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Report Reference ID:	153478-1TRFWL

Test specification:	Title 47 – Telecommunication Chapter I – Federal Communications Commission Subchapter D – Safety and special radio services **Part 90 –** Private land mobile services **Subpart F – Radiolocation service**

Applicant:	Amphitech Systems 3440 Avenue Francis-Hughes, Suite 120 Laval, QC H7L 5A9
Apparatus:	Perimeter Surveillance Radar
FCC ID:	UMN-PSR-MRR
Model:	921-0011-05-R01

Testing laboratory:	**Nemko Canada Inc.** 303 River Road Ottawa, ON, Canada K1V 1H2 Telephone: (613) 737-9680 Facsimile: (613) 737-9691

	Name and title	**Date**
Tested by:	Andrey Adelberg, Senior Wireless/EMC Specialist	**September 16, 2010**
Reviewed by:	 Richard Brazeau, Laboratory Manager	September 16, 2010

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LAB Accrédité CCN

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The tests included in this report are within the scope of this accreditation.

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Section 1: Report summary

1.1 Test specification

Specifications	**Part 90 – Private land mobile services** Subpart F – Radiolocation service

1.2 Statement of compliance

Compliance	In the configuration tested the EUT was found compliant Yes ☒ No ☐ This report contains an assessment of apparatus against specifications based upon tests carried out on samples submitted at Nemko Canada Inc. These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 90; Subpart F. Radiated tests were conducted in accordance with ANSI C63.4-2003 and conducted tests were performed in accordance with ANSI TIA-603-B-2002.

1.3 Exclusions

Exclusions	None

1.4 Registration number

Test site FCC ID number	176392 (3 m Semi anechoic chamber)

1.5 Test report revision history

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

1.6 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.

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Section 2: Summary of test results

2.1 FCC Part 90 Subpart F – Intentional Radiators, test results

Part	Test description	Verdict
§1.1310	Limits for maximum permissive exposure	Pass
§2.1046	Output power	Pass
§2.1049	Occupied bandwidth	Pass
§2.1051	Spurious emissions at the antenna terminal	Pass
§2.1053	Field strength of spurious radiation	Pass
§2.1055	Frequency stability	Pass
Notes: None		

Section 3: Equipment under test (EUT) and application details

3.1 Applicant details		
Applicant complete business name	Name:	Amphitech Systems
	Federal Registration Number (FRN):	0015516792
	Grantee code	UMN
Mailing address	Address: City: Province/State: Post code: Country:	3440 Francis-Hughes, Suite 120 Laval Quebec H7L 5A9 Canada

3.2 Modular equipment	
a) Single modular approval	Single modular approval Yes ☐ No ☒
b) Limited single modular approval	Limited single modular approval Yes ☐ No ☒

3.3 Product details		
FCC ID	Grantee code:	UMN
	Product code:	-PSR-MRR
Equipment class	TNB	
Description of product as it is marketed	A high resolution radar system	
	Model name/number:	921-0011-05-R01
	Serial number:	0810RR0T1

3.4 Application purpose	
Type of application	☒ Original certification ☐ Change in identification of presently authorized equipment Original FCC ID: Grant date: ☐ Class II permissive change or modification of presently authorized equipment

3.5 Composite/related equipment	
a) Composite equipment	The EUT is a composite device subject to an additional equipment authorization Yes ☐ No ☒
b) Related equipment	The EUT is part of a system that operates with, or is marketed with, another device that requires an equipment authorization Yes ☐ No ☒
c) Related FCC ID	If either of the above is “yes”: ☐ has been granted under the FCC ID(s) listed below: ☐ is in the process of being filled under the FCC ID(s) listed below: ☐ is pending with the FCC ID(s) listed below: ☐ has a mix of pending and granted statues under the FCC ID(s) listed below: i FCC ID: ii FCC ID:

3.6 Sample information

Receipt date:	June 30, 2010
Nemko sample ID number:	1

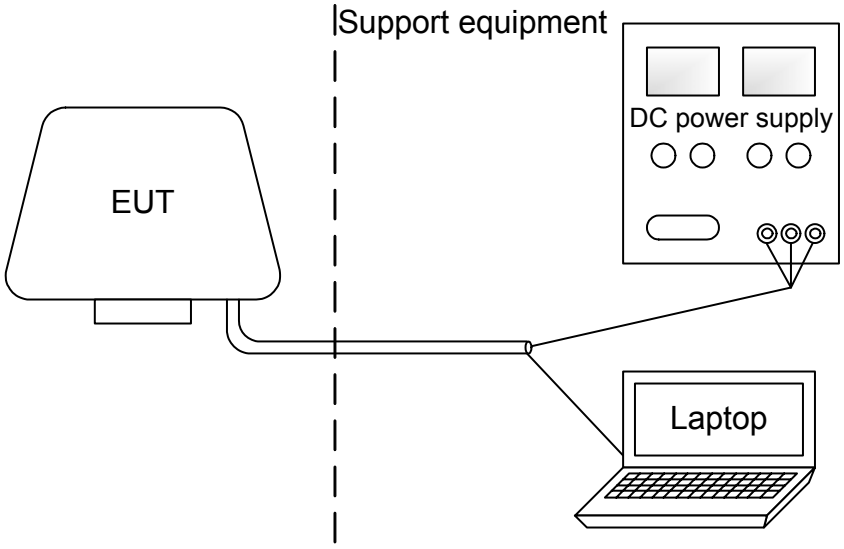
3.7 EUT technical specifications

Operating band:	33400–36000 MHz
Operating frequency:	34650–35350 MHz
Modulation type:	Swept frequency
Occupied bandwidth:	501.6 MHz
Emission designator:	502MN0N
Antenna type:	32 dBi bi-static antenna
Power source:	28 Vdc from DC power supply powered from 120 VAC, 60 Hz

3.8 Operation of the EUT during testing

Details:	During testing the sweeping modulation was stopped using software commands

3.9 EUT setup diagram



Section 4: Engineering considerations

4.1 Modifications incorporated in the EUT

Modifications	Modifications performed to the EUT during this assessment None ☒ Yes ☐, performed by Client ☐ or Nemko ☐ Details:

4.2 Deviations from laboratory tests procedures

Deviations	Deviations from laboratory test procedures None ☒ Yes ☐ - details are listed below:

4.3 Technical judgment

Judgment	None

Section 5: Test conditions

5.1 Power source and ambient temperatures

Normal temperature, humidity and air pressure test conditions	Temperature: 15–30 °C Relative humidity: 20–75 % Air pressure: 86–106 kPa 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.
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

Nemko Canada measurement uncertainty has been calculated using guidance of UKAS LAB 34:2003 and TIA-603-B Nov 7, 2002. All calculations have been performed to provide a confidence level of 95 % and can be found in Nemko Canada document MU-003.

Section 7: Test equipment

7.1 Test equipment list

Equipment	Manufacturer	Model No.	Asset/Serial No.	Next cal.
3 m EMI Test Chamber	TDK	SAC-3	FA002047	Mar. 09/11
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR
Controller	Sunol	SC104V	FA002060	NCR
Antenna Mast	Sunol	TLT2	FA002061	NCR
International Power Supply	California Inst.	3001i	FA001021	COU
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Jan. 14/11
Bilog Antenna	Sunol	JB3	FA002108	Jan. 18/11
Horn Antenna #2	EMCO	3115	FA000825	Jan. 18/11
Horn 18–26.5 GHz	Electro-Metrics	SH-50/60-1	FA000479	COU
Horn 26.5–40 GHz	Electro-Metrics	SH-50/60-2	FA000485	COU
18–26 GHz Amplifier	NARDA	BBS-1826N612	FA001550	COU
26–40 GHz Amplifier	NARDA	DBL-2640N610	FA001556	COU
1–18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 07/10
Mixer/Antenna (40-60GHz)	Olsen	M19HWA	FA001523	VOU
Mixer/Antenna (60-90GHz)	Olsen	M12HWA	FA001524	VOU
Mixer/Antenna (90-140GHz)	Olsen	M08HWA	FA001525	VOU
Mixer/Antenna (140-220GHz)	Olsen	M05HWA	FA001526	VOU
Harmonic Generator	Olsen	40200WGS	FA001546	VOU
Signal Generator	Rhode & Schwarz	SMR 40	FA001879	Aug. 14/10
Spectrum Analyzer	Rohde & Schwarz	FSU46	FA001877	Sep 29/10

Note: N/A = Not applicable, NCR = No cal required, COU = Cal on use; VOU = verify on use

Section 8: Testing data

8.1 Clause 1.1310 Limits for maximum permissible exposure

The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Table 1 – Limits for maximum permissible exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm²)	Averaging time (minutes)
(A) Limits for occupational/controlled exposures				
0.3–3.0	614	1.63	*(100)	6
3.0–30	1842/f	4.89/f	*(900/f²)	6
30–300	61.4	0.163	1.0	6
300–1 500			F/300	6
1 500–100 000			5	6
(B) Limits for general population/uncontrolled exposure				
0.3–1.34	614	1.63	*(100)	30
1.34–30	824/f	2.19/f	*(180/f²)	30
30–300	27.5	0.073	0.2	30
300–1 500			f/1 500	30
1 500–100 000			1.0	30

f = frequency in MHz
* = Plane-wave equivalent power density

Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.
General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or cannot exercise control over their exposure.

Special notes

The test was performed using isotropic probe. The measurements were performed at the EUT and back up to 30 cm from EUT's Radome.

Test data

Measured results

Distance from EUT (cm)	Power density (mW/cm²)	Rotation correction factor	Average power density (mW/cm²)	Limit (mW/cm²)	Margin (mW/cm²)
0	1.885	0.283	0.533	1.000	0.467
5	1.687	0.226	0.381	1.000	0.619
10	1.525	0.189	0.288	1.000	0.712
20	1.123	0.141	0.158	1.000	0.842
30	0.843	0.113	0.095	1.000	0.905

Rotation correction factor:

$$\left(\frac{a}{2\pi d}\right)\times\frac{360}{\theta}$$

where a = length of antenna = 0.3556 m
d = distance from antenna 0.2 m at the edge of Radome
θ = scan angle (360° for full turn)

This measurement data was obtained from test report 111264-3TRFWL for FCC ID: UMN-PSR-1400C and continues to be valid for this equipment. The only difference differences between this equipment and the previous version are

- Transceiver re-packaging by a new manufacturer to improve reliability (the RF oscillator remains unchanged)
- An RF detect signal has been added
- The RF mounting plate, the waveguides and cables have been adjusted to fit with the transceiver re-packaging.

No changes have been made to the waveform, output power, antenna and rotation velocity.

8.2 Clause 2.1046 Output power

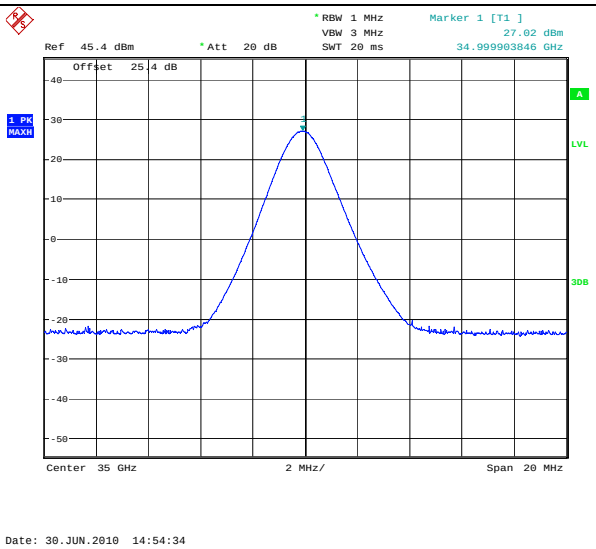
For measurements conducted pursuant to paragraphs (a) and (b) of this section, all calculations and methods used by the applicant for determining carrier power or peak envelope power, as appropriate, on the basis of measured power in the radio frequency load attached to the transmitter output terminals shall be shown. Under the test conditions specified, no components of the emission spectrum shall exceed the limits specified in the applicable rule parts as necessary for meeting occupied bandwidth or emission limitations.

Special notes

The test was performed using peak detector of the spectrum analyzer with RBW of 1 MHz and VBW of 3 MHz. The test was performed with the sweeping turned off.

Test data

Measured results



Frequency (GHz)	Output power (dBm)
35.00	27.02

8.3 Clause 2.1049 Occupied bandwidth

Emission bandwidth must be within assigned band.

Frequency band (MHz)	Channel spacing (kHz)	Authorized bandwidth (kHz)
Below 25*		
25–50	20	20
72–76	20	20
150–174	7.5	20/11.25/6
216–220	6.25	20/11.25/6
220–222	5	4
406–512*	6.25	20/11.25/6
806–809/851–854	12.5	20
809–824/854–869	25	20
896–901/935–940	12.5	13.6
902–928		
929–930	25	20
1427–1432	12.5	12.5
2450–2483.5*		
Above 2500*		

* Bandwidths for radiolocation stations in the 420–450 MHz band and for stations operating in bands subject to this footnote will be reviewed and authorized on a case-by-case basis.

§90.103(b) Radiolocation service frequency table

Frequency (MHz)	Class station(s)
0.07–0.09	Radiolocation land or mobile
0.09–0.11	Radiolocation land
0.11–0.13	Radiolocation land or mobile
1.705–1.715	Radiolocation land or mobile
1.715 to 1.8	Radiolocation land or mobile
1.9 to 2.0	Radiolocation land or mobile
3.23–3.4	Radiolocation land or mobile
420–450	Radiolocation land or mobile
2 450–2 500	Radiolocation land or mobile
2 900 to 3 650	Radiolocation land or mobile
5 250 to 5 650	Radiolocation land or mobile
8 500 to 10 550	Radiolocation land or mobile
13 400 to 14 000	Radiolocation land or mobile
15 700–17 300	Radiolocation land or mobile
24 050–24 250	Radiolocation land or mobile
33 400–36 000	Radiolocation land or mobile

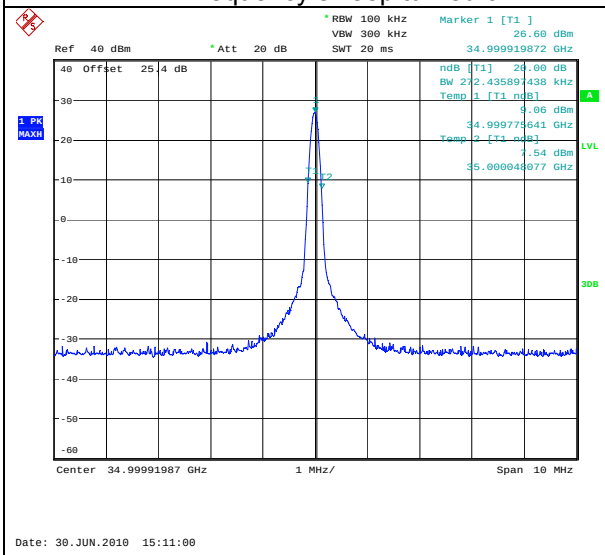
Special notes

The RBW was set to 1 % of occupied bandwidth. VBW was set wider than RBW.
The test was performed using a peak detector of spectrum analyzer.

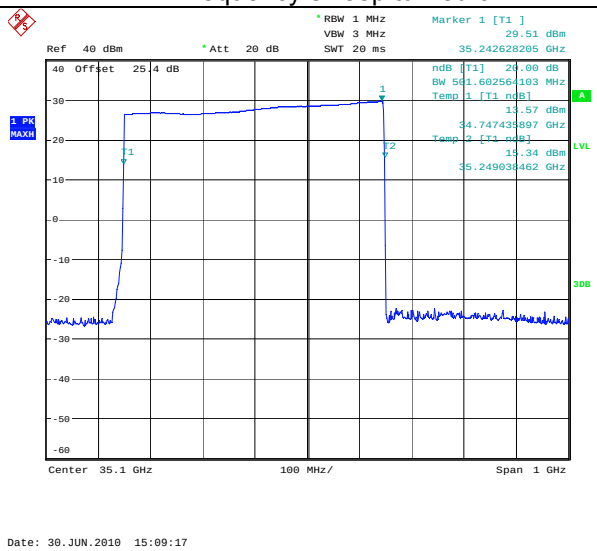
Test data

20 dB bandwidth results:

Frequency sweep turned off



Frequency sweep turned on



Frequency (GHz)	Occupied bandwidth (MHz)
Sweep turned off	
35	0.2724
Sweep turned on	
34.75–35.25	501.6

8.4 Clause 2.1051 Spurious emissions at antenna terminal

The radio frequency voltage or powers generated within the equipment and appearing on a spurious frequency shall be checked at the equipment output terminals when properly loaded with a suitable artificial antenna. Curves or equivalent data shall show the magnitude of each harmonic and other spurious emission that can be detected when the equipment is operated under the conditions specified in §2.1049 as appropriate. The magnitude of spurious emissions, which are attenuated more than 20 dB below the permissible value, need not be specified.

Frequency range (MHz)	Attenuation below carrier (dBc)	Spurious emissions equivalent power (dBm)
30–220 000	43 + 10 Log (P)	-13

Special notes

The spectrum was searched from 30 MHz to 220 GHz. The RBW/VBW were set to 100/300 kHz below 1 GHz and to 1000/3000 kHz for frequencies above 1 GHz.

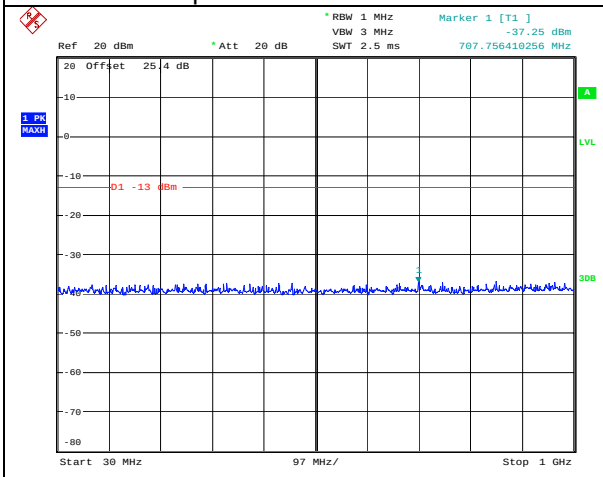
Test data

Spurious emissions results

Frequency (GHz)	Spurious emission (dBm)	Margin (dB)	Limit (dBm)
46.538	-27.09	14.09	-13.00
47.596	-28.55	15.55	-13.00

Test data, continued

Conducted spurious emissions within 30–1000 MHz



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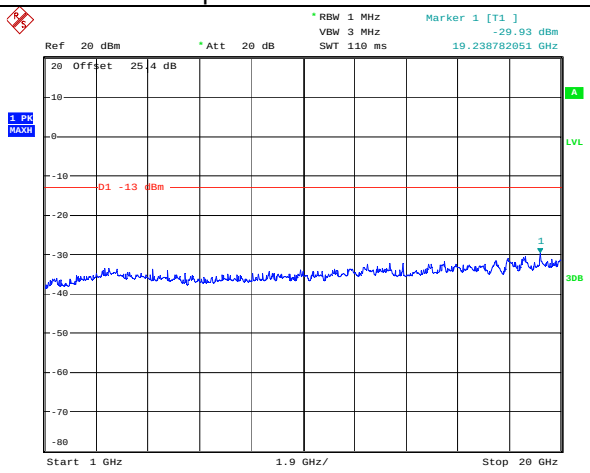
Conducted spurious emissions within 1–20 GHz



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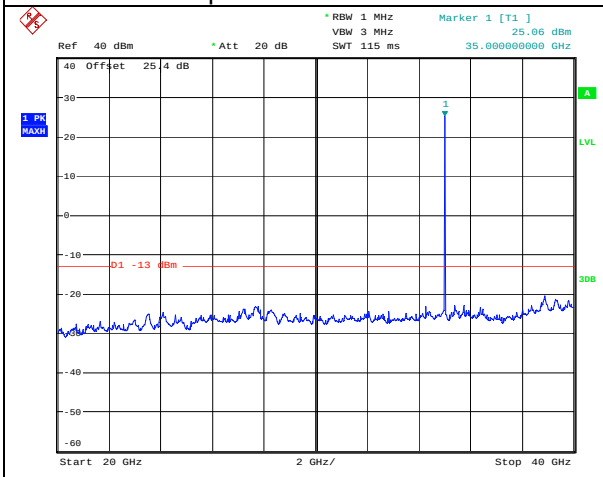
Conducted spurious emissions within 20–40 GHz



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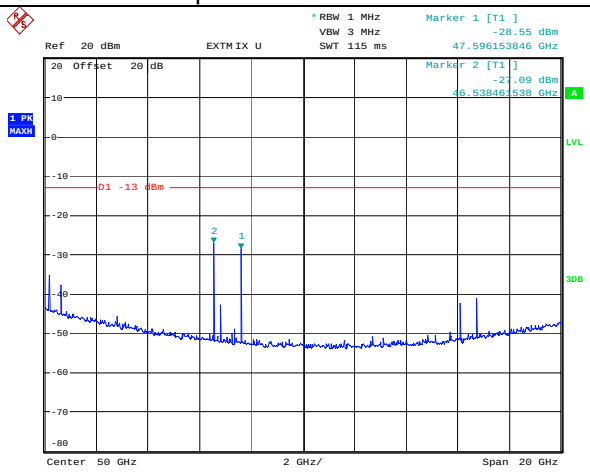
Conducted spurious emissions within 40–60 GHz



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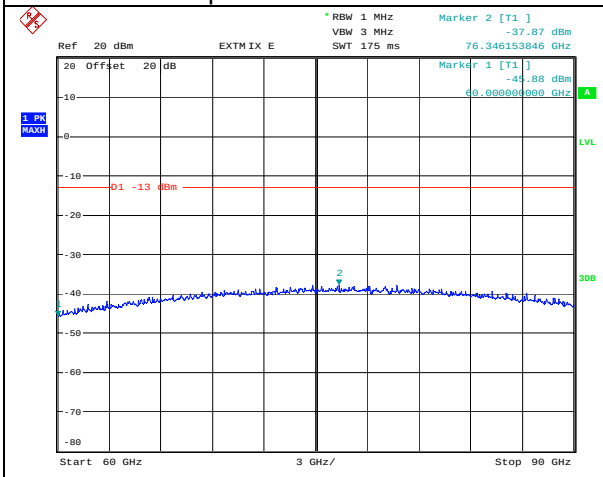
Test data, continued

Conducted spurious emissions within 60–90 GHz



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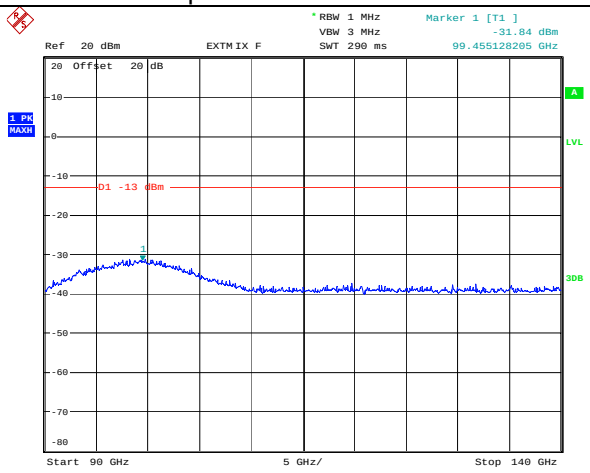
Conducted spurious emissions within 90–140 GHz



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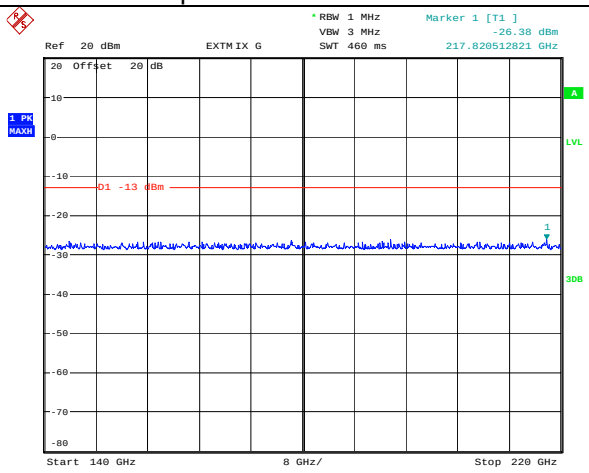
Conducted spurious emissions within 140–220 GHz



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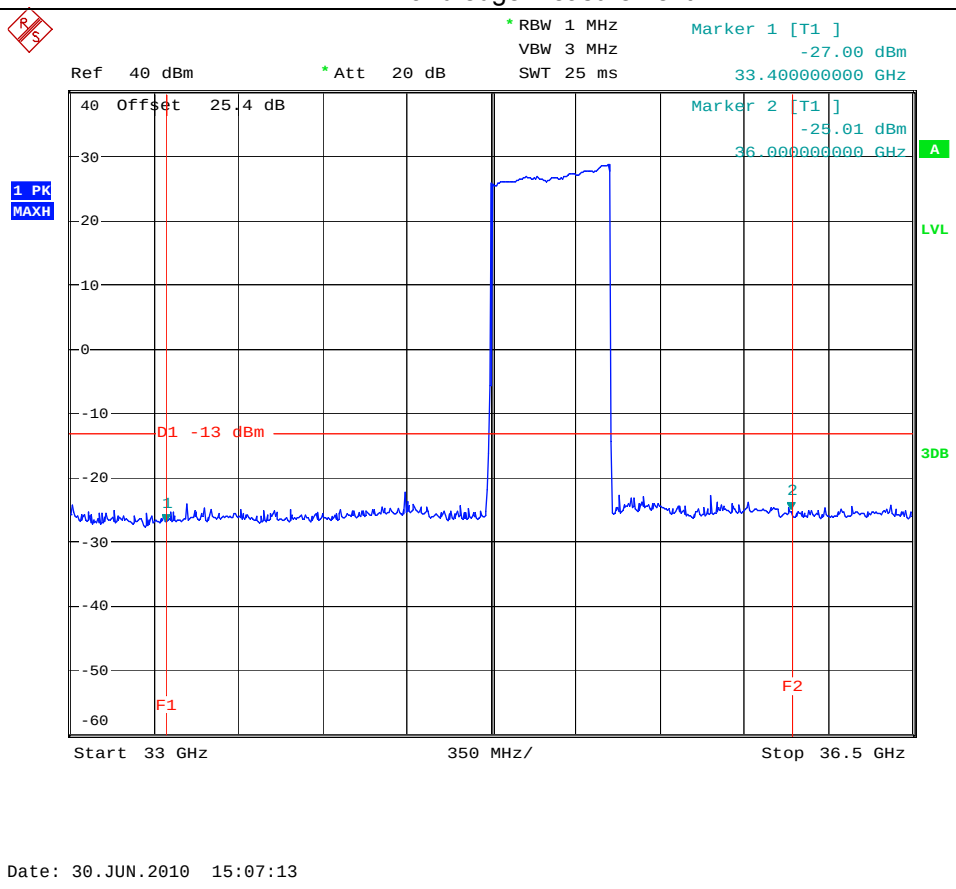
Test data, continued

Band edge measurement:



8.5 Clause 2.1053 Field strength of spurious radiation

(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.

Frequency range (GHz)	Attenuation below carrier (dBc)	ERP of spurious emissions (dBm)	Equivalent field strength at 3 m limit (dBµV/m)
0.03–220	43 + 10 Log (P)	-13	82.23

Special notes

The spectrum was searched from 30 MHz to 220 GHz. The RBW/VBW were set to 100/300 kHz below 1 GHz and to 1000/3000 kHz for frequencies above 1 GHz. The measurements below 18 GHz were performed at 3 m and above 18 GHz at 30 cm. There were no spurious emissions detected above 18 GHz.

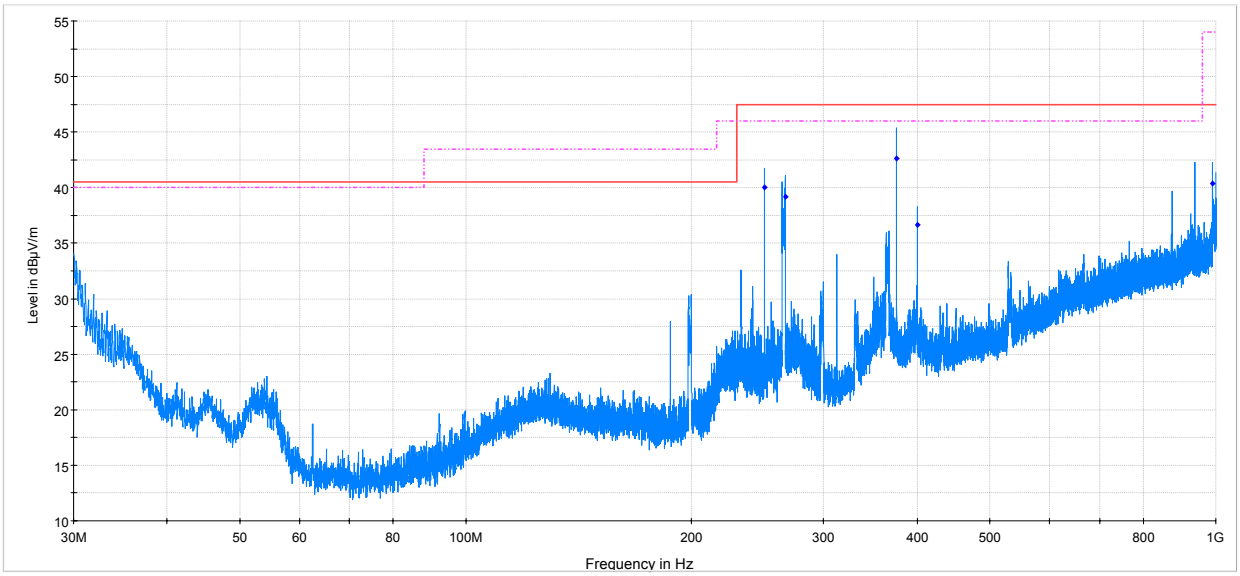
Test data

Radiated measurements

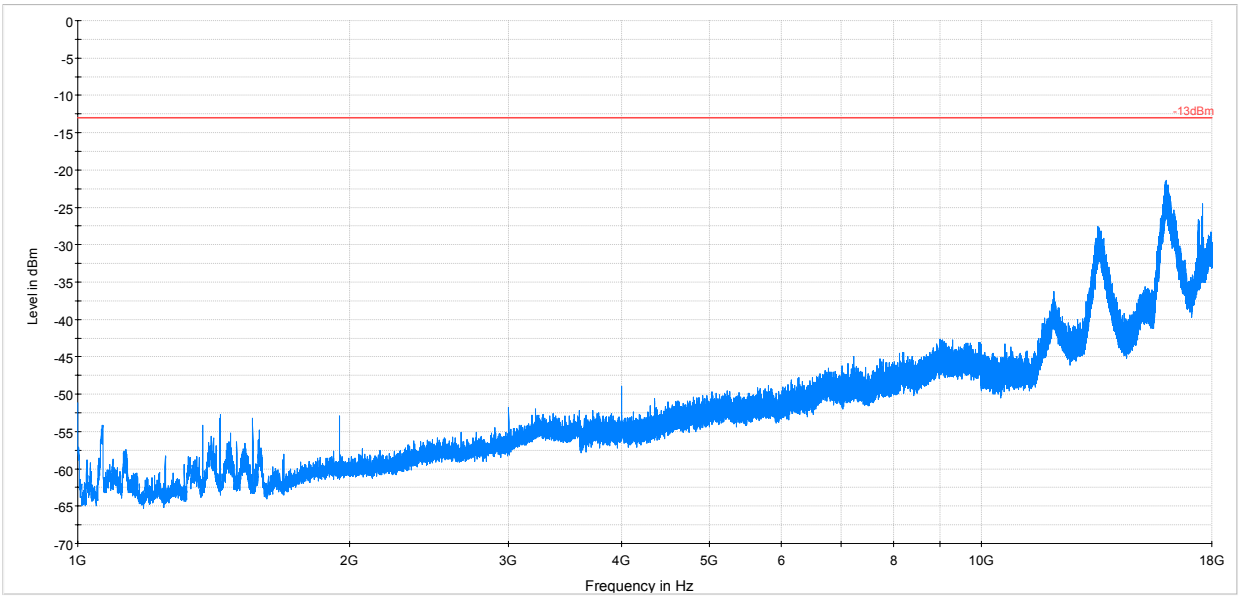
Frequency (MHz)	Polarization V/H	Field strength (dBµV/m)	Substitution factor (dB)	ERP (dBm)	Margin (dB)	Limit (dBm)
All emissions were more than 20 dB below the limit						-13

Test data, continued

Radiated spurious emissions



Radiated emissions pre-scan
MaxPeak-MaxHold
CISPR22 Class B QP 3m
FCC Part 15 Class B 3m QP+AV
QuasiPeak (Single)



Radiated spurious emissions
MaxPeak-MaxHold
-13dBm

8.6 Clause 2.1055 Frequency stability

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

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

(2) From −20° to +50° centigrade for equipment to be licensed for use in the Maritime Services under part 80 of this chapter, except for Class A, B, and S Emergency Position Indicating Radiobeacons (EPIRBS), and equipment to be licensed for use above 952 MHz at operational fixed stations in all services, stations in the Local Television Transmission Service and Point-to-Point Microwave Radio Service under part 21 of this chapter, equipment licensed for use aboard aircraft in the Aviation Services under part 87 of this chapter, and equipment authorized for use in the Family Radio Service under part 95 of this chapter.

(3) From 0° to +50° centigrade for equipment to be licensed for use in the Radio Broadcast Services under part 73 of this chapter.

(b) Frequency measurements shall be made at the extremes of the specified temperature range and at intervals of not more than 10° centigrade through the range. A period of time sufficient to stabilize all of the components of the oscillator circuit at each temperature level shall be allowed prior to frequency measurement. The short term transient effects on the frequency of the transmitter due to keying (except for broadcast transmitters) and any heating element cycling normally occurring at each ambient temperature level also shall be shown. Only the portion or portions of the transmitter containing the frequency determining and stabilizing circuitry need be subjected to the temperature variation test.

(c) In addition to all other requirements of this section, the following information is required for equipment incorporating heater type crystal oscillators to be used in mobile stations, for which type acceptance is first requested after March 25, 1974, except for battery powered, hand carried, portable equipment having less than 3 watts mean output power.
(1) Measurement data showing variation in transmitter output frequency from a cold start and the elapsed time necessary for the frequency to stabilize within the applicable tolerance. Tests shall be made after temperature stabilization at each of the ambient temperature levels; the lower temperature limit, 0° centigrade and +30° centigrade with no primary power applied.
(2) Beginning at each temperature level specified in paragraph (c)(1) of this section, the frequency shall be measured within one minute after application of primary power to the transmitter and at intervals of no more than one minute thereafter until ten minutes have elapsed or until sufficient measurements are obtained to indicate clearly that the frequency has stabilized within the applicable tolerance, whichever time period is greater. During each test, the ambient temperature shall not be allowed to rise more than 10° centigrade above the respective beginning ambient temperature level.
(3) The elapsed time necessary for the frequency to stabilize within the applicable tolerance from each beginning ambient temperature level as determined from the tests specified in this paragraph shall be specified in the instruction book for the transmitter furnished to the user.
(4) When it is impracticable to subject the complete transmitter to this test because of its physical dimensions or power rating, only its frequency determining and stabilizing portions need be tested.

(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.

(2) For hand carried, battery powered equipment, reduce primary supply voltage to the battery operating end point, which shall be specified by the manufacturer.

(3) The supply voltage shall be measured at the input to the cable normally provided with the equipment, or at the power supply terminals if cables are not normally provided. Effects on frequency of transmitter keying (except for broadcast transmitters) and any heating element cycling at the nominal supply voltage and at each extreme also shall be shown.

(e) When deemed necessary, the Commission may require tests of frequency stability under conditions in addition to those specifically set out in paragraphs (a), (b), (c), and (d) of this section. (For example measurements showing the effect of proximity to large metal objects, or of various types of antennas, may be required for portable equipment.)

Frequency range (MHz)	Fixed and base stations (ppm)	Mobile stations (ppm)	
		Over 2 W output power	2 W or less output power
Below 25	100	100	200
25–50	20	20	50
72–76	5		50
150–174	5	5	50
216–220	1		1
220–222	0.1	1.5	1.5
421–512	2.5	5	5
806–809	1	1.5	1.5
809–824	1.5	2.5	2.5
851–854	1	1.5	1.5
854–869	1.5	2.5	2.5
896–901	0.1	1.5	1.5
902–928	2.5	2.5	2.5
902–928	2.5	2.5	2.5
929–930	1.5		
935–940	0.1	1.5	1.5
1427–1432	300	300	300
Above 2450			

Special notes

None

Test data

Test conditions	Frequency (Hz)	Offset* (ppm)
+50 °C, Nominal	34999961871	1.2
+40 °C, Nominal	34999947868	0.8
+30 °C, Nominal	34999902370	-0.5
+20 °C, +15 %	34999923372	0.1
+20 °C, Nominal	34999919872	Reference
+20 °C, -15 %	34999919872	0
+10 °C, Nominal	34999926839	0.2
0 °C, Nominal	34999926811	0.2
-10 °C, Nominal	34999951394	0.9
-20 °C, Nominal	34999958388	1.1
-30 °C, Nominal	34999947832	0.8

* Note: Offset calculation: $\frac{F_{Measured} - F_{reference}}{F_{reference}} \times 1 \cdot 10^{6}$

Section 9: Block diagrams of test set-ups

Radiated emissions set-up