

# Test report

356174-TRFWLR1

Date of issue: September 11, 2018

Applicant:  
KIC

Product:  
Temp Measure Device

Model:  
Smart Reflow Analyzer

Variants:  
N/A

FCC ID:  
MWNSRA001

Specifications:

◆ FCC 47 CFR Part 15 Subpart C, §15.247


Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz

◆ RSS-247, Issue 2, February 2017

Digital Transmission Systems (DTSS), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

#### Test location

Company name	Nemko USA, Inc.
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City	Carlsbad
Province	California
Postal code	92008
Country	USA
Telephone	+1 760 444 3500
Website	www.nemko.com
Site number	FCC: US5058; IC: 2040B-3

Tested by	Andres Martinez, Wireless Engineer
Reviewed by	Chip Fleury, Wireless and Certification Supervisor.
Review date	September 11, 2018
Reviewer signature	

#### Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.

This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contain in this report are within Nemko USA's ISO/IEC 17025 accreditation.

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## Section 1. Report summary

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### 1.1 Applicant and manufacturer

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Company name	KIC
Address	16120 W Bernardo Dr.
City	San Diego
Province/State	CA
Postal/Zip code	92127
Country	U.S.A.

### 1.2 Test specifications

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FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5850 MHz
RSS-247, Issue 2	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and License-Exempt Local Area Network (LE-LAN) Devices

### 1.3 Test methods

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ANSI C63.10-2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
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### 1.4 Statement of compliance

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In the configuration tested, the EUT was found compliant.

Testing was completed against all relevant requirements of the test standard. Results obtained indicate that the product under test complies in full with the requirements tested. The test results relate only to the items tested.

See “Summary of test results” for full details.

### 1.5 Exclusions

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None

### 1.6 Test report revision history

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Revision #	Details of changes made to test report
TRF	Original report issued
R1	Corrected Typo's and inserted test set up figure

## Section 2. Summary of test results

### 2.1 FCC Part 15 Subpart C, general requirements test results

Part	Test description	Verdict
§15.207(a)	Conducted limits	Pass
§15.31(e)	Variation of power source	Pass
§15.203	Antenna requirement	Pass
§15.205	Restricted bands of operation	Pass

Notes:

### 2.2 FCC Part 15 Subpart C, intentional radiators test results

Part	Test description	Verdict
§15.247(a)(1)	20 dB bandwidth of the hopping channel	Not applicable
§15.247(a)(1)(i)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
§15.247(a)(2)	Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
§15.247(b)(1)	Maximum peak output power of frequency hopping systems operating in the 2400–2483.5 MHz band and 5725–5850 MHz band	Not applicable
§15.247(b)(2)	Maximum peak output power of Frequency hopping systems operating in the 902–928 MHz band	Not applicable
§15.247(b)(3)	Maximum peak output power of systems using digital modulation in the 902–928 MHz, 2400–2483.5 MHz, and 5725–5850 MHz bands	Pass
§15.247(c)(1)	Fixed point-to-point operation with directional antenna gains greater than 6 dBi	Not applicable
§15.247(c)(2)	Transmitters operating in the 2400–2483.5 MHz band that emit multiple directional beams	Not applicable
§15.247(d)	Spurious emissions	Pass
§15.247(e)	Power spectral density for digitally modulated devices	Pass
§15.247(f)	Time of occupancy for hybrid systems	Not applicable

### 2.3 IC RSS-GEN, Issue 4, test results

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Not applicable <sup>1</sup>
7.1.3	Receiver conducted emission limits	Not applicable <sup>1</sup>
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not applicable <sup>2</sup>
8.10	Restricted Frequency Bands	Pass

Notes: <sup>1</sup> According to sections 5.2 and 5.3 of RSS-Gen, Issue 4 the EUT does not have a stand-alone receiver neither scanner receiver, therefore exempt from receiver requirements.

<sup>2</sup> EUT is powered from an USB Port and has no direct connection to the AC mains.

## 2.4 IC RSS-247, Issue 2, test results

Part	Test description	Verdict
5.1	Frequency hopping systems (FHSs)	
5.1 (a)	Bandwidth of a frequency hopping channel	Not applicable
5.1 (b)	Minimum channel spacing for frequency hopping systems	Not applicable
5.1 (c)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.1 (d)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.1 (e)	Frequency hopping systems operating in the 5725–5850 MHz band	Not applicable
5.2	Digital modulation systems	
5.2 (a)	Minimum 6 dB bandwidth	Pass
5.2 (b)	Maximum power spectral density	Pass
5.3	Hybrid systems	
5.3 (a)	Digital modulation turned off	Not applicable
5.3 (b)	Frequency hopping turned off	Not applicable
5.4	Transmitter output power and e.i.r.p. requirements	
5.4 (a)	Frequency hopping systems operating in the 902–928 MHz band	Not applicable
5.4 (b)	Frequency hopping systems operating in the 2400–2483.5 MHz band	Not applicable
5.4 (c)	Frequency hopping systems operating in the 5725–5850 MHz	Not applicable
5.4 (d)	Systems employing digital modulation techniques	Pass
5.4 (e)	Point-to-point systems in 2400–2483.5 MHz and 5725–5850 MHz band	Not applicable
5.4 (f)	Transmitters which operate in the 2400–2483.5 MHz band with multiple directional beams	Not applicable
5.5	Unwanted Emissions	Pass

## Section 3. Equipment under test (EUT) details

### 3.1 Sample information

Receipt date	June 20, 2018
Nemko sample ID number	356174

### 3.2 EUT information

Product name	Temp Measure Device
Model	Smart Reflow Analyzer
Model variant	N/A
Serial number	RFL-001854
FCC ID	MWNSRA001
IC Registration Number	N/A

### 3.3 Technical information

Applicant IC company number	N/A
IC UPN number	N/A
All used IC test site(s) Reg. number	2040B
RSS number and Issue number	RSS-247, Issue 2, February 2017
Frequency band	2400-2483.5 MHz
Frequency Min (MHz)	2456
Frequency Max (MHz)	2456
RF power Min (W), Conducted/ERP/EIRP	N/A
RF power Max (W), Conducted/ERP/EIRP	0.000043 (Conducted)
Field strength, Units @ distance	N/A
Measured BW (kHz) (99%)	1784.8
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	GFSK
Emission classification (F1D, G1D, D1D)	F1D
Transmitter spurious, Units @ distance	54.69 dBµV/m @ 3m Peak / 42.0 dBµV/m @ 3m AVG
Power requirements	External 5V DC micro USB charger, Internal rechargeable battery.
Antenna information	Chip antennas on PCB. Antenna gain is 1.6dBi. (TAIYO YUDEN AF216M245001-T) The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

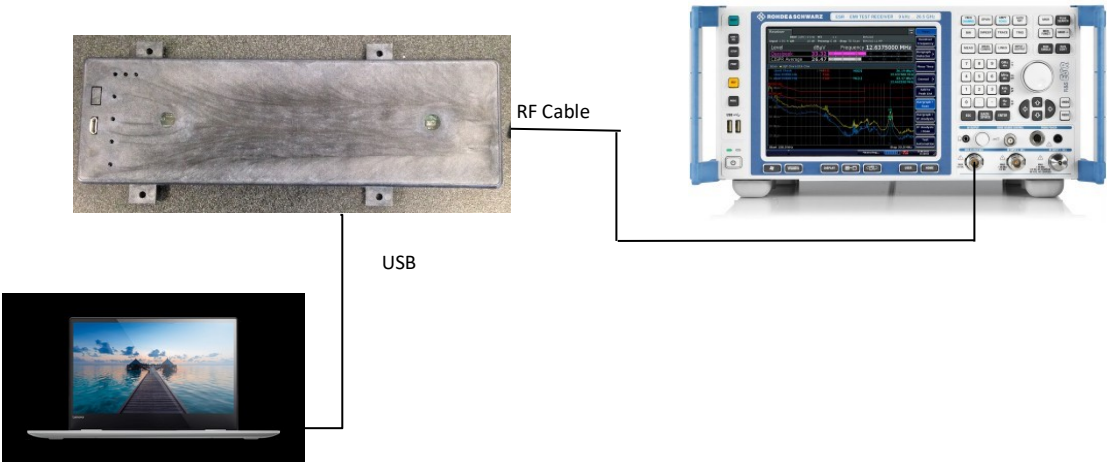
The Smart Reflow Analyzer is smart profiler to send sensor data using ANT technology (2.456MHz).

3.5 EUT exercise details

A test software was used that allows the change of different RF modes/channels. EUT is set to fixed channel test mode with modulation.

RF conducted test was performed on unit with temporary RF output modification (50Ω SMA before antennas).

3.6 EUT setup diagram



3.7 EUT sub assemblies

Table 3.7-1: EUT sub assemblies

Description	Brand name	Model/Part number	FCC ID
EUT – RF Conducted Unit	KIC	RFL-001854	MWNSRA001
Micro USB Cable	N/A	N/A	N/A

Table 3.7-2: Support Equipment

Description	Brand name	Model/Part number	Serial number	Rev.
Laptop Computer	Lenovo	Yoga	N/A	N/A



## Section 4. Engineering considerations

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### 4.1 Modifications incorporated in the EUT

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The following modifications were performed by client: RF conducted cable was re-solder to the board.

### 4.2 Technical judgment

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None.

### 4.3 Deviations from laboratory tests procedures

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No deviations were made from laboratory procedures.

## Section 5. Test conditions

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### 5.1 Atmospheric conditions

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Temperature	15–30 °C
Relative humidity	20–75 %
Air pressure	860–1060 mbar

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

### 5.2 Power supply range

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The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages  $\pm 5\%$ , for which the equipment was designed.

## Section 6. Measurement uncertainty

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### 6.1 Uncertainty of measurement

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Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of  $K = 2$  with 95% certainty.

Test name	Measurement uncertainty, dB
All antenna port measurements	0.55
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

## Section 7. Test equipment

### 7.1 Test equipment list

**Table 7.1-1: Equipment list**

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1120	1 yr.	07-28-2018
EMC Test Receiver	Rohde & Schwarz	ESU 40	E1121	1 yr.	04-28-2019
Antenna, Bilog	Schaffner-Chase	CBL6111C	E1480	1 yr.	11-28-2018
Antenna, Horn	ETS	3117-PA	E1139	2 yr.	01-25-2020
Antenna, Horn	Sage	SAR-2309-42-S2	E1143	2 yr.	03-05-2020
Spectrum Analyzer	Rohde & Schwarz	FSV40	E1120	1 yr.	07-27-2018
Signal Generator	Rohde & Schwarz	SMB 100A	E1128	1 yr.	09-13-2018
High-pass filter	Wainwright Instruments GMBH	WHKX12-2493-2770-18000-60SS	N/A	N/A	Verified with FSV40
USB RF Power Sensor	ETS – Lindgren	7002-006	E1061	1 yr.	04-16-2019

## Section 8. Test Data

### 8.1 FCC 15.247(a) (2) and RSS-247 5.2(a) Minimum 6 dB bandwidth

#### 8.1.1 Definitions and limits

**FCC 15.247:**

- (a) (2) Systems using digital modulation techniques may operate in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

**IC RSS-247:**

- 5.2 (a) The minimum 6 dB bandwidth shall be 500 kHz.

**IC RSS-GEN:**

- 6.7 Occupied bandwidth (or 99% emissions bandwidth)

#### 8.1.2 Test summary

Test date	June 19, 2018	Temperature	20 °C
Test engineer	Andres Martinez	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	51 %

#### 8.1.3 Observations, settings and special notes

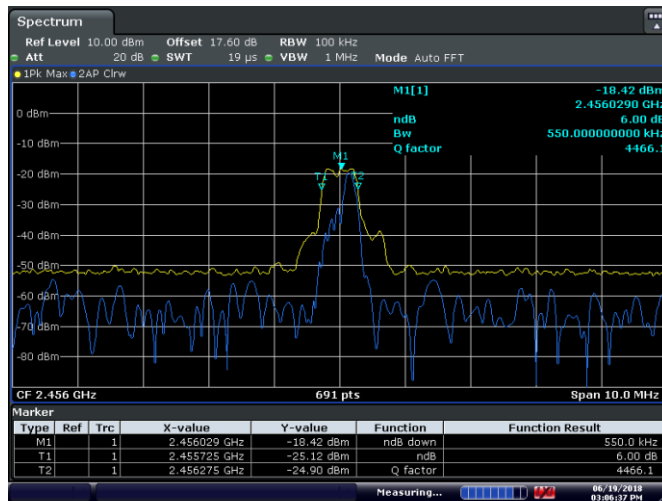
Spectrum analyzer settings:

Resolution bandwidth	100 kHz
Video bandwidth	$\geq 3 \times \text{RBW}$
Frequency span	10 MHz
Detector mode	Peak
Trace mode	Max Hold

## 8.1.4 Test data

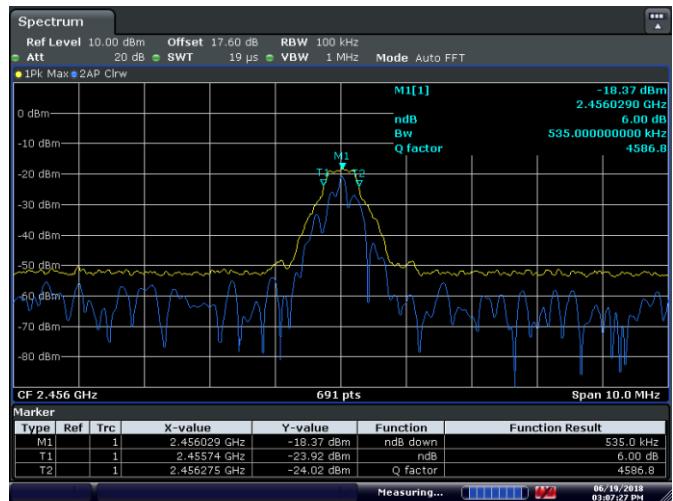
Table 8.1-1: 6 dB bandwidth results @ 2456MHz

Modulation	Frequency, MHz	6dB bandwidth, kHz	Limit, kHz	Margin, kHz
GFSK	2456 (250Kb/s)	550.00	500	50.00
	2456 (1Mb/s)	535.00	500	35.00
	2456 (2Mb/s)	839.00	500	339.00



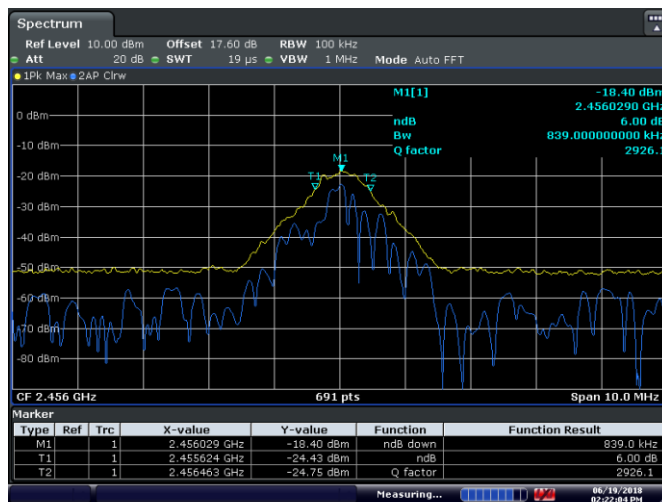
Date: 19 JUN 2018 15:06:37

Figure 8.1-1: 6 dB bandwidth, Data Rate 250Kb/s



Date: 19 JUN 2018 15:07:28

Figure 8.1-2: 6 dB bandwidth, Data Rate 1Mb/s

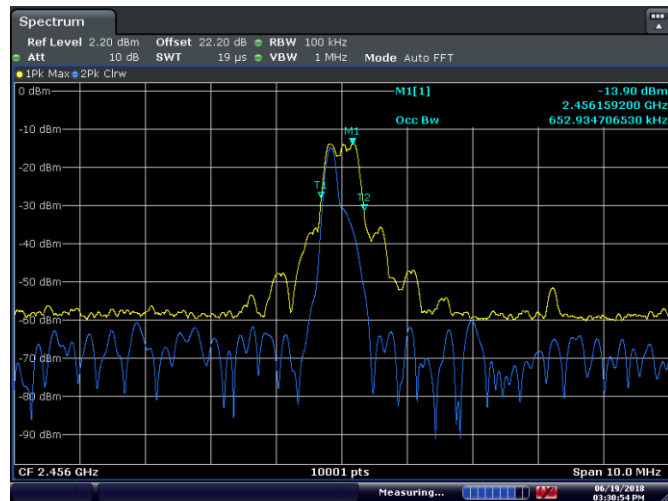


Date: 19 JUN 2018 14:22:04

Figure 8.1-3: 6 dB bandwidth, Data Rate 2Mb/s

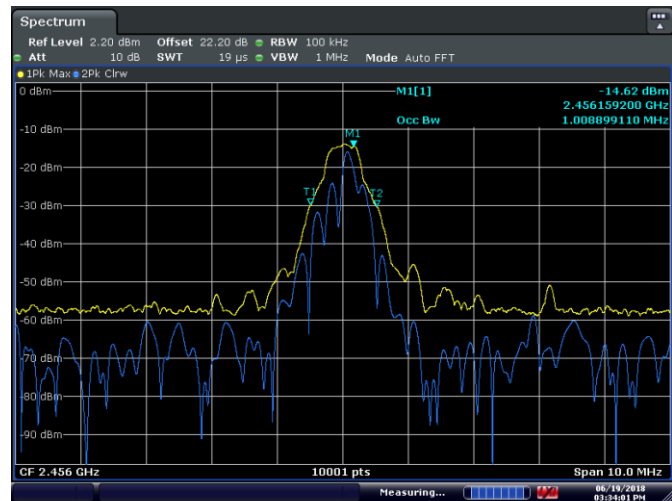
Table 8.1-2: 99% bandwidth results @ 2456MHz

Modulation	Frequency, MHz	6dB bandwidth, kHz	Limit, kHz	Margin, kHz
GFSK	2456 (250Kb/s)	652.9	-	-
	2456 (1Mb/s)	1008.9	-	-
	2456 (2Mb/s)	1784.8	-	-



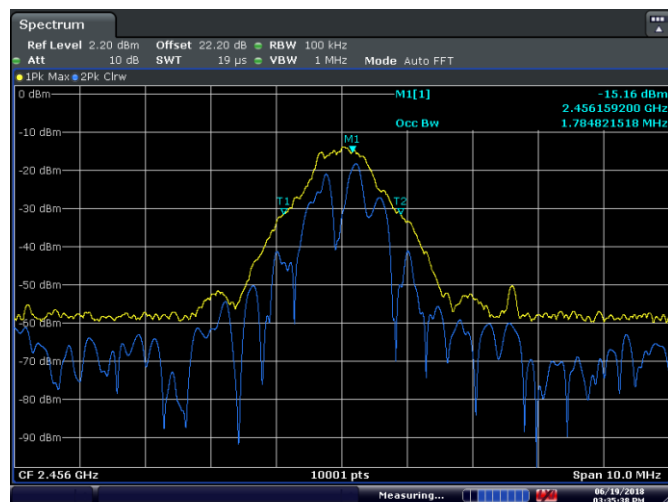
Date: 19 JUN 2018 15:30:54

Figure 8.1-4: 99% bandwidth, Data Rate 250Kb/s



Date: 19 JUN 2018 15:34:02

Figure 8.1-5: 99% bandwidth, Data Rate 1Mb/s



Date: 19 JUN 2018 15:35:38

Figure 8.1-6: 99% bandwidth, Data Rate 2Mb/s

## 8.2 FCC 15.247(b) and RSS-247 5.4 (d) Transmitter output power and e.i.r.p. requirements

## 8.2.1 Definitions and limits

### FCC:

- (b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:
- (3) For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one-Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.
  - (4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

### IC:

#### 5.4 Transmitter Output Power and Equivalent Isotropically Radiated Power (E.I.R.P.) Requirements

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

As an alternative to a peak power measurement, compliance can be based on a measurement of the maximum conducted output power. The maximum conducted output power is the total transmit power delivered to all antennas and antenna elements, averaged across all symbols in the signalling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or transmitting at a reduced power level. If multiple modes of operation are implemented, the maximum conducted output power is the highest total transmit power occurring in any mode.

## 8.2.2 Test summary

Test date	June 20, 2018	Temperature	20 °C
Test engineer	Andres Martinez	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	51 %

## 8.2.3 Observations, settings and special notes

### Peak Conducted Power Measured

#### Spectrum analyzer settings:

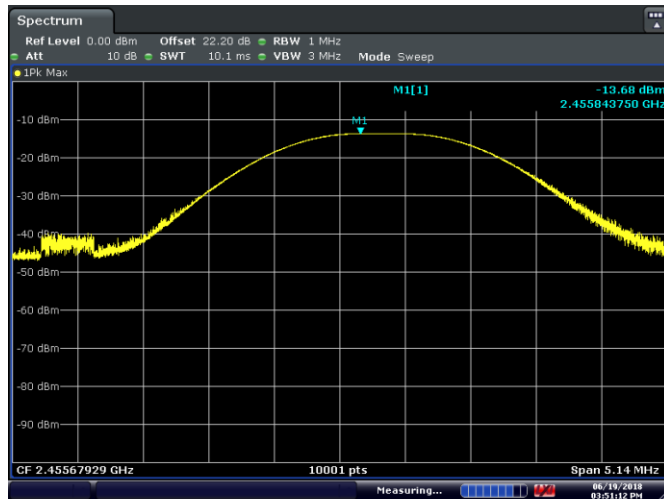
Resolution bandwidth	≥ Channel BW (1MHz)
Video bandwidth	≥ 3 × RBW (3MHz)
Frequency span	≥ 3 × RBW (3MHz)
Detector mode	Peak
Trace mode	Max Hold



## 8.2.4 Test data

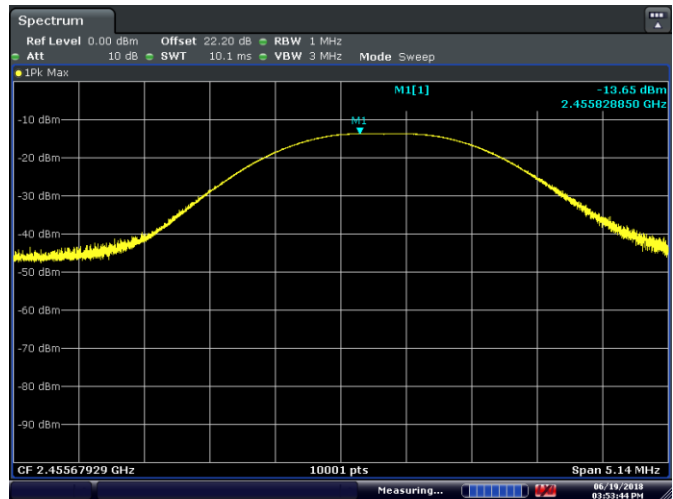
Table 8.2-1: Output power measurements results

Modulation	Frequency, MHz	Conducted output power, dBm		Margin, dB	Max Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
		Measured	Limit					
GFSK	2459(250Kb/s)	-13.68	30	43.68	1.6	-12.08	36	49.68
	2459(1Mb/s)	-13.65	30	43.67	1.6	-12.05	36	49.67
	2459(2Mb/s)	-13.88	30	43.88	1.6	-12.28	36	49.88



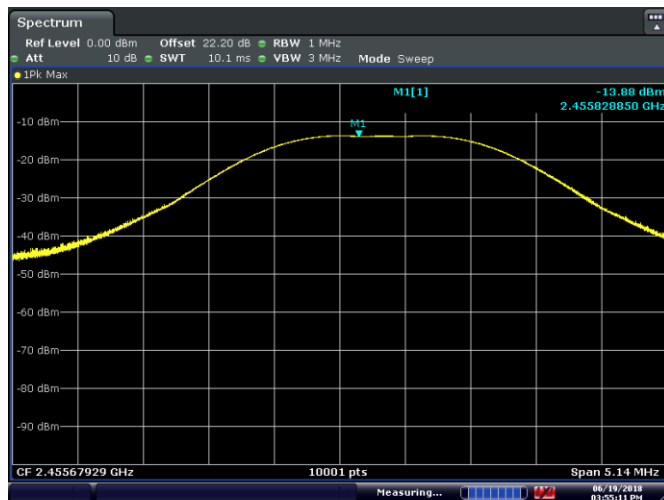
Date: 19 JUN 2018 15:51:12

Figure 8.2-1: Output Power, Data Rate 250Kb/s



Date: 19 JUN 2018 15:53:44

Figure 8.2-2: Output Power, Data Rate 1Mb/s



Date: 19 JUN 2018 15:55:11

Figure 8.2-3: Output Power, Data Rate 2Mb/s

## 8.3 FCC 15.247(d) and RSS-247 5.5 Spurious (out-of-band) emissions

### 8.3.1 Definitions and limits

#### FCC:

In any 100-kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. 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 §15.205(c)).

#### IC:

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

(a) Fundamental components of modulation of license-exempt radio apparatus shall not fall within the restricted bands of Table 8.4-1 except for apparatus complying under RSS-287;

(b) Unwanted emissions that fall into restricted bands of Table 6 shall comply with the limits specified in RSS-Gen; and

(c) Unwanted emissions that do not fall within the restricted frequency bands of Table 8.4-1 shall comply either with the limits specified in the applicable RSS or with those specified in this RSS-Gen.

**Table 8.3-1: FCC §15.209 and RSS-Gen – Radiated emission limits**

Frequency, MHz	Field strength of emissions		Measurement distance, m
	μV/m	dBμV/m	
0.009–0.490	2400/F	$67.6 - 20 \times \log_{10}(F)$	300
0.490–1.705	24000/F	$87.6 - 20 \times \log_{10}(F)$	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges.

For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test.

**Table 8.3-2: IC restricted frequency bands**

MHz	MHz	MHz	GHz
0.090–0.110	12.51975–12.52025	399.9–410	5.35–5.46
2.1735–2.1905	12.57675–12.57725	608–614	7.25–7.75
3.020–3.026	13.36–13.41	960–1427	8.025–8.5
4.125–4.128	16.42–16.423	1435–1626.5	9.0–9.2
4.17725–4.17775	16.69475–16.69525	1645.5–1646.5	9.3–9.5
4.20725–4.20775	16.80425–16.80475	1660–1710	10.6–12.7
5.677–5.683	25.5–25.67	1718.8–1722.2	13.25–13.4
6.215–6.218	37.5–38.25	2200–2300	14.47–14.5
6.26775–6.26825	73–74.6	2310–2390	15.35–16.2
6.31175–6.31225	74.8–75.2	2655–2900	17.7–21.4
8.291–8.294	108–138	3260–3267	22.01–23.12
8.362–8.366	156.52475–156.52525	3332–3339	23.6–24.0
8.37625–8.38675	156.7–156.9	3345.8–3358	31.2–31.8
8.41425–8.41475	240–285	3500–4400	36.43–36.5
12.29–12.293	322–335.4	4500–5150	Above 38.6

**Table 8.3-3: FCC restricted frequency bands**

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
0.495–0.505	16.69475–16.69525	608–614	5.35–5.46
2.1735–2.1905	16.80425–16.80475	960–1240	7.25–7.75
4.125–4.128	25.5–25.67	1300–1427	8.025–8.5
4.17725–4.17775	37.5–38.25	1435–1626.5	9.0–9.2
4.20725–4.20775	73–74.6	1645.5–1646.5	9.3–9.5
6.215–6.218	74.8–75.2	1660–1710	10.6–12.7
6.26775–6.26825	108–121.94	1718.8–1722.2	13.25–13.4
6.31175–6.31225	123–138	2200–2300	14.47–14.5
8.291–8.294	149.9–150.05	2310–2390	15.35–16.2
8.362–8.366	156.52475–156.52525	2483.5–2500	17.7–21.4
8.37625–8.38675	156.7–156.9	2690–2900	22.01–23.12
8.41425–8.41475	162.0125–167.17	3260–3267	23.6–24.0
12.29–12.293	167.72–173.2	3332–3339	31.2–31.8
12.51975–12.52025	240–285	3345.8–3358	36.43–36.5
12.57675–12.57725	322–335.4	3600–4400	Above 38.6
13.36–13.41			

### 8.3.2 Test summary

Test date	June 19, 2018	Temperature	20 °C
Test engineer	Andres Martinez	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	51 %

### 8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10<sup>th</sup> harmonic.  
EUT was set to transmit with 100 % duty cycle.  
Antenna 0 path was selected for most radiated test cases as worst case.

Spectrum analyzer settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyzer settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	AVG
Trace mode:	Max Hold

### 8.3.4 Test data

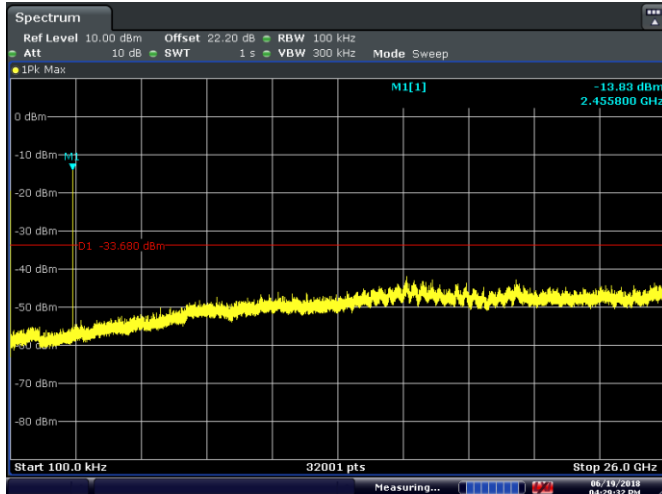


Figure 8.3.1: Conducted spurious emissions, Data Rate 250Kb/s

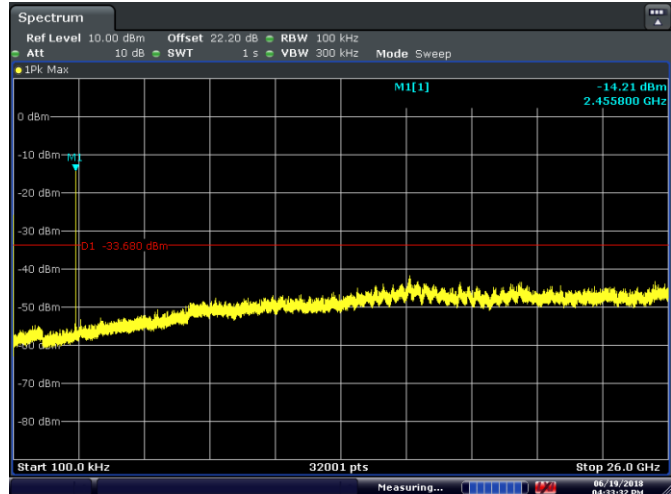


Figure 8.3.2: Conducted spurious emissions, Data Rate 1Mb/s

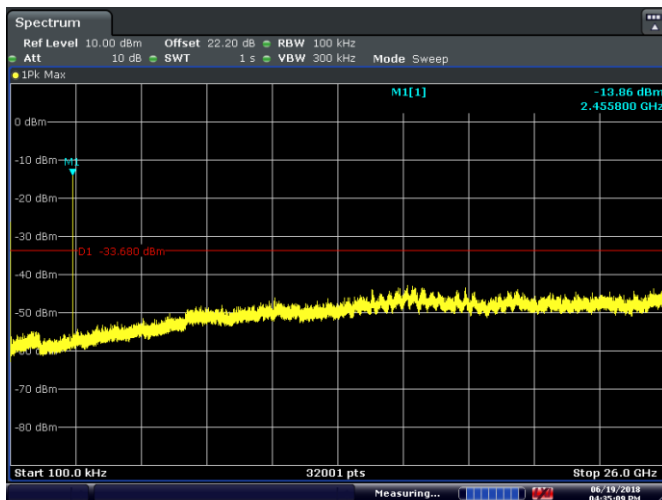
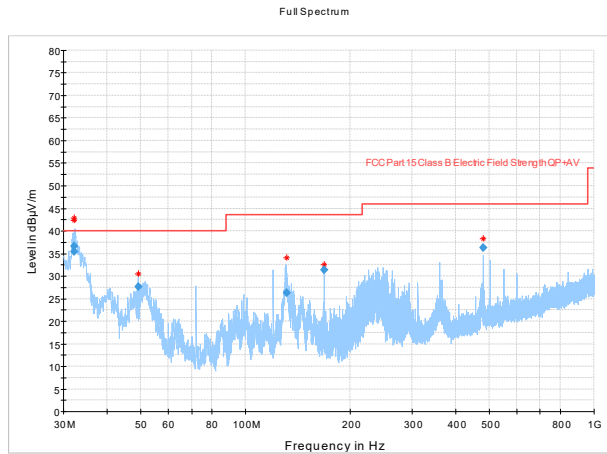
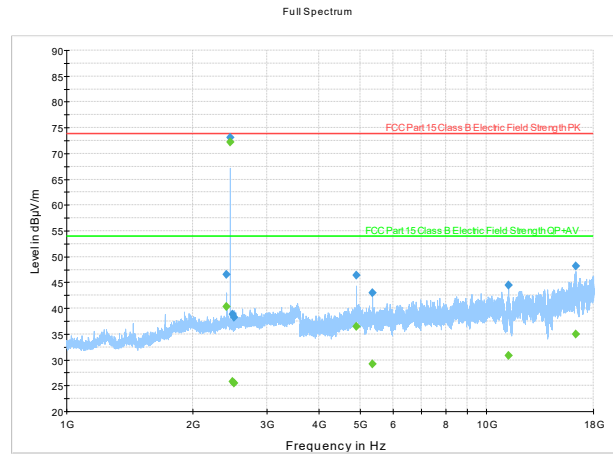


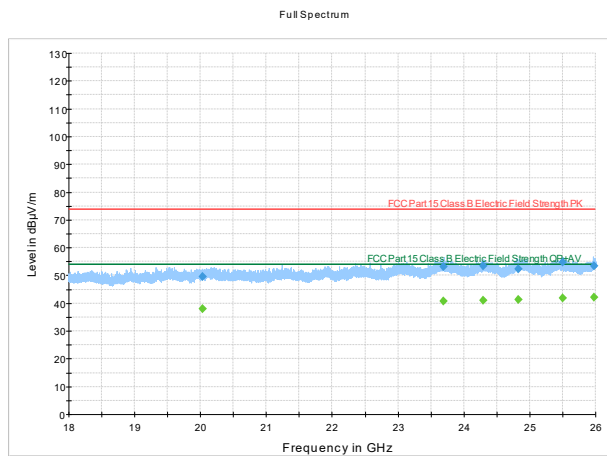
Figure 8.3.3: Conducted spurious emissions, Data Rate 2Mb/s



**Figure 8.3.4: Radiated spurious emissions, 30-1000MHz**



**Figure 8.3.5: Radiated spurious emissions, 1-18GHz**



**Figure 8.3.6: Radiated spurious emissions, 18-26GHz**

Table 8.3-4: Radiated field strength measurement results for low channel 2456MHz

Frequency (MHz)	QuasiPeak (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (db)
32.174000	35.34	40.00	4.66	5000.0	120.000	115.3	V	215.0	19.5
32.225000	36.68	40.00	3.32	5000.0	120.000	117.9	V	280.0	19.5
49.149000	27.65	40.00	12.35	5000.0	120.000	111.3	V	236.0	10.3
130.938000	26.27	43.50	17.23	5000.0	120.000	100.0	V	-2.0	13.9
168.022500	31.38	43.50	12.12	5000.0	120.000	100.0	V	86.0	12.1
480.023000	36.32	46.00	9.68	5000.0	120.000	174.7	V	289.0	20.8

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
1235.00000	36.56	---	73.90	37.34	5000.0	1000.000	286.2	V	26.0	-13.6
1235.00000	---	23.38	53.90	30.52	5000.0	1000.000	286.2	V	26.0	-13.6
2025.13333	39.43	---	73.90	34.47	5000.0	1000.000	195.1	H	274.0	-10.7
2025.13333	---	26.03	53.90	27.87	5000.0	1000.000	195.1	H	274.0	-10.7
3580.43333	---	28.02	53.90	25.88	5000.0	1000.000	282.0	H	94.0	-5.7
3580.43333	41.03	---	73.90	32.87	5000.0	1000.000	282.0	H	94.0	-5.7
6646.83333	---	29.61	53.90	24.29	5000.0	1000.000	385.0	H	322.0	0.2
6646.83333	43.50	---	73.90	30.40	5000.0	1000.000	385.0	H	322.0	0.2
12056.2000	44.60	---	73.90	29.30	5000.0	1000.000	276.6	V	296.0	4.4
12056.2000	---	31.68	53.90	22.22	5000.0	1000.000	276.6	V	296.0	4.4
16308.5666	49.22	---	73.90	24.68	5000.0	1000.000	376.6	V	0.0	10.5
16308.5666	---	35.86	53.90	18.04	5000.0	1000.000	376.6	V	0.0	10.5

Frequency (MHz)	MaxPeak (dBμV/m)	Average (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
20031.8833	49.54	---	73.90	24.36	10.0	1000.000	108.3	V	332.0	38.7
20031.8833	---	38.14	53.90	15.76	10.0	1000.000	108.3	V	332.0	38.7
23688.4833	---	40.65	53.90	13.25	10.0	1000.000	121.7	H	182.0	40.1
23688.4833	53.06	---	73.90	20.84	10.0	1000.000	121.7	H	182.0	40.1
24288.0666	53.41	---	73.90	20.49	10.0	1000.000	125.0	H	75.0	40.3
24288.0666	---	41.04	53.90	12.86	10.0	1000.000	125.0	H	75.0	40.3
24827.3166	52.33	---	73.90	21.57	10.0	1000.000	119.8	H	115.0	40.7
24827.3166	---	41.42	53.90	12.48	10.0	1000.000	119.8	H	115.0	40.7
25503.9833	---	41.86	53.90	12.04	10.0	1000.000	172.0	H	23.0	40.7
25503.9833	54.69	---	73.90	19.21	10.0	1000.000	172.0	H	23.0	40.7
25978.0833	53.53	---	73.90	20.37	10.0	1000.000	125.0	H	204.0	40.9
25978.0833	---	42.00	53.90	11.90	10.0	1000.000	125.0	H	204.0	40.9

**Note:** No considerable EUT emissions were observed.

**Note<sup>1</sup>:** EUT radiated emissions doesn't fall under restricted bands.

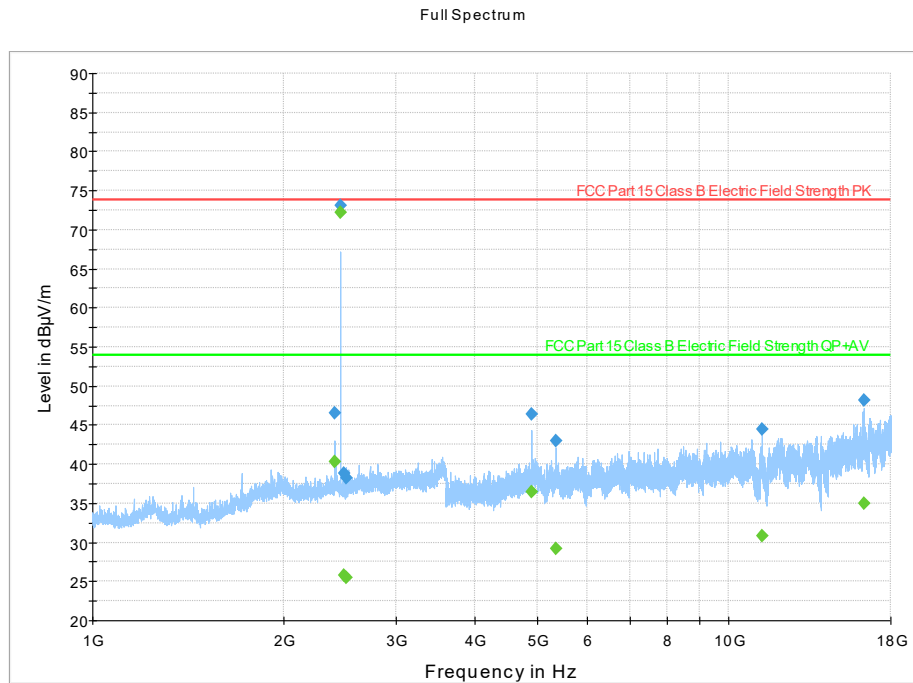


Figure 8.3.7: Radiated spurious emissions Restricted Bands, 1-18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	CAverage (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Meas. Time (ms)	Bandwidth (kHz)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB)
2399.96666	---	40.28	53.90	13.62	5000.0	1000.000	142.1	V	69.0	-9.8
2399.96666	46.62	---	73.90	27.28	5000.0	1000.000	142.1	V	69.0	-9.8
2456.06666	73.14	---	73.90	0.76	5000.0	1000.000	138.2	H	349.0	-9.5
2456.06666	---	72.25	53.90	-18.35	5000.0	1000.000	138.2	H	349.0	-9.5
2481.33333	---	25.77	53.90	28.13	5000.0	1000.000	349.5	V	215.0	-9.5
2481.33333	38.86	---	73.90	35.04	5000.0	1000.000	349.5	V	215.0	-9.5
2501.96666	---	25.50	53.90	28.40	5000.0	1000.000	155.0	H	316.0	-9.5
2501.96666	38.17	---	73.90	35.73	5000.0	1000.000	155.0	H	316.0	-9.5
4911.60000	46.36	---	73.90	27.54	5000.0	1000.000	113.1	H	110.0	-2.3
4911.60000	---	36.53	53.90	17.37	5000.0	1000.000	113.1	H	110.0	-2.3
5358.86666	43.00	---	73.90	30.90	5000.0	1000.000	268.1	H	0.0	-2.3
5358.86666	---	29.27	53.90	24.63	5000.0	1000.000	268.1	H	0.0	-2.3
11283.9333	---	30.88	53.90	23.02	5000.0	1000.000	211.1	H	299.0	2.8
11283.9333	44.54	---	73.90	29.36	5000.0	1000.000	211.1	H	299.0	2.8
16315.9333	48.18	---	73.90	25.72	5000.0	1000.000	180.8	V	32.0	10.5
16315.9333	---	34.98	53.90	18.92	5000.0	1000.000	180.8	V	32.0	10.5

Table 8.3.7: Radiated spurious emissions Restricted bands, 1-18GHz

## 8.4 FCC 15.247(e) and RSS-247 5.2(b) Power Spectrum Density

### 8.4.1 Definitions and limits

#### FCC and IC:

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density.

### 8.4.2 Test summary

Test date	June 19, 2018	Temperature	20 °C
Test engineer	Andres Martinez	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	51 %

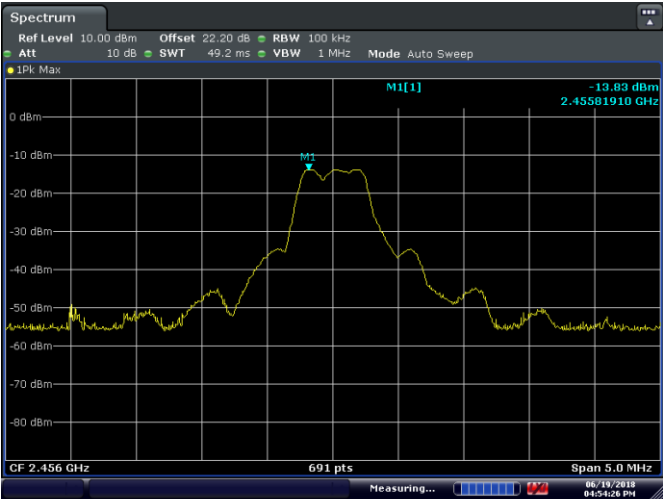
### 8.4.3 Observations, settings and special notes

### 8.4.4 Test data

**Table 8.4-1: Power Spectrum Density**

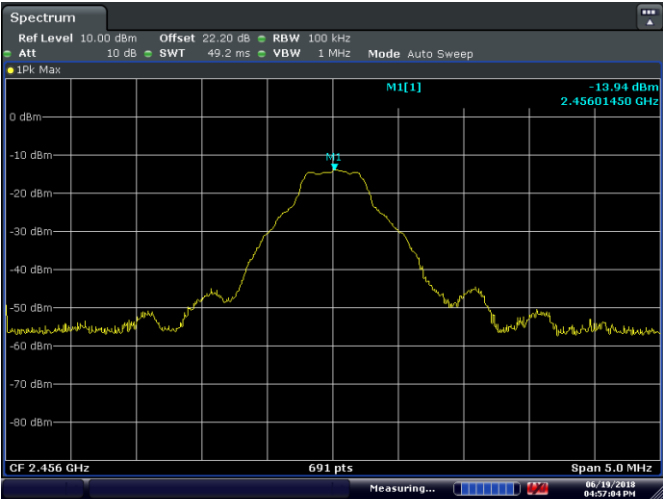
Modulation	Frequency, MHz	Conducted PSD@100kHz, dBm		Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
		Measured	Limit					
GFSK	2459(250Kb/s)	-13.84	8	21.84	1.6	-12.24	14	27.84
	2459(1Mb/s)	-13.94	8	21.94	1.6	-12.34	14	27.94
	2459(2Mb/s)	-13.95	8	21.95	1.6	-12.35	14	27.95





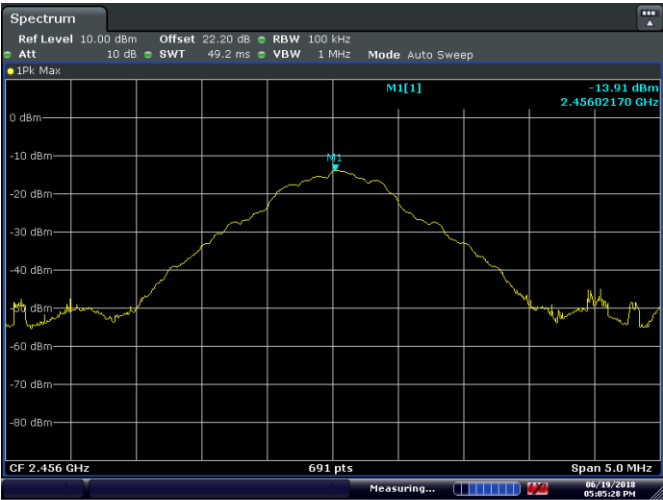
Date: 19 JUN 2018 16:54:26

Figure 8.4-1: PSD, Data Rate 250Kb/s



Date: 19 JUN 2018 16:57:05

Figure 8.4-2: PSD, Data Rate 1Mb/s

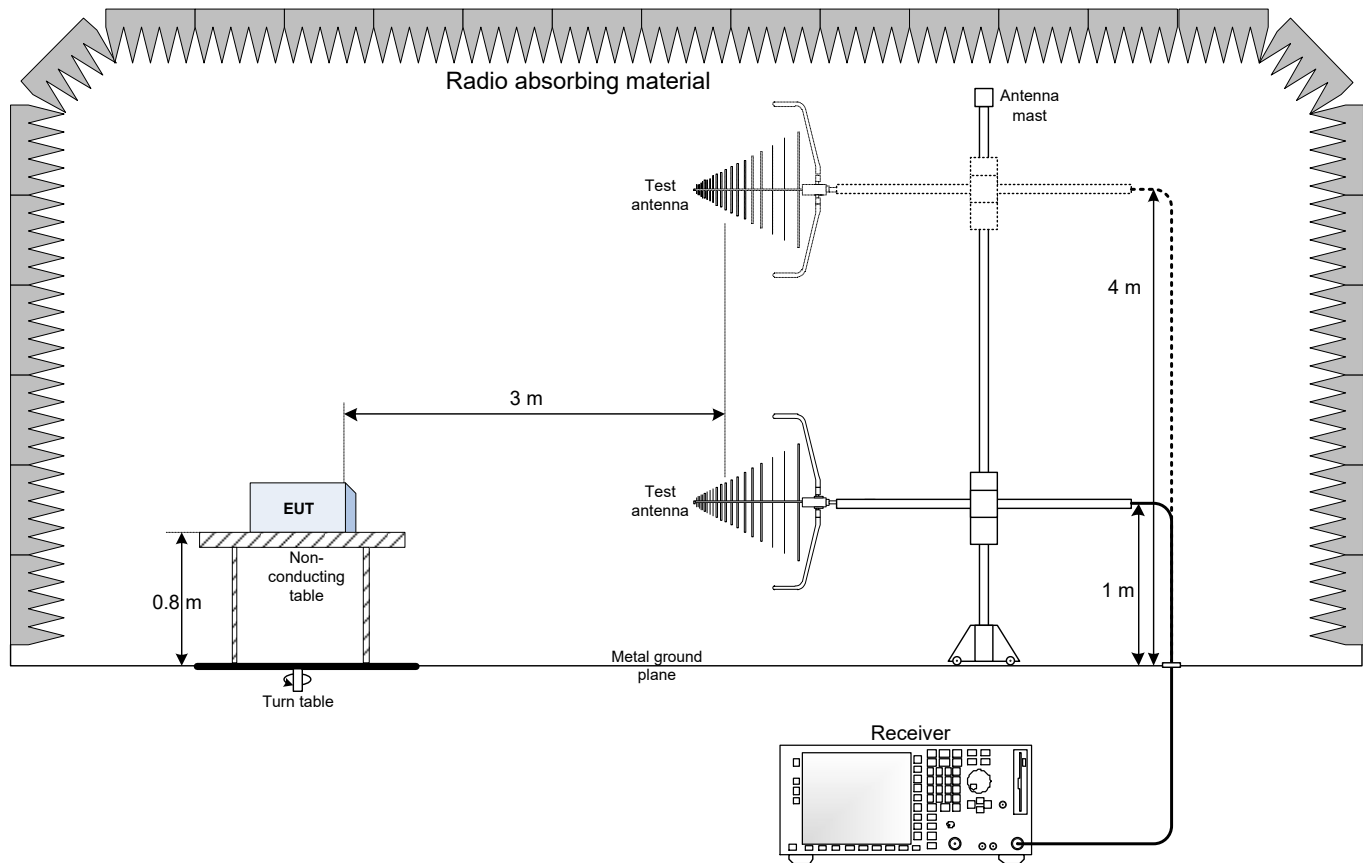


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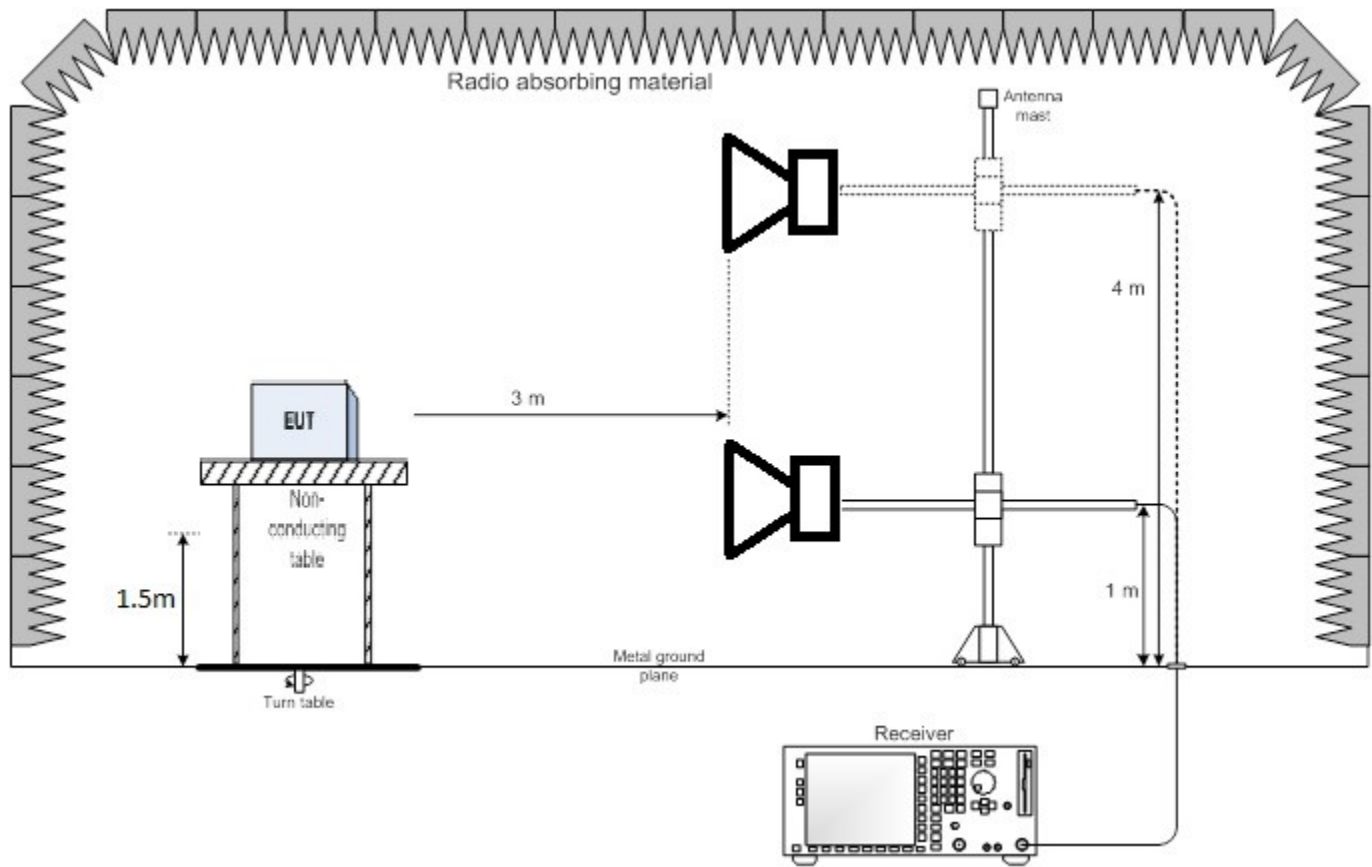
Figure 8.4-3: PSD, Data Rate 2Mb/s

## Section 9. Block diagrams of test set-ups

### 9.1 Radiated emissions set-up – Below 1GHz

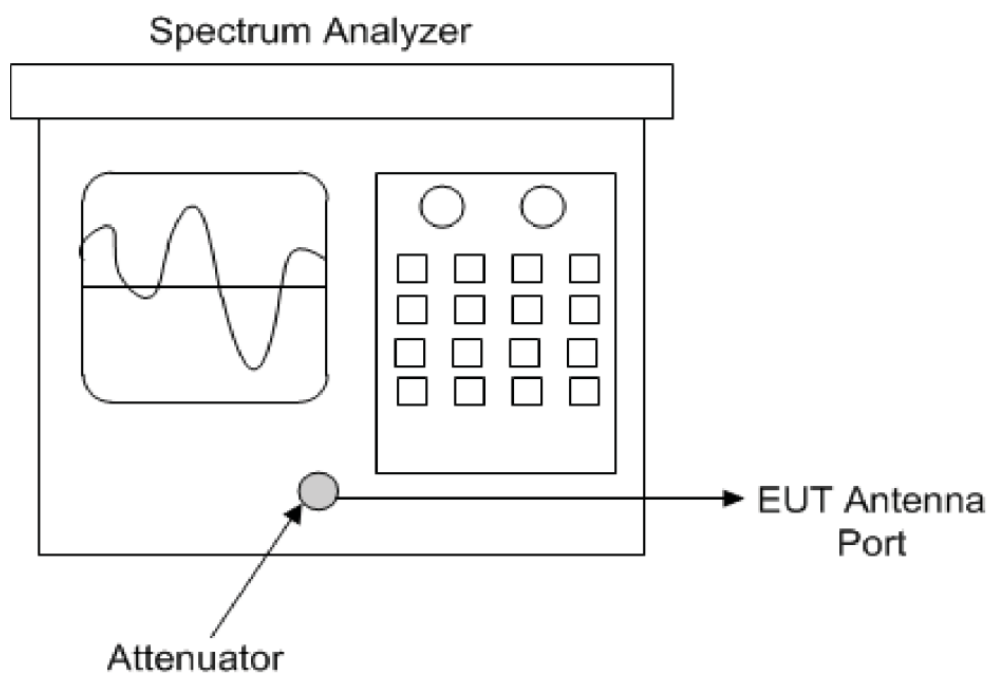


## 9.2 Radiated emissions set-up – Above 1GHz



### 9.3 Antenna Port Conducted emissions set-up –

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Thank you for choosing

