

FCC - TEST REPORT

Report Number : **68.950.19.0562.01** Date of Issue: **June 14, 2019**

Model : E70531, E70533, E70535

Product Type : Element 7S, Element 9S, Element 12S

Applicant : Raymarine UK Limited

Address : Marine House Cartwright Drive, Segensworth Fareham, Hampshire
United Kingdom PO15 5RJ

Manufacturer : Raymarine UK Limited

Address : Marine House Cartwright Drive, Segensworth Fareham, Hampshire
United Kingdom PO15 5RJ

Test Result : Positive Negative

Total pages including Appendices : **35**

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2 Details about the Test Laboratory

Details about the Test Laboratory

Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch
Building 12&13, Zhiheng Wisdomland Business Park,
Nantou Checkpoint Road 2, Nanshan District,
Shenzhen City, 518052,
P. R. China

FCC Registration No.: 514049

Telephone: 86 755 8828 6998
Fax: 86 755 8828 5299

3 Description of the Equipment Under Test

| | |
|----------------------------|--|
| Product: | Element 7S, Element 9S, Element 12S |
| Model no.: | E70531, E70533, E70535 |
| FCC ID: | PJ5-ELEMSDISP |
| Brand Name: | Raymarine |
| Options and accessories: | NIL |
| Rating: | DC 12V, 3A Max |
| RF Transmission Frequency: | 2412-2462MHz |
| No. of Operated Channel: | 11 |
| Modulation: | DSSS, OFDM |
| Antenna Type: | Internal Antenna |
| Antenna Gain: | 2dBi |
| Description of the EUT: | The Equipment Under Test (EUT) is a Raymarine multifunction display which support WiFi function operated at 2.4GHz |

4 Summary of Test Standards

| Test Standards | |
|--|--|
| FCC Part 15 Subpart C 10-1-2018 Edition | PART 15 - RADIO FREQUENCY DEVICES Subpart C - Intentional Radiators |

All the test methods were according to KDB558074 D01 v05r02 DTS Measurement Guidance and ANSI C63.10 (2013).

5 Summary of Test Results

| Technical Requirements | | | | | | |
|------------------------|---|------------|-------------|-------------------------------------|--------------------------|-------------------------------------|
| FCC Part 15 Subpart C | | | | | | |
| Test Condition | Pages | Test Site | Test Result | | | |
| | | | Pass | Fail | N/A | |
| §15.207 | Conducted emission AC power port | --- | --- | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247 (b) (1) | Conducted peak output power | 10 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.247(a)(1) | 20dB bandwidth | --- | --- | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1) | Carrier frequency separation | --- | --- | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii) | Number of hopping frequencies | --- | --- | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii) | Dwell Time | --- | --- | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(2) | 6dB bandwidth and 99% Occupied Bandwidth | 11 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.247(e) | Power spectral density | 18 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.247(d) | Spurious RF conducted emissions | 19 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.247(d) | Band edge | 31 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.247(d) & §15.209 | Spurious radiated emissions for transmitter | 34 | Site 1 | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| §15.203 | Antenna requirement | See note 2 | | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

Note 1: N/A=Not Applicable.

Note 2: The EUT uses an internal antenna, which gain is 2dBi. In accordance to §15.203 and RSS-Gen 6.8, It is considered sufficiently to comply with the provisions of this section.

6 General Remarks

Remarks

This submittal(s) (test report) is intended for FCC ID: PJ5-ELEMSDISP, complies with Section 15.209, 15.247 of the FCC Part 15, Subpart C rules.

< E70531, E70533, E70535> are Raymarine multifunction display which support Wi-Fi function with b, g, n-HT20 mode. The TX and RX range is 2412MHz-2462MHz.

SUMMARY:

All tests according to the regulations cited on page 5 were

- Performed

- **Not** Performed

The Equipment Under Test

- **Fulfills** the general approval requirements.

- **Does not** fulfill the general approval requirements.

Sample Received Date: May 23, 2019

Testing Start Date: May 24, 2019

Testing End Date: June 12, 2019

TÜV SÜD Certification and Testing (China) Co., Ltd. Shenzhen Branch

Reviewed by:



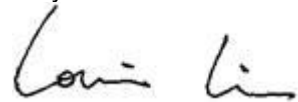
John Zhi
Section Manager

Prepared by:



Moon Xiong
Project Engineer

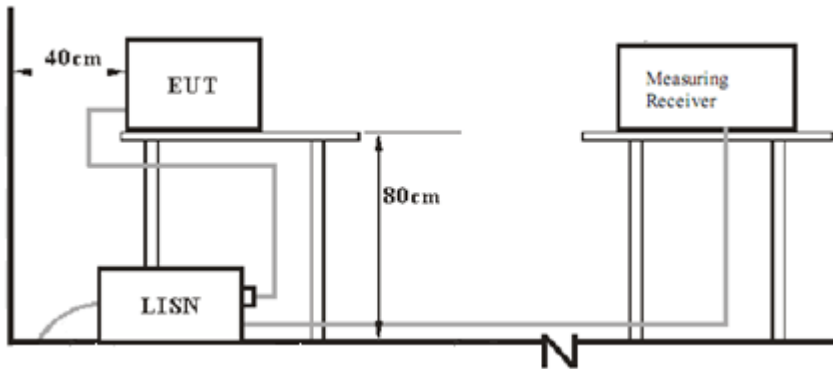
Tested by:



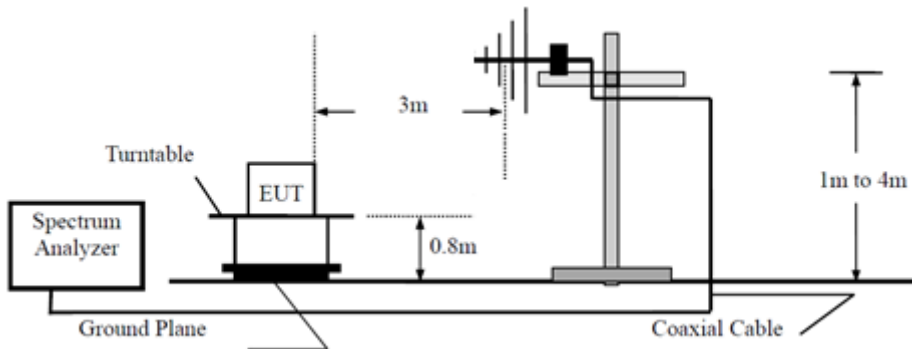
Louise Liu
Test Engineer

7 Test Setups

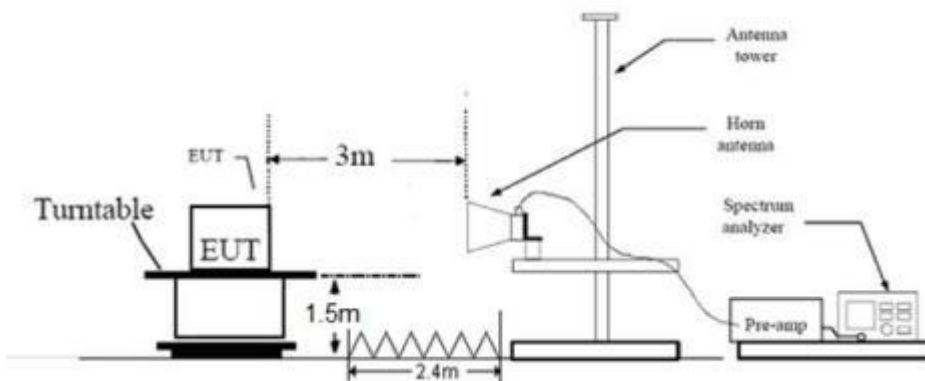
7.1 AC Power Line Conducted Emission test setups



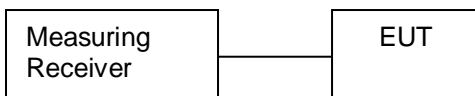
7.2 Radiated test setups Below 1GHz



Above 1GHz



7.3 Conducted RF test setups



8 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH) |
|-------------|--------------|-------------------|-------------|
| -- | -- | -- | -- |

The system was configured to non-hopping mode.

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

Through pre-scan all kind of modulation and all kind of rates, find the 1Mbps of rate is the worst case of 802.11b; the 6Mbps of rate is the worst case of 802.11g; the 6.5Mbps of rate is the worst case of 802.11N20, only the worst case transmitter rate data mode in recorded in the report.

9 Technical Requirement

9.1 Conducted peak output power

Test Method

1. Use the following spectrum analyzer settings:
 Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel
 RBW > the 20 dB bandwidth of the emission being measured, VBW ≥ RBW,
 Sweep = auto, Detector function = peak, Trace = max hold
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power

Limits

According to §15.247 (b) (1), conducted peak output power limit as below:

| Frequency Range MHz | Limit W | Limit dBm |
|------------------------|------------|--------------|
| 2400-2483.5 | ≤1 | ≤30 |

Test result as below table

802.11b modulation Test Result

| Frequency (MHz) | Conducted Peak Output Power (dBm) | Limit (dBm) | Result |
|------------------------|-----------------------------------|-------------|--------|
| Low channel 2412MHz | 14.4 | 30 | Pass |
| Middle channel 2437MHz | 12.4 | 30 | Pass |
| High channel 2462MHz | 11.2 | 30 | Pass |

802.11g modulation Test Result

| Frequency (MHz) | Conducted Peak Output Power (dBm) | Limit (dBm) | Result |
|------------------------|-----------------------------------|-------------|--------|
| Low channel 2412MHz | 12.0 | 30 | Pass |
| Middle channel 2437MHz | 10.4 | 30 | Pass |
| High channel 2462MHz | 9.4 | 30 | Pass |

802.11n20 modulation Test Result

| Frequency (MHz) | Conducted Peak Output Power (dBm) | Limit (dBm) | Result |
|------------------------|-----------------------------------|-------------|--------|
| Low channel 2412MHz | 11.9 | 30 | Pass |
| Middle channel 2437MHz | 10.4 | 30 | Pass |
| High channel 2462MHz | 9.5 | 30 | Pass |

9.2 6dB bandwidth

Test Method for 6 dB Bandwidth

1. Use the following spectrum analyzer settings:
RBW=100K, VBW \geq 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Use the automatic bandwidth measurement capability of an instrument, may be employed using the X dB bandwidth mode with X set to 6 dB, care shall be taken so that the bandwidth measurement is not influenced by any intermediate power nulls in the fundamental emission that might be \geq 6 dB.
3. Allow the trace to stabilize, record the X dB Bandwidth value.

802.11b modulation Test Result

| Frequency (MHz) | 6dB bandwidth (MHz) | Limit (MHz) | Result |
|------------------------|---------------------|-------------|--------|
| Low channel 2412MHz | 7.160 | / | Pass |
| Middle channel 2437MHz | 7.160 | / | Pass |
| High channel 2462MHz | 7.160 | / | Pass |

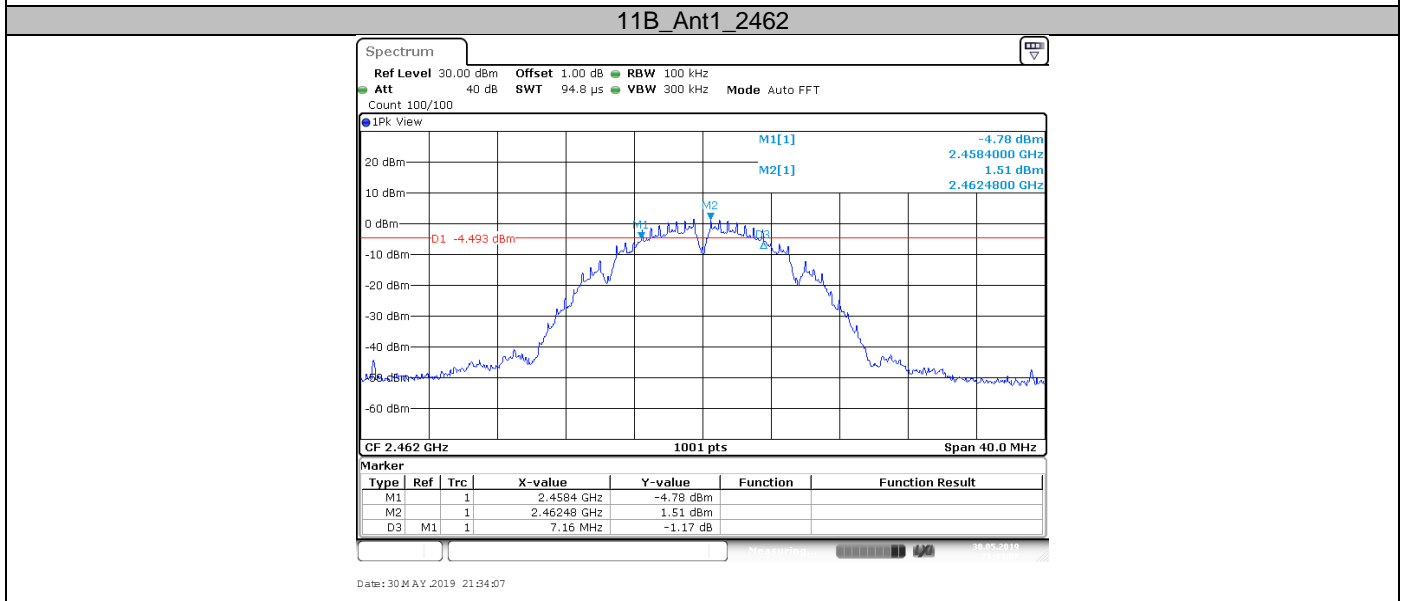
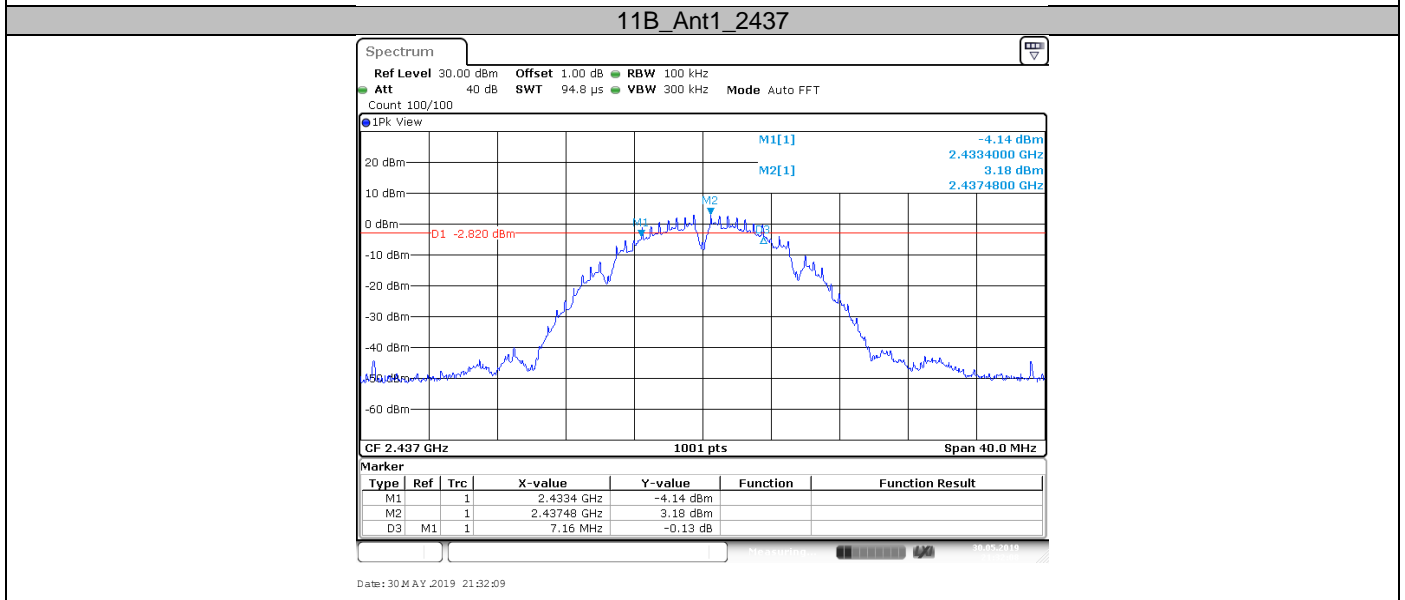
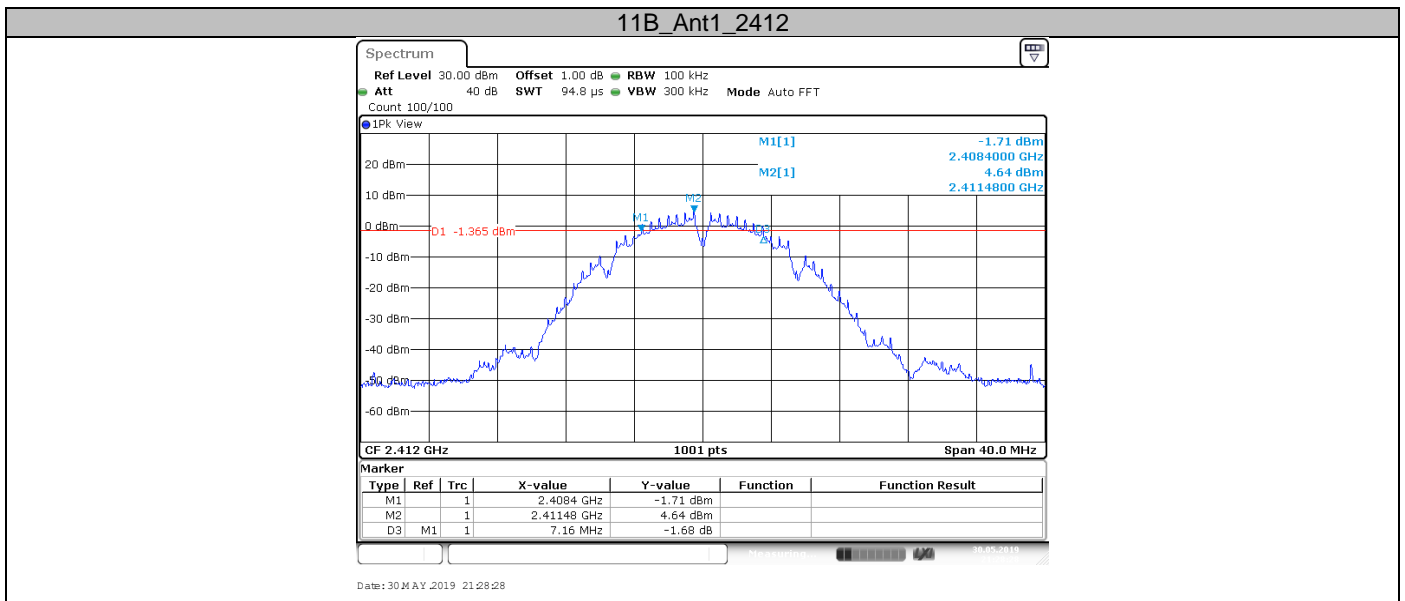
802.11g modulation Test Result

| Frequency (MHz) | 6dB bandwidth (MHz) | Limit (MHz) | Result |
|------------------------|---------------------|-------------|--------|
| Low channel 2412MHz | 16.400 | / | Pass |
| Middle channel 2437MHz | 16.400 | / | Pass |
| High channel 2462MHz | 16.440 | / | Pass |

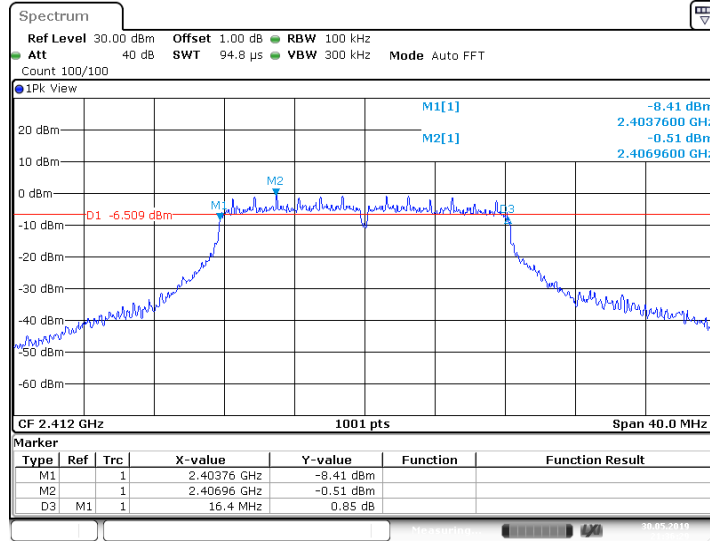
802.11n-HT20 modulation Test Result

| Frequency (MHz) | 6dB bandwidth (MHz) | Limit (MHz) | Result |
|------------------------|---------------------|-------------|--------|
| Low channel 2412MHz | 17.000 | / | Pass |
| Middle channel 2437MHz | 17.640 | / | Pass |
| High channel 2462MHz | 17.680 | / | Pass |

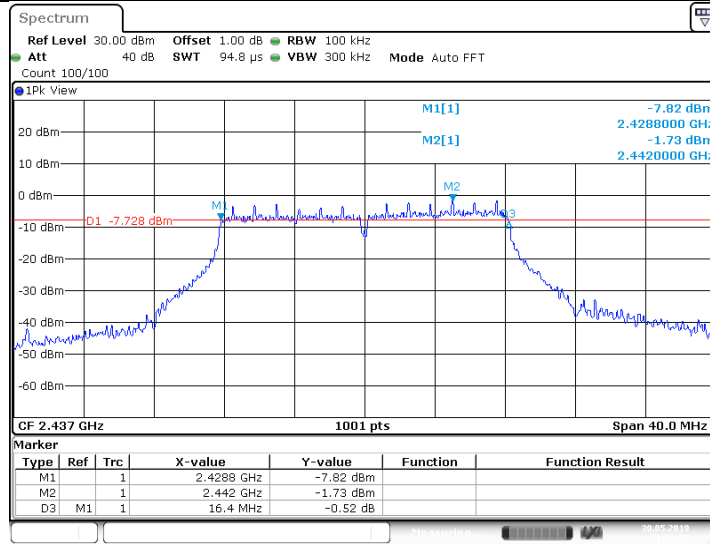
6 dB Bandwidth



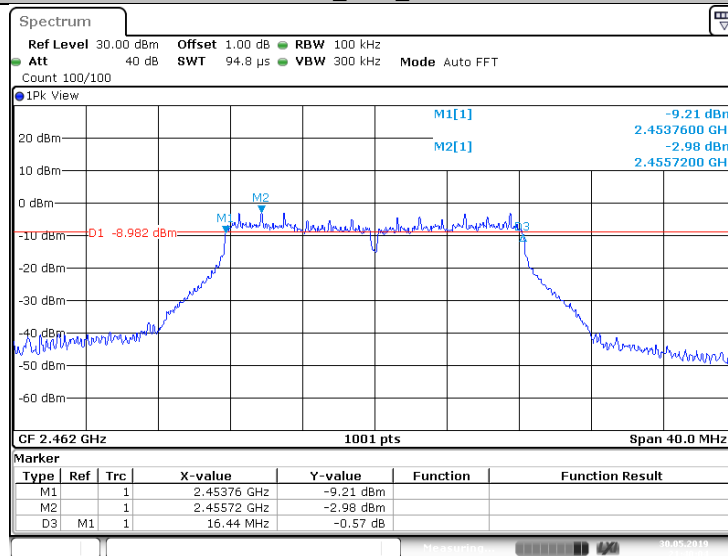
11G_Ant1_2412



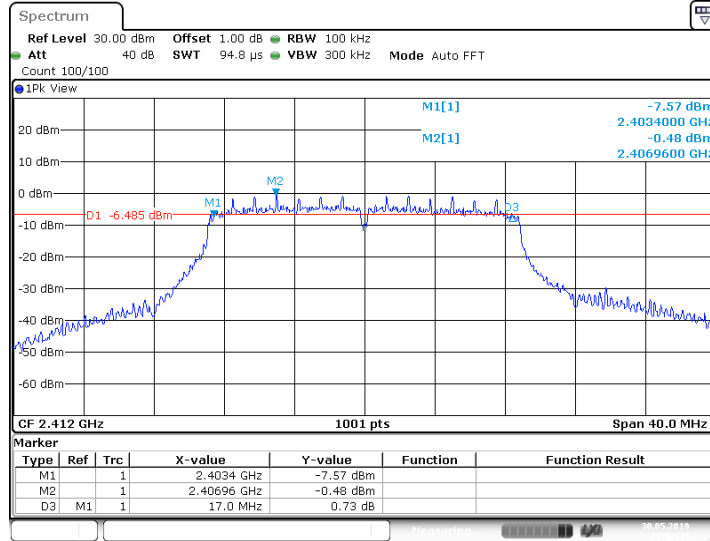
11G_Ant1_2437



11G_Ant1_2462

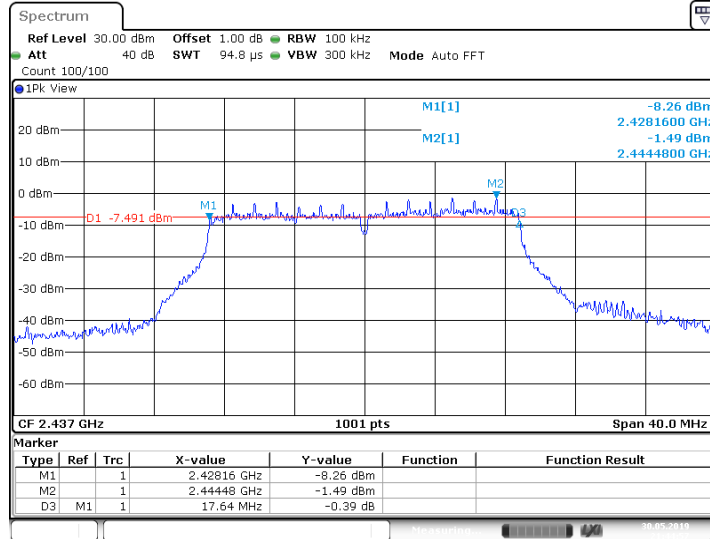


11N20SISO_Ant1_2412



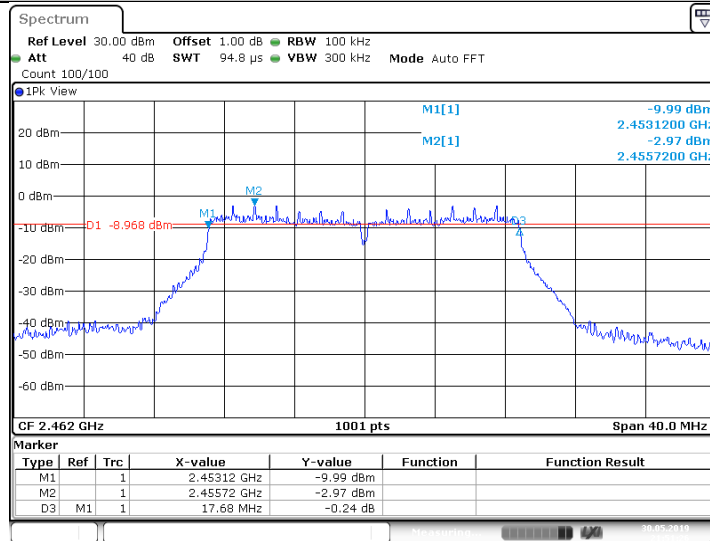
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11N20SISO_Ant1_2437



Date: 30 MAY 2019 21:44:58

11N20SISO_Ant1_2462



Date: 30 MAY 2019 21:51:26

9.3 Power spectral density

Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW \geq 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
2. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
3. Repeat above procedures until other frequencies measured were completed.

Limit

Limit (dBm/3KHz)

≤ 8

802.11b modulation Test Result

| Frequency (MHz) | Power spectral density (dBm/3KHz) | Limit (dBm/3KHz) | Result |
|------------------------|-----------------------------------|------------------|--------|
| Low channel 2412MHz | -9.76 | 8 | Pass |
| Middle channel 2437MHz | -12.12 | 8 | Pass |
| High channel 2462MHz | -12.44 | 8 | Pass |

802.11g modulation Test Result

| Frequency (MHz) | Power spectral density (dBm/3KHz) | Limit (dBm) | Result |
|------------------------|-----------------------------------|-------------|--------|
| Low channel 2412MHz | -14.53 | 8 | Pass |
| Middle channel 2437MHz | -15.11 | 8 | Pass |
| High channel 2462MHz | -17.05 | 8 | Pass |

802.11n-HT20 modulation Test Result

| Frequency (MHz) | Power spectral density (dBm/3KHz) | Limit (dBm/3KHz) | Result |
|------------------------|-----------------------------------|------------------|--------|
| Low channel 2412MHz | -14.15 | 8 | Pass |
| Middle channel 2437MHz | -15.24 | 8 | Pass |
| High channel 2462MHz | -16.05 | 8 | Pass |

9.4 Spurious RF conducted emissions

Test Method

1. Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz, VBW ≥ RBW, Sweep = auto, Detector function = peak, Trace = max hold
2. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
3. The level displayed must comply with the limit specified in this Section. Submit these plots.
4. Repeat above procedures until all frequencies measured were complete.

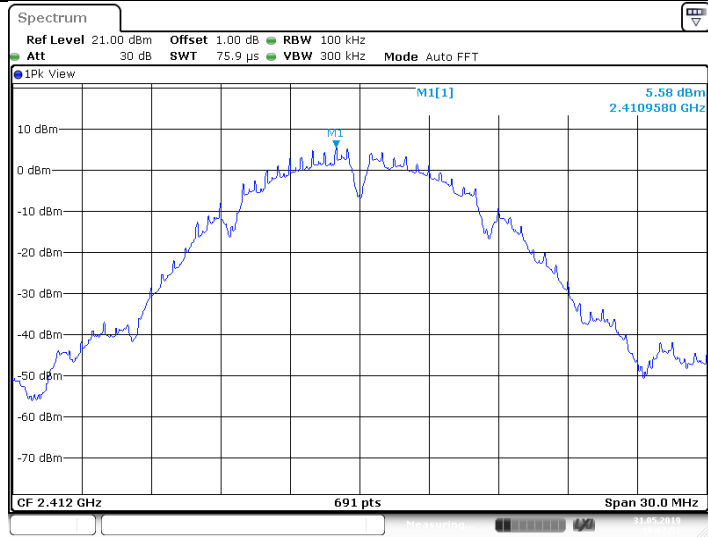
Limit

| Frequency Range MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000 | -20 |

Spurious RF conducted emissions

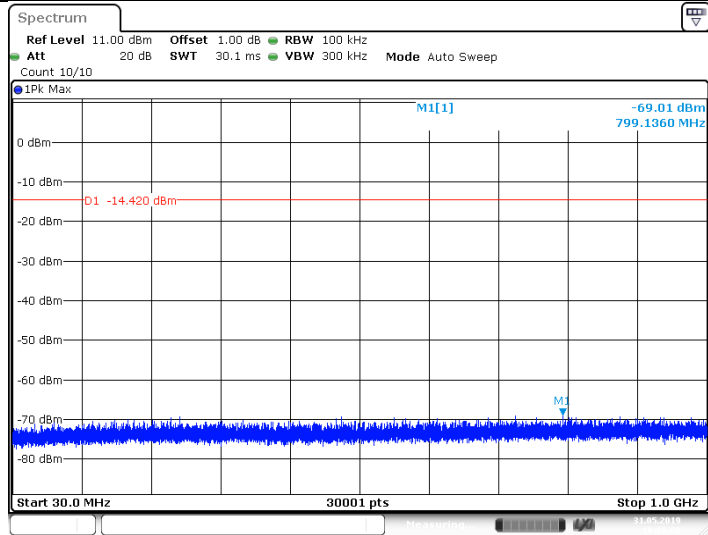
| TestMode | Antenna | Channel | FreqRange | RefLevel | Result | Limit | Verdict |
|-----------|---------|---------|------------|------------|--------|----------|---------|
| 11B | Ant1 | 2412 | Reference | 5.58 | 5.58 | --- | PASS |
| | | 2412 | 30~1000 | 30~1000 | -69.01 | <=-14.42 | PASS |
| | | 2412 | 1000~26500 | 1000~26500 | -50.14 | <=-14.42 | PASS |
| | | 2437 | Reference | 3.76 | 3.76 | --- | PASS |
| | | 2437 | 30~1000 | 30~1000 | -68.87 | <=-16.24 | PASS |
| | | 2437 | 1000~26500 | 1000~26500 | -53.1 | <=-16.24 | PASS |
| | | 2462 | Reference | 3.36 | 3.36 | --- | PASS |
| | | 2462 | 30~1000 | 30~1000 | -68.3 | <=-16.64 | PASS |
| 11G | Ant1 | 2462 | 1000~26500 | 1000~26500 | -47.31 | <=-16.64 | PASS |
| | | 2412 | Reference | -0.49 | -0.49 | --- | PASS |
| | | 2412 | 30~1000 | 30~1000 | -68.83 | <=-20.49 | PASS |
| | | 2412 | 1000~26500 | 1000~26500 | -52.97 | <=-20.49 | PASS |
| | | 2437 | Reference | -2.86 | -2.86 | --- | PASS |
| | | 2437 | 30~1000 | 30~1000 | -68.25 | <=-22.86 | PASS |
| | | 2437 | 1000~26500 | 1000~26500 | -53.14 | <=-22.86 | PASS |
| | | 2462 | Reference | -2.40 | -2.40 | --- | PASS |
| 11N20SISO | Ant1 | 2462 | 30~1000 | 30~1000 | -68.92 | <=-22.4 | PASS |
| | | 2462 | 1000~26500 | 1000~26500 | -52.78 | <=-22.4 | PASS |
| | | 2412 | Reference | -0.41 | -0.41 | --- | PASS |
| | | 2412 | 30~1000 | 30~1000 | -68.7 | <=-20.41 | PASS |
| | | 2412 | 1000~26500 | 1000~26500 | -52.76 | <=-20.41 | PASS |
| | | 2437 | Reference | -0.45 | -0.45 | --- | PASS |
| | | 2437 | 30~1000 | 30~1000 | -68.75 | <=-20.45 | PASS |
| | | 2437 | 1000~26500 | 1000~26500 | -52.53 | <=-20.45 | PASS |
| | | 2462 | Reference | -4.02 | -4.02 | --- | PASS |
| | | 2462 | 30~1000 | 30~1000 | -69.08 | <=-24.02 | PASS |
| | | 2462 | 1000~26500 | 1000~26500 | -52.82 | <=-24.02 | PASS |
| | | | | | | | |

11B_Ant1_2412_0~Reference



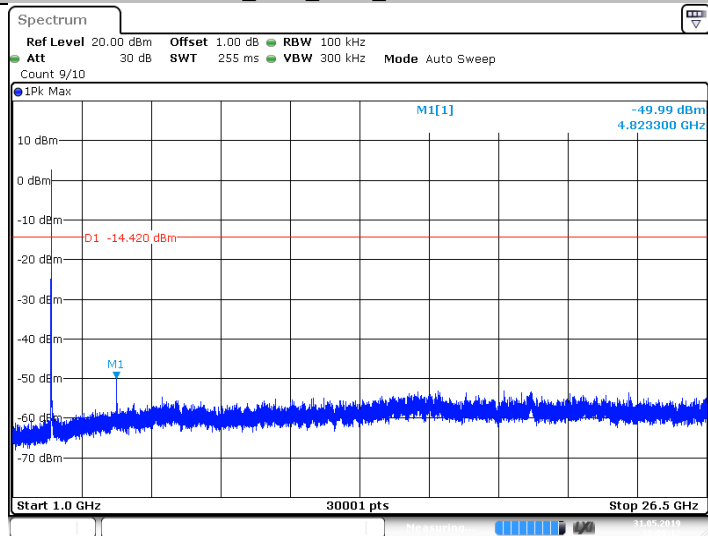
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11B_Ant1_2412_30~1000

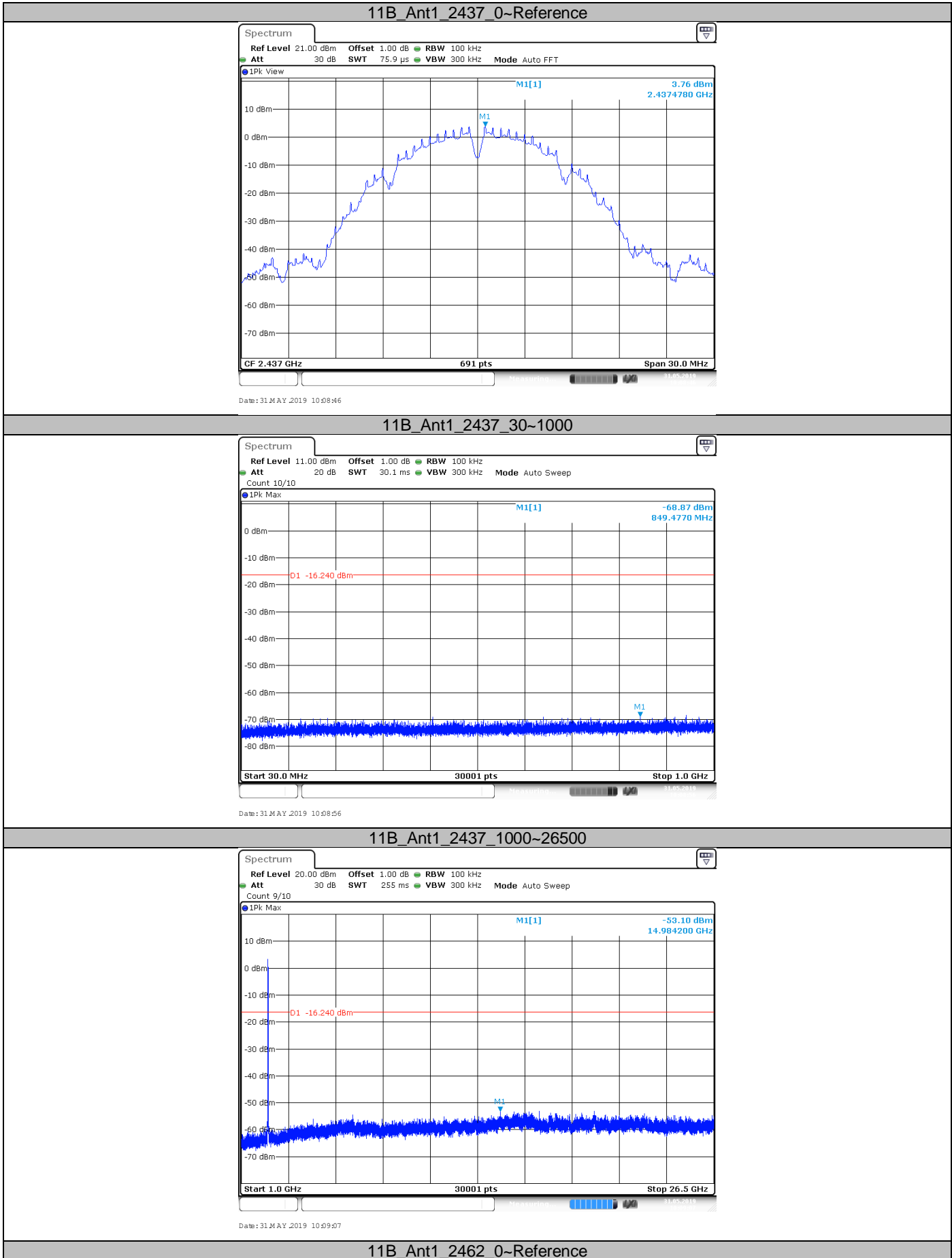


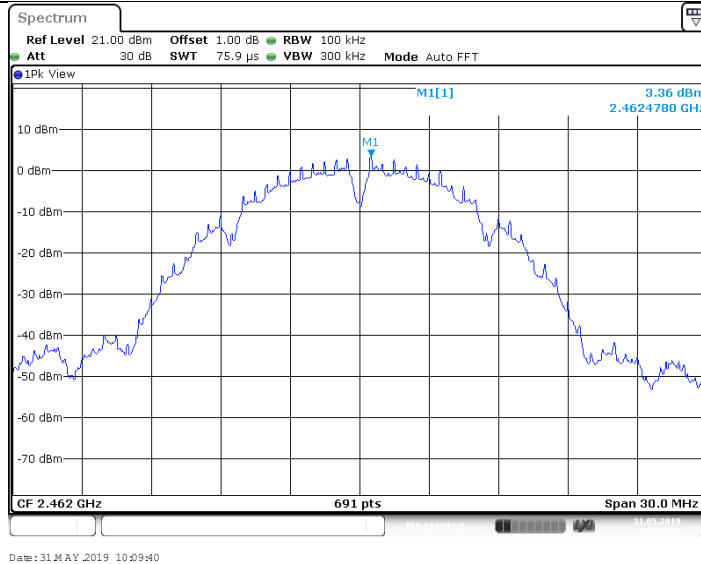
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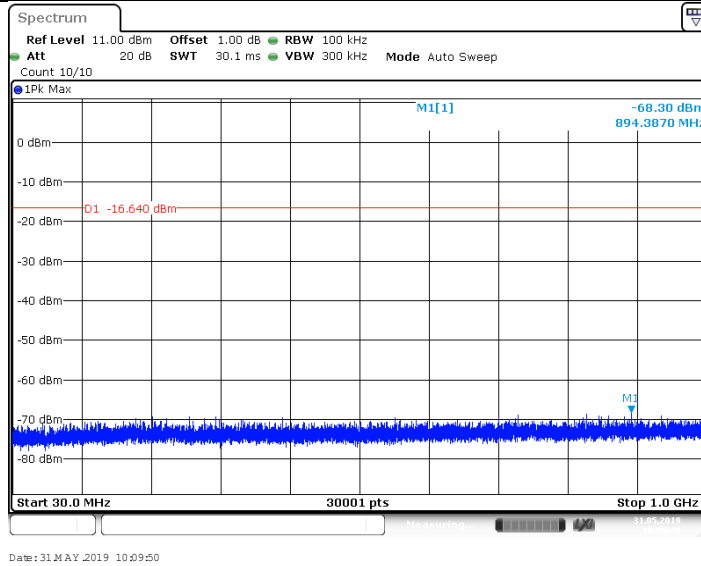


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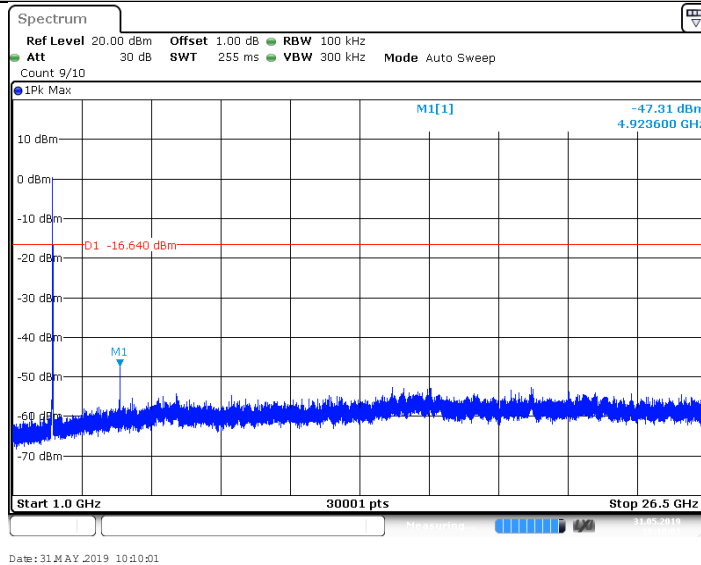




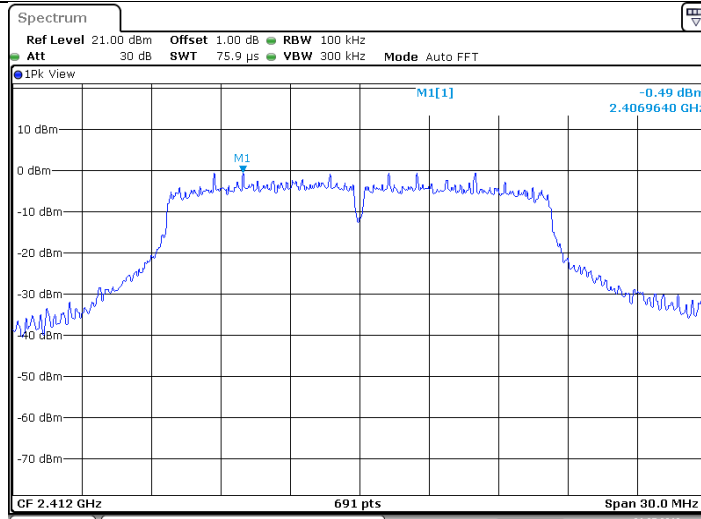
11B_Ant1_2462_30~1000



11B_Ant1_2462_1000~26500

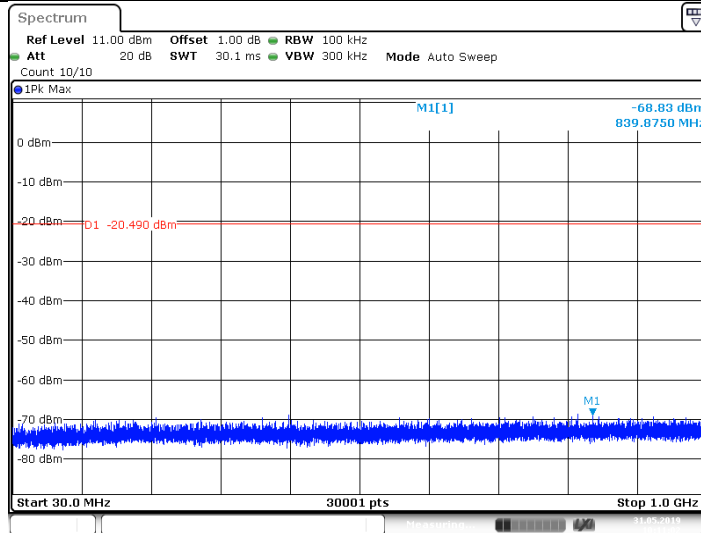


11G_Ant1_2412_0~Reference



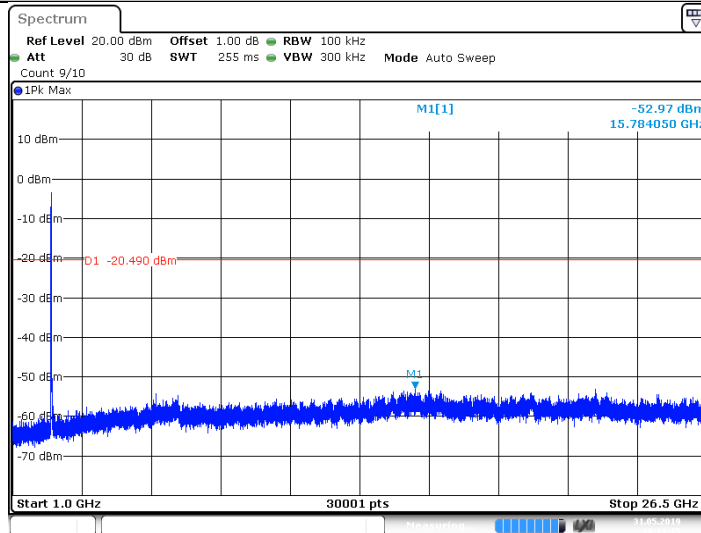
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11G_Ant1_2412_30~1000



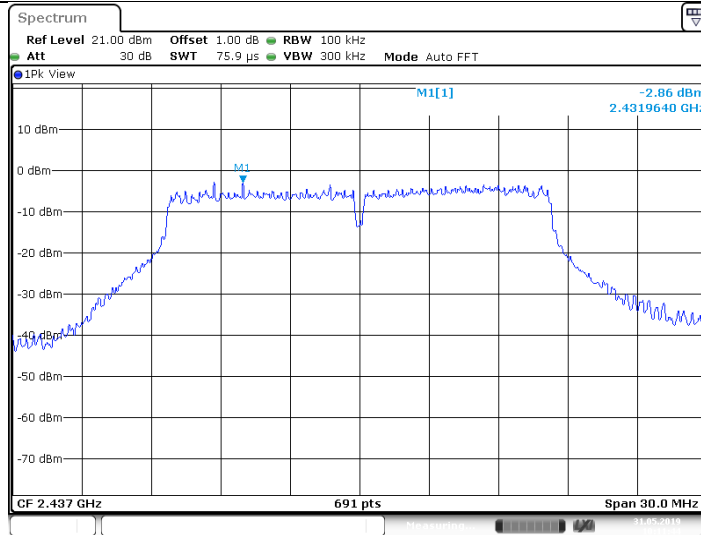
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11G_Ant1_2412_1000~26500



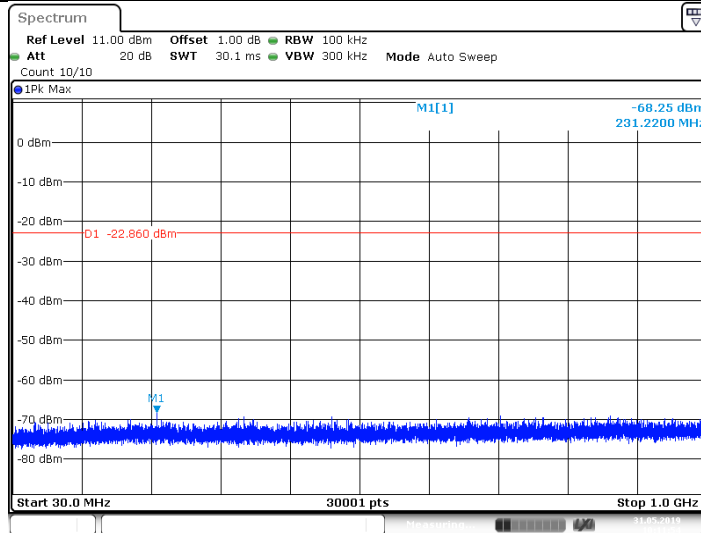
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11G_Ant1_2437_0~Reference



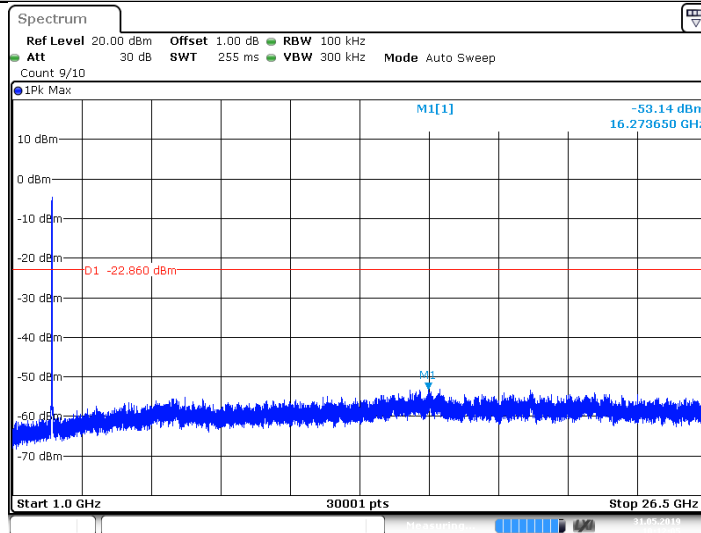
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11G_Ant1_2437_30~1000



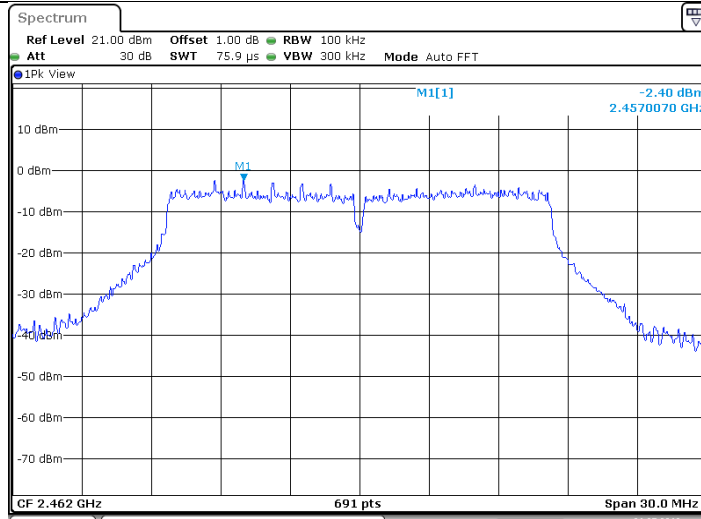
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11G_Ant1_2437_1000~26500



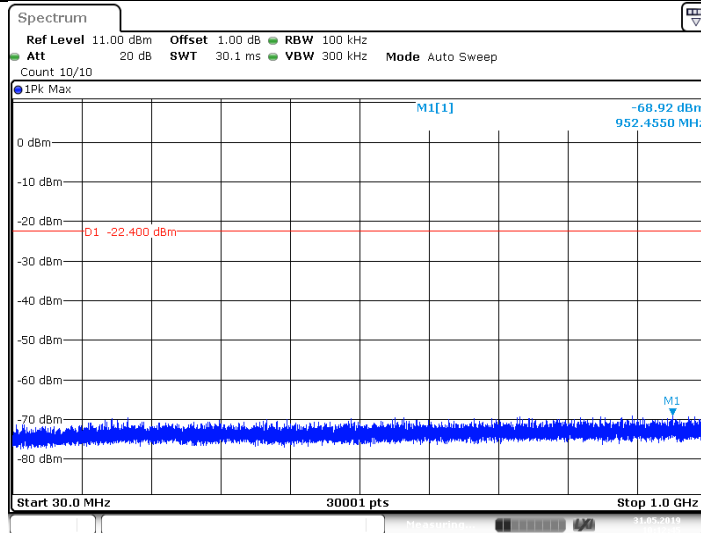
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11G_Ant1_2462_0~Reference



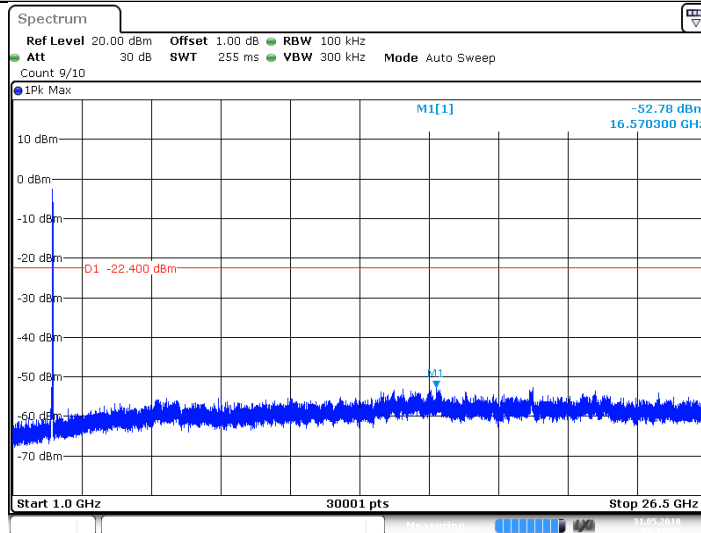
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11G_Ant1_2462_30~1000



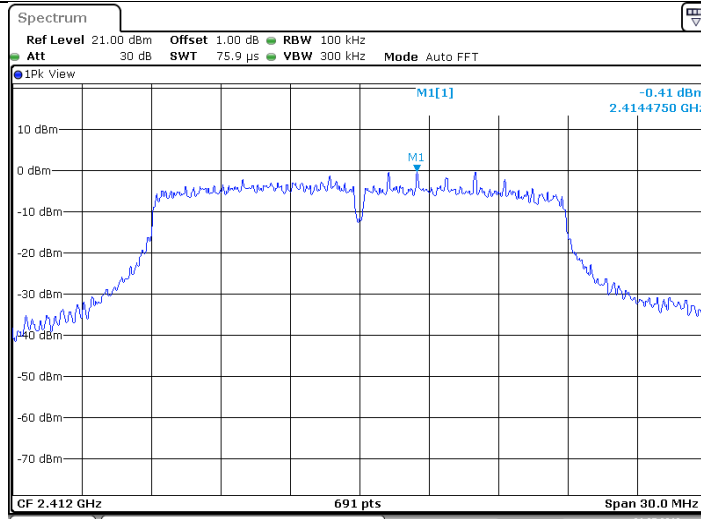
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11G_Ant1_2462_1000~26500

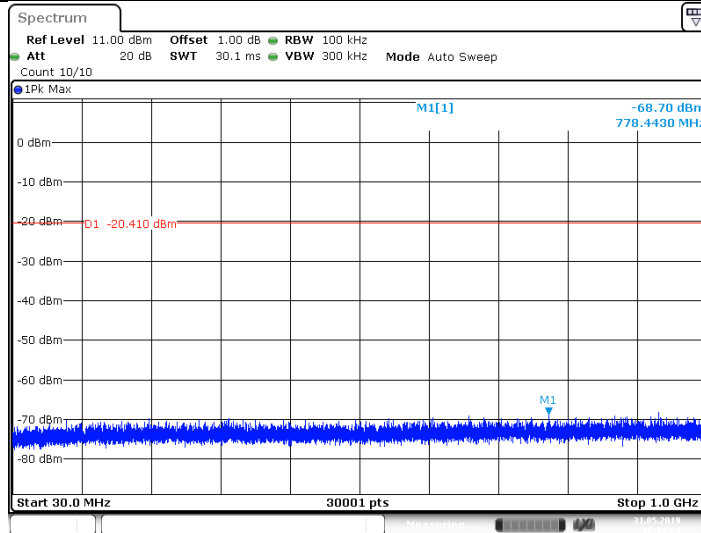


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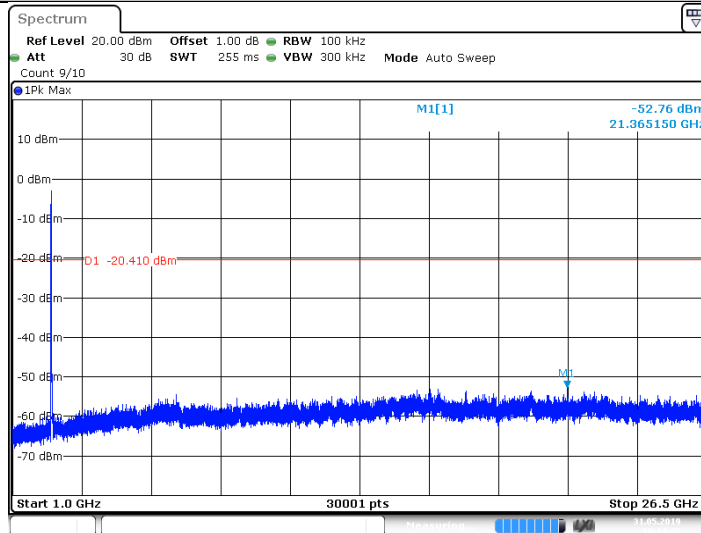
11N20SISO_Ant1_2412_0~Reference



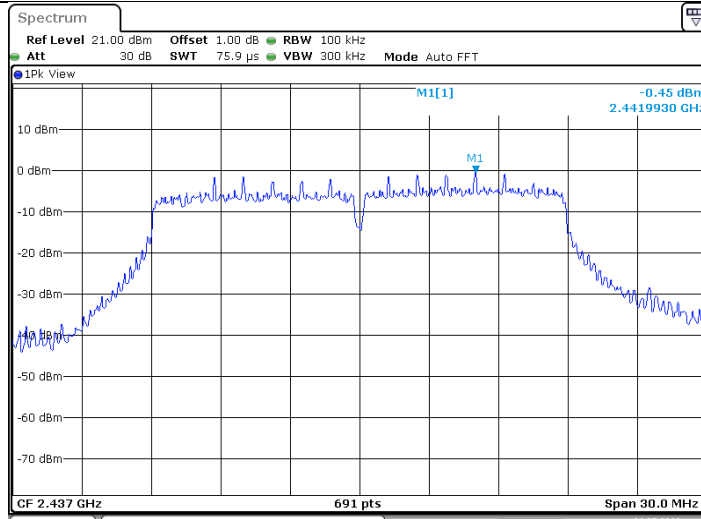
11N20SISO_Ant1_2412_30~1000



11N20SISO_Ant1_2412_1000~26500

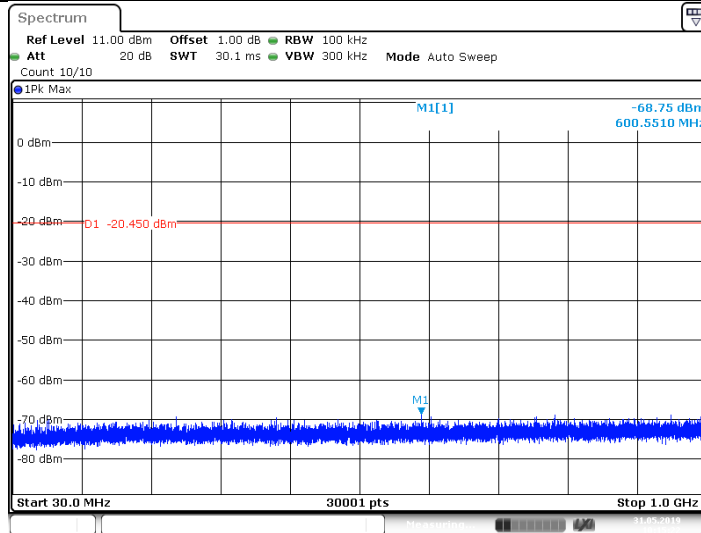


11N20SISO_Ant1_2437_0~Reference



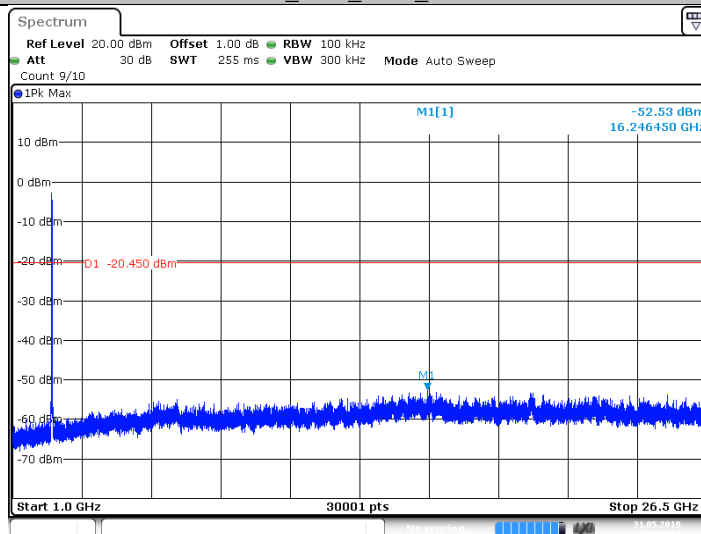
Date: 31 MAY 2019 10:15:13

11N20SISO_Ant1_2437_30~1000



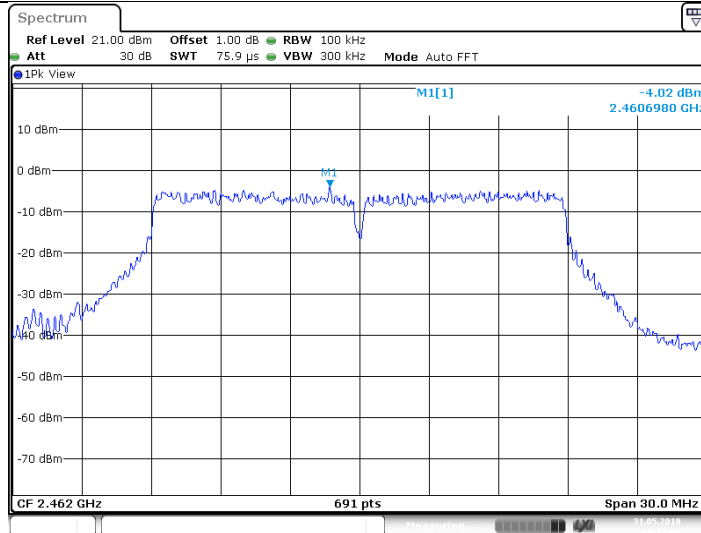
Date: 31 MAY 2019 10:15:23

11N20SISO_Ant1_2437_1000~26500

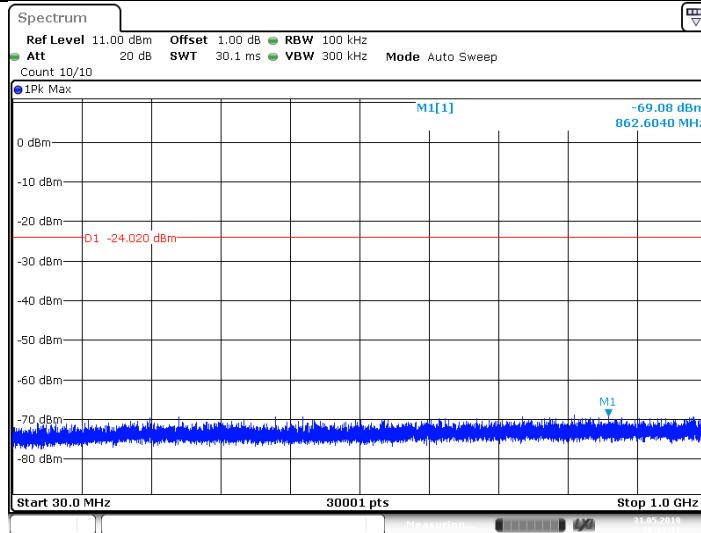


Date: 31 MAY 2019 10:15:34

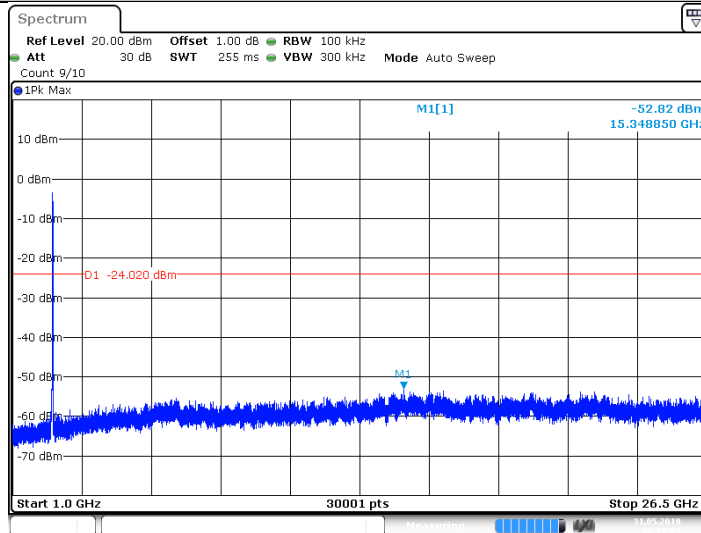
11N20SISO_Ant1_2462_0~Reference



11N20SISO_Ant1_2462_30~1000



11N20SISO_Ant1_2462_1000~26500



Remark: Test of above 1GHz were performed with 1MHz RBW, we can't find any burst, so they are considered to fulfill the requirement with 100KHz RBW without further testing.

9.5 Band edge testing

Test Method

- 1 Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 kHz, VBW \geq RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 2 Allow the trace to stabilize, use the peak and delta measurement to record the result.
- 3 The level displayed must comply with the limit specified in this Section. .
- 4 Repeat the test at the hopping off and hopping on mode, submit all the plots.

Limit:

According to §15.247(d), in any 100 kHz bandwidth outside the frequency bands 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, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. In addition, 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) (see Section 15.205(c)).

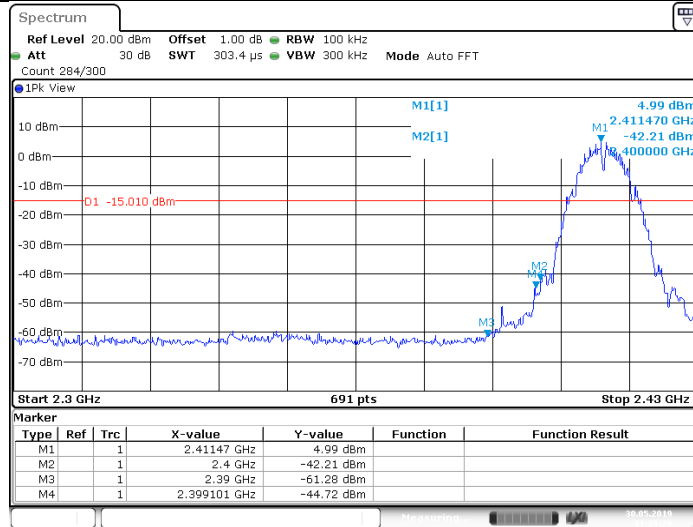
| Frequency Range MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000 | -20 |

Test result:

| TestMode | Antenna | ChName | Channel | RefLevel | Result | Limit | Verdict |
|-----------|---------|--------|---------|----------|--------|---------------|---------|
| 11B | Ant1 | Low | 2412 | 4.99 | -44.72 | ≤ -15.01 | PASS |
| | | High | 2462 | 0.22 | -58.34 | ≤ -19.78 | PASS |
| 11G | Ant1 | Low | 2412 | -1.86 | -32.78 | ≤ -21.86 | PASS |
| | | High | 2462 | -2.97 | -52.2 | ≤ -22.97 | PASS |
| 11N20SISO | Ant1 | Low | 2412 | -1.34 | -35.25 | ≤ -21.34 | PASS |
| | | High | 2462 | -4.34 | -47.97 | ≤ -24.34 | PASS |

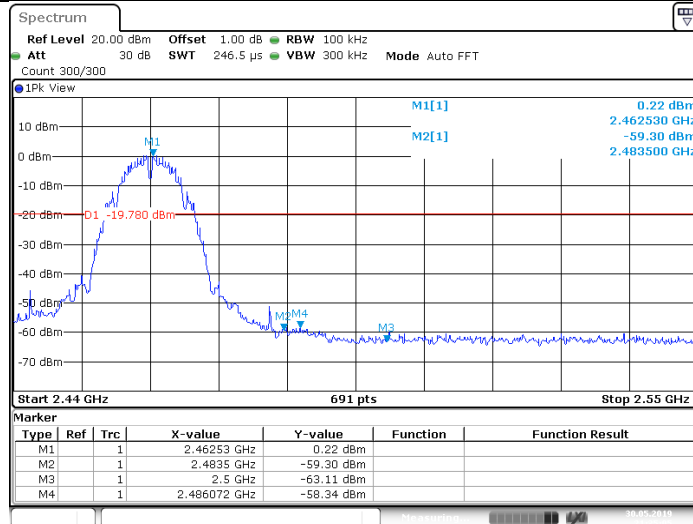
Band edge testing

11B_Ant1_Low_2412



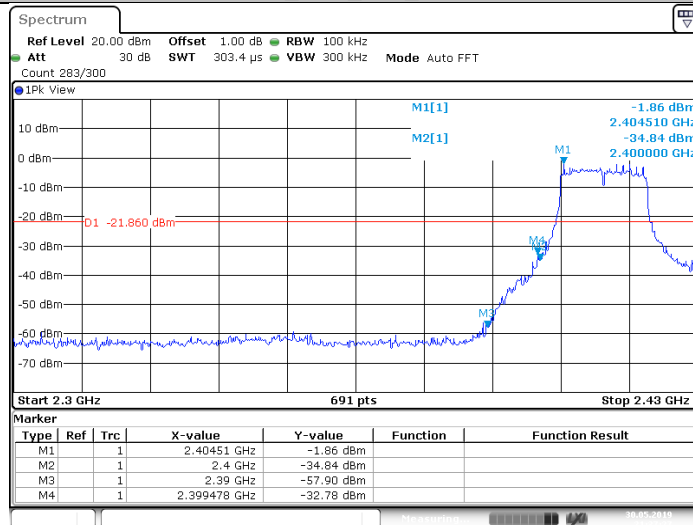
Date: 30 MAY 2019 21:29:26

11B_Ant1_High_2462



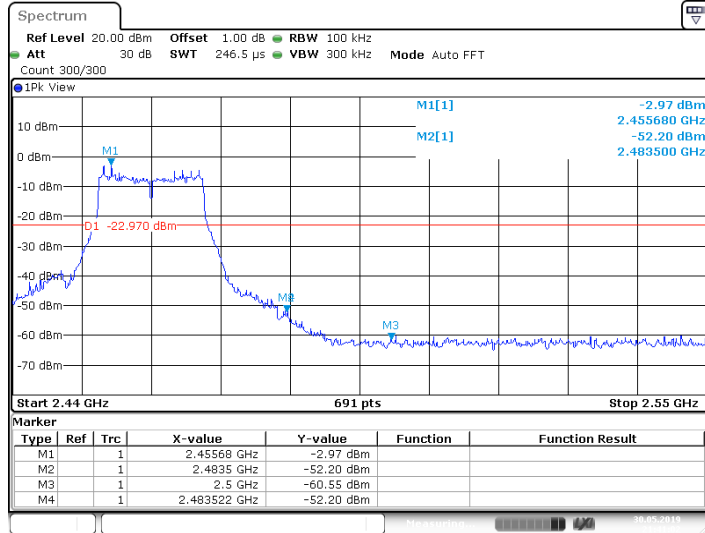
Date: 30 MAY 2019 21:35:05

11G_Ant1_Low_2412

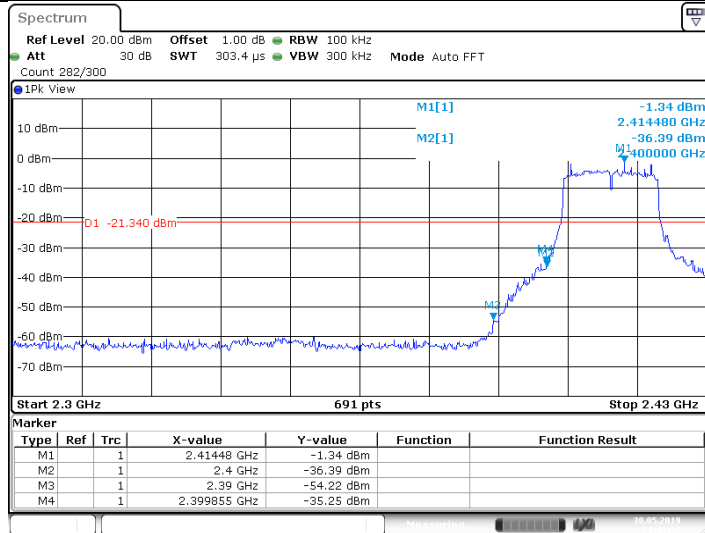


Date: 30 MAY 2019 21:37:27

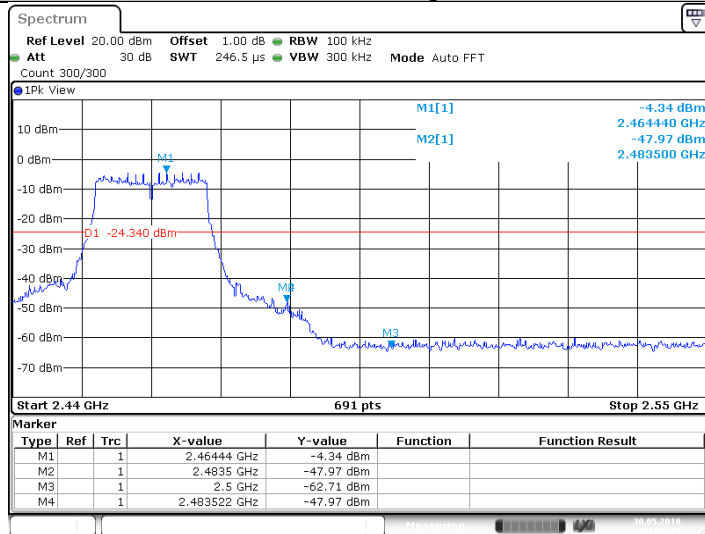
11G_Ant1_High_2462



11N20SISO_Ant1_Low_2412



11N20SISO_Ant1_High_2462



9.6 Spurious radiated emissions for transmitter

Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna 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 set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned
5. Use the following spectrum analyzer settings According to C63.10:
For Above 1GHz
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 1MHz, VBW \geq RBW for peak measurement and VBW = 10Hz for average measurement, Sweep = auto, Detector function = peak, Trace = max hold.
For Below 1GHz
Use the following spectrum analyzer settings:
Span = wide enough to capture the peak level of the in-band emission and all spurious
RBW = 100 KHz, VBW \geq RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.

Note:

1. The resolution bandwidth and video bandwidth of test receiver/spectrum analyzer is 120 KHz for Quasi-peak detection (QP) at frequency below 1GHz.
2. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for peak detection (PK) at frequency above 1GHz.
3. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 3MHz for RMS Average ((duty cycle < 98%) for Average detection (AV) at frequency above 1GHz, then the measurement results was added to a correction factor (20log(1/duty cycle)).
4. The resolution bandwidth of test receiver/spectrum analyzer is 1MHz and the video bandwidth is 10Hz (duty cycle > 98%) for Average detection (AV) at frequency above 1GHz.

Limit

The radio emission outside the operating frequency band 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. Radiated emissions which fall in the restricted bands, as defined in section 15.205, must comply with the radiated emission limits specified in section 15.209.

| Frequency MHz | Field Strength uV/m | Field Strength dB μ V/m | Detector |
|------------------|------------------------|--------------------------------|----------|
| 30-88 | 100 | 40 | QP |
| 88-216 | 150 | 43.5 | QP |
| 216-960 | 200 | 46 | QP |
| 960-1000 | 500 | 54 | QP |
| Above 1000 | 500 | 54 | AV |
| Above 1000 | 5000 | 74 | PK |

Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

The only worst case (802.11B mode) test result is listed in the report.

Transmitting spurious emission test result as below:

802.11B Modulation 2412MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Result |
|----------------|--------------|----------------|--------------|--------|----------|--------|--------|
| | MHz | dBuV/m | | dBuV/m | | dBuV/m | |
| 30-1000MHz | 143.759444 | 38.84 | H | 43.5 | QP | 4.66 | Pass |
| | 287.481111 | 38.53 | H | 46.0 | QP | 7.47 | Pass |
| | 61.578889 | 27.42 | H | 40.0 | QP | 12.58 | Pass |
| | 64.542778 | 31.88 | V | 40 | QP | 8.12 | Pass |
| | 215.647222 | 36.46 | V | 43.5 | QP | 7.04 | Pass |
| | 287.427222 | 31.83 | V | 46.0 | QP | 14.17 | Pass |
| 1000-25000MHz | 12855.468750 | 44.86 | H | 74 | PK | 29.14 | Pass |
| | 15374.531250 | 47.51 | V | 74 | PK | 26.49 | Pass |

802.11B Modulation 2437MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Result |
|----------------|--------------|----------------|--------------|--------|----------|--------|--------|
| | MHz | dBuV/m | | dBuV/m | | dBuV/m | |
| 1000-25000MHz | 15262.031250 | 47.77 | H | 74 | PK | 26.23 | Pass |
| | 9747.656250 | 44.71 | V | 74 | PK | 29.29 | Pass |

802.11B Modulation 2462MHz Test Result

| Frequency Band | Frequency | Emission Level | Polarization | Limit | Detector | Margin | Result |
|----------------|--------------|----------------|--------------|--------|----------|--------|--------|
| | MHz | dBuV/m | | dBuV/m | | dBuV/m | |
| 1000-25000MHz | 17094.375000 | 49.32 | H | 74 | PK | 24.68 | Pass |
| | 15334.218750 | 47.81 | V | 74 | PK | 26.19 | Pass |

Remark:

- (1) Data of measurement within this frequency range shown "-" in the table above means the reading of emissions are attenuated more than 20db below the permissible limits or the field strength is too small to be measured.
- (2) "*" means the emission(s) appear within the restrict bands shall follow the requirement of section 15.205.
- (3) Above 1GHz: Level=Reading Level + Correction Factor; Correction Factor=Antenna Factor + Cable Loss - Pre-amplifier
- (4) Below 1GHz: Level=Reading Level + Correction Factor; Correction Factor=Antenna Factor + Cable Loss

(The Reading Level is recorded by software which is not shown in the sheet)

10 Test Equipment List

Radiated Emission Test

| Description | Manufacturer | Model no. | Serial no. | cal. due date |
|-------------------------------------|-----------------|-----------|-----------------|---------------|
| EMI Test Receiver | Rohde & Schwarz | ESR 26 | 101269 | 2019-7-6 |
| Trilog Super Broadband Test Antenna | Schwarzbeck | VULB 9163 | 707 | 2019-6-28 |
| Horn Antenna | Rohde & Schwarz | HF907 | 102294 | 2019-6-28 |
| Pre-amplifier | Rohde & Schwarz | SCU 18 | 102230 | 2019-7-6 |
| Signal Generator | Rohde & Schwarz | SMY01 | 839369/005 | 2019-7-6 |
| Attenuator | Agilent | 8491A | MY39264334 | 2019-7-6 |
| 3m Semi-anechoic chamber | TDK | 9X6X6 | ---- | 2020-7-7 |
| Test software | Rohde & Schwarz | EMC32 | Version 9.15.00 | N/A |

TS8997 Test System

| DESCRIPTION | MANUFACTURER | MODEL NO. | SERIAL NO. | CAL. DUE DATE |
|------------------|-----------------|--------------------|------------------|---------------|
| Signal Analyzer | Rohde & Schwarz | FSV40 | 101030 | 2019-7-6 |
| RF Switch Module | Rohde & Schwarz | OSP120/OSP-B157 | 101226/100851 | 2019-7-6 |
| 10dB Attenuator | Weinschel | 4M-10 | 43152 | 2019-7-6 |
| Test software | Rohde & Schwarz | EMC32 | Version 10.38.00 | N/A |
| Test software | Tonscend | System for BT/WIFI | Version 2.6 | N/A |

11 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

System Measurement Uncertainty

| System Measurement Uncertainty | |
|---|--|
| Test Items | Extended Uncertainty |
| Uncertainty for Radiated Spurious Emission 25MHz-3000MHz | Horizontal: 4.91dB; Vertical: 4.89dB; |
| Uncertainty for Radiated Spurious Emission 3000MHz-18000MHz | Horizontal: 4.80dB; Vertical: 4.79dB; |
| Uncertainty for Conducted RF test with TS 8997 | RF Power Conducted: 1.16dB Frequency test involved: 0.6x10 ⁻⁷ or 1% |