The Nebraska Center for Excellence in Electronics
4740 Discovery Drive
Lincoln, NE 68521
Phone: 402.323.6233
Fax: 402.323.6238
www.nceelabs.com

Amended

FCC Test Report

Includes NCEE Labs report R20160623-20A and its amendment in full

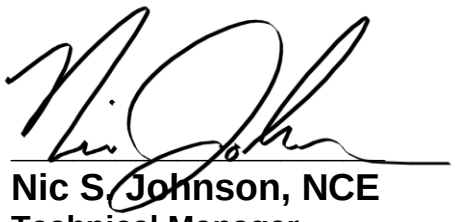
Client: **GolDit LLC**

Address: **720 "O" St., Suite E**
Lincoln, NE 68508

Product: **CarTracker Tag**

Test Report No: **R20160623-20B**

Approved By:



Nic S. Johnson, NCE
Technical Manager
iNARTE Certified EMC Engineer #EMC-003337-NE

DATE: **8 March 2017**

Total Pages: **73**

ACCREDITED
TESTING LABORATORY
CERTIFICATE NO. 1953.01

Tables of Figures
Table of Tables

Table of Figures

Figure **Page**

Table of Tables

Table **Page**

1.0 Summary of test results

1.1 Test Results

The EUT has been tested according to the following specifications:

APPLIED STANDARDS: FCC Part 15, Subpart B and C			
Standard Section	**Test Type and Limit**	**Result**	**Remark**
15.203	Unique Antenna Requirement	Pass	Meets the requirement
15.207 15.107	Conducted Emissions	NA	Not required* EUT can only be powered brom OB2 connection in a car.
15.109	Receiver Spurious Emissions	Pass	Meets the requirement
15.209	Receiver Spurious Emissions	Pass	Meets the requirement
15.247(a)(1)	Minimum Bandwidth, Limit Min. 500kHz	Pass	Meets the requirement
15.247(b)	Maximum Peak Output Power, Limit: Max. 23.9dBm	Pass	Meets the requirement
15.247(c) ,	Transmitter Radiated Emissions, Limit: Table 15.209	Pass	Meets the requirement
15.247(c)	Band Edge Measurement, Limit: 20dB less than the peak value of fundamental frequency	Pass	Meets the requirement
15.247(a)	Power Spectral Density	Pass	Meets the requirement

1.2 Applied standards and regulations

The EUT uses digital modulation and operates in the 2400 to 2483.5 MHz band. According to the specifications of the manufacturer, it must comply with the requirements of the following standards and regulations:

1. **ANSI C63.10:2013 – transmitter measurements**
2. **ANSI C63.4:2014 – receiver measurements**
3. **FCC Part 15, Subpart C (15.247)**
4. **FCC Part 15, Subpart B (15.107 and 15.109)**
5. **FCC Part 15, Subpart C (15.207 and 15.209)**

1.3 Amendment details

-Added output power, PSD, BW and spurious emissions measurements from 802.11n mode

-Added output power measurements from 802.11g mode with integrated channel power

-

2.0 Description

2.1 Equipment under test

The Equipment Under Test (EUT) is a wireless device that plugs into the standard on board diagnostic port automatically acquires detailed information about the location, make, model, year, etc. of the car.

EUT Received Date: 17 August 2016
EUT Tested Dates: 17 August 2016 – 19 August 2016
26 Jan 2017 (802.11(b) mode measurements)
7 - 8 March 2017 (Figure 2, Position 1 preview measurements, 802.11(n) measurements, 802.11(g) BW measurements)

PRODUCT	GoIDit
SERIAL NUMBER	NCEETEST1 (assigned)
POWER SUPPLY	12 VDC
ANTENNA TYPE	PCB antenna

NOTE:
1. For more detailed features description, please refer to the manufacturer's specifications or User's Manual.

2.2 Description of test modes

The EUT operates on, and was tested at the frequencies below:

Channel	Frequency
Low	2412
Mid	2437
High	2462

All test items have been performed and recorded as per the above.

Testing was performed using the 802.11(b), (g) and (n) communication protocols

2.5 Description of support units

None

2.6 Configuration of system under test

This EUT was set to transmit in a worse-case scenario with modulation on. The manufacturer modified the unit to transmit continuously on Low, Mid and High Channels.

3.0 Test Laboratory

3.1 Laboratory description

All testing was performed at the following Facility:

The Nebraska Center for Excellence in Electronics (NCEE Labs)
4740 Discovery Drive
Lincoln, NE 68521

A2LA Certificate Number:	1953.01
FCC Accredited Test Site Designation No:	US1060
Industry Canada Test Site Registration No:	4294A-1
NCC CAB Identification No:	US0177

Environmental conditions varied slightly throughout the tests:

Relative humidity of 36 $\pm$ 4%
Temperature of 23 $\pm$ 3° C

3.2 Test Equipment

DESCRIPTION AND MANUFACTURER	MODEL NO.	SERIAL NO.	LAST CALIBRATION DATE	CALIBRATION DUE DATE
Rohde & Schwarz Test Receiver	ES126	100037	08 Feb 2016	08 Feb 2017
Rohde & Schwarz Test Receiver**	ES126	100037	24 Jan 2017	24 Jan 2018
EMCO Biconilog Antenna 30 MHz – 1 GHz	3142B	1647	02 Aug 2016	02 Aug 2017
EMCO Horn Antenna 1 – 18 GHz	3115	6416	25 Jan 2016	25 Jan 2018
EMCO Horn Antenna 18 - 40 GHz	3116	2576	26 Jan 2016	26 Jan 2018
Rohde & Schwarz Preamplifier, 30 MHz – 18 GHz	TS-PR18	3545700803	14 Dec 2015*	14 Dec 2016*
Rohde & Schwarz Preamplifier, 30 MHz – 18 GHz**	TS-PR18	3545700803	24 Jan 2017*	24 Jan 2018*
Trilithic 3 GHz High Pass Filter	6HC330	23042	14 Dec 2015*	14 Dec 2016*
Trilithic 3 GHz High Pass Filter**	6HC330	23042	24 Jan 2017*	24 Jan 2018*
Mini Circuits 1700 – 5000Mhz High Pass Filter***	15542	31618	16 June 2016*	16 June 2017*

*Internal Characterization ** Used for measurements in 2017.

Notes:

1. All test equipment is calibrated by an A2LA accredited calibration laboratory, unless noted as an internal characterization
2. All calibrations are NIST traceable
3. All antenna calibrations are performed per ANSI 63.5:2006
4. All test receivers and spectrum analyzers are calibrated per CISPR 16-1-1:20104.0

4 Test Results

4.1 Unique antenna requirement

4.1.1 Standard applicable

For intentional device, according to FCC 47 CFR Section 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device.

4.1.2 Antenna description

The antenna is internal to the EUT on a PCB.

4.2 Radiated emissions

Test Method: ANSI C63.10, Section(s) 6.5, 6.6, 11.11, 11.12.1
ANSI C63.4, Section (s) 8.3

4.2.1 Limits for radiated emissions measurements

Emissions radiated outside of the specified bands shall be applied to the limits in 15.209 as followed:

FREQUENCIES (MHz)	FIELD STRENGTH (μV/m)	MEASUREMENT DISTANCE (m)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	3
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

NOTE:
1. The lower limit shall apply at the transition frequencies.
2. Emission level (dBuV/m) = 20 * log * Emission level (μV/m).
3. As shown in 15.35(b), for frequencies above 1000MHz, the field strength limits are based on peak detector values with duty cycle correction, however, the peak field strength of any emission shall not exceed the maximum permitted average limits by more than 20dB under any condition of modulation.

4.2.2 Test procedures

a. The EUT was placed on the top of a rotating table 0.8 meters above the ground plane in a 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.

b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.

c. The antenna was a broadband antenna, and its height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are used to make the measurement.

d. For each suspected emission, the EUT was arranged to maximize its emissions and then the antenna height was varied from 1 meter to 4

meters and the rotating table was turned from 0 degrees to 360 degrees to find the maximum emission reading.

e. The test-receiver system was set to use a peak detector with a specified resolution bandwidth. For spectrum analyzer measurements, the composite maximum of several analyzer sweeps was used for final measurements.

f. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10 dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

g. The EUT was measured in all three orthogonal axis. It was found that Position 3 was the worse-case

Since each of the 3 orientations was rotated 360 degrees, all 3 orthogonal axis of the EUT were investigated for emissions.

See Annex A for test photos.

NOTE:
1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120kHz for Peak detection (PK) and Quasi-peak detection (QP) at frequencies below 1GHz.

2. The resolution bandwidth 1 MHz for all measurements and at frequencies above 1GHz, The video bandwidth was 1MHz for peak measurements and 10Hz for average measurements. A peak detector was used for all measurements above 1GHz. Measurements were made with an EMI Receiver.

4.2.3 Deviations from test standard

No deviation.

4.2.4 Test setup

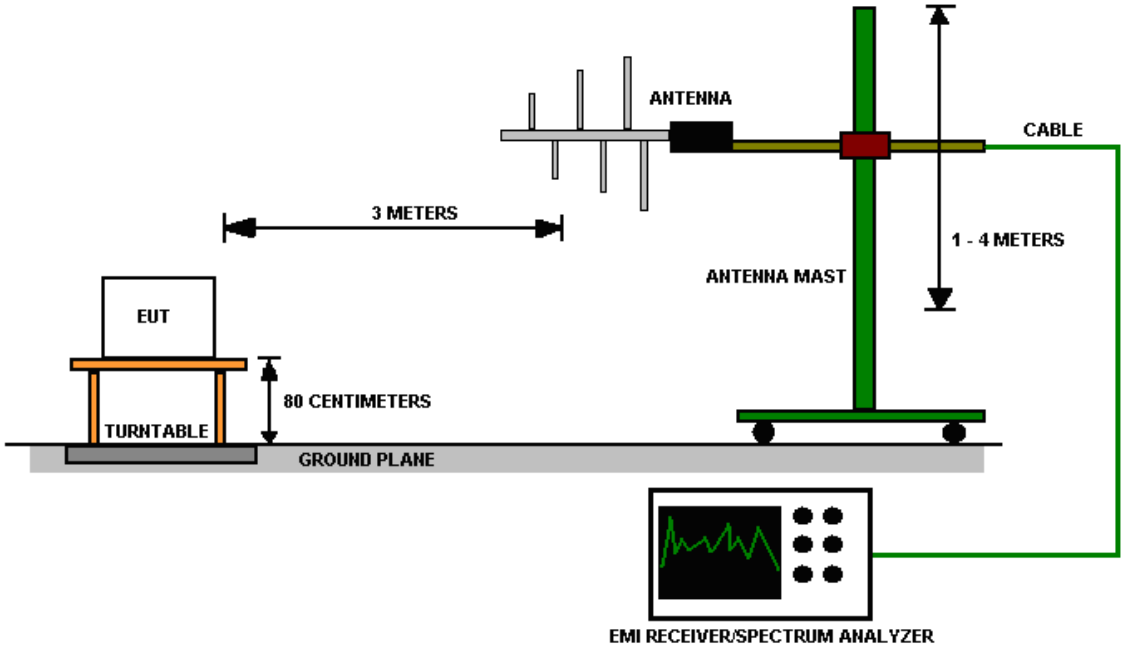


Figure 1 - Radiated Emissions Test Setup

The EUT was tested in both the vertical and horizontal in all 3 positions shown in Figure 2 below in order to measure emissions in all **3 orthogonal axis** of the EUT and meet the requirements from **ANSI C63.10 Section 5.10.1**.

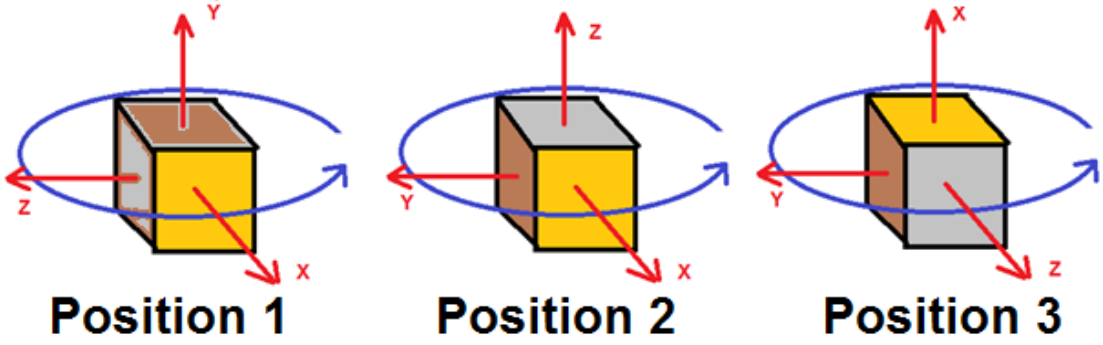


Figure 2 - Testing configuration in all 3 axis

For the actual test configuration, please refer to Appendix A for photographs of the test configuration.

4.2.5 EUT operating conditions

The EUT was powered by 12 VDC unless specified and set to transmit continuously at the highest possible transmission rate on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

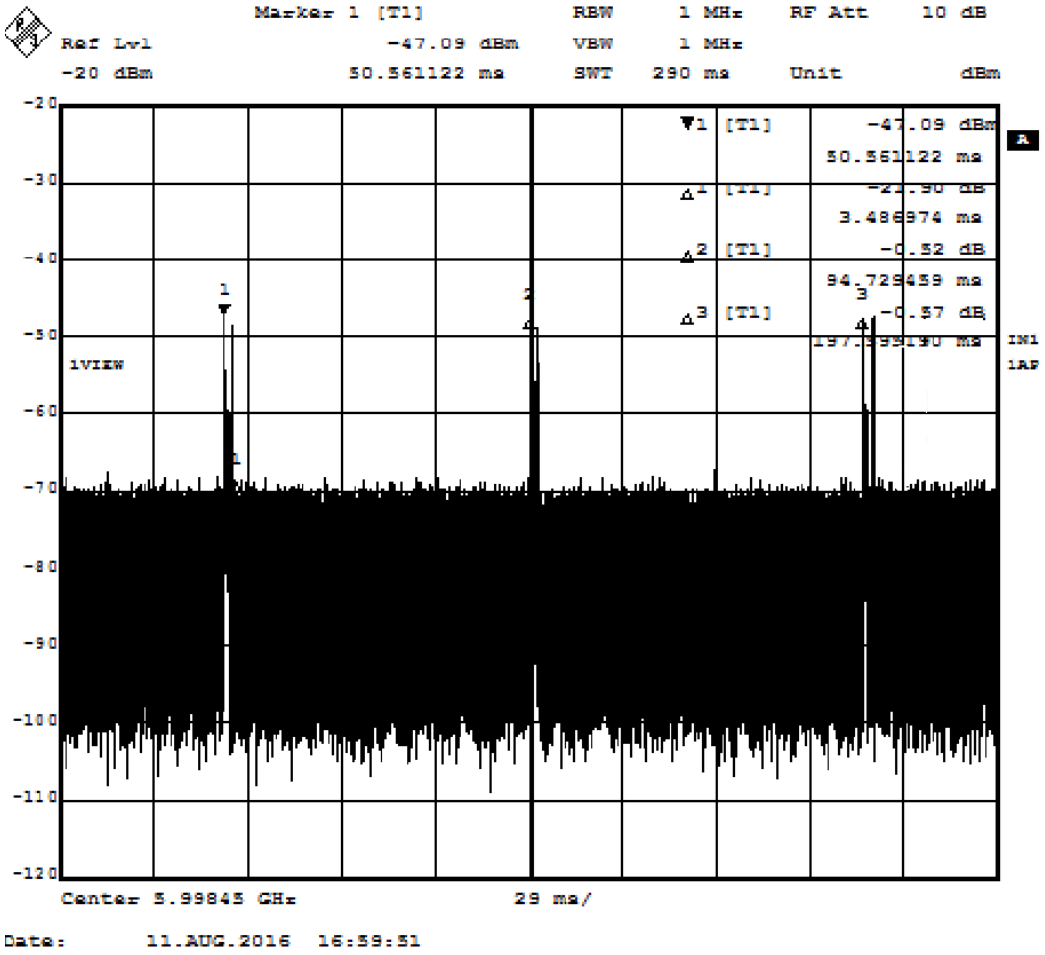


Figure 3 –Duty Cycle

Transmit time per period = 3.48 ms (delta marker in Figure 2)
Period time = 94.72 ms
Duty cycle = Transmit time / period = 3.48 / 94.72 = 0.036
Averaging factor = 20 × log(duty cycle) = 20 × log(0.1983) = -28.69

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle above.

4.2.6 Test results

EUT MODULE	GoIDit	MODE	Receive
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

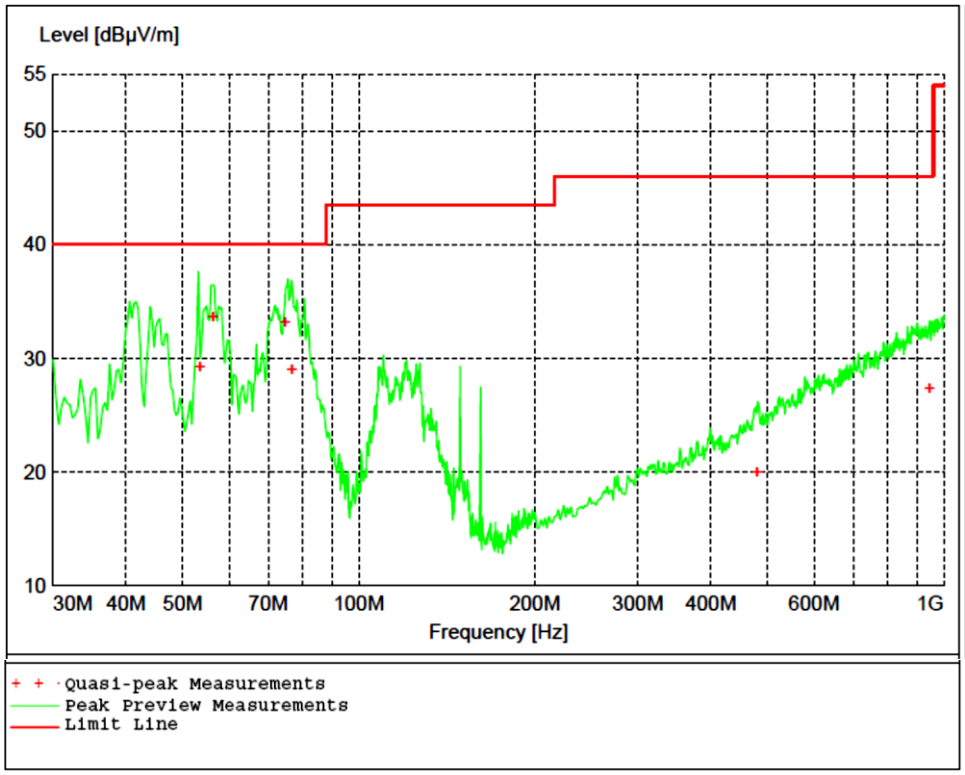


Figure 4 - Radiated Emissions Plot, Receive

Table 1 - Radiated Emissions Quasi-peak Measurements, Receive

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
53.520000	29.25	40.00	10.70	100	131	VERT
56.340000	33.62	40.00	6.40	101	246	VERT
74.820000	33.18	40.00	6.80	98	74	VERT
76.860000	29.03	40.00	11.00	99	178	VERT
480.060000	19.98	46.00	26.00	336	182	VERT
946.200000	27.36	46.00	18.60	100	241	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 2 - Radiated Emissions Peak Measurements, Receive

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2438.800000	36.55	54.00	17.50	399	21	VERT
4880.200000	42.13	54.00	11.90	400	149	VERT
7317.400000	45.11	54.00	8.90	370	95	VERT
9756.600000	46.10	54.00	7.90	322	83	VERT
12156.400000	41.03	54.00	13.00	315	336	VERT

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: peak measurements are compliant with the average limit, so average measurements are not required.

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.

EUT MODULE	GoIDit	MODE	Continuous Transmit, Low Channel
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri, NJohnson

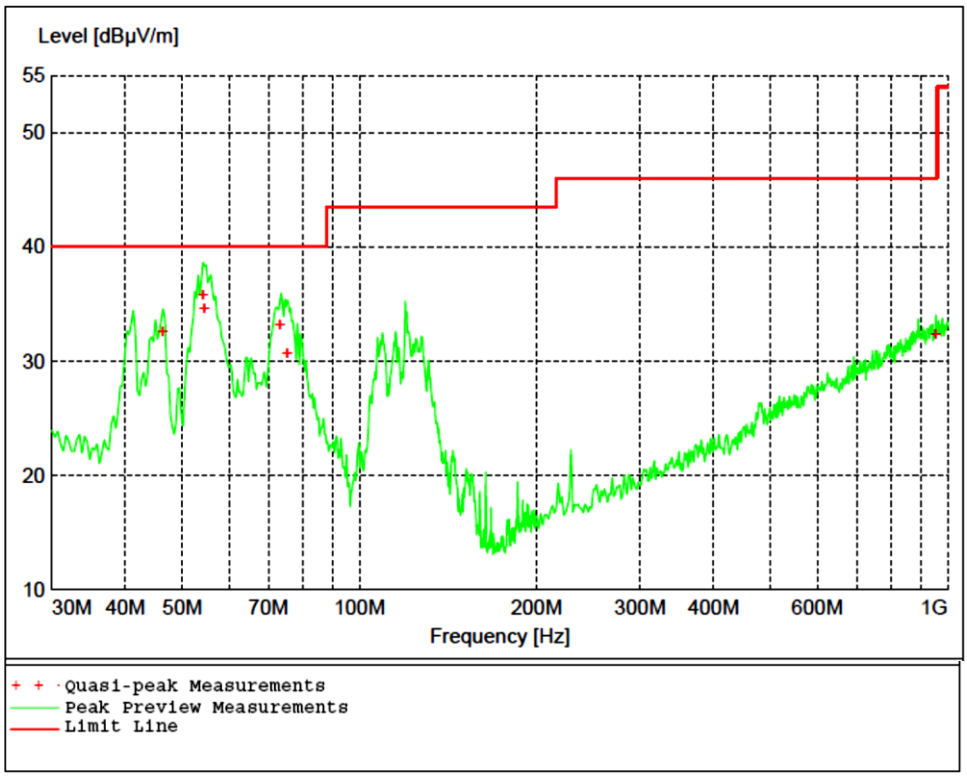


Figure 5 - Radiated Emissions Plot, Low Channel, (g) mode

Note:
The preview scan was run in 802.11(g) mode only. The same frequencies, antenna heights and EUT angles were maximized for 802.11(b) mode.

Table 3 - Radiated Emissions Quasi-peak Measurements, Low Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.260000	32.54	40.00	7.50	98	256	VERT
54.240000	35.79	40.00	4.20	99	82	VERT
54.540000	34.58	40.00	5.40	114	63	VERT
73.320000	33.15	40.00	6.90	100	270	VERT
75.360000	30.67	40.00	9.30	101	76	VERT
954.180000	32.29	46.00	13.70	145	155	VERT

Table 4 - Radiated Emissions Average Measurements, Low Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	73.57	NA	NA	183	57	VERT
4816.400000	22.78	54.00	31.22	109	100	VERT
7253.000000	24.57	54.00	29.43	99	343	HORI
9654.600000	27.11	54.00	26.89	396	114	VERT
12054.000000	24.11	54.00	29.89	146	0	HORI
14483.000000	29.50	54.00	24.50	160	253	HORI
16859.600000	32.76	54.00	21.24	119	195	HORI

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 5 - Radiated Emissions Peak Measurements, Low Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	93.57	NA	NA	183	57	VERT
4816.400000	42.78	74.00	31.22	109	100	VERT
7253.000000	44.57	74.00	29.43	99	343	HORI
9654.600000	47.11	74.00	26.89	396	114	VERT
12054.000000	44.11	74.00	29.89	146	0	HORI
14483.000000	49.50	74.00	24.50	160	253	HORI
16859.600000	52.76	74.00	21.24	119	195	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 6 - Radiated Emissions Quasi-peak Measurements, Low Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.260000	32.28	40.00	7.72	46.26	32.40	40.00
54.240000	35.78	40.00	4.22	54.24	34.97	40.00
54.540000	34.41	40.00	5.59	54.54	33.01	40.00
73.320000	32.87	40.00	7.13	73.32	33.07	40.00
75.360000	30.24	40.00	9.76	75.36	29.34	40.00
954.180000	32.06	46.00	13.94	954.18	31.89	46.00

Table 7 - Radiated Emissions Average Measurements, Low Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	75.16	NA	NA	183	57	VERT
4816.400000	21.56	54.00	32.44	109	100	VERT
7253.000000	21.56	54.00	32.44	99	343	HORI
9654.600000	22.93	54.00	31.07	396	114	VERT
12054.000000	26.01	54.00	27.99	146	0	HORI
14483.000000	23.04	54.00	30.96	160	253	HORI
16859.600000	29.39	54.00	24.61	119	195	HORI

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 8 - Radiated Emissions Peak Measurements, Low Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	95.16	NA	NA	183	57	VERT
4816.400000	41.56	74.00	32.44	109	100	VERT
7253.000000	42.93	74.00	31.07	99	343	HORI
9654.600000	46.01	74.00	27.99	396	114	VERT
12054.000000	43.04	74.00	30.96	146	0	HORI
14483.000000	49.39	74.00	24.61	160	253	HORI
16859.600000	52.56	74.00	21.44	119	195	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 9 - Radiated Emissions Quasi-peak Measurements, Low Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.260000	32.54	40.00	7.46	46.26	32.40	40.00
54.240000	38.51	40.00	1.49	54.24	34.97	40.00
54.540000	36.73	40.00	3.27	54.54	33.01	40.00
73.320000	31.36	40.00	8.64	73.32	33.07	40.00
75.360000	28.02	40.00	11.98	75.36	29.34	40.00
954.180000	31.29	46.00	14.71	954.18	31.89	46.00

Table 10 - Radiated Emissions Average Measurements, Low Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	73.80	NA	NA	183	57	VERT
4816.400000	23.77	54.00	30.23	109	100	VERT
7253.000000	24.89	54.00	29.11	99	343	HORI
9654.600000	29.31	54.00	24.69	396	114	VERT
12054.000000	26.58	54.00	27.42	146	0	HORI
14483.000000	30.76	54.00	23.24	160	253	HORI
16859.600000	33.30	54.00	20.70	119	195	HORI

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 11 - Radiated Emissions Peak Measurements, Low Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2412.000000	93.80	NA	NA	183	57	VERT
4816.400000	43.77	74.00	30.23	109	100	VERT
7253.000000	44.89	74.00	29.11	99	343	HORI
9654.600000	49.31	74.00	24.69	396	114	VERT
12054.000000	46.58	74.00	27.42	146	0	HORI
14483.000000	50.76	74.00	23.24	160	253	HORI
16859.600000	53.30	74.00	20.70	119	195	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

EUT MODULE	GoIDit	MODE	Continuous Transmit, Mid Channel
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

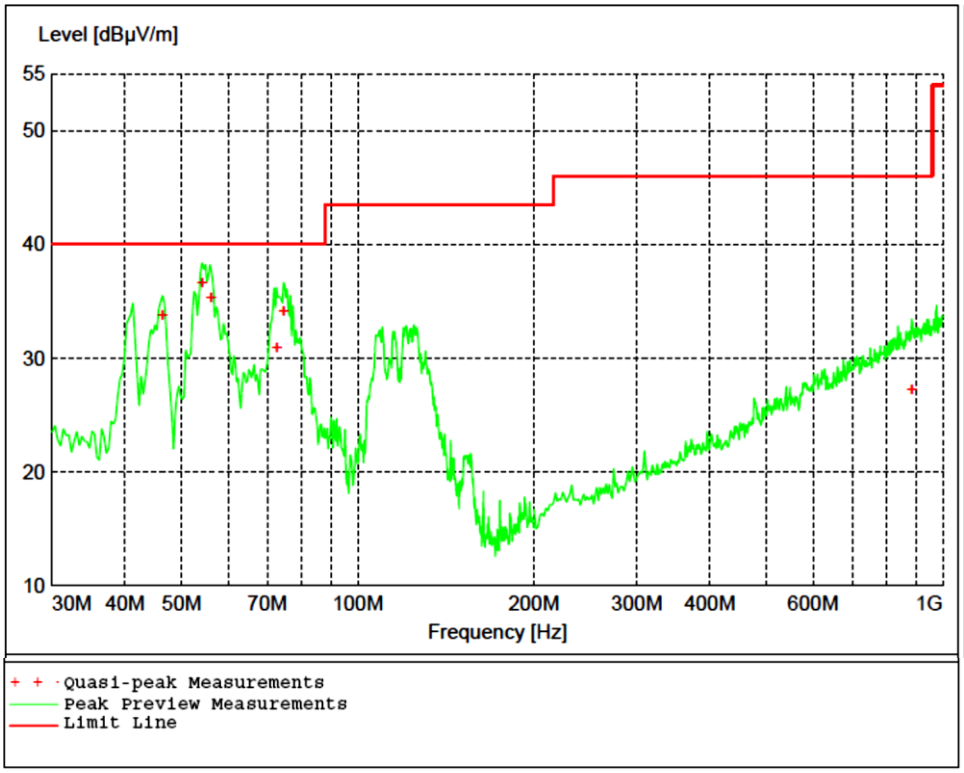


Figure 6 - Radiated Emissions Plot, Mid Channel, (g) mode

Note:
The preview scan was run in 802.11(g) mode only. The same frequencies, antenna heights and EUT angles were maximized for 802.11(b) mode.

Table 12 - Radiated Emissions Quasi-peak Measurements, Mid Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.380000	33.82	40.00	6.20	99	248	VERT
54.180000	36.57	40.00	3.40	100	9	VERT
56.160000	35.25	40.00	4.80	100	0	VERT
72.720000	30.93	40.00	9.10	170	341	VERT
74.760000	34.13	40.00	5.90	171	44	VERT
885.840000	27.17	46.00	18.80	247	245	HORI

Table 13 - Radiated Emissions Average Measurements, Mid Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	79.54	NA	NA	372	36	HORI
4888.600000	23.12	54.00	30.88	293	236	VERT
7306.200000	24.02	54.00	29.98	359	94	VERT
9743.200000	27.02	54.00	26.98	283	95	VERT
12174.800000	23.26	54.00	30.74	106	230	VERT
14630.400000	31.74	54.00	22.26	200	343	HORI
17081.400000	34.10	54.00	19.90	398	349	VERT

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 14 - Radiated Emissions Peak Measurements, Mid Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	99.54	NA	NA	372	36	HORI
4888.600000	43.12	74.00	30.88	293	236	VERT
7306.200000	44.02	74.00	29.98	359	94	VERT
9743.200000	47.02	74.00	26.98	283	95	VERT
12174.800000	43.26	74.00	30.74	106	230	VERT
14630.400000	51.74	74.00	22.26	200	343	HORI
17081.400000	54.10	74.00	19.90	398	349	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 15 - Radiated Emissions Quasi-peak Measurements, Mid Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.380000	33.46	40.00	6.54	99	248	VERT
54.180000	36.36	40.00	3.64	100	9	VERT
56.160000	34.99	40.00	5.01	100	0	VERT
72.720000	30.56	40.00	9.44	170	341	VERT
74.760000	34.11	40.00	5.89	171	44	VERT
885.840000	26.95	46.00	19.05	247	245	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 16 - Radiated Emissions Average Measurements, Mid Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	80.89	NA	NA	372	36	HORI
4888.600000	22.17	54.00	31.83	293	236	VERT
7306.200000	23.13	54.00	30.87	359	94	VERT
9743.200000	26.55	54.00	27.45	283	95	VERT
12174.800000	22.13	54.00	31.87	106	230	VERT
14630.400000	30.48	54.00	23.52	200	343	HORI
17081.400000	32.38	54.00	21.62	398	349	VERT

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 17 - Radiated Emissions Peak Measurements, Mid Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	100.89	NA	NA	372	36	HORI
4888.600000	42.17	74.00	31.83	293	236	VERT
7306.200000	43.13	74.00	30.87	359	94	VERT
9743.200000	46.55	74.00	27.45	283	95	VERT
12174.800000	42.13	74.00	31.87	106	230	VERT
14630.400000	50.48	74.00	23.52	200	343	HORI
17081.400000	52.38	74.00	21.62	398	349	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 18 - Radiated Emissions Quasi-peak Measurements, Mid Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.380000	34.07	40.00	5.93	99	248	VERT
54.180000	36.88	40.00	3.12	100	9	VERT
56.160000	35.92	40.00	4.08	100	0	VERT
72.720000	33.04	40.00	6.96	170	341	VERT
74.760000	35.64	40.00	4.36	171	44	VERT
885.840000	27.09	46.00	18.91	247	245	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 19 - Radiated Emissions Average Measurements, Mid Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	78.68	NA	NA	372	36	HORI
4888.600000	22.93	54.00	31.07	293	236	VERT
7306.200000	23.47	54.00	30.53	359	94	VERT
9743.200000	26.32	54.00	27.68	283	95	VERT
12174.800000	22.99	54.00	31.01	106	230	VERT
14630.400000	31.62	54.00	22.38	200	343	HORI
17081.400000	33.56	54.00	20.44	398	349	VERT

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 20 - Radiated Emissions Peak Measurements, Mid Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2437.000000	98.68	NA	NA	372	36	HORI
4888.600000	42.93	74.00	31.07	293	236	VERT
7306.200000	43.47	74.00	30.53	359	94	VERT
9743.200000	46.32	74.00	27.68	283	95	VERT
12174.800000	42.99	74.00	31.01	106	230	VERT
14630.400000	51.62	74.00	22.38	200	343	HORI
17081.400000	53.56	74.00	20.44	398	349	VERT

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value.
5. Results from vertical position were higher than the horizontal position, so vertical results are shown

EUT MODULE	GoIDit	MODE	Continuous Transmit, High Channel
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

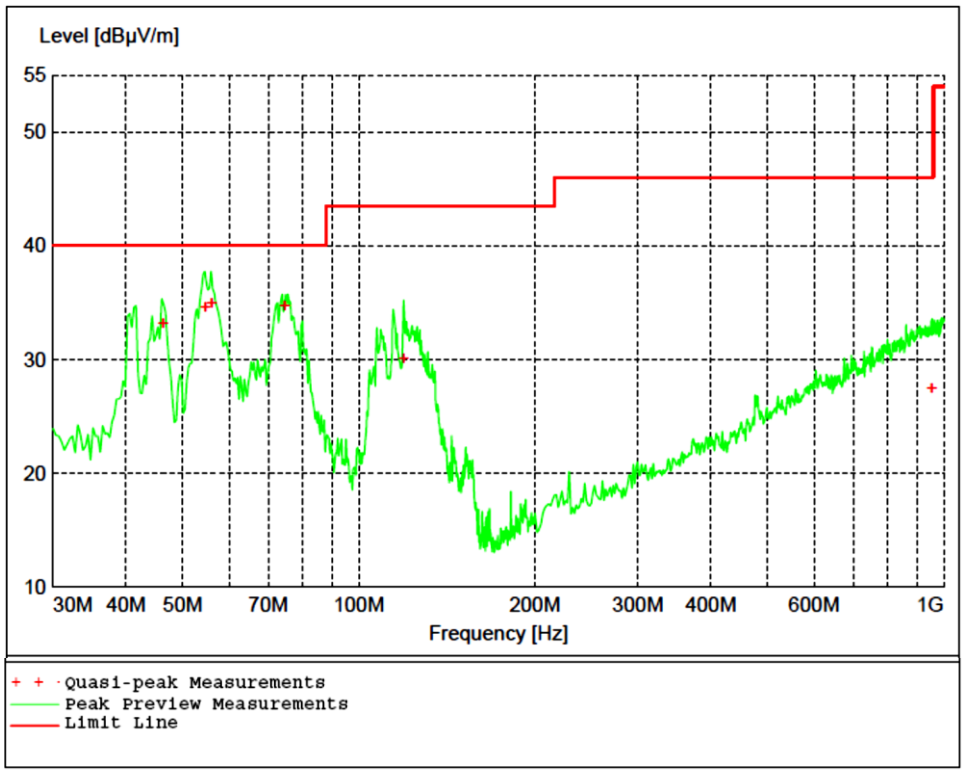


Figure 7 - Radiated Emissions Plot, High Channel, (g) mode

Note:
The preview scan was run in 802.11(g) mode only. The same frequencies, antenna heights and EUT angles were maximized for 802.11(b) mode.

Table 21 - Radiated Emissions Quasi-peak Measurements, High Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.320000	33.22	40.00	6.80	98	53	VERT
54.660000	34.64	40.00	5.40	100	97	VERT
56.040000	34.98	40.00	5.00	112	128	VERT
74.760000	34.68	40.00	5.30	101	42	VERT
119.340000	30.04	43.50	13.50	99	354	VERT
954.240000	27.47	46.00	18.50	129	119	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 22 - Radiated Emissions Average Measurements, High Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	80.93	NA	NA	398	236	HORI
4919.800000	22.99	54.00	31.01	100	18	VERT
7384.600000	24.81	54.00	29.19	324	86	HORI
9861.600000	27.21	54.00	26.79	105	68	VERT
12306.400000	23.00	54.00	31.00	341	211	VERT
14774.600000	29.83	54.00	24.17	399	199	VERT
17251.800000	33.98	54.00	20.02	126	263	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 23 - Radiated Emissions Peak Measurements, High Channel, (g) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	100.93	NA	NA	398	236	HORI
4919.800000	42.99	74.00	31.01	100	18	VERT
7384.600000	44.81	74.00	29.19	324	86	HORI
9861.600000	47.21	74.00	26.79	105	68	VERT
12306.400000	43.00	74.00	31.00	341	211	VERT
14774.600000	49.83	74.00	24.17	399	199	VERT
17251.800000	53.98	74.00	20.02	126	263	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.
4. Margin value = Emission level – Limit value

Table 24 - Radiated Emissions Quasi-peak Measurements, High Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.320000	32.85	40.00	7.15	98	53	VERT
54.660000	34.63	40.00	5.37	100	97	VERT
56.040000	34.62	40.00	5.38	112	128	VERT
74.760000	34.51	40.00	5.49	101	42	VERT
119.340000	29.62	43.50	13.88	99	354	VERT
954.240000	27.21	46.00	18.79	129	119	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 25 - Radiated Emissions Average Measurements, High Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	78.96	NA	NA	398	236	HORI
4919.800000	21.69	54.00	32.31	100	18	VERT
7384.600000	24.08	54.00	29.92	324	86	HORI
9861.600000	26.88	54.00	27.12	105	68	VERT
12306.400000	22.79	54.00	31.21	341	211	VERT
14774.600000	29.38	54.00	24.62	399	199	VERT
17251.800000	32.09	54.00	21.91	126	263	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 26 - Radiated Emissions Peak Measurements, High Channel, (b) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	98.96	NA	NA	398	236	HORI
4919.800000	41.69	74.00	32.31	100	18	VERT
7384.600000	44.08	74.00	29.92	324	86	HORI
9861.600000	46.88	74.00	27.12	105	68	VERT
12306.400000	42.79	74.00	31.21	341	211	VERT
14774.600000	49.38	74.00	24.62	399	199	VERT
17251.800000	52.09	74.00	21.91	126	263	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.

Table 27 - Radiated Emissions Quasi-peak Measurements, High Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
46.320000	34.93	40.00	5.07	98	53	VERT
54.660000	37.06	40.00	2.94	100	97	VERT
56.040000	36.55	40.00	3.45	112	128	VERT
74.760000	37.20	40.00	2.80	101	42	VERT
119.340000	29.34	43.50	14.16	99	354	VERT
954.240000	28.13	46.00	17.87	129	119	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Table 28 - Radiated Emissions Average Measurements, High Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	78.38	NA	NA	398	236	HORI
4919.800000	21.47	54.00	12.53	100	18	VERT
7384.600000	23.69	54.00	10.31	324	86	HORI
9861.600000	25.07	54.00	8.93	105	68	VERT
12306.400000	23.13	54.00	10.87	341	211	VERT
14774.600000	28.1	54.00	5.90	399	199	VERT
17251.800000	31.07	54.00	2.93	126	263	HORI

Results from vertical position were higher than the horizontal position, so vertical results are shown

Note: Average measurements are calculated by taking the peak measurements and applying the averaging factor based on the measured duty cycle in Figure 2.

Table 29 - Radiated Emissions Peak Measurements, High Channel, (n) mode

Frequency	Level	Limit	Margin	Height	Angle	Pol
MHz	dBµV/m	dBµV/m	dB	cm.	deg.	
2462.000000	98.38	NA	NA	398	236	HORI
4919.800000	41.47	74.00	32.53	100	18	VERT
7384.600000	43.69	74.00	30.31	324	86	HORI
9861.600000	45.07	74.00	28.93	105	68	VERT
12306.400000	43.13	74.00	30.87	341	211	VERT
14774.600000	48.10	74.00	25.90	399	199	VERT
17251.800000	51.07	74.00	22.93	126	263	HORI

REMARKS:
1. Emission level (dBuV/m) = Raw Value (dBuV) + Correction Factor (dB)
2. Correction Factor (dB/m) = Antenna Factor (dB/m) + Cable Factor (dB)
3. The other emission levels were very low against the limit.

4.3 Bandwidth

Test Method: ANSI C63.10, Section(s) 6.9, 11.8.1 (Option 1)

4.3.1 Limits of bandwidth measurements

The 6dB bandwidth of the signal must be greater than 500 kHz

4.3.2 Test procedures

6dB Bandwidth:

The transmitter output was connected to the spectrum analyzer directly. The bandwidth of the fundamental frequency was measured by spectrum analyzer with **100 kHz RBW and 300 kHz VBW**. The 6 dB bandwidth is defined as the bandwidth of which is higher than peak power minus 6dB. A peak detector was used in max hold trace mode. The sweep was set to **auto-couple**.

4.3.3 Deviations from test standard

No deviation.

4.3.4 Test setup

See Section 4.2.4

4.3.5 EUT operating conditions

The EUT was powered by 12 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.3.6 Test results

EUT MODULE	GoIDit	MODE	Continuous Transmit
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri, NJohnson

CHANNEL	Operating Mode	CHANNEL FREQUENCY (MHz)	6dB BW (MHz)	6dB Limit Min (kHz)	RESULT
Low	802.11(b)	2412	9.61	500.00	PASS
Middle	802.11(b)	2437	9.23	500.00	PASS
High	802.11(b)	2462	9.61	500.00	PASS
Low	802.11(g)	2412	16.62	500.00	PASS
Middle	802.11(g)	2437	16.20	500.00	PASS
High	802.11(g)	2462	17.88	500.00	PASS
Low	802.11(n)	2412	17.74	500.00	PASS
Middle	802.11(n)	2437	16.41	500.00	PASS
High	802.11(n)	2462	17.58	500.00	PASS

REMARKS:
None

REMARKS:
None

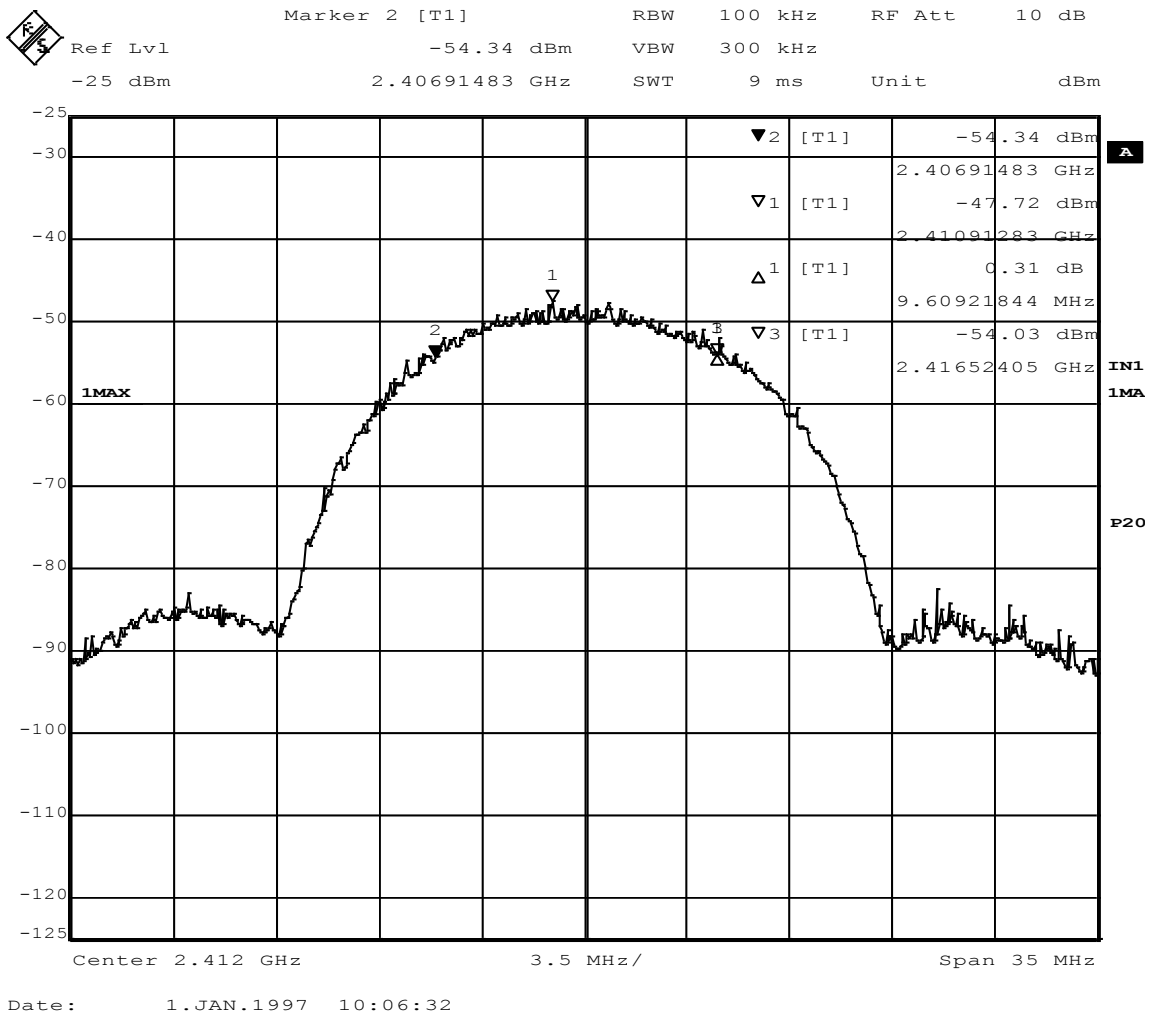


Figure 8 - 6dB Bandwidth, Low Channel, 802.11(b)

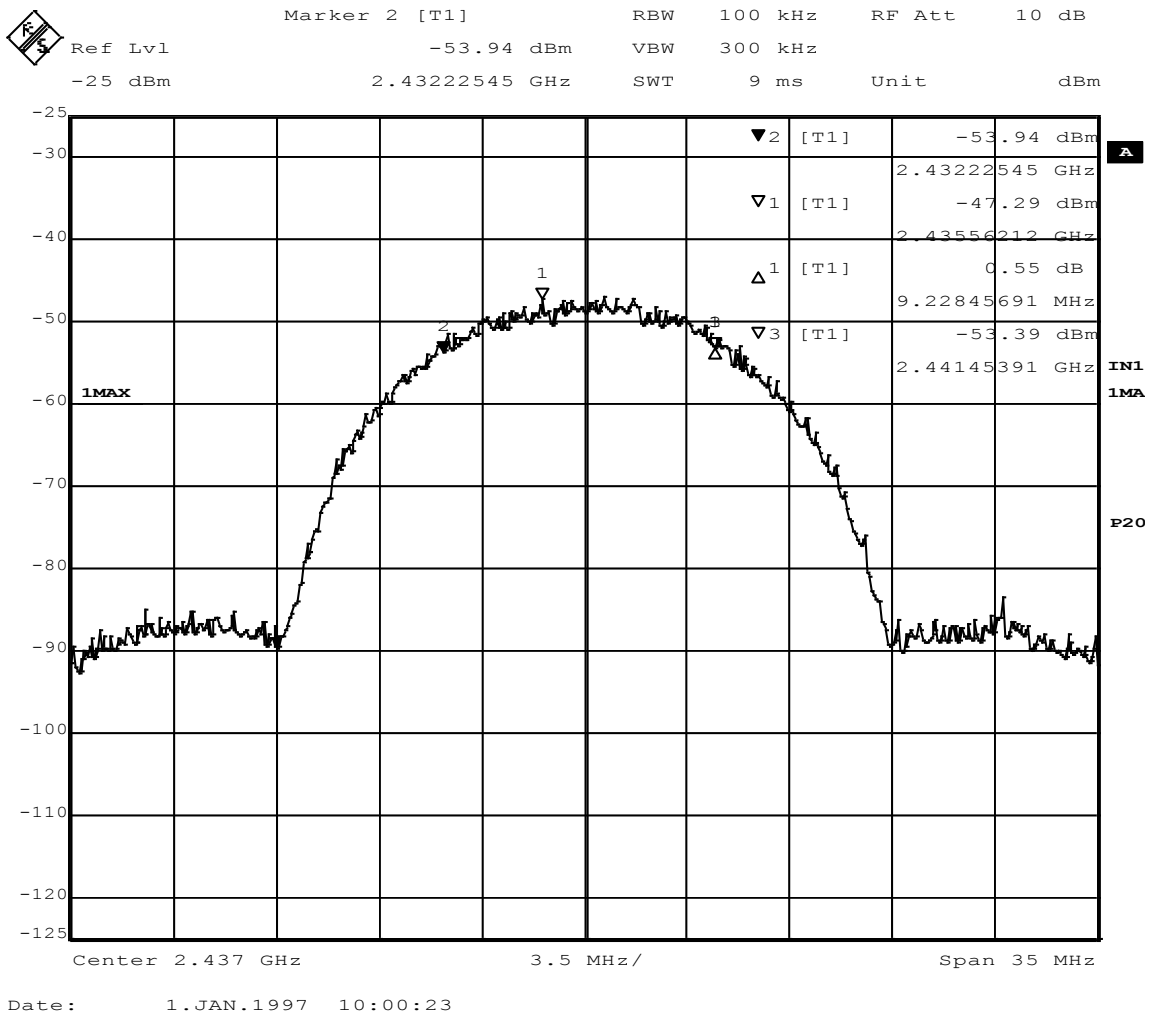


Figure 9 - 6dB Bandwidth, Middle Channel, 802.11(b)

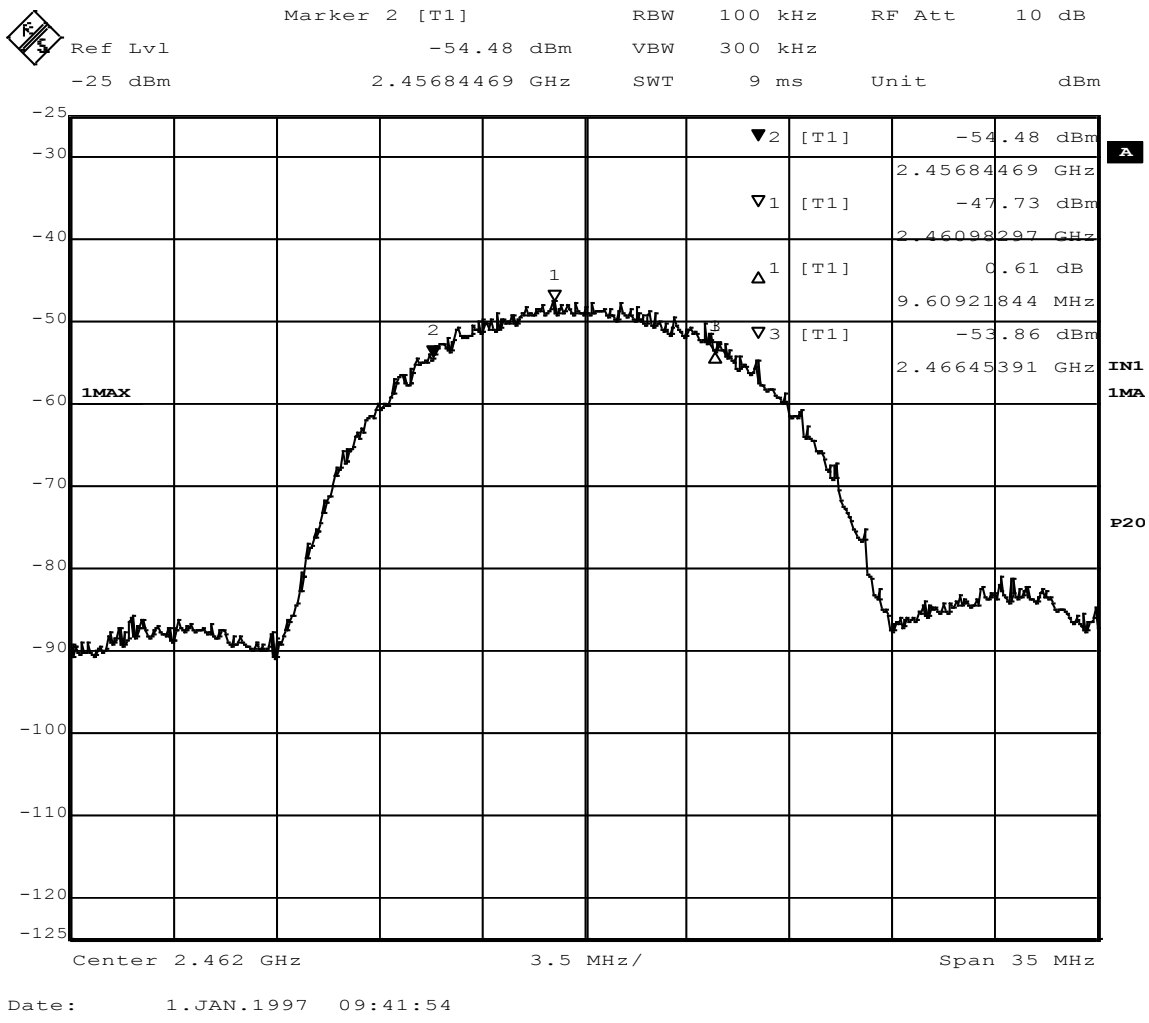


Figure 10 - 6dB Bandwidth, High Channel, 802.11(b)

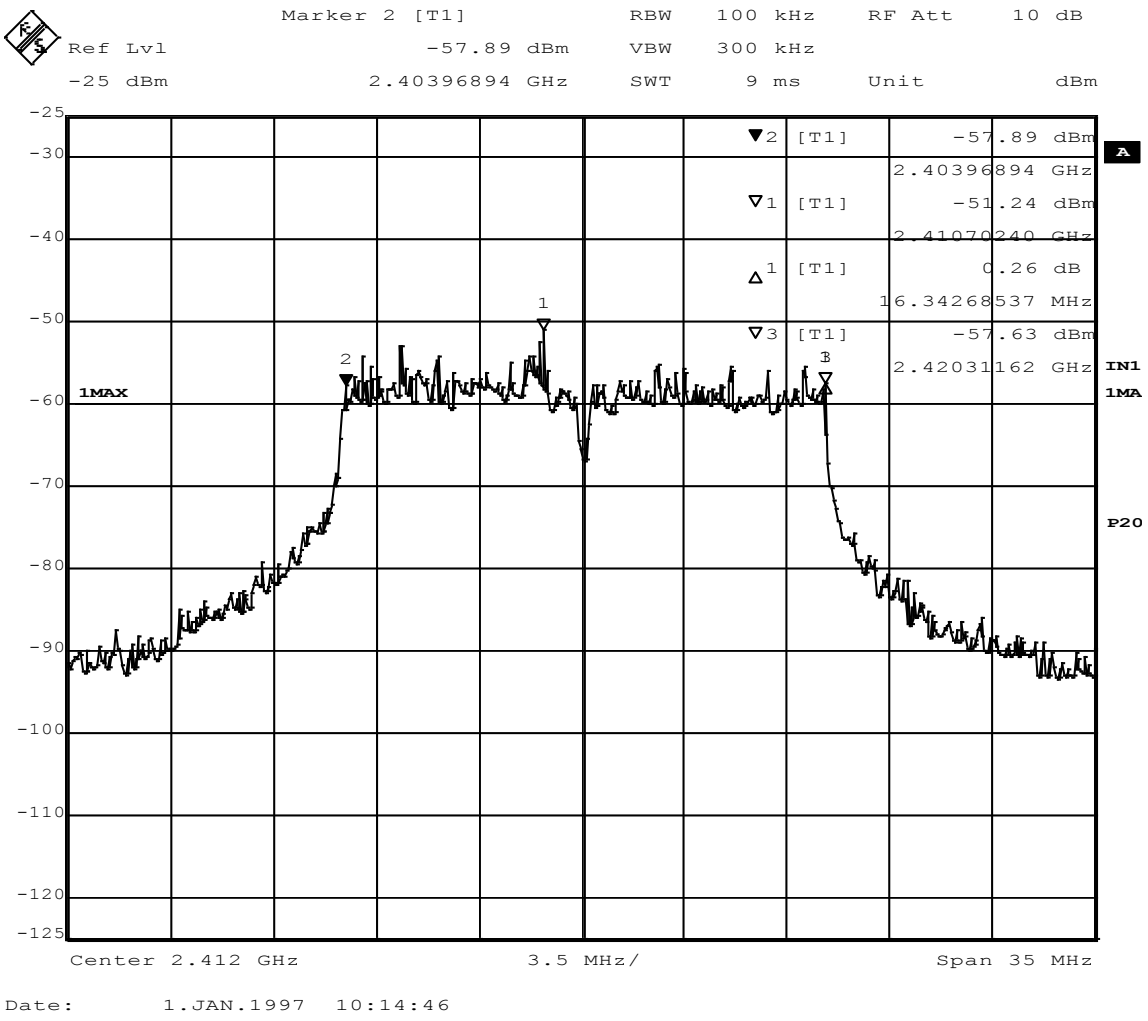


Figure 11 - 6dB Bandwidth, Low Channel, 802.11(g)

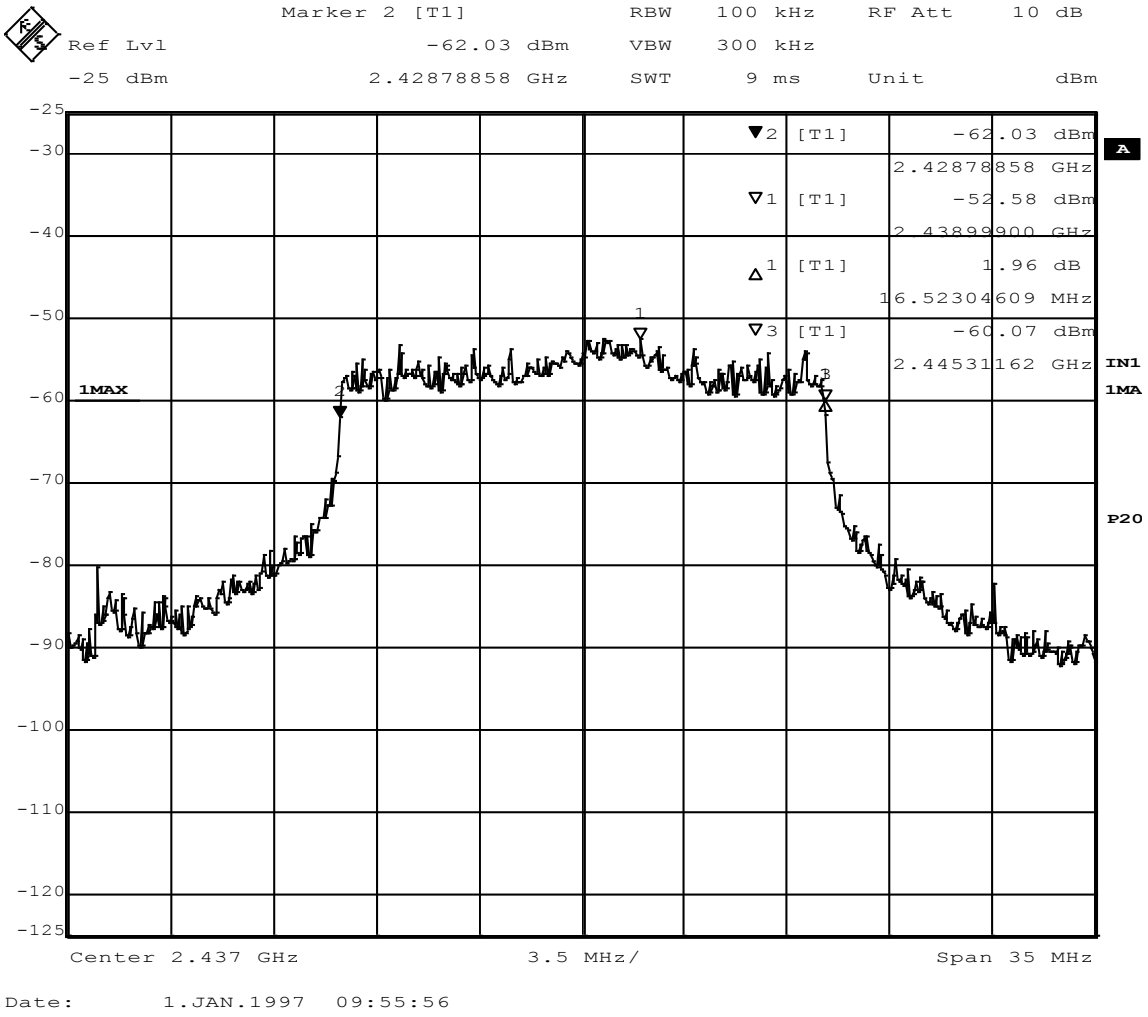


Figure 12 - 6dB Bandwidth, Middle Channel, 802.11(b)

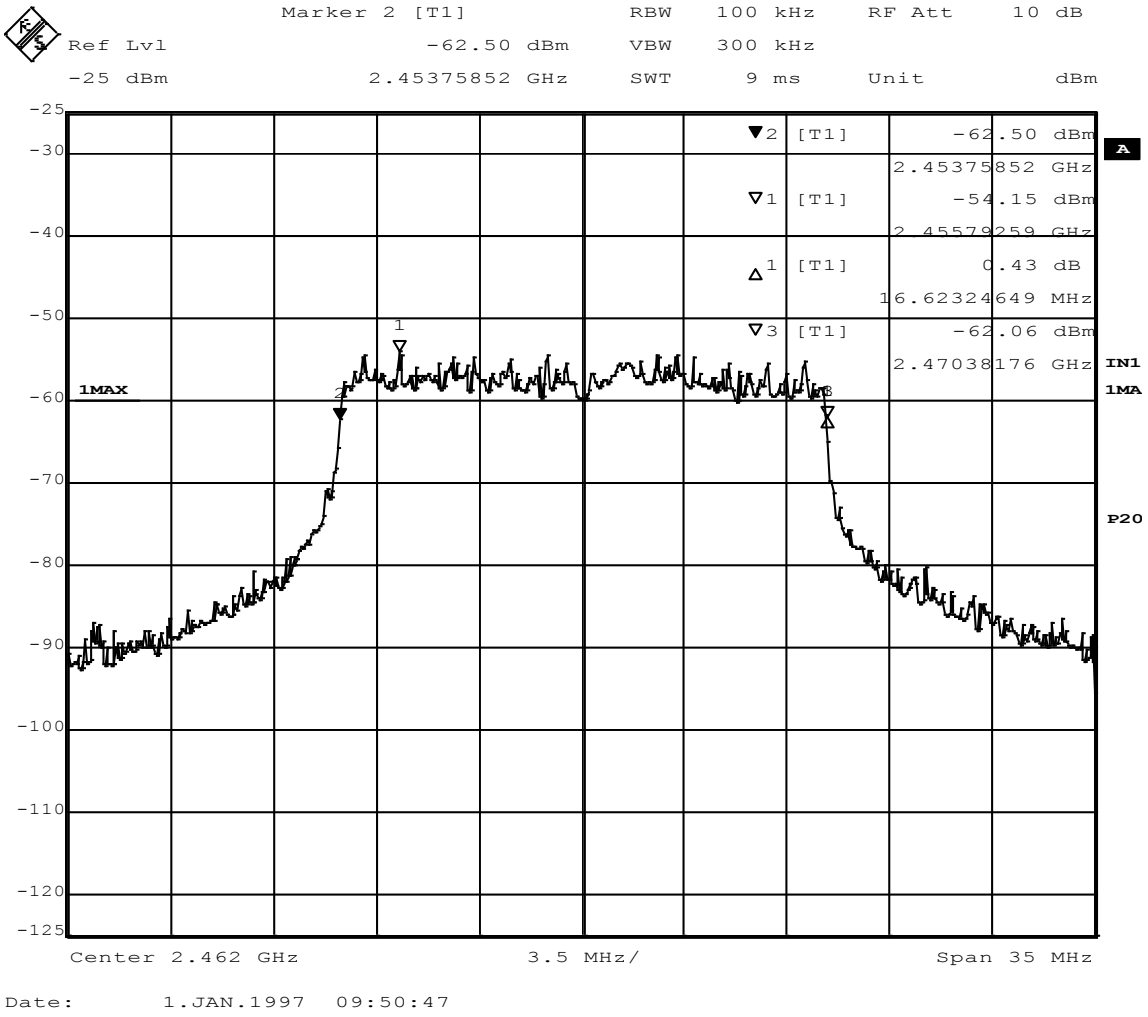


Figure 13 - 6dB Bandwidth, High Channel, 802.11(g)

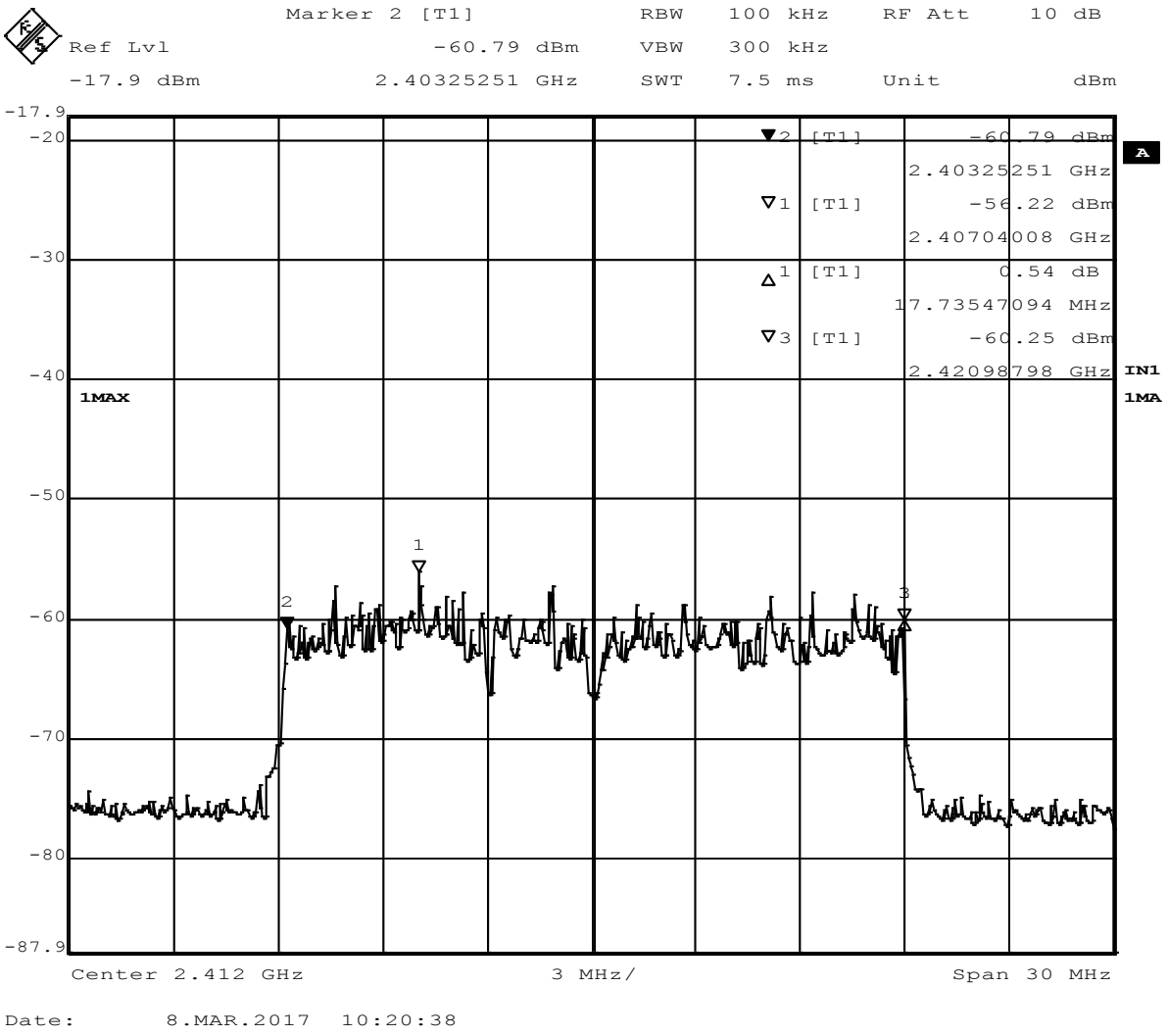


Figure 14 - 6dB Bandwidth, Low Channel, 802.11(n)

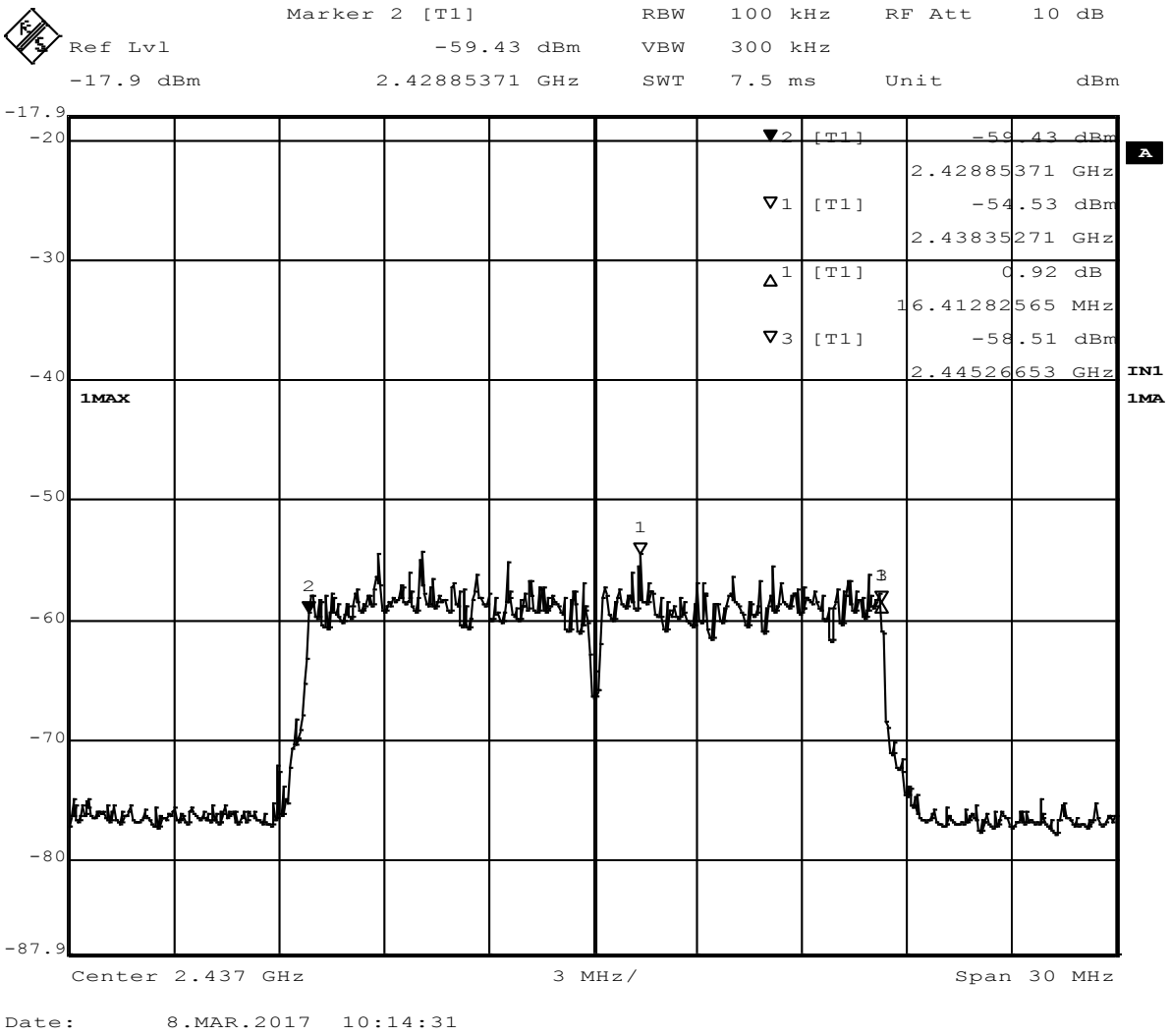


Figure 15 - 6dB Bandwidth, Mid Channel, 802.11(n)

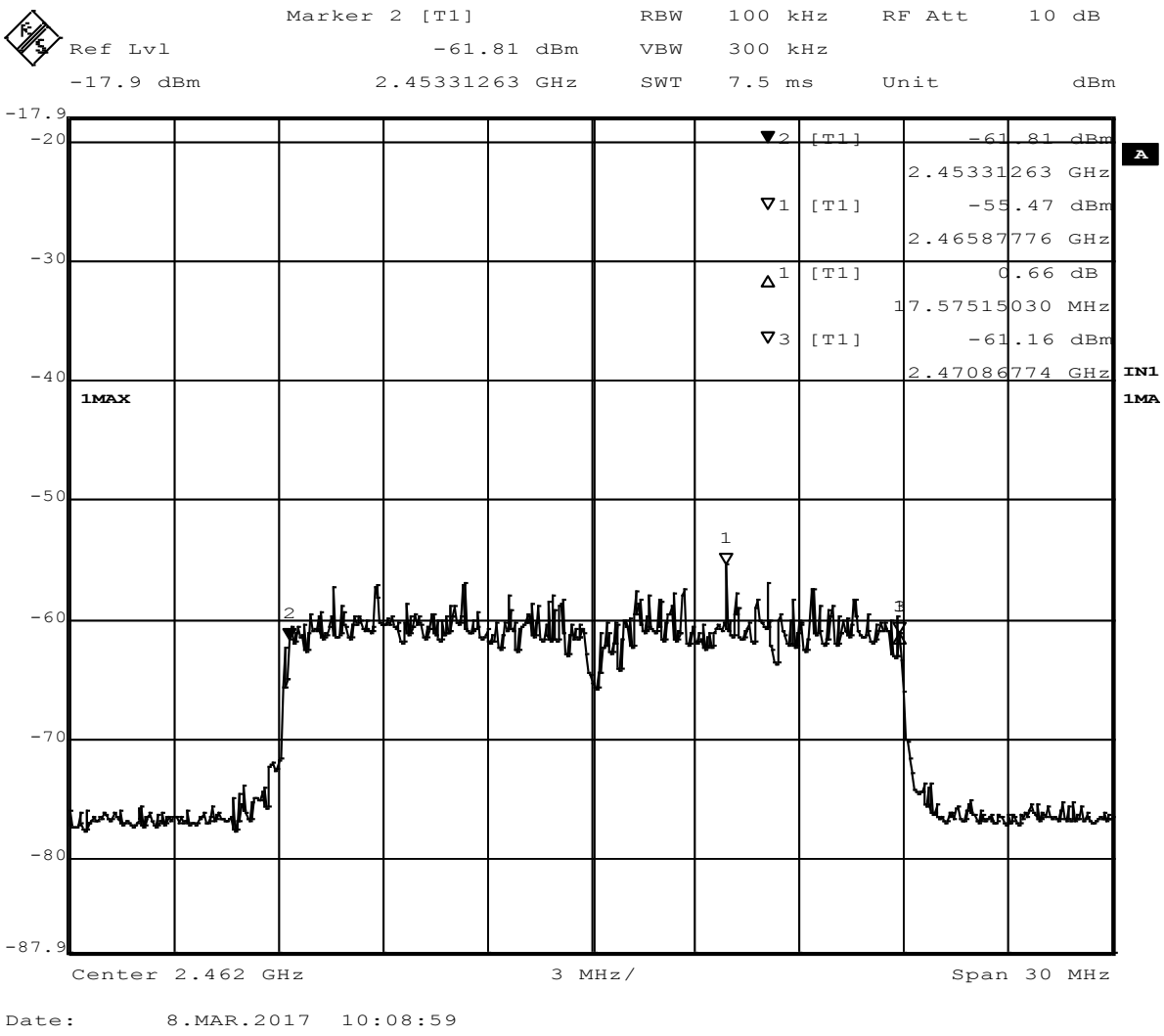


Figure 16 - 6dB Bandwidth, High Channel, 802.11(n)

4.4 Peak power output power

Test Method: ANSI C63.10,
Section(s) 6.7, 11.9.1.2 (Integrated band power method)

4.4.1 Limits of power measurements

The maximum peak output power allowed is 30dBm

4.4.2 Test procedures

All measurements were taken at a distance of 3m from the EUT. The bandwidth of the fundamental frequency was measured by spectrum analyzer with VBW of 10 MHz and RBW as specified in the table in Section 4.4.6.

4.4.3 Deviations from test standard

No deviation.

4.4.4 Test setup

See Section 4.2.4

4.4.5 EUT operating conditions

See Section 2.6

4.4.5 EUT operating conditions

The EUT was powered by 12 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.4.6 Test results

EUT MODULE	GoIDit	MODE	Continuous Transmit
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

Table 30 – Power Measurements

CHANNEL	CHANNEL FREQUENCY (MHz)	Spectrum Analyzer Reading (dBm)	Antenna Factor (dB)	Cable Loss (dB)	3m Field Stregnth (dBuV/m)	EIRP (dBm)	PEAK POWER LIMIT (dBm)	MODE
Low	2412	-36.04	28.8	7.7	107.46	12.23	30	802.11(b)
Middle	2437	-34.91	28.8	7.7	108.59	13.36	30	802.11(b)
High	2462	-34.91	28.8	7.7	108.59	13.36	30	802.11(b)
Low	2412	-37.05	28.8	7.7	106.45	11.22	30	802.11(g)
Middle	2437	-37.65	28.8	7.7	105.85	10.62	30	802.11(g)
High	2462	-38.83	28.8	7.7	104.67	9.44	30	802.11(g)
Low	2412	-37.05	28.8	7.7	106.45	11.22	30	802.11(n)
Middle	2437	-37.29	28.8	7.7	106.21	10.98	30	802.11(n)
High	2462	-38.64	28.8	7.7	104.86	9.63	30	802.11(n)

Bandwidth correction formula:

Peak Power with BW correction = Spectrum Analyzer Reading + Antenna Factor + Cable Loss + 107 – 95.23 (convert 3m FS to EIRP) + 20log([SA BW] / [6dB BW]).

REMARKS:
None

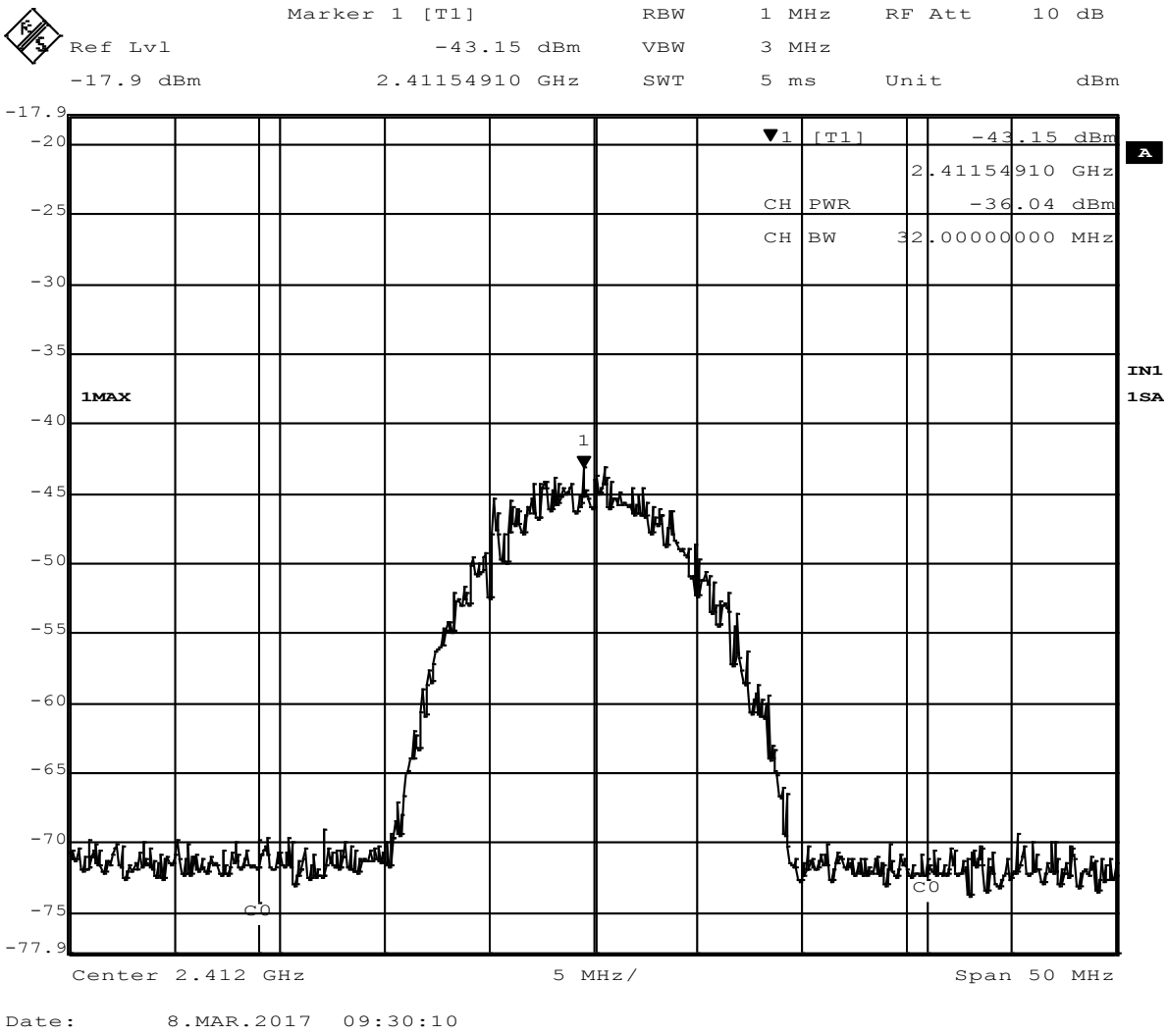


Figure 17 - Low channel, peak output power, 802.11(b) mode

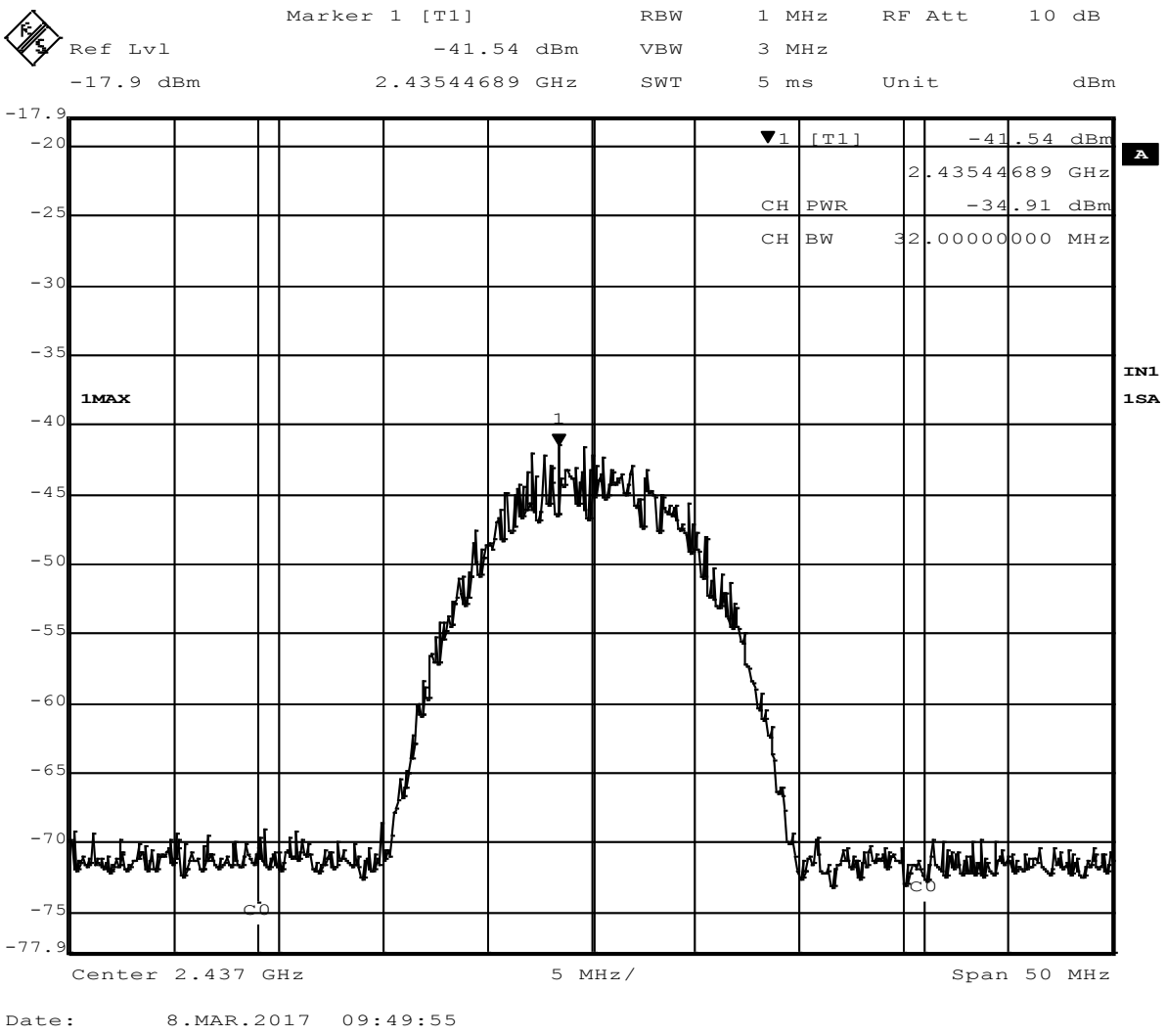


Figure 18 - Middle channel, peak output power, 802.11(b) mode

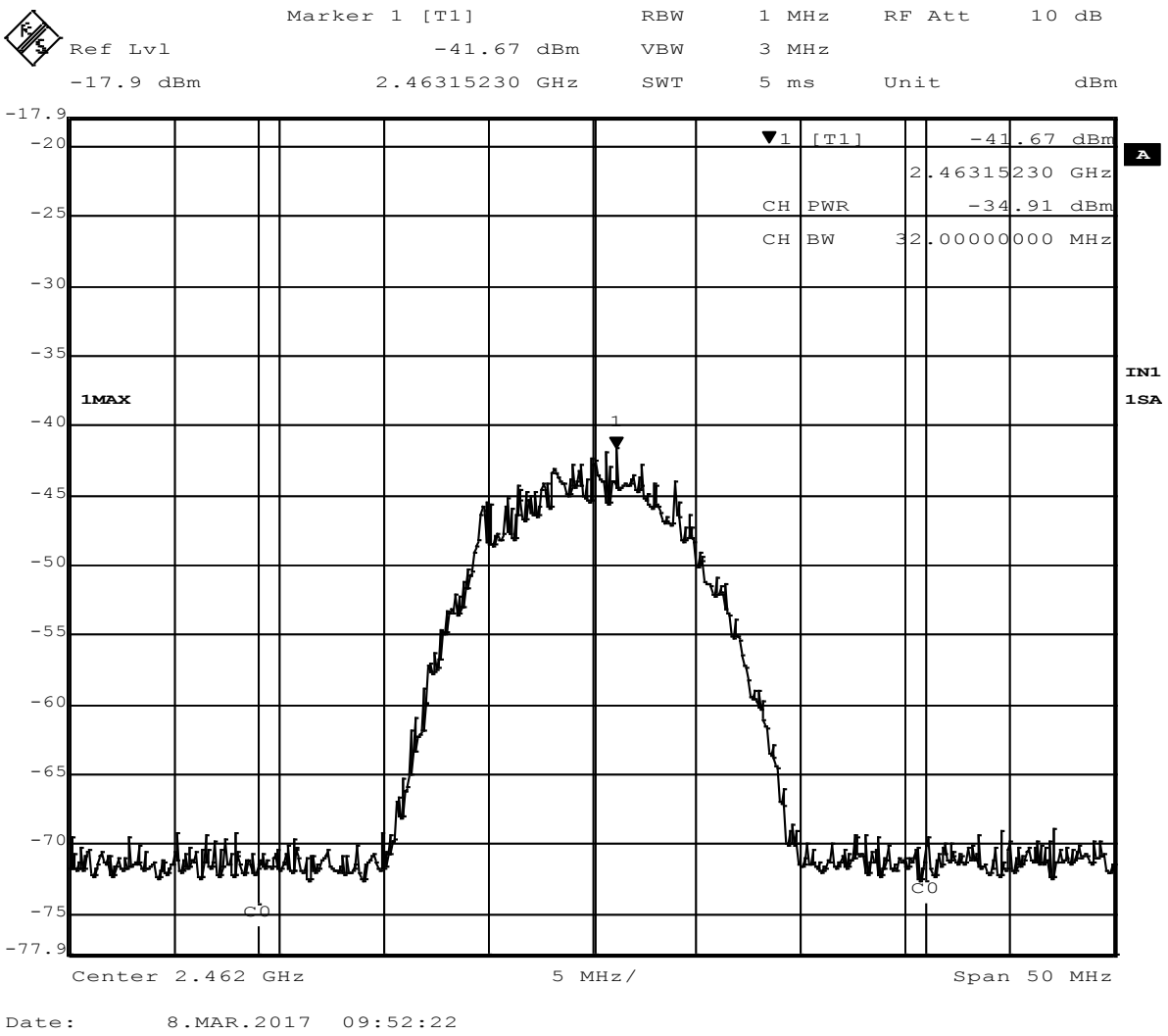


Figure 19 - High channel, peak output power, 802.11(b) mode

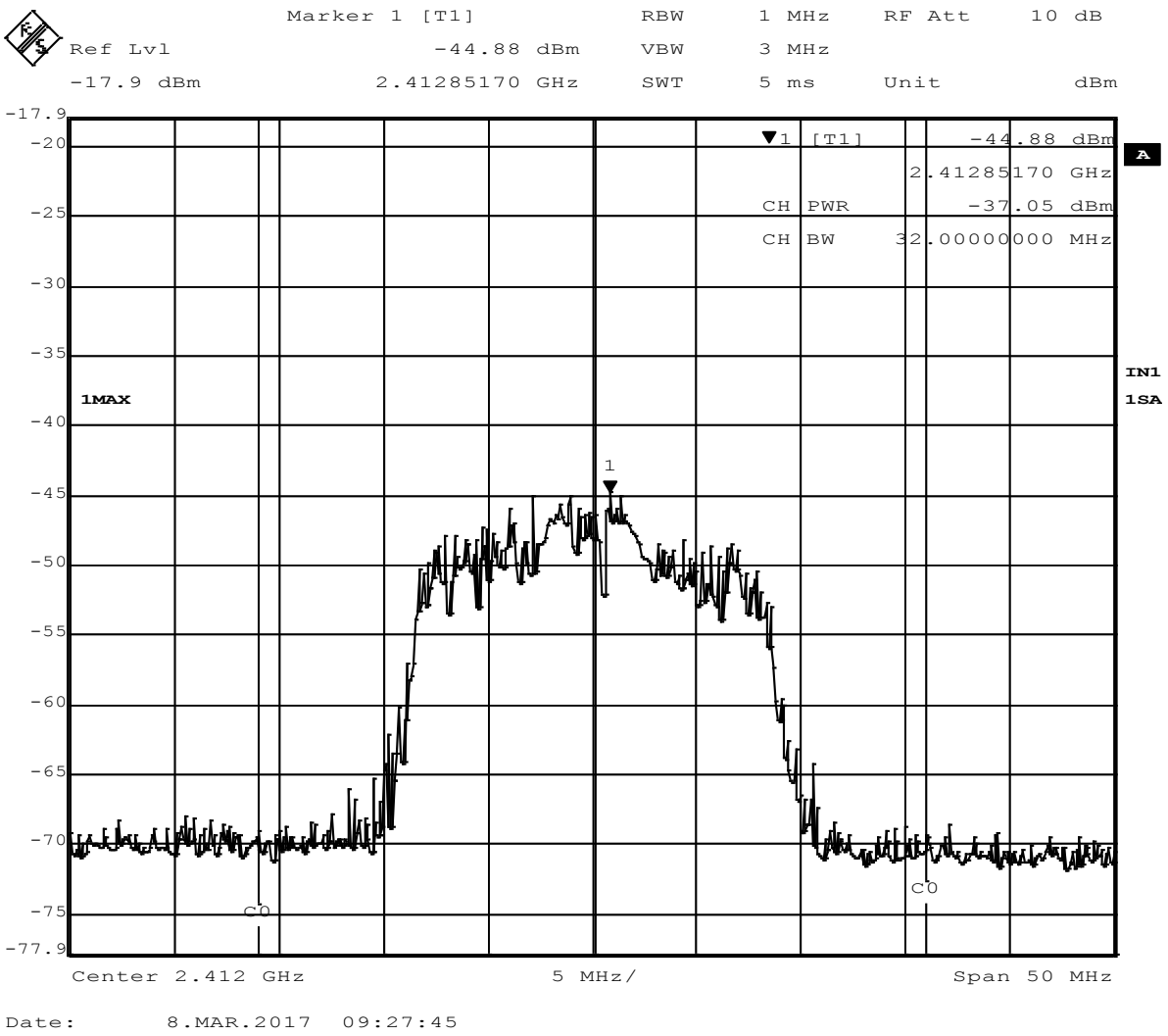


Figure 20 - Low channel, peak output power, 802.11(g) mode

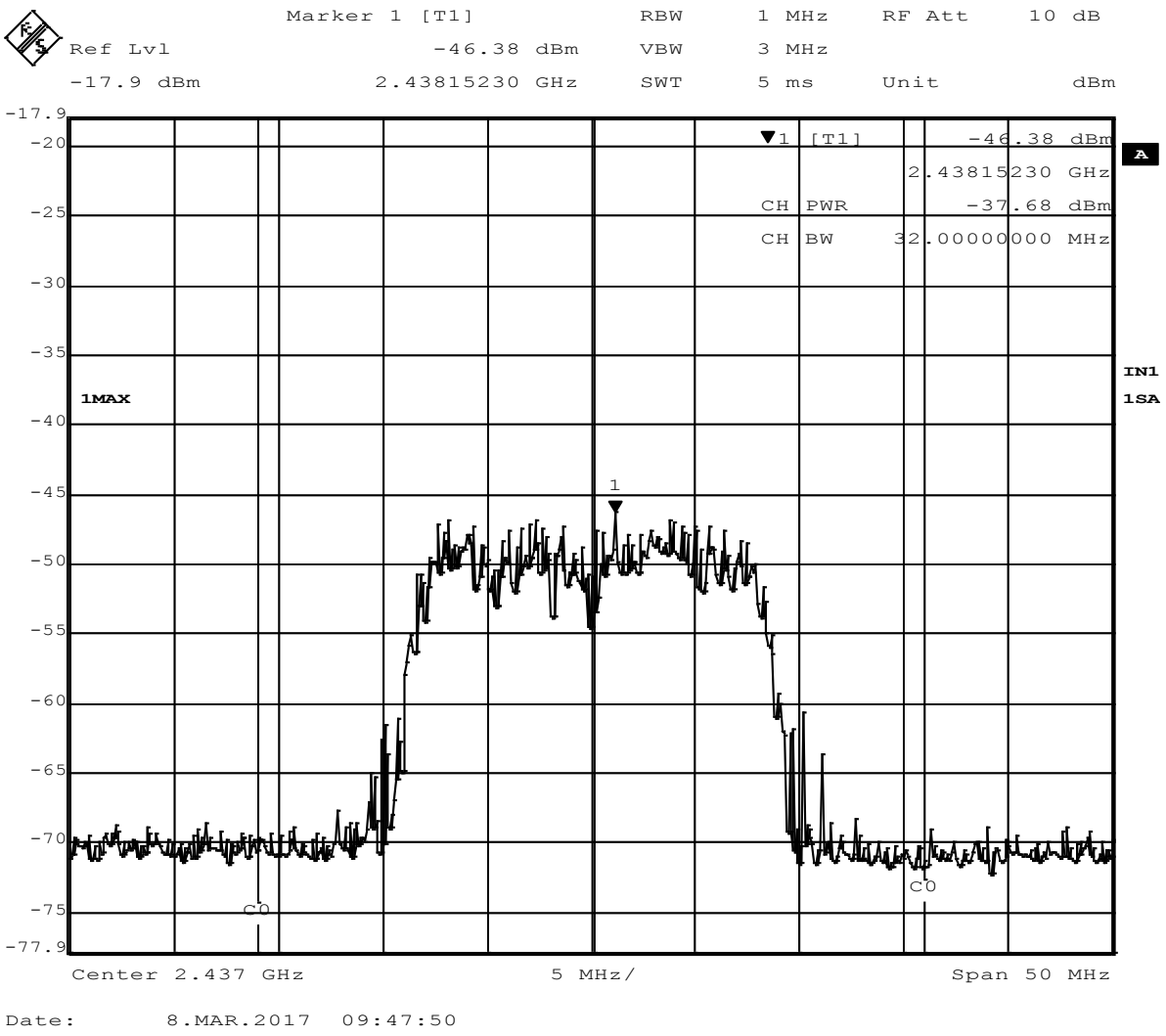


Figure 21 - Middle channel, peak output power, 802.11(g) mode

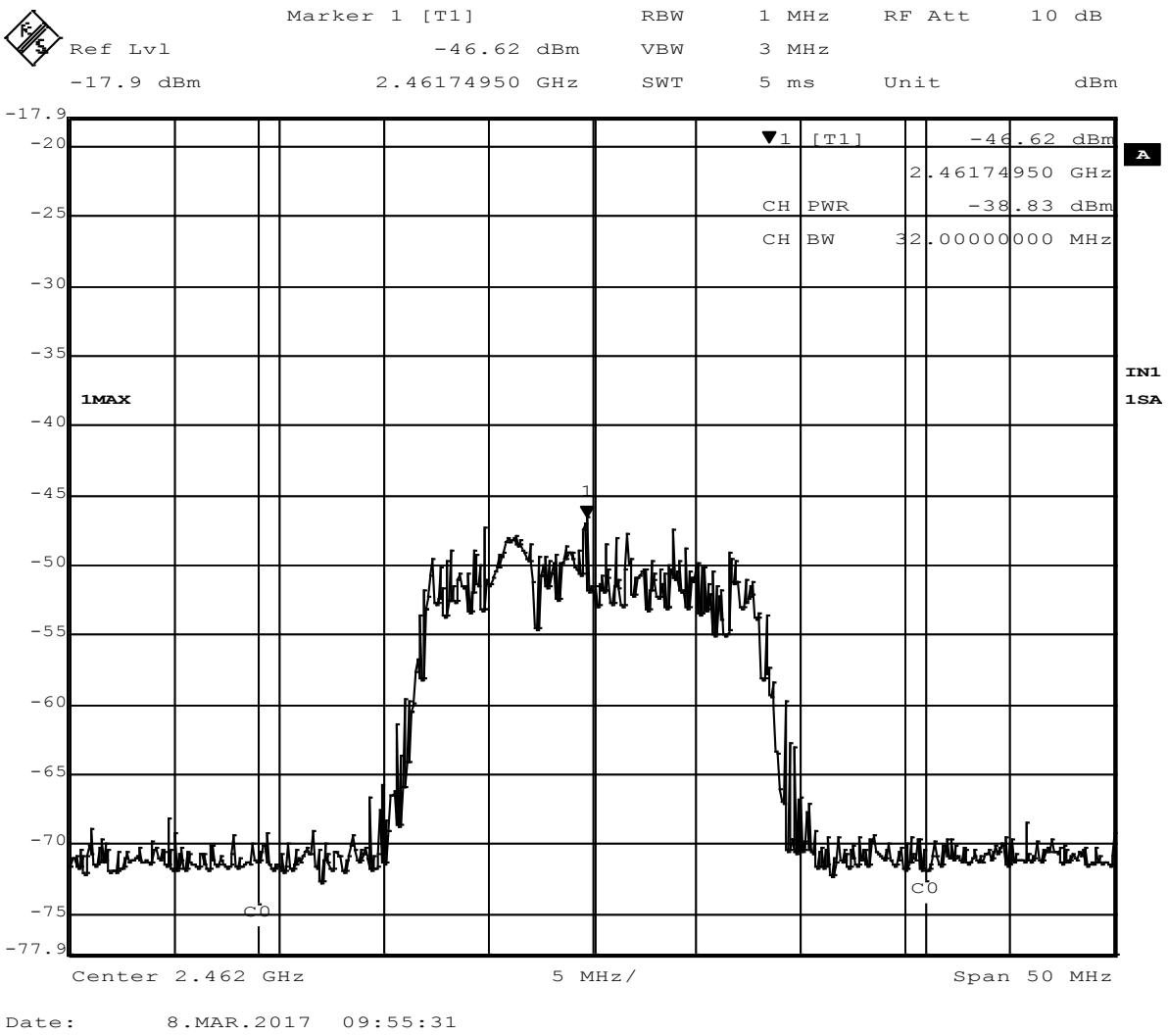


Figure 22 - High channel, peak output power, 802.11(g) mode

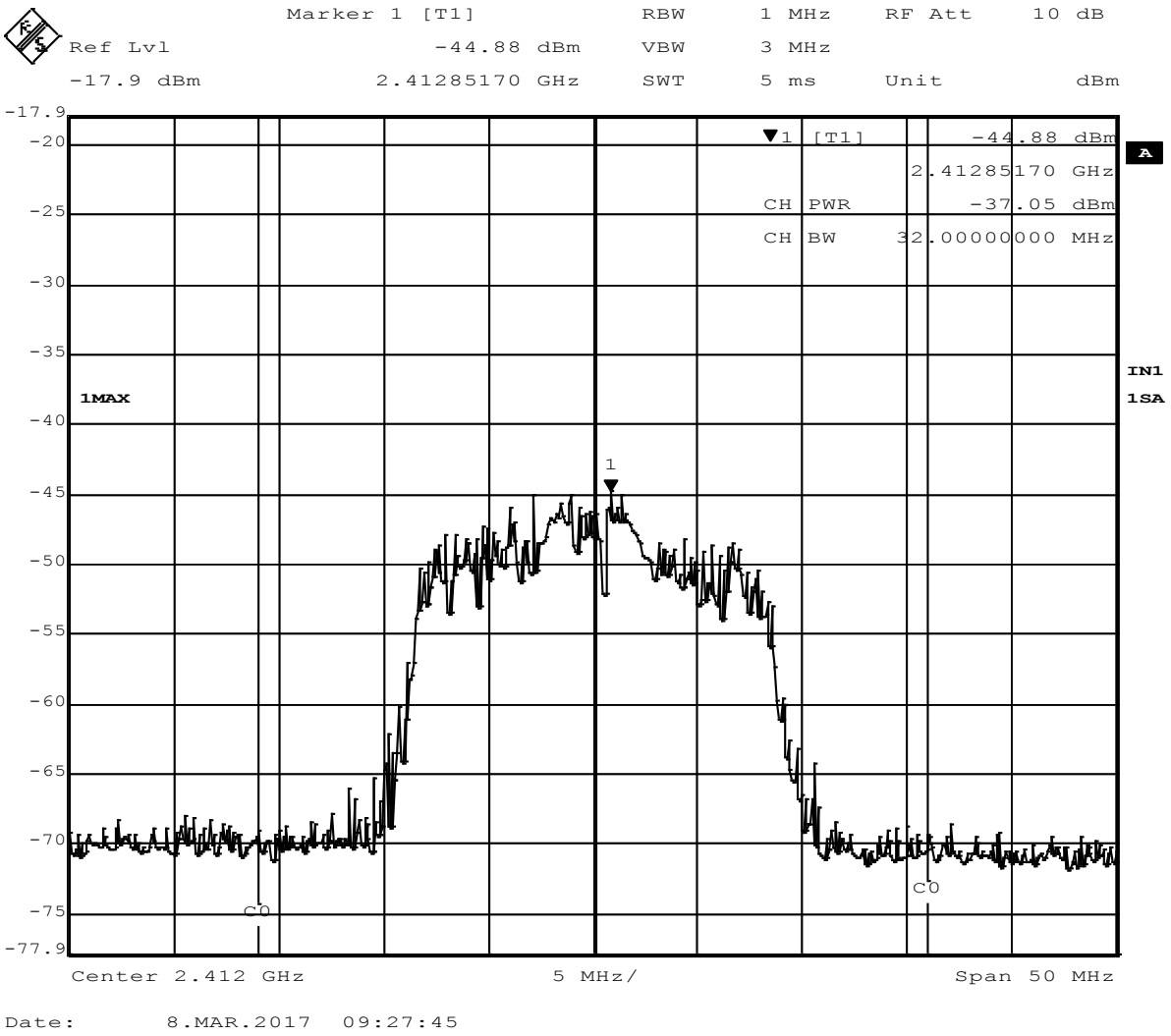


Figure 23 - Low channel, peak output power, 802.11(n) mode

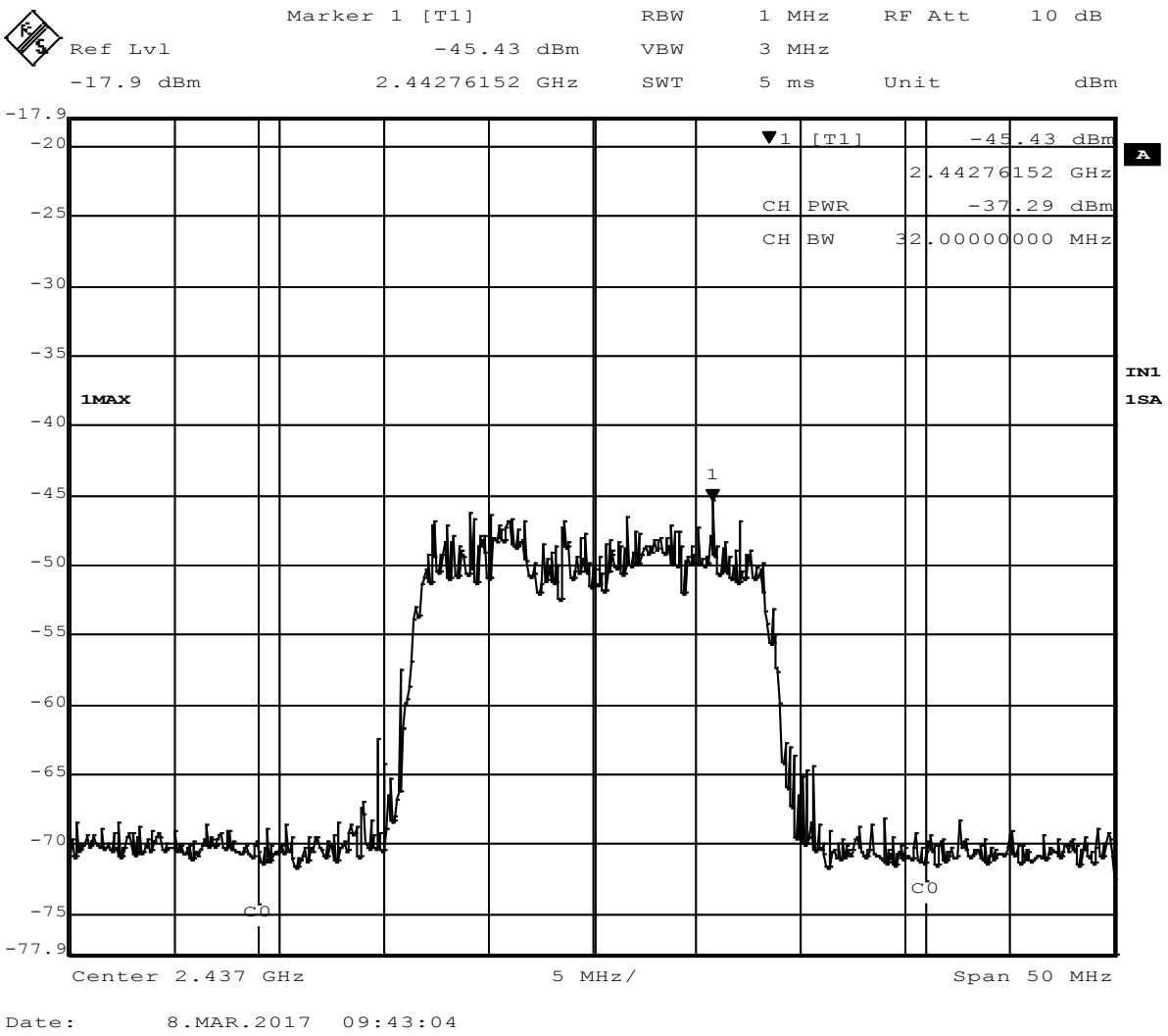


Figure 24 - Mid channel, peak output power, 802.11(n) mode

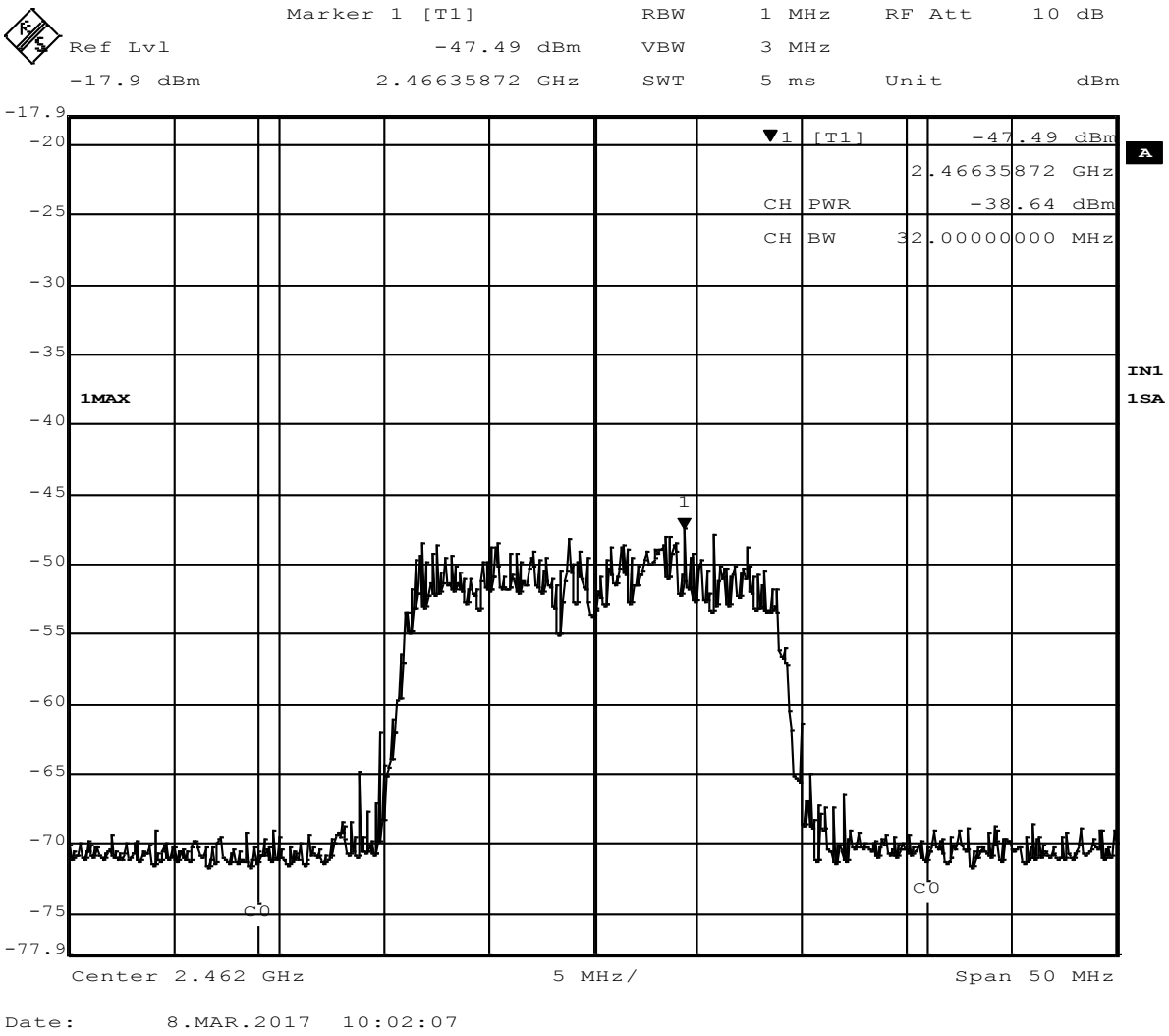


Figure 25 - High channel, peak output power, 802.11(n) mode

4.5 Band edges

Test Method: ANSI C63.10, Section(s) 6.10.5.2, 11.13

4.5.1 Limits of band edge measurements

For emissions outside of the allowed band of operation (2400.0MHz – 2483.5MHz), the emission level needs to be 20dB under the maximum fundamental field strength. However, if the emissions fall within one of the restricted bands from 15.205 the field strength levels need to be under that of the limits in 15.209.

4.5.2 Test procedures

The EUT was tested in the same method as described in section *4.3 - Bandwidth*. The EUT was oriented as to produce the maximum emission levels. The resolution bandwidth was set to 30 kHz and the EMI receiver was used to scan from the bandedge to the fundamental frequency with a peak detector. The highest emissions level beyond the bandedge was measured and recorded. If the out of band emissions do not fall within a restricted band from 15.205, then it is required that the out of band emission be 20dB below that of the fundamental emission level. If the out of band emission falls with a restricted band from 15.205, then it is required that the emission be below the limits from 15.209.

4.5.3 Deviations from test standard

No deviation.

4.5.4 Test setup

See Section 4.4

4.5.5 EUT operating conditions

The EUT was powered by a 12 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

4.5.6 Test results

EUT MODULE	GoIDit	MODE	Continuous Transmit
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

Highest Out of Band Emissions

CHANNEL	Band edge /Measurement Frequency (MHz)	Highest out of band level dBm	Fundamental Level (dBm)	Delta	Min (dBc)	Result
1	2360.0	-103.59	-56.77	46.82	19.57*	PASS
3	2483.5	-103.79	-64.34	39.45	26.93*	PASS

Results from vertical position were higher than the horizontal position, so vertical results are shown

Highest In-Band Emissions

CHANNEL	Band edge /Measurement Frequency (MHz)	Highest in-band level dBm	Fundamental Level (dBm)	Delta	Min (dBc)	Result
1	2400.0	-84.46	-56.77	27.69	20.0	PASS
3	2483.5	-86.43	-59.58	26.85	20.0	PASS

Results from vertical position were higher than the horizontal position, so vertical results are shown

*Minimum delta = [highest fundamental peak field strength from Section 4.2] – [Part 15.209 radiated emissions limit.]

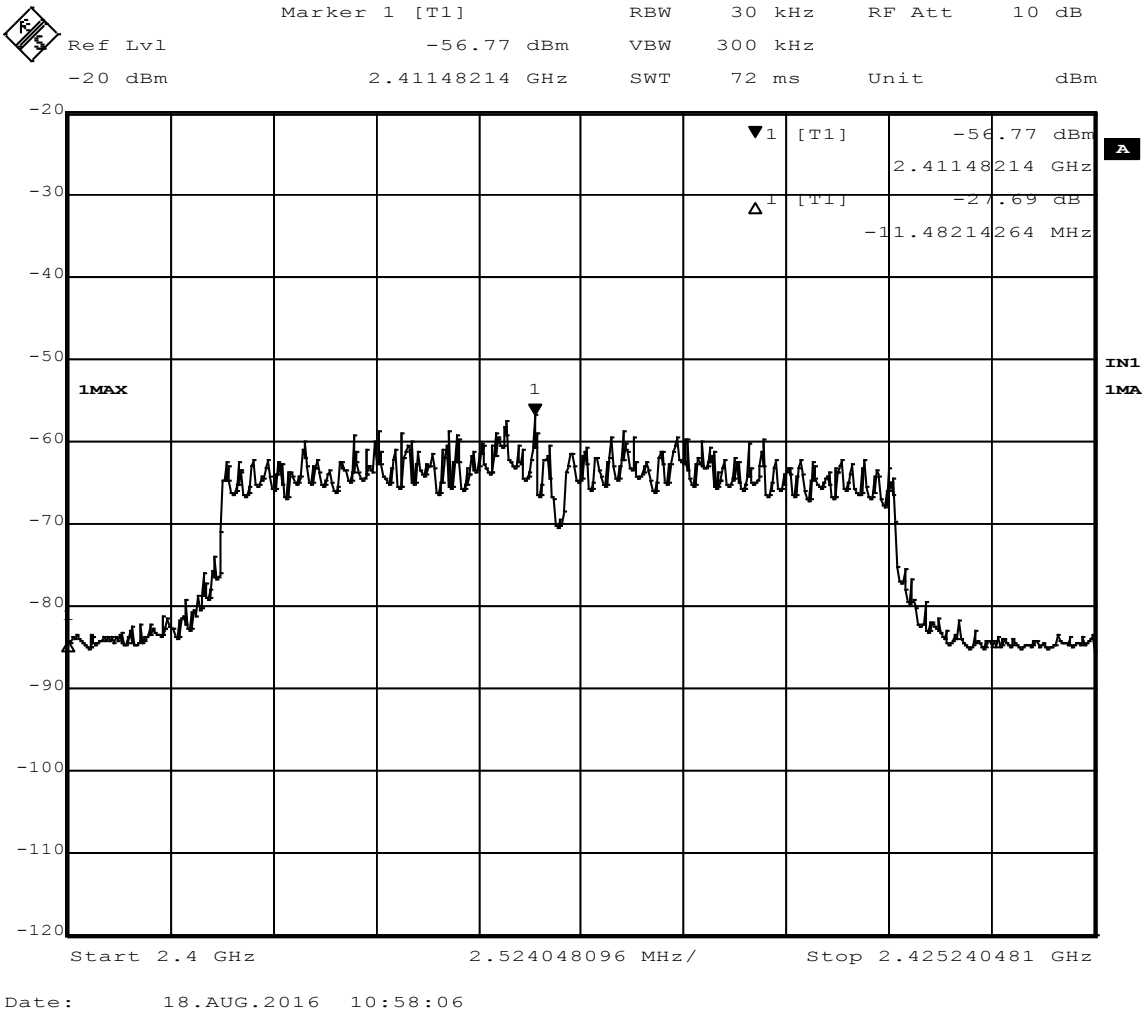


Figure 26 - Band-edge Measurement, Low Channel, In-Band

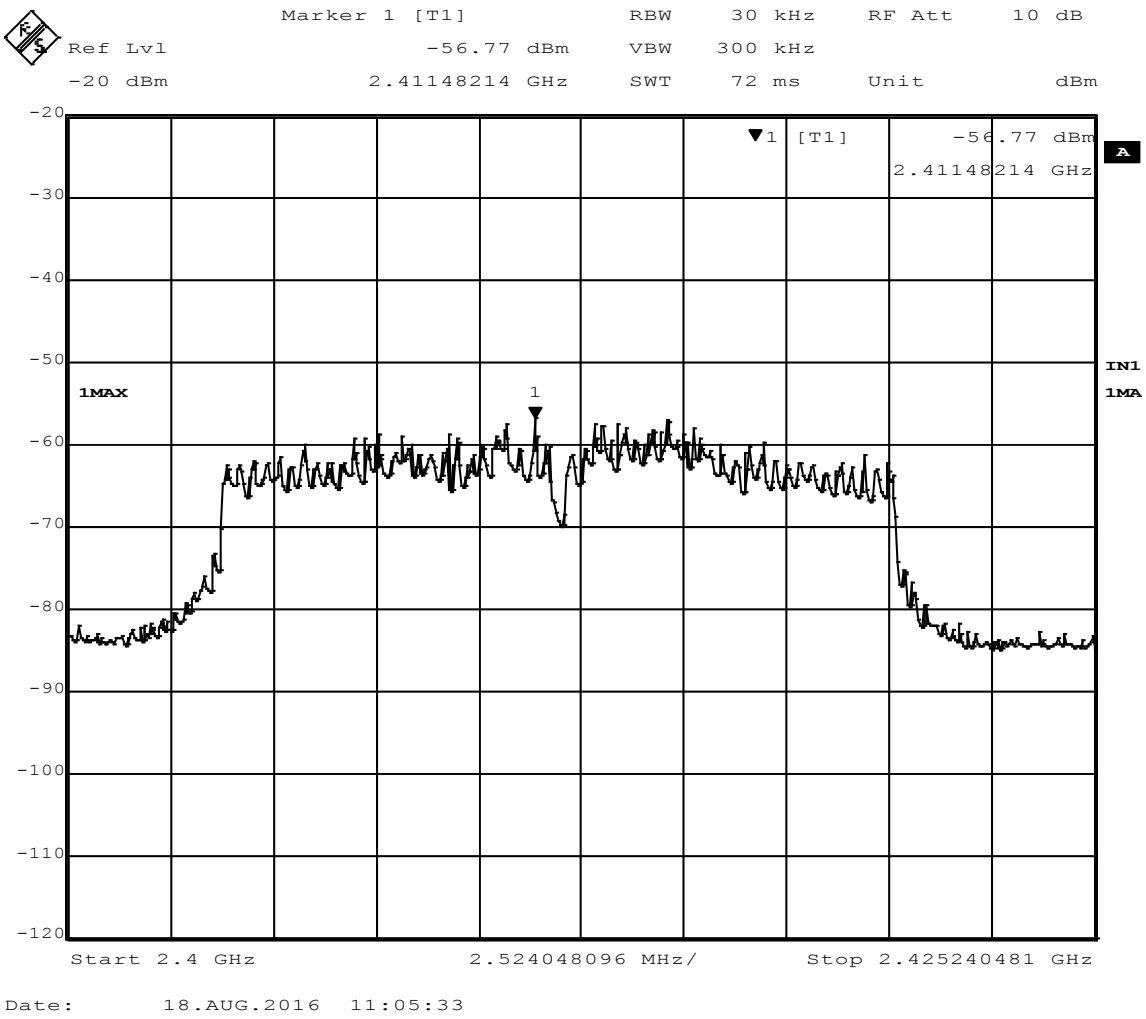


Figure 27 - Band-edge Measurement, Low Channel, Out of Band A

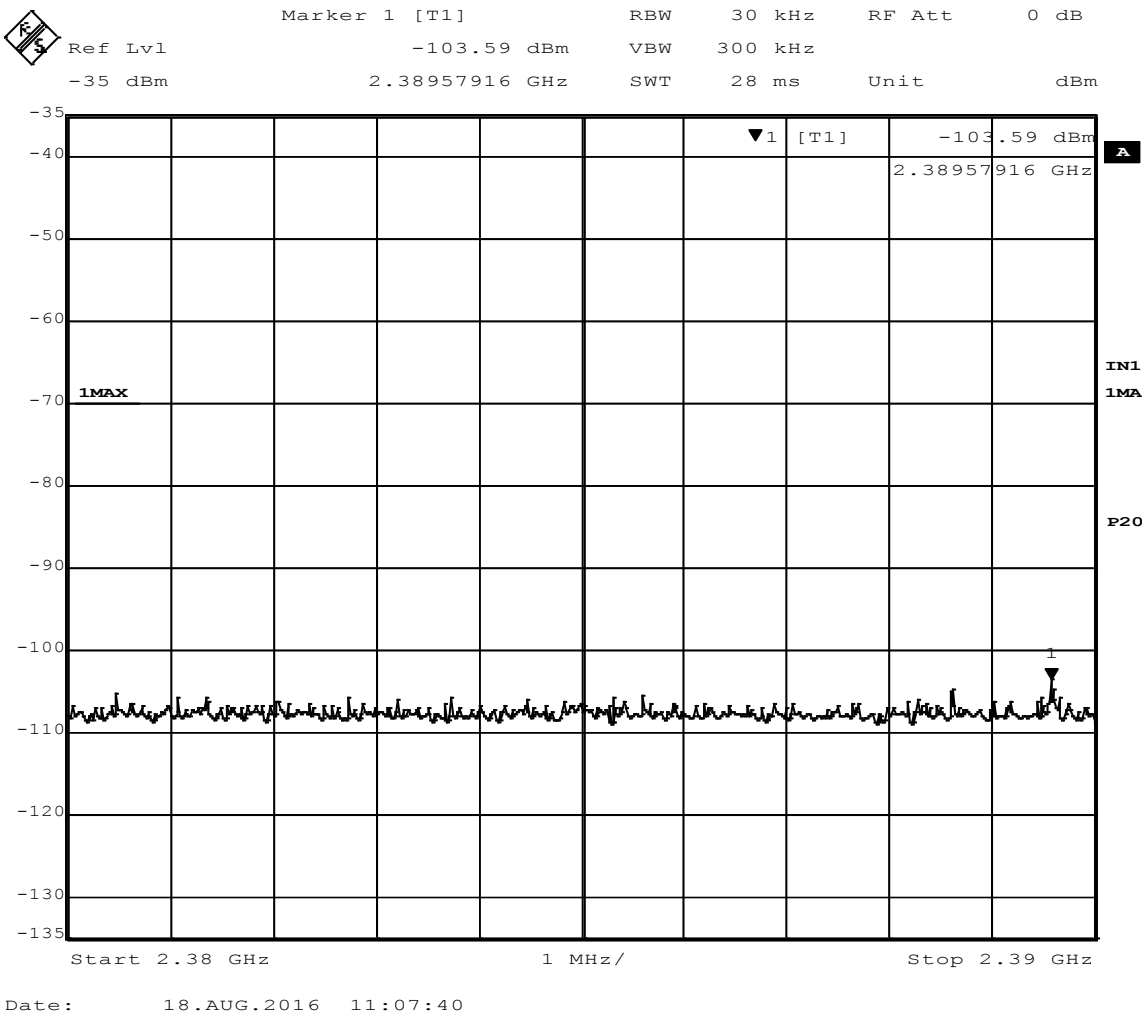


Figure 28 - Band-edge Measurement, Low Channel, Out of Band B

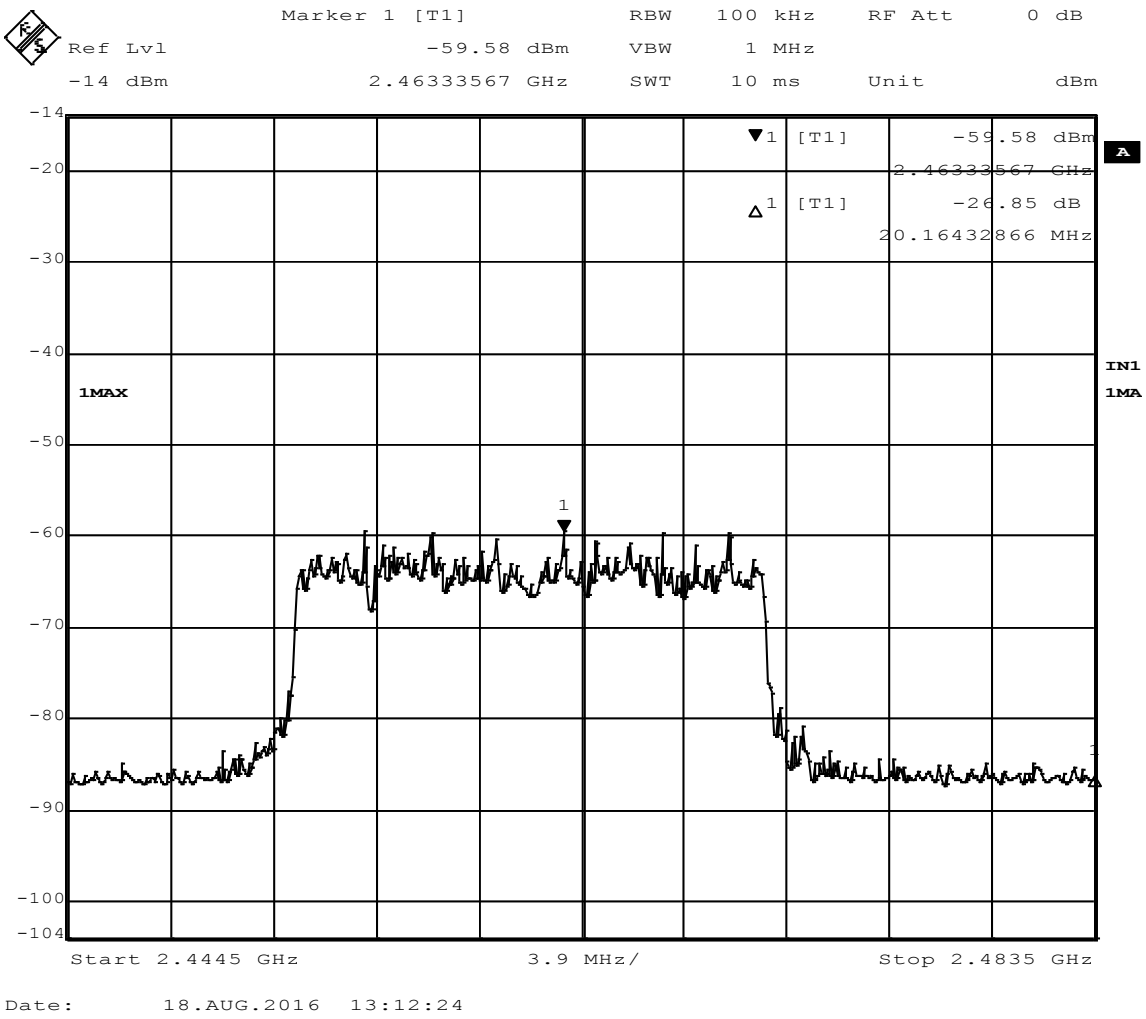


Figure 29 - Band-edge Measurement, High Channel, In-Band

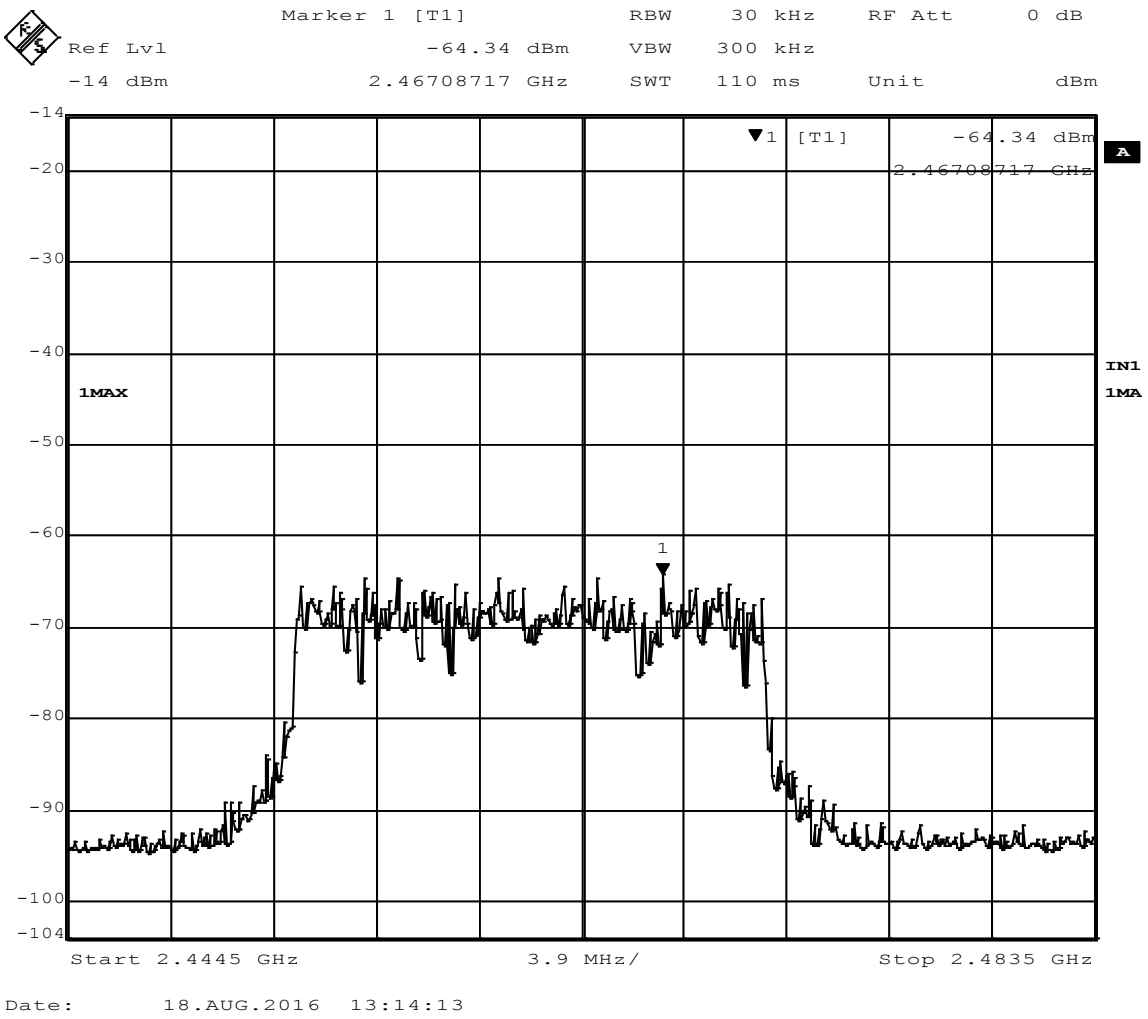


Figure 30 - Band-edge Measurement, High Channel, Out of Band A

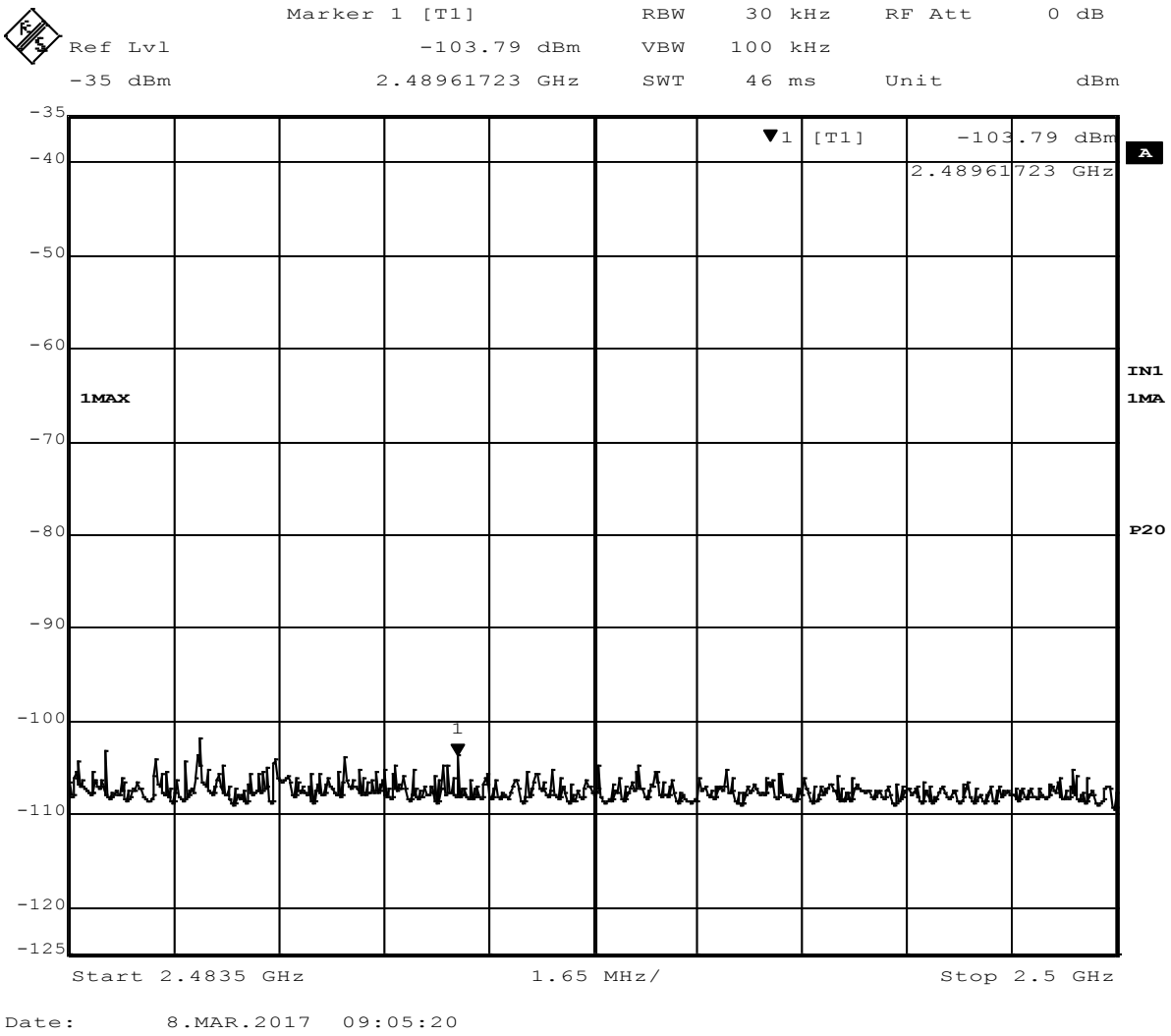


Figure 31 - Band-edge Measurement, High Channel, Out of Band B

4.6 Power Spectral Density

Test Method: ANSI C63.10, Section(s) 10.10.2 (peak PSD)

4.6.1 Power spectral density measurements

The method from ANSI C63.10, Section 11.10.2 was used.

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.

4.6.2 Test procedures

All measurements were taken at a distance of 3m from the EUT. The spectrum analyzer was set to 3 kHz RBW and 30 kHz VBW, the sweep time was set to auto. The power spectral density was measured and recorded at the frequency with the highest emission. The sweep time is allowed to be longer than span/3KHz for a full response of the mixer in the spectrum analyzer.

See Annex B for an example of how the EIRP is calculated in order to report maximum power output.

4.6.3 Deviations from test standard

No deviation.

4.6.4 Test setup

See section 4.3

4.6.5 EUT operating conditions

The EUT was powered by a 12 VDC unless specified and set to transmit continuously on the lowest frequency channel, highest frequency channel and one in the middle of its operating range.

EUT MODULE	GoIDit	MODE	Continuous Transmit
INPUT POWER	12 VDC	FREQUENCY RANGE	2402 MHz – 2483.5 MHz
ENVIRONMENTAL CONDITIONS	52 % ± 5% RH 23 ± 3ºC	TECHNICIAN	KVepuri

Power Spectral Density

CHANNEL	CHANNEL FREQUENCY (MHz)	Spectrum Analyzer Reading (dBm)	Antenna Factor (dB)	Cable Loss (dB)	3m Field Stregnth (dBuV/m)	PSD value EIRP (dBm)	PSD LIMIT (dBm)	MODE
Low	2412	-64.30	28.8	7.7	50.40	-44.83	30.00	802.11(b)
Low	2412	-71.97	28.8	7.7	42.73	-52.5	30.00	802.11(g)
Middle	2437	-62.67	28.8	7.7	52.03	-43.2	30.00	802.11(b)
Middle	2437	-71.73	28.8	7.7	42.97	-52.26	30.00	802.11(g)
High	2462	-64.21	28.8	7.7	50.49	-44.74	30.00	802.11(b)
High	2462	-75.34	28.8	7.7	39.36	-55.87	30.00	802.11(g)

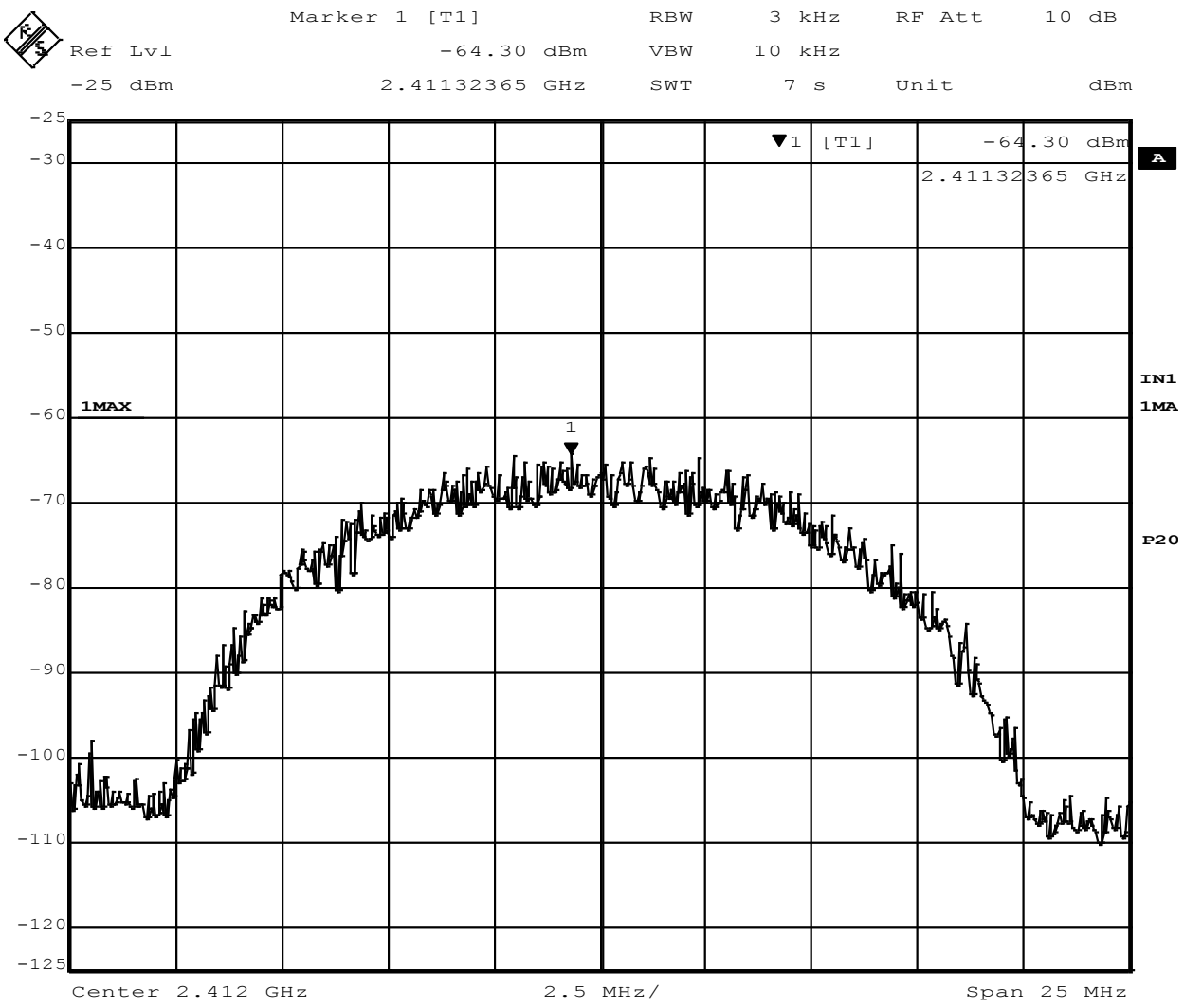


Figure 32 - Power Spectral Density Measurement, Low Channel, 802.11(b)

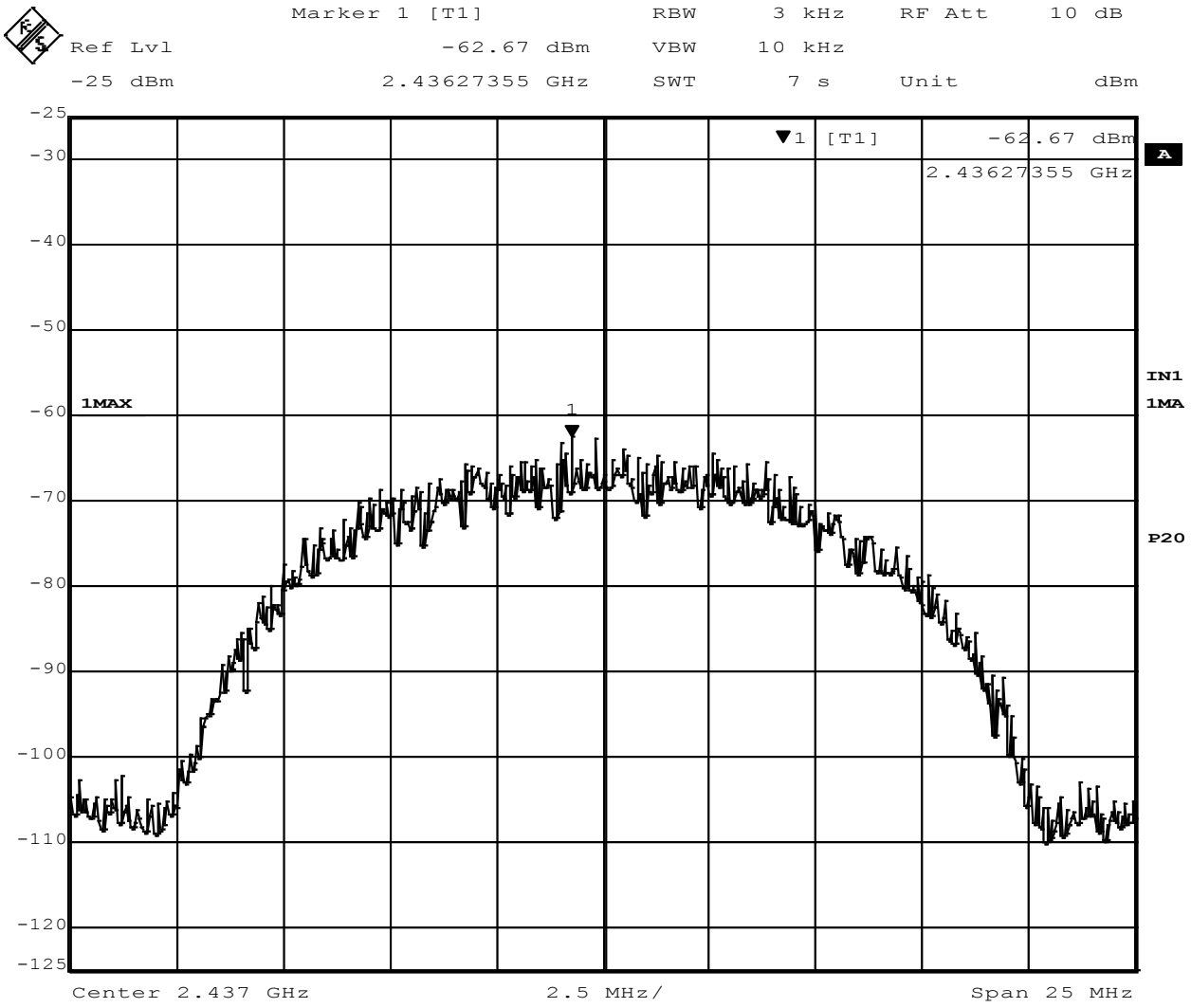


Figure 33 - Power Spectral Density Measurement, Middle Channel, 802.11(b)

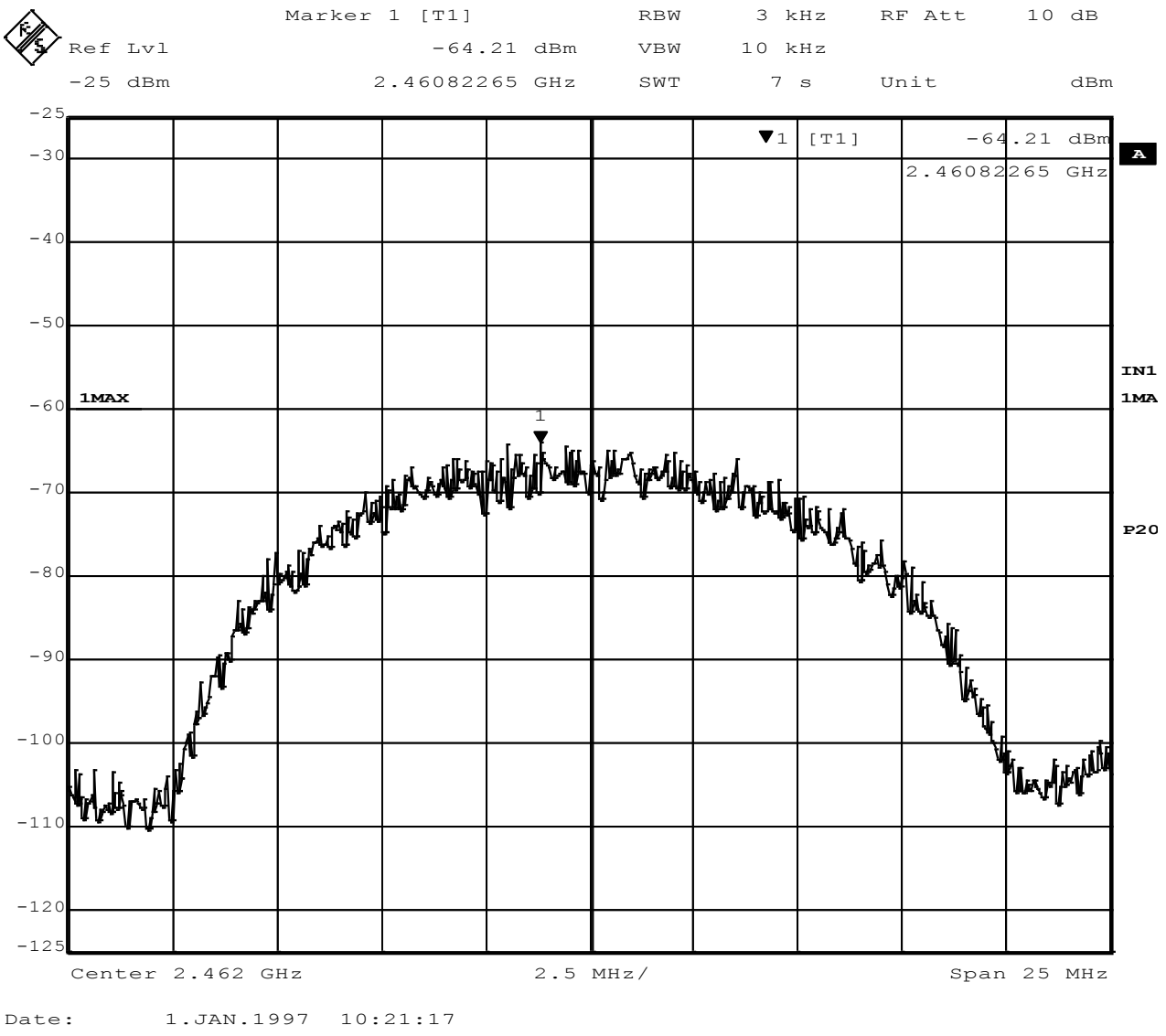


Figure 34 - Power Spectral Density Measurement, High Channel, 802.11(b)

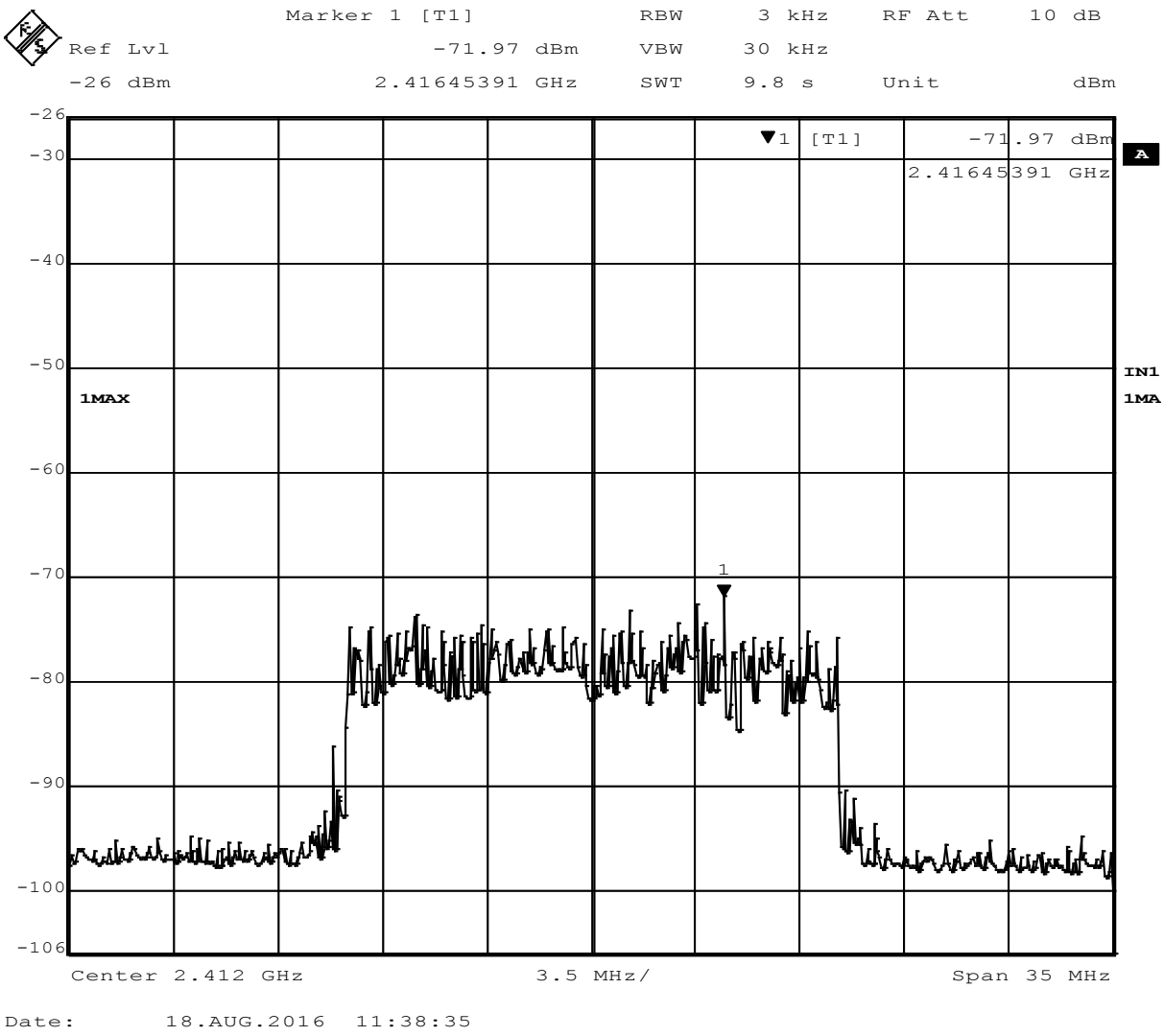


Figure 35 - Power Spectral Density Measurement, Low Channel, 802.11(g)

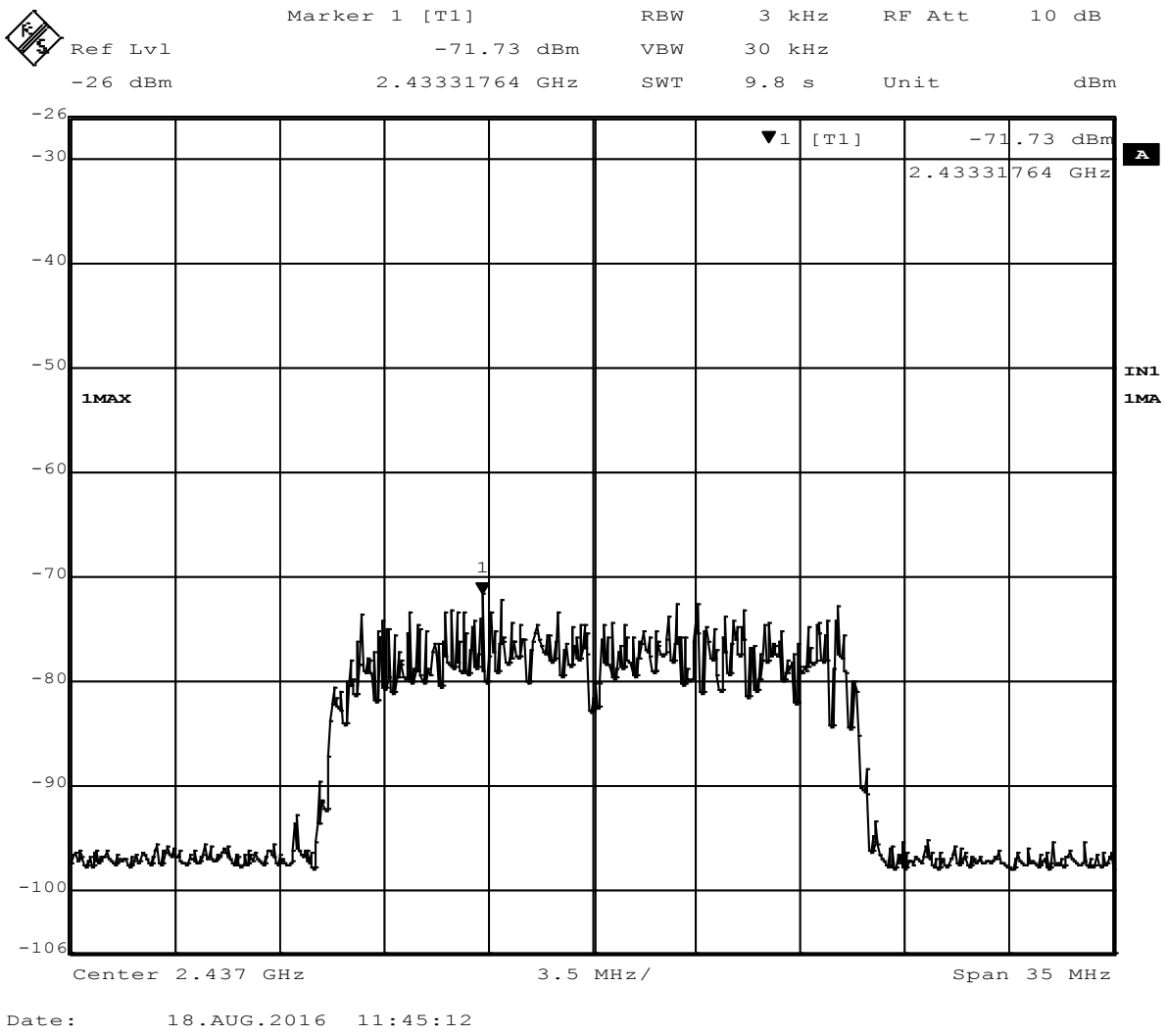


Figure 36 - Power Spectral Density Measurement, Mid Channel, 802.11(g)

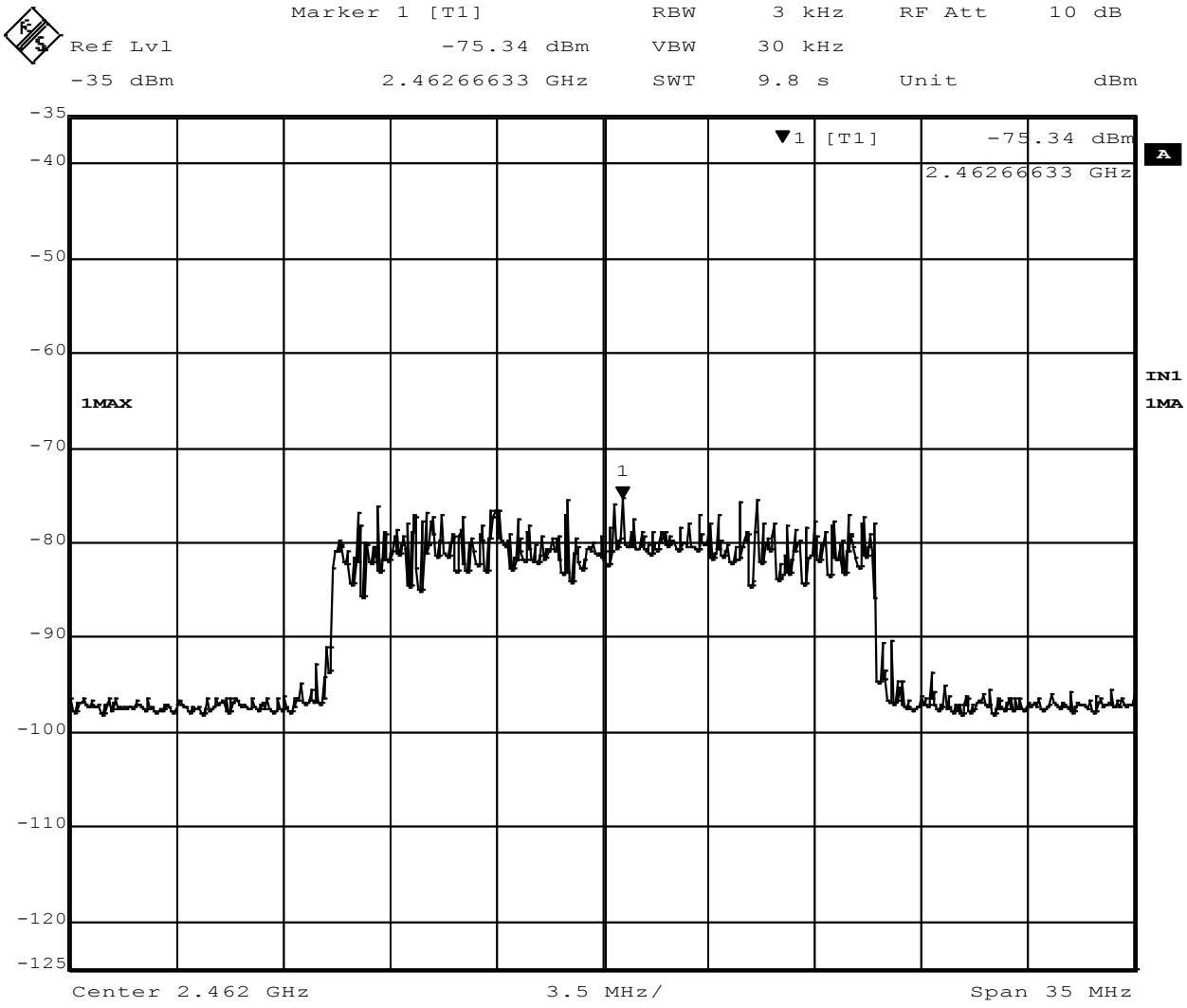


Figure 37 - Power Spectral Density Measurement, High Channel, 802.11(g)

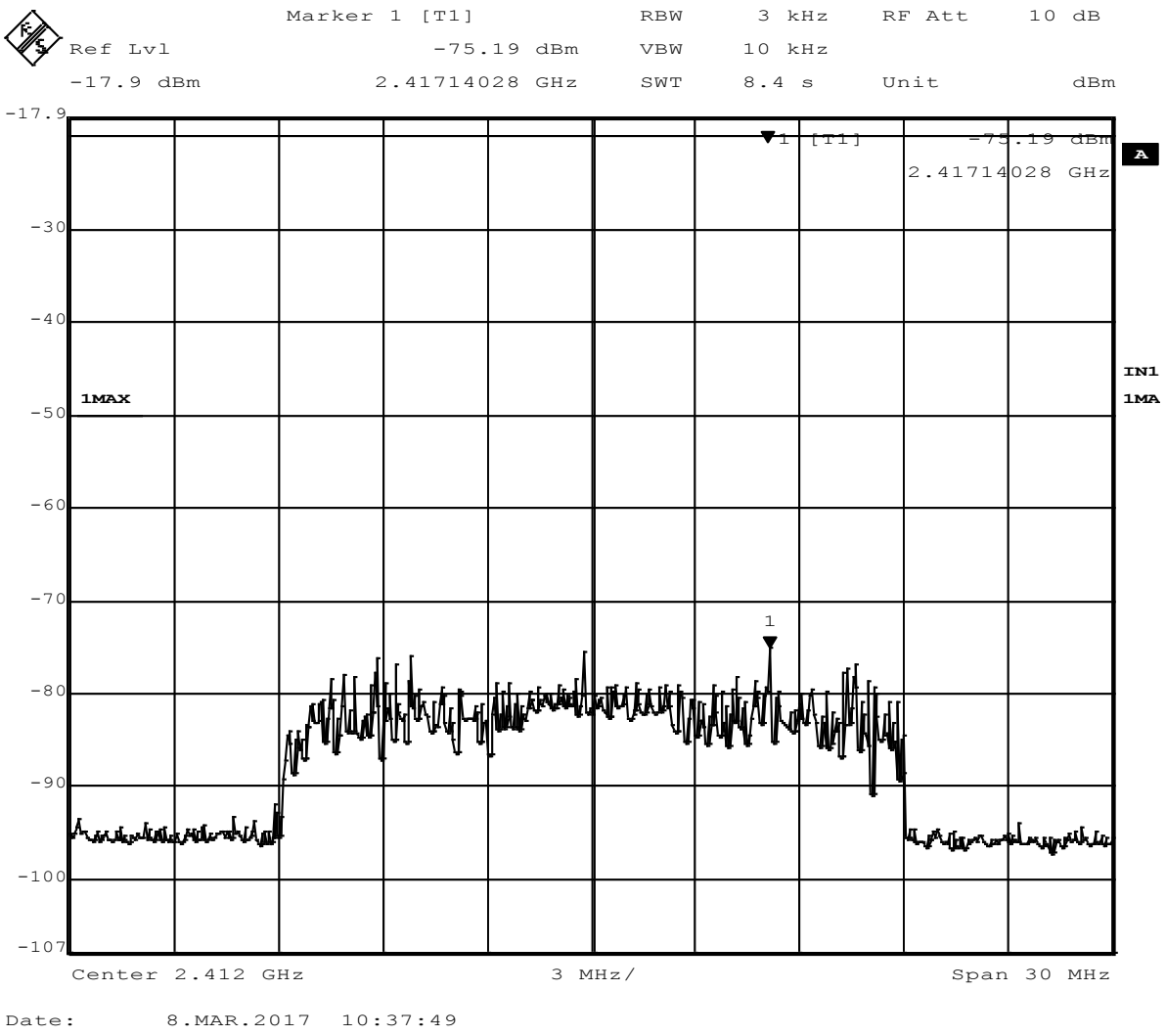


Figure 38 - Power Spectral Density Measurement, Low Channel, 802.11(n)

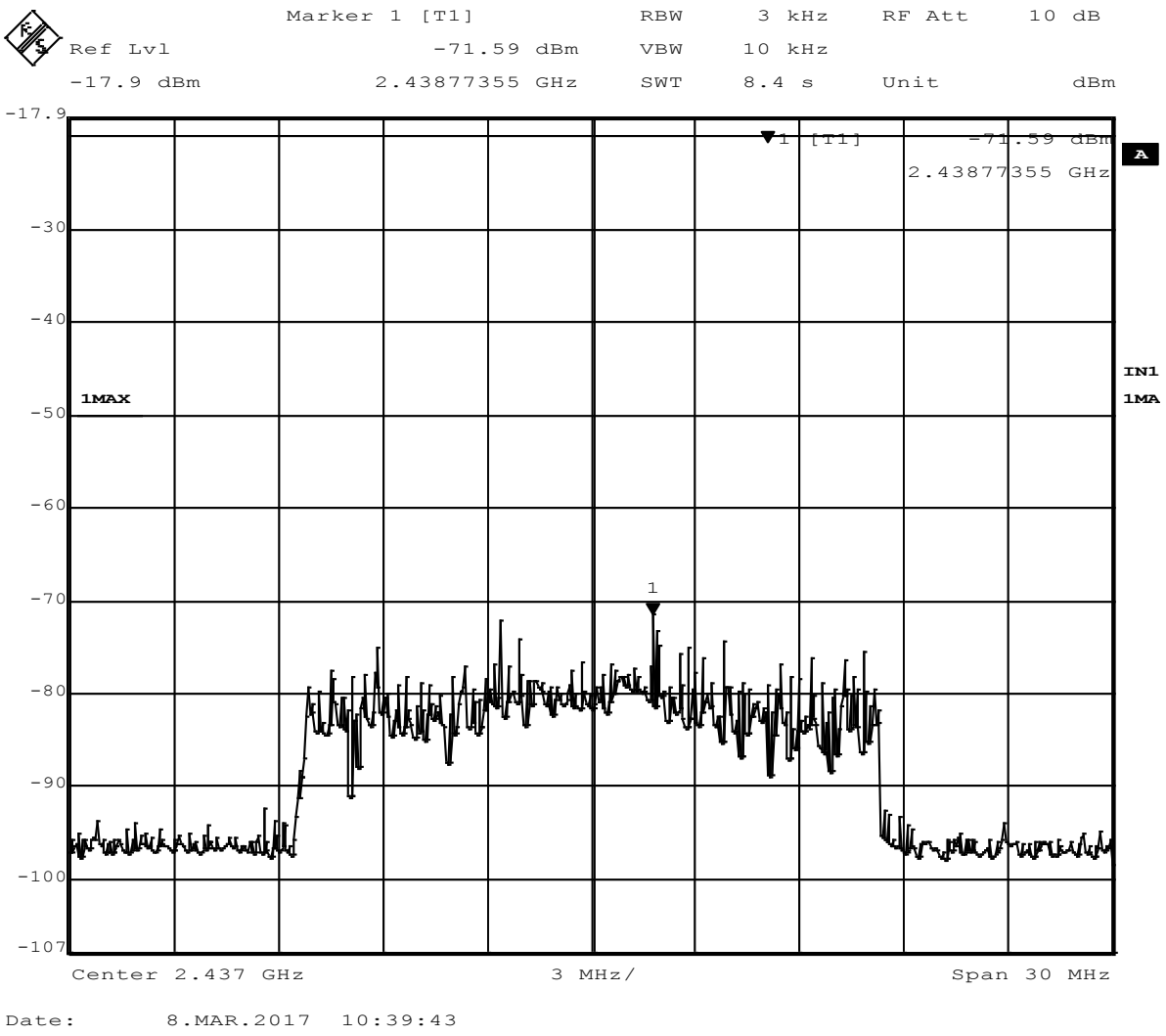


Figure 39 - Power Spectral Density Measurement, Mid Channel, 802.11(n)

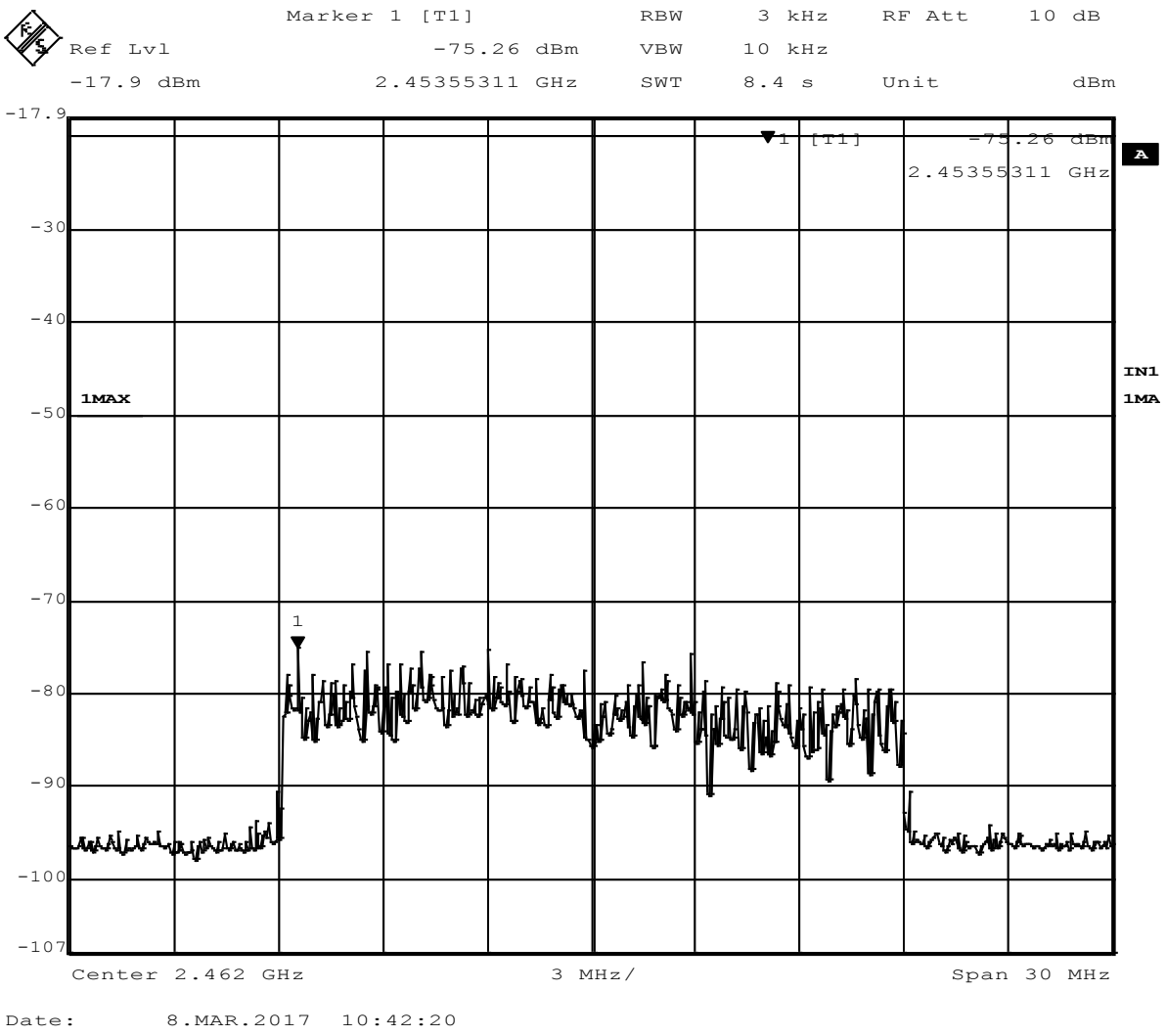


Figure 40 - Power Spectral Density Measurement, High Channel, 802.11(n)

Annex A – Measurement Uncertainty

Where relevant, the following measurement uncertainty levels apply to tests performed in this test report:

Test	Frequency Range	NCEE Labs Uncertainty Value (dB)	Maximum Uncertainty Values per CISPR 16-4-2:2011
AC Line Conducted Emissions	150kHz - 30MHz	3.30	3.40
Radiated Emissions, 10m	30MHz - 1GHz	3.82	5.30
Radiated Emissions, 3m	30MHz – 1GHz	4.25	5.30
Radiated Emissions, 3m	1GHz – 18GHz	5.08	5.20
Radiated Emissions, 3m	6GHz – 18GHz	5.08	5.50

Expanded uncertainty values are calculated to a confidence level of 95%.

NCEE Labs meets the maximum uncertainty requirements per CISPR 16-4-2:2011, and therefore does not require a minimum passing margin to state that an EUT is less than the field strength limits of the applicable CISPR, IEC or EN limit per CISPR 16-4-2:2011, Section 4.1.

Appendix B: Sample Calculation

Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain (if any) from the measured reading. The basic equation with a sample calculation is as follows:
FS = RA + AF – (-CF + AG) + AV

where FS = Field Strength

RA = Receiver Amplitude

AF = Antenna Factor

CF = Cable Attenuation Factor

AG = Amplifier Gain

AV = Averaging Factor (if applicable)

Assume a receiver reading of 55 dBμV is obtained. The Antenna Factor of 12 and a Cable Factor of 1.1 is added. The Amplifier Gain of 20 dB is subtracted, giving a field strength of 48.1 dBμV/m.

FS = 55 + 12 – (-1.1 + 20) + 0 = 48.1 dBμV/m

The 48.1 dBμV/m value can be mathematically converted to its corresponding level in μV/m.

Level in μV/m = Common Antilogarithm [(48.1 dBμV/m)/20]= 254.1 μV/m

AV is calculated by the taking the 20*log(T_{on}/100) where T_{on} is the maximum transmission time in any 100ms window.

EIRP Calculations

In cases where direct antenna port measurement is not possible or would be inaccurate, output power is measured in EIRP. The maximum field strength is measured at a specified distance and the EIRP is calculated using the following equation;

EIRP (Watts) = [Field Stregnth (V/m) x antenna distance (m)]^2 / [30 x Gain (numeric)]

Power (watts) = 10^[Power (dBm)/10] x 1000

Field Strength (dBµV/m) = Field Stregth (dBm) = 107 (for 50Ω measurement systems)

Field Stregnth (V/m) = 10^[Field Stregnth (dBµV/m) / 20] / 10^6

Gain = 1 (numeric gain for isotropic radiator

REPORT END