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Report Reference ID:	148158-1TRFWL

Test specification:	Title 47 - Telecommunication Chapter I - Federal Communications Commission Subchapter A - General Part 15 - Radio Frequency Devices Subpart C - Intentional Radiators – **§15.249 - Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz**

Applicant:	Thomas and Betts Corporation 8155 T&B Blvd Memphis, TN 38125-8888 USA
Apparatus:	Nexus Area Controller and Nexus Area Controller Router
FCC ID:	W3BNEXUSAC
Model:	This is the model number

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:	David Duchesne, Wireless/EMC Specialist	July 22, 2010
Reviewed by:	 Andrey Adelberg, Senior Wireless/EMC Specialist	July 22, 2010

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LAB Accrédité CCN

Nemko Canada Inc., a testing laboratory, is accredited by the Standards Council of Canada.
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	**FCC Part 15 Subpart C, 15.249** Operation in the 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHz and 24.0–24.25 GHz

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 15; Subpart C. Radiated tests were conducted in accordance with ANSI C63.4-2003.

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 15 Subpart C – Intentional Radiators, test results

General requirements for FCC Part 15

Part	Test description	Verdict
§15.31(e)	Variation of power source	Pass
§15.31(m)	Number of operating frequencies	Pass
§15.203	Antenna requirement	Pass
§15.207(a)	Conducted limits	Pass
§15.215(c)	20 dB bandwidth	Pass

Specific requirements for FCC Part 15 Subpart C, 15.249

Part	Test description	Verdict
§15.249(a)	Radiated emissions not in restricted bands	Pass
§15.249(b)	Fixed Point-to-Point operation in the 24.0–24.25 GHz band	N/A
§15.249(d)	Spurious emissions (except harmonics)	Pass

Notes: None

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

3.1 Applicant details

Applicant complete business name	Name:	Thomas & Betts Corporation
	Federal Registration Number (FRN):	0018417071
	Grantee code	W3B
Mailing address	Address: City: Province/State: Post code: Country:	8155 T&B Blvd Memphis TN 38125-8888 USA

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:	W3B
	Product code:	NEXUSAC
Equipment class	DXX, JBP	
Description of product as it is marketed	Nexus Area Controller	
	Model name/number:	199.0555
	Serial number:	809

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:	May 27, 2010
Nemko sample ID number:	Item # 1 and 3

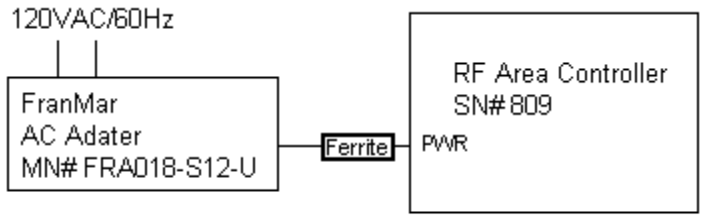
3.7 EUT technical specifications

Operating band:	902–928 MHz
Operating frequency:	918–925.8 MHz
Modulation type:	GFSK and MSK (MSK modulation is only used for backdoor mode)
Occupied bandwidth:	20 dB BW: 469.55 kHz (Backdoor Mode) and 66.67 kHz (Normal Mode) 99 % BW: 336.5 kHz (Backdoor Mode) and 65.7 kHz (Normal Mode)
Channel spacing:	0.6 MHz
Emission designator:	336KG1D (GFSK) 65K7F1D (MSK)
Antenna type/data:	Detachable/ External 1/4 wave monopole antenna Removable antenna supplied and type tested with the radio equipment (Equipment that has an external 50 Ω RF connector)
Power source:	Powered via an external AC adapter, input 100–240 VAC 50–60Hz, output 12 VDC

3.8 Operation of the EUT during testing

Details:	The EUT was controlled to transmit or receive continuously by special test mode.

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

The Nexus Area Controller was assessed as a representative sample. The Nexus Area Router is a de-featured variant of the Nexus Area Controller. Both units have the same RF circuitry.

Nexus Area Controller (AC) model # 199.0555
Nexus Area Controller Router (ACR) model # 199.0578

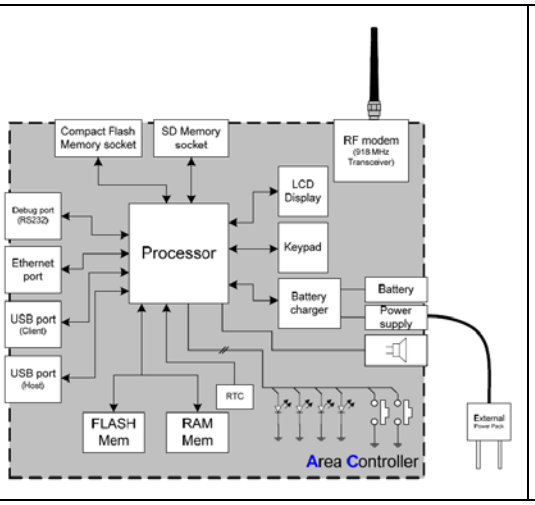
The Area Controller Router is the same unit as the Area Controller but without these three options:

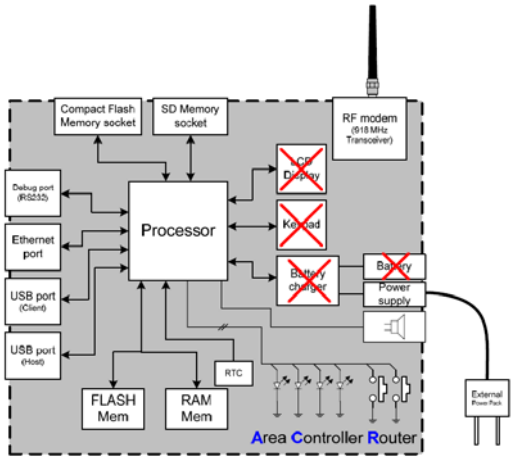
- keyboard
- display
- battery backup

These two units have the same:

- mother board
- software
- processor
- memory
- IO ports
- Supply
- modular RF Modem
- RF configuration (antenna, output power and frequency operation)

The ACR (Router) is a cheaper version of the AC. It is only used for expanding the RF network. An Area Controller could manage up to 100 nodes. For a bigger network we must add other(s) controller(s). It is the reason why we created this de-populated version of controller, for reducing the cost of this network.





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	May 06/11
Flush Mount Turntable	Sunol	FM2022	FA002082	NCR
Bilog	Sunol	JB3	FA002108	Jan. 18/11
Controller	Sunol	SC104V	FA002060	NCR
Mast	Sunol	TLT2	FA002061	NCR
Receiver/Spectrum Analyzer	Rohde & Schwarz	ESU 26	FA002043	Dec. 16/10
International Power Supply	California Inst.	3001i	FA001021	Jan. 13/11
Spectrum Analyzer	Rohde & Schwarz	FSU46	FA001877	Sep. 29/10
Horn Antenna #2	EMCO	3115	FA000825	Jan. 21/11
1 – 18 GHz Amplifier	JCA	JCA118-503	FA002091	Oct 07/10
LISN	Rohde & Schwarz	ENV216	FA002023	Sept. 02/10
Highpass Filter	K&L	1 GHz	FA001434	COU

Note: N/A = Not Applicable, NCR = No Cal Required, COU = CAL On Use

Section 8: Testing data

8.1 Clause 15.31(e) Variation of power source

§ 15.31 Measurement standards.

(e) For intentional radiators, measurements of the variation of the input power or the radiated signal level of the fundamental frequency component of the emission, as appropriate, shall be performed with the supply voltage varied between 85 % and 115 % of the nominal rated supply voltage. For battery-operated equipment, the equipment tests shall be performed using a new battery.

Special notes

None

Test data

Transmit output power was measured while supply voltage was varied from 102 VAC to 138 VAC (85 % to 115 % of the nominal rated supply voltage).

No change in transmit output power was observed.

8.2 Clause 15.31(m) Number of operating frequencies

§ 15.31 Measurement standards.

(m) Measurements on intentional radiators or receivers, other than TV broadcast receivers, shall be performed and, if required, reported for each band in which the device can be operated with the device operating at the number of frequencies in each band specified in the following table:

Frequency range over which device operates	Number of frequencies	Location in the range of operation
1 MHz and less	1	Middle
1 to 10 MHz	2	1 near top and 1 near bottom
More than 10 MHz	3	1 near top, 1 near middle and 1 near bottom

Special notes

None

Test data

Normal mode	
The frequency band is 7.2 MHz therefore number of operating frequencies is 2.	
Low frequency / channel 1	918.6 MHz
High frequency / channel 13	925.8 MHz
Backdoor Mode	
Single frequency / channel 0	918.0 MHz

* Backdoor mode is a separate channel utilized for service only

8.3 Clause 15.203 Antenna requirement

§ 15.203 Antenna requirement.

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

Special notes

None

Test data

The RF port is standard antenna SMA connector. The following statement will be included in the product documentation as detailed by client:

Unauthorized Antenna Modifications
Use only the supplied integral antenna. Unauthorized antenna modifications or attachments could damage the unit and may violate FCC regulations. Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Detailed photo of RF connector:

8.4 Clause 15.207(a) Conducted limits

§ 15.207 Conducted limits.

(a) Except as shown in paragraphs (b) and (c) of this section, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency or frequencies, within the band 150 kHz to 30 MHz, shall not exceed the limits in the following table, as measured using a 50 μH/50 Ω line impedance stabilization network (LISN). Compliance with the provisions of this paragraph shall be based on the measurement of the radio frequency voltage between each power line and ground at the power terminal. The lower limit applies at the boundary between the frequency ranges.

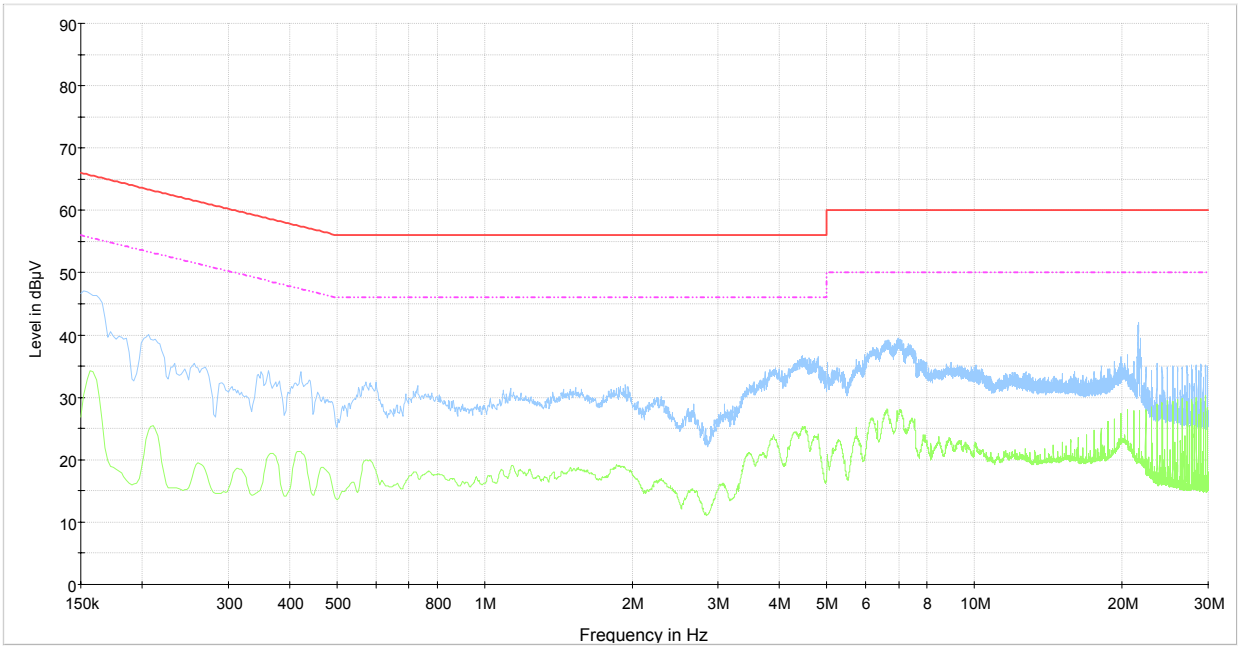
Frequency of emission (MHz)	Conducted limit (dBμV)	
	Quasi-peak	Average
0.15–0.5	66 to 56*	56 to 46*
0.5–5	56	46
5–30	60	50

*-Decreases with the logarithm of the frequency.

Special notes

None

Test data

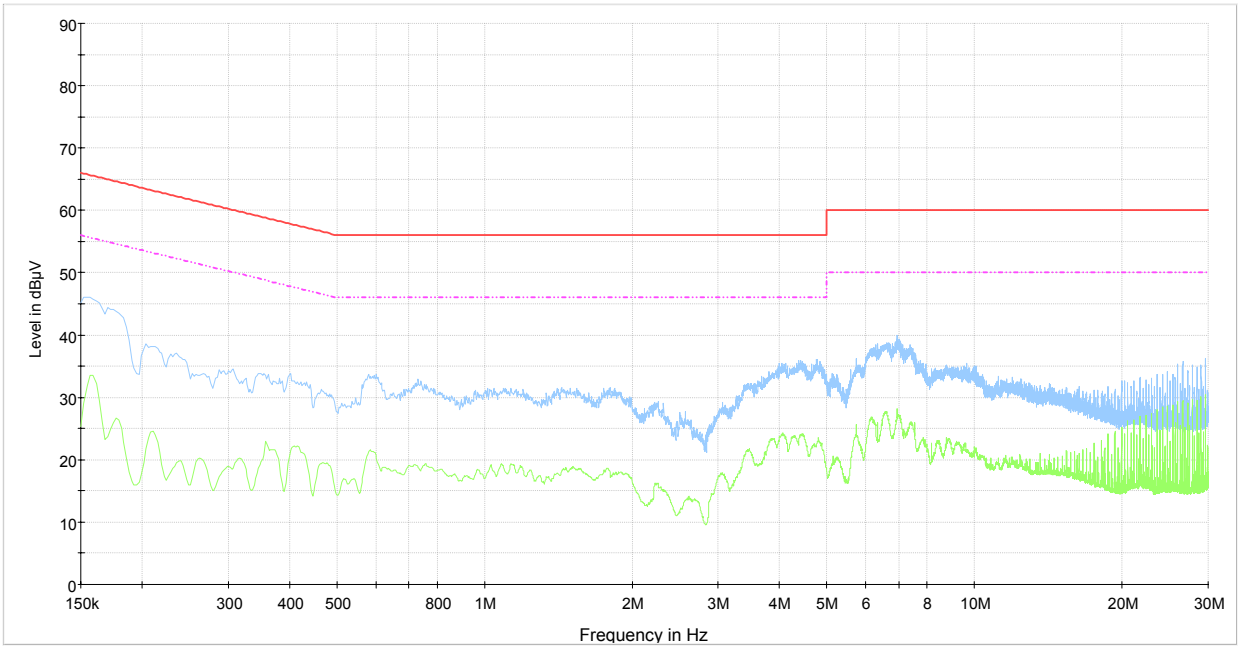


The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/Spectrum analyzer settings:	
0.15 MHz to 30 MHz	
Preview measurements	**Final measurement**
Receiver: 9 kHz RBW, Peak and Average detector, max hold	Receiver: 9 kHz RBW, Quasi-peak and Average detector
Measurement time 100 ms	

Test data, continued



The spectral scan has been corrected with transducer factors (i.e. cable loss, LISN factors, and attenuators) for determination of compliance.

A preview measurement was generated with the receiver in continuous scan mode Emissions detected within 6 dB or above limit were re-measured with the appropriate detector against the correlating limit and recorded as the final measurement.

Receiver/Spectrum analyzer settings:	
0.15 MHz to 30 MHz	
Preview measurements	**Final measurement**
Receiver: 9 kHz RBW, Peak and Average detector, max hold	Receiver: 9 kHz RBW, Quasi-peak and Average detector
Measurement time 100 ms	

Setup photos

8.5 Clause 15.215(c) Emission bandwidth

§ 15.215 Additional provisions to the general radiated emission limitations

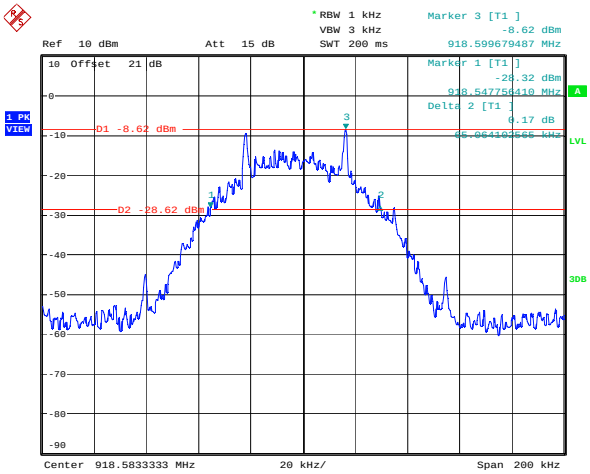
(c) Intentional radiators operating under the alternative provisions to the general emission limits, as contained in §§15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated. The requirement to contain the designated bandwidth of the emission within the specified frequency band includes the effects from frequency sweeping, frequency hopping and other modulation techniques that may be employed as well as the frequency stability of the transmitter over expected variations in temperature and supply voltage. If a frequency stability is not specified in the regulations, it is recommended that the fundamental emission be kept within at least the central 80 % of the permitted band in order to minimize the possibility of out-of-band operation.

Special notes

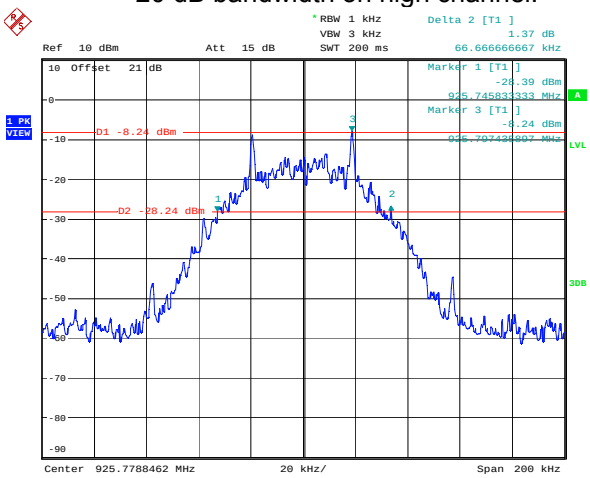
The test was performed using peak detector of the spectrum analyzer with RBW no narrower than 1 % of the emission bandwidth.

Test data

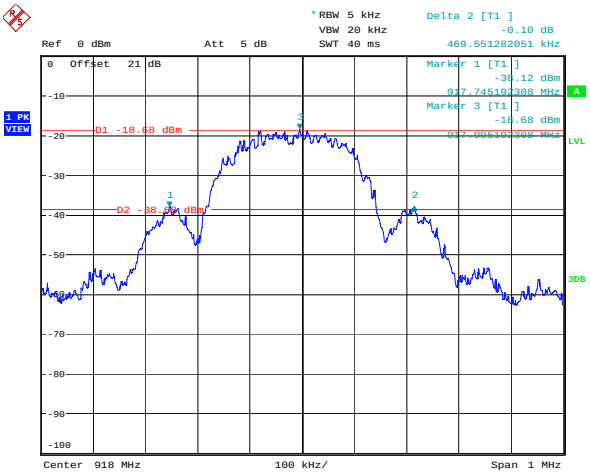
20 dB bandwidth on low channel:



20 dB bandwidth on high channel:



20 dB bandwidth Backdoor mode:



Frequency (MHz)	20 dB bandwidth (kHz)
918.0 (Backdoor mode)	469.55
918.6 (Low channel)	65.06
925.8 (High channel)	66.67

8.6 Clause 15.249(a) Field strength of radiated emissions not in restricted bands

§ 15.249 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ, and 24.0–24.25 GHz.

(a) Except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

Fundamental frequency	Field strength of fundamental		Field strength of spurious emissions	
(MHz)	(mV/m)	(dBµV/m)	(µV/m)	(dBµV/m)
902–928	50	94	500	54
2400–2483.5	50	94	500	54
5725–5875	50	94	500	54
24.0–24.25	250	108	2500	68

(e) As shown in §15.35(b), for frequencies above 1000 MHz, the field strength limits in paragraphs (a) and (b) of this section are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For point-to-point operation under paragraph (b) of this section, the peak field strength shall not exceed 2500 millivolts/meter (128 dBµV/m) at 3 meters along the antenna azimuth.

Special notes

None

Test data

Backdoor mode

Frequency (MHz)	Polarization V/H	FS Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Fundamental				
918	V	84.10	94	9.90
	H	82.42	94	11.58

Harmonics

Frequency (MHz)	Polarization V/H	FS Peak (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	FS Average (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
1836	V	49.90	74	24.10	45.01	54	8.99
	H	48.00	74	26.00	43.20	54	10.80
3672	V	51.00	74	23.00	42.90	54	11.10
	H	51.30	74	22.70	43.10	54	10.90

Low channel (Power level '0': –3.6 dBm)

Frequency (MHz)	Polarization V/H	Field strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Fundamental				
918.6	V	93.32	94	0.68
	H	92.26	94	1.74

Harmonics

Frequency (MHz)	Polarization V/H	FS Peak (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	FS Average (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
1837.2	V	52.64	74	21.36	50.10	54	3.90
	H	50.60	74	23.40	48.26	54	5.74
2755.8	V	51.44	74	22.56	48.29	54	5.71
	H	48.60	74	25.40	44.39	54	9.61
3674.4	V	54.38	74	19.62	51.39	54	2.61
	H	53.92	74	20.08	50.69	54	3.31
4593	V	53.35	74	20.65	50.20	54	3.80
	H	48.00	74	26.00	38.00	54	16.00
5511.6	V	55.35	74	18.65	50.89	54	3.11
	H	49.30	74	24.70	39.00	54	15.00
6430.2	V	54.74	74	19.26	49.12	54	4.88
	H	48.00	74	26.00	36.00	54	18.00

Notes:

- The spectrum was searched from 30 MHz to the 10th harmonic.
- Measurements were performed at a distance of 3 m.
- The EUT was tested at three orthogonal axes. Only worst-case data has been presented.
- Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
- Measurements performed:
  - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results, and using peak detector with 1 MHz/10 Hz RBW/VBW for average results

High channel (Power level '1': –4.8 dBm)

Frequency (MHz)	Polarization V/H	FS (dBµV/m)	Limit (dBµV/m)	Margin (dB)
Fundamental				
925.8	V	93.17	94	0.83
	H	90.89	94	3.11

Harmonics

Frequency (MHz)	Polarization V/H	FS Peak (dBµV/m)	Peak Limit (dBµV/m)	Peak Margin (dB)	FS Average (dBµV/m)	Average Limit (dBµV/m)	Average Margin (dB)
1851.6	V	52.73	74	21.27	50.74	54	3.26
	H	47.84	74	26.16	44.72	54	9.28
2777.4	V	54.36	74	19.64	52.60	54	1.40
	H	47.86	74	26.14	42.89	54	11.11
3703.2	V	56.48	74	17.52	53.89	54	0.11
	H	55.25	74	18.75	52.79	54	1.21
4629.0	V	53.89	74	20.11	50.64	54	3.36
	H	46.70	74	27.30	36.95	54	17.05
5554.8	V	53.49	74	20.51	48.65	54	5.35
	H	50.03	74	23.97	41.80	54	12.20
6480.6	V	54.25	74	19.75	48.70	54	5.30
	H	48.36	74	25.64	36.00	54	18.00

Notes:

- The spectrum was searched from 30 MHz to the 10th harmonic.
- Measurements were performed at a distance of 3 m.
- The EUT was tested at three orthogonal axes. Only worst-case data has been presented.
- Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.
- Measurements performed:
  - within 30–1000 MHz range: using a peak detector with 100 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results, and using peak detector with 1 MHz/10 Hz RBW/VBW for average results

Setup photos

8.7 Clause 15.249(d) Spurious emissions (except for harmonics)

§ 15.249 Operation within the bands 902–928 MHz, 2400–2483.5 MHz, 5725–5875 MHZ, and 24.0–24.25 GHz.

(d) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

Special notes

§15.209 – Radiated emission limits

Frequency (MHz)	Field strength		Measurement distance (m)
	(µV/m)	(dBµV/m)	
0.009–0.490	2400/F	67.6−20log(F)	300
0.490–1.705	24000/F	87.6−20log(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:
- F = fundamental frequency in kHz
- 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.

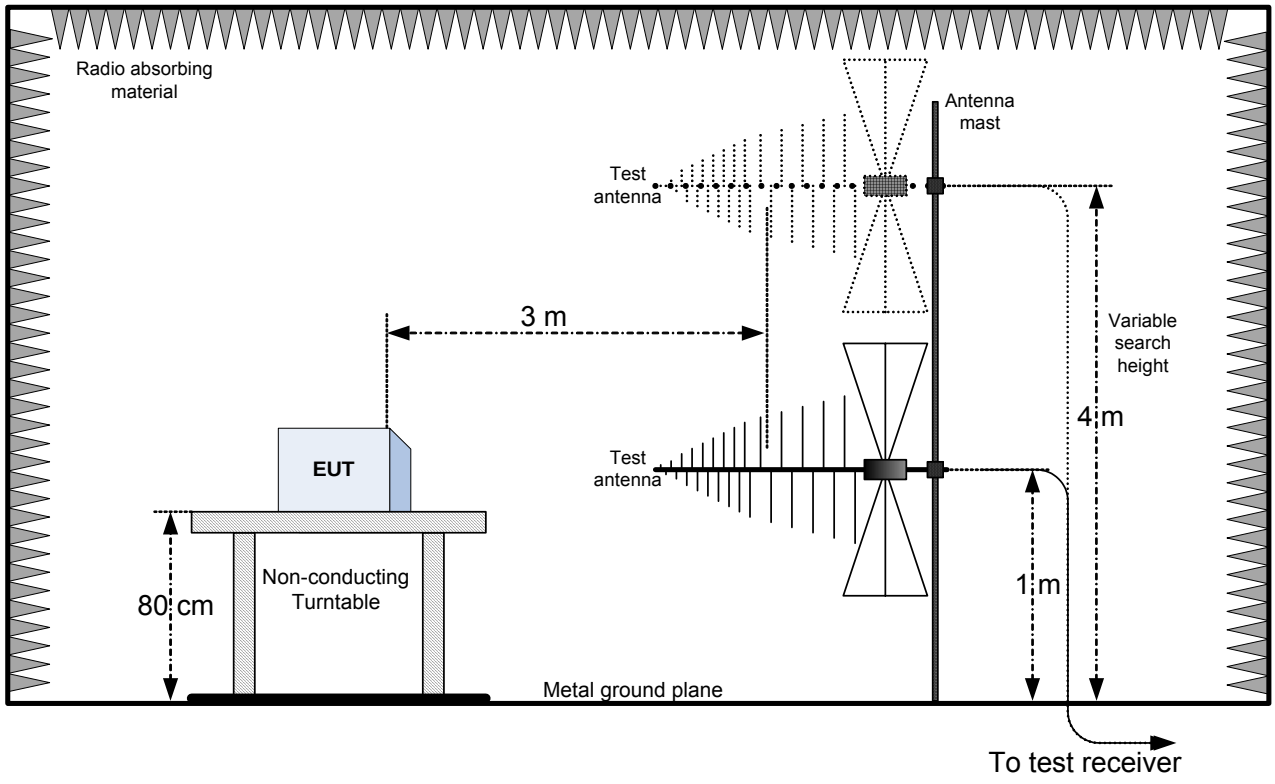
Test data

The test was performed on low, high and backdoor channels
No emissions were detected within 10 dB of §15.209 Radiated emission limits.

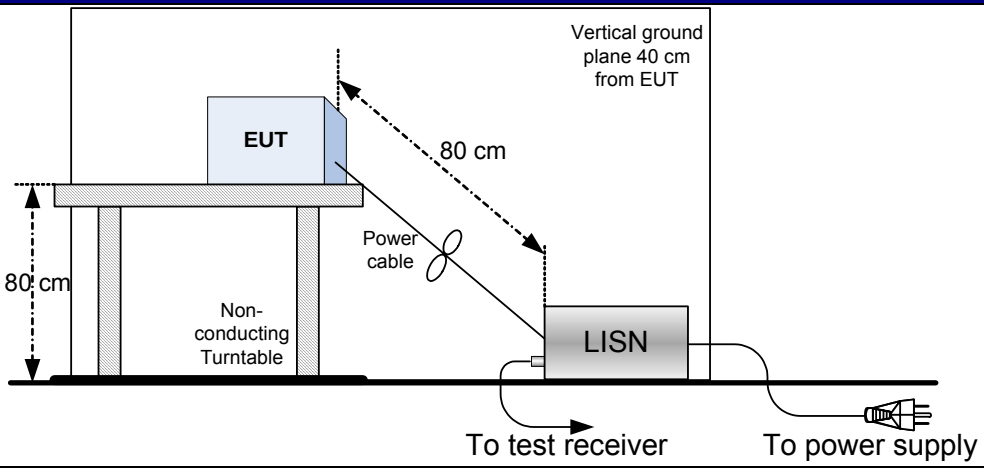
- All measurements were performed at a distance of 3 m.
- The EUT was tested at three orthogonal axes. Only worst-case data has been presented.
- All measurements performed:
  - within 30–1000 MHz range: using a quasi-peak detector with 120 kHz/300 kHz RBW/VBW,
  - above 1 GHz: using peak detector with 1 MHz/3 MHz RBW/VBW for peak results, and using average detector with 1 MHz/3 MHz RBW/VBW for average results

Section 9: Block diagrams of test set-ups

Radiated emissions set-up



Conducted emissions set-up



Section 10: EUT photos

EUT photo

EUT photo

EUT photo

EUT photo

EUT photo