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TEST REPORT

SCOPE OF WORK
FCC TESTING–KFW1A

REPORT NUMBER
221201010SZN-001

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TEST REPORT

Intertek Report No.: 221201010SZN-001

Valeo North America Inc.

Application
For
Certification

FCC ID: 2BAHD-KFW1

Key Fob (WL/WS)

Model: KFW1A

Transmitter

Report No.: 221201010SZN-001

We hereby certify that the sample of the above item is considered to comply with the requirements of FCC Part 15, Subpart C for Intentional Radiator, mention 47 CFR [10-1-21]

Prepared and Checked by:

Robin Zhou
Senior Project Engineer

Approved by:

Ryan Chen
Project Engineer
Date: March 22, 2023

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MEASUREMENT/TECHNICAL REPORT

This report concerns (check one) Original Grant ___X___ Class II Change _____

Equipment Type: DSC - Part 15 Security Remote Control Transmitter

Deferred grant requested per 47 CFR 0.457(d)(1)(ii)? Yes _____ No ___X___

If yes, defer until : _____
date

Company Name agrees to notify the Commission by: _____
date

of the intended date of announcement of the product so that the grant can be issued on that date.

Transition Rules Request per 15.37? Yes _____ No ___X___

If no, assumed Part 15, Subpart C for intentional radiator - the new 47 CFR [10-01-21] Edition] provision.

Report prepared by:

Robin Zhou
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1.0 Summary of Test results

Applicant: Valeo North America Inc.
Applicant Address: 150 Stephenson Hwy, Troy, Michigan 48083, United States

Manufacturer: Valeo North America Inc.
Manufacturer Address: 150 Stephenson Hwy, Troy, Michigan 48083, United States

Equipment Under Test (EUT):

Product Description:	Key Fob (WL/WS)
Model:	KFW1A
Part ID No.:	T04FA27920001 / T14FA279200001
Type of device:	Tx (433.92MHz), Rx (125kHz)
Operating frequency:	433.92MHz
Number of Channels:	1
Modulation Type:	FSK / ASK
Type of Antenna:	Integral (433.92MHz), passive 3D Coil (125kHz)
HW version:	B884328_01 rev. E
SW version:	1.30
FW version:	(none)
Standards/guidance:	FCC Title 47 CFR Part 15.231:2021 ANSI C63.10:2013
Sample Receipt Date:	03 February 2023
Test Conducted Date:	03 February 2023 to 08 March 2023
Test Condition:	21.9 ℃, 43% HR, 101 kPa

FCC ID: 2BAHD-KFW1

TEST ITEM	REFERENCE	RESULTS
Transmitter Field Strength	15.231(b) &15.205	Pass
Bandwidth	15.231(c)	Pass
Timing Requirement	15.231(a)(1)	Pass

Notes: 1. The EUT uses an Integral Antenna which in accordance to Section 15.203 is considered sufficient to comply with the provisions of this section.

2.0 General Description

2.1 Product Description

The Equipment Under Test (EUT) is a Key Fob (WL/WS) operating at 433.92MHz. The EUT is powered by DC 3V by CR2450 Battery. For more detailed features description, please refer to the user's manual.

Antenna Type: Integral Antenna
Modulation: ASK for manually operated, FSK for automatically activated
Antenna Gain: -15dBi Max.

For electronic filing, the brief circuit description is saved with filename: descri.pdf.

2.2 Related Submittal(s) Grants

This is an application for certification of the Key Fob (WL/WS) transmitter portion. which has 433.92MHz transmitting function and 125kHz receiving function, and related report for FCC SDOC is subjected to report number: 230206036SZN-003.

2.3 Test Methodology

Radiated emission measurements were performed according to the procedures in ANSI C63.10 (2013). Radiated emission measurement was performed in Semi-anechoic chamber. For radiated emission measurement, preliminary scans were performed in the semi-anechoic chamber only to determine the worst case modes. All radiated tests were performed at an antenna to EUT distance of 3 meters, unless stated otherwise in the "**Justification Section**" of this Application.

2.4 Test Facility

The Semi-Anechoic chamber used to collect the radiated data is Intertek **Testing Services Shenzhen Ltd. Longhua Branch** and located at 101, 201, Building B, No. 308 Wuhe Avenue, Zhangkengjing Community, GuanHu Subdistrict, LongHua District, ShenZhen. This test facility and site measurement data have been fully placed on file with File Number: CN1188.

3.0 System Test Configuration

3.1 Justification

The system was configured for testing in a typical fashion (as a customer would normally use it), and in the confines as outlined in ANSI C63.10 (2013).

The EUT was powered by a new DC 3V by CR2450 Battery during the test. Only the worst case data was shown in the report.

For maximizing emissions below 30 MHz, the EUT was rotated through 360°, the bottom of the loop antenna was placed 1 meter above the ground, and the antenna polarization was changed. For maximizing emission at and above 30 MHz, the EUT was rotated through 360°, the antenna height was varied from 1 meter to 4 meters above the ground plane, and the antenna polarization was changed. This step by step procedure for maximizing emissions led to the data report in Exhibit 4.0.

The unit was operated standalone and placed in the center of the turntable.

The equipment under test (EUT) was configured for testing in a typical fashion (as a customer would normally use it). The EUT was mounted to a plastic stand if necessary and placed on the styrene turntable, which enabled the engineer to maximize emissions through its placement in the three orthogonal axes.

3.2 EUT Exercising Software

Stallantis WLWS Homogation Tester: TSMASTERR V2022.12.20.810

3.3 Special Accessories

No special accessories used.

3.4 Equipment Modification

Any modifications installed previous to testing by Valeo North America Inc. will be incorporated in each production model sold / leased in the United States.

No modifications were installed by Intertek Testing Services Shenzhen Ltd. Longhua Branch.

3.5 Measurement Uncertainty

When determining of the test conclusion, the Measurement Uncertainty of test has been considered.

Measurement Uncertainty	Uncertainty
Occupied Channel Bandwidth	± 34.64 Hz
timing measurement	±0.83ms
Spurious emission (6GHz to 18GHz)	±5.1dB
Radiated emission (1GHz to 6GHz)	±4.8dB
Radiated emission (Up to 1GHz)	±4.8dB
Temperature	±1°C
Humidity	±5%

3.6 Support Equipment List and Description

Description	Manufacturer	Model/ Cable length
KIN	Valeo	KNW1
RFHM	Valeo	RFH1A
PSU (DHM)	Vitesco Technologies USA	68375285AD
Loadbox	Valeo	TF6208
ToSun CANoE	Tosun	TC1012
Relay	Zhisheng	6QMBS
24 pins connect cable*2	Valeo	2m
USB Cable*2	Valeo	2m
DC input cable*4	Valeo	1m
Relay connect cable*1	Valeo	5m
ToSun CANoE connect cable*1	Valeo	5m
Laptop	DELL	Latitude 3480

4.0 Emission Results

Data is included worst-case configuration (the configuration which resulted in the highest emission levels).

4.1 Radiated Test Results

A sample calculation, configuration photographs and data tables of the emissions are included.

4.1.1 Field Strength Calculation

The field strength is calculated by adding the reading on the Spectrum Analyzer to the factors associated with preamplifiers (if any), antennas, cables, pulse desensitization and average factors (when specified limit is in average and measurements are made with peak detectors).
A sample calculation is included below.

FS = RA + AF + CF − AG + PD + AV

where FS = Field Strength in dBμV/m
RA = Receiver Amplitude (including preamplifier) in dBμV
CF = Cable Attenuation Factor in dB
AF = Antenna Factor in dB/m
AG = Amplifier Gain in dB
PD = Pulse Desensitization in dB
AV = Average Factor in −dB

In the radiated emission table which follows, the reading shown on the data table may reflect the preamplifier gain. An example of the calculations, where the reading does not reflect the preamplifier gain, follows:
FS = RA + AF + CF − AG + PD + AV

Example
Assume a receiver reading of 62.0dBμV is obtained. The antenna factor of 7.4dB and cable factor of 1.6dB is added. The amplifier gain of 29dB is subtracted. The pulse desensitization factor of the spectrum analyzer was 0dB, and the resultant average factor was −10dB. The net field strength for comparison to the appropriate emission limit is 32dBμV/m. This value in dBμV/m was converted to its corresponding level in μV/m.

RA = 62.0dBμV
AF = 7.4 dB/m
CF = 1.6dB
AG = 29.0dB
PD = 0dB
AV = -10dB
FS = 62 + 7.4 + 1.6 - 29 + 0 + (-10) = 32dBμV/m
Level in μV/m = Common Antilogarithm [(32dBμV/m)/20] = 39.8μV/m

4.1.2 Radiated Emission Configuration Photograph

For electronic filing, the worst case radiated emission configuration photographs are saved with filename: radiated photos.pdf.

4.1.3 Radiated Emissions

The data on the following page lists the significant emission frequencies, the limit and the margin of compliance. Numbers with a minus sign are below the limit.

Worst Case Radiated Emission
at
433.92 MHz

Judgement: Passed by 5.1 dB

TEST PERSONNEL:

Sign on file

Robin Zhou, Senior Project Engineer
Typed/Printed Name

March 07, 2023
Date

Applicant: Valeo North America Inc.
Date of Test: March 07, 2023 Model: KFW1A
Worst Case Operating Mode: Transmitting (ASK mode 433.92MHz)

Radiated Emissions (30MHz to 5GHz)

Freq. (MHz)	Ant. Pol.	Reading PK	Pre-amp. gain	antenna factor	Emission Level (dBµV/m)			Limit 3m (dBµV/m)		Margin (dB)	
	H/V	(dBµV)	(dB)	(dB/m)	PK	AV Factor(dB)	AV	PK	AV	PK	AV
433.92	H	65.4	/	23.3	88.7	-13.0	75.7	100.8	80.8	-12.1	-5.1
867.84	H	5.1	/	28.9	34.0	-13.0	21.0	80.8	60.8	-46.8	-39.8
1301.76*	H	44.3	36.1	25.1	33.3	-13.0	20.3	74.0	54.0	-40.7	-33.7
1735.68	H	47.0	35.8	26.9	38.1	-13.0	25.1	80.8	60.8	-42.7	-35.7
2169.60	H	43.9	35.4	28.4	36.3	-13.0	23.3	80.8	60.8	-44.5	-37.5
3905.28*	H	41.9	34.2	31.2	38.9	-13.0	25.9	74.0	54.0	-35.1	-28.1
4339.20*	H	39.8	33.9	31.7	37.6	-13.0	24.6	74.0	54.0	-36.4	-29.4

NOTES:

1. Peak Detector Data unless otherwise stated.
2. All measurements were made at 3-meter. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz, the preamplifier is used for frequencies above 1 GHz only.
5. "*" Emission within restricted band fulfils the requirement of section 15.205.
6. AV factor (dB)= 20log (duty cycle)
   20log (Duty cycle) =20log (0.2240) = -13.0dB

Applicant: Valeo North America Inc.
Date of Test: March 07, 2023 Model: KFW1A
Worst Case Operating Mode: Transmitting (FSK mode 433.92MHz Case 2 Passive Start)

Radiated Emissions (30MHz to 5GHz)

Freq. (MHz)	Ant. Pol.	Reading PK	Pre-amp. gain	antenna factor	Emission Level (dBµV/m)			Limit 3m (dBµV/m)		Margin (dB)	
	H/V	(dBµV)	(dB)	(dB/m)	PK	AV Factor(dB)	AV	PK	AV	PK	AV
433.92	H	63.4	/	23.3	86.7	-20.3	66.4	100.8	80.8	-14.1	-14.4
867.84	H	4.6	/	28.9	33.5	-20.3	13.2	80.8	60.8	-47.3	-47.6
1301.76*	H	44.4	36.1	25.1	33.4	-20.3	13.1	74.0	54.0	-40.6	-40.9
1735.68	H	47.9	35.8	26.9	39.0	-20.3	18.7	80.8	60.8	-41.8	-42.1
2169.60	H	42.7	35.4	28.4	35.7	-20.3	15.4	80.8	60.8	-45.1	-45.4
3905.28*	H	41.8	34.2	31.2	38.8	-20.3	18.5	74.0	54.0	-35.2	-35.5
4339.20*	H	39.6	33.9	31.7	37.4	-20.3	17.1	74.0	54.0	-36.6	-36.9

NOTES:

1. Peak Detector Data unless otherwise stated.
2. All measurements were made at 3-meter. Harmonic emissions not detected at the 3-meter distances were measured at 0.3-meter and an inverse proportional extrapolation was performed to compare the signal level to the 3-meter limit. No other harmonic emissions than those reported were detected at a test distance of 0.3-meter.
3. Negative value in the margin column shows emission below limit.
4. Horn antenna is used for the emission over 1000MHz, the preamplifier is used for frequencies above 1 GHz only.
5. "*" Emission within restricted band fulfils the requirement of section 15.205.
6. AV factor (dB)= 20log (duty cycle)
   20log (Duty cycle) =20log (0.0971) = -20.3dB

5.0 Equipment Photographs

For electronic filing, the photographs are saved with filename: external photos.pdf & internal photos.pdf.

6.0 Product Labeling

For electronic filing, the FCC ID label artwork and location is saved with filename: label.pdf.

7.0 Technical Specifications

For electronic filing, the block diagram and circuit diagram are saved with filename: block.pdf and circuit.pdf respectively.

8.0 Instruction Manual

For electronic filing, a preliminary copy of the Instruction Manual is saved with filename: manual.pdf.

This manual will be provided to the end-user with each unit sold/leased in the United States.

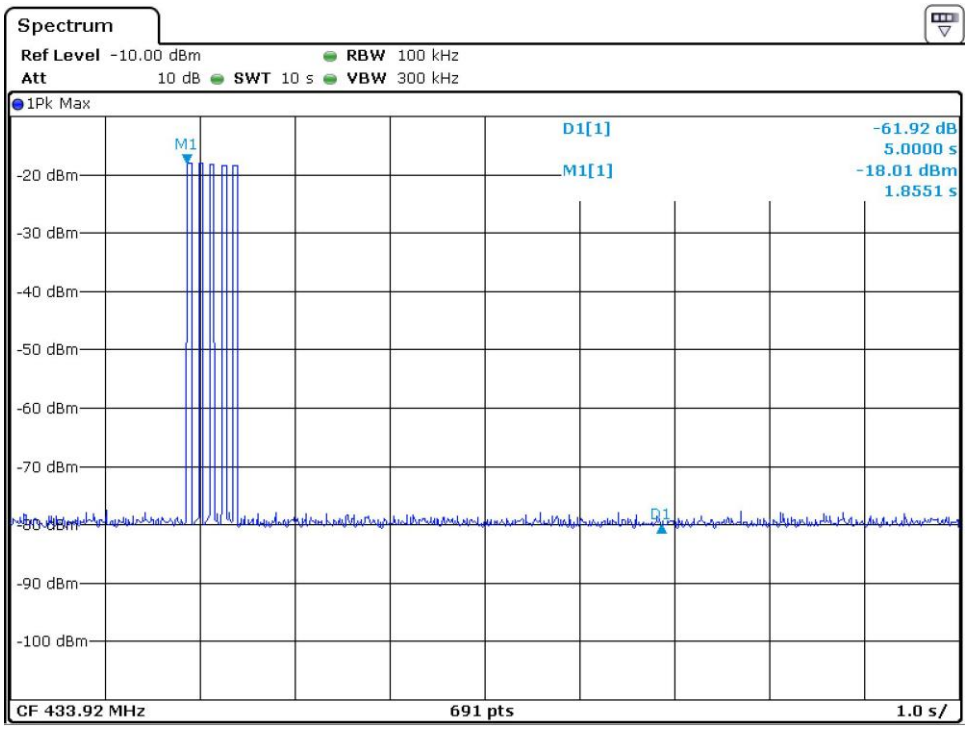
9.0 Miscellaneous Information

This miscellaneous information includes details of the measured bandwidth, the test procedure, calculation of timing requirements and pulse desensitization.

9.1 Timing Plot – Pursuant to FCC Part 15 Section 15.231(a)(1) & 15.231(a)(2)

Mode	Limit seconds	Verdict
Transmission	＜5	PASS

ASK mode

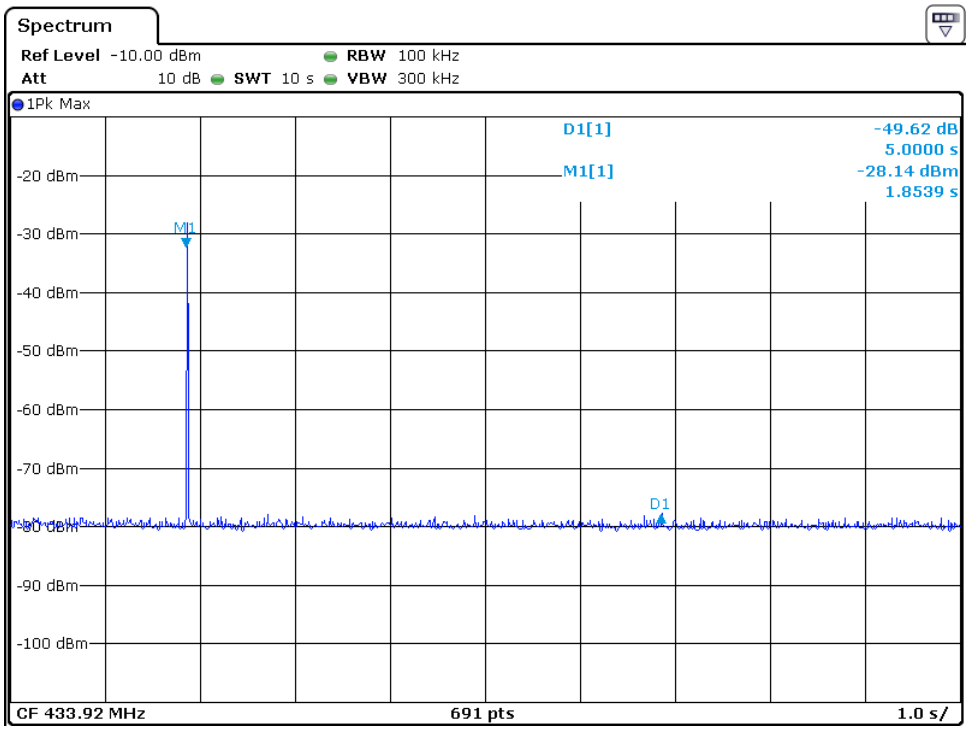


Note: The emission was found to cease within 5 seconds after button release.

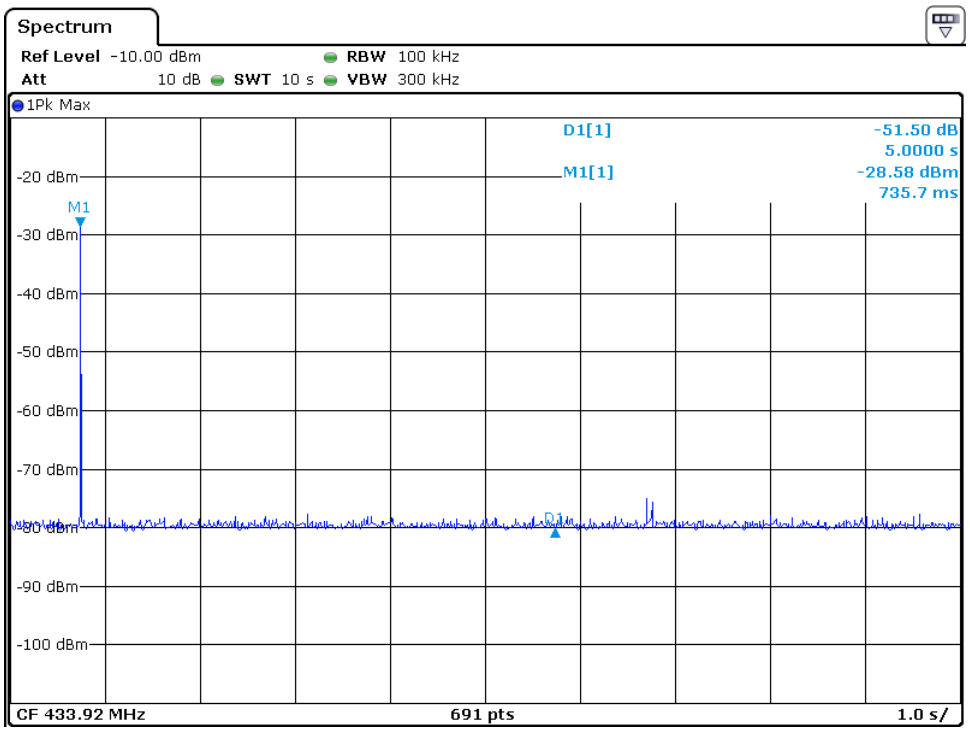
Result: Meet the requirements of FCC Part 15 Section 15.231(a)(1)

FSK mode

Case 1 Passive Enter



Case 2 Passive Start



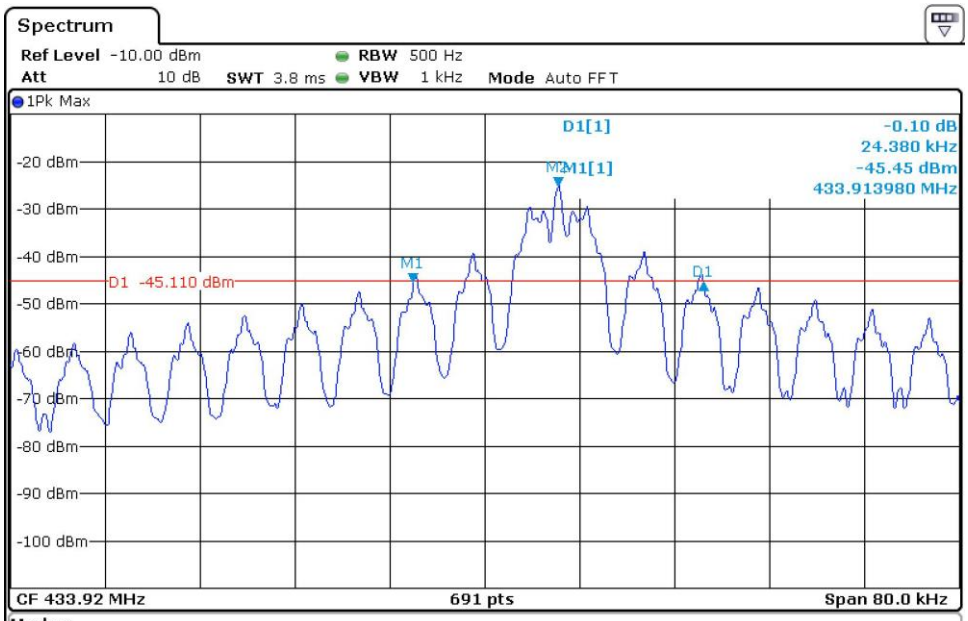
Note: The emission was found to cease within 5 seconds after activation.

Result: Meet the requirements of FCC Part 15 Section 15.231(a)(2)

9.2 Measured Bandwidth

From the plot, the maximum 20dB bandwidth is 160.64 kHz and less than the limit of 1.0848MHz. It fulfils the requirement of 15.231(c).

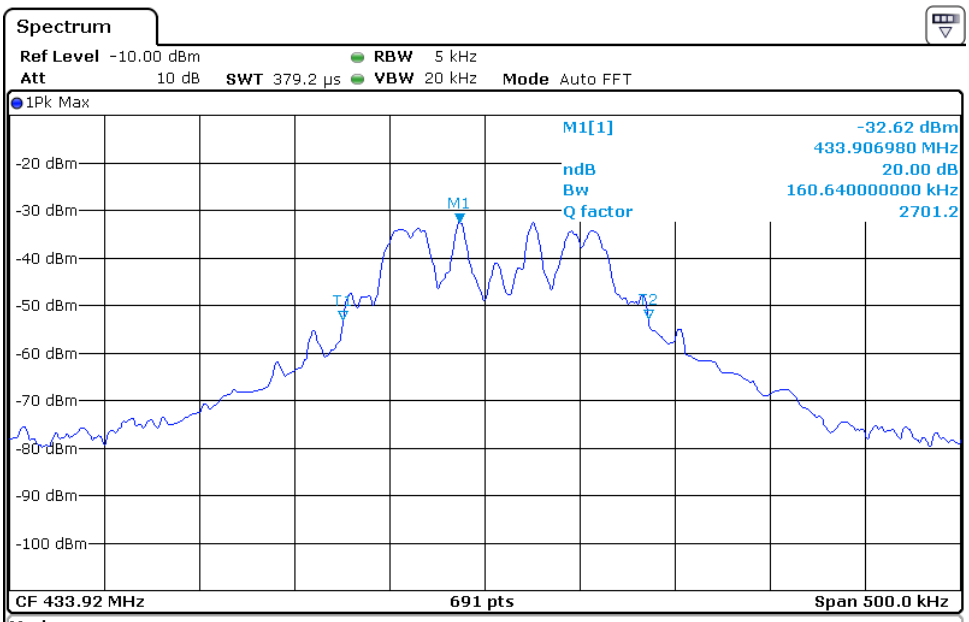
ASK mode



Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	433.91398 MHz	-45.45 dBm		
D1	M1	1	24.38 kHz	-0.10 dB		
M2		1	433.92614 MHz	-25.11 dBm		

FSK mode



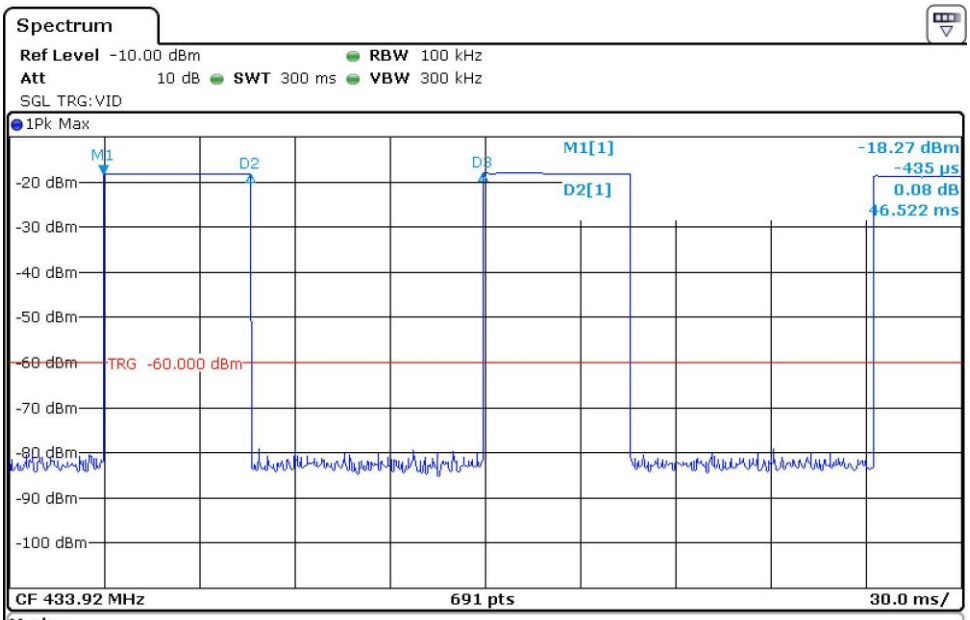
Marker

Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	433.90698 MHz	-32.62 dBm	ndB down	160.64 kHz
T1		1	433.84547 MHz	-52.91 dBm	ndB	20.00 dB
T2		1	434.00611 MHz	-52.70 dBm	Q factor	2701.2

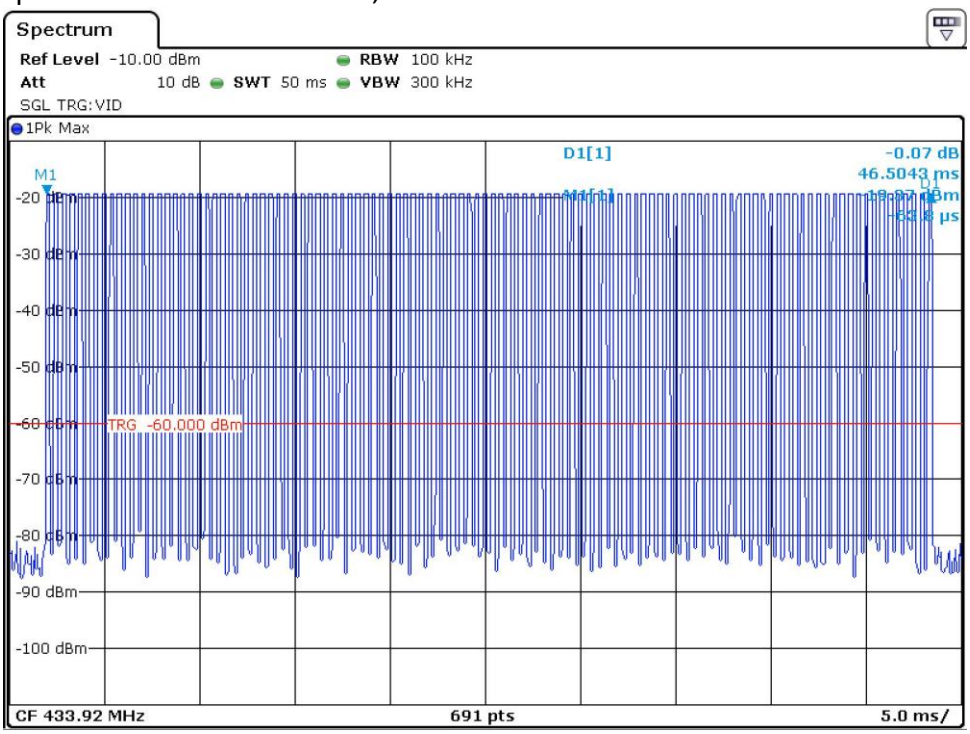
9.3 Discussion of Pulse Desensitization

ASK mode

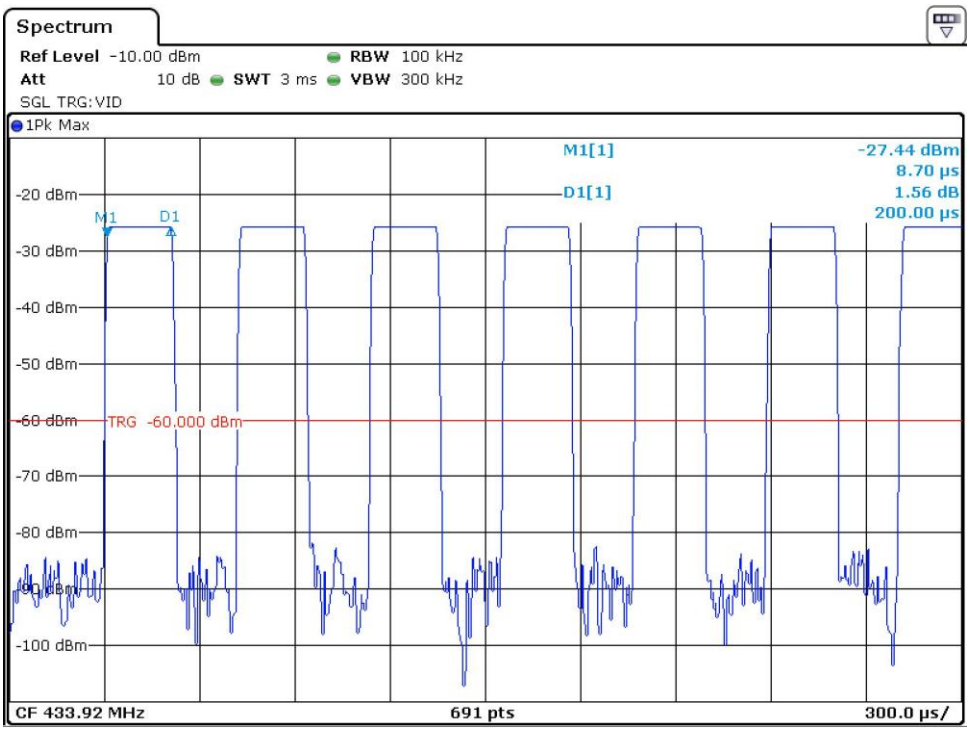
The effective period (T_{eff}) is approximately 22.40ms for a digital "1" bit which illustrated on technical specification. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was -13.0 dB.



The pulse period exceeds 0.1 seconds, so the observation time is 100ms.



1 pulse train has 112 single bursts



single burst time is 200µs

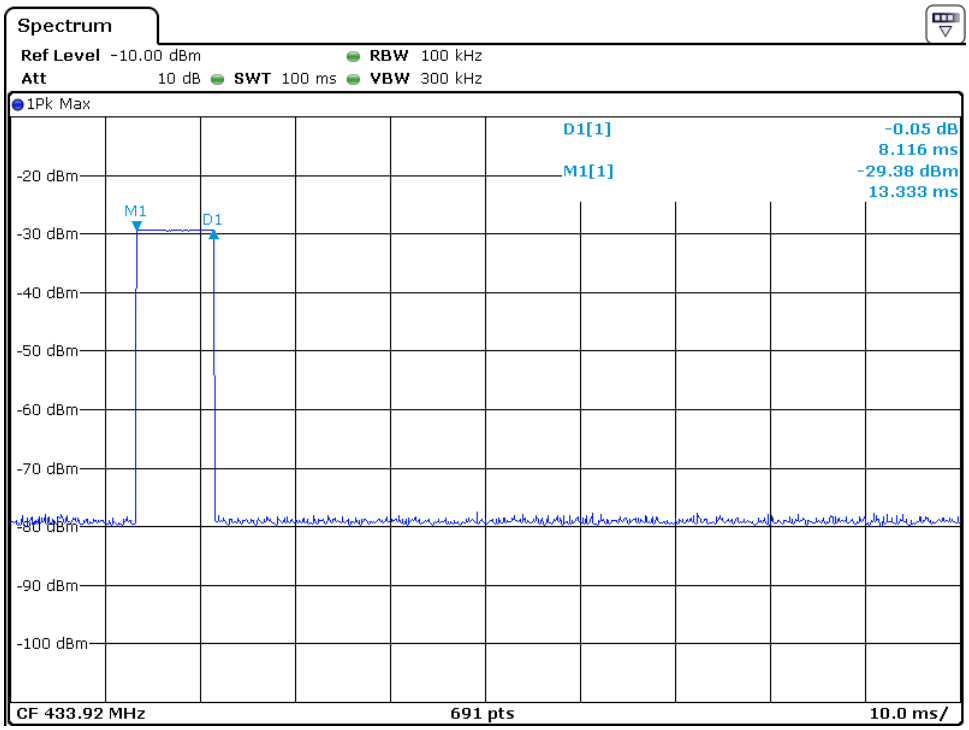
The duty cycle is simply the on-time divided by the observation time:

The observation time = 100ms
The effective period (T_{eff}) = 22.40ms
DC =22.40ms / 100ms =0.2240 or 22.40%

Therefore, the averaging factor is found by 20 $\log_{10}$ (0.2240) = -13.0dB

FSK mode Case 1 Passive Enter

The effective period (T_{eff}) is approximately 8.116ms for a digital "1" bit which illustrated on technical specification. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was -21.8 dB.



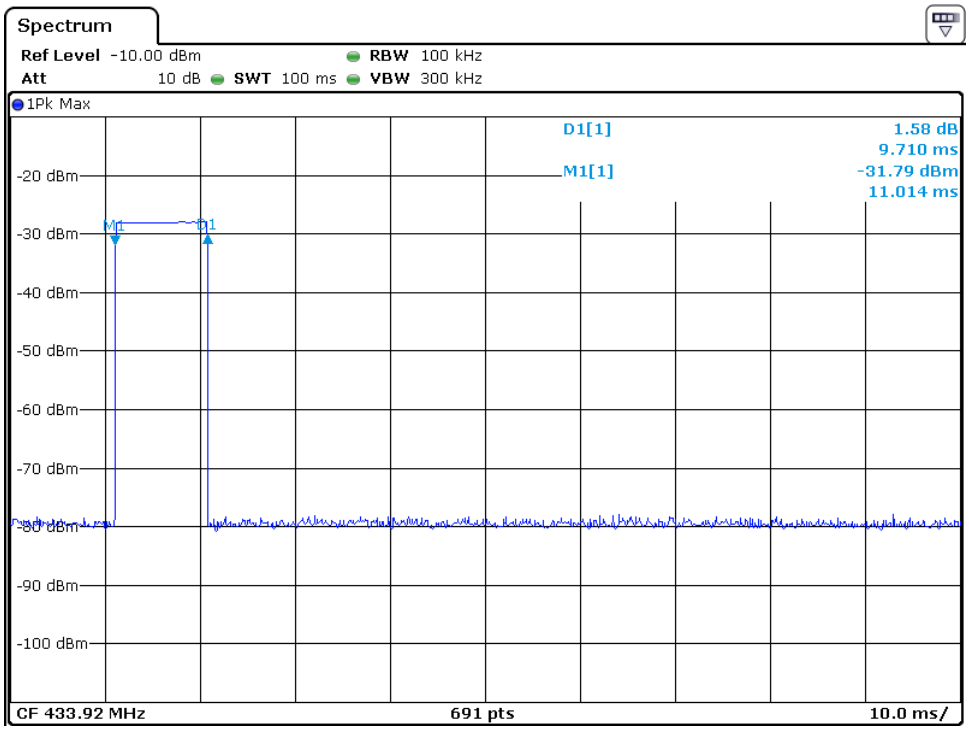
The duty cycle is simply the on-time divided by the observation time:

The observation time = 100ms
The effective period (T_{eff}) = 8.116ms
DC =8.116ms / 100ms =0.0812 or 8.12%

Therefore, the averaging factor is found by 20 $\log_{10}$ (0.0812) = -21.8dB

FSK mode Case 2 Passive Start

The effective period (T_{eff}) is approximately 9.710ms for a digital "1" bit which illustrated on technical specification. With a resolution bandwidth (3 dB) of 100 kHz, the pulse desensitivity factor was -20.3 dB.



The duty cycle is simply the on-time divided by the observation time:

The observation time = 100ms
The effective period (T_{eff}) = 9.710ms
DC =9.710ms / 100ms =0.0971 or 9.71%

Therefore, the averaging factor is found by 20 $\log_{10}$ (0.0971) = -20.3dB

9.4 Emissions Test Procedures

The following is a description of the test procedure used by Intertek Testing Services in the measurements of transmitters operating under Part 15, Subpart C rules.

The test set-up and procedures described below are designed to meet the requirements of ANSI C63.10 - 2013.

The transmitting equipment under test (EUT) is placed on a styrene turntable which is four feet in diameter, up to 1GHz 0.8m and above 1GHz 1.5m in height above the ground plane. During the radiated emissions test, the turntable is rotated and any cables leaving the EUT are manipulated to find the configuration resulting in maximum emissions. The EUT is adjust through all three orthogonal axes to obtain maximum emission levels. The antenna height and polarization are varied during the testing to search for maximum signal levels.

Detector function for radiated emissions is based on the use of measurement instrumentation with a CISPR quasi-peak detector.

The frequency range scanned is from the lowest radio frequency signal generated in the device which is greater than 9 kHz to the tenth harmonic of the highest fundamental frequency or 40 GHz, whichever is lower.

The EUT is warmed up for 15 minutes prior to the test.

AC power to the unit is varied from 85% to 115% nominal and variation in the fundamental emission field strength is recorded. If battery powered, a new, fully charged battery is used.

The IF bandwidth used for measurement of radiated signal strength was 10 kHz for emission below 30 MHz and 120 kHz for emission from 30 MHz to 1000 MHz. Where pulsed transmissions of short enough pulse duration warrant, a greater bandwidth is selected according to the recommendations of Hewlett Packard Application Note 150-2. Above 1000 MHz, a resolution bandwidth of 1 MHz is used.

Transmitter measurements are normally conducted at a measurement distance of three meters. However, to assure low enough noise floor in the restricted bands and above 1 GHz, signals are acquired at a distance of one meter or less. All measurements are extrapolated to three meters using inverse scaling, but those measurements taken at a closer distance are so marked.

10.0 Test Equipment List

Equipment No.	Equipment	Manufacturer	Model No.	Serial No.	Cal. Date	Due Date
SZ061-12	Biconilog Antenna	ETS	3142E	00166158	2021-08-04	2024-08-04
SZ061-06	Active Loop Antenna	Electro-Metrics	EM-6876	217	2021-05-18	2023-05-18
SZ061-08	Horn Antenna	ETS	3115	00092346	2021-09-05	2024-09-05
SZ061-07	Pyramidal Horn Antenna	ETS	3160-09	00083067	2022-08-31	2025-08-31
SZ056-03	Spectrum Analyzer	R&S	FSP30	101148	2022-05-16	2023-05-16
SZ056-06	Signal Analyzer	R&S	FSV 40	101101	2022-12-19	2023-12-19
SZ185-03	EMI Receiver	R & S	ESCI	100547	2022-12-26	2023-12-26
SZ181-04	Preamplifier	Agilent	8449B	3008A02474	2022-05-16	2023-05-16
SZ188-01	Anechoic Chamber	ETS	RFD-F/A-100	4102	2021-12-12	2024-12-12
SZ062-02	RF Cable	RADIALL	RG 213U	--	2022-11-20	2023-05-20
SZ062-05	RF Cable	RADIALL	0.04-26.5GHz	--	2022-11-20	2023-05-20
SZ062-12	RF Cable	RADIALL	0.04-26.5GHz	--	2022-11-20	2023-05-20

**********End of Report**********