EMC TEST REPORT for Bluetooth Device

No. 150301601SHA-001

Applicant	: E&M ACTIVE LIMITED FORTIS HOUSE, 160 LONDON ROAD, LONDON, ENGLAND IG11 8BB UNITED KINGDOM
Manufacturer	: ZHEJIANG HALLEY POWER MACHINE CO.,LTD. No.22 Dangui South Road,Chengxi New Area Yongkang City, Zhejiang 321300 China
Equipment	: Fitness Plate
Type/Model	: EM-313

SUMMARY

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

47CFR Part 15 (2014): Radio Frequency Devices

ANSI C63.10 (2009): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices *(Note: Applied for FCC test)*

RSS-210 Issue 8 (December 2010): Low-power Licence-exempt Radiocommunication Devices (All Frequency Bands): Category I Equipment

RSS-Gen Issue 4 (November 2014): General Requirements and Information for the Certification of Radiocommunication Equipment

ANSI C63.10 (2013): American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices *(Note: Applied for IC test)*

Date of issue: May 14, 2015

Prepared by: Reviewed by:

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Description of Test Facility

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1. General Information

1.1 Applicant Information

Applicant:		E&M ACTIVE LIMITED FORTIS HOUSE, 160 LONDON ROAD, LONDON, ENGLAND IG11 8BB UNITED KINGDOM
Name of contact:		MARGARIDA CORREIA
Tel:		+447788120109
Fax:		/
Manufacturer:		ZHEJIANG HALLEY POWER MACHINE CO.,LTD. No.22 Dangui South Road,Chengxi New Area Yongkang City, Zhejiang 321300 China
Sample received date	:	March 20, 2015
Sample Identification No	:	/
Date of test	:	March 20, 2015 ~ May 10, 2015

1.2 Identification of the EUT

Equipment:	Fitness Plate
Type/model:	EM-313
FCC ID:	2AEHM-EM313
IC:	20096-EM313

1.3 Technical specification

Operation Frequency Band:	2402 - 2480 MHz
Modulation:	GFSK, Pi/4 DQPSK, 8DQPSK
Gain of Antenna:	PCB antenna, -1.6dBi
Rating:	120V ac, 60Hz, 150W
Description of EUT:	The EUT is a Fitness Plate containing a Bluetooth module.
Channel Description:	The channel spacing is 1MHz.

1.4 Mode of operation during the test / Test peripherals used

While testing transmitting mode of EUT, the internal modulation was applied.

Test software setting: Default power setting among the software *RF Control Kit v2.0.*

Test peripherals used:

Item No	Description	Band and Model	S/No
1	Laptop computer	HP ProBook 6470b	NA

Test mode:
Mode 1: Hopping off, GFSK_DH5
Mode 2: Hopping off, Pi/4 DQPSK_DH5
Mode 3: Hopping off, 8DPSK_DH5
Mode 4: Hopping on, GFSK_DH5
Mode 5: Hopping on, Pi/4 DQPSK_DH5
Mode 6: Hopping on, 8DPSK_DH5

Test Channel:

Channel	Frequency (MHz)
L	2402
M	2441
H	2480

1.5 Frequency Hopping System Requirement

☒**Compliance for Section 15.247 (a)(1), (g), (h) requirement**
The system shall hop to channel frequencies that are selected at the system hopping rate from a Pseudorandom ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. However, the system, consisting of both the transmitter and the receiver, must be designed to comply with all of the regulations in this section should the transmitter be presented with a continuous data (or information) stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its transmissions over the minimum number of hopping channels specified in this section.

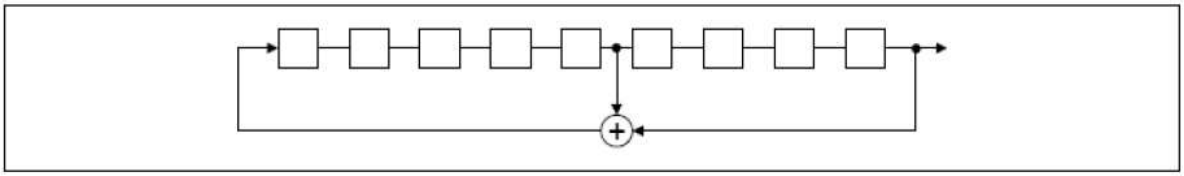
The incorporation of intelligence within a frequency hopping spread spectrum system that permits the system to recognize other users within the spectrum band so that it individually and independently chooses and adapts its hop sets to avoid hopping on occupied channels is

permitted. The coordination of frequency hopping systems in any other manner for the express purpose of avoiding the simultaneous occupancy of individual hopping frequencies by multiple transmitters is not permitted.

☒ **Compliance for Section 15.247 (a)(1)**

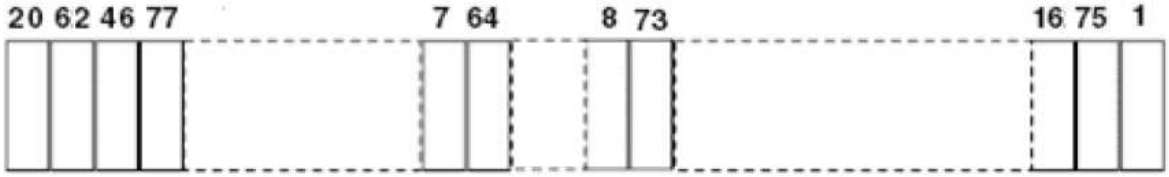
According to Bluetooth Core Specification, the pseudorandom sequence may be generated in a ninestage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. And the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

• Number of shift register stages: 9
• Length of pseudo-random sequence: 2^9 -1 = 511 bits
• Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

According to Bluetooth Core Specification, Bluetooth receivers are designed to have input and IF bandwidths that match the hopping channel bandwidths of any Bluetooth transmitters and shift frequencies in synchronization with the transmitted signals.

☒ **Compliance for section 15.247(g)**

According to Bluetooth Core Specification, the Bluetooth system transmits the packet with the pseudorandom hopping frequency with a continuous data and the short burst transmission from the Bluetooth system is also transmitted under the frequency hopping system with the pseudorandom hopping frequency system.

☒ **Compliance for section 15.247(h)**

According to Bluetooth Core specification, the Bluetooth system incorporates with an adaptive system to detect other user within the spectrum band so that it individually and independently to avoid hopping on the occupied channels.

According to the Bluetooth Core specification, the Bluetooth system is designed not have the ability to coordinate with other FHSS System in an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitter.

2. Test Specification

2.1 Instrument list

Equipment	Type	Manu.	Internal no.	Cal. Date	Due date
Test Receiver	ESCS 30	R&S	EC 2107	2014-10-21	2015-10-20
Test Receiver	ESIB 26	R&S	EC 3045	2014-10-20	2015-10-19
A.M.N.	ESH2-Z5	R&S	EC 3119	2015-1-9	2016-1-8
Bilog Antenna	CBL 6112D	TESEQ	EC 4206	2015-4-28	2016-4-27
Horn antenna	HF 906	R&S	EC 3049	2015-4-28	2016-4-27
Pre-amplifier	Pre-amp 18	R&S	EC 3222	2015-4-12	2016-4-11
Semi-anechoic chamber	-	Albatross project	EC 3048	2014-5-12	2015-5-11
High Pass Filter	WHKX 1.0/15G-10SS	Wainwright	EC4297-1	2015-1-8	2016-1-7
Power sensor / Power meter	N1911A/N1921A	Agilent	EC4318	2015-04-12	2016-04-11
Loop Antenna	FMZB 1516	SCHWARZBECK	/	2014-11-29	2015-11-28
Temperature Camber	SETH-E	tayasaf	EC4315	2015-4-9	2015-6-9
Spectrum analyzer	E7402A	Agilent	EC2254	2014-08-16	2015-08-15

2.2 Test Standard

47CFR Part 15 (2014)
RSS-210 Issue 8 (December 2010)
RSS-Gen Issue 4 (November 2014)
ANSI C63.10 (2009) applied for FCC test
ANSI C63.10 (2013) applied for IC test
DA 00-705 (March 30, 2000)

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	FCC REFERANCE	IC REFERANCE	RESULT
20 dB Bandwidth	15.247(a)(1)	RSS-210 Issue 8 Annex 8	Tested
Carrier Frequency Separation	15.247(a)(1)	RSS-210 Issue 8 Annex 8	Pass
Output power	15.247(b)(1)	RSS-210 Issue 8 Annex 8	Pass
Radiated Spurious Emissions	15.205 & 15.209	RSS-210 Issue 8 Clause 2	Pass
Band Edge Emission	15.247(d)	RSS-210 Issue 8 Annex 8	Pass
Power line conducted emission	15.207	RSS-Gen Clause 8.8	Pass
Number of Hopping Frequencies	15.247(a)(1)(iii)	RSS-210 Issue 8 Annex 8	Pass
Dwell time	15.247(a)(1)(iii)	RSS-210 Issue 8 Annex 8	Pass
Occupied bandwidth	-	RSS-Gen Clause 6.6	Tested

Note: “NA” means “not applied”.

3. 20 dB Bandwidth

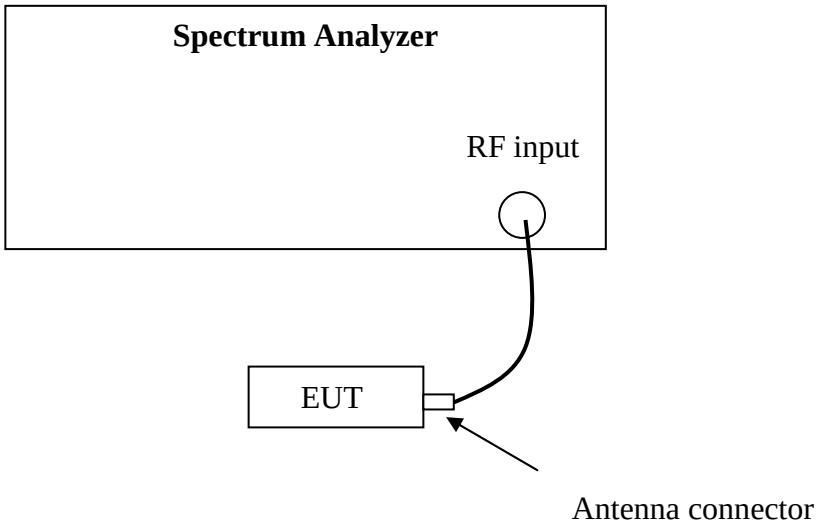
Test result: Tested

3.1 Limit

☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

☒ 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

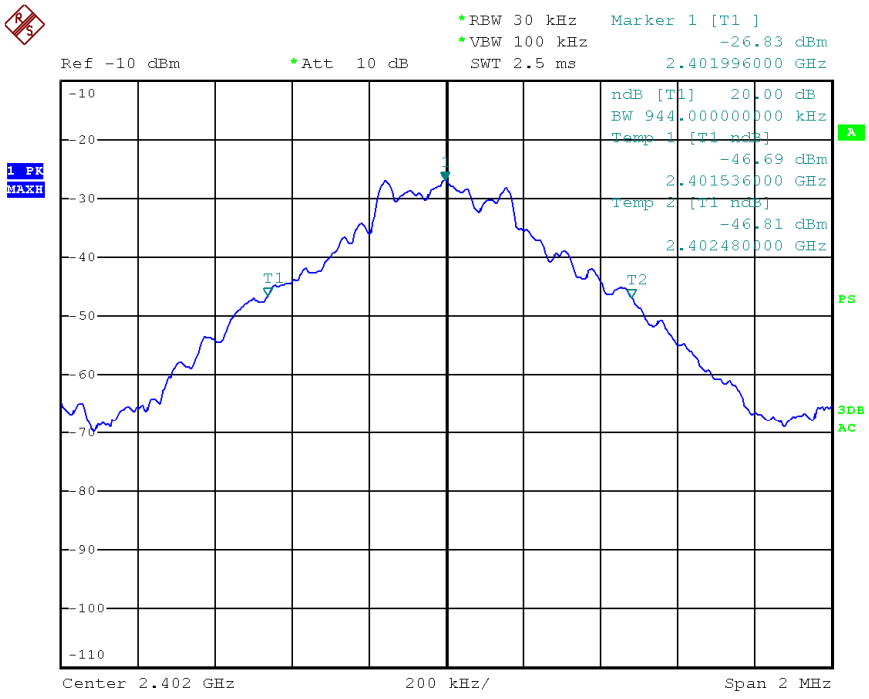
The 20 bandwidth per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span = approximately 2 to 3 times the 20 dB bandwidth, RBW≥1% of the 20 dB bandwidth, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

3.4 Test Protocol

Temperature : 25°C
Relative Humidity : 55 %

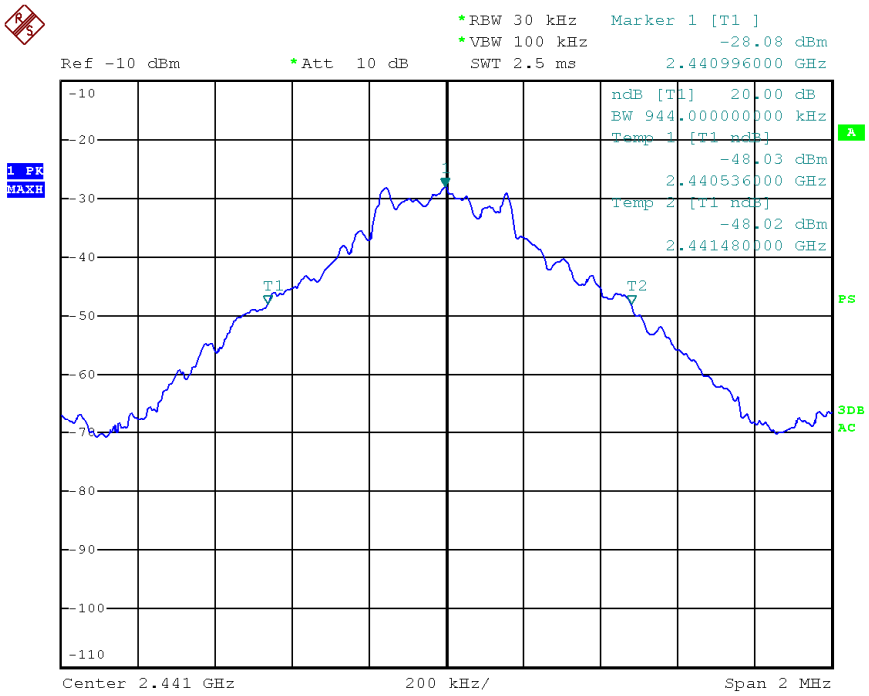
Mode	CH	20dB Bandwidth (kHz)
1	L	944
	M	944
	H	940

Channel L



Date: 4.MAY.2015 11:40:41

Channel M



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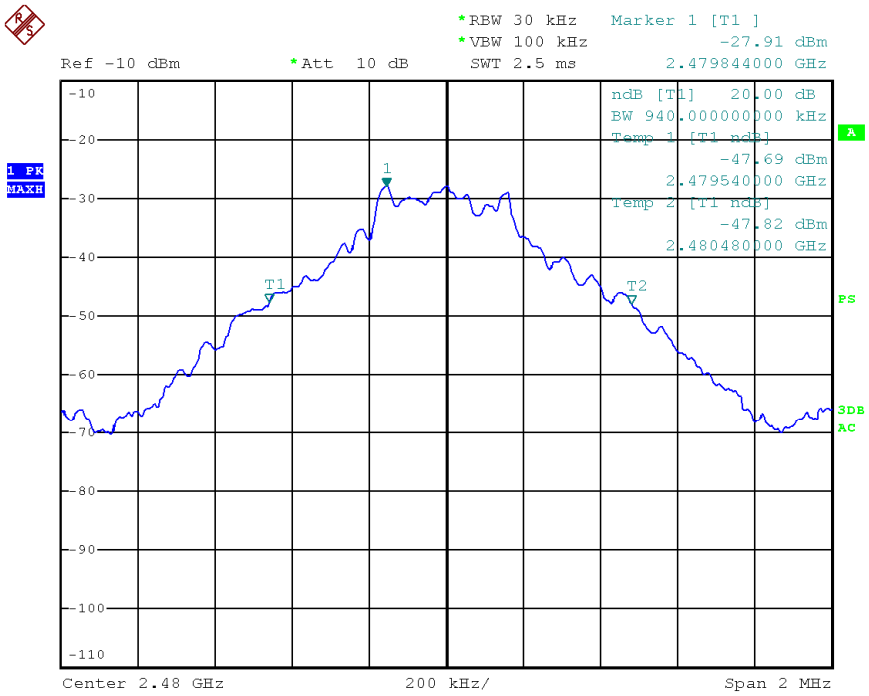
Channel H



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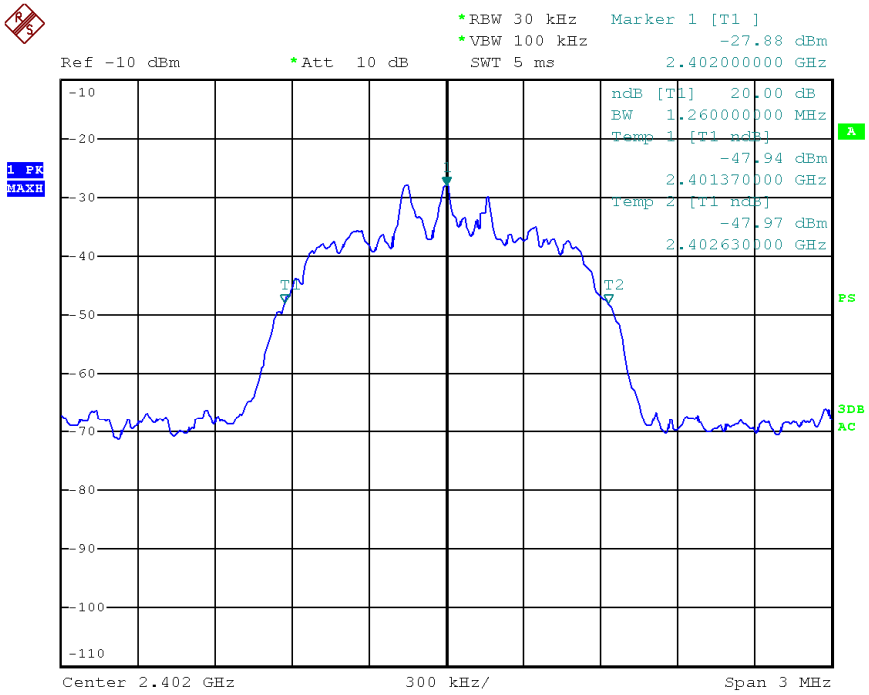
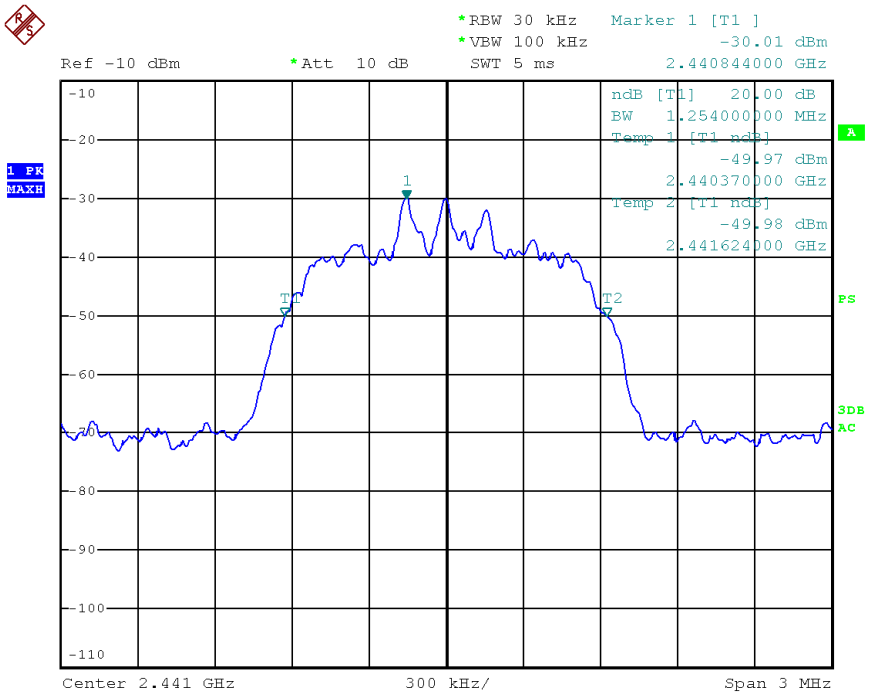
Mode	CH	20dB Bandwidth (kHz)
2	L	1260
	M	1254
	H	1242

Channel L

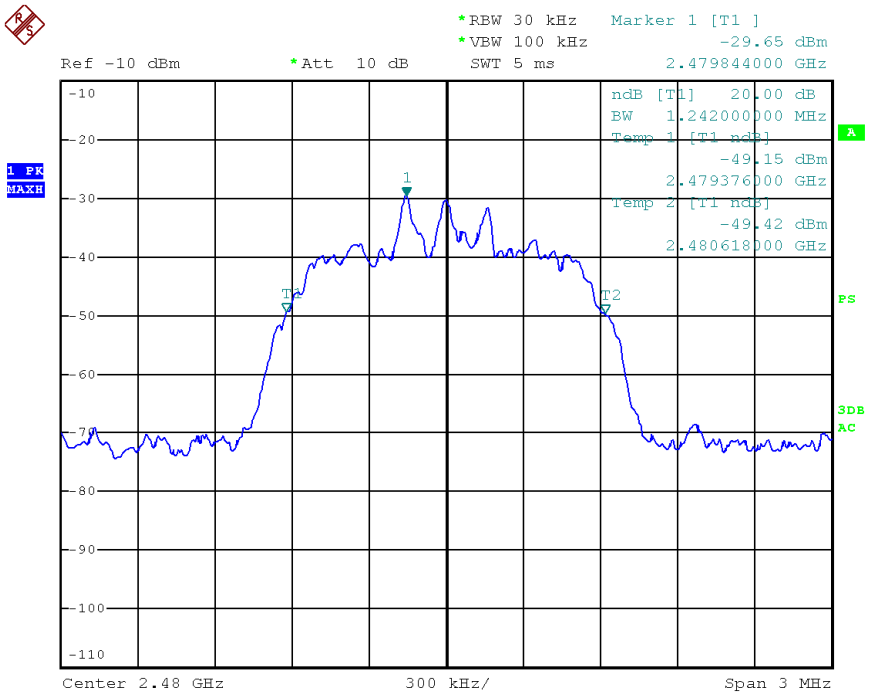


Channel M



Date: 4.MAY.2015 11:48:12

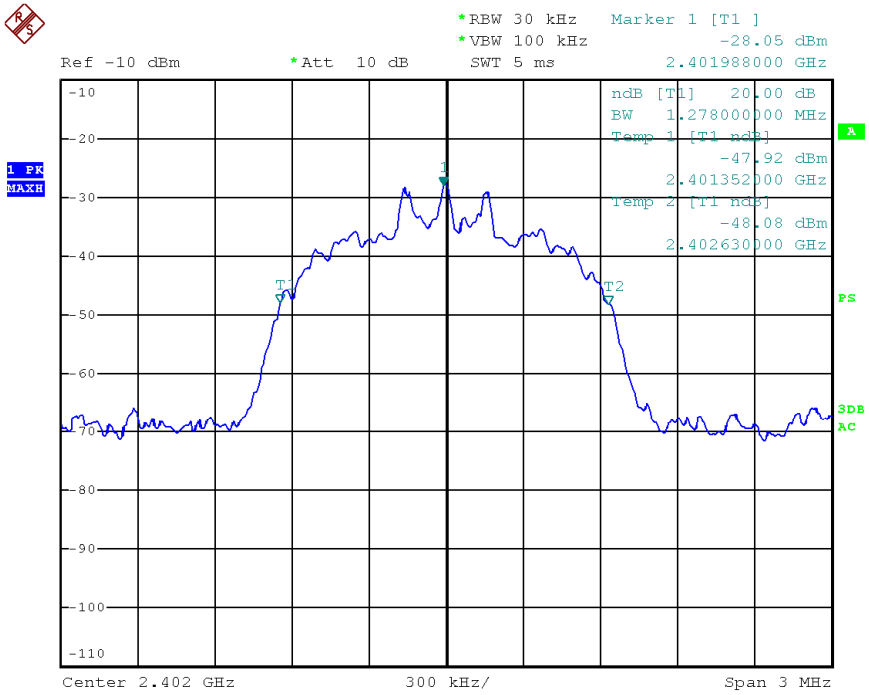
Channel H



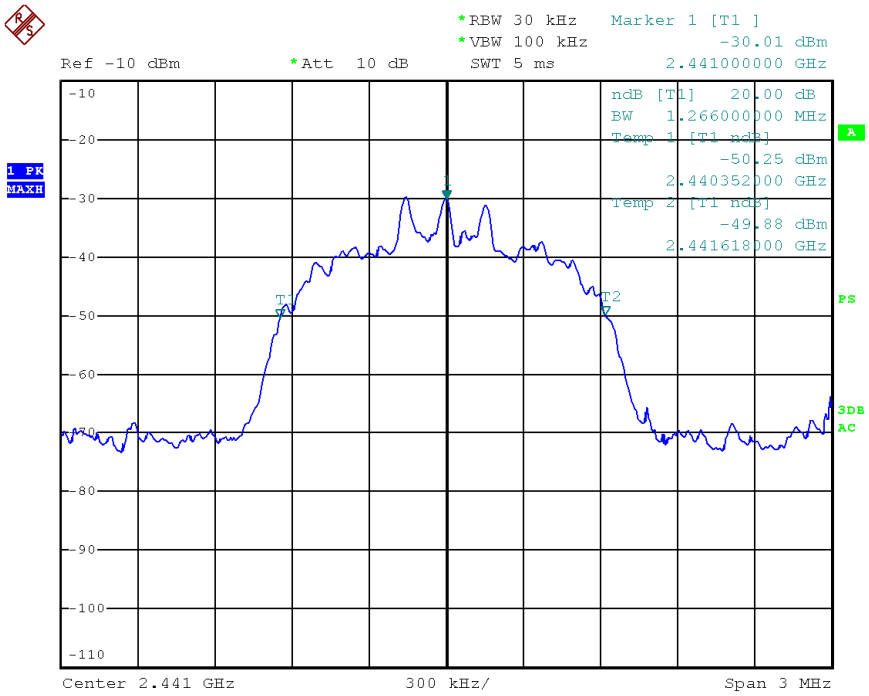
Date: 4.MAY.2015 11:48:52

Mode	CH	20dB Bandwidth (kHz)
3	L	1278
	M	1266
	H	1266

Channel L



Channel M



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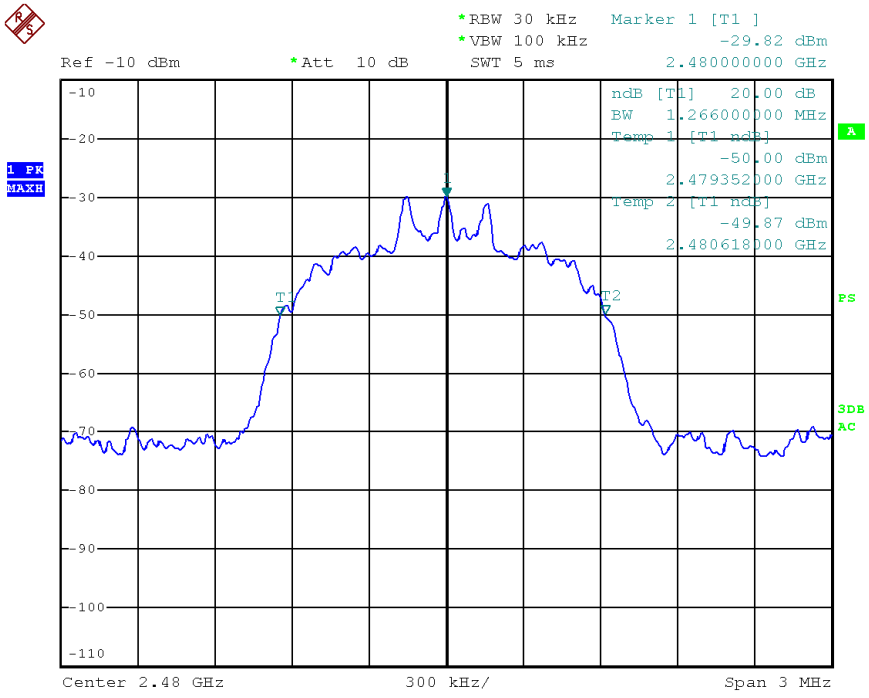
Channel H



Date: 4.MAY.2015 11:51:14

4. Carrier Frequency Separation

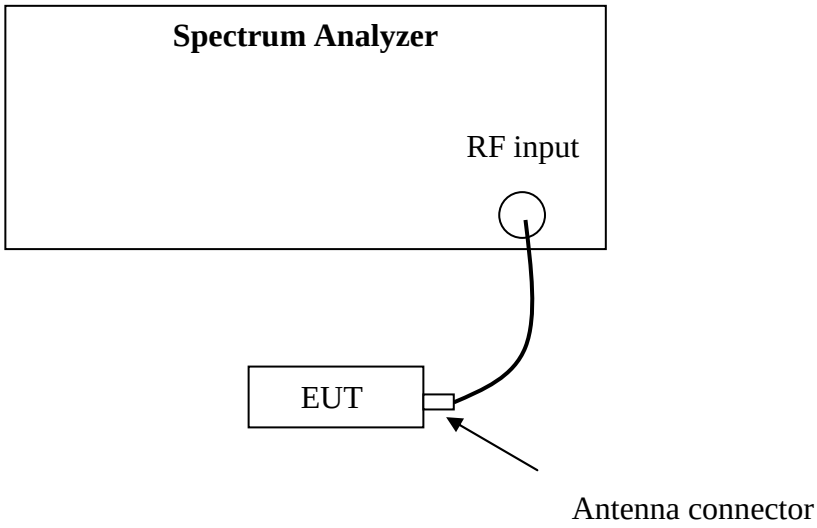
Test result: Pass

4.1 Limit

☐ Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.

☒ 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.

4.2 Test Configuration



4.3 Test Procedure and test setup

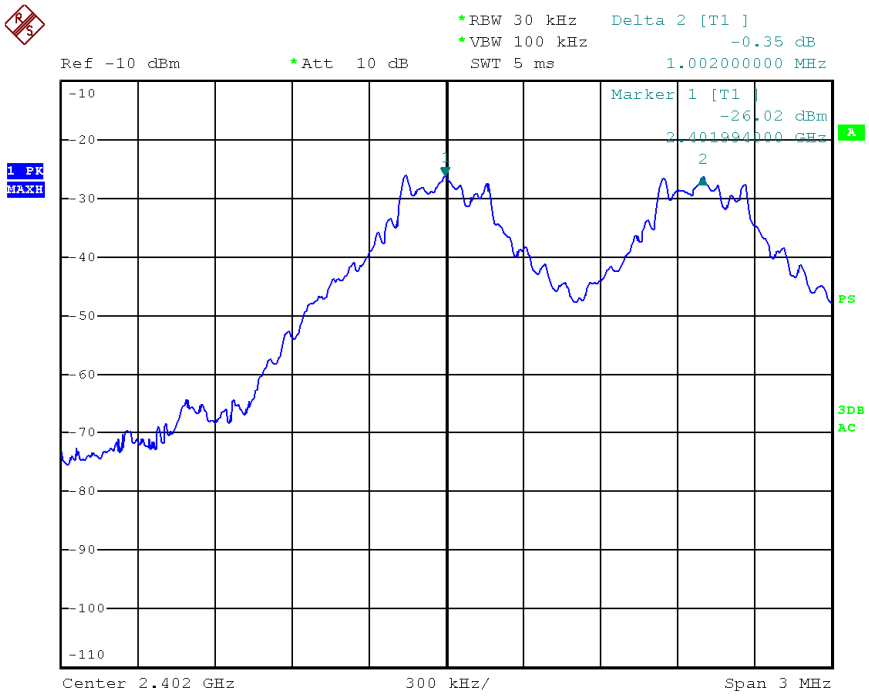
The Carrier Frequency Separation per FCC § 15.247(a)(1) is measured using the Spectrum Analyzer with Span can capture two adjacent channels, RBW≥1% of the span, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

4.4 Test Protocol

Temperature : 25°C
Relative Humidity : 55 %

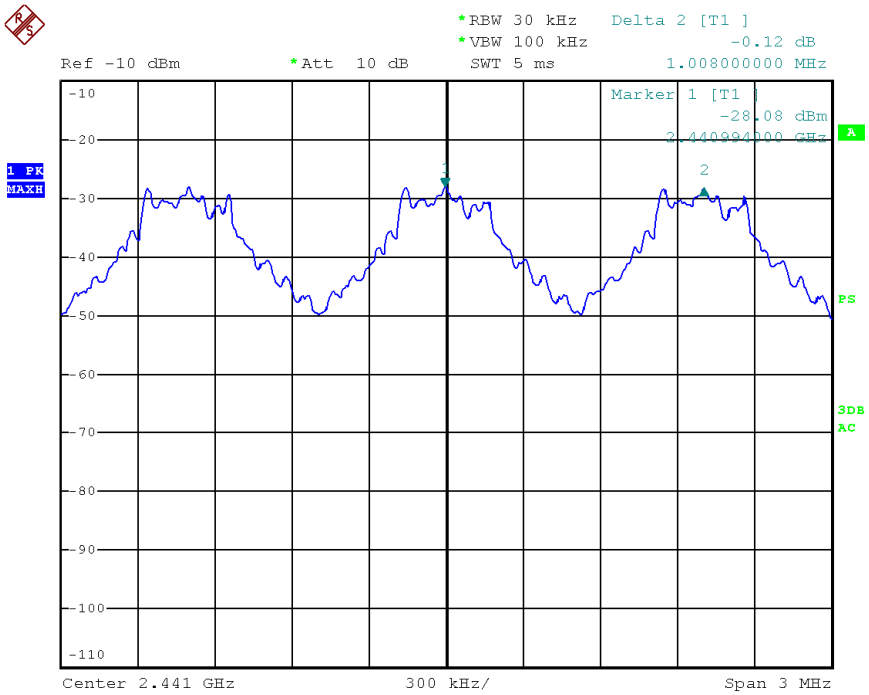
Mode	CH	Frequency Separation (kHz)	Limit (kHz)
1	L	1002	≥ 2/3 of 20dB BW
	M	1008	≥ 2/3 of 20dB BW
	H	1002	≥ 2/3 of 20dB BW

Channel L



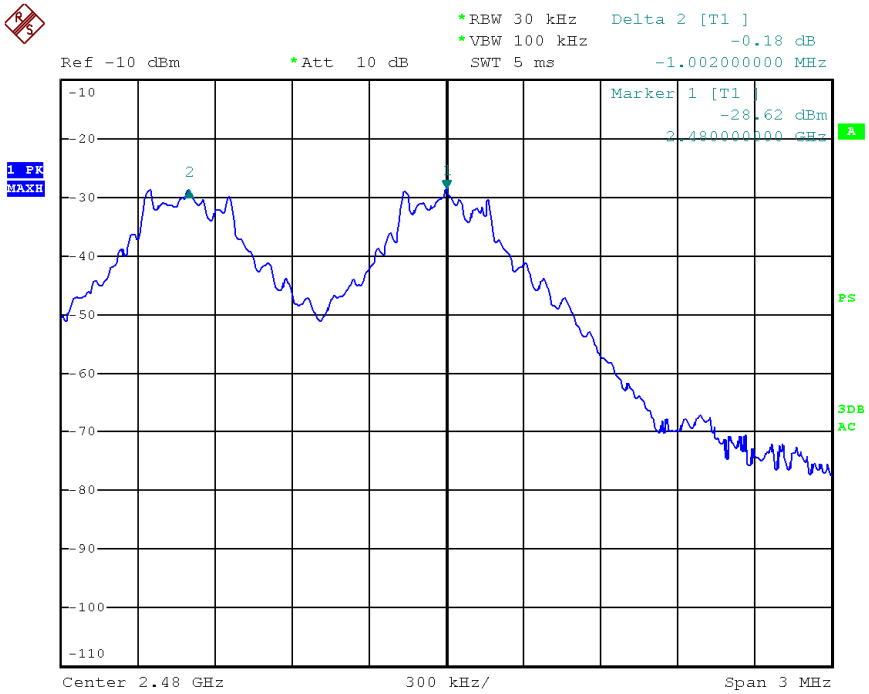
Date: 4.MAY.2015 12:09:21

Channel M



Date: 4.MAY.2015 12:11:00

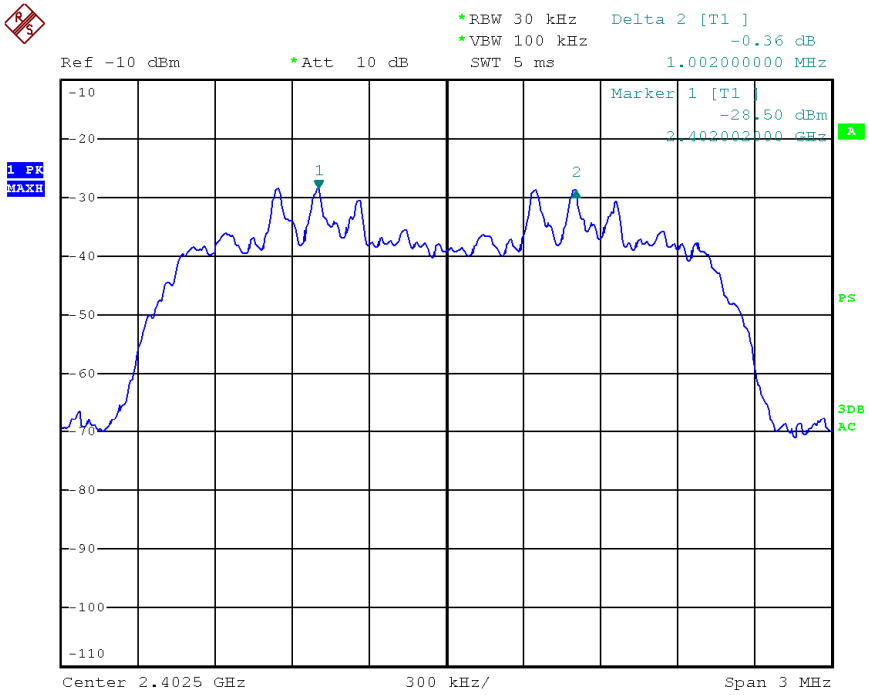
Channel H



Date: 4.MAY.2015 12:11:57

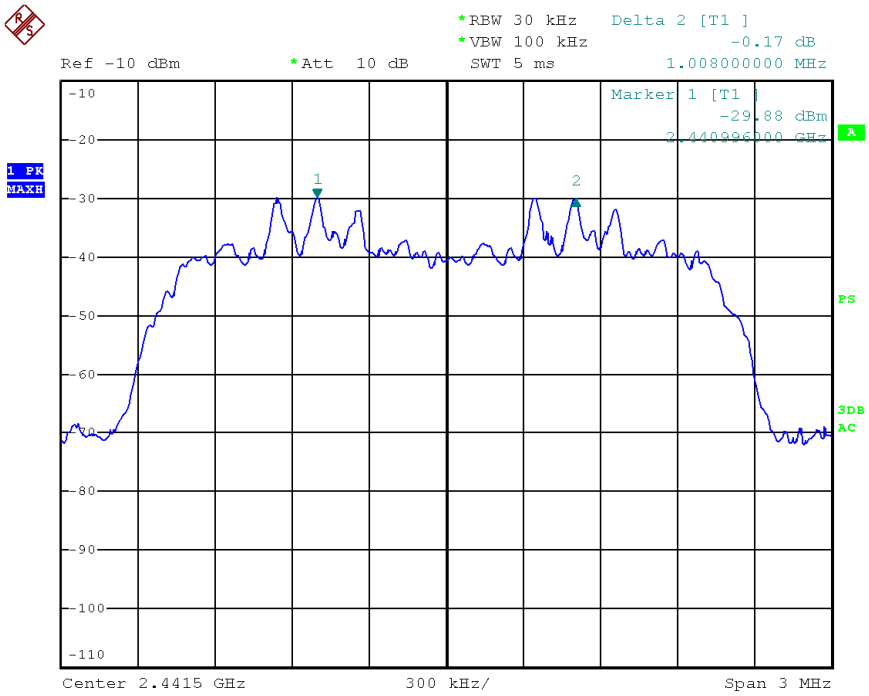
Mode	CH	Frequency Separation (kHz)	Limit (kHz)
2	L	1002	≥ 2/3 of 20dB BW
	M	1008	≥ 2/3 of 20dB BW
	H	1008	≥ 2/3 of 20dB BW

Channel L



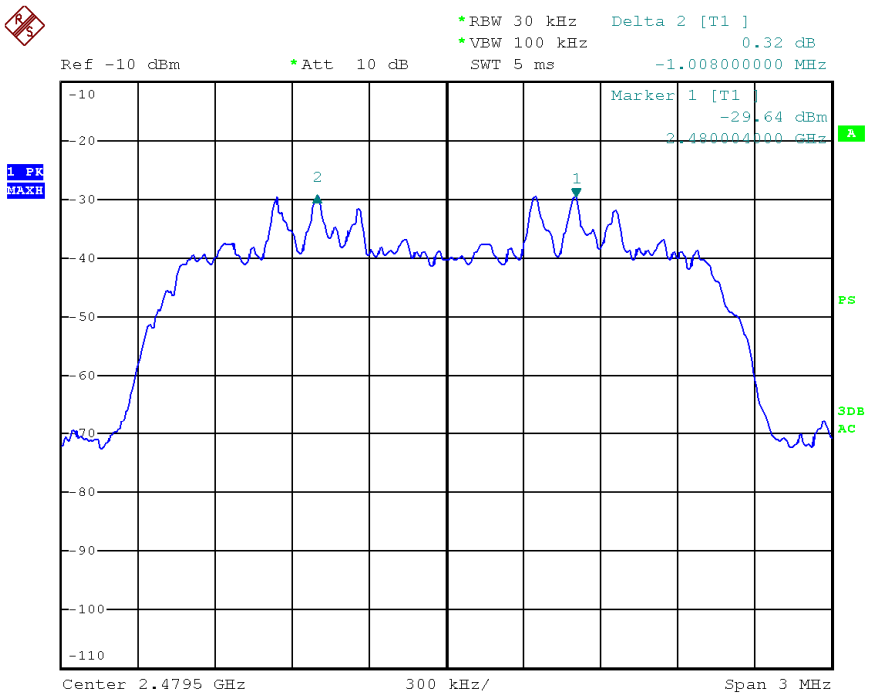
Date: 4.MAY.2015 12:15:17

Channel M



Date: 4.MAY.2015 12:18:12

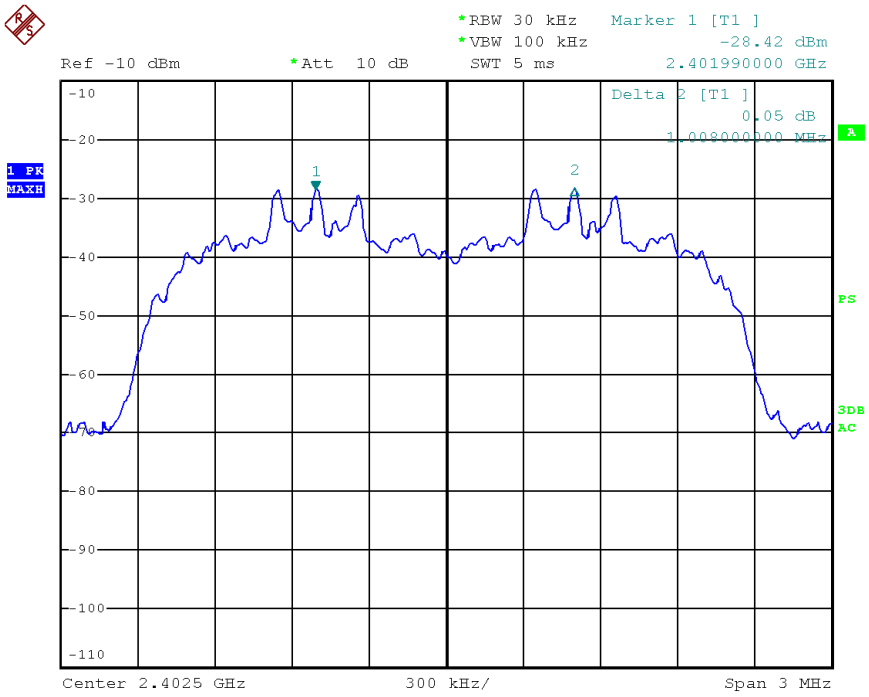
Channel H



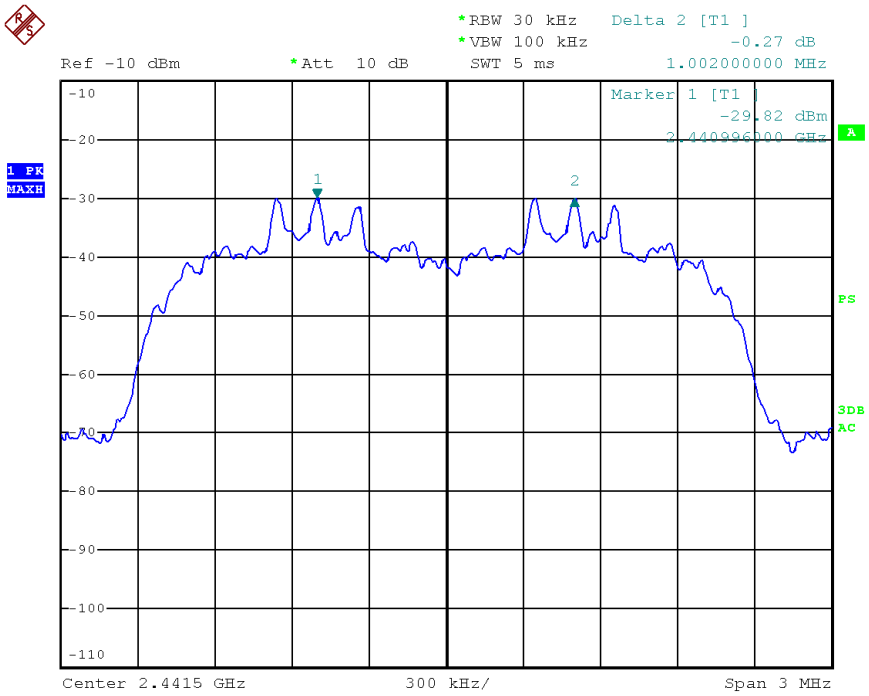
Date: 4.MAY.2015 12:19:07

Mode	CH	Frequency Separation (kHz)	Limit (kHz)
3	L	1008	≥ 2/3 of 20dB BW
	M	1002	≥ 2/3 of 20dB BW
	H	1002	≥ 2/3 of 20dB BW

Channel L

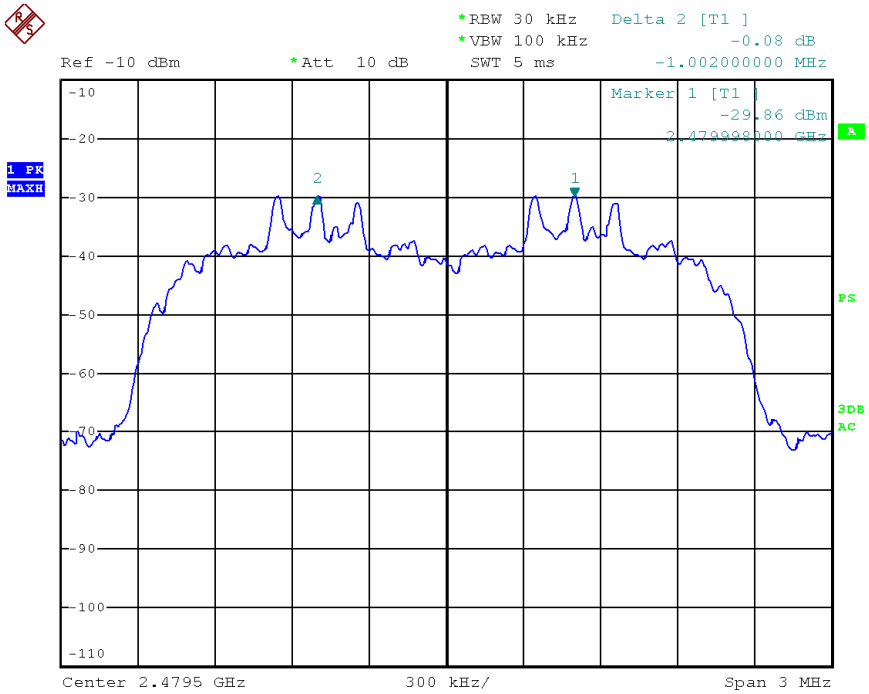


Channel M



Date: 4.MAY.2015 12:21:26

Channel H



Date: 4.MAY.2015 12:22:41

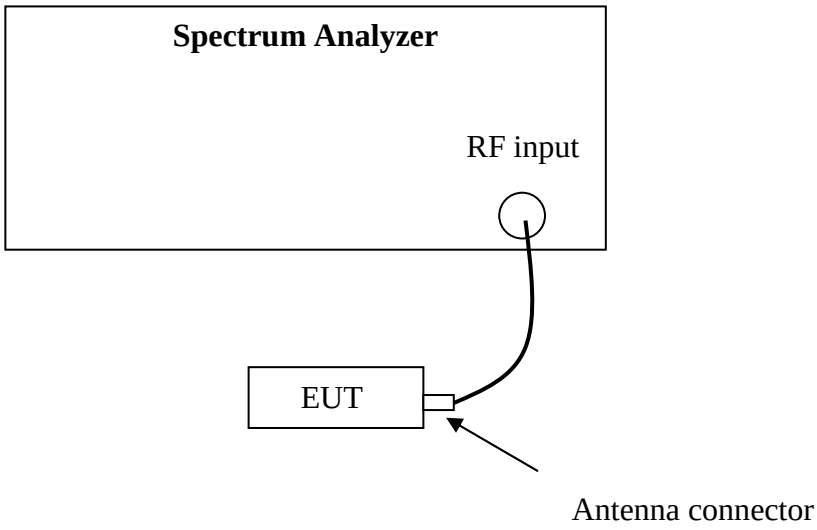
5. Maximum peak output power

Test result: Pass

5.1 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
If the transmitting antenna of directional gain greater than 6dBi is used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.
☐ For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt.

5.2 Test Configuration



5.3 Test procedure and test setup

The power output per FCC § 15.247(b) is measured by setting the Spectrum Analyzer as RBW = 1MHz, VBW = 3MHz, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).
The test method is following DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

5.4 Test protocol

Temperature : 25 °C
Relative Humidity : 55 %

Mode	CH	Conducted Power (dBm)	Limit (dBm)
1	L	3.90	21
	M	3.70	21
	H	3.50	21

Mode	CH	Conducted Power (dBm)	Limit (dBm)
2	L	1.20	21
	M	1.60	21
	H	2.00	21

Mode	CH	Conducted Power (dBm)	Limit (dBm)
3	L	1.30	21
	M	1.70	21
	H	1.90	21

6. Radiated Spurious Emissions

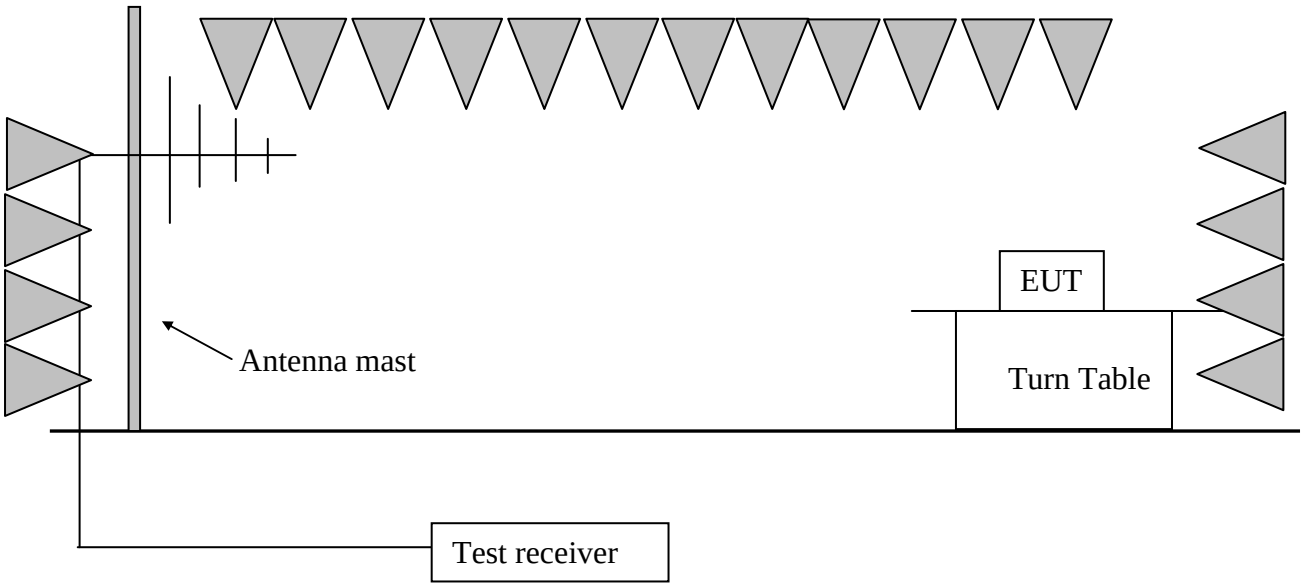
Test result: PASS

6.1 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

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, if applied, the pre-amplifier would be equipped just at the output terminal of the antenna and the EUT was placed on a 1.5m height.
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.

The radiated emission was measured using the Spectrum Analyzer with the resolutions bandwidth set as:

RBW = 100kHz, VBW = 300kHz (30MHz~1GHz)
RBW = 1MHz, VBW = 3MHz (>1GHz for PK);
RBW = 1MHz, VBW = 10Hz (>1GHz for AV);

If the dwell time per channel of the hopping signal is less than 100 ms, then the reading obtained with the 10 Hz VBW may be further adjusted by a “duty cycle correction factor”.

6.4 Test protocol

Mode 1

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	V	2402.00	31.20	97.50	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2390.00	31.20	52.00	54.00	2.00	PK
	V	3000.00	-9.10	40.10	54.00	13.90	PK
	H	4248.49	-4.90	36.30	54.00	17.70	PK
	H	4795.59	-3.60	40.20	54.00	13.80	PK
M	V	2440.90	31.20	97.30	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	H	4882.00	-3.40	40.60	54.00	13.40	PK
	V	6969.93	1.30	40.40	54.00	13.60	PK
H	V	2479.90	31.20	97.10	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2483.50	31.20	52.20	54.00	1.80	PK
	V	3000.00	-9.10	44.60	54.00	9.40	PK
	H	4963.92	-3.20	40.40	54.00	13.60	PK

Mode 2

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	V	2402.00	31.20	94.80	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2390.00	31.20	52.10	54.00	1.90	PK
	V	3000.00	-9.10	39.80	54.00	14.20	PK
	H	4248.49	-4.90	36.70	54.00	17.30	PK
	H	4795.59	-3.60	40.50	54.00	13.50	PK
M	V	2440.90	31.20	95.20	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	H	4882.00	-3.40	40.40	54.00	13.60	PK
	V	6969.93	1.30	40.80	54.00	13.20	PK
H	V	2479.90	31.20	95.60	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2483.50	31.20	52.20	54.00	1.80	PK
	V	3000.00	-9.10	43.50	54.00	10.50	PK
	H	4963.92	-3.20	40.10	54.00	13.90	PK

Mode 3

CH	Antenna	Frequency (MHz)	Correct Factor (dB/m)	Corrected Reading (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector
L	V	2402.00	31.20	94.90	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2390.00	31.20	52.00	54.00	2.00	PK
	V	3000.00	-9.10	40.30	54.00	13.70	PK
	H	4248.49	-4.90	36.50	54.00	17.50	PK
	H	4795.59	-3.60	40.40	54.00	13.60	PK
M	V	2440.90	31.20	95.30	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	H	4882.00	-3.40	40.30	54.00	13.70	PK
	V	6969.93	1.30	40.60	54.00	13.40	PK
H	V	2479.90	31.20	95.50	/	/	PK
	V	111.64	15.70	36.30	43.50	7.20	PK
	V	399.51	18.90	36.40	46.00	9.60	PK
	H	659.82	22.60	28.80	46.00	17.20	PK
	V	665.65	22.60	28.70	46.00	17.30	PK
	V	2483.50	31.20	52.10	54.00	1.90	PK
	V	3000.00	-9.10	43.90	54.00	10.10	PK
	H	4963.92	-3.20	40.30	54.00	13.70	PK

Remark: 1. For fundamental emission, no amplifier is employed.
2. Correct Factor = Antenna Factor + Cable Loss (-Amplifier, is employed)
3. Corrected Reading = Original Receiver Reading + Correct Factor
4. Margin = limit – Corrected Reading
5. If the PK reading is lower than AV limit, the AV test can be elided.
6. The emission was conducted from30MHz to 25GHz.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10dBuV.
Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m; Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m
Assuming limit = 54dBuV/m, Corrected Reading = 10.20dBuV/m, then Margin = 54 -10.20 = 43.80dBuV/m

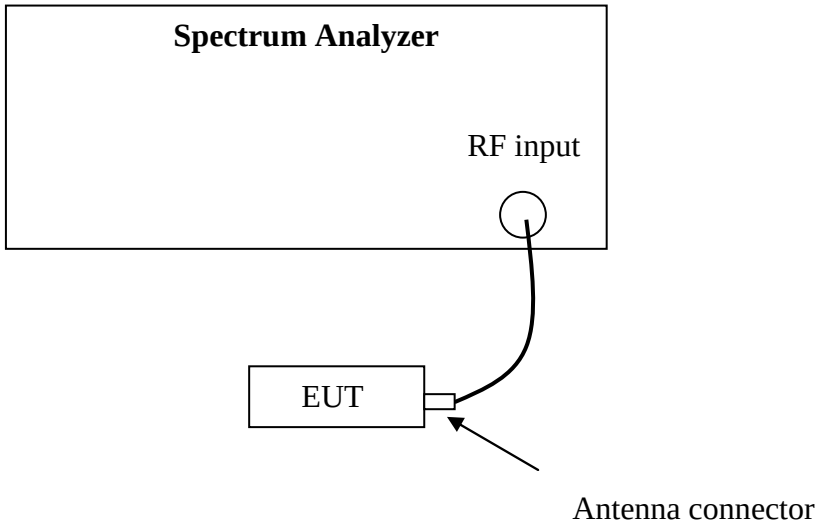
7. Band Edge Emission

Test result: **PASS**

7.1 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.

7.2 Test Configuration

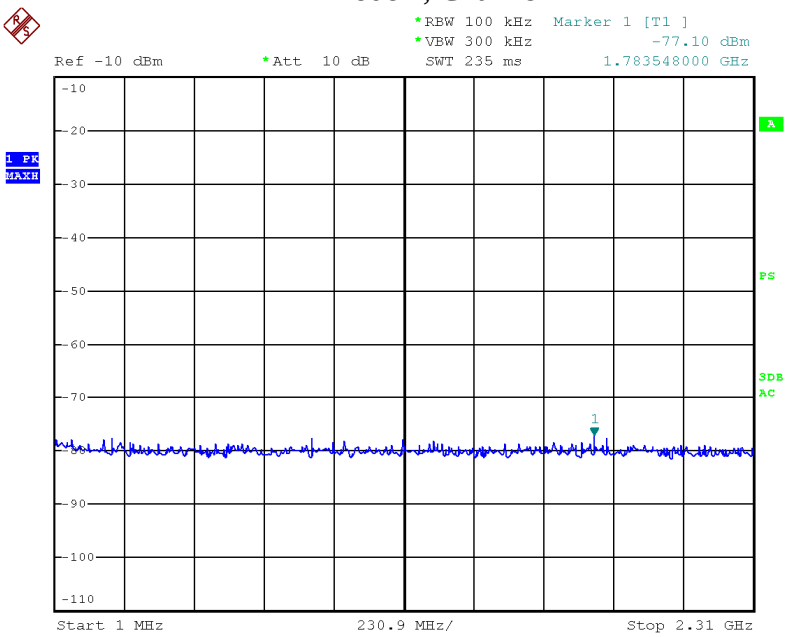


7.3 Test procedure and test setup

The Band Edge Emissions per FCC § 15.247(d) is measured using the Spectrum Analyzer with Span wide enough capturing all spurious from the lowest emission frequency of the EUT up to 10th harmonics, RBW = 100kHz, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The test was performed at 3 channels (lowest, middle and highest channel).
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems)

7.4 Test protocol

Mode 1, Channel L



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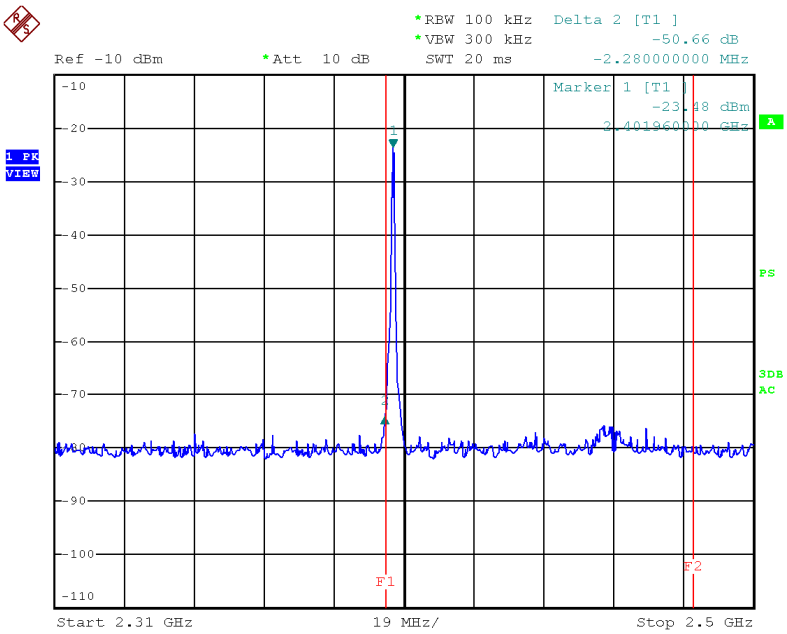

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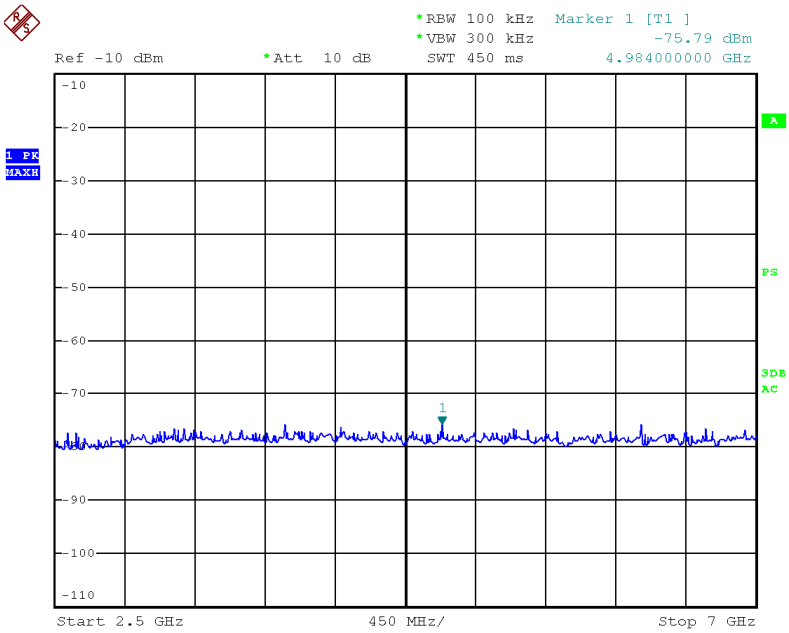

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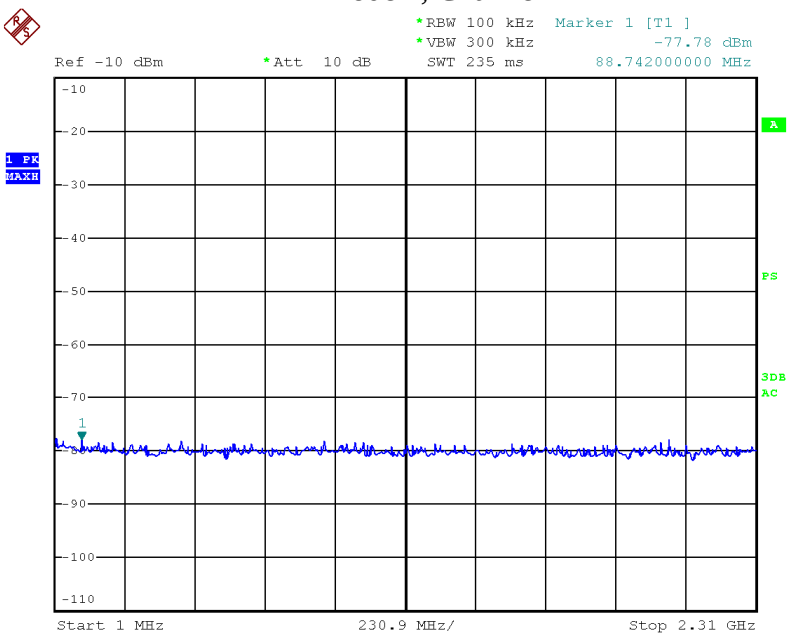
Mode 1, Channel M



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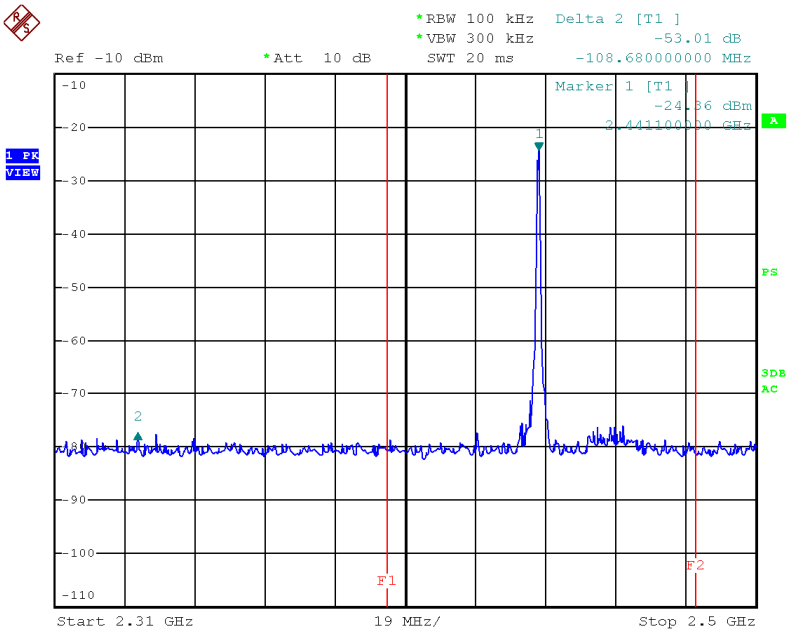

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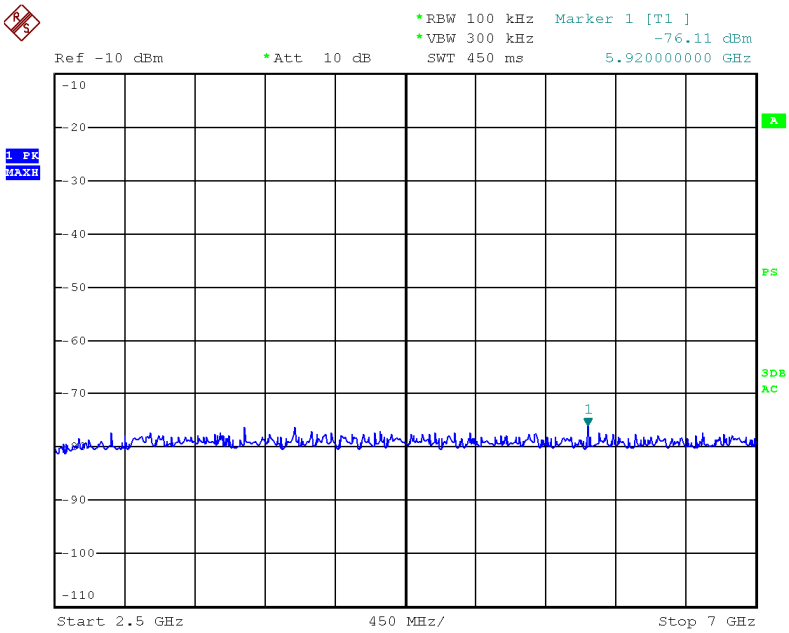

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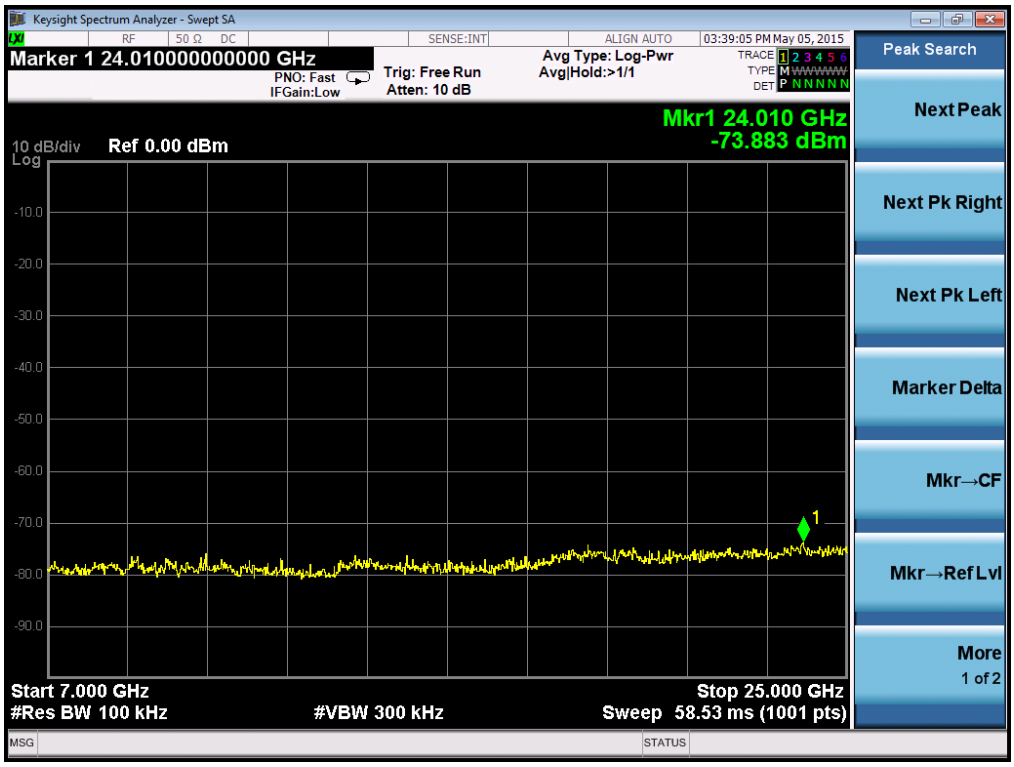
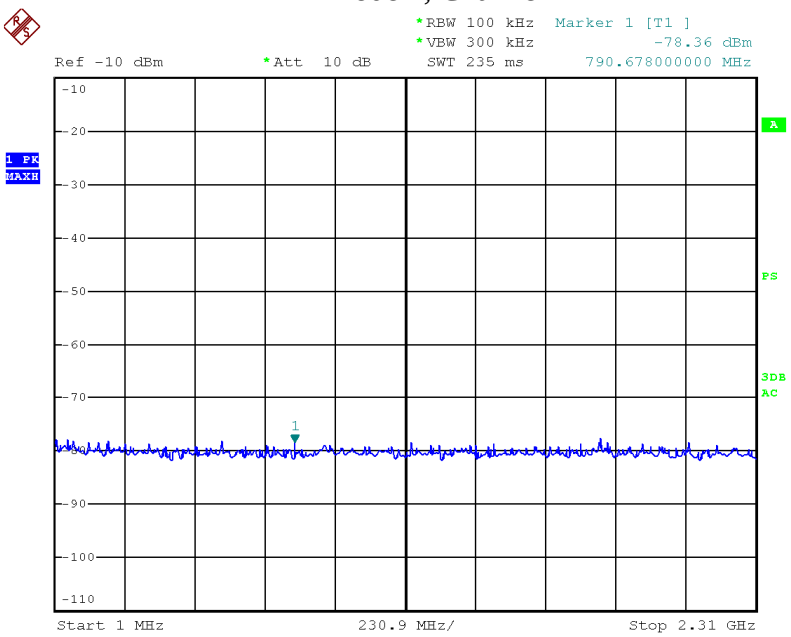


Mode 1, Channel H



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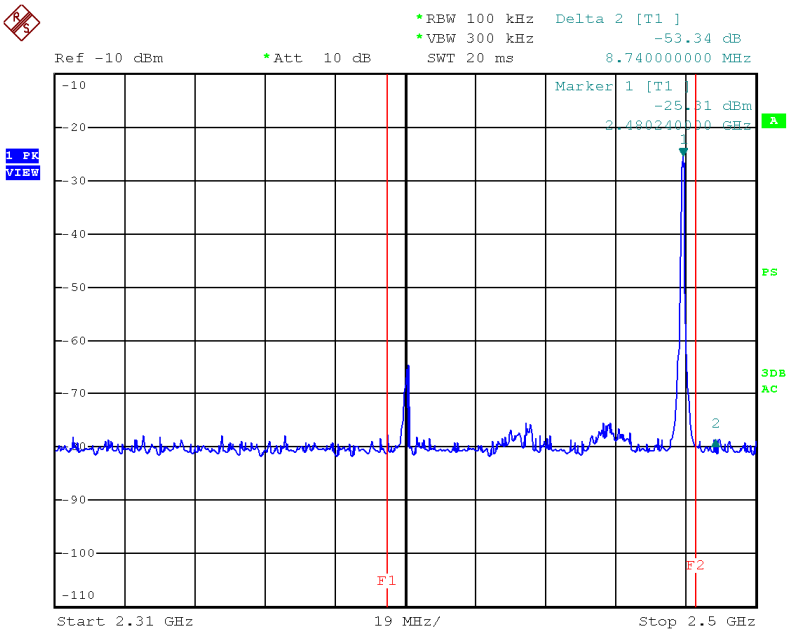

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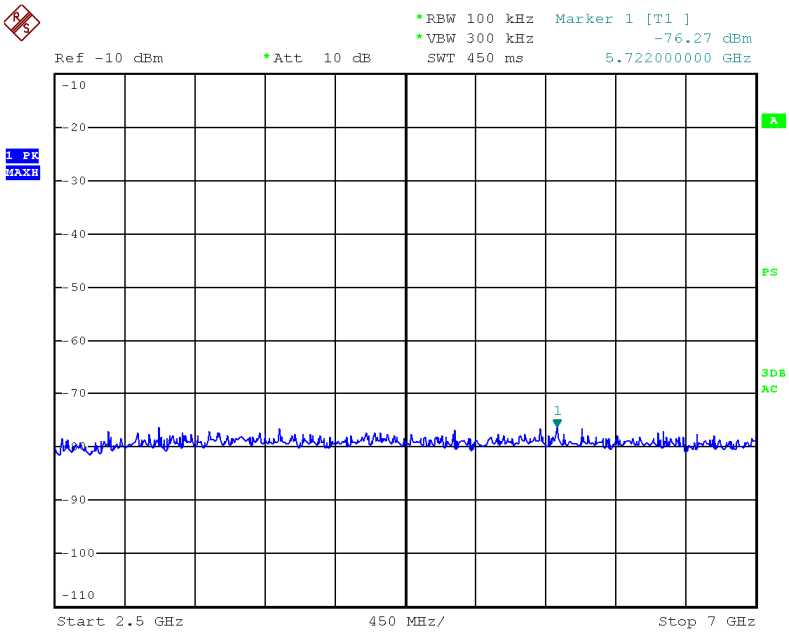
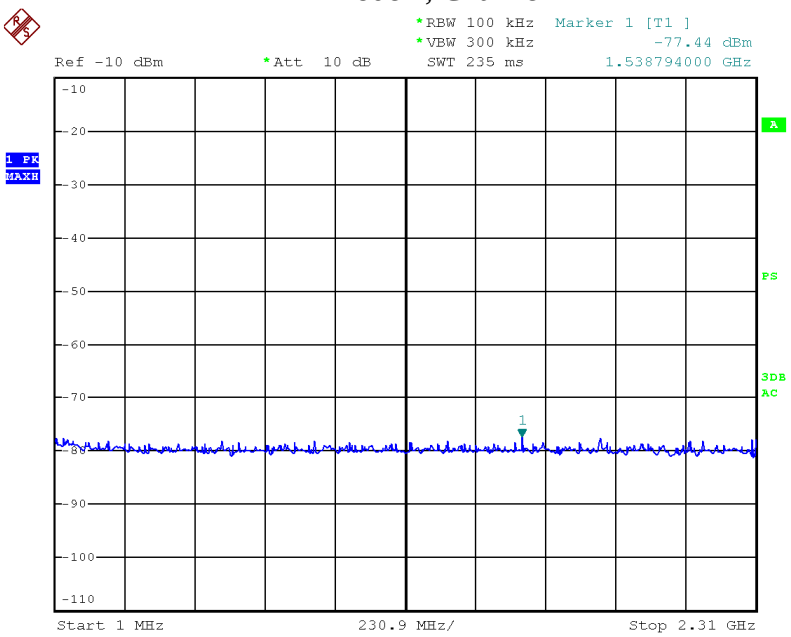


Date: 4.MAY.2015 13:29:51

Mode 2, Channel L



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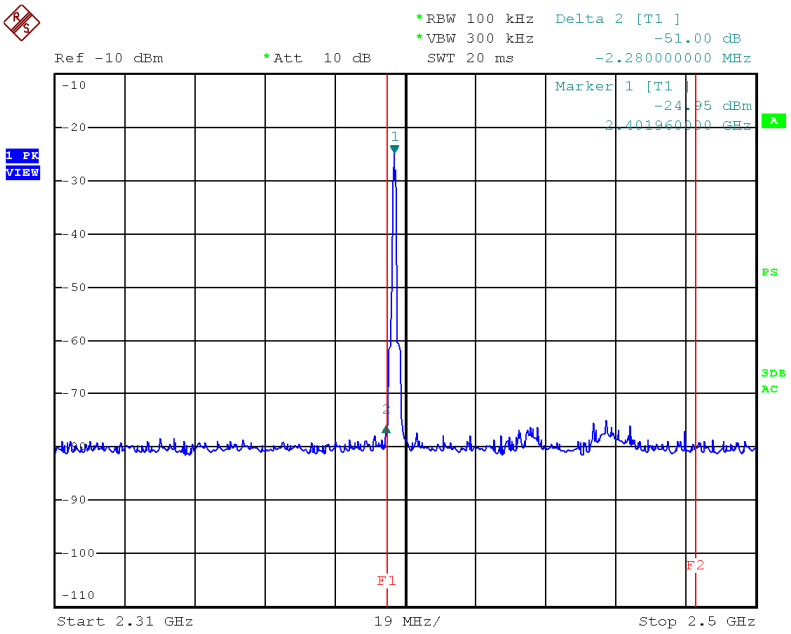

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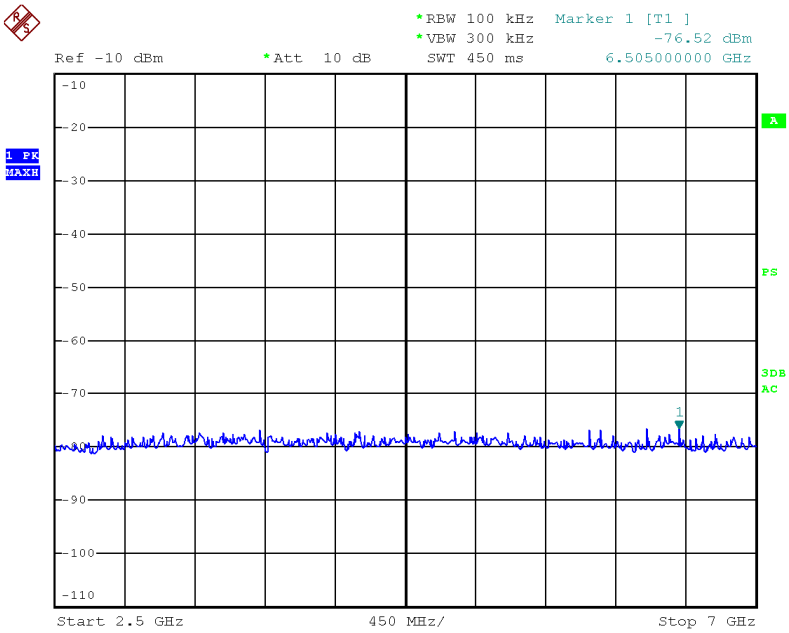

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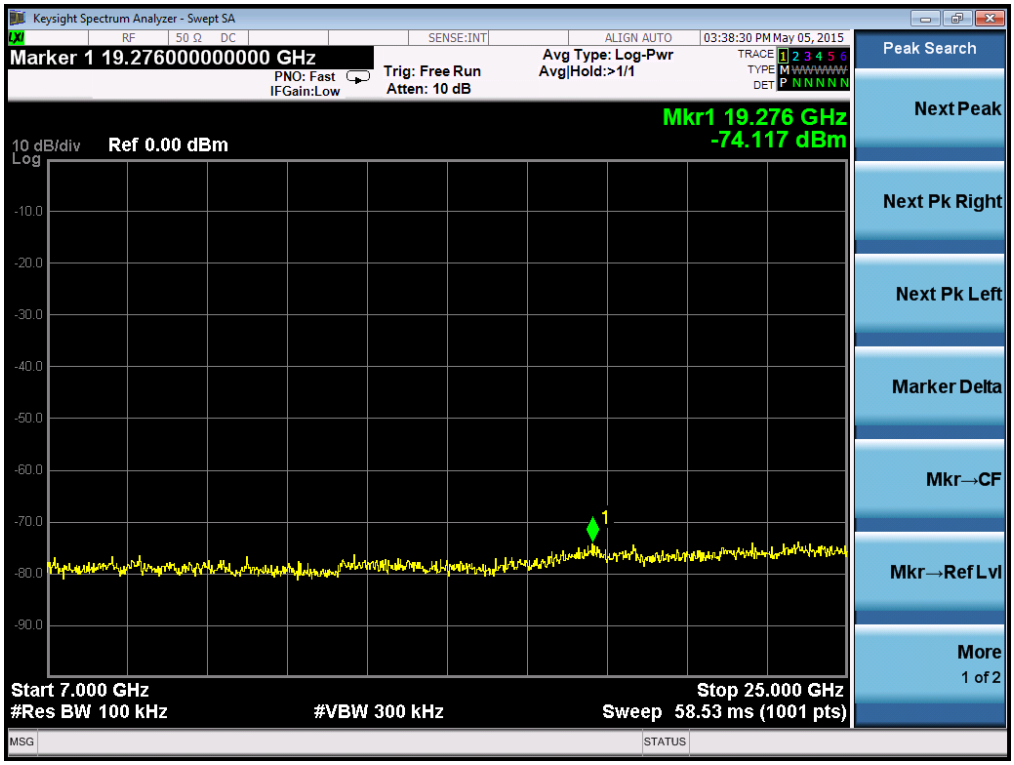
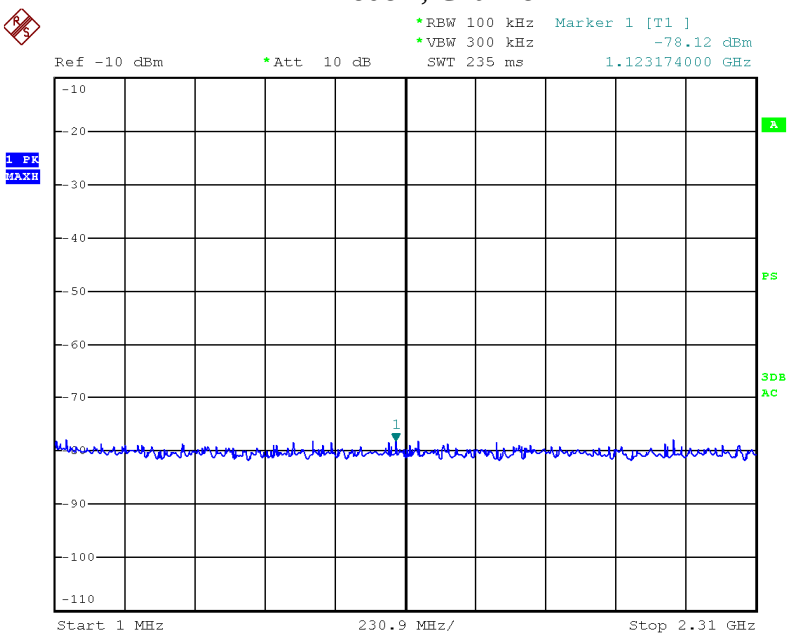


Mode 2, Channel M



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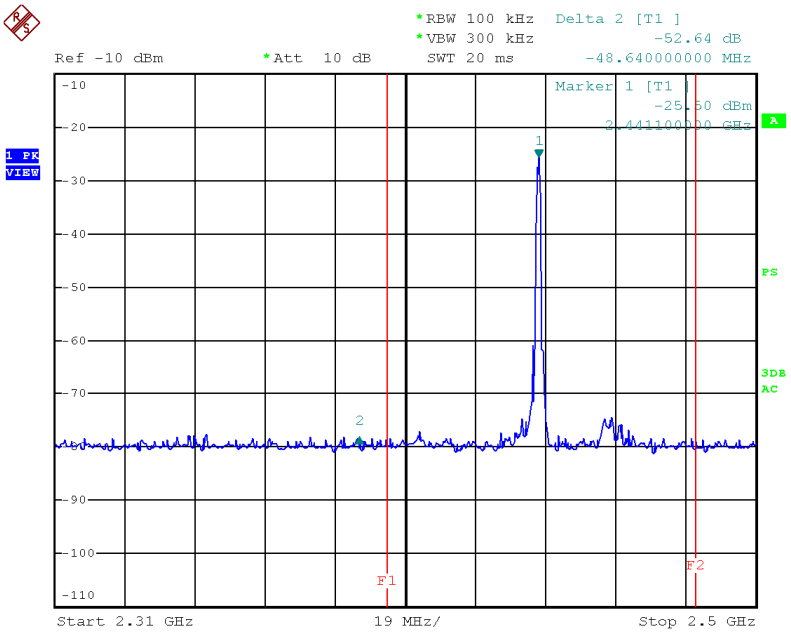

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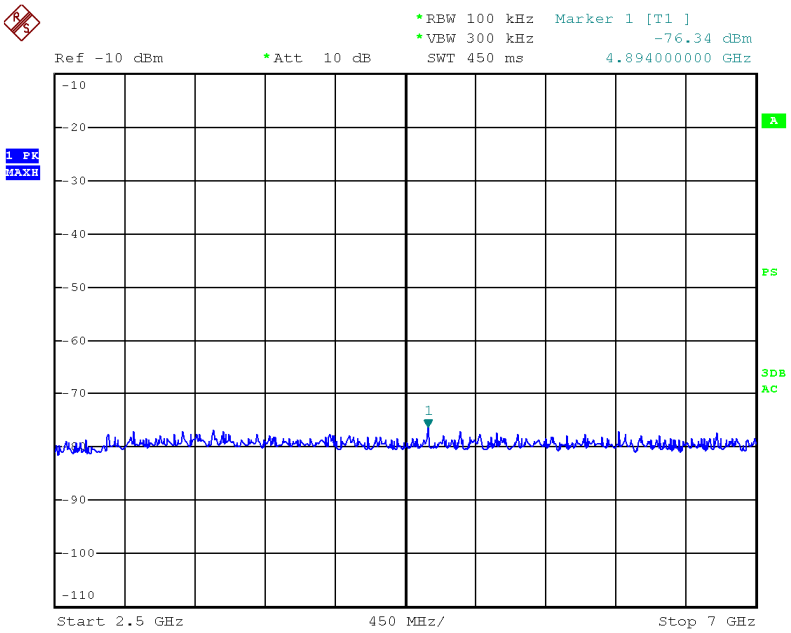

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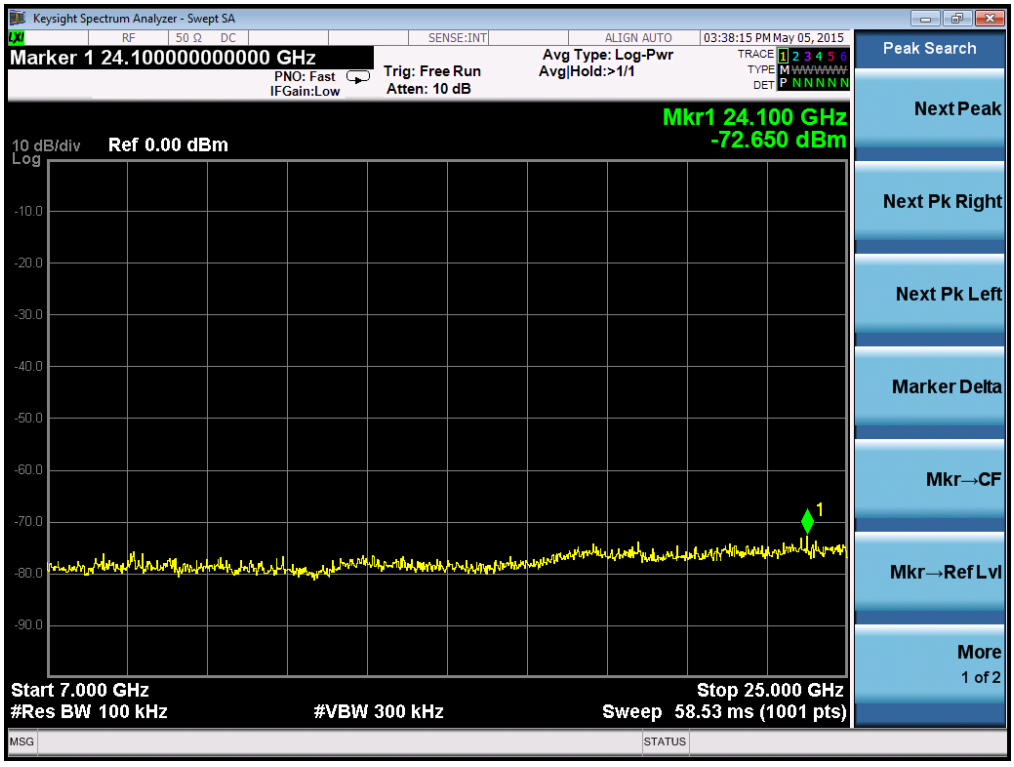
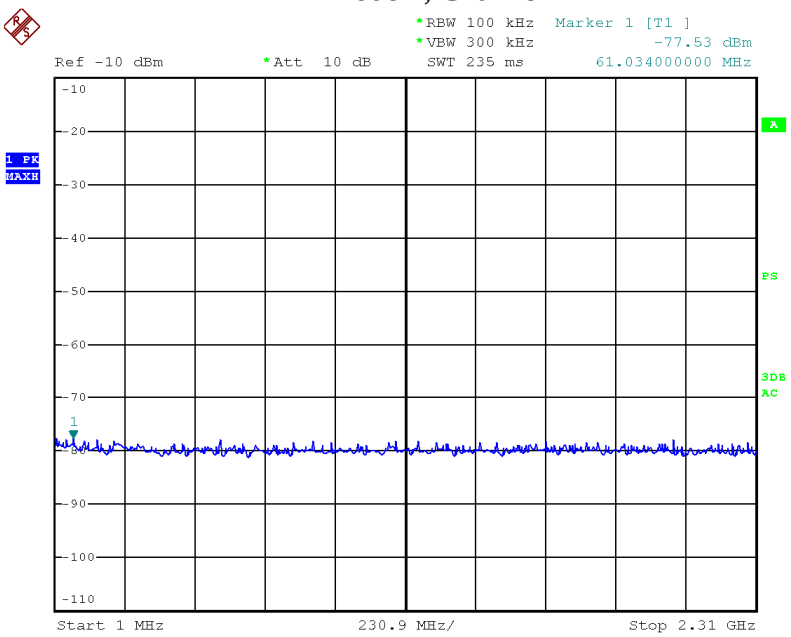


Mode 2, Channel H



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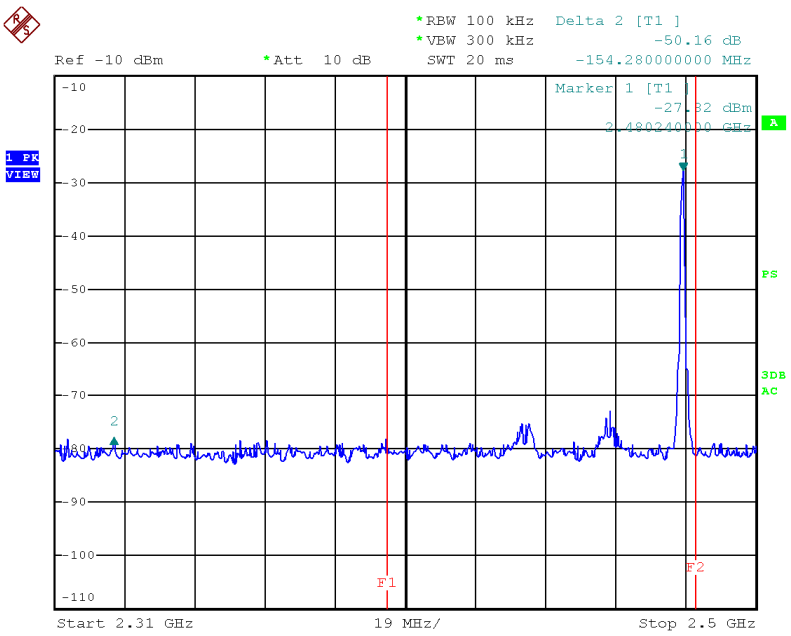

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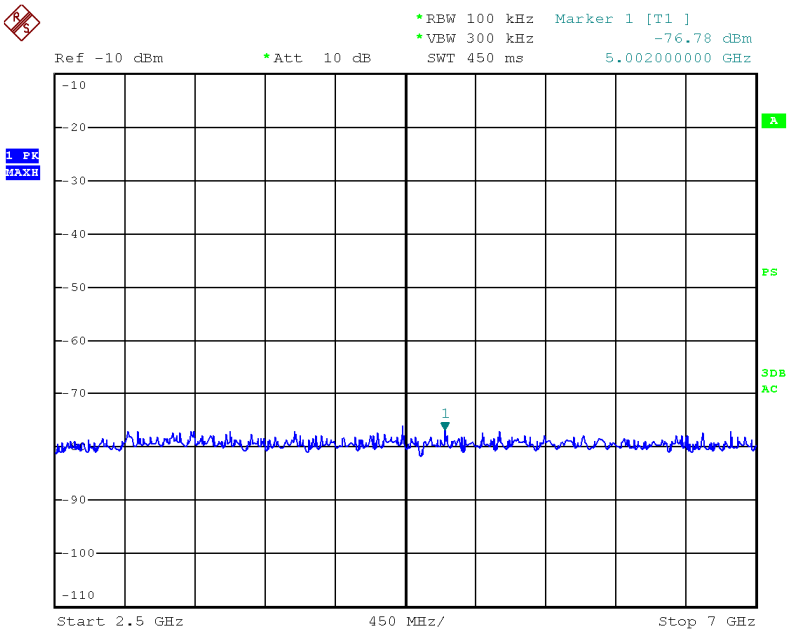

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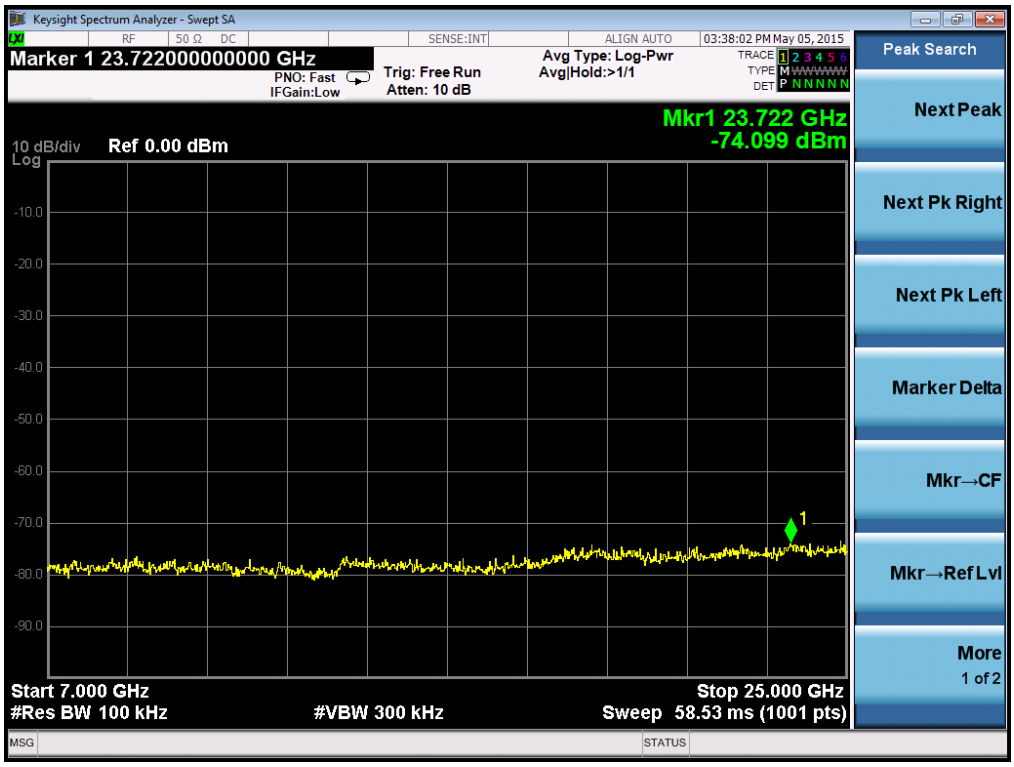
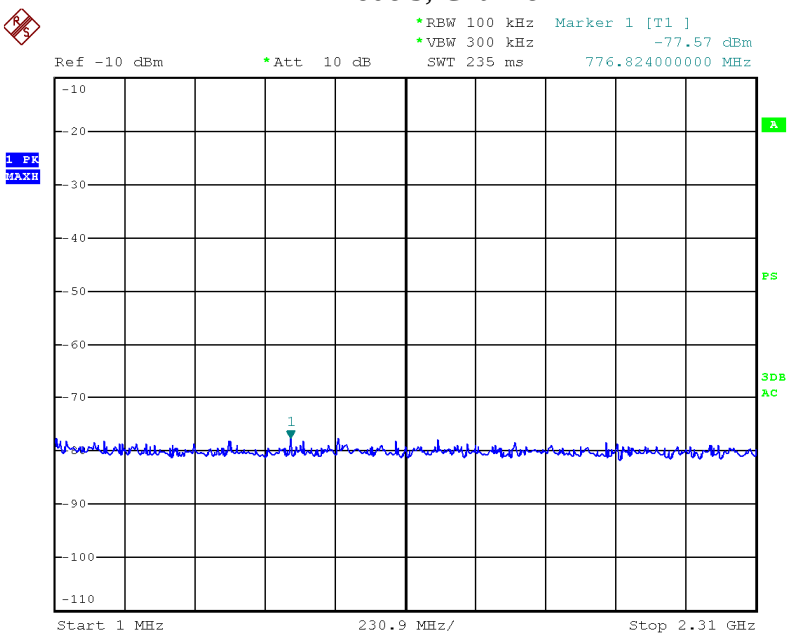


Mode 3, Channel L



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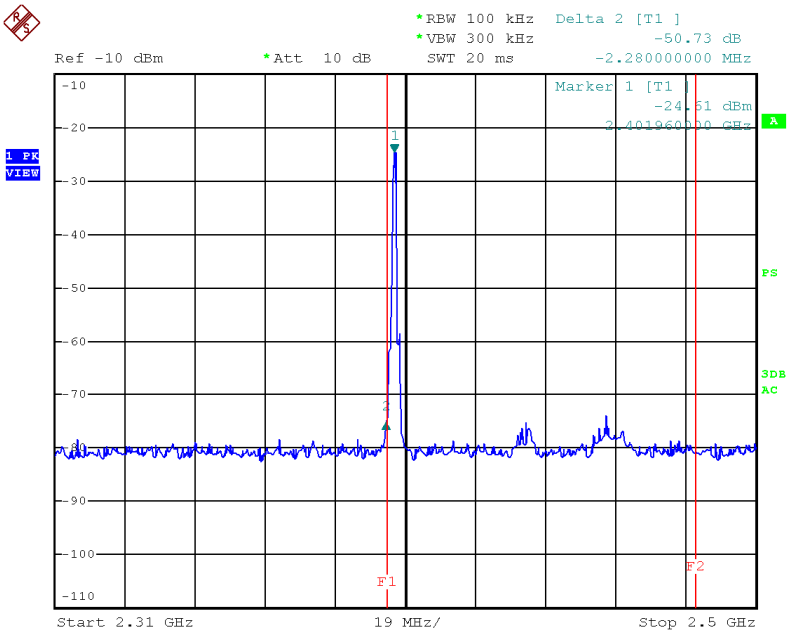

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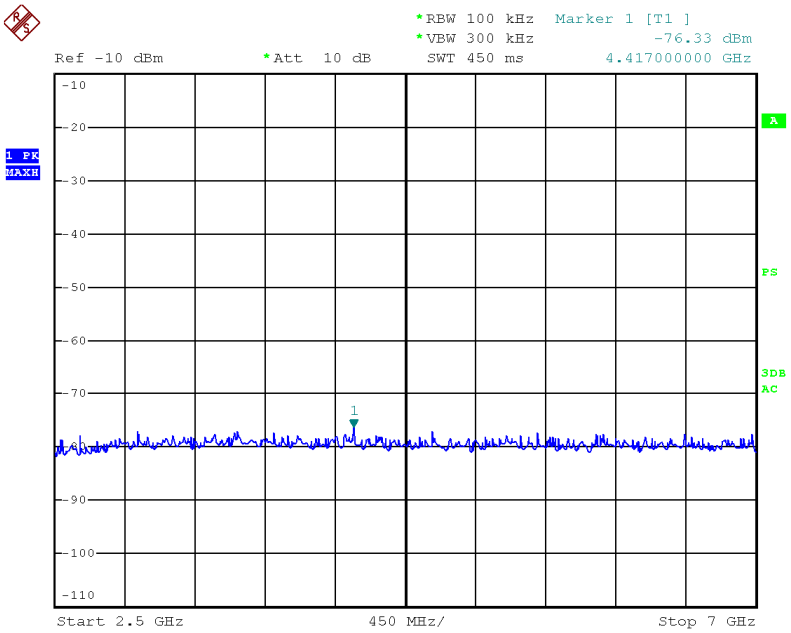

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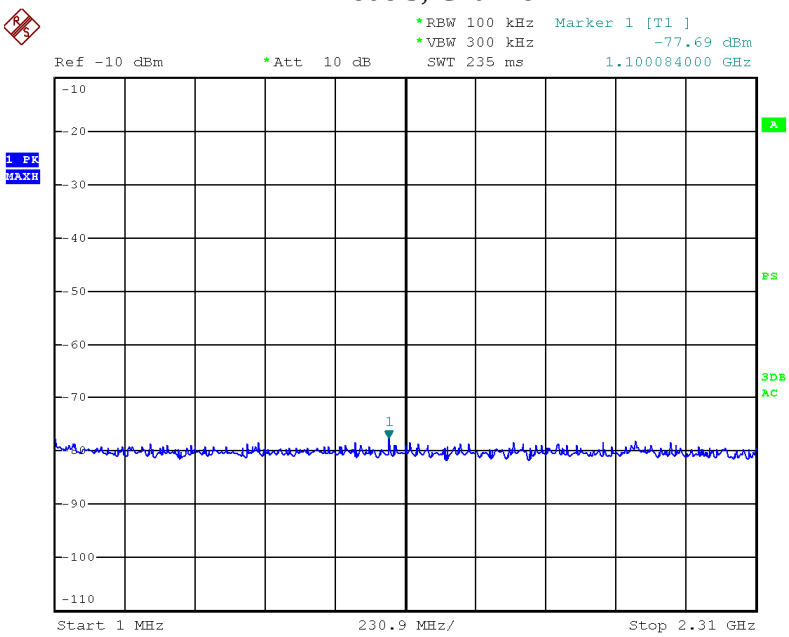
Mode 3, Channel M



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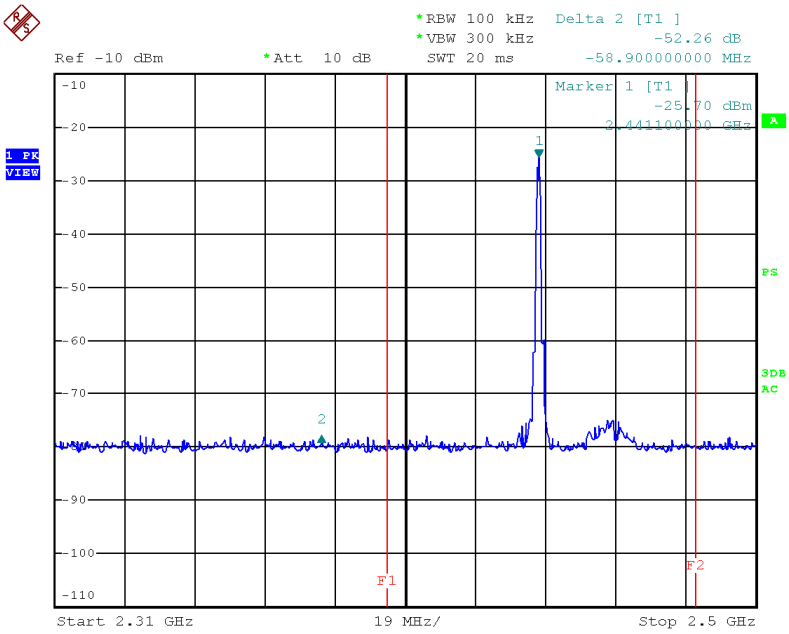

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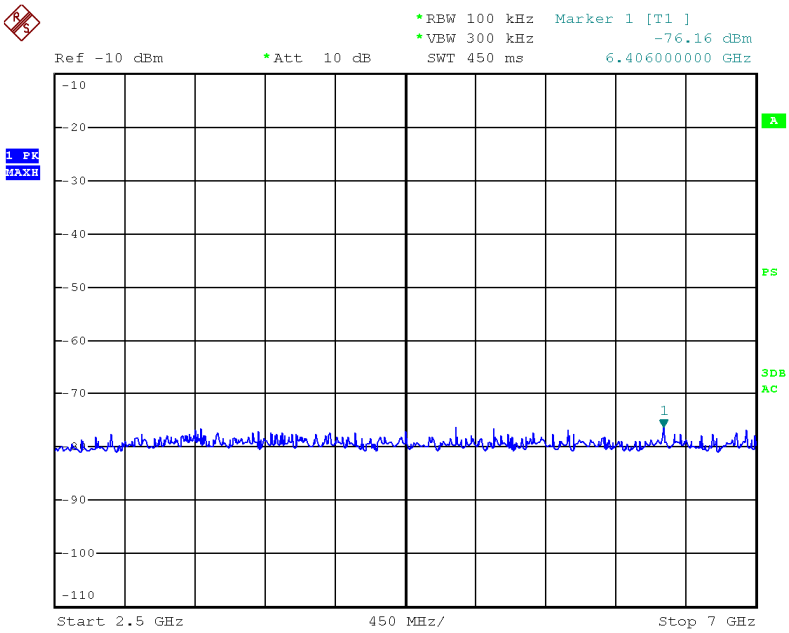

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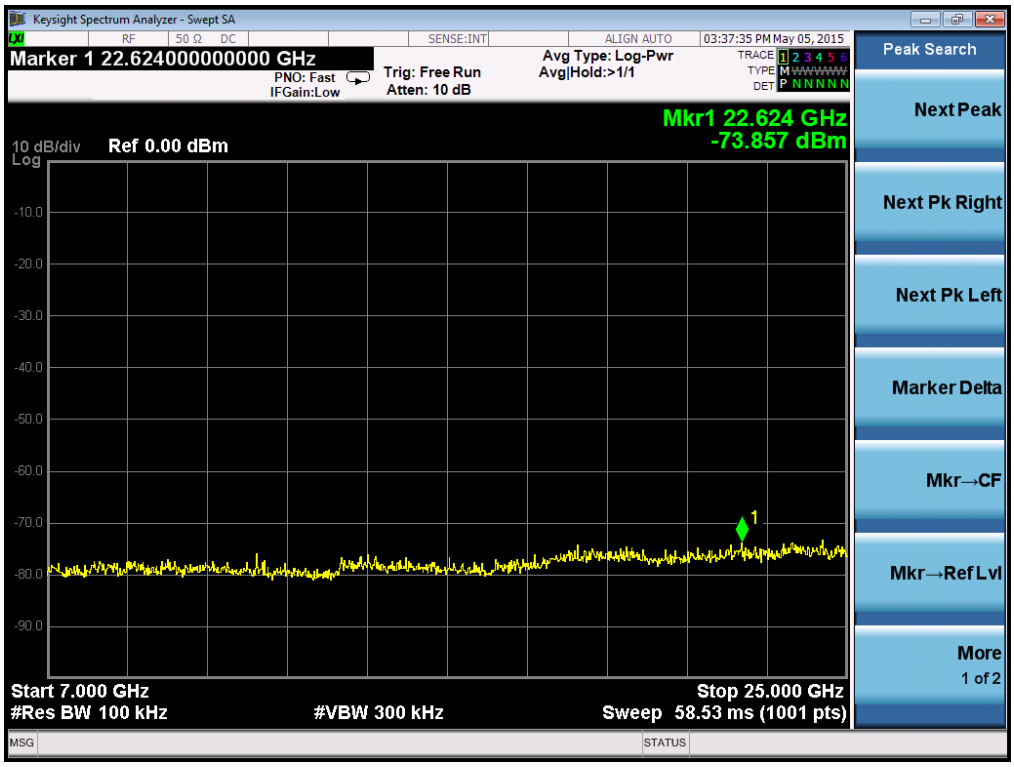
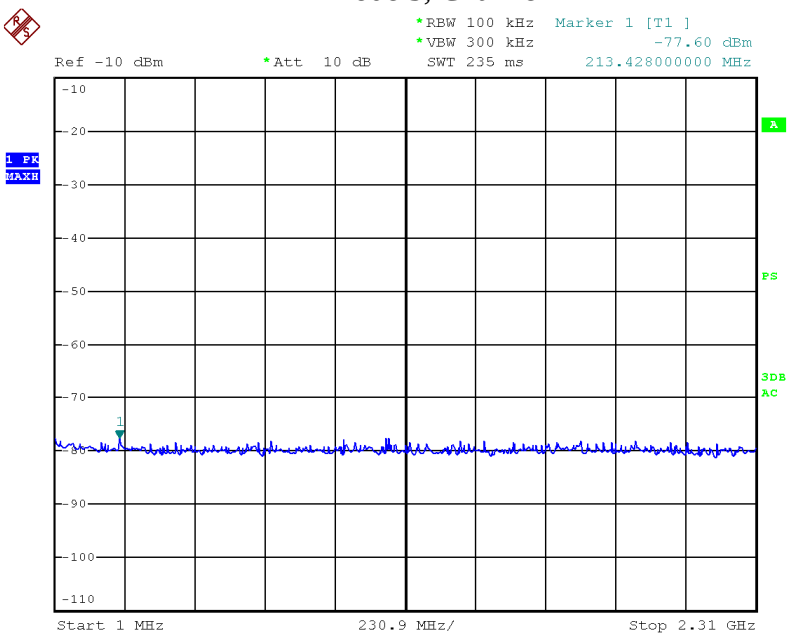


Mode 3, Channel H



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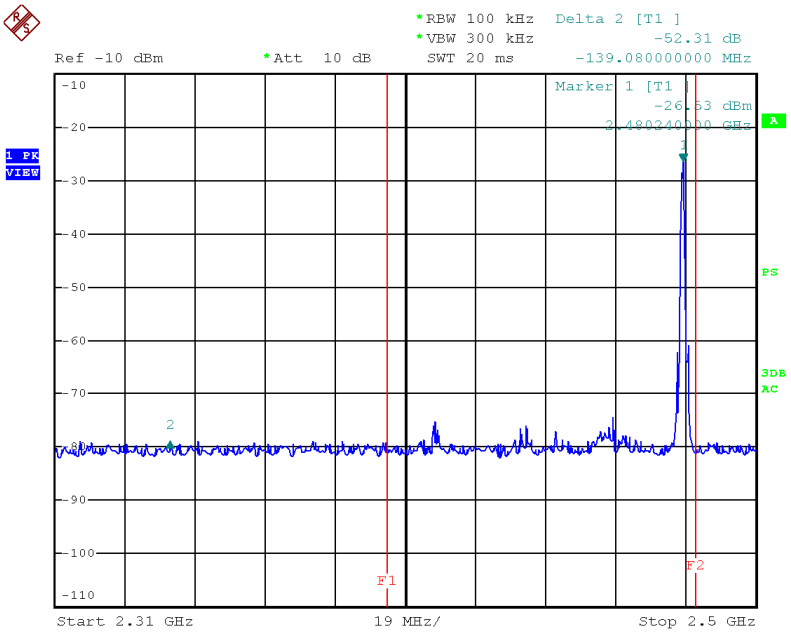

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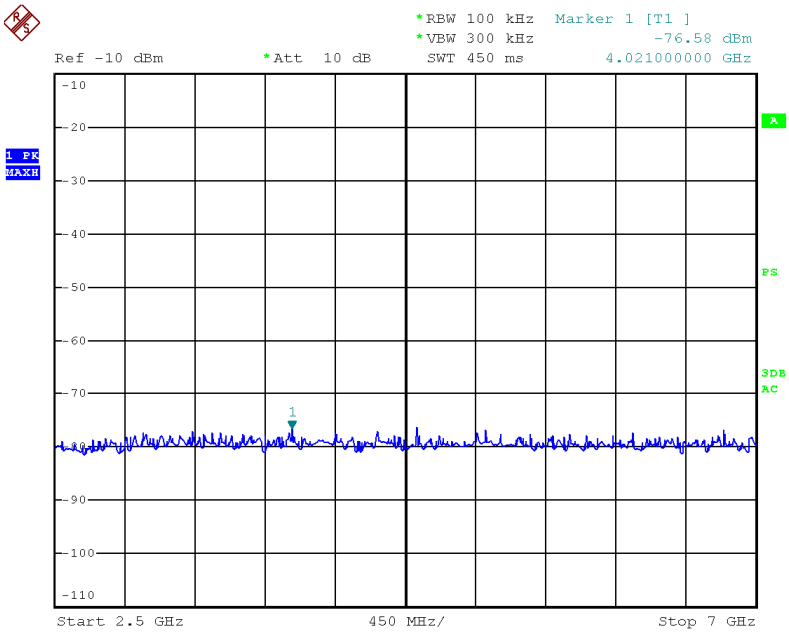
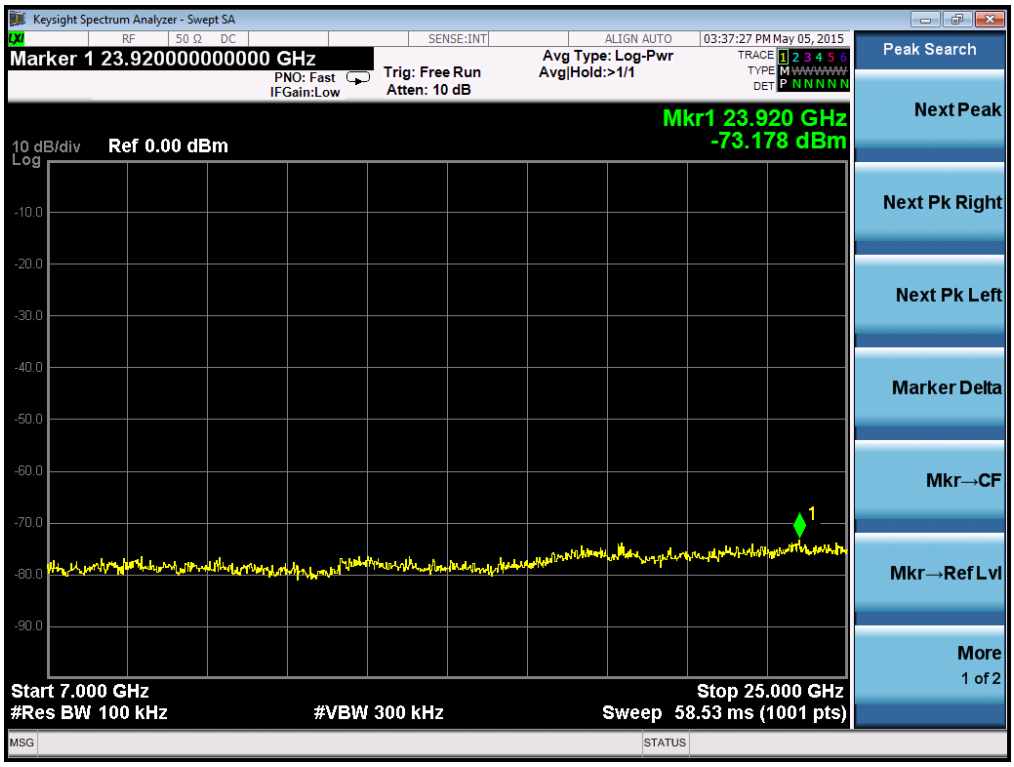
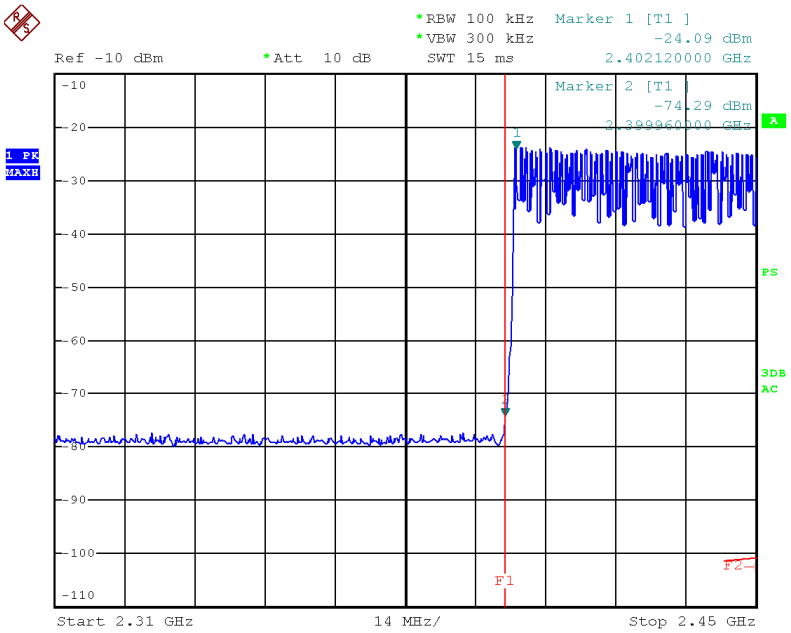

*RBW 100 kHz
Marker 1 [T1]
*VBW 300 kHz
-76.58 dBm
Ref -10 dBm
*Att 10 dB
SWT 450 ms
4.021000000 GHz
1 PK
MAXH
A
PS
3DB
AC
Start 2.5 GHz
450 MHz/
Stop 7 GHz
Date: 4.MAY.2015 13:31:33


Keysight Spectrum Analyzer - Swept SA
RF
50 Ω DC
SENSE:INT
ALIGN AUTO
03:37:27 PM May 05, 2015
Marker 1 23.920000000000 GHz
PNO: Fast
IFGain:Low
Trig: Free Run
Atten: 10 dB
Avg Type: Log-Pwr
Avg|Hold:>1/1
Mkr1 23.920 GHz
-73.178 dBm
10 dB/div
Log
Ref 0.00 dBm
Start 7.000 GHz
#Res BW 100 kHz
#VBW 300 kHz
Stop 25.000 GHz
Sweep 58.53 ms (1001 pts)
Peak Search
Next Peak
Next Pk Right
Next Pk Left
Marker Delta
Mkr→CF
Mkr→Ref Lvl
More
1 of 2
MSG
STATUS

Mode 4



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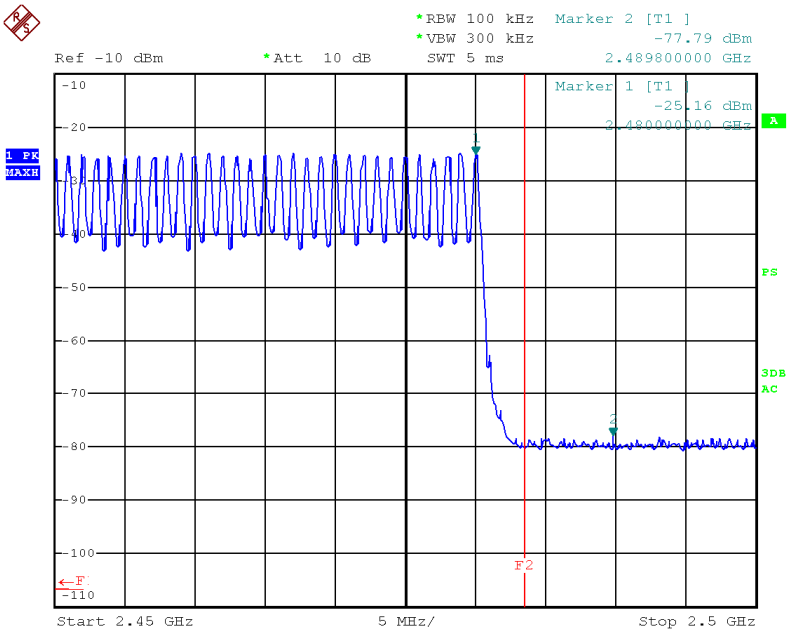

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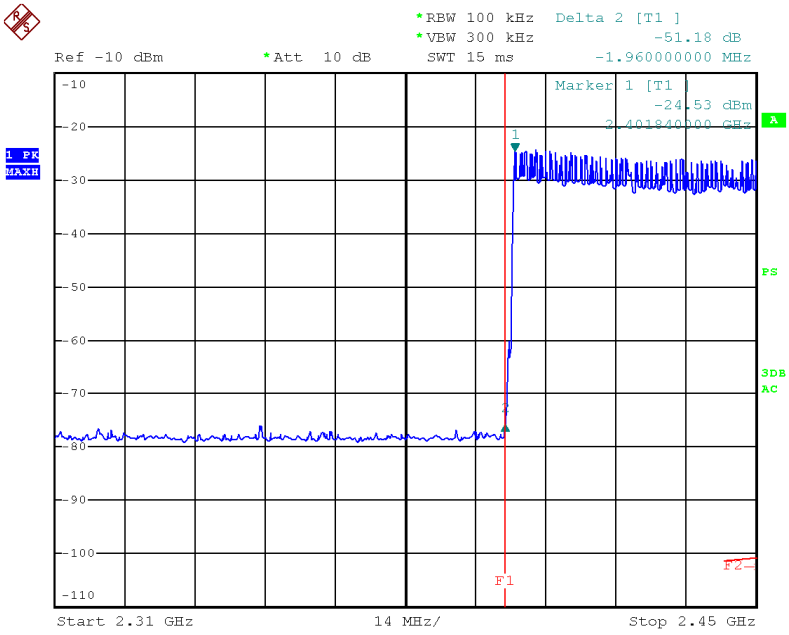
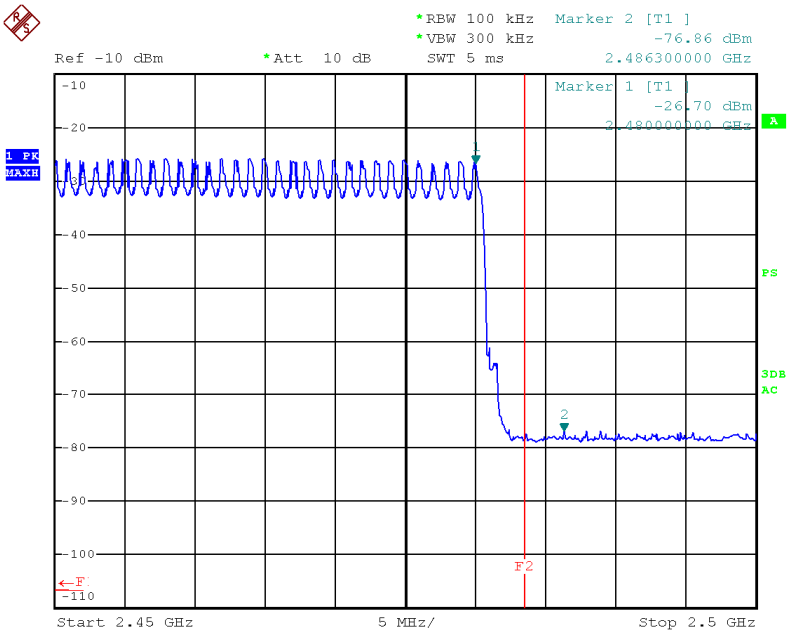
Mode 5

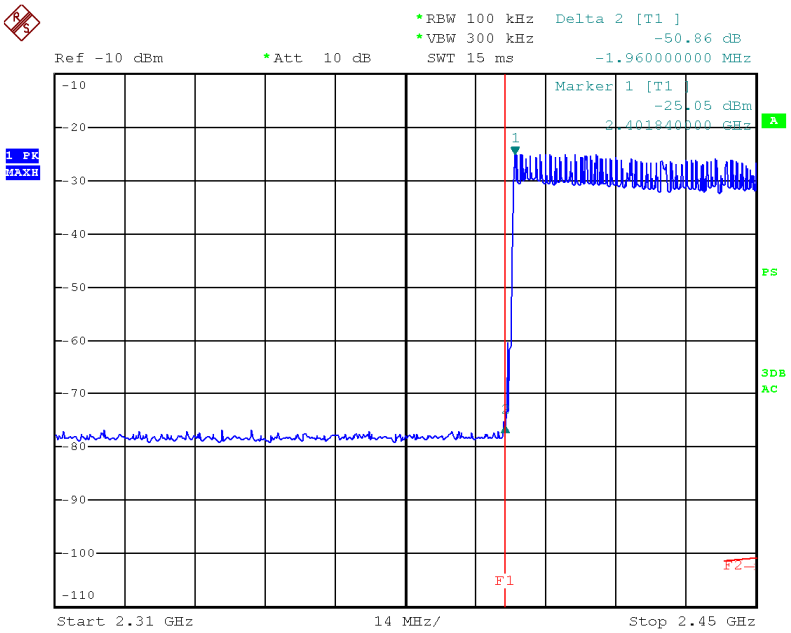


Date: 4.MAY.2015 13:15:27

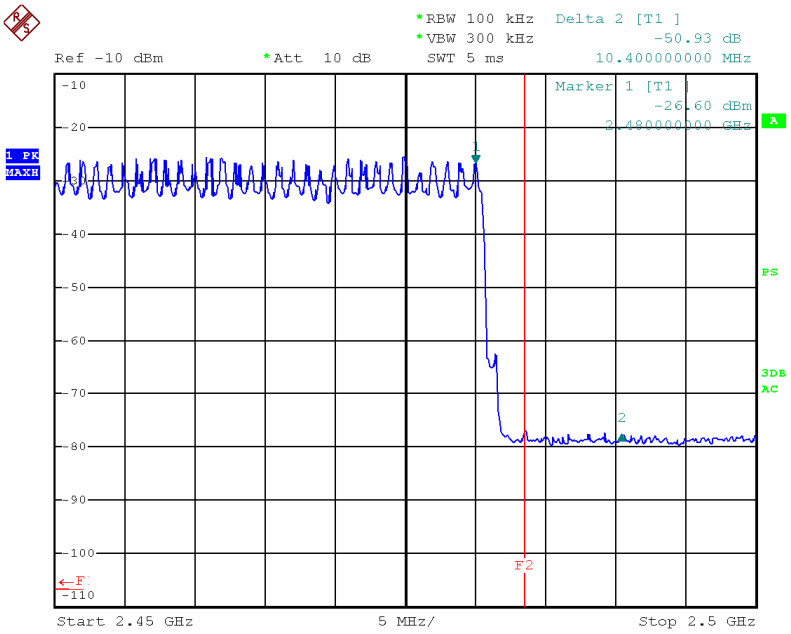


Date: 4.MAY.2015 13:07:28

Mode 6



Date: 4.MAY.2015 13:22:49



Date: 4.MAY.2015 13:27:50

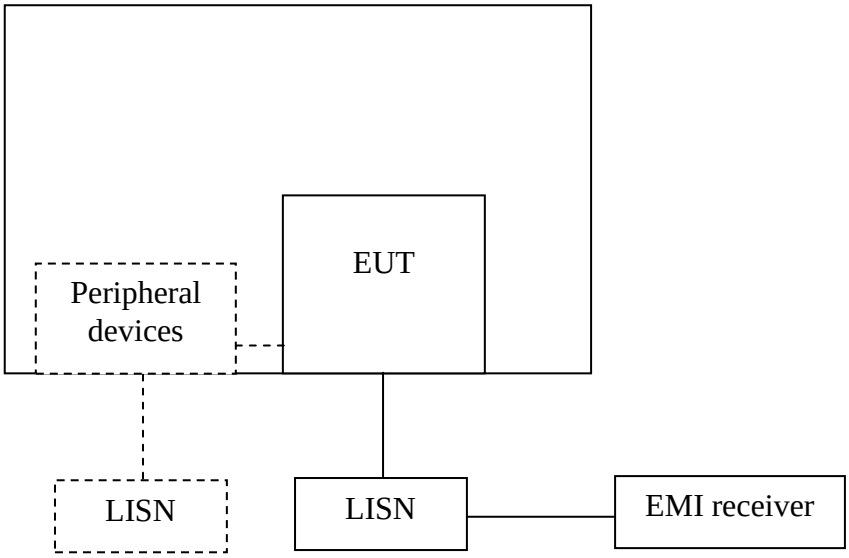
8. Power line conducted emission

Test result: **Pass**

8.1 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.		

8.2 Test configuration



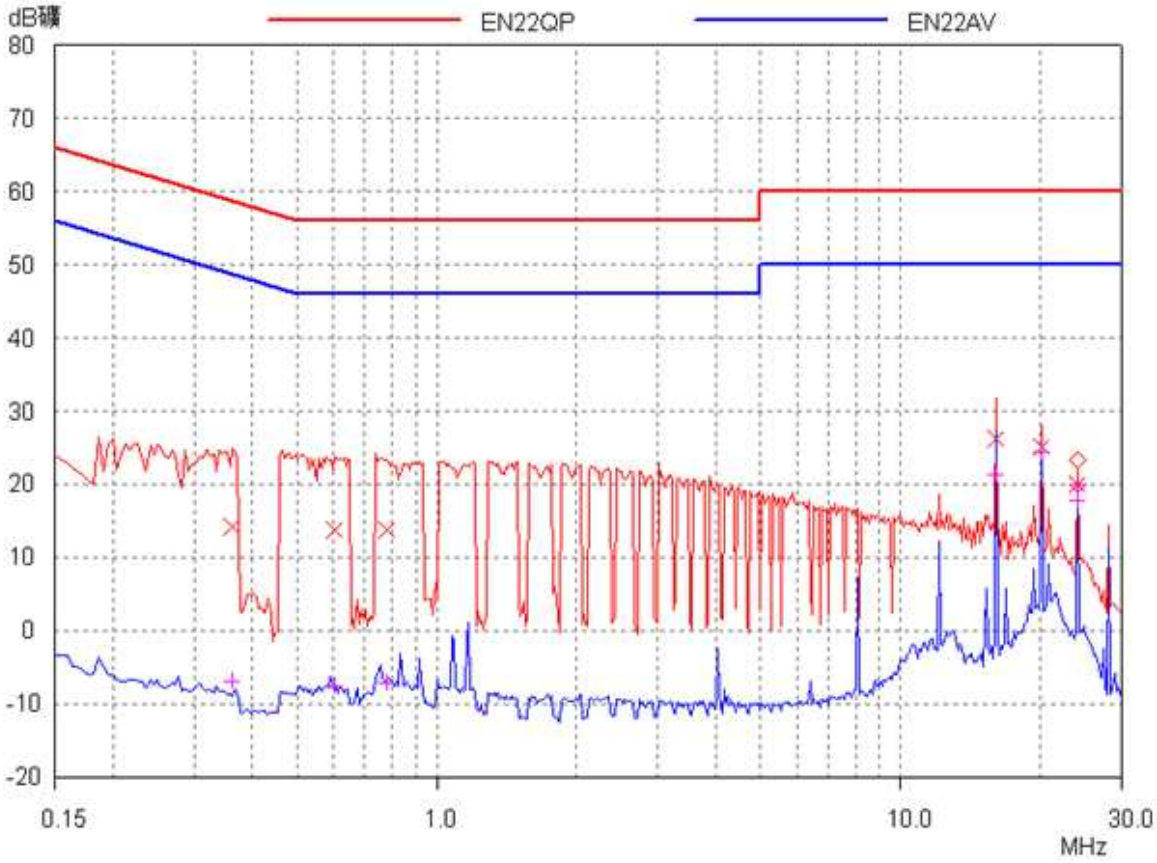
☒ For table top equipment, wooden support is 0.8m height table

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

8.3 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 on conducted measurement.
The bandwidth of the test receiver is set at 9 kHz.

8.4 Test protocol



Frequency	Correct Factor (dB)	Corrected Reading (dBuV)		Limit (dBuV)		Margin (dB)	
		QP	AV	QP	AV	QP	AV
0.36 (N)	3.00	14.25	-6.89	58.69	48.69	44.44	55.58
0.60 (L)	3.00	13.67	-7.68	56.00	46.00	42.33	53.68
0.78 (L)	3.00	13.84	-7.11	56.00	46.00	42.16	53.11
16.04 (N)	3.00	26.26	21.35	60.00	50.00	33.74	28.65
20.04 (L)	3.00	25.02	24.53	60.00	50.00	34.98	25.47
24.05 (N	3.00	20.03	17.67	60.00	50.00	39.97	32.33
Remark: 1. Correction Factor (dB) = LISN Factor (dB) + Cable Loss (dB). 2. Margin (dB) = Limit - Corrected Reading.							

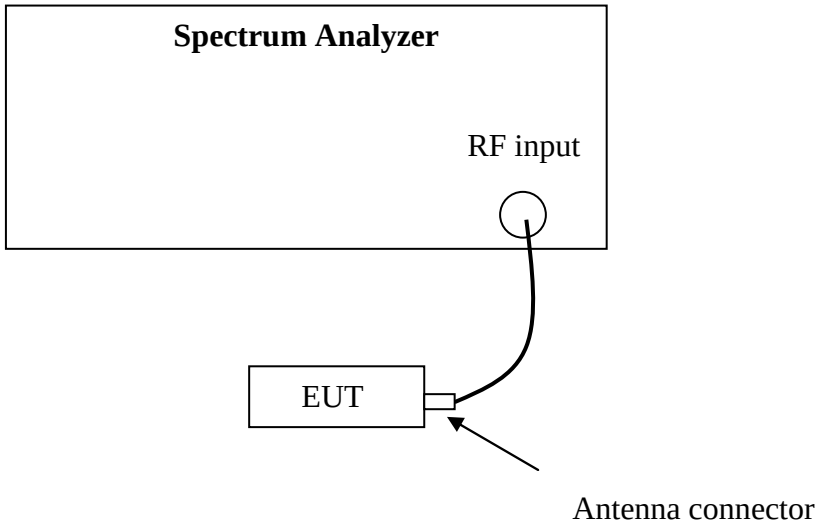
9. Number of Hopping Frequencies

Test result: **Pass**

9.1 Limit

Number of Hopping Frequencies in the 2400-2483.5 MHz band shall use at least 15 channels.

9.2 Test Configuration

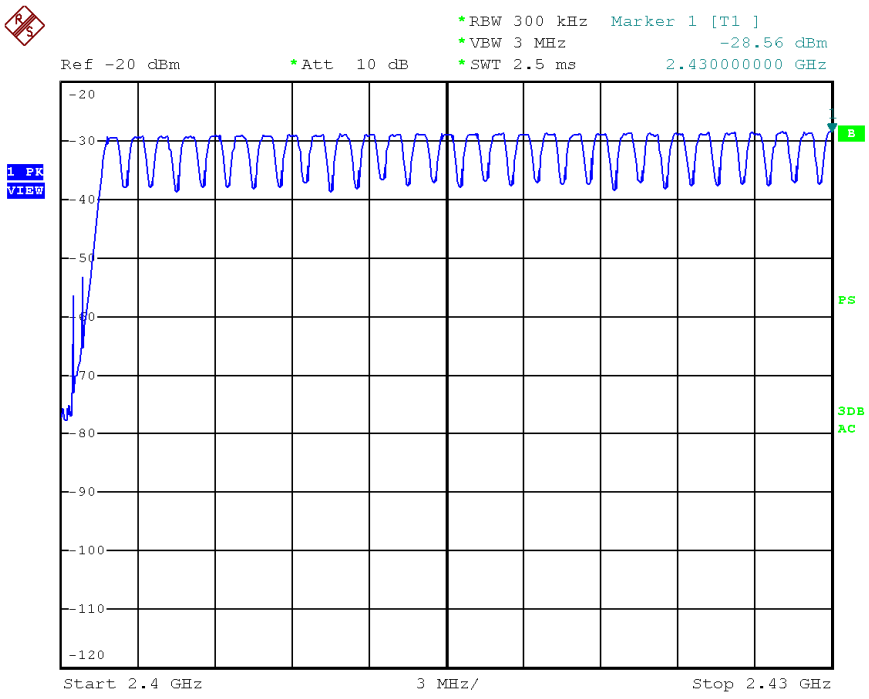


9.3 Test procedure and test setup

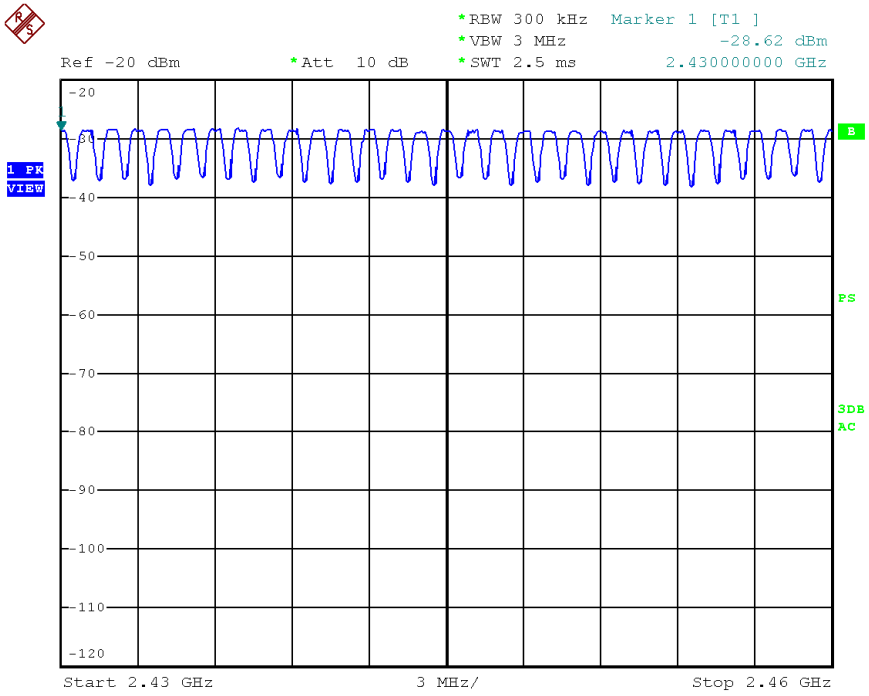
The channel number per FCC §15.247(a)(1)(iii) is measured using the Spectrum Analyzer with RBW=1MHz, VBW≥RBW, Sweep = auto, Detector = peak, Trace = max hold.
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

9.4 Test protocol

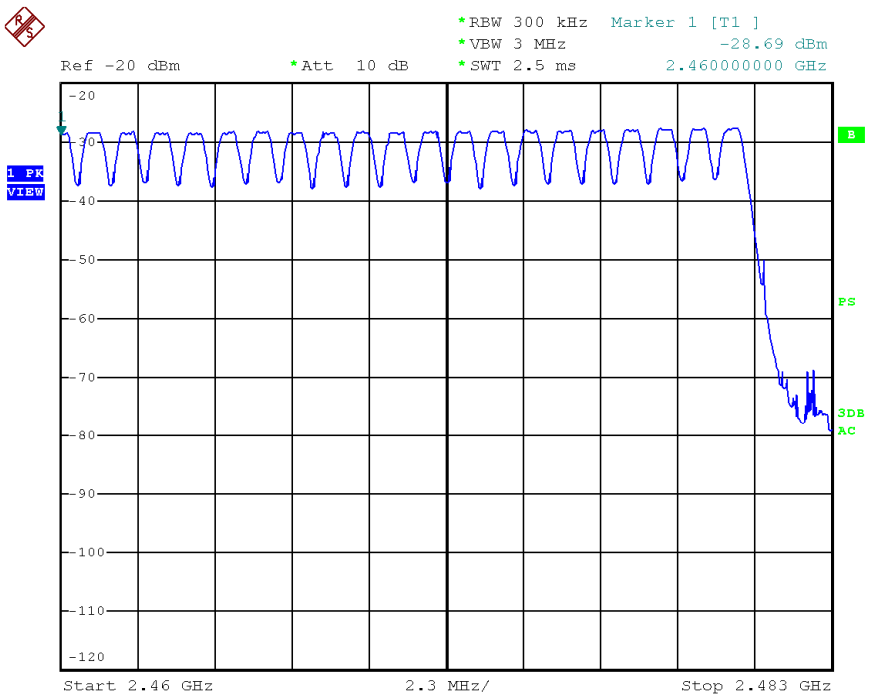
Mode	Channel Number	Limit
4	79	≥15



Date: 24.MAR.2015 18:21:34

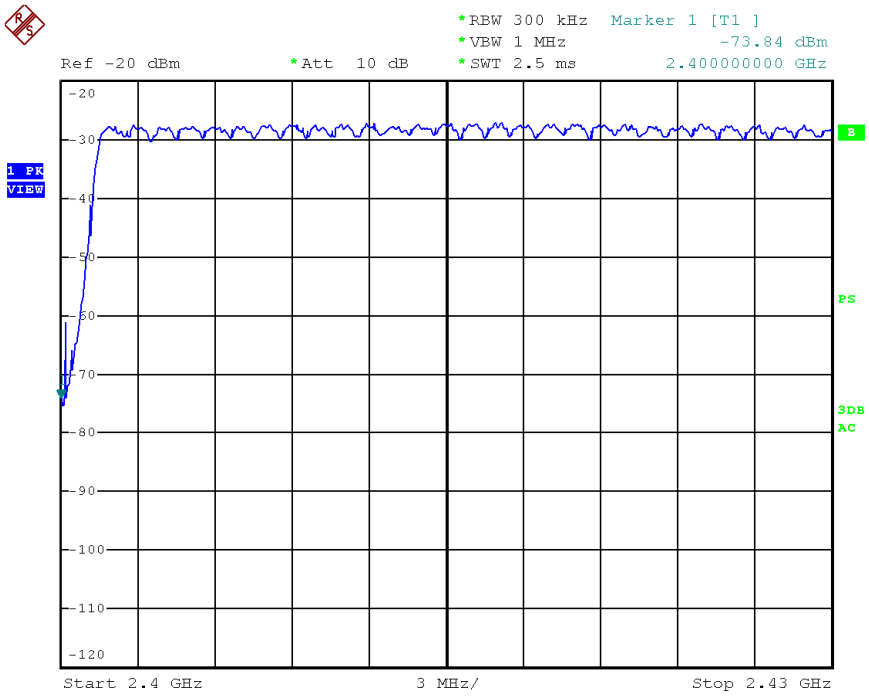


Date: 24.MAR.2015 18:23:28

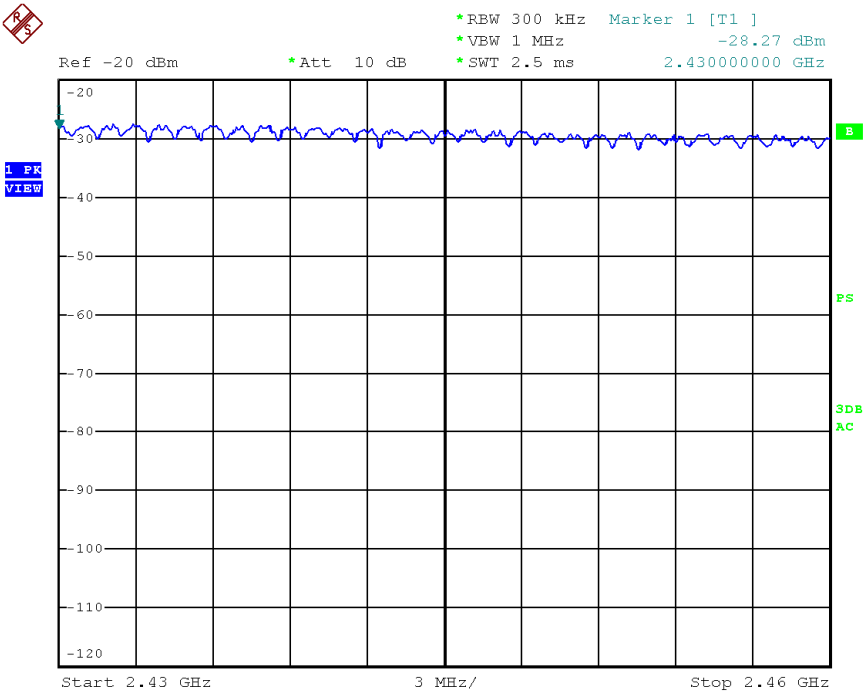


Date: 24.MAR.2015 18:25:10

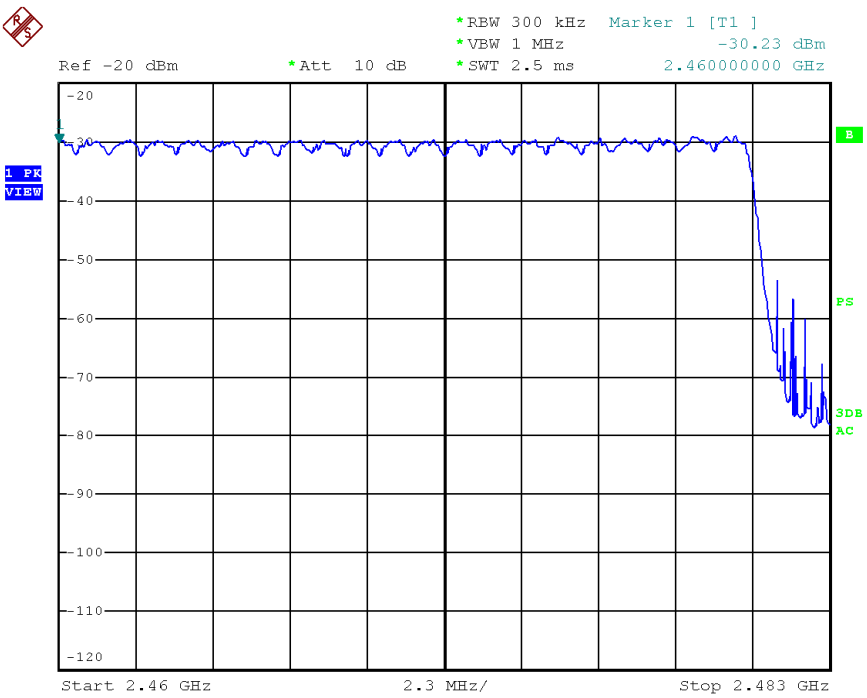
Mode	Channel Number	Limit
5	79	≥15



Date: 24.MAR.2015 17:58:02

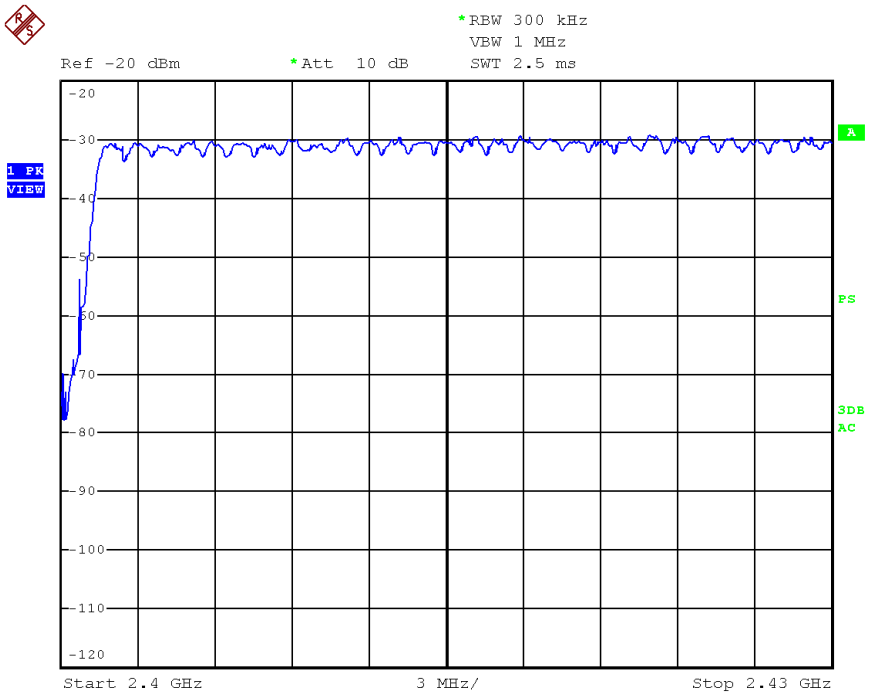


Date: 24.MAR.2015 18:00:33

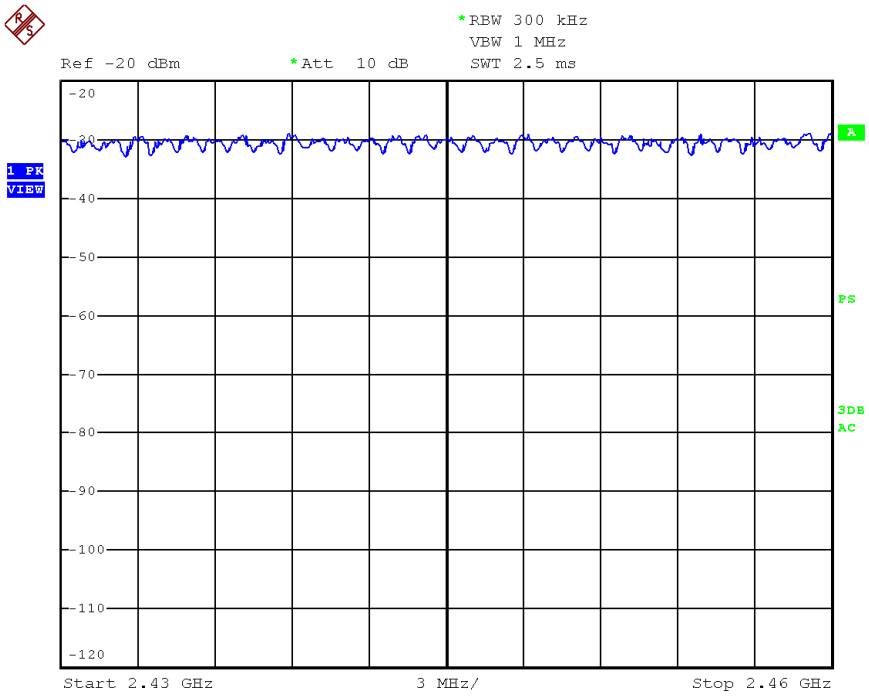


Date: 24.MAR.2015 18:02:00

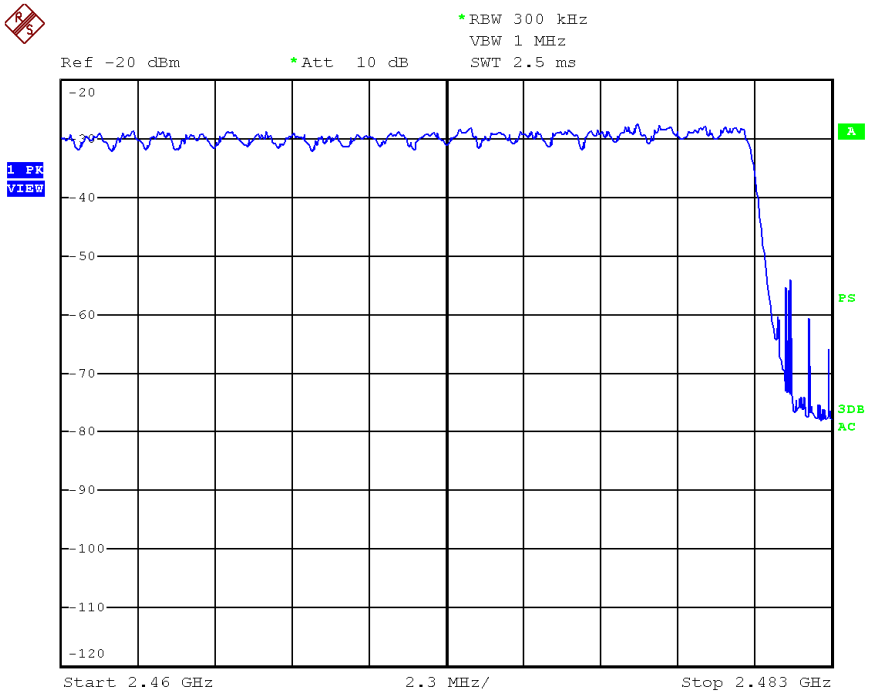
Mode	Channel Number	Limit
6	79	≥15



Date: 24.MAR.2015 17:25:37



Date: 24.MAR.2015 17:26:15



Date: 24.MAR.2015 17:27:01

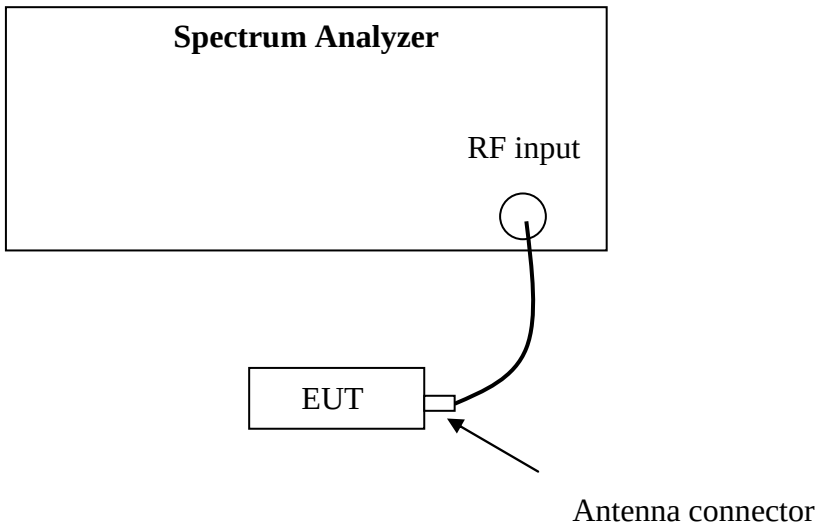
10. Dwell Time

Test result: **Pass**

10.1 Limit

The dwell time 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.

10.2 Test Configuration



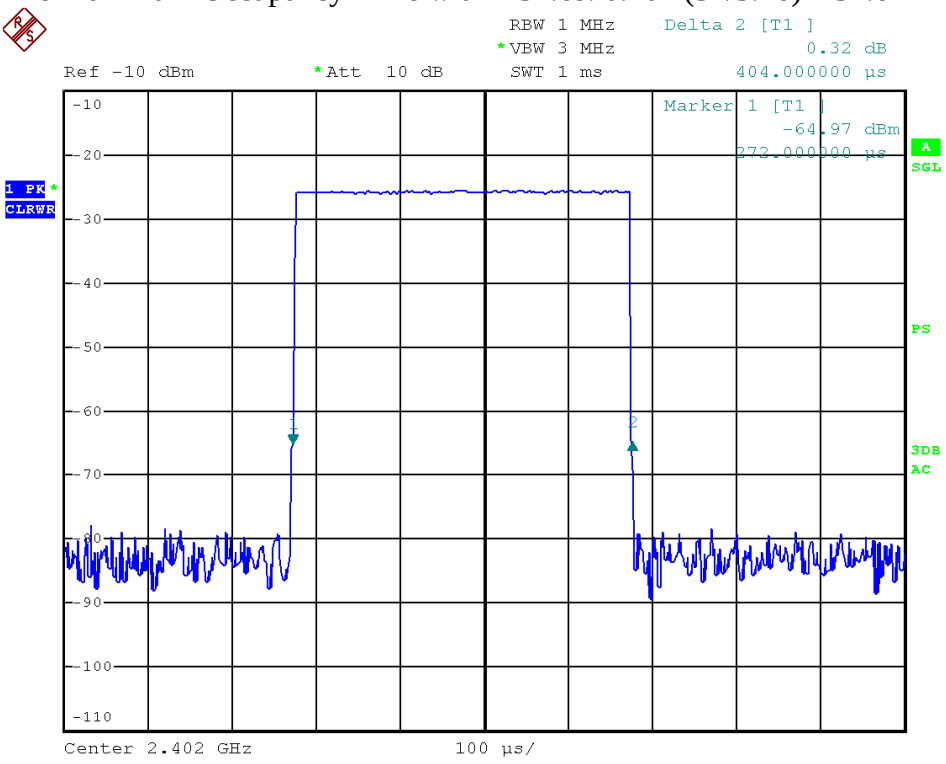
10.3 Test procedure and test setup

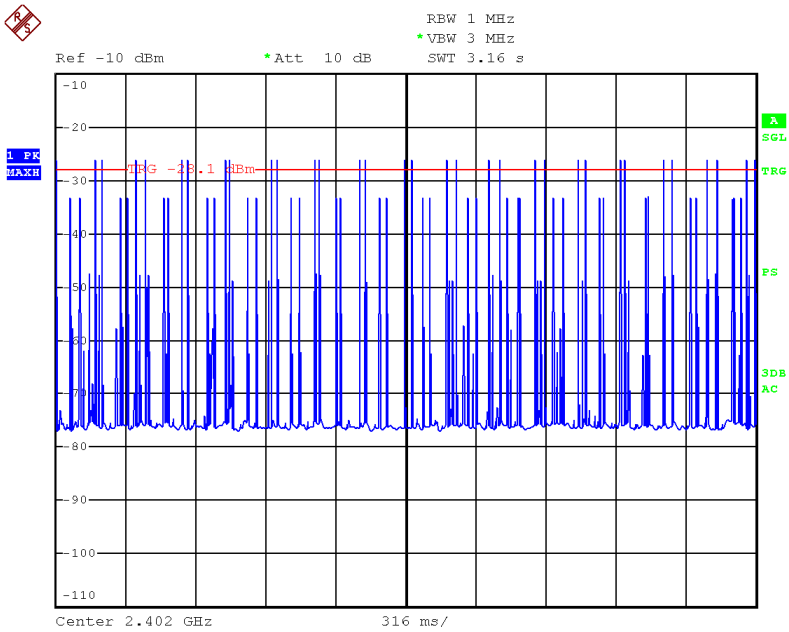
Dwell time per FCC § 15.247(a)(1)(iii) is measured using the Spectrum Analyzer with Span = 0, RBW=1MHz, VBW≥RBW, Sweep can capture the entire dwell time, Detector = peak, Trace = max hold.
The EUT was tested according to DA 00-705 (Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems).

10.4 Test protocol

Channel	Mode	Time of Occupancy (ms)	Limit (ms)
M	8DPSK_DH1	128	≤400

Dwell time for single hop: 0.40ms; Hopping numbers within 1sec: 32hops/3.16s;
Test Time Period: 0.4*79=31.6sec;
The Maximum Occupancy Time within 31.6s: 0.40* (32/3.16) * 31.6= 128ms

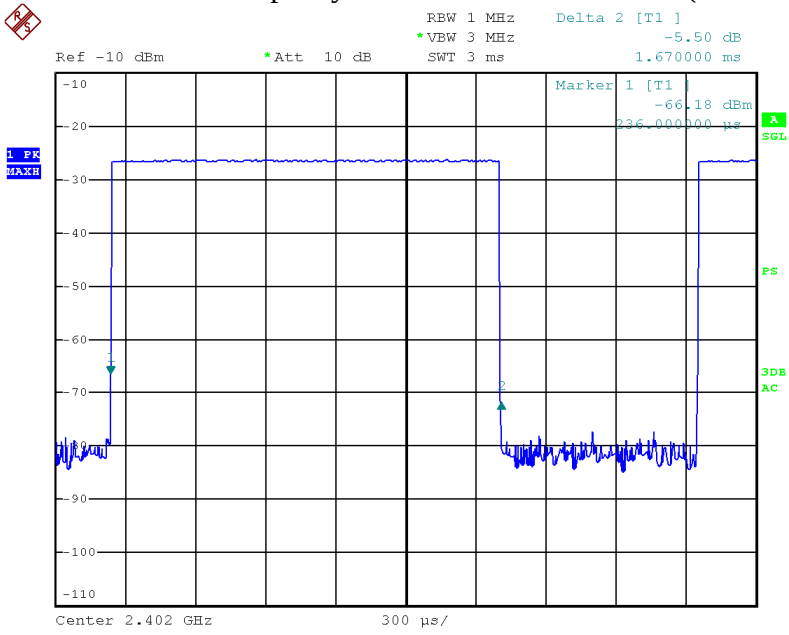




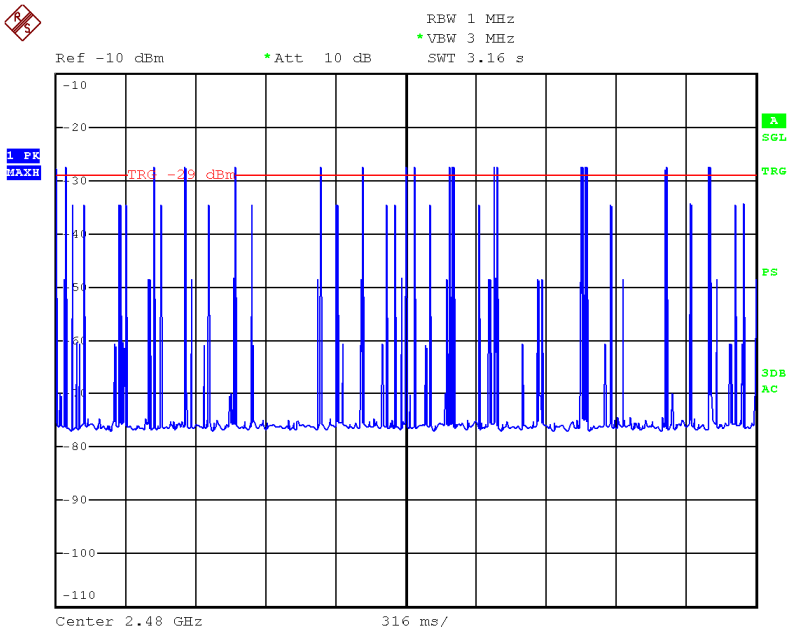
Date: 4.MAY.2015 13:42:39

Channel	Mode	Time of Occupancy (ms)	Limit (ms)
M	8DPSK_DH3	250.5	≤400

Dwell time for single hop: 1.67ms; Hopping numbers within 1sec: 15hops/3.16s;
Test Time Period: 0.4*79=31.6sec;
The Maximum Occupancy Time within 31.6s: 1.67* (15/3.16) * 31.6= 250.5ms



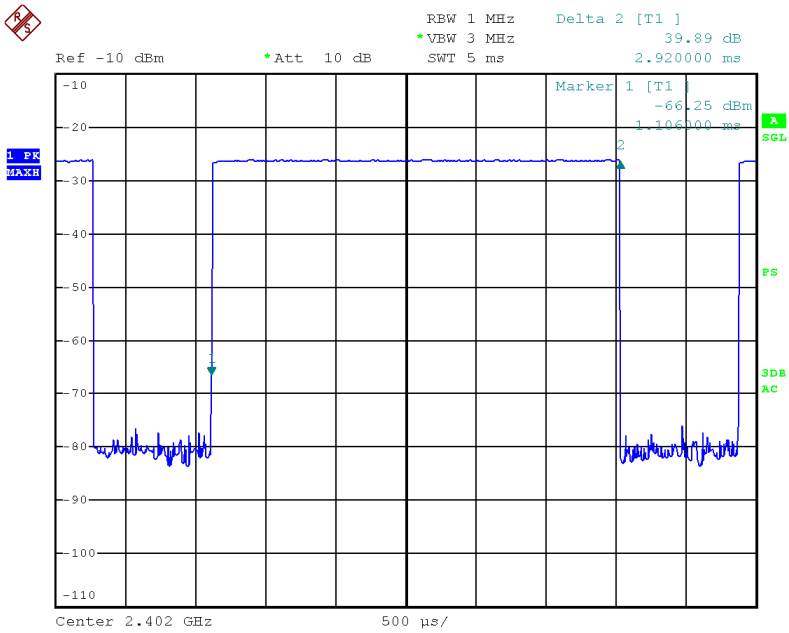
Date: 4.MAY.2015 13:36:50



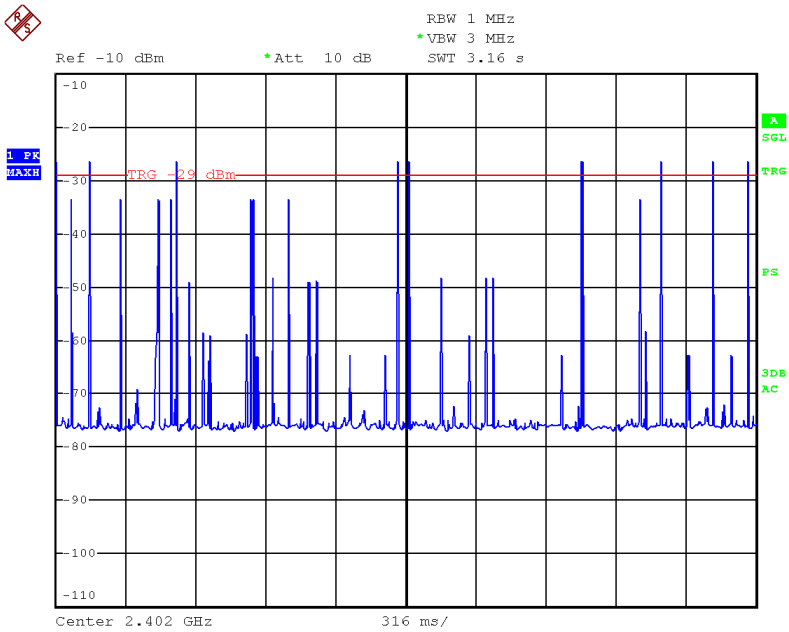
Date: 4.MAY.2015 13:48:39

Channel	Mode	Time of Occupancy (ms)	Limit (ms)
M	8DPSK_DH5	321.2	≤400

Dwell time for single hop: 2.92ms; Hopping numbers within 1sec: 11hops/3.16s;
Test Time Period: 0.4*79=31.6sec;
The Maximum Occupancy Time within 31.6s: 2.92* (11/3.16) * 31.6= 321.2ms



Date: 4.MAY.2015 13:37:27



Date: 4.MAY.2015 13:49:09

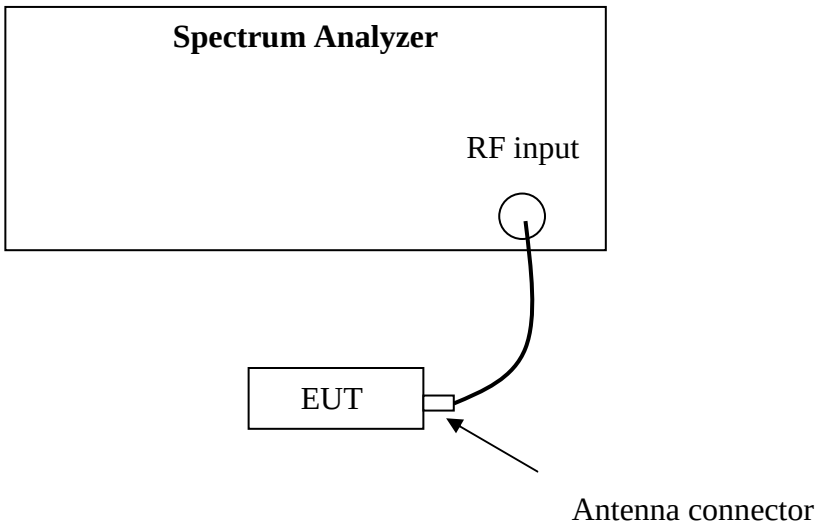
11. Occupied Bandwidth

Test Status: Pass

11.1 Test limit

None

11.2 Test Configuration



11.3 Test procedure and test setup

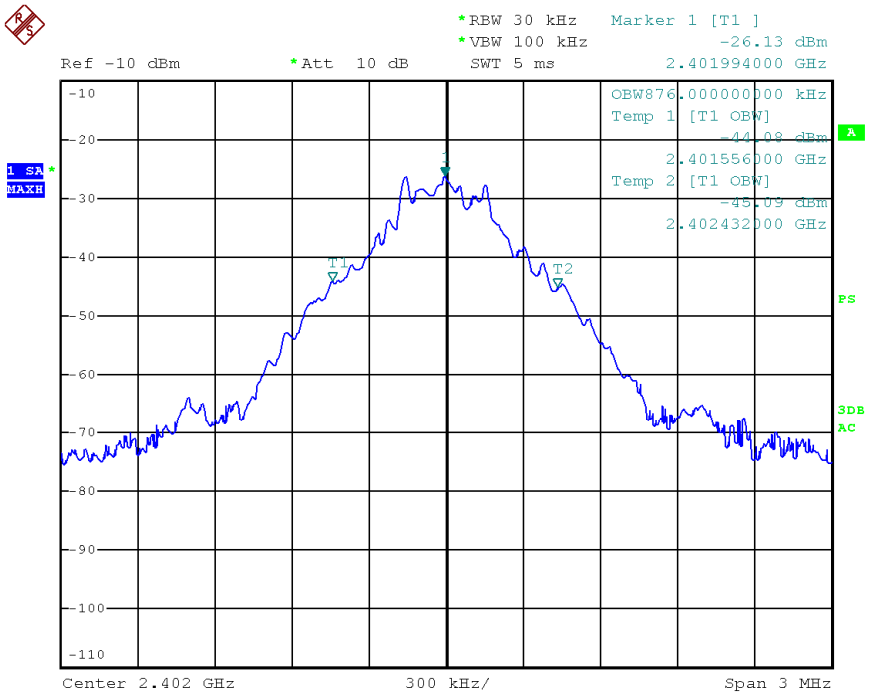
The occupied bandwidth per RSS-Gen Issue 3 Clause 4.6.1 was measured using the Spectrum Analyzer with the RBW close to 1% of the selected span, VBW = 3 * RBW Detector = Sample, Sweep = Auto.

11.4 Test protocol

Temperature : 26 °C
Relative Humidity : 55 %

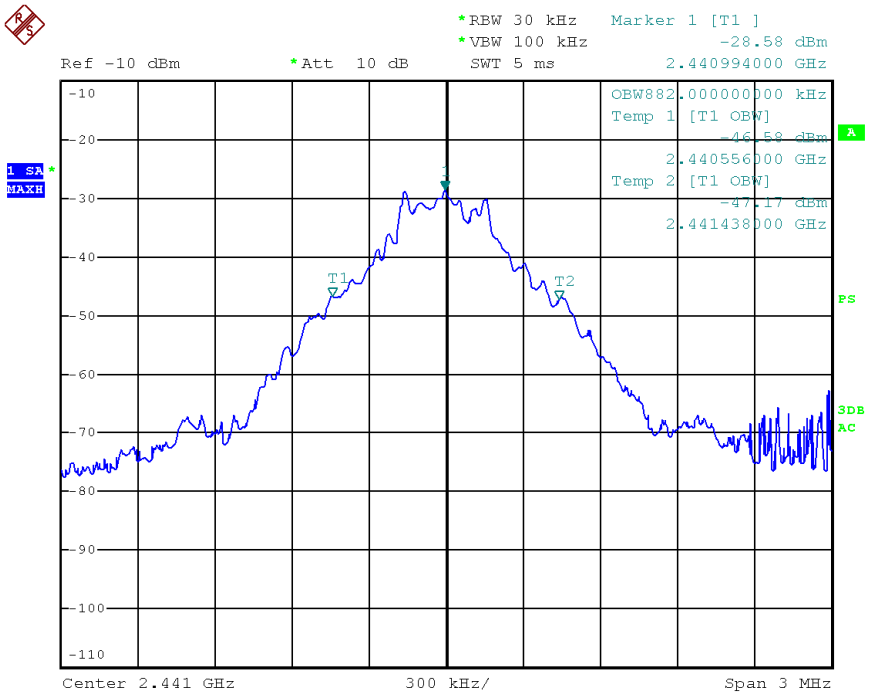
Mode	CH	Occupied Bandwidth (kHz)
1	L	876
	M	882
	H	876

Channel L



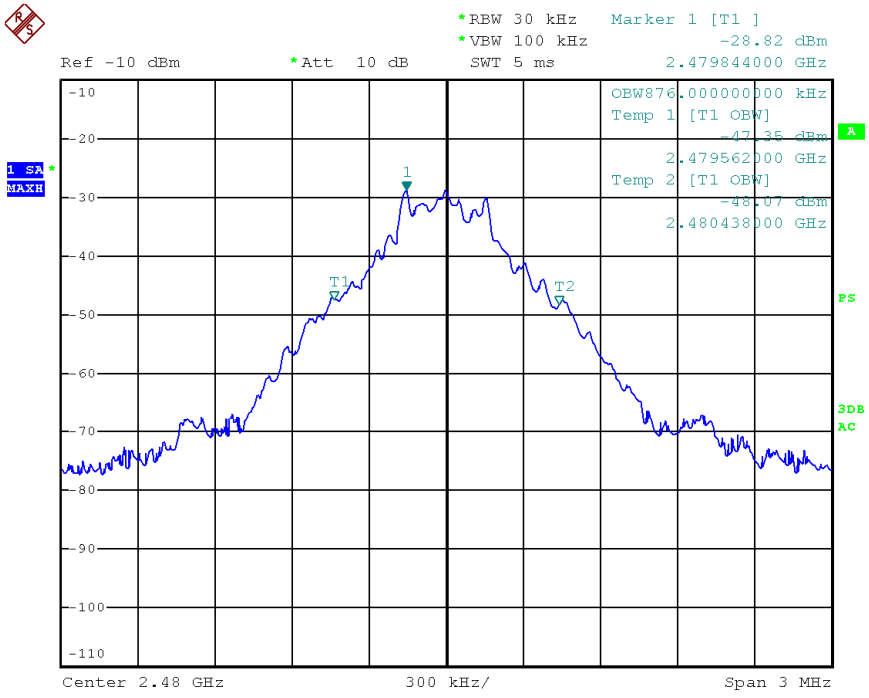
Date: 4.MAY.2015 11:59:32

Channel M



Date: 4.MAY.2015 12:00:17

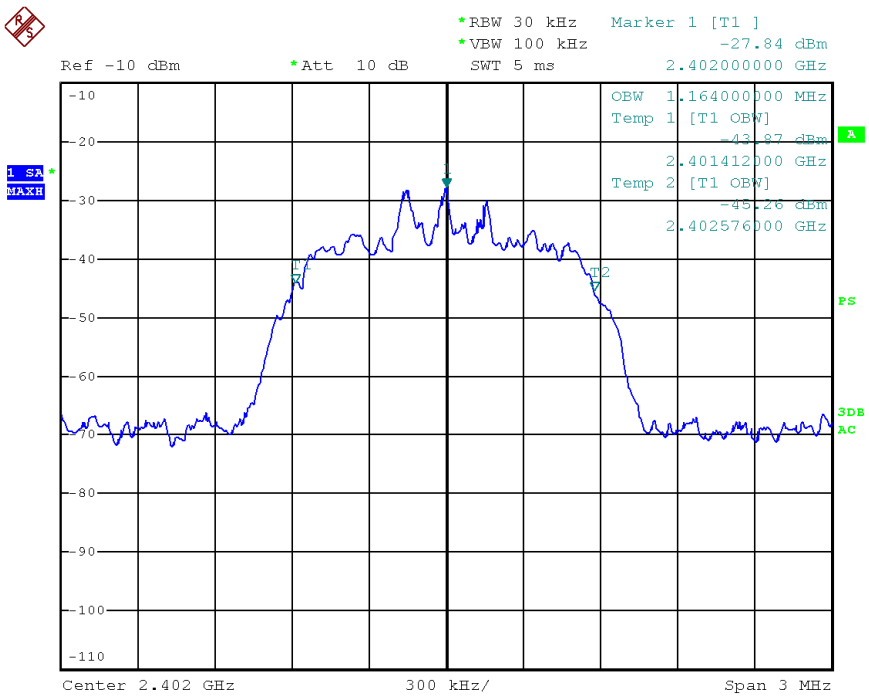
Channel H



Date: 4.MAY.2015 12:01:04

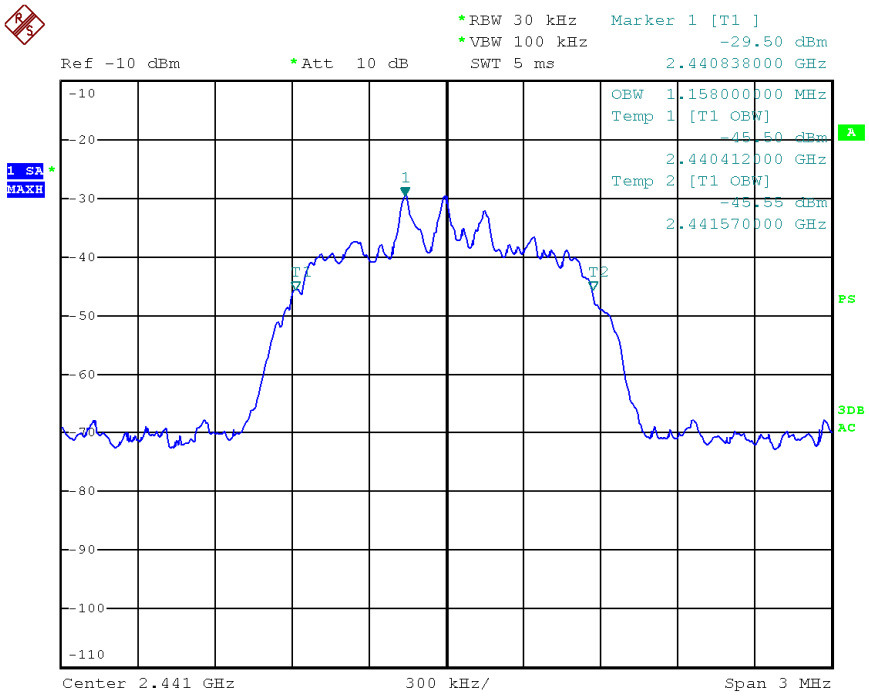
Mode	CH	Occupied Bandwidth (kHz)
2	L	1164
	M	1158
	H	1158

Channel L



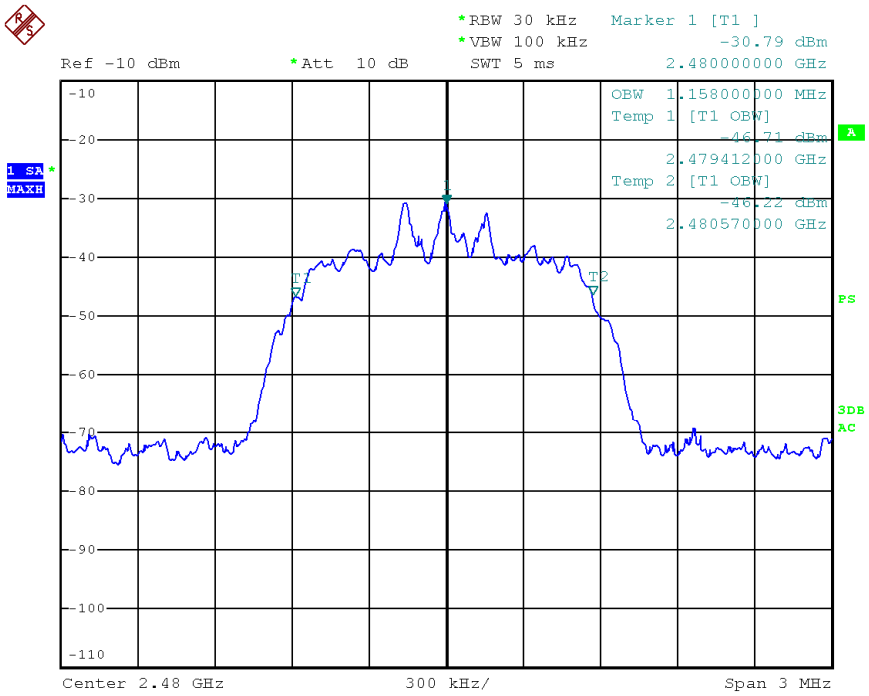
Date: 4.MAY.2015 12:01:56

Channel M



Date: 4.MAY.2015 12:03:25

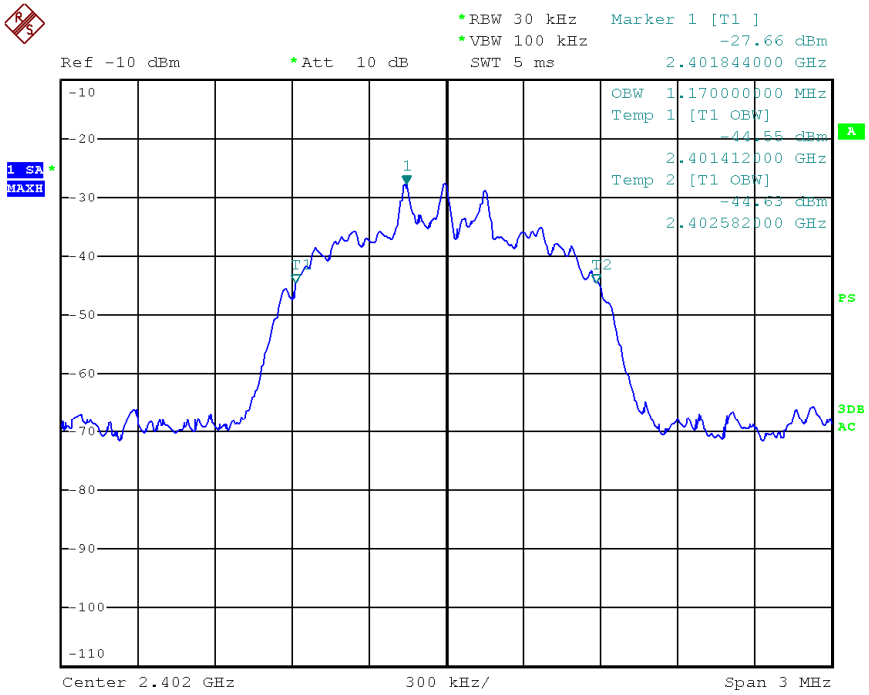
Channel H



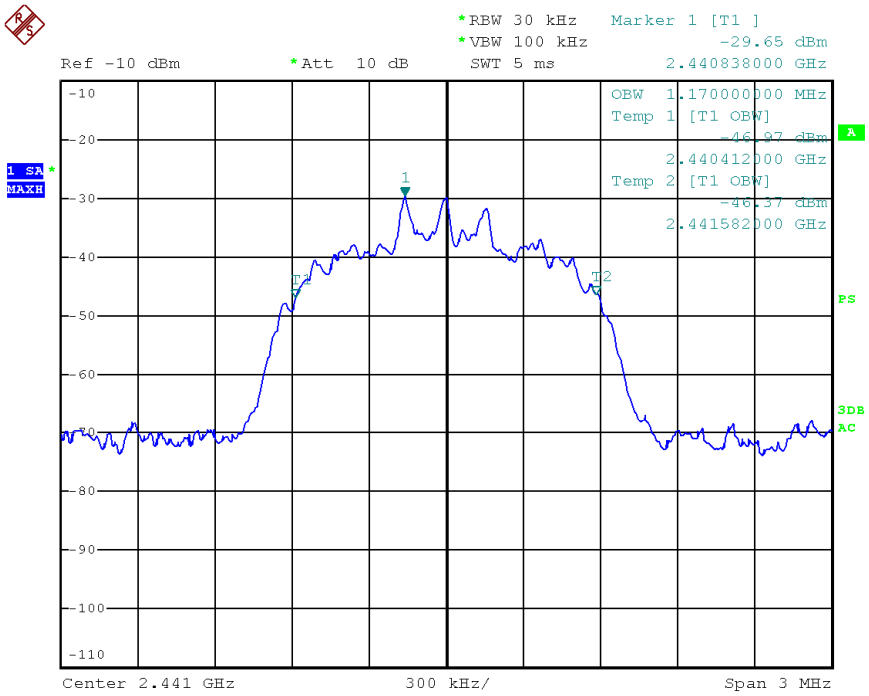
Date: 4.MAY.2015 12:04:05

Mode	CH	Occupied Bandwidth (kHz)
3	L	1170
	M	1170
	H	1158

Channel L

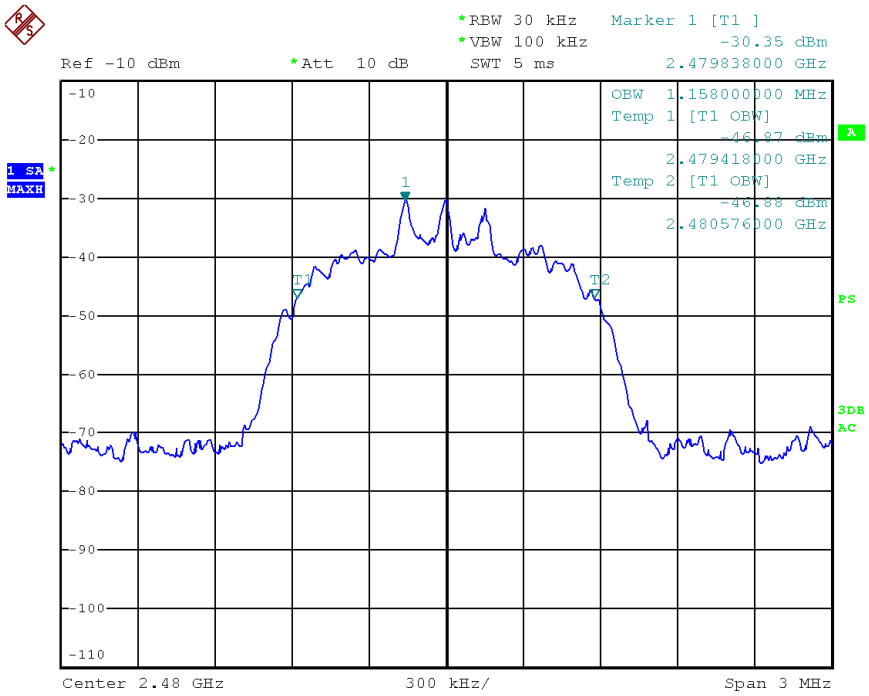


Channel M



Date: 4.MAY.2015 12:05:41

Channel H



Date: 4.MAY.2015 12:06:27