ONE WORLD ○ OUR APPROVAL

Test report

344641-3TRFWL

Date of issue: June 27, 2018

Applicant:

Garmin International, Inc.

Product:

A03391

Model:

A03391

FCC ID: IPH-03391

ISED Registration number: 1792A-03391

Specifications:

- FCC 47 CFR Part 80 Subpart E
  Stations in the maritime services
- RSS-238, Issue 1, July 2013
  Shipborne Radar in the 2900–3100 MHz and 9225–9500 MHz bands

Test location

Company name	Nemko Canada Inc.
Address	303 River Road
City	Ottawa
Province	Ontario
Postal code	K1V 1H2
Country	Canada
Telephone	+1 613 737 9680
Facsimile	+1 613 737 9691
Toll free	+1 800 563 6336
Website	www.nemko.com
Site number	FCC: CA2040; ISED: 2040A-4 (3 m SAC)

Tested by	Kevin Rose, Wireless/EMC Specialist
Reviewed by	Andrey Adelberg, Senior Wireless/EMC Specialist
Date	June 27, 2018
Signature of the reviewer	

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

Table of contents

Section 1. Report summary

1.1 Applicant and manufacturer

Company name	Garmin International, Inc.
Address	1200 East 151st Street
City	Olathe
Province/State	KS
Postal/Zip code	66062
Country	USA

1.2 Test specifications

FCC 47 CFR Part 80 Subpart E	Stations in the maritime services
FCC 47 CFR Part 2 Subpart J	Equipment Authorization Procedures
RSS-238, Issue 1, July 2013	Shipborne Radar in the 2900–3100 MHz and 9225–9500 MHz bands

1.3 Test methods

ANSI C63.26-2015	American National Standard for Compliance Testing of Transmitters Used in Licensed Radio Services

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

Revision #	Details of changes made to test report
TRF	Original report issued

Section 2. Summary of test results

2.1 FCC Part 80 test results

Part 2	Part 80	Test description	Verdict
§2.1046	§80.215 (n)(3)	RF power output	Pass
§2.1049	§80.205	Occupied bandwidth	Pass
§2.1053	§80.211	Field strength of spurious radiation	Pass
§2.1055	§80.209	Frequency stability	Pass

Notes: None

2.2 RSS-238, Issue 1 test results

Part	Test description	Verdict
4.1	Frequency stability	Pass
4.2	Transmitter Output Power and Antenna Gain	Pass
4.3	Transmitter Unwanted Emissions	Pass
3.2	40 dB Bandwidth	Pass

Notes: None

2.3 IC RSS-GEN, Issue 4, test results

Part	Test description	Verdict
6.6	Occupied bandwidth	Pass

Notes: None

Section 3. Equipment under test (EUT) details

3.1 Sample information

Receipt date	January 11, 2018
Nemko sample ID number	2 (48” antenna), 1 (72” antenna), 3 (GPS MAP 8008)

3.2 EUT information

Product name	Marine Radar Equipment
Model	A03391
Serial number	NA
Part number	NA

3.3 Technical information

Frequency band	9300–9500 MHz
Frequency Min (MHz)	9335
Frequency Max (MHz)	9455
Rated output power (W)	40 peak power and 13.93 average power
RF power Max (W)	48.9 peak power and 13.06 mean power
Field strength, Units @ distance	N/A
Measured BW (kHz) (99 %)	4280
Emission classification (F1D, G1D, D1D)	P0N
Transmitter spurious, Units @ distance	75.88 dBµV/m at 18.75 GHz @ 3 m
Power requirements	30 V_{DC},
Antenna information	48” antenna with 27 dBi gain 72” antenna with 29 dBi gain The EUT uses a unique antenna coupling/ non-detachable antenna to the intentional radiator.

3.4 Product description and theory of operation

The EUT is a ship borne marine radar designed to provide bearing and distance of ships in land targets in the vicinity from the ship. The radar unit is integrated into a full Marine system installation, including the chart plotter for display purposes. As the radar sweeps through 360°, reflected signal s are displayed on the chart plotter as indications of hazards.

3.5 EUT exercise details

EUT was powered up, transmission of Radar was enabled via plotter display at selected channel (1 – low, 2 – mid, 4 – high) and distance sensitivity was selected between 72 nmi to 1/16 nmi

3.6 EUT setup diagram

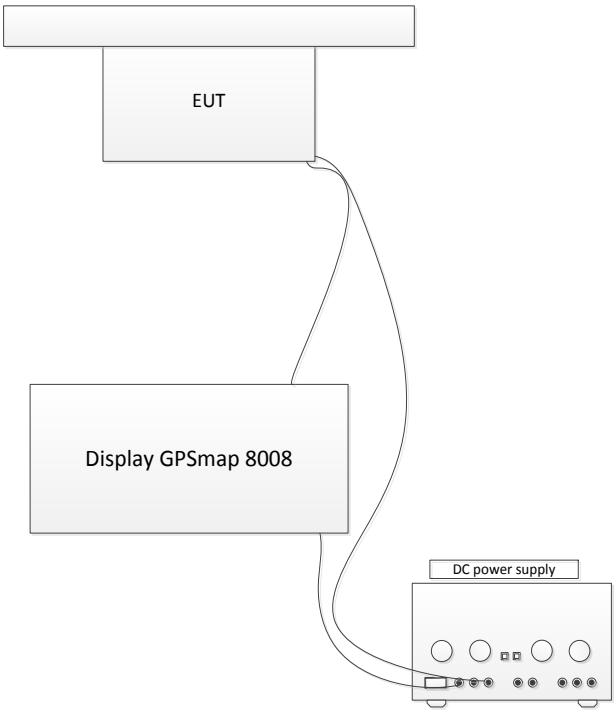


Figure 3.6-1: *Setup diagram*

3.7 EUT sub assemblies

Table 3.7-1: *EUT sub assemblies*

Description	Brand name	Model/Part number	Serial number
48” antenna	Garmin	–	1366 3963745253 00
72” antenna	Garmin	–	1366 3926701959 00
Display GPSmap 8008	Garmin	M2APGN00	1928 3855826969 00

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

A03391 uses the sample system with a lower power level

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
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.
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	Dec. 09/18
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
DC Power source	Ametek	SGA80X125C-0AAA	FA002737	—	VOU
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	March 26/19
Spectrum analyzer	Rohde & Schwarz	FSP	FA001920	1 year	Aug. 08/18
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	June 27/18
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	June 21/18
Active loop antenna (0.01–30 MHz)	Com-Power	AL-130	FA002674	1 year	June 21/18
Preamp (1–18 GHz)	ETS-Lindgren	124334	FA002877	1 year	Nov. 14/18
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU
Pre-amplifier (26–40 GHz)	Narda	DBL-2640N610	FA001556	—	VOU
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	June 27/18

Note: NCR - no calibration required, VOU - verify on use

Section 8. Testing data

8.1 FCC 2.1046, 80.215 and RSS-238 4.2 RF output power

8.1.1 Definitions and limits

FCC:
See FCC KDB guidance associated with this filing

ISED:
The transmitter output power shall not exceed 60 kW (77.8 dBm) and the antenna gain shall not exceed 35 dBi.

8.1.2 Test summary

Test date	June 11, 2018	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	42 %

8.1.3 Observations, settings and special notes

The test was performed with the spectrum analyzer:

Resolution bandwidth	≥ OBW
Video bandwidth	≥ 3 × RBW
Detector	Peak
Trace mode	Max hold

8.1.4 Test data

Table 8.1-1: *Output power measurement result RSS 238*

Transmitter range setting, nmi	Channel	Peak dBm	Conducted Limit, dBm	Margin, dB
1/16	Low	46.31	77.8	31.49
72	Low	45.05	77.8	32.75
1/16	Mid	46.40	77.8	31.40
72	Mid	45.20	77.8	32.60
1/16	High	46.89	77.8	30.91
72	High	44.99	77.8	32.81

Table 8.1-2: *Antennas types*

Type	Gain, dBi	Beam width, deg.	Sidelobe Level, dB	Front-back ratio, dB
4' waveguide slot array antenna	26.5	1.7	-23	36
6' waveguide slot array antenna	29.2	1.2	-22	39

Table 8.1-3: *Output power measurement result FCC*

Transmitter range setting, nmi	Channel	Peak Power, W	Duty cycle, %	Average power, W
1/16	Low	42.76	0.0088	0.38
72	Low	31.99	0.1393	4.46
1/16	Mid	43.65	0.0088	0.38
72	Mid	33.11	0.1393	4.61
1/16	High	48.87	0.0088	0.43
72	High	31.55	0.1393	4.39

Notes: See FCC KDB guidance associated with this filing

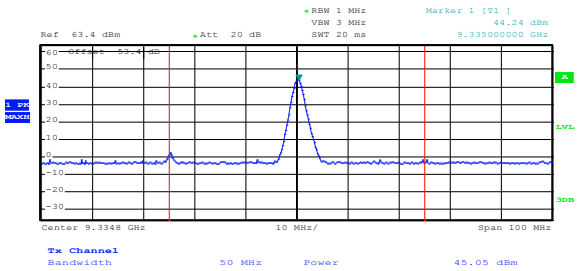


Figure 8.1-1: *Conducted Power, sample plot 72 nmi*

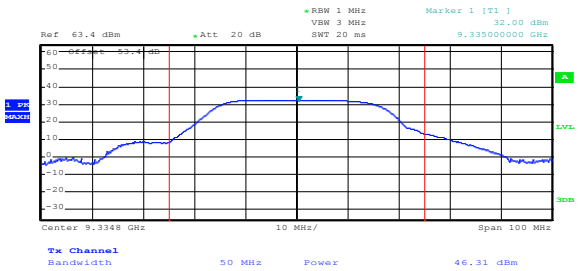


Figure 8.1-2: *Conducted Power, sample plot 1/16 nmi*

Maximum allowed antenna gain as per RSS-238 is 35 dBi.

Table 8.1-4: *Modulation Details*

		First Interval						Second Interval						
RPM	Range [NM]	Pulse Length [us]	Pulse Length [us]	Pulse Length [us]	Pulse Length [us]	Period [us]	Repetitions	Pulse Length [us]	Period [us]	Repetitions	Transmit time per frame [us]	Total Frame Length [us]	Overall Duty Cycle [%]	(High Power Unit) Avg Transmit Power [W]	(Low Power Unit) Avg Transmit Power [W]
24	0.0625	0.08	0.16	0.64	1.28	244.96	8				17.28	1959.68	0.88%	1.06	0.44
24	0.125	0.08	0.32	0.64	1.28	244.96	8				18.56	1959.68	0.95%	1.14	0.47
24	0.25	0.08	0.64	2.56	5.12	244.96	8				67.2	1959.68	3.43%	4.11	1.71
24	0.5	0.16	1.28	5.12	10.24	244.96	8				134.4	1959.68	6.86%	8.23	3.43
24	0.75	0.16	1.28	5.12	10.24	244.96	8				134.4	1959.68	6.86%	8.23	3.43
24	1	0.16	1.28	5.12	10.24	244.96	8				134.4	1959.68	6.86%	8.23	3.43
24	1.5	0.32	0.64	2.56	10.24	244.96	8				110.08	1959.68	5.62%	6.74	2.81
24	2	0.64	2.56	10.24	20.48	244.96	8				271.36	1959.68	13.85%	16.62	6.92
24	3	0.64	2.56	10.24	0	244.96	4	20.48	244.96	4	135.68	1959.68	6.92%	8.31	3.46
24	4	0.64	2.56	10.24	0	244.96	4	20.48	244.96	4	135.68	1959.68	6.92%	8.31	3.46
24	6	1.28	5.12	20.48	0	244.96	4	40.96	244.96	4	271.36	1959.68	13.85%	16.62	6.92
24	8	1.28	5.12	20.48	0	244.96	4	40.96	272	3	230.4	1795.84	12.83%	15.40	6.41
24	12	1.28	5.12	20.48	0	244.96	3	40.96	372	3	203.52	1850.88	11.00%	13.20	5.50
24	18	1.28	5.12	20.48	0	282	3	81.92	572	2	244.48	1990	12.29%	14.74	6.14
24	24	5.12	20.48	0	0	282	3	81.92	720	2	240.64	2286	10.53%	12.63	5.26
24	36	5.12	40.96	0	0	356	3	163.84	1100	1	302.08	2168	13.93%	16.72	6.97
24	48	5.12	40.96	0	0	356	3	163.84	1100	1	302.08	2168	13.93%	16.72	6.97
24	64	5.12	40.96	0	0	356	3	163.84	1100	1	302.08	2168	13.93%	16.72	6.97
24	72	5.12	40.96	0	0	356	3	163.84	1100	1	302.08	2168	13.93%	16.72	6.97
		First Interval						Second Interval							
RPM	Range [NM]	Pulse Length [us]	Pulse Length [us]	Pulse Length [us]	Pulse Length [us]	Period [us]	Repetitions	Pulse Length [us]	Period [us]	Repetitions	Transmit time per frame [us]	Total Frame Length [us]	Overall Duty Cycle [%]	(High Power Unit) Avg Transmit Power [W]	(Low Power Unit) Avg Transmit Power [W]
48	0.0625	0.08	0.16	0.64	1.28	244.96	4				8.64	979.84	0.88%	1.06	0.44
48	0.125	0.08	0.32	0.64	1.28	244.96	4				9.28	979.84	0.95%	1.14	0.47
48	0.25	0.08	0.64	2.56	5.12	244.96	4				33.6	979.84	3.43%	4.11	1.71
48	0.5	0.16	1.28	5.12	10.24	244.96	4				67.2	979.84	6.86%	8.23	3.43
48	0.75	0.16	1.28	5.12	10.24	244.96	4				67.2	979.84	6.86%	8.23	3.43
48	1	0.16	1.28	5.12	10.24	244.96	4				67.2	979.84	6.86%	8.23	3.43
48	1.5	0.32	0.64	2.56	10.24	244.96	4				55.04	979.84	5.62%	6.74	2.81
48	2	0.64	2.56	10.24	20.48	244.96	4				135.68	979.84	13.85%	16.62	6.92
48	3	0.64	2.56	10.24	0	244.96	2	20.48	244.96	2	67.84	979.84	6.92%	8.31	3.46
48	4	0.64	2.56	10.24	0	244.96	2	20.48	244.96	2	67.84	979.84	6.92%	8.31	3.46
48	6	1.28	5.12	20.48	0	244.96	2	40.96	244.96	2	135.68	979.84	13.85%	16.62	6.92
48	8	1.28	5.12	20.48	0	244.96	2	40.96	272	1	94.72	761.92	12.43%	14.92	6.22
48	12	1.28	5.12	20.48	0	244.96	1	40.96	372	1	67.84	616.96	11.00%	13.20	5.50

8.2 FCC 2.1049 and RSS-238 3.2 Occupied bandwidth

8.2.1 Definitions and limits

FCC:
The occupied bandwidth, that is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers radiated are each equal to 0.5 percent of the total mean power radiated by a given emission
ISED:
In addition to the required information and measurements specified in RSS‑Gen, the test report submitted with the application shall contain the following information: the 40 dB bandwidth.

8.2.2 Test summary

Test date	June 27, 2018	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	42 %

8.2.3 Observations, settings and special notes

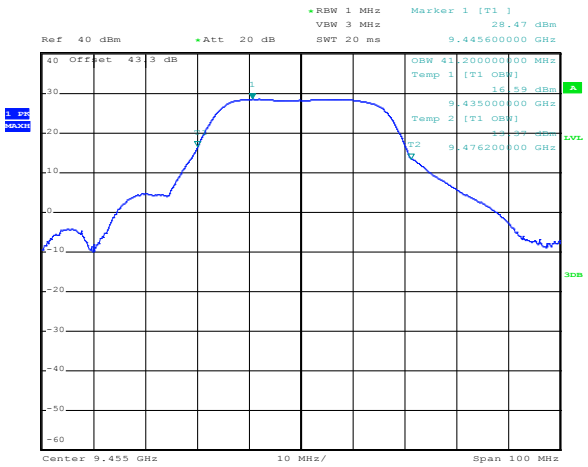
Spectrum analyser settings:

Resolution bandwidth	1% to 5% of the anticipated OBW
Video bandwidth	≥ 3 × RBW
Detector mode	Peak
Trace mode	Max Hold

8.2.4 Test data

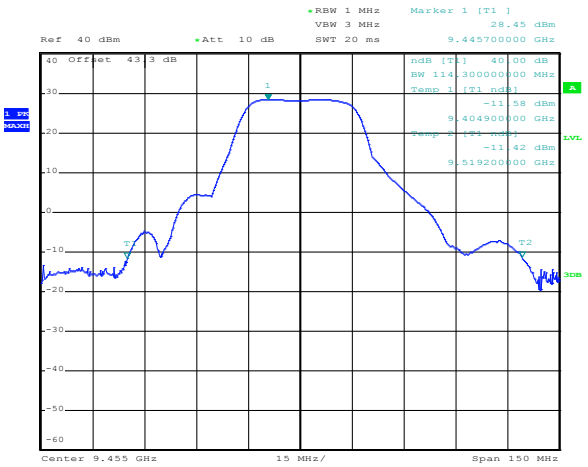
Table 8.2-1: *Occupied bandwidth measurement results*

Transmitter range setting, nmi	99% occupied bandwidth, MHz	40 dB bandwidth, MHz
1/16	41.2	114.3
72	0.378	1.494



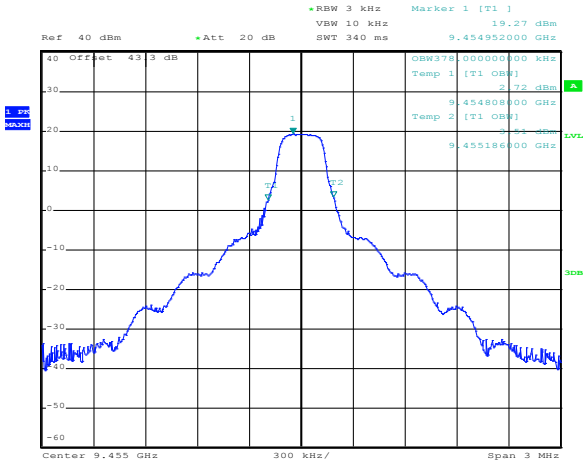
Date: 26.JUN.2018 15:22:18

Figure 8.2-1: *99 % Occupied bandwidth, 1/16 nmi*



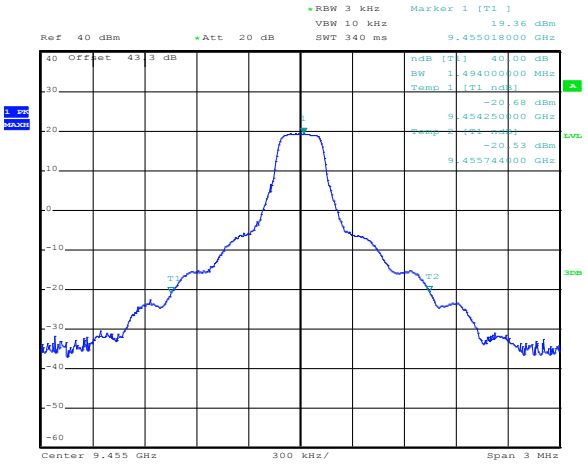
Date: 26.JUN.2018 15:23:38

Figure 8.2-2: *40 dB bandwidth, 1/16 nmi*



Date: 26.JUN.2018 15:20:20

Figure 8.2-3: *99 % Occupied bandwidth, 72 nmi*



Date: 26.JUN.2018 15:19:10

Figure 8.2-4: *40 dB bandwidth, 72 nmi*

8.3 FCC 2.1053, 80.211(f) and RSS-238 4.3 Field strength of spurious radiation

8.3.1 Definitions and limits

FCC:

(a) Measurements shall be made to detect spurious emissions that may be radiated directly from the cabinet, control circuits, power leads, or intermediate circuit elements under normal conditions of installation and operation. Curves or equivalent data shall be supplied showing the magnitude of each harmonic and other spurious emission. For this test, single sideband, independent sideband, and controlled carrier transmitters shall be modulated under the conditions specified in paragraph (c) of §2.1049, as appropriate. For equipment operating on frequencies below 890 MHz, an open field test is normally required; with the measuring instrument antenna located in the far field at all test frequencies. In the event it is either impractical or impossible to make open field measurements (e.g. a broadcast transmitter installed in a building) measurements will be accepted of the equipment as installed. Such measurements must be accompanied by a description of the site where the measurements were made showing the location of any possible source of reflections, which might distort the field strength measurements. Information submitted shall include the relative radiated power of each spurious emission with reference to the rated power output of the transmitter, assuming all emissions are radiated from half wave dipole antennas.

(b) The measurements specified in paragraph (a) of this section shall be made for the following equipment:

(1) Those in which the spurious emissions are required to be 60 dB or more below the mean power of the transmitter.
(2) All equipment operating on frequencies higher than 25 MHz.
(3) All equipment where the antenna is an integral part of, and attached directly to the transmitter.
(4) Other types of equipment as required, when deemed necessary by the Commission.

80.211

(f) The mean power when using emissions other than those in paragraphs (a), (b), (c) and (d) of this section:

(1) On any frequency removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth: At least 25 dB;
(2) On any frequency removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth: At least 35 dB; and
(3) On any frequency removed from the assigned frequency by more than 250 percent of the authorized bandwidth: At least 43 plus $10\log_{10}$ (mean power in watts) dB (−13 dBm).

ISED:

The unwanted emission and the transmitter power shall be measured using a peak detector.
The unwanted emission power in any 1 MHz bandwidth shall be attenuated below the transmitter peak power by at least 20 dB per decade from the edge of the 40 dB bandwidth and beyond.
The unwanted emissions power shall not need to be attenuated more than 60 dB below the transmitter peak power.

Table 8.3-1: *Spurious emissions limit as per FCC requirements*

Frequency range, MHz	Attenuation below carrier, dBc	Spurious emissions, dBm	Field strength of spurious radiation* at 3 m, dBµV/m
30–40 000	43 + 10 Log_{10} (P)	−13	82.23

Note: −13 dBm + 95.23 dB = 82.23 dBµV/m

Table 8.3-2: *Spurious emissions limit as per RSS requirements*

Frequency range, MHz	Attenuation below carrier, dBc
30–40 000	60

8.3.2 Test summary

Test date	June 11, 2018	Temperature	23 °C
Test engineer	Kevin Rose	Air pressure	1007 mbar
Verdict	Pass	Relative humidity	42 %

8.3.3 Observations, settings and special notes

The spectrum was searched from 30 MHz to 40 GHz.
RSS-238 The unwanted emission and the transmitter power shall be measured using a peak detector.

The unwanted emission power in any 1 MHz bandwidth shall be attenuated below the transmitter peak power by at least 20 dB per decade from the edge of the 40 dB bandwidth and beyond.

The unwanted emissions power shall not need to be attenuated more than 60 dB below the transmitter peak power.:

Resolution bandwidth	120 kHz
Video bandwidth	300 kHz
Detector mode	Peak
Trace mode	Max Hold

Spectrum analyser settings for measurements above 1 GHz:

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

8.3.4 Test data

Table 8.3-3: *Radiated emissions (Quasi-Peak) results*

Frequency (MHz)	Quasi-Peak field strength[1] (dBµV/m)	3 m Quasi-Peak limit [3] (dBµV/m)	Margin (dB)	Measurement time (ms)	Bandwidth (kHz)	Antenna height (cm)	Pol. (V/H)	Turn table position (°)	Correction factor[2] (dB)
30.600	27.6	49.6	22.0	100	120	106.8	V	298.0	22.7
55.300	34.5	49.6	15.1	100	120	101.9	V	83.0	8.2
56.000	34.6	49.6	15.0	100	120	102.2	V	50.0	8.3
116.225	30.8	54.0	23.2	100	120	101.9	V	208.0	15.2
200.000	34.3	54.0	19.7	100	120	150.0	H	158.0	14.9
212.850	35.6	54.0	18.5	100	120	179.4	V	228.0	13.0
374.325	29.4	56.9	27.5	100	120	100.0	H	121.0	17.8
395.975	36.5	56.9	20.4	100	120	126.8	V	116.0	18.1
663.225	23.6	56.9	33.3	100	120	188.2	V	27.0	23.0
991.675	27.4	60.0	32.6	100	120	187.7	V	340.0	26.8

Notes: [1] Field strength (dBµV/m) = receiver/spectrum analyzer value (dBµV) + correction factor (dB)
[2] Correction factor = antenna factor ACF (dB) + cable loss (dB)
[3] Emissions that were continuously present for a minimum of 1 second and occurred more than once for every 15 seconds observation period were considered valid emissions. The maximum value of valid emissions have been recorded.
Sample calculation: 27.1 dBµV/m (field strength) = 0.4 dBµV (receiver reading) + 26.7 dB (Correction factor)

Table 8.3-4: *Spurious emissions measurement results, harmonics FCC*

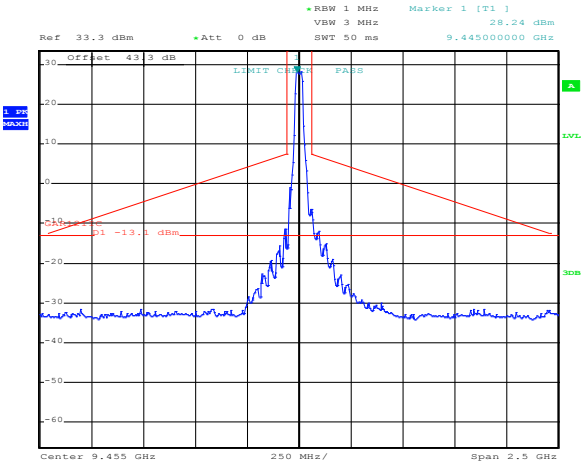
Channel	Frequency, GHz	Spurious emission at 3 m, dBµV/m	Limit, dBµV/m	Margin, dB
Low	18.67	73.27	82.23	8.96
Mid	18.75	75.88	82.23	6.35
High	18.90	74.74	82.23	7.49

No other harmonics were detected.

Table 8.3-5: *Spurious emissions measurement results, harmonics RSS 238*

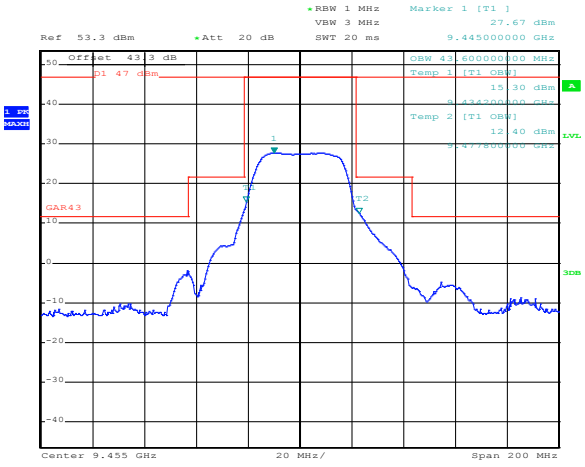
Channel	Frequency, GHz	Spurious emission, dBm	Limit, dBm	Margin, dB
Low	18.67	-21.96	16.09	38.05
Mid	18.75	-19.35	16.09	35.44
High	18.90	-20.49	16.09	36.58

Note: Fundamental highest EIRP is 76.09 dBm (46.89 dBm + 29.2 dBi). Spurious emissions limit was calculated as follows:
76.09 dBm – 60 dB = 16.09 dBm



Date: 21.JUN.2018 14:38:07

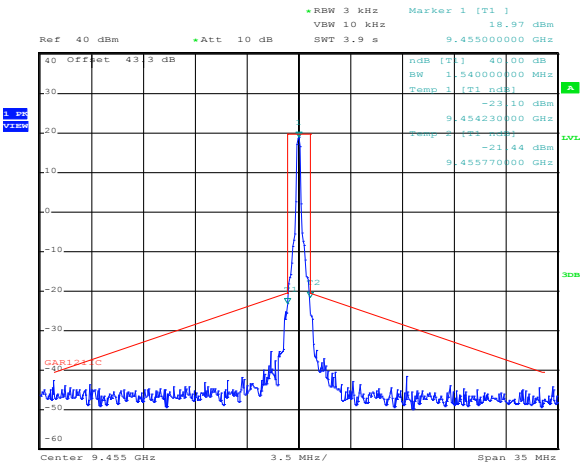
Figure 8.3-1: *ISED Mask 1/16 nmi*



Date: 21.JUN.2018 14:49:23

Figure 8.3-2: *FCC mask 1/16 nmi*

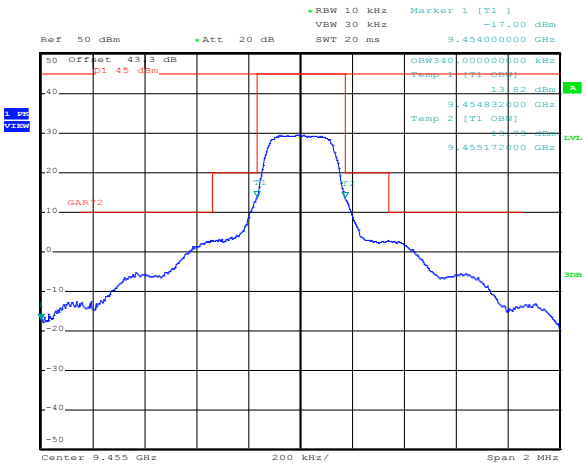
Note: −13.1 dBm is 60 dBc peak power



Date: 26.JUN.2018 16:01:13

Figure 8.3-3: *ISED Mask 72 mni*

Note:3 kHz was used to accurately determine compliance due to the fundamental is < 1 MHz



Date: 21.JUN.2018 15:10:55

Figure 8.3-4: *FCC mask 72 nmi*

Note:10 kHz was used to accurately determine compliance

8.4 FCC 2.1055, RSS-238 4.1 Frequency stability

8.4.1 Definitions and limits

FCC:

(a) The frequency stability shall be measured with variation of ambient temperature as follows:

(1) From −30°C to +50°C for all equipment except that specified in paragraphs (a)(2) and (3) of this section

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° C through the range.

(d) The frequency stability shall be measured with variation of primary supply voltage as follows:

(1) Vary primary supply voltage from 85 to 115 percent of the nominal value for other than hand carried battery equipment.

ISED:

The carrier frequency shall not depart from the reference frequency in excess of 800 ppm for equipment which operates in the band 2900–3100 MHz nor in excess of 1250 ppm for equipment which operates in the band 9225–9500 MHz.

8.4.2 Test summary

Test date:	June 11, 2018	Temperature	23 °C
Test engineer:	Kevin Rose	Air pressure	1007 mbar
Verdict:	Pass	Relative humidity	42 %

8.4.3 Observations, settings and special notes

Note: Given that the narrowest pulse width we use is 80 ns, the worst case limits are as follows.

Upper Limit: 9500-(1.5/0.08) = 9481 MHz

Lower Limit: 9300+(1.5/0.08) = 9319 MHz

Spectrum analyser settings:

Resolution bandwidth	≥ 1 % of emission bandwidth
Video bandwidth	≥ 3 × RBW
Frequency span	Wider than emission bandwidth
Detector mode	Peak

8.4.4 Test data

Table 8.4-1: *Frequency drift measurement results*

Test conditions	Frequency, GHz	Drift, ppm	Limit, ppm	Margin, ppm
+50 °C, Nominal	9.4550050	1.27	1250	1248.73
+40 °C, Nominal	9.4550000	0.74	1250	1249.26
+30 °C, Nominal	9.4549970	0.42	1250	1249.58
+20 °C, +15 %	9.4549930	0.00	1250	1250.00
+20 °C, Nominal	9.4549930	Reference	1250	Reference
+20 °C, -15 %	9.4549930	0.00	1250	1250.00
+10 °C, Nominal	9.4549950	0.21	1250	1250.21
0 °C, Nominal	9.4549860	-0.74	1250	1249.26
−10 °C, Nominal	9.4549840	-0.95	1250	1249.05
−20 °C, Nominal	9.4549840	-0.95	1250	1249.05
−30 °C, Nominal	9.4549860	-0.74	1250	1249.26

Note: Offset was calculated as per the following formula:

$$\frac{F_{Measured} - F_{reference}}{F_{reference}} \times 1 \cdot 10^{6}$$

Table 8.4-2: *Frequency drift measurement results FCC worst case*

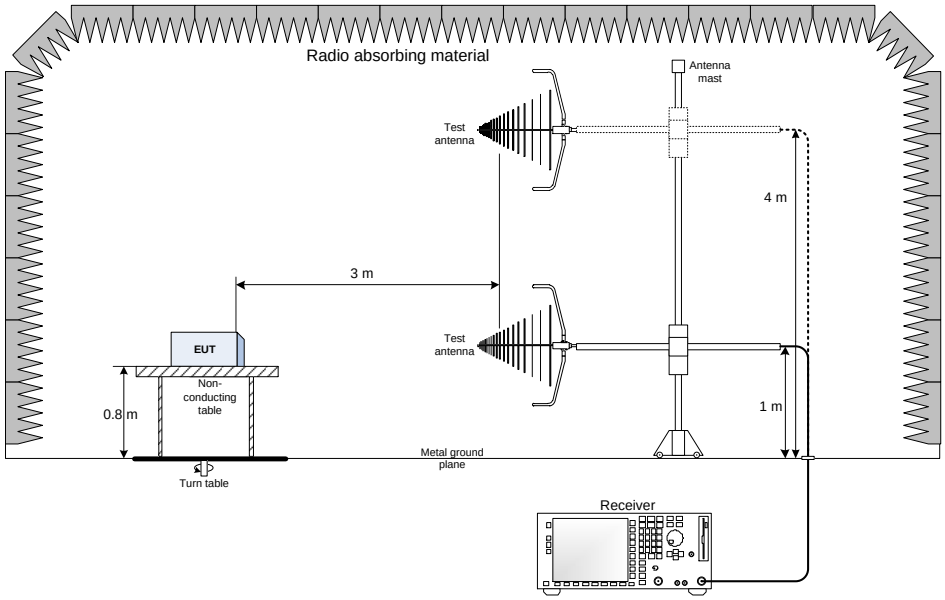
Limit, GHz	99% point, GHz	Margin, MHz
>9.319	9.350	31
<9.481	9.455	26

Note: According to FCC part 80 guidance plus TCB training note (part 80.209(b))

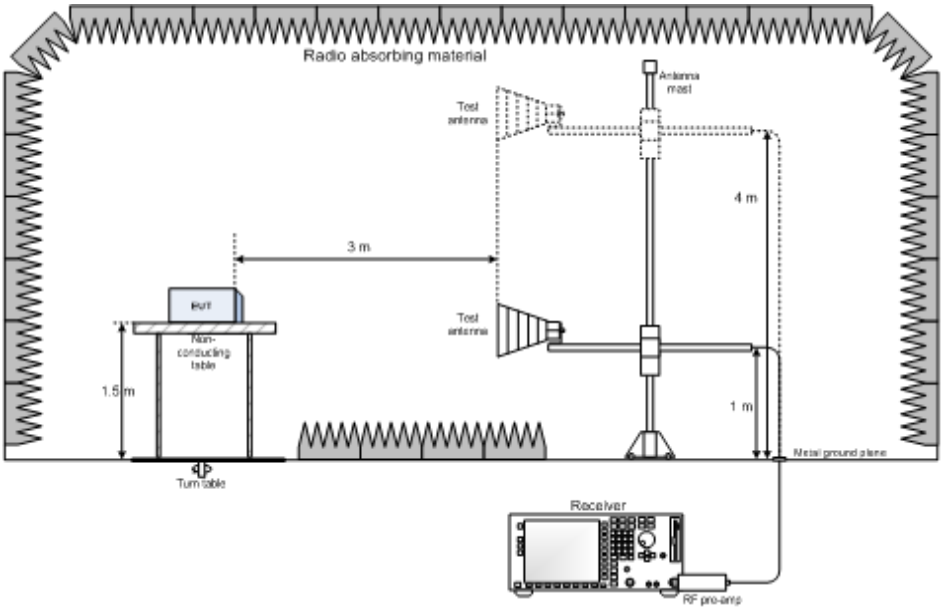
Frequency Stability – temperature & voltage
variation
– Sections 2.1055, 80.209(b)
– 1.5/T where T=Pulse Duration (microseconds)
• Upper Limit = 9500 – 1.5/T
• Lower Limit = 9300 + 1.5/T

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 Antenna port set-up