TEST REPORT NO: RU1130/5802

COPY NO: 2

ISSUE NO: 1

FCC ID: Q63-9505A

REPORT ON THE CERTIFICATION TESTING OF AN
IRIDIUM SATELLITE LLC
MONACO HANDSET
WITH RESPECT TO
THE FCC RULES CFR 47, PART 25

TEST DATE: 15th September 2004 - 17th September 2004

TESTED BY: JOHN CHARTERS (Signature Not Verified; Digitally signed by JOHN CHARTERS DN: cn=JOHN CHARTERS, o=TRL COMPLIANCE SERVICES, c=US Date: 2004.10.12 09:04:32 +01'00') J CHARTERS

APPROVED BY: Peter Green (Signature Not Verified; Digitally signed by Peter Green DN: cn=Peter Green, o=TRL Compliance Services, c=GB Date: 2004.10.12 10:58:06 Z) P GREEN
PRODUCT MANAGER
EMC

DATE: 8th October 2004

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FS 21805

CONTENTS

Notes:

1. Component failure during test — YES [ ] / NO [X]
2. If Yes, details of failure:
3. The facilities used for the testing of the product contain in this report are FCC Listed.

CERTIFICATE OF CONFORMITY & COMPLIANCE

FCC IDENTITY:	Q63-9505A
PURPOSE OF TEST:	CERTIFICATION
TEST SPECIFICATION:	FCC RULES CFR 47, Part 25
TEST RESULT:	Compliant to Specification
ITU EMISSIONS DESIGNATOR	41K7Q7W
EQUIPMENT UNDER TEST:	Monaco Handset
EQUIPMENT TYPE:	Satellite Telephone
MAXIMUM OUTPUT	+41.76 dBm, 15.9 W, 11.76 dBW
ANTENNA TYPE:	Part No: Radiated Antenna Type - C7032-GR082 Conducted Antenna Type - C7032-GR080
CHANNEL SPACING:	41.667 kHz
NUMBER OF CHANNELS:	252
MODULATION TYPE:	Q7W
POWER SOURCE(s):	+3.7 Vdc
TEST DATE(s):	15th September 2004 – 17th September 2004
ORDER No(s):	EU2910
APPLICANT:	IRIDIUM SATELLITE LLC
ADDRESS:	6701 Democracy Blvd. Suite 500 Bethesda United States of America MD 20817
TESTED BY:	JOHN CHARTERS Digitally signed by JOHN CHARTERS DN: cn=JOHN CHARTERS, o=TRL COMPLIANCE SERVICES, c=US Date: 2004.10.12 09:04:52 BST Signature Not Verified J CHARTERS
APPROVED BY:	Peter Green Digitally signed by Peter Green DN: cn=Peter Green, o=TRL Compliance Services, c=GB Date: 2004.10.12 10:58:24 Z Signature Not Verified P GREEN PRODUCT MANAGER EMC

APPLICANT'S SUMMARY

EQUIPMENT UNDER TEST (EUT):	MONACO HANDSET
EQUIPMENT TYPE:	Satellite Telephone
PURPOSE OF TEST:	CERTIFICATION
TEST SPECIFICATION(s):	FCC RULES CFR 47, Part 25
TEST RESULT:	COMPLIANT Yes [X] No [ ]
APPLICANT'S CATEGORY:	MANUFACTURER [X] IMPORTER [ ] DISTRIBUTOR [ ] TEST HOUSE [ ] AGENT [ ]
APPLICANT'S CONTACT PERSON(s):	Mr C Geibel
E-mail address:	Conrad.geibel@iridium.com
APPLICANT:	IRIDIUM SATELLITE LLC
ADDRESS:	6701 Democracy Blvd. Suite 500 Bethesda United States of America MD 20817
TEL:	+1 301 571 6277
FAX:	+1 301 571 6250
MANUFACTURER:	IRIDIUM SATELLITE LLC
DEVELOPMENT AGENT	Cambridge Consultants Limited
DEVELOPMENT AGENT S CONTACT PERSON(s):	Mr P Williams
E-mail address:	paul.williams@cambridgeconsultants.com
ADDRESS:	Science Park Milton Road Cambridge CB4 4DW United Kingdom
TEL:	+44 (0)1223 420024
FAX:	+44 (0)1223 423373
EUT(s) COUNTRY OF ORIGIN:	United States
TEST LABORATORY:	TRL EMC
UKAS ACCREDITATION No:	0728
TEST DATE(s)	15th September 2004 – 17th September 2004
TEST REPORT No:	RU1130/5802

EQUIPMENT TEST / EXAMINATIONS REQUIRED

1.

TEST/EXAMINATION	FCC Part 2	FCC Part 25	APPLICABILITY	RESULT
RF Power Output		25.204 (a)	YES	PASS
Emissions Limitations		25.202 (f)	YES	PASS
Spurious Emissions at Antenna Terminals	2.1051	25.202 (f) 25.213	YES	PASS
Spurious Emissions Radiated	2.1053	25.202 (f) 25.213	YES	PASS
Frequency Stability Temperature	2.1055	25.202 (d)	YES	PASS
Frequency Stability Voltage	2.1055	25.202 (d)	YES	PASS

Note: The Monaco handset is subject to FCC Part 25 & Part 2 for FCC Certification for units marketed within the United States. The above tests, as specified in FCC Part 2, with limits as defined in FCC part 25 were performed on the Mobile Ididium Subscriber Unit.

2. Product Use: Satellite Telephone

3. Emission Designator: 41k7Q7W

4. Temperatures: Ambient (Tnom) 18°C

5. Supply Voltages: Vnom +3.7 Vdc

Note: Vnom voltages are as stated above unless otherwise shown on the test report page

6. Equipment Category:
   Single channel [ ]
   Two channel [ ]
   Multi-channel [X]

7. Channel spacing:
   Narrowband [X] 41.667 kHz
   Wideband [ ]

8. Test Location
   TRL Compliance Services
   Up Holland [X]
   Long Green [ ]

9. Modifications made during test program No modifications were performed.

Product Description

The Satellite phone consist of an L-Band Transceiver (LBT) capable of simultaneous transmit and receive (duplex) operation covering the frequency range of 1616MHz to 1626.5MHz. The frequency accesses used for duplex channels are organised into sub-bands each of which contains eight frequency accesses. Each sub-band, therefore occupies 333.33 kHz (i.e. 8x41.667kHz). Up to 30 sub-bands containing 240 frequency accesses may be used for duplex channels.

Standard References

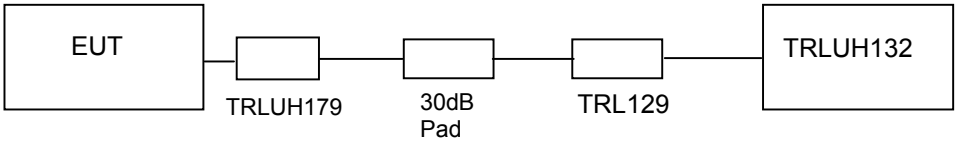
47 CFR 2 10-1-03 Edition	Code of Federal Regulations, Title 47, Part 2, “Frequency allocations and Radio Telemetry Matters; General Rules and Regulations”
47 CFR 25 10-1-03 Edition	Code of Federal Regulations, Title 47, Part 25,”Sattelite Communications” Subpart C, “Technical Matters”
C63.4-2001	American National Standards Institute (ANSI), “Methods of Measurement of Radio Noise Emissions from Low Voltage Electrical and Electronic Equipment in the Range 9 kHz to 40 GHz”

COMPLIANCE TESTS

TRANSMITTER TESTS

RF OUTPUT POWER – CONDUCTED – PART 25.204 (a)

Ambient temperature	=	25°C	Radio Laboratory
Relative humidity	=	58%	
Supply voltage	=	+3.7 Vdc	
Channel number	=	See test results	



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using the manual test command 27 XXX YY Z# (See Annex D for explanation of test command).

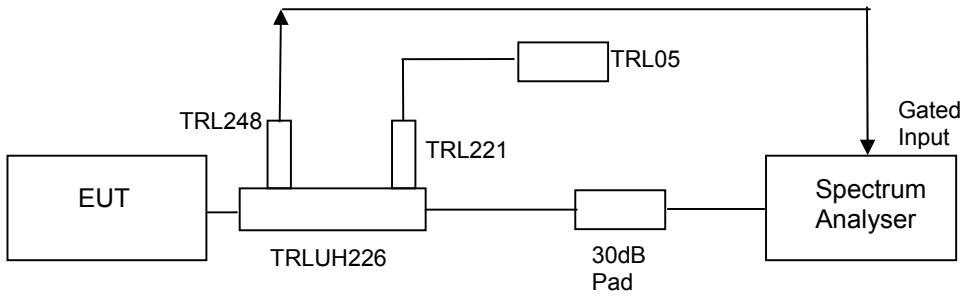
Frequency MHz	Attenuator and cable loss dB	Level at Power Meter dBm	Antenna Gain dB	Duty Cycle Factor dB (See Annex D)	Carrier power dBm	Carrier power dBw	Limit dBW
Channel 1	62.54	-34.73	3	10.4	41.21	11.21	40
Channel 75	62.54	-35.48	3	10.4	40.46	10.46	40
Channel 150	62.54	-34.00	3	10.4	41.14	11.14	40
Channel 241	62.54	-34.18	3	10.4	41.76	11.76	40

Notes:
1. Duty Cycle Factor = 10 x log (1/**X**) Where **X=** (Ton / Tframe). See Annex E for duty cycle plots
2. Correction Factor for dBm to dBW = -30dB
3. Antenna gain of 3dBi is the worst case gain over an isotropic antenna

TRANSMITTER TESTS

EMISSIONS LIMITATIONS – CONDUCTED – PART 25.202 (f)

Ambient temperature	=	20°C	Radio Laboratory
Relative humidity	=	54%	
Supply voltage	=	+3.7 Vdc	



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using the manual test command 27 XXX YY Z# (See Annex D for explanation of test command).

To enable an average measurement to be taken the gated input trigger of the spectrum analyser was used.

The Spurious limit is as follows:

On any frequency removed from the assigned frequency by the following percentage of the authorised bandwidth

±50%	-	100%	-25 dBc
±100%	-	250 %	-35 dBc
> ±250%			At least 43 + 10 log PdB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

Where the Authorised Bandwidth = 41.667 kHz

The 3 kHz to 4 kHz bandwidth correction has been taken into account in the Ref level offset figure.

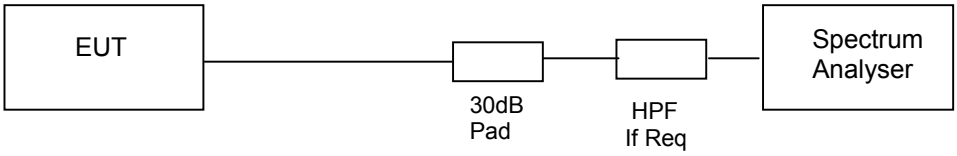
The Monaco Handset was found to comply with the limits

See plots in Annex F.

TRANSMITTER TESTS

SPURIOUS EMISSIONS – CONDUCTED – PART 25.202 (f) & 25.213

Ambient temperature	=	26°C	Radio Laboratory
Relative humidity	=	62%	
Supply voltage	=	+3.7 Vdc	



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using the manual test command 27 XXX YY Z# (See Annex D for explanation of test command).

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log (P)dB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

RESULTS

Frequency Range (MHz)	Spectrum Analyser Level dBm	Attenuator and Cable Losses dB	3 kHz – 4 kHz Bandwidth Correction dB	Spurious Emission Level dBm	Limit dBm
30 MHz – 1610 MHz	No Significant Emissions Within 20dB's of the Limit				-13
1628.5 MHz – 2 GHz	No Significant Emissions Within 20dB's of the Limit				-13
2 GHz – 7 GHz	No Significant Emissions Within 20dB's of the Limit				-13
7 GHz – 12 GHz	No Significant Emissions Within 20dB's of the Limit				-13
12 GHz – 16.3 GHz	No Significant Emissions Within 20dB's of the Limit				-13

Notes :
1. Emissions Checked up to 10 times Fc
2. Limit Line D1 on Scan plots in Annex G already has cable and atten losses and 3kHz to 4 kHz Bandwidth correction taken into account

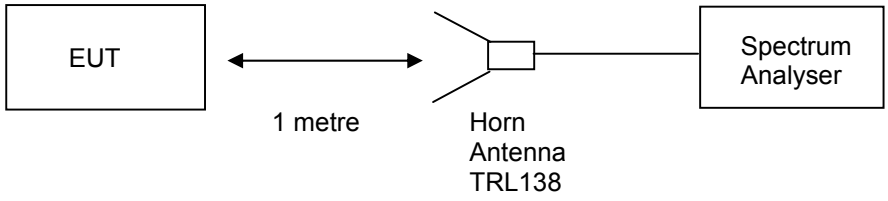
The Monaco Handset was found to comply with the limits

See plots in Annex G.

TRANSMITTER TESTS

SPURIOUS EMISSIONS – RADIATED – PART 25.202 (f) & 25.213

Ambient temperature	=	18°C
Relative humidity	=	55%
Conditions	=	OATS
Supply voltage	=	+3.7 Vdc
Supply Frequency	=	N/A



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using the manual test command 27 XXX YY Z# (See Annex D for explanation of test command). The unit was mounted on a turntable and rotated through 360^0 to find the worst case emission.

The Spurious limit was calculated as follows:

On any frequency removed from the assigned frequency by more that 250% of the authorised bandwidth

At least 43 + 10 log PdB

$(10\log P_{watts}) – (43+10\log (P_{watts} * 1000)) = LIMIT = -13$ dBm

RESULTS

Frequency Range (MHz)	Spectrum Analyser Level dBm	Attenuator and Cable Losses dB	3 kHz – 4 kHz Bandwidth Correction dB	Spurious Emission Level dBm	Limit dBm
30 MHz – 1610 MHz	No Significant Emissions Within 20dB's of the Limit				-13
1628.5 MHz – 2 GHz	No Significant Emissions Within 20dB's of the Limit				-13
2 GHz – 7 GHz	No Significant Emissions Within 20dB's of the Limit				-13
7 GHz – 12 GHz	No Significant Emissions Within 20dB's of the Limit				-13
12 GHz – 16.3 GHz	No Significant Emissions Within 20dB's of the Limit				-13

Notes :
1.Emissions Checked up to 10 times Fc
2. Scan plots of channels 1 and 241 with receive antenna in vertical polarization in annex H.
3. The unit was mounted on a turntable and rotated through 360^0 to find the worst case emission.

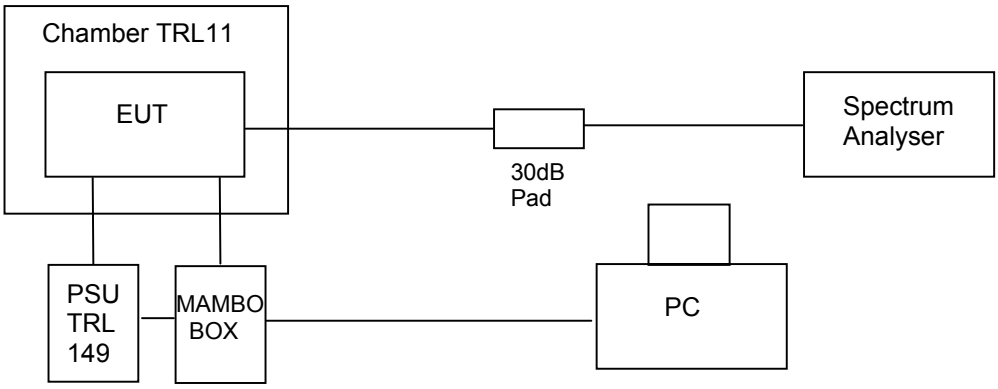
The Monaco Handset was found to comply with the limits

See plots in Annex H.

TRANSMITTER TESTS

FREQUENCY STABILITY – CONDUCTED – TEMPERATURE – PART 25.202 (d)

Ambient temperature = 28°C Radio Laboratory
Relative humidity = 49%
Supply voltage = +3.7 Vdc



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using test commands sent from a PC via the MAMBO Box that were equivalent to the manual test command 27 XXX YY Z# (See Annex D for explanation of test command). The Analyser was set to max hold

RESULTS

TEMP	Frequency (MHz)			
^{0}C	Channel 1	Channel 75	Channel 150	Channel 241
+60	1616.02000	1619.09000	1622.22050	1626.02500
+50	1616.02000	1619.10000	1622.23005	1626.01500
+40	1616.02000	1619.10500	1622.23000	1626.02000
+30	1616.01500	1619.10000	1622.22500	1626.01000
+20	1616.02000	1619.09500	1622.23000	1626.02000
+10	1616.03000	1619.09000	1622.22500	1626.02000
0	1616.02000	1619.10500	1622.22500	1626.02000
-10	1616.02000	1619.10000	1622.23500	1626.02000
-20	1616.01000	1619.10500	1622.33000	1626.01000
-30	1616.02500	1619.09500	1622.22500	1626.01000

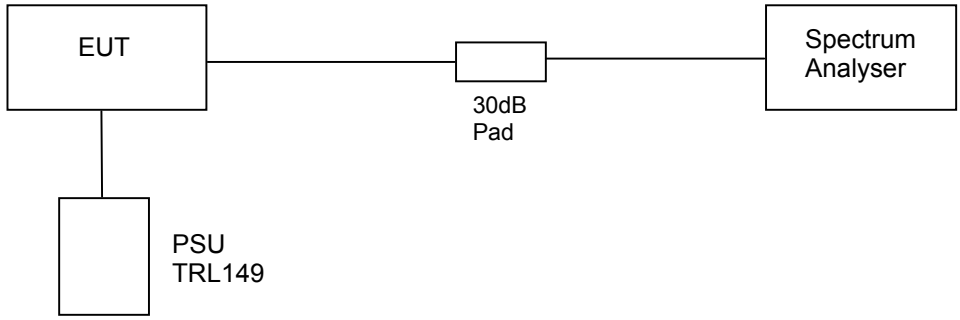
Notes: 1.Limit ± 10ppm (See Annex I for plots verses limit)

The Monaco Handset was found to comply with the limits

TRANSMITTER TESTS

FREQUENCY STABILITY – CONDUCTED – VOLTAGE – PART 25.202 (d)

Ambient temperature	=	28°C	Radio Laboratory
Relative humidity	=	49%	
Supply voltage	=	+3.7 Vdc	



See Annex C for full list of test equipment

The test setup was as per the above diagram. The unit was tested on four channels .The unit was put into test mode and set to operate at maximum power and with a random modulating signal using the manual test command 27 XXX YY Z# (See Annex D for explanation of test command). The Analyser was set to max hold

RESULTS

VOLTAGE	Frequency (MHz)			
%	Channel 1	Channel 75	Channel 150	Channel 241
85	1616.020	1619.095	1622.225	1626.005
90	1616.020	1619.110	1622.222	1626.020
95	1616.020	1619.105	1622.230	1626.005
100	1616.020	1619.095	1622.230	1626.020
105	1616.020	1619.095	1622.225	1626.020
110	1616.010	1619.095	1622.230	1626.020
115	1616.030	1619.095	1622.226	1626.015

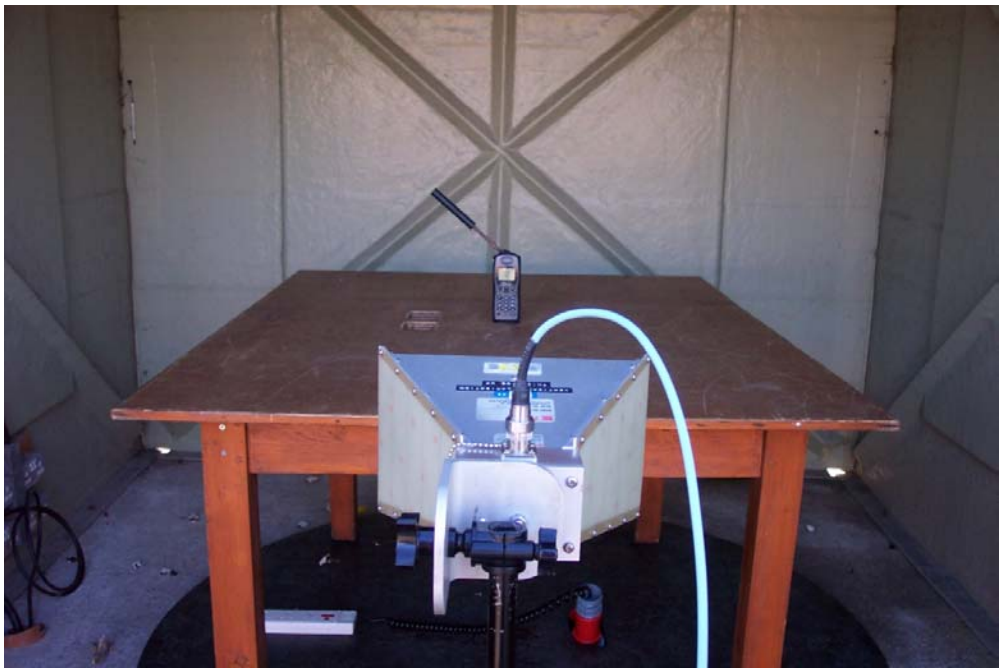
Notes: 1.Limit ± 10ppm (See Annex J for plots verses limit)

The Monaco Handset was found to comply with the limits

ANNEX A

PHOTOGRAPHS

PHOTOGRAPH 1. RADIATED TEST SETUP



PHOTOGRAPH 2. CONDUCTED TEST SETUP

ANNEX B

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

APPLICANT'S SUBMISSION OF DOCUMENTATION LIST

a.	TCB	-	APPLICATION	[X]
		-	FEE	[X]
b.	AGENT'S LETTER OF AUTHORISATION	-		[X]
c.	MODEL(s) vs IDENTITY	-		[ ]
d.	ALTERNATIVE TRADE NAME DECLARATION(s)	-		[ ]
e.	LABELLING	-	PHOTOGRAPHS	[ ]
		-	DECLARATION	[ ]
		-	DRAWINGS	[ ]
f.	TECHNICAL DESCRIPTION	-		[X]
g.	BLOCK DIAGRAMS	-	Tx	[X]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
h.	CIRCUIT DIAGRAMS	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
i.	COMPONENT LOCATION	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
j.	PCB TRACK LAYOUT	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
k.	BILL OF MATERIALS	-	Tx	[ ]
		-	Rx	[ ]
		-	PSU	[ ]
		-	AUX	[ ]
l.	USER INSTALLATION / OPERATING INSTRUCTIONS	-		[X]

ANNEX C

TEST EQUIPMENT LIST

TYPE OF EQUIPMENT	MAKER/ SUPPLIER	MODEL No	SERIAL No	TRL No
SPECTRUM ANALYSER	R & S	ESIB 26 1088.7490K26	100202	N/A
HIGH PASS FILTER	AFL	N/A	N/A	N/A
PSU	MANSON	EP-603	60316619	149
RF DIODE	SUHNER	H7	1001.17.A	248
HORN	EMCO	3115	9010-3581	139
BIDIRECTIONAL COUPLER	NARDA	3022	72622	UH226
CABLE	ROSENBERGER	MICRO COAX	N/A	280
ENVIRONMENTAL CHAMBER(TEMP)	SHARTREE	TCC125-815P	CS 203	11
POWER METER	MARCONI	6960B	237034019	UH132
POWER SENSOR	MARCONI	6924	951206/006	129
30 dB ATTENUATOR	N/A	N/A	N/A	UH179
30 dB ATTENUATOR	NARDA	776C-30	577	N/A

ANNEX D

TEST COMMANDS

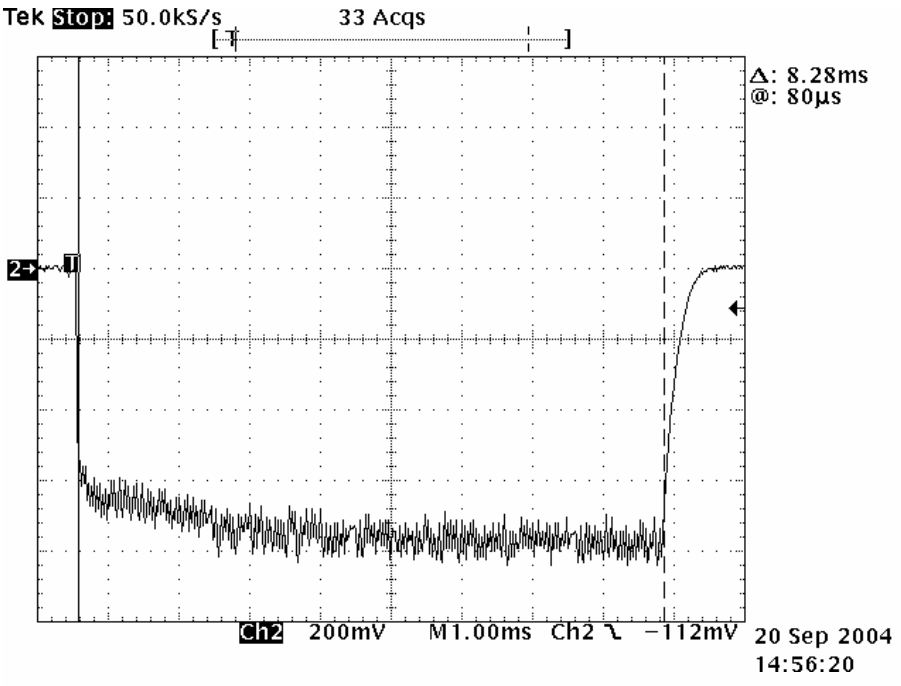
TEST COMMANDS

Command Function	Keypad Sequence
Enter Manual Test Mode	Press and Hold # Key for more than 3 seconds
Exit Manual Test Mode	01#
Turn on transmission with maximum power enabled and with random modulation	27 xxx yy z# xxx = Channel Number yy = power setp z = Modulation
Example 1 Channel number 001 (Min frequency), power level 0 (Max) Modulation set to random data (z = 1, z = 0 is a tone)	27 001 00 1#
Example 2 Channel number 241 (Max frequency), power level 8 (Min) Modulation set to random data (z = 1, z = 0 is a tone)	27 241 1#
Turn off transmission with maximum power enabled and with random modulation	27#

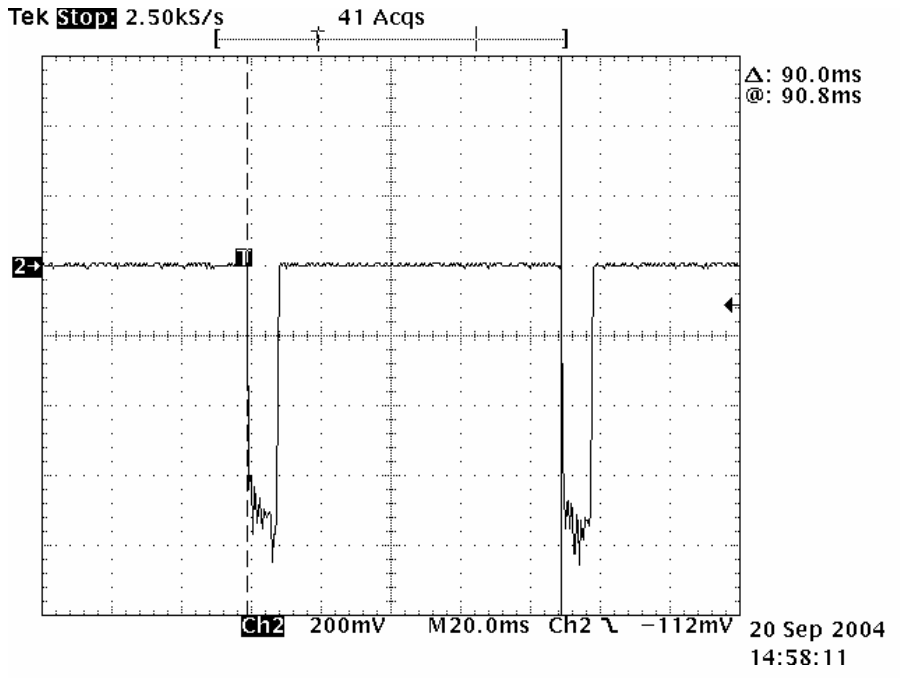
ANNEX E

DUTY CYCLE

Duty Cycle Plots



T_{on} = 8.28mS

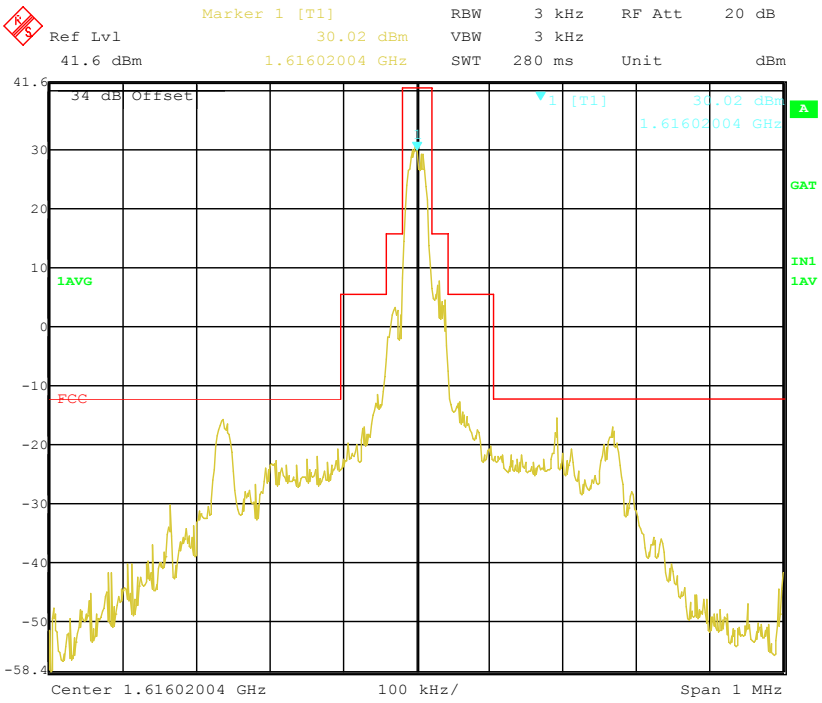


T_{frame} = 90mS

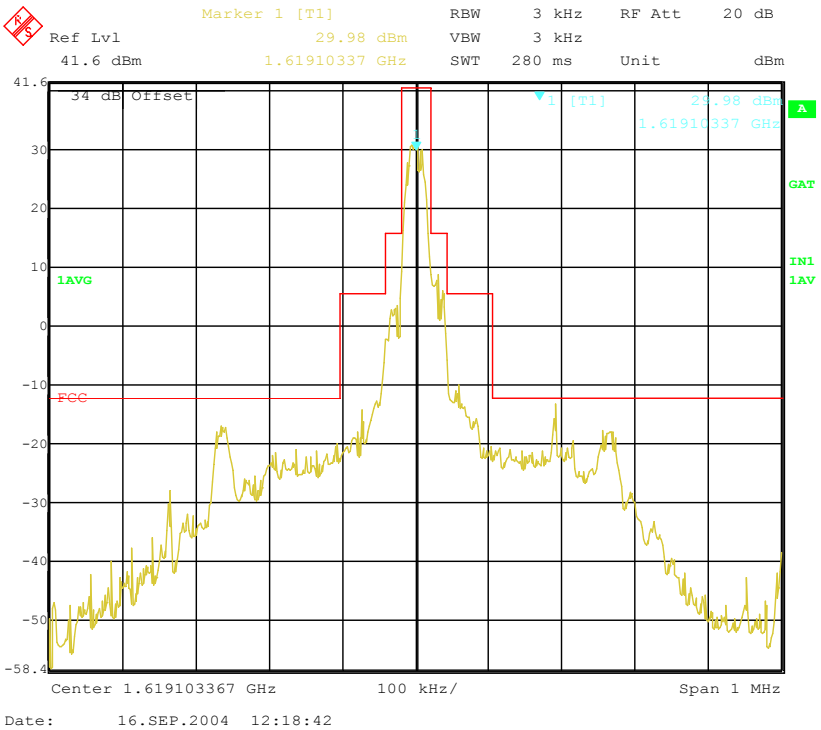
ANNEX F

EMISSIONS LIMITATIONS

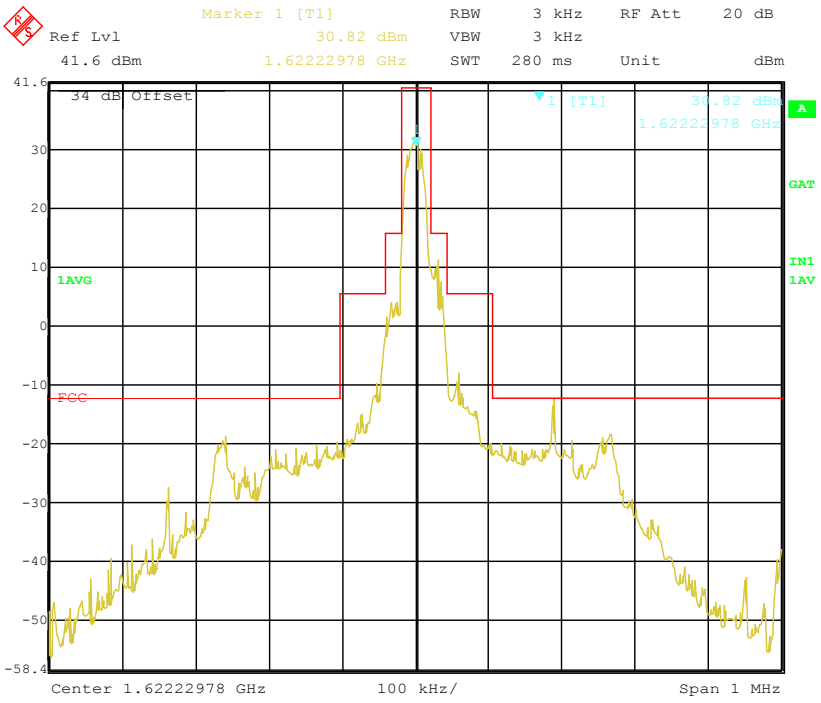
Channel 1



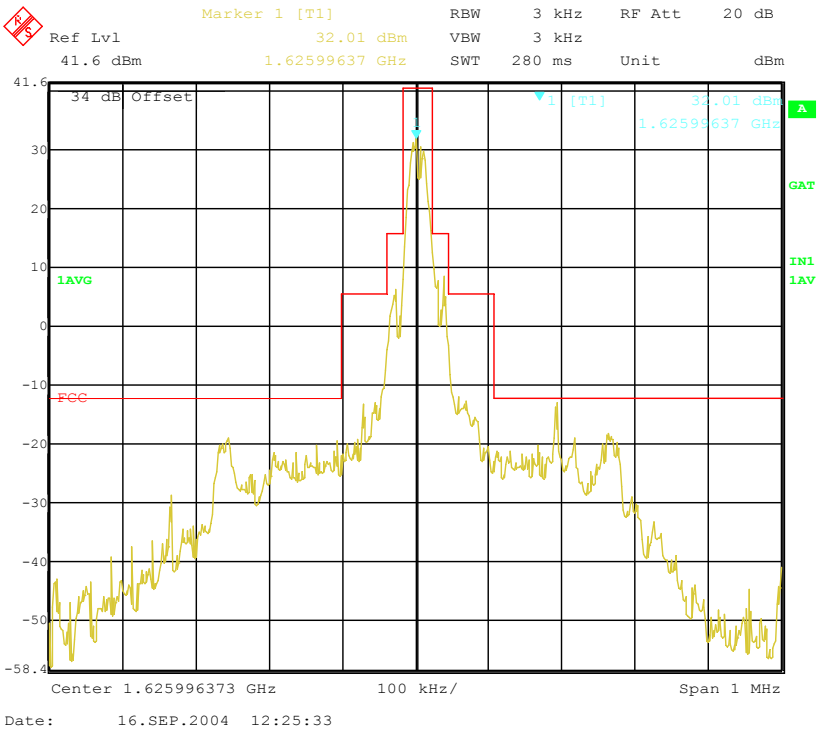
Channel 75



Channel 150

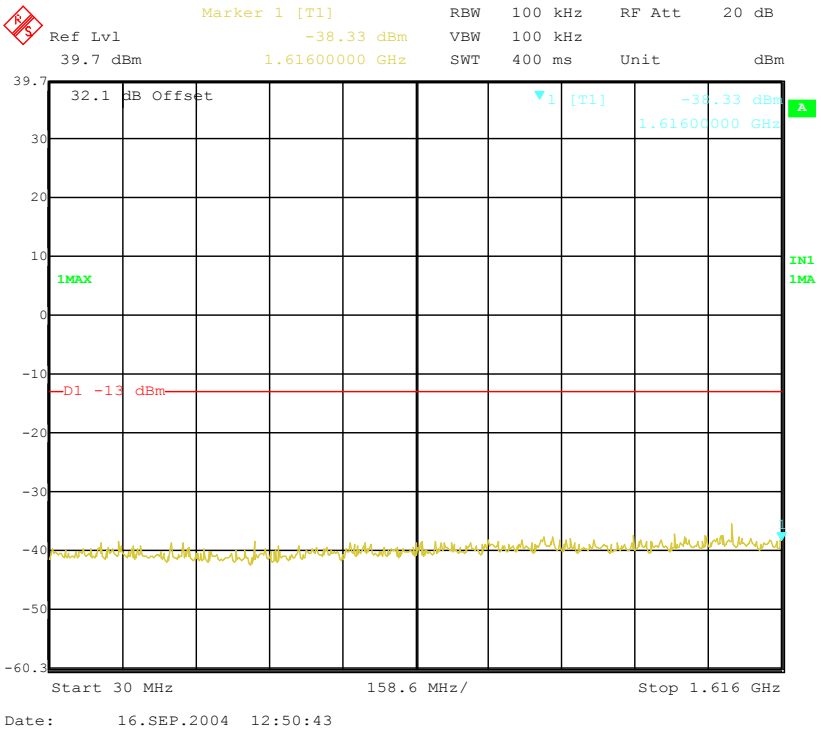


Channel 241

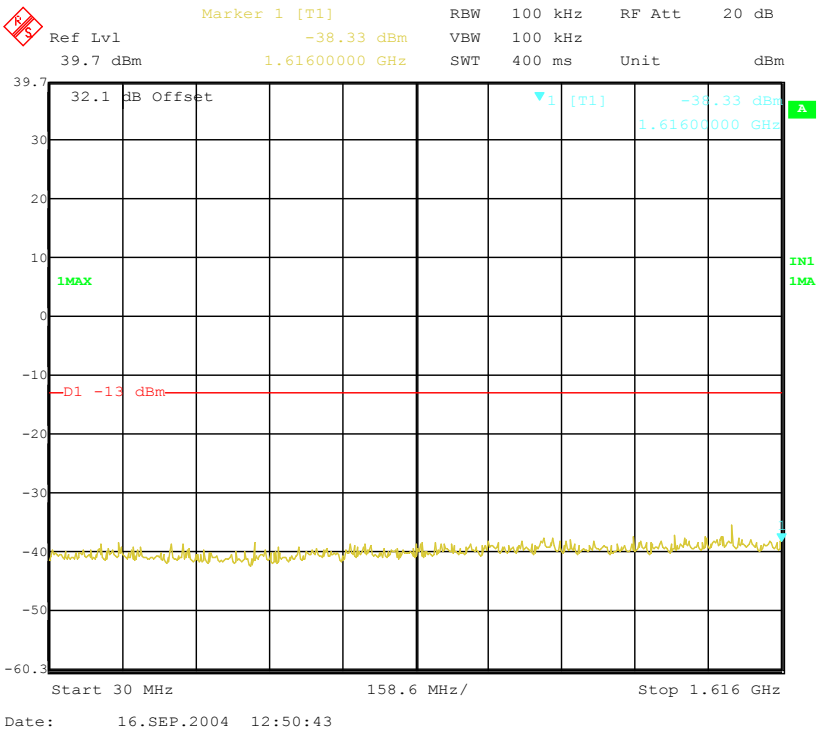


ANNEX G

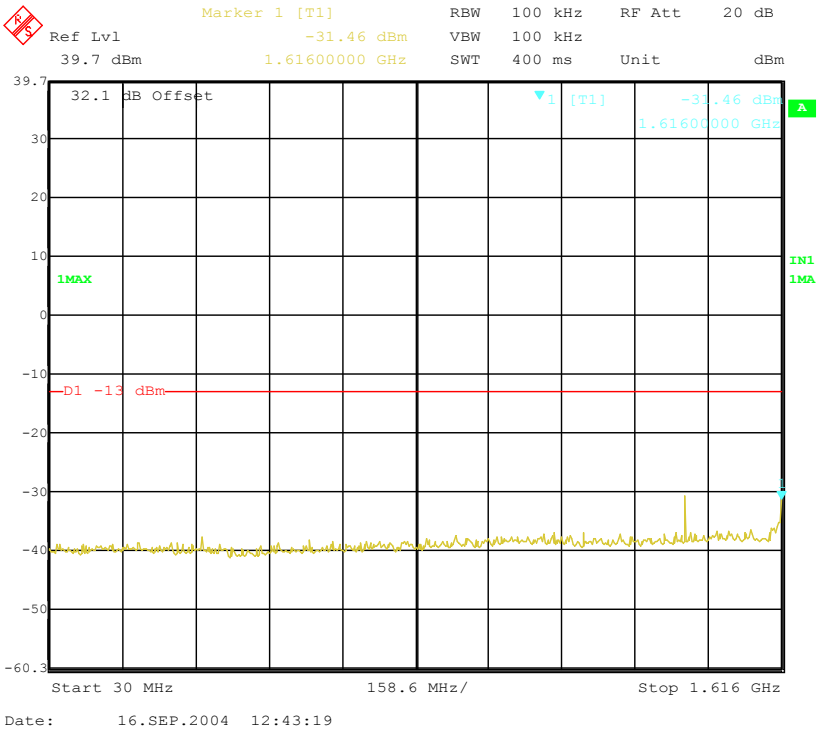
TRANSMITTER SPURIOUS EMISSIONS - Conducted



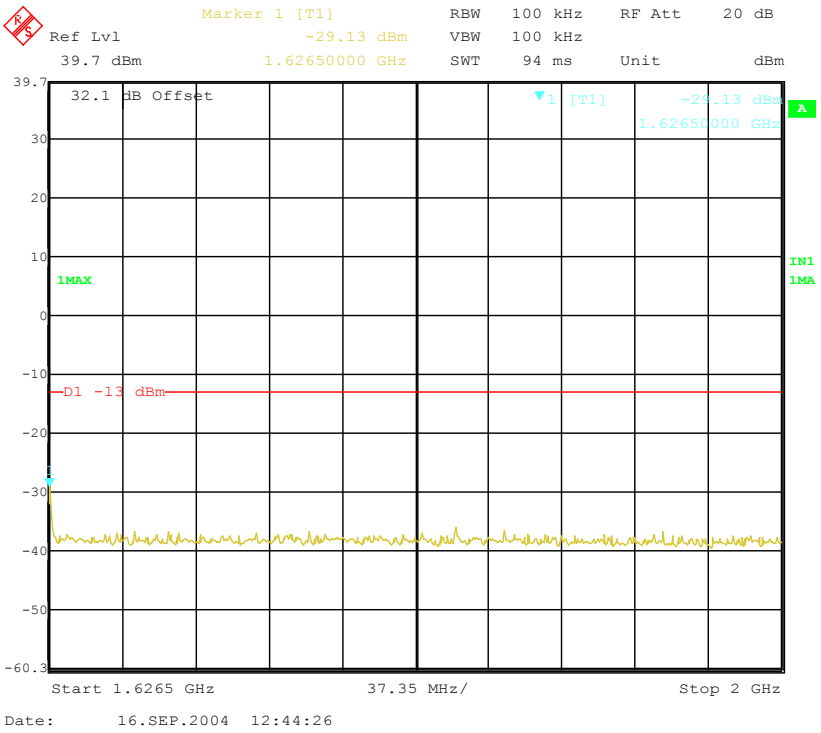
30MHz – 1610MHz



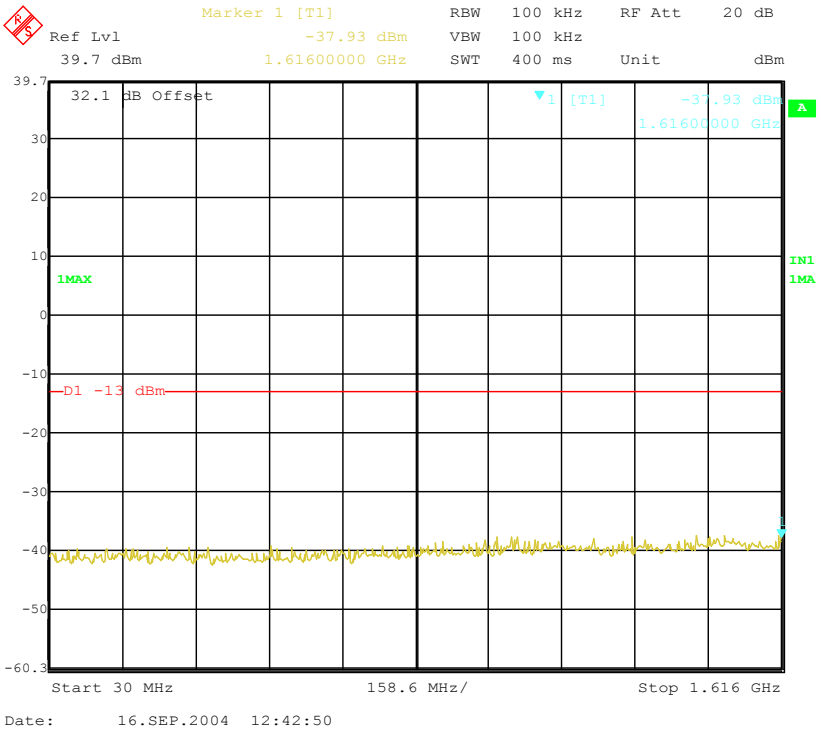
1628.5MHz – 2000MHz



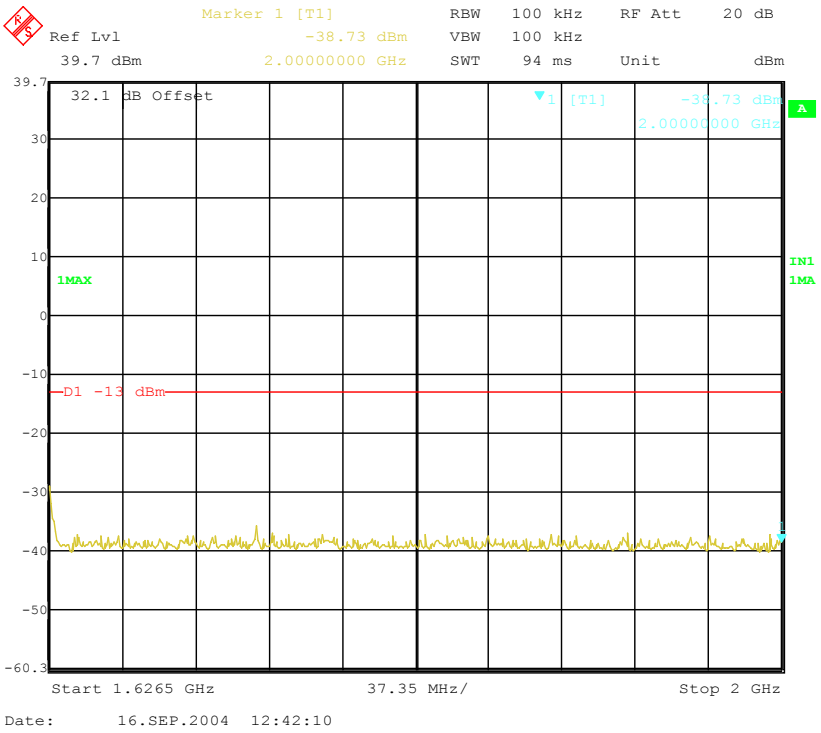
30MHz – 1610MHz



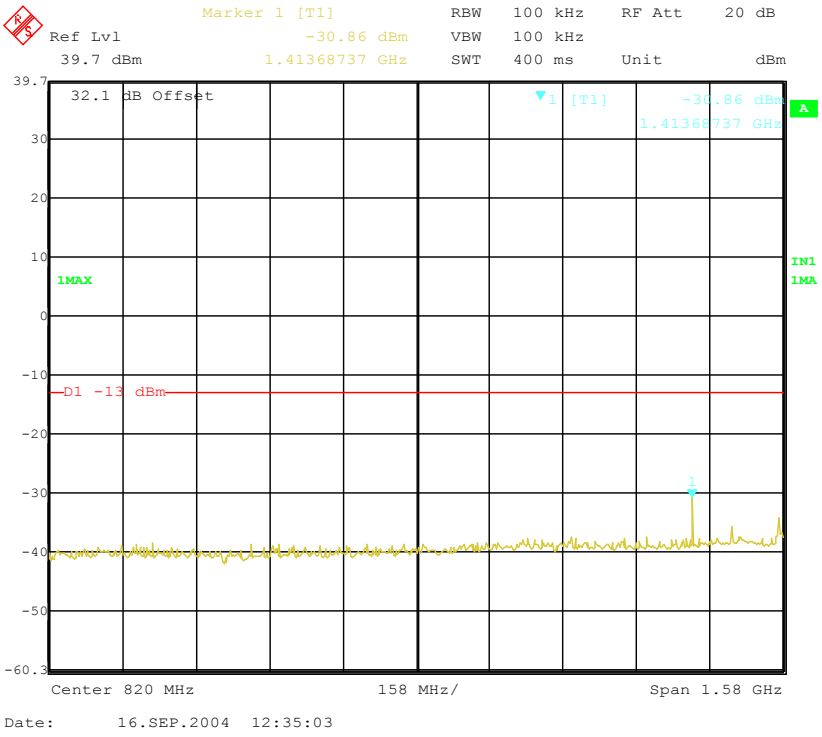
1628.5MHz – 2000MHz



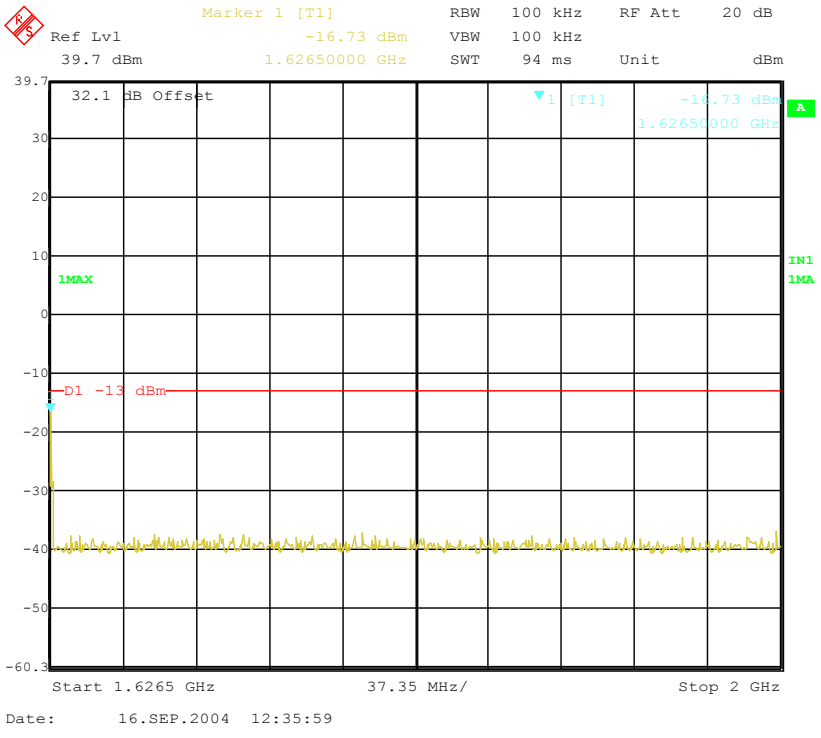
30MHz – 1610MHz



1628.5MHz – 2000MHz

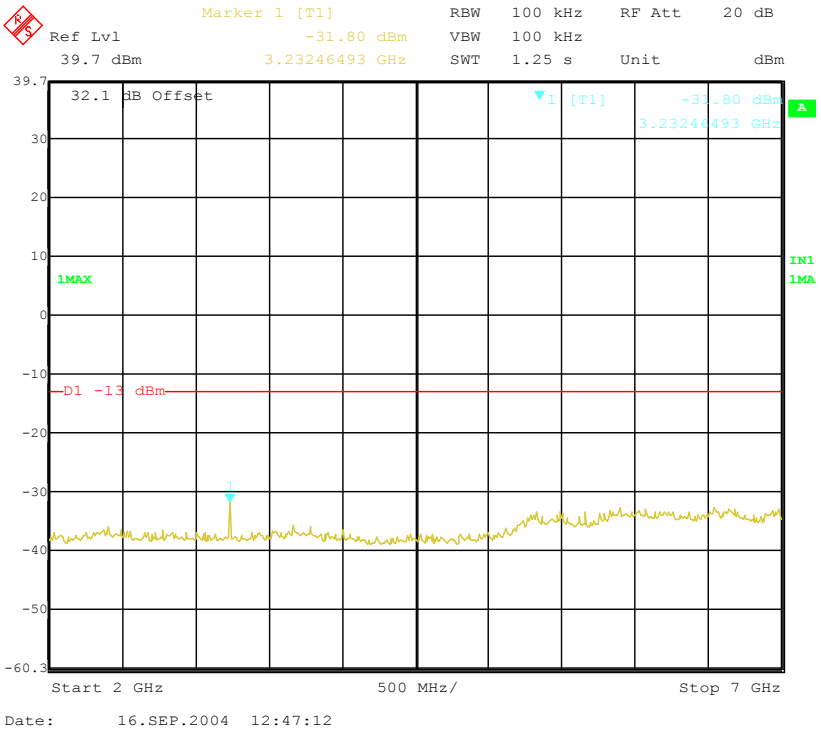


30MHz – 1610MHz

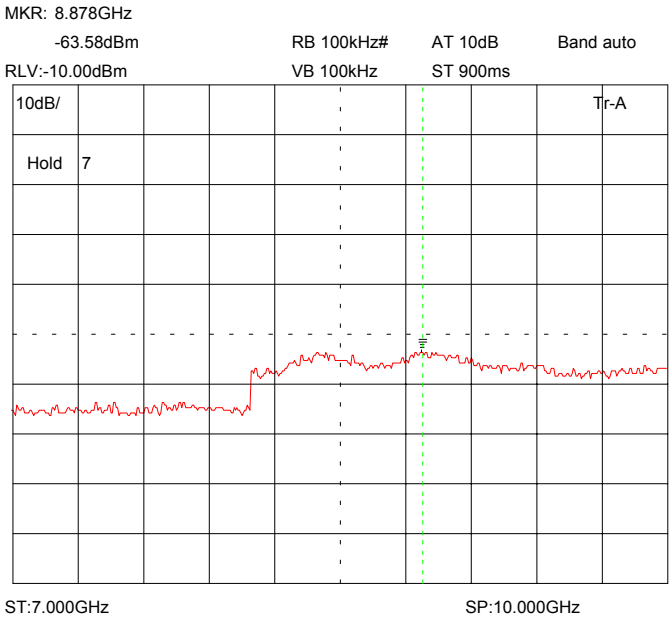


1628.5MHz – 2000MHz

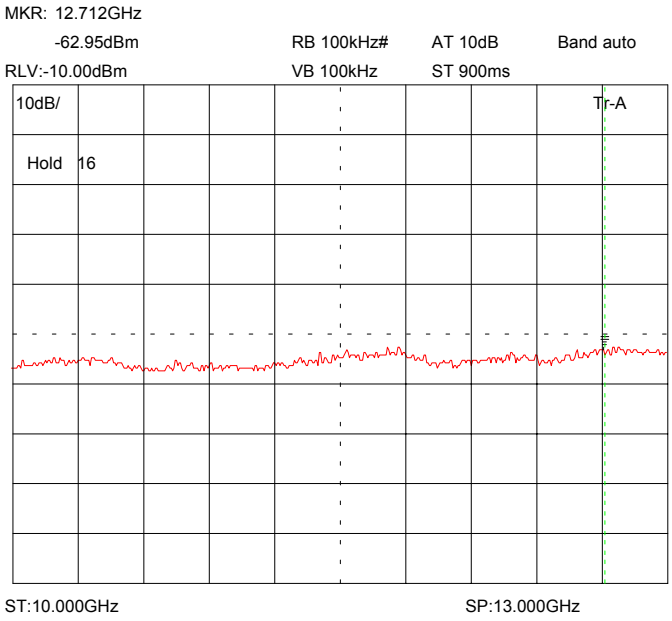
TRANSMITTER SPURIOUS EMISSIONS – Conducted



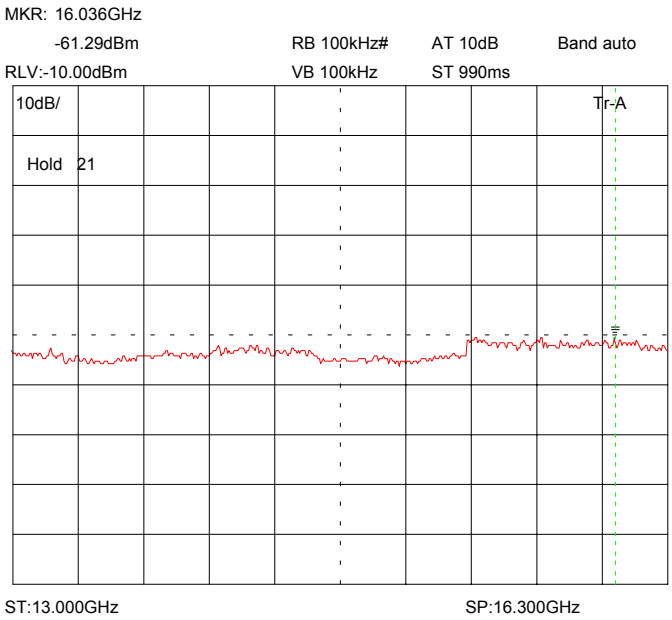
2GHz – 7GHz



7GHz –10GHz



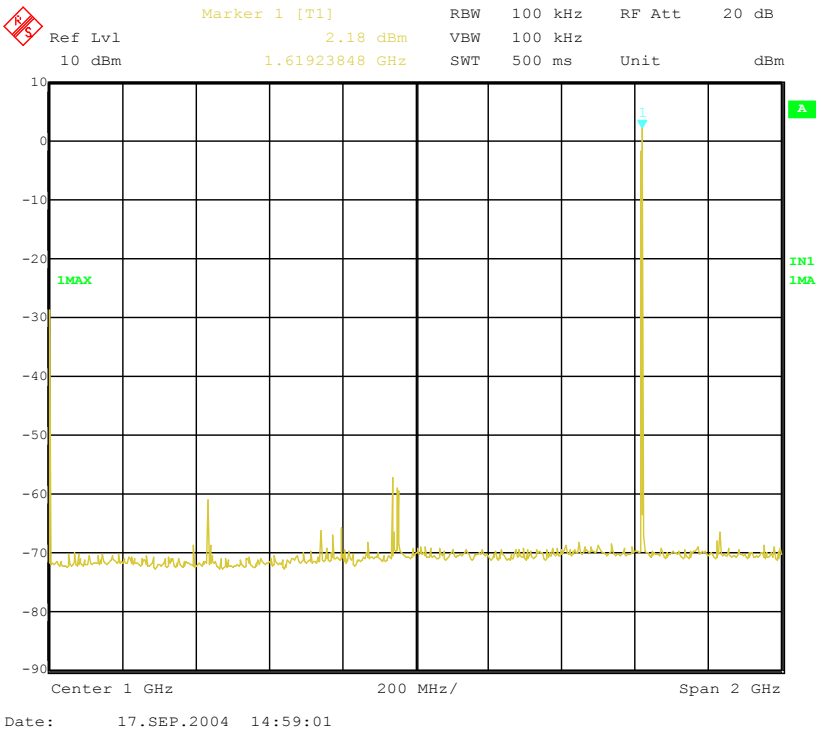
10GHz – 13GHz



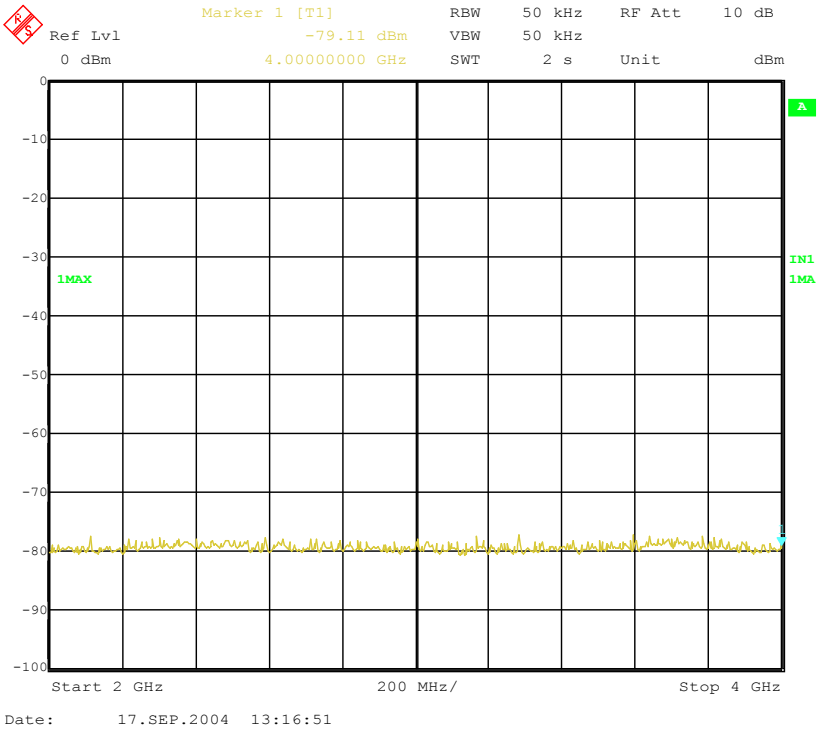
12GHz – 16.3GHz

ANNEX H

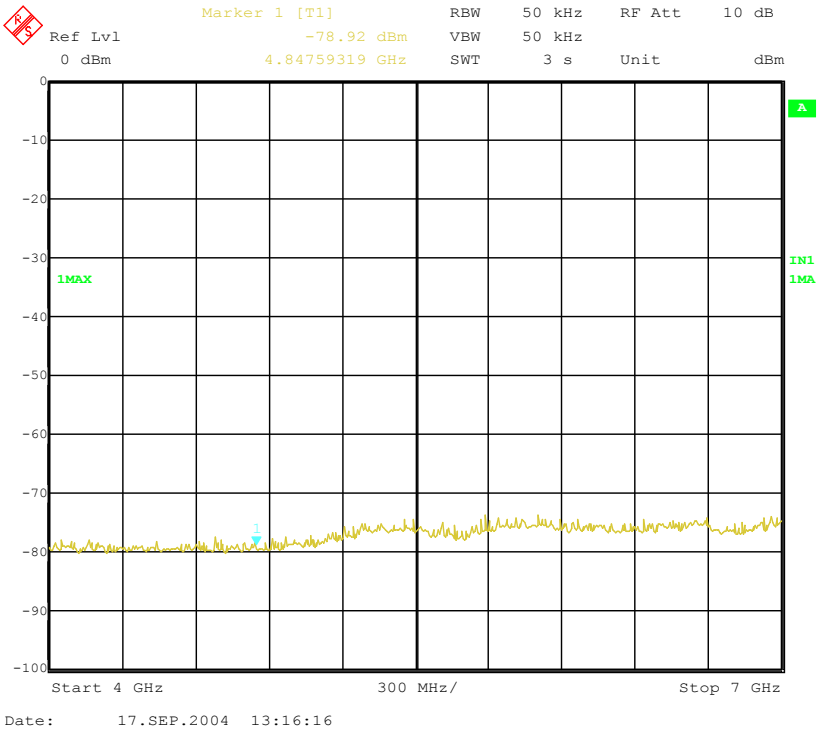
TRANSMITTER SPURIOUS EMISSIONS - Radiated



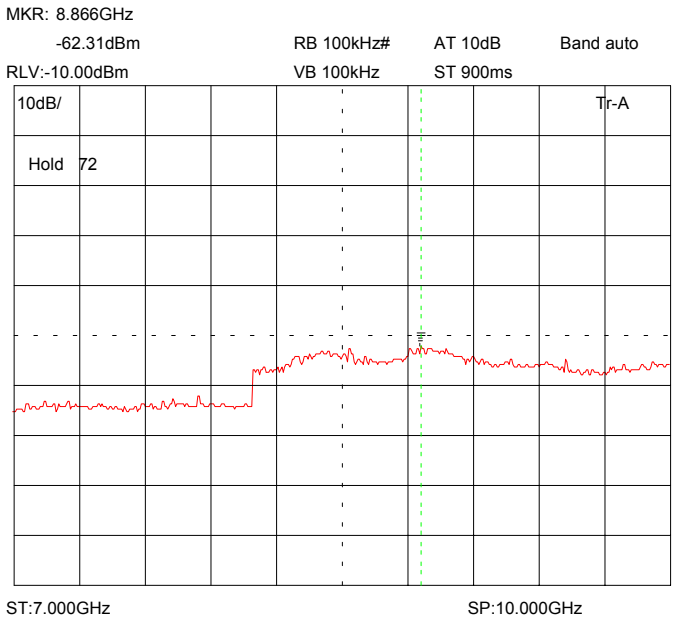
0 GHz – 2 GHz



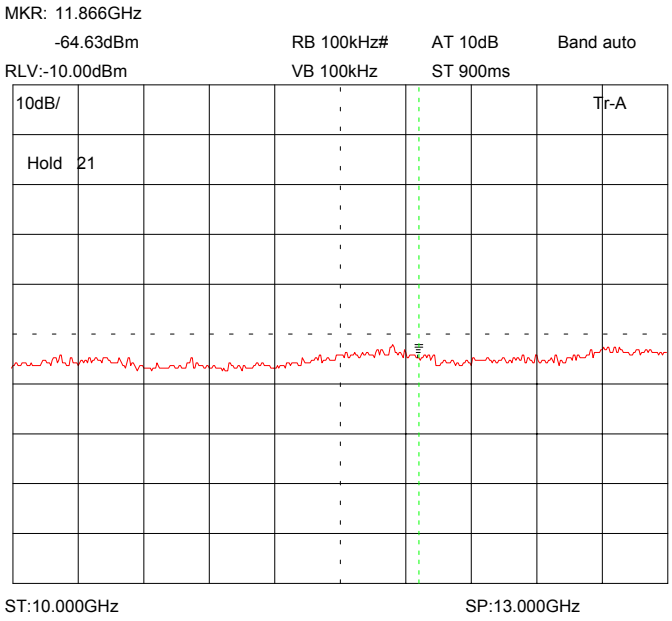
2 GHz – 4 GHz



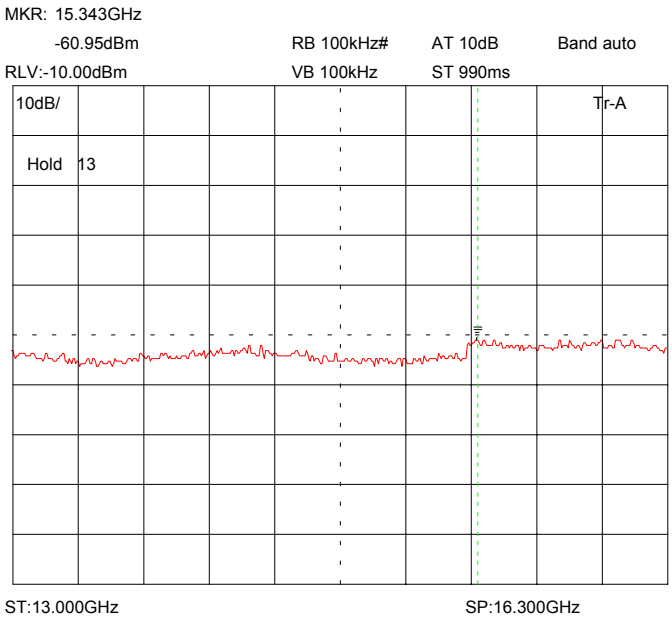
4 GHz – 7 GHz



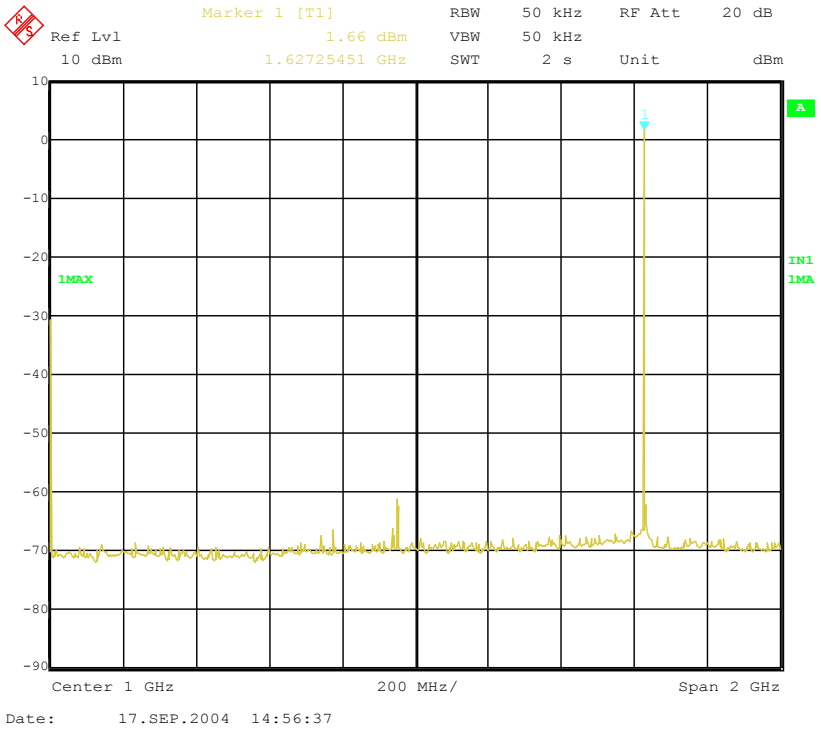
7 GHz – 10 GHz



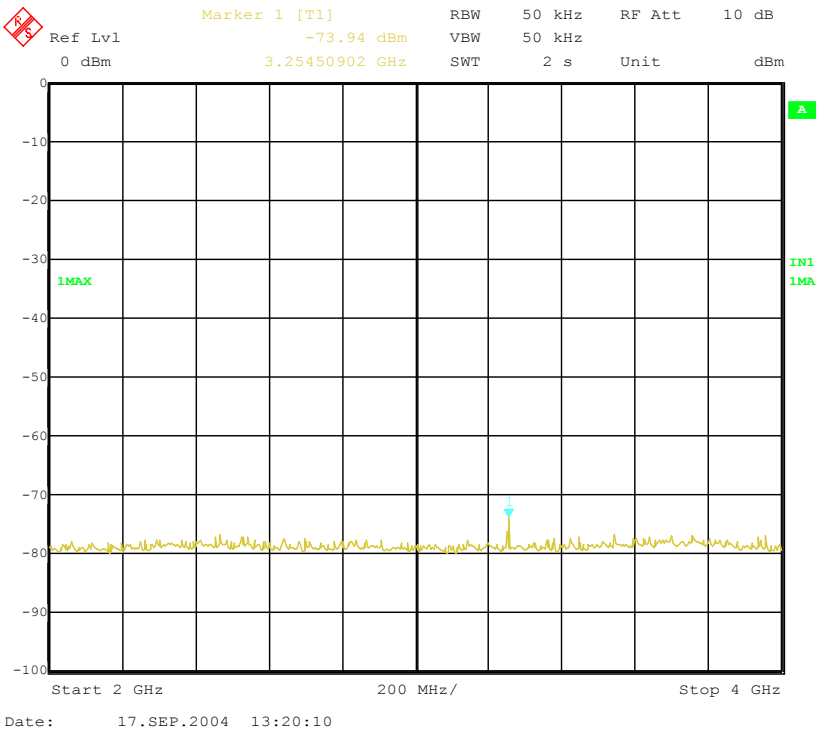
10 GHz – 13 GHz



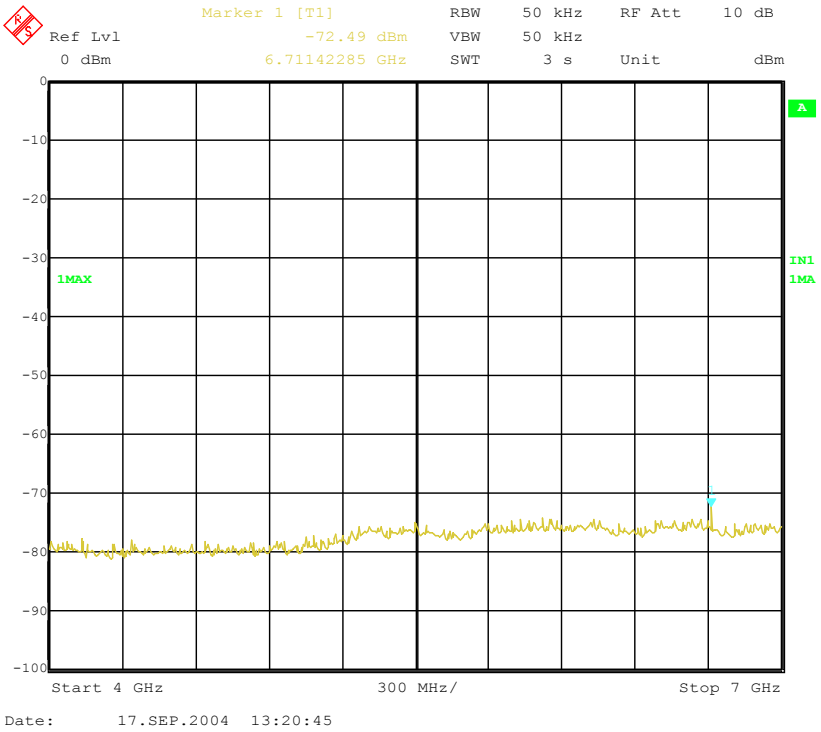
13 GHz – 16.3 GHz



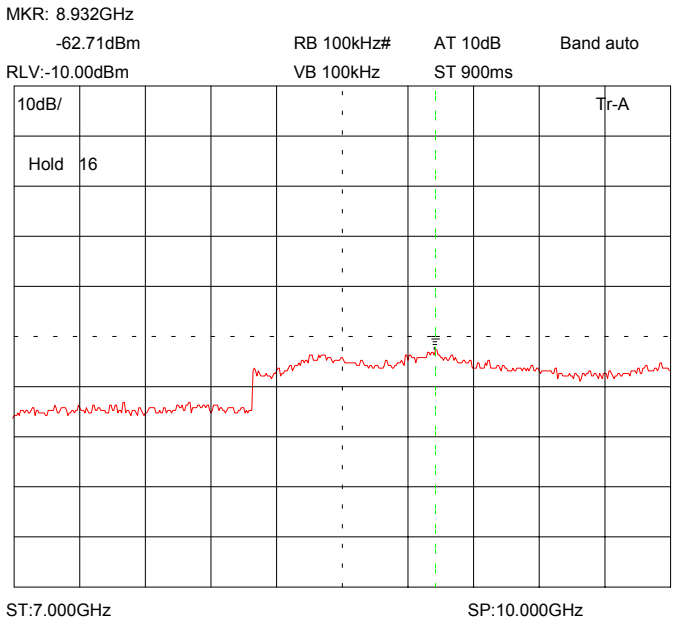
0 GHz – 2 GHz



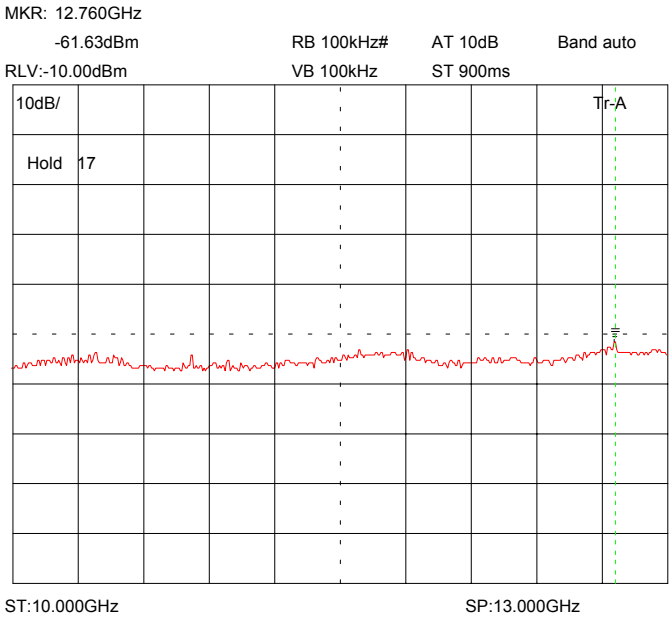
2 GHz – 4 GHz



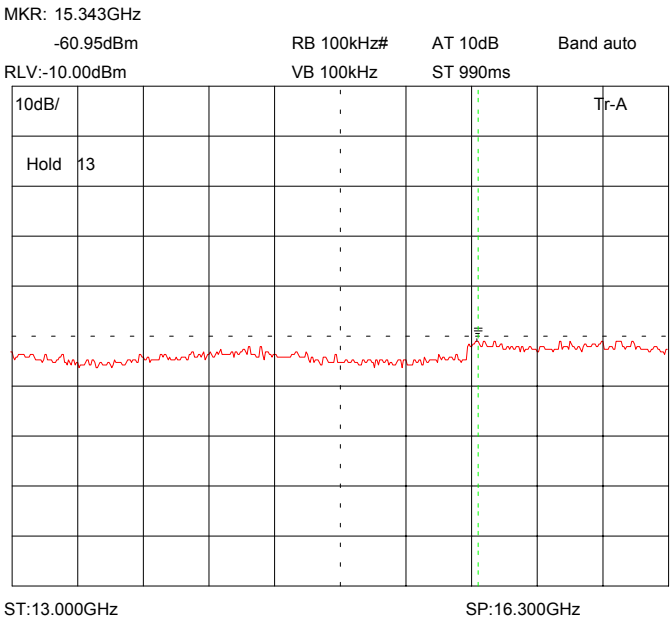
4 GHz – 7 GHz



7 GHz – 10 GHz



10 GHz – 13 GHz

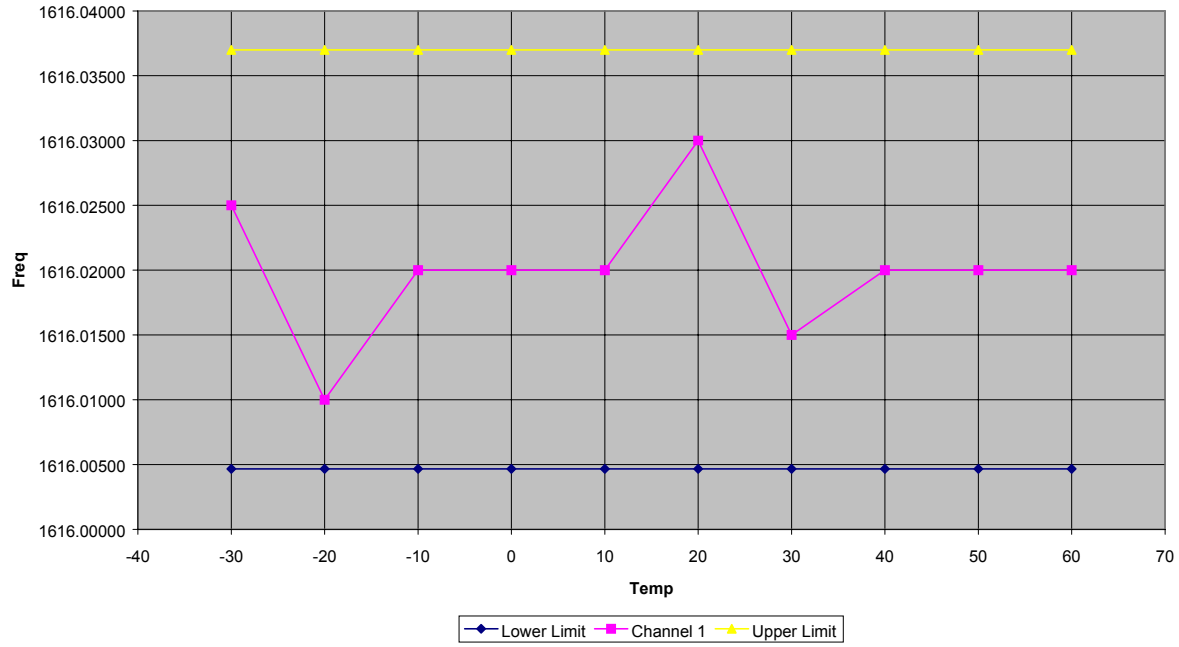


13 GHz – 16.3 GHz

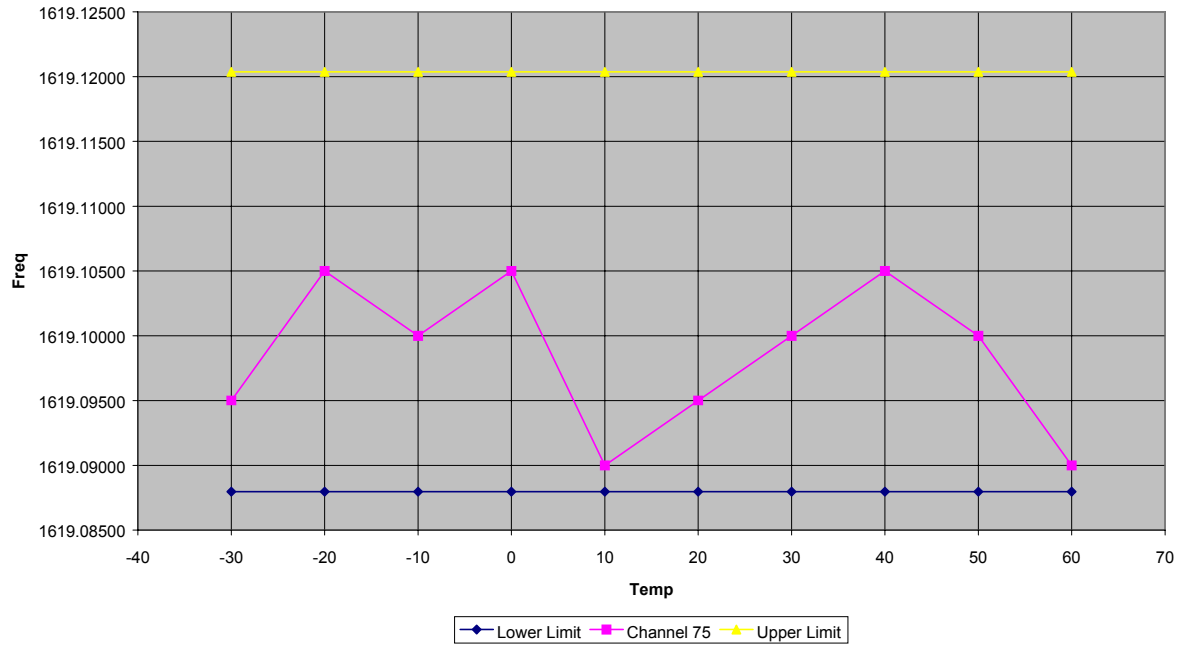
ANNEX I

FREQUENCY STABILITY - Temperature

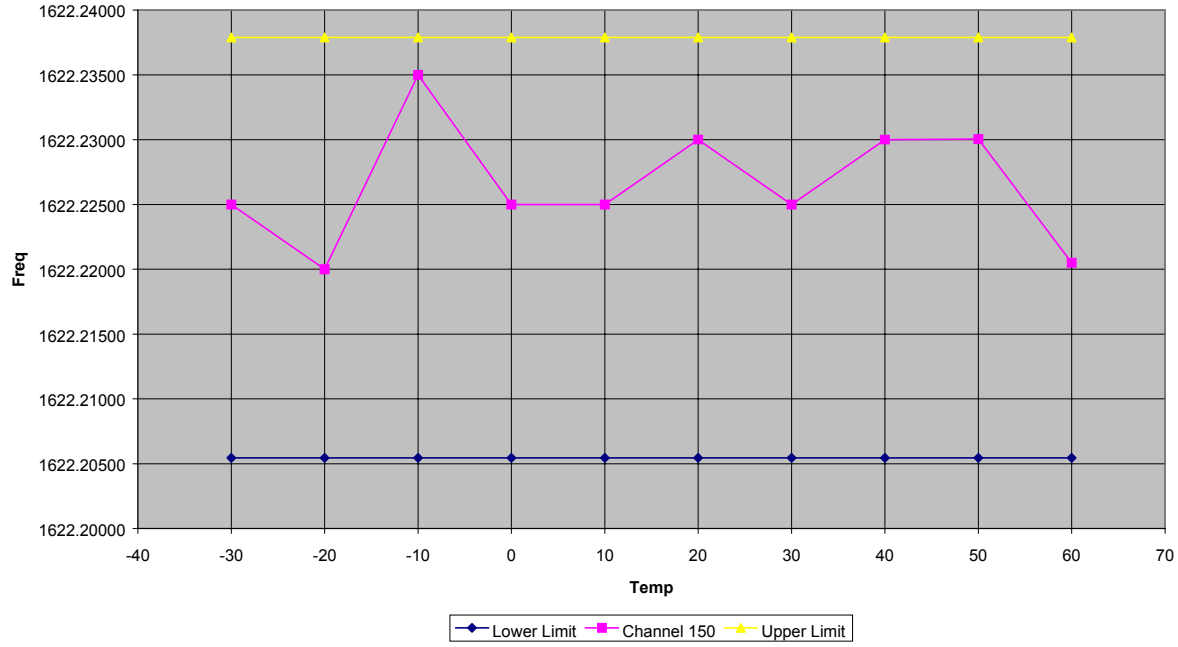
Channel 1 Frequency Stability - Temperature



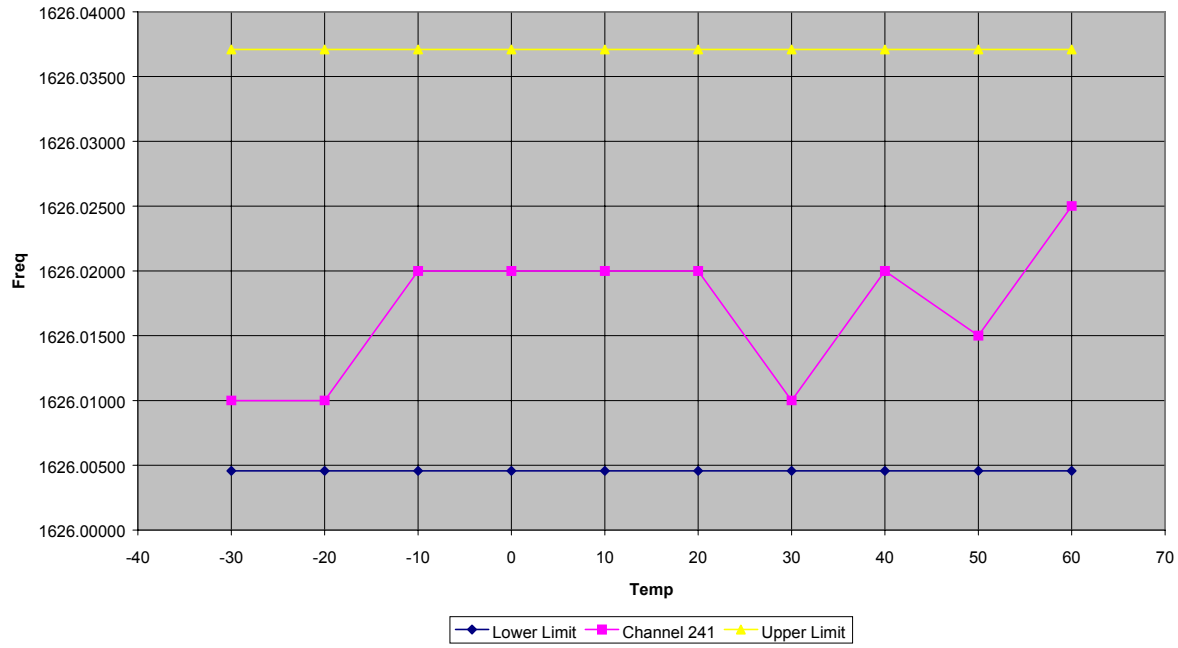
Channel 75 Frequency Stability - Temperature



Channel 150 Frequency Stability - Temperature

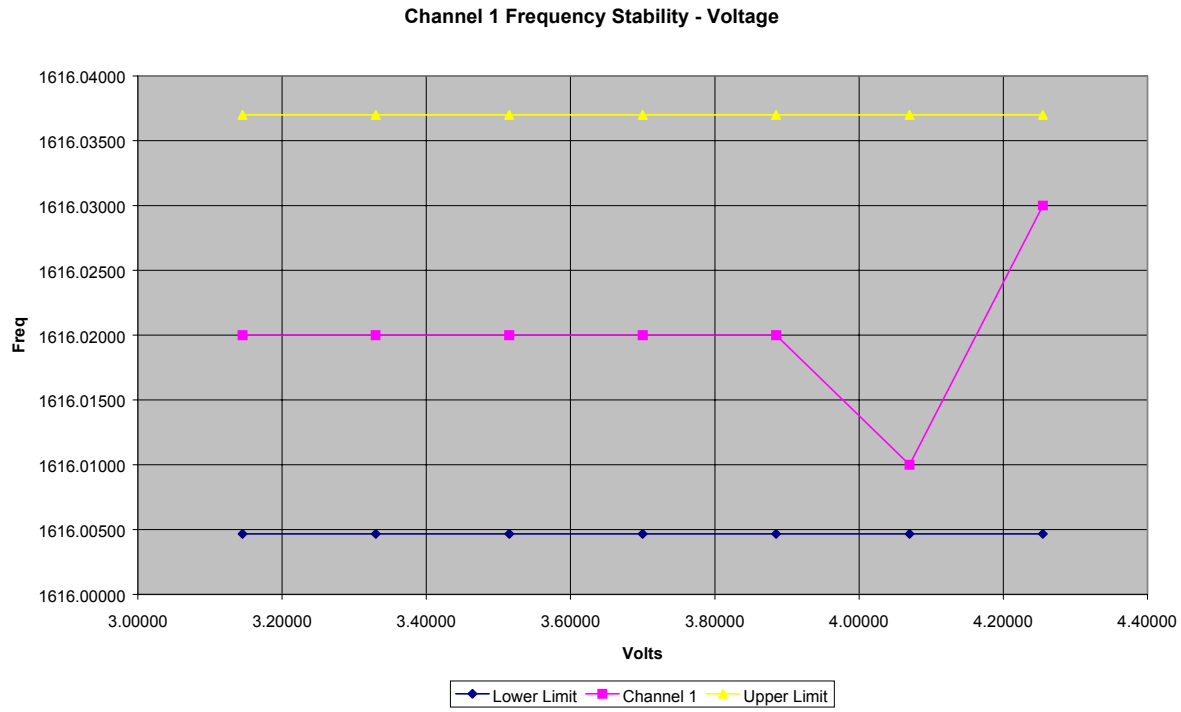


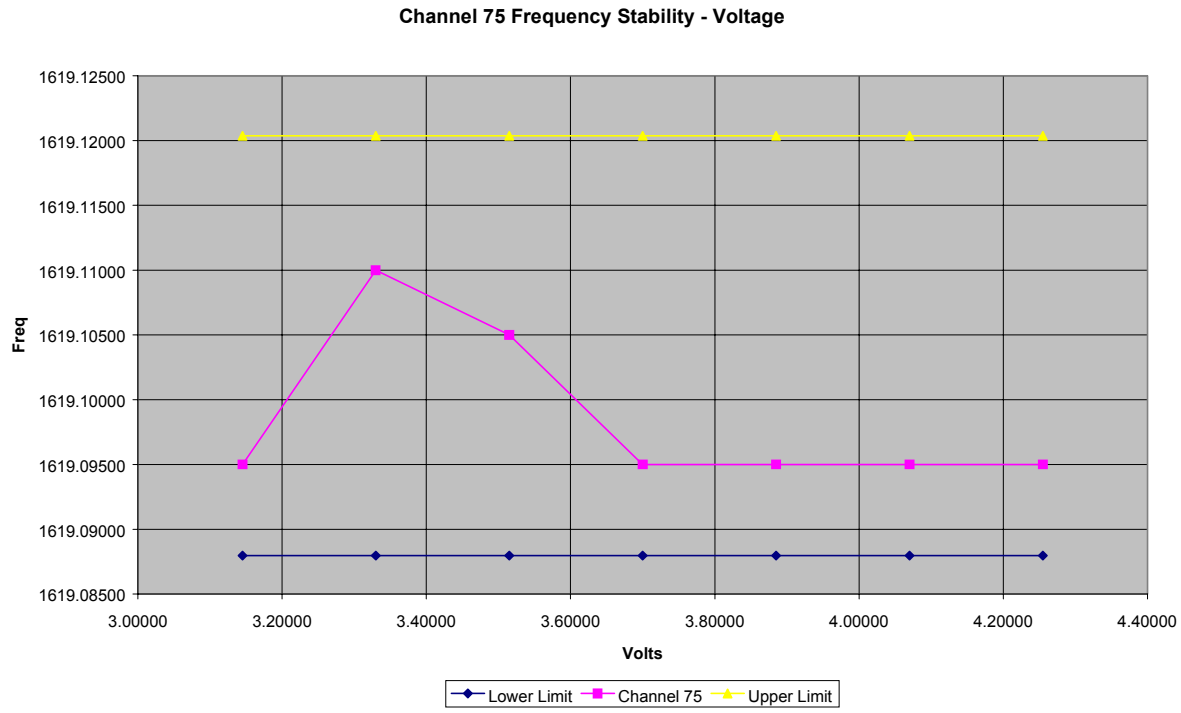
Channel 241 Frequency Stability - Temperature

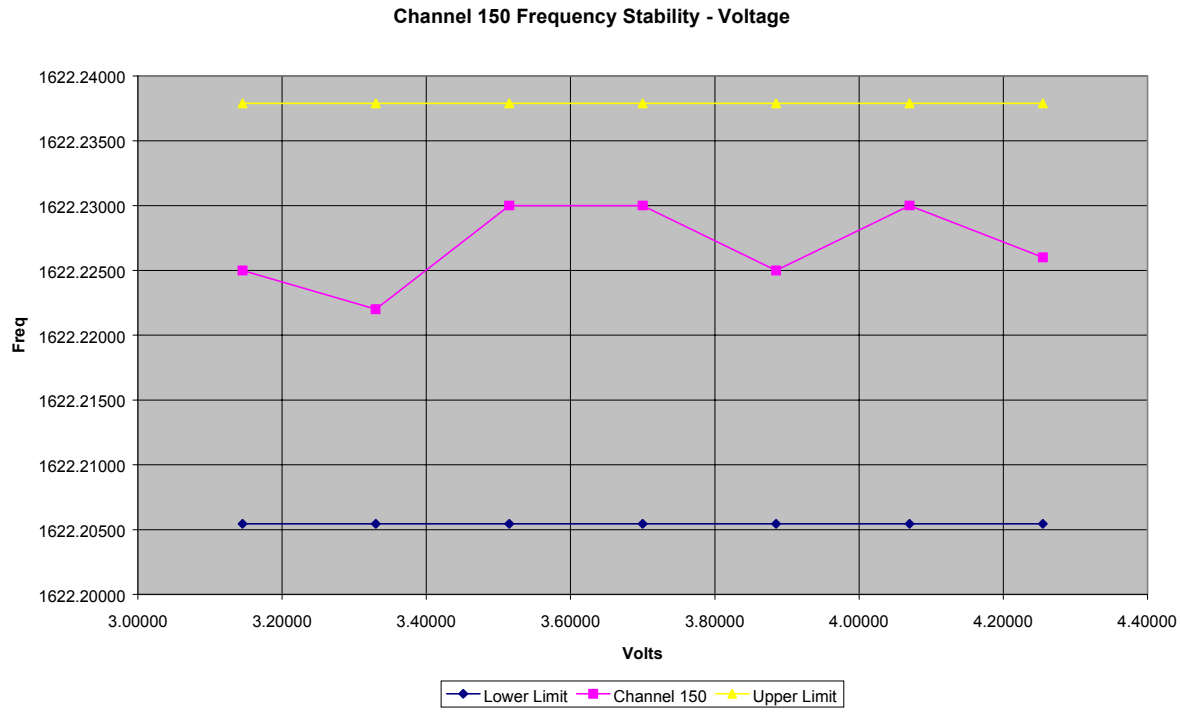


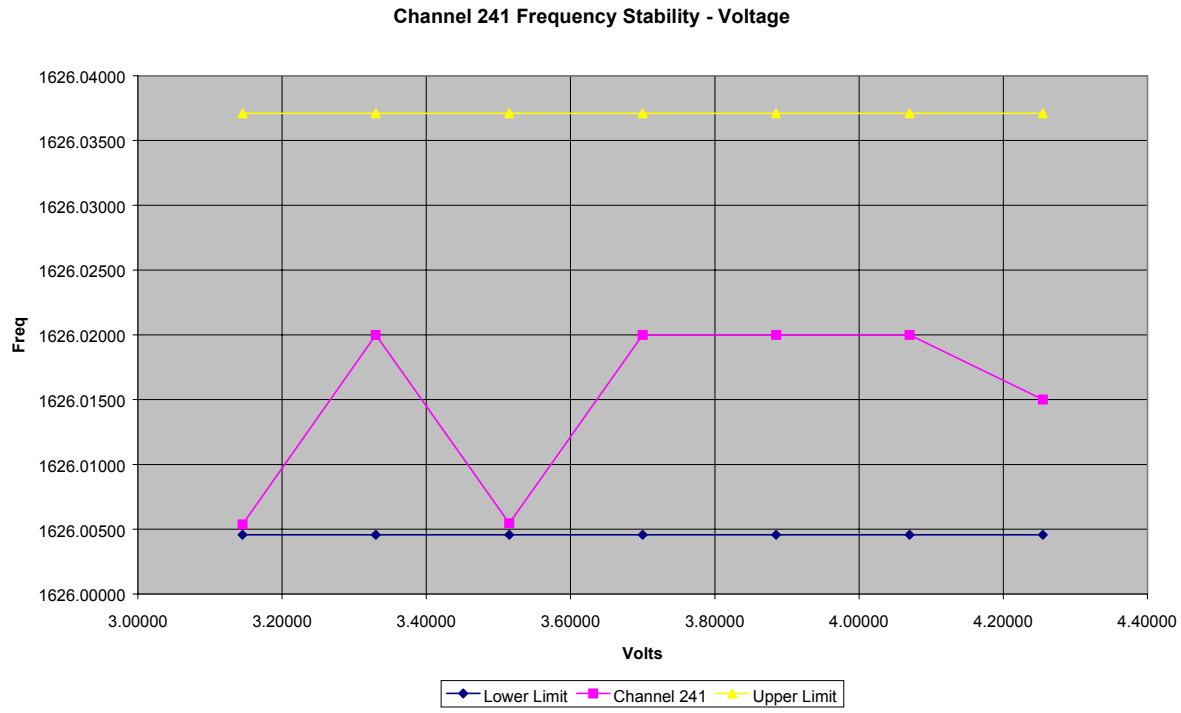
ANNEX J

FREQUENCY STABILITY – Voltage


Channel 1 Frequency Stability - Voltage
1616.04000
1616.03500
1616.03000
1616.02500
1616.02000
1616.01500
1616.01000
1616.00500
1616.00000
Freq
3.00000
3.20000
3.40000
3.60000
3.80000
4.00000
4.20000
4.40000
Volts
Lower Limit
Channel 1
Upper Limit


Channel 75 Frequency Stability - Voltage
1619.12500
1619.12000
1619.11500
1619.11000
1619.10500
1619.10000
1619.09500
1619.09000
1619.08500
Freq
3.00000
3.20000
3.40000
3.60000
3.80000
4.00000
4.20000
4.40000
Volts
Lower Limit
Channel 75
Upper Limit


Channel 150 Frequency Stability - Voltage
1622.24000
1622.23500
1622.23000
1622.22500
1622.22000
1622.21500
1622.21000
1622.20500
1622.20000
Freq
3.00000
3.20000
3.40000
3.60000
3.80000
4.00000
4.20000
4.40000
Volts
Lower Limit
Channel 150
Upper Limit


Channel 241 Frequency Stability - Voltage
1626.04000
1626.03500
1626.03000
1626.02500
1626.02000
1626.01500
1626.01000
1626.00500
1626.00000
Freq
3.00000
3.20000
3.40000
3.60000
3.80000
4.00000
4.20000
4.40000
Volts
Lower Limit
Channel 241
Upper Limit