



Appendix A

Modulation Characteristic Measurement

According to FCC part 2.1047 and part 27 subpart C



CHANNEL BANDWIDTH: 10MHz

TM2.0: 64QAM

Single Carrier

No.5090 (M)
737MHz

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK			17.50			%
EVM PDSCH 16QAM			12.50			%
EVM PDSCH 64QAM		0.87	8.00			%
EVM Phys. Channel	0.80	0.85		0.93		%
EVM Phys. Signal	0.66	0.68		0.70		%
EVM All	0.72	0.75		0.80		%
Frequency Error	-0.51	0.37		0.90		Hz
Sampling Error	-0.07	-0.02		0.04		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-46.35	-44.66		-44.22		dB
IQ Gain Imbalance	0.00			0.00		dB
IQ Quadrature Error	0.00			0.08		°
OSTP	-44.34	-43.14		-42.21		dBm
Power	-37.11	-36.72		-35.09		dBm
Crest Factor		15.99				dB



TM3.1: 64QAM

Single Carrier

No.5090 (M)
737MHz

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK			17.50			%
EVM PDSCH 16QAM			12.50			%
EVM PDSCH 64QAM		6.24	8.00			%
EVM Phys. Channel	5.42	6.21		6.63		%
EVM Phys. Signal	4.72	6.13		7.05		%
EVM All	5.45	6.21		6.65		%
Frequency Error	-1.15	0.26		1.47		Hz
Sampling Error	-0.65	0.05		1.41		ppm
Time Alignment Error Δ2.1						ns
Time Alignment Error Δ3.1						ns
Time Alignment Error Δ4.1						ns
IQ Offset	-52.92	-50.52		-48.63		dB
IQ Gain Imbalance	-0.02	0.01		0.04		dB
IQ Quadrature Error	-0.24	0.00		0.23		°
OS/TP	-26.35	-26.20		-25.94		dBm
Power	-26.30	-26.24		-26.21		dBm
Crest Factor		6.54				dB

TM3.2: 16QAM

Single Carrier

No.5090 (M)
737MHz

Rohde & Schwarz EUTRA/LTE Analysis Software Version 2.3 Beta 9

Freq 737 MHz	CP / Cell Grp / ID Norm / Grp 0 / ID 1	Master Ref Level 30.00 dBm, 10 dB
Mode DL FDD, 50 RBs (10 MHz)	Sync State OK	Capture Length 20.10 ms (306736 Sam.)

Result Summary Subframes: ALL Selection: Antenna: 1
 Symbols Meas.: 140

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK		4.79	17.50			%
EVM PDSCH 16QAM		8.75	12.50			%
EVM PDSCH 64QAM			8.00			%
EVM Phys. Channel	6.98	7.37		7.74		%
EVM Phys. Signal	5.65	6.06		6.66		%
EVM All	6.93	7.31		7.68		%
Frequency Error	-2.74	0.04		2.82		Hz
Sampling Error	-0.83	-0.11		0.50		ppm
Time Alignment Error Δ2.1						ns
Time Alignment Error Δ3.1						ns
Time Alignment Error Δ4.1						ns
IQ Offset	-51.68	-50.14		-48.79		dB
IQ Gain Imbalance	-0.02	0.01		0.04		dB
IQ Quadrature Error	-0.23	0.03		0.14		°
OSTP	-26.32	-26.23		-26.13		dBm
Power	-26.31	-26.25		-26.23		dBm
Crest Factor		6.39				dB

CAPTURE DSP

EXIT EUTRA.LTE EUTRA.LTE RUI SGL RUI CONT REFRESH SCREEN A PRESET

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TM3.3: QPSK

Single Carrier

No.5090 (M)
737MHz

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK		12.10	17.50			%
EVM PDSCH 16QAM		4.76	12.50			%
EVM PDSCH 64QAM			8.00			%
EVM Phys. Channel	7.96	9.08		10.15		%
EVM Phys. Signal	5.36	6.05		7.01		%
EVM All	7.86	8.95		9.99		%
Frequency Error	-1.01	0.78		2.70		Hz
Sampling Error	-0.37	0.42		1.39		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-52.70	-49.86		-48.54		dB
IQ Gain Imbalance	-0.02	0.01		0.04		dB
IQ Quadrature Error	-0.25	-0.04		0.15		°
OSTP	3.90	4.20		4.40		dBm
Power	4.10	4.22		4.29		dBm
Crest Factor		6.46				dB

CHANNEL BANDWIDTH: 5M

TM2.0: 64QAM

Single Carrier

No.5090 (M)
737MHz

◆ Rohde & Schwarz EUTRA/LTE Analysis Software Version 2.3 Beta 9

Freq 737 MHz	CP / Cell Grp / ID Norm / Grp 0 / ID 1	Master Ref Level 20.70 dBm, 20 dB
Mode DL FDD, 25 RBs (5 MHz)	Sync State OK	Capture Length 20.10 ms (154368 Sam.)

Result Summary Subframes: ALL Selection: Antenna: 1
Symbols Meas.: 140

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK			17.50			%
EVM PDSCH 16QAM			12.50			%
EVM PDSCH 64QAM		0.68	8.00			%
EVM Phys. Channel	0.61	0.70		0.96		%
EVM Phys. Signal	0.53	0.58		0.62		%
EVM All	0.58	0.65		0.83		%
Frequency Error	0.57	1.14		1.86		Hz
Sampling Error	-0.09	0.00		0.08		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-48.27	-46.02		-45.57		dB
IQ Gain Imbalance	0.00			0.00		dB
IQ Quadrature Error	0.00			0.03		°
OSTP	-1.21	-0.04		0.87		dBm
Power	4.26	4.82		6.97		dBm
Crest Factor		14.95				dB

CAPTURE **DSP**

EXIT EUTRA LTE EUTRA LTE
RUII SGL **RUII CONT** REFRESH SCREEN A
PRESET

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TM3.1: 64QAM

Single Carrier

No.5090 (M)
737MHz

Rohde & Schwarz EUTRA/LTE Analysis Software Version 2.3 Beta 9

Freq 737 MHz	CP / Cell Grp / ID Norm / Grp 0 / ID 1	Master Ref Level 22.50 dBm, 30 dB
Mode DL FDD, 25 RBs (5 MHz)	Sync State OK	Capture Length 20.10 ms (154368 Sam.)

Result Summary Subframes: ALL Selection: Antenna: 1
Symbols Meas.: 140

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK			17.50			%
EVM PDSCH 16QAM			12.50			%
EVM PDSCH 64QAM		6.03	8.00			%
EVM Phys. Channel	5.50	6.01		6.78		%
EVM Phys. Signal	4.44	6.11		7.58		%
EVM All	5.56	6.02		6.79		%
Frequency Error	0.44	2.69		6.81		Hz
Sampling Error	-1.12	0.83		2.39		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-50.52	-40.27		-46.10		dB
IQ Gain Imbalance	-0.05	0.00		0.05		dB
IQ Quadrature Error	-0.46	-0.14		0.12		°
OSTP	13.83	13.99		14.15		dBm
Power	13.88	13.98		14.00		dBm
Crest Factor		6.55				dB

CAPTURE **DSP**

EXIT EUTRA LTE EUTRA LTE PUII SGL **RUN CONT** REFRESH SCREEN A

MEAS

LOAD DEMOD SETTINGS SETUP

SAVE DEMOD SETTINGS FILE

DISP

MKR

OPEN IN SEPARATE WINDOW

SAVE IO DATA

PRESET

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TM3.2: 16QAM

Single Carrier

No.5090 (M)
737MHz

Rohde & Schwarz EUTRA/LTE Analysis Software Version 2.3 Beta 9

Freq 737 MHz	CP / Cell Grp / ID Norm / Grp 0 / ID 1	Master Ref Level 22.50 dBm, 30 dB
Mode DL FDD, 25 RBs (5 MHz)	Sync State OK	Capture Length 20.10 ms (154368 Sam.)

Result Summary Subframes: ALL Selection: Antenna: 1
Symbols Meas.: 140

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK		4.74	17.50			%
EVM PDSCH 16QAM		8.34	12.50			%
EVM PDSCH 64QAM			8.00			%
EVM Phys. Channel	5.96	7.09		7.62		%
EVM Phys. Signal	5.01	6.19		8.65		%
EVM All	5.94	7.05		7.56		%
Frequency Error	-3.49	0.67		5.19		Hz
Sampling Error	-1.83	0.08		1.75		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-50.41	-47.83		-46.12		dB
IQ Gain Imbalance	-0.02	0.01		0.04		dB
IQ Quadrature Error	-0.10	0.04		0.17		°
OSTP	13.74	13.92		14.05		dBm
Power	13.85	13.94		13.99		dBm
Crest Factor		6.40				dB

CAPTURE DSP

EXIT EUTRA.LTE EUTRA.LTE RUI SGL RUN CONT REFRESH SCREEN A

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TM3.3: QPSK

Single Carrier

No.5090 (M)
737MHz

Rohde & Schwarz EUTRA/LTE Analysis Software Version 2.3 Beta 9

Freq 737 MHz	CP / Cell Grp / ID Norm / Grp 0 / ID 1	Master Ref Level 20.00 dBm, 30 dB
Mode DL FDD, 25 RBs (5 MHz)	Sync State OK	Capture Length 20.10 ms (154368 Sam.)

Subframes ALL Selection Antenna: 1
Symbols Meas. 140

Item	Min	Mean	Mean Limit	Max	Max Limit	Unit
EVM PDSCH QPSK		11.76	17.50			%
EVM PDSCH 16QAM		4.68	12.50			%
EVM PDSCH 64QAM			8.00			%
EVM Phys. Channel	7.48	8.99		10.01		%
EVM Phys. Signal	3.85	5.53		7.61		%
EVM All	7.26	8.84		9.84		%
Frequency Error	-2.70	1.13		4.60		Hz
Sampling Error	-0.01	0.46		1.93		ppm
Time Alignment Error Δ2,1						ns
Time Alignment Error Δ3,1						ns
Time Alignment Error Δ4,1						ns
IQ Offset	-51.11	-48.49		-46.30		dB
IQ Gain Imbalance	-0.05	-0.01		0.02		dB
IQ Quadrature Error	-0.29	0.00		0.46		°
OSTP	13.58	13.98		14.30		dBm
Power	13.86	14.03		14.13		dBm
Crest Factor		6.42				dB

CAPTURE DSP

EXIT EUTRA/LTE EUTRA/LTE RUN SGL RUN CONT REFRESH SCREEN A PRESET

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Appendix B

Occupied Bandwidth Measurement

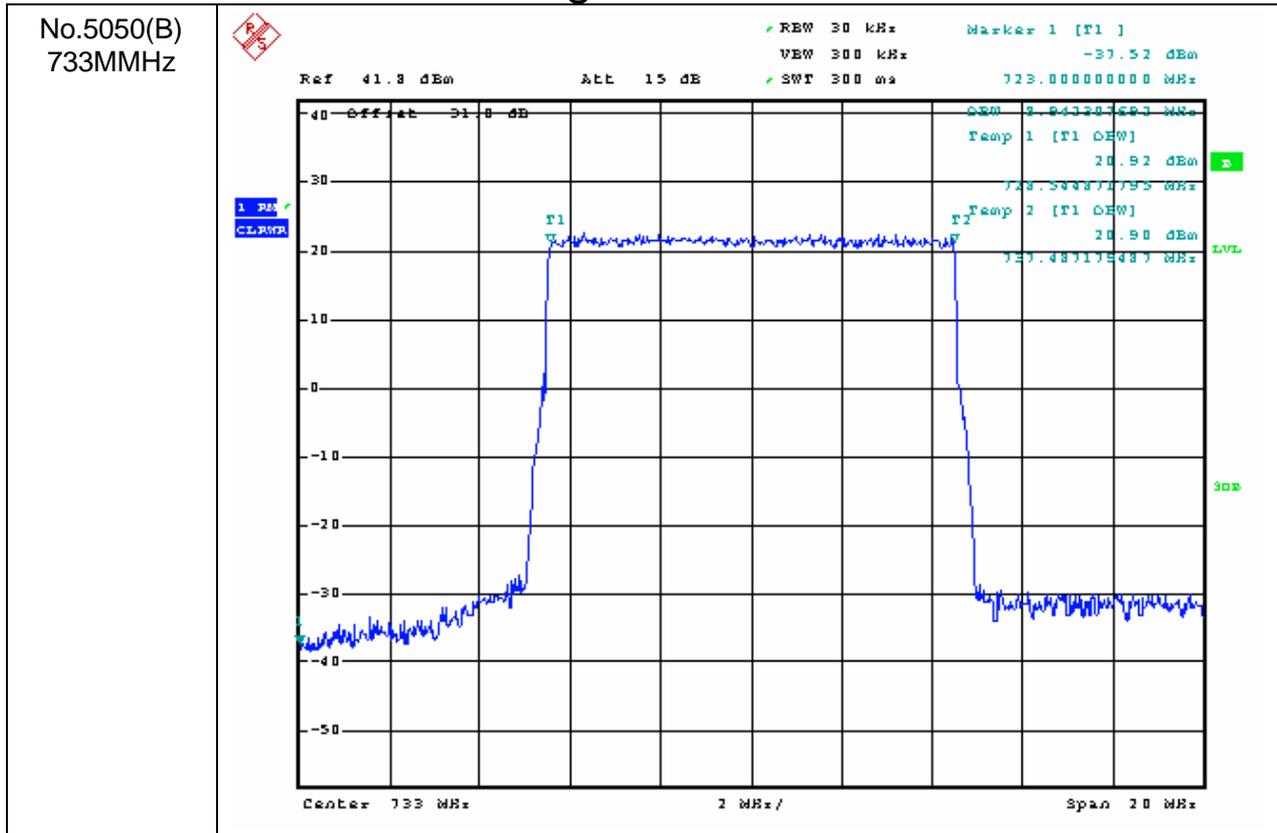
According to FCC part 2.1049 and part 27 subpart C



CHANNEL BANDWIDTH: 10M

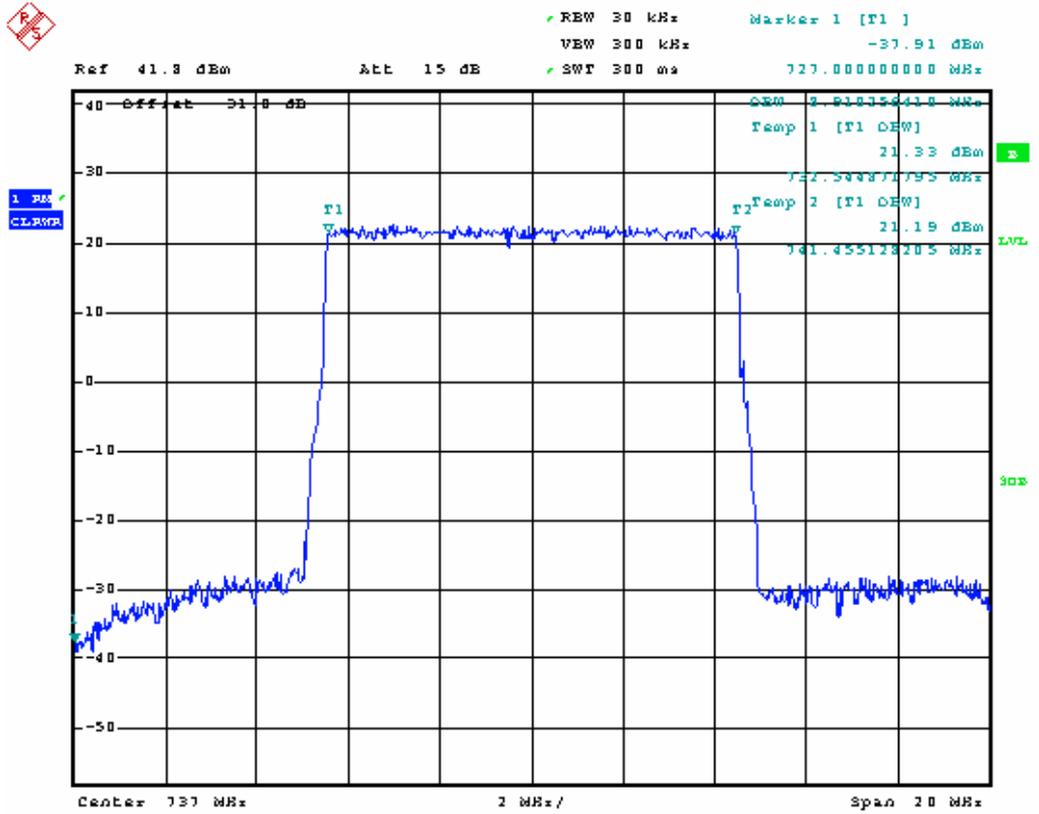
TM1.1:

Single Carrier

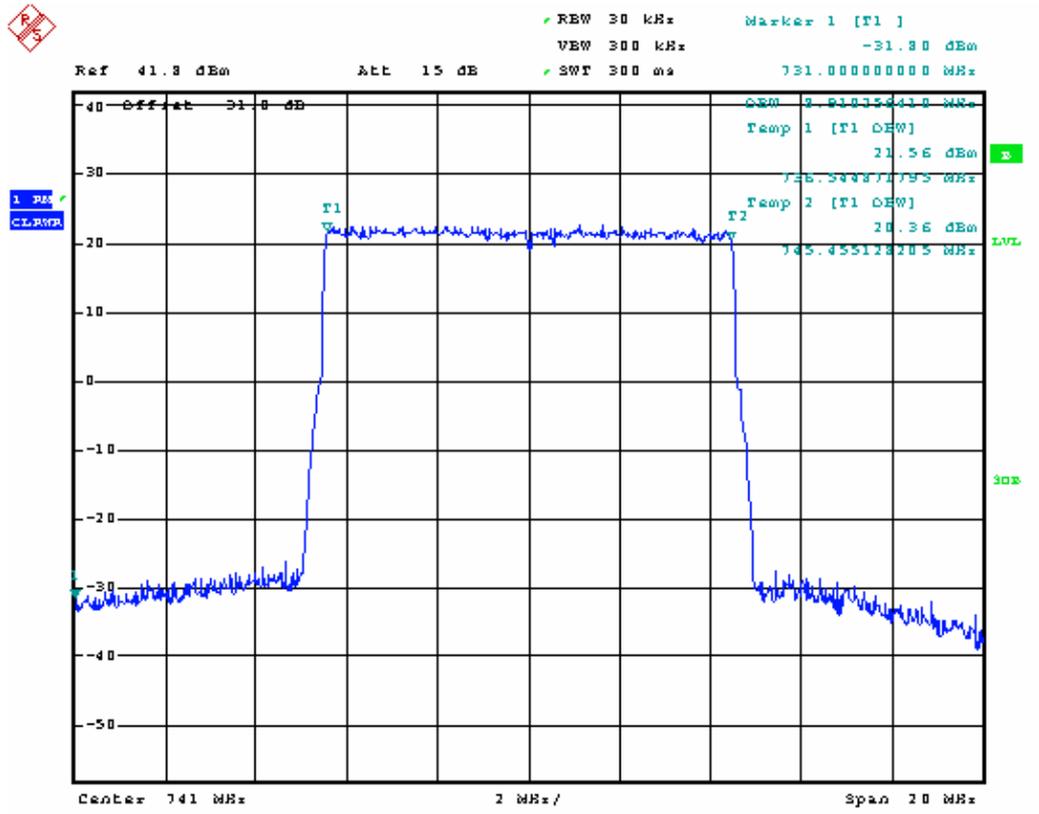




No.5090 (M)
737MHz

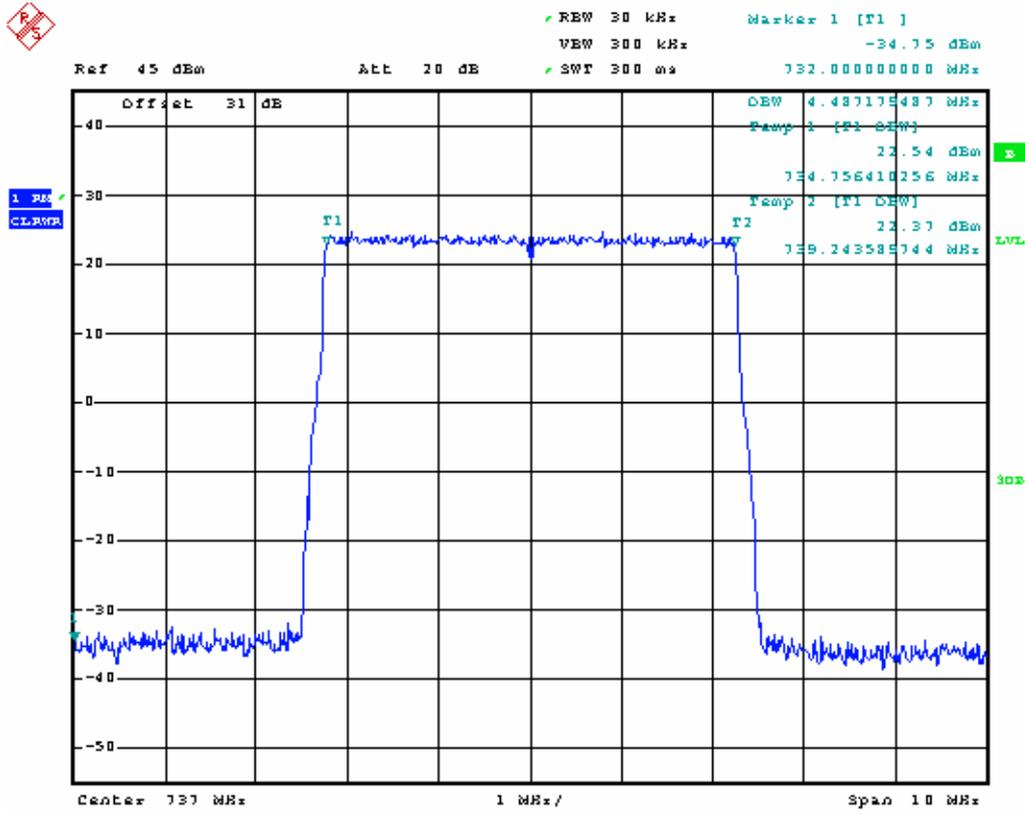


No.5130 (T)
741MHz

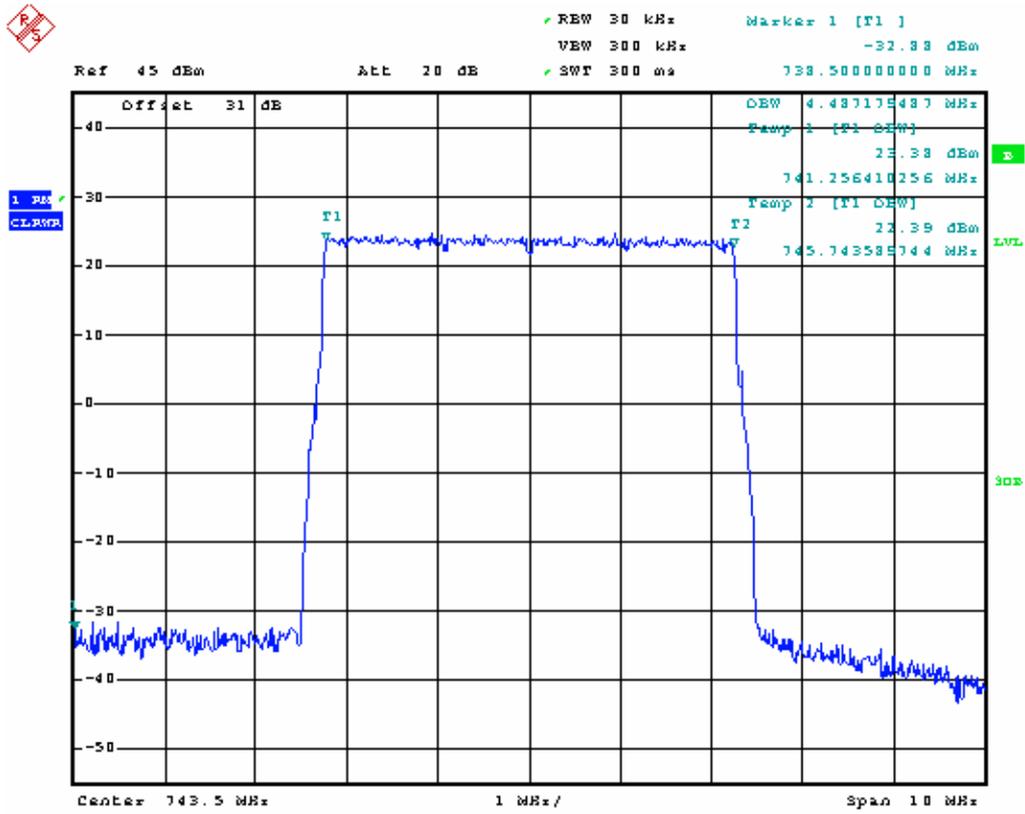




No.5090 (M)
737MHz



No.5155 (T)
743.5MHz





Appendix C

Band Edge Measurement

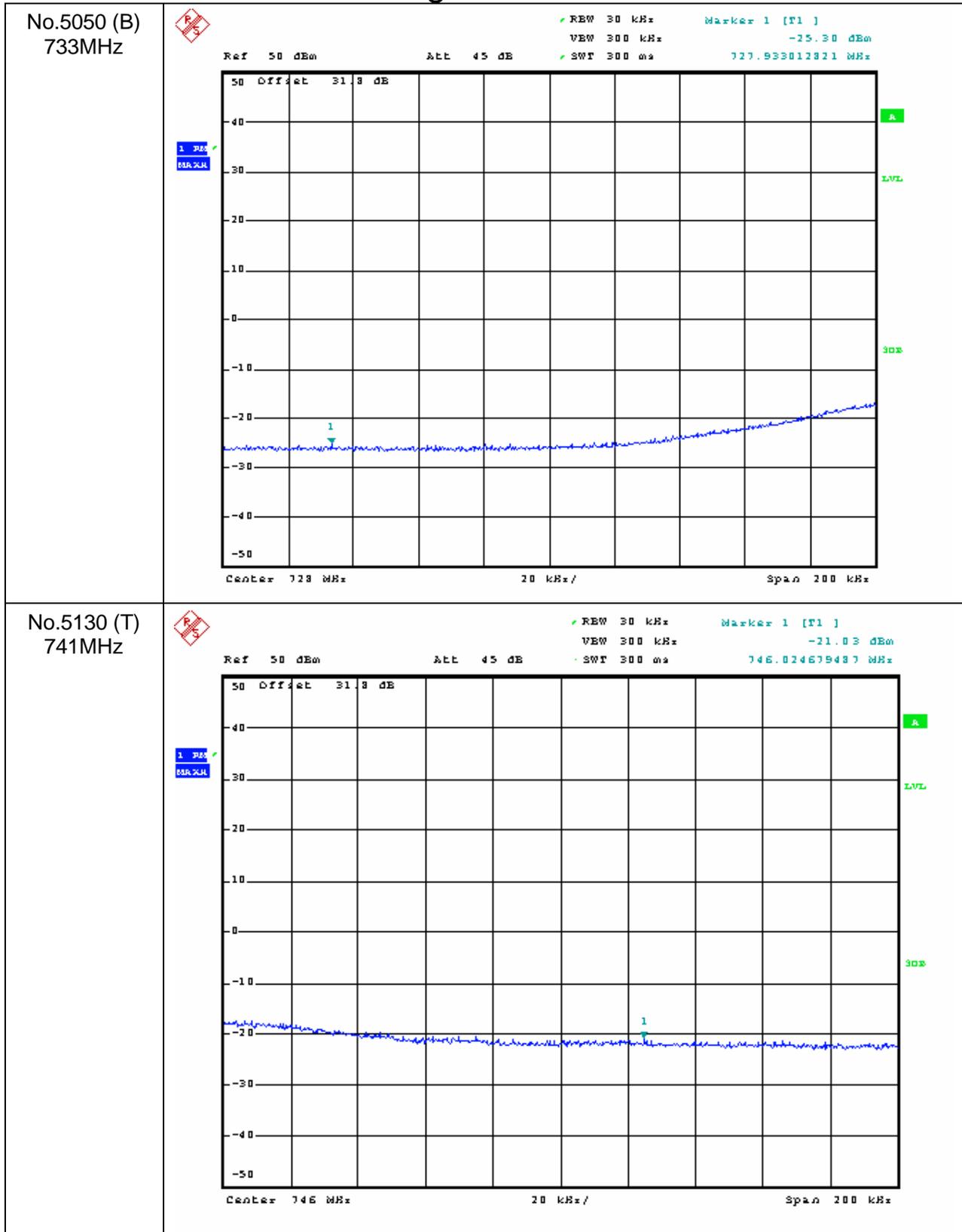
According to FCC part 2.1051 and part 27.53(g)



CHANNEL BANDWIDTH: 10M

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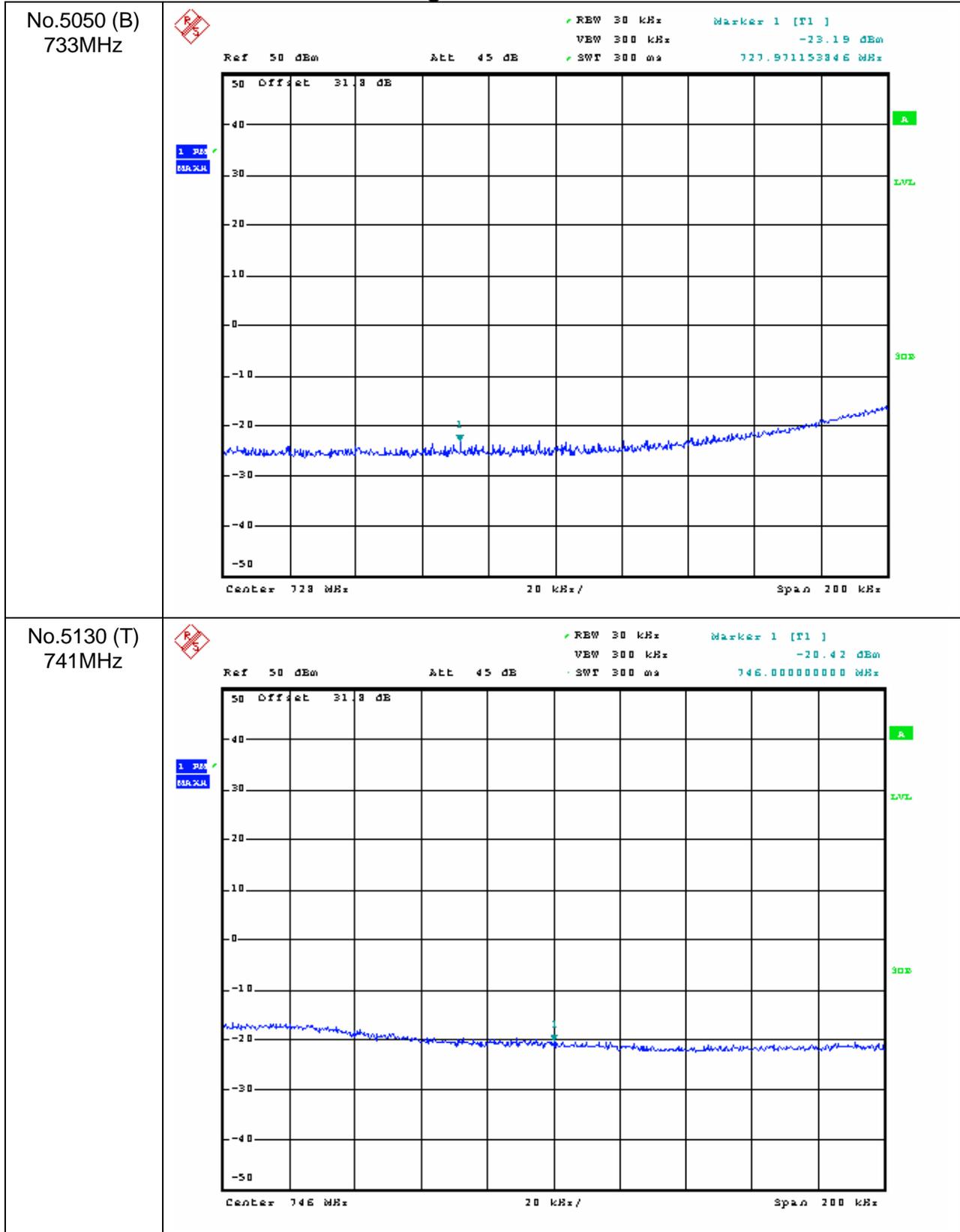
Single Carrier





TM1.2:

Single Carrier

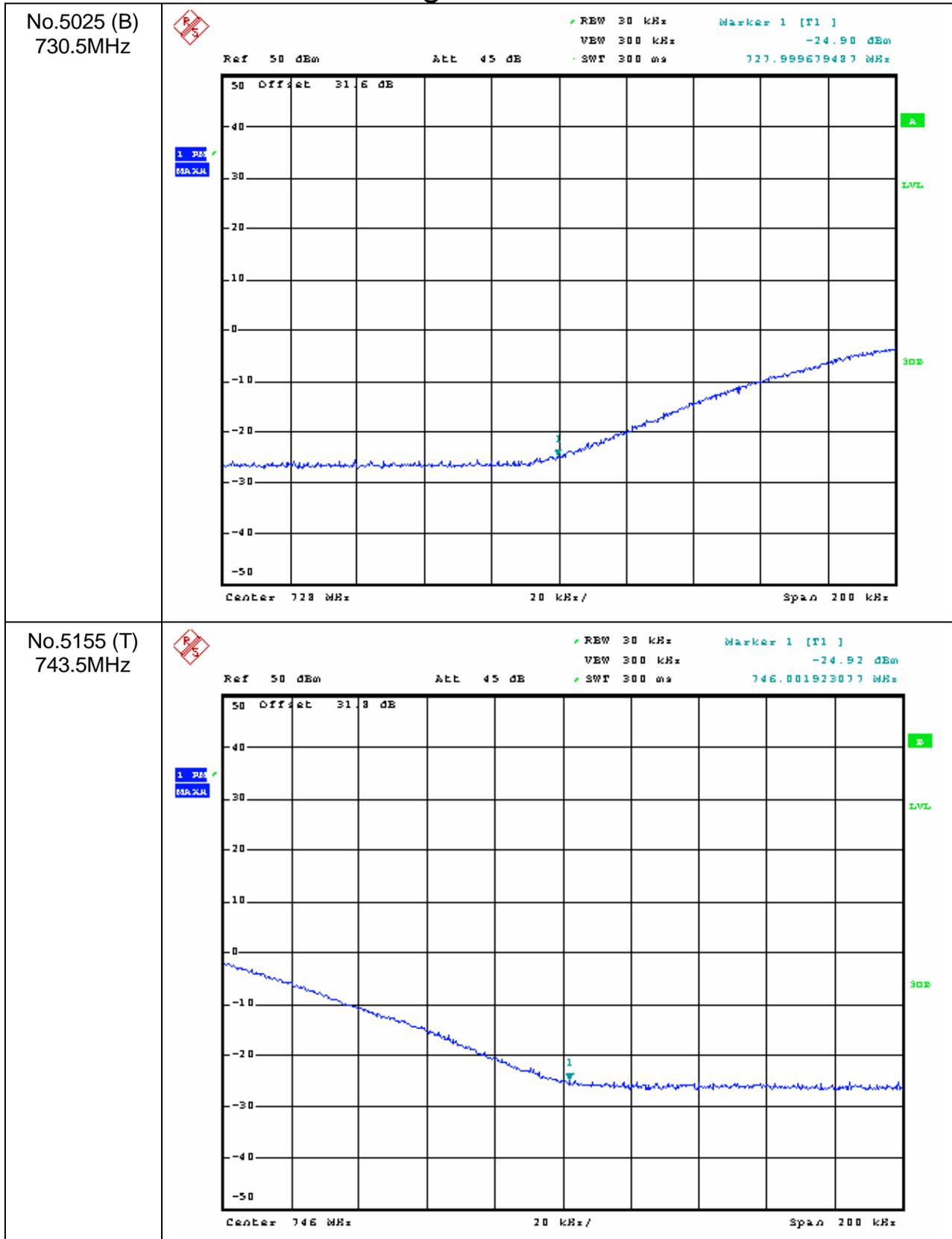




CHANNEL BANDWIDTH: 5M

TM1.1:

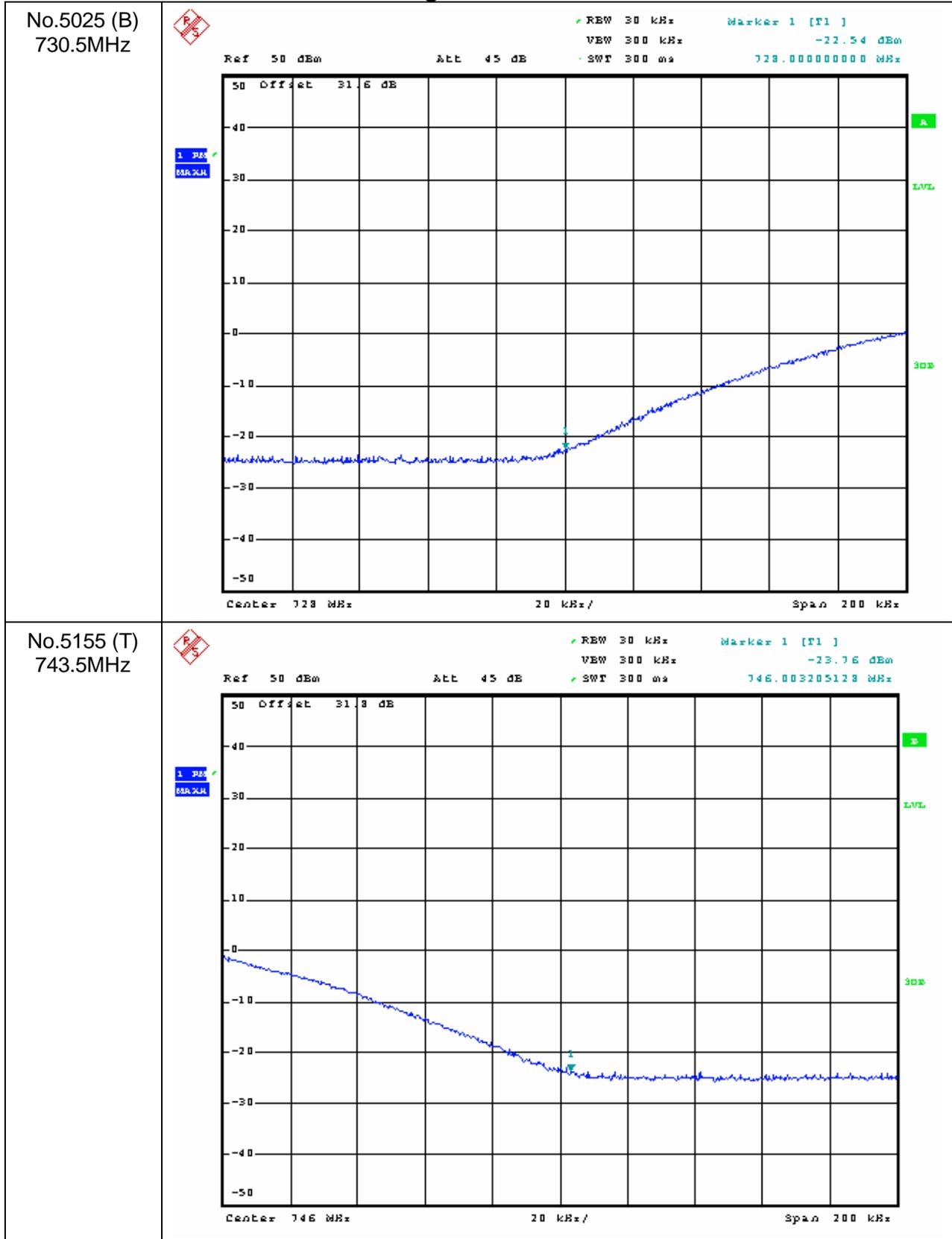
Single Carrier





TM1.2:

Single Carrier





Appendix D

Spurious Emission at Antenna Terminal Measurement

According to FCC part 2.1051 and part 27.53(g)

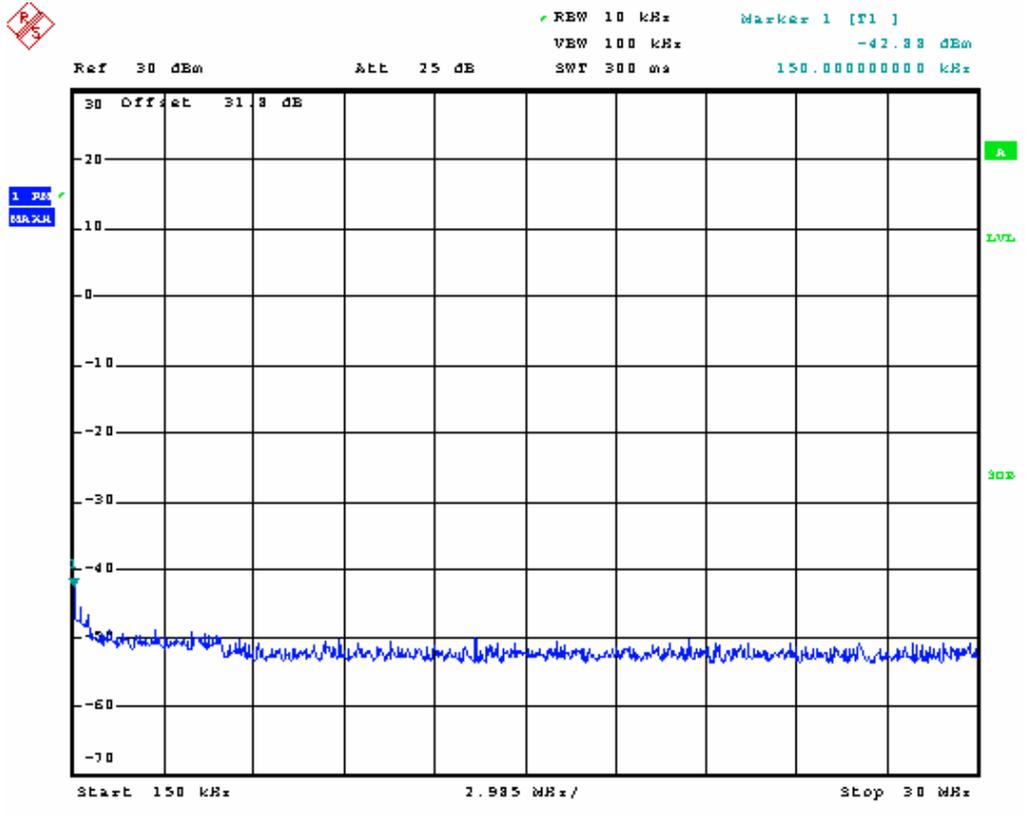
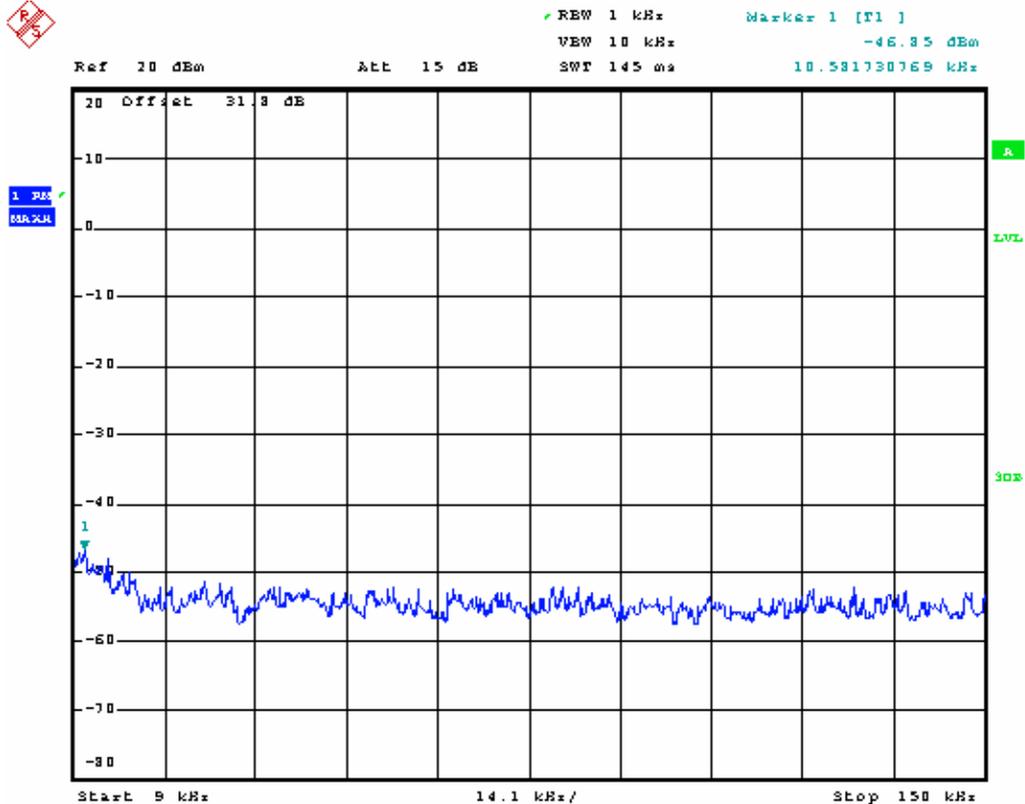


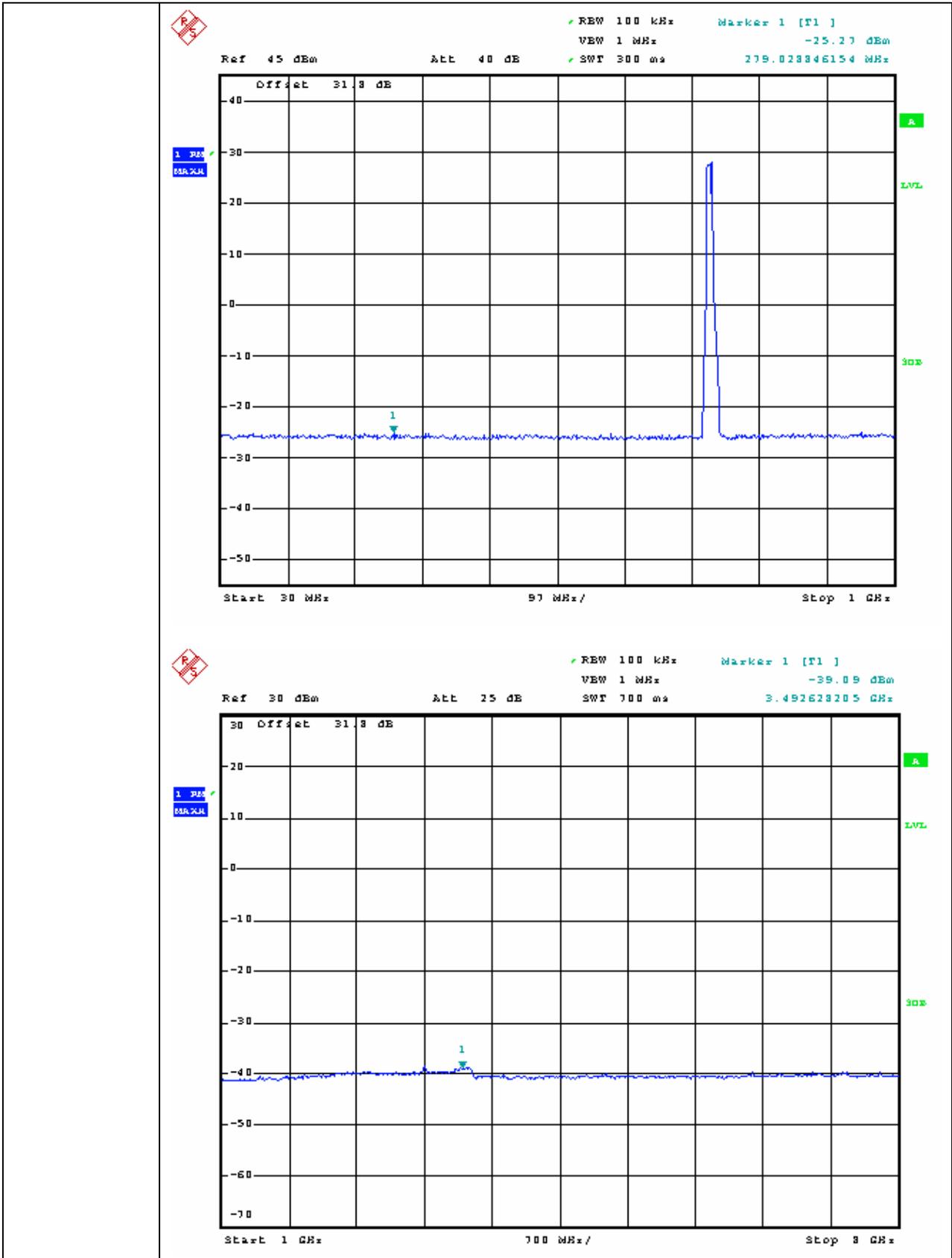
CHANNEL BANDWIDTH: 10M

TM1.1:

Single Carrier

No.5050 (B)
733MHz



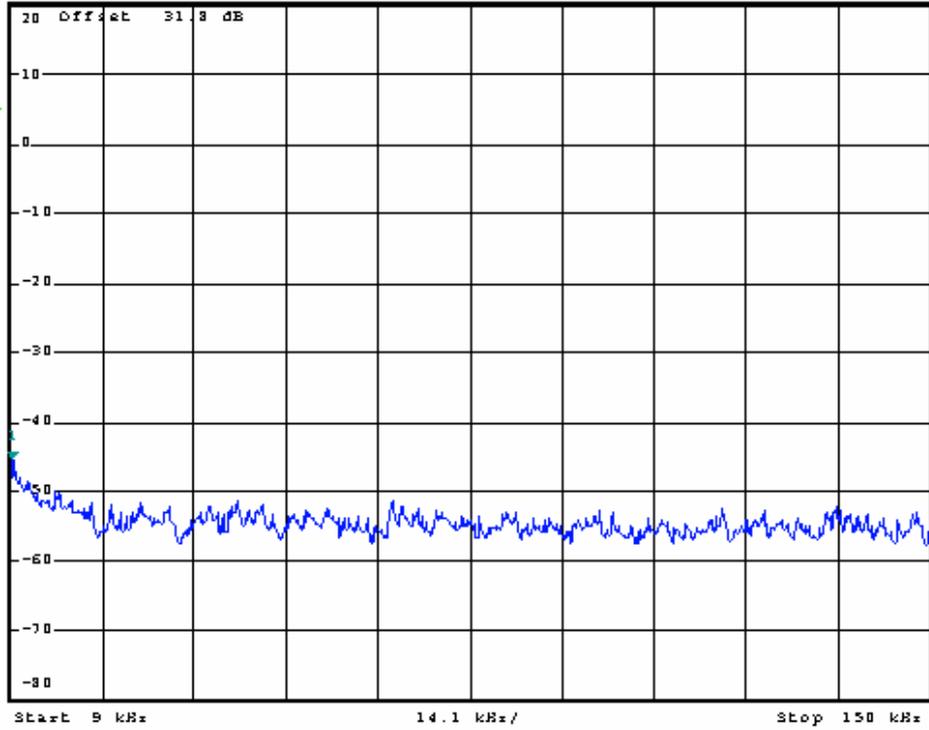




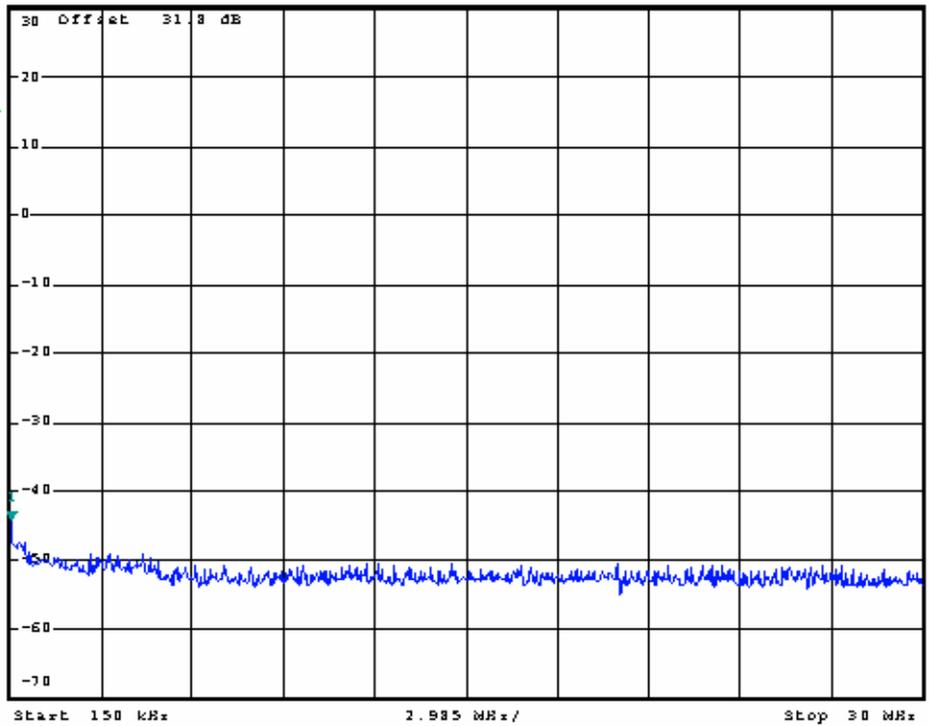
No.5090 (M)
737MHz

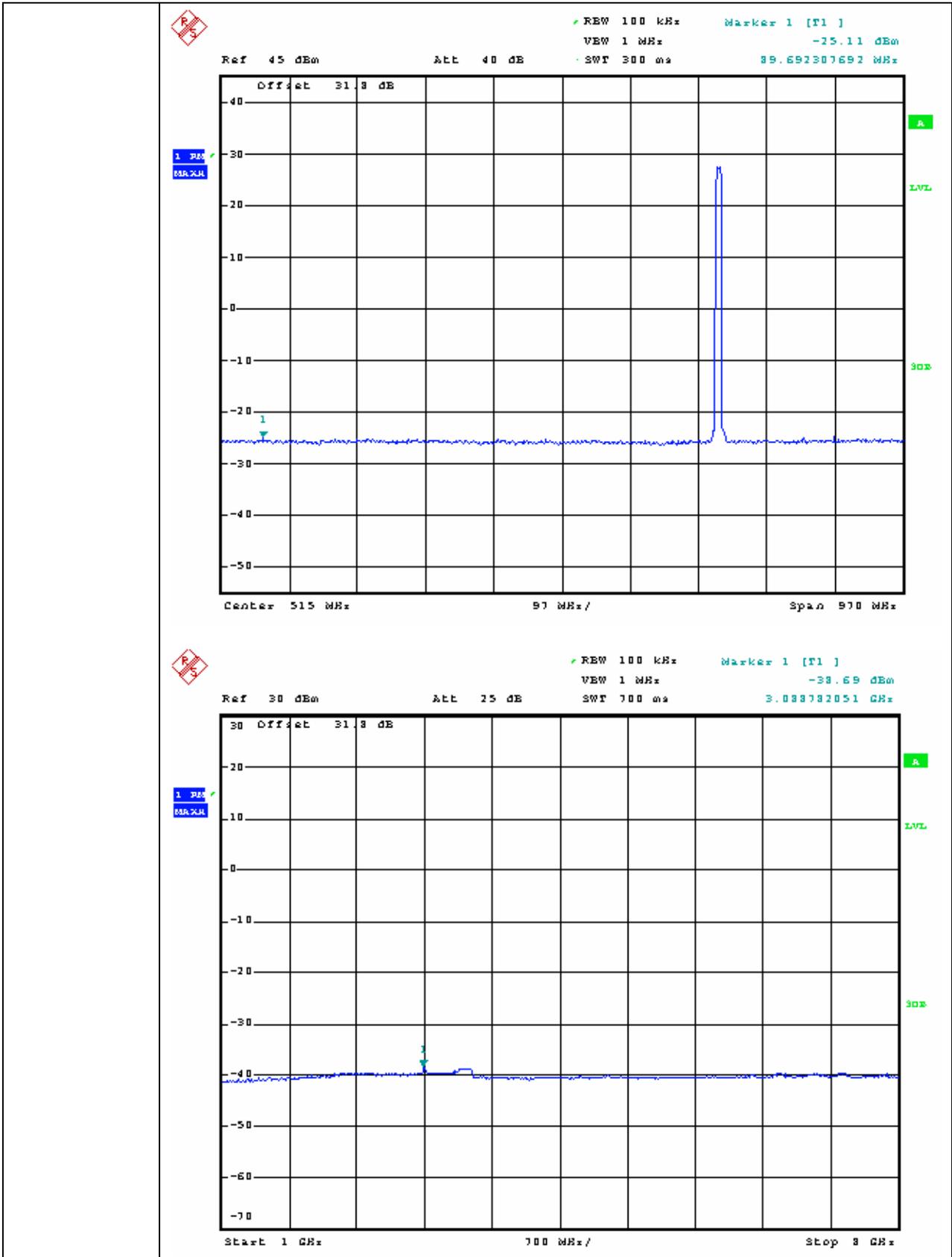


Ref 20 dBm Att 15 dB SWT 145 ms Marker 1 [T1] -45.59 dBm
9.225961538 kHz



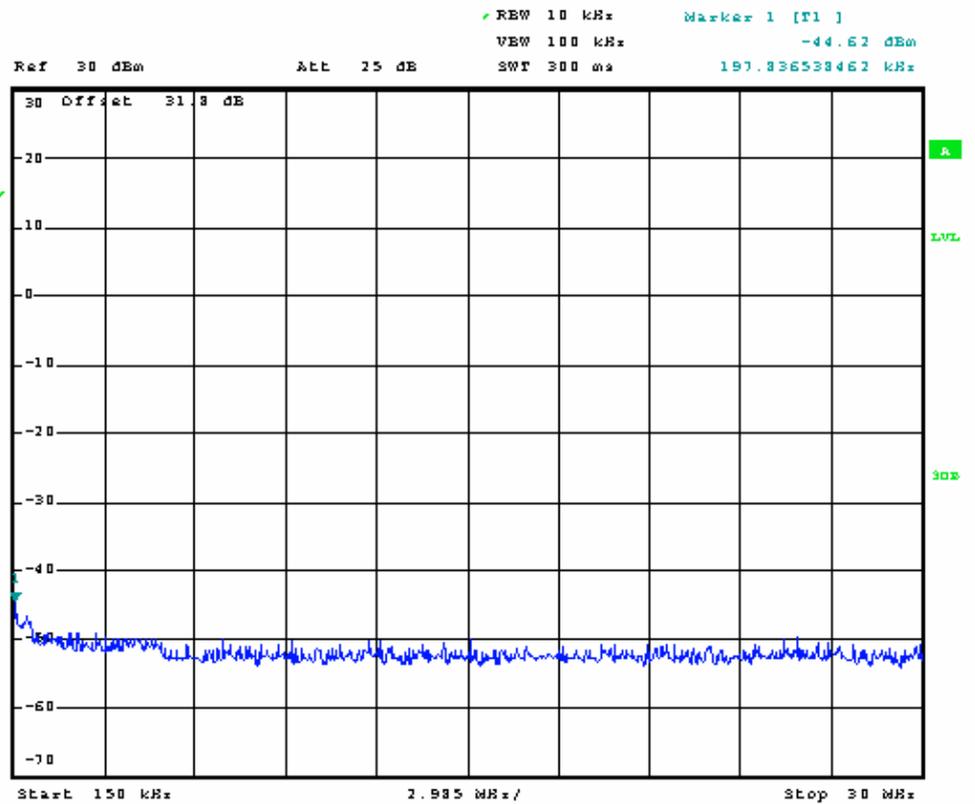
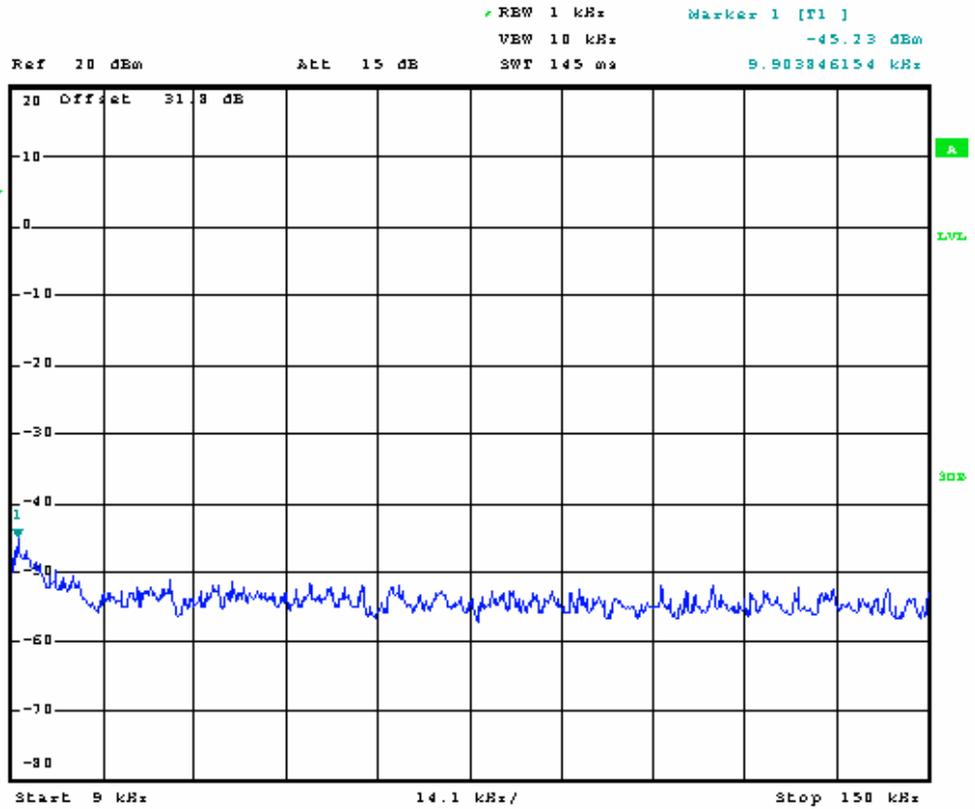
Ref 30 dBm Att 25 dB SWT 300 ms Marker 1 [T1] -44.41 dBm
197.836538462 MHz

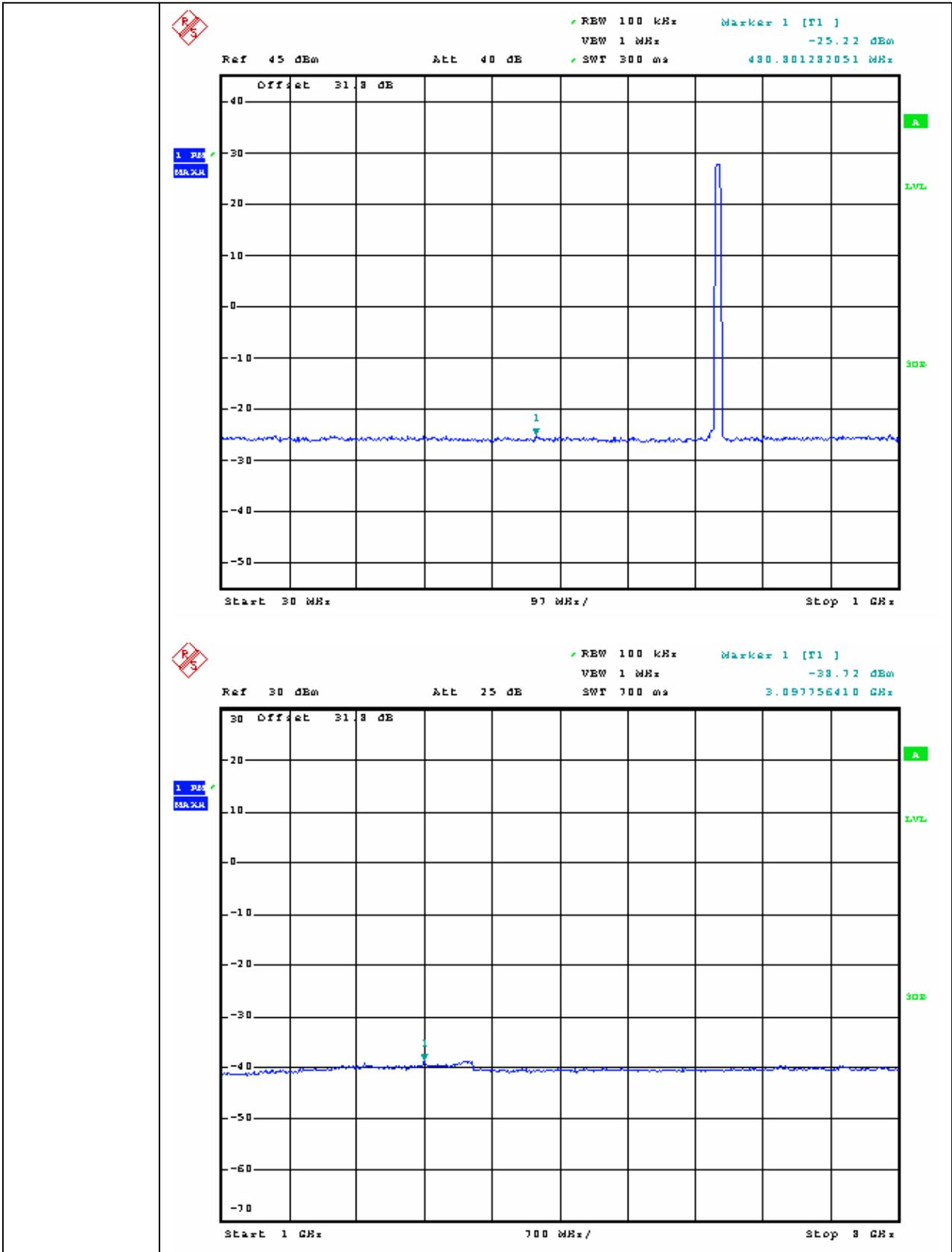






No.5130 (T)
741MHz





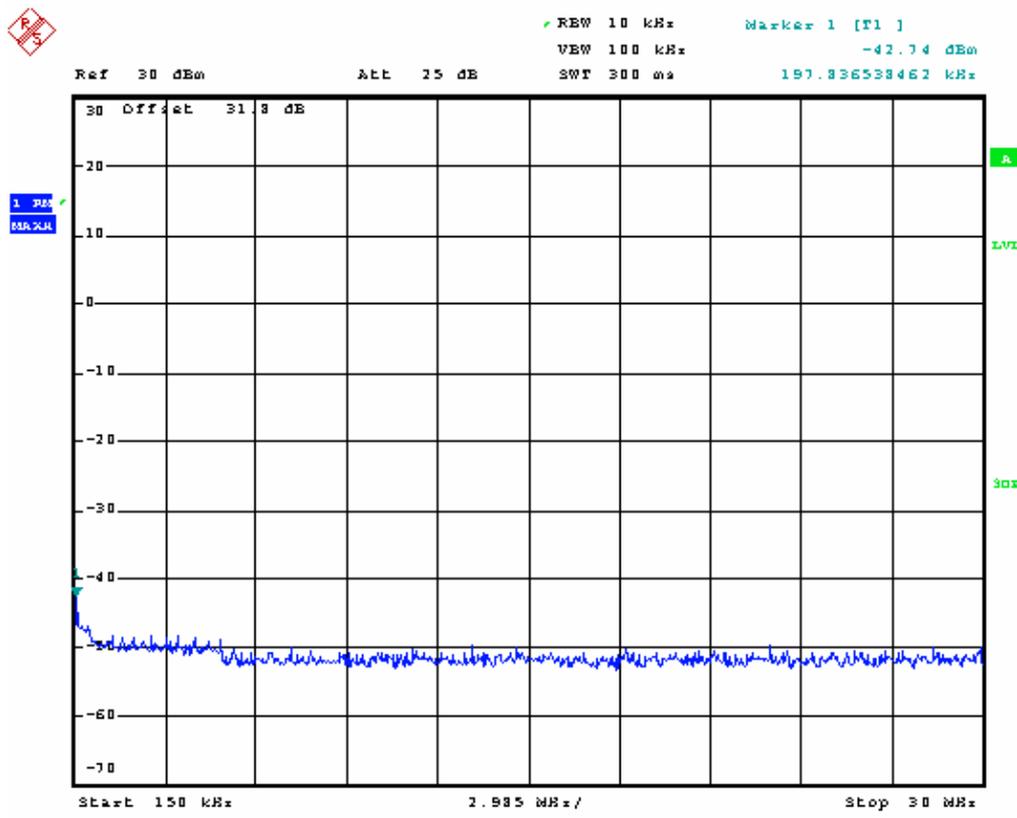
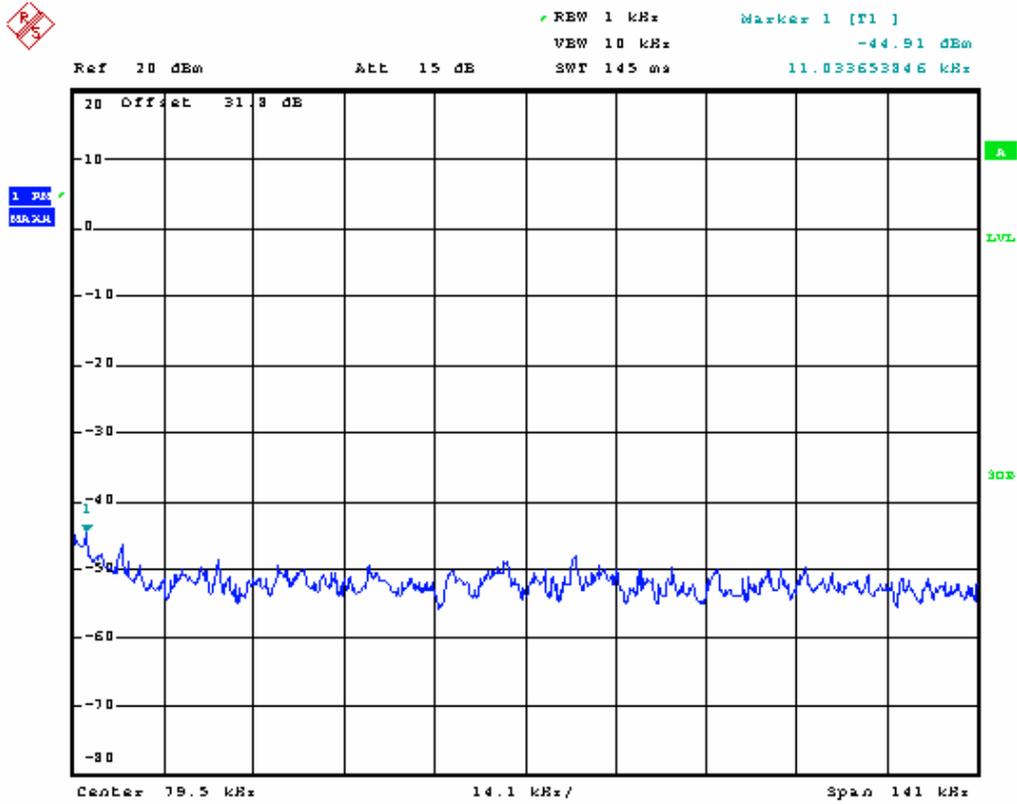


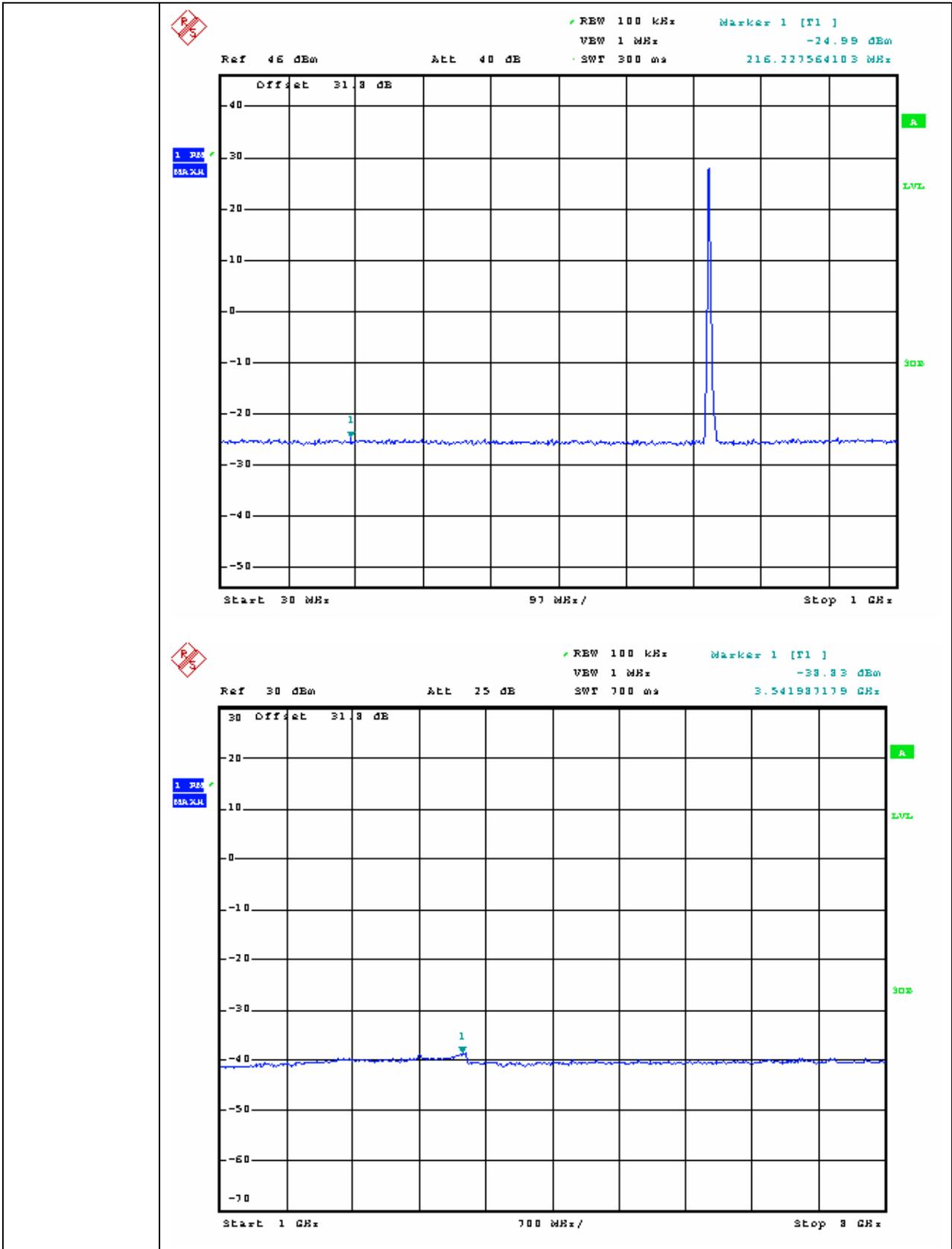
CHANNEL BANDWIDTH: 5M

TM1.1:

Single Carrier

No.5025 (B)
730.5MHz



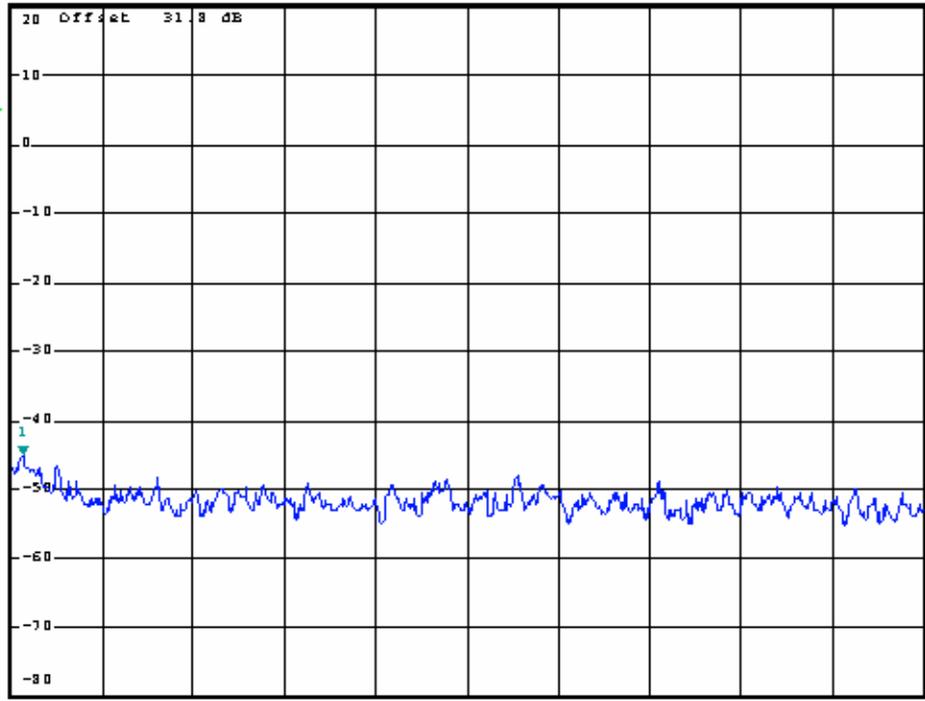




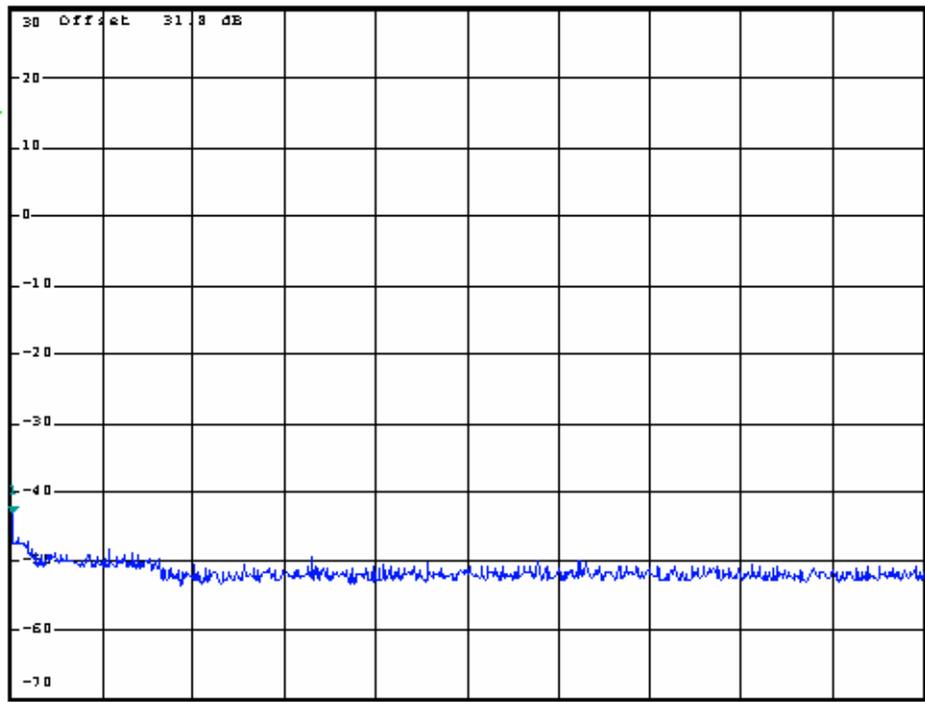
No.5090 (M)
 737MHz

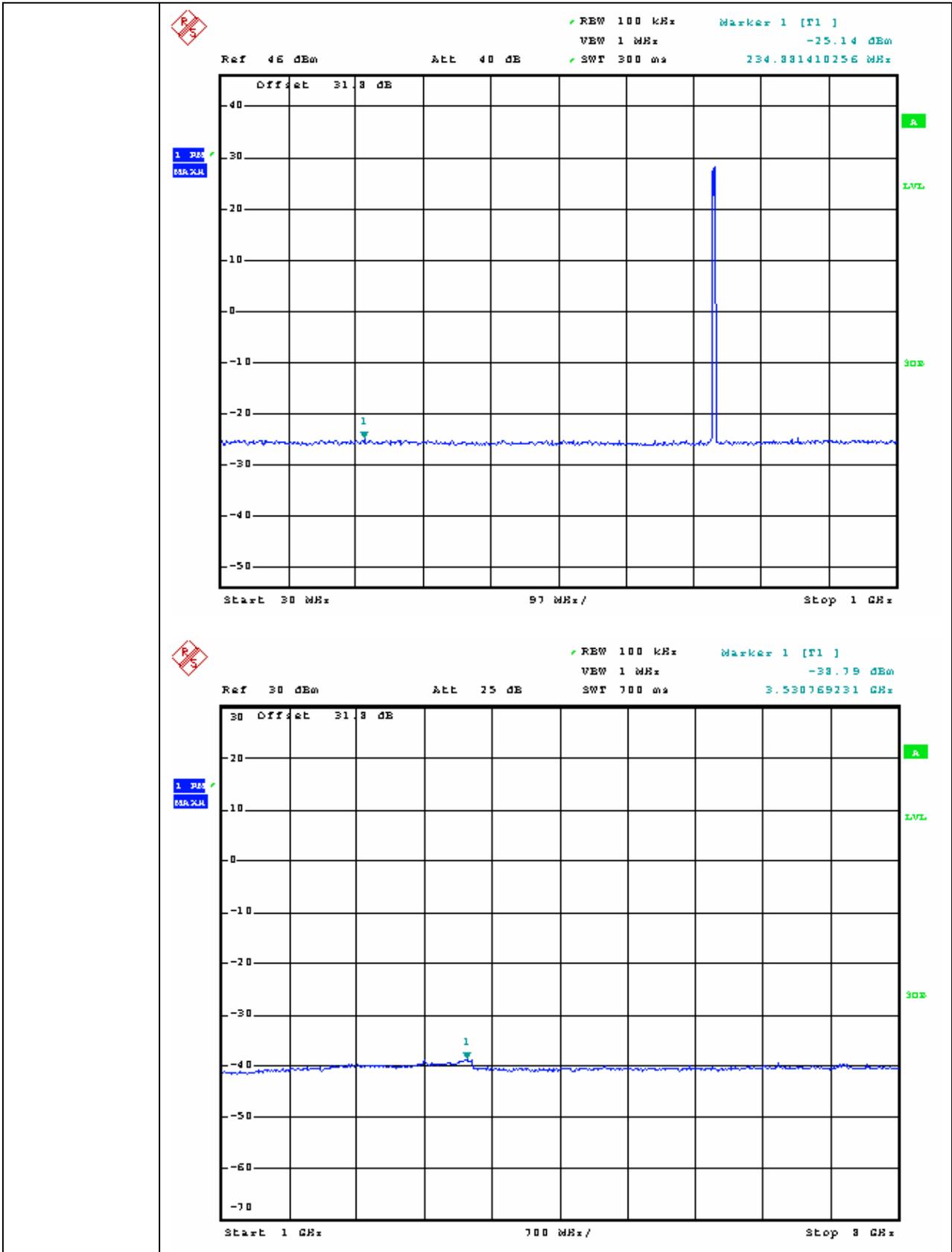


Ref 20 dBm Att 15 dB SWT 145 ms Marker 1 [T1] -45.19 dBm
 REW 1 kHz VEW 10 kHz
 10.807692308 kHz



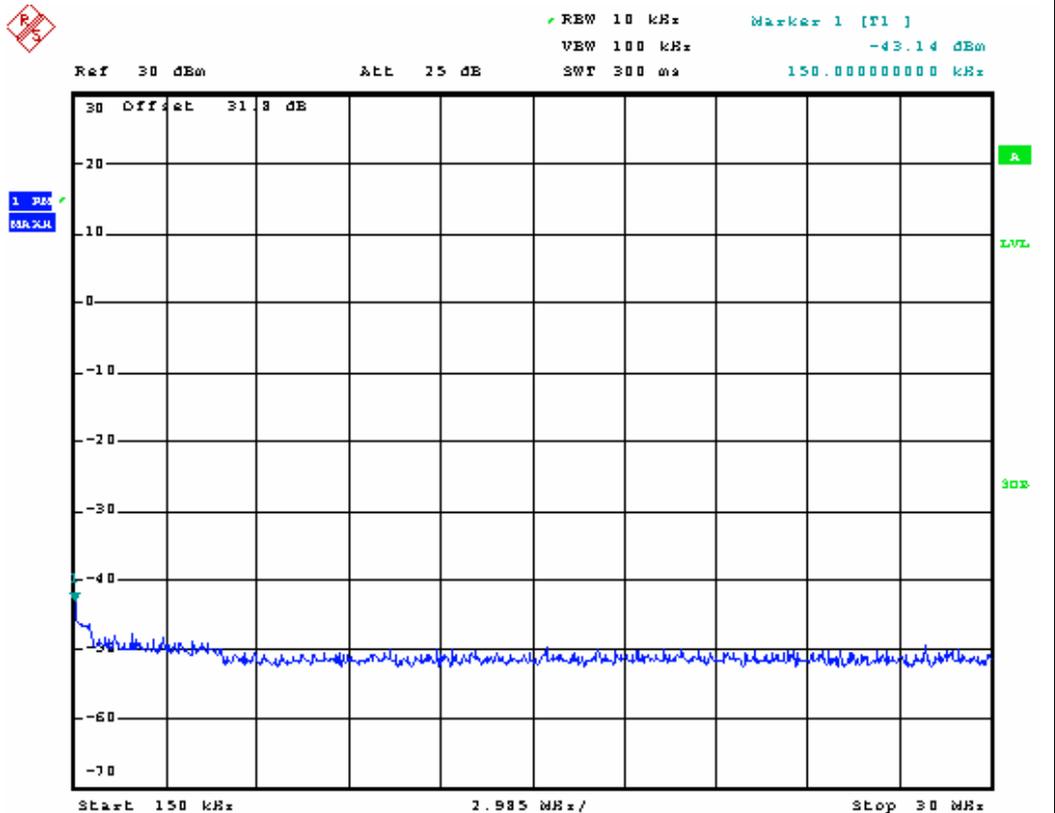
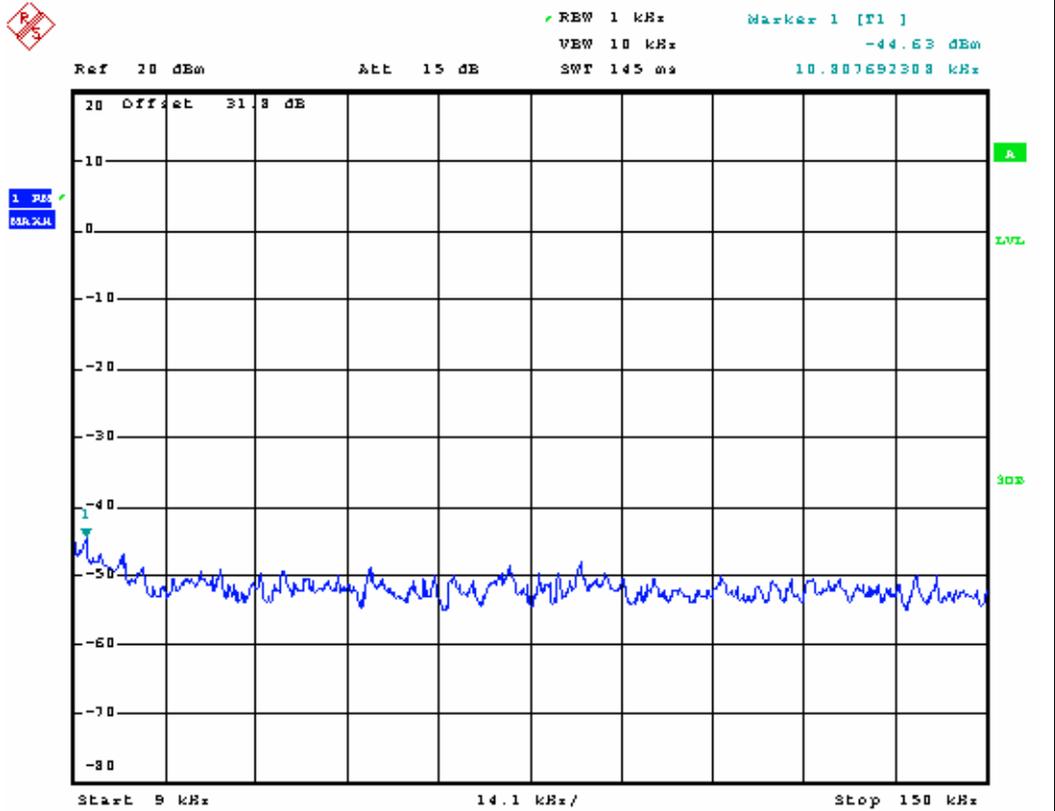
Ref 30 dBm Att 25 dB SWT 300 ms Marker 1 [T1] -43.44 dBm
 REW 10 kHz VEW 100 kHz
 197.836538462 kHz

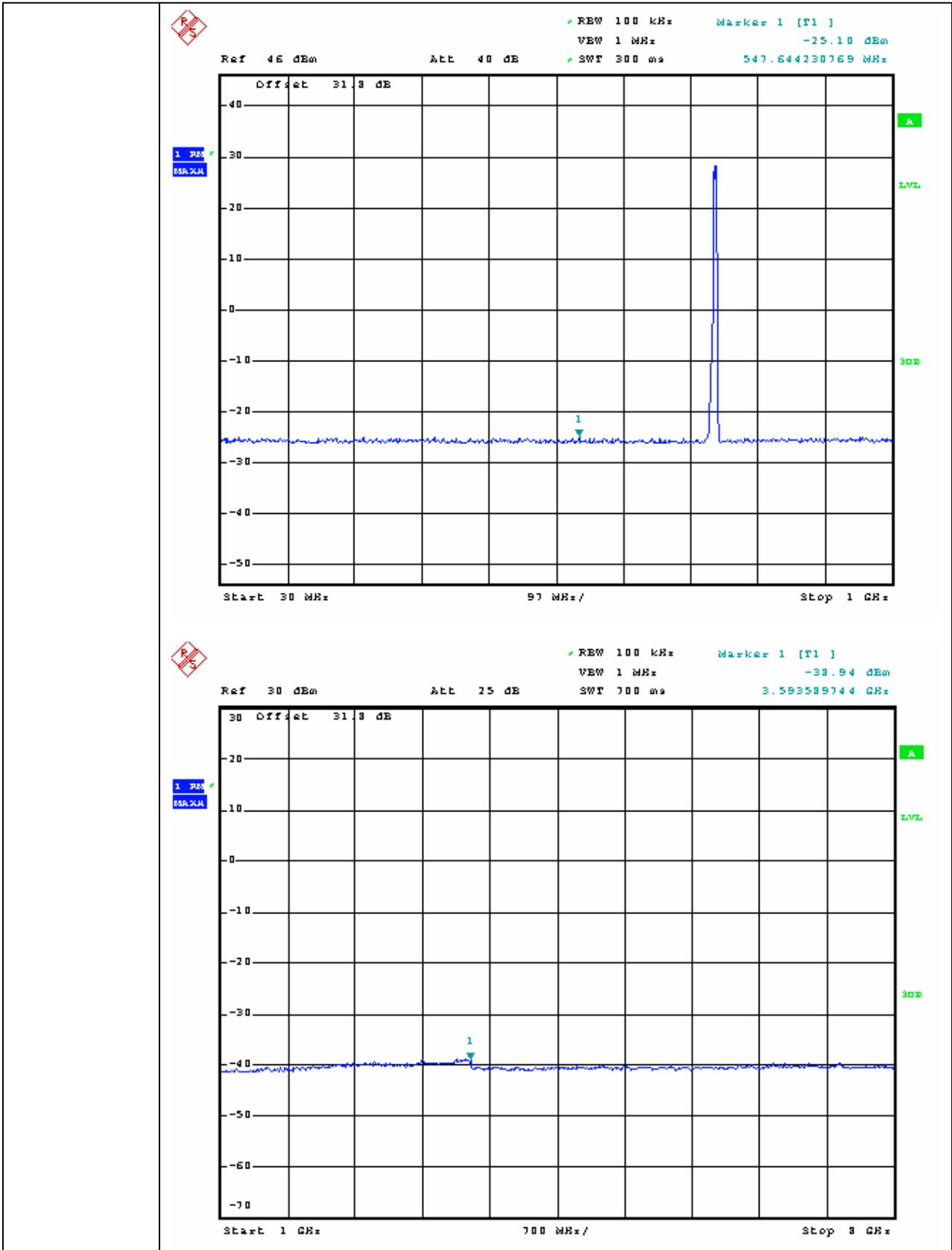






No.5155 (T)
743.5MHz







Appendix E

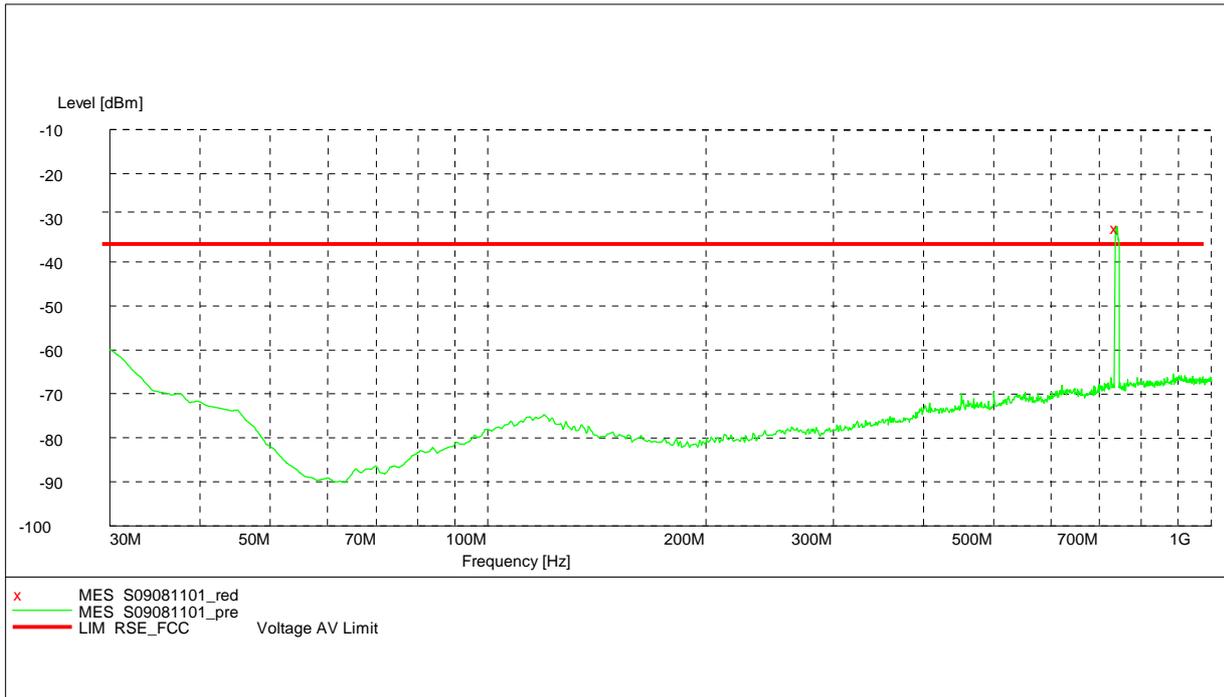
Field Strength of Spurious Radiation Measurement

According to FCC part 2.1053 and part 27.53(g)



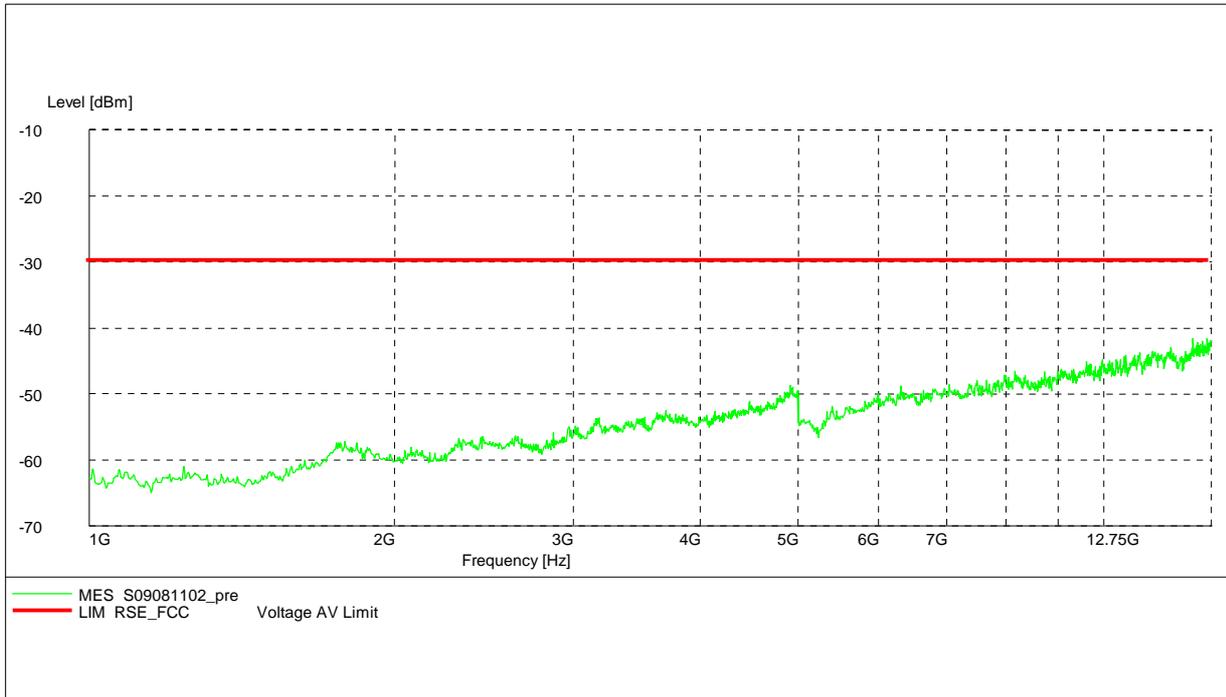
Note: a more stringent limit line than FCC required is used in this test.

Below 1GHz:





Above 1GHz:



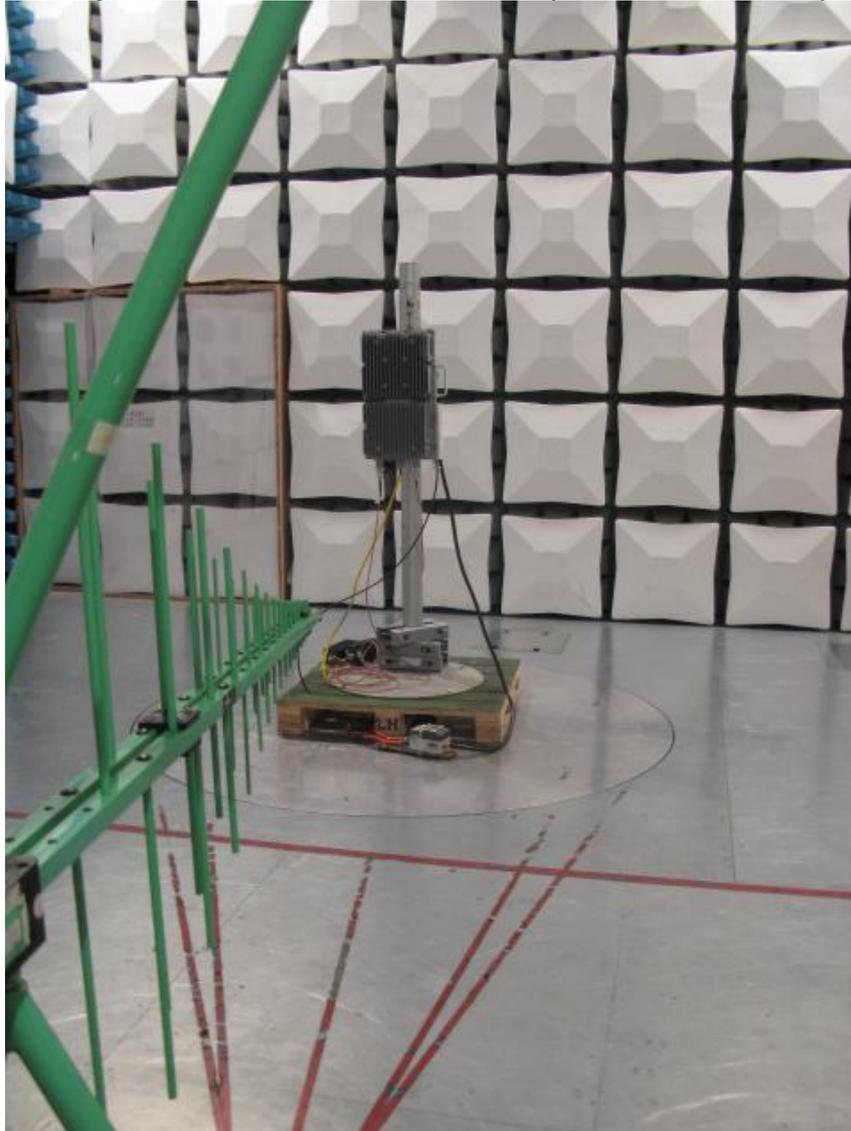


Appendix F

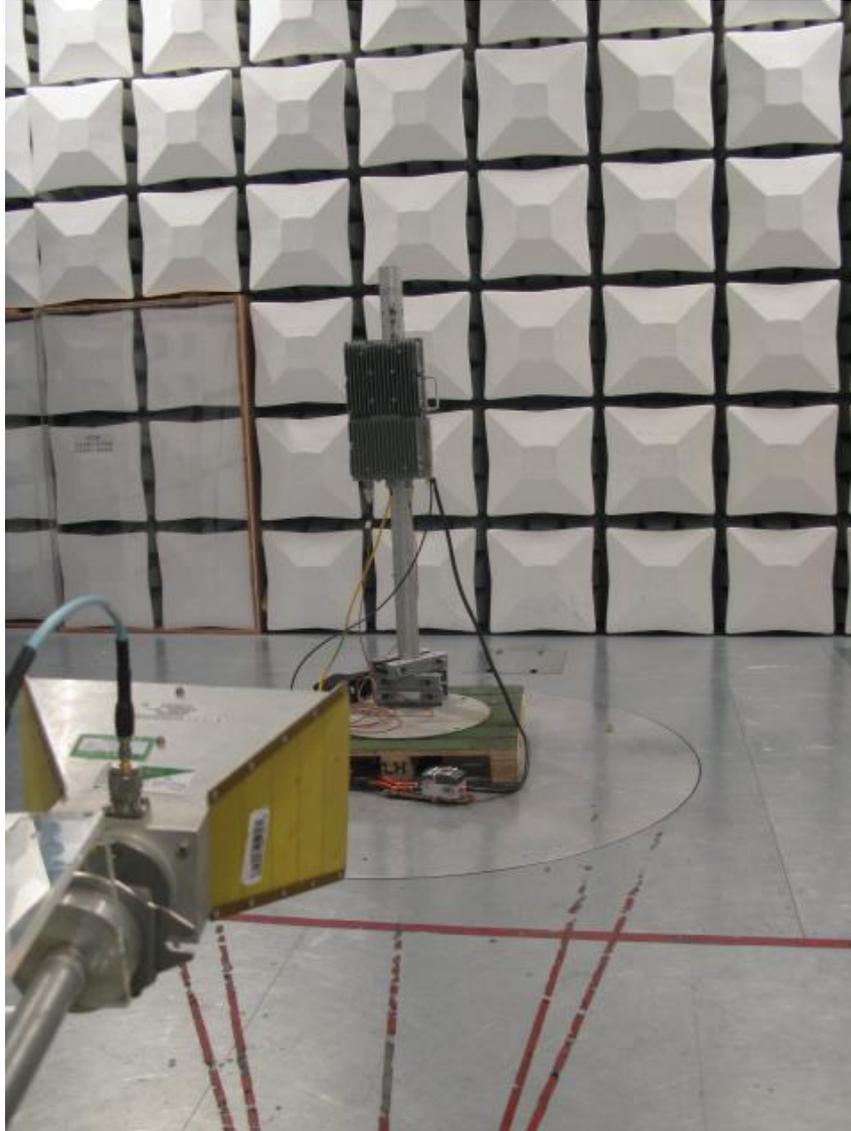
Photos of Test Setup

1. Photos for Radiated Spurious Emissions:

1) Radiated Spurious Disturbance (below 1GHz)



2) Radiated Spurious Disturbance (above 1GHz)



END