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Wireless test report – 324905-2R2TRFWL

Applicant:

Garmin International, Inc.

Product name:

GMA 36B

Model:

GMN-01627

Model variant:

GMN-01340, GMA-1360D

FCC ID:

IPH-0272510

IC Registration number:

1792A-0272500

Specifications:

- FCC 47 CFR Part 15 Subpart C, §15.247

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

- RSS-247, Issue 2, Feb 2017, Section 5

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

  5) Standard specifications for frequency hopping systems and digital transmission systems operating in the bands 902–928 MHz, 2400–2483.5 MHz and 5725–5850 MHz

Date of issue: May 31, 2018

Test engineer(s):	Avul Nzenza	Signature:	
Reviewed by:	Andrey Adelberg, Senior Wireless/EMC Specialist	Signature:	Andrey Adelberg

Test location

Company name	Nemko Canada Inc.	
Address	303 River Road	292 Labrosse Avenue
City	Ottawa	Pointe-Claire
Province	Ontario	Quebec
Postal code	K1V 1H2	H9R 5L8
Country	Canada	Canada
Telephone	+1 613 737 9680	+1 514 694 2684
Facsimile	+1 613 737 9691	+1 514 694 3528
Toll free	+1 800 563 6336	
Website	www.nemko.com	www.nemko.com
Site number	FCC: CA2040; IC: 2040A-4 (3 m SAC)	FCC: CA2041; IC: 2040G-5 (3 m SAC)

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 Canada's ISO/IEC 17025 accreditation.

Copyright notification

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Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Garmin International, Inc.
Address	1200 E 151st Street Olathe, KS 66062USA

1.2 Test specifications

FCC 47 CFR Part 15, Subpart C, Clause 15.247	Operation in the 902–928 MHz, 2400–2483.5 MHz, and 5725-5850 MHz.
RSS-247, Issue 2, Feb. 2017, Section 5	Digital Transmission Systems (DTSs), Frequency Hopping Systems (FHSs) and Licence-Exempt Local Area Network (LE-LAN) Devices

1.3 Test methods

DA 00-705, Released March 30, 2000	Filing and Measurement Guidelines for Frequency Hopping Spread Spectrum Systems
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.4 Statement of compliance

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

None

1.6 Test report revision history

Table 1.6-1: Test report revision history

Revision #	Details of changes made to test report
TRF	Original report issued
R2	Customer modified the software to increase the number of channel from 32 to 79 Also testing was done on GMN-01627 model which previously was considered as a variant. It has more output power than GMN-01340.
R3	Corrected FCC ID, Frequency separation results, antenna gain.

Section 2. Summary of test results

2.1 FCC Part 15 Subpart C, general requirements test results

Table 2.1-1: *FCC general requirements results*

Part	Test description	Verdict
§15.207(a)	Conducted limits	Not applicable[1]
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of tested frequencies	Pass
§15.203	Antenna requirement	Pass[2]

Notes:

[1] Equipment is DC powered.

[2] The equipment will be professionally installed.

2.2 FCC Part 15 Subpart C, intentional radiators test results for frequency hopping spread spectrum systems

Table 2.2-1: *FCC 15.247 results for FHSS*

Part	Test description	Verdict
§15.247(a)(1)(i)	Requirements for operation in the 902–928 MHz band	Not applicable
§15.247(a)(1)(ii)	Requirements for operation in the 5725–5850 MHz band	Not applicable
§15.247(a)(1)(iii)	Requirements for operation in the 2400–2483.5 MHz band	Pass
§15.247(b)(1)	Maximum peak output power in the 2400–2483.5 MHz band and 5725–5850 MHz band	Pass
§15.247(b)(2)	Maximum peak output power in the 902–928 MHz band	Not applicable
§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(f)	Time of occupancy for hybrid systems	Not applicable

2.3 FCC Part 15 Subpart C, general requirements test results

Table 2.3-1: *RSS-Gen results*

Part	Test description	Verdict
7.1.2	Receiver radiated emission limits	Not applicable
7.1.3	Receiver conducted emission limits	Not applicable[1]
6.8	Number of frequencies	Pass
8.8	Power Line Conducted Emissions Limits for Licence-Exempt Radio Apparatus	Not applicable

Notes:

[1] 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.

[2]The EUT will be connected to a DC source

2.4 ISED RSS-247, Issue 2, test results for frequency hopping spread spectrum systems (FHSS)

Table 2.4-1: *RSS-247 results for FHSS*

Part	Test description	Verdict
5.1 (a)	Bandwidth of a frequency hopping channel	Pass
5.1 (b)	Minimum channel spacing	Pass
5.1 (c)	Systems operating in the 902–928 MHz band	Not applicable
5.1 (d)	Systems operating in the 2400–2483.5 MHz band	Pass
5.1 (e)	Systems operating in the 5725–5850 MHz band	Not applicable
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)	Systems operating in the 902–928 MHz band	Not applicable
5.4 (b)	Systems operating in the 2400–2483.5 MHz band	Pass
5.4 (c)	Systems operating in the 5725–5850 MHz	Not applicable
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

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	March 15, 2017
Nemko sample ID number	#1

3.2 EUT information

Product name	GMA 36B
Model	GMN-01627
Model variants	GMN-01340
Serial number	4RK000019

3.3 Technical information

Applicant IC company number	1792A
IC UPN number	0272500
All used IC test site(s) Reg. number	2040G-5
RSS number and Issue number	RSS-247 Issue 2, Feb. 2017
Frequency band	2400–2483.5 MHz
Frequency Min (MHz)	2402
Frequency Max (MHz)	2480
RF power (W), Conducted	0.002 (3.01 dBm)
Field strength, Units @ distance	N/A
Measured BW (MHz) (99%)	1.20
Calculated BW (kHz), as per TRC-43	N/A
Type of modulation	GFSK, EDR2, EDR3
Emission classification (F1D, G1D, D1D)	1M20F1D
Transmitter spurious, Units @ distance	51.0 dBµV/m Peak and 43.0 dBµV/m Average @ 3 m @ 860 MHz
Power requirements	14/28 Vdc
Antenna information	The EUT is professionally installed. Antenna: 0 dBi

3.4 Product description and theory of operation

The GMA 1360 (Including GMA1360D and GMA 36B) is a Marker Beacon receiver and audio processor that primarily interfaces to a display unit, communications and navigation radios, headsets, and speakers.

3.5 EUT exercise details

EUT was set to transmit continuously

Section 4. Engineering considerations

4.1 Modifications incorporated in the EUT

There were no modifications performed to the EUT during this assessment.

4.2 Technical judgment

None

4.3 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Section 5. Test conditions

5.1 Atmospheric conditions

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

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 ±5 %, for which the equipment was designed.

Section 6. Measurement uncertainty

6.1 Uncertainty of measurement

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

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.
3 m EMI test chamber	TDK	SAC-3	FA002532	2 year	June 5/19
Flush mount turntable	Sunol	FM2022	FA002550	—	NCR
Controller	Sunol	SC104V	FA002551	—	NCR
Antenna mast	Sunol	TLT2	FA002552	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 40	FA002071	1 year	Sept. 18/18
Bilog antenna (20–2000 MHz)	Sunol	JB1	FA002517	1 year	Dec. 6/18
Horn antenna (1–18 GHz)	EMCO	3115	FA001451	1 year	April 5/18
Pre-amplifier (0.5–18 GHz)	COM-POWER	PAM-118A	FA002561	1 year	Sept. 21/18
Pre-amplifier (18–40 GHz)	COM-POWER	PAM-840	FA002508	1 year	May 8/18
2400-2483 MHz Notch Filter	Microwave Circuits	N0324413	FA002693	—	VOU

Notes: NCR - no calibration required
VOU - verify on use

Table 7.1-2: test software

Test description	Manufacturer of Software	Details
Radiated emissions – Ottawa	Rhode & Schwarz	EMC32, Software for EMC Measurements, Version 9.26.01

Notes: None

Section 8. Testing data

8.1 FCC 15.247(a)(1) and RSS-247 5.1 Frequency Hopping Systems requirements, 2 GHz operation

8.1.1 Definitions and limits

FCC:

(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400–2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly 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.

(iii) Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

(f) For the purposes of this section, hybrid systems are those that employ a combination of both frequency hopping and digital modulation techniques. The frequency hopping operation of the hybrid system, with the direct sequence or digital modulation operation turned-off, shall have an average time of occupancy on any frequency not to exceed 0.4 seconds within a time period in seconds equal to the number of hopping frequencies employed multiplied by 0.4. The power spectral density conducted from the intentional radiator to the antenna due to the digital modulation operation of the hybrid system, with the frequency hopping operation turned off, shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.

ISED:

a) The bandwidth of a frequency hopping channel is the 20 dB emission bandwidth, measured with the hopping stopped. The system's radio frequency (RF) bandwidth is equal to the channel bandwidth multiplied by the number of channels in the hopset. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. 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.

b) FHSs shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, FHSs operating in the band 2400–2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

d) FHSs operating in the band 2400–2483.5 MHz shall use at least 15 hopping channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds, multiplied by the number of hopping channels employed. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

5.3 Hybrid systems

Hybrid systems employ a combination of both frequency hopping and digital transmission techniques and shall comply with the following:

a With the digital transmission operation of the hybrid system turned off, the frequency hopping operation shall have an average time of occupancy on any frequency not exceeding 0.4 seconds within a duration in seconds equal to the number of hopping frequencies multiplied by 0.4.

8.1.1 Test date

Start date	March 1, 2018

8.1.2 Observations, settings and special notes

Spectrum analyser settings for carrier frequency separation:

Resolution bandwidth	≥ 1 % of the span
Video bandwidth	≥ RBW
Frequency span	wide enough to capture the peaks of two adjacent channels
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for number of hopping frequencies:

Resolution bandwidth	≥ 1 % of the span
Video bandwidth	≥ RBW
Frequency span	the frequency band of operation
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for time of occupancy (dwell time):

Resolution bandwidth	1 MHz
Video bandwidth	≥ RBW
Frequency span	Zero span
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for 20 dB bandwidth:

Resolution bandwidth	≥ 1% of the 20 dB bandwidth
Video bandwidth	≥ RBW
Frequency span	approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

8.1.3 Test data

Table 8.1-1: 99% bandwidth results

Frequency, MHz	99% bandwidth, kHz
EDR3	
2402	1195
2441	1198
2480	1201
EDR2	
2402	1192
2441	1195
2480	1192
GFSK	
2402	858
2441	862
2480	863

Table 8.1-2: Carrier frequency separation results

Carrier frequency separation, kHz	Minimum limit, kHz	Margin, kHz
EDR3		
1004	899	105
EDR2		
1017	895	122
GFSK		
1006	669	337

Notes: The maximum power of the unit is 2 mW (less than 125 mW). We have applied the 2/3 of 20 dB BW rule

Table 8.1-3: Number of hopping frequencies results

Number of hopping frequencies	Minimum limit	Margin
EDR3		
79	15	64
EDR2		
79	15	64
GFSK		
79	15	64

Table 8.1-4: Average time of occupancy results

Dwell time of each pulse, ms	Number of pulses within period	Total dwell time within period, ms	Limit, ms	Margin, ms
EDR3				
2.9	84	243	400	157
EDR2				
2.9	75	217	400	183
GFSK				
2.9	91	264	400	136

Measurement Period is 31.6 s, which is equal to 0.4 s multiplied by the number of hopping channels 79

Sample of 20 dB bandwidth Measurements

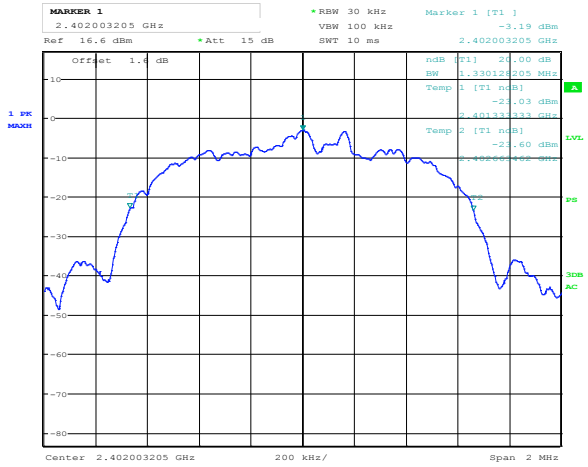


Figure 8.1-1: 20 dB bandwidth on low channel

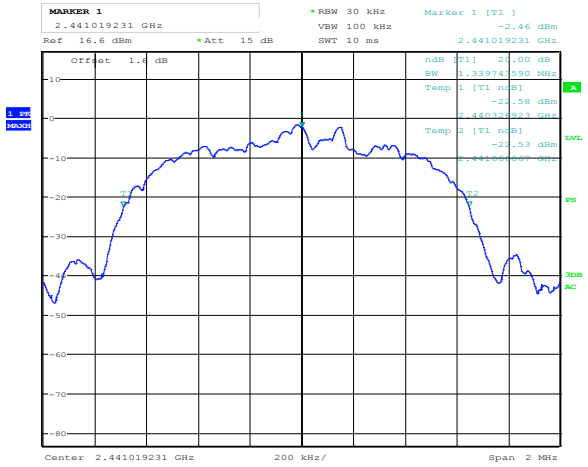


Figure 8.1-2: 20 dB bandwidth on mid channel

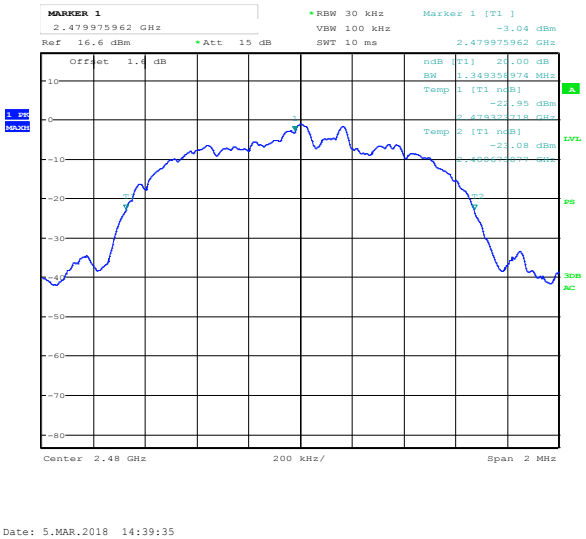


Figure 8.1-3: 20 dB bandwidth on high channel

Sample of Measurements

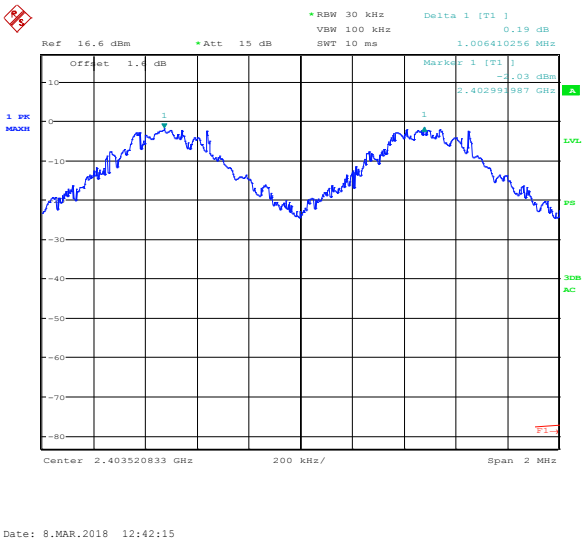


Figure 8.1-4: Carrier frequency separation

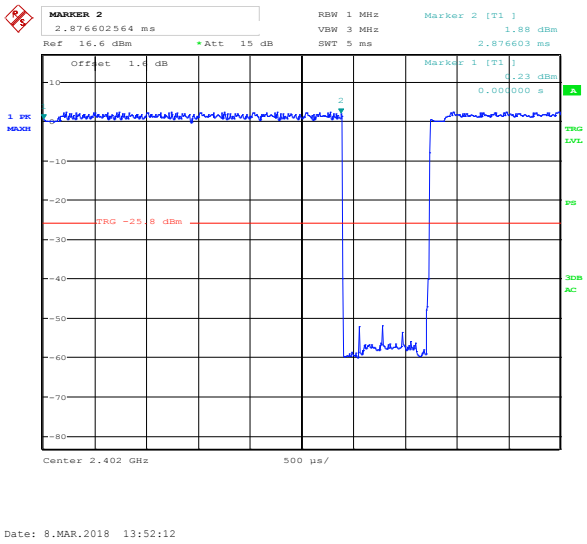


Figure 8.1-5: Dwell time

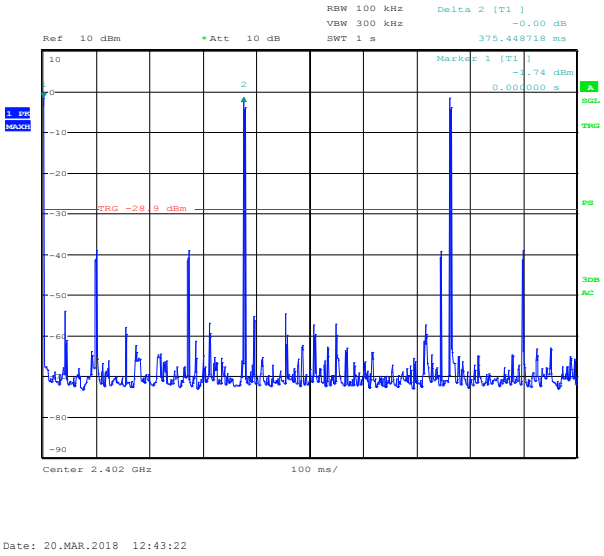


Figure 8.1-6: *Pulse repetition on the same channel*

Sample of Number of hopping channels Measurement (79 Hopping Channels)

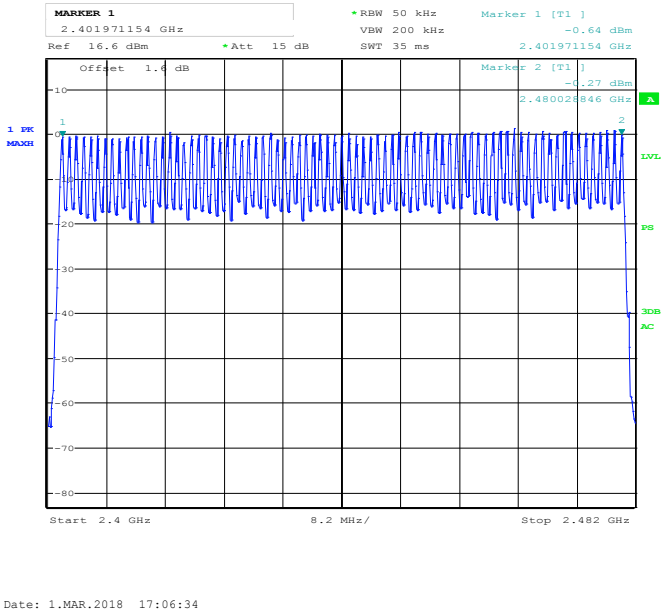


Figure 8.1-7: Number of hopping channels

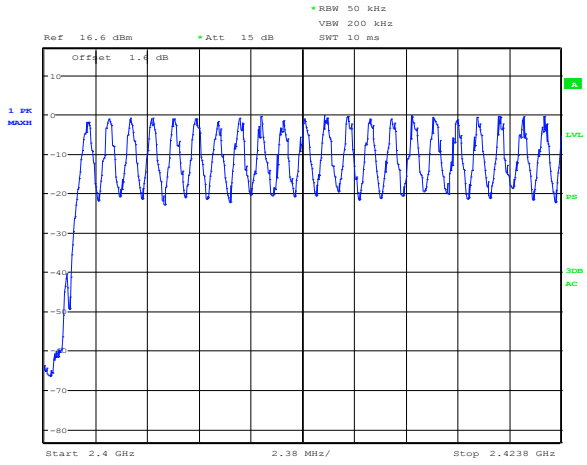


Figure 8.1-8: Number of hopping channels (22)

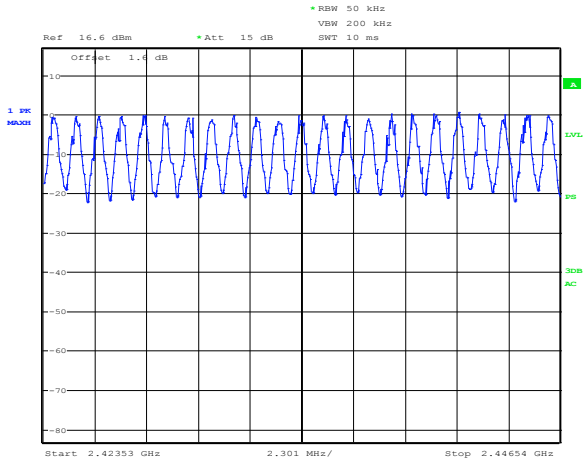


Figure 8.1-9: Number of hopping channels (23)

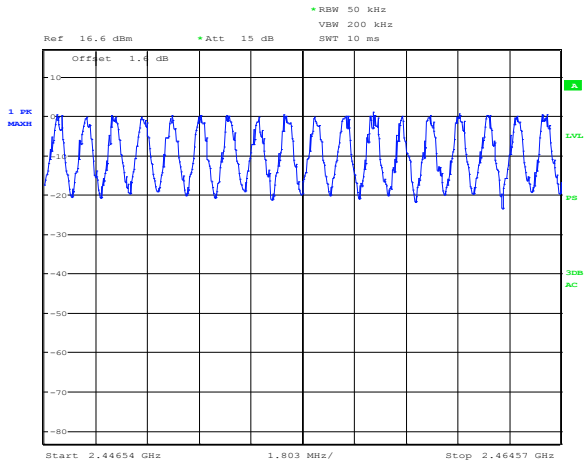


Figure 8.1-10: Number of hopping channels (18)

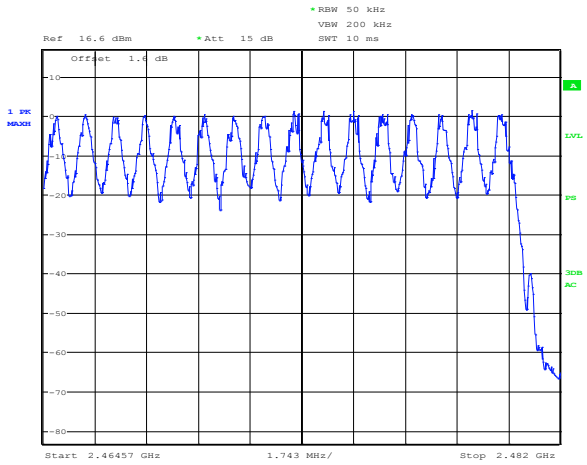


Figure 8.1-11: Number of hopping channels (16)

8.2 FCC 15.247(b) and RSS-247 5.4 (b) Transmitter output power and e.i.r.p. requirements for FHSS 2 GHz

8.2.1 Definitions and limits

FCC:

(b) The maximum peak conducted output power of the intentional radiator shall not exceed the following:

(1) 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 (30 dBm). For all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts (21 dBm).

(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.

ISED:

For FHSs operating in the band 2400–2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W (30 dBm) if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W (21 dBm) if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W (36 dBm), except as provided in section 5.4(e).

Section 5.4(e)

Fixed point-to-point systems in the bands 2400–2483.5 MHz and 5725–5850 MHz are permitted to have an e.i.r.p. higher than 4 W provided that the higher e.i.r.p. is achieved by employing higher gain directional antennas and not higher transmitter output powers. Point-to-multipoint systems, omnidirectional applications and multiple co-located transmitters transmitting the same information are prohibited from exceeding an e.i.r.p. of 4 W.

8.2.2 Test date

Start date	March 8, 2018

8.2.3 Observations, settings and special notes

Spectrum analyser settings for output power:

Resolution bandwidth	> the 20 dB bandwidth of the emission being measured
Video bandwidth	≥ RBW
Frequency span	approximately 5 times the 20 dB bandwidth, centered on a hopping channel
Detector mode	Peak
Trace mode	Max Hold

8.2.4 Test data

Table 8.2-1: *Output power and EIRP results*

Frequency, MHz	Output power, dBm	Output power limit, dBm	Margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
EDR3							
2402	1.88	30.00	28.12	0.0	1.88	36.00	34.12
2441	2.81	30.00	27.19	0.0	2.81	36.00	33.19
2480	3.01	30.00	26.99	0.0	3.01	36.00	32.99
EDR2							
2402	1.29	30.00	28.71	0.0	1.29	36.00	34.71
2441	2.43	30.00	27.57	0.0	2.43	36.00	33.57
2480	2.78	30.00	27.22	0.0	2.78	36.00	33.22
GFSK							
2402	1.24	30.00	28.76	0.0	1.24	36.00	34.76
2441	1.79	30.00	28.21	0.0	1.79	36.00	34.21
2480	2.33	30.00	27.67	0.0	2.33	36.00	33.67

EIRP = Output power + Antenna gain.

In order to comply with minimum frequency carrier separation requirements option, EUT's maximum output power should be below 125 mW (21 dBm).

Maximum measured output power was 3.01 dBm which is more than 17 dB below the limit.

Sample of Output Power Measurement

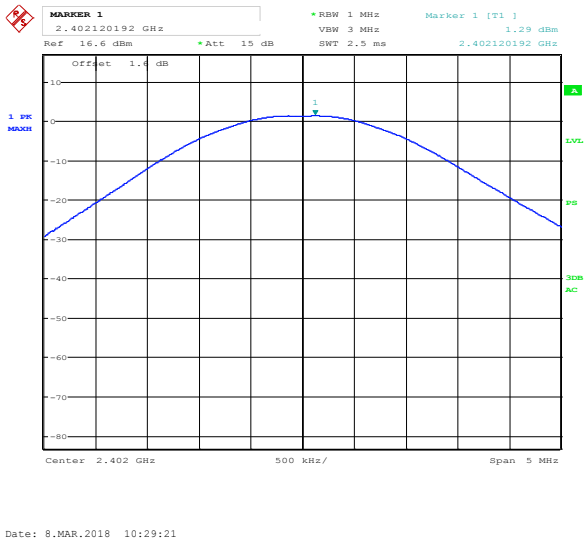


Figure 8.2-1: *Output power on low channel*

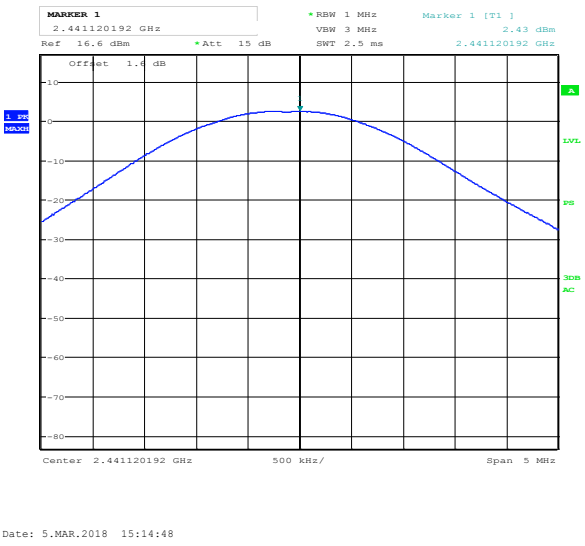


Figure 8.2-2: *Output power on mid channel*

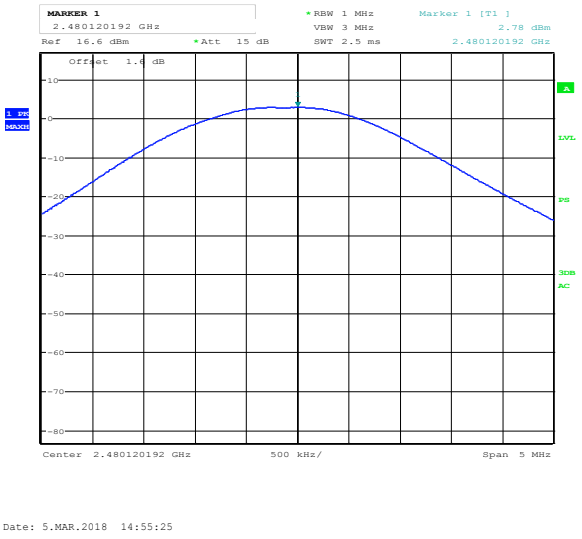


Figure 8.2-3: *Output power on high channel*

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)).

ISED:
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.

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: ISED 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

Note: Certain frequency bands listed in 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 and above 38.6 GHz are designated for low-power licence-exempt applications. These frequency bands and the requirements that apply to the devices are set out in this Standard.

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 date

Start date	March 6, 2018

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to the 10th harmonic.
EUT was set to transmit with 100 % duty cycle.
Radiated measurements were performed at a distance of 3 m

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

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

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

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

Sample of Band Edge Measurements

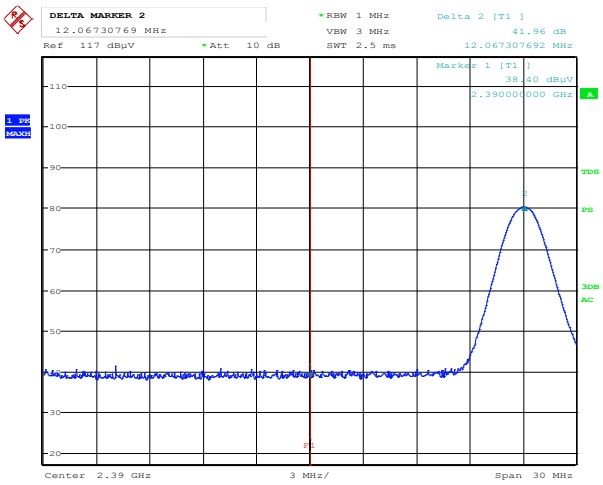


Figure 8.3-1: *Lower band edge emission, tx on low ch, FHSS mode*

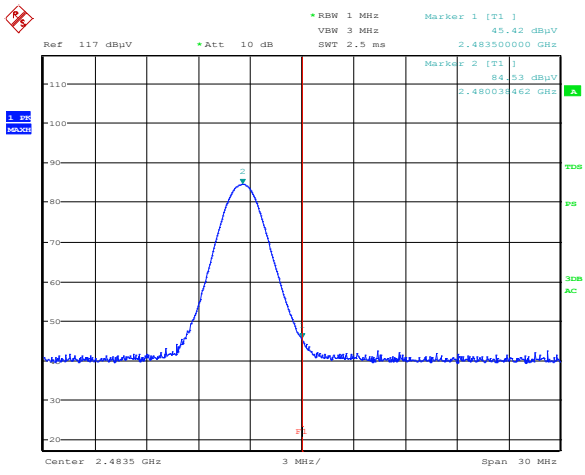


Figure 8.3-2: *Upper band edge emission, tx on high channel, FHSS mode*

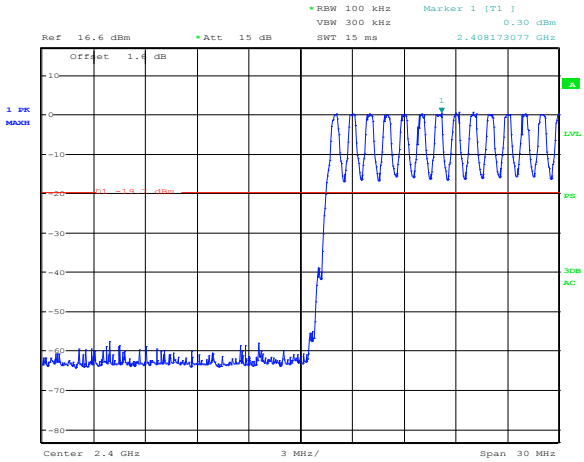


Figure 8.3-3: *Lower band edge emission, tx hopping on, FHSS mode*

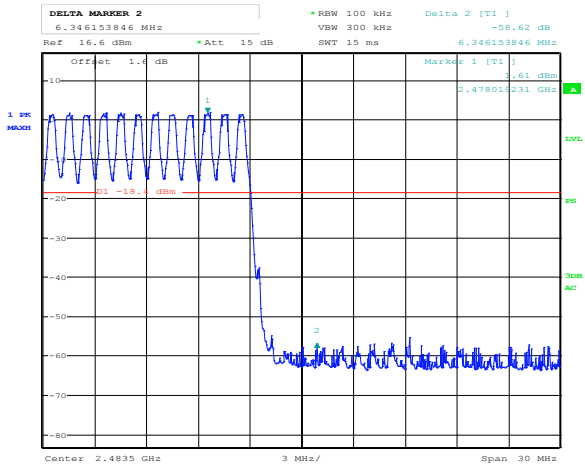


Figure 8.3-4: *Upper band edge emission, tx hopping on, FHSS mode*

Sample of Conducted Spurious Emissions Measurements

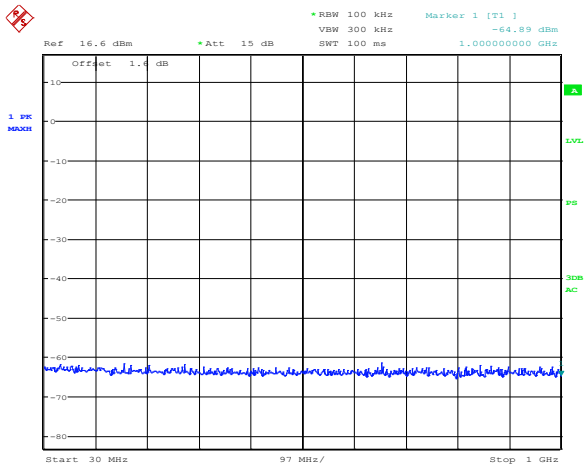


Figure 8.3-5: *Conducted spurious emissions, Low channel (30 MHz to 1 GHz)*

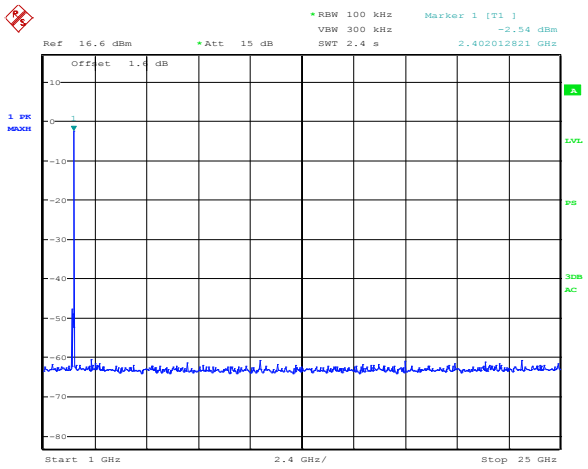


Figure 8.3-6: *Conducted spurious emissions, Low channel (1 GHz to 25 GHz)*

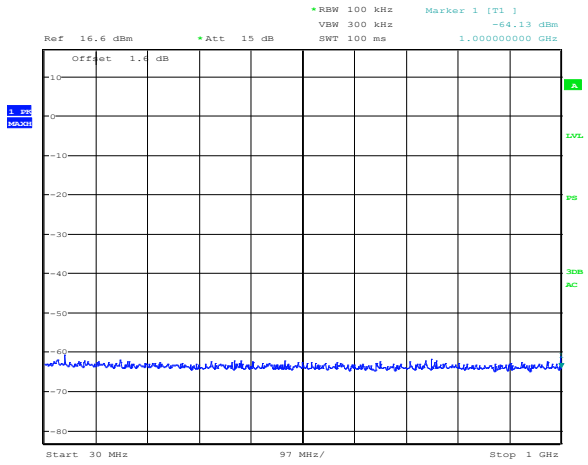


Figure 8.3-7: *Conducted spurious emissions, Mid channel (30 MHz to 1 GHz)*

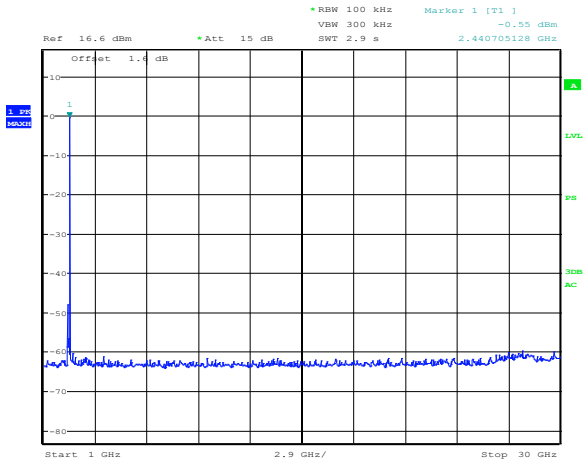


Figure 8.3-8: *Conducted spurious emissions, Mid channel (1 GHz to 25 GHz)*

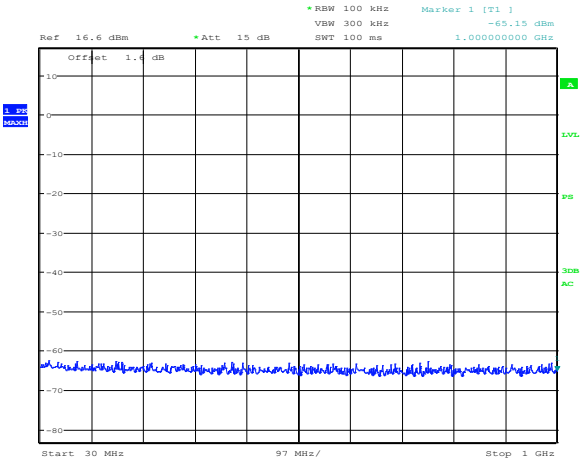


Figure 8.3-9: *Conducted spurious emissions, High channel (30 MHz to 1 GHz)*

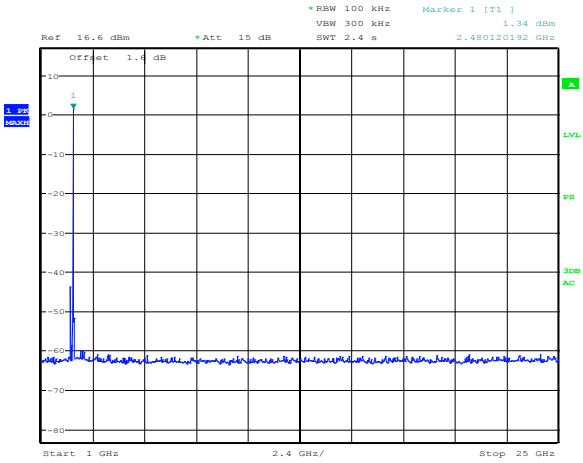


Figure 8.3-10: *Conducted spurious emissions, High channel (1 GHz to 25 GHz)*

Sample of Radiated Spurious (Out-of-band) Emissions Measurements

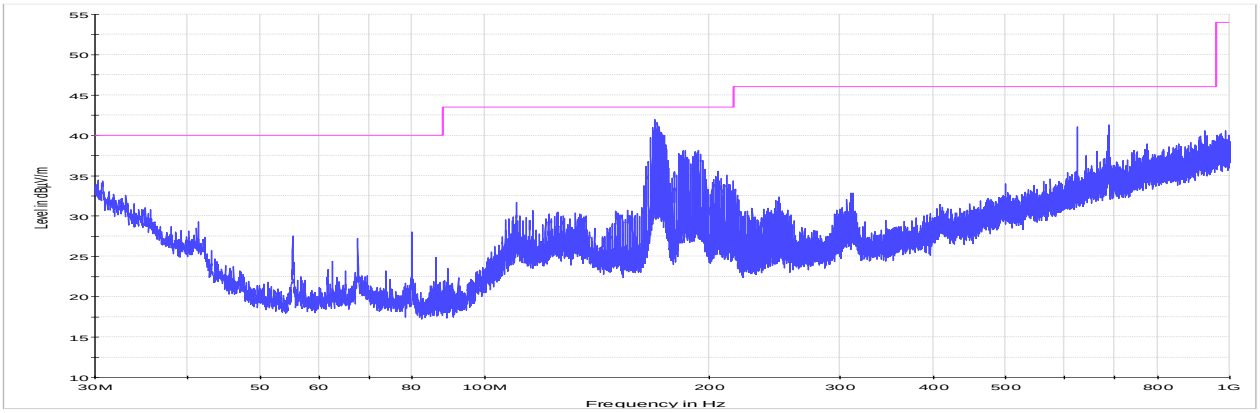


Figure 8.3-11: Radiated spurious (out-of-band) emissions, low channel, 30 to 1000 MHz

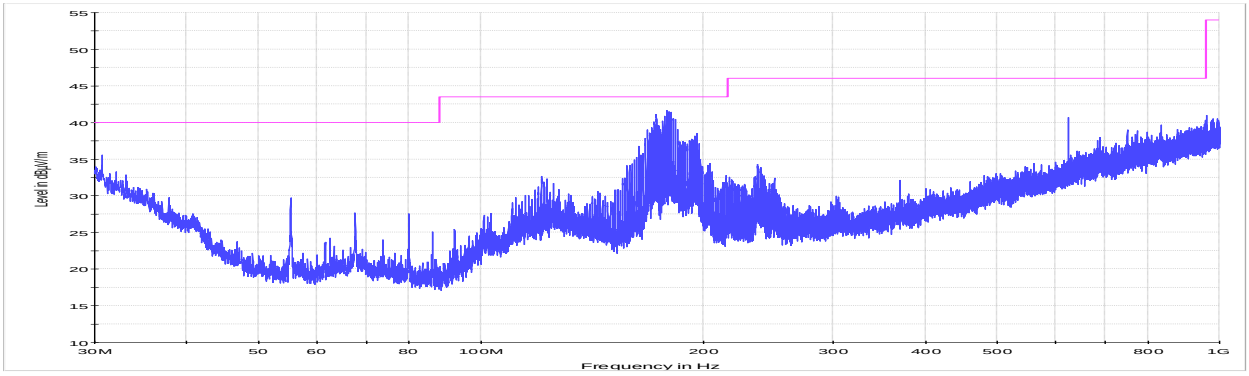


Figure 8.3-12: Radiated spurious (out-of-band) emissions, Mid channel, 30 to 1000 MHz

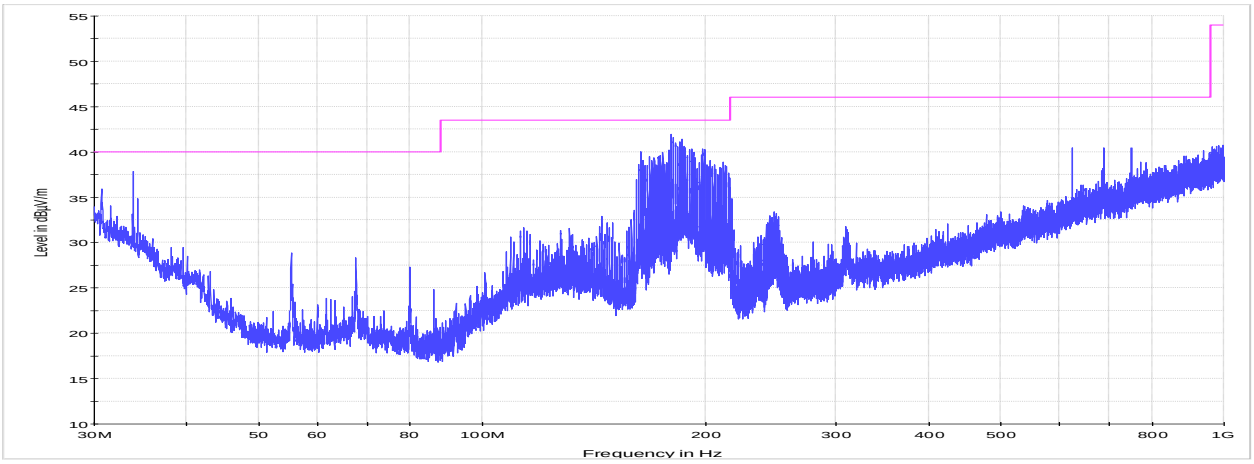


Figure 8.3-13: Radiated spurious (out-of-band) emissions, High channel, 30 to 1000 MHz

8.3.5 Test data, continued

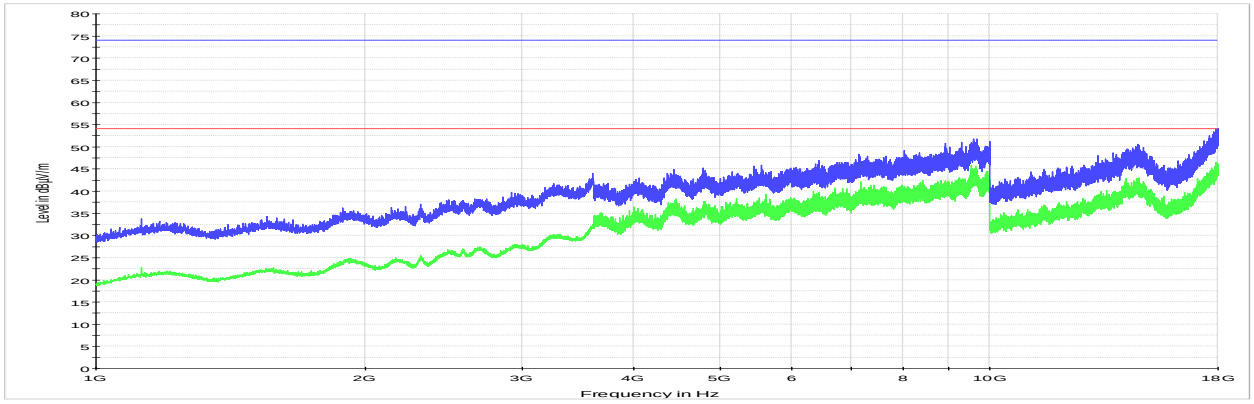


Figure 8.3-14: Radiated spurious emissions for BT, low channel – 1 to 18 GHz

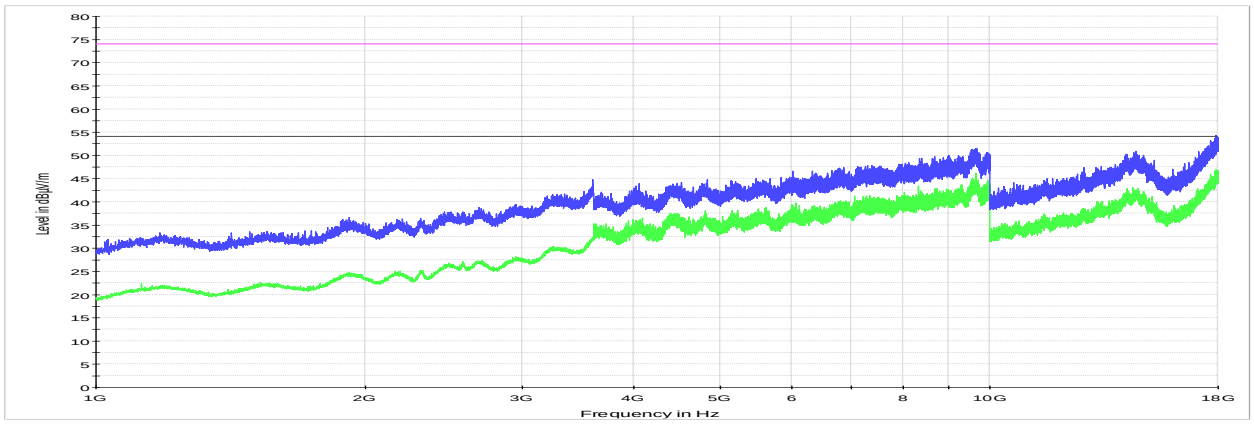


Figure 8.3-15: Radiated spurious emissions for BT, Mid channel – 1 to 18 GHz

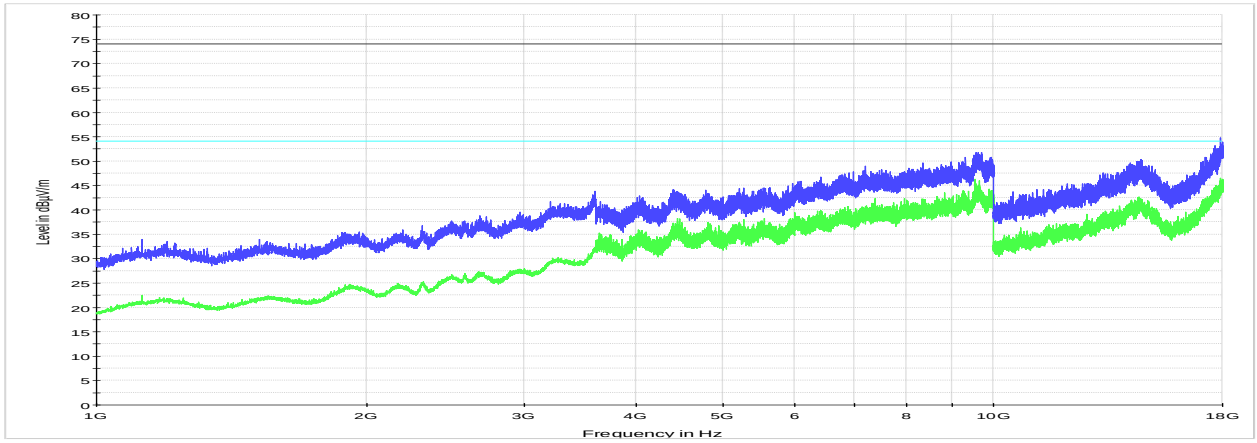


Figure 8.3-16: Radiated spurious emissions for BT, high channel – 1 to 18 GHz

Note: Spectrum was investigated up to 25 GHz, no emission related to RF transmission was detected within 6 dB below the limit above 18 GHz

8.3.5 Test data, continued

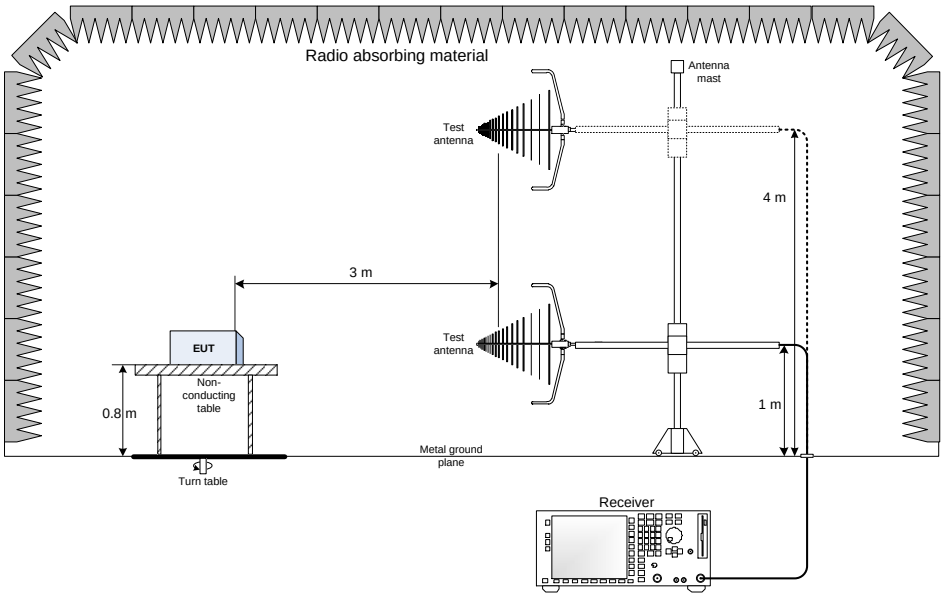
Table 8.3-4: Radiated spurious emissions test results.

Channel	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
		Measured	Limit			Limit	
GFSK_Low	7996.2	50.6	74.0	23.4	43.2	54.0	10.8
GFSK_Mid	8608	51.0	74.0	23.0	43.0	54.0	11.0
GFSK_High	7194	48.8	74.0	25.2	43.6	54.0	10.4
EDR2_Low	7997.3	50.2	74.0	23.8	42.9	54.0	11.1
EDR2_Mid	7228.4	49.7	74.0	24.3	42.5	54.0	11.5
EDR2_High	8596.4	50.3	74.0	23.7	43.3	54.0	10.7
EDR3_Low	7658.8	49.5	74.0	24.5	42.5	54.0	11.5
EDR3_Mid	8735.6	51.0	74.0	23.0	42.9	54.0	11.1
EDR3_High	7048.8	49.5	74.0	24.5	42.5	54.0	11.5

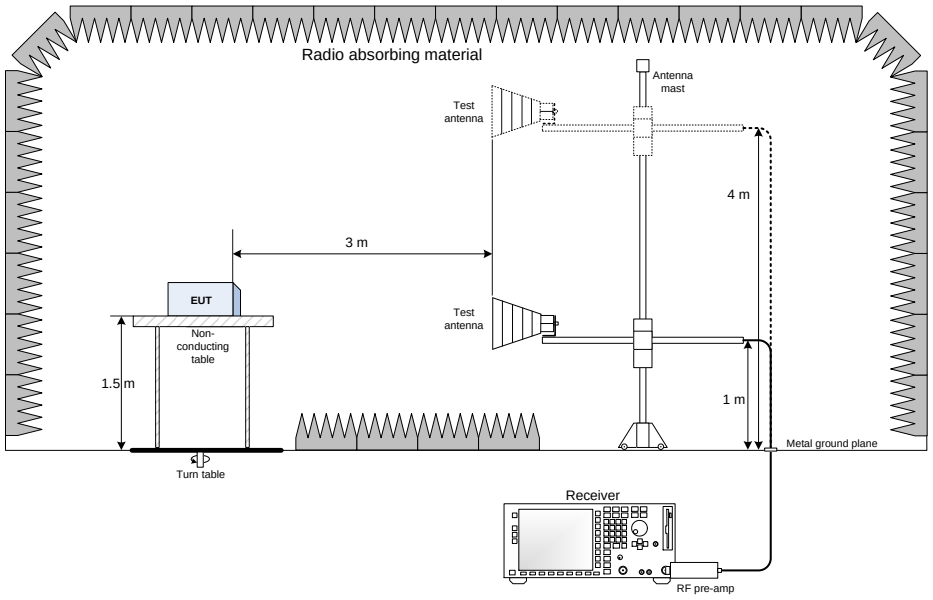
Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

Section 9. Block diagrams of test set-ups

9.1 Radiated emissions set-up for frequencies below 1 GHz



9.2 Radiated emissions set-up for frequencies above 1 GHz



9.3 Conducted antenna port set-up