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Equipment Authorization measurements on 2412-2462 MHz Transceiver Unit
FCC ID: XO2BOX860
IC: 8713A-BOX860

(11 appendices)

Test object

Product name: BOX860
Product number: BOX860 R2A

Summary

See Appendix 1 for general information and Appendix 11 for photos.
Emission measurements as specified below have been performed.

Standard	Compliant	Appendix	Remarks
FCC 47 CFR Part 15 C 15.247 Operation within the band 2400-2483.5 MHz	**Yes**		
IC RSS-247, Issue 1, May 2015/ **IC RSS-Gen Issue 4 November 2014** DTSs, Operation within the band 2400-2483.5 MHz	**Yes**		
Duty cycle measurements	N/A	2	
15.247 (a) (2) / RSS-247 5.2 (1), 6 dB bandwidth	Yes	3	
15.247 (b) (3) / RSS-247 5.4 (4), Maximum peak conducted power	Yes	4	
15.247 (d) / RSS-247 5.5/RSS-Gen 8.10, Restricted bands of operation and 20 dB below fundamental	Yes	5	
15.247 (e) / RSS-247 5.2 (2), Power spectral density	Yes	6	
15.247 (i) / RSS-102 2.5.1, RF Exposure	Yes	7	
15.215 (c), 20 dB bandwidth	Yes	8	
15.207 / RSS-Gen 8.8, Conducted emission limits	N/A	-	
2.1049 / RSS-Gen 6.6, Occupied bandwidth	Yes	9	
2.1049 / RSS-247 5.5/RSS-Gen 8.10, Band Edge	Yes	10	

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Purpose of test

The tests were performed to verify that BOX860 module meets the electromagnetic compatibility requirements of FCC 47 CFR part 15 C and IC RSS-Gen/RSS-247.

Test facility

The used semi-anechoic chamber is compliant with the requirements of section 2.948 of the FCC rules and listed, registration number 96866, as a facility accepted for certification under parts 15 and 18. The site complies with RSS Gen, Issue 4 and is accepted by Industry Canada for the performance of radiated measurements, IC-file number 3482A-2.

Test objects

The BOX860 contains the SPB820 radio module reference design which contains the SiP module HDG820 with HDG820 firmware.
Two test samples were used during the tests. One radiated sample, with the PCB antenna, one conducted sample, with a temporary antenna connector.
Identity numbers: Radiated sample, s/n: 5, MAC address 78:C4:0E:21:D7:01.
Conducted sample, s/n: 4, MAC address 78:C4:0E:21:D6:FF.
Firmware revision: 1.0.8, Software messaging_plush 1.8.0.
During the test the BOX860 was also connected to the PC connection board (SPB406), for controlling the BOX860.

Transceiver:	BOX860
Antenna:	Inverted-F PCB antenna
Antenna gain, peak (simulated):	2.5 dBi
Supply voltage:	Nominal: 4.5 V DC Internal batteries,3x1.5VDC,Alkaline AA LR6 Extreme voltage acc. to client: 3.0-4.6 VDC
Frequencies used during test:	2412 MHz 2442 MHz 2462 MHz
Modulations/Data rate:	BPSK, 1 Mbit/s QPSK, 2 Mbit/s CCK/QPSK, 5.5 Mbits/s CCK/QPSK, 11 Mbits/s OFDM/BPSK, 6 Mbits/s OFDM/BPSK, 9 Mbit/s OFDM/QPSK, 12 Mbit/s OFDM/QPSK, 18 Mbit/s OFDM/16-QAM, 24 Mbit/s OFDM/16-QAM, 36 Mbit/s OFDM/64-QAM, 48 Mbit/s OFDM/64-QAM, 54 Mbit/s MCS-0, OFDM/BPSK, 7.2 Mbit/s MCS-1, OFDM/QPSK, 14.4 Mbit/s MCS-2, OFDM/QPSK, 21.7 Mbit/s MCS-3, OFDM/16-QAM, 28.9 Mbit/s MCS-4, OFDM/16-QAM, 43.4 Mbit/s MCS-5, OFDM/64-QAM, 57.8 Mbit/s MCS-6, OFDM/64-QAM, 65 Mbit/s

Radiated tests, BOX860:
The test object was powered by the internal batteries, new batteries, 4.5 V DC. During the test the test object was also connected to the PC connection board (SPB406) via USB, for controlling the test object.
Justification measurements were performed with rotation of the EUT through three orthogonal axes to determine which orientation the BOX860 had the highest emission levels, see photos in Append ix 11.
During the radiated tests the PC was placed outside the semi-anechoic chamber during the test. Twenty clamp on ferrites, type amidon 2X-43-151 were attached. The shield of the cable was also grounded at lead-through of the chamber and also a ferrite clamp Lüthi FTC101 was attached at the lead-through.

Conducted tests/Justifications measurements, BOX860:
The test object was powered by a separate external DC Power supply, 4.5 V DC, which was powered with 120 V AC/60 Hz, The PC Connection board was powered via USB from a PC laptop, which was also powered with 120 V AC/60 Hz.

Conducted tests, SPB820P:
Conducted test was performed on SPB820P which is declared by the client to be an identical RF radio design related to conducted radio measurements.
Justifications conducted measurements were performed, comparing the Maximum peak conducted power between the BOX860 unit and the SPB820P unit. As these results were identical, then the conducted measurements from the SPB820P unit were used in this report. See Appendix 4 for these justifications measurements.

Transceiver:	SBP820P
Antenna:	Chip antenna, Amotech ALA931C5
Antenna gain, peak, typical:	3.5 dBi
Antenna gain, total average, typical:	-0.2 dBi
Frequency range:	2412-2462 MHz
Supply voltage:	Nominal: 3.3 V DC via USB Extreme voltage acc. to client: 2.85-4.35 VDC ±15% acc. to 15.31(e): 2.805-3.795 V DC

Product number SPB820P: Unit for conducted tests: SPB820-D (The EUT was also a mounted on an adapter PCB (SPB419) to fit in the PC connection board (SPB406)).
Identity numbers: 78C40E104796 (unit for conducted tests).
Firmware revision: 1.0.8.
Radio firmware: pico 2.2.

The test object was tested stand alone as a module The module was powered by a separate external DC Power supply, 3.3 V DC, which was powered with 120 V AC/60 Hz, The PC Connection board was powered via USB from a PC laptop, which was also powered with 120 V AC/60 Hz.

Preliminary conducted tests were performed with the SPB820P at mid channel (2442 MHz) and all data rates (modulations). The measurements were then done at OFDM/BPSK, 9 Mbit/s mode since this mode had the highest peak conducted output power. See Appendix 4, if not otherwise stated. Some complementary test with other modulation/data rates were also performed for some different tests, see each Appendix.

Measurement equipment

Measurement equipment	Calibration Due	SP number
Test Site Galvani	-	15:117
Test site Edison	2015-12	504 114
Signal Analyser R&S FSQ26	2015-07	BX50694
R&S FSIQ40 Signal Analyser	2015-07	503 738
EMI Test Receiver R&S ESU 26	2015-07	902 210
LISN Schwarzbeck NNLA 8120	2016-01	504 129
LISN Schwarzbeck NSLK 8126	2016-01	503 114
Antenna Schaffner CBL 6143	2016-10	504 079
Horn antenna ETS Lindgren 3115	2016-10	902 212
Standard gain horn Flann 16240-25	-	503 939
Standard gain horn Flann 18240-25	-	503 900
Standard gain horn Flann 20240-20	-	503 674
Low Noise Amplifier Miteq	2015-12	503 277
Low Noise Amplifier Miteq	2016-02	504 160
2.45 band reject filter TTE	2016-06	503 575
120 V AC/60 Hz AC Power source HP 6813B	2016-04	503 091
DC power supply HP E3632A	-	503 170
True RMS Multimeter Fluke 85III	2015-08	503 418
Multimeter Fluke 83	2015-08	501 522
Temperature and humidity meter Testo 615	2015-06	503 498
Temperature and humidity meter Testo 625	2015-06	504 117
Used during RMS measurements for the RF Exposure evaluation 2015-08-18--24		
Test site Marconi	-	15:121
Signal Analyser R&S FSQ40	2016-08	504 143
DC power supply Keysight E3631A	-	503 997
Multimeter Fluke 87	2016-06	502 190
Temperature and humidity meter Testo 635	2016-04	504 203

Operational test mode

The following were set in the s/w RF test software, if not otherwise stated.
Modulation/Rate: OFDM/BPSK 9 Mbit/s with PRBS9 (9-bits Pseudo Random Bit Sequence) (the rate with the highest peak output power, see Appendix 4).
All the measurements were performed with maximum output power (setting 20 dBm) except for the band edge measurements, which were performed with reduced output power according to the table below.
Tx power dBm: 20 dBm
Idle time: 0
Number of frames: 1 000 000
Frame length (byte): 1536
Tx power settings table for the band edge measurements (dBm):

		FCC "Tx Power dbm" in ProdtestGUI										
Modulation (data rate)	802.11	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9	Ch10	Ch11
BPSK 1Mbit/s	b	18	20	20	20	20	20	20	20	20	20	18
QPSK 2Mbit/s	b	18	18	20	20	20	20	20	20	20	18	18
CCK/QPSK 5.5Mbit/s	b	18	20	20	20	20	20	20	20	20	20	18
CCK/QPSK 11Mbit/s	b	18	18	20	20	20	20	20	20	20	18	18
OFDM/BPSK 6Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/BPSK 9Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/QPSK 12Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/QPSK 18Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/16-QAM 24Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/16-QAM 36Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/64-QAM 48Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/64-QAM 54Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
MCS-0, OFDM/BPSK 7.2Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-1, OFDM/QPSK 14.4Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-2, OFDM/QPSK 21.7Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-3, OFDM/16-QAM 28.9Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-4, OFDM/16-QAM 43.4Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-5, OFDM/64-QAM 57.8Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-6, OFDM/64-QAM 65Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10

For duty cycle measurements see appendix 2.
With the setting above (OFDM/BPSK 9 Mbit/s) the duty cycle was measured and was varied between 431.39/774.39 µs = 0.557 = 55.7% and 431.39/495.49 µs = 0.871 = 87.1% .
The PRF was calculated to PRF = 1/T = 1/495.49 µs = 2 018 Hz, broad band,"pulse spectrum", RBW>PRF=1/T.
$1/\tau$ = 1/431.39 µs = 2 318 Hz, $1/\tau$<RBW.

The PRF was calculated to PRF = 1/T = 1/495.49 µs = 2 018 Hz, thus QP-detector was used without any correction for pulse desensitization.

Cabling during radiated emission test:

Cable type	Termination / use
15 cm 3 wires stripe	
2 pcs 31 cm wire, (green)	potentiometer
2 pcs 31 cm wire, (blue)	potentiometer
2 pcs 32 cm wire, (black and red)	LED diode
2 pcs 12 cm wire, (black and red)	Battery box

Connected equipment during the test

PC laptop Dell Vostro with s/w: ProdTestGui.	Client equipment

Uncertainties

Measurement and test instrument uncertainties are described in the quality assurance documentation ”SP QD 10885”. The measurement uncertainties can be found in the table below. The uncertainties are calculated with a coverage factor k=2 (95% level of confidence). The measurement uncertainties can be found in the table below:

Method	**Uncertainty**
Duty cycle	1.3 %
6 dB bandwidth	2.6 %
Maximum peak conducted power	2.6 dB
Restricted bands of operation:	
Radiated emission, 30 – 1000 MHz	4.8/5.6 dB (V/H-pol)
Radiated emission, 1 – 40 GHz	2.6 dB
Conducted 20 dBc	2.6 dB
Power spectral density	2.2 dB
RF Safety	2.6 dB
20 dB bandwidth	2.6 %
Occupied bandwidth	2.6 %
Band edge, restricted bands, radiated	2.6 dB
Band edge, 20 dBc, conducted	2.6 dB

Compliancy 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: 2015-04-24

Test engineers

Fredrik Isaksson and Ermin Pasalic, SP

Duty cycle measurements

Date	Temperature	Humidity
2015-03-12	24 °C ± 3 °C	18 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014, according to clause 6.0 b).

Conducted measurements were performed with the SPB820P unit at the antenna connector and with continuous transmission and with normal modulation, OFDM/BPSK 9 Mbits/s.
The sweep points were set to 1251 in the signal analyser.
The test equipment was connected to an external 10 MHz reference standard during measurements.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

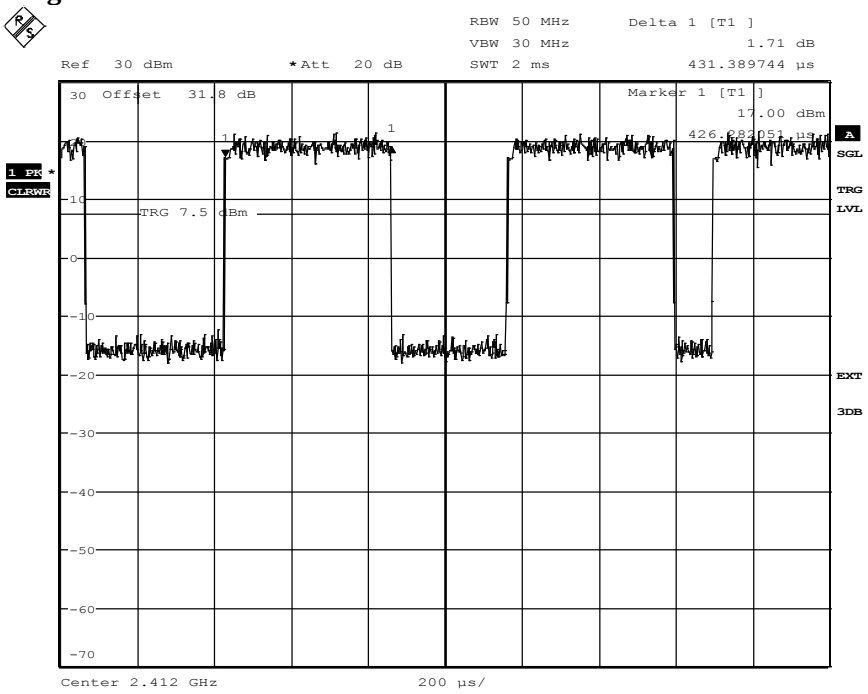
Results

The duty cycle measurements can be found in the diagrams below:

Diagram 1:	2412 MHz, Tx on, OFDM/BPSK 9 Mbit/s, Frame length=1536 byte
Diagram 2:	2412 MHz, Period time, measurement 1 (T min), OFDM/BPSK 9 Mbit/s, Frame length=1536 byte
Diagram 3:	2412 MHz, Period time, measurement 2 (T max), OFDM/BPSK 9 Mbit/s, Frame length=1536 byte

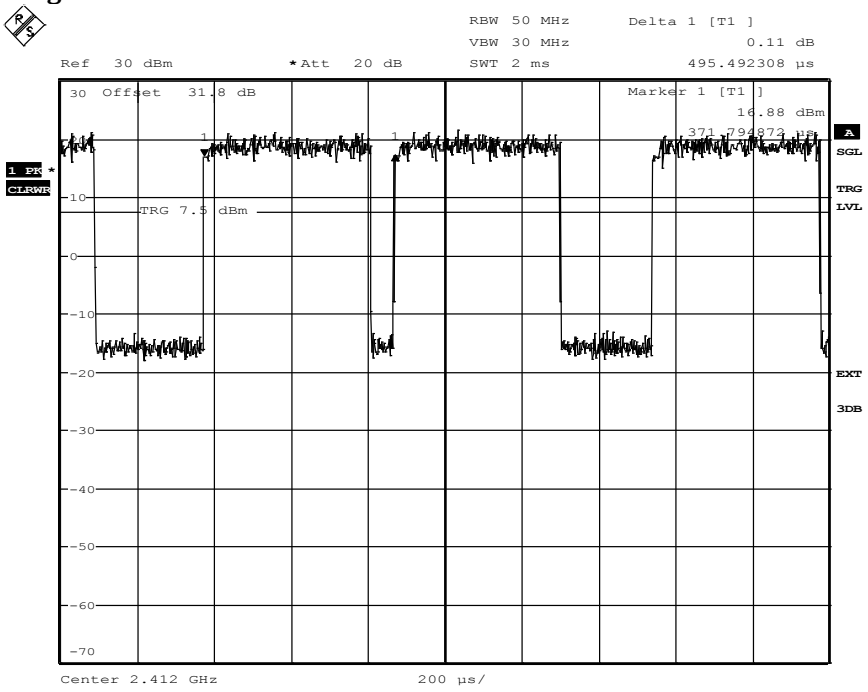
Complies?	N/A

Diagram 1



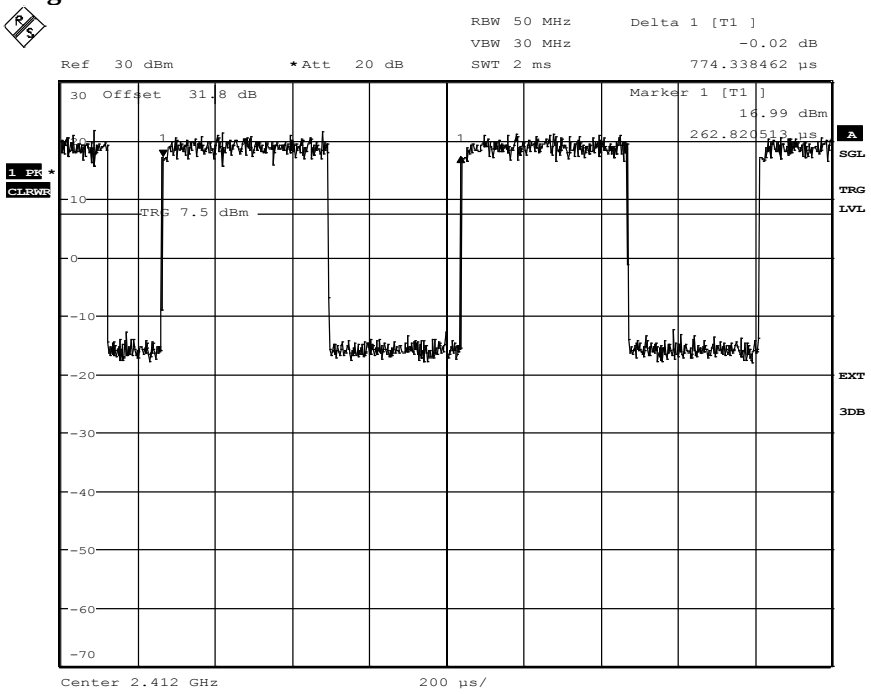
Date: 12.MAR.2015 09:46:07

Diagram 2



Date: 12.MAR.2015 09:47:17

Diagram 3



Date: 12.MAR.2015 09:48:11

6 dB bandwidth measurements according to FCC 47 CFR part 15.247 (a) (2) / RSS-247 5.2 (1)

Date	Temperature	Humidity
2015-06-08	24 °C ± 3 °C	22 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014, clause 8.1 option 1.

Conducted measurements were performed with the SPB820P at the antenna connector and with continuous transmission and with different modulations, see the results.
The test equipment was connected to an external 10 MHz reference standard during measurements.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Preliminary test, 2447 MHz, 6 dB BW vs. modulation/data rate:

Data rate (modulation)	6 dB BW, MHz
BPSK, 1 Mbit/s	10.16
QPSK, 2 Mbit/s	10.16
CCK/QPSK, 5.5 Mbits/s	**8.27**
CCK/QPSK, 11 Mbits/s	9.13
OFDM/BPSK, 6 Mbits/s	16.06
OFDM/BPSK, 9 Mbit/s	16.15
OFDM/QPSK, 12 Mbit/s	15.86
OFDM/QPSK, 18 Mbit/s	15.51
OFDM/16-QAM, 24 Mbit/s	16.41
OFDM/16-QAM, 36 Mbit/s	16.31
OFDM/64-QAM, 48 Mbit/s	16.38
OFDM/64-QAM, 54 Mbit/s	16.31
MCS-0, OFDM/BPSK, 7.2 Mbit/	16.79
MCS-1, OFDM/QPSK, 14.4 Mbit/s	15.48
MCS-2, OFDM/QPSK, 21.7 Mbit/s	15.74
MCS-3, OFDM/16-QAM, 28.9 Mbit/s	16.47
MCS-4, OFDM/16-QAM, 43.4 Mbit/s	16.63
MCS-5, OFDM/64-QAM, 57.8 Mbit/s	16.60
MCS-6, OFDM/64-QAM, 65 Mbit/s	16.89

Final test, 6 dB measurements with modulation CCK/QPSK, 5.5 Mbits/s, can be found in the diagrams below:

Diagram 1	2412 MHz	6 dBW = **7.95 MHz**
Diagram 2	2442 MHz	6 dBW = **8.20 MHz**
Diagram 3	2462 MHz	6 dBW = **8.27 MHz**

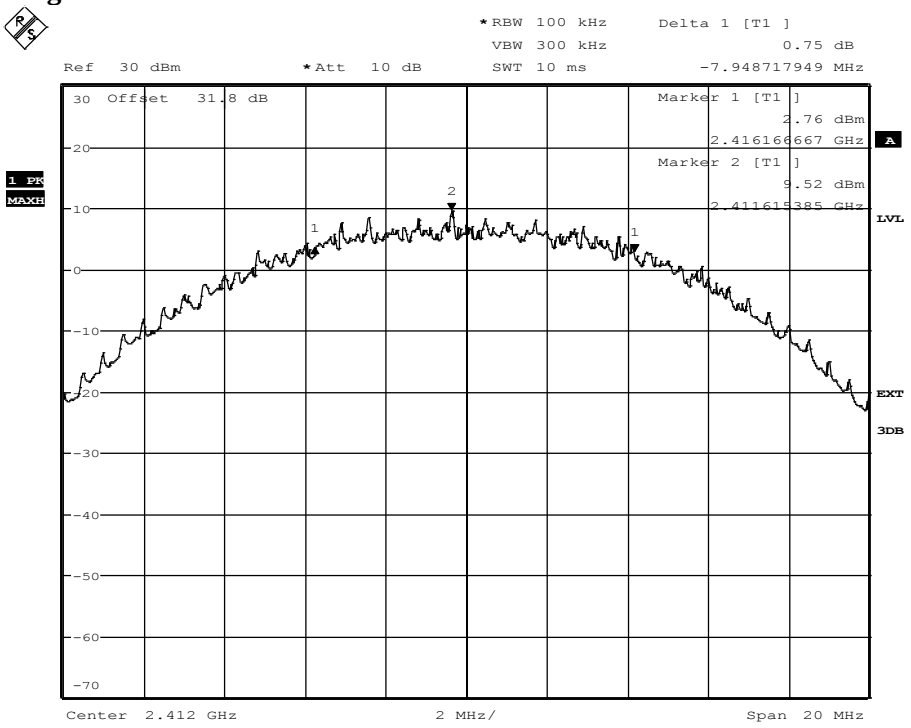
Limits

According to 47CFR 15.247(a)(2), the minimum 6 dB bandwidth shall be at least 500 kHz.

According to RSS-247 5.2 (1), the minimum 6 dB bandwidth shall be 500 kHz.

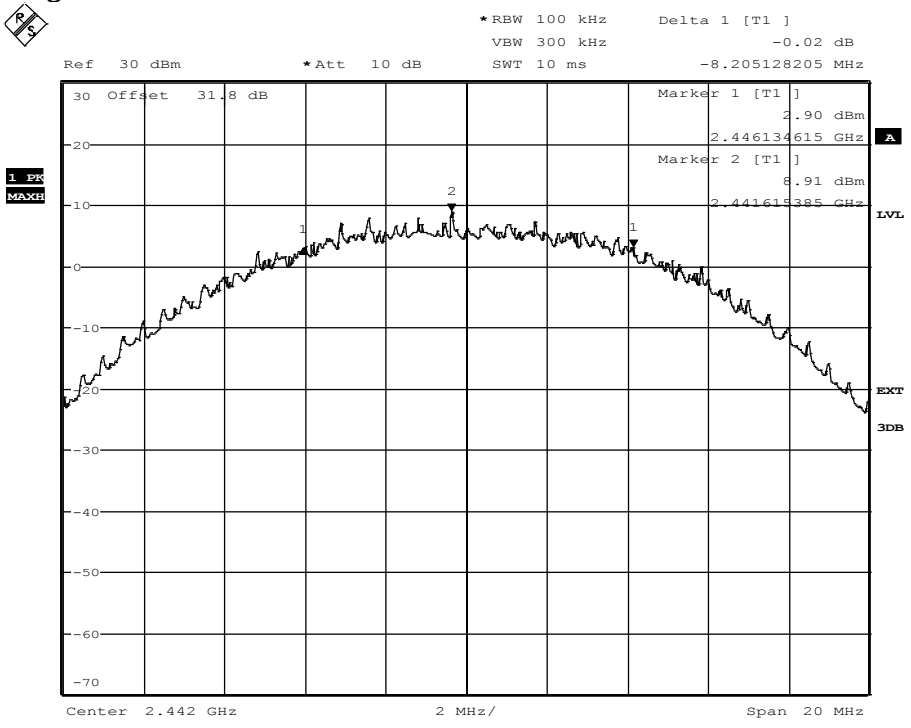
Complies?	Yes

Diagram 1



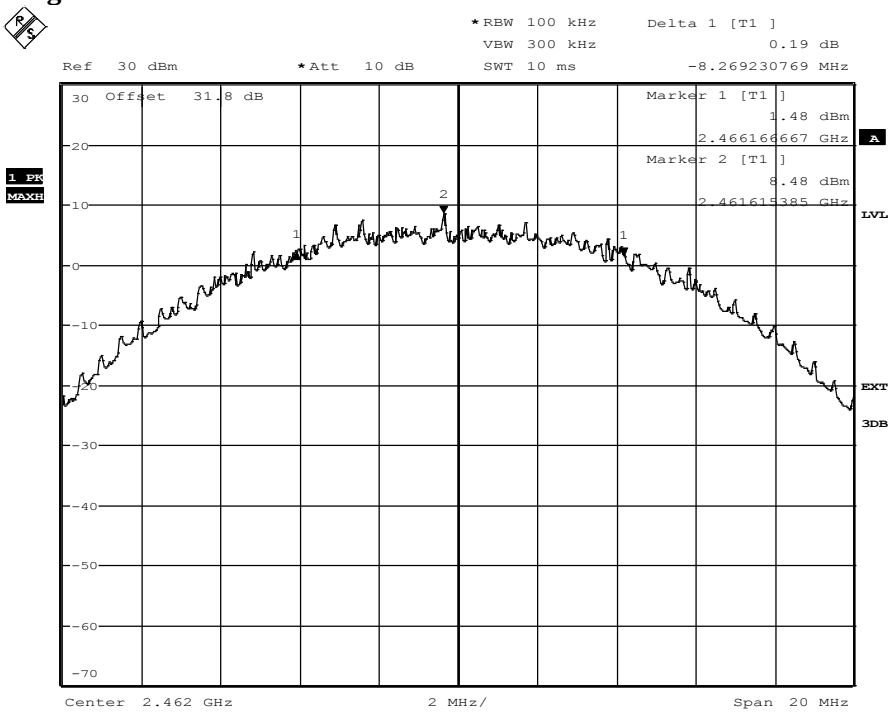
Date: 8.JUN.2015 14:27:55

Diagram 2



Date: 8.JUN.2015 14:33:52

Diagram 3



Date: 8.JUN.2015 14:37:06

Maximum peak conducted output power measurements according to FCC 47 CFR part 15.247 (b) (3) / RSS-247 5.4 (4)

Date	Temperature	Humidity
2015-03-12	24 °C ± 3 °C	18 % ± 5 %
2015-05-27	22 °C ± 3 °C	37 % ± 5 %
2015-07-07	21 °C ± 3 °C	46 % ± 5 %
2015-08-20	23 °C ± 3 °C	36 % ± 5 %
2015-08-21	21 °C ± 3 °C	36 % ± 5 %
2015-08-24	22 °C ± 3 °C	54 % ± 5 %

Test set-up and procedure

Both peak and RMS measurements were performed. The average/RMS values were used for the RF exposure evaluation.
The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014, for peak measurements according to clause clause 9.1.1 and for RMS measurements according to clause 9.2.3.2 in the KDB 558074.

Conducted measurements were performed with the BOX860 and the SPB820P at the antenna connector and with continuous transmission and with different modulations, see the results.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498
Used during RMS measurements 2015-08	
Test site Marconi	15:121
Signal Analyser R&S FSQ40	504 143
DC power supply Keysight E3631A	503 997
Multimeter Fluke 87	502 190
Temperature and humidity meter Testo 635	504 203

Results

Preliminary test, 2442 MHz, maximum conducted peak output power, SPB820P vs. BOX860 and vs. modulation/data rates:

Data rate (modulation)	SPB820P Max conducted output power Peak det, dBm	BOX860 Max conducted output power Peak det, dBm	RBW, MHz (RBW>6 dB BW, DTS BW)
BPSK, 1 Mbit/s	19.0	18.8	20
QPSK, 2 Mbit/s	19.1	18.8	20
CCK/QPSK, 5.5 Mbits/s	19.2	18.9	20
CCK/QPSK, 11 Mbits/s	19.4	18.9	20
OFDM/BPSK, 6 Mbits/s	21.7	21.5	20
OFDM/BPSK, 9 Mbit/s	**22.1**	**22.0**	**20**
OFDM/QPSK, 12 Mbit/s	21,4	21.3	20
OFDM/QPSK, 18 Mbit/s	21.2	20.9	20
OFDM/16-QAM, 24 Mbit/s	21.8	21.7	20
OFDM/16-QAM, 36 Mbit/s	21.6	21.5	20
OFDM/64-QAM, 48 Mbit/s	21.5	21.5	20
OFDM/64-QAM, 54 Mbit/s	21.6	21.7	20
MCS-0, OFDM/BPSK, 7.2 Mbit/	20.0	19.9	20
MCS-1, OFDM/QPSK, 14.4 Mbit/s	19.4	19.1	20
MCS-2, OFDM/QPSK, 21.7 Mbit/s	19.7	19.2	20
MCS-3, OFDM/16-QAM, 28.9 Mbit/s	19.4	18.7	20
MCS-4, OFDM/16-QAM, 43.4 Mbit/s	19.5	19.2	20
MCS-5, OFDM/64-QAM, 57.8 Mbit/s	19.0	18.6	20
MCS-6, OFDM/64-QAM, 65 Mbit/s	19.7	19.5	20

Justifications conducted measurements were performed, comparing the Maximum peak conducted power between the BOX860 unit and the SPB820P unit. As these results were identical or the output power was lower from the BOX860 unit, then the conducted measurements from the SPB820P unit were used in this report.

Preliminary test, 2442 MHz, maximum conducted RMS output power, BOX860 vs. modulation/data rates with the Signal Analyser in CDF-mode:

Data rate (modulation)	BOX860 Max conducted output power RMS Det, dBm
BPSK, 1 Mbit/s	15.9
QPSK, 2 Mbit/s	15.9
CCK/QPSK, 5.5 Mbits/s	**16.3**
CCK/QPSK, 11 Mbits/s	16.2
OFDM/BPSK, 6 Mbits/s	12.8
OFDM/BPSK, 9 Mbit/s	12.8
OFDM/QPSK, 12 Mbit/s	12.9
OFDM/QPSK, 18 Mbit/s	13.0
OFDM/16-QAM, 24 Mbit/s	13.0
OFDM/16-QAM, 36 Mbit/s	13.0
OFDM/64-QAM, 48 Mbit/s	13.1
OFDM/64-QAM, 54 Mbit/s	13.0
MCS-0, OFDM/BPSK, 7.2 Mbit/	9.9
MCS-1, OFDM/QPSK, 14.4 Mbit/s	10.1
MCS-2, OFDM/QPSK, 21.7 Mbit/s	10.2
MCS-3, OFDM/16-QAM, 28.9 Mbit/s	10.1
MCS-4, OFDM/16-QAM, 43.4 Mbit/s	10.2
MCS-5, OFDM/64-QAM, 57.8 Mbit/s	10.3
MCS-6, OFDM/64-QAM, 65 Mbit/s	10.4

Final test with peak detector on BOX860, powered by the external power supply, maximum conducted peak output power, OFDM/BPSK, 9 Mbit/s can be found in the diagrams below:

Diagram 1	2412 MHz	4.50 V DC
Diagram 2	2442 MHz	4.50 V DC
Diagram 3	2462 MHz	4.50 V DC

Final test, OFDM/BPSK, 9 Mbit/s, RBW= 20 MHz (greater than 6 dB BW):

		Max peak output power Peak detector(dBm)		
		2412 MHz	2442 MHz	2462 MHz
T_{nom} 24°C	V_{nom} 4.5 V DC	22.1	22.0	22.1

Final test with RMS detector on BOX860, powered by the external power supply, maximum conducted peak output power, CCK/QPSK, 5.5 Mbits/s s can be found in the diagrams below:

Diagram 4	2412 MHz	4.50 V DC
Diagram 5	2442 MHz	4.50 V DC
Diagram 6	2462 MHz	4.50 V DC

Final test, CCK/QPSK, 5.5 Mbits/s with the Signal analyser in CDF-mode:

		Max peak output power RMS detector (dBm)		
		2412 MHz	2442 MHz	2462 MHz
T_{nom} 22°C	V_{nom} 4.5 V DC	16.3	16.3	16.4

Note 1: According 47CFR 15.31(e), for intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85% and 115% of the nominal rated supply voltage. For battery operated equipment, the equipment tests shall be performed using a new battery.

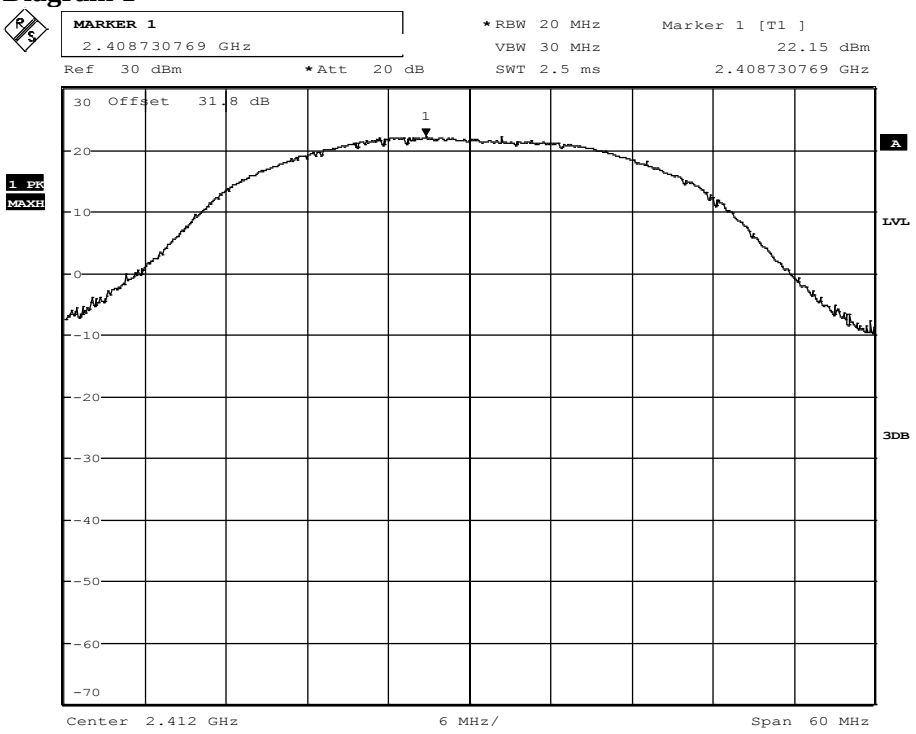
Limits

According to 47CFR 15.247(b)(3), for systems using digital modulation in the 2400-2483.5 MHz band: 1 Watt (30 dBm).

According to RSS-247 5.4 (4), For DTSs employing digital modulation techniques operating in the bands 902-928 MHz and 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1W. Except as provided in Section 5.4(5), the e.i.r.p. shall not exceed 4 W.

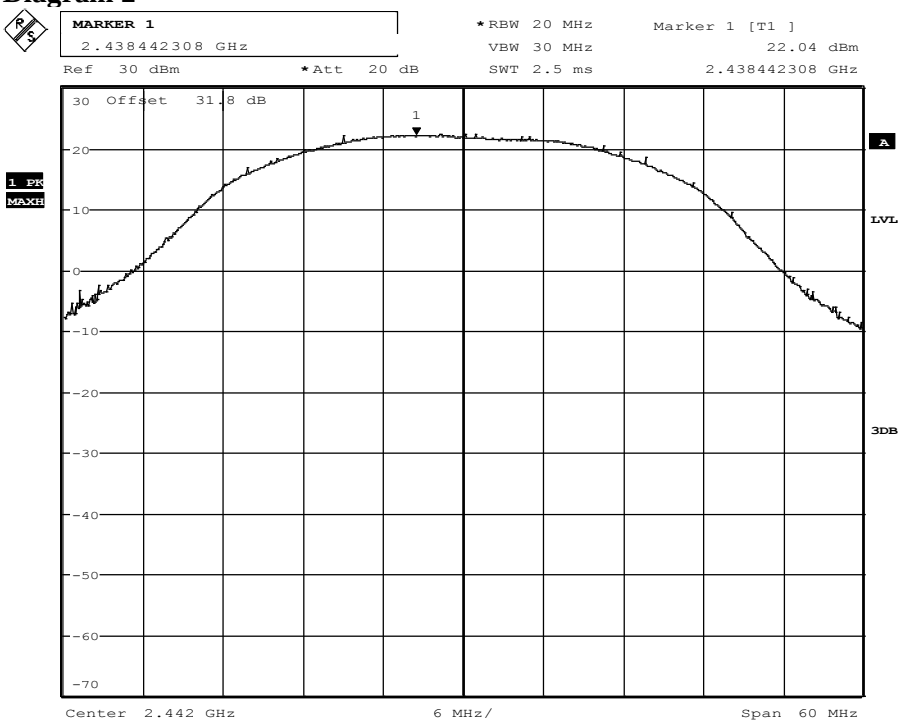
Complies?	Yes

Diagram 1



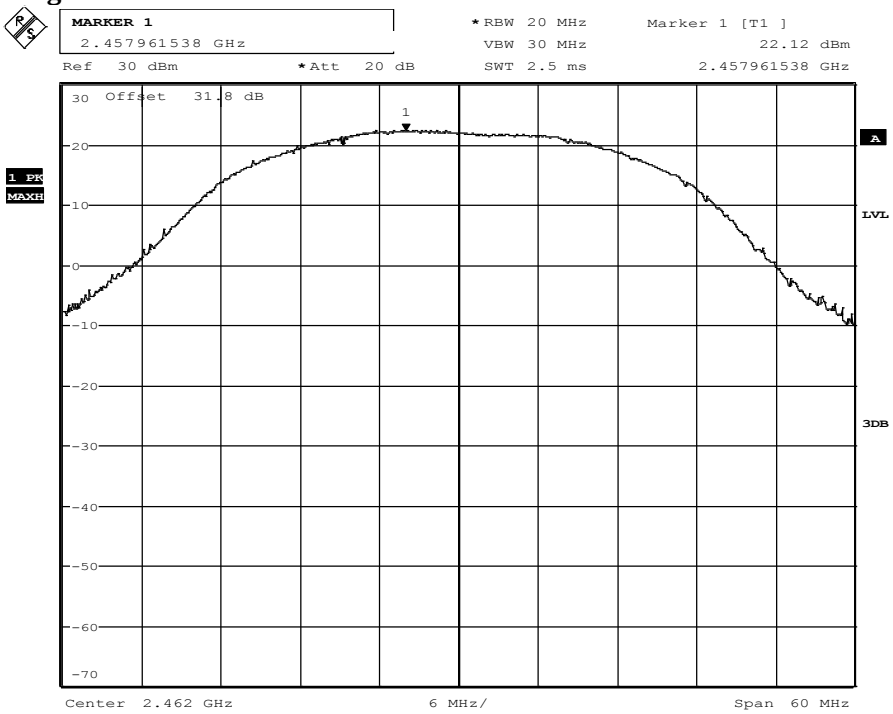
Date: 7.JUL.2015 06:24:36

Diagram 2



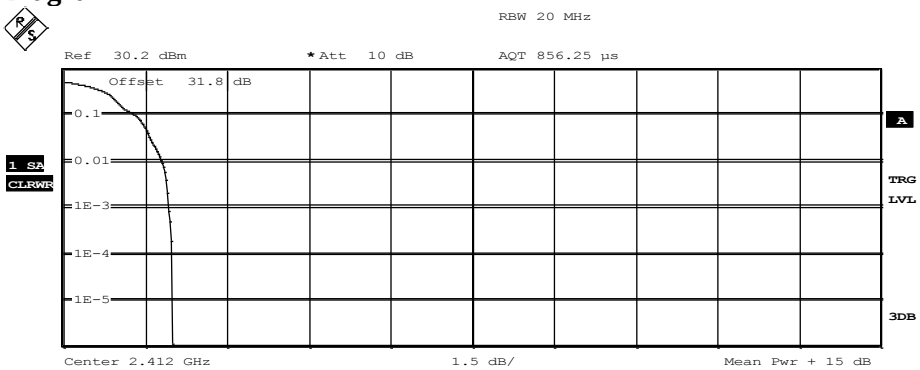
Date: 7.JUL.2015 06:22:02

Diagram 3



Date: 7.JUL.2015 06:27:12

Diagram 4

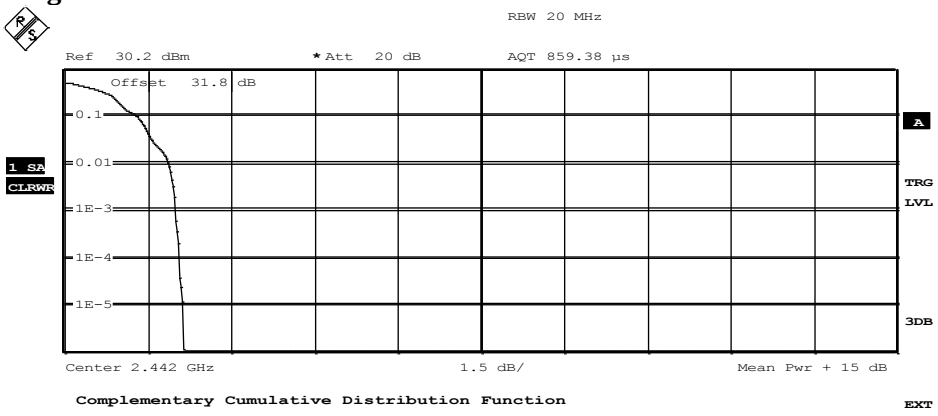


Complementary Cumulative Distribution Function
NOF samples: 27400, Usable BW: 23.7MHz

	Trace 1
Mean	16.30 dBm
Peak	18.28 dBm
Crest	1.98 dB
10 %	1.30 dB
1 %	1.78 dB
.1 %	1.92 dB
.01 %	1.97 dB

Date: 24.AUG.2015 16:23:20

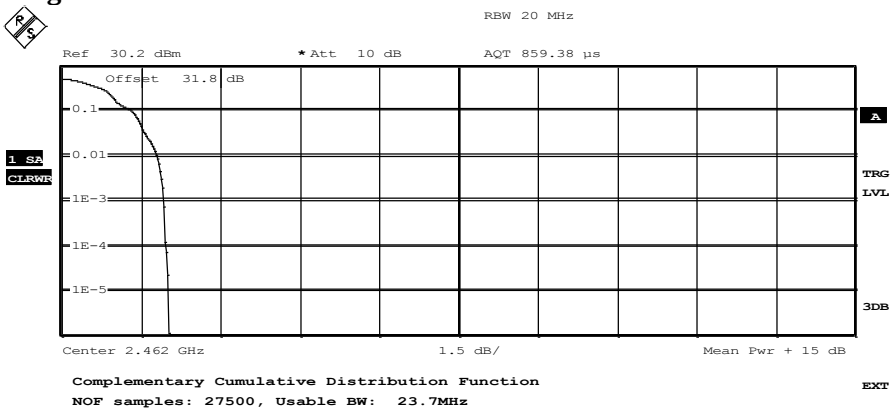
Diagram 5



	Trace 1
Mean	16.26 dBm
Peak	18.39 dBm
Crest	2.13 dB
10 %	1.30 dB
1 %	1.85 dB
.1 %	2.00 dB
.01 %	2.07 dB

Date: 20.AUG.2015 14:29:32

Diagram 6



	Trace 1
Mean	16.35 dBm
Peak	18.35 dBm
Crest	2.00 dB
10 %	1.30 dB
1 %	1.78 dB
.1 %	1.92 dB
.01 %	1.95 dB

Date: 24.AUG.2015 16:20:45

Restricted bands of operation and 20 dBc below fundamental measurements according to FCC 47 CFR part 15.247 (d) / RSS-247 5.5/RSS-Gen 8.10

Date	Temperature	Humidity
2015-04-30	22 °C ± 3 °C	21 % ± 5 %
2015-05-08	23 °C ± 3 °C	31 % ± 5 %
2015-05-12	22 °C ± 3 °C	41 % ± 5 %
2015-07-03	23 °C ± 3 °C	46 % ± 5 %
2015-07-06	23 °C ± 3 °C	65 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014.
Measured average levels related to the fundamental were measured according to cl. 12.2.5.3 in the KDB and ANSI C63.10 with trace mode in Max hold and video filtering with reduced VBW (2 kHz).
Justification measurements were performed with rotation of the EUT through three orthogonal axes to determine which orientation the BOX860 had the highest emission levels, see photos in Append ix 11.

The test was performed with the BOX860 with continuous transmission and with modulation OFDM/BPSK, 9 Mbit/s, which was deemed to be worst case according to Appendix 4.

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 during the measurements was 3.0 m in the frequency range
30 MHz-18 GHz and 1.0 m in the frequency range 18-25 GHz.
The EUT height above the reference ground plane was 0.8 m in the frequency range 30-1000 MHz and 1.5 m in the frequency range 1-25 GHz.

The measurement procedure is as follows:

1. A pre-measurement is performed with peak detector. The test object is measured in eight directions with the antenna in the frequency range 30-1000 MHz and in sixteen directions at frequencies above 1 GHz, with the antenna at three heights, 1.0 m, 1.5 m and 2.0 m.
2. If the emission is close or above the limit during the pre-measurement, the test object is scanned 360 degrees and the antenna height scanned from 1 to 4 m for maximum response. Then the emission is measured with the quasi-peak detector on frequencies below 1 GHz and with the average detector above 1 GHz.

The following RBW were used:
30 MHz-1 GHz: RBW=120 kHz
1-25 GHz: RBW=1 MHz

Test set-up photos during the tests can be found in Appendix 12.

Measurement equipment	SP number
Semi anechoic chamber, Edison	504 114
EMI Test Receiver R&S ESU 26	902 210
Signal Analyser R&S FSIQ40	503 738
EMI measurement computer	-
Software: R&S EMC32, ver. 9.15.0	503 745
Antenna Schaffner Bilog CBL6143	504 079
Horn antenna ETS Lindgren 3115	902 212
Low Noise Amplifier Miteq	504 160
Low Noise Amplifier Miteq	503 277
Standard gain horn Flann 16240-25	503 939
Standard gain horn Flann 18240-25	503 900
Standard gain horn Flann 20240-20	503 674
2.45 band reject filter TTE	503 575
Multimeter Fluke 83	501 522
Temperature and humidity meter Testo 625	504 117

Results

The pre-measurement emission spectra for the worst case configuration can be found in the diagrams below:

Diagram 1:	Ambient, 30-1000 MHz, PC connection board SPB406 power off, vertical and horizontal polarization
Diagram 2:	Ambient, 30-1000 MHz, PC connection board SPB406 power on, vertical and horizontal polarization
Diagram 3:	Ambient, 1-8.2 GHz, PC connection board SPB406 power on, vertical and horizontal polarization
Diagram 4:	30-1000 MHz, 2442 MHz, EUT in pos “3”, vertical and horizontal polarization
Diagram 5:	1-3 GHz, 2442 MHz, EUT in pos “1”, vertical and horizontal polarization
Diagram 6:	1-3 GHz, 2442 MHz, EUT in pos “3”, vertical and horizontal polarization
Diagram 7:	1-3 GHz, 2442 MHz, EUT in pos “3”. With 2.45 GHz band reject filter, vertical and horizontal polarization
Diagram 8:	3-8.2 GHz, 2412 MHz, EUT in pos “3”, vertical and horizontal polarization
Diagram 9:	8.2-12 GHz, 2442 MHz, EUT in pos “3”, vertical and horizontal polarization
Diagram 10:	12-18 GHz, 2442 MHz, EUT in pos “3”, vertical and horizontal polarization
Diagram 11:	18-25 GHz, 2442 MHz, EUT in pos “3”, vertical polarization
Diagram 12:	18-25 GHz, 2442 MHz, EUT in pos “3”, horizontal polarization

Note: Worst-case plots are attached.

The highest detected levels during the final measurement in the frequency range 30 MHz-25 GHz are listed in the tables below.

2412 MHz, EUT in pos "3":

Frequency (MHz)	QP level (dBµV/m)	CAV level (dBµV/m)	Peak level (dBµV/m)	Corr (dB)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
2407.913	N/A	95.7	108.8 *)	31.5	Carrier	1.31	0	Vertical
4824.000	N/A	**50.2 ***)**	**57.9**	-10.1	54 (Av)	1.00	34	Horizontal
7232.314	N/A	**43.1 ***)**	**54.9**	-2.0	54 (Av)	1.94	176	Vertical
9652.295	N/A	40.5	**44.8** **)	-14.1	81.5 (Pk) (20 dBc)	1.67	216	Vertical
11025.981	N/A	**41.0**	**44.8**	-11.4	54 (Av)	1.76	224	Vertical

Above 1 GHz the peak limit is 20 dB above the Average limit (in the restricted bands).
*) With RBW 100 kHz the peak level was 101.5 dBµV/m.
**) Measured with RBW=100 kHz.
***) Average measurements were performed according to clause 12.2.5.3 in the KDB 558074 with max hold.

2442 MHz, EUT in pos "1":

Frequency (MHz)	QP level (dBµV/m)	CAV level (dBµV/m)	Peak level (dBµV/m)	Corr (dB)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
2160.688	N/A	**32.1**	**45.6**	32.1	54 (Av)	3.42	211	Vertical
2720.368	N/A	**33.2**	**46.5**	32.9	54 (Av)	1.49	85	Vertical
2790.726	N/A	**33.1**	**46.1**	33.2	54 (Av)	2.52	160	Vertical

2442 MHz, EUT in pos "3":

Frequency (MHz)	QP level (dBµV/m)	CAV level (dBµV/m)	Peak level (dBµV/m)	Corr (dB)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
34.269	25.8	N/A	**30.8**	21.5	80.8 (Pk) (20 dBc)	1.05	348	Vertical
35.999	28.6	N/A	**32.4**	21.2	80.8 (Pk) (20 dBc)	1.14	341	Vertical
39.828	26.4	N/A	**30.4**	18.2	80.8 (Pk) (20 dBc)	1.07	348	Vertical
48.004	32.4	N/A	**34.1**	14.6	80.8 (Pk) (20 dBc)	1.00	102	Vertical
639.987	36.8	N/A	**38.5**	20.9	80.8 (Pk) (20 dBc)	1.43	322	Horizontal
959.999	40.0	N/A	**41.7**	23.3	80.8 (Pk) (20 dBc)	1.61	327	Horizontal
2439.298	N/A	94.2	106.7 *)	31.5	Carrier	1.00	11	Vertical
2436.757 ****)	N/A	88.3	100.9	31.5	Carrier	1.00	55	Horizontal
2436.757 *****)	N/A	93.3	106.0	31.5	Carrier	1.34	341	Vertical
2733.149	N/A	**46.3**	**59.6**	33.0	54 (Av)	2.99	12	Vertical
4885.398	N/A	**47.3 ***)**	**60.0**	-10.1	54 (Av)	1.51	245	Horizontal
7322.546	N/A	**41.8 ***)**	**54.3**	-2.0	54 (Av)	1.97	195	Vertical
7466.026	N/A	**33.9**	**47.2**	-1.7	54 (Av)	2.47	293	Horizontal
9769.671	N/A	36.2	**42.9** **)	-14.1	80.8 (Pk) (20 dBc)	1.59	164	Vertical
11163.555	N/A	**41.2**	**44.4**	-11.4	54 (Av)	1.59	229	Vertical
12206.569	N/A	**26.5 ***)**	**42.1**	-7.6	54 (Av)	1.67	200	Vertical

Above 1 GHz the peak limit is 20 dB above the Average limit (in the restricted bands).
*) With RBW 100 kHz the peak level was 100.8 dBµV/m.
**) Measured with RBW=100 kHz.
***) Average measurements were performed according to clause 12.2.5.3 in the KDB 558074 with max hold.
****) With EUT in pos "1".
*****) With EUT in pos "2".

2462 MHz, EUT in pos "3":

Frequency (MHz)	QP level (dBµV/m)	CAV level (dBµV/m)	Peak level (dBµV/m)	Corr (dB)	Limit (dBµV/m)	Height (m)	Azimuth (deg)	Polarization
2460.029	N/A	95.4	108.7 *)	31.5	Carrier	1.23	0	Vertical
4925.442	N/A	**50.4 ***)**	**60.0**	-10.1	54 (Av)	1.01	32	Horizontal
7390.006	N/A	**40.3 ***)**	**52.9**	-2.0	54 (Av)	2.02	172	Vertical
9845.997	N/A	38.3	**45.1** **)	-14.1	80.3 (Pk) (20 dBc)	1.69	161	Vertical
11255.147	N/A	**36.9**	**42.2**	-11.4	54 (Av)	1.67	227	Vertical

Above 1 GHz the peak limit is 20 dB above the Average limit (in the restricted bands).
*) With RBW 100 kHz the peak level was 100.3 dBµV/m.
**) Measured with RBW=100 kHz.
***) Average measurements were performed according to clause 12.2.5.3 in the KDB 558074 with max hold.

Limits

According to 47CFR 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.
Radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a).

According to RSS-247 5.5, modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

According to RSS-Gen 8.10, Restricted bands, identified in Table 6, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:
(a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287;
(b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and
(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Complies?	Yes

Diagram 1

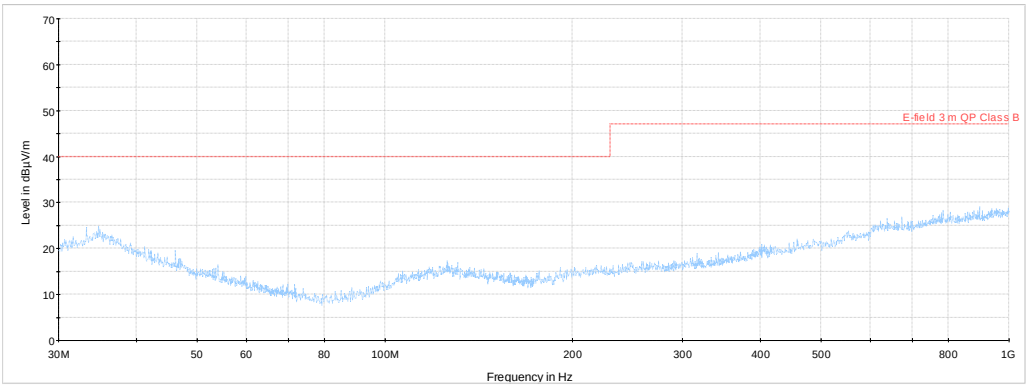


Diagram 2

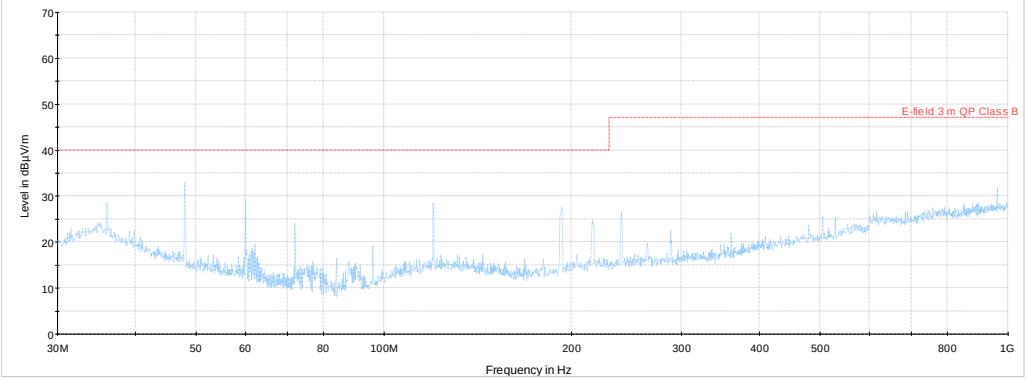


Diagram 3

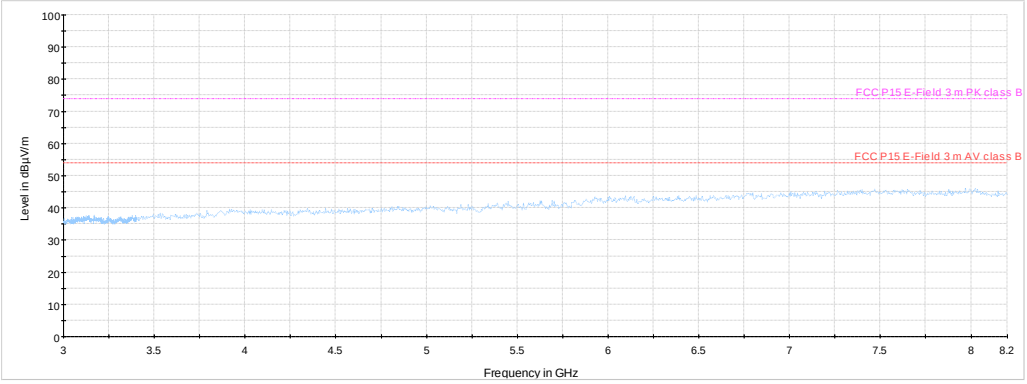


Diagram 4

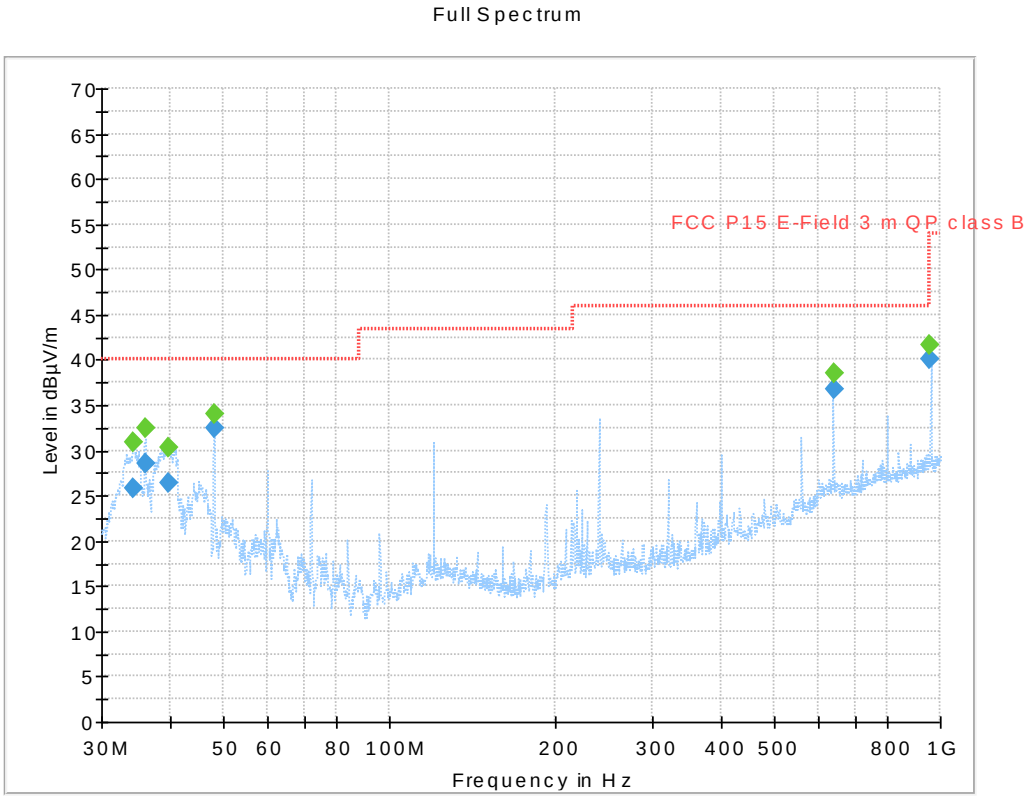


Diagram 5

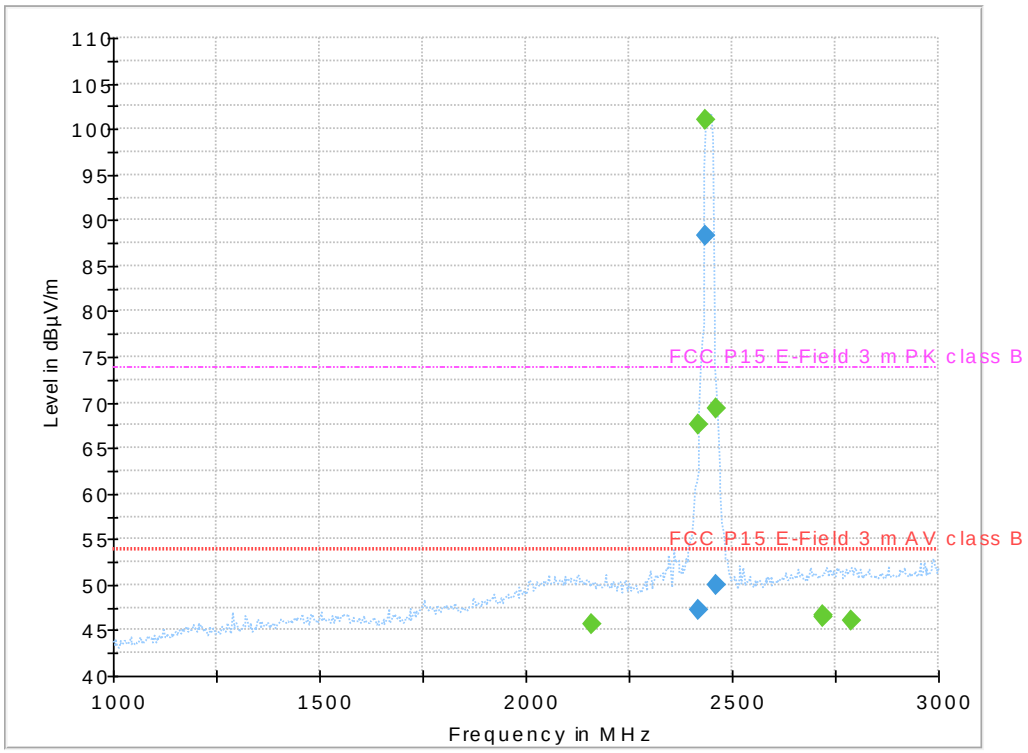


Diagram 6

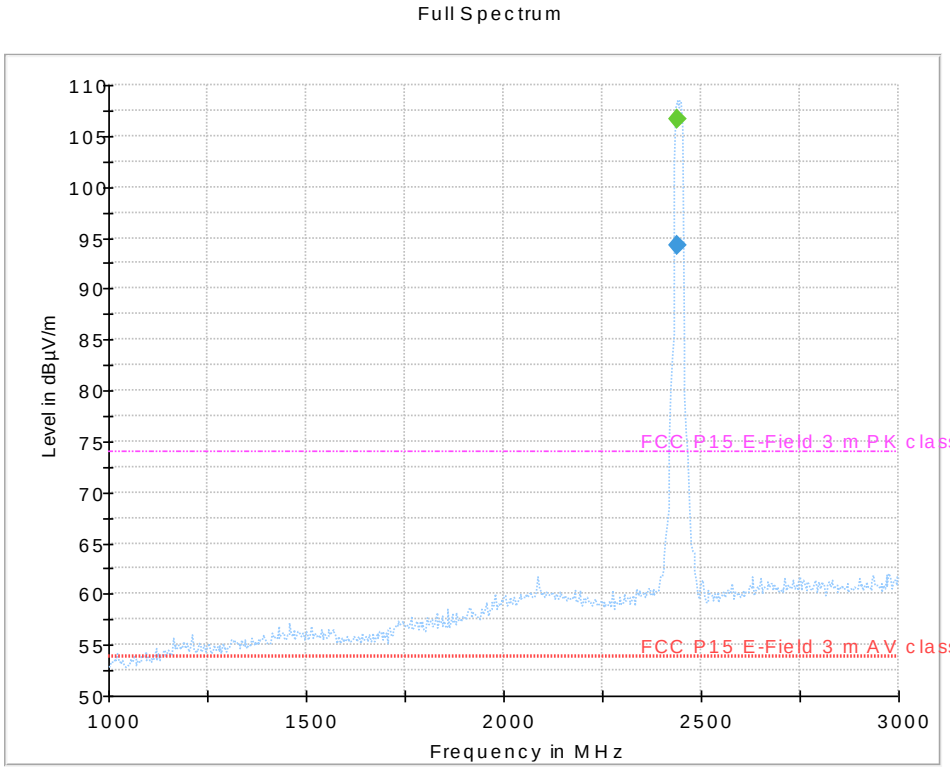


Diagram 7

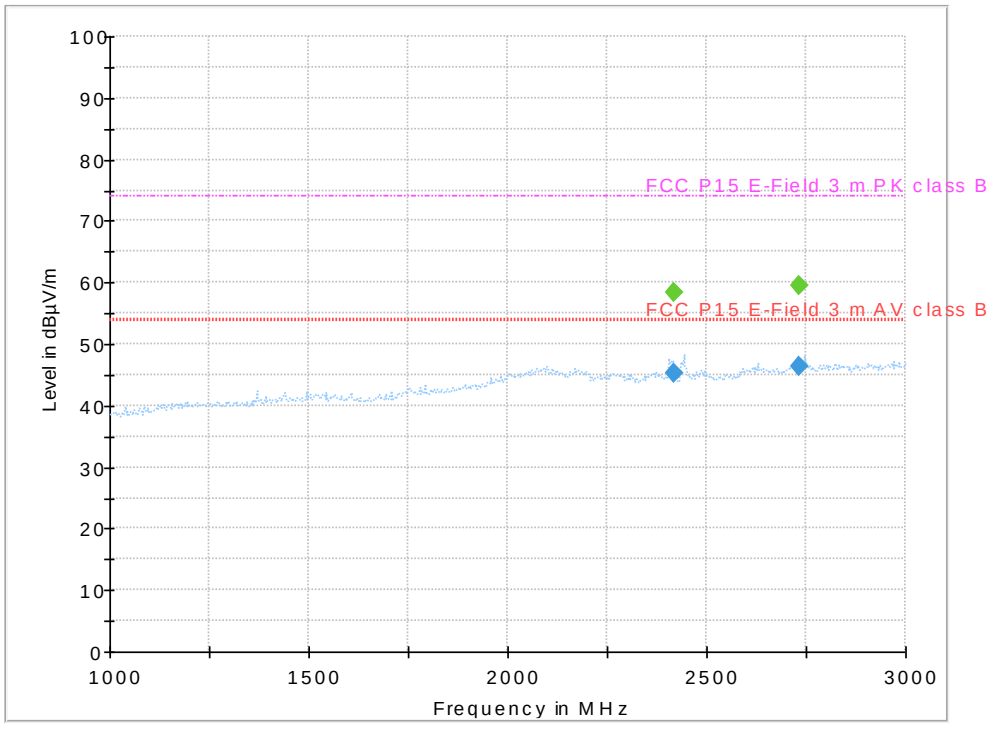


Diagram 8

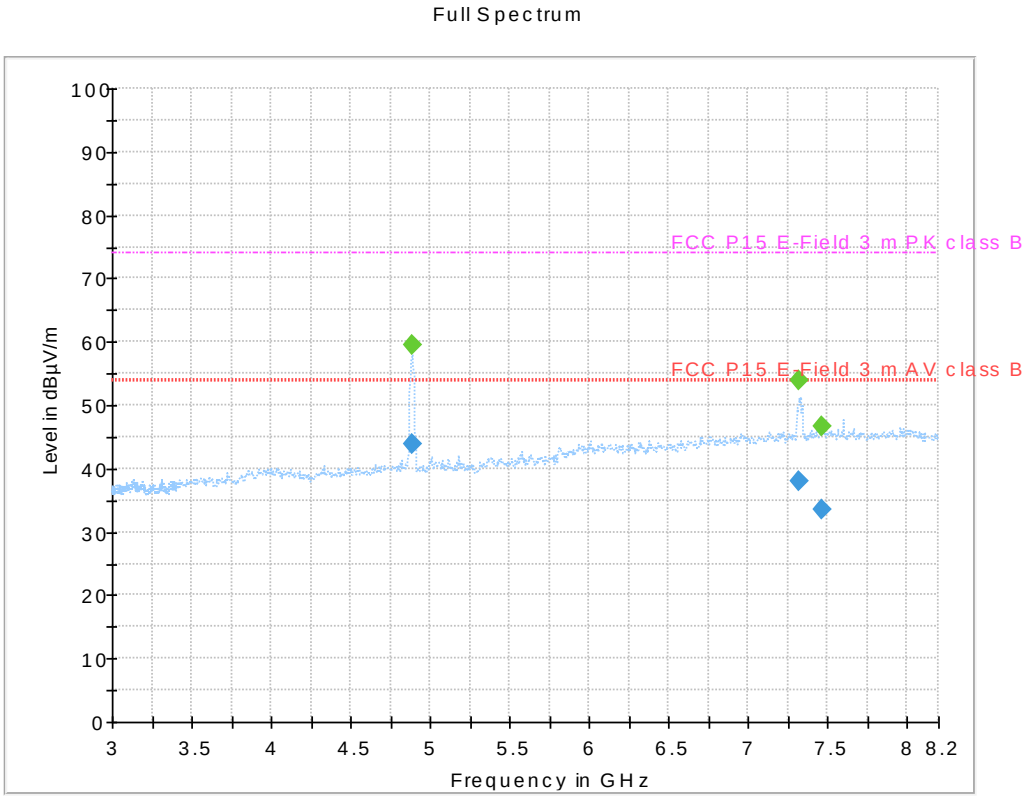


Diagram 9

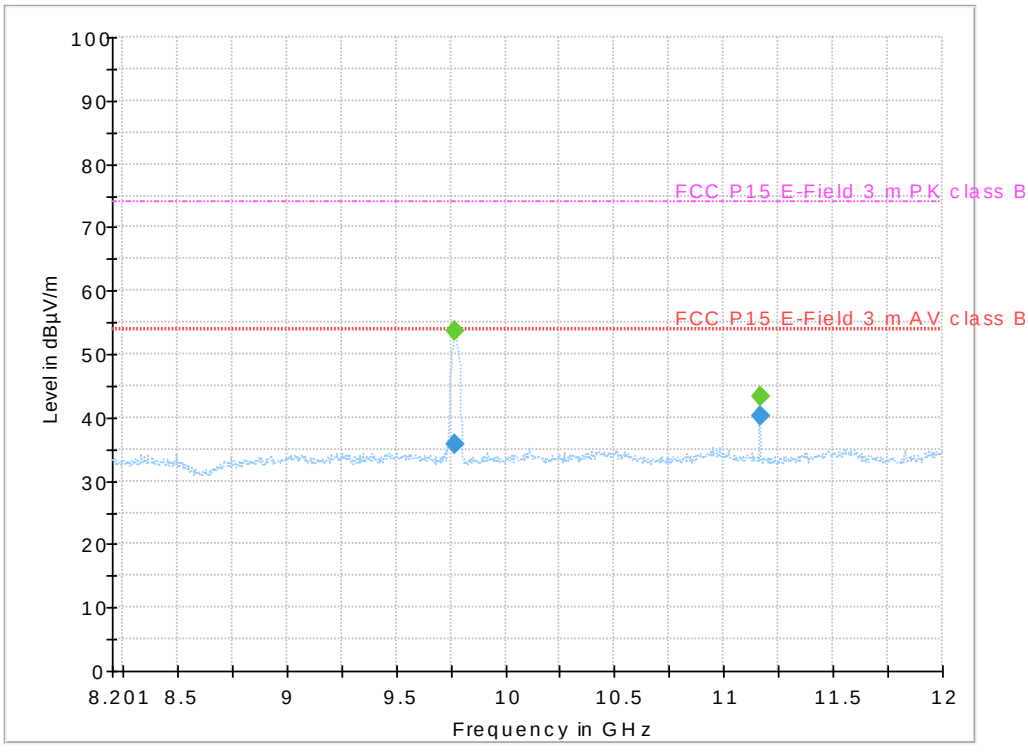


Diagram 10

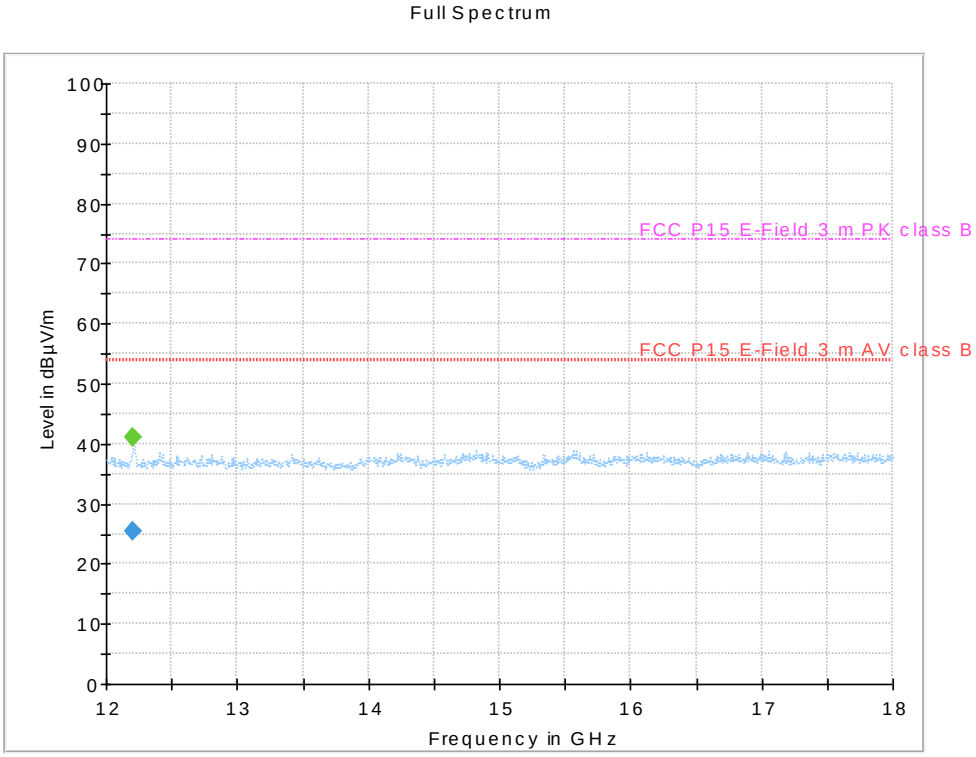


Diagram 11

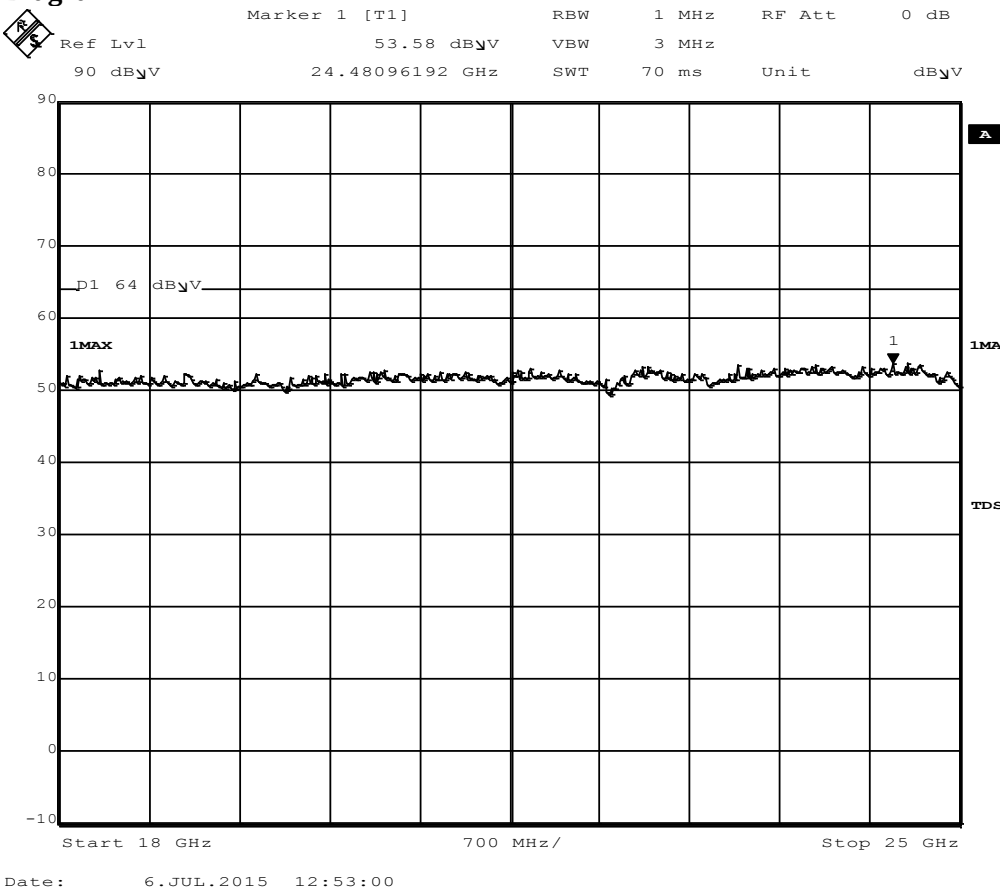
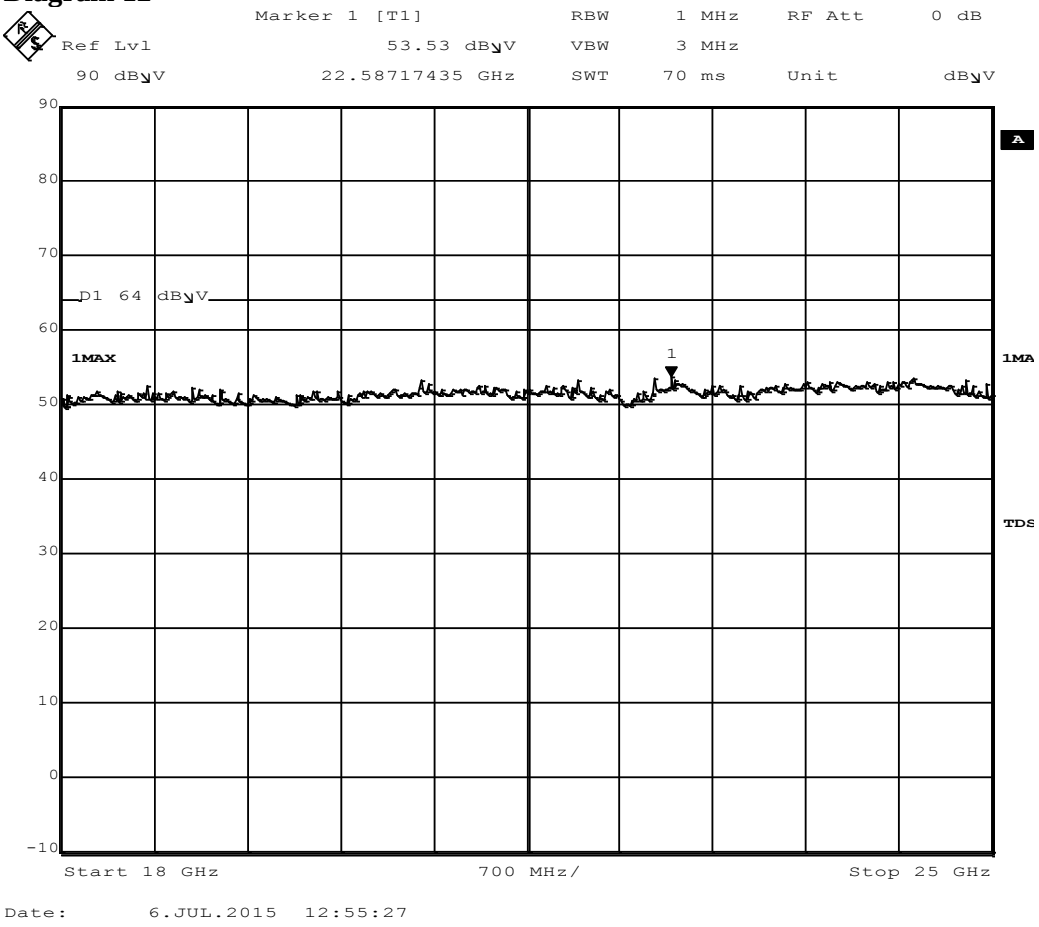


Diagram 12


Marker 1 [T1]
RBW 1 MHz
RF Att 0 dB
Ref Lvl
53.53 dBµV
VBW 3 MHz
90 dBµV
22.58717435 GHz
SWT 70 ms
Unit dBµV
90
80
70
60
50
40
30
20
10
0
-10
D1 64 dBµV
1MAX
1
A
1MA
TDS
Start 18 GHz
700 MHz/
Stop 25 GHz
Date: 6.JUL.2015 12:55:27

Power spectral density measurements according to FCC 47 CFR part 15.247 (e) / RSS-247 5.2 (2)

Date	Temperature	Humidity
2015-04-17	22 °C ± 3 °C	21 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014, clause 10.2.

Conducted measurements were performed with the SPB820P at the antenna connector and with continuous transmission and with different modulations, see the results.
The sweep points were set to 30 001 in the signal analyser.
The test equipment was connected to an external 10 MHz reference standard during measurements.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Preliminary test, 2442 MHz, Power spectral density vs. modulation/data rates:

Data rate (modulation)	Power spectral density, dBm RBW=20 kHz
BPSK, 1 Mbit/s	7.4
QPSK, 2 Mbit/s	7.4
CCK/QPSK, 5.5 Mbits/s	7.3
CCK/QPSK, 11 Mbits/s	**7.6**
OFDM/BPSK, 6 Mbits/s	-3.8
OFDM/BPSK, 9 Mbit/s	-3.2
OFDM/QPSK, 12 Mbit/s	-3.5
OFDM/QPSK, 18 Mbit/s	-3.0
OFDM/16-QAM, 24 Mbit/s	-2.8
OFDM/16-QAM, 36 Mbit/s	-2.5
OFDM/64-QAM, 48 Mbit/s	-3.6
OFDM/64-QAM, 54 Mbit/s	-3.6
MCS-0, OFDM/BPSK, 7.2 Mbit/	-6.3
MCS-1, OFDM/QPSK, 14.4 Mbit/s	-6.7
MCS-2, OFDM/QPSK, 21.7 Mbit/s	-5.9
MCS-3, OFDM/16-QAM, 28.9 Mbit/s	-5.2
MCS-4, OFDM/16-QAM, 43.4 Mbit/s	-5.7
MCS-5, OFDM/64-QAM, 57.8 Mbit/s	-5.5
MCS-6, OFDM/64-QAM, 65 Mbit/s	-5.8

The final measurements with CCK/DPSK, 11 Mbits/s can be found in the diagrams below:
RBW=3 kHz

Diagram 1	2412 MHz	Power spectral density = **6.9 dBm**
Diagram 2	2442 MHz	Power spectral density = **6.0 dBm**
Diagram 3	2462 MHz	Power spectral density = **5.1 dBm**

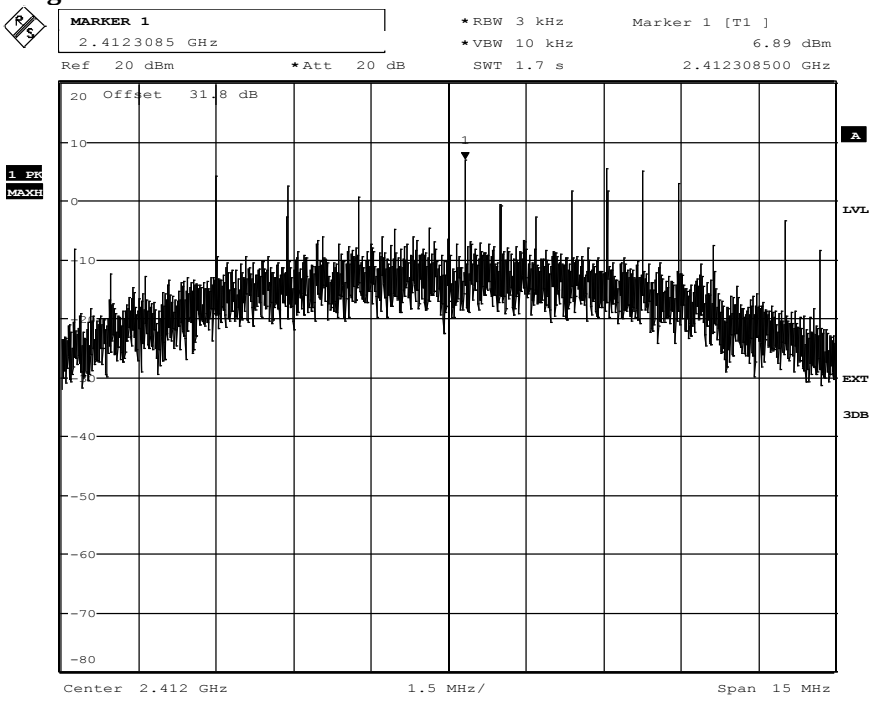
Limits

According to 47CFR 15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

According to RSS-247 5.2 (2), The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

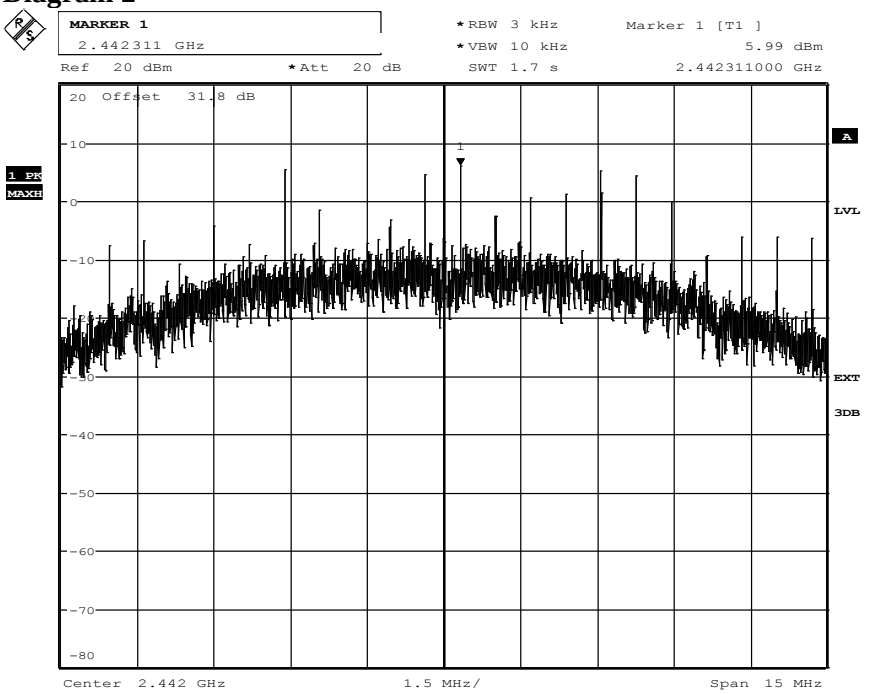
Complies?	Yes

Diagram 1



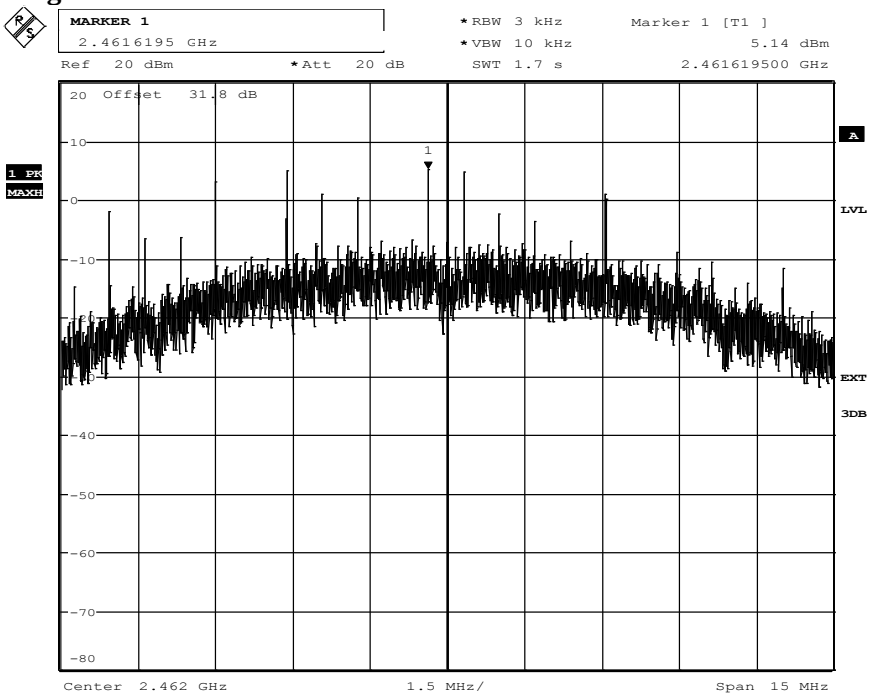
Date: 17.APR.2015 13:18:15

Diagram 2



Date: 17.APR.2015 13:14:40

Diagram 3



Date: 17.APR.2015 13:23:53

RF exposure evaluation: 2.1093 Portable devices FCC 47 CFR part 15.247 (i) / KDB 447498 / RSS-102 2.5.1

Date	Temperature	Humidity
2015-08-19	23 °C ± 3 °C	29 % ± 5 %

Procedure

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1093 this device has been defined as a portable device to be used within 20 centimetres of the body of the user.

Results

Standalone SAR exclusion:

Step 1:
The following formula was used to calculate the RF exposure SAR exclusion threshold,
Thld=[Pout /r] x [√f]

where,
Thld= SAR exclusion threshold
Pout = Maximum output power measured with RMS detector, in mW
r = minimum test separation distance, in mm
f=frequency, in GHz

Frequency f, (GHz)	Maximum output power Pout with RMS det, (mW)	Distance r, (mm)	Exclusion threshold Thld	Limit Threshold 1-g SAR	Limit Threshold 10-g SAR
2.462	50.12 Note 1	27	2.9	< 3	< 7.5

Note 1: The maximum measured RMS level was 16.3 dBm (CCK/QPSK, 5.5 Mbits/s). According to RSS-102 cl. 2.5.1 the RMS value shall be adjusted for tune-up tolerance, thus 17 dBm (50.12 mW) was used as Maximum output power Pout in the table above.

Limits

FCC 2.1093 / KDB 447498 (ver 5 rev 2) 4.3.1:

4.3.1 Standalone SAR exclusion:

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] x [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where

• f(GHz) is the RF channel transmit frequency in GHz
• Power and distance are rounded to the nearest mW and mm before calculation
• The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following, and as illustrated in Appendix B.
a) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) x (f(MHz)/150)] mW, at 100 MHz to 1500 MHz
b) [Power allowed at numeric threshold for 50 mm in step 1) + (test separation distance - 50 mm) x 10] mW at > 1500 MHz and ≤ 6 GHz

Appendix B

SAR Test Exclusion Thresholds for 100 MHz – 6 GHz and > 50 mm

Approximate SAR test exclusion power thresholds at selected frequencies and test separation distances are illustrated in the following table. The equation and threshold in section 4.3.1 must be applied to determine SAR test exclusion.

MHz	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	mm
100	474	481	487	494	501	507	514	521	527	534	541	547	554	561	567	
150	387	397	407	417	427	437	447	457	467	477	487	497	507	517	527	
300	274	294	314	334	354	374	394	414	434	454	474	494	514	534	554	
450	224	254	284	314	344	374	404	434	464	494	524	554	584	614	644	
835	164	220	275	331	387	442	498	554	609	665	721	776	832	888	943	
900	158	218	278	338	398	458	518	578	638	698	758	818	878	938	998	
1500	122	222	322	422	522	622	722	822	922	1022	1122	1222	1322	1422	1522	mW
1900	109	209	309	409	509	609	709	809	909	1009	1109	1209	1309	1409	1509	
2450	96	196	296	396	496	596	696	796	896	996	1096	1196	1296	1396	1496	
3600	79	179	279	379	479	579	679	779	879	979	1079	1179	1279	1379	1479	
5200	66	166	266	366	466	566	666	766	866	966	1066	1166	1266	1366	1466	
5400	65	165	265	365	465	565	665	765	865	965	1065	1165	1265	1365	1465	
5800	62	162	262	362	462	562	662	762	862	962	1062	1162	1262	1362	1462	

IC RSS-102 Issue 5 cl. 2.5.1 Exemption from Routine Evaluation Limits – SAR Evaluation

SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table 1.

Table 1: SAR evaluation – Exemption limits for routine evaluation based on frequency and separation distance

Frequency (MHz)	Exemtion Limits (mW)				
	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	71 mW	101 mW	132 mW	162 mW	193 mW
450	52 mW	70 mW	88 mW	106 mW	123 mW
835	17 mW	30 mW	42 mW	55 mW	67 mW
1900	7 mW	10 mW	18 mW	34 mW	60 mW
2450	4 mW	7 mW	15 mW	30 mW	**52 mW**
3500	2 mW	6 mW	16 mW	32 mW	55 mW
5800	1 mW	6 mW	15 mW	27 mW	41 mW

Frequency (MHz)	Exemtion Limits (mW)				
	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of ≥50 mm
≤300	223 mW	254 mW	284 mW	315 mW	193 mW
450	141 mW	159 mW	177 mW	195 mW	123 mW
835	80 mW	92 mW	105 mW	117 mW	67 mW
1900	99 mW	153 mW	225 mW	316 mW	60 mW
2450	83 mW	123 mW	173 mW	235 mW	52 mW
3500	86 mW	124 mW	170 mW	225 mW	55 mW
5800	56 mW	71 mW	85 mW	27 mW	41 mW

Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 5. For limb-worn devices where the 10 gram value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table 1, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.
For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

For medical implants devices, the exemption limit for routine evaluation is set at 1 mW. The output power of a medical implants device is defined as the higher of the conducted or e.i.r.p to determine whether the device is exempt from the SAR evaluation.

Complies?	Yes

20 dB bandwidth measurements according to FCC 47 CFR part 15.215 (c)

Date	Temperature	Humidity
2015-03-12	24 °C ± 3 °C	18 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013.

Conducted measurements were performed with the SPB820P at the antenna connector and with continuous transmission and with modulation MCS-0, OFDM/BPSK, 7.2 Mbit/s, which deemed to be worst case according to Appendix 10, OBW.
The sweep points were set to 1251 in the signal analyser.
The test equipment was connected to an external 10 MHz reference standard during measurements.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

For preliminary test, see OBW in Appendix 10.

The final measurements with modulation MCS-0, OFDM/BPSK, 7.2 Mbit/s, can be found in the diagrams below:

Diagram 1:	2412 MHz	20 dB BW = **19.81 MHz**
Diagram 2:	2442 MHz	20 dB BW = **19.81 MHz**
Diagram 3:	2462 MHz	20 dB BW = **19.97 MHz**

Limits

According to 47CFR 15.215(c), intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80% of the permitted band in order to minimize the possibility of out-of-band operation.

Complies?	Yes

Diagram 1

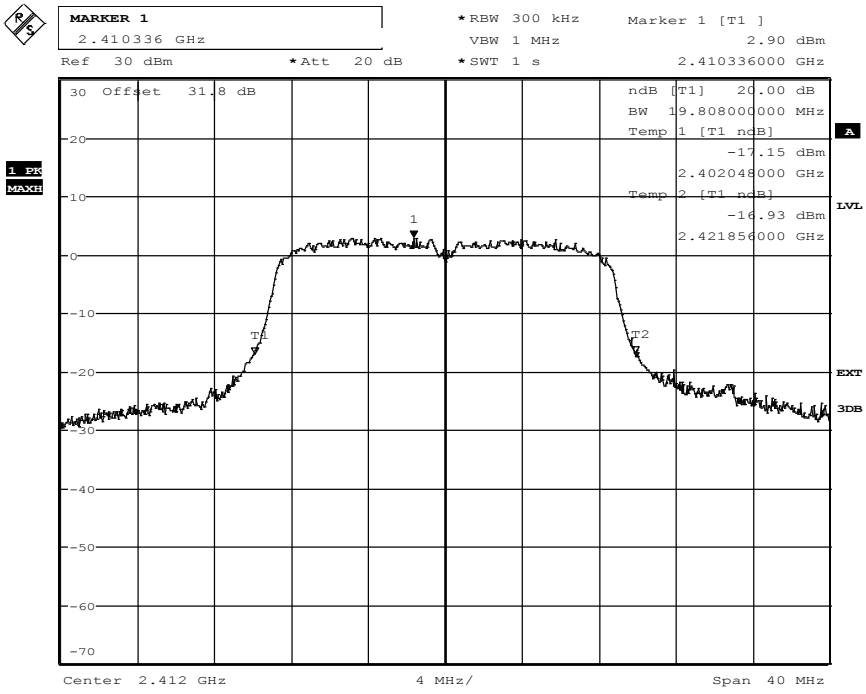

MARKER 1
2.410336 GHz
*RBW 300 kHz
VBW 1 MHz
*SWT 1 s
Marker 1 [T1]
2.90 dBm
2.410336000 GHz
Ref 30 dBm
*Att 20 dB
30 Offset 31.8 dB
ndB [T1] 20.00 dB
BW 19.808000000 MHz
Temp 1 [T1 ndB]
-17.15 dBm
2.402048000 GHz
Temp 2 [T1 ndB]
-16.93 dBm
2.421856000 GHz
Center 2.412 GHz
4 MHz/
Span 40 MHz
Date: 12.MAR.2015 11:39:32

Diagram 2

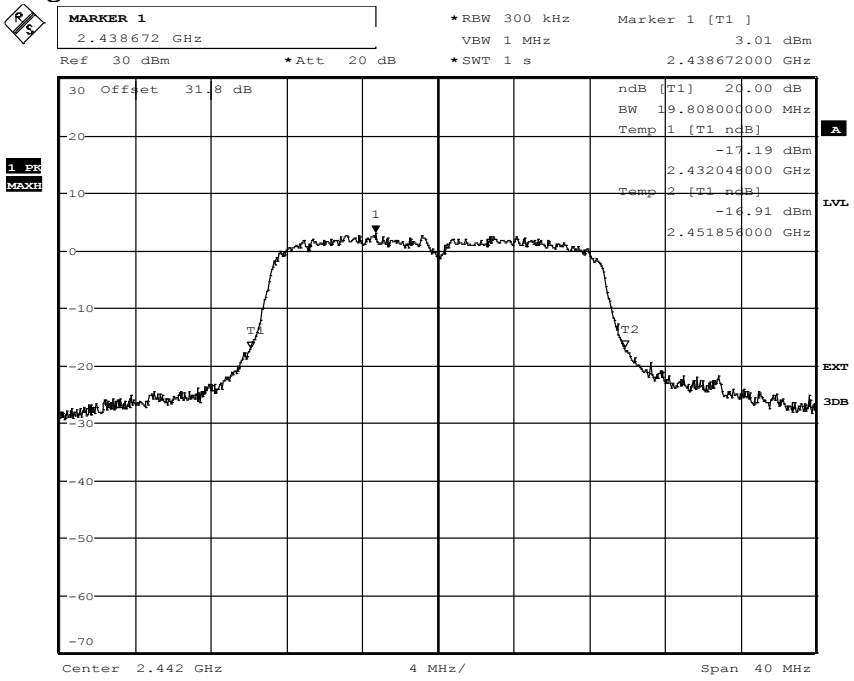
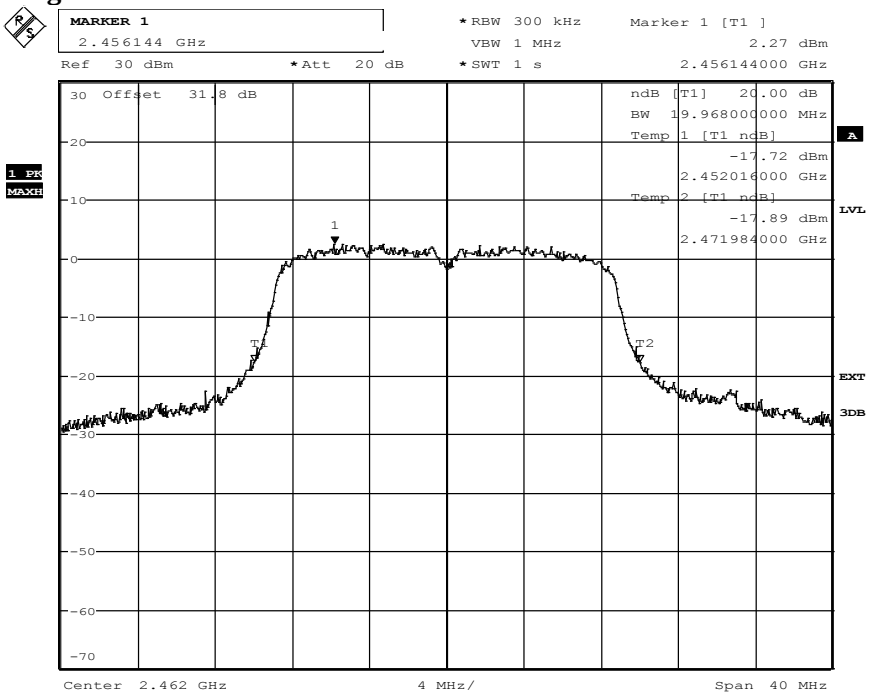

MARKER 1
2.438672 GHz
*RBW 300 kHz
VBW 1 MHz
*SWT 1 s
Marker 1 [T1]
3.01 dBm
2.438672000 GHz
Ref 30 dBm
*Att 20 dB
30 Offset 31.8 dB
ndB [T1] 20.00 dB
BW 19.808000000 MHz
Temp 1 [T1 ndB]
-17.19 dBm
2.432048000 GHz
Temp 2 [T1 ndB]
-16.91 dBm
2.451856000 GHz
Center 2.442 GHz
4 MHz/
Span 40 MHz
Date: 12.MAR.2015 11:37:11

Diagram 3



Date: 12.MAR.2015 11:33:16

Occupied bandwidth measurements according to 47CFR 2.1049 / RSS-Gen 6.6

Date	Temperature	Humidity
2015-03-12	24 °C ± 3 °C	18 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013.

Conducted measurements were performed with the SPB820P at the antenna connector and with continuous transmission and with different modulations, see the results.
The sweep points were set to 1251 in the signal analyser.
The test equipment was connected to an external 10 MHz reference standard during measurements.

Measurement equipment	SP number
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Preliminary test, 2442 MHz, OBW vs. modulation/data rates:

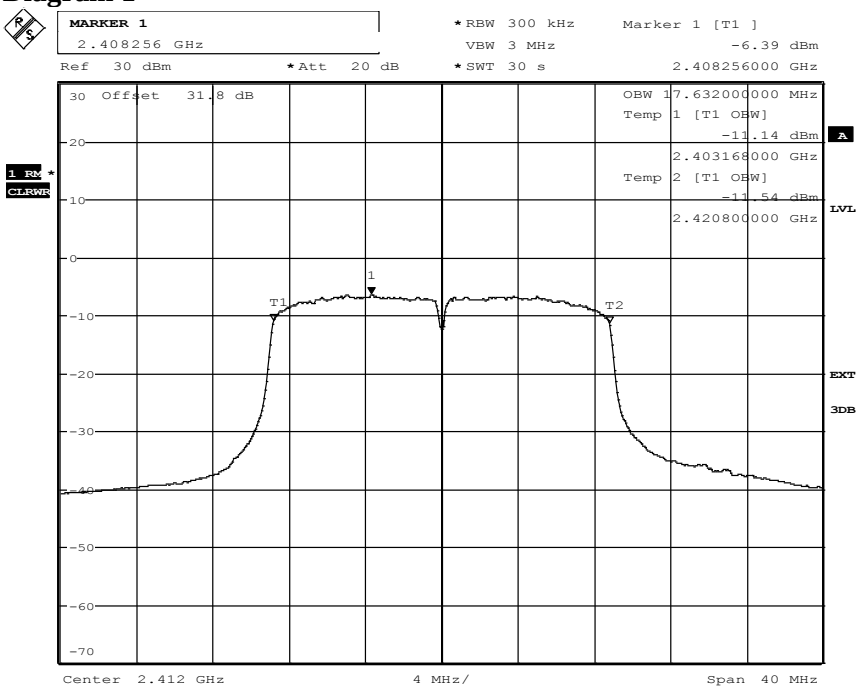
Data rate (modulation)	OBW, MHz
BPSK, 1 Mbit/s	15.39
QPSK, 2 Mbit/s	15.42
CCK/QPSK, 5.5 Mbits/s	14.14
CCK/QPSK, 11 Mbits/s	14.84
OFDM/BPSK, 6 Mbits/s	16.51
OFDM/BPSK, 9 Mbit/s	16.51
OFDM/QPSK, 12 Mbit/s	16.51
OFDM/QPSK, 18 Mbit/s	16.48
OFDM/16-QAM, 24 Mbit/s	16.48
OFDM/16-QAM, 36 Mbit/s	16.51
OFDM/64-QAM, 48 Mbit/s	16.48
OFDM/64-QAM, 54 Mbit/s	16.48
MCS-0, OFDM/BPSK, 7.2 Mbit/	**17.63**
MCS-1, OFDM/QPSK, 14.4 Mbit/s	17.63
MCS-2, OFDM/QPSK, 21.7 Mbit/s	17.60
MCS-3, OFDM/16-QAM, 28.9 Mbit/s	17.60
MCS-4, OFDM/16-QAM, 43.4 Mbit/s	17.57
MCS-5, OFDM/64-QAM, 57.8 Mbit/s	17.54
MCS-6, OFDM/64-QAM, 65 Mbit/s	17.54

The final measurements with modulation MCS-0, OFDM/BPSK 7.2 Mbit/s can be found in the diagrams below:

Diagram 1	2412 MHz	OBW = **17.60 MHz** (99%)
Diagram 2	2442 MHz	OBW = **17.63 MHz** (99%)
Diagram 3	2462 MHz	OBW = **17.63 MHz** (99%)

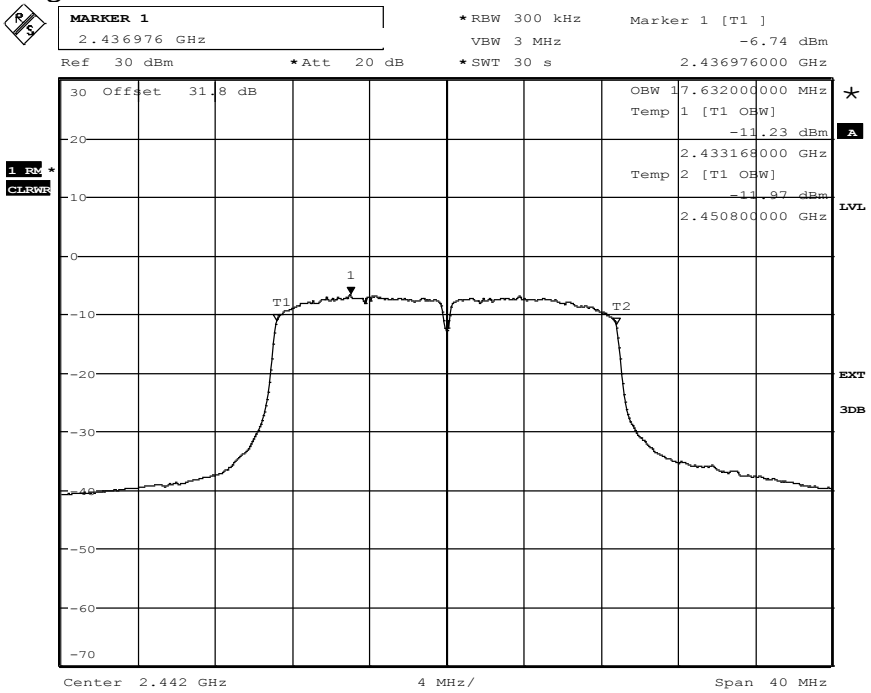
Complies?	Yes

Diagram 1



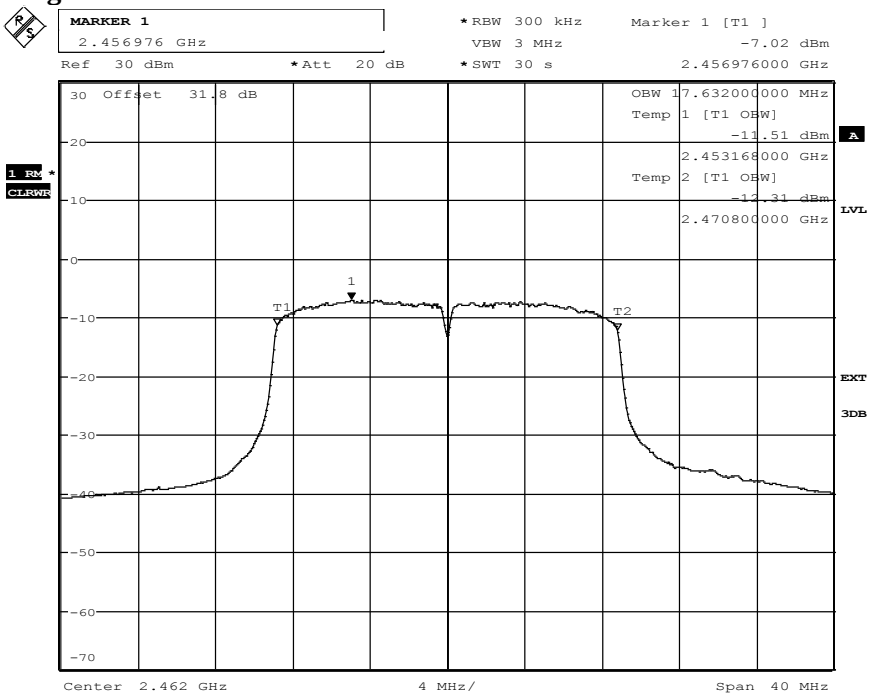
Date: 12.MAR.2015 10:43:51

Diagram 2



Date: 12.MAR.2015 10:33:05

Diagram 3



Date: 12.MAR.2015 10:45:02

Band edge measurements according to 47CFR 2.1049 / RSS-247 5.5/RSS-Gen 8.10

Date	Temperature	Humidity
2015-07-01	24 °C ± 3 °C	46 % ± 5 %
2015-07-02	23 °C ± 3 °C	50 % ± 5 %
2015-07-07	21 °C ± 3 °C	46 % ± 5 %

Test set-up and procedure

The measurements were performed according to ANSI C63.10-2013 and the KDB 558074 D01 DTS Meas Guidance v03r03, June 9, 2014.
Average levels were measured according to cl. 13.3.3 in the KDB and ANSI C63.10 with trace mode in Max hold and video filtering with reduced VBW (2 kHz).

The test was performed with the BOX860 with continuous transmission and with different modulations.
The power settings were according to the table below (dBm):

		FCC "Tx Power dbm" in ProdtestGUI										
Modulation (data rate)	802.11	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9	Ch10	Ch11
BPSK 1Mbit/s	b	18	20	20	20	20	20	20	20	20	20	18
QPSK 2Mbit/s	b	18	18	20	20	20	20	20	20	20	18	18
CCK/QPSK 5.5Mbit/s	b	18	20	20	20	20	20	20	20	20	20	18
CCK/QPSK 11Mbit/s	b	18	18	20	20	20	20	20	20	20	18	18
OFDM/BPSK 6Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/BPSK 9Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/QPSK 12Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/QPSK 18Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/16-QAM 24Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/16-QAM 36Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/64-QAM 48Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
OFDM/64-QAM 54Mbit/s	g	10	12	15	20	20	20	20	20	15	12	10
MCS-0, OFDM/BPSK 7.2Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-1, OFDM/QPSK 14.4Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-2, OFDM/QPSK 21.7Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-3, OFDM/16-QAM 28.9Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-4, OFDM/16-QAM 43.4Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-5, OFDM/64-QAM 57.8Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10
MCS-6, OFDM/64-QAM 65Mbit/s	n	10	12	20	20	20	20	20	20	20	12	10

Regarding the output power, OBW and the spectrum curve the following modulations deemed to be the worst-case configuration during the band edge measurements, QPSK/2 Mbit/s, CCK/QPSK/11 Mbits/s, OFDM/BPSK/9 Mbit/s and MCS-0, OFDM/BPSK/ 7.2 Mbit/s.

Radiated measurements at the restricted bands were performed in a semi anechoic chamber. The measurements were performed with the antenna and the turntable at the position with the highest level of the fundamental. The antenna distance was 3.0 m.
The EUT height above the reference ground plane was 1.5 m.

Conducted measurements with 20 dBc limit were performed with the BOX860 at the antenna connector.

Test set-up photos during the tests can be found in Appendix 11.

Measurement equipment	SP number
Radiated measurements	
Semi anechoic chamber, Edison	504 114
EMI Test Receiver R&S ESU 26	902 210
EMI measurement computer	-
Software: R&S EMC32, ver. 8.52.0	503 745
Horn antenna EMCO 3115	501 548
Multimeter Fluke 83	501 522
Temperature and humidity meter Testo 625	504 117
Conducted measurements	
Test site Galvani	15:117
Signal Analyser R&S FSQ26	BX50694
120 V AC/60 Hz AC Power source HP 6813B	503 091
DC power supply HP E3632A	503 170
Multimeter Fluke 85 III	503 418
Temperature and humidity meter Testo 625	503 498

Results

Operation band 2400-2483.5 MHz

The pre-measurement diagrams with peak detector can be found in the diagrams below:

Diagram 1	2412 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 2	2412 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 3	2417 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 4	2417 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 5	2422 MHz/ 20 dBm	QPSK, 2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 6	2422 MHz/ 20 dBm	QPSK, 2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 7	2452 MHz/ 20 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 8	2452 MHz/ 20 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 9	2457 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 10	2457 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 11	2462 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 12	2462 MHz/ 18 dBm	QPSK, 2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 13	2412 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2390 MHz (restricted band)
Diagram 14	2412 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2400 MHz (20 dBc)
Diagram 15	2417 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2390 MHz (restricted band)
Diagram 16	2417 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2400 MHz (20 dBc)
Diagram 17	2422 MHz/ 20 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2390 MHz (restricted band)
Diagram 18	2422 MHz/ 20 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2400 MHz (20 dBc)
Diagram 19	2457 MHz/ 20 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 20	2457 MHz/ 20 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 21	2462 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 22	2462 MHz/ 18 dBm	CCK/QPSK, 11 Mbits/s	Band edge at 2483.5 MHz (IC, 20 dBc)

Diagram 23	2412 MHz/ 10 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 24	2412 MHz/ 10 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 25	2417 MHz/ 12 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 26	2417 MHz/ 12 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 27	2422 MHz/ 15 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 28	2422 MHz/ 15 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 29	2427 MHz/ 20 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 30	2427 MHz/ 20 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 31	2447 MHz/ 20 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 32	2447 MHz/ 20 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 33	2452 MHz/ 15 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 34	2452 MHz/ 15 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 35	2457 MHz/ 12 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 36	2457 MHz/ 12 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 37	2462 MHz/ 10 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 38	2462 MHz/ 10 dBm	OFDM/BPSK, 9 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 39	2412 MHz/ 10 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 40	2412 MHz/ 10 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 41	2417 MHz/ 12 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 42	2417 MHz/ 12 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 43	2422 MHz/ 20 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2390 MHz (restricted band)
Diagram 44	2422 MHz/ 20 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2400 MHz (20 dBc)
Diagram 45	2452 MHz/ 20 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 46	2452 MHz/ 20 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 47	2457 MHz/ 212 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)

Diagram 48	2457 MHz/ 12 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)
Diagram 49	2462 MHz/ 10 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (FCC, restricted band)
Diagram 50	2462 MHz/ 10 dBm	MCS-0, OFDM/ BPSK, 7.2 Mbit/s	Band edge at 2483.5 MHz (IC, 20 dBc)

Final measurements:
Average levels were measured according to cl. 13.3.3 in the KDB and ANSI C63.10 with trace mode in Max hold and video filtering with reduced VBW (2 kHz).

2412 MHz, 18 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	53.4	60.2	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	42.1	Cond meas

2417 MHz, 18 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	49.4	62.5	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	40.8	Cond meas

2422 MHz, 20 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	49.4	62.4	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	45.2	Cond meas

2452 MHz, 20 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	46.9	60.3	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	45.9	Cond meas

2457 MHz, 18 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	47.7	60.8	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	46.9	Cond meas

2462 MHz, 18 dBm, QPSK, 2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	49.4	59.3	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	46.7	Cond meas

2412 MHz, 18 dBm, CCK/QPSK, 11 Mbits/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	52.3	61.3	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	39.7	Cond meas

2417 MHz, 18 dBm, CCK/QPSK, 11 Mbits/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	48.6	62.8	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	42.7	Cond meas

2422 MHz, 20 dBm, CCK/QPSK, 11 Mbits/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	49.1	62.5	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	47.6	Cond meas

2457 MHz, 20 dBm, CCK/QPSK, 11 Mbits/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	52.2	61.9	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	47,6	Cond meas

2462 MHz, 18 dBm, CCK/QPSK, 11 Mbits/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	49.8	59.8	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	46.6	Cond meas

2412 MHz, 10 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	47.2	61.1	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	31.7	Cond meas

2417 MHz, 12 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	47.3	61.2	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	35.6	Cond meas

2422 MHz, 15 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	51.7	66.6	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	39.2	Cond meas

2427 MHz, 20 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	51.3	64.0	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	40.6	Cond meas

2447 MHz, 20 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	49.7	63.1	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	41.4	Cond meas

2452 MHz, 15 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	49.8	66.8	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	40.3	Cond meas

2457 MHz, 12 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	48.7	61.6	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	38.3	Cond meas

2462 MHz, 10 dBm, OFDM/BPSK, 9 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	51.3	66.6	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	35.2	Cond meas

2412 MHz, 10 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	50.2	66.0	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	30.8	Cond meas

2417 MHz, 12 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	48.0	63.0	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	35.4	Cond meas

2422 MHz, 20 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2390.00 *)	51.4	65.4	54.0	74.0	N/A	Vertical
2400.00 **)	N/A	N/A	N/A	N/A	38.2	Cond meas

2452 MHz, 20 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	50.8	65.0	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	39.1	Cond meas

2457 MHz, 12 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	48.7	62.4	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	38.0	Cond meas

2462 MHz, 10 dBm, MCS-0, OFDM/BPSK, 7.2 Mbit/s:

Frequency (MHz)	CAV level (dBµV/m)	Peak level (dBµV/m)	AV Limit (dBµV/m)	Peak Limit (dBµV/m)	dBc, peak det (limit=20dBc)	Polarization
2483.5 *)	53.2	68.8	54.0	74.0	N/A	Vertical
2483.5 **)	N/A	N/A	N/A	N/A	35.4	Cond meas

*) Restricted band
**) 20 dBc

Limits

Band edge at 2390 MHz:
According to 47CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section15.209(a).

According to RSS-Gen 8.10, Restricted bands, identified in Table 6, are designated primarily for safety-of-life services (distress calling and certain aeronautical bands), certain satellite downlinks, radio astronomy and some government uses. Except where otherwise indicated, the following restrictions apply:
(a) Fundamental components of modulation of licence-exempt radio apparatus shall not fall within the restricted bands of Table 6 except for apparatus complying under RSS-287;
(b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and
(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 6 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

Band edge at 2400 MHz:
According to 47CFR 15.247(d), in any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB.

According to RSS-247 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the
100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

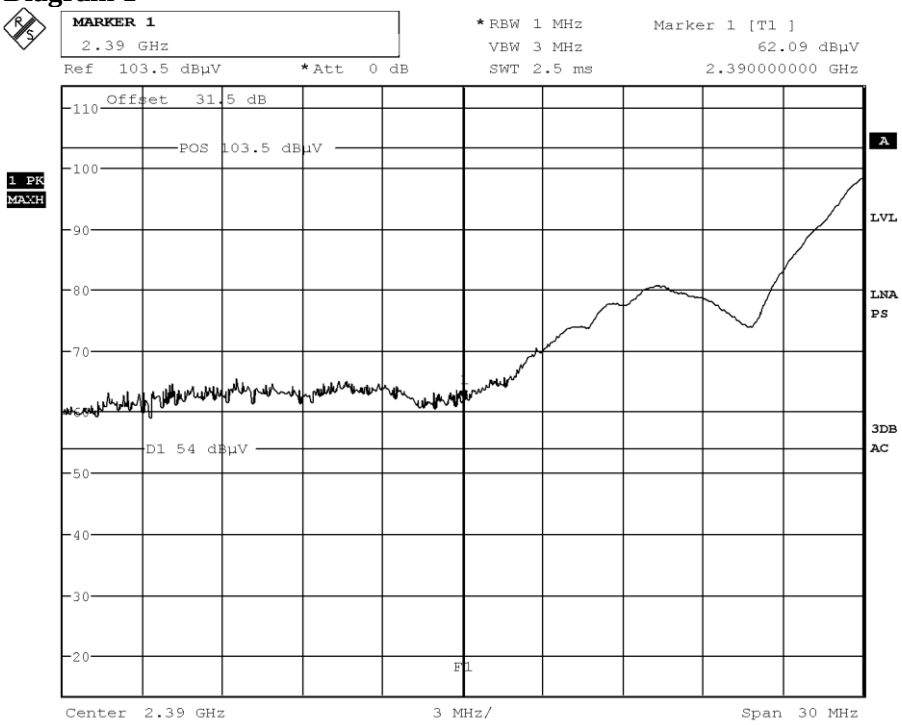
Band edge at 2483.5 MHz:
According to 47CFR 15.247(d), In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section15.209(a).

According to RSS-247 5.5, In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced shall be at least 20 dB below that in the
100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(4), the attenuation required shall be 30 dB instead of

20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

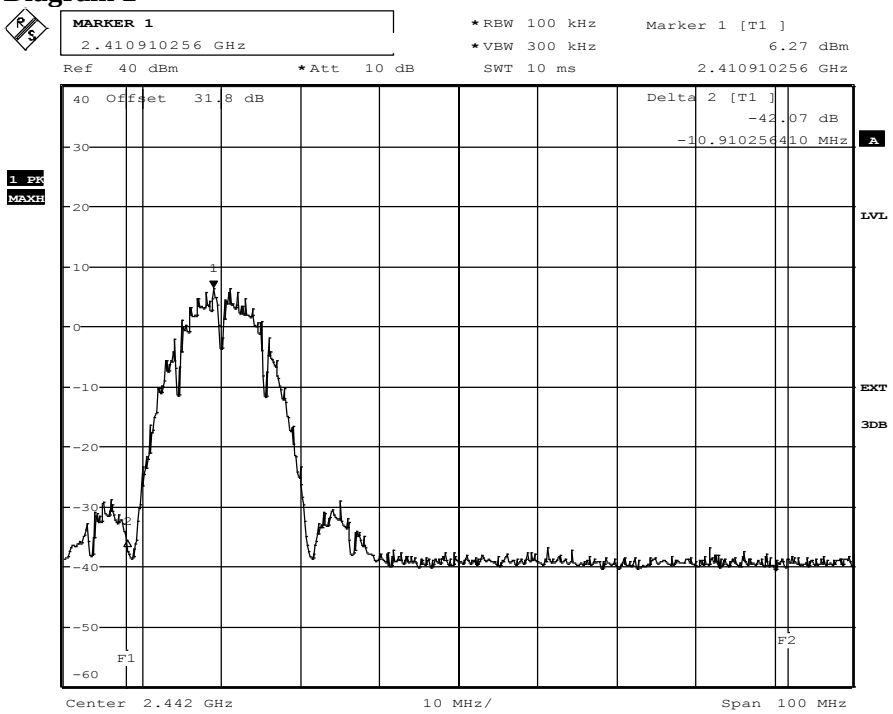
Complies?	Yes

Diagram 1



Date: 1.JUL.2015 12:59:07

Diagram 2



Date: 7.JUL.2015 06:56:55

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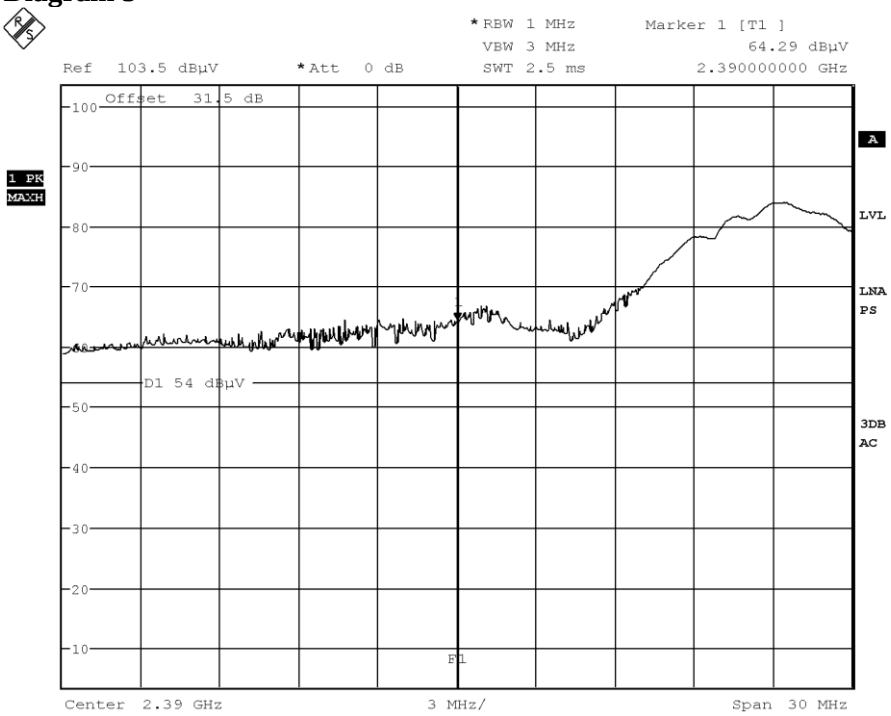
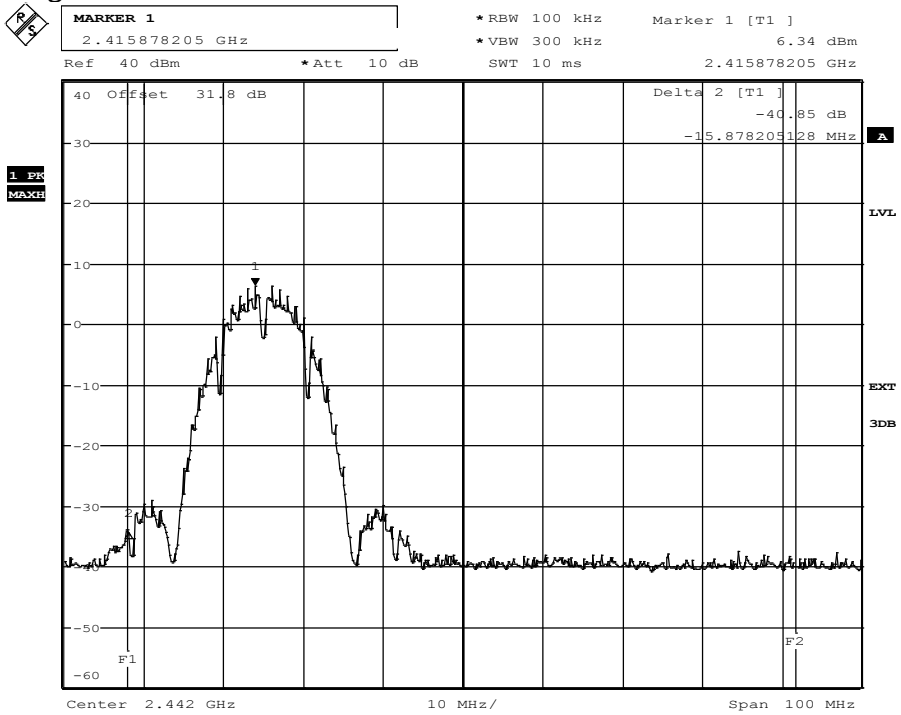


Date: 2.JUL.2015 09:02:49

Diagram 4



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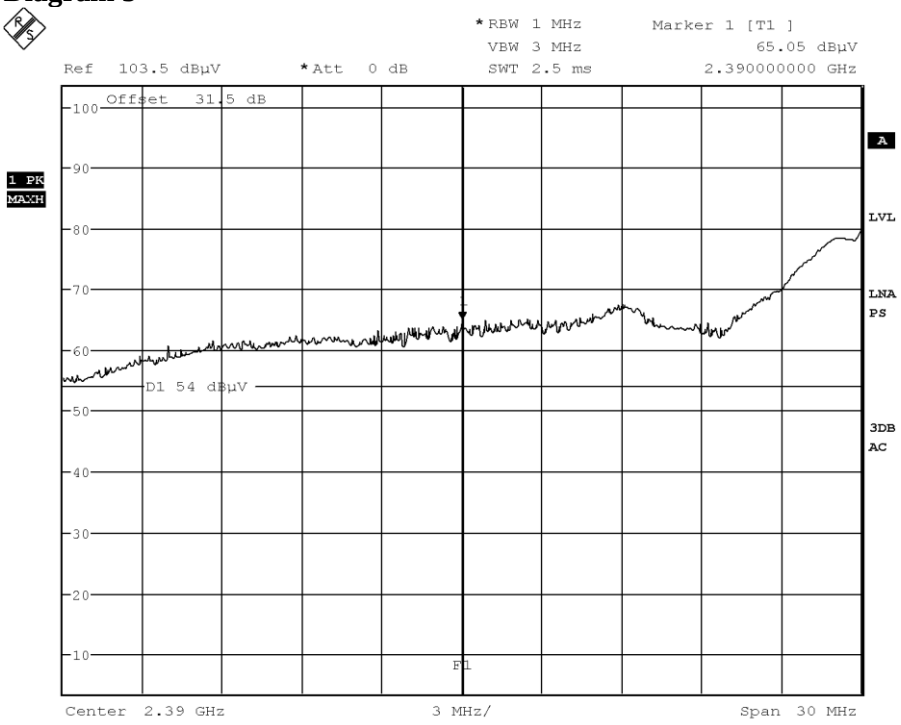

Date: 2.JUL.2015 11:44:34

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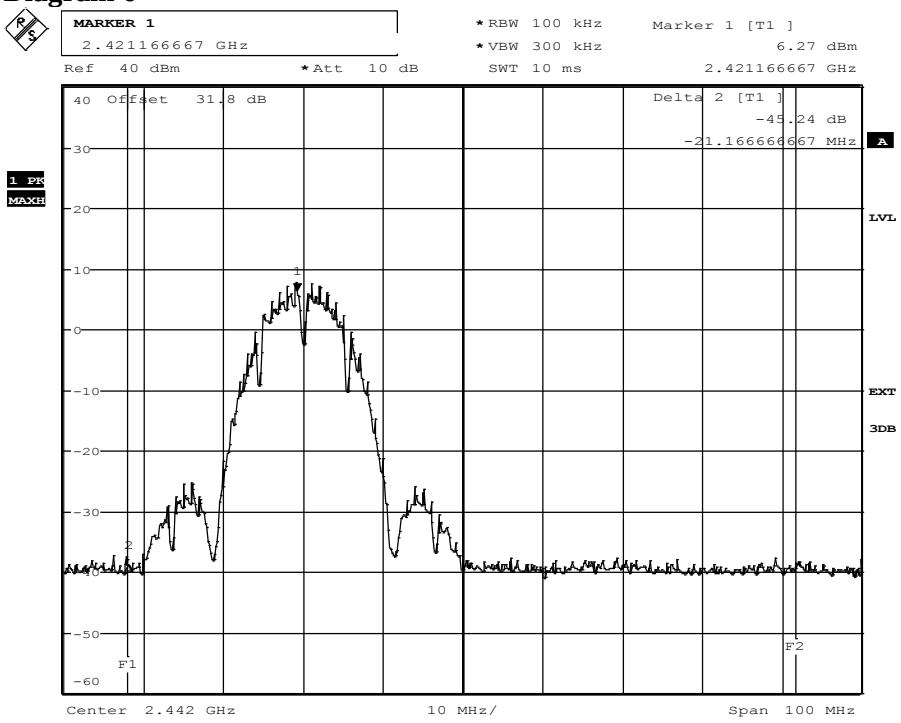

Date: 7.JUL.2015 07:00:15

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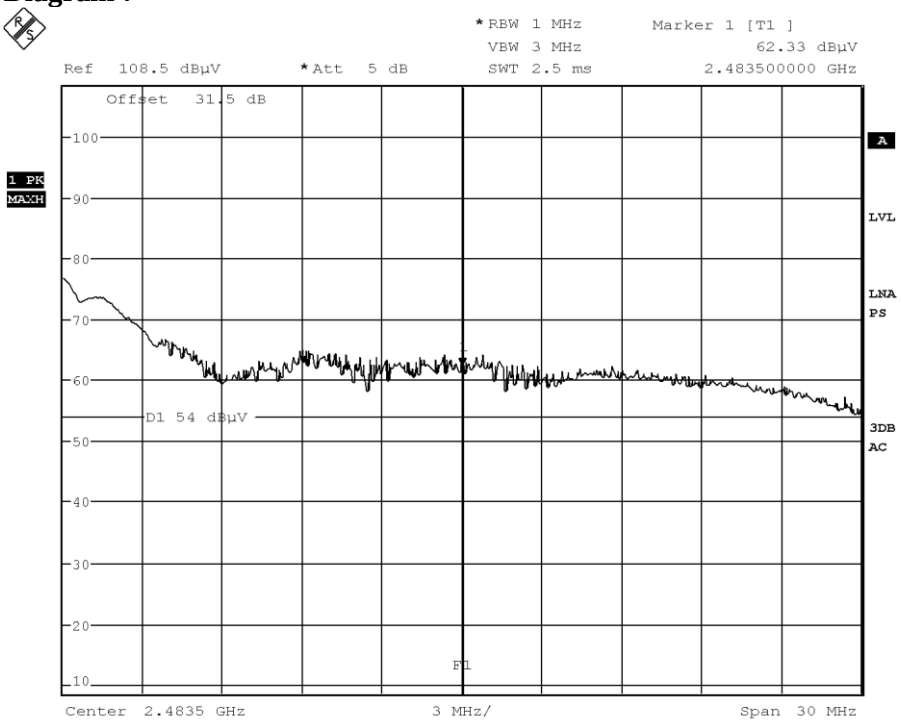

Date: 2.JUL.2015 14:39:47

Diagram 8

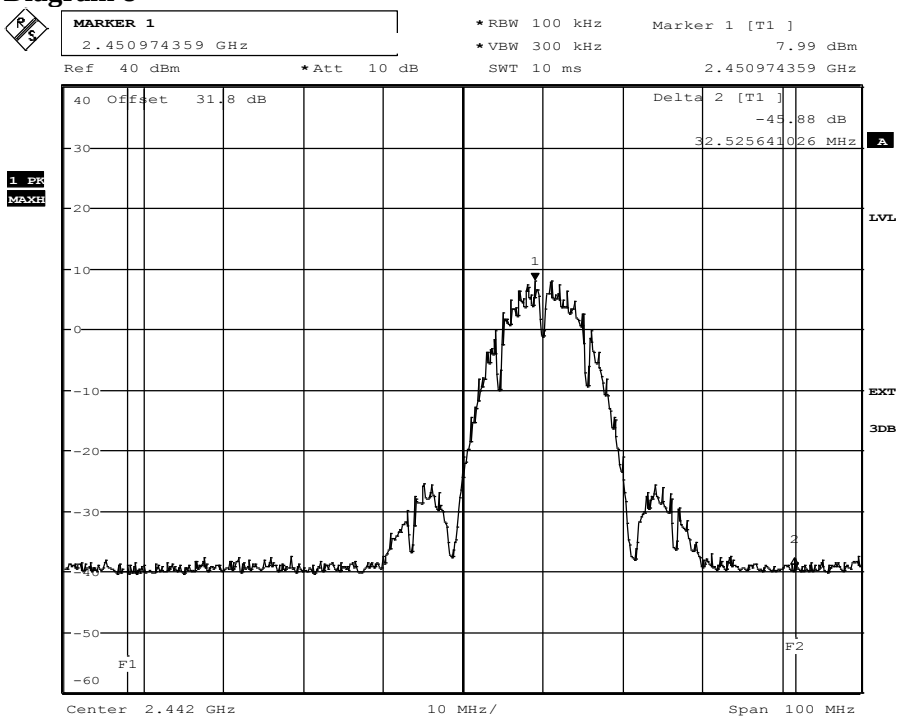

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Diagram 9

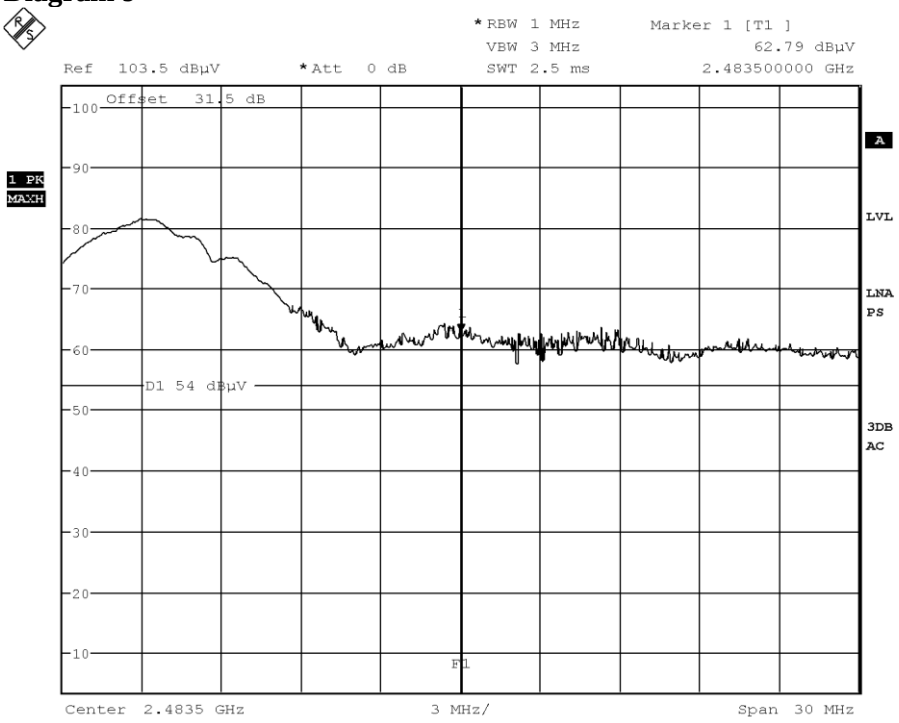

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Diagram 10

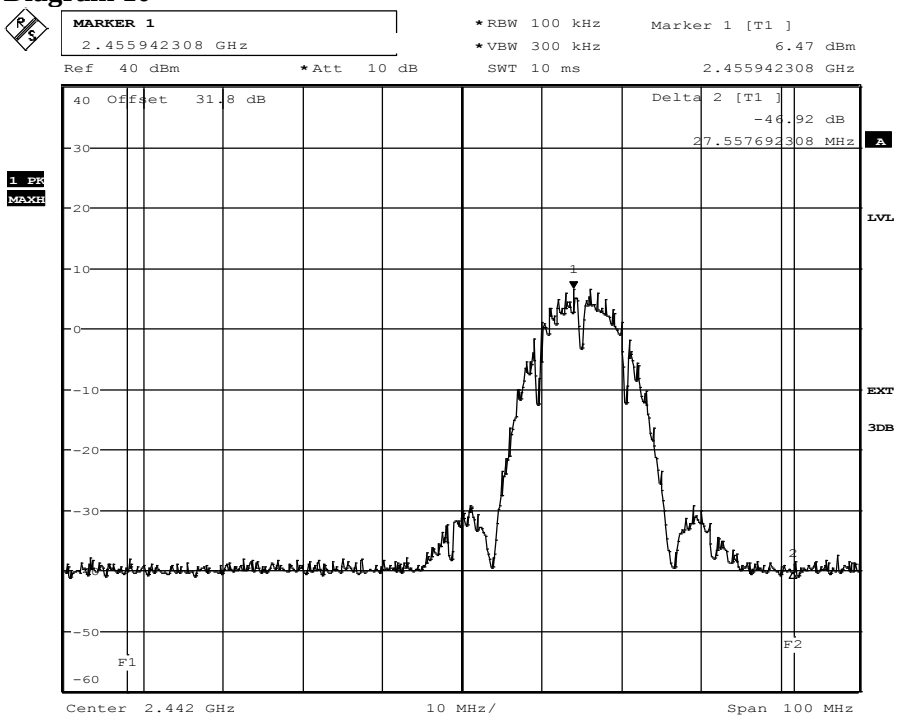

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Diagram 11

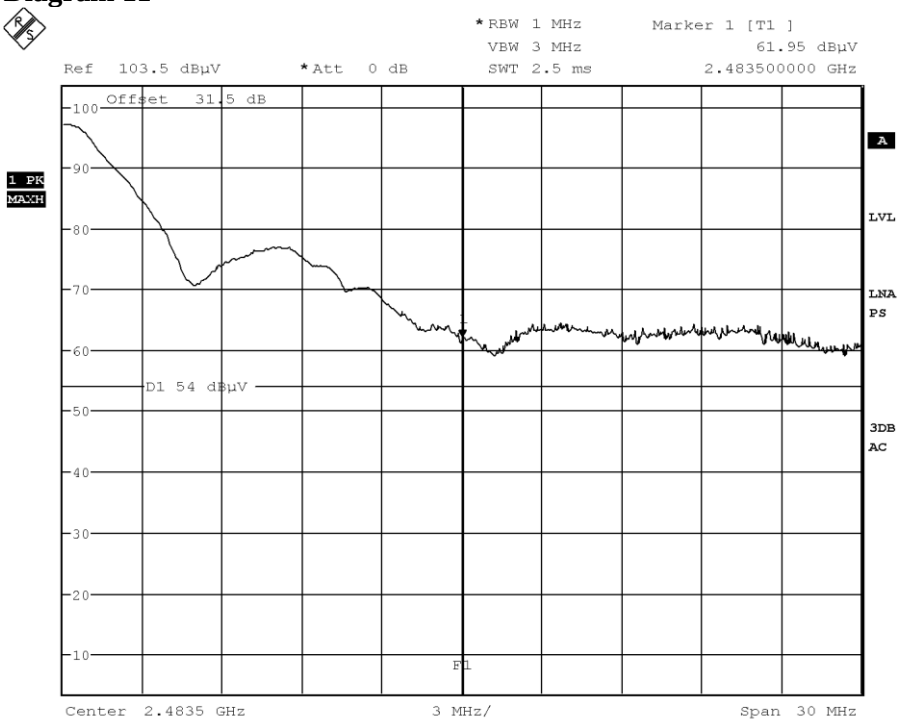

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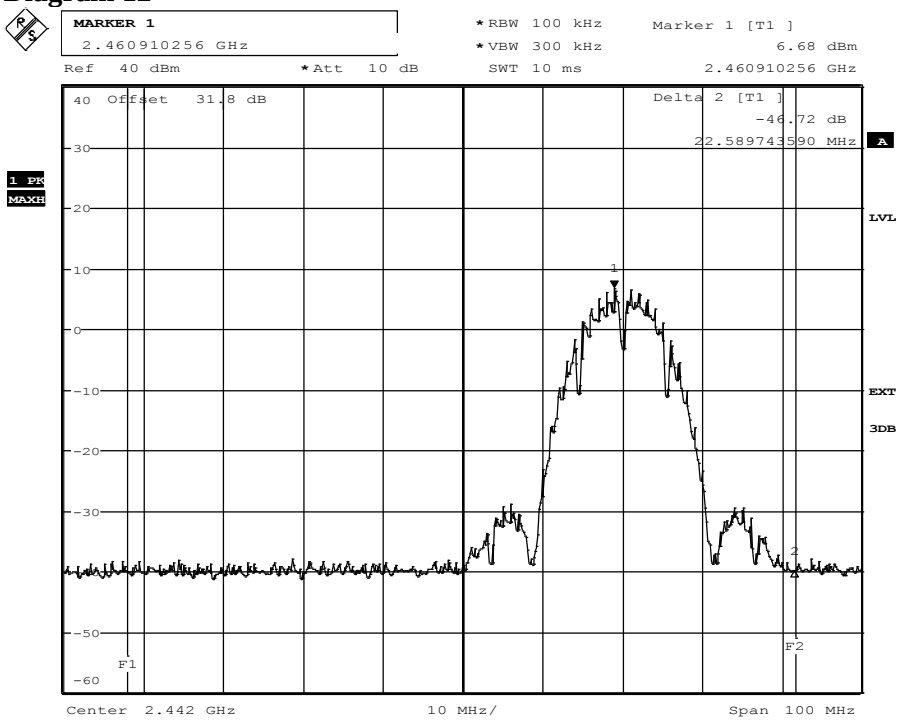
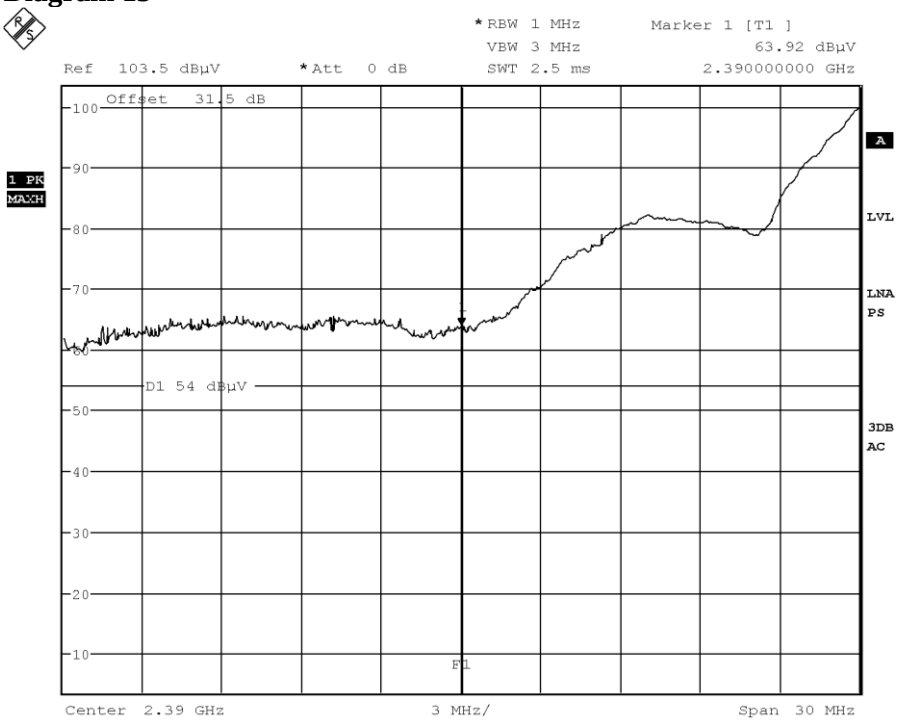
Diagram 12



Date: 7.JUL.2015 07:06:56

Diagram 13



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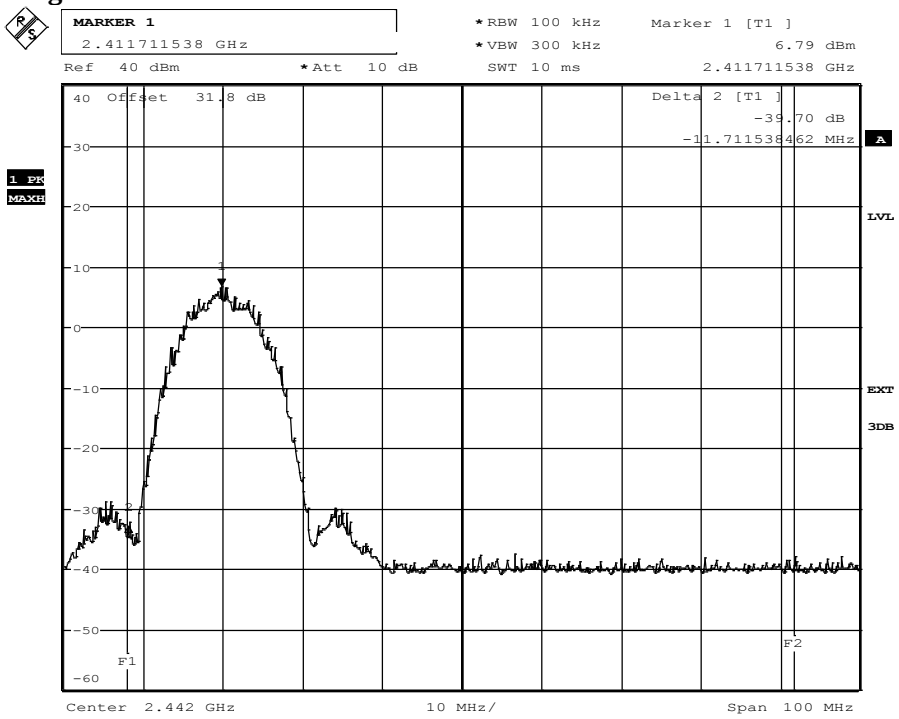

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Diagram 15

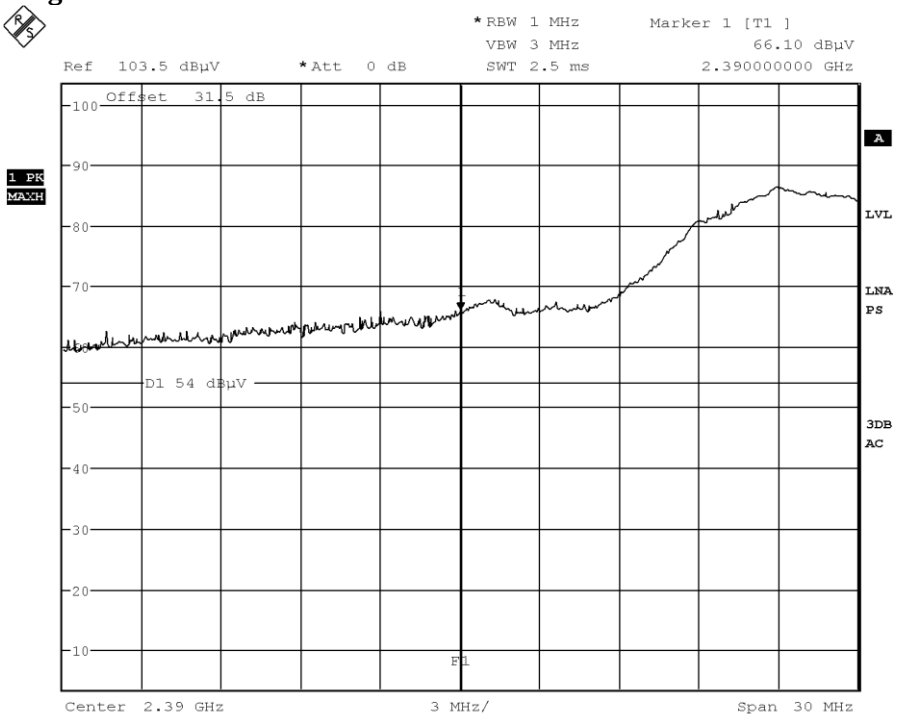

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Diagram 16

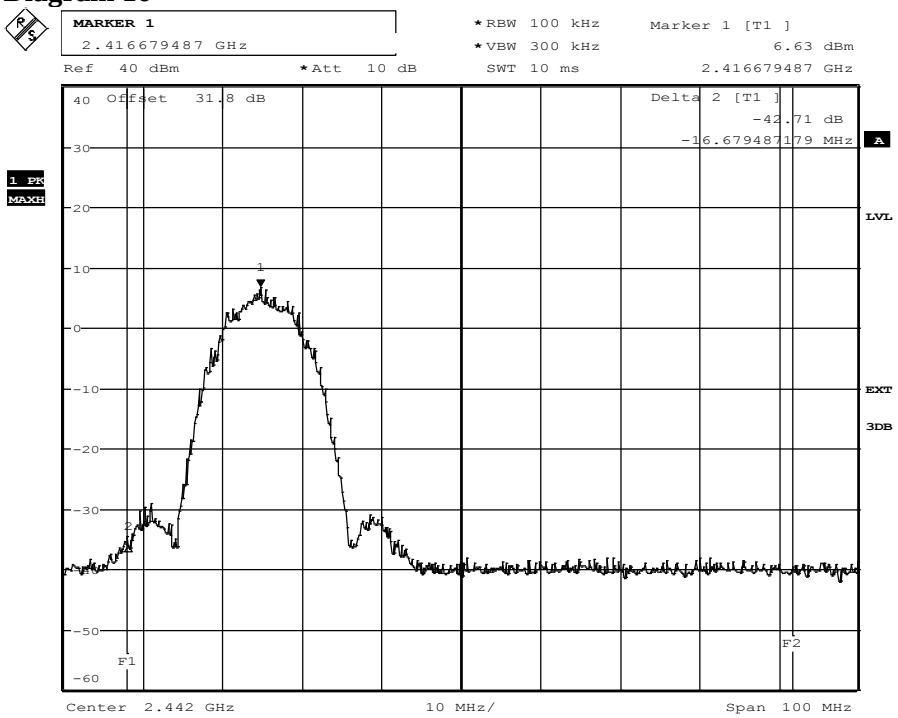

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Diagram 17

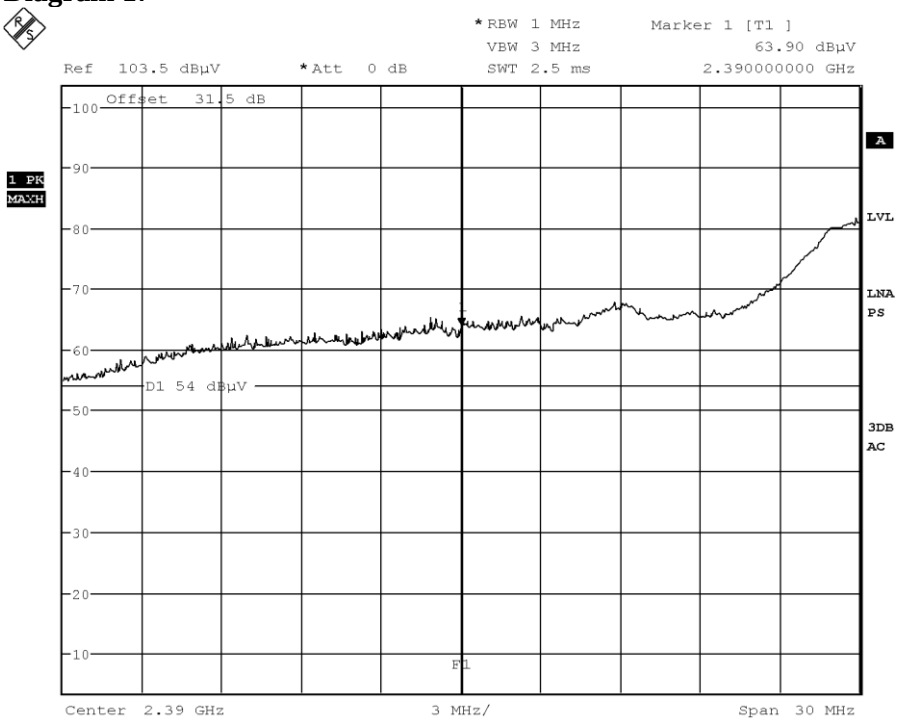

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Diagram 18

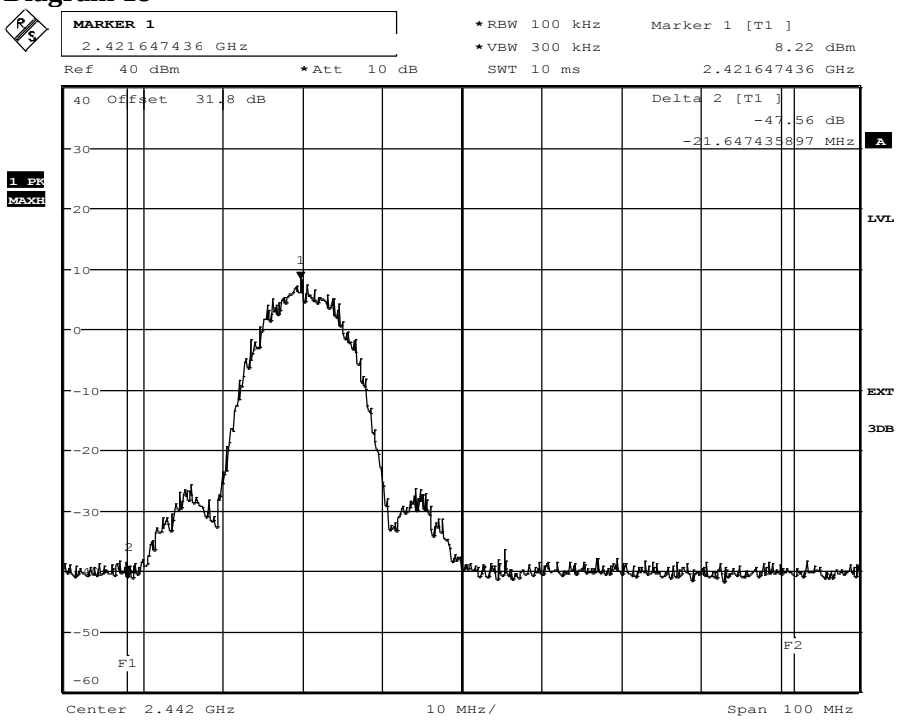

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Diagram 19

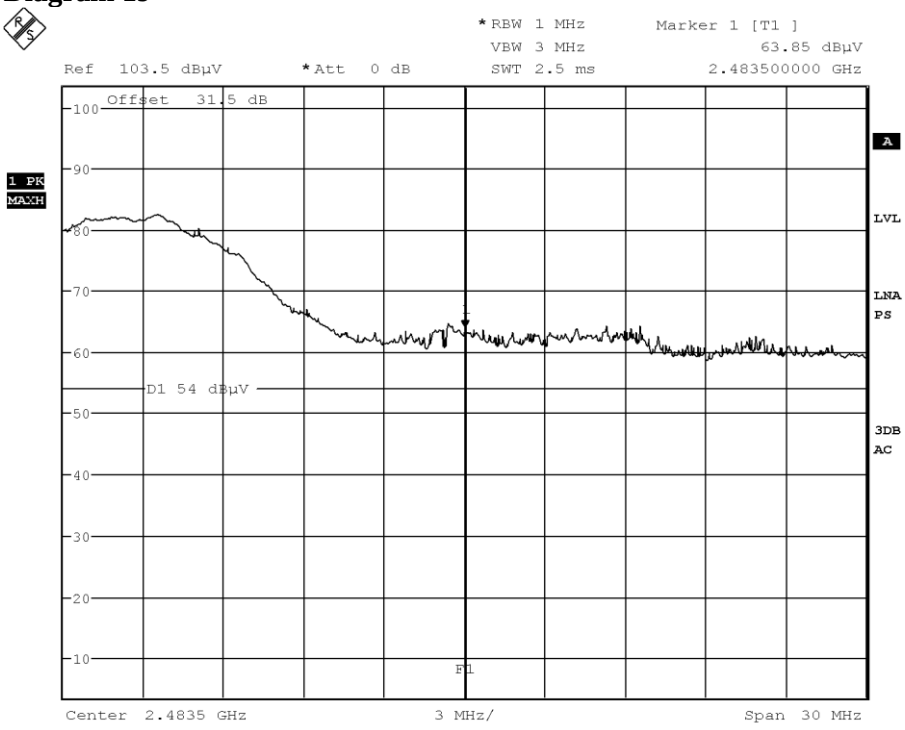

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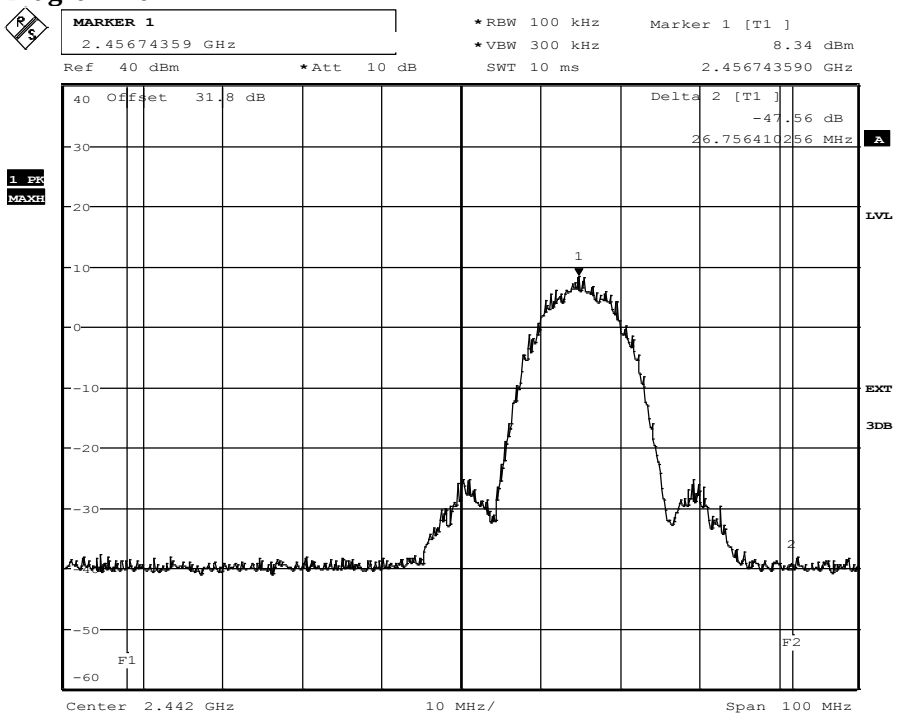
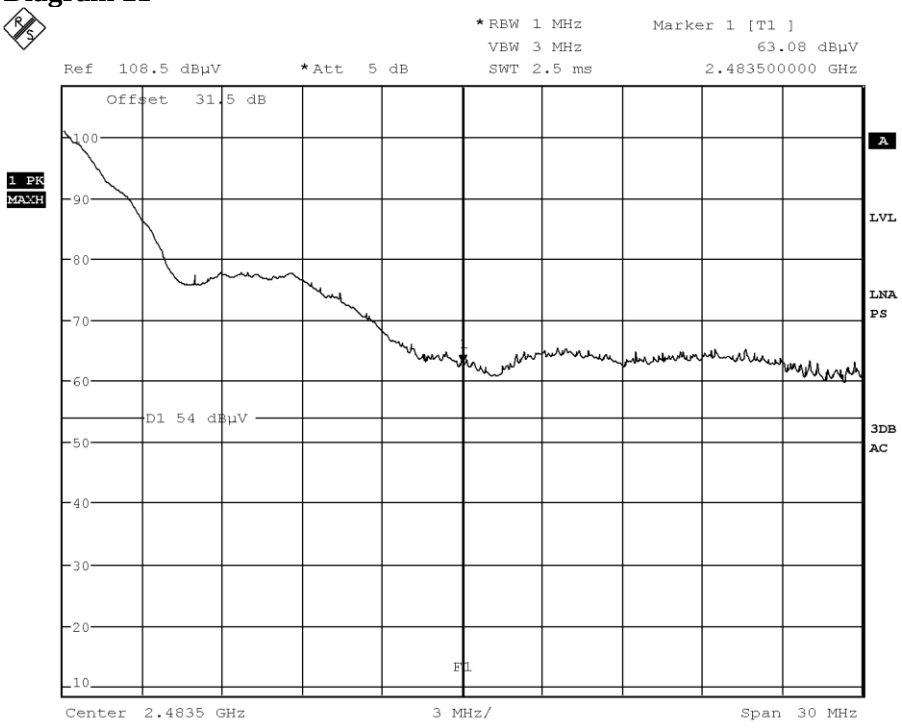
Diagram 20



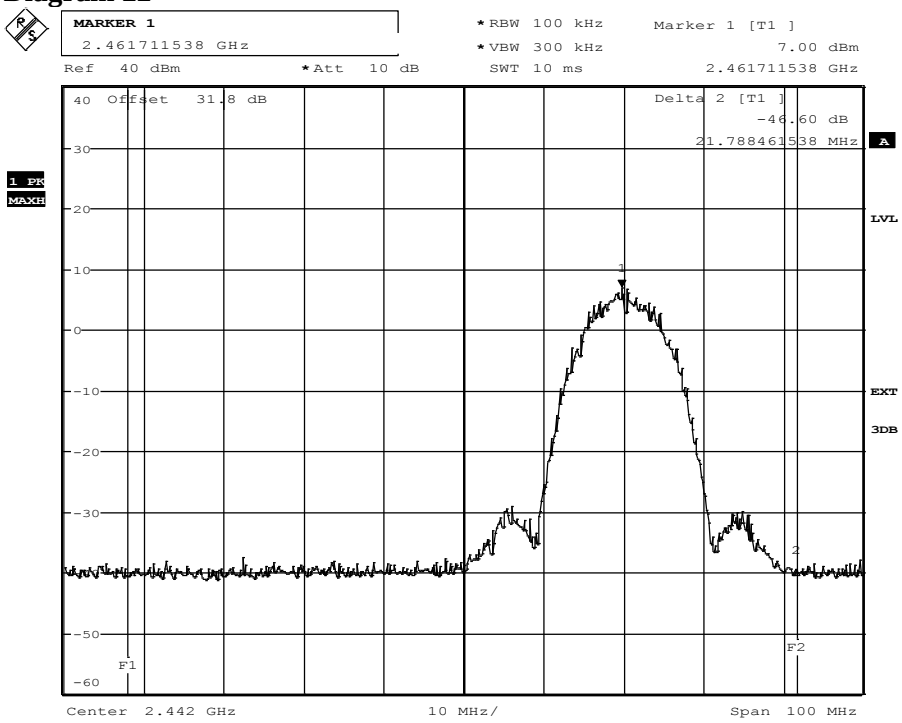
Date: 7.JUL.2015 07:12:56

Diagram 21



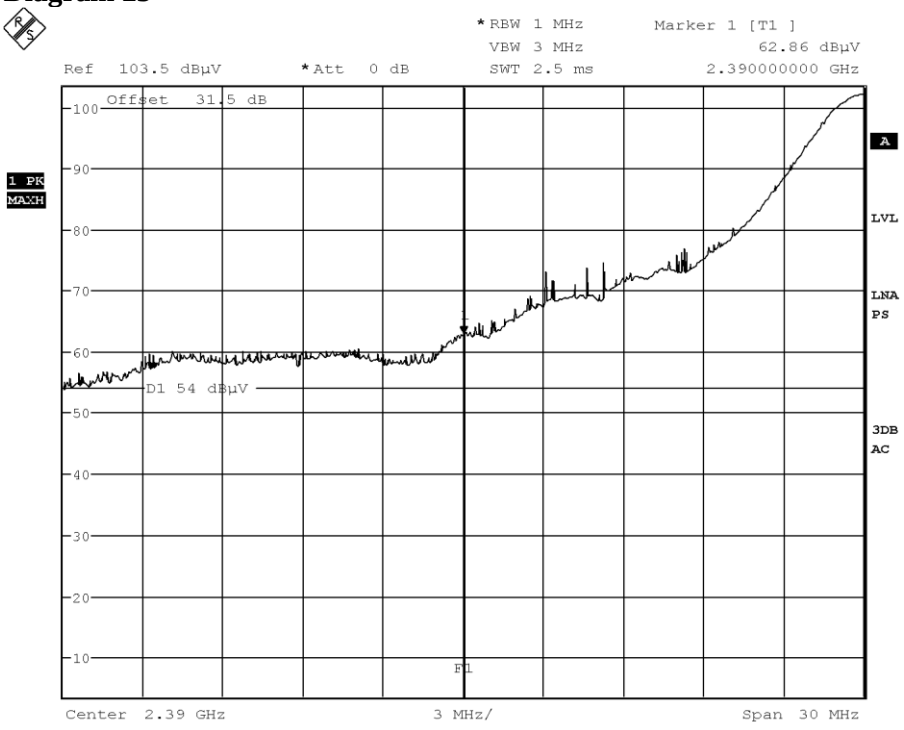
Date: 2.JUL.2015 13:35:41

Diagram 22



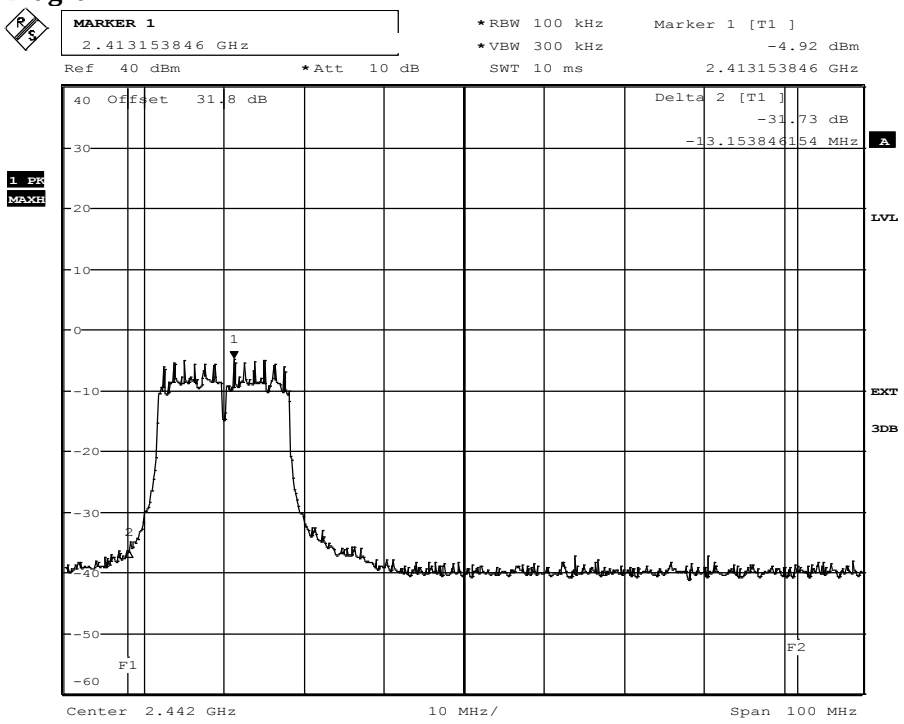
Date: 7.JUL.2015 07:14:23

Diagram 23



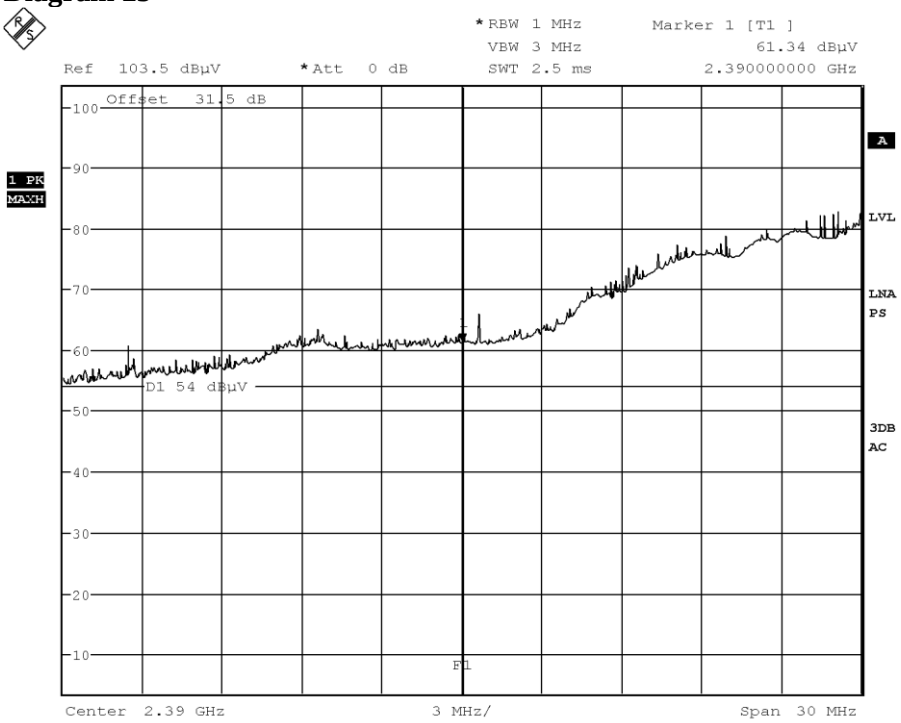
Date: 2.JUL.2015 08:40:29

Diagram 24



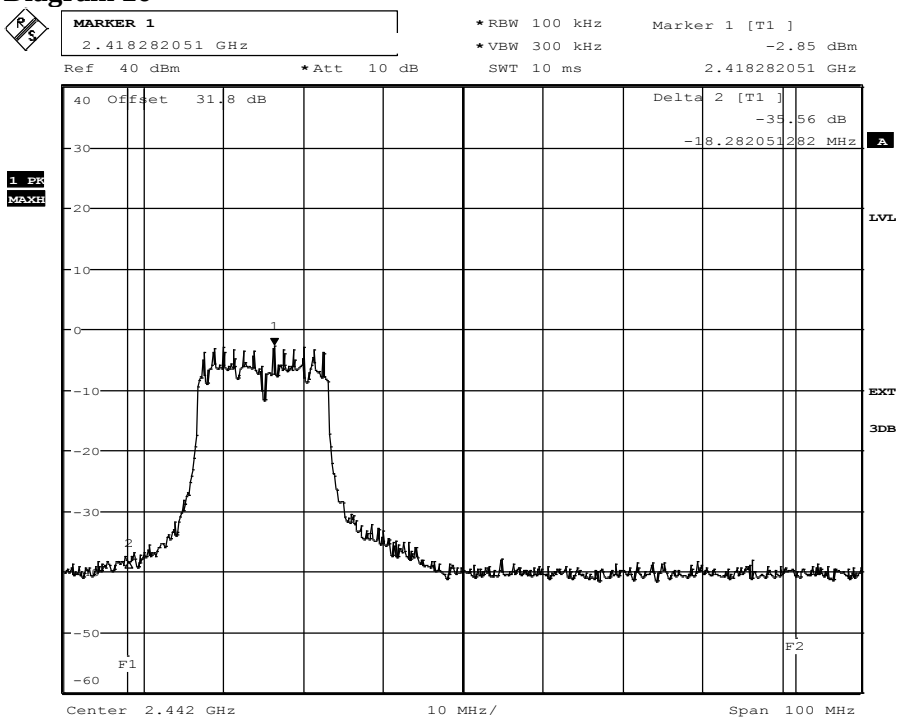
Date: 7.JUL.2015 07:16:41

Diagram 25



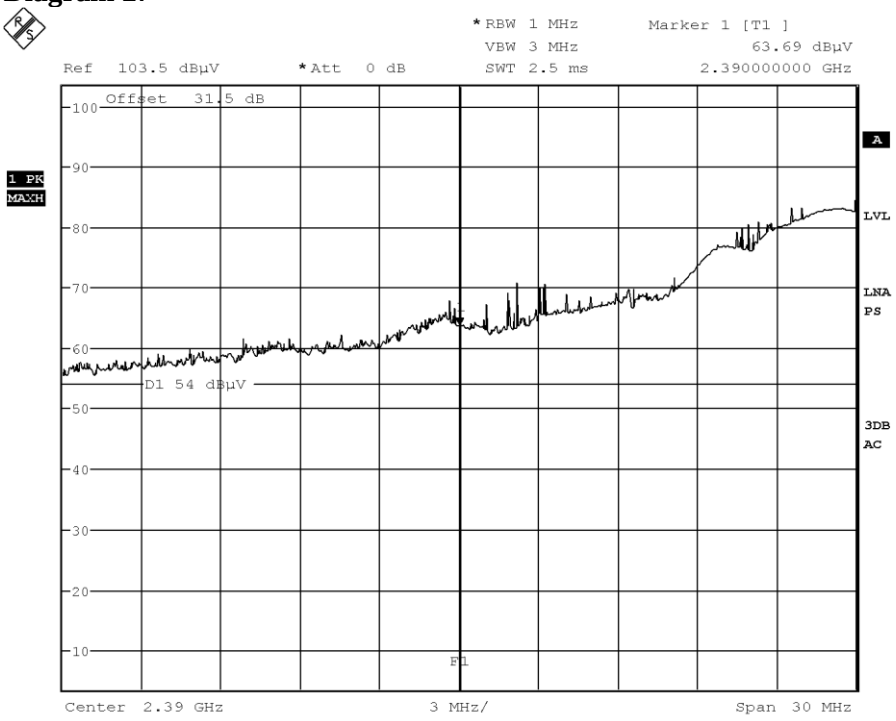
Date: 2.JUL.2015 11:05:39

Diagram 26



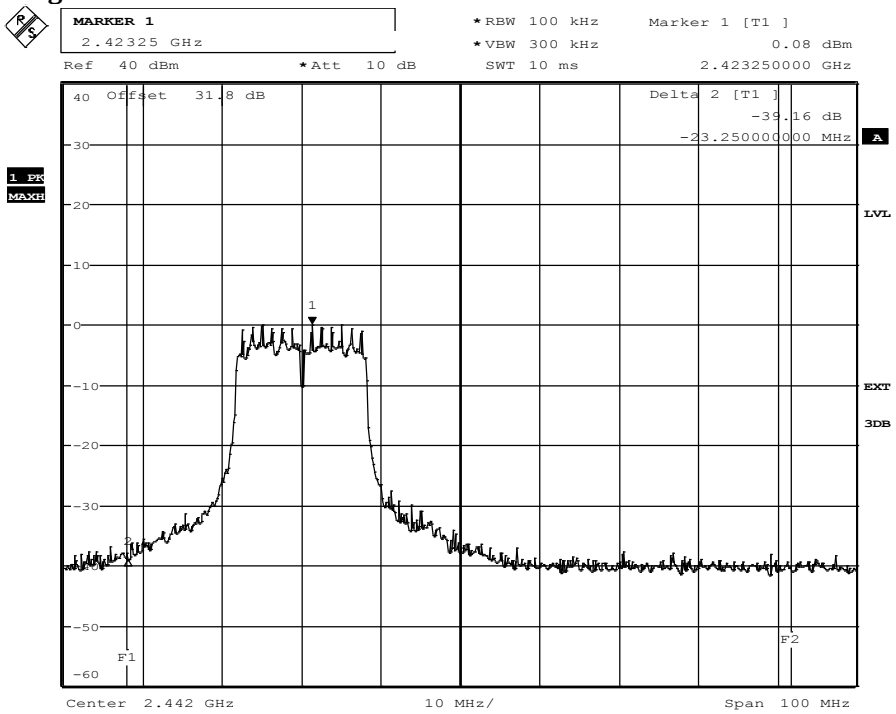
Date: 7.JUL.2015 07:17:44

Diagram 27



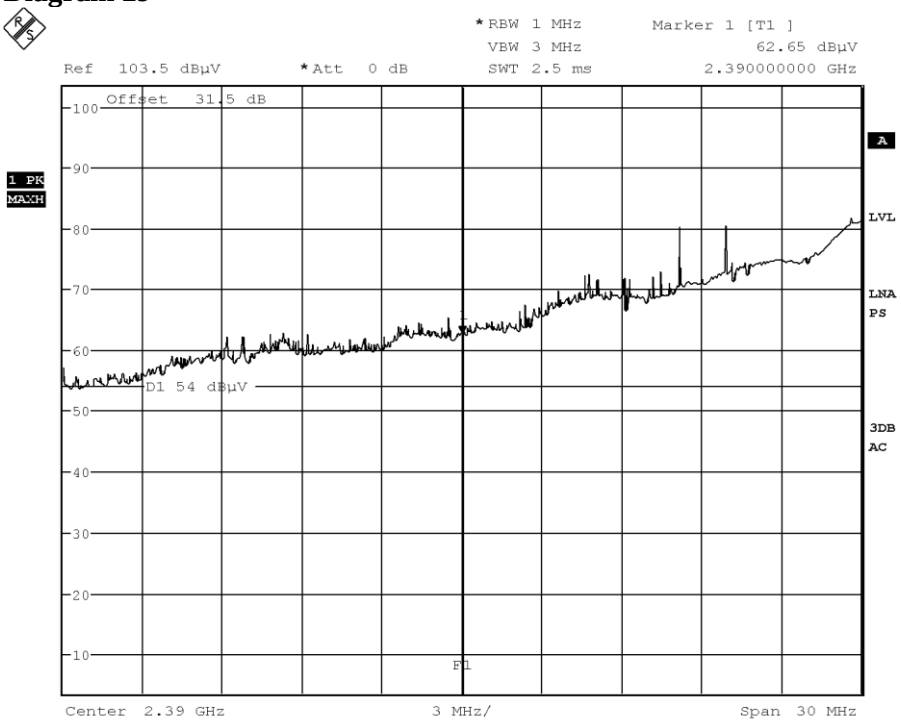
Date: 2.JUL.2015 12:37:29

Diagram 28



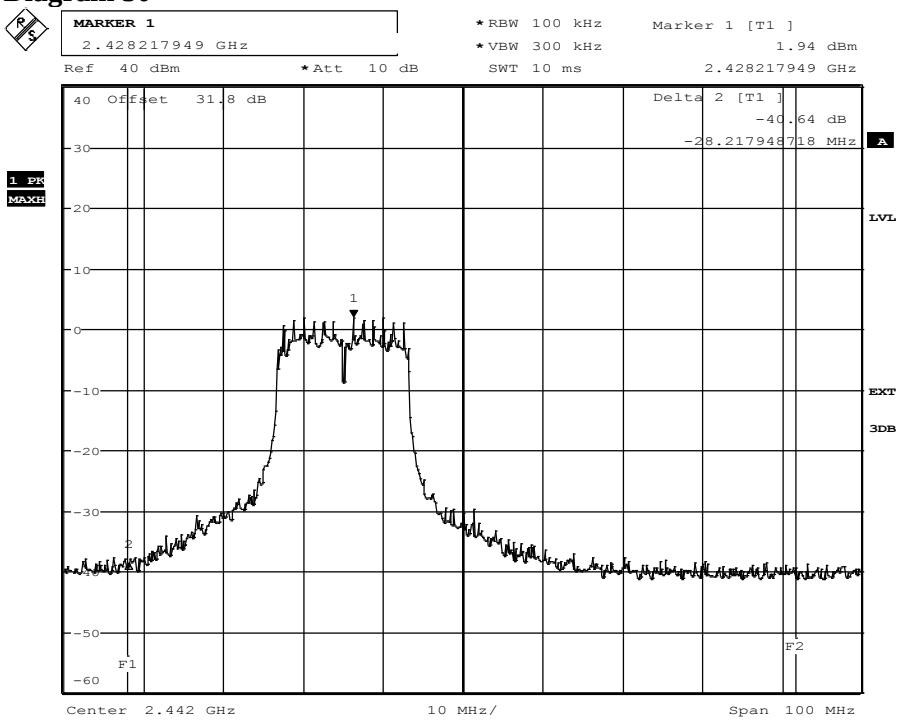
Date: 7.JUL.2015 07:19:16

Diagram 29



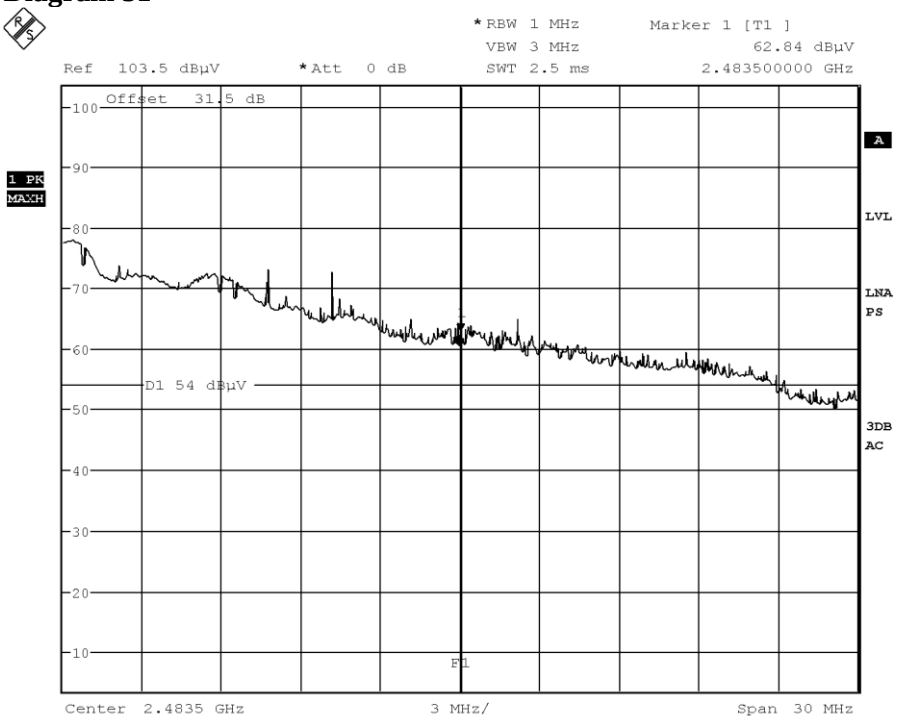
Date: 2.JUL.2015 12:56:16

Diagram 30



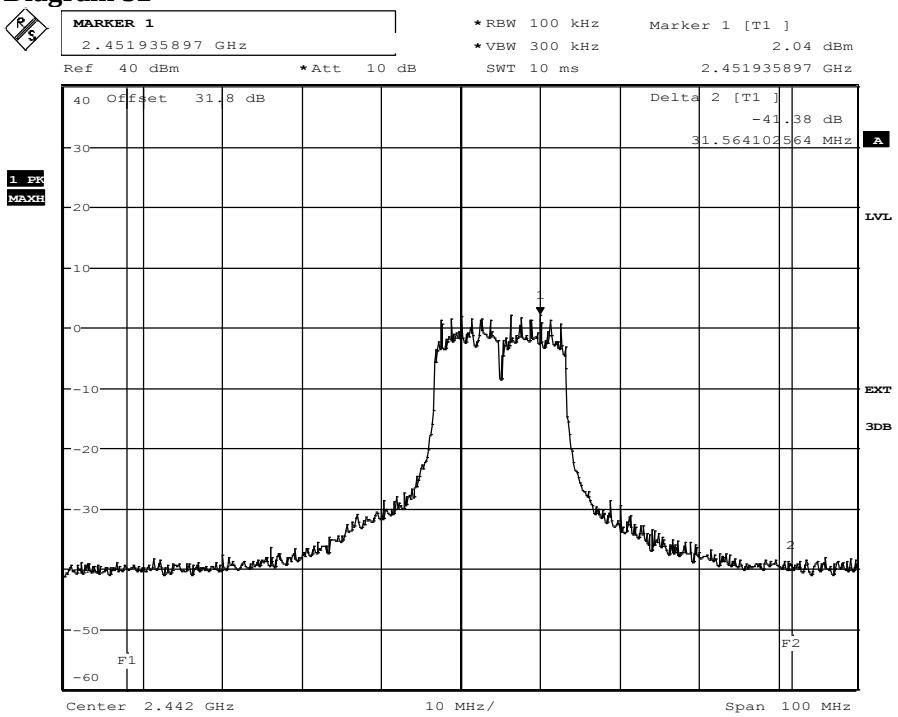
Date: 7.JUL.2015 07:20:24

Diagram 31



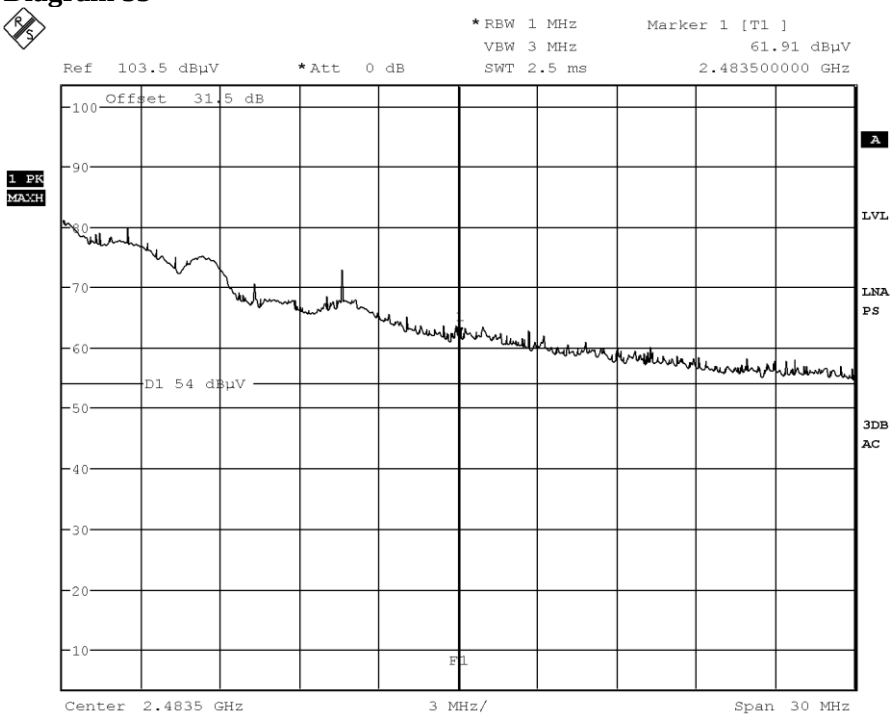
Date: 2.JUL.2015 15:01:37

Diagram 32



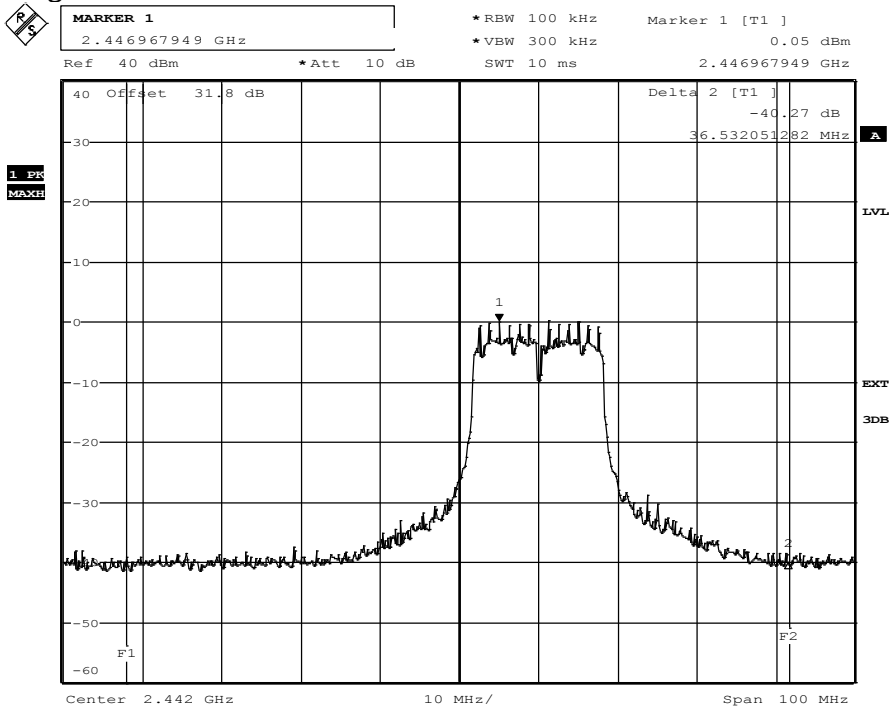
Date: 7.JUL.2015 07:21:43

Diagram 33



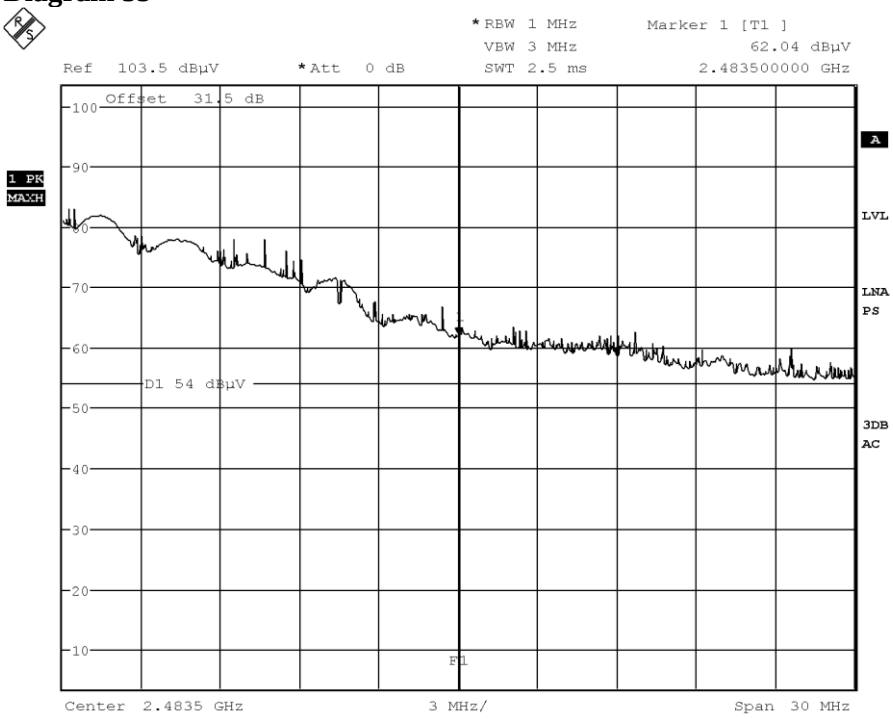
Date: 2.JUL.2015 14:46:03

Diagram 34



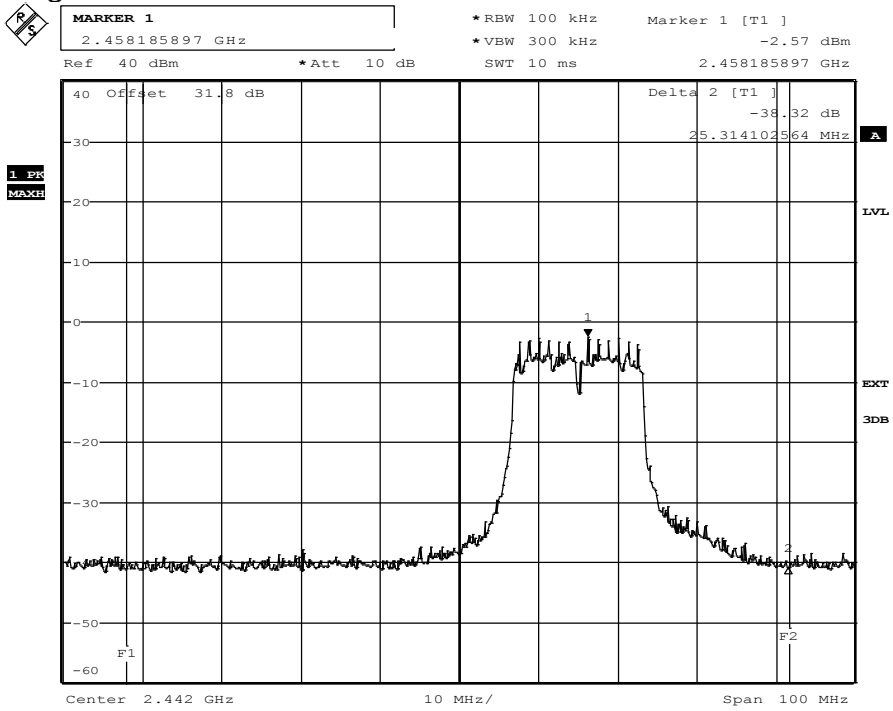
Date: 7.JUL.2015 07:23:03

Diagram 35



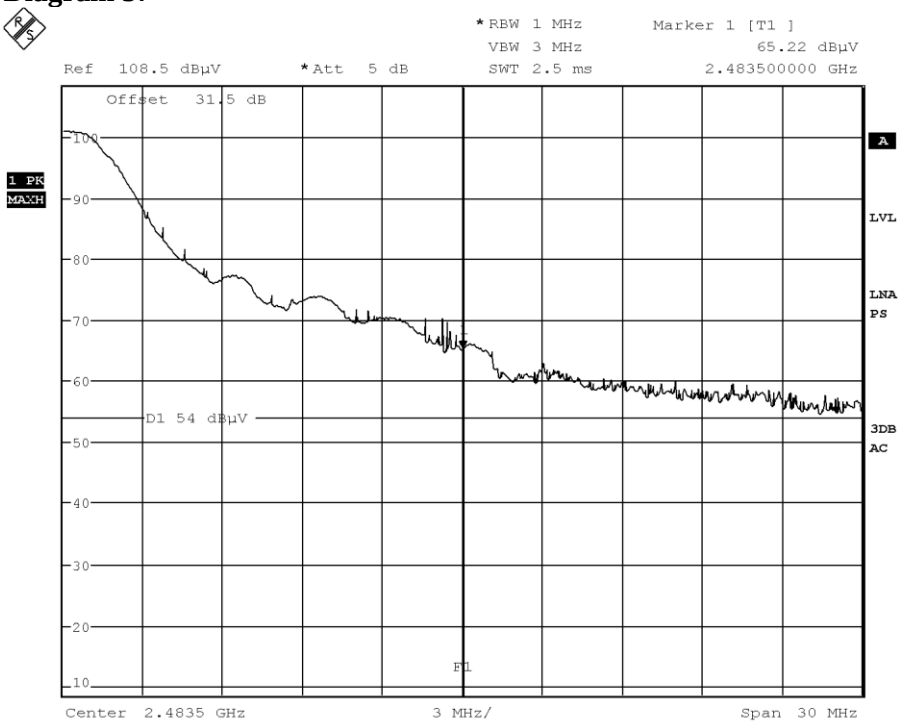
Date: 2.JUL.2015 14:19:08

Diagram 36



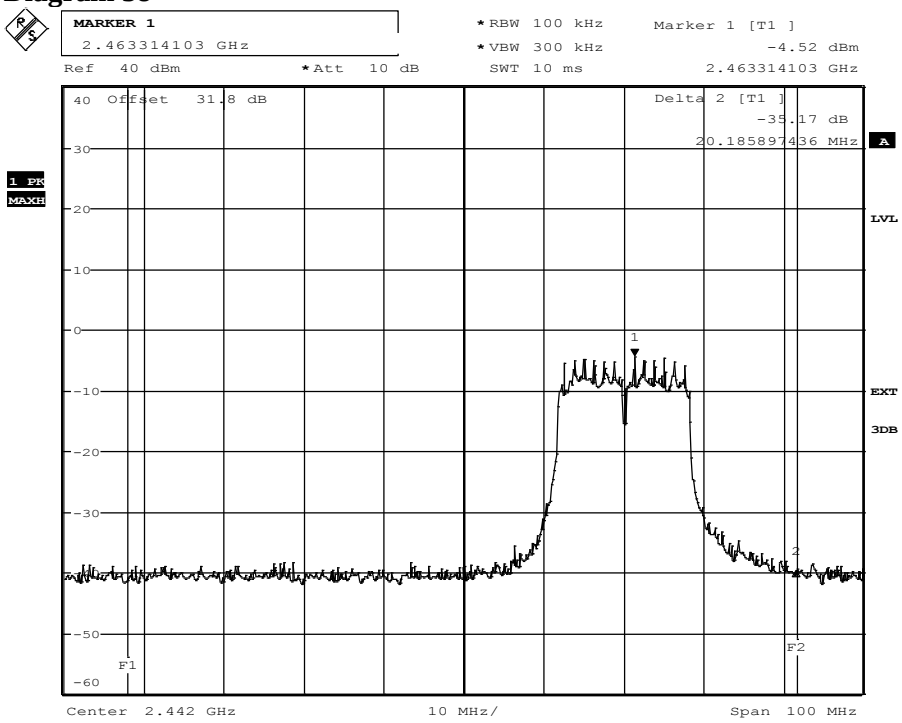
Date: 7.JUL.2015 07:24:23

Diagram 37



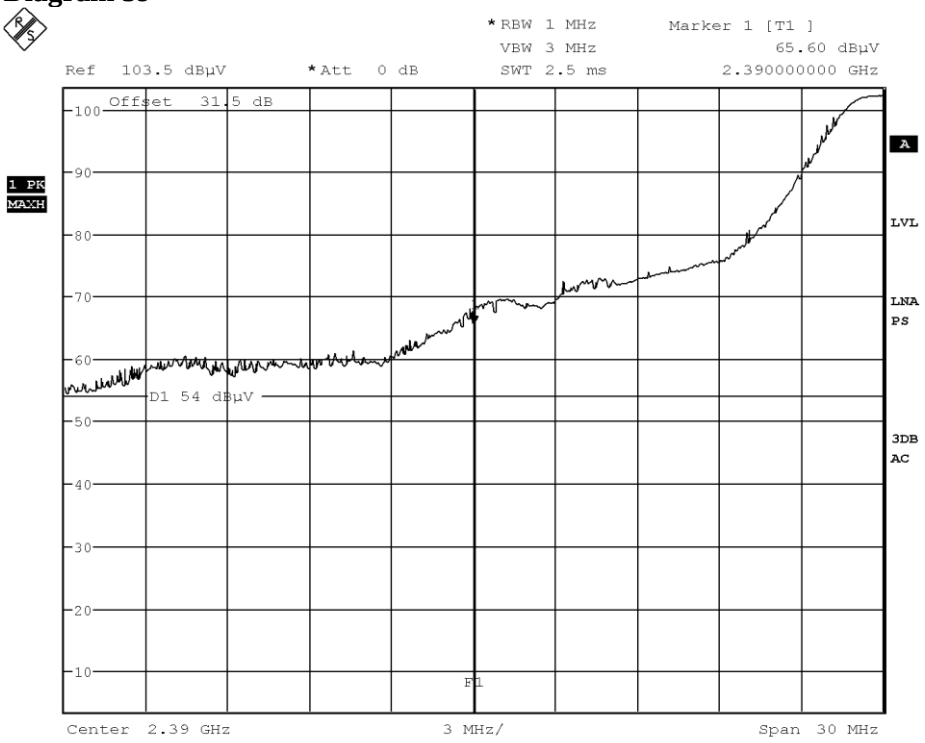
Date: 2.JUL.2015 13:42:23

Diagram 38



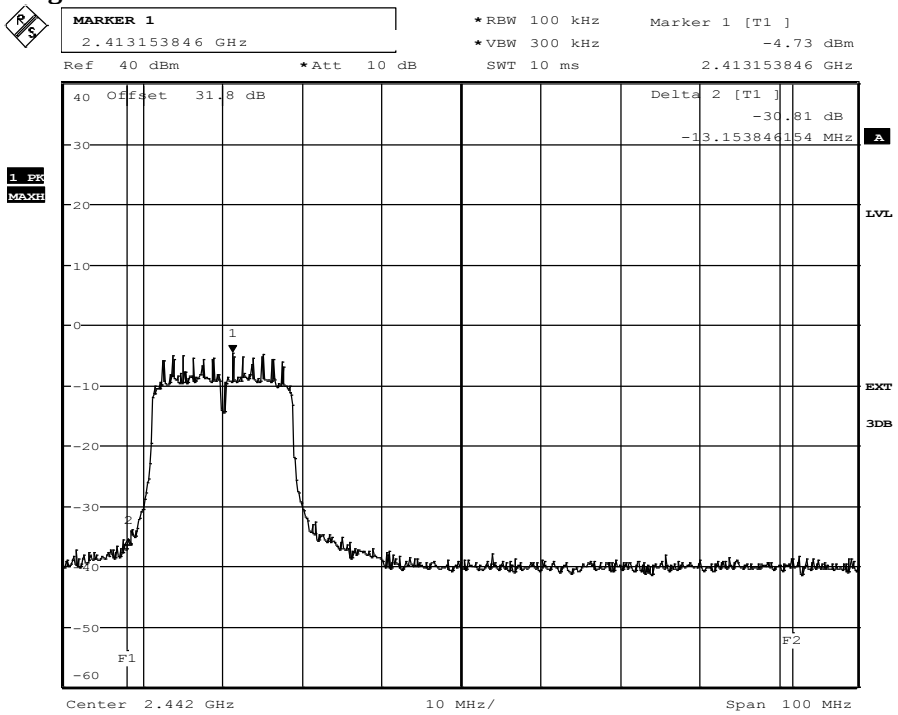
Date: 7.JUL.2015 07:25:41

Diagram 39



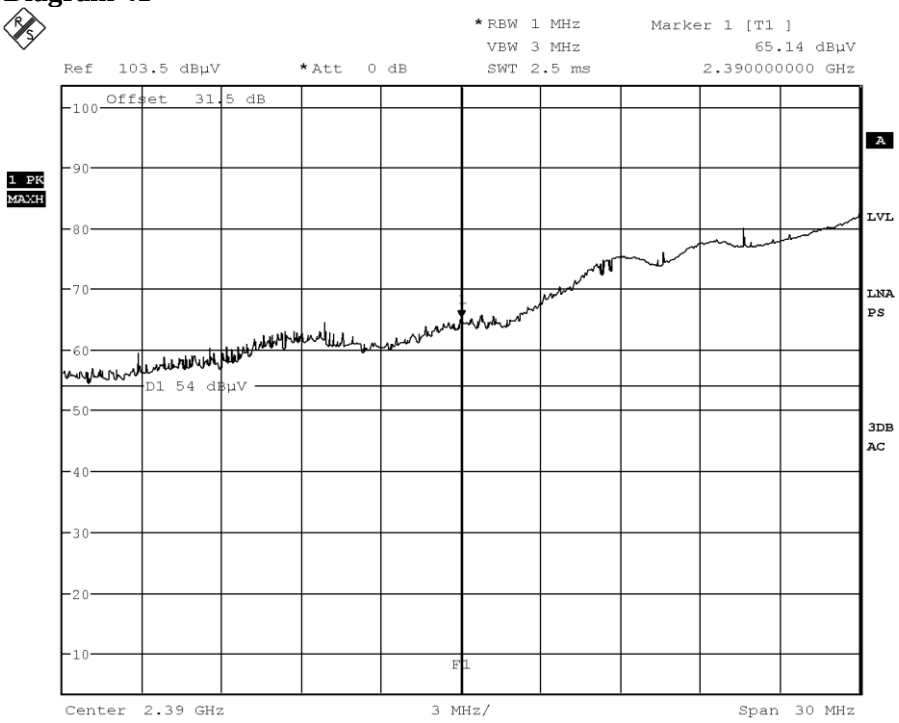
Date: 2.JUL.2015 08:52:47

Diagram 40



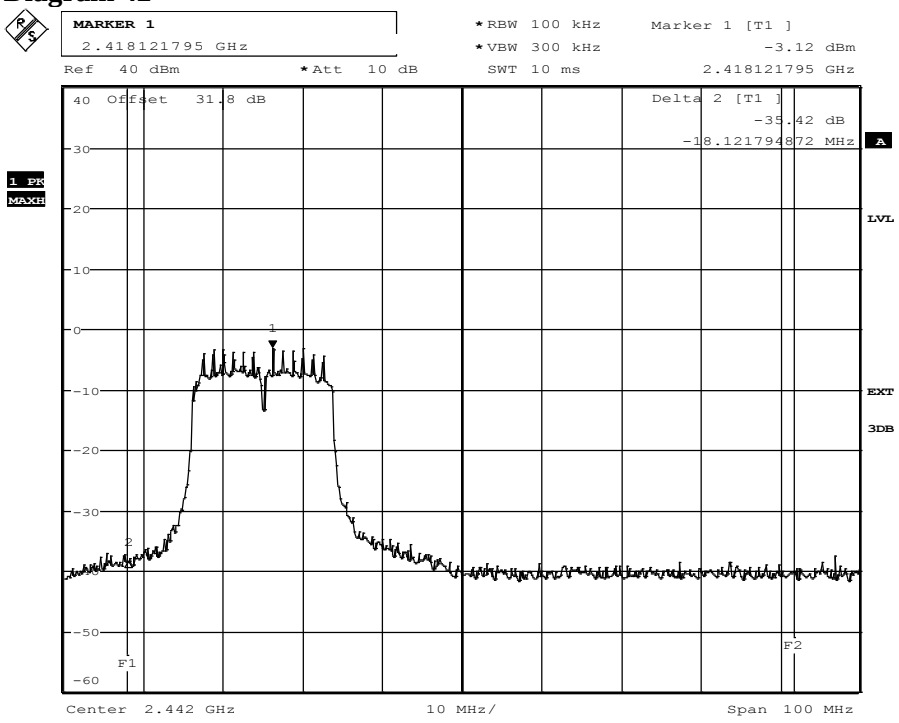
Date: 7.JUL.2015 07:27:28

Diagram 41



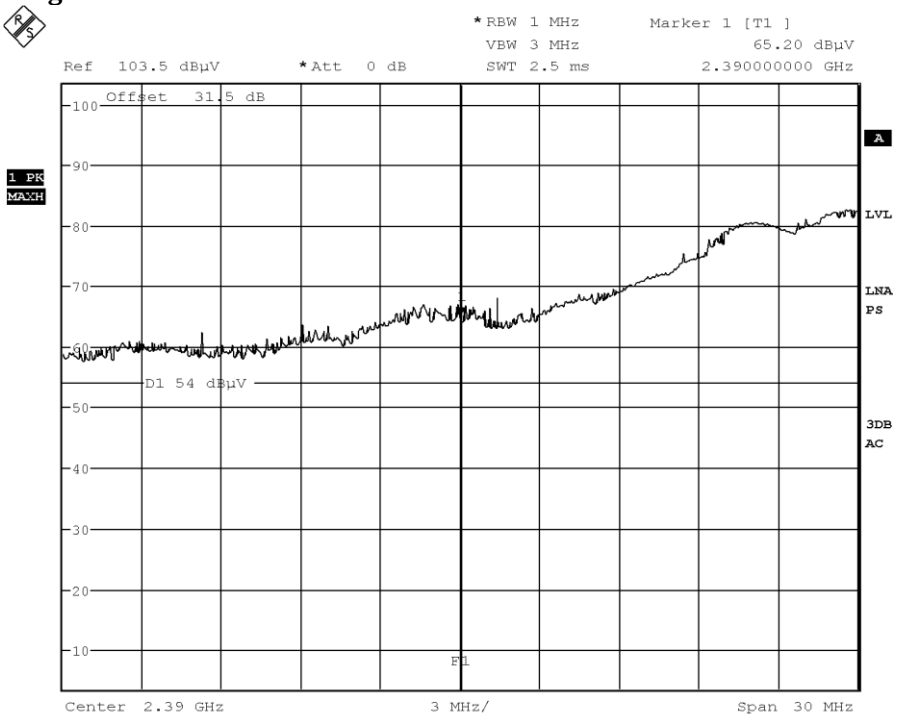
Date: 2.JUL.2015 11:12:11

Diagram 42



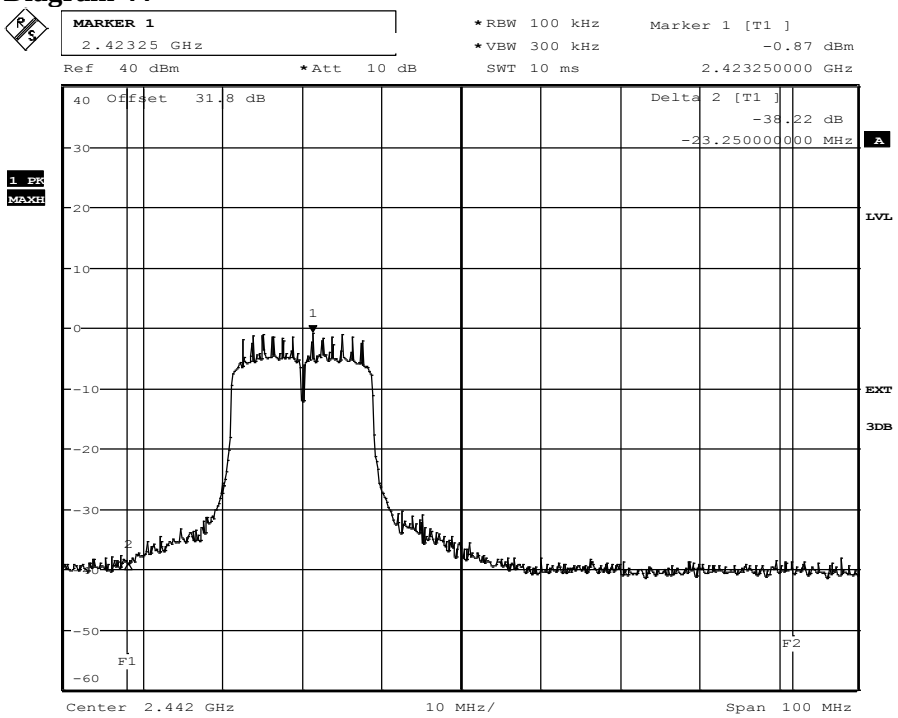
Date: 7.JUL.2015 07:28:54

Diagram 43



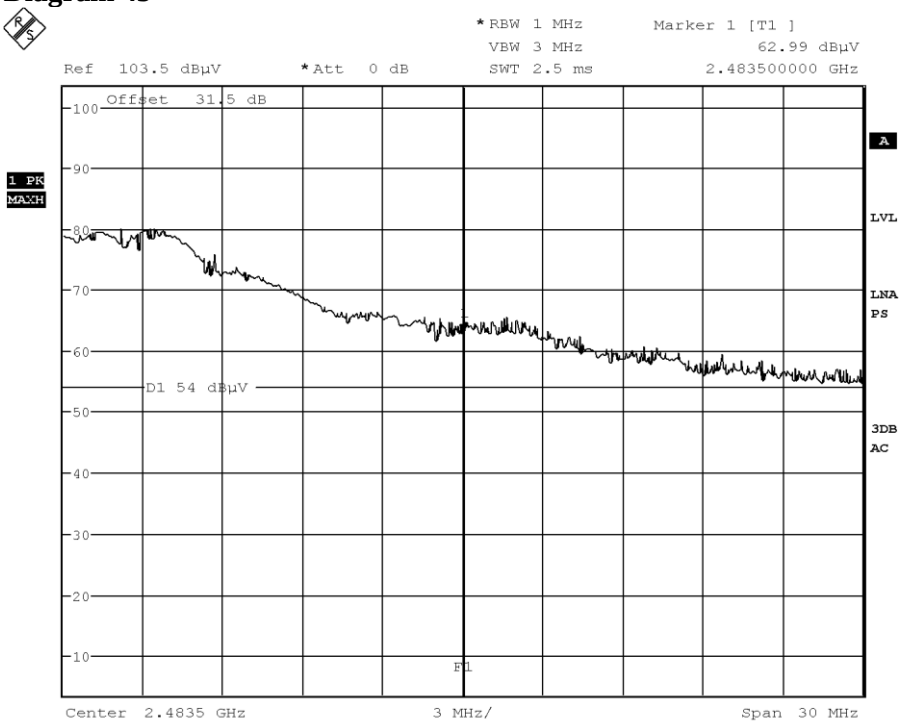
Date: 2.JUL.2015 12:44:11

Diagram 44



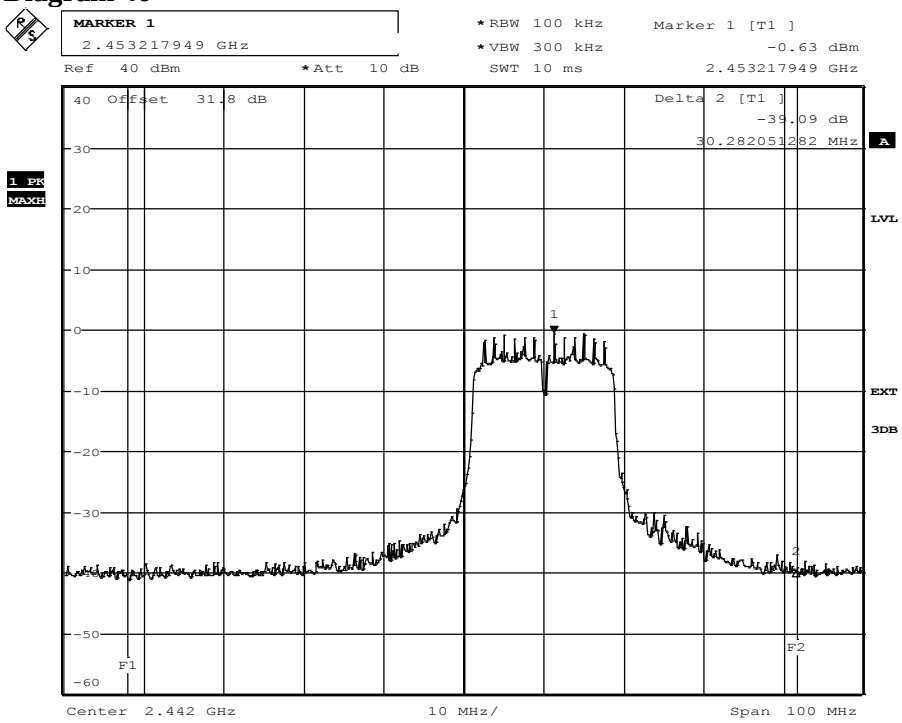
Date: 7.JUL.2015 07:31:20

Diagram 45



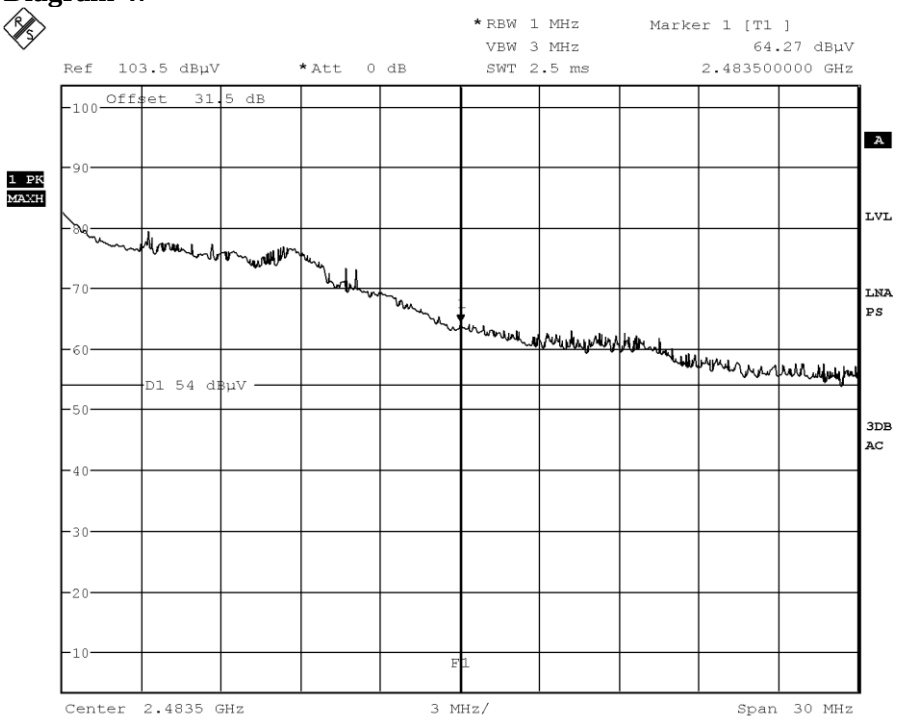
Date: 2.JUL.2015 14:54:58

Diagram 46



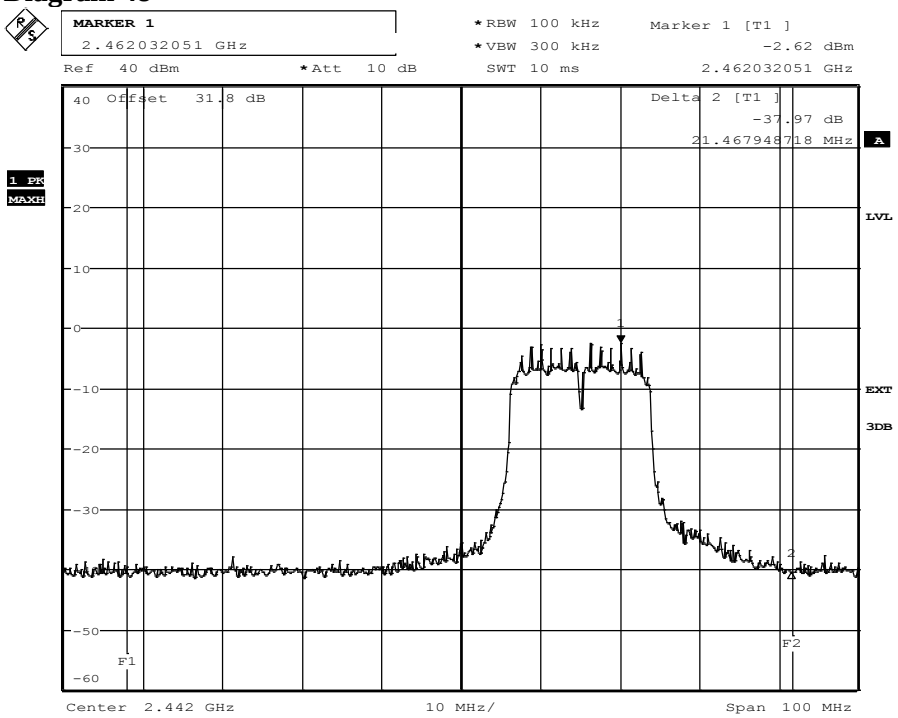
Date: 7.JUL.2015 07:33:20

Diagram 47



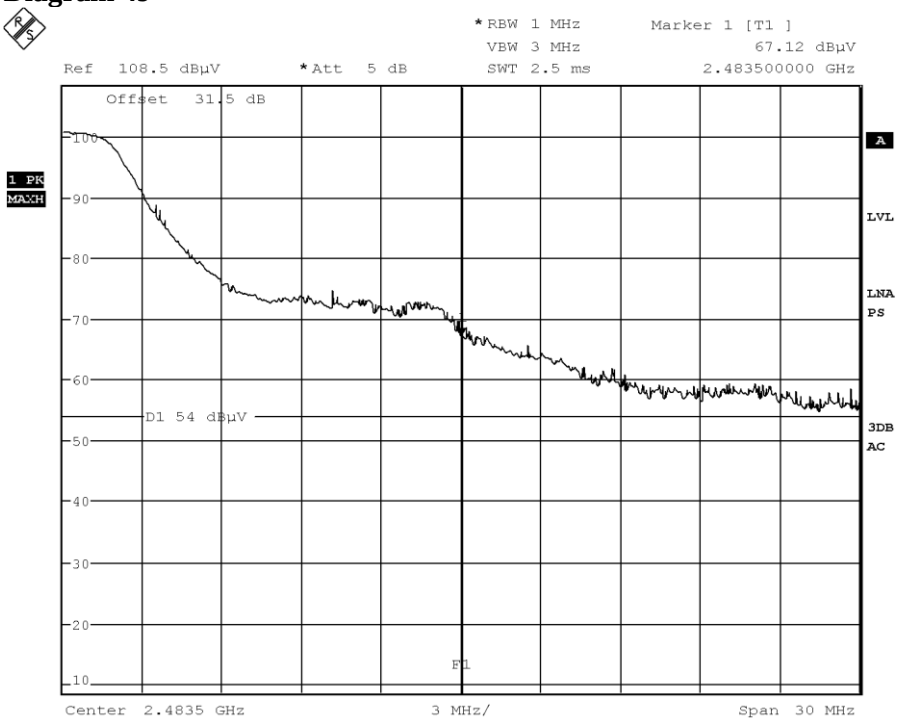
Date: 2.JUL.2015 14:31:09

Diagram 48



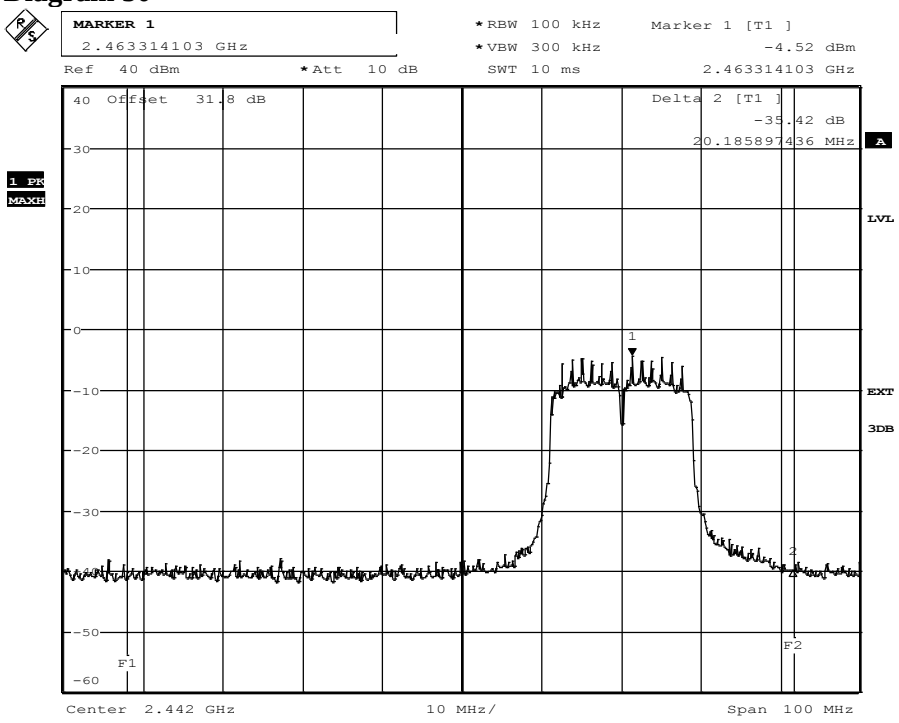
Date: 7.JUL.2015 07:34:29

Diagram 49



Date: 2.JUL.2015 13:48:33

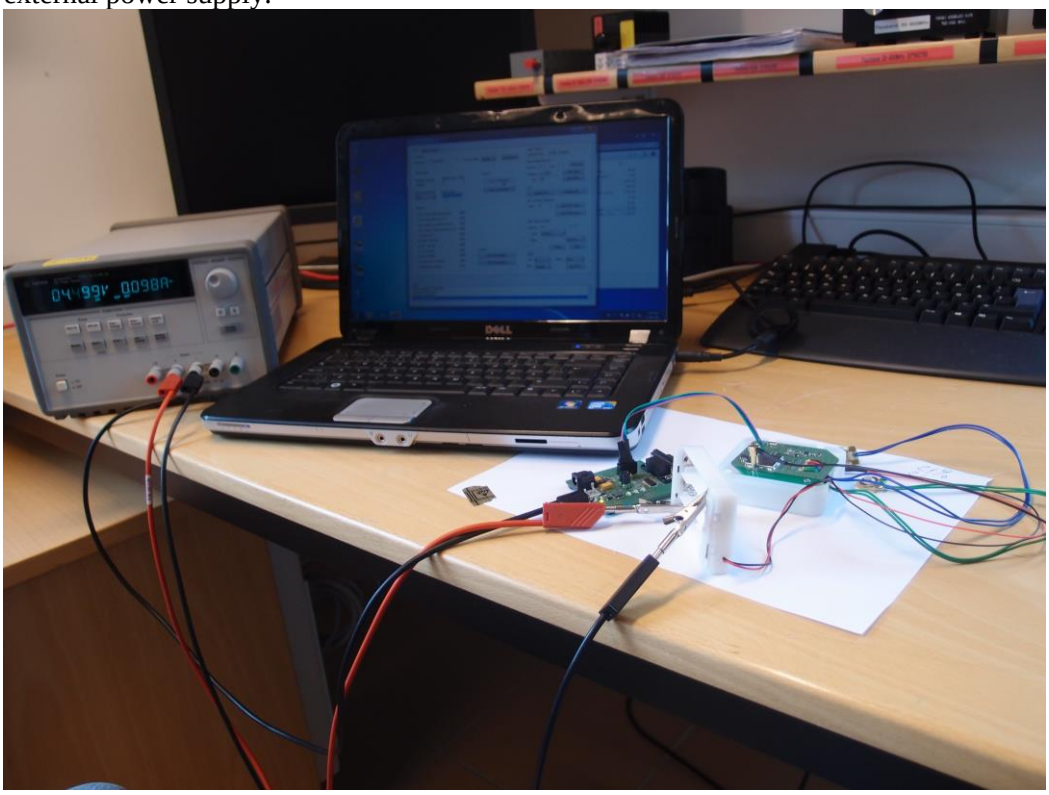
Diagram 50

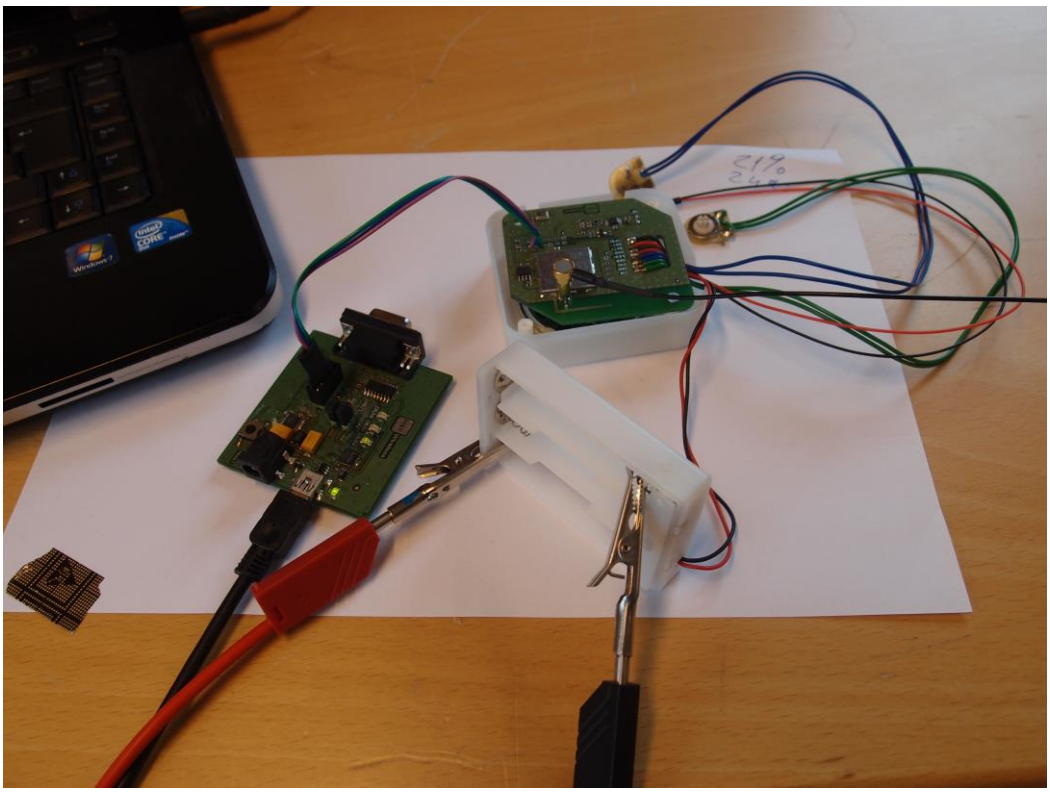


Date: 7.JUL.2015 07:35:25

Photos

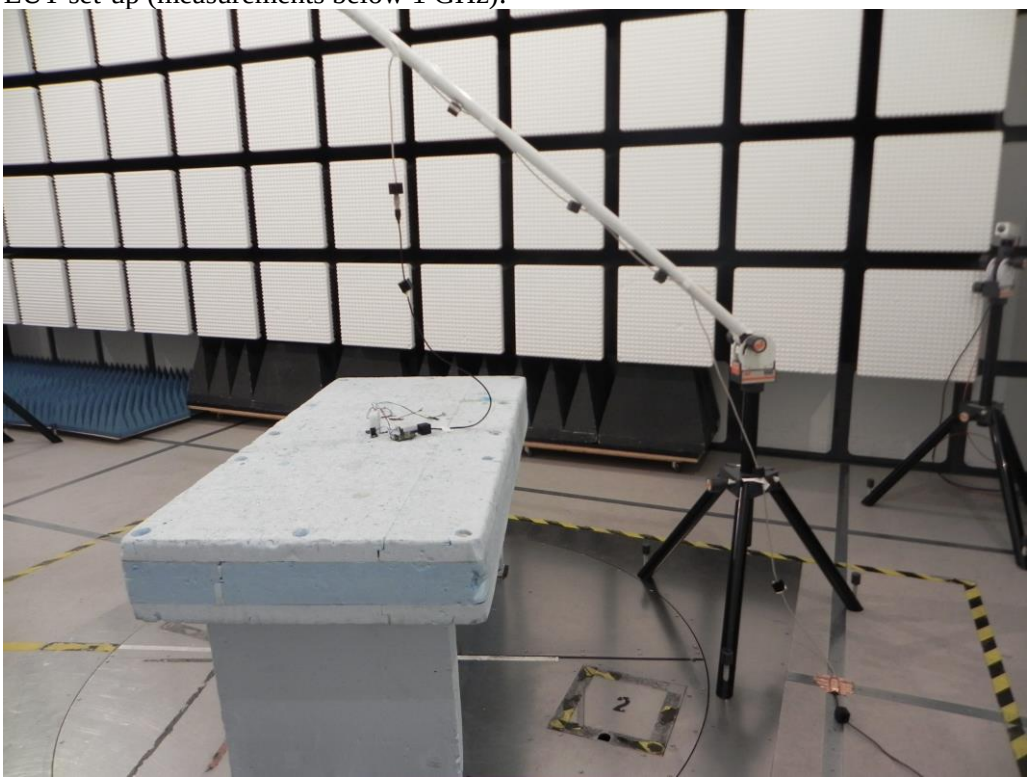
The test set-up during all the conducted RF tests can be seen in the pictures below, powered by the external power supply.

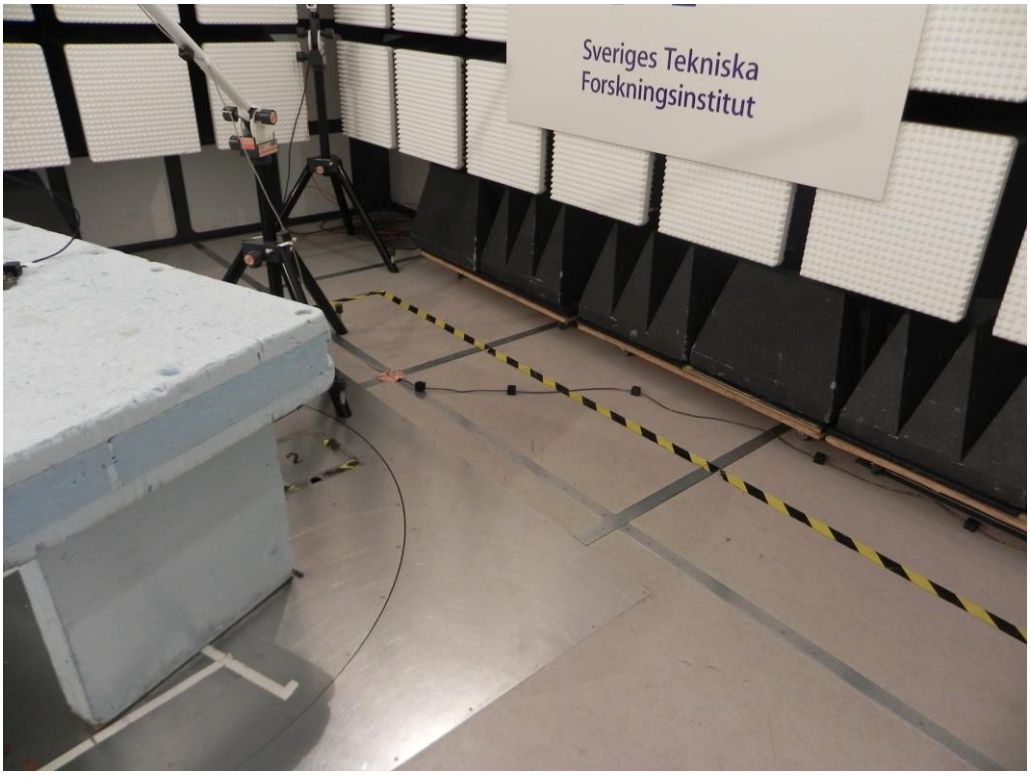




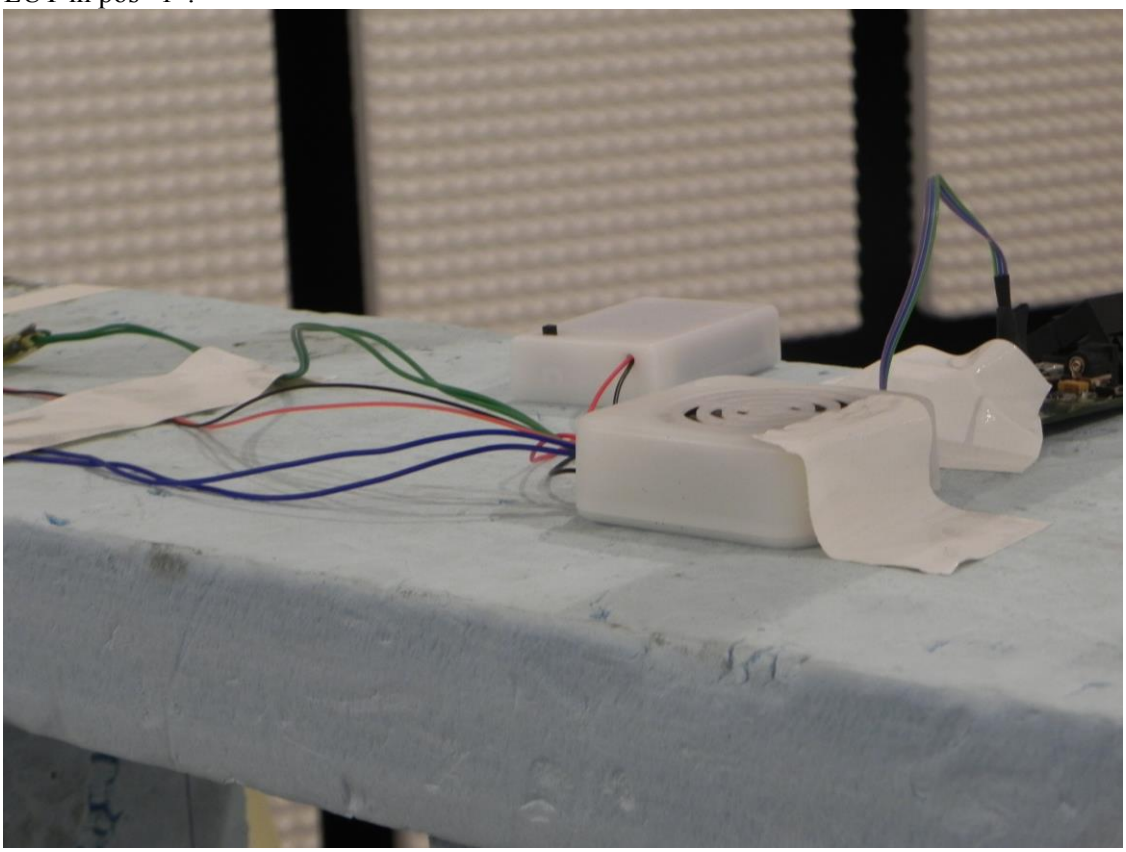
The test set-up during all the radiated tests can be seen in the pictures below.

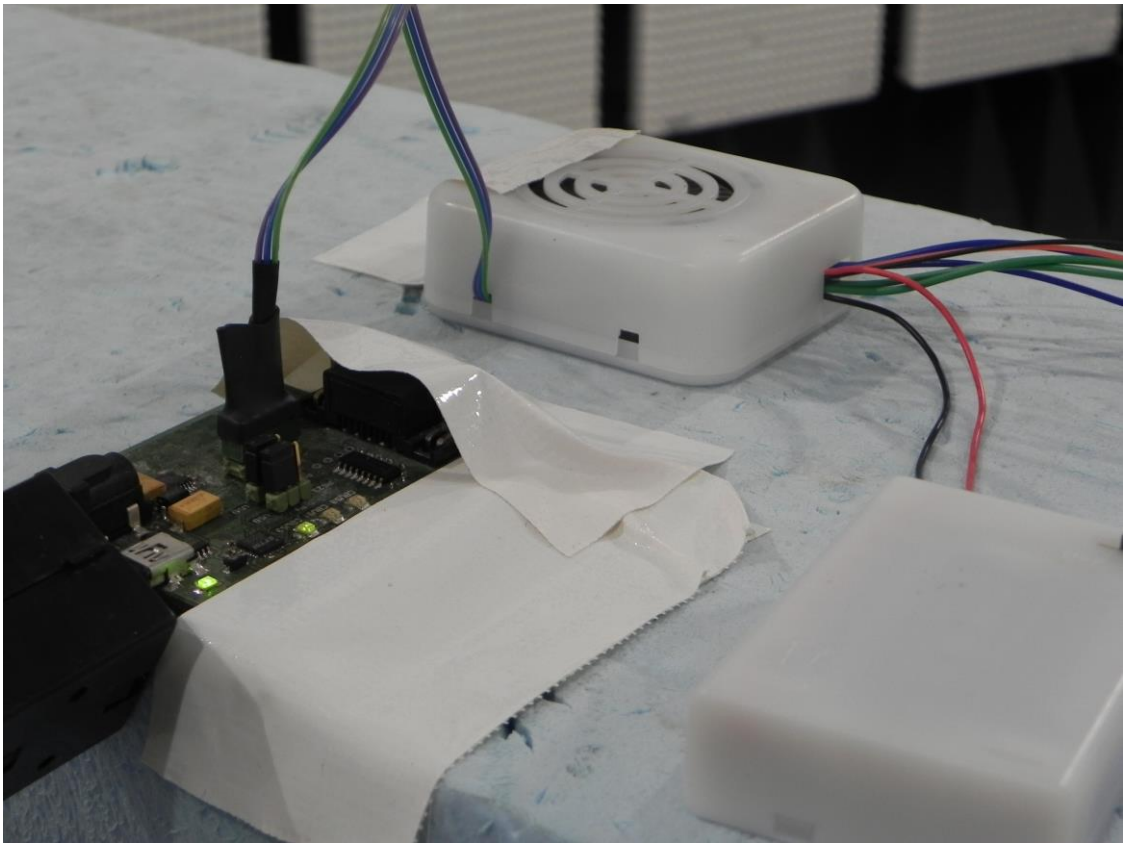
EUT set-up (measurements below 1 GHz):



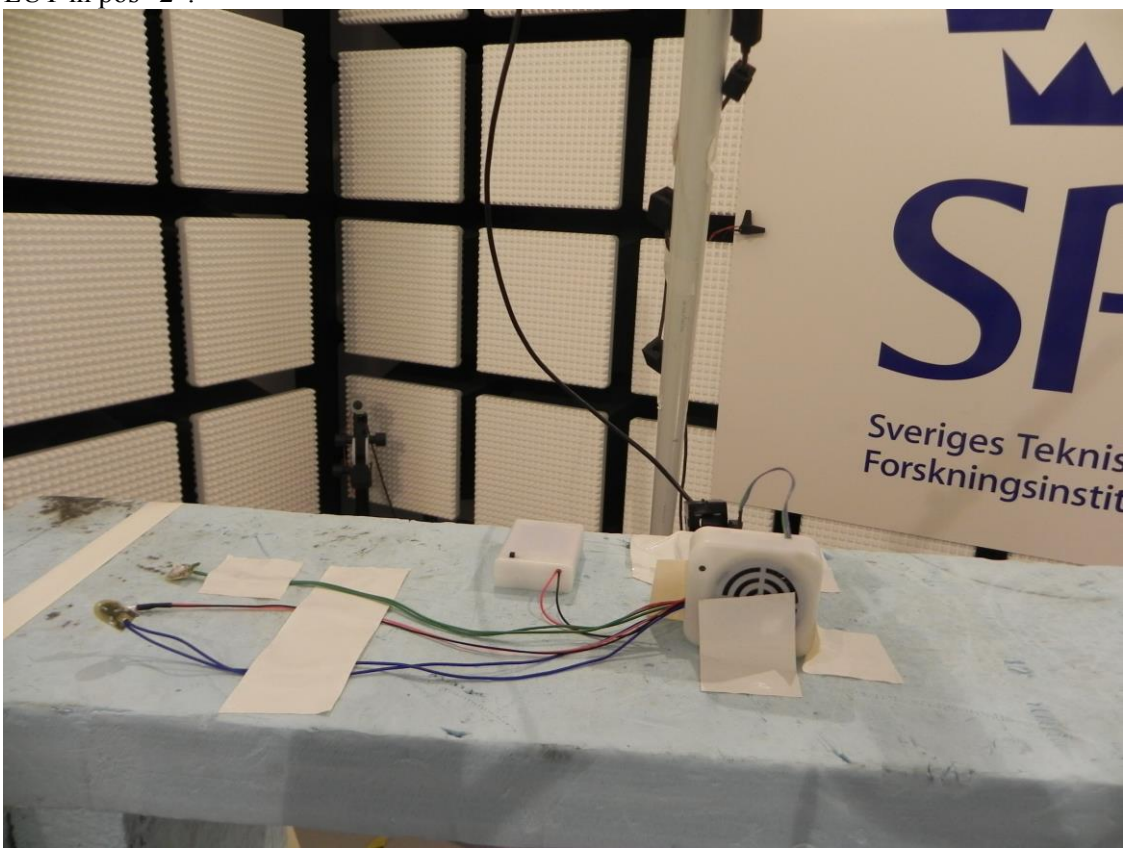


EUT in pos “1”:

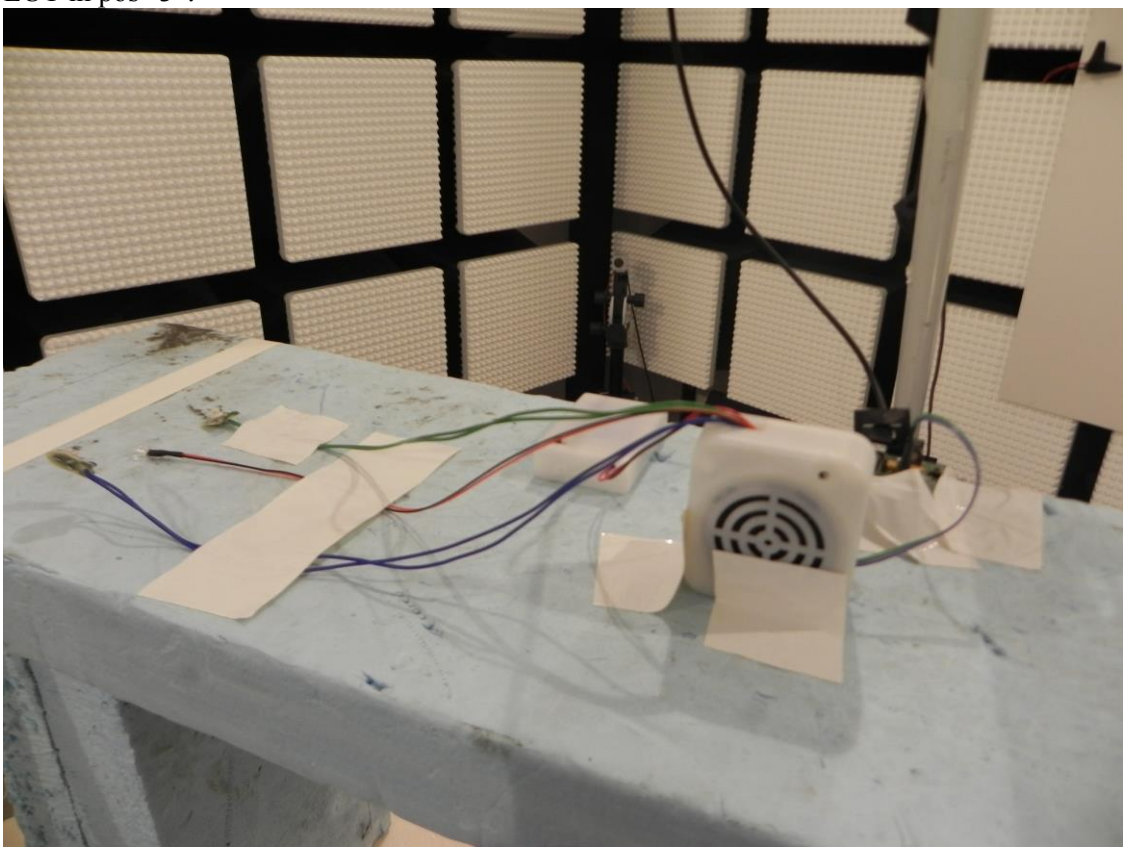




EUT in pos “2”:

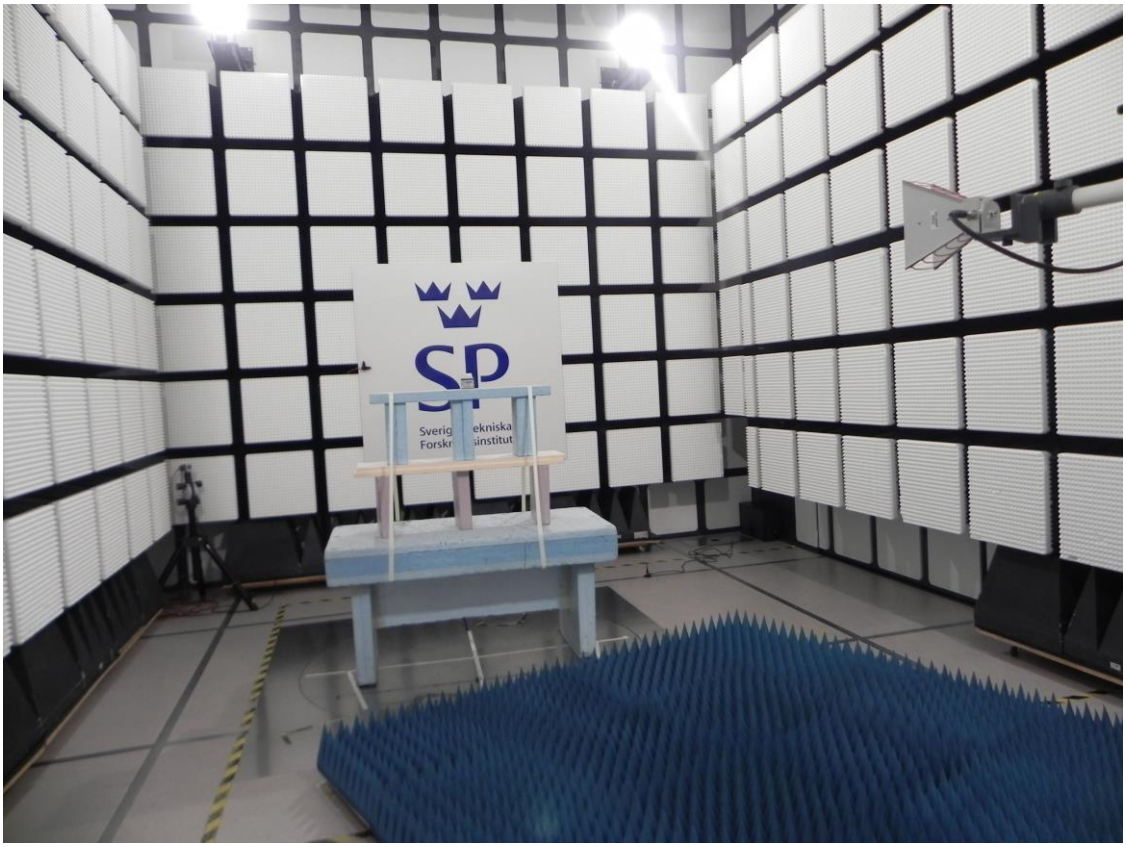


EUT in pos “3”:



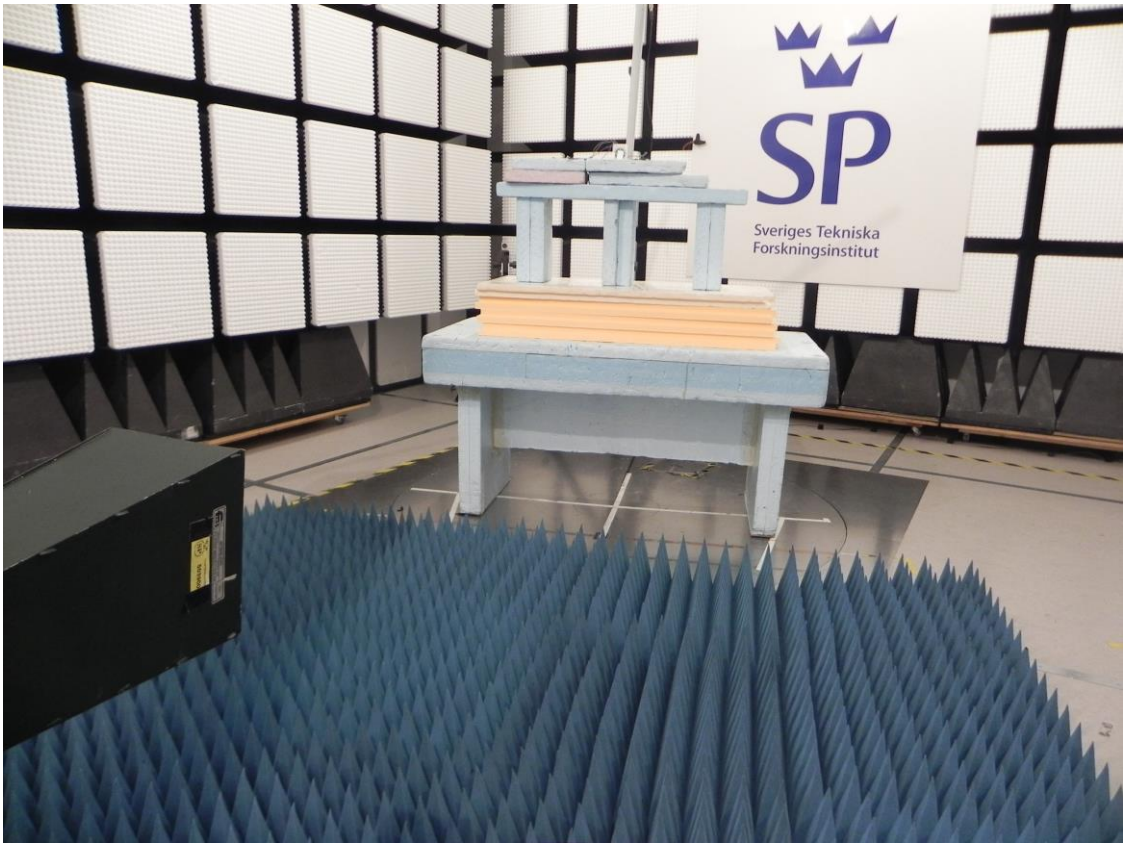
30-1000 MHz:

1-8.2 GHz:

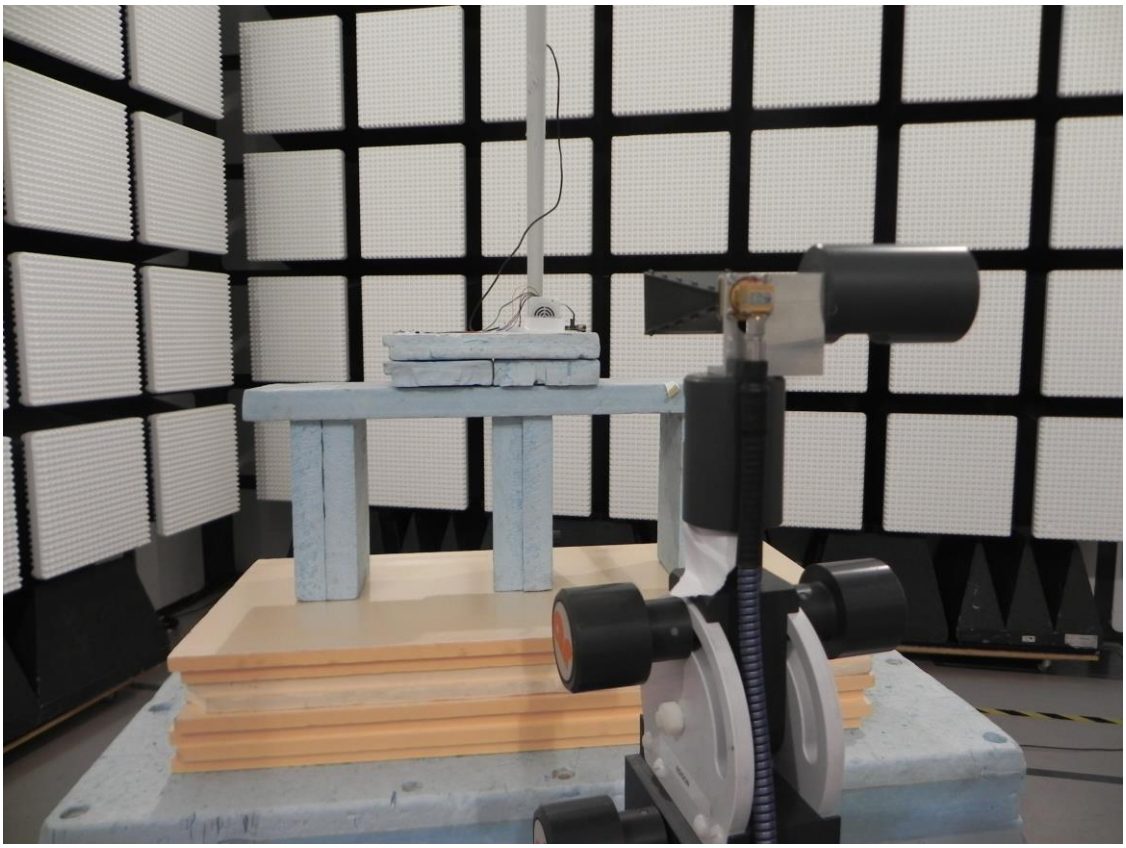


8.2-12 GHz

12-18 GHz

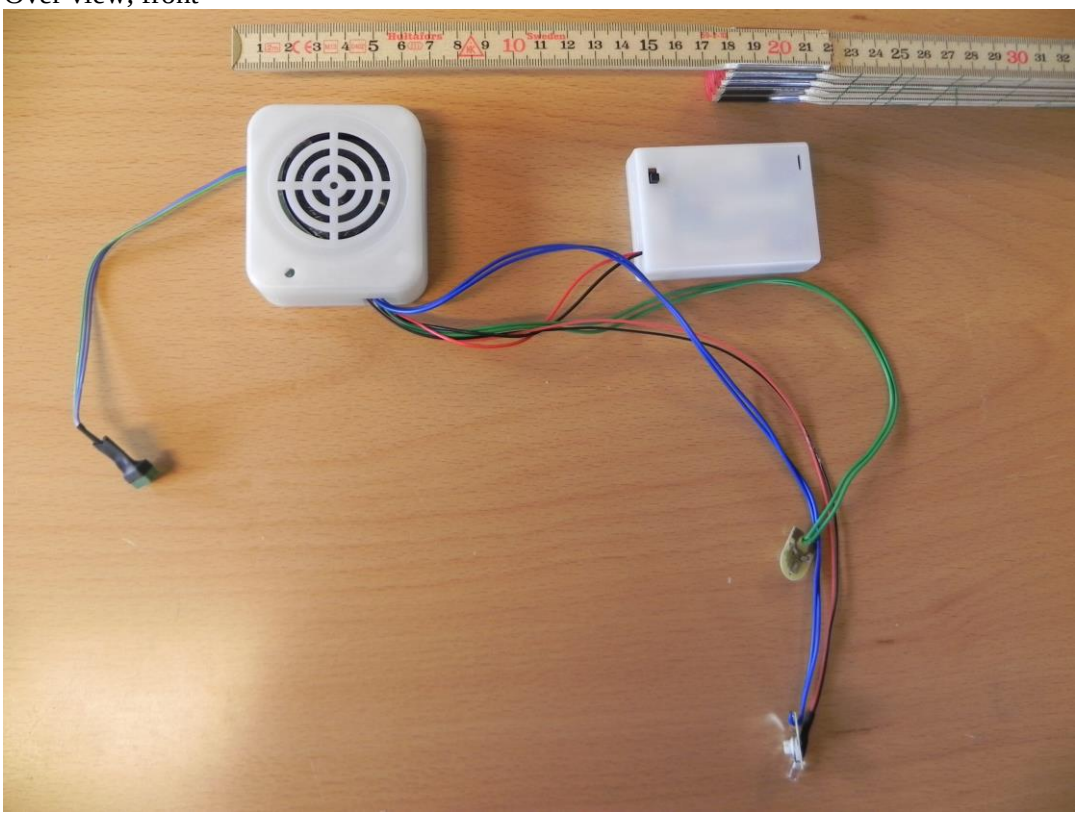


18-25 GHz:

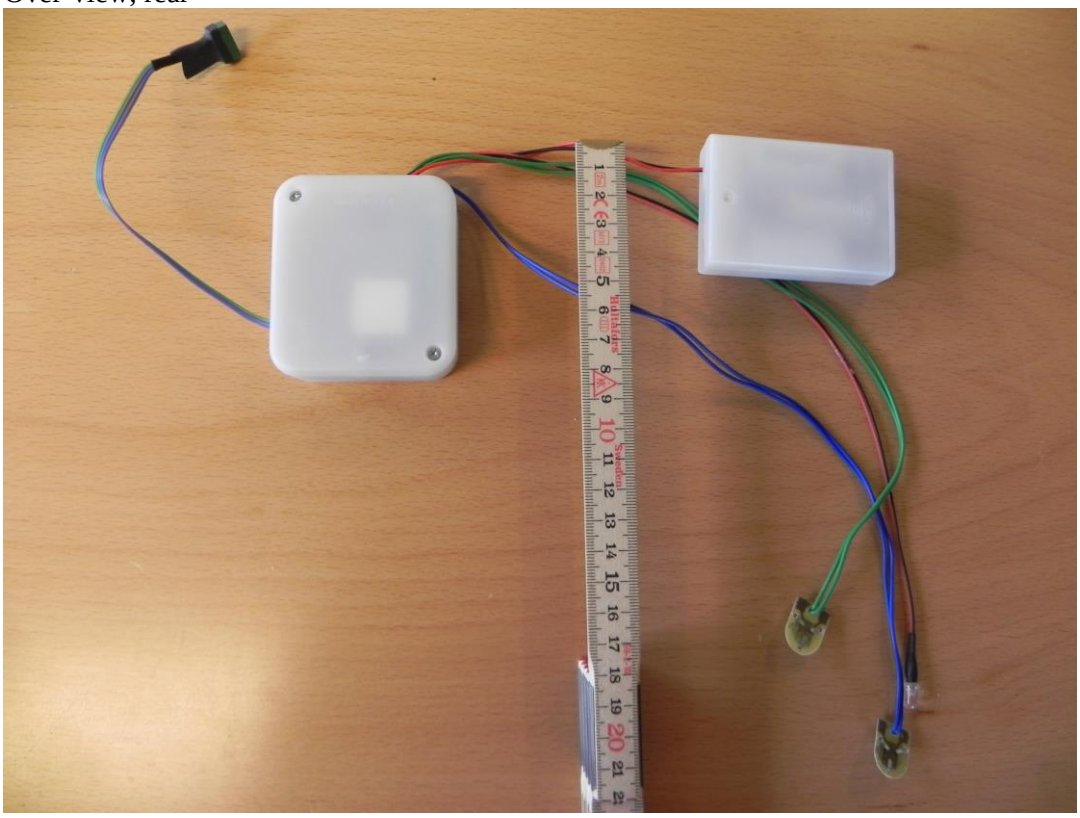


EUT, radiated sample

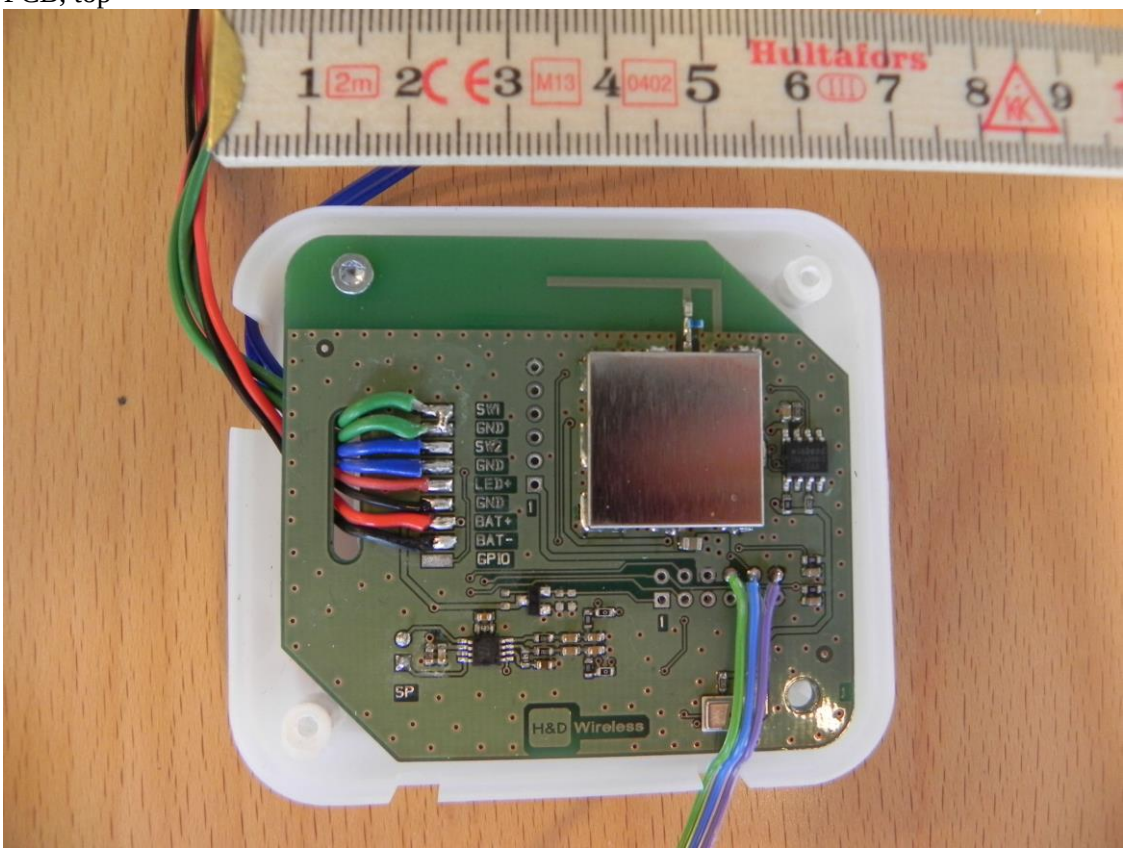
Over view, front



Over-view, rear

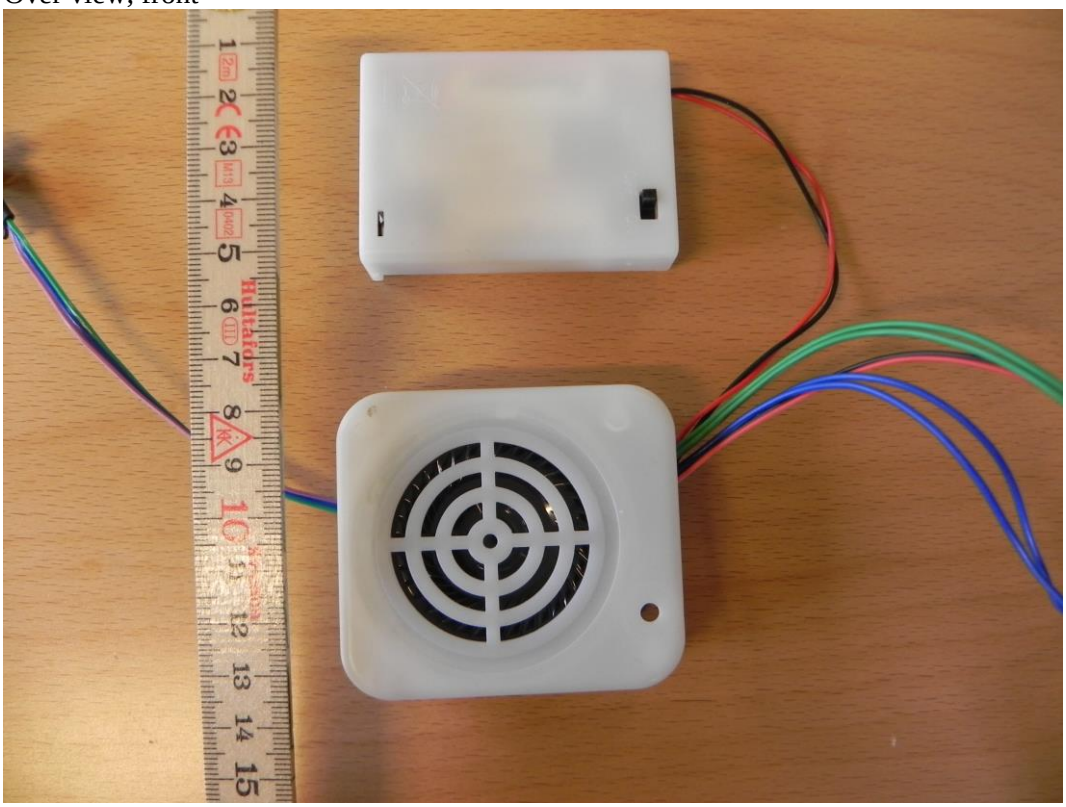


PCB, top

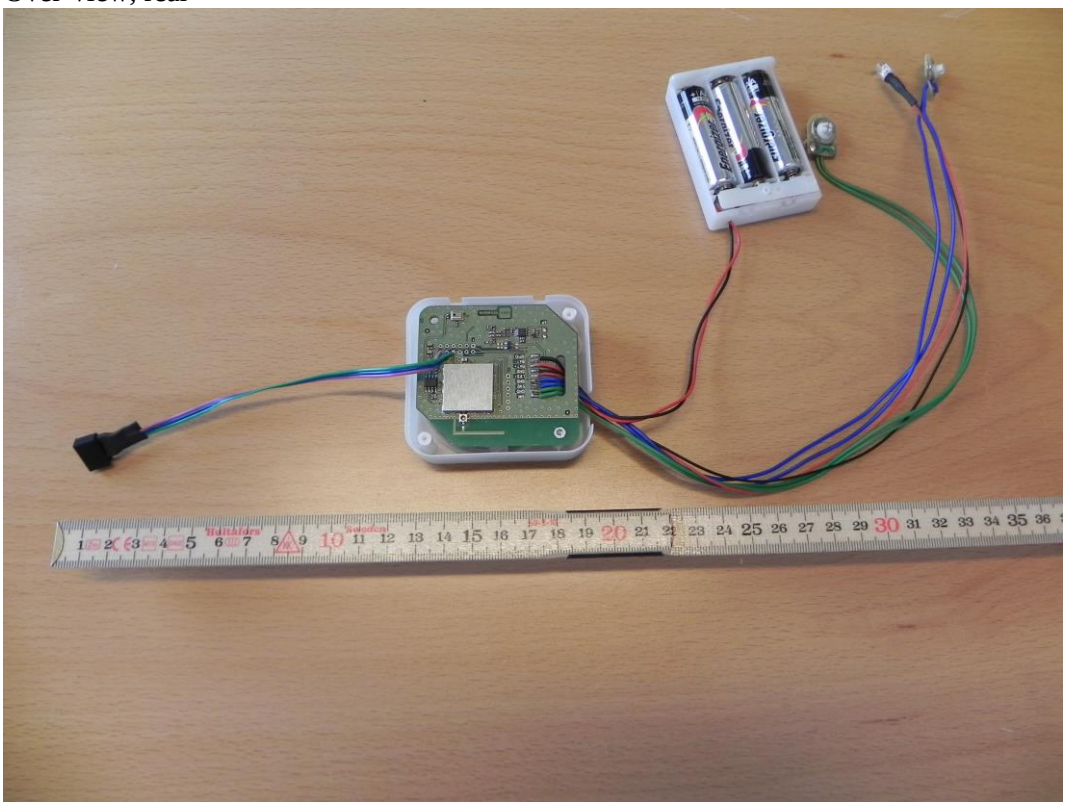


EUT, conducted sample

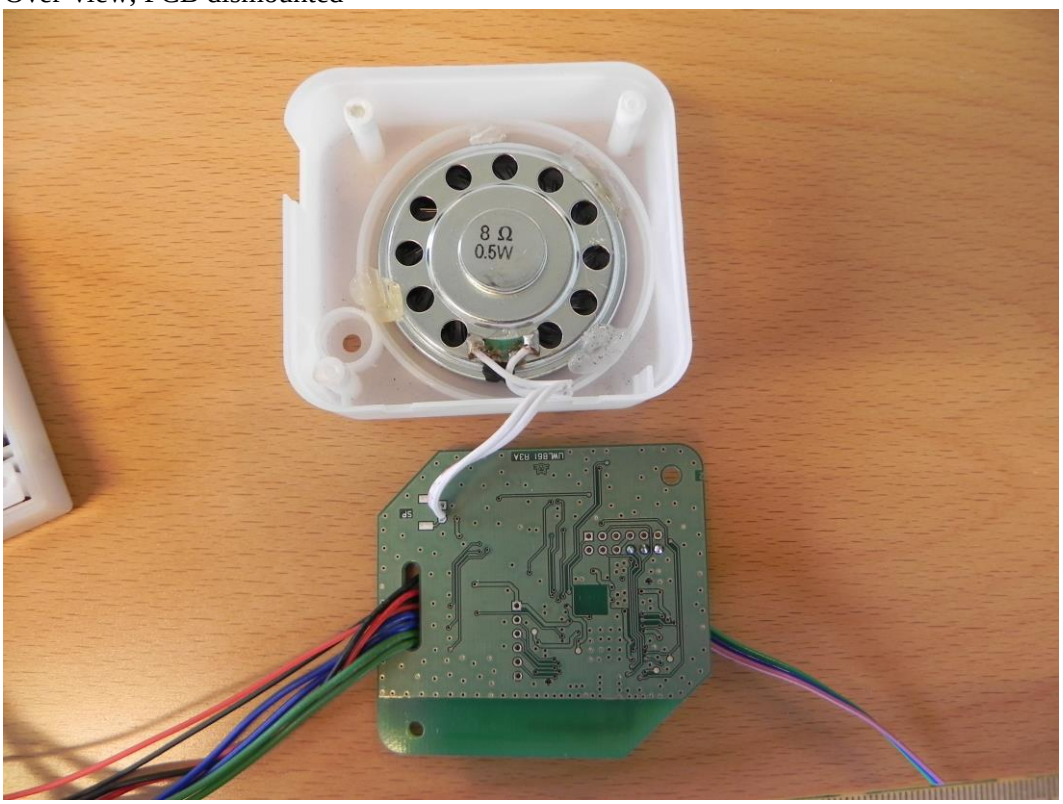
Over view, front



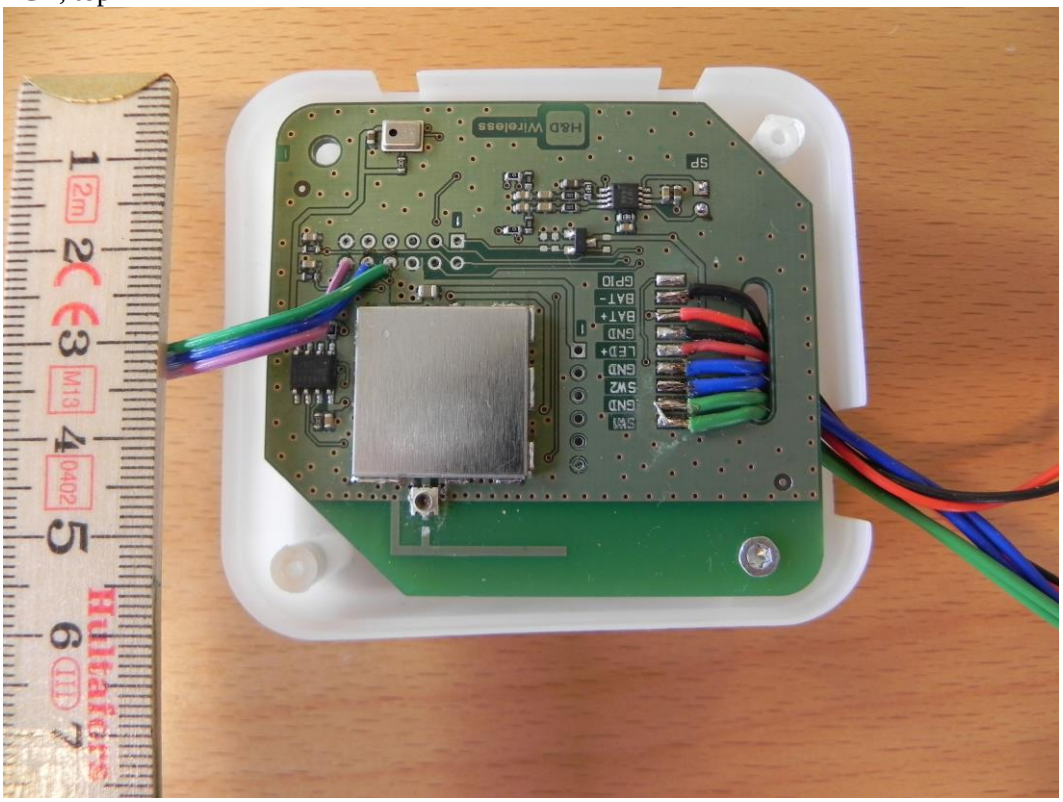
Over-view, rear



Over-view, PCB dismounted



PCB, top



PCB, rear