EMC TEST REPORT
No. JSH006090224-001

Applicant	:	Navigon AG Schottmuellerstrasse 20a, Hamburg, 20251, Germany
Manufacturer	:	Solectron (Suzhou) Technology Co., Ltd. No.268, Suhong Zhong Road, China-Singapore, Suzhou Industrial Park, 215126 Suzhou, Jiangsu, China
Equipment	:	PNA (Personal Navigation Assistant)
Type/Model	:	P'9611

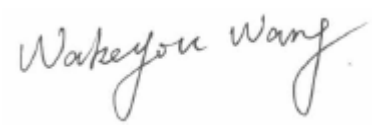
SUMMARY

The equipment complies with the requirements according to the following standard(s):

47CFR Part 15 (2006): Radio Frequency Devices
ANSIC63.4 (2003): American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 kHz to 40 GHz

Date of issue: July 23, 2007

Tested by:



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Description of Test Facility

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Content

1. General Information

1.1 Applicant Information

Applicant:	Navigon AG Schottmuellerstrasse 20a, Hamburg, 20251, Germany
Name of contact:	Mr. Lars Boysen
Tel: Fax:	+49 40 37088-429 +49 40 37088-479
Manufacturer:	Solectron (Suzhou) Technology Co., Ltd. No.268, Suhong Zhong Road, China-Singapore, Suzhou Industrial Park, 215126 Suzhou, Jiangsu, China

1.2 Identification of the EUT

Equipment:	PNA (Personal Navigation Assistant)
Type/model:	P'9611
FCC ID:	VIL-P9611

1.3 Technical specification

Operation Frequency Band:	2.4GHz ~ 2.4835 GHz
Modulation:	FHSS
Antenna Designation:	Chip antenna, Non-User Replaceable (Fixed)
Gain of Antenna:	3.1dBi max.
Rating:	Input 5VDC, 2A [MAX.]. (Supplied by a AC/DC adaptor)
Description of EUT:	The EUT is a Personal Navigation Assistant. The basic function of it is navigating. But there are also two secondary functions namely MP3 and Bluetooth. As a result, Bluetooth function which classed to be intentional radiator is observed in this report.
Channel Description:	There are 79 channels named channel 0 to channel 78. Channel 0 corresponds to carrier frequency 2402MHz and channel 78 corresponds to 2480MHz.

1.4 Mode of operation during the test / Test peripherals used

While performing “dwell time” test, three packet settings were observed separately, namely Packet Type 4, Packet Type 11 and Packet Type 15.
For other tests, if hopping mode is necessary, Packet Type 15 with the biggest packet as the client’s description was setting to get the worst test results.

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2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESIB 26	R&S	EC 3045	2007-6-1	2008-5-31
Ultra-broadband antenna	HL 562	R&S	EC 3046-1	2007-6-1	2008-5-31
Horn antenna	HF 906	R&S	EC 3049	2007-6-1	2008-5-31
Signal generator	SMR 20	R&S	EC 3044-1	2006-8-22	2007-8-21
Power meter	PM2002	AR	EC3043-7	2007-1-23	2008-1-22
Power sensor	PH2000	AR	EC3043-8	2007-1-23	2008-1-22
Semi-anechoic chamber	-	Albatross project	EC 3048	2007-6-1	2008-5-31
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2007-6-1	2008-5-31
Pre-amplifier	Pre-amp 40	Beijing Radio 2	-	2007-3-4	2008-3-3
Horn antenna	K638A	Beijing Radio 2	-	2007-3-4	2008-3-3
A.M.N.	ESH2-Z5	R&S	EC 3119	2007-1-23	2008-1-22
Test Receiver	ESCS 30	R&S	EC 2107	2007-1-23	2008-1-22

2.2 Test Standard

47CFR Part 15 (2006)
ANSI C63.4: 2003

2.3 Test Summary

This report applies to tested sample only. This report shall not be reproduced in part without written approval of Intertek Testing Service Shanghai Limited.

TEST ITEM	REFERANCE	RESULT
Hopping channel separation	15.247(a)(1)	Pass
Maximum peak output power	15.247(b)(1)	Pass
Power spectrum density	15.247(e)	NA
Spurious emission	15.209	Pass
Restrict band radiated emission	15.205	Pass
Emission outside the frequency band	15.247(d)	Pass
Power line conducted emission	15.207	Pass
Channel number of hopping system	15.247(a)(1)(iii)	Pass
Average time of occupancy in any channel	15.247(a)(1)(iii)	Pass

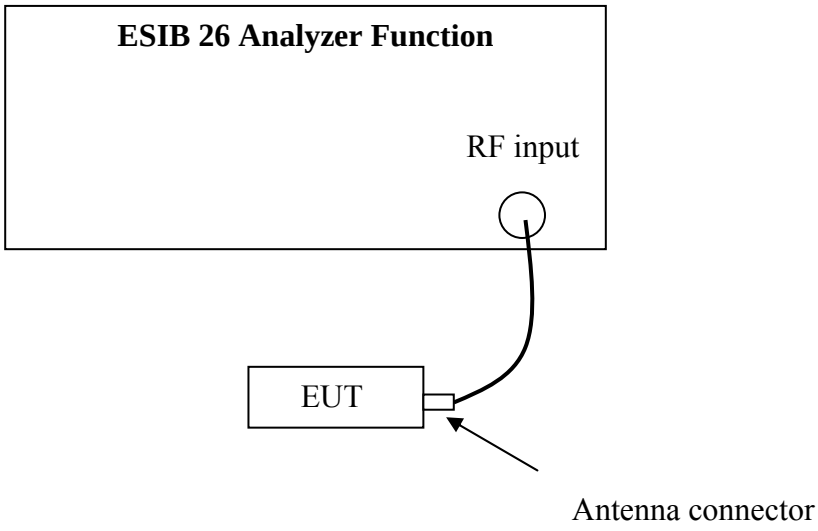
3. Hopping channel separation

Test result: PASS

3.1 Limit

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125mW.

3.2 Test Configuration



3.3 Test Procedure and test setup

Hopping Channel separation per FCC § 15.247(a)(1) is measured using the ESIB 26 analyzer function with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW. The test was performed at 3 channels (lowest, middle and highest channel).

3.4 Test Protocol

Temperature : 22°C
Relative Humidity : 43%

Channel	Channel Frequency(GHz)	20 dB Bandwidth (kHz) **B**	Channel Separation with adjacent channel (kHz) **S**	Margin (kHz) **M**
0(lowest)	2.402	385	1011	626
39(middle)	2.441	379	1010	631
78(highest)	2.480	379	996	617

Remark: **M = S -B**

3.5 Measurement uncertainty

The measurement uncertainty is ±100Hz.

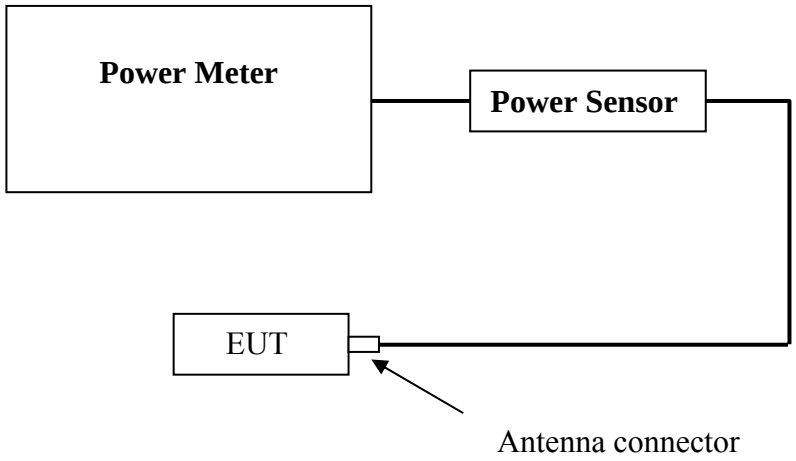
4. Maximum peak output power

Test result: Pass

4.1 Test limit

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt
For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts

4.2 Test Configuration



4.3 Test procedure and test setup

The power output per FCC § 15.247(b)(1) was measured on the EUT using a power meter via power sensor. The test was performed at 3 channels (lowest, middle and highest channel).

4.4 Test protocol

Temperature : 22°C
Relative Humidity : 43%

Channel	Reading of power meter (dBm) **R**	Cable loss (dB) **L**	Corrected Reading (dBm) **C**	Limit (dBm)
0(lowest)	1.07	0.35	1.42	30
39(middle)	1.03	0.35	1.38	30
78(highest)	1.05	0.35	1.40	30

Remark: **C = R+ L**

4.5 Measurement uncertainty

The measurement uncertainty is ±1dB.

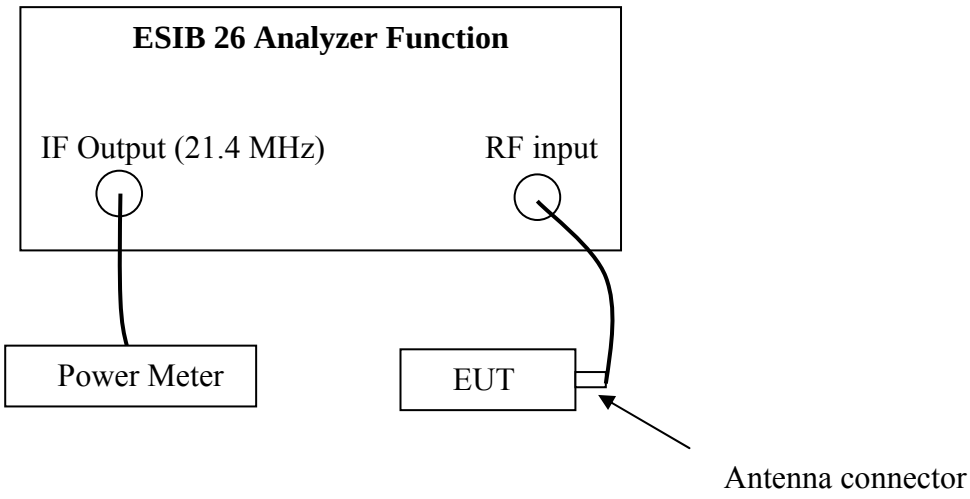
5. Power spectrum density

Test result: **NA**

5.1 Test limit

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission.

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC §15.247(e) is measured using the ESIB 26 analyzer function with a power meter connected to IF output (21.4MHz) port. Under spectral measurement mode, catch the frequency point with maximum power spectrum. Then set the span to be 0 and the resolutions bandwidth to be 3 kHz. After calibration, it is found that the power spectral density equals the reference level of analyzer plus the reading of power meter.
The test was performed at 3 channels (lowest, middle and highest channel).

5.4 Test Protocol

Temperature : °C

Relative Humidity : %

Channel	Channel Frequency(GHz)	Maximum power spectral density (dBm/3kHz)	Limit (dBm/3kHz)
-	-	-	-
-	-	-	-
-	-	-	-

5.5 Measurement uncertainty

The measurement uncertainty is ±1dB/3kHz.

6. Spurious emission

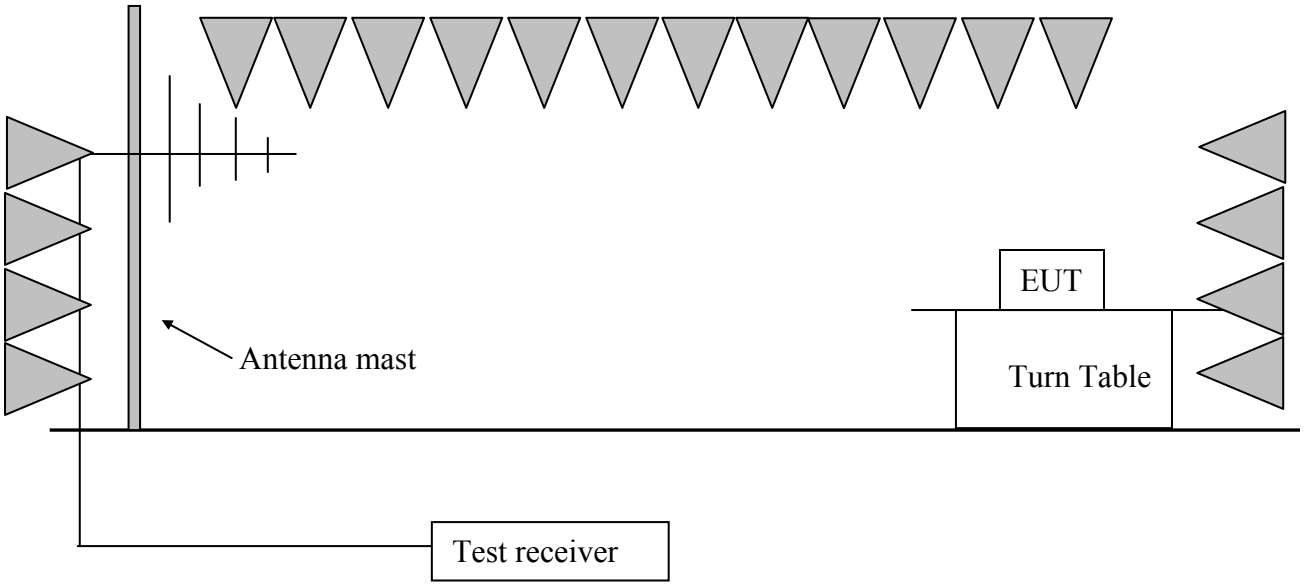
Test result: PASS

6.1 Test limit

The spurious emission shall test through the 10th harmonic. It must comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

6.2 Test Configuration



6.3 Test procedure and test setup

The measurement was applied in a semi-anechoic chamber. While testing for spurious emission higher than 1GHz, the pre-amplifier is equipped just at the output terminal of the antenna.
The EUT and simulators were placed on a 0.8m high wooden turntable above the horizontal metal ground plane. The turn table rotated 360 degrees to determine the position of the maximum emission level. The EUT was set 3 meters away from the receiving antenna which was mounted on an antenna mast. The antenna moved up and down between from 1meter to 4 meters to find out the maximum emission level.

6.4 Test protocol

For QP test below 1GHz, highest reading related to the limit

Channel	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	H	337.13	13.60	38.60	46.00	7.40
0	V	47.49	9.80	34.60	40.00	5.40
39	H	337.46	13.60	40.80	46.00	5.20
39	V	51.38	10.20	35.30	40.00	4.70
78	H	337.25	13.60	39.70	46.00	6.30
78	V	55.41	10.30	33.50	40.00	6.50

Remark: 1.Correct Factor = Antenna Factor + Cable Loss
2. Corrected Reading = Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. For more details, please refer to the test data.

For PK test above 1GHz, highest reading related to the limit

Channel	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)
0	H	1102.20	-0.20	45.80	54.00	8.20
0	V	1102.20	-0.20	45.40	54.00	8.60
39	H	1205.40	-0.20	46.30	54.00	7.70
39	V	1836.70	0.60	45.40	54.00	8.60
78	H	1480.20	0.40	45.30	54.00	8.70
78	V	1926.10	0.60	46.80	54.00	7.20

Remark: 1.Correct Factor = Antenna Factor + Cable Loss - Gain of Preamplifier
2. Corrected Reading = Receiver Reading + Correct Factor
3. Margin = limit - Corrected Reading
4. Here the AV limit is used to evaluate PK test data and therefore AV test is not necessary .
5. For more details, please refer to the test data (the emission within2.4GHz ~ 2.4835GHz is fundamental signal and not observed in this test).

6.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty of radiated emission is: ± 5.31dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

7. Restrict band radiated emission

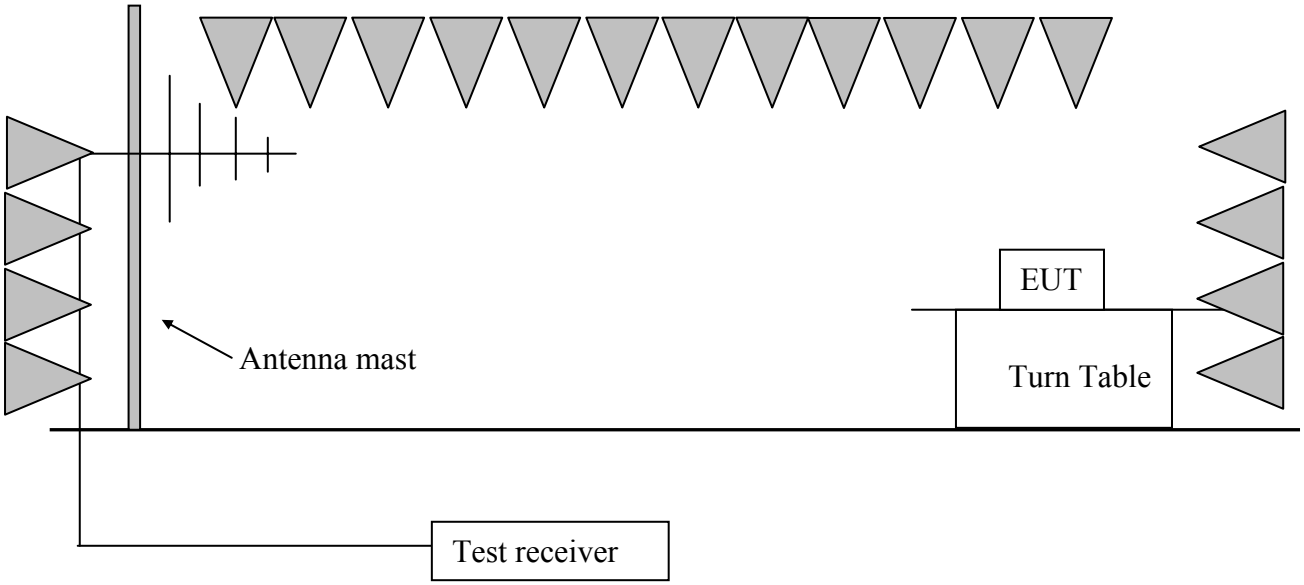
Test result: PASS

7.1 Test limit

The radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) showed as below:

Frequency (MHz)	Field Strength (dBuV/m)	Measurement Distance (m)
30 - 88	40.0	3
88 - 216	43.5	3
216 - 960	46.0	3
Above 960	54.0	3

7.2 Test Configuration



7.3 Test procedure and test setup

1. Perform an in-band field strength measurement of the fundamental emission using the RBW and detector function as the Spurious Radiated Emissions test procedure.
2. Choose a spectrum analyzer span that encompasses both the peak of the fundamental emission and the band-edge emission under investigation. Set the analyzer RBW to 1% of the total span (but never less than 30 kHz) with a video bandwidth equal to or greater than the RBW. Record the peak levels of the fundamental emission and the relevant band-edge emission (i.e., run several sweeps in

peak hold mode). Observe the stored trace and measure the amplitude delta between the peak of the fundamental and the peak of the band-edge emission. This is not a field strength measurement; it is only a relative measurement to determine the amount by which the emission drops at the band-edge relative to the highest fundamental emission level.
3. Subtract the delta measured in step (2) from the field strengths measured in step (1). The resultant field strengths (CISPR QP, average, or peak, as appropriate) are then used to determine band-edge compliance as required by Section 15.205.
4. The above "delta" measurement technique may be used for measuring emissions that are up to two "standard" bandwidths away from the band-edge, where a "standard" bandwidth is the bandwidth specified by C63.4 for the frequency being measured. For example, for band-edge measurements in the restricted band that begins at 2483.5 MHz, C63.4 specifies a measurement bandwidth of at least 1 MHz. Therefore you may use the "delta" technique for measuring emissions up to 2 MHz removed from the band-edge.
5. Radiated emissions that are removed by more than two “standard” bandwidths must be measured as the above Spurious Radiated Emissions test procedure.

7.4 Test protocol

Highest reading on restrict band 2310MHz ~ 2390MHz, hopping on channel 0

Detector	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)
PK	2386.00	2.20	51.03	74
AV	2386.00	2.20	40.56	54

Highest reading on restrict band 2483.5MHz ~ 2500MHz, hopping on channel 78

Detector	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)
PK	2484.50	2.20	55.67	74
AV	2484.00	2.20	46.02	54

7.5 Measurement uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty of radiated emission is: ± 5.31dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

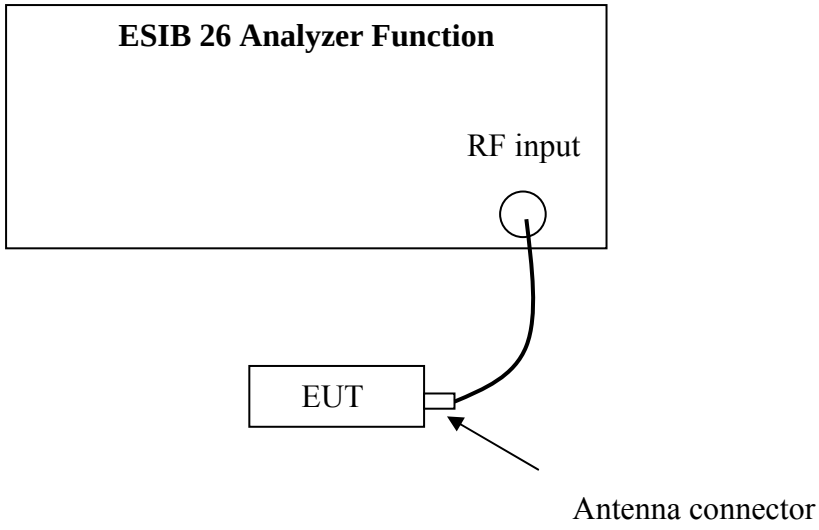
8. Emission outside the frequency Band

Test result: **PASS**

8.1 Limit

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum 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.

8.2 Test Configuration



8.3 Test procedure and test setup

The Emission outside the frequency Band per FCC §15.247(d) is measured using the ESIB 26 analyzer function with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.

8.4 Test protocol

Highest level outside the band edge (dBm)	Highest emission within the band edge (dBm)	Delta (dBm)	Limit
-40.56 (frequency lower than 2.4GHz)	-2.12	38.44	≥ 20dB
-43.38 (frequency higher than 2.4835GHz)	-2.12	41.26	≥ 20dB

8.5 Measurement uncertainty

The measurement uncertainty is ±1dB.

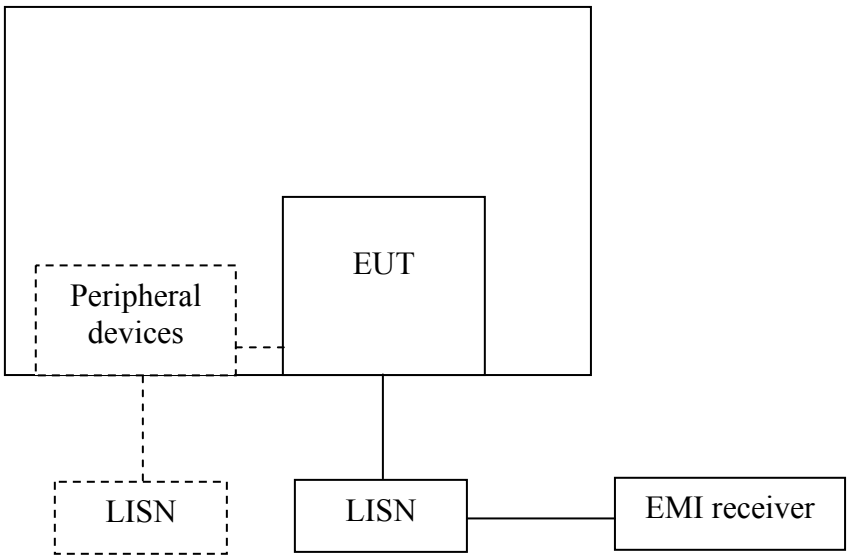
9. Power line conducted emission

Test result: **Pass**

9.1 Limit

Frequency of Emission (MHz)	Conducted Limit (dBuV)	
	QP	AV
0.15-0.5	66 to 56*	56 to 46 *
0.5-5	56	46
5-30	60	50
* Decreases with the logarithm of the frequency.		

9.2 Test configuration



☒ For table top equipment, wooden support is 0.8m height table

☐ For floor standing equipment, wooden support is 0.1m height rack.

9.3 Test procedure and test set up

The EUT are connected to the main power through a line impedance stabilization network (LISN). This provides a 50Ω/50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50Ω/50uH coupling impedance with 50Ω termination.
Both sides (Line and Neutral) of AC line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4: 2003 on conducted measurement.
The bandwidth of the test receiver is set at 9 kHz.

9.4 Test protocol

Power line: L

Freq	Correct Factor (dB)	Receiver Reading (dBuV)		Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV	QP	AV
0.17	3.00	*	*	*	*	*	*	*	*
0.20	3.00	*	*	*	*	*	*	*	*
0.26	3.00	*	*	*	*	*	*	*	*
0.55	3.00	34.15	25.76	37.15	28.76	56.00	46.00	18.85	17.24
2.01	3.00	*	*	*	*	*	*	*	*
8.39	3.00	*	*	*	*	*	*	*	*

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
2. Margin (dB) = Limit - Corrected Reading.
If margin>20dB, it would be marked as *.

Power line: N

Freq	Correct Factor (dB)	Receiver Reading (dBuV)		Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV	QP	AV
0.23	3.00	40.92	*	43.92	*	62.62	*	18.70	*
0.26	3.00	42.89	*	45.89	*	61.30	*	15.41	*
0.47	3.00	40.38	*	43.38	*	56.54	*	13.16	*
0.57	3.00	44.84	*	47.84	*	56.00	*	8.16	*
0.89	3.00	40.06	*	43.06	*	56.00	*	12.94	*
1.30	3.00	*	*	*	*	*	*	*	*

Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB).
2. Margin (dB) = Limit - Corrected Reading.
If margin>20dB, it would be marked as *.

9.5 Measurement Uncertainty

The measurement uncertainty describes the overall uncertainty of the given measured value during the operation of the EUT.
Measurement uncertainty at mains terminal: ± 1.99dB
The measurement uncertainty is given with a confidence of 95%, k=2.
The measurement uncertainty is traceable to internal procedure TI-036.

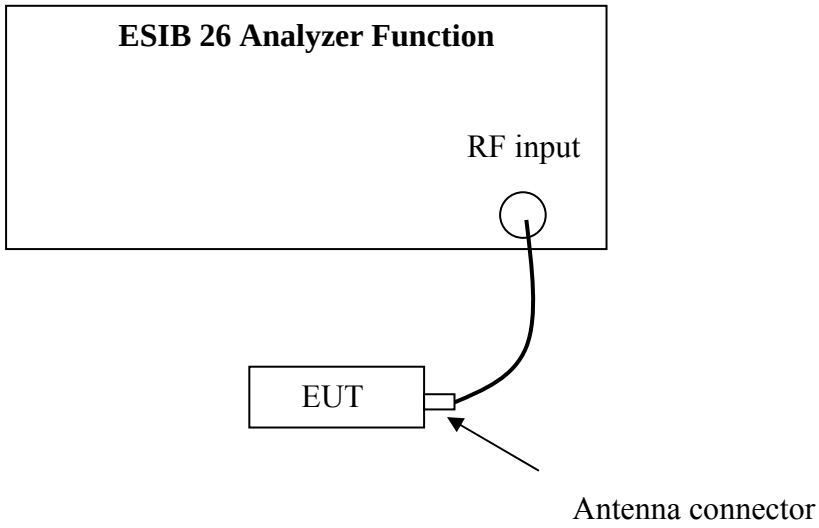
10. Channel Number of hopping system

Test result: **PASS**

10.1 Limit

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

10.2 Test Configuration



10.3 Test procedure and test setup

The channel number per FCC §15.247(a)(1)(iii) is measured using the ESIB 26 analyzer function with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN>>RBW.
The RF passband of the EUT was divided into 3 appropriate bands to test.

10.4 Test protocol

Channel Number	Limit
79	≥15

10.5 Measurement uncertainty

The measurement uncertainty is ±1dB.

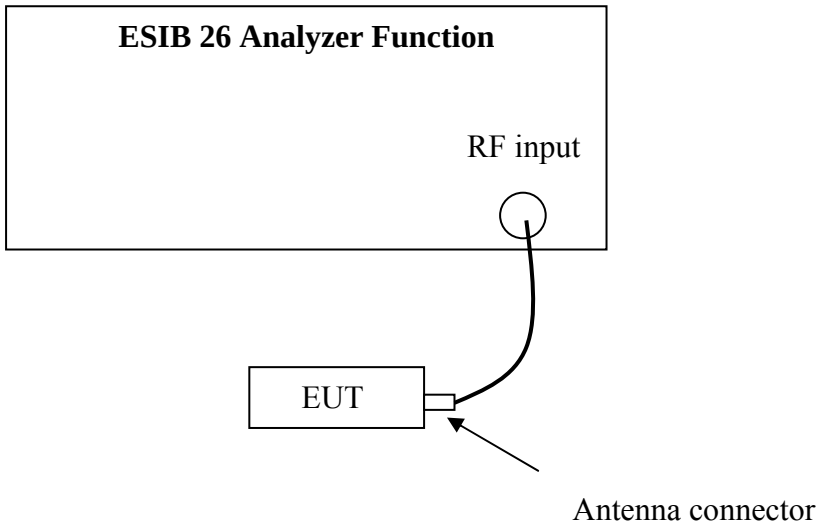
11. Average time of occupancy in any channel

Test result: **PASS**

11.1 Limit

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

11.2 Test Configuration



11.3 Test procedure and test setup

Average time of occupancy in any channel per FCC § 15.247(a)(1)(iii) is measured using the ESIB 26 analyzer function with the resolutions bandwidth set at 100kHz, the video bandwidth set at 300kHz, and the SPAN set to be 0Hz to test in time domain. The test is performed at the middle channel.

11.4 Test protocol

Packet	Observed period (s) **P**	Time of occupancy for single hopping (ms) **O**	Hops among the interval of 3.6 s **I**	Average time of occupancy (s) **T**	Limit (s)
Packet Type 4	31.6	0.48	36	0.15	≤0.4
Packet Type 11	31.6	1.72	18	0.27	≤0.4
Packet Type 15	31.6	2.97	12	0.31	≤0.4

Remark: 1. There are 79 channels in all. So the observed period P = 0.4 * 79 = 31.6 s.
2. Average time of occupancy **T = O *I * P / 3.6**

11.5 Measurement uncertainty

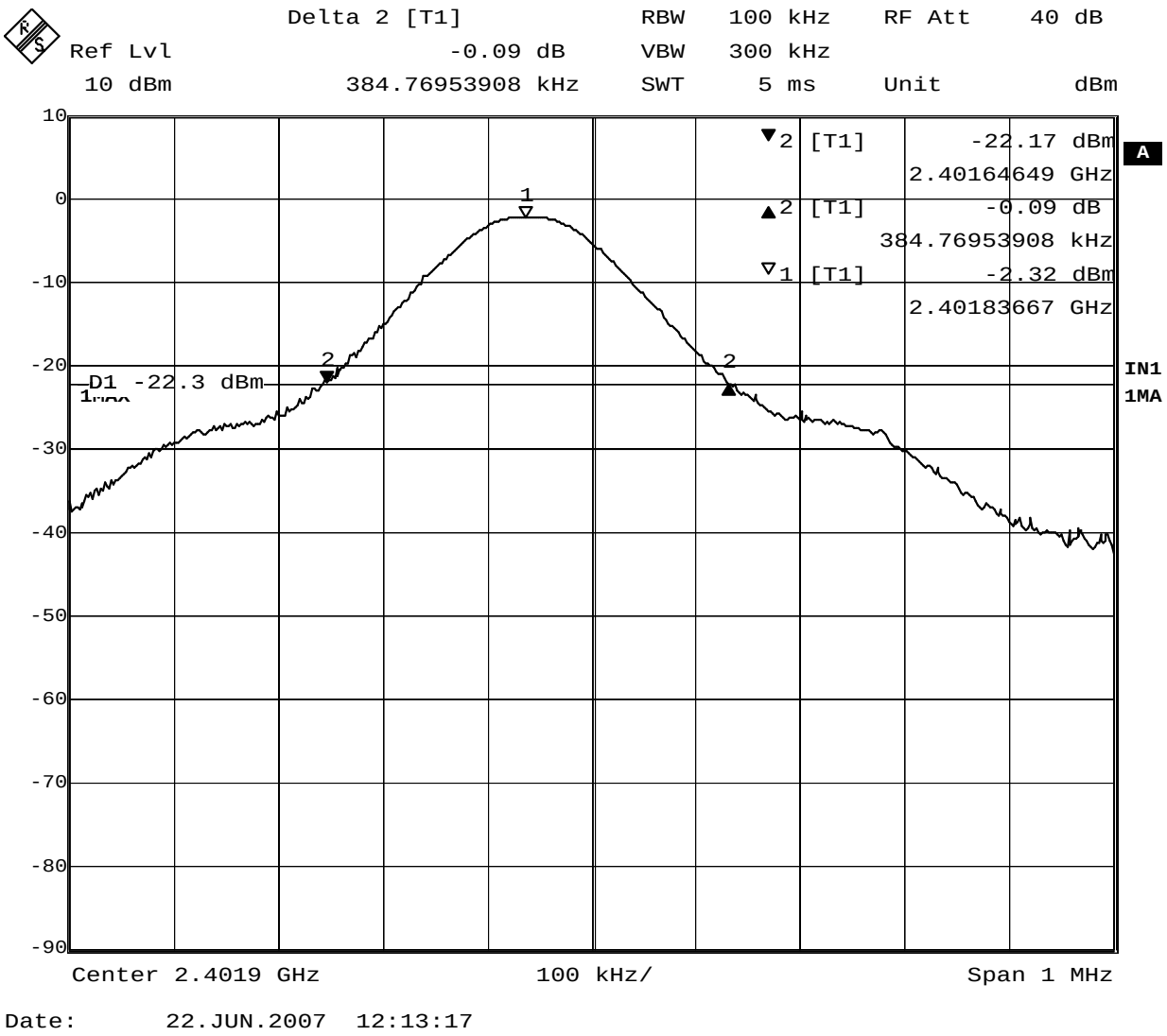
The measurement uncertainty is ± 10μs.

Test Data

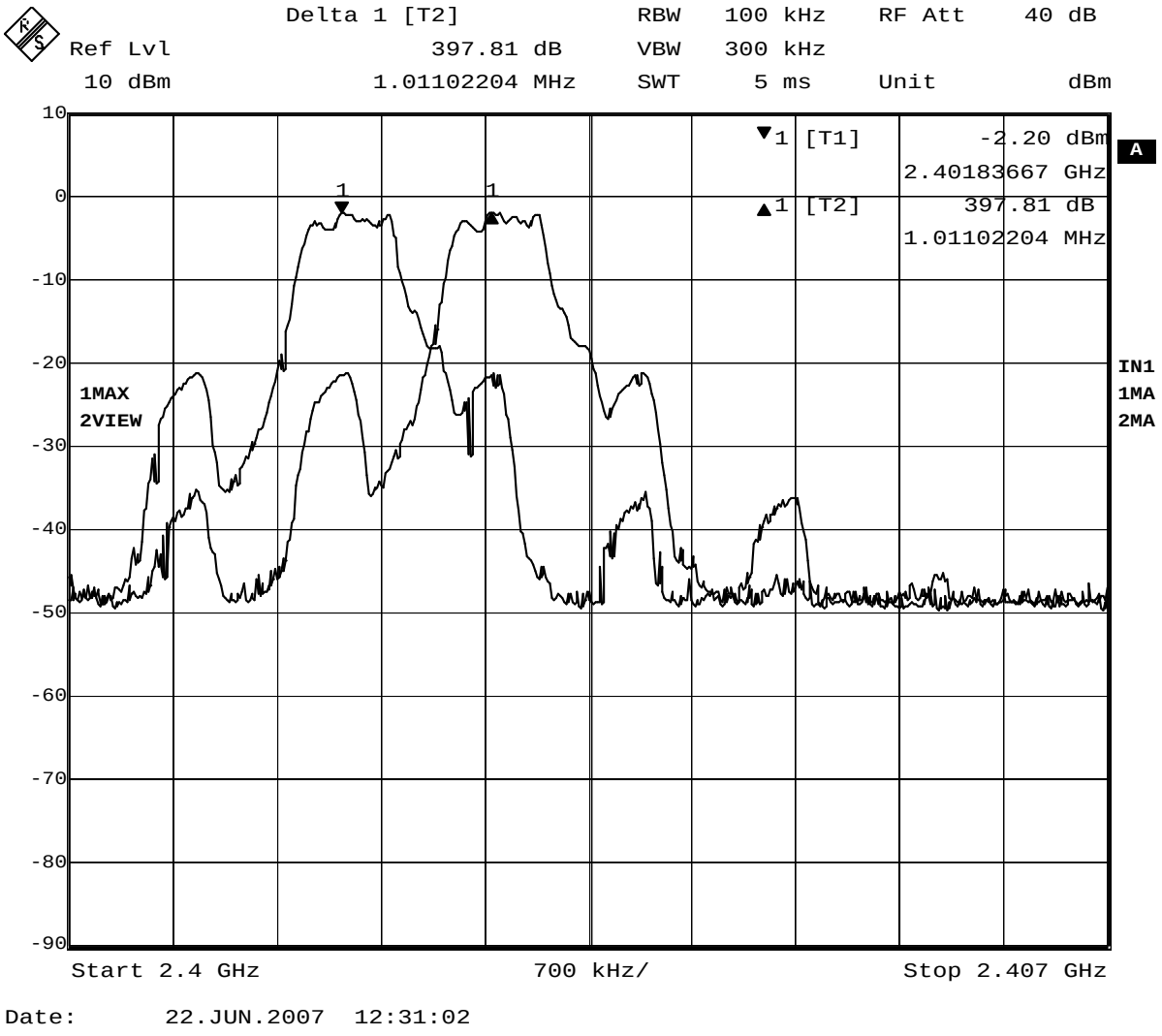
1. Hopping channel separation

Channel 0

20dB bandwidth

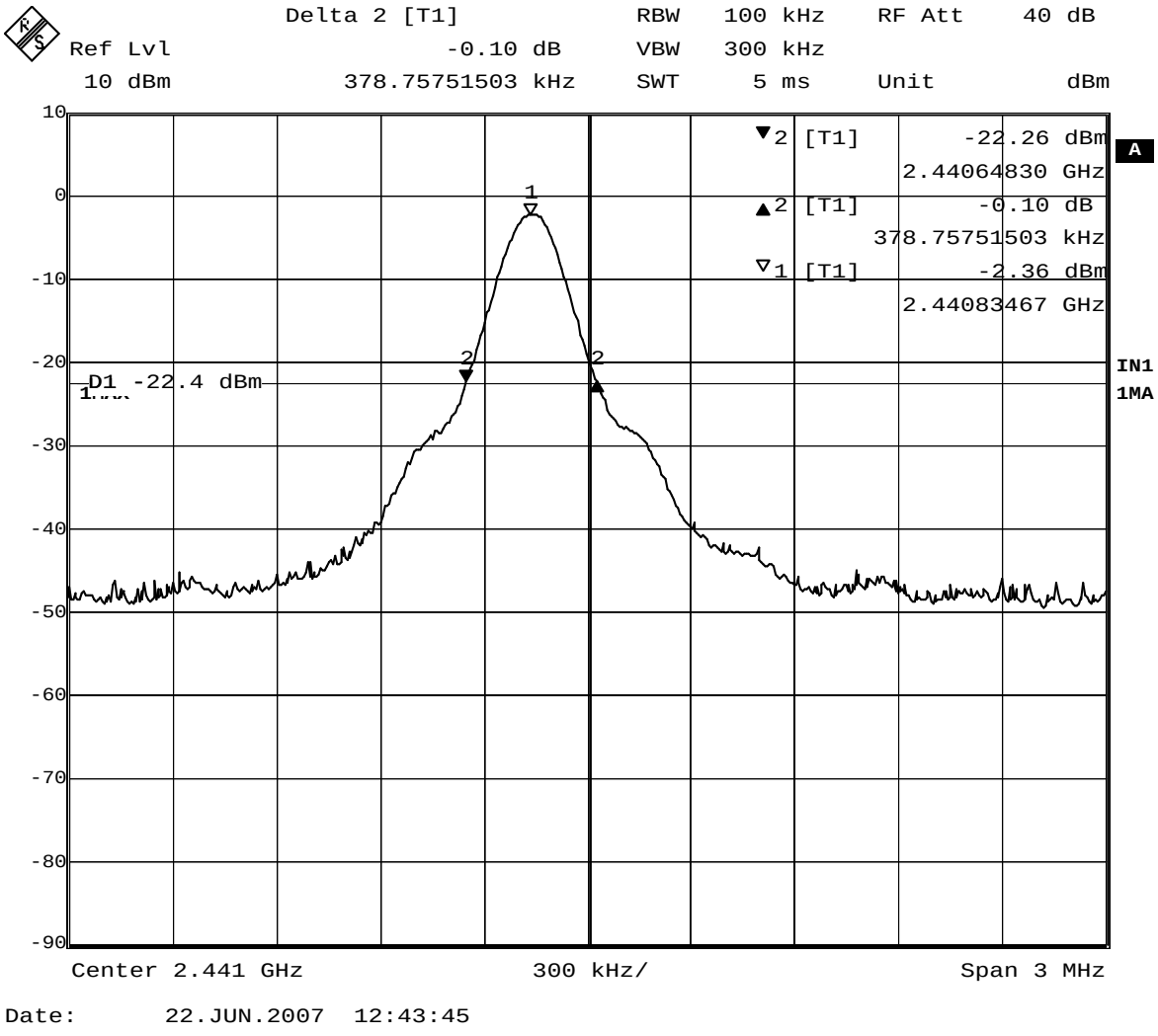


Channel Separation with adjacent channel

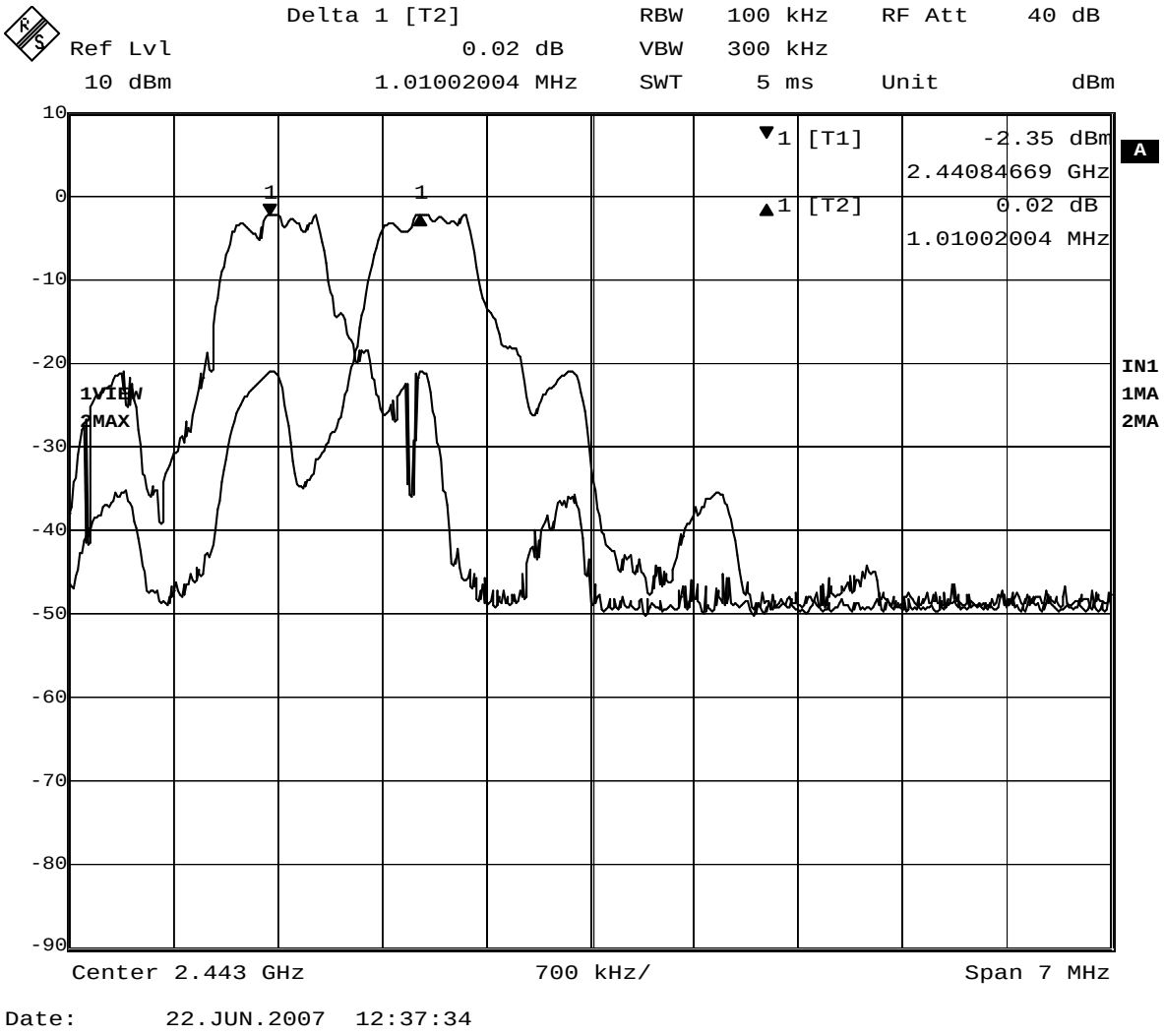


Channel 39

20dB bandwidth

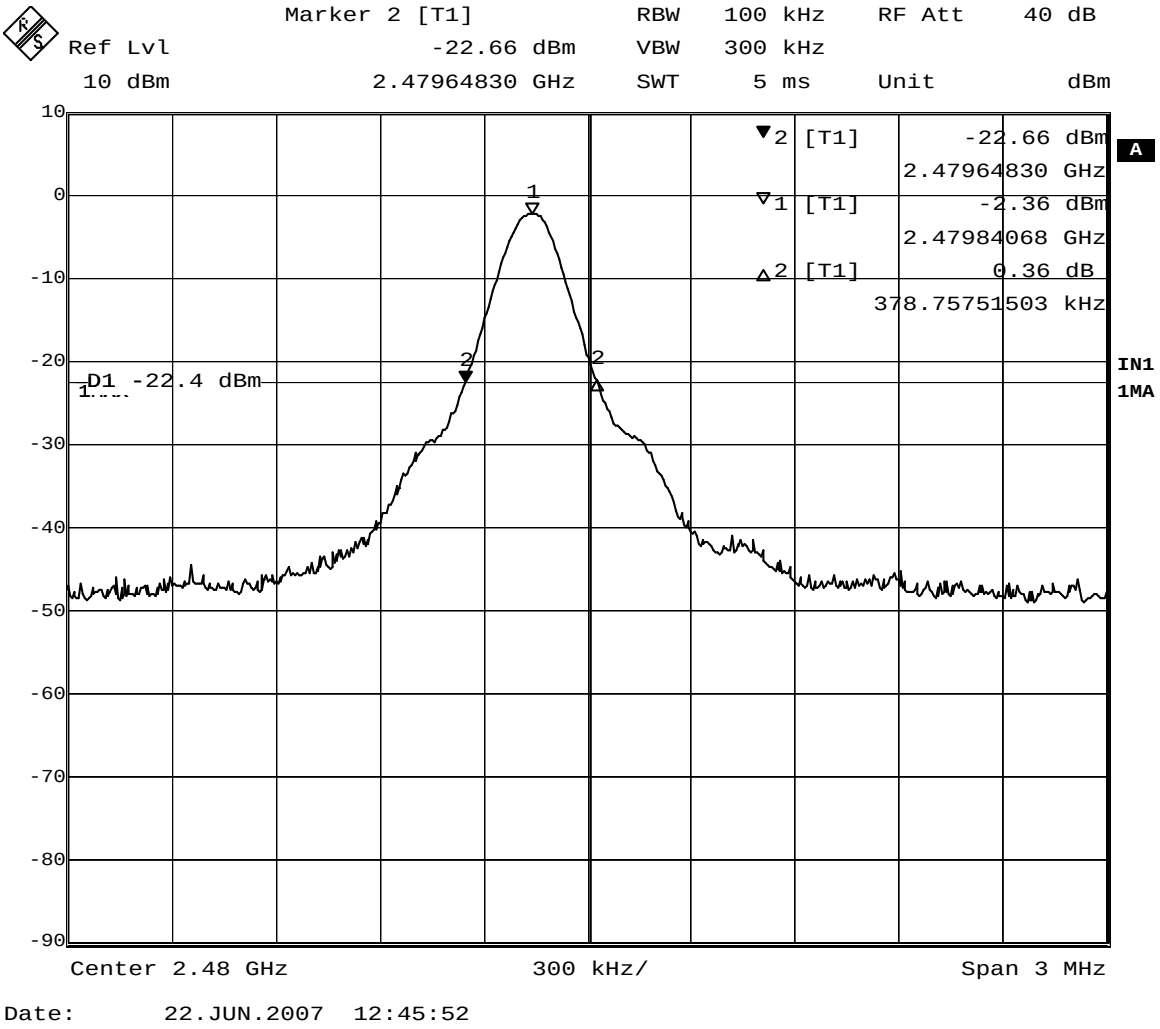


Channel Separation with adjacent channel

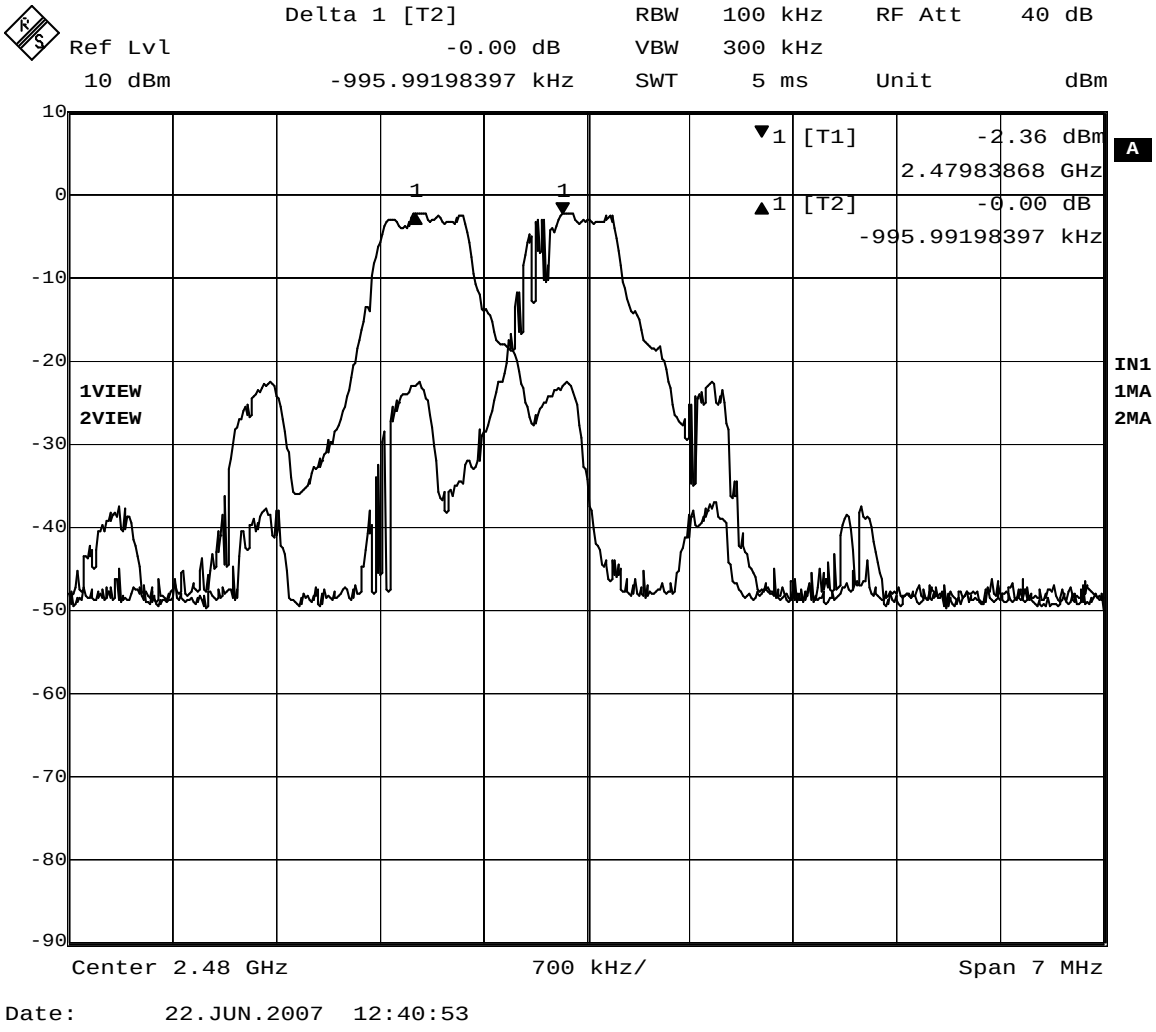


Channel 78

20dB bandwidth



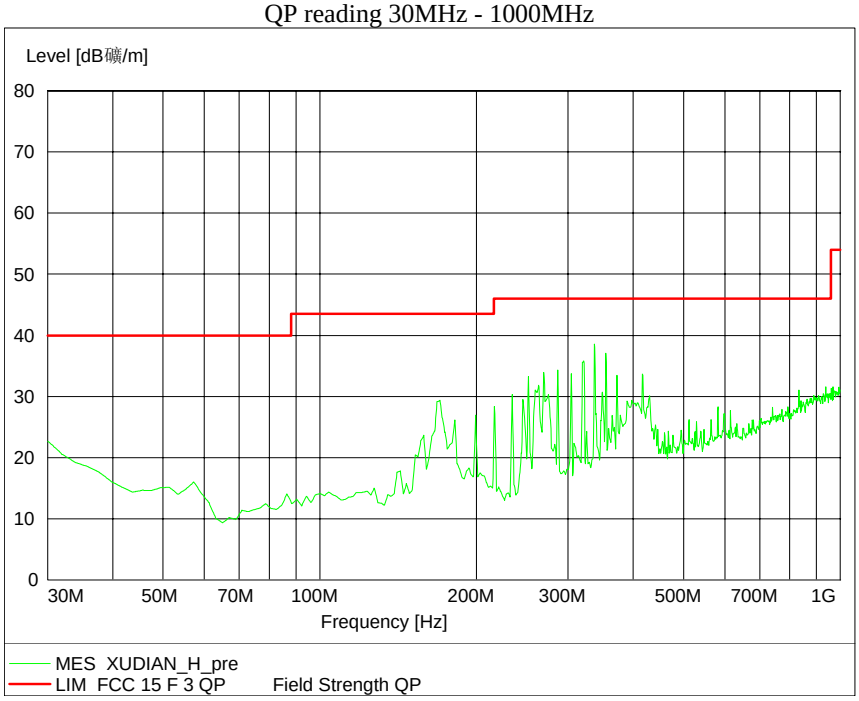
Channel Separation with adjacent channel



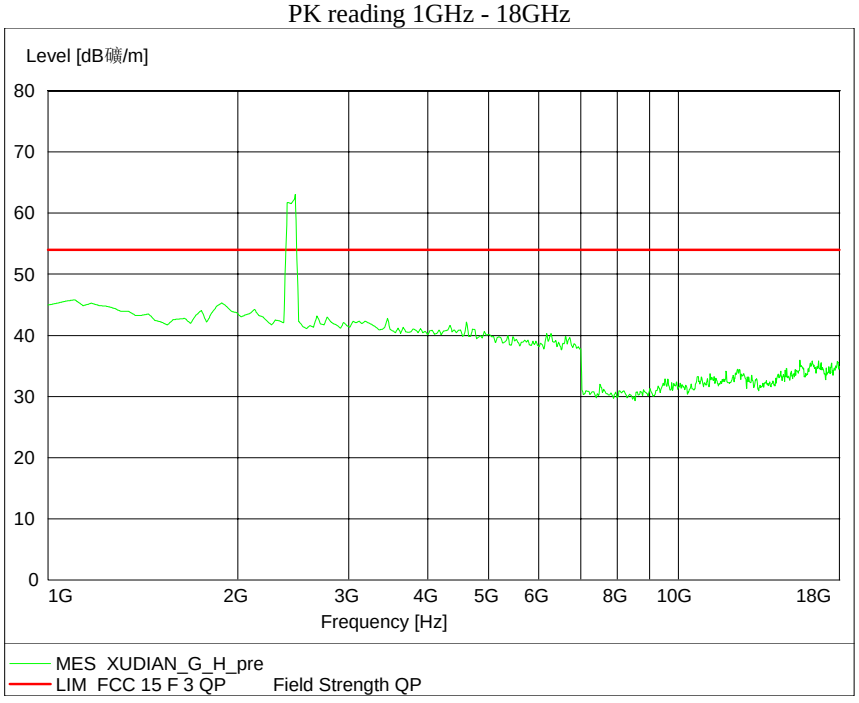
2. Spurious Emission

Channel 0, Horizontal

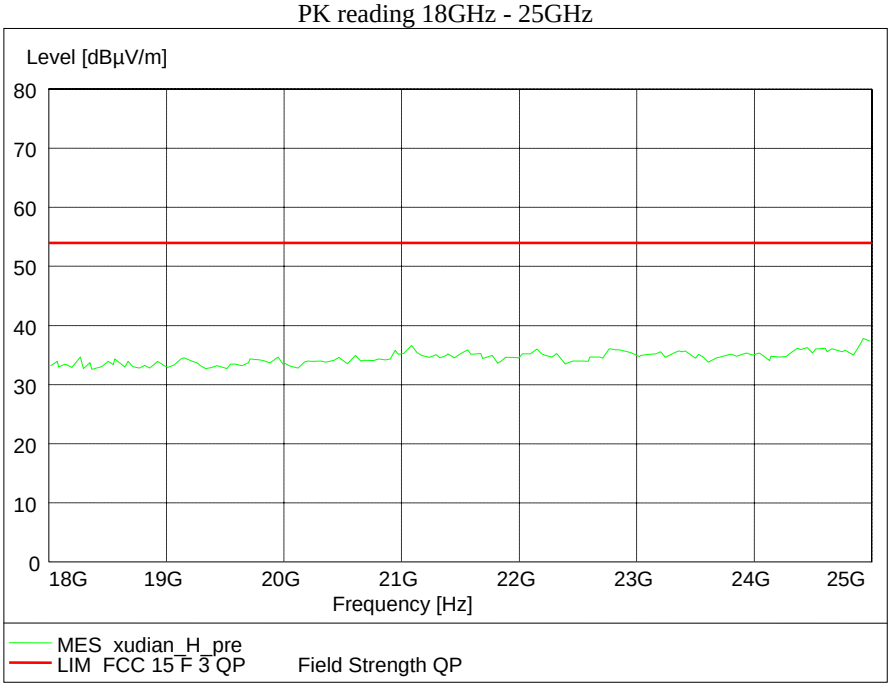
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

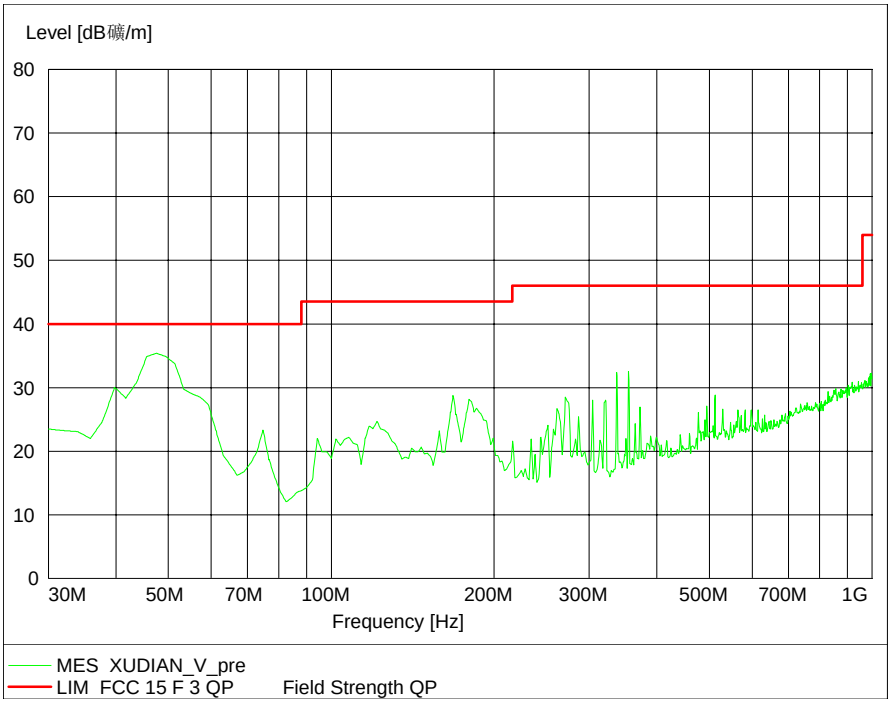


PK reading 18GHz - 25GHz

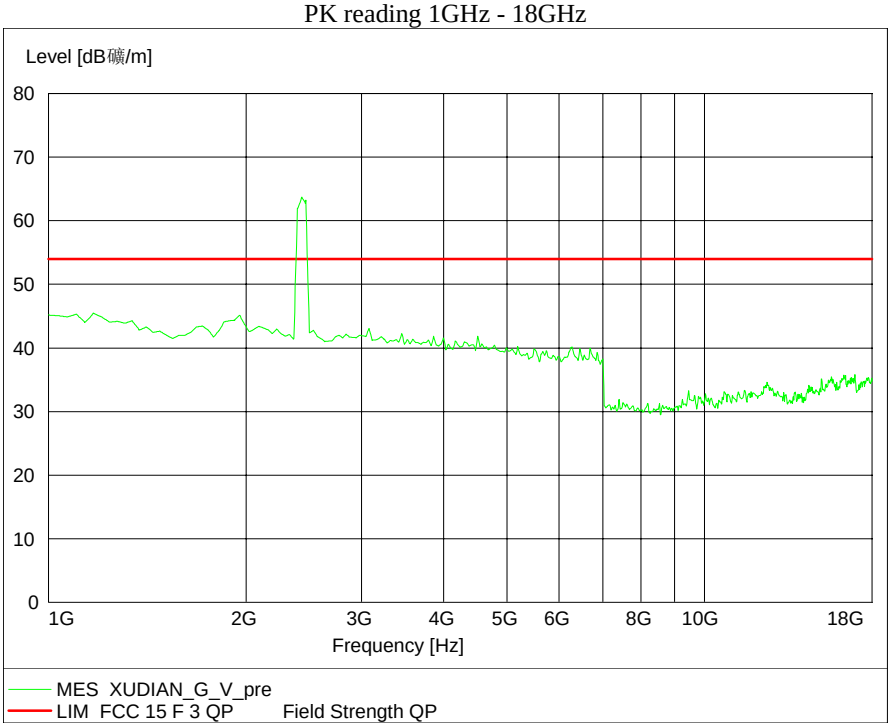


Channel 0, Vertical

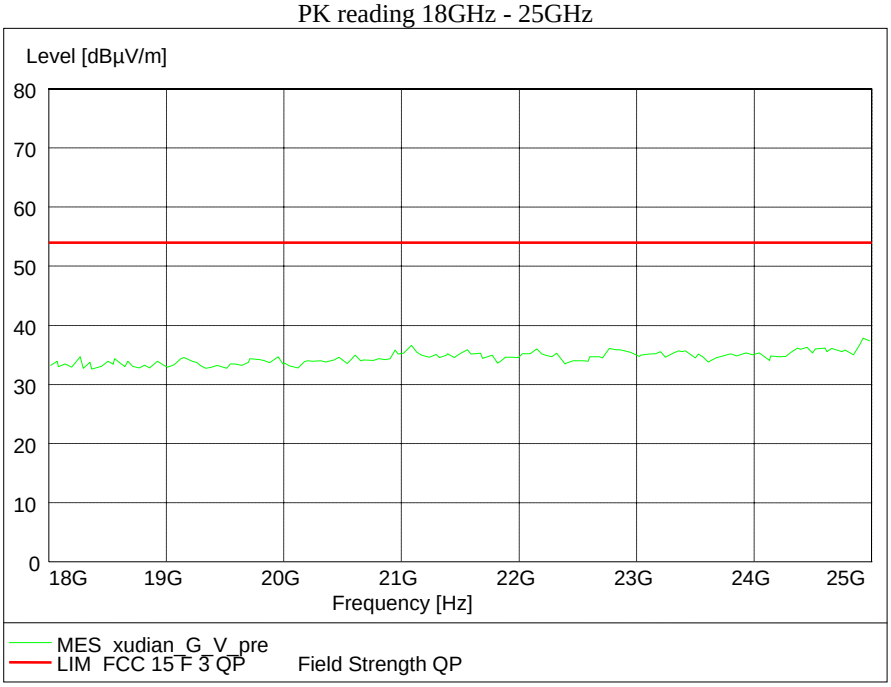
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

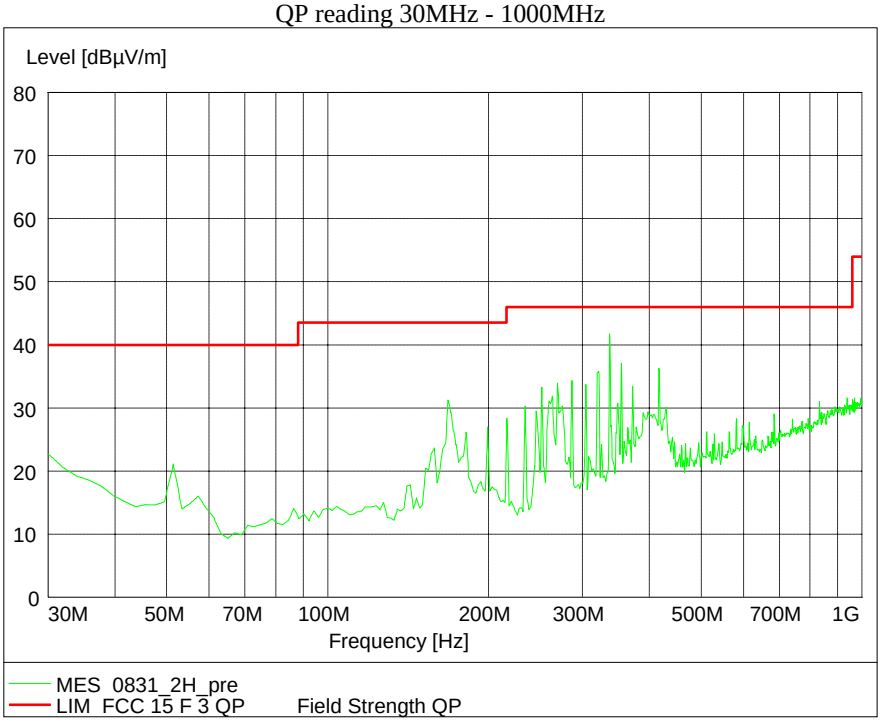


PK reading 18GHz - 25GHz

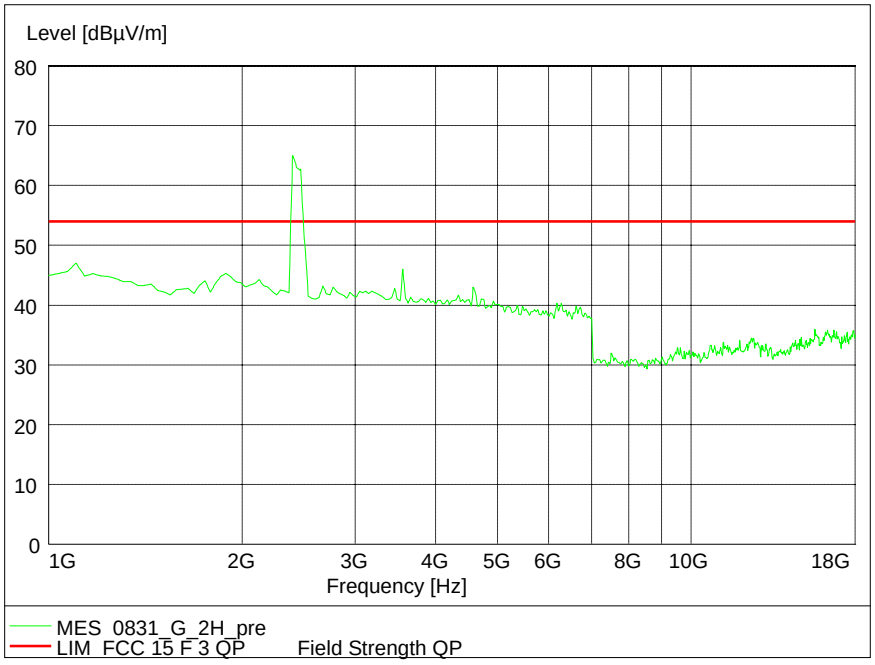


Channel 39, Horizontal

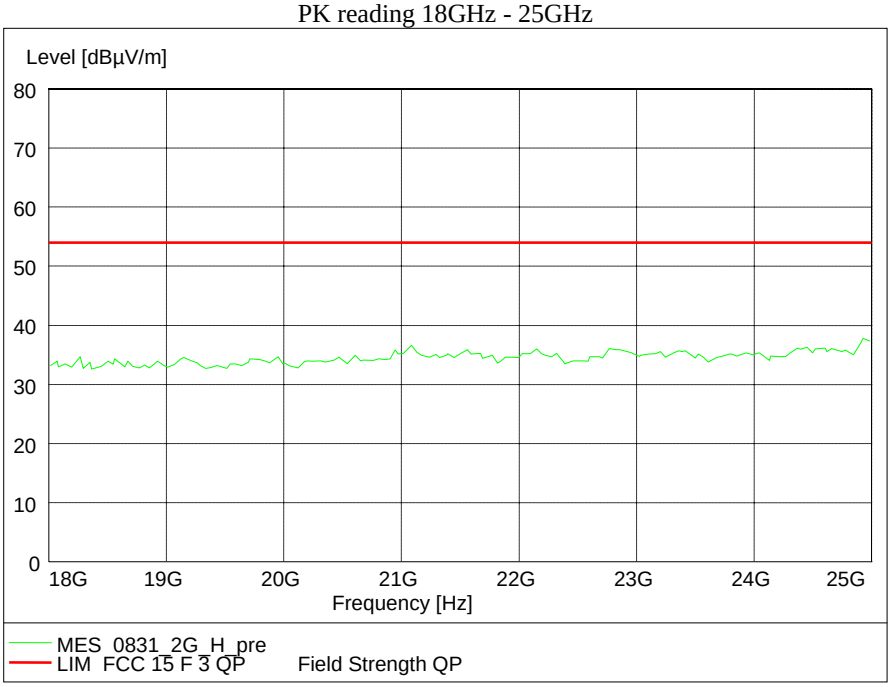
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

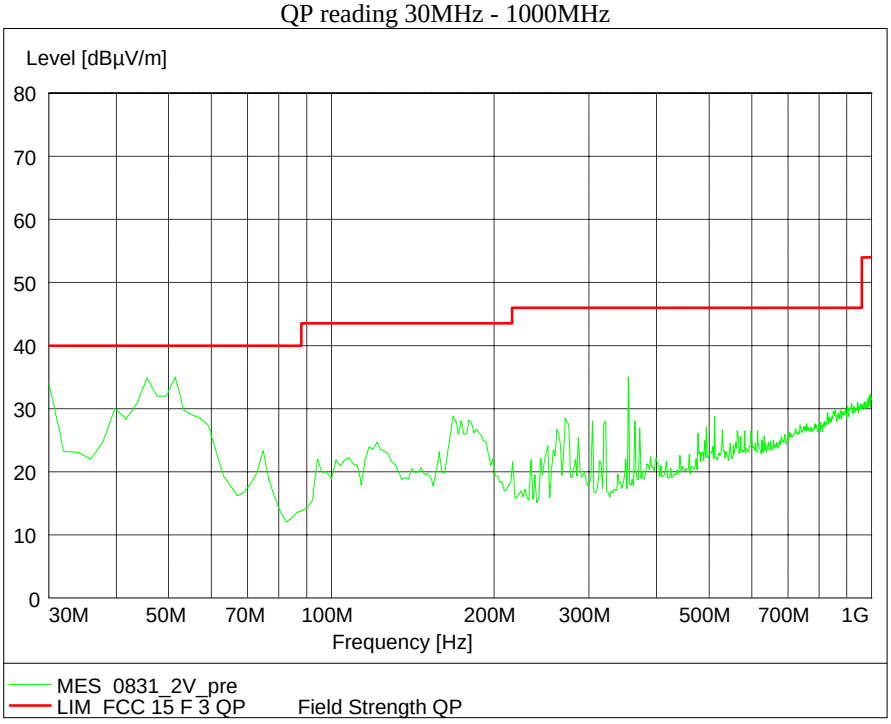


PK reading 18GHz - 25GHz

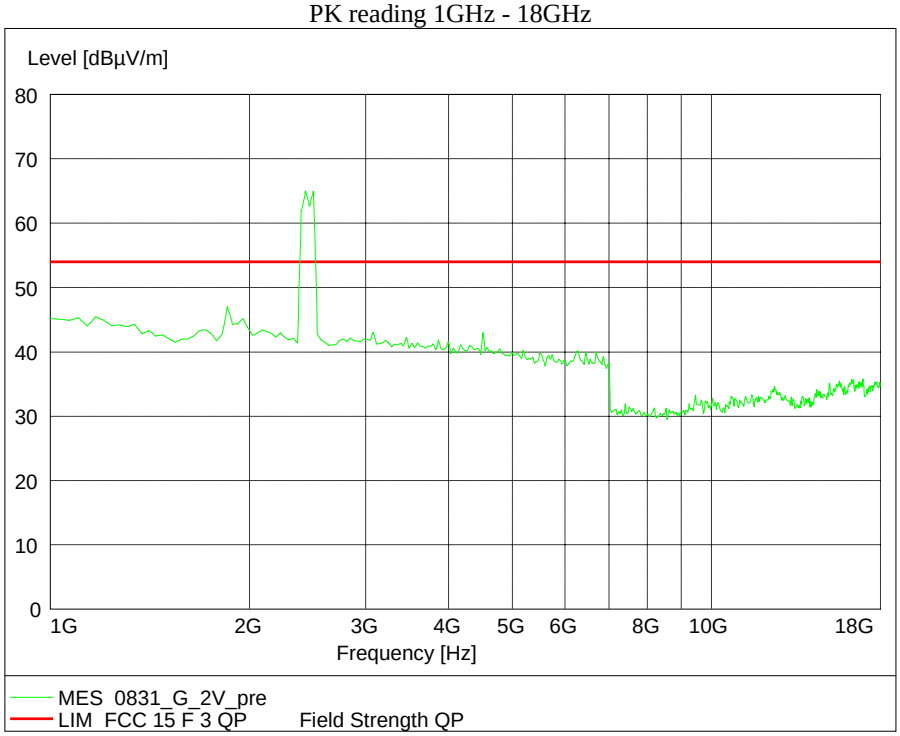


Channel 39, Vertical

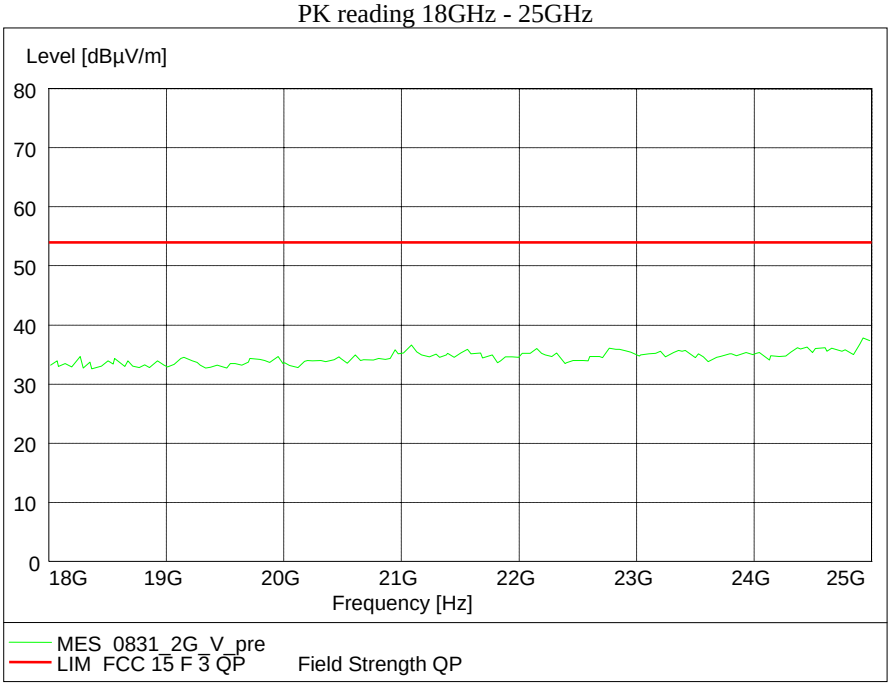
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

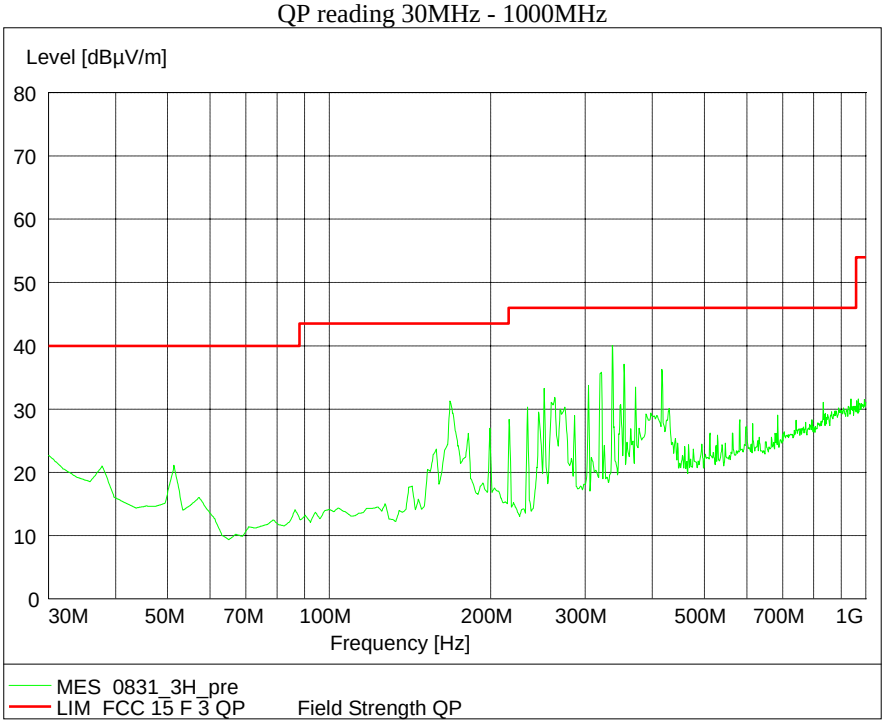


PK reading 18GHz - 25GHz

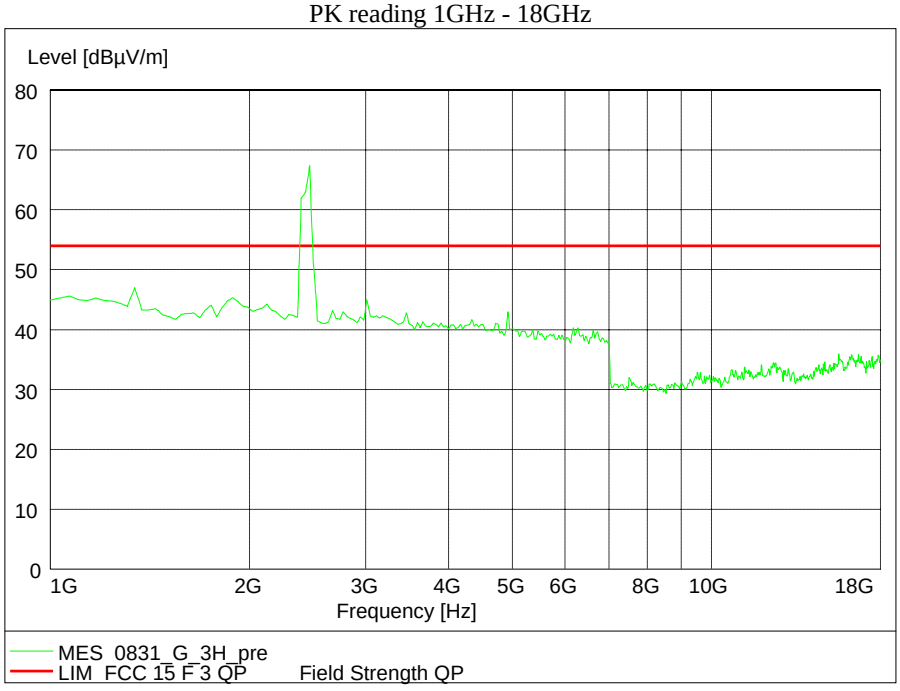


Channel 78, Horizontal

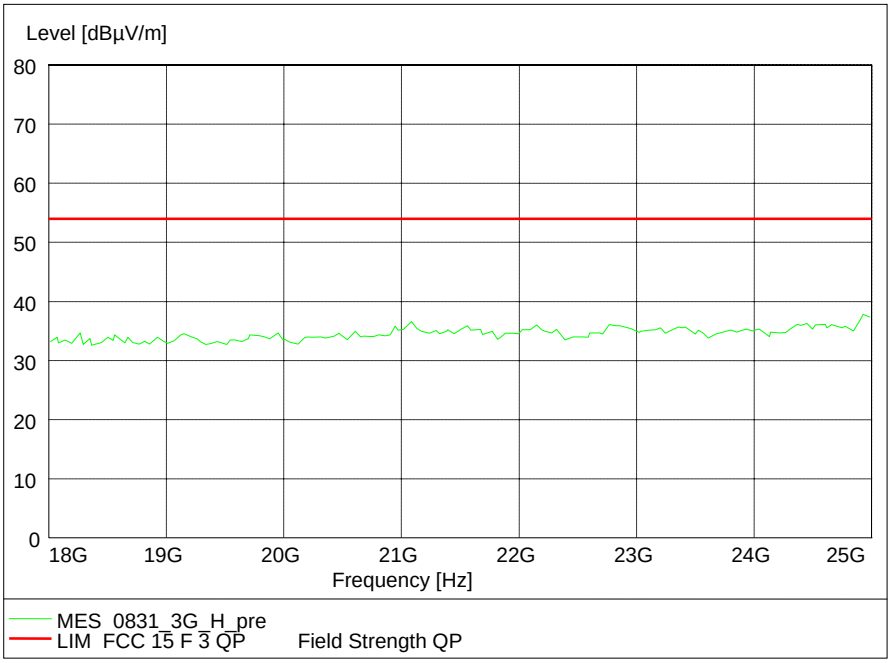
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

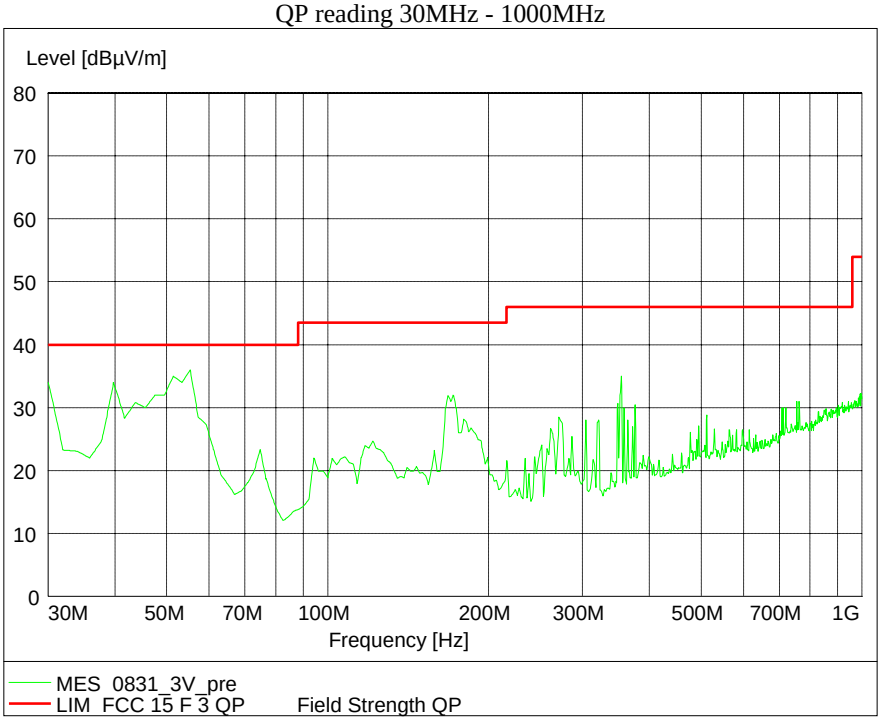


PK reading 18GHz - 25GHz

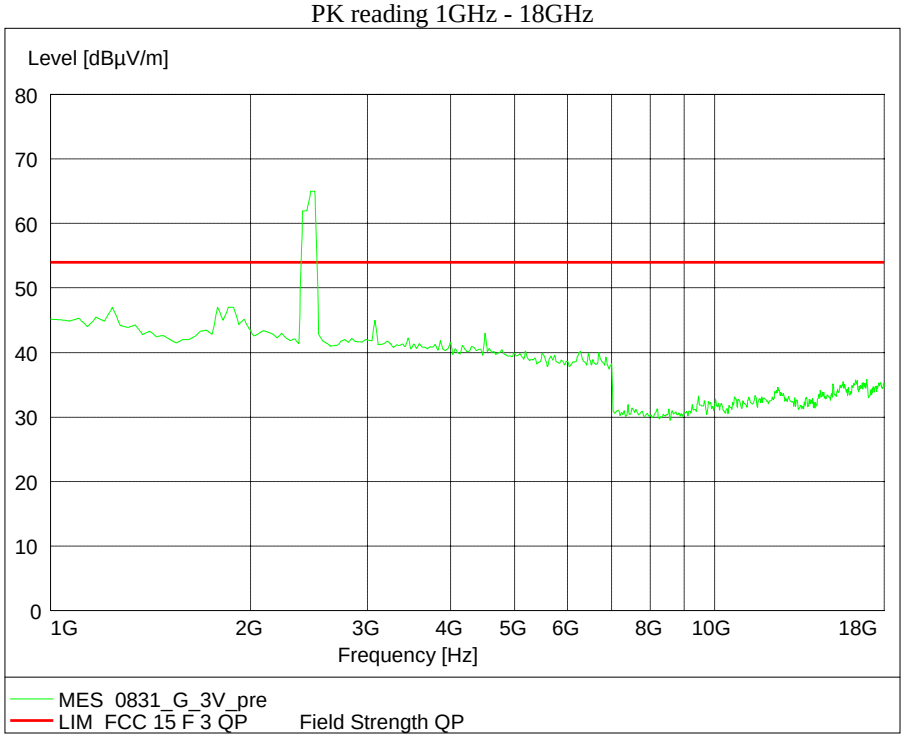


Channel 78, Vertical

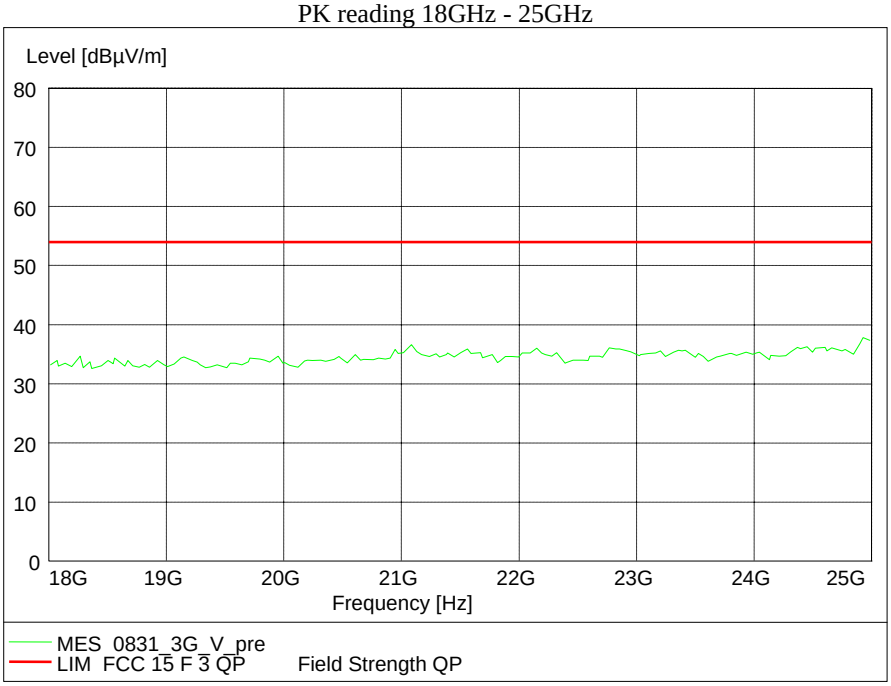
QP reading 30MHz - 1000MHz



PK reading 1GHz - 18GHz

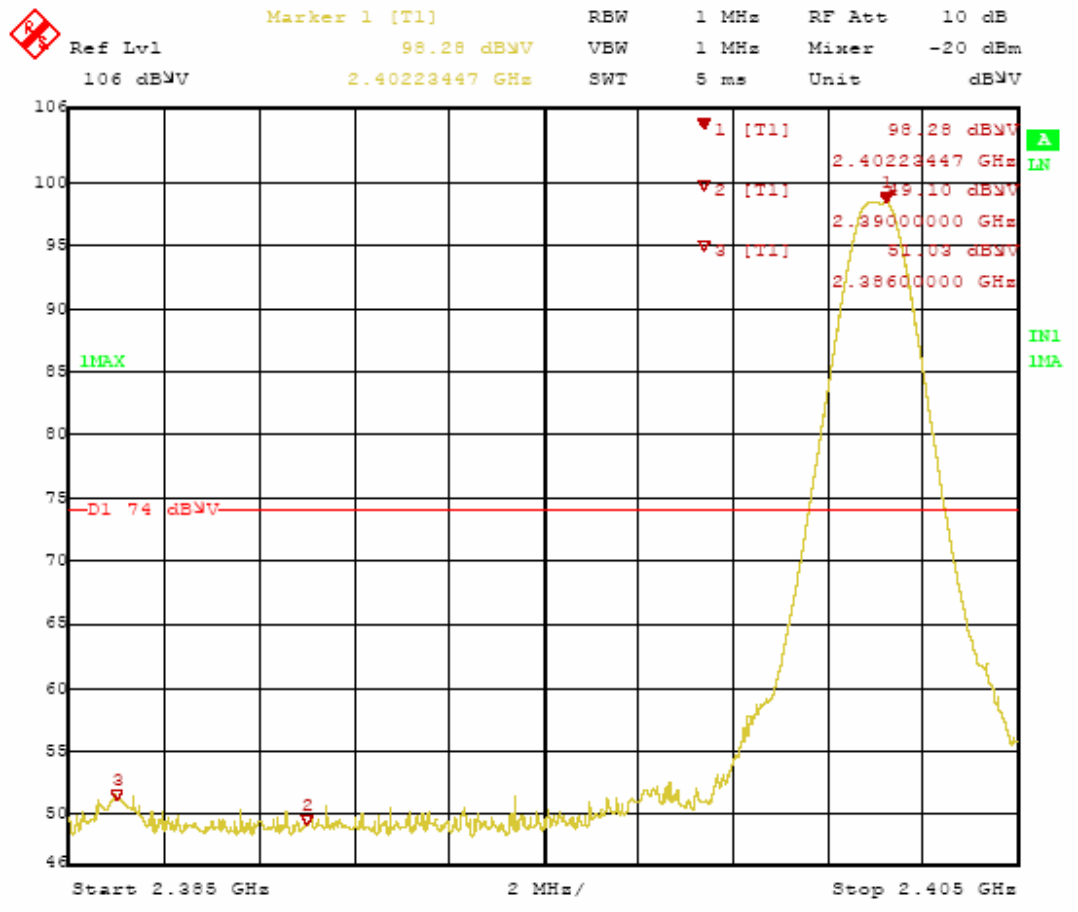


PK reading 18GHz - 25GHz

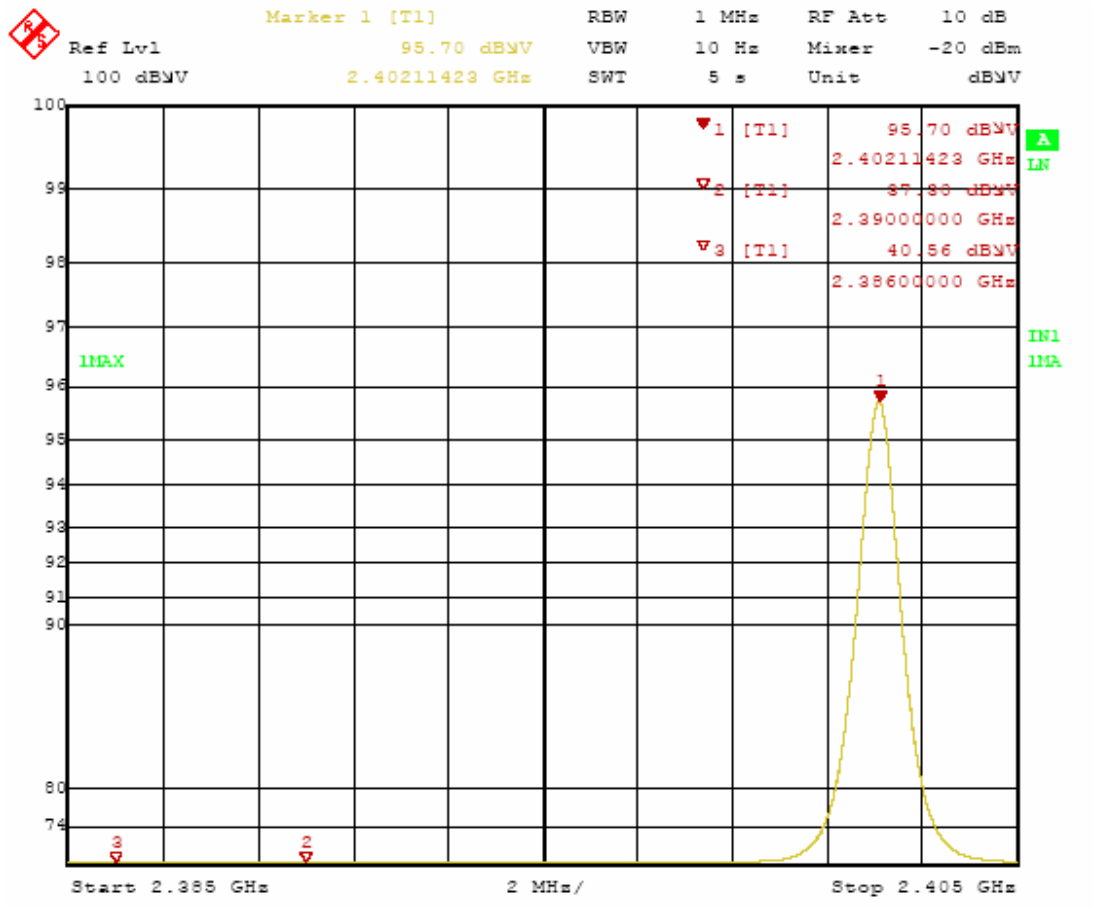


3. Restrict band radiated Emission

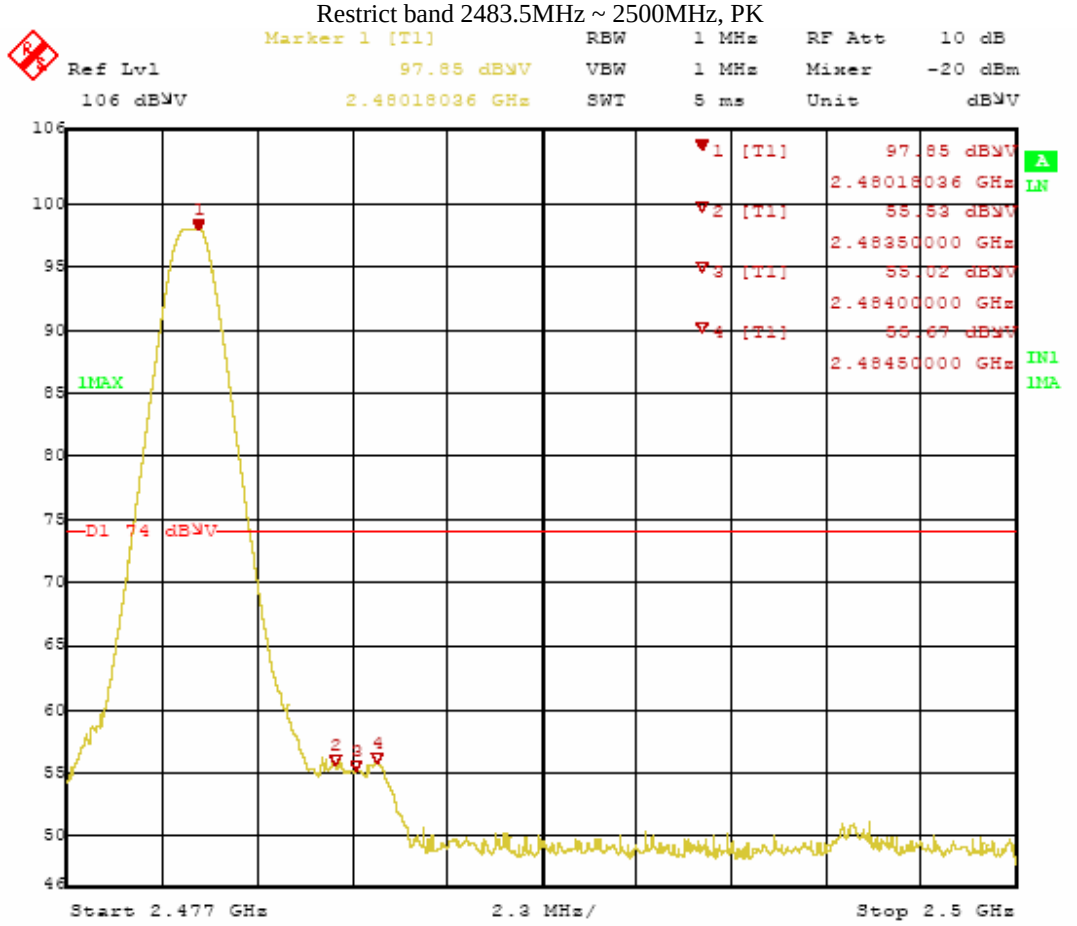
Restrict band 2310MHz ~ 2390MHz, PK



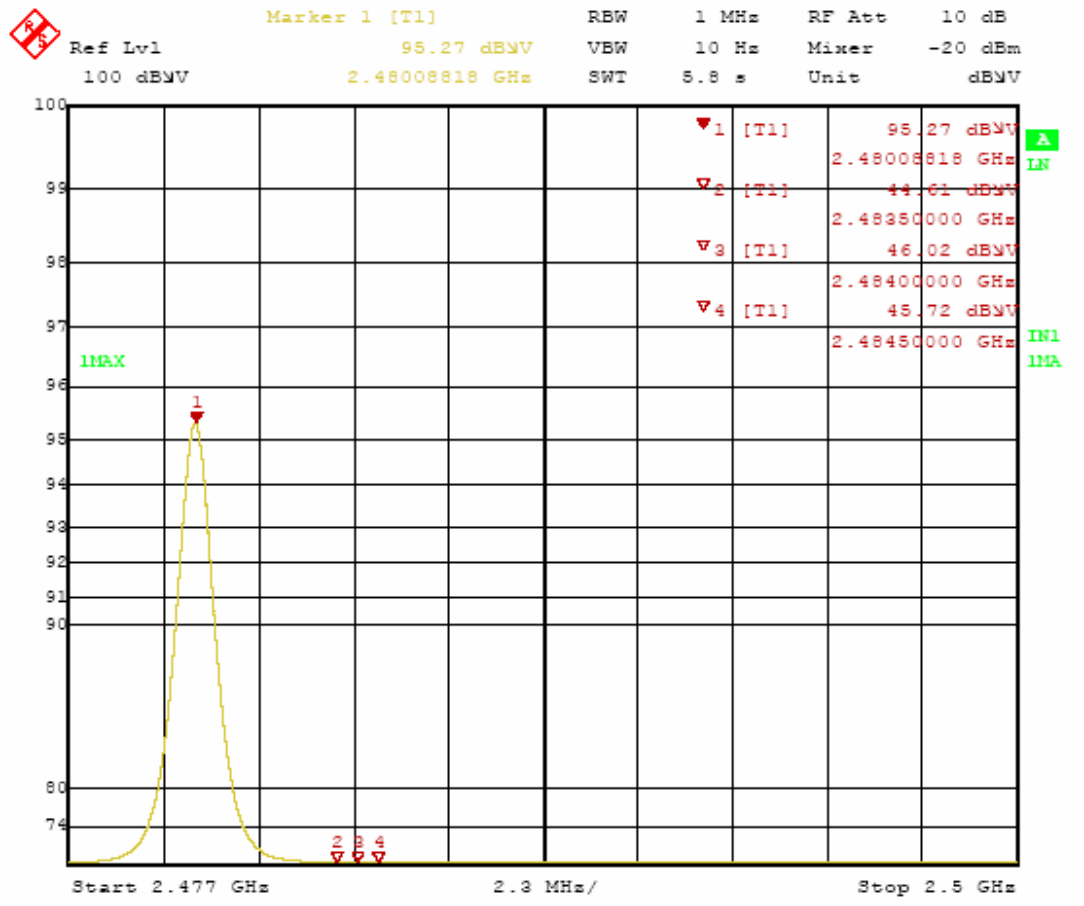
Restrict band 2310MHz ~ 2390MHz, AV



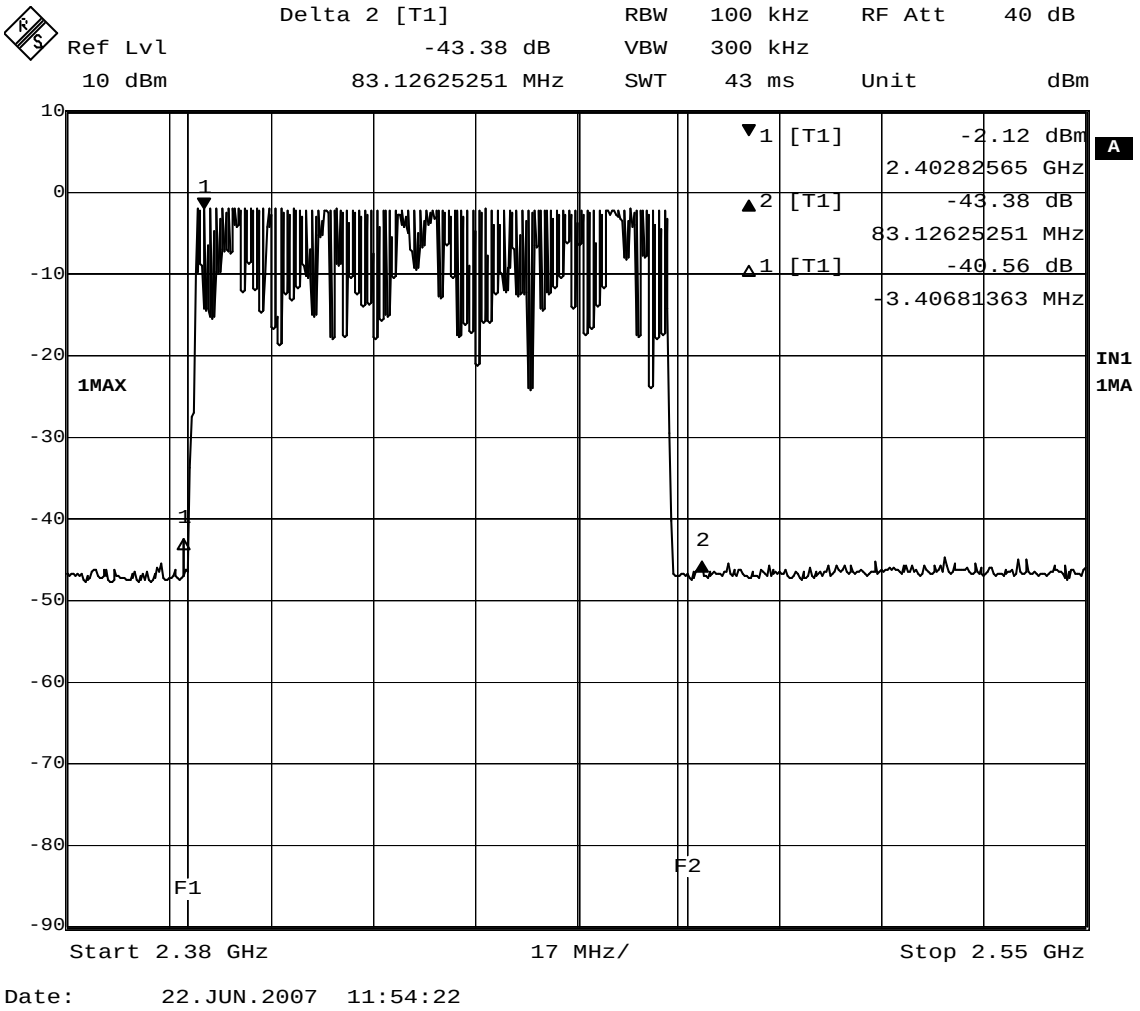
Restrict band 2483.5MHz ~ 2500MHz, PK



Restrict band 2483.5MHz ~ 2500MHz, AV

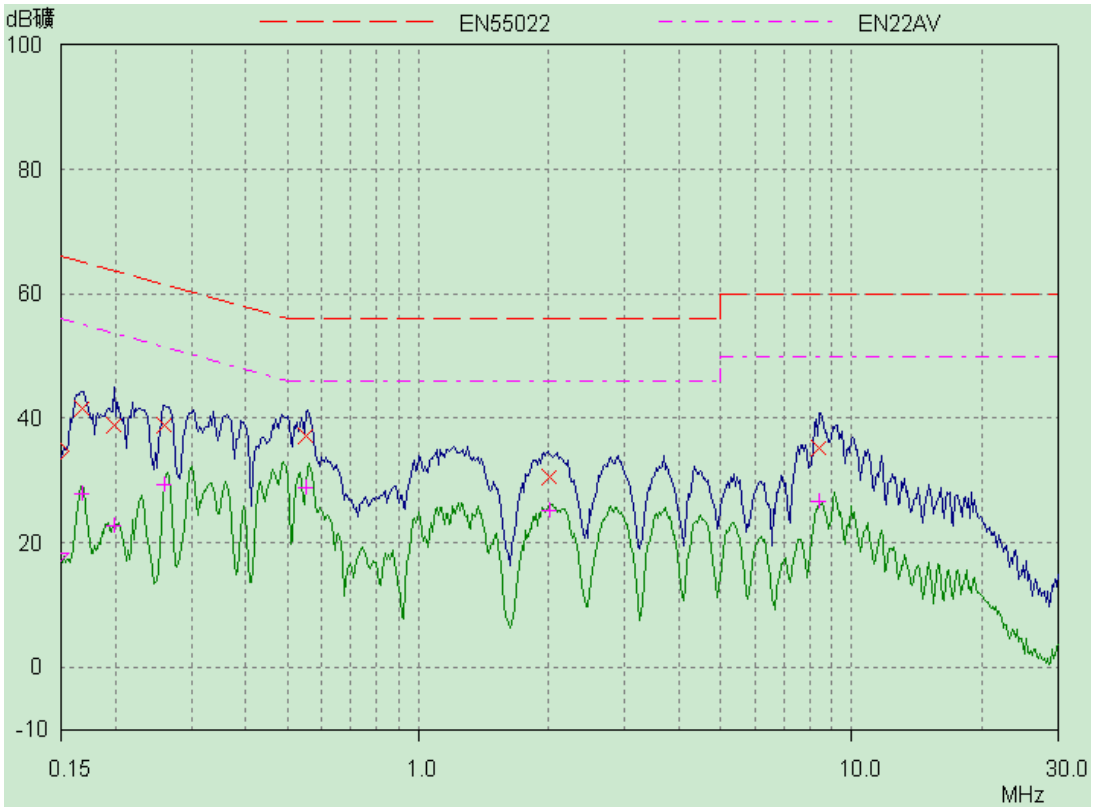


4. Emission outside the frequency band

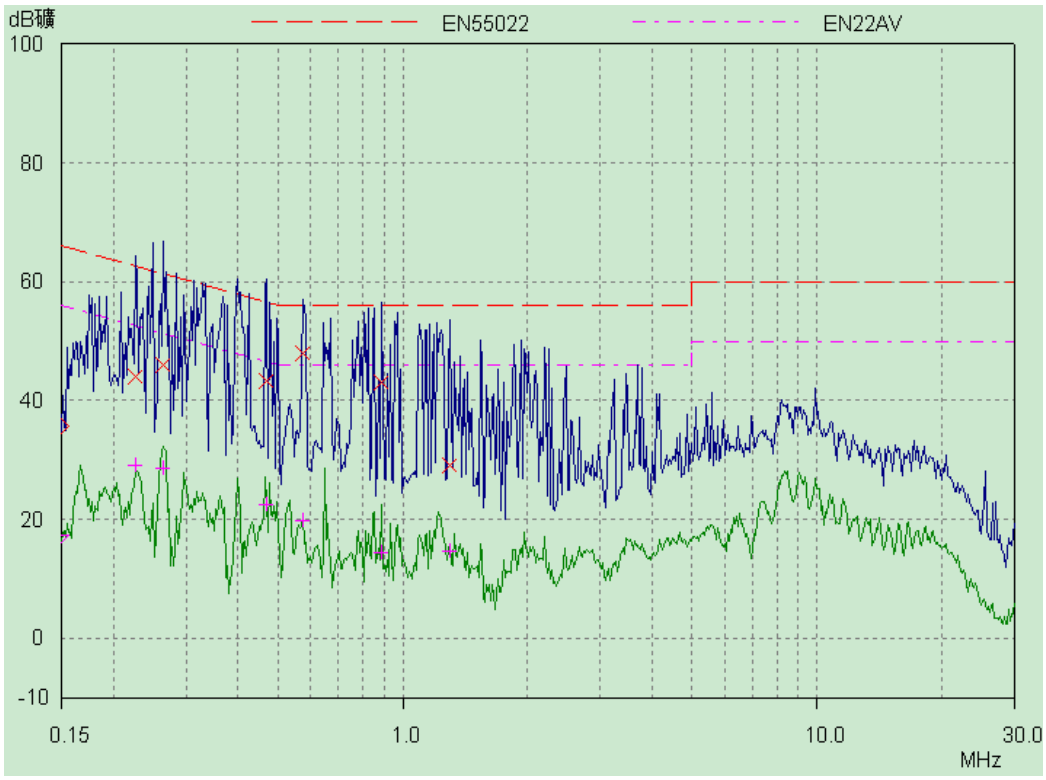


5. Conducted Emission

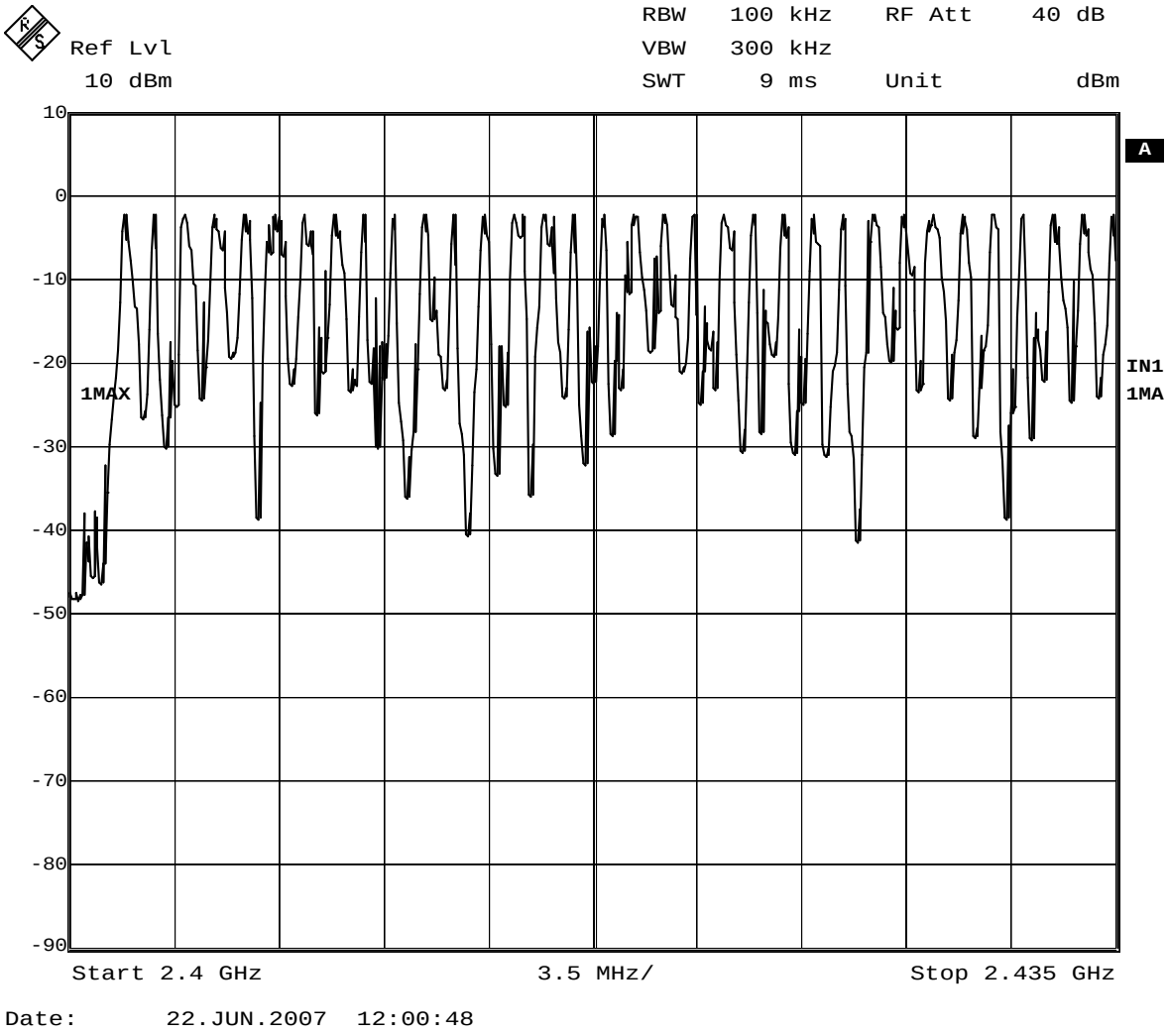
Power line: L

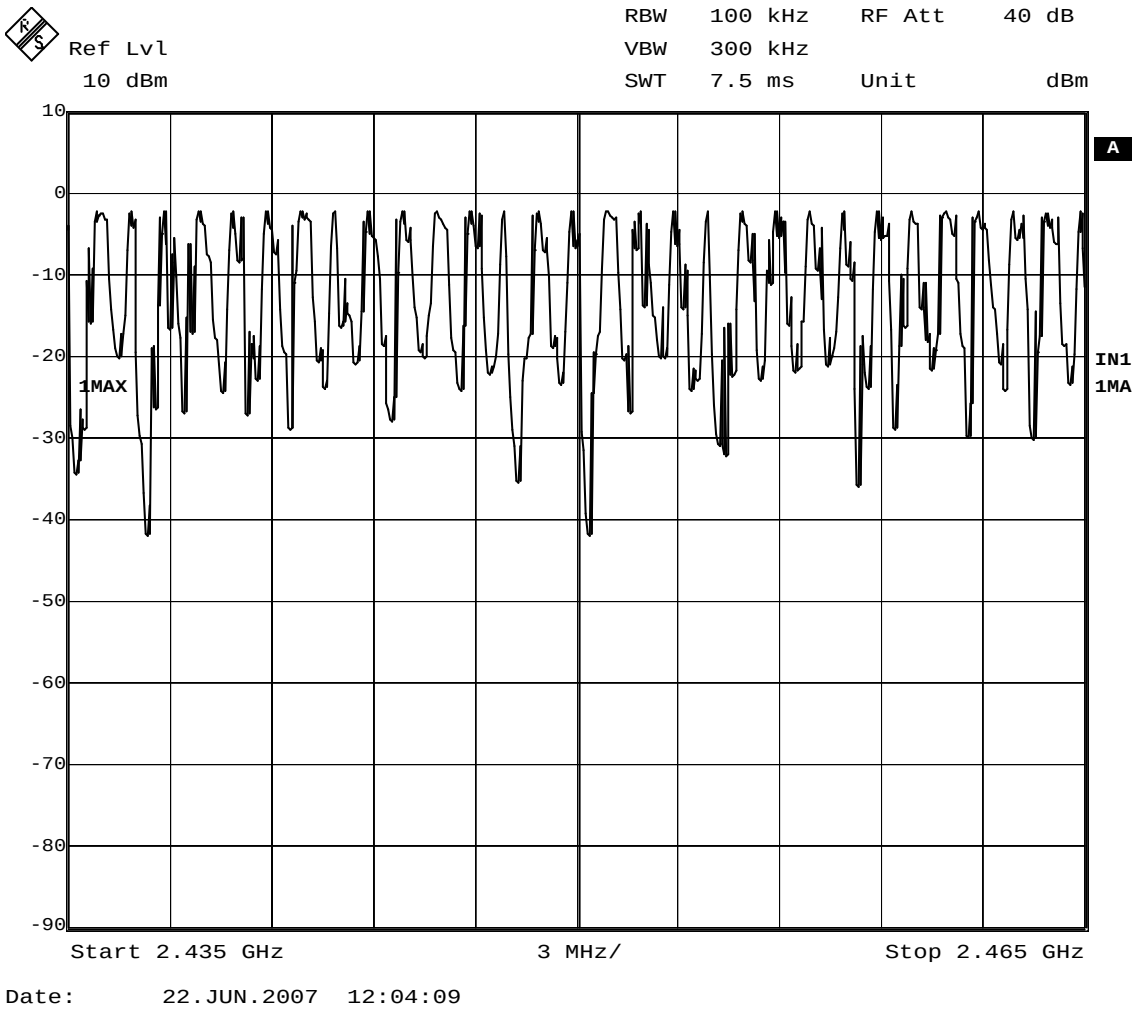


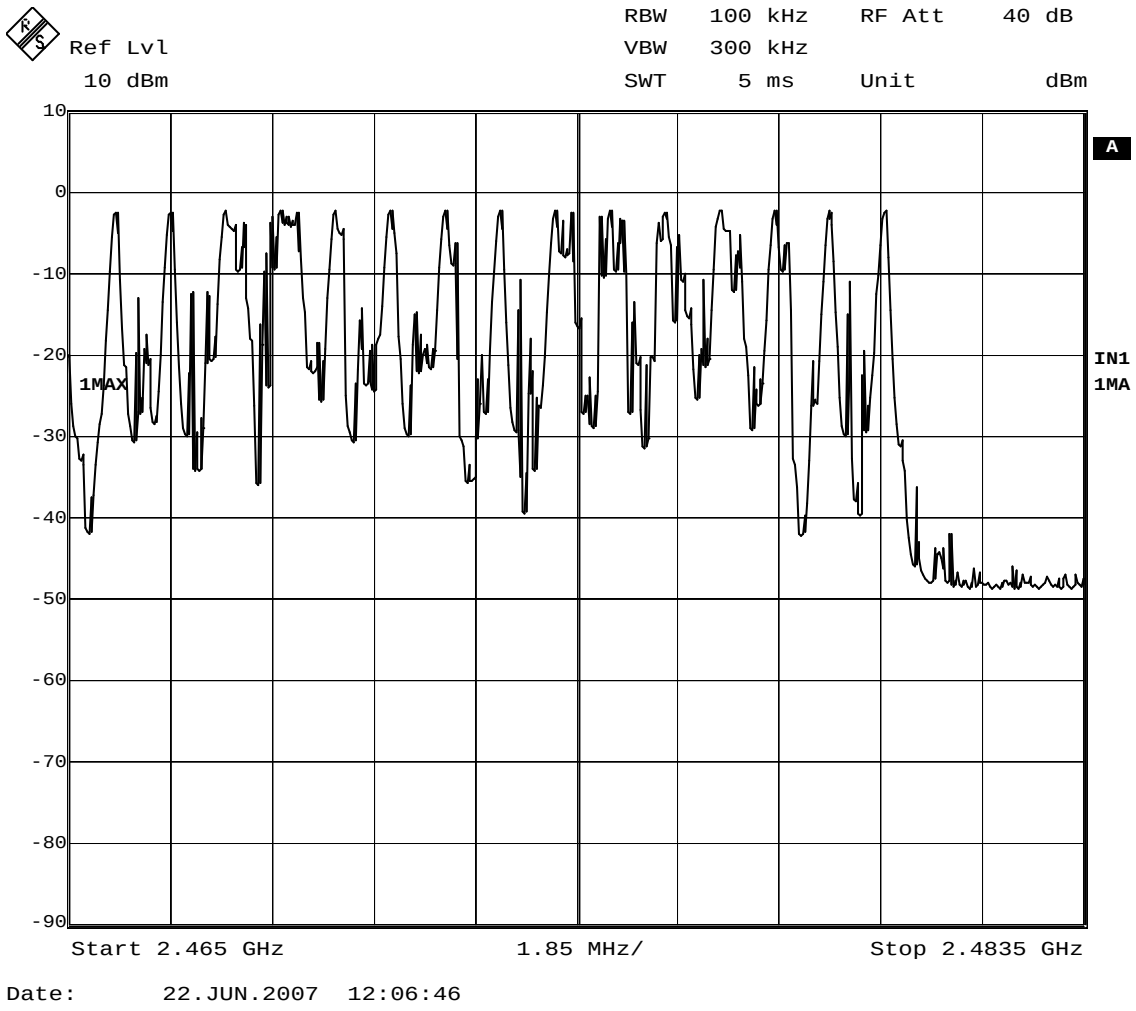
Power line: N



6. Channel Number of hopping system



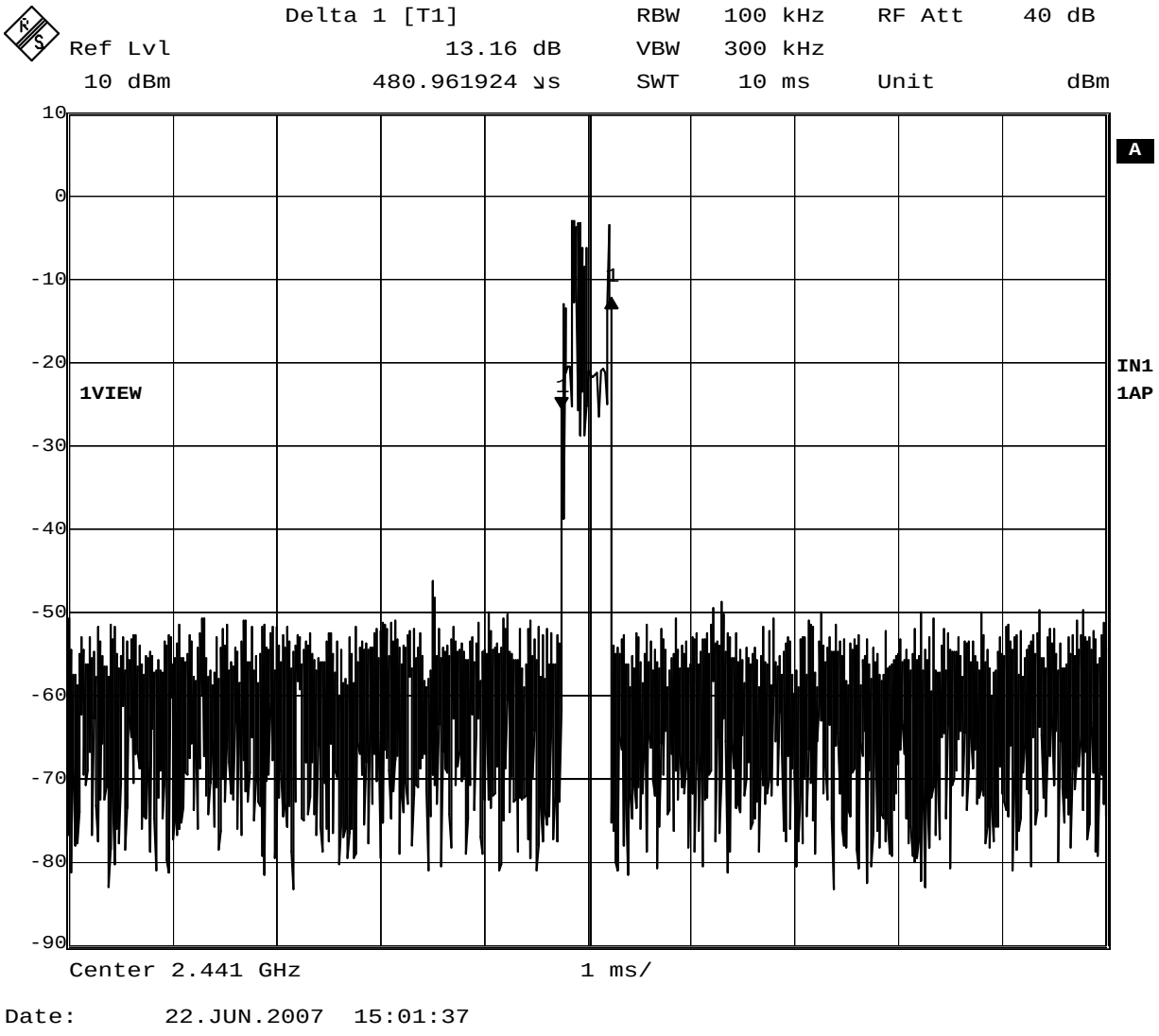

RBW 100 kHz
RF Att 40 dB
Ref Lvl
10 dBm
VBW 300 kHz
SWT 7.5 ms
Unit dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
A
IN1
1MA
1MAX
Start 2.435 GHz
3 MHz/
Stop 2.465 GHz
Date: 22.JUN.2007 12:04:09


RBW 100 kHz
RF Att 40 dB
Ref Lvl
VBW 300 kHz
10 dBm
SWT 5 ms
Unit dBm
10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
A
IN1
1MA
1MAX
Start 2.465 GHz
1.85 MHz/
Stop 2.4835 GHz
Date: 22.JUN.2007 12:06:46

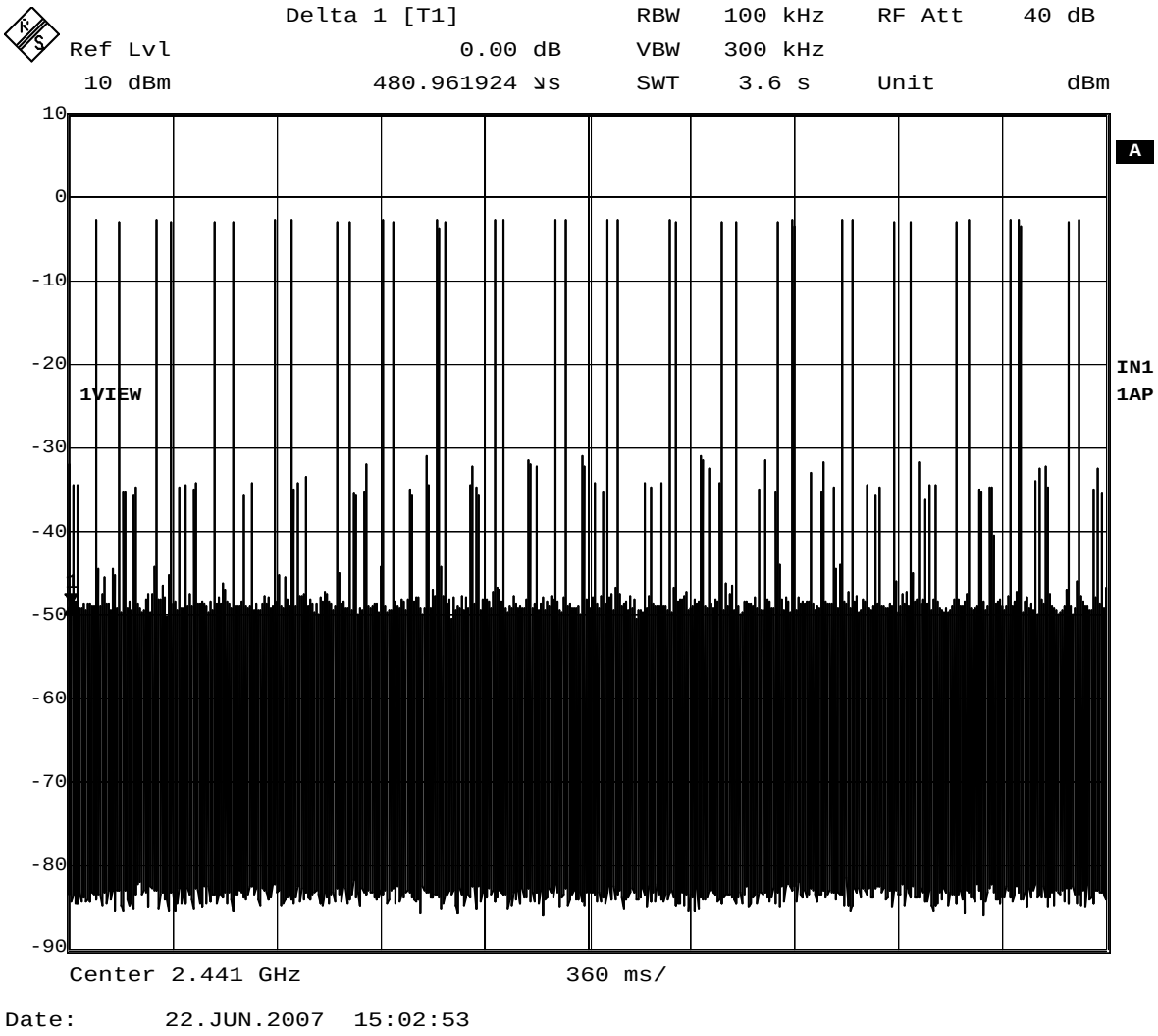
7. Average time of occupancy in any channel

Packet Type 4

Time of occupancy for single hopping

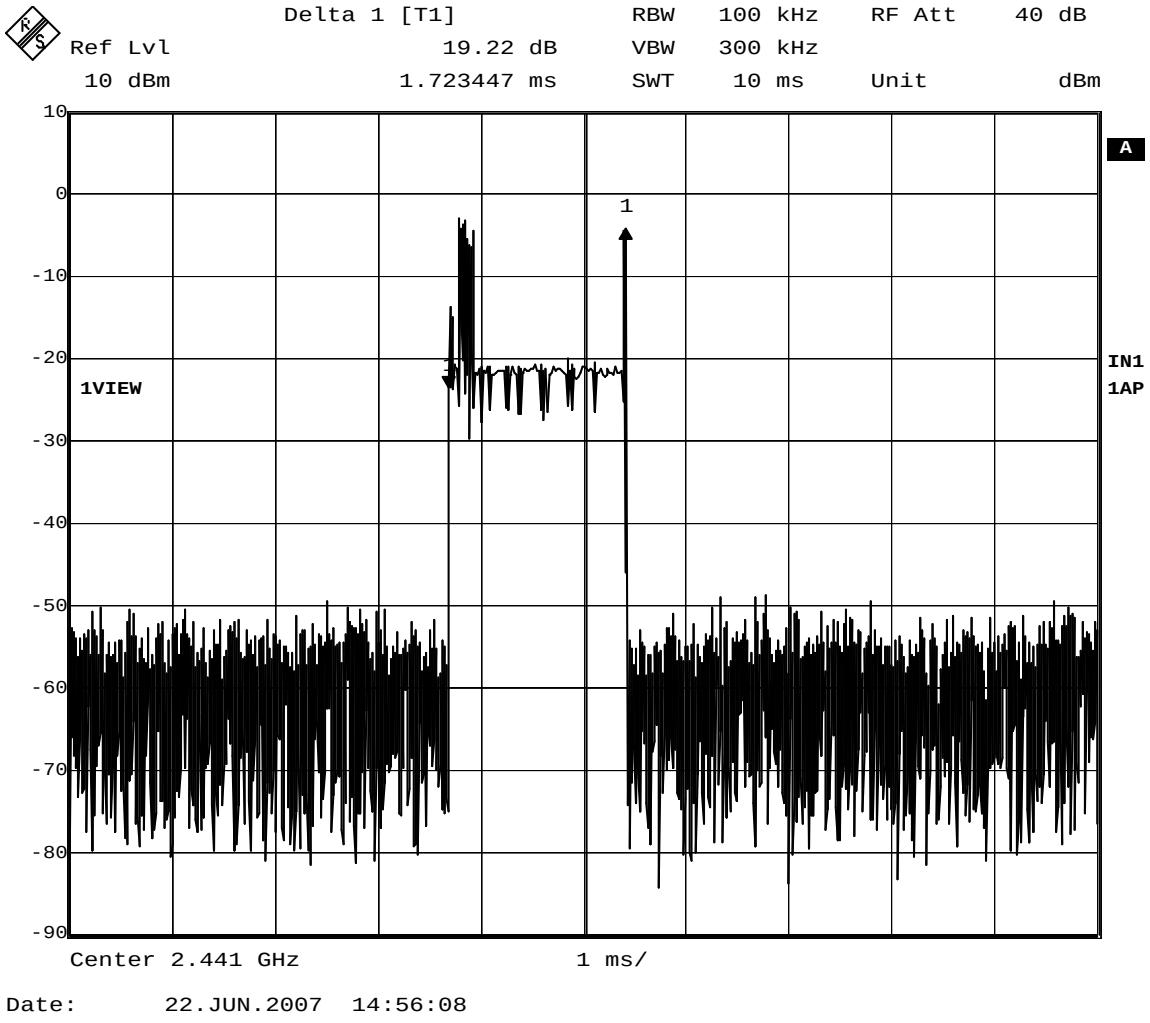


Hops among the interval of 3.6 s

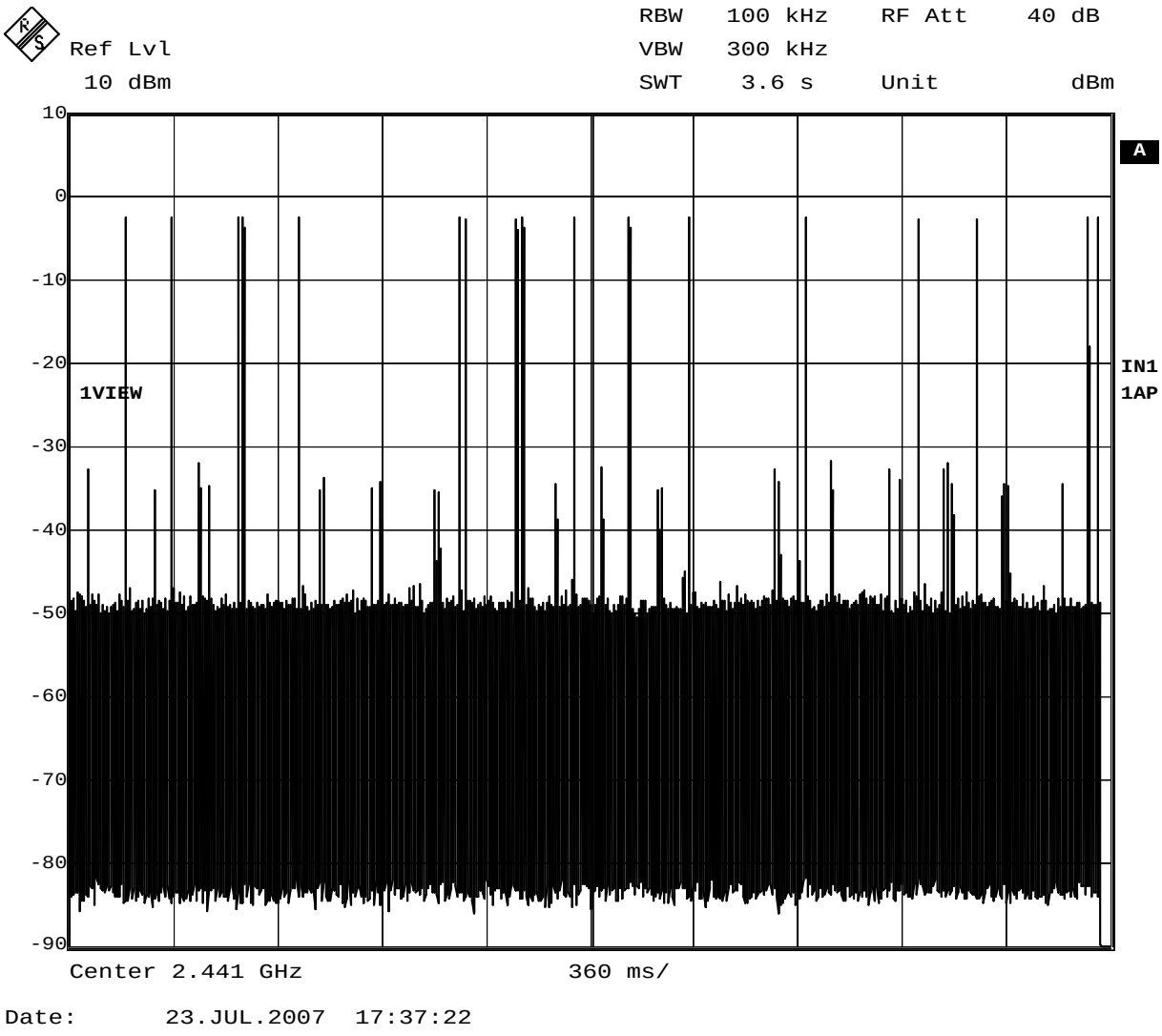


Packet Type 11

Time of occupancy for single hopping

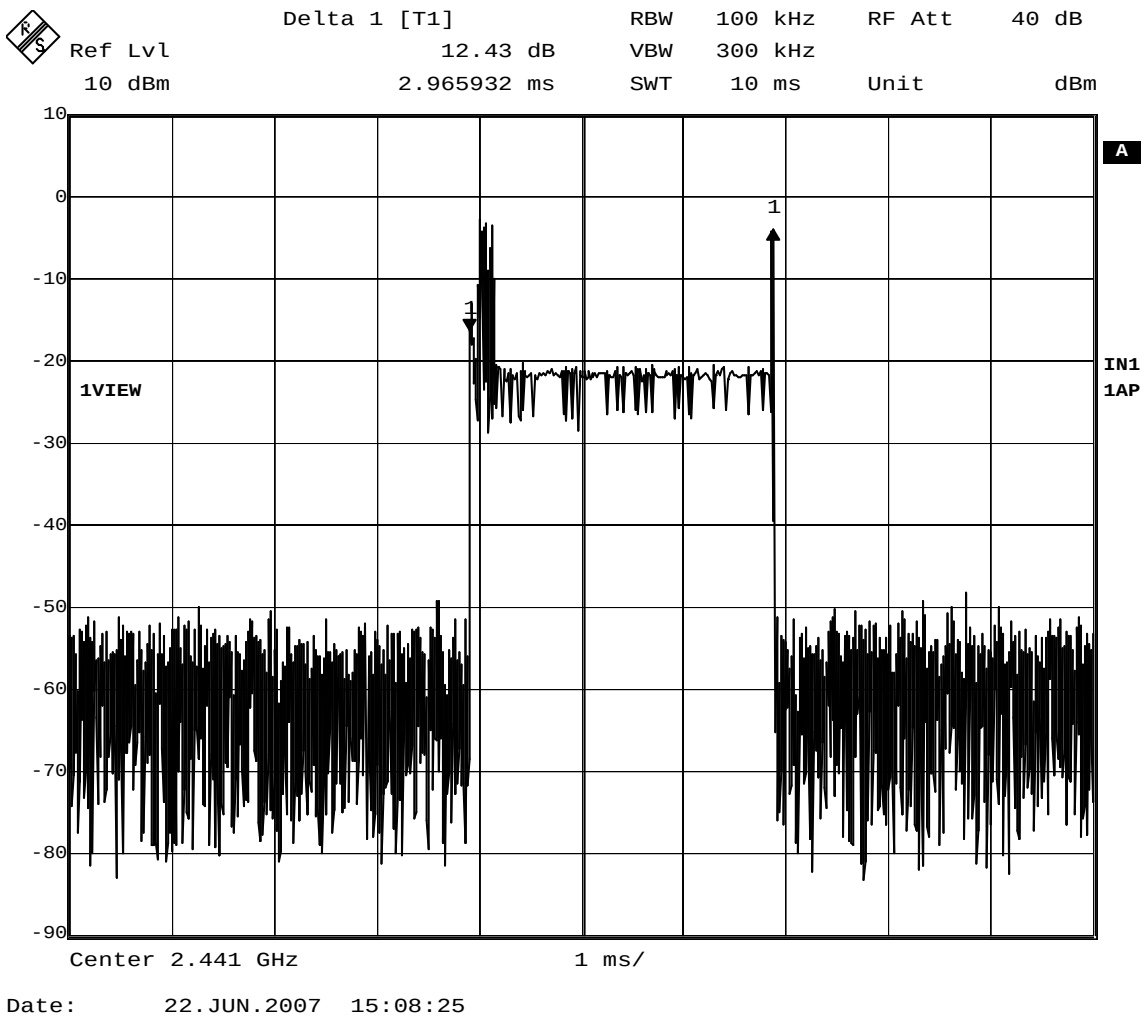


Hops among the interval of 3.6 s



Packet Type 15

Time of occupancy for single hopping



Hops among the interval of 3.6 s