REPORT

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1002
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Date 2014-11-20 | Reference 4P06856-F27 | Page 1 (2)

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Radio measurements on RD 2242 B17 with FCC ID: TA8AKRY901326-1

(9 appendices)

Test object

Product name: RD 2242 B17
Product number: KRY 901 326/1, R1B, see appendix 1 for details.

Summary

Standard		Compliant	Appendix
FCC CFR 47			
2.1046	RF power output	Yes	2
2.1046	RF power output, radiated	Yes	3
2.1049	Occupied bandwidth	Yes	4
2.1051	Band edge	Yes	5
2.1051	Spurious emission at antenna terminals	Yes	6
2.1053	Field strength of spurious radiation	Yes	7
2.1055	Frequency stability	Yes	8

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Electronics - EMC

Performed by

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Appendix 1

Description of the test object

Radio equipment:	RD 2242 B17 Product number: KRY 901 326/1 FCC ID: TA8AKRY901326-1
Tested configuration:	LTE single RAT
Frequency bands:	TX: 734 – 745 MHz RX: 704 – 715 MHz
Antenna ports:	2 TX/RX ports, (internally connected to integrated Omni directional antenna elements)
RF configuration:	Single carrier, multi carrier,TX-diversity and MIMO 2x2
Nominal output power per antenna port:	Single carrier: 1 x 17 dBm (1 x 50mW) Multi carrier: 2 x 14 dBm (2 x 25mW)
RF power Tolerance:	±2 dB
Antenna type:	Omni directional antenna
Antenna gain:	-2.6 dBi
Channel bandwidths:	Singel carrier: 5 MHz, 10 MHz Multi carrier: 5 MHz
Modulations:	QPSK, 16QAM and 64QAM
Nominal supply voltage:	-48VDC

Operation mode during measurements

Measurements were performed with the test object transmitting test models as defined in 3GPP TS 36.141. Test model E-TM1.1 represent QPSK modulation, test model E-TM3.2 represent 16QAM modulation and test model E-TM3.1 represent 64QAM modulation.

The settings below were deemed representative for all traffic scenarios when settings with different modulations, channel bandwidths, number of carriers and RF configurations has been tested to find the worst case setting. All measurements were performed with the test object configured for maximum transmit power. The settings below were used for all measurements if not otherwise noted.

MIMO mode, single carrier: E-TM1.1
MIMO mode, multi carrier: 2 carriers E-TM1.1

Cable configurations between RD and IRU

The cables, used during tests, correspond to minimum and maximum length, according to table 8 in Exhibit 12 – Technical Circuit Description for FCC ID: TA8AKRY901326-1. The following cable configurations has been used:

RDI Cable 20m: total cabel length 20m patch cables included.

RDI Cable 52m: total cabel length 52m patch cables included.

RDI Cable 100m: total cabel length 100m patch cables included.

Patch cable	Cat 6a Schneider Electric Actassi CL-MNC6A
RDI cable	Cat 6a Schneider Electric Actassi CL-MXC6A

Conducted measurements

The conducted measurements were performed on RD 2242 B17 with product number KRY 901 326/1.

The test object was mounted in a fixture powered by the RDI LAN cable.
All TX parameters were measured at port RF B with port RF A terminated into 50 ohm. Complete measurements were made on RF B with additional measurements on RF A to verify that the ports are identical.

Radiated measurements

The test object was mounted in a fixture and powered by the RDI LAN cable. In field strength of spurios radition both RF ports were terminated into 50 ohm. For RF power output measurement the internal antenna was used.

Purpose of test

The purpose of the tests is to verify compliance to the performance characteristics specified in applicable items of FCC CFR 47.

References

Measurements were done according to relevant parts of the following standards:

3GPP TS 36.141, version 11.4.0
ANSI 63.4-2009
ANSI/TIA/EIA-603-C-2004
CFR 47 part 2, December 16th , 2013
CFR 47 part 27, December 16th, 2013

Measurement equipment

	Calibration Due	SP number
Test site Tesla	2017-01	503 881
R&S ESU 26	2015-05	901 553
R&S ESI 26	2015-07	503 292
R&S FSQ 40	2015-07	504 143
R&S FSW 43	2015-07	902 073
R&S FSIQ 40	2015-07	503 738
Control computer with R&S software EMC32 version 8.52.0	-	503 899
High pass filter	2015-01	BX40074
High pass filter	2015-07	901 501
High pass filter	2015-07	901 502
High pass filter	2015-07	504 199
High pass filter	2015-07	901 373
High pass filter	2016-07	503 739
High pass filter	2015-07	503 740
RF attenuator	2016-07	503 248
RF attenuator	2016-06	503 249
RF attenuator	2015-08	504 159
RF attenuator	2015-07	900 233
RF attenuator	2015-06	901 384
RF attenuator	2014-11	901 508
Chase Bilog Antenna CBL 6111A	2014-10	503 182
EMCO Horn Antenna 3115	2016-09	502 175
µComp Nordic, Low Noise Amplifier	2015-01	901 545
Flann STD Gain Horn Antenna 16240-25	-	503 939
Flann STD Gain Horn Antenna 18240-25	-	503 900
Flann STD Gain Horn Antenna 20240-20	-	503 674
Miteq, Low Noise Amplifier	2015-08	503 285
Schwarzbeck preamplifier BBV 9742	2015-01	504 085
Temperature and humidity meter, Testo 635	2015-03	504 203
Temperature and humidity meter, Testo 625	2015-06	504 188
Temperature Chamber	-	503 360
Multimeter Fluke 87	2015-08	502 190

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP-QD 10885”. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence).
Compliance evaluation is based on a shared risk principle with respect to the measurement uncertainty.

Reservation

The test results in this report apply only to the particular test object as declared in the report.

Delivery of test object

The test object was delivered 2014-10-15.

Manufacturer’s representative

Christer Gustavsson, Ericsson AB.

Test engineers

Andreas Johnson, Tomas Lennhager, Maulo Rivera, Tomas Isbring, Patric Augustsson, Jörgen Wassholm and Rolf Kühn, SP.

Test participants

David Travis and Berkin Can, Ericsson AB.

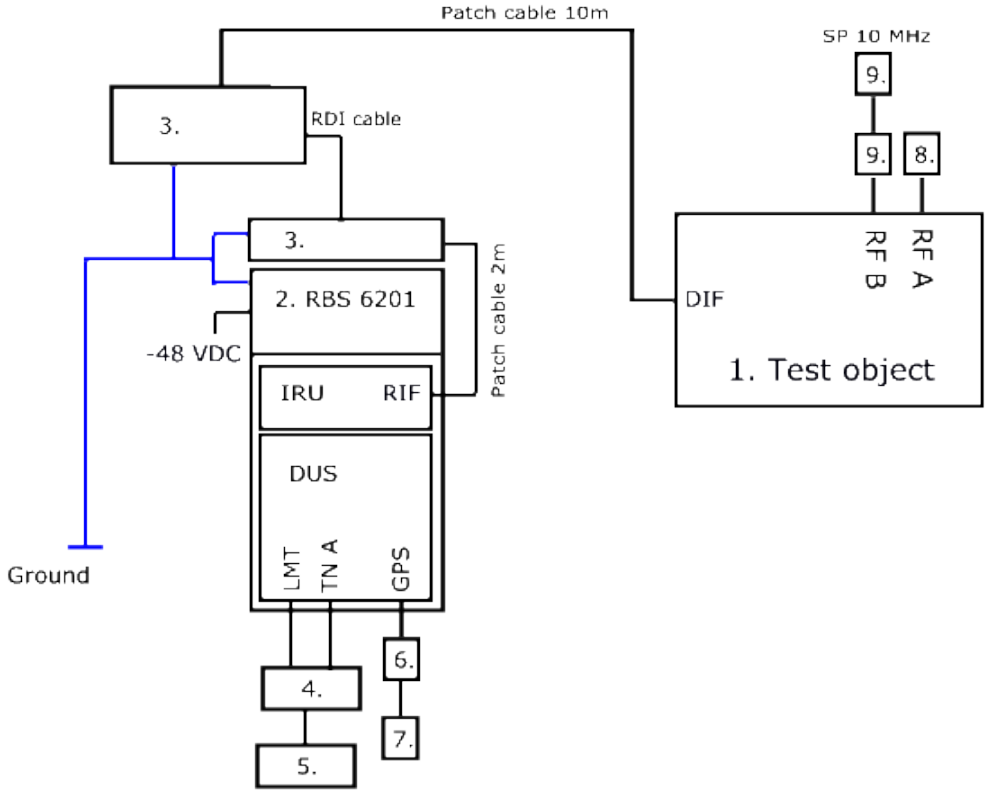
Test frequencies during measurements

EARFCN Downlink	Frequency [MHz]	BW [MHz]	Symbolic name	Comment
5755	736.5	5	B5	TX bottom frequency 5 MHz BW configuration
5780	739.0	10	B10	TX bottom frequency 10MHz BW configurations
5785	739.5	5	M5	TX mid frequency 5MHz BW configurations
5785	739.5	10	M10	TX mid frequency 10MHz BW configurations
5815	742.5	5	T5	TX top frequency 5 MHz BW configuration
5790	740.0	10	T10	TX top frequency 10MHz BW configurations
5755 5805	736.5 741.5	5 5	2B5	2 carrier TX bottom frequency 5 MHz BW configuration.
5760 5810	737.0 742.0	5 5	2M5	2 carrier TX mid frequency 5 MHz BW configuration.
5765 5815	737.5 742.5	5 5	2T5	2 carrier TX top frequency 5 MHz BW configuration.

All RX frequencies were configured 30 MHz below the corresponding TX frequency according the applicable duplex offset for the operating band.

Appendix 1

Test setup conducted measurements



Test object

1.	RD 2242 B17, KRY 901 326/1, revision R1B, s/n: C828326007 software CXP901 3268/14, revision R59BK with FCC ID: TA8AKRY901326-1

Associated equipment:

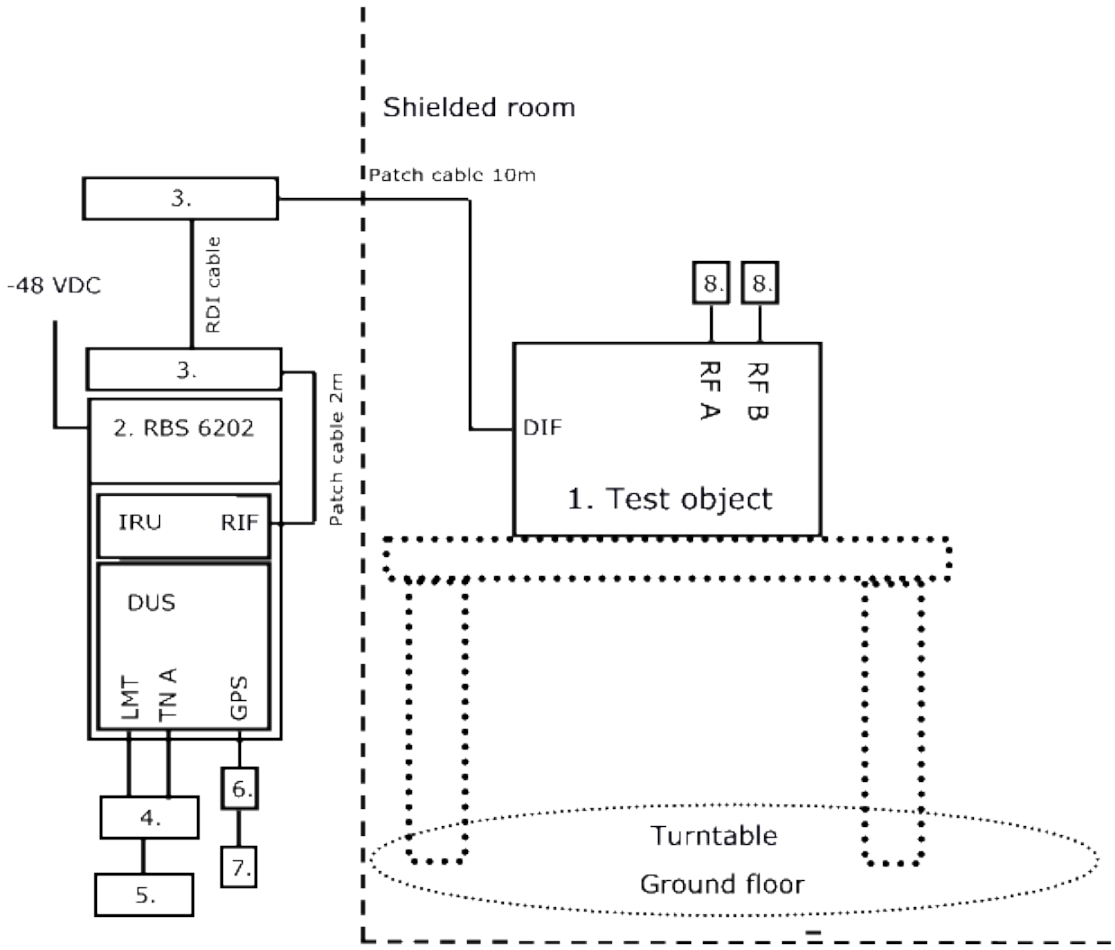
2.	RBS 6201: DUS 41 01, KDU 137 624/1, revision R5A/A, s/n: D16G937758 IRU 2242, KRC 161 444/1, revision R1B, s/n: C828361595
3.	Patch panel, BGK 901 55/1, revision R1A, s/n: -
6.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K474887
7.	GPS Active Antenna, KRE 101 2082/1

Functional test equipment

4.	Switch Netgear GSM 7224, BAMS – 1001356228
5.	Laptop EliteBook 8540w, BAMS – 1001052032
8.	Attenuator/ Terminator 50 ohm
9.	SP test instrument according measurement equipment list

Appendix 1

Test setup radiated measurements



Test object:

1.	RD 2242 B17, KRY 901 326/1, revision R1B, s/n: C828326007 with software: CXP901 3268/14, revision R59BK FCC ID: TA8AKRY901326-1

Associated equipment:

2.	RBS 6202: DUS 41 01, KDU 137 624/1, revision R5A/A, s/n: D16G937758 IRU 2242, KRC 161 444/1, revision R1B, s/n: C828361595
3.	Patch panel, BGK 901 55/1, revision R1A, s/n: -
6.	GPS 02 01, NCD 901 41/1, revision R1D, s/n: TU8K388084
7.	GPS Active Antenna, KRE 101 2082/1

Functional test equipment:

4.	Switch Netgear GSM 7224, BAMS – 1001356228
5.	Laptop EliteBook 8540w, BAMS – 1001052032
8.	Attenuator/ Terminator 50 ohm

Appendix 1

Interfaces:	**Type of port:**
Antenna port (A), hirose connector	Antenna
Antenna port (B), hirose connector	Antenna
DIF, Patch cable Cat 6a Schneider Electric Actassi CL-MNC6A	Signal
RDI, Cat 6a Schneider Electric Actassi CL-MXC6A	Signal

RBS software:

Product number	**Revision**
CXP 102 051/22	R34X

RF power output measurements according to CFR 47 §27.50

Date	Temperature	Humidity
2014-10-17	18 °C ± 3°C	40 % ± 5%
2014-10-21	22 °C ± 3°C	38 % ± 5%
2014-10-29	23 °C ± 3°C	45 % ± 5%

Test set-up and procedure

The test object was connected to a signal analyser measuring peak and RMS output power in CDF mode. A resolution bandwidth of 80 MHz was used.

Measurement equipment	SP number
R&S FSW	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 1.1 dB

Results

Configuration: RDI Cable 20m

MIMO mode, single carrier
Rated output power level at RF connector 1x 17 dBm.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power[1)]
5	B5	16.98/ 6.82	17.18/ 6.86	20.09
5	M5	16.94/ 6.86	16.83/ 6.84	19.90
10	M10	16.93/ 6.86	17.36/ 6.88	20.16
5	T5	16.71/ 6.88	16.37/ 6.90	19.55

[1)]: Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.
Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, multi Carrier
Rated output power 2 x 14.0 dBm per RF port.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	2B5	16.92	17.02	19.98
5	2T5	16.77	16.89	19.84

[1)]: Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.

Single carrier, MIMO

Output power per 1 MHz				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	B5	11.07	11.24	14.24
5	M5	11.13	11.06	14.13
10	M10	8.10	8.22	11.22
5	T5	11.22	10.96	14.22

[1)]: Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). "Measure and add 10 log(N_{Ant})".

Configuration: RDI Cable 52m

MIMO mode, single carrier
Rated output power level at RF connector 1x 17 dBm.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power[1)]
5	B5	16.71/ 6.80	16.93/ 6.84	19.83
5	M5	16.68/ 6.82	16.86/ 6.86	19.78
10	M10	16.66/ 6.84	16.88/ 6.88	19.78
5	T5	16.60/ 6.86	16.56/ 6.90	19.59

[1)]: Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.
Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, multi Carrier
Rated output power 2 x 14.0 dBm per RF port.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	2B5	16.44	16.79	19.63
5	2T5	16.28	16.58	19.44

[1)]: Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.

Appendix 2

Single carrier, MIMO

Output power per 1 MHz				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	B5	10.82	11.19	14.19
5	M5	10.89	10.61	13.89
10	M10	8.21	8.21	11.21
5	T5	10.98	10.96	13.98

1): Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). "Measure and add 10 log(N_{Ant})".

Configuration: RDI Cable 100m

MIMO mode, single carrier
Rated output power level at RF connector 1x 17 dBm.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm/ PAR dB]		
		Port RF A	Port RF B	Total power[1)]
5	B5	16.10/ 6.80	16.27/ 6.84	19.20
5	M5	16.04/ 6.82	16.49/ 6.86	19.28
10	M10	16.20/ 6.86	16.47/ 6.88	19.35
5	T5	16.02/ 6.84	16.23/ 6.90	19.14

1): Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.
Note: The PAR value is the 0.1 % Peak to Average Ratio.

MIMO mode, multi Carrier
Rated output power 2 x 14.0 dBm per RF port.

Output power CCDF				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	2B5	16.39	16.39	19.40
5	2T5	16.14	16.22	19.19

1): Summed output power according to FCC KDB662911 Multiple transmitter output v02r01.

Single carrier, MIMO

Output power per 1 MHz				
Carrier BW [MHz]	Symbolic name	[RMS dBm]		Total power[1)] [RMS dBm]
		Port RF A	Port RF B	
5	B5	11.12	10.68	14.11
5	M5	10.77	10.36	13.77
10	M10	7.92	7.51	10.92
5	T5	10.71	10.35	13.71

1): Measured according to FCC KDB662911 D01 Multiple Transmitter Output v02r01. Method E), 2), c). “Measure and add 10 log(N_{Ant})”.

Limits

§ 27.50 (c) (3): Base stations transmitting in the 698 –746 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz.

Complies?	Yes

Appendix 3

RF power output measurements according to CFR 47 §27.50, radiated

Date	Temperature	Humidity
2014-10-20	23 °C ± 3°C	47 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.4-2009.

The test was performed with continuous transmission.

The test of radiated emission was performed in a semi anechoic chamber. The measurements were performed with both horizontal and vertical polarizations of the antenna. The antenna distance was 3.0 m.

The fundamental was scanned with PEAK-detector with the antenna height was varied between 1-4 m and the turntable was rotated between 0-360 degrees for maximum response. The carrier power was measured with RMS- detector activated with a RBW of 1 MHz. The output power was verified with the substitution method .The antenna distance during the measurements was 3.0 m.

Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	503 881
R&S ESU 26	901 553
EMC 32 ver. 8.52.0	503 899
Schwarzbeck dipol	500 593
R&S SMB 100A	900 120
Attenuator	BX41643
Testo 635 temperature and humidity meter	504 203

Measurement uncertainty:

3.2 dB

Appendix 3

The test set-up during the effective radiated output power measurements is shown in the picture below, side mounted.

The test set-up during the effective radiated output power measurements is shown in the picture below, upright mounted.

Appendix 3

Results

Upright mounted

Bandwidth configuration [MHz]	Tested frequency B		Tested frequency M		Tested frequency T	
	Vertical/Horizontal RMS power (ERP)		Vertical/Horizontal RMS power (ERP)		Vertical/Horizontal RMS power (ERP)	
	dBm/ MHz	mW/ MHz	dBm/ MHz	mW/ MHz	dBm/ MHz	mW/ MHz
5	0.4/ 3.0	1.1/ 2.0	-0.9/ 2.9	0.8/ 1.9	-3.3/ 2.1	0.5/ 1.6
10	-	-	-3.4/ 0.1	0.5/ 1.0	-	-

Side mounted

Bandwidth configuration [MHz]	Tested frequency B		Tested frequency M		Tested frequency T	
	Vertical/Horizontal RMS power (ERP)		Vertical/Horizontal RMS power (ERP)		Vertical/Horizontal RMS power (ERP)	
	dBm/ MHz	mW/ MHz	dBm/ MHz	mW/ MHz	dBm/ MHz	mW/ MHz
5	1.6/ 2.1	1.4/ 1.6	0.6/ 1.9	1.1/ 1.5	0.5/ 1.3	1.1/ 1.3
10	-	-	-1.4/ -0.9	0.7/ 0.8	-	-

§ 27.50 (c) (3): Base stations transmitting in the 698 –746 MHz band with an emission bandwidth greater than 1 MHz must not exceed an ERP of 1000 watts/MHz.

Complies?	Yes

Appendix 4

Occupied bandwidth measurements according to CFR 47 2.1049

Date	Temperature	Humidity
2014-10-21	22 °C ± 3°C	38 % ± 5%
2014-10-22	23 °C ± 3°C	34 % ± 5%
2014-10-23	23 °C ± 3°C	31 % ± 5%

Test set-up and procedure

The measurements were made per definition in §2.1049. The output was connected to a signal analyzer with the RMS detector activated. The signal analyzer was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Configuration: RDI Cable 20m

MIMO mode, Single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port	Occupied BW (99%) [MHz]
1	5	B5	RF A	4.48
2	10	B10	RF A	8.93
3	5	M5	RF A	4.48
4	10	M10	RF A	8.93
5	5	T5	RF A	4.47
6	10	T10	RF A	8.93

Configuration: RDI Cable 100m

MIMO mode, Single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port	Occupied BW (99%) [MHz]
7	5	B5	RF A	4.48
8	10	B10	RF A	8.93
9	5	M5	RF A	4.48
10	10	M10	RF A	8.93
11	5	T5	RF A	4.47
12	10	T10	RF A	8.93

Appendix 4

Diagram 1:

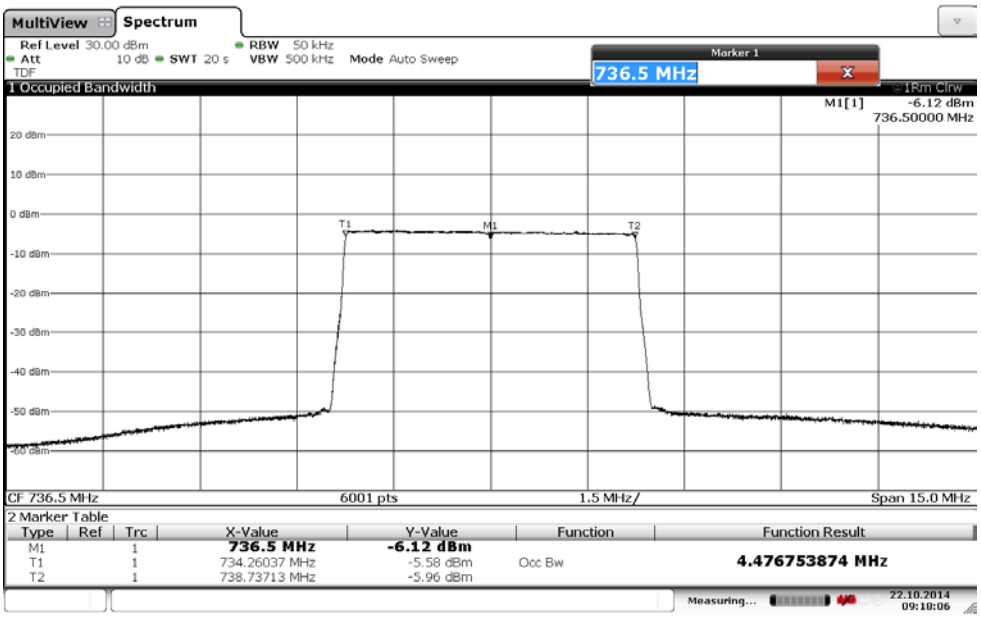


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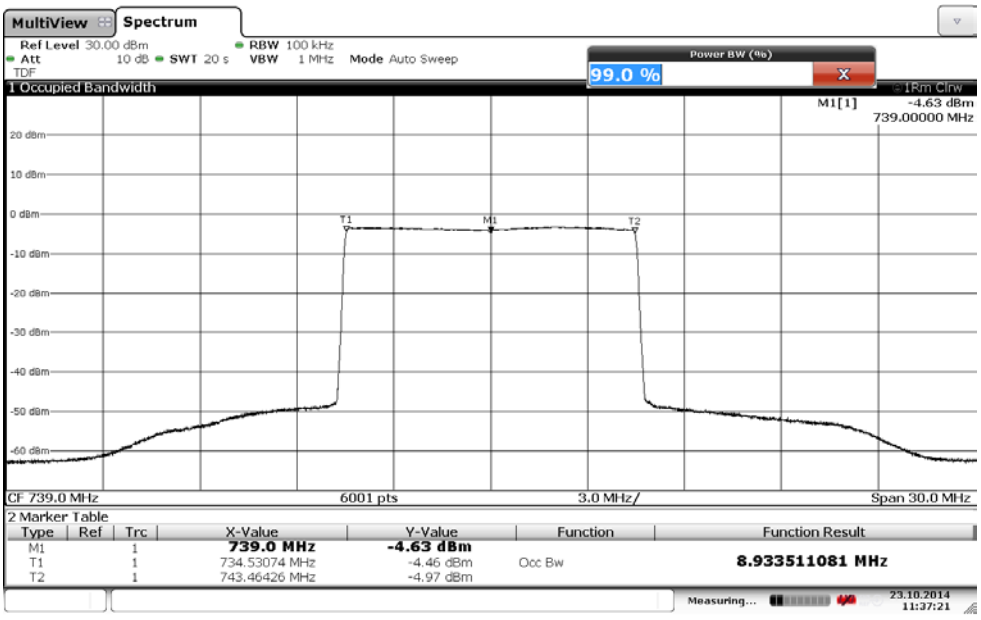
Diagram 2:



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Appendix 4

Diagram 3:

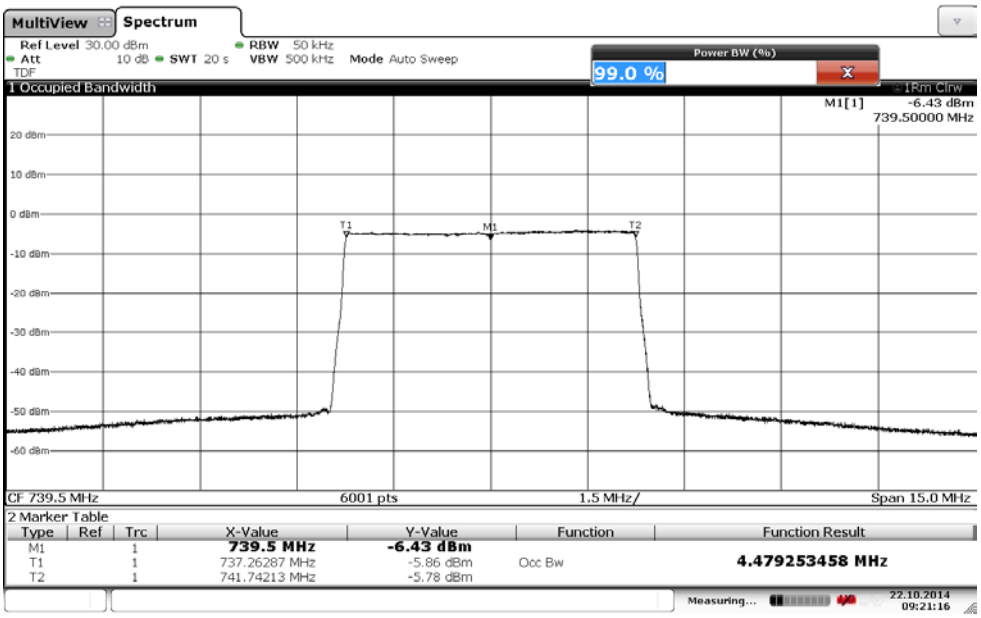

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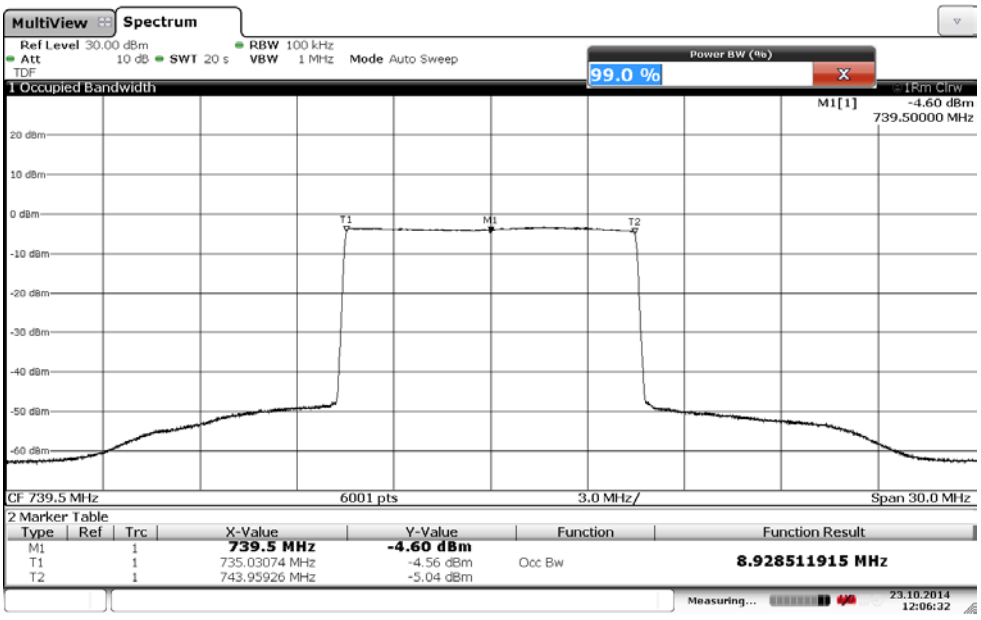
Diagram 4:



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Appendix 4

Diagram 5:

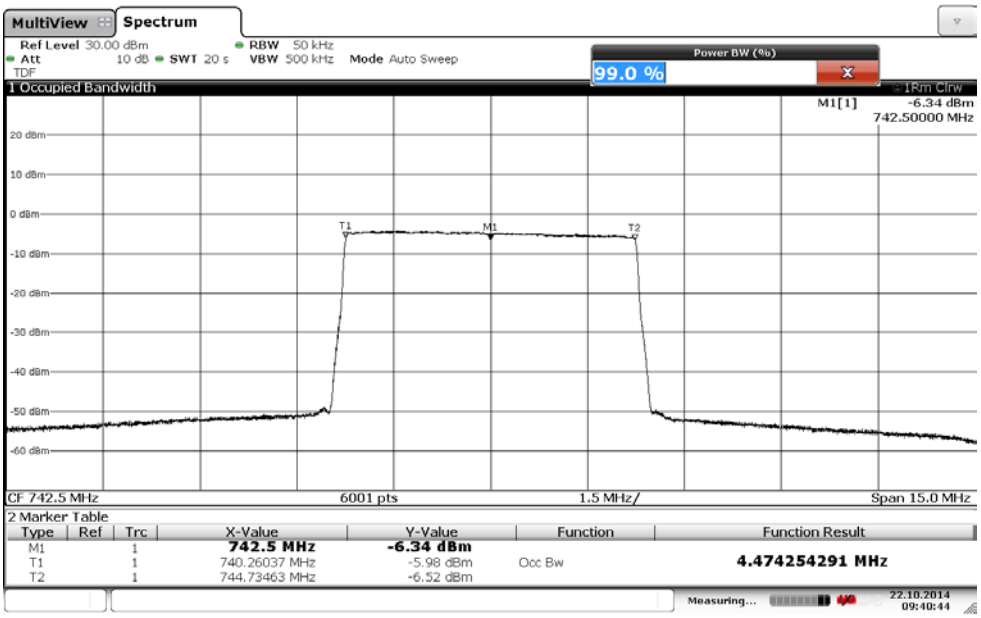

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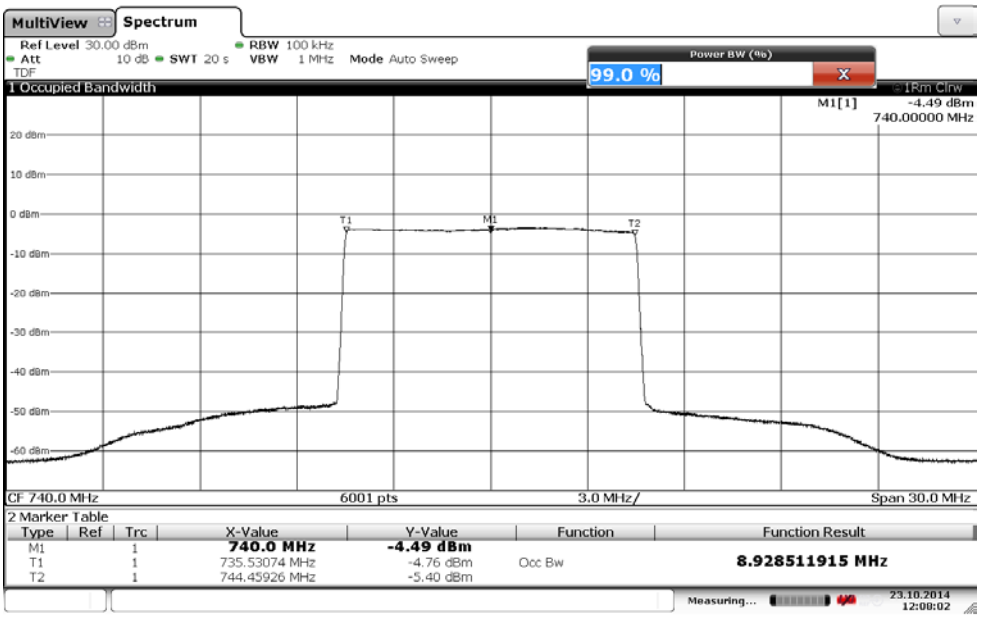
Diagram 6:



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Appendix 4

Diagram 7:

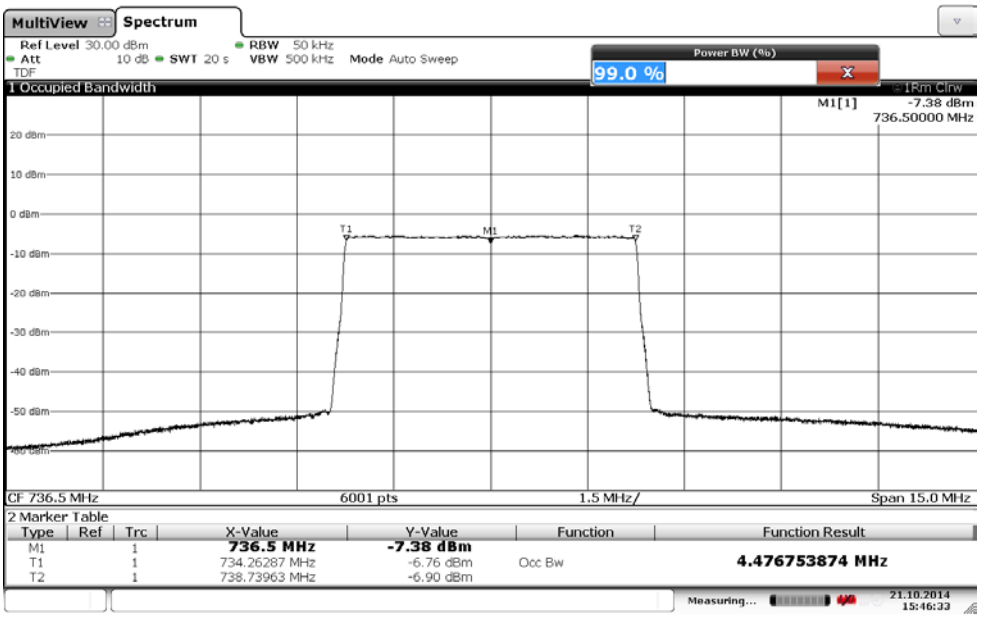

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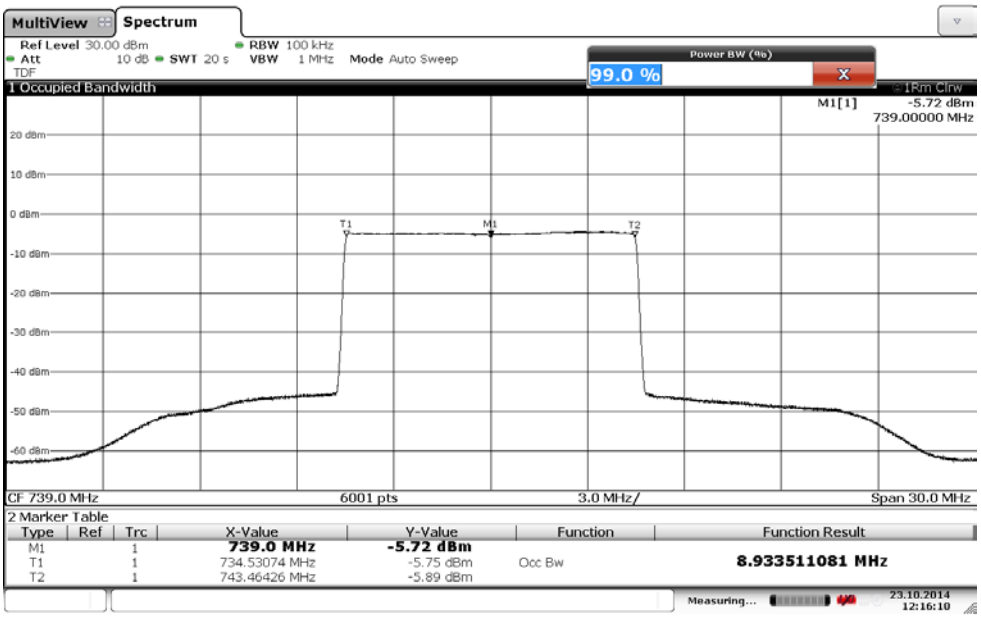
Diagram 8:



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Appendix 4

Diagram 9:

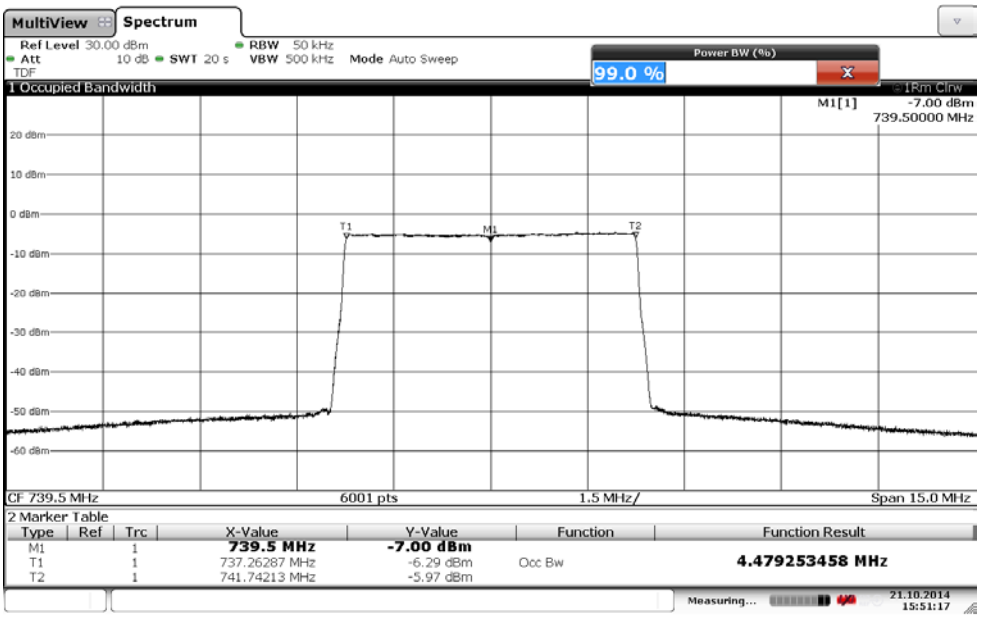

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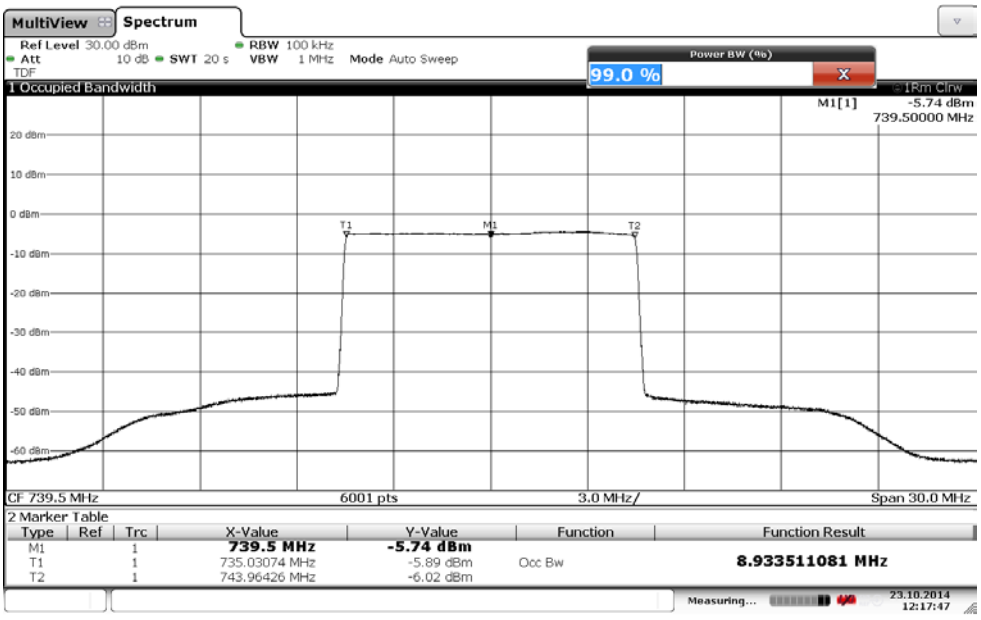
Diagram 10:



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Appendix 4

Diagram 11:

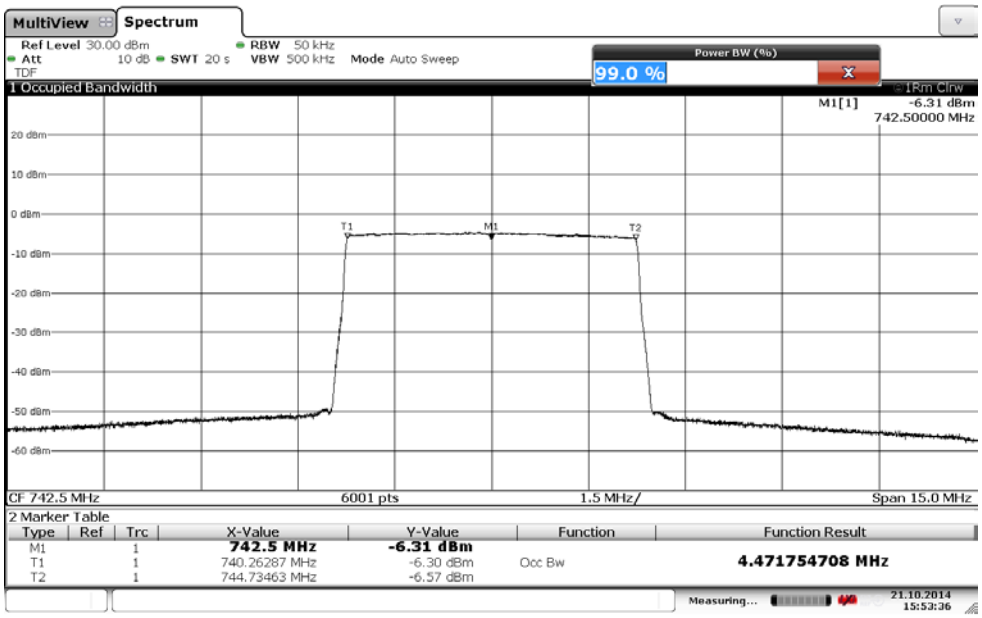

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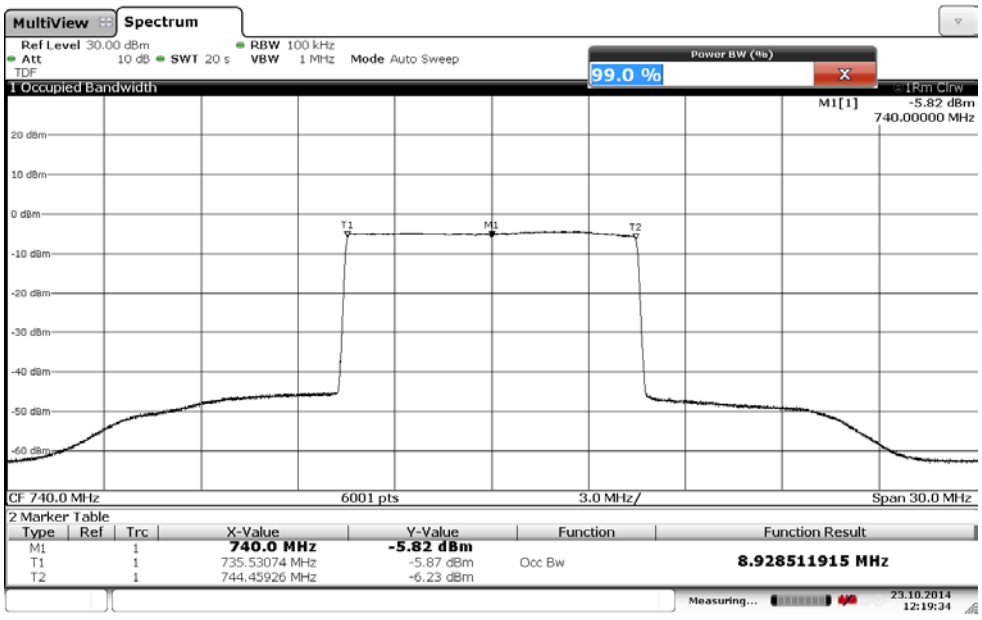
Diagram 12:



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Appendix 5

Band edge measurements according to CFR 47 2.1051

Date	Temperature	Humidity
2014-10-22	23 °C ± 3°C	34 % ± 5%

Test set-up and procedure

The measurements were made per definition in CFR 47 §27.53 The test object was connected to a spectrum analyzer with the RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

The measurements were made as defined in §27.53 (g). The FCC rules, specifying a RBW of at least 30k up to 100 kHz away from the band edges and a RBW of 100 kHz for measurements of emissions more than 100 kHz away from the band edges.

A resolution bandwidth of 100 kHz was used at the band edges up to 10 MHz from the band edges.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method 2 “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v02r01.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Configuration: RDI Cable 20m

MIMO mode, single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port
1	5	B5	RF A
2	10	B10	RF A
3	5	T5	RF A
4	10	T10	RF A

MIMO mode, multi carrier

Diagram	BW configuration [MHz]	Testedfrequency	Tested Port
5	5	2B5	RF A
6	5	2T5	RF A

Configuration: RDI Cable 100m

MIMO mode, single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port
7	5	B5	RF A
8	10	B10	RF A
9	5	T5	RF A
10	10	T10	RF A

MIMO mode, multi carrier

Diagram	BW configuration [MHz]	Testedfrequency	Tested Port
11	5	2B5	RF A
12	5	2T5	RF A

Limits

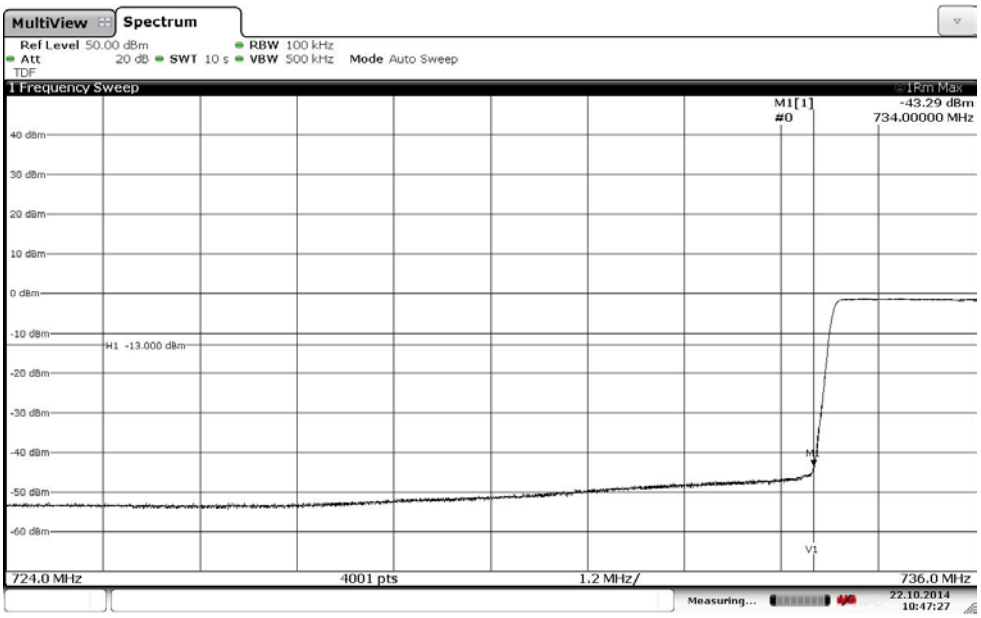
CFR 47 § 27.53 (g):

Outside a licensee’s frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm.

Complies?	Yes

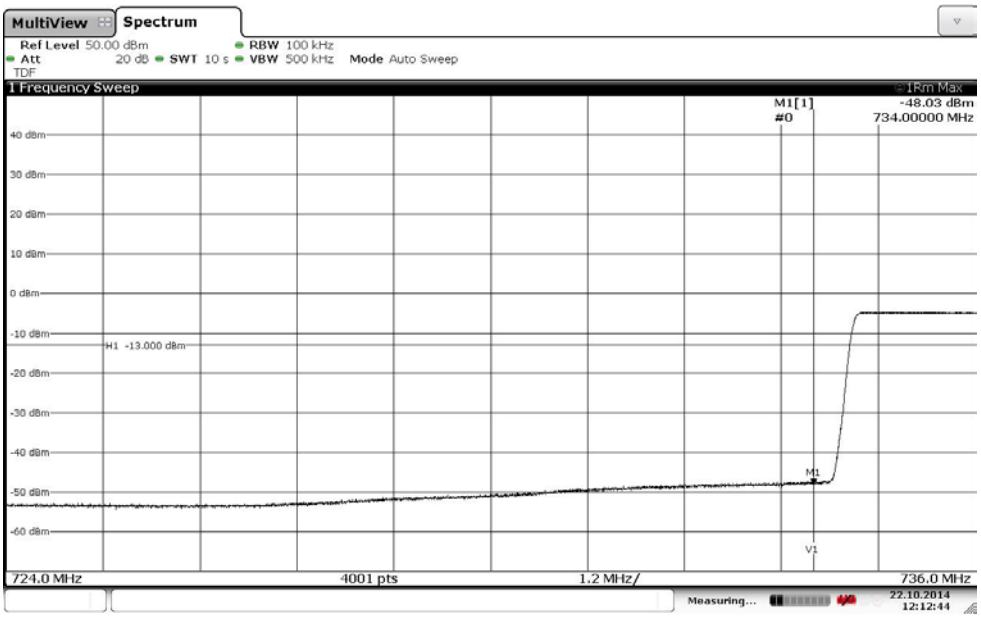
Appendix 5

Diagram 1:



Date: 22.OCT.2014 10:47:27

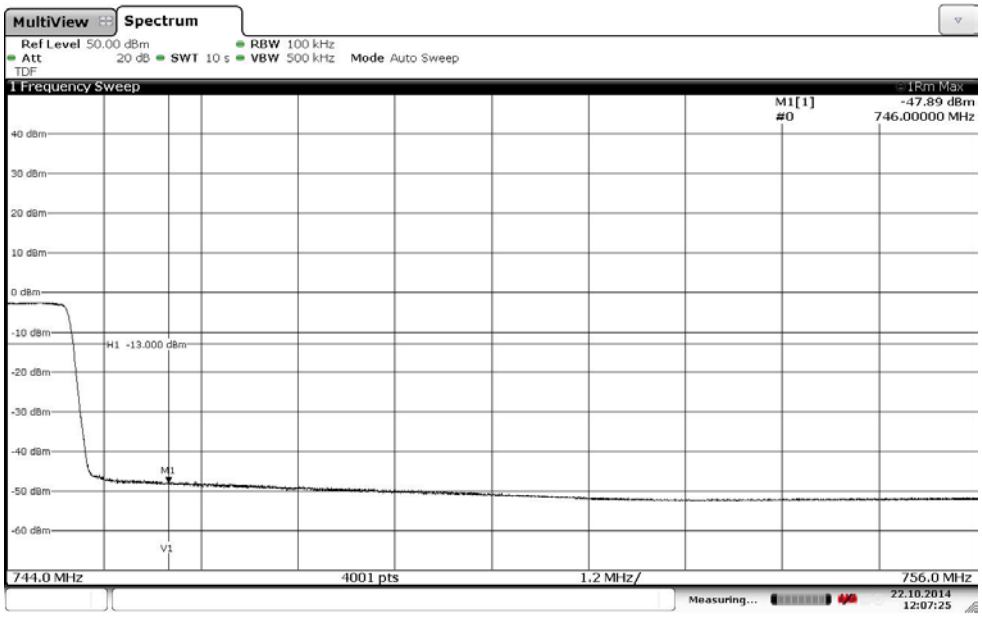
Diagram 2:



Date: 22.OCT.2014 12:12:44

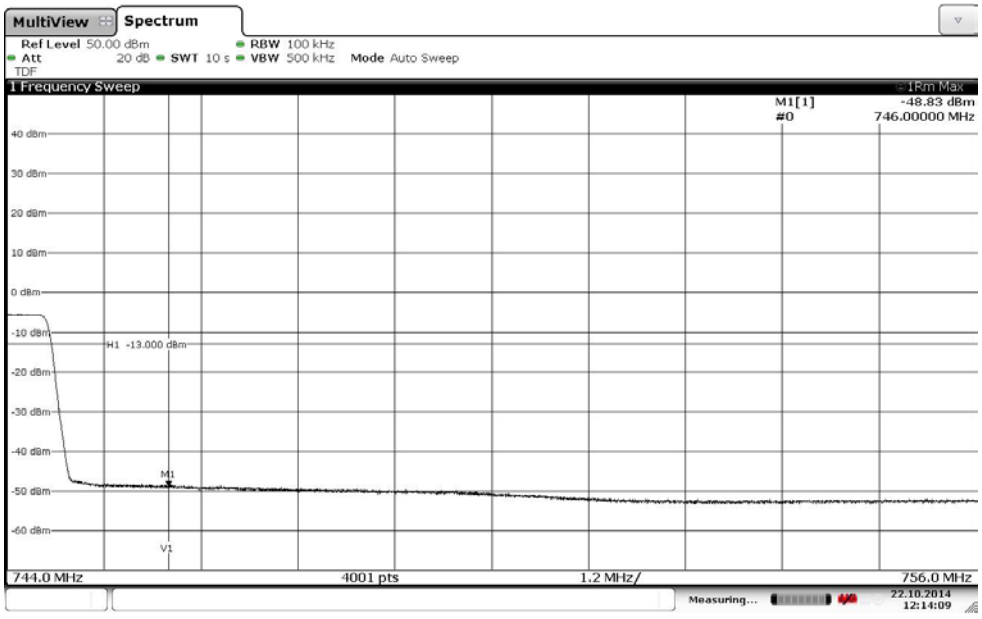
Appendix 5

Diagram 3:



Date: 22.OCT.2014 12:07:25

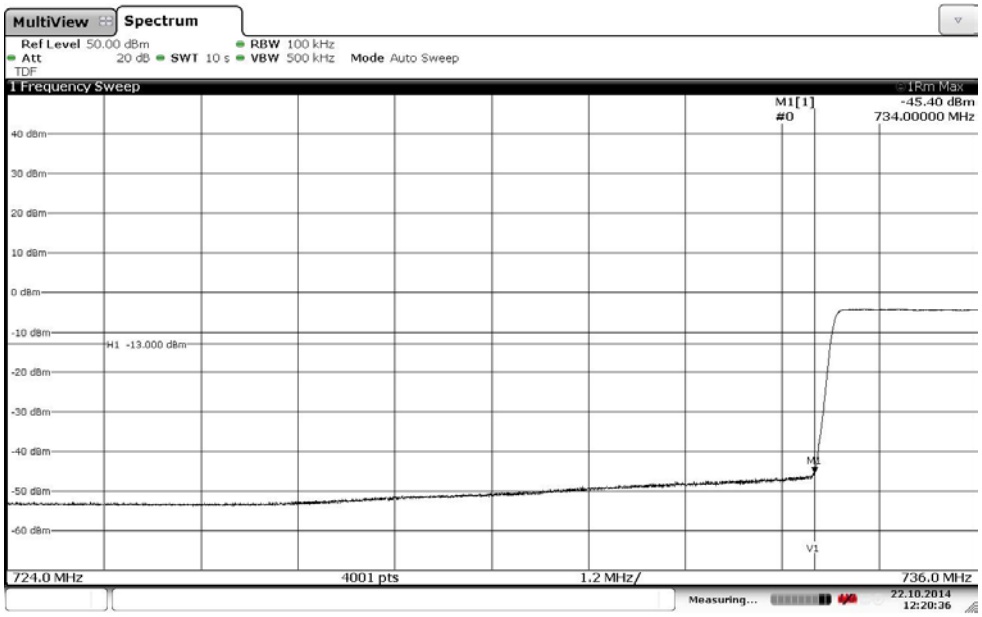
Diagram 4:



Date: 22.OCT.2014 12:14:09

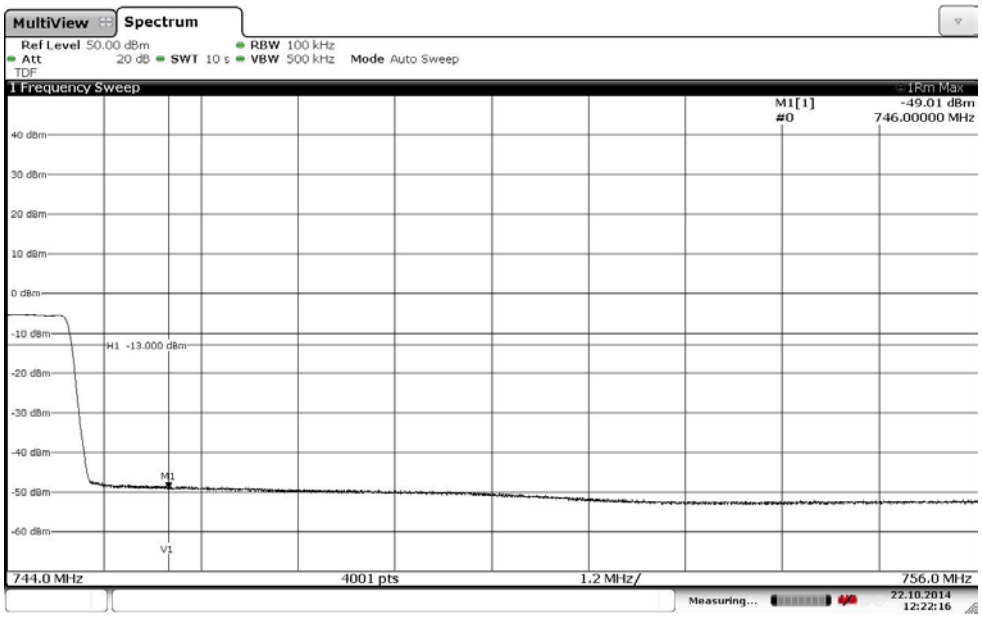
Appendix 5

Diagram 5:



Date: 22.OCT.2014 12:20:36

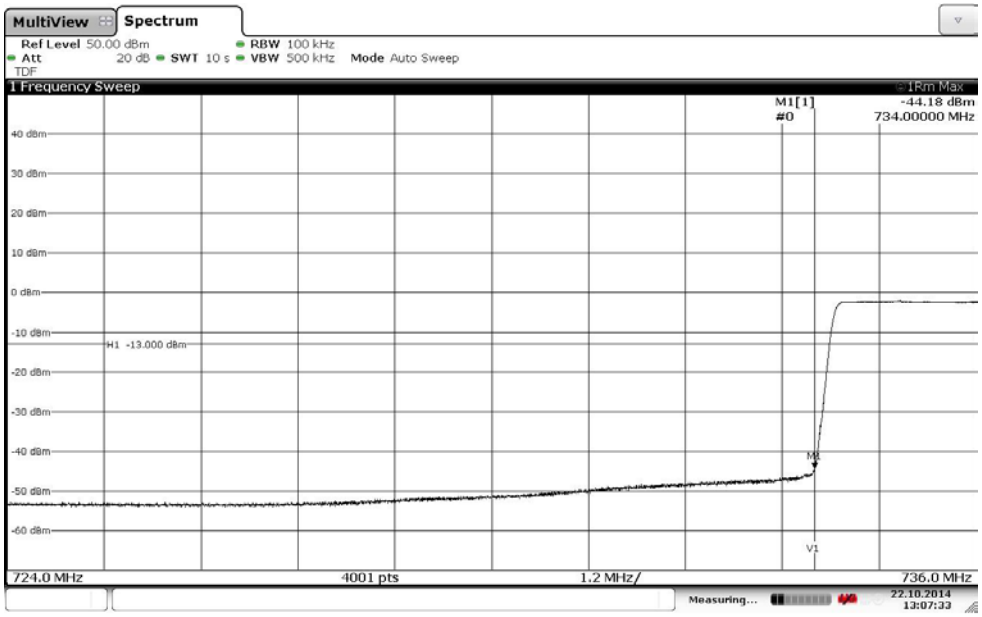
Diagram 6:



Date: 22.OCT.2014 12:22:15

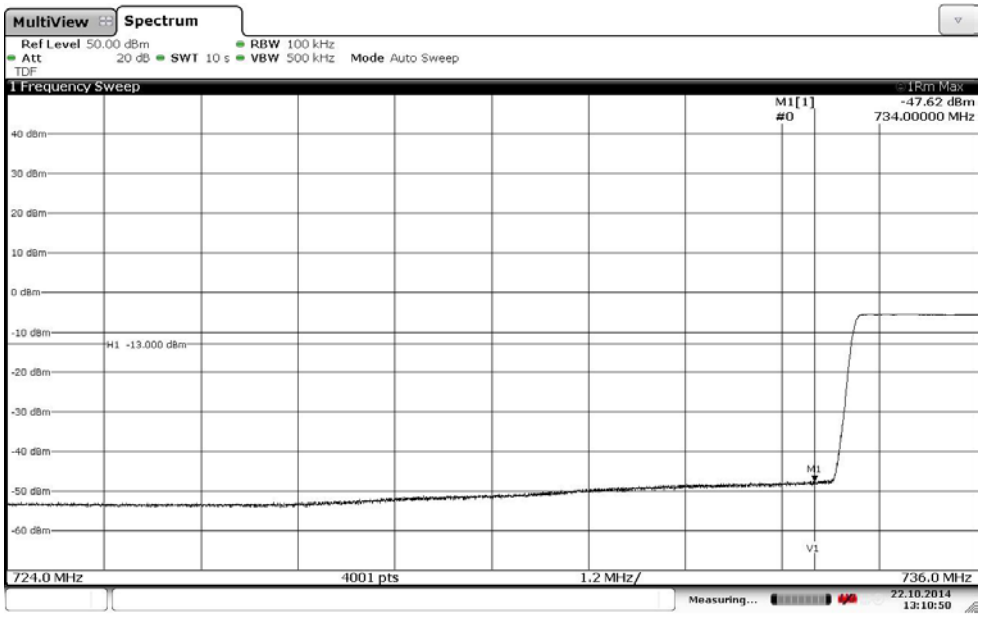
Appendix 5

Diagram 7:



Date: 22.OCT.2014 13:07:34

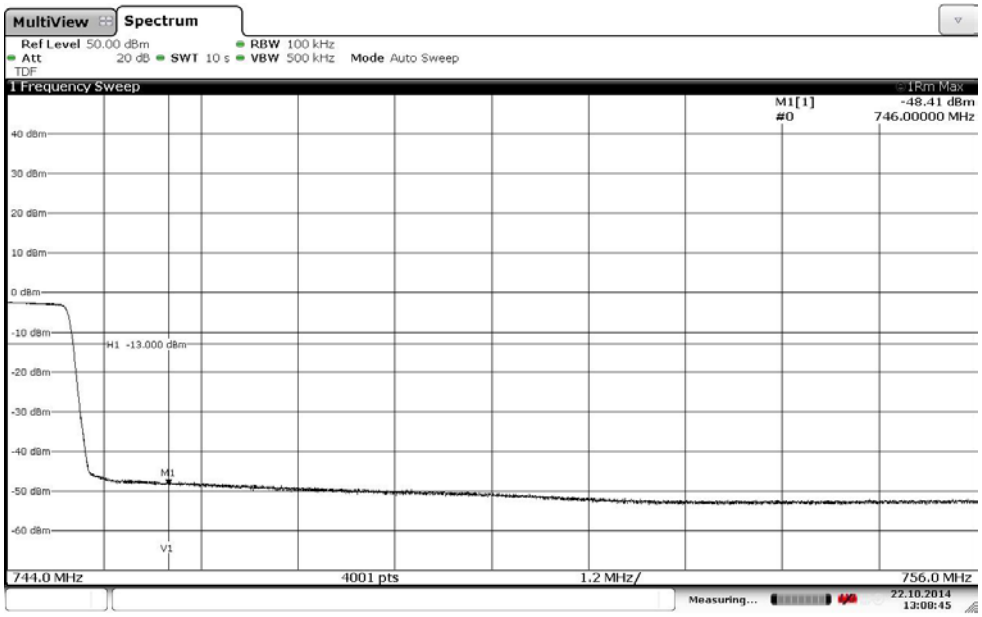
Diagram 8:



Date: 22.OCT.2014 13:10:50

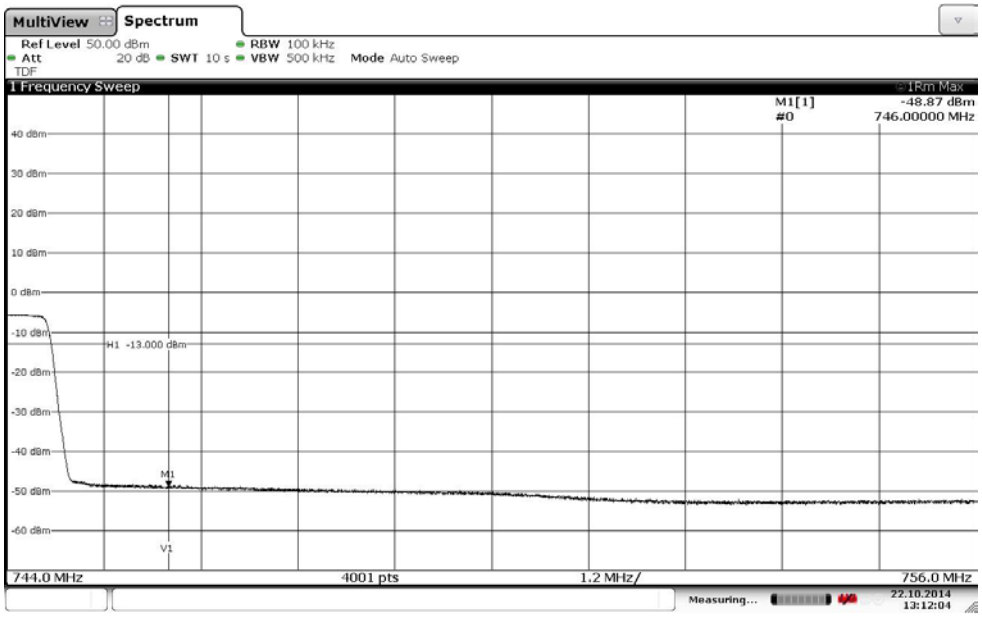
Appendix 5

Diagram 9:



Date: 22.OCT.2014 13:08:45

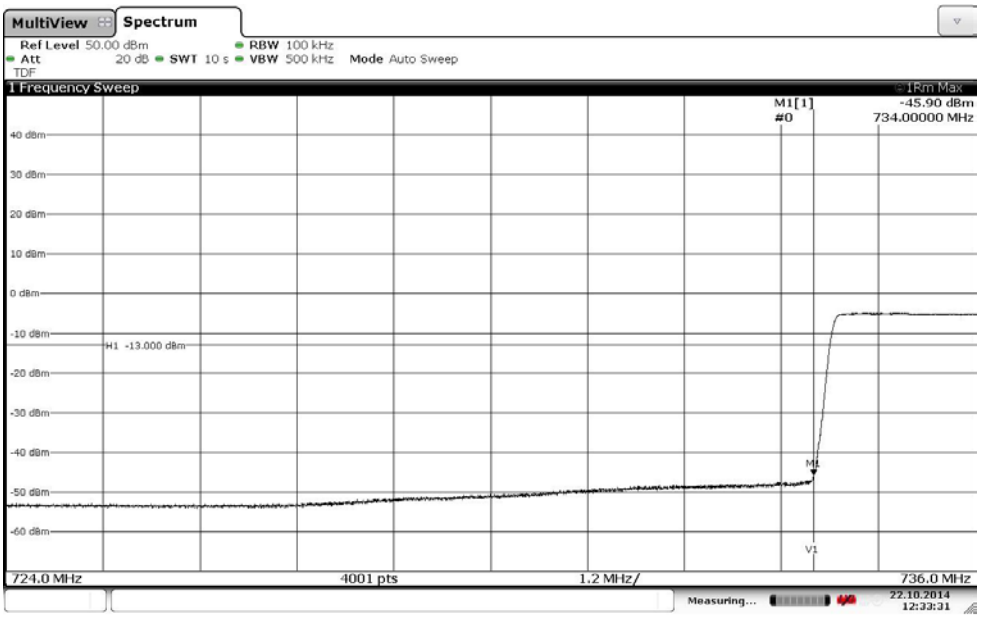
Diagram 10:



Date: 22.OCT.2014 13:12:04

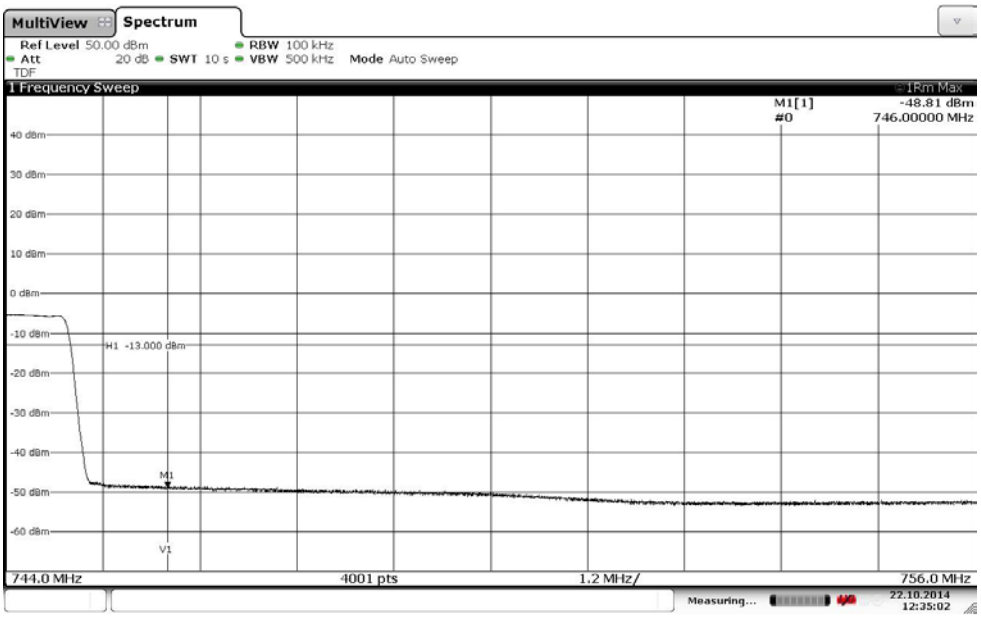
Appendix 5

Diagram 11:



Date: 22.OCT.2014 12:33:31

Diagram 12:



Date: 22.OCT.2014 12:35:03

Appendix 6

Conducted spurious emission measurements according to CFR 47 §27.53

Date	Temperature	Humidity
2014-10-22	23 °C ± 3°C	34% ± 5%

Test set-up and procedure

The measurements were made per definition in §27.53. The output was connected to a spectrum analyzer with a RBW setting of 1 MHz and RMS detector activated. The spectrum analyzer was connected to an external 10 MHz reference standard during the measurements.

Before comparing the results to the limit, 3 dB [10 log (2)] should be added according to method 2 “measure and add 10 log(N_{ANT})” of FCC KDB662911 D01 Multiple Transmitter Output v02r01.

Measurement equipment	SP number
R&S FSW 43	902 073
RF attenuator	900 691
Testo 635, temperature and humidity meter	504 203

Measurement uncertainty: 3.7 dB

Results

Configuration: RDI Cable 20m

MIMO mode, Single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port
1 a+b	5	B5	RF A
2 a+b	5	M5	RF A
3 a+b	10	M10	RF A
4 a+b	5	T5	RF A

MIMO mode, multi carrier

Diagram	BW configuration [MHz]	Symbolic name	Tested Port
5 a+b+c	5	2B5	RF A
6 a+b+c	5	2M5	RF A
7 a+b+c	5	2T5	RF A

Configuration: RDI Cable 100m

MIMO mode, Single carrier

Diagram	BW configuration [MHz]	Tested frequency	Tested Port
8 a+b	5	B5	RF A
9 a+b	5	M5	RF A
10 a+b	5	M5	RF B
10 a+b	10	M10	RF A
11 a+b	5	T5	RF A

MIMO mode, multi carrier

Diagram	BW configuration [MHz]	Symbolic name	Tested Port
12 a+b+c	5	2B5	RF A
13 a+b+c	5	2M5	RF A
14 a+b+c	5	2T5	RF A

Note: Measurements were limited to port RF A due to the measurement result in LTE single carrier MIMO mode that shows that the ports are electrical identical as declared by the client.

Remark

The emission at 9 kHz on the plots was not generated by the test object. A complementary measurement with a smaller RBW showed that it was related to the LO feed-through.

The highest fundamental frequency is 745 MHz. The measurements were made up to 8 GHz (10x745 MHz = 7.45 GHz).

Limits

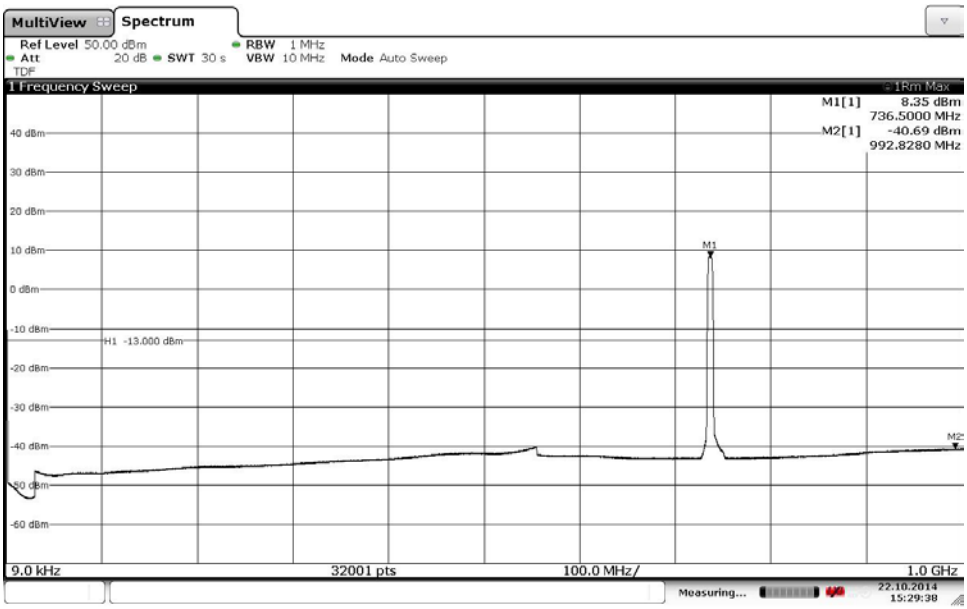
CFR 47 § 27.53 (g)

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 100 kHz RBW.

Complies?	Yes

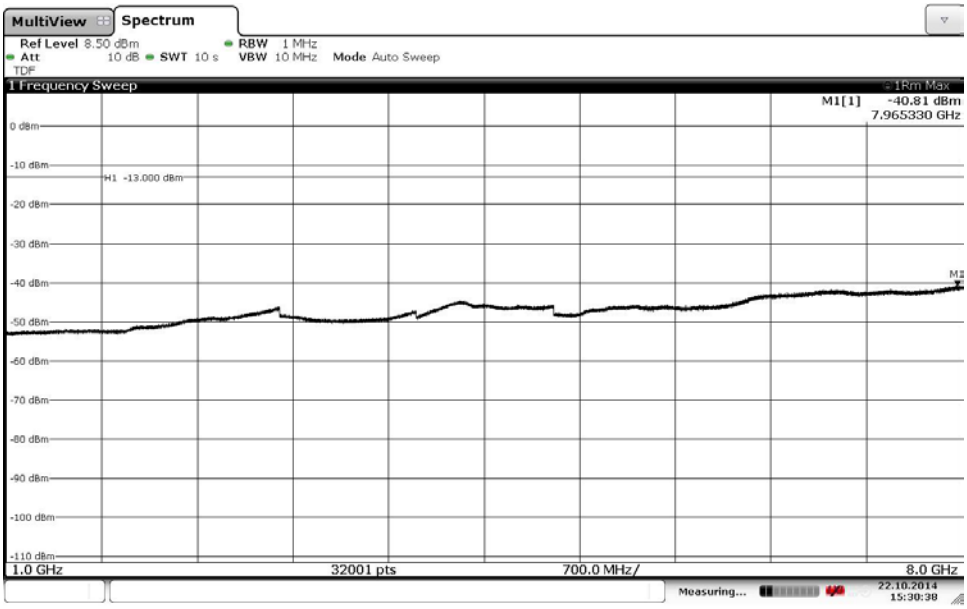
Appendix 6

Diagram 1a:



Date: 22.OCT.2014 15:29:38

Diagram 1b:



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Appendix 6

Diagram 2a:

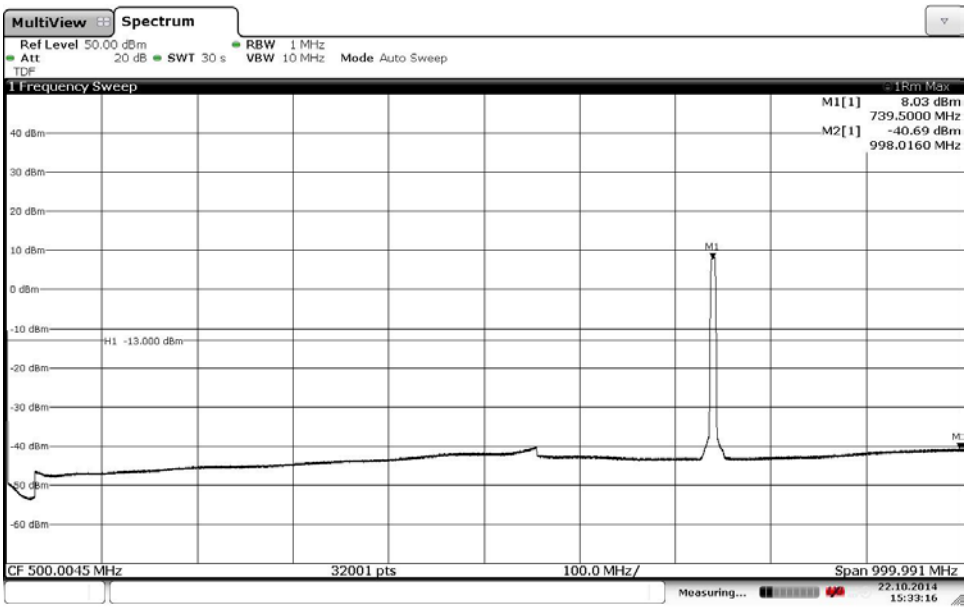

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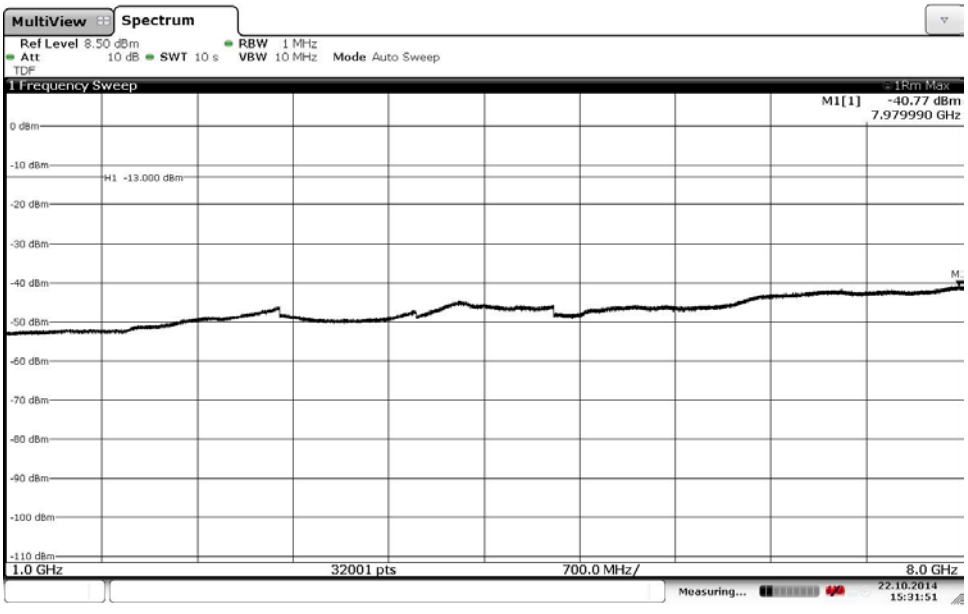
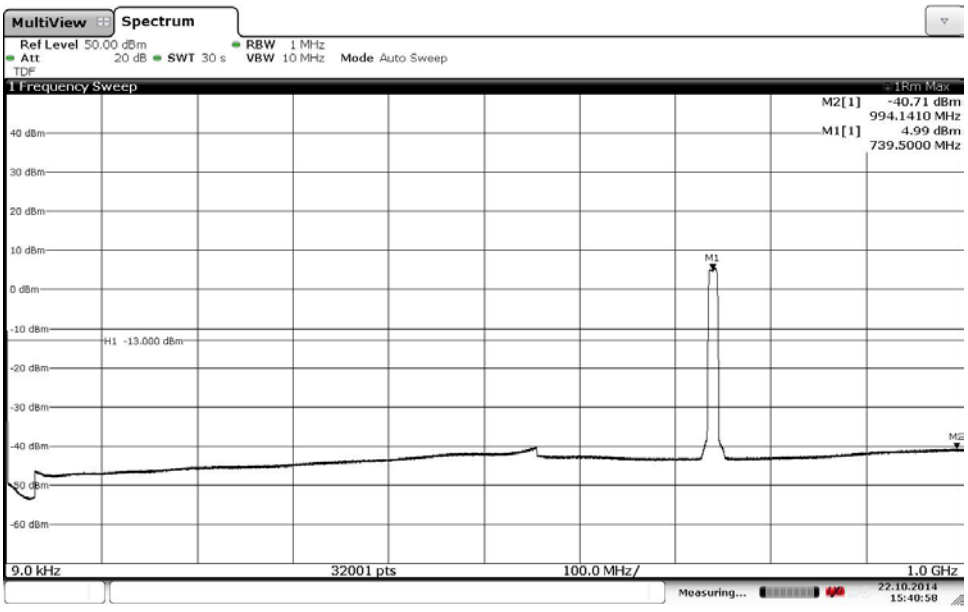
Diagram 2b:



Date: 22.OCT.2014 15:31:51

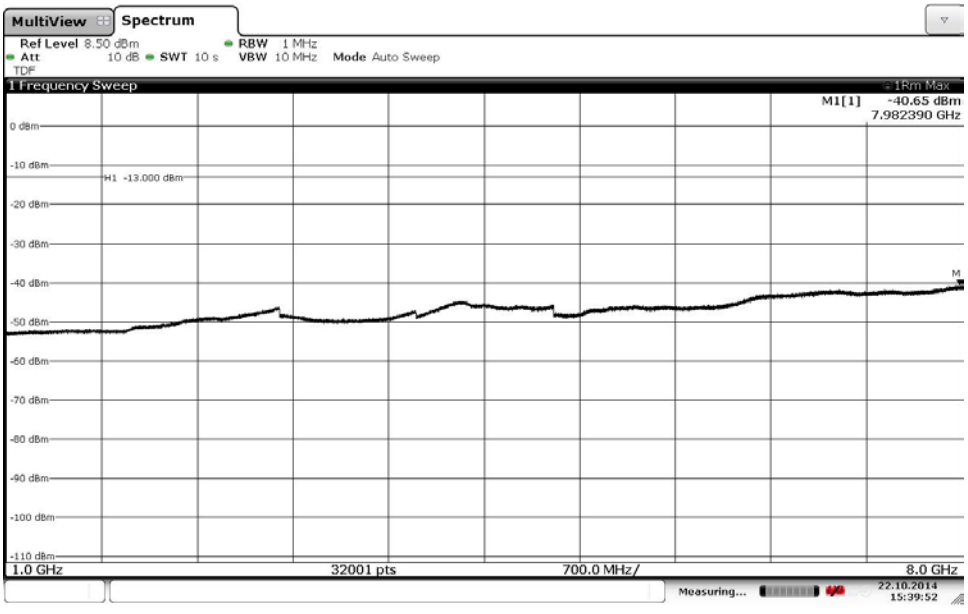
Appendix 6

Diagram 3a:



Date: 22.OCT.2014 15:40:59

Diagram 3b:



Date: 22.OCT.2014 15:39:52

Appendix 6

Diagram 4a:

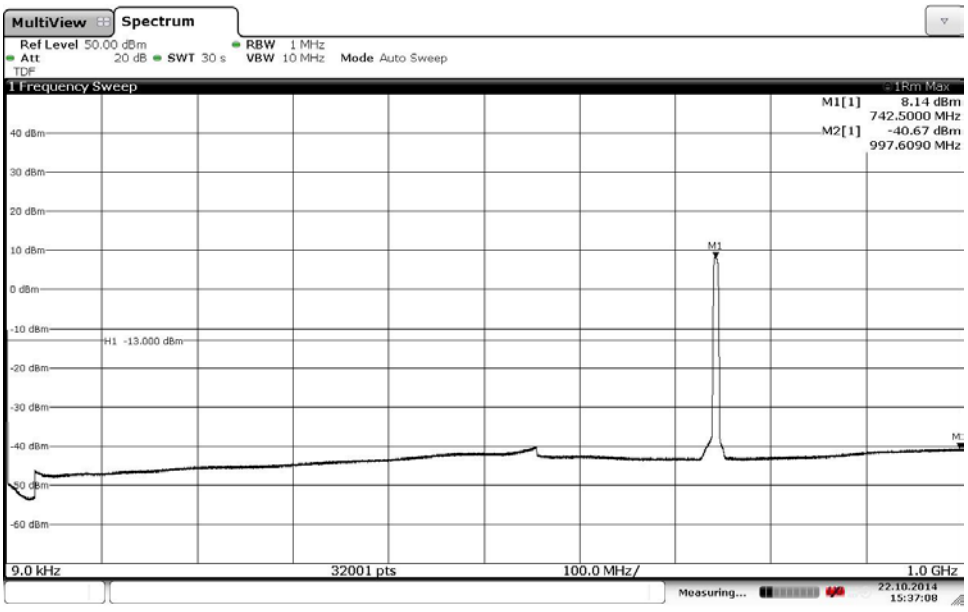


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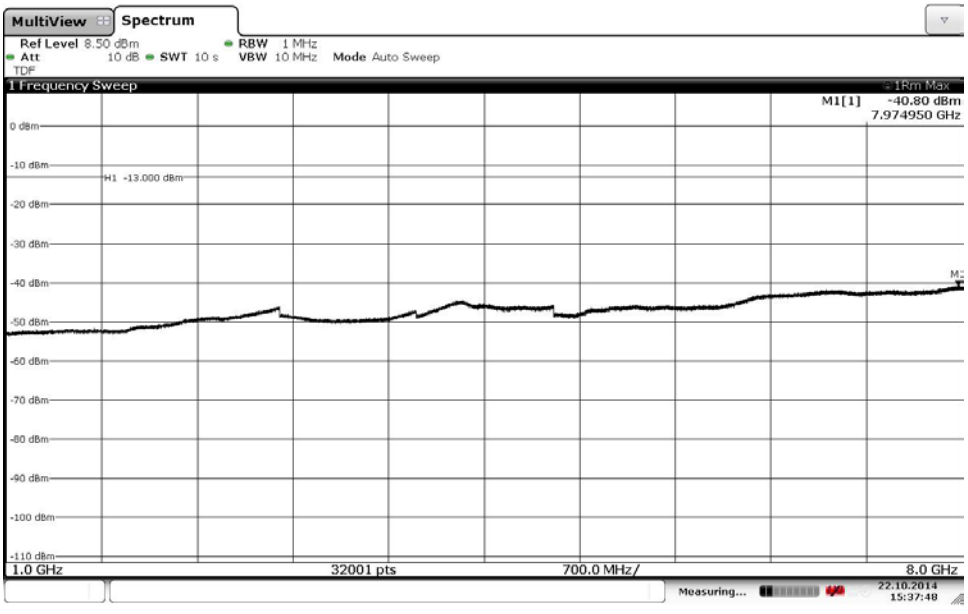
Diagram 4b:



Date: 22.OCT.2014 15:37:48

Appendix 6

Diagram 5a:

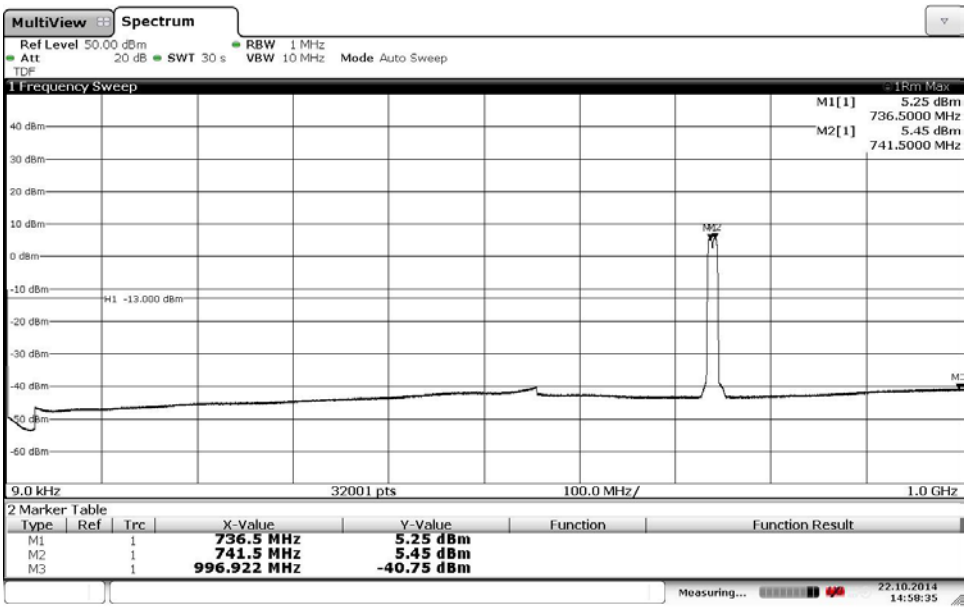


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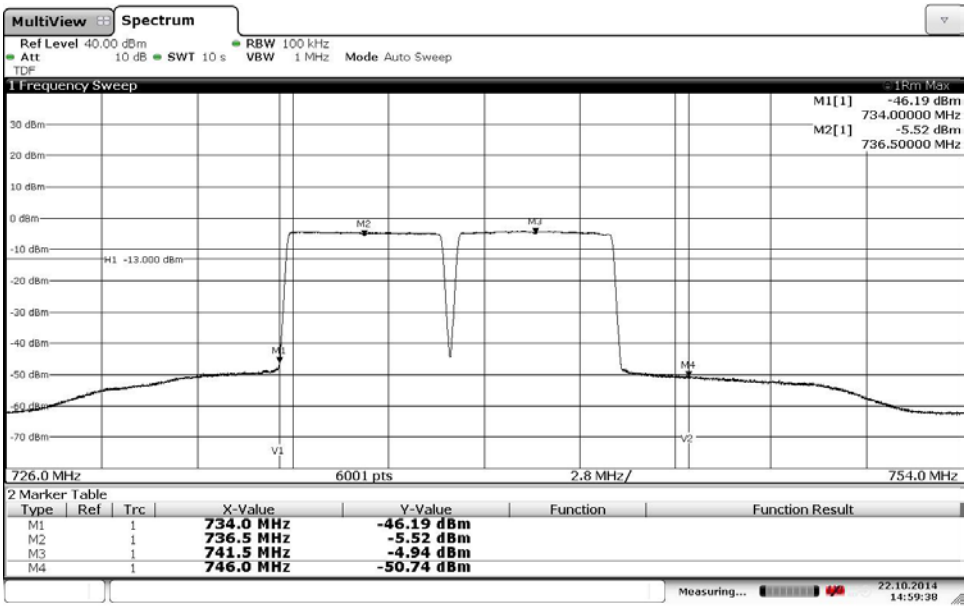
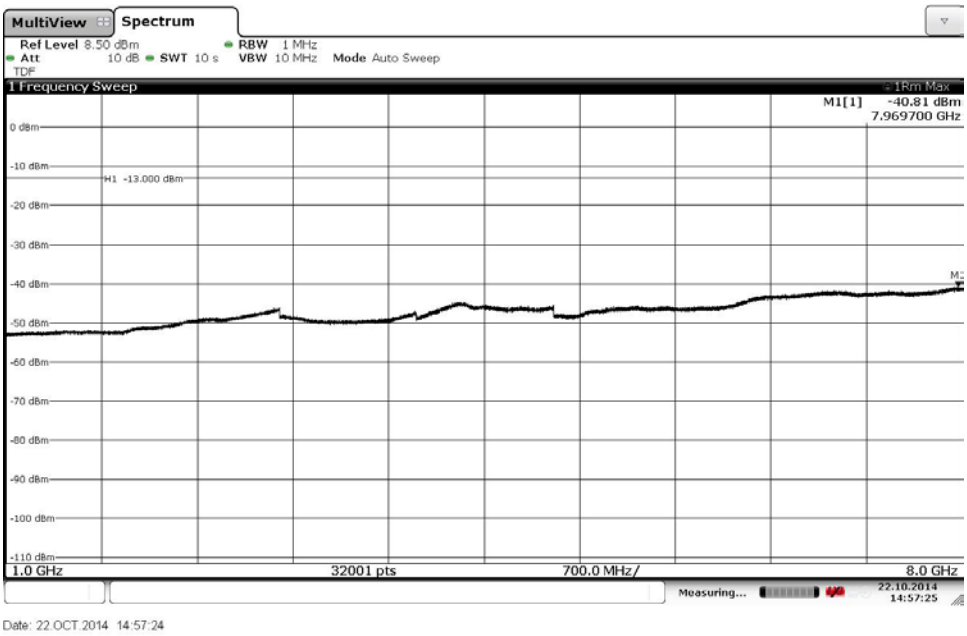
Diagram 5b:



Date: 22.OCT.2014 14:59:38

Appendix 6

Diagram 5c:



Appendix 6

Diagram 6a:

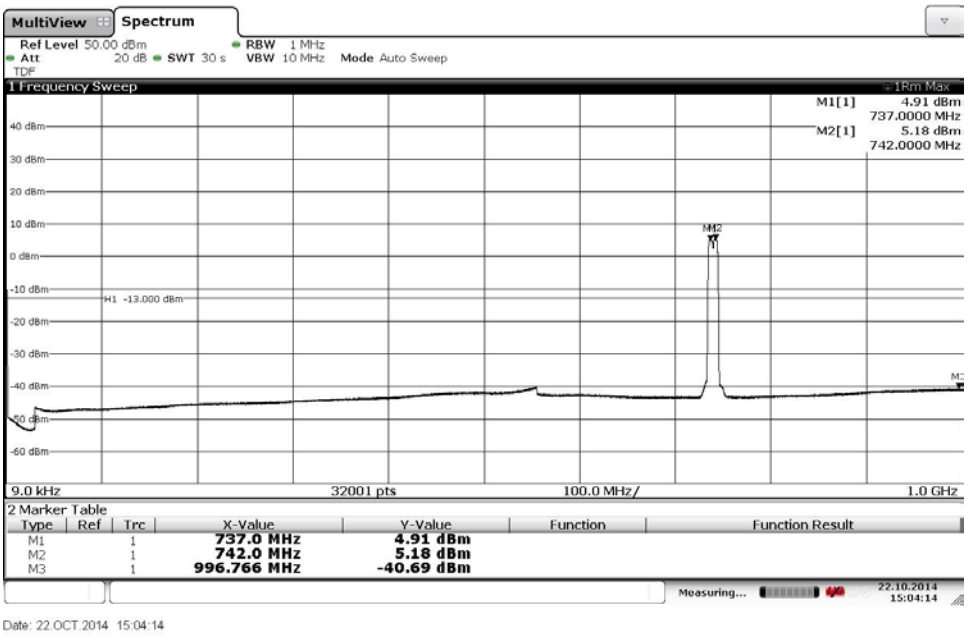


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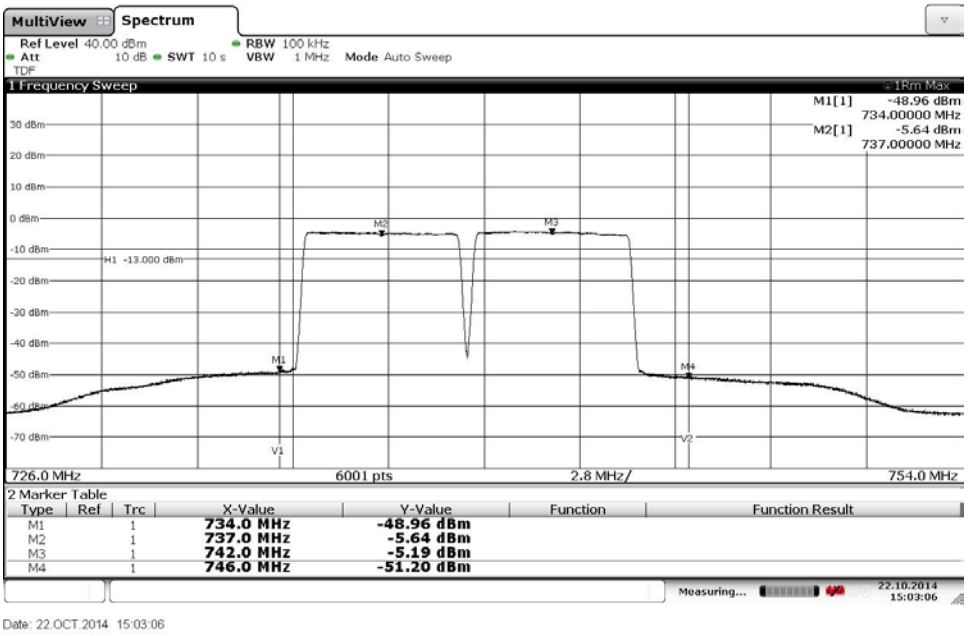
Diagram 6b:



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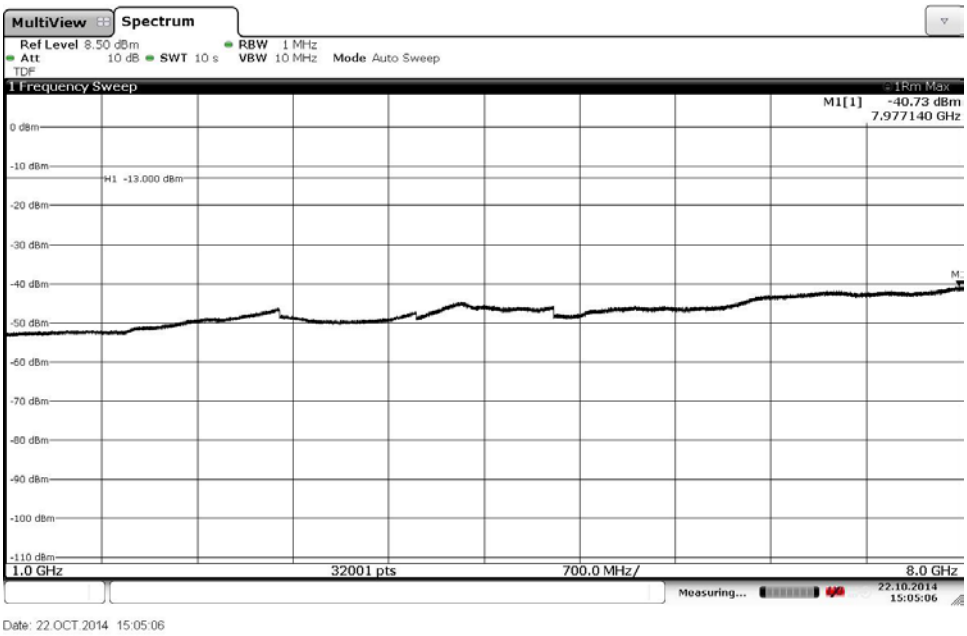
Appendix 6

Diagram 6c:



Appendix 6

Diagram 7a:

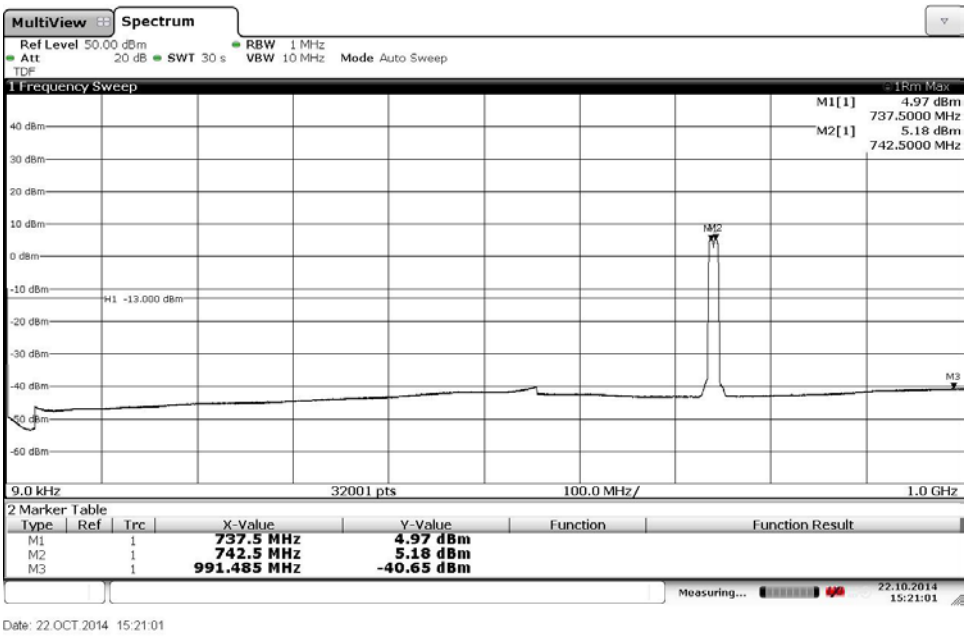


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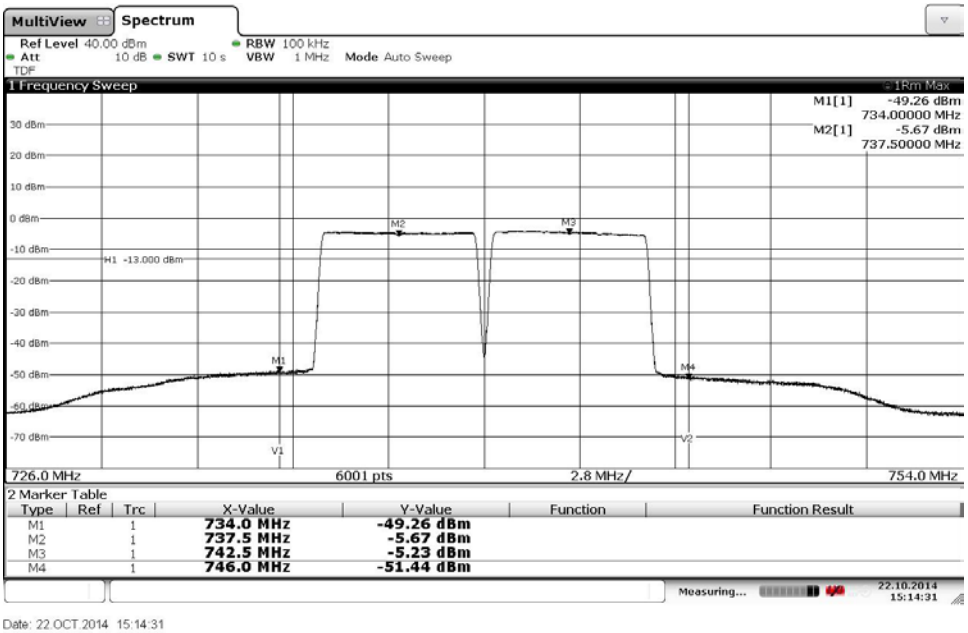
Diagram 7b:



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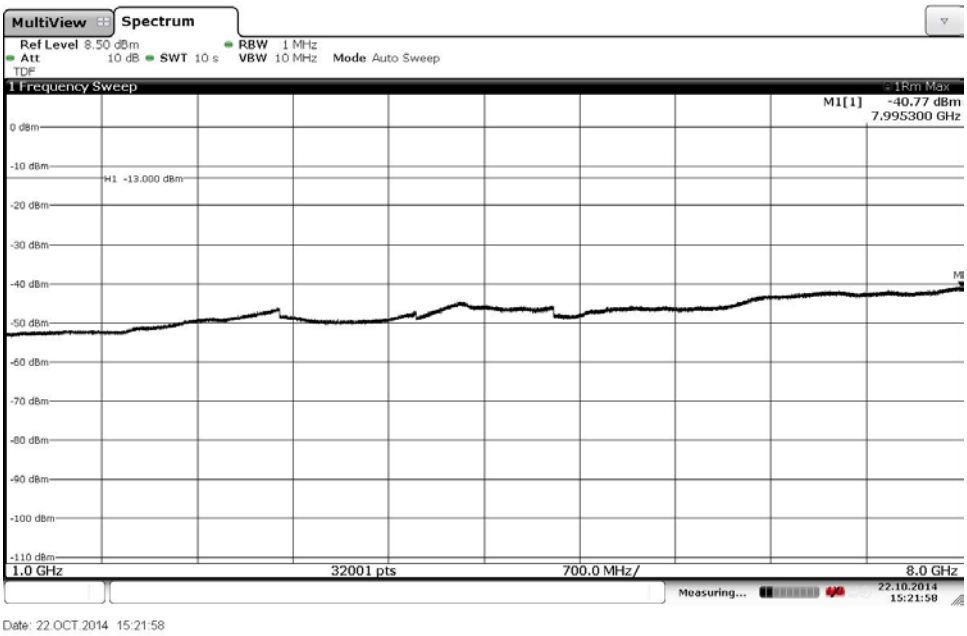
Appendix 6

Diagram 7c:



Appendix 6

Diagram 8a:

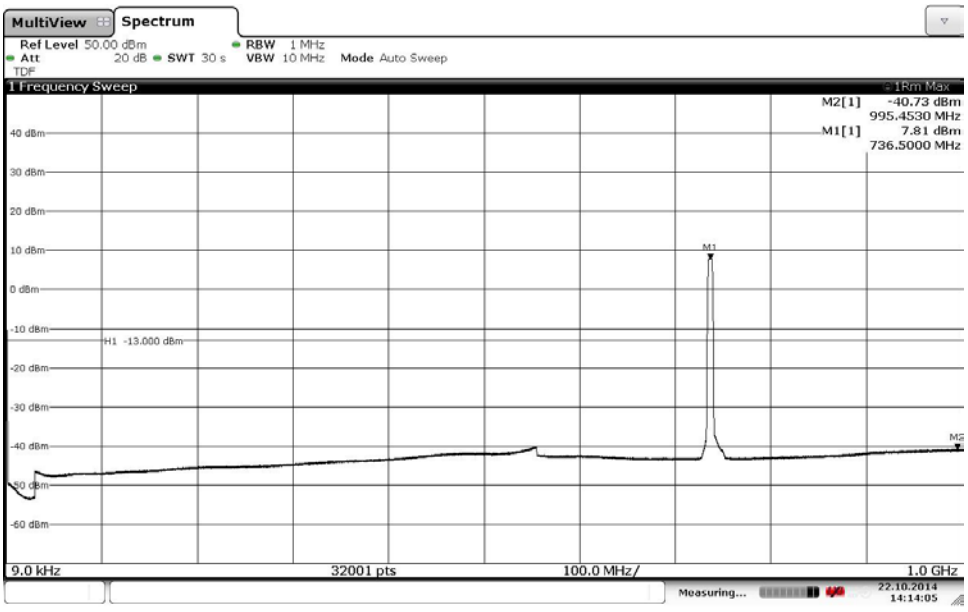


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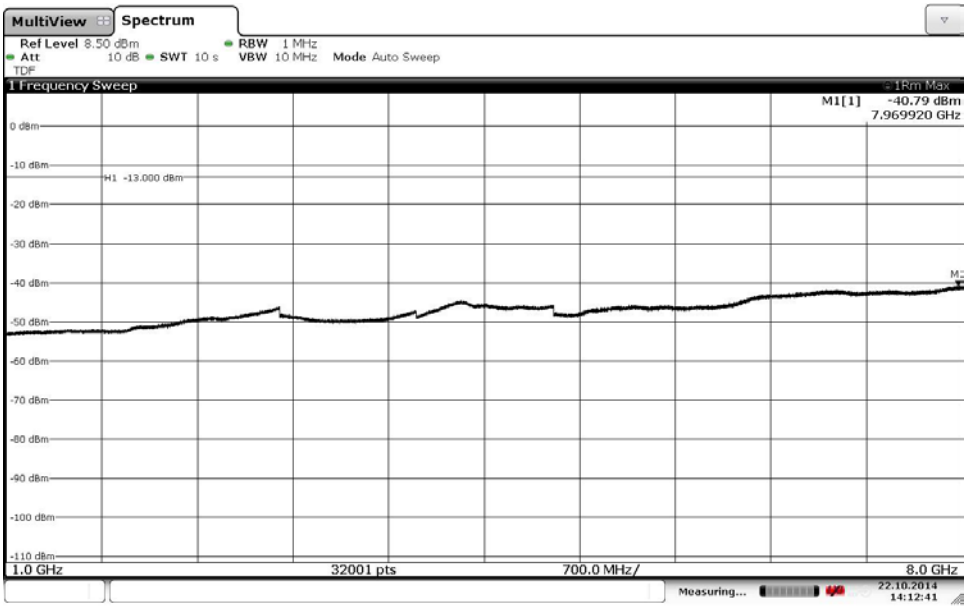
Diagram 8b:



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Appendix 6

Diagram 9a:

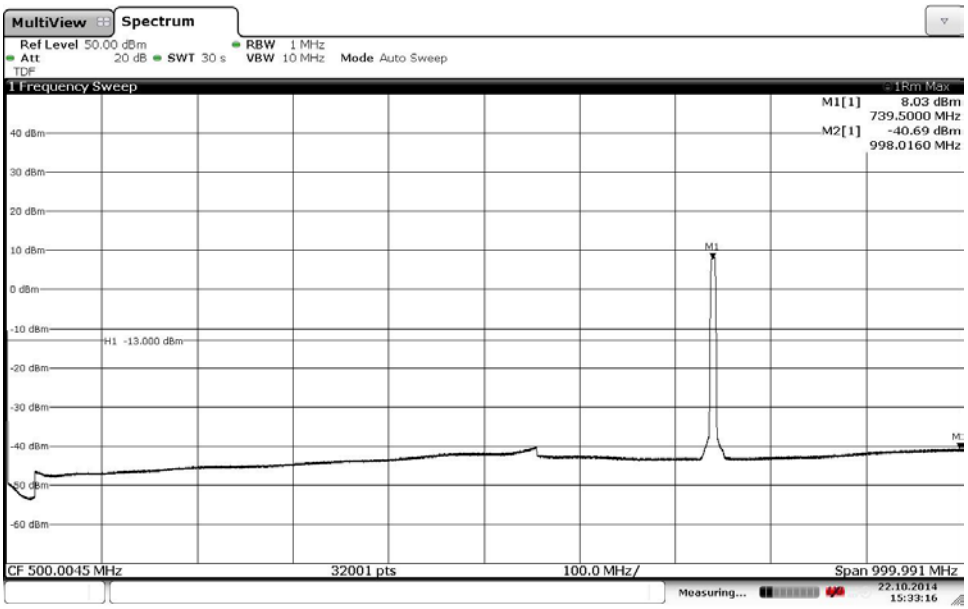

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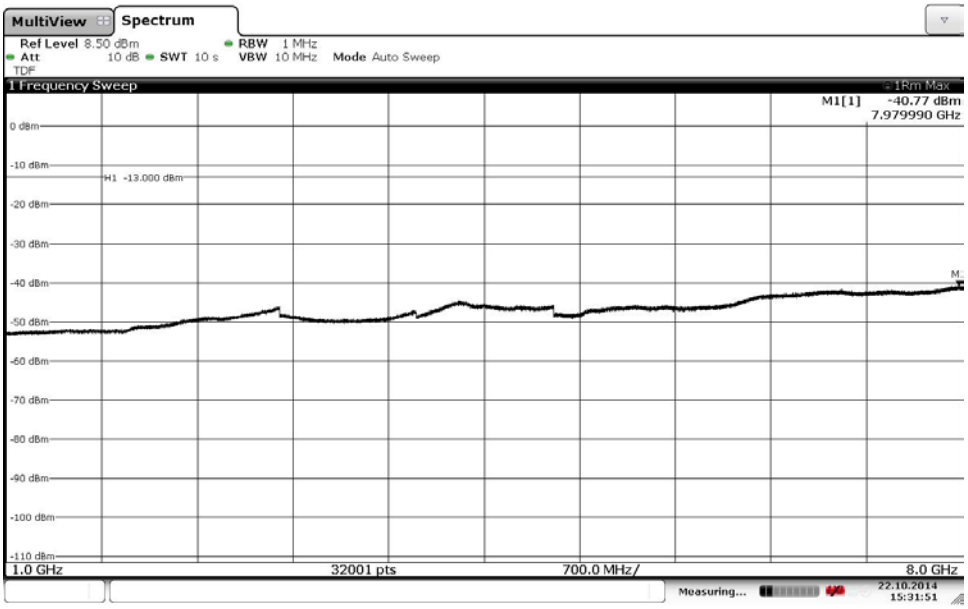
Diagram 9b:



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Appendix 6

Diagram 10a:

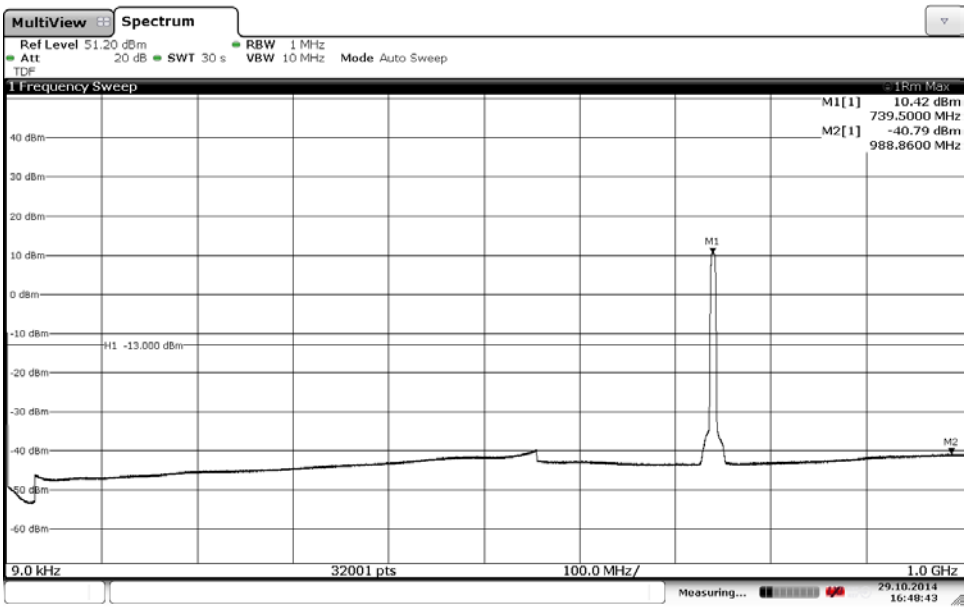

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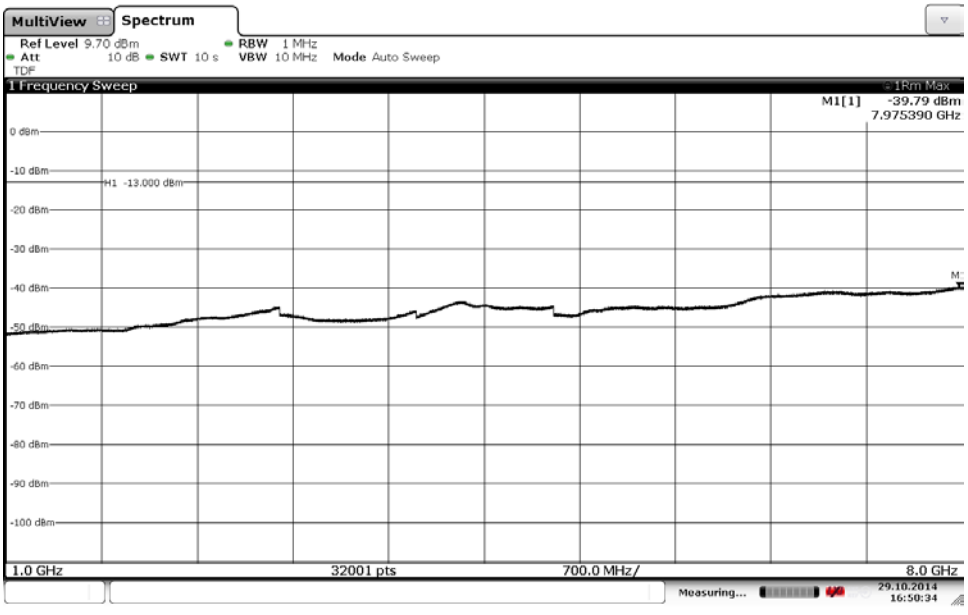
Diagram 10b:



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Appendix 6

Diagram 11a:

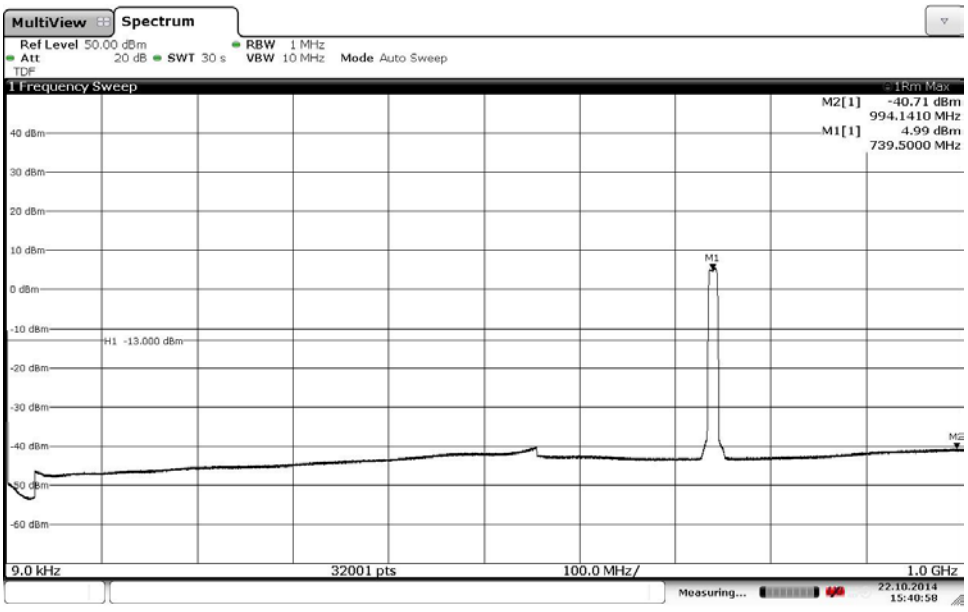

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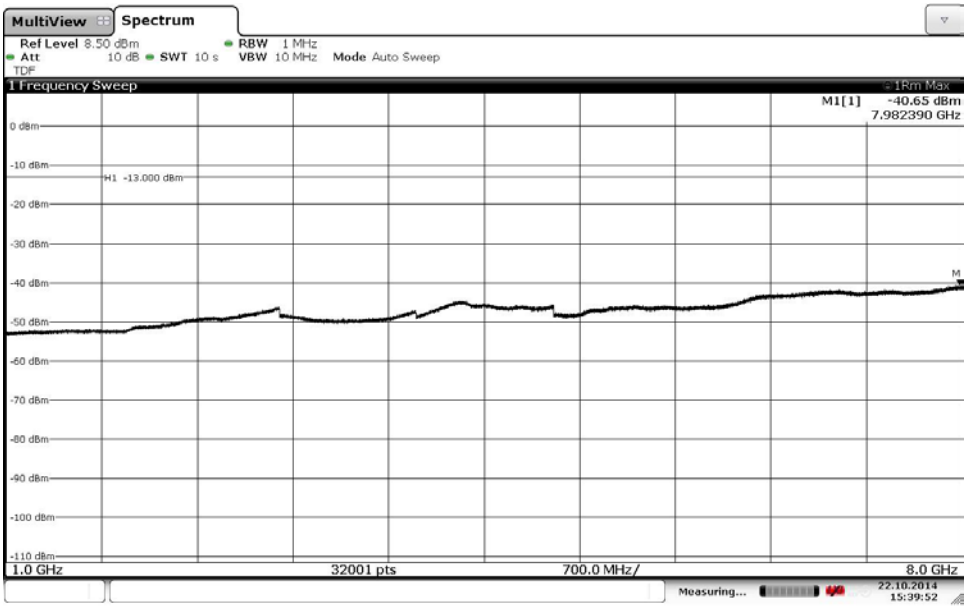
Diagram 11b:



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Appendix 6

Diagram 12a:

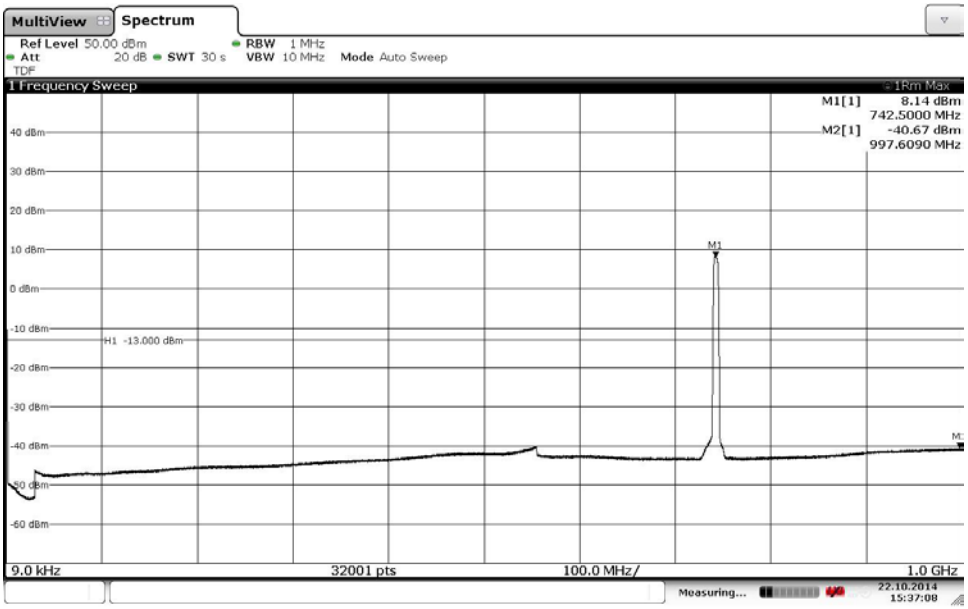

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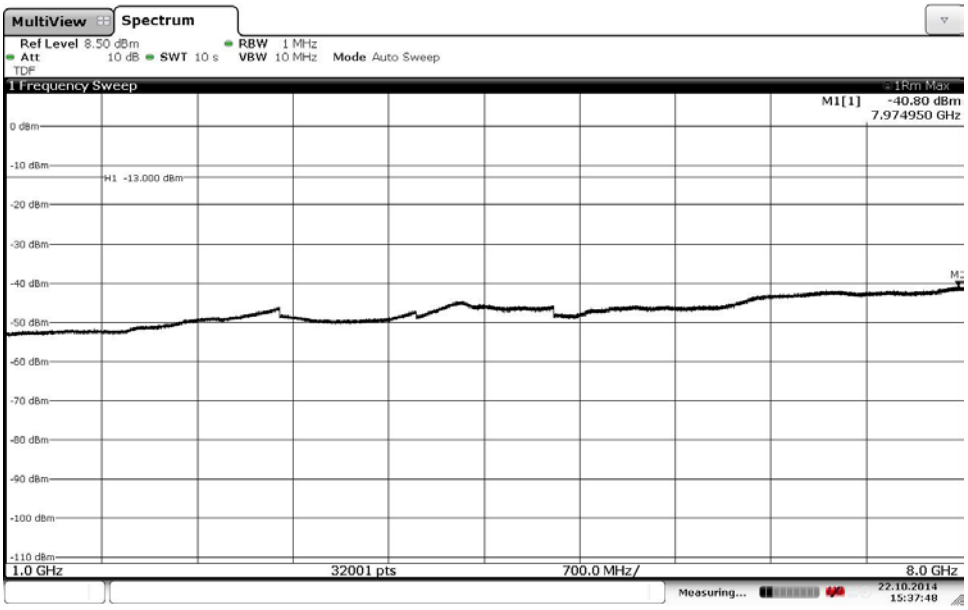
Diagram 12b:



Date: 22.OCT.2014 15:37:48

Appendix 6

Diagram 13a:

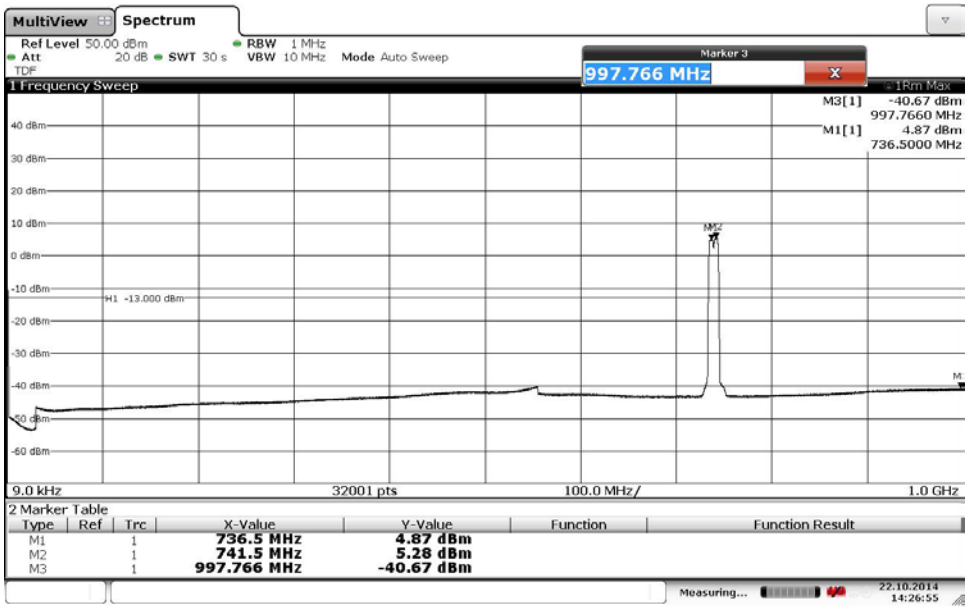


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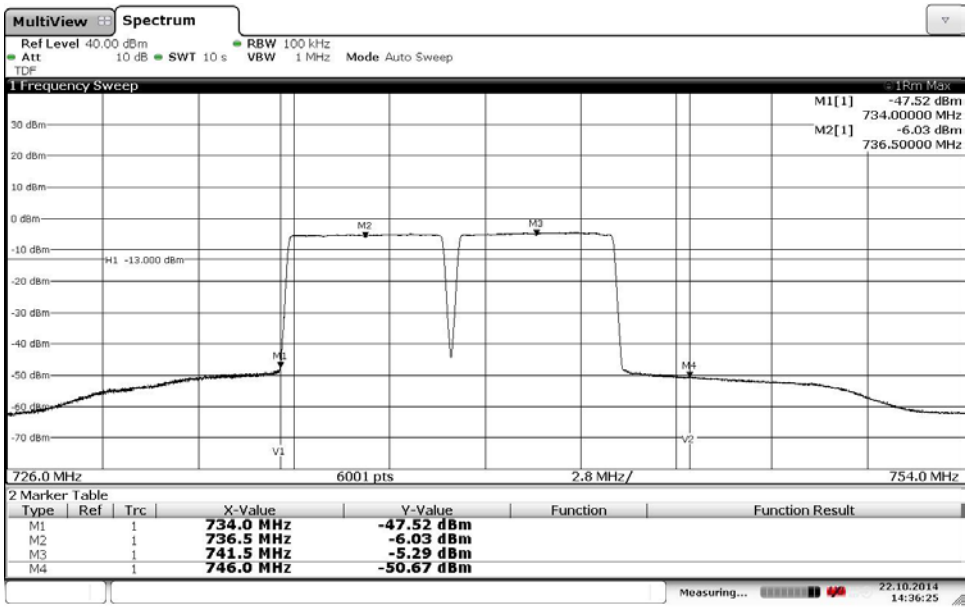
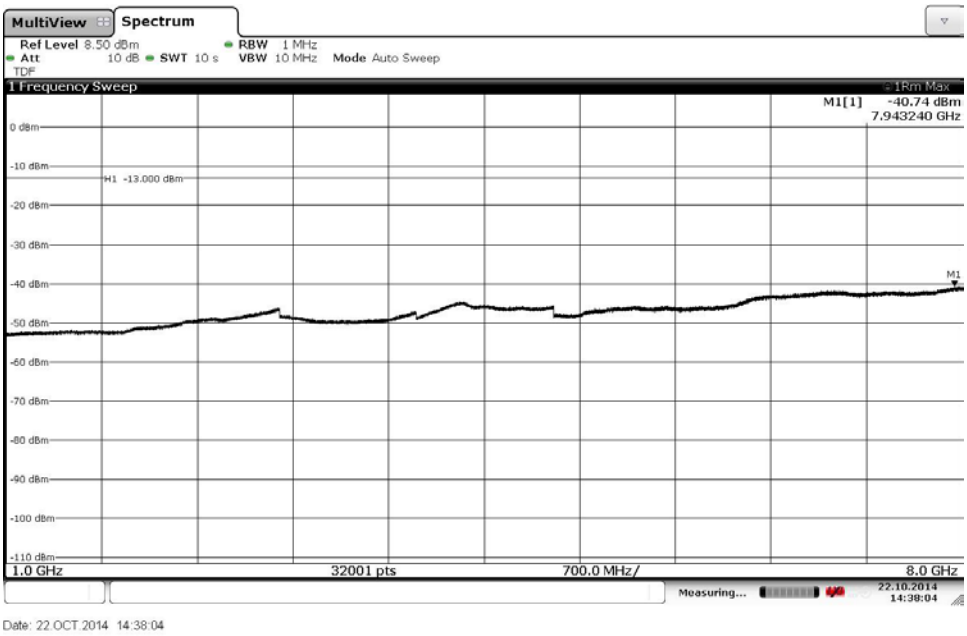
Diagram 13b:



Date: 22.OCT.2014 14:36:25

Appendix 6

Diagram 13c:



Appendix 6

Diagram 14a:

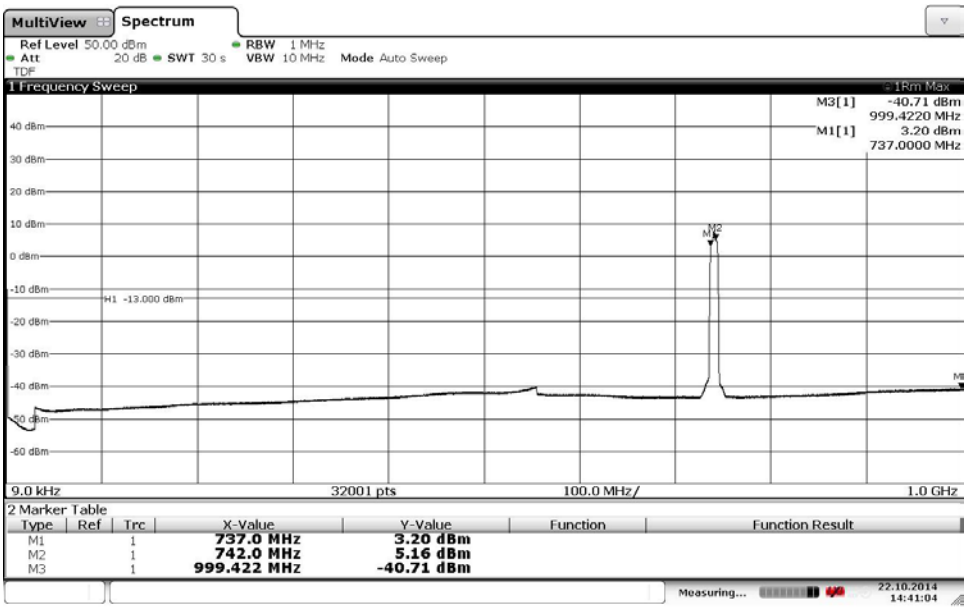


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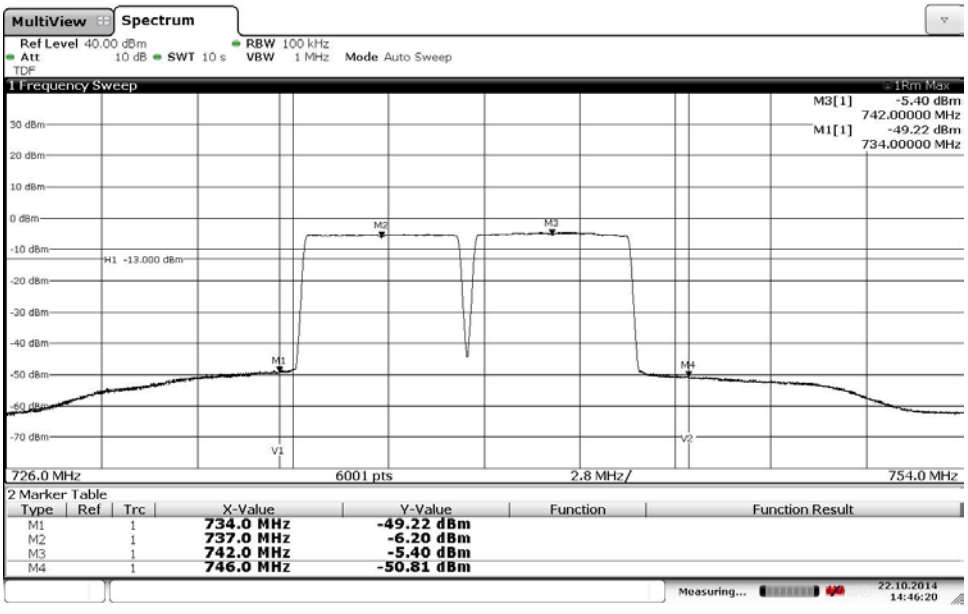
Diagram 14b:



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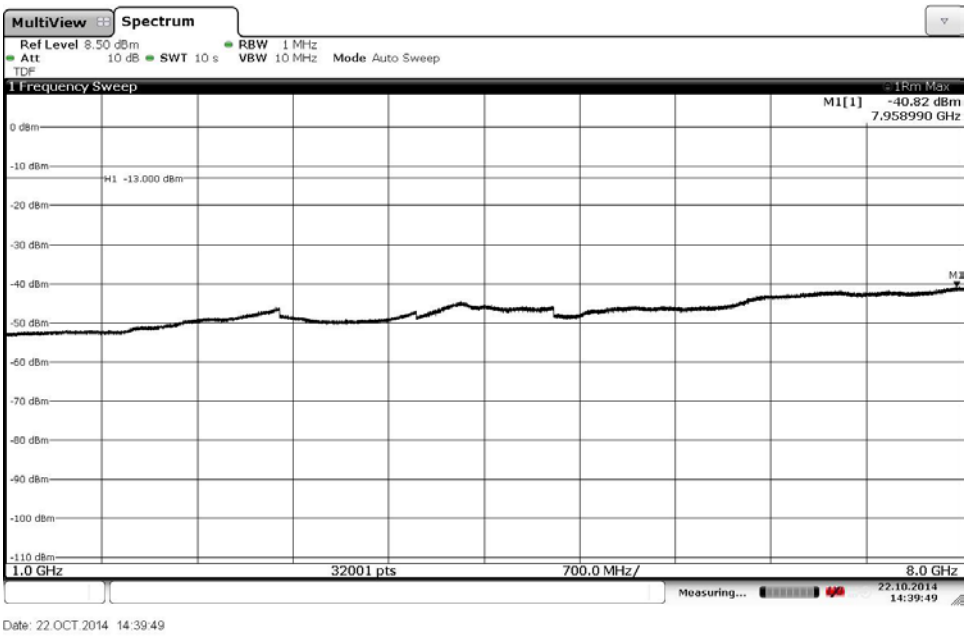
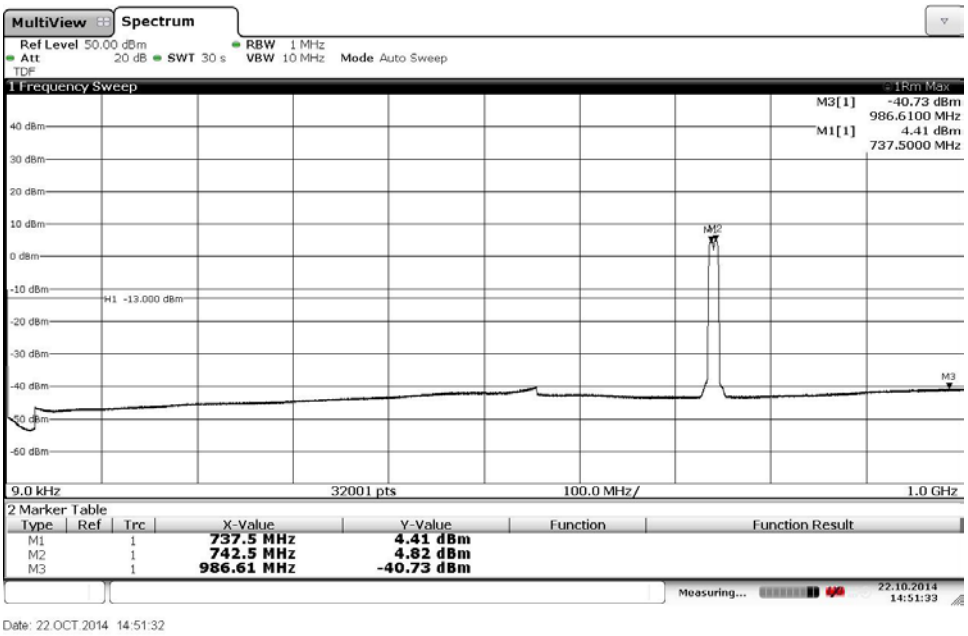
Appendix 6

Diagram 14c:



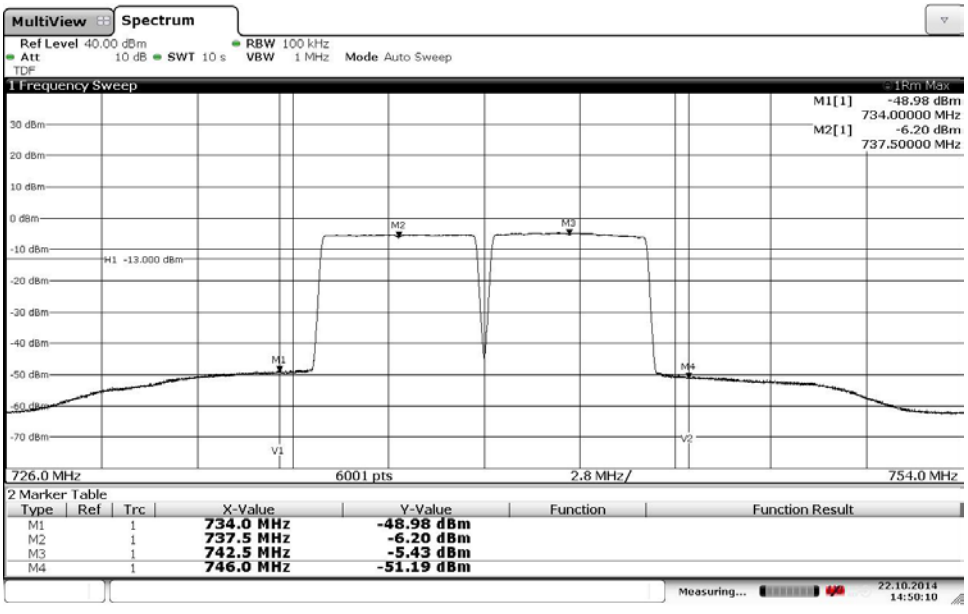
Appendix 6

Diagram 15a:



Date: 22.OCT.2014 14:51:32

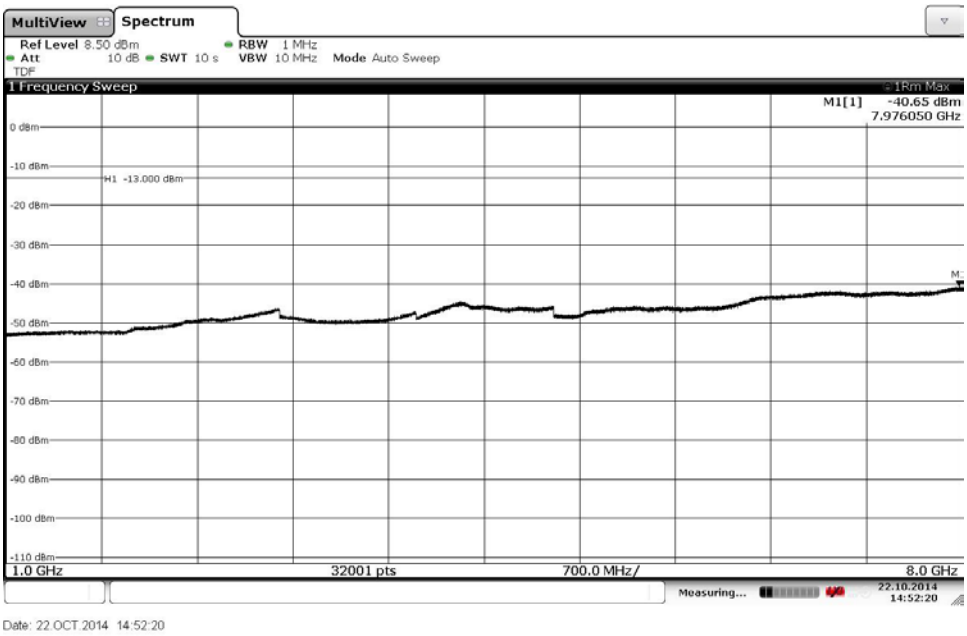
Diagram 15b:



Date: 22.OCT.2014 14:50:10

Appendix 6

Diagram 15c:



Field strength of spurious radiation measurements according to 47 CFR 27.53 (f)

Date	Temperature	Humidity
2014-10-17	23 °C ± 3°C	35 % ± 5 %

Test set-up and procedure

The test sites are listed at FCC, Columbia with registration number: 93866. The test site complies with RSS-Gen, Industry Canada file no. 3482A-1.

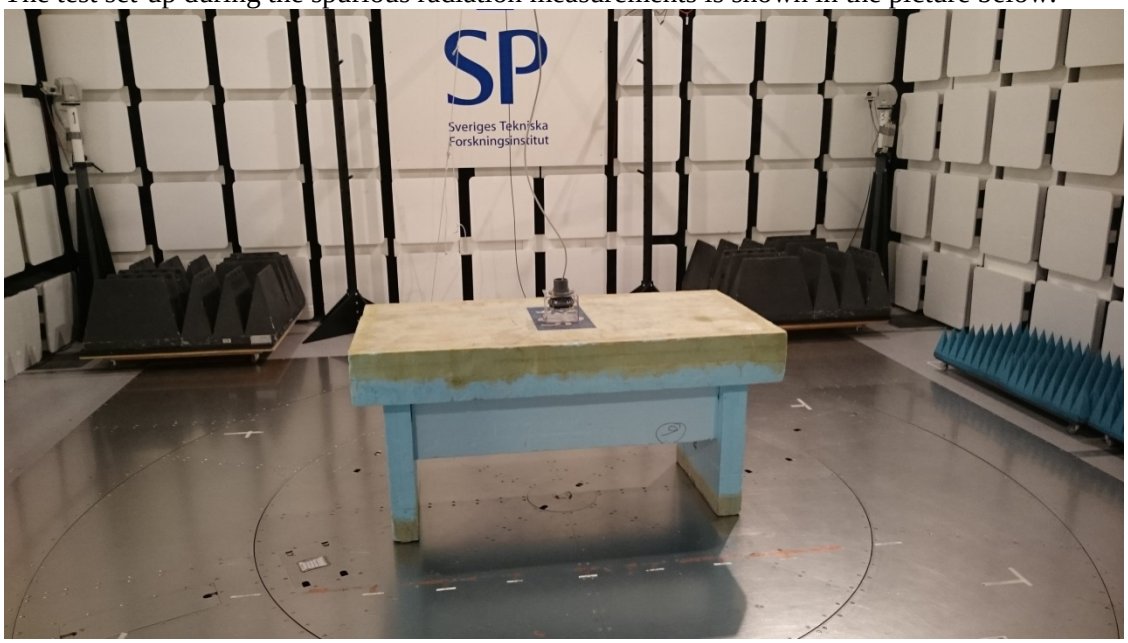
The measurements were performed with both horizontal and vertical polarization of the antenna. The antenna distance was 3 m in the frequency range 30 MHz – 8 GHz.

In the frequency range 30 MHz – 8 GHz the measurement was performed in power with a RBW of 1 MHz. A propagation loss in free space was calculated. The used formula was $\gamma = 20\log\left(\frac{4\pi D}{\lambda}\right)$, γ is the propagation loss and D is the antenna distance.

The measurement procedure was as the following:

1. A pre-measurement is performed with peak detector. For measurement < 1 GHz the test object is measured in eight directions with the antenna at three heights, 1.0 m, 1.5 m and 2.0. For measurements > 1 GHz the test object was measured in seventeen directions with the antenna at 1.0 m in height.
2. Spurious radiation on frequencies closer than 20 dB to the limit in the pre-measurement is scanned 0-360 degrees and the antenna is scanned 1- 4 m for maximum response. The emission is then measured with the RMS detector and the RMS value is reported. Frequencies closer than 10 dB to the limit when measured with the RMS detector were measured with the substitution method according to the standard.

The test set-up during the spurious radiation measurements is shown in the picture below:



Measurement equipment

Measurement equipment	SP number
Semi anechoic chamber	503 881
R&S ESU 26	901 553
EMC 32 ver. 8.52.0	503 899
Chase Bilog Antenna CBL 6111A	503 182
EMCO Horn Antenna 3115	502 175
High pass filter, RLC Electronics	901 373
µComp Nordic, Low Noise Amplifier	901 545
Testo 625 temperature and humidity meter	504 188

Tested configurations

B5
M5
M10
T5
2M5

Results, representing worst case

M, BW: 5 MHz Diagram 1 a-b

Frequency (MHz)	Spurious emission level (dBm)	
	Vertical	Horizontal
30-8000	All emission > 20 dB below limit	All emission > 20 dB below limit

Measurement uncertainty:

3.2 dB up to 18 GHz

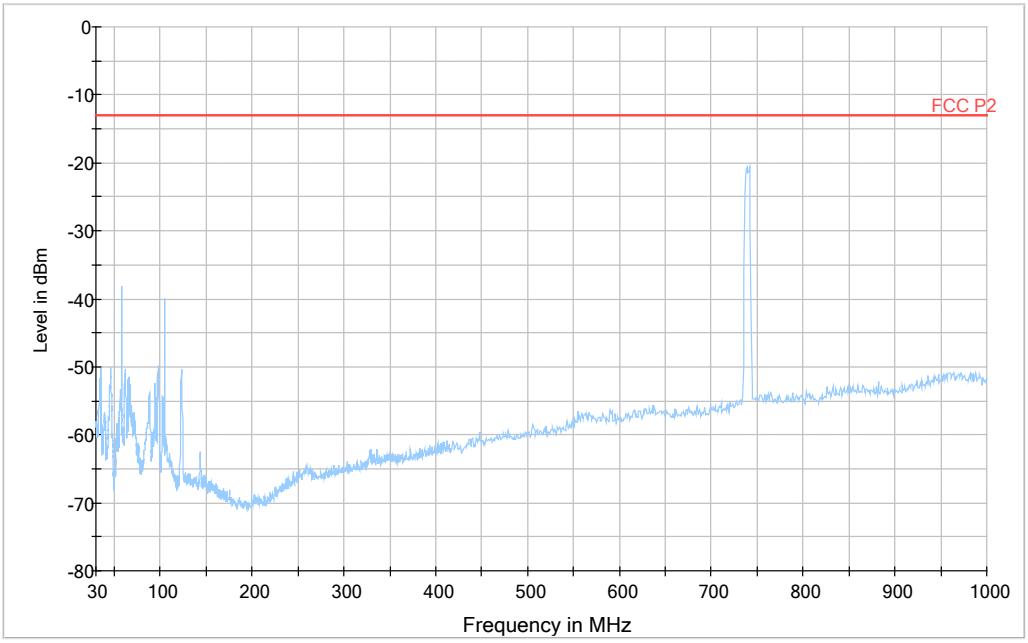
Limits

CFR 47 §27.53 (f)

Outside a licensee's frequency band(s) of operation the power of any emission shall be attenuated below the transmitter power (P) by at least 43 + 10 log (P) dB, resulting in a limit of -13 dBm per 100 kHz RBW.

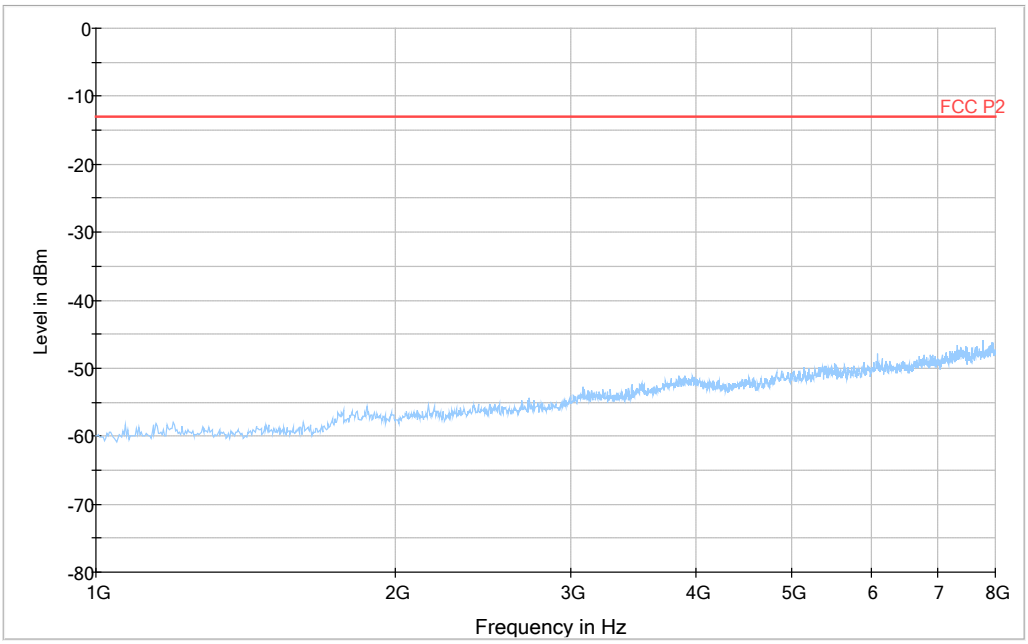
Complies?	Yes

Diagram 1a:



Note: The emission at 739.5 MHz is the carriers frequency and shall be ignored in the context.

Diagram 1b:



Frequency stability measurements according to CFR 47 § 27.54

Date	Temperature	Humidity
2014-10-22	23 °C ± 3°C	34% ± 5%

Test set-up and procedure

The measurement was made per 3GPP TS 36.141. The output was connected to a spectrum analyser. The spectrum analyser was connected to an external 10 MHz reference standard during the measurements.

Measurement equipment	SP number
R&S FSQ 40	504 143
RF attenuator	900 233
RF Terminator	-
Temperature Chamber	503 360
Testo 635, temperature and humidity meter	504 203
Multimeter Fluke 87	502 190

Results

Maximum output power at mid channel (M). Channel Bandwidth 5 MHz. Rated output power level at connector RF A (maximum): 17 dBm.

Configuration: RDI Cable 100m

Test conditions		Frequency error (Hz)
Supply voltage DC (V)	T (°C)	Test model E-TM1.1
-48.0	+20	-17
-55.2	+20	-16
-40.8	+20	-22
-48.0	+30	-22
-48.0	+40	-19
-48.0	+50	-19
-48.0	+10	-17
-48.0	0	-18
-48.0	-10	-14
-48.0	-20	-13
-48.0	-30	-16
Maximum freq. error (Hz)		22
Measurement uncertainty		$< \pm 1 \times 10^{-7}$

Measurements according to 3GPP TS 36.141.

Results

Maximum output power at mid channel (M). Channel Bandwidth 5 MHz. Rated output power level at connector RF A (maximum): 17 dBm.

Configuration: RDI Cable 20m

Test conditions			Frequency margin to band edge at -16 dBm			
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth [MHz]	Test frequency Symbolic name B5		Test frequency Symbolic name T5	
			fL [MHz]	Offset to lower band edge (>2110 MHz) [kHz]	fH [MHz]	Offset to upper band edge (<2155 MHz) [kHz]
-48.0	+20	5	734.207	207	744.789	1211
-48.0	+20	10	734.426	426	744.568	1432

Configuration: RDI Cable 100m

Test conditions			Frequency margin to band edge at -16 dBm			
Supply voltage DC [V]	Temp [°C].	Carrier Bandwidth [MHz]	Test frequency Symbolic name B5		Test frequency Symbolic name T5	
			fL [MHz]	Offset to lower band edge (>2110 MHz) [kHz]	fH [MHz]	Offset to upper band edge (<2155 MHz) [kHz]
-48.0	+20	5	734.208	208	744.789	1211
-48.0	+20	10	734.428	428	744.567	1433

Measurements according to FCC CFR 47 § 27.54

The frequency error results clearly shows that the frequency stability is good enough to ensure that the transmitted carrier stay within the operating band.

Remark

It was deemed sufficient to test one combination of TX frequency, channel bandwidth configuration and test model (modulation), as all combinations share a common internal reference to derive the TX frequency from.

Limits

CFR 47 § 27.54 Frequency stability

The frequency stability shall be sufficient to ensure that the fundamental emissions stay within the authorized bands of operation.

Complies?	Yes

Appendix 9

External photos

Top side

Bottom side

Side

Label