ENGINEERING TEST REPORT

Room Sensor
Model: EBERS41
FCC ID: WR91881541519

Applicant:

ecobee Incorporated
207 Queens Quay West, Suite 600
Toronto, Ontario
Canada M5J 1A7

In Accordance With

Federal Communications Commission (FCC)
Part 15, Subpart C, Section 15.247- Hybrid System

UltraTech's File No.: 19AVAN010_FCC15C247

This Test report is Issued under the Authority of Tri M. Luu Vice President of Engineering UltraTech Group of Labs Date: February 5, 2019	
Report Prepared by: Dan Huynh Issued Date: February 5, 2019	Tested by: Hung Trinh Test Dates: January 9, 10, 14, 24 & 28, 2019

- *The results in this Test Report apply only to the sample(s) tested, and the sample tested is randomly selected.*
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TABLE OF CONTENTS

EXHIBIT 1. INTRODUCTION

1.1. SCOPE

Reference:	FCC Part 15, Subpart C, Section 15.247
Title:	Code of Federal Regulations (CFR), Title 47 – Telecommunication, Part 15
Purpose of Test:	Equipment Certification for Part 15C Spread Spectrum Transmitter and Digital Transmission System
Test Procedures:	▪ ANSI C63.4 ▪ ANSI C63.10 ▪ FCC KDB 558074 D01 15.247 Meas Guidance v05
Environmental Classification:	[x] Commercial, industrial or business environment [x] Residential environment

1.2. RELATED SUBMITTAL(S)/GRANT(S)

None.

1.3. NORMATIVE REFERENCES

Publication	Year	Title
47 CFR Parts 0-19	2018	Code of Federal Regulations (CFR), Title 47 – Telecommunication
ANSI C63.4	2014	American National Standard for Methods of Measurement of Radio-Noise Emissions from Low-Voltage Electrical and Electronic Equipment in the Range of 9 KHz to 40 GHz
ANSI C63.10	2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices
FCC KDB 558074 D01 15.247 Meas Guidance v05	2018	GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES

EXHIBIT 2. PERFORMANCE ASSESSMENT

2.1. CLIENT INFORMATION

Applicant	
Name:	ecobee Incorporated
Address:	207 Queens Quay West, Suite 600 Toronto, Ontario Canada M5J 1A7
Contact Person:	Mark Wright Phone #: (647) 428-2220 Fax #: N/A Email Address: mark.w@ecobee.com

Manufacturer	
Name:	ecobee Incorporated
Address:	207 Queens Quay West, Suite 600 Toronto, Ontario Canada M5J 1A7
Contact Person:	Mark Wright Phone #: (647) 428-2220 Fax #: N/A Email Address: mark.w@ecobee.com

2.2. EQUIPMENT UNDER TEST (EUT) INFORMATION

The following information (with the exception of the Date of Receipt) has been supplied by the applicant.

Brand Name:	ecobee Incorporated
Product Name:	Room Sensor
Model Name or Number:	EBERS41
Serial Number:	Test Sample
Type of Equipment:	Hybrid, Spread Spectrum Transmitter and Digital Transmission System
Input Power Supply Type:	Li Coin Cell Battery
Primary User Functions of EUT:	Provides room temperature and occupancy sensing to ecobee smart thermostat.

2.3. EUT'S TECHNICAL SPECIFICATIONS

Transmitter	
Equipment Type:	▪ Mobile ▪ Base Station (fixed use)
Intended Operating Environment:	Residential Commercial, industrial or business environment
Power Supply Requirement:	3.0 VDC via Li coin cell battery
RF Output Power Rating:	11.88 dBm, 0.015417 W (conducted)
Operating Frequency Range:	920.00 - 927.35 MHz
RF Output Impedance:	50 Ω
Duty Cycle:	18.61 %
Modulation Type:	FSK
Antenna Connector Type:	Integral

2.4. ASSOCIATED ANTENNA DESCRIPTIONS

Antenna Type	Maximum Gain (dBi)
Proprietary IFA ribbon FPC type	-5

2.5. LIST OF EUT'S PORTS

Port Number	EUT's Port Description	Number of Identical Ports	Connector Type	Cable Type (Shielded/Non-shielded)
No external EUT port				

2.6. ANCILLARY EQUIPMENT

The EUT was tested while connected to the following representative configuration of ancillary equipment necessary to exercise the ports during tests:

None.

EXHIBIT 3. EUT OPERATING CONDITIONS AND CONFIGURATIONS DURING TESTS

3.1. CLIMATE TEST CONDITIONS

The climate conditions of the test environment are as follows:

Temperature:	21 to 23 ^{o}C
Humidity:	45 to 58%
Pressure:	102 kPa
Power Input Source:	3.0 VDC Li coin cell battery

3.2. OPERATIONAL TEST CONDITIONS & ARRANGEMENT FOR TESTS

Operating Modes:	▪ Each of lowest and highest channel frequencies transmits continuously for emissions measurements. ▪ The EUT operates in Frequency Hopping mode for occupancy duration, and frequency separation.
Special Test Software & Hardware:	Test software provided by the Applicant is installed to allow the EUT to operate in hopping mode and DTS mode or at each channel frequency continuously. For example, the transmitter will be operated at each of lowest and highest frequencies individually continuously during testing.
Transmitter Test Antenna:	The EUT is tested with the antenna fitted in a manner typical of normal intended use as integral antenna equipment as described with the test results.

Transmitter Test Signals	
Frequency Band(s):	920.00 - 927.35 MHz
Frequency(ies) Tested: (Near lowest & near highest frequencies in the frequency range of operation.)	920.00 MHz and 927.35 MHz
RF Power Output: (measured maximum output power at antenna terminals)	11.88 dBm, 0.015417 W (conducted)
Normal Test Modulation:	FSK
Modulating Signal Source:	Internal

EXHIBIT 4. SUMMARY OF TEST RESULTS

4.1. LOCATION OF TESTS

All of the measurements described in this report were performed at Ultratech Group of Labs located in the city of Oakville, Province of Ontario, Canada.

- AC Power Line Conducted Emissions were performed in UltraTech's shielded room, 24'(L) by 16'(W) by 8'(H).
- Radiated Emissions were performed at the Ultratech's 3-10 TDK Semi-Anechoic Chamber situated in the Town of Oakville, province of Ontario. This test site been calibrated in accordance with ANSI C63.4, and found to be in compliance with the requirements of Sec. 2.948 of the FCC Rules. The descriptions and site measurement data of the Oakville 3-10 TDK Semi-Anechoic Chamber has been filed with ANAB File No.: AT-1945.

4.2. APPLICABILITY & SUMMARY OF EMC EMISSION TEST RESULTS

FCC Section(s)	Test Requirements for Hybrid System	Compliance (Yes/No)
15.203	Antenna requirements	Yes[1]
15.207(a)	AC Power Line Conducted Emissions	N/A
15.247(a)	Provisions for Frequency Hopping Systems	Yes
15.247(b)(3)	Maximum Peak Conducted Output Power	Yes
15.247(d), 15.209 & 15.205	Transmitter Spurious Radiated Emissions	Yes
15.247(f)	Average Time Of Occupancy	Yes
15.247(f)	Maximum Power Spectral Density	Yes
15.247(i), 1.1307, 1.1310, 2.1091	RF Exposure	Yes

[1]Its antenna is permanently attached.

4.3. MODIFICATIONS INCORPORATED IN THE EUT FOR COMPLIANCE PURPOSES

None.

EXHIBIT 5. TEST DATA

5.1. COMPLIANCE WITH FCC PART 15 – GENERAL TECHNICAL REQUIREMENTS

FCC Section	FCC Rules	Manufacturer's Clarification
15.247(a)	**Pseudorandom frequency hopping sequence** Describe how the hopping sequence is generated. Provide an example of the hopping sequence channels, to demonstrate that the sequence meets the requirement specified in the definition of an FHSS system, found in Section 2.1(c). Per the definition in Section 2.1(c), the hop set shall appear as random in the near term, shall appear as evenly distributed in the long term, and sequential hops shall be randomly distributed in both direction and magnitude of change.	See Operational Description
15.247(a)	**Equal hopping frequency use** Describe how each individual EUT meets the requirement that each of its hopping channels is used equally on average (*e.g.,* that each new transmission event begins on the next channel in the hopping sequence after the final channel used in the previous transmission event).	See Operational Description
15.247(a)	**System receiver input bandwidth** Describe how the associated receiver(s) complies with the requirement that the input bandwidth (either RF or IF) matches the bandwidth of the transmitted signal.	See Operational Description
15.247(a)	**System receiver hopping capability** Describe how the associated receiver(s) has the ability to shift frequencies in synchronization with the transmitted signals.	See Operational Description
15.247(g)	For short burst systems, describe how the EUT complies with the requirement that it be designed to be capable of operating as a true frequency hopping system. Specifically, the device shall comply with the equal frequency use and pseudorandom hopping sequence requirement when transmitting in short bursts, and shall be designed to comply when presented with continuous data(or information) stream.	See Operational Description
15.247(h)	Describe how the EUT complies with the requirement that it not have the ability to coordinated with other FHSS is an effort to avoid the simultaneous occupancy of individual hopping frequencies by multiple transmitters	See Operational Description

5.2. PROVISIONS FOR FREQUENCY HOPPING SYSTEMS [§ 15.247(a)(1)]

5.2.1. Limits

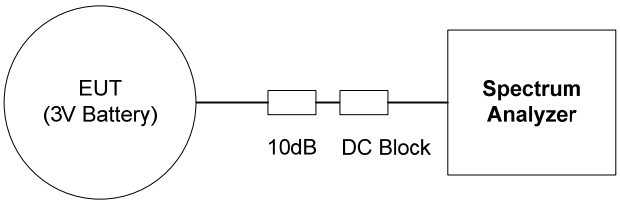
§ 15.247(a)(1): Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier 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.

§ 15.247(f) (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.

5.2.2. Method of Measurements

ANSI C63.10-2013, Sections 7.8.2, 7.8.4 and 11.8.1.

5.2.3. Test Arrangement



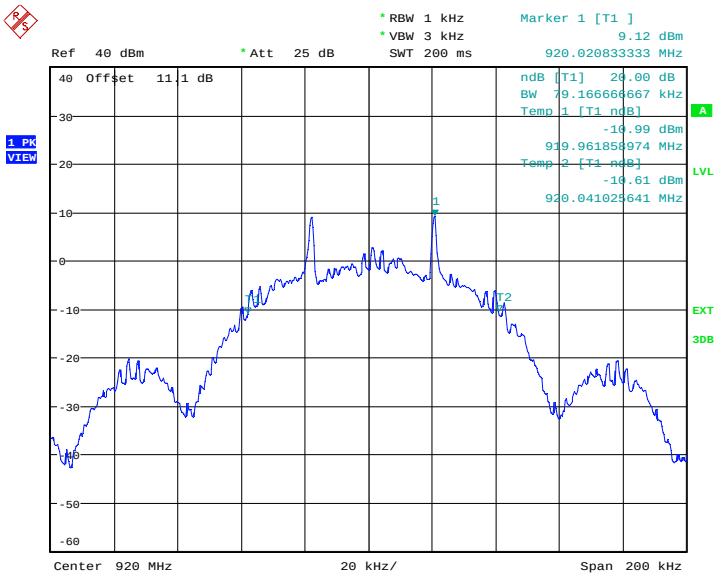
5.2.4. Test Data

Test Description	FCC Specification	Measured Values	Comments
Frequency Hopping Systems Requirements	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.	--	See Note 1
BW of the hopping channel	There is no requirement for this type of hybrid system to comply with the 500 kHz minimum bandwidth normally associated with a DTS device.	79.49 kHz	--
Channel Hopping Frequency Separation	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.	Carrier Frequency Separation: 150 kHz	See Note 2
Number of hopping frequencies	There is no minimum number of hopping channels associated with this type of hybrid system.	--	--
Average Time of Occupancy	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.	There are 50-Channel Mode and 2-Channel Mode. Average time of occupancy for 50-Channel mode within a period of 20s (0.4s x 50 employed channels): 78.48 ms Average time of occupancy for 2-Channel mode within a period of 0.8s (0.4s x 2 employed channels): 78.48 ms	See Note 2

Note 1: See operational description exhibit for details.

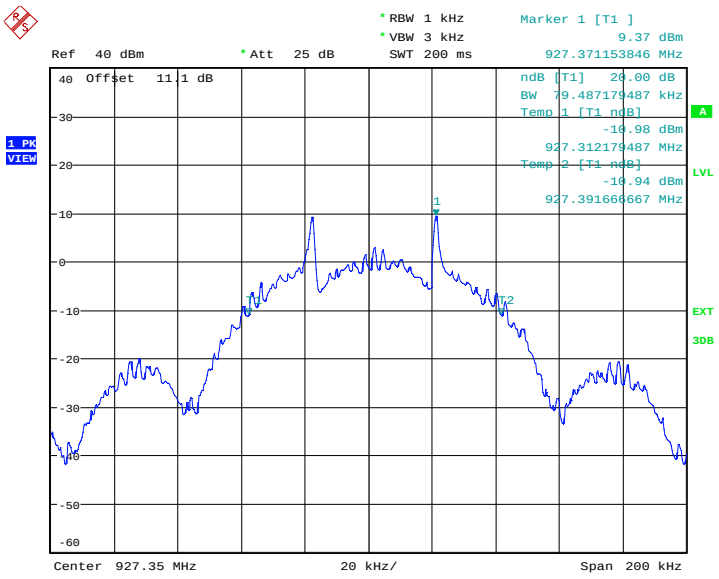
Note 2: See the following plots for detail.

Plot 5.2.4.1. 20 dB Bandwidth, 920.00 MHz



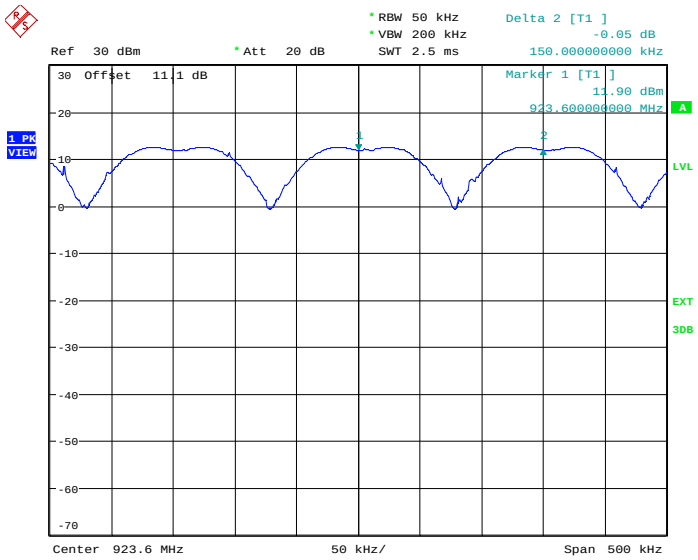
Date: 9.JAN.2019 12:01:38

Plot 5.2.4.2. 20 dB Bandwidth, 927.35 MHz

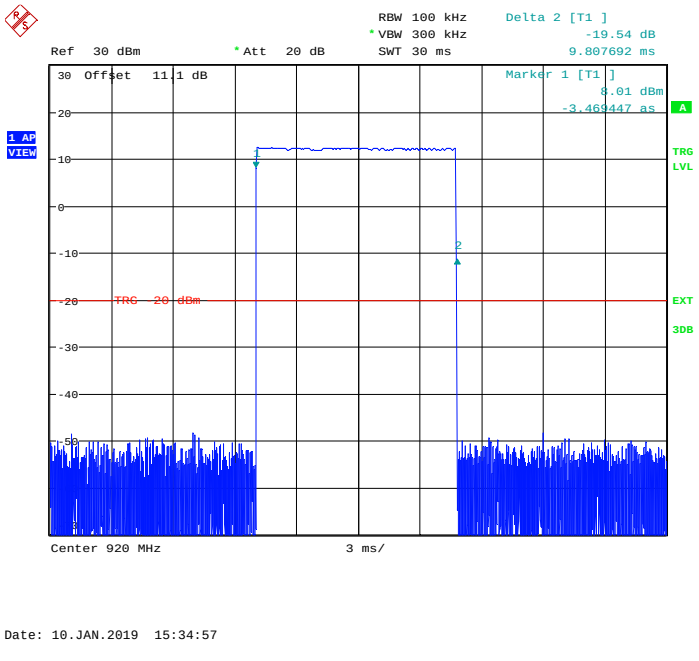


Date: 9.JAN.2019 11:57:28

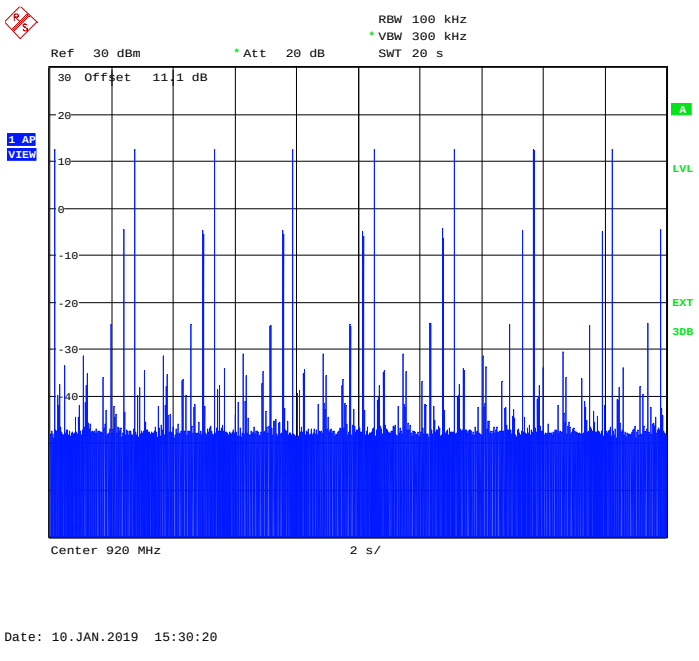
Plot 5.2.4.3. Carrier Frequency Separation



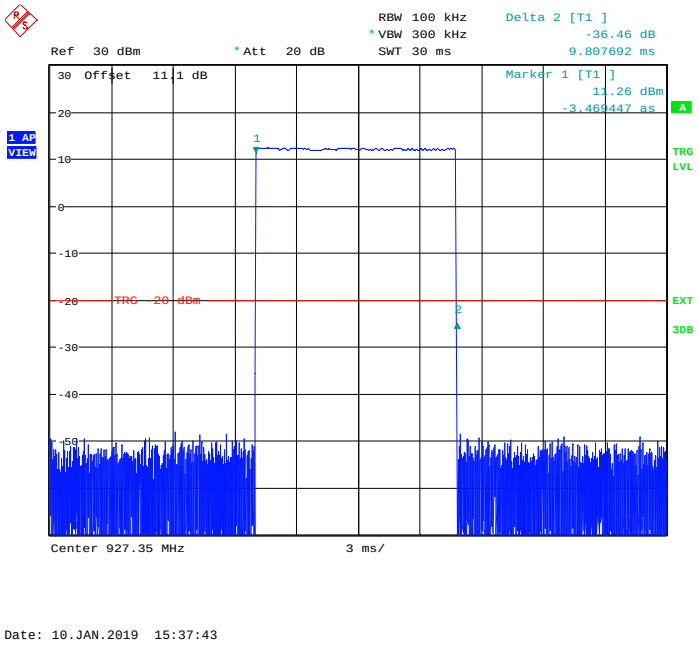
Plot 5.2.4.4. Average Time of Occupancy for 50 Hopping Frequencies, 920.00 MHz
Dwell Time @ 902.4 MHz = 9.81 ms



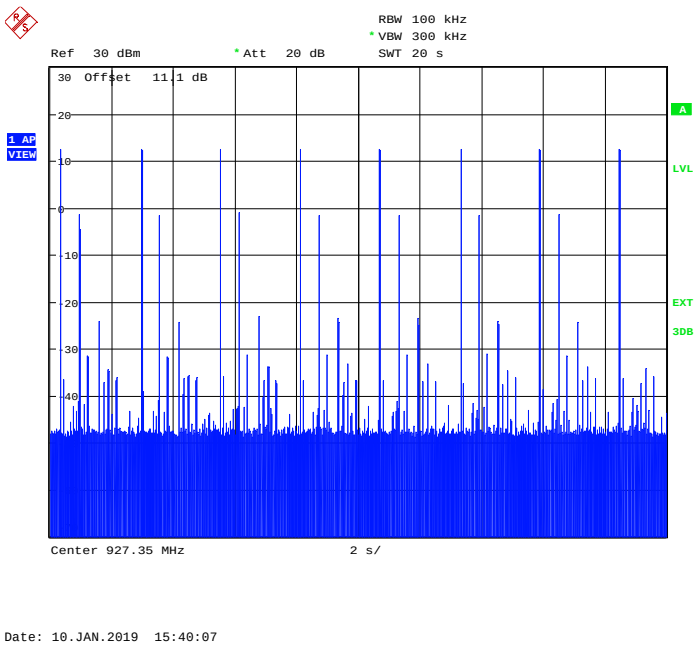
Plot 5.2.4.5. Average Time of Occupancy for 50 Hopping Frequencies, 920.00 MHz
Average time of occupancy = [Dwell Time] x [number of hops within a period of 20s (0.4s x 50 employed channels)]
= 9.81 ms x 8 = 78.48 ms



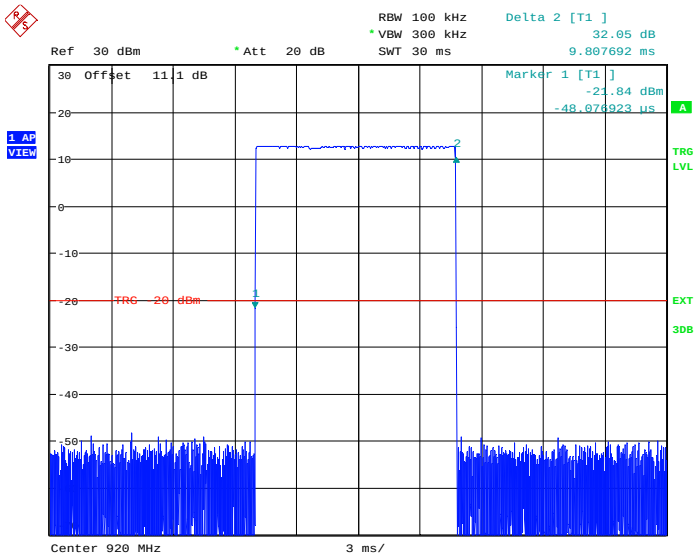
Plot 5.2.4.6. Average Time of Occupancy for 50 Hopping Frequencies, 927.35 MHz
Dwell Time @ 927.35 MHz = 9.81 ms



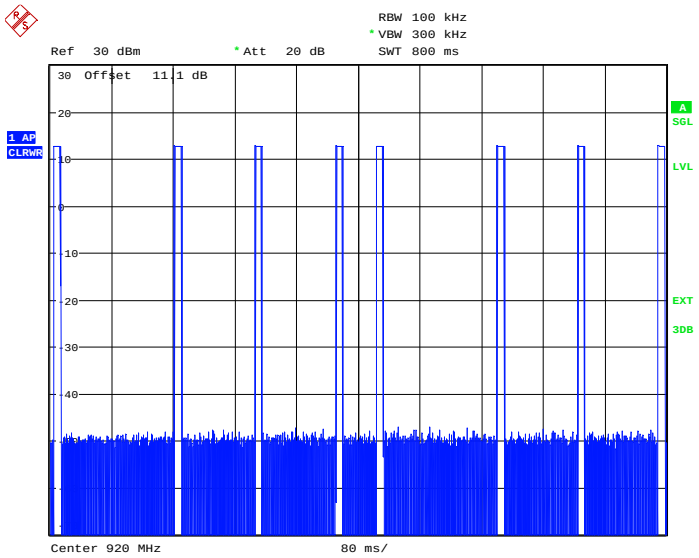
Plot 5.2.4.7. Average Time of Occupancy for 50 Hopping Frequencies, 927.35 MHz
Average time of occupancy = [Dwell Time] x [number of hops within a period of 20s (0.4s x 50 employed channels)]
= 9.81 ms x 8 = 78.48 ms



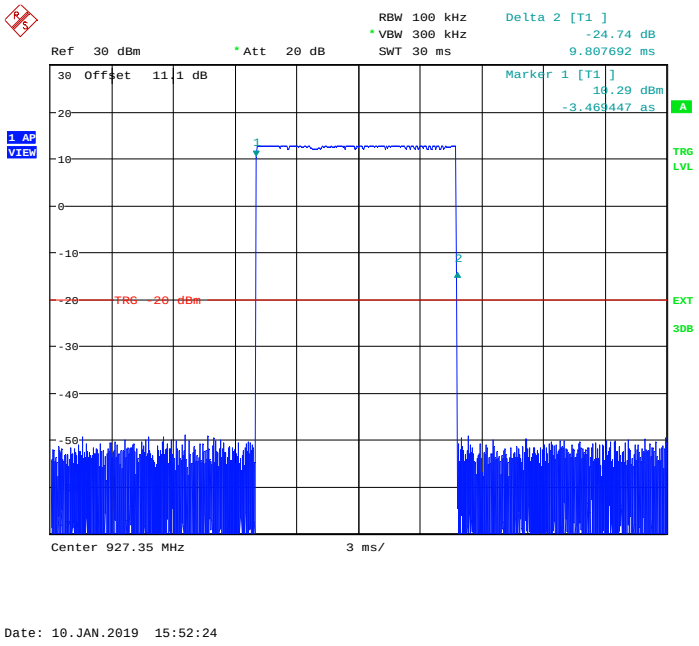
Plot 5.2.4.8. Average Time of Occupancy for 2 Hopping Frequencies, 920.00 MHz
Dwell Time @ 902.4 MHz = 9.81 ms



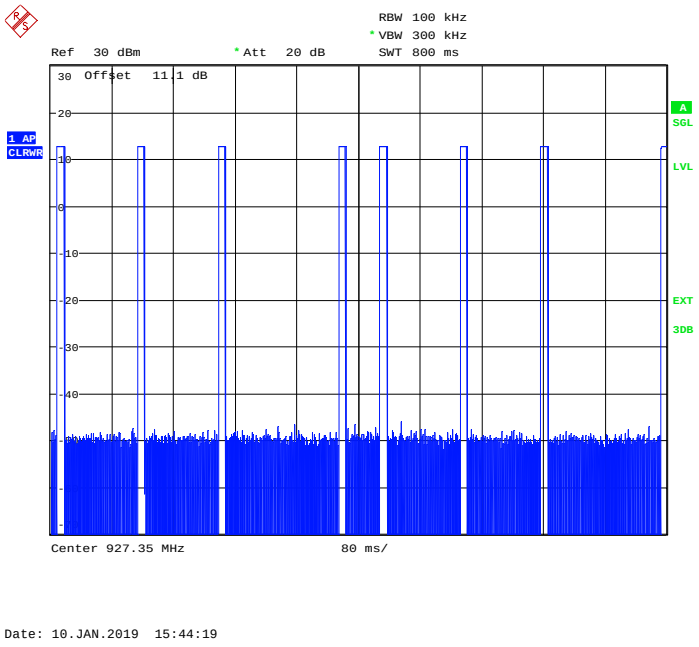
Plot 5.2.4.9. Average Time of Occupancy for 2 Hopping Frequencies, 920.00 MHz
Average time of occupancy = [Dwell Time] x [number of hops within a period of 0.8s (0.4s x 2 employed channels)]
= 9.81 ms x 8 = 78.48 ms



Plot 5.2.4.10. Average Time of Occupancy for 2 Hopping Frequencies, 927.35 MHz
Dwell Time @ 927.35 MHz = 9.81 ms



Plot 5.2.4.11. Average Time of Occupancy for 2 Hopping Frequencies, 927.35 MHz
Average time of occupancy = [Dwell Time] x [number of hops within a period of 0.8s (0.4s x 2 employed channels)]
= 9.81 ms x 8 = 78.48 ms



5.3. MAXIMUM PEAK CONDUCTED OUTPUT POWER [§ 15.247(b)(3)]

5.3.1. Limits

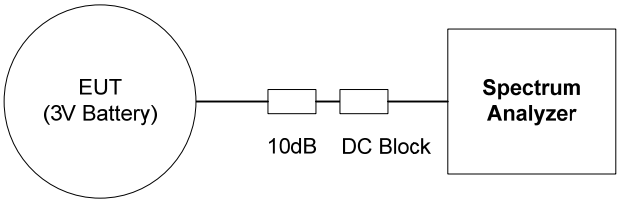
§15.247(b)(3): For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements. The average must not include any time intervals during which the transmitter is off or is transmitting at a reduced power level. If multiple modes of operation are possible (e.g., alternative modulation methods), the maximum conducted output power is the highest total transmit power occurring in any mode.

§15.247(b)(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.

5.3.2. Method of Measurements

Subclause 11.9.2.2.2 Method AVGSA-1 of ANSI C63.10

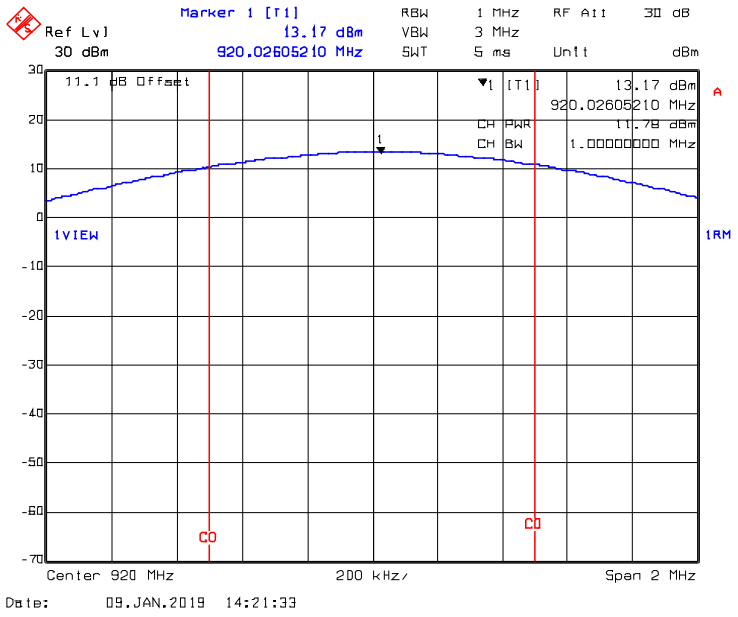
5.3.3. Test Arrangement



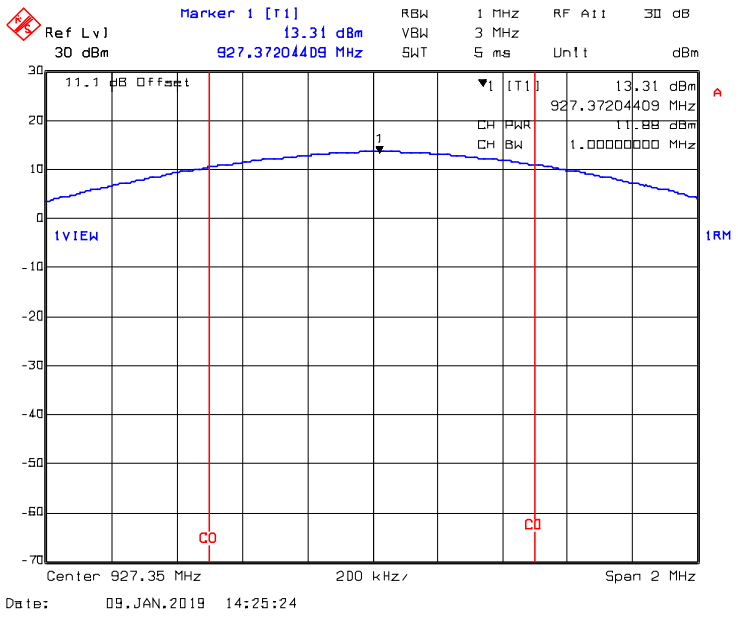
5.3.4. Test Data

Modulation	Frequency (MHz)	Maximum Conducted (Average) Output Power		Antenna Assembly Gain (dBi)	EIRP (dBm)	Maximum Conducted Output Power Limit (dBm)	EIRP Limit (dBm)
		(dBm)	(W)				
38.4kbps FSK	920.00	11.78	0.015066	-5	6.78	30	36
	927.35	11.88	0.015417	-5	6.88	30	36

Plot 5.3.4.1. Maximum Conducted Output Power, FSK Modulation, Channel 0, 920.00 MHz



Plot 5.3.4.2. Maximum Conducted Output Power, FSK Modulation, Channel 49, 927.35 MHz



5.4. MAXIMUM POWER SPECTRAL DENSITY [§ 15.247(f)]

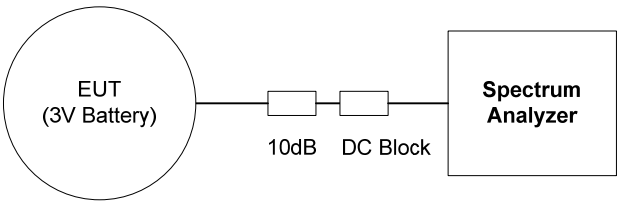
5.4.1. Limit(s)

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.

5.4.2. Method of Measurements

KDB 558074 D01 15.247 Meas Guidance v05, Section 8.4 (Subclause 11.10.3 Method AVGPSD-1 of ANSI C63.10)

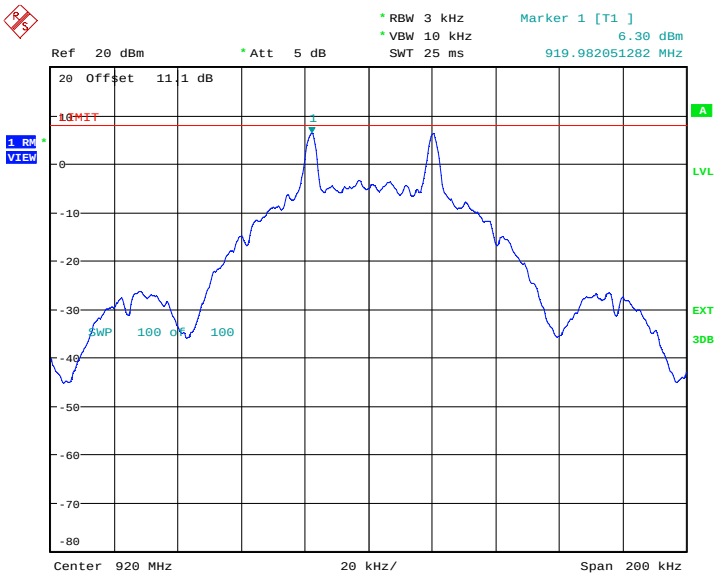
5.4.3. Test Arrangement



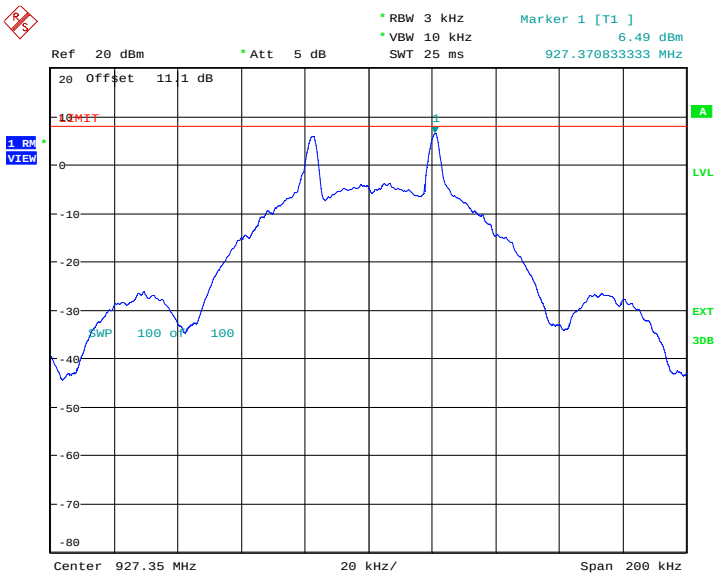
5.4.4. Test Data

Modulation	Channel	Frequency (MHz)	PSD (dBm)	Max. Limit (dBm)	Margin (dBm)
FSK	0	920.00	6.30	8	-1.70
	49	927.35	6.49	8	-1.51

Plot 5.4.4.1. Maximum Power Spectral Density, FSK Modulation, Channel 0, 920.00 MHz



Plot 5.4.4.2. Maximum Power Spectral Density, FSK Modulation, Channel 49, 927.35 MHz



5.5. TRANSMITTER SPURIOUS RADIATED EMISSIONS AT 3 METERS [§§ 15.247(d), 15.209 & 15.205]

5.5.1. Limit

§ 15.247 (d): 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)).

Section 15.205(a) - Restricted Bands of Operation

MHz	MHz	MHz	GHz
0.090–0.110	16.42–16.423	399.9–410	4.5–5.15
[1] 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	2655–2900	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	([2])
13.36–13.41.			

[1] Until February 1, 1999, this restricted band shall be 0.490–0.510 MHz.
[2] Above 38.6

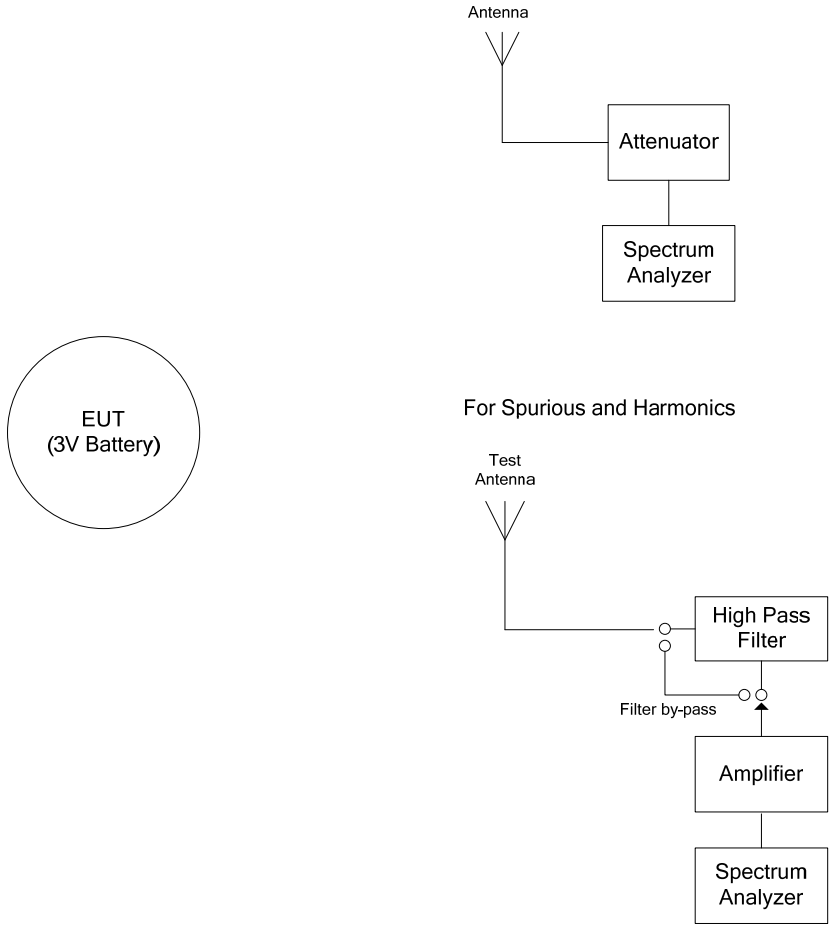
Section 15.209(a) - Field Strength Limits within Restricted Frequency Bands

Frequency (MHz)	Field Strength (microvolts/meter)	Measurement Distance (meters)
0.009 - 0.490	2,400 / F (kHz)	300
0.490 - 1.705	24,000 / F (kHz)	30
1.705 - 30.0	30	30
30 – 88	100	3
88 – 216	150	3
216 – 960	200	3
Above 960	500	3

5.5.2. Method of Measurements

ANSI C63.10-2013, Sections 6.10 and 6.11.

5.5.3. Test Arrangement



5.5.4. Test Data

Remark(s):

- The following test data represent the worst-case derived from exploratory tests.
- All spurious emissions that are in excess of 20 dB below the specified limit shall be recorded.
- Under normal mode of operation the duty cycle is 18.61 %, a duty cycle correction factor of -14.61 dB, as computed in section 5.5.4.1.1 were applied to measurements made with an average detector.

5.5.4.1. Spurious Radiated Emission

Fundamental Frequency: 920.00 MHz
Frequency Test Range: 30 MHz – 10 GHz

Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
920.00	108.14	--	V	--	--	--	--
920.00	102.22	--	H	--	--	--	--
2760.00	66.31	51.06	V	54.0	78.1	-2.9	Pass*
2760.00	70.13	53.62	H	54.0	78.1	-0.4	Pass*
4600.00	70.48	52.66	V	54.0	78.1	-1.3	Pass*
4600.00	62.23	45.94	H	54.0	78.1	-8.1	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

Fundamental Frequency: 927.35 MHz
Frequency Test Range: 30 MHz – 10 GHz

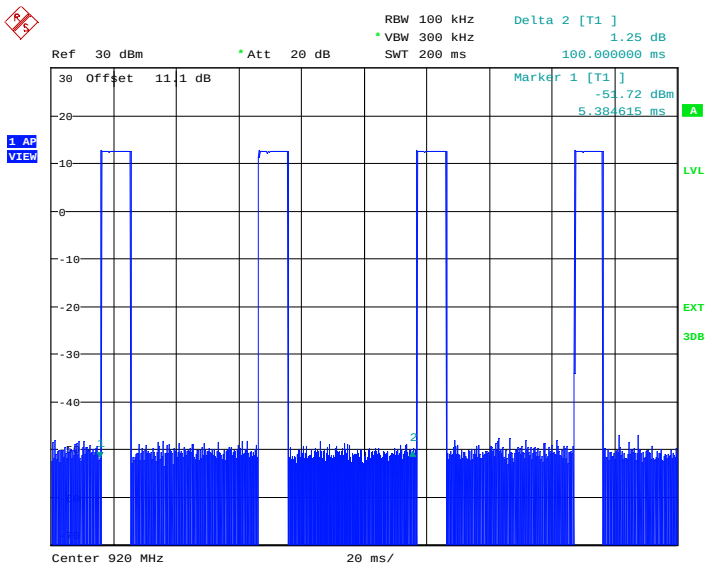
Frequency (MHz)	RF Peak Level (dBµV/m)	RF Avg Level (dBµV/m)	Antenna Plane (H/V)	Limit 15.209 (dBµV/m)	Limit 15.247 (dBµV/m)	Margin (dB)	Pass/ Fail
927.35	108.25	--	V	--	--	--	--
927.35	102.49	--	H	--	--	--	--
2782.05	65.17	49.83	V	54.0	78.3	-4.2	Pass*
4636.75	68.87	53.55	V	54.0	78.3	-0.5	Pass*
2782.05	69.10	53.27	H	54.0	78.3	-0.7	Pass*
4636.75	67.36	51.68	H	54.0	78.3	-2.3	Pass*

All other spurious emissions and harmonics are more than 20 dB below the applicable limit.

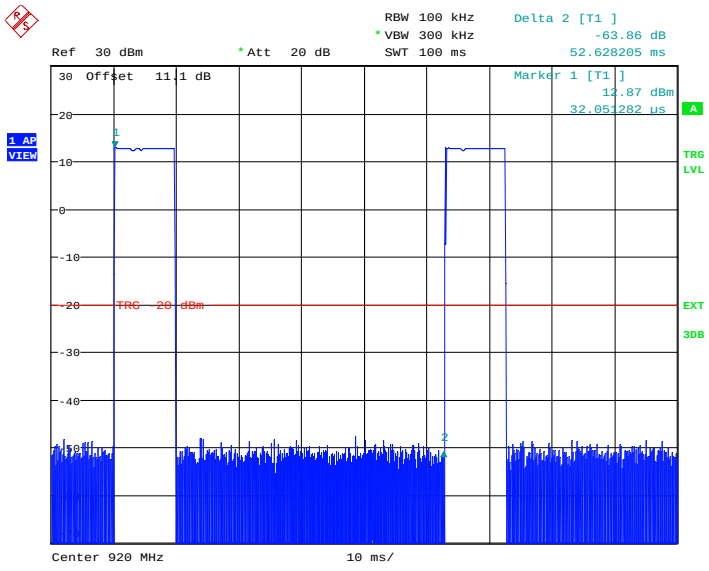
*Field strength of emissions appearing within restricted frequency bands shall not exceed the limits in § 15.209.

5.5.4.1.1. Duty-Cycle Correction Factor

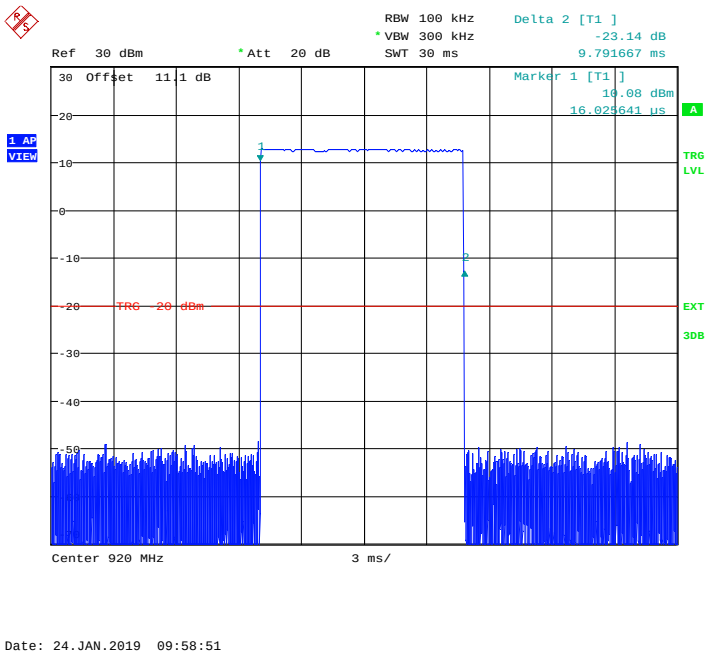
Plot 5.5.4.1.1.1. Pulse Train in 200 ms



Plot 5.5.4.1.1.2. Period, 52.6282 ms



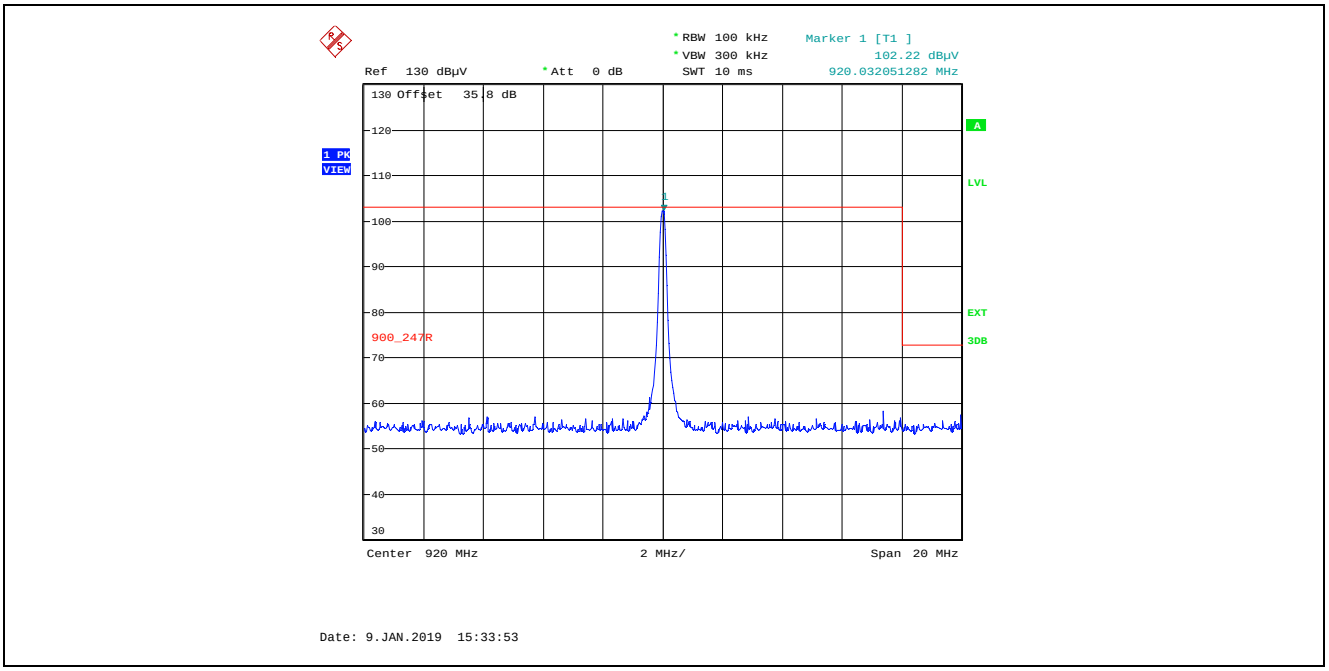
Plot 5.5.4.1.1.3. Pulse, 9.7917 ms



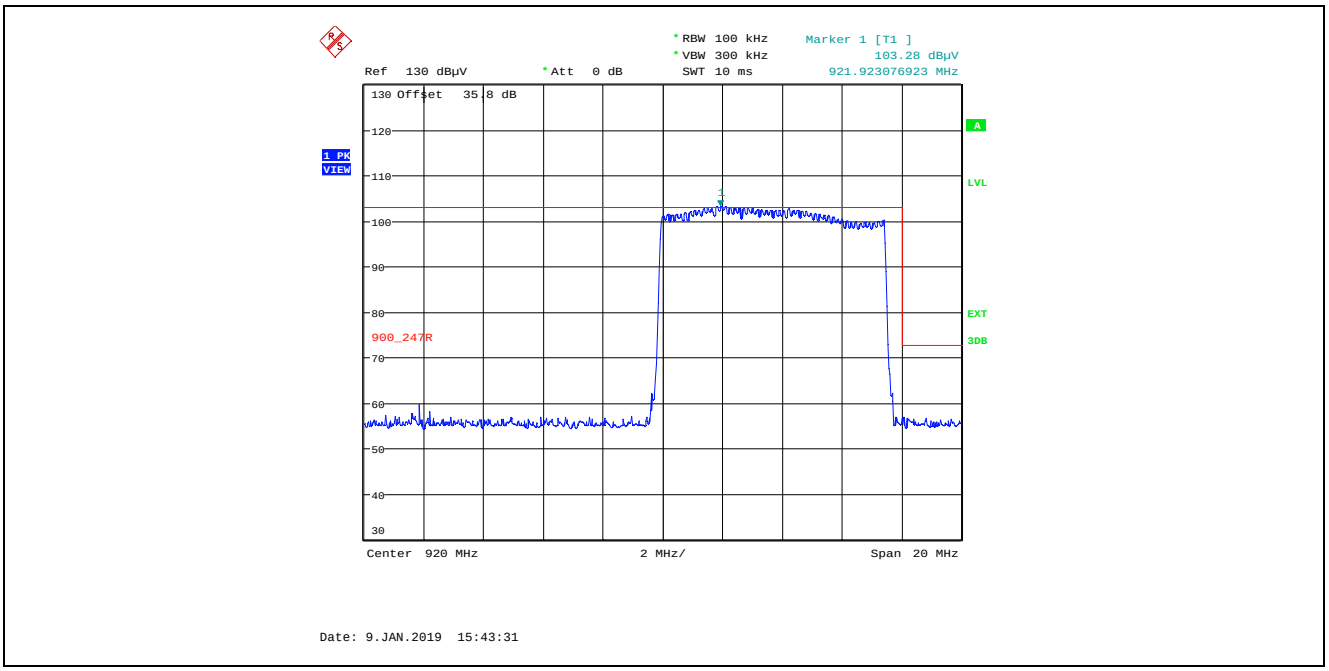
Duty Cycle Correction Factor = 20*log (9.7917ms / 52.6282ms) = -14.61 dB

5.5.4.2. Band –Edge RF Radiated Emissions

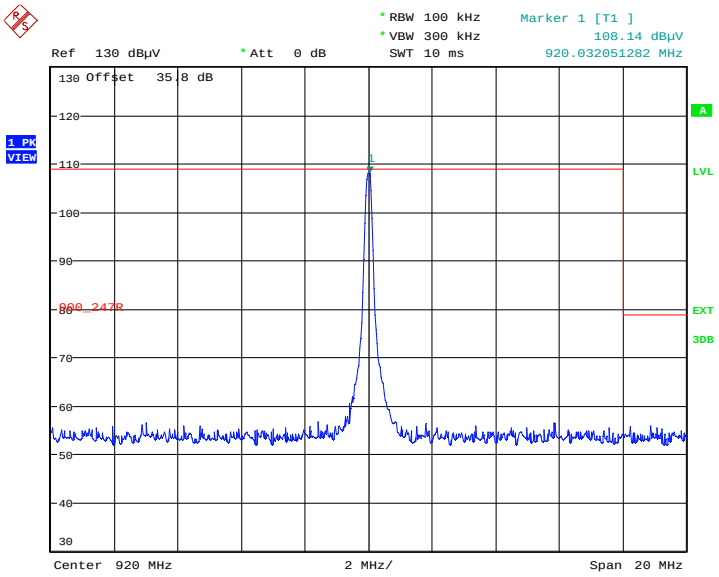
Plot 5.5.4.2.1. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Single Frequency Mode, 920.00 MHz



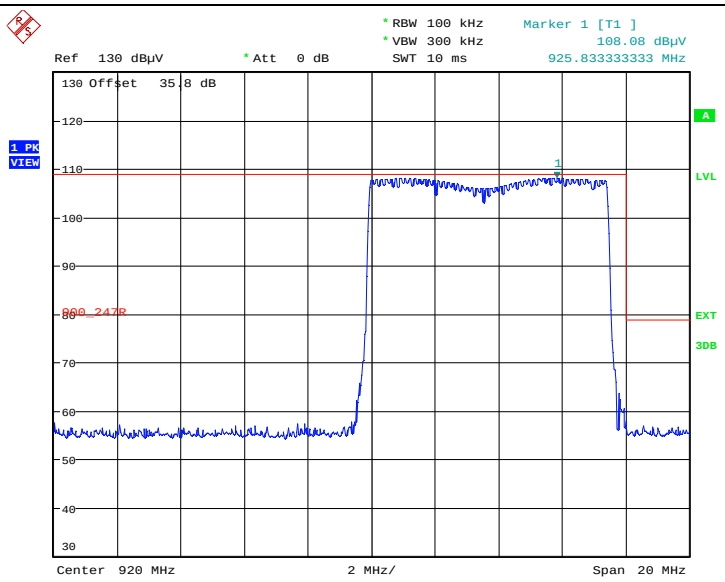
Plot 5.5.4.2.2. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Pseudorandom Channel Hopping Mode, 920.00 MHz



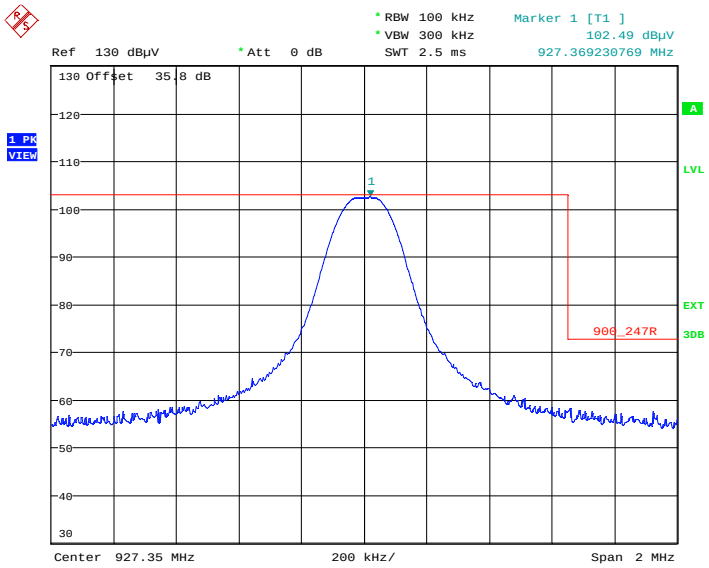
Plot 5.5.4.2.3. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Single Frequency Mode, 920.00 MHz



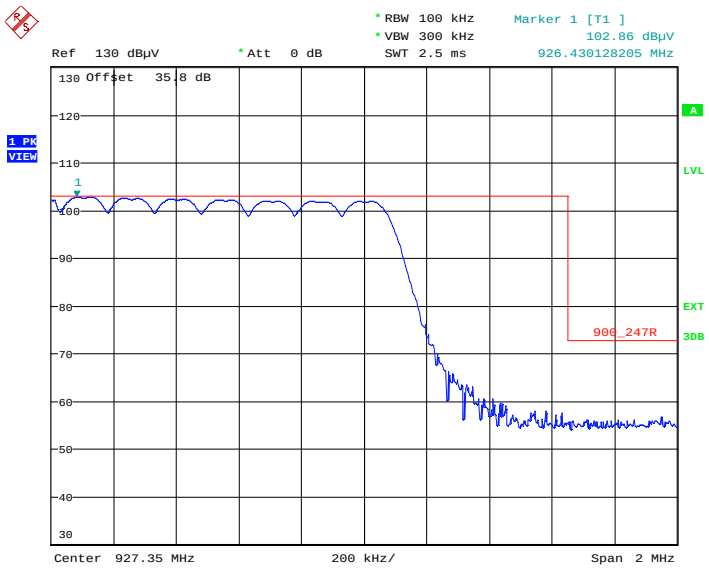
Plot 5.5.4.2.4. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Pseudorandom Channel Hopping Mode, 920.00 MHz



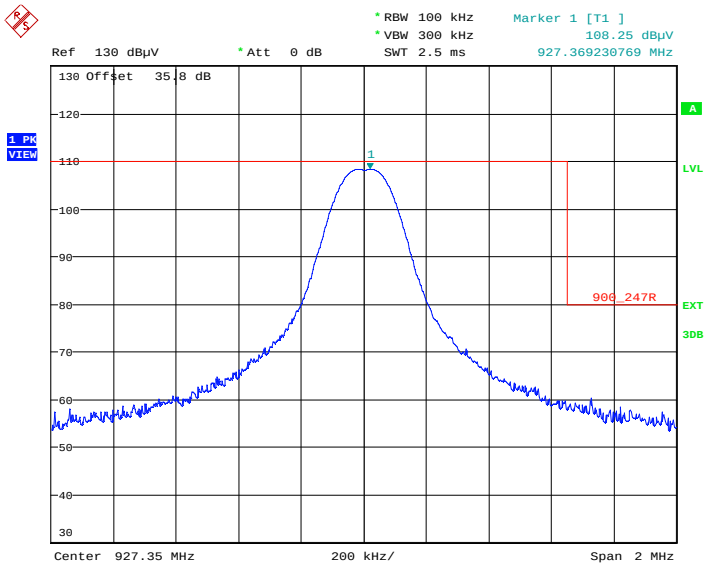
Plot 5.5.4.2.5. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Single Frequency Mode, 927.35 MHz



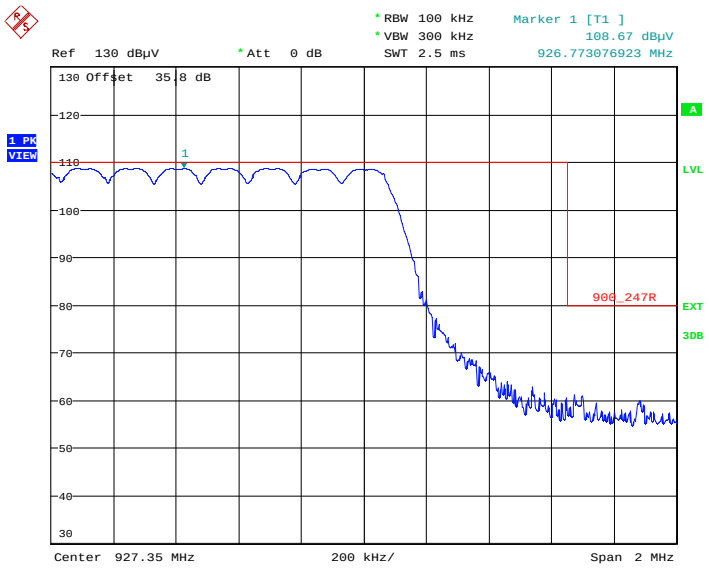
Plot 5.5.4.2.6. Band-Edge RF Radiated Emissions at 3 m, Horizontal Polarization
Pseudorandom Channel Hopping Mode, 927.35 MHz



Plot 5.5.4.2.7. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Single Frequency Mode, 927.35 MHz



Plot 5.5.4.2.8. Band-Edge RF Radiated Emissions at 3 m, Vertical Polarization
Pseudorandom Channel Hopping Mode, 927.35 MHz



5.6. RF EXPOSURE REQUIRMENTS [§§ 15.247(i), 1.1310 & 2.1091]

§ **1.1310:** The criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in 1.1307(b).

Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm^2)	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	*($900/f^2$)	6
30-300	61.4	0.163	1.0	6
300-1500			f/300	6
1500-100,000			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	*($180/f^2$)	30
30-300	27.5	0.073	0.2	30
300-1500			f/1500	30
1500-100,000			1.0	30

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

Note 1: 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.

Note 2: 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 can not exercise control over their exposure.

5.6.1. Method of Measurements

Calculation Method of Power Density/RF Safety Distance:

$$S = \frac{PG}{4\pi \cdot r^2} = \frac{EIRP}{4\pi \cdot r^2}$$

Where, P: power input to the antenna in mW
EIRP: Equivalent (effective) isotropic radiated power.
S: power density mW/cm^2
G: numeric gain of antenna relative to isotropic radiator
r: distance to centre of radiation in cm

5.6.2. RF Evaluation

Frequency (MHz)	EIRP (dBm)	EIRP (mW)	Evaluation Distance, r (cm)	Power Density, S (mW/cm^2)	MPE Limit (mW/cm^2)	Margin (mW/cm^2)
920.00	6.88	4.875	20	0.001	0.613	-0.612

EXHIBIT 6. TEST EQUIPMENT LIST

Test Instruments	Manufacturer	Model No.	Serial No.	Frequency Range	Cal. Due Date
Spectrum Analyzer	Rohde & Schwarz	FSU26	200946	20Hz–26.5 GHz	25 Jul 2020
Attenuator	Hewlett Packard	8493C	0465	DC–26.5 GHz	See Note 1
DC Block	Hewlett Packard	11742A	12460	0.045–26.5 GHz	See Note 1
EMI Receiver	Rohde & Schwarz	ESU40	100037	20Hz–40 GHz	04 May 2019
RF Amplifier	Com-Power	PAM-0118A	551052	0.5 – 18 GHz	26 Jun 2019
RF Amplifier	Hewlett Packard	84498	3008A00769	1 – 26.5 GHz	01 Oct 2019
Biconilog	EMCO	3142C	00026873	26-3000 MHz	27 Apr 2020
Horn Antenna	EMCO	3155	6570	1 – 18 GHz	11 Oct 2020
High Pass Filter	K & L	11SH10-1500/T8000	2	Cut off 900 MHz	See Note 1
Band-Reject Filter	Micro-Tronics	BRC50722	001	Cut off 900 MHz	See Note 1
Log Periodic	ETS-Lindgren	3148	23845	200-2000 MHz	02 Aug 2020
Note 1: Internal Verification/Calibration check					

EXHIBIT 7. MEASUREMENT UNCERTAINTY

The measurement uncertainties stated were calculated in accordance with the requirements of CISPR 16-4-2 @ IEC:2003 and JCGM 100:2008 (GUM 1995) – Guide to the Expression of Uncertainty in Measurement.

7.1. LINE CONDUCTED EMISSION MEASUREMENT UNCERTAINTY

	Line Conducted Emission Measurement Uncertainty (9 kHz – 30 MHz):	**Measured**	**Limit**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.44**	**± 1.8**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 2.89**	**± 3.6**

7.2. RADIATED EMISSION MEASUREMENT UNCERTAINTY

	Radiated Emission Measurement Uncertainty @ 3m, Horizontal (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.79**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3m, Vertical (30-1000 MHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 2.39**	**± 2.6**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 4.78**	**± 5.2**

	Radiated Emission Measurement Uncertainty @ 3 m, Horizontal & Vertical (1 – 18 GHz):	**Measured (dB)**	**Limit (dB)**
u_c	**Combined standard uncertainty:** $u_c(y) = \sqrt{\sum_{i=1}^{m} u_i^2(y)}$	**± 1.87**	**Under consideration**
U	**Expanded uncertainty U:** $U = 2u_c(y)$	**± 3.75**	**Under consideration**