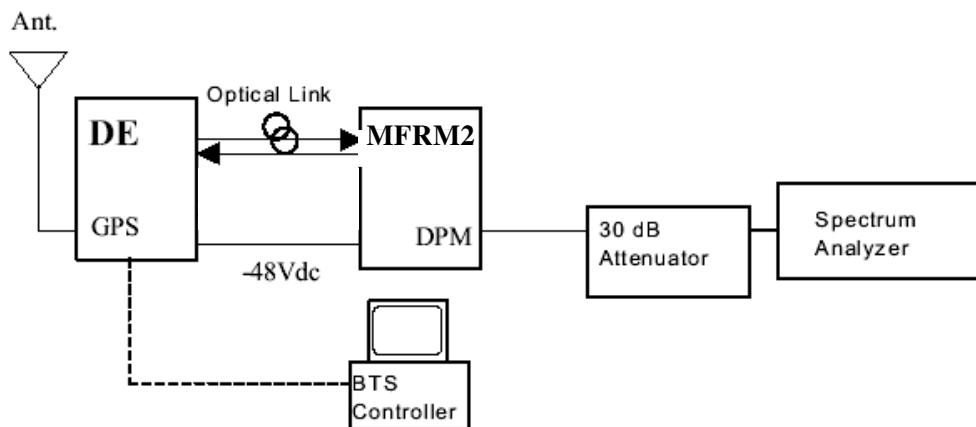


Figure 9 : Test Setup for Spurious Emissions Measurement

4.4.4 DOM

The conducted spurious emissions of the MFRM-2, with IS-856 (1xEV DO) waveforms were tested at full power.

4.4.5 Test Results

The frequency spectrum from 1 MHz to 20 GHz is scanned for emissions using the spectrum analyzer settings outlined in 4.4.2. Measurements are made over temperature on channels at the bottom and top of the licensed sub-bands in one, two and three carrier configurations and for each of the supported modulation formats. The MFRM2 complies with the limit of -13 dBm per 1 MHz of BW. Table 23 through Table 27 show the spurious emissions at the antenna port of the MFRM2 for 1, 2 and 3 carrier configurations and for each of the supported modulation formats. The plots that follow show the spurious emissions in one, two and three carrier configurations. Although plots were recorded for all channels tested, only one sample plot per carrier configuration is provided to reduce the number of figures.

Table 23 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 1 Carrier, IS-95 Mode

Channel Number (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25 (A)	1929 -:- 1930 (lower adjacent 1 MHz)	-28.47	15.47
	1950 -:- 1951 (upper adjacent 1 MHz)	-41.16	28.16
1175 (C)	1969 -:- 1970 (lower adjacent 1 MHz)	-42.68	29.68
	1990 -:- 1991 (upper adjacent 1 MHz)	-26.71	13.71
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-29.87	16.87 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-20.12	7.12 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-22.05	8.05

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
 b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 24 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 1 Carrier, IS-856, 16-QAM Mode

Channel Number (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
425 (B)	1949 -:- 1950 (lower adjacent 1MHz)	-27	14
	1970 -:- 1971 (upper adjacent 1 MHz)	-41.77	28.77
775 (E)	1949 -:- 1950 (lower adjacent 1MHz)	-42.18	29.18
	1970 -:- 1971 (upper adjacent 1 MHz)	-29.99	16.99
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-28.54	15.54 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-20.21	7.21 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-20.85	7.85

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 25 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 2 Carrier, IS-95 Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25, 50 (A)	1929 -:- 1930 (lower adjacent 1 MHz)	-20.25	7.25
	1950 -:- 1951 (upper adjacent 1 MHz)	-41.13	28.13
1150, 1175 (C)	1969 -:- 1970 (lower adjacent 1 MHz)	-42.08	29.08
	1990 -:- 1991 (upper adjacent 1 MHz)	-24.65	11.65
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-31.61	18.61 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-22.09	9.09 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-22.34	9.34

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 26 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 3 Carrier, IS-95 Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25, 50, 75 (A)	1929 -:- 1930 (lower adjacent 1 MHz)	-21.55	8.55
	1950 -:- 1951 (upper adjacent 1 MHz)	-36.05	23.05
325, 350, 375 (D)	1929 -:- 1930 (lower adjacent 1 MHz)	-35.7	22.7
	1950 -:- 1951 (upper adjacent 1 MHz)	-29.02	16.02
425, 450, 475 (B)	1949 -:- 1950 (lower adjacent 1 MHz)	-22.6	9.6
	1970 -:- 1971 (upper adjacent 1 MHz)	-35.84	22.84
725, 750, 775 (E)	1949 -:- 1950 (lower adjacent 1 MHz)	-35.29	22.29
	1970 -:- 1971 (upper adjacent 1 MHz)	-28.53	15.53
825, 850, 875 (F)	1969 -:- 1970 (lower adjacent 1 MHz)	-21.64	8.64
	1990 -:- 1991 (upper adjacent 1 MHz)	-35.53	22.53
1125, 1150, 1175 (C)	1969 -:- 1970 (lower adjacent 1 MHz)	-35.93	22.93
	1990 -:- 1991 (upper adjacent 1 MHz)	-26.96	13.96
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-21.26	8.26 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-18.84	5.84 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-21.95	8.95

a. Emission levels given in these ranges represents the worst case value over all the tested channels

b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 27 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 3 Carrier IS-856 16-QAM Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
25, 50, 75 (A)	1929 -:- 1930 (lower adjacent 1 MHz)	-23.09	10.09
	1950 -:- 1951 (upper adjacent 1 MHz)	-36.59	23.59
325, 350, 375 (D)	1929 -:- 1930 (lower adjacent 1 MHz)	-35.27	22.27
	1950 -:- 1951 (upper adjacent 1 MHz)	-29.26	16.26
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-30.94	17.94 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-22.43	9.43 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-22.37	9.37

a. Emission levels given in these ranges represents the worst case value over all the tested channels

b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 28 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 3 Carrier IS-856 QPSK Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
425, 450, 475 (B)	1949 -:- 1950 (lower adjacent 1 MHz)	-24.35	11.35
	1970 -:- 1971 (upper adjacent 1 MHz)	-36.30	23.3
725, 750, 775 (E)	1949 -:- 1950 (lower adjacent 1 MHz)	-35.58	22.58
	1970 -:- 1971 (upper adjacent 1 MHz)	-29.35	16.35
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-30.1	17.1 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-19.9	6.9 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-22.15	9.15

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
 b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 29 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 3 Carrier IS-856 8PSK Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
825, 850, 875 (F)	1969 -:- 1970 (lower adjacent 1 MHz)	-27.21	14.21
	1990 -:- 1991 (upper adjacent 1 MHz)	-35.06	22.06
1125, 1150, 1175 (C)	1969 -:- 1970 (lower adjacent 1 MHz)	-35.86	22.86
	1990 -:- 1991 (upper adjacent 1 MHz)	-23.99	10.99
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-30.27	17.27 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-20.34	7.34 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-22.31	9.31

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
 b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Table 30 : Spurious Emissions at the 1900 MHz MFRM2 Antenna Port, 2 Carrier IS-95 & 1 Carrier IS-856, 16-QAM Mode

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
425, 450, 475 (B)	1949 -:- 1950 (lower adjacent 1 MHz)	-21.94	8.94
	1970 -:- 1971 (upper adjacent 1 MHz)	-36.1	23.1
725, 750, 775 (E)	1949 -:- 1950 (lower adjacent 1 MHz)	-39.19	26.19
	1970 -:- 1971 (upper adjacent 1 MHz)	-28.78	15.78

Channel Numbers (Band)	Frequency (MHz)	Worst Case Spurious Emissions Level (dBm)	Margin to FCC Limit of -13 dBm (dB)
825, 850, 875 (F)	1969 -:- 1970 (lower adjacent 1 MHz)	-21.64	8.64
	1990 -:- 1991 (upper adjacent 1 MHz)	-35.53	22.53
1125, 1150, 1175 (C)	1969 -:- 1970 (lower adjacent 1 MHz)	-36.64	23.64
	1990 -:- 1991 (upper adjacent 1 MHz)	-28.03	15.03
N/A	0 -:- lower adjacent MHz ^a (RBW=1 MHz)	-29.62	16.62 ^b
N/A	upper adjacent MHz -:- 5000 ^a (RBW=1 MHz)	-20.31	7.31 ^b
N/A	5000 - 20000 ^a (RBW=1 MHz)	-21.3	8.3

- a. Emission levels given in these ranges represents the worst case value over all the tested channels
b. Worst Case margin values determined by the emissions performance in the 1 MHz band immediately outside the lower/upper adjacent MHz

Figure 10 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (Lower Adjacent 1 MHz)

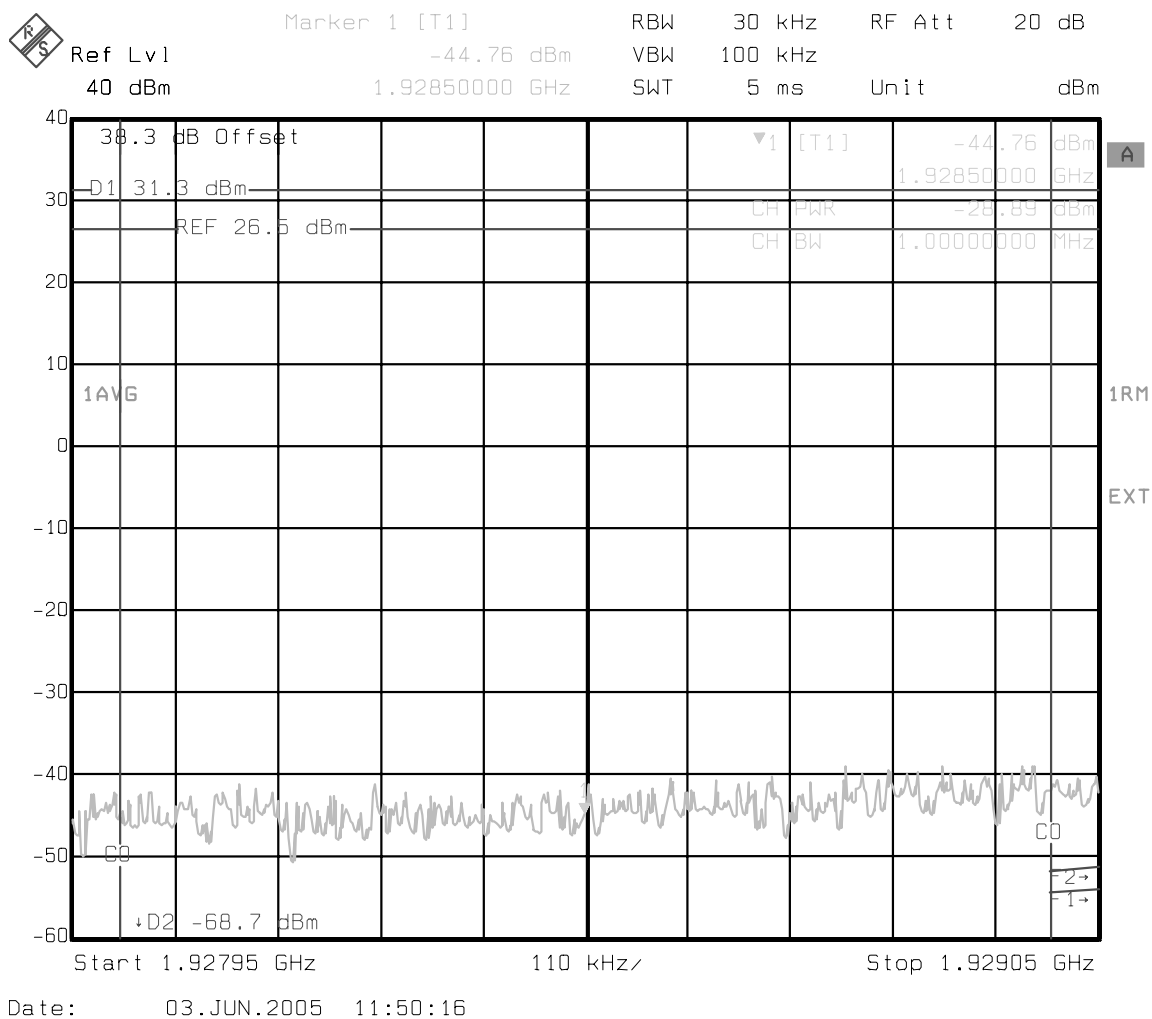


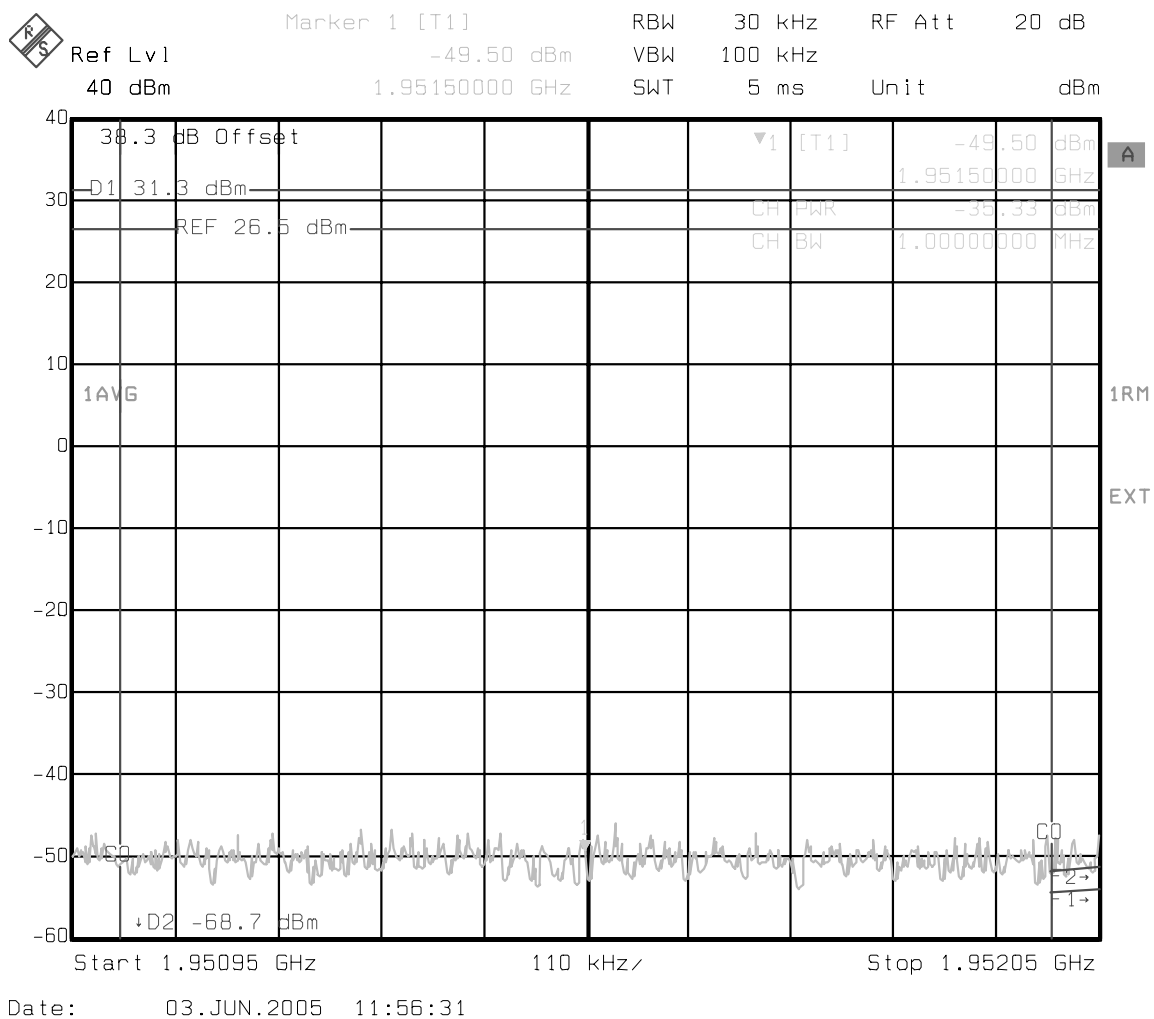
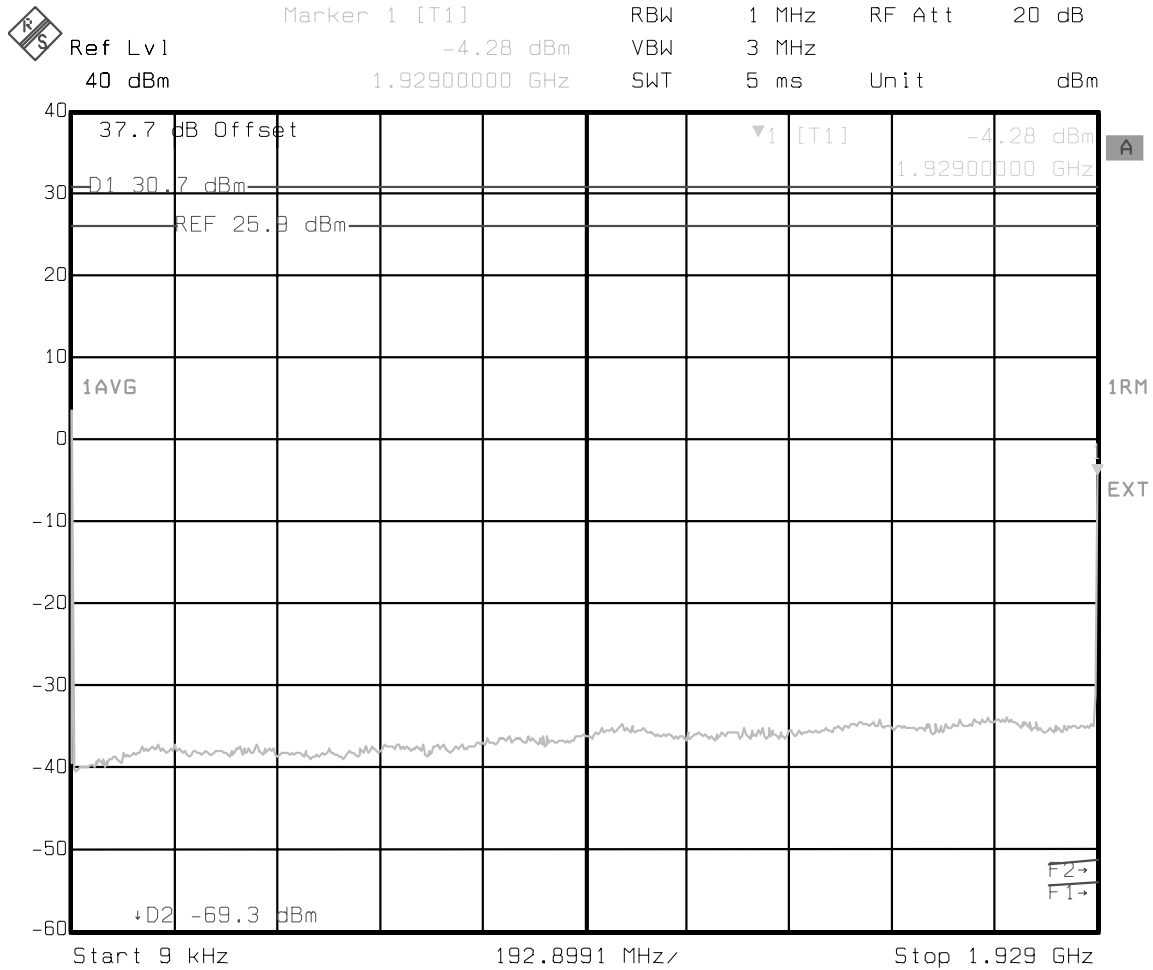
Figure 11 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (Upper Adjacent 1 MHz)


Figure 12 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (9kHz :- Lower Adjacent 1 MHz)



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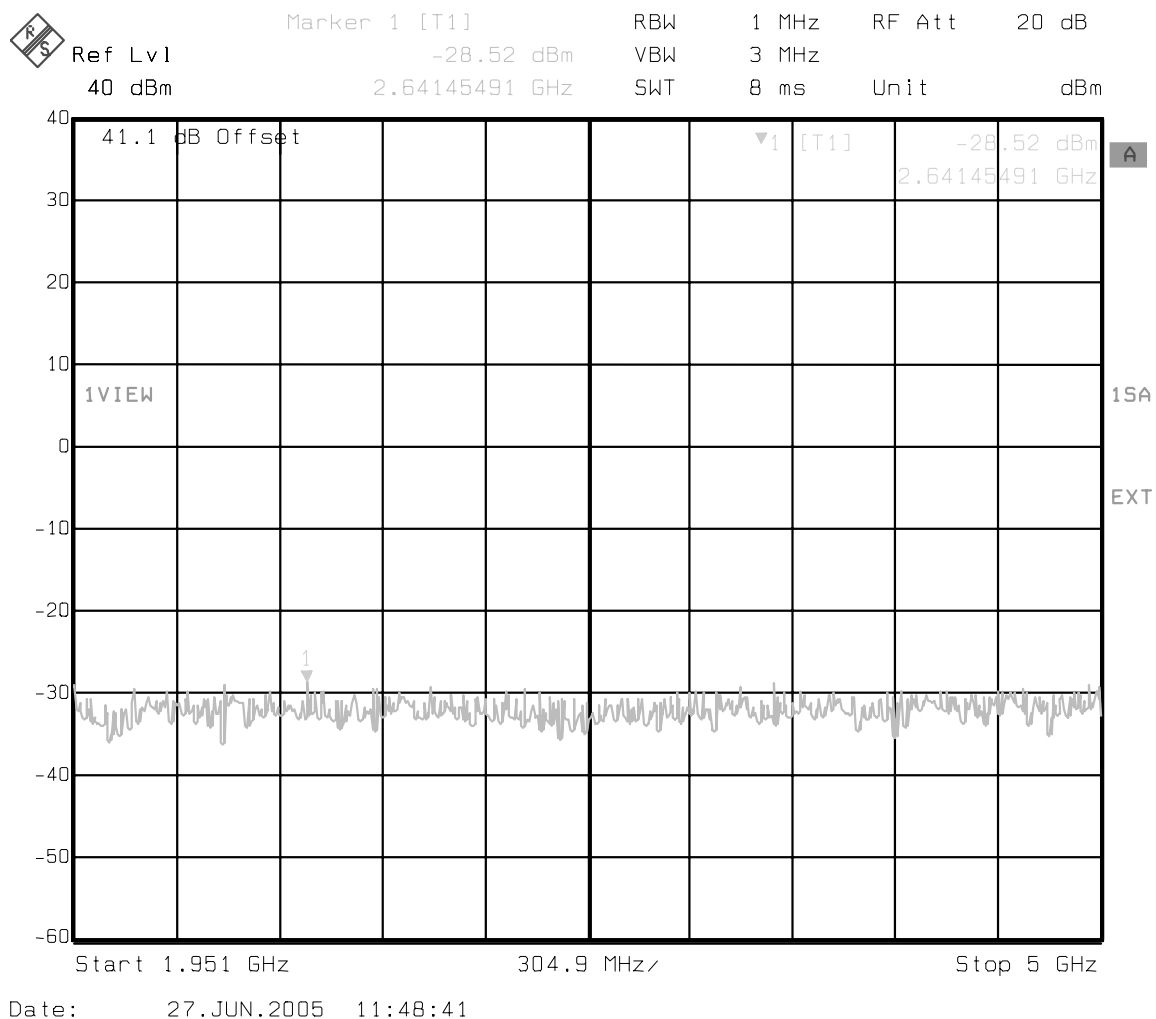
**Figure 13 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (Upper Adjacent
1 MHz :- 5 GHz)**

Figure 14 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (5 GHz :- 12.50 GHz

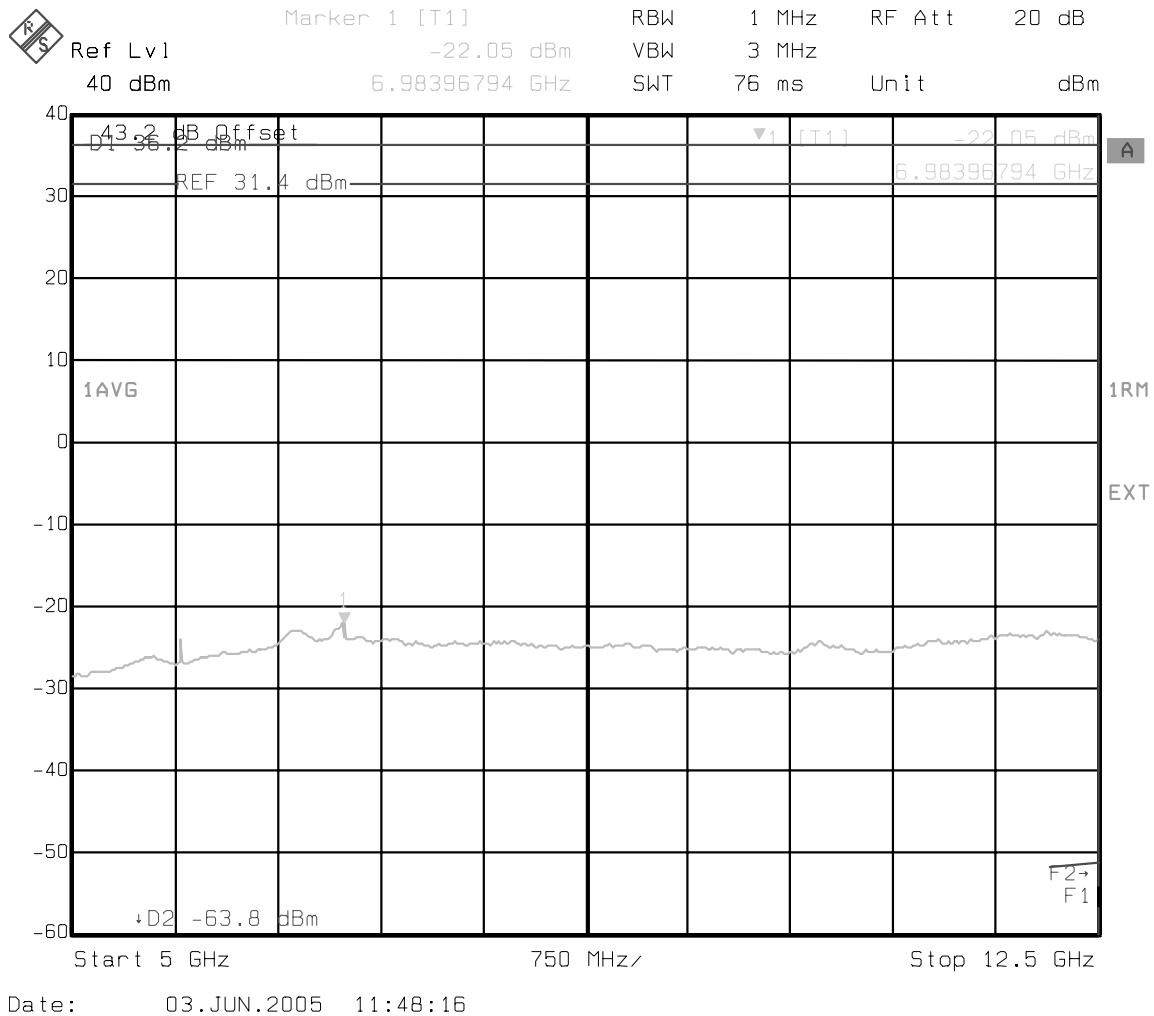
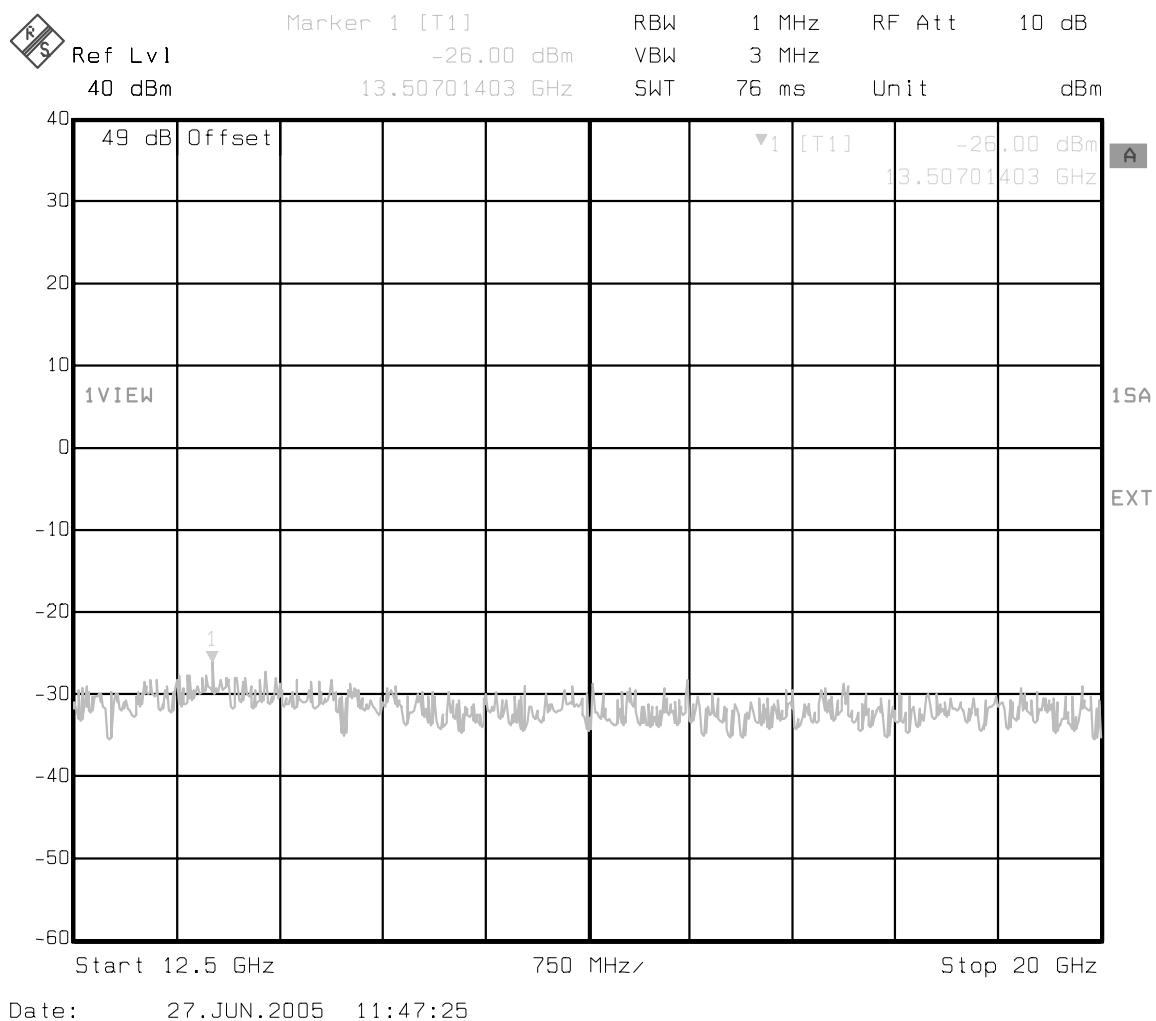
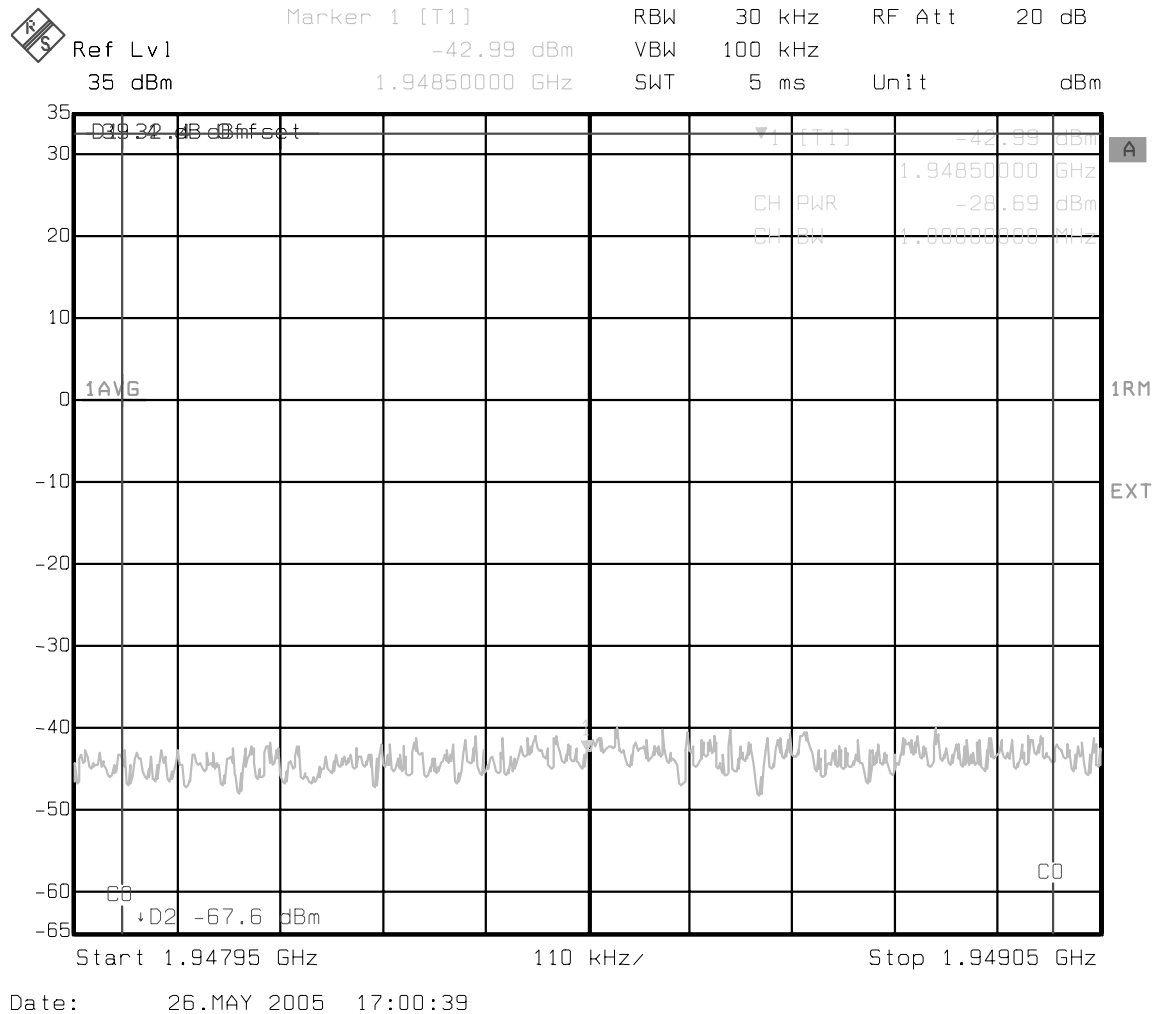
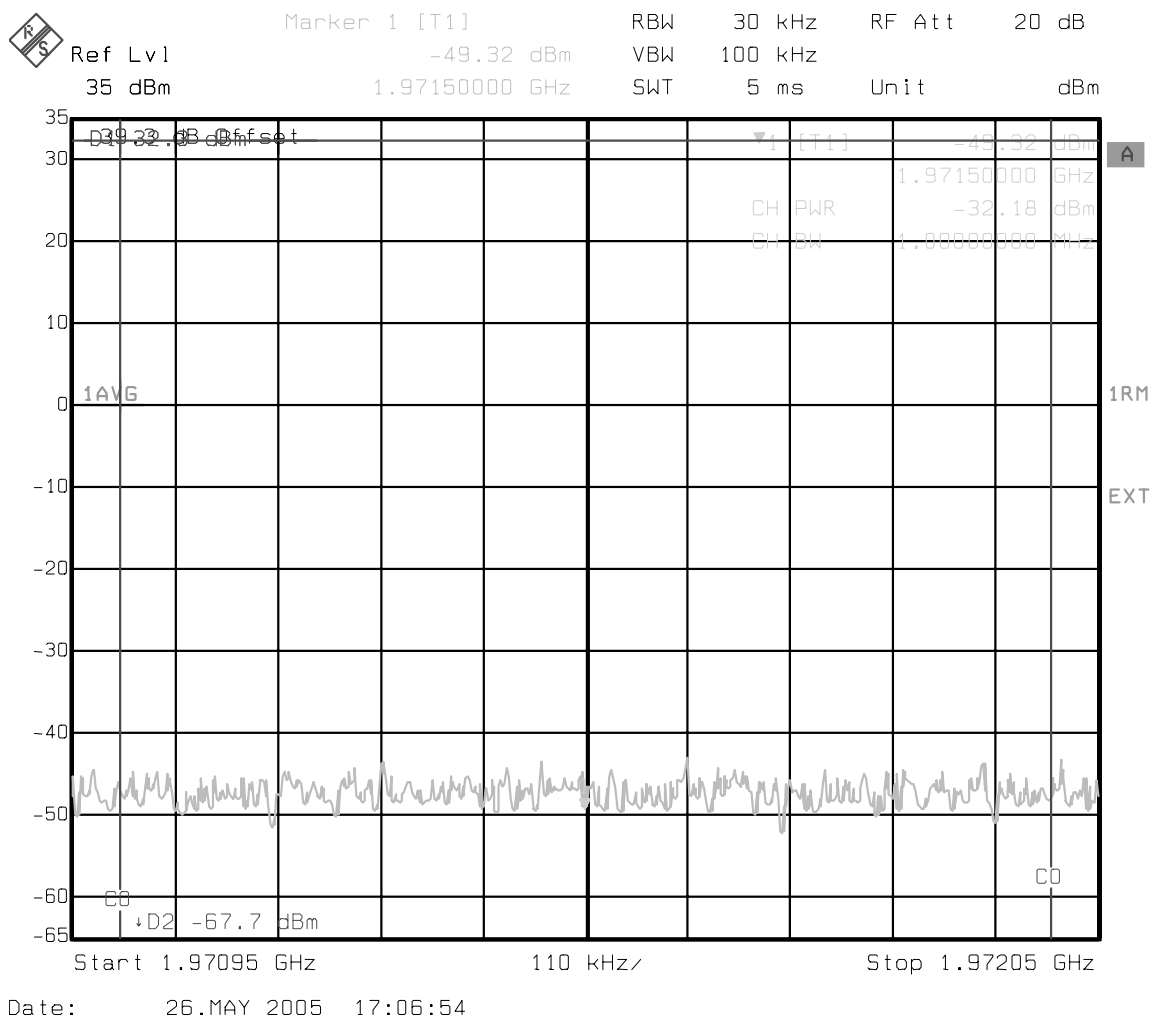


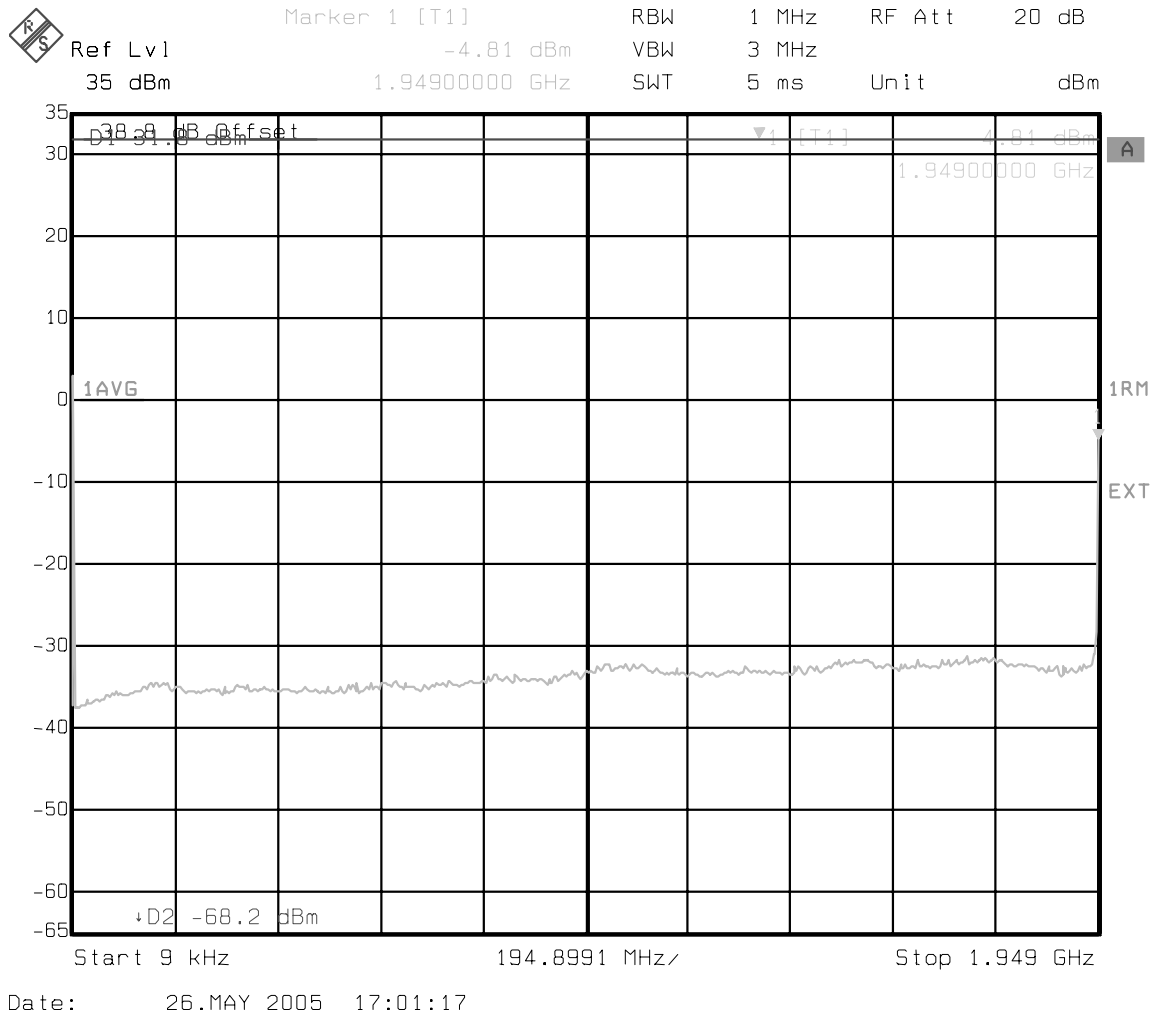
Figure 15 : Conducted Spurious Emissions - 1 Carrier, Channel 25, IS-95 (12.5 GHz :- 20 GHz)

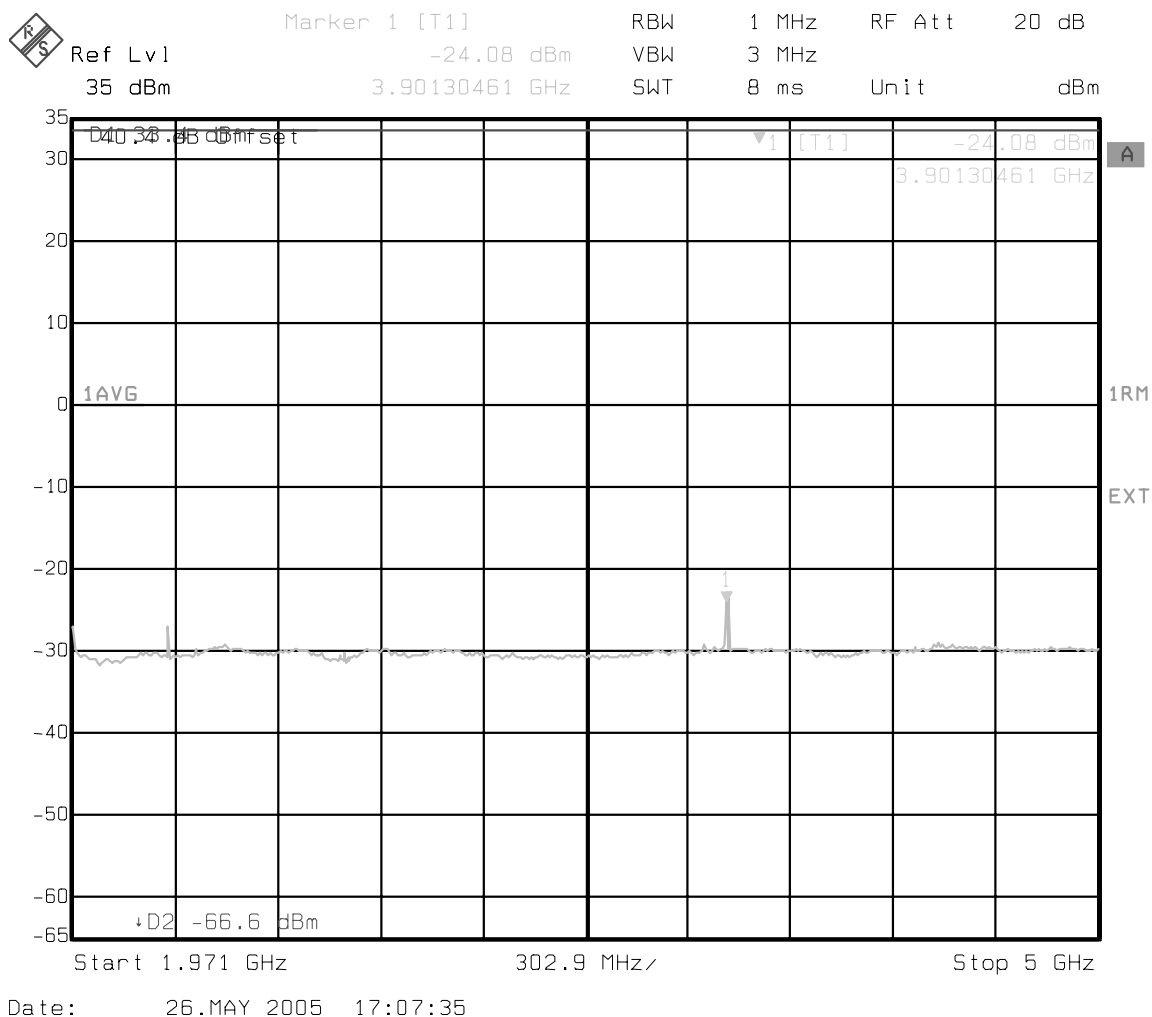
**Figure 16 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
 (Lower Adjacent 1 MHz)**



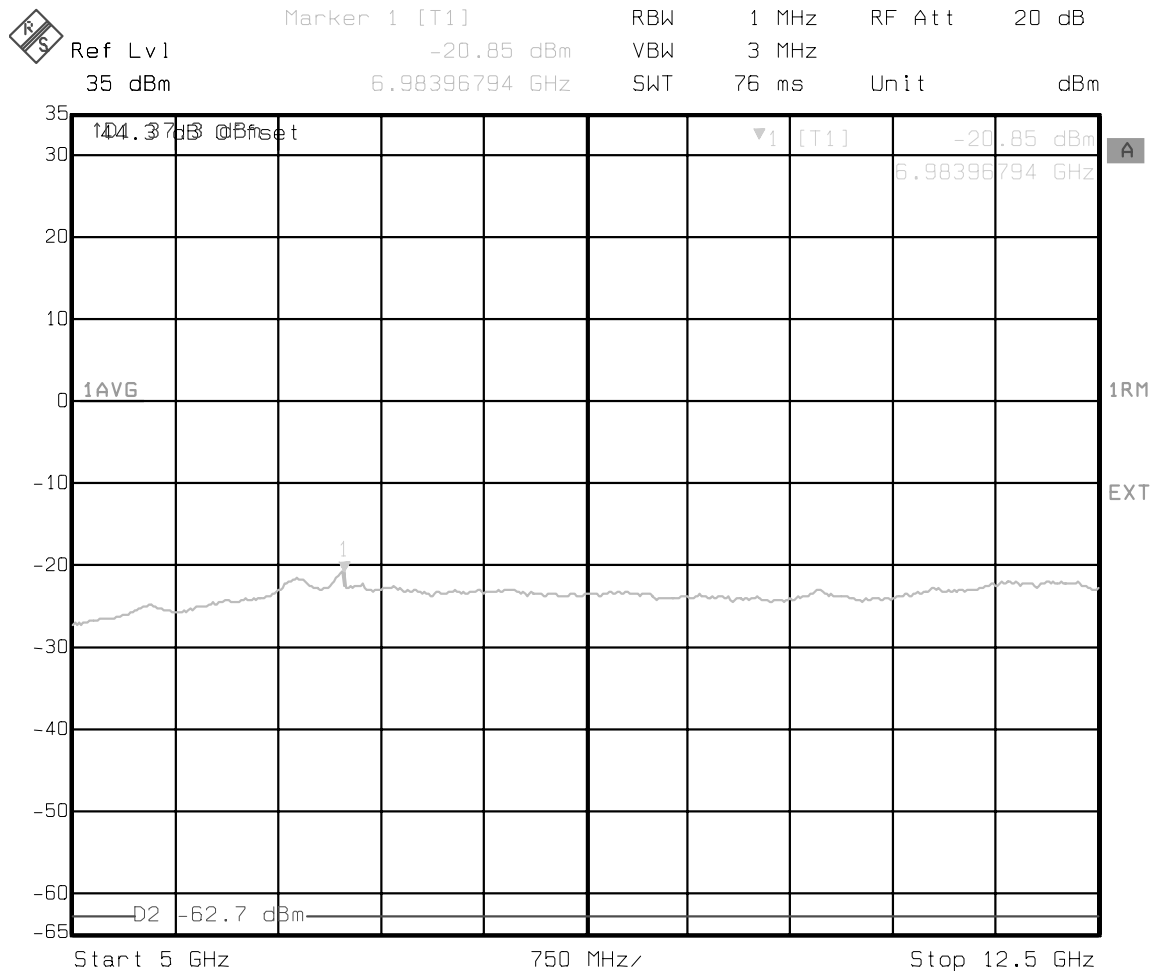
**Figure 17 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
(Upper Adjacent 1 MHz)**

**Figure 18 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
 (9kHz :- Lower Adjacent 1 MHz)**



**Figure 19 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
(Upper Adjacent 1 MHz -:- 5 GHz)**

**Figure 20 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
 (5 GHz :- 12.50 GHz)**



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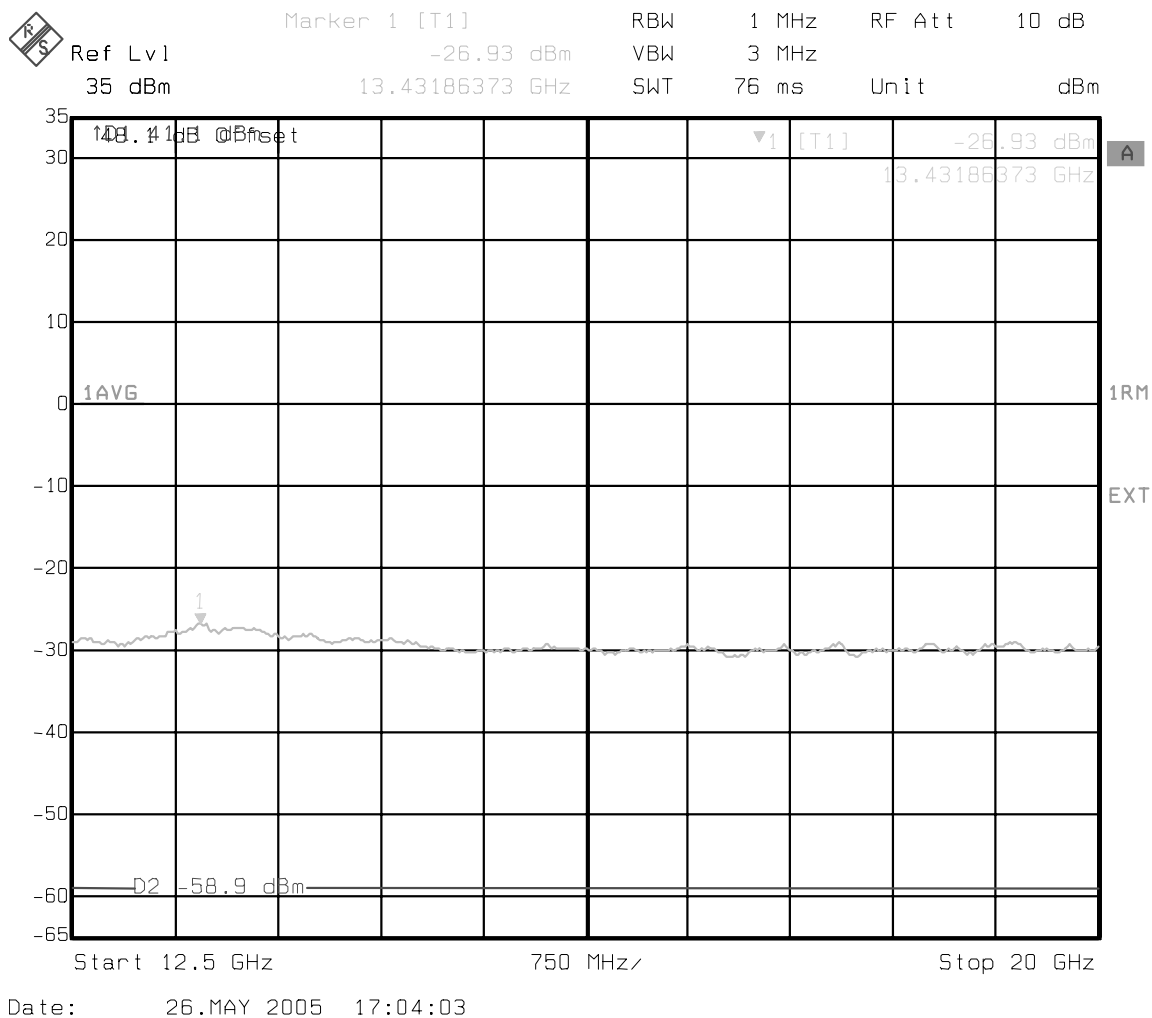
**Figure 21 : Conducted Spurious Emissions - 1 Carrier, Channel 425, IS-856, 16-QAM Mode
(12.5 GHz :- 20 GHz)**

Figure 22 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (Lower Adjacent 1 MHz)

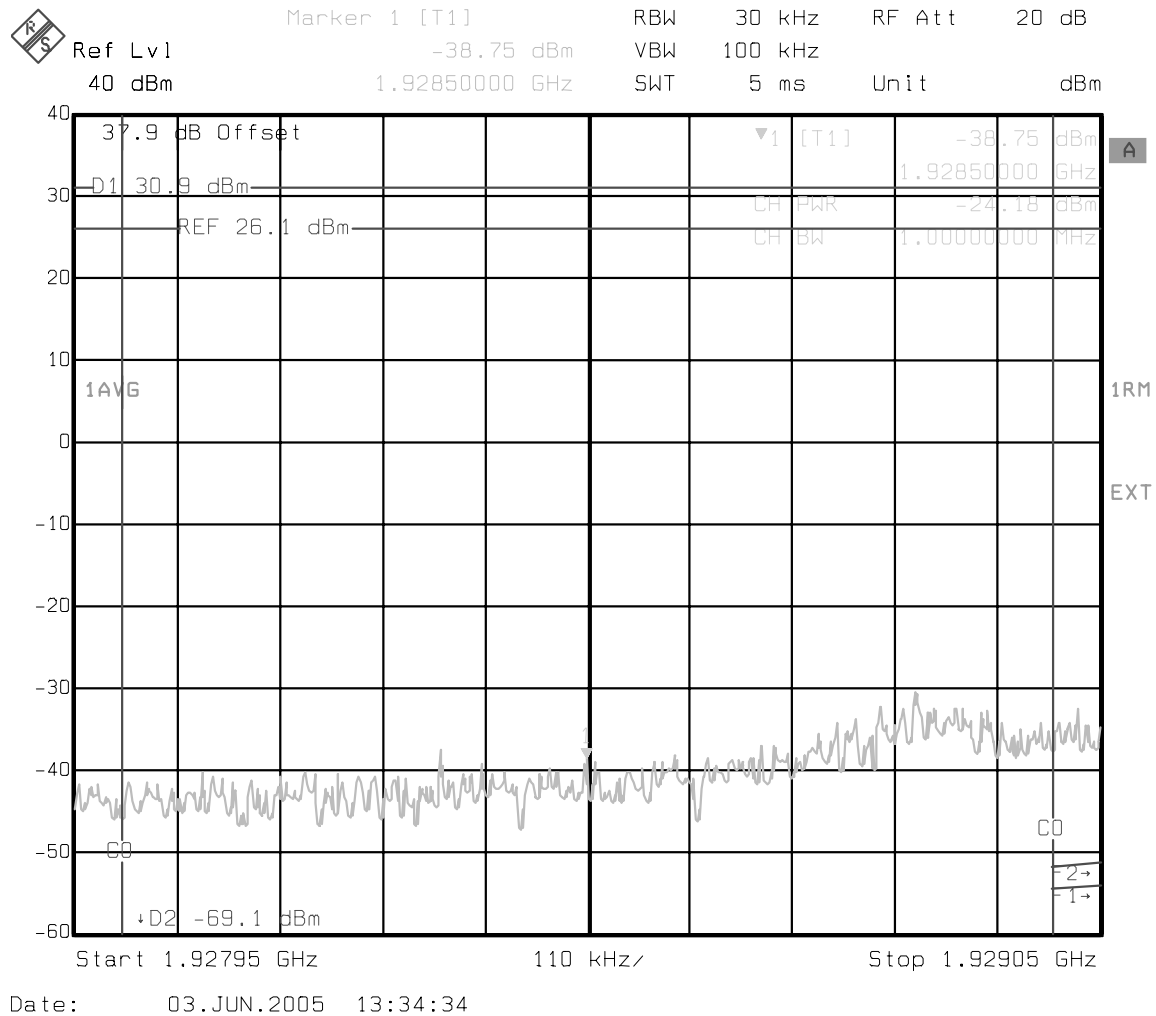
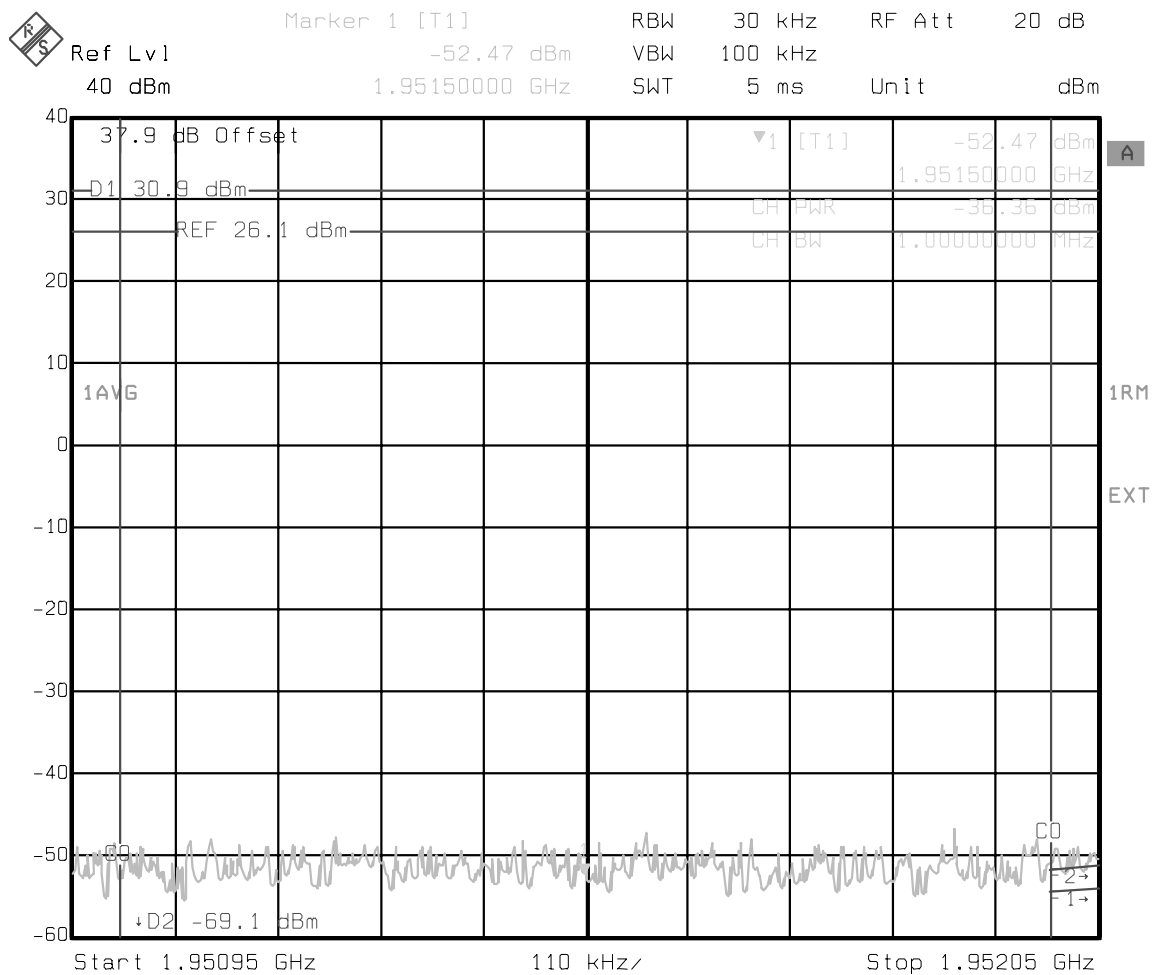
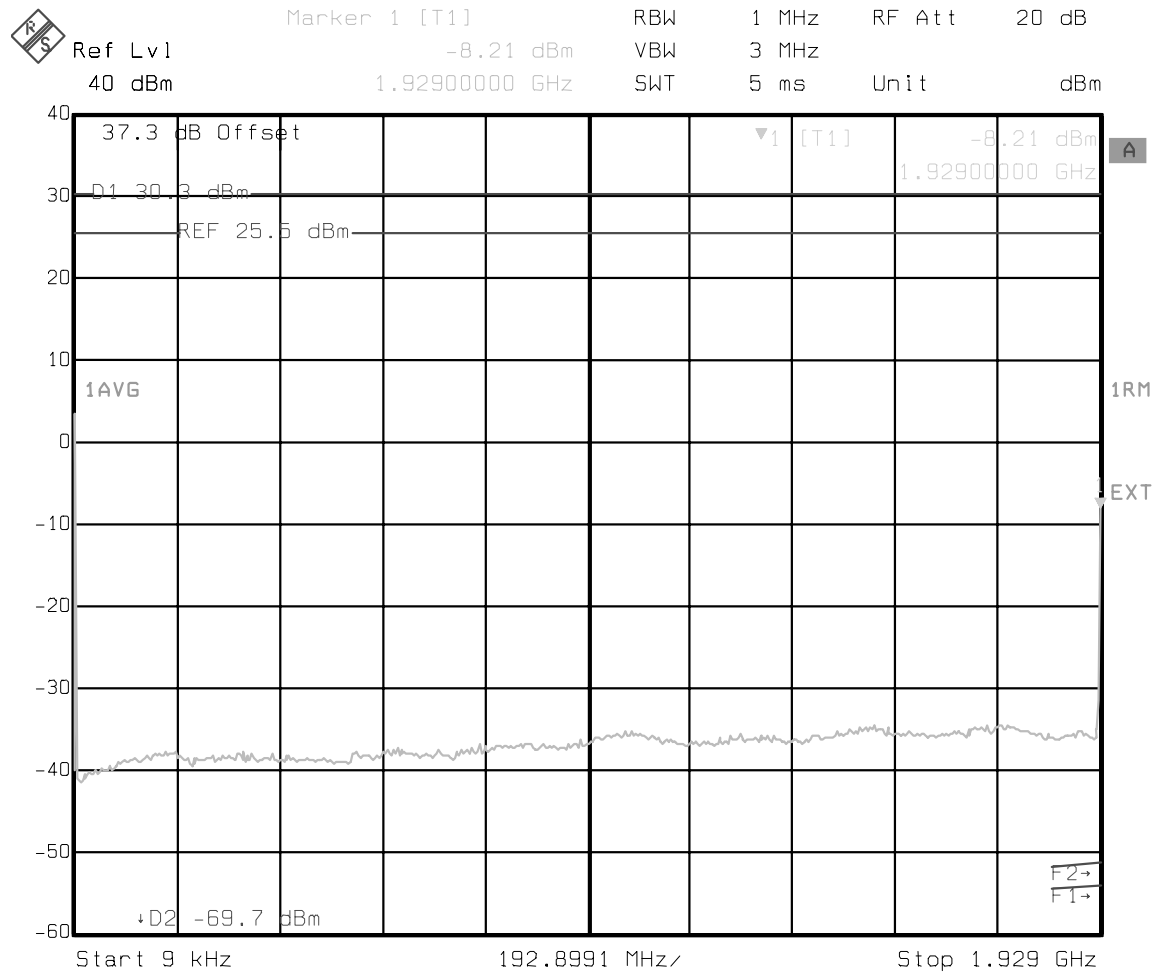


Figure 23 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (Upper Adjacent 1 MHz)


**Figure 24 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (9kHz :-
 Lower Adjacent 1 MHz)**



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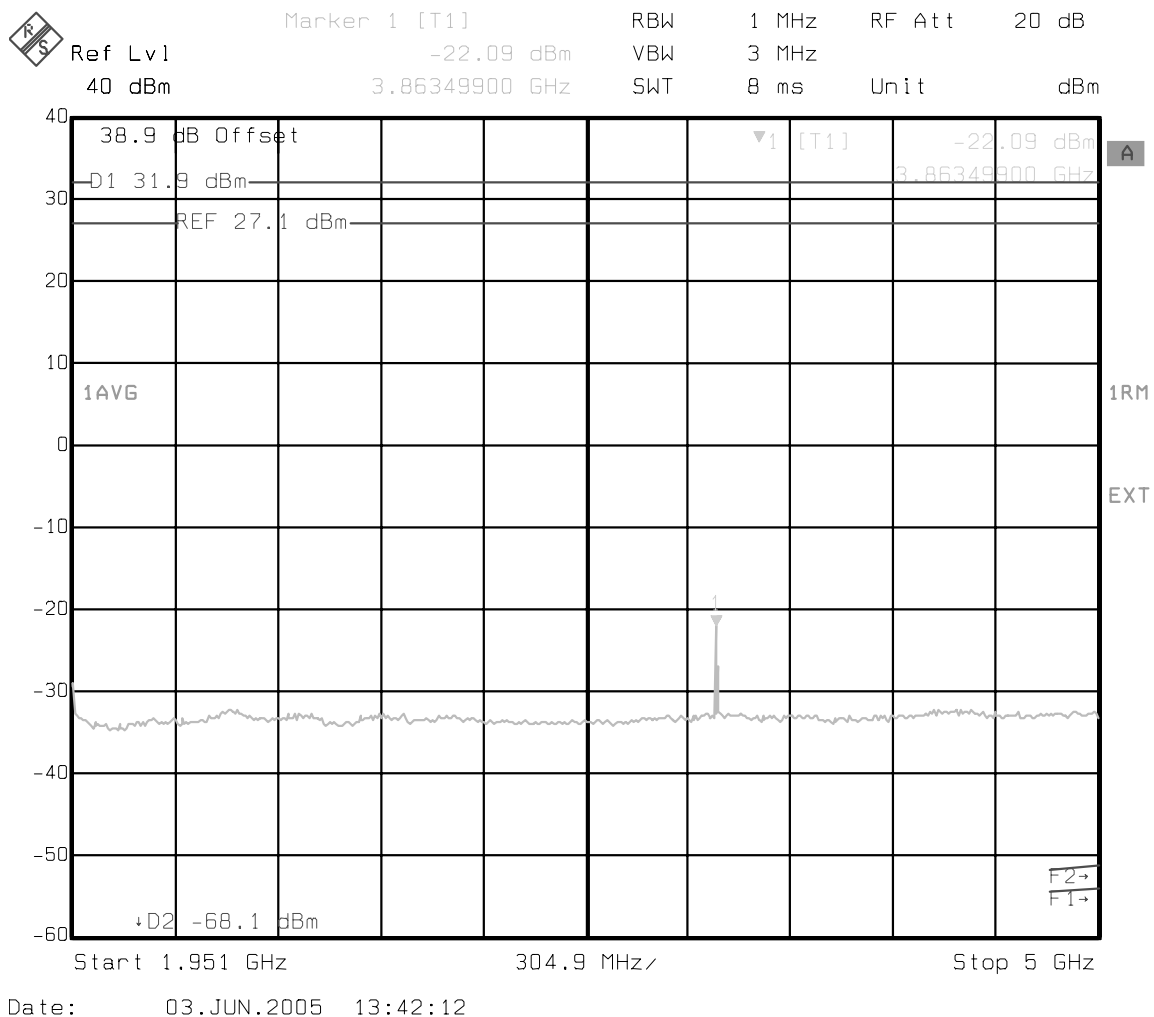
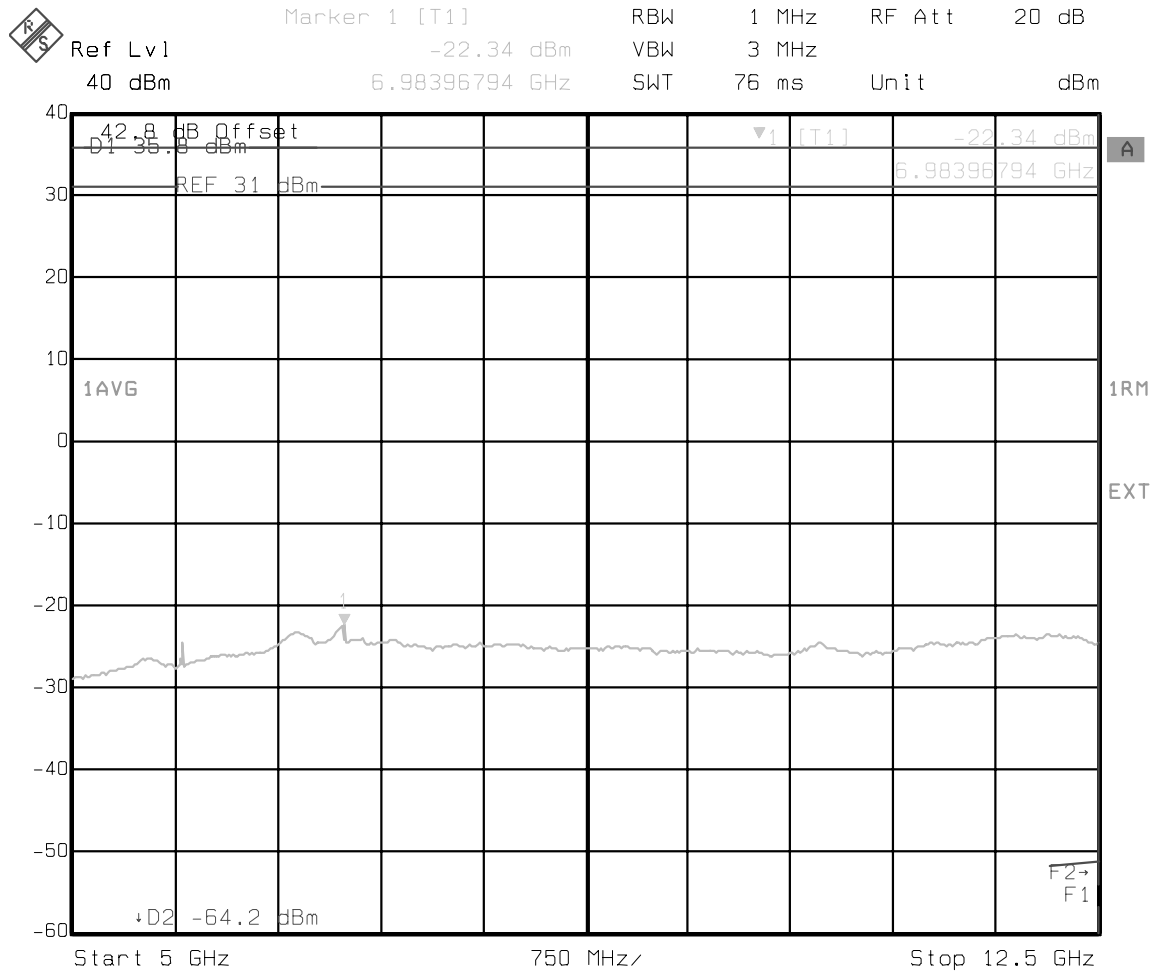
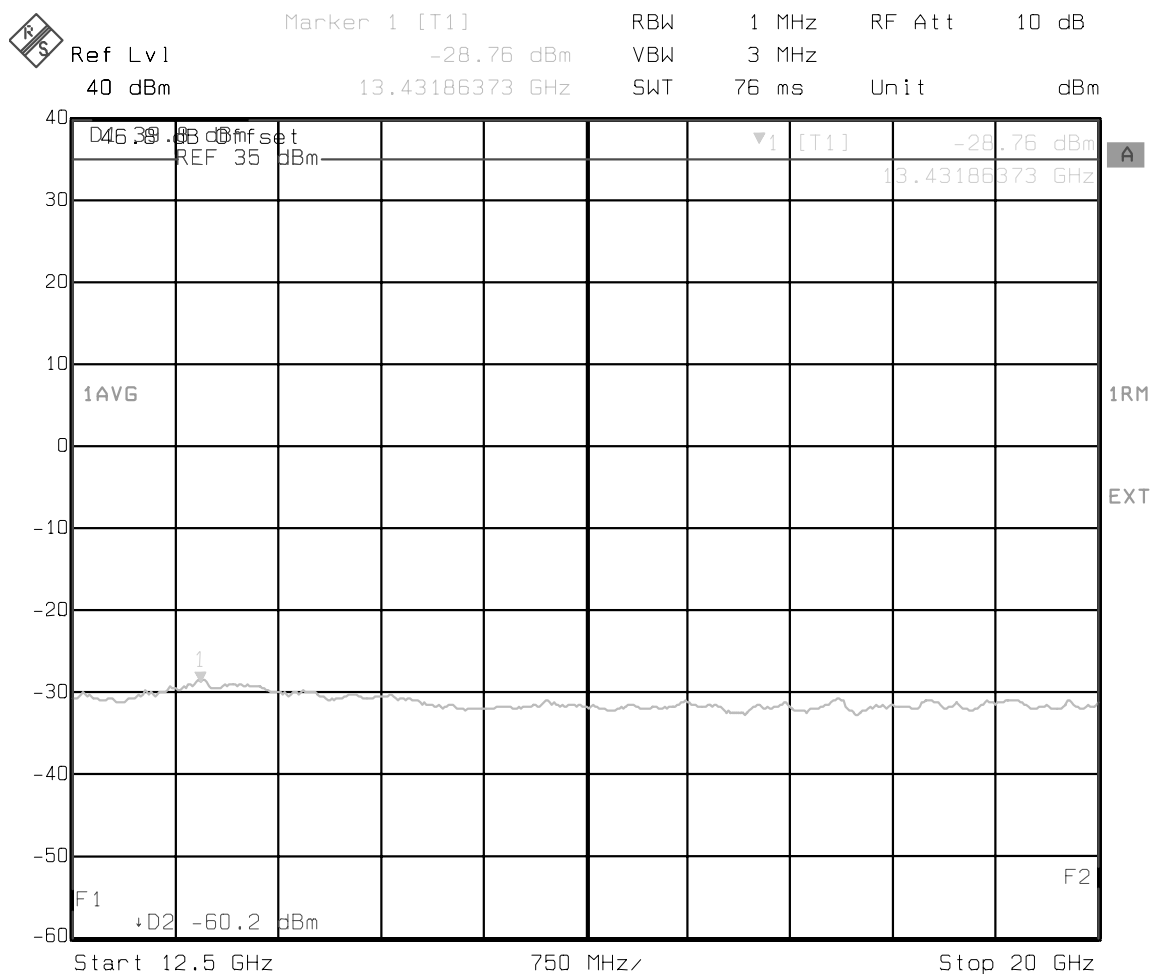
Figure 25 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (Upper Adjacent 1 MHz :- 5 GHz)

Figure 26 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (5 GHz :-1 2.50 GHz)

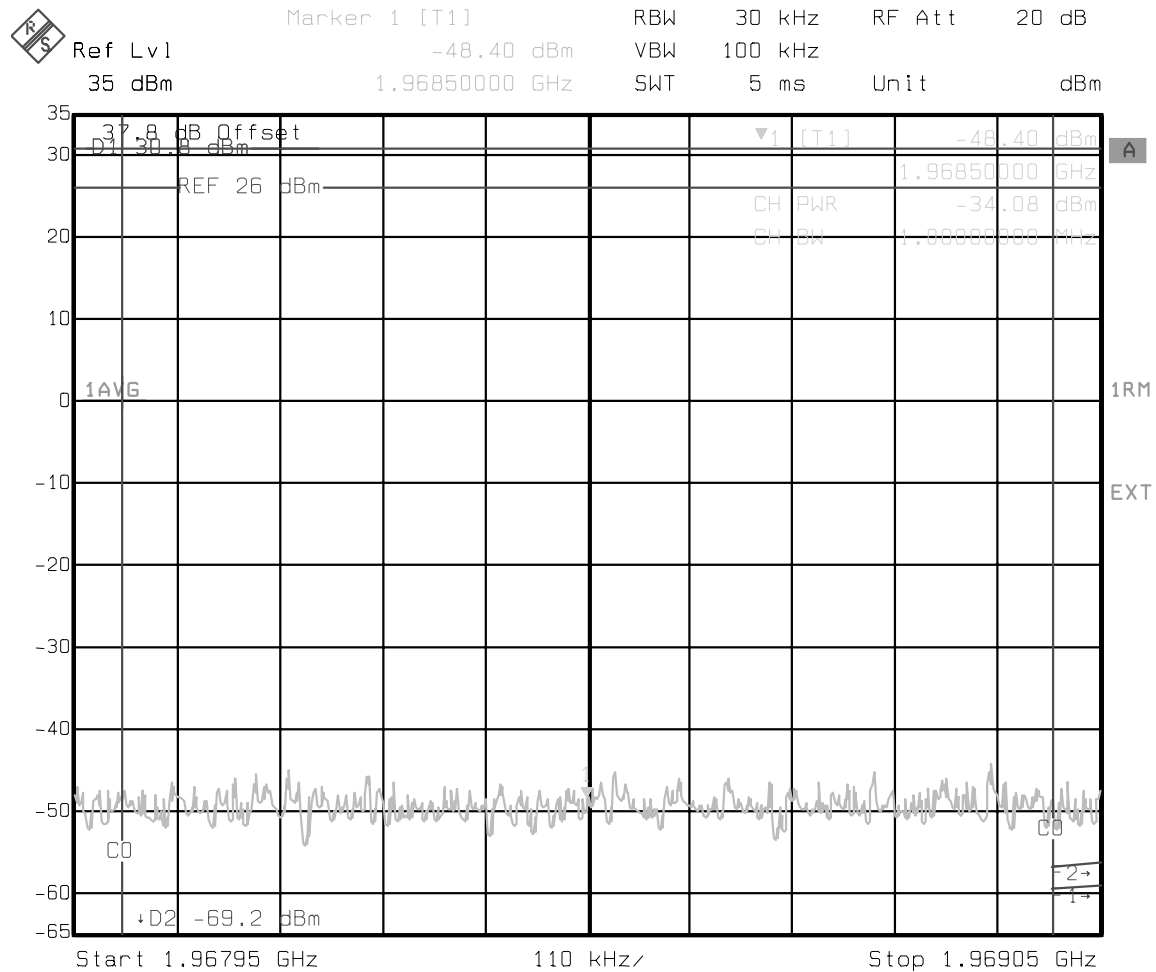


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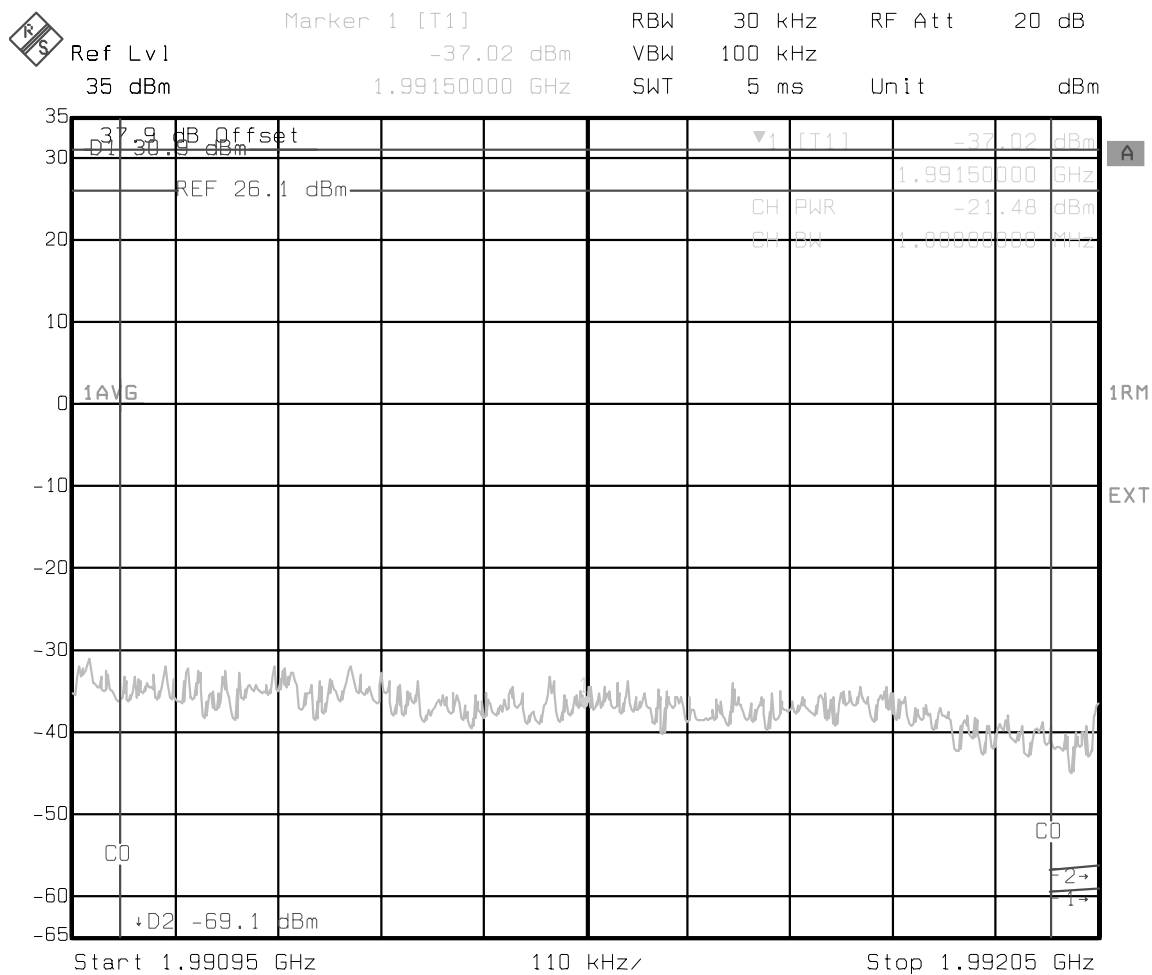
**Figure 27 : Conducted Spurious Emissions - 2 Carrier, Channels 25, 50, IS-95 (12.5 GHz :-
20 GHz)**

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**Figure 28 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95
 (Lower Adjacent 1 MHz)**

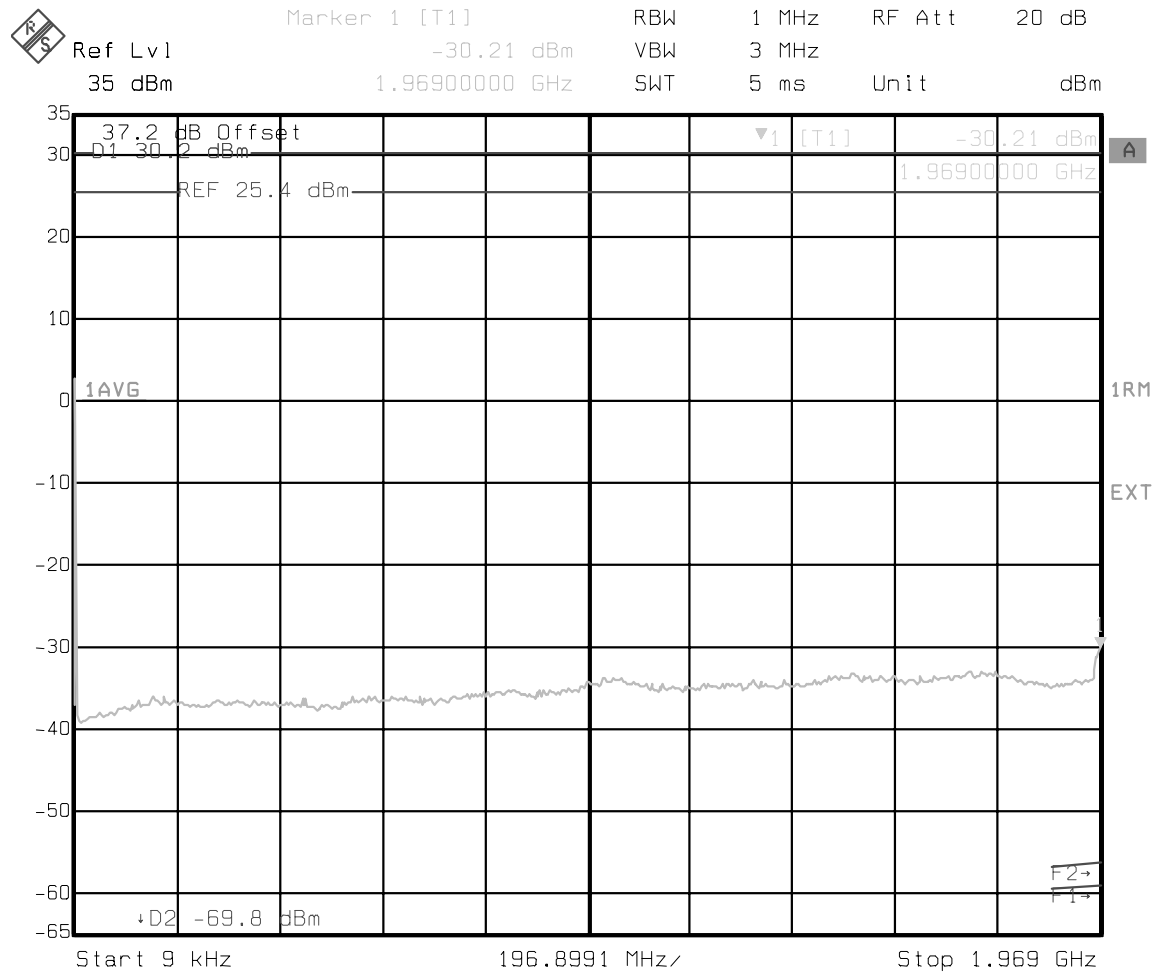


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**Figure 29 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95
(Upper Adjacent 1 MHz)**

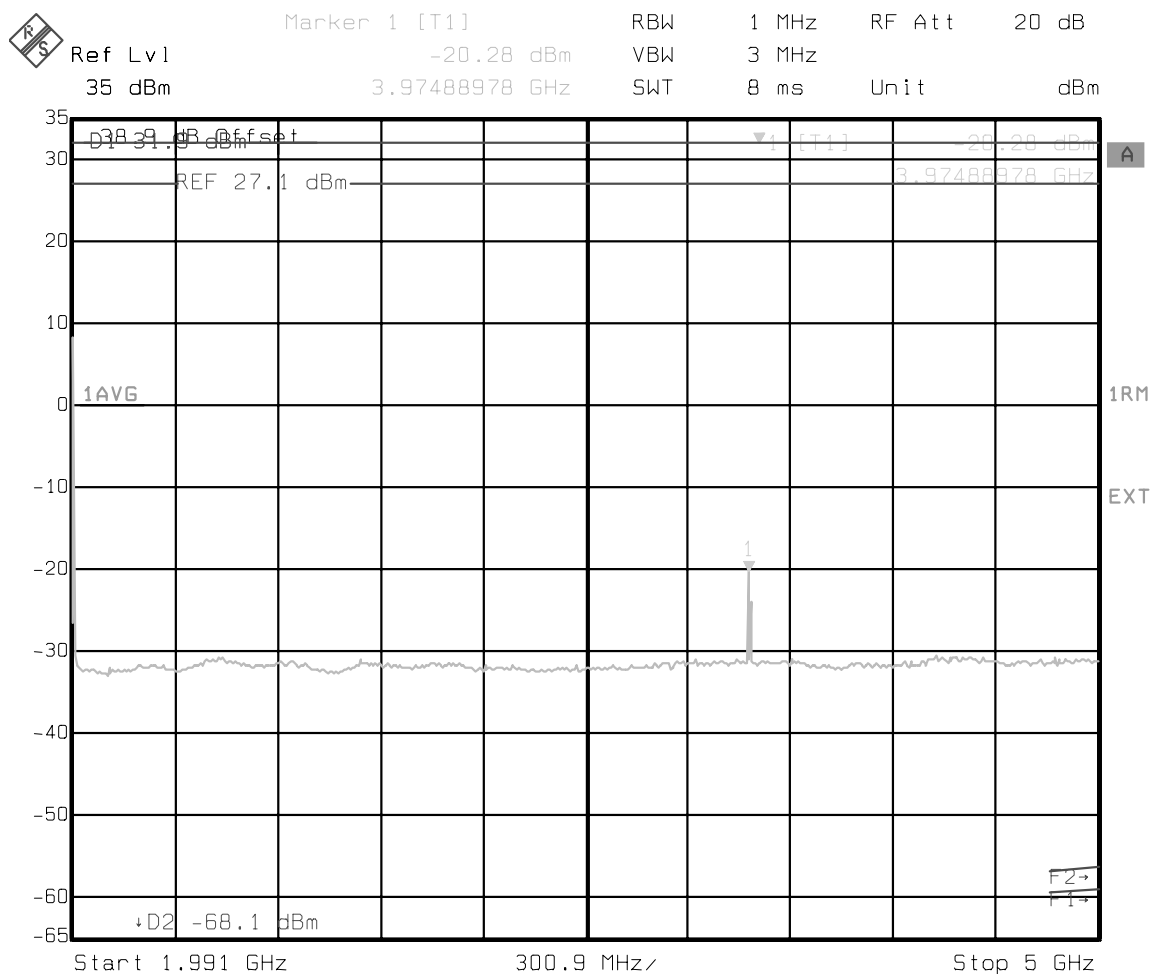
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**Figure 30 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95
 (9kHz :- Lower Adjacent 1 MHz)**



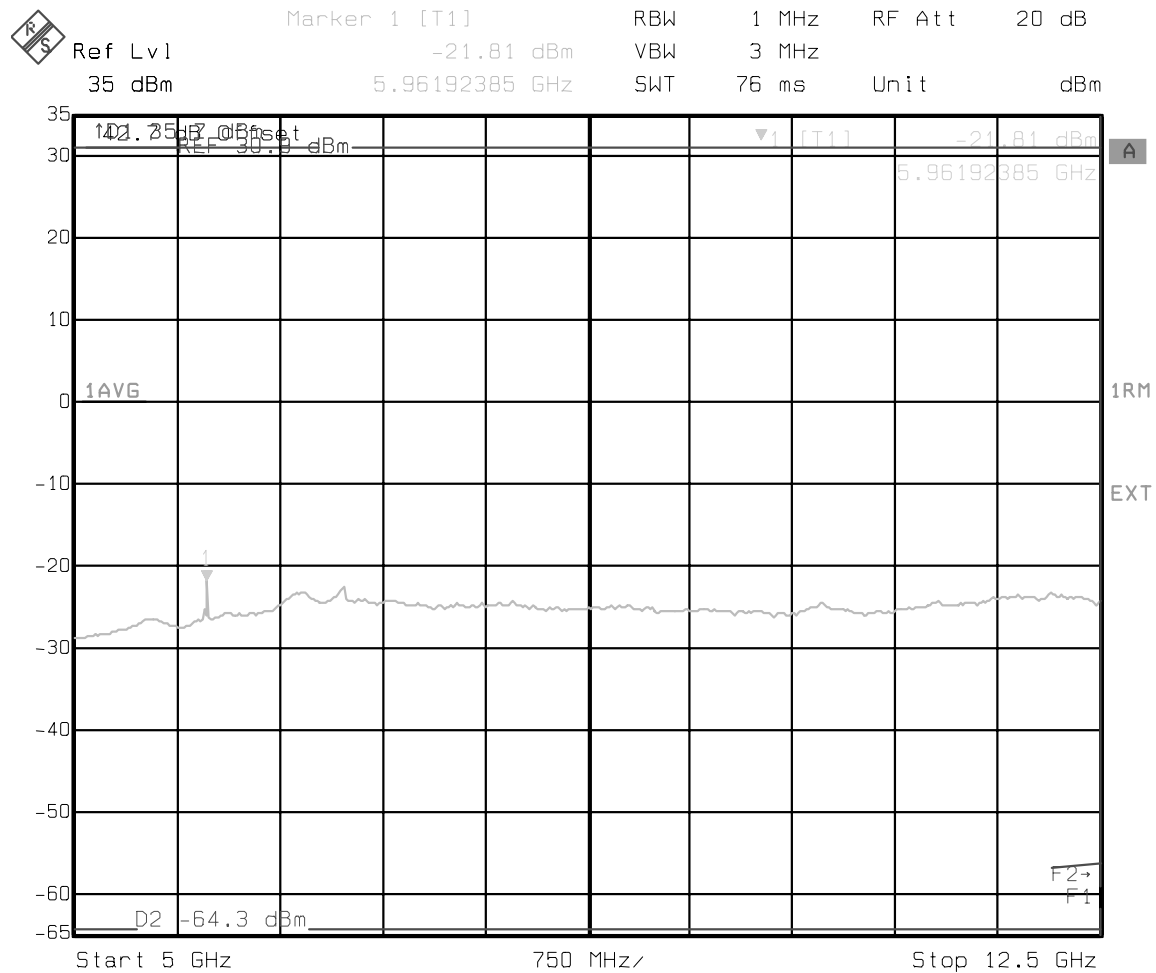
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**Figure 31 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95
(Upper Adjacent 1 MHz :- 5 GHz)**



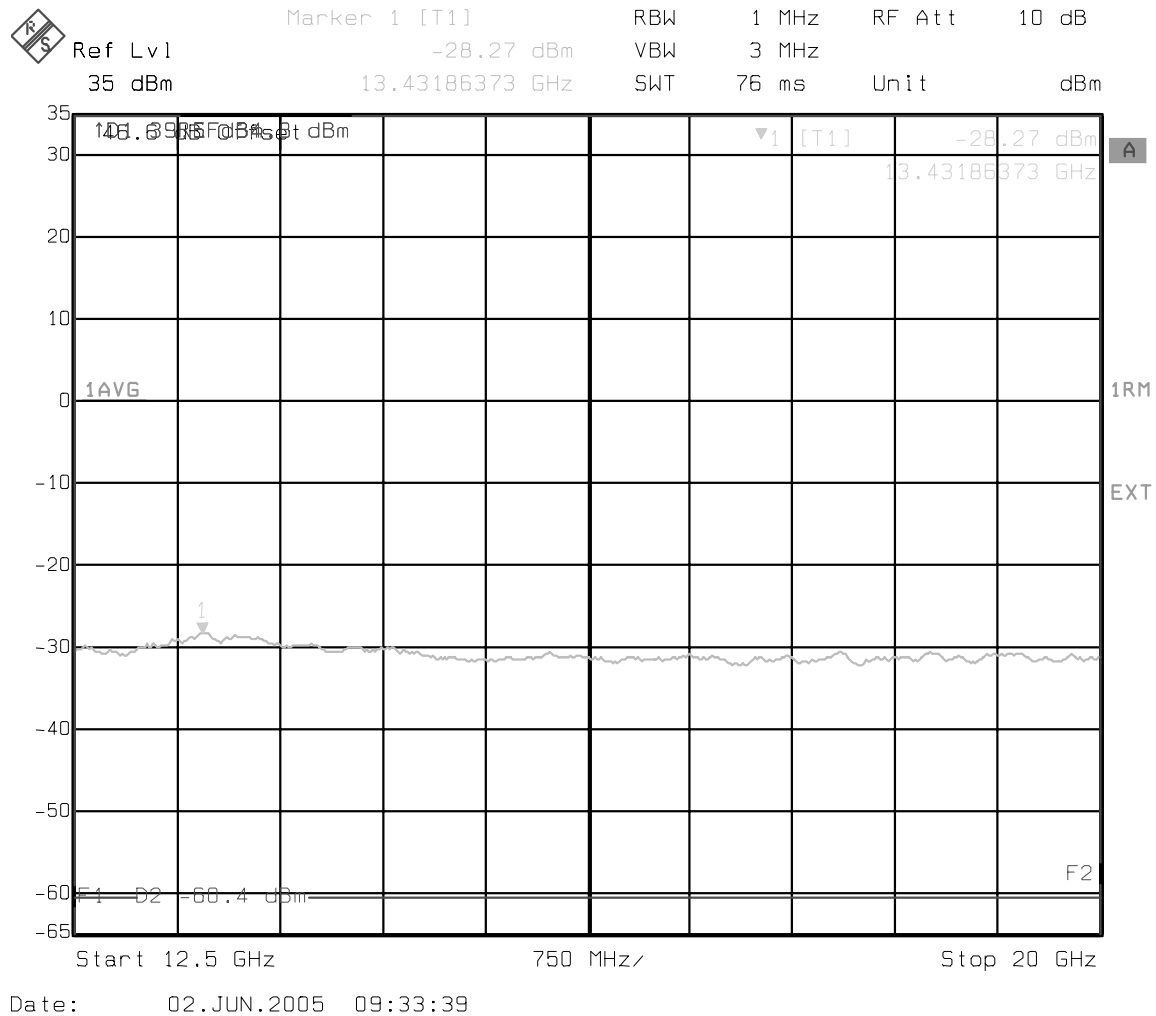
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Figure 32 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95 (5 GHz :- 12.50 GHz)



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**Figure 33 : Conducted Spurious Emissions - 3 Carrier, Channels 1125, 1150, 1175, IS-95
(12.5 GHz :- 20 GHz)**



4.5 Frequency Stability

4.5.1 Frequency Stability Requirements

FCC Part 2.1055

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From -30 deg. to +50 deg. centigrade for all equipment except that specified in paragraphs (a) (2) and (3) of this section.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10 deg. centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

FCC Part 24.235 Limit

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

4.5.2 Test Method

The DE is configured via the BTS controller to enable the MFRM2 to transmit at nominal output power level. Measurements are made for three carrier configuration, channels 575, 600 & 625.

The MFRM2 System is subjected to ambient temperatures from -30° to $+50^{\circ}$ C at intervals of 10° C. A period of at least 2 hours is allowed prior to taking measurement to ensure that all of the oscillator circuit components have stabilized.

At each of the above specified temperatures, the average and maximum carrier deviation is recorded from the time the transmitter is keyed-on for a period of fifteen minutes using the HP 4406A VSA measurement system. Recorded data is based on processing 100 samples with 10 averages/sample.

At 25° C ambient temperature, measurements are made with the primary supply voltage set to 85%, 100% and 115% of the nominal value. The nominal primary supply voltage for the MFRM2 is -48 VDC. The same measurements will also be made for nominal primary supply voltage of +24 VDC.

4.5.3 Test Setup

The set-up used for the MFRM2 Frequency Stability test is illustrated in Figure 34. Frequency Stability measurements are referenced to the antenna port of the DPM.

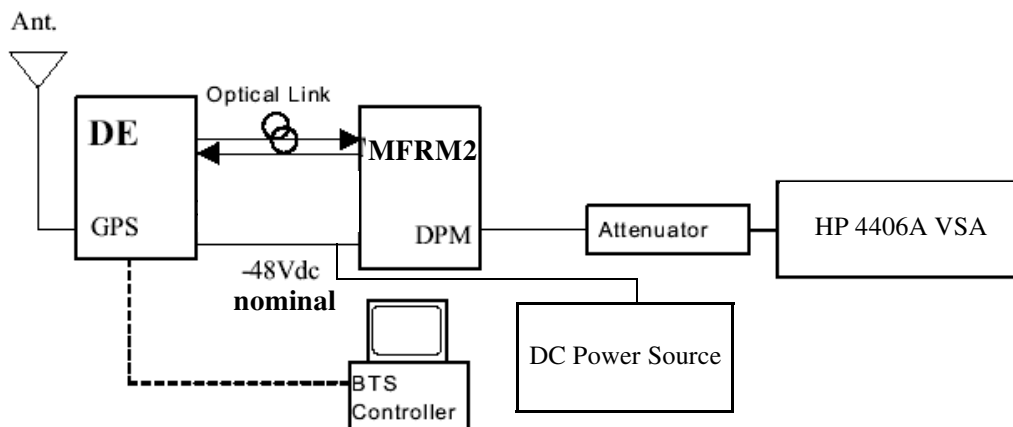


Figure 34 : Test Setup for Frequency Stability Measurement

4.5.4 Results

The MFRM2 System complies with the requirements. Table 31 shows the results for Frequency Stability versus Temperature Variation of the MFRM2 for 3 carrier configuration, channels 575, 600 & 625. Table 32 and Table 33 show the results for Frequency Stability versus Power Supply Voltage of the MFRM2 for 3 carrier configuration, channels 575, 600 & 625.

Table 31 : Frequency Stability versus Temperature Variation, 3 Carrier Mode

Temperature (°C)	Carrier Frequency Deviation (Hz)	
	Average	Maximum
-30	0.100	8.123
-20	0.788	-11.326
-10	-1.210	-17.048
0	0.450	14.274
10	-0.794	-11.120
20	0.536	13.733
30	-1.905	-13.549
40	0.362	12.202
50	0.864	-14.086

Table 32 : Frequency Stability versus Power Supply Voltage, 3 Carrier Mode, -48 VDC

Power Supply Voltage	Carrier Frequency Deviation (Hz)	
	Average	Maximum
-40.8 VDC	0.582	10.813
-48.0 VDC	-0.629	-8.639
-55.2 VDC	0.466	-11.810

Table 33 : Frequency Stability versus Power Supply Voltage, 3 Carrier Mode, +24 VDC

Power Supply Voltage	Carrier Frequency Deviation (Hz)	
	Average	Maximum
+20.4 VDC	-0.702	-12.806
+24.0 VDC	1.666	12.371
+27.6 VDC	1.418	11.29

References

- [1] FCC Part 24 Subpart E, “Personal Communication Services”, http://www.access.gpo.gov/nara/cfr/waisidx_00/47cfr24_00.html
- [2] FCC Part 2 Subpart J, “Frequency allocations and radio treaty matters; general rules and regulations”, http://www.access.gpo.gov/nara/cfr/waisidx_00/47cfr2_00.html
- [3] Industry Canada RSS-133, “2 GHz Personal Communication Services”, <http://strategis.ic.gc.ca/SSG/sf01520e.html>
- [4] ANSI-97-E “Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations”, December 2002

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