Annex 1: Measurement diagrams to
T E S T R E P O R T
No.: 16-1-0032501T20a

According to:
FCC Regulations
Part 15.209, Part 15.205

for

Huf Tools GmbH Velbert

BMW Keywriter Production Keywriter for transponder based vehicle keys

FCC-ID: PD6MU125134

Laboratory Accreditation and Listings			
DAkkS Deutsche Akkreditierungsstelle D-PL-12047-01-01	MRA US-EU 0003	Industry Canada Reg. No.: 3462D-2 Reg. No.: 3462D-3	Voluntary Controls for Electromagnetic Emissions Reg. No.: R-2666 C-2914, T-1967, G-301
WiFi ALLIANCE AUTHORIZED RF LABORATORY	ctia Authorized™ Test Lab Lab Code: 20011130-00		
accredited according to DIN EN ISO/IEC 17025			

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1. Measurement diagrams of emission test

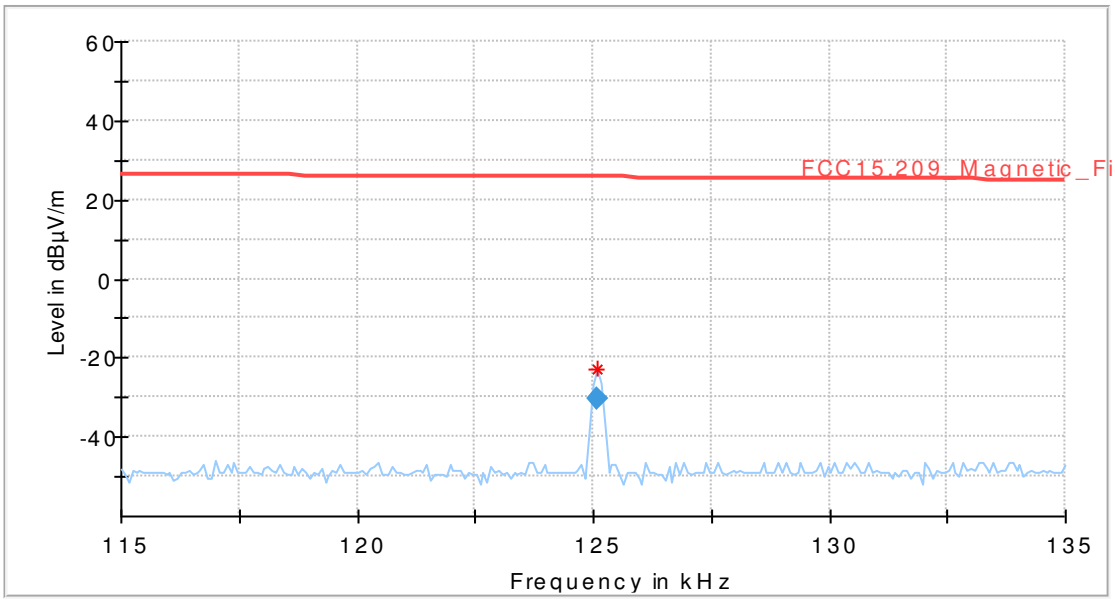
1.1. Diagrams of radiated field strength emissions, 9kHz to 30 MHz (Diagram group 02)

2.01_Power_Measurement_125KHz_lying_Position||1

	Date: 18.08.2016 Page 1 of 3
Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	HLa
Operating conditions:	TX-on at 125KHz
Power during tests:	5V DC
Comment 1:	--
Comment 2:	with Tag

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	125kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-



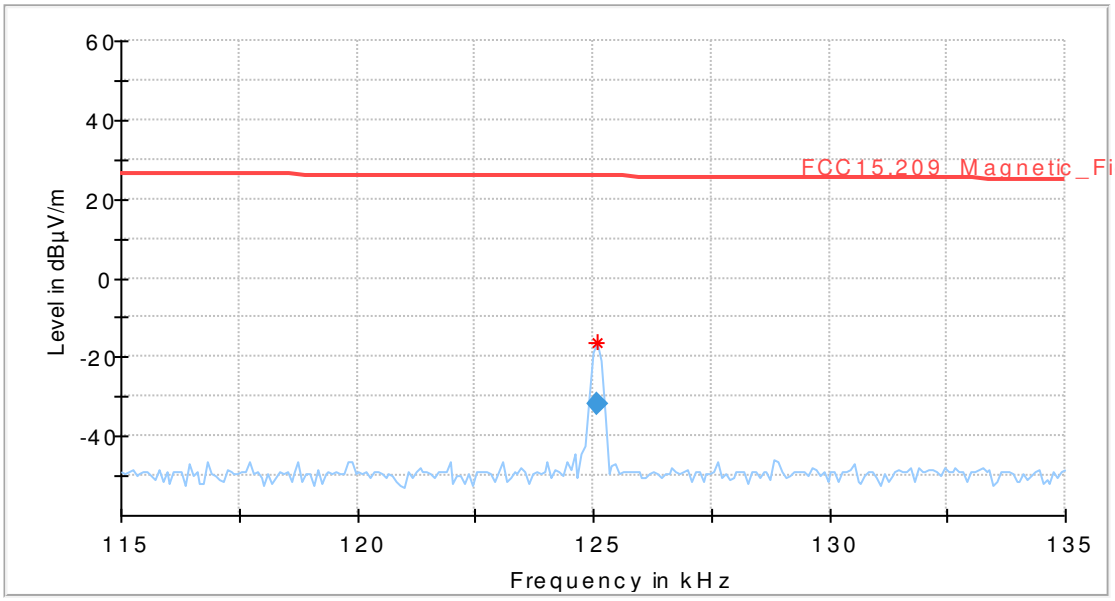
Final_Result

Frequency (MHz)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.125080	-30.40	25.66	56.05	1000.0	0.200	100.0	V	124.0	-59.9

2.05_Power_Measurement_125KHz_standing_Position||1

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	125kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-



Final_Result

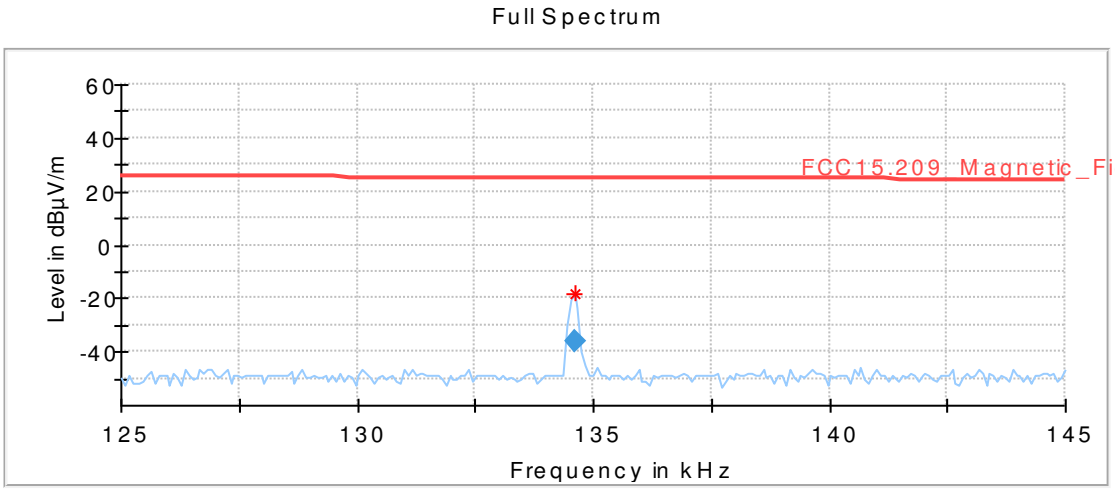
Frequency (MHz)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.125080	-31.82	25.66	57.47	1000.0	0.200	100.0	V	108.0	-59.9

Diagram No. 2.06_Power_Measurement_134KHz_standing_Position

	Date: 19.08.2016 Page 1 of 1
Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	AFr
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-



Final_Result

Frequency (MHz)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.134600	-35.98	25.02	61.00	1000.0	0.200	100.0	V	111.0	-59.7

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
0.134600	08:37:44 - 19.08.2016

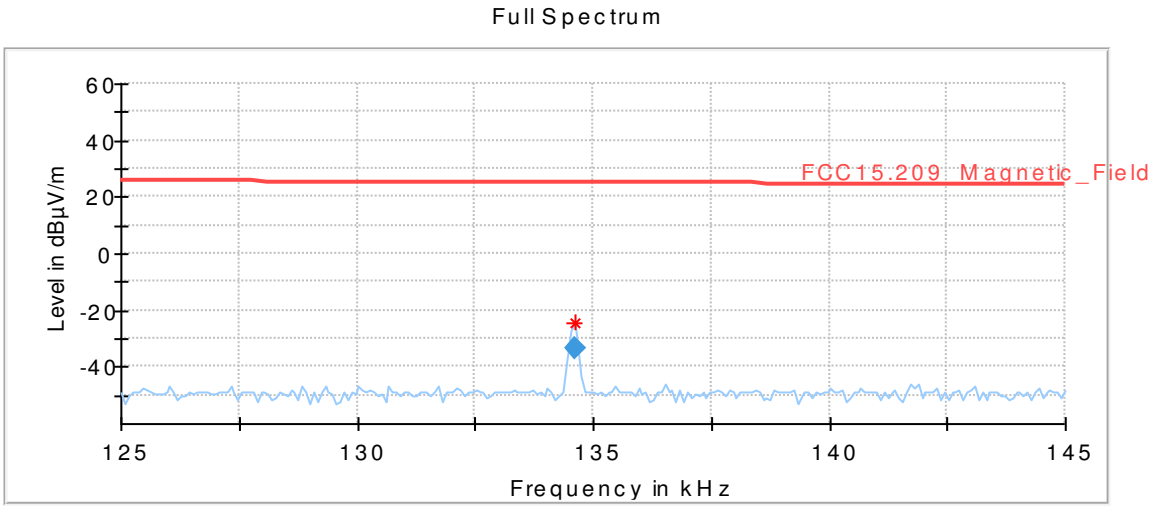
Diagram No. 2.07_Power_Measurement_134KHz_laying_Position

Date: 19.08.2016 Page 1 of 1

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	AFr
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-



Final_Result

Frequency (MHz)	RMS (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
0.134600	-33.63	25.02	58.65	1000.0	0.200	100.0	V	119.0	-59.7

(continuation of the "Final_Result" table from column 16 ...)

Frequency (MHz)	Comment
0.134600	08:58:56 - 19.08.2016

Diagram No. 2.01_Spurious_Emission_125KHz_laying_position

Date: 18.08.2016 Page 1 of 3

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	HLa
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC
Comment 1:	Channel low/middle/high
Comment 2:	with Tag

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-

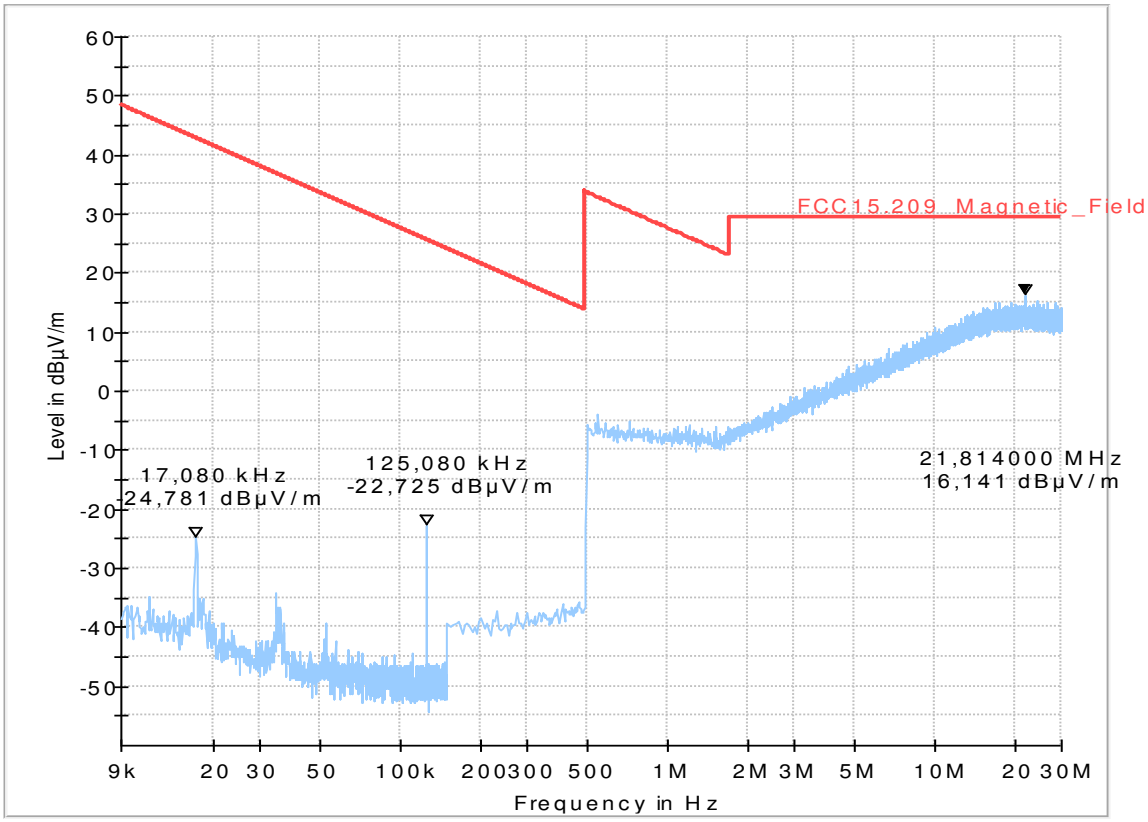


Diagram No. 2.02_Spurious_Emission_125KHz_standing_position

Date: 18.08.2016 Page 1 of 3

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	HLa
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC
Comment 1:	Channel low/middle/high
Comment 2:	with Tag

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-

Full Spectrum

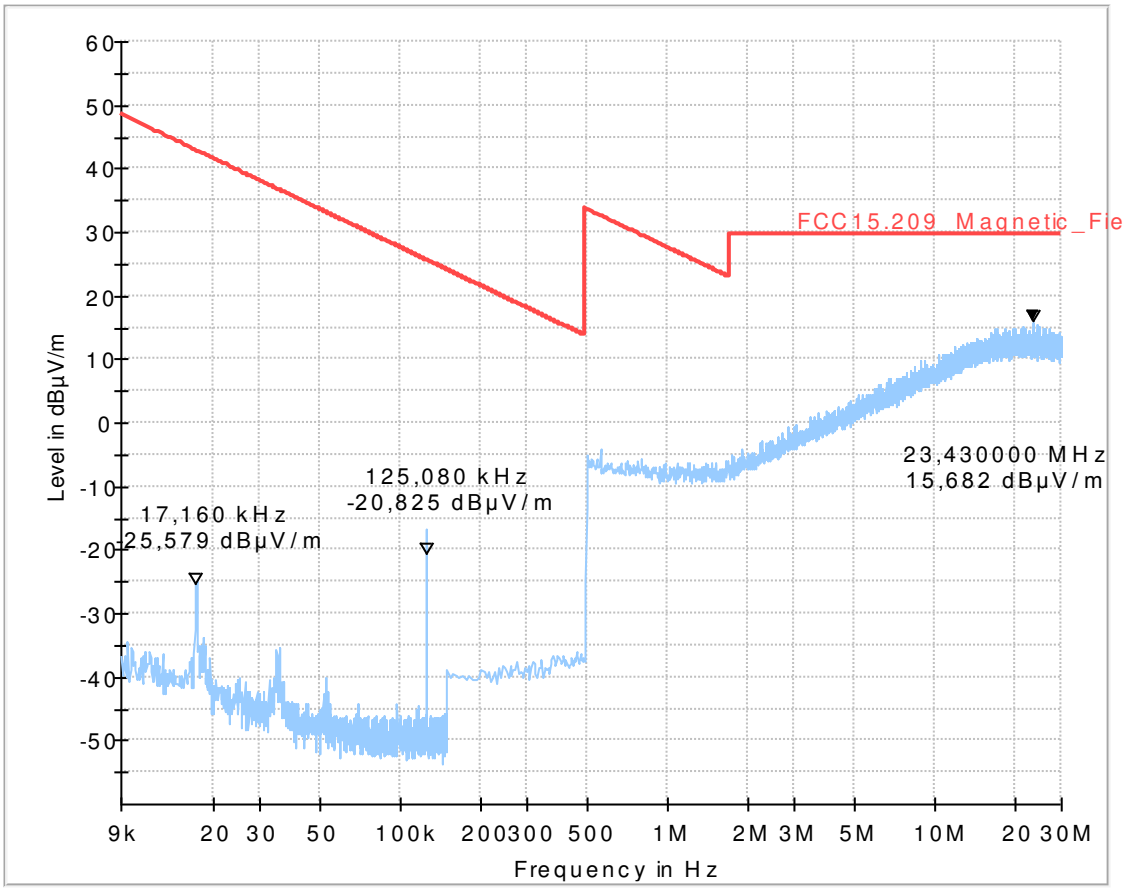


Diagram No. 2.03_Spurious_Emission_134KHz_lying_position

	Date: 18.08.2016 Page 1 of 5
Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	HLa
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC
Comment 1:	Channel low/middle/high
Comment 2:	with Tag

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-

Full Spectrum

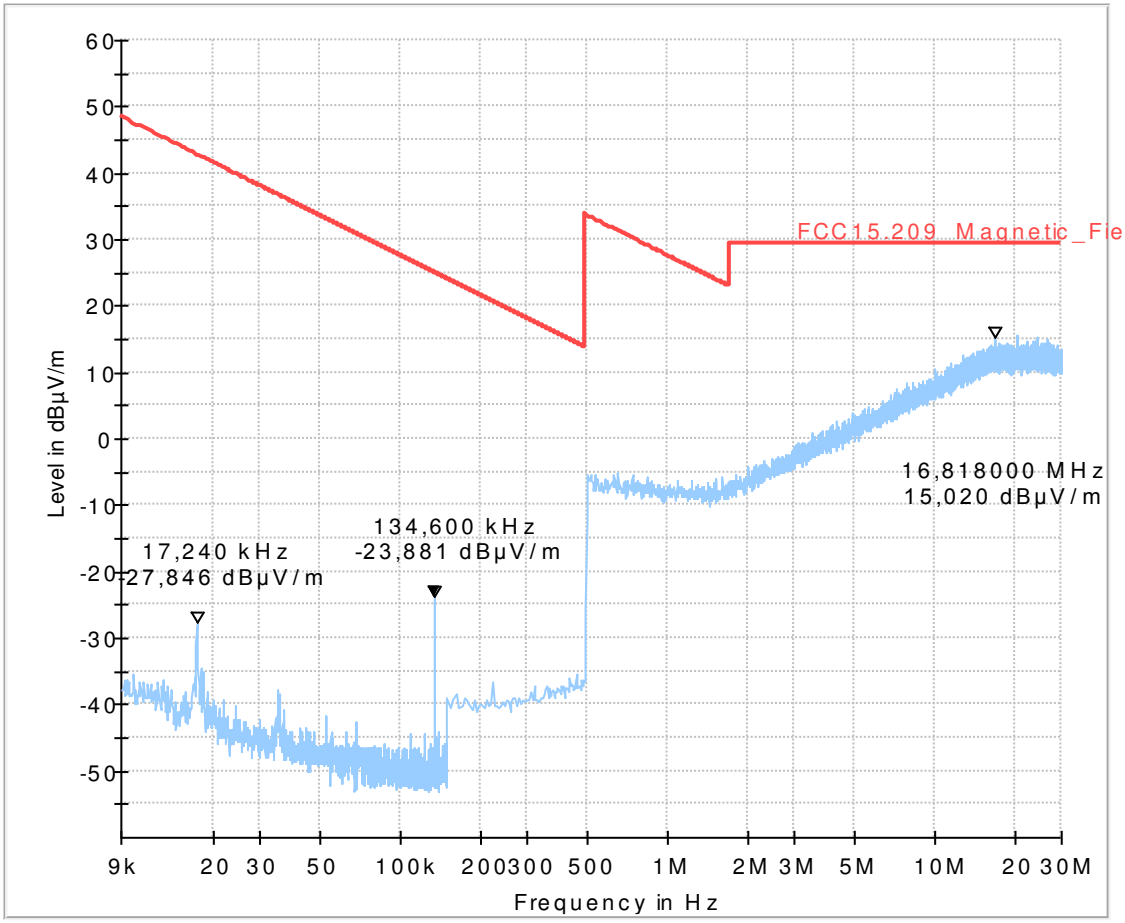


Diagram No. 2.04_Spurious_Emission_134KHz_standing_position

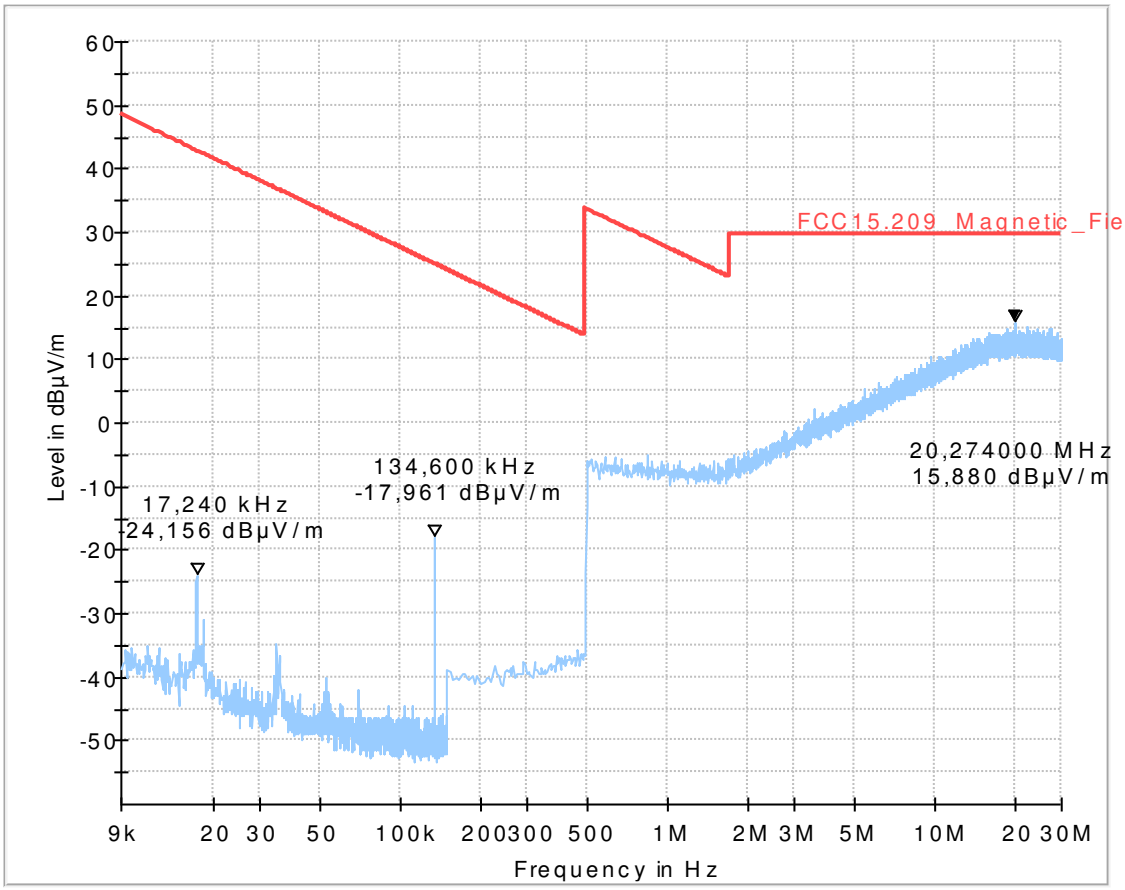
Date: 18.08.2016 Page 1 of 3

Test description:	Magnetic Field Strength Measurement related to 30/300 m distance
Test site and distance:	Ref.-Nr. 441 Semi Anechoic Room (SAR) with 3 m measurement distance
Version of Testsoftware:	EMC32 V9.25.0
Distance correction:	used accord. table, pls. see test report
Technical Data:	Please see page 2 for detailed data of measurement setup
Rec. antenna (pre-scan):	height 1.00 m, parallel and 90° to EUT polarisation
Used filter:	bypass
Test specification:	FCC 15.205 § 15.209; RSS-Gen: Issue 4
Operator:	HLa
Operating conditions:	TX-on at 134KHz
Power during tests:	5V DC
Comment 1:	Channel low/middle/high
Comment 2:	with Tag

EUT Information

Manufacturer:	Huf Tools GmbH
EuT:	Keywriter Prod
---	---
HW Version:	Rev.1
SW Version:	134kHz
Serial Number:	201629-Testsample 004
Connected Interfaces:	USB
Power Supply:	5VDC
Comments:	-

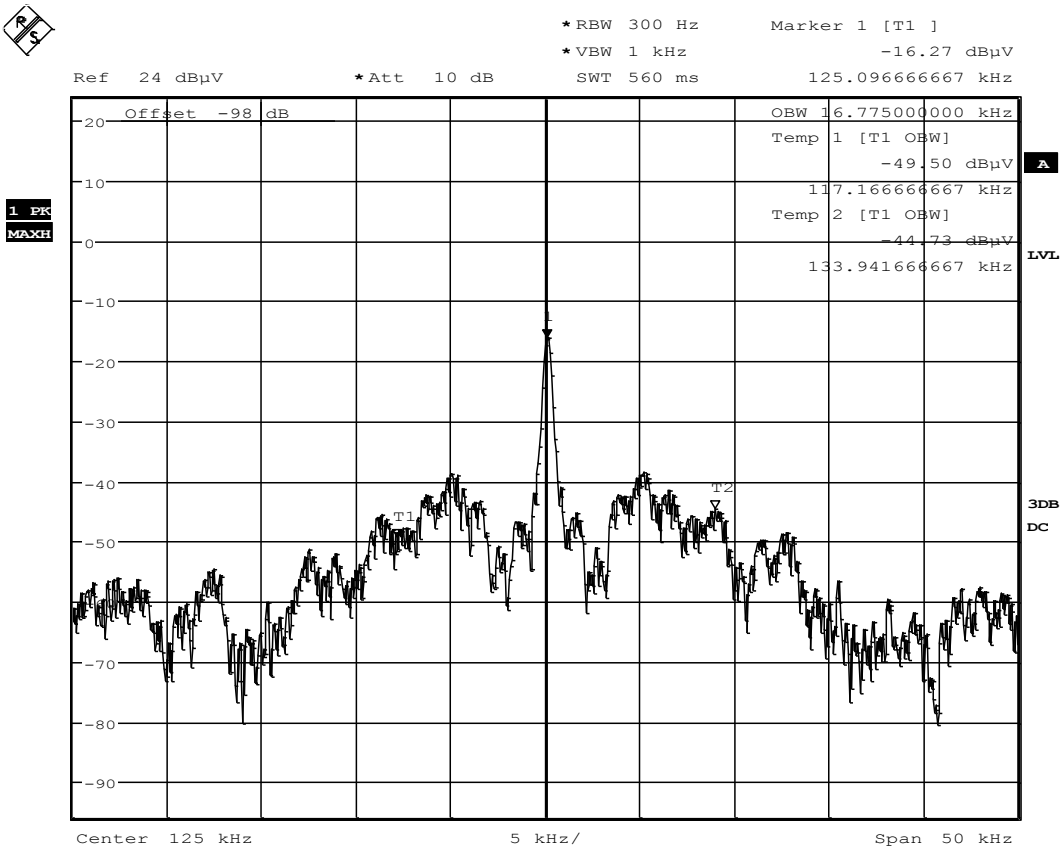
Full Spectrum



1.2. Occupied bandwidth under temperature/voltage variations measurements

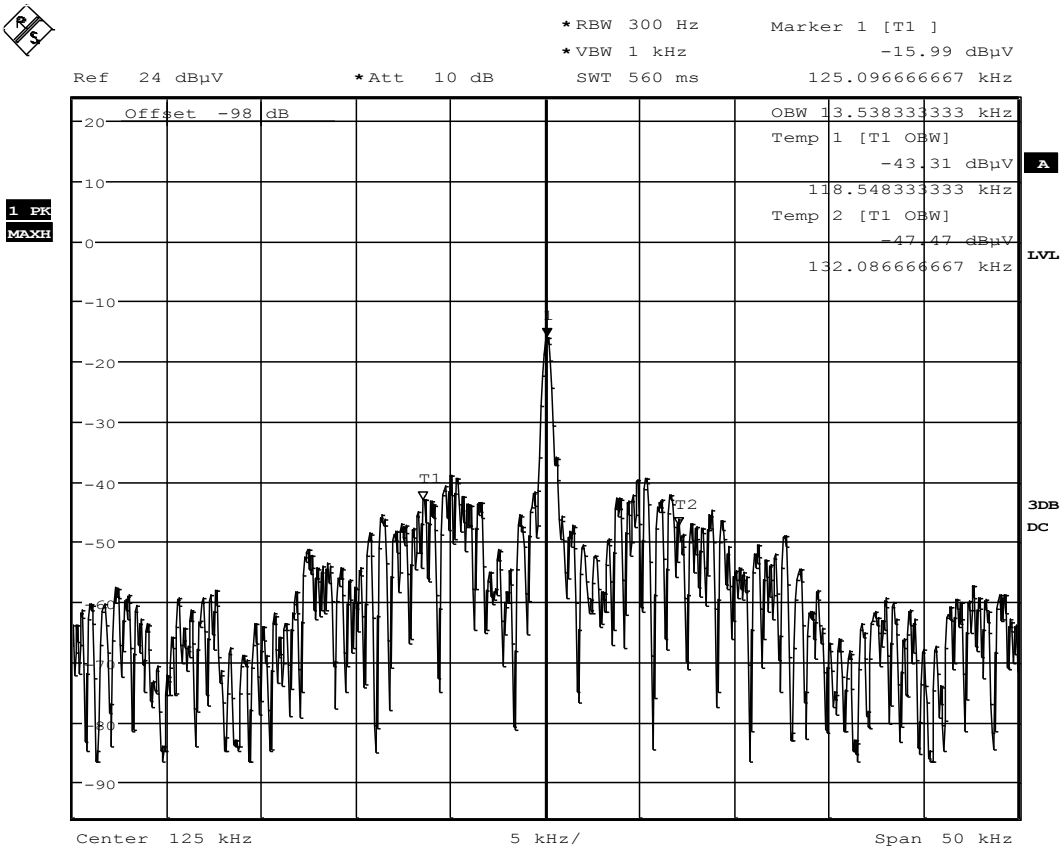
1.2.1. 125 kHz transmitter

1.2.1.1. Temperature variations



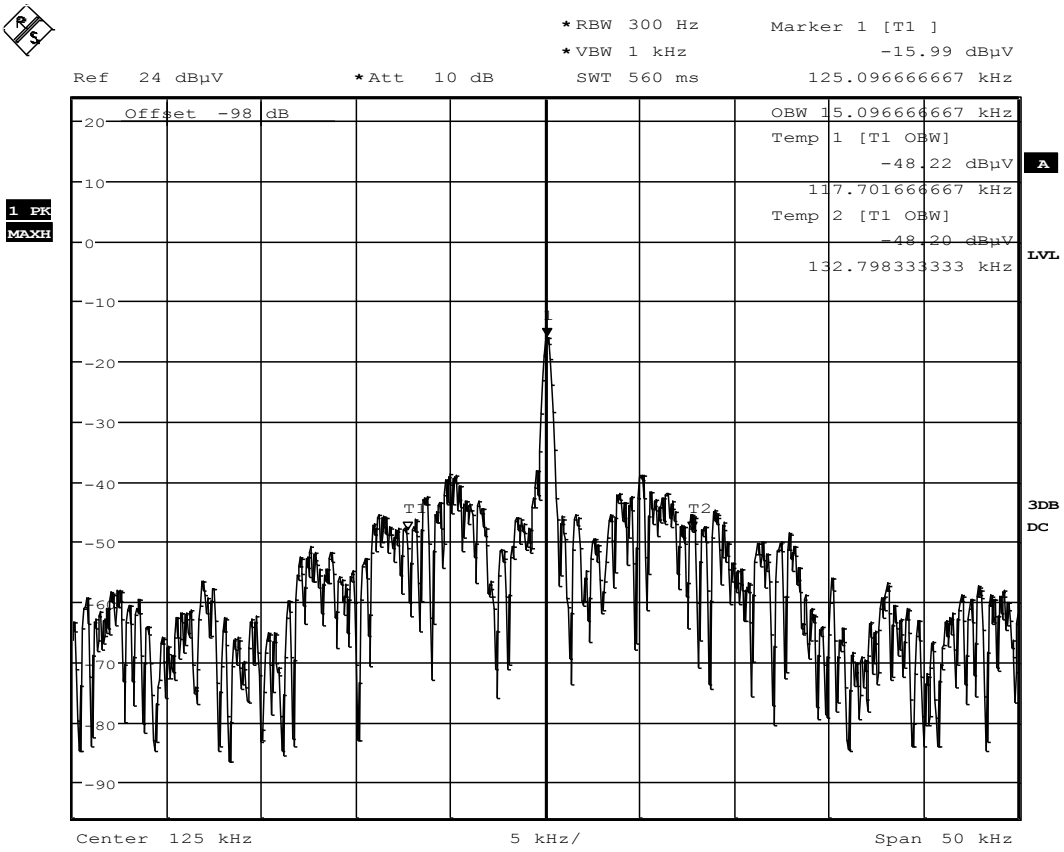
Date: 24.OCT.2016 09:44:08

Diagram 1: OBW_125kHz_TnomVnom_FCC (reference at nominal conditions)



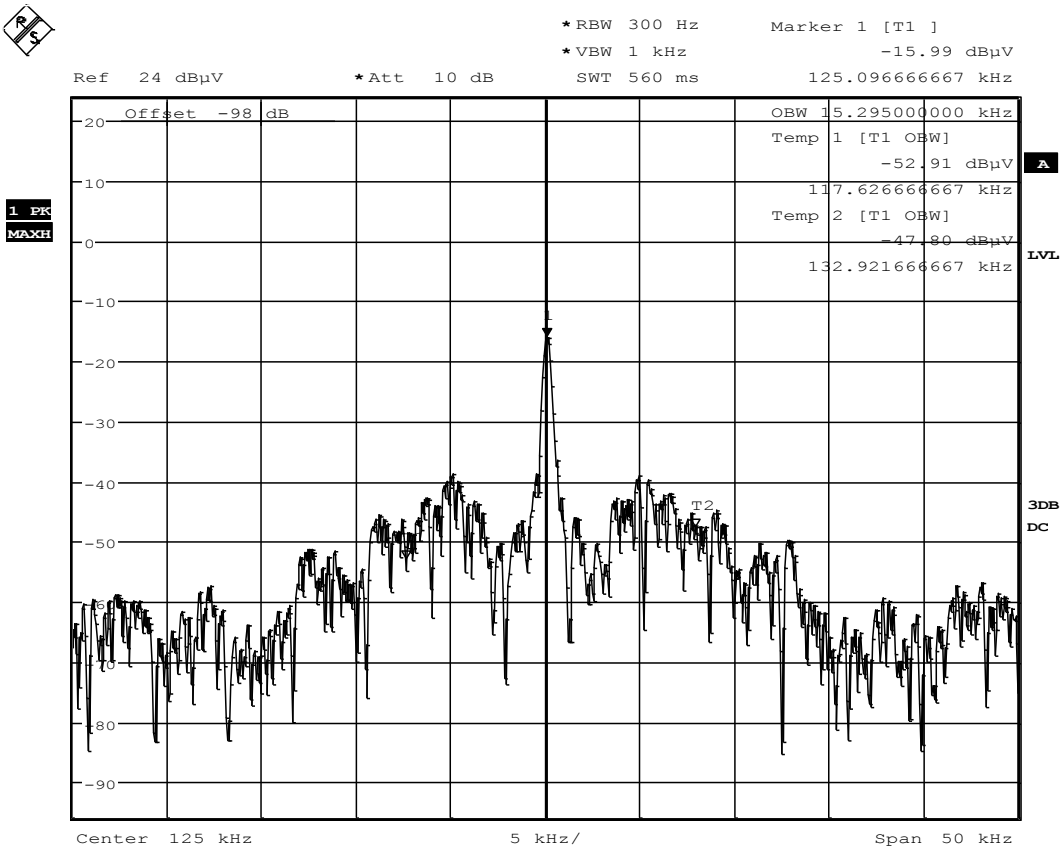
Date: 21.OCT.2016 15:32:39

Diagram 2: OBW_125kHz_M20_T1



Date: 21.OCT.2016 15:34:19

Diagram 3: OBW_125kHz_M20_T2



Date: 21.OCT.2016 15:37:19

Diagram 4: OBW_125kHz_M20_T3

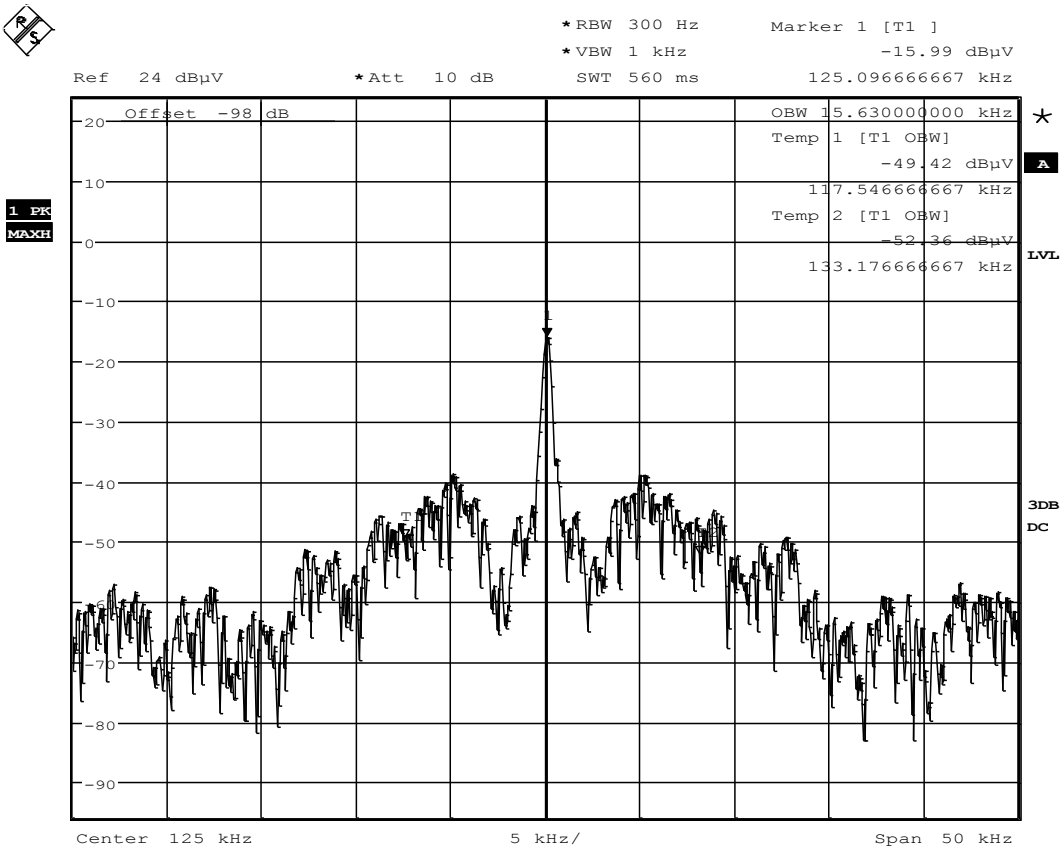


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Diagram 5: OBW_125kHz_M20_T4

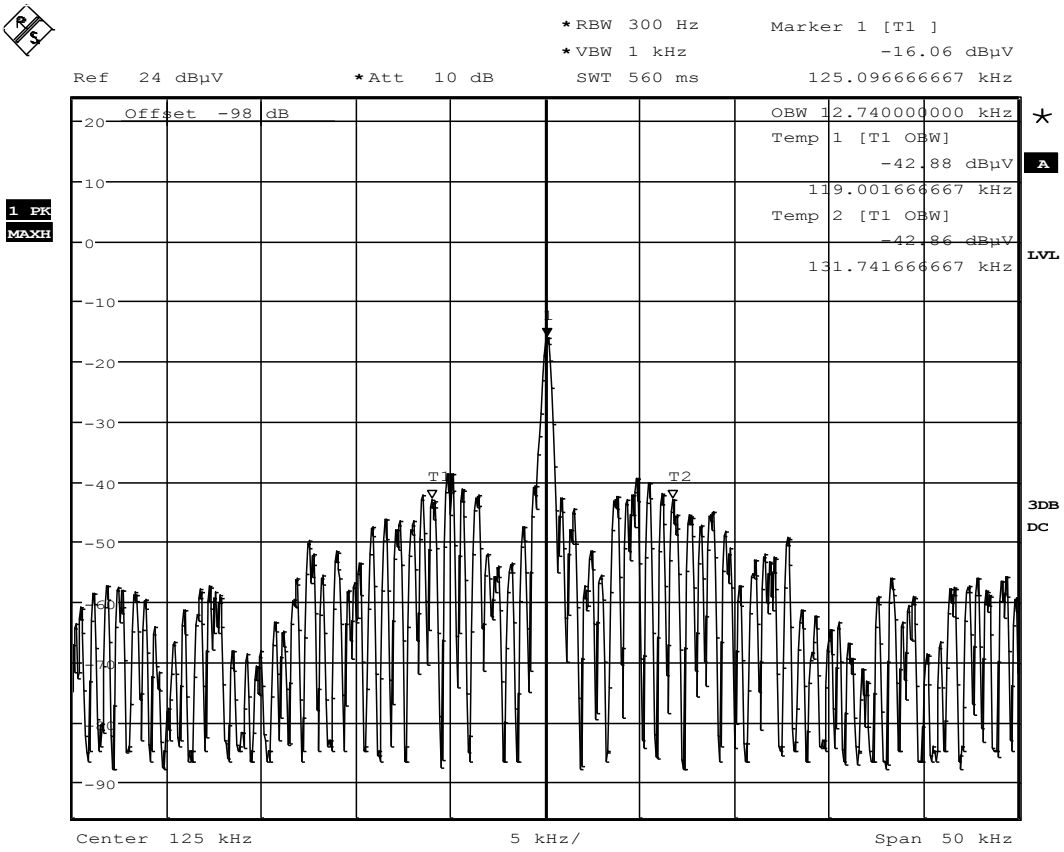

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Diagram 6: OBW_125kHz_P5_T1

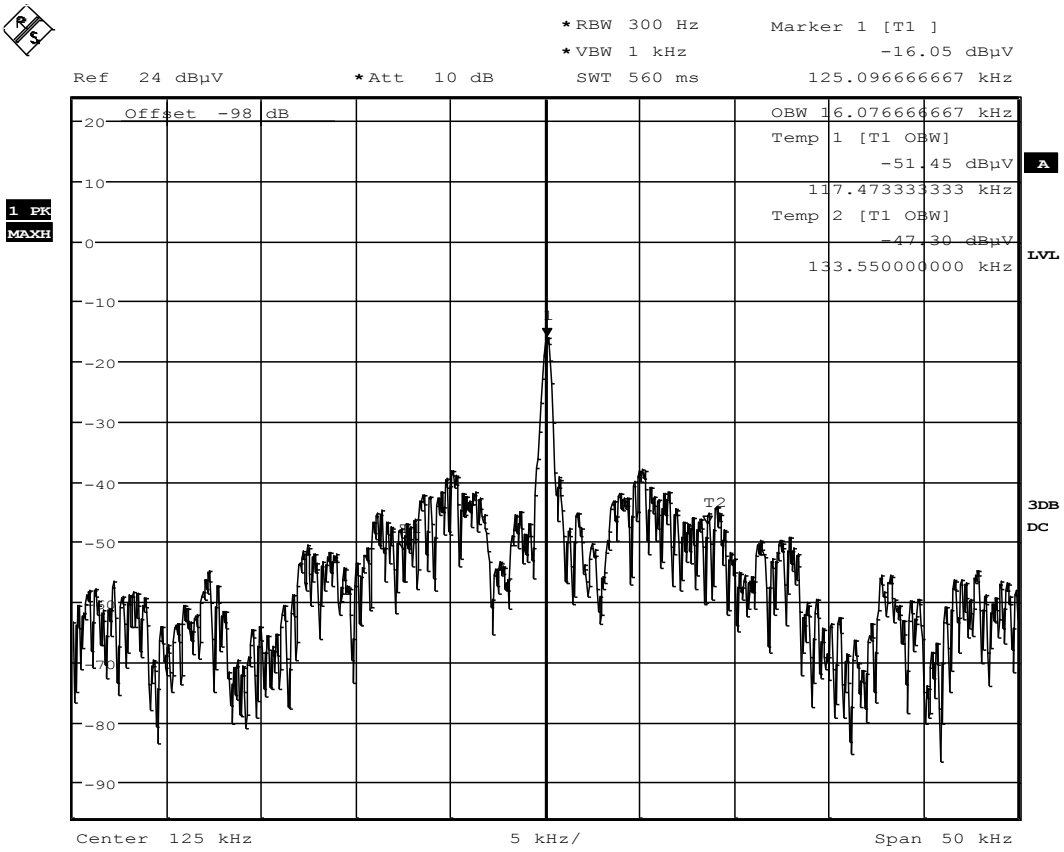

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Diagram 7: OBW_125kHz_P5_T2

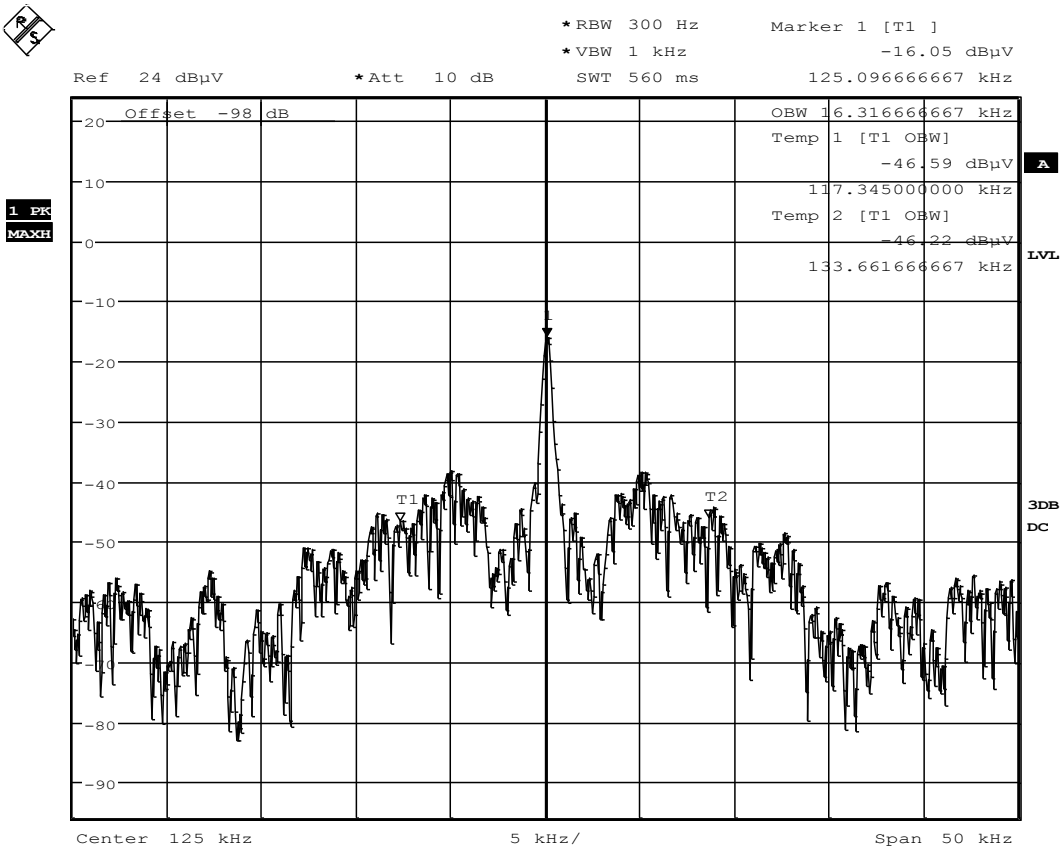

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Diagram 8: OBW_125kHz_P5_T3

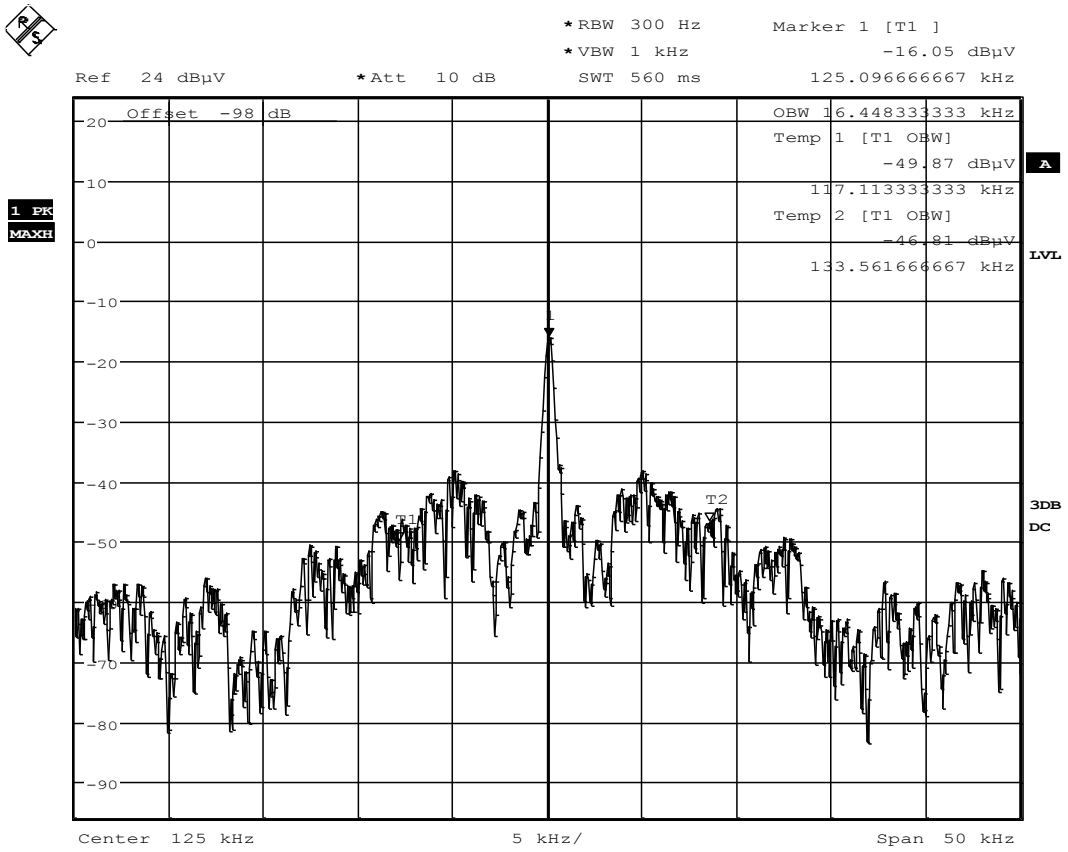

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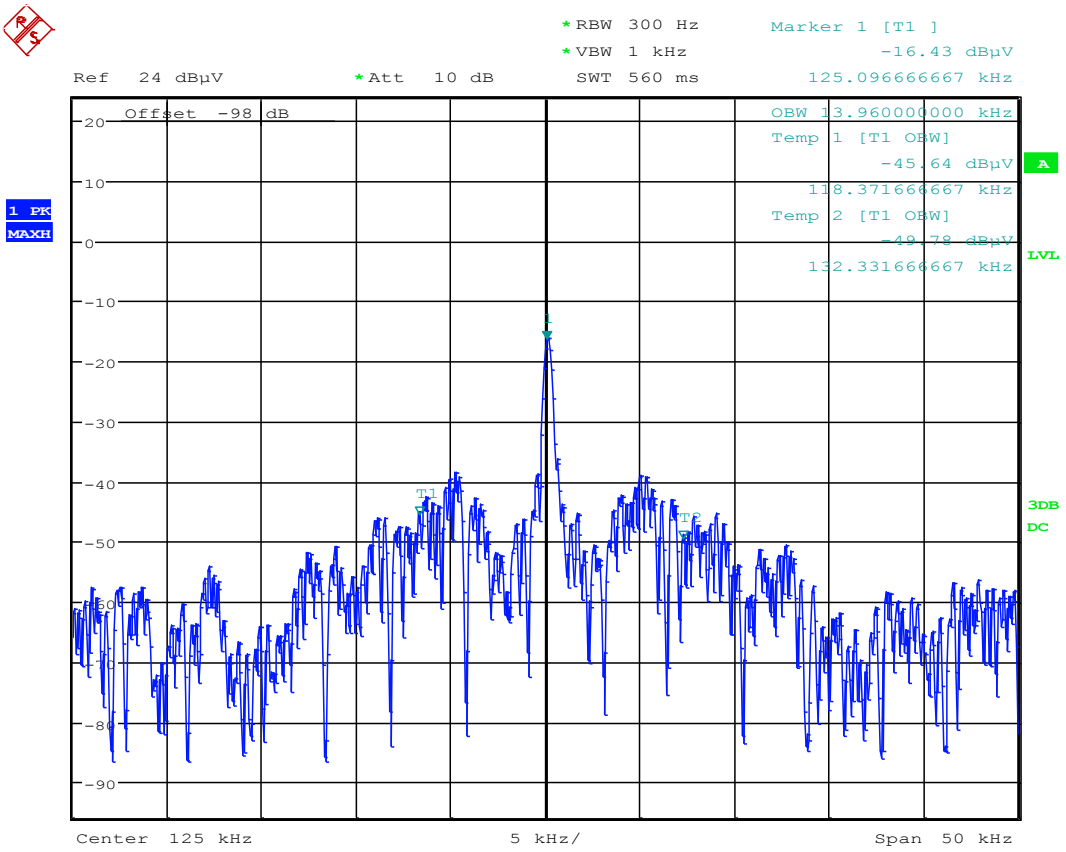
Diagram 9: OBW_125kHz_P5_T4



Date: 21.OCT.2016 11:45:39

Diagram 10: OBW_125kHz_P35_T1

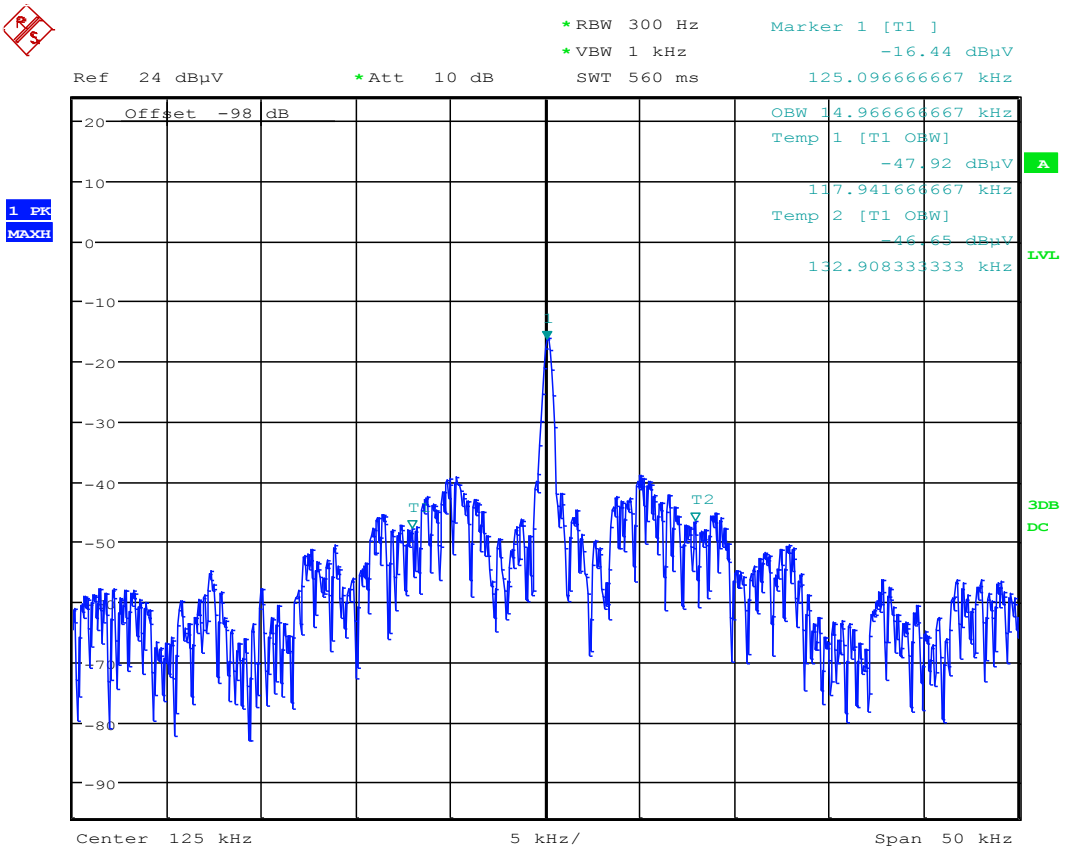


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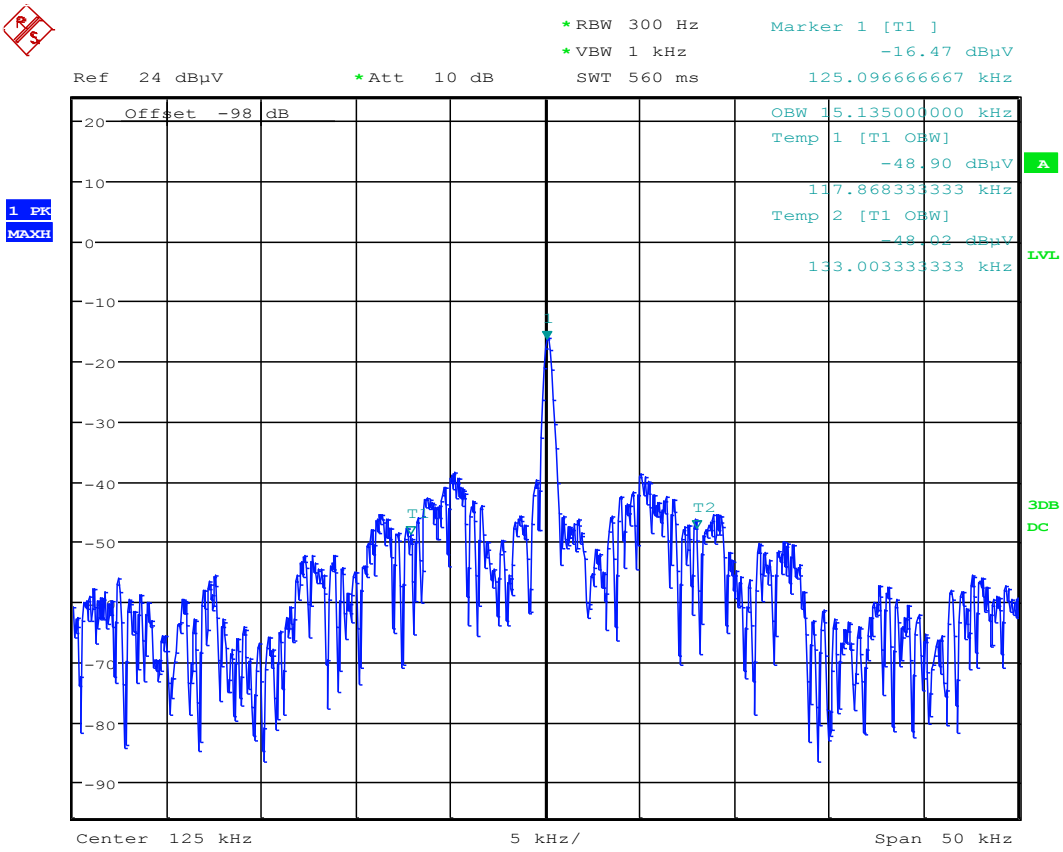
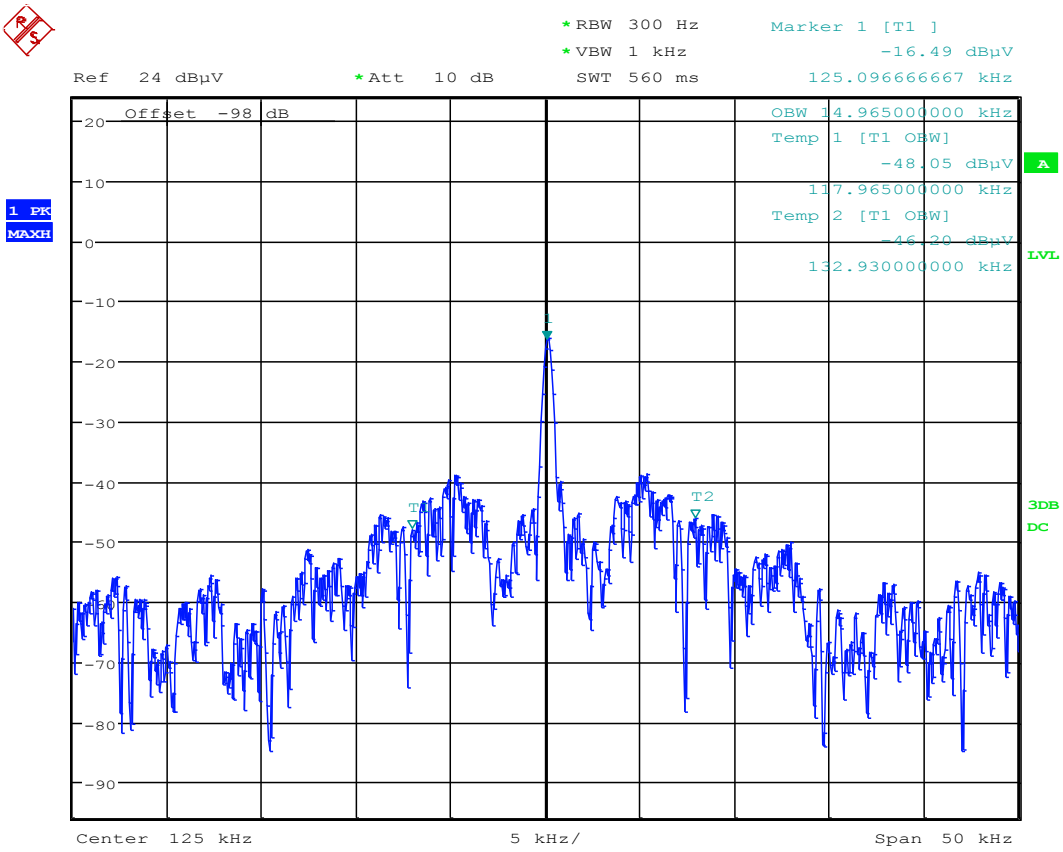
Diagram 11: OBW_125kHz_P35_T2



Date: 21.OCT.2016 11:50:19

Diagram 12: OBW_125kHz_P35_T3



Date: 21.OCT.2016 11:55:19

Diagram 13: OBW_125kHz_P35_T4

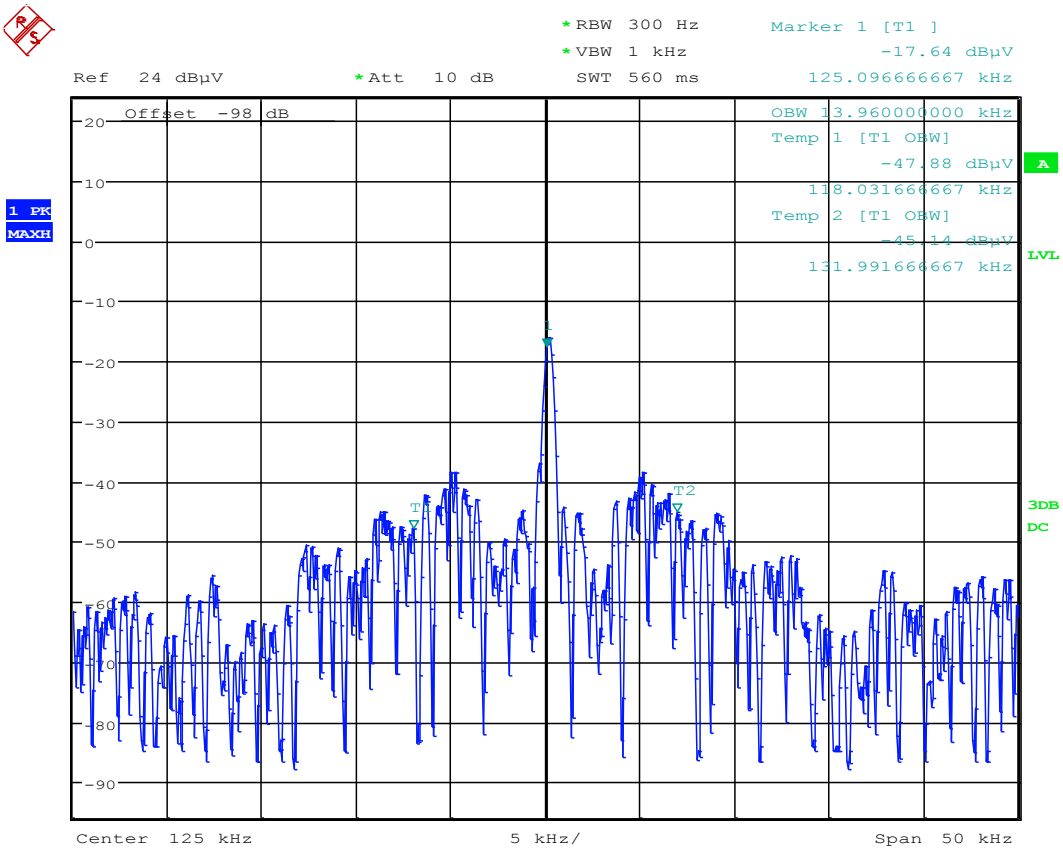


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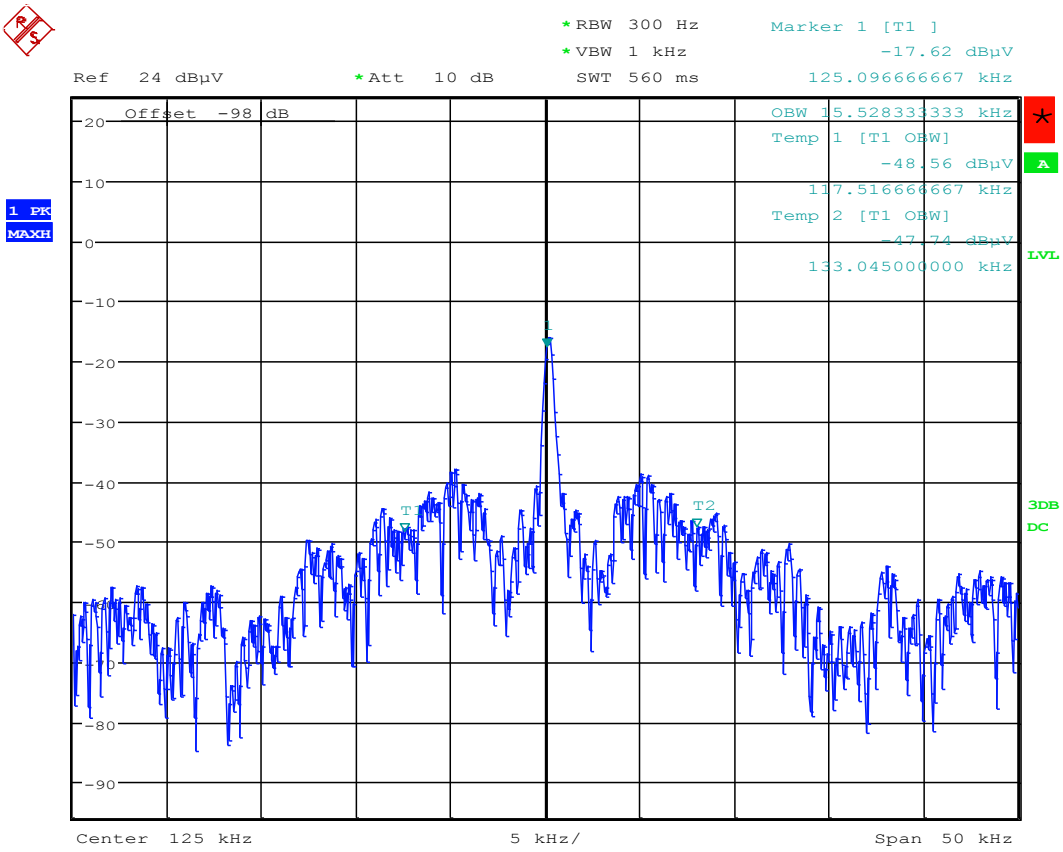
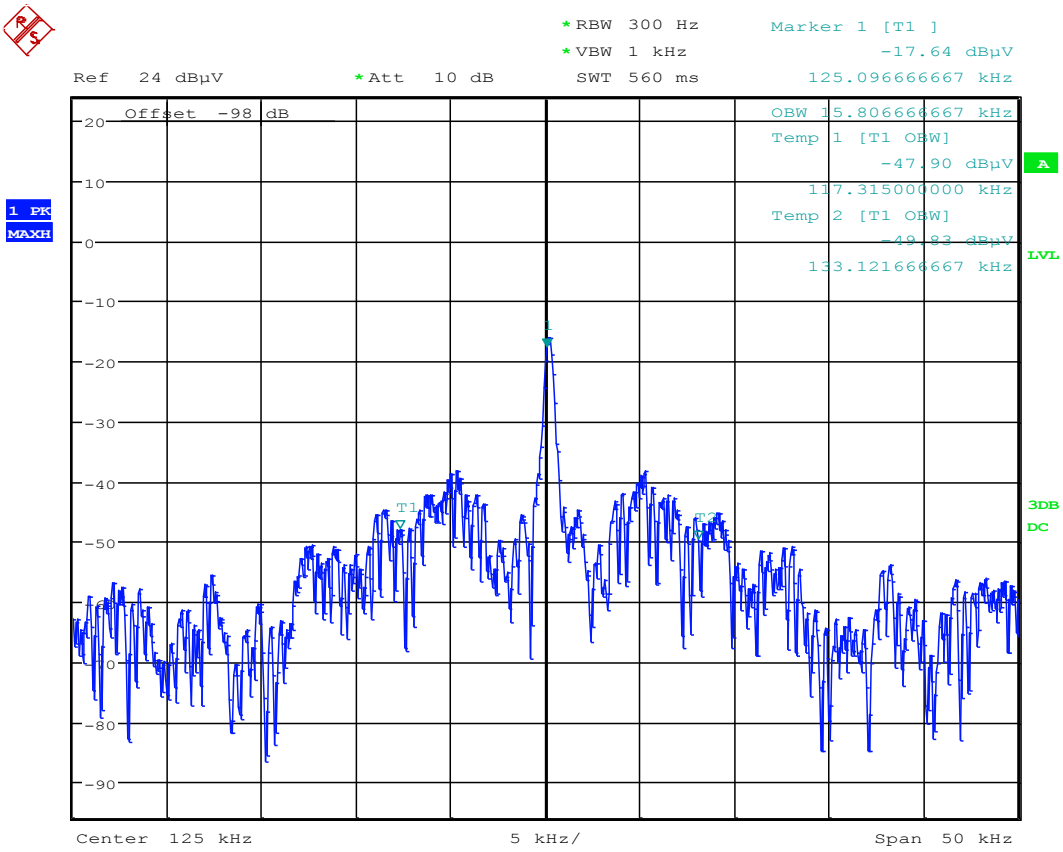
Diagram 14: OBW_125kHz_P50_T1



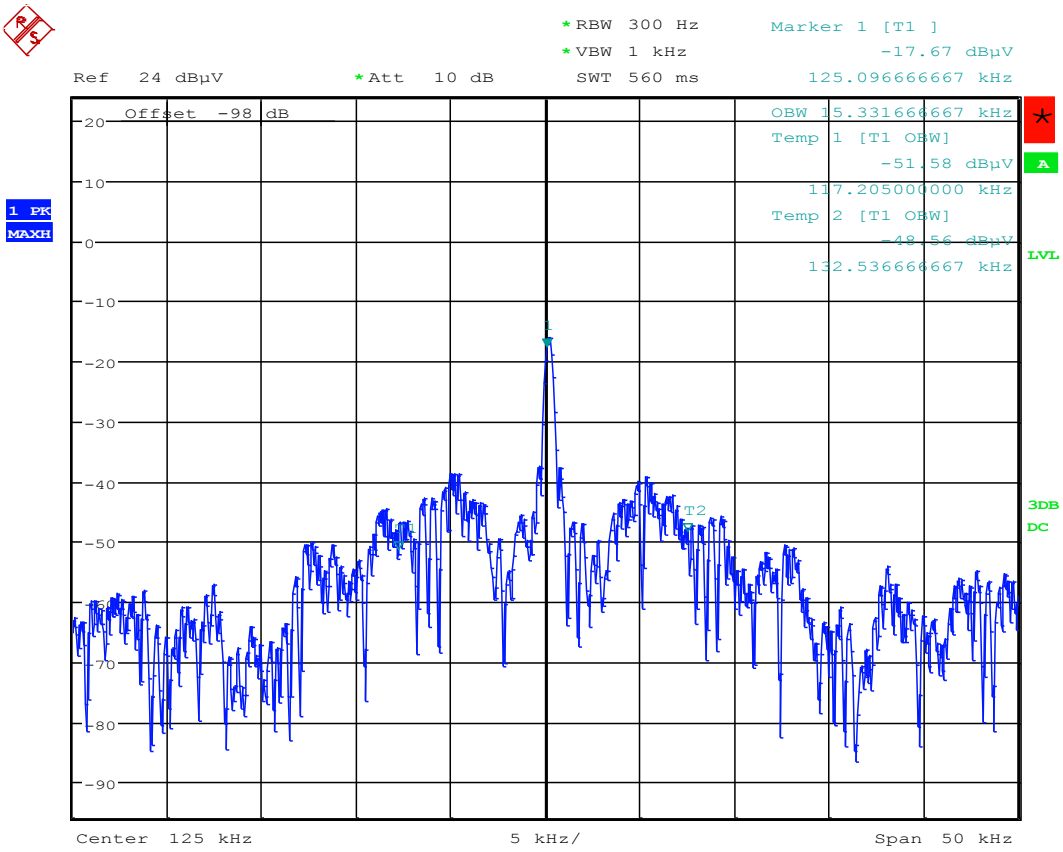
Date: 21.OCT.2016 13:08:19

Diagram 15: OBW_125kHz_P50_T2



Date: 21.OCT.2016 13:11:19

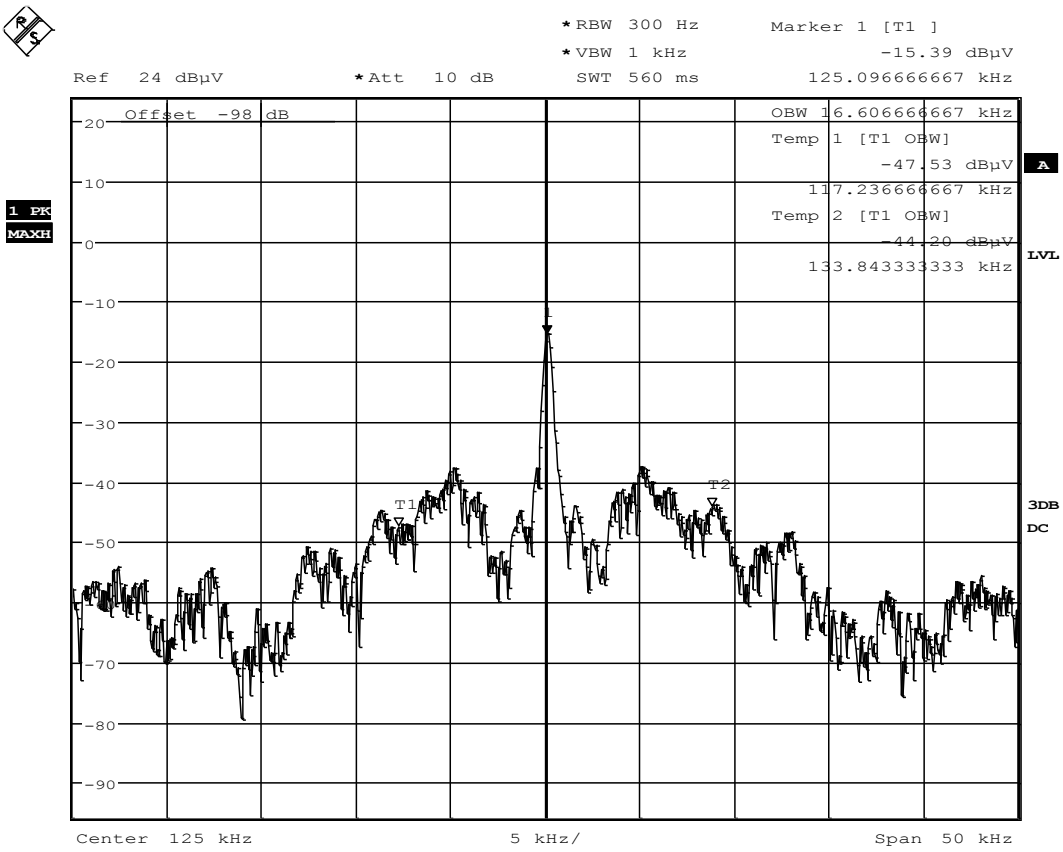
Diagram 16: OBW_125kHz_P50_T3



Date: 21.OCT.2016 13:16:19

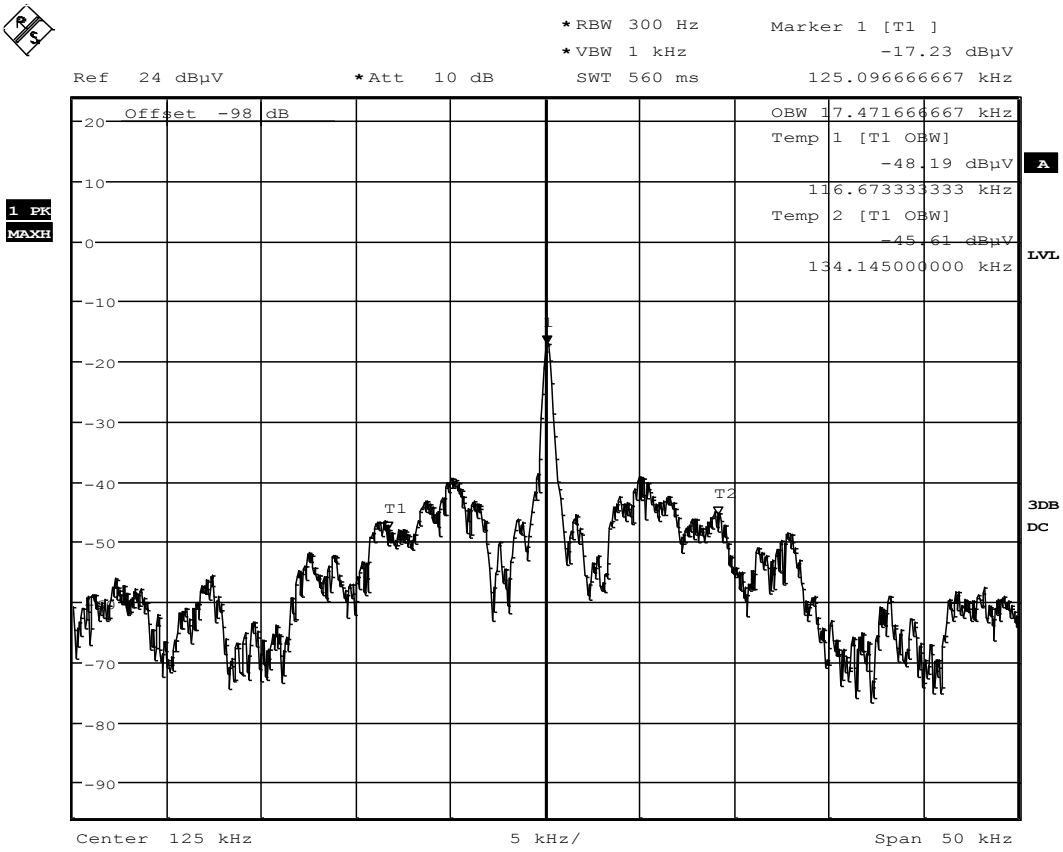
Diagram 17: OBW_125kHz_P50_T4

1.2.1.2. Voltage variations



Date: 24.OCT.2016 09:42:51

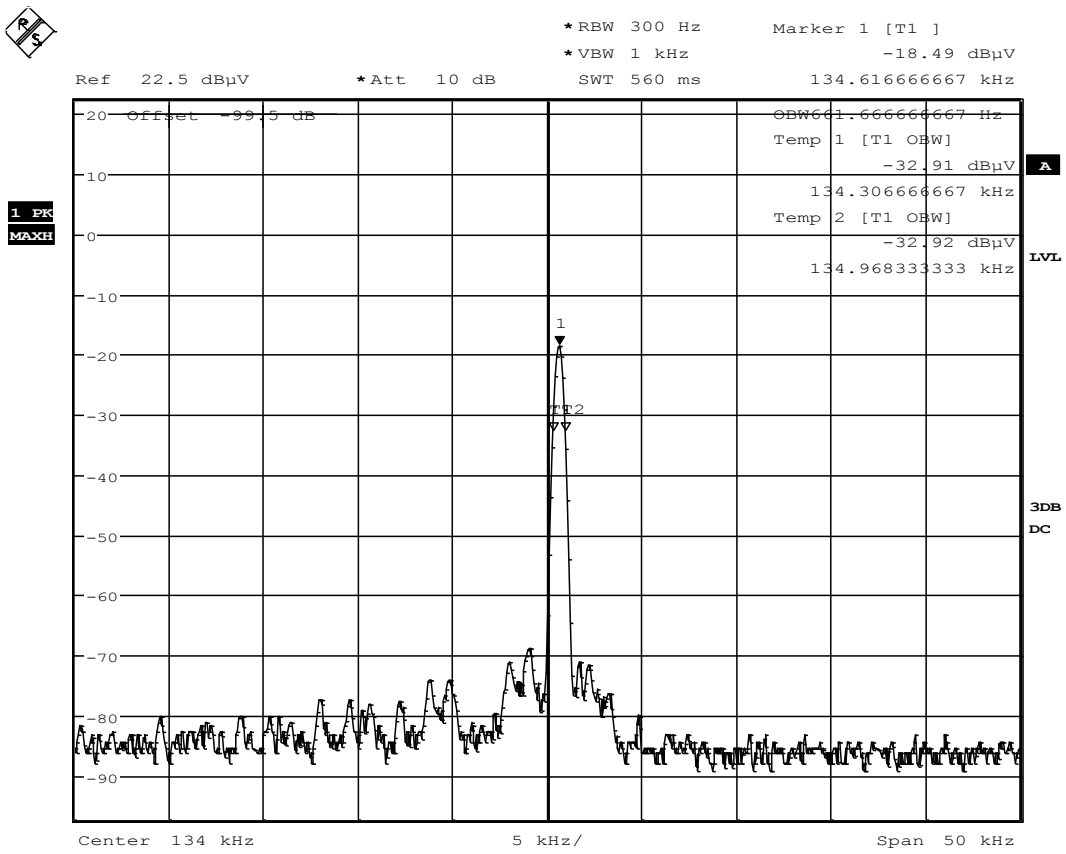
Diagram 18: OBW_125kHz_TnomVmax_FCC



Date: 24.OCT.2016 09:45:32

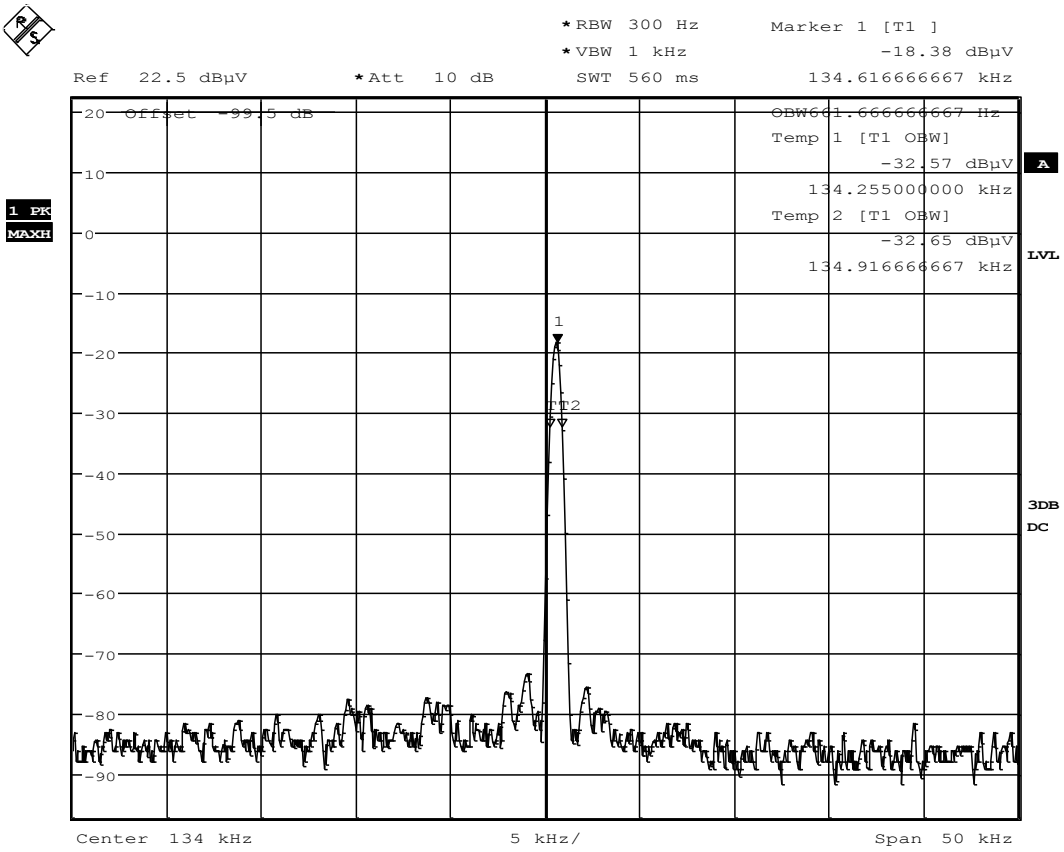
Diagram 19: OBW_125kHz_TnomVmin_FCC

1.2.2. 134 kHz transmitter
1.2.2.1. Temperature variations



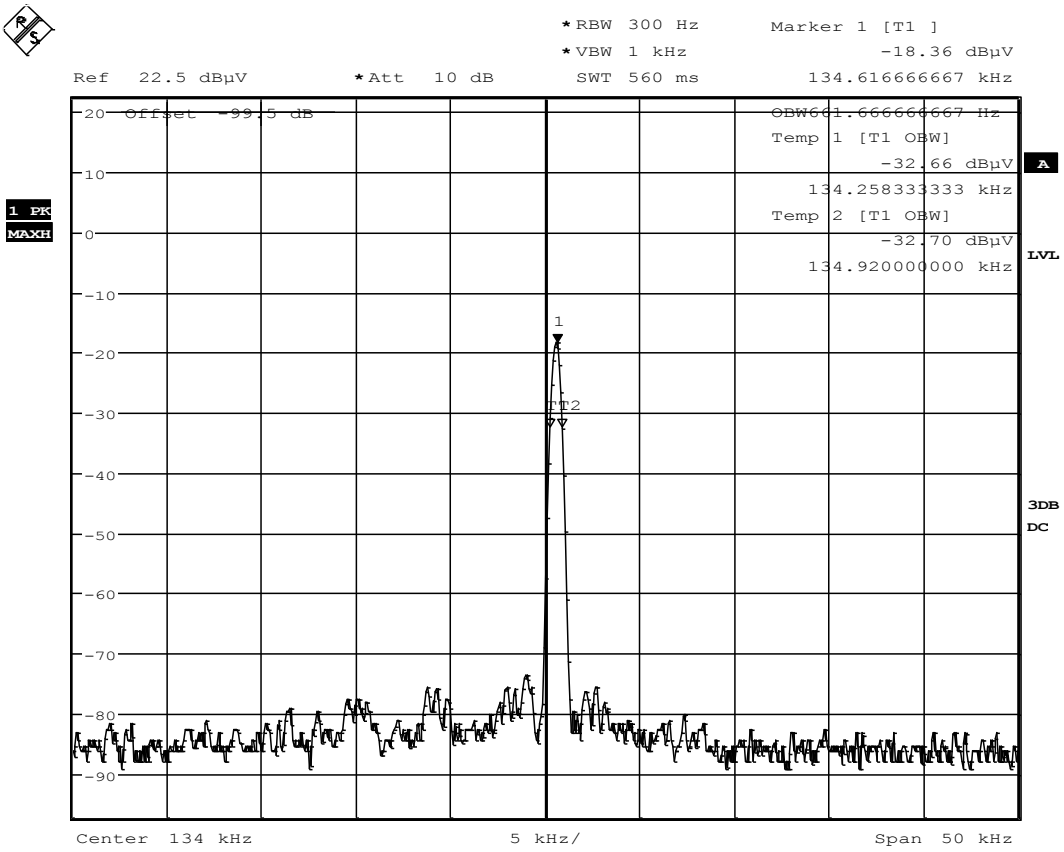
Date: 24.OCT.2016 11:22:28

Diagram 20: OBW_134kHz_TnomVnom_FCC (reference at nominal conditions)



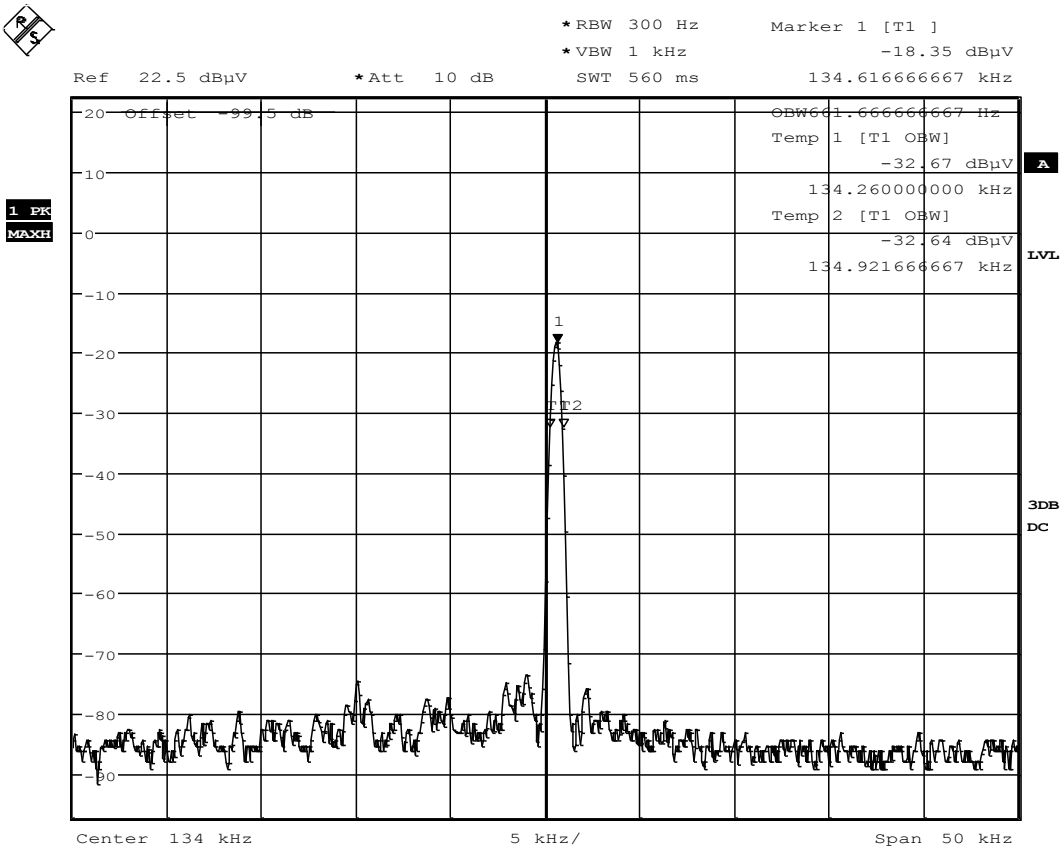
Date: 21.OCT.2016 15:19:49

Diagram 21: OBW_134kHz_M20_T1



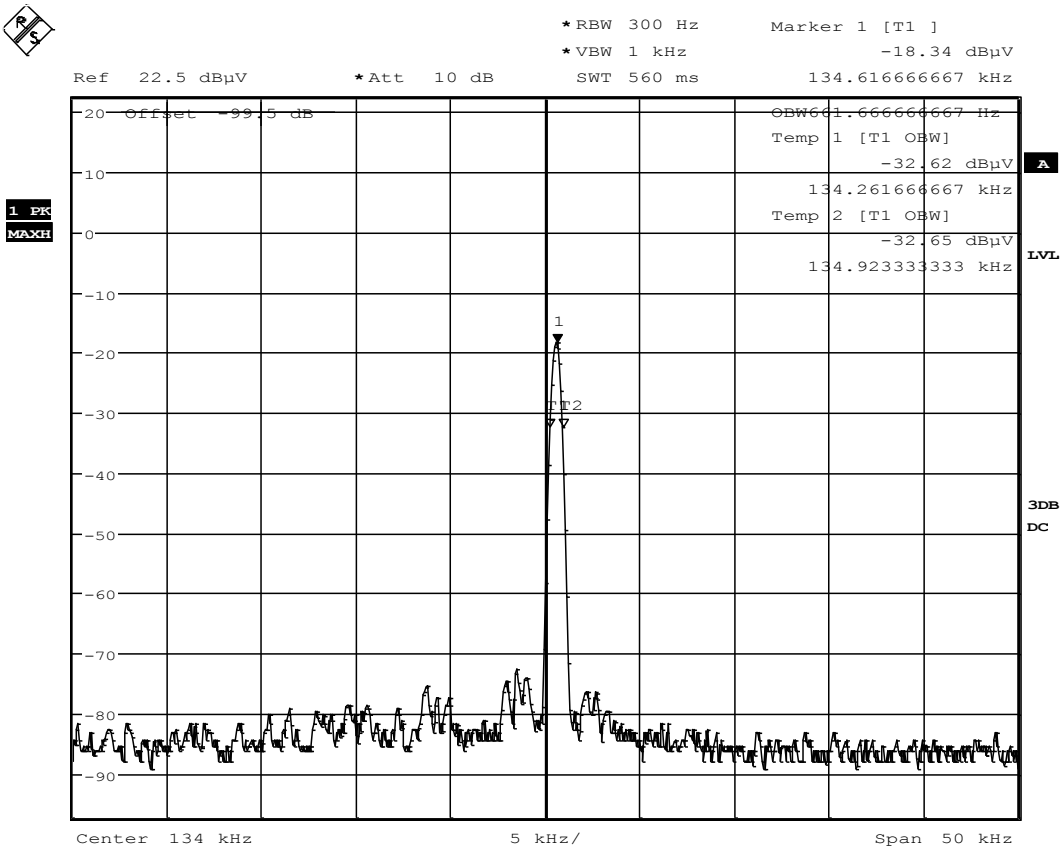
Date: 21.OCT.2016 15:21:29

Diagram 22: OBW_134kHz_M20_T2



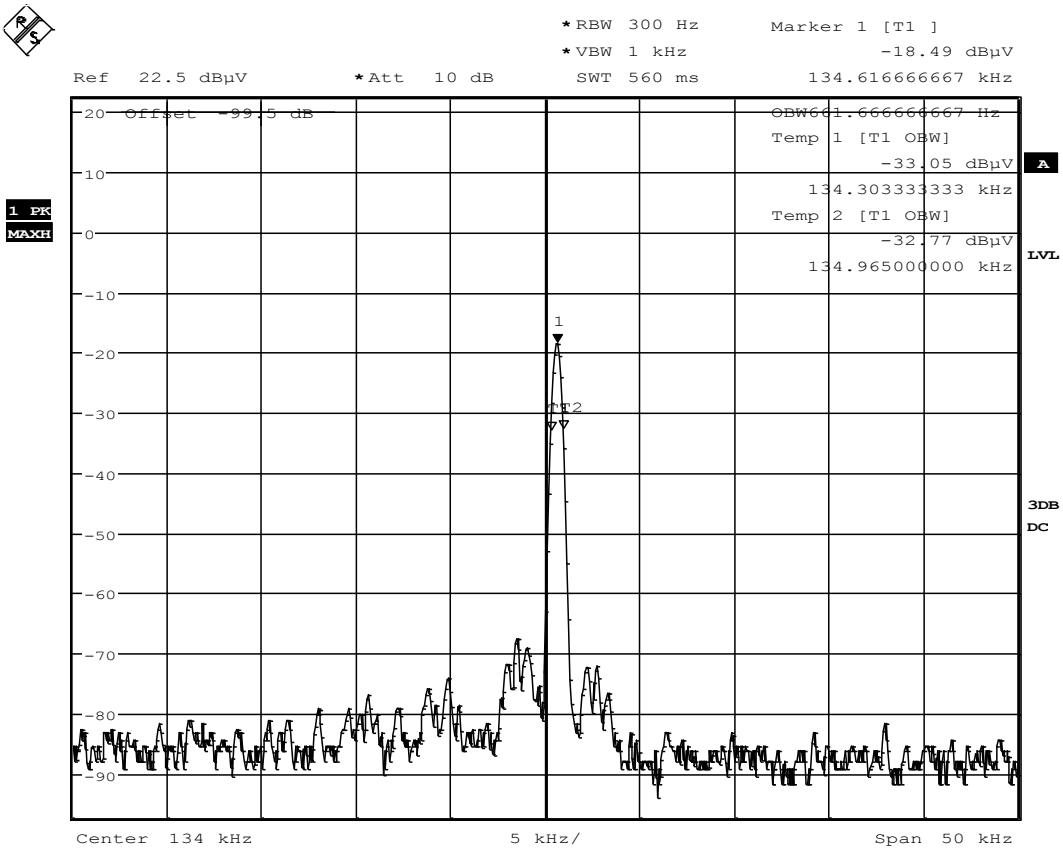
Date: 21.OCT.2016 15:24:29

Diagram 23: OBW_134kHz_M20_T3



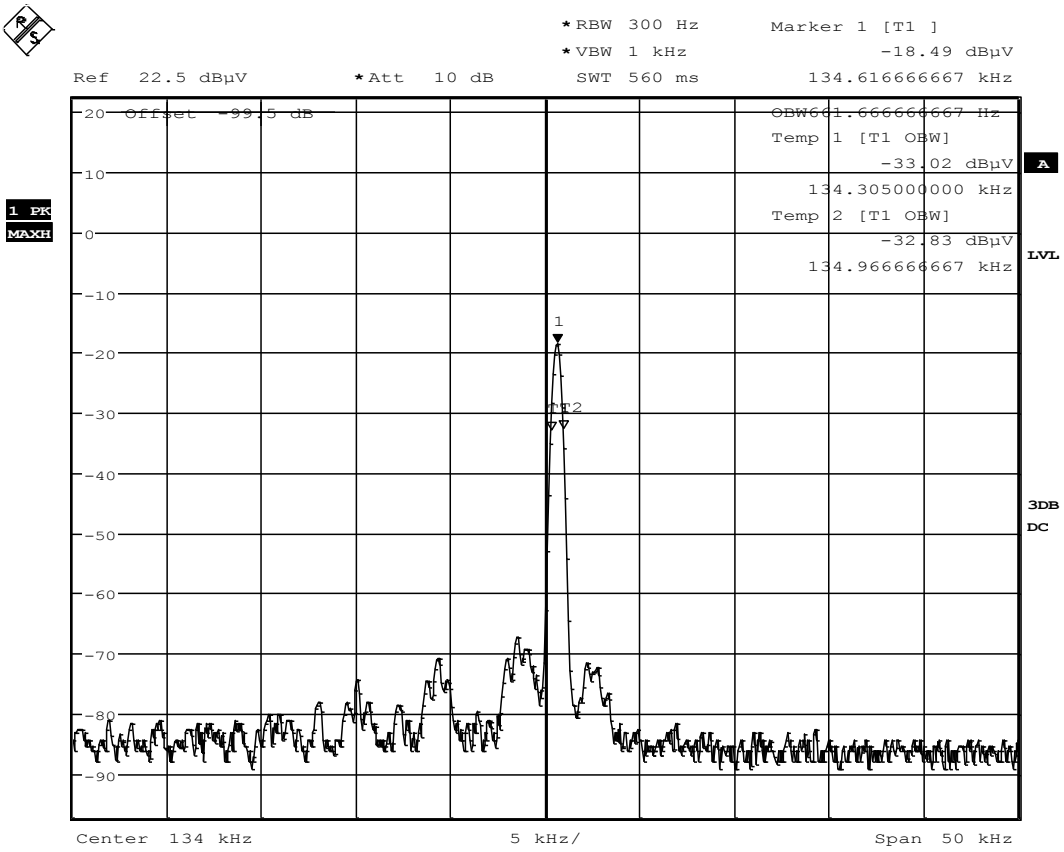
Date: 21.OCT.2016 15:29:30

Diagram 24: OBW_134kHz_M20_T4



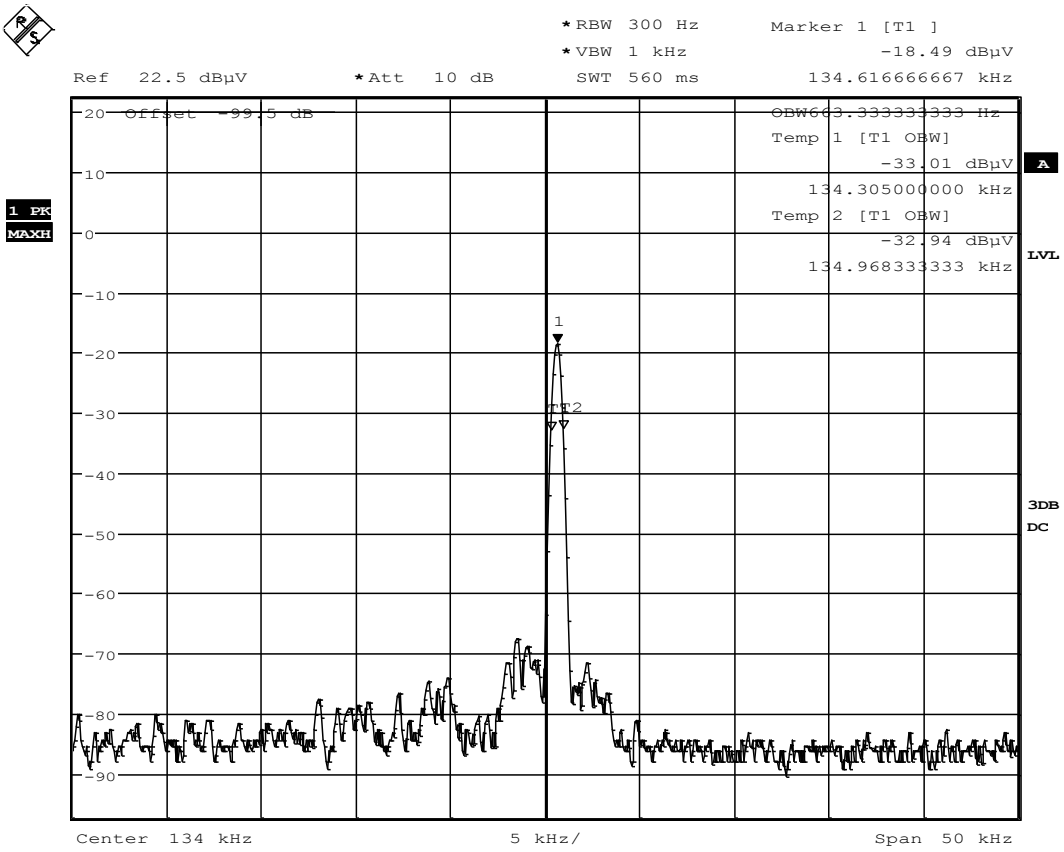
Date: 24.OCT.2016 11:12:43

Diagram 25: OBW_134kHz_P5_T1



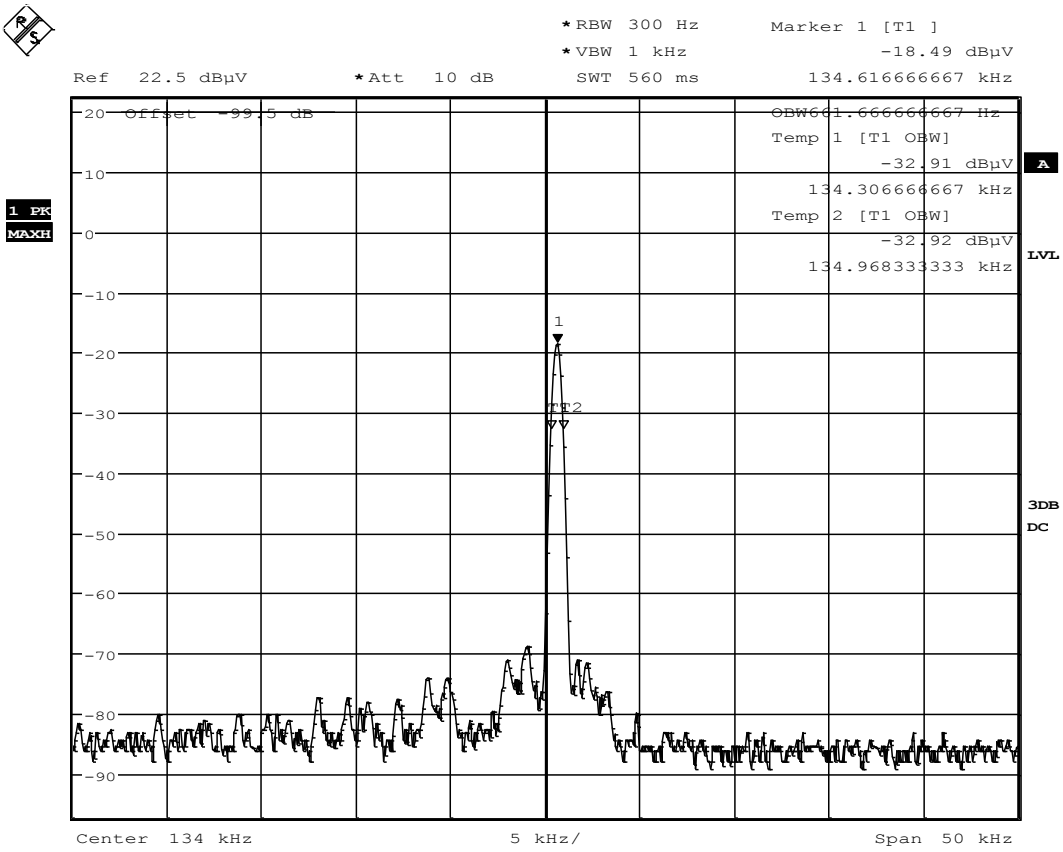
Date: 24.OCT.2016 11:14:27

Diagram 26: OBW_134kHz_P5_T2



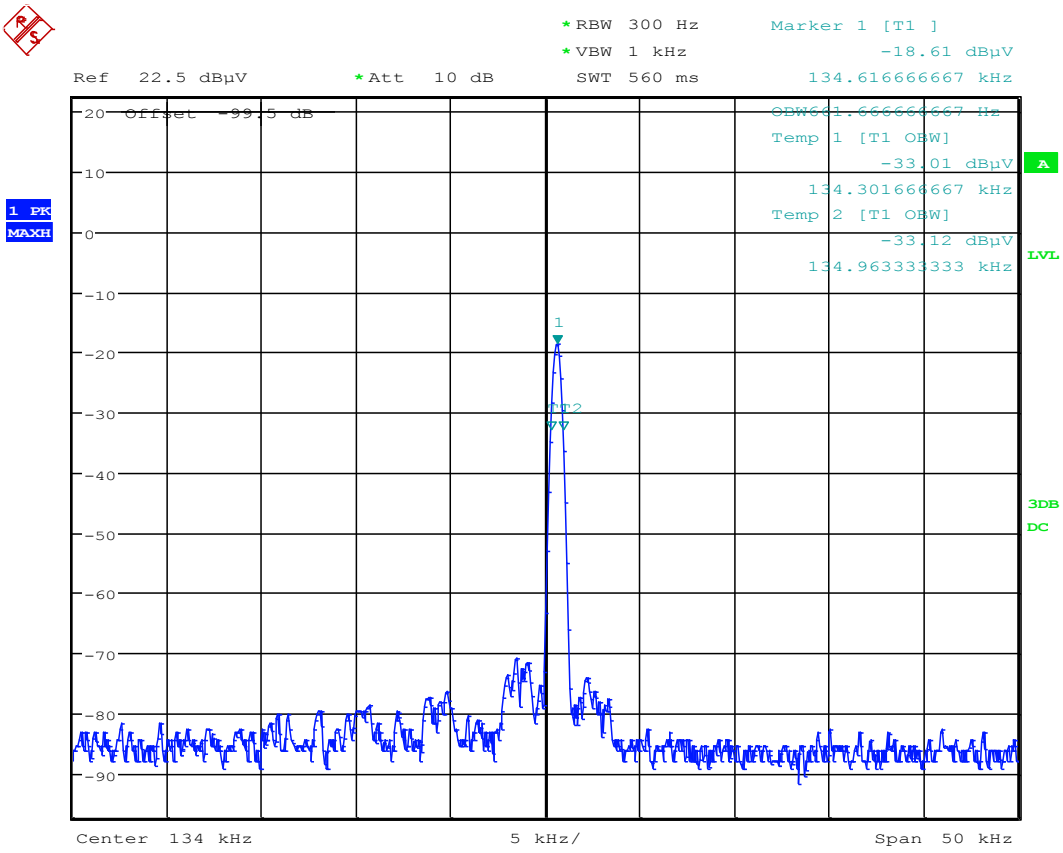
Date: 24.OCT.2016 11:17:28

Diagram 27: OBW_134kHz_P5_T3



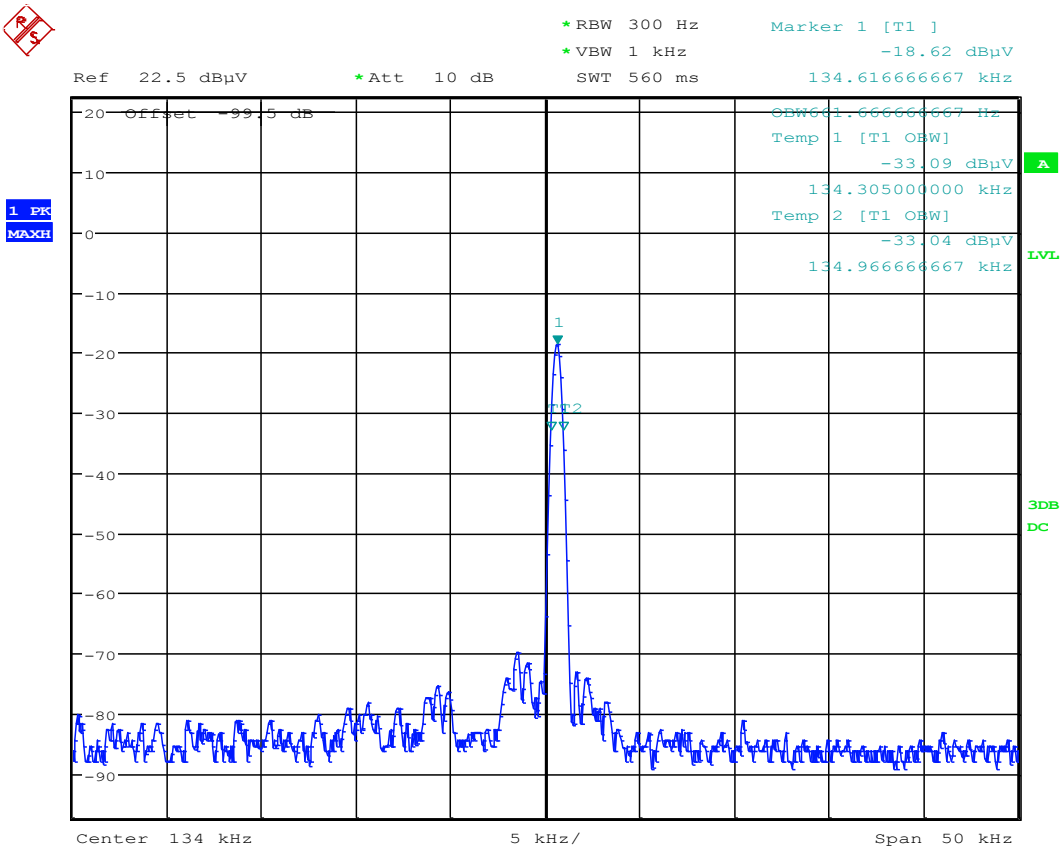
Date: 24.OCT.2016 11:22:28

Diagram 28: OBW_134kHz_P5_T4



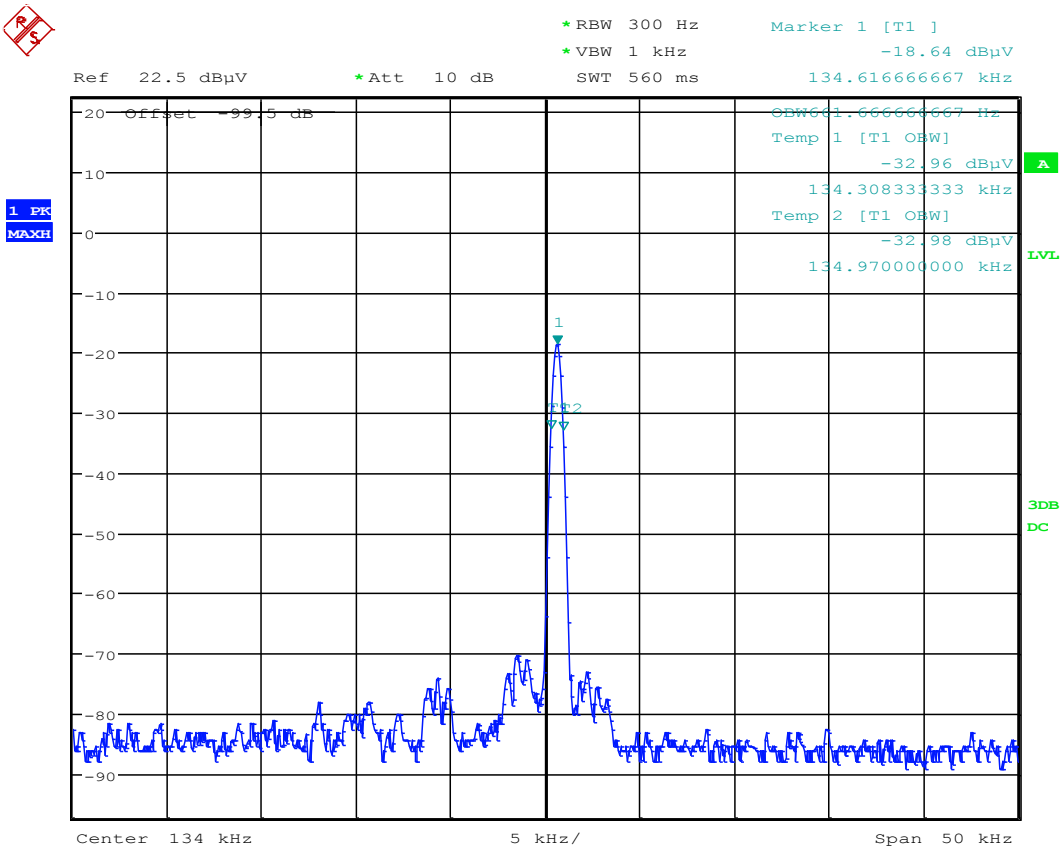
Date: 21.OCT.2016 11:33:03

Diagram 29: OBW_134kHz_P35_T1



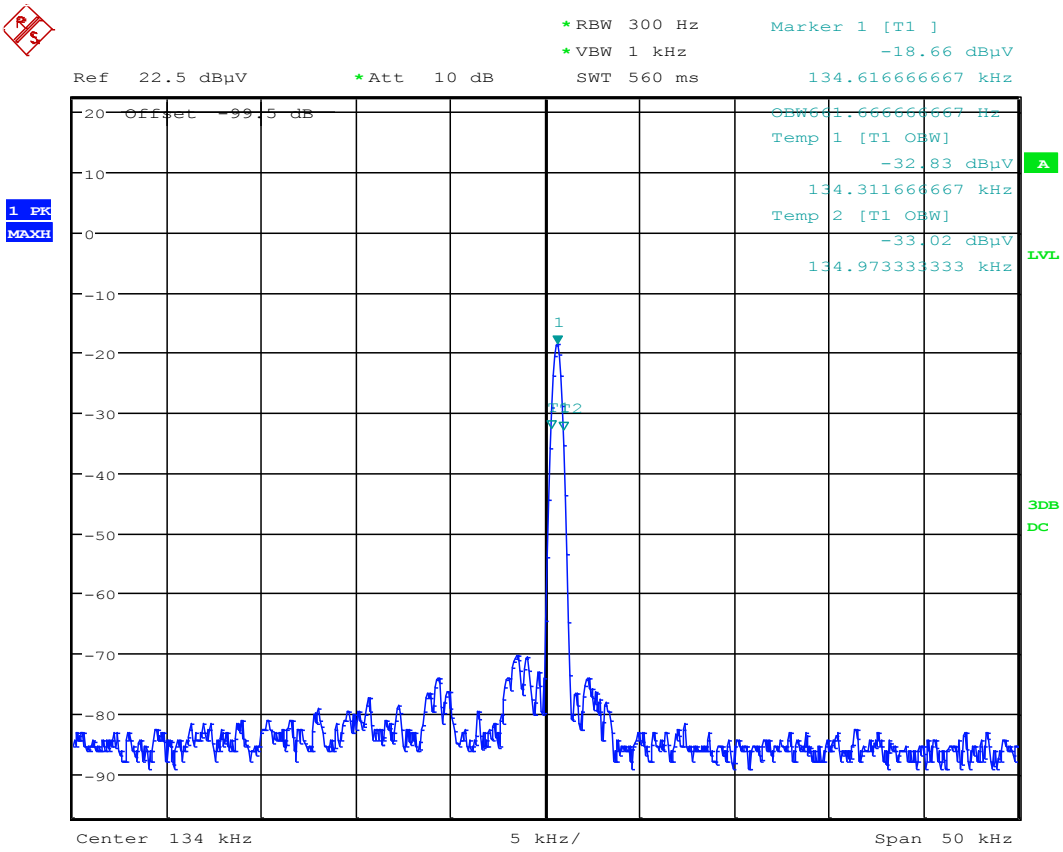
Date: 21.OCT.2016 11:34:43

Diagram 30: OBW_134kHz_P35_T2



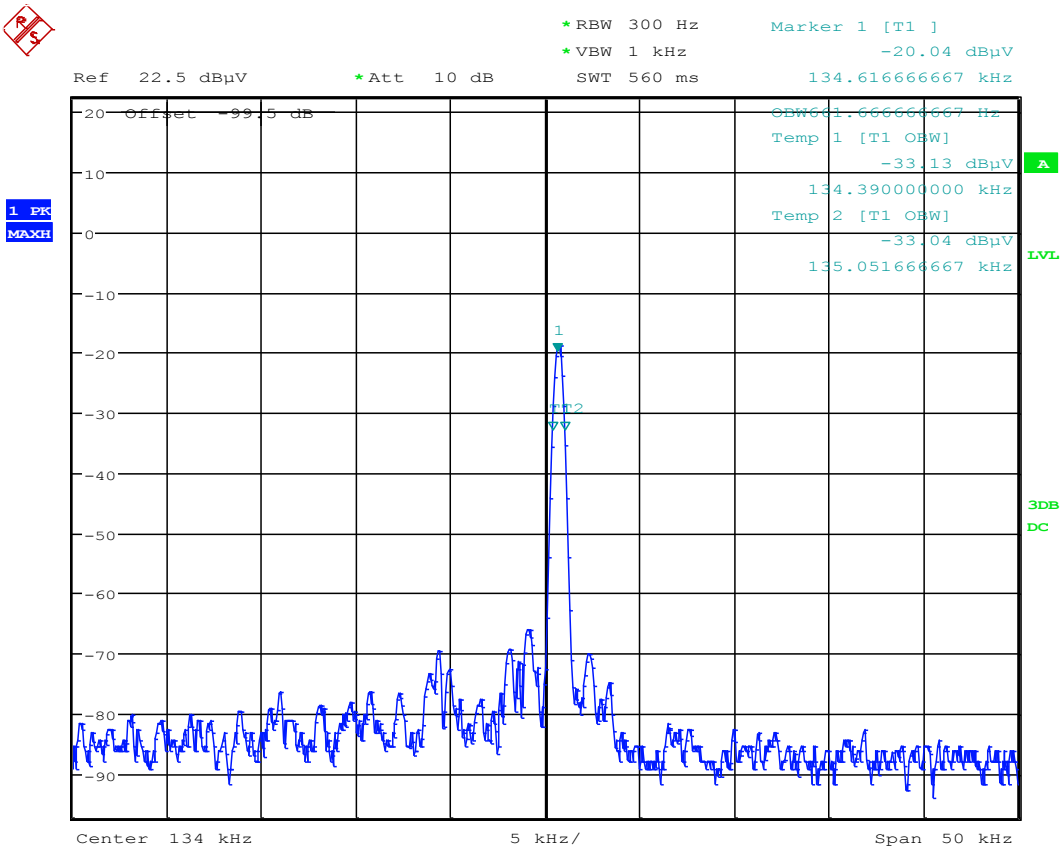
Date: 21.OCT.2016 11:37:52

Diagram 31: OBW_134kHz_P35_T3



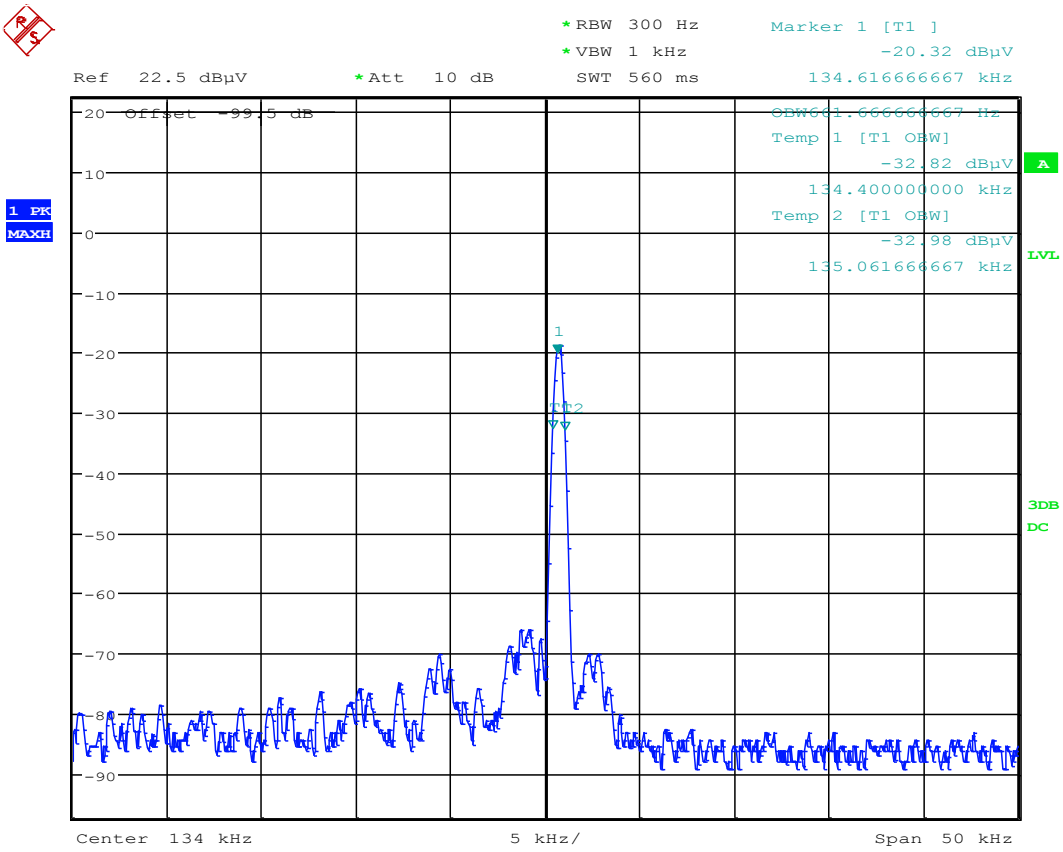
Date: 21.OCT.2016 11:42:45

Diagram 32: OBW_134kHz_P35_T4



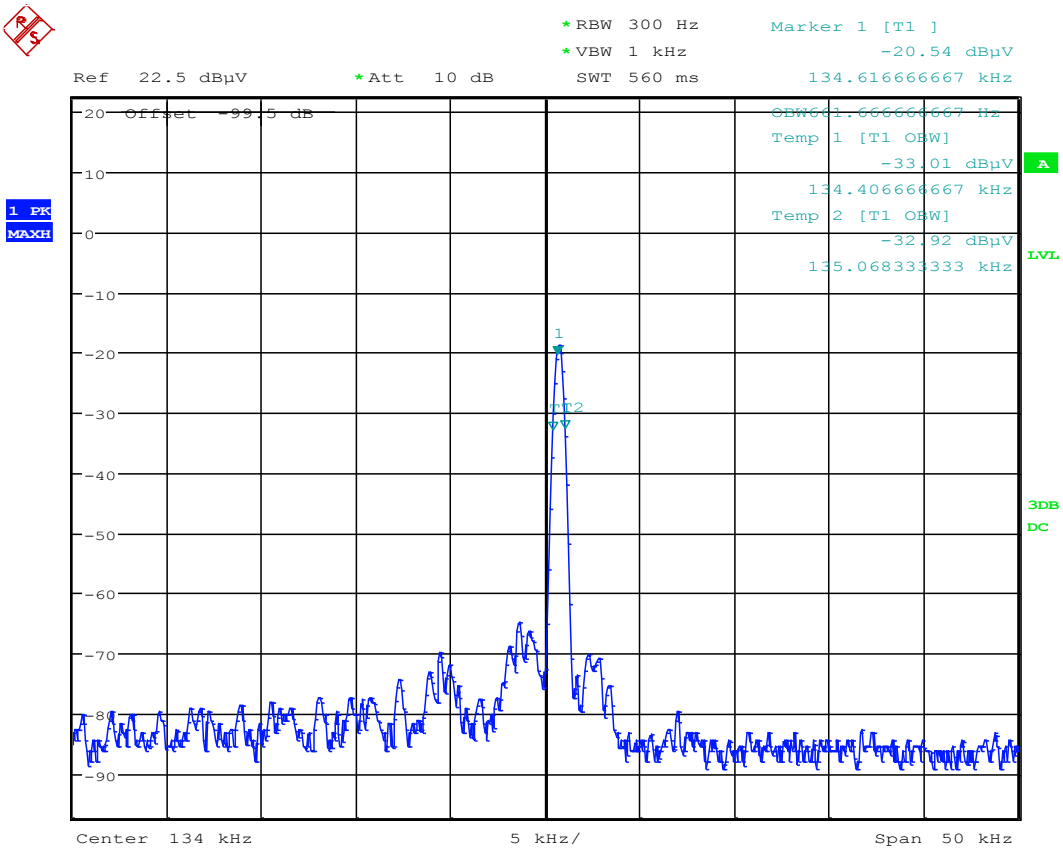
Date: 21.OCT.2016 12:55:39

Diagram 33: OBW_134kHz_P50_T1



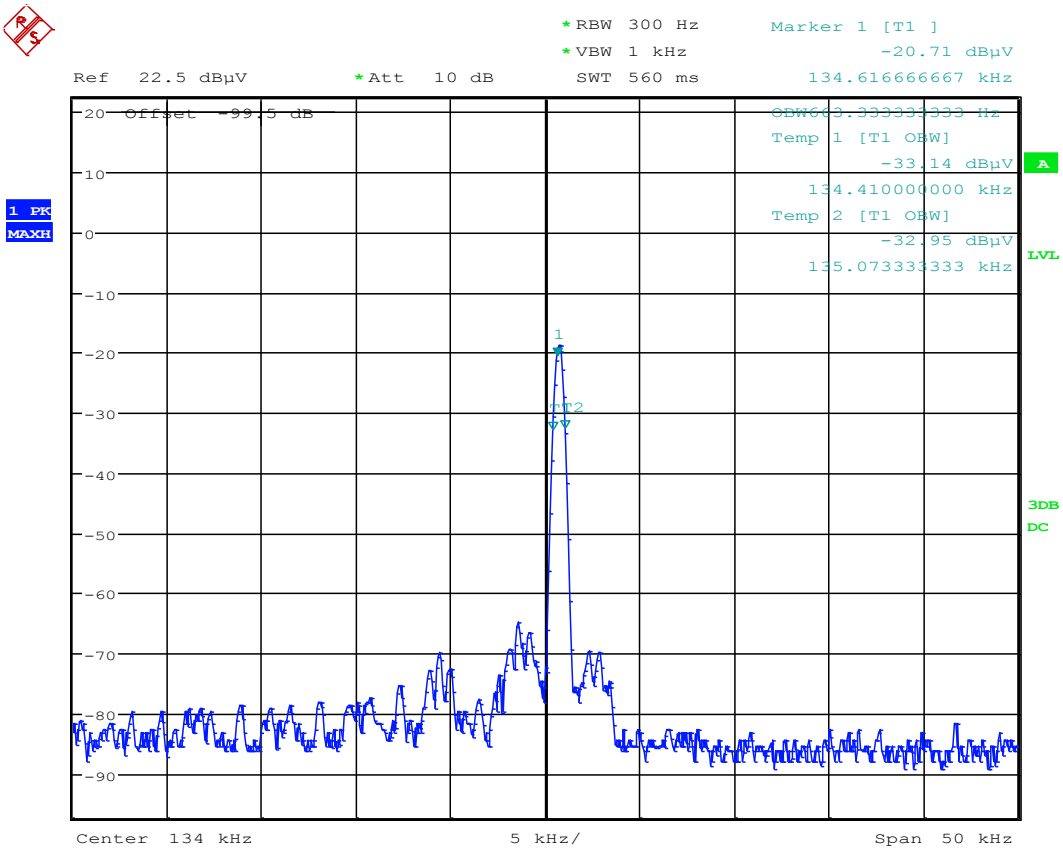
Date: 21.OCT.2016 12:57:19

Diagram 34: OBW_134kHz_P50_T2



Date: 21.OCT.2016 13:00:19

Diagram 35: OBW_134kHz_P50_T3



Date: 21.OCT.2016 13:05:19

Diagram 36: OBW_134kHz_P50_T4

1.2.2.2. Voltage variations

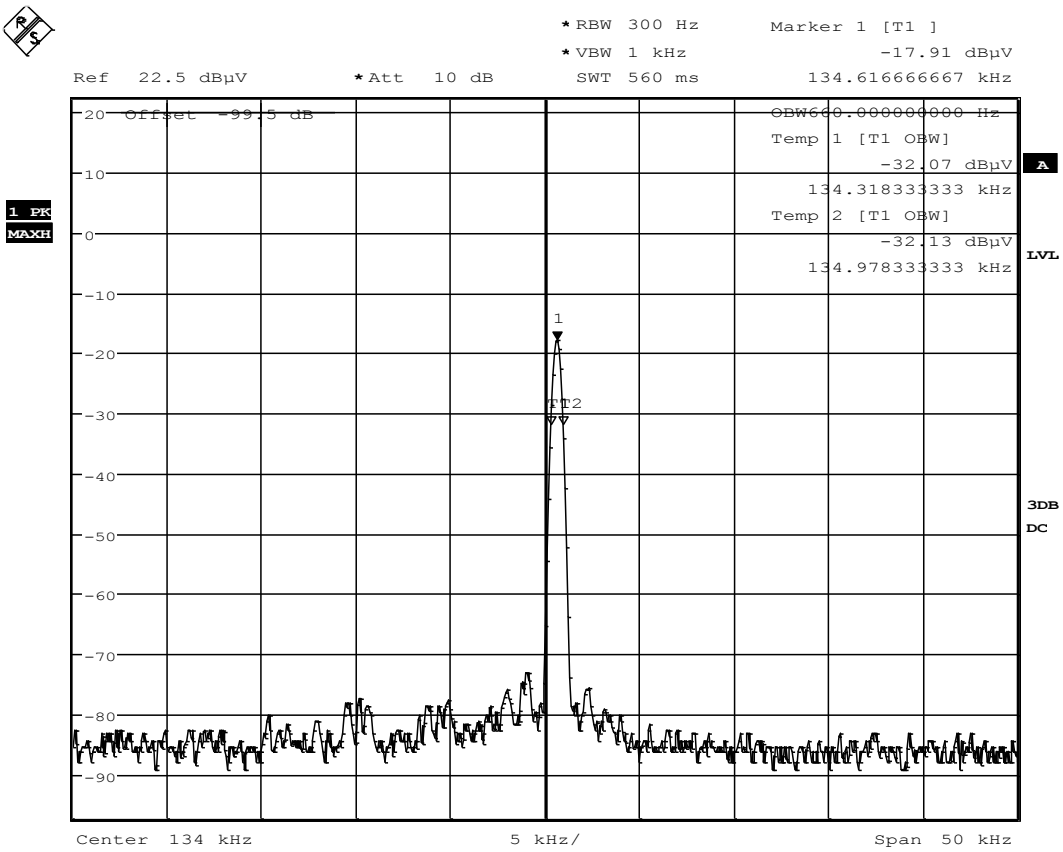


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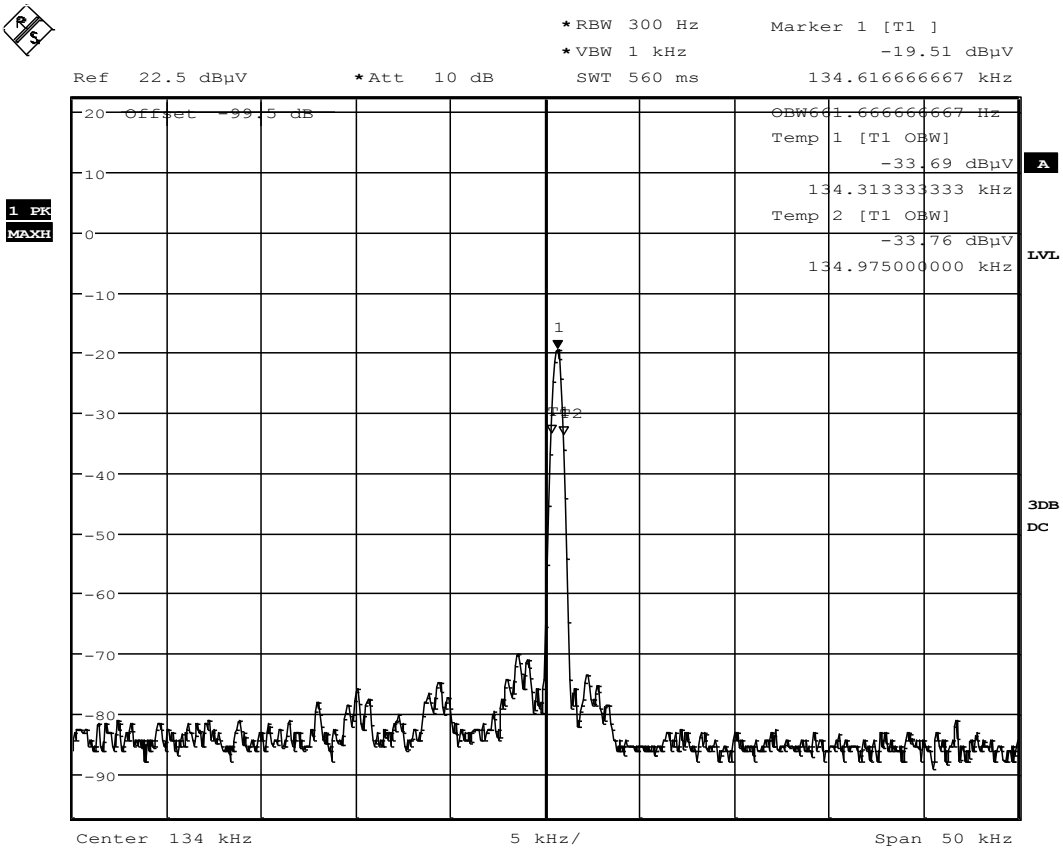
Diagram 37: OBW_134kHz_TnomVmax_FCC



Date: 24.OCT.2016 09:31:58

Diagram 38: OBW_134kHz_TnomVmin_FCC